

# **FC-VPN**

## **Cloud-Native Elastic VPN Solution**

**Liu Yafei**

**Qin Sihan**

**Zhang Runze**

**Zhang zeshen**

July 2025

# Problem Statement

Traditional Solutions	Cloud-based Solutions
<ul style="list-style-type: none"><li>- Fixed, inflexible capacity</li><li>- Billing: fixed number of nodes</li><li>- Poor at handling traffic spikes</li><li>- Designed for large enterprises only</li></ul>	<ul style="list-style-type: none"><li>- Elastic scaling on demand</li><li>- Instances created as needed</li><li>- Pay-per-use billing</li><li>- Flexible deployment for small businesses/teams</li><li>- auto-scaliing</li></ul>

# Implementation Principle

(Internal technical discussion only)

- **VPN prototype:** Proxy forwards traffic (HTTPS over SOCKS5)
- **Elastic scaling:** Managed by Kubernetes (k8s)
- **User scaling:** Each proxy handles a fixed number of users; k8s auto-scales pods as amount of users changes

# Flowchart

(Internal technical discussion only)

```
A[User] --> B[Cloud VPN Proxy]
B --> C[k8s Operator (Manages Pods)]
C --> D[Each Pod Connects to Target Server]
[draw on the broad, maybe]
```

# Assumptions

(Internal technical discussion only)

- Pool of public IPs; each pod can be assigned a public IP to connect the Internet
- Target users (two directions):
  - 1. small businesses/teams (NAT traversalNetwork Address Translation traversal)
  - 2. Bypassing the firewall
- Complete VPN component is available (instead the prototype)

# Demo

## Client (Frontend):

- Multiple clients, each with a personal user profile (StatefulSet)
- Display outgoing public IP (optional, or as an element to show different IP by proxy)

## Proxy Monitor:

- Real-time traffic monitoring
- Dynamic pod/node/objects count&details (via k8s dashboard, e.g. AWS)

# Discussion Questions

- The key technical challenges?
- Divide the work?
- Regarding "direction": good to see two or just focus on one?

