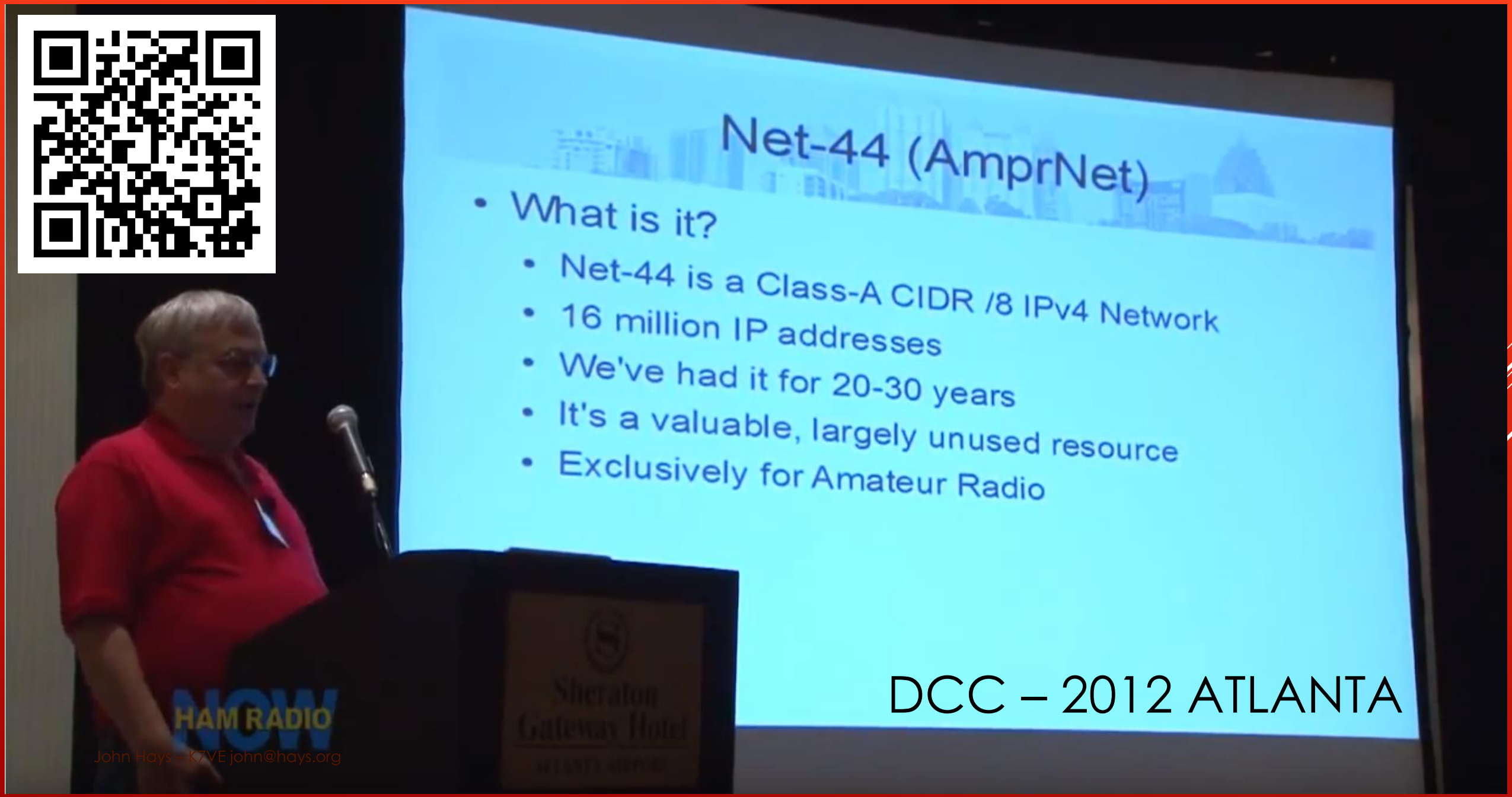
BRINGING NET-44 AND IPV6 TO YOUR STATION VIA VPN

A brief presentation on creating your own Internet connected network for Amateur Radio using a VPN tunnel and BGP advertised static IP address space.



DCC – 2012 ATLANTA

What Will Be Covered

This presentation will examine the steps and resources to create a VPN connected static IP address space in Net-44 and IPv6 to:

- Enable Amateur Radio services such as websites and databases
- Enable access to station resources over the Internet
- Add Amateur Radio IoT (WX station, Remote Control, …)

Ground rules:
Net-44 addresses may only be used for Amateur Radio experimentation and infrastructure.
IPv6 Addresses may be used for any legal purpose.

Transmissions on amateur frequencies must conform to Amateur Radio Service rules.

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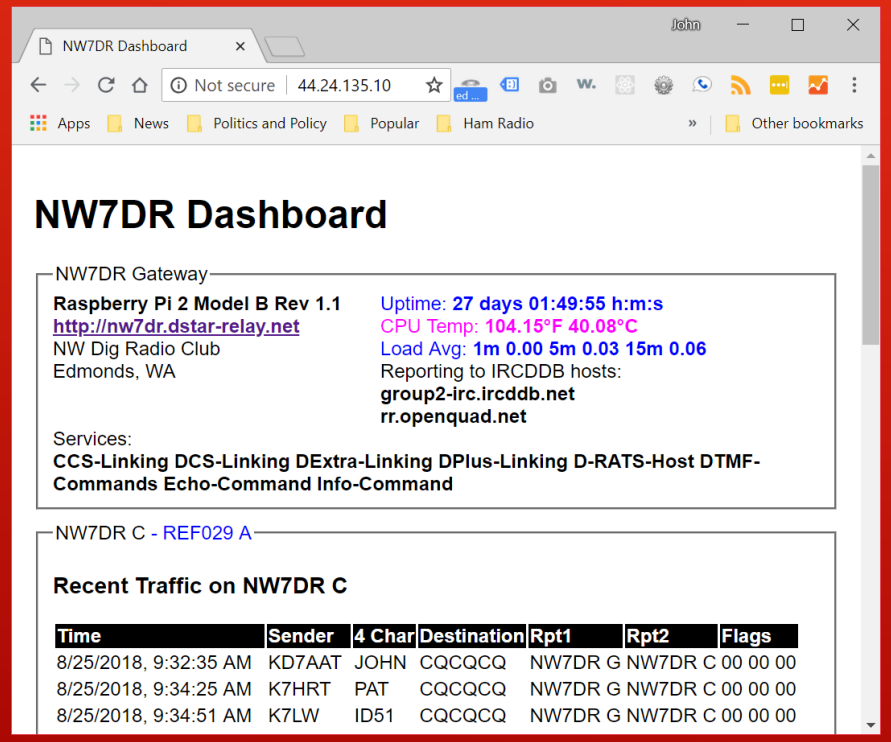
Applications

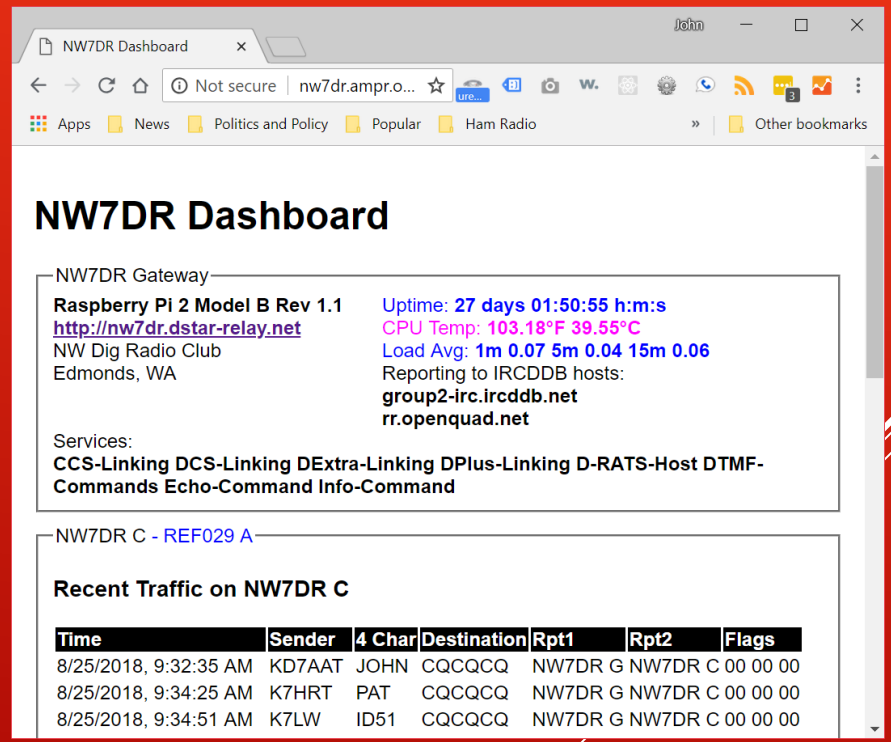
Self hosted Amateur Radio Websites and Services

- Fixed (static) IP addresses and domain names (Reuse well known ports, e.g. 80/443)
  - nw7dr.ampr.org
  - 44.24.135.10



Scan me

Scan me



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Applications

Remote Station Management and Operation

44.x.x.100

VPN – Internet - VPN

44.x.x.25

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Applications

Fixed IP While Traveling / Mobile (Tunnel through LTE Example)

LAN – 44.x.x.x

Wifi/Wired with DHCP/Static

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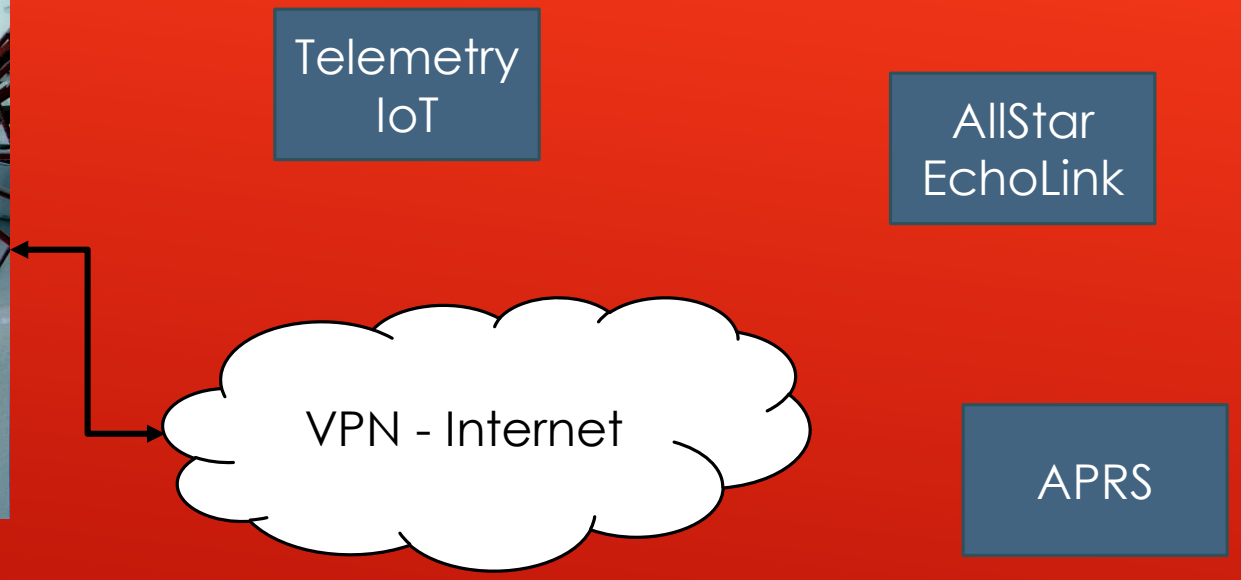
Applications

Repeater/Node/Gateway Site Linking with Static IP Addresses

Farnsworth Peak - Photo by Sam Kunz of DTV Utah



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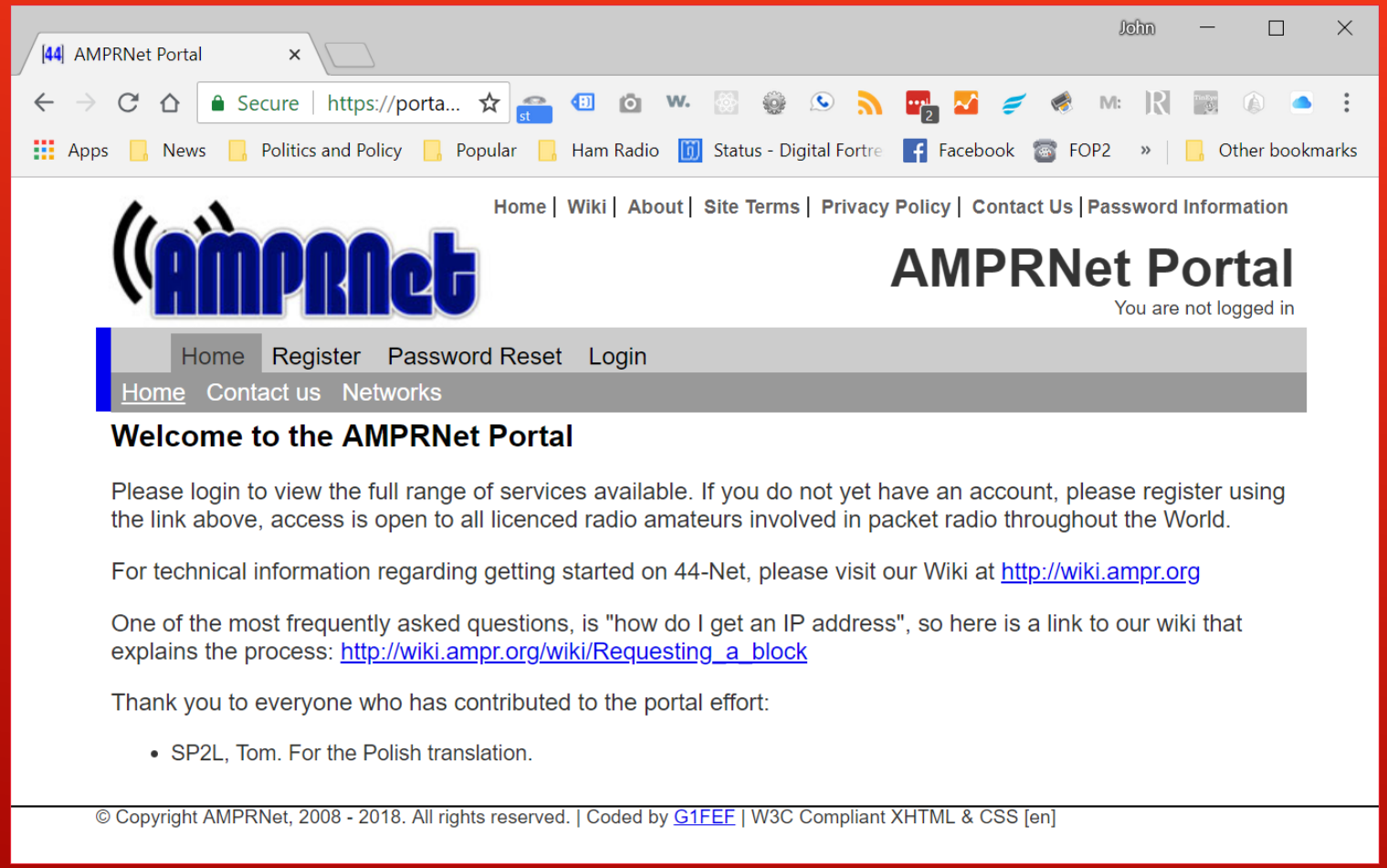
Obtaining Net-44 Addresses

Create an account on https://portal.ampr.org



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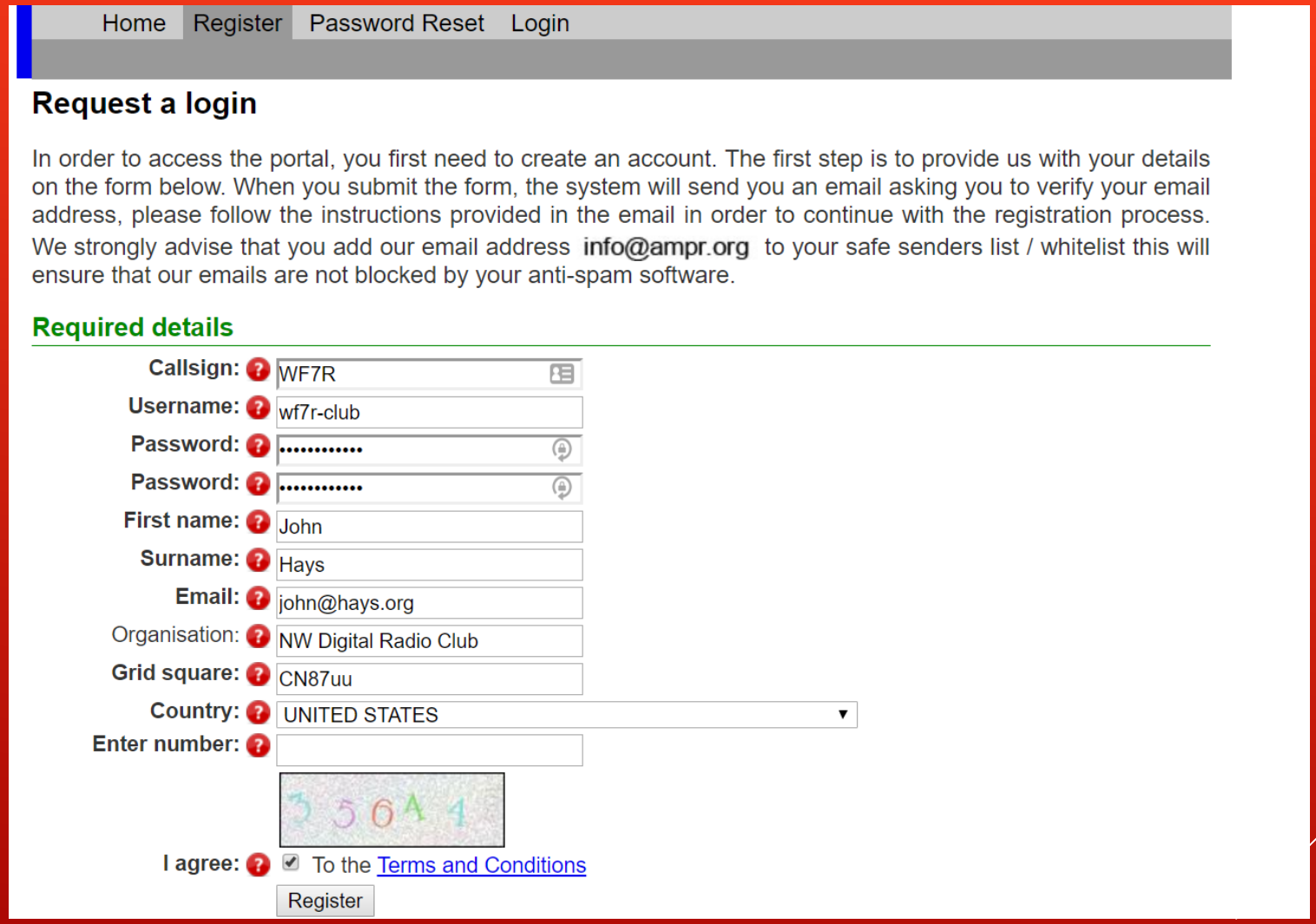
Obtaining Net-44 Addresses



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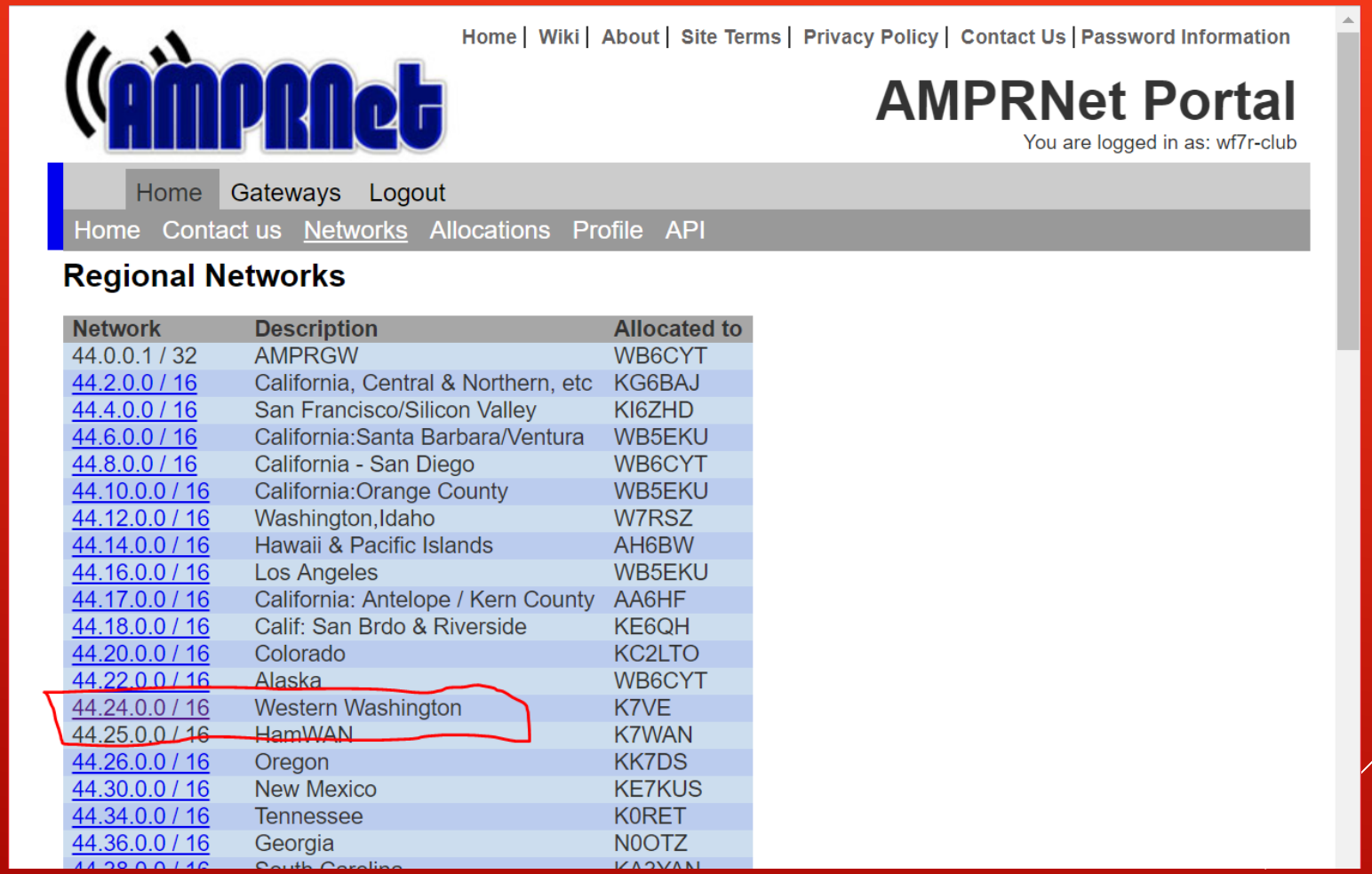
Obtaining Net-44 Addresses

Select ‘Networks’ and navigate to your regional network



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Obtaining Net-44 Addresses

When you reach your regional network, you will be presented with existing allocations.

At the bottom of the list, you can request an allocation by clicking on the link, e.g. 44.24.0.0/16

44.24.200.0 / 22	San Juan County KD7KAB	KD7KAB
44.24.221.0 / 24	HamWAN PSDR Anycast	K7WAN
44.24.240.0 / 20	HamWAN PSDR	K7WAN

If the address range you want is not within any of the subnets above, or the region you are located in is not listed above, you may request an allocation from the parent network by clicking here: 44.24.0.0/16

You need to be logged in to request an allocation. If you are not logged in when you make a request, you will be re-directed to the login page.

Go back to parent network

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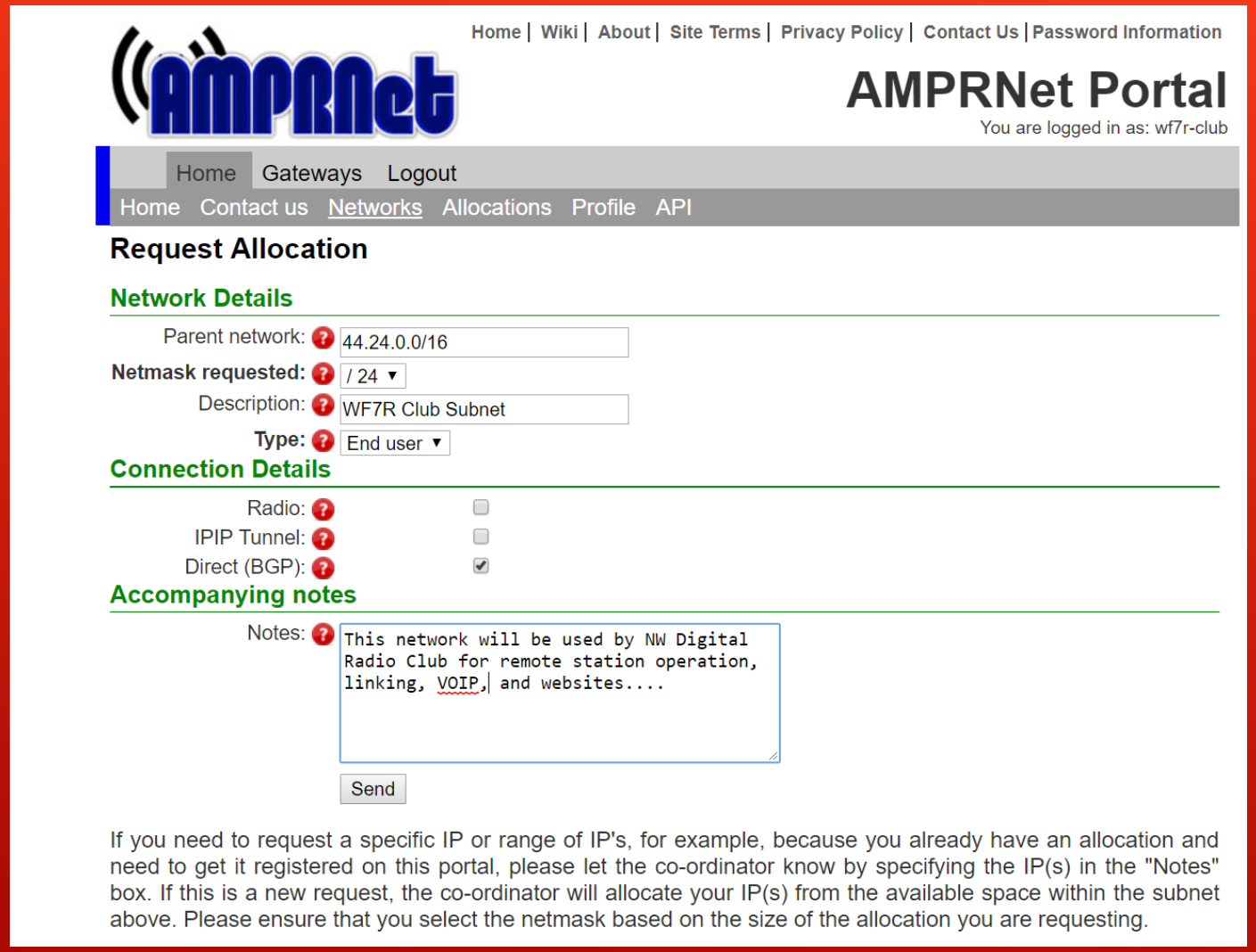
Obtaining Net-44 Addresses



Fill in the form, select a /24 netmask, end user, and direct(BGP). In the notes, let the coordinator know your plans for the network.

Send and await the allocation. BGP allocations will pass through ARDC and require additional paperwork.

ARDC will generate a letter for your network provider to permit routing and advertisement of your subnet.

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Additional Information for Routing Net-44

When your ‘direct (BGP)’ allocation is processed, you will be assigned the block of addresses for your subnet.

In order to have a network service provider route your subnet, additional information will be required by the ARDC.

Example information from Spartan Host <sales@spartanhost.net> – verify with provider before submitting.

- ASN that will advertise the subnet: *201106*
- Network Service Provider name: *Spartan Host Ltd*
- NSP postal address: *280 Comber Road, Dundonald, Belfast, BT16 1UR, United Kingdom*
- NSP telephone: *+446029105858*

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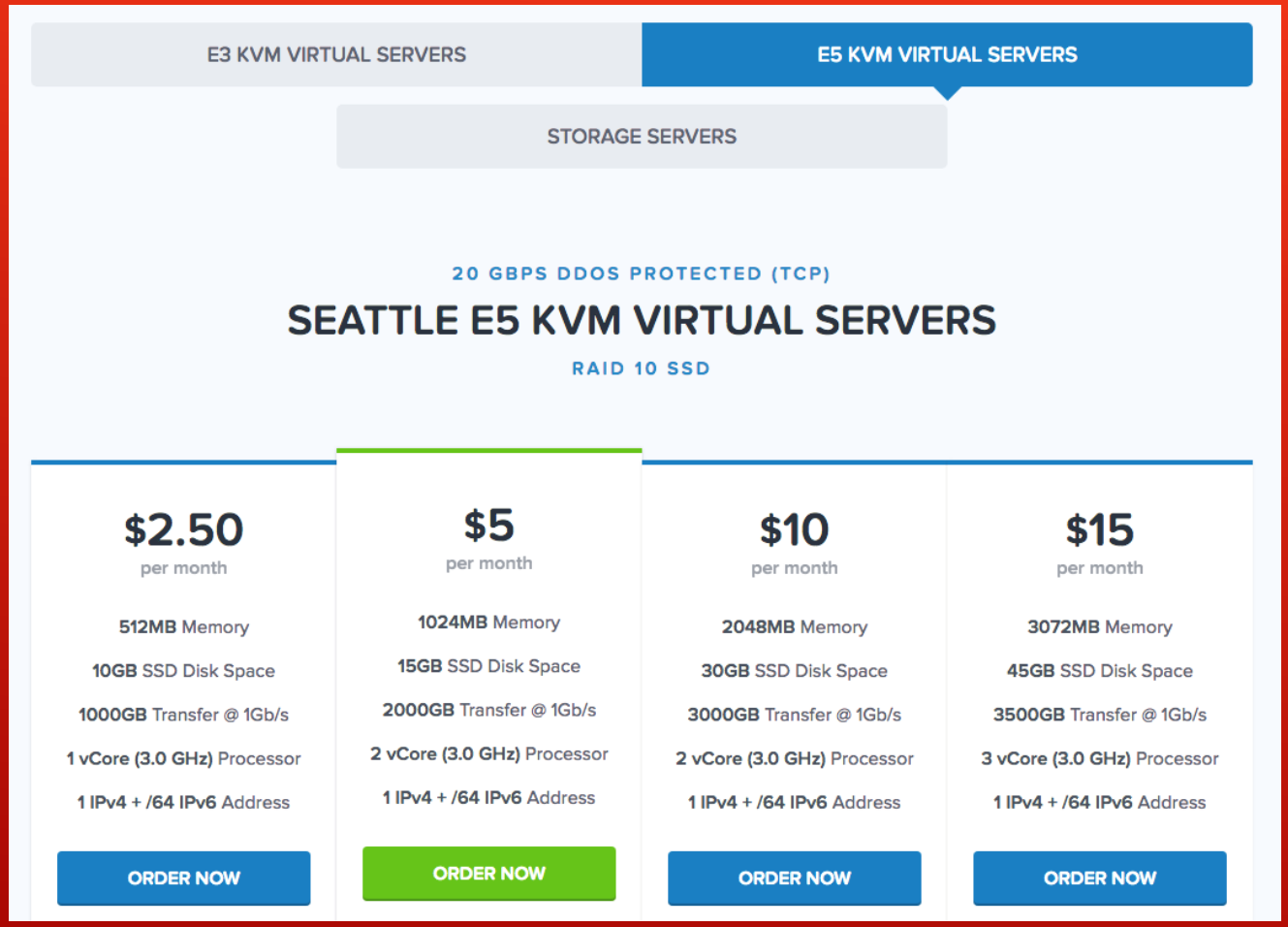
Spartan Host Provisioning Example

Order at https://spartanhost.org/vps



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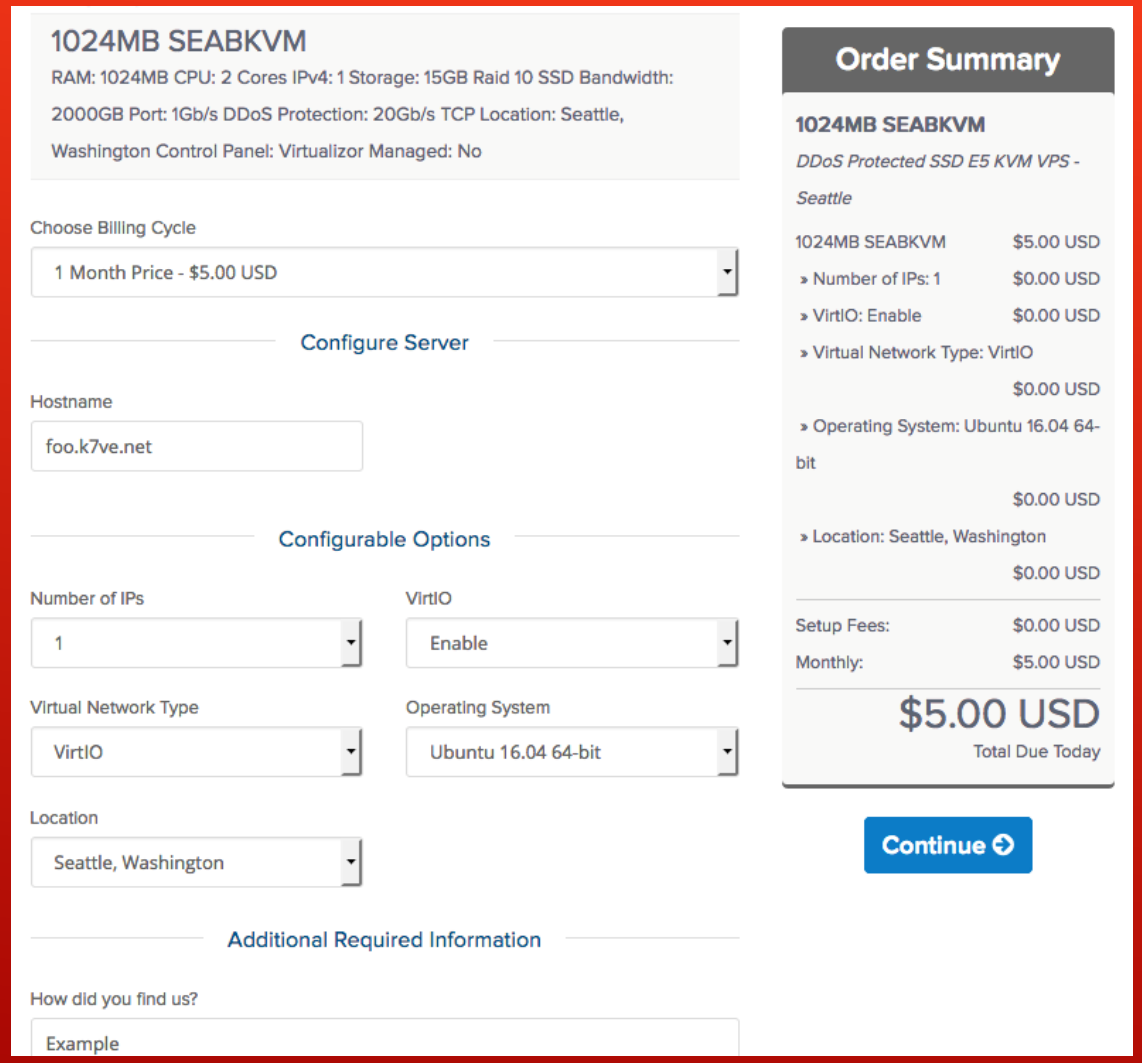
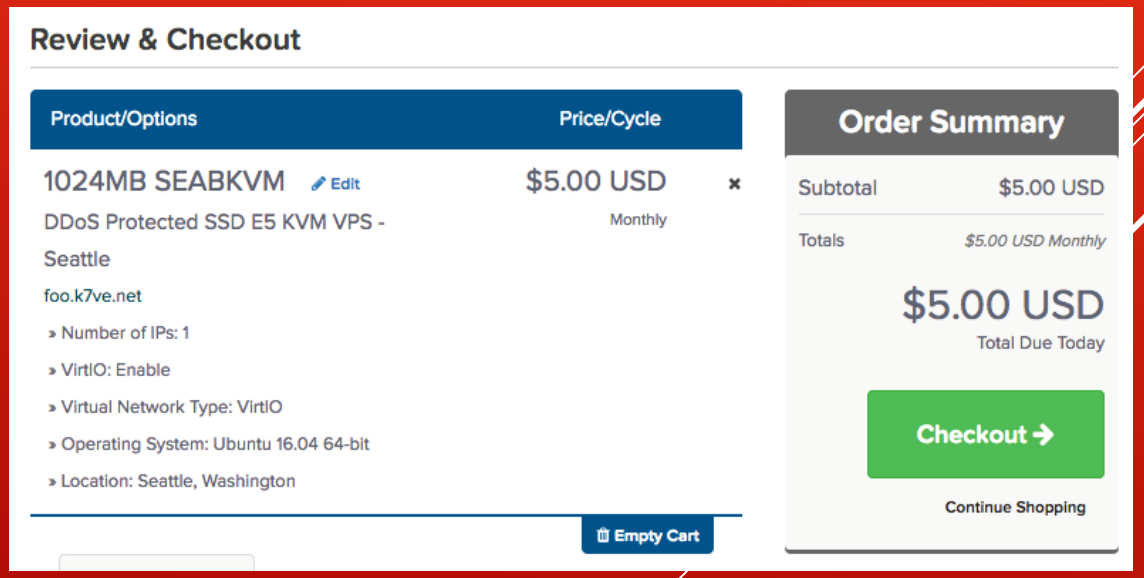
Spartan Host Provisioning Example



Select your plan and configure on next screen

I use Ubuntu 64-bit 16.04, select defaults on the rest



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Spartan Host Provisioning Example

Check out

Shortly thereafter the host will be setup and ready to use.

Optionally, and recommended, as part of the setup you can enable 2 factor authentication for the VPS control panel. It uses the Google Authenticator application.

Google Authticator

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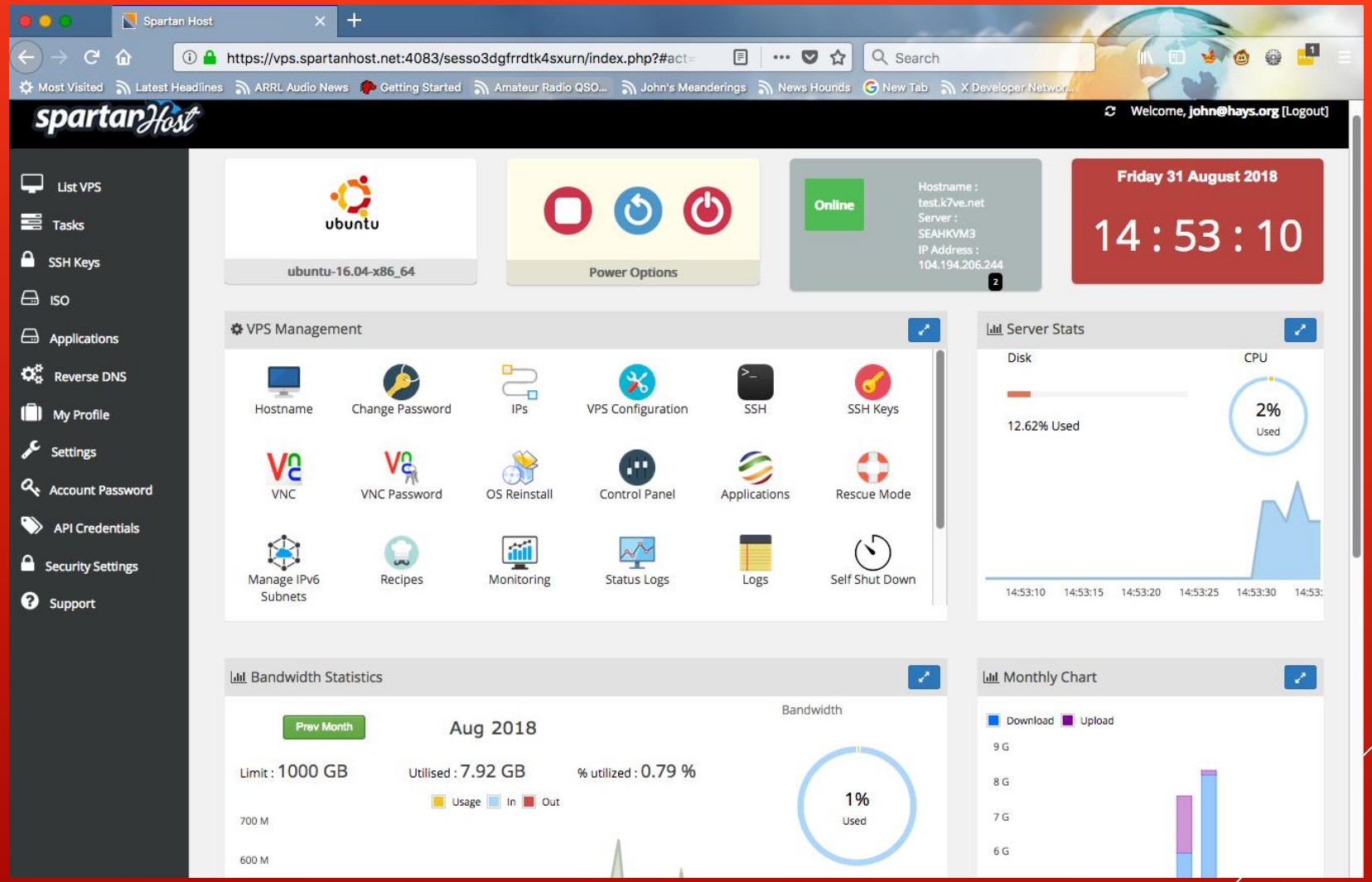
Spartan Host Provisioning Example (Control Panel)



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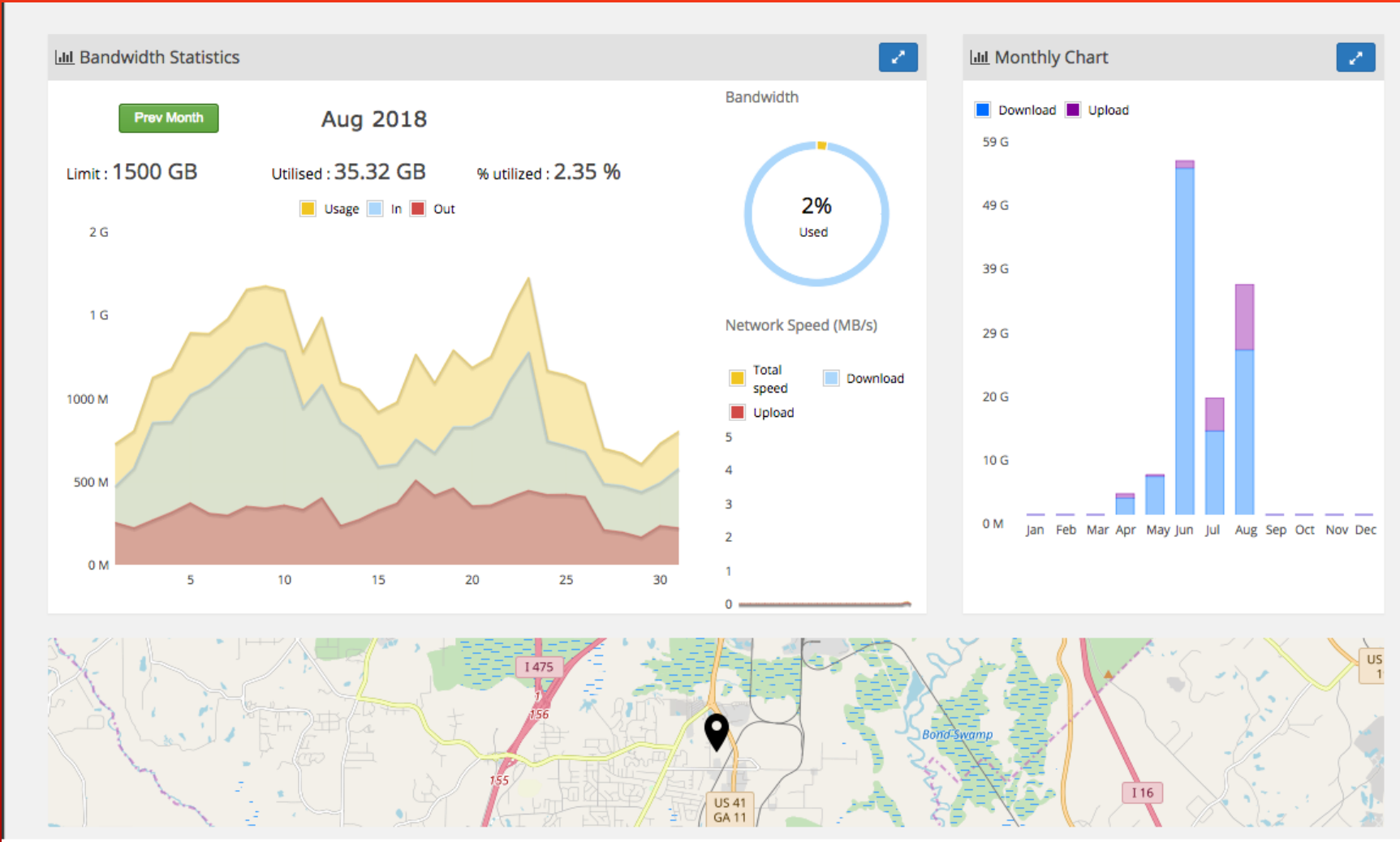
Spartan Host Provisioning Example (Report)



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Spartan Host Provisioning Example

ssh or **vnc** into your host

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Update the VPS Server

See **https://groups.io/g/net-44-vpn/wiki/**

Update Ubuntu
Issue the following commands
apt-get update
apt-get upgrade

Change the ssh port number by editing **/etc/ssh/sshd_config**

Note the new ssh port for future logins

Change the timezone using:
dpkg-reconfigure tzdata

reboot

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Turn on router capabilities for the VPS

Edit the file **/etc/sysctl.conf** and uncomment, update, or add the following lines:

net.ipv4.ip_forward=1
net.ipv6.conf.all.forwarding=1
net.ipv6.conf.all.proxy_ndp=1
net.ipv4.conf.all.accept_redirects=0
net.ipv6.conf.all.accept_redirects=0
net.ipv4.conf.all.send_redirects=0

Save the file and then reload it with the command

sysctl -p

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Install and Prepare OpenVPN

apt-get install openvpn easy-rsa

Adding a special new account, allows OpenVPN to run under non-root privileges, which is a good security enhancement.

useradd vpn

Edit and add the account to **/etc/sudoers**

```
# OpenVPN
Defaults:vpn env_keep += "ifconfig_pool_remote_ip common_name"
vpn ALL=NOPASSWD: /etc/openvpn/server-clientconnect.sh
vpn ALL=NOPASSWD: /etc/openvpn/server-clientdisconnect.sh
```

Make these changes active with a reboot

reboot

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Create your Certificate Authority (CA)

cd /usr/share/easy-rsa

Edit and save a file named **vars** using your preferred editor.
Update these variables:

export KEY_COUNTRY="US"
export KEY_PROVINCE="CA"
export KEY_CITY="SanFrancisco"
export KEY_ORG="Fort-Funston"
export KEY_EMAIL="me@myhost.mydomain"
export KEY_OU="MyOrganizationalUnit“
export KEY_NAME="server“

Run: **source ./vars**

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Create your Certificate Authority (CA)

Generate server and Diffie Hellman parameters, then copy to /etc/openvpn:

```
./clean-all
./build-dh
./build-ca
./build-key-server server
openvpn --genkey --secret keys/ta.key
cd keys
cp ca.crt server.crt server.key ta.key dh2048.pem /etc/openvpn
```

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Download Scripts and Support Files

Get allfiles.tgz from **https://groups.io/g/net-44-vpn/files** and save to **/tmp**

```
cd  /tmp
tar -xzvf allfiles.tgz
cd /tmp/etc/openvpn
cp * /etc/openvpn
cd /tmp/usr/share/easy-rsa
cp * /usr/share/easy-rsa
```

Make sure the scripts are executable and create the "Client Configuration Directory"

```
cd /usr/share/easy-rsa
chmod +x *.sh
cd /etc/openvpn
chmod +x *.sh
mkdir ccd
```

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Update Network Variables and Make server.conf

With your net-44 subnet and netmask in hand, along with the IPv6 prefix from your Spartan Host account, edit the file **/etc/openvpn/network-variables**
Replace values marked in yellow below with your network values

LOCALIPV4=127.0.0.1
IPV6PRE=2006:f00d:beef:4e
IPV4NETWORK=44.1.0.0
IPV4NETMASK=255.255.255.0

Run the script to build the server.conf file

cd /etc/openvpn
./server.config.sh

This will create a file named **server.conf.new**, review it's contents and if it looks right copy it to **server.conf**

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Set Tunnel Value and Start OpenVPN

Define the Tunnel

Edit the file **/etc/openvpn/variables** it will contain two lines

prefix=aaaa:bbbb:cccc:dddd:80::
prefixlen=112

aaaa:bbbb:cccc:dddd should be the IPv6 prefix from your Spartan Host account.

Startup and Enable the VPN server

Start the server, look at it's status, and if OK, then enable it.

systemctl start openvpn@server
systemctl status openvpn@server
systemctl enable openvpn@server

If you followed all of the steps correctly, you should have a working VPN Server!

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Setup Clients – Update Template

Run build-template.sh, It will create a file config.openvpn.tpl.new which should be copied to config.openvpn.tpl

cd /usr/share/easy-rsa
./build-template.sh
cp config.ovpn.tpl.new config.ovpn.tpl

Note: This configuration file uses the public IP address of the VPS, you may want to change it to a domain name, if you have given one to your VPS.

It only needs to be run once, you can edit the resulting config.openvpn.tpl if you need to make changes.

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Setup Clients – Create OVPN Files

Repeat for each client:

cd /usr/share/easy-rsa
./generate_openvpn_config.sh

Pick a user name, you might want to use a callsign or other designation. Since we previously edited the vars file, most values will be populated correctly, so just hit return, except for the following questions:

Please type in user name for the new config:**username-of-client**
Sign the certificate? [y/n]:**y**
1 out of 1 certificate requests certified, commit? [y/n]**y**

This will create a file a file named **openvpn_username-of-client.ovpn**

This file will be transferred to your client after installing OpenVPN on the client.

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Install and Configure OpenVPN on Clients

OpenVPN is available for almost all major modern operating system, including Microsoft Windows, Mac OS, Linux, Unix, Android, Apple IOS, ... see https://openvpn.net/ for many clients.

Raspberry Pi - Raspbian and Similar Linux Devices

Login to your device and do the install

sudo apt-get update
sudo-apt-get upgrade
sudo apt-get install openvpn unzip

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Install and Configure OpenVPN on Clients

Install OVPN Configuration
Copy the .ovpn file you created to the local system. It should be placed in /etc/openvpn - sftp is a good method.

cd /etc/openvpn
If you have changed the ssh port, use sftp -P <portnumber> root@[VPS Host]
sudo sftp root@[Your VPS IP or Domain Name]
sftp> cd /usr/share/easy-rsa
sftp> get openvpn_username-of-client.ovpn
sftp> exit
sudo mv openvpn_username-of-client.ovpn username-of-client.conf

I like dropping the openvpn_, and on Linux .conf is preferred to .ovpn for the filename

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Running OpenVPN on Clients

Startup Your Client

sudo openvpn --config /etc/openvpn/username-of-client.conf --daemon
wait a short time and
ifconfig tun0
hostname -I

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Assigning IP Addresses and Subnets to a Client

Login to your VPS as root, then

cd /etc/openvpn
./make-ccd.sh
Example (Use a netmask of 255.255.255.255 for a single address, see what mask to use for subnets at http://www.rjsmith.com/CIDR-Table.html

Building CCD file ..
Client Name (same as used when building ovpn file
username-of-client

Host IPv4 address to assign to client (in 44.1.0.0/255.255.255.0)
44.1.0.20

Client subnet mask, eg. 255.255.255.255 or 255.255.255.240
255.255.255.240

Host IPv6 address to assign to client (2006:f00d:beef:4e:80::xxxx)
2006:f00d:beef:4e:80::1001

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Assigning and Monitoring Client IP Addresses

The **make-ccd.sh** will create a file in **/etc/openvpn/ccd** with the same name as the username, e.g. **username-of-client** that will be used to setup the client addressing and routing.

Example content of **/etc/openvpn/ccd/username-of-client**:

```
ifconfig-push 44.1.0.20 255.255.255.0
ifconfig-ipv6-push 2006:f00d:beef:4e:80::1001/112 2006:f00d:beef:4e::1
iroute 44.1.0.20 255.255.255.240
route-ipv6 2006:f00d:beef:4e:80::
```

If your client doesn't pick up these values, restart the OpenVPN server, as root on your VPS:

systemctl restart openvpn@server

You can see the clients that logged in with:

cat /etc/openvpn/openvpn-status.log

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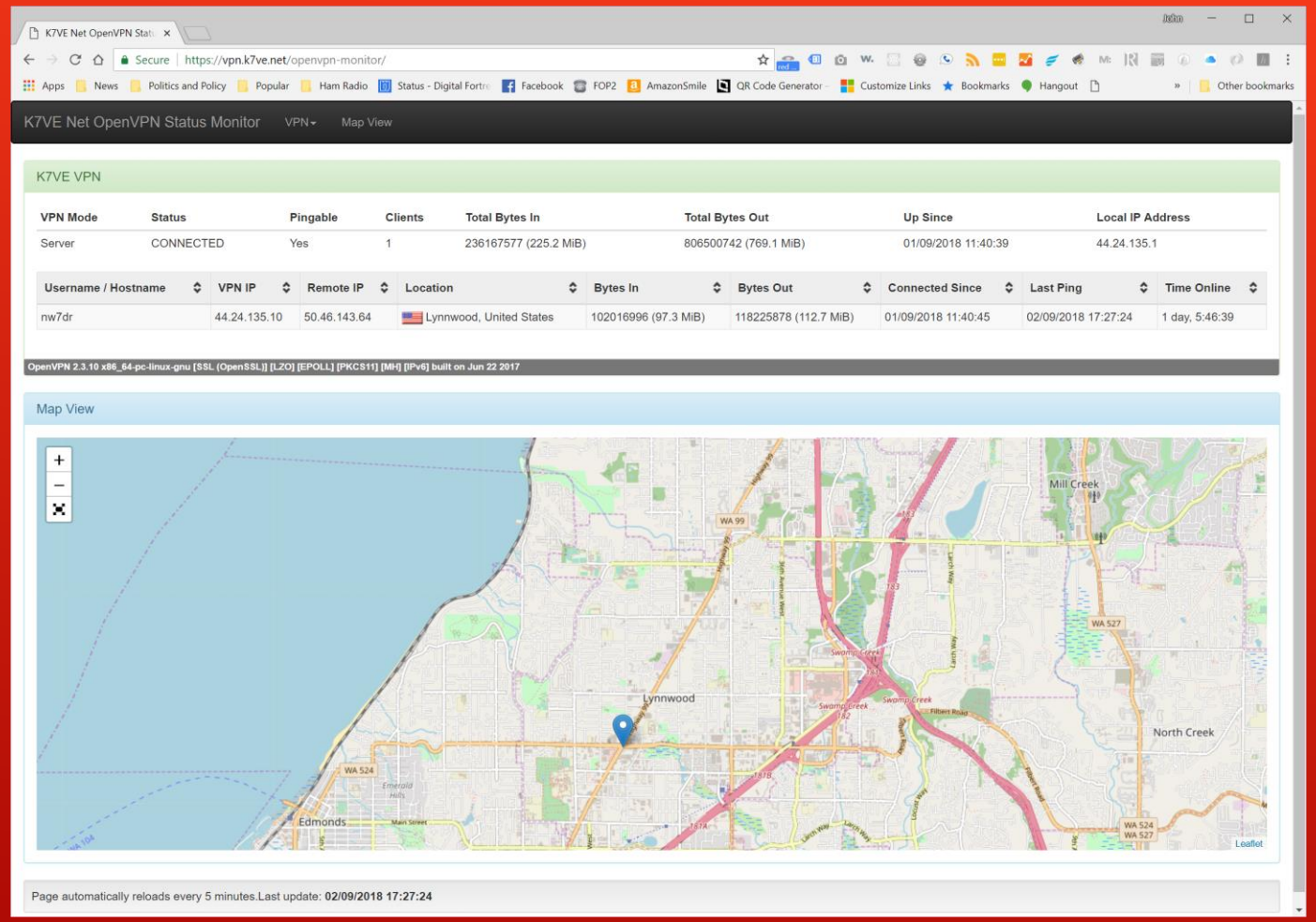
Monitoring Connected Clients



A web based monitoring tool is available.

You can optionally use Let's Encrypt to provide https for non-radio connections.

https://github.com/furlongm/openvpn-monitor

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Caveats and Considerations

I encourage sharing an account and subnet, but this comes with special responsibilities:

- Keep up to date contact information on portal.ampr.org
- Periodically make sure that the addresses are not being used inappropriately
  - Revoke certificates of abusers
  - Stop routing subnets that have been compromised or for DMCA takedown requests.

Install and maintain firewalls to help enforce useage standards
A VPN'ed host has access to your LAN, so take proper isolation measures and/or firewall rules.

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Q&A – and Help

A support and sharing group is at
https://groups.io/g/net-44-vpn

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