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1.1 Revision History

DATE	VERSION	EDITOR	CHANGES
17 Nov 2019	0.1	Ariya Parsamanesh	Initial creation
18 Nov 2019	0.2	Ariya Parsamanesh	Added the L2 configuration

2 CX switch OVA setup

Here in this short technote we'll go through and setup the virtual environment on Windows 10 laptop so that we can run a number of Aruba CX switch OVA as well as NetEdit OVA to configure them.

We'll make use of GNS3, VirtualBox and Aruba switch and NetEdit OVAs.

2.1 Things you need

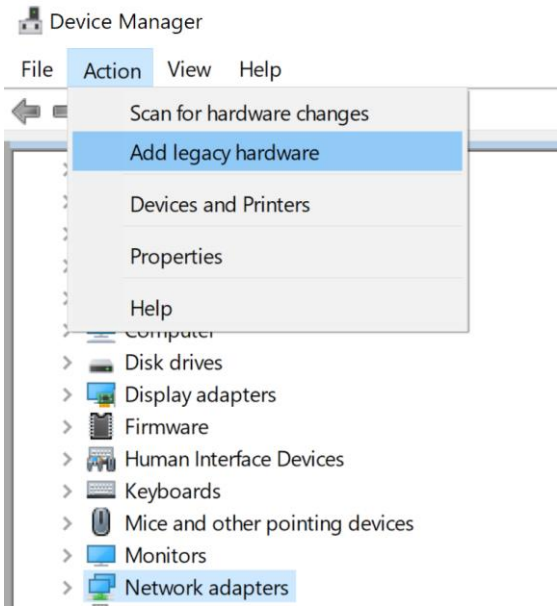
- Windows 10 with min version of 10.0.16299.1387, that has at least 16G of memory
- VirtualBox version 6.0.8-130520 VirtualBox-6.0.8-130520-Win.exe
- GNS3 version 2.1.20 GNS3-2.1.20-all-in-one-regular.exe

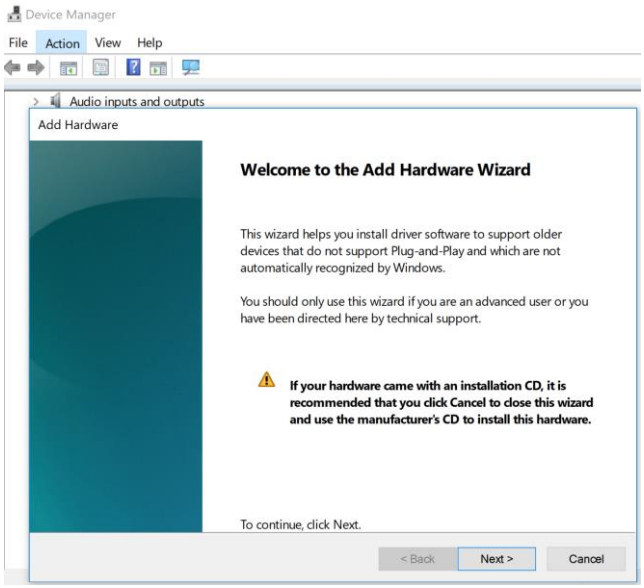
3 Win10 Laptop Setup

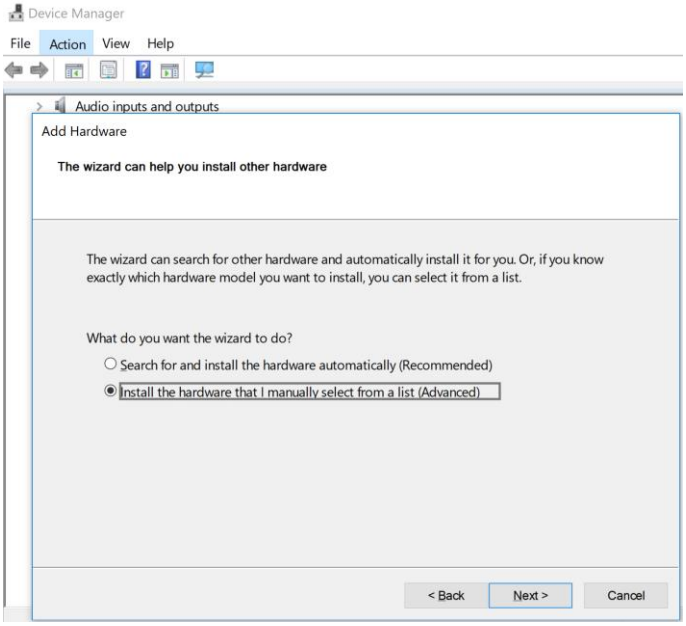
In this section we'll create a loopback interface so we can use it to connect our virtual CX switches to the outside networks.

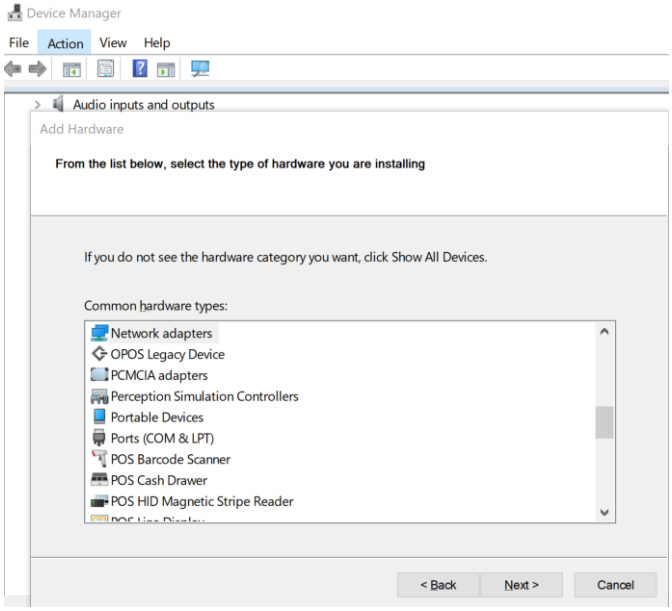
3.1 Loopback Interface Configuration

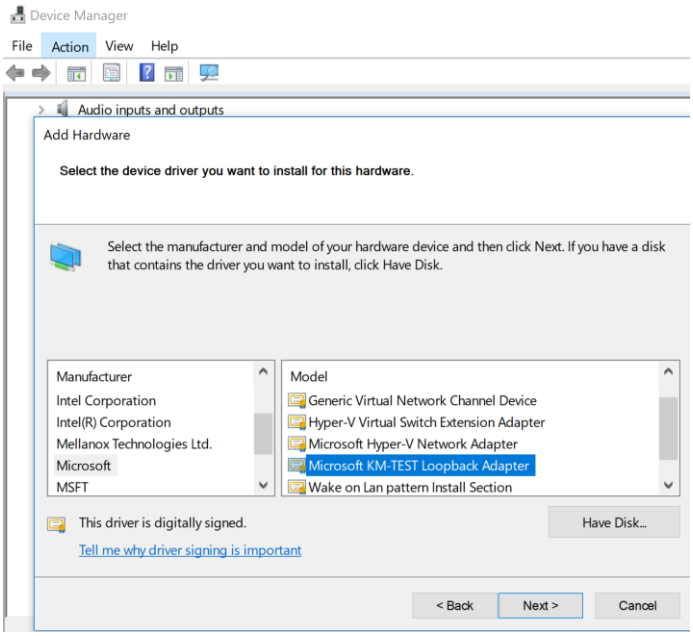
Open your Device Manager, select "Network Adapters" and add Legacy hardware

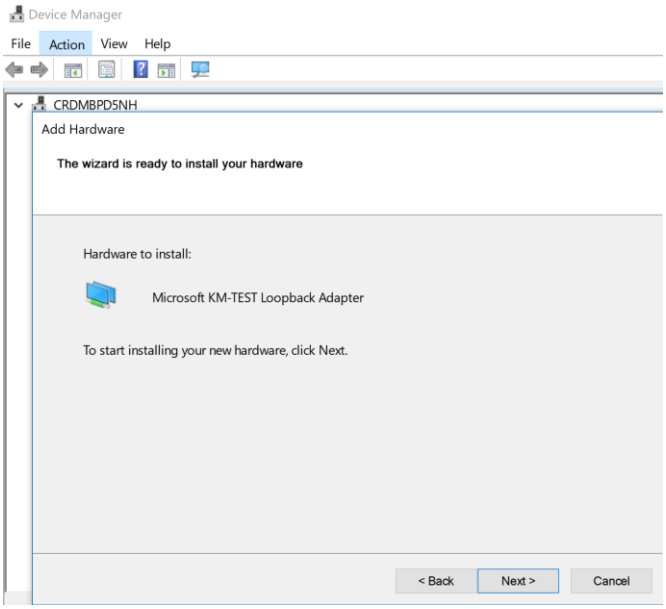












Once you finish the installation you can then assign a valid IP address to that interface.

3.2 Loopback Interface IP Address

Open the control panel and select “Network and sharing Centre” and then click on “change adapter setting”, your KM-Test adapter should be listed there, select it and then choose to rename it to “loopback” so that you can identify it easier. Then assign a static IP address to it and save setting.

Here is my setup, I have assigned 192.168.99.254/24 to it.

```
C:\>ipconfig/all

Windows IP Configuration

   Host Name . . . . . . . . . . . . : AriyaP
   Primary Dns Suffix  . . . . . . . :
   Node Type . . . . . . . . . . . . : Hybrid
   IP Routing Enabled. . . . . . . . : Yes
   WINS Proxy Enabled. . . . . . . . : No
   DNS Suffix Search List. . . . . . : home

Ethernet adapter Ethernet:

   Connection-specific DNS Suffix  . : home
   Description . . . . . . . . . . . : Intel(R) 82579LM Gigabit Network Connection
   Physical Address. . . . . . . . . : F0-DE-F1-64-0A-82
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes
   IPv4 Address. . . . . . . . . . . : 192.168.1.123(Preferred)
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Lease Obtained. . . . . . . . . . : Sunday, November 17, 2019 8:39:39 AM
   Lease Expires . . . . . . . . . . : Monday, November 18, 2019 10:13:51 AM
   Default Gateway . . . . . . . . . : 192.168.1.1
   DHCP Server . . . . . . . . . . . : 192.168.1.1
   DNS Servers . . . . . . . . . . . : 1.1.1.1
                                       192.168.1.1
   NetBIOS over Tcpip. . . . . . . . : Enabled

Ethernet adapter Ethernet 3:

   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Npcap Loopback Adapter
```

```
   Physical Address. . . . . . . . . : 02-00-4C-4F-4F-50
   DHCP Enabled. . . . . . . . . . . : No
   Autoconfiguration Enabled . . . . : Yes
   IPv4 Address. . . . . . . . . . . : 172.16.2.10(Preferred)
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . :
   NetBIOS over Tcpip. . . . . . . . : Enabled


Ethernet adapter Loopback:

   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Microsoft KM-TEST Loopback Adapter
   Physical Address. . . . . . . . . : 02-00-4C-4F-4F-50
   DHCP Enabled. . . . . . . . . . . : No
   Autoconfiguration Enabled . . . . : Yes
   IPv4 Address. . . . . . . . . . . : 192.168.99.254(Preferred)
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . :
   NetBIOS over Tcpip. . . . . . . . : Enabled

Wireless LAN adapter Wi-Fi:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . : home
   Description . . . . . . . . . . . : Intel(R) Centrino(R) Advanced-N 6205
   Physical Address. . . . . . . . . : A0-88-B4-50-C0-84
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes

C:\>
```

4 VirtualBox

Here we'll cover the installation and setup of VirtualBox. Try to get this specific version as it works nicely with most of the windows and MAC laptops, however you can also use other version and spend time getting it to work.

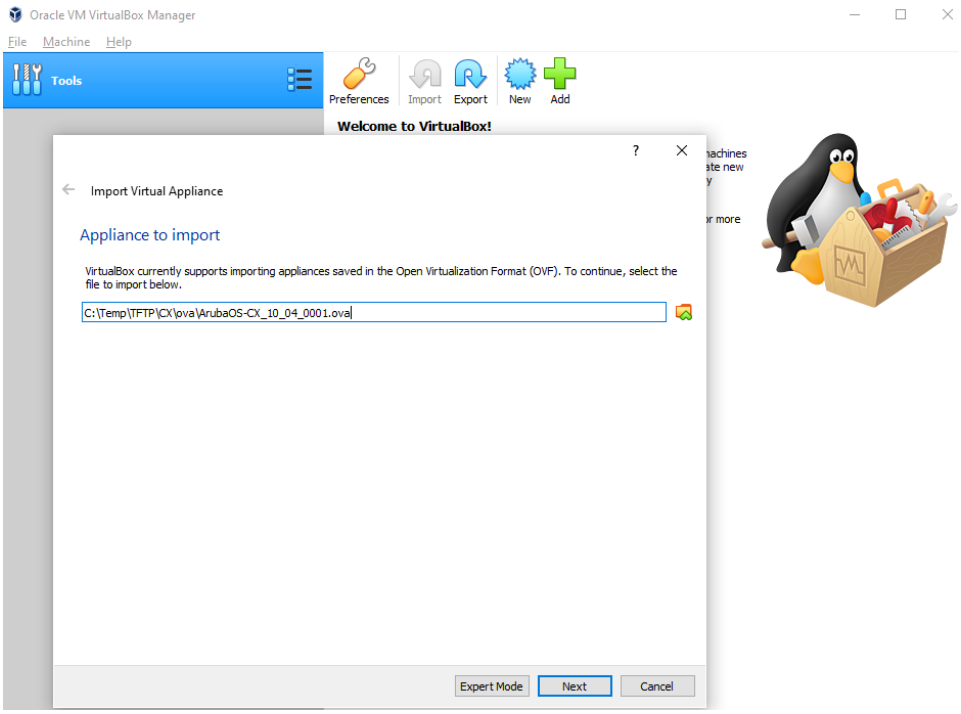
The installation is straight forward so we won't be covering it here. We'll start with importing the OVA images.

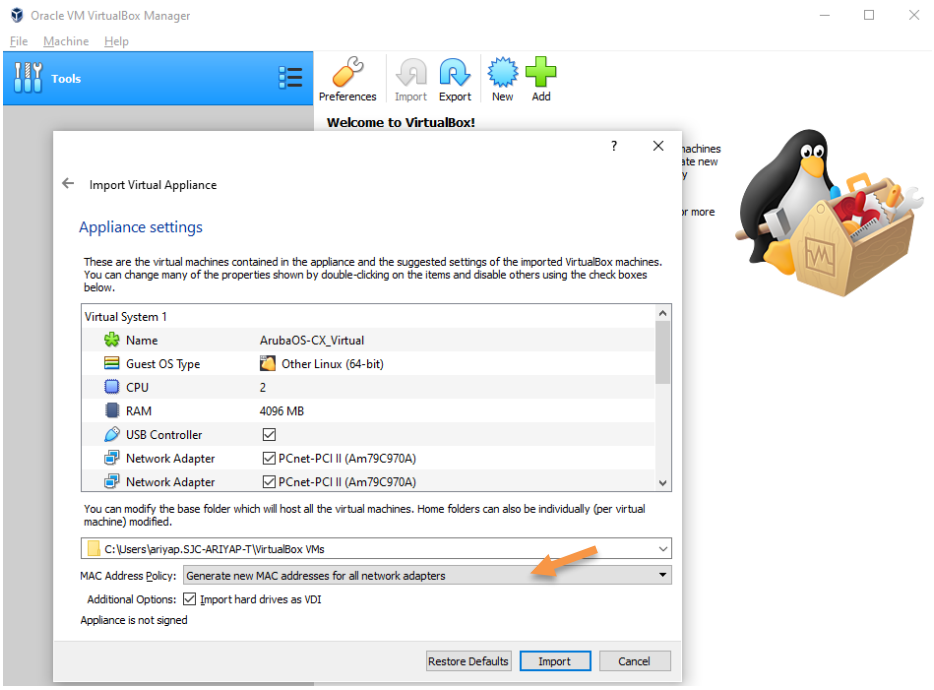
4.1 Importing Aruba OVA Images

Here we'll have 2x OVA images that we want to import

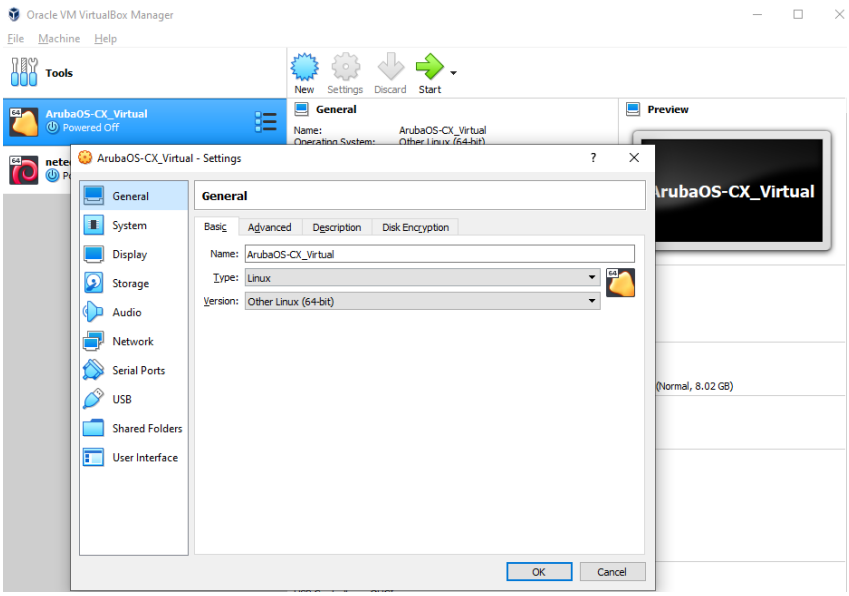
1. ArubaOS-CX_10_04_0001.ova
2. Aruba_NetEdit-2.0.0.ova

We'll start with the CX ova file.

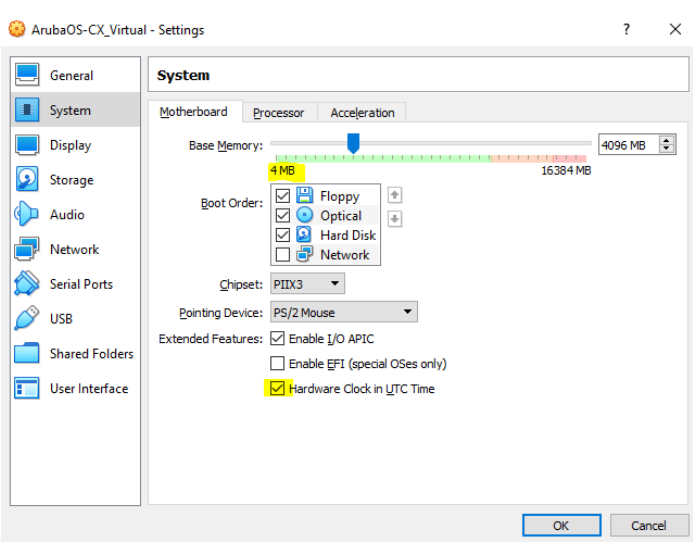


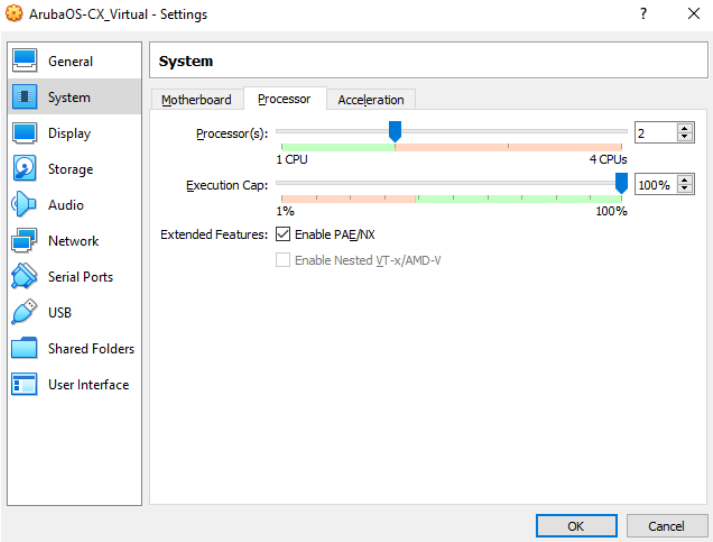


Do the same for the NetEdit ova as well. Next we'll edit the setting for the ArubaOS-CX machine.

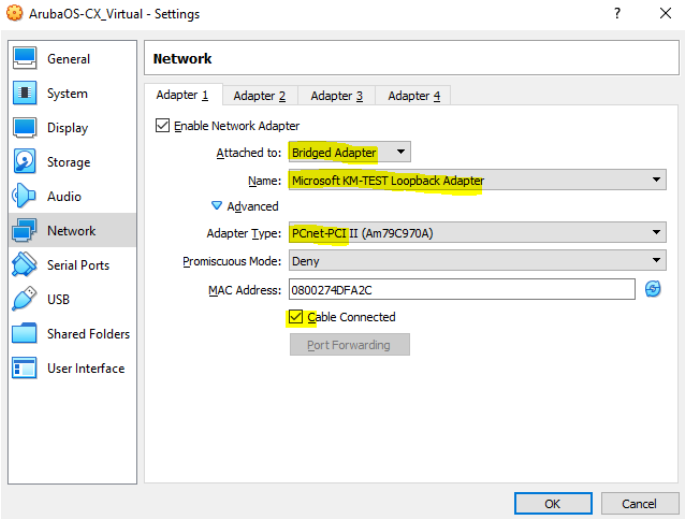


Check to see that CPU is set to 2 and memory is set to 4G and set the checkbox for "Hardware clock in UTC Time"





Then go to the Network section and select these setting only for the Adapter1, leave the rest of the Adapters 2-4 as their default settings.

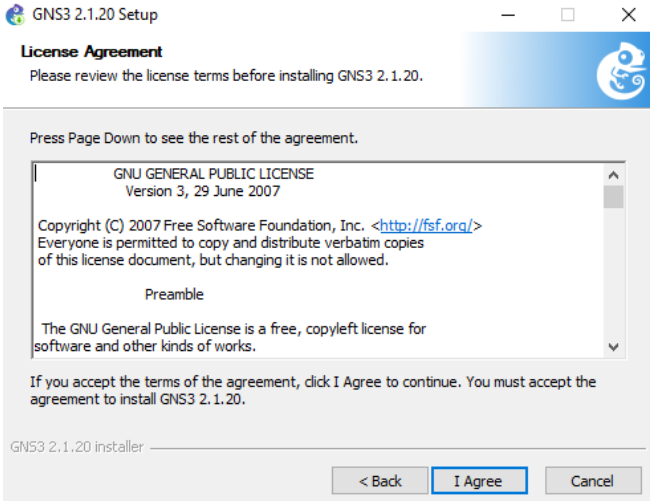


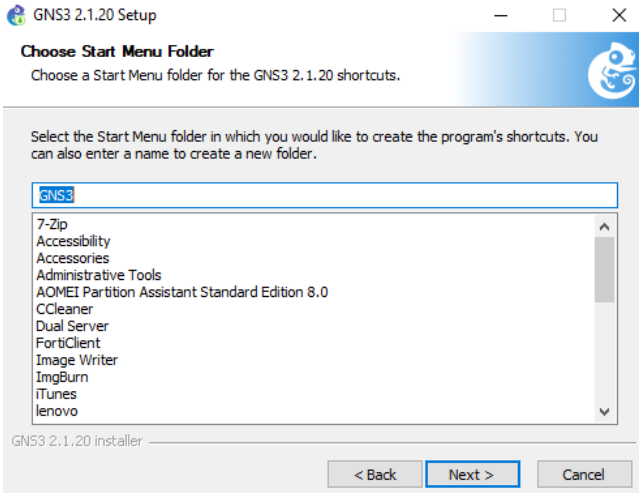
Here we are ensuring that first adapter will be on the same network as the loopback interface. It will be clearer as we dot the GNS3 configuration.

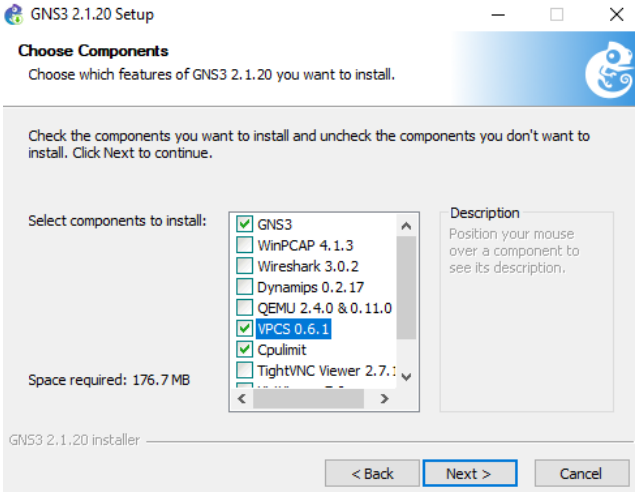
Save all the changes you have made and don't power up the host from VirtualBox, we'll do all that from GNS3.

5 GNS3 Installation

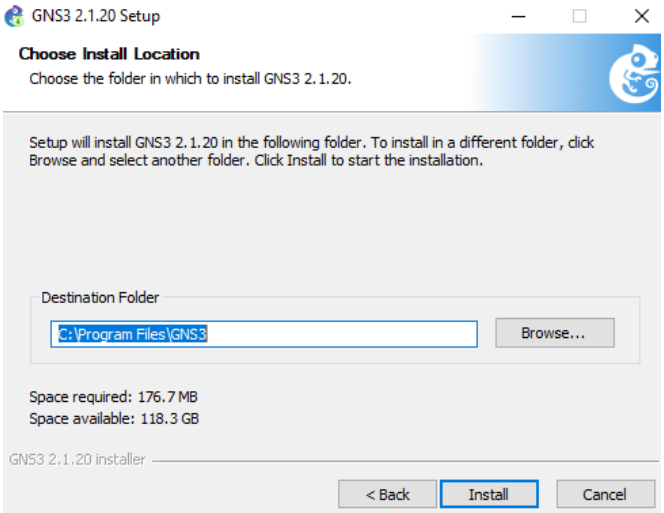
Here we'll install GNS3 and since we are using windows platform, you get many options that needs to be covered here.

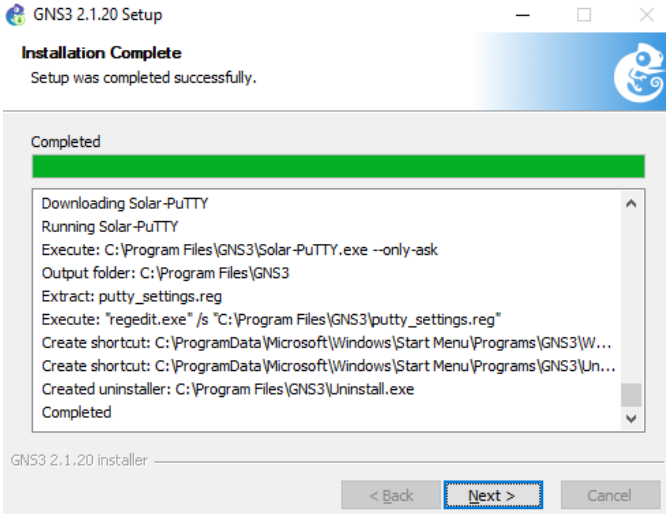


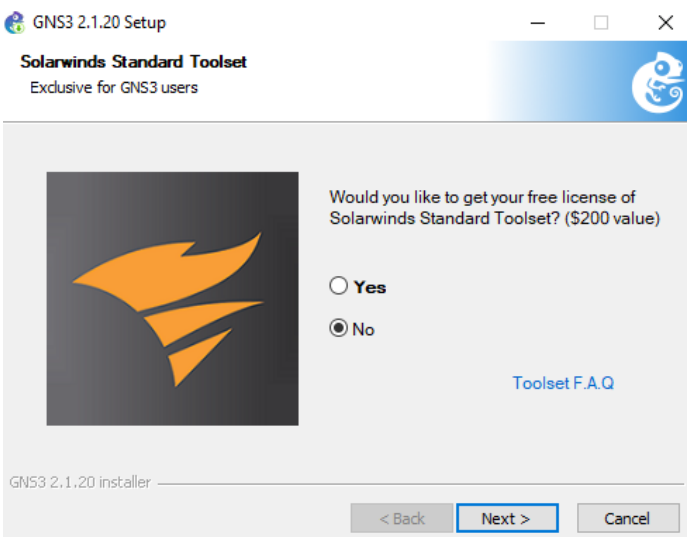


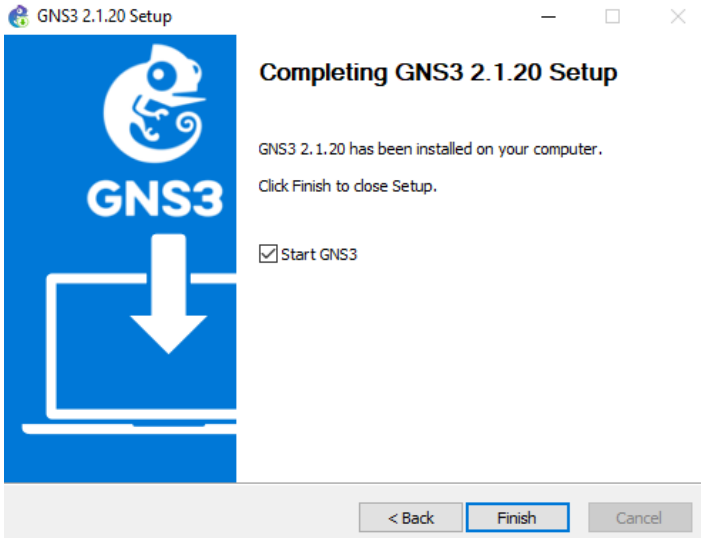


I choose the above extra bits, VPCS, Cpulimit and SolarPutty. None of them are mandatory but with these you can get added benefits, for example with solar putty, it gives you a tabbed putty session which can be very handy.



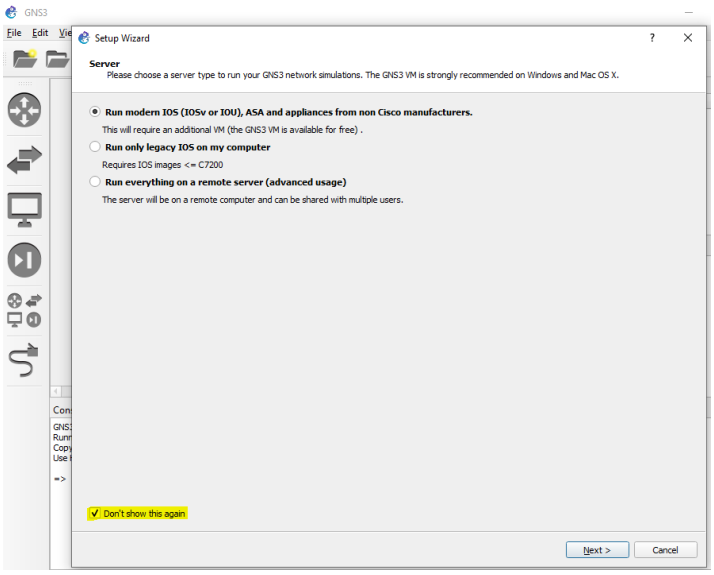


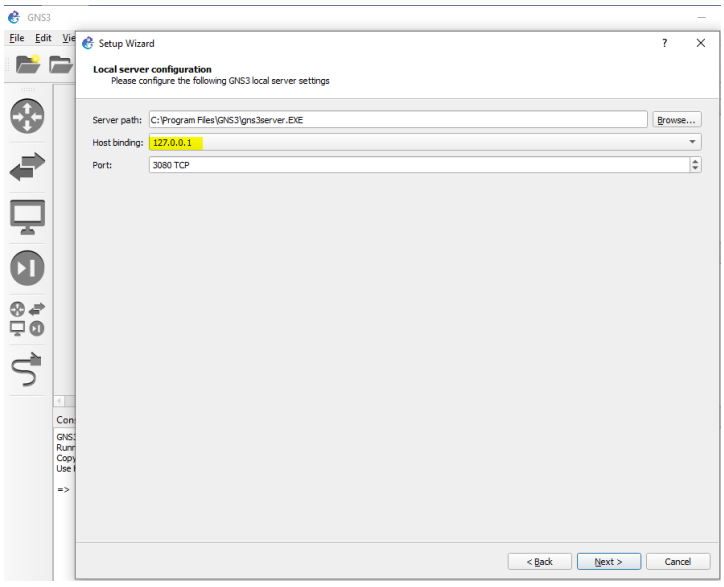




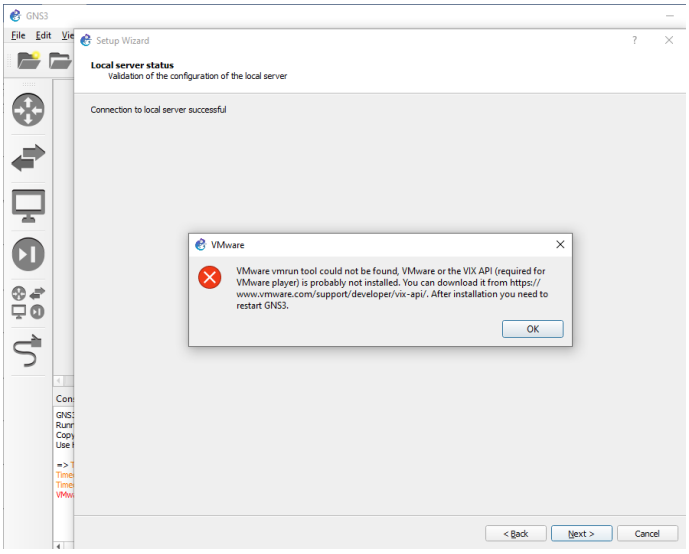
5.1 GNS3 Configuration

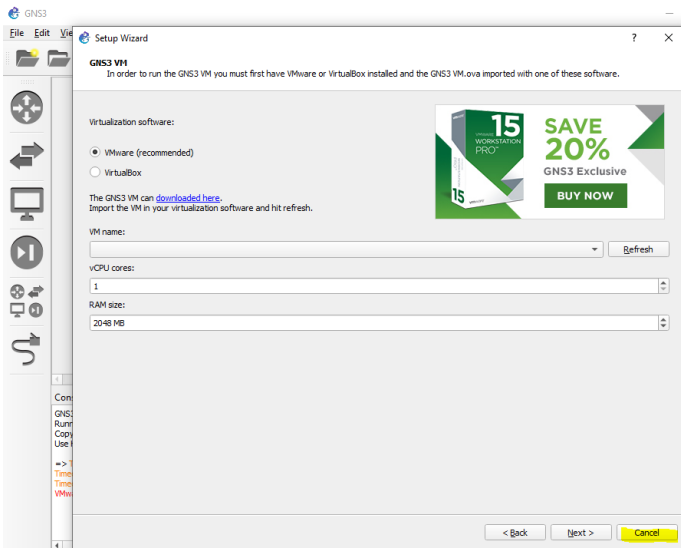
When GNS3 is started, you get this window.



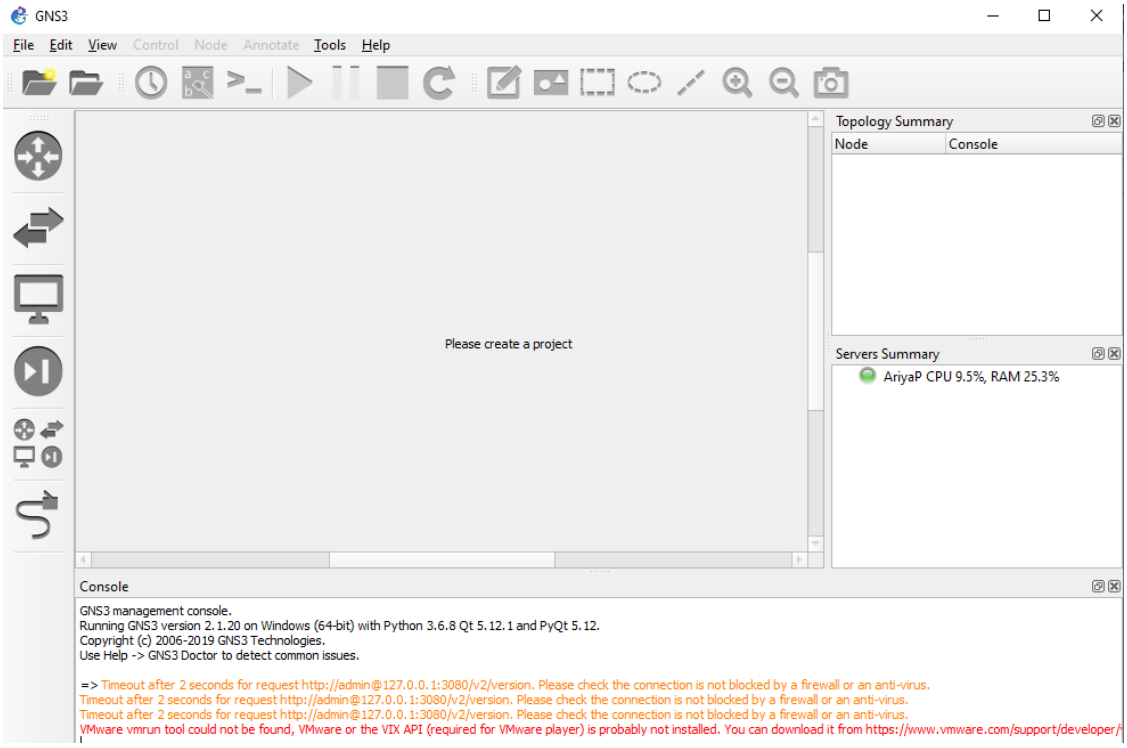


Then you get that the connection is successful but you get this error, click ok and the cancel out of it.

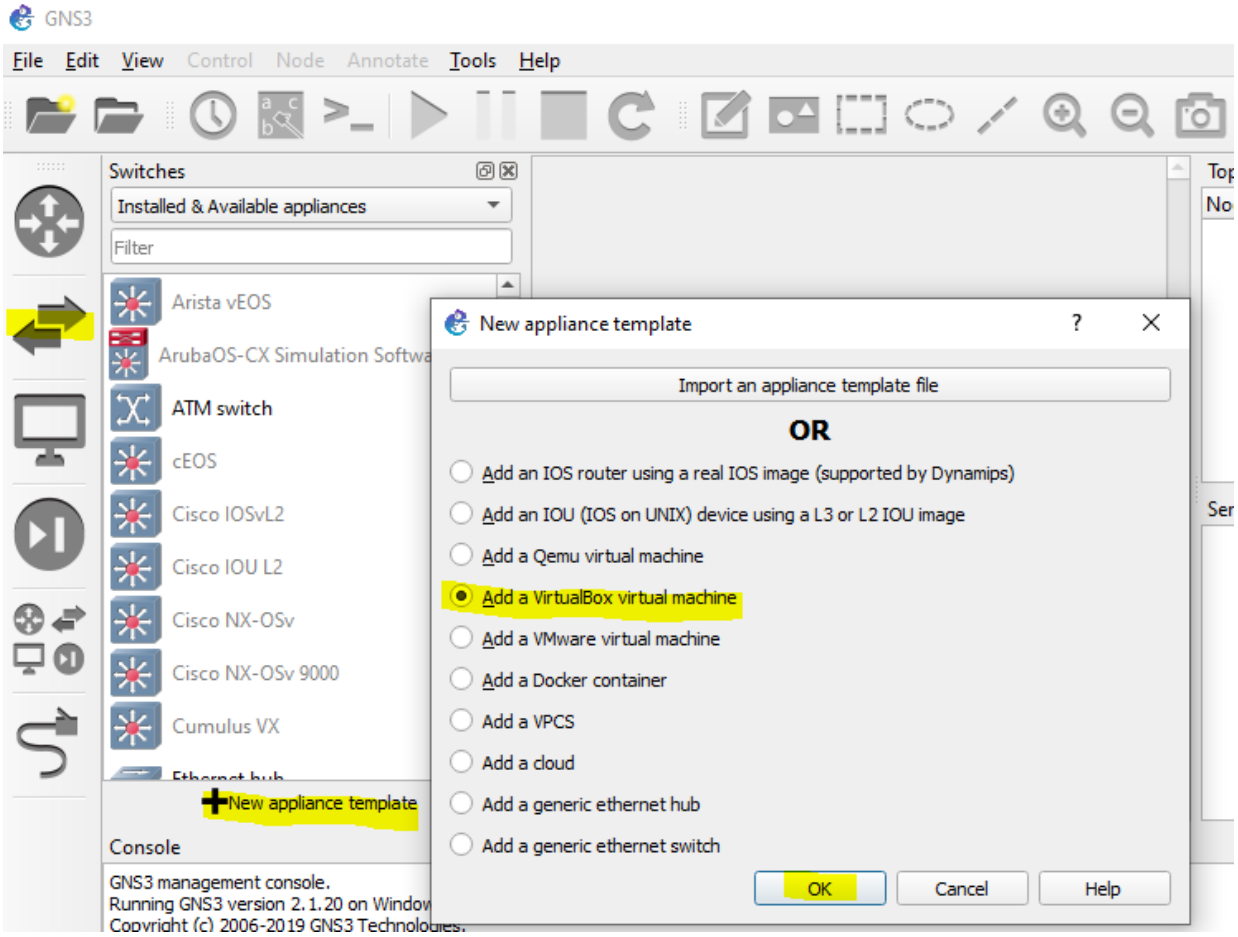


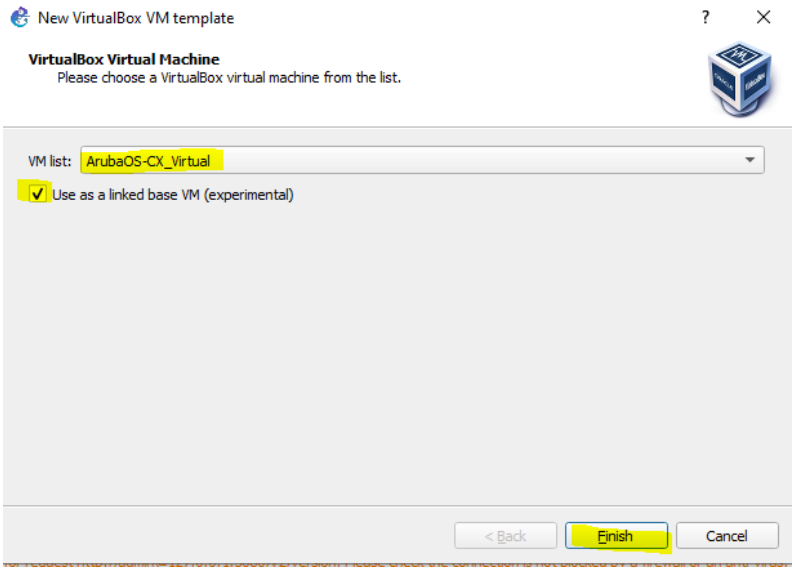


Then this is our final windows before we can start.

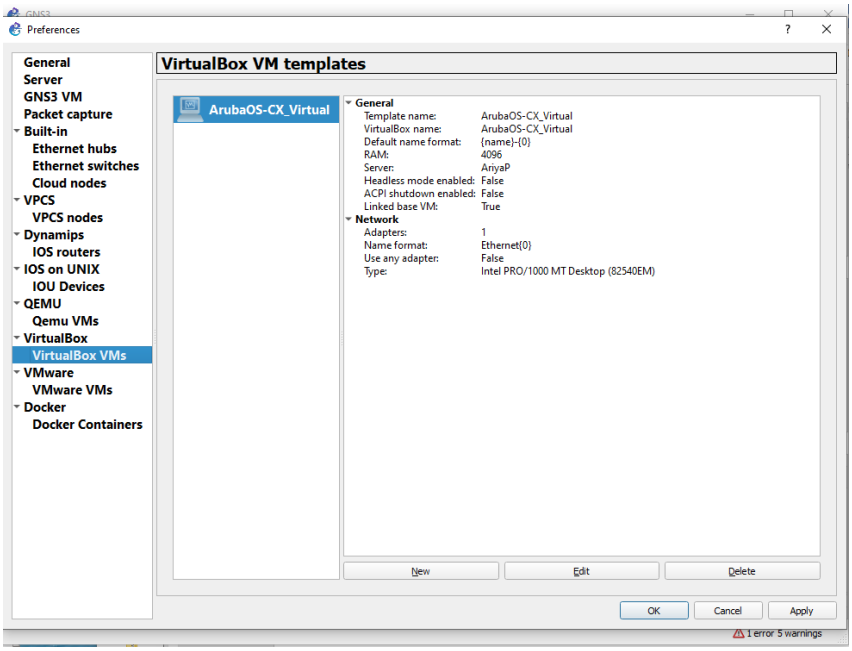


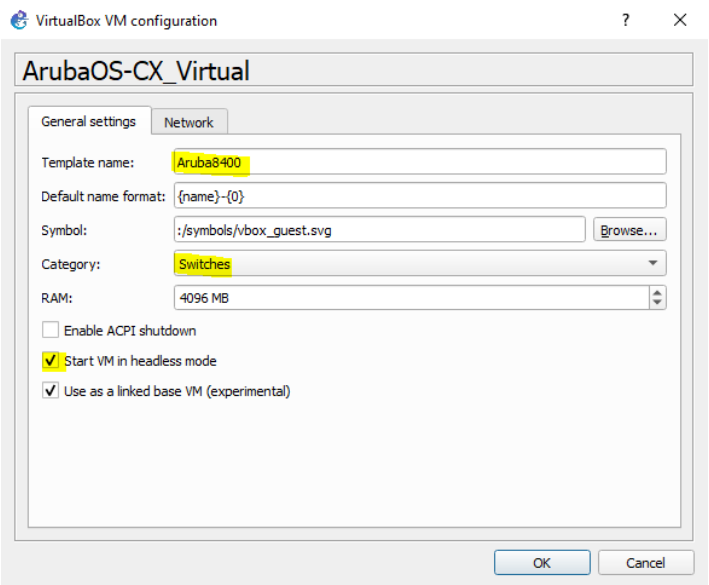
Now we want to create a new virtual appliance to represent Aruba CX switches.

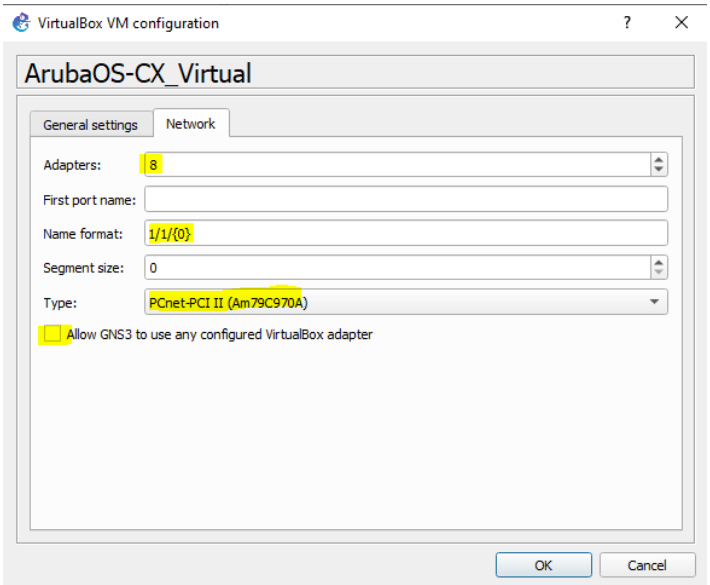




Then once you click on finish button, you are presented with the ArubaOS-CX template that needs to be edited.

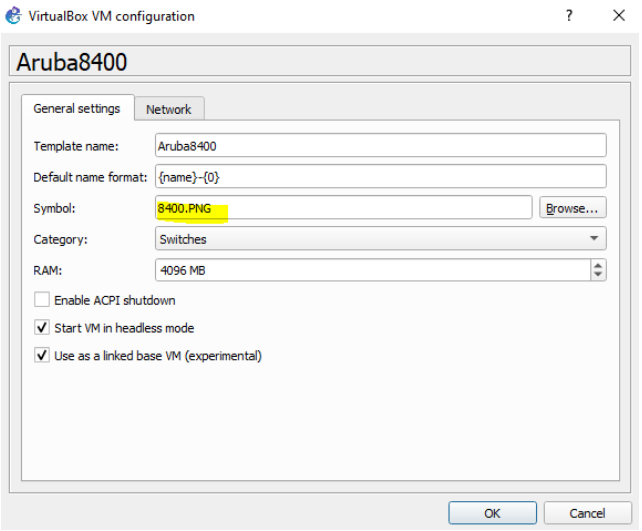


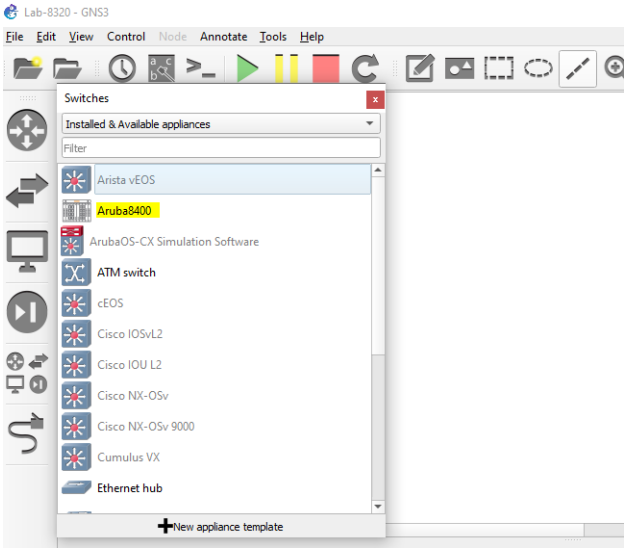




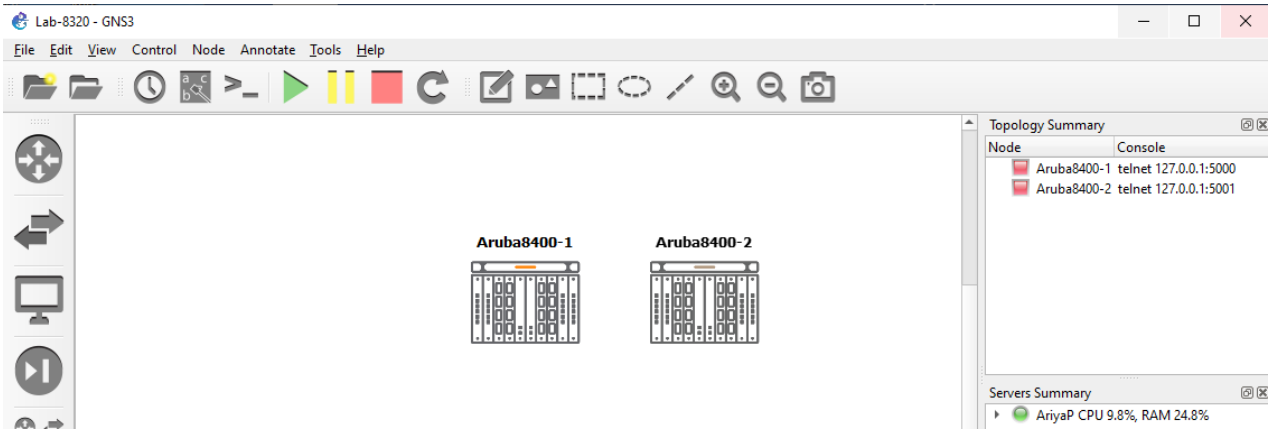
Note the changes we have made to the template, now apply and save it.

We can also change the symbol to an Aruba 8400 icon, this is what I have done.

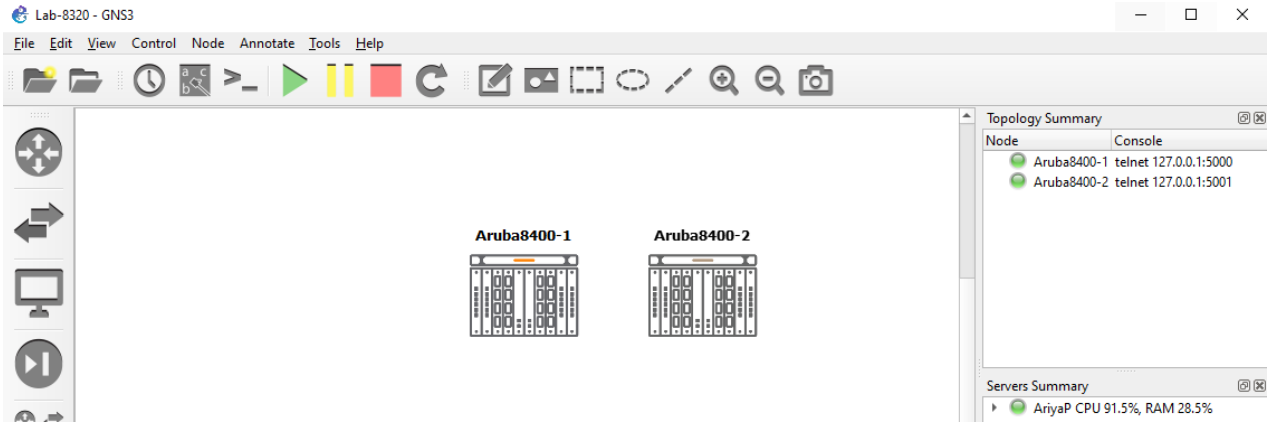




Next we'll drag and drop the Aruba 8400 switch to our new project as shown below.



Now we'll powered them on.



Next we'll open a console connection to both to configure their OOBM ports. You can double click on both the switches and that will open a solarwinds putty tabbed session.

We are going to assign 192.168.99.1/24 and 192.168.99.2/24 to the switches.

```
hostname 8400-1
interface mgmt
    no shutdown
    ip static 192.168.99.1/24
    default-gateway 192.168.99.254
https-server rest access-mode read-write
https-server vrf mgmt
ssh server vrf mgmt

>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>

hostname 8400-2
interface mgmt
    no shutdown
    ip static 192.168.99.2/24
    default-gateway 192.168.99.254
https-server rest access-mode read-write
https-server vrf mgmt
ssh server vrf mgmt
```

Note that the IP addressing is on the same IP subnet as that of our laptop loopback interface.

```
8400-1# sh int mgmt
  Address Mode                  : static
  Admin State                   : up
  Mac Address                   : 08:00:27:29:2f:f5
  IPv4 address/subnet-mask      : 192.168.99.1/24
  Default gateway IPv4          : 192.168.99.254
  IPv6 address/prefix           :
  IPv6 link local address/prefix:
  Default gateway IPv6          :
  Primary Nameserver            :
  Secondary Nameserver          :
8400-1#

8400-2# sh int mgmt
  Address Mode                  : static
  Admin State                   : up
  Mac Address                   : 08:00:27:81:f8:1b
  IPv4 address/subnet-mask      : 192.168.99.2/24
```

```
  Default gateway IPv4          : 192.168.99.254
  IPv6 address/prefix           :
  IPv6 link local address/prefix: fe80::a00:27ff:fe81:f81b/64
  Default gateway IPv6          :
  Primary Nameserver            :
  Secondary Nameserver          :
8400-2#
```

Now we should have full connectivity to the switches and should be able to ping them from our laptop.

```
C:\>ping 192.168.99.1

Pinging 192.168.99.1 with 32 bytes of data:
Reply from 192.168.99.1: bytes=32 time<1ms TTL=64
Reply from 192.168.99.1: bytes=32 time<1ms TTL=64
Reply from 192.168.99.1: bytes=32 time<1ms TTL=64
Reply from 192.168.99.1: bytes=32 time<1ms TTL=64

Ping statistics for 192.168.99.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>ping 192.168.99.2

Pinging 192.168.99.2 with 32 bytes of data:
Reply from 192.168.99.2: bytes=32 time<1ms TTL=64
Reply from 192.168.99.2: bytes=32 time<1ms TTL=64
Reply from 192.168.99.2: bytes=32 time<1ms TTL=64
Reply from 192.168.99.2: bytes=32 time<1ms TTL=64

Ping statistics for 192.168.99.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>
```

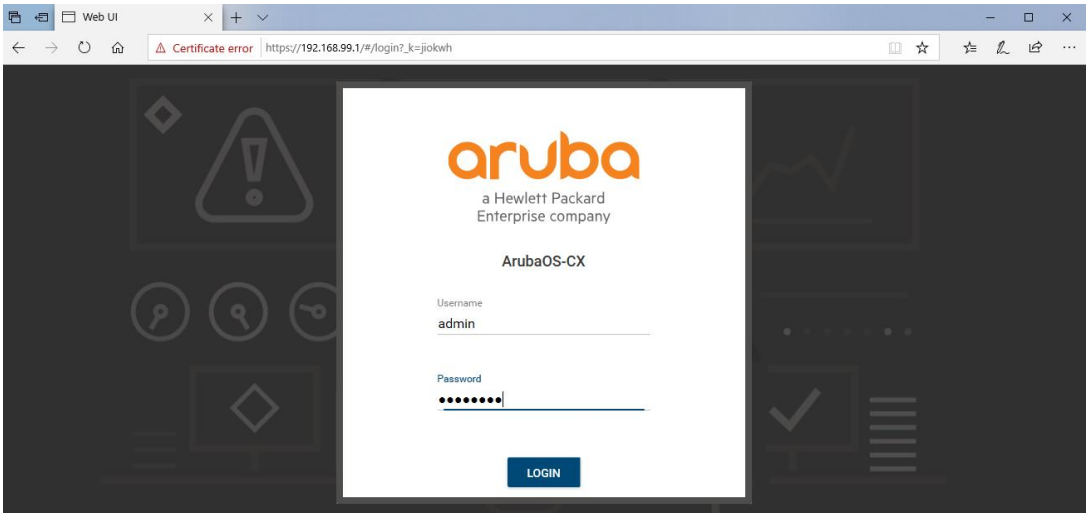
And the same from the virtual switches.

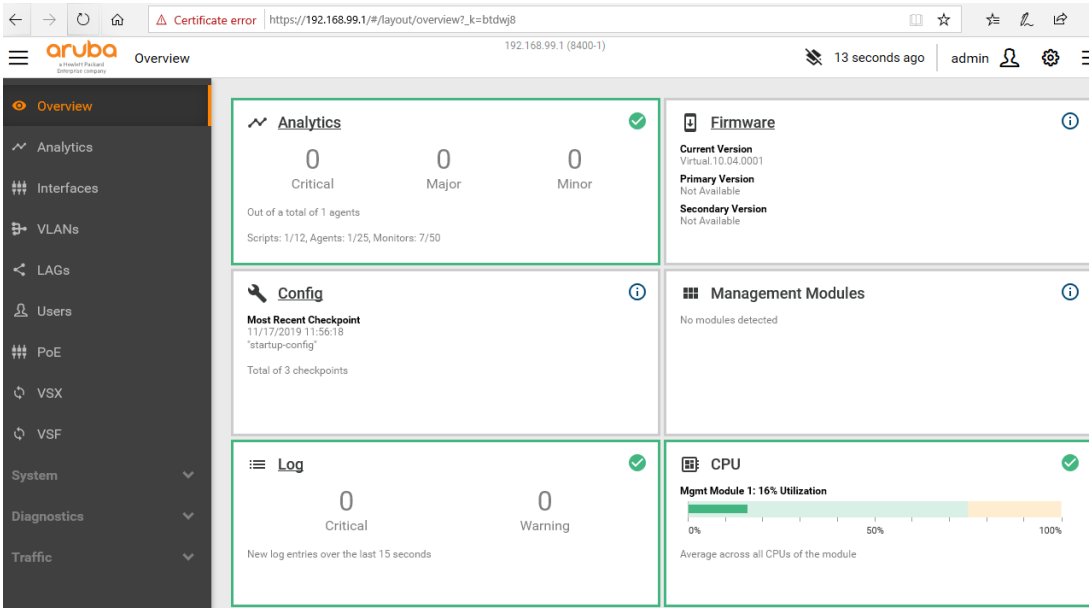
```
8400-1# ping 192.168.99.254 vrf mgmt
PING 192.168.99.254 (192.168.99.254) 100(128) bytes of data.
108 bytes from 192.168.99.254: icmp_seq=1 ttl=128 time=1.49 ms
108 bytes from 192.168.99.254: icmp_seq=2 ttl=128 time=0.325 ms
108 bytes from 192.168.99.254: icmp_seq=3 ttl=128 time=0.408 ms
108 bytes from 192.168.99.254: icmp_seq=4 ttl=128 time=0.254 ms
108 bytes from 192.168.99.254: icmp_seq=5 ttl=128 time=0.463 ms

--- 192.168.99.254 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4006ms
rtt min/avg/max/mdev = 0.254/0.589/1.495/0.458 ms

8400-1# ping 192.168.99.2 vrf mgmt
PING 192.168.99.2 (192.168.99.2) 100(128) bytes of data.
108 bytes from 192.168.99.2: icmp_seq=1 ttl=64 time=0.558 ms
108 bytes from 192.168.99.2: icmp_seq=2 ttl=64 time=0.596 ms
108 bytes from 192.168.99.2: icmp_seq=3 ttl=64 time=0.563 ms
108 bytes from 192.168.99.2: icmp_seq=4 ttl=64 time=0.481 ms
108 bytes from 192.168.99.2: icmp_seq=5 ttl=64 time=0.447 ms

--- 192.168.99.2 ping statistics ---
```

```
5 packets transmitted, 5 received, 0% packet loss, time 4004ms
rtt min/avg/max/mdev = 0.447/0.529/0.596/0.055 ms
8400-1#

8400-2# ping 192.168.99.1 vrf mgmt
PING 192.168.99.1 (192.168.99.1) 100(128) bytes of data.
108 bytes from 192.168.99.1: icmp_seq=1 ttl=64 time=1.05 ms
108 bytes from 192.168.99.1: icmp_seq=2 ttl=64 time=0.783 ms
108 bytes from 192.168.99.1: icmp_seq=3 ttl=64 time=0.443 ms
108 bytes from 192.168.99.1: icmp_seq=4 ttl=64 time=0.544 ms
108 bytes from 192.168.99.1: icmp_seq=5 ttl=64 time=0.629 ms

--- 192.168.99.1 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4100ms
rtt min/avg/max/mdev = 0.443/0.689/1.050/0.214 ms
8400-2#
```

5.2 CX Switch WebUI Access

Now that we have the management interface up and running on the CX switches, we should also have full webUI access.

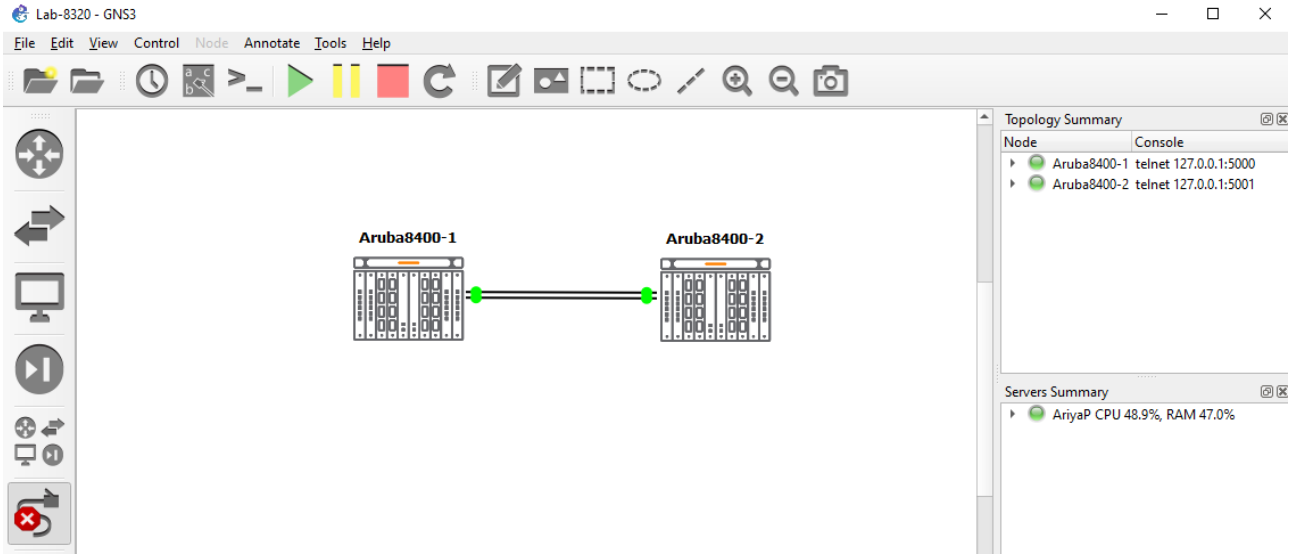




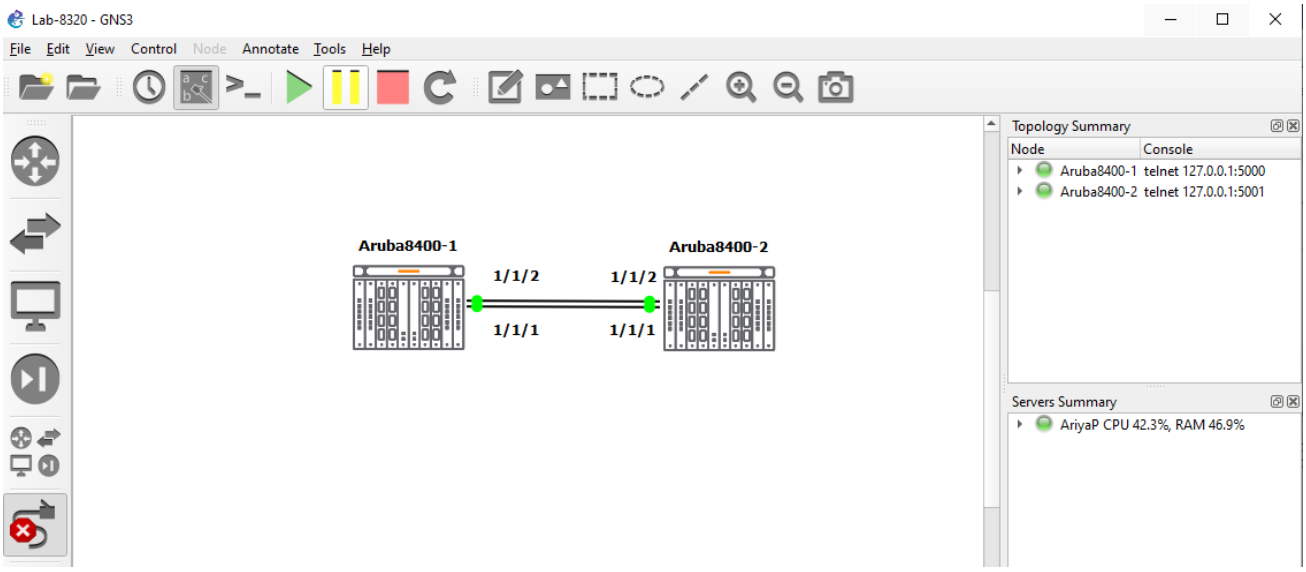
Note that because we were using bridged Adapter in VirtualBox VM setting for Adapter1, the Interface 1/1/0 of all CX switches will be connected to that loopback interface.

6 CX Switch Configuration

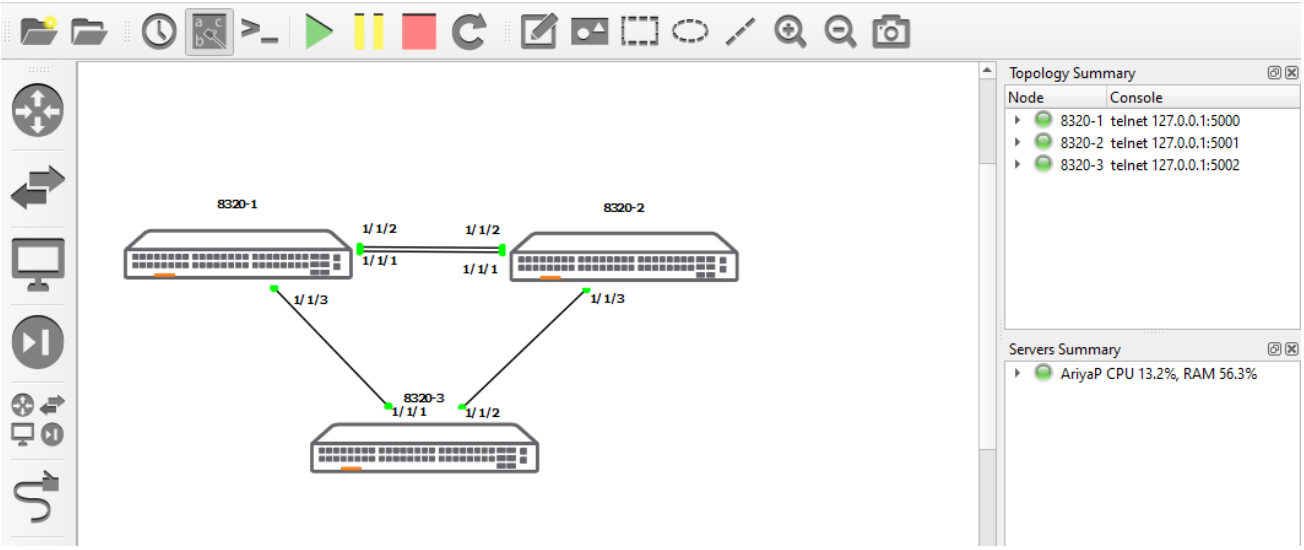
Now we use the connector icon to connect the switches. Note that every virtual CX switch will only have 8x interfaces, out of which 1/1/0 is the out of band mgmt. interface. So here we start with 1/1/1-2 interfaces.



Now we can use to toggle “show/hide interface label” under GNS3 view menu.



Adding the third CX switch and connecting it up. Note that I have changed the icons to reflect 8320s.



6.1 Switch Configuration

Here we'll go through some basic configuration. Furst thing is that the CX OVA will ave only 6x interfaces. Interface 1/1/0 is the mgmt. interface and 1/1/7 is used internally.

```
8320-1# show interface brief
--------------------------------------------------------------------------------
Port      Native  Mode   Type           Enabled Status  Reason                Speed
          VLAN                                                                 (Mb/s)
--------------------------------------------------------------------------------
1/1/1     --      routed --             no      down    Administratively down  --
1/1/2     --      routed --             no      down    Administratively down  --
1/1/3     --      routed --             no      down    Administratively down  --
1/1/4     --      routed --             no      down    Administratively down  --
1/1/5     --      routed --             no      down    Administratively down  --
1/1/6     --      routed --             no      down    Administratively down  --
8320-1#
```

6.1.1 Link Aggregation Configuration

We'll be configuring LACP for 1/1/1 and 1/1/2 for both 8320-1 and 8320-2 switches.

```
8320-1# conf t
8320-1(config)# int 1/1/1
8320-1(config-if)# no shut
8320-1(config-if)# int 1/1/2
8320-1(config-if)# no shut
8320-1(config-if)# ^Z

8320-2# conf t
8320-2(config)# int 1/1/1
8320-2(config-if)# no shut
8320-2(config-if)# int 1/1/2
8320-2(config-if)# no shut
8320-2(config-if)# ^Z
8320-2#

8320-1# sh lldp neighbor-info

LLDP Neighbor Information
=========================

Total Neighbor Entries          : 0
Total Neighbor Entries Deleted  : 0
Total Neighbor Entries Dropped  : 0
Total Neighbor Entries Aged-Out : 0

LOCAL-PORT  CHASSIS-ID         PORT-ID       PORT-DESC     TTL      SYS-NAME
--------------------------------------------------------------------------------
8320-1# sh lldp neighbor-info

LLDP Neighbor Information
=========================

Total Neighbor Entries          : 2
Total Neighbor Entries Deleted  : 0
Total Neighbor Entries Dropped  : 0
Total Neighbor Entries Aged-Out : 0

LOCAL-PORT  CHASSIS-ID         PORT-ID       PORT-DESC     TTL      SYS-NAME
```

```
--------------------------------------------------------------------------------
1/1/1       08:00:09:72:d0:20  1/1/1         1/1/1         120      8320-2
1/1/2       08:00:09:72:d0:20  1/1/2         1/1/2         120      8320-2
8320-1#
```

Next is the LACP configuration that you need on both the switches.

```
8320-1# conf t
8320-1(config)# interface lag 101
8320-1(config-lag-if)# no shutdown
8320-1(config-lag-if)# lacp mode active
8320-1(config-lag-if)# interface 1/1/1
8320-1(config-if)# mtu 2048
8320-1(config-if)# lag 101
8320-1(config-if)# interface 1/1/2
8320-1(config-if)# mtu 2048
8320-1(config-if)# lag 101

8320-1# sh lacp agg

Aggregate name   : lag101
Interfaces       : 1/1/2 1/1/1
Heartbeat rate   : Slow
Hash             : l3-src-dst
Aggregate mode   : Active

8320-1#
8320-1# sh lacp interfaces

State abbreviations :
A - Active        P - Passive      F - Aggregable I - Individual
S - Short-timeout L - Long-timeout N - InSync     O - OutofSync
C - Collecting    D - Distributing
X - State m/c expired              E - Default neighbor state

Actor details of all interfaces:
--------------------------------------------------------------------------------
Intf    Aggr       Port  Port  State   System-ID         System Aggr Forwarding
        Name       Id    Pri                             Pri    Key  State
--------------------------------------------------------------------------------
1/1/1   lag101     2     1     ALFOE   08:00:09:c8:5a:12 65534  101  lacp-block
1/1/2   lag101     3     1     ALFOE   08:00:09:c8:5a:12 65534  101  lacp-block


Partner details of all interfaces:
--------------------------------------------------------------------------------
Intf    Aggr       Port  Port  State   System-ID         System Aggr
        Name       Id    Pri                             Pri    Key
--------------------------------------------------------------------------------
1/1/1   lag101     0     65534 PLFOEX  00:00:00:00:00:00 65534  0
1/1/2   lag101     0     65534 PLFOEX  00:00:00:00:00:00 65534  0
8320-1#
8320-1# sh interface brief
------------------------------------------------------------------------------------
Port      Native  Mode   Type           Enabled Status  Reason                 Speed
          VLAN                                                                  (Mb/s)
------------------------------------------------------------------------------------
1/1/1     --      routed --             yes     up                             1000
1/1/2     --      routed --             yes     up                             1000
1/1/3     --      routed --             no      down    Administratively down  --
1/1/4     --      routed --             no      down    Administratively down  --
1/1/5     --      routed --             no      down    Administratively down  --
1/1/6     --      routed --             no      down    Administratively down  --
lag100    --      routed --             yes     blocked --                     auto
8320-1#
```

Now when we configure LACP on the second switch, the link will come up.

```
interface lag 102
    no shutdown
    lacp mode active
interface 1/1/1
    no shutdown
    mtu 2048
    lag 102
interface 1/1/2
    no shutdown
    mtu 2048
    lag 102

8320-2# sh lacp aggregates

Aggregate name    : lag102
Interfaces        : 1/1/1 1/1/2
Heartbeat rate    : Slow
Hash              : l3-src-dst
Aggregate mode    : Active

8320-2# sh lacp inter

State abbreviations :
A - Active        P - Passive      F - Aggregable I - Individual
S - Short-timeout L - Long-timeout N - InSync     O - OutofSync
C - Collecting    D - Distributing
X - State m/c expired              E - Default neighbor state

Actor details of all interfaces:
--------------------------------------------------------------------------------
Intf    Aggr       Port  Port  State   System-ID         System Aggr Forwarding
        Name       Id    Pri                             Pri    Key  State
--------------------------------------------------------------------------------
1/1/1   lag102     2     1     ALFNCD  08:00:09:72:d0:20 65534  102  up
1/1/2   lag102     3     1     ALFNCD  08:00:09:72:d0:20 65534  102  up


Partner details of all interfaces:
--------------------------------------------------------------------------------
Intf    Aggr       Port  Port  State   System-ID         System Aggr
        Name       Id    Pri                             Pri    Key
--------------------------------------------------------------------------------
1/1/1   lag102     2     1     ALFNCD  08:00:09:c8:5a:12 65534  101
1/1/2   lag102     3     1     ALFNCD  08:00:09:c8:5a:12 65534  101
8320-2#

8320-2# sh int b
------------------------------------------------------------------------------------
Port       Native  Mode   Type           Enabled Status  Reason                 Speed
           VLAN                                                                  (Mb/s)
------------------------------------------------------------------------------------
1/1/1      --      routed --             yes     up                             1000
1/1/2      --      routed --             yes     up                             1000
1/1/3      --      routed --             no      down    Administratively down  --
1/1/4      --      routed --             no      down    Administratively down  --
1/1/5      --      routed --             no      down    Administratively down  --
1/1/6      --      routed --             no      down    Administratively down  --
lag102     --      routed --             yes     up      --                     2000
8320-2#
```

6.1.2 VLAN Configuration

Now we'll configure couple of VLANs that will use the LACP link.

```
8320-1# sh vlan

--------------------------------------------------------------------------------------------
VLAN  Name                                Status  Reason                Type
Interfaces
--------------------------------------------------------------------------------------------
1     DEFAULT_VLAN_1                      down    no_member_port        default

8320-1#conf t
8320-1(config)# vlan 10,20
8320-1(config-vlan-<10,20>)# interface lag 101
8320-1(config-lag-if)# no routing
8320-1(config-lag-if)# vlan trunk allow 10,20
8320-1(config-lag-if)# end
8320-1#
8320-1# sh vlan

--------------------------------------------------------------------------------------------
---------------------
VLAN  Name                                Status  Reason                Type
Interfaces
--------------------------------------------------------------------------------------------
---------------------
1     DEFAULT_VLAN_1                      down    no_member_port        default
10    VLAN10                              up      ok                    static    lag101
20    VLAN20                              up      ok                    static    lag101
8320-1#
```

```
8320-2# conf t
8320-2(config)# vlan 10,20
8320-2(config-vlan-<10,20>)# interface lag 102
8320-2(config-lag-if)# no routing
8320-2(config-lag-if)# vlan trunk allow 10,20
8320-2(config-lag-if)# end
8320-2#
8320-2# sh vlan

--------------------------------------------------------------------------------------------
---------------------
VLAN  Name                                Status  Reason                Type
Interfaces
--------------------------------------------------------------------------------------------
---------------------
1     DEFAULT_VLAN_1                      down    no_member_port        default
10    VLAN10                              up      ok                    static    lag102
20    VLAN20                              up      ok                    static    lag102
8320-2#
```

Adding VLAN interface IP address.

```
8320-1# conf t
8320-1(config)# interface vlan 10
8320-1(config-if-vlan)# ip address 10.0.10.1/24
8320-1(config-if-vlan)# interface vlan 20
8320-1(config-if-vlan)# ip address 10.0.20.1/24
8320-1(config-if-vlan)# end
8320-1#
```

```
8320-1# sh ip interface brief
Interface         IP Address             Interface Status
                                           link/admin
1/1/3            No Address                down/down
1/1/4            No Address                down/down
1/1/5            No Address                down/down
1/1/6            No Address                down/down
vlan10           10.0.10.1/24              up/up
vlan20           10.0.20.1/24              up/up

8320-1#
```

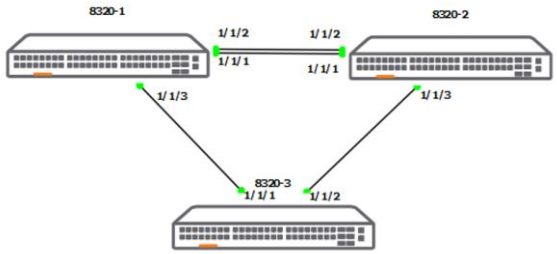
```
8320-2#conf t
8320-2(config)# configure t
8320-2(config)# interface vlan 10
8320-2(config-if-vlan)# ip address 10.0.10.2/24
8320-2(config-if-vlan)# interface vlan 20
8320-2(config-if-vlan)# ip address 10.0.20.2/24
8320-2(config-if-vlan)# end
8320-2# sh ip interface brief
Interface         IP Address             Interface Status
                                           link/admin
1/1/3            No Address                down/down
1/1/4            No Address                down/down
1/1/5            No Address                down/down
1/1/6            No Address                down/down
vlan10           10.0.10.2/24              up/up
vlan20           10.0.20.2/24              up/up

8320-2#
```

Finally doing the ping test

```
8320-1# sh ip route

Displaying ipv4 routes selected for forwarding

'[x/y]' denotes [distance/metric]

10.0.10.0/24, vrf default
        via  vlan10,  [0/0],  connected
10.0.10.1/32, vrf default
        via  vlan10,  [0/0],  local
10.0.20.0/24, vrf default
        via  vlan20,  [0/0],  connected
10.0.20.1/32, vrf default
        via  vlan20,  [0/0],  local

8320-1# ping 10.0.10.2
PING 10.0.10.2 (10.0.10.2) 100(128) bytes of data.
108 bytes from 10.0.10.2: icmp_seq=1 ttl=64 time=26.5 ms
108 bytes from 10.0.10.2: icmp_seq=2 ttl=64 time=3.41 ms
108 bytes from 10.0.10.2: icmp_seq=3 ttl=64 time=3.68 ms
108 bytes from 10.0.10.2: icmp_seq=4 ttl=64 time=3.60 ms
108 bytes from 10.0.10.2: icmp_seq=5 ttl=64 time=3.83 ms

--- 10.0.10.2 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4005ms
rtt min/avg/max/mdev = 3.412/8.224/26.583/9.180 ms
8320-1#
```

6.1.3 Configuring the third Switch

Now we'll configure couple of VLANs




```
8320-1# conf t
8320-1(config)# interface 1/1/3
8320-1(config-if)# no routing
8320-1(config-if)# no shut
8320-1(config-if)# vlan trunk allow 10,20
8320-1(config-if)# exit
8320-1(config)# exit
8320-1#
```

```
8320-2# conf t
8320-2(config)# interface 1/1/3
8320-2(config-if)# no routing
8320-2(config-if)# no shut
8320-2(config-if)# vlan trunk allow 10,20
8320-2(config-if)# exit
8320-2(config)# exit
8320-2#
```

```
8320-3# conf t
8320-3(config)# interface 1/1/1
8320-3(config-if)# no shutdown
8320-3(config-if)# interface 1/1/2
8320-3(config-if)# no shutdown
8320-3(config-if)# end
8320-3#

8320-3# sh lldp neighbor-info

LLDP Neighbor Information
=========================

Total Neighbor Entries          : 2
Total Neighbor Entries Deleted  : 0
Total Neighbor Entries Dropped  : 0
Total Neighbor Entries Aged-Out : 0

LOCAL-PORT  CHASSIS-ID         PORT-ID       PORT-DESC     TTL      SYS-NAME
--------------------------------------------------------------------------------
1/1/1       08:00:09:c8:5a:12  1/1/3         1/1/3         120      8320-1
1/1/2       08:00:09:72:d0:20  1/1/3         1/1/3         120      8320-2
8320-3#
8320-3# sh int b
--------------------------------------------------------------------------------
Port       Native  Mode   Type           Enabled Status  Reason                Speed
           VLAN                                                                 (Mb/s)
--------------------------------------------------------------------------------
1/1/1      --      routed --             yes     up                            1000
```

```
1/1/2     --      routed --             yes     up                              1000
1/1/3     --      routed --             no      down    Administratively down   --
1/1/4     --      routed --             no      down    Administratively down   --
1/1/5     --      routed --             no      down    Administratively down   --
1/1/6     --      routed --             no      down    Administratively down   --
8320-3#
```

Checking the interface status on 8320-1 and -2

```
8320-1# sh int b
--------------------------------------------------------------------------------
Port      Native  Mode   Type           Enabled Status  Reason                 Speed
          VLAN                                                                  (Mb/s)
--------------------------------------------------------------------------------
1/1/1     1       trunk  --             yes     up                             1000
1/1/2     1       trunk  --             yes     up                             1000
1/1/3     1       trunk  --             yes     up                             1000
1/1/4     --      routed --             no      down    Administratively down  --
1/1/5     --      routed --             no      down    Administratively down  --
1/1/6     --      routed --             no      down    Administratively down  --
vlan10    --             --             yes     up                             --
vlan20    --             --             yes     up                             --
lag101    1       trunk  --             yes     up      --                     2000
8320-1#
```

```
8320-2# sh int b
--------------------------------------------------------------------------------
Port      Native  Mode   Type           Enabled Status  Reason                 Speed
          VLAN                                                                  (Mb/s)
--------------------------------------------------------------------------------
1/1/1     1       trunk  --             yes     up                             1000
1/1/2     1       trunk  --             yes     up                             1000
1/1/3     1       trunk  --             yes     up                             1000
1/1/4     --      routed --             no      down    Administratively down  --
1/1/5     --      routed --             no      down    Administratively down  --
1/1/6     --      routed --             no      down    Administratively down  --
vlan10    --             --             yes     up                             --
vlan20    --             --             yes     up                             --
lag102    1       trunk  --             yes     up      --                     2000
8320-2#
```

Adding the VLANs to the third switch

```
vlan 10,20
interface 1/1/1
no routing
vlan trunk allow 10,20
interface 1/1/2
no routing
vlan trunk allow 10,20

8320-3# sh vlan

-------------------------------------------------------------------------------------
VLAN  Name                                Status  Reason                Type
Interfaces
-------------------------------------------------------------------------------------
1     DEFAULT_VLAN_1                      down    no_member_port        default
10    VLAN10                              up      ok                    static    1/1/1-
1/1/2
20    VLAN20                              up      ok                    static    1/1/1-
1/1/2
8320-3#
```

6.1.4 Configuring MSTP

The 802.1s multiple spanning tree protocol (MSTP) is the default mode for spaning tree on CX switches. Also note that spanning tree is disabled by default.

Run the following commands on the switches.

Switch name	Spanning tree command

8320-1	`spanning-tree config-name STP`
	`spanning-tree config-revision 1`
	`spanning-tree instance 1 vlan 10`
	`spanning-tree instance 2 vlan 20`
	`spanning-tree instance 1 priority 1`
	`spanning-tree`

8320-2	`spanning-tree config-name STP`
	`spanning-tree config-revision 1`
	`spanning-tree instance 1 vlan 10`
	`spanning-tree instance 2 vlan 20`
	`spanning-tree instance 2 priority 1`
	`spanning-tree`

8320-3	`spanning-tree config-name STP`
	`spanning-tree config-revision 1`
	`spanning-tree instance 1 vlan 10`
	`spanning-tree instance 2 vlan 20`
	`spanning-tree`

```
8320-1# sh spanning-tree mst 1

#### MST1
Vlans mapped:  10
Bridge         Address:08:00:09:c8:5a:12    Priority:4096
Root           Address:08:00:09:c8:5a:12    Priority:4096
               Port:0, Cost:0, Rem Hops:20

Port           Role           State        Cost    Priority   Type
-------------- -------------- ------------ ------- ---------- ----------
1/1/3          Designated     Forwarding   20000   128        point_to_point
lag101         Designated     Forwarding   20000   64         point_to_point

Topology change flag          : True
Number of topology changes    : 3
Last topology change occurred : 399 seconds ago

8320-1#
8320-1# sh spanning-tree mst 2

#### MST2
Vlans mapped:  20
Bridge         Address:08:00:09:c8:5a:12    Priority:32768
Root           Address:08:00:09:72:d0:20    Priority:4096
               Port:lag101, Cost:20000, Rem Hops:19

Port           Role           State        Cost    Priority   Type
-------------- -------------- ------------ ------- ---------- ----------
1/1/3          Alternate      Blocking     20000   128        point_to_point
lag101         Root           Forwarding   20000   64         point_to_point

Topology change flag          : True
Number of topology changes    : 3
Last topology change occurred : 483 seconds ago

8320-1#
```

This shows that 8320-1 is the root bridge for MST instant 1 which is for VLAN 10 and for instant 2, we have Root bridge with address of 08:00:09:72:d0:20. This happen to be the 8320-2 switch.

```
8320-2# sh spanning-tree mst 1

#### MST1
Vlans mapped:  10
Bridge         Address:08:00:09:72:d0:20    Priority:32768
Root           Address:08:00:09:c8:5a:12    Priority:4096
               Port:lag102, Cost:20000, Rem Hops:19

Port           Role           State        Cost    Priority   Type
-------------- -------------- ------------ ------- ---------- ----------
1/1/3          Designated     Forwarding   20000   128        point_to_point
lag102         Root           Forwarding   20000   64         point_to_point

Topology change flag          : True
Number of topology changes    : 3
Last topology change occurred : 581 seconds ago

8320-2# sh spanning-tree mst 2

#### MST2
Vlans mapped:  20
Bridge         Address:08:00:09:72:d0:20    Priority:4096
Root           Address:08:00:09:72:d0:20    Priority:4096
               Port:0, Cost:0, Rem Hops:20

Port           Role           State        Cost    Priority   Type
-------------- -------------- ------------ ------- ---------- ----------
1/1/3          Designated     Forwarding   20000   128        point_to_point
lag102         Designated     Forwarding   20000   64         point_to_point

Topology change flag          : True
Number of topology changes    : 5
Last topology change occurred : 579 seconds ago

8320-2#
```

And this is what we see on 8320-3

```
8320-3# sh spanning-tree mst 1

#### MST1
Vlans mapped:  10
Bridge         Address:08:00:09:9d:d1:f7    Priority:32768
Root           Address:08:00:09:c8:5a:12    Priority:4096
               Port:1/1/1, Cost:20000, Rem Hops:19

Port           Role           State        Cost    Priority   Type
-------------- -------------- ------------ ------- ---------- ----------
1/1/1          Root           Forwarding   20000   128        point_to_point
1/1/2          Alternate      Blocking     20000   128        point_to_point

Topology change flag          : True
Number of topology changes    : 1
Last topology change occurred : 825 seconds ago

8320-3# sh spanning-tree mst 2

#### MST2
Vlans mapped:  20
```

```
Bridge          Address:08:00:09:9d:d1:f7    Priority:32768
Root            Address:08:00:09:72:d0:20    Priority:4096
                Port:1/1/2, Cost:20000, Rem Hops:19

Port            Role            State        Cost    Priority   Type
--------------- --------------- ------------ ------- ---------- ----------
1/1/1           Designated      Forwarding   20000   128        point_to_point
1/1/2           Root            Forwarding   20000   128        point_to_point

Topology change flag           : True
Number of topology changes     : 2
Last topology change occurred : 827 seconds ago

8320-3#
```

6.1.5 Configuring RSTP+

Rapid spanning tree protocol (RSTP) requires less config and the RSTP+ version allows it run on per VLAN basis. We should remove the previous MSTP configs from the switches.

```
no spanning-tree
no spanning-tree config-name
no spanning-tree config-revision
no spanning-tree instance 1
no spanning-tree instance 2
```

Switch name	Spanning tree command
8320-1	spanning-tree mode rpvst spanning-tree vlan 10,20 spanning-tree vlan 10 priority 1 spanning-tree
8320-2	spanning-tree mode rpvst spanning-tree vlan 10,20 spanning-tree vlan 20 priority 1 spanning-tree
8320-3	spanning-tree mode rpvst spanning-tree vlan 10,20 spanning-tree

Checking the spanning tree status for VLAN 10

8320-1

```
8320-1# show spanning-tree vlan 10
VLAN10
Spanning tree status : Enabled Protocol: RPVST
  Root ID    Priority    : 4096
             MAC-Address: 08:00:09:c8:5a:12
             This bridge is the root
             Hello time(in seconds):2  Max Age(in seconds):20
             Forward Delay(in seconds):15

  Bridge ID  Priority  : 4096
             MAC-Address: 08:00:09:c8:5a:12
             Hello time(in seconds):2  Max Age(in seconds):20
             Forward Delay(in seconds):15

Port         Role            State        Cost           Priority   Type
------------ --------------- ------------ ------------ ---------- ----------
1/1/3        Designated      Forwarding   20000          128        point_to_point
lag101       Designated      Forwarding   20000          64         point_to_point

8320-1#
```

8320-2

```
8320-2# show spanning-tree vlan 10

VLAN10
Spanning tree status : Enabled Protocol: RPVST
```

	Root ID Priority : 4096 MAC-Address: 08:00:09:c8:5a:12 Hello time(in seconds):2 Max Age(in seconds):20 Forward Delay(in seconds):15 Bridge ID Priority : 32768 MAC-Address: 08:00:09:72:d0:20 Hello time(in seconds):2 Max Age(in seconds):20 Forward Delay(in seconds):15 Port Role State Cost Priority Type --- --- --- --- --- --- 1/1/3 Designated Forwarding 20000 128 point_to_point lag102 Root Forwarding 20000 64 point_to_point 8320-2#
8320-3	8320-3# show spanning-tree vlan 10 VLAN10 Spanning tree status : Enabled Protocol: RPVST Root ID Priority : 4096 MAC-Address: 08:00:09:c8:5a:12 Hello time(in seconds):2 Max Age(in seconds):20 Forward Delay(in seconds):15 Bridge ID Priority : 32768 MAC-Address: 08:00:09:9d:d1:f7 Hello time(in seconds):2 Max Age(in seconds):20 Forward Delay(in seconds):15 Port Role State Cost Priority Type --- --- --- --- --- --- 1/1/1 Root Forwarding 20000 128 point_to_point 1/1/2 Alternate Blocking 20000 128 point_to_point 8320-3#

Checking the spanning tree status for VLAN 20

8320-1	8320-1# show spanning-tree vlan 20 VLAN20 Spanning tree status : Enabled Protocol: RPVST Root ID Priority : 4096 MAC-Address: 08:00:09:72:d0:20 Hello time(in seconds):2 Max Age(in seconds):20 Forward Delay(in seconds):15 Bridge ID Priority : 32768 MAC-Address: 08:00:09:c8:5a:12 Hello time(in seconds):2 Max Age(in seconds):20 Forward Delay(in seconds):15 Port Role State Cost Priority Type --- --- --- --- --- --- 1/1/3 Alternate Blocking 20000 128 point_to_point lag101 Root Forwarding 20000 64 point_to_point 8320-1#
8320-2	8320-2# show spanning-tree vlan 20 VLAN20 Spanning tree status : Enabled Protocol: RPVST Root ID Priority : 4096 MAC-Address: 08:00:09:72:d0:20 This bridge is the root Hello time(in seconds):2 Max Age(in seconds):20 Forward Delay(in seconds):15 Bridge ID Priority : 4096 MAC-Address: 08:00:09:72:d0:20 Hello time(in seconds):2 Max Age(in seconds):20

```
                Forward Delay(in seconds):15

Port          Role           State        Cost           Priority   Type
------------ -------------- ------------ ------------ ---------- ----------
1/1/3         Designated     Forwarding   20000          128        point_to_point
lag102        Designated     Forwarding   20000          64         point_to_point

8320-2#
```

8320-3

```
8320-3# show spanning-tree vlan 20

VLAN20
Spanning tree status : Enabled Protocol: RPVST
  Root ID     Priority    : 4096
              MAC-Address: 08:00:09:72:d0:20
              Hello time(in seconds):2  Max Age(in seconds):20
              Forward Delay(in seconds):15

  Bridge ID   Priority   : 32768
              MAC-Address: 08:00:09:9d:d1:f7
              Hello time(in seconds):2  Max Age(in seconds):20
              Forward Delay(in seconds):15

Port          Role           State        Cost           Priority   Type
------------ -------------- ------------ ------------ ---------- ----------
1/1/1         Designated     Forwarding   20000          128        point_to_point
1/1/2         Root           Forwarding   20000          128        point_to_point

8320-3#
```

And here is an easy way to find out who is the root bridge for various VLANs

8320-1

```
8320-1# sh spanning-tree summary root
Spanning tree status: Enabled Protocol: RPVST
Root bridge for VLAN : 10

                                      Root    Hello Max Fwd
VLAN     Priority     Root ID         cost    Time  Age Dly Root Port
-------- -------- ----------------- --------- ----- --- --- ------------
VLAN10       4096 08:00:09:c8:5a:12         0     2  20  15            0
VLAN20       4096 08:00:09:72:d0:20     20000     2  20  15       lag101

8320-1#
```

8320-2

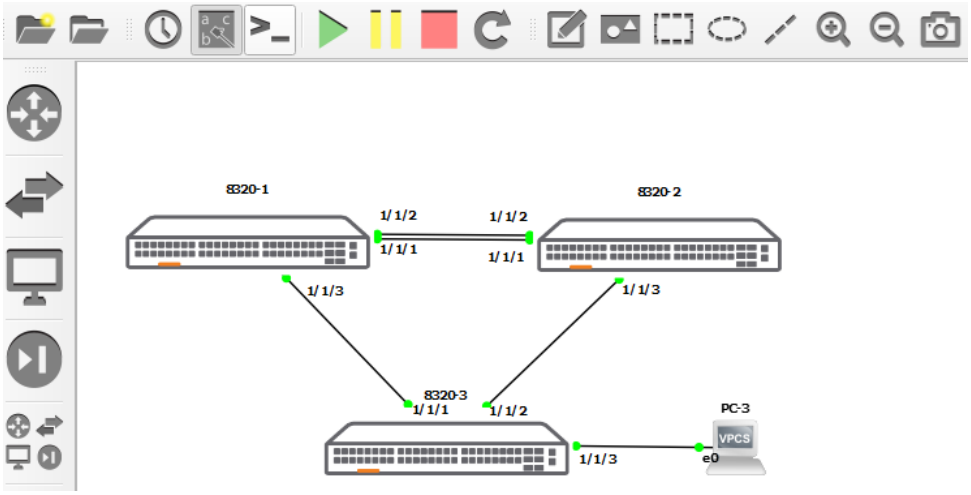
```
8320-2# sh spanning-tree summary root
Spanning tree status: Enabled Protocol: RPVST
Root bridge for VLAN : 20

                                      Root    Hello Max Fwd
VLAN     Priority     Root ID         cost    Time  Age Dly Root Port
-------- -------- ----------------- --------- ----- --- --- ------------
VLAN10       4096 08:00:09:c8:5a:12     20000     2  20  15       lag102
VLAN20       4096 08:00:09:72:d0:20         0     2  20  15            0

8320-2#
```

8320-3

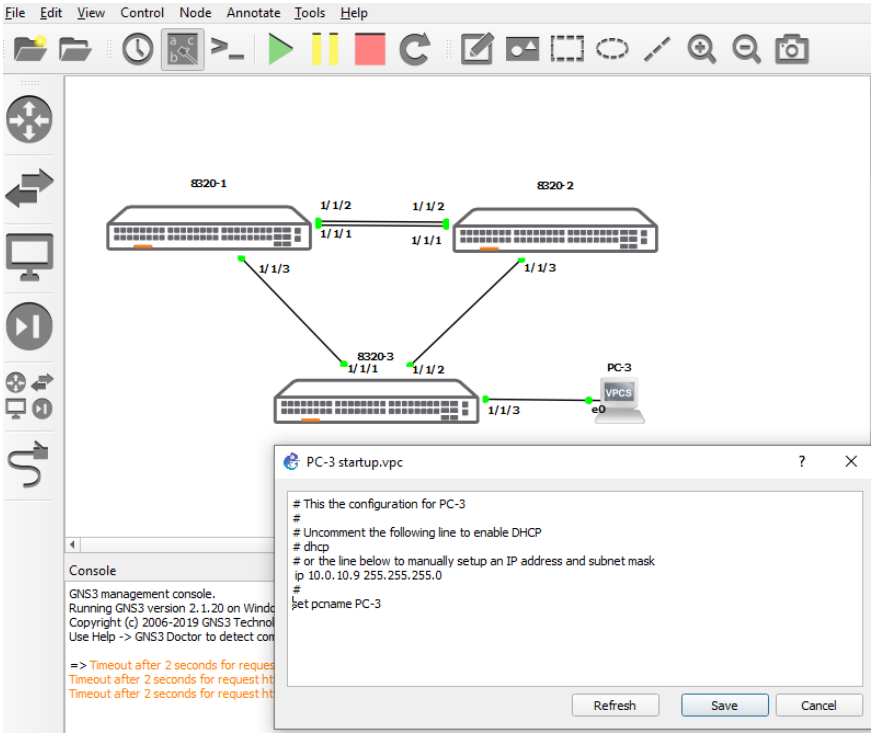
```
8320-3# sh spanning-tree summary root
Spanning tree status: Enabled Protocol: RPVST
Root bridge for VLAN :

                                      Root    Hello Max Fwd
VLAN     Priority     Root ID         cost    Time  Age Dly Root Port
-------- -------- ----------------- --------- ----- --- --- ------------
VLAN10       4096 08:00:09:c8:5a:12     20000     2  20  15        1/1/1
VLAN20       4096 08:00:09:72:d0:20     20000     2  20  15        1/1/2

8320-3#
```

7 VPCS Testing

Here I have added a VPCS as PC-3 to GNS3 that is connected to 8320-3 switch on 1/1/3 interface.



You need to edit the VPCS to assign it an IP address.



Now we'll configure the interface 1/1/3 on 8320-3 to be on VLAN 10.

```
8320-3# sh int b
--------------------------------------------------------------------------------
Port       Native  Mode   Type            Enabled Status  Reason                 Speed
           VLAN                                                                   (Mb/s)
--------------------------------------------------------------------------------
1/1/1      1       trunk  --              yes     up                             1000
1/1/2      1       trunk  --              yes     up                             1000
1/1/3      --      routed --              no      down    Administratively down  --
1/1/4      --      routed --              no      down    Administratively down  --
1/1/5      --      routed --              no      down    Administratively down  --
1/1/6      --      routed --              no      down    Administratively down  --
8320-3#


8320-3# conf t
8320-3(config)# int 1/1/3
8320-3(config-if)# no routing
```

```
8320-3(config-if)# vlan access 10
8320-3(config-if)# no shut
8320-3(config-if)# ^Z
8320-3#
8320-3# sh int b
--------------------------------------------------------------------------------
Port      Native  Mode   Type           Enabled Status  Reason                 Speed
          VLAN                                                                  (Mb/s)
--------------------------------------------------------------------------------
1/1/1     1       trunk  --             yes     up                             1000
1/1/2     1       trunk  --             yes     up                             1000
1/1/3     10      access --             yes     up                             1000
1/1/4     --      routed --             no      down    Administratively down  --
1/1/5     --      routed --             no      down    Administratively down  --
1/1/6     --      routed --             no      down    Administratively down  --
8320-3#
```

Here are the successful pings from 8320-1

```
8320-1# ping 10.0.10.9
PING 10.0.10.9 (10.0.10.9) 100(128) bytes of data.
108 bytes from 10.0.10.9: icmp_seq=1 ttl=64 time=630 ms
108 bytes from 10.0.10.9: icmp_seq=2 ttl=64 time=22.6 ms
108 bytes from 10.0.10.9: icmp_seq=3 ttl=64 time=77.3 ms
108 bytes from 10.0.10.9: icmp_seq=4 ttl=64 time=331 ms
108 bytes from 10.0.10.9: icmp_seq=5 ttl=64 time=181 ms

--- 10.0.10.9 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4007ms
rtt min/avg/max/mdev = 22.618/248.520/630.541/218.004 ms
8320-1#
```

And from 8320-2

```
8320-2# ping 10.0.10.9
PING 10.0.10.9 (10.0.10.9) 100(128) bytes of data.
108 bytes from 10.0.10.9: icmp_seq=1 ttl=64 time=1649 ms
108 bytes from 10.0.10.9: icmp_seq=2 ttl=64 time=639 ms
108 bytes from 10.0.10.9: icmp_seq=4 ttl=64 time=436 ms
108 bytes from 10.0.10.9: icmp_seq=5 ttl=64 time=210 ms

--- 10.0.10.9 ping statistics ---
5 packets transmitted, 4 received, 20% packet loss, time 4056ms
rtt min/avg/max/mdev = 210.679/733.937/1649.112/549.674 ms
8320-2#
```

8 Appendix A – Running Configuration

8.1 Switch 8320-1 Configuration

```
8320-1# sh run
Current configuration:
!
!Version ArubaOS-CX Virtual.10.04.0001
!export-password: default
hostname 8320-1
user admin group administrators password ciphertext
AQBapdSJvDbI8mCzVw141v+U2CPE819nioJBWwMxPn5DR/DVYgAAAEp2TDMjdoehptPcmQgMSyctoBezpsBIp9mGC
Tj8krTJwWclyo64nZbwZVA/9ekvKo7k3wvIAWu3Z3/Kd2Rc24Pjuu9H72TcgWJLMO+1MXVtUVi+vrTfiS/n3WZmfA
gVV6S/
led locator on
cli-session
    timeout 0
!
ssh server vrf mgmt
!
vlan 1,10,20
spanning-tree mode rpvst
spanning-tree
spanning-tree vlan 10,20
spanning-tree vlan 10 priority 1
interface mgmt
    no shutdown
    ip static 192.168.99.1/24
    default-gateway 192.168.99.254
interface lag 101
    no shutdown
    no routing
    vlan trunk native 1
    vlan trunk allowed 10,20
    lacp mode active
interface 1/1/1
    no shutdown
    mtu 2048
    lag 101
interface 1/1/2
    no shutdown
    mtu 2048
    lag 101
interface 1/1/3
    no shutdown
    no routing
    vlan trunk native 1
    vlan trunk allowed 10,20
interface vlan10
    ip address 10.0.10.1/24
interface vlan20
    ip address 10.0.20.1/24
https-server rest access-mode read-write
https-server vrf mgmt
8320-1#
```

8.2 Switch 8320-2 Configuration

```
8320-2# sh run
Current configuration:
```

```
!
!Version ArubaOS-CX Virtual.10.04.0001
!export-password: default
hostname 8320-2
user admin group administrators password ciphertext
AQBapX+j5qWK7K7bO3CfA30uBoX6dz3vNovtRL2jzam0b/NoYgAAABrOdm8ZBHGwRjPANCi6lGfa59dZFptfstxSa
KbHpkKwgQ+agwfeNRCCDUP/vw87aT3lXksFQsa0wTJSdcTkR7hEyOFmWmME250vE8bTUvmn5ZVt0PDih6VqX7BUWs
zuTwQt
led locator on
cli-session
    timeout 0
!
ssh server vrf mgmt
!
vlan 1,10,20
spanning-tree mode rpvst
spanning-tree
spanning-tree vlan 10,20
spanning-tree vlan 20 priority 1
interface mgmt
    no shutdown
    ip static 192.168.99.2/24
    default-gateway 192.168.99.254
interface lag 102
    no shutdown
    no routing
    vlan trunk native 1
    vlan trunk allowed 10,20
    lacp mode active
interface 1/1/1
    no shutdown
    mtu 2048
    lag 102
interface 1/1/2
    no shutdown
    mtu 2048
    lag 102
interface 1/1/3
    no shutdown
    no routing
    vlan trunk native 1
    vlan trunk allowed 10,20
interface vlan10
    ip address 10.0.10.2/24
interface vlan20
    ip address 10.0.20.2/24
https-server rest access-mode read-write
https-server vrf mgmt
8320-2#
```

8.3 Switch 8320-3 Configuration

```
8320-3# sh run
Current configuration:
!
!Version ArubaOS-CX Virtual.10.04.0001
!export-password: default
hostname 8320-3
user admin group administrators password ciphertext
AQBape4cFSNn+kHfqJrC5yqajUJl4OpfWz5j0nlpwqe+KLwNYgAAAA4CROYIKzm6MhJD1Z1AEMVp3OYVlmauMSfKe
j4Ry4zGJQ6+n8SOpV4IRNpktJcHZC1mYQDEGYRhaTEeGZOoGIYvFHmCju6BbkkhpC/yG9M40XC6m+dw51wzNXyn84
VOcthw
led locator on
```

```
!
ssh server vrf mgmt
!
vlan 1,10,20
spanning-tree mode rpvst
spanning-tree
spanning-tree vlan 10,20
interface mgmt
    no shutdown
    ip static 192.168.99.3/24
    default-gateway 192.168.99.254
interface 1/1/1
    no shutdown
    no routing
    vlan trunk native 1
    vlan trunk allowed 10,20
interface 1/1/2
    no shutdown
    no routing
    vlan trunk native 1
    vlan trunk allowed 10,20
interface 1/1/3
    no shutdown
    no routing
    vlan access 10
https-server rest access-mode read-write
https-server vrf mgmt
8320-3#
```