Netris docs Documentation

Release Netris v2.9

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Netris is the automatic NetOps platform that runs the physical network and provides cloud-like user experience for NetOps and DevOps engineers.

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Chapter 1

Concepts

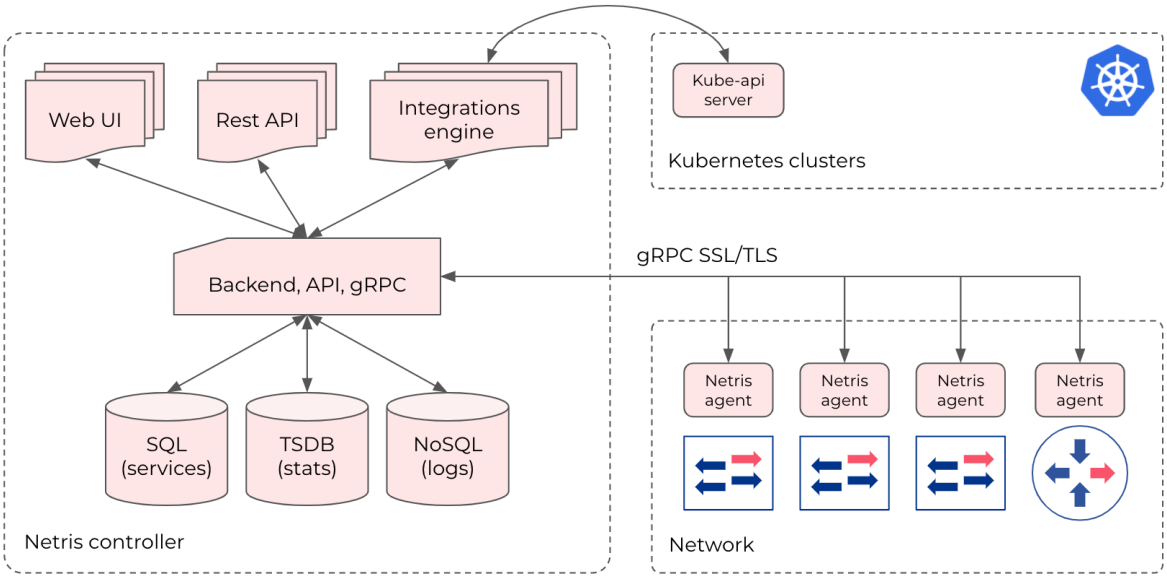
1.1 Introduction to Netris

Netris is an automatic netops software for operating physical networks like it is a cloud. Netris automatically configures switching, routing, load-balancing, and network security based on user-defined services and policies. Netris continuously monitors the network's health and either apply software remediation or informs you of necessary actions if human intervention is required. Netris abstracts away the complexities of detailed network configuration, letting you perform efficiently by operating your physical network in a top down approach like a cloud – instead of the legacy box by box operation.

1.2 What is Netris Controller

Netris Controller is the main operations control center for engineers using GUI/RestAPI/Kubernetes, systems, and network devices. Netris Controller stores the data representing the user-defined network services and policies, health, statistics, analytics received from the network devices, and information from integration modules with external systems (Kubernetes). Netris Controller can run as a VM or container, on/off-prem, or in Netris cloud.

Diagram: High level Netris architecture.



- **Controller HA.** We highly recommend running more than one copy of the controller for database replication.
- **Multiple sites.** Netris is designed to operate multiple sites with just a single controller with HA.
- **What if the controller is unreachable.** Netris operated switches/routers can tolerate the unreachability of the Netris Controller. Changes and stats collection will be unavailable during the controller unavailability window; however, switches/routers' core operation will not be affected.

1.3 Netris Switch Agent

Netris Switch Agent is software running in the user space of the network operating system (NOS) of the switch and is responsible for automatically generating the particular switch configuration according to service requirements and policies defined in the Netris Controller. Netris Switch Agent uses an encrypted GRPC protocol for secure communication with the Netris Controller accessible through a local management network or over the Internet.

1.4 Netris SoftGate

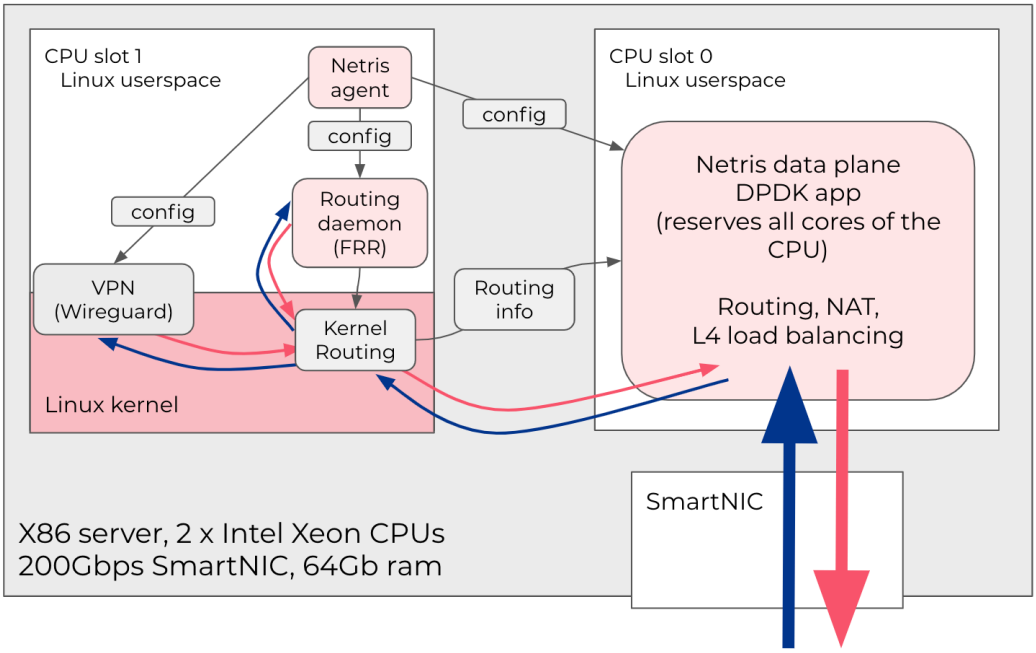
Netris SoftGate is automatic configuration software and reference architecture for enabling border routing, Layer-4 Load Balancing, Network Address Translation (NAT), and site-to-site VPN function on a regular x86 server with a SmartNIC card.

Netris SoftGate supports a high-performance DPDK data plane running in the user-space. It configures the system so that packets entering the NIC (network interface card) bypass Linux Kernel and go directly to the user space application. So traffic from the NIC travels through the PCIe bus to the closest CPU's last level cache and then into one of 8 cores, all reserved for the data-plane application. DPDK data-plane software processes the traffic for routing, load-balancing, NAT and makes necessary changes in the packet header (rewrites mac/VLAN-id) then returns the packet to the NIC, which sends it further into the switch for traveling further in Layer-2.

The server has to have 2 x Intel CPUs (8+ cores each). One CPU (closest to the SmartNIC card) is reserved for the data-plane process only (OS will report 100% CPU usage). Another CPU is used for running Linux OS, routing control plane (FRR), Netris agent, and other standard Linux utilities.

Netris agents can also configure Wireguard to form full mesh VPN tunnels between customer sites and then run necessary dynamic routing. So, servers and applications in multiple data centers can communicate over the Internet using encrypted tunnels.

Diagram: Netris SoftGate high level architecture


CPU slot 1
Linux userspace
Netris agent
config
config
Routing daemon (FRR)
VPN (Wireguard)
Kernel Routing
Linux kernel
config
Routing info
CPU slot 0
Linux userspace
Netris data plane DPDK app (reserves all cores of the CPU)
Routing, NAT, L4 load balancing
SmartNIC
X86 server, 2 x Intel Xeon CPUs
200Gbps SmartNIC, 64Gb ram

Chapter 2

On-prem Netris Controller installation

Netris Controller can be hosted in Netris cloud, installed locally as a VM, or deployed as a Kubernetes application. All three options provide the same functionality. Cloud-hosted Controller can be moved into on-prem anytime.

2.1 KVM virtual machine

Minimal system requirements for the VM:
CPU - 8 Core
RAM - 16 Gb
Disk - 100Gb
Network - 1 virtual NIC

2.2 Installation steps for KVM hypervisor

If KVM is not already installed, install Qemu/KVM on the host machine (example provided for Ubuntu Linux 18.04)

```
sudo apt-get install virt-manager
```

2.3 Netris Controller Installation steps

1. Download the Netris Controller image. (contact Netris support for repository access permissions).

```
cd /var/lib/libvirt/images

sudo wget http://img.netris.ai/netris-controller.qcow2
```

2. Download vm definition file.

```
cd /etc/libvirt/qemu

sudo wget http://img.netris.ai/netris-controller.xml
```

3. Define the KVM virtual machine

```
sudo virsh define netris-controller.xml
```

Note Netris controller virtual NIC will bind to the "br-mgmt" interface on the KVM host machine. See below network interface configuration exam

Example: Network configuration on host (hypervisor) machine.

Note replace <Physical NIC>, <host server management IP/prefix length> and <host server default gateway> with the correct NIC and IP for your host machine.

```
sudo vim /etc/network/interfaces
```

```
#Physical NIC connected to the management network
auto <Physical NIC>
iface <Physical NIC> inet static
                        address 0.0.0.0/0

#bridge interface
auto br-mgmt
iface br-mgmt inet static
                        address <host server management IP/prefix length>
                        gateway <host server default gateway>
                        bridge-ports <Physical NIC>

source /etc/network/interfaces.d/*
```

```
sudo ifreload -a
```

4. Set the virtual machine to autostart and start it.

```
sudo virsh autostart netris-controller
```

```
sudo virsh start netris-controller
```

2.4 Accessing the Netris Controller

By default, Netris Controller will obtain an IP address from a **DHCP** server.

Below steps describe how to configure a **static IP** address for the Netris Controller.

1. Connecting to the VM console.

default credentials. **login**: `netris` **password**: `newNet0ps`

```
sudo virsh console netris-controller
```

Note Do not forget to change the default password (using passwd command).

2. Setting a static IP address.

Edit network configuration file.

```
sudo vim /etc/network/interfaces
```

Example: IP configuration file.

```
# The loopback network interface
```

```
auto lo
iface lo inet loopback


# The primary network interface
auto eth0
iface eth0 inet static
        address <Netris Controller IP/prefix length>
        gateway <Netris Controller default gateway>
        dns-nameserver <a DNS server address>

source /etc/network/interfaces.d/*
```

Reload the network config.

```
sudo ifreload -a
```

Note Make sure Netris Controller has Internet access.

3. Reboot the controller

```
sudo reboot
```

After reboot, the Netris Controller GUI should be accessible using a browser. Use `netris/newNet0ps` credentials.

Don't forget to change the default password by clicking your login name in the top right corner and then clicking "Change Password".

2.5 Security hardening

Recommended for production use.

2.5.1 Changing the default GRPC authentication key.

Connect to the Netris Controller CLI (SSH or Console)

Tip: You can generate a random and secure key using sha256sum.

```
echo "<some random text here>" | sha256sum
```

example:

```
netris@iris:~$ echo "<some random text here>" | sha256sum
6a284d55148f81728f932b28e9d020736c8f78e1950b3d576f6e679d90516df1  -
```

Set your newly generated secure key into Netris Controller.

```
sudo /opt/telescope/netris-set-auth.sh --key <your key>
```

Please store the auth key in a safe place as it will be required every time when installing Netris Agent for the switches and SoftGates.

2.5.2 Replacing the SSL certificate

1. Replace below file with your SSL certificate file.

```
/etc/nginx/ssl/controller.cert.pem;
```

2. Replace below file with your SSL private key.

```
/etc/nginx/ssl/controller.key.pem;
```

3. Restart Nginx service.

```
systemctl restart nginx.service
```

Netris Controller Helm Chart

- Installs the automatic NetOps platform Netris Controller

3.1 Prerequisites

- Kubernetes 1.12+
- Helm 3.1+
- PV provisioner support in the underlying infrastructure

3.2 Get Repo Info

Add the Netris Helm repository:

```
helm repo add netrisai https://netrisai.github.io/charts
helm repo update
```

3.3 Installing the Chart

In order to install the Helm chart, you must follow these steps:

Create the namespace for netris-controller:

```
kubectl create namespace netris-controller
```

Generate strong auth key

```
export mystrongauthkey=$(date |base64 | md5sum | base64 | head -c 32)
```

Install helm chart with netris-controller

```
helm install netris-controller netrisai/netris-controller \
  --namespace netris-controller \
  --set app.ingress.hosts={my.domain.com} \
  --set netris.authKey=$mystrongauthkey
```

3.4 Uninstalling the Chart

To uninstall/delete the `netris-controller` helm release:

```
helm uninstall netris-controller
```

3.5 Configuration

The following table lists the configurable parameters of the netris-controller chart and their default values.

3.5.1 Common parameters

Parameter	Description	Default
`nameOverride`	String to partially override common.names.fullname template with a string (will prepend the release name)	`nil`
`fullnameOverride`	String to fully override common.names.fullname template with a string	`nil`
`serviceAccount.create`	Create a serviceAccount for the deployment	`true`
`serviceAccount.name`	Use the serviceAccount with the specified name	`""`
`serviceAccount.annotations`	Annotations to add to the service account	`{}`
`podAnnotations`	Pod annotations	`{}`
`podSecurityContext`	Pod Security Context	`{}`
`securityContext`	Containers security context	`{}`
`resources`	CPU/memory resource requests/limits	`{}`
`nodeSelector`	Node labels for pod assignment	`{}`
`tolerations`	Node tolerations for pod assignment	`[]`
`affinity`	Node affinity for pod assignment	`{}`

3.5.2 Netris-Controller common parameters

Parameter	Description	Default
`netris.webLogin`	Netris Controller GUI default login	`netris`
`netris.webPassword`	Netris Controller GUI default password	`newNet0ps`
`netris.authKey`	Netris Controller agents authentication key	`mystrongkey`

3.5.3 Netris-Controller app parameters

Parameter	Description	Default
`app.replicaCount`	Number of replicas in app deployment	`1`
`app.image.repository`	Image repository	`netrisai/xcaas-xcaas-web`

app.image.tag	Image tag. Overrides the image tag whose default is the chart appVersion	""
app.image.pullPolicy	Image pull policy	IfNotPresent
app.imagePullSecrets	Reference to one or more secrets to be used when pulling images	[]
app.service.type	Kubernetes service type	ClusterIP
app.service.port	Kubernetes port where service is expose	80
app.service.portName	Name of the port on the service	http
app.ingress.enabled	Enables Ingress	true
app.ingress.annotations	Ingress annotations (values are templated)	{ kubernetes.io/ingress.class: nginx }
app.ingress.labels	Custom labels	{}
app.ingress.path	Ingress accepted path	/
app.ingress.pathType	Ingress type of path	Prefix
app.ingress.hosts	Ingress accepted hostnames	["chart-example.local"]

`app.ingress.tls`	Ingress TLS configuration	`[]`
`app.autoscaling.enabled`	Option to turn autoscaling on for app and specify params for HPA. Autoscaling needs metrics-server to access cpu metrics	`false`
`app.autoscaling.minReplicas`	Default min replicas for autoscaling	`1`
`app.autoscaling.maxReplicas`	Default max replicas for autoscaling	`100`
`app.autoscaling.targetCPUUtilizationPercentage`	The desired target CPU utilization for autoscaling	`80`

3.5.4 Netris-Controller grpc parameters

Parameter	Description	Default
`grpc.replicaCount`	Number of replicas in grpc deployment	`1`
`grpc.image.repository`	Image repository	`netrisai/xcaas-agent-api-server`

`grpc.image.tag`	Image tag. Overrides the image tag whose default is the chart appVersion	`""`
`grpc.image.pullPolicy`	Image pull policy	`IfNotPresent`
`grpc.imagePullSecrets`	Reference to one or more secrets to be used when pulling images	`[]`
`grpc.service.type`	Kubernetes service type	`ClusterIP`
`grpc.service.port`	Kubernetes port where service is expose	`443`
`grpc.service.portName`	Name of the port on the service	`grpc`
`grpc.autoscaling.enabled`	Option to turn autoscaling on for app and specify params for HPA. Autoscaling needs metrics-server to access cpu metrics	`false`

`grpc.autoscaling.minReplicas`	Default min replicas for autoscaling	`1`
`grpc.autoscaling.maxReplicas`	Default max replicas for autoscaling	`100`
`grpc.autoscaling.targetCPUUtilizationPercentage`	Target CPU utilization for autoscaling	`80`

3.5.5 Netris-Controller telescope parameters

Parameter	Description	Default
`telescope.replicaCount`	Number of replicas in telescope deployment	`1`
`telescope.image.repository`	Image repository	`netrisai/xcaas-telescope-go`
`telescope.image.tag`	Image tag. Overrides the image tag whose default is the chart appVersion	`""`
`telescope.image.pullPolicy`	Image pull policy	`IfNotPresent`
`telescope.imagePullSecrets`	Reference to one or more secrets to be used when pulling images	`[]`
`telescope.service.type`	Kubernetes service type	`ClusterIP`

`telescope.service.port`	Kubernetes port where service is expose	`80`
`telescope.service.portName`	Name of the port on the service	`ws`
`telescope.service.securePort`	Kubernetes secure port where service is expose	`443`
`telescope.service.securePortName`	Name of the secure port on the service	`wss`
`telescope.autoscaling.enabled`	Option to turn autoscaling on for app and specify params for HPA. Autoscaling needs metrics-server to access cpu metrics	`false`
`telescope.autoscaling.minReplicas`	Default min replicas for autoscaling	`1`
`telescope.autoscaling.maxReplicas`	Default max replicas for autoscaling	`100`

`telescope.autoscaling.targetCPUUtilizationPercentage`	`80`	The desired target CPU utilization for autoscaling

3.5.6 Netris-Controller k8s-watcher parameters

Parameter	Description	Default
`k8s-watcher.replicaCount`	Number of replicas in k8s-watcher deployment	`1`
`k8s-watcher.image.repository`	Image repository	`netrisai/xcaas-kuberis-k8-api-agent`
`k8s-watcher.image.tag`	Image tag. Overrides the image tag whose default is the chart appVersion	`""`
`k8s-watcher.image.pullPolicy`	Image pull policy	`IfNotPresent`
`k8s-watcher.imagePullSecrets`	Reference to one or more secrets to be used when pulling images	`[]`

k8s-watcher.autoscaling.enabled	Option to turn autoscaling on for app and specify params for HPA. Autoscaling needs metrics-server to access cpu metrics	false
k8s-watcher.autoscaling.minReplicas	Default min replicas for autoscaling	1
k8s-watcher.autoscaling.maxReplicas	Default max replicas for autoscaling	100
k8s-watcher.autoscaling.targetCPUUtilizationPercentage	The desired target CPU utilization for autoscaling	80

3.5.7 Netris-Controller telescope-notifier parameters

Parameter	Description	Default
telescope-notifier.replicaCount	Number of replicas in telescope-notifier deployment	1
telescope-notifier.image.repository	Image repository	netrisai/xcaas-xcaas-notifier

telescope-notifier.image.tag	Image tag. Overrides the image tag whose default is the chart appVersion
telescope-notifier.image.pullPolicy	Image pull policy
telescope-notifier.imagePullSecrets	Reference to one or more secrets to be used when pulling images
telescope-notifier.autoscaling.enabled	Option to turn autoscaling on for app and specify params for HPA. Autoscaling needs metrics-server to access cpu metrics
telescope-notifier.autoscaling.minReplicas	Default min replicas for autoscaling
telescope-notifier.autoscaling.maxReplicas	Default max replicas for autoscaling

`telescope-notifier.autoscaling.targetCPUUtilizationPercentage`	The desired target CPU utilization for autoscaling

3.5.8 Mariadb parameters

Using default values from

Parameter	Description	Default
`mariadb.image.repository`	MariaDB image name. We extended bitnami's mariadb image with own plugin	`netrisai/netris-mariadb`
`mariadb.image.tag`	MariaDB image tag. (only 10.1 is supported)	`10.1`
`mariadb.initdbScriptsConfigMap`	ConfigMap with the initdb scripts.	`netris-controller-initdb`
`mariadb.auth.database`	Name for a database to create	`netris`
`mariadb.auth.username`	Name for a user to create	`netris`
`mariadb.auth.password`	Password for the new user	`changeme`
`mariadb.auth.rootPassword`	Password for the root user	`changeme`

Auth from existing secret not supported at the momment

3.5.9 Mongodb parameters

Using default values from

Parameter	Description	Default
`mongodb.useStatefulSet`	Use StatefulSet instead of Deployment when deploying standalone	`true`
`mongodb.initdbScriptsConfigMap`	ConfigMap with the initdb scripts.	`netris-controller-initdb-mongodb`
`mongodb.auth.database`	Name for a database to create	`netris`
`mongodb.auth.username`	Name for a user to create	`netris`

`mongodb.auth.password`	Password for the new user	`changeme`
`mongodb.auth.rootPassword`	Password for the root user	`changeme`

Auth from existing secret not supported at the momment

3.5.10 Redis parameters

Using default values from

Parameter	Description	Default
`redis.cluster.enabled`	Use master-slave topology	`false`
`redis.usePassword`	Use password	`false`

Auth not supported at the momment

3.5.11 Smtp parameters

Using default values from

Parameter	Description	Default
`smtp.config.DISABLE_IPV6`	Disable IPv6	`1`
`smtp.config.RELAY_NETWORKS`	Relay networks. Change if your CNI use other subnets	`:172.16.0.0/12:10.0.0.0/8:192.168.0.0/16`

3.5.12 HAproxy parameters

Using default values from

Parameter	Description	Default
`haproxy.enabled`	Enable HAProxy. Used for exposing netris agents ports from single loadbalancer ip. Disable if you can't have type:LoadBalancer service in cluster	`true`
`haproxy.service.type`	Kubernetes service type	`LoadBalancer`

3.5.13 Graphite parameters

Using default values from

Parameter	Description	Default
`graphite.configMaps`	Netris-Controller supported graphite's config files	`see in values.yaml`
`graphite.service.type`	Kubernetes service type	`ClusterIP`

3.6 Usage

Specify each parameter using the –set key=value[,key=value] argument to helm install. For example,

```
helm install netris-controller netrisai/netris-controller \
  --namespace netris-controller \
  --set app.ingress.hosts={my.domain.com} \
  --set netris.authKey=$mystrongauthkey \
  --set mariadb.auth.rootPassword=my-root-password \
  --set mariadb.auth.password=my-password \
  --set mongodb.auth.rootPassword=my-root-password \
  --set mongodb.auth.password=my-password
```

The above command sets netris-controller application ingress host to `my.domain.com` and sets generated netris.authKey. Additionally, it sets MariaDB and MongoDB root account password to `my-root-password` and user account password to `my-password`.

Alternatively, a YAML file that specifies the values for the parameters can be provided while installing the chart. For example,

```
helm install netris-controller netrisai/netris-controller --namespace
netris-controller -f values.yaml
```

After installation use `EXTERNAL-IP` of haproxy service as `--controller` parameter in netris-setup

```
kubectl get svc -nnetris-controller |grep haproxy
```

and `$mystrongauthkey` as `--auth` parameter in netris-setup

```
echo $mystrongauthkey
```

Also you can see overrides values from helm get values

```
helm get values netris-controller
```

Controller initial configuration

4.1 Definitions

- **User** - A user account for accessing Netris Controller through GUI, RestAPI, and Kubernetes. The default username is `netris`, with password `newNet0ps`.
- **Tenant** - IP addresses and Switch Ports are network resources assigned to different Tenants to have under their management. Admin is the default tenant, and by default, it owns all the resources. You can use different Tenants for sharing and delegation of control over the network resources. Network teams typically use Tenants to grant access to other groups to request & manage network services using the Netris Controller as a self-service portal or programmatically (with Kubernetes CRDs) DevOps/NetOps pipeline.
- **Permission Group** - List of permissions on a per section basis can be attached individually to a User or a User Role.
- **User Role** - Group of user permissions and tenants for role-based access control.
- **Site** - Each separate deployment (each data center) should be defined as a Site. All network units and resources are attached to a site. Netris Controller comes with a "default" site preconfigured. Site entry defines global attributes such as; AS numbers, default ACL policy, Site Mesh (site to site VPN) type.
- **Subnet** - IPv4/IPv6 address resources linked to Sites and Tenants.
- **Switch Port** - Physical ports of all switches attached to the system. Switch port objects represent statuses, take basic parameters, and are assigned to Tenants.
- **Inventory** - This is an inventory of all network units that are operated using Netris Agent.
- **E-BGP** - Is for defining all External BGP peers (iBGP and eBGP).

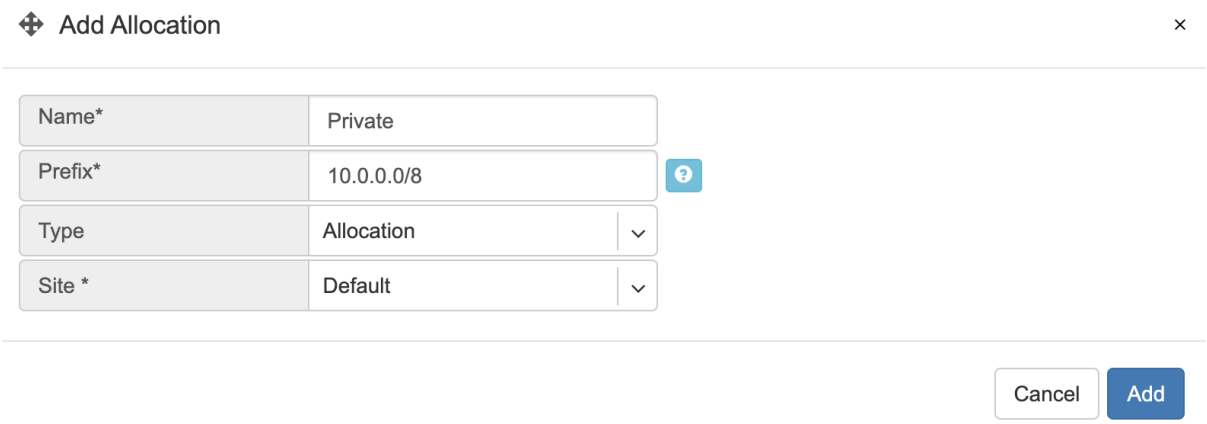
4.2 Subnets

It is required to define at least two subnets to get started. One subnet is for the management interfaces, another for the loopback addresses. Every network unit managed with Netris should have at least one management IP and at least one loopback IP. Loopback IP addresses are used for network unit identification by network protocols and by Netris Agent/Controller. There's no need for defining any IP addresses for the switch-to-switch links. Netris is using IPv6 link-local addresses for all switch-to-switch communication.

4.2.1 Example: (IP addresses used are just examples, please replace them following your IP planning.)

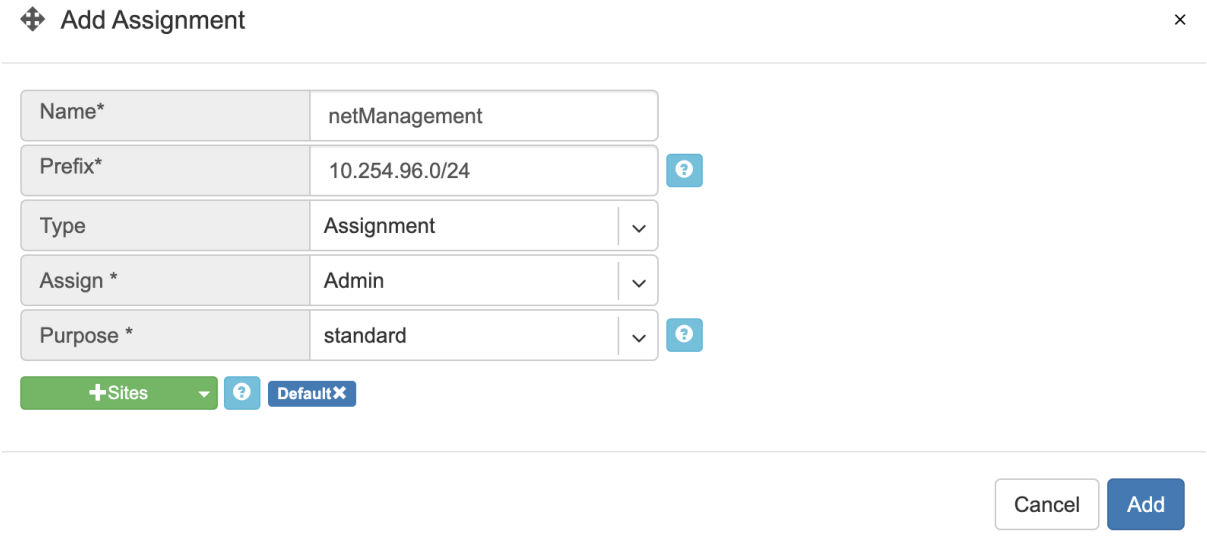
In NET->Subnets section of the Netris Controller GUI, you can add new subnet entries. Subnets are of 2 types of allocation and assignment. Allocations are the large blocks of IP resources assigned to the organization. Assignments are IP blocks that are smaller blocks inside the allocation and can be used by services or policies that yet to be defined.

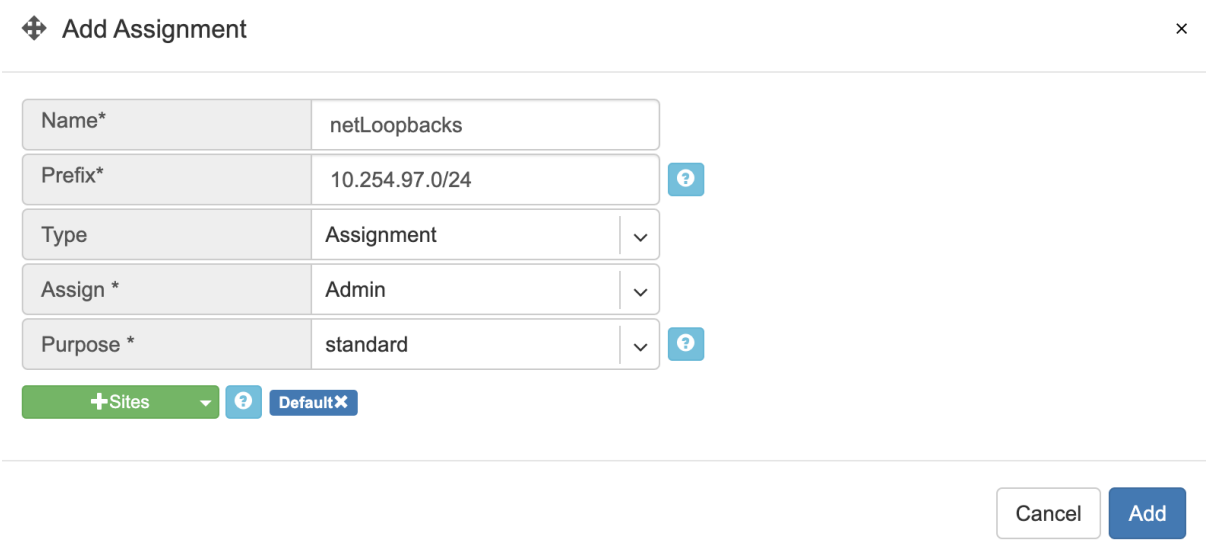
1. Adding a new allocation. In this example, 10.0.0.0/8 is used as a large block of allocation. You can add as many allocations as required.



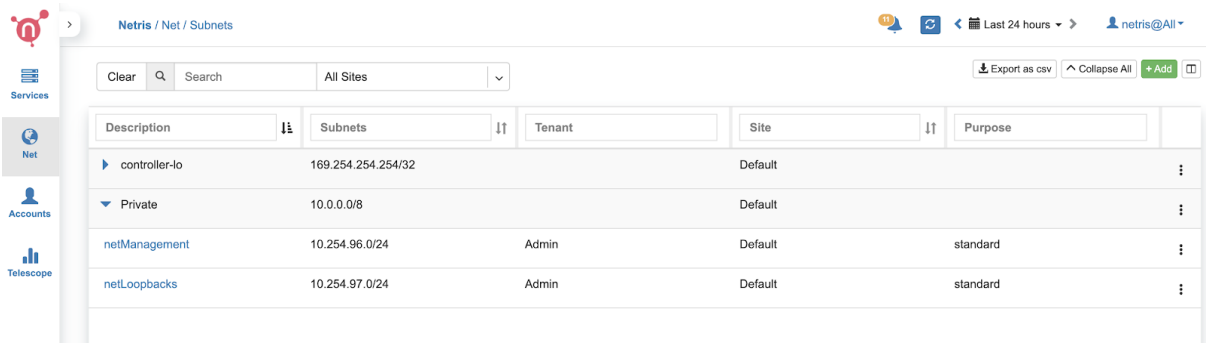
2. Adding two new assignments.

- 10.254.96.0/24 (netManagement) assigned to the tenant "Admin" and available for the site "Default".
- 10.254.97.0/24 (netLoopbacks) assigned to the tenant "Admin" and available for the site "Default".





Screenshot: Listing of the Subnets section after adding the new objects.



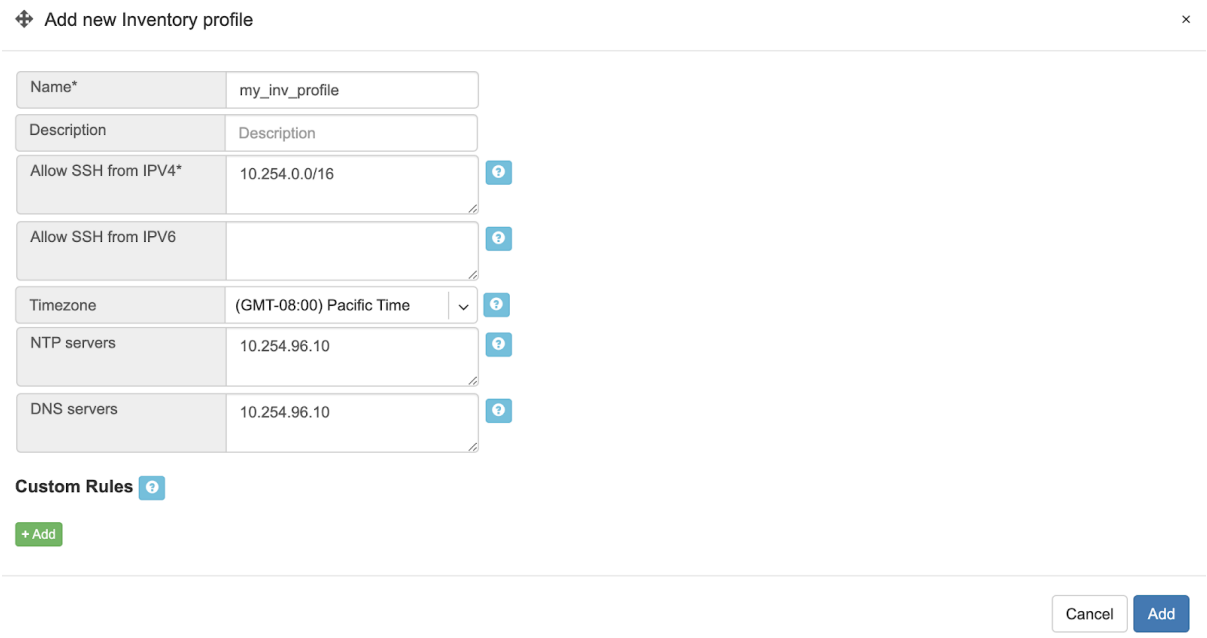
4.3 Inventory Profiles

Inventory profiles define access security, timezone, DNS, NTP settings profiles for network switches and SoftGate nodes. To create a new Inventory profile, click +Add under the Net→Inventory Profiles section.

4.3.1 Fields descriptions:

- **Name** - Profile name.
- **Description** - Free text description.
- **Allow SSH from IPv4** - List of IPv4 subnets allowed to ssh (one address per line)
- **Allow SSH from IPv6** - List of IPv6 subnets allowed to ssh (one address per line)
- **Timezone** - Devices using this inventory profile will adjust their system time to the selected timezone.
- **NTP servers** - List of domain names or IP addresses of NTP servers (one address per line). You can use your Netris Controller address as an NTP server for your switches and SoftGate.
- **DNS servers** - List of IP addresses of DNS servers (one address per line). You can use your Netris Controller address as a DNS server for your switches and SoftGate.

Example: In this example Netris Controller is used to provide NTP and DNS services to the switches (common setup).

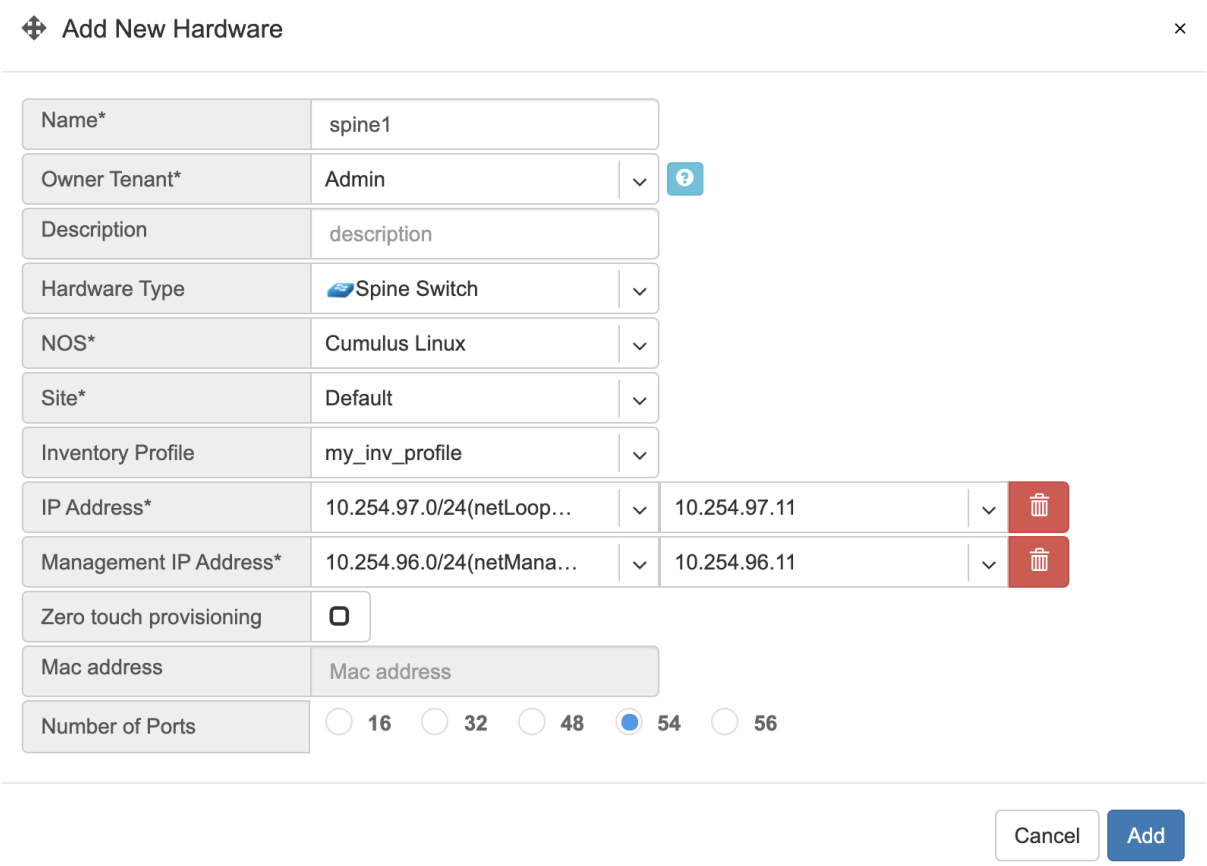


4.4 Adding Switches to Topology

You need to define every switch in the Net→Topology section. To add a switch, please go to Net→-Topology and click +Add.

- **Name** - Descriptive name.
- **Owner Tenant** - Tenant(typically Admin) who administers this node.
- **Description** - Free text description.
- **Hardware Type** - For switches: Spine Switch or Leaf Switch.
- **NOS*** - Network operating system. Cumulus Linux, Ubuntu SwitchDev (Nvidia Mellanox only), SONiC (not for production use yet)
- **Site*** - The site where the switch belongs.
- **Inventory Profile** - Reference to Timezone, DNS, NTP, and Security features profile.
- **IP Address*** - IPv4 address for the loopback interface.
- **Management IP address** - IPv4 address for the out of band management interface.
- **Zero-touch provisioning** - Automatically install the NOS. (Experimental in this version)
- **MAC address** - Out of band management interface MAC address used for zero-touch provisioning. (Experimental in this version)
- **The number of ports** - It is required for the topology manager. WIll be synced to the real number of Switch Ports when Netris Switch Agent establishes the very first connection with the Netris Controller.

Example: Adding a spine switch w/ Cumulus Linux.



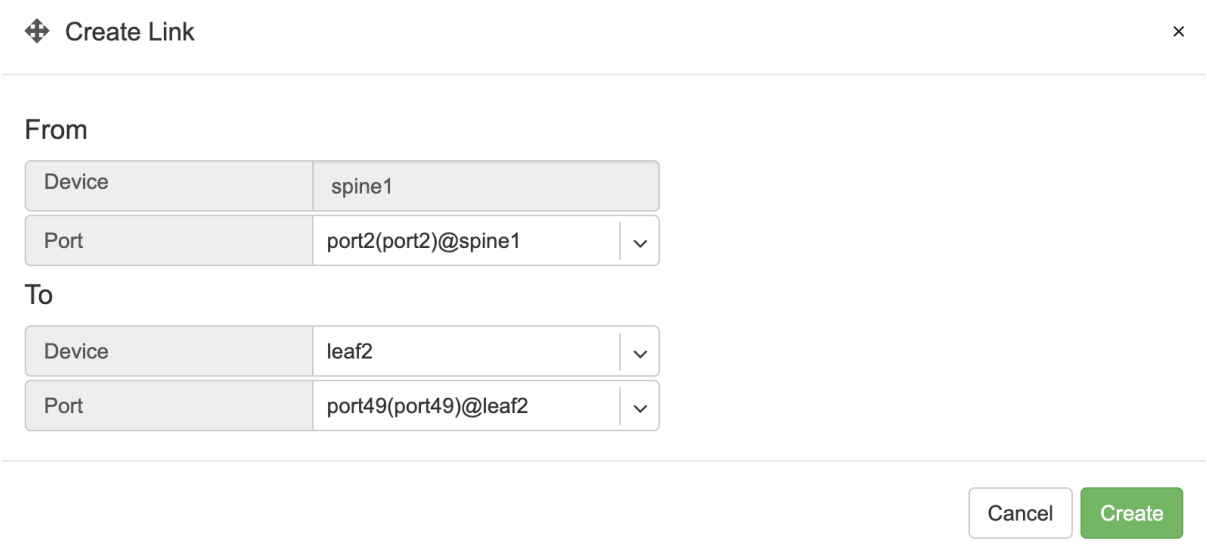
Tip: You can drag/move the units to your desired positions and click “Save positions”.

Note: Repeat this process to define all your switches.

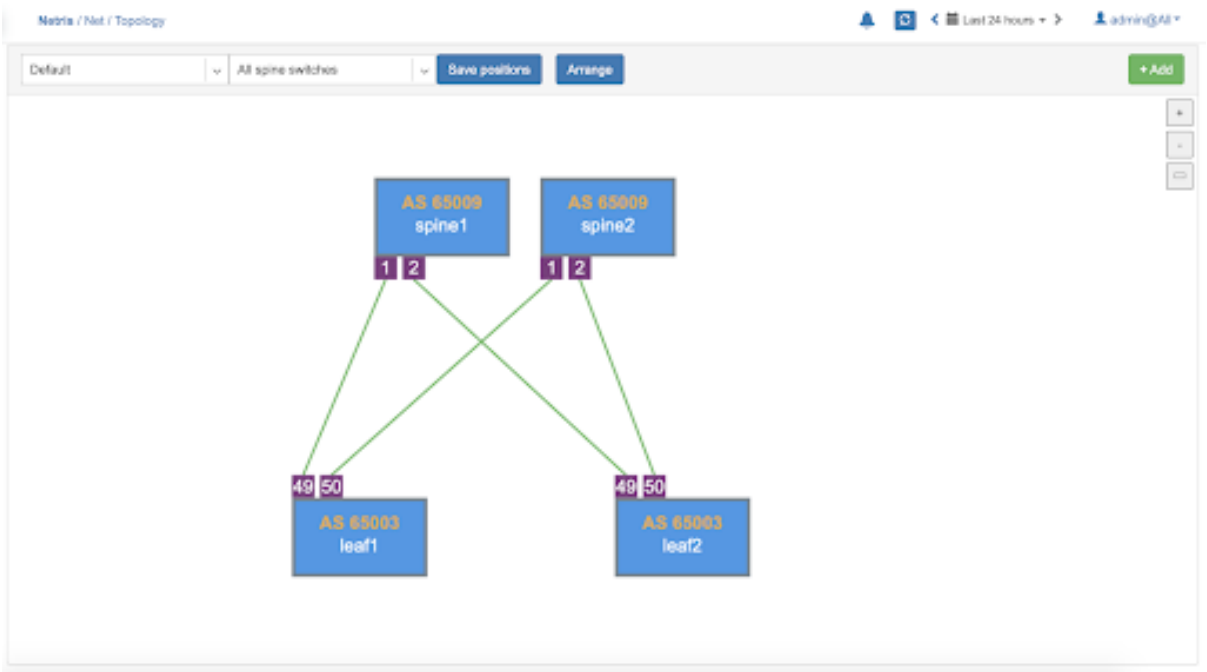
4.5 Topology Manager

The topology manager is for describing and monitoring the desired network topology. Netris Switch Agents will configure the underlying network devices according to this topology dynamically and start watching against potential failures.

To define the links, right-click on the spine switch, then click create a link. Select the “from port,” then “to device” and “port.” See the example below.



All links require definition in the topology manager. Topology links can also be described through a .yaml file when using Kubernetes CRD. (a GUI wizard is planned to be available in v2.10).



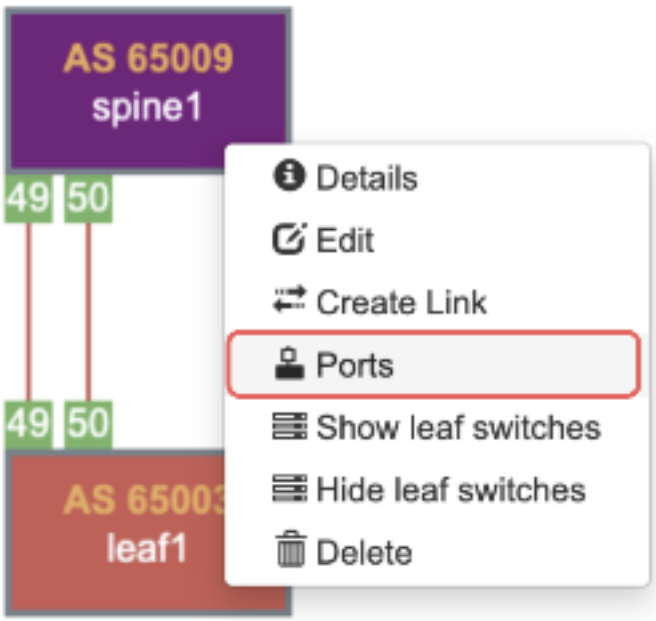
Now when network units and links are defined, your network is automatically configured as long as physical connectivity is in place and Netris Agents can communicate with Netris Controller.

4.6 Hairpin (Cumulus only)

With Cumulus Linux only, we need to loop two ports on spine switches (hairpin cable) in the current release, usually two upstream (higher capacity) ports. We are planning to lift this requirement in the next Netris release (v2.10).

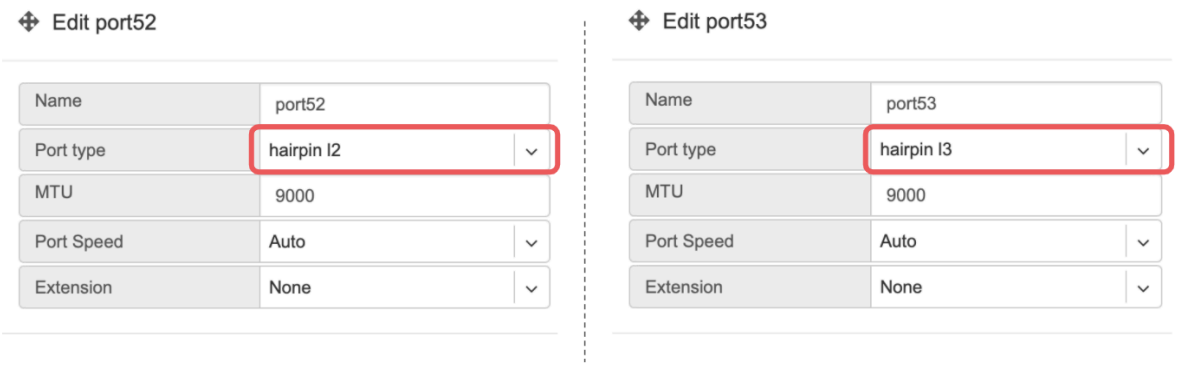
To define what ports will be used as a hairpin, navigate to Net→Switch Ports, or right-click on the spine switch, click Ports in Net–>Topology.

Example: Accessing Switch Ports from Net→Topology

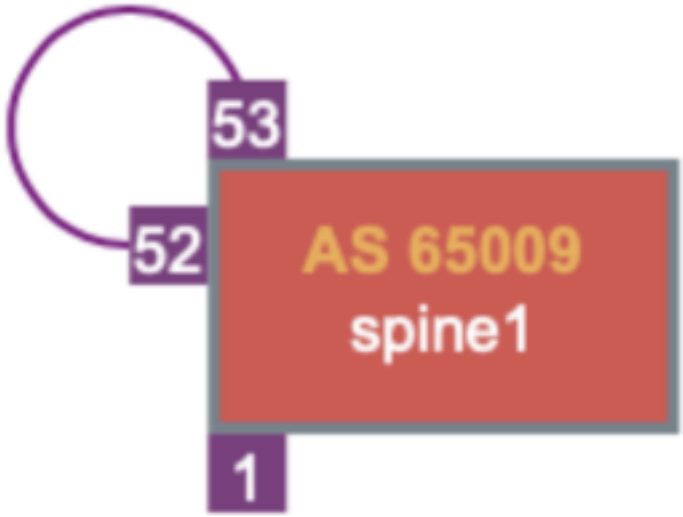


For each spine switch, find the two ports that you are going to connect (loop/hairpin) and configure one port as a "hairpin **l2**" and another port as "hairpin **l3**". The order doesn't matter. The system needs to know which ports you have dedicated for the hairpin/loop on each spine switch. (do not do this for non-Cumulus switches) | | Example: Editing Switch Port from Net→Switch Ports.

Example: Setting port types to "hairpin l2" and "hairpin l3".



Screenshot: Hairpin visualized in Net→Topology

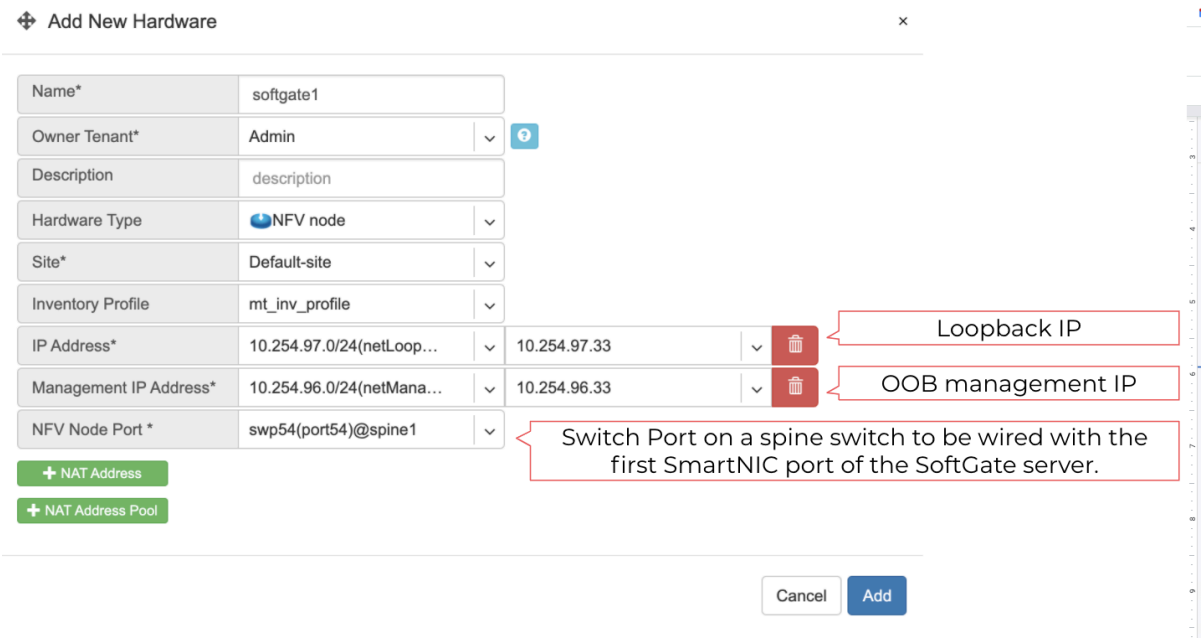


4.7 Adding SoftGate nodes to Topology

Every SoftGate node first needs to be defined in Netris Controller. To add a SoftGate node, please go to Net→Topology and click +Add.

- **Name** - Descriptive name.
- **Owner Tenant** - Tenant(typically Admin), who administers this node.
- **Description** - Free text description.
- **Hardware Type** - NFV node.
- **Site** - The data center where the current SoftGate node belongs.
- **Inventory Profile** - Profile describing the timezone, DNS, NTP, and Security features.
- **IP Address** - IPv4 address for the loopback interface.
- **Management IP address** - IPv4 address for the out of band management interface.
- **NFV Node Port** - A physical port on a spine switch where the SoftGate node's first SmartNIC port is connected. Typically each spine switch has one SoftGate node connected to it.
- **+NAT address** - Public IP addresses to be used as global IP for SNAT/DNAT. (check Enabling NAT section of Network Policies chapter)
- **+NAT address pool** - Public IP address subnets to be used as rolling global IP addresses for SNAT. (check Enabling NAT section of Network Policies chapter)

Example: Adding a SoftGate Node to Topology.


Add New Hardware
Name*
softgate1
Owner Tenant*
Admin
Description
description
Hardware Type
NFV node
Site*
Default-site
Inventory Profile
mt_inv_profile
IP Address*
10.254.97.0/24(netLoop...
10.254.97.33
Loopback IP
Management IP Address*
10.254.96.0/24(netMana...
10.254.96.33
OOB management IP
NFV Node Port *
swp54(port54)@spine1
Switch Port on a spine switch to be wired with the first SmartNIC port of the SoftGate server.
NAT Address
NAT Address Pool
Cancel
Add

Chapter 5

Netris switch agent installation

5.1 For Cumulus Linux

Requirements: * Fresh install of Cumulus Linux v. 3.7.(x) - Cumulus 4.X is in the process of validation and will be supported in the next Netris release.

5.1.1 Configure the OOB Management IP address

Configure out of band management IP address, and in case Netris Controller is not in the same OOB network then configure a route to Netris Controller. No default route or other IP addresses should be configured.

```
sudo vim /etc/network/interfaces
```

```
# The loopback network interface
auto lo
iface lo inet loopback

# The primary network interface
auto eth0
iface eth0 inet static
        address <Management IP address/prefix length>
        up ip ro add <Controller address> via <Management network gateway> #delete
this line if Netris Controller is located in the same network with the switch.

source /etc/network/interfaces.d/*
```

```
sudo ifreload -a
```

5.1.2 Configure Cumulus Linux license

```
sudo cl-license -i
```

Copy/paste the Cumulus Linux license string then press ctrl-d.

5.1.3 Install the Netris Agent

1. Add netris repository using Netris Controller as an http proxy. Replace <Your Netris Controller address> with your actual Netris Controller address.

Note Netris Controller built-in proxy, by default, permits RFC1918 IP addresses (10.0.0.0/8, 172.16.0.0/12, 192.168.0.0/16). If your management network is using IP addresses outside these ranges

you will need to configure iptables on the Netris Controller accordingly.

```
export http_proxy=http://<Your Netris Controller address>:3128

wget -qO - http://repo.netris.ai/repo/public.key | sudo apt-key add -

echo "deb http://repo.netris.ai/repo/ jessie main" | sudo tee
/etc/apt/sources.list.d/netris.list
```

2. Update the apt

```
echo -e 'Acquire::http::Proxy "http://<Your Netris Controller
address>:3128";\nAcquire::https::Proxy "http://<Your Netris Controller
address>:3128";' | sudo tee -a /etc/apt/apt.conf.d/netris-proxy

sudo apt update
```

3. Install Netris Agent and dependencies

```
sudo apt install netris-sw
```

4. Initialize the switch using netris-setup

Description of netris-setup parameters

```
--auth - Authentication key, "6878C6DD88224981967F67EE2A73F092" is the default
key.
--controller - IP address or domain name of Netris Controller.
--hostname - The hostname for the current switch, this hostname should match
the name defined in the Controller.
--lo - IP address for the loopback interface, as it is defined in the controller.
--type - Role of the switch in your topology: spine/leaf
```

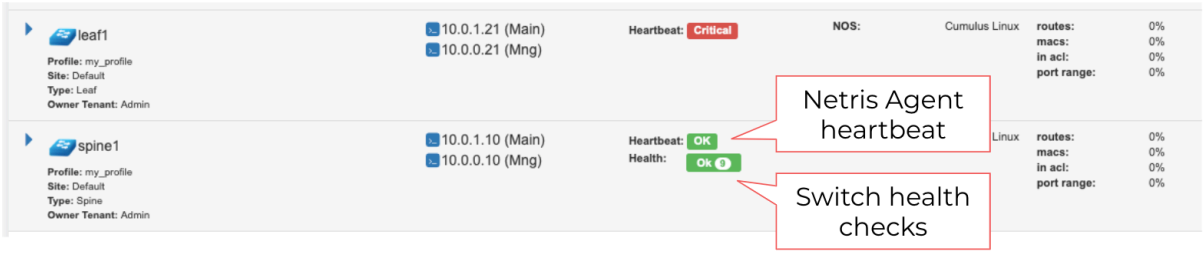
```
sudo /opt/netris/bin/netris-setup --auth=<authentication key> --controller=<IP or
FQDN> --hostname=<name> --lo=<loopback IP address> --type=<spine/leaf>
```

5. Reboot the switch

```
sudo reboot
```

Once the switch boots up you should see its heartbeat going from Critical to OK in Net→Inventory, Telescope→Dashboard, and switch color will reflect its health in Net→Topology

Screenshot: Net→Inventory

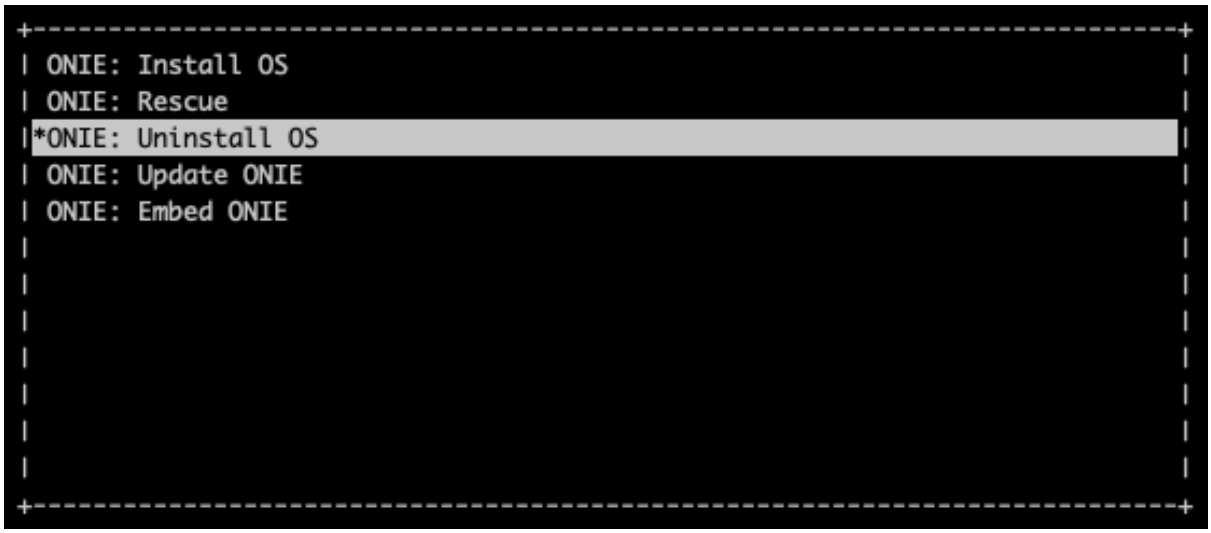


5.2 For Ubuntu SwitchDev

Note Further installation requires a Console and Internet connectivity via management port!

1. NOS Uninstall

Fist of all uninstall current NOS using **Uninstall OS** from grub menu:



Once the uninstallation is completed, the switch will reboot automatically.

2. Update ONIE

Select **Update ONIE** from grub menu:

In case you don't have DHCP in the management network, then stop ONIE discovery service and configure IP address and default gateway manually:

```
onie-discovery-stop
ip addr add <management IP address/prefix> dev eth0
ip route add default via <gateway of management network>
echo "nameserver 1.1.1.1" > /etc/resolv.conf
```

Update ONIE to the supported version.

Note ONIE image available for Mellanox switches only!

```
onie-self-update http://repo.netris.ai/repo/onie-updater-x86_64-mlnx_x86-r0
```

3. NOS Install

Select **Install OS** from grub menu:

In case you don't have DHCP in the management network, then stop ONIE discovery service and configure IP address and default gateway manually:

```
onie-discovery-stop
ip addr add <management IP address/prefix> dev eth0
ip route add default via <gateway of management network>
echo "nameserver 1.1.1.1" > /etc/resolv.conf
```

Install Ubuntu-SiwtchDev from the Netris custom image:

```
onie-nos-install http://repo.netris.ai/repo/netris-ubuntu-18.04.1.bin
```

Default username/password

`netris/newNet0ps`

5.2.1 Configure the OOB Management IP address

Configure out of band management IP address, and in case Netris Controller is not in the same OOB network then configure a route to Netris Controller. No default route or other IP addresses should be configured.

```
sudo vim /etc/network/interfaces
```

```
# The loopback network interface
auto lo
iface lo inet loopback

# The primary network interface
auto eth0
iface eth0 inet static
    address <Management IP address/prefix length>
    up ip ro add <Controller address> via <Management network gateway> #delete
```

```
this line if Netris Controller is located in the same network with the switch.

source /etc/network/interfaces.d/*
```

```
sudo ifreload -a
```

5.2.2 Install the Netris Agent

1. Add netris repository using Netris Controller as an http proxy. Replace <Your Netris Controller address> with your actual Netris Controller address.

Note Netris Controller built-in proxy, by default, permits RFC1918 IP addresses (10.0.0.0/8, 172.16.0.0/12, 192.168.0.0/16). If your management network is using IP addresses outside these ranges you will need to configure iptables on the Netris Controller accordingly.

```
export http_proxy=http://<Your Netris Controller address>:3128

wget -qO - http://repo.netris.ai/repo/public.key | sudo apt-key add -

echo "deb http://repo.netris.ai/repo/ bionic main" | sudo tee
/etc/apt/sources.list.d/netris.list
```

2. Update the apt

```
echo -e 'Acquire::http::Proxy "http://<Your Netris Controller
address>:3128";\nAcquire::https::Proxy "http://<Your Netris Controller
address>:3128";' | sudo tee -a /etc/apt/apt.conf.d/netris-proxy

sudo apt update
```

3. Install Netris Agent and dependencies

```
sudo apt-get update && sudo apt-get install netris-sw
```

4. Initialize the switch using netris-setup

Description of netris-setup parameters

```
--auth - Authentication key, "6878C6DD88224981967F67EE2A73F092" is the default
key.
--controller - IP address or domain name of Netris Controller.
--hostname - The hostname for the current switch, this hostname should match
the name defined in the Controller.
--lo - IP address for the loopback interface, as it is defined in the controller.
--type - Role of the switch in your topology: spine/leaf
```

```
sudo /opt/netris/bin/netris-setup --auth=<authentication key> --controller=<IP or
FQDN> --hostname=<name> --lo=<loopback IP address> --type=<spine/leaf>
```

5. Reboot the switch

```
sudo reboot
```

Chapter 6

Netris SoftGate agent installation

6.1 Minimal hardware requirements

- 2 x Intel Silver CPU
- 96 GB RAM
- 300 GB HDD
- Nvidia Mellanox Connect-X 5 SmartNIC card

6.2 BIOS configuration

The following are some recommendations on BIOS settings. Different vendors will have different BIOS naming so the following is mainly for reference:

- Before starting consider resetting all BIOS settings to their defaults.
- Disable all power saving options such as: Power performance tuning, CPU P-State, CPU C3 Report and CPU C6 Report.
- Select Performance as the CPU Power and Performance policy.
- Disable Turbo Boost to ensure the performance scaling increases with the number of cores.
- Set memory frequency to the highest available number, NOT auto.
- Disable all virtualization options when you test the physical function of the NIC, and turn off VT-d.
- Disable Hyper-Threading.

6.3 Software installation

Requires freshly installed Ubuntu Linux 18.04 and network connectivity with your Netris Controller over the out-of-band management network.

1. Set environment variables to use Netris Controller as a proxy.

```
export http_proxy=http://<Your Netris Controller address>:3128 && export
https_proxy=http://<Your Netris Controller address>:3128

echo -e 'Acquire::http::Proxy "http://<Your Netris Controller
```

```
address>:3128";\nAcquire::https::Proxy "http://<Your Netris Controller
address>:3128";' | sudo tee -a /etc/apt/apt.conf.d/netris-proxy
```

2. Config the apt for Mellanox repository.

```
wget -qO - https://www.mellanox.com/downloads/ofed/RPM-GPG-KEY-Mellanox | sudo
apt-key add -

wget
http://linux.mellanox.com/public/repo/mlnx_ofed/5.0-2.1.8.0/ubuntu18.04/mellanox_mlnx_ofed.list
-O /tmp/mellanox_mlnx_ofed.list && sudo mv /tmp/mellanox_mlnx_ofed.list
/etc/apt/sources.list.d/
```

3. Config the apt for Netris repository.

```
wget -qO - http://repo.netris.ai/repo/public.key | sudo apt-key add -

echo "deb http://repo.netris.ai/repo/ bionic main" | sudo tee
/etc/apt/sources.list.d/netris.list
```

4. Install Mellanox drivers

```
sudo apt-get update && sudo apt-get install mlnx-ofed-dpdk
```

5. Install Netris agent package and dependencies, including specific Linux Kernel version.

```
sudo apt-get install netris-dpdk-mlnx
```

6. Configure Management IP address

Configure out of band management IP address. In case Netris Controller is not in the same OOB network then add a route to Netris Controller. No default route or other IP addresses should be configured.

```
sudo vim /etc/network/interfaces
```

```
# The loopback network interface
auto lo
iface lo inet loopback

# The primary network interface
auto eth0
iface eth0 inet static
       address <Management IP address/prefix length>
       up ip ro add <Controller address> via <Management network gateway> #delete
this line if Netris Controller is located in the same network with the SoftGate
node.

source /etc/network/interfaces.d/*
```

```
sudo ifreload -a
```

7. Initialize the SoftGate

netris-setup parameters, described below.

–auth - Authentication key, "6878C6DD88224981967F67EE2A73F092" is the default value, we strongly recommend to change this string in your controller as described in Controller initial configuration section.
–controller - IP address or domain name of Netris Controller.

–hostname - Specify the hostname for the current switch, this hostname should match the name defined for particular switch in the Controller..
–lo - IP address for the loopback interface, as it is defined in the controller.
–node-prio - brief explanation of node priority goes here

Run netris-setup.

```
sudo /opt/netris/bin/netris-setup --lo=<SoftGate loopback IP address as defined in
controller>  --controller=<Netris Controller IP or FQDN> --hostname=<node name as
defined in controller> --auth=<authentication key> --node-prio=<node priority 1/2>
```

Example: Running netris-setup

```
netris@ubuntu:~$ sudo /opt/netris/bin/netris-setup --lo=10.254.97.33
--controller=10.254.97.10 --hostname=softgate1
--auth=6a284d55148f81728f932b28e9d020736c8f78e1950b3d576f6e679d90516df1
--node-prio=1
* Setup Hostname
* Setup Hosts
* Setup Keepalived
* Setup Collectd
* Setup Loopback
* Get CPU List
* Setup FRR BGP Daemon
* Setup Netris Agent Config
* Setup DPDK Router Config
* Setup DPDK Router Systemd Unit
└─ └─ * Setup Grub Config
* Update Grub
└─
```

*** ATTENTION: You must reboot SoftGate to complete the installation
netris@ubuntu:~$

8. Reboot the server

```
sudo reboot
```

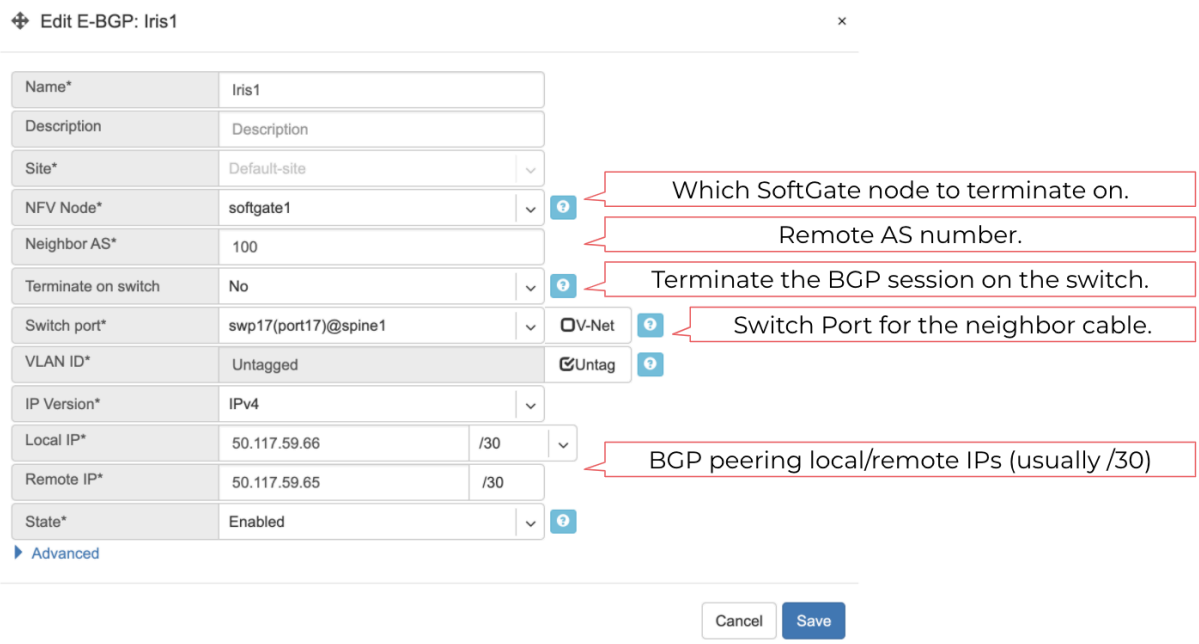
When server boots up, you should see it's heartbeat status in Net→Inventory

Basic BGP

BGP neighbors can be declared in the Net→E-BGP section. Netris will automatically generate and inject the right configuration to meet your requirements as declared. See below description of E-BGP neighbor declaration fields.

- **Name** - Name for BGP session.
- **Description** - Free description.
- **Site** - Selects the site (data center) where this BGP session should be terminated on.
- **NFV Node** - Only if SoftGate nodes are in use, define on which node BGP session should be terminated on.
- **Neighbor AS** - Autonomous System number of the remote side. (Local AS is defined at Net→Sites section)
- **Terminate on switch** - Typically used for setups without SoftGate, for connecting with upstream routers. Instructs the system to terminate the BGP session directly on the switch.
- **Switch port** - Switch Port for the physical cable to the BGP neighbor. (any port on the fabric). Optionally can bind to a V-NET service, typically used for peering with IXPs or systems like GGC (Google Global Cache).
- **VLAN ID** - Optionally tag with a VLAN ID. (usually untagged)
- **IP Version** - IPv4 / IPv6
- **Local IP** - BGP peering IP address on Netris controlled side.
- **Remote IP** - BGP peering IP address on the remote end.
- **State** - Administrative state. (Enabled/Disabled)
- **Advanced** - Advanced policy settings are described in the next section.

Example: Declare a basic BGP neighbor.


Edit E-BGP: Iris1
Name*
Iris1
Description
Description
Site*
Default-site
NFV Node*
softgate1
Neighbor AS*
100
Terminate on switch
No
Switch port*
swp17(port17)@spine1
V-Net
VLAN ID*
Untagged
Untag
IP Version*
IPv4
Local IP*
50.117.59.66
/30
Remote IP*
50.117.59.65
/30
State*
Enabled
Advanced
Cancel
Save
Which SoftGate node to terminate on.
Remote AS number.
Terminate the BGP session on the switch.
Switch Port for the neighbor cable.
BGP peering local/remote IPs (usually /30)

Advanced BGP

BGP neighbor declaration can optionally include advanced BGP attributes and BGP route-maps for fine-tuning of BGP policies.

Click Advanced to expand the BGP neighbor add/edit window.

- **Neighbor address** - IP address of the neighbor when peering with the loopback IP address instead of the interface IP address. (aka Multihop).
- **Update source** - When Multihop BGP peering is used, it allows the operator to choose one of the loopback IP addresses of the SoftGate node as a BGP speaker source IP address.
- **BGP password** - Password for the BGP session.
- **Allowas-in** - Define the number of allowed occurrences of the self AS number in the received BGP NLRI to consider it valid. (normally 0)
- **Default Originate** - Originate default route to the current neighbor.
- **Prefix Inbound Max** - Drop the BGP session if the number of received prefixes exceeds this max limit. For switch termination maximum allowed is 1000 prefixes, while SoftGate termination can handle up to one million prefixes.
- **Inbound Route-Map** - Apply BGP policies described in a route-map for inbound BGP updates.
- **Outbound Route-Map** - Apply BGP policies described in a route-map for outbound BGP updates.
- **Local Preference** - Set local preference for all inbound routes for the current neighbor.
- **Weight** - Set weight for all inbound routes for the current neighbor.
- **Prepend Inbound(times)** - How many times to prepend self AS number for inbound routes.
- **Prepend Outbound(times)** - How many times to prepend self AS number for outbound routes.
- **Prefix List Inbound** - List of IP addresses prefixes to permit or deny inbound.
- **Prefix List Outbound** - List of IP addresses prefixes to permit or deny outbound.
- **Send BGP Community** - List of BGP communities to send to the current neighbor.

8.1 BGP objects

Under Net→E-BGP objects, you can define various BGP objects referenced from a route-map to declare a dynamic BGP policy.
Supported objects are:

- IPv4 Prefix
- IPv6 Prefix
- AS-PATH

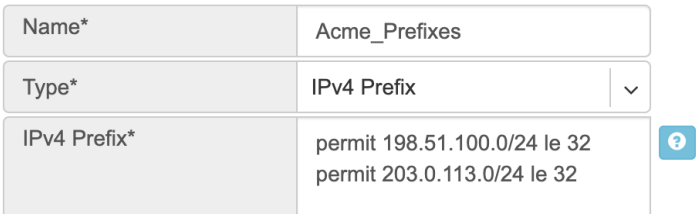
- Community
- Extended Community
- Large Community

8.1.1 IPv4 Prefix.

Rules defined one per line.
Each line in IPv4 prefix list field consists of three parts:

- Action - Possible values are: permit or deny (mandatory).
- IP Prefix - Any valid IPv4 prefix (mandatory).
- Length - Possible values are: le <len>, ge <len> or ge <len> le <len>.

Example: Creating an IPv4 Prefix list.

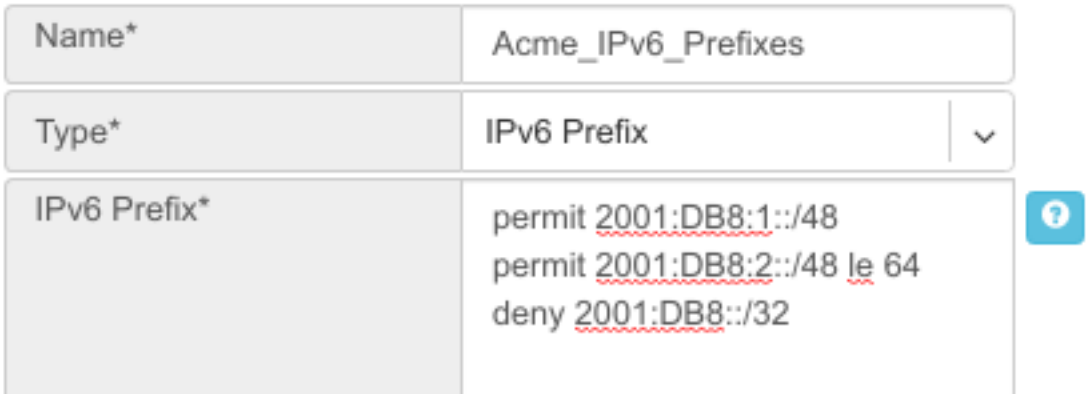


8.1.2 IPv6 Prefix.

Rules defined one per line.
Each line in IPv6 prefix list field consists of three parts:

- Action - Possible values are: permit or deny (mandatory).
- IP Prefix - Any valid IPv6 prefix (mandatory).
- Keyword - Possible values are: le <len>, ge <len> or ge <len> le <len>.

Example: Creating an IPv6 Prefix list.



8.1.3 Community.

Community field has two parts:

- Action - Possible values: permit or deny (mandatory).
- Community string - format is AA:NN, where AA and NN are any number from 0 to 65535 range or alternatively well known string (local-AS | no-advertise | no-export | internet | additive).

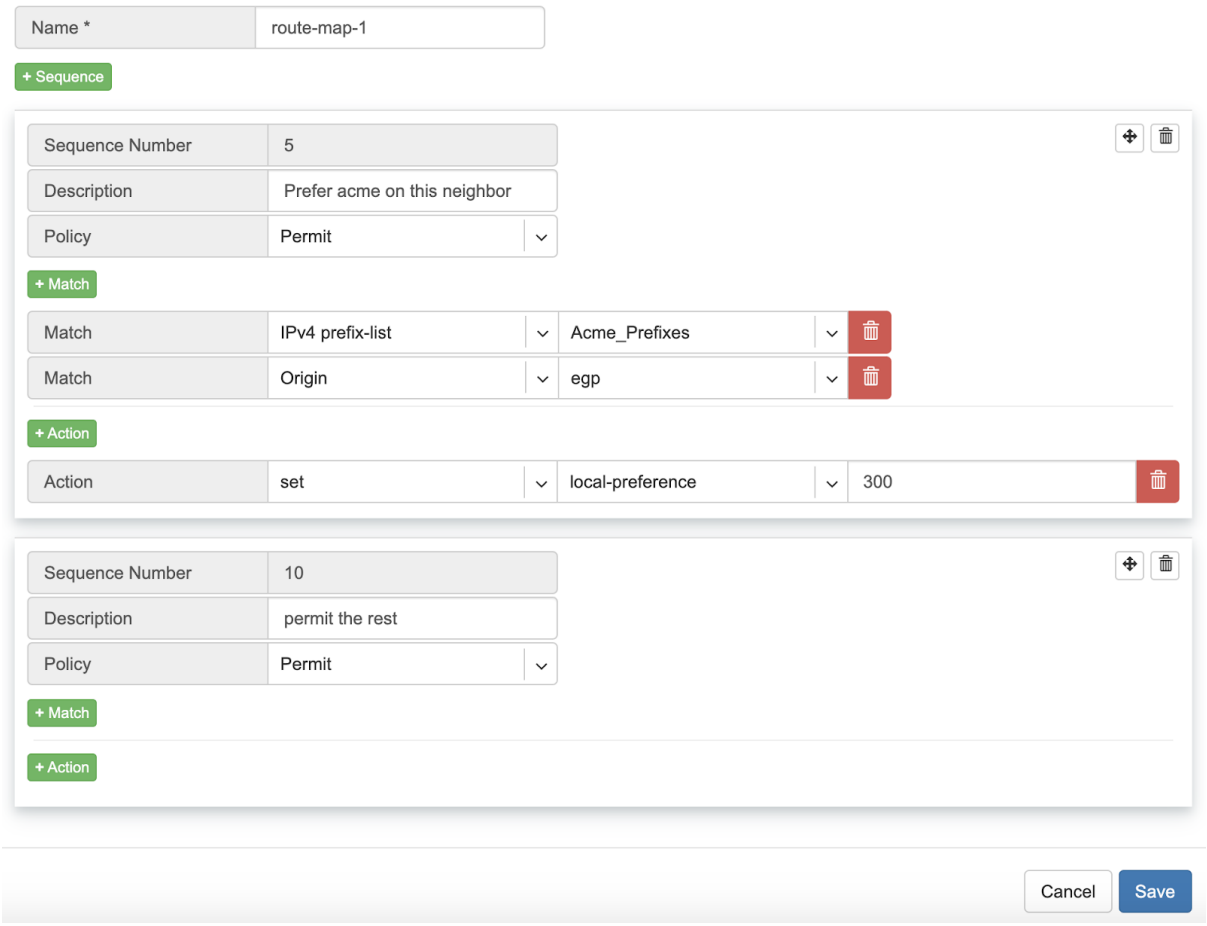
Example: Creating community.

8.2 BGP route-maps

Under the Net→E-BGP Route-maps section, you can define route-map policies, which can be associated with the BGP neighbors inbound or outbound.
Description of route-map fields:

- **Sequence Number** - Automatically assigned a sequence number. Drag and move sequences to organize the order.
- **Description** - Free description.
- **Policy** - Permit or deny the routes which match below all match clauses within the current sequence.
- **+Match** - Rules for route matching.
  - **Type** - Type of the object to match: AS-Path, Community, Extended Community, Large Community, IPv4 prefix-list, IPv4 next-hop, Route Source, IPv6 prefix-list. IPv6 next-hop, local-preference, MED, Origin, Route Tag.
  - **Object** - Select an object from the list.
- **Action** - Action when all match clauses are met.
  - **Action type** - Define whether to manipulate a particular BGP attribute or go to another sequence.
  - **Attribute** - The attribute to be manipulated.
  - **Value** - New attribute value.

Example: route-map


Name *
route-map-1
+ Sequence
Sequence Number
5
Description
Prefer acme on this neighbor
Policy
Permit
+ Match
Match
IPv4 prefix-list
Acme_Prefixes
Match
Origin
egp
+ Action
Action
set
local-preference
300
Sequence Number
10
Description
permit the rest
Policy
Permit
+ Match
+ Action
Cancel
Save

Routes (static routing)

Located under Net→Routes is a method for describing static routing policies that Netris will dynamically inject on switches and/or SoftGate where appropriate. We recommend using the Routes only if BGP is not supported by the remote end.

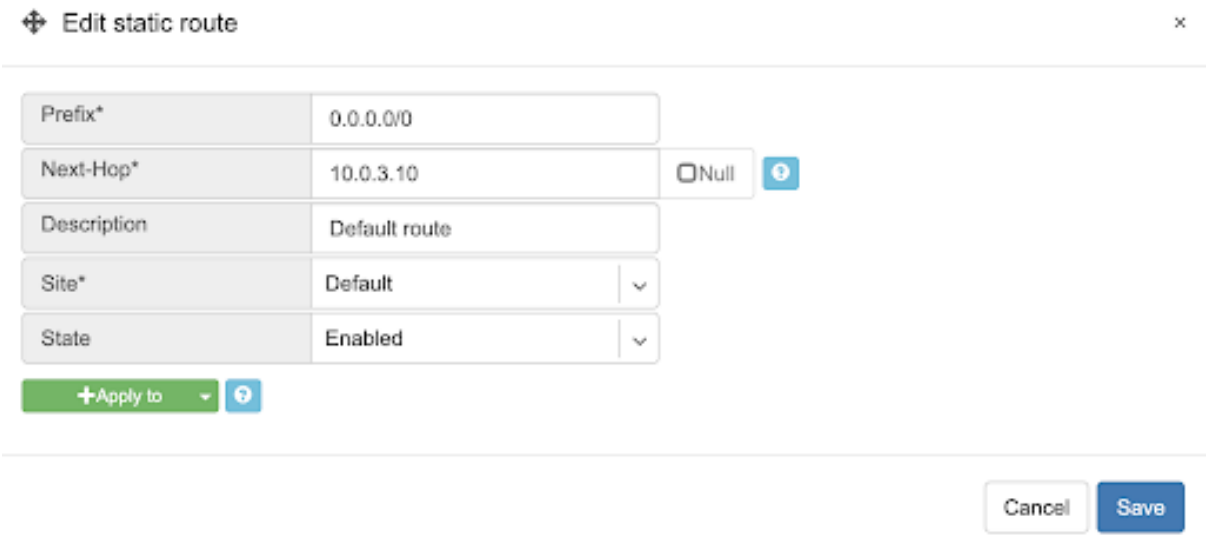
Typical use cases for Routes

- To connect the switch fabric to an ISP or upstream router in a situation where BGP and dual-homing are not supported.
- Temporary interconnection with the old network for a migration.
- Routing a subnet behind a VM hypervisor machine for an internal VM network.
- Specifically routing traffic destined to a particular prefix through an out-of-band management network.

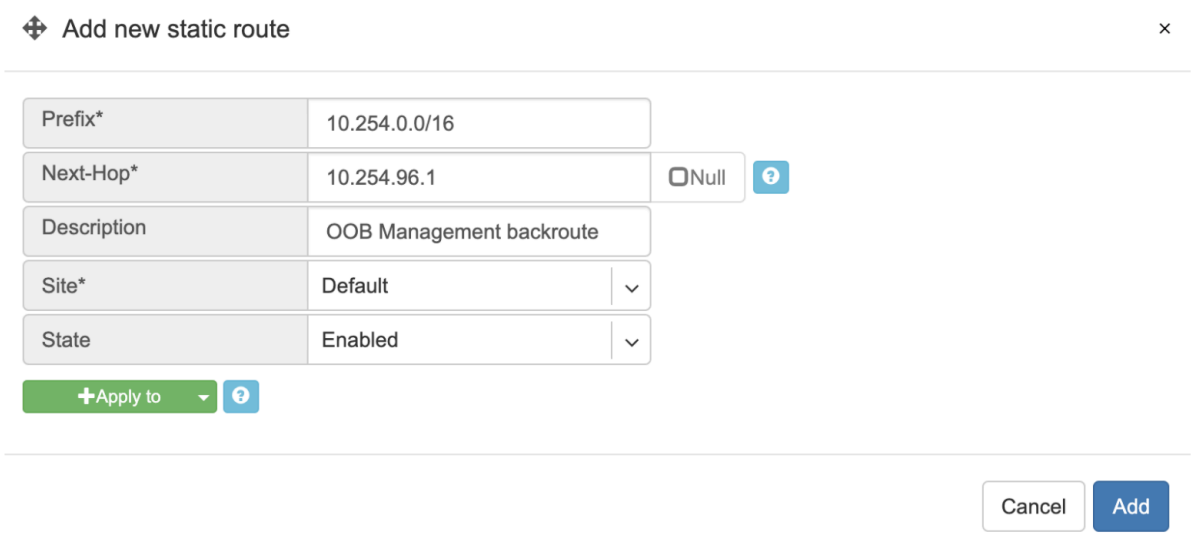
Add new static route fields description:

- **Prefix** - Route destination to match.
- **Next-Hop** - Traffic destined to the Prefix will be routed towards the Next-Hop. Note that static routes will be injected only on units that have the Next-Hop as a connected network.
- **Description** - Free description.
- **Site*** - Site where Route belongs.
- **State** - Administrative (enable/disable) state of the Route.
- **+Apply to** - Limit the scope to particular units. It's typically used for Null routes.

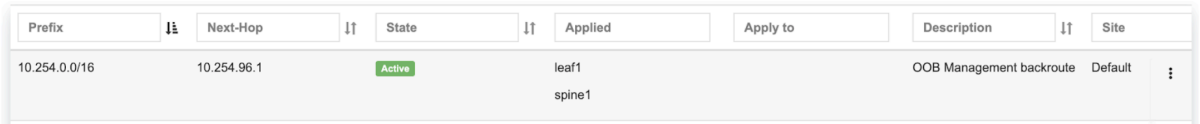
Example: Default route pointing to a Next-Hop that belongs to one of V-NETs.



Example: Adding a back route to 10.254.0.0/16 through an out-of-band management network.



Screenshot: This Shows that my back route is actually applied on leaf1 and spine1.



NAT

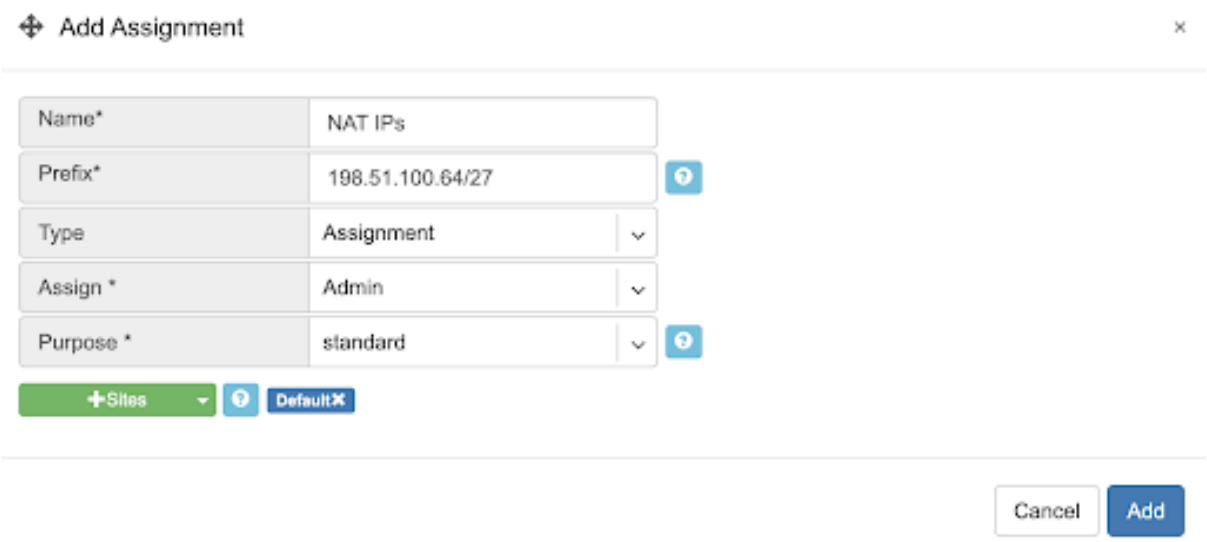
Netris SoftGate nodes are required to support NAT (Network Address Translation).

10.1 Enabling NAT

To enable NAT for a given site, you first need to attach NAT IP addresses and/or NAT IP pool resources to SoftGate nodes. NAT IP addresses can be used for SNAT or DNAT as a global IP address (the public IP visible on the Internet). NAT IP pools are IP address ranges that SNAT can use as a rolling global IP (for a larger scale, similar to carrier-grade SNAT). SNAT is always overloading the ports, so many local hosts can share one or just a few public IP addresses. You can add as many NAT IP addresses and NAT pools as you need, assuming it's configured as an allocation under Net→-Subnets section.

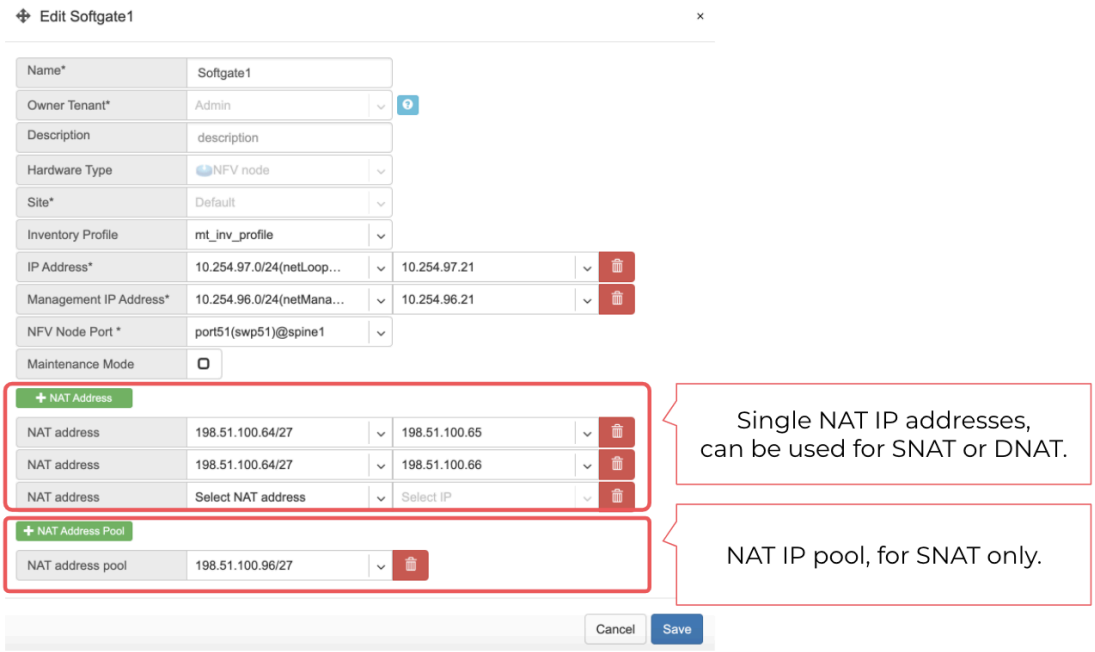
1. Allocate a public IP subnet for NAT under Net→Subnets.

Example: Adding an IP allocation under Net→Subnets.



2. Attach NAT IP addresses and/or NAT IP Pools to just one SoftGate node. Other SoftGate Nodes on the same site will automatically add the same NAT IP/Pool resources for proper consistency and high availability.

Example: Adding NAT IP addresses and NAT IP Address Pools to a SoftGate node.



10.2 Defining NAT rules

NAT rules are defined under Net→NAT.

NAT rule fields described:

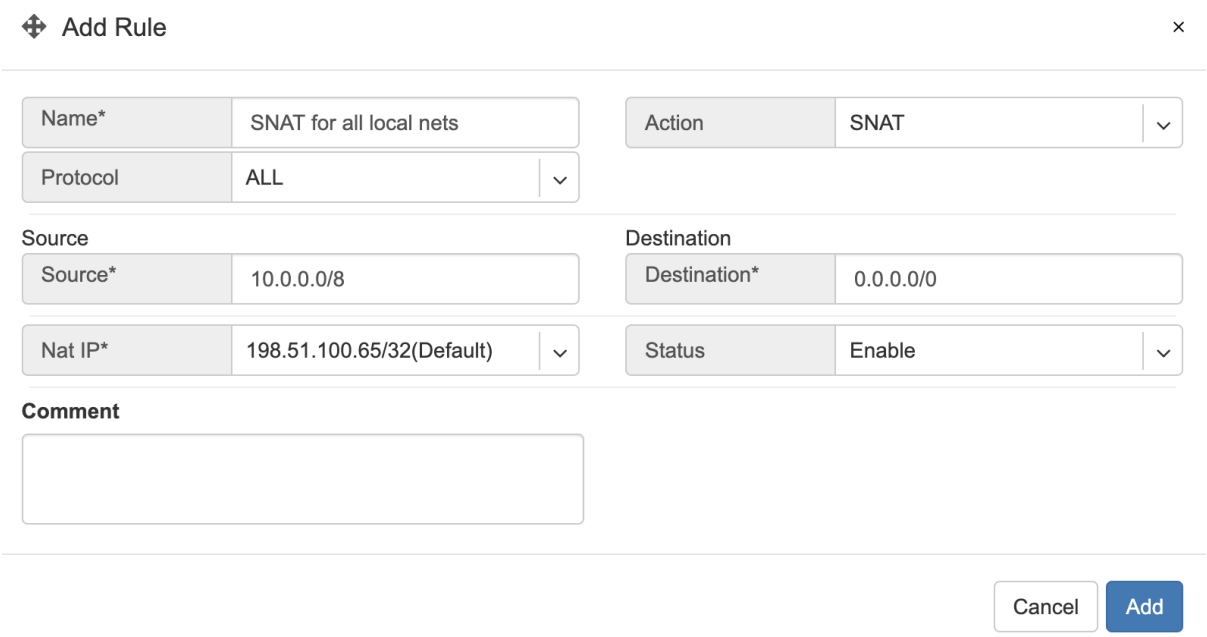
- **Name** - Unique name.
- **Protocol**
  - **All** - Match any IP protocol.
  - **TCP** - Match TCP traffic and ports.
  - **UDP** - Match UDP traffic and ports
  - **ICMP** - Match ICMP traffic.
- **Action**
  - **SNAT** - Replace the source IP address with specified NAT IP.
  - **DNAT** - Replace the destination IP address and/or destination port with specified NAT IP.
  - **ACCEPT** - Silently forward, typically used to add an exemption to broader SNAT or DNAT rule.
- **Source**
  - **Address** - Source IP address to match.
  - **From port** - Source ports to match starting with this value (TCP/UDP)
  - **To port** - Source ports to much up to this value (TCP/UDP)
- **Destination**
  - **Address** - Destination IP address to match. In the case of DNAT it should be one of the predefined NAT IP addresses.
  - **Port** - For DNAT only, to match a single destination port.
  - **From port** - For SNAT/ACCEPT only. Destination ports to match starting with this value

(TCP/UDP)

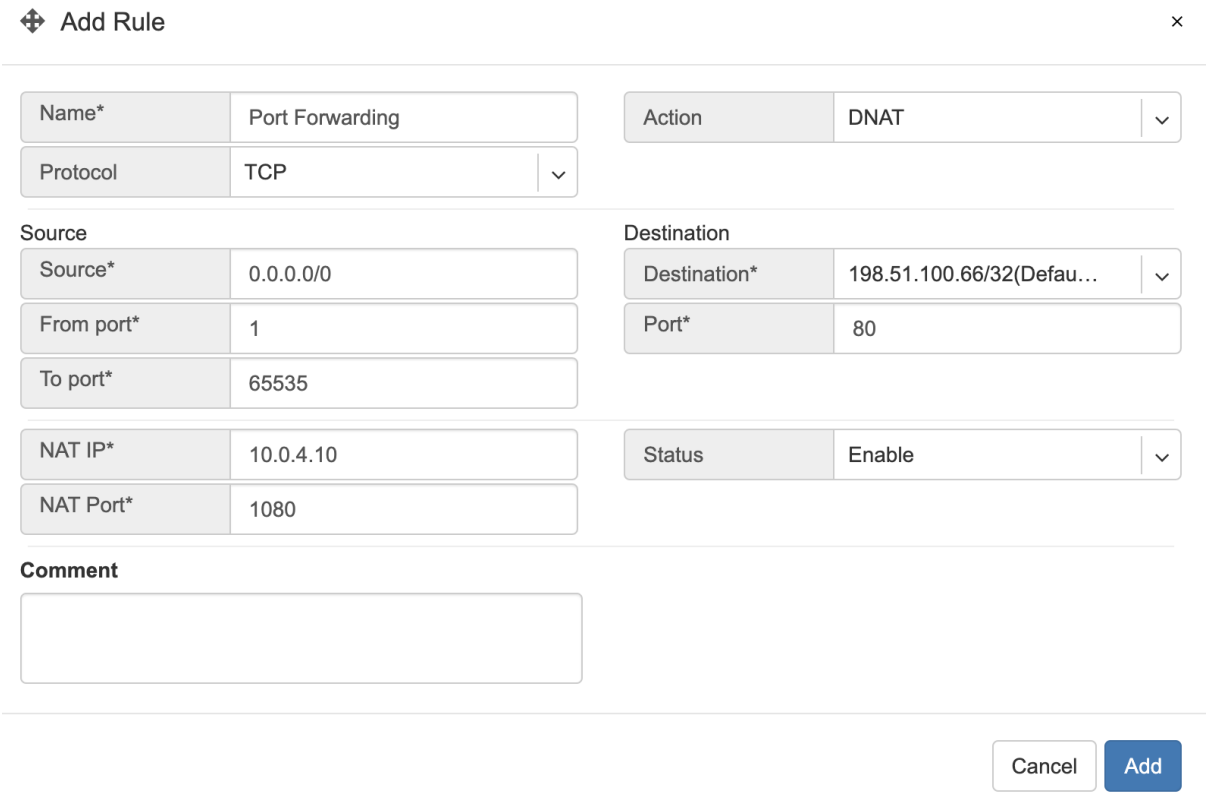
- **To port** - For SNAT/ACCEPT only. Destination ports to much up to this value (TCP/UDP)

- **NAT IP** - The global IP address for SNAT to be visible on Public Internet. The internal IP address for DNAT to replace the original destination address with.
- **Status** - Administrative state (enable/disable).
- **Comment** - Free optional comment.

Example: SNAT all hosts on 10.0.0.0/8 to the Internet using 198.51.100.65 as a global IP.



Example: Port forwarding. DNAT the traffic destined to 198.51.100.66:80 to be forwarded to the host 10.0.4.10 on port tcp/1080.

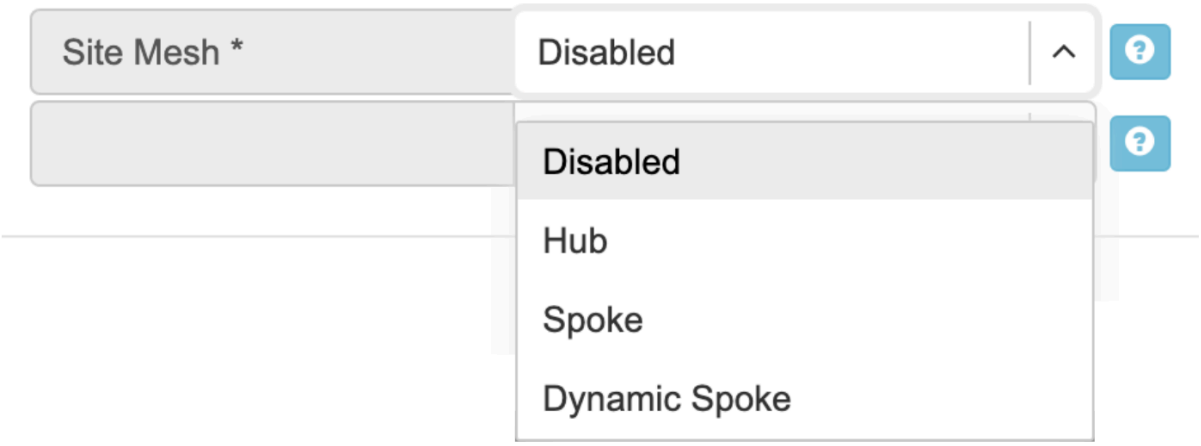


SiteMesh is a Netris service for site-to-site interconnects over the public Internet. SiteMesh automatically generates configuration for WireGuard to create encrypted tunnels between participating sites and automatically generates a configuration for FRR to run dynamic routing. Hence, sites learn how to reach each other over the mesh WireGuard tunnels. The SiteMesh feature requires a SoftGate node at each participating site.

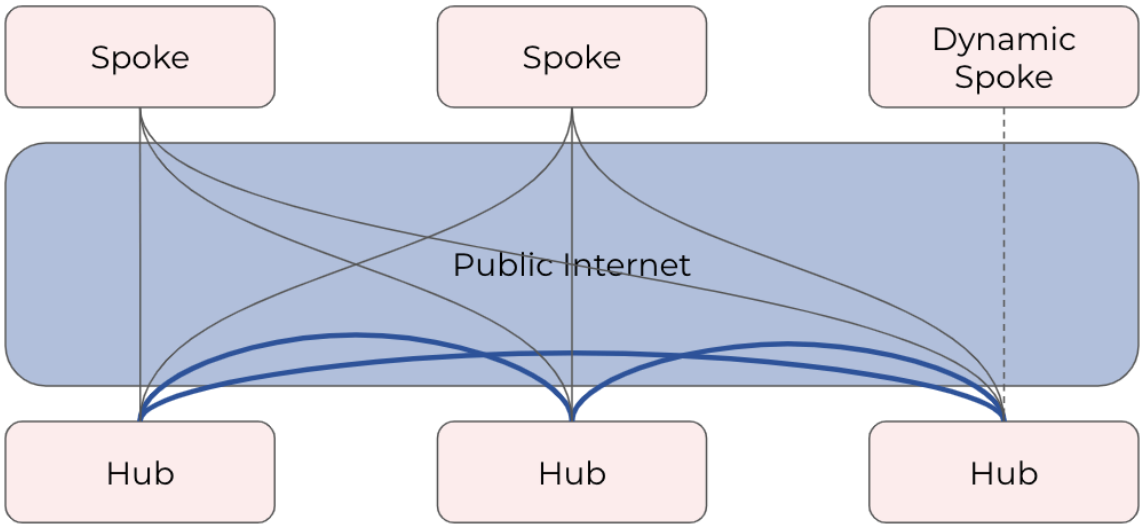
Edit Net->Sites, do declare what sites should form a SiteMesh. See SiteMesh types described below.

- **Disabled** - Do not participate in SiteMesh.
- **Hub** - Hub sites form full-mesh tunnels with all other sites (Hub and non-Hub) and can carry transit traffic for non-Hub sites. (usually major data center sites)
- **Spoke** - Spoke sites form tunnels with all Hub sites. Spoke to Spoke traffic will transit a Hub site. (small data center sites or major office sites)
- **Dynamic Spoke** - Dynamic Spoke is like Spoke, but it will maintain a tunnel only with one Hub site, based on dynamic connectivity measurements underneath and mathematical modeling. (small office sites)

Screenshot: Site Mesh parameter editing a Site under Net→Sites.

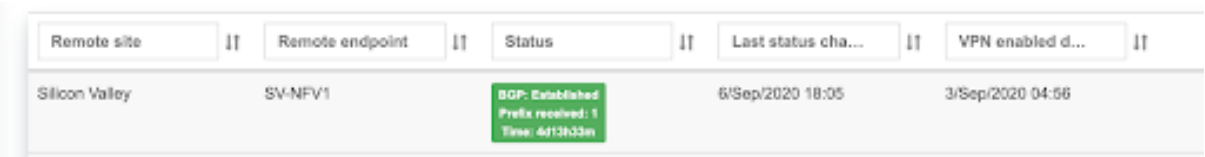


You only need to define your site-to-site VPN architecture policy by selecting SiteMesh mode for every site. Netris will generate the WireGuard tunnels (using randomly generated keys, and generate FRR rules to get the dynamic routing to converge.



Check the Net→Site Mesh section for the listing of tunnel statuses.

Screenshot: Listing of SiteMesh tunnels and BGP statuses (Net→Site Mesh)



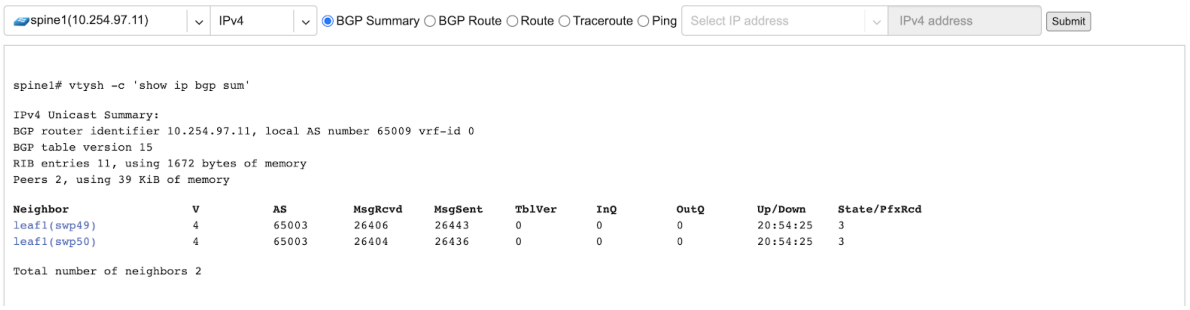
Looking Glass

The Looking Glass Is a GUI-based tool for looking up routing information from a switch or SoftGate perspective. You can access the Looking Glass either from Topology, individually for every device (right click on device → details → Looking Glass), or by navigating to Net→Looking Glass then selecting the device from the top-left dropdown menu.

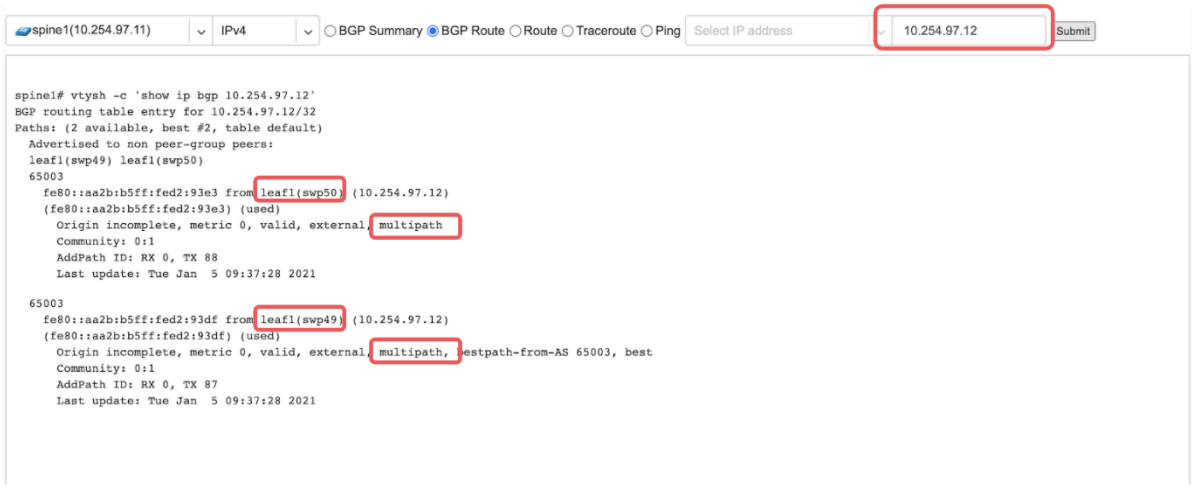
Looking Glass controls described for IPv4/IPv6 protocol families.

- **BGP Summary** - Shows the summary of BGP adjacencies with neighbors, interface names, prefixes received. You can click on the neighbor name then query for the list of advertised/received prefixes.
- **BGP Route** - Lookup the BGP table (RIB) for the given address.
- **Route** - Lookup switch routing table for the given address.
- **Traceroute** - Conduct a traceroute from the selected device towards the given destination, optionally allowing to determine the source IP address.
- **Ping** - Execute a ping on the selected device towards the given destination, optionally allowing to select the source IP address.

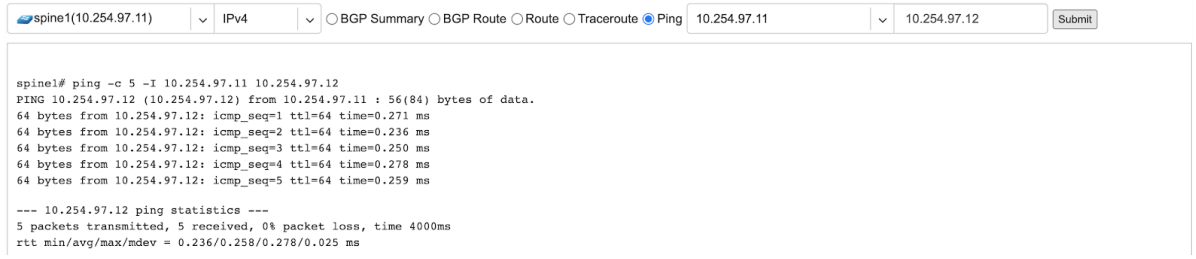
Example: Spine1: listing BGP neighbors and number of received prefixes.



Example: BGP Route - looking up my leaf1 switch's loopback address from spine1's perspective. Spine1 is load balancing between two available paths.



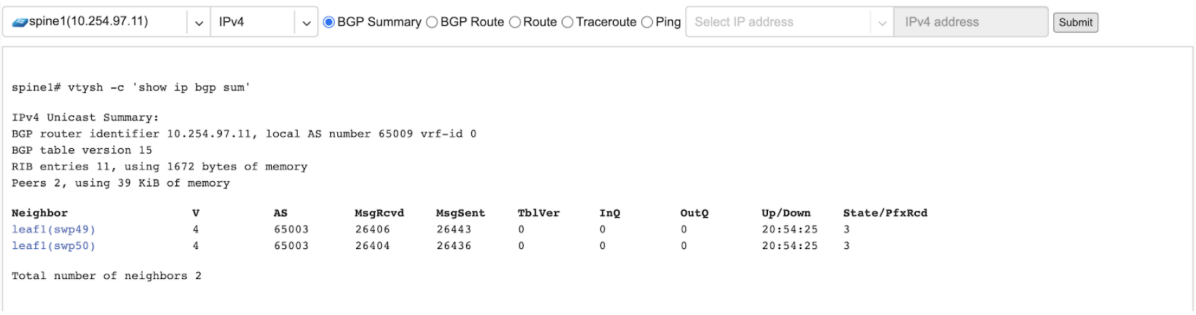
Example: Ping.



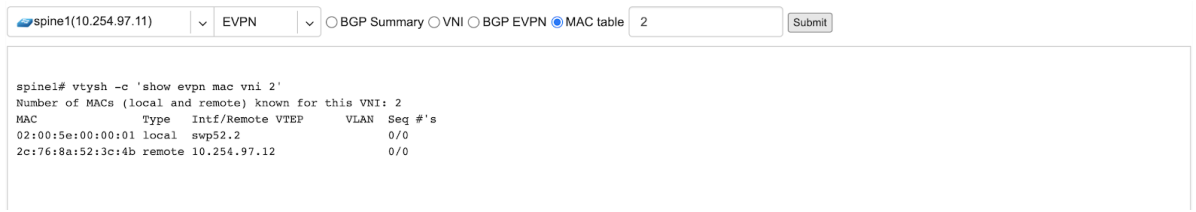
Looking Glass controls described for the EVPN family.

- **BGP Summary** - Show brief summary of BGP adjacencies with neighbors, interface names, and EVPN prefixes received.
- **VNI** - List VNIs learned.
- **BGP EVPN** - List detailed EVPN routing information optionally for the given route distinguisher.
- **MAC table** - List MAC address table for the given VNI.

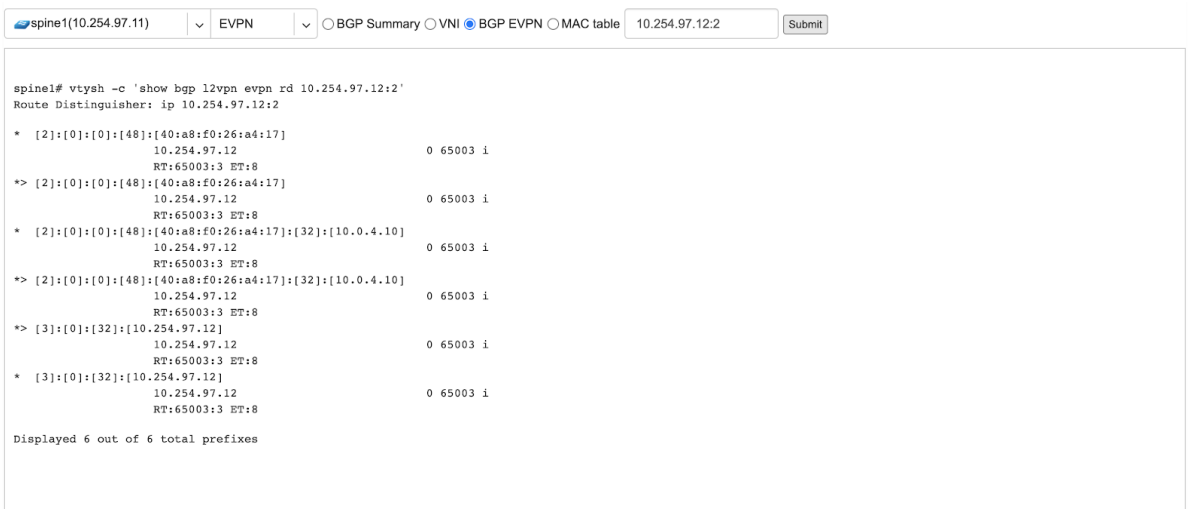
Example: Listing of adjacent BGP neighbors and number of EVPN prefixes received.



Example: Listing MAC addresses on VNI 2.



Example: EVPN routing information listing for a specified route distinguisher.



V-NET

V-NET is a virtual networking service. V-NETs can be used for Layer-2 (unrouted) or Layer-3 (routed) virtual network segments involving switch ports anywhere on the switch fabric. V-NETs can be created and managed by a single tenant (single team) or created and managed collaboratively by multiple tenants (different teams inside and/or outside the organization).

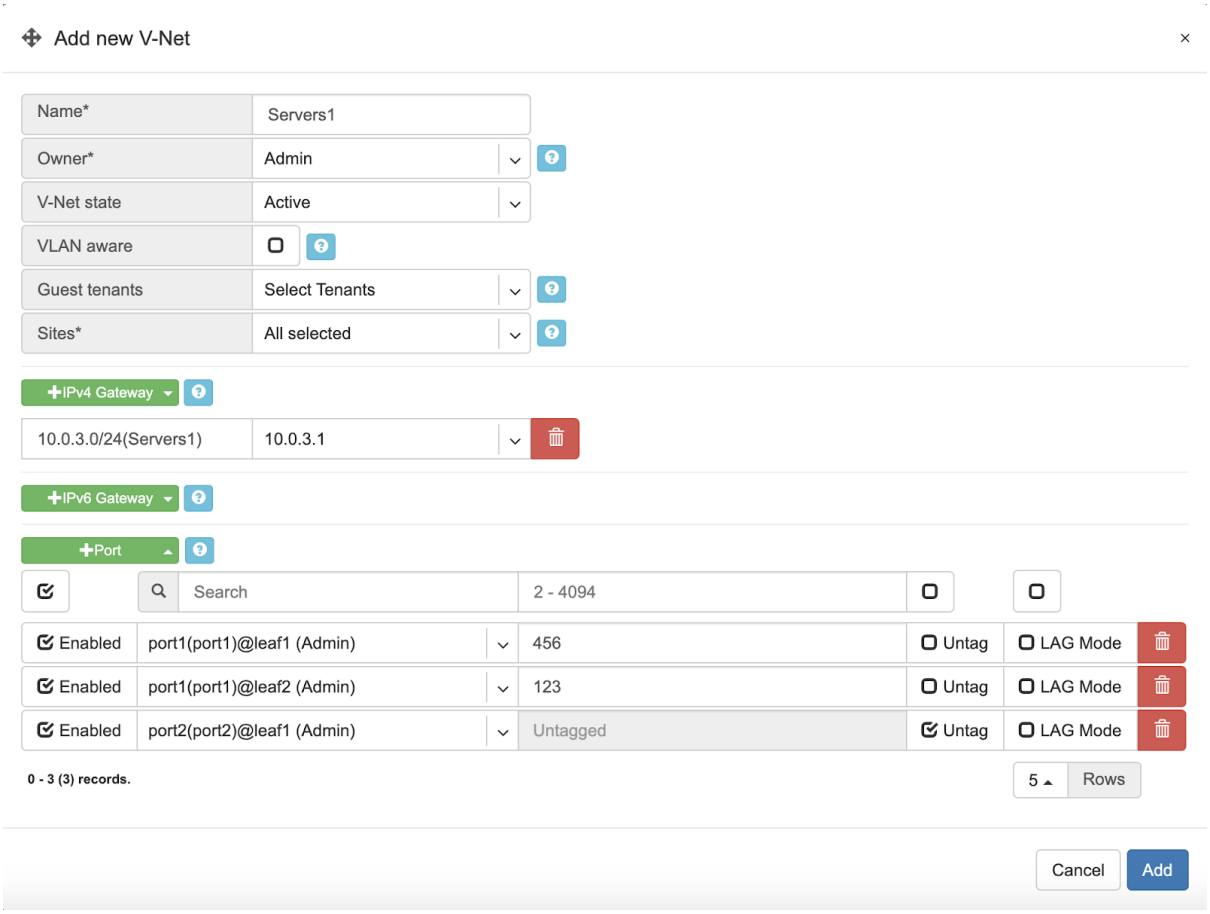
> Automatically, Netris will configure a VXLAN with an EVPN control plane over an unnumbered BGP Layer-3 underlay network and organize the high availability for the default gateway behind the scenes.

V-Net fields.

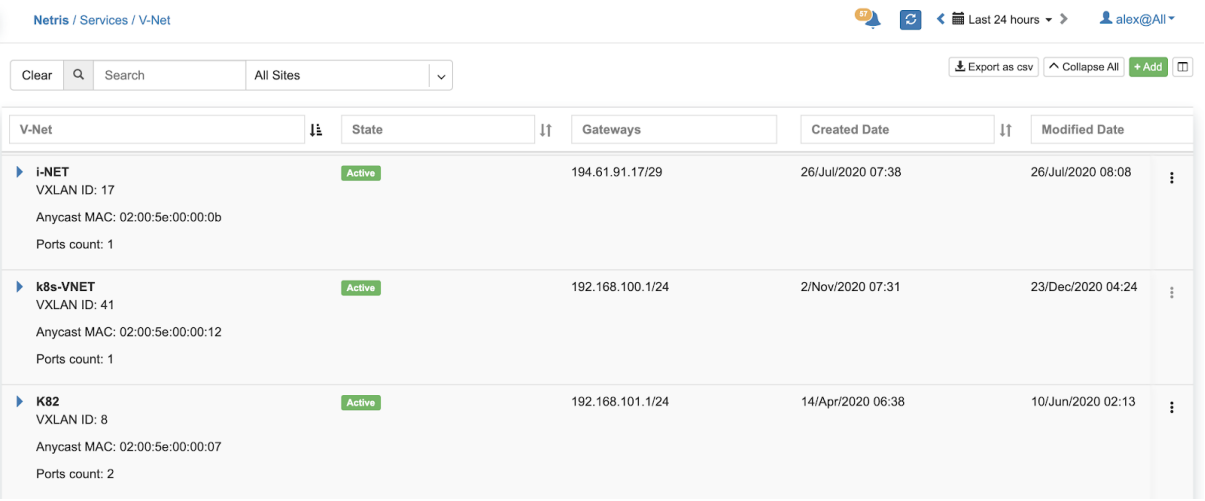
- **Name** - Unique name for the V-NET.
- **Owner** - Tenant, who can make any changes to current V-NET.
- **V-Net state** - Active/Disable state for entire V-NET.
- **VLAN aware** - Enable VLAN aware bridge, use only in rare cases, if otherwise is not possible.
- **Guest tenants** - List of tenants allowed to add/edit/remove ports to the V-Net but not manage other parameters.
- **Sites** - Ports from these sites will be allowed to participate in the V-Net. (Multi-site circuits would require backbone connectivity between sites).
- **IPv4 Gateway** - IPv4 address to be used as a default gateway in this V-NET. Should be configured under Net→Subnets as an assignment, assigned to the owner tenant, and available in the site where V-NET is intended to span.
- **IPv6 Gateway** - IPv6 address to be used as a default gateway in this V-NET. Should be configured under Net→Subnets as an assignment, assigned to the owner tenant, and available in the site or sites where V-NET is intended to span.
- **Port** - Physical Switch Port anywhere on the network. Switch Port should be assigned to the owner or guest tenant under Net→Switch Ports.
  - **Enabled** - Enable or disable individual Switch Port under current V-NET
  - **Port Name** - Switch Port format: <alias>(swp<number>)@<switch name>
  - **VLAN ID / Untag** - Specify a VLAN ID for tagging traffic on a per-port basis or set Untag not to use tagging on a particular port. VLAN tags are only significant on each port's ingress/egress unless VLAN aware mode is used.
  - **LAG Mode** - Allows for active-standby dual-homing, assuming LAG configuration on the remote end. Active/active dual homing will be enabled in future releases (dependence on SVI support by NOSes).

Tip: Many switches can't autodetect old 1Gbps ports. If attaching hosts with 1Gbps ports to 10Gpbs switch ports, you'll need to change the speed for a given Switch Port from Auto(default) to 1Gbps. You can edit a port in Net→Switch Ports individually or in bulk.

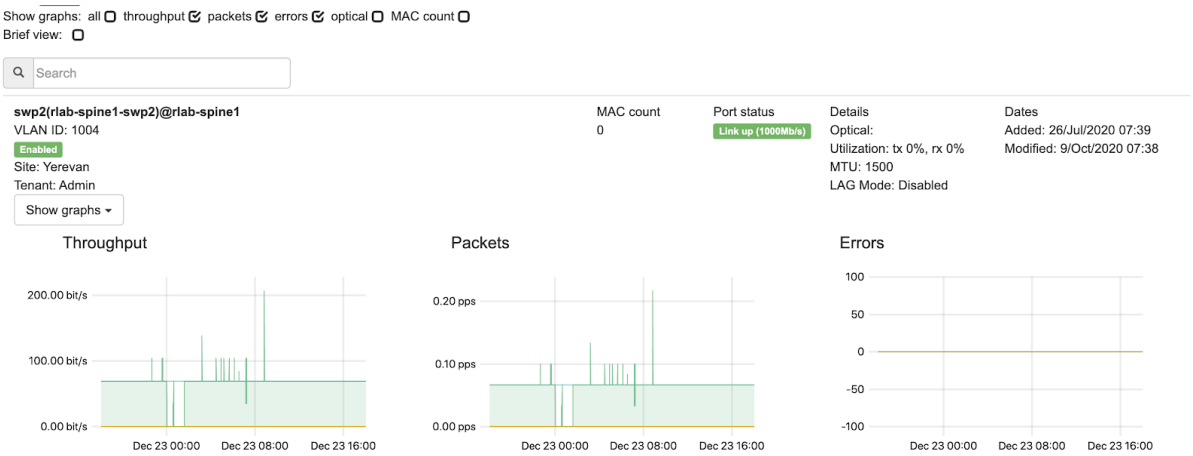
Example: Adding a new V-NET.



Example: Listing of V-NETs.



Example: Expanded view of a V-NET listing.


Show graphs: all throughput packets errors optical MAC count
Brief view:
Search
swp2(rlab-spine1-swp2)@rlab-spine1
VLAN ID: 1004
Enabled
Site: Yerevan
Tenant: Admin
Show graphs
MAC count
0
Port status
Link up (1000Mb/s)
Details
Optical:
Utilization: tx 0%, rx 0%
MTU: 1500
LAG Mode: Disabled
Dates
Added: 26/Jul/2020 07:39
Modified: 9/Oct/2020 07:38
Throughput
200.00 bit/s
100.00 bit/s
0.00 bit/s
Dec 23 00:00
Dec 23 08:00
Dec 23 16:00
Packets
0.20 pps
0.10 pps
0.00 pps
Dec 23 00:00
Dec 23 08:00
Dec 23 16:00
Errors
100
50
0
-50
-100
Dec 23 00:00
Dec 23 08:00
Dec 23 16:00

Kubenet

Kubenet is a network service purpose-built for Kubernetes cluster nodes. Netris integrates with Kube API to provide on-demand load balancer and other Kubernetes specific networking features. Netris Kubenet is designed to complement Kubernetes CNI networking and provide a cloud-like user experience to local Kubernetes clusters.

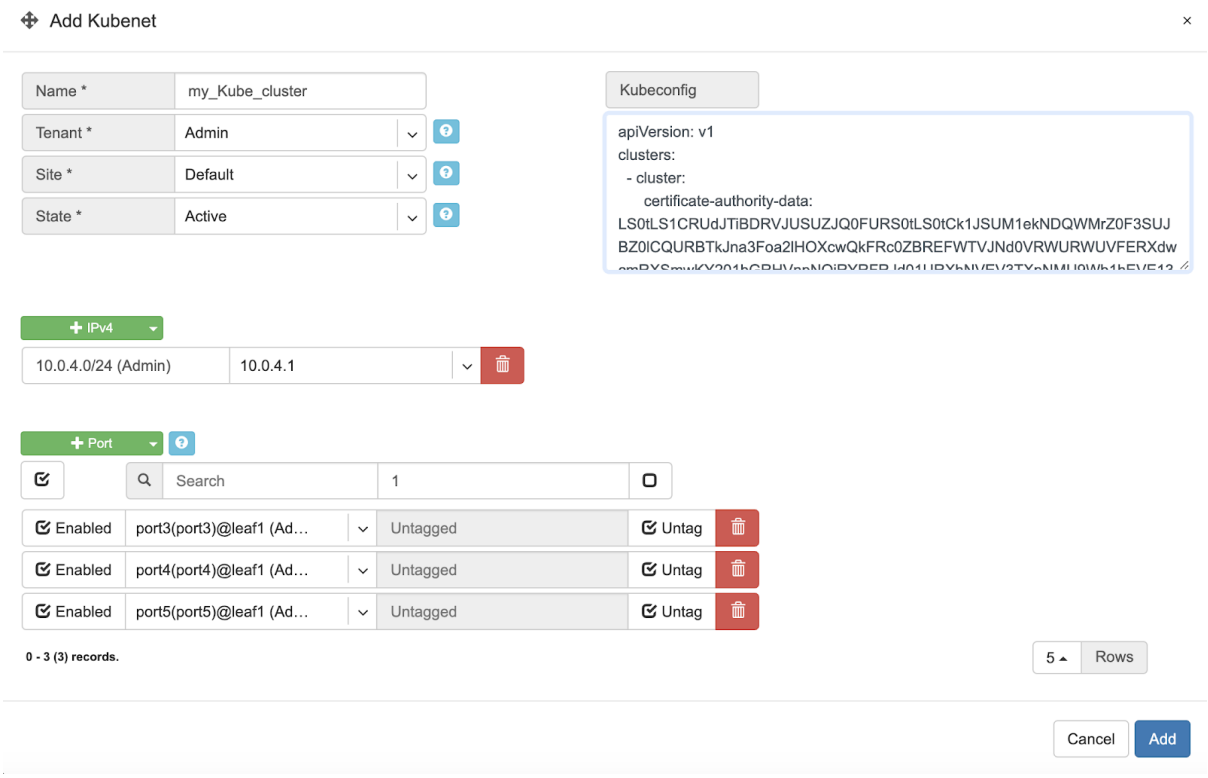
The Gateway and Switch Port part of Kubenet is similar to the V-NET. In fact, it is leveraging a V-NET. Kubeconfig is for granting Netris Controller access to your Kube API. Kubenet therefore, dynamically leverages Netris L4LB and other services based on events that Netris kube-watcher (Kube API integration adapter) watches in your Kube API.

Description of Kubenet fields.

- **Name** - Unique name for the Kubenet.
- **Tenant** - Tenant, who can make any changes to current Kubenet.
- **Site** - Site where Kubernetes cluster belongs.
- **State** - Active/Disable state for particular Kubenet service.
- **IPv4** Gateway - IPv4 address to be used as a default gateway for current Kubenet.
- **Port** - Physical Switch Port anywhere on the switch fabric. Switch Port should be assigned to the owner tenant under Net→Switch Ports.
    - **Enabled** - Enable or disable individual Switch Port under current Kubenet.
    - **Port Name** - Switch Port format: <alias>(swp<number>)@<switch name>
    - **VLAN ID / Untag** - Specify a VLAN ID for tagging traffic on a per-port basis or set to Untag not to use tagging on a particular port.
- **Kubeconfig** - After installing the Kubernetes cluster, add your Kube config for granting Netris at least read-only access to the Kube API.

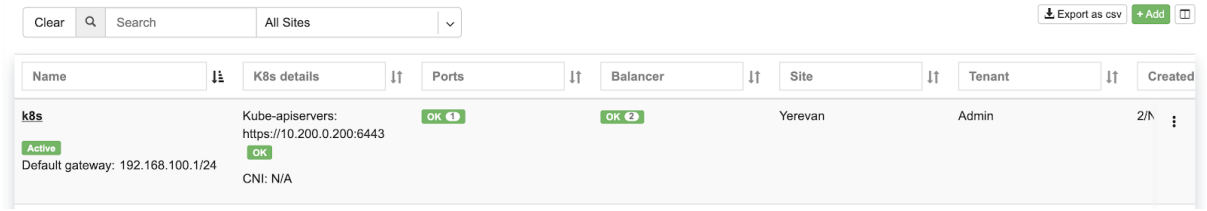
Tip: Many switches can't autodetect old 1Gbps ports. If attaching hosts with 1Gbps ports to 10Gpbs switch ports, you'll need to change the speed for a given Switch Port from Auto(default) to 1Gbps. You can edit a port in Net→Switch Ports individually or in bulk.

Example: Adding a new Kubenet service.

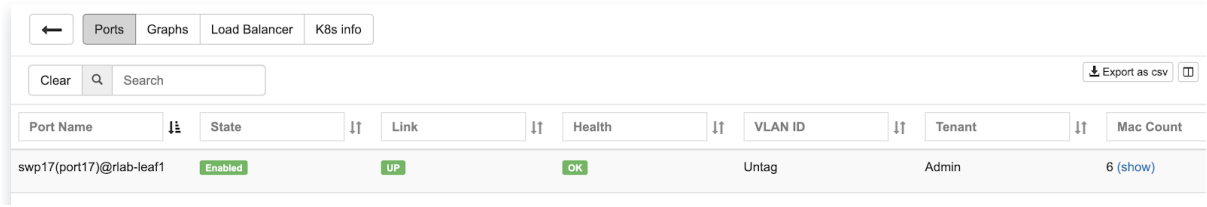


Once Netris Controller establishes a connection with Kube API, status will reflect on the listing.

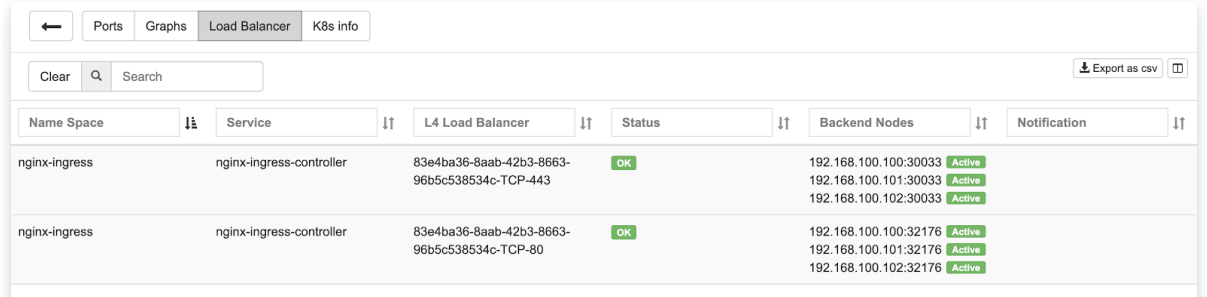
Screenshot: Listing of Kubenet services. Kube API connection is successful.



Screenshot: Physical Switch Port statuses.



Screenshot: Statuses of on-demand load balancers (type: load-balancer)



ROH (Routing on the Host)

To create more resilient and higher-performance data centers, some companies leverage the Linux ecosystem to run routing protocols directly to their servers. Known as ROH (Routing on the Host).

In ROH architectures, servers use a routing demon to establish a BGP adjacency with the switch fabric on every physical link. ROH can run on bare metal servers, VMs, and even containers. The most commonly used routing daemon is FRR.

Hosts connected to the network in ROH architecture don't have IP addresses on a shared Ethernet segment; instead IP address is configured on the loopback interface and advertised over all BGP links towards switch fabric. Thus, leveraging the Layer-3 network throughout the entire network down the servers.

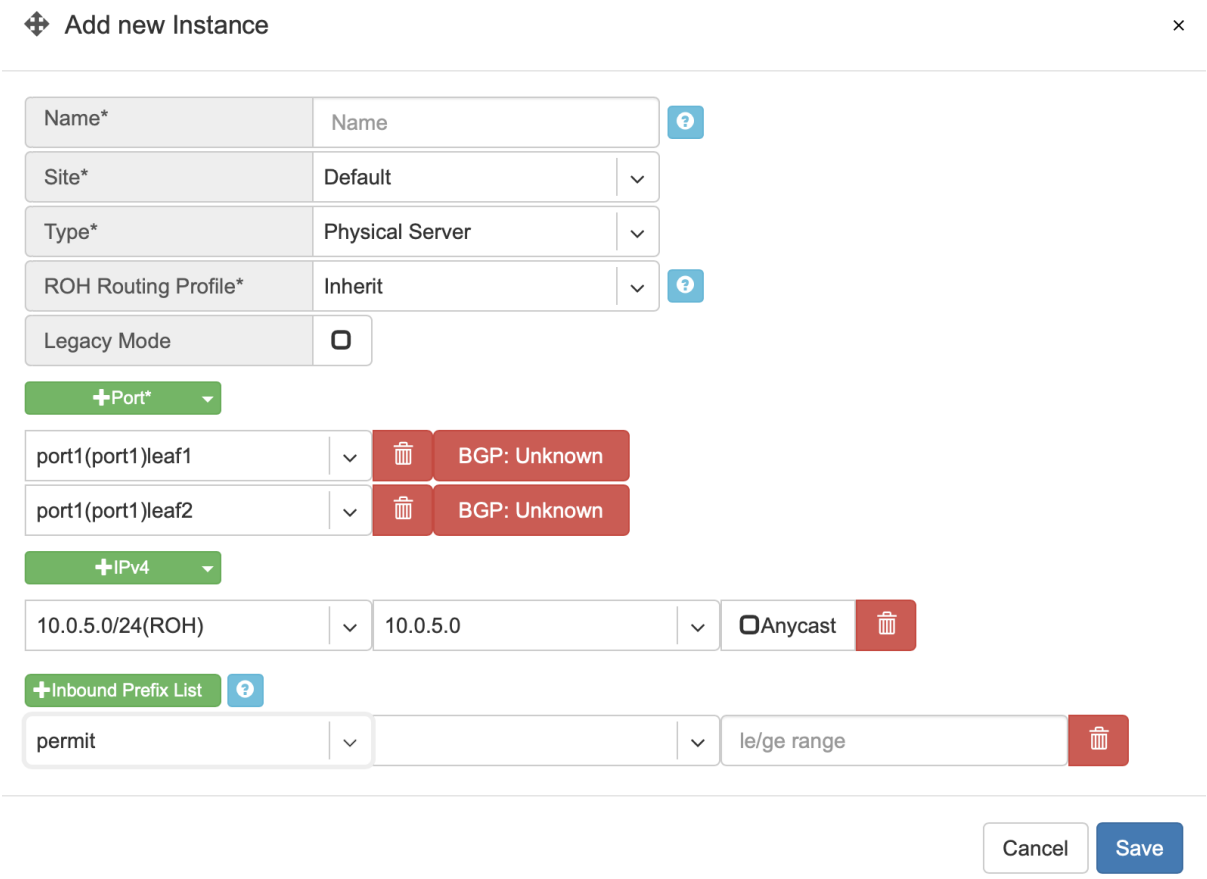
ROH architecture with Netris allows for leveraging ECMP load balancing capabilities of the switching hardware for the high-performance server load balancing (described in L3 Load Balancer section). For each instance of ROH, you'll need to create an ROH entry in Netris Controller.

Description of ROH instance fields:

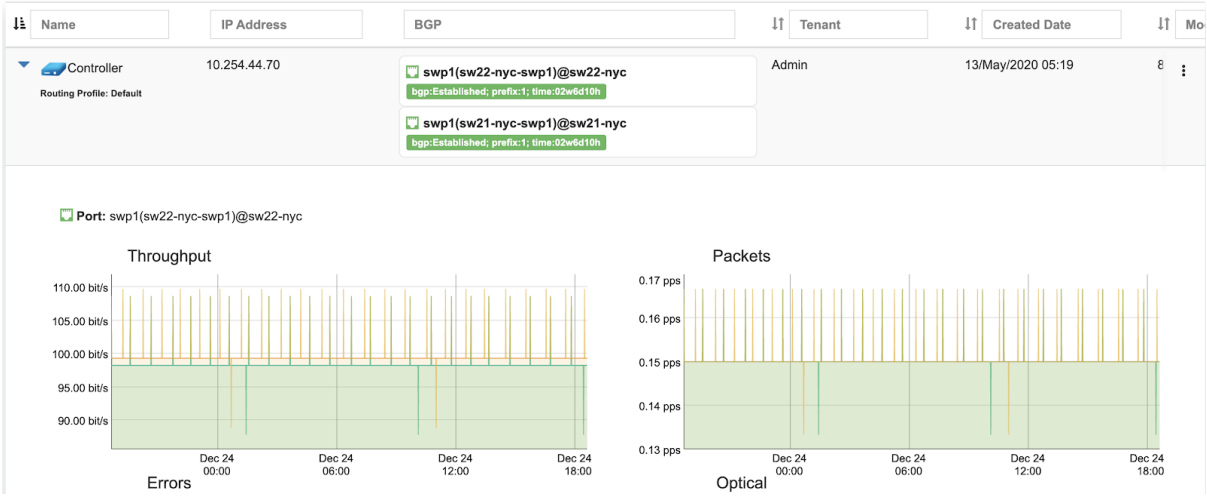
- **Name** - Unique name for the ROH instance.
- **Site** - Site where the current ROH instance belongs.
- **Type** - Physical Server, for all servers forming a BGP adjacency directly with the switch fabric. Hypervisor, for using the hypervisor as an interim router. Proxmox is currently the only supported hypervisor.
- **ROH Routing Profile** - ROH Routing profile defines what set of routing prefixes to be advertised to ROH instances.
    - **Default route only (a most common choice)** - Will advertise 0.0.0.0/0 + loopback address of the physically connected switch.
    - **Default + Aggregate** - Will add prefixes of defined assignments + "Default" profile.
    - **Full table** - Will advertise all prefixes available in the routing table of the connected switch.
    - **Inherit** - will inherit policy from site objects defined under Net→Sites.
- **Legacy Mode** - Switch from default zero-config mode to using /30 IP addresses. Use for MS Windows Servers or other OS that doesn't support FRR.
- **+Port** - Physical Switch Ports anywhere on the network.
- **+IPv4** - IPv4 addresses for the loopback interface.
- **+Inbound Prefix List** - List of additional prefixes that the ROH server may advertise. Sometimes used to advertise container or VM networks.

Tip: Many switches can't autodetect old 1Gbps ports. If attaching hosts with 1Gbps ports to 10Gpbs switch ports, you'll need to change the speed for a given Switch Port from Auto(default) to 1Gbps. You can edit a port in Net→Switch Ports individually or in bulk.

Example: Adding an ROH instance. (Yes, you can use A.B.C.0/32 and A.B.C.255/32)



Screenshot: Expanded view of ROH listing. BGP sessions are up, and the expected IP is in fact received from the actual ROH server. Traffic stats are available per port.



L3 Load Balancer (Anycast LB)

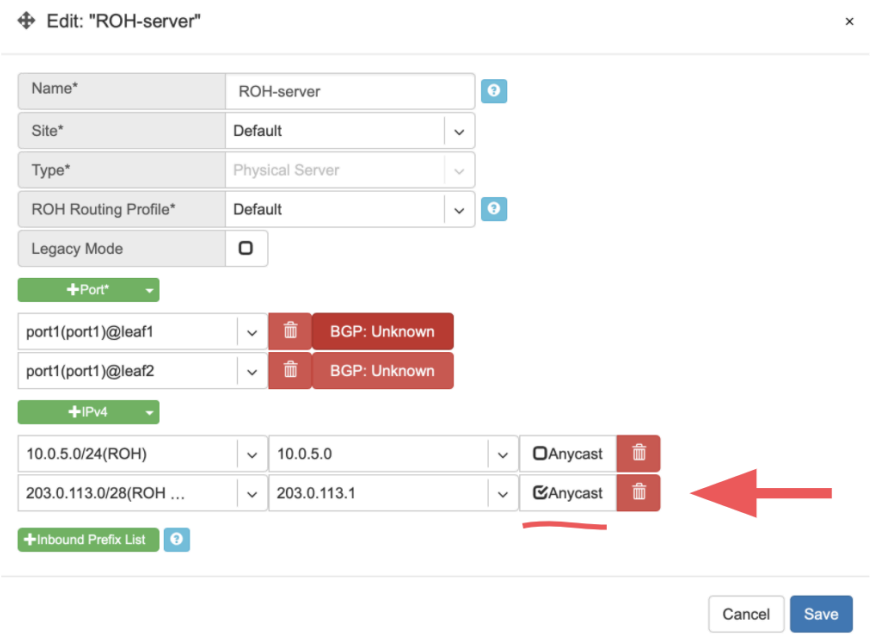
L3 (Anycast) load balancer is leveraging ECMP load balancing and hashing capability of spine and leaf switches to deliver line-rate server load balancing with health checks.

ROH servers, besides advertising their unicast (unique) loopback IP address, need to configure and advertise an additional anycast (the same IP) IP address. Unicast IP address is used for connecting to each individual server.

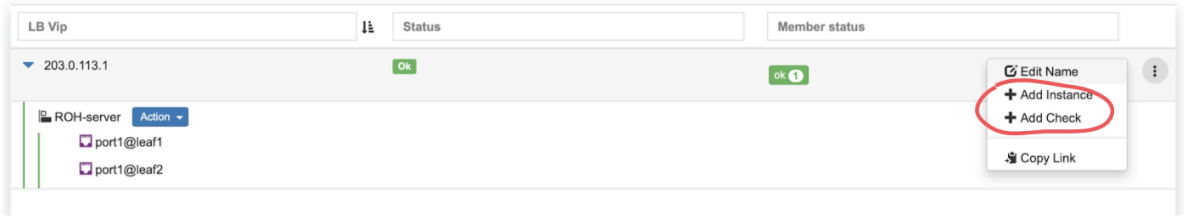
End-user traffic should be destined to the anycast IP address. Switch fabric will ECMP load balance the traffic towards every server, as well as will hash based on IP/Protocol/Port such that TCP sessions will keep complete between given end-user and server pair. Optionally health checks are available to reroute the traffic away in the event of application failure.

To configure L3 (Anycast) load balancing, edit an existing ROH instance entry and add an extra IPv4 address, and select Anycast. This will create a service under Services→Load Balancer and permit using the Anycast IP address in multiple ROH instances.

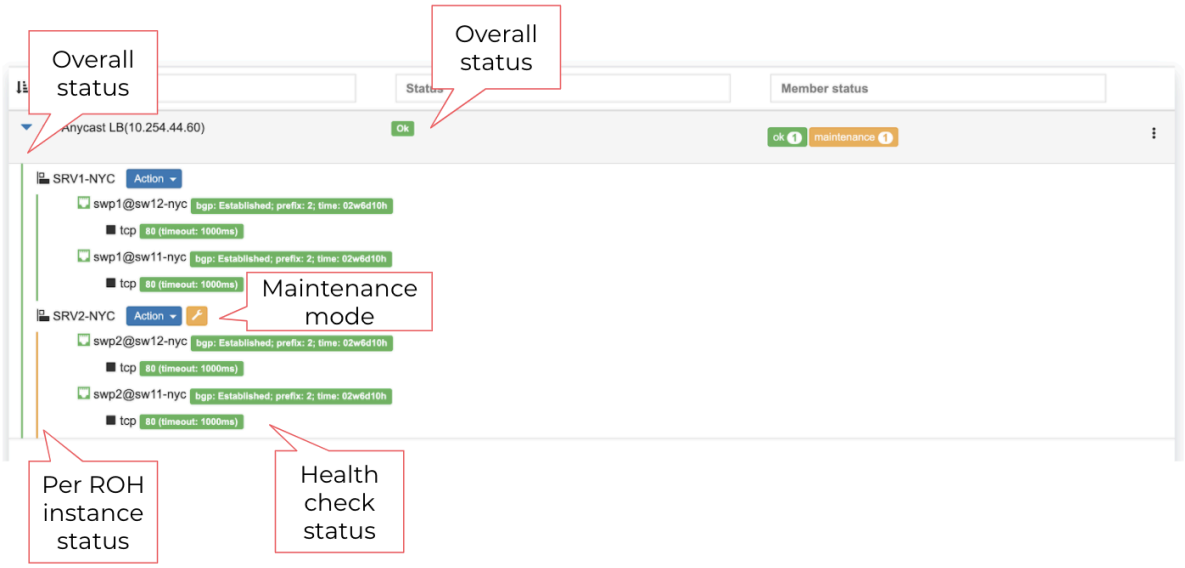
Example: Adding an Anycast IPv4 address



Example: Under Services→Load Balancer, you can find the listing of L3 (Anycast) Load Balancers, service statuses, and you can add/remove more ROH instances and/or health checks.



Screenshot: L3 (Anycast) Load Balancer listing.



L4 Load Balancer (L4LB)

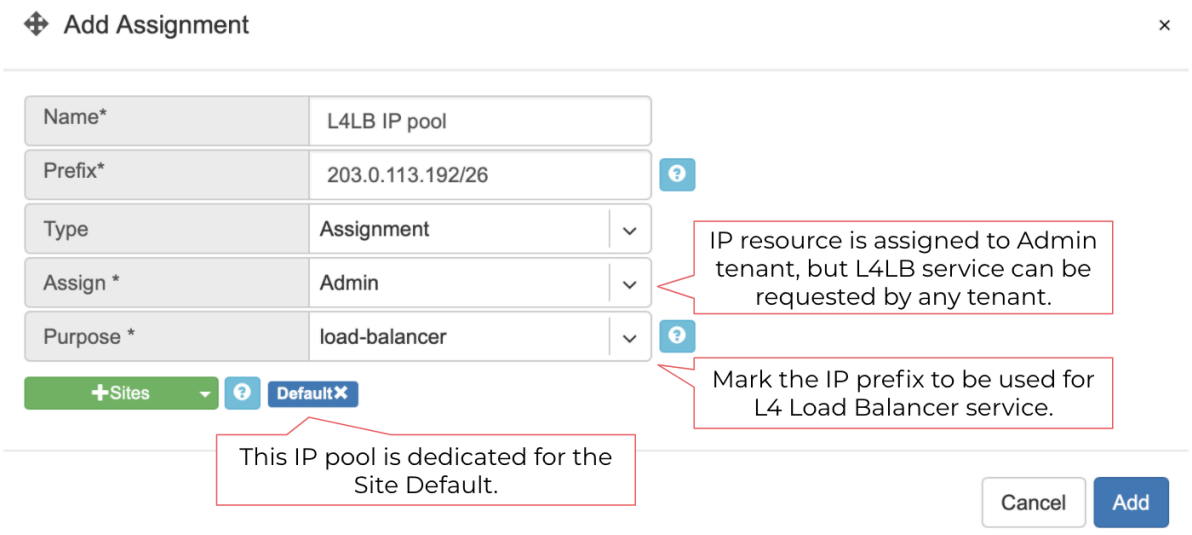
Netris L4 Load Balancer (L4LB) is leveraging SoftGate(Linux router) nodes for providing Layer-4 load balancing service, including on-demand cloud load balancer with native integration with Kubernetes.

16.1 Enabling L4LB service

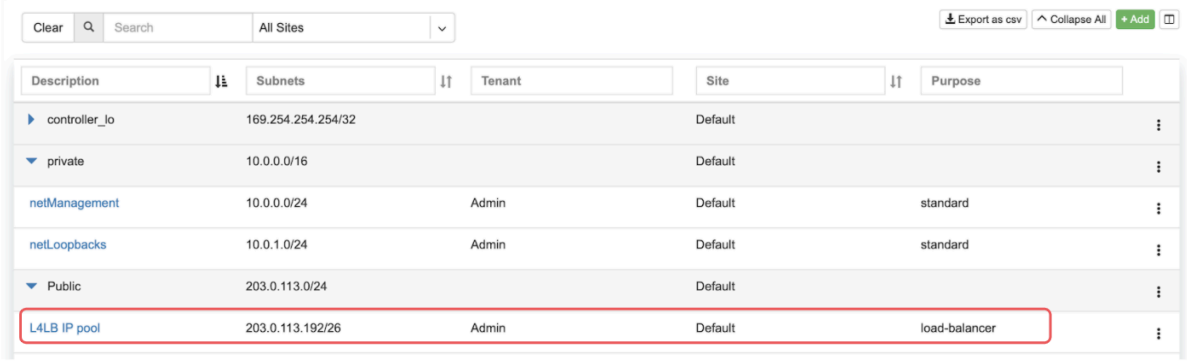
L4 Load Balancer service requires at least one SoftGate node to be available in a given Site, as well as at least one IP address assignment (purpose=load balancer).

The IP address pool for L4LB can be defined in the Net→Subnets section by adding an Allocation and setting the purpose field to 'load-balancer.' You can define multiple IP pools for L4LB at any given Site. See the below example.

Example: Adding a load-balancer IP pool assignment.



Screenshot: Listing of Net→Subnets after adding a load-balancer assignment



16.2 Consuming L4LB service

This guide describes how to request an L4 Load Balancer using GUI. For Kubernetes integration, check the Kubenet section.

Click +add under Services→L4 Load Balancer to request an L4LB service.

Add new L4 Load Balancer fields are described below:

General fields

- **Name*** - Unique name.
- **Protocol*** - TCP or UDP.
- **Tenant*** - Requestor Tenant should have access to the backend IP space.
- **Site*** - Site where L4LB service is being requested for. Backends should belong on this site.
- **State*** - Administrative state.

Frontend

- **Address*** - Frontend IP address to be exposed for this L4LB service. "Assign automatically" will provide the next available IP address from the defined load-balancer pool. Alternatively, users can select manually from the list of available addresses.
- **Port*** - TCP or UDP port to be exposed.

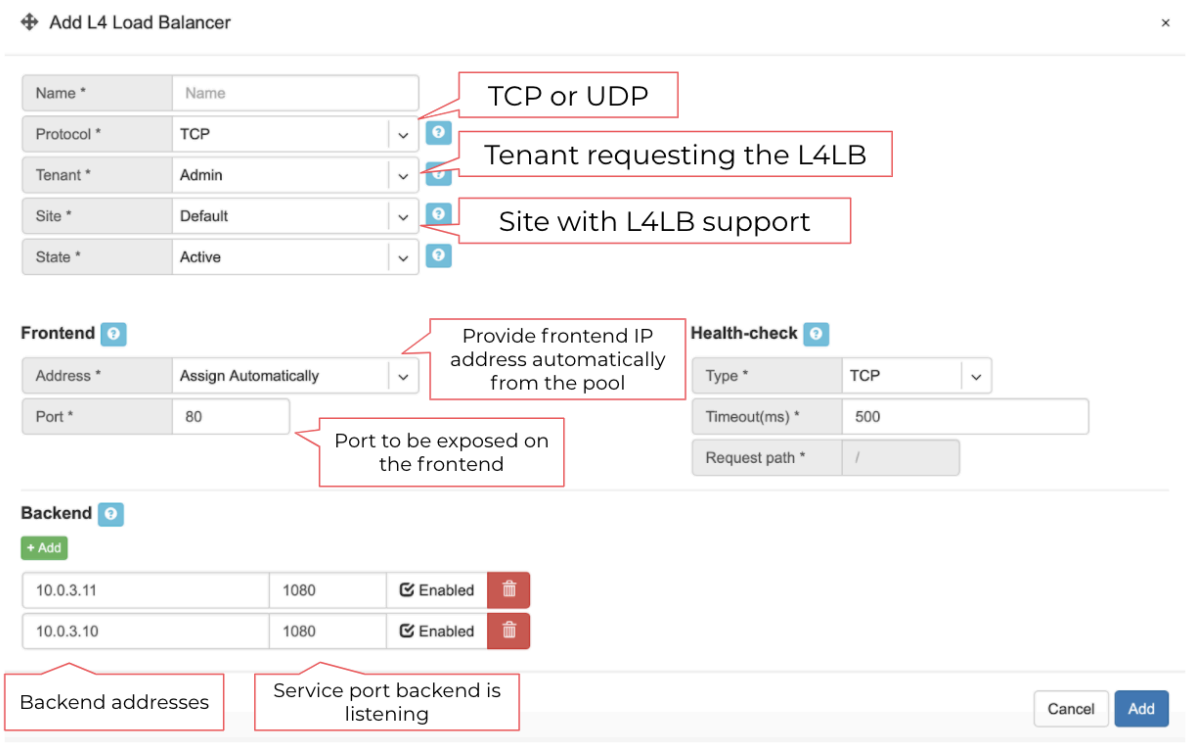
Health-check

- **Type*** - Probe backends on service availability.
  - **None** - load balance unconditionally.
  - **TCP** - probe backend service availability through TCP connect checks.
  - **HTTP** - probe backend service availability through http GET checks.
- **Timeout(ms)*** - Probe timeout in milliseconds.
- **Request path*** - Http request path.

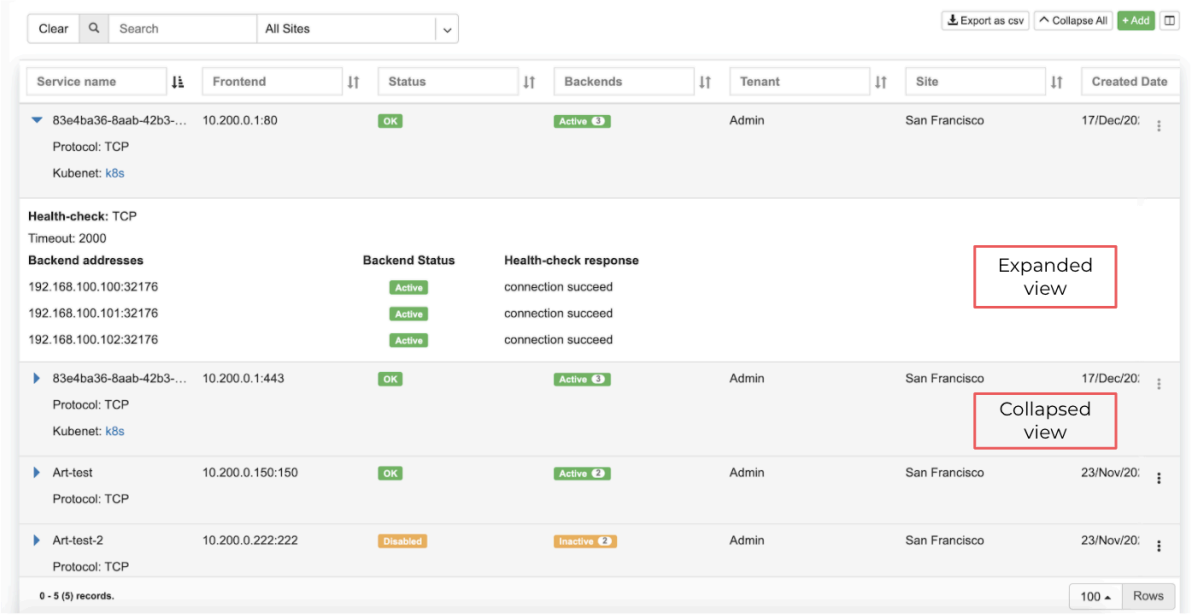
Backend

- **+Add** - add a backend host.
- **Address** - IP address of the backend host.
- **Port** - Service port on the backend host.
- **Enabled** - Administrative state of particular backend.

Example: Requesting an L4 Load Balancer service.



Example: Listing of L4 Load Balancer services

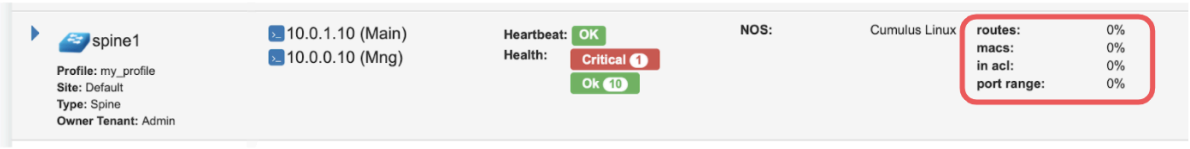


Access Control Lists (ACL)

Netris supports ACLs for switch network access control. (ACL and ACL2.0) ACL is for defining network access lists in a source IP: Port, destination IP: Port format. ACL2.0 is an object-oriented service way of describing network access.

Both ACL and ACL2.0 services support tenant/RBAC based approval workflows. Access control lists execute in switch hardware providing line-rate performance for security enforcement. It's important to keep in mind that the number of ACLs is limited to the limited size of TCAM of network switches.

Screenshot: TCAM utilization can be seen under Net→Inventory

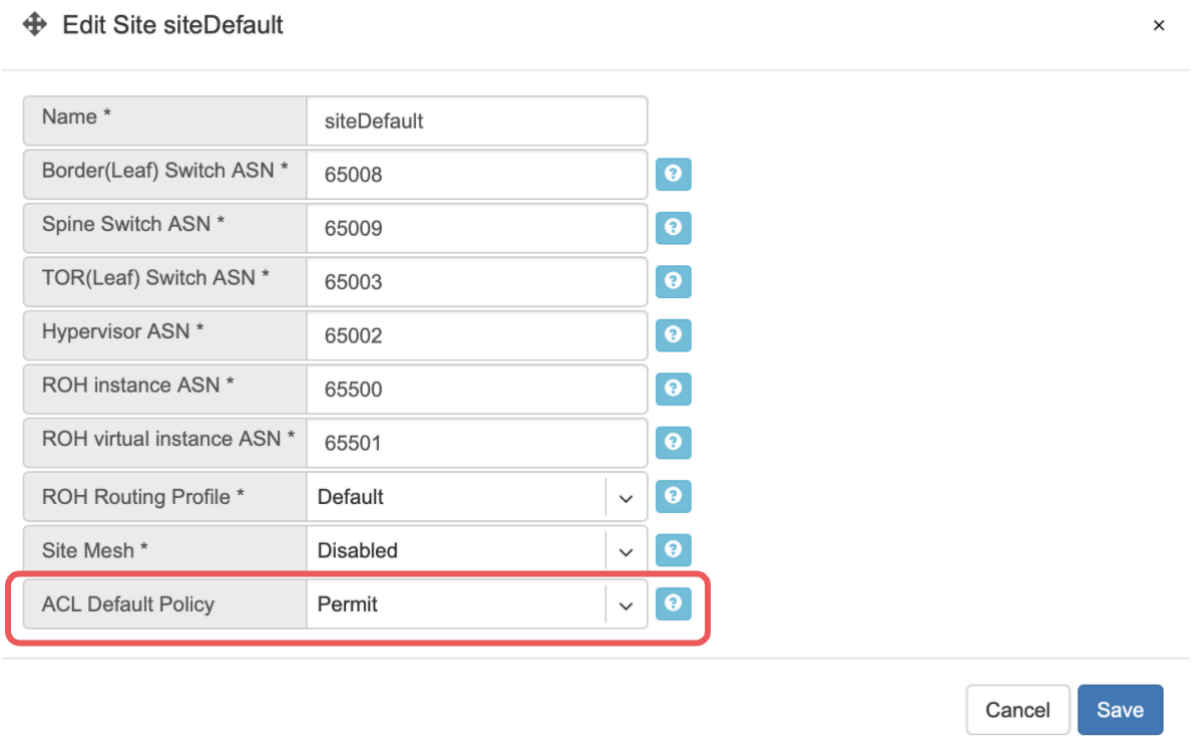


Netris is applying several optimization algorithms to minimize the usage of TCAM while achieving the user-defined requirements.

17.1 ACL Default Policy.

The ACL default policy is to permit all hosts to communicate with each other. You can change the default policy on a per Site basis by editing the Site features under Net→Sites. Once the "ACL Default Policy" is changed to "Deny," the given site will start dropping any traffic unless specific communication is permitted through ACL or ACL2.0 rules.

Example: Changing "ACL Default Policy" for the site "siteDefault".



17.2 ACL rules

ACL rules can be created, listed, edited, approved under Services→ACL.

Description of ACL fields. General

- **Name*** - Unique name for the ACL entry.
- **Protocol*** - IP protocol to match.
  - All - Any IP protocols.
  - IP - Specific IP protocol number.
  - TCP - TCP.
  - UDP - UDP.
  - ICMP ALL - Any IPv4 ICMP protocol.
  - ICMP Custom - Custom IPv4 ICMP code.
  - ICMPv6 ALL - Any IPv6 ICMP protocol.
  - ICMPv6 Custom - Custom IPv6 ICMP code.
- **Active Until** - Disable this rule at the defined date/time.
- **Action** - Permit or Deny forwarding of matched packets.
- **Established/Reverse** - For TCP, also match reverse packets except with TCP SYN flag. For non-TCP, also generate a reverse rule with swapped source/destination.

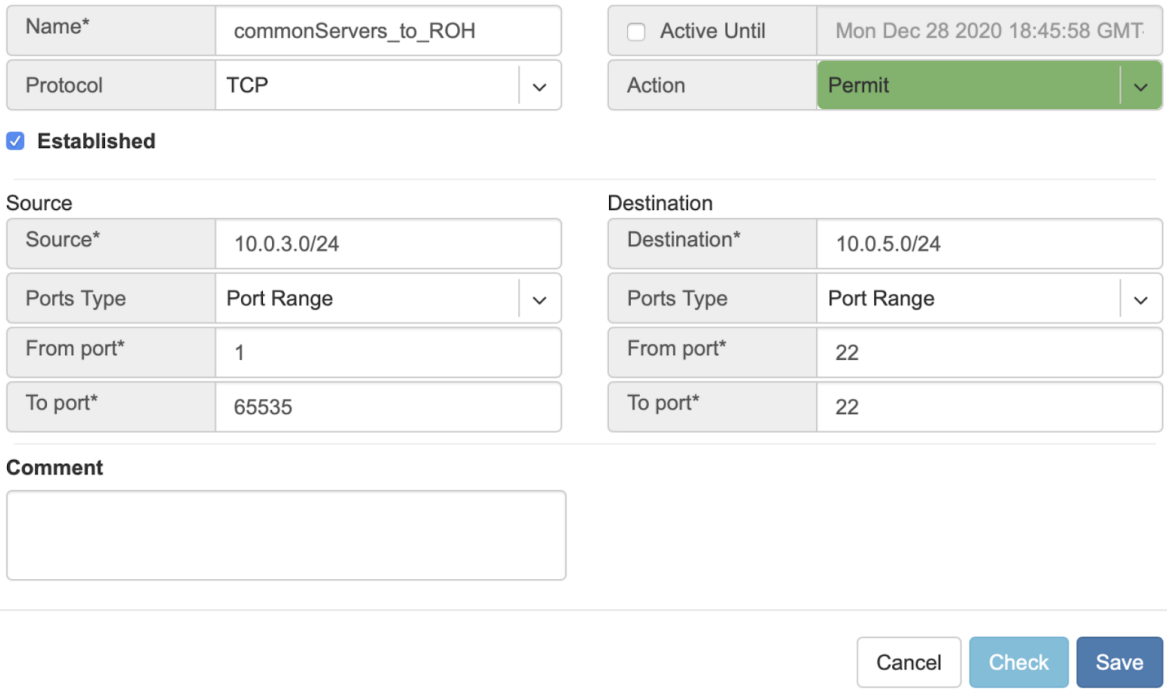
Source/Destination - Source and destination addresses and ports to match.

- **Source*** IPv4/IPv6 - IPv4/IPv6 address.
- **Ports Type***
  - Port Range - Match on the port or a port range defined in this window.

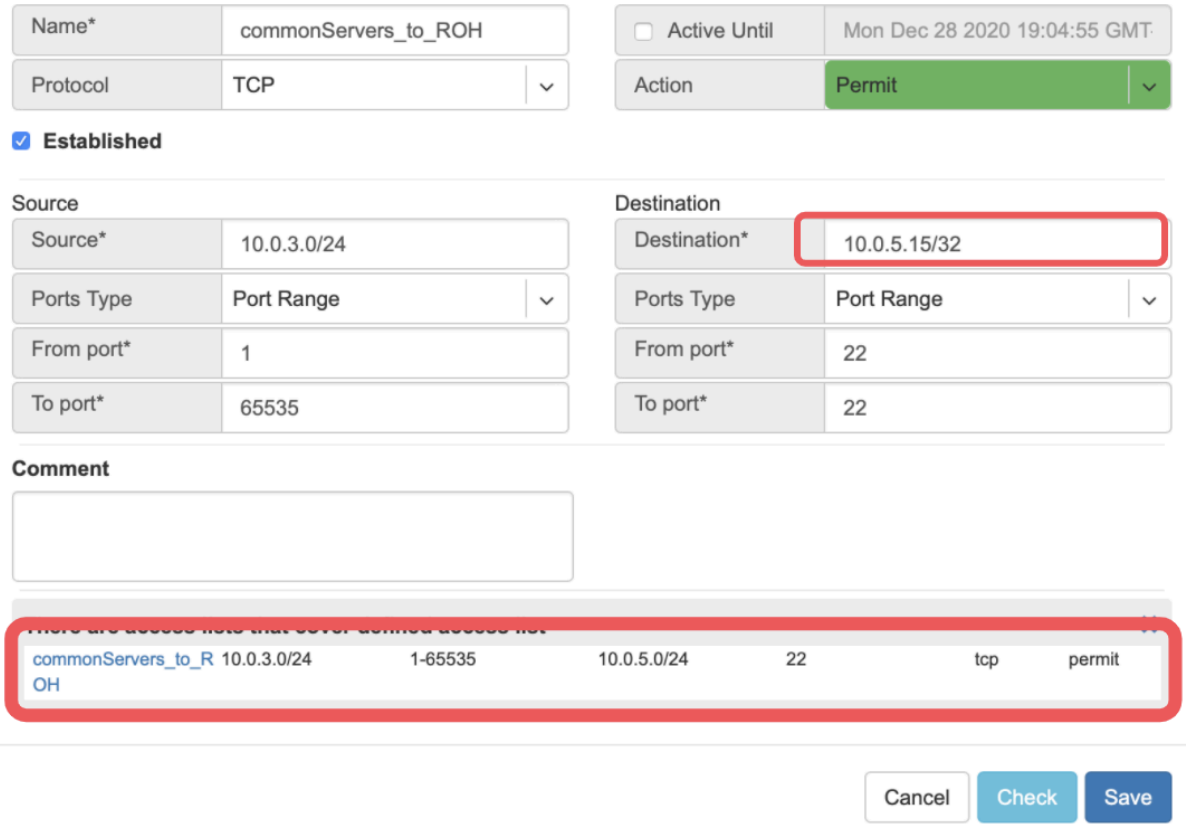
  - Port Group - Match on a group of ports defined under Services→ ACL Port Group.

- **From Port*** - Port range starting from.
- **To Port*** - Port range ending with.
- **Comment** - Descriptive comment, commonly used for approval workflows.
- **Check button** - Check if Another ACL on the system already permits the described network access.

Example: Permit hosts in 10.0.3.0/24 to access hosts in 10.0.5.0/24 by SSH, also permit the return traffic (Established).



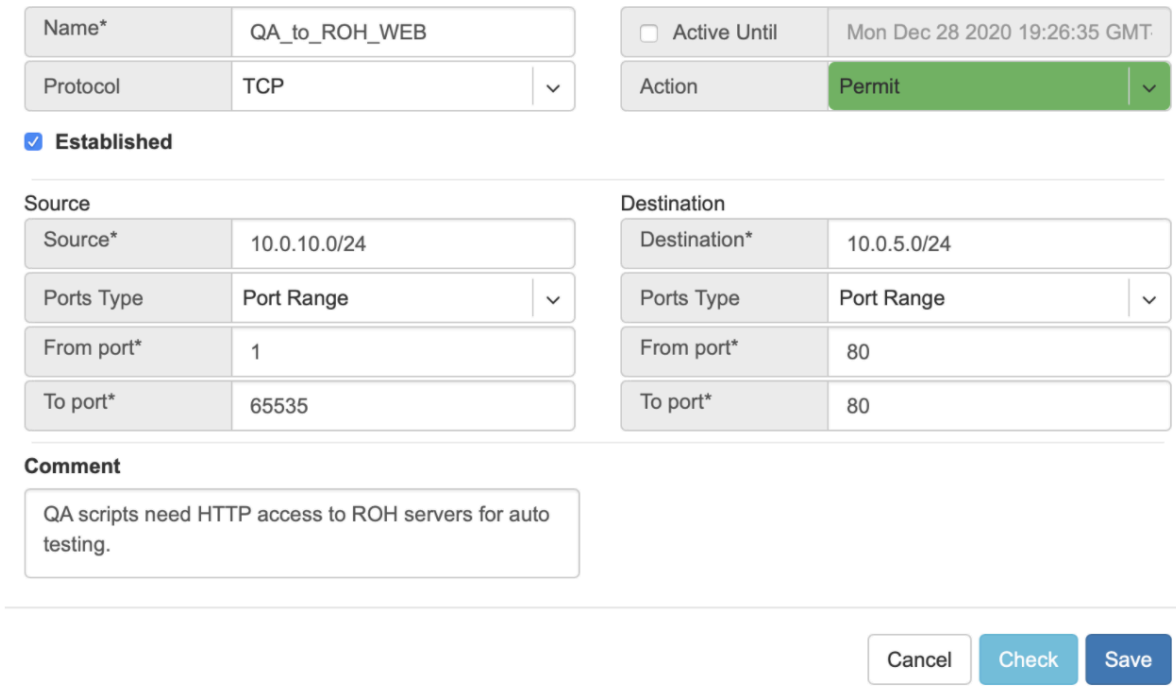
Example: “Check” shows that requested access is already provided by a broader ACL rule.



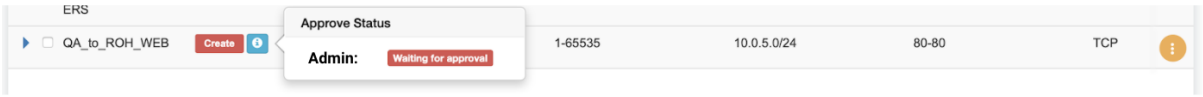
17.3 ACL approval workflow

When one Tenant (one team) needs to get network access to resources under the responsibility of another Tenant (another team), an ACL can be created but will activate only after approval of the Tenant responsible for the destination address resources. See the below example.

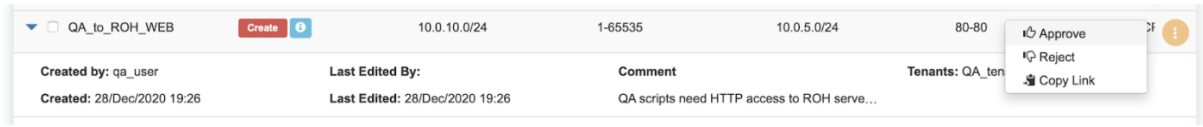
Example: User representing QA_tenant is creating an ACL where source belongs to QA_tenant, but destination belongs to the Admin tenant.



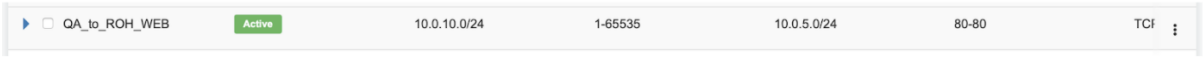
Screenshot: ACL stays in "waiting for approval" state until approved.



Screenshot: Users of tenant Admin, receive a notification in the GUI, and optionally by email. Then one can review the access request and either approve or reject it.



Screenshot: Once approved, users of both tenants will see the ACL in the "Active" state, and soon Netris Agents will push the appropriate config throughout the switch fabric.



17.4 The sequence order of ACL rules

1. User-defined Deny Rules
2. User-defined Permit Rules
3. Deny the rest

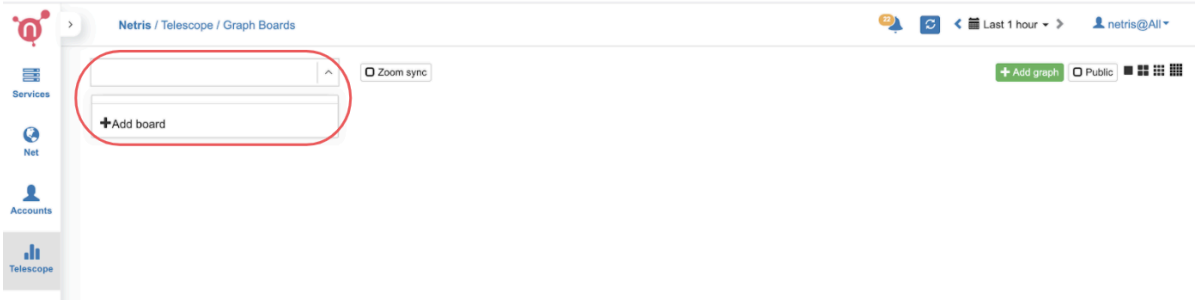
Visibility (Telescope)

18.1 Graph Boards

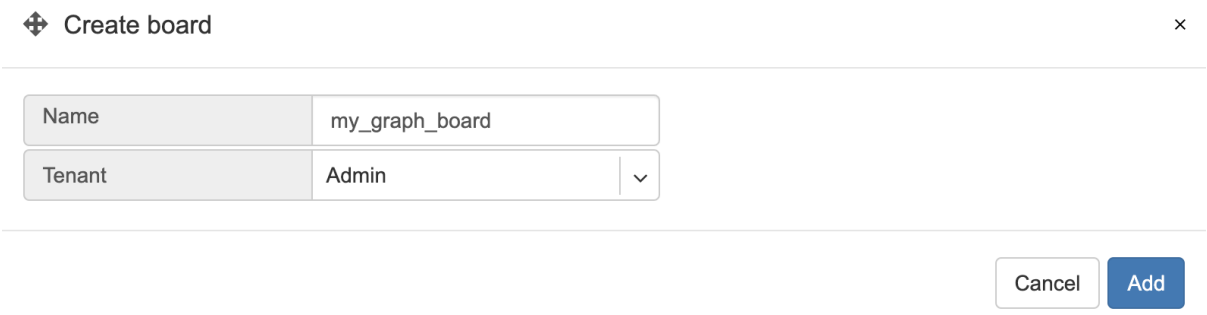
You can create custom graph boards with data sources available in different parts of the system. You can even sum multiple graphs and visualize them in a single view.

To start with Graph Boards, first, you need to add a new Graph Board.

1. Navigate to Telescope→Graph Boards, open the dropdown menu in the top left corner, then click +Add board.



2. Type a name and assign it to one of the tenants that you manage. Later on, you can optionally mark the Graph Board as public if you want the particular board to be visible to all users across multiple tenants.



Now you can add graphs by clicking +Add graph.

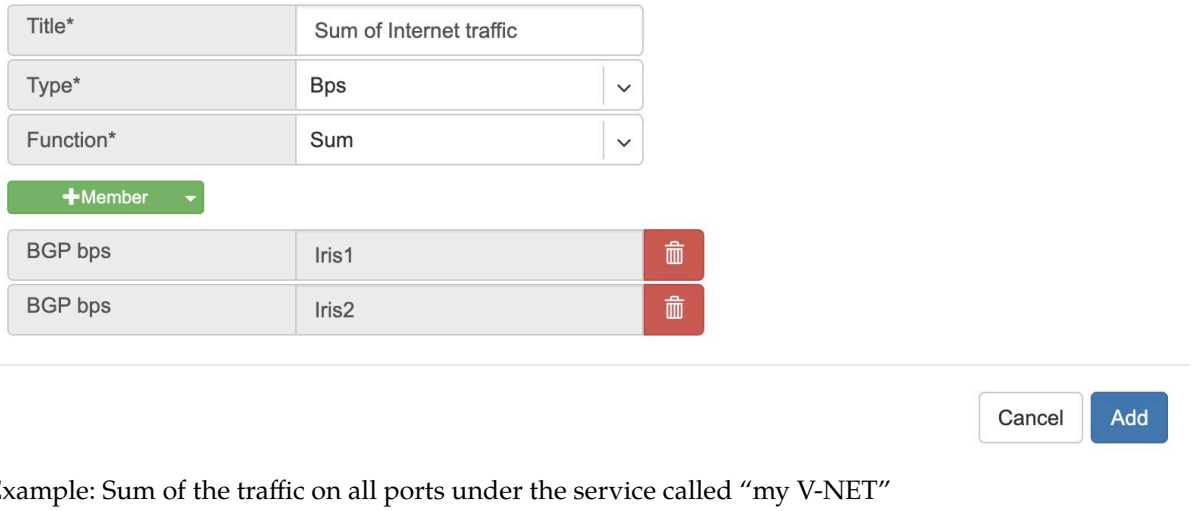
Description of +Add graph fields:

- **Title** - Title for the new graph.
- **Type** - Type of data source.

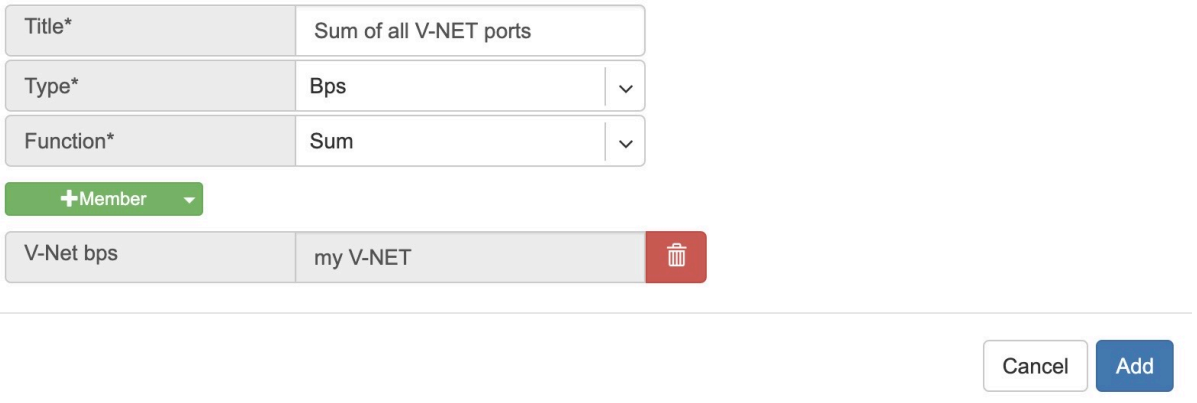
- Bps - Traffic bits per second.
- Pps - Traffic packets per second.
- Errors - Errors per second.
- Optical - Optical signal statistics/history.
- MAC Count - History of the number of MAC addresses on the port.

- **Function** - Currently, only summing is supported.
- **+Member** - Add data sources by service (E-BGP, V-NET, etc..) or by Switch Port.

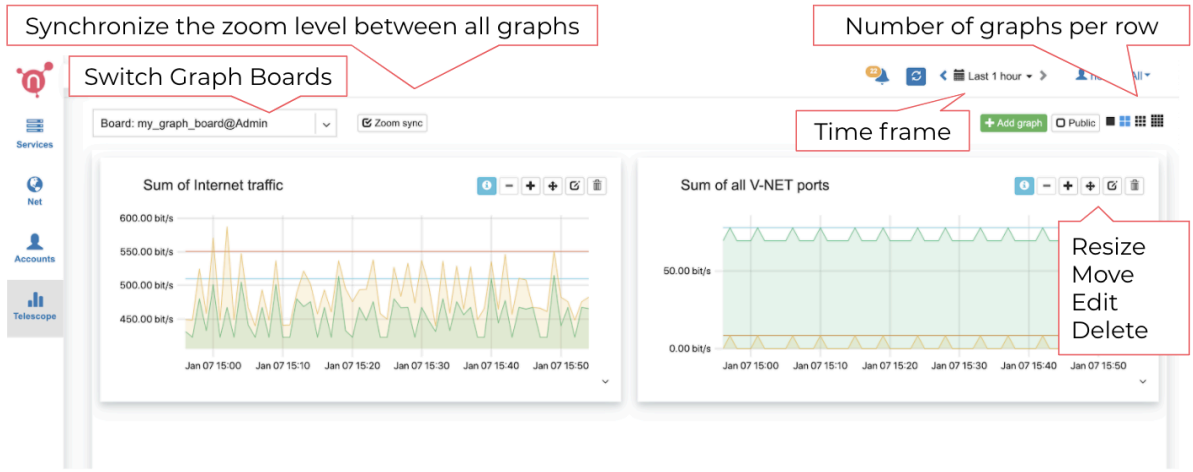
Example: Sum of traffic on two ISP(Iris1 + Iris2) links.



Example: Sum of the traffic on all ports under the service called “my V-NET”



Screenshot: Listing of a Graph Board with the explanation of the controls.



18.2 API Logs

Comprehensive logging of all API calls sent to Netris Controller with the ability to search by various attributes, sort by each column, and filter by method type.

18.3 Dashboard

Netris, besides automatic configuration, also provides automatic monitoring of the entire network without the need for configuration of the monitoring systems.

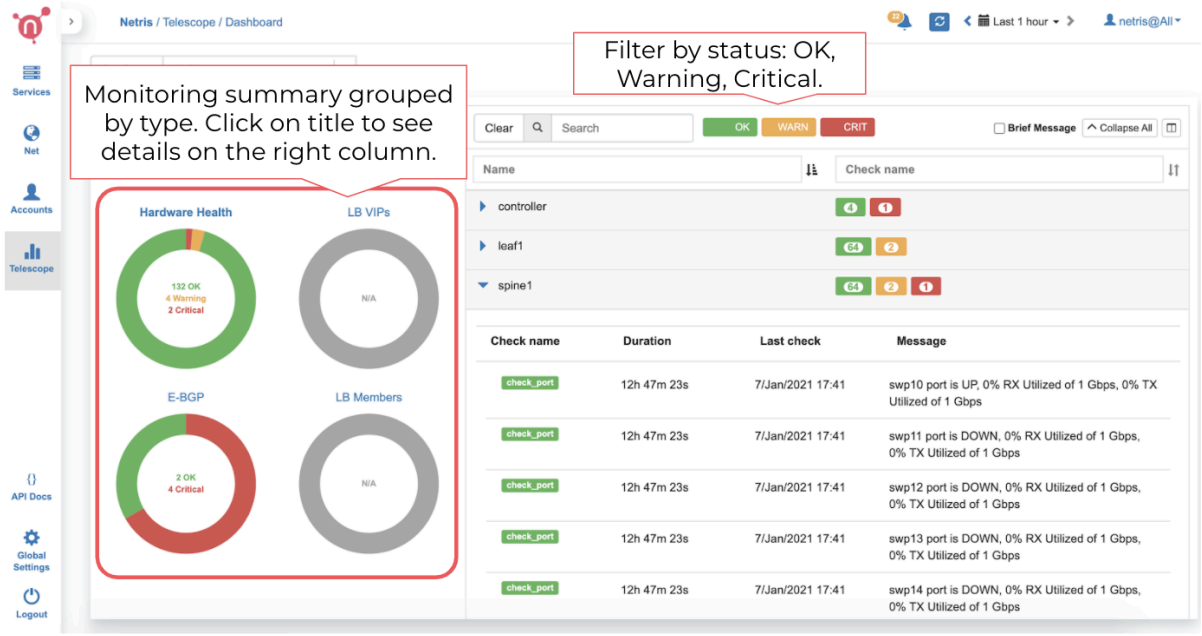
Telescope→Dashboard summarizes Network Health, which can also be accessed by clicking on the Netris icon in the top left corner.

Description of the pie charts.

- **Hardware Health** - summary of CPU, RAM, disk utilization. Statuses of power supplies, fans, temperature sensors, critical system services, and time synchronization. Statuses of switch port link, utilization, optical signal levels, and BGP sessions.
- **E-BGP** - Statuses of external BGP sessions.
- **LB VIP** - Statuses of Load Balancer frontend / VIP availability.
- **LB Members** - Statuses of Load Balancer backend members.

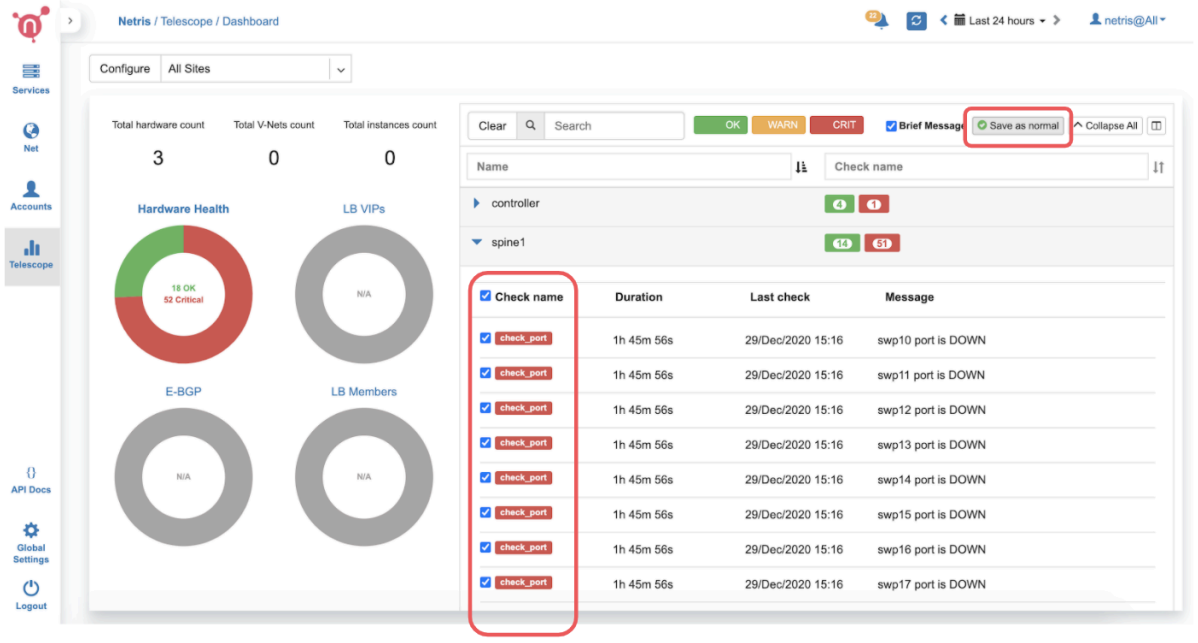
By clicking on each title you can see the details of the checks on the right side.

Screenshot: Dashboard showing details of “Hardware Health.”



Port up/down state can be set to "Save as normal." So the system will alarm only if the actual state is different from the saved as the normal state.

Screenshot: "Save as normal" on selected ports.



Accounts

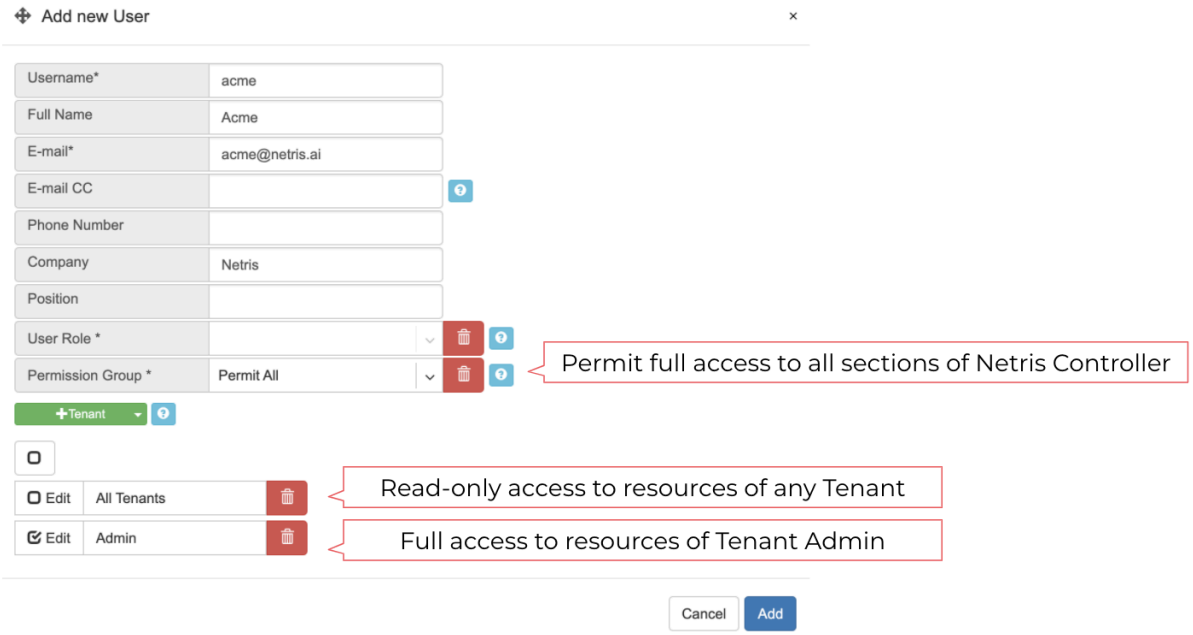
The accounts section is for the management of user accounts, access permissions, and tenants.

19.1 Users

Description of User account fields:

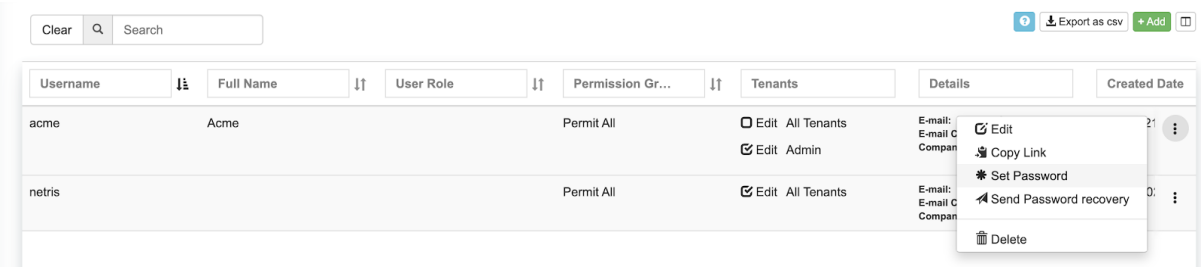
- **Username** - Unique username.
- **Full Name** - Full Name of the user.
- **E-mail** - The email address of the user. Also used for system notifications and for password retrieval.
- **E-mail CC** - Send copies of email notifications to this address.
- **Phone Number** - User's phone number.
- **Company** - Company the user works for. Usually useful for multi-tenant systems where the company provides Netris Controller access to customers.
- **Position** - Position within the company.
- **User Role** - When using a User Role object to define RBAC (role-based access control), Permissions Group and Tenant fields will deactivate.
- **Permission Group** - User permissions for viewing and editing parts of the Netris Controller. (if User Role is not used)
- **+Tenant** - User permissions for viewing and editing services using Switch Port and IP resources assigned to various Tenants. (if User Role is not used)

Example: Creating a user with full access to all sections of Netris Controller, read-only access to resources managed by any Tenant, and full access to resources assigned to the Tenant Admin.



Password: To set a password or email the user for a password form, go to the listing of usernames and click the menu on the right side.

Example: Listing of user accounts.

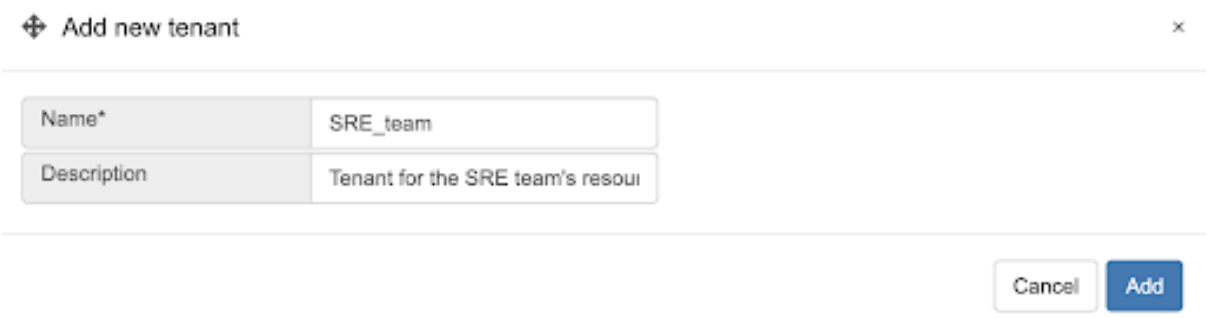


19.2 Tenants

IP addresses and Switch Ports are network resources that can be assigned to different Tenants to have under their management. Admin is the default tenant, and by default, it owns all the resources. The concept of Tenants can be used for sharing and delegation of control over the network resources, typically used by network teams to grant access to other teams for requesting & managing network services using the Netris Controller as a self service portal or programmatically (with Kubernetes CRDs) as part of DevOps/NetOps pipeline.

A Tenant has just two fields, the unique name and custom description.

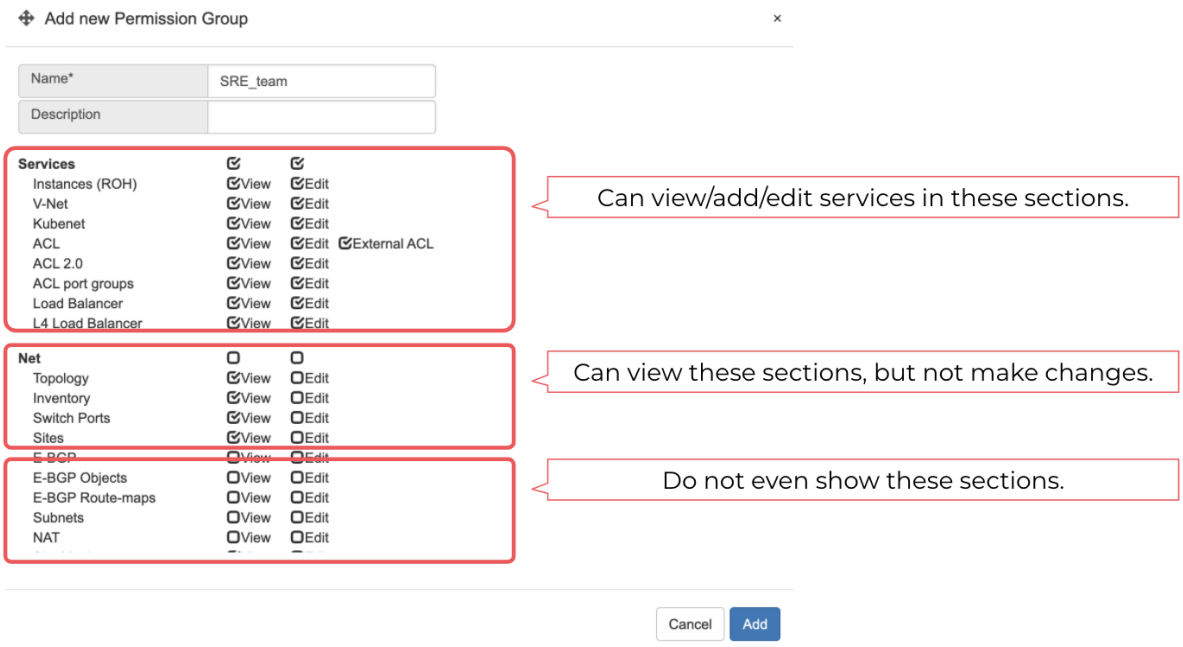
Example: Adding a tenant.



19.3 Permission Groups

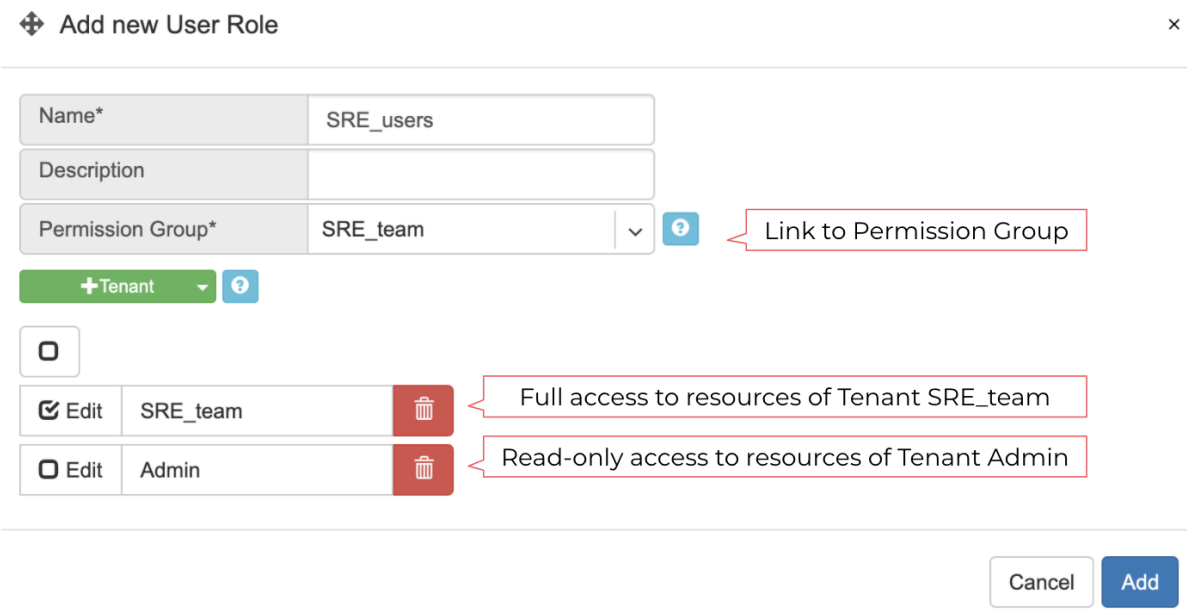
Permission Groups are a list of permissions on a per section basis that can be attached individually to a User or a User Role. Every section has a View and Edit attribute. The view defines if users with this Permission Group can see the particular section at all. Edit defines if users with this Permission Group can edit services and policies in specific sections.

Example: Permission Group.



19.4 User Roles

Permission Groups and Tenants can be either linked directly to an individual username or can be linked to a User Role object which then can be linked to an individual username.


Add new User Role
Name*
SRE_users
Description
Permission Group*
SRE_team
Link to Permission Group
+Tenant
Edit
SRE_team
Full access to resources of Tenant SRE_team
Edit
Admin
Read-only access to resources of Tenant Admin
Cancel
Add

Release notes

- DPDK data plane support for SoftGate nodes. - Provides higher SoftGateperformance. Up to 27Mpps, 100Gbps for L3 routing, 12Mpps with NAT rules on.
- L4 Load Balancer. - In addition to switch-based Anycast Load Balancer, wenow support a SoftGate/DPDK-based L4 Load Balancer. L4LB integrates withKubernetes providing cloud-like load balancer service (type: load-balancer).
- Kubenet - a network service purpose-built for Kubernetes cluster nodes.Kubenet integrates with Kube API to provide an on-demand load balancer andother Kubernetes specific networking features. Netris Kubenet is designed tocomplement Kubernetes CNI networking with modern physical networking.
- API logs - Comprehensive logging of all API calls sent to Netris Controller withthe ability to search by various attributes, sort by each column, and filter bymethod type.
- SiteMesh - a Netris service for automatically configuring site-to-siteinterconnect over the public Internet. SiteMesh supports configuration forWireGuard to create encrypted tunnels between participating sites andautomatically generates configuration for FRR to run dynamic routing. In a fewclicks, services in one site get connectivity to services in other sites over a meshof WireGuard tunnels.
- Ubuntu/SwitchDev updates - Removed the requirement for a hairpin loopcable. Removed the need for IP address reservation for V-NET, switchingentirely to the anycast default gateway.
- Controller distributions - Netris controller, is now available in threedeployment forms. 1) On-prem KVM virtual machine. 2) Kubernetes application.3) Managed/Hosted in the cloud.
- Inventory Profiles - A construct for defining access security, timezone, DNS,NTP settings profiles for network switches and SoftGate nodes.
- Switch/SoftGate agents - New installer with easy initial config tool. Support forIP and FQDN as a controller address. Authentication key.
- GUI - Improved Net→Topology section, becoming the main and required placefor defining the network topology. All sections got a column organizer, so everyuser can order and hide/show columns to their comfort.