CLOUDSWXTCH

Version 2.1.0

Table of Contents

cloudSwXtch

cloudSwXtch > Getting Started

cloudSwXtch > Getting Started > cloudSwXtch Features

cloudSwXtch > Installing cloudSwXtch

cloudSwXtch > Installing cloudSwXtch > cloudSwXtch on AWS

cloudSwXtch > Installing cloudSwXtch > cloudSwXtch on Azure

cloudSwXtch > Installing cloudSwXtch > cloudSwXtch on GCP

cloudSwXtch > Installing cloudSwXtch > cloudSwXtch on OCI

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

cloudSwXtch > Upgrading cloudSwXtch

cloudSwXtch > Installing cloudSwXtch Bridge

cloudSwXtch > Installing xNIC

cloudSwXtch > Installing xNIC > Install xNIC on Linux

cloudSwXtch > Installing xNIC > Install xNIC on Windows

cloudSwXtch > Installing xNIC > Install xNIC on Kubernetes

cloudSwXtch > Using wXcked Eye for cloudSwXtch

cloudSwXtch > Using wXcked Eye for cloudSwXtch > Monitor cloudSwXtch with wXcked Eye

cloudSwXtch > Using wXcked Eye for cloudSwXtch > Configure cloudSwXtch with wXcked Eye

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

cloudSwXtch > Configuring cloudSwXtch

cloudSwXtch > Monitoring cloudSwXtch

cloudSwXtch > Testing cloudSwXtch

cloudSwXtch > cloudSwXtch How To's

cloudSwXtch > Market Use Cases > Media Use Cases

cloudSwXtch > Resources

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Quotas

cloudSwXtch

All bandwidth and packet per second values are aggregate values (i.e ingress + egress) unless otherwise noted.

Name	Default Value	Configurable
Multicast Packet Size	Up to 3750	Yes
Endpoint Connections	Unlimited	NA
Max Throughput per cloudSwXtch	Up to 100 Gb/s	No
Max Bandwidth per flow	Up to 15 Gb/s	No
Max Packets per second per cloudSwXtch	Up to 10M	No
Max cloudSwXtch instances per mesh	32	No
Max Bridge instances per cloudSwXtch	4	No
Max fanout outputs per cloudSwXtch	1000	No

cloudSwXtch Sizing

cloudSwXtch Multicast (Marketplace)

# Endpoints	Bandwidth	Core	Memory	Hard Drive
10 (max)	100 Mbps (max)	8	16GB DDR	64GB SSD

cloudSwXtch BYOL (Marketplace)

# Endpoints	Bandwidth	Core	Memory	Hard Drive
Up to 100	2 Gb/s (max)	16+	16GB DDR	64GB SSD
Up to 200	More than 2Gb/s	64+	16GB DDR	64GB SSD

xNIC

Name	Default Value	Configurable
Multicast Packet Size	Up to 3750	Yes
Multicast Groups	Unlimited	NA
Max cloudSwXtch Connections	4	No
Max Bandwidth	Up to 15 Gb/s	Yes

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

FAQ

Please see the swxtch.io website FAQ page for the most up-to-date version of the FAQ.

Q: What is a cloudSwXtch?

A: cloudSwXtch is a virtual overlay network that runs in your Azure tenant. It creates a standards-compliant network by deploying virtual network switches and virtual Network Interface Controllers (xNICs) that allow software workloads running on virtual machines to distribute their information as if they were running on a physical network. Many features not available on cloud networks, like multicast, PTP, packet pacing, custom packet filtering, and others may be implemented as features on this virtual network.

Q: What is required to run cloudSwXtch?

A: cloudSwXtch is available for workloads running on virtual machines that run RHEL 7 or later, CentOS 7 or later, and Ubuntu 18.04 or later. These operating systems must run on an x86_64 CPU. Each client VM must have two Network Interface Cards.

Q: What happens when I run cloudSwXtch?

A: cloudSwXtch creates a virtual switch architecture that behaves like a physical network switch. The switch runs on its own virtual machine(s) that is scaled for the network load that you require. Each virtual machine in your tenant that needs to access the multicast network must run a very small network interface application that communicates with the switch. Any workload that sends or receives multicast packets can join or leave a multicast group using standard IGMP calls.

Q: What operating systems does xNIC support?

A: It depends on the xNIC version.

Version 1: RHEL 7+, CentOS 7+, or Ubuntu 18.04 | 20.04, Windows 10, Windows Server 2016+

Version 2: RHEL 8, CentOS 8, or Ubuntu 20.04, Windows 10, Windows Server 2016+

Q: Which version of IGMP does cloudSwXtch support?

A: cloudSwXtch is fully compliant with IGMP Version 2, and partially compliant with IGMP Version 3. cloudSwXtch currently supports many of the features of IGMP Version 3 that are in common use, and will fully support IGMP version 3 in a future release.

Q: Can I send multicast traffic across Azure vNets?

A: cloudSwXtch is currently able to transfer packets between vNets or VPCs.

Q: What resources are used by a cloudSwXtch?

A: A cloudSwXtch uses only the VM resources in which is runs. The size of the VM determines the level of performance of the switch. The minimum VM size (core count) supported is 4 cores.

> NOTE
>
> You can select custom, to select a specific VM type and size.

> NOTE:
>
> Please be aware that the owner of the subscription in which the cloudSwXtch instance is created is responsible for all cloud resources used by the cloudSwXtch. These fees are to the cloud provider and do not include any fees to swxtch.io for licensing.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Getting Started

Quick Start Guide (for those in a hurry)

Introduction

swXtch.io implements a software-based network switch called cloudSwXtch . cloudSwXtch consists of a software network switch and virtual NIC service called xNIC . Together, these components create an overlay network on top of a standard cloud network. This overlay network adds many valuable network features, one of which is a seamless IP multicast experience. With cloudSwXtch, existing user applications and services, that expect standards-based IP multicast, will work on any cloud without requiring any code changes. This enables performance to approach that of bare metal.

Installing cloudSwXtch and xNIC

WHAT TO EXPECT

- In this section, users will be able to learn more about installing cloudSwXtch and the xNIC on AWS, Azure, GCP and OCI.
- Users must install an xNIC on every VM that needs to send or receive cloudSwXtch multicast or broadcast traffic.

Before you install cloudSwXtch, please review the System Requirements.

AWS cloudSwXtch Installation Guide

Azure cloudSwXtch Installation Guide

GCP cloudSwXtch Installation Guide

OCI cloudSwXtch Installation Guide

xNIC Installation Guide for Windows and Linux

---

wXcked Eye for Monitoring and Orchestration

wXcked Eye is a web-based monitoring and configuration tool for cloudSwXtch. It presents users with a high-level view of their cloudSwXtch environment with an interactive network graph detailing connections to different endpoints. With an expansive look at performance metrics, users can ensure that their data is flowing as expected.

In addition, wXcked Eye unlocks the ability to configure Mesh, High Availability, Protocol Fanout, and Precision Time Protocol (PTP) from the comfort of a user's web browser.

For more information, see Using wXcked Eye for cloudSwXtch.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Testing

The xNIC installation includes the following utilities that can be used to verify both the functionality and performance of the network:

- swxtch-top: This utility shows detailed switch statistics in the console. For more information, click here.
- `swxtch-perf`: This utility can be used to produce and consume multicast traffic for testing. For more information, click here.

Each of the utilities can be run from a VM, which has the xNIC software installed. Detailed usage information can be found for each by entering in the `—help` command-line argument.

Multicast Examples

Users can find examples of the multicast by scrolling down to the Multicast Example section in the swxtch-perf article.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

What is cloudSwXtch?

WHAT TO EXPECT

In this article, users will get a deeper understanding of cloudSwXtch and how it can improve their networking capabilities. This article also gives users a preliminary introduction to the main features available while using cloudSwXtch.

Meet cloudSwXtch

cloudSwXtch creates a virtual overlay network that lets users add high performance networking to their cloud or edge applications with the touch of a button, requiring no code changes!

cloudSwXtch is available on Azure and AWS and can be instantiated via their respective Marketplaces. It is also available as a BYOL software install.

Supported Enviroments

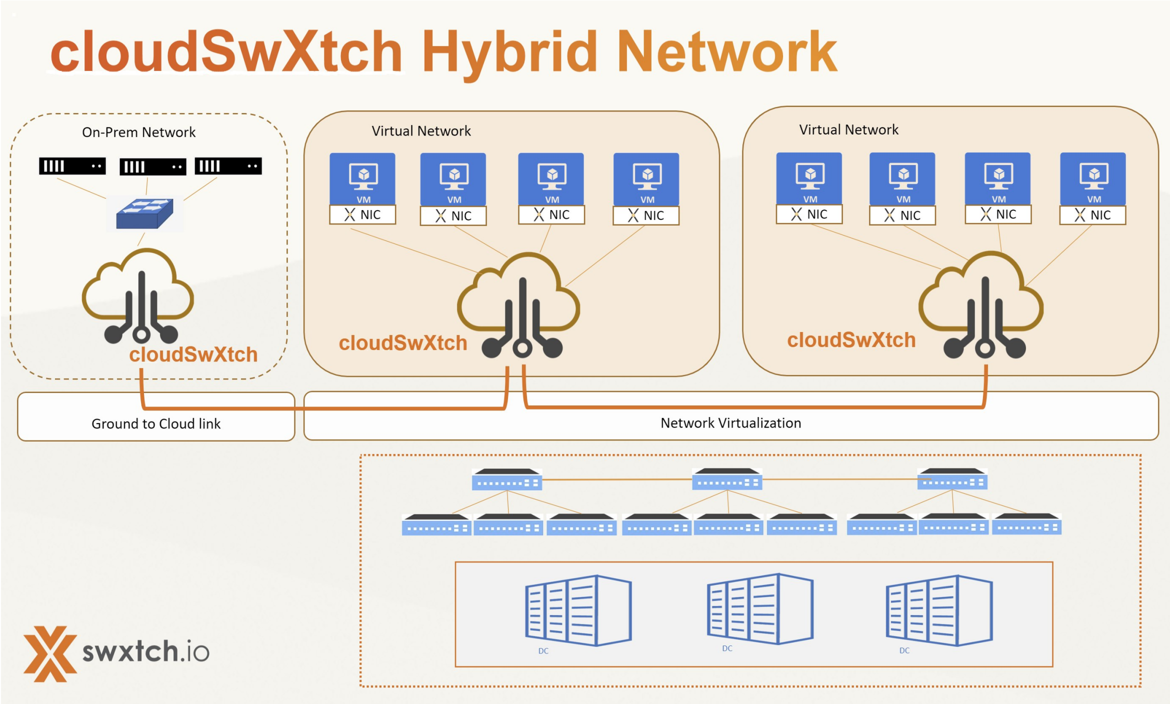
- Microsoft’s Azure
- Amazon's AWS
- Google's GCP
- Oracle's OCI
- On-Premises with cloudSwXtch Bridge

What is a Virtual Overlay Network?

swXtch.io provides an application that implements a *Cloud Based Virtual Switch - cloudSwXtch.* It consists of a software-based network switch and a virtual NIC service (*xNIC*). Together, these components create an overlay network on top of the standard cloud network.

This overlay network adds many valuable, high-performance network features that aren't traditionally available in the cloud; one of which is a seamless IP multicast experience.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



cloudSwXtch Instance

A cloudSwXtch instance running on a user's virtual machines will provide extremely low latency ($< 3\mu s$), high determinism, and elastic scalability. A user can build a 1,000-port switch or create a cloudSwXtch mesh of switches to optimize network reliability.

With *cloudSwXtch*, existing user applications and services that expect standards-based IP multicast will work in the cloud without requiring any code changes. This enables performance to approach that of bare metal.

Benefits of cloudSwXtch

- Unblock Cloud Migrations – Migrate critical workloads that couldn't move to the cloud because of missing network features or performance limitations.
- Extend On-Prem Networks to the Cloud – Create a single data plane across private networks and the cloud, traversing virtual networks, availability zones, and regions.
- Massive Scale – Extended networks with unlimited endpoints share identical features and sub-millisecond performance.
- Enhanced Packet Monitoring – The cloudSwXtch architecture provides a unique view into low level network traffic across the entire extended network.
- Simplified and Flexible Network Configuration – Add and remove endpoints dynamically from global networks as conditions dictate. Eliminate the need to reconfigure individual workloads.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

cloudSwXtch Liscensable Features

WHAT TO EXPECT

The following section gives a preliminary introduction to the main features available while using a cloudSwXtch.

Licensing cloudSwXtch Features

In addition to Multicast and wXcked Eye, users can license the following features for their cloudSwXtch:

Protocol Fanout	Protocol Conversion (e.g. SRT to Multicast)	Ground to Cloud/Cloud to Ground	Mesh	SMPTE ST 2022-7 & High Availability
Precision Time Protocol (PTP)	Tachyon LIVE!	Increase Bandwidth Capacity (Ingress)	Additional Endpoint Connections	

Multicast

cloudSwXtch enables true and seamless IP-multicast. Using multicast, instead of unicast, optimizes a user's network configuration, reducing their cloud distribution and egress costs. In addition, receivers can dynamically subscribe and unsubscribe to a user's streams as workflows dictate. cloudSwXtch alleviates the need to have to constantly reconfigure unicast streams to accommodate downstream receivers. cloudSwXtch uses the industry standard IGMPv2/v3 for its management of multicast group membership.

For more information, check out the Multicast feature article.

Single Source Multicast (SSM)

Traditionally, Single Source Multicast (SSM) is a method for delivering multicast packets in which the only packets that are delivered to the receiver are those originating from a specific source address requested by the receiver. This can be accomplished as either a consumer command for swxtch-perf, the cloudSwXtch-based tool for simulating traffic movement, or via an external application.

Protocol Conversion and Fanout

cloudSwXtch supports a unique feature called protocol conversion and fanout. This feature is useful when a user's multicast application needs to stream to an endpoint that does not support multicast or it is not possible to install an xNIC in the endpoint. cloudSwXtch can map a multicast group address to a unicast address. Similarily, a unicast input to cloudSwXtch can be mapped to a multicast group enabling mulitple endpoints to consume the original unicast input stream. Protocol Fanout converts many packet protocols and distributes them out as if they were multicast; freely integrating multicast, unicast and Secure Reliable Transport (SRT) streams while making the network more efficient and reducing egress costs.

For more information, check out the Protocol Conversion and Fanout feature article.

SMPTE 2022-7 and High Availability (HA)

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

High Availability (HA) protects users against data path errors by sending the same stream through as many as eight different distributed data paths. It compares packet reception from the multiple paths, detects dropped packets and reconstructs the output stream in the correct order. This feature is compliant with SMPTE 2022-7 for media workflows.

For more information, check out the High Availability feature article.

Mesh

Multiple cloudSwXtches can be connected together in a mesh for routing throughout the cloud network. This includes cloudSwXtches in any topology across all dispersed network locations (different Vnets, regions, clouds, subnets, etc.). Additionally, a mesh allows cloudSwXtch to scale vertically.

For more information, check out the Mesh feature article.

Ground to Cloud <==> Cloud to Ground

A user can connect their On-Prem network to their cloudSwXtches in the Cloud via the bridge application.

For more information, check out the Installing cloudSwXtch Bridge guide.

wXcked Eye for Monitoring and Configuration

cloudSwXtch also provides its users with visibility down to the packet level for enhanced Monitoring and Quality of Service (QoS). wXcked Eye is the cloudSwXtch monitoring UI tool that enables users to deeply audit the performance of their cloudSwXtch network. Each cloudSwXtch performs complete packet capture.

In addition, wXcked Eye also provides users with an additional avenue to configure their cloudSwXtch environment for mesh, high availability, protocol conversion and fanout, and precision time protocol.

A REST API is provided to help users manage and control their network in their own way.

For more information, please see the Using wXcked Eye for cloudSwXtch article.

Precision Time Protocol (PTP)

Precision Time Protocol (PTP) is a cloudSwXtch feature that facilitates clock synchronization between agents connected to the network. The cloudSwXtch acts as the Master Node, passing on the information gained from the true clock source to the Follower Nodes or agent end points.

For more information, please see the Precision Time Protocol (PTP) feature article.

Tachyon LIVE!

Tachyon LIVE! is a live, high-quality standards, format, and frame rate converter software stack that maximizes video quality across all conversions. It performs standards conversion including PAL/NTSC frame rate and format conversions, high-quality deinterlacing, and up/down rescaling from SD through HD, and it can process the highest-quality conversions for HD 59.97p to HD 50p, faster than real time in a VM with NVIDIA GPU-accelerated infrastructure.

This feature is an exclusive offer for cloudSwXtch from Cinnafilm and available as either an HD or UHD add-on.

For more information, please visit Cinnafilm's website.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Multicast

Multicast

Software defined multicast (SDMC™) is a feature of the cloudSwXtch overlay network. With SDMC, existing applications and services that expect standards-based, IP multicast will work without requiring any code changes and with performance that approaches that of bare metal.

At a high level, cloudSwXtch implements a *software switch* that serves the same role as a hardware switch. cloudSwXtch receives multicast packets from producers and sends a copy of each packet to every destination VM. The cloudSwXtch control plane uses the industry standard IGMPv2/3 specification for the management of group membership.

The xNIC service handles multicast traffic between the switch and the VM operating system. The xNIC service must be installed on every VM that needs to send or receive multicast traffic.

SUMMARY

The cloudSwXtch system consists of a software switch instantiated within a virtual network and a set of virtual machines that have an xNIC virtual interface.

Applications can send and receive IP multicast by targeting the virtual network interface. IGMP control packets are generated by the local operating system and the xNIC virtual interface seamlessly picks these up and sends them to the cloudSwXtch instance. Local applications will work in this environment just as they would on a similar bare-metal network.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Source Specific Multicast

> WHAT TO EXPECT
>
> In this section, we will go into detail about Source Specific Multicast, or SSM, and how it improves security when sending/receiving multicast packets.

Source Specific Multicast, or SSM, is defined as a method for delivering multicast packets in which the only packets that are delivered to the receiver are those originating from a specific source address requested by the receiver. Not only does this improve security within the cloudSwXtch but it also alleviates strain on the network since the sender will know to only send a multicast stream from the specified single source and not via other source addresses.

This feature can be tested using swxtch-perf, a cloudSwXtch-based tool for simulating consumer and producer traffic, as well as external applications that support SSM. For more information on using it for SSM, please see the swxtch-perf article under Testing cloudSwXtch.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Broadcast

Broadcast is a feature of the cloudSwXtch overlay network. With Broadcast, existing applications and services that expect standards-based broadcast will work without requiring any code changes and with performance that approaches that of bare metal.

At a high level, cloudSwXtch implements a software switch that serves the same role as a hardware switch. cloudSwXtch receives broadcast packets from producers and sends a copy of each packet to every destination VM.

The xNIC 2 service handles tunneling broadcast traffic between the cloudSwXtch and the VM operating system. The xNIC 2 service must be installed on every VM that needs to send or receive broadcast traffic.

SUMMARY

The cloudSwXtch system consists of a software switch instantiated within a virtual network and a set of virtual machines that have an xNIC 2 virtual interface.
Applications can send and receive broadcast by targeting the virtual network interface. Broadcast packets are generated by the local operating system and the xNIC 2 virtual interface seamlessly picks these up and sends them to the cloudSwXtch instance. Local applications will work unchanged in this environment just as they would on a similar bare-metal network.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

High Availability

WHAT TO EXPECT

High Availability (HA) is an implementation of data path redundancy and stream duplication. It protects users from data loss by replicating and sending packets through multiple network paths. xNIC compares packets received from those multiple paths and automatically reconstructs the original stream.

In this section, users will learn more about the benefits of implementing the High Availability feature in their cloudSwXtch and understand how to leverage it for their future needs.

Creating A More Resilient Network

With High Availability, critical workloads can be configured to be more resilient, stretching across regions or availability zones in a single cloud. In addition, it can be used across multiple cloud providers. Although there can only be up to eight redundant paths, there are no limits to the number of consumers that can receive the HA stream, other than bandwidth constraints.

In addition, there is no limit to the number of multicast groups per data path. If one cloud, availability zone or region should go down, then the data is still sent in the other 2-8 paths, ensuring that the consumer gets the necessary data. Consumers can also be put into different clouds, availability zones or regions so that if a consumer becomes unavailable, users can still sign into a different cloud, availability zone or region and get the data desired.

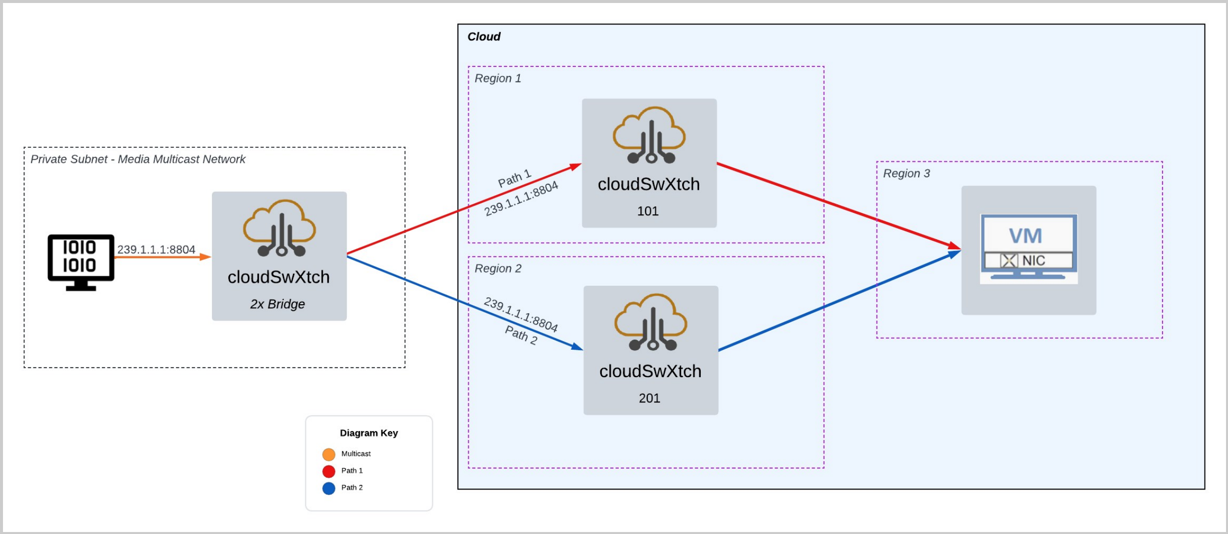
The HA feature forwards packets to the receiving application from any of the configured paths as soon as the "next" expected packet is received. Redundant packets from other paths are discarded. There is no additional latency imposed by the HA feature.

IMPORTANT

A cloudSwXtch configured in a HA path cannot be used in a cloudSwXtch mesh. They are mutually exclusive.

High Availability Example

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



The simple diagram above shows high availability with one multicast group 239.1.1.1:8804 originating from an on prem source. From the bridge, two paths are created with redundant packets being sent to alternate cloudSwXtches in different regions. The number of regions and cloud providers needed for High Availability will vary depending upon the customer's environment.

Independent path redundancy ensures no packet loss if every packet arrives at the consumer from at least one path. For example:

- In the event that cloudSwXtch101 goes offline, the consumer will still get the multicast traffic via cloudSwXtch201 (or vice versa).
- In the event that there are network issues in Region 1 where some of the packets are lost in path one, the consumer can still get the multicast traffic with High Availability pulling data from Region 2 in path two.
- In the event that there are network issues in Region 1 and 2 where some of the packets are lost in both paths, both consumers can still get the multicast since the high availability function will take the valid packets and reconstruct the multicast stream from Region 1 and 2.

In each example, despite losing paths, multicast data was still able to get to the end point using high availability with no packet loss. Configuring more paths will ensure higher availability of the multicast group.

HA can be monitored via swxtch-top, see swxtch-top section 4-6.

To configure the system for high availability, refer to: High Availability Configuration.

Installing cloudSwXtch - Firewall Exceptions

When installing the cloudSwXtch, high availability requires special firewall exceptions. To learn more, see cloudSwXtch System Requirements.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Mesh

What is a Mesh?

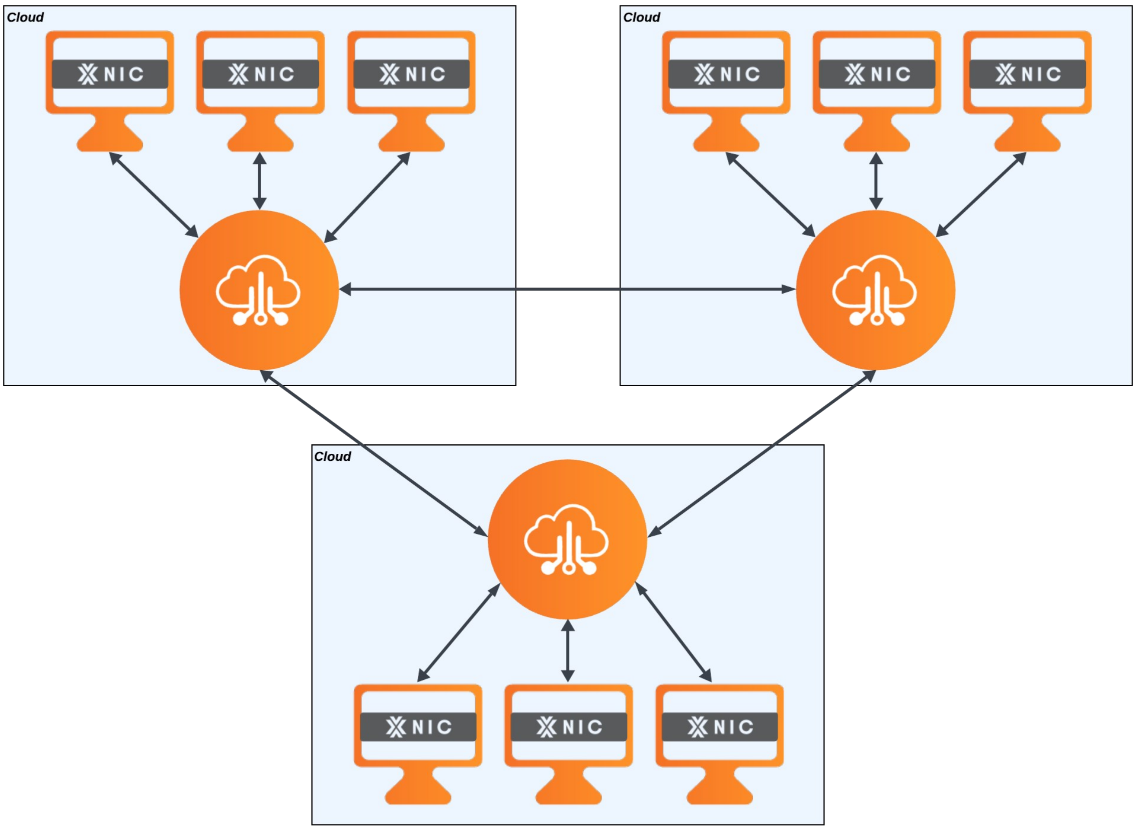
A mesh connects cloudSwXtches in a variety of dispersed network locations – different Vnets, regions, clouds, subnets, data centers, ect.). Additionally, a mesh is a way to group two or more swXtch's together to act as one to gain network performance.

Learn more about a Mesh

- See Monitor cloudSwXtch with wXcked Eye to learn more about monitoring cloudSwXtches to understand existing capacity to know if you need to consider creating a cloudSwXtch mesh.
- See cloudSwXtch Installation for installing a cloudswXtch.
- See Mesh with wXcked Eye for mesh configuration.

Mesh

A Mesh is formed by linking cloudSwXtches so that they are eligible to receive and transmit multicast traffic to other cloudSwXtches in the same mesh. Configuring a mesh with wXcked Eye allows a user to create a network of cloudSwXtches across Availability Zones, Regions, and On-Prem Networks to manage multicast traffic.



©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

NOTE

- A member of a mesh is called a swxtch-node, or simply node.
- Mesh membership is managed by via a REST API and a CLI tool.
- A node can be added as long as it is reachable via IP traffic. This means a node can be in any other VNet as long as IP traffic can be routed between at least one other node in the mesh.

IMPORTANT

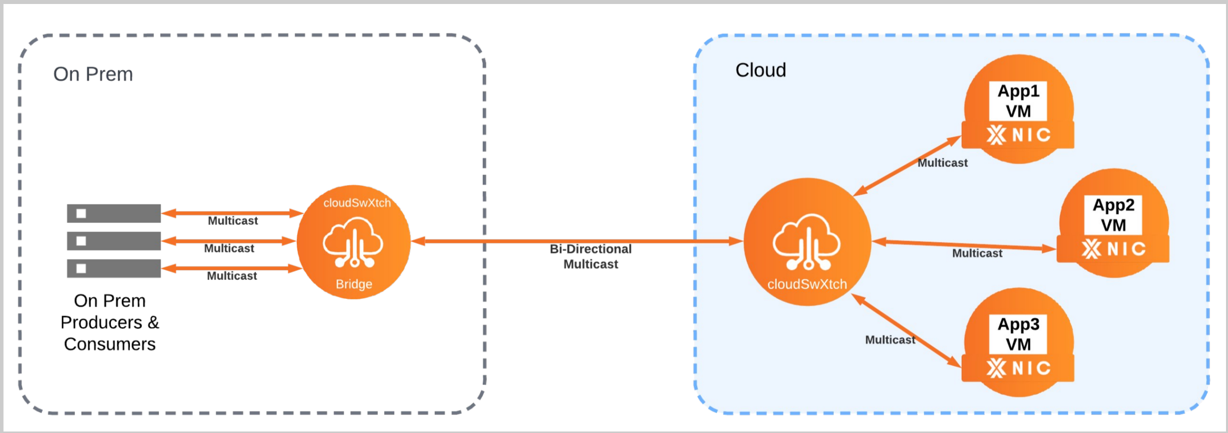
- A cloudSwXtch configured for mesh cannot be used in an HA path. Mesh and High Availability are mutually exclusive.
- Mesh membership doesn’t mean that all multicast traffic is sent to every other node in the mesh. Packets destined for a multicast group are only sent to nodes that have consumers that have joined the same multicast group.
- A cloudSwXtch can only be a member of a single mesh.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Bridge

cloudSwXtch Bridge

The cloudSwXtch Bridge application enables bi-directional multicast traffic between a non-cloud and cloud network. The source network can be bare-metal and on-premises. The destination network can be a cloud virtual network with a cloudSwXtch instance deployed. With cloudSwXtch, multicast traffic generated from the on-prem network can be received and processed in the cloud which then in turn can be sent back to the on-prem network.



The cloudSwXtch Bridge is bi-directional. It sends multicast traffic from the on-premises network to the cloud and from the cloud to on-premises.

From on-prem to the cloud, the bridge is dynamic. This means that users in the cloud can subscribe to a multicast group via IGMP joins. Then, the bridge will allow that traffic through. This ensures that only necessary traffic goes through the VPN or Express Route/Gateway into the cloud. It guarantees the best use of the gateway and incurs less ingress bandwidth into the cloud.

Operation

The operation of the cloudSwXtch Bridge varies based on direction.

Ground-->Cloud

For Ground to Cloud, a mesh must be configured between the cloudSwXtch and the cloudSwXtch Bridge at the ground. From then on, the operation is dynamic, meaning the user does not need to map multicast addresses to go into the cloud. Instead, when a user is in an application and use an IGMP join then a message is sent to the cloudSwXtch Bridge via the cloudSwXtch through the mesh and then the Bridge allows that traffic through. When the user stops using multicast group and does an IGMP leave, then the bridge stops sending multicast data.

Cloud-->Ground

For Cloud to ground there is no current support to propagate IGMP joins and leaves from cloudSwXtch to on-prem. In this case, multicast groups must be explicitly configured to let the bridge know what traffic is allowed.

See Bridge Installation on how to install the Bridge and the differences between Bridge Type 1 and Type2. See our configuration pages for Bridge Type 1 and Bridge Type 2.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

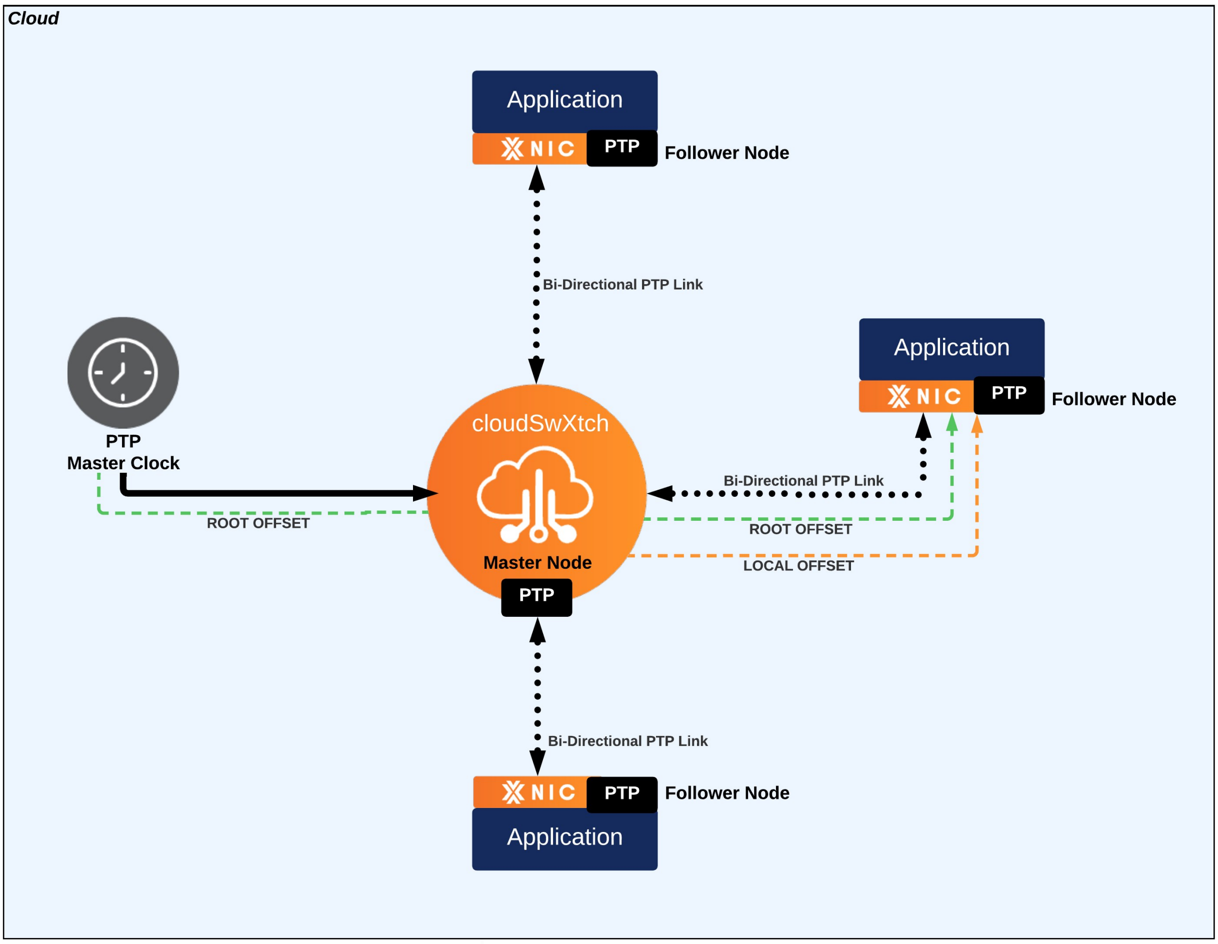
Precision Time Protocol

WHAT TO EXPECT

In this article, users will learn how Precision Time Protocol (PTP) works in a cloudSwXtch environment when the feature is activated.

What is Precision Time Protocol?

Precision Time Protocol (PTP) is a cloudSwXtch feature that facilitates clock synchronization between agents connected to the network. The cloudSwXtch acts as the Master Node, passing on the information gained from the true clock source to the Follower Nodes or agent end points.



Information regarding PTP will display in both swXtch-top under the PTP page and wXcked Eye under Timing Nodes. Both cloudSwXtch tools will show the local and root offset. The local offset denotes the offset in time from the cloudSwXtch to the xNIC. The root offset denotes the offset in time from the True Clock Source and the cloudSwXtch's follower nodes (xNICs). The root value will always be larger than the local since the distance between the follower node and the True Clock Source is greater than the offset between a cloudSwXtch and xNIC.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Protocol Conversion and Fanout

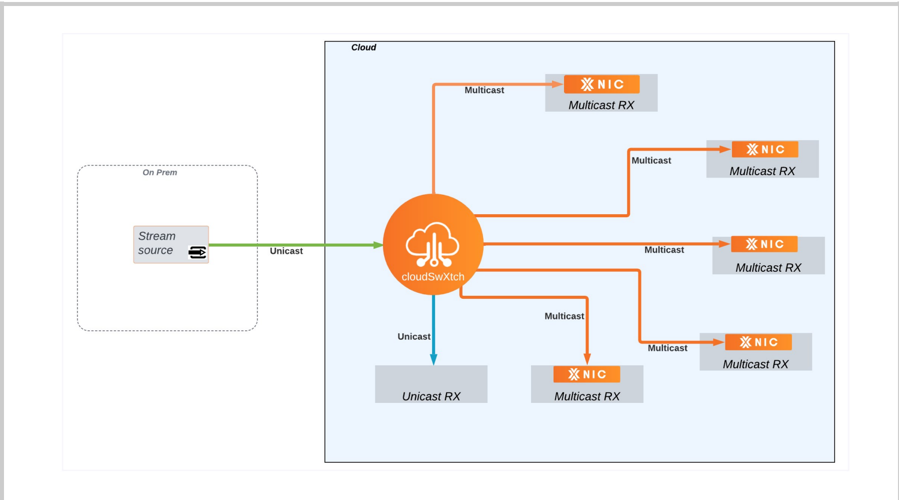
WHAT TO EXPECT

Protocol Conversion and Fanout allows users to send copies of a single input stream in any supported protocol to multiple destinations. This gives each destination the option of being a different protocol from the input stream. An example would be a UDP input being sent to a set of multicast destination and, additionally, to one using SRT.

In this section, users will become more familiar with how Protocol Conversion and Fanout works in a cloudSwXtch-enabled environment.

What is Protocol Conversion and Fanout?

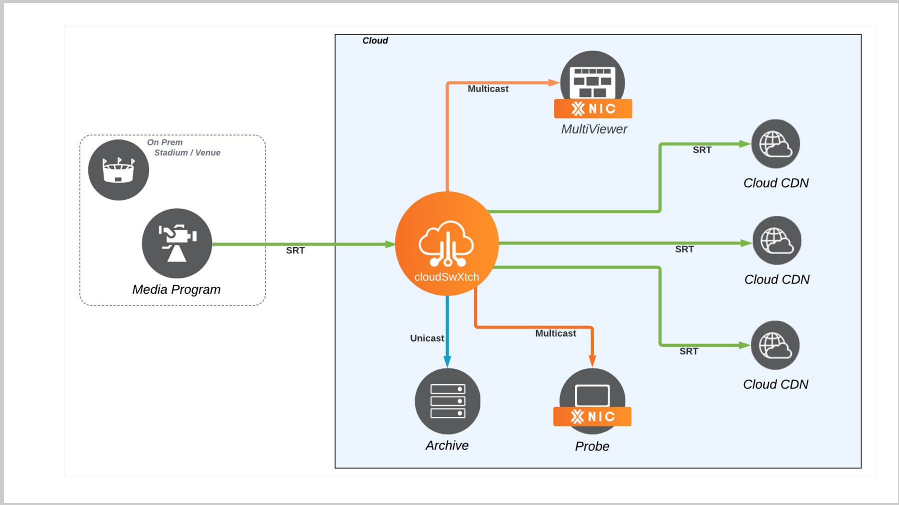
It is not usual for workflows to have many endpoints with each having their own protocols: SRT, Unicast and Multicast. Configuring each device can be a difficult and time consuming endeavor and up until now, impossible in the cloud. However, with cloudSwXtch, that is no longer the case. Users can convert protocols and send out multiple copies of payloads to different receivers regardless of protocol type without the need to add custom software or hardware.



This is a generic depiction of a Protocol Conversion and Fanout configuration.

In the above example, unicast data flows from the stream source into the cloudSwXtch. With Protocol Conversion and Fanout enabled, the cloudSwXtch can convert the unicast stream into multicast and fan it out to multiple receivers. In addition, the cloudSwXtch is sending out the stream to a unicast receiver. Please note: While it is not depicted in the above example, the cloudSwXtch can send the stream out to multiple unicast receivers.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



This is a media depiction of a Protocol Fanout configuration.

In the alternative example, SRT data flows from the stream source into the cloudSwXtch. With Protocol Fanout enabled, the cloudSwXtch can convert the SRT stream into multicast and fan it out to multiple receivers. In addition, the cloudSwXtch is sending out the stream to a unicast receiver and to multiple SRT receivers. Please note: While it is not depicted in the above example, the cloudSwXtch can send the stream out to multiple unicast receivers.

Understanding Endpoints

Workflows often have many endpoints: some requiring unicast, and some requiring multicast. Configuring for each device can be difficult and supporting both unicast and multicast for the same stream requires custom software or hardware. cloudSwXtch has the ability to map multicast streams to unicast streams and unicast streams to multicast streams allowing non-xNIC endpoints to participate in the cloudSwXtch network. This feature actualizes two different scenarios:

1. Non-xNIC producers, such as, those external to the cloud can send traffic to the cloudSwXtch, via unicast or SRT. The cloudSwXtch, then, can map that unicast or SRT stream to a multicast group for consumption within the cloudSwXtch network.

2. Non-xNIC consumers can receive traffic from a cloudSwXtch, as multicast streams can be mapped to unicast or SRT endpoints. This implies that non-xNIC consumers can receive packets created from a xNIC producer.

xNIC consumers and producers can consume SRT, unicast, and/or multicast based on consumer/producer workflow. For example, a VM may have 3 applications installed with each requiring a different protocol. The cloudSwXtch can send all three in the event that all three are needed.

Configuring Protocol Conversion and Fanout for cloudSwXtch

Users can configure Protocol Conversion and Fanout using two methods:

- Via wXcked Eye
- Via API - Please see the section on Protocol Fanout.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

cloudSwXtch System Requirements

cloudSwXtch Sizing Guidelines

cloudSwXtch Multicast (Marketplace)

# Endpoints	Bandwidth	Core	Memory	Hard Drive
10 (max)	100 Mbps (max)	8	16GB DDR	64GB SSD

cloudSwXtch BYOL (Marketplace)

# Endpoints	Bandwidth	Core	Memory	Hard Drive
Up to 100	2 Gb/s (max)	16+	16GB DDR	64GB SSD
Up to 200	More than 2Gb/s	64+	16GB DDR	64GB SSD

Sizing and Feature Selection for Your cloudSwXtch

The number of endpoints and bandwidth dictate cloudSwXtch sizing requirements. It is recommended for users to contact a swXtch.io sales representative to discuss cloudSwXtch sizing and additional features so that the appropriate license can be distributed. Please note: A cloudSwXtch BYOL offering will not work without a license.

- Sizing: For bandwidth greater than 2 Gb/s and endpoints greater than 100, you will need different virtual CPUs/NIC sizing.
- Adding Features: Many additional licensable features are available for cloudSwXtch. For more information, see cloudSwXtch Features.

To contact sales, please visit swXtch.io/contact.

Internet Connection

Installing and upgrading cloudSwXtch requires internet connection. Alternatively, if a user *does not have access* to the internet, they can use the Air-Gapped installation guide for Azure.

Supported Cloud Environments

- Amazon's AWS Cloud
- Microsoft's Azure Cloud
- Google's GCP Cloud
- Oracle's OCI Cloud

Virtual Network

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

A cloudSwXtch instance must have 2 NICs. However, both NICs can share a single subnet for control and data plane communications. This is the preferred method.

In the event that a user needs higher performance, a user can separate their subnets as described below.

- Contain a subnet for control plane traffic (referred to as the ctrl-subnet from here on).
- Contain a subnet for data plane traffic (referred to as the data-subnet from here on).

Please note: GCP does not allow for single subnet configuration. A user must have 2 separate subnets for their data and control NICs.

Subnet Selection

The subnets must be the same subnets used for the xNIC installations.

The virtual network and subnets may be shared with other services in addition to the cloudSwXtch. The size of each subnet should include at least 32 addresses.

Minimum CPU and Memory

A cloudSwXtch must be a minimum of 4 cores and 16 GiB memory.

Firewall and Security Group Rules

The xNIC software and the cloudSwXtch communicate with each other using the following protocols and ports. These firewall exceptions must be allowed in the xNIC VMs and the cloudSwXtch VM.

Subnet	Protocol	Ports	VM
ctrl-subnet	http	80	cloudSwXtch
ctrl-subnet	udp	10800-10803	all
data-subnet	udp	9999	all

Mesh and High Availability

Both Mesh and High Availability need special firewall exceptions in order to properly work in a user's cloudSwXtchenvironment. If you plan on using either features, please allow the following:

Mesh

Subnet	Protocol	Ports	VM
ctrl-subnet	tcp+udp	37856	cloudSwXtch

High Availability

Subnet	Protocol	Ports	VM
ctrl-subnet	tcp+udp	42000	cloudSwXtch

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Reminder: HA Mesh are mutually exclusive and cannot be used together.

PTP

PTP needs special firewall exceptions in order to properly work in a user's cloudSwXtch environment. If you plan on using the feature, please allow the following:

Subnet	Protocol	Ports	VM
ctrl-subnet	http	80	cloudSwXtch
ctrl-subnet	udp	10800-10803	all
data-subnet	udp	9999	all

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Cloud agnostic cloudSwXtch VM Install

WHAT TO EXPECT

In this article, you will learn how to install a cloudSwXtch instance on an existing Linux Ubuntu 20.04 virtual machine. This install process can be used on any cloud but requires a license file from swXtch.io. For more information about VM prerequisites, please see the cloudSwXtch System Requirements.

Pre-Installation Step: Create VM

Before installing cloudSwXtch, you will need to create an Ubuntu 20.04 virtual machine on your desired cloud with connection to the internet. In addition, it should encompass all the perquisites outlined in the cloudSwXtch System Requirements

Step One: Install cloudSwXtch

In this step, users will execute commands in their VMs to manually install a cloudSwXtch instance.

1. Run your freshly created virtual machine using your desired tool.
2. Enter the following command to download the cloudSwXtch installer script:

   Shell

   Bash | Copy

```bash
token="si=RDONLY&spr=https&sv=2021-06-08&sr=c&sig=xyPF7SyI1cagUAEIZViqCHz7RroFTy2Fkltn2wwvMzc%3D"
curl -X GET -H "x-ms-date: $(date -u)" "https://sdmcdevstorage.blob.core.windows.net/imagebuilder/image_install.sh?$token" -o image_install.sh
chmod +x image_install.sh
```

3. Use the following command to get the latest version of cloudSwXtch. The latest release is 2.1.0.

   Shell

   Bash | Copy

```bash
ver="v2.1.0"
```

4. Enter the following to download that version.

   Shell

   Bash | Copy

```bash
curl -X GET -H "x-ms-date: $(date -u)" "https://sdmcdevstorage.blob.core.windows.net/imagebuilder/install-${ver}.tar.gz?$token" -o install-${ver}.tar.gz
```

5. Execute the installer.

   Shell

   Bash | Copy

```bash
sudo ./image_install.sh ${ver}
```

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

This will automatically reboot the machine.

Step Two: Contact swXtch.io for a license

Users will need to contact swXtch.io for a license file. For more information, see How to License a cloudSwXtch.

NEXT STEPS

The cloudSwXtch is ready to use. The next step is to install the xNIC on each client expected to get traffic from the cloudSwXtch. See Installing xNIC for more information on preparing clients.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

cloudSwXtch on AWS

Pre-Creation Steps

Before creating an EC2 instance with cloudSwXtch installed for AWS, users must already have an AWS account *and* a VPC (Virtual Private Cloud) already created.

Installation Method:

1. Review system requirements
2. Validate subnets on AWS
3. Verify security groups *Optional*
4. Create SSH key pair
5. Install cloudSwXtch on AWS

Disclaimers

- swxtch.io does not handle any policy access rights for deployment nor does it have any special IAM roles or policies that are needed. That being said, swxtch.io suggests using a policy of least privilege for all access granted as part of the deployment. Please refer to AWS for best practices for policy rights and IAM roles and policies: AWS Identity
- swxtch.io does not require any public resources for deployment such as Amazon S3 buckets.
- swxtch.io cloudSwXtch installation does not use any AWS Secrets in Secret Manager as swxtch.io does not natively store any customer sensitive data. Customers can encrypt their traffic and the cloudSwXtch will still be able to handle the network traffic.
- swxtch.io does not encrypt data. It pass through any data sent in the multicast which may be encrypted.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Validate Subnets on AWS

WHAT TO EXPECT

A virtual network must be created before deploying a cloudSwXtch EC2 instance.

- It must contain at least one subnet that's used for both the control and data plane communication.
  - It is recommended that it is private facing and does not auto-assign public IPs.
  - This single subnet will be used for xNIC installation.

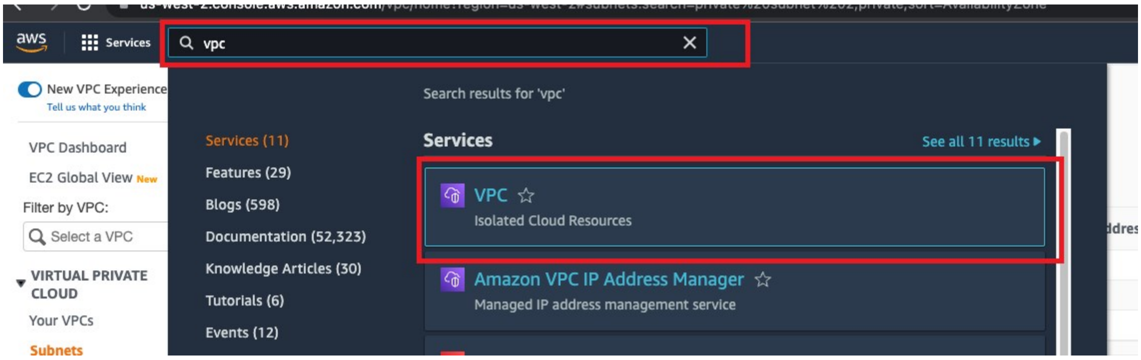
In this section, users will learn how to validate whether a subnet exists to be used as both the control and the data plane for their virtual network. This is in preparation for cloudSwXtch installation on AWS. We will also walk through an alternative method of using 2 subnets, separating the control and data plane.

Method #1: Single-subnet

Typically, when deploying a VPC, a user will automatically create a subnet. During the main installation process, this subnet can be used for both control and data plane communications. This is the preferred method and will be used by a majority of users. Before installing cloudSwXtch, users should validate that the control subnet exists.

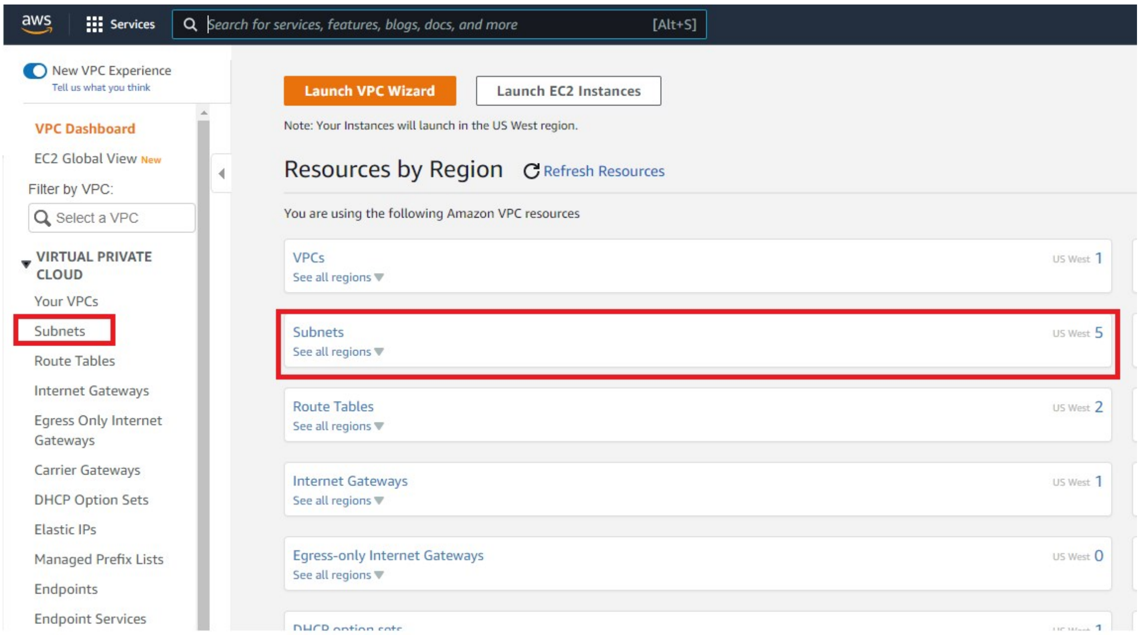
To validate:

1. Navigate to the VPC Console in AWS. In the example below, the user entered VPC in search field to find it under Services.



©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

2. Select "Subnets" under the Virtual Private Cloud tab or under Resources by Region in the VPC Dashboard.



3. Check that the subnet you wish to use for the cloudSwXtch is listed. In addition to the cloudSwXtch installation, this single subnet will be used during xNIC installation.

Method #2: Two Subnets

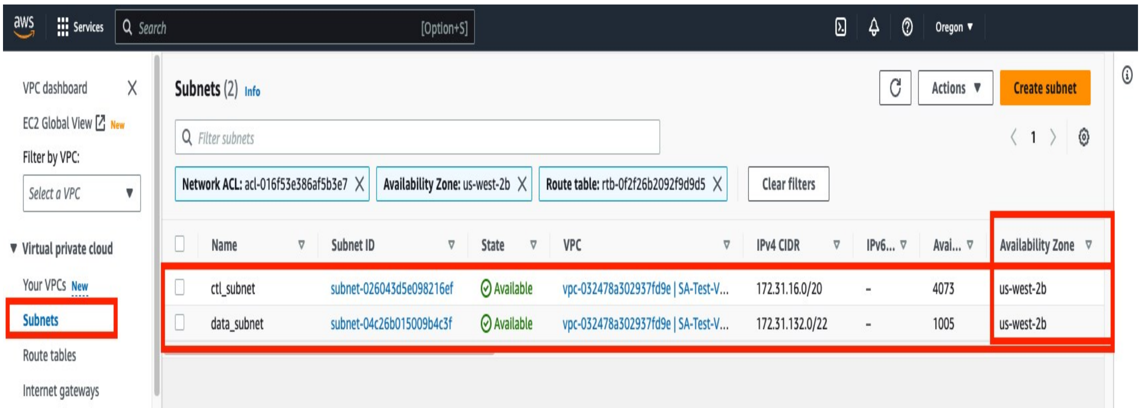
Alternatively, a user may decide that they want to have two separate subnets for their cloudSwXtch: one for the control plane and another for data. In addition, the same subnets must be used for the xNIC installations. This method is recommended for individuals who want higher performance.

To accomplish this:

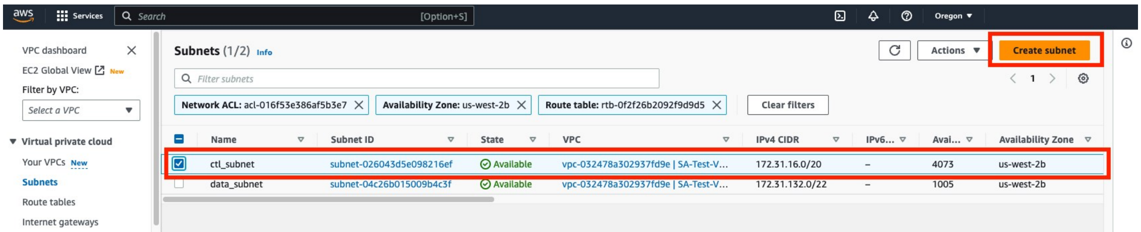
1. Navigate to the VPC Console in AWS.
2. Select Subnets under the Virtual Private Cloud tab or under Resources by Region in the VPC Dashboard.
3. Check that 2 subnets exists: one for the data and another for the control plane. Ensure that both subnets are in the same Availability Zone. This allows be both NICs to be connected on the EC2 instance at the same time.

> Naming your subnets
>
> For ease of use, name the subnets are ctrl-subnet and data-subnet to distinguish between them when creating an EC2 instance with cloudSwXtch installed.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

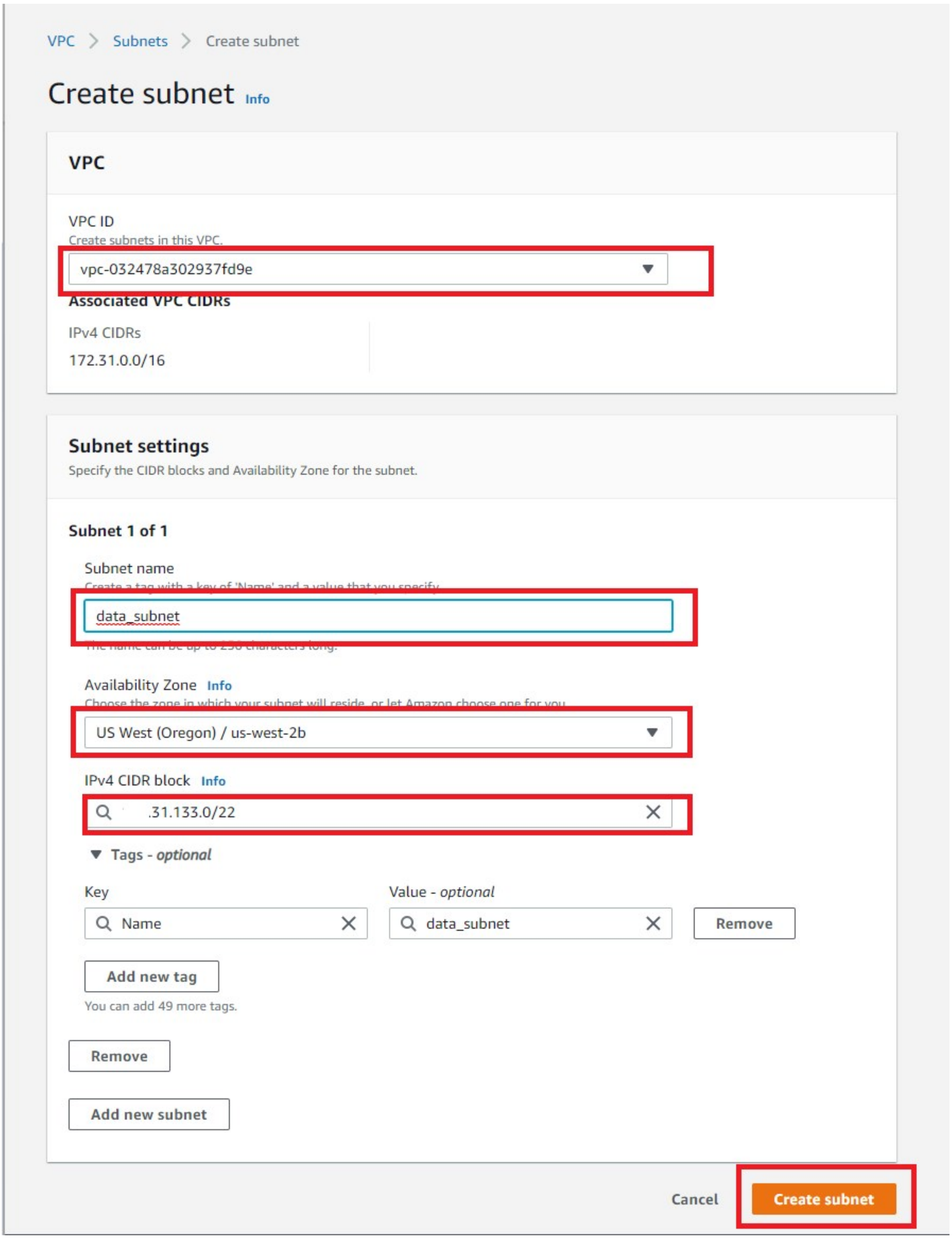


4. If a second subnet does not exist, select the orange Create Subnet button in the top right corner of the page.



5. Fill in the Create Subnet form like the example shown below, ensuring that the subnet is in the same VPC ID and Availability Zone as your other subnet. In the example below, the user is creating their data subnet.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



6. Click "Create Subnet." You should now have a new subnet on your list.

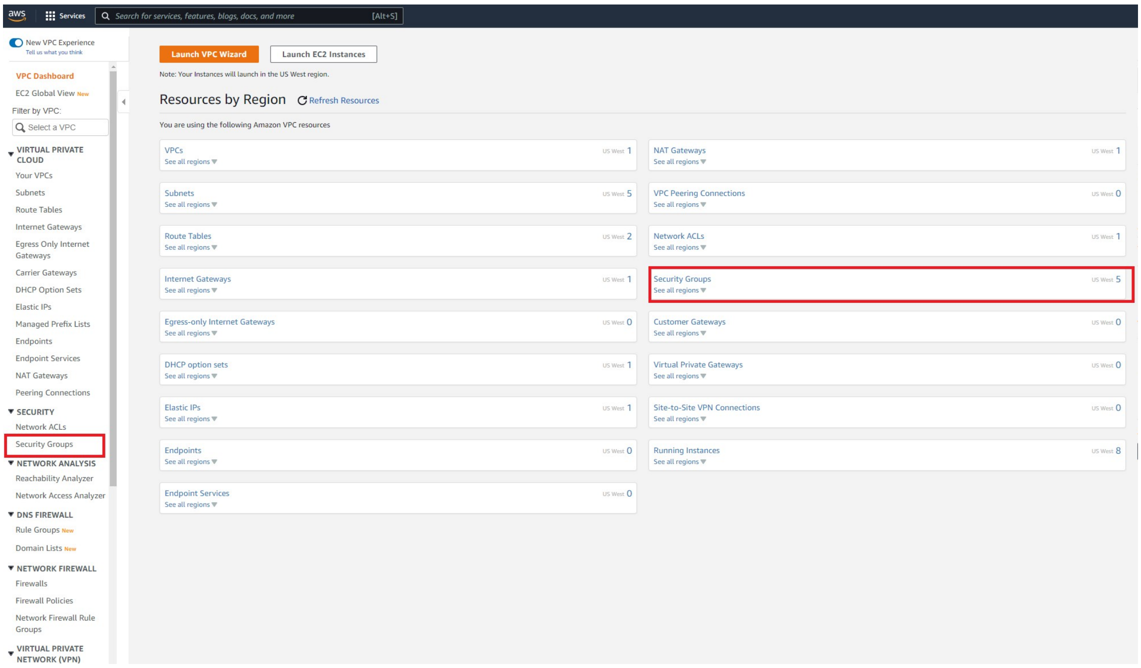
©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Verify Security Groups

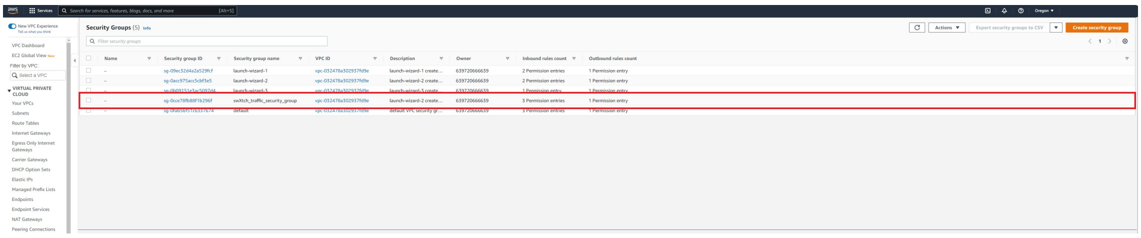
The security group contains the firewall settings for EC2 instances and interfaces (xNICs).

To ensure security groups are set up properly for cloudSwXtch:

1. Navigate to the VPC console.
2. Select the "Security Groups" link as shown below. (Note: There are multiple ways to get to the "Security Groups" page.)

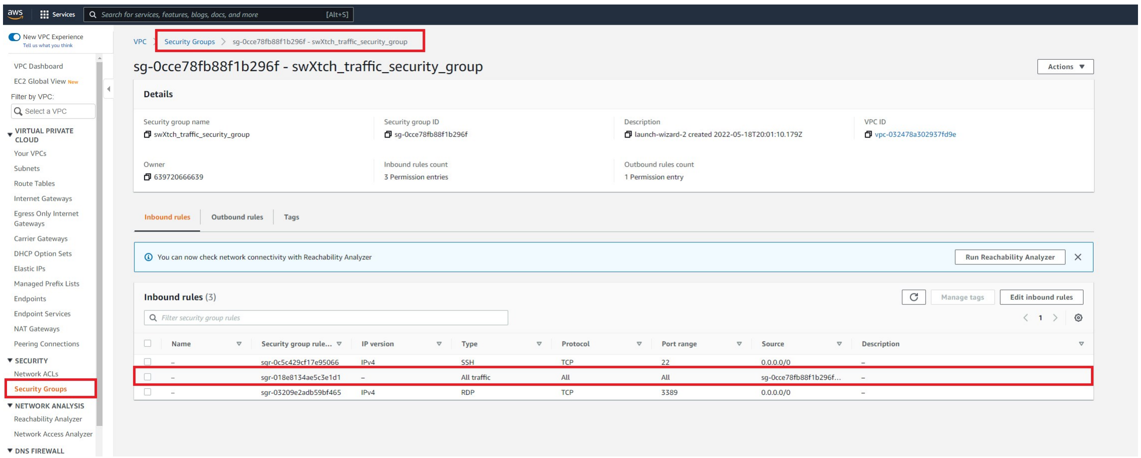


3. Select the Security Group that is normally used to create your EC2 instances for your application. (Note: The names in the example will be different in your environment.)

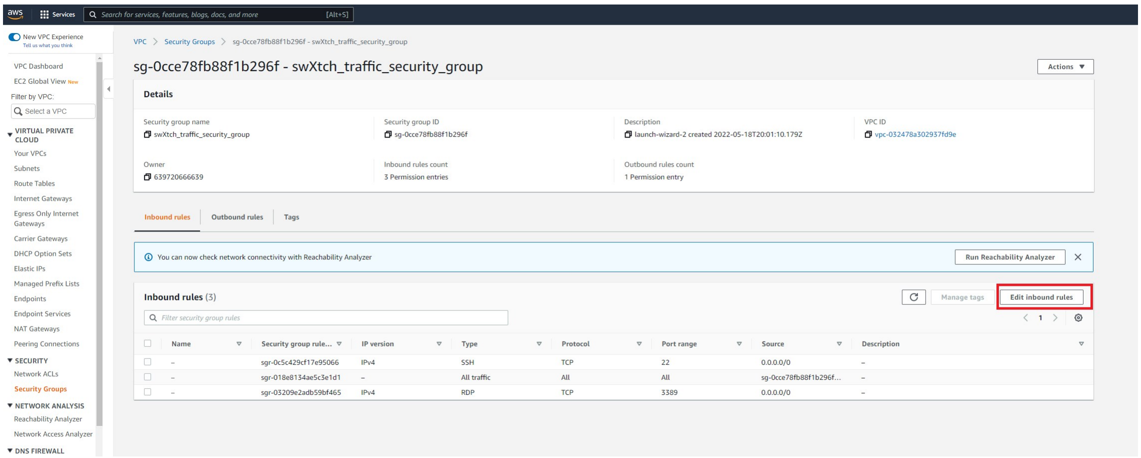


4. In order for certain features to work in your cloudSwXtch, you will need to add inbound rules to open specific ports originating from that security group. You can find the ports outlined in the cloudSwXtch System Requirements article under "Firewall and Security Group Rules."

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

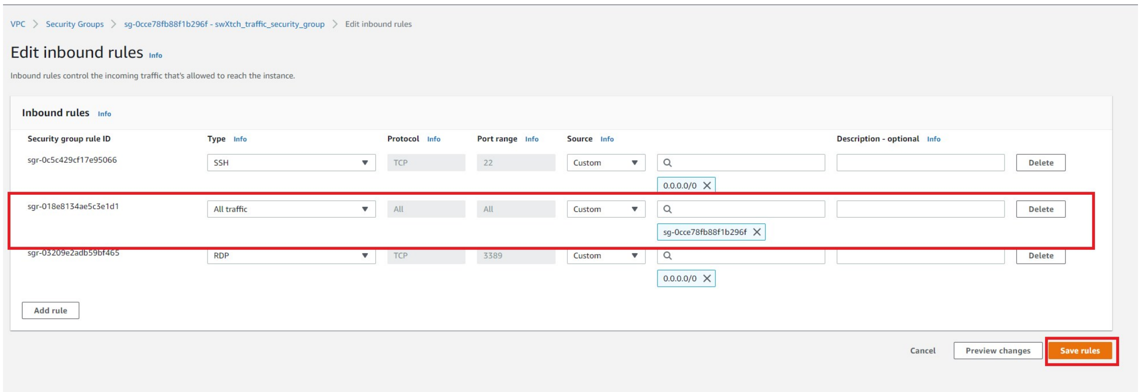


5. If an inbound rule does not exist, create it by selecting "Edit inbound rules."



6. Select "Add Rule."

7. Enter the information like the screenshot shown below verifying that the ID of the SG on Source matches the SG you are editing.



8. Save the rule.

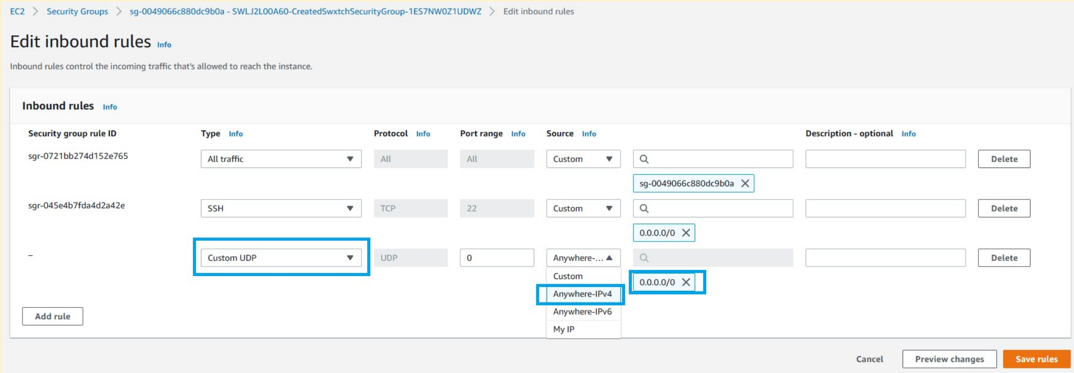
Additional Rules

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Mandatory Inbound Rule For Mesh

In order to use the Mesh feature bidirectionally between VPCs, users must also add the following inbound rule to each SG:

- Type: Custom UDP
- Protocol: UDP
- Port Range: 9999
- Source: Custom/Anywhere-IPv4 0.0.0.0/0



©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

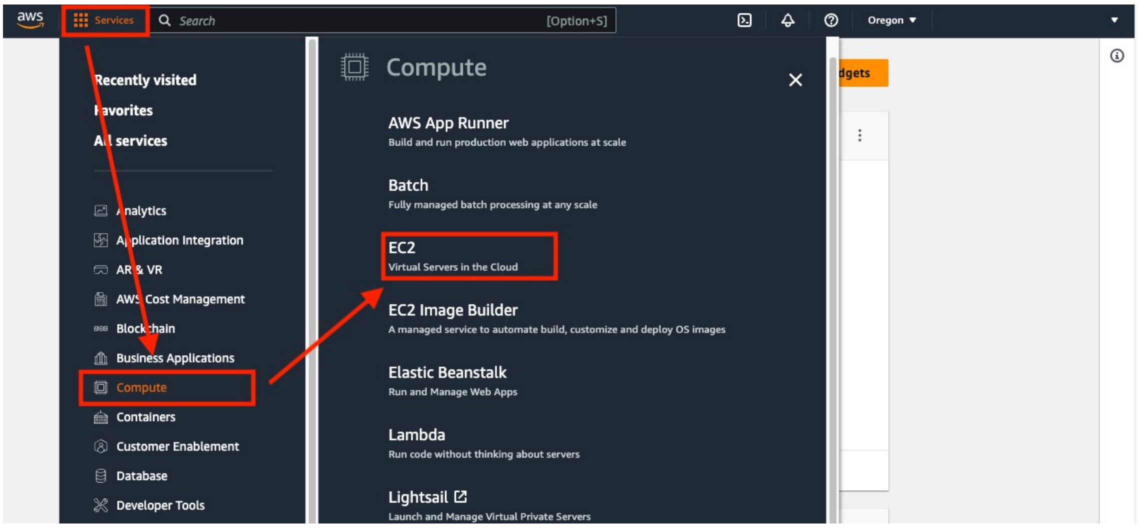
Create SSH Key Pair

WHAT TO EXPECT

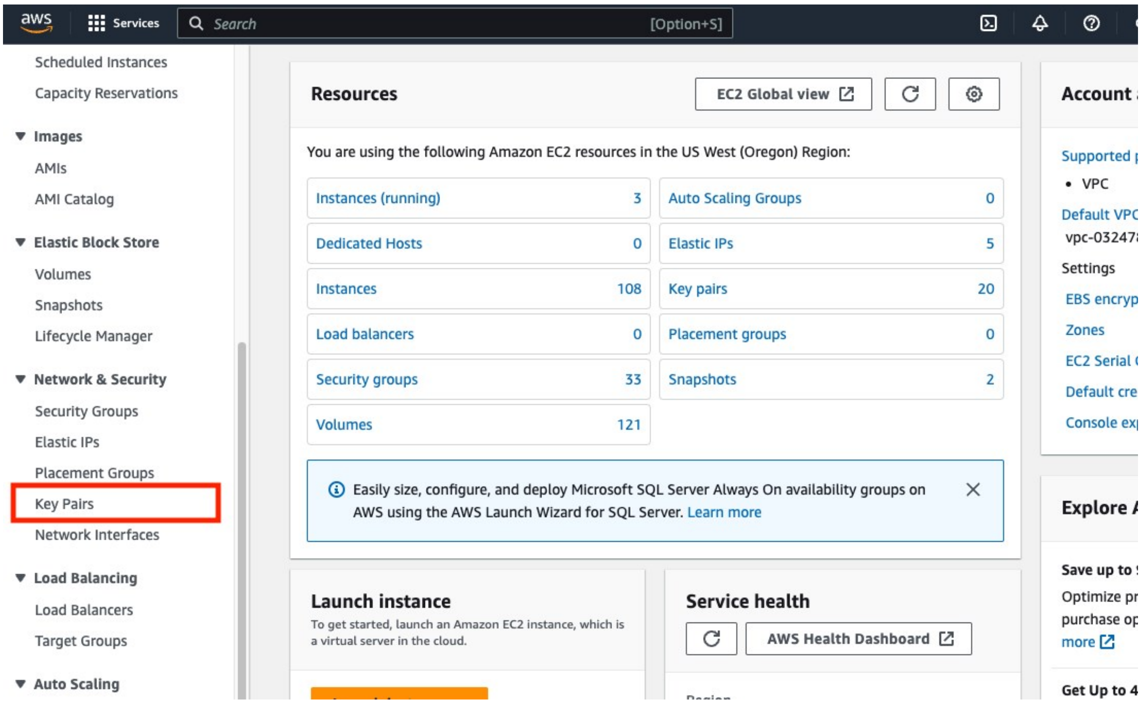
An SSH key pair is necessary when accessing a cloudSwXtch EC2 instance. If you do not already have one imported, please create an SSH key pair before beginning the cloudSwXtch on AWS creation process.

In the *AWS Management Console*, make sure you are in the region where you plan to use the cloudSwXtch instance.

1. Navigate to EC2
   - Select the “Services” menu in the AWS Management Console.
   - Click “Compute”
   - Select “EC2”



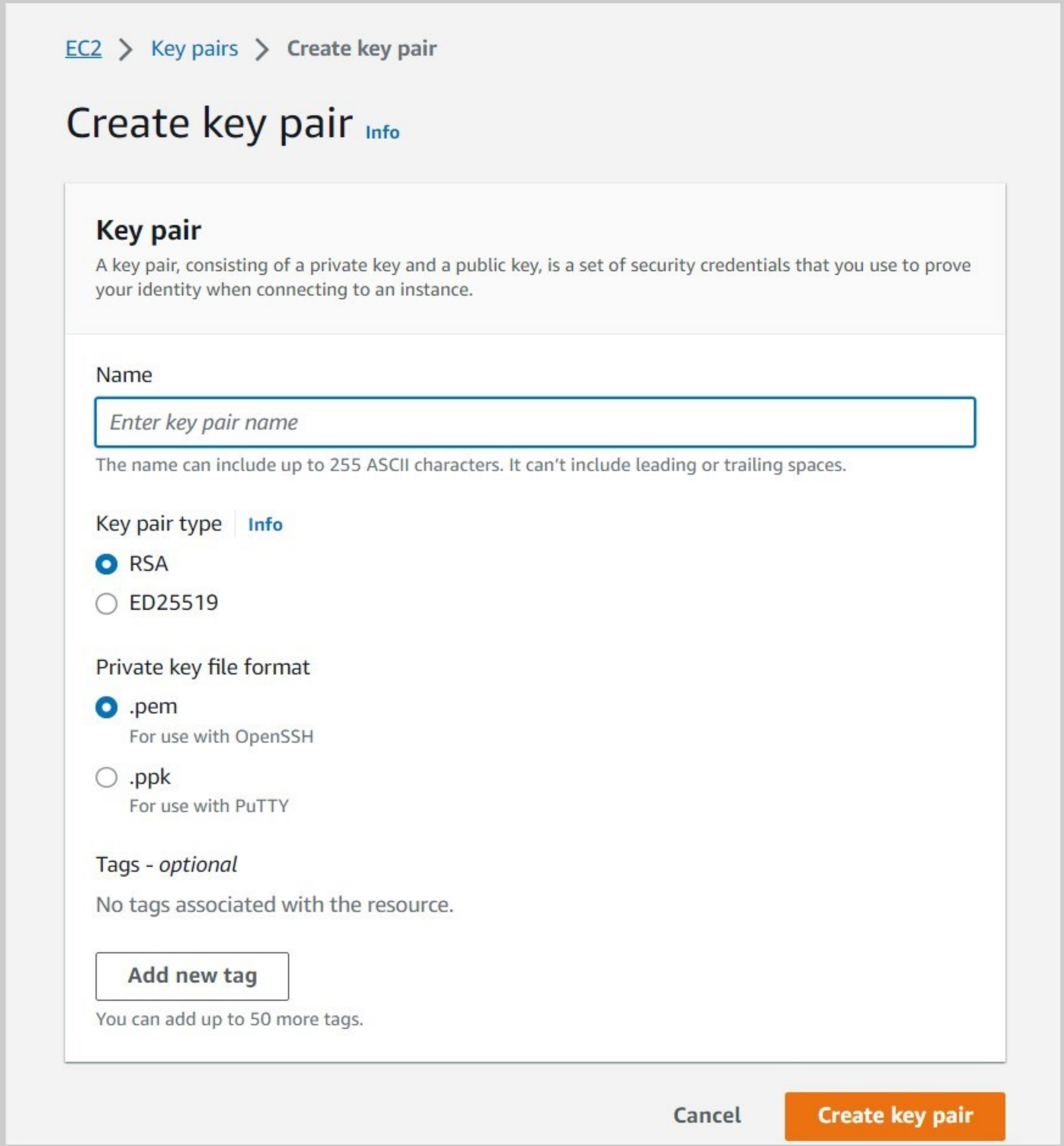
2. In EC2, click “Key Pairs” under the “Network & Security” tab in the menu on the left-hand side.



©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

3. Click “Create Key Pair”. A new window should open.
4. Under Name, enter something meaningful and descriptive for the key.
5. Depending on your needs, you have to choose RSA or ED25519, and .pem or .ppk (OpenSSH or PuTTY access).
6. Click on Create Key Pair.

   A file with the chosen extension will be downloaded to your computer (secret private key), and the other half of the pair will be store on AWS for later use (public key, used in conjunction with your private key to validate the access).



©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Install cloudSwXtch on AWS

WHAT TO EXPECT

Deployment of a cloudSwXtch consists of two parts: the creation of an EC2 instance containing cloudSwXtch and the installation of the xNIC software. The cloudSwXtch is considered "installed" once while the xNIC is installed on each agent instance that is a part of the network.

In this section, users will learn how to deploy cloudSwXtch for their AWS environment.

NOTE:

Root privileges are not required for deployment or operation. Our CloudFormation template allows an automated mechanism to update the installed cloudSwXtch version. This will deploy the latest version of the cloudSwXtch instead of the one packaged in the AMI, which requires root privileges to trigger the update from the product side. For upgrades, please see Upgrade cloudSwXtch on AWS on how to perform an upgrade from the client side. An upgrade from the client side does not require root privileges.

Creating a cloudSwXtch EC2 Instance

Prerequisites

Before starting, a user must do the following:

1. Review cloudSwXtch System Requirements.
2. Ensure that you already have an AWS account.
3. Create a virtual network (VPC). This *must* be created before deploying a cloudSwXtch.
4. Validate you have at least one subnet for your virtual network. A single subnet can be used for the control and data plane.
5. Verify a Security Group that allows access to all traffic inside the VPC. If one is not created, use default when creating a cloudSwXtch.
6. Create an SSH Key Pair.

Post-Installation

The following instructions detail how to deploy a cloudSwXtch Multicast instance. However, if a user decides to deploy a BYOL instance, they will need to complete the additional step of licensing their cloudSwXtch.

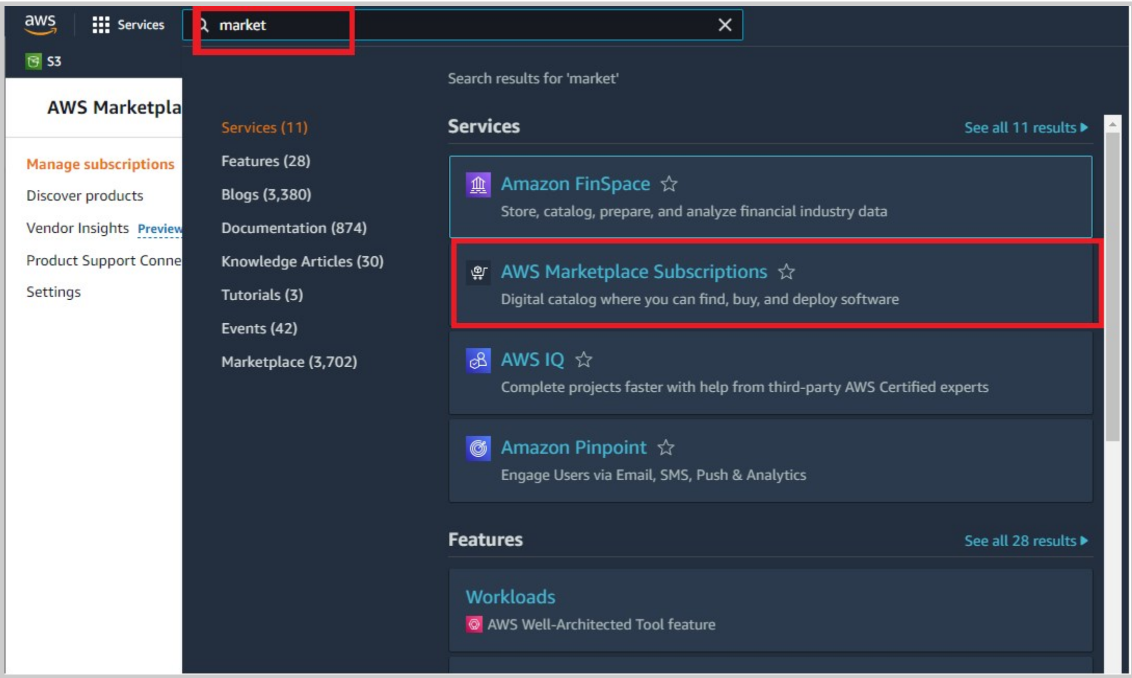
If all prerequisites are met, a cloudSwXtch can be created via the Marketplace in any region in approximately 10 minutes. If multi-AZ or multi-region is required then see Mesh for details. The installer will create a CloudFormation Stack to include the following resources:

- ControlEni Networking Interface for control data
- DataENI Networking Interface for data such as Multicast
- EC2Instance in Linux for the cloudSwxtch to run on

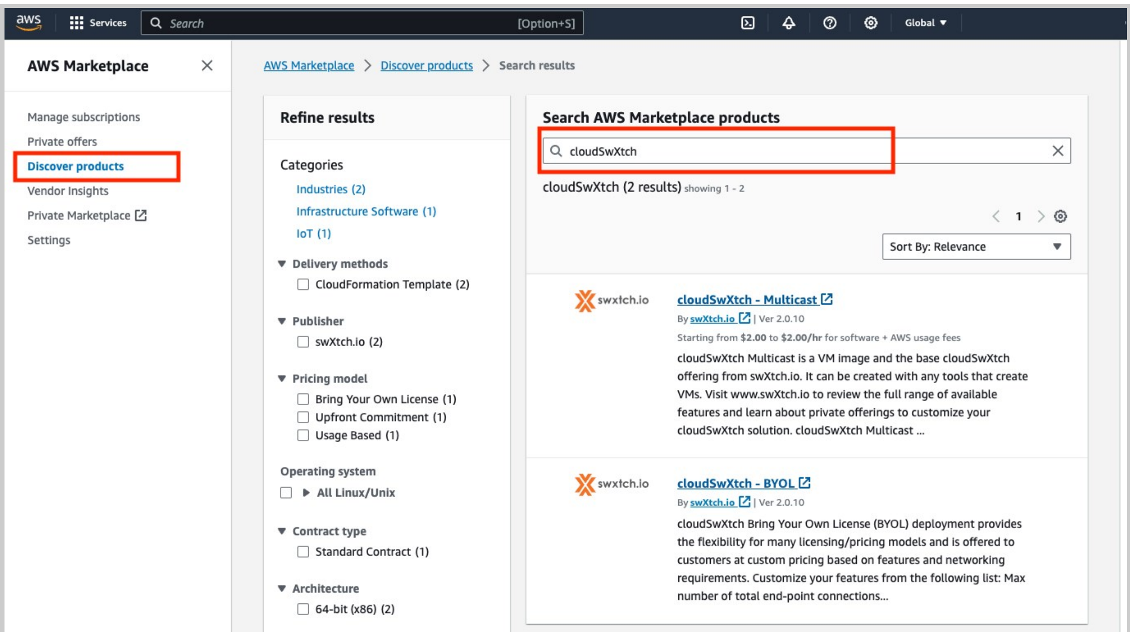
©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

In order to create a cloudSwXtch, please do the following steps.

1. Sign into AWS.
2. From the AWS console, search "Market" and select "AWS Marketplace Subscriptions" from the search results.



3. Select "Discover Products" in the AWS Marketplace menu on the left hand side.
4. Search for "cloudSwXtch."



5. Select a Tier (cloudSwXtch - Multicast or cloudSwXtch - BYOL) based on your usage requirements and features needed.
    1. Please read the cloudSwXtch System Requirements article for more information regarding cloudSwXtch sizing.
    2. For the purpose of this guide, the next screenshots will be for a cloudSwXtch Multicast deployment.

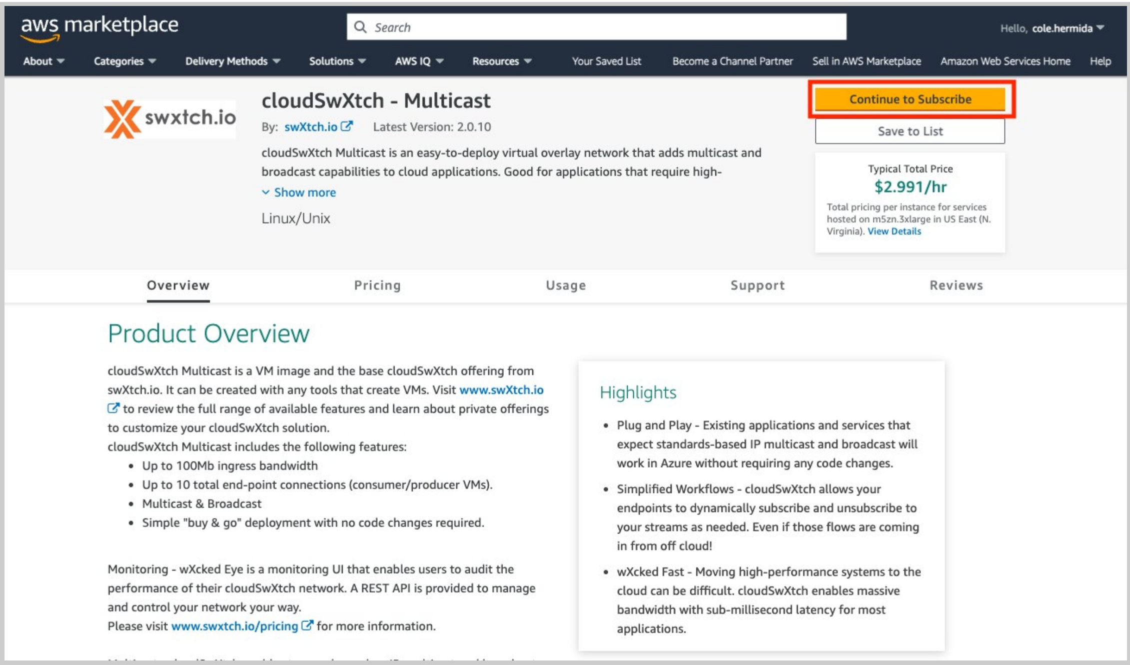
©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Endpoint Connections Limit

Be mindful of the number of endpoints you connect to your cloudSwXtch after creation. For example, by selecting the "cloudSwXtch Multicast" tier, you will be limited to 10 endpoint connections. If you know you will need more than that, consider deploying a cloudSwXtch BYOL instance.

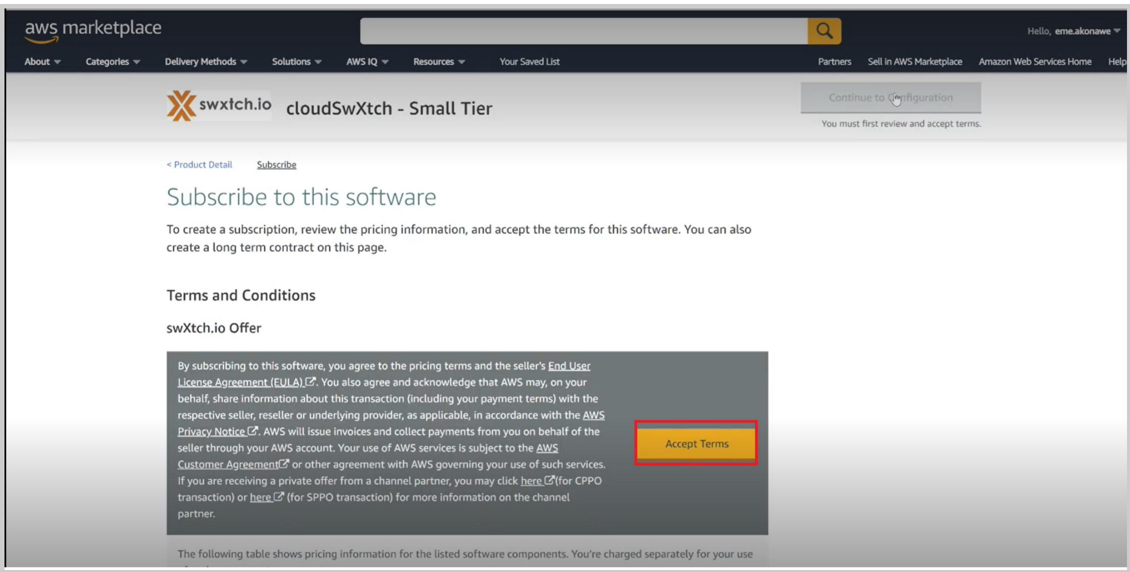
If you need to increase the number of endpoints, please view the AWS instructions here. Note that if your new instance type exceeds the size of your tier, you must contact support@swxtch.io to update your license.

6. Select "Continue to Subscribe" after reviewing the product information. Note: The "Typical Total Price" is calculated with the recommended instance size included in the final monthly value and a utilization of 24x7. Please note: The cost in "Software Pricing Details" is for the cloudSwXtch and does not include costs for the AWS instance.



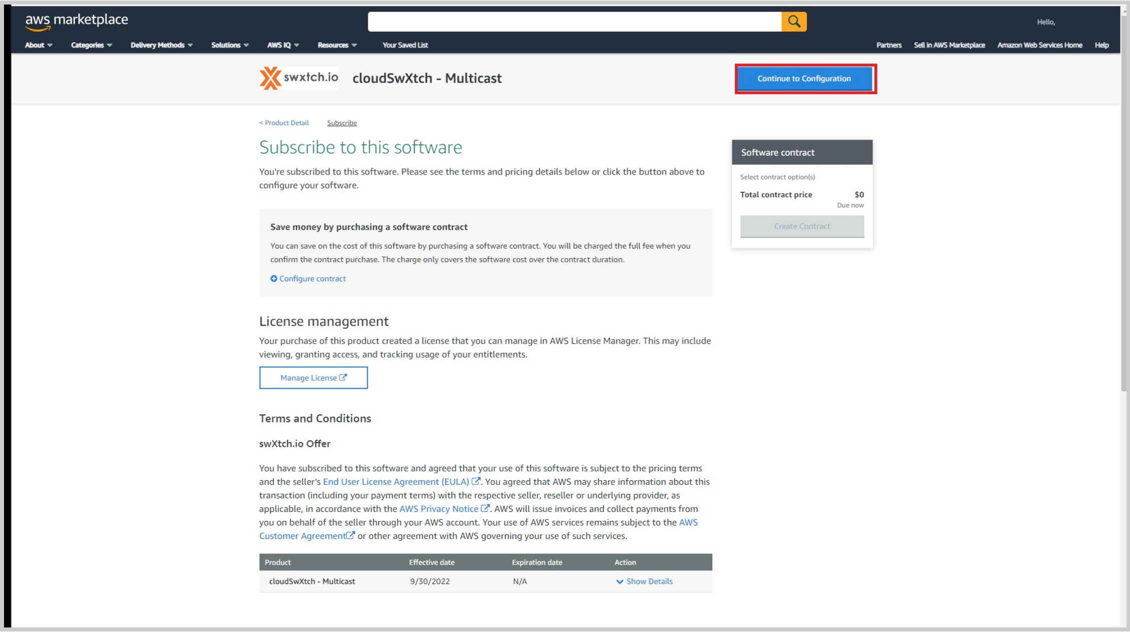
7. Review the Terms and Conditions.

8. Select "Accept Terms" if they are acceptable.

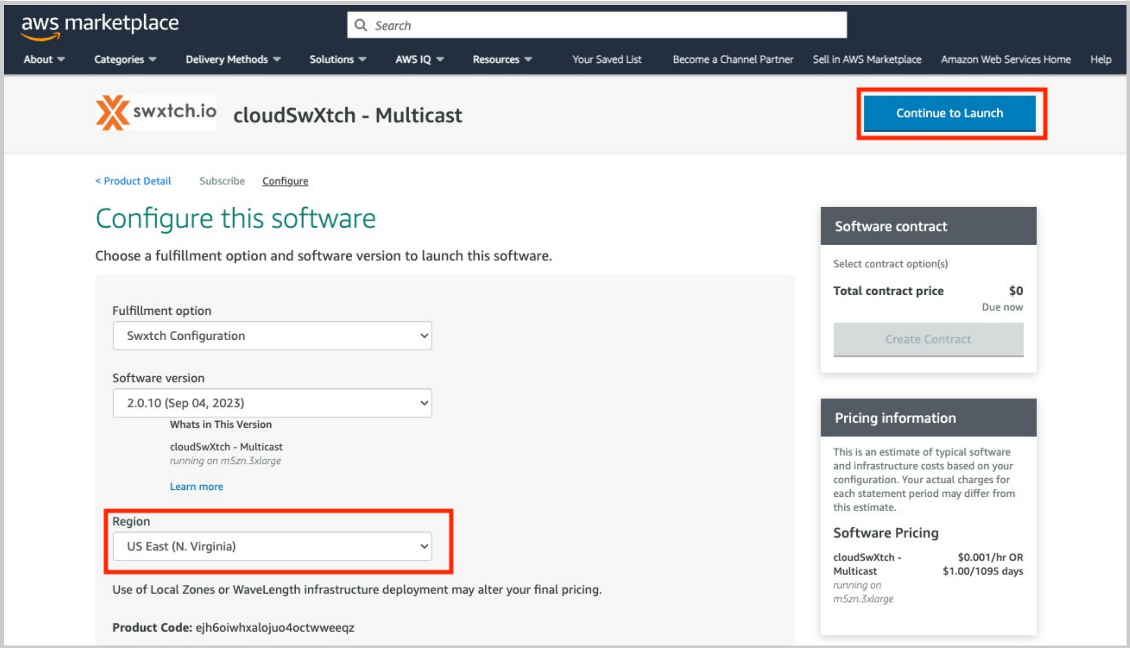


©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

9. Select "Continue to Configuration" after reading the subscription and license management.



10. Select the desired "Region" and then select "Continue to Launch". (Note: If you select a region that does not match the region you began with, then it may not work even if selected here.)



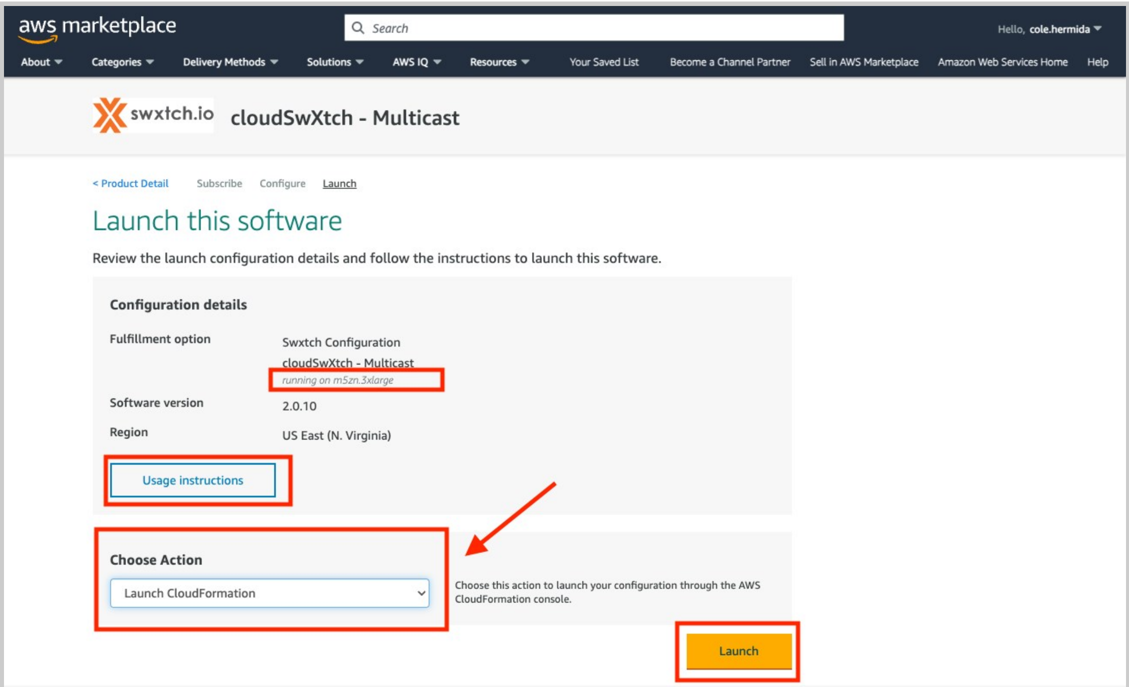
©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

INSTANCE TYPES

Note how the cloudSwXtch Marketplace install selects the appropriate VM size in the Fulfillment section based on the cloudSwXtch tier. Please ensure that the instance type matches one of the options below:

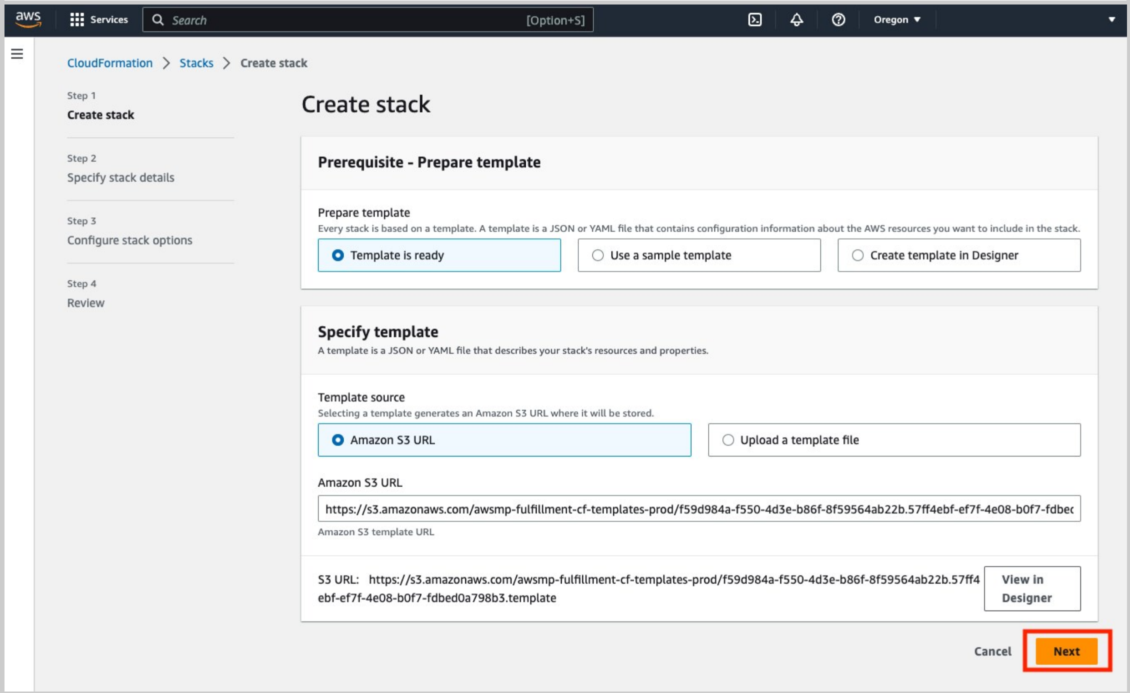
- m5.xlarge
- m5.2xlarge
- m5.4xlarge
- m5.12xlarge
- m5.16xlarge
- m5.24xlarge
- m5zn.xlarge
- m5zn.2xlarge
- m5zn.3xlarge
- m5zn.6xlarge
- m5zn.12xlarge

11. Read “Usage Instructions” if you desire.
12. Use the “Choose Action” dropdown menu and select “Launch CloudFormation”.
13. Click “Launch”.



14. Keep Settings on default on the "Create Stack" page and select "Next."

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



15. On the Specify stack details page, complete the following:

    1. Under “Stack name," enter your desired name. Keep in mind that this will be used for everything added to the stack. For example: “resource name,” “security groups,” “EC2 instance name,” etc.

    2. Under “CidrIpForInboundOutboundTraffic,” use 0.0.0.0/0 so that you can SSH to the virtual machine from any IP address. You can also pick a more restrictive range if desired.

    3. Under “ControlSubnet,” use the dropdown to find the control subnet you created (recommended: *ctrl-subnet*).

    4. Under “DataSubnet,” use the dropdown to find the control subnet you created. Both control and data can share the same subnet.

        1. Alternatively, for better performance, a user can assign a separate subnet for their data subnet.

    5. For “InstanceType,” there should be "Fulfillment" data from the earlier step.

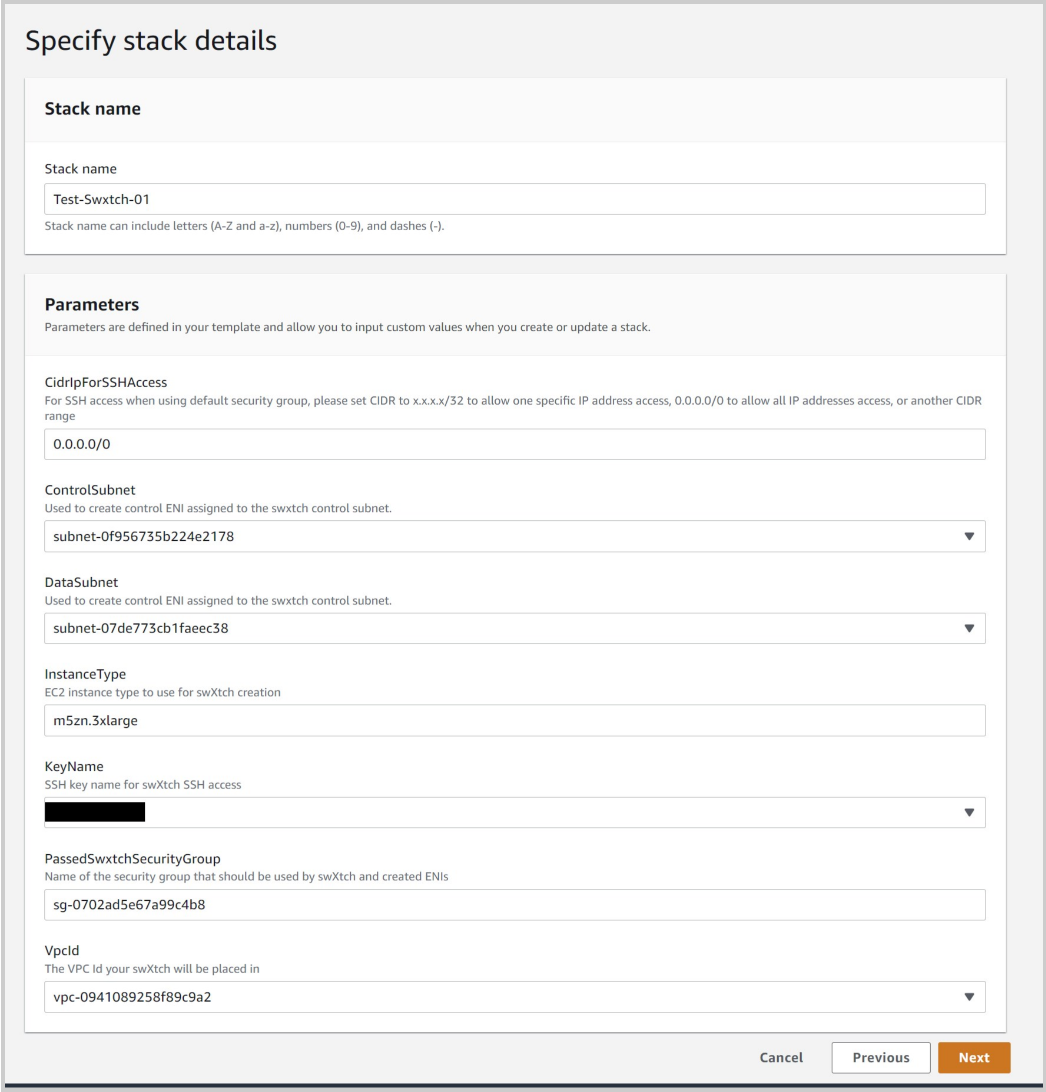
    6. Under “KeyName,” use the dropdown to find your previously created or imported SSH key.

    7. In “PassedSwxtchSecruityGroup,” use “default” and one will be created during the installation process. Alternatively, you can enter the ID of an already created security group. It will be something similar to "sg-009273855418af38d."

    8. Under “VpcId,” select from the dropdown to find the already created VPC id.

    9. Here is an example of how your template would look like:

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



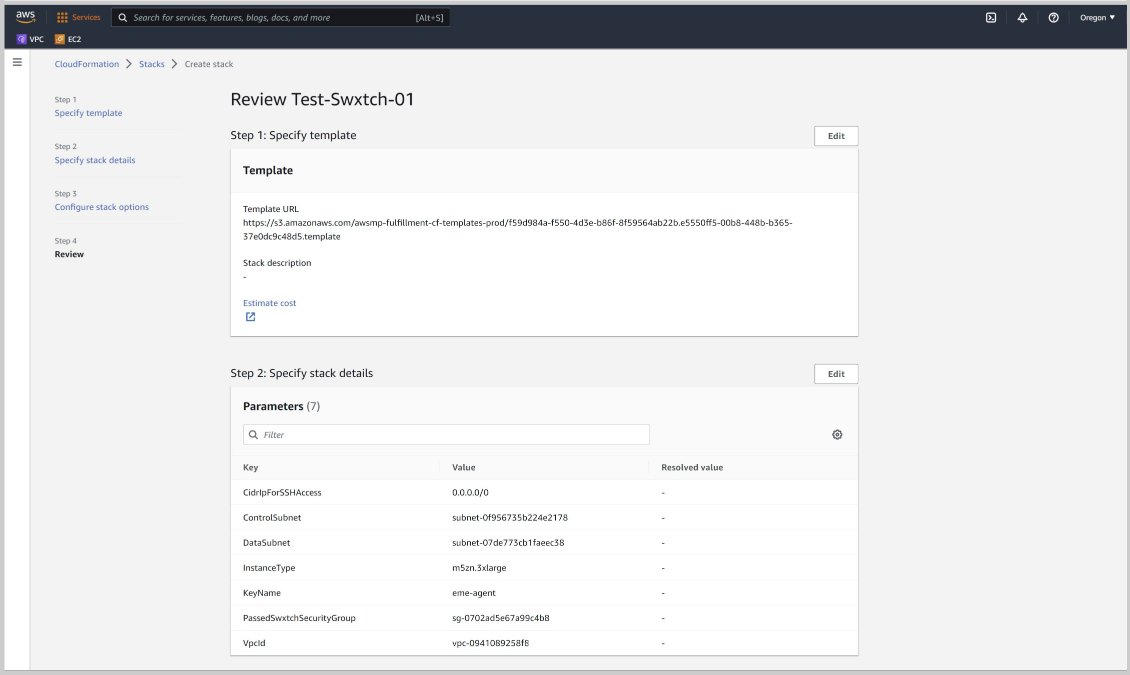
16. Click "Next."

17. The “Configuring stack options” page is completely optional. You can assign tags for your stack, set additional IAM permissions, stack failure options, etc.

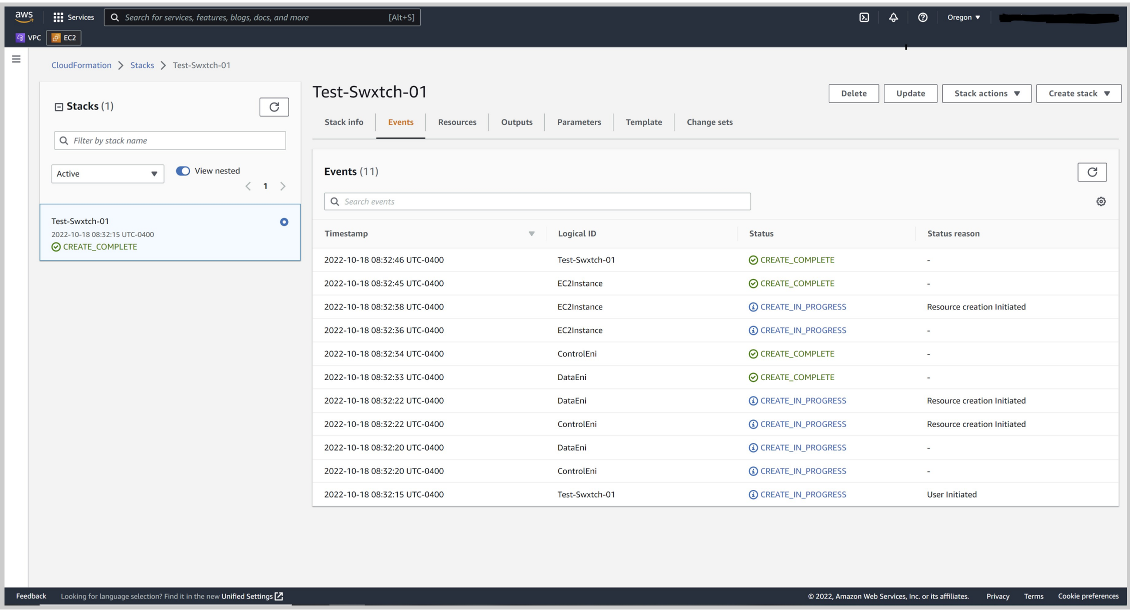
18. Click "Next" if you don't need to make any changes.

19. Verify that your parameters are accurate on the final "Review" page. If you need to change anything, select "Edit."

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



20. Click "Submit." On the next page, you can view the creation of your stack.



Your EC2 instance has now been created. You can view it on the EC2/Instances list and connect to your cloudSwXtch from there.

21. Once you have connected with SSH to your cloudSwXtch as root user (sudo su), navigate to the cloudSwXtch directory (cd /swxtch) then run the following command:

Text

None | Copy

```
sudo swxtch/swxtch-top dashboard --switch <swXtch-ip>
```

NOTE

Use the cloudSwXtch-name in place of the IP address if DNS resolution is setup or "localhost."

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

This will display the cloudSwXtch's swxtch-top dashboard. In "Status," you should see "OK." This will let you know that your cloudSwXtch has been successfully deployed. You can review more information regarding swxtch-top in the swxtch-top article.

> INSTALLING AN XNIC
>
> If this is a new installation, then each client that is expected to receive or transmit to the cloudSwXtch will need an xNIC installed.
>
> If this is an existing cloudSwXtch replacement, then each client with an xNIC already installed will need to be upgraded to match the current cloudSwXtch version.
>
> You can find more information about xNIC installation, here.

Required Step for BYOL: Contact swXtch.io for a license

Users deploying a BYOL instance of cloudSwXtch will need to contact swXtch.io for a license file. For more information, see How to License a cloudSwXtch.

Checking the Health of Your cloudSwXtch Instance

It is important to ensure your AWS system is healthy. AWS provides AWS CloudWatch as a way to check on the health of your system. To check on the cloudSwXtch EC2 instance, read more here.

Upgrading cloudSwXtch on AWS

It is important that your cloudSwXtch instance is up to date. To learn how to upgrade your cloudSwXtch, you can read more here.

Deleting cloudSwXtch on AWS

To learn how to delete your cloudSwXtch, you can read more here.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Deploy cloudSwXtch with Terraform on AWS

WHAT TO EXPECT

In this article, you will learn how to deploy a cloudSwXtch instance on AWS using a Terraform script.

Prerequisites:

For this script to work, you will need to have already provisioned your VPC, Subnets, and SSH Keys. You will plug those parameter values into your AWS/terraform/terraform.tfvars file.

Deploying a Terraform Script

1. Choose what platform you would like to run Terraform on. For this example, the user is on a Linux machine. Download intructions can be found at: terraform.io/downloads

2. Clone the repository using SSH. Please note: You will need an SSH key set up with GitHub.

   Console | Copy

   ```
   $ git clone git@github.com:swxtchio/cloudSwXtch-support
   ```

   Or, alternatively, you can clone with the HTTPS URL: (here on GitHub)

   Console | Copy

   ```
   $ git clone https://github.com/swxtchio/cloudSwXtch-support.git
   ```

   Then:

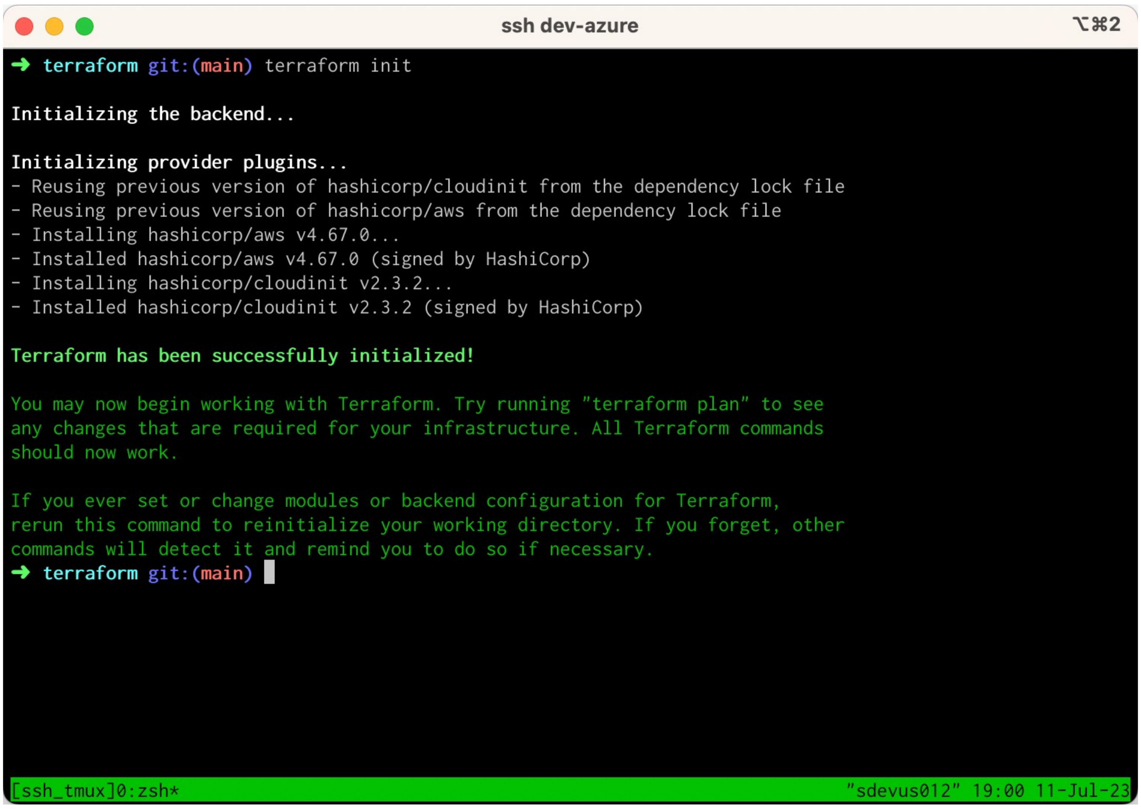
   Console | Copy

   ```
   $ cd cloudSwXtch-support/AWS/terraform
   ```

3. Update the values in the AWS/terraform/terraform.tfvars file to match your existing AWS resources such as: VPC id, Subnet IDs, and SSH Key names.

4. Run terraform init inside the AWS/terraform/ directory.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



5. For this step you'll need to have authenticated your AWS credentials inside the console. Or you can pass the credentials with environmental variables. One simple way to do this is using an Access Key (AK). If you don't have one, you can generate your AK in Amazon's IAM->Users->(your user), on the Security Credentials tab, Access Keys. Then, you have to export the following:

Console | Copy

```
$ export AWS_ACCESS_KEY_ID="anaccesskey"
$ export AWS_SECRET_ACCESS_KEY="asecretkey"
$ export AWS_REGION="us-west-2"
```

Now that Terraform has been initialized and you're authenticated, run this command to evaluate the config and confirm the desired output which will be shown:

Console | Copy

```
$ terraform plan
```

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

```
ssh dev-azure                                                                    ⌥⌘2
      + tags                   = {
          + "Name" = "swxtch_traffic_swxtch-tf-example_sg"
        }
      + tags_all               = {
          + "Name" = "swxtch_traffic_swxtch-tf-example_sg"
        }
      + vpc_id                 = "vpc-06974b4b531c0f697"
    }

Plan: 7 to add, 0 to change, 0 to destroy.

Changes to Outputs:
  + swxtches = [
      + {
          + ctrl_ip  = (known after apply)
          + data_ip  = (known after apply)
          + username = "ubuntu"
        },
      + {
          + ctrl_ip  = (known after apply)
          + data_ip  = (known after apply)
          + username = "ubuntu"
        },
    ]

─────────────────────────────────────────────────────────────────────────────────────────

Note: You didn't use the -out option to save this plan, so Terraform can't guarantee to take exactly
these actions if you run "terraform apply" now.
➜ terraform git:(main)
[ssh_tmux]0:zsh*                                                "sdevus012" 19:02 11-Jul-23
```

> This is the result of running terraform plan with 2 cloudSwXtches. The provided terraform example creates a security group for all of the deployed resources: two aws_network_interface for each of the cloudSwXtches and an aws_instance for each cloudSwXtch.

6. Run the Terraform apply command (followed by “yes” when prompted) to approve the action.

Console | Copy

```
terraform apply
yes
```

7. Once the resources have been applied successfully, you should see an output similar to this:

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

```
ssh dev-azure                                                                 ⌥⌘2
aws_network_interface.swxtch_data[1]: Creating...
aws_network_interface.swxtch_data[0]: Creating...
aws_network_interface.swxtch_ctrl[1]: Creation complete after 1s [id=eni-099a6704b48871b65]
aws_network_interface.swxtch_data[0]: Creation complete after 1s [id=eni-05c53da54a04ea3be]
aws_network_interface.swxtch_data[1]: Creation complete after 1s [id=eni-0c364aa6898a7e2a2]
aws_network_interface.swxtch_ctrl[0]: Creation complete after 1s [id=eni-0c765fb2ad379495b]
aws_instance.swxtch[0]: Creating...
aws_instance.swxtch[1]: Creating...
aws_instance.swxtch[0]: Still creating... [10s elapsed]
aws_instance.swxtch[1]: Still creating... [10s elapsed]
aws_instance.swxtch[1]: Creation complete after 14s [id=i-06032053dbf5a744e]
aws_instance.swxtch[0]: Creation complete after 14s [id=i-08ba3f7cfa686764c]

Apply complete! Resources: 7 added, 0 changed, 0 destroyed.

Outputs:

swxtches = [
  {
    "ctrl_ip" = "172.31.33.152"
    "data_ip" = "172.31.132.216"
    "username" = "ubuntu"
  },
  {
    "ctrl_ip" = "172.31.46.220"
    "data_ip" = "172.31.133.206"
    "username" = "ubuntu"
  },
]
➜ terraform git:(main) 
[ssh_tmux]0:terraform*                                        "sdevus012" 19:05 11-Jul-23
```

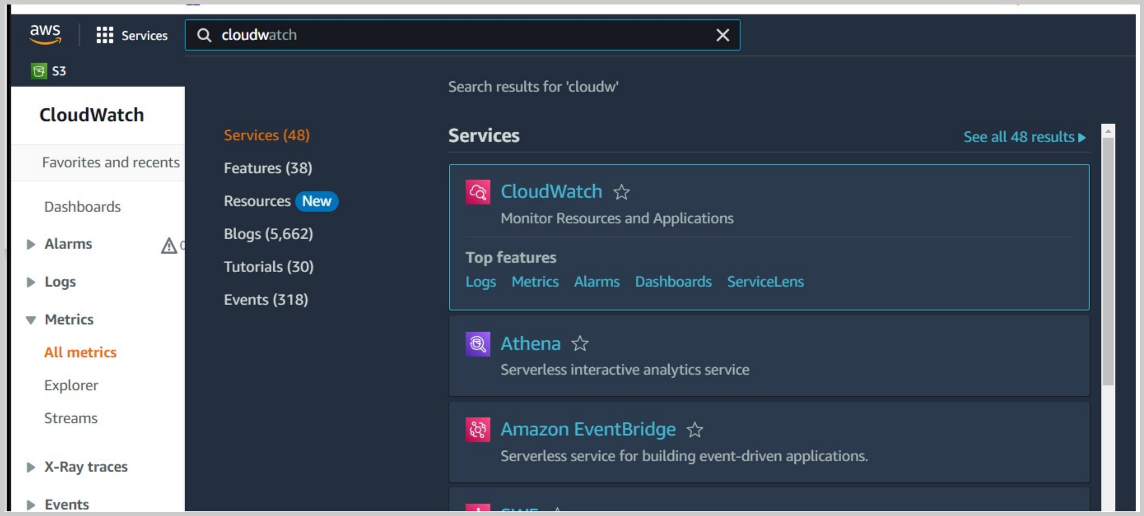
You can view the resources created from your AWS portal as confirmation of a successful deployment.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Check Health of cloudSwXtch Instance on AWS

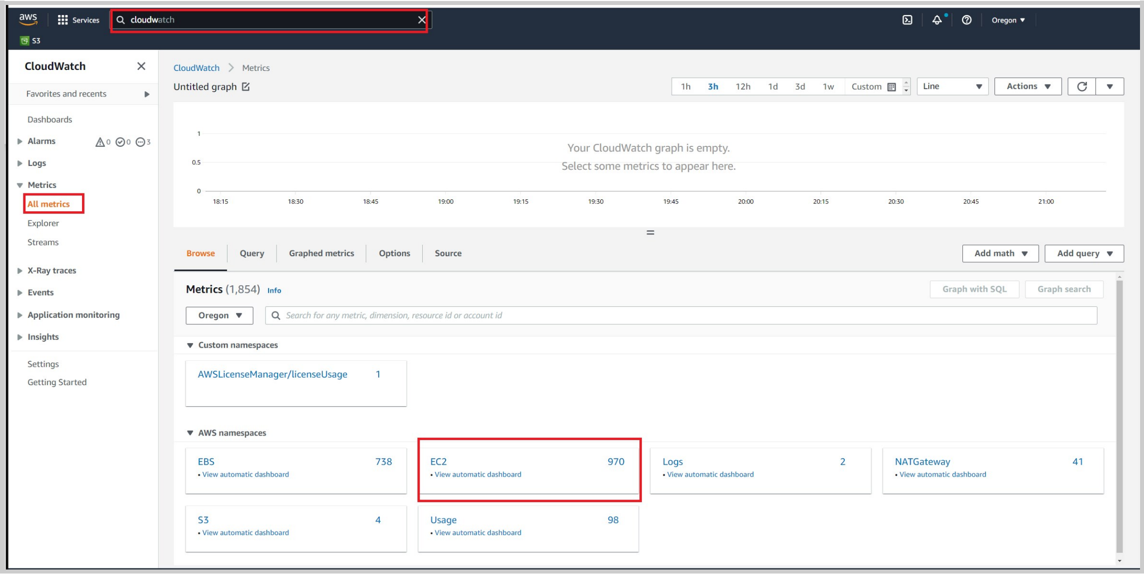
It is important to ensure your AWS system is healthy. AWS provides AWS CloudWatch as a way to check on the health of your system. To check on the cloudSwXtch EC2 instance:

1. Search for "CloudWatch" in the AWS Search bar.



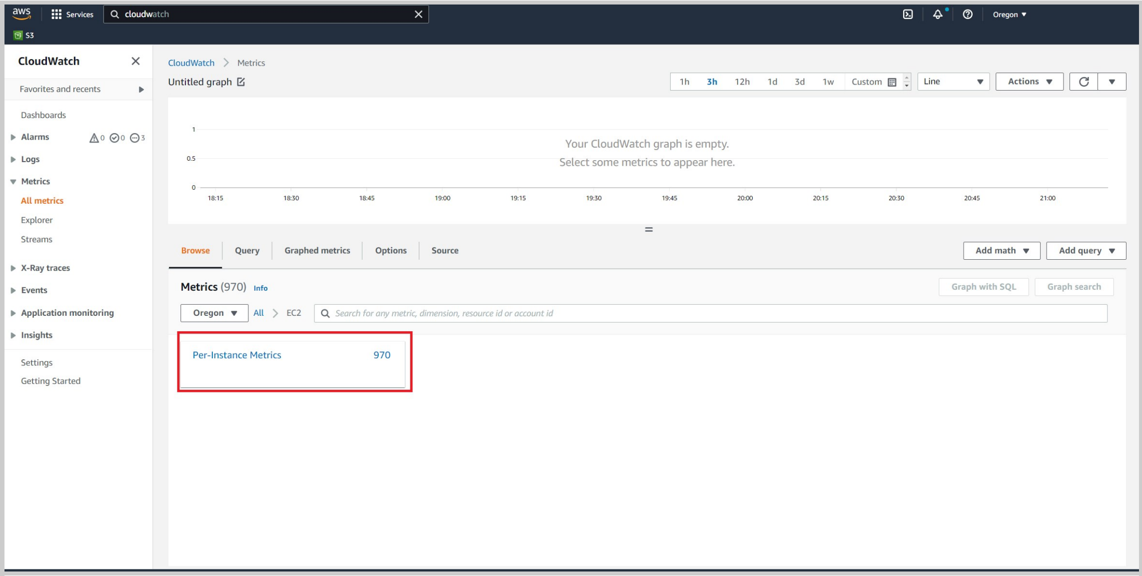
2. Select "All Metrics" on the left tree menu under "Metrics."

3. Select "EC2."



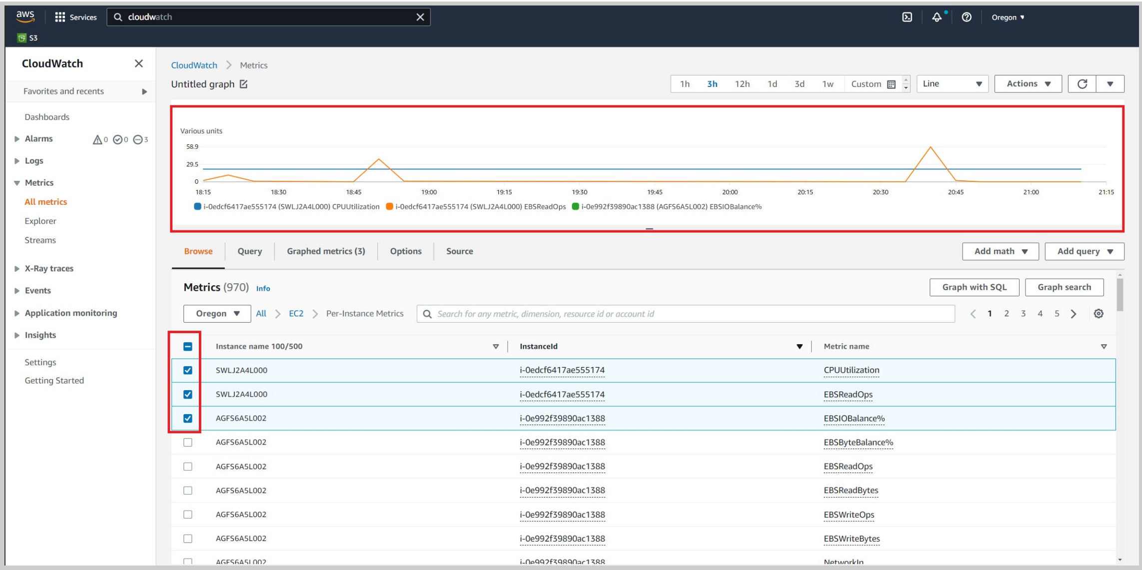
©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

4. Select "Per-Instance Metrics."



5. Sort as desired. Instance ID works well.

6. View data in graph.



WARNING

A cloudSwXtch instance will consume CPU even when the connected agents are not producing/consuming data. This is because there are several vCPUs configured to constantly watch the interfaces.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Delete cloudSwXtch on AWS

WHAT TO EXPECT

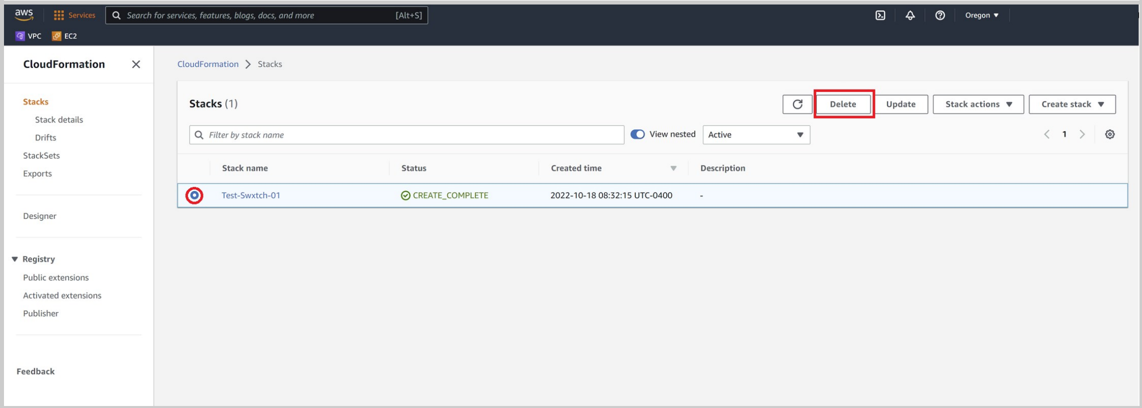
In this section, users will learn how to delete cloudSwXtch from their AWS environment.

Prior to deleting a cloudSwXtch, it is advised to uninstall any xNICs using it. See xNIC Installation.

It is important to note that since your cloudSwXtch was created using a Stack, you do not want to just delete the EC2 instance by itself. Rather, you will want to delete the Stack as whole, which will also delete all associated resources as well.

To delete a cloudSwXtch:

1. Navigate to your cloud stack: “Cloud Formation → Stacks”



2. Select the stack you want to delete.
3. Click "Delete" and then confirm on the popup window.
4. Refresh the page after a minute or so to confirm the stack has been deleted.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

cloudSwXtch on Azure

Pre-installation Steps

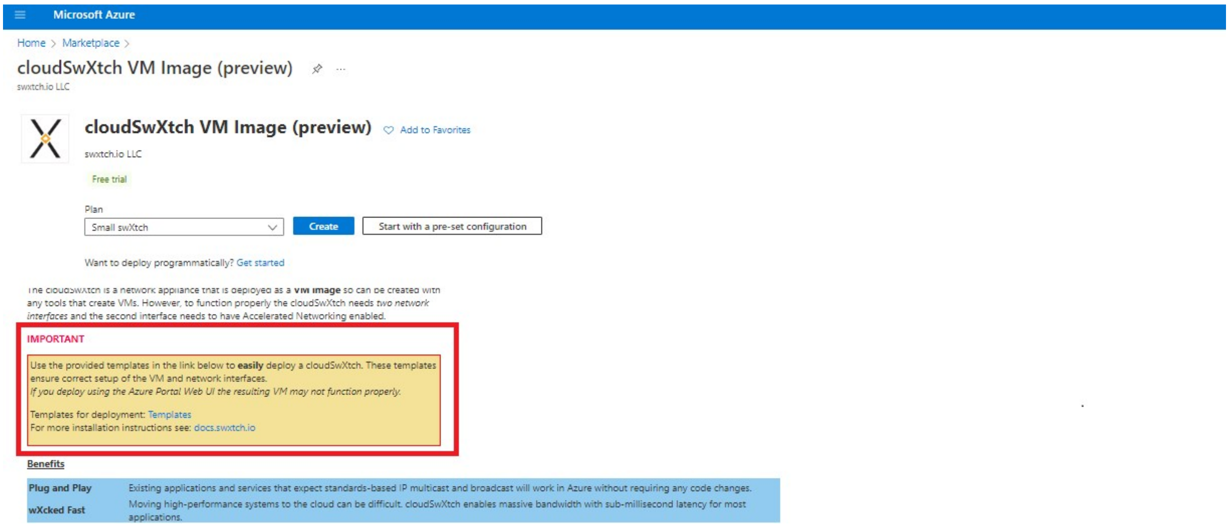
There are three methods that a cloudSwXtch instance can be deployed using the Azure Portal: via template, via Terraform, and via the Market Place.

Out of those three options, the `preferred method is via template` as it will create the two subnets needed for a cloudSwXtch to operate. In addition, the Network Interface will have "Accelerated Networking" enabled.

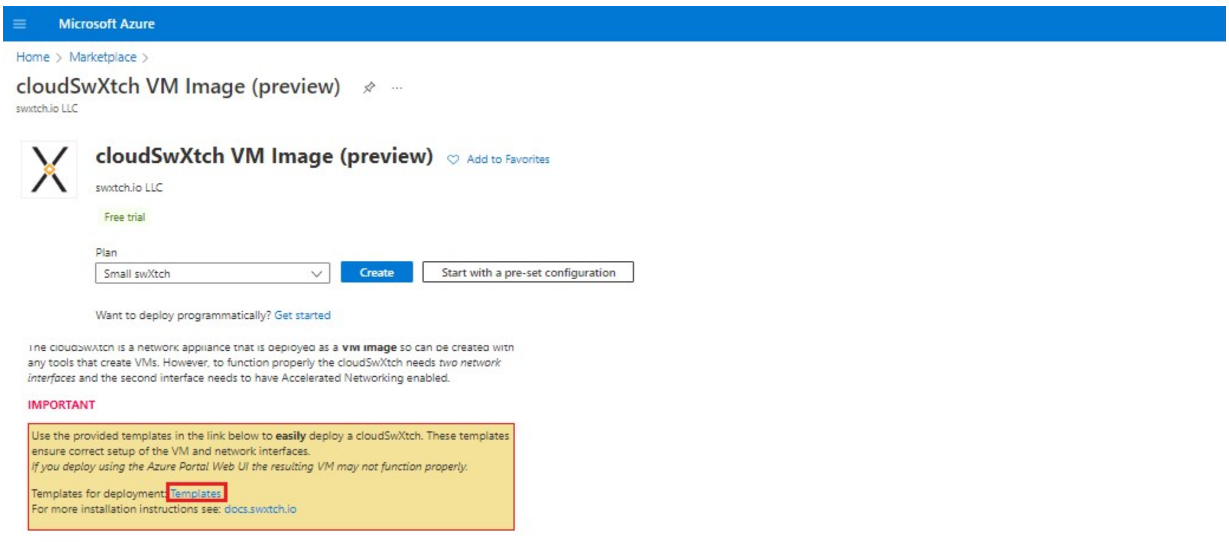
Template Method (PREFERRED):

1. Review system requirements
2. Validate subnets on Azure
3. Create Azure cloudSwXtch Template
4. Install cloudSwXtch on Azure

The template method is also mentioned in the Market Place cloudSwXtch installation as highlighted below:

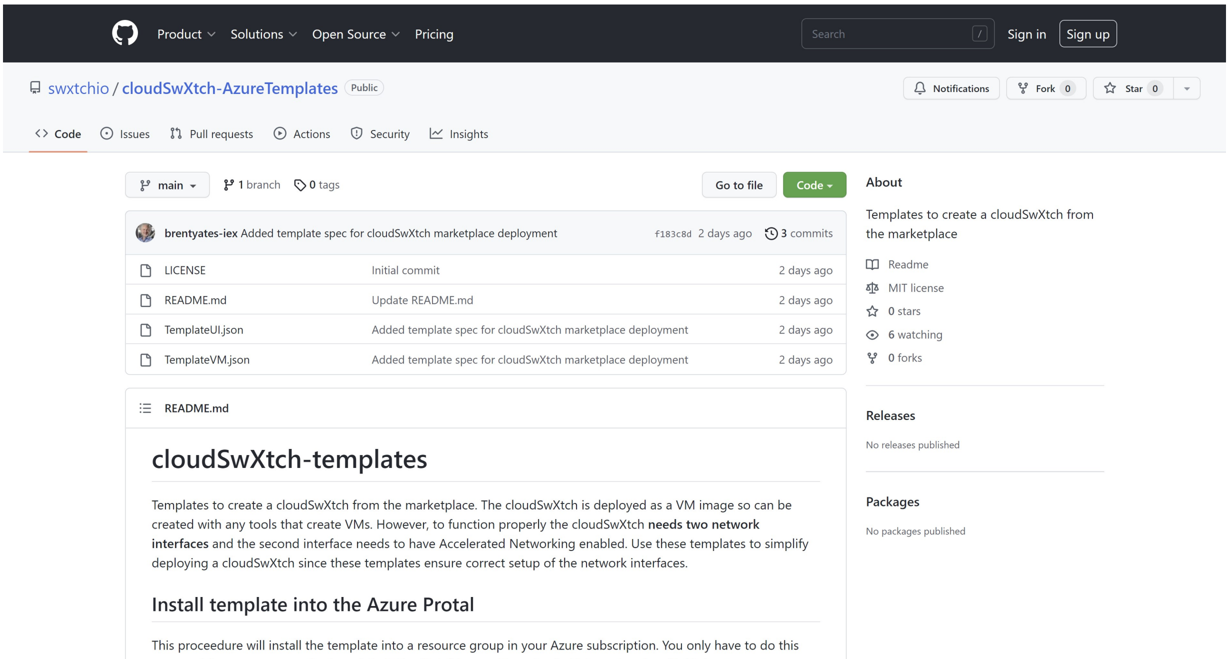


Clicking on the “Templates” hyperlink shows more information about the template creation method.



Selecting this link will open the page below:

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



Alternative Install Methods

Market Place

While a user can create a cloudSwXtch via the Market Place, it will require additional work in terms of maintenance. For example, the cloudSwXtch would have to be updated to add a second NIC and then have accelerated networking manually enabled. With the template method, users can bypass all this.

If you still wish to use the Market Place method, you can find more information here.

Terraform

If you wish to deploy cloudSwXtch via Terraform, you can find more information here.

Air-Gapped

For closed environments, users can follow the Azure Air-Gapped installation instructions here.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Validate Subnets on Azure

WHAT TO EXPECT

A virtual network must be created before deploying a cloudSwXtch EC2 instance.

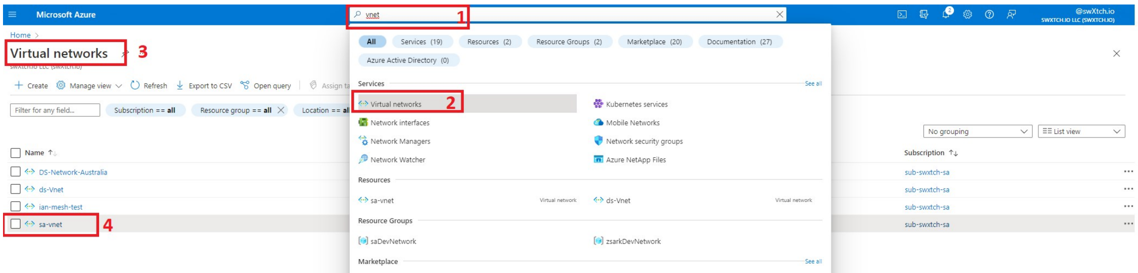
- It must contain at least one subnet that's used for both the control and data plane communication.
  - It is recommended that it is private facing and does not auto-assign public IPs.
  - This single subnet will be used for xNIC installation.

The subnets will also be used xNIC installations.

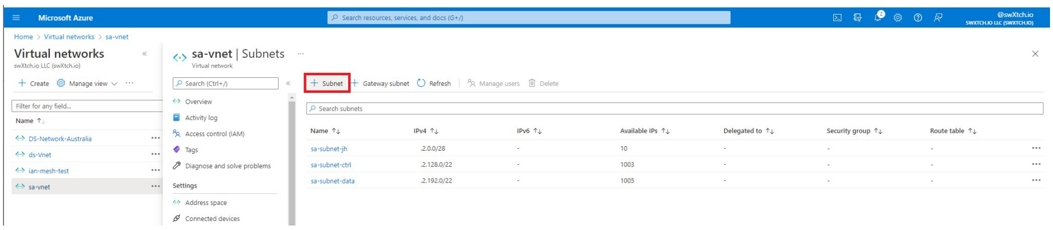
In this section, users will learn how to validate whether a subnet exists to be used as both the control and the data plane for their virtual network. This is in preparation for cloudSwXtch installation on Azure. We will also walk through an alternative method of using 2 subnets, separating the control and data plane.

To validate:

1. Go to the Azure Console.
2. Search for "vnet".
3. Select Virtual Networks.
4. Select the vnet to be used for cloudSwXtch.

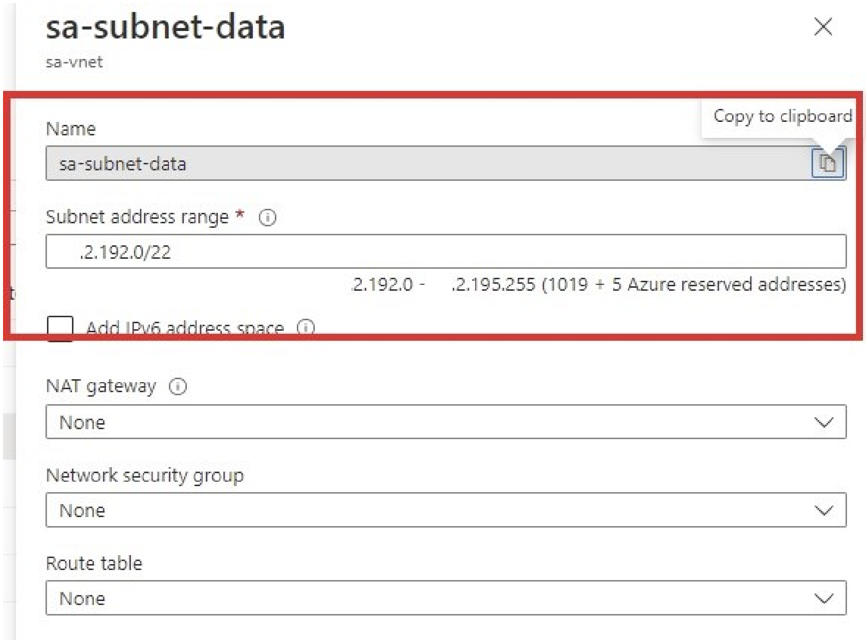


5. If using a single-subnet, name the subnet as "ctl." If using two subnets, name the second one "data" to distinguish between them when creating an VM instance. Using two subnets will require them to be in the same Region (for example, East US). This enables a single VM instance to have two NICs connected to both subnets at the same time.
   1. In the event that the second subnet does not exist, create it by selecting "+ Subnet."



©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

2. Enter data as shown below making sure the subnet in the same VNET and Availability zone as shown below:



Endpoint Connections Limit

Please be mindful of the number of endpoints (virtual machines) you are allowed to connect to your cloudSwXtch after creation. For example, for the *small* tier, users will be limited to 10 endpoint connections. If you know you will need more than that, consider deploying a larger sized cloudSwXtch as you walk through the deployment steps below.

NEXT STEP: Creating an Azure cloudSwXtch Template

After validating the subnets on Azure, continue on to the Create an Azure cloudSwXtch Template guide. This is in preparation for installing cloudSwXtch on Azure.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Create an Azure cloudSwXtch Template

WHAT TO EXPECT

The easiest way to deploy a cloudSwXtch instance in your Azure environment is through the template method. The following process is a one-time task per subscription.

This section will walk you through the template creation process in preparation for Azure cloudSwXtch installation.

Template Creation

A cloudSwXtch template can be created by using the Azure Portal. This template will be used to create a cloudSwXtch "Creating cloudSwXtch via Template method". The template is not used during creation of a cloudSwXtch via the Market Place. The creation of the Template is a one-time task per subscription

1. Log into the Azure Portal. You will need permissions to create and manage virtual machines.
    - virtual-machine-contributor
2. Open Cloud Shell

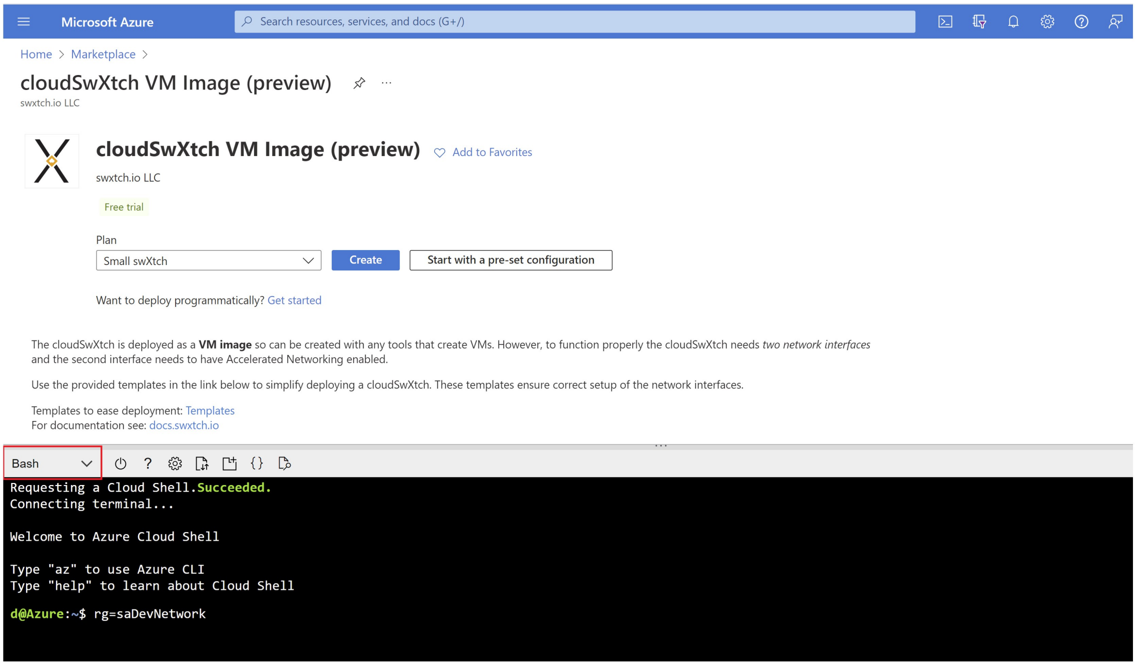

If you need help setting up your Azure cloud-shell, use the link below for setup instructions.
[azure cloud-shell quick start]
3. Make sure you are running your cloud shell terminal in Bash mode.
4. Enter in the following command to get to the proper resource group:

None | Copy

```
rg="<your-rg-here>"
```

Example below:

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

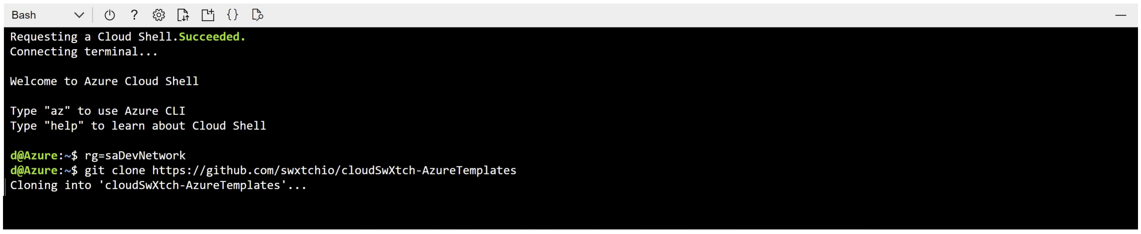


5. Enter in the following command to clone the "cloudSwXth-AzureTemplates":

None | Copy

```
git clone https://github.com/swxtchio/cloudSwXtch-AzureTemplates
```

Example below:

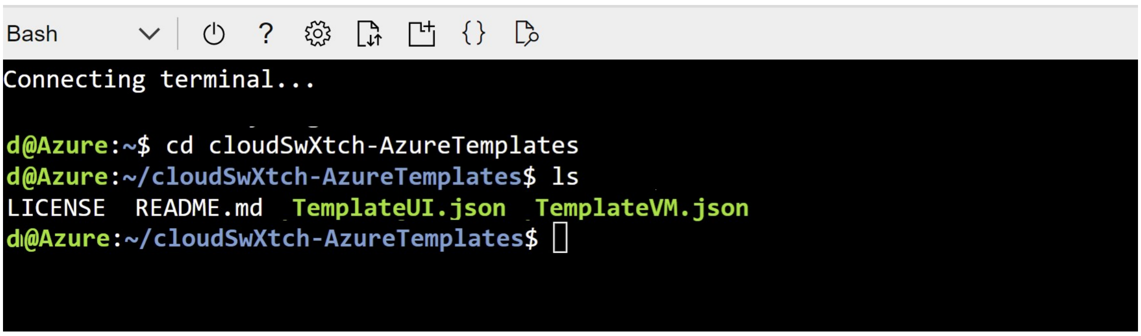


6. Change directory (cd) to "cloudSwXtch-AzureTemplates".

None | Copy

```
cd cloudSwXtch-AzureTemplates
```

If desired, use the "ls" command to see what is in the directory. Example below:



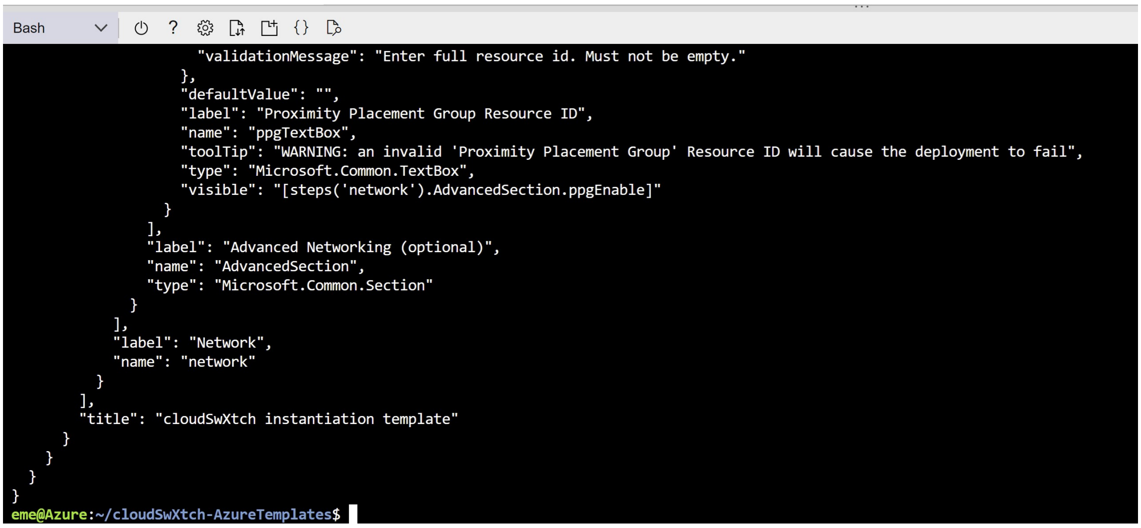
7. Create "cloudSwxtch-from-mp-image" using the following command:

None | Copy

```
az ts create -n cloudSwxtch-from-mp-image -g $rg -v 1 -f TemplateVM.json --ui-
form-definition TemplateUI.json
```

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

The output should look like the below screenshot:




```
                "validationMessage": "Enter full resource id. Must not be empty."
              },
              "defaultValue": "",
              "label": "Proximity Placement Group Resource ID",
              "name": "ppgTextBox",
              "toolTip": "WARNING: an invalid 'Proximity Placement Group' Resource ID will cause the deployment to fail",
              "type": "Microsoft.Common.TextBox",
              "visible": "[steps('network').AdvancedSection.ppgEnable]"
            }
          ],
          "label": "Advanced Networking (optional)",
          "name": "AdvancedSection",
          "type": "Microsoft.Common.Section"
        }
      ],
      "label": "Network",
      "name": "network"
    }
  ],
  "title": "cloudSwXtch instantiation template"
  }
 }
}
}
eme@Azure:~/cloudSwXtch-AzureTemplates$
```

NEXT STEP: Azure cloudSwXtch Installation

After completing template creation and validating subnets, continue on to the main Azure cloudSwXtch Installation guide.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Install cloudSwXtch on Azure

WHAT TO EXPECT

Installation of a cloudSwXtch instance consists of two parts: the cloudSwXtch and the xNIC software. The cloudSwXtch is instantiated once while the xNIC is installed on each VM that is part of the cloudSwXtch network.

In this section, users will learn how to install cloudSwXtch for their Azure environment through the template method.

Please note: This is the preferred method of installation. However, alternatively, you can do a manual install via the Marketplace. For more information on this method, please see the Install cloudSwXtch via Market Place guide.

NOTE:

- Access to https://services.swxtch.io should be enabled for marketplace installation of the cloudSwXtch. For closed environments, swXtch.io offers a BYOL model to allow installation and operation for highly secure deployments. Please contact support@swxtch.io for more details.

Deploying a cloudSwXtch instance

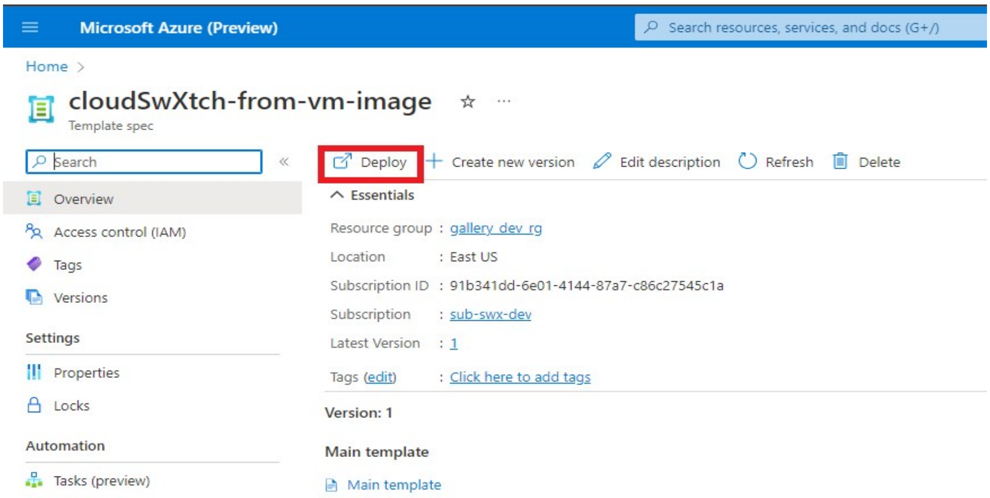
PREREQUISITES

Before starting, a user must do the following:

1. Review cloudSwXtch System Requirements.
2. Validate that there are two Subnets: A virtual network must be created before creating a cloudSwXtch instance. This must contain two subnets, known as the ctrl- and data-subnet. In addition, the data subnet must have the "Network Acceleration" feature enabled.
3. Create an Azure cloudSwXtch Template: Creating a template will allows users to follow the easiest method for cloudSwXtch deployment detailed below.
4. Make sure that your Azure subscription has the quota and access privileges to create the virtual machine instance used to run the cloudSwXtch. Your instance will fail if you do not have the quota for the selected machine size.

1. Log into the Azure Portal
2. Find the template by using the "Search resource, services, and docs" bar (G+/) and enter "cloudSwxtch-from-mp-image" in the search. This will take to directly to the template.
3. Select the template.
4. Click "Deploy" to launch the template UI

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



In the cloudSwXtch commercial plan area, click on the “Choose a cloudSwXtch plan” dropdown and select a plan (Multicast or BYOL). For more information on plans see: cloudSwXtch System Requirements.

5. In the "Project Details" area, select a Subscription.
6. Pick (or create) an Azure Resource Group.
7. In the "Instance details" area, notice how the region is filled in from the Azure Resource Group.
8. Assign the Virtual Machine a name. This name must be unique in both the resource group and the virtual network in which the instance will exist. It also must meet the requirements for a VM host name.
9. Select the cloudSwXtch size.

> cloudSwXtch Size Explained
>
> The default size is 1x Standard D4 V4. The cloudSwXtch size should work well for testing purposes, for production the size should be carefully considered based on traffic egress and ingress into and out of the cloudSwXtch.

> NOTE:
>
> Please be aware that the owner of the Azure Subscription in which the cloudSwXtch instance is created is responsible for all cloud resources used by the switch. These fees are to the cloud provider and do not include any fees to swxtch.io for cloudSwXtch licensing.

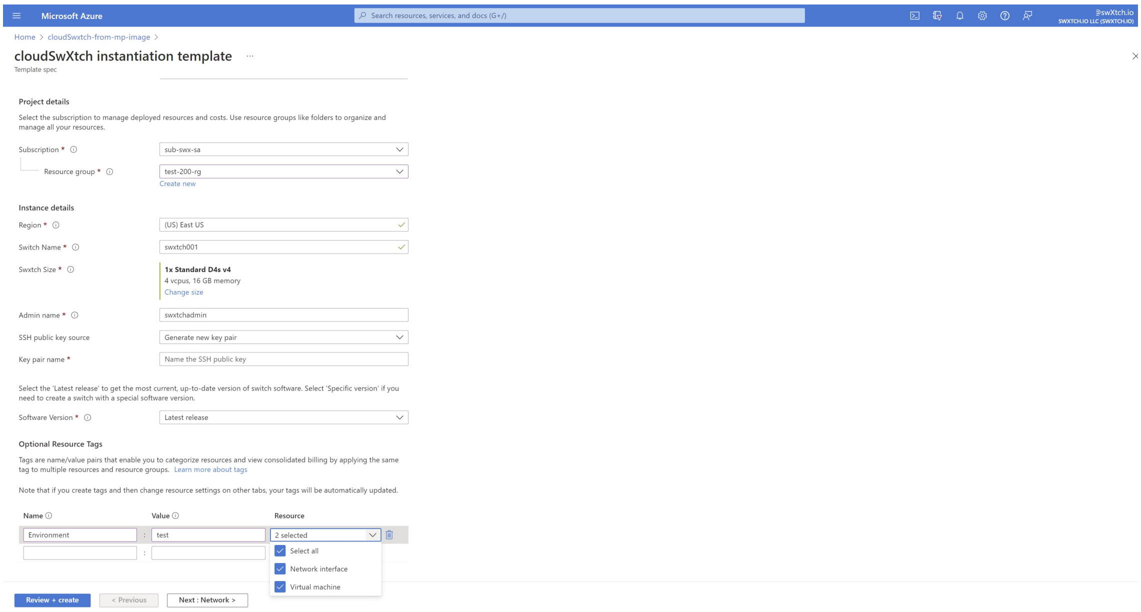
10. Enter in an "Admin name." This will default to "swxtchadmin," but can be modified.
11. Enter in a "SSH public key source." The options are:
    - "Generate new key pair."
        - If selected, enter in "Key Pair Name." This name must be unique among other key pairs in Azure.
    - "Use existing key stored in Azure."
        - If selected, choose a "stored key" from the drop-down menu.
    - "Use existing public key."

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

- If selected, paste in a "SSH public Key" from Azure. Refer to https://learn.microsoft.com/en-us/azure/virtual-machines/ssh-keys-portal for how to get an existing public key.

12. Select the software version. The most common choice is “latest” which will use the most recent software release for this instance. For more control, a specific release version can be entered.

13. 14. In the **"Optional Resource Tags" area, optionally add Tags. Tags can be added to all Resources



14. Select "Next - Network."

15. In the "Configure virtual networks" area, select a previously created virtual network.

> WARNING
>
> Due to an issue with Azure templates, do not select the “Create new” option for the network because the created network will not be accessible to you. Always select a previously created virtual network.

> Network
>
> The cloudSwXtch must be associated with a virtual network and the virtual network must have at least two subnets: one for control plane and one for data plane traffic. See “System Requirements” above for details.

16. In the "Configure virtual networks" area, select a "Control Subnet Name."

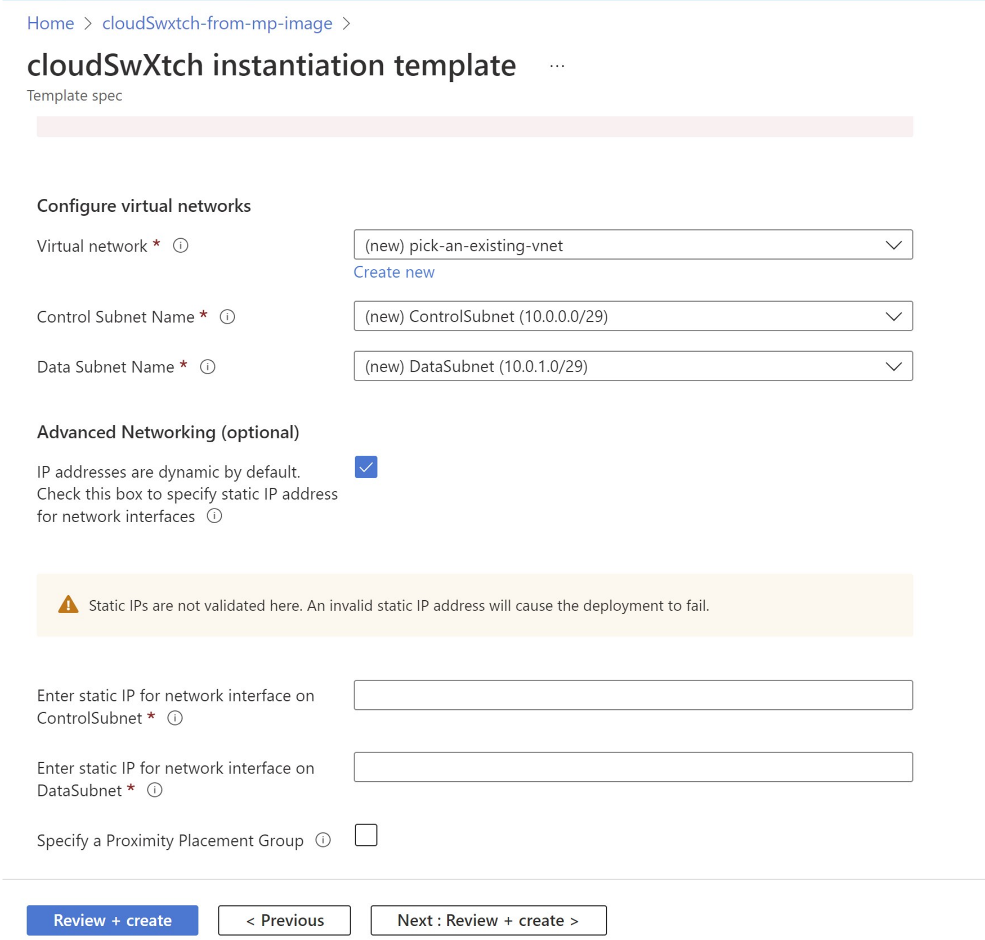
17. Select a "Data Subnet Name. "

18. OPTIONAL: In the "Advanced Networking (optional)" section:

    - Add a static IP Address

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

- Specify a Proximity Placement Group



19. Select "Review and Create."

20. Review the plan pricing.

21. Read the "Terms & Conditions."

22. Select “I agree” when ready.

The creation will take 1-3 minutes depending on Azure vagaries. When done, a cloudSwXtch instance shall exist within the selected Azure Resource Group. Your cloudSwXtch is now ready for use.

Post-Installation

- IMPORTANT: If this is a new install then each client that is expected to get traffic from the cloudSwXtch will need a xNIC installed. If this is a existing install then each client with an xNIC already installed will need to be upgraded. Please see xNIC Installation.
- For Windows-related OS/servers, It's important to reboot the machine, once the installation is complete, in order to be able to execute cloudSwXtch tools properly from any client's user home directory.

24/7 Operations

If the services need to be up and running 24/7 swXtch.io suggests that redundant systems exist for which will be referred to as "Main" and "Backup". During an upgrade the Backup system should be upgraded, then the traffic should be routed to the Backup while the Main is upgraded.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Uninstalling cloudSwXtch

Delete the cloudSwXtch instance as you would any other virtual machine.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Install cloudSwXtch via Azure Marketplace

Installing cloudSwXtch via Template

The best method for deploying a cloudSwXtch on Azure is via a template. For more information on this method, please review the Install cloudSwXtch on Azure guide.

Prerequisites

Before starting, ensure that you validate your subnets on Azure. Return to this page after completing that preliminary step.

Creating a Virtual Machine

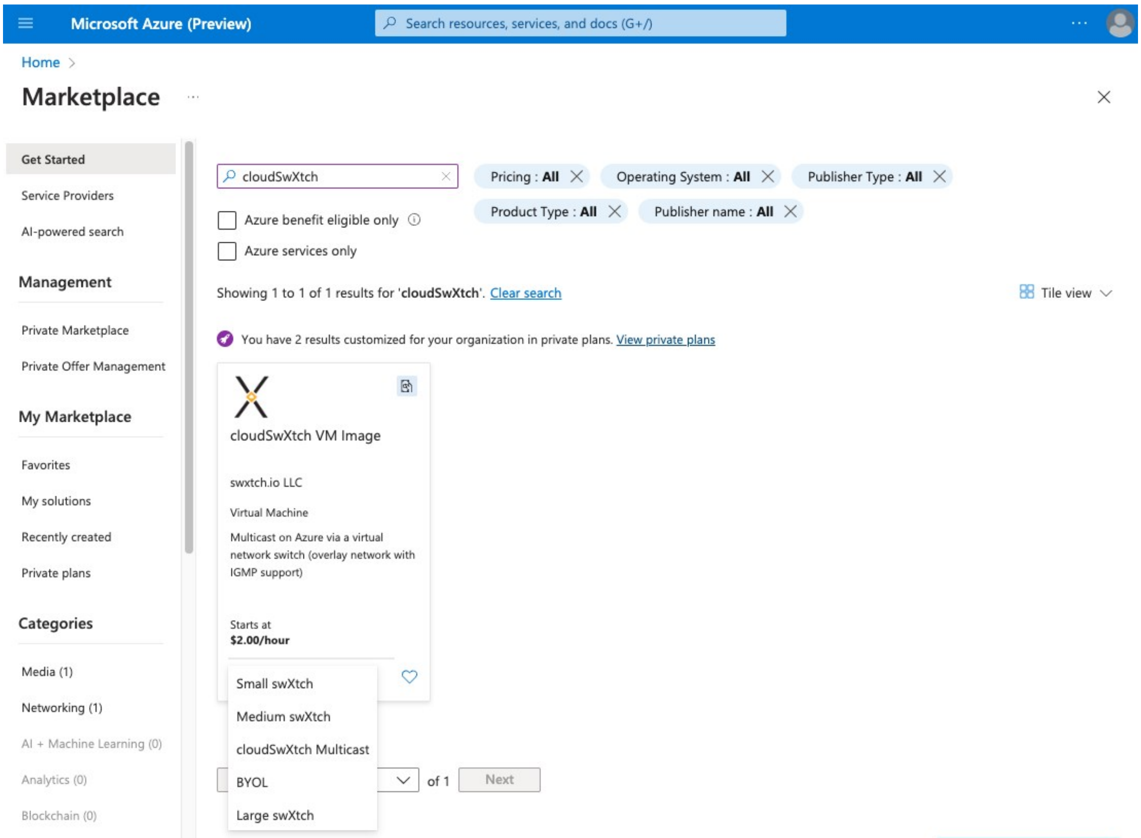
1. Log in to the Azure Portal. You will need the following permissions to create and manage virtual machines and to create Managed Applications.
    - virtual-machine-contributor: To create and manage virtual machines.
    - managed-application-contributor-role: To create Managed Applications.
2. Select "Marketplace"
3. Search for "cloudswXtch"
4. Select a plan. For more information, see: cloudSwXtch System Requirements.
5. Click on the "cloudSwXtch VM Image" drop down menu to select a plan. Please note: A BYOL instance will require users to obtain a license from swXtch.io. For more information, see here.

    Warning: Phasing Out Small, Medium, Large

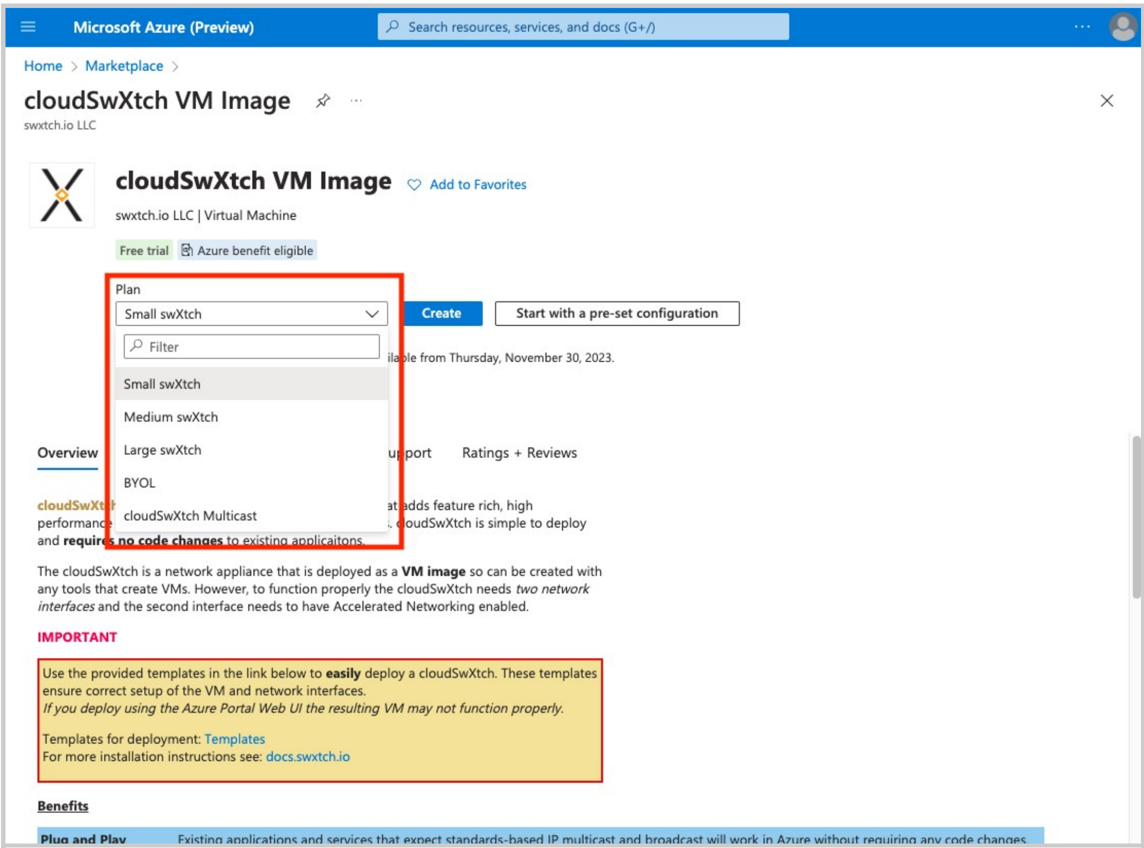
    Although they are currently listed, cloudSwXtch Small, Medium and Large tiers will be phased out and no longer supported.

    It is recommended that users select either cloudSwXtch Multicast, which is similar sizing to a Small, or cloudSwXtch BYOL, which allows for more customizability including expanded bandwidth, increased endpoint limit and additional licensable features. For more information, please see cloudSwXtch System Requirements.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



The "Create a virtual machine" will open with the selected plan. If the plan was not selected in the previous screen, then the following screen will display to choose a plan.



6. Select either "Create" or "Start with a pre-set configuration."

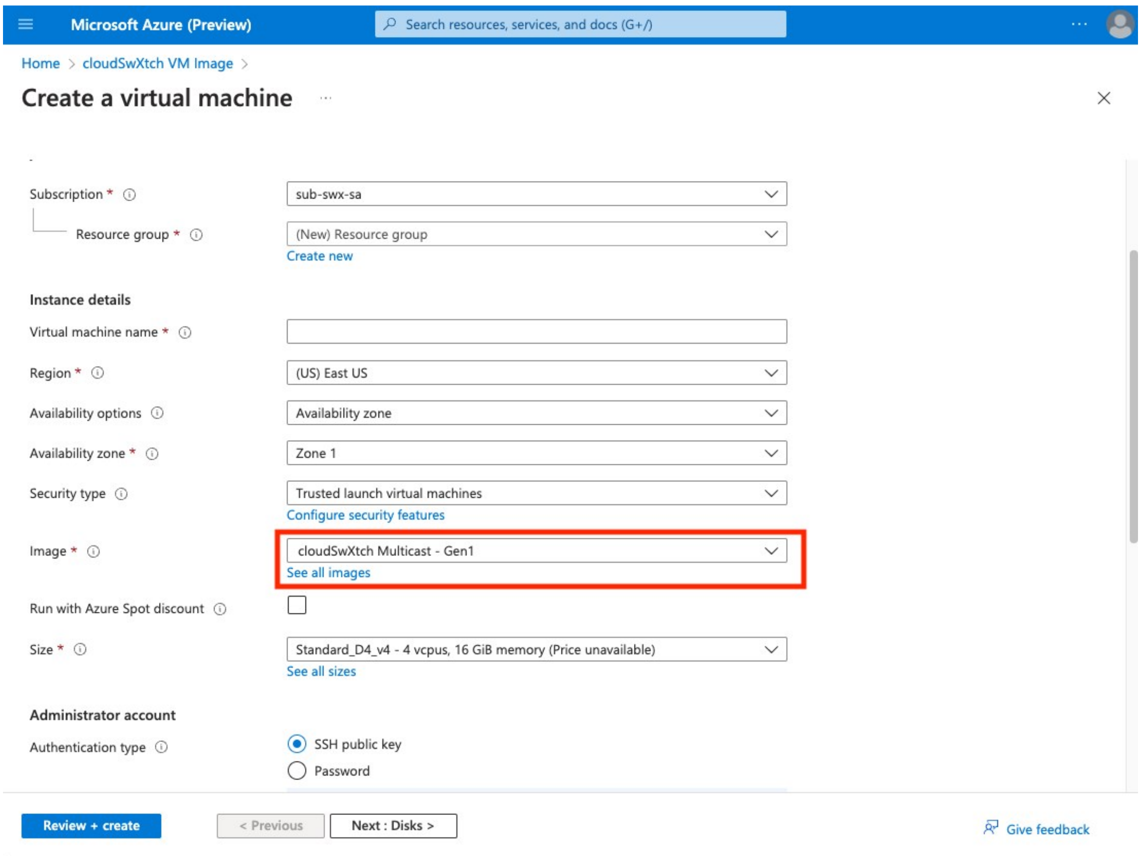
©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

NOTE

swxtch.io is just using the standard Azure Marketplace VM from Image method, this document will not go over all the tabs and fields in the tabs as they are not CloudSwxtch specific. Some things of note in the Azure Marketplace VM image creation are as follows:

- The "Start with a pre-set configuration" vs "Create" will eventually lead to the same UI where there are many tabs to enter data. However, the "Start with a pre-set configuration" will fill in certain fields based on the user's selections. For example, in the "Basics" tab it will fill in "Boot diagnostics," "Availability options," and "Size." In addition, the "Disks" tab will fill in the OS disk type.
- REMINDER: This Market Place method will only create one NIC. The second required NIC will need to be added after creation.

7. Follow the tabs and make appropriate selections – there are a number of fields that have to be filled in to create a cloudSwXtch instance.
8. In the "Basics tab, select a "Subscription"
9. Choose (or create) an "Resource Group"
10. Assign the "Virtual Machine Name." This name must be unique.
11. Select a "Region"
12. Select the "Image" and choose an appropriate image based on the plan type: cloudSwXtch Multicast or cloudSwXtch BYOL.



13. Select the "Software Version." The most common choice is “latest,” which will use the most recent software release for this instance. For more control, a specific release version can be entered.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

14. Continue on the Networking Tab.

> Networking Tab
>
> The cloudSwXtch instance must be associated with a virtual network and the virtual network must have at least two subnets: one for control plane and one for data plane traffic. This user interface only allows attachment of one subnet. Below steps will describe how to add a second subnet after creation. See “System Requirements” above for details.

15. Check "Delete public IP and NIC when VM is deleted"

16. OPTIONAL: Change values on other tabs.

17. Select **Review and Create**.

18. Carefully review the plan pricing.

19. Read the Terms & Conditions.

20. Select “I agree” when ready.
    Please note: The creation will take 2-3 minutes depending on Azure varieties.

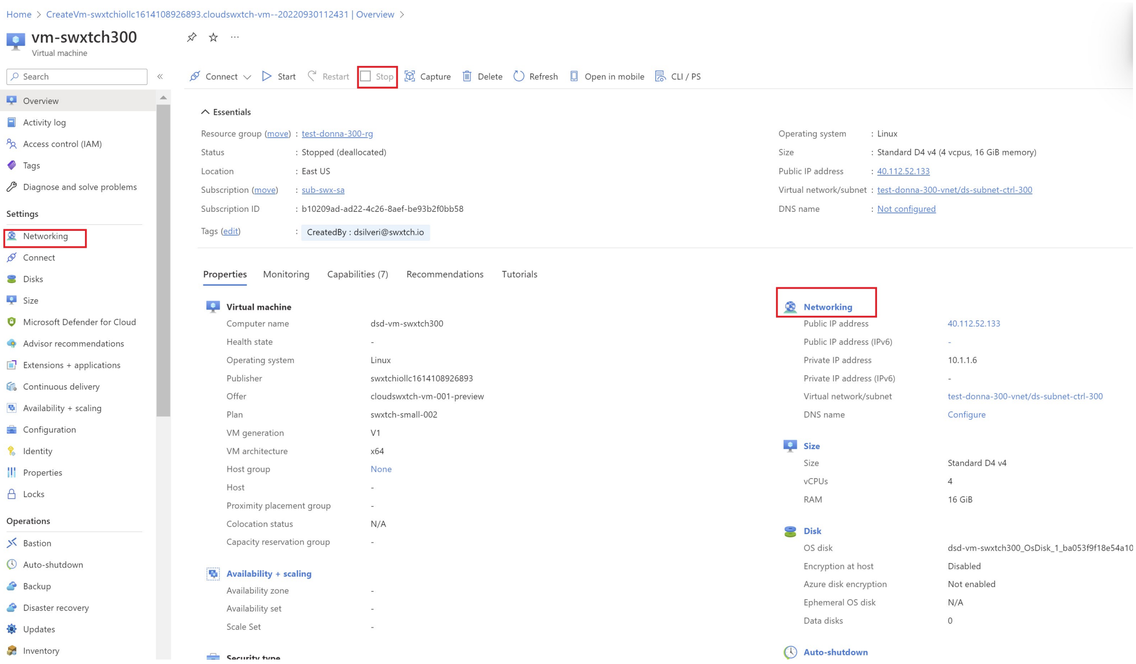
Creating the Second Subnet *REQUIRED*

1. Navigate to the newly created VM by selecting the "Go to Resource" button.

2. Click "Stop" at the top of the toolbar.

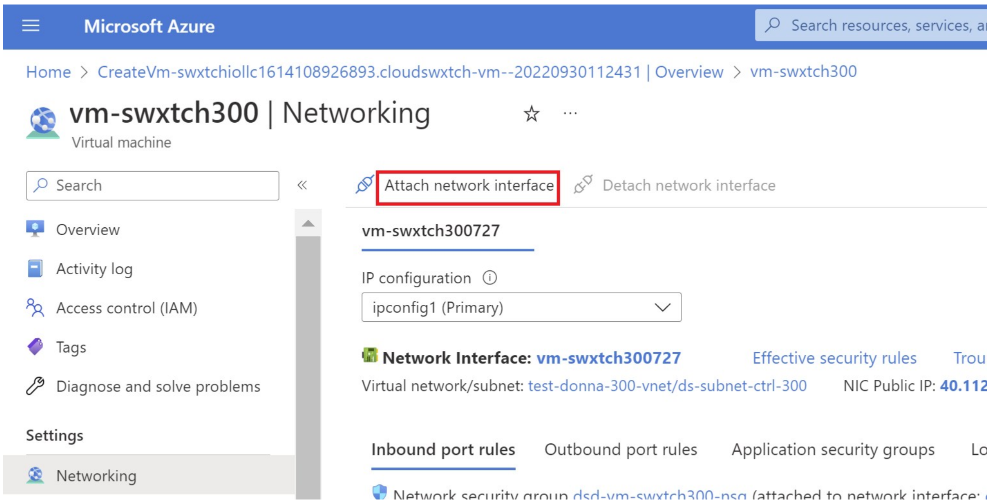
3. Select "Yes" when prompted.

4. Click "Networking" on the left hand side under settings. Alternatively, you can select "Networking" in the main Properties page.



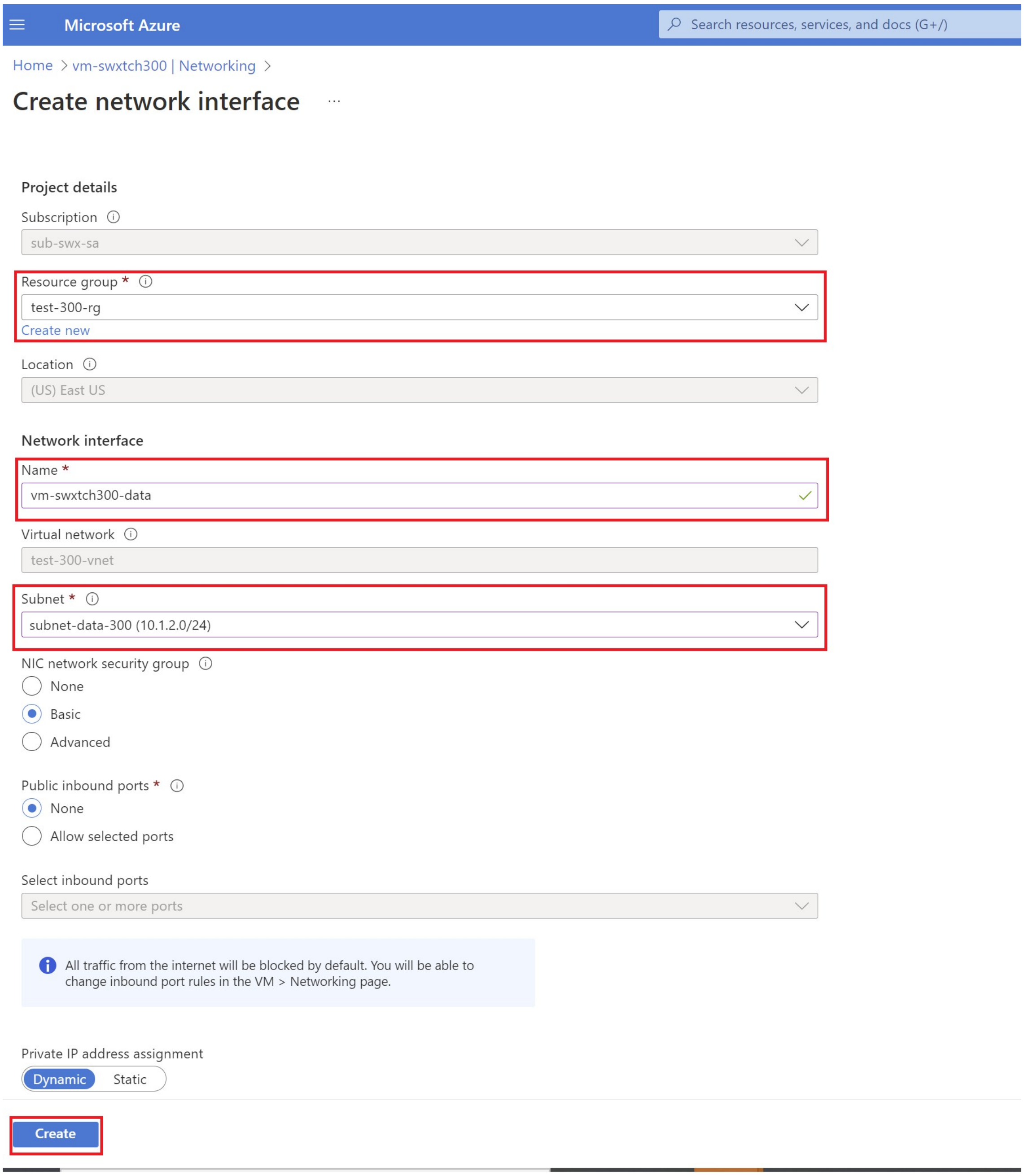
5. Select "Attach network interface."

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



6. Select a "Resource Group" under Project Details.
7. Enter in a "Name" under Network Interface.
8. Select a "Subnet."
   Please note: You can optionally change other data.
9. Select "Create"

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



10. Refresh the screen after completing the form and the second subnet should be added in a second tab.

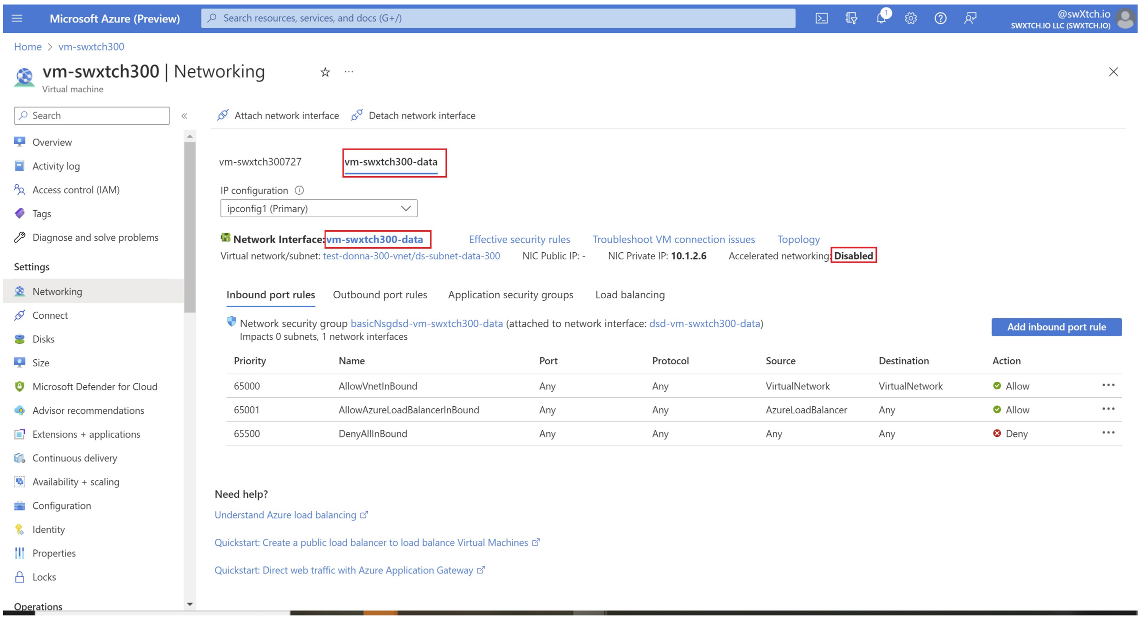
Enabling "Accelerated Networking" *REQUIRED*

The newly created Network Interface needs to be updated to enable "Accelerated Networking" to do this follow the steps below:

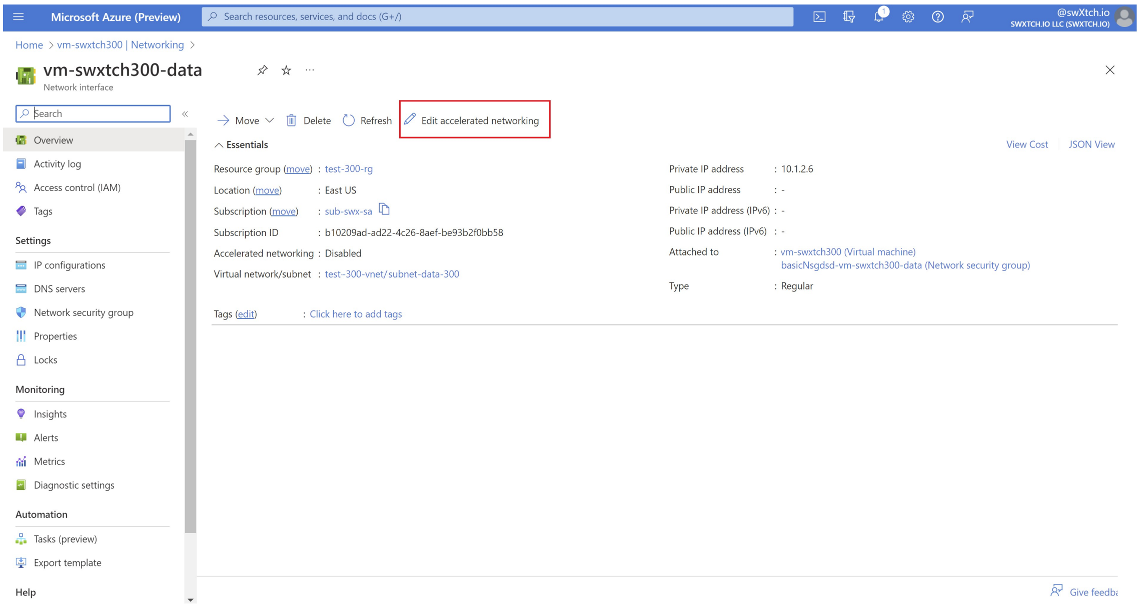
1. Select the "Network Interface." In the example below, it is named "vm-swxtch-300-data."

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

2. Click the blue link to the "Network Interface."



3. Click "Edit accelerated networking."

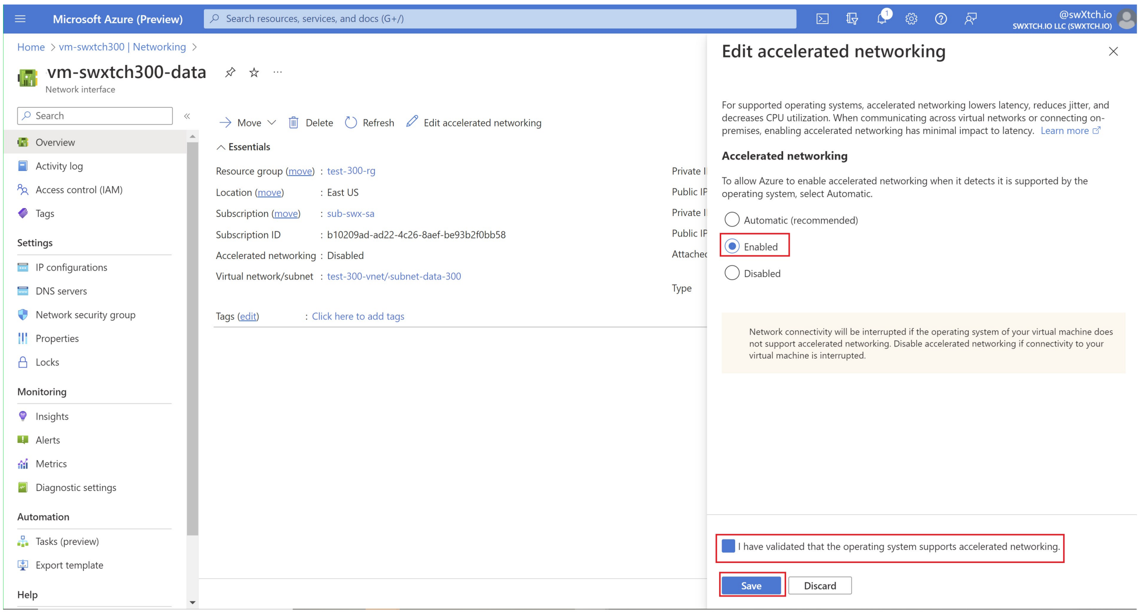


4. Select "Enable."

5. Select "I have validated that the operating system supports accelerated networking."

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

6. Click "Save."



7. Start the VM for use.

For cloudSwXtch BYOL

Users will need to contact swXtch.io in order to obtain a license file. For more information, see How to License a cloudSwXtch.

Important

If this is a new install then each client that is expected to get traffic from the cloudSwXtch or send to the cloudSwXtch will need a xNIC installed. If this is a existing install then each client with an xNIC already installed will need to be upgraded. Please see xNIC Installation.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Deploy cloudSwXtch with Terraform on Azure

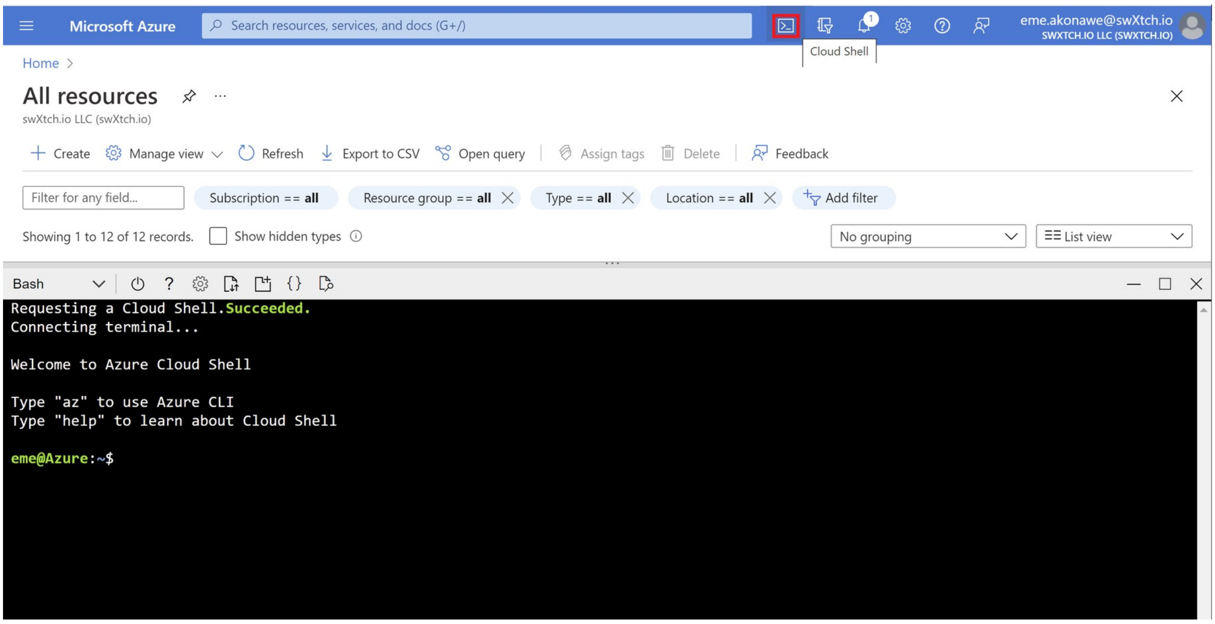
WHAT TO EXPECT

By default, the terraform script will spin up a "small" cloudSwStch. You can make edits to the Azure/terraform/terraform.tfvarse file to declare a different cloudSwXtch size.

There is also an option to delegate static ip addresses on your cloudSwXtch. Further details on how to do this can be found at the end of this article.

Deploying cloudSwXtch with Terraform on Azure

1. Sign-in to your Azure portal under the subscription where you want to deploy the cloudSwXtch.
2. Open the Azure Cloud Shell interface and select the Bash environment as shown.



3. Clone the example repository from GitHub.

You can do this either via SSH (requires setting up your SSH authentication with GitHub):

Console | Copy

```
$ git clone git@github.com:swxtchio/cloudSwXtch-support.git
```

or via HTTPS:

```
$ git clone https://github.com/swxtchio/cloudSwXtch-support.git
```

4. Update the values in the Azure/terraform/terraform.tfvarse file to match your existing azure resources such as: resource group, virtual network, subnets, etc.

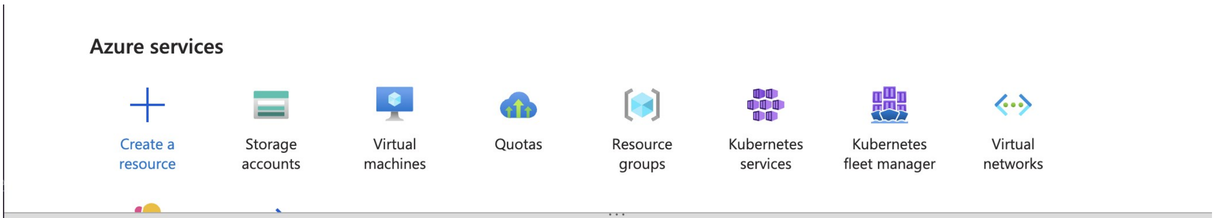
> The format of the key file that the scripts can process is the ssh-rsa type. The content of the file should start with "ssh-rsa AAAAB3..."

5. In the Cloud Shell terminal, cd into the Azure/terraform directory and initialize the terraform environment:

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Console Copy

```
$ cd Azure/terraform
$ terraform init
```




```
Bash

Initializing the backend...

Initializing provider plugins...
- Finding hashicorp/azurerm versions matching "~> 3.0"...
- Installing hashicorp/azurerm v3.64.0...
- Installed hashicorp/azurerm v3.64.0 (signed by HashiCorp)

Terraform has created a lock file .terraform.lock.hcl to record the provider
selections it made above. Include this file in your version control repository
so that Terraform can guarantee to make the same selections by default when
you run "terraform init" in the future.

Terraform has been successfully initialized!

You may now begin working with Terraform. Try running "terraform plan" to see
any changes that are required for your infrastructure. All Terraform commands
should now work.

If you ever set or change modules or backend configuration for Terraform,
rerun this command to reinitialize your working directory. If you forget, other
commands will detect it and remind you to do so if necessary.
nicholas [ ~/projects/cloudSwXtch-support/Azure/terraform ]$
```

6. Now that Terraform has been initialized, run this command to evaluate the config and confirm the desired output which will be shown:

```
$ terraform plan
```

```
Bash

  # azurerm_network_interface.data_network_interface[0] will be created
  + resource "azurerm_network_interface" "data_network_interface" {
      + applied_dns_servers           = (known after apply)
      + dns_servers                   = (known after apply)
      + enable_accelerated_networking = true
      + enable_ip_forwarding          = false
      + id                            = (known after apply)
      + internal_dns_name_label       = (known after apply)
      + internal_domain_name_suffix   = (known after apply)
      + location                      = "eastus"
      + mac_address                   = (known after apply)
      + name                          = "swxtch-example-data-nic-1"
      + private_ip_address            = (known after apply)
      + private_ip_addresses          = (known after apply)
      + resource_group_name           = "test-tf-managed-kyle"
      + virtual_machine_id            = (known after apply)

      + ip_configuration {
          + gateway_load_balancer_frontend_ip_configuration_id = (known after apply)
          + name                                               = "dinternal"
          + primary                                            = (known after apply)
          + private_ip_address                                 = (known after apply)
          + private_ip_address_allocation                      = "Dynamic"
          + private_ip_address_version                         = "IPv4"
          + subnet_id                                          = "/subscriptions/91b341dd-6e01-4144-87a7-c86
c27545c1a/resourceGroups/DevNetwork/providers/Microsoft.Network/virtualNetworks/dev-vnet/subnets/automation-
test-data"
        }
    }

Plan: 3 to add, 0 to change, 0 to destroy.

Note: You didn't use the -out option to save this plan, so Terraform can't guarantee to take exactly these
actions if you run "terraform apply" now.
```

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

> Since you are using all pre-existing resources to deploy your cloudSwXtch, there should only be 3 resources added - 1 cloudSwxtch, and 2 NICs - as can be seen at the bottom of the screenshot, “Plan: 3 to add, 0 to change, 0 to destroy.”

7. Run the Terraform apply command (followed by “yes” when prompted) to approve the action.

```
Terraform apply
yes
```

8. Once the resources have applied successfully you can view the resources created from your Azure portal as confirmation of a successful deployment.

STATIC IPs

If you'd like to deploy a cloudSwXtch using Static IPs, then you just need to make some small changes to the azure_deployswxtch.tf & terraform.tfvars files.

1. Un-comment the Parameter private_ip_address in the azure_deployswxtch.tf code file for both your data_network_interface & control_network_interface resources.

```
source "azurerm_network_interface" "data_network_interface" {
count                   = var.counter
name                    = "${var.data_nic}-${count.index +1}"
location                = data.azurerm_resource_group.resource_group.location
resource_group_name = data.azurerm_resource_group.resource_group.name
enable_accelerated_networking = true

ip_configuration {
  name                          = "dinternal"
  subnet_id                     = data.azurerm_subnet.datasubnet.id
  private_ip_address_allocation = "Static"
  private_ip_address            = var.datanic_staticip
}
```

```
resource "azurerm_network_interface" "control_network_interface {
  count               = var.counter
  name                = "${var.control_nic}-${count.index +1}"
  location            = data.azurerm_resource_group.resource_group.locatio
  resource_group_name = data.azurerm_resource_group.resource_group.name

  ip_configuration {
    name                      = "cinternal"
    subnet_id                 = data.azurerm_subnet.ctrlsubnet.id
    private_ip_address_allocation = "Static"
    private_ip_address = var.controlnic_staticip
  }
}
```

2. Set the parameter private_ip_address_allocation to "Static".

Your 2 lines of code should look like below for both network interface resources:

```
private_ip_address_allocation = “Static”
private_ip_address = var.datanic_staticip
```

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Your terraform.tfvars file will have variables defined for your control and data NIC StaticIP definitions. You can update those values based on your subnet setup.

Note: This static IP address allocation will only work for swxtch_count of 1.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Install cloudSwXtch for an Air-Gapped Environment

> WHAT TO EXPECT
>
> In this article, you will learn how to install a cloudSwXtch in an Air-Gapped (Closed Network) environment for Azure. For standard Azure installation instructions, please see the cloudSwXtch on Azure article.

Before You Start

Review VM Requirements for a cloudSwXtch Instance in cloudSwXtch System Requirements.

VM Image Creation

The cloudSwXtch software is delivered as a Virtual Machine Disk Image. This Image file can be added to an Azure Image Gallery. Images in an Image Gallery can be used to create Virtual Machines.

To assist with creation of VMs from images in a gallery, swXtch.io provides instructions on how to accomplish the following:

1. Get the VM Disk Image
2. Upload the VM Image into an Azure Storage Account
3. Create a VM Image from the Disk Image
4. Create cloudSwXtch from VM Image
5. License the cloudSwXtch

Complete all steps to successfully install cloudSwXtch for an Air-Gapped environment.

STEP ONE: Get the VM Disk Image

Log onto an environment that has access to the internet and download the following file (~30GB):

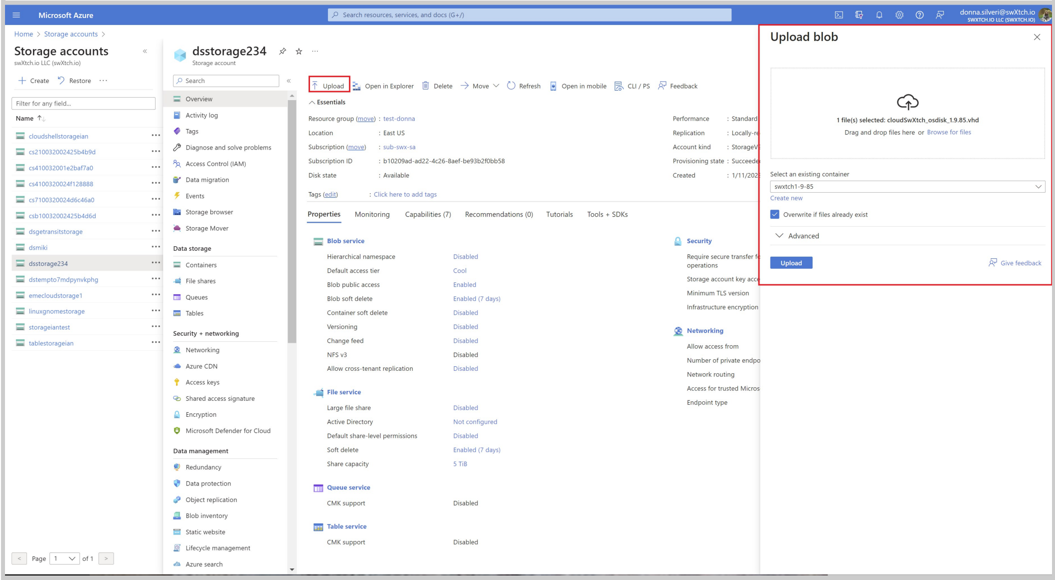
None Copy

```
https://swxtchpublic.blob.core.windows.net/3hwgfe98hfglsrdfh4/cloudSwXtch_osdisk_1.9.85.vhd
```

STEP TWO: Upload the VM Disk Image into an Azure Storage Account

1. Place the file onto a machine with access to the Azure Air Gapped Environment.
2. Upload the files into an Azure storage account in the secure Azure Environment.
    1. Log into the Azure Portal
    2. Navigate to Storage Accounts.
    3. Select the desired storage account.
    4. Select the desired Container or create a new one.
    5. Select Upload and select the VM Disk Image file you copied to the local PC.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

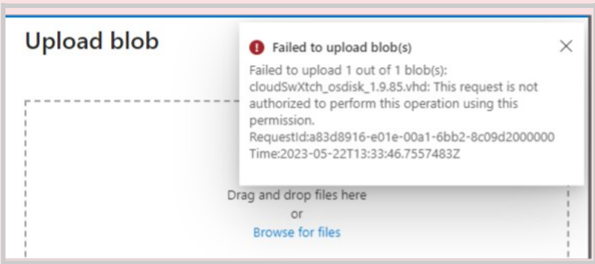


6. Start the upload and wait for it to complete.

This may take some time to upload the file (up to an hour). When completed, the file should show with a green checkbox.

Failed to Upload Blob(s) Message

If you receive a "Failed to Upload Blob(s)" message when uploading the file in the Storage Account, select Configuration and validate the Allow storage key access is enabled.

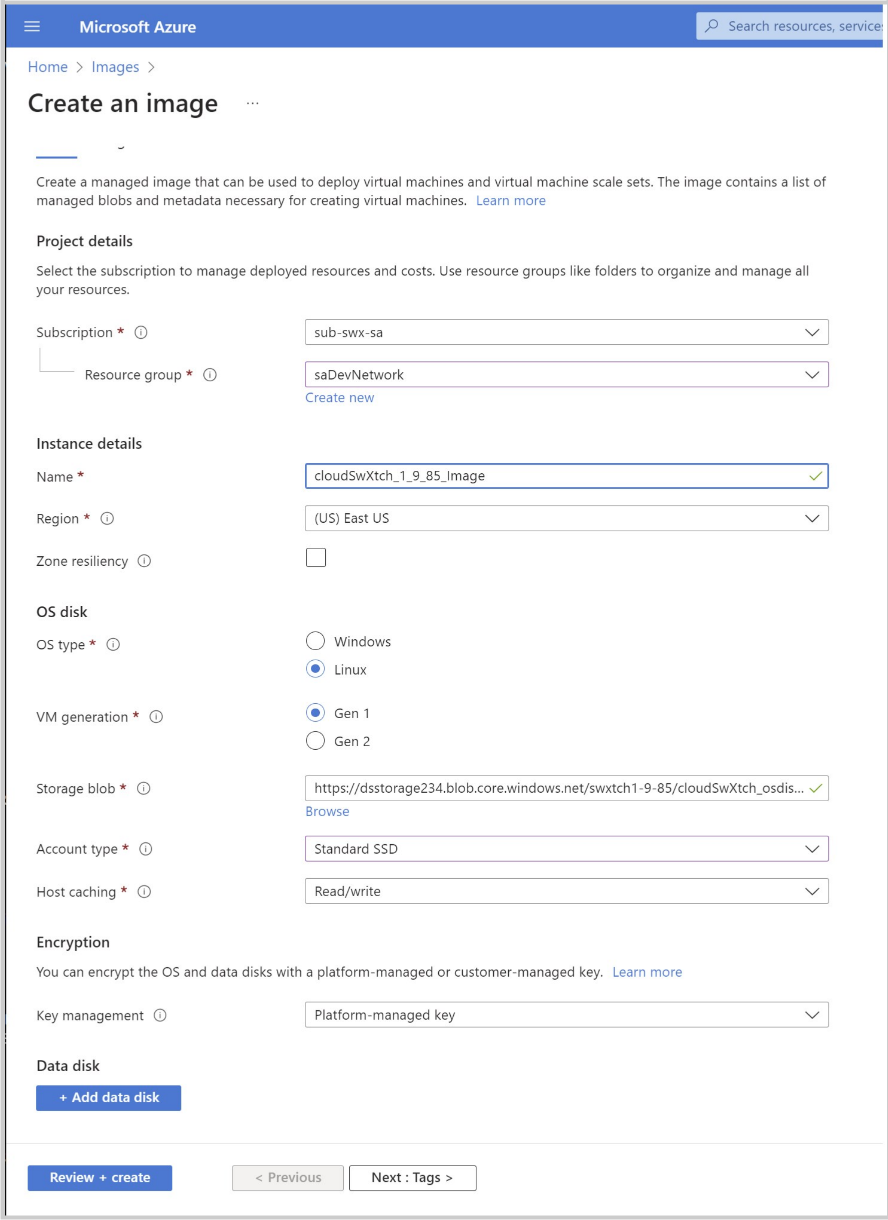


STEP THREE: Create a VM Image from the Disk Image

Once we have a disk image in storage, we can use it to create a VM image. A VM image is a *description of* a VM. The real VM will be created later. The VM Image only needs to be created once. Any number of VMs can be instantiated from a single VM image.

1. In the Azure Portal, Search for and select Images.
2. Select Create.
3. Select the appropriate Resource Group.
4. Give the VM Image a name. The cloudSwXtch instance will be created later with a different name. Pick a name with the cloudSwXtch software version in it as you may end up with multiple images after some time.
5. Ensure that the region is the same for the storage account holding the disk image.
6. Select Linux as the OS type
7. Select Gen 1.
8. Click Browse on the Storage Blob.
    1. In the new panel, navigate to the storage account and container holding the disk image.
    2. Select the file that was previously uploaded.
9. For Account Type, select Standard SSD. See the example of the screen filled out completely.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



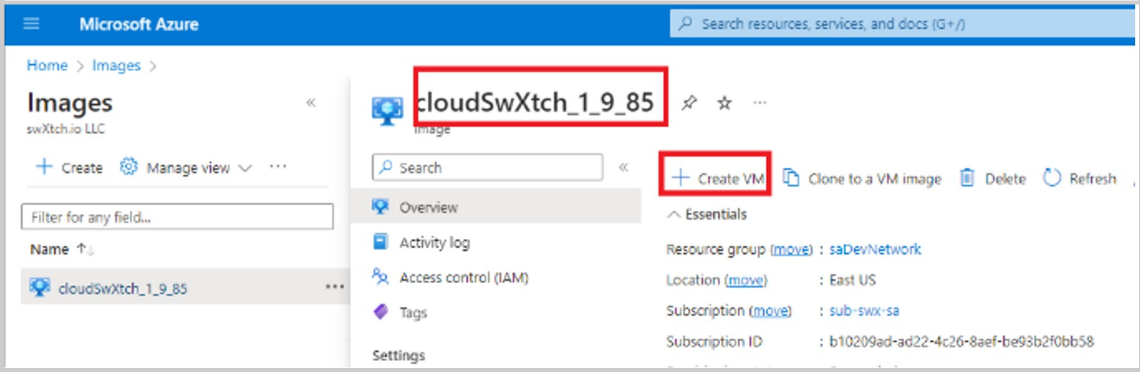
10. If tags are desired, then select Tags and enter the required tags.
11. The other fields can be left as default.
12. Select Review and create.
13. When validation passes, select Create. When it is complete, click Go to Resource to see the image.

STEP FOUR: Create cloudSwXtch from VM Image

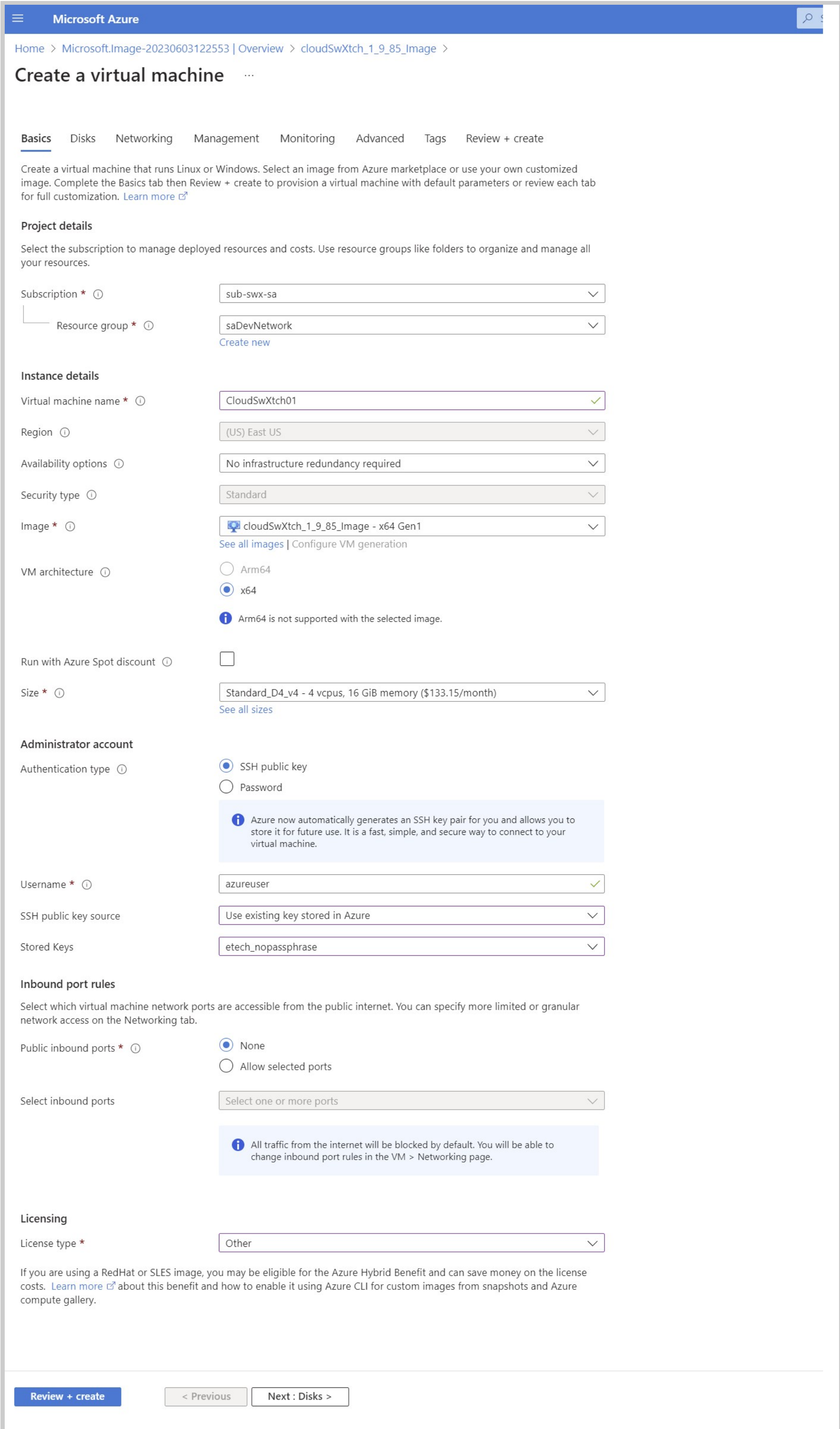
Now that we have a cloudSwXtch VM Image, we can use it to instantiate a cloudSwXtch.

1. Navigate to Images.
2. Select the image with the cloudSwXtch version you require.
3. Select Create VM.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



4. Fill out the Create Virtual machine form like below:

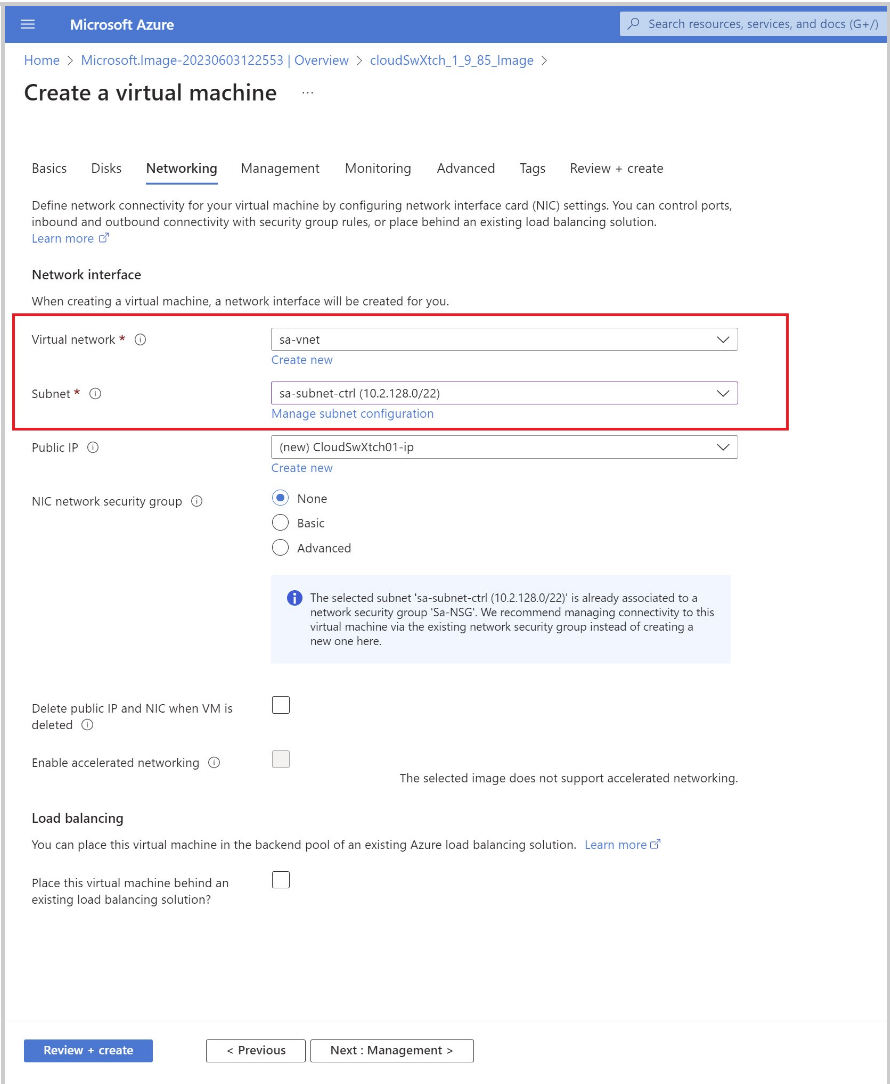


1. Set the subscription and Resource Group for where you want the cloudSwXtch instance to be

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

located.

2. Name the Virtual Machine with a valid host name.
3. Select appropriate machine size. For recommendations based on features, endpoints, and bandwidth needs, read the Quotas article.
4. Use SSH for the authentication type. Enter your SSH public key source. Refer to ssh-keys-portal for details.
5. Set the Licensing Type to Other.
6. Navigate to the Networking tab and fill out the form like below:



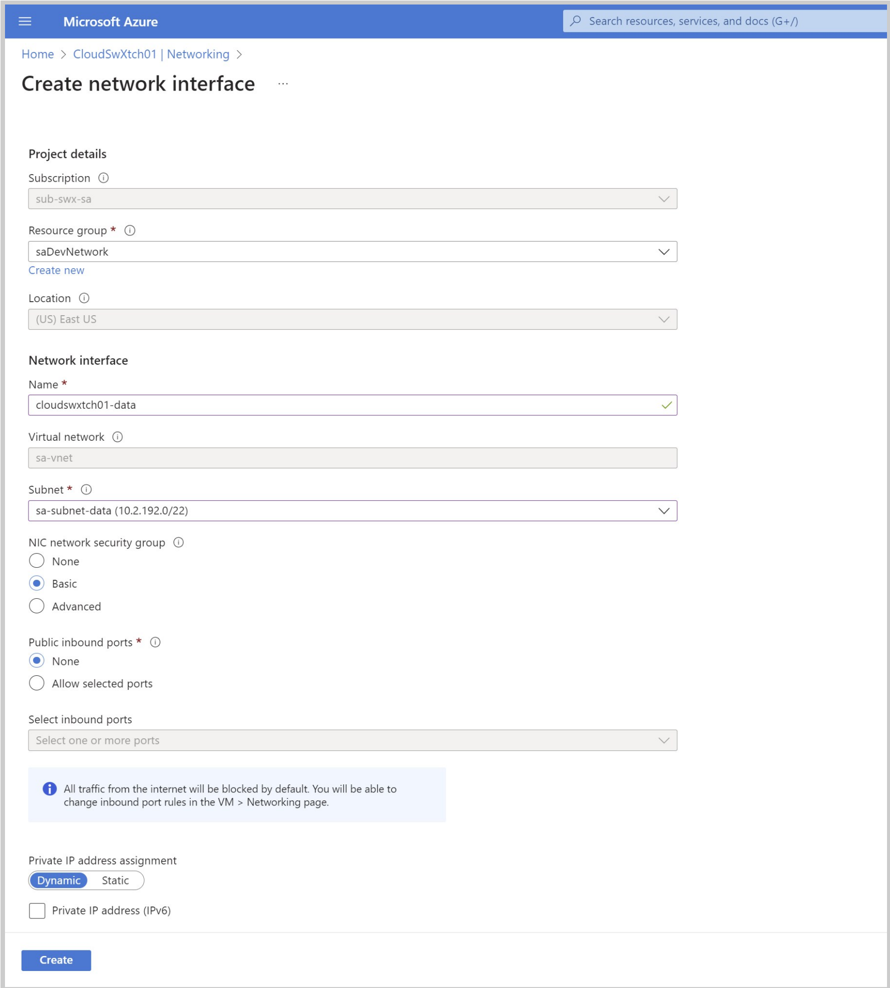
1. Select the appropriate Virtual Network.
2. Select the appropriate control subnet.

7. Navigate to other tabs as desired and enter in information as preferred. For example, some installations expect Tags to be entered.
8. Select Review + Create.
9. When validation passes, select Create.

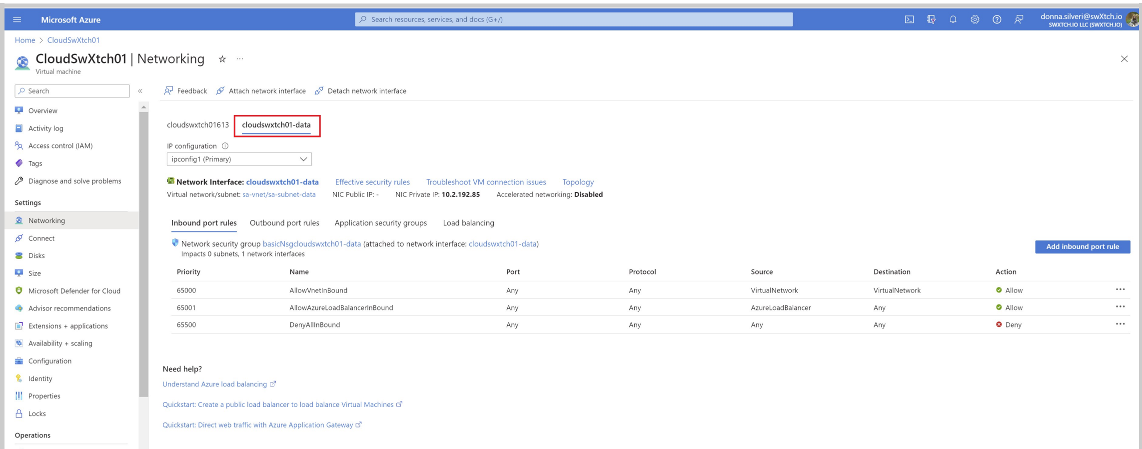
5. When the deployment is complete, select Go to Resource.
    1. Select Stop to stop the VM.

6. Navigate to Networking.
7. Select Attach network Interface.
8. Select Create and attach Network and enter in data into the form to add a new NIC like shown.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

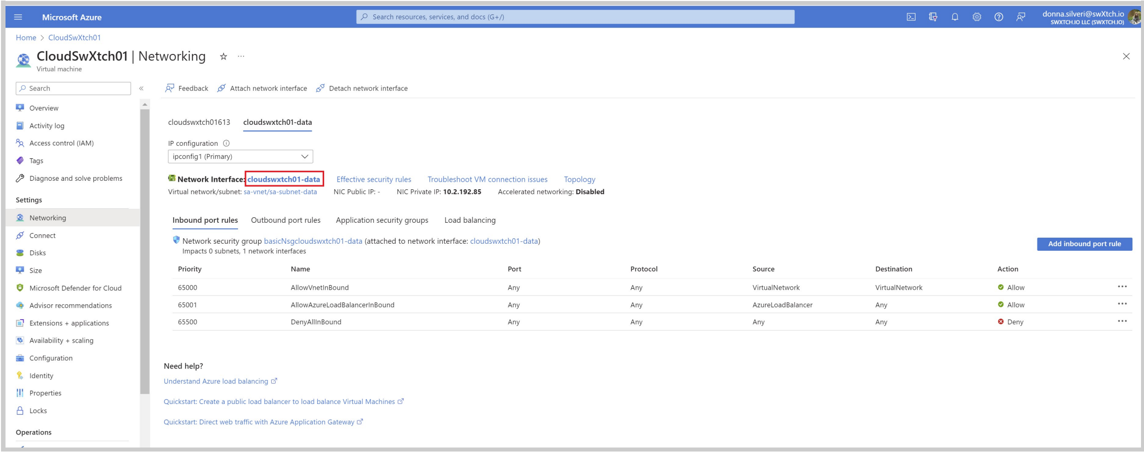


9. Select Create.
10. When it is done, refresh the screen. There should now be a control and data interface.

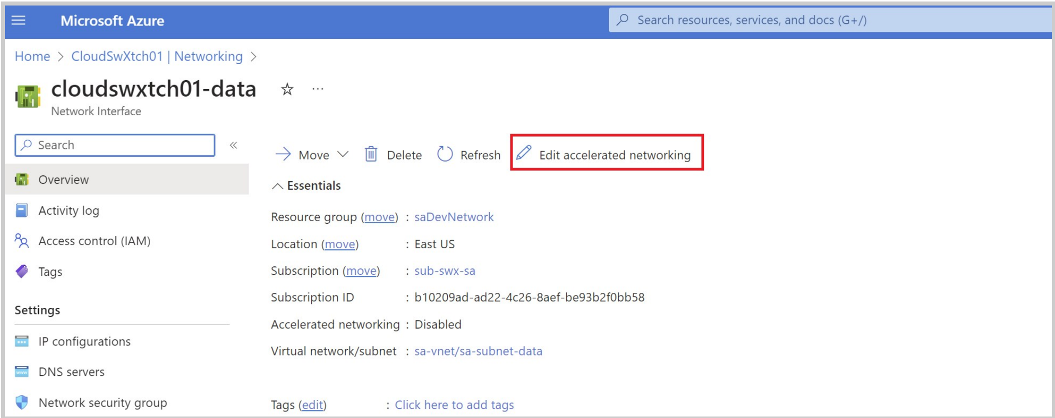


11. Select the data Network Interface.

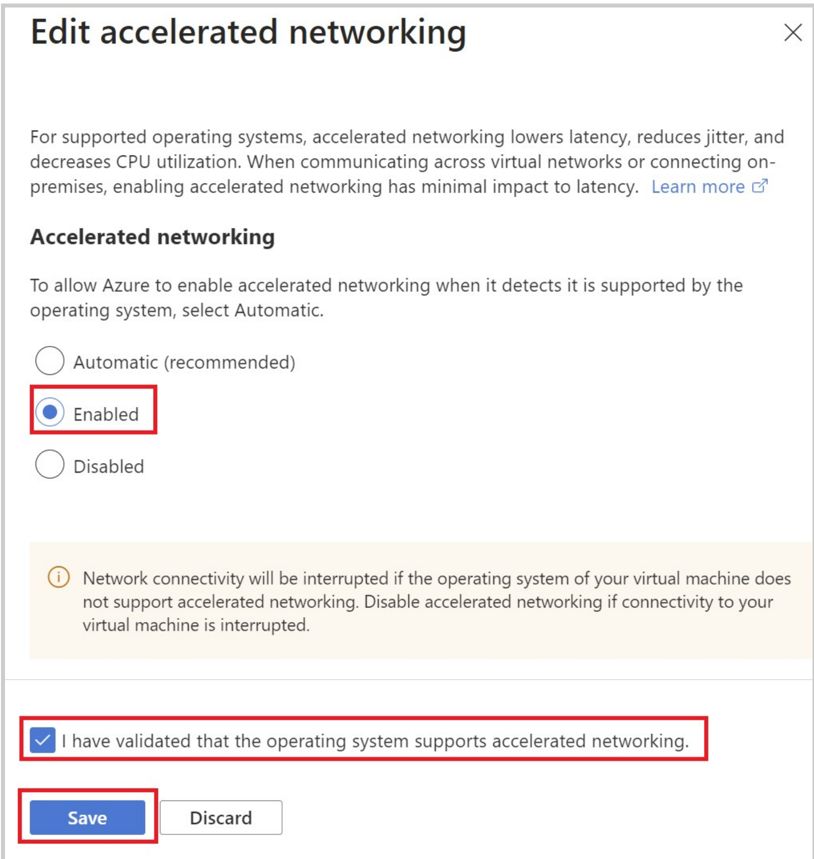
©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



1. Select Edit accelerated Networking.



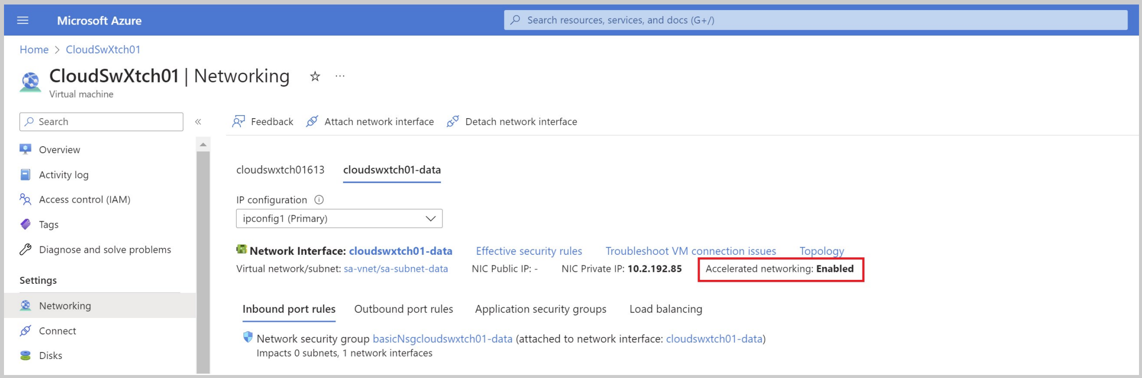
2. A new window will display.



3. Select Enabled.
4. Check the agreement.
5. Select Save.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

12. Refresh page and navigate back to Networking data tab to validate that Accelerated networking is Enabled.



13. Start the newly created cloudSwXtch VM.

STEP FIVE: License the cloudSwXtch

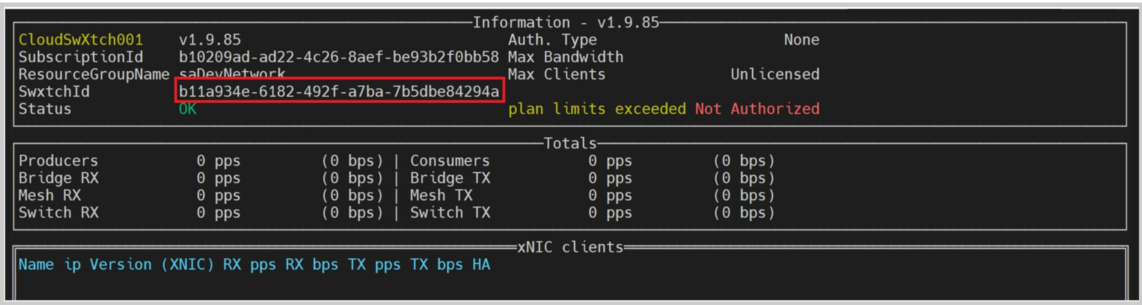
1. Log onto the newly created VM.
2. Run this command:

Text

Bash | Copy

```bash
sudo /swxtch/swxtch-top dashboard --switch localhost
```

3. The swXtch-top dashboard will display.



4. Copy the “SwxtchId” and email it to support@swxtch.io requesting a license.
5. When you receive the license file, upload it onto the cloudSwXtch VM.
6. Move the license.json file to the /swxtch directory using the following command replacing user with the appropriate value:

Text

Bash | Copy

```bash
sudo mv /home/<user>/license.json /swxtch
```

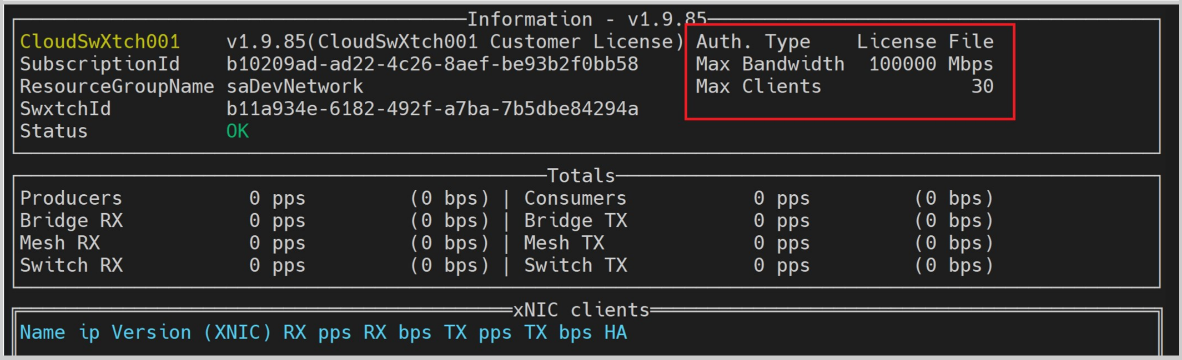
7. Reboot the cloudSwXtch and run swxtch-top again or journal to check the license took place:

Text

Bash | Copy

```bash
sudo journalctl  -u swxtch-ctrl.service -f -n 500
```

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



The cloudSwXtch is ready for use. IMPORTANT: Each client that is expected to get traffic from the cloudSwXtch will need an xNIC installed. See Installing xNIC for next steps in preparing clients (producers and consumers of Multicast).

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

cloudSwXtch on GCP

> WHAT TO EXPECT
> In this article, users will find links to articles on deploying a cloudSwXtch on Google Cloud Platform (GCP).

Currently, there is two ways of deploying a cloudSwXtch on GCP:

- From the Google Cloud Marketplace
  - Note: This method will require users to contact swXtch.io for a license.
- Cloud agnostic cloudSwXtch VM Install
  - Note: This method will require the user to already have a Virtual Machine installed with Ubuntu 20.04 that adheres to all the cloudSwXtch System Requirements.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Install cloudSwXtch via GCP Marketplace

WHAT TO EXPECT

In this article, users will learn how to deploy a cloudSwXtch instance via the Google Cloud Platform (GCP) Marketplace.

- Step One: Navigate to cloudSwXtch in the GCP Marketplace
- Step Two: Configure cloudSwXtch deployment
- Step Three: Add SSH Key(s)
- Required Step for BYOL: Contact swXtch.io for a License

Prerequisites

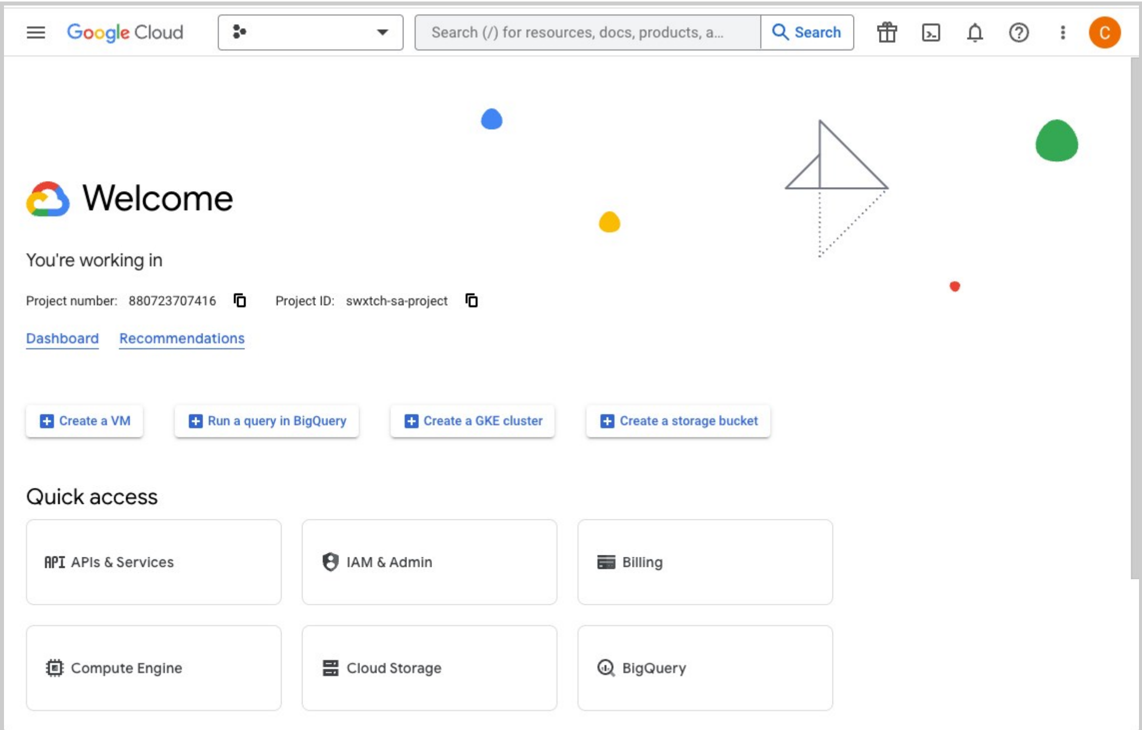
A user needs the following to deploy a cloudSwXtch via the GCP Marketplace:

- An existing Deployment Service Account established in their Google Cloud Console project. Creating a new account is further detailed in Step Two.
- Two (2) VPCs available -- one for the Control NIC and another for Data. All cloudSwXtch installations require 2 NICs. Please review GCP documentation on how to create and modify VPCs.

Please review cloudSwXtch System Requirements for additional prerequisites.

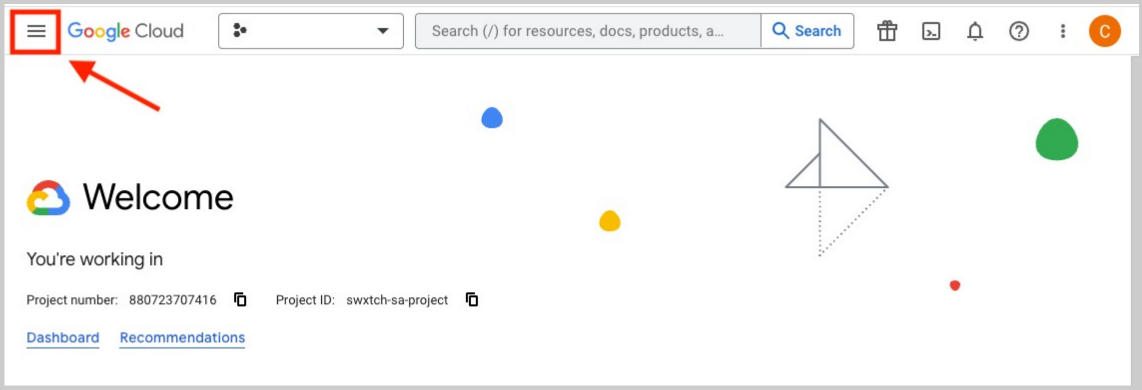
Step One: Navigate to cloudSwXtch in the GCP Marketplace

1. Log into the Google Cloud Console.

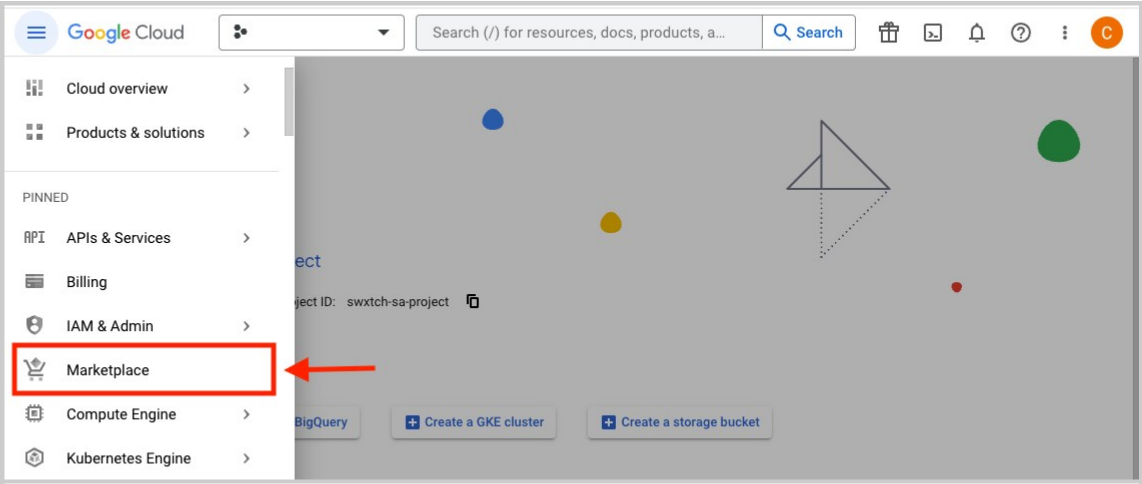


2. Navigate to the Google Cloud Marketplace using the Navigation menu at the top left corner.

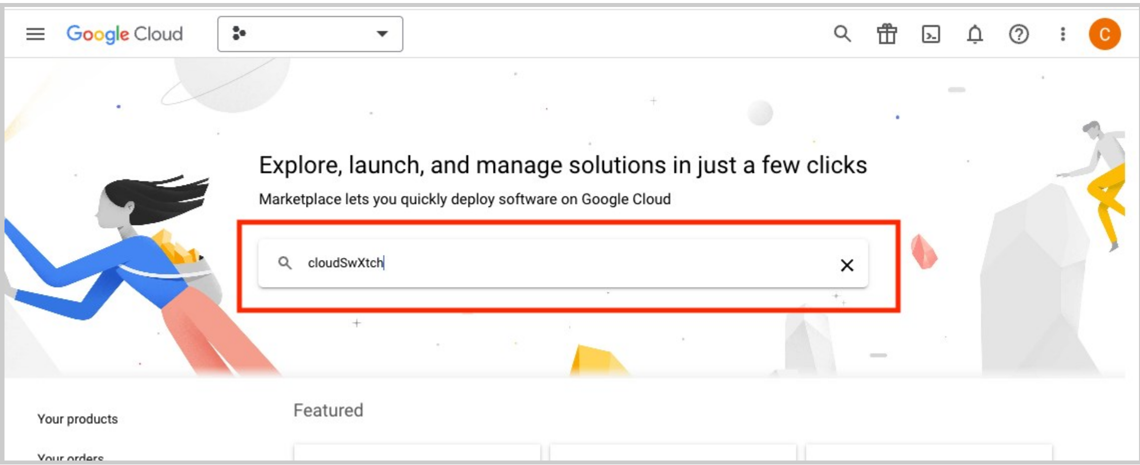
©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



3. Select Marketplace.

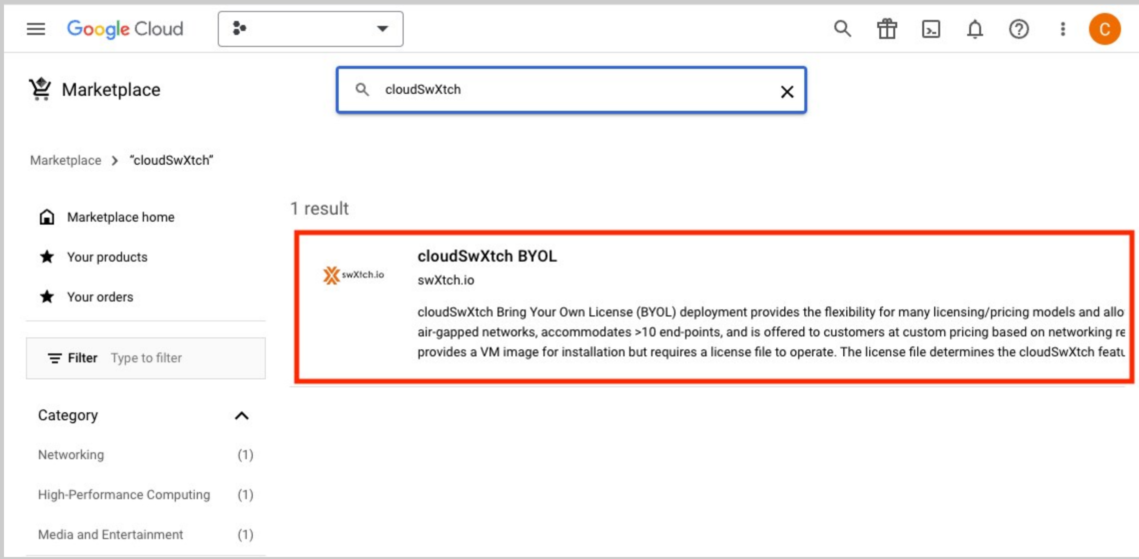


4. Search for cloudSwXtch.

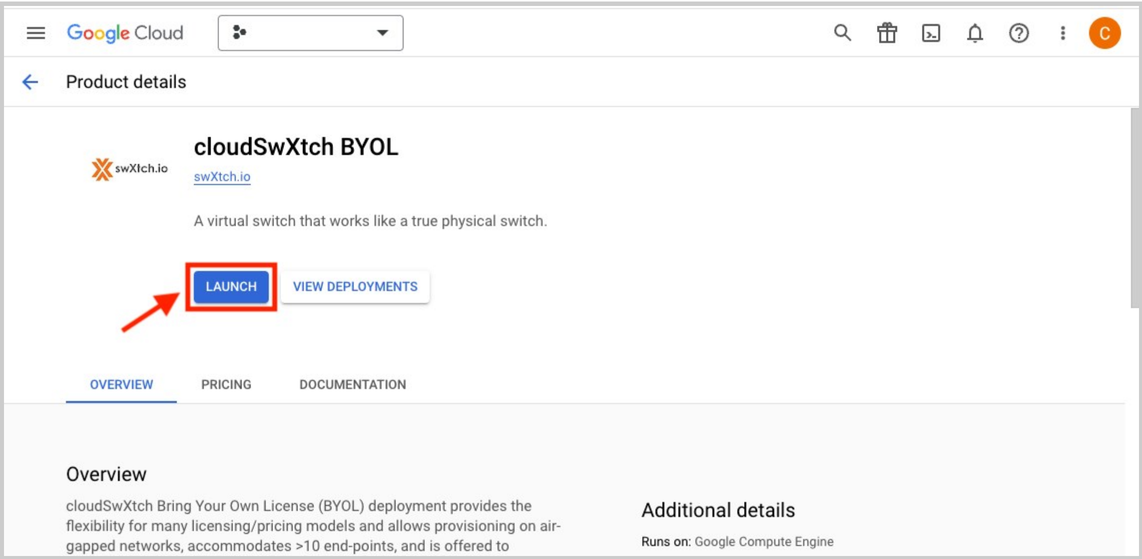


5. Select the product, cloudSwXtch BYOL.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



6. Click Launch to open the deployment configuration page.



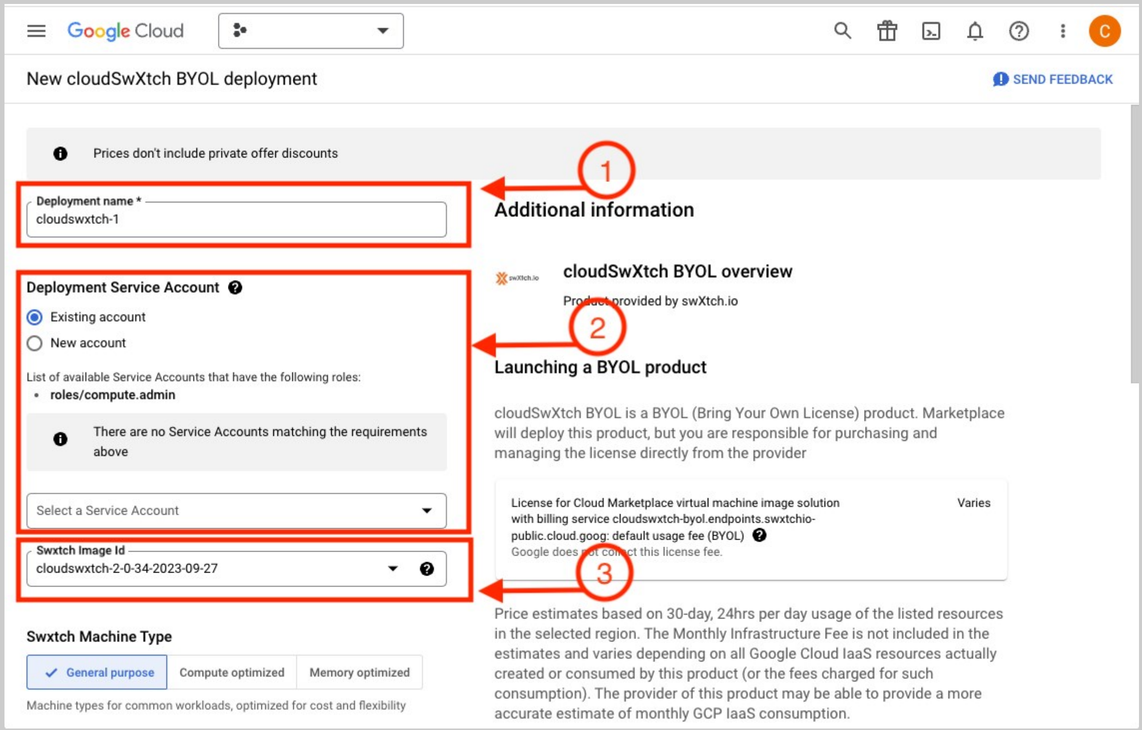
Enabling APIs

After hitting launch, a new window might open asking you to enable Google APIs. You must enable the suggested APIs to continue.

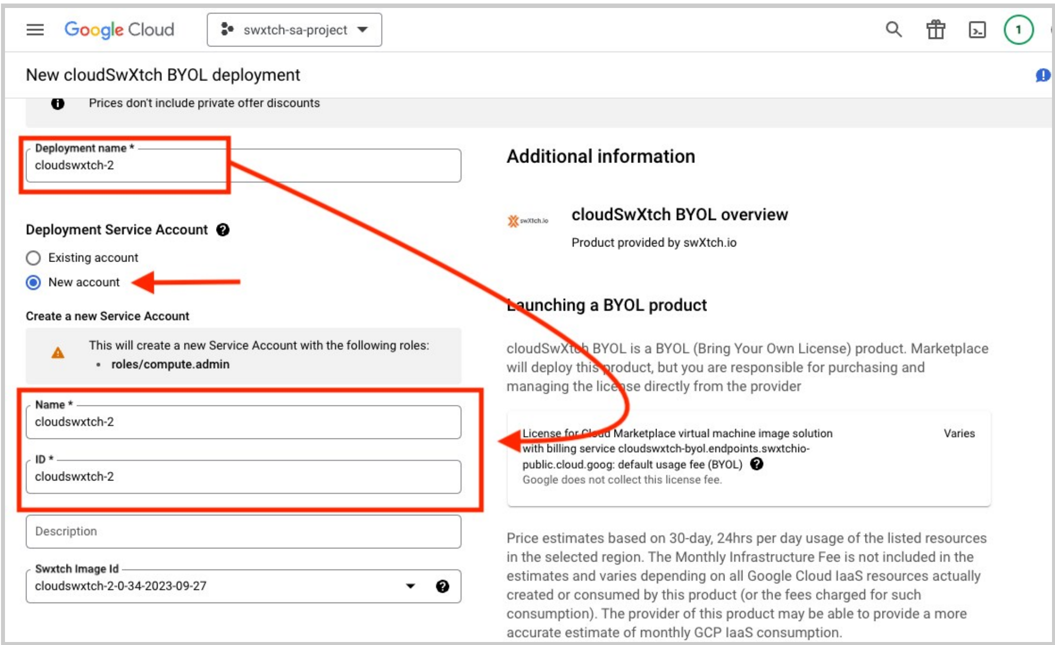
Step Two: Configure cloudSwXtch Deployment

1. Enter a Deployment name for your cloudSwXtch.
2. Select an Existing account under Deployment Service Account.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

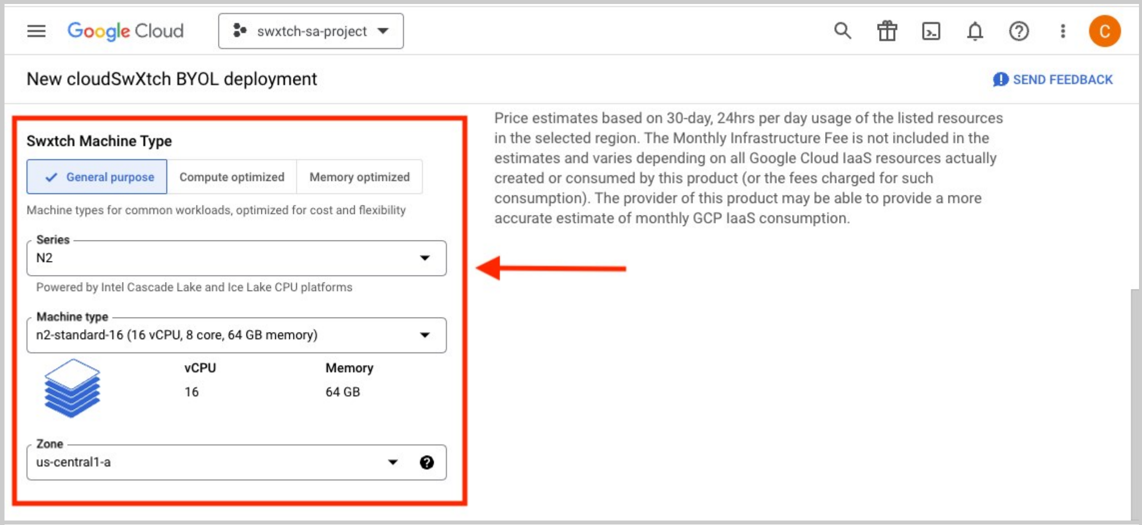


1. If you do not have a Deployment Service Account, select New Account. You will need permissions from your Project IAM Admin (or someone with the resourcemanager.projects.setiampolicy permissions) to allow you to create a new Deployment Service Account.
2. Enter the same name used for your cloudSwXtch Deployment for your New Account Name and ID. The names must match and only use lowercase letters and numbers.
3. The account will be created after you deploy your cloudSwXtch. Once an account is created, users without permissions can use it as an Existing account option.

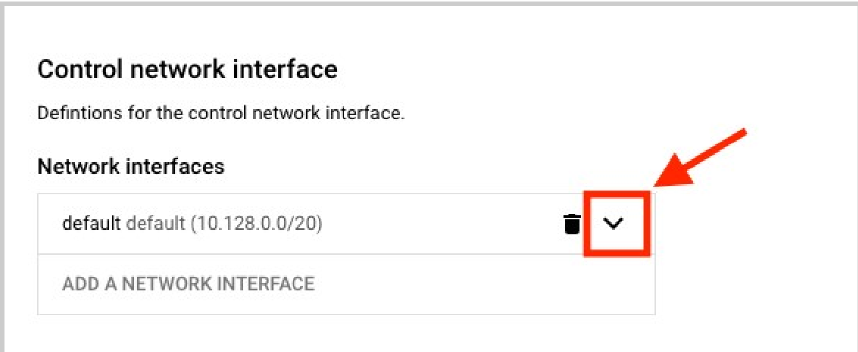


3. Select the desired SwXtch Image ID. This will auto-populate with the most recent version of cloudSwXtch.
4. Under SwXtch Machine Type, confirm that N2 is selected under Series.
5. Confirm your sizing under Machine Type. The default is set to n2-standard-16, which is 16 core. A cloudSwXtch must have a minimum of 4 cores. For cloudSwXtch Sizing guidelines, see cloudSwXtch System Requirements.
6. Confirm your desired Zone.

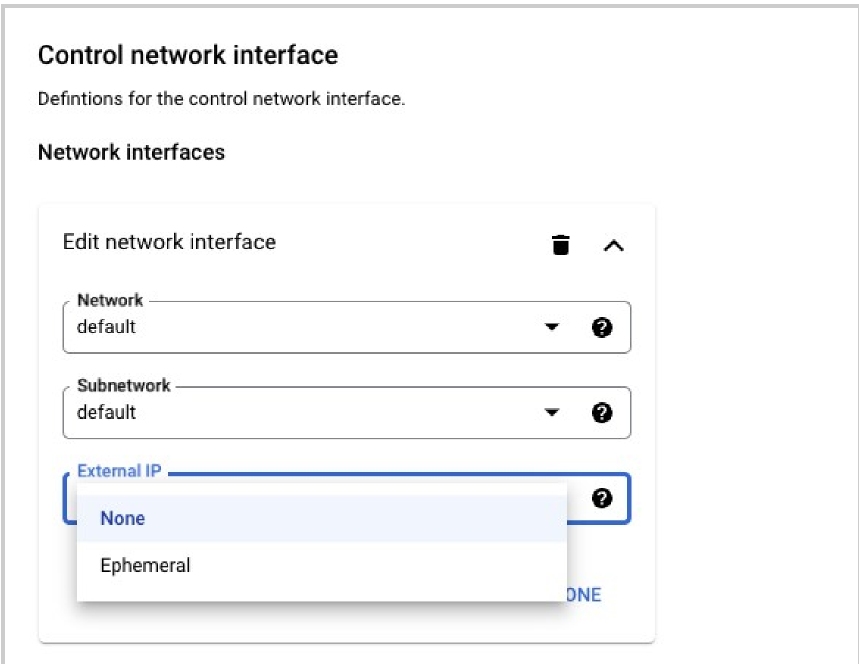
©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



7. Use the dropdown arrow under `Control network interface` to open the configuration panel. If your default subnet is already selected and you do not wish to set a public IP, continue you on Step 10.

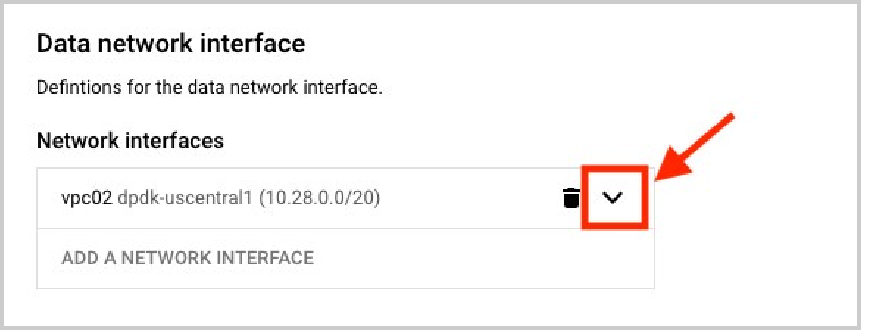


8. Select a `Network` and `Subnetwork`. This subnet will be used for your control plane communications.
    1. Optional: Users can select Ephemeral under External IP if they wish for their Control NIC to be assigned a randomized public IP address.

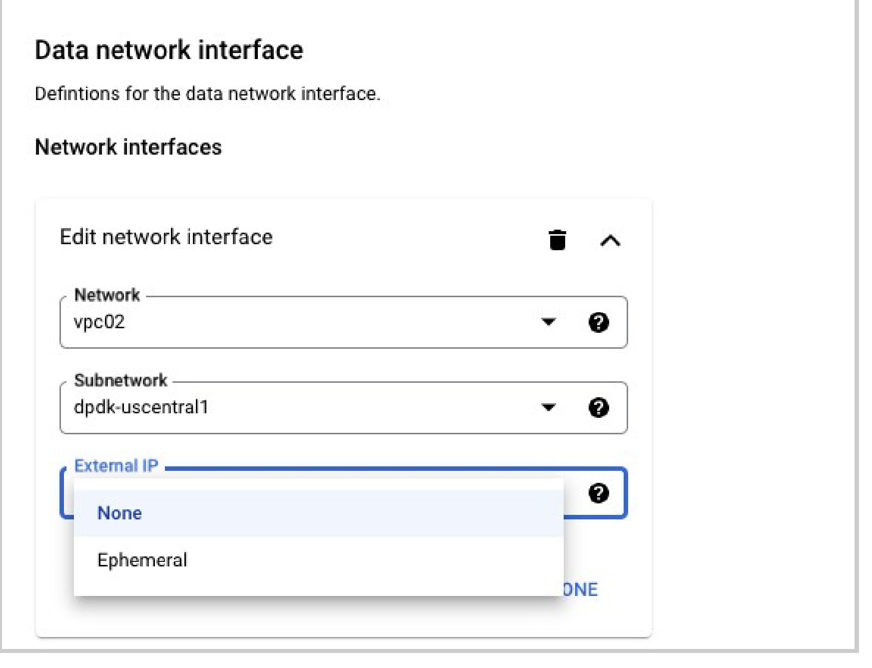


9. Click `Done` when you are happy with your selections.
10. Use the dropdown arrow under `Data network interface` to open the configuration panel.

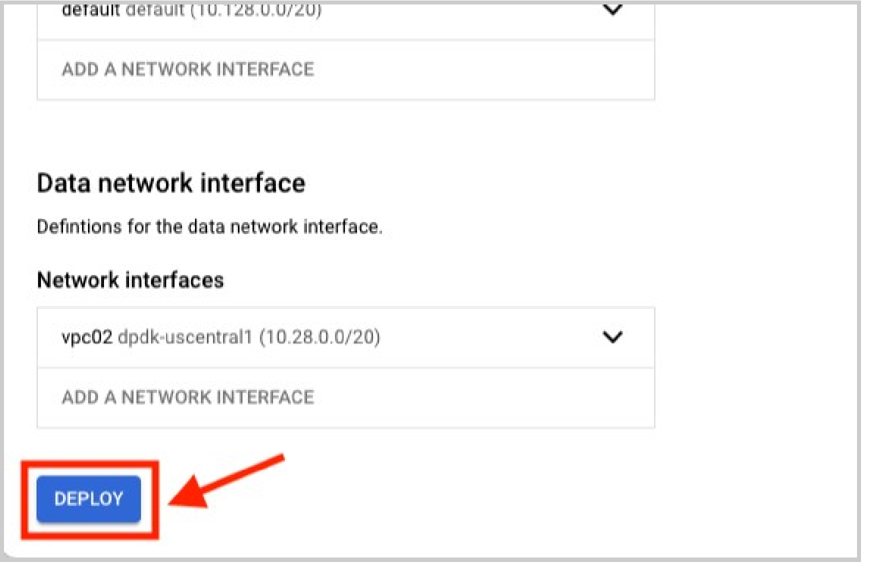
©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



11. Select a Network and Subnetwork. This 2nd subnet will be used for your data plane communications and should've been created before starting the deployment process.
    1. Please note: The control and data NICs cannot share a subnet. They must have separate subnets.
    2. Optional: Users can select Ephemeral under External IP if they wish for their Data NIC to be assigned a randomized public IP address.

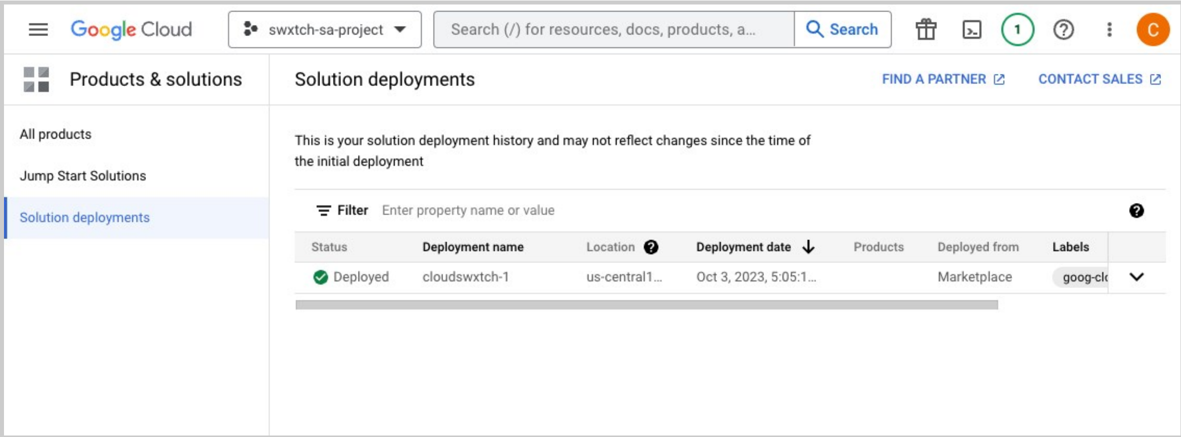


12. Click Done when you are happy with your selections.
13. Click Deploy.



©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

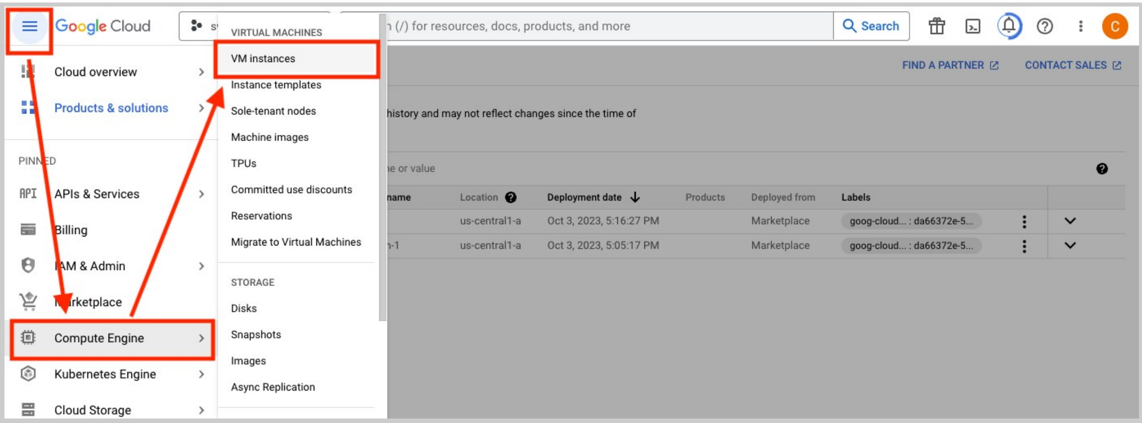
Your cloudSwXtch instance will now be deployed.



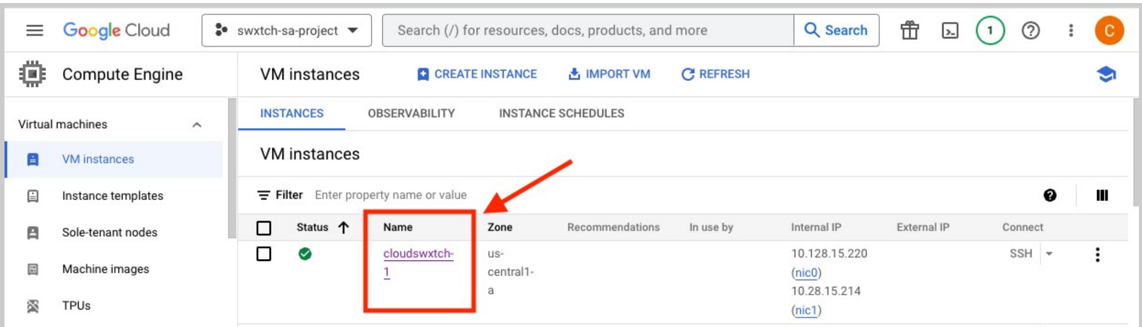
Step Three: Add SSH Key(s)

In order to access your Google Cloud VM instance, you will need to add an SSH key to your cloudSwXtch deployment.

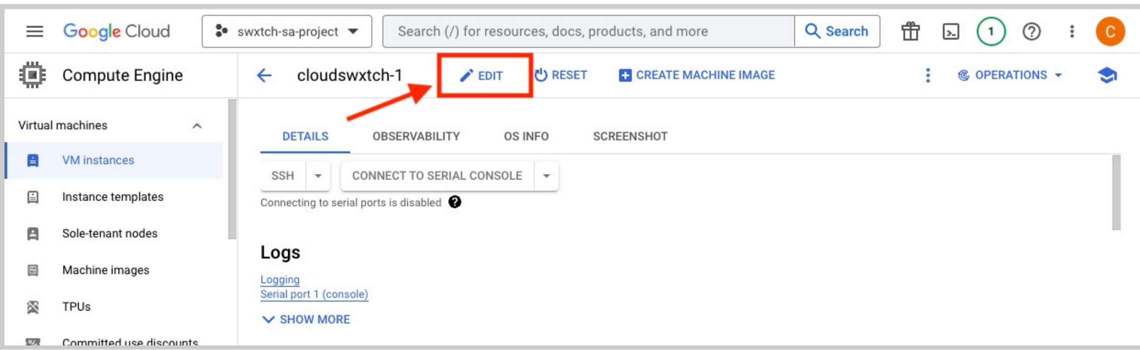
1. Click on the Navigation menu on the left hand corner, highlight Compute Engine and select VM instances.



2. Select the name of your cloudSwXtch deployment to open its configuration page.

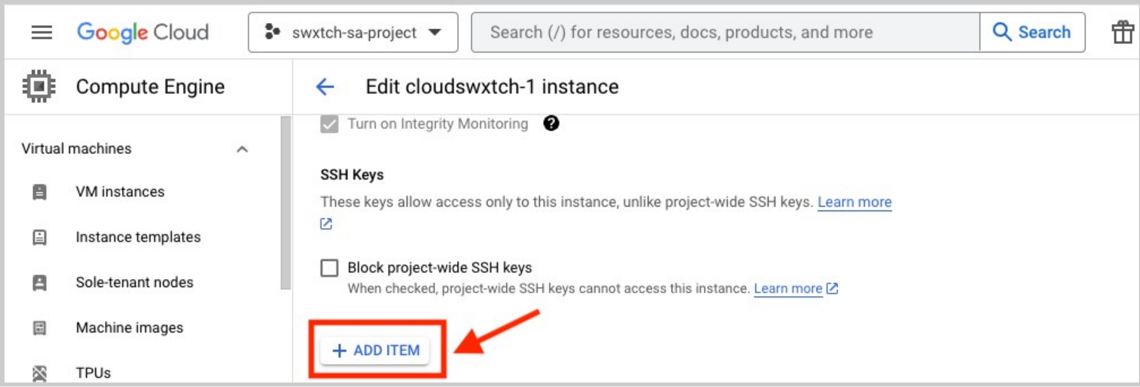


3. Choose Edit next to your cloudSwXtch deployment name.

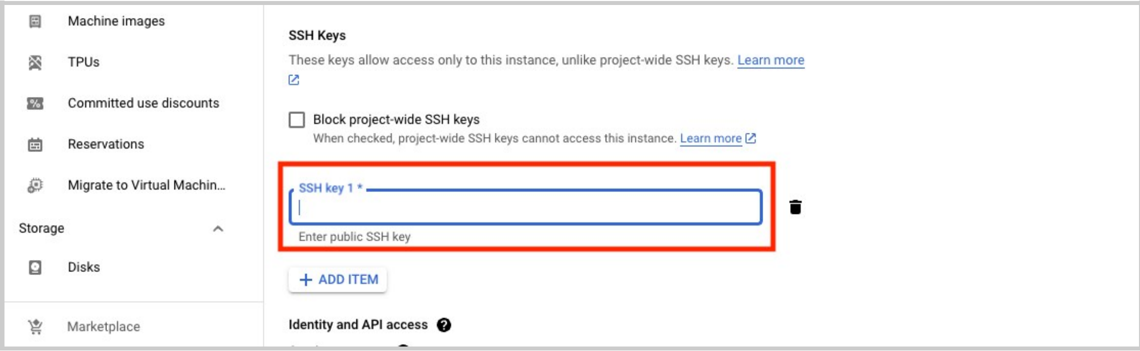


©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

4. Scroll down to SSH Keys under Security and Access.
5. Click +Add Item.



6. Enter your SSH key. You can add multiple.



7. Hit Save at the bottom of the page.

Required Step for BYOL: Contact swXtch.io for a license

Users deploying a BYOL instance of cloudSwXtch will need to contact swXtch.io for a license file. For more information, see How to License a cloudSwXtch.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

cloudSwXtch on OCI

WHAT TO EXPECT

In this article, users will find links to articles on deploying a cloudSwXtch in Oracle Cloud Infrastructure (OCI).

Currently, there are only two ways of deploying a cloudSwXtch on OCI:

- From the Oracle Cloud Marketplace
  - Note: This method will require users to contact swXtch.io for a license.
- Cloud agnostic cloudSwXtch VM Install
  - Note: This method will require the user to already have a Virtual Machine installed with Ubuntu 20.04 that adheres to all the cloudSwXtch System Requirements.

Please stay tuned for more information about alternative methods of installation.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Install cloudSwXtch via OCI Marketplace

WHAT TO EXPECT

In this article, users will learn how to deploy a cloudSwXtch instance via the Oracle Cloud Marketplace.

- Step One: Navigate to cloudSwXtch in the Oracle Marketplace
- Step Two: Create Compute Instance
- Step Three: Attach Secondary VNIC
- Optional Step for BYOL: Contact swXtch.io for License

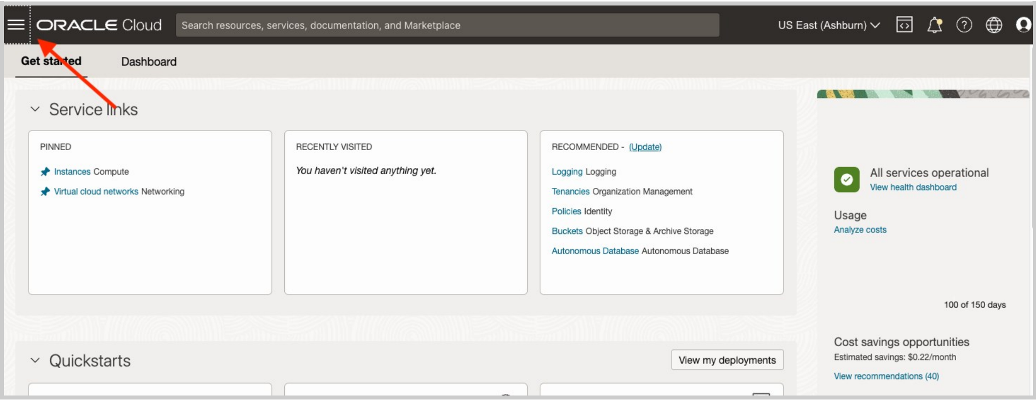
Please note: At this time, our only product offering in OCI is a BYOL instance of cloudSwXtch. This requires a user to contact swXtch.io for a license.

Prerequisites

A user should have a Compartment established in their Oracle Cloud console before they start to deploy a cloudSwXtch. For more information about compartments, please see the Managing Compartments page under Oracle Cloud Infrastructure Documentation.

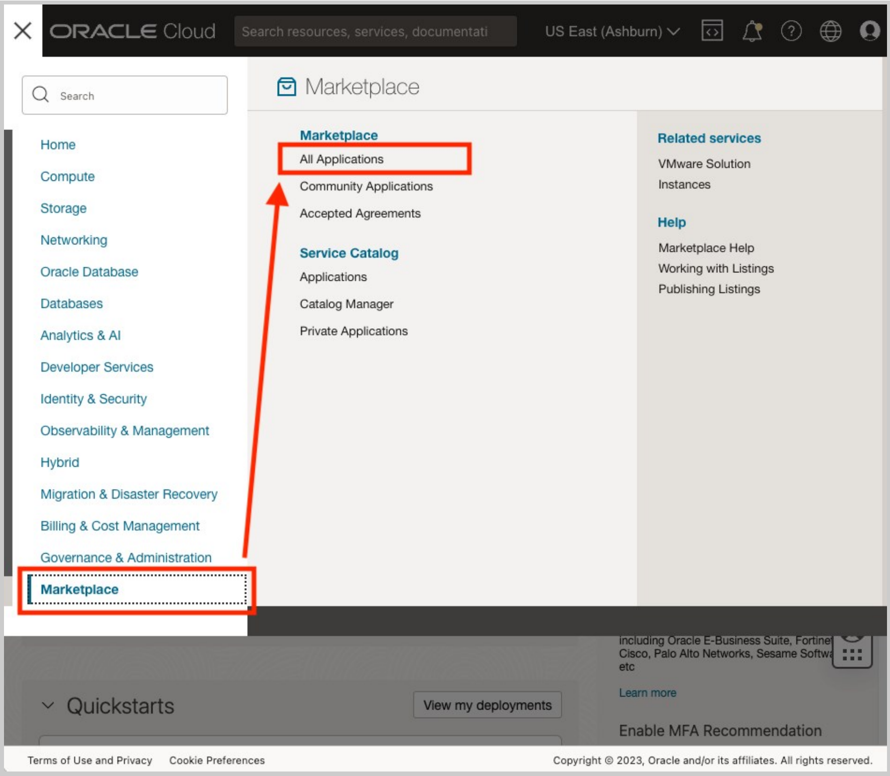
Step One: Navigate to cloudSwXtch in the Oracle Marketplace

1. Log into Oracle Cloud.
2. Navigate to the Oracle Cloud Marketplace using the Navigation menu at the top left corner.

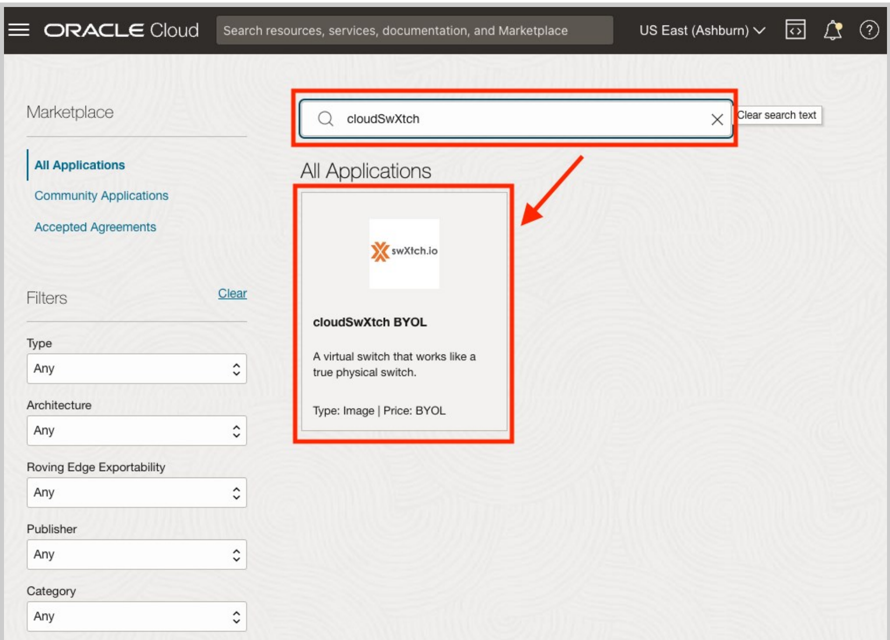


3. Select Marketplace and All Applications.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

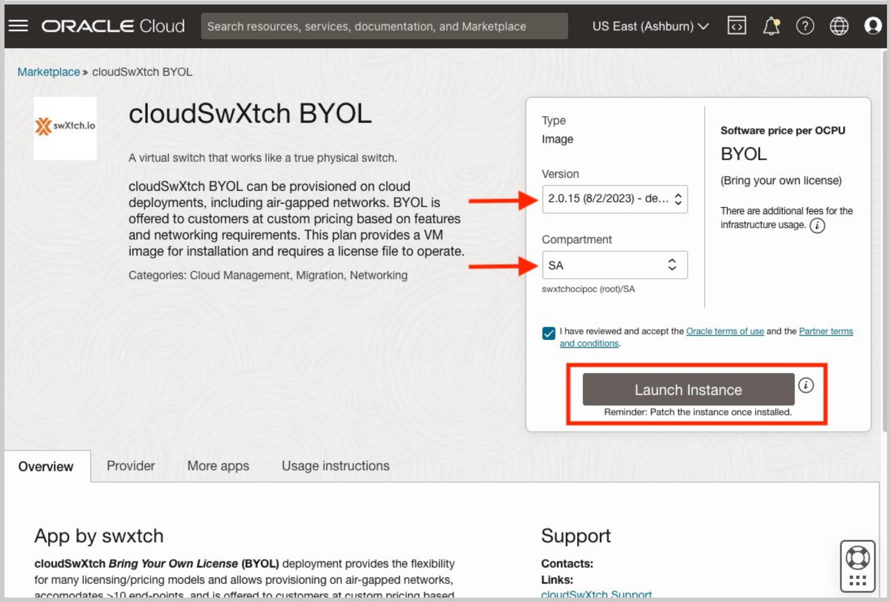


4. Search for cloudSwXtch and select the product, cloudSwXtch BYOL.



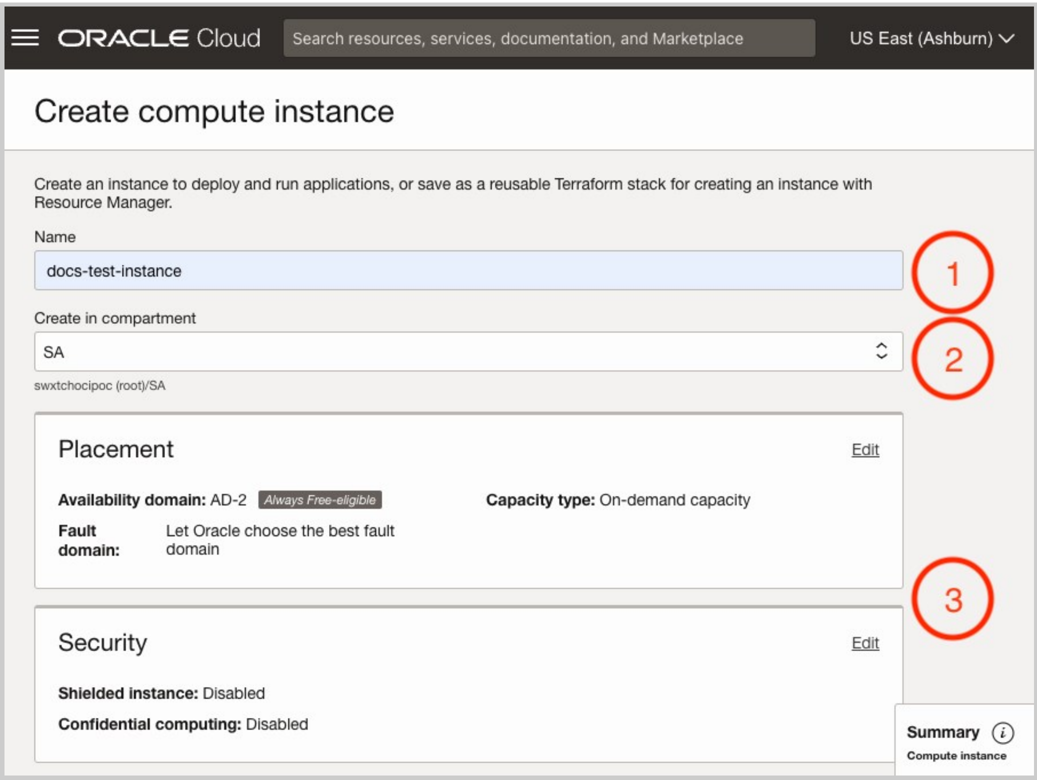
5. Select the Version and the Compartment that you will like to use. It is best to use the default since it will be the most recent version.
6. Click Launch Instance when you're happy with your selections.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

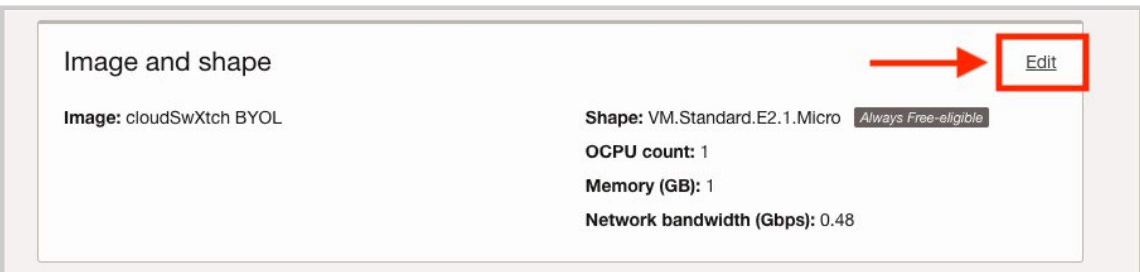


Step Two: Create Compute Instance

1. Give your Compute Instance a unique name.
2. Confirm that your desired Compartment is populated.
3. Optional: Edit selections for Placement and Security. This is dependent on a user's specific needs.

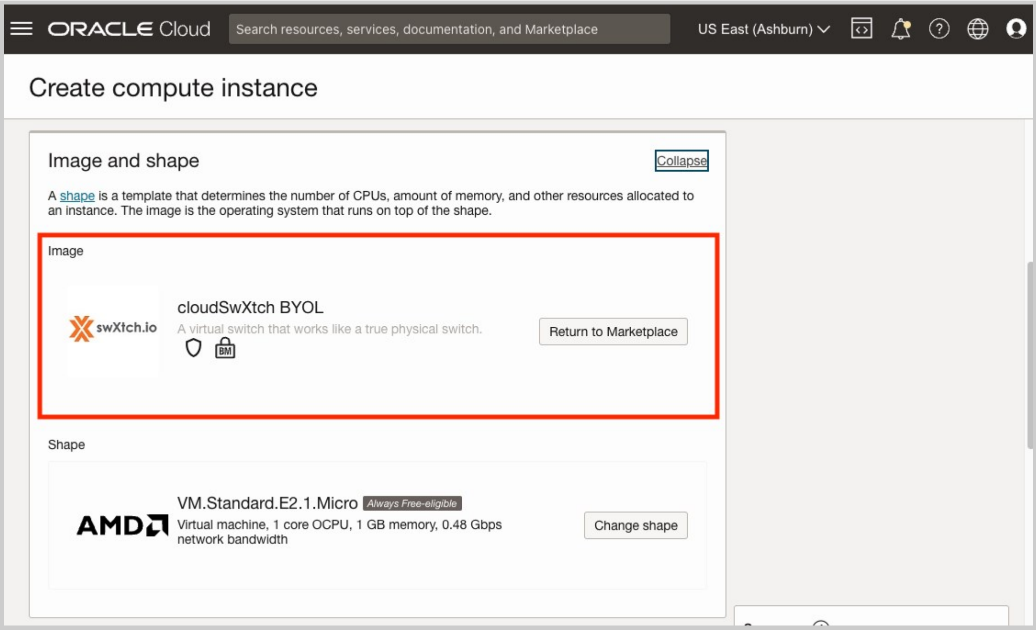


4. Select the Edit button for Image and Shape.

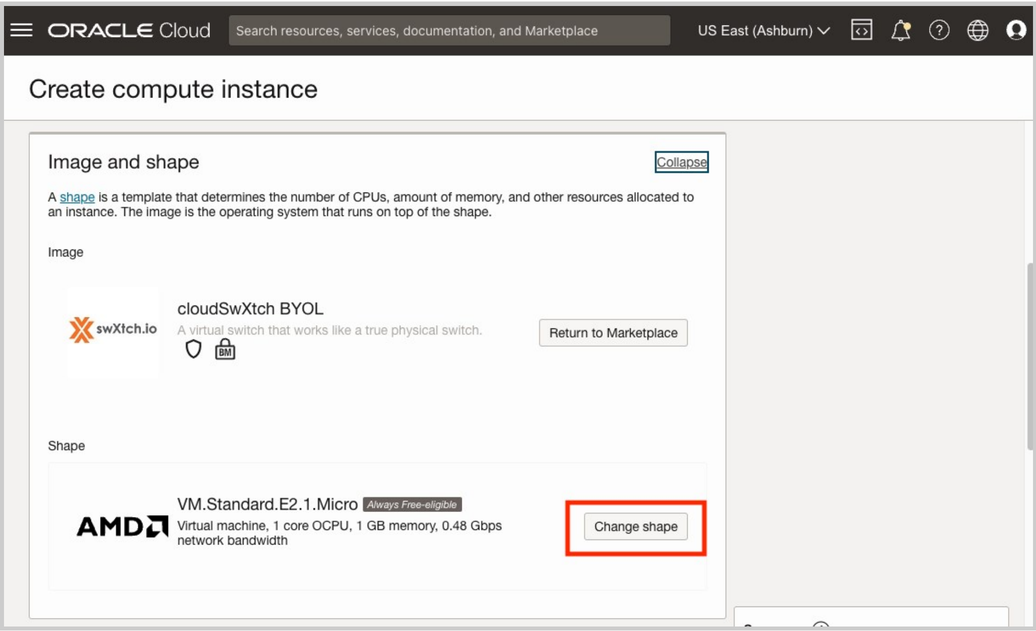


   1. Confirm that cloudSwXtch BYOL is selected for Image.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

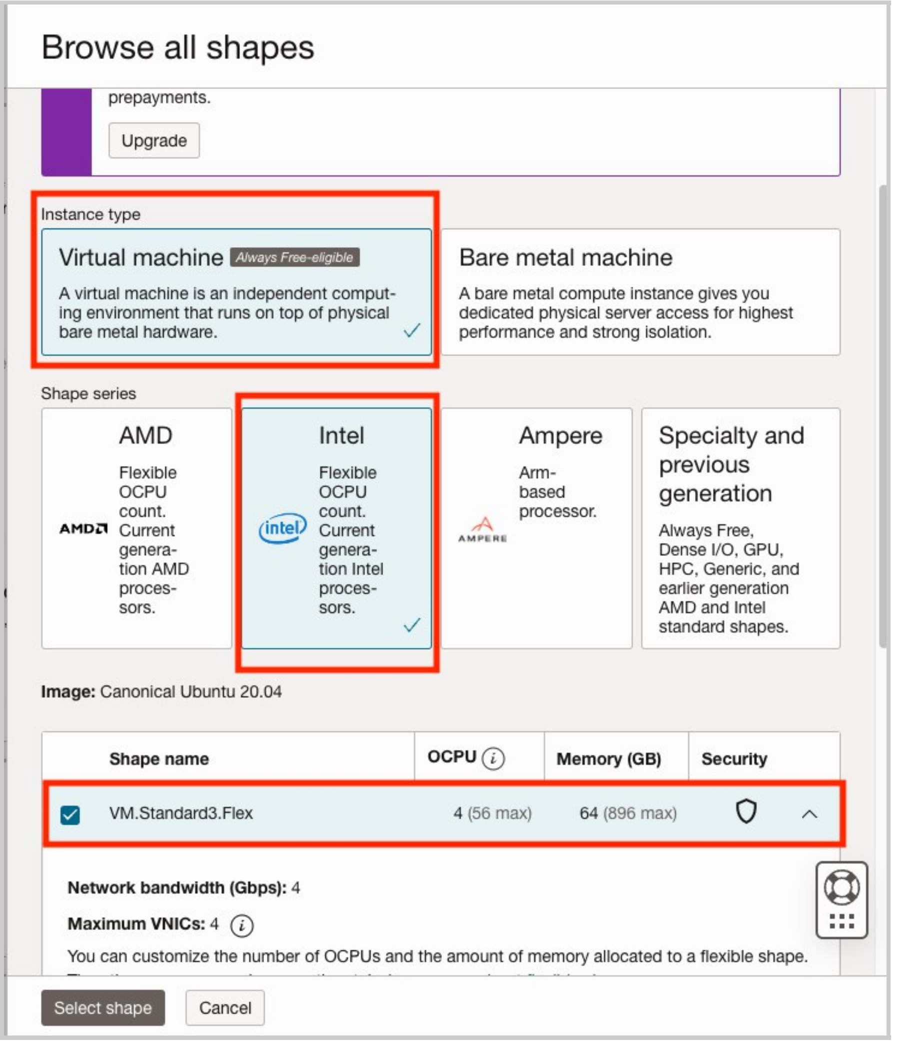


2. Click Change Shape.



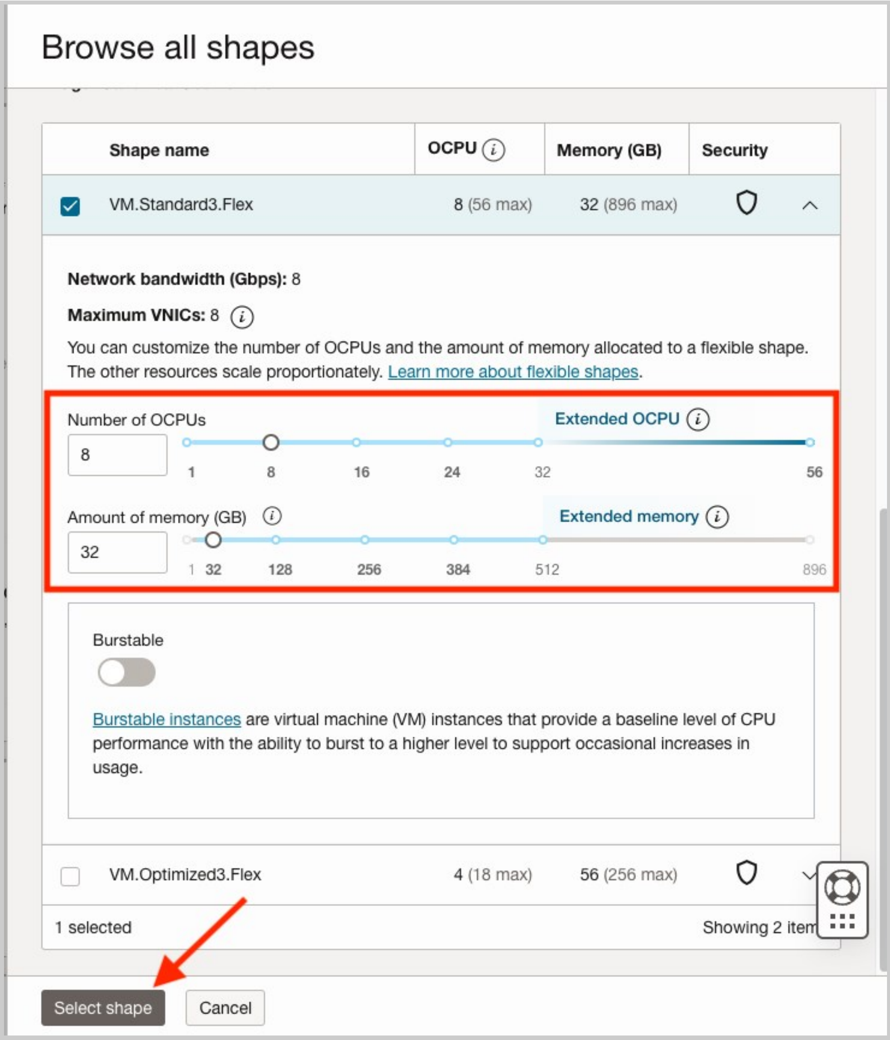
3. Choose Intel and VM.Standard3.Flex.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



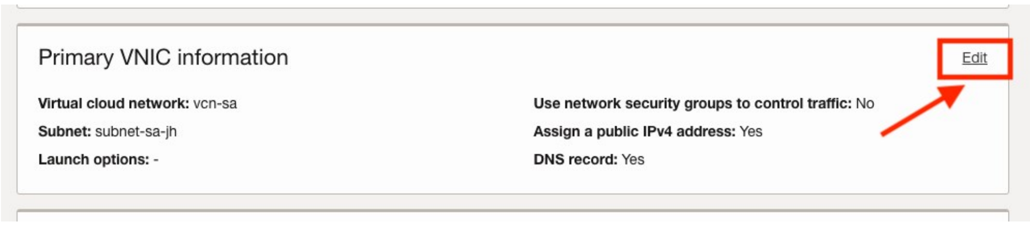
4. Configure the Number of OCPUs and Amount of memory (GB). Please note: It is recommended to have at least four (4) cores for your cloudSwXtch instance. This is typical sizing for a small cloudSwXtch. For more information on recommended sizing, please see cloudSwXtch System Requirements.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



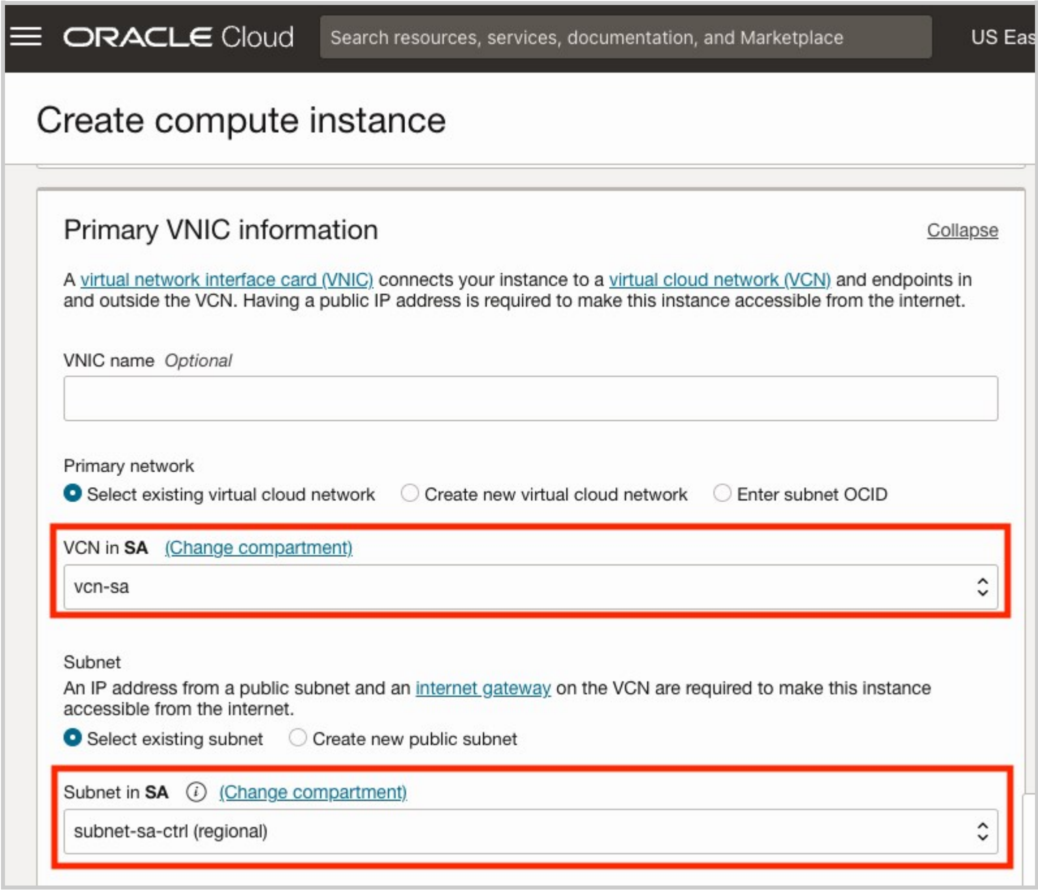
5. Click Select Shape when you're happy with your selection.

5. Select the Edit button for Primary VNIC information.

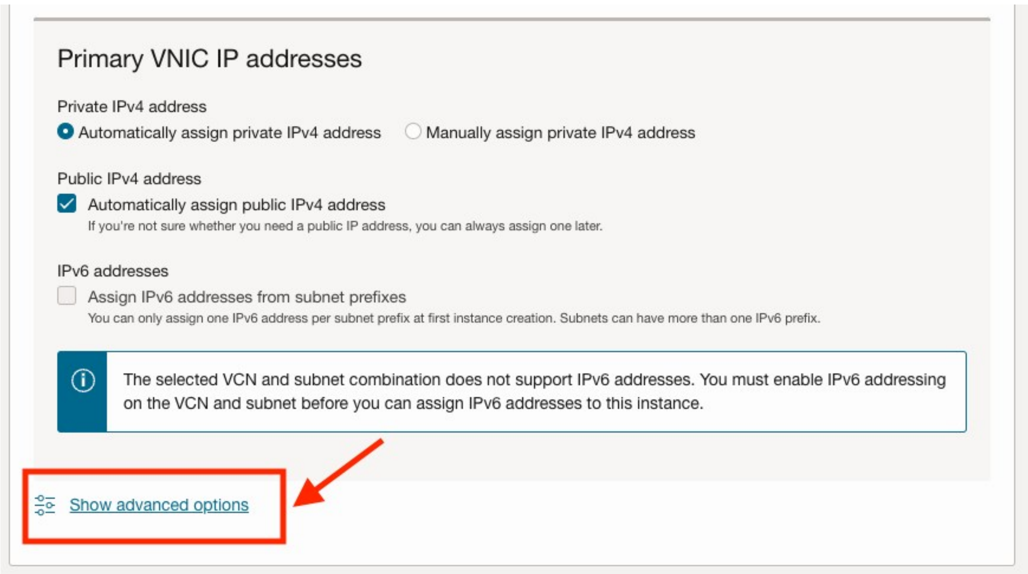


1. Optional: Add a name to your VNIC. If left blank, Oracle will assign it the name of your instance with a note that it is the Primary VNIC.
2. Assign a VCN to your Primary VNIC.
3. Select a subnet. Please note: This ctrl subnet will also be used for your secondary VNIC.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

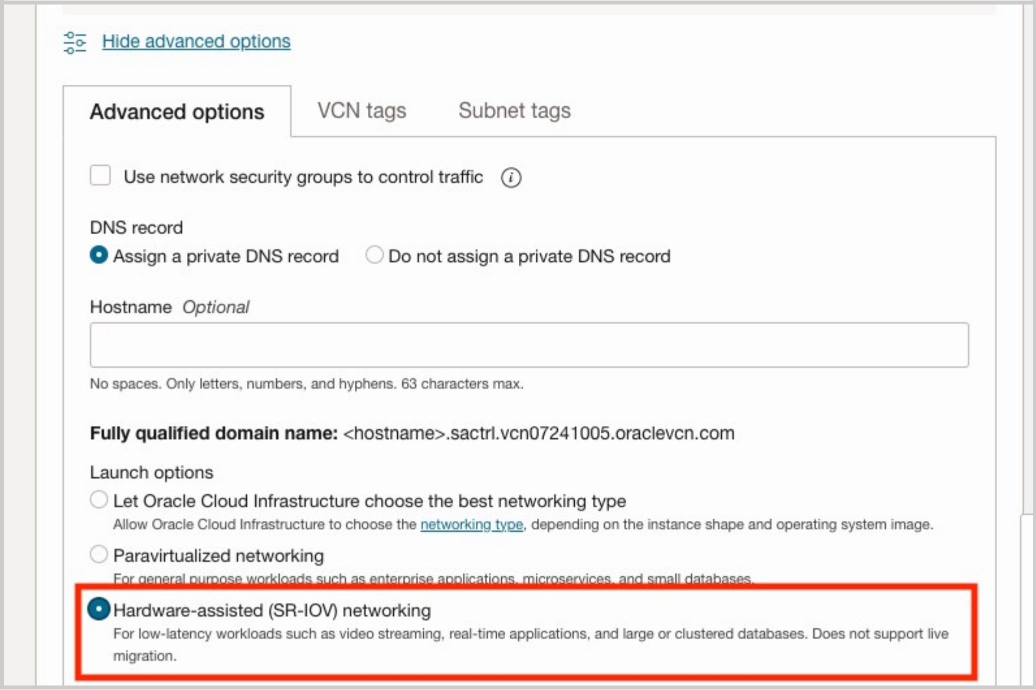


4. Click on Show advanced options.

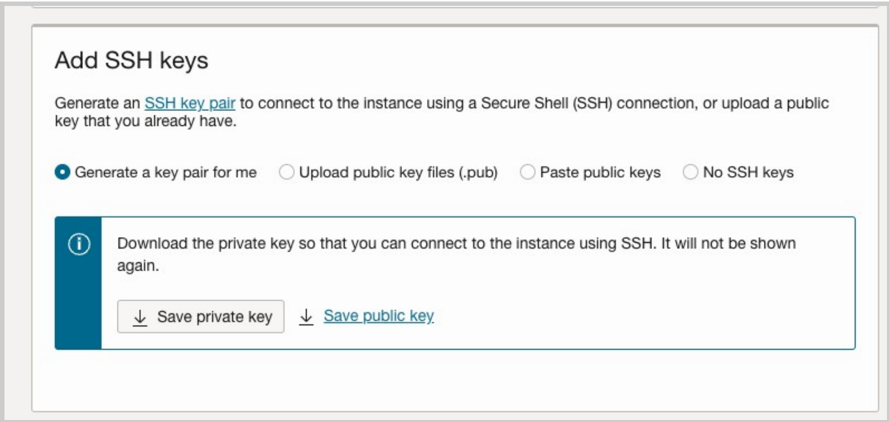


5. Select Hardware-assisted (SR-IOV) networking under Launch options.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



6. Add an SSH key.

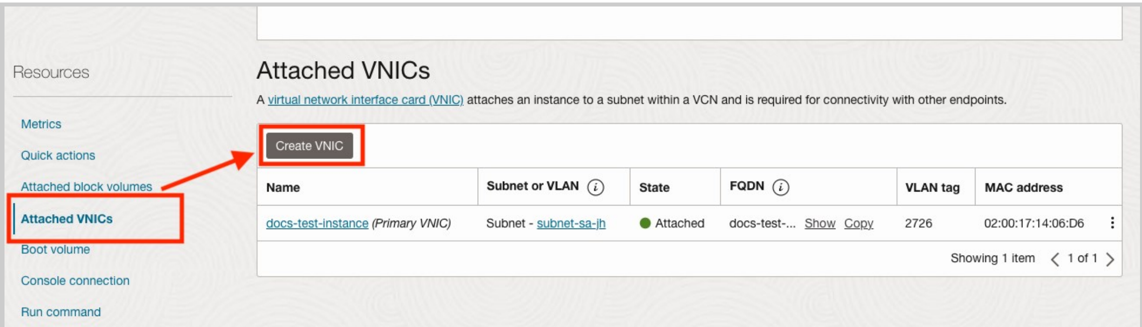


7. Hit Create button when you're happy with all of your selections.

Step Three: Attach a Secondary VNIC

When deploying a cloudSwXtch, you will need two VNICs. Both can share a single subnet for control and data plane communications. In this step, we will walkthrough how to attach your secondary VNIC and how to manually add its IP to your cloudSwXtch instance.

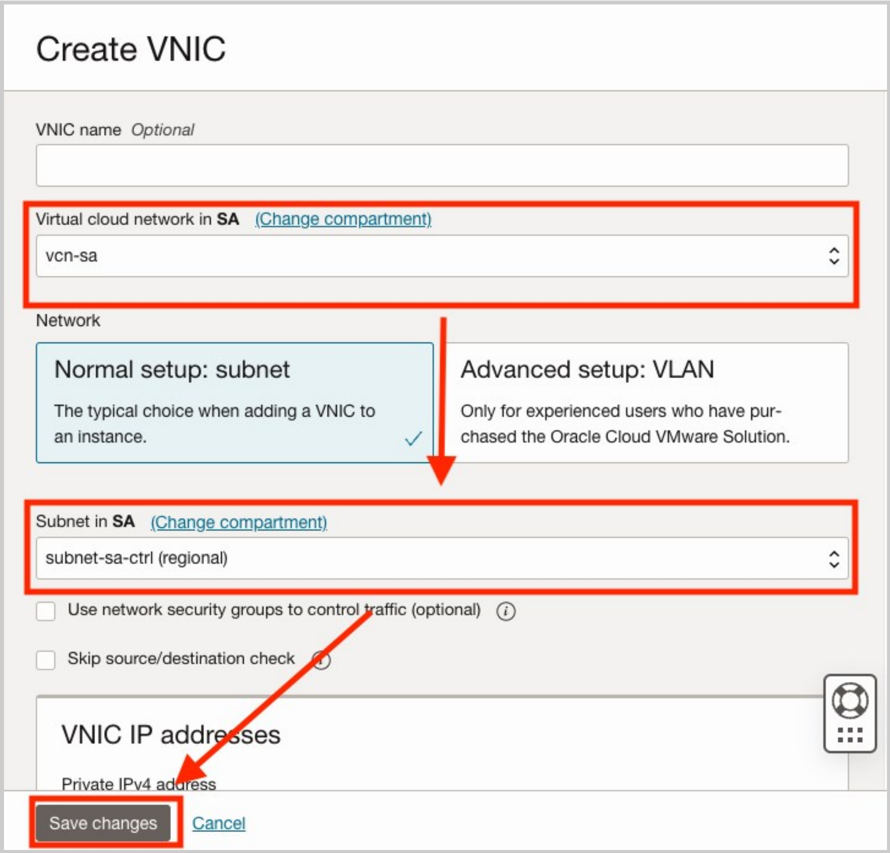
1. Make sure that your Instance with cloudSwXtch installed is running. You cannot attach a secondary VNIC if the machine is off.
2. Select Attached VNICs under Resources.



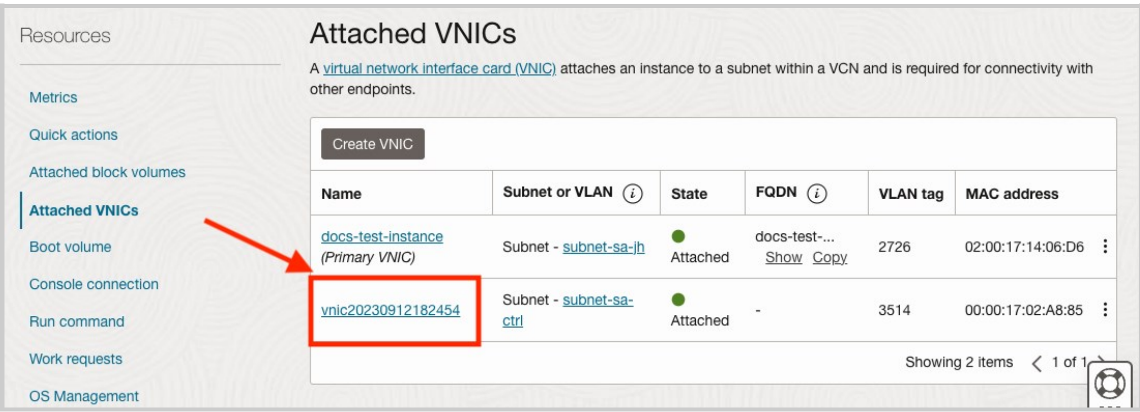
3. Click Create VNIC.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

1. Pro-Tip: Assign your secondary VNIC a user-friendly name. Otherwise, Oracle will assign a randomized ID.
2. Choose the same Virtual cloud network and ctrl Subnet as your Primary VNIC.
3. Select Save Changes.

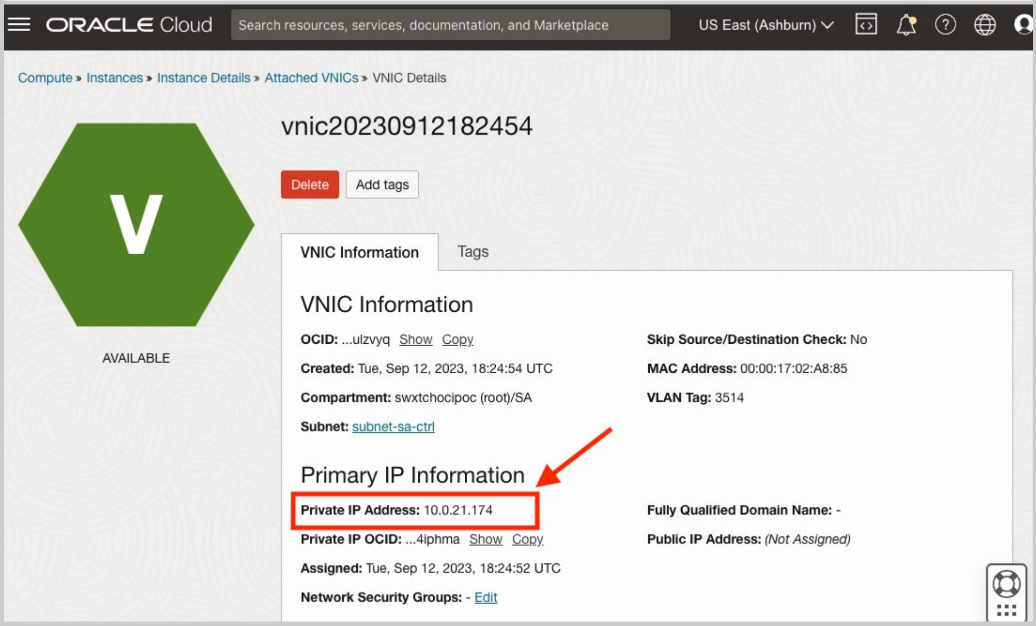


4. Click on the freshly created VNIC's name after it finishes attaching.



5. Record the Private IP address. You will need it later.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



6. Log into your Instancewith cloudSwXtch installed.
7. Create the following file in the /etc/netplan folder and name it 02-datanic-static-config.yaml. Please note: You will need to add the Private IP Address of the secondary VNIC into the file below.

Bash | Copy

```
network:
                version: 2
                ethernets:
                    ens4:
                        match:
                            macaddress: 02:00:17:09:c2:cf
                        dhcp4: false
                        addresses:
                            - <ADD IP ADDRESS OF 2ND VNIC>/<XX>
```

Where the <XX> is the net mask (or network mask) of ctrl-plane CIDR (in single-subnet configuration).

8. Apply the new config (sudo netplan apply).
9. Find the file /etc/iptables/rules.v4 and open it in your editor.
10. Search for the following lines:

Bash | Copy

```
-A INPUT -p all -s 10.0.128.0/24 -j ACCEPT
-A INPUT -p all -s 10.0.192.0/24 -j ACCEPT
```

11. Replace the CIDRs with your own CIDRs, corresponding to the ctrl and data subnets. These numbers can be the same if using a single-subnet configuration for both your VNICs.
12. Save file and reboot instance.

The secondary VNIC should now be successfully attached.

Optional Step for BYOL: Contact swXtch.io for a license

Users deploying a BYOL instance of cloudSwXtch will need to contact swXtch.io for a license file. For more information. see How to License a cloudSwXtch.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

NEXT STEPS

The cloudSwXtch is ready to use. The next step is to install the xNIC on each client expected to get traffic from the cloudSwXtch. See Installing xNIC for more information on preparing clients.How to License a cloudSwXtch

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Upgrading cloudSwXtch

WHAT TO EXPECT

In this article, users will learn how to update their cloudSwXtch when new versions are available. The following commands are cloud agnostic so they should work regardless of what cloud they're using.

There are two ways of ensuring your cloudSwXtch is up-to-date: via the cloudSwXtch or via the xNIC.

Upgrading cloudSwXtch via the cloudSwXtch

1. Sign onto the VM where the cloudSwXtch is running.
2. Run the following command:

   Shell

   Bash | Copy

   ```bash
   sudo /swxtch/swx update -i localhost -v v<desired version>
   ```

Example:

Shell

Bash | Copy

```bash
sudo /swxtch/swx update -i localhost -v v2.0.34
```

Upgrading cloudSwXtch via the xNIC

1. Connect to any VM where an xNIC is running.
2. Run the following command:

   Shell

   Bash | Copy

   ```bash
   swx update -v <desired version> --ip <ip of cloudSwXtch>
   ```

Example:

Bash | Copy

```bash
swx update -v v2.0.34 --ip 10.5.1.6
```

Note: The <desired version> includes a "v" before the version number (e.g. v2.0.34).

Upgrading cloudSwXtch and xNICs

Make sure you upgrade all cloudSwXtches and xNICs in the environment to have the best functionality.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Installing cloudSwXtch Bridge

WHAT TO EXPECT

There are currently 2 types of cloudSwXtch Bridges: Type 1 and Type 2. It is suggested for users to use cloudSwXtch Bridge Type 2 for most cases. Bridge Type 1 should really only be used for testing purposes.

In this article, users will learn about the difference between each cloudSwXtch Bridge Types and links on installation instructions for both.

Bridge Type 2

Type 2 of the cloudSwXtch Bridge is the more performant version of Bridge Type 1. It supports the following:

- Bi-directional traffic between on-prem and the cloud
- Dynamic IGMP joins and leaves. When an application in the cloud sends an IGMP join, then the cloudSwXtch in the cloud sends the information to the ground cloudSwXtch as a bridge, allowing the traffic to go through. Dynamic bridge is only supported from ground to cloud, not from cloud to ground.

See Install cloudSwXtch Bridge Type 2 for installation instructions.

Bridge Type 1

Type 1 of the cloudSwXtch Bridge should only be used for testing purposes where there is no VPN or Express Route, only access via the Internet. Unlike Bridge Type 2, it does not support bi-directional traffic between the on-prem and the cloud. It only supports one direction: on-prem to the cloud. Additionally, it does not support dynamic bridge.

See Install cloudSwXtch Bridge Type 1 for installation instructions.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Install cloudSwXtch Bridge Type 2

PREREQUISITES

- A cloudSwXtch instance running in any cloud.
- Network connectivity from on-premises to the Virtual Network hosting the cloudSwXtch instance. A user should be able to ping the cloudSwXtch instance from the on-premises network.
- The cloudSwXtch Bridge requires 2 NICs with the non-primary NIC as a Mellanox card.
    - Note: ConnectX-5 cards are preferred for the non-primary NIC. For a list of recommendations, please visit the following link: https://www.cisco.com/c/en/us/products/servers-unified-computing/third-party-adapters-listing.html?flt2_general-table0=Nvidia%2FMellanox
- A VM or BareMetal bridge host machine running Ubuntu 20.04 with Kernel 5.15 or greater OR RHEL8/CentOS8 with Kernel of 5.11 or greater.
    - Minimum of 4 cores, 8GB RAM.
    - Hard drive: Minimum 20GB, Recommended: 40GB
- The bridge host must be able to receive and/or send multicast traffic from the local network and send UDP packets to the cloud's Virtual Network using a VPN or Express Route. Internet only access is NOT viable for V2. (See Install cloudSwXtch Bridge V1 if this is your only option.)

Firewall Rules

- cloudSwXtch Ctrl IP <-> Bridge Ctrl IP 80 (TCP)
- cloudSwXtch Data IP <-> Bridge Data IP 9999 (UDP)

Pre-Installation: Update Ubuntu 20.04 to Kernel 5.15

1. Use the following commands:
   Shell

   Bash | Copy
   ```bash
   sudo apt-get install linux-generic-hwe-20.04
   ```

   Bash | Copy
   ```bash
   sudo apt update && sudo apt full-upgrade
   ```

3. Reboot your machine. If a user is running an Air-Gapped install, they will need to download and Install the package manually: https://vitux.com/how-to-install-latest-linux-kernel-5-15-on-ubuntu-20-04/
4. Use the following to verify the kernel version is at 5.15:
   Shell

   Bash | Copy
   ```bash
   uname -r
   ```

   The output will read:

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Bash Copy

```
5.15.0-1023
```

Updating RHEL8/CentOS8 with Kernel 5.11 or Greater

For more information on how to update your kernel for RHEL8/CentOS8, please read the following articles:

- https://www.ubuntumint.com/install-linux-kernel-rhel-8/
- https://www.2daygeek.com/changing-default-kernel-rhel-8-rhel-9/

WARNING: Update your kernel at your own risk for RHEL/CentOS8.

Installation

This method can be used to install the bridge application onto the bridge host machine. It will only work if the cloudSwXtch instance is up and running and the bridge host has network connectivity to the cloudSwXtch instance.

1. Open a bash console on any VM that is on the same control plane network as the cloudSwXtch that you intend to use as the bridge host.
2. Ping the cloudSwXtch using your instance name or IP.
   Text

   None Copy

   ```
   ping <swxtch-instance-ip or instance-name>
   ```

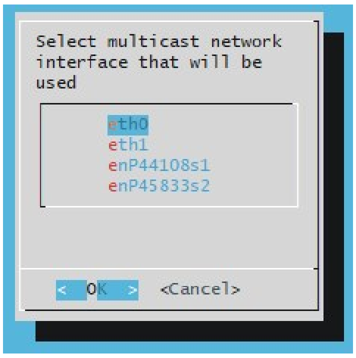
   1. If the ping fails to find the cloudSwXtch instance by name, try pinging the IP address of the cloudSwXtch instance. If the IP works, they use the IP address in place of the name in all future commands. This can happen if the default DNS settings are changed for the Virtual Network.
3. Run the cloudSwXtch bridge installer script:
   Text

   None Copy

   ```
   sudo sh -c "curl -s http://<swxtch-ip>/services/install/swxtch-bridge-install.sh |
   bash -s -- -v 2"
   ```

   1. When prompted, select the network interface that will be used to receive and send multicast traffic (i.e. interface to/from on prem).

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



The service will be automatically initialized and the logs can be seen with:

None

```
sudo journalctl -u swxtch-bridge2 -f -n 100
```

TROUBLESHOOT: Configuring Bridge Type 2 Interfaces or Gateway

In the event that your cloudSwXtch Bridge is not sending data to the cloudSwXtch, then it is recommended to review the Bridge Type 2 configuration json file to verify the correct interfaces have been selected. For more information on how to do this, please see the Configuring cloudSwXtch Bridge Type 2 Instances section.

Alternatively, there can be an issue with the gateway address. For more information, see Using a Specific Gateway Address for Bridge Type 2.

Configuring cloudSwXtch Bridge Type 2

There may be some scenarios that require special configuration for the cloudSwXtch Bridge. For more information, see Bridge Type 2 under Configuring cloudSwXtch.

cloudSwXtch Bridge Type 2 Commands

After deploying your cloudSwXtch Bridge Type 2, a user can execute commands to stop, start, and restart their instance. They can execute these commands in the command window of their cloudSwXtch Bridge.

STOP

Bash

```bash
sudo systemctl stop swxtch-bridge2.service
```

START

Bash

```bash
sudo systemctl start swxtch-bridge2.service
```

RESTART

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

```bash
sudo systemctl restart swxtch-bridge2.service
```

Uninstalling cloudSwXtch Bridge Type 2

To uninstall your cloudSwXtch Bridge Type 2 application from your bridge host machine:

1. Execute the following command on the Bridge VM on-prem:

```bash
sudo sh -c "curl -s http://<swxtch-ip>/services/install/swxtch-bridge-install.sh | bash -s -- -u"
```

Your cloudSwXtch Bridge Type 2 instance should now be uninstalled.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Install cloudSwXtch Bridge Type 1

PREREQUISITES

You will need:

- A cloudSwXtch instance running in a cloud.
- Network connectivity from on-premises to the Virtual Network hosting the cloudSwXtch instance. You should be able to ping the cloudSwXtch instance from the on-premises network.
- A VM or Bare Metal bridge host machine running RHEL 7+, CentOS 7+, or Ubuntu 18.04+ with a minimum of 2 cores, 4GB RAM.
- A bridge host that must be able to receive multicast traffic from the local network and send UDP packets to the cloud Virtual Network.

Direct installation to bridge host -V1

This method can be used to install the bridge application onto the bridge host machine. It will only work if the cloudSwXtch instance is up and running and the bridge host has network connectivity to the cloudSwXtch instance.

1. Open a shell script on any VM that is on the same control plane network as the cloudSwXtch that you intend to use as the bridge host.
2. Ping the cloudSwXtch using your instance name.
   Text

   Bash Copy

   ```bash
   sudo ping <swxtch-instance-name>
   ```

   1. If the ping fails to find the switch instance by name, try pinging the IP address of the cloudSwXtch instance. If the IP works, then use the IP address in place of the <swxtch-instance-name> in all future commands. This can happen if the default DNS settings are changed for the virtual network.

3. Run the bridge installer script:
   Text

   Bash Copy

   ```bash
   curl http://<swxtch-instance-name>/services/install/swxtch-bridge-install.sh |
   bash -s -- -k -v 1
   ```

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Installing xNIC

SUMMARY

- The following article will explain how to install the xNIC component on your Windows and Linux system.
- xNIC is the software that runs on your VM to create a virtual NIC. The xNIC connects your VM to a cloudSwXtch instance.

xNIC System Requirements

There are some major feature considerations to make when deciding what xNIC version to use. These prerequisites are further detailed in the xNIC System Requirements article.

Linux Installation Guide

xNIC Linux Installation

The installer script will install the xNIC as a service as well as the utility applications used to verify the operation of the xNIC and cloudSwXtch instance network for a Linux system. See Testing.

Windows Installation Guide

xNIC Windows Installation

The installer script will install the xNIC as a service as well as the utility applications used to verify the operation of the xNIC and the cloudSwXtch instance network for a Windows system.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

xNIC System Requirements

A cloudSwxtch must exist to create a xNIC. See cloudSwXtch System Requirements for more information.

xNIC software

The xNIC software must be run on each virtual machine that is to be part of the IP multicast network and not a cloudSwXtch or a cloudSwXtch Bridge. This software can be installed on hosts which meet the following requirements:

Available Operating Systems

Linux	Windows
• AlmaLinux 8.8 - *Minimum Kernel Version 4.18* • Amazon Linux 2023 - *Minimum Kernel Version 5.14* • Centos 8 Minimum - *Minimum Kernel Version 4.18* • Oracle Linux 8 - *Minimum Kernel Version 4.18* • RHEL 8.8 - *Minimum Kernel Version 4.18* • RHEL 9.2 - *Minimum Kernel Version 5.14* • Rocky Linux 8 - *Minimum Kernel Version 4.18* • Rocky Linux 9 - *Minimum Kernel Version 5.14* • Ubuntu 20.04 - *Minimum Kernel Version 5.5* • Ubuntu 22.04 - *Minimum Kernel Version 6.2*	• Windows Server 2022 • Windows Server 2019 • Windows 11 Pro/Enterprise • Windows 10 Pro/Enterprise

CPU Architecture

x86_x64

Network Connectivity

1 NIC or 2 NICs for higher performance (one for each sub-net: ctrl-subnet and data-subnet)

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

1 NIC vs. 2 NICs

An xNIC instance may have 1 or 2 NICs depending on the subnet configuration of the cloudSwXtch.

- If a cloudSwXtch has 2 NICs sharing a single subnet, an xNIC needs only 1 NIC (control). This NIC will share the same single subnet for control and data plane communications as the cloudSwXtch.
- For high performance, a cloudSwXtch should have 2 NICs using 2 different subnets, an xNIC will need 2 NICs connected to separate subnets:
    - A subnet for control plane traffic (referred to as the `ctrl-subnet` from here on).
    - A subnet for data plane traffic (referred to as the `data-subnet` from here on).

Subnet Selection

The subnets must be the same subnets used for the cloudSwXtch.

The install requires a simple command that installs the xNIC from the cloudSwXtch. The install typically takes less than one minute per host. See the installation sections for more details.

Tunnel network

The xNIC software must be installed on each virtual machine that is to send or receive multicast traffic. The xNIC software will create a tunnel network interface (called `swxtch-tun0` for Linux and `swxtch-tun` for Windows) that presents to the application a network subnet of 172.30.X.Y. Each virtual machine running the xNIC software will be assigned an IP address in this range.

NOTE:

The swxtch tunnel interface should only be used for multicast traffic. Any other network traffic should target other network interfaces.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Install xNIC on Linux

WHAT TO EXPECT

The xNIC is a lightweight service that must be installed on every VM sending or receiving multicast traffic to and from a cloudSwXtch. An xNIC should not be installed on a cloudSwXtch or cloudSwXtch Bridge VM.

In this article, users will learn how to install the xNIC software in the Linux systems.

Installing xNIC for Linux

BEFORE YOU START

Review xNIC System requirements.

Network Acceleration

If using Azure, the data-subnet must have the "Network Acceleration" feature enabled.

Running the Install Script

To make installation easy, the xNIC is installed from the cloudSwXtch instance via a one-time shell command. The xNIC is matched to the attached cloudSwXtch instance and should be reinstalled if the cloudSwXtch version changes.

To run the install:

1. Open a terminal on the VM you wish to install the xNIC software on.
2. Verify network connectivity to the cloudSwXtch instance by "pinging" the switch.

Bash | Copy

```bash
ping <switch-instance-name>
```

Ping Fails

If the ping fails to find the cloudSwXtch instance by name, try pinging the IP address of the cloudSwXtch instance. If the IP works, then use the IP address in place of the <switch-instance-name> in all further commands.

This can happen if the DNS settings are not configured for the virtual network.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

TURNING OFF FIREWALL

It is recommended for users to turn off their firewall. The installer script will automatically open ports 10800 and 9999.

To open up additional ports for producing/consuming multicast traffic, use the following command:

Bash Copy

```bash
sudo firewall-cmd --add-port=<port>/udp --permanent
sudo systemctl restart firewalld
```

3. **Run** the following installer script:

Bash Copy

```bash
curl http://<swxtch-instance-name>/services/install/swxtch-xnic-install.sh | bash
```

Alternatively, you can run the install script after downloading it using the wget command:

Bash Copy

```bash
wget http://<swxtch-ip>/services/install/swxtch-xnic-install.sh
chmod +x swxtch-xnic-install.sh
./swxtch-xnic-install.sh
```

Additional Arguments

There are additional arguments when installing the xNIC.

Note that the ctrl- and data- interfaces are from the VM the xNIC is installed. For example, if you have three network interfaces and you want to specify what you want to use for ctrl or data, you can manually select them using the -ctrl_interface <interface index> or -data_interface <interface index> arguments. Also, these argument help in complex contexts where the agent is in a different vNet/VPC from the cloudSwXtch.

A full list of arguments is detailed below:

Bash Copy

```bash
$ ./swxtch-xnic-install.sh -h
Usage: ./swxtch-xnic-install.sh [OPTIONS]
  -t <1|2>                          xNIC type to install (default: 2 if supported in
this OS, 1 otherwise)
  -u                                uninstall xNIC instances
  --ctrl_interface <interface name>   manual selection of the Control interface
  --data_interface <interface name>   manual selection of the Data interface
  --ptp <true|false>                  installing of Precision Time Protocol (default:
true)
  -h | --help                         shows this help
```

Note: There is an option for users to switch between xNIC Type 1 and Type 2, latter being the default. All installation instructions and system requirements are solely for Type 2. It is not recommended to use Type 1 unless otherwise suggested by swXtch.io Support.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Skipping PTP Installation

If you would like to skip Precision Time Protocol installation, they can run the following command:

Bash Copy

```bash
./swxtch-xnic-install.sh --ptp false
```

The installer script will install the xNIC as a service and will install a set of utility applications that can be used to verify the operation of your cloudSwXtch network. Refer to Testing for details.

A successful install is shown below.

```
testadmin@agent-101:~$ curl http://10.2.128.10/services/install/swxtch-xnic-install.sh | bash
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100 21432    0 21432    0     0  5232k      0 --:--:-- --:--:-- --:--:-- 5232k
xNIC installer detected ubuntu 20.04. Installing xNIC version 1.
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100 7308k  100 7308k    0     0   113M      0 --:--:-- --:--:-- --:--:--  113M
Selecting previously unselected package swxtch-xnic.
(Reading database ... 141654 files and directories currently installed.)
Preparing to unpack swxtch-xnic_1.0.0_ubuntu20.04_amd64.deb ...
Unpacking swxtch-xnic (1.0.0) ...
Setting up swxtch-xnic (1.0.0) ...
/var/opt/swxtch/swxtch-xnic.conf has been updated.
Service swxtch-xnic.service started
testadmin@DSd-agent-101:~$
```

IF THE INSTALL FAILS:

If the install fails, validate that the VM has at least two NICs and the NICs are on the same subnets for control and data as the cloudSwXtch. The ctrl-subnet should be assigned to the primary NIC.

If you are using Azure, validate that the data-subnet has "Network Acceleration" feature enabled.

Testing

xNIC installation includes a set of utility applications that you can use to verify the operation of your cloudSwXtch network. Refer to Testing for details.

- **swxtch-top**: An application to display real-time statistics of the cloudSwXtch instance.
- **swxtch-perf**: An application to produce and consume unicast and multicast traffic for testing purposes.

Running swxtch-top on Linux

<swxtch-hostname>: name of your existing swxtch or "host" swxtch

Bash Copy

```bash
swxtch-top dashboard --switch <swxtch-hostname>
```

Uninstalling xNIC on Linux

To uninstall xNIC on Linux, users can follow the steps in the xNIC Linux Uninstall Guide.

Upgrading xNIC on Linux

To upgrade xNIC on Linux, users can follow the steps in the xNIC Linux Upgrade Guide.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

xNIC Linux Uninstall

WHAT TO EXPECT

In this article, users will learn how to remove the xNIC from their Linux system for both Ubuntu and Redhat.

Uninstalling xNIC on Linux

1. Open a shell on the host VM. The host VM is the VM where you wish to uninstall the xNIC software.
2. Run the following command depending the xNIC version:

None | Copy

```
curl http://<swxtch-instance-name>/services/install/swxtch-xnic-install.sh | bash -s  --
-u
```

3. The uninstall script will remove Linux xNIC.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

xNIC Linux Upgrade

BEFORE YOU START

When a cloudSwXtch has been updated, it's recommended to update connected xNICs as well.

In this article, users will be able to use the appropriate script to upgrade their xNIC.

Upgrading Linux xNIC

24/7 Operations

If the services need to be up and running 24/7, swXtch.io suggests that redundant systems exist for which will be referred to as "Main" and "Backup". During an upgrade the Backup system should be upgraded, then the traffic should be routed to the Backup while the Main is upgraded.

You can use the following command to uninstall the existing xNIC and upgrade it.

1. Run the installer script:
   Shell

   Bash Copy

   ```bash
   curl http://<swxtch-instance-name/services/install/swxtch-xnic-install.sh | bash -s -- -u
   ```

Additional Arguments

In addition to the -v argument, there are additional options when installing the xNIC.

Note that the ctrl- and data- interfaces are from the VM the xNIC is installed. For example, if you have three network interfaces and you want to specify what you want to use for ctrl or data, you can manually select them using the -ctrl_interface or -data_interface arguments. Also, these argument help in complex contexts where the agent is in a different vNet/VPC from the cloudSwXtch.

For xNIC 1 on Linux, multiple xNICs can be installed on one VM by using the -i and the --tun-subnet arguments. In this case, the control interface will be the same while the data interface will differ for each xNIC on the Linux VM.

A full list of arguments is detailed below:

Bash Copy

```bash
$ ./swxtch-xnic-install.sh -h
Usage: ./swxtch-xnic-install.sh [OPTIONS]
  -t <1|2>                           xNIC type to install (default: 2 if supported in this OS, 1 otherwise)
  -u                                 uninstall xNIC instances
  --ctrl_interface <interface name>  manual selection of the Control interface
  --data_interface <interface name>  manual selection of the Data interface
  --ptp <true|false>                 installing of Precision Time Protocol (default: true)
  -h | --help                        shows this help
```

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Install xNIC on Windows

WHAT TO EXPECT

The xNIC is a lightweight service that must be installed on every VM sending or receiving multicast traffic to and from a cloudSwXtch. An xNIC should not be installed on a cloudSwXtch or a cloudSwXtch Bridge VM.

In this article, users will learn how to install the xNIC software on Windows systems.

Installing xNIC for Windows

BEFORE YOU START

Review xNIC System Requirements.

Firewall Restrictions

The Windows installation process adds rules to Windows Defender Firewall, which allow for traffic through the UDP ports 10800 and 9999. The rule names are SwXtchControl, SwXtchData, and SwXtchTun.

Network Acceleration

If using Azure, the data-subnet must have the "Network Acceleration" feature enabled.

Running the Install script

To make installation easy, the xNIC is installed from the cloudSwXtch instance via a one-line shell command. The xNIC is matched to the attached cloudSwXtch instance and should be reinstalled if the cloudSwXtch version changes.

The xNIC takes less than a minute to install on an existing VM.

To run the install:

1. Open a PowerShell terminal on the Windows VM that you aspire to install the xNIC software on.
    - If you are working on Windows 11, please use Windows Terminal instead for installation.
2. Verify network connectivity to the cloudSwXtch instance by “pinging” the switch.

Bash Copy

```bash
ping <switch-instance-name>
```

Ping Fails

If the ping fails to find the cloudSwXtch instance by name, try pinging the IP address of the cloudSwXtch instance. If the IP works, then use the IP address in place of the `<switch-instance-name>` in all further commands.

This can happen if the default DNS settings are changed for the virtual network.

3. The installer script will automatically remove any firewall restrictions to UDP ports 10800 and 9999. The cloudSwXtch sends UDP packets to these ports as part of normal operation.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Special Rules for Windows Defender Firewall

It is recommended to simply turn off the firewall. Additionally, users can open up additional ports for producing/consuming multicast traffic by using the following command in PowerShell:

Bash Copy

```
New-NetFirewallRule -Name 'rule_name' -DisplayName 'rule_name' -Enabled True -
Direction Inbound -Protocol UDP -Action Allow -LocalPort 1234
```

4. Ensure Windows SecureBoot UEFI is disabled. This can be enabled or disabled fom the administrative console of the cloud.

5. Download the installer script:

Bash Copy

```
Invoke-WebRequest -Uri 'http://<swxtch-instance-name>/services/install/swxtch-xnic-win-
install.ps1' -Outfile swxtch-xnic-win-install.ps1
```

6. Run the installer script. Note: The installer script will differ depending on the version you decided to use.

Bash Copy

```
./swxtch-xnic-win-install.ps1
```

Additional Arguments

There are additional options when installing the xNIC. To see these options, use the -h argument. Note that the ctrl- and data- interfaces are from the VM the xNIC is installed. For example, if you have three network interfaces and you want to specify what you want to use for ctrl or data, you can manually select them using the -ctrl_interface <interface index> or -data_interface <interface index> arguments detailed below.

Note: There is an option (-t) for users to switch between xNIC Type 1 and xNIC Type 2 (default). All installation instructions and system requirements are solely for Type 2. It is not recommended to use Type 1 unless otherwise suggested by swXtch.io Support.

Bash Copy

```
PS C:\Users\testadmin> ./swxtch-xnic-win-install.ps1 -h
This PowerShell script manages the xNIC installation for Windows
Usage: swxtch-xnic-win-install.ps1 [OPTIONS]
  -v [1|2]                            xNIC version to install (default: 2)
  -u                                  uninstall xNIC only (no other options allowed)
-unattended                         unattended installation (in case of reboot, the
user will not be prompted)
  -ctrl_interface <interface index>   manual selection of the Control interface
  -data_interface <interface index>  manual selection of the Data interface
-h                                  shows this help
```

Please note: The ctrl_interface and data_interface commands should only be used in complex configurations where the installer cannot locate them. Contact support@swXtch.io for more information.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Getting the interface index for ctrl_interface and data_interface

To get the interface index, you can run the following command:

Bash Copy

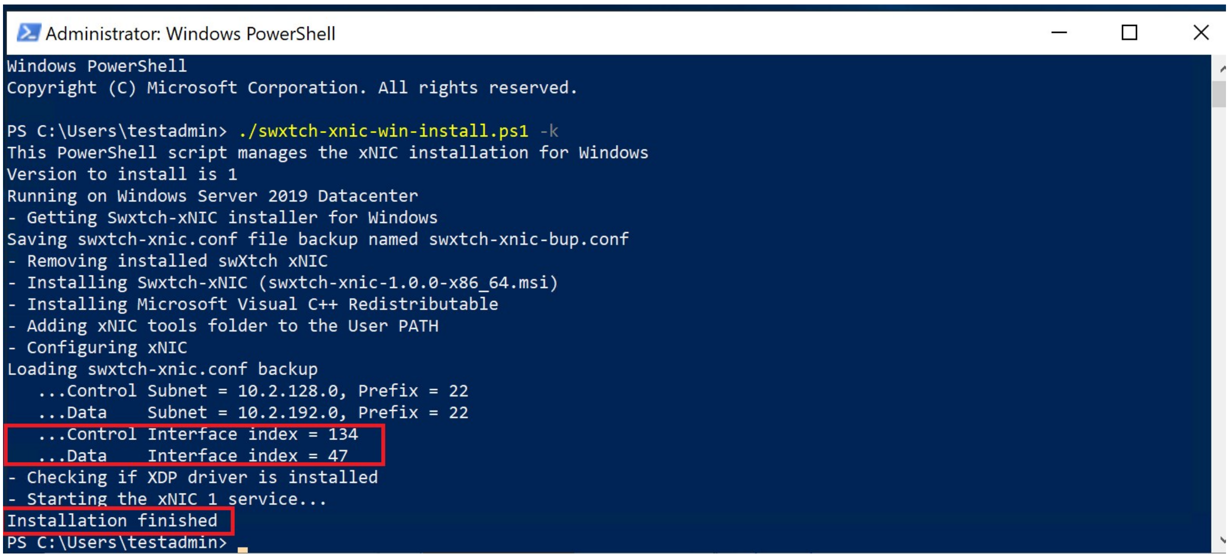
```
get-netipconfiguration
```

A sample of the response will be returned with the InterfaceIndex (***) listed for both:

Bash Copy

```
PS C:\Users\testadmin> get-netipconfiguration

InterfaceAlias       : Ethernet
InterfaceIndex       : 36 ***
InterfaceDescription : Microsoft Hyper-V Network Adapter
NetProfile.Name      : Network
IPv4Address          : 10.2.128.75
IPv6DefaultGateway   :
IPv4DefaultGateway   : 10.2.128.1
DNSServer            : 168.63.129.16



InterfaceAlias       : Ethernet 2
InterfaceIndex       : 60 ***
InterfaceDescription : Microsoft Hyper-V Network Adapter #2
NetProfile.Name      : Unidentified network
IPv4Address          : 10.2.192.82
IPv6DefaultGateway   :
IPv4DefaultGateway   :
DNSServer            : 168.63.129.16
```

7. The installer script will install a Windows service called swXtchNIC:



8. Reboot your machine once the installation is complete. This will enable you to execute cloudSwXtch tools properly from your user home directory such as swxtch-top.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Errors

The control and data interfaces should have proper numbers. A 0, or negative number, indicates an error in the configuration of the control or data subnets for the xNIC. The control and data subnets of the cloudSwXtch and the xNICs should be the same.

If you are using Azure, validate that the data-subnet has "Network Acceleration" featured enabled.

Testing

The installation includes a set of utility applications that you can use to verify the operation of your cloudSwXtch network. Refer to Testing for details.

- `swxtch-top.exe` : An application to display real-time statistics of the cloudSwXtch instance.
- `swxtch-perf.exe` : An application to produce and consume multicast traffic for testing purposes.

Running swxtch-top on Windows

Bash Copy

```
swxtch-top dashboard --switch <swxtch-hostname>
```

- **<swxtch-hostname>**: the name of your existing or "host" swxtch

Uninstalling xNIC on Windows

To uninstall xNIC on Windows, users can follow the steps in the Uninstall xNIC on Windows guide.

Upgrading xNIC on Windows

To upgrade xNIC on Windows, users can follow the steps in the Upgrade xNIC on Windows guide.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Uninstall xNIC on Windows

WHAT TO EXPECT

In this article, users will learn how to remove the xNIC from their Windows system.

Uninstalling xNIC on Windows

When uninstalling xNIC on Windows, please `do not` uninstall using the Add/Remove Programs feature. It is important to use the command below instead for uninstall.

1. Open Powershell on your Windows system (command window if Windows 11).
2. Run the following command:

   Text

   None | Copy

   ```
   .\swxtch-xnic-win-install.ps1 -u
   ```

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Upgrade xNIC on Windows

WHAT TO EXPECT

When a cloudSwXtch has been updated, their xNIC should be upgraded as well. This is very simple since you will only need to reinstall the script. The installer will automatically remove the older version of xNIC.

In this article, users will learn to use the appropriate script to upgrade their xNIC.

Make sure that you have the latest version of cloudSwXtch installed. You can find information about how to upgrade your cloudSwXtch by clicking here: Upgrading cloudSwXtch. You can also upgrade your cloudSwXtch by deleting and recreating the instance.

Upgrading xNIC on Windows

1. Open PowerShell. If you are using Windows 11, please use Windows Terminal.

2. Download the installer script:

Bash Copy

```
Invoke-WebRequest -Uri 'http://<swxtch-instance-name>/services/install/swxtch-xnic-win-install.ps1' -Outfile swxtch-xnic-win-install.ps1
```

3. Run the script. Please use the appropriate command for your version. Note: xNIC Type 2 is the default.

None Copy

```
./swxtch-xnic-win-install.ps1
```

The latest version of the Windows xNIC will be installed.

Remember to Reboot

Reboot the machine after the upgrade is complete. You must do this to be able to execute the cloudSwXtch tools properly from your user home directory.

Additional Arguments

To see all the options available for the xNIC installation/update script, use the `-h` argument. Note that the ctrl- and data- interfaces are from the VM the xNIC is installed. For example, if you have three network interfaces and you want to specify ctrl or data interfaces, you can manually select them using the `-ctrl_interface <interface index>` or `-data_interface <interface index>` arguments detailed below.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Bash Copy

```
PS C:\Users\testadmin> ./swxtch-xnic-win-install.ps1 -h
This PowerShell script manages the xNIC installation for Windows
Usage: swxtch-xnic-win-install.ps1 [OPTIONS]
  -t <1|2>                              xNIC type to install (default: 2 if supported in
this OS, 1 otherwise)
  -u                                    uninstall xNIC only (no other options allowed)
  -unattended                           unattended installation (in case of reboot, the
user will not be prompted)
  -ctrl_interface <interface index>     manual selection of the Control interface
  -data_interface <interface index>     manual selection of the Data interface
  -h                                    shows this help
```

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Install xNIC on Kubernetes

WHAT TO EXPECT

The xNIC is a lightweight service that must be installed on every VM sending or receiving cloudSwXtch traffic. This creates a virtual network interface within the node in a Kubernetes Cluster. Applications that use IP multicast should target this virtual network interface.

In this article, you will learn how to install xNIC on K8s.

Supported Types

Below is a list of supported K8s Clusters.

- AKS (Cilium or Kubernetes)
- EKS
- GKE

The following operating systems in a pod are supported for the xNIC on K8s: RHEL 8, CentOS 8 or Ubuntu 20.04.

Installation

The installation process can be split into three steps:

1. Create a Kubernetes Cluster (AKS with Cilium/Kubernetes, EKS or GKE)
2. Install xNIC on K8s Cluster
3. Test xNIC on K8s

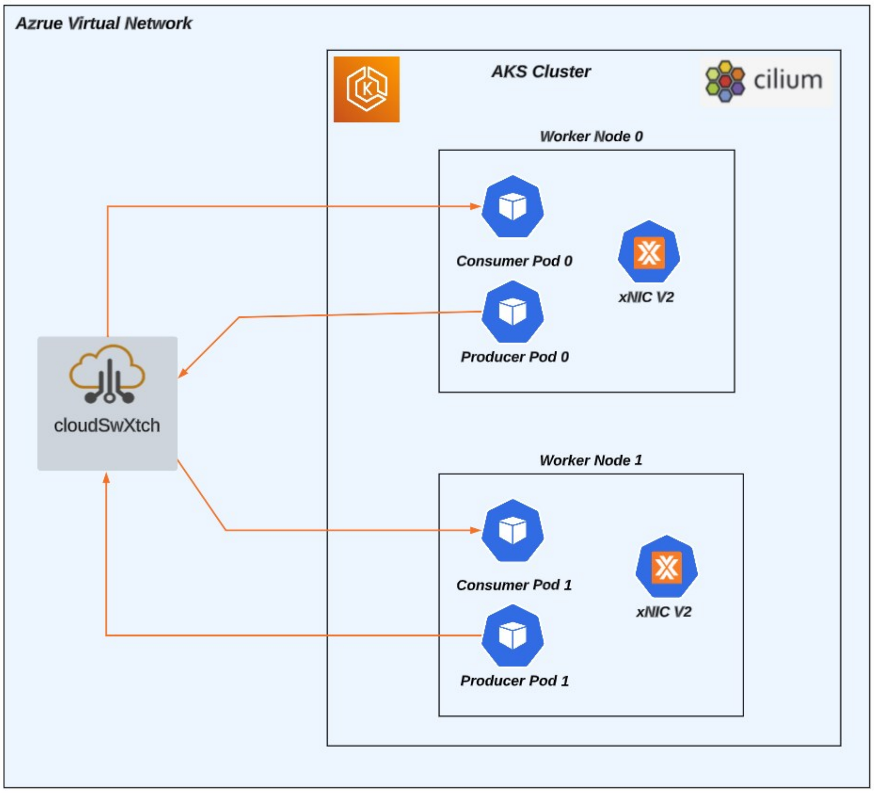
Post-Installation

You can learn how to upgrade your xNIC nodes on K8s, here.

xNIC Architecture Diagram

Below is an example architecture for an xNIC installed on AKS with Cilium with communication to and from a cloudSwXtch. Other Virtual Machines (not AKS) with xNICs installed could also communicate with the AKS worker nodes via cloudSwXtch and xNIC v2.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Install xNIC on K8s Cluster

> WHAT TO EXPECT
> xNIC is a lightweight service that must be installed on every Kubernetes cluster used for sending and/or receiving cloudSwXtch traffic. This creates a virtual network interface within the VM's operation system. Applications that use IP multicast should target this virtual network interface.
> In this article, users will learn how to install xNIC on one of the supported types of Kubernetes.

Overview

Unicast traffic will not be affected by this feature since it will work as it did before. The xNIC will only be used for Multicast traffic. The default interface xNIC will use is eth0. It can be installed via your preferred cloud's CloudShell or you can assign a VM as a manager to control your cluster. Either way, it is required to have access to the cloudSwXtch and the cluster.

In this document, we will discuss how to do it via the CloudShell. However, the commands below will work in either the CloudShell or on the VM managing the K8s cluster.

Running the Install Script

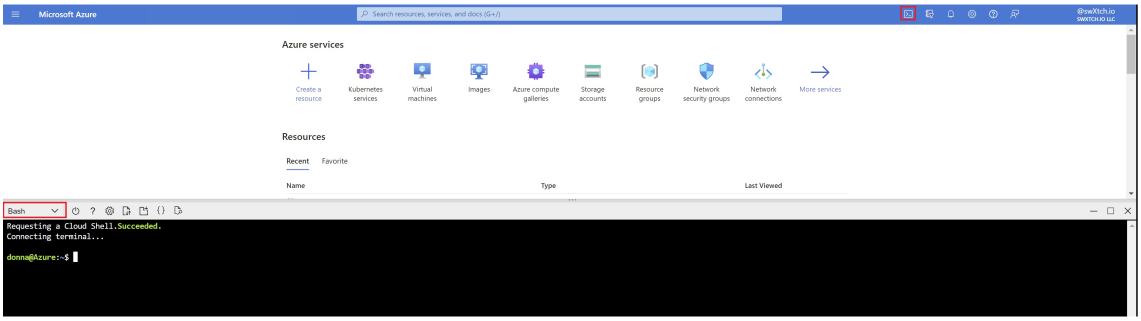
> BEFORE YOU START
> If you haven't already, please create a Kubernetes Cluster. This is a prerequisite before installing the xNIC.

To make installation easy, the xNIC is installed from the cloudSwXtch instance via a one-line shell command. The xNIC is matched to the attached cloudSwXtch and should be reinstalled if the cloudSwXtch version changes.

This process takes less than a minute to install on an existing K8s cluster.

To run the install:

1. Ensure your cloudSwXtch is version 2.0.89 or greater. If it is not upgraded, see Upgrading cloudSwXtch.
2. Sign into your desired cloud provider.
3. Open cloudShell as Bash.



4. Paste in the following commands, replacing the <cloudSwXtch_IP> with your cloudSwXtch's Ctrl IP address.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

```bash
kubectl run installer --image=busybox -- sh -c "wget
http://<cloudSwXtch_IP>/services/install/xnic_ds_installer.sh; sleep 3650"
kubectl cp default/installer:/xnic_ds_installer.sh xnic_ds_installer.sh
kubectl delete po/installer --grace-period 1
chmod +x xnic_ds_installer.sh
```

5. Run one of the following scripts:

   With Internet Access:

```bash
./xnic_ds_installer.sh
```

   Without Internet Access:

```bash
./xnic_ds_installer.sh -ag
```

   An example of a successful install without INTERNET access is shown below:

```bash
$ ./xnic_ds_installer.sh -ag

[i] Detected Cloud: AZURE
[i] Cilium Installation detected
[i] Setting CNI to CILIUM...

##################################################################################
######################
        This script modifies the underlying configuration of Cilium CNI to make it
compatible
        with Multicast Networks.
        It also installs xNIC DaemonSet on the existing cluster.
##################################################################################
######################


- RUNNING INSTALLER: Airgap

- IMAGE: 10.144.0.115:443/xnicv2:airgap

- CNI PLUGIN: CILIUM

- SWXTCH IP ADDRESS: 10.144.0.115

- AGENT TYPE: XNIC XCD

=======================================================
      Adjusting BPF filter priority on Cilium
=======================================================
```

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

```
Setting flag "bpf-filter-priority" to "50000"
configmap/cilium-config patched
Done!

=======================================================
             Restarting Cilium Agents
=======================================================
daemonset.apps/cilium restarted
daemonset.apps/cilium-node-init restarted
Waiting for Cilium Agents to be fully UP and Running......OK
Done!
Proceeding with xNIC Installation

=======================================================
             Creating xNIC ConfigMap
=======================================================
configmap/xnic-config created

=======================================================
                Installing xNIC
=======================================================
daemonset.apps/swxtch-xnic created
Done!

==================== Completed! =======================

Please allow a minute for the xNIC DaemonSet to fully spin up before starting to use it.
Feel free to follow up on the xNIC Agents installation by running

 kubectl logs -n kube-system daemonsets/swxtch-xnic -f
```

6. Run the following script to view **kubectl** logs in the Bash window in Azure:

Bash | Copy

```bash
kubectl logs -n kube-system daemonsets/swxtch-xnic -f
```

7. Use the command below to follow the AKS node status in the Bash window in Azure and check if they have started:

Example:

Bash | Copy

```bash
user@Azure:~$ kubectl get pods -l app=swxtch-xnic -n kube-system
NAME                   READY   STATUS    RESTARTS   AGE
swxtch-xnic-fc58t      1/1     Running   0          11d
swxtch-xnic-kn9hg      1/1     Running   0          11d
```

8. Sign into your cloudSwXtch and enter in the following command to see the new instances in swXtch-top.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Bash Copy

```bash
sudo /swxtch/swxtch-top dashboard --switch localhost
```

Restarting xNIC services

To restart xNIC services for K8s, run the following command:

Bash Copy

```bash
kubectl rollout restart ds/swxtch-xnic -n kube-system
```

Managing Multicast Traffic

Following are some `tc` commands that can be useful when it comes to allowing/denying either incoming or outgoing multicast traffic on producer and consumer pods. You must run these commands inside the target producer/consumer pods so that the correct interface name (eth0 in the examples) is picked up.

By default, ALL multicast traffic is allowed on every pod.

For Outgoing (Traffic leaving the Pod)

Deny ALL outgoing multicast

To deny all outgoing multicast, use the following commands:

Specific syntax:

Bash Copy

```bash
# DENY ALL OUTGOING
tc qdisc add dev eth0 root handle 1: prio
tc filter add dev eth0 parent 1: protocol ip u32 match ip dst 224.0.0.0/4 action drop
```

Alternatively, users can deny outgoing multicast to specific groups:

General Syntax:

Bash Copy

```bash
# DENY OUTGOING TO SPECIFIC GROUP(S)
tc qdisc add dev eth0 root handle 1: prio
tc filter add dev eth0 parent 1: protocol ip u32 match ip dst <multicast_group_0> action
drop
...
tc filter add dev eth0 parent 1: protocol ip u32 match ip dst <multicast_group_n> action
drop
```

Example: denying outgoing traffic to multicast group `239.0.0.1` :

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

```bash
tc qdisc add dev eth0 root handle 1: prio
tc filter add dev eth0 parent 1: protocol ip u32 match ip dst 239.0.0.1/32 action drop
```

Allow outgoing multicast to a specific group(s) - Deny any other

```bash
# DENY ALL OUTGOING
tc qdisc add dev eth0 root handle 1: prio
tc filter add dev eth0 parent 1: protocol ip u32 match ip dst 224.0.0.0/4 action drop

# ALLOW SPECIFIC GROUP(S)
tc filter add dev eth0 parent 1: protocol ip u32 match ip dst <multicast_group_0> action
ok
...
tc filter add dev eth0 parent 1: protocol ip u32 match ip dst <multicast_group_n> action
ok
```

Example: allowing outgoing traffic ONLY to multicast group `239.0.0.1`:

```bash
tc qdisc add dev eth0 root handle 1: prio
tc filter add dev eth0 parent 1: protocol ip u32 match ip dst 224.0.0.0/4 action drop
tc filter add dev eth0 parent 1: protocol ip u32 match ip dst 239.0.0.1/32 action ok
```

Incoming (Traffic entering the Pod)

To deny ALL incoming multicast, use the following command:

Specific syntax:

```bash
# DENY ALL INCOMING
tc qdisc add dev eth0 ingress
tc qdisc add dev eth0 parent ffff: protocol ip u32 match ip dst 224.0.0.0/4 action drop
```

Alternatively, users can deny incoming multicast for a specific group(s)

General syntax:

```bash
# DENY INCOMING TO SPECIFIC GROUP(S)
tc qdisc add dev eth0 ingress
tc filter add dev eth0 parent ffff: protocol ip u32 match ip dst <multicast_group_0>
action drop
...
tc filter add dev eth0 parent ffff: protocol ip u32 match ip dst <multicast_group_n>
action drop
```

Example: denying incoming multicast traffic to multicast group `239.0.0.1`:

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

```bash
tc qdisc add dev eth0 ingress
tc filter add dev eth0 parent ffff: protocol ip u32 match ip dst 239.0.0.1/32 action drop
```

In addition, users can specify allowing incoming multicast by a specific group(s) while denying any other:

General syntax:

```bash
# DENY ALL INCOMING
tc qdisc add dev eth0 ingress
tc qdisc add dev eth0 parent ffff: protocol ip u32 match ip dst 224.0.0.0/4 action drop

# ALLOW SPECIFIC GROUP(S)
tc filter add dev eth0 parent ffff: protocol ip u32 match ip dst <multicast_group_0> action ok
...
tc filter add dev eth0 parent ffff: protocol ip u32 match ip dst <multicast_group_n> action ok
```

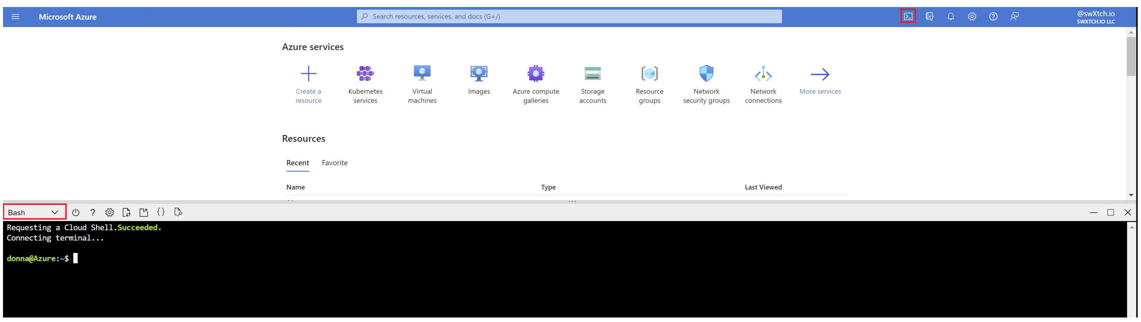
Example: allowing incoming traffic ONLY to multicast group `239.0.0.1`:

```bash
tc qdisc add dev eth0 ingress
tc qdisc add dev eth0 parent ffff: protocol ip u32 match ip dst 224.0.0.0/4 action drop
tc filter add dev eth0 parent ffff: protocol ip u32 match ip dst 239.0.0.1/32 action ok
```

Accessing an xNIC Pod

At times, it is nice to be able to get into the pod and be able to run commands such as swxtch-tcpdump. To accomplish this, follow these steps:

1. Sign into your desired cloud.
2. Open cloudShell as Bash. In this example, the user is using Azure.



3. Enter in the following command to get the pod name:

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Bash Copy

```bash
kubectl get pods -l app=swxtch-xnic -n kube-system
```

Example:

Bash Copy

```bash
user@Azure:~$ kubectl get pods -l app=swxtch-xnic -n kube-system
NAME                READY   STATUS    RESTARTS   AGE
swxtch-xnic-fc58t   1/1     Running   0          11d
swxtch-xnic-kn9hg   1/1     Running   0          11d
```

4. Enter in the following command, replacing **Pod** with the pod name:

Bash Copy

```bash
kubectl exec -it pod/swxtch-xnic-name -n kube-system -- bash
```

Example:

Bash Copy

```bash
user@Azure:~$ kubectl exec -it pod/swxtch-xnic-kn9hg -n kube-system -- bash
root@aks-nodepool1-23164585-vmss00000A:/
```

You can now enter in commands similar to any VM Node, such as "ip a" or "sudo swxcth-tcpdump -i eth0". Note that the pods created in this example do not have tools such as the standard tcpdump. However, swxtch-tcpdump will work. For testing use swxtch-perf, see swxtch-top under Testing cloudSwXtch.

> Switching Contexts
> If you have more than one AKS Kubernetes services, then you may need to change the context to work on the desired instance. For more information, please review the Changing K8s Context in Your Preferred Cloud section.

Signing into K8s node instance in Bash

If you want to sign into your preferred cloud instance and access the CloudShell as Bash, complete the following:

1. Ensure the pods are running using this command:

Bash Copy

```bash
kubectl get pods -l app=swxtch-xnic -n kube-system
```

Example:

Bash Copy

```bash
user@Azure:~$ kubectl get pods -l app=swxtch-xnic -n kube-system
NAME                READY   STATUS    RESTARTS   AGE
swxtch-xnic-fc58t   1/1     Running   0          11d
swxtch-xnic-kn9hg   1/1     Running   0          11d
```

2. Run this command to sign into the pod:

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

```bash
kubectl exec -it pod/<swxtch-xnic-name> -n kube-system -- bash
```

Example:

```bash
user@Azure:~$ kubectl exec -it pod/swxtch-xnic-kn9hg -n kube-system -- bash

root@aks-nodepool1-23164585-vmss00000A:/#
```

3. Now you can run any command for example "ip a" or run swxtch-perf (or a user application) as a consumer or producer to run tests.

Accessing xNIC Logs

You can get xNIC logs once signed in to the pod. See How to Find xNIC Logs and follow directions for xNIC.

Using xNIC config

Getting to the xNIC config is available once you're signed into the Pod. To get to the xNIC config, use the command below:

```bash
cat /var/opt/swxtch/swxtch-xnic.conf
```

Exiting the Pod

To exit the pod, enter in the following command:

```bash
exit
```

To Change K8s Context in Your Preferred Cloud

If there are more than one K8s instances in your preferred cloud then you may need to be able to switch between them to run commands in the CloudShell Bash. Below are steps to switch between K8s instances.

1. Get a list of all K8s Contexts by using the following command:

```bash
kubectl config get-contexts
```

Example in Azure:

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Bash | Copy

```
user@Azure:~$ kubectl config get-contexts

CURRENT   NAME                 CLUSTER              AUTHINFO
NAMESPACE

          cilium-sample        cilium-sample
clusterUser_saDevNetwork_cilium-sample

          cilium-sample-200    cilium-sample-200    clusterUser_test-donna-200-
rg_cilium-sample-200

          cilium-sample2       cilium-sample2
clusterUser_saDevNetwork_cilium-sample2

*         cilium-sample300     cilium-sample300     clusterUser_test-donna-300-
rg_cilium-sample300

          dsd-k8-cluster-100   dsd-k8-cluster-100   clusterUser_saDevNetwork_dsd-
k8-cluster-100
```

Notice in the above list there are multiple context but only one has the asterisks (*).

2. To change context, run the following command. The example is changing to cilium-sample2.

Bash | Copy

```
kubectl config use-context cilium-sample2
```

3. Re-run the get-context command:

Bash | Copy

```
kubectl config get-contexts
```

Example in Azure:

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Bash Copy

```bash
user@Azure:~$ kubectl config get-contexts

CURRENT   NAME                 CLUSTER              AUTHINFO
NAMESPACE

          cilium-sample        cilium-sample
clusterUser_saDevNetwork_cilium-sample

          cilium-sample-200    cilium-sample-200    clusterUser_test-donna-200-
rg_cilium-sample-200

*         cilium-sample2       cilium-sample2
clusterUser_saDevNetwork_cilium-sample2

          cilium-sample300     cilium-sample300     clusterUser_test-donna-300-
rg_cilium-sample300

          dsd-k8-cluster-100   dsd-k8-cluster-100   clusterUser_saDevNetwork_dsd-
k8-cluster-100
```

As you can see above, the asterisk (*) has changed positions to the desired context, cilium-sample2.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Uninstall xNIC on K8s

WHAT TO EXPECT

In this article, users will learn how to uninstall xNIC on Kubernetes (K8s).

To uninstall xNIC on K8s, please follow these steps:

1. Sign into Cloud.
2. Open cloudShell as Bash.
3. Run the following command in the terminal:
   Shell

   Bash Copy

   ```bash
   ./xnic_ds_installer.sh -u
   ```

4. xNIC on K8s should now be uninstalled.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Test xNIC with K8s

> WHAT TO EXPECT
>
> Before running your application in your preferred cloud, it is a good idea to test with swXtch.io's provided tools/examples.
>
> In this article, you will learn how to test xNIC with K8s. Please complete the installation process outlined in Install xNIC on K8s before you begin testing.

STEP ONE: Create A Consumer

1. Create a TestConsumer.yaml file using the example below.
   Replace the XNIC_SWXTCH_ADDR with the cloudSwXtch control address.

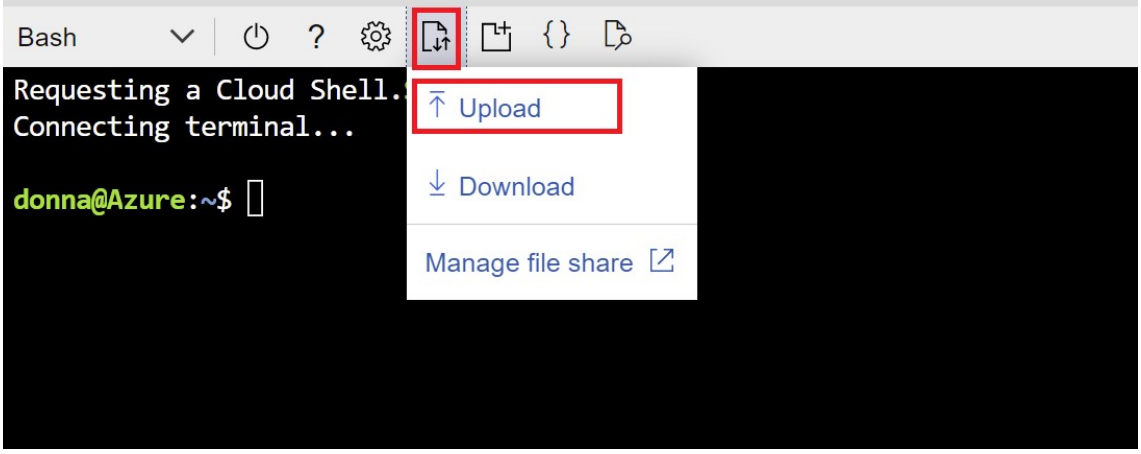
©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Bash Copy

```yaml
apiVersion: v1
kind: Pod
metadata:
  name: consumer-a
  labels:
    app: consumer-a
spec:
  affinity:
    podAntiAffinity:
      requiredDuringSchedulingIgnoredDuringExecution:
      - labelSelector:
          matchExpressions:
          - key: app
            operator: In
            values:
            - producer-a
            - consumer-b
        topologyKey: kubernetes.io/hostname
  containers:
  - name: consumer-a
    image: ubuntu:20.04
    securityContext:
      privileged: true
    env:
    - name: IS_DAEMON
      value: "false"
    - name: PERF_TYPE
      value: "consumer"
    - name: PERF_NIC
      value: "eth0"
    - name: PERF_MCGIP
      value: "239.0.0.10"
    - name: PERF_MCGPORT
      value: "8410"
    - name: XNIC_SWXTCH_ADDR
      value: "10.224.0.115"
    command: ["/bin/bash"]
    args: ["-c", "apt update && apt install curl -y;
                  curl http://$(XNIC_SWXTCH_ADDR)/services/install/swxtch-xnic-
k8s-install.sh --output swxtch-xnic-k8s-install.sh;
                  chmod +x swxtch-xnic-k8s-install.sh;
                  ./swxtch-xnic-k8s-install.sh -v 2;
                  sleep infinity"]
```

2. Upload the file into the Azure CloudShell.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



STEP TWO: Create a Producer

1. Create a TestProducer.yaml file using the example below.
   Replace XNIC_SWXTCH_ADDR with the cloudSwXtch control address.
   Shell

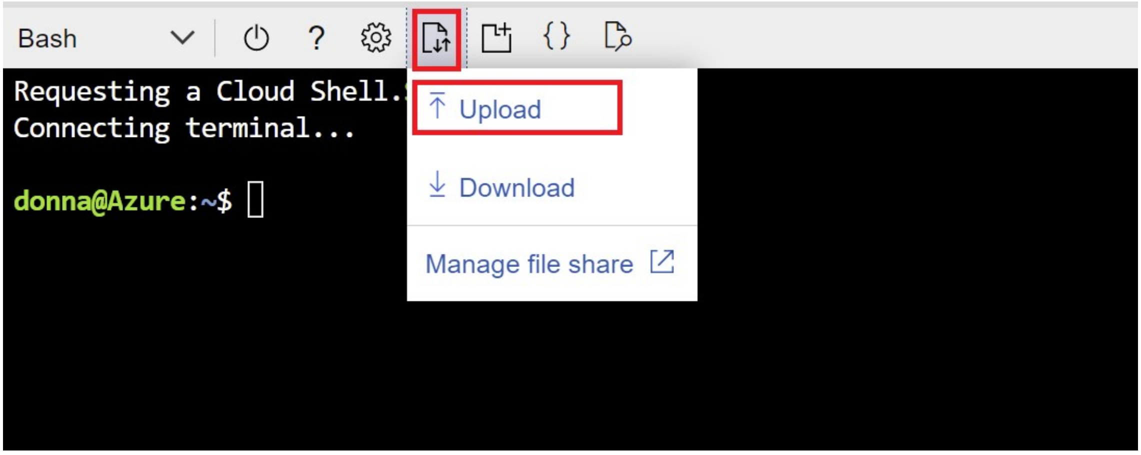
©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Bash Copy

```
apiVersion: v1
kind: Pod
metadata:
  name: producer-a
  labels:
    app: producer-a
spec:
  affinity:
    podAntiAffinity:
      requiredDuringSchedulingIgnoredDuringExecution:
      - labelSelector:
          matchExpressions:
          - key: app
            operator: In
            values:
            - consumer-a
            - producer-b
        topologyKey: kubernetes.io/hostname
  containers:
  - name: producer-a
    image: ubuntu:20.04
    securityContext:
      privileged: true
    env:
    - name: IS_DAEMON
      value: "false"
    - name: PERF_TYPE
      value: "producer"
    - name: PERF_NIC
      value: "eth0"
    - name: PERF_MCGIP
      value: "239.0.0.10"
    - name: PERF_MCGPORT
      value: "8410"
    - name: PERF_PPS
      value: "100"
    - name: XNIC_SWXTCH_ADDR
      value: "10.224.0.115"
    command: ["/bin/bash"]
    args: ["-c", "apt update && apt install curl -y;
                  curl http://$(XNIC_SWXTCH_ADDR)/services/install/swxtch-xnic-
k8s-install.sh --output swxtch-xnic-k8s-install.sh;
                  chmod +x swxtch-xnic-k8s-install.sh;
                  ./swxtch-xnic-k8s-install.sh -v 2;
                  sleep infinity"]
```

2. Upload the file into the Azure CloudShell.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



STEP THREE: Run Test

- Run the producer by running this command in your preferred cloud's cloudShell Bash window. Wait for the cursor to return to know it is fully created.
  Shell

  Bash Copy
  ```
  kubectl create -f TestProducer.yaml
  ```

- Run the consumer by running this command in your preferred cloud'scloudShell bash window. Wait for the cursor to return to know it is fully created.

  Bash Copy
  ```
  kubectl create -f TestConsumer.yaml
  ```

Validate they are running using this command:

Bash Copy
```
kubectl get pods -o wide -A
```

Below is an example in Azure showing the consumer-a and producer-a running:

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Bash Copy

```bash
donna@Azure:~$ kubectl get pods -o wide -A
NAMESPACE     NAME                                 READY   STATUS    RESTARTS   AGE   IP
NODE                                 NOMINATED NODE   READINESS GATES
kube-system   cilium-node-init-kbql4               1/1     Running   0          27h
10.2.128.101   aks-nodepool1-23164585-vmss00000j   <none>           <none>
kube-system   cilium-node-init-sg4vc               1/1     Running   0          27h
10.2.128.100   aks-nodepool1-23164585-vmss00000i   <none>           <none>
kube-system   cilium-nx7vl                         1/1     Running   0          27h
10.2.128.100   aks-nodepool1-23164585-vmss00000i   <none>           <none>
kube-system   cilium-operator-6485c89c66-748tz     1/1     Running   0          27h
10.2.128.101   aks-nodepool1-23164585-vmss00000j   <none>           <none>
kube-system   cilium-vv4qs                         1/1     Running   0          27h
10.2.128.101   aks-nodepool1-23164585-vmss00000j   <none>           <none>
kube-system   cloud-node-manager-mncgk             1/1     Running   0          27h
10.2.128.100   aks-nodepool1-23164585-vmss00000i   <none>           <none>
kube-system   cloud-node-manager-qg5wf             1/1     Running   0          27h
10.2.128.101   aks-nodepool1-23164585-vmss00000j   <none>           <none>
kube-system   coredns-autoscaler-569f6ff56-qtqpr   1/1     Running   0          28h
10.0.0.121     aks-nodepool1-23164585-vmss00000i   <none>           <none>
kube-system   coredns-fb6b9d95f-blk6j              1/1     Running   0          28h
10.0.0.236     aks-nodepool1-23164585-vmss00000i   <none>           <none>
kube-system   coredns-fb6b9d95f-pxzh2              1/1     Running   0          28h
10.0.0.131     aks-nodepool1-23164585-vmss00000i   <none>           <none>
```

You can also validate it is working by running logs with this command:

Bash Copy

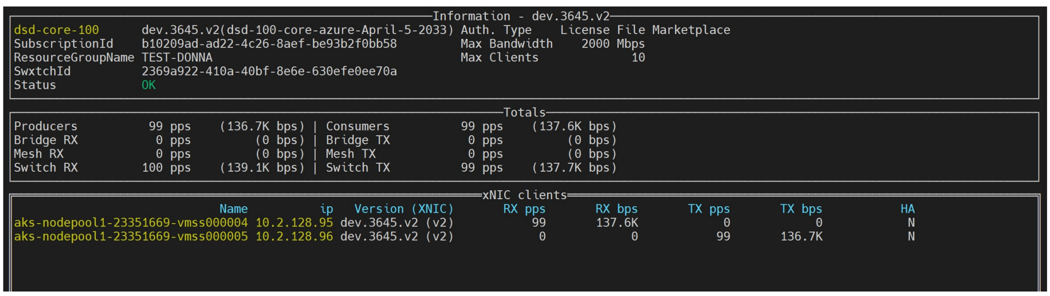
```bash
kubectl logs pods/producer-a -f
```

- Log into your cloudSwXtch and run this command:

  Bash Copy

  ```bash
  sudo /swxtch/swxtch-top dashboard --swxtch localhost
  ```

  1. swXtch-top should show the producer and the consumer. This may take a minute to completely show all metrics.



- Stop the test consumer by running this command back in your preferred cloud's CloudShell bash window.

  1. Wait for the cursor to return to know it is deleted fully.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Bash Copy

```
kubectl delete -f TestConsumer.yaml
```

2. swXtch-top should no longer show the consumer. This may take a minute to display. Additionally, running `kubectl get pods -o wide` should now show just the test consumer as shown below:

Bash Copy

```
donna@Azure:~$ kubectl get pods -o wide -A
NAME                READY   STATUS        RESTARTS   AGE   IP
NODE                                NOMINATED NODE   READINESS GATES
producer-a          1/1     Terminating   0          15m   10.0.1.90
aks-nodepool1-23351669-vmss000005   <none>           <none>
swxtch-xnic-46qgg   1/1     Running       0          39m   10.2.128.96
aks-nodepool1-23351669-vmss000005   <none>           <none>
swxtch-xnic-szdk7   1/1     Running       0          40m   10.2.128.95
aks-nodepool1-23351669-vmss000004   <none>           <none>
```

- Stop the test producer by running this command in your preferred cloud's CloudShell bash window.
  1. Wait for the cursor to return to know its fully deleted.

Bash Copy

```
kubectl delete -f TestProducer.yaml
```

2. swXtch-top should no longer show the producer. This may take a minute to display. Additionally, running `kubectl get pods -o wide` should now show just the test producer as shown below:

Bash Copy

```
donna@Azure:~$ kubectl get pods -o wide -A
NAME                READY   STATUS    RESTARTS   AGE   IP            NODE
NOMINATED NODE   READINESS GATES
swxtch-xnic-46qgg   1/1     Running   0          42m   10.2.128.96   aks-
nodepool1-23351669-vmss000005   <none>           <none>
swxtch-xnic-szdk7   1/1     Running   0          42m   10.2.128.95   aks-
nodepool1-23351669-vmss000004   <none>           <none>
```

Now that the system is validated using swXtch.io, you can test with your K8s application.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Upgrade xNIC nodes on K8s

> WHAT TO EXPECT
>
> The nodes upgrade is automatic based on the restart of the nodes containing the xNIC. This can be done by restarting the xNIC Daemonset.
>
> In this article, you will learn how you can use this method to upgrade your xNIC nodes on K8s to match the version of your cloudSwXtch.

Before you upgrade the xNIC nodes on K8s, you need to upgrade the cloudSwXtch to the latest version. See Upgrading cloudSwXtch for more information

Restarting the xNIC Daemon set

1. Sign into your preferred cloud's portal.
2. Open cloudShell as Bash.
3. Run the following command:

   Bash | Copy

   ```bash
   kubectl rollout restart ds swxtch-xnic -n kube-system
   ```

   1. This will restart the Kubernetes swxtch-xnic daemon set and update the version of the xNIC to match that of the cloudSwXtch.

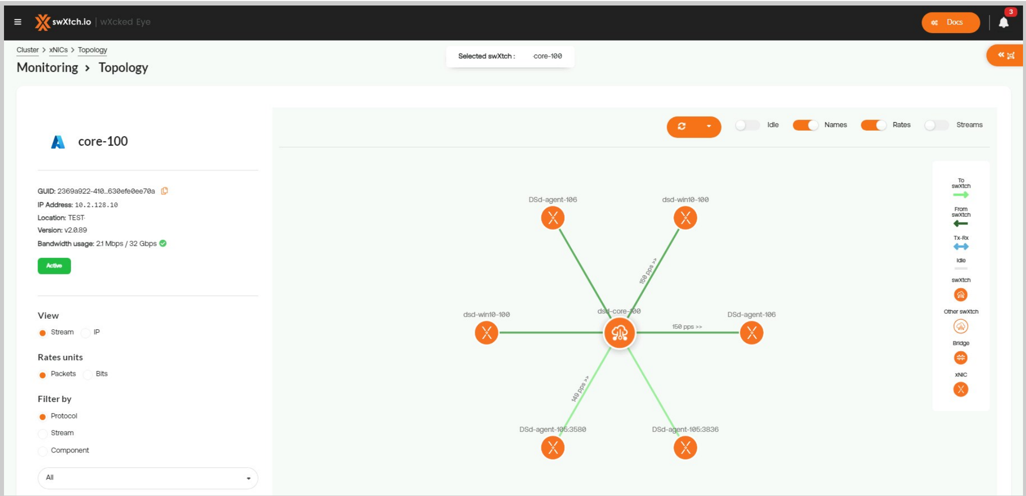
©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Using wXcked Eye for cloudSwXtch

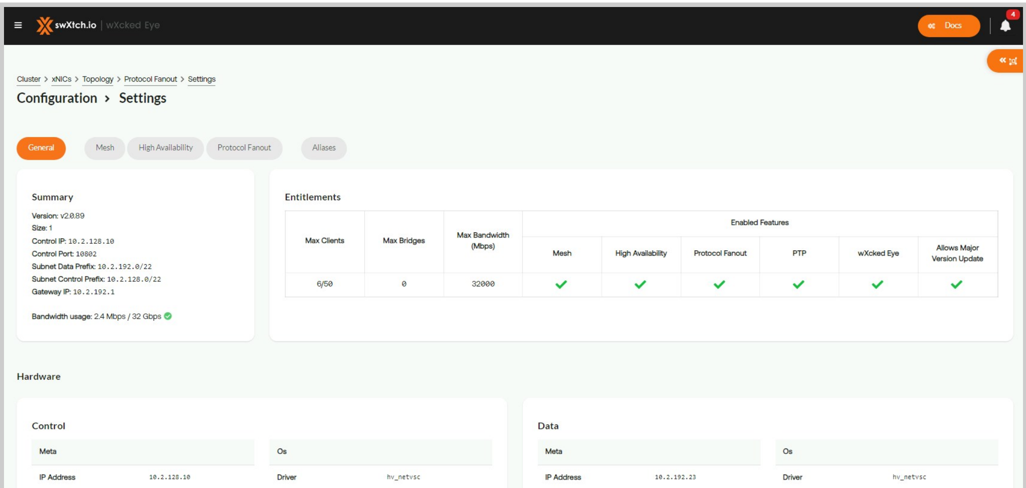
> WHAT TO EXPECT
>
> In this article, you will learn more about wXcked Eye and the benefits of using it to configure and monitor your cloudSwXtch environment.

What is wXcked Eye?

wXcked Eye is a web-based monitoring and configuration tool for cloudSwXtch. It presents users with a high-level view of their cloudSwXtch environment with an interactive graph detailing connections to different endpoints. With an expansive look at performance metrics, users can ensure that their data is flowing as expected.



In addition, wXcked Eye unlocks the ability to configure Mesh, High Availability, Protocol Fanout and Conversion, and Precision Time Protocol (PTP) from the comfort of a web browser.



How to Access wXcked Eye

To access the wXcked Eye UI, users will need to enter the following URL into a web browser of a VM in the cloudswXtch environment. They should use the IP address of their cloudSwXtch to prefix the URL.

```bash
<swxtch-ip-address>/wxckedeye/
```

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Monitor cloudSwXtch with wXcked Eye

To learn more about the monitoring capabilities of wXcked Eye such as the Network Graph or the cloudSwXtch and xNIC metrics views, see Monitor cloudSwXtch with wXcked Eye.

Configure cloudSwXtch with wXcked Eye

To learn more about the configuration capabilities of wXcked Eye such as Mesh, High Availability, Protocol Fanout and Precision Time Protocol, see Configure cloudSwXtch with wXcked Eye.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Monitor cloudSwXtch with wXcked Eye

WHAT TO EXPECT

The wXcked Eye UI provides users with an additional way to monitor the performance of their cloudSwXtch network.

To learn more about how to configure your cloudSwXtch for mesh, high availability and protocol fanout with wXcked eye, please read the "Configure cloudSwXtch with wXcked Eye" article.

In this section, we will walk through the user interface, explaining overall functionality and how it provides users with additional control over their cloudSwXtch network.

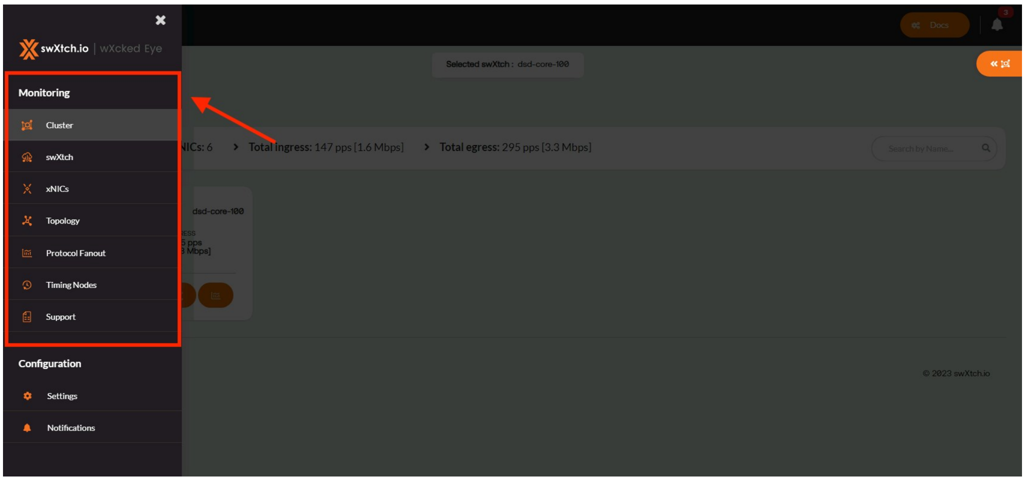
Accessing the wXcked Eye UI

To access the wXcked Eye UI, users will need to enter the following URL into a web browser of a VM in their cloudswXtch environment. They should use the IP address of their cloudSwXtch to prefix the URL.

PowerShell | Copy

```
<swxtch-ip-address>/wxckedeye/
```

Navigating the Monitoring pages



The wXcked Eye's monitoring capabilities are organized into seven pages. For more information on a page's contents, please view their respective articles.

- Cluster View
- cloudSwXtch Stats
- xNICs Stats
- Topology
- Protocol Fanout Stats
- Timing Nodes
- Support

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Note: The Cluster view is the default main page for wXcked Eye and will be the first thing users see when using the UI.

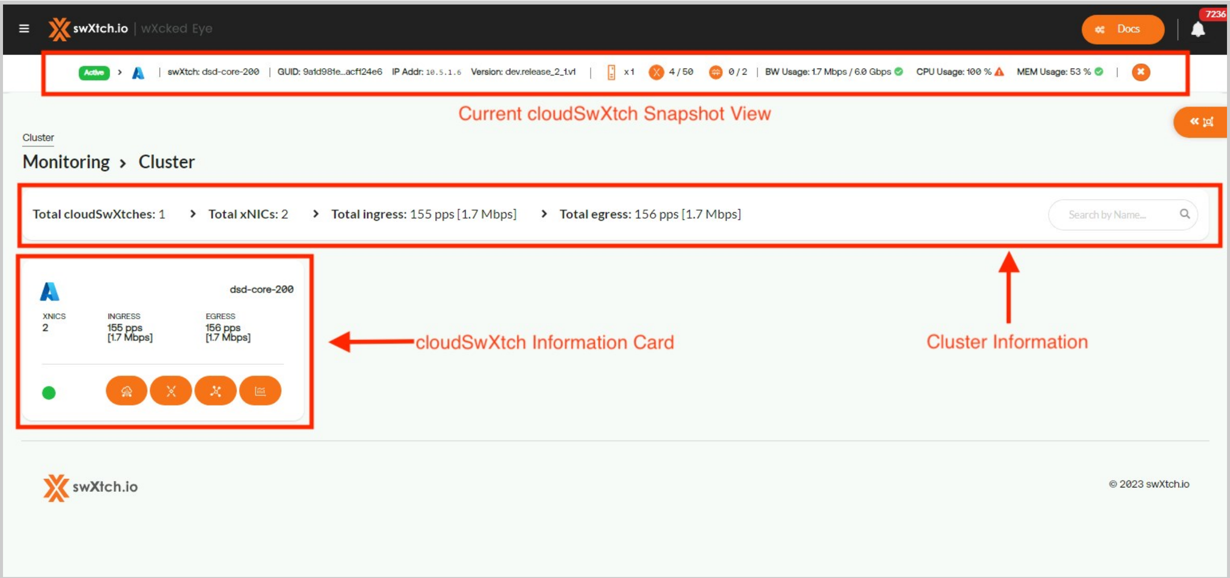
©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

wXcked Eye Cluster Page

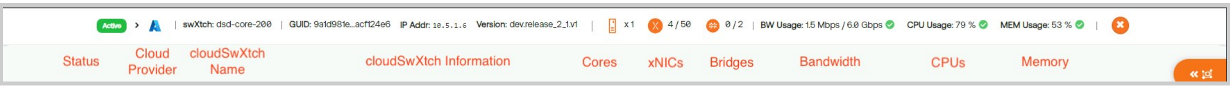
> **WHAT TO EXPECT**
>
> The Cluster page in wXcked Eye provides user with a high-level view of all their connected cloudSwXtches. Users can easily go between different cloudSwXtches and view their stats and the stats of associated xNICs. In addition, a new generalized side panel allows users to jump between cloudSwXtches.
>
> In this section, we will walk you through the Cluster page and how it improves navigation between cloudSwXtches.

Introduction

The Cluster page is the main page of wXcked Eye. It segments cloudSwXtches into byte sized cards with some top level information, such as the name, the cloud provider, the status, the number of attached xNICs, and the flow of data for both Ingress and Egress in packets per seconds (pps). The Cluster Information panel shows the total number of cloudSwXtches and xNICs with the cumulative total in pps for both Ingress and Egress.



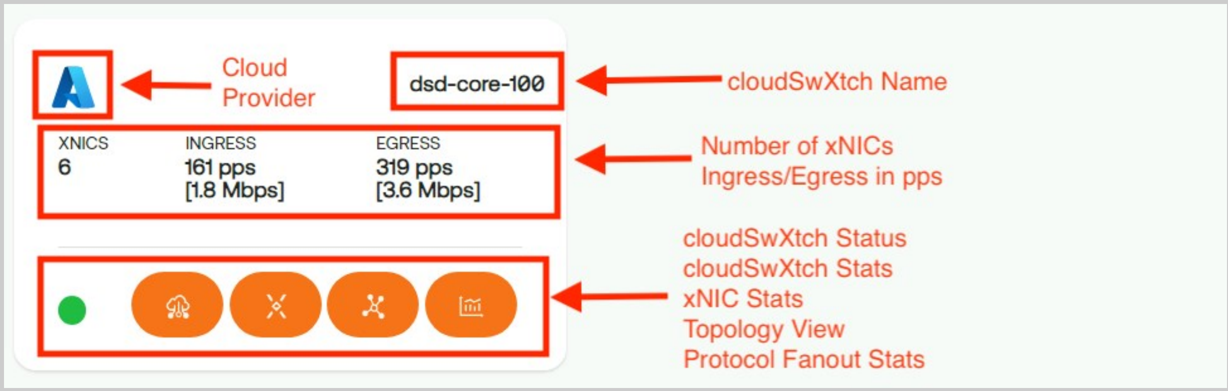
At the top of each page in wXcked Eye, the Current cloudSwXtch Snapshot banner will display relevant information regarding the cloudSwXtch a user is currently on.



A cloudSwXtch's membership in a Cluster is dependent on whether or not it is involved in a mesh or high availability configuration. For more information on how to set up mesh and high availability in wXcked Eye, please visit their respective articles under Configure cloudSwXtch in wXcked Eye.

Navigating using cloudSwXtch Information Card

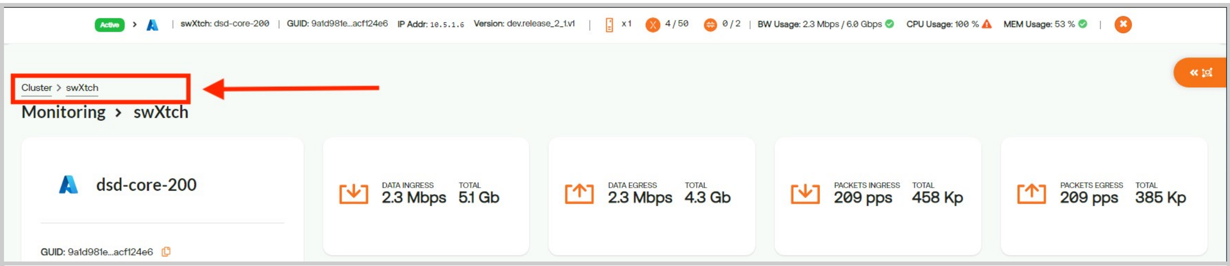
©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



In each cloudSwXtch Information card, users will find four buttons linking you to additional information and metrics within wXcked Eye. This includes:

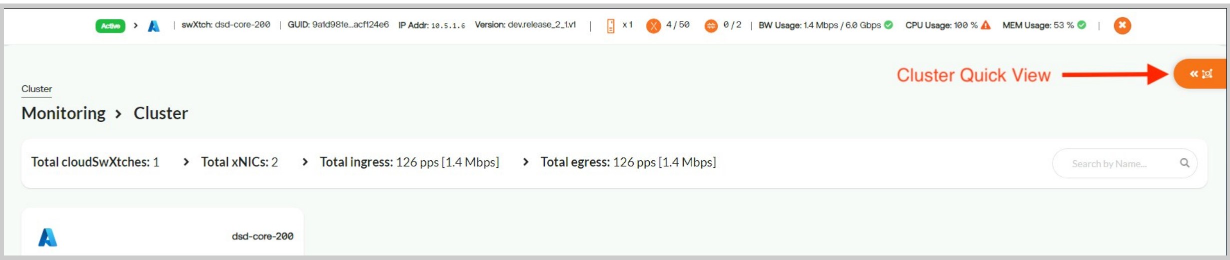
- cloudSwXtch Stats
- xNIC Stats
- Topology
- Protocol Fanout Stats

A user can return to the cluster view by selecting "Cluster" in the breadcrumb trail at the top of the page.



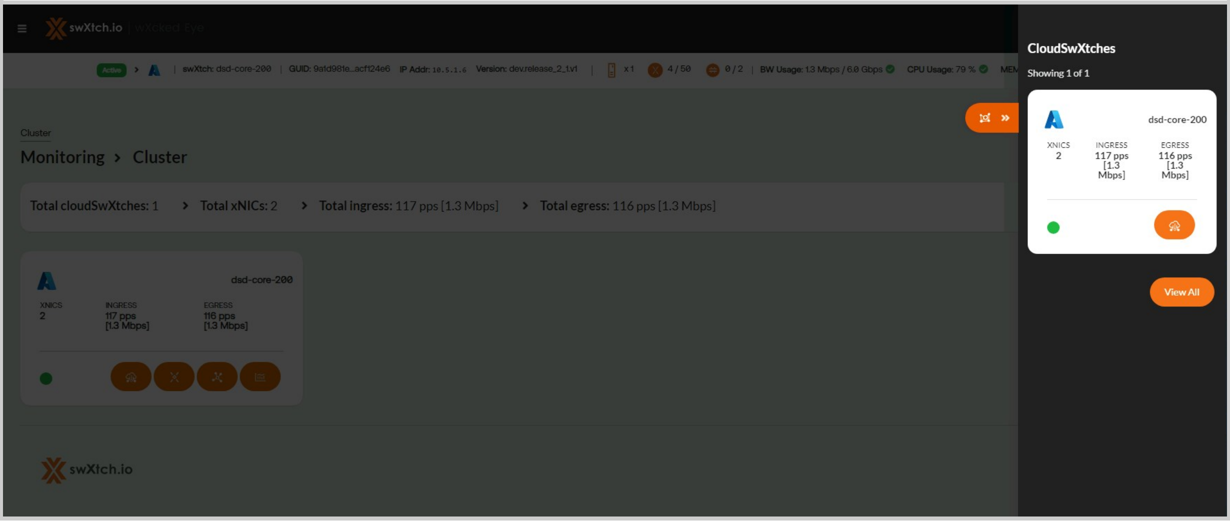
Cluster Quick View Panel

A user can quickly access a condensed list of up to 5 cloudSwXtches from any page in wXcked Eye by using the new Cluster Quick View side panel at the top right hand corner. The selected swXtch will be displayed at the top of the page.



The cloudSwXtch Information card will contain the same metrics displayed in the Cluster Main page and the cloudSwXtch Stats navigation button.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

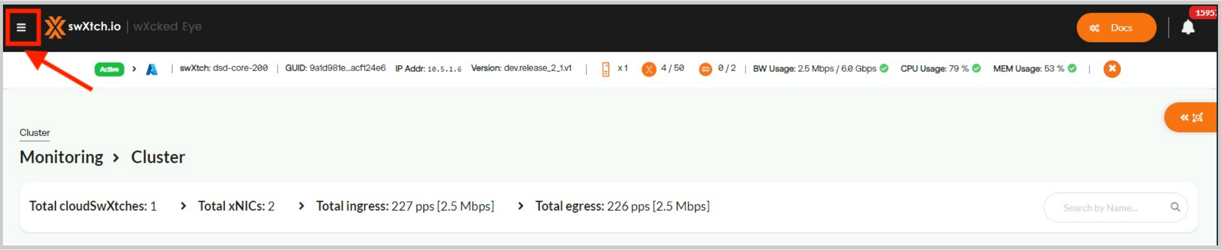


©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

wXcked Eye cloudSwXtch Page

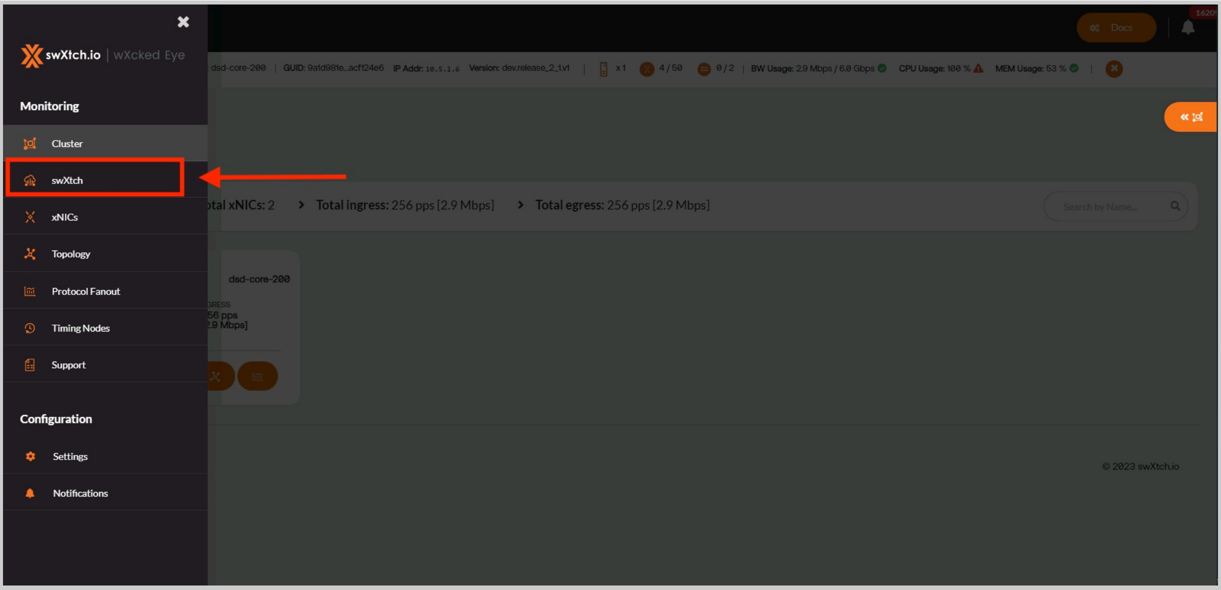
Locating the wXcked Eye cloudSwXtch Page

To navigate to the cloudSwXtch page, users will need to click on the menu (≡) option at the top left hand corner by the swXtch.io logo.



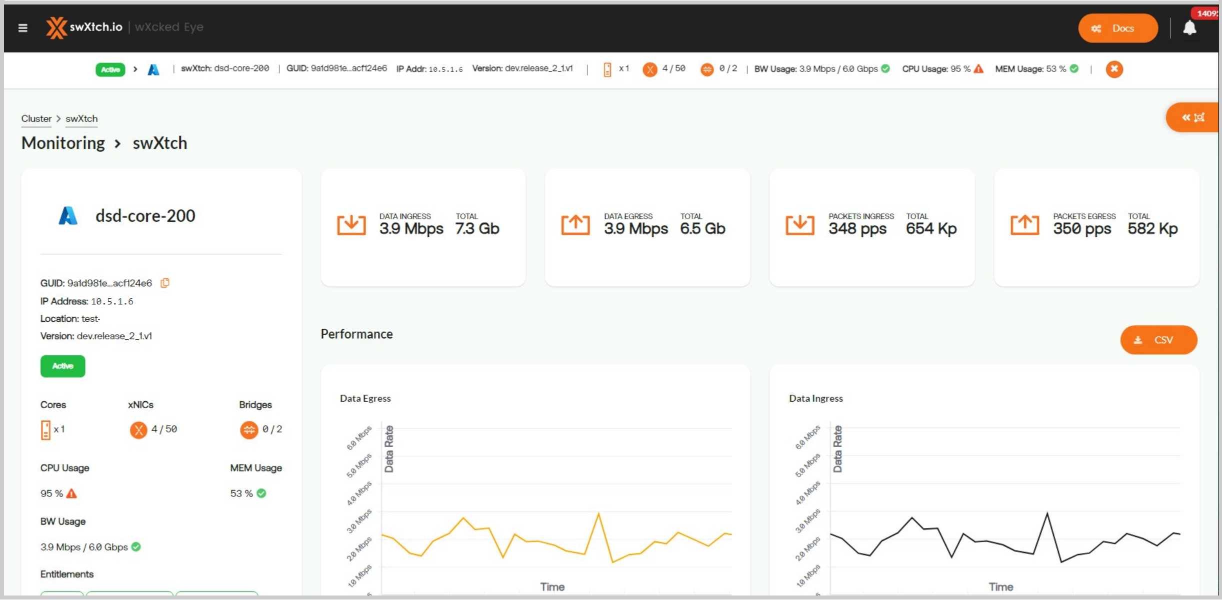
From there, select "swXtch" under "Monitoring."

Alternatively, if a user is on the Cluster page, they can select the cloudSwXtch Stats button in a cloudSwXtch's Information card.



Navigating the wXcked Eye cloudSwXtch Page

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

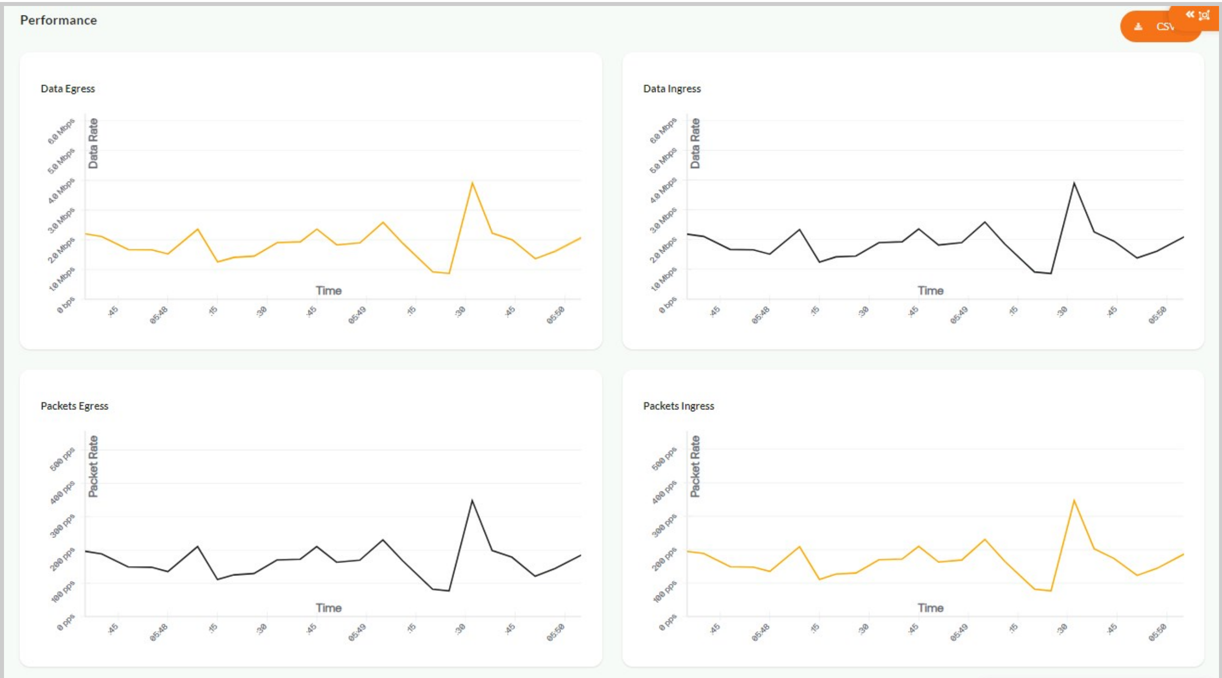


cloudSwXtch Key Performance Metrics

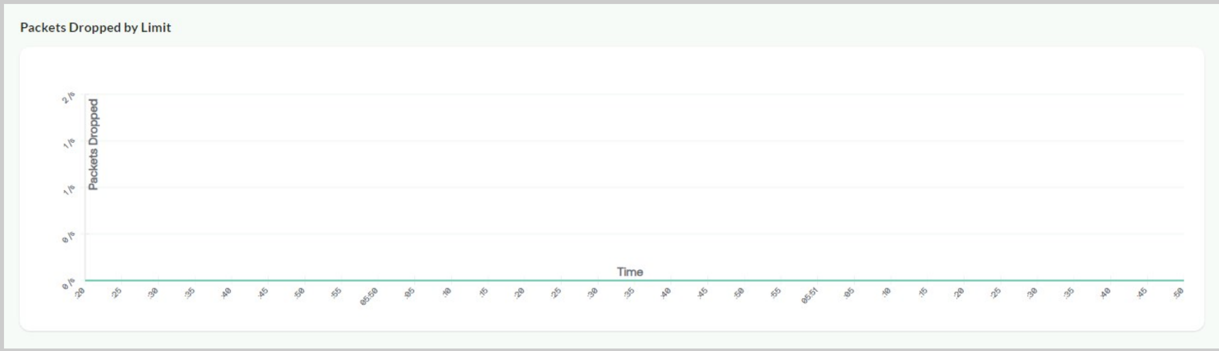
Once the page loads, users will be presented a high-level view of their selected cloudSwXtch's data flow. This page provides detailed information regarding the cloudSwXtch and illustrates 4 key performance metrics:

- Data Egress
- Data Ingress
- Packets Egress
- Packets Ingress

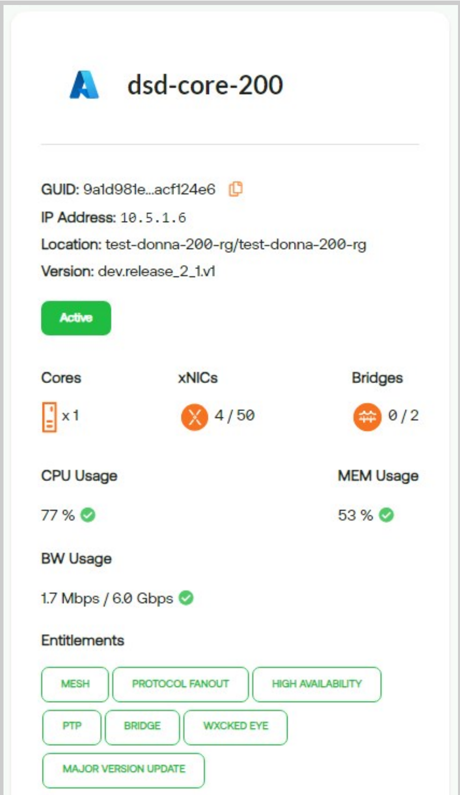
Data egress/ingress are displayed in bits per second (bps) while packets egress/ingress are displayed in packets per second (pps). In addition to the rate, the total number of bits and packets are displayed for the user. These metrics are further explored in the Performance section with four related graphs and an additional Packets Dropped graph.



©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



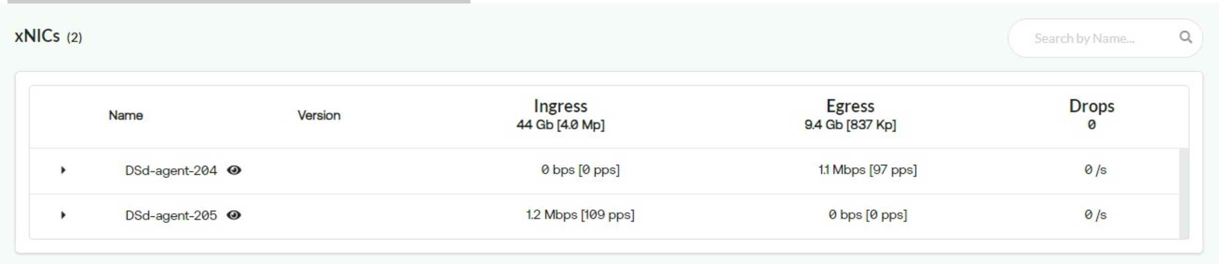
cloudSwXtch Information Panel



Important network information of the cloudSwXtch such as the GUID, IP address, location (resource groups), cloud provider, version, & replicator status is shown in the top left card along with its name, which in this case is core-200. In addition, the number of cores and number of associated xNICs to the cloudSwXtch will also be displayed.

Bandwidth usage is also listed. In the event that a cloudSwXtch exceeds its allotted bandwidth, a warning symbol will appear.

xNICs Panel



In the bottom of the cloudSwXtch page, users will be able to see the xNICs panel. This panel lists the agents that are connected to the cloudSwXtch -- in this case, core-200. Each listed xNIC is accompanied with its version, ingress/egress rates, and packet drops. When using the dropdown feature for an agent, a user can see the multicast groups associated with the xNIC and its ingress/egress rates.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

wXcked Eye xNICs Page

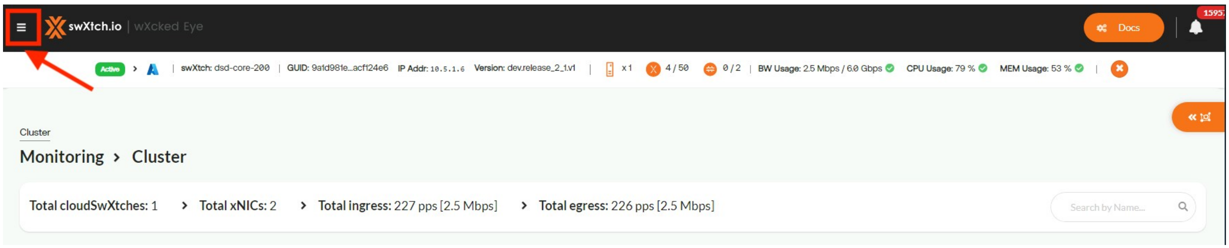
WHAT TO EXPECT

In this article, users will learn how to view performance metrics from the xNICs perspective.

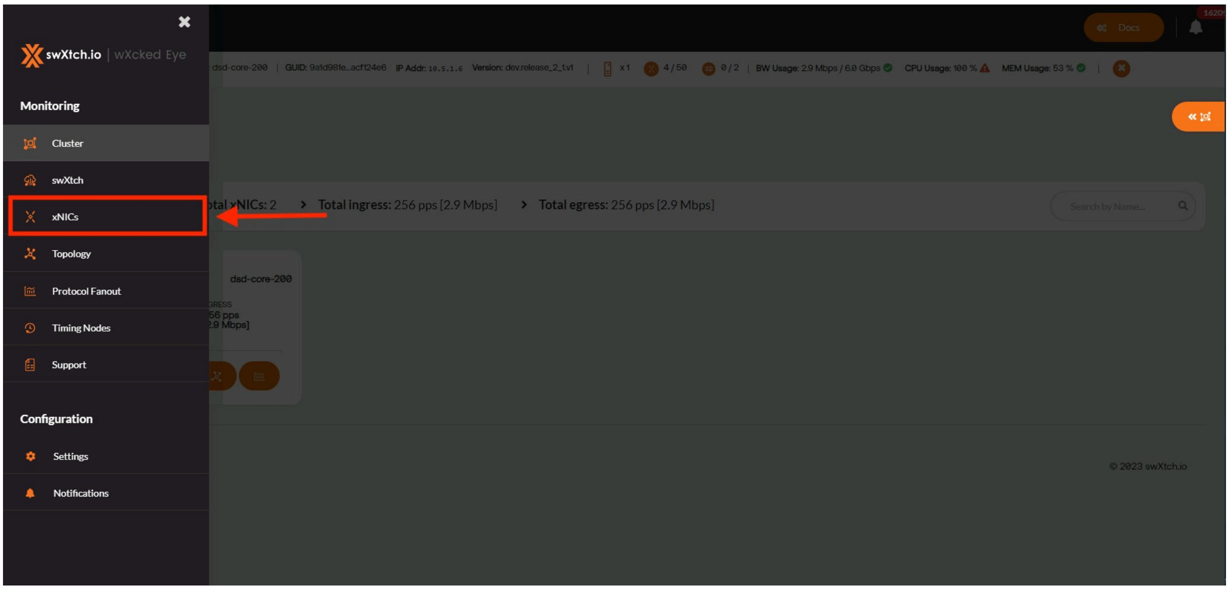
Locating the xNIC View Page

The xNIC page provides users with a look of their cloudSwXtch environment from the xNICs' perspective, breaking down performance at an agent's level.

To navigate to the xNIC page, users will need to click on the menu option at the top left hand corner by the swXtch.io logo.

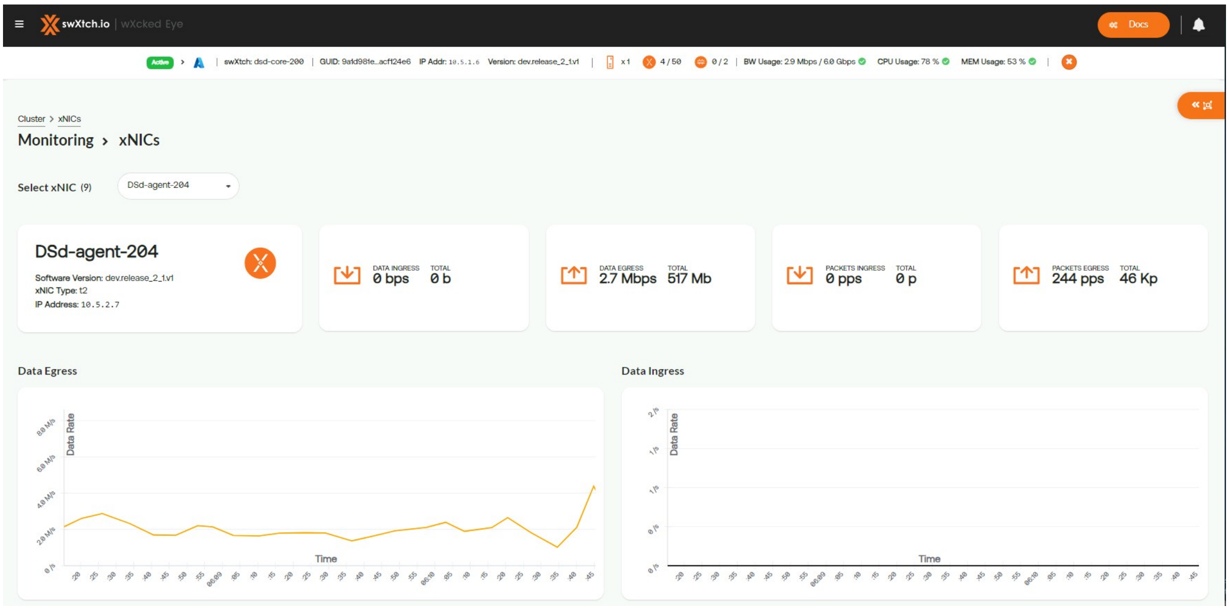


The navigation menu will open, revealing the other wXcked Eye pages. **Select xNICs** to view the xNIC page.



Navigating the xNIC page

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



At first glance, the xNIC page looks very similar to the cloudSwXtch view. However, instead of focusing on the cloudSwXtch, users are given key information and performance metrics for a single xNIC.

- Data Ingress (bps) - Data being consumed by the xNIC
- Data Egress (bps) - Data being sent from the xNIC
- Packets Ingress (pps) - Packets being consumed by the xNIC
- Packets Egress (pps) - Packets being sent from the xNIC

In the example above, one noticeable difference is the inclusion of the Select an xNIC dropdown menu next to "Select xNIC." Here, a user can select an agent they wish to monitor (DSd-agent-204).

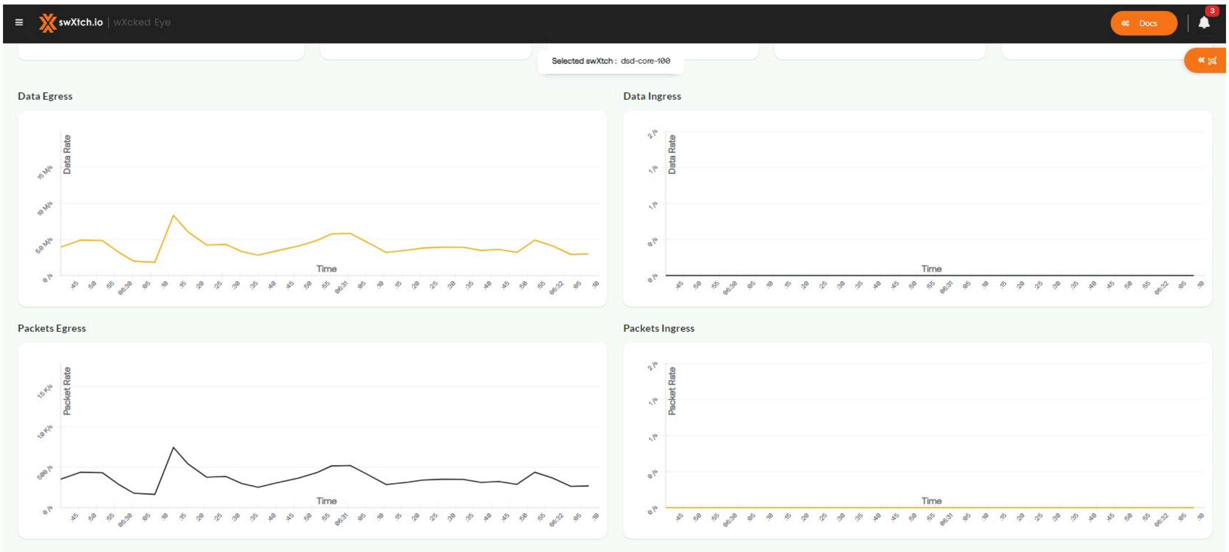
After selecting an xNIC, the agent's information will display in the same area as the cloudSwXtch on the main page. The information includes the software version, xNIC version and the IP address.

Just like the xNIC panel in the wXcked Eye main page, users are able to see the Multicast Groups associated with the xNIC and their ingress/egress rates.

Performance

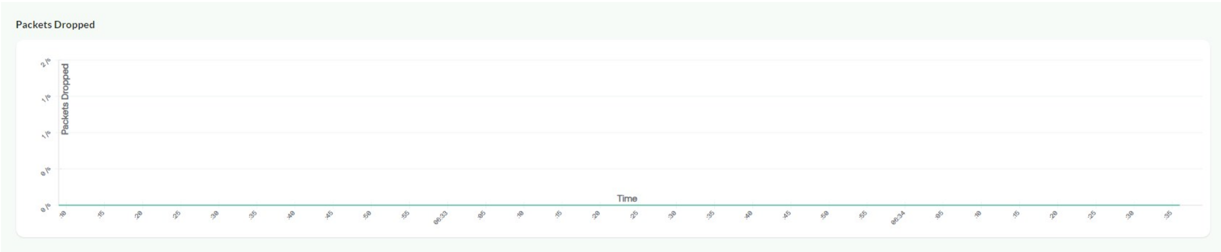
The xNIC view provides users with another way to visualize data flow. Towards the bottom of the page, users will be able to see the 5 key performance metrics displayed as active histograms. The first four deal with data and packet egress/ingress over 15 second increments.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



Perfomance: Data Egress/Ingress and Packets Egress/Ingress

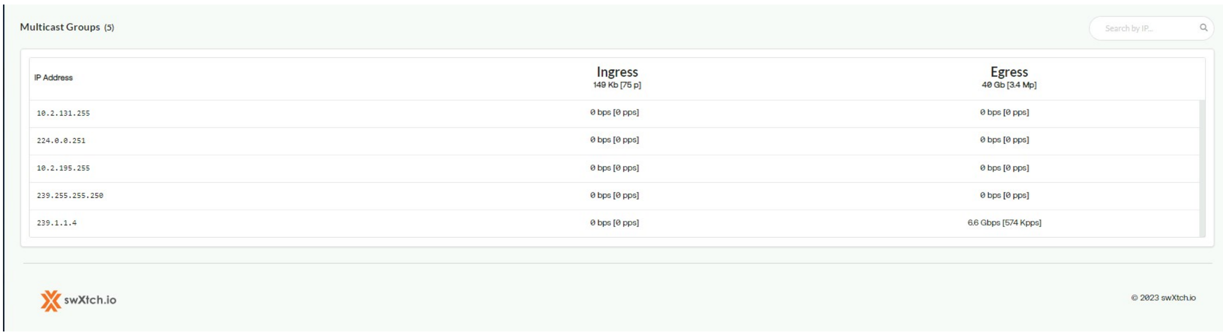
The bottom graph displays the number of packets dropped over time. A successful stream would show no packets dropping like the example below. The X-Axis is organized into 5 second increments.



Packets Dropped by Limit (:05 second increments)

Multicast Groups

The Multicast Groups panel lists the IP addresses of different data streams related to the cloudSwXtch with the ingress/egress rates displayed.



Multicast Groups (5)

IP Address	Ingress 149 Kb [75 p]	Egress 40 Gb [3.4 Mp]
10.2.131.255	0 bps [0 pps]	0 bps [0 pps]
224.0.0.251	0 bps [0 pps]	0 bps [0 pps]
10.2.195.255	0 bps [0 pps]	0 bps [0 pps]
239.255.255.250	0 bps [0 pps]	0 bps [0 pps]
239.1.1.4	0 bps [0 pps]	6.6 Gbps [574 Kpps]

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

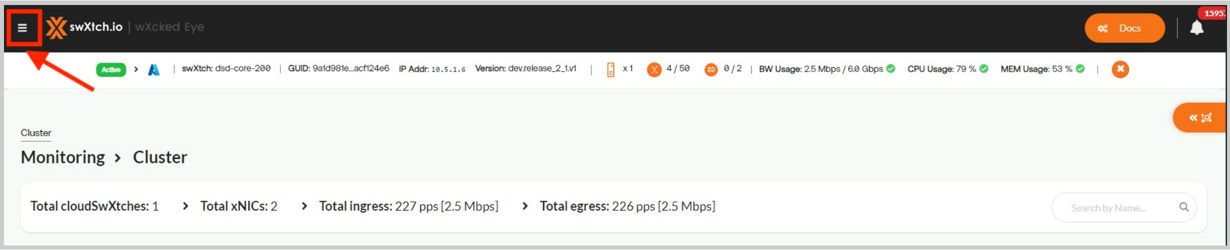
wXcked Eye Topology

WHAT TO EXPECT

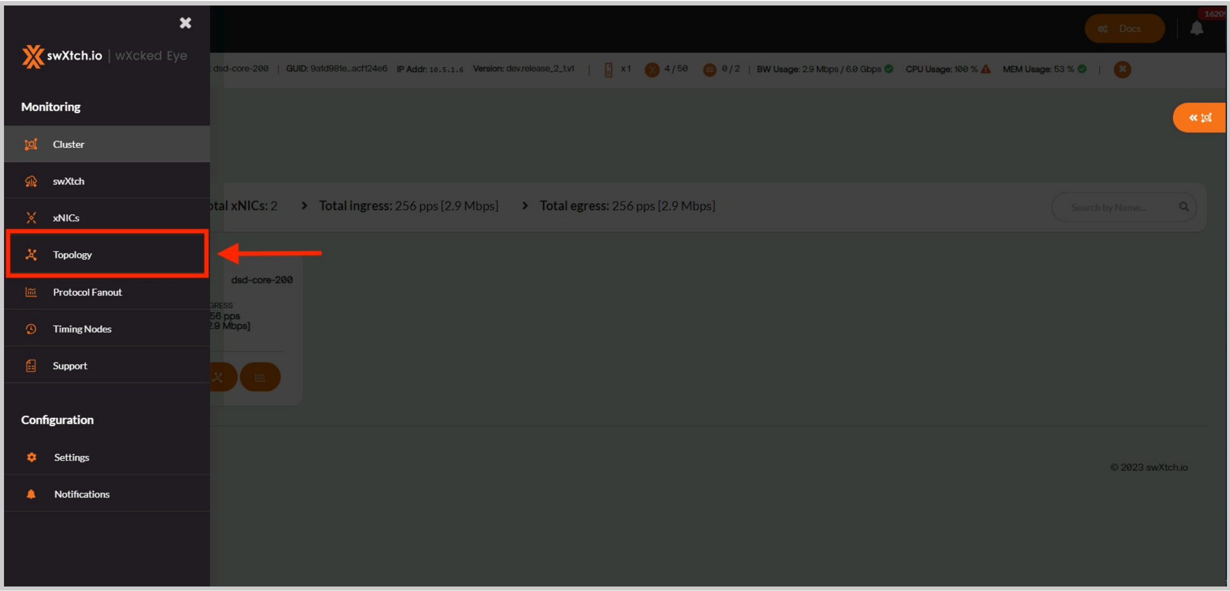
In this article, users will learn how to use the wXcked Eye Topology and reformat it for their needs.

Locating the wXcked Eye Topology

To navigate to the wXcked Eye Topology page, users will need to click on the menu (≡) option at the top right hand corner by the swXtch.io logo.

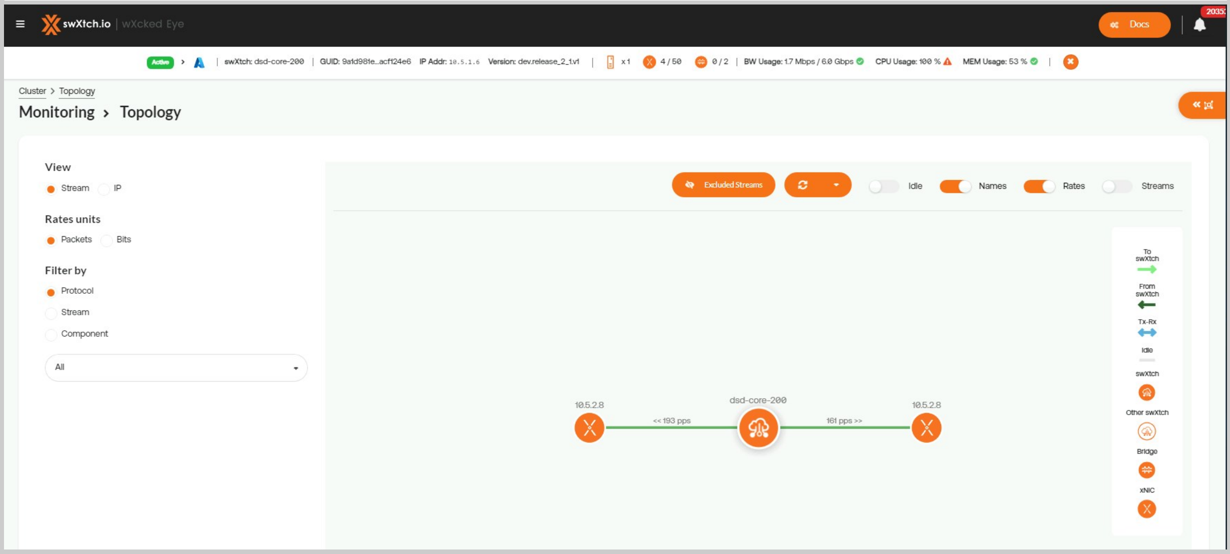


From there, select "Topology" under "Monitoring."



Using the wXcked Eye Topology

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



The wXcked Eye Topology page displays a network graph, providing a high level view of the cloudSwXtch environment. On the top panel, users will find the name of the cloudSwXtch with a list of relevant network information. The center of the graph will display the cloudSwXtch you are currently on with green lines indicating traffic flowing either to or from it. Next to each line, users will be able to see the flow's direction with the transmission rates (either in pps or bps). The endpoints can be either xNICs, cloudSwXtch Bridges or other cloudSwXtch instances as detailed in the key on the right hand side of the graph.

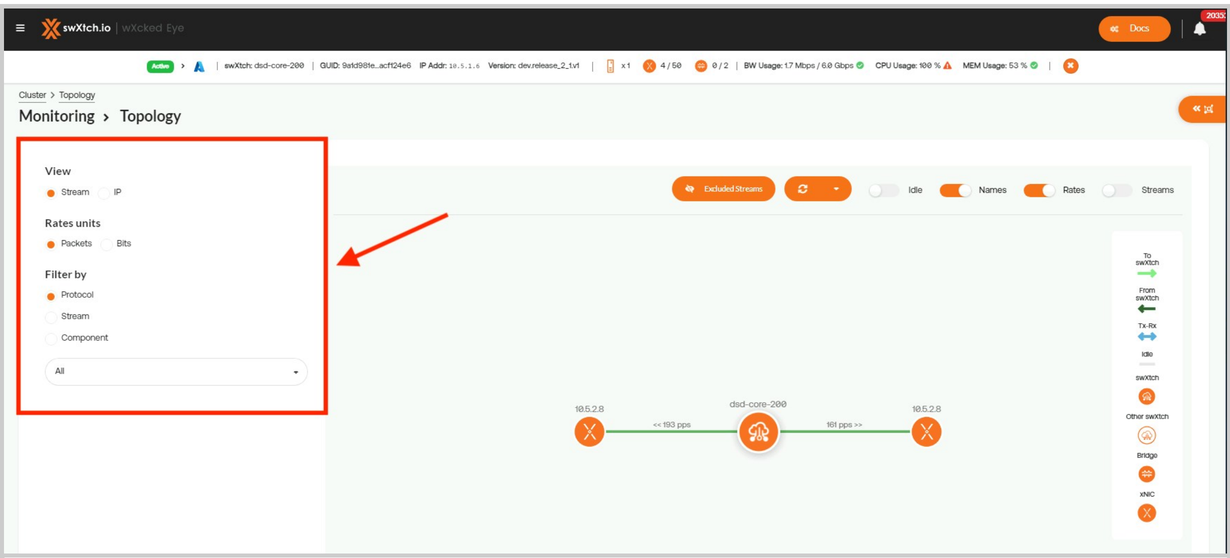
Reformatting the Topology

It is very simple to alter the Topology for a user's desired configuration. In addition to being able to physically drag and rearrange the icons in the graph, users can zoom in and out, refresh the page, and toggle names/rates on and off. These options are available next to the graph key.

For Rates, users can select between Packets and Bits for their unit.

Users can also filter by components, protocols, and streams. Selecting one of these options will change the list in the dropdown menu.

- **Components -** This will allow users to highlight specific icons like cloudSwXtch, xNICs, UDP, and SRT.
- **Protocol -** Multicast, UDP, SRT Caller, and SRT Listener
- **Stream -** This will allow users to highlight a specific data stream from producer to consumer.



©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

wXcked Eye Protocol Fanout Stats

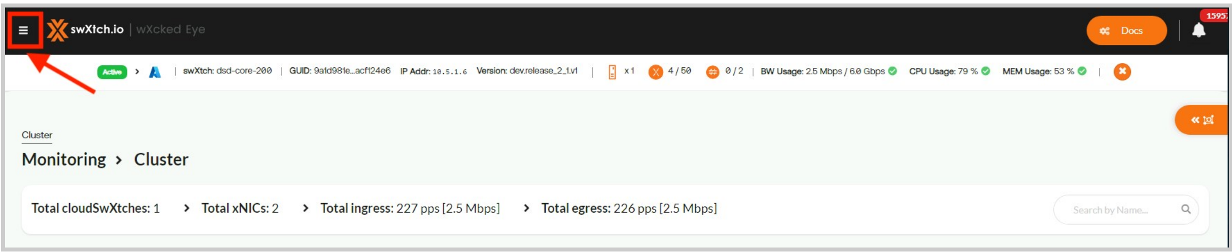
WHAT TO EXPECT

The Protocol Fanout Stats page allows users to see metrics for non-Multicast and non-Broadcast data flows. This includes protocols, such as SRT Caller, SRT Listener, RIST Caller and RIST Listener.

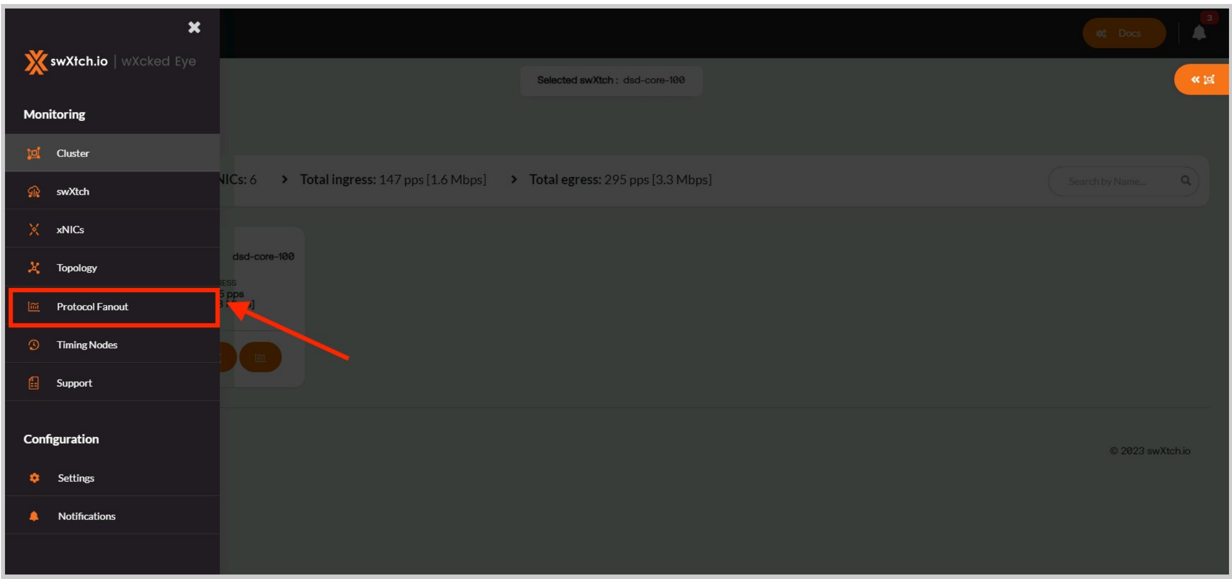
In this section, users will learn how to navigate between different protocols and their adaptors in order to better visualize their packets' movements. Please note: This page only shows the stats for protocol fanout configurations. To learn how to configure your cloudSwXtch for Protocol Fanout and Conversion in the wXcked Eye UI, please read this article.

Locating the Protocol Fanout Stats Page

To navigate to the Protocol Fanout Stats page, users will need to click on the menu option at the top right corner by the swXtch.io logo.



From there, select Protocol Fanout under Monitoring.

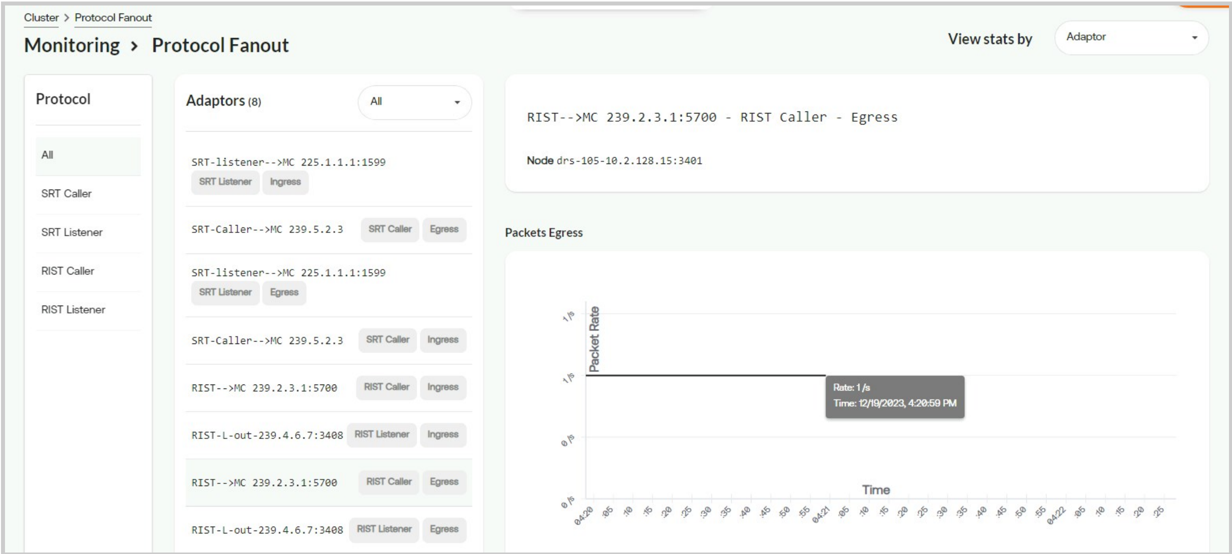


Navigating the Protocol Fanout Stats page

Statistics displayed through the wXcked Eye UI focus primarily on multicast and broadcast data flow. The Protocol Fanout Stats page provides users with a dedicated area to see data flow for alternative protocols like SRT and RIST.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Adaptor View



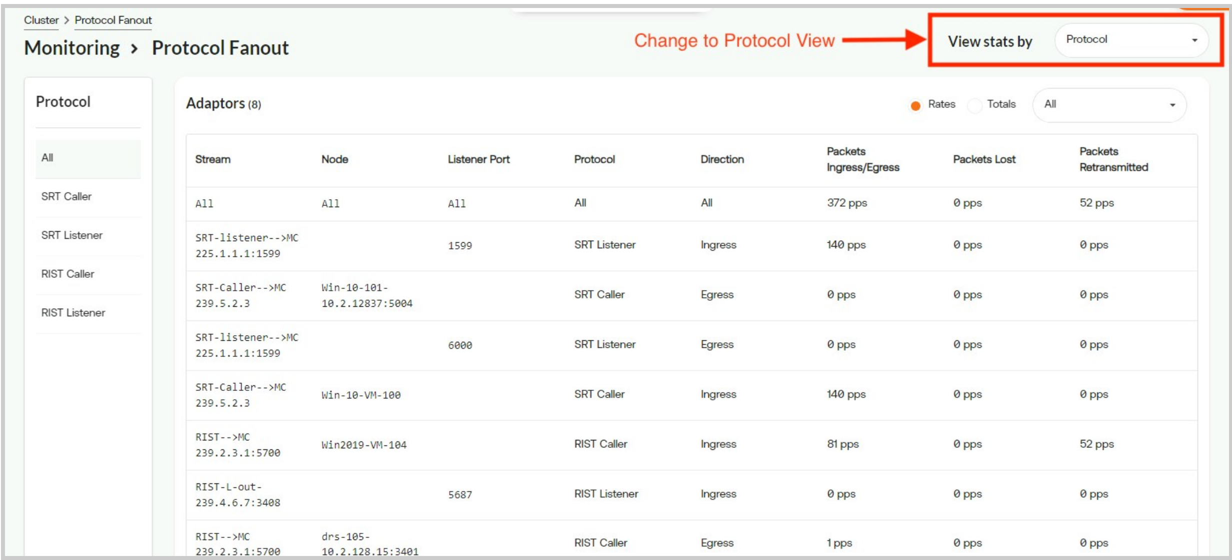
Adaptor View

At start-up, the page will be in Adaptors view and display 3 graphs:

1. Packets Egress
2. Packets Lost
3. Packets Retransmitted

A user can select Protocols in the left hand side to filter Adaptors or return to "All" to see them all listed. At the top of the Adaptors panel, users can filter the list further by direction -- either Ingress or Egress.

Protocol View



A user can select to View Stats by Protocol by clicking the dropdown menu in the upper right hand corner. This will provide users with a table view, listing adaptors by protocol. This allows for closer comparison between adaptors. The table can be configured to display in both Rates (pps) or Total Packets.

Similar to the Adaptors view, users can group adaptors by protocol. In addition, they can also group protocols by direction -- either Ingress or Egress.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

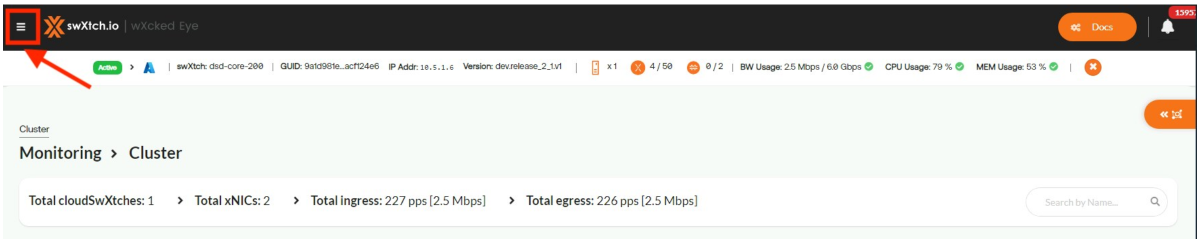
©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

wXcked Eye Timing Nodes

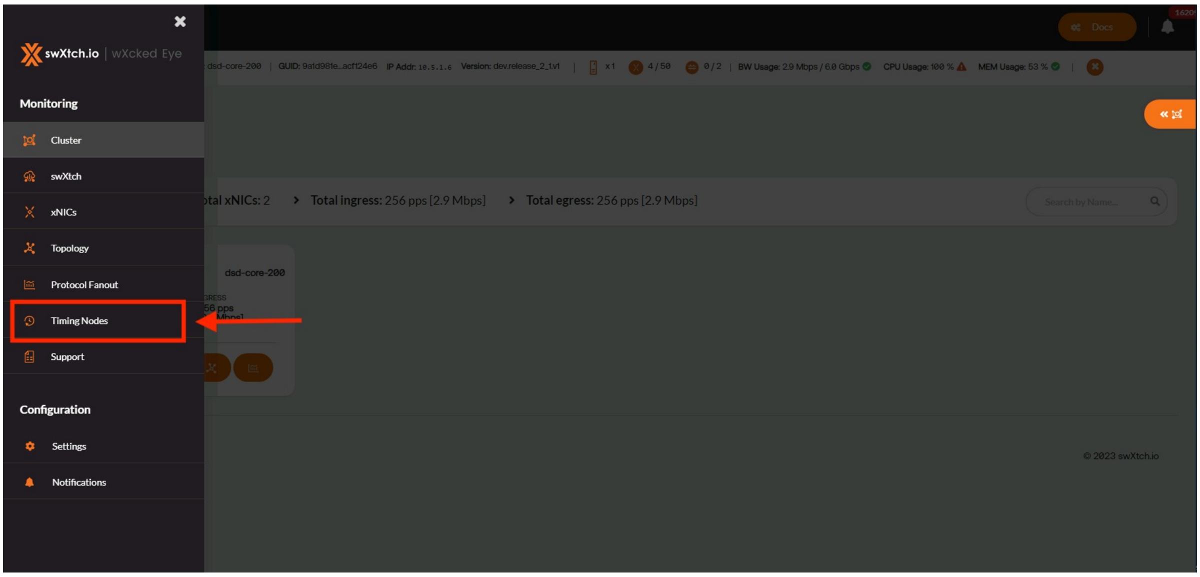
Finding the Timing Nodes page

To find the Timing Nodes page in the wXcked Eye UI:

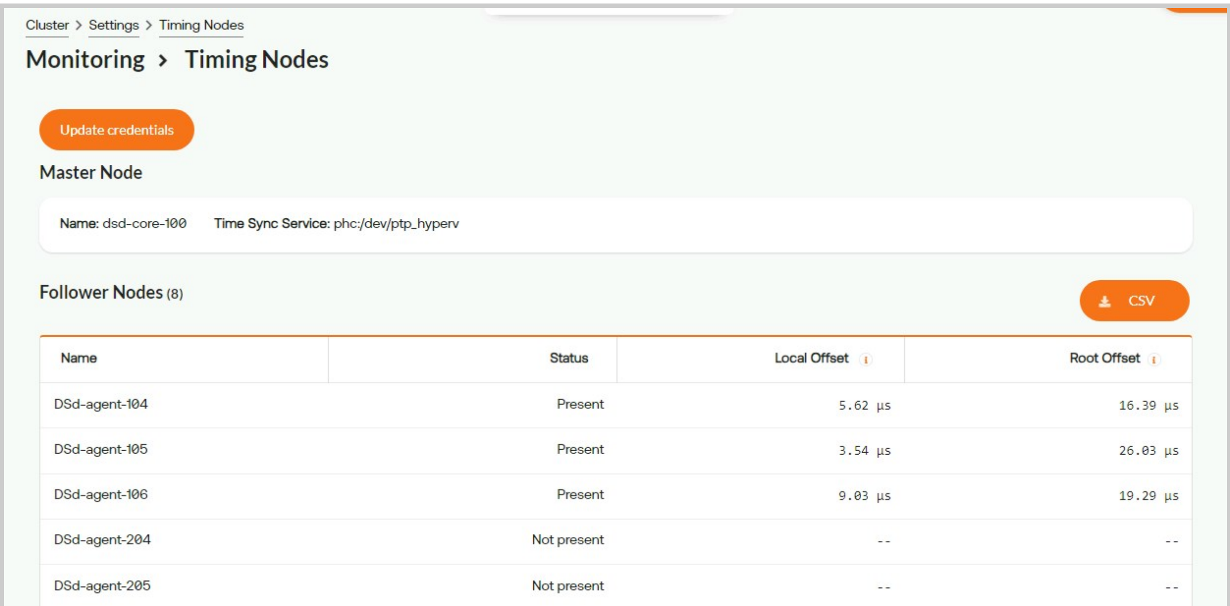
1. **Click** the menu icon (≡) next to the swXtch.io logo.



2. Select Timing Nodes under Monitoring.



Understanding the Timing Nodes page



©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

The Timing Nodes page displays information regarding clock sync configuration for the cloudSwXtch. This page in wXcked Eye will only populate with information if the user has the PTP feature enabled.

In the example above, the cloudSwXtch (DSd-core-100) is acting as the Master Node.

- Master Node- The Master Node is what the PTP configuration sets as the most reliable time source. This will send the true time it receives from the source clock to the Follower Nodes.
  - Name - The name of the cloudSwXtch
  - Time Sync Service - The source clock
- Follower Nodes- The Follower Nodes lists the agents/VMs that subscribe to the Master Node for accurate timing.
  - Name - The name of the endpoints
  - Status - The status of the endpoints, noting if the node is active in the PTP configuration
  - Local Offset - The local offset denotes the offset in time from the cloudSwXtch to the xNIC.
  - Root Offset - The root offset denotes the offset in time from the GrandMaster clock to the cloudSwXtch and its follower nodes (xNIC). Note how the root offset is larger than the local offset. This is normal behavior since the distance between the follower node and the Grandmaster clock is greater than the offset between a cloudSwXtch and xNIC.

Timing Nodes Stabilization

After upgrading or rebooting your cloudSwXtch system, you may notice that the local and root offset values are much larger than they actually are. It can take up to 30 minutes for the values to stabilize and return back to normal levels.

Exporting your Timing Nodes

You can export your timing nodes by hitting the CSV button next to Follower Nodes.

Formatting CSV Timing Nodes file in Excel

To prevent incorrect formatting in your CSV Timing Nodes file in Excel, complete the following steps:

1. Make sure your Timing Nodes CSV file is already downloaded from wXcked Eye.
2. Select "Data" from the top ribbon of a new Excel spreadsheet.
3. Click "Get Data (Power Query)."
4. Select "Text/CSV" from the "Choose data source" options.
5. Browse for your file and click "Get Data."
6. Click "Next."
7. Select "Unicode (UTF-8) from the File Origin dropdown menu. This ensure your data displays as it was intended.
8. Click "Load."

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

wXcked Eye Support Page

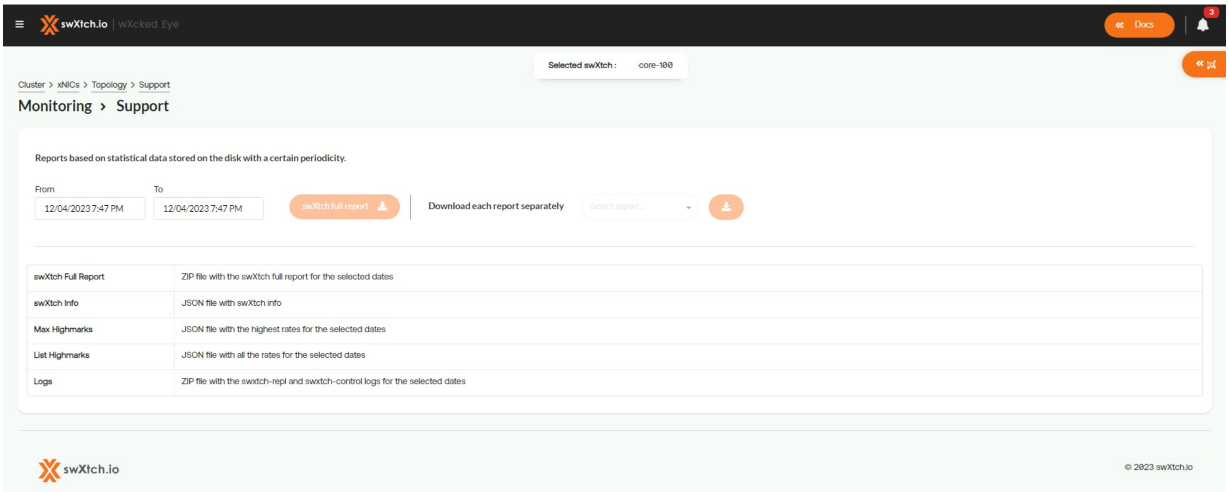
WHAT TO EXPECT

The wXcked Eye Support Page allows users to export a report detailing the statistical data stored within the cloudSwXtch over a set period of time. This report includes JSON files containing cloudSwXtch information, Max Highmarks, List Highmarks, and Logs -- all in a compressed file. This report should be provided to swXtch.io Support when troubleshooting an issue.

In this section, we will walkthrough exporting both a full report and also individual files. Alternatively, you can use the swx support command in the cloudSwXtch VM to export a report. For more information, see [How to View cloudSwXtch Logs for Troubleshooting].

Navigating the wXcked Eye Support Page

The wXcked Eye Support page can be located under Monitoring in the wXcked Eye navigation menu. The page has two functionalities: exporting a full report or selecting individual JSON files to download separately. When troubleshooting, it is recommended for users to send the complete report so that swXtch.io Support can fully understand the situation.



To do this, simply set a start and end time for the report and select the download button, SwXtch full report. User should set the duration to at least 24 hours of time, spanning from a little before the issue began to up until now.

In the event that a user only wants a specific section of the report, they can use the dropdown menu after Download each report separately and download their desired JSON file. The wXcked Eye UI will then export using the time period set in the From and To fields.

Contacting swXtch.io Support

For all troubleshooting requests, email the compressed file to support@swxtch.io for further instructions.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Configure cloudSwXtch with wXcked Eye

WHAT TO EXPECT

wXcked Eye allows users to configure their cloudSwXtch directly from a graphical user interface (GUI).

To learn how to use wXcked Eye to monitor your cloudSwXtch, please see the "Monitor cloudSwXtch with wXcked Eye" article.

In this article, users will learn how to navigate the "Settings" option in the wXcked Eye UI and to configure their cloudSwXtch for mesh, high availability and protocol fanout. To learn how to access the wXcked Eye UI, please review the following article.

Accessing wXcked Eye

To access the wXcked Eye UI, users will need to enter the following URL into a web browser of a VM in their cloudswXtch environment. They should use the IP address of their cloudSwXtch to prefix the URL.

Custom

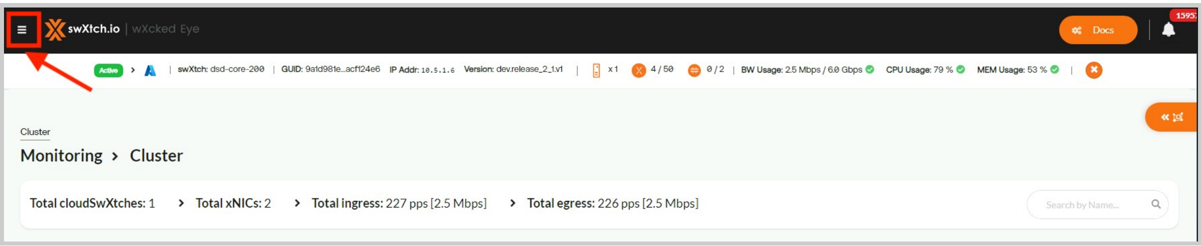
Copy

```
<swxtch-ip-address>/wxckedeye/
```

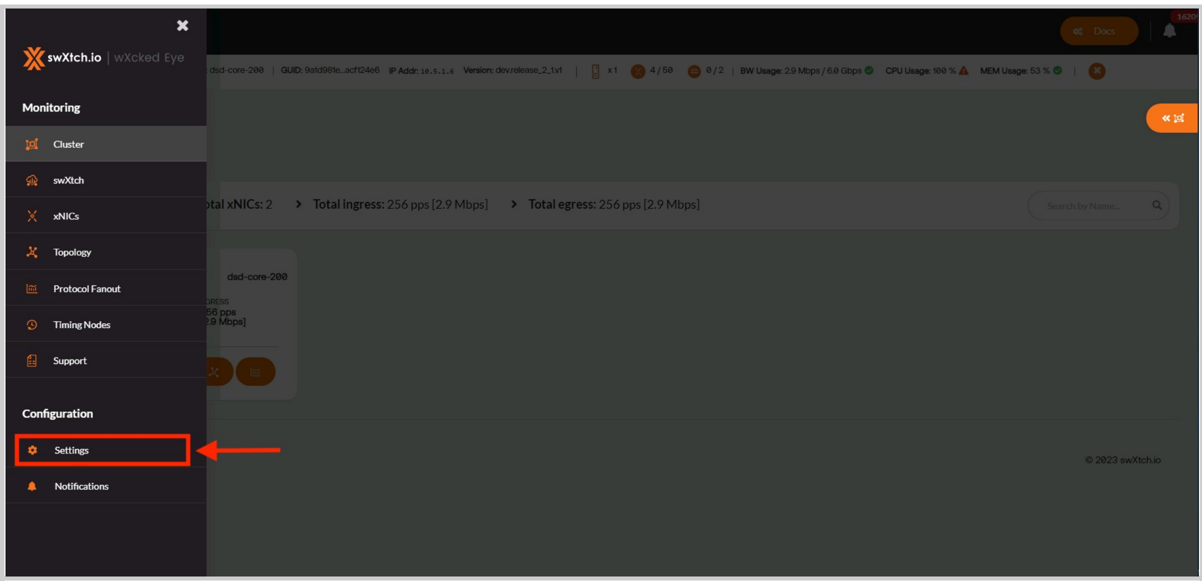
Finding the Settings page

To find the Settings page in the wXcked Eye UI:

1. **Click** the menu icon (≡) next to the swXtch.io logo.



2. Select Settings under Configuration.



©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

3. You should now be on the **Settings** page.

Navigating Settings

The Settings page is organized into five tabs with varying functionalities:

- General
- Mesh
- High Availability
- Protocol Conversion and Fanout
- Aliases

In this section, we will discuss each tab and how it offers the user additional control over their cloudSwXtch network.

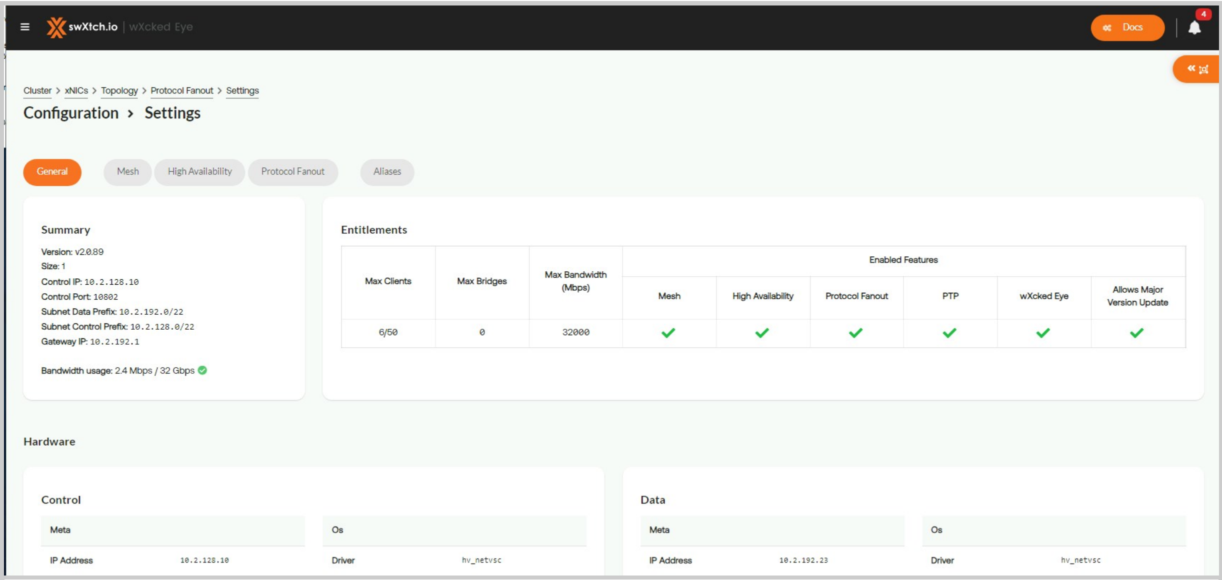
©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

General

How to Navigate to the General tab

To learn how to navigate to Settings from the wXcked Eye main page, please review the [Configure cloudSwXtch with wXcked Eye](#) article.

Navigating the General Tab



The General tab is organized into four sections:

- cloudSwXtch Summary
- Entitlements
- Hardware
- Actions

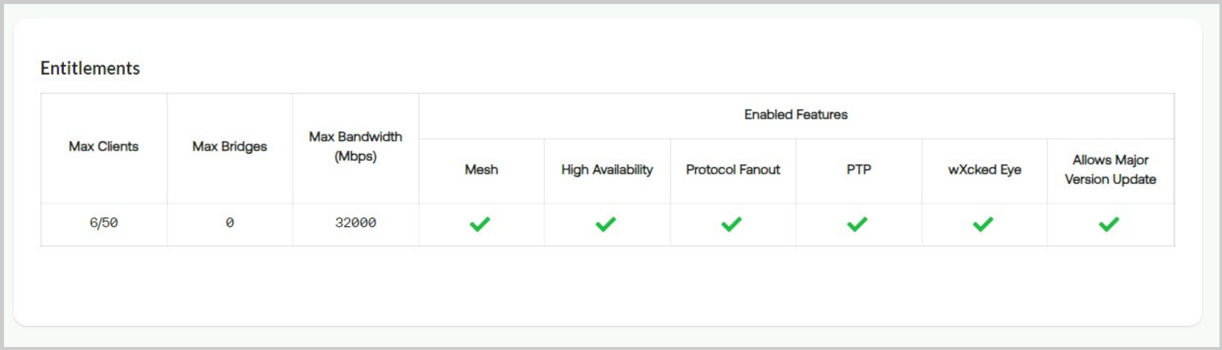
cloudSwXtch Summary

The Summary panel details basic information regarding the cloudSwXtch, specifically on the data and control subnets configured during installation. Similar to the cloudSwXtch view, the Summary panel also displays the amount of bandwidth currently in use.

Entitlements

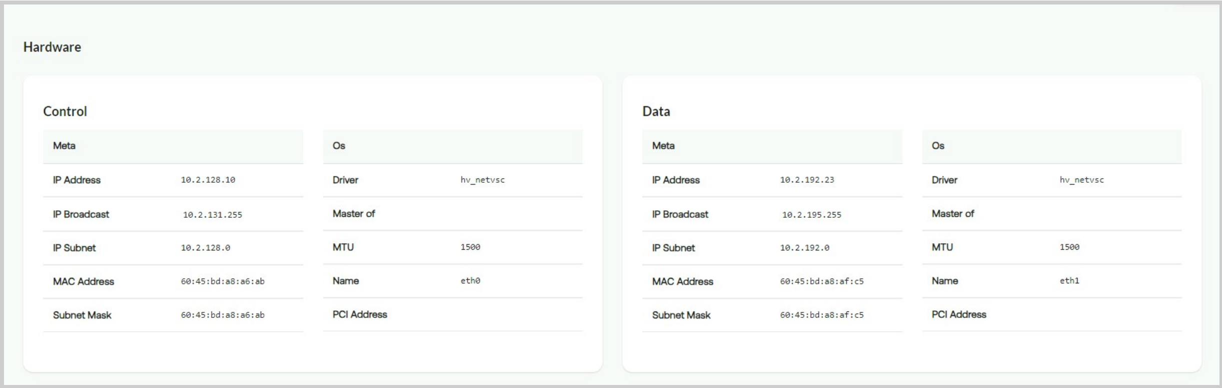
The General tab is designed to give users a detailed look into the entitlements associated with their network. In the example, the user has a license that enables mesh, high availability, protocol fanout, and PTP with a max of 50 clients, 0 cloudSwXtch bridges, and 32 Gbps max bandwidth.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



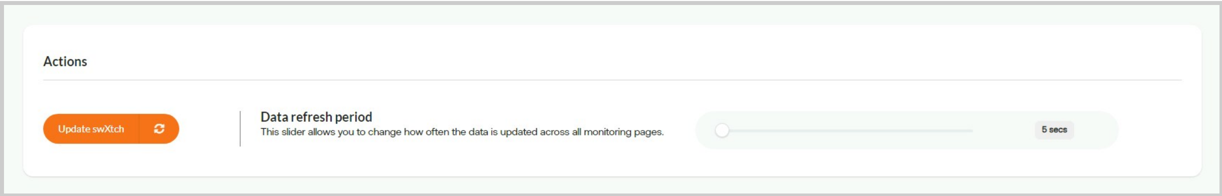
Hardware

The Hardware section of the General tab gives an extensive look at the Data and Control planes with each split into Meta and Operating System (OS) data.



Actions

The General tab also allows users to adjust the Data Refresh period for all Monitoring pages in wXcked Eye. This gives users control on how often the data is updating with the default value set to the minimum of 5 seconds.



©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Mesh with wXcked Eye

Navigating to the Mesh tab

The Mesh tab is located on the Settings page in wXcked Eye. To learn how to navigate there from the wXcked Eye main page, please review the Configure cloudSwXtch with wXcked Eye article.

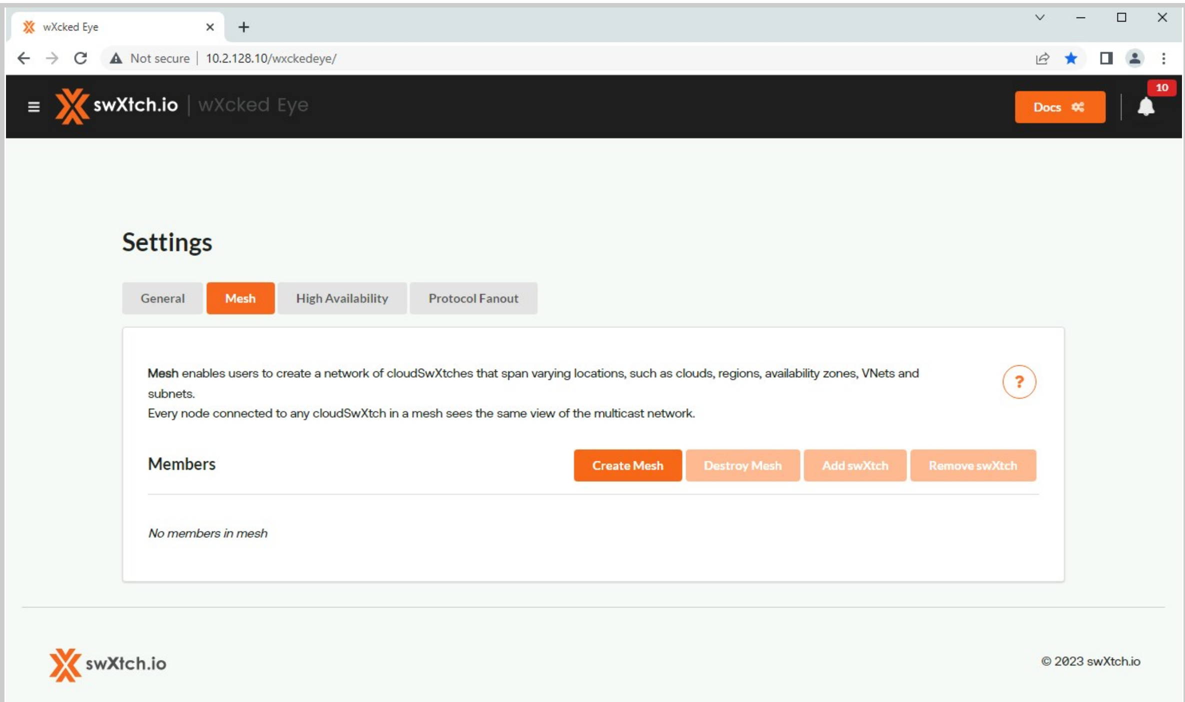
The Mesh tab is organized into 4 functions:

- Create Mesh
- Destroy Mesh
- Add SwXtch
- Remove SwXtch

When there is no mesh, the page will be blank as seen in the example above with a "No members in mesh" disclaimer. The "Create Mesh" button will be the only one activated. This section will explain how to create a mesh, add/remove cloudSwXtch(s) and destroy an existing mesh. If a user wishes to use commands in a terminal instead, please read the following article on configuring mesh.

Mesh Command-Line Alternatives

In addition to configuring your mesh through the wXcked Eye UI, users can also use swXtch specific commands in their terminal. To learn more, please see the Mesh article under Configuring cloudSwXtch.



Mesh and High Availability

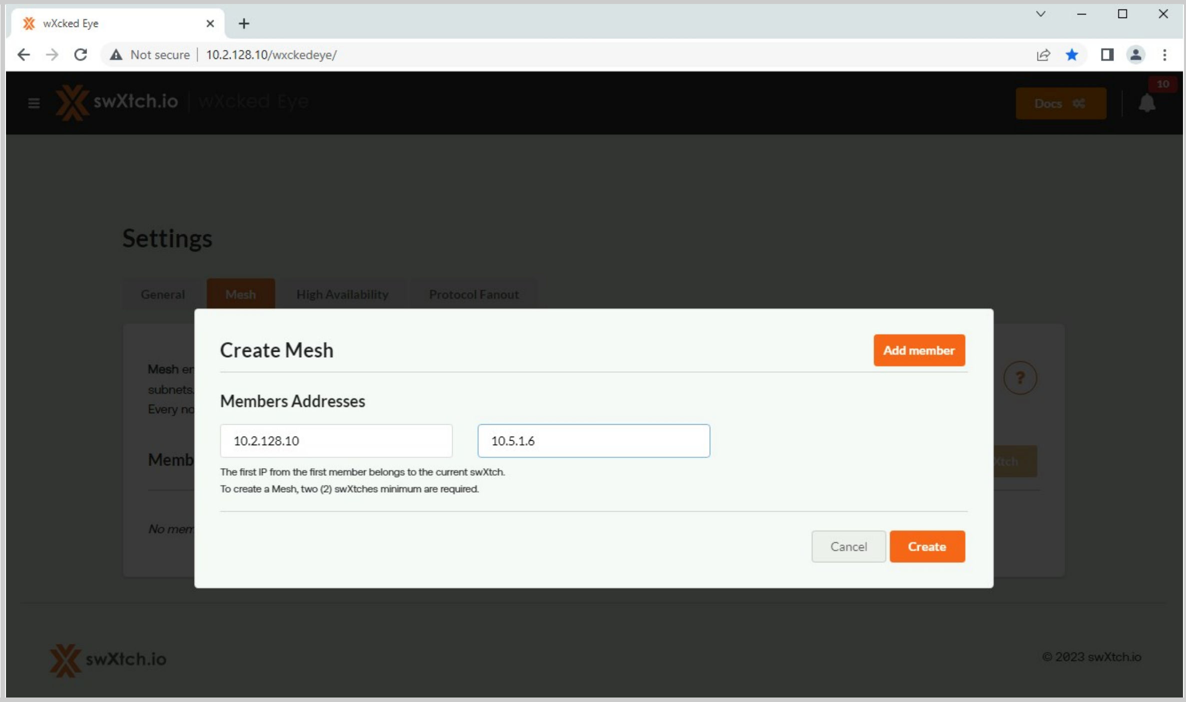
Both features are mutually exclusive and cannot be used together.

Create Mesh

Creating a mesh using the wXcked Eye UI is a relatively straight forward process. To start:

1. Click on the "Create Mesh" button. A new window will pop up.

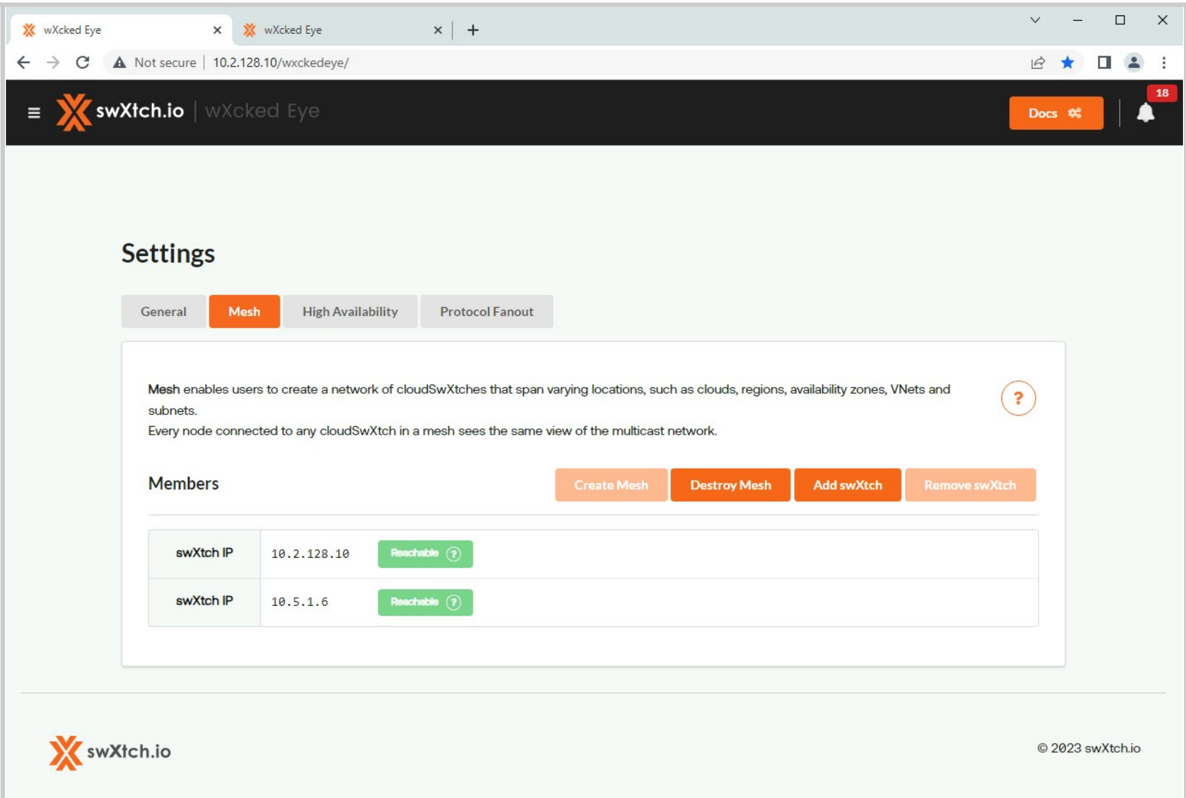
©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



2. Add the cloudSwXtch IP address you wish to add to the Mesh. The current cloudSwXtch you are on will automatically fill in the first slot. In this case, 10.2.128.10.

1. If you want to add additional cloudSwXtches to the Mesh, select the "Add Member" in the top right corner. This will display an additional IP address field.
2. Please note: You must enter at least 2 cloudSwXtches in order to successfully create a mesh.

3. Click "Create" after you have completed adding members. The members should now be listed in the newly formed mesh. A tag on each swXtch IP will display whether or not the VM is reachable.

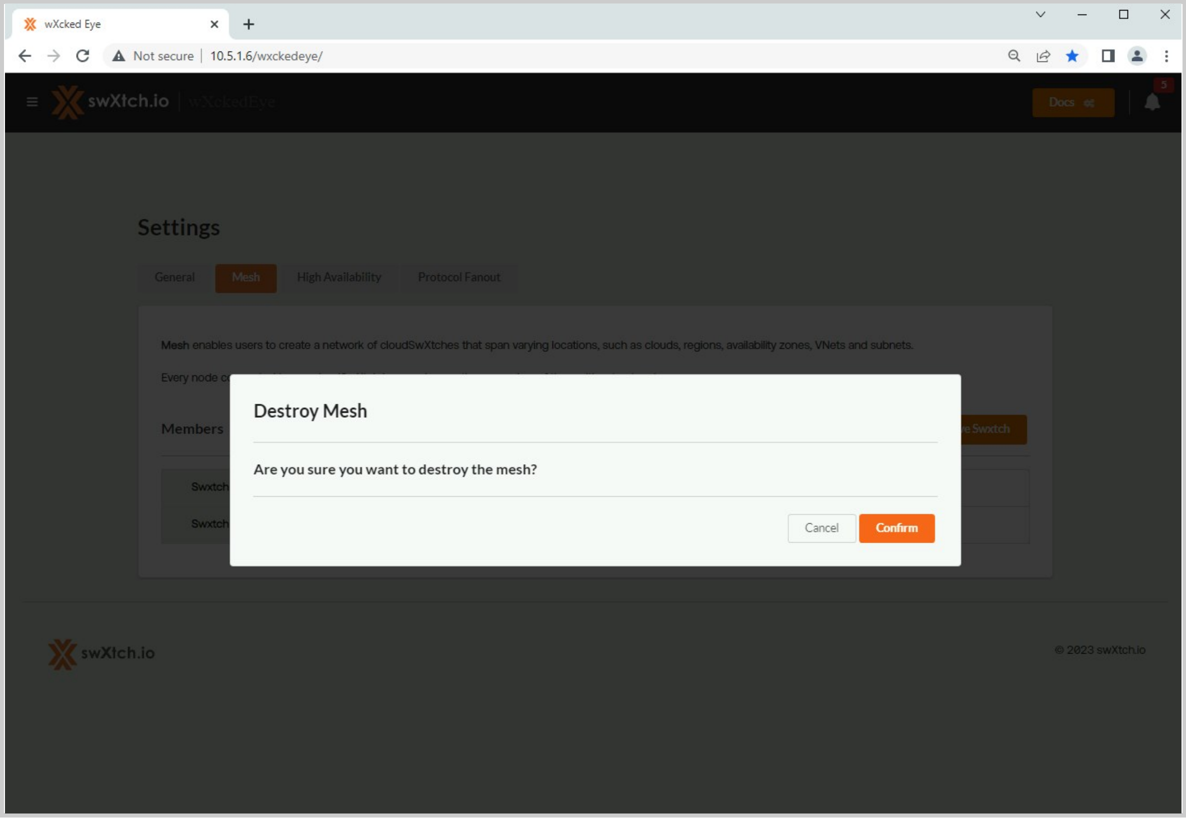


If a user were to view the wXcked Eye of another cloudSwXtch in the mesh, they would be able to see the other members as well. For example, if a user was on the wXcked Eye for cloudSwXtch 10.5.1.6 instead, they would see the same member list.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Destroy Mesh

1. Click "Destroy Mesh." A warning pop-up will appear.



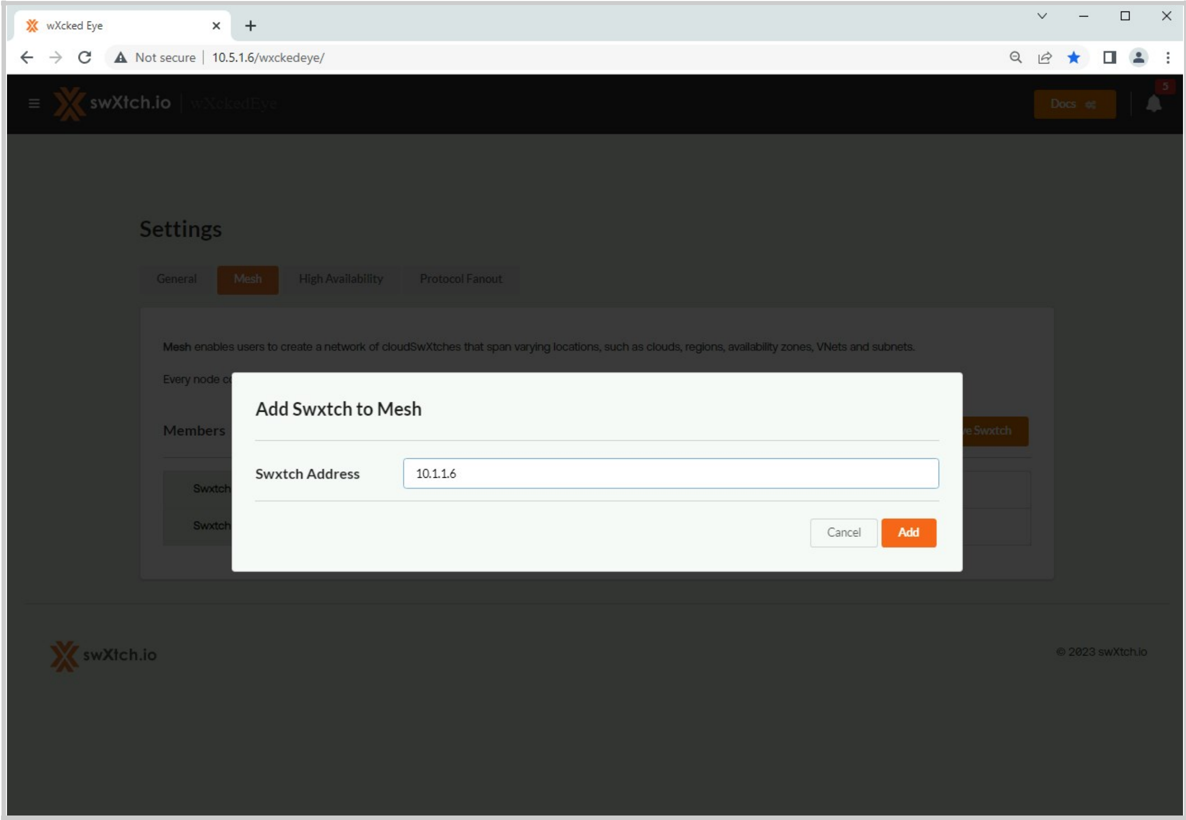
2. Select "Confirm." Your mesh and its members should no longer be listed in the Mesh tab.

Add SwXtch

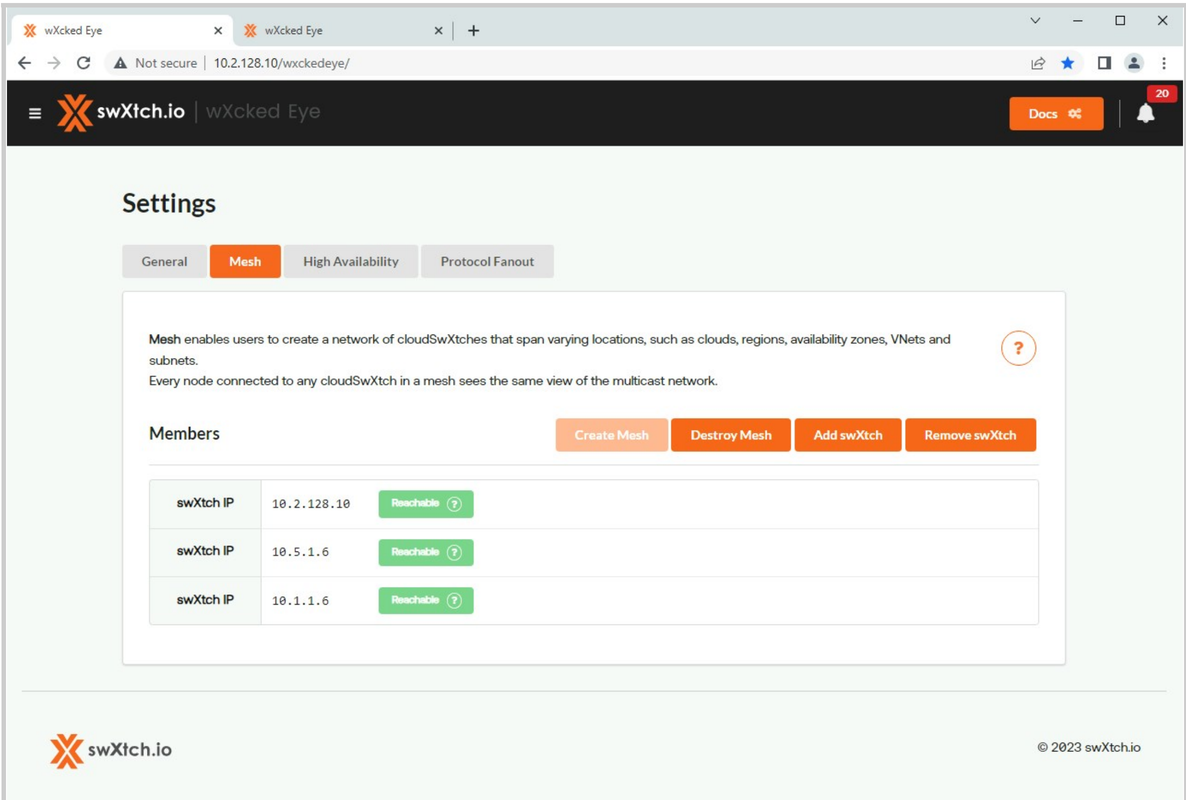
After creating a mesh, users may decide that they need additional cloudSwXtches. To add a cloudSwXtch:

1. Click on the "Add SwXtch" button in the Mesh main page of any existing cloudSwXtch.
2. Enter the IP address of the cloudSwXtch you wish to add to the mesh.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



3. Click "Add." A new cloudSwXtch should now be listed in your mesh.

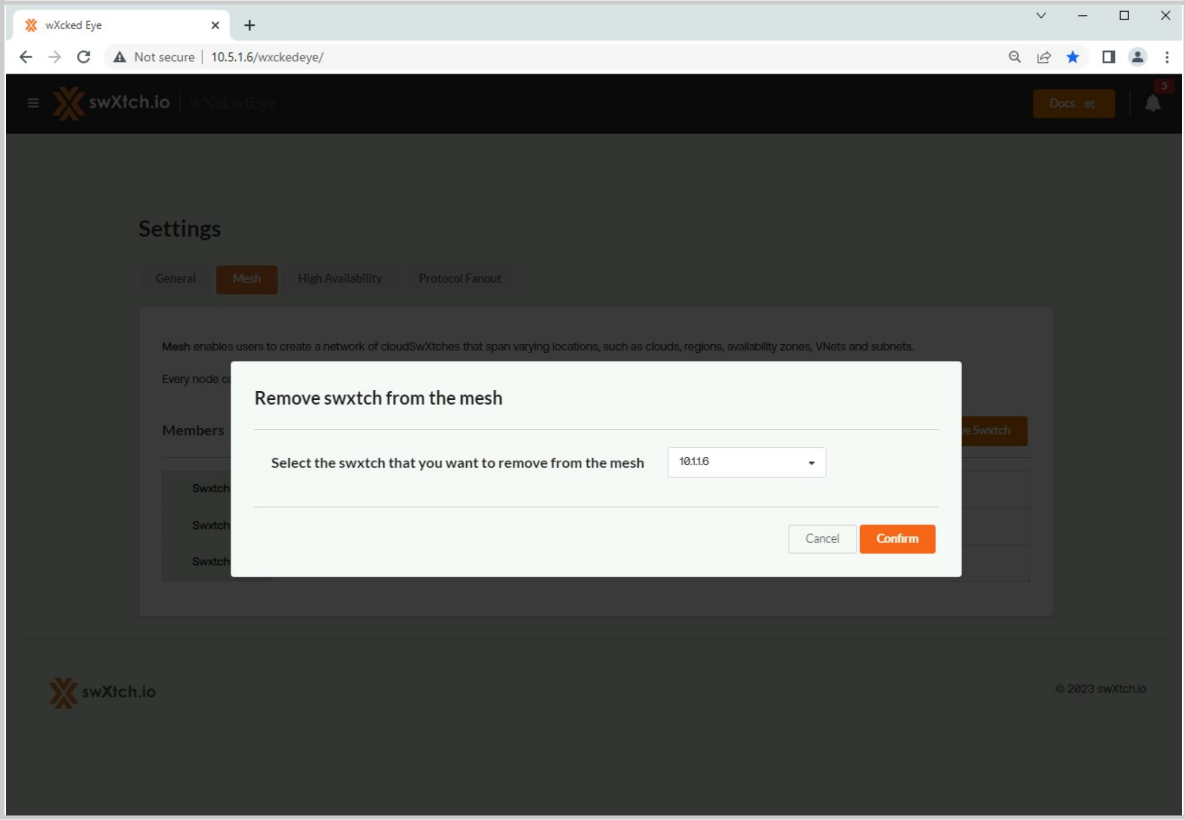


Remove SwXtch

1. Click the "Remove Swxtch" option. A new window will open confirming the removal.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

2. Use the dropdown menu to select the cloudSwXtch you would like to remove from your mesh configuration.



3. Select "Confirm." If you are on the mesh settings page of the cloudSwXtch you removed, the page should now appear blank. However, if you are on a different cloudSwXtch, the page should still be populated with the other remaining cloudSwXtches.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

High Availability with wXcked Eye

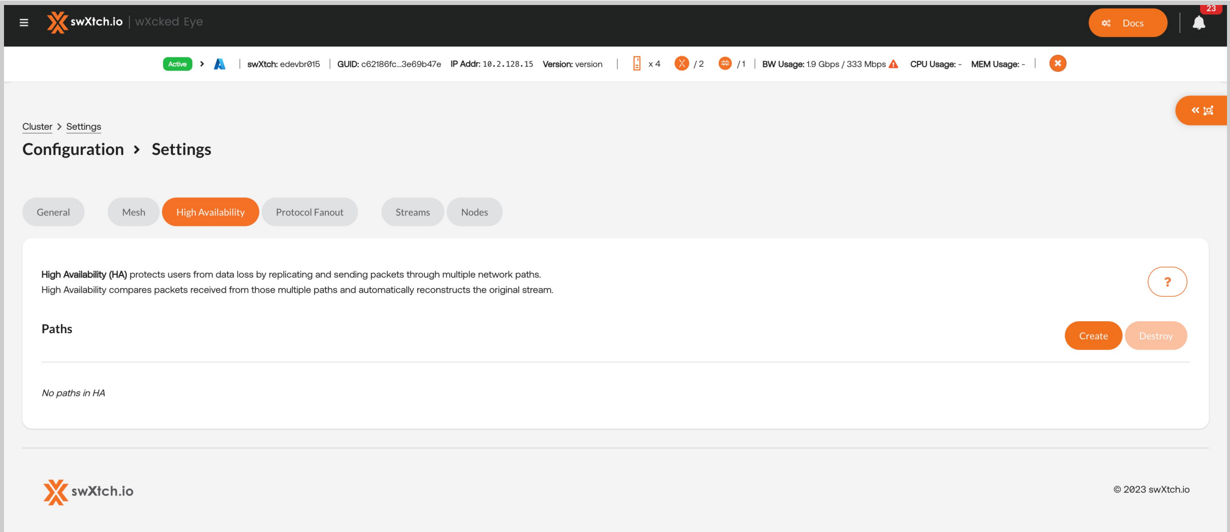
Navigating to the High Availability tab

The High Availability tab is located in the Settings page on wXcked Eye. To learn how to navigate there, please review the Configure cloudSwXtch with wXcked Eye article.

The High Availability tab is organized into 2 functions:

- Create HA
- Destroy HA

In this section, we will discuss each tab and how it offers a user additional control over their cloudSwXtch network.



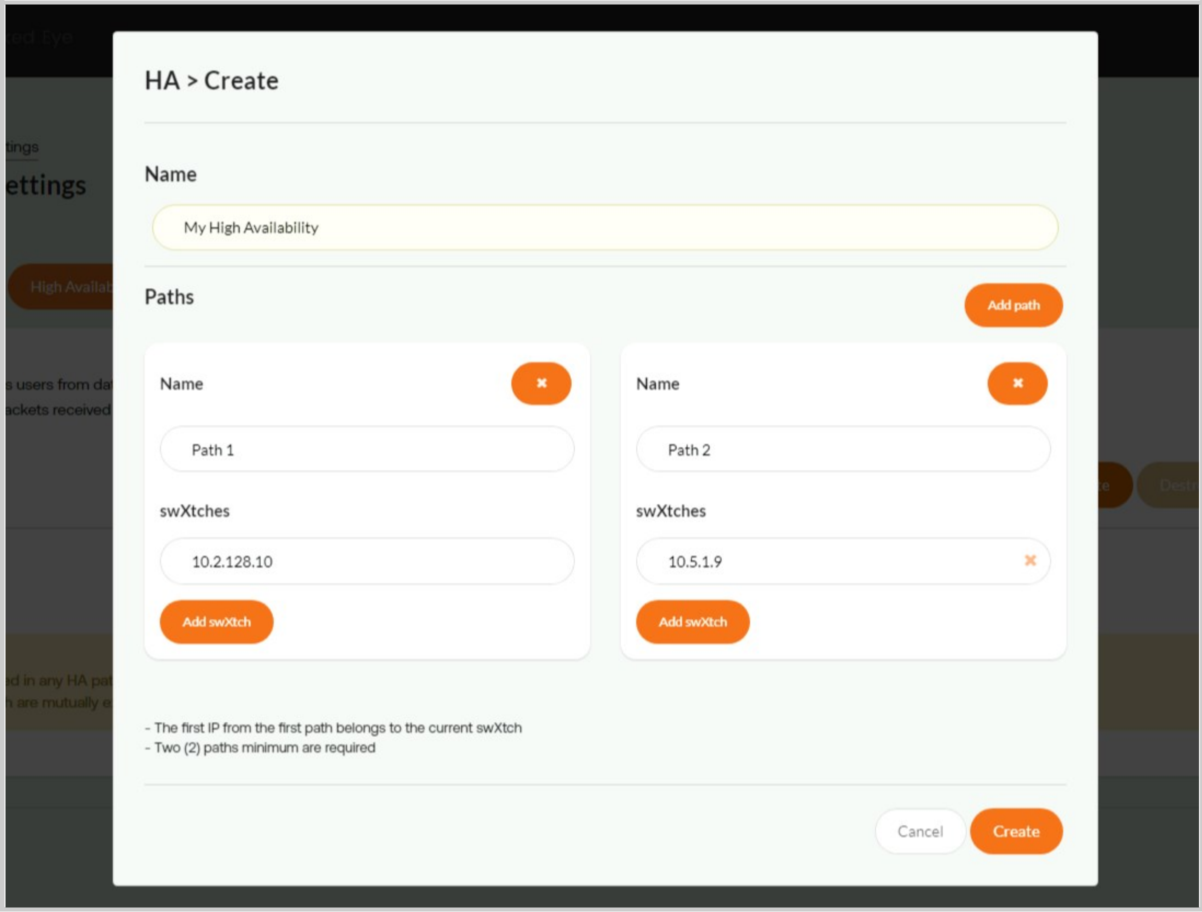
High Availability Command-Line Alternatives

In addition to configuring your high availability through the wXcked Eye UI, users can also swXtch specific commands in their terminal. To learn more, please visit the High Availability article under Configuring cloudSwXtch.

Create HA

1. **Click** the "Create" button in the cloudSwXtch you wish to include in your high availability configuration. A pop-up will open.
2. Name your HA configuration. In this example, the HA is named "My High Availability."

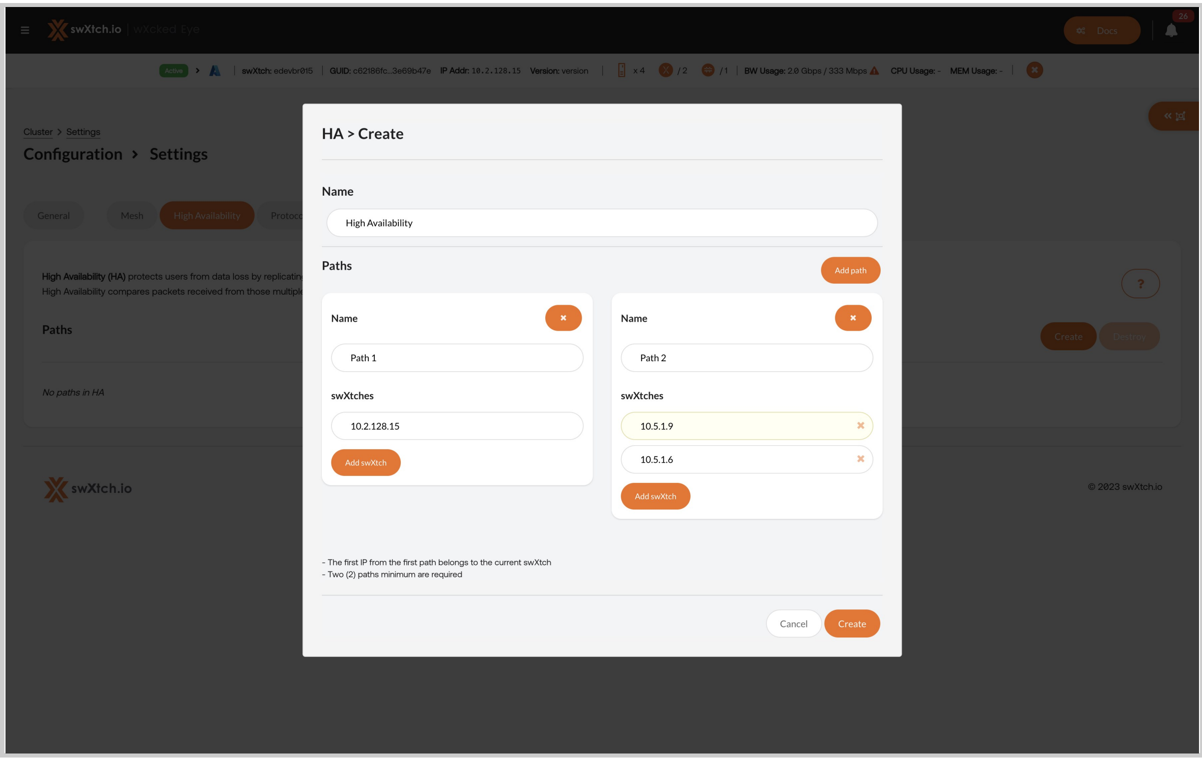
©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



3. Name the first path and enter the **IP addresses** for the relevant cloudSwXtches.
4. **Name** the second path and enter the IP addresses for the relevant cloudSwXtches.

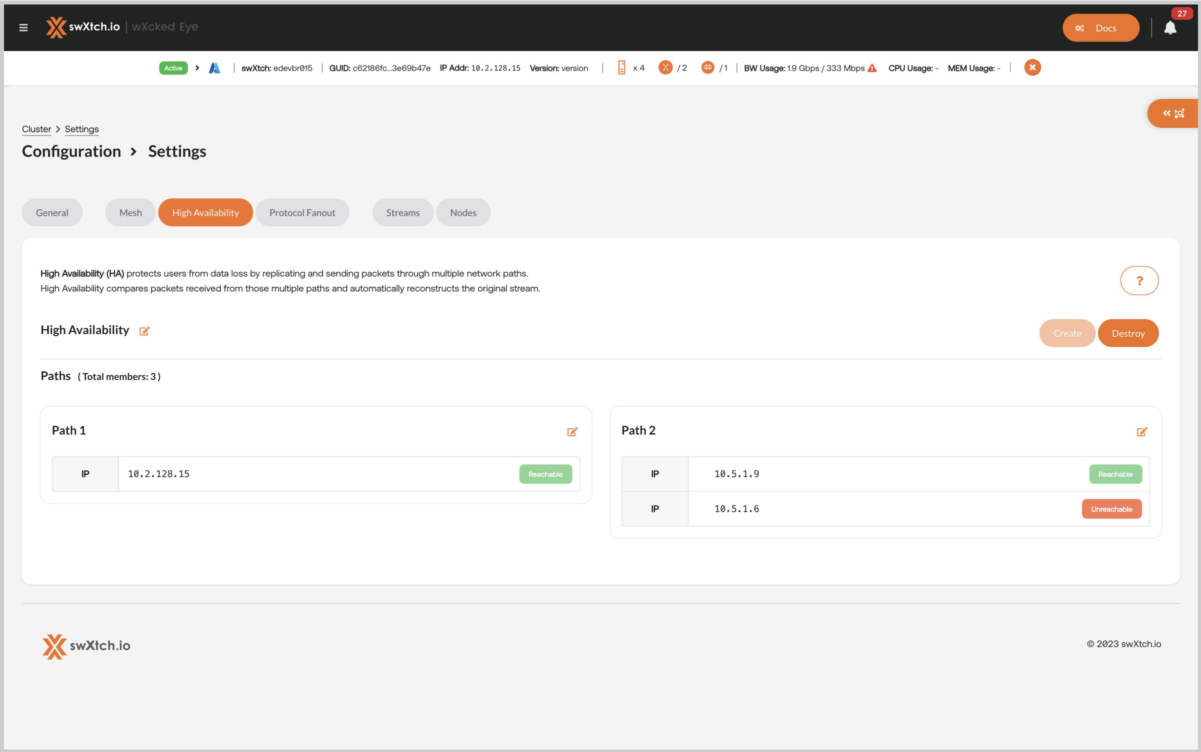
Note: You must have *more than 1 path* in order to have a working HA flow.

5. **OPTIONAL**: Add an additional cloudSwXtch to a Path by clicking "Add SwXtch." In this example, the user assigned 2 cloudSwXtches to Path 2.



6. **Click** "Create." A new High Availability flow has been created.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



With High Availability now configured, users can switch between different cloudSwXtches in their HA, refresh the HA page and see the members listed with their associated paths. For example, if a user were to look at the wXcked Eye for cloudSwXtch 10.5.1.6 instead of the above 10.2.128.10, they will see the same My High Availability member list.

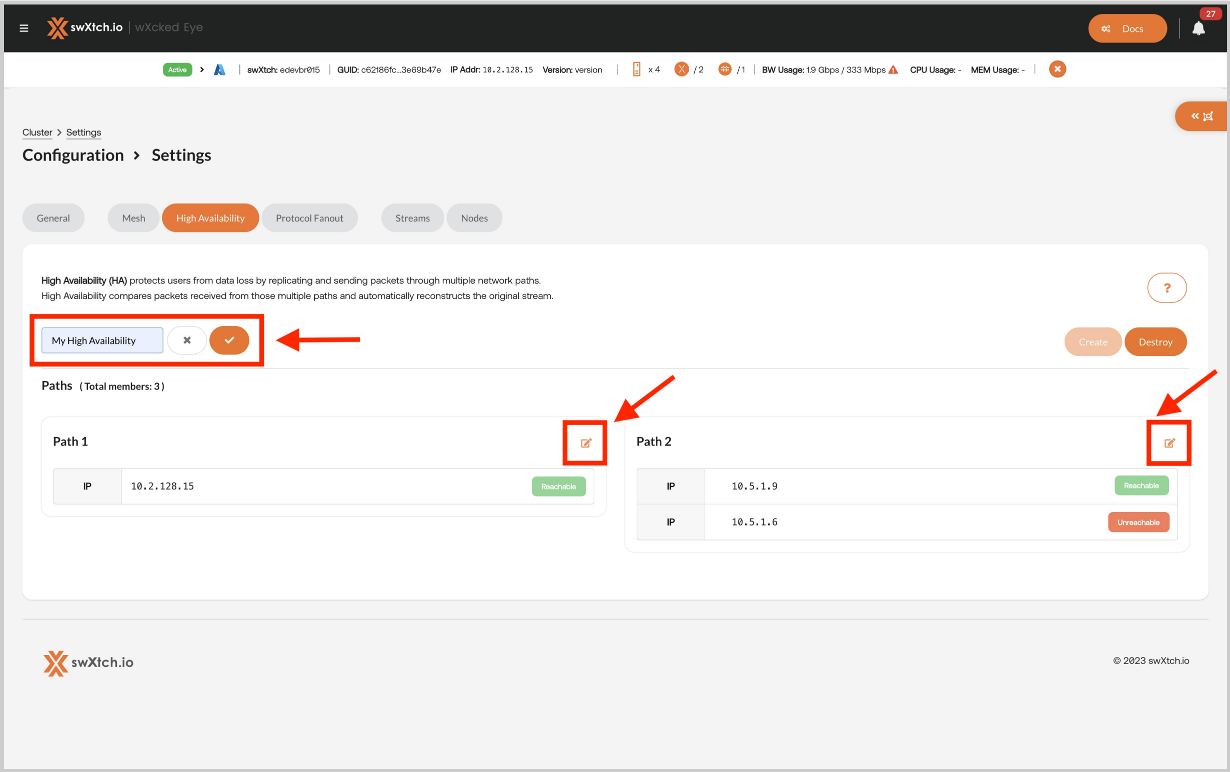
From any of the connected cloudSwXtches, users can destroy their HA configuration.

> **Warning**
>
> If you try to create another HA, the wXcked Eye UI will destroy the current HA and replace it with the new configuration.

Renaming High Availability and Path Names

Users can dynamically change their high availability and paths' names directly in the UI. To do this, simply click the edit button next to the paths.

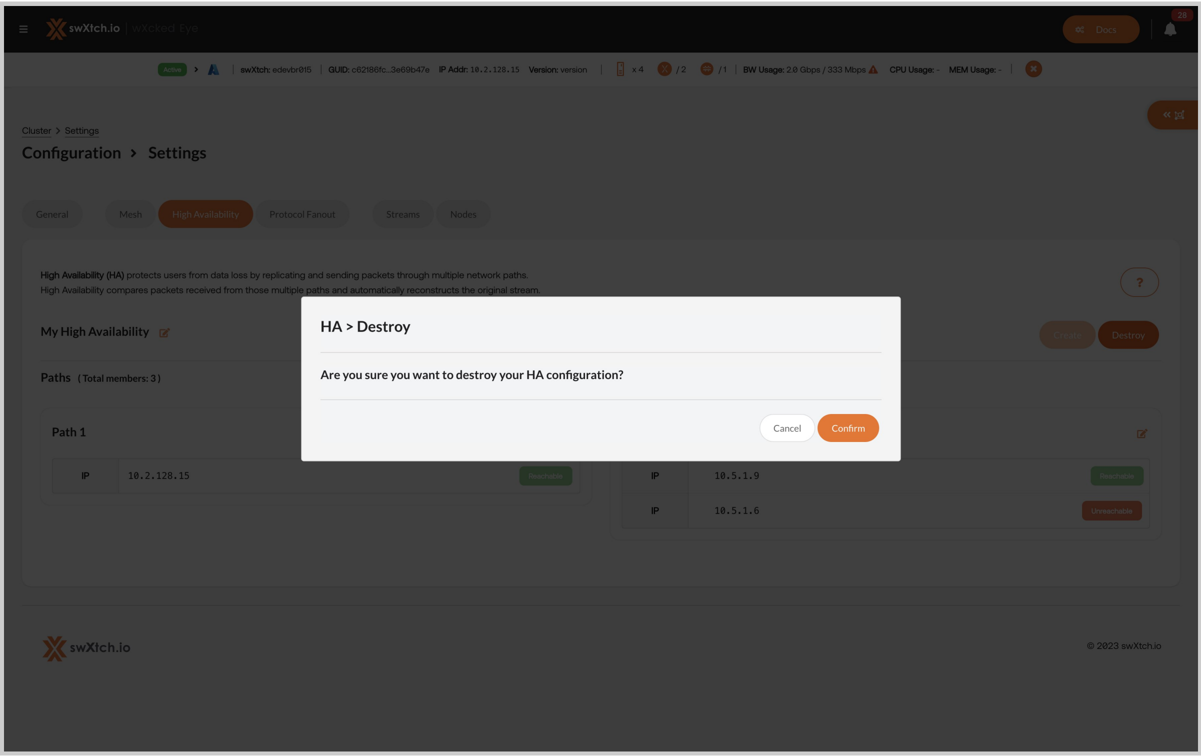
©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



Destroy HA

To destroy an HA configuration, a user will need to go to the HA page of any associated cloudSwXtches.

1. **Click** "Destroy HA." A new prompt will appear, asking you to confirm the action.



2. **Select** "Confirm."

Your HA is now destroyed. All associated cloudSwXtches will show a blank list for HA and your Cluster page will be empty.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Removing a cloudSwXtch from an HA configuration

To remove a cloudSwXtch from a user's HA configuration, they will need to delete and recreate their HA cluster without that cloudSwXtch.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Protocol Conversion and Fanout with wXcked Eye

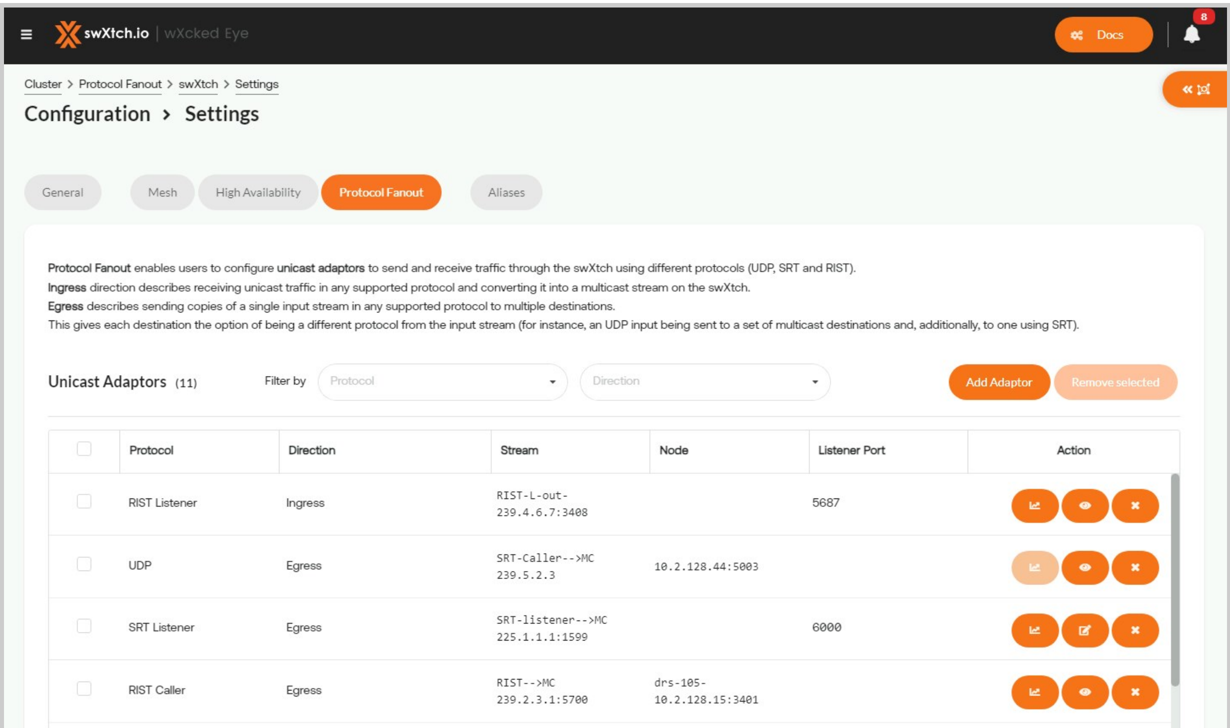
WHAT TO EXPECT

The Protocol Fanout tab can be found on the Settings page in wXcked Eye. To learn more about how to navigate there, please review the Configure cloudSwXtch with wXcked Eye article.

In this article, users will learn how to establish UDP, SRT and RIST connections via the Protocol Conversion and Fanout feature on wXcked Eye. It can also be used to convert multicast into one or more of these protocols. For example, imagine you have an SRT stream coming into the cloudSwXtch with five different clients requiring different protocols (one needing SRT, another RIST, another UDP and the last two for multicast). This can be accomplished by using this tool. For a walkthrough on configuring Protocol Conversion and Fanout in wXcked Eye, see the Protocol Conversion and Fanout Example article.

Setting Up Aliases

The Protocol Fanout tab utilizes Stream and Node names set up in the Aliases tab. For more information on how to do this, please see the Aliases article.



Protocol Fanout and Conversion is a cloudSwXtch feature that allows users to send copies of a single input stream in any supported protocol to multiple destinations. In wXcked Eye, users can send/receive UDP traffic or establish SRT/RIST caller/listener connection methods.

To add an adaptor, select "Add Adaptor." Here, a user can select between the three protocols.

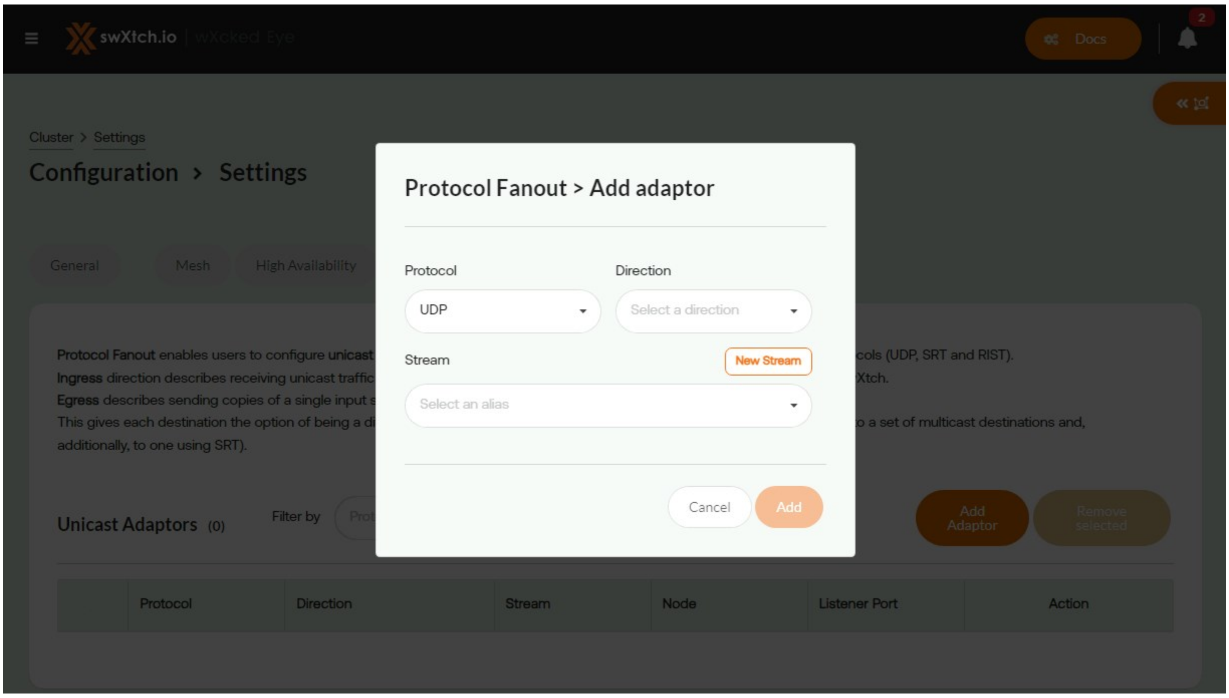
UDP

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Ingress vs. Egress

Differentiating between ingress and egress can be difficult. It is important to imagine it in relation to the cloudSwXtch.

- Ingress: Data is coming into the cloudSwXtch.
- Egress: Data is leaving the cloudSwXtch.

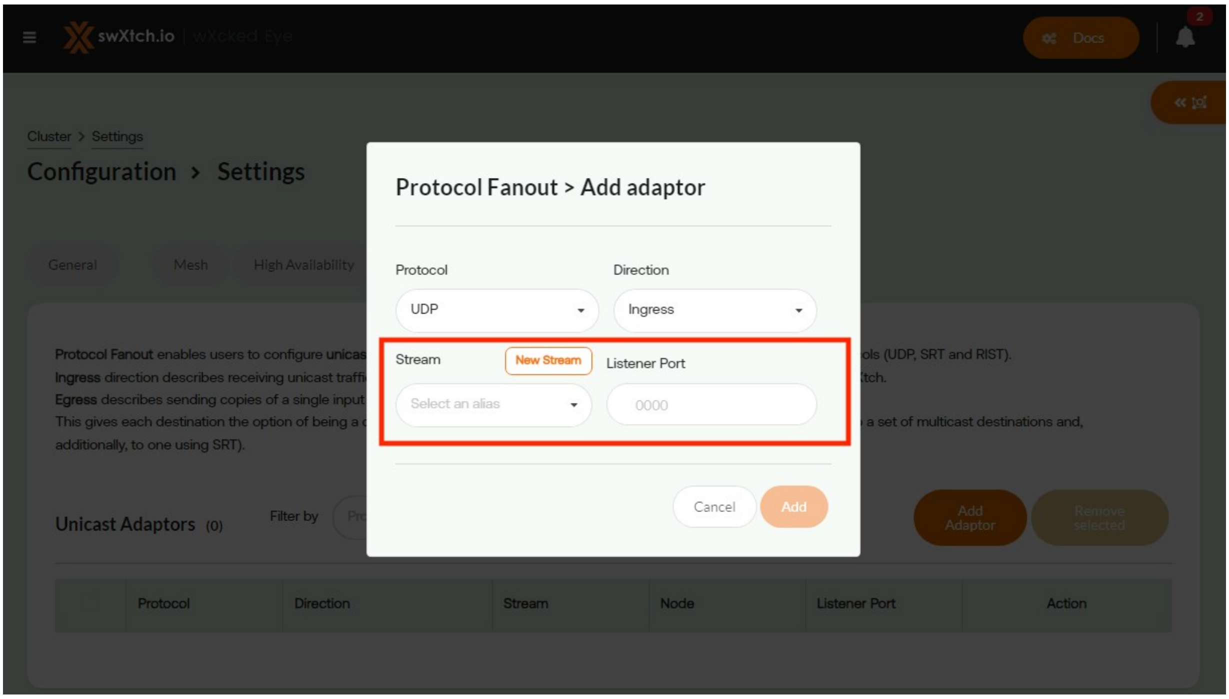


Selecting UDP under Protocol allows users to add mapping for UDP traffic entering and leaving the cloudSwXtch. Depending on the direction of the data, a user will have to add additional information to set up a successful connection.

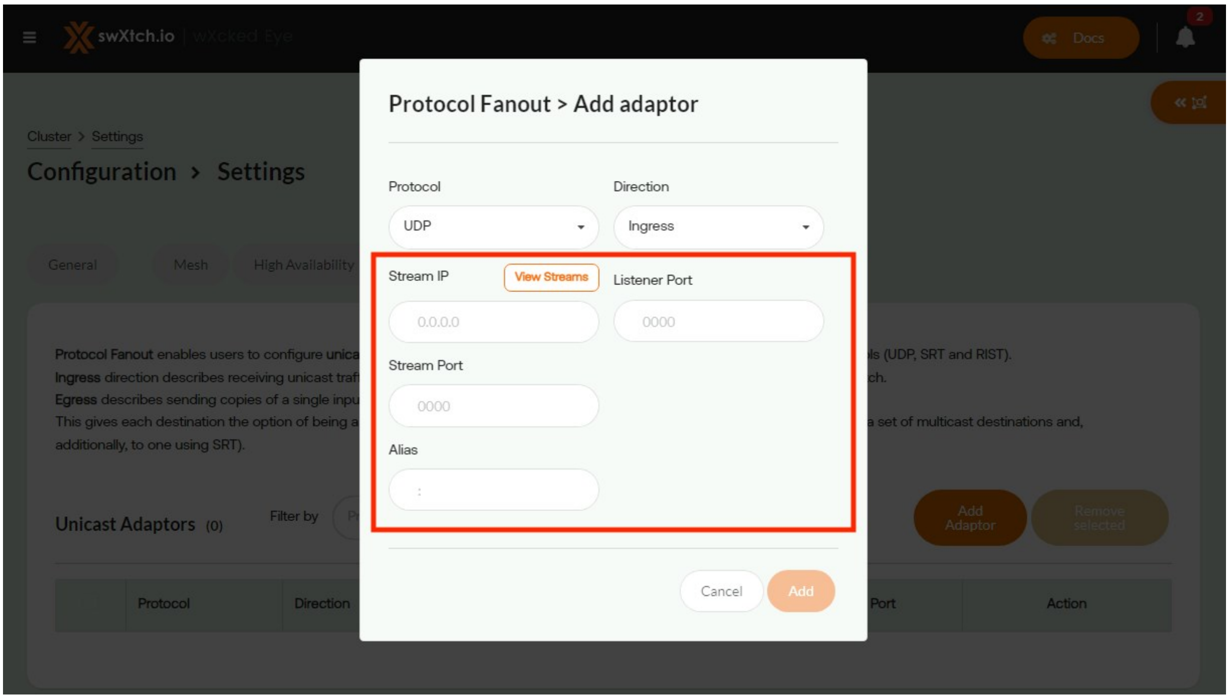
UDP Ingress

For Ingress, a user will select one of the Streams created in the Aliases tab from the dropdown and designate a Listener Port.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



Alternatively, if a user does not have an Alias set up for their desired stream, they can manually specify a Stream IP, Listener Port, a Stream Port and an Alias name to add one. To do this, they would have to select the New Stream option in the panel.

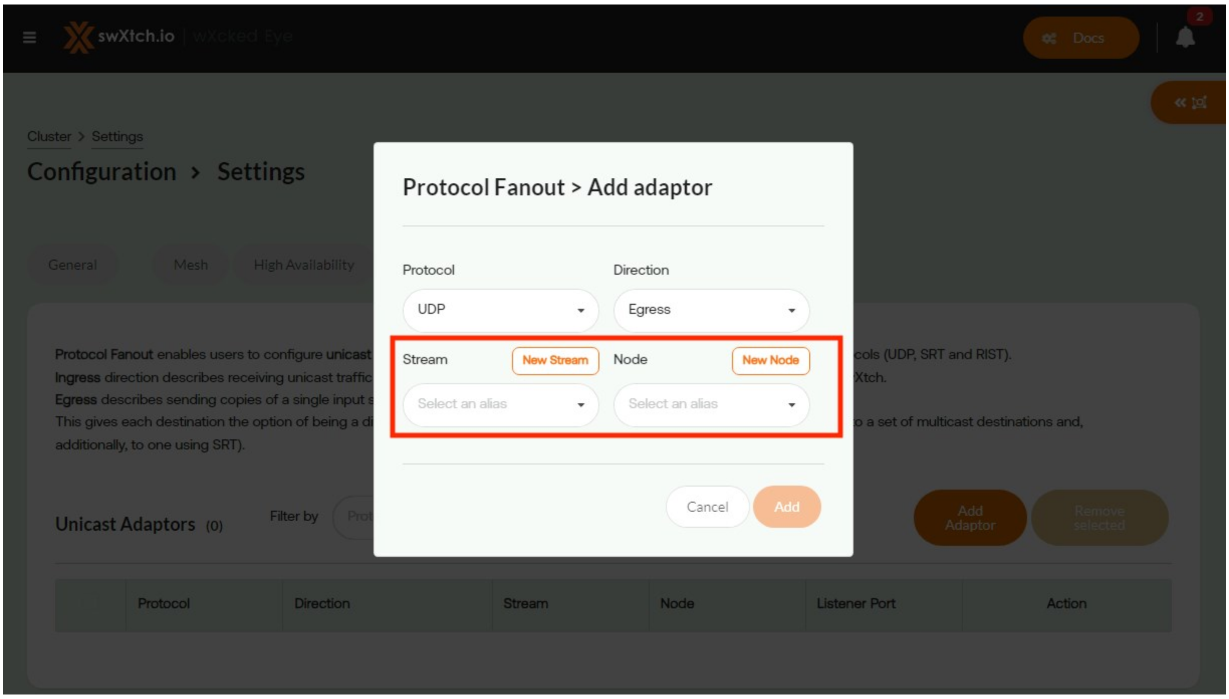


Both methods will allow endpoints to send unicast data. Once that connection has been established, the cloudSwXtch will be able to ingest the unicast data as multicast.

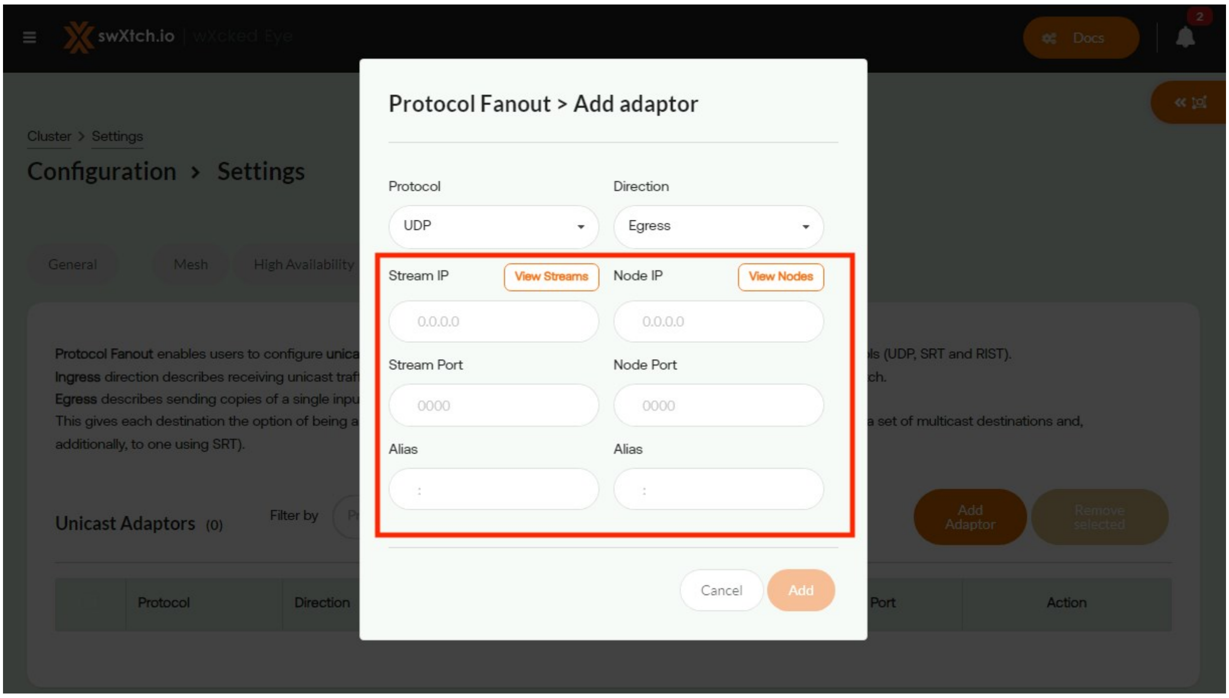
UDP Egress

For Egress, a user will set the parameters for fanning out a multicast stream as unicast. To do this, the cloudSwXtch would need to select a Stream and Target Node from their respective Alias dropdown.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



If an Alias was not created prior, they can manually add a New Stream and New Node by entering the appropriate information for both. To create a New Stream, a user will need the Stream IP, Stream Port and Alias name. Similarly, a New Node would require a Node IP, Node Port and Alias name.

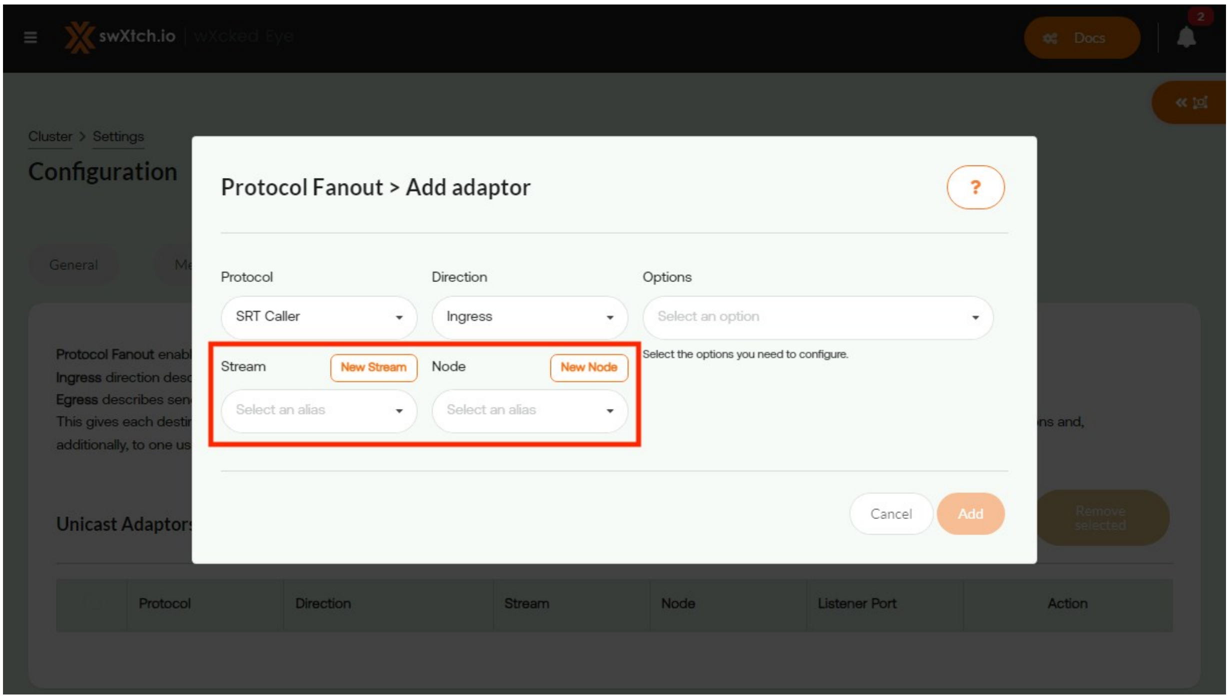


Whether it is from existing Aliases or ones manually created, this will allow the cloudSwXtch to transmit a multicast stream as unicast to a desired endpoint.

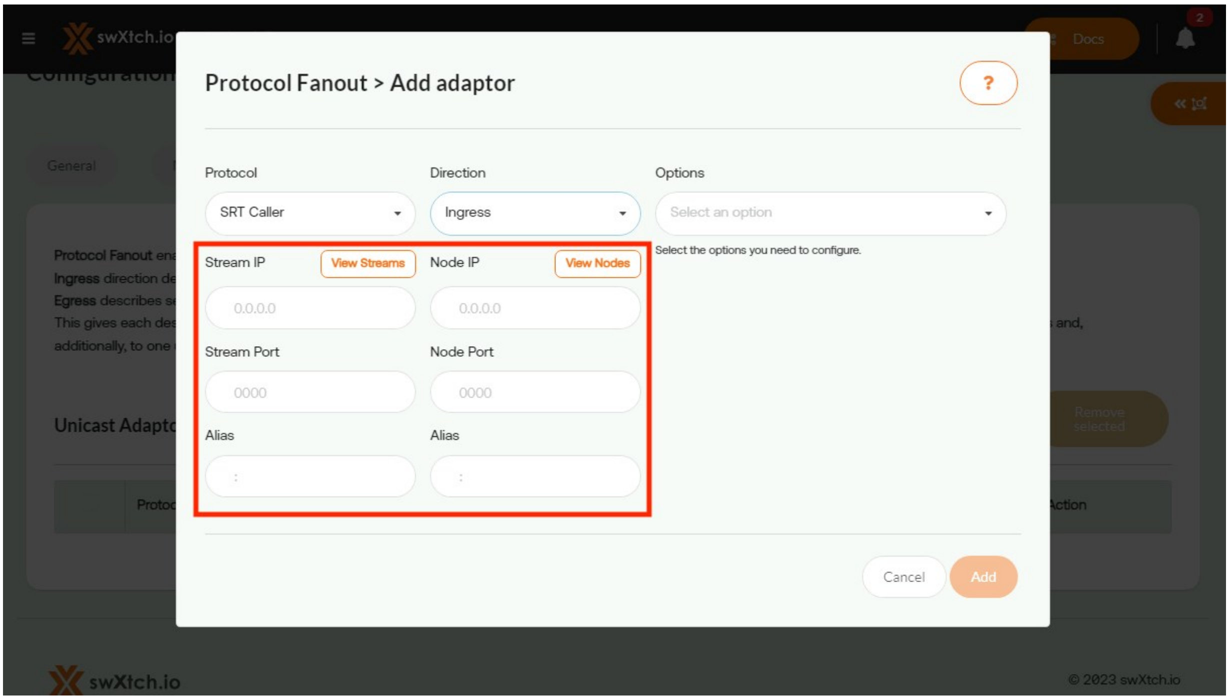
SRT and RIST Caller

To set up SRT or RIST Caller, a user will need to choose what direction they will like their data to flow: Ingress or Egress. Regardless of their choice, both Ingress and Egress requires a selection for Stream and Node. These can either be selected from the Alias dropdown (assigned in the Alias tab under Settings) or manually created in the panel.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



If a user wants to manually create a stream and node, they will need to select the "New Stream" and "New Node" buttons. This will reveal additional fields necessary for both. For Stream, a user will need to enter a Stream IP, Stream Port and Alias name. For Node, they will need a Node IP, Node Port and Alias. This will act as a Target Node. It is the source of where the traffic will be coming from outside the cloudSwXtch. This information is crucial since it will dictate where the cloudSwXtch sends the caller message.



The Options dropdown allows for additional fine tuning based on standards of the protocol. Selection of an option will open another field.

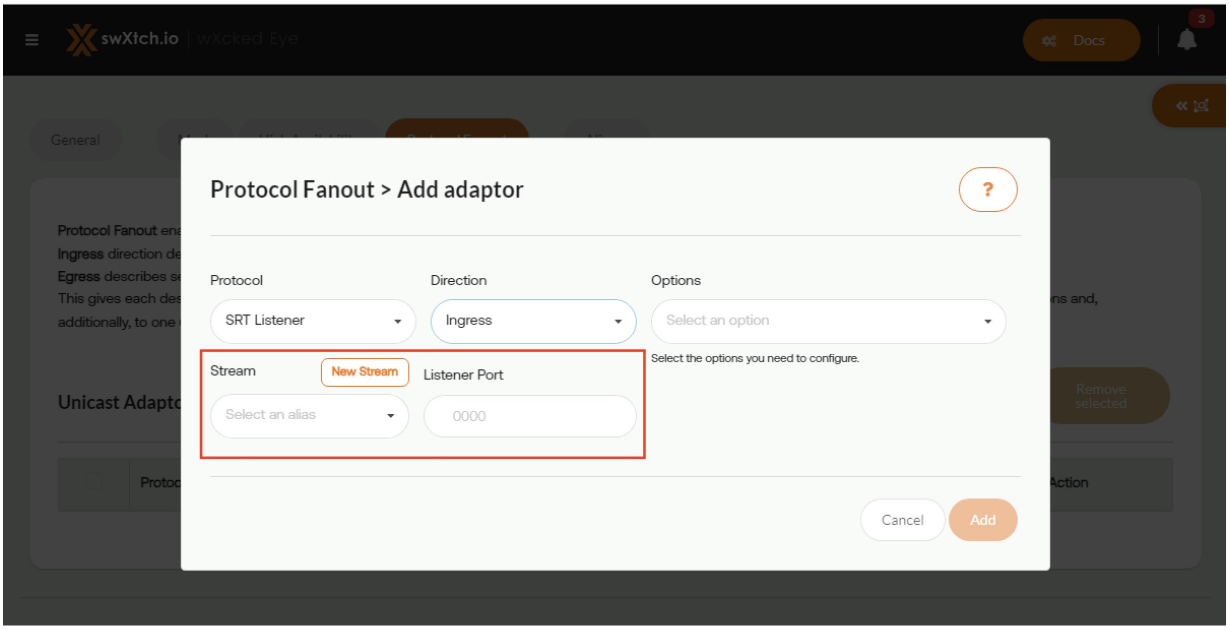
After filling out all the required fields, select "Add." The cloudSwXtch will then call out to the target source and receive multicast traffic through the designated node.

For Egress, the user will be specifying the Target Node for an endpoint to receive an SRT or RIST stream from the cloudSwXtch. The cloudSwXtch will then call to the Destination or Target Node to establish a connection before transmitting the stream.

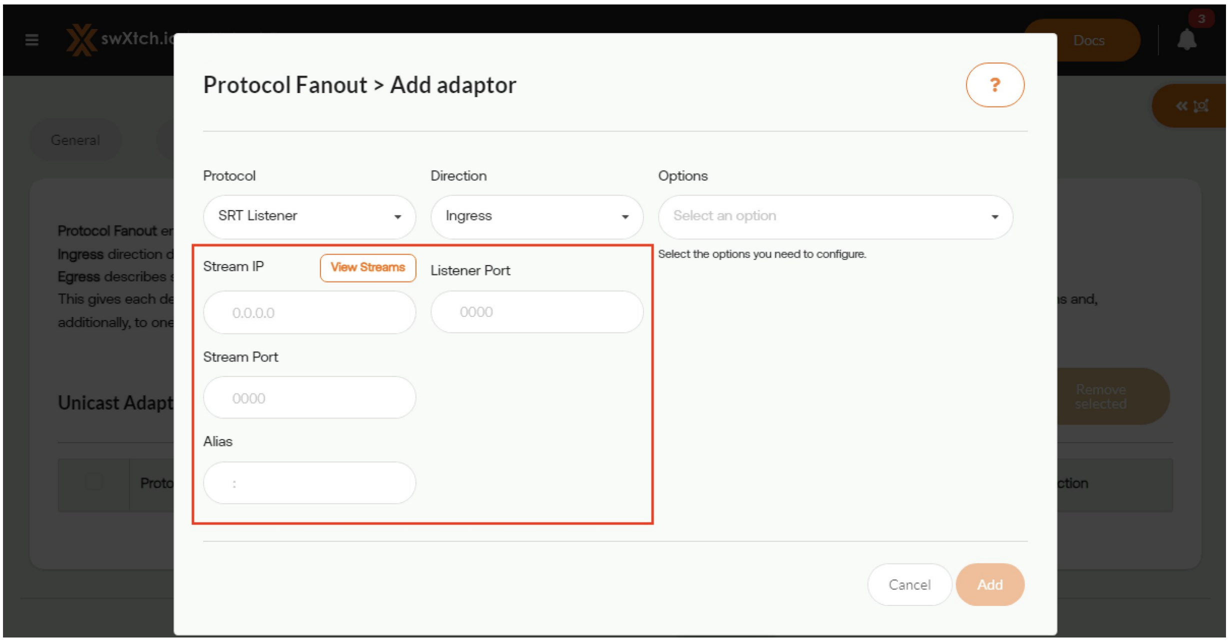
©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

SRT and RIST Listener

Similar to the SRT or RIST Caller panel, Listener requires the user to specify the direction of their data flow: Ingress or Egress. However, what differs is that the SRT or RIST Listener is essentially "listening" for any incoming messages from endpoints ready to send/receive SRT or RIST data. This method of transmission is considered to be more user-friendly since a user will not have to worry about pointing to a specific IP address. It places the burden of targeting the endpoint instead.



Both Ingress and Egress will require a user to select a multicast Stream from the Alias dropdown. Stream Aliases are assigned in the Alias tab under Settings. Alternatively, users can enter a new Stream by selecting the New Stream button and entering the following information: Stream IP, Stream Port and Alias Name. In addition to the Stream, a user will also need to specify a Listener Port where an endpoint can send data through.



The Options dropdown allows for additional fine tuning based on standards of the protocol. Selection of an option will open another field.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

For Ingress, once the configuration is complete, the cloudSwXtch will now listen for producers of SRT or RIST traffic who connect to the port. When a connection has been established, the cloudSwXtch will begin ingesting data.

Likewise for Egress, the cloudSwXtch is listening for endpoints that are trying to receive SRT or RIST data. From there, depending on the user's bandwidth, they can create up to 32 Listener ports from which an endpoint can connect to the the steam. By setting the necessary parameters, a consumer will then be able locate a target port and begin streaming data from the cloudSwXtch.

Protocol Conversion and Fanout Example

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Protocol Conversion and Fanout Example

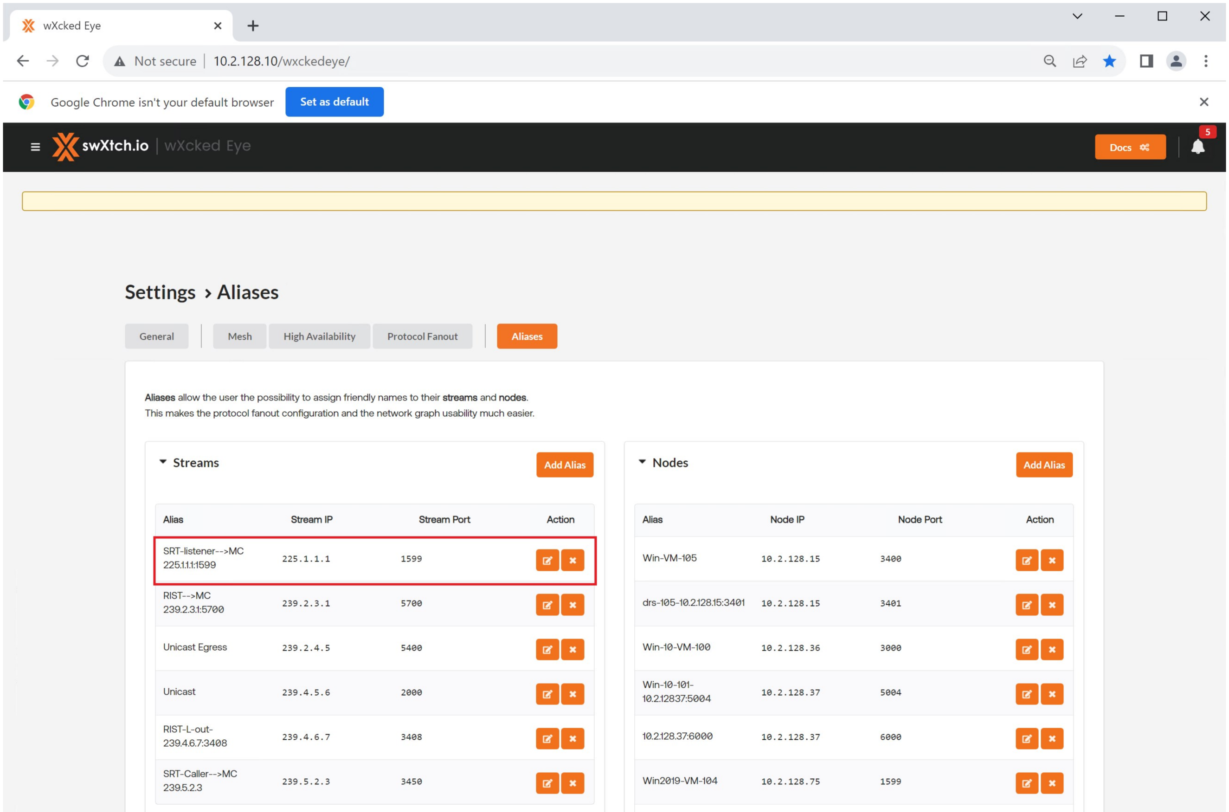
WHAT TO EXPECT

Navigating the Protocol Fanout and Conversion tab in wXcked Eye can be a little confusing when first starting out.

In this article, we will walk you through a typical SRT Listener configuration workflow to explain the various pieces that go into setting it up. We will look at the differences between ingress and egress and what that means in relation to the cloudSwXtch.

Step One: Setting up Your Aliases

The Aliases tab allows users to set friendly names or "aliases" for their streams and nodes so that it is easier to organize them in the Protocol Fanout tab. In this example, the user has named their stream `SRT-listener -> MC 225.1.1.1:1599`, inputting a stream IP of 225.1.1.1 and a Stream Port of 1599. This name is helpful for the user because it illustrates what they hope to do when setting up for Protocol Fanout. They are going to set up for an SRT to MC conversion using the stream IP and Stream Port assigned to the name.

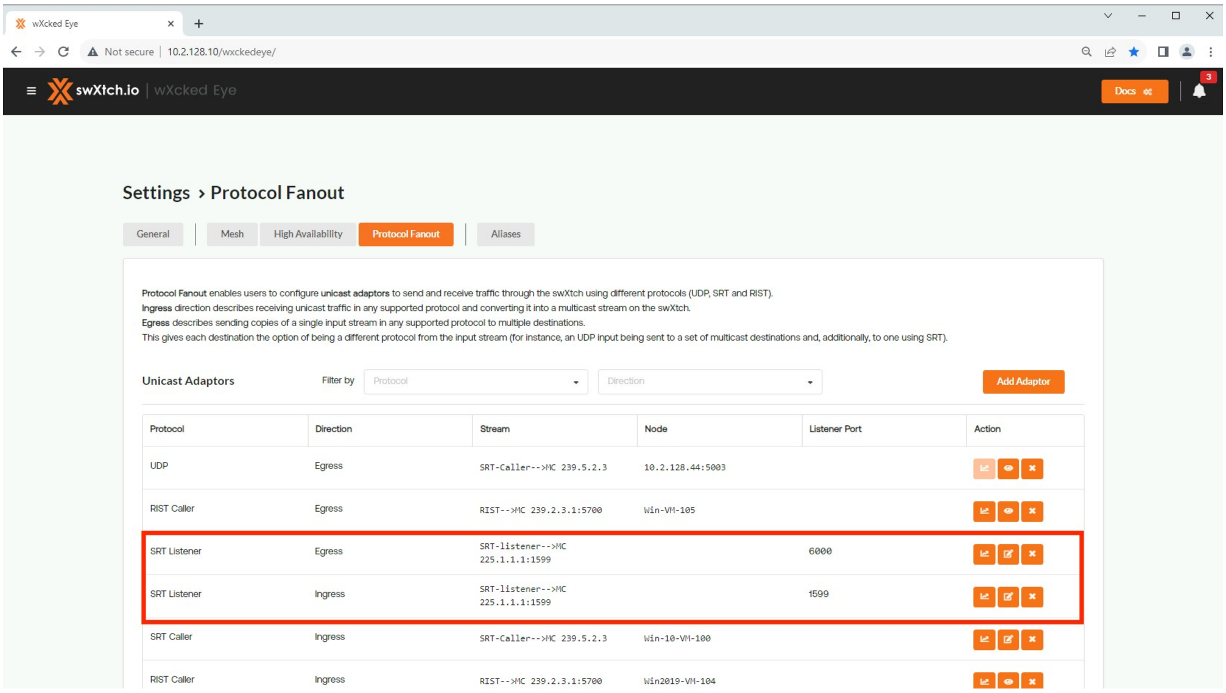


For more information about how aliases work, see the Aliases article under Configure cloudSwXtch with wXcked Eye.

Step Two: Adding Adaptors

In the Protocol Fanout Settings page, the user has set up two SRT Listeners. An SRT Listener configuration is telling the cloudSwXtch to listen for any incoming messages from endpoints ready to send/receive SRT data. This method of transmission is considered to be more user-friendly since a user will not have to worry about pointing to a specific IP address. It places the burden of targeting on the endpoint instead.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

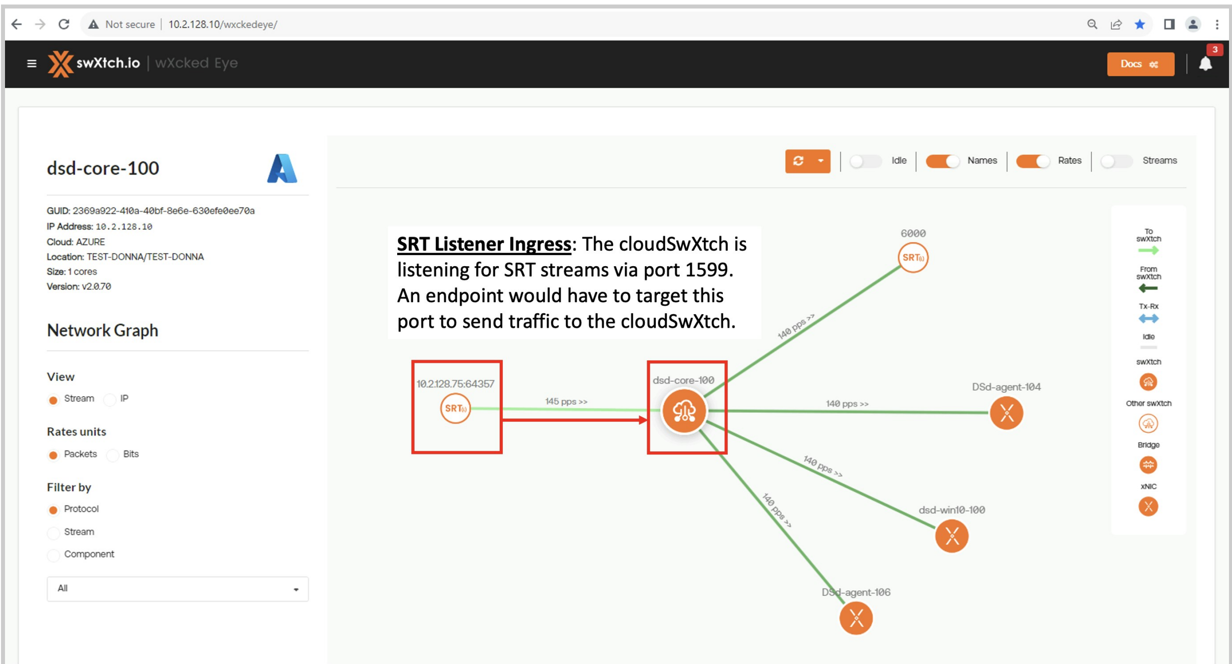


The user has set up SRT Listener for both Egress and Ingress using the Alias assigned earlier: SRT-Listener -> Multicast 225.1.1.1:1599. When differentiating between Egress and Ingress, always imagine it from the perspective of the cloudSwXtch:

SRT Listener Ingress

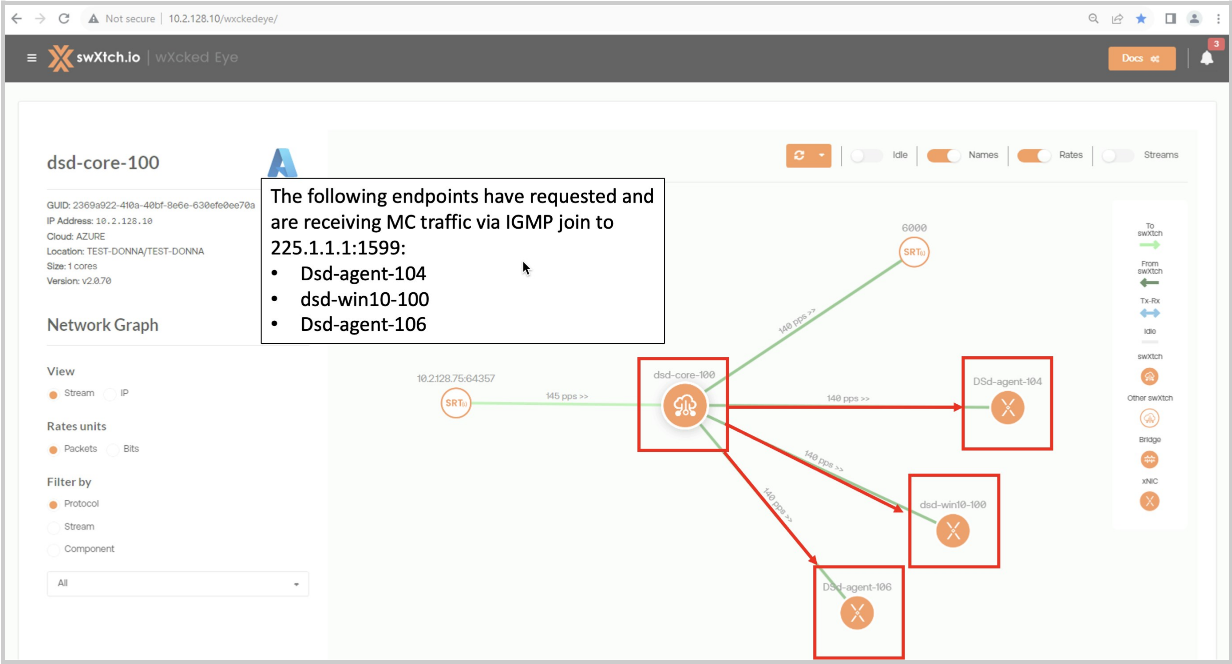
For Ingress, think about the cloudSwXtch Ingesting a stream. The user has set up an SRT Listener Ingress using the SRT-Listener -> Multicast 225.1.1.1:1599 stream with Listener Port 1599. That means that an endpoint will have to target port 1599 to send SRT traffic to the cloudSwXtch. Since it is ingress, the cloudSwXtch will automatically convert the SRT stream it receives into multicast.

Using the Topology in wXcked Eye, you can see how SRT Listener Ingress is set up in relation to the cloudSwXtch below.



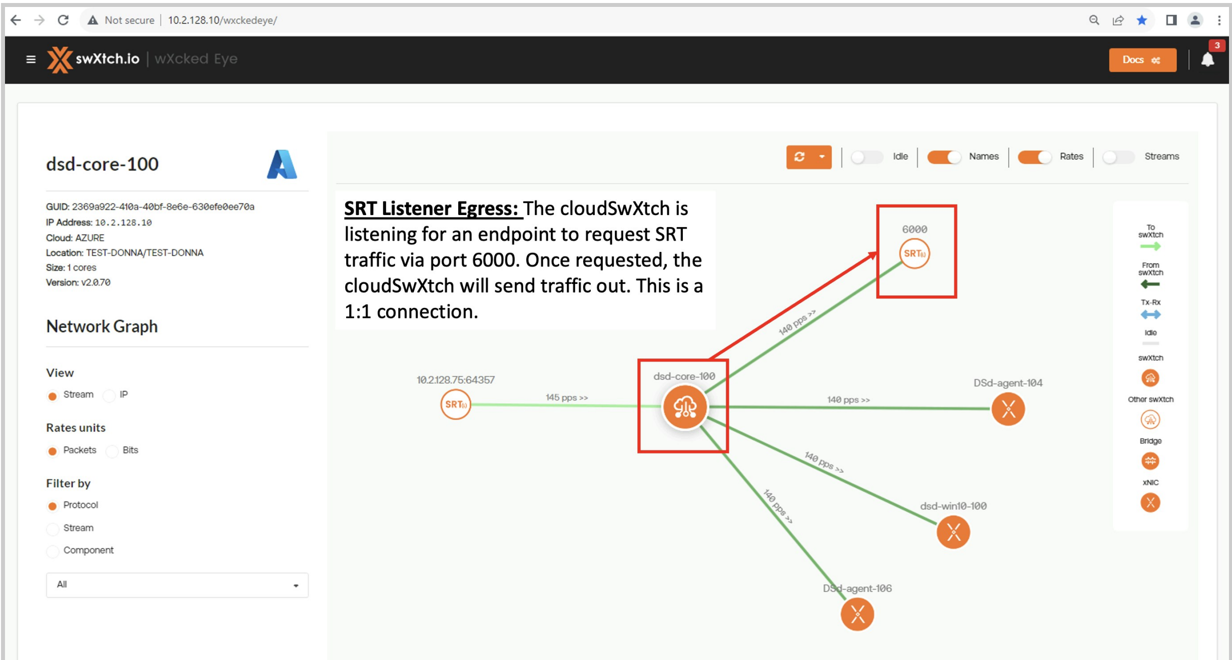
The endpoints highlighted will then request and receive multicast traffic via IGMP join to 225.1.1.1:1599.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



SRT Listener Egress

For Egress, imagine the stream EXITING the cloudSwXtch (->). In this example, the user has set up SRT Listener Egress using the SRT-Listener -> Multicast 225.1.1.1:1599 stream and opening Listener Port 6000. That means that an endpoint will have to target port 6000 and let the cloudSwXtch know that it would like to receive SRT traffic. Note that this is a 1:1 connection, meaning only one SRT endpoint can use the listener port. In the example below, an endpoint has requested the SRT traffic and the cloudSwXtch is sending it out 140pps via port 6000.



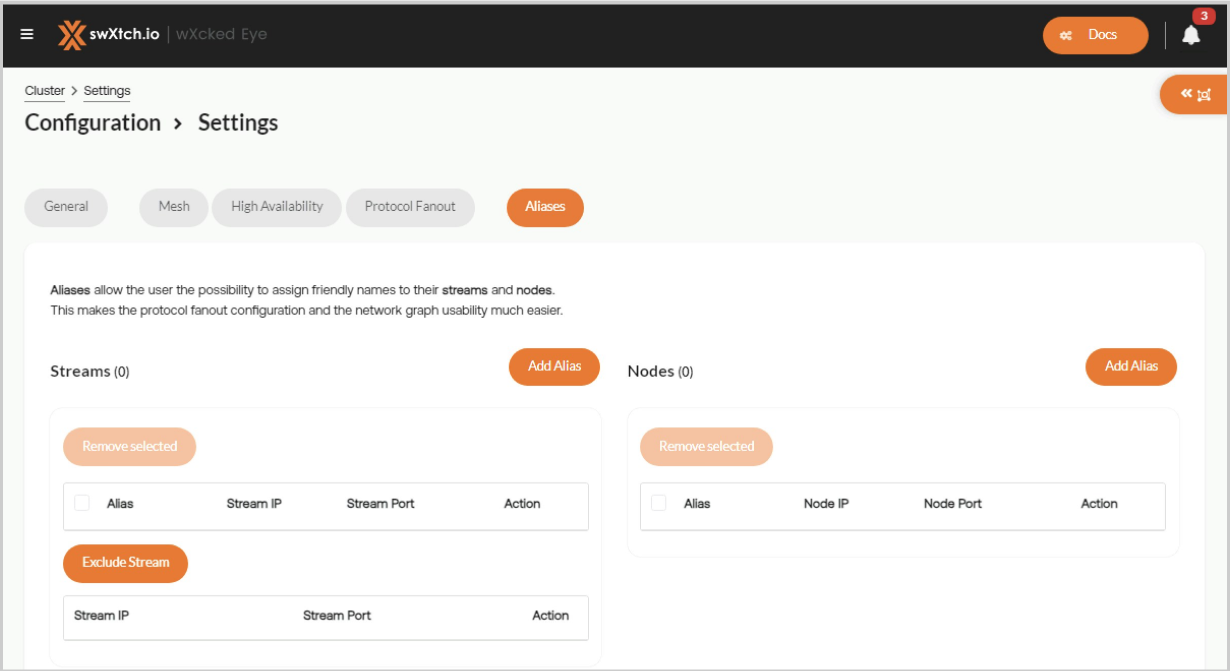
©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Aliases

WHAT TO EXPECT

The Aliases tab on the Settings page allows users to assign friendly names to their streams and nodes. In addition to streamlining protocol conversion and fanout configuration, the Aliases feature also makes the network graph easier to use.

In this section, users will learn how to add/edit streams and nodes in wXcked Eye. Additionally, they will learn how to exclude streams.



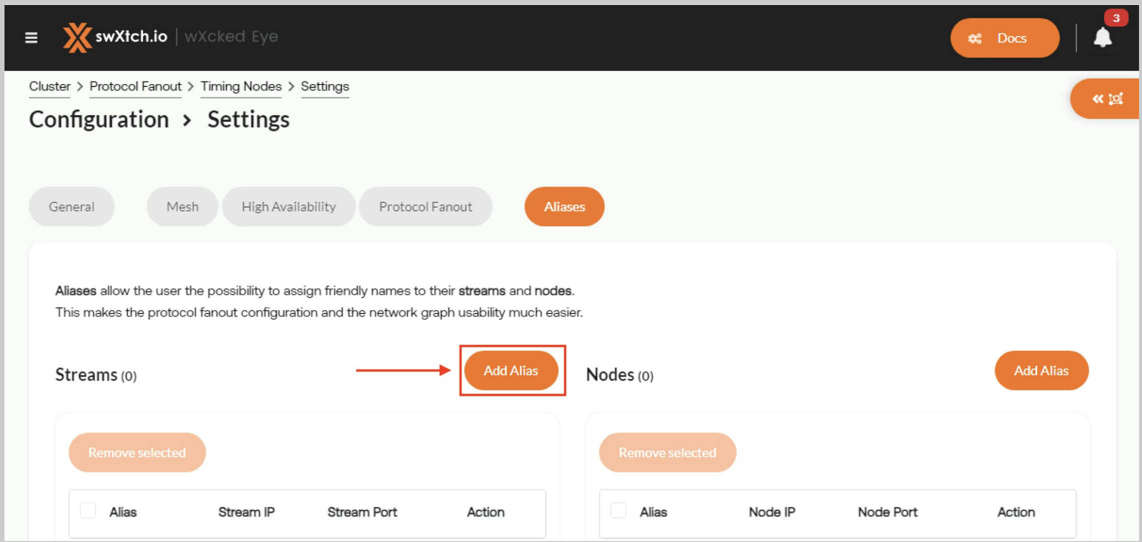
Streams

The Streams panel allows users to name their Multicast IP addresses. This creates a shortcut for users in dropdown menus throughout the Protocol Fanout tab, allowing them to easily differentiate between multiple streams.

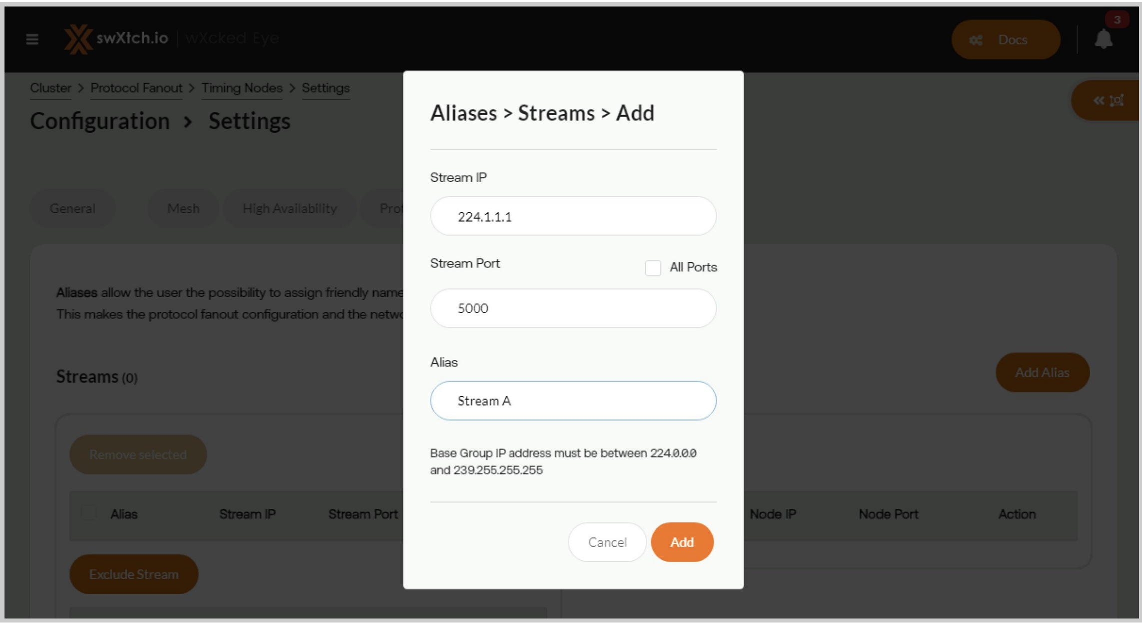
To add a new stream:

1. Select Add Alias in the top right corner of the Streams panel. A pop-up will open.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



2. Enter the multicast Stream IP, Stream Port and a user-friendly name under Alias. In the example, the user assigns the Alias, Stream A. In addition to setting a single Stream Port, you may also open 'All Ports' by selecting the checkbox.



3. Click Add.
4. A new stream will be added to the list.

Users can edit the name of the stream or remove it from the list by clicking either buttons under the Action column.

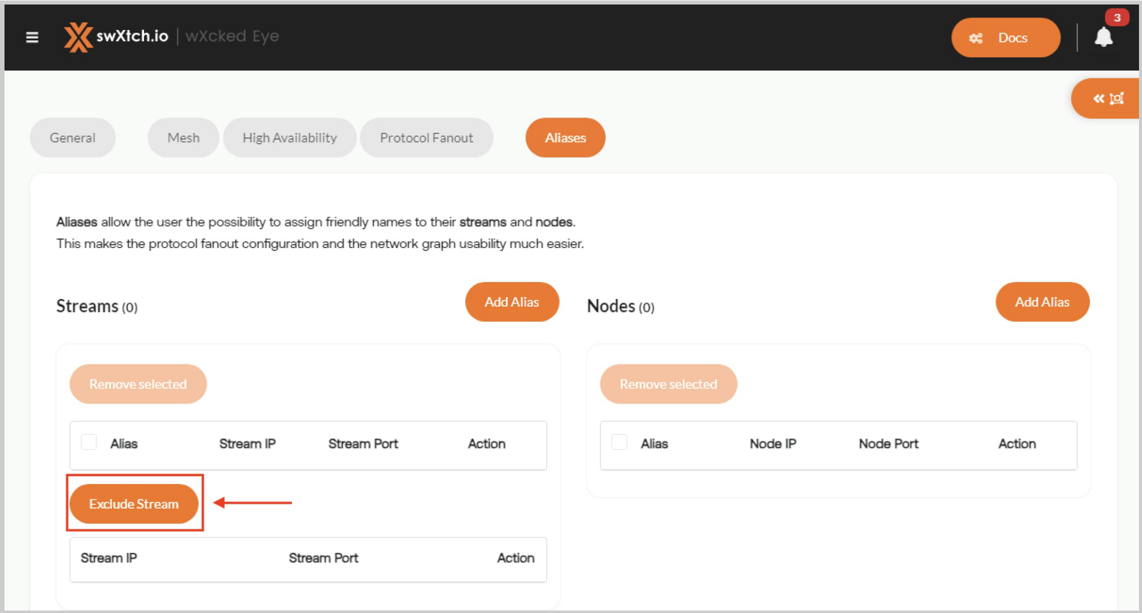
Please note: The edit feature does not let you change the Group IP or Group Port. To do this, delete the stream and re-add.

To Exclude A Stream:

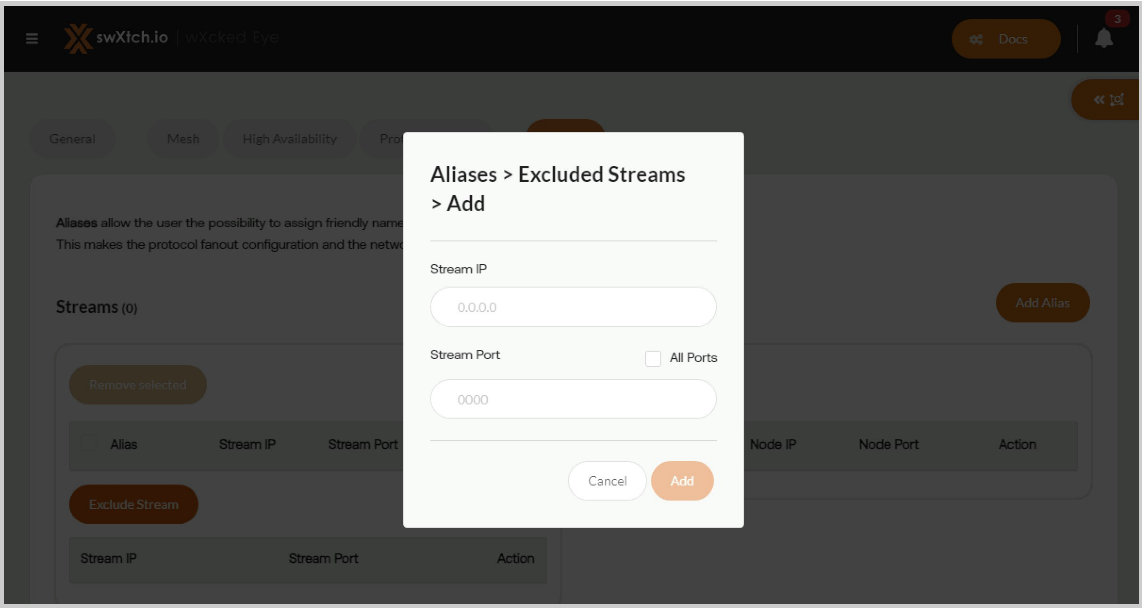
In addition to adding a stream, the Alias tab also includes the functionality to exclude streams from all monitoring related activities in wXcked Eye and swXtch-top. This is especially beneficial for users who use external software to generate additional streams that don't want this included when monitoring packet and data flow through the cloudSwXtch. To do this:

1. Click Exclude Stream.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



2. Enter the Stream IP and the Stream Port you would like to exclude. In addition to setting a single Stream Port, you may also open All Ports by selecting the checkbox.



3. Click Add when you have made all your edits.
4. A new Stream will be added to your Exclude Stream list. It will no longer appear in wXcked Eye and swXtch-top monitoring.

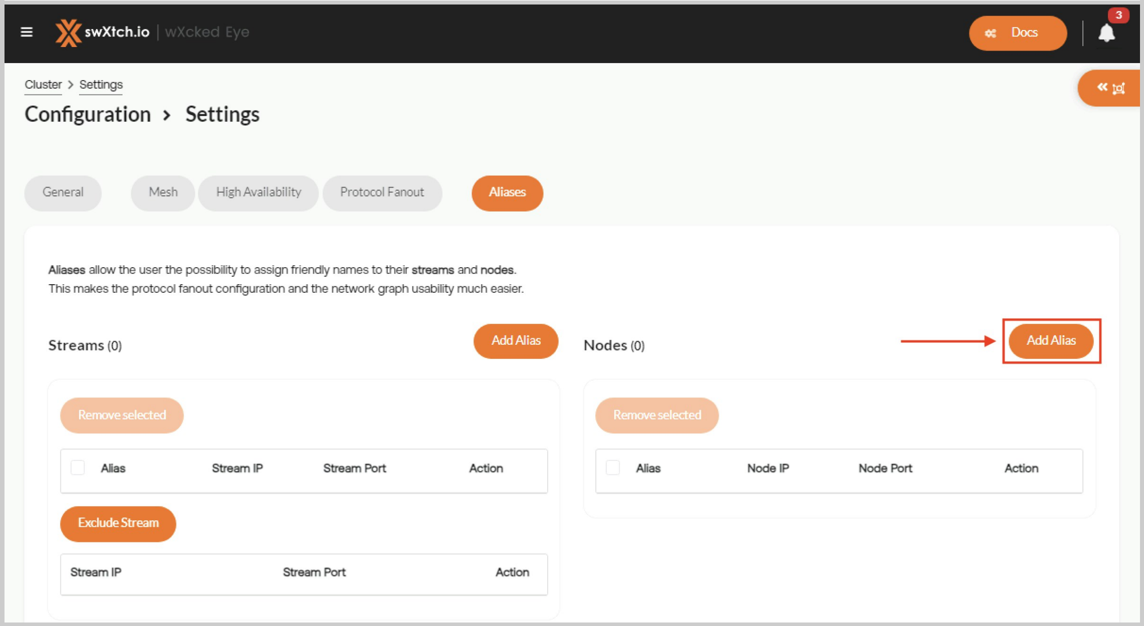
Nodes

Similar to the Streams function, users can set up Aliases for their Nodes, avoiding the need to re-write the node IP and port during UDP, SRT or RIST mapping.

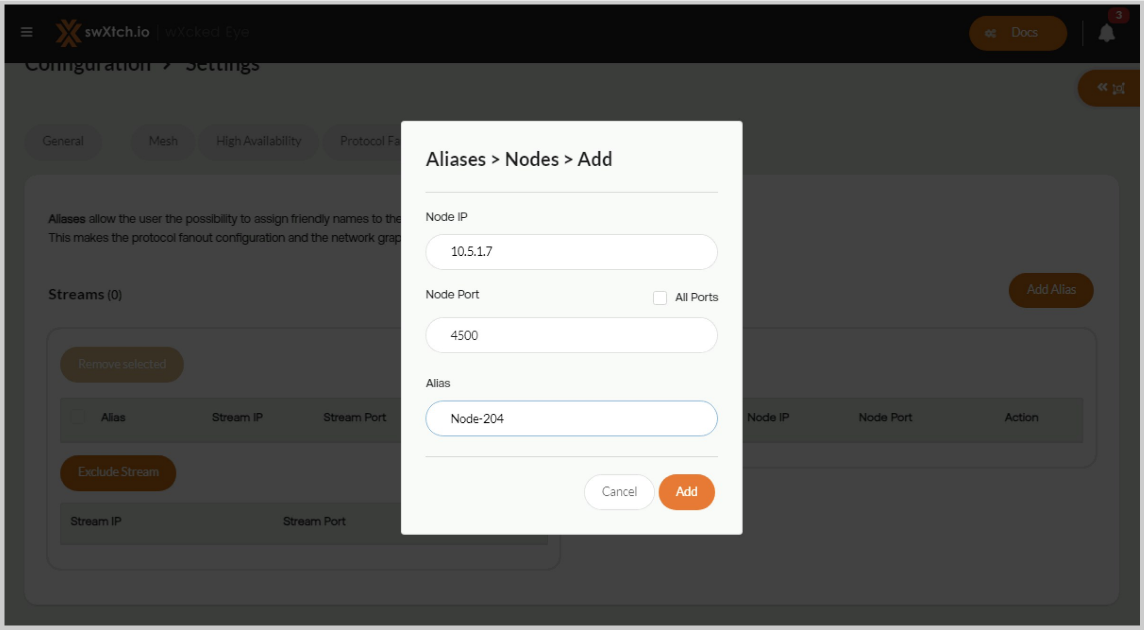
To add a new node:

1. Click on the Add Alias button in the top right corner of the Nodes panel. A new window will open.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

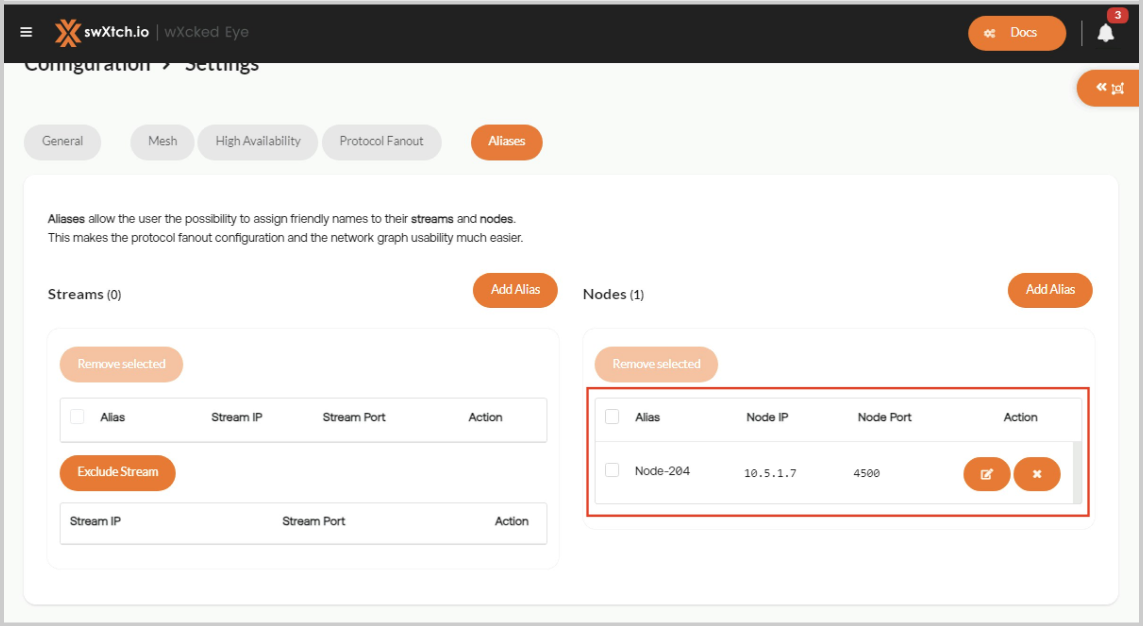


2. Enter the Node IP address, Node Port and a user-friendly name. In this example, the user sets the Alias as Node-204.



3. Click Add to confirm.
4. A new node will be added to the list.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



Users can edit the name of the node or remove it from the list by clicking the buttons under the Action column.

Please note: The edit feature does not let you change the Node IP or Node Port. To do this, delete the node and re-add.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

High Availability

WHAT TO EXPECT

In this article, users will learn how to configure high availability for both the cloudSwXtch and the xNIC.

- For the cloudSwXtch, users will learn about the specific commands they can use to configure high availability. Alternatively, users can also configure the cloudSwXtch for high availability via wXcked Eye. This is the preferred method. For more information, see High Availability with wXcked Eye. cloudSwXtch configuration is the same for both xNIC and xNIC Classic.
- For xNIC, high availability is preconfigured after cloudSwXtch configuration. If Multiple Multicast IP addresses are required, those must be configured on each xNIC.

Configuring cloudSwXtch for High Availability

For High Availability to work, the cloudSwXtch must be configured. This allows for the system to know the paths through user naming and ultimately enables HA views in swXtch-top. In this section, we will review the various HA commands available to the user for a successful high availability configuration.

Users can also configure High Availability for the cloudSwXtch in wXcked Eye. This is the preferred method. For more information, see High Availability with wXcked Eye.

HA Help

To get a list of the HA commands, use -h or --help as shown below.

Bash

Copy

```
PS C:\Users\testadmin> swx ha -h
High Availability cluster management tool (create, show, and destroy the HA cluster)

Usage:
  swx ha [command]

Available Commands:
  create        Create or Update the HA cluster of swxtches using a config file
  destroy       Destroy the HA cluster
  show          Show information about the HA cluster

Flags:
  -h, --help                          help for ha
  -s, --service-host-address string   Host swxtch address in the form <host>[:port]
  -d, --show-error                    show-error - display additional information for
error messages.

Use "swx ha [command] --help" for more information about a command.
```

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

NOTE

The default port in which the cloudSwXtch listens for these swx configuration commands is port 80. You can safely omit the port in the "-s" parameter since 80 will be used. Do not use port 10802 (the one used in the config file), as it is intended for xNIC communications only. It will not work for swx commands.

HA Create

To create or update an HA cluster, a `HAconfig.json` file must exist. Note that the IP is for the control plane. The following shows the format:

Bash | Copy

```
{
    "name": "MY High Availability",
    "paths": [
        {
            "name": "Path 1",
            "swxtches": [
                "10.2.128.10"
            ]
        },
        {
            "name": "Path 2",
            "swxtches": [
                "10.5.1.6"
            ]
        }
    ]
}
```

If there are multiple cloudSwXtches in a path then the last cloudSwXtch added will have the IP address in the configuration. The rest of the cloudSwXtches do not need to be listed.

The -h and --help commands will show the syntax for the "swx ha create" command.

Bash | Copy

```
PS C:\Users\testadmin> swx ha create -h
Create or Update the HA cluster of swxtches using a config file

Usage:
  swx ha create [flags]

Flags:
  -h, --help           help for create
  -i, --input string   JSON input file

Global Flags:
  -s, --service-host-address string   Host swxtch address in the form <host>[:port]
  -d, --show-error                    show-error - display additional information for
error messages.
```

Below is the command:

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Bash Copy

```
swx ha create -i <path_to_config> -s <cloudSwXtch_IP>
```

HA Destroy

To remove a cloudSwXtch from the High Availability flow, the "ha destroy" command can be used. The -h and --help commands will show the syntax for the "swx ha destroy" command.

Bash Copy

```
PS C:\Users\testadmin> swx ha destroy -h
Destroy the HA cluster

Usage:
  swx ha destroy [flags]

Flags:
  -h, --help   help for destroy

Global Flags:
  -s, --service-host-address string   Host swxtch address in the form <host>[:port]
  -d, --show-error                    show-error - display additional information for
error messages.
```

Below is the command to leave:

Bash Copy

```
PS C:\Users\testadmin> swx ha destroy -s <swxtch name or control data ip of a
cloudSwXtch in the HA configuration>
```

Example:

Bash Copy

```
PS C:\Users\testadmin> swx ha destroy -s cloudswxtch101
Validating cluster deletion.
Successfully deleted the cluster.
```

Removing a cloudSwXtch from an HA configuration

To remove a cloudSwXtch from a user's HA configuration, they will need to delete and recreate their HA cluster without that cloudSwXtch.

HA Show

To get a list of cloudSwXtches part of the HA flow, the "ha show" command can be used. The -h and --help commands will show the syntax for the "swx ha show" command.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

```bash
PS C:\Users\testadmin> swx ha show -h
Show information about the HA cluster

Usage:
  swx ha show [flags]

Flags:
  -h, --help   help for show

Global Flags:
  -s, --service-host-address string   Host swxtch address in the form <host>[:port]
  -d, --show-error                    show-error - display additional information for
error messages.
```

Below is the command to list:

```bash
swx ha show -s <swxtch name or control data IP of a cloudSwXtch in the HA configuration>
```

Example below:

```bash
PS C:\Users\testadmin> swx ha show -s  cloudswxtch101
{
    "clusterConfig": {
        "uid": "D20E820C-91DE-A571-4C7C-B60C1695973D",
        "name": "dsd-100-200-HA",
        "paths": [
            {
                "name": "Path1",
                "swxtches": [
                    "10.2.128.10"
                ]
            },
            {
                "name": "Path2",
                "swxtches": [
                    "10.5.1.6"
                ]
            }
        ]
    }
}
```

swxtch-top has options for High Availability. For more information, see the swxtch-top article.

Running Bridge 1 for High Availability

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

WHAT TO EXPECT

In order for a bridge to send multiple streams, it must have an separate instance running for each cloudSwXtch within the HA configuration. In the example above, the bridge was sending data to two cloudSwXtch, resulting in two separate cloudSwXtch Bridge 1 instances.

In this section, you will find the commands to run the Bridge 1 as separate instances.

Below are the swxtch-bridge arguments. **Note**: You can also find this list of arguments using **swxtch-bridge -h**

Bash | Copy

```bash
agent-101:~$ swxtch-bridge -h
Usage: swxtch-bridge [options]
Optional arguments:
-h --help                              shows help message and exits [default: false]
-v --version                           prints version information and exits [default:
false]
-i --input                             input url: [udp|tcp|-](://<ip>:<port> [default:
"-"]
-o --output                            input url: [udp|tcp|-](://<ip>:<port> [default:
"-"]
-c --core                              start core [default: 1]
-n --core-count                        core count [default: 4]
-r --override-multicast-sender-ip      --override-multicast-sender-ip xxx.xxx.xxx.xxx:
override multicast sender ip to make it routable [default: "0.0.0.0"]
-p --path-id                           path start identification for HA flow [default:
0]
-f --first-leg                         first leg from repl, we need to offset incoming
packet for length field in IexHeader [default: false]
-l --last-leg                          last leg to repl, we need to stripe away the
Length field in IexHeader [default: false]
```

The diagram above sends paths from two instances of the same cloudSwXtch Bridge 1 to two different cloudSwXtches. Below are example calls a user would use for each of the bridge instances.

Bridge Instance 1

Bash | Copy

```bash
swxtch-bridge --input
multicast://239.1.1.4:172.30.0.4:8804,multicast://239.1.1.5:172.30.0.4:8804,multicast://
239.5.69.2:172.30.0.4:10000 --output udp://10.2.192.23:9999 --last-leg --path-id 0 -c 0

OUTPUT:
set cpu: 0
set cpu: 1
```

Bridge Instance 2

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Bash | Copy

```bash
swxtch-bridge --input
multicast://239.1.1.4:172.30.0.4:8804,multicast://239.1.1.5:172.30.0.4:8804,multicast://
239.5.69.2:172.30.0.4:10000 --output udp://10.5.2.6:9999 --last-leg --path-id 1 -c 2

OUTPUT:
set cpu: 2
set cpu: 3
```

- **--input**: Multiple multicast groups can be entered as shown in both examples above.
- **--output**: This is the cloudSwXtch consumer's data NIC.
- --**path-id**: Here, a user will designate a path number, starting with 0 as Path 1. (Increment by 1 for each path. For example, 1 for Path 2, 2 for Path 3, etc.)

For all additional arguments, please see the **swxtch-bridge -h** list above.

Configuring xNIC for High Availability

After a user sets up their cloudSwXtch for High Availability, the xNIC will automatically configure itself to receive and/or send HA traffic for a single multicast group. Users can confirm high availability has been configured by viewing the JSON file in the VM where their xNIC resides.

> Where To Find The xNIC JSON File
>
> To configure xNIC for High Availability streams, the **xnic.json** file needs to be updated for both the producer and consumer.
>
> **For Linux:**
> The file can be found in **/var/opt/swxtch/xnic.json**. Currently, only V1 is supported for Linux.
> To edit the file, one option is to use nano as shown below:
>
> Bash | Copy
>
> ```bash
> sudo nano /var/opt/swxtch/xnic.json
> ```
>
> **For Windows:**
> The file can be found in **C:\Program Files\SwXtch.io\Swxtch-xNIC\xnic.json**

Single Multicast Group

An example of the xnic.json file is shown below. Note the `ha` section has been added.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Bash | Copy

```bash
{
    "swxtch": "10.2.128.10",
    "controlInterface": "Ethernet 2",
    "dataInterface": "Ethernet",
    "dataPort": 9999,
    "xnicType": 2,
    "dataPlaneSpecs": {
        "verbosity": 0,
        "virtualInterface": {
            "name": "swxtch-tun0",
            "ip": "172.30.0.0",
            "subnet": "255.255.0.0",
            "mtu": 4096
        },
        "bpfPrograms": [
        ]
    },
    "ha": {
        "maxTimeToBufferPacketsMs": 50,
        "bufferSizeInPackets": 131072,
        "protocol": "swxtch"
    },
    "statsReportWait": 60
}
```

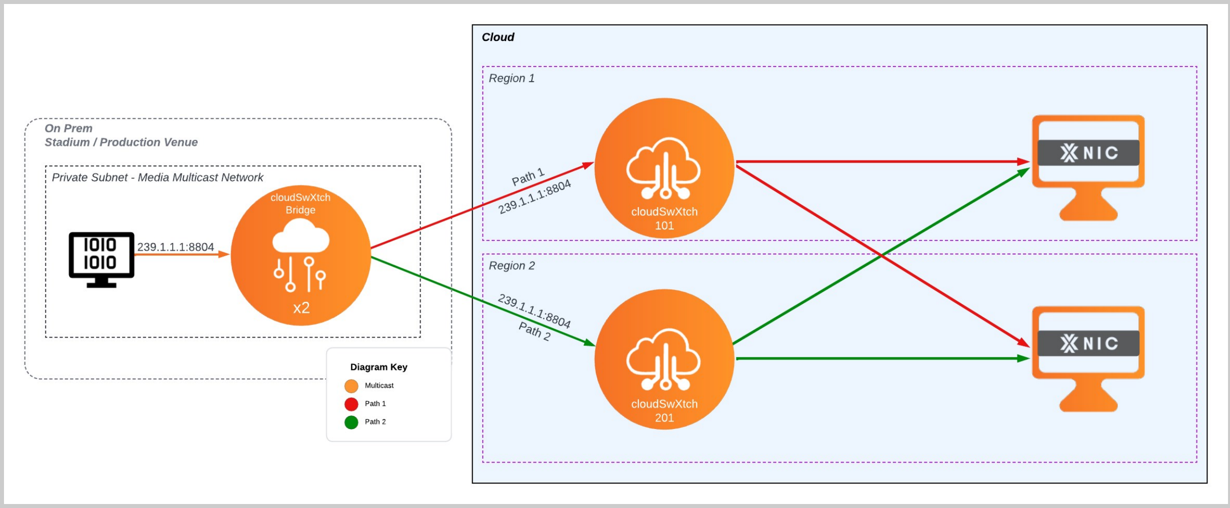
ha Section Explained

The ha section exposes variables that can alter the behavior of the hitless switching code. The values for MaxTimeToBufferPackets_ms and BufferSizeInPackets in the example are good, suggested values; however, they can be tweaked to meet desired high availability requirements.

- MaxTimeToBufferPackets_ms - how long to buffer packets before declaring it as lost.
- BufferSizeInPackets- the max number of packets that can be buffered.
- Protocol- how to parse the packet. The available options are swxtch or rtp.
    - *swxtch* = This can be used when the xNIC is duplicating or deduplicating the multicast. The xNIC will reconstruct based on the sequence count inside the cloudSwXtch packet header.
    - *rtp* = This should be used when processing RTP packets sent from a non-xNIC source. The xNIC will reconstruct based on the RTP timestamp information for Real-time Transport Protocol.

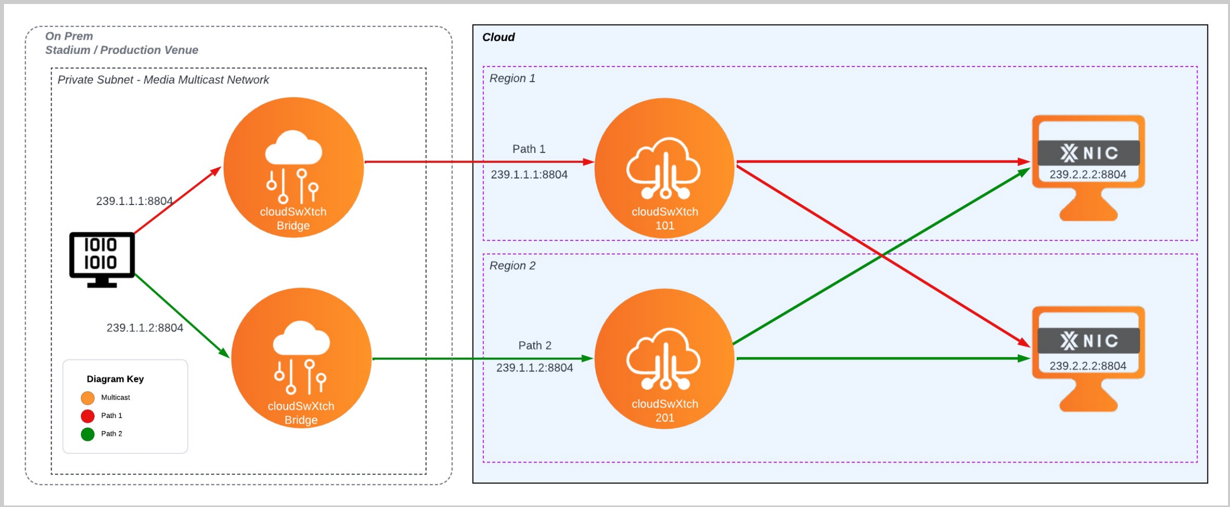
Below is an example of what a single multicast group configuration might look like. In this example, a user is sending the same multicast traffic (239.1.1.1:8804) via two paths with the xNIC consuming both and deduplicating at the end point.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



Multiple Multicast for xNIC

If a user wants to set up for Multiple Multicast groups, they will need to manually configure the xnic.json file. Below is an example of what a multiple multicast group configuration might look like:



In this example, you have two paths with the same multicast traffic with different IP addresses. Path 1 is 239.1.1.1 while Path 2 is 239.1.1.2. The application at the end point is listening to 239.2.2.2, which is grouping together Path 1 and Path 2. The xNIC at the end point is tasked with deduplication.

A sample xnic.json file of the diagram is shown below with a "streamSpecs" section added.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

```bash
{
    "swxtch": "10.2.128.10",
    "controlInterface": "Ethernet 2",
    "dataInterface": "Ethernet",
    "dataPort": 9999,
    "xnicType": 2,
    "dataPlaneSpecs": {
        "verbosity": 0,
        "virtualInterface": {
            "name": "swxtch-tun0",
            "ip": "172.30.0.0",
            "subnet": "255.255.0.0",
            "mtu": 4096
        },
        "bpfPrograms": [
        ]
    },
    "ha": {
        "maxTimeToBufferPacketsMs": 50,
        "bufferSizeInPackets": 131072,
        "protocol": "rtp"
    },
    "streamSpecs": {
        "MmcProducerEnable": false,
        "multipleMulticastGroups": [
            {
                "parent": "239.2.2.2:8804",
                "childs": [
                    "239.1.1.1:8804",
                    "239.1.1.2:8804"
                ]
            },
        ]
    },
    "statsReportWait": 60
}
```

Here, the user is grouping together 2 multicast IPs (239.1.1.1 and 239.1.1.2) and assigning it a "Parent" IP address (239.2.2.2). The application at the endpoint is listening for 239.2.2.2, which the xNIC will deduplicate into a stream from 239.1.1.1 and 239.1.1.2. This was illustrated in the diagram above.

Please note: At this time, the ports for the Parent and the Children must be the same.

How to update xnic.json file for Multiple Multicast Groups

The user will have to make the following changes to their xnic.json file found in the single multicast group configuration to match the example above. These alterations to the xnic.json file should happen after Configuring the cloudSwXtch for High Availability.

1. Change the protocol under ha from "swxtch" to "rtp" including the quotation marks.

2. For each multicast group, add the following "streamSpecs" section as shown below with your parent and child groups listed. Note: A user can enter multiple multicast groups.

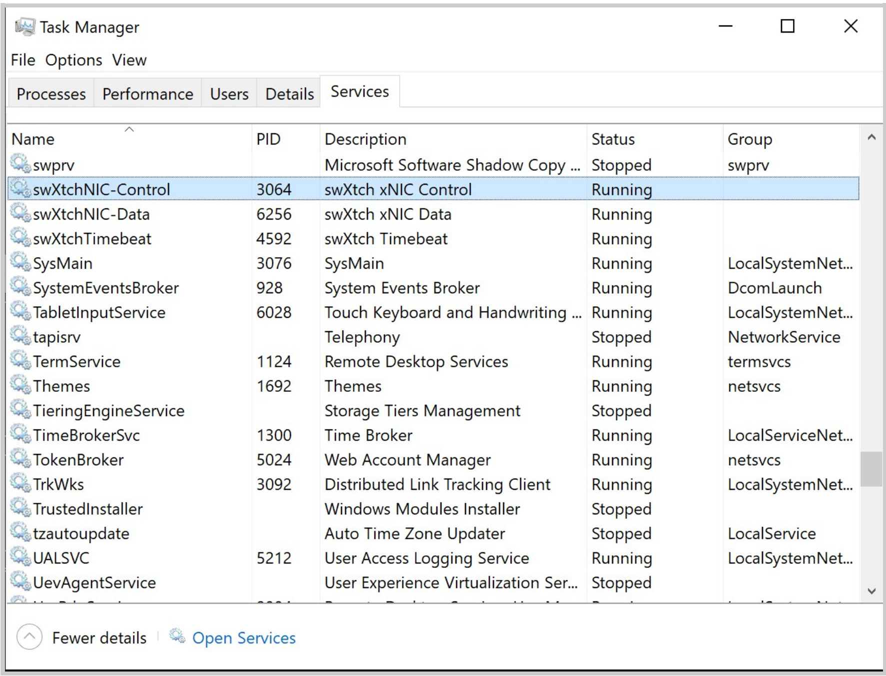
©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

```bash
},
    "streamSpecs": {
        "MmcProducerEnable": false,
        "multipleMulticastGroups": [
            {
                "parent": "239.2.2.2:8804",
                "childs": [
                    "239.1.1.1:8804",
                    "239.1.1.2:8804"
                ]
            },
            {
                "parent": "239.3.3.3:8804",
                "childs": [
                    "239.1.1.3:8804",
                    "239.1.1.4:8804"
                ]
            }
        ]
    },
```

3. Save the xnic.json file.

4. Restart the swXtch-NIC Control service.

- For Windows, go to the Task Manager and under the Services tab, select and restart swXtchNIC-Control.



- For Linux, use the following command:

```bash
sudo service swxtch-xnic-control restart
```

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Mesh

WHAT TO EXPECT

The following article details the available commands a user can input in order to create, destroy or modify a mesh configuration.

A user can also use the wXcked Eye UI to accomplish the same tasks. To learn more, visit the "Configure with wXcked Eye" article under Configuring cloudSwXtch.

Supported Versions:

Mesh commands below is supported in v1.9.16 or higher. For older versions contact support at support@swXtch.io.

Mesh

Mesh configuration with the commands below should only be done on a VM with an active xNIC running on it. Please note that these commands should not be done on the cloudSwXtch VM itself.

None Copy

```
PS C:\Users\testadmin> swx mesh -h
Mesh management tool (create, destroy, members, add switch, remove switch, print members
& routes)

Usage:
  swx mesh [command]

Available Commands:
  add-swxtch    Add swxtch to the mesh
  create        Create the mesh of swxtches using a config file
  destroy       Destroy the mesh
  remove-swxtch Remove swxtch from the mesh
  show          Show information about the mesh

Flags:
  -h, --help                          help for mesh
  -s, --service-host-address string   Host swxtch address in the form <host>[:port]

Use "swx mesh [command] --help" for more information about a command.
```

CREATE

This command provides a mechanism to create a mesh using an input configuration file.

The configuration file describes the cloudSwXtches that will participate in the mesh. Each element in the list is the IP address for the cloudSwXtch's control interface.

Command:

`swx mesh create -i <config.json> -s <service-host-address>`

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Arguments:
`-i, --input`
`-s, service-host-address of a cloudSwXtch to be included in the mesh.`

Example

None Copy

```
swx mesh create -i meshconfig.json -s 10.2.128.5

OUTPUT:
Validating mesh..
Mesh succesfully created.
```

Below is an example of a meshconfig.json file:

None Copy

```
{
  "name": "customer-mesh",
  "switches": ["10.2.128.5", "10.2.162.4"]
}
```

ADD cloudSwXtch to a Mesh

This command adds a cloudSwXtch to an already existing mesh configuration.

Command
`swx mesh add-swxtch -s <service-host-address of a cloudSwXtch in an existing Mesh configuration> -a <swxtch-addr>`

Arguments:
`-s, --service-host-address string Host swxtch address in the form <host>[:port]`
`-a, --swxtch-addr : ip address of the swxtch that is being added to the mesh`

Example

None Copy

```
swx mesh add-swxtch -s 10.2.128.10 -a 10.1.1.6
Validating that the swxtch was added.
Swxtch successfully added to the mesh.
```

SHOW

This command reports a list of cloudSwXtches participating in the specified mesh. Any cloudSwXtch participating in the mesh is able to provide the current state of the mesh configuration. The query can be issued against any of them.

Command
`swx mesh show -s <service-host-address for any cloudSwXtch in the Mesh configuration>`

Arguments:
`- -s, --service-host-address string Host swxtch address in the form <host>[:port]`

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Example

None Copy

```
swx mesh show -s 10.2.128.10
{
    "routes": {
        "destinationMap": {
            "10.1.1.6": "10.1.1.6",
            "10.5.1.6": "10.1.1.6"
        }
    },
    "members": [
        "10.2.128.10",
        "10.5.1.6",
        "10.1.1.6"
    ],
    "subscriptions": {
        "groups": {
            "224.0.0.251": {
                "groupAddress": "224.0.0.251",
                "swxtches": {
                    "10.1.1.6": "10.1.1.6",
                    "10.5.1.6": "10.5.1.6"
                }
            },
            "224.0.0.252": {
                "groupAddress": "224.0.0.252",
                "swxtches": {
                    "10.1.1.6": "10.1.1.6",
                    "10.5.1.6": "10.5.1.6"
                }
            },
            "224.0.1.129": {
                "groupAddress": "224.0.1.129",
                "swxtches": {
                    "10.1.1.6": "10.1.1.6",
                    "10.5.1.6": "10.5.1.6"
                }
            },
            "239.1.1.1": {
                "groupAddress": "239.1.1.1",
                "swxtches": {
                    "10.5.1.6": "10.5.1.6"
                }
            },
            "239.1.1.2": {
                "groupAddress": "239.1.1.2",
                "swxtches": {
                    "10.1.1.6": "10.1.1.6"
                }
            },
            "239.1.1.3": {
                "groupAddress": "239.1.1.3",
                "swxtches": {
                    "10.1.1.6": "10.1.1.6"
                }
```

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

```
            },
            "239.1.1.4": {
                "groupAddress": "239.1.1.4",
                "swxtches": {
                    "10.1.1.6": "10.1.1.6"
                }
            },
            "239.255.255.250": {
                "groupAddress": "239.255.255.250",
                "swxtches": {
                    "10.1.1.6": "10.1.1.6"
                }
            }
        }
    }
}
```


Remove a cloudSwXtch from a Mesh

This command removes a given cloudSwXtch from the specified mesh.

Command

`swx mesh remove-swxtch -s <host-addr of the cloudSwXtch you wish to remove from the Mesh>`

Arguments:

`-s, --service-host-address string Host swxtch address in the form <host>[:port]`

Example

None | Copy

```
swx mesh remove-swxtch -s 10.1.1.6
Validating that the swxtch was removed.
Swxtch successfully removed from the mesh.
```

Destroy

This command will delete or destroy the entire mesh.

Comand:

`swx mesh destroy -s <host-addr for one of the cloudSwXtches in the Mesh you wish to destroy>`

Arguments:

`-s, --service-host-address string Host swxtch address in the form <host>[:port]`

Example

None | Copy

```
swx mesh destroy -s 10.2.128.10
Validating that the mesh was destroyed.
Mesh successfully destroyed.
```

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Bridge Type 2

Configuring cloudSwXtch Bridge Type 2 Interfaces

By default, cloudSwXtch Bridge Type 2 installation will attempt to resolve the interface that is routable to the cloudSwXtch. However, if a user would like to do this manually, the cloudSwXtch Bridge Type 2 can be configured in one of two ways:

- For hairpin forwarding on a single interface
- For bridge in the middle redirection between two interfaces

This section will go into the changes a user would have to make to the cloudSwXtch Bridge Type 2 JSON configuration file to apply the above methods. The location of the configuration file is /var/opt/swxtch/swxtch-bridge.json.

Bash | Copy

```
{
    "bridgeConfig": {
        "ctrlInterfaceName": "eth0",
        "dataInterfaceName": "eth1",
        "userInterfaceName": "eth0",
        "swxtchCtrlIp": "10.0.0.1",
        "swxtchCtrlPort": 80,
        "swxtchDataIp": "10.0.1.1",
        "swxtchDataPort": 9999,
        "pathId": 0,
        "groundToCloudSubscriptions": [],
        "cloudToGroundSubscriptions": [
        "225.0.23.182:12000",
        "225.0.23.183:12000",
        "225.0.23.184:12000",
        "225.0.23.185:12000"],
        "pollingIntervalMilliseconds": 1000
    }
}
```

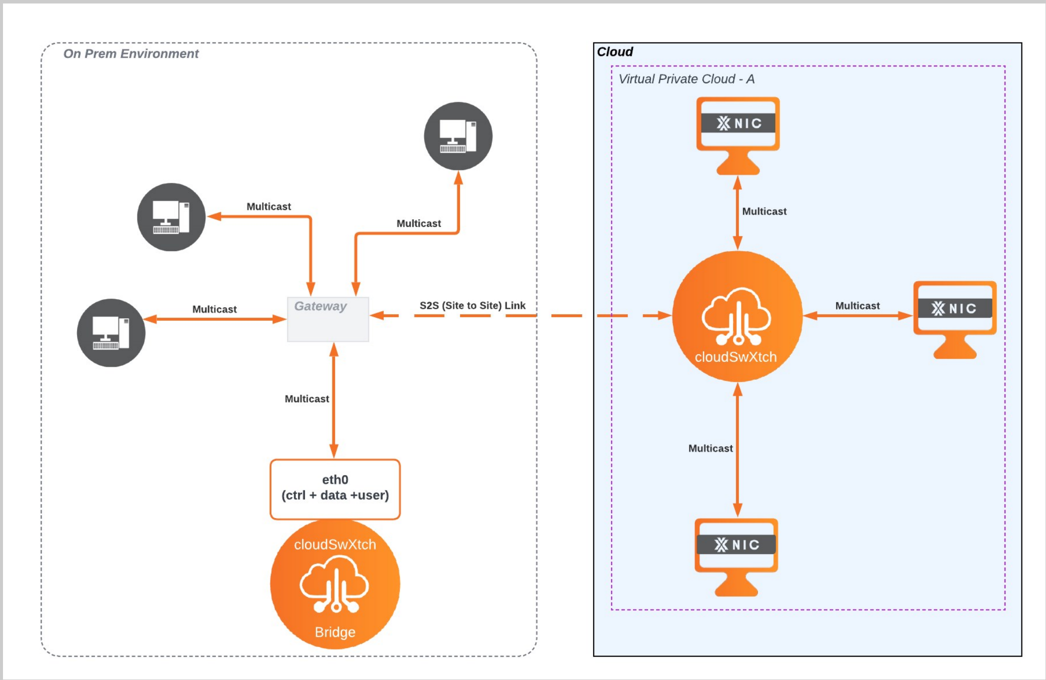
Fields Explained

Below are deeper explanations for certain fields in the cloudSwXtch Bridge Type 2 config file:

- "ctrlInterfaceName": NIC used for control-plane communication with cloudSwXtch
- "dataInterfaceName": NIC used for the data-plane communication with cloudSwXtch
- "userInterfaceName": NIC used for multicast ground traffic
- "pathId": Please set this to zero.
- "groundToCloudSubscriptions": Please leave blank as it is no longer necessary since ground to cloud is done dynamically via IGMP joins from the cloud client.
- "cloudToGroundSubscriptions": Traffic coming into the cloudSwXtch with these addresses will be forwarded to bridge and then to the userInterface.
- "pollingIntervalMilliseconds:" Polling consists on a sync with the cloudSwXtch to exchange MC groups information.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

For a single interface

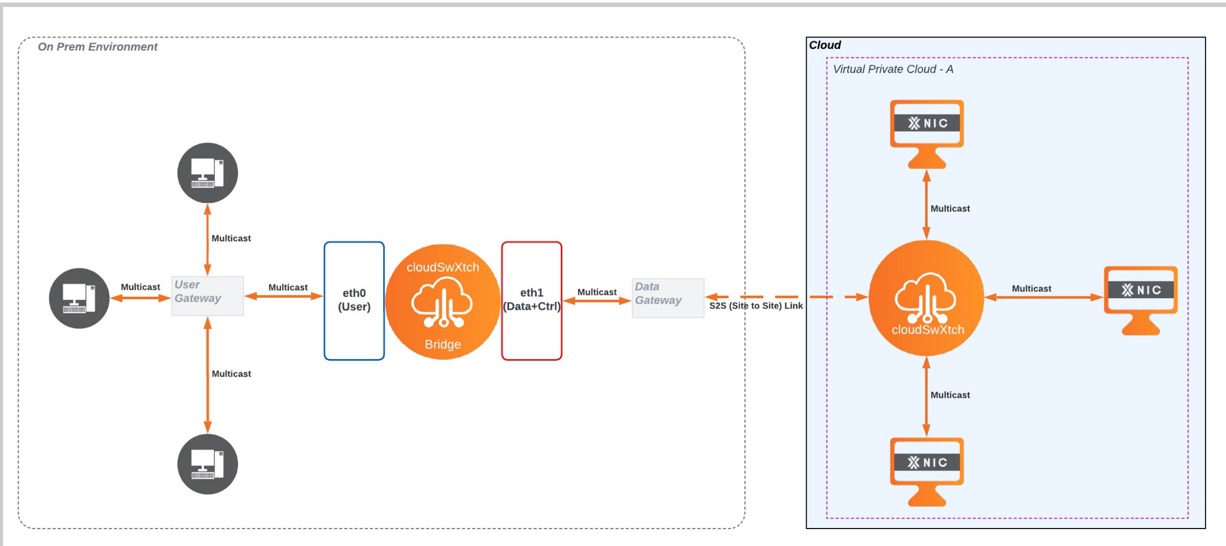


To accomplish a single interface configuration for your cloudSwXtch Bridge Type 2, users will need to specify the same InterfaceName for Ctrl, Data and User in the swxtch-bridge.json file. In the example, each are assigned to eth0.

Bash

```
        "ctrlInterfaceName": "eth0",
        "dataInterfaceName": "eth0",
        "userInterfaceName": "eth0",
```

For bridge in the middle of two interfaces



Alternatively to the single interface approach, a user can decide to place the cloudSwXtch Bridge between two interfaces in order to redirect traffic from the user interface to the data interface. In the example below, the ctrlInterfaceName and the dataInterfaceName are the same (eth1) while the userInterfaceName differs (eth0).

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

```bash
        "ctrlInterfaceName": "eth1",
        "dataInterfaceName": "eth1",
        "userInterfaceName": "eth0",
```

Using Bridge Type 2 cloud to ground API to Join/Leave

Bridge Type 2 has the capability to do join and leaves from ground to cloud via an HTTP endpoint on the bridge. This will enable the forwarding of multicast traffic from cloud to ground.

To Join:

```bash
curl -X POST http://<BRIDGE_CTRL_IP>/addCloudToGround -d '{"MulticastGroups":
["239.239.239.99"],"UpdateConfigFile":false}'
```

To Leave:

```bash
curl -X POST http://<BRIDGE_CTRL_IP>/removeCloudToGround -d '{"MulticastGroups":
["239.239.239.99"],"UpdateConfigFile":false}'
```

Note: A user can set the UpdateConfigFile to "`true`" in order to make their configuration permanent. This means that the changes to cloudSwXtch Bridge Type 2 will persist between restarts.

Configuring Bridge Type 2 Static Subscriptions

The cloud to ground and ground to cloud flows are static based on entry into a json file. In order to do this, modify the bridge JSON configuration file and add the static multicast groups for either groundToCloudSubscriptions or cloudToGroundSubscriptions

The location of the configuration file is **/var/opt/swxtch/swxtch-bridge.json**.
Modify the JSON array attribute for **"cloudToGroundSubscriptions" or "groundToCloudSubscriptions"** and add the appropriate multicast groups from either option.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Bash Copy

```
{
    "bridgeConfig": {
        "ctrlInterfaceName": "eth0",
        "dataInterfaceName": "eth1",
        "userInterfaceName": "eth0",
        "swxtchCtrlIp": "10.0.0.1",
        "swxtchCtrlPort": 80,
        "swxtchDataIp": "10.0.1.1",
        "swxtchDataPort": 9999,
        "pathId": 0,
        "groundToCloudSubscriptions": [
        "226.0.23.182:13000",
        "226.0.23.183:13000",
        "226.0.23.184:13000",
        "226.0.23.185:13000"],
        "cloudToGroundSubscriptions": [
        "225.0.23.182:12000",
        "225.0.23.183:12000",
        "225.0.23.184:12000",
        "225.0.23.185:12000"],
        "pollingIntervalMilliseconds": 1000
    }
}
```

After modifying the configuration file, restart the swxtch-bridge2 service with the following command:

Bash Copy

```
sudo systemctl restart swxtch-bridge2.service
```

In the example above, these multicast groups will now be sent from both cloud to ground and ground to cloud at startup for bridge.

Using a specific gateway address for Bridge Type 2

By default, Bridge Type 2 will resolve the data gateway MAC address by arping the first IP address of the subnet for the data interface. However, if the gateway IP address is not there, then the dataGatewayIP field can be added into the configuration file. This will force the Bridge to resolve the gateway MAC address by using the IP address specified. In the example below, the user inserted their own data gateway IP address.

Bash Copy

```
"dataGatewayIp": "192.168.1.2",
```

Using a specific source IP for Bridge Type 2

The bridge application needs to know what IP address to use for the source of the multicast packets when those packets are injected into the tunnel network. This is because the network in which the bridge exists is not the same network as the tunnel network used by the application software for sending and receiving multicast traffic. This IP address should be a valid IP address in the 172.30.X.Y range and should be a unique address: i.e., not one used by another VM. This IP address in the 172.30.X.Y range shall be called the bridge source address.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

To accomplish this, add the following parameter into the JSON configuration file with IP address to use for the source:

Bash | Copy

```bash
"overwriteSenderIp": "172.30.1.1",
```

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Bridge Type 1

Configuring cloudSwXtch Bridge Type 1

When launching the cloudSwXtch Bridge Type 1, the command line arguments for the input must specify the input multicast group IP address, the IP address to use within the multicast network, and the input multicast group port.

The format for the bridge --input argument is:

Bash

```bash
--input multicast://<multicast-group-ip>:<nic-ip>:<multicast-group-port>
```

Multiple multicast groups can be specified by separating them with commas:

PowerShell

```powershell
--input multicast://<multicast-group-ip>:<nic-ip>:<multicast-group-port>,multicast://<multicast-group-ip>:<nic-ip>:<multicast-group-port>
```

The output parameter is the IP and Port of the cloudSwXtch instance where the multicast traffic will be sent to. The format for the bridge --output argument is:

PowerShell

```powershell
--output udp://<swxtch-data-ip>:9999
```

The bridge application needs to know what IP address to use for the source of the multicast packets when those packets are injected into the tunnel network. This is because the network in which the bridge exists is not the same network as the tunnel network used by the application software for sending and receiving multicast traffic. This IP address should be a valid IP address in the 172.30.X.Y range and should be a unique address: i.e., not one used by another VM. This IP address in the 172.30.X.Y range shall be called the bridge source address. The format for the bridge --override-multicast-sender-ip argument is:

PowerShell

```powershell
--override-multicast-sender-ip <bridge-source-address> --last-leg
```

Example: Bridge Type 2 from two multicast groups to a cloudSwXtch

In this example, the system is configured such that:

- cloudSwXtch is at 10.2.192.7 (data plane) and this IP address is reachable from the machine running the swxtch-bridge application.
- NIC IP address which the swxtch-bridge will use for receiving multicast traffic is at 169.192.0.4
- The multicast groups are 239.1.1.4:8804 and 239.1.1.1:8801
- The bridge source address was chosen to be 172.30.1.1

Example command to run the bridge:

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

PowerShell Copy

```
swxtch-bridge --input
multicast://239.1.1.4:169.192.0.4:8804,multicast://239.1.1.1:169.192.0.4:8801 --output
udp://10.2.192.7:9999 --override-multicast-sender-ip 172.30.1.1 --last-leg
```

> NOTE:
> The bridge application assigns itself to use CPU cores 1 and 2 by default. This can be changed using the following command line parameters:
>
> PowerShell Copy
>
> ```
> --core 1 --core-count 2
> ```
>
> Where core sets the starting core index (from 0) and core-count sets the number of cores to use.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Protocol Conversion and Fanout

Configuring Protocol Conversion and Fanout

There are two options for configuring Protocol Conversion and Fanout: via wXcked Eye or via the API. For more information, please see the following articles:

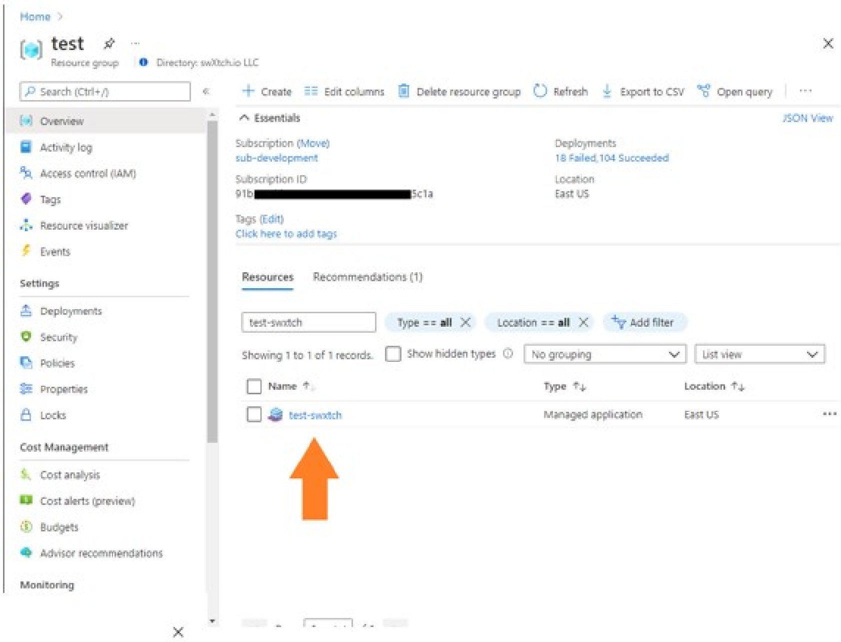
- Protocol Conversion and Fanout with wXcked Eye
- Configuration API

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

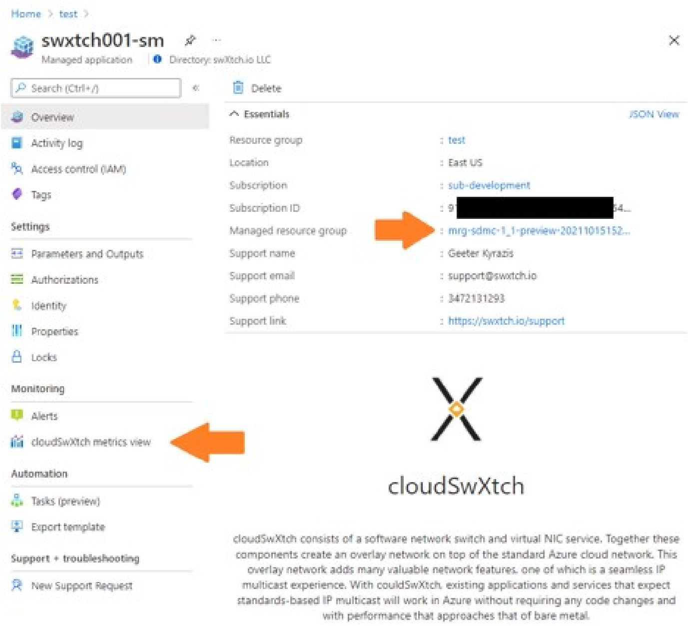
Azure Monitoring

cloudSwXtch instances will show up in your Azure Resource Groups as “Managed applications” with the name given during creation. For example, the below image shows a cloudSwXtch instance with the name “test-switch” in the resource group “test”.

When you click on a cloudSwXtch instance in a resource group, you are taken to the cloudSwXtch information page for that instance. From this page you can view properties and other standard Azure component screens.



In addition to the standard Azure component sections, this screen has two sections that are unique to the cloudSwXtch managed application: metrics view and managed application resource group.



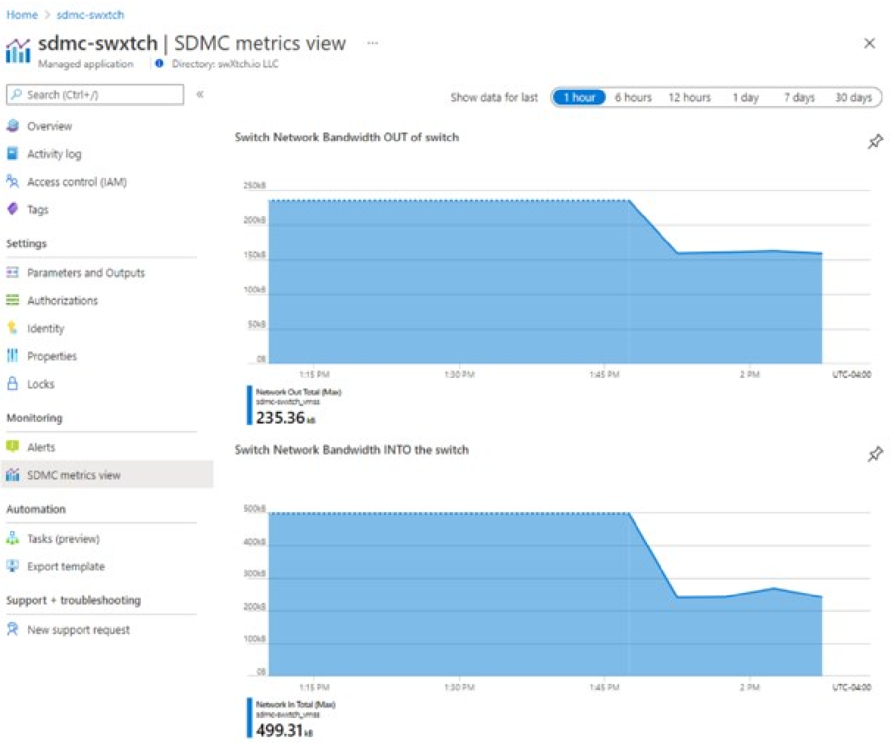
cloudSwXtch metrics view

The metrics view shows two simple graphs of the network activity of the cloudSwXtch instance. The metrics available are the total bandwidth into and out of the instance. The bandwidth units change based on the timescale chosen.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

NOTE:

due to Azure idiosyncrasies, the metrics view will first show up around 15 minutes or so after a cloudSwXtch instance is first created. The swxtch-top application can be used immediately.



Managed resource group

The cloudSwXtch product is delivered as a “managed application”. This means that a cloudSwXtch instance lives within the customer’s subscription and is made up of Azure resources (VMs, etc.) that are instantiated within the same subscription. These resources are directly billed to the subscription owner.

PRO TIP:

When a cloudSwXtch instance is created, it is assigned to the resource group selected by the creator and to an auto-generated resource group that holds the low-level components needed to compose the managed application. The creator of the instance has full access to the resource group that holds the instance and partial access to the auto-generated managed application resource group. The partial access allows the creator to see the various components and view their properties and metrics. It does not, however, allow the creator access to the internal VM instances that make up the managed application. The creator cannot directly control these resources from the portal, except to start/stop the VM.
For more details see:
[Azure managed applications overview]

Figure 2 - SDMC metrics view

Changing xNIC configuration settings

All xNIC configuration values are normally set by the xNIC installation script. If manual changes are made to the configuration values, the xNIC service must be restarted:

`sudo systemctl restart swxtch-xnic`

The configuration settings for the xNIC are located at:

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

- Linux: `/var/opt/swxtch/swxtch-xnic.conf`
- Windows: `<tdb>`

The configuration file is a simple text file in `*.ini` format. The following values are available:

Key Name	Default value	Description and notes
SvcAddr	<ip-of-instance>	IPv4 address of the cloudSwXtch instance.
SvcPort	10802	Control port on cloudSwXtch instance.
VirtualInterfaceName	"swxtch-tun"	Base name of the virtual network interface. Must be < 15 characters.
VirtualInterfaceIpAddr	"172.30.0.0"	IPv4 subnet of the virtual network interface as seen from the host applications
VirtualInterfaceSubnet	"255.255.0.0"	IPv4 subnet mask
CtrlInterface	"eth0"	Network interface to use for control plane traffic.
DataInterface	"eth1"	Network interface to use for data plane traffic.
CtrlPort	10800	Local port used for control traffic *from* the SDMC switch
DataPort	9999	Local port used for data traffic *from* the SDMC switch

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Prometheus Monitoring

WHAT TO EXPECT
In this article, users will learn how to integrate Prometheus and Grafana as an additional way to monitor their cloudSwXtch environment.

PREREQUISITES
The following process assumes that you already have Prometheus and Grafana installed in a docker container.

STEP ONE: Validate cloudSwXtch can create Prometheus data

On the cloudSwXtch VM, run the following command:

Plaintext

```
curl http://localhost/prometheus/metrics
```

The output will list information about each metric with example output data. Metrics starting with swx_core are from the cloudSwXtch while metrics starting with swx_xnic are from xNICs. Since this example has only one cloudSwXtch but many VMs with xNICs, the xNIC data has multiple sample rows. Note that for brevity some of the xNIC rows returned have been deleted.

PowerShell

```
# HELP swx_core_droppedPacketCountByByteLimit Bytes dropped in the swXtch
# TYPE swx_core_droppedPacketCountByByteLimit counter
swx_core_droppedPacketCountByByteLimit{category="swxtch_repl",host="10.2.192.23"} 0
# HELP swx_core_droppedPacketCountByPacketLimit Packets dropped in the swXtch
# TYPE swx_core_droppedPacketCountByPacketLimit counter
swx_core_droppedPacketCountByPacketLimit{category="swxtch_repl",host="10.2.192.23"} 0
# HELP swx_core_rxBridgeByteCount Bridge bytes received into the swXtch
# TYPE swx_core_rxBridgeByteCount counter
swx_core_rxBridgeByteCount{category="swxtch_repl",host="10.2.192.23"} 0
# HELP swx_core_rxBridgePacketCount Bridge packets received into the swXtch
# TYPE swx_core_rxBridgePacketCount counter
swx_core_rxBridgePacketCount{category="swxtch_repl",host="10.2.192.23"} 0
# HELP swx_core_rxByteCount Bytes received into the swXtch
# TYPE swx_core_rxByteCount counter
swx_core_rxByteCount{category="swxtch_repl",host="10.2.192.23"} 2.97954346e+09
# HELP swx_core_rxMeshByteCount Mesh bytes received into the swXtch
# TYPE swx_core_rxMeshByteCount counter
swx_core_rxMeshByteCount{category="swxtch_repl",host="10.2.192.23"} 0
# HELP swx_core_rxMeshPacketCount Mesh packets received into the swXtch
# TYPE swx_core_rxMeshPacketCount counter
swx_core_rxMeshPacketCount{category="swxtch_repl",host="10.2.192.23"} 0
# HELP swx_core_rxPacketCount Packets received into the swXtch
# TYPE swx_core_rxPacketCount counter
swx_core_rxPacketCount{category="swxtch_repl",host="10.2.192.23"} 2.128647e+06
# HELP swx_core_rxUnicastByteCount Unicast bytes received into the swXtch
# TYPE swx_core_rxUnicastByteCount counter
swx_core_rxUnicastByteCount{category="swxtch_repl",host="10.2.192.23"} 0
# HELP swx_core_rxUnicastPacketCount Unicast packets received into the swXtch
# TYPE swx_core_rxUnicastPacketCount counter
```

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

```
swx_core_rxUnicastPacketCount{category="swxtch_repl",host="10.2.192.23"} 0
# HELP swx_core_sequence swXtch sequence number
# TYPE swx_core_sequence counter
swx_core_sequence{category="swxtch_repl",host="10.2.192.23"} 7308
# HELP swx_core_txBridgeByteCount Bridge bytes sent from the swXtch
# TYPE swx_core_txBridgeByteCount counter
swx_core_txBridgeByteCount{category="swxtch_repl",host="10.2.192.23"} 0
# HELP swx_core_txBridgePacketCount Bridge packets sent from the swXtch
# TYPE swx_core_txBridgePacketCount counter
swx_core_txBridgePacketCount{category="swxtch_repl",host="10.2.192.23"} 0
# HELP swx_core_txByteCount Bytes sent from the swXtch
# TYPE swx_core_txByteCount counter
swx_core_txByteCount{category="swxtch_repl",host="10.2.192.23"} 6.917285867e+09
# HELP swx_core_txMeshByteCount Mesh bytes sent from the swXtch
# TYPE swx_core_txMeshByteCount counter
swx_core_txMeshByteCount{category="swxtch_repl",host="10.2.192.23"} 0
# HELP swx_core_txMeshPacketCount Mesh packets sent from the swXtch
# TYPE swx_core_txMeshPacketCount counter
swx_core_txMeshPacketCount{category="swxtch_repl",host="10.2.192.23"} 0
# HELP swx_core_txPacketCount Packets sent from the swXtch
# TYPE swx_core_txPacketCount counter
swx_core_txPacketCount{category="swxtch_repl",host="10.2.192.23"} 4.939906e+06
# HELP swx_core_txUnicastByteCount Unicast bytes sent from the swXtch
# TYPE swx_core_txUnicastByteCount counter
swx_core_txUnicastByteCount{category="swxtch_repl",host="10.2.192.23"} 0
# HELP swx_core_txUnicastPacketCount Unicast packets sent from the swXtch
# TYPE swx_core_txUnicastPacketCount counter
swx_core_txUnicastPacketCount{category="swxtch_repl",host="10.2.192.23"} 0
# HELP swx_xnic_activeConnectionCount xNIC active connections
# TYPE swx_xnic_activeConnectionCount gauge
swx_xnic_activeConnectionCount{category="swxtch_xnic",cloudSwxtchVersion="dev.release_2_
1.v1",host="DSd-agent-204",hostAddress="10.5.1.7",osDistribution="Windows Server 2019
Datacenter - Microsoft Windows [Version 10.0.17763.5206]",xNicMode="HA",xNicType="t2"} 2
swx_xnic_activeConnectionCount{category="swxtch_xnic",cloudSwxtchVersion="dev.v2_0_89_pr
ometheus.v4",host="aks-nodepool1-23164585-
vmss00000I",hostAddress="10.2.128.100",osDistribution="Ubuntu
20.04",xNicMode="Normal",xNicType="t2"} 1
swx_xnic_activeConnectionCount{category="swxtch_xnic",cloudSwxtchVersion="dev.v2_0_89_pr
ometheus.v4",host="aks-nodepool1-23164585-
vmss00000J",hostAddress="10.2.128.101",osDistribution="Ubuntu
20.04",xNicMode="Normal",xNicType="t2"} 1
swx_xnic_activeConnectionCount{category="swxtch_xnic",cloudSwxtchVersion="dev.v2_0_89_pr
ometheus.v7",host="DSd-agent-101",hostAddress="10.2.128.6",osDistribution="Ubuntu
20.04",xNicMode="Normal",xNicType="t2"} 1
swx_xnic_activeConnectionCount{category="swxtch_xnic",cloudSwxtchVersion="dev.v2_0_89_pr
ometheus.v7",host="DSd-agent-102",hostAddress="10.2.128.13",osDistribution="Ubuntu
20.04",xNicMode="Normal",xNicType="t2"} 1
swx_xnic_activeConnectionCount{category="swxtch_xnic",cloudSwxtchVersion="dev.v2_0_89_pr
ometheus.v7",host="DSd-agent-104",hostAddress="10.2.128.75",osDistribution="Windows
Server 2019 Datacenter - Microsoft Windows [Version
10.0.17763.5122]",xNicMode="Normal",xNicType="t2"} 1
swx_xnic_activeConnectionCount{category="swxtch_xnic",cloudSwxtchVersion="dev.v2_0_89_pr
ometheus.v7",host="DSd-agent-105",hostAddress="10.2.128.15",osDistribution="Windows
Server 2019 Datacenter - Microsoft Windows [Version
10.0.17763.5206]",xNicMode="Normal",xNicType="t2"} 1
swx_xnic_activeConnectionCount{category="swxtch_xnic",cloudSwxtchVersion="dev.v2_0_89_pr
```

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

```
ometheus.v7",host="DSd-agent-106",hostAddress="10.2.128.44",osDistribution="Windows
Server 2019 Datacenter - Microsoft Windows [Version
10.0.17763.5206]",xNicMode="Normal",xNicType="t2"} 1
swx_xnic_activeConnectionCount{category="swxtch_xnic",cloudSwxtchVersion="dev.v2_0_89_pr
ometheus.v7",host="aks-nodepool1-23164585-
vmss00000K",hostAddress="10.2.128.101",osDistribution="Ubuntu
20.04",xNicMode="Normal",xNicType="t2"} 1
swx_xnic_activeConnectionCount{category="swxtch_xnic",cloudSwxtchVersion="dev.v2_0_89_pr
ometheus.v7",host="aks-nodepool1-23164585-
vmss00000L",hostAddress="10.2.128.100",osDistribution="Ubuntu
20.04",xNicMode="Normal",xNicType="t2"} 1
# HELP swx_xnic_byteCounters_rxMulticastCount Multicast bytes received from the swXtch
into the xNIC
# TYPE swx_xnic_byteCounters_rxMulticastCount counter
swx_xnic_byteCounters_rxMulticastCount{category="swxtch_xnic",host="DSd-agent-101"}
7.7451617e+07
swx_xnic_byteCounters_rxMulticastCount{category="swxtch_xnic",host="DSd-agent-102"}
7.7451617e+07
swx_xnic_byteCounters_rxMulticastCount{category="swxtch_xnic",host="DSd-agent-104"} 1491
swx_xnic_byteCounters_rxMulticastCount{category="swxtch_xnic",host="DSd-agent-105"}
7.6501858e+07
swx_xnic_byteCounters_rxMulticastCount{category="swxtch_xnic",host="DSd-agent-106"}
7.6507703e+07
swx_xnic_byteCounters_rxMulticastCount{category="swxtch_xnic",host="DSd-agent-204"}
1.12009024e+08
swx_xnic_byteCounters_rxMulticastCount{category="swxtch_xnic",host="aks-nodepool1-
23164585-vmss00000I"} 1.654719409e+09
swx_xnic_byteCounters_rxMulticastCount{category="swxtch_xnic",host="aks-nodepool1-
23164585-vmss00000J"} 1.658995603e+09
swx_xnic_byteCounters_rxMulticastCount{category="swxtch_xnic",host="aks-nodepool1-
23164585-vmss00000K"} 7.3200593e+07
swx_xnic_byteCounters_rxMulticastCount{category="swxtch_xnic",host="aks-nodepool1-
23164585-vmss00000L"} 7.4302399e+07
# HELP swx_xnic_byteCounters_rxTotalCount Total bytes received from the swXtch into the
xNIC
# TYPE swx_xnic_byteCounters_rxTotalCount counter
swx_xnic_byteCounters_rxTotalCount{category="swxtch_xnic",host="DSd-agent-101"}
7.9263137e+07
swx_xnic_byteCounters_rxTotalCount{category="swxtch_xnic",host="DSd-agent-102"}
7.9263137e+07
swx_xnic_byteCounters_rxTotalCount{category="swxtch_xnic",host="DSd-agent-104"} 1747
swx_xnic_byteCounters_rxTotalCount{category="swxtch_xnic",host="DSd-agent-105"}
7.8291138e+07
swx_xnic_byteCounters_rxTotalCount{category="swxtch_xnic",host="DSd-agent-106"}
7.8296951e+07
swx_xnic_byteCounters_rxTotalCount{category="swxtch_xnic",host="DSd-agent-204"}
1.14627386e+08
swx_xnic_byteCounters_rxTotalCount{category="swxtch_xnic",host="aks-nodepool1-23164585-
vmss00000I"} 1.693414833e+09
swx_xnic_byteCounters_rxTotalCount{category="swxtch_xnic",host="aks-nodepool1-23164585-
vmss00000J"} 1.697791027e+09
swx_xnic_byteCounters_rxTotalCount{category="swxtch_xnic",host="aks-nodepool1-23164585-
vmss00000K"} 7.4912305e+07
swx_xnic_byteCounters_rxTotalCount{category="swxtch_xnic",host="aks-nodepool1-23164585-
vmss00000L"} 7.6039935e+07
# HELP swx_xnic_byteCounters_txMulticastCount Multicast bytes sent from the xNIC into
```

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

```
the swXtch
# TYPE swx_xnic_byteCounters_txMulticastCount counter
swx_xnic_byteCounters_txMulticastCount{category="swxtch_xnic",host="DSd-agent-101"} 0
swx_xnic_byteCounters_txMulticastCount{category="swxtch_xnic",host="DSd-agent-102"} 0
swx_xnic_byteCounters_txMulticastCount{category="swxtch_xnic",host="DSd-agent-104"}
4.02533178e+08
swx_xnic_byteCounters_txMulticastCount{category="swxtch_xnic",host="DSd-agent-105"} 972
swx_xnic_byteCounters_txMulticastCount{category="swxtch_xnic",host="DSd-agent-106"} 2628
swx_xnic_byteCounters_txMulticastCount{category="swxtch_xnic",host="DSd-agent-204"}
212784
swx_xnic_byteCounters_txMulticastCount{category="swxtch_xnic",host="aks-nodepool1-
23164585-vmss00000I"} 0
swx_xnic_byteCounters_txMulticastCount{category="swxtch_xnic",host="aks-nodepool1-
23164585-vmss00000J"} 0
swx_xnic_byteCounters_txMulticastCount{category="swxtch_xnic",host="aks-nodepool1-
23164585-vmss00000K"} 0
swx_xnic_byteCounters_txMulticastCount{category="swxtch_xnic",host="aks-nodepool1-
23164585-vmss00000L"} 0
# HELP swx_xnic_byteCounters_txTotalCount Total bytes sent from the xNIC into the swXtch
# TYPE swx_xnic_byteCounters_txTotalCount counter
swx_xnic_byteCounters_txTotalCount{category="swxtch_xnic",host="DSd-agent-101"} 0
swx_xnic_byteCounters_txTotalCount{category="swxtch_xnic",host="DSd-agent-102"} 0
swx_xnic_byteCounters_txTotalCount{category="swxtch_xnic",host="DSd-agent-104"}
4.11949478e+08
swx_xnic_byteCounters_txTotalCount{category="swxtch_xnic",host="DSd-agent-105"} 1208
swx_xnic_byteCounters_txTotalCount{category="swxtch_xnic",host="DSd-agent-106"} 3440
swx_xnic_byteCounters_txTotalCount{category="swxtch_xnic",host="DSd-agent-204"} 199048
swx_xnic_byteCounters_txTotalCount{category="swxtch_xnic",host="aks-nodepool1-23164585-
vmss00000I"} 0
swx_xnic_byteCounters_txTotalCount{category="swxtch_xnic",host="aks-nodepool1-23164585-
vmss00000J"} 0
swx_xnic_byteCounters_txTotalCount{category="swxtch_xnic",host="aks-nodepool1-23164585-
vmss00000K"} 0
swx_xnic_byteCounters_txTotalCount{category="swxtch_xnic",host="aks-nodepool1-23164585-
vmss00000L"} 0
# HELP swx_xnic_latencies_count xNIC latency count
# TYPE swx_xnic_latencies_count gauge
swx_xnic_latencies_count{category="swxtch_xnic",host="DSd-agent-101"} 0
swx_xnic_latencies_count{category="swxtch_xnic",host="DSd-agent-102"} 0
swx_xnic_latencies_count{category="swxtch_xnic",host="DSd-agent-104"} 0
swx_xnic_latencies_count{category="swxtch_xnic",host="DSd-agent-105"} 0
swx_xnic_latencies_count{category="swxtch_xnic",host="DSd-agent-106"} 0
swx_xnic_latencies_count{category="swxtch_xnic",host="DSd-agent-204"} 0
swx_xnic_latencies_count{category="swxtch_xnic",host="aks-nodepool1-23164585-
vmss00000I"} 0
swx_xnic_latencies_count{category="swxtch_xnic",host="aks-nodepool1-23164585-
vmss00000J"} 0
swx_xnic_latencies_count{category="swxtch_xnic",host="aks-nodepool1-23164585-
vmss00000K"} 0
swx_xnic_latencies_count{category="swxtch_xnic",host="aks-nodepool1-23164585-
vmss00000L"} 0
# HELP swx_xnic_latencies_sum xNIC latency sum
# TYPE swx_xnic_latencies_sum gauge
swx_xnic_latencies_sum{category="swxtch_xnic",host="DSd-agent-101"} 0
swx_xnic_latencies_sum{category="swxtch_xnic",host="DSd-agent-102"} 0
swx_xnic_latencies_sum{category="swxtch_xnic",host="DSd-agent-104"} 0
```

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

```
swx_xnic_latencies_sum{category="swxtch_xnic",host="DSd-agent-105"} 0
swx_xnic_latencies_sum{category="swxtch_xnic",host="DSd-agent-106"} 0
swx_xnic_latencies_sum{category="swxtch_xnic",host="DSd-agent-204"} 0
swx_xnic_latencies_sum{category="swxtch_xnic",host="aks-nodepool1-23164585-vmss00000I"}
0
swx_xnic_latencies_sum{category="swxtch_xnic",host="aks-nodepool1-23164585-vmss00000J"}
0
swx_xnic_latencies_sum{category="swxtch_xnic",host="aks-nodepool1-23164585-vmss00000K"}
0
swx_xnic_latencies_sum{category="swxtch_xnic",host="aks-nodepool1-23164585-vmss00000L"}
0
# HELP swx_xnic_maxActiveConnections xNIC max number of active connections
# TYPE swx_xnic_maxActiveConnections gauge
swx_xnic_maxActiveConnections{category="swxtch_xnic",cloudSwxtchVersion="dev.release_2_1
.v1",host="DSd-agent-204",hostAddress="10.5.1.7",osDistribution="Windows Server 2019
Datacenter - Microsoft Windows [Version 10.0.17763.5206]",xNicMode="HA",xNicType="t2"} 2
swx_xnic_maxActiveConnections{category="swxtch_xnic",cloudSwxtchVersion="dev.v2_0_89_pro
metheus.v4",host="aks-nodepool1-23164585-
vmss00000I",hostAddress="10.2.128.100",osDistribution="Ubuntu
20.04",xNicMode="Normal",xNicType="t2"} 1
swx_xnic_maxActiveConnections{category="swxtch_xnic",cloudSwxtchVersion="dev.v2_0_89_pro
metheus.v4",host="aks-nodepool1-23164585-
vmss00000J",hostAddress="10.2.128.101",osDistribution="Ubuntu
20.04",xNicMode="Normal",xNicType="t2"} 1
swx_xnic_maxActiveConnections{category="swxtch_xnic",cloudSwxtchVersion="dev.v2_0_89_pro
metheus.v7",host="DSd-agent-101",hostAddress="10.2.128.6",osDistribution="Ubuntu
20.04",xNicMode="Normal",xNicType="t2"} 1
swx_xnic_maxActiveConnections{category="swxtch_xnic",cloudSwxtchVersion="dev.v2_0_89_pro
metheus.v7",host="DSd-agent-102",hostAddress="10.2.128.13",osDistribution="Ubuntu
20.04",xNicMode="Normal",xNicType="t2"} 1
swx_xnic_maxActiveConnections{category="swxtch_xnic",cloudSwxtchVersion="dev.v2_0_89_pro
metheus.v7",host="DSd-agent-104",hostAddress="10.2.128.75",osDistribution="Windows
Server 2019 Datacenter - Microsoft Windows [Version
10.0.17763.5122]",xNicMode="Normal",xNicType="t2"} 1
swx_xnic_maxActiveConnections{category="swxtch_xnic",cloudSwxtchVersion="dev.v2_0_89_pro
metheus.v7",host="DSd-agent-105",hostAddress="10.2.128.15",osDistribution="Windows
Server 2019 Datacenter - Microsoft Windows [Version
10.0.17763.5206]",xNicMode="Normal",xNicType="t2"} 1
swx_xnic_maxActiveConnections{category="swxtch_xnic",cloudSwxtchVersion="dev.v2_0_89_pro
metheus.v7",host="DSd-agent-106",hostAddress="10.2.128.44",osDistribution="Windows
Server 2019 Datacenter - Microsoft Windows [Version
10.0.17763.5206]",xNicMode="Normal",xNicType="t2"} 1
swx_xnic_maxActiveConnections{category="swxtch_xnic",cloudSwxtchVersion="dev.v2_0_89_pro
metheus.v7",host="aks-nodepool1-23164585-
vmss00000K",hostAddress="10.2.128.101",osDistribution="Ubuntu
20.04",xNicMode="Normal",xNicType="t2"} 1
swx_xnic_maxActiveConnections{category="swxtch_xnic",cloudSwxtchVersion="dev.v2_0_89_pro
metheus.v7",host="aks-nodepool1-23164585-
vmss00000L",hostAddress="10.2.128.100",osDistribution="Ubuntu
20.04",xNicMode="Normal",xNicType="t2"} 1
# HELP swx_xnic_packetCounters_rxDroppedCount Lost packets received from the swXtch into
the xNIC
# TYPE swx_xnic_packetCounters_rxDroppedCount counter
swx_xnic_packetCounters_rxDroppedCount{category="swxtch_xnic",host="DSd-agent-101"} 0
swx_xnic_packetCounters_rxDroppedCount{category="swxtch_xnic",host="DSd-agent-102"} 0
swx_xnic_packetCounters_rxDroppedCount{category="swxtch_xnic",host="DSd-agent-104"} 0
```

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

```
swx_xnic_packetCounters_rxDroppedCount{category="swxtch_xnic",host="DSd-agent-105"} 0
swx_xnic_packetCounters_rxDroppedCount{category="swxtch_xnic",host="DSd-agent-106"} 0
swx_xnic_packetCounters_rxDroppedCount{category="swxtch_xnic",host="DSd-agent-204"} 0
swx_xnic_packetCounters_rxDroppedCount{category="swxtch_xnic",host="aks-nodepool1-
23164585-vmss00000K"} 0
swx_xnic_packetCounters_rxDroppedCount{category="swxtch_xnic",host="aks-nodepool1-
23164585-vmss00000L"} 0
# HELP swx_xnic_packetCounters_rxMulticastCount Multicast packets received from the
swXtch into the xNIC
# TYPE swx_xnic_packetCounters_rxMulticastCount counter
swx_xnic_packetCounters_rxMulticastCount{category="swxtch_xnic",host="DSd-agent-101"}
56610
swx_xnic_packetCounters_rxMulticastCount{category="swxtch_xnic",host="DSd-agent-102"}
56610
swx_xnic_packetCounters_rxMulticastCount{category="swxtch_xnic",host="DSd-agent-104"} 8
swx_xnic_packetCounters_rxMulticastCount{category="swxtch_xnic",host="DSd-agent-105"}
55915
swx_xnic_packetCounters_rxMulticastCount{category="swxtch_xnic",host="DSd-agent-106"}
55914
swx_xnic_packetCounters_rxMulticastCount{category="swxtch_xnic",host="DSd-agent-204"}
81861
swx_xnic_packetCounters_rxMulticastCount{category="swxtch_xnic",host="aks-nodepool1-
23164585-vmss00000K"} 53491
swx_xnic_packetCounters_rxMulticastCount{category="swxtch_xnic",host="aks-nodepool1-
23164585-vmss00000L"} 54298
# HELP swx_xnic_packetCounters_rxTotalCount Total packets received from the swXtch into
the xNIC
# TYPE swx_xnic_packetCounters_rxTotalCount counter
swx_xnic_packetCounters_rxTotalCount{category="swxtch_xnic",host="DSd-agent-101"} 56610
swx_xnic_packetCounters_rxTotalCount{category="swxtch_xnic",host="DSd-agent-102"} 56610
swx_xnic_packetCounters_rxTotalCount{category="swxtch_xnic",host="DSd-agent-104"} 8
swx_xnic_packetCounters_rxTotalCount{category="swxtch_xnic",host="DSd-agent-105"} 55915
swx_xnic_packetCounters_rxTotalCount{category="swxtch_xnic",host="DSd-agent-106"} 55914
swx_xnic_packetCounters_rxTotalCount{category="swxtch_xnic",host="DSd-agent-204"} 81851
swx_xnic_packetCounters_rxTotalCount{category="swxtch_xnic",host="aks-nodepool1-
23164585-vmss00000K"} 53491
swx_xnic_packetCounters_rxTotalCount{category="swxtch_xnic",host="aks-nodepool1-
23164585-vmss00000L"} 54298
# HELP swx_xnic_packetCounters_txDroppedCount Lost packets sent from the xNIC into the
swXtch
# TYPE swx_xnic_packetCounters_txDroppedCount counter
swx_xnic_packetCounters_txDroppedCount{category="swxtch_xnic",host="DSd-agent-101"} 0
swx_xnic_packetCounters_txDroppedCount{category="swxtch_xnic",host="DSd-agent-102"} 0
swx_xnic_packetCounters_txDroppedCount{category="swxtch_xnic",host="DSd-agent-104"} 0
swx_xnic_packetCounters_txDroppedCount{category="swxtch_xnic",host="DSd-agent-105"} 0
swx_xnic_packetCounters_txDroppedCount{category="swxtch_xnic",host="DSd-agent-106"} 0
swx_xnic_packetCounters_txDroppedCount{category="swxtch_xnic",host="DSd-agent-204"} 0
swx_xnic_packetCounters_txDroppedCount{category="swxtch_xnic",host="aks-nodepool1-
23164585-vmss00000K"} 0
swx_xnic_packetCounters_txDroppedCount{category="swxtch_xnic",host="aks-nodepool1-
23164585-vmss00000L"} 0
# HELP swx_xnic_packetCounters_txIgmpCount IGMP packets sent from the xNIC into the
swXtch
# TYPE swx_xnic_packetCounters_txIgmpCount counter
swx_xnic_packetCounters_txIgmpCount{category="swxtch_xnic",host="DSd-agent-101"} 0
swx_xnic_packetCounters_txIgmpCount{category="swxtch_xnic",host="DSd-agent-102"} 0
```

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

```
swx_xnic_packetCounters_txIgmpCount{category="swxtch_xnic",host="DSd-agent-104"} 0
swx_xnic_packetCounters_txIgmpCount{category="swxtch_xnic",host="DSd-agent-105"} 0
swx_xnic_packetCounters_txIgmpCount{category="swxtch_xnic",host="DSd-agent-106"} 0
swx_xnic_packetCounters_txIgmpCount{category="swxtch_xnic",host="DSd-agent-204"} 0
swx_xnic_packetCounters_txIgmpCount{category="swxtch_xnic",host="aks-nodepool1-23164585-vmss00000K"} 0
swx_xnic_packetCounters_txIgmpCount{category="swxtch_xnic",host="aks-nodepool1-23164585-vmss00000L"} 0
# HELP swx_xnic_packetCounters_txMulticastCount Multicast packets sent from the xNIC into the swXtch
# TYPE swx_xnic_packetCounters_txMulticastCount counter
swx_xnic_packetCounters_txMulticastCount{category="swxtch_xnic",host="DSd-agent-101"} 0
swx_xnic_packetCounters_txMulticastCount{category="swxtch_xnic",host="DSd-agent-102"} 0
swx_xnic_packetCounters_txMulticastCount{category="swxtch_xnic",host="DSd-agent-104"} 294256
swx_xnic_packetCounters_txMulticastCount{category="swxtch_xnic",host="DSd-agent-105"} 4
swx_xnic_packetCounters_txMulticastCount{category="swxtch_xnic",host="DSd-agent-106"} 22
swx_xnic_packetCounters_txMulticastCount{category="swxtch_xnic",host="DSd-agent-204"} 1048
swx_xnic_packetCounters_txMulticastCount{category="swxtch_xnic",host="aks-nodepool1-23164585-vmss00000K"} 0
swx_xnic_packetCounters_txMulticastCount{category="swxtch_xnic",host="aks-nodepool1-23164585-vmss00000L"} 0
# HELP swx_xnic_packetCounters_txTotalCount Total packets sent from the xNIC into the swXtch
# TYPE swx_xnic_packetCounters_txTotalCount counter
swx_xnic_packetCounters_txTotalCount{category="swxtch_xnic",host="DSd-agent-101"} 0
swx_xnic_packetCounters_txTotalCount{category="swxtch_xnic",host="DSd-agent-102"} 0
swx_xnic_packetCounters_txTotalCount{category="swxtch_xnic",host="DSd-agent-104"} 294258
swx_xnic_packetCounters_txTotalCount{category="swxtch_xnic",host="DSd-agent-105"} 6
swx_xnic_packetCounters_txTotalCount{category="swxtch_xnic",host="DSd-agent-106"} 24
swx_xnic_packetCounters_txTotalCount{category="swxtch_xnic",host="DSd-agent-204"} 854
swx_xnic_packetCounters_txTotalCount{category="swxtch_xnic",host="aks-nodepool1-23164585-vmss00000K"} 0
swx_xnic_packetCounters_txTotalCount{category="swxtch_xnic",host="aks-nodepool1-23164585-vmss00000L"} 0
# HELP swx_xnic_rxHaCounters_egressByteCount HA bytes sent
# TYPE swx_xnic_rxHaCounters_egressByteCount counter
swx_xnic_rxHaCounters_egressByteCount{category="swxtch_xnic",host="DSd-agent-204",index="0"} 1.146135e+08
# HELP swx_xnic_rxHaCounters_egressPacketCount HA packets sent
# TYPE swx_xnic_rxHaCounters_egressPacketCount counter
swx_xnic_rxHaCounters_egressPacketCount{category="swxtch_xnic",host="DSd-agent-204",index="0"} 81750
# HELP swx_xnic_rxHaCounters_enqueueFailureCount HA enqueue failure count
# TYPE swx_xnic_rxHaCounters_enqueueFailureCount counter
swx_xnic_rxHaCounters_enqueueFailureCount{category="swxtch_xnic",host="DSd-agent-204",index="0"} 0
# HELP swx_xnic_rxHaCounters_outputStreamLossCount HA output stream lose packets
# TYPE swx_xnic_rxHaCounters_outputStreamLossCount counter
swx_xnic_rxHaCounters_outputStreamLossCount{category="swxtch_xnic",host="DSd-agent-204",index="0"} 0
# HELP swx_xnic_rxHaCounters_paths_ingressByteCount Bytes received
# TYPE swx_xnic_rxHaCounters_paths_ingressByteCount counter
swx_xnic_rxHaCounters_paths_ingressByteCount{category="swxtch_xnic",host="DSd-agent-204",index="0"} 1.146135e+08
```

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

```
# HELP swx_xnic_rxHaCounters_paths_ingressPacketCount Packets received
# TYPE swx_xnic_rxHaCounters_paths_ingressPacketCount counter
swx_xnic_rxHaCounters_paths_ingressPacketCount{category="swxtch_xnic",host="DSd-agent-
204",index="0"} 81750
# HELP swx_xnic_rxHaCounters_paths_missingPacketCount Packets missing
# TYPE swx_xnic_rxHaCounters_paths_missingPacketCount counter
swx_xnic_rxHaCounters_paths_missingPacketCount{category="swxtch_xnic",host="DSd-agent-
204",index="0"} 0
# HELP swx_xnic_rxHaCounters_paths_usedPacketCount Packets used
# TYPE swx_xnic_rxHaCounters_paths_usedPacketCount counter
swx_xnic_rxHaCounters_paths_usedPacketCount{category="swxtch_xnic",host="DSd-agent-
204",index="0"} 81750
# HELP swx_xnic_rxMulticastGroups_byteCount Bytes
# TYPE swx_xnic_rxMulticastGroups_byteCount counter
swx_xnic_rxMulticastGroups_byteCount{category="swxtch_xnic",cloudSwxtchVersion="dev.v2_0
_89_prometheus.v7",groupIp="10.2.131.255",host="aks-nodepool1-23164585-
vmss00000K",hostAddress="10.2.128.101",index="1",osDistribution="Ubuntu
20.04",xNicType="t2"} 620
swx_xnic_rxMulticastGroups_byteCount{category="swxtch_xnic",cloudSwxtchVersion="dev.v2_0
_89_prometheus.v7",groupIp="239.1.1.1",host="DSd-agent-
101",hostAddress="10.2.128.6",index="10",osDistribution="Ubuntu 20.04",xNicType="t2"}
1250
swx_xnic_rxMulticastGroups_byteCount{category="swxtch_xnic",cloudSwxtchVersion="dev.v2_0
_89_prometheus.v7",groupIp="239.1.1.1",host="DSd-agent-
102",hostAddress="10.2.128.13",index="0",osDistribution="Ubuntu 20.04",xNicType="t2"}
5.150948e+06
swx_xnic_rxMulticastGroups_byteCount{category="swxtch_xnic",cloudSwxtchVersion="dev.v2_0
_89_prometheus.v7",groupIp="239.1.1.1",host="DSd-agent-
105",hostAddress="10.2.128.15",index="0",osDistribution="Windows Server 2019 Datacenter
- Microsoft Windows [Version 10.0.17763.5206]",xNicType="t2"} 1.0791194e+07
swx_xnic_rxMulticastGroups_byteCount{category="swxtch_xnic",cloudSwxtchVersion="dev.v2_0
_89_prometheus.v7",groupIp="239.1.1.1",host="DSd-agent-
106",hostAddress="10.2.128.44",index="10",osDistribution="Windows Server 2019 Datacenter
- Microsoft Windows [Version 10.0.17763.5206]",xNicType="t2"} 1.5448638e+07
# HELP swx_xnic_rxMulticastGroups_packetCount Packets
# TYPE swx_xnic_rxMulticastGroups_packetCount counter
swx_xnic_rxMulticastGroups_packetCount{category="swxtch_xnic",cloudSwxtchVersion="dev.re
lease_2_1.v1",groupIp="224.0.0.251",host="DSd-agent-
204",hostAddress="10.5.1.7",index="2",osDistribution="Windows Server 2019 Datacenter -
Microsoft Windows [Version 10.0.17763.5206]",xNicType="t2"} 7
swx_xnic_rxMulticastGroups_packetCount{category="swxtch_xnic",cloudSwxtchVersion="dev.v2
_0_89_prometheus.v4",groupIp="10.2.131.255",host="aks-nodepool1-23164585-
vmss00000I",hostAddress="10.2.128.100",index="141",osDistribution="Ubuntu
20.04",xNicType="t2"} 11
swx_xnic_rxMulticastGroups_packetCount{category="swxtch_xnic",cloudSwxtchVersion="dev.v2
_0_89_prometheus.v7",groupIp="10.2.131.255",host="DSd-agent-
101",hostAddress="10.2.128.6",index="14",osDistribution="Ubuntu 20.04",xNicType="t2"} 2
swx_xnic_rxMulticastGroups_packetCount{category="swxtch_xnic",cloudSwxtchVersion="dev.v2
_0_89_prometheus.v7",groupIp="10.2.131.255",host="DSd-agent-
102",hostAddress="10.2.128.13",index="11",osDistribution="Ubuntu 20.04",xNicType="t2"} 2
swx_xnic_rxMulticastGroups_packetCount{category="swxtch_xnic",cloudSwxtchVersion="dev.v2
_0_89_prometheus.v7",groupIp="10.2.131.255",host="DSd-agent-
104",hostAddress="10.2.128.75",index="0",osDistribution="Windows Server 2019 Datacenter
- Microsoft Windows [Version 10.0.17763.5122]",xNicType="t2"} 2
swx_xnic_rxMulticastGroups_packetCount{category="swxtch_xnic",cloudSwxtchVersion="dev.v2
_0_89_prometheus.v7",groupIp="10.2.131.255",host="DSd-agent-
```

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

```
105",hostAddress="10.2.128.15",index="2",osDistribution="Windows Server 2019 Datacenter
- Microsoft Windows [Version 10.0.17763.5206]",xNicType="t2"} 2
swx_xnic_rxMulticastGroups_packetCount{category="swxtch_xnic",cloudSwxtchVersion="dev.v2
_0_89_prometheus.v7",groupIp="10.2.131.255",host="DSd-agent-
106",hostAddress="10.2.128.44",index="1",osDistribution="Windows Server 2019 Datacenter
- Microsoft Windows [Version 10.0.17763.5206]",xNicType="t2"} 5
swx_xnic_rxMulticastGroups_packetCount{category="swxtch_xnic",cloudSwxtchVersion="dev.v2
_0_89_prometheus.v7",groupIp="10.2.131.255",host="aks-nodepool1-23164585-
vmss00000K",hostAddress="10.2.128.101",index="1",osDistribution="Ubuntu
20.04",xNicType="t2"} 5
swx_xnic_rxMulticastGroups_packetCount{category="swxtch_xnic",cloudSwxtchVersion="dev.v2
_0_89_prometheus.v7",groupIp="10.2.131.255",host="aks-nodepool1-23164585-
vmss00000K",hostAddress="10.2.128.101",index="8",osDistribution="Ubuntu
20.04",xNicType="t2"} 1
swx_xnic_rxMulticastGroups_packetCount{category="swxtch_xnic",cloudSwxtchVersion="dev.v2
_0_89_prometheus.v7",groupIp="10.2.131.255",host="aks-nodepool1-23164585-
vmss00000L",hostAddress="10.2.128.100",index="13",osDistribution="Ubuntu
20.04",xNicType="t2"} 5
swx_xnic_rxMulticastGroups_packetCount{category="swxtch_xnic",cloudSwxtchVersion="dev.v2
_0_89_prometheus.v7",groupIp="10.2.131.255",host="aks-nodepool1-23164585-
vmss00000L",hostAddress="10.2.128.100",index="7",osDistribution="Ubuntu
20.04",xNicType="t2"} 1
# HELP swx_xnic_timestamp Unix timestamp
# TYPE swx_xnic_timestamp counter
swx_xnic_timestamp{category="swxtch_xnic",cloudSwxtchVersion="dev.release_2_1.v1",host="
DSd-agent-204",hostAddress="10.5.1.7",osDistribution="Windows Server 2019 Datacenter -
Microsoft Windows [Version 10.0.17763.5206]",xNicMode="HA",xNicType="t2"}
1.7024832015879683e+18
swx_xnic_timestamp{category="swxtch_xnic",cloudSwxtchVersion="dev.v2_0_89_prometheus.v4",
host="aks-nodepool1-23164585-
vmss00000I",hostAddress="10.2.128.100",osDistribution="Ubuntu
20.04",xNicMode="Normal",xNicType="t2"} 1.70249158330441e+18
swx_xnic_timestamp{category="swxtch_xnic",cloudSwxtchVersion="dev.v2_0_89_prometheus.v4",
host="aks-nodepool1-23164585-
vmss00000J",hostAddress="10.2.128.101",osDistribution="Ubuntu
20.04",xNicMode="Normal",xNicType="t2"} 1.7024915840198095e+18
swx_xnic_timestamp{category="swxtch_xnic",cloudSwxtchVersion="dev.v2_0_89_prometheus.v7",
host="DSd-agent-101",hostAddress="10.2.128.6",osDistribution="Ubuntu
20.04",xNicMode="Normal",xNicType="t2"} 1.7024932475638725e+18
swx_xnic_timestamp{category="swxtch_xnic",cloudSwxtchVersion="dev.v2_0_89_prometheus.v7",
host="DSd-agent-102",hostAddress="10.2.128.13",osDistribution="Ubuntu
20.04",xNicMode="Normal",xNicType="t2"} 1.7024932479053084e+18
swx_xnic_timestamp{category="swxtch_xnic",cloudSwxtchVersion="dev.v2_0_89_prometheus.v7",
host="DSd-agent-104",hostAddress="10.2.128.75",osDistribution="Windows Server 2019
Datacenter - Microsoft Windows [Version
10.0.17763.5122]",xNicMode="Normal",xNicType="t2"} 1.7024932476848394e+18
swx_xnic_timestamp{category="swxtch_xnic",cloudSwxtchVersion="dev.v2_0_89_prometheus.v7",
host="DSd-agent-105",hostAddress="10.2.128.15",osDistribution="Windows Server 2019
Datacenter - Microsoft Windows [Version
10.0.17763.5206]",xNicMode="Normal",xNicType="t2"} 1.7024932470683958e+18
swx_xnic_timestamp{category="swxtch_xnic",cloudSwxtchVersion="dev.v2_0_89_prometheus.v7",
host="DSd-agent-106",hostAddress="10.2.128.44",osDistribution="Windows Server 2019
Datacenter - Microsoft Windows [Version
10.0.17763.5206]",xNicMode="Normal",xNicType="t2"} 1.702493248257358e+18
swx_xnic_timestamp{category="swxtch_xnic",cloudSwxtchVersion="dev.v2_0_89_prometheus.v7",
host="aks-nodepool1-23164585-
```

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

```
vmss00000K",hostAddress="10.2.128.101",osDistribution="Ubuntu
20.04",xNicMode="Normal",xNicType="t2"} 1.702493248745294e+18
swx_xnic_timestamp{category="swxtch_xnic",cloudSwxtchVersion="dev.v2_0_89_prometheus.v7",
host="aks-nodepool1-23164585-
vmss00000L",hostAddress="10.2.128.100",osDistribution="Ubuntu
20.04",xNicMode="Normal",xNicType="t2"} 1.7024932480324667e+18
# HELP swx_xnic_txMulticastGroups_byteCount Bytes
# TYPE swx_xnic_txMulticastGroups_byteCount counter
swx_xnic_txMulticastGroups_byteCount{category="swxtch_xnic",cloudSwxtchVersion="dev.rele
ase_2_1.v1",groupIp="10.5.1.255",host="DSd-agent-
204",hostAddress="10.5.1.7",index="115",osDistribution="Windows Server 2019 Datacenter -
Microsoft Windows [Version 10.0.17763.5206]",xNicType="t2"} 6474
swx_xnic_txMulticastGroups_byteCount{category="swxtch_xnic",cloudSwxtchVersion="dev.rele
ase_2_1.v1",groupIp="239.255.255.250",host="DSd-agent-
204",hostAddress="10.5.1.7",index="0",osDistribution="Windows Server 2019 Datacenter -
Microsoft Windows [Version 10.0.17763.5206]",xNicType="t2"} 1160
swx_xnic_txMulticastGroups_byteCount{category="swxtch_xnic",cloudSwxtchVersion="dev.v2_0
_89_prometheus.v7",groupIp="10.2.131.255",host="DSd-agent-
104",hostAddress="10.2.128.75",index="15",osDistribution="Windows Server 2019 Datacenter
- Microsoft Windows [Version 10.0.17763.5122]",xNicType="t2"} 951
swx_xnic_txMulticastGroups_byteCount{category="swxtch_xnic",cloudSwxtchVersion="dev.v2_0
_89_prometheus.v7",groupIp="10.2.131.255",host="DSd-agent-
104",hostAddress="10.2.128.75",index="32",osDistribution="Windows Server 2019 Datacenter
- Microsoft Windows [Version 10.0.17763.5122]",xNicType="t2"} 1494
swx_xnic_txMulticastGroups_byteCount{category="swxtch_xnic",cloudSwxtchVersion="dev.v2_0
_89_prometheus.v7",groupIp="10.2.131.255",host="DSd-agent-
105",hostAddress="10.2.128.15",index="1",osDistribution="Windows Server 2019 Datacenter
- Microsoft Windows [Version 10.0.17763.5206]",xNicType="t2"} 634
swx_xnic_txMulticastGroups_byteCount{category="swxtch_xnic",cloudSwxtchVersion="dev.v2_0
_89_prometheus.v7",groupIp="10.2.131.255",host="DSd-agent-
106",hostAddress="10.2.128.44",index="1",osDistribution="Windows Server 2019 Datacenter
- Microsoft Windows [Version 10.0.17763.5206]",xNicType="t2"} 634
swx_xnic_txMulticastGroups_byteCount{category="swxtch_xnic",cloudSwxtchVersion="dev.v2_0
_89_prometheus.v7",groupIp="10.2.131.255",host="DSd-agent-
106",hostAddress="10.2.128.44",index="2",osDistribution="Windows Server 2019 Datacenter
- Microsoft Windows [Version 10.0.17763.5206]",xNicType="t2"} 1494
# HELP swx_xnic_txMulticastGroups_packetCount Packets
# TYPE swx_xnic_txMulticastGroups_packetCount counter
swx_xnic_txMulticastGroups_packetCount{category="swxtch_xnic",cloudSwxtchVersion="dev.re
lease_2_1.v1",groupIp="10.5.1.255",host="DSd-agent-
204",hostAddress="10.5.1.7",index="115",osDistribution="Windows Server 2019 Datacenter -
Microsoft Windows [Version 10.0.17763.5206]",xNicType="t2"} 39
swx_xnic_txMulticastGroups_packetCount{category="swxtch_xnic",cloudSwxtchVersion="dev.re
lease_2_1.v1",groupIp="10.5.1.255",host="DSd-agent-
204",hostAddress="10.5.1.7",index="79",osDistribution="Windows Server 2019 Datacenter -
Microsoft Windows [Version 10.0.17763.5206]",xNicType="t2"} 14
swx_xnic_txMulticastGroups_packetCount{category="swxtch_xnic",cloudSwxtchVersion="dev.v2
_0_89_prometheus.v7",groupIp="10.2.131.255",host="DSd-agent-
104",hostAddress="10.2.128.75",index="15",osDistribution="Windows Server 2019 Datacenter
- Microsoft Windows [Version 10.0.17763.5122]",xNicType="t2"} 3
swx_xnic_txMulticastGroups_packetCount{category="swxtch_xnic",cloudSwxtchVersion="dev.v2
_0_89_prometheus.v7",groupIp="10.2.131.255",host="DSd-agent-
104",hostAddress="10.2.128.75",index="32",osDistribution="Windows Server 2019 Datacenter
- Microsoft Windows [Version 10.0.17763.5122]",xNicType="t2"} 9
swx_xnic_txMulticastGroups_packetCount{category="swxtch_xnic",cloudSwxtchVersion="dev.v2
_0_89_prometheus.v7",groupIp="10.2.131.255",host="DSd-agent-
```

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

```
105",hostAddress="10.2.128.15",index="1",osDistribution="Windows Server 2019 Datacenter
- Microsoft Windows [Version 10.0.17763.5206]",xNicType="t2"} 2
swx_xnic_txMulticastGroups_packetCount{category="swxtch_xnic",cloudSwxtchVersion="dev.v2
_0_89_prometheus.v7",groupIp="10.2.131.255",host="DSd-agent-
106",hostAddress="10.2.128.44",index="1",osDistribution="Windows Server 2019 Datacenter
- Microsoft Windows [Version 10.0.17763.5206]",xNicType="t2"} 2
swx_xnic_txMulticastGroups_packetCount{category="swxtch_xnic",cloudSwxtchVersion="dev.v2
_0_89_prometheus.v7",groupIp="10.2.131.255",host="DSd-agent-
106",hostAddress="10.2.128.44",index="2",osDistribution="Windows Server 2019 Datacenter
- Microsoft Windows [Version 10.0.17763.5206]",xNicType="t2"} 9
swx_xnic_txMulticastGroups_packetCount{category="swxtch_xnic",cloudSwxtchVersion="dev.v2
_0_89_prometheus.v7",groupIp="10.2.195.255",host="DSd-agent-
104",hostAddress="10.2.128.75",index="24",osDistribution="Windows Server 2019 Datacenter
- Microsoft Windows [Version 10.0.17763.5122]",xNicType="t2"} 9
```

If successful (there is an output), continue on to updating your Prometheus Directory for cloudSwXtch.

STEP TWO: Update Prometheus Directory for cloudSwXtch

Attached is an example prometheus.yaml file with an cloudSwXtch job name configuration.

1. Open the example `prometheus.yml` file and copy lines 26-36.
2. Paste those lines into your existing `prometheus.yml` file.
3. Update the cloudSwXtch `targets` line that has " `127.0.0.1:80`" and put in the IP address of the cloudSwXtch in place of the localhost IP.
    1. Please note: If Prometheus and cloudSwXtch are on the same VM, then the localhost IP (127.0.0.1) will still work.

```
26  - job_name: swxtch
27    honor_timestamps: true
28    scrape_interval: 5s
29    scrape_timeout: 2s
30    metrics_path: /prometheus/metrics
31    scheme: http
32    follow_redirects: true
33    enable_http2: true
34    static_configs:
35    - targets:
36       - 127.0.0.1:80
37
```

4. Run the following docker command to run it in VM. If you decide to run it this way, you will need to run it after every reboot or when you close your window. Please use this method when testing in order to limit the amount of records added to the Prometheus database.

Plaintext Copy
```
docker run --network host -v ~/prometheus/:/etc/prometheus prom/prometheus
```

5. Use this command to run Prometheus automatically upon reboot. (Preferred method for a production environment.)

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Plaintext Copy

```
docker run --network host --restart always -v ~/prometheus/:/etc/prometheus
prom/prometheus
```

STEP THREE: Access Prometheus UI

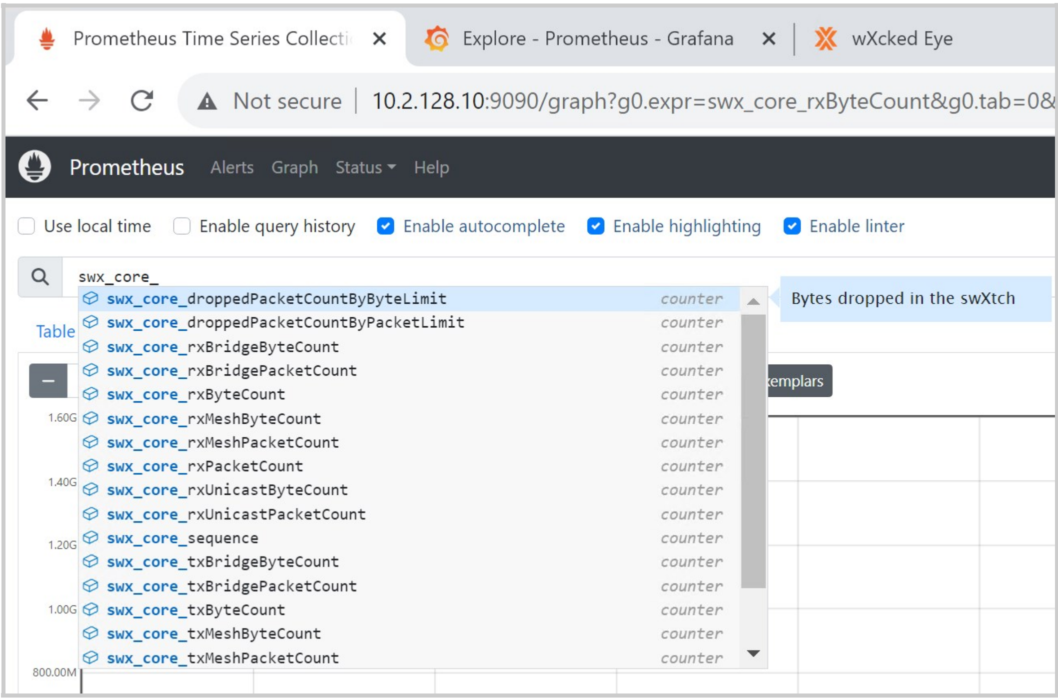
In order to access the Prometheus UI, users should open a browser on their Windows machine in the same VNET and enter the following URL:

Plaintext Copy

```
http://<prometheus-IP>:9090/
```

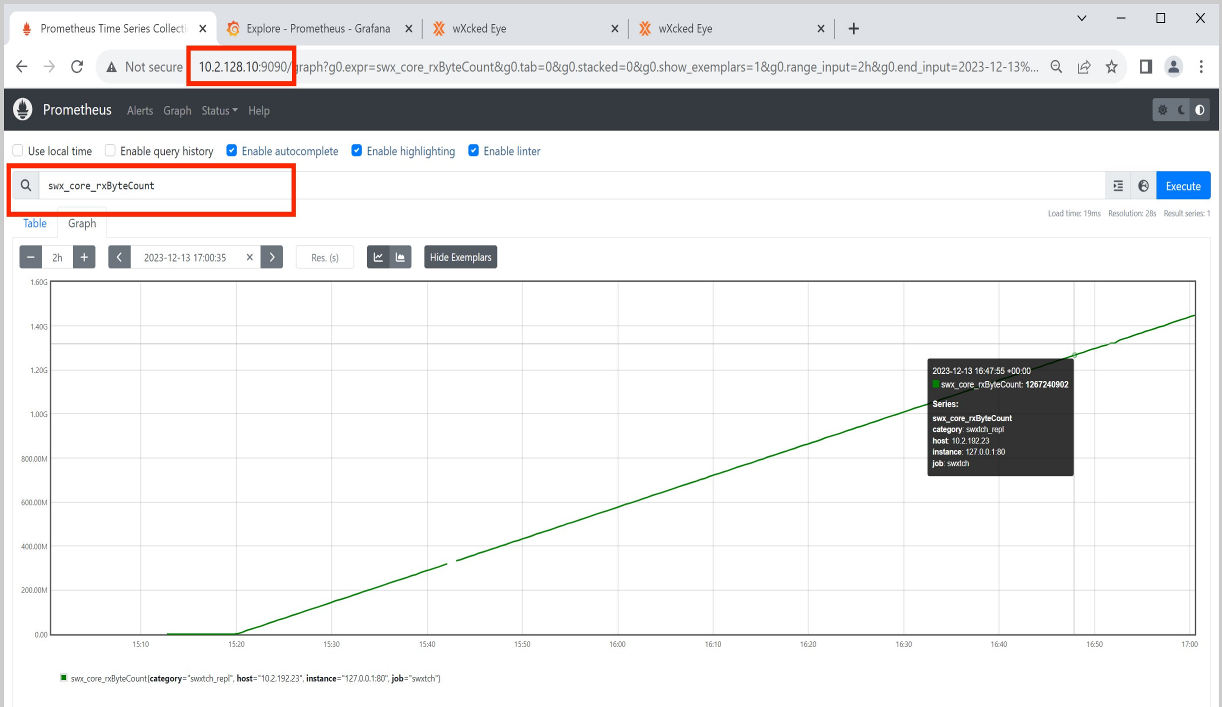
Note: Replace the <prometheus-IP> with the IP address of your Prometheus instance.

Users can enter the prefix “swx” into the search field to see a list of data fields related to the cloudSwXtch (swx_core) and its xNICs (swx_xnic).



In the example below, the user has chosen swx_core_rxByteCount as their data field.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



By selecting Execute, users will be able to populate the table with the desired data. Note: Producers and consumers must be running in order to see data. In the example above, a user can select Execute multiple times and notice that the number in the orange box grow in size.

For a list of available data fields, view the dropdown section here:

▶
prometheus/metrics

STEP FOUR: Access Grafana UI

Alternatively, users can also use Grafana as another method for viewing cloudSwXtch metrics.

1. In a Windows machine on the same VNET, open a browser and enter the following URL:

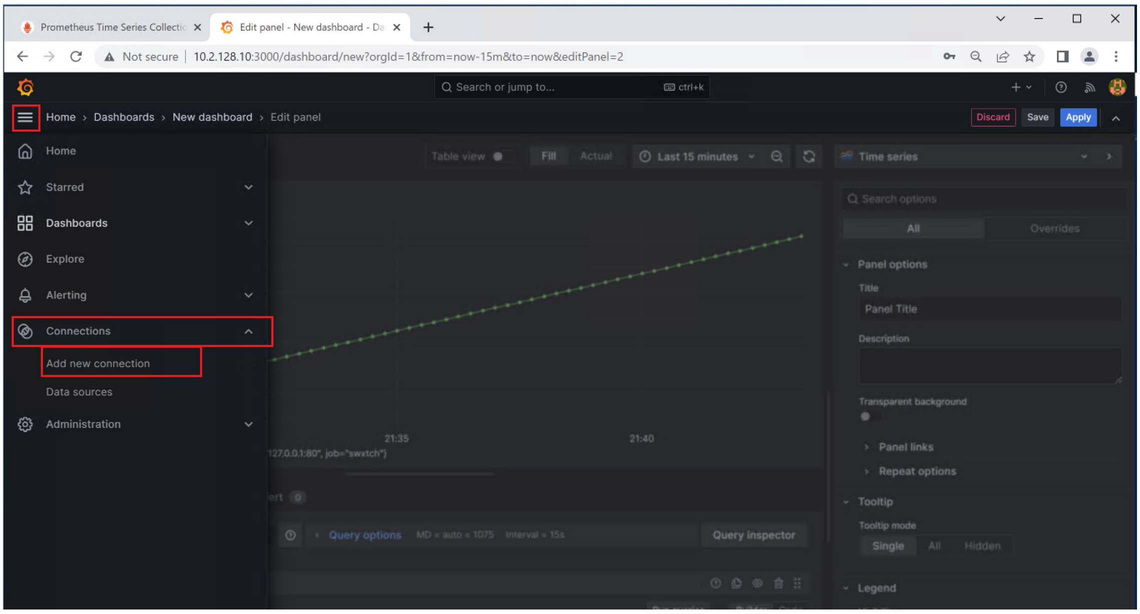
Plaintext | Copy

```
http://<Grafana-IP>:3000/
```

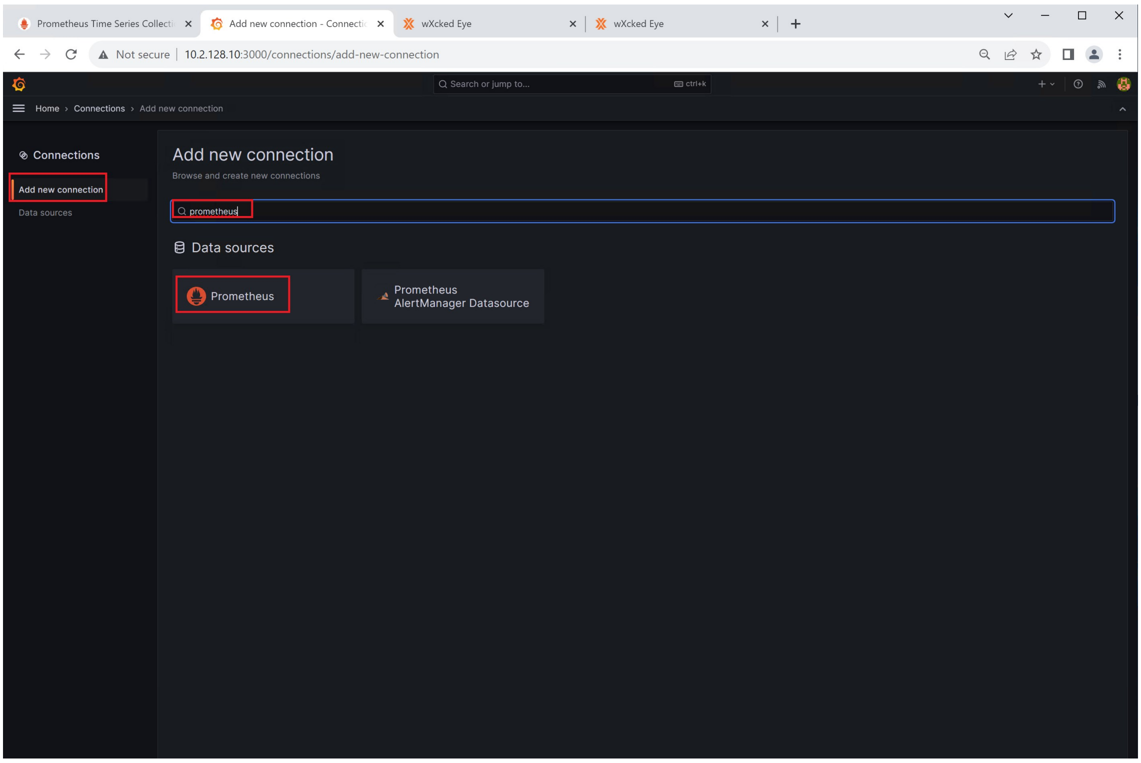
Note: Replace the <Grafana-IP> with the IP address of your Grafana instance.

2. Sign in as a user admin and the password admin.
3. Click on the three horizontal lines next to Home to get additional options.
4. Select Connection.
5. Click Add new connection.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

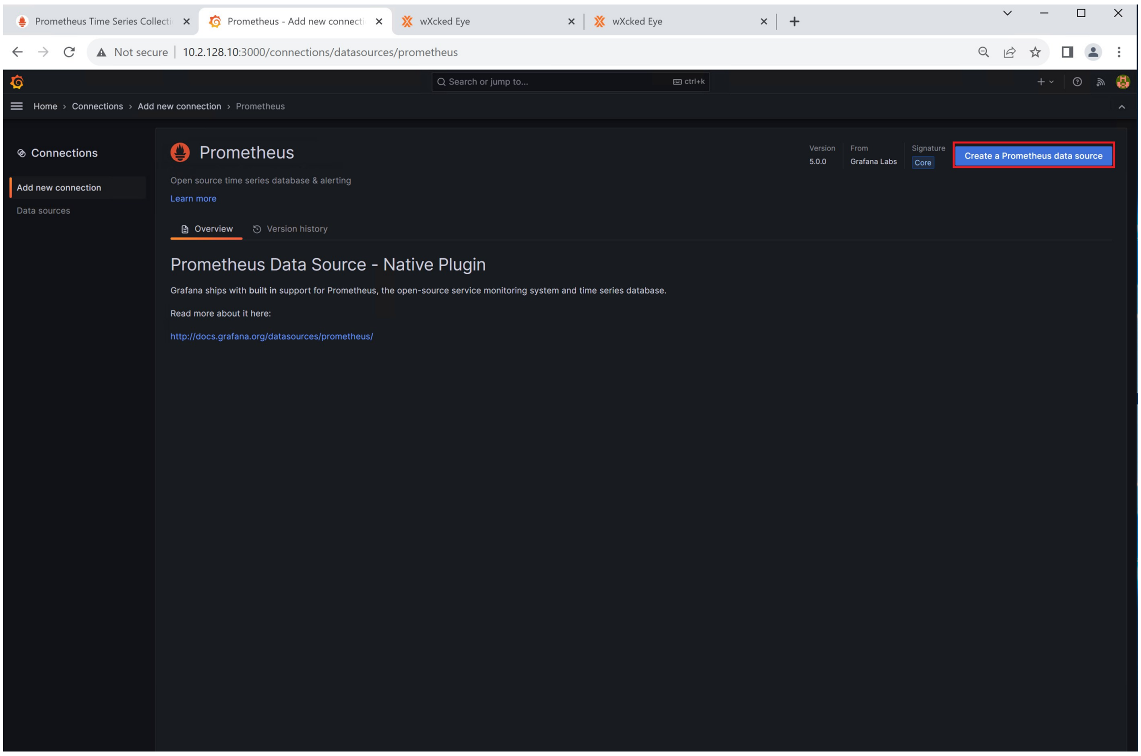


6. Search Prometheus on the Add new connection page and select it from the options.



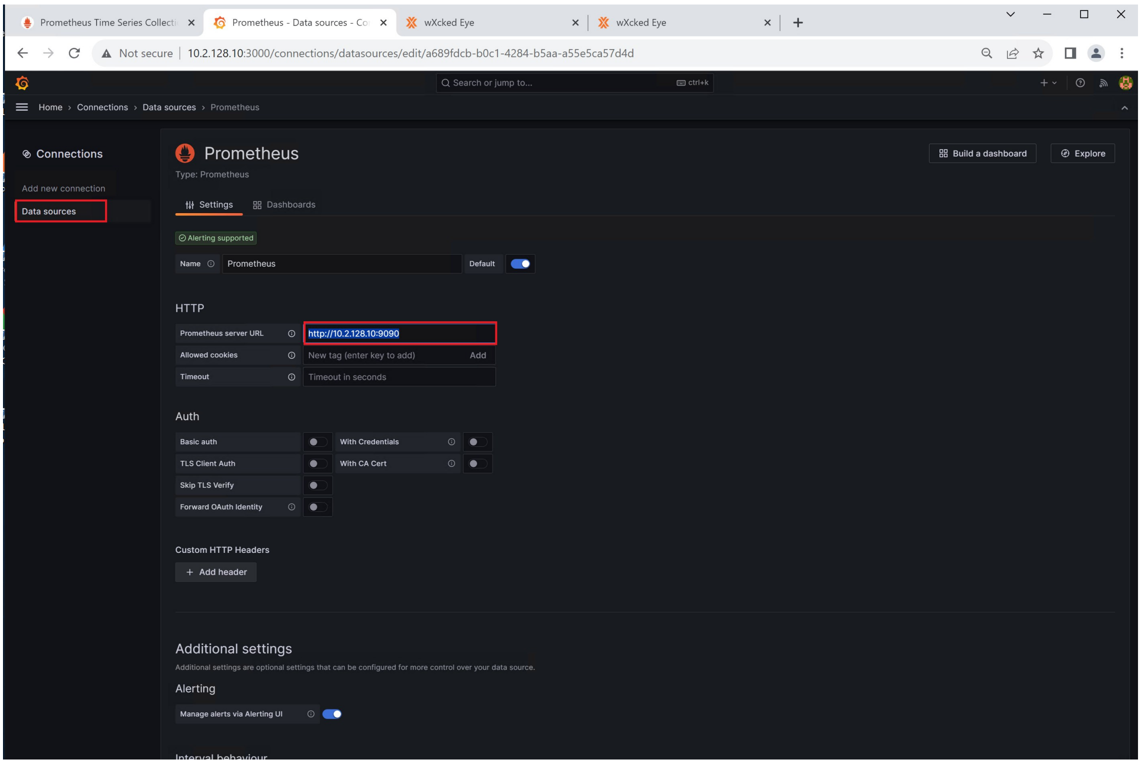
7. Click Create a Prometheus data source.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



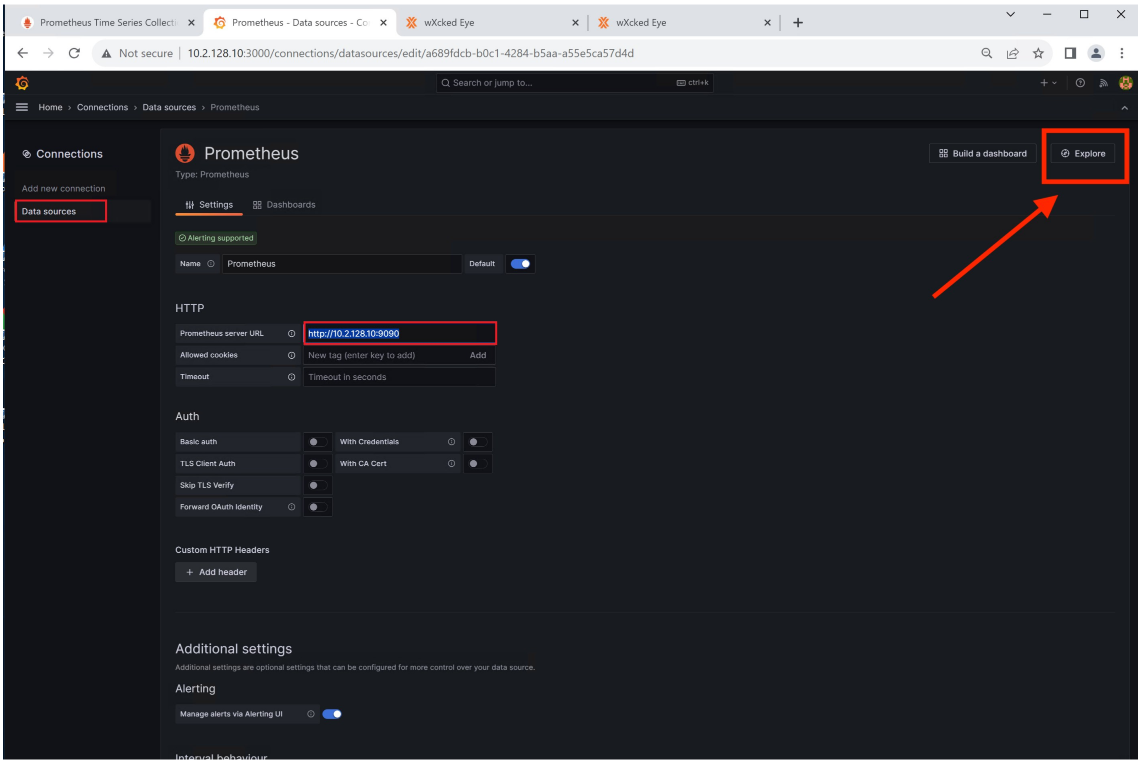
8. Go to Data Sources and select the Prometheus data source created.

9. Enter the Prometheus server URL. This should include the IP address of your Prometheus instance.

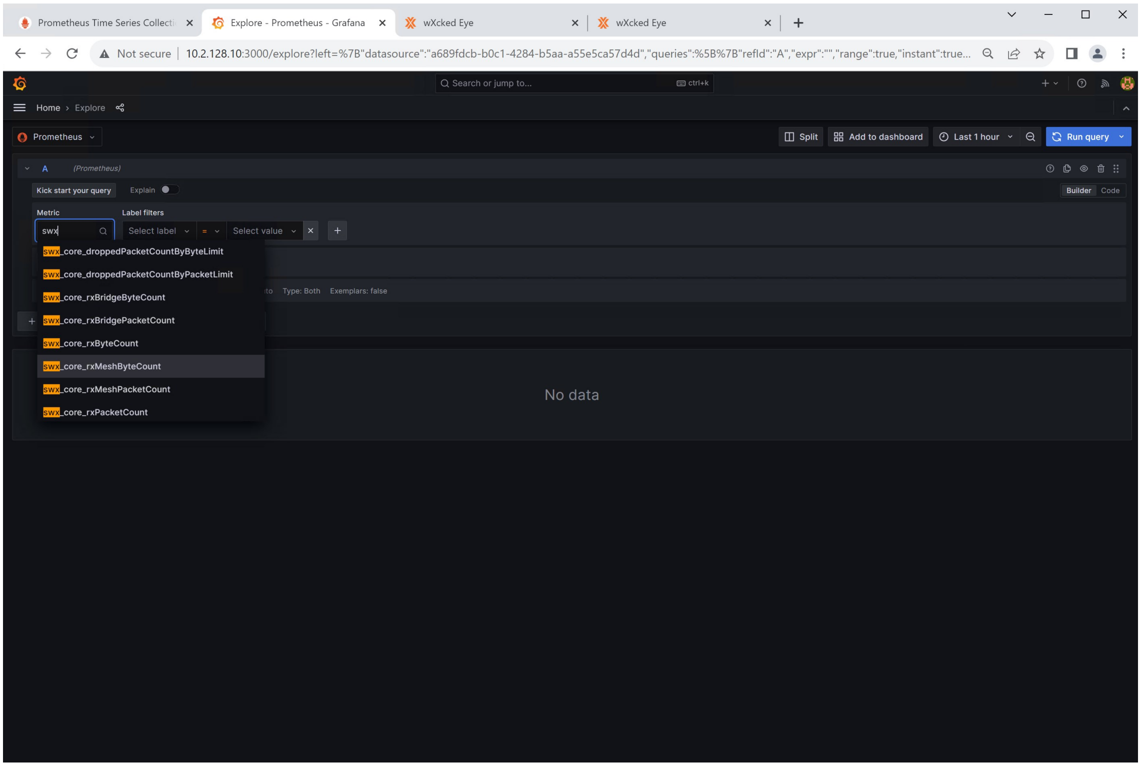


10. Click Explore.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



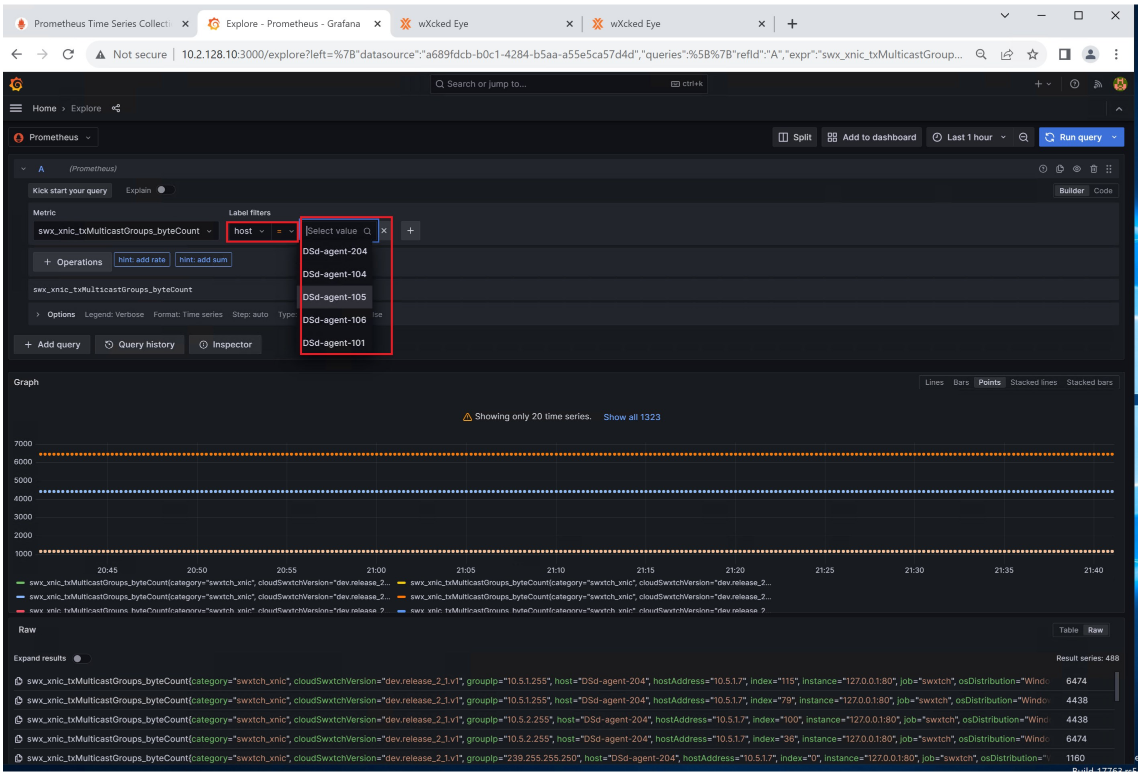
11. In the search bar under Metric, use the prefix “swx” to populate a list of potential data fields.



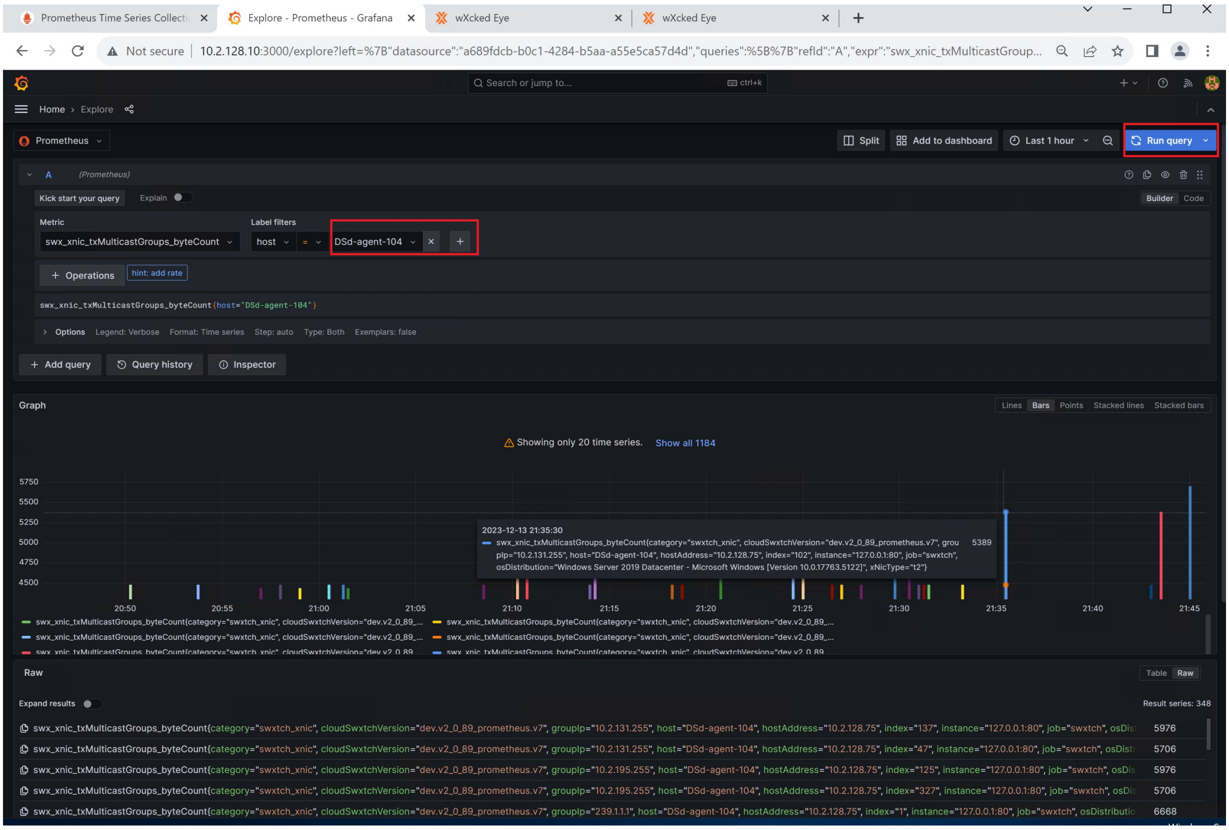
12. Scroll through the list and select what is desired.

13. Run the query. The results will appear below.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

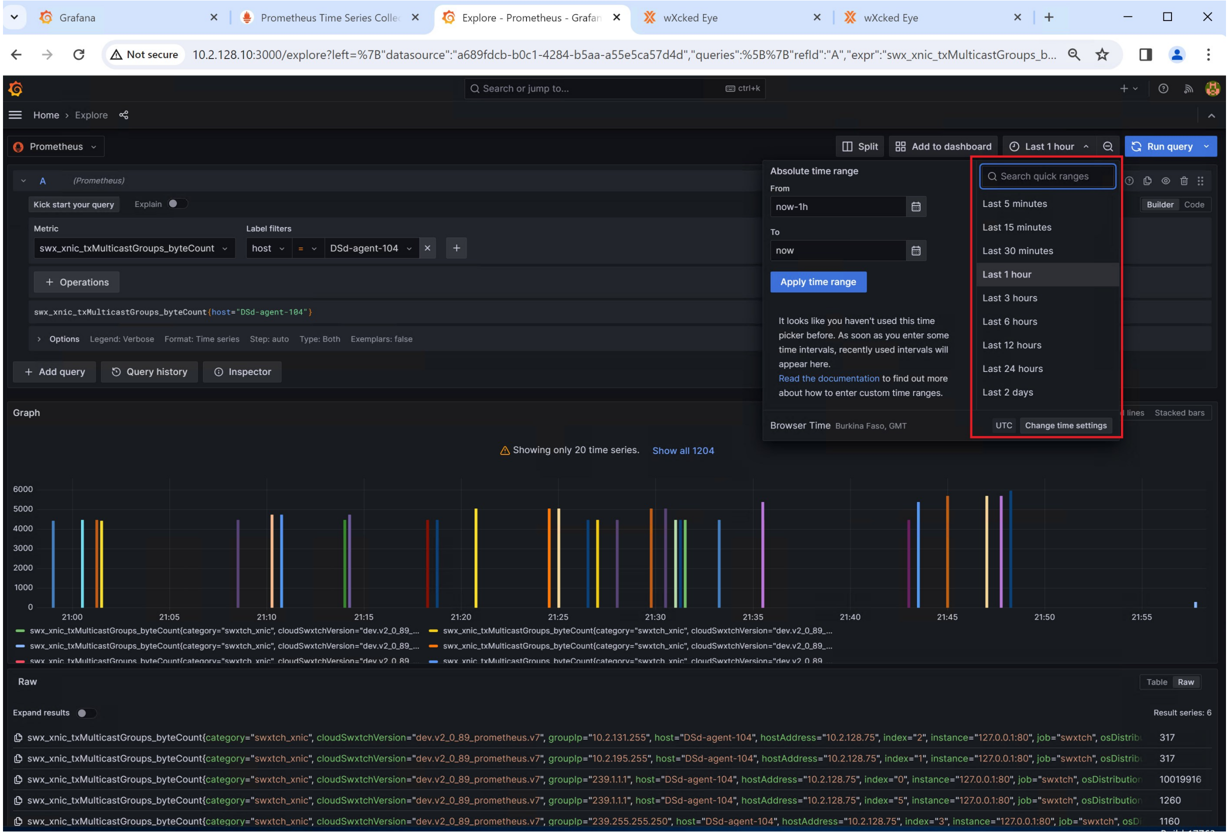


For xNIC-related metrics, users can specify a host under Label Filters and select an agent. After selecting an agent, a user will need to run the query again to populate the graph as shown above.



If desired, a user can also change the amount of time in the top of the window.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Testing cloudSwXtch

Testing

It is easy to test the functionality and performance of a cloudSwXtch multicast network. Included within the xNIC installation are utilities that can be used to verify both the functionality and performance of your network.

- swxtch-perf – used to produce and consume unicast and multicast traffic
- swxtch-top – shows detailed system statistics in the console

Additionally, the metrics view in the cloudSwXtch information page (see the Advanced cloudSwXtch Operation section below) shows global network traffic into and out of the cloudSwXtch instance.
Each of the utilities above can be run from a VM which has the xNIC software installed. Detailed usage information can be found for each by passing in the `--help` command-line argument

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

swxtch-perf

Overview

To simulate traffic movement throughout the cloudswxtch overlay network you can use swxtch-perf to create producer and consumers on machines with the xNIC installed.

`swxtch-perf producer` has multiple parameters that can be configured to generate different traffic flows. There can be multiple instances of swxtch-perf generating traffic on a single machine.

None Copy

```
swxtch-perf producer --sendto <MC_ADDRESS:DEST_PORT> --nic <NETWORK_INTERFACE>
```

`swxtch-perf consumer` will pick up the traffic generated by the producer(s) in the network.

None Copy

```
swxtch-perf consumer --recvfrom <MC_ADDRESS:DEST_PORT> --nic <NETWORK_INTERFACE>
```

> NOTE
> `<MC_ADDRESS>` = Multicast Address
> `<DEST_PORT>` = Destination Port
> `<NETWORK_INTERFACE>` = Network Interface where xNIC conncted to. The network interface does not have to be specified in xNic V1, but must be specified in xNic V2. (See xNIC Linux Installation for V1 and V2 differences.

swxtch-perf

For a quick view at the functionality and usage of swxtch-perf use `-h` or `-help`.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

None Copy

```
swxtch-perf -h
Usage: swxtch-perf [options] command

Positional arguments:
command                 [producer|consumer] suported commands

Optional arguments:
-h --help               shows help message and exits [default: false]
-v --version            prints version information and exits [default: false]
--nic                   name of NIC to use this is Mandatory for swxtch-perf to work.
--recvfrom              IP:Port The IP and Port where packets come from [default:
"239.5.69.2:10000"]
--sendto                IP:Port The IP and Port where packets are sent to [default:
"239.5.69.2:10000"]
  --ssm_include           (consumer command only) List of SSM addresses to include (i.e.
192.168.2.1 193.168.2.4) [nargs: 1 or more]
  --ssm_exclude           (consumer command only) List of SSM addresses to exclude (i.e.
192.168.2.1 193.168.2.4) [nargs: 1 or more]
--payload_length        (producer command only) number of bytes for the multicast udp
payload [default: 100]
--total_pkts            Total packets to send/receive. To run without this limit use 0
[default: 0]
--pps                   (producer command only) packet-rate or packet per seconds
[default: 1]
--seconds               Number of seconds to run the application. To run without this
limit use 0 [default: 0]
--loopback              Receives packets from --recvfrom and sends packets to --sendto
[default: false]
--generic               (consumer command only) to consume generic packets [default:
false]
--latency               Enables timestamp propagation and measurement of latency
[default: false]
--broadcast             Enables broadcast packets in NIC, this overrides IP argument
[default: false]
--generic-broadcast     Sends broadcast packets to 255.255.255.255, valid only with --
broadcast argument [default: false]
--broadcast-port        Port for broadcast traffic, valid only with --broadcast argument
[default: 10000]
--rtt-latency           Enables timestamp propagation and measurement of RTT/2 where RTT
= round trip time [default: false]
--one-way-latency       Enables timestamp propagation and measurement of one way latency
[default: false]
--latency-buckets       Enables histogram of latency. Use with --latency [default:
false]
--dbg                   Enables more information in the logs [default: false]
--show-full-packet-bps  Shows the bps with all headers included
```

Parameters

Argument	Description	Default Value	Valid Range	Machine Type	Operating System
`h`	Shows commands that are available.				All

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

`v`	Shows version.			Both	All
`nic`	Specify which network interface xNIC will listen to this command is Mandatory.		--	Both	All
`recvfrom`	Specify the multicast group and port to listen for packets IPv4 addresses are valid; Ports: 1024 <= x <= 65535. Mandatory for Consumer Mode and Multicast.			Consumer	All
`sendto`	Specify the multicast group and port to send packets, mandatory for producer if using multicast.	All	IPv4 addresses are valid; Ports: 1024 <= x <= 65535 Mandatory for Producer Mode and Multicast.	Producer	All
`ssm_include`	List of SSM addresses to include (i.e. 192.168.2.1 193.168.2.4)		1 or more	Consumer	All
`ssm_exclude`	List of SSM addresses to exclude (i.e. 192.168.2.1 193.168.2.4)		1 or more	Consumer	All
`payload_length`	Number of bytes per packet.	100	8 and 65475	Producer	All
`total_pkts`	Number packets to receive or send before exiting iperf.	0	8 and 3750	Producer	Windows
`pps`	packet-rate or packets per second.	1	100000	Producer	All
`seconds`	Number of seconds to run the application, use 0 to run without a limit.	0		Both	Windows
`loopback`	Receives packets from recvfrom and sends packets to sendto.	false	true:false	Both	All
`generic`	Consume generic packets.	false	true:false	Consumer	All
`latency`	Enables timstamp propagation and measurement of latency.	false	true:false	Both	Linux
`broadcast`	Sets swxtch-perf to use normal broadcast mode, when sending it will use the IP of the --nic argument.	false	true:false	Both	All
`generic-broadcast`	Sets iperf to use broadcast mode using the IP of 255.255.255.255.	false	true:false	Both	All
`broadcast-port`	Sets port to be used for broadcast, and is only valid with --broadcast and --generic-broadcast arguement and is Mandatory for --broadcast --generic-broadcast .		Ports: 1024 <= x <= 65535	Both	All
`rtt-latency`	Enables timestamp propagation and measurement of RTT/2 where RTT = round trip time	false			Windows
`one-way-latency`	Enables timestamp propagation and measure of one way latency	false			Windows
`latency-buckets`	Enables histogram of latency. Use with --latency	false			Windows
`dbg`	Enables more information in the logs	false			All
`show-full-packet-bps`	Shows the bps with all headers included			Both	All

Multicast - Example

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

These examples can be run from one machine or across multiple machines. Parameters for NIC names assume default installation options.

> EXAMPLE
>
> Single Producer, Single Consumer, and one multicast group

Run this command on a VM to create a multicast group on the address `230.1.1.1` and port `3490` :

None Copy

```
Linux:
swxtch-perf producer --sendto 239.1.1.1:3490 --pps 1000 --nic swxtch-tun0
Windows:
swxtch-perf producer --sendto 239.1.1.1:3490 --pps 1000 --nic swxtch-tun
```

Example with results:

None Copy

```
swxtch-perf producer --sendto 239.1.1.1:3490 --pps 1000 --nic swxtch-tun0
Trying to reach a packet-rate of 1000 pps
swxtch-perf producer threads started...  Ctrl+C to exit.
|-------------------------------------|-------------------------------|
|                TOTALS               |          THIS PERIOD          |
|    TX PKTS     | TX BYTES | TX DROPS |  TX-PPS  |  TX-bps  | TX-DPS  |
|---------------|----------|----------|----------|----------|---------|
|         1,283 |    128KB |        0 |    1.28K |  1.0Mbps |       0 |
|         2,274 |    227KB |        0 |      991 |  792Kbps |       0 |
|         3,267 |    326KB |        0 |      993 |  794Kbps |       0 |
|         4,262 |    426KB |        0 |      995 |  796Kbps |       0 |
```

Run this command on one of the VMs to listen to traffic on the Multicast Address `230.1.1.1` port `13490` :

None Copy

```
Linux:
swxtch-perf consumer --recvfrom 239.1.1.1:3490 --nic swxtch-tun0
Windows:
swxtch-perf consumer --recvfrom 239.1.1.1:3490 --nic swxtch-tun
```

Example with results:

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

None Copy

```
testadmin@DSd-agent-102:~$ swxtch-perf consumer --recvfrom 239.1.1.1:3490 --nic swxtch-
tun0
swxtch-perf consumer threads started...  Ctrl+C to exit.
|-----------------------------------|-----------------------------|
|                 TOTALS            |          THIS PERIOD        |
|    RX PKTS     | RX BYTES | RX DROPS |  RX-PPS  |  RX-bps  | RX-DPS  |
|---------------|----------|----------|----------|----------|---------|
|             0 |       0B |        0 |        0 |     0bps |       0 |
|             0 |       0B |        0 |        0 |     0bps |       0 |
|             0 |       0B |        0 |        0 |     0bps |       0 |
|           330 |  33.00KB |        0 |      330 |  264Kbps |       0 |
|         1,326 |    132KB |        0 |      996 |  796Kbps |       0 |
|         2,328 |    232KB |        0 |    1.00K |  801Kbps |       0 |
|         3,330 |    333KB |        0 |    1.00K |  801Kbps |       0 |
|         4,332 |    433KB |        0 |    1.00K |  801Kbps |       0 |
|         5,328 |    532KB |        0 |      996 |  796Kbps |       0 |
|         6,330 |    633KB |        0 |    1.00K |  801Kbps |       0 |
```

- To add more consumers you simply run the same swxtch-perf command on new VMs.

Broadcast - Example

These examples can be run from one machine or across multiple machines. Parameters for NIC names assume default installation options.

EXAMPLE

Single Producer, Single Consumer, and broadcast

Run this command on a VM to create a broadcast

None Copy

```
Linux:
swxtch-perf producer --broadcast --nic eth1 --pps 1000 --broadcast-port 1234
Windows:
swxtch-perf producer --broadcast --nic 'Ethernet 2' --pps 1000 --broadcast-port 1234
```

Example with results:

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

None Copy

```
PS C:\Users\testadmin> swxtch-perf producer --broadcast --nic 'Ethernet 2' --pps 1000 --
broadcast-port 1234
Config:
        Sending traffic to  broadcast address.
        Ip Address: 10.2.195.255
        Port      : 10000
        Interface IP Address: 45
        Running without a total packet counter limit
        Running the application without a timing limit
Sent 972 total packets, throughput: 890.383 pkts/sec
Sent 2047 total packets, throughput: 993.128 pkts/sec
Sent 3123 total packets, throughput: 991.82 pkts/sec
Sent 4198 total packets, throughput: 990.419 pkts/sec
```

Run this command on one of the VMs to listen for broadcast

None Copy

```
Linux:
swxtch-perf consumer --broadcast --nic eth1--pps 1000
Windows:
swxtch-perf consumer --broadcast --nic 'Ethernet 3' --pps 1000
```

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

swxtch-top

WHAT TO EXPECT

swxtch-top is one of the utility applications included in the xNIC installation. It can be run from the console of any VM that has an xNIC software installed, displaying real-time statistics of an attached cloudSwXtch instance. This includes data regarding mesh, high availability, multicast and PTP.

In this article, you will learn how to navigate through the different pages in swxtch-top and get better visibility on how data flows in your cloudSwXtch instance.

Running swxtch-top

Depending on your operating system, you can use certain commands to run swxtch-top on your VM.

For both Windows and Linux agents (xNICs), users can enter the following into the terminal:

Bash Copy

```bash
swxtch-top --swxtch <cloudSwXtch-IP>
```

Example:

Bash Copy

```bash
swxtch-top --swxtch 10.5.1.6
```

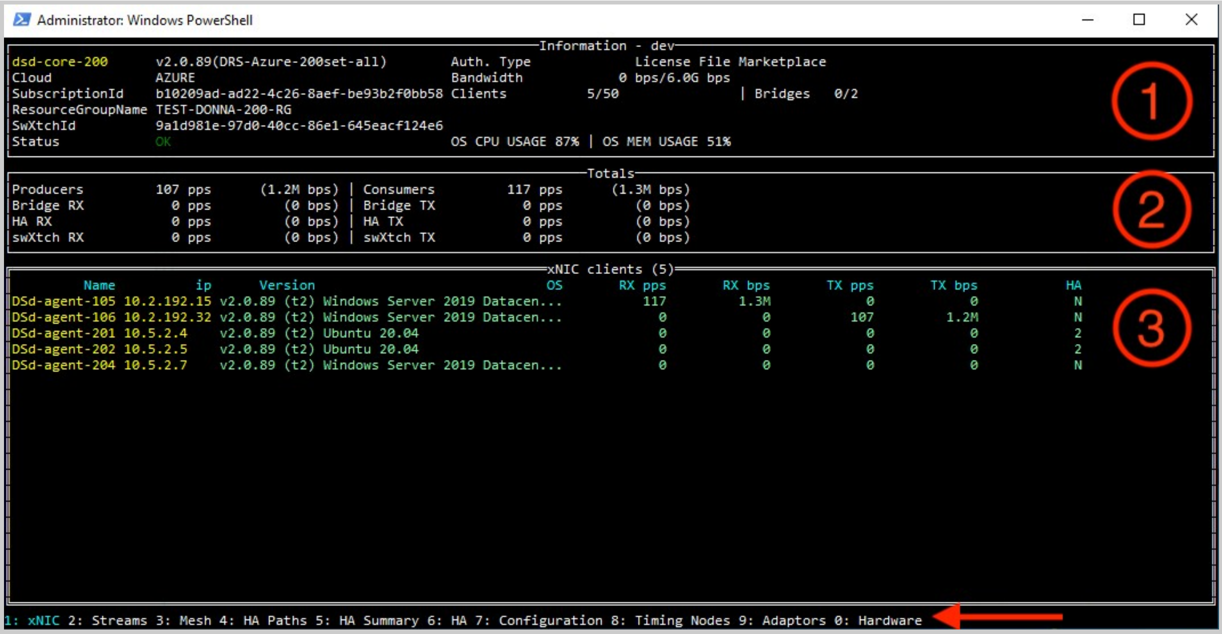
From the cloudSwXtch, users can enter the following command:

Bash Copy

```bash
sudo /swxtch/swxtch-top dashboard --swxtch localhost
```

Navigating swxtch-top Dashboard

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



The swxtch-top dashboard is organized into 3 panels as shown in the screenshot above. While the top 2 panels remain static, the third panel will change depending on the selected view. The swxtch-top dashboard has 10 different views:

1. xNIC
2. Streams
3. Mesh
4. HA Paths
5. HA Summary
6. HA
7. Configuration
8. Timing Nodes
9. Adaptors
10. (0) Hardware

The default is the 1: xNIC view. To switch between them, simply enter the number that matches the view type. For example, to toggle to "0: Hardware," enter in the number 0 on your keypad.

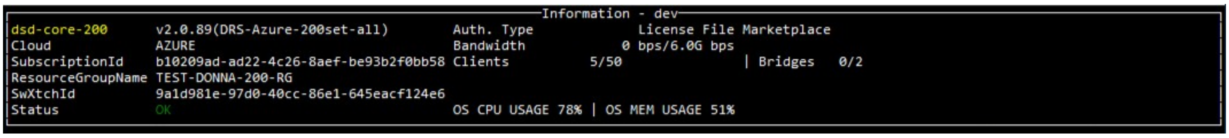
> PLEASE NOTE
>
> The following screenshots have been taken on the latest version of cloudSwXtch. To learn how to upgrade your cloudSwXtch, please see the article, [Upgrading cloudSwXtch](#).

Panel 1: Information

The first panel of the swxtch-top dashboard provides users with information regarding their cloudSwXtch as well as their subscription plan. In the screenshot above, the cloudSwXtch is running on Azure. Each cloud provider will have alternative titles for some of the listed items but for the most part, the information is the same.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

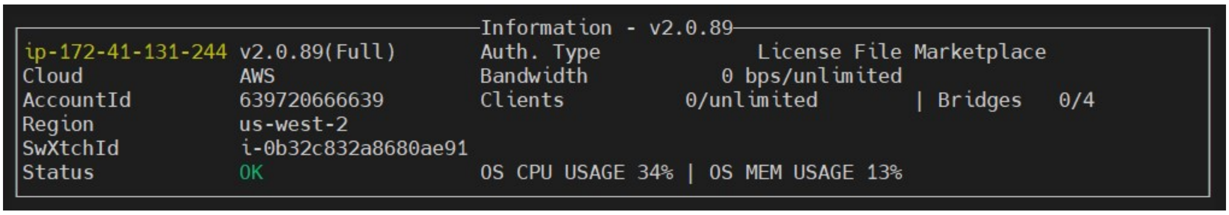
Azure



On the left side of the section, users will be able to read the name given to their cloudSwXtch, when it was instantiated as well as the cloud provider (Azure), version, cloud Subscription ID, ResourceGroupName, SwXtchID and Status.

On the right side, users can see the Authorization Type based on their cloudSwXtch license and the max bandwidth, clients, and bridges associated with that plan. The operating system's CPU and Memory usage is also displayed. For more information regarding licensing, please read the cloudSwXtch System Requirements article.

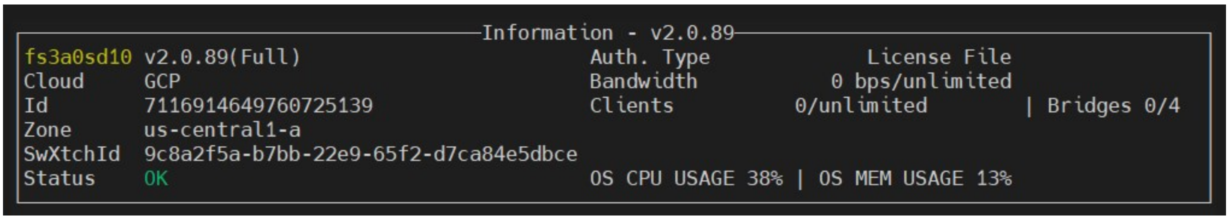
AWS



On the left side of the section, users will be able to read the name given to their cloudSwXtch with the version and the cloud provider (AWS). In addition, they can find the AccountID, Region, SwXtchID and cloudSwXtch status.

On the right side, users can see the Authorization Type based on their cloudSwXtch license and the max bandwidth, clients, and bridges associated with that plan. The operating system's CPU and Memory usage is also displayed. For more information regarding licensing, please read the cloudSwXtch System Requirements article.

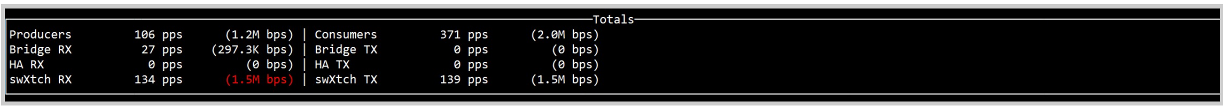
GCP



On the left side of the section, users will be able to read the name given to their cloudSwXtch with the version and the cloud provider (GCP). In addition, they can find the ID, Zone, SwXtchID and cloudSwXtch status.

On the right side, users can see the Authorization Type based on their cloudSwXtch license and the max bandwidth, clients, and bridges associated with that plan. The operating system's CPU and Memory usage is also displayed. For more information regarding licensing, please read the cloudSwXtch System Requirements article.

Panel 2: Totals



Panel 2 breaks down the statistics regarding data flow to and from the cloudSwXtch. Both the ingress and egress bandwidth will be displayed in both `packets per seconds (pps)` and `bits per second (bps)`.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

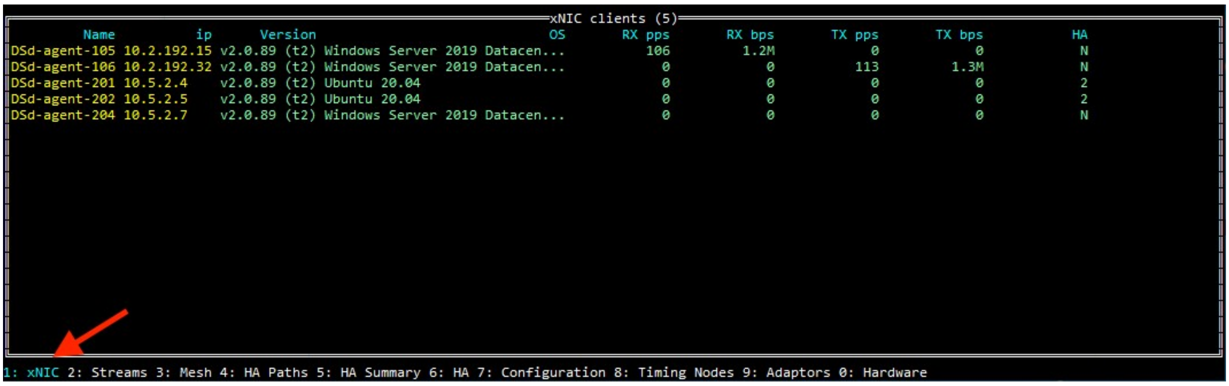
Please note: If your cloudSwXtch is part of a mesh or a bridge, the ingress/egress will show data in those sections.

- Producers - The total egress for all producers connected to the cloudSwXtch.
- Consumers - The total ingress for all consumers connected to the cloudSwxtch.
- Bridge RX - The total egress for the bridge that is connected to the cloudSwXtch (Ground-->Cloud).
- Bridge TX - The total ingress for the bridge that is connected to the cloudSwXtch (Cloud-->Ground).
- HA RX - The total egress for the entire high availability configuration of cloudSwXtches.
- HA TX - The total ingress for the entire high availability configuration of cloudSwXtches.
- swXtch RX - The total ingress that the cloudSwXtch is receiving.
- swXtch TX - The total egress that the cloudSwXtch is transmitting.

Panel 3: Views

Panel 3 defaults to "1: xNIC view" and is shown in the picture above. However, the display changes based on the selections at the bottom of the screen. To change views, key in the numeric value for that view.

1: xNIC view

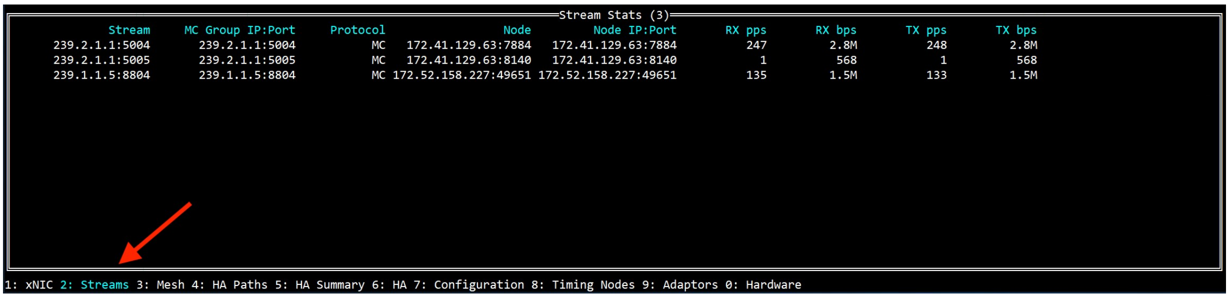


This view shows all the xNIC clients that are connected to the cloudSwXtch. This view includes:

- Name - Name of the Virtual Machine (Azure) or the HostName (AWS)
- IP - The IP of the data plane of the Virtual Machine.
- Version - The version of the xNIC. This value should match the cloudSwXtch's version.
- XNIC - The xNIC type: xNIC2 (T2) or xNIC1 (T1)
- RX pps - The total ingress packets per second that the xNIC is receiving.
- RX bps - The total ingress bits per second that the xNIC is receiving.
- TX pps - The total egress packets per second that the xNIC is transmitting.
- TX bps - The total egress bits per second that the xNIC is transmitting.
- HA - Whether the xNIC is configured for High Availability or not. This states how many cloudSwXtches are attached to this xNIC and if it is HA or not indicated by the -7. See also: High Availability Feature Description and High Availability Configuration

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

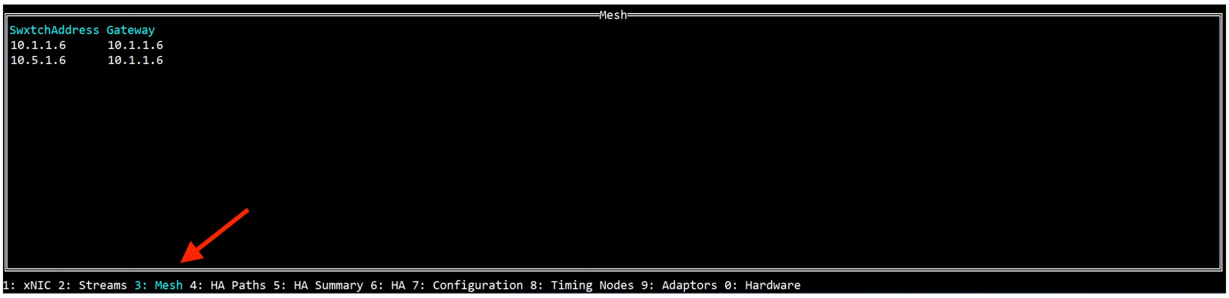
2: Streams



This view shows all the multicast groups that are being received and transmitted by the cloudSwXtch. This view includes:

- Name - The name is the stream IP and Port. For Multicast, it is the MC Group IP:Port. For broadcast, it is the Broadcast IP:Port.
- Src IP:Port: IP address of where the data is flowing from (the producer)
- Protocol - Multicast or Broadcast
- RX pps: The total ingress packets per second being received by the multicast group.
- RX bps: The total ingress bits per second that is received by the multicast group.
- TX pps: The total egress packets per second that is transmitted by the multicast group.
- TX bps: The total egress bits per second that that is transmitted by the multicast group.
- Destinations: The number of destinations receiving the multicast group.

3: Mesh

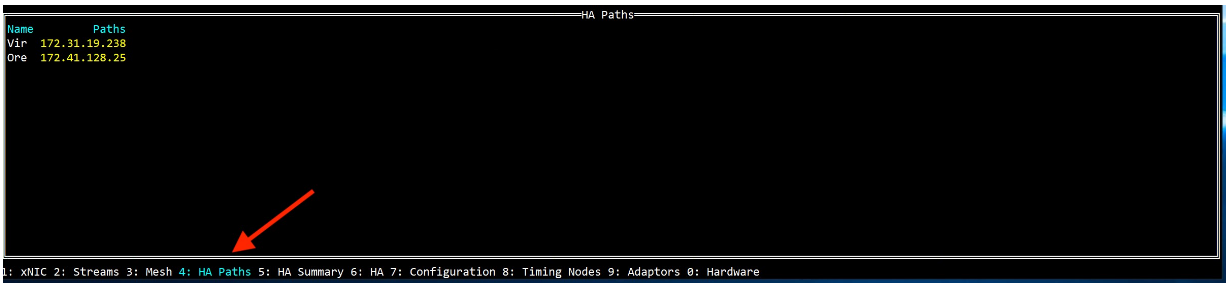


This view shows all the cloudSwXtches that are in a mesh. It only shows data if a mesh has been configured. This view includes:

- SwitchAddress - The IP address's of the cloudSwXtch(s) that is in the mesh with the cloudSwXtch that swxtch-top is set to.
- Gateway - The IP address that serves as entry/exit point for traffic between networks.

4: HA Paths

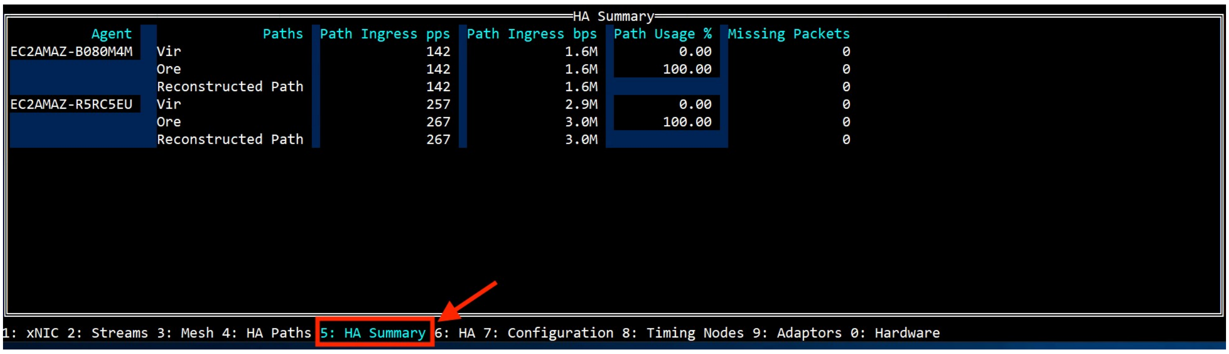
©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



This view shows all the paths for high availability. It will only show data if High Availability has been configured. See High Availability for configuration details. This view includes:

- Name - The name of the Path
- Paths - The cloudSwXtches that are in the path. In this example, both paths have a single cloudSwXtch associated with it.

5: HA Summary

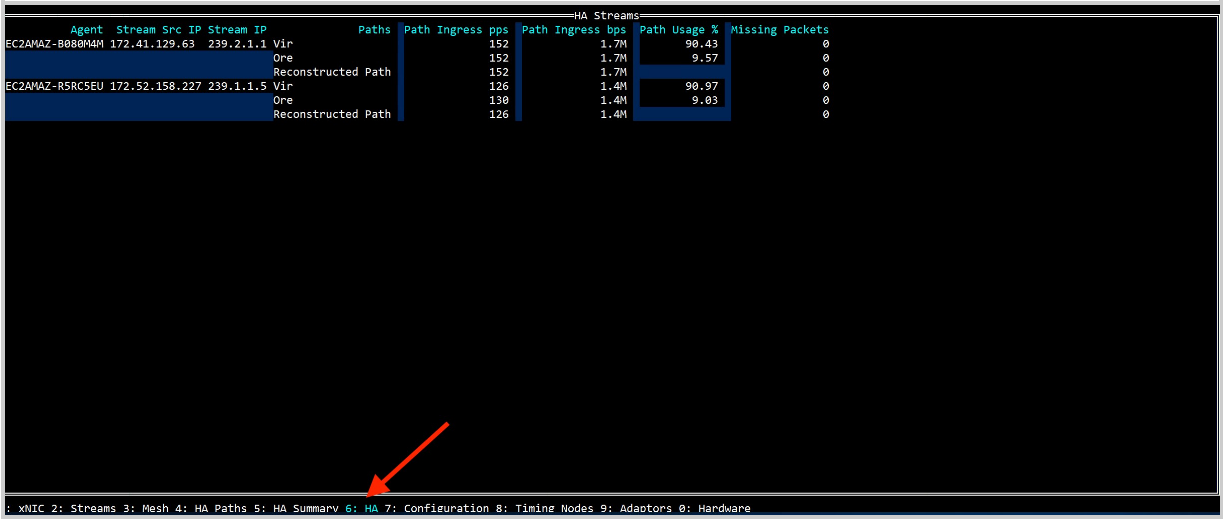


The HA Summary view shows a breakdown of high availability for the cloudSwxtch. This will only display data if High Availability has been configured. See High Availability for configuration details. This view includes:

- Agent - The agent that is receiving the multicast traffic.
- Paths - The paths that the multicast is taking as well as an outcome of the reconstructed path.
- Path Ingress pps - The total ingress packets per second that is received in the path for the multicast group.
- Path Ingress bps - The total ingress bits per second that is received in the path for the multicast group.
- Path Usage % - The percentage of the path that is used in the High Availability multicast group.
- Missing packets - The total number of missing packets for the path since the inception of the stream. If you stop the stream or any of the cloudSwXtches, the number will stop increasing but will not reset.

6: HA

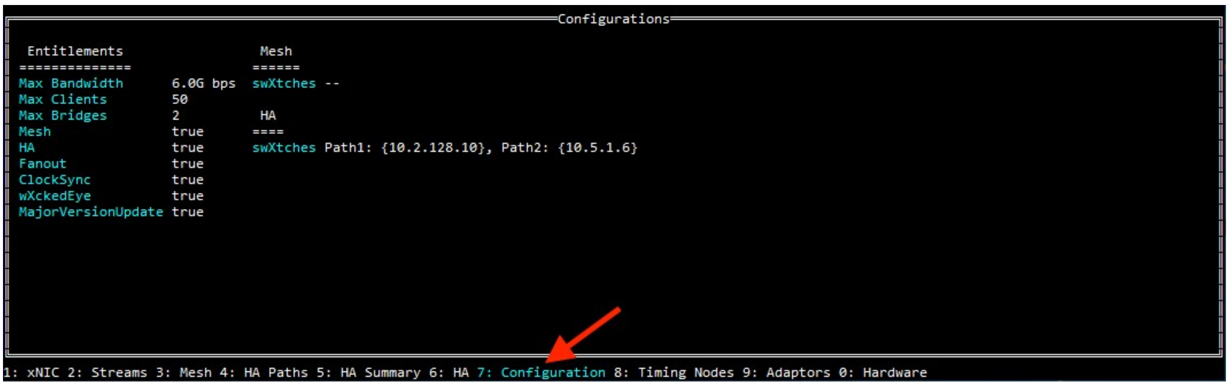
©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



The HA view shows additional details for high availability. It will only show data if High Availability has been configured. See High Availability for configuration details. This view includes:

- Agent - The agent that is receiving the multicast.
- Stream Src. IP - The IP address of where the stream is coming from (the producer).
- Stream IP - The IP of the multicast stream.
- Paths - The paths that the multicast is taking as well as an outcome of the reconstructed path.
- Path Ingress pps - The total ingress packets per second that is received in the path for the multicast group.
- Path Ingress bps - The total ingress bits per second that is received in the path for the multicast group.
- Missing packets - The total number of missing packets for the path since the inception of the stream. If you stop the stream or cloudSwXtches, the number will stop increasing but will not reset.
- Path Usage % - The percentage that the path is used in the highly available multicast group.

7. Configuration



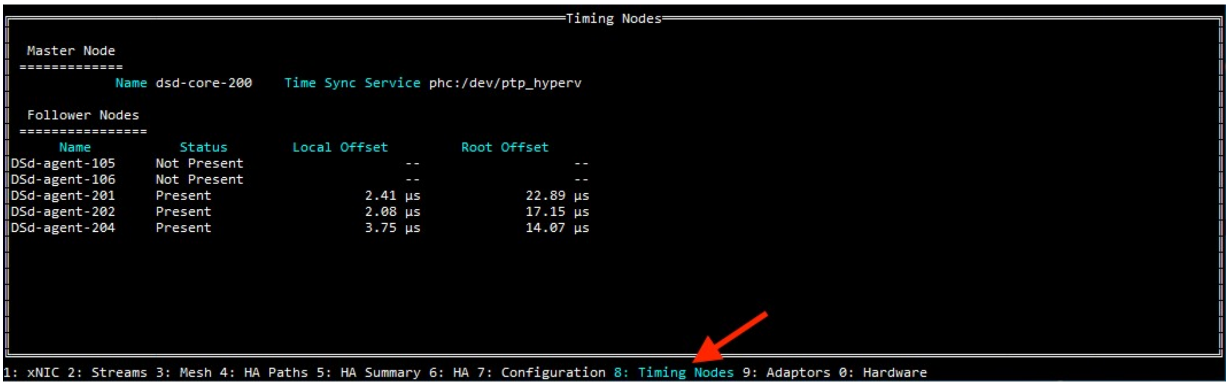
The Configuration view provides users with an expanded look at the licensing details found in the Information panel. In addition, they can see the cloudSwXtches connected in their mesh and HA configurations as well as details on their unicast.

- Entitlements: Depending on their license, users will have a set number for their Max Bandwidth, Max Clients and Max bridges. In the example above, the user has a max bandwidth of 6 GBs with 50 clients max and 2 bridges max. This section will also show if a user has the following features enabled: Mesh, HA, Fanout, Clock Sync (PTP), wXckedEye, and Major Version Update.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

- Mesh: This will list the IP addresses of the cloudSwXtches connected to a mesh.
- HA: This will list the Paths created for High Availability with each path showing the IP addresses of connected cloudSwXtches.

8. Timing Nodes view



The Timing Nodes view displays information regarding the clock sync configuration for the cloudSwXtch. The page in swxtch-top will only populate with information if the user has the PTP feature enabled.

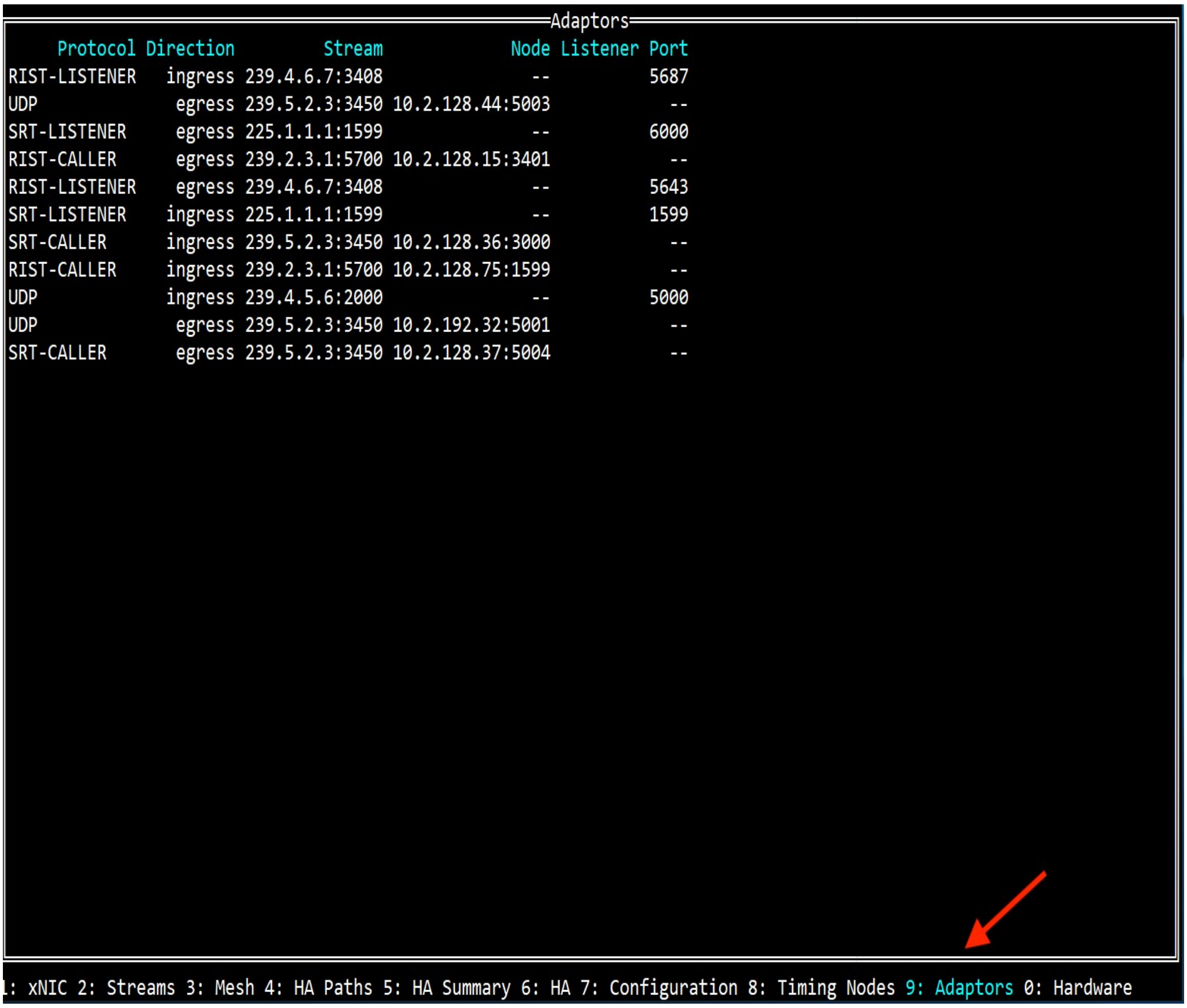
In the example above, the cloudSwXtch (core-200) is acting as the Master Node.

- Master Node- The Master Node is what the PTP configuration sets as the most reliable time source. This will send the true time it receives from the source clock to the Follower Nodes.
    - Name - The name of the cloudSwXtch
    - Time Sync Service - The source clock
- Follower Nodes- The Follower Nodes lists the agents/VMs that subscribe to the Master Node for accurate timing.
    - Name - The name of the endpoints
    - Status - The status of the endpoints, noting if the node is active in the PTP configuration
    - Local Offset - The local offset denotes the offset in time from the cloudSwXtch to the xNIC.
    - Root Offset - The root offset denotes the offset in time from the GrandMaster clock to the cloudSwXtch and its follower nodes (xNIC). Note how the root is larger than the local. This is normal behavior since the distance between the follower node and the Grandmaster clock is greater than the offset between a cloudSwXtch and xNIC.

> PTP Stabilization
>
> After upgrading your cloudSwXtch system, you may notice that the local and root offset values are much larger than they actually are. It can take up to 30 minutes for the values to stabilize and return back to normal levels.

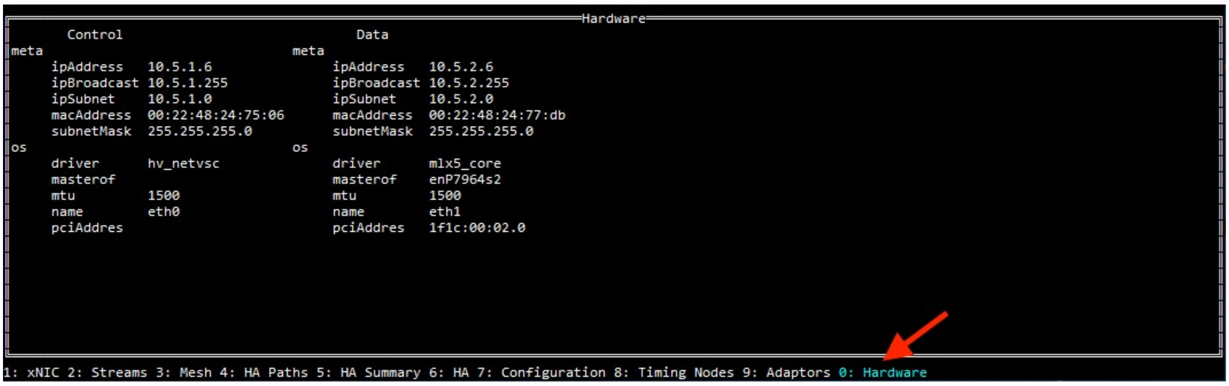
9. Adaptors

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



The Adaptors view displays information regarding Protocol Conversion and Fanout. It includes a detailed list of configured protocols (UDP, SRT Caller/Listener, or RIST Caller/Listener), their direction (ingress/egress), the stream, the node, and Listener Port.

0. Hardware



The Hardware view displays information regarding the control and data subnets configured during cloudSwXtch instantiation. Both subnets are split into two sections: metadata and OS (Operating System).

Troubleshooting swxtch-top

1. If the swxtch-top "Status" is showing that there is a "Connection error:"

    1. Check that the cloudSwXtch is started.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

    2. Check that you entered in the proper cloudswxtch name or IP when running the swxtch-top command.

    3. If name does not work when running the swxtch-top command then the DNS is not set-up correctly, use the IP address instead.

2. If an xNIC was installed but is not showing up in swxtch-top:

    1. Navigate to the swxtch-nic.conf file and validate that the "SwxtchSvcAddr" is correct.

        - Windows can be found at "C:\Program Files\SwXtch.io\Swxtch-xNIC"

        - Linux can be found at "/var/opt/swxtch/swxtch-xnic.conf"

    2. Check that the firewall is open for the following ports:

subnet	protocol	ports	vm
ctrl-subnet	tcp	80	cloudSwXtch
ctrl-subnet	udp	10800-10803	all
data-subnet	udp	9999	all

3. If a multicast group is not showing up then check that they have registered.

    - In Linux, run this command:

    Text

    None | Copy

```
ip maddress show
```

    - In Windows, run this command in PowerShell:

    Text

    None | Copy

```
netsh.exe interface ipv4 show joins
```

    - If the joins are not showing here then the application is not joining the multi-cast group. In this case run swxtch-perf for the same IP:Port combination and then re-try in the program.

    - If the joins are not showing here then the application is not joining the multi-cast group. In this case run swxtch-perf for the same IP:Port combination and then re-try in the program.

    - If using Windows make use of Task Manager and view Performance to know where data is being sent/received.

    - Validate using TCPdump or Wireshark to identify where traffic is going as it could be going to the wrong network interface, it should be going to the Data Interface if xNIC2 and Swxtch-tun0 if xNIC1. An example is below:

Plaintext | Copy

```
$ sudo tcpdump udp -X -i <interface>
```

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

NOTE

xNIC1 interface: `swxtch-tun0`
xNIC2 interface: data nic (usually `eth1 for Linux, and "Ethernet 2" for Windows`)

- Validate that a firewall is not stopping the multicast and open up the firewall to include port exceptions.

swxtch-top on a cloudSwXtch

swxtch-top should be run from a virtual machine with an xNIC installed, it should be avoided to run it or anything else directly on a cloudSwXtch. That being said it can be done, but you must run it with sudo. Only run it on the cloudSwXtch if doing advanced troubleshooting.

sudo /swxtch/swxtch-top dashboard --switch localhost

Alternatively use 127.0.0.1 or swxtch-hostname or swxtch-IP in place of localhost

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

swxtch-tcpdump

WHAT TO EXPECT

Users can use a cloudSwXtch specific version of tcpdump called swxtch-tcpcump. This tool helps with capturing multicast packets sent to and from the cloudSwXtch. It is the same as tcpdump but with logic to decode our own header and display the original MC payload.

In this article, users will learn about the available arguments for swxtch-tcpdump.

Using swxtch-tcpdump

Execute the following command:

Bash

```bash
swxtch-tcpdump
```

Note: The default is swxtch-tun (Windows) or swxtch-tun0 (Linux). If their multicast is running on a different interface, then a user will need to specify that interface. To get a list of interfaces for Windows, you can use ip config. For Linux, you can use ip a. After you get the name of the correct interface, you can use the -i argument followed by your desired interface name.

Example:

Bash

```bash
swxtch-tcpdump -i ens6
```

Additional arguments

Users can use the -h argument as shown below to get a list of available arguments for swXtch-tcpdump.

Bash

```bash
ubuntu@ip-172-41-128-232:/var/opt$ swxtch-tcpdump -h
swxtch-tcpdump version 5.0.0-PRE-GIT
libpcap version 1.9.1 (with TPACKET_V3)
OpenSSL 1.1.1f  31 Mar 2020
Usage: swxtch-tcpdump [-AbdDefhHIJKlLnNOpqStuUvxX#] [ -B size ] [ -c count ] [--count]
                [ -C file_size ] [ -E algo:secret ] [ -F file ] [ -G seconds ]
                [ -i interface ] [ --immediate-mode ] [ -j tstamptype ]
                [ -M secret ] [ --number ] [ --print ]
                [ --print-sampling nth ] [ -Q in|out|inout ] [ -r file ]
                [ -s snaplen ] [ -T type ] [ --version ]
                [ -V file ] [ -w file ] [ -W filecount ] [ -y datalinktype ]
                [ --time-stamp-precision precision ] [ --micro ] [ --nano ]
                [ -z postrotate-command ] [ -Z user ] [ expression ]
```

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

swxtch-where

WHAT TO EXPECT

swxtch-where allows users to call for hardware information regarding their cloudSwXtch VM.

In this article, users will learn about the different arguments they can use with swxtch-where and example outputs they should expect.

swXtch-where Cloud Type

Below are the Linux and Windows commands to call swxtch-where. An empty command (without an argument) like the examples below will only return the cloud type.

Windows

For Windows VM, swxtch-where must be called from the xNIC directory and have the .exe extension.

Bash | Copy

```
PS C:\Program Files\SwXtch.io\Swxtch-xNIC2> .\swxtch-where.exe
```

Linux

For Linux VM, a user would only need to input the following:

Bash | Copy

```
swxtch-where
```

swxtch-where Format

What is probably the most useful option in the swxtch-where argument list is `-f json` or `--format json`, which provides users with a json of hardware-related information regarding the cloudSwXtch VM. This is information is similar to the Hardware view in swxtch-top and Hardware panel in wXcked Eye's Settings' General tab. It presents a breakdown of the control and data subnet with information categorized as either metadata or operating system.

Windows

Bash | Copy

```
PS C:\Program Files\SwXtch.io\Swxtch-xNIC2> .\swxtch-where.exe --format json
```

Linux

Bash | Copy

```
swxtch-where -f json
```

Example Output in Windows:

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Bash Copy

```bash
S C:\Program Files\SwXtch.io\Swxtch-xNIC2> .\swxtch-where.exe --format json
```


```json
{
  "cloudType": "AZURE",
  "nics": [
    {
      "computed": {
        "isPreferredControlNic": false,
        "isPreferredDataNic": true,
        "isSRIOV": false
      },
      "meta": {
        "ipAddress": "10.5.1.7",
        "ipBroadcast": "10.5.1.255",
        "ipSubnet": "10.5.1.0",
        "mac": "00:22:48:27:0e:dc",
        "subnetMask": "255.255.255.0"
      },
      "os": {
        "driver": "mlx5.sys",
        "mac": "00:22:48:27:0e:dc",
        "mtu": 1500,
        "name": "Ethernet 261",
        "pciAddress": "65025:00:02.0"
      }
    },
    {
      "computed": {
        "isPreferredControlNic": true,
        "isPreferredDataNic": false,
        "isSRIOV": false
      },
      "meta": {
        "ipAddress": "10.5.2.7",
        "ipBroadcast": "10.5.2.255",
        "ipSubnet": "10.5.2.0",
        "mac": "00:22:48:27:07:14",
        "subnetMask": "255.255.255.0"
      },
      "os": {
        "driver": "netvsc.sys",
        "ipAddress": "10.5.2.7",
        "ipBroadcast": "10.5.2.255",
        "ipSubnet": "10.5.2.0",
        "mac": "00:22:48:27:07:14",
        "mtu": 1500,
        "name": "Ethernet",
        "pciAddress": "",
        "subnetMask": "255.255.255.0"
      }
    }
  ]
}
```


©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

swxtch-where Version

Using the -v or `--version` argument after the swxtch-where command will return the version.

Example in Windows:

```bash
PS C:\Program Files\SwXtch.io\Swxtch-xNIC2> .\swxtch-where.exe -v
1.0
```

swxtch-where Help

The swXtch-where -h or --help argument provides users with a detailed list of available arguments.

Example in Windows:

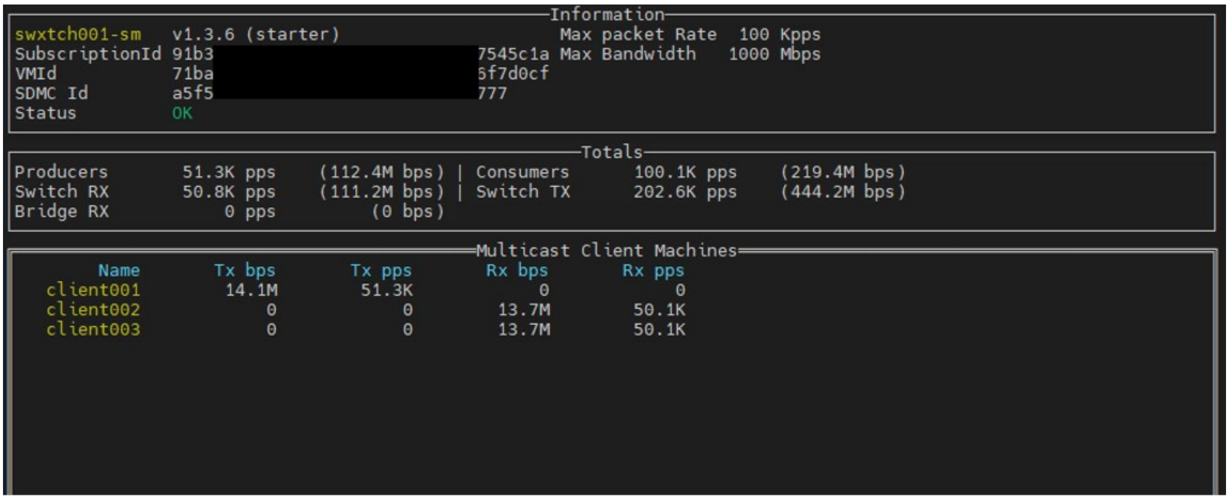
```bash
PS C:\Program Files\SwXtch.io\Swxtch-xNIC2> .\swxtch-where.exe - h
Usage: C:\Program Files\SwXtch.io\Swxtch-xNIC2\swxtch-where.exe [options]

swxtch-where utility.
Calling with no arguments simply returns the cloud type.


Optional arguments:
-h --help       shows help message and exits [default: false]
-v --version    prints version information and exits [default: false]
-f --format     output format (example: "json")
```

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Troubleshooting

The swxtch-top program is the best way to quickly check system status. It can be run from any machine that has network access to the control subnet assigned to the switch instance. The swxtch-top program is automatically installed by the xNIC installer.

When run with no command line options, it connects to the switch instance associated with the local VM. There are command line arguments that allow you to specify the exact switch if more than one is reachable. Use the --help option for details.



Cannot ping the cloudSwXtch instance

If `ping <swxtch-instance-name>` fails, try directly pinging the IP address of the cloudSwXtch instance. If ping by IP address also fails, check to make sure that the VM from which you are running the ping command has its network configured properly: The host VM must have at least *two NICs* and the NICs must be on the *same subnets* for control and data as the SDMC switch.

Client machine doesn’t show up in the switch list in swxtch-top

1. Verify that ping works from the client machine to the switch instance.
2. Check firewall settings (especially on RHEL). Remove any firewall restrictions to UDP ports 10800 and 9999. The cloudSwXtch sends UDP packets to these ports as part of normal operation.
3. Check xNIC log: `sudo journalctl -u swxtch-xnic`

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

How to View cloudSwXtch Logs for Troubleshooting

WHAT TO EXPECT

In this article, users will learn about accessing cloudSwXtch logs for the purpose of troubleshooting. We will break down two commands: `swx support` and `sudo journalctrl`. Common arguments that can be used when compiling information for the support team at swXtch.io will also be discussed.

Support may also request for you to send xNIC logs. For more information, see How to Find xNIC Logs.

swx support Logs

When troubleshooting, swXtch.io Support will request a report detailing the statistical data stored within the cloudSwXtch during a certain period. This report will include max highmarks, list highmarks, logs, swxtch Info, License and Config -- all in a compressed file.

Accessing the Report

The following command will compile the data stored on the disk between a certain time period by executing all other commands, saving it in a compressed file.

Bash Copy

```bash
./swx support -f "yyyy-dd-mm" -t "yyy-dd-mm"  -s localhost
```

- Following the -f `(date_from)`, enter the starting date.
- Following the -t `(date_to)`, enter the end date.
  - Both dates can also include the time, using the ISO 8601 date format (Example: 2006-01-02T15:04:05Z)

The output file will be named `swxtch-report-date_from.tar.gz`.

---

cloudSwXtch Service Logs

In addition to the swx support logs, swXtch.io Support might request logs for the -ctrl/-repl services. For log requests, the standard command, `sudo journalctl -u`, can used with either `swxtch-ctrl.service` or `swxtch-repl.service` to get a detailed breakdown of cloudSwXtch activity.

- `swxtch-ctrl.service` - This will display information regarding the cloudSwXtch's control plane.
- `swxtch-repl.service` - This will display information regarding the cloudSwXtch's replicator app that is on the data plane.

In addition, the log request command can be used for `swxtch-bridge2 (Bridge Type 2)` and `swXtch-bridge (Bridge Type 1)` for bridge-related logs.

It is recommended for users to send logs from both services to support@swxtch.io. The logs should cover 24 hours worth of time, starting from before the issue to up until now.

Users can use any combination of the arguments below to create their logs.

Accessing and Following Logs (-f)

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

The following command will begin to display logs for either the swxtch-ctrl or swxtch-repl service at the time of the request. The -f argument will follow the logs and continually update. Logs prior to the call will not display.

Bash Copy

```bash
sudo journalctl -u <swxtch-ctrl.service OR swxtch-repl.service> -f
```

Note: A user will need to choose between swxtch-ctrl or swxtch-repl. The .service is not necessary and will work with or without.

Listing a Certain Number of Lines in a Log (-n)

The following argument can be used to list a specific number of lines in a log.

Bash Copy

```bash
sudo journalctl -u <swxtch-ctrl OR swxtch-repl> -n <number of lines>
```

Example:

Bash Copy

```bash
sudo journalctl -u swxtch-repl -n 200
```

Displaying Logs within a Timeframe (--since --until)

The following command will display logs within a set timeframe (between 2 dates).

Bash Copy

```bash
sudo journalctl - u <swxtch-ctrl or swxtch-repl> --since <yyyy-mm-dd> --until <yyyy-mm-
dd>
```

Example:

Bash Copy

```bash
sudo journalctl - u swxtch-repl --since 2023-03-07 --until 2023-03-10
```

--since "Yesterday", "today", "now"

You can also use the words "yesterday," "today" or "now" after --since to get logs from that time period.

Bash Copy

```bash
sudo journalctl - u swxtch-repl --since yesterday
```

Displaying Logs since Last Boot (-b)

To display logs since last boot, users can use the -b argument.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Bash Copy

```bash
sudo journalctl -u <swxtch-ctrl OR swxtch-repl> -b
```

List boots (--list-boot)

The following argument can be used to list all the boots in date/time order.

Bash Copy

```bash
sudo journalctl -u <swxtch-ctrl OR swxtch-repl> --list-boot
```

Exporting Logs (>)

The following command will export your logs to a .txt file. Logs should be emailed to support@swxtch.io.

Bash Copy

```bash
sudo journalctl - u <swxtch-ctrl or swxtch-repl> > <file-name>.txt
```

Example:

Bash Copy

```bash
sudo journalctl - u swxtch-repl > cloudswxtch-test.txt
```

You can also combine arguments to export logs from a timeframe or from last boot. It is recommended that logs should cover 24 hours worth of time, starting from before the issue to up until now.

Example:

Bash Copy

```bash
LAST BOOT:
sudo journalctl - u swxtch-ctrl -b > cloudswxtch-test.txt

TIMEFRAME:
sudo journalctl - u swxtch-repl --since 2023-03-07 --until 2023-03-10 > cloudswxtch-
test.txt
```

Change Logs to UTC (--utc)

To switch logs from local time to UTC, use the following argument:

Bash Copy

```bash
sudo journalctl --utc
```

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

How to View cloudSwXtch Bridge Logs

WHAT TO EXPECT

In this article, users will learn how to access cloudSwXtch Bridge logs for the purpose of troubleshooting. Common arguments that can be used when compiling information for the Support team at swXtch.io will also be discussed.

Support may also request for you to send xNIC logs. For more information, see [How to Find xNIC Logs](#).

cloudSwXtch Bridge Service Logs

For log requests, the standard command, `sudo journalctl -u` can be used with either `swxtch-bridge2` (Bridge Type 2) or `swxtch-bridge` (Bridge Type 1) to get a detailed breakdown of cloudSwXtch Bridge activity.

For example:

Bash | Copy

```bash
sudo journalctl -u swxtch-bridge2
```

It is recommended to send logs to support@swxtch.io, coverign 24 hours worth of time, starting form before the issue to up until now.

Users can use any combination of arguments below to create their logs.

Accessing and Following Logs (-f)

The following command will begin to display cloudSwXtch Bridge logs at the time of the request. The `-f` argument will follow the logs and continually update. Logs prior to the call will not display.

Bash | Copy

```bash
sudo journalctl -u <swxtch-bridge2 OR swxtch-bridge> -f
```

Note: A user will need to choose between `swxtch-bridge2` or `swxtch-bridge`.

Example:

Bash | Copy

```bash
sudo journalctl -u swxtch-bridge2 -n 200
```

Displaying Logs within a Timeframe (--since --until)

The following command will display logs within a set timeframe (between 2 dates).

Bash | Copy

```bash
sudo journalctl - u <swxtch-bridge2 or swxtch-bridge> --since <yyyy-mm-dd> --until
<yyyy-mm-dd>
```

Example:

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

```bash
sudo journalctl - u swxtch-bridge2 --since 2023-03-07 --until 2023-03-10
```

--since "Yesterday", "today", "now"

You can also use the words "yesterday," "today", or "now" after `--since` to get logs from that time period.

```bash
sudo journalctl - u swxtch-bridge2 --since yesterday
```

Displaying Logs since Last Boot (-b)

To display logs since last boot, users can use the `-b` argument.

```bash
sudo journalctl -u <swxtch-bridge2 OR swxtch-bridge> -b
```

List boots (--list-boot)

The following argument can be used to list all the boots in date/time order.

```bash
sudo journalctl -u <swxtch-bridge2 or swxtch-bridge> --list-boot
```

Exporting Logs (>)

The following command will export your logs to a .txt file. Logs should be emailed to support@swxtch.io.

```bash
sudo journalctl -u <swxtch-bridge2 or swxtch-bridge> > <file-name>.txt
```

Example:

```bash
sudo journalctl -u swxtch-bridge2 > cloudswxtch-test.txt
```

You can also combine arguments to export logs from a timeframe or from last boot. It is recommended that logs should cover 24 hours worth of time, starting from before the issue to up until now.

Example:

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

```bash
LAST BOOT:
sudo journalctl - u swxtch-bridge2 -b > cloudswxtch-test.txt

TIMEFRAME:
sudo journalctl - u swxtch-bridge2 --since 2023-03-07 --until 2023-03-10 > cloudswxtch-test.txt
```

Change Logs to UTC (--utc)

To switch logs from local time to UTC, use the following argument:

```bash
sudo journalctl --utc
```

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

How to Find xNIC Logs

> WHAT TO EXPECT
>
> In this article, you will learn how to find xNICs logs on your VM and how to alter its verbosity level.
>
> swXtch.io Support may also request for you to send cloudSwXtch logs. For more information, see How to View cloudSwXtch Logs for Troubleshooting.

Locating xNIC Logs

An xNIC installed on a virtual machine creates one .log file per day with the following naming structure: swxtch-xnic-YYYYMMDD.log. If the file size exceeds the maximum within the same day (16MB), it will be renamed by adding a counter as a suffix. Then, a new file will be created.

To find your logs, use the following file paths:

- Windows: C:\Users\Public\SwXtch.io\logs
    - Swxtch-xNIC\ for xNIC1
    - Swxtch-xNIC2\ for xNIC2
- Linux: /var/log/swxtch
    - swxtch-xnic for xNIC1
    - swxtch-xnic2 for xNIC2

For Windows and Linux, you will see a folder for both versions of xNIC (1 and 2). Logs will only populate in the folder of the xNIC version you're using.

> Log File Deletion
>
> Log files older than 30 days are automatically deleted.

What is verbosity?

Depending on the level of verbosity detailed in the xNIC config file, a log will contain different application messages and usage statistics. The default verbosity level after xNIC installation is 0, which means that no periodic statistics are being reported. It will only show start and stop information as well as critical errors.

A user can change the verbosity to pull more information out from their xNIC. The levels are detailed below:

- Level 0: Only show start and stop info as well as critical errors. This is the default.
- Level 1: Shows statistics and IGMP messages
- Level 2: Additional control messages
- Level 3: Hexadecimal dumps of control/config packages
- Level 4: Hexadecimal dumps of data packages

An average user would typically only need up to Level 2 for troubleshooting issues with their xNIC.

> Verbosity and File Size
>
> Please note that increasing the verbosity level of future logs will result in larger file sizes. It is recommended to revert back to the default Level 0 when testing and troubleshooting is complete.

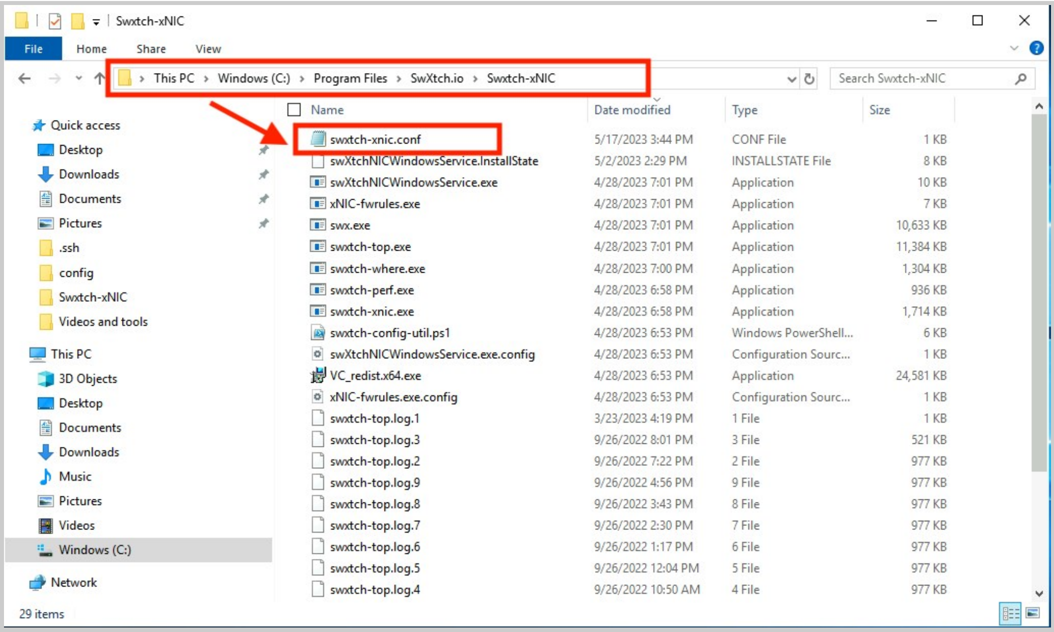
©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

How to Change Verbosity

To change the verbosity, a user can manually edit the xNIC config file on their VM.

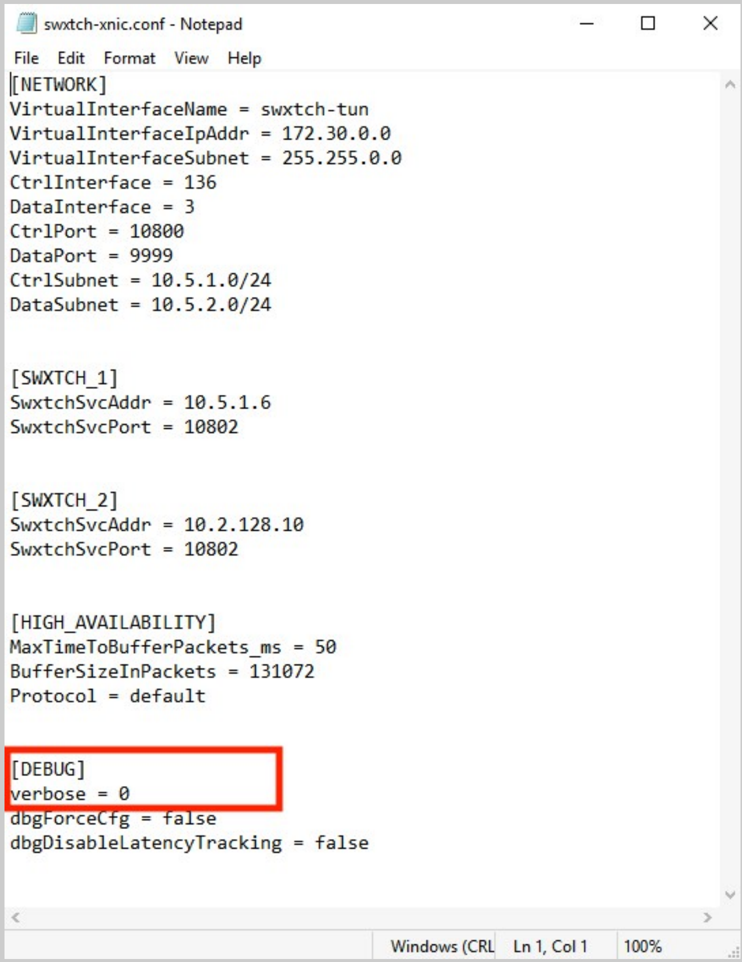
For Windows:

1. Go to the Swxtch-xNIC folder on the VM you have an xNIC installed. Make sure it is the xNIC you want logs for.
    1. For xNIC1: C:\Program Files\SwXtch.io\Swxtch-xNIC
    2. For xNIC2: C:\Program Files\SwXtch.io\Swxtch-xNIC2

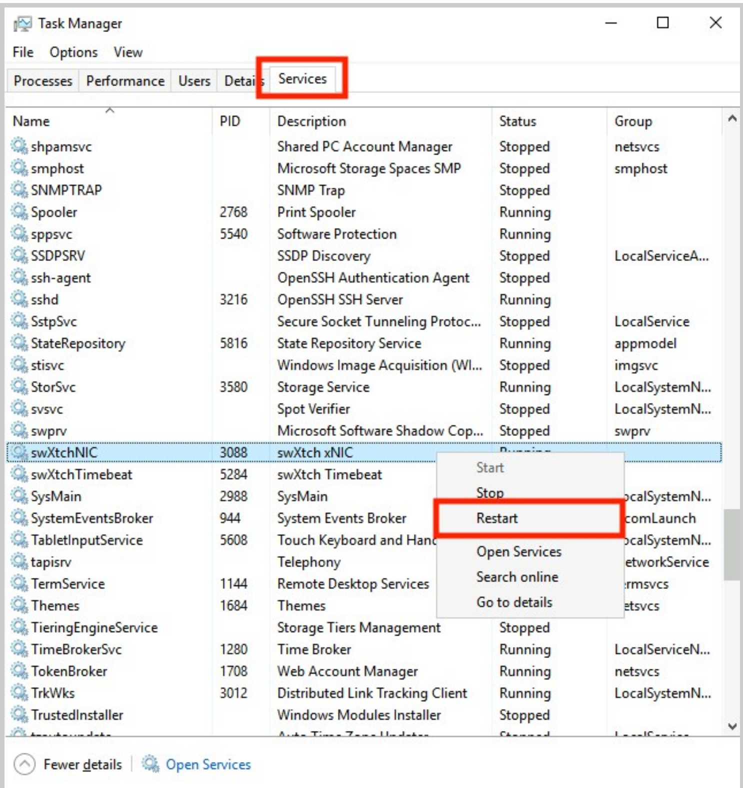


2. Open the "swxtch-xnic.conf" file.
3. Change the number next to "verbose" so that it matches the level you desire. The default is 0.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



4. Save and Close the config file.
5. Open "Task Manager" and go to the "Services" tab towards the top of the window.
6. Scroll down to "swXtchNIC" and right-click on it.
7. Select "Restart."



Your selection in verbosity will now be applied to future logs.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

For Linux:

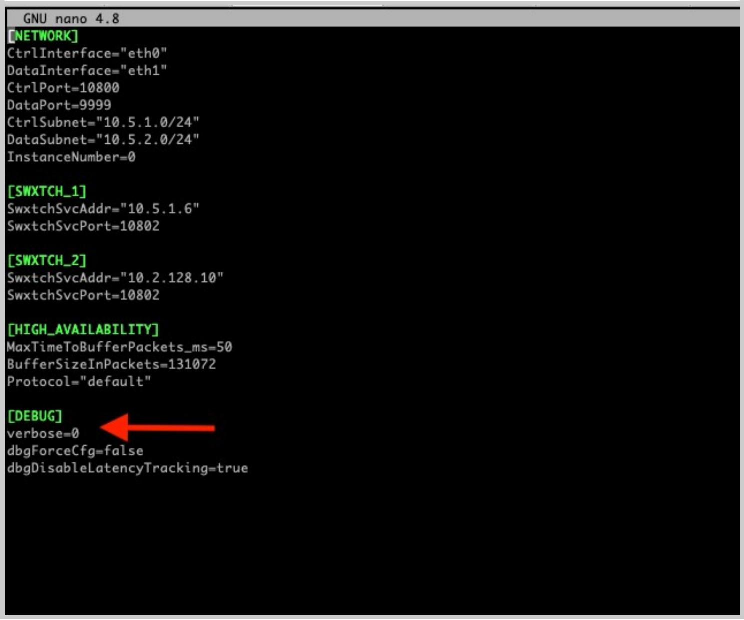
1. Enter the following command to view your config file in the Bash terminal. Make sure it is on the xNIC you want logs for.

   Text

   None | Copy

   ```
   xNIC1:

   sudo nano /var/opt/swxtch/swxtch-xnic/swxtch-xnic.conf

   xNIC2:

   sudo nano /var/opt/swxtch/swxtch-xnic2/swxtch-xnic.conf
   ```

2. Change the number next to "verbose" so that it matches the level you desire. The default is 0.



3. Save and Exit the file.
4. Restart your xNIC by using the following command:

   Text

   None | Copy

   ```
   sudo systemctl restart swxtch-xnic.service
   ```

Your selection in verbosity will now be applied to future logs.

PRO-TIP

Rename your existing log file before restarting the xNIC service in order to differentiate it with the freshly generated log file containing the new verbosity data.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

How to License a cloudSwXtch

WHAT TO EXPECT

In this article, users will learn the appropriate steps for licensing their cloudSwXtch instance.

1. Log into the newly created cloudSwXtch VM.

2. Run the command:

Bash | Copy

```bash
sudo /swxtch/swxtch-top dashboard --swxtch localhost
```

3. The **swXtch-top dashboard** will display.

Alternatively, if you do not want to open swXtch-top, you can also use the following command to get the SwXtchID:

Bash | Copy

```bash
curl -s http://127.0.0.1/top/dashboard | grep -m 2 -Eo '"fingerprint"[^,]*' | head -1
```

4. Copy the **SwXtchID** and email it to support@swxtch.io requesting a license.

5. When you receive the license, upload it onto the cloudSwXtch VM.

6. Move the **license.json** file to the **/swxtch** directory using the following command replacing user with the appropriate value:

Bash | Copy

```bash
sudo mv /home/<user>/license.json /swxtch
```

7. Return to the **swxtch-top dashboard** again check the license took hold.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

How to Install a cloudSwXtch Licensing Server

WHAT TO EXPECT

The Licensing Server allows users to circumvent the traditional license request process by installing a license bundle server directly onto a VM connected to the cloudSwXtch. Instead of having to email support@swXtch.io for a SwXtchID specific license file for every instance, the user themselves can grant a locked set of entitlements to a specific number of instances. This pair of maximum instances permitted and entitlements set is called a bundle.

In this article, users will learn how to install a self-hosted licensing server for their cloudSwXtch network.

Accessing the Licensing Server Installer

Installing the Licensing Server is a relatively straight-forward process.

1. Request the Licensing Server installer and the license.dat file containing the bundle from support@swXtch.io or directly from your Solutions Architect.
2. Run the following command in the VM that you would like to act as the Licensing Server VM. This will initiate the installer and create a folder that would hold the license bundles (/swxtch/bundles). At install, the folder will be empty.

   Shell

   Bash | Copy
   ```bash
   sudo dpkg -i swxtch-license-svr_1.0.0_amd64.deb
   ```
3. Run the following command to start the Licensing Server. This *MUST* be done after the initial installation. It will automatically start when start the VM in the future.

   Bash | Copy
   ```bash
   sudo systemctl start swxtch-license-svr
   ```
4. Move license.dat file into the bundle folder located under /swxtch/bundles.

You should now be ready to configure the cloudSwXtch.

Configuring the cloudSwXtch

After installing the Licensing Server on your designated VM, a user will need to configure their cloudSwXtch to point at it when looking for a license file.

1. Create the remote-licensing.json file in your cloudSwXtch directory. It *MUST* have the name: remote-licensing.json
2. Enter the following information in the remote-licensing.json file, replacing <IP-license-server> with the IP address of the VM selected to be the licensing server.

   Shell

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

```bash
{
        "Url": "http://<IP-license-server>:8081/swxtch/bundles",
        "bundleName": "license"
}
```

1. Note: In version 2.1.0, there is currently only one bundle file available with specific entitlements named "license".

3. Save and close the file.
4. Restart the cloudSwXtch, specifically the swxtch-ctrl.service.

The cloudSwXtch is now ready and pointing to the license server.

Viewing License Bundles

A user can view their bundles by running the following command on their cloudSwXtch, its agents or the licensing server VM:

```bash
curl http://<IP-license-server>:8081/swxtch/bundles/show
```

Please note that there is currently only one bundle file available with specific entitlements named "license". The example below shows what that output will look like:

```bash
testadmin@agent-000:/swxtch$ curl http://localhost:8081/swxtch/bundles/show
[
    {
        "bundleName": "license",
        "poolSize": 5,
        "consumedCount": 1,
        "authorized": [
            {
                "Fingerprint": "86224545-12aa-42af-9a24-374a6c1a8a7c",
                "UpdateTime": "2023-12-28T16:35:46.214579179Z"
            }
        ]
    }
]
```

poolSize lists the amount of cloudSwXtches allowed on this bundle. In this example, 5 cloudSwXtches are allows with 1 already consuming a license (consumedCount).

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

How to set MTU size

In some cases the MTU Size of the multicast group may exceed the 1500 set limit in Windows and Linux virtual machines. This article will explain how to increase the MTU size if this should occur.

To know if the MTU size has been exceeded Wireshark or tcpdump can be used. Below is an example from Wireshark.

	Time	Source	Destination	Protocol	Length	Info
1	0.000000	172.30.0.11	239.192.10.160	UDP	1482	60000 → 4002 [BAD UDP LENGTH 1449 > IP PAYLOAD LENGTH] Len=1441
2	0.000000	172.30.0.11	239.192.10.160	UDP	1482	60000 → 4002 [BAD UDP LENGTH 1450 > IP PAYLOAD LENGTH] Len=1442
3	0.000000	172.30.0.11	239.192.10.160	UDP	1482	60000 → 4002 [BAD UDP LENGTH 1450 > IP PAYLOAD LENGTH] Len=1442
4	0.000000	172.30.0.11	239.192.10.160	UDP	1482	60000 → 4002 [BAD UDP LENGTH 1450 > IP PAYLOAD LENGTH] Len=1442
5	0.000203	172.30.0.11	239.192.10.160	UDP	1482	60000 → 4002 [BAD UDP LENGTH 1450 > IP PAYLOAD LENGTH] Len=1442
6	0.000203	172.30.0.11	239.192.10.160	UDP	1482	60000 → 4002 [BAD UDP LENGTH 1450 > IP PAYLOAD LENGTH] Len=1442

your title goes here

your content goes here
:::Note: The UDP length error shows it is exceeding the Length.

Linux update MTU Size:

First check MTU current size by running the following command:

None Copy

```
ifconfig | grep mtu
```

Example:

None Copy

```
someadmin@my-agent-101:~$ ifconfig | grep mtu
enP43852s1: flags=6211<UP,BROADCAST,RUNNING,SLAVE,MULTICAST>  mtu 1500
enP4589s2: flags=6211<UP,BROADCAST,RUNNING,SLAVE,MULTICAST>  mtu 1500
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
```

Note: The MTU size of eth1 = 1500

To change MTU size to 2000 for example - use the command below:

None Copy

```
sudo ifconfig eth1 mtu 2000 up
```

Validate it is set to new value in this case 2000 by running this command:

None Copy

```
ifconfig | grep mtu
```

Example:

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

None Copy

```
someadmin@my-agent-101:~$ ifconfig | grep mtu
enP43852s1: flags=6211<UP,BROADCAST,RUNNING,SLAVE,MULTICAST>  mtu 1500
enP4589s2: flags=6211<UP,BROADCAST,RUNNING,SLAVE,MULTICAST>  mtu 2000
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 2000
lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
```

Note: The MTU size of eth1 is now = 2000

Windows Update MTU Size

1. Check MTU Size by running this command:

None Copy

```
netsh interface ipv4 show subinterfaces
```

You will see a list of network interfaces.
2. Set the MTU Size (in this case to 2000) using the following commands:

None Copy

```
netsh
```

None Copy

```
interface
```

None Copy

```
ipv4
```

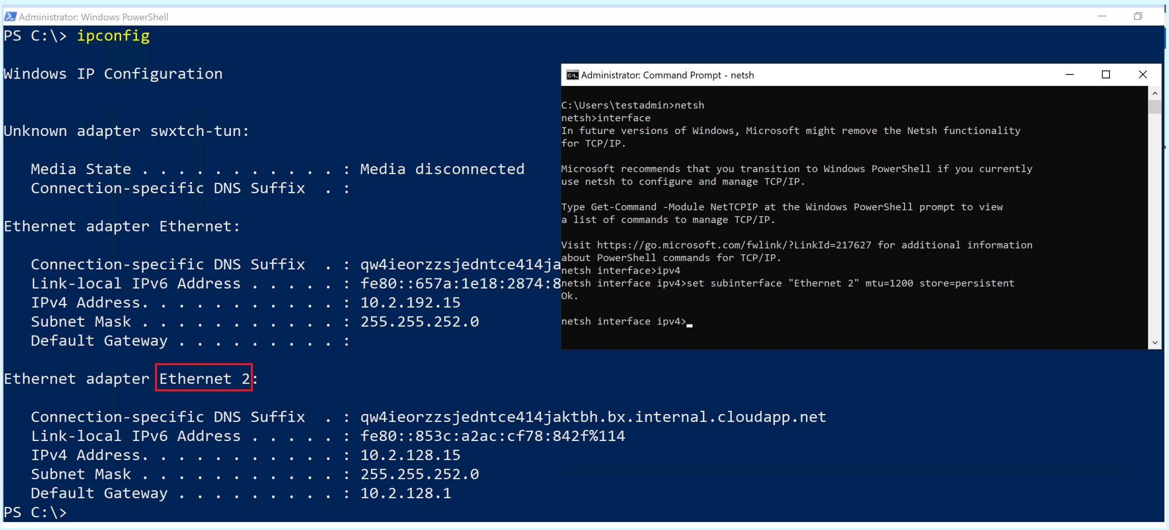
and finally to acturally set the value:

None Copy

```
set subinterface “Local Area Connection” mtu=2000 store=persistent
```

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Where “Local Area Connection” is the Ethernet adaptor to be set - for example:



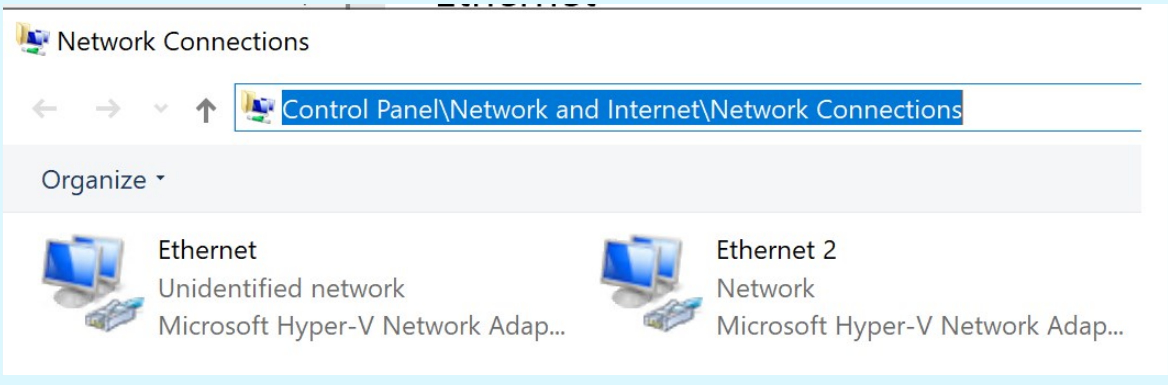
{height="" width=""}

2a. If you get the following error then follow steps after error:

None | Copy

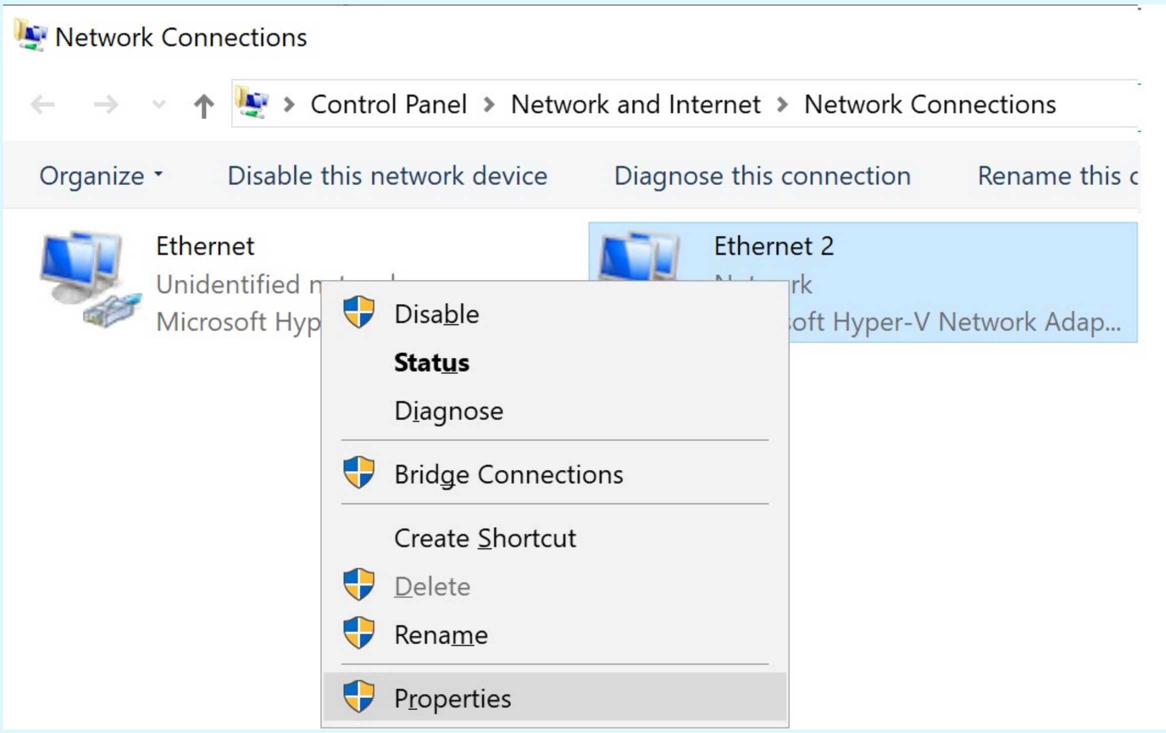
```
netsh interface ipv4>set subinterface "Ethernet 2" mtu=2000 store=persistent
The parameter is incorrect.
```

2b. Go to the Network connection → “Control Panel\Network and Internet\Network Connections”



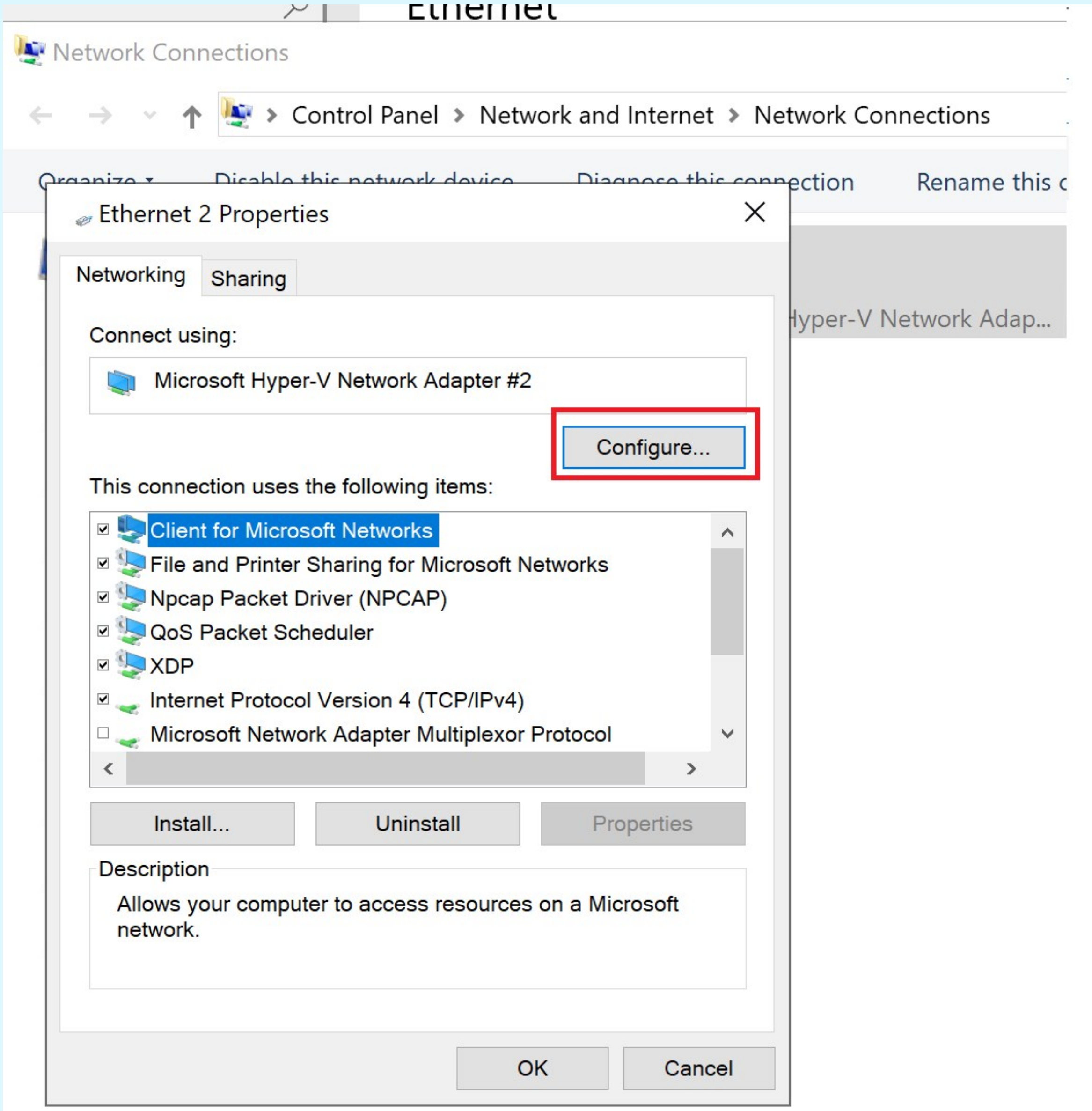
©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

2c. Right click on the Ethernet Adaptor that the traffic is expected and select Properties.



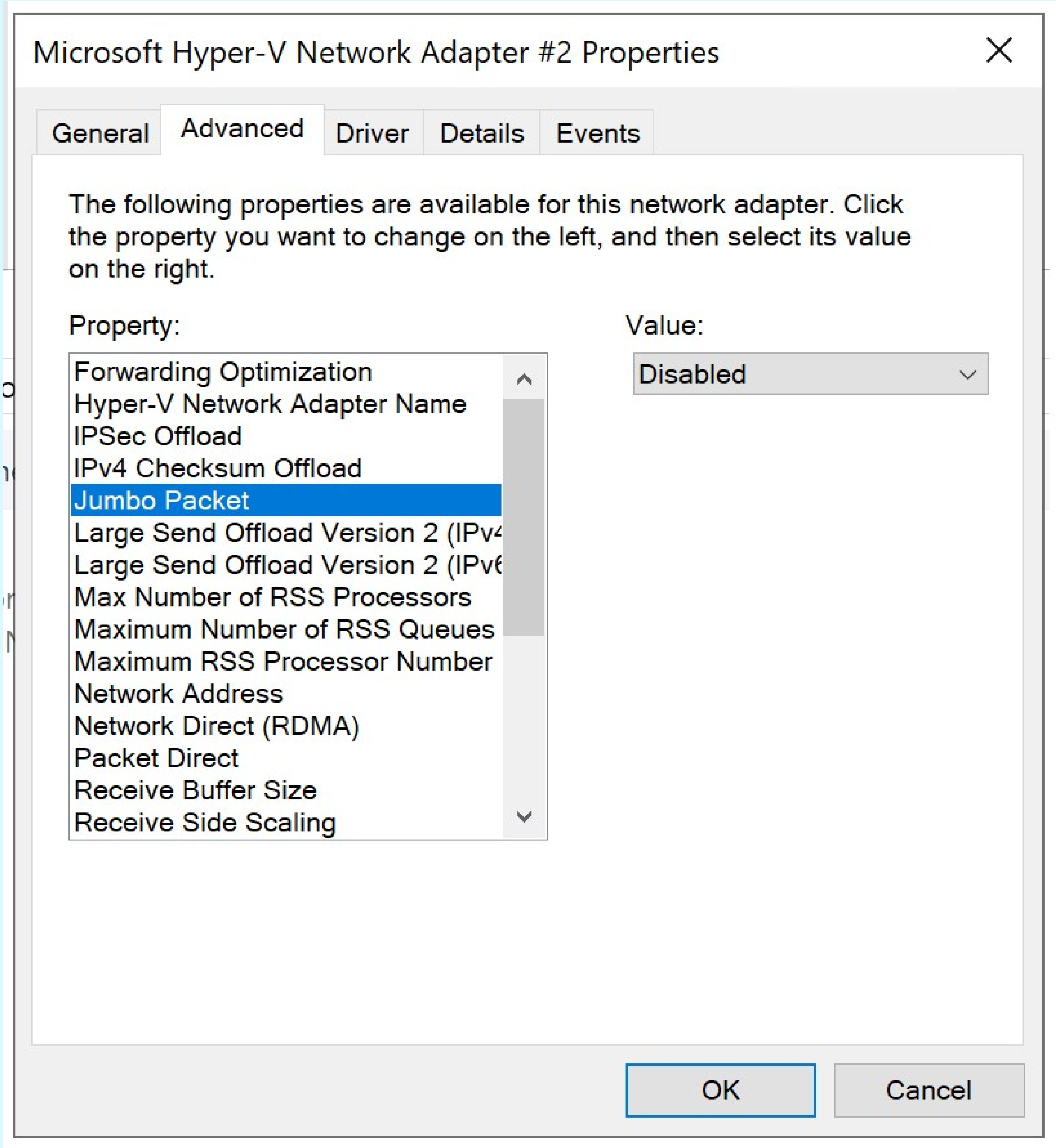
©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

2d. Select “Configure”



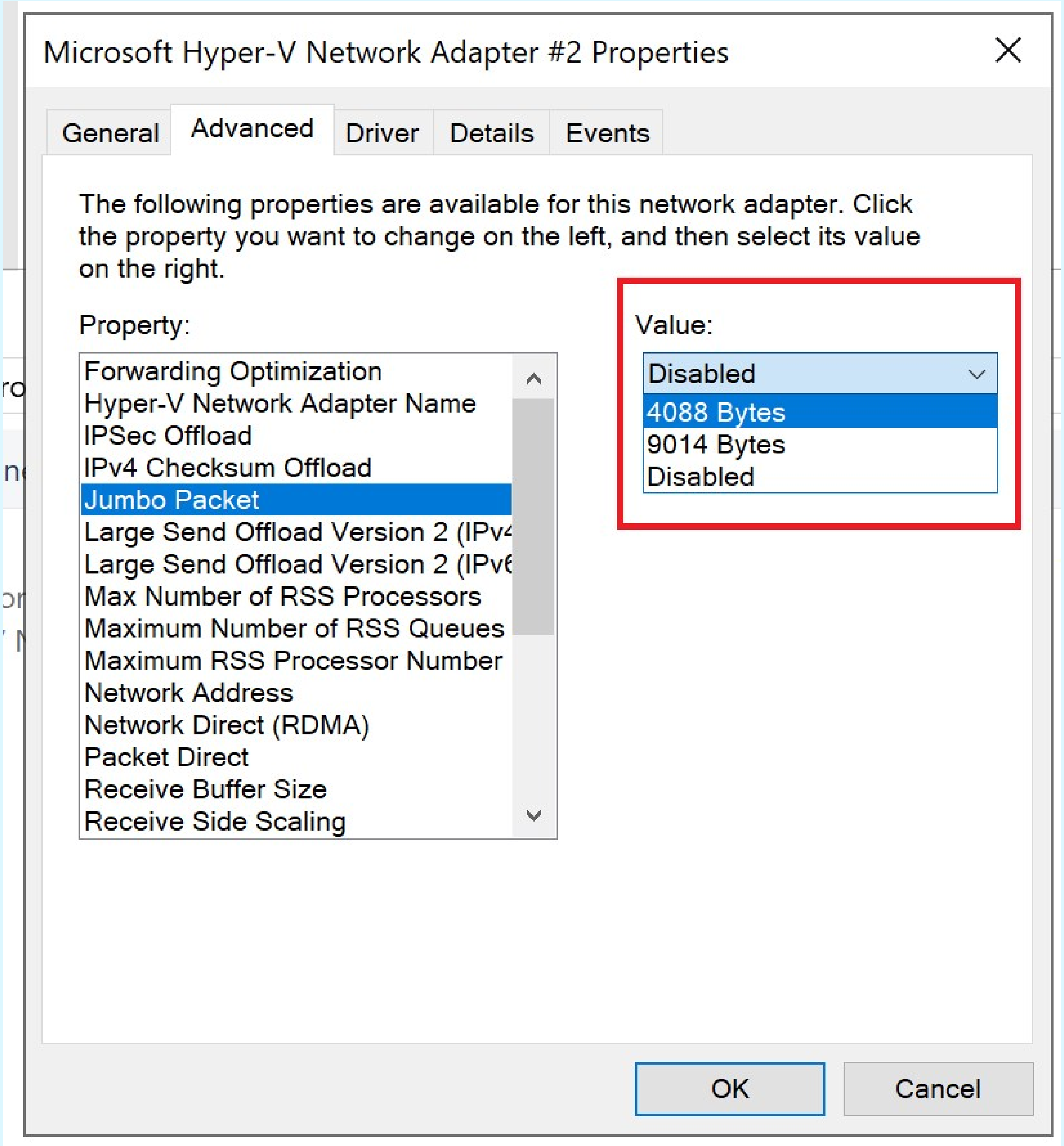
©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

2e. Select "Jumbo Packet"



©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

2f. Select "4088 Bytes" then select "OK".



{height="" width=""}

3. Re-run step 2 to set MTU size
5. Reboot your computer
6. Re-run step 1 to validate the MTU size is correct

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

How to Peer between VPCs in Different Regions for AWS

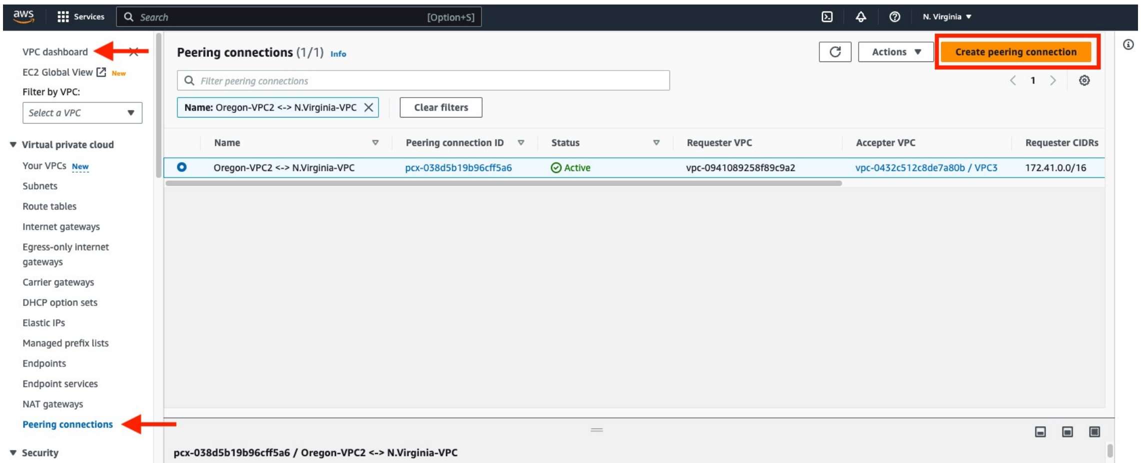
WHAT TO EXPECT

In order to successfully do Peering Connections between VPCs in different regions on AWS, a user must configure their route tables to allow traffic between instances. This will ensure that packets destined for a specific network segment on the other region/VPC/subnet are correctly routed.

In this article, users will learn how to [Create a Peering Connection between Different Regions](), [Modify Route Tables]() and [Edit Subnet Associations](). Step 2 and 3 of the process will need to be repeated for both regions.

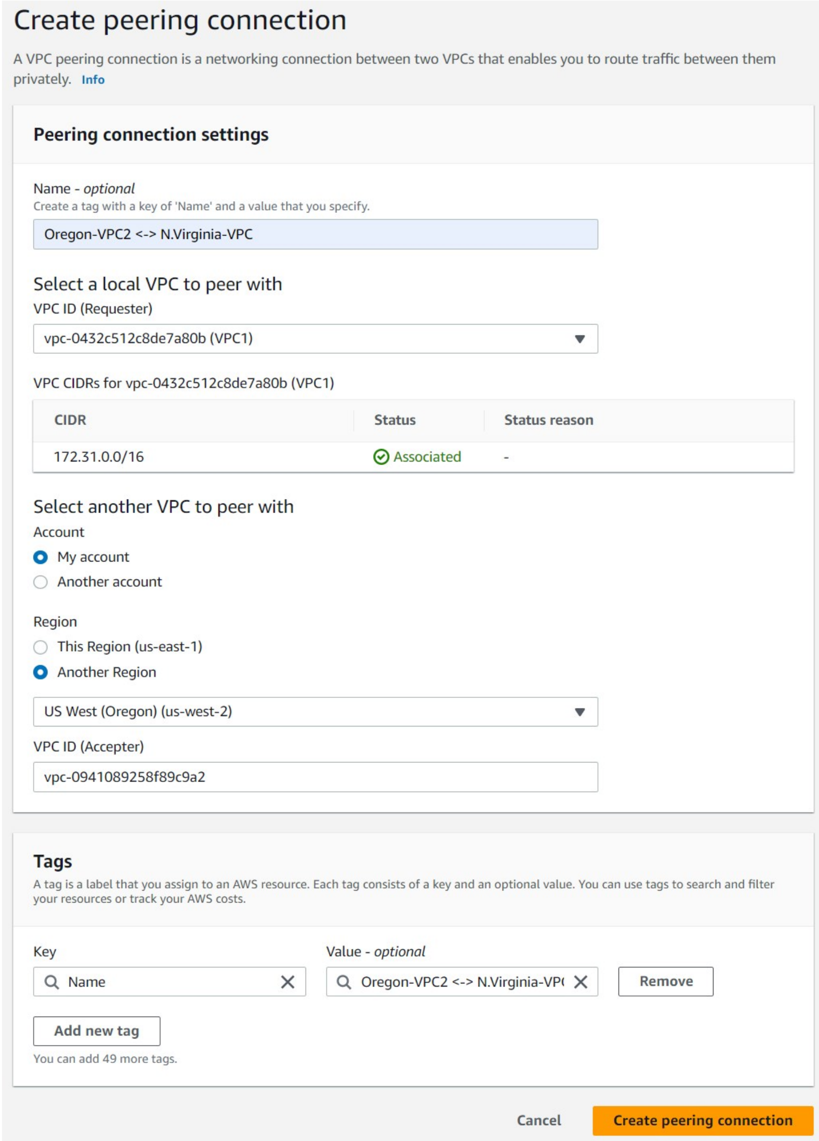
STEP ONE: Create a Peering Connection between Different Regions

1. Go to the VPC Dashboard and select Peering Connections.
2. Click Create peering connection.

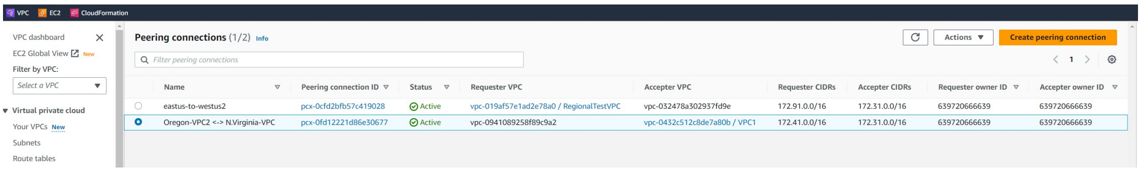


3. Edit the following in the Create peering connection form:
    1. Set a descriptive name. In the example, the user lists the connection between VPCs from Oregon and N. Virginia.
    2. Select the VPC of the instance you want to connect from.
    3. Select Another Region and select the destination region from the dropdown menu.
    4. Enter the VPC ID of the target VPC in the target region.
    5. Add any tag needed for organization purposes.

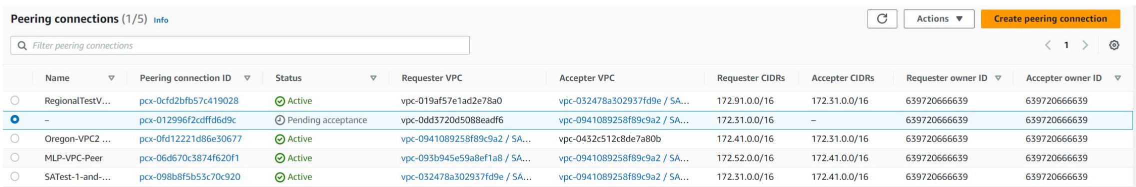
©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



4. Click Create peering connection. A new Peering Connection should now be listed for the region you're on. Please note: A "mirrored connection" will be created on the "destination" region. It must be accepted manually to be active.

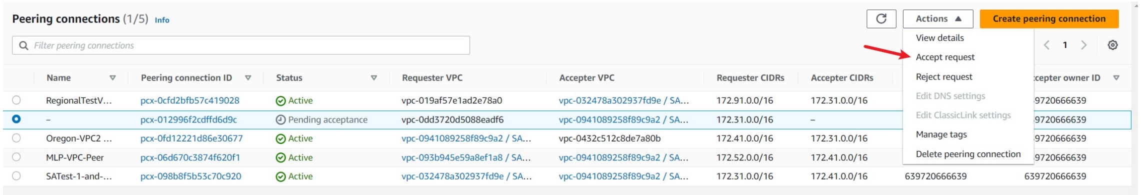


5. Change to the other region.
6. Go to Peering Connections.
7. Select the new Peering Connection listed as "Pending acceptance."



8. Under the Actions dropdown, select Accept request.

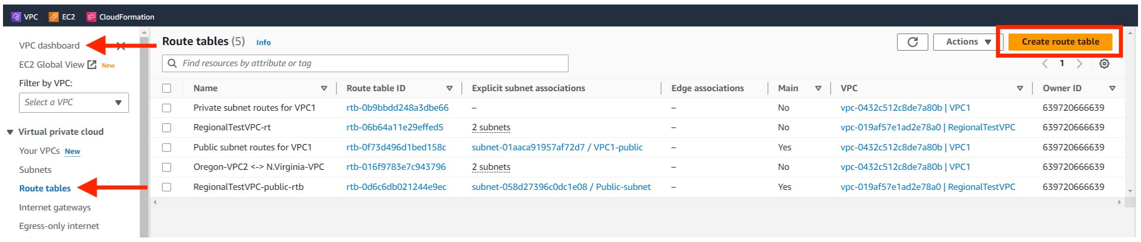
©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



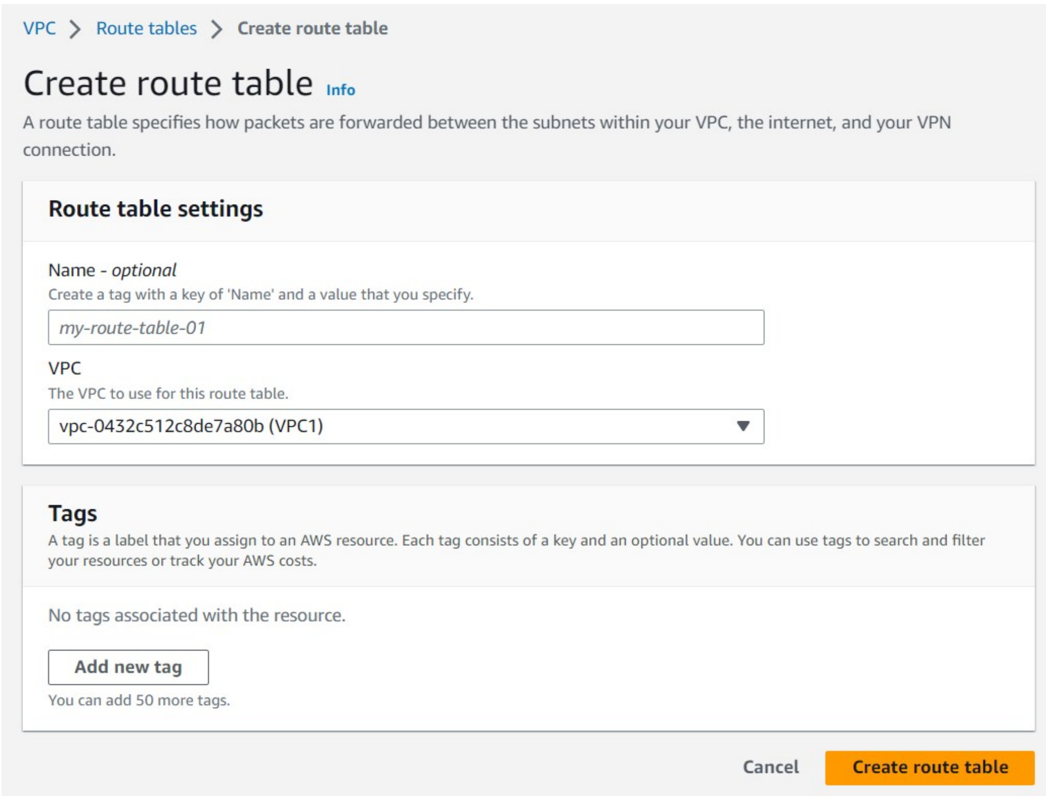
STEP TWO: Modify Route Tables in Both Regions

Once the peering connections are created, the route table must be modified in both regions. Start with the 1st region and complete STEP TWO and STEP THREE.

1. Go to the VPC Dashboard.
2. Click on Route tables in the Virtual private cloud section.
3. Select Create route table button.

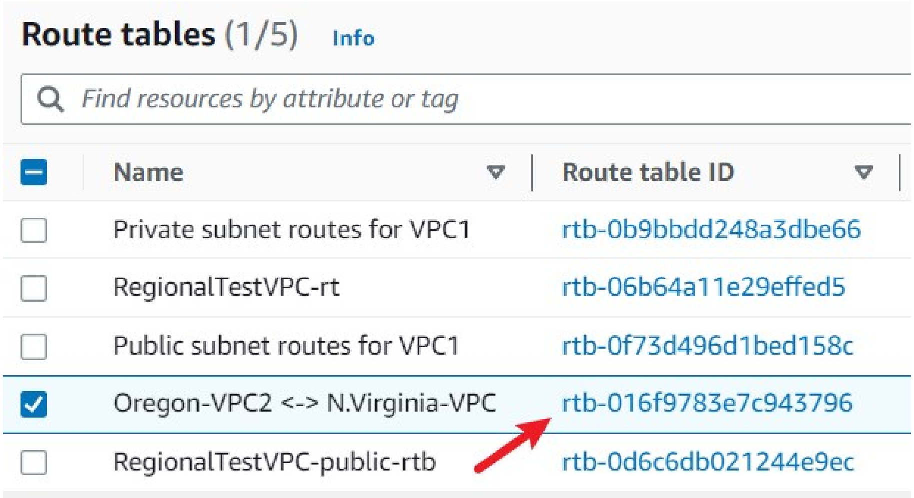


4. Edit the following in the Create route table form:
    1. Enter a descriptive name.
    2. Select the correct VPC.
    3. Add any necessary tags.

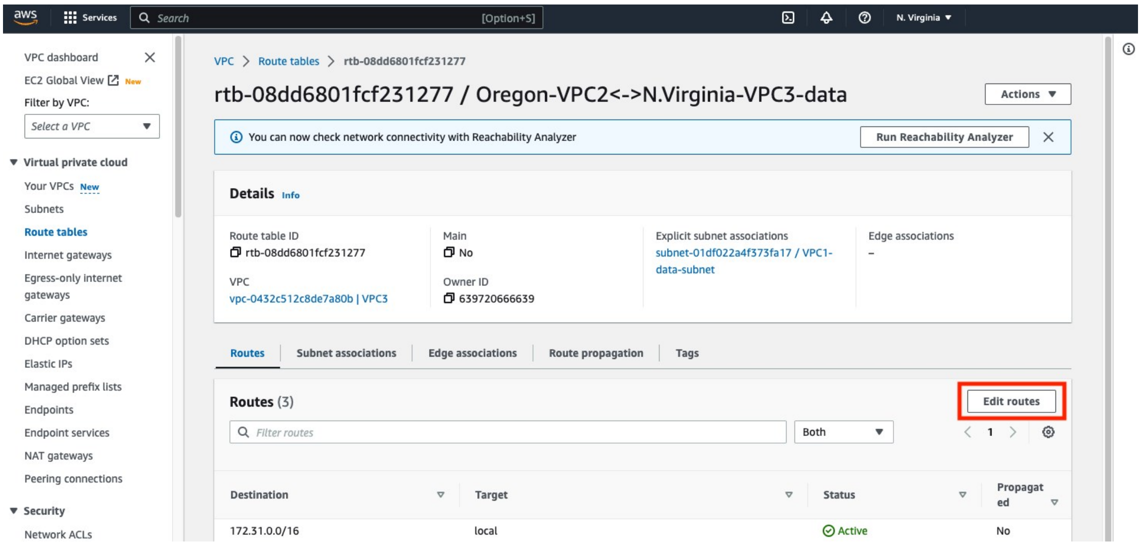


5. Select Create route table.
6. Select the Route table ID of the route table you just created.

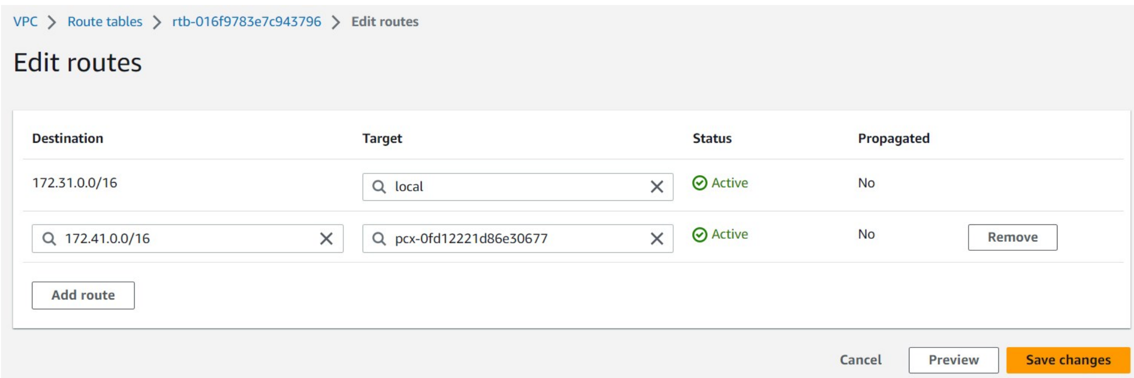
©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



7. Select Edit routes button the next screen.



8. Add the Destination by entering the CIDR of the destination network.
9. Under Target, select the recently created Peering Connection from the list.



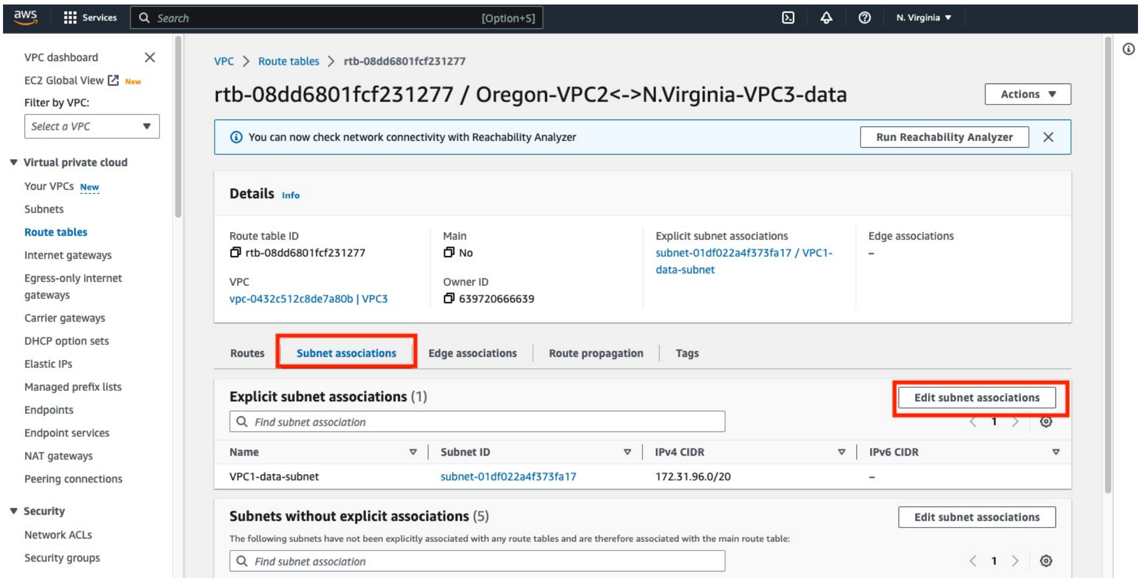
10. Click the Save changes button.

> **Internet Access**
>
> If you need the agents to have access to the internet, you will also need to add the route for the 0.0.0.0/0 towards the NAT gateway.

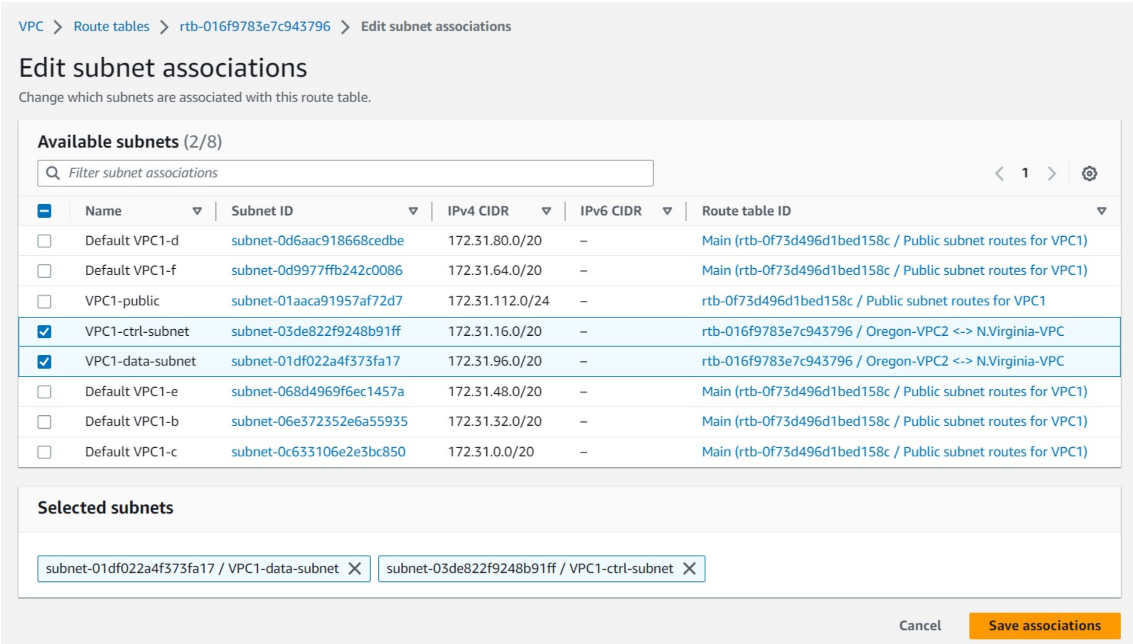
STEP THREE: Edit Subnet Associations

1. Select Subnet associations tab.
2. Select Edit subnet associations button under the Explicit subnet associations box.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



3. Select the subnet(s) of the instance that must be connected to the destination.



4. Click the Save associations button.

> **Security Groups**
>
> It is important that security groups on each EC2 and on each Subnet on both Regions match and should both encompass the port exceptions listed in the [cloudSwXtch System Requirements]article.

Repeat STEP TWO and THREE for the Other Region

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Media Use Cases

The media market can take advantage of several cloudSwXtch features such as:

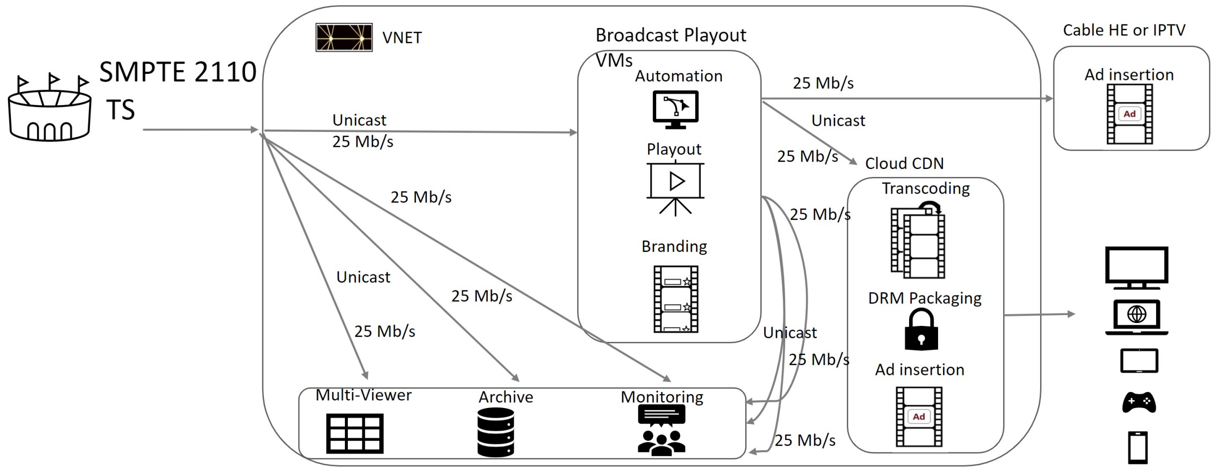
- Multicast
- Hitless Merge
- Compression support
- Protocol Fanout
- Disaster Recovery

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Media Multicast made easy with cloudswXtch

Media companies want to build dynamic workflows on the cloud, but clouds only support unicast workflows. This makes media workflows cumbersome as each stream would need to be configured for each reciever. Network provisioning and administration is complex, distributed, difficult to modify and must be be replicated for every workflow as shown below:

Unicast Playout in cloud without cloudSwXtch



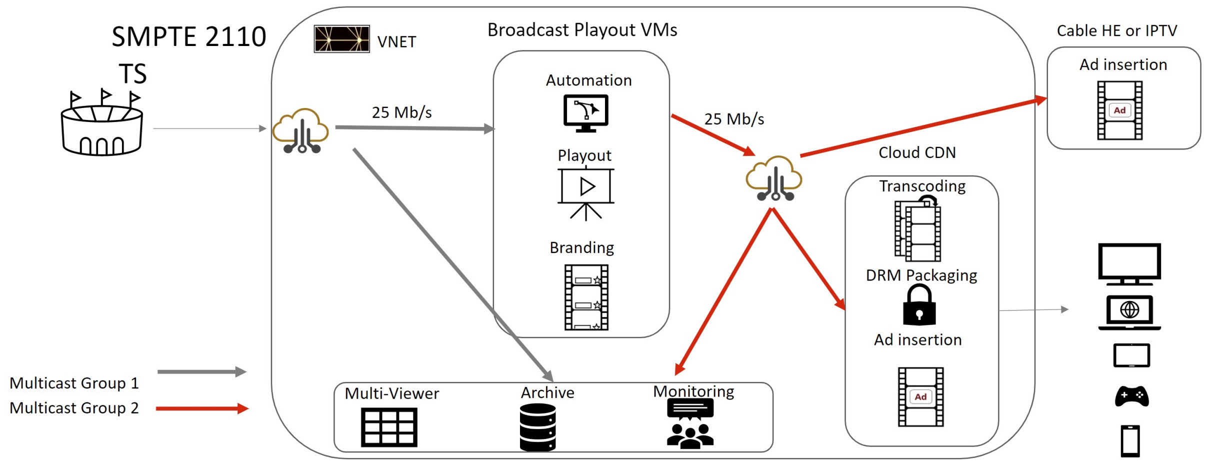
With unicast there are a number of issues:

- Network provisioning and administration is complex, distributed, difficult to modify and must be replicated for each channel or workflow
- The users cannot add endpoints without reconfiguring servers
- Larger VMs are required to support unicast which equates to higher cloud costs.
- Disaster Recovery is difficult to execute
- The load to the network is much larger
- SMPTE 2110 - 100+x more bandwidth

Multicast Playout in cloud with cloudSwXtch Multicast

cloudSwXtch enables true and seamless IP-multicast. Using multicast instead of unicast optimizes your network configuration and reduces your cloud distribution and egress costs. In addition, receivers can dynamically subscribe and unsubscribe to your streams as workflows dictate. cloudSwXtch eliminates having to configure and unconfigure unicast streams to accommodate configuration changes.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.



With cloudSwXtch Multicast:

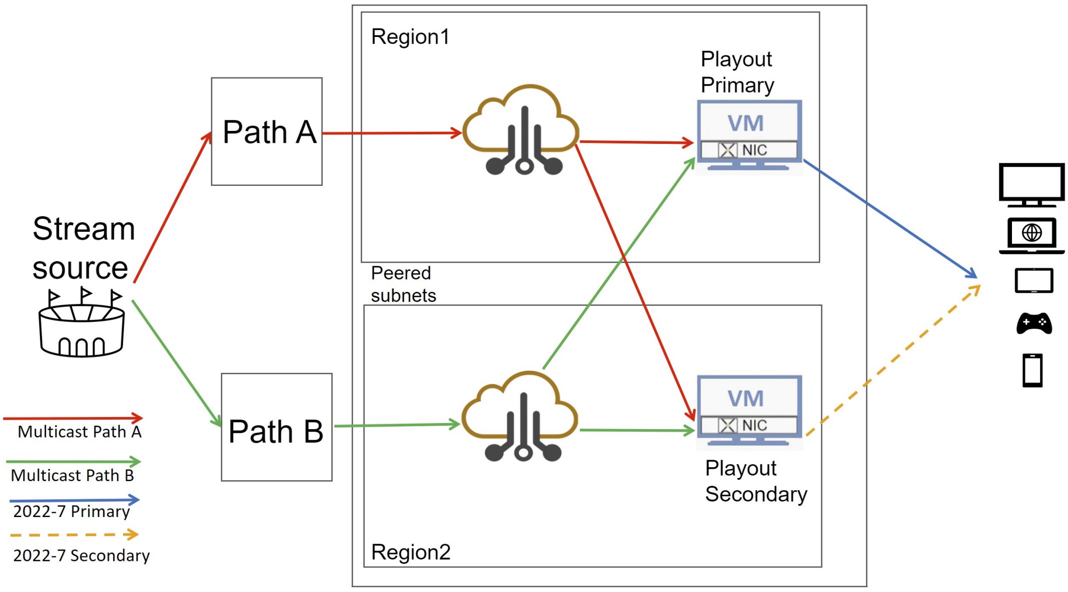
- Network may be modified and extended simply by joining multicast groups, with powerful centralized control and monitoring.
- Users can dynamically add new endpoints without playout server (or any other workflows/products) involvement.
- VM Sizes are minimized to workflow/product needs
- Disaster recovery is easy to set-up
- Minimal network load

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Hitless Merge - 2022-7

It is never good enough to have one broadcast instance, we all know things can and will go wrong. The show must always go on, media companies are used to having primary and backup streams to ensure the best user experience with NO downtime.

cloudSwXtch SMPTE 2022-7 Hitless Merge protects against data path failures by supporting two or more data paths. It compares packet reception from the multiple streams, detecting dropped packets, and reconstructs the output stream in the correct packet order.



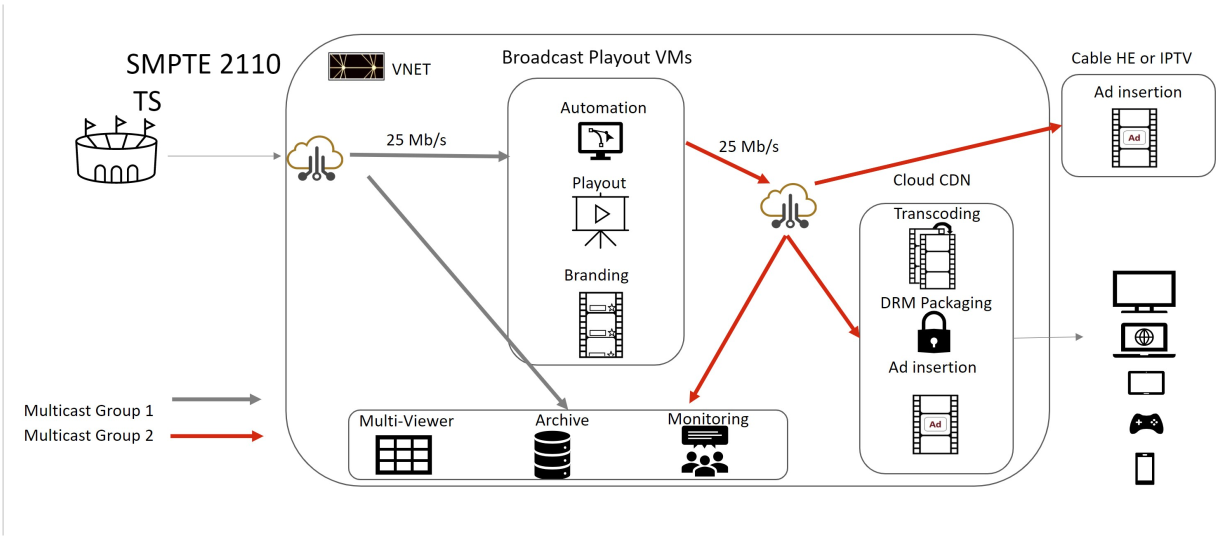
©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Media support for Compressed and Uncompressed Workflows

At swXtch.io we know that the media companies rely highly on both compressed and uncompressed content. cloudSwXtch has SMPTE 2110 support without the necessity of additional gateways or other on-ramp/off-ramp appliances. The cloudSwXtch architecture is designed to treat content the same whether it is compressed or uncompressed. This means the ingest of streams from on-prem to the cloud and the streaming of content within the cloud, whether unicast or multicast, is the same regardless of the content type. No SDK is required for uncompressed video, and the cloud network becomes an extension of your broadcast network.

There are two workflow examples below, one is a compressed workflow and the other is an uncompressed workflow. The compressed workflow is a typical playout scenario where compressed inputs come into the cloud environment and are distributed via multicast to the necessary VM workloads by cloudSwXtch. All that is required is for the workloads to subscribe to the necessary multicast group(s). This eliminates the need to continually update unicast configurations to ensure your streams get to where they need to go. However, if there are workloads that only work with unicast, cloudSwXtch can map multicast streams to unicast devices.

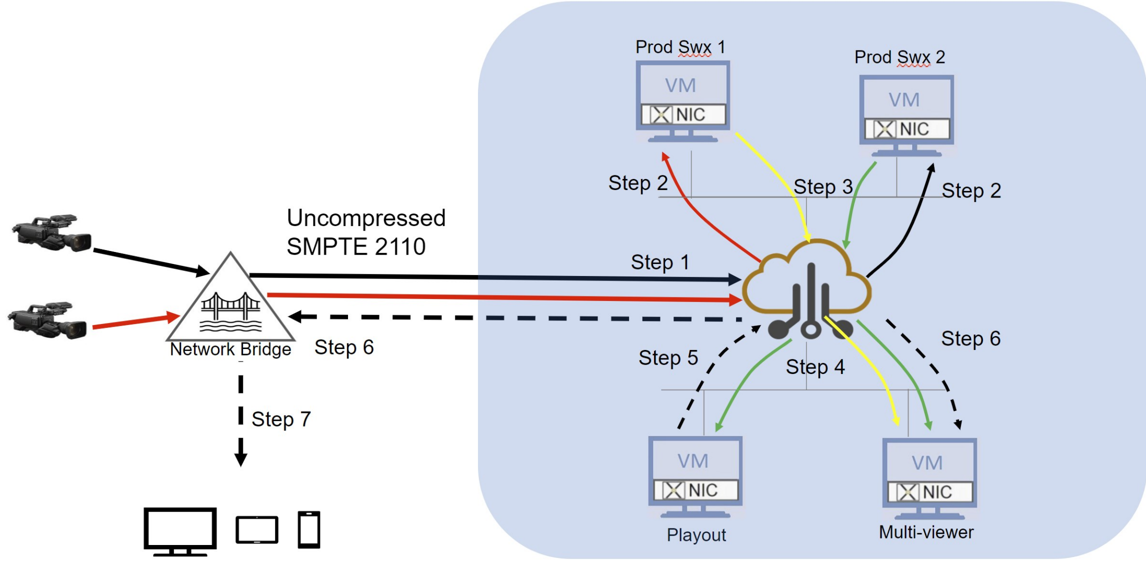
Example Compressed Playout in the Cloud with SMPTE 2110 Multicast TS



Example Uncompressed Playout in the Cloud with SMPTE 2110 Multicast

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Consider the following production workflow:



The workflow consists of a playout server which receives multiple camera feeds via 2 production switchers and determines which camera's to take to air. The cloudSwXtch is used to deliver the various streams via mulitcast to the workloads that subscribe to the stream:

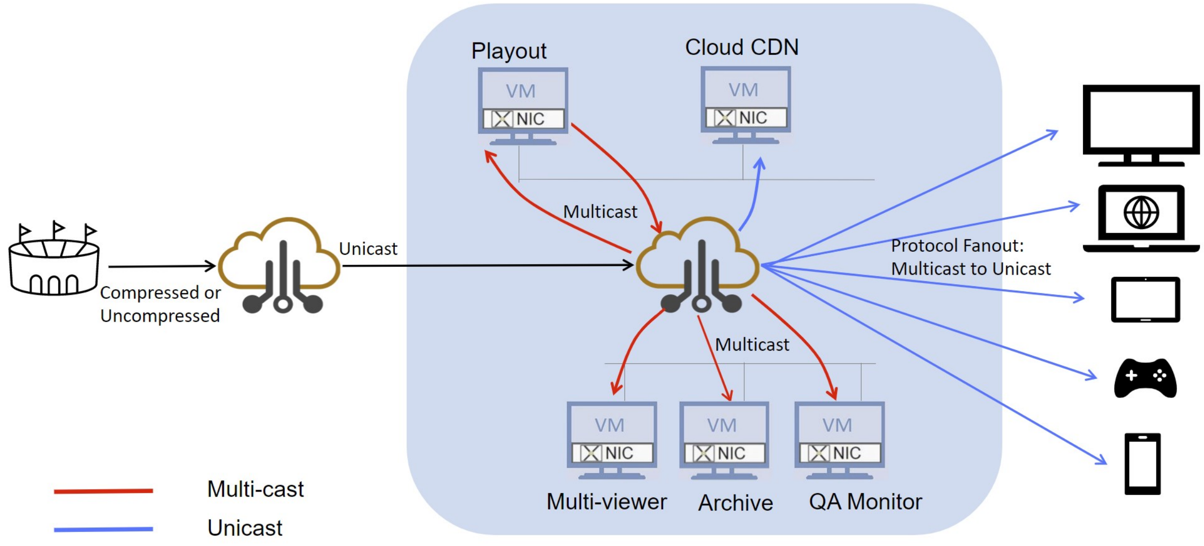
Step 1: Two inputs red and black go from Network Bridge into cloudSwXtch.
Step 2: Red stream goes from cloudSwXtch to Production Switcher 1 and black stream goes to production switcher 2.
Step 3: The modified ouptut stream from production switcher 1 is represented by the yellow path and the modified output stream from production switcher 2 is represented by the green path to the cloudSwXtch.
Step 4: All streams are multicasted to the multiviewer, via cloudSwXtch, so the director can make operational decisions.
Step 5: The playout server is directed to process and output one of the switcher outputs as represented by the dotted black to the cloudSwXtch.
Step 6: cloudSwXtch outputs the stream to the multiviewer, and the network bridge.
Step 7: The network bridge distributes to the clients for viewing consumption.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Protocol Fanout

****Media companies have many devices. Some require unicast, and some require multicast. Configuring for each device can be difficult and supporting both unicast and multicast for the same stream is impossible. Additionally multicast is not offered in the cloud see .

swXtch.io has the answer to your needs with the 'Protocol FanOut' feature which can take non-multicast packet protocols and fan them out in the same way that multicast does. It can forward a stream to many interested receivers or distribute a multicast stream to many unicast devices. This integrates unicast and multicast workflows in a way that hasn't been possible in the cloud.



©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Disaster Recovery

Disaster Recovery Scenerio

Coupling Hitless Merge - 2022-7 with redundant media workloads ensures high availability uptime for critical content and provides a new method to create highly available disaster recovery pathways in and between clouds.

There are many configurations that cloudSwXtch can recommend for redundancy, one is depicted below.

Path Redundancy

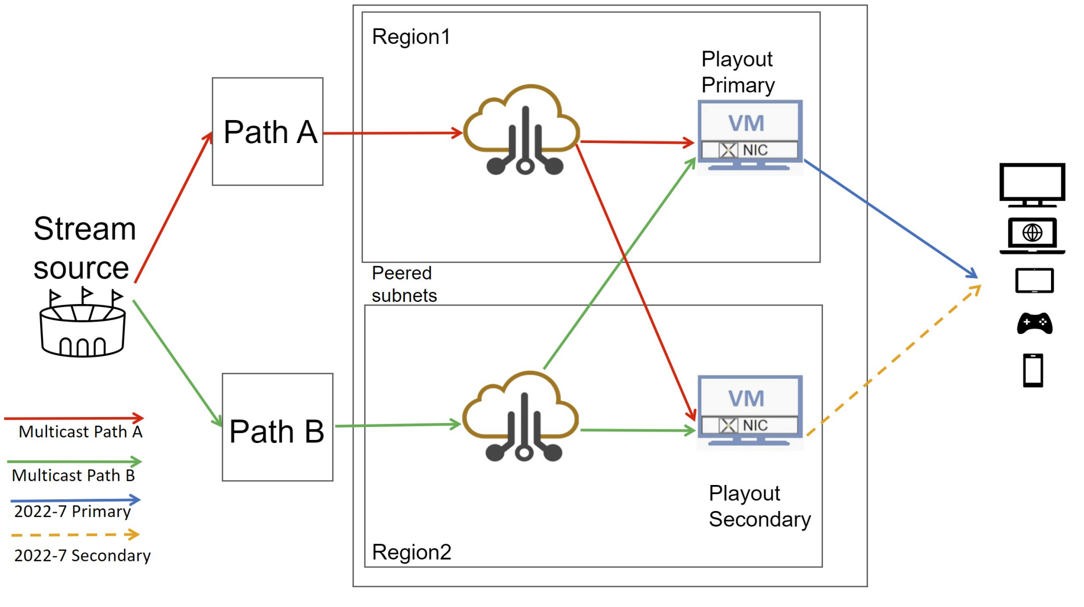
- The cloudswXtch in Region 1 can recieve the stream from Path A to Region 2.
- The cloudswXtch in Region 2 can recieve the stream from Path B to Region 1.
- If either path were to fail then the stream is still available in both Region 1 and 2 due to the redundancy.

Playout Redundancy

- Each Region has a playout system, "Primary Playout" in Region 1 and "Secondary Playout" in Region 2.
- If the "Primary Playout" should fail, the stream is still playing out in the "Secondary Playout".
- As long as it is just the playout server that fails, then there is still stream redundancy from Path A and Path B.

Region Redundancy

If one region should fail the playout should still succeed in the other Region.



This depiction only shows two stream paths, there could be a third or more. In any of these scenarios the paths could be in differnet regions or different clouds. This is done by using a cloudSwXtch as a Bridge between clouds or from on-prem to cloud.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

Resources

PDFs

Powered by

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.

©2024 IEX Group, Inc. and its subsidiaries, including swXtch.io, Investors' Exchange LLC and IEX Services LLC. IEX Services LLC, Member SIPC/FINRA. All rights reserved.