

Homework 1

Network Environment Setting

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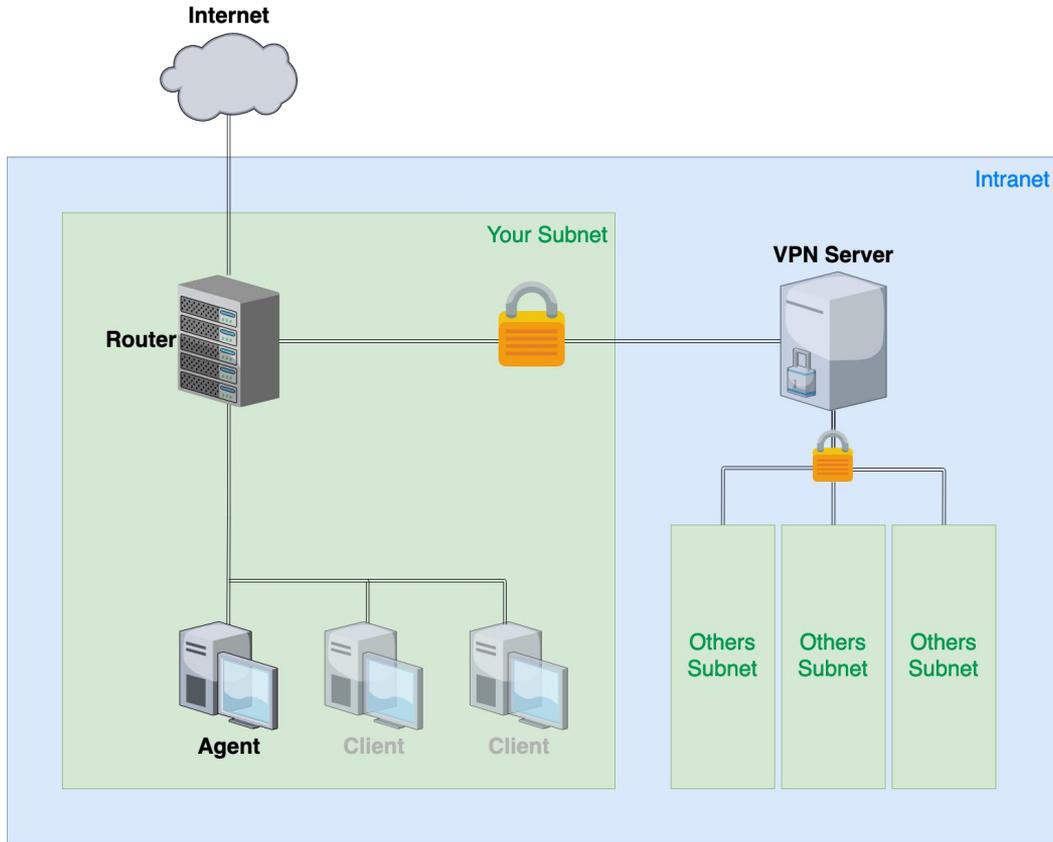
Purpose

- The goal is to build an intranet provides several services, which may include DHCP, NAT, VPN, DNS, Mail, LDAP, WWW, etc.
- Know what you should know about configuring and managing of these services.

Overview

- Create an intranet which contains several VMs:
 - “Router”
 - The only VM which directly connect to outside world (Internet).
 - Provides NAT and DHCPd.
 - Can connects to all VMs inside your intranet.
 - Can connects to VPN server and the whole 10.113.0.0/16 intranet.
 - “Agent”
 - Simulates a simple VM inside your subnet to help TAs and OJ verify results.
 - “Client” (Optional)
 - Simulates a simple VM inside your subnet to help you verify results.

Intranet Schematic Diagram



Definitions

- Internet
 - The IP addresses that is not in our intranet.
- Intranet
 - 10.113.0.0/16, a private network for you to do your homeworks.
- OJ
 - Online Judge system, <https://nasa.nycucs.org/> .
- ID
 - See the profile page on OJ.
- Your subnet
 - 10.113.{ID}.0/24, a subnet of intranet controlled by yourself.
- VPN server
 - A WireGuard server which connects subnets together.

Requirements (1/4)

- “Router”
 - Any Unix-like OS is acceptable. **Please set the hostname to “nasa-router”.**
 - This VM **MUST** have these network interfaces:
 - **Public(WAN):** Internet facing
 - Provide NAT on this interface. Packets from your subnet can go to Internet through this interface.
 - IP: No limitation.
 - **Private(LAN):** To your subnet (10.113.{ID}.0/24)
 - Provide DHCP on this interface. IP offered by DHCP should be **between 10.113.{ID}.111 and 10.113.{ID}.222.**
 - IP: 10.113.{ID}.254.
 - **WireGuard:** To VPN server and intranet (10.113.0.0/16)
 - Connect to VPN server. Everyone in intranet can access your public services through this interface.
 - IP: 10.113.0.{ID}.
 - Enable **sshd** service.

Requirements (2/4)

- “Agent”
 - **There is this VM OVA file below, don't install this VM by yourself.**
 - [NA_2021_HW1_Agent_OVA](#)
 - This VM will get IP **10.113.{ID}.123** by DHCP.
 - OJ will login “Agent” to judge your VMs' settings.

Requirements (3/4)

- Routing
 - All traffic from and to your subnet should go through “Router”.
 - Traffic to the Internet go through the public interface of “Router” and should be NAT wrapped.
 - Traffic to the intranet go through the VPN interface of “Router” and **should not be NAT wrapped**.
 - Traffic to your subnet go through the private interface of “Router” and then go to its destination.

Requirements (4/4)

- Firewall
 - Consider you are providing services to the Internet, so several firewall configurations must be taken for security.
 - We suggest you to configure firewall rules on “Router”.
 - Rules:
 - By default, all connections from outside (include Intranet) to your subnet should be rejected.
 - By default, all services only trust the connections from your subnet.
 - SSH connections from anywhere to “Agent” are allowed.
 - ICMP connections from anywhere to anywhere are allowed.

Hints

- How to check Internet is connected?
 - Ping 8.8.8.8 from different VMs.
 - Ping www.google.com from different VMs.
- How to check WireGuard is connected?
(Please make sure your private key is correct.)
 - Ping nasa.nycucs.org (VPN server).
 - Ping 10.113.0.254 (intranet gateway).
 - Ping from/to your test IP (10.113.254.{ID}).

Appendix: About VPN (1/2)

- Install WireGuard
 - Server Address:
 - nasa.nycucs.org:51821
 - Using information on [OJ profile](#) to connect WireGuard Server:
 - ID (Your IP in WireGuard is 10.113.0.{ID}.)
 - WG_PRIVATE_KEY
 - WG_PRIVATE_TEST_KEY (Test IP is 10.113.254.{ID}.)
 - WG_PUBLIC_KEY

Appendix: About VPN (2/2)

- WireGuard config example

```
# wg0.conf
[Interface]
Address = 10.113.0.{ID}/32      # Test IP: 10.113.254.{ID}/32
PrivateKey = {WG_PRIVATE_KEY}

[Peer]
PublicKey = {WG_PUBLIC_KEY}
AllowedIPs = 10.113.0.0/16
Endpoint = nasa.nycucs.org:51821
PersistentKeepalive = 25
```

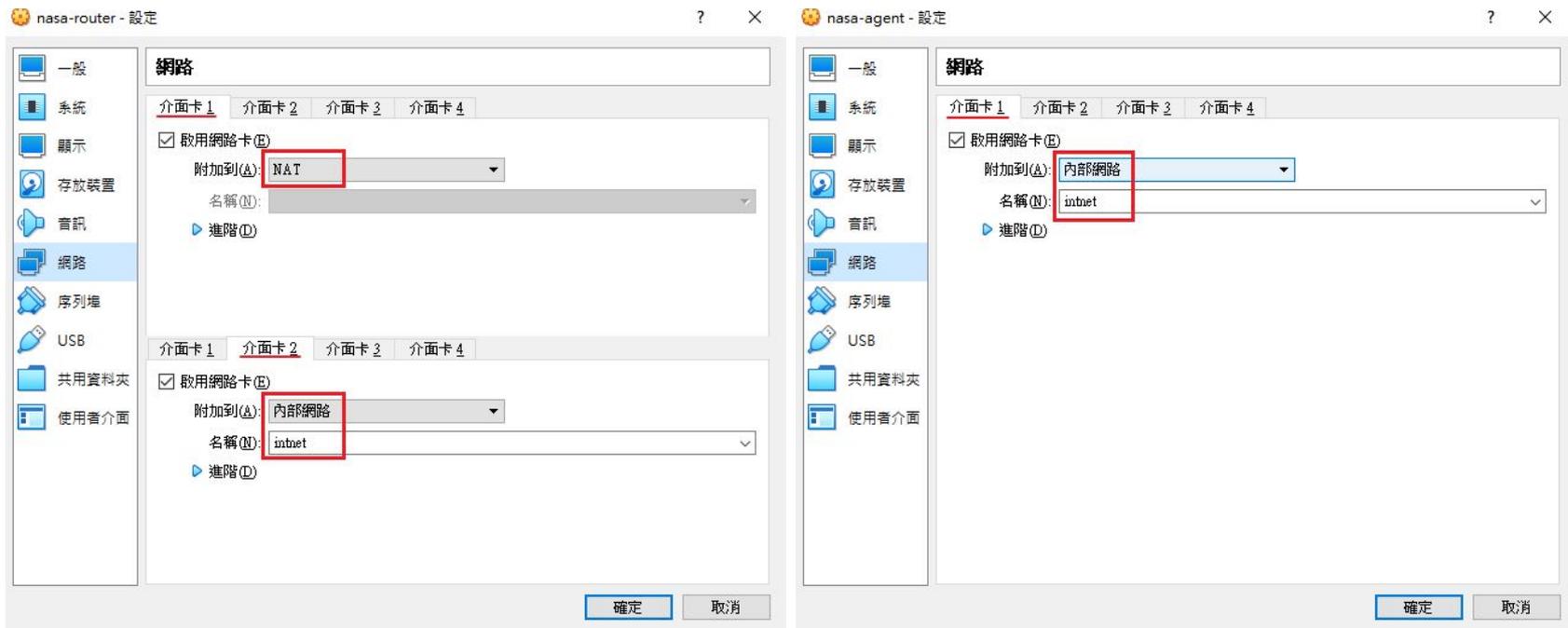
Appendix: About VM Network (1/2)

- We assume that you use Virtualbox. You can choose other VM engines. However, the network structure should satisfy the requirements.
- About the network interfaces type (take Virtualbox as an example):
 - You can use “**NAT**” for the public interface of “Router”; “**Internal Network**” for the private interface of “Router”.
 - For other VMs, you should only assign an interface with the type of “**Internal Network**”. That is, all the network traffics from these VMs should go through the private interface of “Router”.



Appendix: About VM Network (2/2)

● VirtualBox



Appendix: About OS

- Any Unix-like OS is acceptable. However, those services required by homeworks should be provided by the OS you choose.
 - CentOS, Ubuntu or FreeBSD should be fine.
 - The OS of each VM doesn't need to be the same.

Attention

- Your work will be tested by Online Judge system.
 - You can submit multiple judge requests. However, OJ will **cool down for 30 minutes** after each judge.
 - **We will take the last submitted score** instead of the highest score.
 - Late submissions will not be accepted.
- Make sure everything is fine after reboot.
- Backup your VM before judge every time.
 - We may do something bad when judging.
- Due date: **23:59 March 31st (Wed.) 2021**

Help Me!

- TA office hours: W78 (15:30~17:20 Wed.) at EC 324 (PC Lab).
 - We do not allow walk-ins except TA office hours or e-mail appointments.
- Questions about this homework.
 1. Make sure you have studied through lecture slides and the HW spec.
 2. Clarify your problems and google it to find out solutions.
 3. Ask them on <https://groups.google.com/g/nctunasa> .
 - Be sure to include all information you think others would need.
- We MIGHT give out hints on google group.
 - Be sure to join the group!
- Do not mail us unless it's personal or you're making an appointment.

Good Luck!