LAB01 - Simple Virtual Port Channel

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Introduction

Virtual Port Channel (vPC) is a feature that enables the extension of a port channel across two different physical switches. The main advantage of this feature is the possibility to configure dual-homing for downstream devices to two upstream switches, without the need for a loop control mechanism such Spanning Tree Protocol.

In this first virtual lab of the tutorial we will learn how to configure vPC in its simplest form (single-sided vPC) and to check all the status related parameters.

If you are attending a live training session, you can skip the Preparation Activities section and go directly to this section.

Prerequisites

- Minimum RAM: 16+ GB
- Windows, MacOS or Linux
- Download and install GNS3
- Download NX-OSv GNS3 appliance
- Download appliance required software: NX-OSv version 7.3.0[^1]

[^1]: A valid Cisco account is required.

Preparation Activities

The following steps show how to setup GNS3 LAB from scratch if you are using GNS3 directly on a Linux (Ubuntu 18.04) host, i.e. without GNS VM.

Currently I'm using GNS3 version 2.2.5.

> ⚠️ If you are using GNS3 VM some step can be slightly different.

GNS3 initial setup

Open GNS3 and go to **File>Import appliance**. Choose the path of the downloaded appliance **cisco-nxosv.gns3a** and click Open in the top right corner. If you didn't change the path while downloading the file, you should find it under **~/Downloads/**.

Select **Install the appliance on your local computer** and press **Next** twice. If you downloaded NX-OSv software (*titanium-final.7.3.0.D1.1.qcow2*) in the **~/Downloads/** folder, you should read **Ready to install** in the status column next to **NX-OSv version 7.3.0**. If so, select it and press **Next**, then **Ok**; otherwise press the **Import** button and select downloaded software before moving forward. Click **Finish** to complete this step.
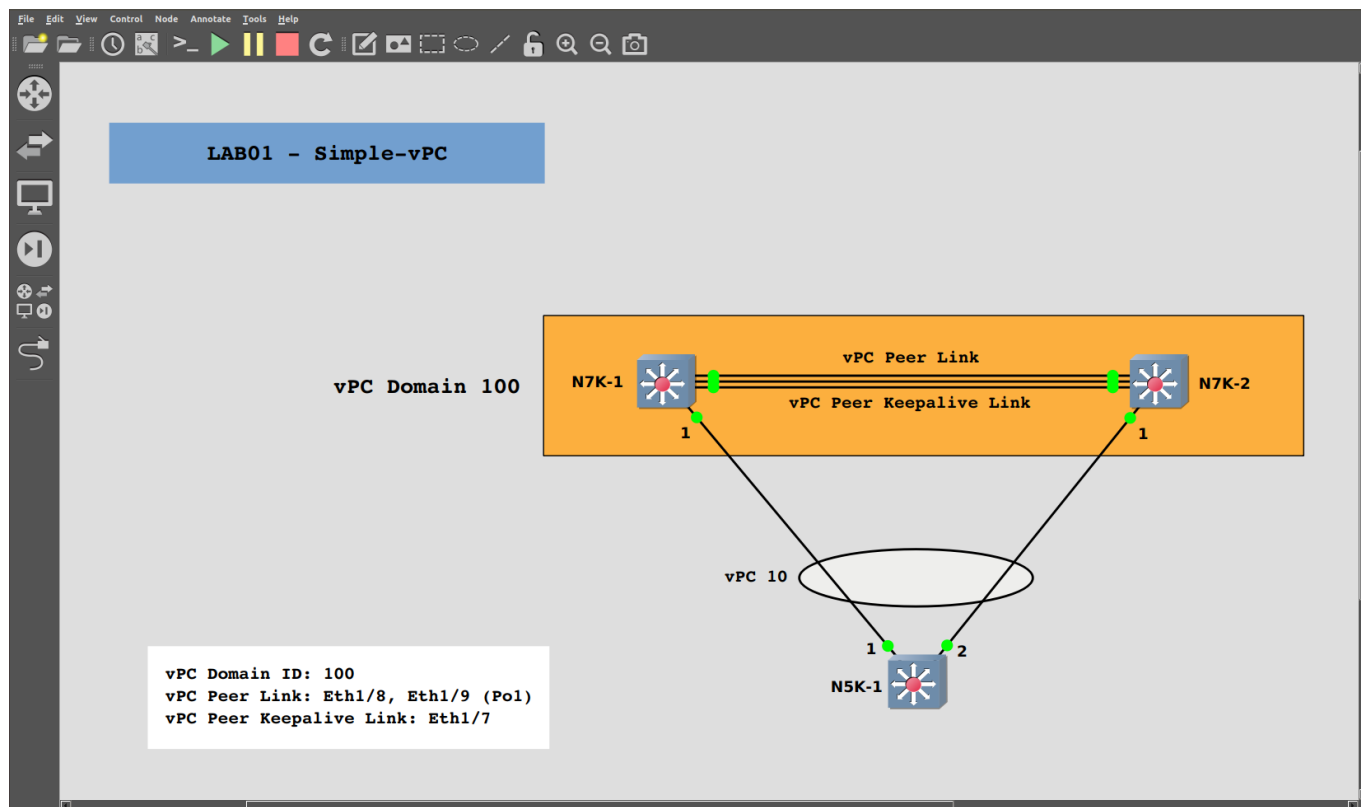
Nexus template setup

Press the **Browse switches** button. It is the icon with the parallel arrows on the left side vertical bar.

Right-click on the newly installed Nexus appliance and select **Configure template**. Under the **Network** tab, fill the *Adapters* form with the value "16" and press the **Ok** button.

GNS3 project setup

We are ready to build the following topology:

Let's create a new GNS3 project. Go to **File>New blank project** and name this project as
TrainingNexus_LAB01_Simple-vPC, or choose the name you prefer. Press **Ok**.

Now press the **Browse switches** button and drag-and-drop 3 times the Nexus template on the workspace.
Rename the devices just linke the previous image: it will be easier to follow next steps. Choose two devices to
be Nexus 7K of the virtual infrastructure, and name them as **N7K-1** and **N7K-2**. The third switch will act as if it
was a Nexus 5K, albeit it is simulated with a Nexus 7K image: name it **N5K-1**.

Before starting the devices we need to create the links between them. As you can see from the topology,
there are 3 links between **N7K-1** and **N7K-2** and 2 links, one for each N7K-1, between **N5K-1** and the other
switches. Creating a link is straightforward: push the **Add a link** button, it is the last icon on the left side
vertical bar, and then click on the two devices you want to connect. Once you click on a device you have to
chose the port you want to use. Please follow the connectivity scheme provided below.

Device 1	Port 1	Port 2	Device 2	Link Role
N7K-1	Ethernet1/7	Ethernet1/7	N7K-2	vPC Peer Keepalive Link
N7K-1	Ethernet1/8	Ethernet1/8	N7K-2	vPC Peer Link
N7K-1	Ethernet1/9	Ethernet1/9	N7K-2	vPC Peer Link
N5K-1	Ethernet1/1	Ethernet1/1	N7K-1	Uplink
N5K-1	Ethernet1/2	Ethernet1/1	N7K-2	Uplink

Please don't consider the last column of the table, the meaning of that roles will be explained later on this
tutorial.

Devices setup

Click on the **Start/resume nodes** button, the one with the green icon on the top bar, and wait for the devices
to start (~5 minutes, but it depends on host resources!). You can follow the boot process of each switch
opening its console: double-click on the switch and a terminal window will pop up displaying device boot
messages.

When prompted, insert the following credentials:

```
username: admin
password: admin
```

▶ CLI view

Now copy-paste the following lines on the switch CLI. We will not go into details on them because they are
not in scope for this tutorial, but they could be useful in particoular if for some reason you need to restart the
devices.

If you are familiar with other Cisco OSes (e.g. IOS or IOS XE ..), consider the second line: it allows you to use
the shortcut "*wr*" to save the configuration during the rest of this tutorial.

```
configure terminal
cli alias name wr copy run sta
no ip domain-lookup
hostname N7K-1
boot nxos bootflash:nxos.7.0.3.I7.3.bin
wr
!
```

⚠️ *These lines can be used as they are for the N7K-1 switch only. For the other two switches you have to customize the hostname before copy-pasting.*

Great, we are ready to start this lab!

Virtual Port Channel Configuration (N7K Side)

We need to perform 5 steps to configure a vPC

- ☐ Enable features
- ☐ vPC Peer Keepalive Link preconfig
- ☐ vPC Domain
- ☐ vPC Peer Link
- ☐ vPC creation

Enable features

The first thing to do when working with Nexus switches is to activate the required features. For this lab we need to enable two features: **LACP** and **VPC**.

Open the console of **N7K-1** and **N7K-2** switches, insert the credentials (*admin/admin*) and use the following commands to enable the features:

```
configure terminal
feature vpc
feature lacp
```

▶ CLI view

These commands don't return any output. To check if the features are enabled, you can use the following commands:

```
show feature | include vpc
```

▶ Command Output

```
show feature | include lacp
```

▶ Command Output

As you can see from the outputs above, the features are *enabled*. If you hadn't enabled them, you would see something like that

```
N7K-1# show feature | include bgp
bgp                          1          disabled
```

> ✔ Well done! Step completed successfully!
>
> **Progress Map**
>
> - ☑ Enable features
> - ☐ vPC Peer Keepalive Link preconfig
> - ☐ vPC Domain
> - ☐ vPC Peer Link
> - ☐ vPC creation

vPC Peer Keepalive Link preconfig

vPC peer keepalive link can be in any VRF, including *default* or *mgmt*. Nevertheless, we are going to create a dedicated VRF for the peer keepalive link. On both **N7K-1** and **N7K-2** use the command

```
vrf context keepalive-link
```

to create the VRF named "*keepalive-link*".

Referring to the connectivity scheme in the GNS3 project setup section, the port **Ethernet1/7** on **N7K-1** and **N7K-2** is used to form the vPC peer keepalive link.

N7K-1 Configuration

```
interface Ethernet 1/7
description *** vPC Peer Keepalive Link ***
no switchport
vrf member keepalive-link
ip address 10.0.100.1/30
no shutdown
```

▶ CLI view

Syntax description:

Command	Purpose
interface Ethernet 1/7	Enters interface Ethernet1/7 configuration mode.
description *** vPC Peer Keepalive Link ***	Sets interface description.
no switchport	Configures the interface as a Layer3 interface.
vrf member keepalive-link	Adds this interface to the "keepalive-link" VRF.
ip address 10.0.100.1/30	Configures the IP address 10.0.100.1/30 for this interface.
no shutdown	Turns on this interface.

N7K-2 Configuration & Link Verification

```
interface Ethernet 1/7
description *** vPC Peer Keepalive Link ***
no switchport
vrf member keepalive-link
ip address 10.0.100.2/30
no shutdown
```

▶ CLI view

As you can see from the commands above, the configuration is almost the same as the the one for the **N7K-1** switch. The only difference is the IP address assigned to the interface Ethernet1/7. You can choose the IP subnet you prefer for the L3 connectivity on the peer keepalive link: just make sure to assign two different IP addresses in the same subnet to the link ends.

Let's check L3 connectivity on the peer keepalive link. On **N7K-2** use the command:

```
ping 10.0.100.1 vrf keepalive-link
```

▶ Command Output

If your output is similar to the one above you are fine, otherwise look for typos in the configurations with some *show* command, e.g.>

```
show run interface Ethernet1/7
```

or verify the interface operational status

```
show ip interface brief vrf keepalive-link
```

✔️ Well done! Step completed successfully!

Progress Map

- ☑ Enable features
- ☑ vPC Peer Keepalive Link preconfig
- ☐ vPC Domain
- ☐ vPC Peer Link
- ☐ vPC creation

vPC Domain

Now, let's create the vPC Domain *100* on both **N7K-1** and **N7K-2**:

N7K-1 Configuration

```
vpc domain 100
peer-keepalive destination 10.0.100.2 source 10.0.100.1 vrf keepalive-link
```

▶ CLI view

N7K-1(config-vpc-domain)# peer-keepalive destination 10.0.100.2 source 10.0.100.1 vrf keepalive-link N7K-1(config-vpc-domain)#

N7K-2 Configuration

```
vpc domain 100
peer-keepalive destination 10.0.100.1 source 10.0.100.2 vrf keepalive-link
```

▶ CLI view

✔️ Well done! Step completed successfully!

Progress Map

- ☑ Enable features
- ☑ vPC Peer Keepalive Link preconfig
- ☑ vPC Domain
- ☐ vPC Peer Link
- ☐ vPC creation

vPC Peer Link

One more piece of configuration has to be completed before actually creating the vPC: the vPC Peer Link.

To create the vPC Peer Link, we have to aggregate at least two 10G interfaces on each switch that is part of the vPC Domain. Referring to the connectivity scheme in the GNS3 project setup section, the ports **Ethernet1/8** and **Ethernet1/9** on both **N7K-1** and **N7K-2** are used to form the vPC peer link. Use the following commands on both **N7K-1** and **N7K-2**:

```
interface Ethernet 1/8-9
switchport
channel-group 1 mode active
interface port-channel 1
description *** vPC Peer Link ***
switchport
switchport mode trunk
vpc peer-link
no shutdown
```

▶ CLI view

Syntax description:

Command	Purpose
interface Ethernet 1/8-9	Specifies the interface that you are configuring.
switchport	Configures the interfaces as a Layer2 interface.
channel-group 1 mode active	Configures the ports in the channel group *1* and sets the mode *active* (LACP protocol)
no shutdown	Turns on these interfaces.
interface port-channel 1	Enters the interface port-channel1 configuration mode.
description *** vPC Peer Link ***	Sets interface description.
switchport mode trunk	Configures the interface as a Layer 2 trunk port.
vpc peer-link	Configures the selected port channel as the vPC peer link.

To see the operational status of the port-channel and its interface members, use the following command:

```
show port-channel summary
```

▶ Command Output

The expected port-channel state is **SU**, i.e. *Switched* and *Up*. If you see a different code next to *Po1*, something was not configured properly and you need to look for errors in the configuration. If you are

completely sure that the commands are correct, turn off and then turn back on the port-channel member interfaces, like this:

```
interface Ethernet1/8-9
shutdown
no shutdown
```

✔️ Well done! Step completed successfully!

Progress Map

- ☑ Enable features
- ☑ vPC Peer Keepalive Link preconfig
- ☑ vPC Domain
- ☑ vPC Peer Link
- ☐ vPC creation

vPC creation

In this final step we have to assign two interfaces, one for each Nexus 7K switch, to the port-channel that sees the Nexus **N5K-1** at the other end. This port-channel will be our vPC. That means that even if the two member interfaces reside on two different devices, they will be part of the same link aggregation group thanks to the previous configuration steps.

On both **N7K-1** and **N7K-2** use use the following commands to configure the vPC. The interfaces are defined in the connectivity scheme of the GNS3 project setup section.

```
interface Ethernet 1/1
description *** vPC 10 ***
switchport
channel-group 10 mode active
no shutdown
interface port-channel 10
switchport mode trunk
vpc 10
```

▶ CLI view

Now that we have finally completed the vPC configuration (on N7K side...), we can check if all the main parameters are properly set or if there is something in an unexpected or inconsitent status between the vPC peers.

For the purpose of this LAB, please use the following commands to inspect the operational state of the vPC:

Command	Description

Command	Description
show running-config vpc	Shows the running configuration for all vPCs.
show vpc brief	Displays brief information about all vPCs.
show vpc peer-keepalive	Displays information about the keepalive messages of vPC.

Please find below the expected outputs.

show running-config vpc

▶ CLI view

!Command: show running-config vpc !Time: Fri Jan 24 13:09:22 2020

version 7.0(3)I7(3) feature vpc

vpc domain 100 peer-keepalive destination 10.0.100.2 source 10.0.100.1 vrf keepalive-link

interface port-channel1 vpc peer-link

interface port-channel10 vpc 10

!!!

N7K-2# show running-config vpc

!Command: show running-config vpc !Time: Fri Jan 24 13:14:00 2020

version 7.0(3)I7(3) feature vpc

vpc domain 100 peer-keepalive destination 10.0.100.1 source 10.0.100.2 vrf keepalive-link

interface port-channel1 vpc peer-link

interface port-channel10 vpc 10

show vpc brief

▶ CLI view

vPC domain id : 100 Peer status : peer adjacency formed ok
vPC keep-alive status : peer is alive
Configuration consistency status : success Per-vlan consistency status : success
Type-2 consistency status : success vPC role : primary
Number of vPCs configured : 1
Peer Gateway : Disabled Dual-active excluded VLANs : - Graceful Consistency Check : Enabled Auto-
recovery status : Disabled Delay-restore status : Timer is off.(timeout = 30s) Delay-restore SVI status : Timer
is off.(timeout = 10s) Operational Layer3 Peer-router : Disabled

vPC Peer-link status -- id Port Status Active vlans
-- ---- ------ -- 1 Po1 up 1

vPC status --- Id Port Status Consistency Reason
Active vlans

---

10 Po10 down* success success -

!!

N7K-2# show vpc brief Legend: (*) - local vPC is down, forwarding via vPC peer-link

vPC domain id : 100 Peer status : peer adjacency formed ok
vPC keep-alive status : peer is alive
Configuration consistency status : success Per-vlan consistency status : success
Type-2 consistency status : success vPC role : secondary
Number of vPCs configured : 1
Peer Gateway : Disabled Dual-active excluded VLANs : - Graceful Consistency Check : Enabled Auto-recovery status : Disabled Delay-restore status : Timer is off.(timeout = 30s) Delay-restore SVI status : Timer is off.(timeout = 10s) Operational Layer3 Peer-router : Disabled

vPC Peer-link status -- id Port Status Active vlans
-- ---- ------ -- 1 Po1 up 1

vPC status --- Id Port Status Consistency Reason
Active vlans

---

10 Po10 down* success success -

show vpc peer-keepalive

▶ CLI view

N7K-1# show vpc peer-keepalive

vPC keep-alive status : peer is alive
--Peer is alive for : (15915) seconds, (159) msec --Send status : Success --Last send at : 2020.01.24
13:26:45 596 ms --Sent on interface : Eth1/7 --Receive status : Success --Last receive at : 2020.01.24
13:26:45 602 ms --Received on interface : Eth1/7 --Last update from peer : (0) seconds, (282) msec

vPC Keep-alive parameters --Destination : 10.0.100.2 --Keepalive interval : 1000 msec --Keepalive timeout :
5 seconds --Keepalive hold timeout : 3 seconds --Keepalive vrf : keepalive-link --Keepalive udp port : 3200 --
Keepalive tos : 192

!!

N7K-2# show vpc peer-keepalive

vPC keep-alive status : peer is alive
--Peer is alive for : (15948) seconds, (469) msec --Send status : Success --Last send at : 2020.01.24
13:27:17 811 ms --Sent on interface : Eth1/7 --Receive status : Success --Last receive at : 2020.01.24
13:27:17 816 ms --Received on interface : Eth1/7 --Last update from peer : (0) seconds, (577) msec

vPC Keep-alive parameters --Destination : 10.0.100.1 --Keepalive interval : 1000 msec --Keepalive timeout : 5 seconds --Keepalive hold timeout : 3 seconds --Keepalive vrf : keepalive-link --Keepalive udp port : 3200 -- Keepalive tos : 192

> ✔️ Well done! Step completed successfully!
>
> *Progress Map*
>
> - ☑ Enable features
> - ☑ vPC Peer Keepalive Link preconfig
> - ☑ vPC Domain
> - ☑ vPC Peer Link
> - ☑ vPC creation

Virtual Port Channel Configuration (N5K Side)

Honestly, the title of this section is absolutely misleading.

There is not any "*vPC configuration*" on the N5K side, because in this lab we are configuring a single-sided vPC, and this means that only on the N7K switches side there are some "special" settings, while on the N5K side the vPC is equal to an old-fashioned port-channel.

Nevertheless, the architectural scenario of all these three switches is a vPC, even if on one side the vPC configuration collapses on the port-channel configuration.

To complete this short section you have to aggregate the two interfaces **Ethernet1/1** and **Ethernet1/2** on the **N5K-1** in a port-channel.

This activity has only 2 steps:

- Enable LACP feature
- Create port-channel

We already did both of these steps during the vPC configuration on N7K side, no further details are needed.

Before configuring this port-channel, notice that in this output the vPC status is ***down****: that's because that interface does not see any LACP BPDU coming from the link.

Use the followings to configure the port-channel on **N5K-1**:

```
configure terminal
feature lacp
interface Ethernet 1/1-2
switchport
channel-group 10 mode active
no shutdown
interface port-channel 10
description *** vPC 10 ***
switchport mode trunk
```

▶ CLI view

Run again the command *show vpc brief* on the **N7K-1** or on the **N7K-2**: now you should be able to see the vPC status as ***up***:

```
show vpc brief
```

▶ CLI view

vPC domain id : 100 Peer status : peer adjacency formed ok

vPC keep-alive status : peer is alive

Configuration consistency status : success Per-vlan consistency status : success

Type-2 consistency status : success vPC role : primary

Number of vPCs configured : 1

Peer Gateway : Disabled Dual-active excluded VLANs : - Graceful Consistency Check : Enabled Auto-recovery status : Disabled Delay-restore status : Timer is off.(timeout = 30s) Delay-restore SVI status : Timer is off.(timeout = 10s) Operational Layer3 Peer-router : Disabled

vPC Peer-link status -- id Port Status Active vlans

-- ---- ------ --- 1 Po1 up 1

vPC status -- Id Port Status Consistency Reason Active vlans -- ------------ ------ ---------- ------ -------------- 10 Po10 up success success 1

Conclusions

👍 Congratulations! You just completed this LAB!

In this LAB we learnt **how to**:

- set up the required softwares to build up the virtual environment;
- configure a single-sided Virtual Port Channel between two Nexus 7K and a Nexus 5K

In the next LAB we will see how to configure a dual-sided Virtual Port Channels, so as to take full advantage of the vPC feature.