Project 1. Linux Network

網路規劃管理與實務 - CCNA 2026 Spring

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Outline

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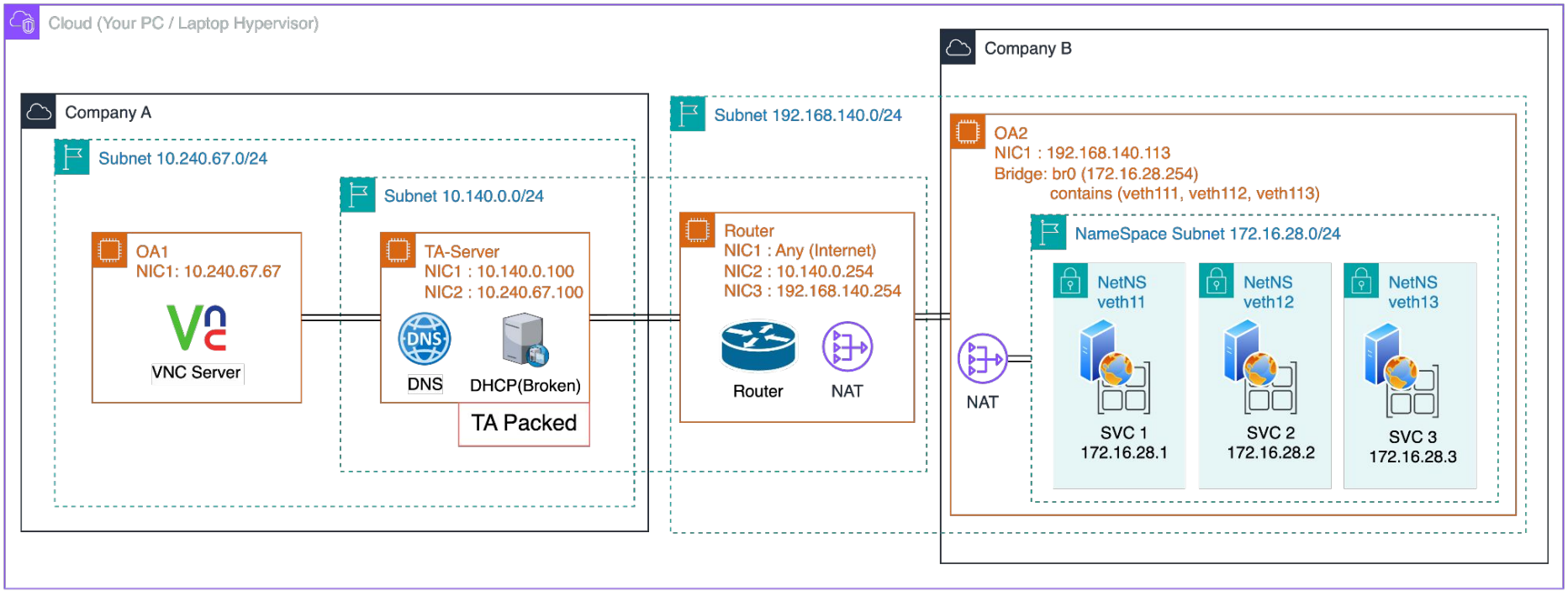
Topology

<<Note>>
Company A and B are logical sections.
Hostname are **not case-sensitive**.

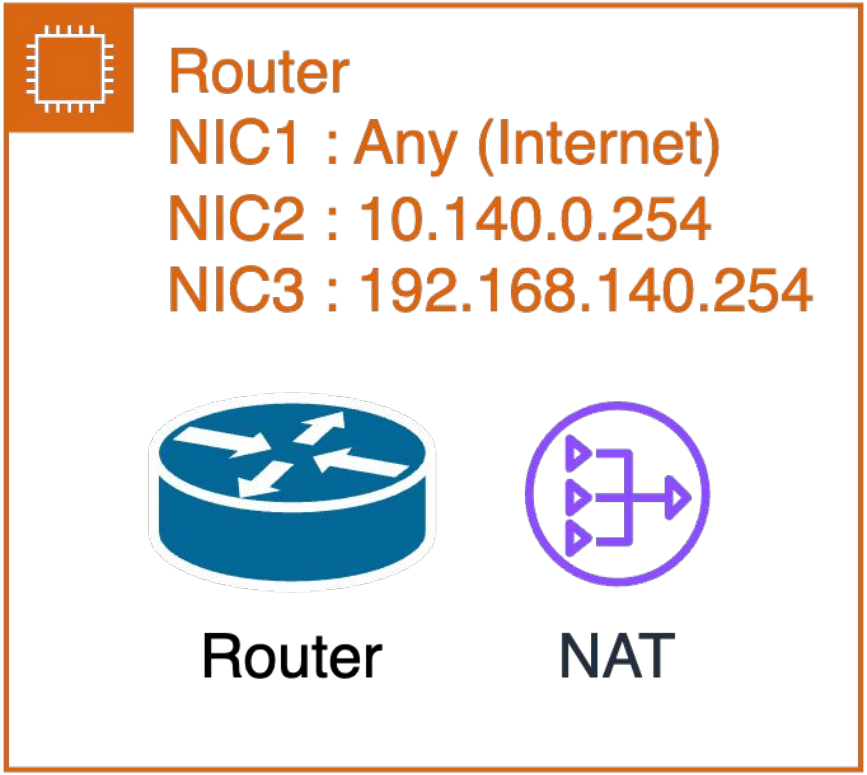


Specs - General

- 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 may run out of compute resources)
- 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
  - Make sure it has internet connection.
- NIC 2 - To Company A
  - IP: 10.140.0.254/24
- NIC 3 - To Company B
  - IP : 192.168.140.254/24

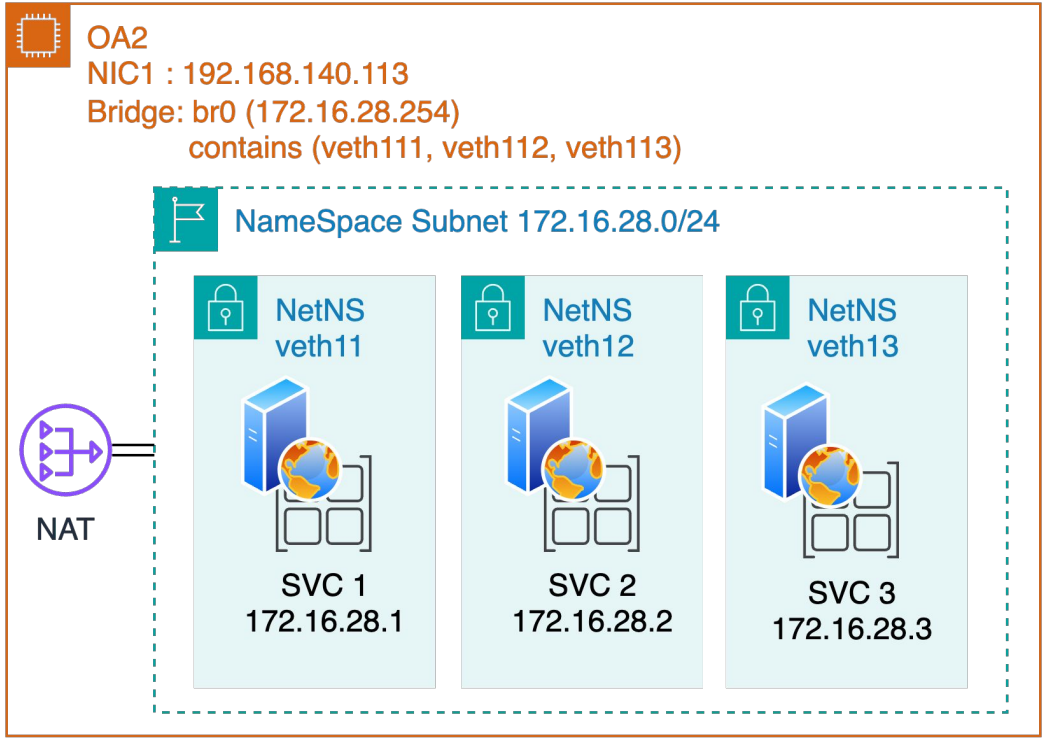


Specs - OA1

- NIC 1 - To TA-Server
  - IP: 10.240.67.67/24

Specs - OA2

- NIC 1 - To Router
  - IP: 192.168.140.113
  - Gateway: 192.168.140.254
- Bridge - br0
  - IP: 172.16.28.254
  - [IPMasquerade] Required
  - Ports (OA2 → NetNS)
    - veth111 → veth11
    - veth112 → veth12
    - veth113 → veth13

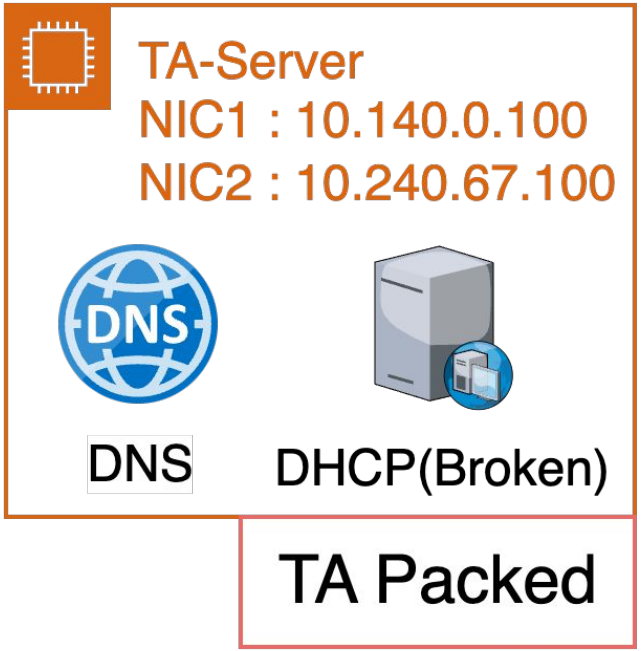


- Bridge should be used for pseudo containers to attach on it.

Important ! You only need to import VM with the corresponding settings

Specs - TA Server

- NIC 1 - To Router
  - IP: 10.140.0.100/24
  - Gateway: 10.140.0.254
- NIC 2 - To OA1
  - IP: 10.240.67.100/24
- You don’t need install any services.
- Your topology should be work with this packed VM without modify it.
- Guest Account
  - `ccna / happyCCNA@2026`
- `VM OVA Download Link`
  - https://reurl.cc/R2dOAG



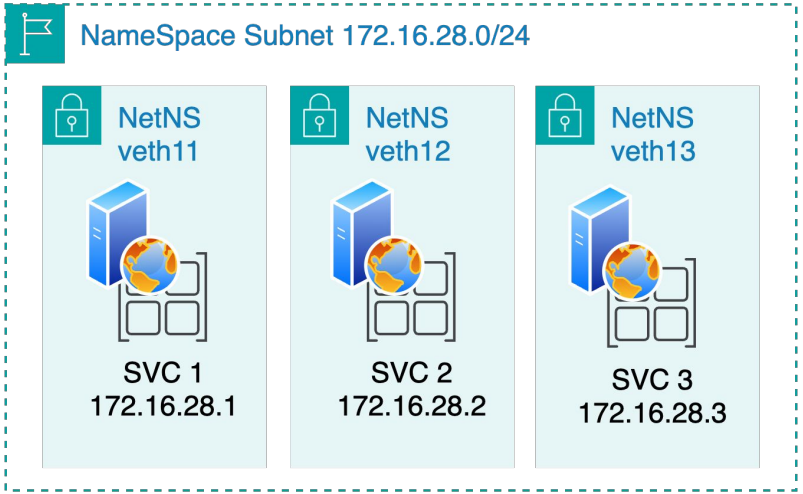
Important Notes on Importing TA-Server VM

The TA-Server contains **two** network adapters. When importing the VM into your hypervisor (e.g., VirtualBox, VMware, Proxmox), please ensure your hardware settings are mapped exactly as follows:

- **Network Adapter 1**: Must be connected to the virtual switch (Internal Network / LAN Segment / VMnet) associated with the 10.140.0.0/24 subnet. This interface is persistently configured as eth0 inside the guest OS (IP: 10.140.0.100).
- **Network Adapter 2**: Must be connected to the virtual switch associated with the 10.240.67.0/24 subnet. This interface is persistently configured as eth1 inside the guest OS (IP: 10.240.67.100).

Spec - Pseudo Containers

- SVC 1 ~ 3
  - IP: 172.16.28.1/24 ~ 172.16.28.3/24
  - Gateway: 172.16.28.254
- You don’t need to install any container services such as Docker or etc.



Requirements - Connectivity

- VM (OA2, Router) should be able to access the Internet.
  - e.g. `ping 1.1.1.1`
- VM OA1 and TA-Server is in an isolated subnet
- Every Pseudo containers should be able to access the Internet.
- Every NICs on each VM must be correctly config following the topology.
- All the egress traffic must pass through the gateway (Router VM)
- The subnet `10.240.67.0/24` is a restricted internal zone. VM OA1 must NOT be able to access the Internet (outbound), but it must remain accessible from the Host for internal services (e.g., VNC).

Requirements - NAT

- VM Router should perform NAT to the connections from VM (OA2, TA-Server).
- VM OA2 should perform NAT to the connections from Pseudo containers.
- VM Router should forward the incoming connections that comes to TCP 2026 port to TCP 22 port on TA-Server.
- VM Router should forward the incoming connections that comes to TCP 2222 port to TCP 22 port on OA2.

Requirements - NAT

- VM Router should forward the incoming connections that comes to TCP 8026 port to 80 on OA2.
- Note: In the base requirement, OA2 should DNAT/forward the incoming TCP 80 traffic to at least one of the pseudo containers (e.g., SVC 1)

Requirements - SSH

- Host => TA-Server
- Host => TA-Server => OA1
- Host => OA2 => TA-Server => OA1

Requirements - Services

- A VNC Server must be install on VM OA1 and can be connected from host.
- You should be able to use `dig`, `tcpdump`, `nmap` on VM OA1 to query the services on VM TA-Server.
  - Try to query A record `test.ccna2026.tw` from TA-Server.
  - Try to use tcpdump to capture network traffic on VM OA1.
- You should be able to use Python3 on VM OA2.
- A Python HTTP server should run on each pseudo container with TCP port 80 and can be reached according to the settings in NAT

Bonus - Port knocking

- TCP 22 port on VM OA1 will be closed by default.
- After TCP 5555, 6666, and 7777 port receive connection attempts in a row within **30** sec, TCP 22 will be open for the specific source ip for **10** min.
- Note : You can use iptable / nftable etc. to achieve the requirement.

Bonus - LoadBalancing

- VM OA2 should forward to the incoming connections that comes to TCP 80 port to 80 on SVC 1 ~ 3, in Round-robin.
- Note : You can use iptable / nftable etc. to achieve the requirement.

Grading (110%)

- Specifications (10%)
  - Correctly implementing the network topology.
- Requirements (50%)
  - Fulfilling all basic functional requirements.
- Bonus Requirements (10%)
  - Completing the advanced tasks.
- Demo Questions (40%)
  - Questions will be revealed during the demo session.

Note

- You are **NOT ALLOWED** to use the GUI version of NetworkManager.
- You are **NOT ALLOWED** to change the root password of TA-Server.
- You are **NOT ALLOWED** to use systemd-nspawn, Docker or any kinds of container service to automatically generate the network configuration to bypass the manual creation of Network Namespaces, Veth pairs, and Bridges.
- Even if you choose to skip the bonus requirement, you still NEED to complete the topology.

Demo Schedule

- 2026/03/20 (Fri.) 19:30 ~ 21:30 at **EC324**
- Fill in your student id in the spreadsheet
- https://docs.google.com/spreadsheets/d/1E4md6VcY8yq3kR6Zzx3BQCzzpYUhe4wE8_LVF2hiTMo/edit?usp=sharing
- Attendance at the demo session is **mandatory**; failure to attend will result in a score of **zero**.
- If you encounter any extenuating circumstances, please contact (CC) all TAs via the E3 email system before **2026/03/12** .

For Your References

- ArchLinux Installation Guide https://wiki.archlinux.org/title/Installation_guide
- NYCU CS Debian Mirror http://debian.cs.nycu.edu.tw/
- Round-Robin https://www.cdnetworks.com/glossary/round-robin/
- iptables manual https://man7.org/linux/man-pages/man8/iptables.8.html
- iptables debian https://wiki.debian.org/iptables
- systelctl manual https://man7.org/linux/man-pages/man8/sysctl.8.html
- Linux ip forward https://linuxconfig.org/how-to-turn-on-off-ip-forwarding-in-linux
- port knocking https://wiki.archlinux.org/title/Port_knocking
- BIOS settings for Hypervisor https://www.asus.com/tw/support/faq/1045141/