

ProxyGuard

WireGuard behind a reverse proxy



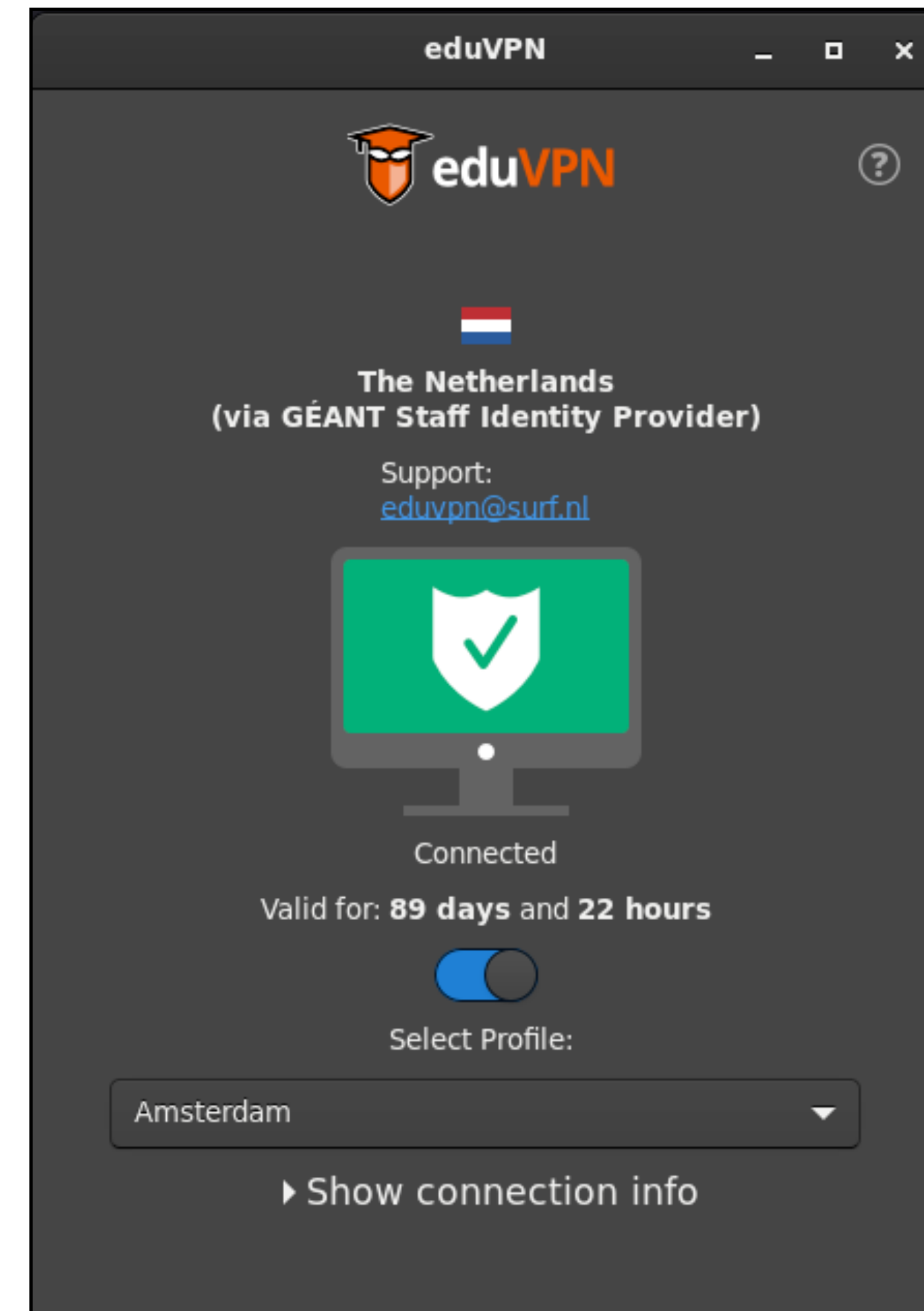
Jeroen Wijenbergh, 2nd of February 2025 FOSDEM, Network track

Me



eduVPN

- Free & open-source VPN
- Focused on research & education
- Easy to self-host: <https://docs.eduvpn.org/server/v3/>
- Supports OpenVPN & WireGuard (since version 3)
- OpenVPN has UDP + TCP out of the box
- WireGuard only UDP



So what?

- UDP can be blocked 😞
- MTU issues
- 443/53 not the holy grail





- Less is more: 4,000 LOC ¹, compared to OpenVPN's 70,000 ²
- Missing features: TCP
- Quote: *Transforming WireGuard's UDP packets into TCP is the job of an upper layer of obfuscation* <https://wireguard.com/known-limitations/>

1: <https://www.wireguard.com/papers/wireguard.pdf>

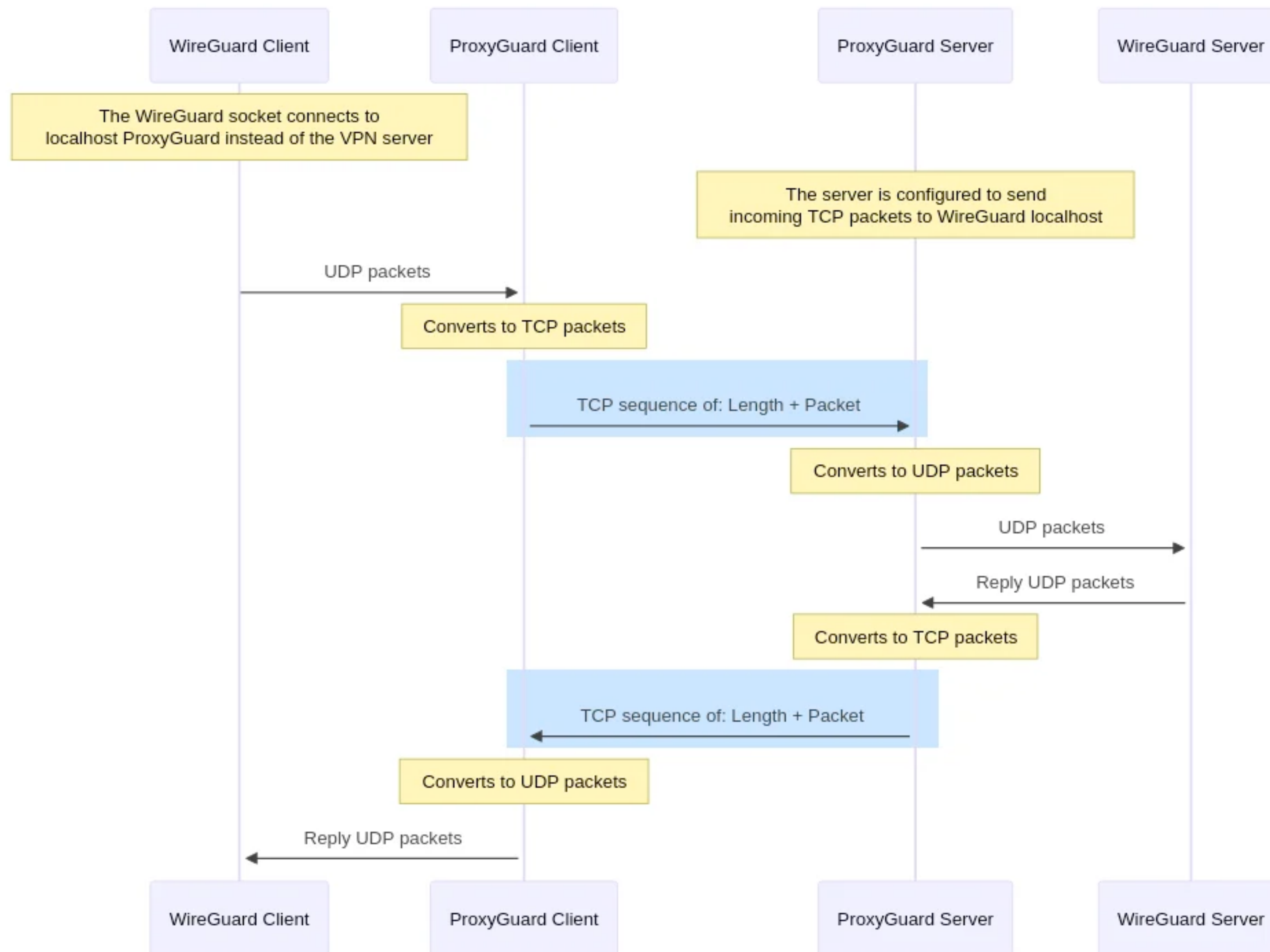
2: <https://blog.openvpn.net/what-is-cloudflare-vpn/>

Finding a tool

- Must: Client & Server implementation
- Nice to have:
 - Go implementation 
 - Run behind reverse proxy (port sharing) 
 - TLS

ProxyGuard

- <https://codeberg.org/eduvpn/proxyguard>
- First version in Go
- Simple UDP wrapper over TCP
- How to deal with cut-off packets?



Checking the requirements

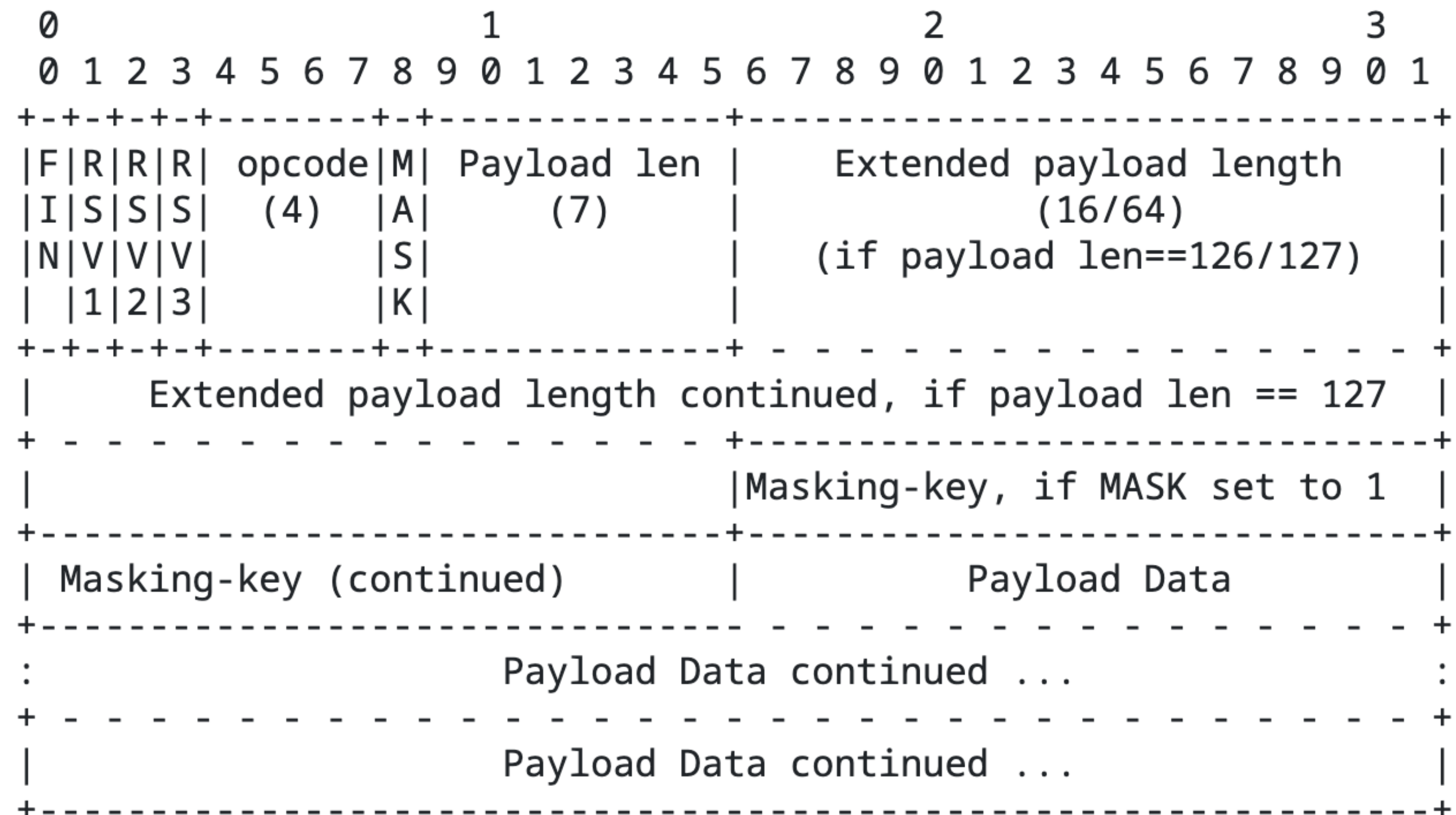
-  Client & Server implementation
- Nice to have:
 -  Go implementation
 -  Run behind reverse proxy (port sharing)
 -  TLS

Reverse proxy?

- Need to somehow proxy the connection?

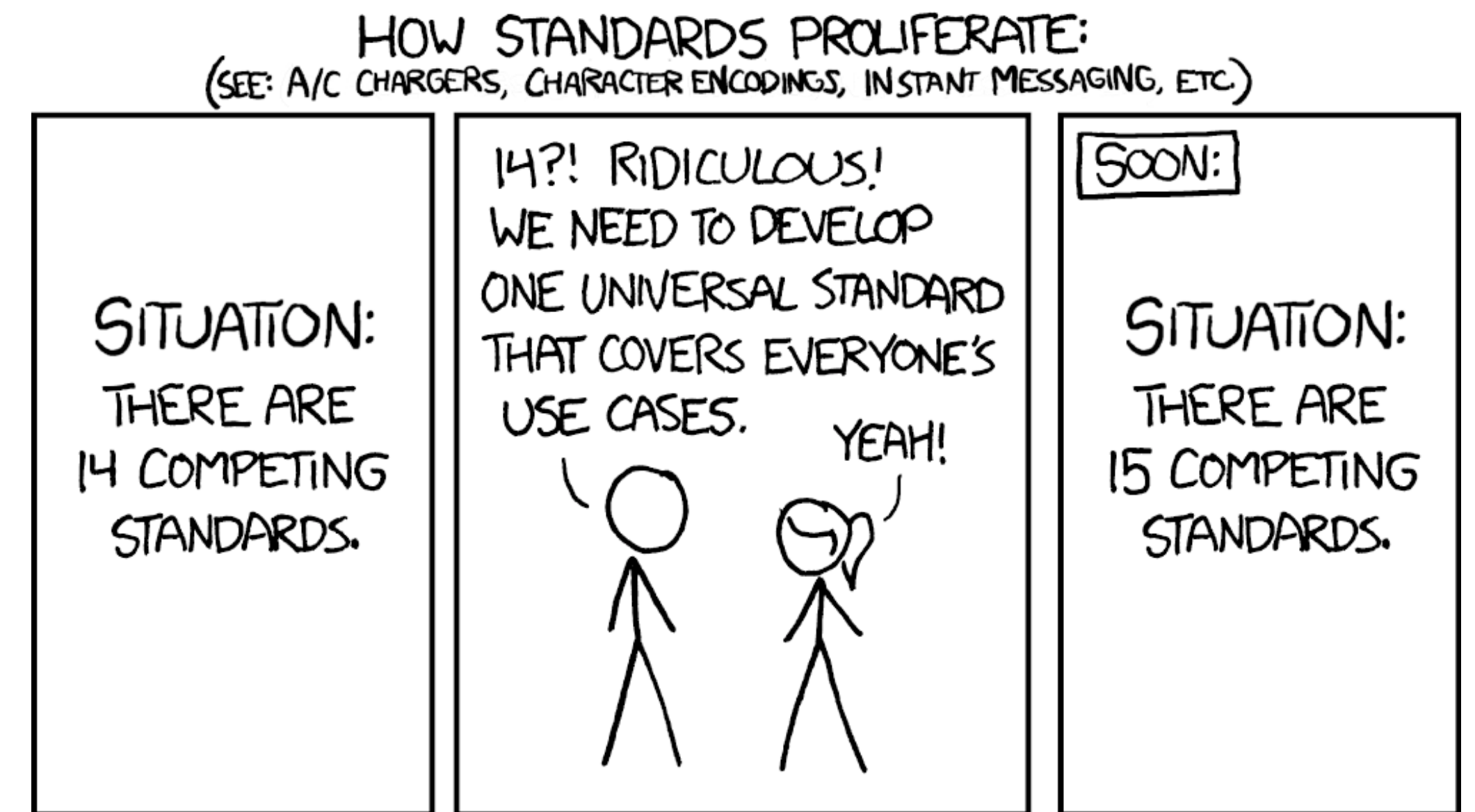
- WebSockets?

- Complex packet format
- Does more than we need



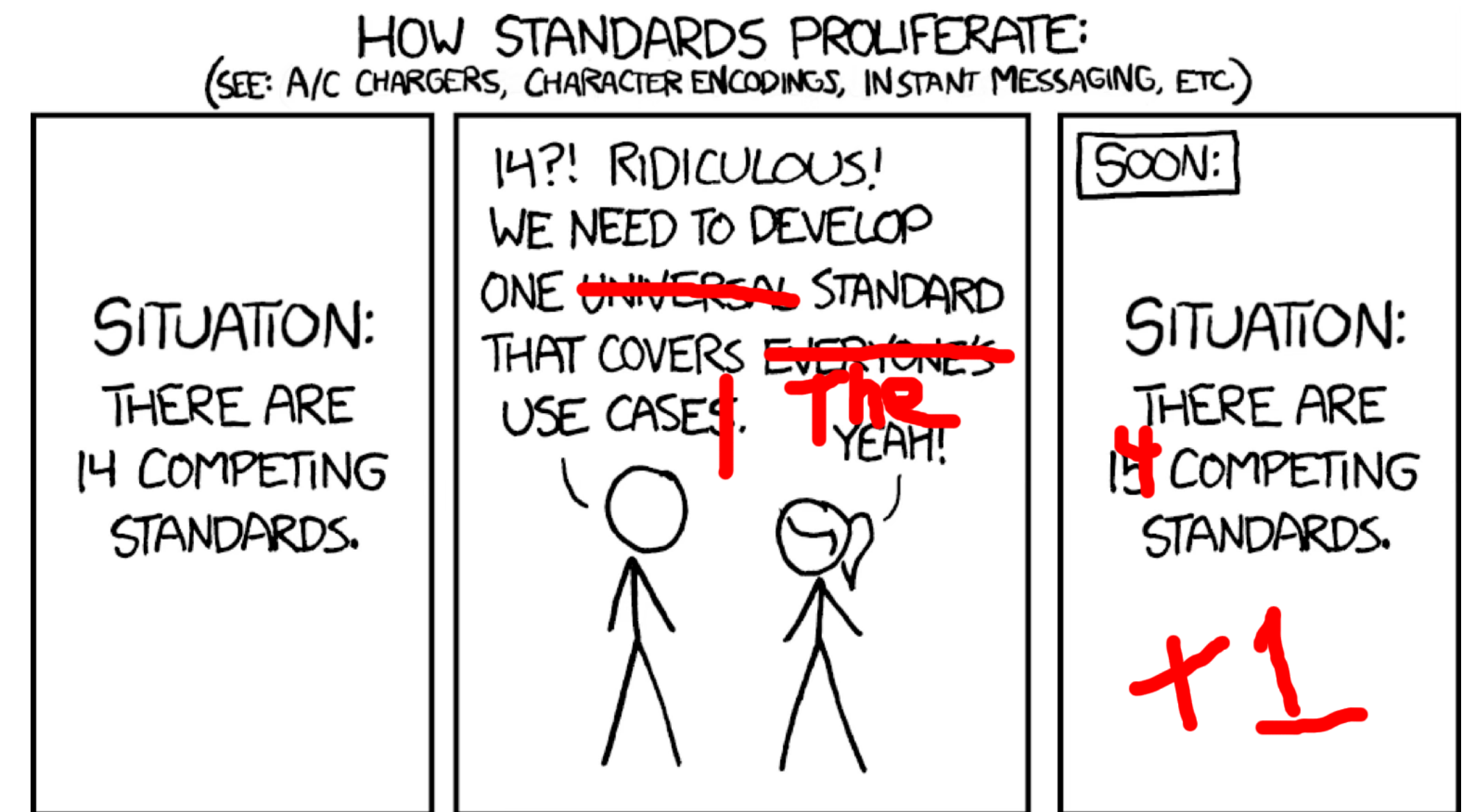
Fine, our own protocol?!

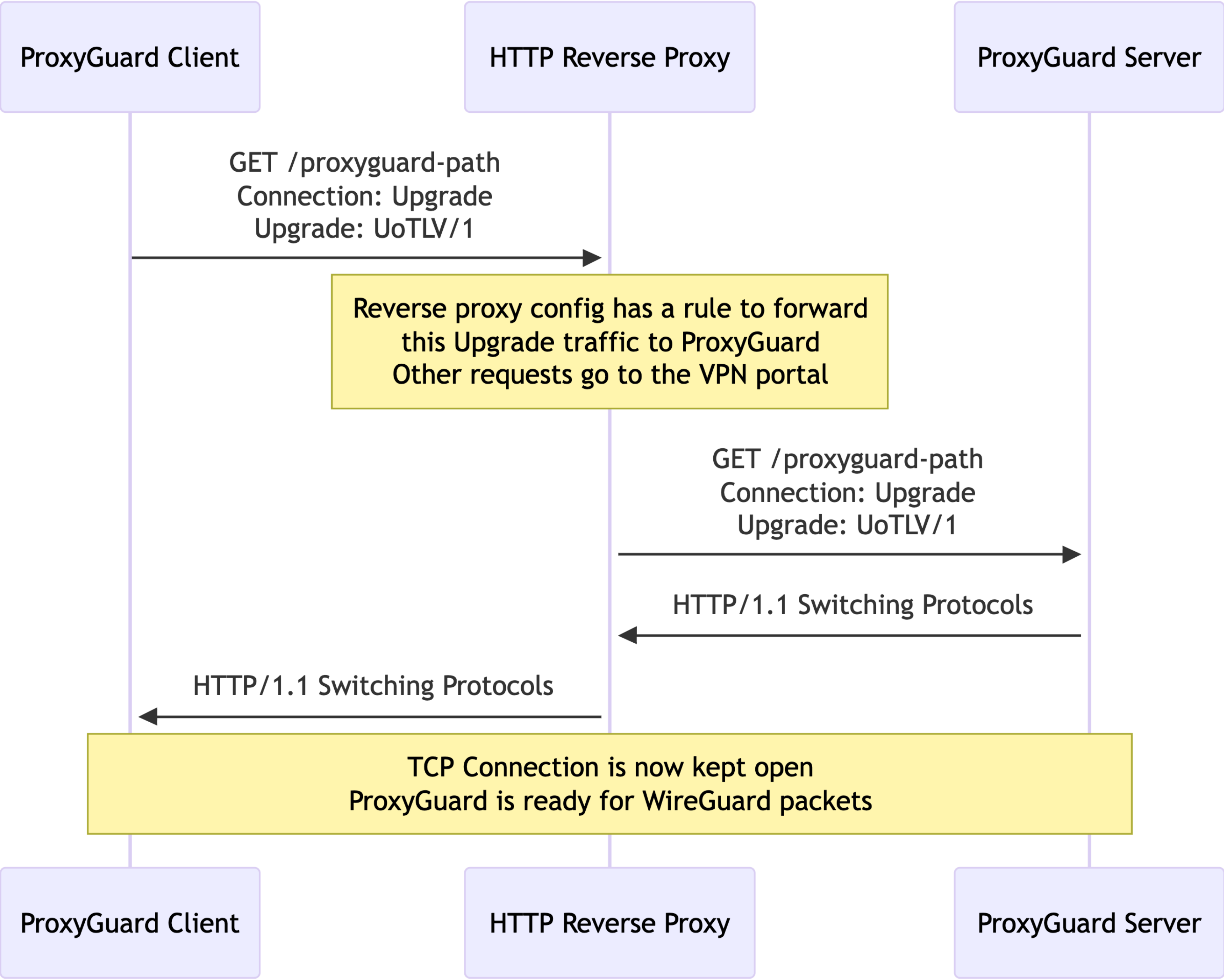
- Idea:
 - Re-use the handshake of web-sockets
 - Keep the packet format length + value



Fine, our own protocol?!

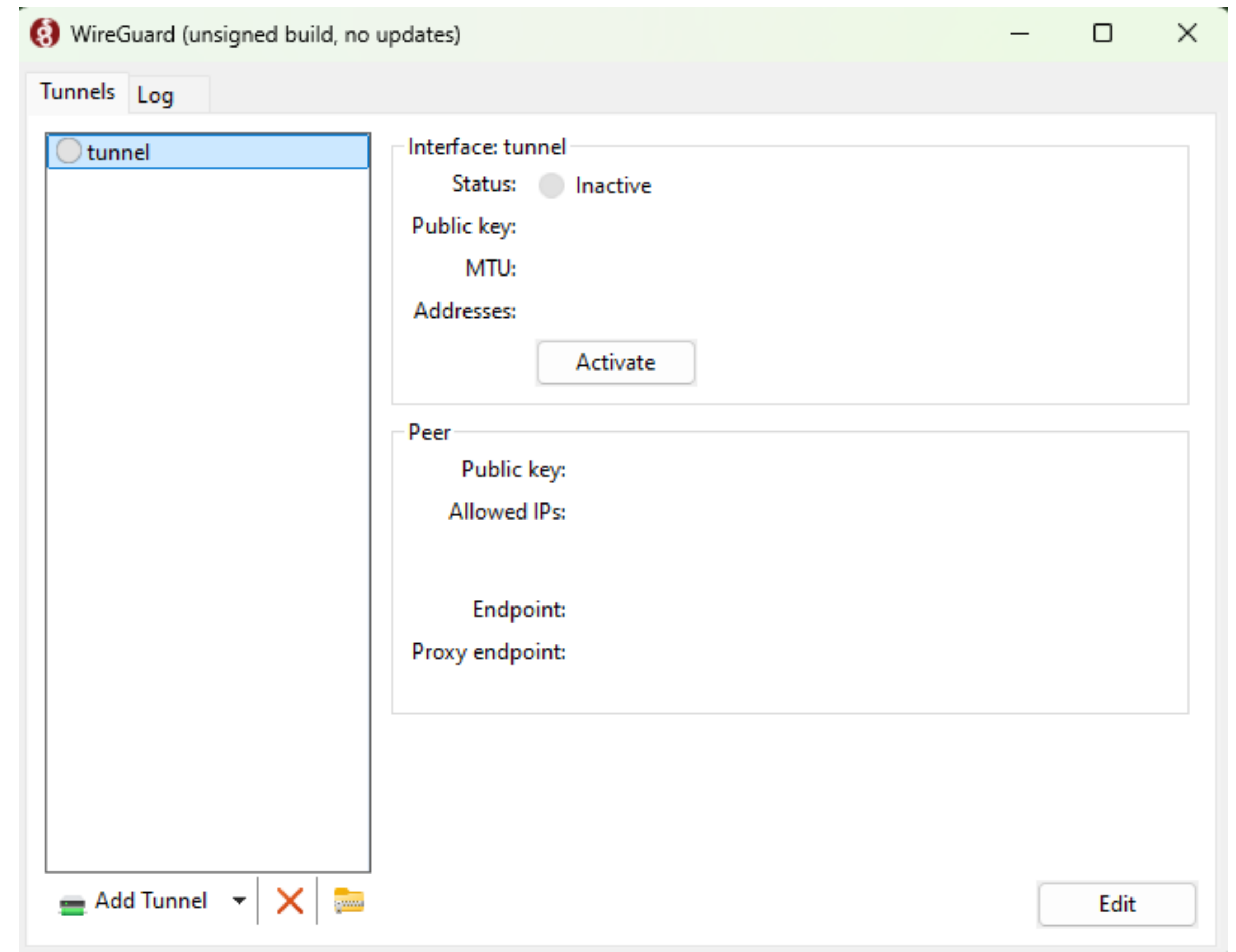
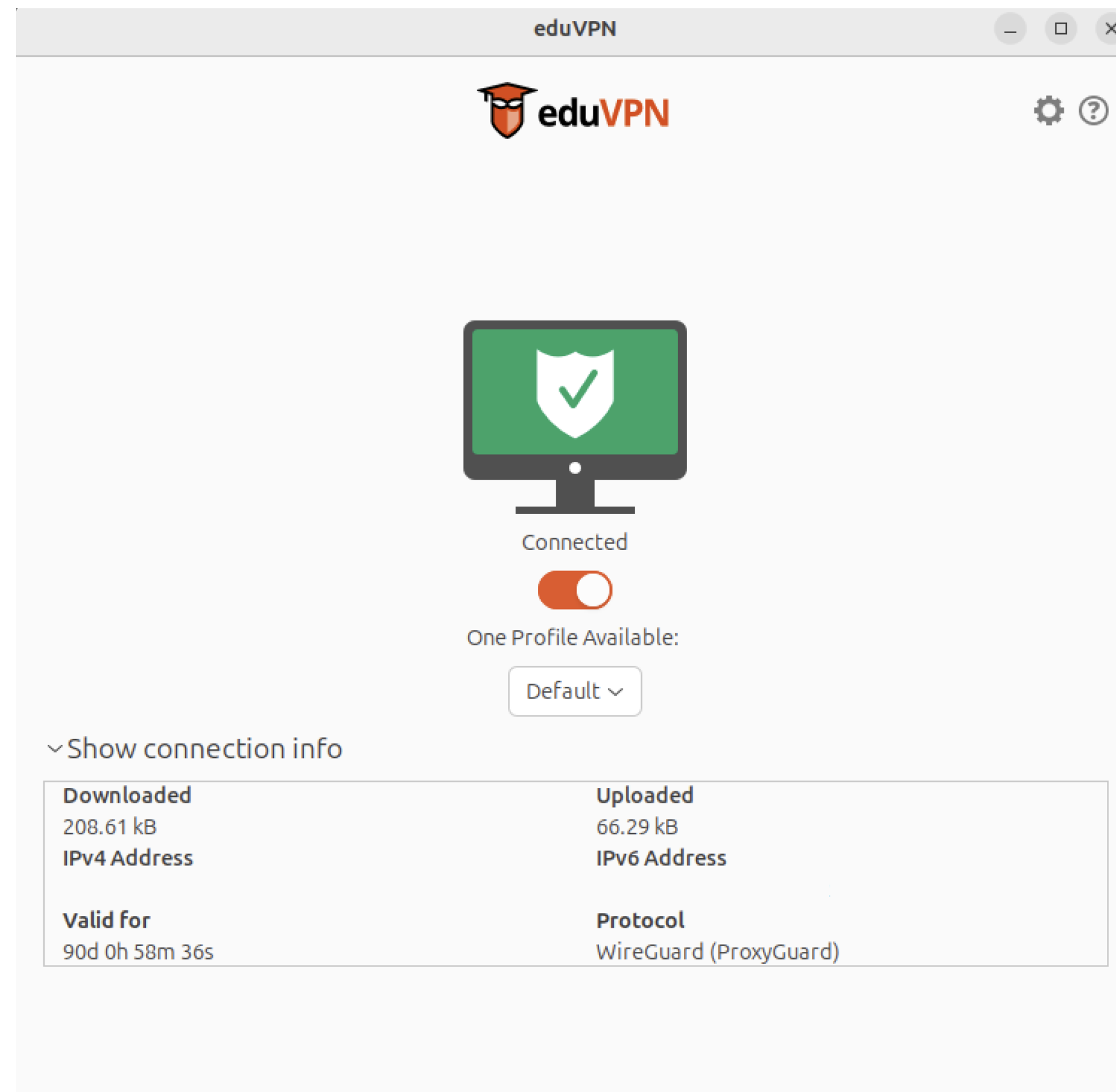
- Idea:
 - Re-use the handshake of web-sockets
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```
dev@dev-QEMU-Virtual-Machine: ~  
[Interface]  
PrivateKey = ...  
Address = ...  
DNS = ...  
ListenPort = 51820  
Fwmark = 51820  
[Peer]  
PublicKey = ...  
AllowedIPs = 0.0.0.0/0,::/0  
PersistentKeepalive = ...  
# ProxyGuard client listener  
Endpoint = 127.0.0.1:51821  
~  
~  
~  
7,0-1 All  
Home
```

ProxyGuard: Client implementations



<https://codeberg.org/amebis/wireguard-windows>

Challenges & Future plans

- Initial impl. easy
- Performance testing and improvements
- Roaming and routing issues 😞
- Investigate macOS/iOS/Android
- Linux daemon
 - Automatically restart on sleep, roaming
 - Get WireGuard properties dynamically

Questions?

- <https://codeberg.org/eduvpn/proxyguard>
- Come visit us and our friends
- WireGuard stand:
 - 🏠 Building K, Level 1, stand 6
- NLnet stand:
 - 🏠 Building K, Level 2, stand 13
- GÉANT stand:
 - 🏠 Building F, Level 2, stand 6

