

# Nebula Lab Report

## ## 1. Objective

- Deploy a \*\*Nebula Lighthouse\*\* on a cloud VPS (with public IP).
- Configure \*\*Windows PC\*\* (behind NAT) as a Nebula client.
- Establish a secure overlay network between Lighthouse and client.
- Verify connectivity using \*\*ping\*\* and \*\*SSH login\*\*.

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## ## 2. Environment

- \*\*Operating Systems\*\*: Windows 10 (local PC), Linux VPS (Lighthouse)
- \*\*Software Tools\*\*:
  - Nebula 1.9.6
  - PowerShell
  - GitHub (for report submission)
- \*\*Network Setup\*\*:
  - Lighthouse VPN IP: `192.168.100.1`
  - Client VPN IP: `192.168.100.150`
  - Overlay subnet: `192.168.100.0/24`

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## ## 3. Steps

### #### 3.1 Download and Install Nebula

Downloaded from [Releases](<https://github.com/slackhq/nebula/releases>) and extracted to `C:\nebula\`.

Screenshot 1: Nebula folder structure

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### #### 3.2 Obtain Certificates and Keys

Received the following files from the instructor and placed them in `C:\nebula\config\`:

- `ca.crt`
- `tanzelin.crt`
- `tanzelin.key`

Screenshot 2: Certificate files in config folder

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### #### 3.3 Edit `config.yaml`

Configured as follows (use `/` or double `\\` in paths):

```
```yaml
pki:
  ca: "C:/nebula/config/ca.crt"
  cert: "C:/nebula/config/tanzelin.crt"
  key: "C:/nebula/config/tanzelin.key"

static_host_map:
  "192.168.100.1": ["104.243.20.247:554"]

lighthouse:
  am_lighthouse: false
  hosts:
    - "192.168.100.1"

listen:
  host: 0.0.0.0
  port: 554

tun:
  dev: nebula1
  cidr: 192.168.100.150/24

punchy:
  punch: true
  # Some options in this file are HUPable, including the pki section. (A HUP will reload credentials from disk without affecting existing connections)
  # PKI defines the location of credentials for this node. Each of these can also be inlined by using the yaml ": /" syntax.
  pki:
    # The CAs that are accepted by this node. Must contain one or more certificates created by 'nebula-cert ca'
    ca: "C:\\nebula\\config\\ca.crt"
    cert: "C:\\nebula\\config\\tanzelin.crt"
    key: "C:\\nebula\\config\\tanzelin.key"
    # blocklist is a list of certificate fingerprints that we will refuse to talk to
    #blocklist:
    # - c99d4eb58533b92061b09918e838a5d0a5aee21eed1d12fd937682865936c72
    # disconnect_invalid is a toggle to force a client to be disconnected if the certificate is expired or invalid.
    #disconnect_invalid: false
  # The static host map defines a set of hosts with fixed IP addresses on the internet (or any network).
  # A host can have multiple fixed IP addresses defined here, and nebula will try each when establishing a tunnel.
  static_host_map:
    "192.168.100.1": ["104.243.20.247:554"]
```

```
管理员: Windows PowerShell
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安装最新的 PowerShell！了解新功能和改进！https://aka.ms/PSWindows

PS C:\Windows\system32> cd C:\nebulia
PS C:\nebulia> ./nebulia.exe -config ./config/config.yaml
time=2025-09-16T16:09:41+08:00 level=info msg="Firewall rule added" firewallRule="map[caName: caSha: direction:outgoing endPort:0 groups:[] host:any ip: localIp: proto:0 startPort:0]"
time=2025-09-16T16:09:41+08:00 level=info msg="Firewall rule added" firewallRule="map[caName: caSha: direction:incoming endPort:0 groups:[] host:any ip: localIp: proto:0 startPort:0]"
time=2025-09-16T16:09:41+08:00 level=info msg="Firewall started" firewallHashes="SHA-496215dec4e5687a2353f51c10838c113bdaf35ef72b8e8c9f336996ada5417, PNV-2782948616"
2025/09/16 16:09:41 Using existing adapter
2025/09/16 16:09:41 Creating adapter
time=2025-09-16T16:09:42+08:00 level=info msg="listening on 0.0.0.0:554"
time=2025-09-16T16:09:42+08:00 level=error msg="Failed to standard udp sockets" error="bind: The attempted operation is not supported for the type of object referenced."
time=2025-09-16T16:09:42+08:00 level=info msg="Main HostMap created" network="192.168.100.150/24 preferredRanges='[]'"
time=2025-09-16T16:09:42+08:00 level=info msg="punchy enabled"
time=2025-09-16T16:09:42+08:00 level=info msg="Loaded send_recv_error config" sendRecvError=always
time=2025-09-16T16:09:42+08:00 level=info msg="Nebula interface is active, boringcrypto=false build=9.6 interface=nebulia network=192.168.100.150/24 udpAddr=[::]:554"
time=2025-09-16T16:09:42+08:00 level=info msg="Handshake message sent" handshake="map[stage=1 style:ix_psk0]" initiatorIndex=17550575 localIndex=17550575 remoteIndex=0 udpAddr=[104.243.20.247:554]" vpnIp=192.168.100.1
time=2025-09-16T16:09:42+08:00 level=info msg="Handshake message received" certName=lighthouse durationNs=443061600 fingerprint="fb19988566c8275810bdbe0c175cd7cf31be0340dc2a831ae16f9669a52617 handshaker="map[stage=1 style:ix_psk0]" initiatorIndex=17550575 issuer=e430f52615e22d11bd269482943865f17aa42c800491e56169a087e592c0 remoteIndex=17550575 responderIndex=56995743 sentCachedPackets=1 udpAddr=[104.243.20.247:554]" vpnIp=192.168.100.1
time=2025-09-16T16:09:48+08:00 level=info msg="Handshake timed out" durationNs=6701691800 handshake="map[stage=1 style:ix_psk0]" initiatorIndex=2640036116 localIndex=2640036116 remoteIndex=0 udpAddr=[::]" vpnIp=192.168.100.255

Microsoft Windows [版本 10.0.26100.6584]
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C:\Users\lenovo>ping 192.168.100.1

正在 Ping 192.168.100.1 具有 32 字节的数据：
来自 192.168.100.1 的回复：字节=32 时间=215ms TTL=64
来自 192.168.100.1 的回复：字节=32 时间=213ms TTL=64
来自 192.168.100.1 的回复：字节=32 时间=573ms TTL=64
来自 192.168.100.1 的回复：字节=32 时间=210ms TTL=64

192.168.100.1 的 Ping 统计信息：
数据包：已发送 = 4, 已接收 = 4, 丢失 = 0 (0% 丢失),
往返行程的估计时间(以毫秒为单位):
最短 = 210ms, 最长 = 573ms, 平均 = 302ms

C:\Users\lenovo>
```

```
C:\Users\lenovo>ssh nuist@192.168.100.1
The authenticity of host '192.168.100.1 (192.168.100.1)' can't be established. [X]
ED25519 key fingerprint is SHA256:TmUkvmFj55DEVuujeA28kHINrqVK39QgRh9eZ2Uy0zA.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '192.168.100.1' (ED25519) to the list of known hosts.
nuist@192.168.100.1's password:
Permission denied, please try again.
nuist@192.168.100.1's password:
Welcome to Ubuntu 22.04.5 LTS (GNU/Linux 5.15.0-151-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:    https://landscape.canonical.com
 * Support:       https://ubuntu.com/pro

This system has been minimized by removing packages and content that are
not required on a system that users do not log into.

To restore this content, you can run the 'unminimize' command.
New release '24.04.3 LTS' available.
Run 'do-release-upgrade' to upgrade to it.

Last login: Tue Sep 16 08:29:40 2025 from 192.168.100.135
```