Effective techniques for building home labs and using remote labs

Building Labs: Slow yourself down

- Many decisions involved in building your own home-based lab.
  - $$
  - Space
  - Convenience/ Inconvenience
  - Hardware/ Software Selection
- Building any lab (personal or work) requires a logical thought-process.

PPDIOO - Introduction

- PPDIOO: Concept introduced in Cisco CCNP SWITCH exam topics.
- Cisco methodology that defines the continuous life-cycle of services required for a network.
- First five steps (PPDIO) should be used when designing a home-based lab.

PPDIOO

- Prepare
- Plan
- Design
- Implement
- Operate
- Optimize (**not a consideration for designing practice labs**)

PPDIOO = Prepare

Prepare:

- "Involves establishing the organizational requirements, **developing a network strategy**, and proposing a **high-level conceptual architecture identifying technologies that can best support the requirements**. The prepare phase can establish a financial justification for network strategy by assessing the business case for the proposed architecture."

What are your "requirements"?

- Practice CCNA-level features?
- Practice CCNP-level features?
- Practice CCIE-level features?
- Provide a resource for future learning efforts?

Prepare - CCNA

- If pursing your CCNA, my best advice…don't build a rack.
- Use Remote Equipment instead.
- Why?

Prepare – CCNP and beyond

- At the CCNP level (and beyond) you should have enough prior networking knowledge to answer these questions;
  - How much $$ are you willing to invest?
  - Do you expect to use this rack for testing any features/protocols NOT included in CCNP/CCIE blueprints?
  - **Can you make a list of all required protocols/features you plan on implementing in this rack?**
  - Do you know how to effectively use the Cisco IOS Feature Navigator?
  - Can you understand/find Cisco Datasheets?
  - Do you consider IOS 15.x mandatory in your home lab?

PPDIOO = Plan

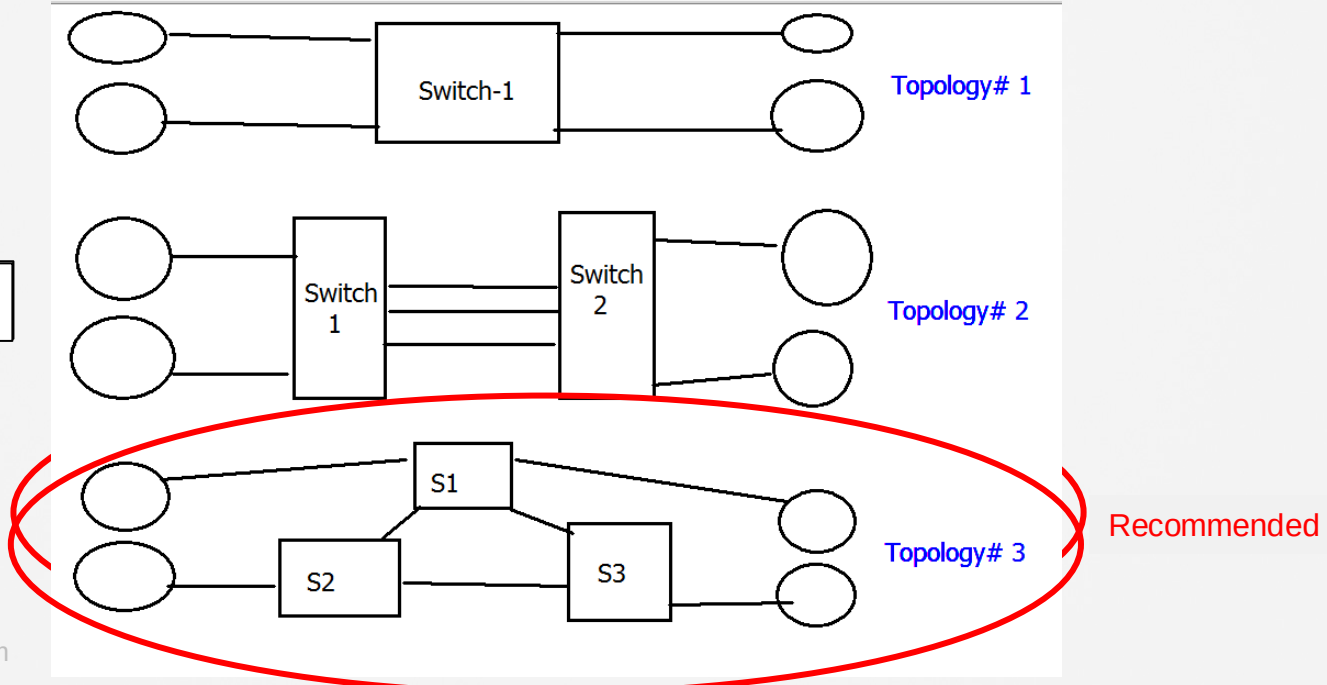
- Plan;
- Involves identifying initial network requirements based on goals, facilities, user needs, and so on. The plan phase involves characterizing sites and assessing any existing networks and performing a gap analysis to determine whether the existing system infrastructure, sites, and the operational environment can support the proposed system.

- Let's go into each of these in more detail…

Plan - Goals

- Involves identifying initial network requirements **based on goals**, …
  - For each protocol selected in the "Prepare" stage, draw a diagram showing the minimum quantity of interfaces/chassis you'd need to "play with" that protocol.

L2 Switching



Plan - Facilities

- Involves identifying initial network requirements based on goals, **facilities**….
  - ✓ Do you have physical space to house a rack, or a stack of equipment on a desk?
  - ✓ Do you have have enough power in your room to support the proposed rack?
    - ❑ Enough electrical outlets?
    - ❑ Circuit-Breakers that won't trip?
  - ✓ How will you cool the equipment, and yourself?
  - ✓ Will the noise be a problem?

Plan – Electrical (1)

- Each electical outlet in your home leads back to a Circuit Breaker
- Typically, one Circuit Breaker will control multiple wall outlets.
- Circuit Breakers are designed to trip (turn off) if the load going through them is too high, preventing fires.

Plan – Electrical (2)

- One of your goals: Do not trip circuit breakers with your lab.
- How to ensure this:
  - Ideally, power your lab devices from more than one circuit breaker.
  - Know the power draw (amps, volts) of your devices (Datasheets).
  - Use the following formula:

Remember that the circuit you're using is probably also powering other home devices/appliances.

Circuits must be derated by 20% A SAFETY CODE REQUIREMENT. Maximum wattage allowed on a circuit is calculated by multiplying the derated amps by the voltage.

Example:
20 amp circuit with 120 volt application
1. 20 amps x 20% = 4 amps
2. 20 amps - 4 amps = 16 amps (max allowed)
3. 16 amps x 120 volts = 1,920 watts (max allowed).

Quoted from: http://www.techrepublic.com/forums/questions/how-many-computers-needed-for-a-nice-ccna-ccnp-home-lab/

PPDIOO = Design

- Design;
- The initial requirements that were derived in the planning phase drive the activities of the network design specialists. The network design specification is a **comprehensive detailed design that meets** current business and **technical requirements**, and **incorporates specifications** to support availability, reliability, security, **scalability**, and performance.
- It is at this stage that you'll determine things like:
  - Chassis models that you desire..and possible cheaper alternatives
  - WICs/NMs that you'll need.
  - Types of WAN/LAN Cables that you'll need.
  - Quantity of memory devices will need to support desired IOS
  - Where you plan to purchase all of this stuff from.

PPDIOO = Implement

- Implement:
- **The network is built** or additional components are incorporated according to the design specifications, with the goal of integrating devices without disrupting the existing network or creating points of vulnerability.
- It is at this stage that you will:
  - Purchase all of your equipment
  - Rack-n-Stack everything
  - Cable everything
  - Hold your breath and cross your fingers.

PPDIOO = Implement (Tips)

1. Ensure you that obtain the following from any sellers of equipment:
   - Return policy (if any)
   - Current IOS on the device they are selling.
   - Shipping costs of equipment
2. Read this if you plan to use Ebay:

   http://www.ebay.com/gds/Buying-Used-Cisco-Equipment-on-eBay-/10000000004063516/g.html
3. Make sure you purchase a flat console cable as well as any adapters needed to connect it to your laptop/PC.
4. When purchasing switches;
   a) Buy Multilayer Switches (not just L2 Switches)
   b) Ensure most ports are dual/tri speed ports (10/100 or 10/100/1000)
   c) Ensure they support Private VLANs, IPv6, and DHCP Snooping

PPDIOO = Implement (Tips)

5. When purchasing routers:
   a) Ensure each router has (at minimum) two (2) FastEthernet and two (2) Serial interfaces.
   b) Ensure that FastEthernet ports on routers are really “routed” ports (not switch modules).
6. Purchase at least one really long Ethernet cable to connect your laptop to your hub.
7. Stack heaviest items at the bottom of the rack.
8. Ensure that all equipment fans have room to breathe.
9. Only use velcro cable ties for LAN/WAN cables…you’ll probably be doing a lot of plugging/unplugging as you use your rack.

PPDIOO = Operate

- Operate
- It is at this stage that you begin to have fun and all of your hard work at Preparing, Planning, and Designing pay off.
- Tips:
  - Don’t leave your devices on when not using them (reduce electricity bills)
  - Make it a habit of saving your configs to text files prior to shutting down equipment.
  - Make sure cables don’t pose a tripping hazard.
  - Keep your door open if possible to keep room cool.
  - Make sure you dust regularly.

INE CCNA/CCNP Rack Hardware (1)

» Routers:

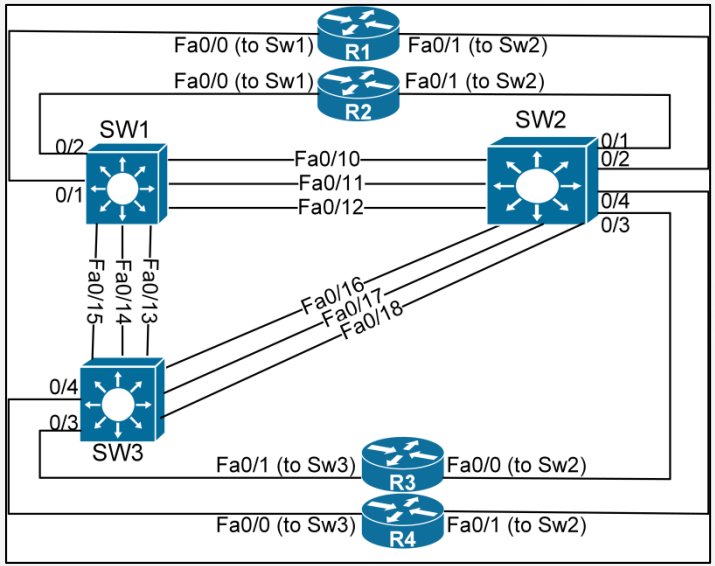
- Cisco 3845 (x2)
  - **NM-8A/S** (8-Low Speed Serial Interfaces for Frame-Relay support)
  - **NM-32A** (32-port Async Module..to connect to Console Ports of rack devices)
- Cisco 2811 (x2)
  - 2-FastEthernet Interfaces (built into chassis)
  - NM-4A/S (Serial Interfaces)
  - HWIC-4ESW (4-port Etherswitch module)
- Cisco 1841 (x2)
  - 2-FastEthernet Interfaces (built into chassis)
  - Two WIC-1T's (1-port Serial interface)
- Module support for above router platforms:

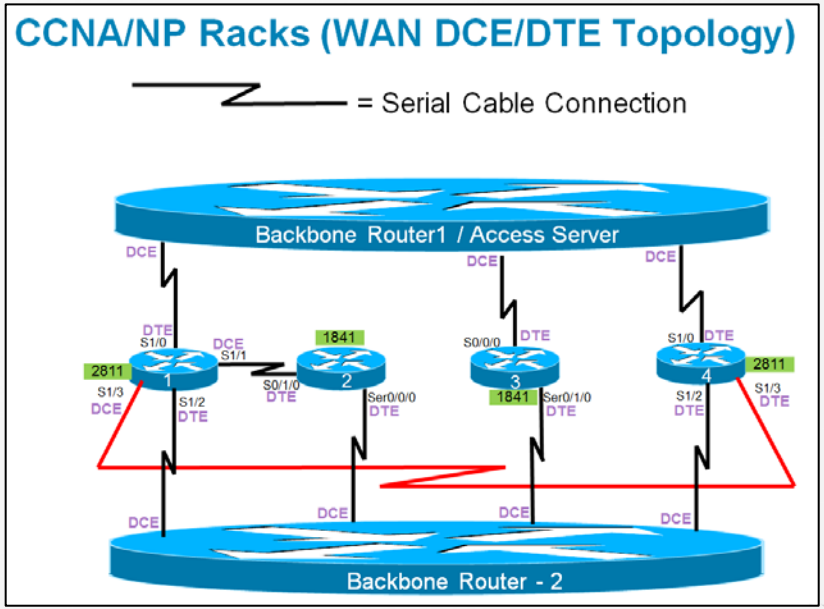
https://www.cisco.com/c/dam/en/us/products/collateral/routers/1900-series-integrated-services-routers-isr/aag_c07_563807.pdf

INE CCNA/CCNP Rack Hardware (2)

» Switches:

- Cisco 3560 (x3)
  - WS-C3560-24TS





Building a Lab: Last Tips

- Don't forget about a Terminal Server, very handy. (Cisco 2509 and 2511s)
- Don't think about resale value…there is none.
- Research other, online articles about building home-based labs.
- If, (after your lab is built) you discover it doesn't meet all of your needs…supplementing with rack rentals might be less $$ than purchasing more equipment.

Part-2: Effective techniques for using remote labs

Following, or Creating

- Before renting time on any remote lab system ask yourself which of the following you plan on doing:
  - Following a pre-designed Lab Guide
  - Designing your own labs tasks
- Techniques for efficient use of remote labs differ depending on your preference above.

Utilizing Pre-Designed Lab Workbooks/Guides

Following Lab Guides: Pros and Cons

Pros:

- Pre-built hierarchical learning approach
- Features/ Protocols match Cisco Certification requirements.
- Screenshots to help with self-assessment
- Pre-built topology diagrams
- Questions/ Assessments to answer
- Pre-configured initial configurations

Following Lab Guides: Pros and Cons

Cons:

- Not designed to encourage “creative exploration”.
- May be poorly written (bad syntax, grammar, etc)
- Failure to complete one section may result in inability to continue to remaining sections.
- May not include tasks on protocols/ features that you, personally, wish to explore.

Lab Guides and Remote Racks

- Lab Guides are written based on one-of-two assumptions:
  1. You will have access to the same equipment as the lab developer.
  2. You will need to find/build your own topology to match that of the Lab Guide.
- Advice: If you decide to use a pre-designed Lab Guide, select one that allows you access to the same equipment as that used by the Lab Designer.

Lab Guides and Time Management (1)

- Objective: Avoid idle time when minutes on a rack equal $$.
- Read through Lab Guide prior to renting any rack time.
  - Ensure that you understand each objective.
  - Ensure that you understand the instructions.
  - Ensure that LG is readable.
  - Estimate time you will need for each task.
  - If you are not given IOS command to accomplish a task, look it up and write it down.
  - Print multiple copies of topology drawings

Lab Guides and Time Management (2)

- Once you start working on the remote rack…ignore any timers.
- When you feel the urge to experiment…do so.
- When you have an “Ah HA!” moment…write it down.
- If Lab tasks are independent (not cumulative) try to recreate some of the previous tasks from memory and add to your current task.
- Save your configs often to local .txt files.

Creating your own Labs.

Designing your own labs: Pros and Cons

Pros:

- Custom-tailor your lab based on available resources.
- Custom-tailor your lab based on your interests.
- Opportunity to go into greater depth on a topic than typically found in a pre-designed lab.
- Trying something..and failing = great learning opportunity.

Designing your own labs: Pros and Cons

Cons:

- Valuable time spent on troubleshooting problems.
- You may miss critical features/protocols.
- You might design a lab unsupported by your available hardware/feature set.
- You might lead yourself down a rat hole.

Approaches to Remote Lab Design

- Two approaches:
  - **Approach#1**: Find an available topology first, and design labs around your resources.
  - **Approach#2**: Design your labs using minimal equipment, and find a topology that will suit your needs.
- Approach#1 will save you more time.
  - Difficult to find racks that meet a pre-designed topology.

Step-1: Finding the equipment

- Lots of remote equipment available.
- Key things to look for:
  - Price
  - Availability of both routers and switches in a single topology.
  - Is it real equipment or emulated?
  - Flexible topologies
  - Scheduling availability
  - Does it require you to download any special front-end software?
  - Pre-Loaded Configurations available?

Step-2: Designing Your Lab (1)

- Creative-Labs (those you design) are best used as a supplement alongside reading/watching VODs.
- As inspiration strikes you:
  1. Pause your reading/VOD-watching
  2. Write down what you'd like to do (text).
     - ✓ What feature/protocol/keyword do you want to try?
     - ✓ What are ways you could intentionally try to break it?
  3. Draw the minimum topology that would enable you to accomplish your objective.

Step-2: Designing Your Lab (2)

4. Compare your drawing against available lab topology.
5. Add port numbers/interface numbers to your drawing to match lab topology.
6. Devise IP addressing scheme and any other pre-requisite configurations.
7. In text editor, create pre-configs for copy-and-paste.
8. Devise a rough time estimate to complete the objective.
9. Don’t login to remote equipment until you have enough lab objectives to fill your scheduled timeslot.

Step-3: Implementing your Lab Design (1)

- When using a vendor's remote rack system for the first time, budget at least 5-10 minutes to become familiar with the system, menu, and controls.
- Start with a clean slate…delete any existing configurations.
- After implementing your own initial configs, save them to .txt files if any changes were made.

Step-3: Implementing your Lab Design (2)

- Working with “debug”
  - Debugs are fun, play around with them, but can be hazardous to your health.
  - Disable debug output to console
    - (config)#**no logging console debug**
    - (config)#**logging buffer debug**
- View debug output within confines of memory buffer…not “live”.
  - Router#**clear log**
  - Router#**debug eigrp packet (*example*)**
  - Router#**un all**
  - Router#**show log**

Any Questions?