Project 1. Linux Network

網路規劃管理與實務 - CCNA 2025 Spring
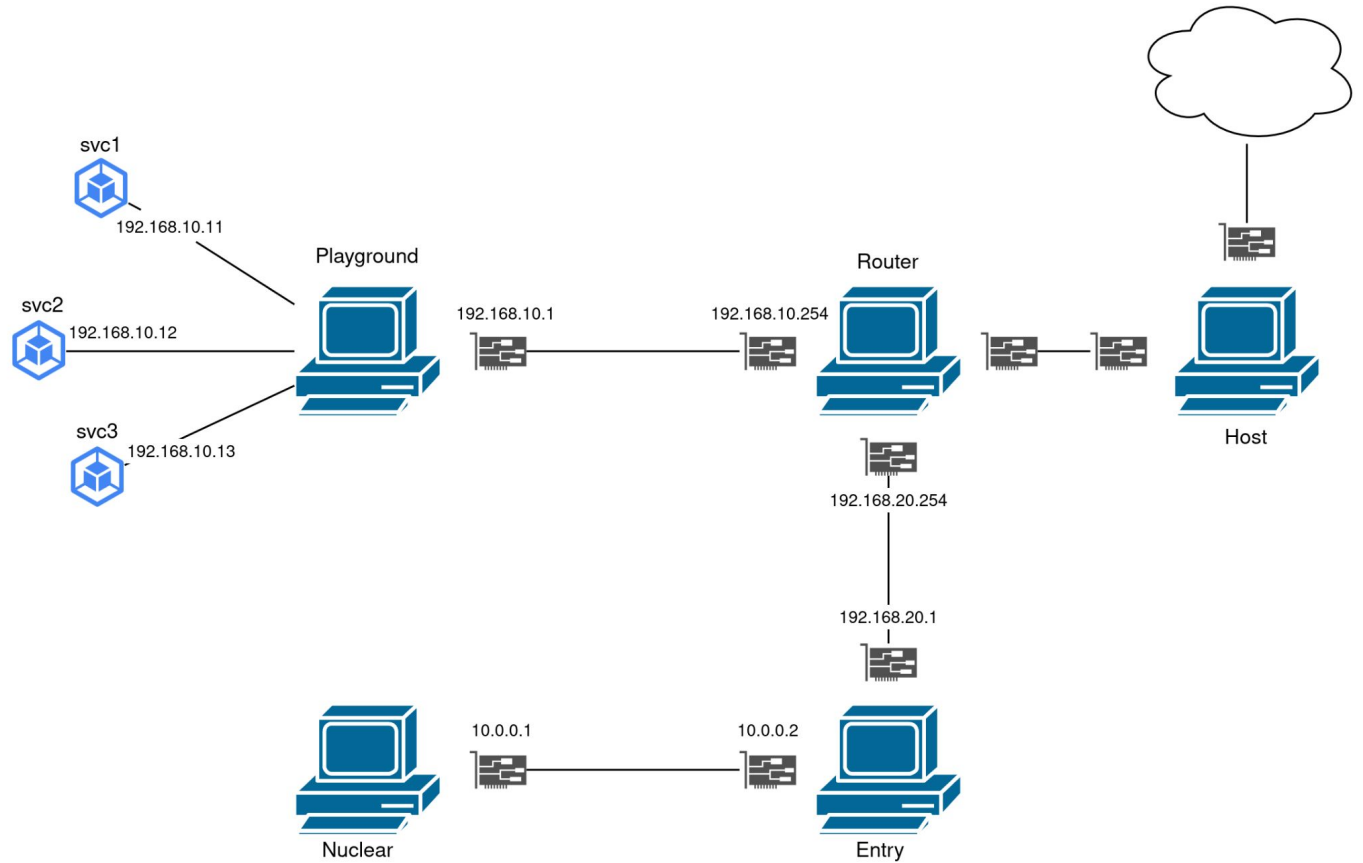Authors:

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Outline

- Topology

- Specifications

- Requirements
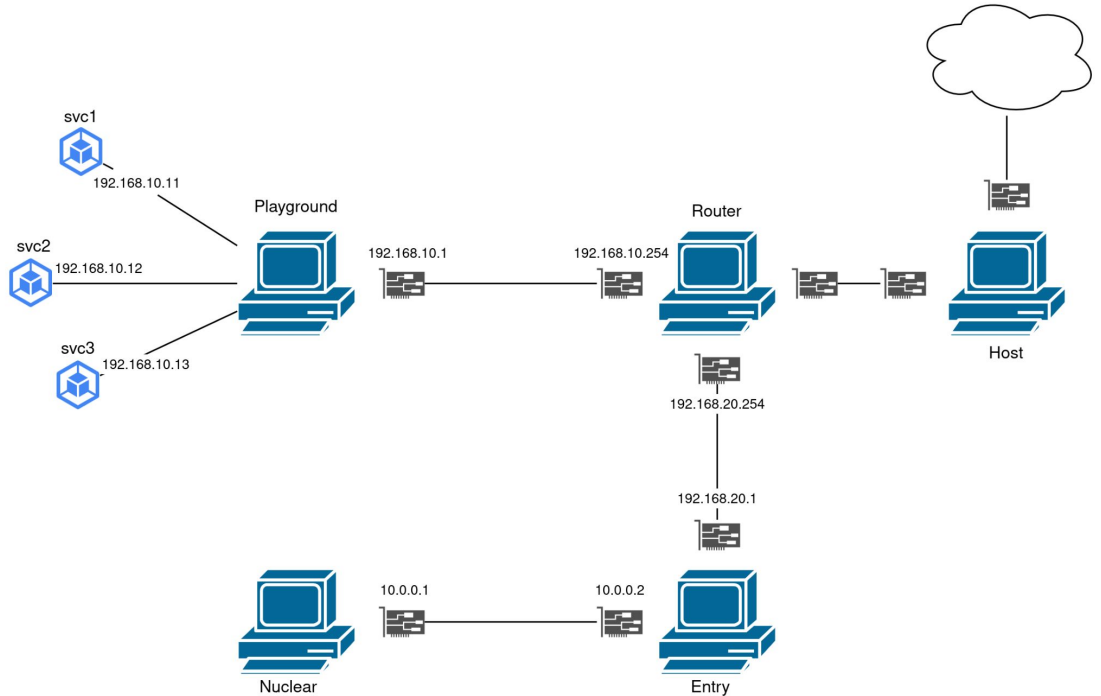
- Grading

- Demo Schedule

Topology

Specs - General

- You can use any Linux distributions for the VMs.
    - ArchLinux, Debian, Ubuntu, NixOS, etc.
    - Install desktop environment might be a bad idea because you will have to run multiple VM on your laptop at the same time.
- You can use any VM Hypervisor.
    - KVM, Qemu, VirtualBox, VMWare Workstation, Proxmox VE, etc.
    - You might have to explain how the hypervisor achieve the network topology during demo.
- Each VM should:
    - Have their ssh server enabled.
   - Keep their configurations after reboots.

Specs - Router

- ## NIC 1 - To Host
  - IP: any
  - Bridge to Host.
- ## NIC 2 - To Playground
  - IP: 192.168.10.254/24
- ## NIC 3 - To Entry
  - IP 1: 192.168.20.254/24

svc1
192.168.10.11

svc2 192.168.10.12

svc3
192.168.10.13

Playground

192.168.10.1

192.168.10.254

Router

Host

192.168.20.254

192.168.20.1

10.0.0.1
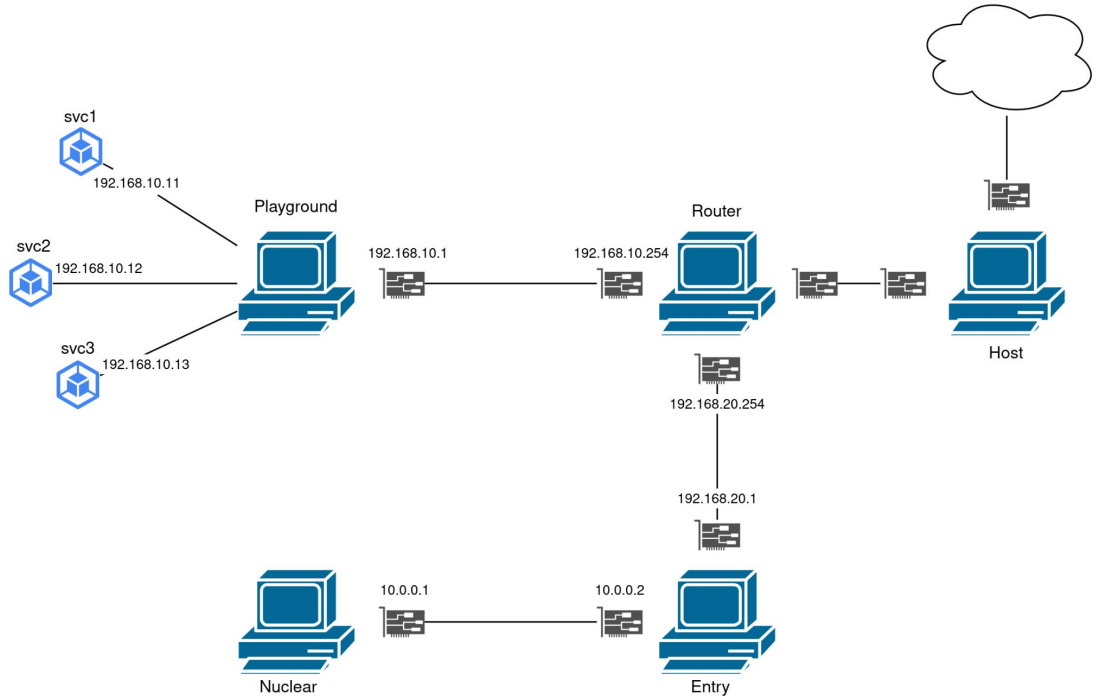
10.0.0.2

Nuclear

Entry

Specs - Entry

- NIC 1 - To Router
  - IP: 192.168.20.1/24
  - Gateway: 192.168.20.254
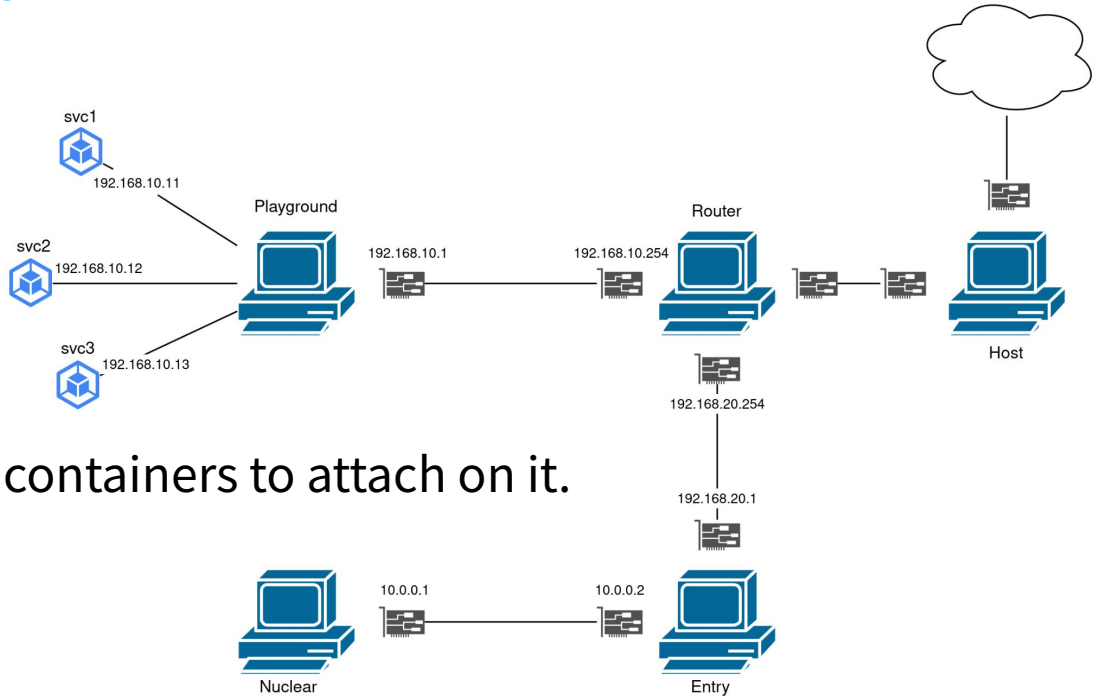- NIC 2 - To Nuclear
  - IP: 10.0.0.2/30
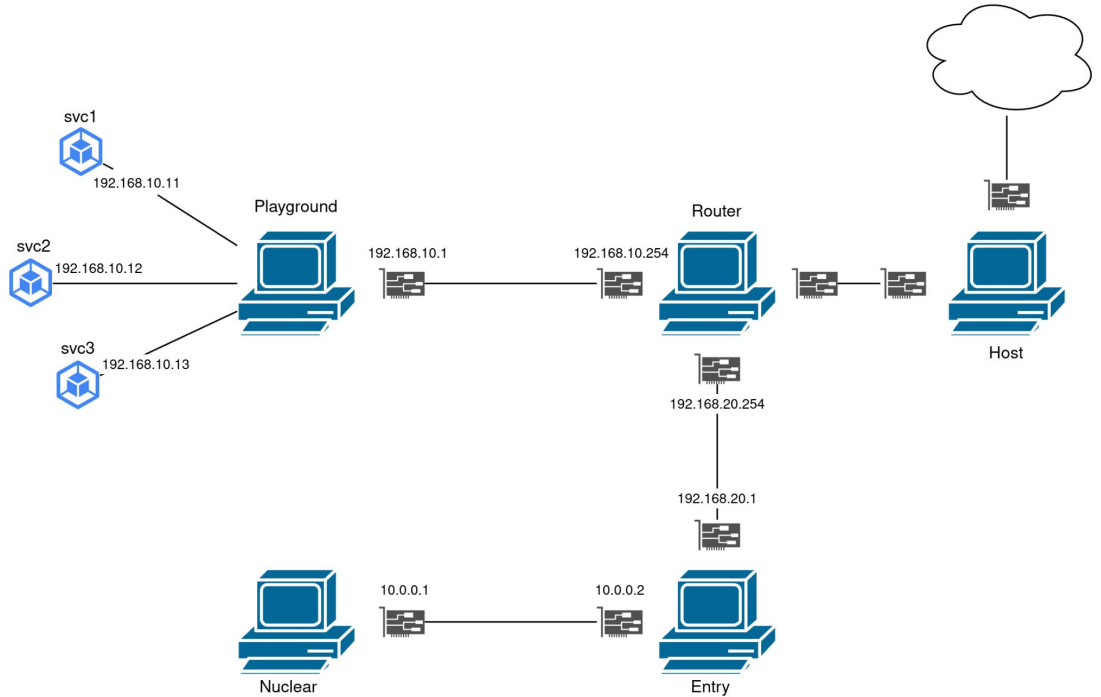
Specs - Nuclear

- ## NIC 1 - To Entry
  - ### IP: 10.0.0.1/30

Specs - Playground

- NIC 1 - To Router
  - Attach to br0
- Bridge - br0
  - IP: 192.168.10.1/24
  - Gateway: 192.168.10.254
- Bridge should be used for containers to attach on it.

svc1
192.168.10.11

Playground

svc2
192.168.10.12

192.168.10.1

192.168.10.254

Router

Host

svc3
192.168.10.13

192.168.20.254

192.168.20.1

Nuclear

10.0.0.1

10.0.0.2

Entry

Spec - Containers

- svc1 ~ svc3
  - IP: 192.168.10.11/24 ~ 192.168.10.13/24
  - Gateway: 192.168.10.254
- FYR: Appendix. A

Requirements - Connectivity

- Every VM should be able to access the Internet.

    - e.g. `ping 1.1.1.1`

- Every Containers should be able to access the Internet.

Requirements - NAT

- Router should perform NAT to the connections from Playground.

- Router should perform NAT to the connections from Entry.

- Entry should perform NAT to the connections from Nuclear.

- Router should forward to the incoming connections that comes to tcp 2222 port to tcp 22 port on Playground.

- Router should forward to the incoming connections that comes to tcp 80 port to 80 on Playground.

Requirements - Loadbalancing

- Playground should forward to the incoming connections that comes to tcp 80 port to 80 on svc1 ~ 3, in Round-robin.

Requirements - Firewall

- All the ICMP packet should pass.

- All the established and related connection should pass.

- No connections (other than ICMP) can go to Nuclear unless they are initiated from Nuclear.

Requirements - Port knocking

- Tcp 22 port on Entry will be closed by default.

- After tcp 1111, 2222, and 3333 port recieve connection attempts in a row within 30 sec, tcp 22 will be open for the specific source ip for 10min.

Requirements - SSH

- Host => Playground

- Host => Playground => Entry

- Host => Playground => Entry => Nuclear

    - You might have to do something on nuclear to make this work.

Grading

- Requirements - 60%

- Demo questions - 40%

Demo Schedule

- 3/14 (Fri.) 19:30 ~ 21:30

- Fill in your student id in the spreadsheet

- https://docs.google.com/spreadsheets/d/13EjZeJcP3LXyICSSxpXgWSitN5KAkqBqw7c9W4NybAI/edit?usp=sharing

Appendix. A - systemd-nspawn

- The containers svc1 ~ svc3 might use the systemd-nspawn image that we prepared.

- Use systemd-networkd on the VM which runs nspawn containers may help, as systemd-nsapwn will generate veth for you.

- See systemd-nspawn(1), systemd.nspawn(5) man pages.

```
> sudo importctl pull-tar -m --verify=checksum \
    https://people.cs.nycu.edu.tw/~ytshih/ccna-2025/lab2/ccna.tar.xz <container-name>
> sudo machinectl start <container-name> # Start container
> sudo machinectl shell <container-name> # Get the container shell
```

FYR

- ArchLinux Installation Guide https://wiki.archlinux.org/title/Installation_guide

- NYCU CS Debian Mirror http://debian.cs.nycu.edu.tw/

- ArchLinux Wiki - Qemu https://wiki.archlinux.org/title/QEMU

- ArchLinux Wiki - systemd-networkd https://wiki.archlinux.org/title/Systemd-networkd