



Simple, Secure and Flexible VPN solution for home and business

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me

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Summary

- VPN solutions : multiple choices for multiple situations
- OpenVPN
- « Once upon a time... » - Few tales and demos featuring OpenVPN
- Want more ? Need help ?

Summary

- **VPN solutions : multiple choices for multiple situations**
 - Quick reminder about secure VPN
 - IPsec based solutions
 - SSL based solutions
 - Commercial fake SSL “VPN”
- OpenVPN
- « Once upon a time... » - Few tales and demos featuring OpenVPN
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VPN solutions overview

Quick reminder about secure VPNs

- Main objective :
 - securely encapsulates data between 2 or more networked devices not on the same private network.
- Responsible for :
 - Authenticate (both ways)
 - Insure data integrity
 - Encrypt/Decrypt
 - Encapsulate/"decapsulate"
- Lots of solutions, very few compatibility

VPN Solutions

Ipsec based solutions

- IPsec pros :
 - Widely supported
 - Interoperability is achievable for lan-to-lan connectivity
- IPsec cons :
 - Specific protocols AH, ESP
 - No automatic negotiation
 - Difficult to open in firewalls
 - Bad NAT support
 - IPsec in itself is not enough for VPN roadwarriors :
Needs specific implementations

VPN Solutions

Ipsec based solutions

- Specific Implementations
 - Vendor specific implementation for endusers : Cisco VPN Client, Checkpoint Secure Client, Juniper IPsec Client...
 - MS PPP/L2TP/IPsec : natively supported in Windows OS and devices
- Still good for : **LAN-to-LAN in heterogeneous situations**

VPN Solutions

SSL/TLS based VPN

- Uses SSL/TLS security for authentication, key negotiation and session renegotiation
- Data encapsulation is still specific.
- Implementations
 - *Clientless* : ActiveX or Java applet based SSL/TLS VPN (transport through loopback listening sockets)
 - Client based commercial solution : Cisco, Juniper, Connectra
 - Openssh, Openvpn
- Good for : Securing endusers connection (roadwarriors, wifi, admin networks...)

VPN Solution

Commercial fake SSL VPN

- Commercially called SSL VPN... they are just https servers with :
 - Reverse proxy to serve internal web resources
 - Web interfaces to add fonctionnality : VNC/RDP for remote administration, WebMail, Web access to windows shares...

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 - Quick facts
 - In-depth presentation
 - Few more things
 - Performances
 - Configuration basis
 - Plugability & Hooks for fun and creativity
- « Once upon a time... » - Few tales and demos featuring OpenVPN
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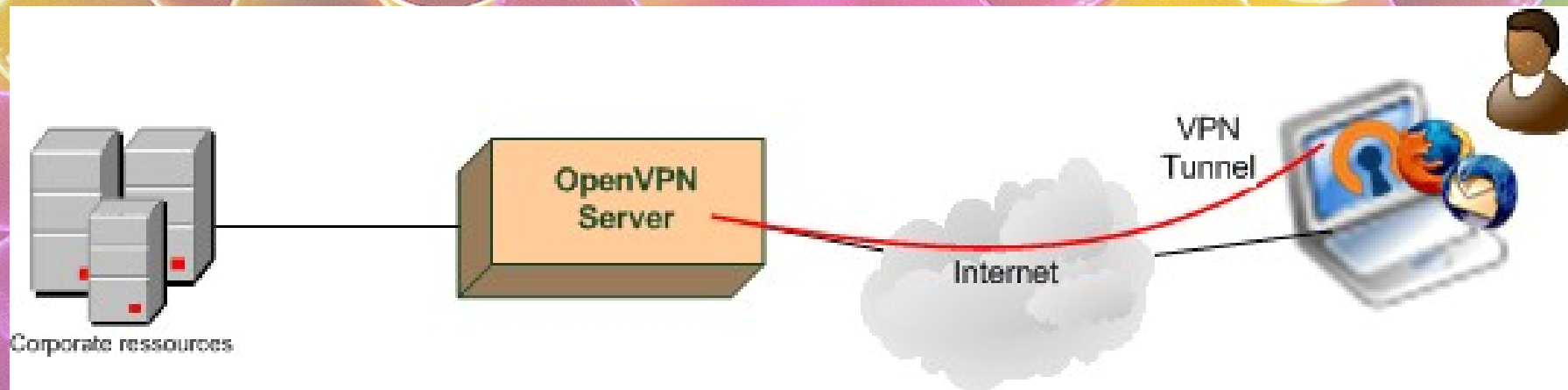
Open VPN

Quick facts

- Created for personal use by James Yonan
- Dual license :
 - Community edition : GPL v2
 - Commercial edition. Adds a distribution server and Client and Management GUI
- Version history
 - May 2001 : v0.9 first release
 -
 - Dec 2009 : v2.1.1
- Roadmap for v3.0 : Become a generic network stack with modules for everything...
- Available in : Linux, Solaris, *BSD, Windows (XP to 7 and Mobile), MAC OS, Android, Iphone...

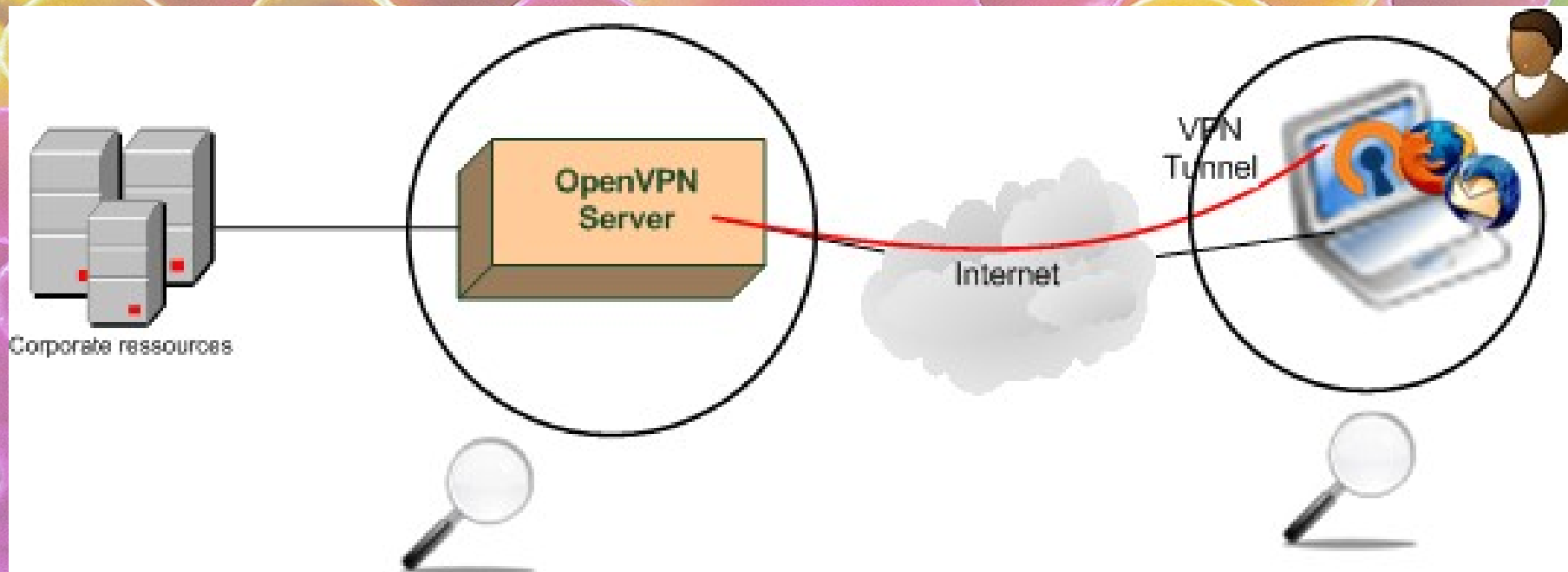
OpenVPN in-depth Architecture

- Case study : simple VPN connection

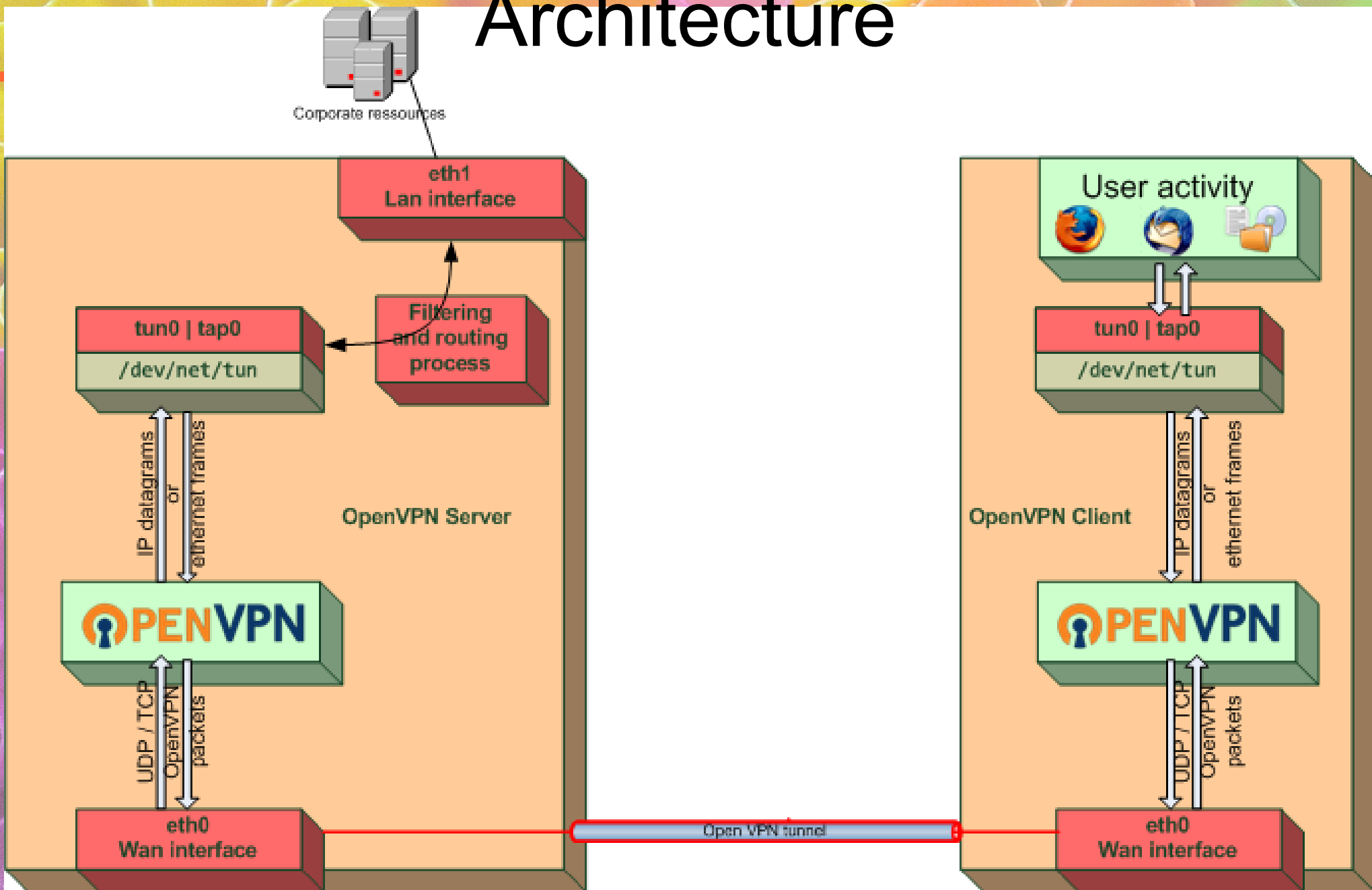


OpenVPN in-depth Architecture

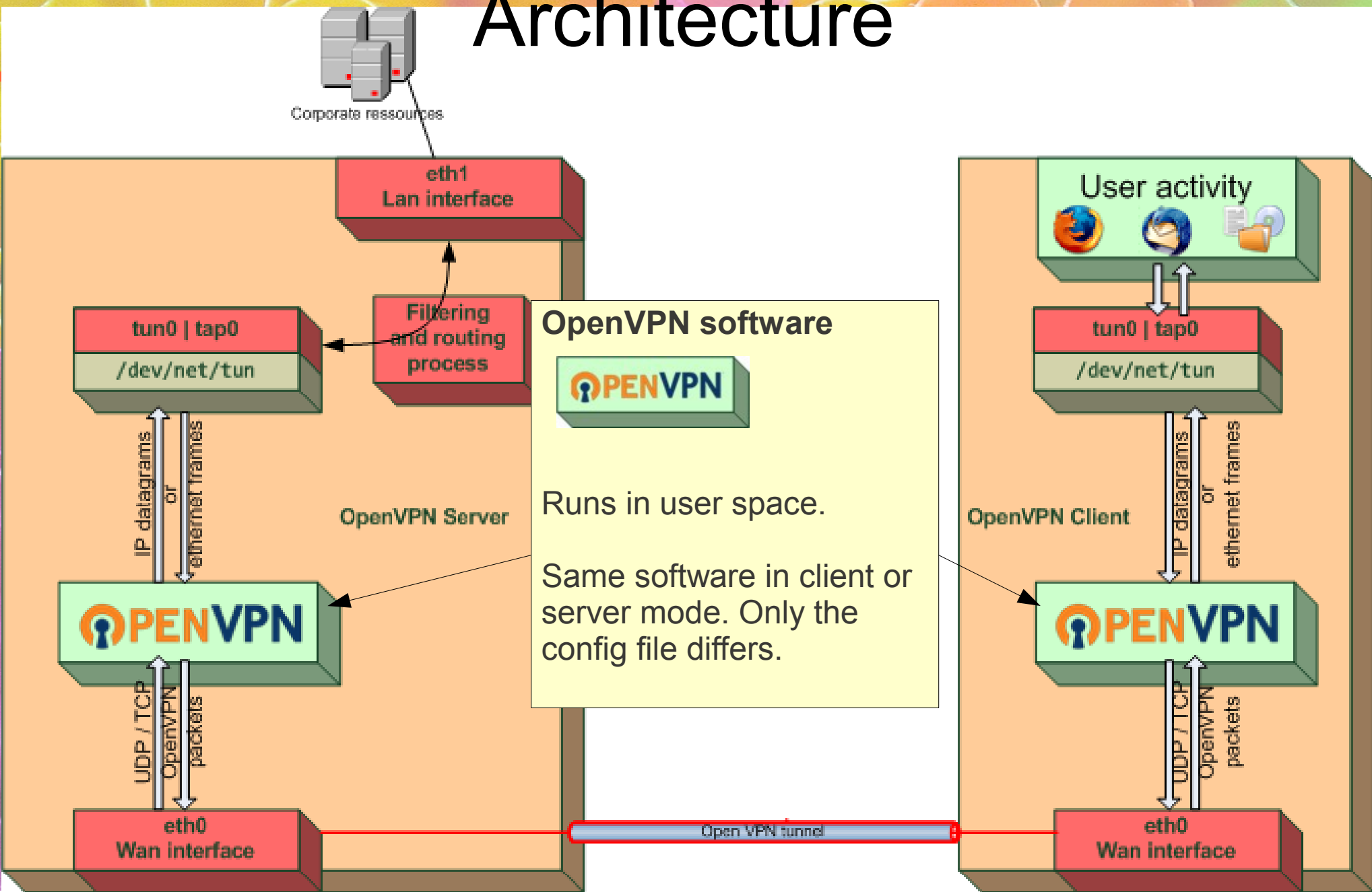
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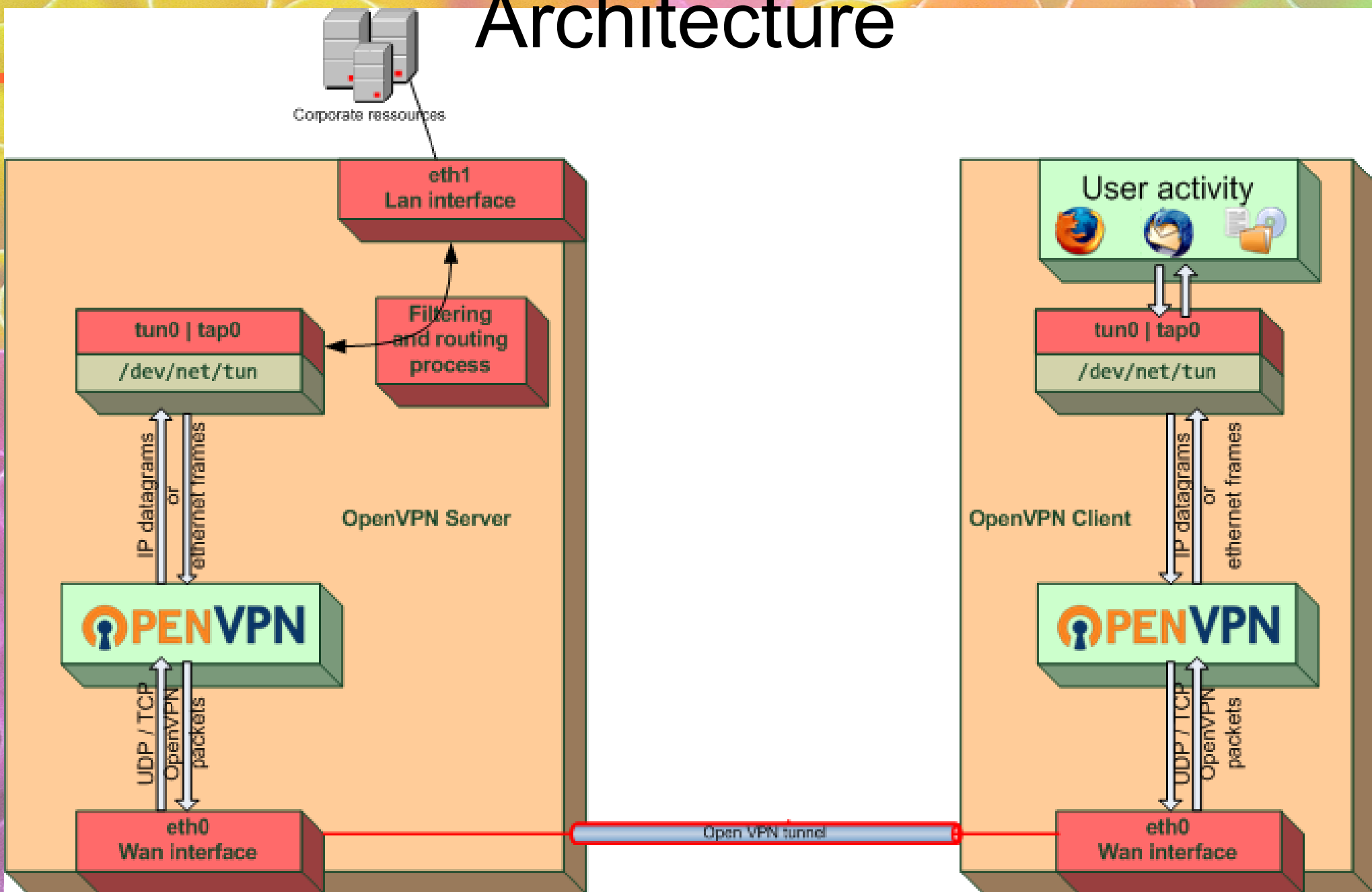
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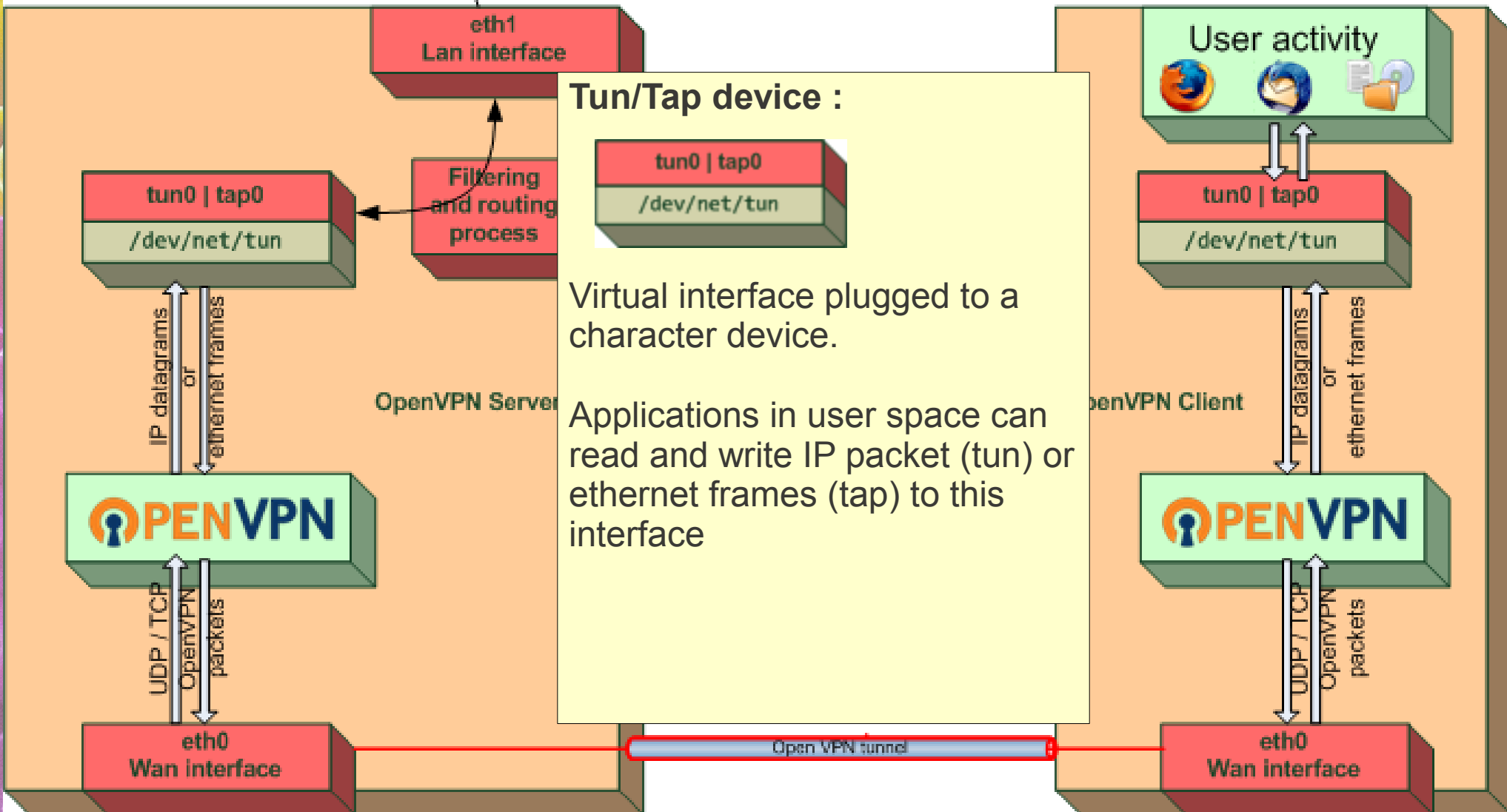
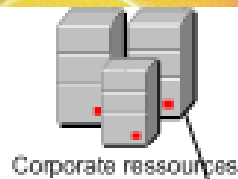
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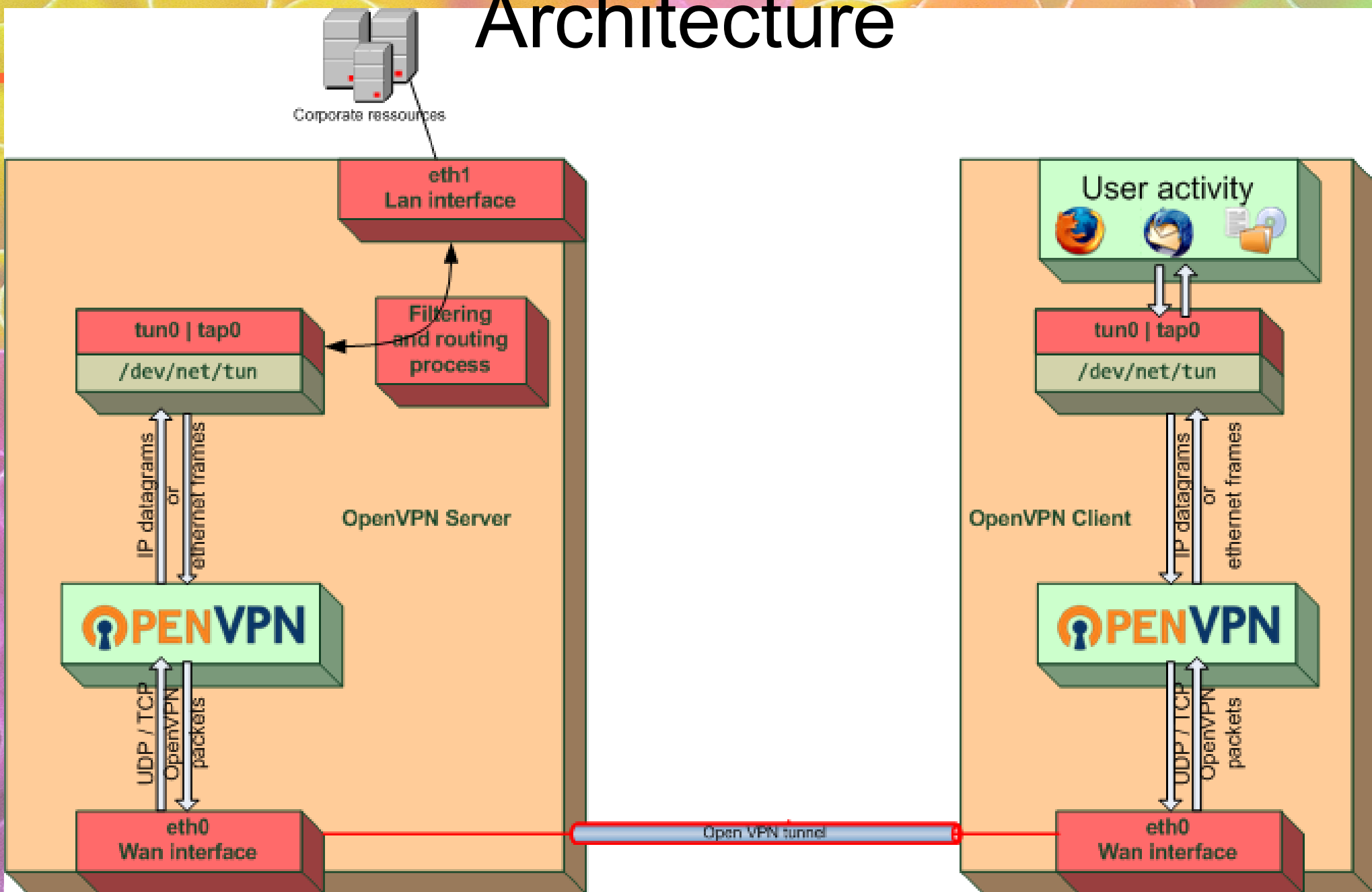


Tun/Tap device :

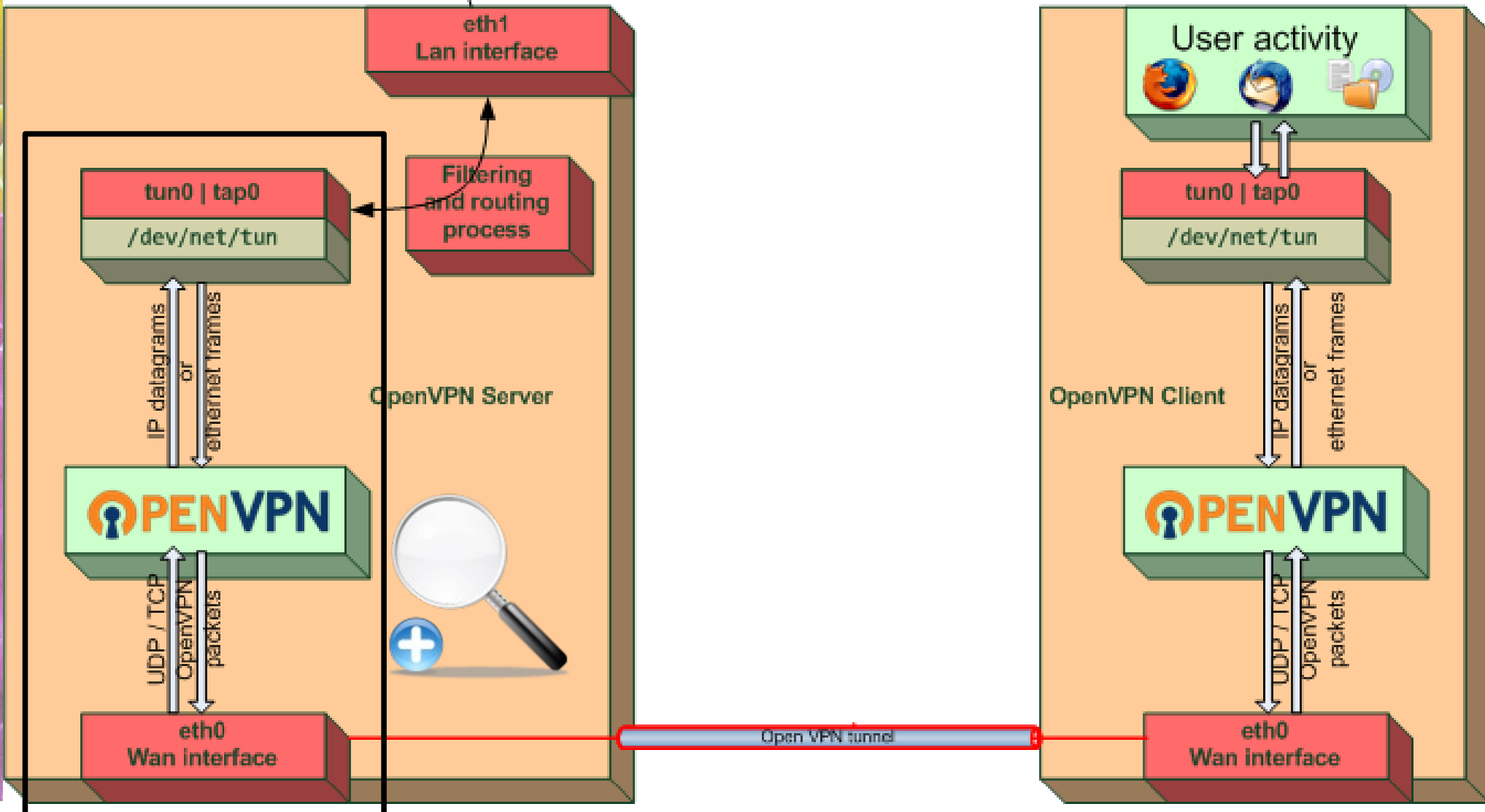
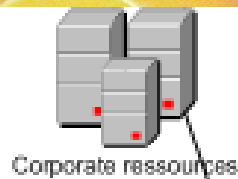
Virtual interface plugged to a character device.

Applications in user space can read and write IP packet (tun) or ethernet frames (tap) to this interface

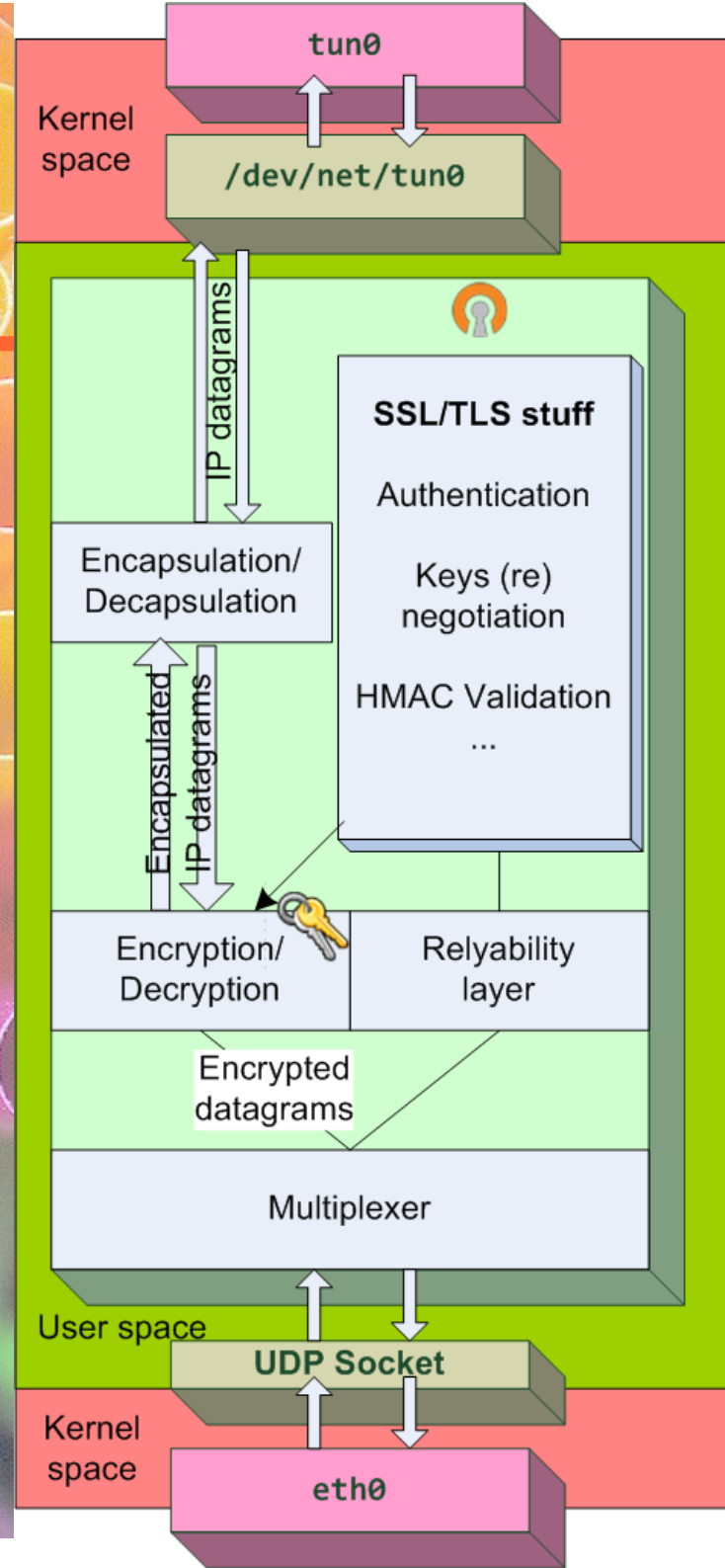
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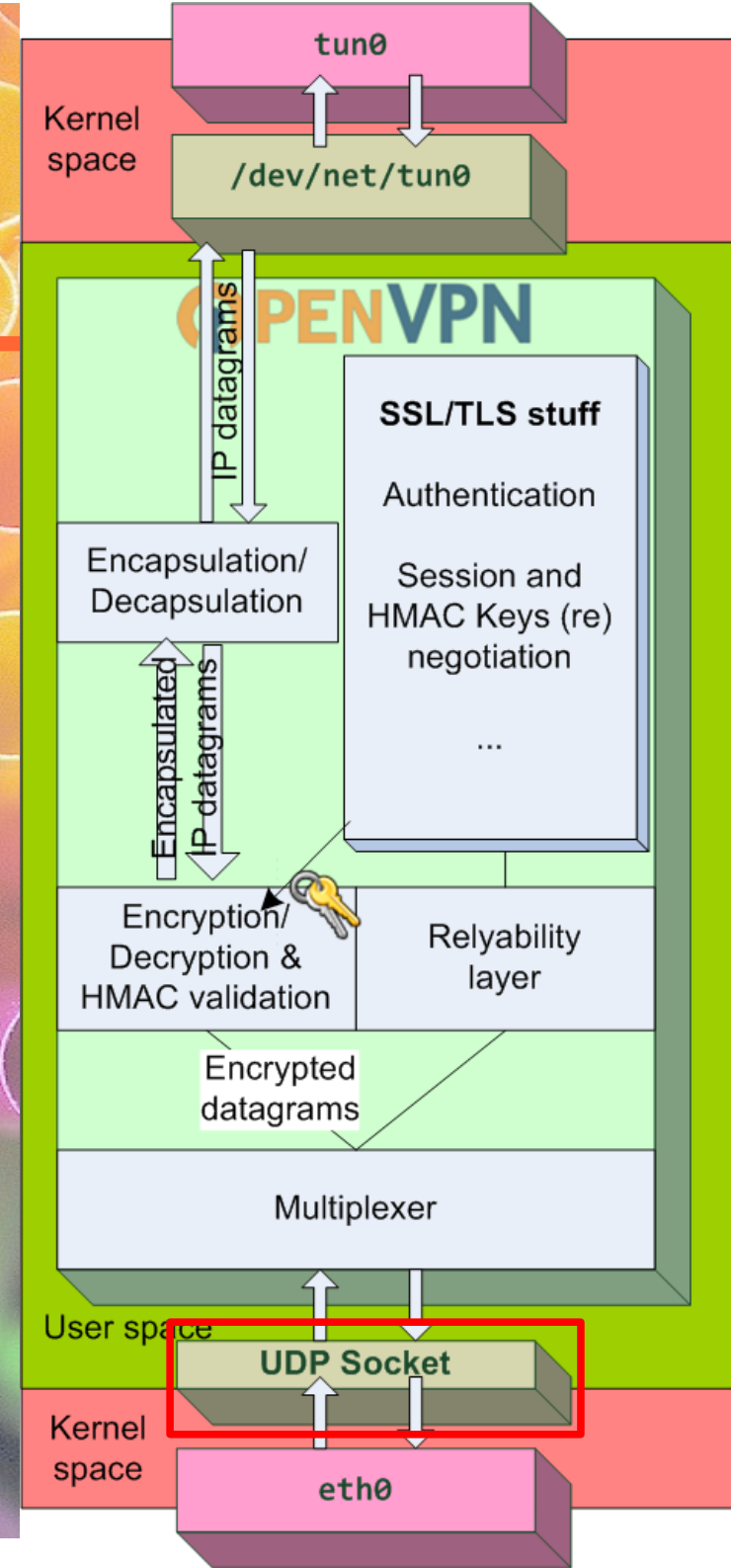


OpenVPN in-depth



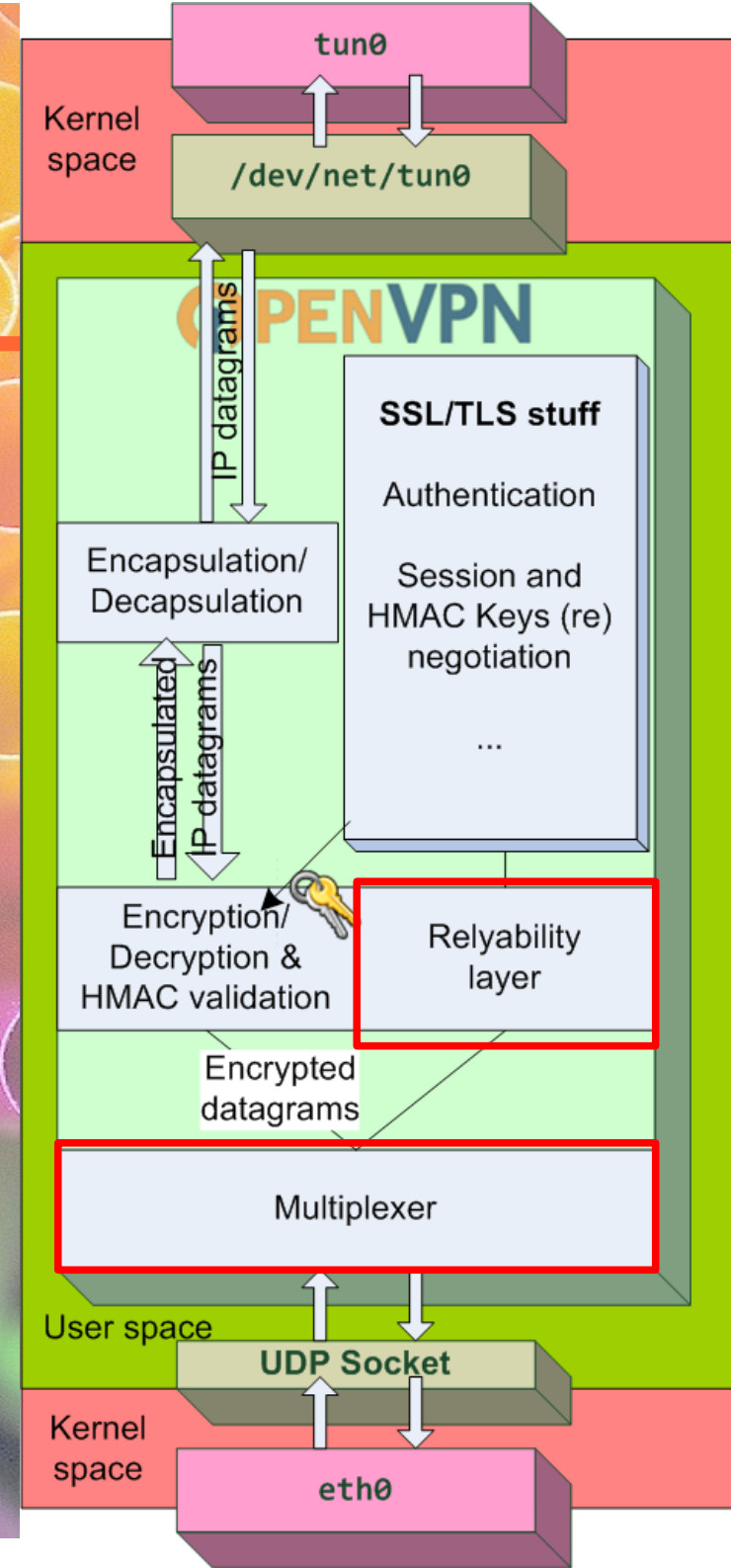
OpenVPN in-depth Transport

- OpenVPN tunnels can be transported over TCP or UDP
- With TCP transport, TCP data are tunneled **over TCP**. Congestion controls are running twice and badly interact when congestion occurs
- Still, TCP 443 might be your only way out
- HTTP proxy is also supported



OpenVPN in-depth Multiplexer & Reliability

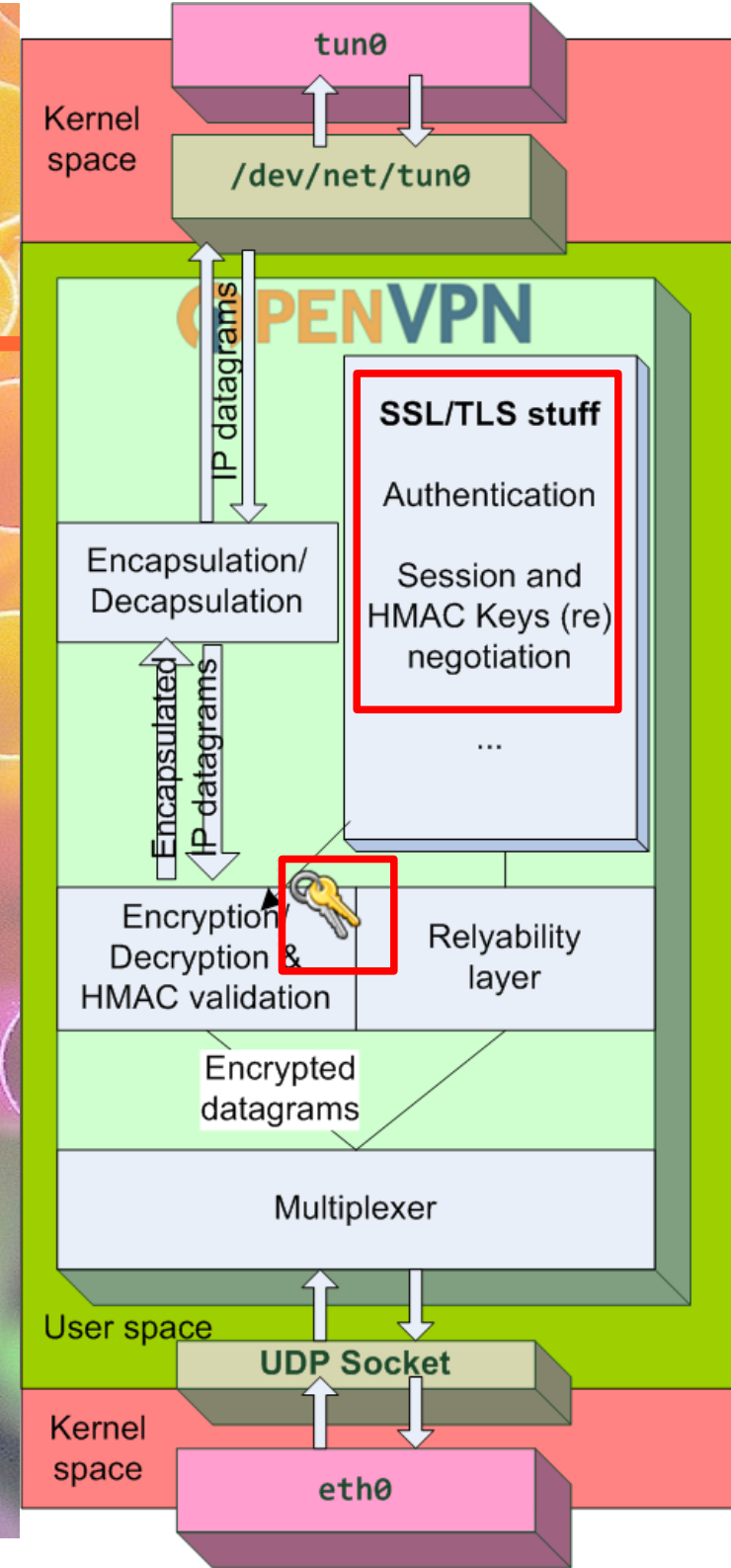
- Packets and frames transport need unreliability but SSL/TLS stuff does...
- The reliability layer provides it (only in UDP mode).
- An optional pre-openSSL HMAC (pre shared key) can be added at this layer



OpenVPN in-depth

- Authentication & key gen

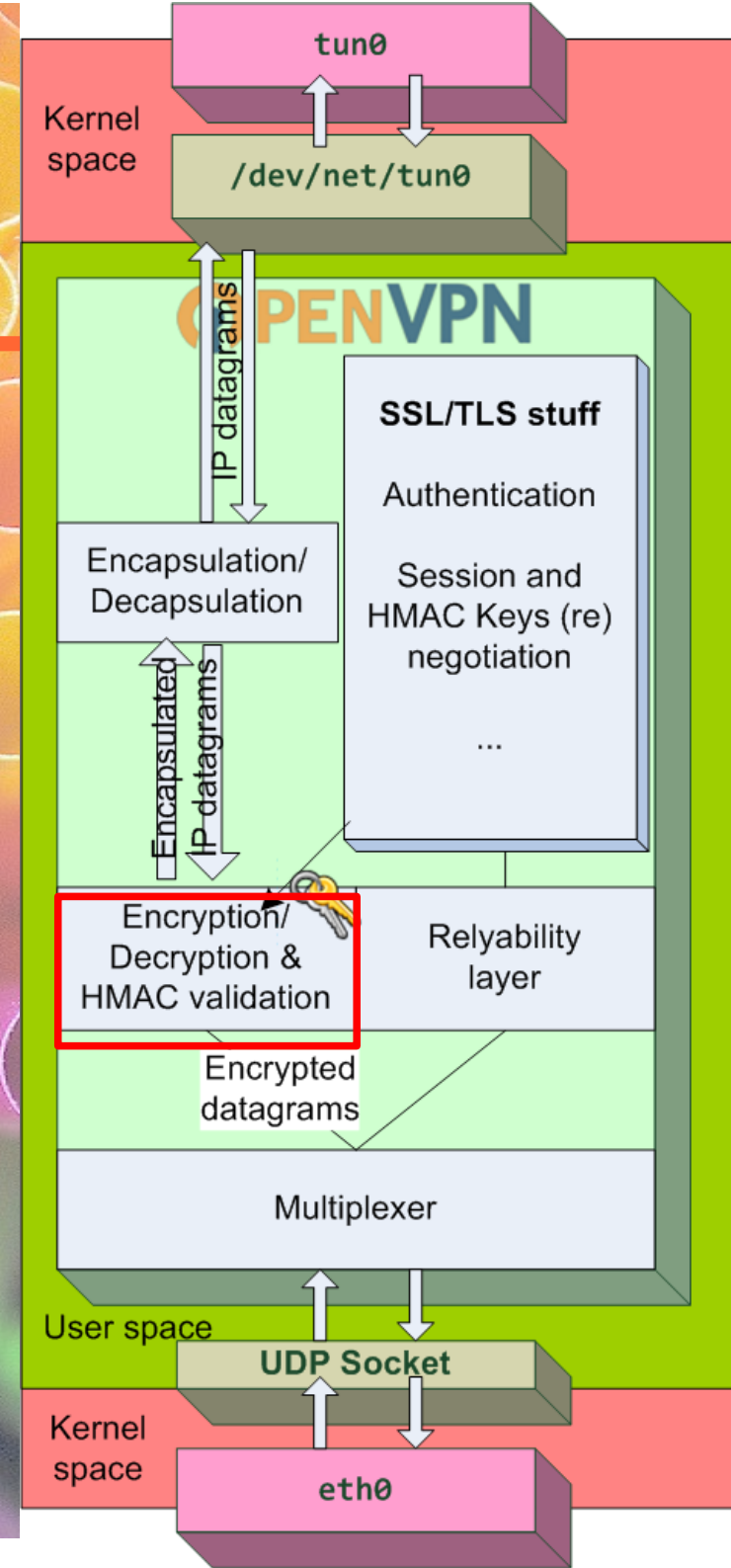
- 2 authentication modes supported :
 - Static pre-shared key (doesn't scale well...)
 - SSL/TLS with certificates for authentication and keys negotiation (preferred)
- easyca provided for simple PKI certificate generation
- Provides keys for encryption & HMAC validation



OpenVPN in-depth

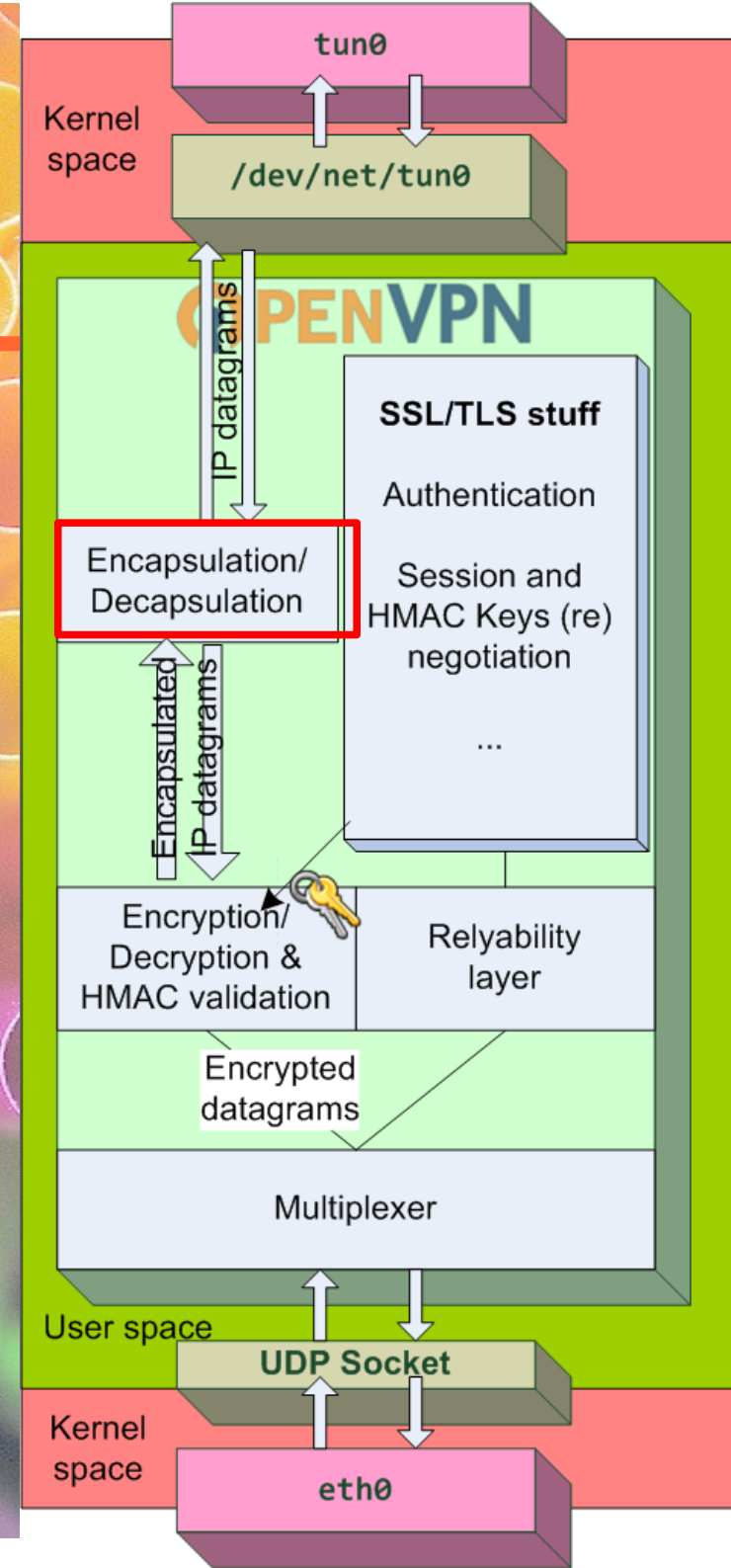
Data encryption

- Data Encryption/decryption is made by standard OpenSSL EVP interface with the negotiated keys.
- HMAC validation is also made with OpenSSL EVP
- An optional pre-OpenSSL HMAC header can be added.



OpenVPN in-depth Encapsulation

- Packets are read/written from the tuntap device
- The MSS is adjusted by OpenVPN request to avoid fragmentation



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Few more things

- Authentication
 - Can also be :
 - Without client certificate
 - and/or login password validated with user script (pam, ldap, OTP, db...)
 - Dual factor PKCS11 and MS cryptoapi supported
- Clients management :
 - OpenVPN server acts as a DHCP server. DHCP options supported.
 - IP pool management with sticky address
 - Routes can be pushed from server
- LB & FailOver :
 - Natively supported in client config file

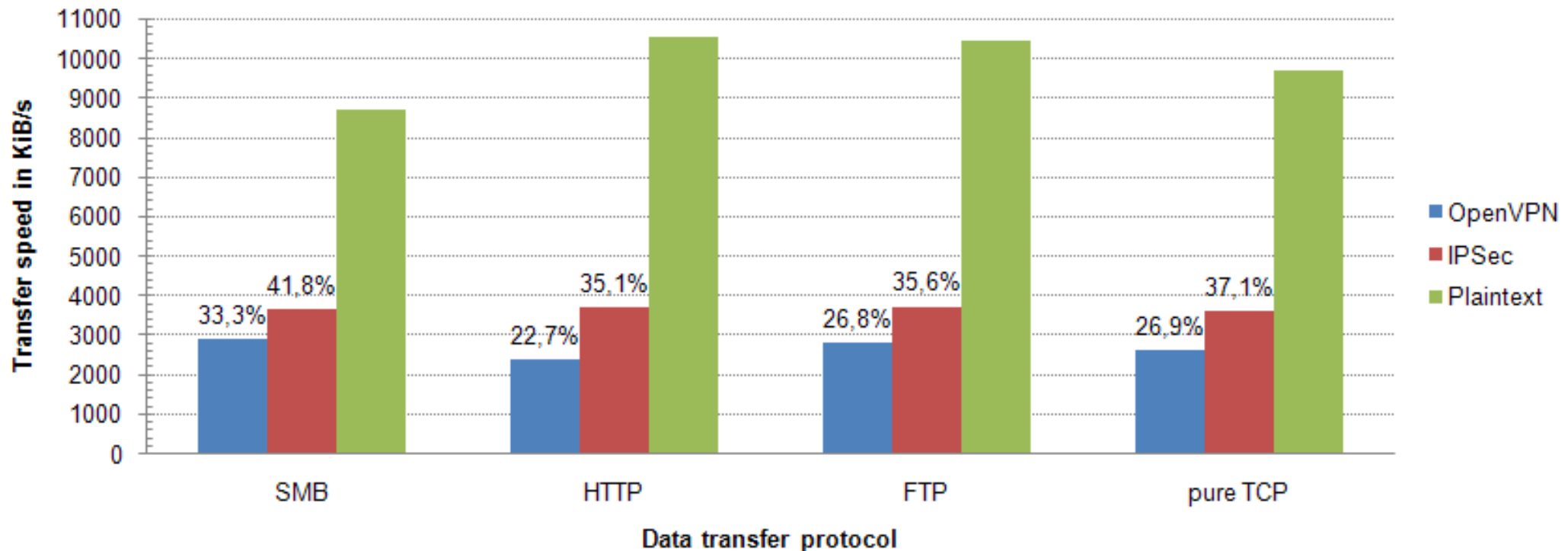
Hardening OpenVPN

- Tls-auth : A simple but efficient HMAC
A shared static key is used to add an integrity header to vpn packets. If the HMAC is false : packet dropped. Prevent bruteforce, tempering, libssl exploitation.
- root privilege dropping
 - After init
 - With sudo for iproute
 - In chrooted environment

Performances

- Due to heavy kernel space/user space data transferts, OpenVPN performances are not as good as Ipsec's

Data transfer slowdown at $i = 1$



Using OpenVPN : configuration basis

- Installing and running openvpn on linux
 - (apt-get|yum|urpmi|...) install openvpn
 - /etc/openvpn/ for config file(s)
 - /etc/init.d/openvpn start [configfile]
- Configuration
 - 2 modes : commands args and/or config file

Plugability & Hooks for fun and creativity

Client and server side user defined scripts can be easily called on multiple events :

- Tunnel up/down
- Certificate verification
- Login/password verification
- Client authenticated (*server* side)
- Remote IP address change
- Route up (*client* side)
- Client disconnected
- New route/MAC address added to the server

Lots of environment variables are set before calling the scripts.

Telnet management interface

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- **« Once upon a time... » - Few tales and demos featuring OpenVPN**
 - Tale I : “Home sweet home : The Simple 4 Lines Config“
 - Tale II : “Escaping the evil proxy“
 - Tale III : “The OpenVPN server, the CAS WebSSO, and the brave firewall“
- Want more ? Need help ?

Tale I : “Home sweet home : The Simple 4 Lines Config”

- Goal : configure a host-to-host connection for accessing your home network (192.168.1.0/24) anywhere.

- Static key generation :

```
openvpn --genkey --secret static.key
```

- Server config :

```
dev tun  
ifconfig 10.1.0.1 10.1.0.2  
secret static.key
```

- Client config :

```
remote serveraddress  
dev tun  
ifconfig 10.1.0.2 10.1.0.1  
secret static.key  
route 192.168.1.0 255.255.255.0
```

Tale II : “Escaping the evil proxy“

- Objective : transport your VPN over an http proxy and route everything to it
- Change to tcp mode : `proto tcp`
- And just add this to the client configuration :
`http-proxy [proxyaddress] [proxyport]`

Tale III : OpenVPN with CAS sso authentication

- Objective : Using scripts capabilities of openvpn, delegate authentication on a CAS web SSO server
- Ingredients :
 - A CAS Web SSO server
 - A firewall
 - A gatekeeper : web application relying on CAS SSO
 - An OpenVPN server
 - A client
 - Few scripts

Tale III : OpenVPN conf

- Connection to openVPN is made without authentication : `--certificate-free`.
- `--ha-mac` is used to prevent total strangers
- User's VPN IP is blocked by a firewall
- An application relying on cas authentication allow the IP address on the firewall upon successful SSO authentication.
- An action script is triggered when client disconnects to clear the IP on the firewall

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Want more ? Need help ?

- Useful links :

- <http://openvpn.net> → community

- Wiki : <https://community.openvpn.net/openvpn/wiki/>

- Related projects :

- <https://community.openvpn.net/openvpn/wiki/RelatedProjects>

- Official Quickstart, manuals, HOWTO

- Mailing list : users and developers

- IRC chan : #openvpn on irc.freenode.net

- Get involved : git repository, IRC weekly meeting, Wiki, bug fixes and patch submission, donation...

- Book : “OpenVPN: Building and Integrating Virtual Private Networks”