

Homework 1

Network Environment Setting

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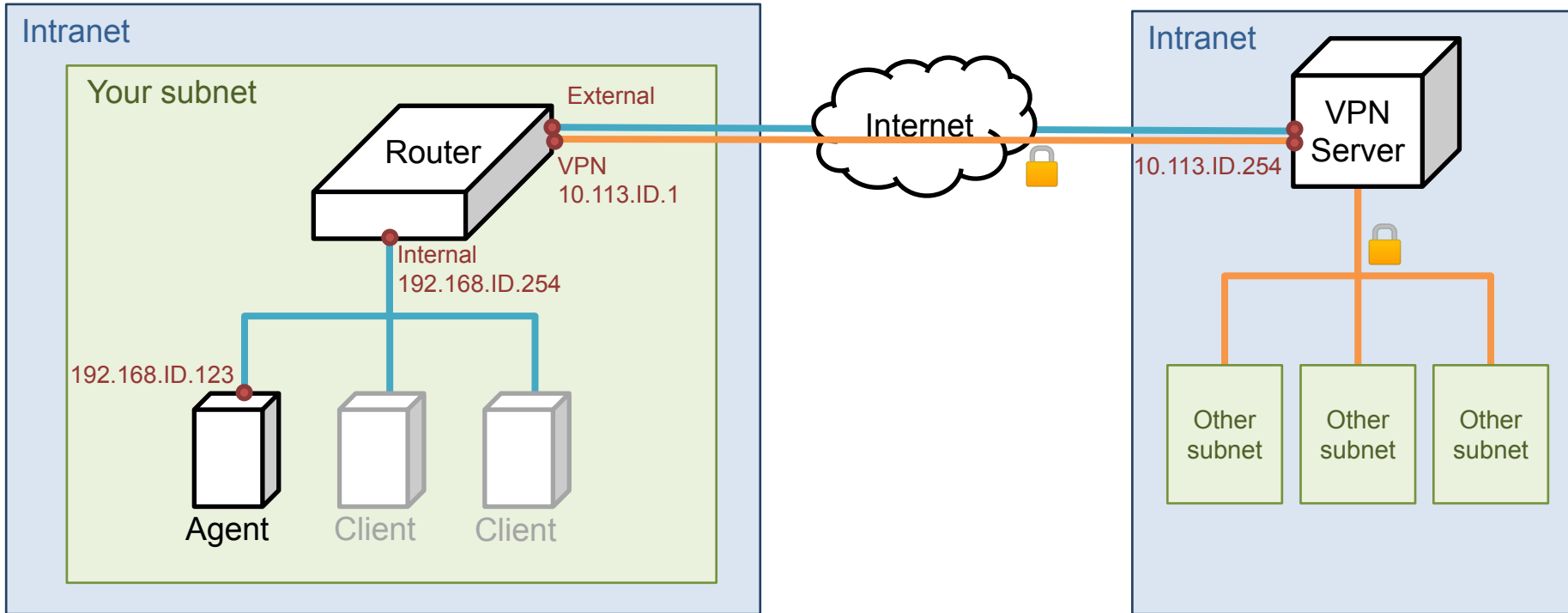
Purpose

- The goal is to build an intranet that provides several services including DHCP, NAT, VPN, DNS, Mail, LDAP, WWW, etc.
- Know what you should know about the configuration and management of these services.

Overview

- Create an intranet which contains several VMs:
 - “Router”
 - The only VM is directly connected to the outside world (Internet).
 - Provides NAT and DHCP.
 - Can connect to all VMs inside your subnet.
 - Can connect to the 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.

Topology (1)



Definitions

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

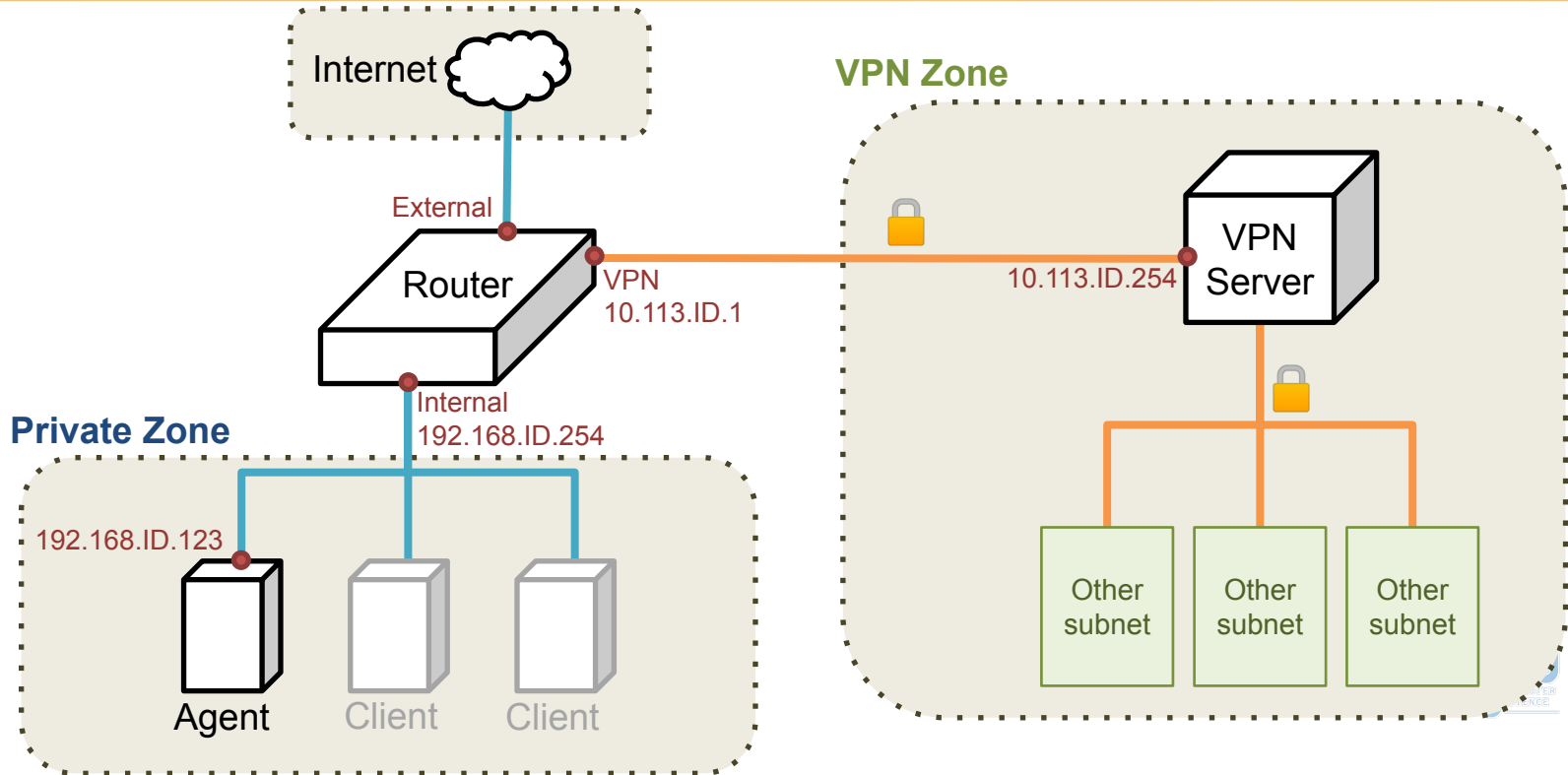
Requirements (1/4)

- “Router”
 - Any OS is acceptable.
 - This VM MUST have these network interfaces:
 - **External**: Internet facing
 - Provides NAT on this interface. Packets from your subnet can go to the Internet through this interface.
 - IP: No limitation.
 - **Internal**: To your subnet (192.168.{ID}.0/24)
 - Provides DHCP on this interface. IP offered by DHCP should **from 192.168.{ID}.111 to 192.168.{ID}.222** .
 - IP: 192.168.{ID}.254
 - **VPN**: To WireGuard server and intranet (10.113.0.0/16)
 - Connected to the WireGuard server.
 - Everyone in the intranet can access your public services through this interface.
 - IP: 10.113.{ID}.1
 - Enable **sshd** service on port 22.

Requirements (2/4)

- “Agent”
 - **Get this VM OVA file below, don't install this VM by yourself.**
 - Download from <https://bit.ly/na2023agent>
 - This VM will get IP **192.168.{ID}.123** by DHCP (Hint: MAC binding).
 - OJ will log in to “Agent” to judge your VMs' settings.

Topology (2)



Requirements (3/4)

- Routing
 - All inbound and outbound traffic in and out your subnet should go through “Router”.
 - Traffic from **Private zone** to Internet **should** be NAT masqueraded.
 - Traffic from **Private zone** to **VPN zone** **should not** be NAT masqueraded.
 - Traffic from **VPN zone** to **Private zone** should 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.
 - Configure firewall rules on “**Router**”.
 - Rules:
 - SSH connections from anywhere to “**Agent**” are allowed.
 - SSH connections from **VPN zone** to “**Router**” are not allowed.
 - ICMP connections from anywhere to anywhere are allowed.
 - In **Private zone** (including router) all connections are allowed.
 - By default, all connections from Internet to **Private zone** should be rejected.

Grading

Automated grading (Online Judge), 100pts

- Enable Router's sshd service. (5%)
- Trace Route from Agent to Internet. (15%)
- Trace Route from Agent to **Private Zone**. (15%)
- IP offered by DHCP should be 192.168.{ID}.111-222 (20%)
- Agent get IP 192.168.{ID}.123 by DHCP (15%)
- Check Firewall rules for Router (15%)
- Check Firewall rules for Agent (15%)

Hints

- How to check if Internet connection is fine?
 - 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 10.113.\$ID.254 (intranet gateway).

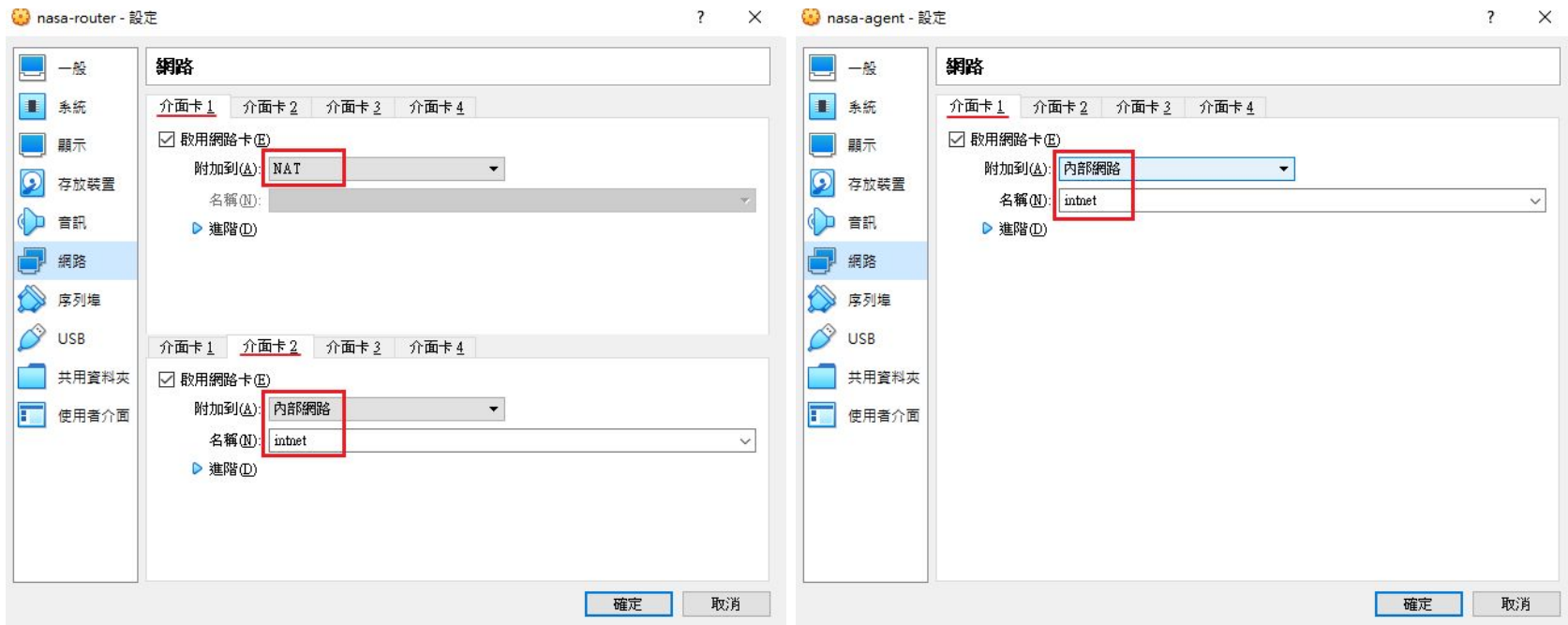
Appendix: VM Network

- We assume that you use Virtualbox. You can choose other VM hypervisor. However, the network structure should satisfy the requirements.
- About the network interfaces type (take Virtualbox as an example):
 - You can use “**NAT**” for the External interface of “Router”; “**Internal Network**” for the Internal 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 Internal interface of “Router”.



Appendix: VM Network

● VirtualBox



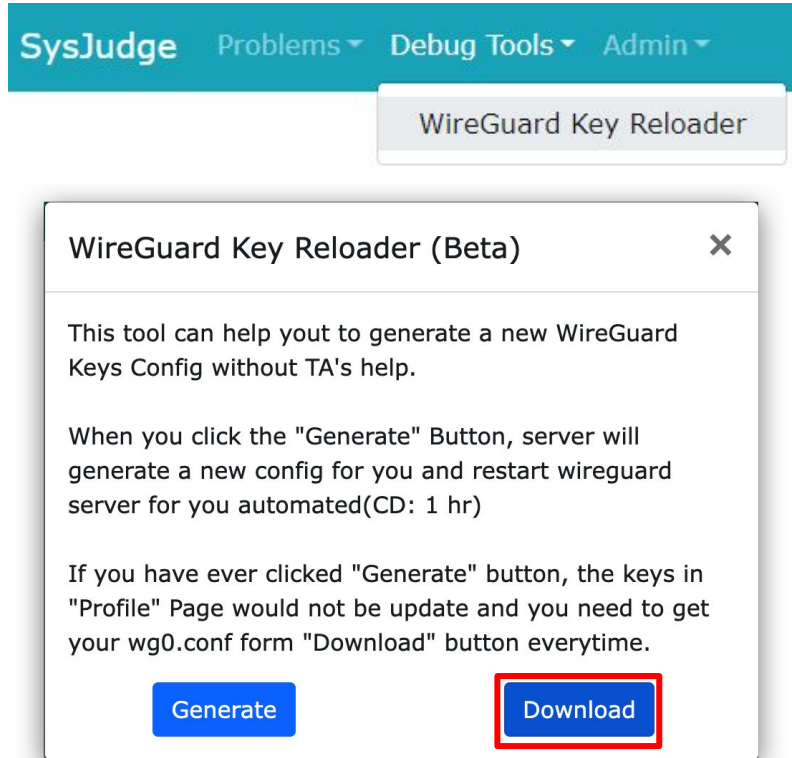
Appendix: Online Judge System

- Login into <https://nasaaj.cs.nycu.edu.tw/>
 - You can login with NYCU or CSIT account.



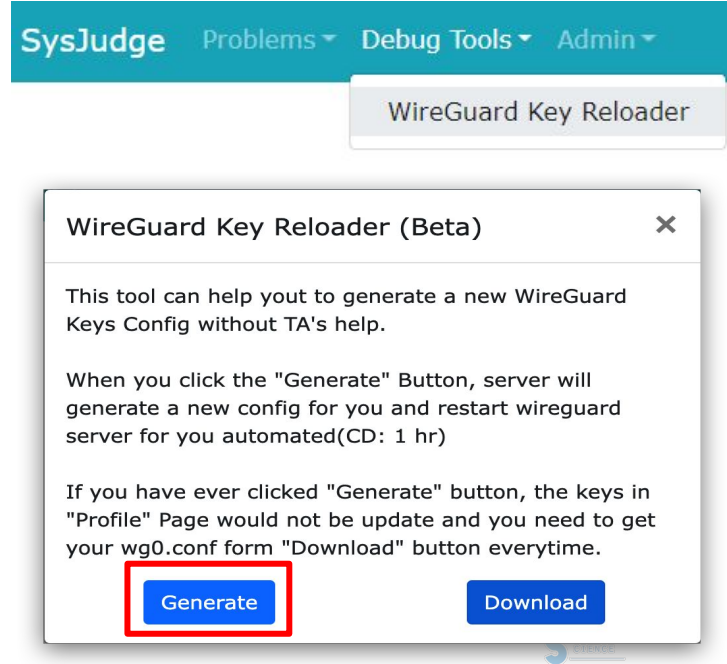
Wireguard – Get key and configuration

- Install WireGuard
- Configure VPN connection
 - Download the configuration file
 - Apply it to connect VPN server



Wireguard – Regenerate key

- If you cannot connect to Wireguard
 - Regenerate key and configuration file
 - Download and apply it



The screenshot shows the SysJudge interface with a teal header containing 'SysJudge', 'Problems', 'Debug Tools', and 'Admin'. A dropdown menu is open, showing 'WireGuard Key Reloader'. Below this, a modal window titled 'WireGuard Key Reloader (Beta)' is displayed. The modal contains the following text: 'This tool can help you to generate a new WireGuard Keys Config without TA's help.', 'When you click the "Generate" Button, server will generate a new config for you and restart wireguard server for you automated(CD: 1 hr)', and 'If you have ever clicked "Generate" button, the keys in "Profile" Page would not be update and you need to get your wg0.conf form "Download" button everytime.' At the bottom of the modal, there are two buttons: 'Generate' (highlighted with a red box) and 'Download'.

Attention

- Your work will be tested by Online Judge system.
 - You can submit multiple judge requests. However, OJ will **cool down for 10 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 judging every time.**
 - We may do something bad when judging.
- Due date: **2023/03/22 Thu. 23:59:59**

Help Me!

- Questions about this homework.
 1. Make sure you have studied through lecture slides and the HW spec.
 2. Clarify your problems and google them 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.



Help Me!

- UNIX 常見指令教學
 - <https://it.cs.nycu.edu.tw/unix-basic-commands>
- How To Ask Questions The Smart Way
 - <https://github.com/ryanhanwu/How-To-Ask-Questions-The-Smart-Way>

Good Luck!