Advanced Networking 2020

Lab #4: Build a net

Total points: 75 pts

Assignment
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Abstract

In this lab you will create your own network. Cool! You have to use the equipment that is provided, but **you** design what your network will look like. At the end you will write a report about its architecture and implementation.

Teams

The teams are already formed and created on Canvas.

Each team is assigned to one of the Juniper T1600 routers.

- Chico-1 to 6: Lab 4 team 1..6 (on Canvas)
- Zaza-1 and 6: Lab 4 team 7..12 (on Canvas)

Each team is assigned:

- Network devices
  - one Nortel 5530 or an HP-6600
  - one Cisco 3750 switch with IPSERVICES firmware
  - one Juniper J2320 router
- Cables
  - 2 x SC-LC single mode fibers (short)
  - 1 x SC-SC single mode fiber (long)
  - 3 x LC-LC single mode (short)
  - 1 x LC-LC single mode (long)
  - 2 x LC-LC multi mode (short)
- Optics
  - 5 x SFP 1 Gbps 1310 nm (LR,blue handle) fiber optic
  - 4 x SFP 1 Gbps 850 nm (SR,black handle) fiber optic
- Juniper Physical Interface Cards assignment
  - 2 x XENPAK 10 Gbps (SC, blue frame), already installed
  - 3 x SFP empty slots

  Note: you will have to assign these to logical systems on the Juniper.

If you are in team Router-X, use the equipment labeled Router-X.

The Ciscos for each team also have a 1 Gbps 1310 nm (LR, blue handle) optic installed. **Please do not remove this!** And be careful inserting and removing fibers.

In addition there is an Arista 7124S(X) on each side of the aisle, that the teams on that side can use collectively. There are 4 x 10 Gbps fiber optics preinstalled, and some extra LC-LC fibers available.

Do not wind up the fibers in any tighter loop than they are in the packaging. This will destroy the fibers. Please keep all the packaging and protection for the fibers in the box, such that they can be put back later.

Each team should use the hardware that is assigned. Extra hardware is not allowed, unless you bring enough for everybody. **Installing a different software version is not allowed.**

Documentation

The documentation for the switches and routers can be found at:

- Nortel 5530: http://software.os3.nl/AdvancedNetworking/Nortel/v5
- Juniper T1600: https://www.juniper.net/techpubs/en_US/junos10.4/information-products/pathway-pages/product/10.4/
- Local info on T1600: http://software.os3.nl/AdvancedNetworking/Juniper
- Cisco 3750: http://software.os3.nl/AdvancedNetworking/Cisco/3750*
- Arista 7124S: http://software.os3.nl/AdvancedNetworking/Arista

Note: the serial console of the Nortel requires a NULL modem cable or converter, and you need to press Ctrl-Y to get access to the menu/CLI. There are four small orange 'NULL modem converters' in the server room. Share them and set up terminal access via ssh/telnet as soon as possible, such that you can all work in parallel. As before, there are serial console servers on each side that can be accessed respectively, on the management network. The IP addresses are written on the devices (10.0.1.3 to .6). The login details are as before:

Username is: dialout
Password: os3xsjun

The Nortels will do a DHCP request for an IP address. If needed, the MAC addresses of the switches can be found in http://software.os3.nl/AdvancedNetworking/Nortel/dhcpd.conf. You can use the grey and white cables that run from your desktop to the patch panel in the server room to attach e.g. your laptop and work from your desk.

Task 1: Logically divide the Juniper (5 points)

The goal of this lab is to learn, understand and use techniques that professional service providers (VPC/Serverless/ISP/VPN/Hosting/MobileTelecom) would also use and build a network with it. In this task you work with the whole team.

There is a management network with switches labeled Mgmt for both sides of the aisle. You can hook your systems up to these Mgmt switches such that all teams can access their logical slice of the Juniper in parallel.

The two routers are ssh accessible via the Mgmt switches at their management addresses:

- Chico: 10.0.1.22 or fd42::1234::678::1/48
- Zaza: 10.0.1.42 fd42::1234::567::1/48
- (Reserved: 10.0.1.1-10.0.1.63)

Username is: sne
Password: os3xsjun

You need to logically partition the Juniper T1600 such that each one of the teams gets assigned a logical router with 2 x 10 Gbps XENPAK optics, and 5 x 1 Gbps SFP optics (right-bottom corner).

See: http://www.juniper.net/techpubs/en_US/junos11.4/information-products/topic-collections/security/software-all/logical-systems-config/index.html?topic-54092.html

Define on your logical router a user with the name of your team. Once this is done you will always ssh directly into your logical router or alternatively you can use the 'set cli' command from the main account to move into your logical router.

Don't forget! You can install several logical routers per team, as long as you respect the interface assignment rules. This is what you've learned during the JunOS intro.

You have 90 minutes to accomplish this, after this time you need to give us the configuration running on the Juniper to show how far you are. If you don't manage in time you will get support from us.

Task 2: Network design (30 points)

Take stock of the routers and switches you have been given and their capabilities. Next, read the full lab exercise (this document) and brainstorm about the following points:

- What type of network will you design (access network, backbone, ISP, IX etc)?
- What kind of network services will your provide?
- Which transport protocols / network layer protocols will your network support / need?
- How can you be resilient to failures / attacks (LACP, VRRP, segmentation)?

- How will you manage / monitor / support your network and keep it secure?
- Lastly, when your design is finished, take account of the shortcomings and limitations you might have.

Follow these steps in order to ensure that you build something that actually works:

- Design your network
- Check the capabilities of your devices
- Think about the cabling required and the cable layout
- Set up an addressing plan
- Decide which devices you need and where in your network
- Draw a physical as well as a structural / logical map of your network

Explain the rationale behind your choices in your report. Implement your design using the provided hardware.

The lasers in the fiber optics are Class 1 laser products, so should be safe. But better to NOT LOOK INTO THE INTERFACES OR FIBERS! They emit high intensity light outside the humanly visible spectrum!

If you are unsure about connecting a fiber, consult a lab teacher. The fibers do not need to be attenuated (light output reduced), but they might need cleaning. Consult lab teachers for cleaning equipment.

Task 2.1: Internal routing

- Consider why and how would you like to arrange internal routing within your network. You should come up with a semi-realistic scenario of IP address space separation (subnetting).
- Check which routing protocols are available on the equipment and incorporate them in your design.

Explain your decisions in your report.

Task 3: External connections (15 points)

Choose at least another team to cooperate / peer with. Connect your network to their network and demonstrate connectivity between both networks.

Think ahead about the following points:

- The peering relation: what are you going to advertise and what metrics will you use (if needed)?
- What are you going to accept?
- Think about security: you are setting up a connection with the "outside world".

Justify your decisions with reasoning in the report.

Task 4: Support systems and security (20 points)

A network is not only built and left on its own: it has to be maintained as well. Make sure you take adequate measures by setting up supporting tools for management / monitoring and security. Prepare for being able to conduct effective forensics. For this you may include technologies such as:

- ACL
- Firewalling
- Strong / protected authentication and login mechanisms
- Real time logging and monitoring with alarms and notifications
- Configuration version management / backup strategy
- DNS
- etc...

Explain your decisions in your report.

Task 5: Potential customer request: MPLS, VXLAN, EVPN (up to 10 bonus points, ONLY if you've scored at least 60 points in the previous parts)

On top of a network, applications will be run. Think about what it takes for a provider to do a live migration from one VPS to another.

- Could you provide a (private) overlay network?
- Could you do a live migration from one team to another (e.g.: container orchestration)?
- Could you guarantee a bandwidth?

Submission: 5 points for report style and consistency

The submission must contain following:

1. The final configurations of devices in readable format as Appendix
2. Report containing the final version of the topology drawings where you explain the role of each device and the functions it fulfills, with references to the configuration. Include the description of the connectivity to the respective team(s).
3. Maximum 15 pages excl. Appendices, in PDF format.
4. Because SNE depends on gifted equipment, we realise that the hardware given to you is not ideal. Therefor we want to see a paragraph in your report dedicated to **Future Work** where you can explain what you would improve, in terms of device or link redundancy, infrastructure maintainability, or security; if you had unlimited resources!
5. Your grade is based on the report.