Installation and Configuration Guide for PROXMOX VE

Multi-Device Pod (MDP)

Document Version: 2025-6-09

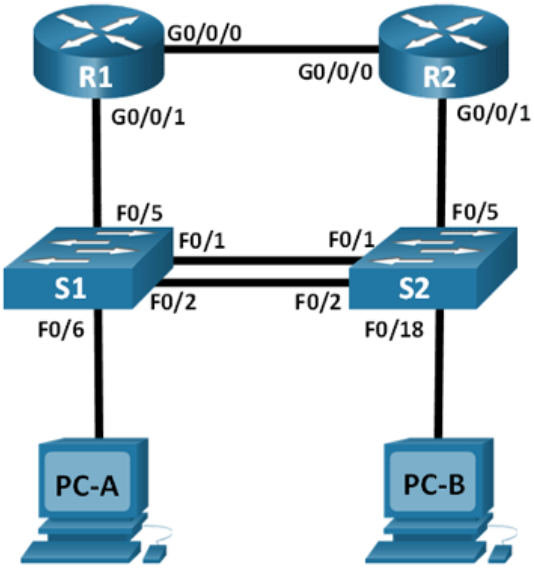
For Cisco Networking Academy® courses, including:

CCNA ROUTING AND SWITCHING V7

The *CCNAv7* courses supported using the *Multi-Device Pod* require **NETLAB+ VE 25.0.0** or greater for Proxmox VE.

1 Introduction

The *NETLAB+ Multi-Device Pod (MDP)* is a versatile pod, which includes **2 routers and 2 switches**. This pod is designed to support *CCNA1: Introduction to Networks v7*, *CCNA2: Switching, Routing, and Wireless Essentials v7*, and *CCNA3: Enterprise Networking, Security, and Automation v7* labs.



The *Multi-Device Pod (MDP)* features direct access to router and switch consoles. Integration with a separate *Proxmox VE* server supports up to 2 virtual PCs. *NETLAB+* can provide remote access to the keyboard, video, and mouse of the *Proxmox VE* virtual machines in the pod.

NETLAB+ users in a team or instructor-led class can share access to a device console or PC.

1.1 Deviations

Remote users may get confused by local deviations from the standard curriculum and labs. The curriculum is relatively complex and offers many opportunities to "make adjustments to the labs". If your *NETLAB+* pods will be made accessible outside your local Academy, you should carefully consider the impact of deviations and substitutions.

Even if your user community is local or relatively small, we recommend that you (1) document the specifics of your pods and (2) use the *NETLAB+ News and Announcements* feature to point users to your documentation.

1.2 Remote PC Support

A *Multi-Device Pod (MDP)* supports up to 2 remote PCs implemented using *Proxmox VE*. *NETLAB+* allows several settings for each:

- Users can control the keyboard, video, and mouse.
- Users can power on, shutdown, reboot, and revert to a clean state.
- Users can have administrator rights.

The *NETLAB+ Virtual Machine Infrastructure* provides detailed, version-specific information on the implementation of Proxmox VE and virtual machines.

1.3 Dynamic Topologies

The *Multi-Device Pod* features dynamic topologies. *NETLAB+* can alter the topology and reposition PCs by manipulating VLANs on the control switch. This is done automatically based on the selected lab exercise. Instructors can change exercises and topologies during instructor-led class reservations.

2 Lab Device & Software Requirements

Lab devices are part of the topology, and users can interact with them either directly or indirectly. The lab device requirements vary for the *Multi-Device Pod (MDP)*, depending on the *Cisco* equipment you plan to use.

Please also refer to the NDG website for the latest information:
https://www.netdevgroup.com/content/cnap/topologies/multidevice_pod.html

- If you plan to use your *Multi-Device Pod (MDP)* for the *CCNA1 v7*, *CCNA2 v7*, and *CCNA3 v7* courses, please refer to the lab device requirements in Section 2.1.

Other equipment may work if it is supported by *NETLAB+* and can meet the minimum requirements for feature sets, interfaces, IOS, RAM, and Flash. A list of *NETLAB+* supported lab equipment can be found on the NDG website. Please note, compatibility with *NETLAB+* does not guarantee compatibility with the Academy labs.

2.1 Lab Device Requirements for CCNA1 v7, CCNA2 v7, CCNA3 v7

Details on requirements are provided on the lab pages for each course:

CCNA1 v7:
https://www.netdevgroup.com/content/cnap/labs/ccna_v7_intro_to_networks.html
CCNA2 v7:
https://www.netdevgroup.com/content/cnap/labs/ccna_v7_routing_and_switching_essentials.html
CCNA3 v7:
https://www.netdevgroup.com/content/cnap/labs/ccna_v7_enterprise_networking.html

Device	Recommended Model(s)	Minimum DRAM	Minimum Flash	Minimum IOS	Feature Set/Technology Packages
R1	Cisco 4221 Cisco 4321 Cisco 4331	4 GB 4GB 4 GB	8 GB 4 GB 4 GB	Fuji - 16.9.4 (MD)	IPBase, Security

Device	Recommended Model(s)	Minimum DRAM	Minimum Flash	Minimum IOS	Feature Set/Technology Packages
R2	Cisco 4221 Cisco 4321 Cisco 4331	4 GB 4GB 4 GB	8 GB 4 GB 4 GB	Fuji - 16.9.4 (MD)	IPBase, Security
S1	Cisco WS-C2960+24TC-L	128 MB	64 MB	15.2.7E4 (MD)	LAN Base
S2	Cisco WS-C2960+24TC-L	128 MB	64 MB	15.2.7E4 (MD)	LAN Base

The global command **boot enable-break** must be enabled on all switches for proper operation. Please refer to Section 6.

2.2 VM Resource Requirements

A *Multi-Device Pod (MDP)* supports 2 *Proxmox VE* virtual machines. The *NETLAB+* supported *Proxmox VE* virtualization product is installed on a separate server.

The following virtual machines listed, along with their storage requirements, are to be used in each pod instance.

Virtual Machine	Pod Deployment (Thin Provisioned)	Maximum Allocated Memory
PC-A	24.1 GB	6 GB
PC-B	24.1 GB	6 GB
Total	**48.2 GB**	**12 GB**

2.3 Proxmox VE Host Server Requirements

Please refer to the *NDG* website for specific *Proxmox VE* host requirements to support virtual machine delivery: https://www.netdevgroup.com/products/requirements/

The deployment of the *Multi-Device Pod (MDP)* requires *Proxmox VE* version of **8.4** or greater.

The number of **active** pods that can be used simultaneously depends on the *NETLAB+* product license and the number of *Proxmox VE* host servers meeting the hardware requirements specifications.

2.4 NETLAB+ Requirements

Installation of the *Multi-Device Pod (MDP)*, as described in this guide, requires that you are running *NETLAB+ VE* **25.0.0 or greater**.

Previous versions of *NETLAB+* do not support requirements for the *Multi-Device Pod (MDP)* on the physical host servers for Proxmox VE.

Please refer to the *NETLAB+ Virtual Machine Infrastructure*.

2.5 NETLAB+ Virtual Machine Infrastructure Setup

The *NETLAB+ Virtual Machine Infrastructure* setup is described in the following sections of the *NETLAB+ Virtual* Machine Infrastructure*:*

- *Registering a Datacenter in NETLAB+*
- *Adding hosts in NETLAB+*
- *Proactive Resource Awareness*

It is important to configure *Proactive Resource Awareness* to maximize the number of active pods per physical *Proxmox VE* host.

2.6 Software Requirements

For the purpose of software licensing, each virtual machine is treated as an individual machine, PC, or server. Please refer to the specific vendor license agreements (and educational discount programs, if applicable) to determine licensing requirements for your virtual machines' software, operating system, and applications.

The minimum virtual infrastructure software required for standing up this pod is in the following table.

Virtual Infrastructure Requirements

Software	Version
Proxmox VE	8.4

2.7 Networking Requirements

To accommodate the movement of large *VMs* and *ISO* disk images from one host to another, gigabit Ethernet or better connectivity is recommended to interconnect your *NETLAB+* and *Proxmox VE* host systems.

The two standard networking models recommended to interconnect your servers are described in detail in the *Networking Models* section of the *NETLAB+ Virtual Machine Infrastructure*.

2.8 Obtaining Windows Software Licenses

The following table lists the software that is required for the virtual machines inside the *Multi-Device Pod (MDP)*. Your organization needs to be a member of the vendor programs listed in the *Source* column to obtain and use the licenses. To subscribe to the *Microsoft Azure Dev Tools for Teaching* program, visit: https://azureforeducation.microsoft.com/en-us/Institutions.

Pod Software Requirements

Software	Version	Source
Windows	10 Pro (64-bit)	Azure Dev Tools for Teaching

To enable all features of the *Windows*-based virtual machines, licensing will be required, followed through with activations. This needs to be done before cloning.

For more information regarding the *Microsoft Azure Dev Tools for Teaching* program, you may visit their FAQ page: https://azure.microsoft.com/en-us/education/institutions/dev-tools-for-teaching-faq/.

It is recommended to acquire the *Multiple Activation Key* (*MAK*) lab key license for a specified *Windows* product. This type of key enables you to activate multiple installations of a product with the same key.

2.9 Setup NDG VM Distribution Storage

The virtual machines are made available from the NDG VM Distribution System. Please follow the guide at *NDG VM Distribution System*.

This pod requires you are connected to the **vmdist.cisco.windows** storage.

To request access to the preconfigured virtual machine templates from *CSSIA* and *NDG*:

1. Go to *the CSSIA VM Image Sharing Agreement* page: CSSIA VM Image Sharing Agreement
2. Complete and submit your access request by following the instructions on the request form.
3. *CSSIA* will confirm your access and notify *NDG Support*.
4. NDG Support will authorize your access to the NDG VM Distribution System.
5. Contact NDG Support if you need your username and password credentials.

3 Control Device Requirements

NETLAB+ control devices provide internal connectivity, console access, and managed power. Control devices are dynamically managed by *NETLAB+* and are not accessible or configurable by lab users.

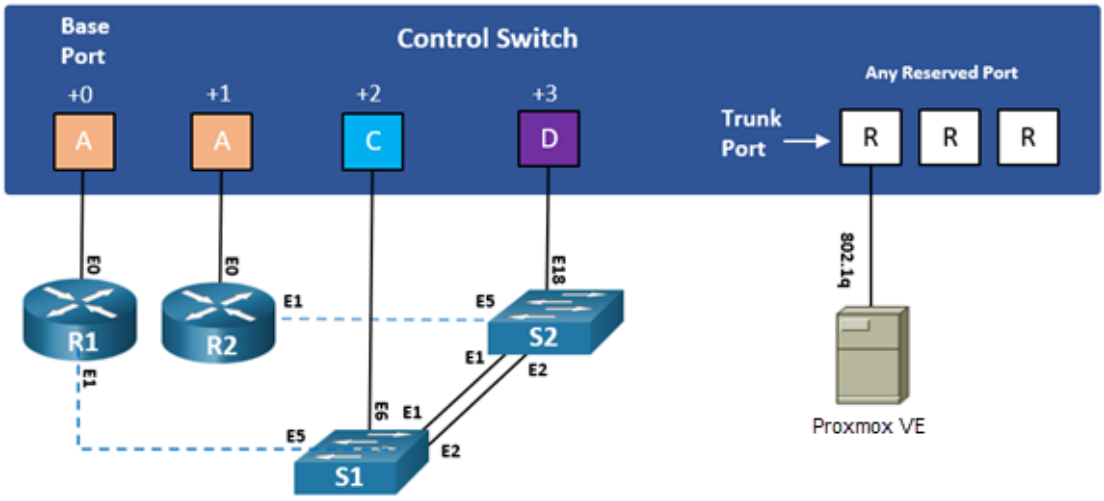
The *Real Equipment Pod Installation Guide* explains how to add, change, or delete control devices.

A *Multi-Device Pod (MDP)* requires the following control device resources:

Control Device Resource	Quantity Required
Control Switch	**4** consecutive ports **1** reserved port (Proxmox VE)
Access Server	**4** lines
Power Distribution Units	**4** outlets

3.1 Control Switch Overview

NETLAB+ uses a control switch to provide connectivity between devices in a Multi-Device Pod and Proxmox VE server(s). This pod requires **4 consecutive ports** on a supported control switch (other than a Catalyst 1900 series).

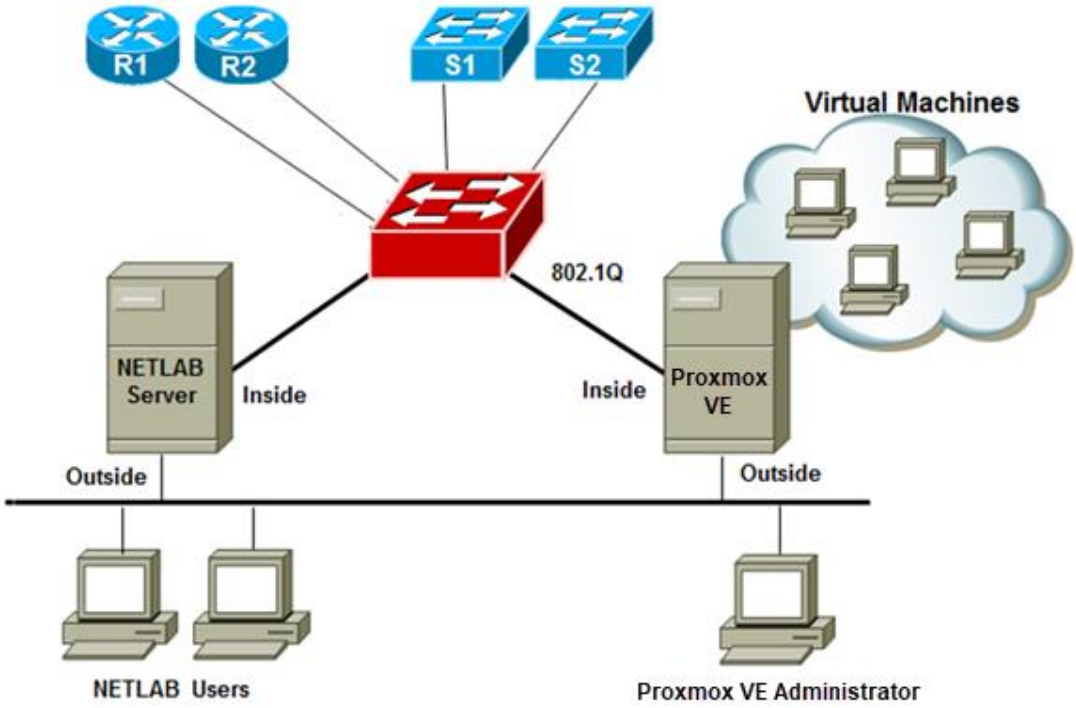


Ports are labeled **+0** to **+3** in the diagram and are relative to the *base port*. These ports must be consecutive on the same control switch. As with all pods, you choose a base port for the pod during pod installation. A control switch can support multiple pods. To determine the actual port numbers used for this pod, add the base port number to the relative port numbers shown in the diagram. For example, if the base port is 4, the actual port numbers will be 4 to 7.

Using SNMP, *NETLAB+* will automatically set up VLANs and configure ports on the control switch. These VLANs are depicted as letters “A” through “D” and represent one subnet in the topology. Each *NETLAB+* pod has a unique *VLAN pool,* and the actual VLAN numbers will be unique for each *NETLAB+* pod. This is to avoid conflict between multiple pods.

One “reserved” port on the control switch connects to an 802.1q NIC card on the Proxmox VE server. This allows devices in the pod to communicate with virtual machines.

The reserved port may be located on a different control switch, provided that all links between control switches are also configured as 802.1q trunks, and all VLANs are allowed. You may also have more than one Proxmox VE server.



It is important that control switches are equipped with the minimum required image. For a supported list of device images for the control switch, please visit:
https://www.netdevgroup.com/support/netlabve_control_devices.html#control_switch

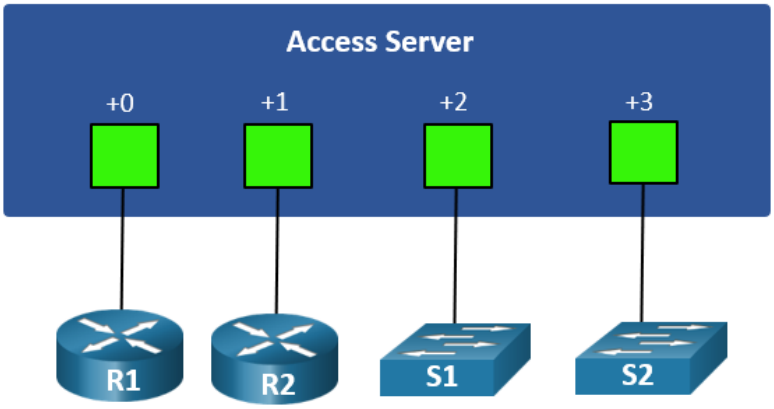
3.2 Access Server Ports

Access servers provide console connections to lab routers so that users can access them from *NETLAB+*. Users do not communicate directly with the access server. Rather, all connections are proxied through *NETLAB+*.

A *Multi-Device Pod (MDP)* requires **4** access server ports.

Please Note

These ports do not have to be consecutive and can span multiple access servers.



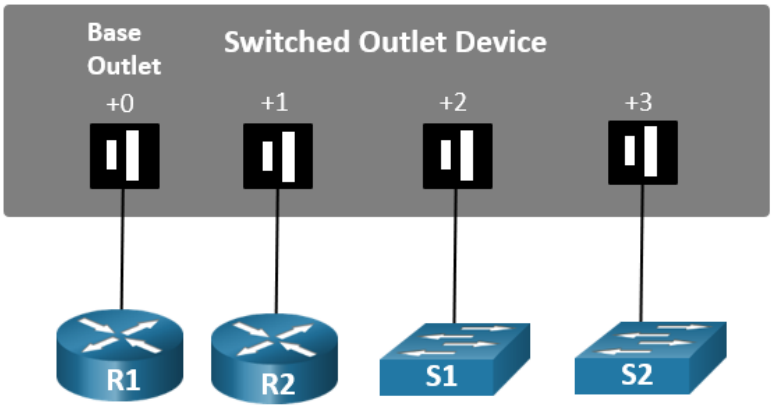
It is important that access servers are equipped with the minimum required image. To view the most current recommended device image for the access server, please visit:
https://www.netdevgroup.com/support/netlabve_control_devices.html#access_server

3.3 Power Distribution Units

Power distribution units (PDUs), also known as switched outlet devices, provide managed electrical power, allowing *NETLAB+* and users to turn lab equipment on and off. A *Multi-Device Pod (MDP)* requires **4** outlets, one for each router and switch.

Please Note

Outlets do not have to be consecutive and may span multiple PDUs (i.e., APC7900 or APC7920).



4 Pre-requisites

This section covers tasks that should be executed prior to adding a *Multi-Device Pod (MDP)*.

4.1 Understanding Proxmox VE Virtualization and Virtual Machines

The *NETLAB+ Virtual* Machine Infrastructure provides detailed, version-specific information on the implementation of *Proxmox VE* virtualization product and virtual machines.

4.2 Setup Control Devices

Using the guidelines in *Section 3*, decide which control switch ports, access server ports, and power distribution units you will use for your *Multi-Device Pod (MDP)*. Add control devices if necessary. Control device configuration is documented in the *Real Equipment Pod Installation Guide*.

4.3 Upload IOS Images

Upload the IOS images for the lab routers. *NETLAB+* will recover these images on the devices if they are erased from flash.

4.4 Disable User Logins (optional)

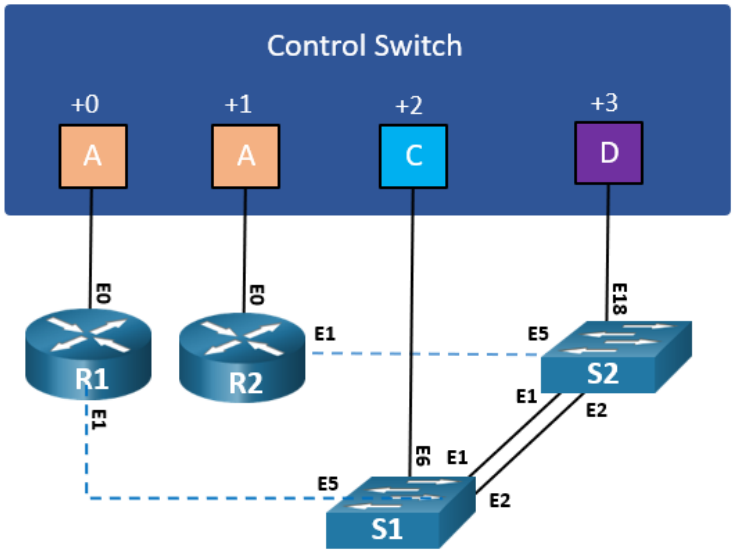
You must take all equipment pods offline to add pods or configure control devices. You may wish to disable user logins during this time.

5 Pod Configuration

This section walks you through the process of adding a *Multi-Device Pod (MDP)*.

5.1 Cable the Pod

Use the diagram below to cable the *Multi-Device Pod (MDP)* to a control switch.



Then proceed to cable the access server lines as well as the PDU outlets; use *Section 3* from this guide as a reference.

5.2 Deploying from NDG VM Distribution System

Deploy on your management server the pod virtual machine files from the NDG VM Distribution System.

1. Navigate to your **Proxmox VE Management Server** using your management workstation in a web browser.
2. Using your navigation panels, in the **Resource Tree**, navigate to **Datacenter** > *your_management_server* > **vmdist.cisco.windows**.
3. In the **Content Panel**, select **Backups**.
4. In the Notes column, select the name **Cisco-MDP.PC-A** *(build).*

Pod VM Name	VM OS	VM ID	Notes
PC-A	Windows 10	4211011	Cisco-MDP.PC-A *(build)*
PC-B	Windows 10	4211012	Cisco-MDP.PC-B *(build)*

Please Note

These build numbers may vary. Please refer to the Release Notes of the content to determine the latest version.

5. Click the **Restore** button.
6. In the **Restore: VM** popup window, select your **Storage** (generally NETLAB1).
7. Set the **VM** field to *4211011.*
8. Click the **Restore** button.
9. *Proxmox VE* will begin deploying the virtual machine. This may take some time, depending on the speed of your connection, HDDs, etc. Repeat the previous steps for each remaining virtual machine in the pod.

5.3 Make Changes to Virtual Machines

Some pods have software that needs to be altered on the host machine before it can be used properly. This normally happens when software requires licenses to function.

For the *Multi-Device Pod (MDP)* you will need to license all the *Microsoft Windows* machines.

5.3.1 Virtual Machine Credentials

For your reference, the following table provides a list of the credentials for the systems in the pod:

Machine	User name	Password
PC-A	sysadmin	Train1ng$
PC-B	sysadmin	Train1ng$

5.3.2 Provide Temporary Internet Access to the PC-A and PC-B VMs

1. Navigate to your **Proxmox VE cluster** using your management workstation, and login.
2. Using your navigation panels, in the *Resource Tree*, navigate to *Datacenter*, your management server and expand its view to see the virtual machines deployed in *Section 5.2*.
3. Locate the **PC-A** virtual machine. In the *Content Panel*, select **Hardware**.
4. Select *Network Device (net0)* and click the **Edit** button.
5. In the *Edit: Network Device* window, set the *Bridge* field to an internet-accessible bridge.

Alternatively, you can add a new *Network Device* to the VM and use it to link to a virtual machine port group that is linked to an internet accessible physical adapter.

6. Click **OK** to confirm the changes.
7. Repeat these instructions for the **PC-B** virtual machine.

5.3.3 License and Activate PC-A and PC-B

1. Select **PC-A** virtual machine and click the **Start** button in the upper right.
2. Click the down arrow next to the **Console** button in the upper right, and select **noVNC.**
3. Make sure the TCP/IP settings are temporarily configured correctly so that the internet is reachable. This can vary depending on how your environment is set up.

If you added a new temporary *Network Device* from the previous section, make sure to configure the *TCP/IP* settings for the newly added network adapter and use it to connect out to the internet.

4. Click on the **Start** icon in the lower left.
5. Right-click on **This PC** and select **Properties**.
6. On the *System* window, in the *Windows activation* pane, click the **Activate Windows** link.
7. Enter the product key.
8. Windows should now be activated.
9. Repeat these instructions for the **PC-B** virtual machine.

5.3.4 Shut Down PC-A and PC-B

1. While on the *PC-A* machine, click the **Start** menu followed by clicking the **Shut Down** button.
2. Repeat these instructions for the **PC-B** virtual machines.

5.3.5 Reset the NIC to SAFETY_NET

1. Navigate to your **Proxmox VE cluster** using your management workstation, and login.
2. Using your navigation panels, in the *Resource Tree*, navigate to *Datacenter*, your management server and expand its view to see the virtual machines deployed in *Section 5.2*.
3. Locate the **PC-A** virtual machine. In the *Content Panel*, select **Hardware**.

4. Select *Network Device (net0)* and click the **Edit** button.
5. In the *Edit: Network Device* window, set the *Bridge* field to **SAFETY_NET**.

If you added a new temporary *Network Device* from the previous section, make sure to remove the *Network Device*.

10. Click **OK** to confirm settings.
11. Repeat these instructions for the **PC-B** virtual machine.

5.3.6 Create a Snapshot on the Changed Virtual Machines

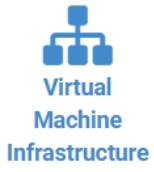
1. Locate the **PC-A** virtual machine. In the *Content Panel*, select **Snapshots**.
2. Click the **Take Snapshot** button.
3. In the *Create Snapshot* window, type **GOLDEN** or whatever prior snapshot name the virtual machine had. Click **Take Snapshot** to take a snapshot.
4. Repeat these instructions for the **PC-B** machine.

5.4 NETLAB+ Virtual Machine Inventory Setup

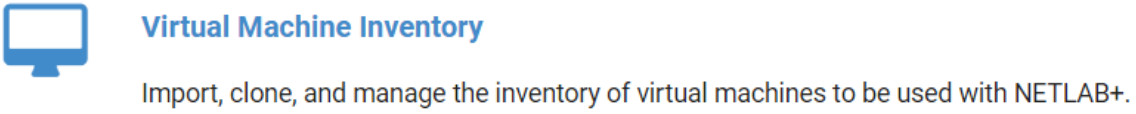
This section will guide you in adding your master virtual machines to the *Virtual Machine Inventory* of your *NETLAB+ VE* system and preparing host servers for use.

5.4.1 Add Master Virtual Machines to NETLAB+ Virtual Machine Inventory

1. Log in to your *NETLAB+ VE* system using the administrator account.
2. Select the **Virtual Machine Infrastructure** icon.



3. Click the **Virtual Machine Inventory** icon.



4. Click the **Import Virtual Machines** button located at the bottom of the list.

5. Select the appropriate datacenter from the list where your VMs reside.
6. Select the checkbox next to the virtual machines you had just deployed and click **Import Selected Virtual Machines**.

7. When the *Configure VMs* window loads, you can set your virtual machine parameters.

    a. Check the dropdown box for the correct operating system for each imported virtual machine.
    b. Change *Role* to **Master** for each VM.
    c. Add any comments for each virtual machine in the last column.

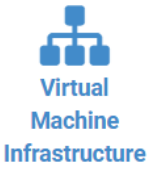
It is advised to leave the *Version* and *Build* numbers for reference when requesting *NDG* support.

    d. Verify your settings and click **Import (X) Virtual Machines** (notice the number in parenthesis is dynamic, depending on the amount of VMs selected).

    e. Verify all *Import Statuses* report back with *OK* and then click on the **Dismiss** button.
    f. Verify that your virtual machines show up in the inventory.

5.4.2 Create Full Clone Templates on Host Server

1. Log in to your *NETLAB+ VE* system using the administrator account.
2. Select the **Virtual Machine Infrastructure** icon.



3. Click the **Virtual Machine Inventory** icon.

Virtual Machine Inventory

Import, clone, and manage the inventory of virtual machines to be used with NETLAB+.

4. Select **Cisco-MDP.PC-A** from the list of virtual machines.
5. Scroll to the bottom and click the **Clone** button.
6. Set the **Parent Snapshot** field is pointing to the snapshot taken in *Section 5.3.6*.
7. Set the **Clone Name** field to a valid name.

NDG recommends you name this virtual machine with the following format for clarity and ease of troubleshooting:
host_identifier-TEMPLATE.MDP.PC-A
i.e. **H21-TEMPLATE.MDP.PC-A**

8. Set **Clone Role** to **Template.**
9. Set **Runtime Host or Group** to your host server. This should **NOT** be your management server.
10. Set **Datastore** to the storage of your choice. This should be **NETLAB1** or **NETLAB2** if you have multiple drives.
11. Click the **Clone** button.
12. Repeat these instructions for the **PC-B** machine.

5.5 Enabling Cisco CCNA v7 in Course Manager

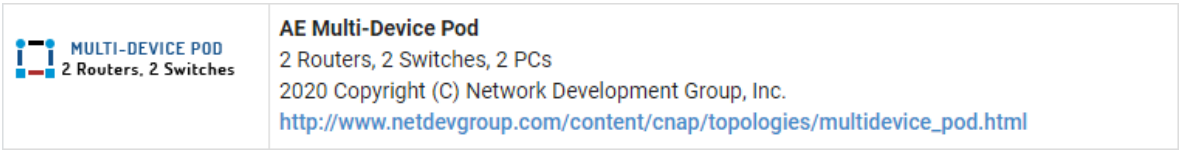
Please refer to the *Course Manager* section *of the NETLAB+ VE Administrator Guide* on how to enable content. Please install the desired Cisco course(s) that will be taught using the *NETLAB+* system.

5.6 Create the Multi-Device Pod

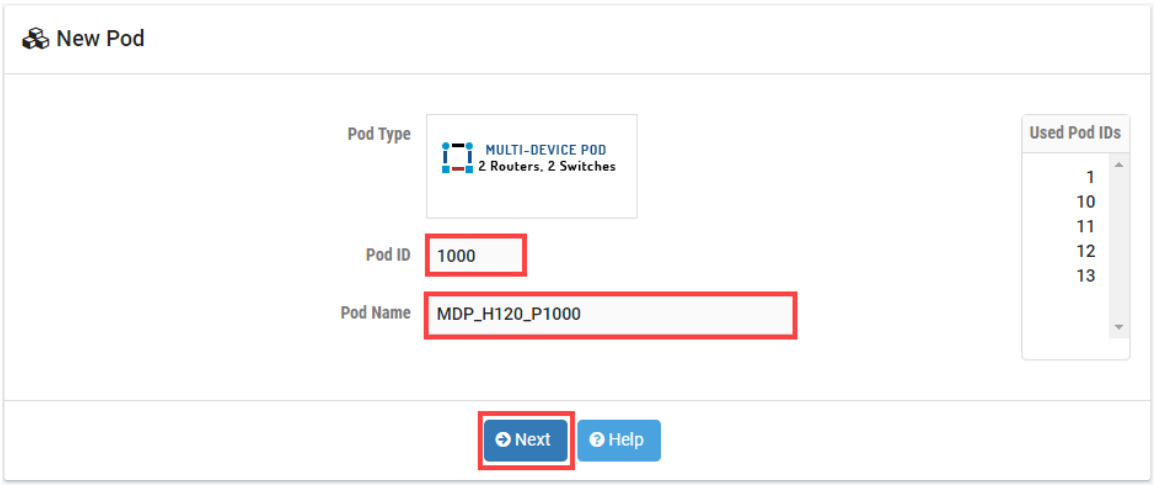
1. Log into **NETLAB+ VE** with the *administrator* account.
2. Select the **Pods** icon.

3. Create a new pod by scrolling to the bottom and clicking the **Create New Pod** button.

4. Then, click on the **AE Multi-Device Pod** entry from the list of installed pod types.



5. On the *New Pod* window, input a value into the **Pod ID** and **Pod Name** fields. Click **Next**.



The ***Pod ID*** determines the order in which the pods will appear in the scheduler. It is best practice to use a block of sequential ID numbers for the *Pod Id* that allows for the number of pods you are going to install.

The ***Pod Name*** identifies the pod and is unique per pod. Here we used the name of the lab set or course in a shortened form along with a host identifier (H120), and the number of the pod (P1000).

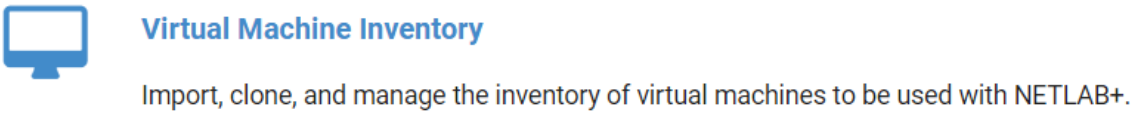
6. To finalize the wizard, click **OK**.

For additional information, please refer to the *NETLAB+ VE Administrator Guide*.

5.7 Create Link Clone VMs on Host Server

1. Select the **Virtual Machine Infrastructure** icon.

2. Click the **Virtual Machine Inventory** icon.



3. Select the Full Clone Template VMs you created in *Section 5.4.2* from the list of virtual machines.
4. Scroll to the bottom and click the **Clone** button.
5. Set the **Clone Name** field to a valid name.

> NDG recommends you name this virtual machine with the following format for clarity and ease of troubleshooting:
> *host_identifier-MDP.PodID.PC-A*
> i.e. **H21-MDP.P01.PC-A**

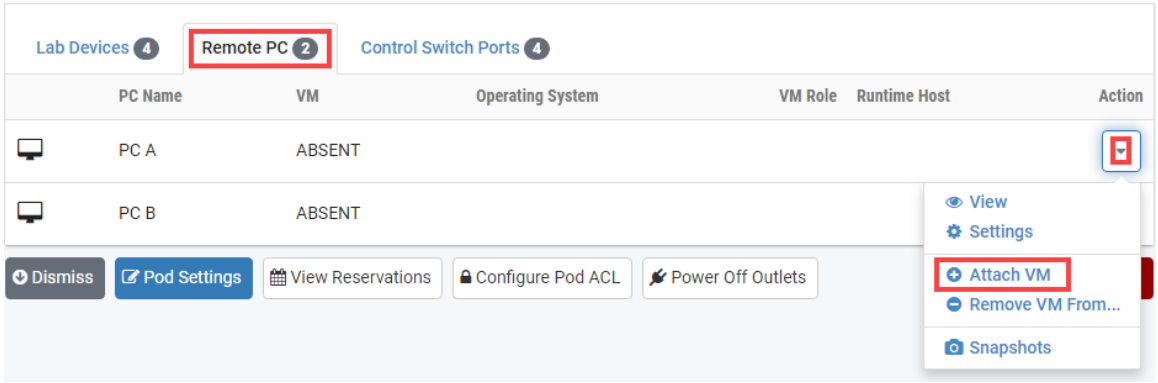
6. Set **Clone Type** to **Linked Clone**.
7. Set **Clone Role** to **Normal.**
8. Click the **Clone** button.
9. Repeat these instructions for the **PC-B** machine.

5.8 Attach Virtual Machines to the Pod

Update the pod to associate the virtual machines with the newly created pod.

1. Select the **Multi-Device Pod (MDP)** from the pod list.

2. In the pod view, click on the **Remote PC** tab. Proceed by then clicking on the **Action** dropdown next to the virtual machine you are about to assign and select **Attach VM**.



3. Select the corresponding virtual machine from the inventory list you created in *Section 5.7.*

4. Click **OK** to confirm the VM attachment and repeat the previous steps for the remaining virtual machines.

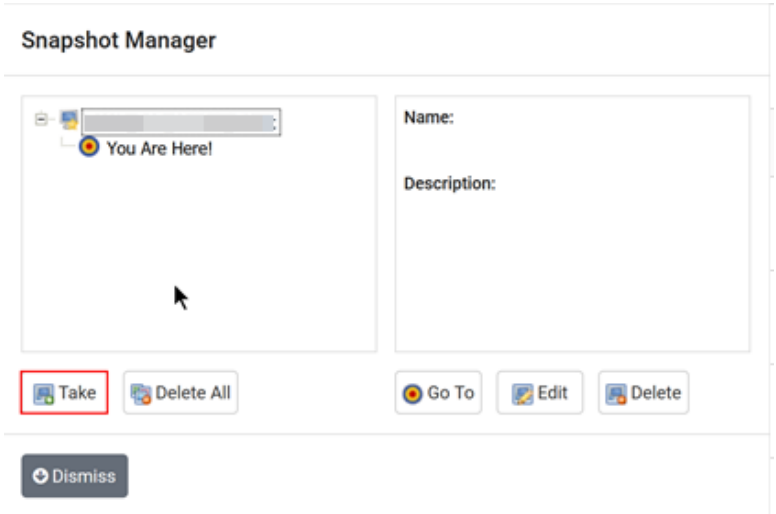
5.9 Create Snapshots for the Virtual Machines

In order to proceed with pod reservations, snapshots must be created on each of the pod's virtual machines.

Verify that all VMs are still powered off before taking snapshots.

1. Make sure to view the **Multi-Device Pod (MDP)** you just assigned machines to. In the pod view, click on the dropdown menu option underneath the *Action* column for a specific VM and select **Snapshots**.

2. In the *Snapshot Manager* window, click on the **Take** button. This will take a snapshot of the current state of the virtual machine.



Any changes made after this will require a new snapshot or those changes will not reflect in the reset state of the pod or its clones.

3. In the *Take Snapshot* window, type **GOLDEN** into the *Name* text field, or you may choose another naming convention as long as it is consistent for easy management. Click **OK**.

It is recommended to use *GOLDEN* as the snapshot name when working with normalized pod types.

4. In the *Snapshot Manager* window, notice the snapshot is created. Click the **Dismiss** button.

At this point it is good to verify that you have only one snapshot on the virtual machine. Multiple snapshots increase the likelihood of having problems, especially if the snapshots are named the same. Also, the more snapshots a virtual machine has, the slower the performance and the more drive space is used.

5. Repeat the previous steps for the remaining virtual machines.

5.10 Set the Revert to Snapshot

1. Make sure to view the **Multi-Device Pod (MDP)** you just created snapshots for. In the pod view, click on the dropdown menu option underneath the *Action* column and select **Settings**.

2. In the virtual machine's *Settings* window, click on the *Revert to Snapshot* dropbox and select **GOLDEN** and then click the **Submit** button.

This sets the snapshot on the virtual machine that will get reverted to each time the pod is scheduled.

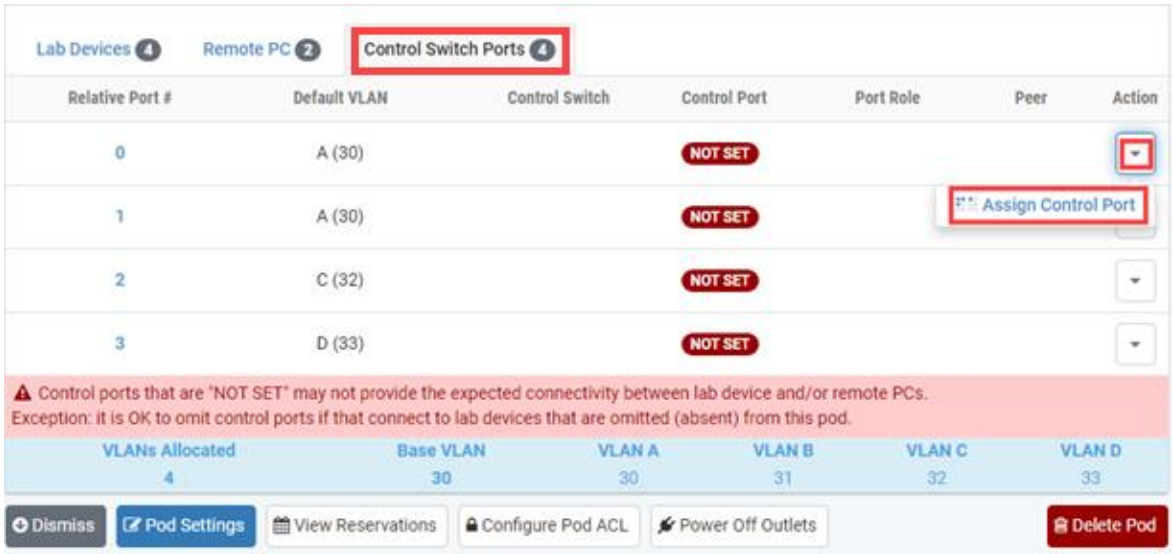
3. Click **OK** to confirm.
4. Return to the pod view page and repeat the previous steps for the remaining virtual machines.

5.11 Select Control Switch and Ports

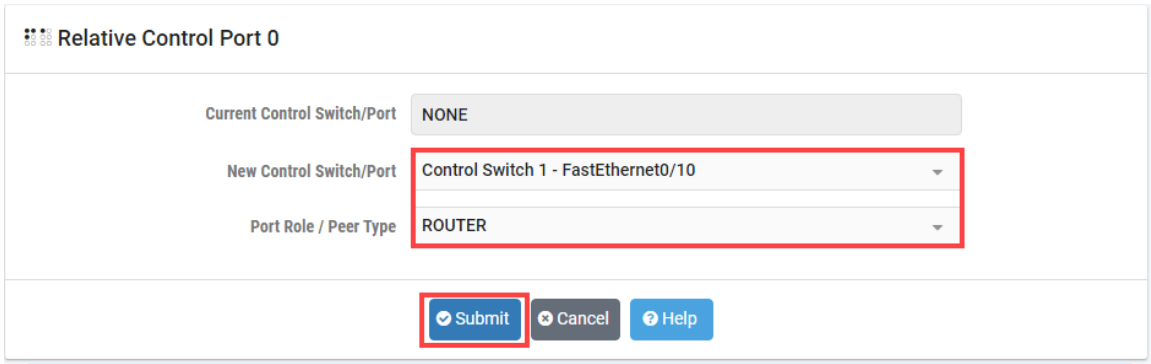
A *Multi-Device Pod (MDP)* requires **4 consecutive control switch ports**. *NETLAB+* will present a list of the control switches on your system. Switches that meet the port requirement can be selected. Choose one control switch for your new pod.

If no control switches have been added to your *NETLAB+*, you may reference the *Real Equipment Pod Installation Guide*. *Section 9.1*, "*Control Devices*", provides instructions on how to add new control devices.

1. Make sure to view the **Multi-Device Pod (MDP)**. In the pod view, click on the **Control Switch Ports** tab and then click on the **Action** dropdown menu for the first entry, followed by clicking **Assign Control Port**.



2. Choose the control switch port and identify the correct port role type. Click **Submit**.



When configuring the control switch ports, refer to *Section 3.1* to identify the respective *Relative Port #* and *Base Port* numbers along with the *Port Role* based on the lab device.

3. Once configured by *NETLAB+*, click **Dismiss** to proceed.
4. Return to the pod view page and repeat the previous steps for the remaining control switch ports.

5.12 Select Device Types, Access Server & PDU Ports

A *Multi-Device Pod (MDP)* requires **4 access server lines**.

It is a good idea to use consecutive lines on one access server if possible. This practice will make it easier to cable and troubleshoot. If consecutive ports are not available, you can use non-consecutive ports on different access servers if necessary.

NETLAB+ allows you to choose consecutive lines on one access server, or you can choose to select an access server and line for each router.

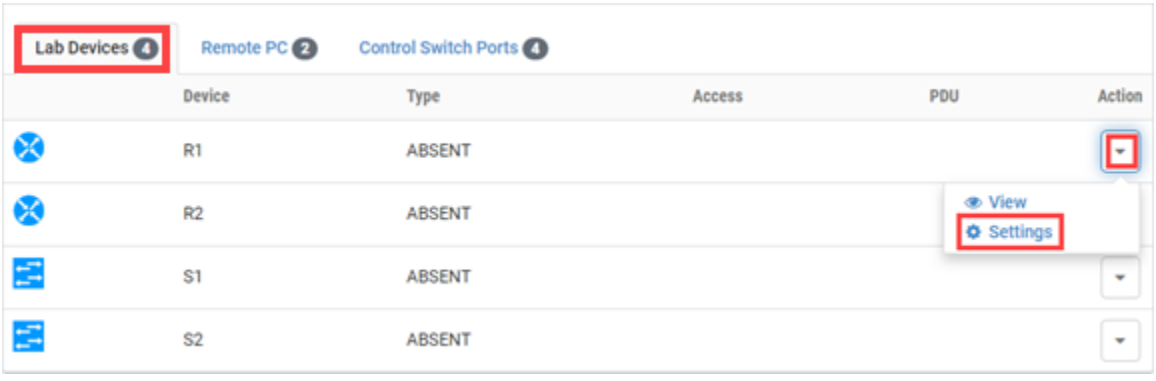
If no access servers have been added to your *NETLAB+*, you may reference the *Real Equipment Pod Installation Guide*. *Section 9.2*, "*Access Servers*", provides instructions on how to add new access servers.

A *Multi-Device Pod (MDP)* requires **4 outlets**.

It is a good idea to use consecutive outlets on one power distribution unit if possible. This practice will make it easier to cable and troubleshoot. If consecutive outlets are not available, you may use non-consecutive outlets, spanning multiple SODs if necessary.

If no PDUs have been added to your *NETLAB+*, you may reference the *Real Equipment Pod Installation Guide*. *Section 9.3*, "*Power Distribution Units*", provides instructions on how to add new PDU devices.

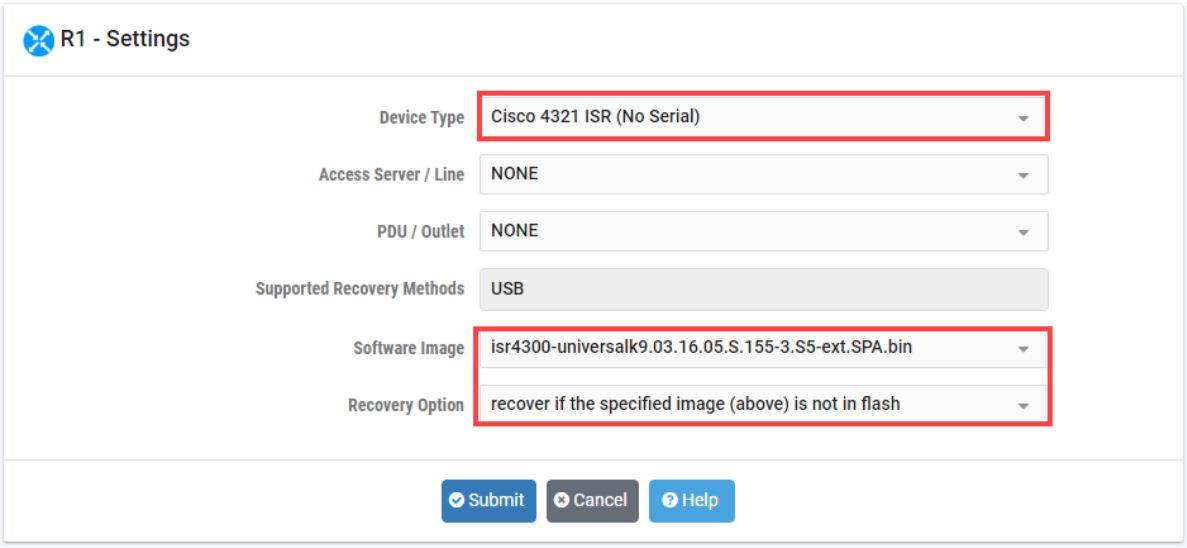
1. Make sure to view the **Multi-Device Pod (MDP)**. In the pod view, click on the **Lab Devices** tab and then click on the **Action** dropdown menu for the first entry, followed by clicking **Settings**.



2. First, choose the appropriate device type in relation to the specific Cisco model being used as well as its respective software image to be used for *NETLAB+* recovery. Make sure to select a recovery option.

Device type selections are used to assign the appropriate NETLAB+ device drivers. Improper selections may cause errors.

NETLAB+ scrubs each router at the end of lab reservation or upon request. During a scrub, NETLAB+ can recover an IOS image if it is erased from flash.



If no lab device images have been added to your *NETLAB+*, you may reference the *Real Equipment Pod Installation Guide*. *Section 11*, "*Lab Device Images*", provides instructions on how to add new lab device images.

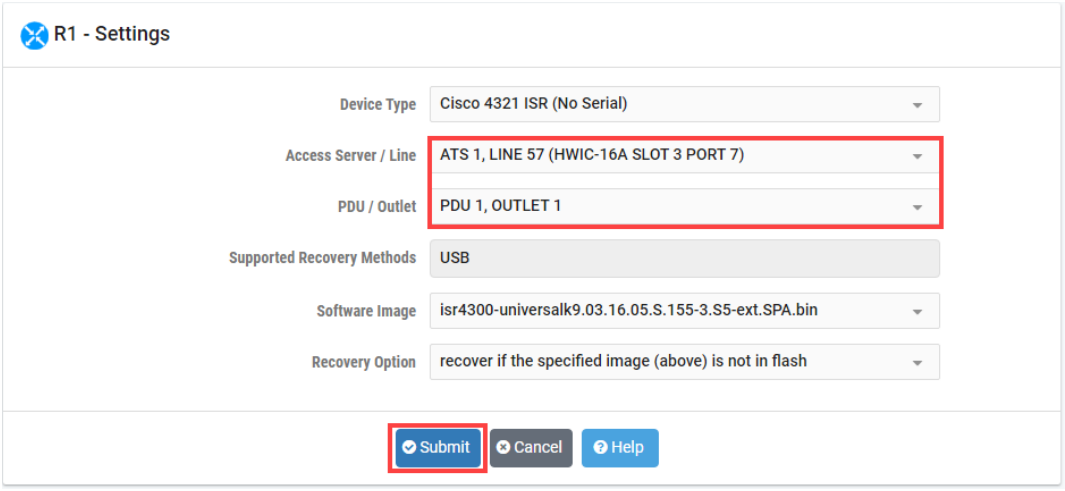
You have three choices for flash recovery:

Recovery Using Specified Image	During A Scrub Operation…
recover if the specified image (above) is not in flash	Restores the selected software image if that image is not in flash.
recover if there is no image in flash	Restores the selected software image if there are no .bin images in flash. No action is taken if flash contains a .bin image (even if it is not the specified one).
never recover image (device may become unusable)	NETLAB+ will take no action if the flash does not contain a bootable image. In this case, the NETLAB+ automated boot process will fail, and manual restoration of IOS will be required.

If you select an automatic recovery option, you must also select a software image supported by the curriculum.

3. Then choose the line number for the access server line connected, followed by the PDU outlet being used. Once finished, click **Submit**.

The options available here allows you to make granular selections. For access servers using octal cables, both the line number and the cable label are displayed.



4. Click **OK** and repeat the previous steps for the remaining lab devices in the pod.

6 Switch Configuration Tasks

The *Multi-Device Pod (MDP)* requires additional switch configuration tasks for successful operation. Using *PuTTy* or other terminal software, connect to the console port of the control switch to which the *Multi-Device Pod (MDP)* is connected. The following passwords are used on the control switch.

Console login password	**router**
Enable secret password	**cisco**

Please Note

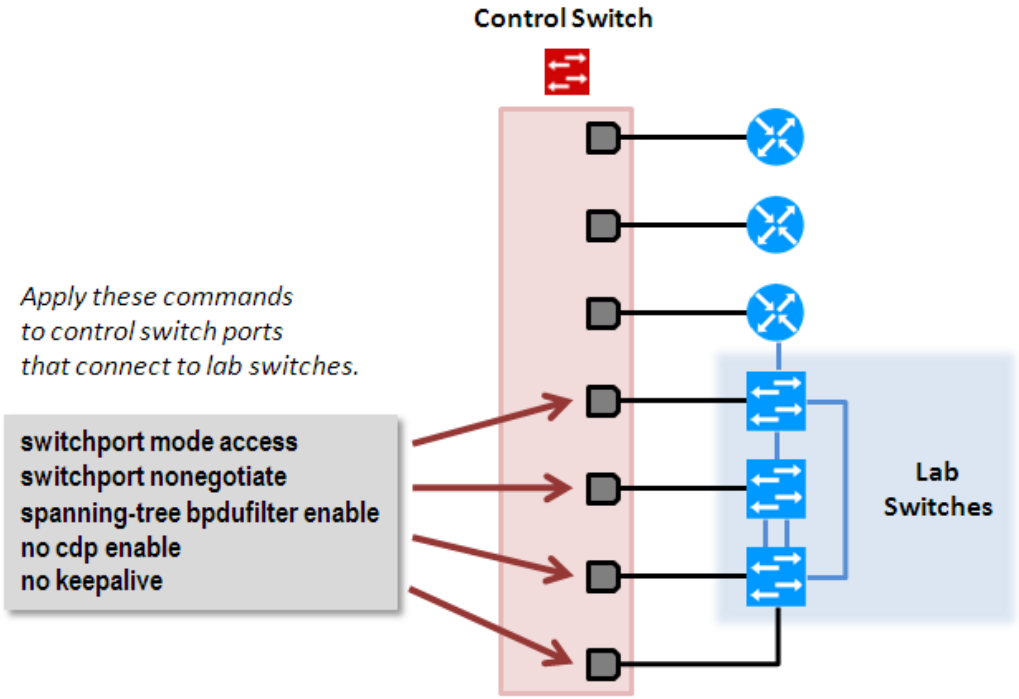
Please do not change the passwords, they are used by NETLAB+ automation and technical support.

6.1 Verify Control Switch IOS Version

Each control switch should be running the minimum required image. Earlier versions may have defects that affect NETLAB+. For a complete, up-to-date list, reference here: https://www.netdevgroup.com/support/control_devices.html#control_switch

6.2 Configure Control Switch Ports

There are several essential commands that must be manually configured on each control switch port that connects to a lab switch (S1 and S2 in this case).



Locate the 2 control switch ports connecting to S1 and S2. Refer to the cabling diagram if necessary (*Section 5.1*). The following commands must be manually added to each switch port.

- **switchport mode access**
  - Prevents the link from becoming a trunk port.
  - The labs will not work as designed if the link between control switch and lab switch is trunking.
  - Trunking on ports that should be access ports, combined with BPDU filtering, creates loops that are not prevented by spanning-tree.

- **switchport nonegotiate**
  - Prevents the interface from sending DTP messages.
  - Disabling DTP messages is not critical, but will hide the control switch's MAC address from lab switches when users are performing commands to see the CAM table.

- **spanning-tree bpdufilter enable**
  - Instructs control switch port not to send and receive spanning-tree BPDU frames to and from the lab switch.
  - Spanning tree in the lab must not mingle with spanning tree on the control switch. This would cause several undesirable effects in both the lab and on the control switches.

- **no cdp enable**
  - Disabling CDP is not critical, but will hide the control switch from lab switch users performing CDP commands.

- **no keepalive**
  - Prevents the interface from sending L2 keepalive messages.
  - Disabling L2 keepalives messages is not critical, but will hide the control switch's MAC address from lab switches when users are performing commands to see the CAM table.

Do not omit these commands! Without them, loops will form causing high CPU utilization, error-disabled ports, and connectivity loss. These commands are specific to switch pods and are not automatically configured.

Example switch port configuration from a control switch. Interface numbers will vary.

```
interface FastEthernet0/12
 description port to S1 port 6
 switchport mode access
 switchport nonegotiate
 spanning-tree bpdufilter enable
 no cdp enable
 no keepalive


interface FastEthernet0/13
 description port to S2 port 18
 switchport mode access
 switchport nonegotiate
 spanning-tree bpdufilter enable
 no cdp enable
 no keepalive
```

6.3 Initial Lab Switch Setup

Several switch models are subject to a common problem when used as a **lab switch**. These include (but are not limited to):

- Cisco Catalyst 2900 XL Series
- Cisco Catalyst 2950 Series
- Cisco Catalyst 2960 Series
- Cisco Catalyst 3550 Series
- Cisco Catalyst 3560 Series
- Cisco Catalyst 3650 Series

Cisco WS-C3560V2-24PS switches ("V2" models) do not respond to a console break signal, regardless of "enable break" setting, and therefore do not work with NETLAB+ automation (reference Cisco bug CSCsv92241). Although the bug was reported fixed, the problem still persists on the V2 models as of this writing. Workarounds: use WS-C3560-24PS (non-"V2" version) switches if available or turn off automation by using the Generic Console Device setting.

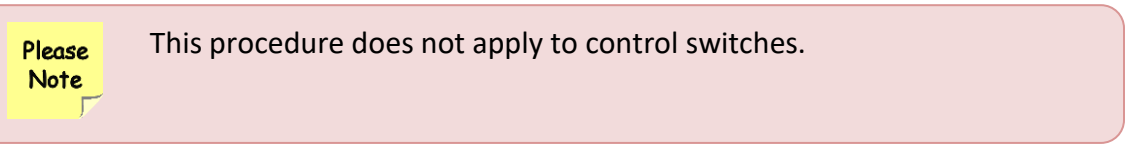
By default, these switches will not respond to a console break signal the same way routers do. There are two *environment variables* that affect this: **Enable Break** and **BOOT path-list**.

The following procedure explains how to check these variables and set them so that the console port will respond to a break signal.

When to Use

You must initialize the environment variables when:

- Installing a lab switch for the first time.
- The Enable Break environment variable is set to "no".
- The BOOT path-list environment variable is set.



Determining the Boot Status

From the enable mode, issue the following IOS command.

```
Lab_Sw# show boot

BOOT path-list:      flash:c2950-i6q4l2-mz.121-22.EA4.bin
Config file:         flash:config.text
Private Config file: flash:private-config.text
Enable Break:        no
Manual Boot:         no
```

Setting Up the Environment

Follow this procedure if Enable Break is set to “no” and/or the boot path-list is set to an image.

```
Lab_Sw# configure terminal
Lab_Sw(config)# boot enable-break
Lab_Sw(config)# no boot system
Lab_Sw(config)# end
Lab_Sw# copy run start
Lab_Sw# show boot

BOOT path-list:

Config file:         flash:config.text
Private Config file: flash:private-config.text
Enable Break:        yes
Manual Boot:         no
```


Please Note

For *Cisco Catalyst 3650 Series* switches, the procedure for enabling break is slightly different, see below.

```
Lab_Sw# configure terminal
Lab_Sw(config)# boot enable-break
Lab_Sw(config)# boot system flash:packages.conf
Lab_Sw(config)# end
Lab_Sw# copy run start
Lab_Sw# show boot
```

Verification

With Enable Break set to "yes" and removal of a BOOT path-list, a pod test should pass.

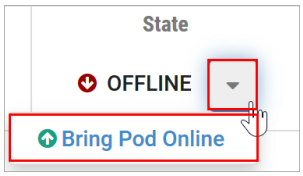
If the environment variables are not set correctly, you may experience one of the following symptoms:

1. Pod test fails with a message such as "unable to put the switch into monitor mode".
2. Lab automation such as scrub fails.
3. Users cannot perform password recovery (automated or manual.

7 Finishing Up

7.1 Bring the Pod Online

1. In the pod view, click the drop arrow under *State* and select **Online**.



7.2 Create Class

Create a class as identified in the *Add Classes* section of the *NETLAB+ VE Instructor Guide*.

7.3 Assigning Pods to Students, Teams, or Classes

Please refer to the *NETLAB+ VE Instructor Guide* for details on using the *Pod ACLs* feature.