Basic Switch Pod – Version 2

Planning and Installation Guide

For Cisco Networking Academy® CCNA Curriculum

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NETLAB Academy Edition features two variations of the Basic Switch Pod. You may implement either pod type based on available resources.

- **Version 2** (this guide) **supports remote PCs** using VMware Server.
- **Version 1** (separate guide) **does not support PCs**.

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1 Introduction................................................................................................................. 3
  1.1 Deviations.............................................................................................................. 4
  1.2 Remote PC Support............................................................................................... 4
2 Lab Device Requirements......................................................................................... 5
  2.1 Router R1.............................................................................................................. 5
  2.2 Switches S1 and S2.............................................................................................. 5
  2.3 PCs and Servers.................................................................................................. 6
3 Control Device Requirements.................................................................................. 7
  3.1 Control Switch Overview...................................................................................... 7
  3.2 Access Server Ports............................................................................................. 9
  3.3 Switched Outlets.................................................................................................. 9
4 Pre-requisites........................................................................................................... 10
  4.1 Understanding VMware Server and Virtual Machines................................. 10
  4.2 Setup Control Devices....................................................................................... 10
  4.3 Upload IOS Images............................................................................................. 10
  4.4 Disable User Logins (optional)......................................................................... 10
5 Adding the Pod........................................................................................................ 11
  5.1 Start the New Pod Wizard................................................................................... 11
  5.2 Add a Basic Switch Pod V2................................................................................ 11
  5.3 Select Control Switch and Ports........................................................................ 11
  5.4 Select Access Server(s) and Ports..................................................................... 12
  5.5 Select Switched Outlets...................................................................................... 13
  5.6 Select Device Types............................................................................................ 14
  5.7 Select Software Images and Recovery Options............................................. 15
  5.8 Select PC Options................................................................................................ 16
  5.9 VMware Settings................................................................................................ 17
  5.10 Select a Pod ID.................................................................................................. 17
  5.11 Select a Pod Name............................................................................................. 17
  5.12 Verify Your Settings......................................................................................... 18
6 Cable the Pod........................................................................................................... 20
7 Configuring VMware and Virtual Machines....................................................... 21
  7.1 Connecting Virtual Machines to the Pod......................................................... 21
  7.2 VMware Virtual Switches and VLANs............................................................. 22
  7.3 Configure VMware Server Inside Port.............................................................. 24
  7.4 Create Virtual Switches (VMnet)....................................................................... 25
  7.5 Binding Virtual Machines to Virtual Switches (VMnet)................................. 26
  7.6 Configuring the Control Switch for VMware................................................... 27
  7.7 VMware Server(s) on Different Control Switch............................................... 28
8 Switch Configuration Tasks...................................................................................... 29
  8.1 Verify Control Switch IOS Version................................................................. 29
  8.2 Configure Control Switch Ports........................................................................ 29
  8.3 Initial Lab Switch Setup...................................................................................... 30
9 Testing the Pod.......................................................................................................... 32
10 Finishing Up........................................................................................................... 33
  10.1 Bring the Pod(s) Back Online.......................................................................... 33
  10.2 Enable Lab Exercises...................................................................................... 34
  10.3 Schedule a Lab Reservation for Your New Pod............................................. 35
PART 1 – PLANNING

1 Introduction

Did you see the video? NDG features a flash video at www.netdevgroup.com/ae/doc/bspv2.htm that provides a good introduction to this pod.

Basic Switch Pod Version 2 (V2) is designed for CCNA switch lab exercises. NETLAB Academy Edition features two variations of the Basic Switch Pod. You may implement either pod type based on available resources.

- **Version 2** (this guide) supports remote PCs using VMware Server.
- **Version 1** (separate guide) does not support PCs.

You may have up to eight (8) Basic Switch Pod V2 per NETLAB\textsubscript{AE} system.

Basic Switch Pod V2 features direct access to router and switch consoles. Integration with a separate VMware Server supports up to 3 virtual PCs. NETLAB\textsubscript{AE} can provide remote access to the keyboard, video, and mouse of VMware virtual machines in the pod.

NETLAB\textsubscript{AE} 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\textsubscript{AE} 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\textsubscript{AE} News and Announcements feature to point users to your documentation.

1.2 Remote PC Support

Basic Switch Pod V2 supports 3 remote PCs. NETLAB\textsubscript{AE} allows three alternative settings for each:

- **Direct/VMware.** The PC is implemented as a VMware virtual machine.
  - 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.

- **Indirect.** The PC is implemented, but not managed by NETLAB\textsubscript{AE}.
  - Users may be able to interact with the PC, but cannot access the keyboard, video, or mouse through NETLAB\textsubscript{AE}.

- **Absent.** The PC is not implemented.

These options are fully explained in the NETLAB+ Remote PC Guide for VMware Server Implementation. Direct/VMware offers complete administrative access on the remote PC and offers the greatest support for labs. To learn more about VMware Server, please visit [http://www.netdevgroup.com/ae/vmware.htm](http://www.netdevgroup.com/ae/vmware.htm).

Direct/Standalone mode, as described in the NETLAB+ Remote PC Guide for Standalone Implementation, is not supported on this pod.
2 Lab Device Requirements

Lab devices are part of the topology and users can interact with them either directly or indirectly.

The equipment listed in subsequent sections is derived from the official Academy spreadsheet CCNAConfigurationandPricingGuide.xls (August 2005).

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

2.1 Router R1

<table>
<thead>
<tr>
<th>Recommended Router Models</th>
<th>Ethernet Ports Required</th>
<th>Serial Port Module</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cisco 1841</td>
<td>2</td>
<td>not required</td>
</tr>
<tr>
<td>Cisco 2801</td>
<td>2</td>
<td>not required</td>
</tr>
<tr>
<td>Cisco 2621XM</td>
<td>2</td>
<td>not required</td>
</tr>
<tr>
<td>Cisco 17xx</td>
<td>router not supported</td>
<td></td>
</tr>
</tbody>
</table>

2.2 Switches S1 and S2

<table>
<thead>
<tr>
<th>Recommended Switch Models</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>WS-C2950-24</td>
<td>24 port, 10/100 autosensing, autonegotiating Catalyst Switch</td>
</tr>
<tr>
<td>WS-C2950T-24</td>
<td>24 10/100 ports w/ 2 10/100/1000BASE-T ports, Enhanced Image</td>
</tr>
</tbody>
</table>

The global command `boot enable-break` must be enabled on all switches for proper operation. Please see refer to section 8.
2.3 PCs and Servers

Basic Switch Pod V2 supports 3 VMware Server virtual machines. VMware Server is installed on a separate server. The NETLAB+ Remote PC Guide for VMware Server Implementation contains general information for setting up a VMware Server.

The following operating system choices are typical based on the curriculum. These choices are not mandatory; you can make substitutions provided:

1. VMware Server supports the operating system (as a “guest”).
2. Your choices are compatible with the curriculum.

<table>
<thead>
<tr>
<th>Virtual Machine</th>
<th>Recommended O/S</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC1a</td>
<td>Windows XP</td>
<td>Student PC, client activities</td>
</tr>
<tr>
<td>PC1b</td>
<td>Windows XP</td>
<td>Student PC, client activities</td>
</tr>
<tr>
<td>PC2</td>
<td>Windows XP</td>
<td>Student PC, client activities</td>
</tr>
</tbody>
</table>
3 Control Device Requirements

NETLAB\textsubscript{AE} control devices provide internal connectivity, console access, and managed power. Control devices are dynamically managed by NETLAB\textsubscript{AE} and are not accessible or configurable by lab users.

⇒ The \textit{NETLAB+ Administrator Guide} explains how to add, change, or delete control devices.

Basic Switch Pod V2 requires the following control device resources:

<table>
<thead>
<tr>
<th>Control Device Resource</th>
<th>Quantity Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Switch</td>
<td>4 consecutive ports, 1 reserved port (VMware Server)</td>
</tr>
<tr>
<td>Access Server</td>
<td>3 lines</td>
</tr>
<tr>
<td>Switched Outlet Devices</td>
<td>3 outlets</td>
</tr>
</tbody>
</table>

3.1 Control Switch Overview

NETLAB\textsubscript{AE} uses a control switch to provide connectivity between devices in the Basic Switch Pod V2 and VMware Server(s). This pod requires \textbf{4 consecutive ports} on a supported control switch (other than a Catalyst 1900 series).

Port numbers 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 (section 5). 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 5, the actual port numbers will be 5 to 8.

Using SNMP, NETLAB\textsubscript{AE} will automatically setup 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\textsubscript{AE} pod has a unique \textit{VLAN pool} and the actual
VLAN numbers will be unique for each NETLAB\textsubscript{AE} pod. This is to avoid conflict between pods.

**IMPORTANT:** section 8.2 outlines configuration tasks that are essential when connecting a lab switch to a control switch. These tasks must be performed manually and are required to prevent loops, high CPU utilization, error-disabled ports, and connectivity loss.

One “reserved” port on the control switch connects to an 802.1q NIC card on the VMware 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 VMware Server and virtual machines in the pod can be located on different Servers. For more details, please see section 7.
### 3.2 Access Server Ports

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

Basic Switch Pod V2 requires 3 access server ports. These ports do not have to be consecutive, and can span multiple access servers.

![Diagram of Access Server Ports](image)

### 3.3 Switched Outlets

Switched outlets provide managed electrical power, allowing NETLAB\textsubscript{AE} and users to turn lab equipment on and off. Basic Switch Pod V2 requires 3 switched outlets, one for each lab device.

Outlets do not have to be consecutive and may span multiple switched outlet devices (i.e. APC7900 or APC7920).

![Diagram of Switched Outlets](image)
PART 2 – IMPLEMENTATION

4 Pre-requisites

This section covers tasks that should be executed prior to adding a Basic Switch Pod V2.

4.1 Understanding VMware Server and Virtual Machines

The NETLAB+ Remote PC Guide for VMware Server Implementation contains essential information for setting up a VMware Server and virtual machines. It should be used in conjunction with this guide.

4.2 Setup Control Devices

Using the guidelines in section 3, decide which control switch ports, access server ports, and switched outlets you will use for your Basic Switch Pod V2. Add control devices if necessary. Control device configuration is documented in the NETLAB+ Administrator Guide.

Basic Switch Pod V2 requires additional IOS commands issued on control switch ports. Please refer to section 8.2.

4.3 Upload IOS Images

Upload the IOS image for the lab router (R1). NETLABAE will recover this image on the router if erased from flash. Note: IOS recovery is not currently supported on lab switches.

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 Adding the Pod

This section walks you through the process of adding a Basic Switch Pod V2 using the NETLAB\textsubscript{AE} New Pod Wizard.

5.1 Start the New Pod Wizard

Login to the administrator account.

Select Equipment Pods.

Select \textcolor{red}{\textbullet} Take All OFFLINE if any of the pods are online. Caution: this will cancel any reservations in progress.

Select \textcolor{green}{+} Add a Pod.

The New Pod Wizard will now help you add an equipment pod to your system.

5.2 Add a Basic Switch Pod V2

When prompted, select Basic Switch Pod v2.

5.3 Select Control Switch and Ports

Basic Switch Pod V2 requires 4 consecutive control switch ports. NETLAB\textsubscript{AE} 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.

<table>
<thead>
<tr>
<th>SELECT</th>
<th>ID</th>
<th>SWITCH TYPE</th>
<th>PORTS THAT ARE FREE</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>INELIGIBLE</td>
<td>1</td>
<td>Catalyst 2950-24</td>
<td>NONE</td>
<td>NO FREE PORTS</td>
</tr>
<tr>
<td>INELIGIBLE</td>
<td>2</td>
<td>Catalyst 2950-24</td>
<td>PORT 15-20</td>
<td>NOT ENOUGH CONSECUTIVE PORTS</td>
</tr>
<tr>
<td>✔️</td>
<td>3</td>
<td>Catalyst 2950-24</td>
<td>PORT 1-20</td>
<td>OK TO USE</td>
</tr>
</tbody>
</table>

[Next] [Back] [Cancel]
Next, select the ports you want to use.

You have chosen control switch 3.

A Basic Switch Pod (Version 2) requires 4 consecutive control switch ports.

Which free 4-port range would you like to use? Ports 1 to 4

5.4 Select Access Server(s) and Ports

Basic Switch Pod V2 pod requires 3 access server ports.

It is a good idea to use consecutive ports 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.

Use the physical port numbers shown on the access server. Some models start at port 1 (Cisco 2509 and 2511) and others start at port 0 (Cisco NM-16A and NM-32A modules).

NETLAB\textsubscript{AE} allows you to choose consecutive ports on one access server, or you can choose “Let me pick” to select an access server and port for each router.

<table>
<thead>
<tr>
<th>ACCESS SERVERS</th>
<th>PORTS THAT ARE FREE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cisco 2511-RJ</td>
</tr>
<tr>
<td>2</td>
<td>NM-32A Module in Cisco Router</td>
</tr>
<tr>
<td>3</td>
<td>Cisco 2509-RJ</td>
</tr>
</tbody>
</table>

A Basic Switch Pod (Version 2) requires 3 access server ports.

- Use 3 consecutive ports on access server 1 starting at port 10
- Let me pick the access server and ports for each device
“Let me pick”, allows you to make granular selections and split ports among several access servers.

### 5.5 Select Switched Outlets

Basic Switch Pod V2 Pod requires 3 switched outlets.

It is a good idea to use consecutive outlets on one switched outlet device (SOD) 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.

<table>
<thead>
<tr>
<th></th>
<th>APC 7900 Switched Rack PDU 1-8</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>APC 7900 Switched Rack PDU 1-8</td>
</tr>
<tr>
<td>7</td>
<td>APC 7900 Switched Rack PDU 1-8</td>
</tr>
<tr>
<td>8</td>
<td>APC 7900 Switched Rack PDU 1-8</td>
</tr>
</tbody>
</table>

A Basic Switch Pod (Version 2) requires 3 switched outlets.

- Use 3 consecutive outlets on switched outlet device 6 starting at outlet 1
- Let me pick select outlets for each device manually

“Let me Pick”, will allow you to make granular selections.
5.6 Select Device Types

Select the lab device router and switch models you are going to deploy.

⇒ Your selections are used to assign the appropriate NETLABÆ device driver.

⇒ Improper selections may cause errors.

⇒ NETLABÆ may offer selections that do not support the curriculum. See section 2 for a list of recommended devices for this pod.

<table>
<thead>
<tr>
<th>LAB DEVICE</th>
<th>TYPE</th>
<th>MODEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>Router</td>
<td>Cisco 1841 (No Serial)</td>
</tr>
<tr>
<td>S1</td>
<td>Switch</td>
<td>Cisco 2950-24</td>
</tr>
<tr>
<td>S2</td>
<td>Switch</td>
<td>Cisco 2950-24</td>
</tr>
</tbody>
</table>
5.7 Select Software Images and Recovery Options

NETLABÆ scrubs each lab device at the end of lab reservation or upon request. During a scrub, NETLABÆ can recover an IOS image on router R1 if it has been erased from flash.

<table>
<thead>
<tr>
<th>DEVICE</th>
<th>TYPE</th>
<th>SOFTWARE IMAGE</th>
<th>RECOVER USING SPECIFIED IMAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>Cisco 1841 (No Serial)</td>
<td>c1841-ipbase-mz.123-14.T5.bin</td>
<td>If specified image not in flash</td>
</tr>
<tr>
<td>S1</td>
<td>Cisco 2950-24</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>S2</td>
<td>Cisco 2950-24</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

You have three choices for flash recovery:

<table>
<thead>
<tr>
<th>Recovery Using Specified Image</th>
<th>During A Scrub Operation…</th>
</tr>
</thead>
<tbody>
<tr>
<td>If specified image not in flash</td>
<td>Restores the selected software image if that image is not in flash.</td>
</tr>
<tr>
<td>If no image in flash (erased)</td>
<td>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).</td>
</tr>
<tr>
<td>Never (device may become unusable)</td>
<td>NETLABÆ will take no action if the flash does not contain a bootable image. In this case, NETLABÆ automated boot process will fail and manual restoration of IOS will be required.</td>
</tr>
</tbody>
</table>

⇒ If you select an automatic recovery option, you must also select a software image supported by the curriculum (see section 2).
5.8 Select PC Options

In this task, you will select an ID, type, access method, and operating system for your PCs and servers.

Figure 5.8.1 – Typical remote PC settings

<table>
<thead>
<tr>
<th>PC NAME</th>
<th>ID</th>
<th>TYPE</th>
<th>ACCESS</th>
<th>OPERATING SYSTEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC1a</td>
<td>13</td>
<td>VMWARE</td>
<td>VNC</td>
<td>Windows XP</td>
</tr>
<tr>
<td>PC1b</td>
<td>14</td>
<td>VMWARE</td>
<td>VNC</td>
<td>Windows XP</td>
</tr>
<tr>
<td>PC2</td>
<td>15</td>
<td>VMWARE</td>
<td>VNC</td>
<td>Windows XP</td>
</tr>
</tbody>
</table>

The following TYPE and ACCESS combinations correspond to the documentation.

The default type settings is STANDALONE. This setting is not supported in the Basic Switch Pod V2. You must change the default setting.

<table>
<thead>
<tr>
<th>To implement…</th>
<th>Set TYPE to…</th>
<th>Set ACCESS to…</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct/VMware</td>
<td>VMWARE</td>
<td>VNC</td>
</tr>
<tr>
<td>Direct/Standalone (not supported in this pod)</td>
<td>STANDALONE</td>
<td>VNC</td>
</tr>
<tr>
<td>Indirect</td>
<td>(any)</td>
<td>INDIRECT</td>
</tr>
<tr>
<td>Absent (no PC)</td>
<td>ABSENT</td>
<td>n/a</td>
</tr>
</tbody>
</table>
5.9  VMware Settings

Please enter the following settings for your VMware GSX virtual machines.

- **IP Address**: The IP address of the VMware GSX host and the address used for accessing the VMware management API.
- **Username**: The username of the host account used for controlling the virtual machine through the VMware API.
- **Password**: The password of the host account.
- **Configuration File**: The full path of the virtual machine's configuration file (for example, C:\Virtual Machines\POD_7\PC_2\winXPprof.vmx)

<table>
<thead>
<tr>
<th>PC ID</th>
<th>PC Name</th>
<th>IP Address</th>
<th>Username</th>
<th>Password</th>
<th>Configuration File</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>PC1a</td>
<td>10.0.0.25</td>
<td>NETLABa</td>
<td>NETLABa</td>
<td>C:\Virtual Machines\POD_7\PC1a\winXPprof.vmx</td>
</tr>
<tr>
<td>14</td>
<td>PC1b</td>
<td>10.0.0.25</td>
<td>NETLABa</td>
<td>NETLABa</td>
<td>C:\Virtual Machines\POD_7\PC1b\winXPprof.vmx</td>
</tr>
<tr>
<td>15</td>
<td>PC2</td>
<td>10.0.0.25</td>
<td>NETLABa</td>
<td>NETLABa</td>
<td>C:\Virtual Machines\POD_7\PC2\winXPprof.vmx</td>
</tr>
</tbody>
</table>

**5.10  Select a Pod ID**

Each pod is assigned a unique numeric ID.

Please select a Pod ID.

Pod ID: 7

**5.11  Select a Pod Name**

Each pod can have a unique name. This name will appear in the scheduler, along with the pod type.

Pod Name: Galactica
5.12 Verify Your Settings

At this point NETLAB\textsubscript{AE} has added the pod to its database. However, the pod has not been brought online yet. You will want to cable up the pod, configure PCs, and run a pod test before bringing the pod online. These tasks are discussed in the remaining sections.

**New Pod Wizard**

- The New Pod Wizard has added the pod.
- New pods are not brought online automatically.
- You should cable the pod and run a pod test before bringing the pod online.

After you click OK, the new pod will appear in the list of equipment pods.

Click on the magnifier button or pod ID to manage your new pod.
NETLAB will display the status of the pod and the high-level settings for each device, PC, and control switch.

### POD 7 - STATUS

<table>
<thead>
<tr>
<th>POD ID</th>
<th>POD NAME</th>
<th>STATUS</th>
<th>ACTIVITY</th>
<th>POD TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Galactica</td>
<td>OFFLINE</td>
<td>IDLE</td>
<td></td>
</tr>
</tbody>
</table>

### POD 7 - ROUTERS, SWITCHES, AND FIREWALLS

(Click on the GO buttons to reconfigure devices)

<table>
<thead>
<tr>
<th>GO</th>
<th>NAME</th>
<th>TYPE</th>
<th>ACCESS PORTS</th>
<th>SWITCHED OUTLETS</th>
<th>SOFTWARE IMAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>Cisco 1841 (No Serial)</td>
<td>AS1</td>
<td>PORT 10</td>
<td>SOD 6 OUTLET 1</td>
<td>c1841-ipbase-mz.123-14.T5.bin</td>
</tr>
<tr>
<td>S1</td>
<td>Cisco 2950-24</td>
<td>AS1</td>
<td>PORT 11</td>
<td>SOD 6 OUTLET 2</td>
<td>n/a</td>
</tr>
<tr>
<td>S2</td>
<td>Cisco 2950-24</td>
<td>AS1</td>
<td>PORT 12</td>
<td>SOD 6 OUTLET 3</td>
<td>n/a</td>
</tr>
</tbody>
</table>

### POD 7 - PCs AND SERVERS

(Click the GO buttons to reconfigure)

<table>
<thead>
<tr>
<th>GO</th>
<th>NAME</th>
<th>PC ID</th>
<th>STATUS</th>
<th>TYPE</th>
<th>ACCESS</th>
<th>CONTROL IP</th>
<th>OPERATING SYSTEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC1a</td>
<td></td>
<td>13</td>
<td>ONLINE</td>
<td>VMWARE</td>
<td>VNC</td>
<td>10.0.0.25</td>
<td>Windows XP</td>
</tr>
<tr>
<td>PC1b</td>
<td></td>
<td>14</td>
<td>ONLINE</td>
<td>VMWARE</td>
<td>VNC</td>
<td>10.0.0.25</td>
<td>Windows XP</td>
</tr>
<tr>
<td>PC2</td>
<td></td>
<td>15</td>
<td>ONLINE</td>
<td>VMWARE</td>
<td>VNC</td>
<td>10.0.0.25</td>
<td>Windows XP</td>
</tr>
</tbody>
</table>

### POD 7 - CONTROL SWITCH

<table>
<thead>
<tr>
<th>SWITCH ID</th>
<th>POD PORT RANGE</th>
<th>BASE VLAN</th>
<th>VLAN POOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1-4</td>
<td>160</td>
<td>160-163</td>
</tr>
</tbody>
</table>
6  Cable the Pod

Use the NETLAB\textsubscript{AE} cable chart feature to help you connect the lab devices in your pod. The chart is generated in real-time and contains port-specific information based on your current lab device and control device settings. The cable chart function is accessed from the pod management page.

<table>
<thead>
<tr>
<th>Pod 5 -- Management Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Online] Bring this pod ONLINE and make it available for reservations.</td>
</tr>
<tr>
<td>![Test] Tell me if this pod is working properly.</td>
</tr>
<tr>
<td>![Cable] Show me how to cable this pod.</td>
</tr>
<tr>
<td>![Delete] Remove this pod from NETLAB\textsubscript{AE}.</td>
</tr>
</tbody>
</table>

**CABLE CHART FOR POD 7**

**R1 (Cisco 1841 (No Serial))**

<table>
<thead>
<tr>
<th>CONNECT FROM</th>
<th>USING CABLE</th>
<th>CONNECT TO</th>
</tr>
</thead>
<tbody>
<tr>
<td>FastEthernet0/0</td>
<td>CAT-5 Straight Through</td>
<td>S1  Port 8</td>
</tr>
<tr>
<td>FastEthernet0/1</td>
<td>CAT-5 Straight Through</td>
<td>CS 3 Port 1</td>
</tr>
<tr>
<td>Console</td>
<td>Console Cable</td>
<td>AVS 1 Port 10</td>
</tr>
<tr>
<td>Power</td>
<td>Power Cord</td>
<td>SCD 6 Outlet 1</td>
</tr>
</tbody>
</table>

**S1 (Cisco 2950-24)**

<table>
<thead>
<tr>
<th>CONNECT FROM</th>
<th>USING CABLE</th>
<th>CONNECT TO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Port 8</td>
<td>CAT-5 Straight Through</td>
<td>R1  FEIGE 0</td>
</tr>
<tr>
<td>Port 1</td>
<td>CAT-5 Crossover</td>
<td>S2  Port 1</td>
</tr>
<tr>
<td>Port 4</td>
<td>CAT-5 Crossover</td>
<td>S2  Port 4</td>
</tr>
<tr>
<td>Port 2</td>
<td>CAT-5 Crossover</td>
<td>CS 3 Port 2</td>
</tr>
<tr>
<td>Port 3</td>
<td>CAT-5 Crossover</td>
<td>CS 3 Port 3</td>
</tr>
</tbody>
</table>

Virtual machine information will not appear on the cable chart. Refer to section 7 for configuration instructions.
# Configuring VMware and Virtual Machines

The *NETLAB+ Remote PC Guide for VMware Implementation* explains how to set up VMware Server and virtual machines. Please review the pod-specific information in this section and apply it to the general information in the *NETLAB+ Remote PC Guide for VMware Implementation*. Please note, only the sections referring to VMware are relevant; Basic Switch Pod V2 does not support standalone PCs.

After you load applications or make changes to a PC, be sure to take a VMware snapshot. *NETLAB* instructs VMware to “revert” to the snapshot at the end of each lab reservation. Any changes made after a snapshot are lost.

The IP addresses and/or default gateways of each PC may vary. Depending on your snapshots, the student may need to adjust IP settings to reflect the lab.

## 7.1 Connecting Virtual Machines to the Pod

Virtual Machines must communicate with routers in the pod. Control switches provide the connection point. In the recommended configuration (below), the VMware Server is equipped with an inside and outside interface. The inside interface is configured for 802.1Q connects to a reserved port on a control switch. Traffic between virtual machines and devices in the pod traverse the VMware Server inside interface. Preferably, the VMware Server should connect to the same control switch as the pod.

![Diagram of network setup](image-url)
7.2 VMware Virtual Switches and VLANs

VMware Server virtual network adapters and virtual LAN switches (VMnets) are used to connect virtual machines to the pod. Basic Switch Pod V2 uses 3 VMnets. Since VMware Server supports 10 virtual switches, it is possible to host up to 3 complete Basic Switch Pods on a single VMware Server.

Each virtual switch is mapped to a specific VLAN and bound to the VMware inside 802.1Q NIC card. The actual VLAN numbers used are based on the pod’s ID number.
Each NETLAB^{AE} pod is automatically assigned a pool of unique VLAN numbers. You must determine which VLAN numbers correspond to each virtual switch on the VMware Server.

First, determine the base VLAN for the pod you are setting up. This is shown on the pod management page. From the administrative account, go to Equipment Pods and select the pod from the list. Obtain the BASE VLAN from the CONTROL SWITCH table.

<table>
<thead>
<tr>
<th>POD 7 - CONTROL SWITCH</th>
</tr>
</thead>
<tbody>
<tr>
<td>SWITCH ID</td>
</tr>
<tr>
<td>3</td>
</tr>
</tbody>
</table>

In this example, pod 7 uses VLANs 160-163. The base VLAN is 160.

Next, determine the actual VLAN number for each virtual network by adding the base VLAN to the offsets in the table below.

<table>
<thead>
<tr>
<th>Virtual Machines</th>
<th>Virtual Switch (VMnet)</th>
<th>Offset (add to base VLAN)</th>
<th>Actual VLAN</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC1a</td>
<td>PC1a VMnet</td>
<td>+ 1</td>
<td>= _____</td>
<td>160 + 1 = 161</td>
</tr>
<tr>
<td>PC1b</td>
<td>PC1b VMnet</td>
<td>+ 2</td>
<td>= _____</td>
<td>160 + 2 = 162</td>
</tr>
<tr>
<td>PC2</td>
<td>PC2 VMnet</td>
<td>+ 3</td>
<td>= _____</td>
<td>160 + 3 = 163</td>
</tr>
</tbody>
</table>
7.3 Configure VMware Server Inside Port

Refer to section 6 of the *NETLAB+ Remote PC Guide*. Create the VLANs (calculated above) on the VMware Server’s inside 802.1Q NIC.

Although it is possible to bind an IP address, mask, and gateway to each VLAN on the server’s inside NIC, you should not do so. The VLANs created on the server act as a layer 2 conduit between lab devices and virtual machines. Binding layer 3 information to the VLAN interfaces on the server adapter may cause unpredictable routing and/or leakage to outside networks.
7.4 Create Virtual Switches (VMnet)

Refer to section 6 of the **NETLAB+ Remote PC Guide for VMware Server Implementation**. Create the virtual switches and bind them to the VLANs created in the previous section.

It does not matter which VMnet number you use. By default, VMnet0, VMnet1, and VMnet8 are reserved for special functions in VMware. However, you can convert these into ordinary VMnets to use with pods. This is explained in Appendix A of the **NETLAB+ Remote PC Guide for VMware Server Implementation**.

![Virtual Network Editor](image-url)
7.5 Binding Virtual Machines to Virtual Switches (VMnet)

Refer to section 7 of the NETLAB+ Remote PC Guide for VMware Server Implementation. In the last section, you associated a specific VLAN with a virtual switch (VMnet). When you create a virtual machine, you must bind it to the correct virtual switch (and by association, VLAN).

<table>
<thead>
<tr>
<th>Virtual Machines</th>
<th>Virtual Switch (VMnet)</th>
<th>Offset (add to base VLAN)</th>
<th>Actual VLAN</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC1a</td>
<td>PC1a VMnet</td>
<td>+ 1</td>
<td>= ________</td>
<td>160 + 1 = 161</td>
</tr>
<tr>
<td>PC1b</td>
<td>PC1b VMnet</td>
<td>+ 2</td>
<td>= ________</td>
<td>160 + 2 = 162</td>
</tr>
<tr>
<td>PC2</td>
<td>PC2 VMnet</td>
<td>+ 3</td>
<td>= ________</td>
<td>160 + 3 = 163</td>
</tr>
</tbody>
</table>

 Virtual Machine Settings

<table>
<thead>
<tr>
<th>Device</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Memory</td>
<td>256 MB</td>
</tr>
<tr>
<td>Hard Disk 1 (IDE 0:0)</td>
<td>Auto detect</td>
</tr>
<tr>
<td>CD-ROM 1 (IDE 1:0)</td>
<td>Custom</td>
</tr>
</tbody>
</table>

Device status
- Connected
- Connect at power on

Adapter type
- vlance
- vmxnet

Network connection
- Bridged: Connected directly to the physical network
- NAT: Used to share the host’s IP address
- Host-only: A private network shared with the host
- Custom: Specific virtual network

VMnet1 < as required
7.6 Configuring the Control Switch for VMware

One “reserved” port on the control switch connects to an 802.1q NIC card on the VMware Server. This allows devices in the pod to communicate with virtual machines. The reserved port should be configured as an 802.1q trunk port.

Once you have allocated a reserved port on the control switch, connect the VMware Server inside NIC using a straight through CAT5 cable. Configure the switch port as a trunk and allow only the VLANs that were bound to the VMnets. If your VMware Server hosts virtual machines for more than one pod, allow all the relevant VLANs for each pod.

Example switch port configuration. Interface number and VLANs will vary.

```
interface FastEthernet0/23
switchport mode trunk
switchport trunk allowed vlan 161,162,163
switchport nonegotiate
no switchport access vlan
no shutdown
```
7.7 VMware Server(s) on Different Control Switch

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 VMware Server. Virtual machines in the pod can be located on different VMware Servers.

![Diagram of VMware Server(s) on Different Control Switches]

Ports connecting to VMware Servers should only allow the VLANs associated with the pods being served. In addition, “switchport nonegotiate” should be used to suppress Dynamic Trunk Protocol (DTP):

```
interface FastEthernet0/23
switchport mode trunk
switchport trunk allowed vlan 161,162,163
switchport nonegotiate
no switchport access vlan
no shutdown
```

Ports connecting control switches together, allow all VLANs and DTP:

```
interface FastEthernet0/24
switchport mode trunk
no switchport access vlan
switchport trunk allowed vlan all
no shutdown
```
8 Switch Configuration Tasks

Basic Switch Pod V2 requires additional switch configuration tasks for successful operation. Using Hyperterm or other terminal, connect to the console port of the control switch in which the Basic Switch Pod is connected. The following passwords are used on the control switch.

<table>
<thead>
<tr>
<th>Console login password</th>
<th>router</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enable secret password</td>
<td>cisco</td>
</tr>
</tbody>
</table>

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

8.1 Verify Control Switch IOS Version

Each control switch should be running **IOS 12.1(22)EA2 or later**. Earlier versions may have defects that affect NETLABAE.

8.2 Configure Control Switch Ports

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

- **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.

- **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.

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

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.
Locate the 3 control switch ports connecting to S1 and S2. Refer to the cabling diagram if necessary (section 6). The following commands must be manually added to each switch port.

**Example switch port configuration. Interface numbers will vary.**

```
interface FastEthernet0/2
  description port to S1 port 2 (PC1a)
  switchport mode access
  spanning-tree bpdufilter enable
  no cdp enable

interface FastEthernet0/3
  description port to S1 port 3 (PC1b)
  switchport mode access
  spanning-tree bpdufilter enable
  no cdp enable

interface FastEthernet0/4
  description port to S2 port 2 (PC2)
  switchport mode access
  spanning-tree bpdufilter enable
  no cdp enable
```

If the control switch does not recognize the `spanning-tree bpdufilter` command, make sure the switch is running at least 12.1(22)EA2.

### 8.3 Initial Lab Switch Setup

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

- Cisco Catalyst 2900 XL Series Switches
- Cisco Catalyst 2950 Series Switches
- Cisco Catalyst 3550 Series Switches
- Cisco Catalyst 3560 Series Switches

By default, these switches will not respond to a console break signal the same way routers do. There are two *environment variables*, which 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.
This procedure does not apply to control switches.

**Determining the Boot Status**

From the enable mode, issue the following IOS command.

```
Lab_Sw# show boot
```

<table>
<thead>
<tr>
<th>BOOT path-list:</th>
<th>flash:c2950-i6q412-mz.121-22.EA4.bin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Config file:</td>
<td>flash:config.text</td>
</tr>
<tr>
<td>Private Config file:</td>
<td>flash:private-config.text</td>
</tr>
<tr>
<td>Enable Break:</td>
<td>no</td>
</tr>
<tr>
<td>Manual Boot:</td>
<td>no</td>
</tr>
</tbody>
</table>

**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:

<table>
<thead>
<tr>
<th>Config file:</th>
<th>flash:config.text</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private Config file:</td>
<td>flash:private-config.text</td>
</tr>
<tr>
<td>Enable Break:</td>
<td>yes</td>
</tr>
<tr>
<td>Manual Boot:</td>
<td>no</td>
</tr>
</tbody>
</table>
```

**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)
Testing the Pod

After all routers and virtual machines have been installed, you should run a pod test to verify that your pod is working. The pod test will detect common configuration and cabling problems.

Some tests may take a long time. During the BOOTIOS test, NETLABAE may have to load the specified IOS image if it is not in flash. Some images are very large and can take up to 30 minutes to program into flash memory.

If you cannot resolve an issue and decide to contact technical support, please cut and paste the text from the POD TEST LOG and include with your e-mail.

![Pod Test Log Example]

IMPORTANT: Use the STOP button to the right if you want to stop the pod test.
10 Finishing Up

10.1 Bring the Pod(s) Back Online

Now you can bring the pod online and make it available for lab reservations. You can bring just this pod online by clicking the Online button under Management Options.

Pod 5 -- Management Options

- **Online**: Bring this pod ONLINE and make it available for reservations.
- **Test**: Tell me if this pod is working properly.
- **Cable**: Show me how to cable this pod.
- **Delete**: Remove this pod from NETLAB.

Alternatively, you can click **Bring All ONLINE** on the Equipment Pods page. Choose this option when you have no more additions or modifications to pods or control devices and you wish to put all pods into service.
10.2 Enable Lab Exercises

To make Basic Switch Pod V2 pods available to classes and students, you must enable the corresponding lab exercise content in each new or existing class.

To add or edit class information, log into NETLABAE using your instructor account. See the Instructor Accounts section of the NETLAB+ Administrator Guide for details.

Select **Class** from the menu bar at the top of the MyNETLAB page, or the link in the body of the page.

The Class Manager page will be displayed.

Select to add a new class or select an existing class from the class list by clicking on a class name.
To enable Basic Switch Pod Version 2 and associated lab exercises in a class, be sure to check CCNA Labs and Pods in the class settings.

10.3 Schedule a Lab Reservation for Your New Pod

To schedule a lab reservation, select Scheduler from the menu bar or the link on the body of the MyNETLAB page.

The Scheduler Options screen will be displayed. Detailed descriptions of the scheduler options are available by selecting Help on the menu bar. In this example, we will reserve an equipment pod for your own use.

Select OK to proceed to the reservation calendar.
The selection of pods depicted may be different from the pods available at your site.

The reservation time area may be scrolled up and down. Scroll to the bottom to display the color legend.
Select an available time, and the Reserve Instructor Access Time page will be displayed.

<table>
<thead>
<tr>
<th>Reservation Type</th>
<th>Instructor Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment Pod</td>
<td>Galactica</td>
</tr>
<tr>
<td>Reserved For</td>
<td>Antonio Labmeister (alab)</td>
</tr>
<tr>
<td>Start Time</td>
<td>Sun Mar 13, 2005 8:00PM (GMT-08:00) Pacific Time (US &amp; Canada)</td>
</tr>
<tr>
<td>End Time</td>
<td>Mar 13, 2005 9:30 PM</td>
</tr>
<tr>
<td>Initial Configuration</td>
<td>□ restore configs from last Security Router Pod reservation (if any) □ no configs loaded (clean)</td>
</tr>
</tbody>
</table>

Review the details of the reservation and select **Confirm Reservation**. You can return to the reservation calendar to see your lab reservation on the time reservation portion. Remember, you may need to scroll the page to see your information.

<table>
<thead>
<tr>
<th>Time</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>8pm</td>
<td>638 alab</td>
</tr>
<tr>
<td>9pm</td>
<td></td>
</tr>
</tbody>
</table>

For more information on scheduling reservations, see the Scheduler section of the *NETLAB+ Instructor Guide*. 