Guide for
Inter-VLAN in SONiC

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Introduction to Inter-VLAN

A VLAN, or Virtual Local Area Network, is a logical grouping of devices on a network. In a traditional network, all devices are part of the same physical LAN, meaning that they are all on the same broadcast domain and can communicate with each other freely. However, with VLANs, a single physical network can be divided into multiple virtual networks, each with its own unique VLAN ID.

Devices within the same VLAN can communicate with each other as if they were on the same physical LAN, but devices in different VLANs cannot communicate with each other unless specifically allowed by a router or Multilayer Switch.

VLANs divide broadcast domains in a LAN environment. Whenever hosts in one VLAN need to communicate with hosts in another VLAN, the traffic must be routed between them. This is known as inter-VLAN routing.

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Network Topology

Suppose we have a network with two departments: Electrical, and Software. We want to establish communication between these departments by keeping them in different VLAN.

To do this, we would need to configure our switches and hosts accordingly. Let's say we have two switches, S1 and S2, and four hosts, PC1 through PC4. Now draw network topology in GNS3 using community SONiC (version 202205) switches and hosts.
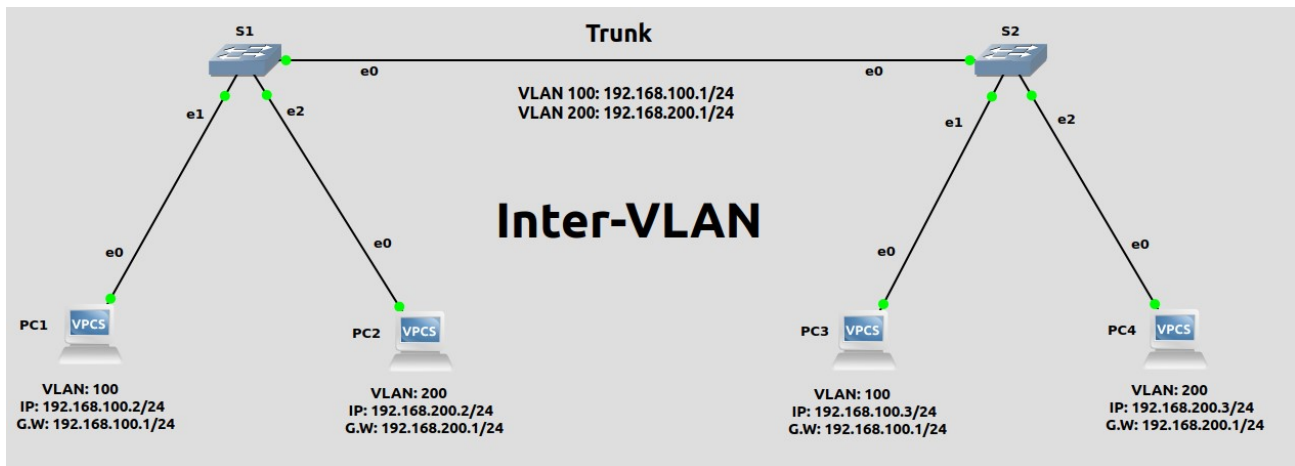
Port Mapping

GNS3	SONiC
Ethernet 0	Ethernet 0
Ethernet 1	Ethernet 4
Ethernet 2	Ethernet 8
Ethernet 3	Ethernet 12

Configurations

For the above topology, all hosts and switches are first configured before sending traffic. First, switch S1 is configured and the same steps are repeated for the switch S2. Command Reference guide is also available on GitHub for SONiC, whose link is given here.

Follow these steps to configure S1.

Step 1

Check the status of interfaces by using the command given below:

- `show interfaces status`

```
admin@sonic:~$ show interfaces status
  Interface           Lanes    Speed    MTU    FEC           Alias    Vlan     Oper    Admin    Type    Asym PFC
-----------   ---------------  -------  -----  -----  ---------------  ------  ------  -------  ------  ----------
  Ethernet0     25,26,27,28       1G    9100    N/A   fortyGigE0/0    routed     up       up    N/A         N/A
  Ethernet4     29,30,31,32       1G    9100    N/A   fortyGigE0/4    routed     up       up    N/A         N/A
  Ethernet8     33,34,35,36       1G    9100    N/A   fortyGigE0/8    routed     up       up    N/A         N/A
 Ethernet12     37,38,39,40      40G    9100    N/A   fortyGigE0/12   routed   down       up    N/A         N/A
```

- The administrative port refers to the settings and configurations applied by a network administrator to a specific port on a switch, while the operational port status reflects the current operational state of that port. Suppose one wants to enable a port and sets Admin Status to "up," but there is no cable connected to the port. So, it can never reach Oper Status "up" and will stay in Oper Status "down."

Step 2

By default, all interfaces are routed (L3) and IP is assigned to them. To check the status of IP addresses, use the following command given below:

- `show ip interfaces`

```
admin@sonic:~$ show ip interfaces
Interface     Master     IPv4 address/mask     Admin/Oper     BGP Neighbor     Neighbor IP
----------    --------   ------------------    -----------    --------------   -------------
Ethernet0                10.0.0.0/31           up/up          ARISTA01T2       10.0.0.1
Ethernet4                10.0.0.2/31           up/up          ARISTA02T2       10.0.0.3
Ethernet8                10.0.0.4/31           up/up          ARISTA03T2       10.0.0.5
Ethernet12               10.0.0.6/31           up/up          ARISTA04T2       10.0.0.7
Ethernet16               10.0.0.8/31           up/up          ARISTA05T2       10.0.0.9
```

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Step 2 (Continued)

Remove the IP addresses to make that interface a switch port (L2). For this, command is given below:

- `sudo config interface ip remove/add <interface_name> <ip_addr>`

```
admin@sonic:~$ sudo config interface ip remove Ethernet0 10.0.0.0/31
admin@sonic:~$ sudo config interface ip remove Ethernet4 10.0.0.2/31
admin@sonic:~$ sudo config interface ip remove Ethernet8 10.0.0.4/31
```

Note: It is better practice to save configurations after executing two or three commands by using "sudo config save -y" command.

Step 3

Now create VLANs for topology. Before creating VLANs, check VLAN table by using the following command given below:

- `show vlan brief`

```
admin@sonic:~$ show vlan brief
+-----------+---------------+---------+---------------+--------------+
| VLAN ID   | IP Address    | Ports   | Port Tagging  | Proxy ARP    |
+===========+===============+=========+===============+==============+
+-----------+---------------+---------+---------------+--------------+
```

In the above table, no VLAN is created, so create VLANs by using the following command given below:

- `sudo config vlan (add | del) <vlan_id>`

```
admin@sonic:~$ sudo config vlan add 100
admin@sonic:~$ sudo config vlan add 200
```

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Step 4

Assign VLANs to ports. In SONiC, a port can be tagged or un-tagged. Trunk ports are usually tagged while access ports are un-tagged.

- `sudo config vlan member add/del [-u|--untagged] <vlan_id> <member_portname>`

```
admin@sonic:~$ sudo config vlan member add -u 100 Ethernet4
admin@sonic:~$ sudo config vlan member add -u 200 Ethernet8
admin@sonic:~$ sudo config vlan member add 100 Ethernet0
admin@sonic:~$ sudo config vlan member add 200 Ethernet0
```

Now check the status of VLAN table.

```
admin@sonic:~$ show vlan brief
+-----------+--------------+-----------+----------------+--------------+
|  VLAN ID  | IP Address   | Ports     | Port Tagging   | Proxy ARP    |
+===========+==============+===========+================+==============+
|       100 |              | Ethernet0 | tagged         | disabled     |
|           |              | Ethernet4 | untagged       |              |
+-----------+--------------+-----------+----------------+--------------+
|       200 |              | Ethernet0 | tagged         | disabled     |
|           |              | Ethernet8 | untagged       |              |
+-----------+--------------+-----------+----------------+--------------+
```

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Step 5

For Inter-VLAN communication, IP address must be assigned to VLAN Interface. To assign IP address the command is given below:

-       `sudo config interface ip remove/add <interface_name> <ip_addr>`

```
admin@sonic:~$ sudo config interface ip add Vlan100 192.168.100.1/24
admin@sonic:~$ sudo config interface ip add Vlan200 192.168.200.1/24
```

Note: While assigning IP address to VLAN, the name should be started with capital "V" like in our case "VLAN100".

Step 6

Now check the status of VLAN table using command given below:

-       `show vlan brief`

```
admin@sonic:~$ show vlan brief
+-----------+-------------------+-------------+----------------+-------------+
|  VLAN ID  | IP Address        | Ports       | Port Tagging   | Proxy ARP   |
+===========+===================+=============+================+=============+
|       100 | 192.168.100.1/24  | Ethernet0   | tagged         | disabled    |
|           |                   | Ethernet4   | untagged       |             |
+-----------+-------------------+-------------+----------------+-------------+
|       200 | 192.168.200.1/24  | Ethernet0   | tagged         | disabled    |
|           |                   | Ethernet8   | untagged       |             |
+-----------+-------------------+-------------+----------------+-------------+
```

Step 7

Repeat steps 1-6 for the switch S2.

Step 8

Assign IP addresses to hosts PC1 to PC4 by using command given below:

- `ip <ip_addr> <gateway>`

```
PC1> ip 192.168.100.2/24 192.168.100.1
Checking for duplicate address...
PC1 : 192.168.100.2 255.255.255.0 gateway 192.168.100.1
```

After assigning IP addresses, check the status of IP address using command given below:

- `show ip`

```
PC1> sh ip

NAME          : PC1[1]
IP/MASK       : 192.168.100.2/24
GATEWAY       : 192.168.100.1
DNS           :
MAC           : 00:50:79:66:68:00
LPORT         : 10010
RHOST:PORT    : 127.0.0.1:10011
MTU           : 1500
```

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Result

PC1 to PC4

Once the switches and hosts are configured, communication becomes possible among hosts in the different VLAN. As is evident from the provided figure below, PC1 is receiving a response from PC4, as both of them belong to different VLAN. Furthermore, the TTL (Time-to-Live) value is decremented by one which is 63 in our case because the packet passes through one hop. Therefore, the inter-VLAN has been successfully configured.

```
PC1> ping 192.168.200.3

84 bytes from 192.168.200.3 icmp_seq=1 ttl=63 time=10.800 ms
84 bytes from 192.168.200.3 icmp_seq=2 ttl=63 time=2.539 ms
84 bytes from 192.168.200.3 icmp_seq=3 ttl=63 time=5.459 ms
84 bytes from 192.168.200.3 icmp_seq=4 ttl=63 time=5.335 ms
84 bytes from 192.168.200.3 icmp_seq=5 ttl=63 time=5.670 ms
```

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PC1 to PC3

```
PC1> ping 192.168.100.3

84 bytes from 192.168.100.3 icmp_seq=1 ttl=64 time=5.675 ms
84 bytes from 192.168.100.3 icmp_seq=2 ttl=64 time=5.430 ms
84 bytes from 192.168.100.3 icmp_seq=3 ttl=64 time=5.329 ms
84 bytes from 192.168.100.3 icmp_seq=4 ttl=64 time=5.341 ms
84 bytes from 192.168.100.3 icmp_seq=5 ttl=64 time=5.740 ms
```

PC4 to PC3

```
PC4> ping 192.168.100.3

84 bytes from 192.168.100.3 icmp_seq=1 ttl=63 time=18.984 ms
84 bytes from 192.168.100.3 icmp_seq=2 ttl=63 time=7.371 ms
84 bytes from 192.168.100.3 icmp_seq=3 ttl=63 time=7.831 ms
84 bytes from 192.168.100.3 icmp_seq=4 ttl=63 time=9.281 ms
84 bytes from 192.168.100.3 icmp_seq=5 ttl=63 time=7.975 ms
```

References

https://github.com/sonic-net/sonic-utilities/blob/master/doc/Command-Reference.md

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