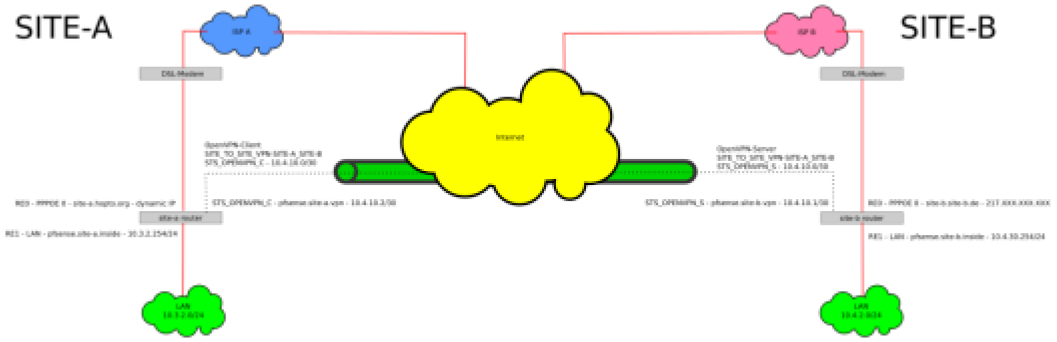
howto, openvpn, pfsense, sitetosite, vpn, apu1c4, pcengines

simple site to site VPN with pfSense and OpenVPN

I just had to set up a simple site to site VPN between a site with a fixed IP (SITE-B) and a site with a dynamic IP (SITE-A). Both routers are running the ‘Community Edition’ of pfSense and are installed on PC Engines APU.1C4. I have followed the documentation at pfSense.org about how to configure a Site To Site VPN with OpenVPN to get the VPN up and running. Because some things aren’t documented there I will put up my own HowTo here. Please do yourself a favour and read the documentation at pfsense.org first because it explains things in more detail than I will do here.


SITE-A
ISP A
DSL-Modem
OpenVPN-Client
SITE_TO_SITE_VPN-SITE-A_SITE-B
STS_OPENVPN_C - 10.4.10.0/30
RE0 - PPPOE 0 - site-a.hopto.org - dynamic IP
STS_OPENVPN_C - pfsense.site-a.vpn - 10.4.10.2/30
site-a router
RE1 - LAN - pfsense.site-a.inside - 10.3.2.154/24
LAN
10.3.2.0/24
Internet
SITE-B
ISP B
DSL-Modem
OpenVPN-Server
SITE_TO_SITE_VPN-SITE-A_SITE-B
STS_OPENVPN_S - 10.4.10.0/30
STS_OPENVPN_S - pfsense.site-b.vpn - 10.4.10.1/30
RE0 - PPPOE 0 - site-b.site-b.de - 217.XXX.XXX.XXX
site-b router
RE1 - LAN - pfsense.site-b.inside - 10.4.10.254/24
LAN
10.4.2.0/24

This HowTo will guide you trough the setup of:

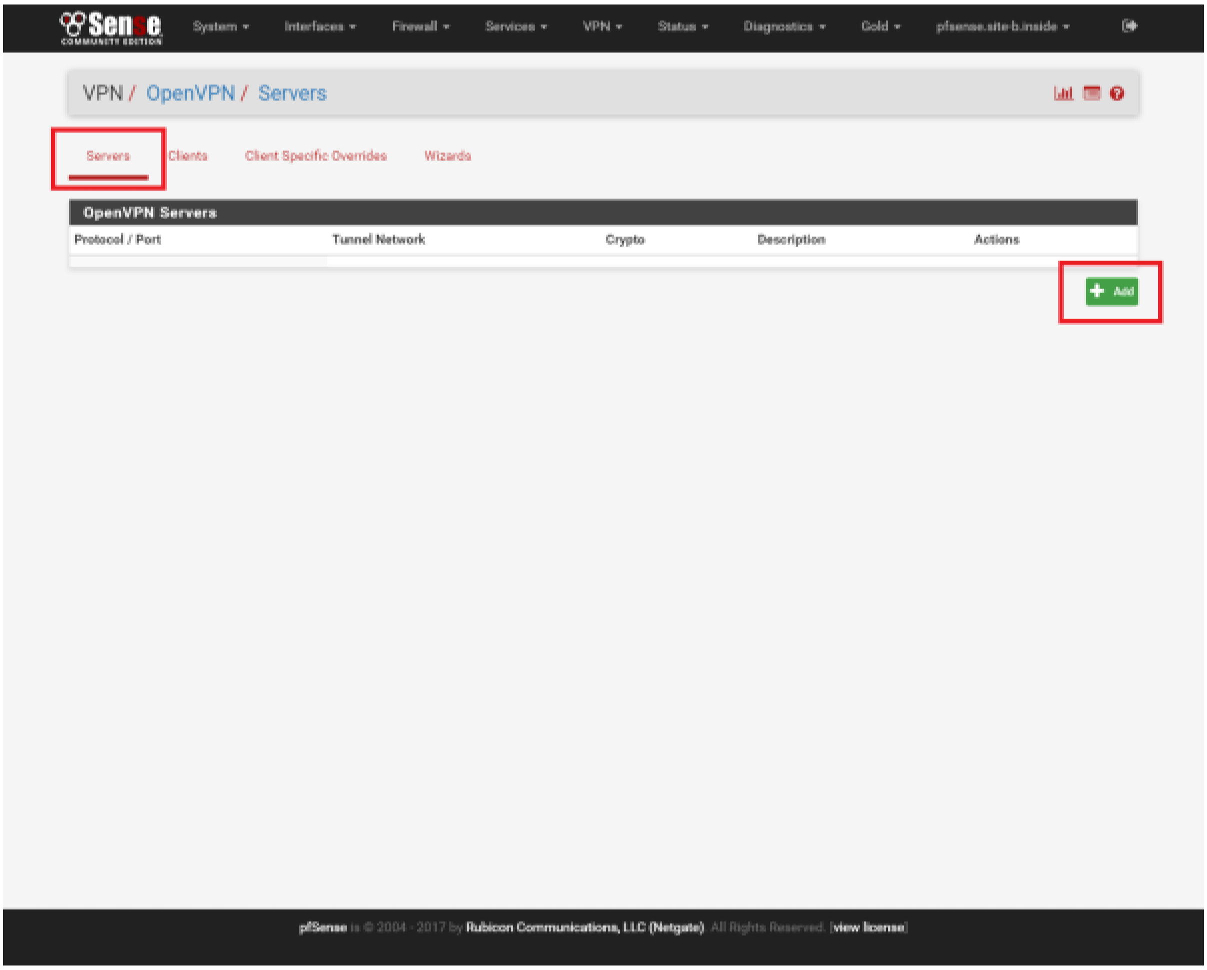
- An IPv4 ‘Site To Site VPN’ with OpenVPN on the pfSense platform (2.3.4 at time of writing) as seen in the schema above with the specific settings for the PC Engines APU hardware platform.
- The client will autoconnect to the server and (in the event of disconnection) reconnect automatically.
- The authentication between the client and the server will happen automatically via pre-shared key.

Sources

- pfsense.org – OpenVPN Site To Site
- The pfSense Book

Configure the OpenVPN server on SITE-B router

- Navigate to ‘**VPN – OpenVPN**‘


System
Interfaces
Firewall
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VPN
Status
Diagnostics
Gold
pfsense.site-b.inside
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Clients
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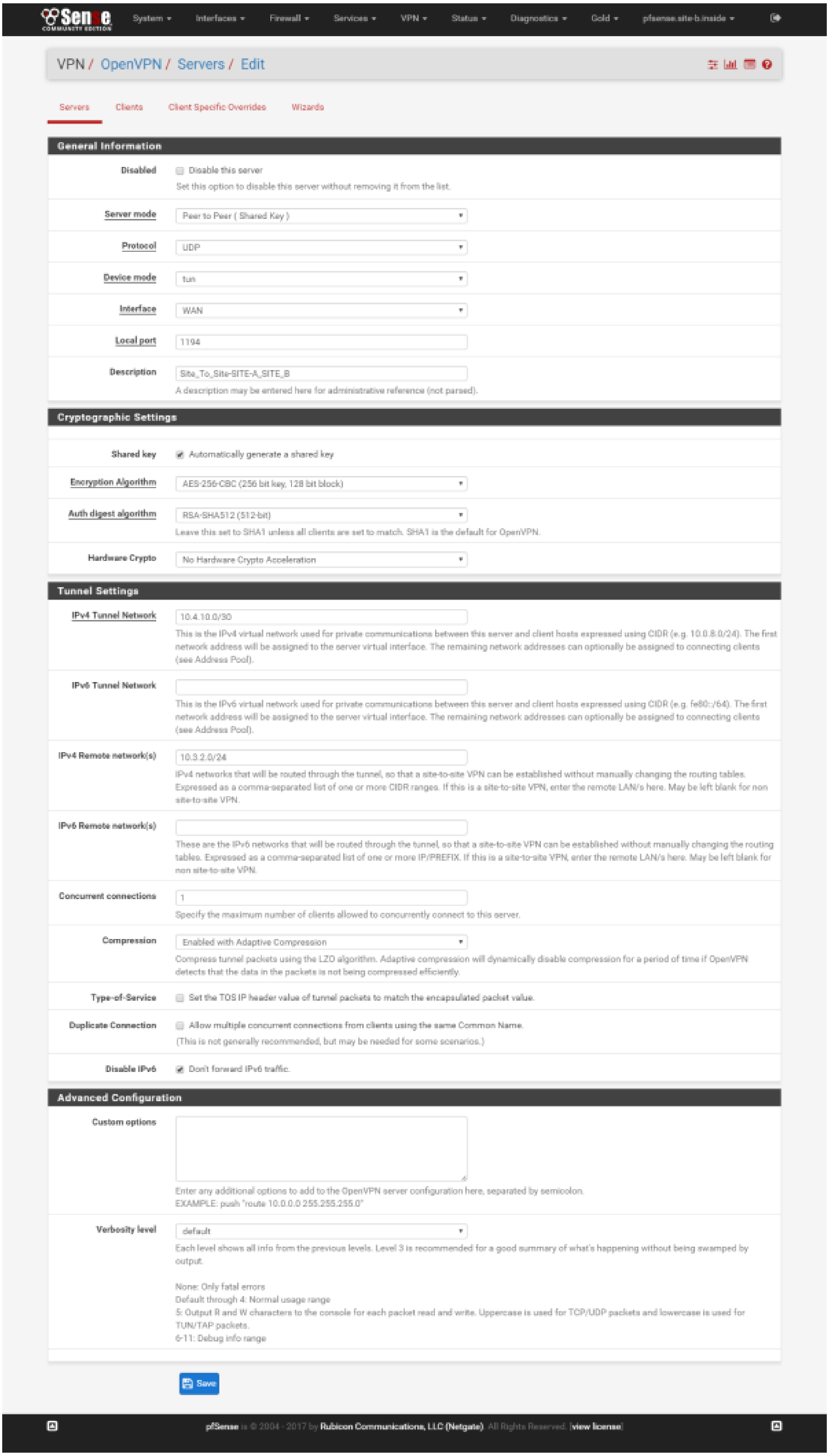
OpenVPN Servers

Protocol / Port	Tunnel Network	Crypto	Description	Actions

- On the ‘**Servers**‘-Tab click on the ‘**+ Add**‘-button to add a new server



VPN / OpenVPN / Servers / Edit

General Information

Disabled: □ Disable this server
Set this option to disable this server without removing it from the list.

Server mode: Peer to Peer (Shared Key)

Protocol: UDP

Device mode: tun

Interface: WAN

Local port: 1194

Description: Site_To_Site-SITE-A_SITE_B
A description may be entered here for administrative reference (not parsed).

Cryptographic Settings

Shared key: ☑ Automatically generate a shared key

Encryption Algorithm: AES-256-CBC (256 bit key, 128 bit block)

Auth digest algorithm: RSA-SHA512 (512-bit)
Leave this set to SHA1 unless all clients are set to match. SHA1 is the default for OpenVPN.

Hardware Crypto: No Hardware Crypto Acceleration

Tunnel Settings

IPv4 Tunnel Network: 10.4.10.0/30
This is the IPv4 virtual network used for private communications between this server and client hosts expressed using CIDR (e.g. 10.0.8.0/24). The first network address will be assigned to the server virtual interface. The remaining network addresses can optionally be assigned to connecting clients (see Address Pool).

IPv6 Tunnel Network:
This is the IPv6 virtual network used for private communications between this server and client hosts expressed using CIDR (e.g. fe80::/64). The first network address will be assigned to the server virtual interface. The remaining network addresses can optionally be assigned to connecting clients (see Address Pool).

IPv4 Remote network(s): 10.3.2.0/24
IPv4 networks that will be routed through the tunnel, so that a site-to-site VPN can be established without manually changing the routing tables. Expressed as a comma-separated list of one or more CIDR ranges. If this is a site-to-site VPN, enter the remote LAN/s here. May be left blank for non site-to-site VPN.

IPv6 Remote network(s):
These are the IPv6 networks that will be routed through the tunnel, so that a site-to-site VPN can be established without manually changing the routing tables. Expressed as a comma-separated list of one or more IP/PREFIX. If this is a site-to-site VPN, enter the remote LAN/s here. May be left blank for non site-to-site VPN.

Concurrent connections: 1
Specify the maximum number of clients allowed to concurrently connect to this server.

Compression: Enabled with Adaptive Compression
Compress tunnel packets using the LZO algorithm. Adaptive compression will dynamically disable compression for a period of time if OpenVPN detects that the data in the packets is not being compressed efficiently.

Type-of-Service: □ Set the TOS IP header value of tunnel packets to match the encapsulated packet value.

Duplicate Connection: □ Allow multiple concurrent connections from clients using the same Common Name.
(This is not generally recommended, but may be needed for some scenarios.)

Disable IPv6: ☑ Don't forward IPv6 traffic.

Advanced Configuration

Custom options:
Enter any additional options to add to the OpenVPN server configuration here, separated by semicolon.
EXAMPLE: push "route 10.0.0.0 255.255.255.0"

Verbosity level: default
Each level shows all info from the previous levels. Level 3 is recommended for a good summary of what's happening without being swamped by output.

None: Only fatal errors
Default through 4: Normal usage range
5: Output R and W characters to the console for each packet read and write. Uppercase is used for TCP/UDP packets and lowercase is used for TUN/TAP packets.
6-11: Debug info range

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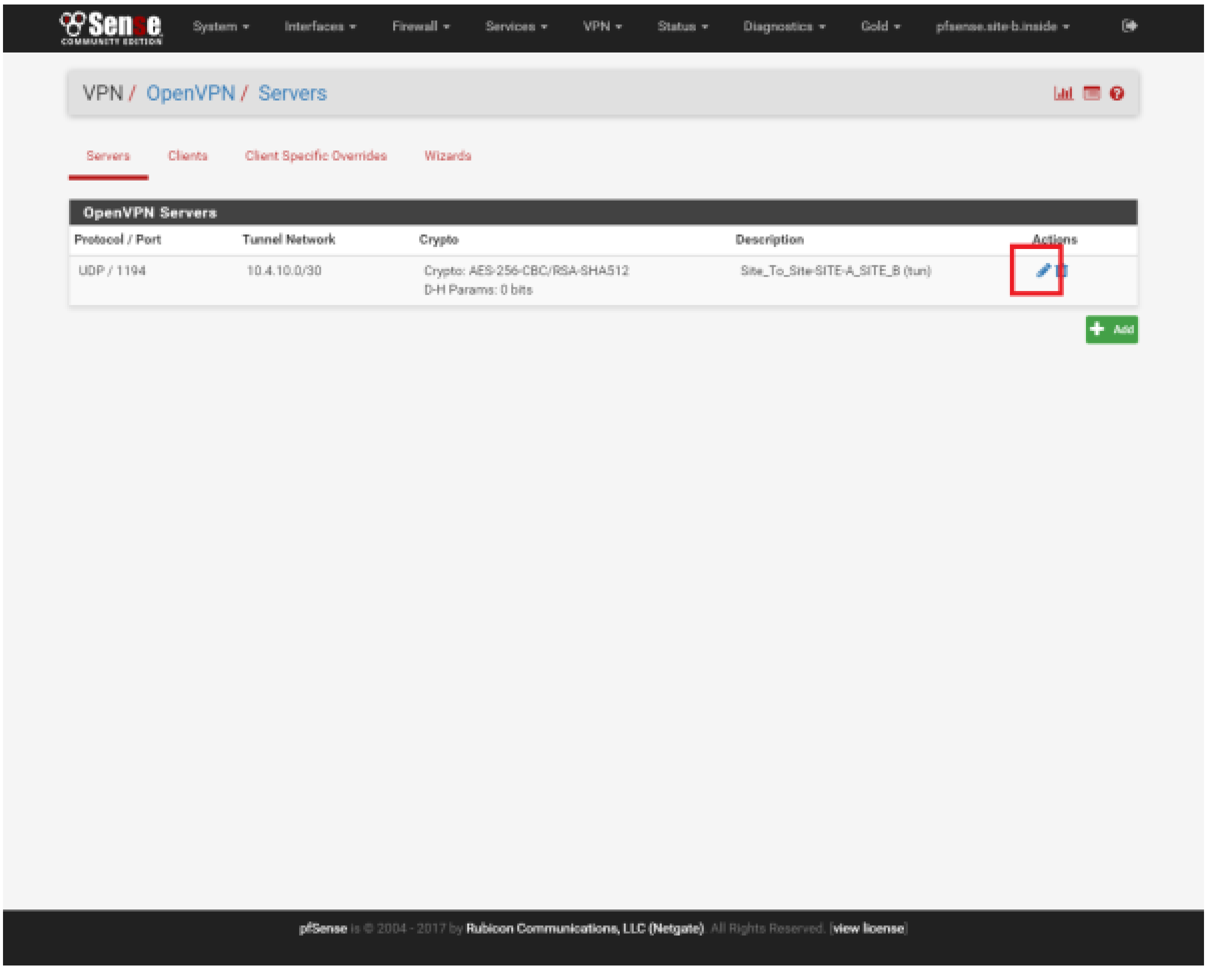
- In the ‘**General Information**‘-section:
  - **Disable this server:** ☐
  - **Server mode:** Peer to Peer (Shared Key)
  - **Protocol:** UDP
  - **Device Mode:** tun
  - **Interface:** set it to whatever external interface you want to have your OpenVPN server listening on. In my case this is ‘*WAN*‘.
  - **Local port:** set it to the port you want the local OpenVPN server to listen on. Default is ‘*1194*‘.
  - **Description:** Set an appropriate description e.g. ‘*Site_To_Site-SITE-A_SITE_B*‘
- In the ‘**Cryptographic Settings**‘-section:
  - **Automatically generate a shared key:** ☒
  - **Encryption Algorithm:** AES-256-CBC (256 bit key, 128 bit block)
  - **Auth digest algorithm:** RSA-SHA512 (512-bit)
  - **Hardware Crypto:** No Hardware Crypto Acceleration (this is PC Engines APU specific, if your hardware has crypto support – enable it)
- In the ‘**Tunnel Settings**‘-Section:
  - **IPv4 Tunnel Network:** 10.4.10.0/30 (this a very small subnet with 2 useable IP adresses since there is only one server and one client)
  - **IPv6 Tunnel Network:** leave empty
  - **IPv4 Remote network(s):** 10.3.2.0/24 (this is a comma separated list for all the networks you want to connect to on the client side (SITE A))
  - **IPv6 Remote network(s):** leave empty
  - **Concurrent connections:** 1
  - **Compression:** Enabled with Adaptive Compression
  - **Type-of-Service:** ☐ Set the TOS IP header value of tunnel packets to match the encapsulated packet value
  - **Duplicate Connection:** ☐ Allow multiple concurrent connections from clients using the same Common Name
  - **Disable IPv6:** ☒ Don't forward IPv6 traffic
- In the ‘**Advanced Configuration**‘-section:
  - **Custom options:** leave empty
  - **Verbosity Level:** default
- Click on ‘**Save**‘-button

You should now be forwarded to the list with your configured OpenVPN servers under ‘**VPN – OpenVPN**‘ on the ‘**Servers**‘-tab



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Firewall
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VPN
Status
Diagnostics
Gold
pfsense.site-b.inside
VPN / OpenVPN / Servers
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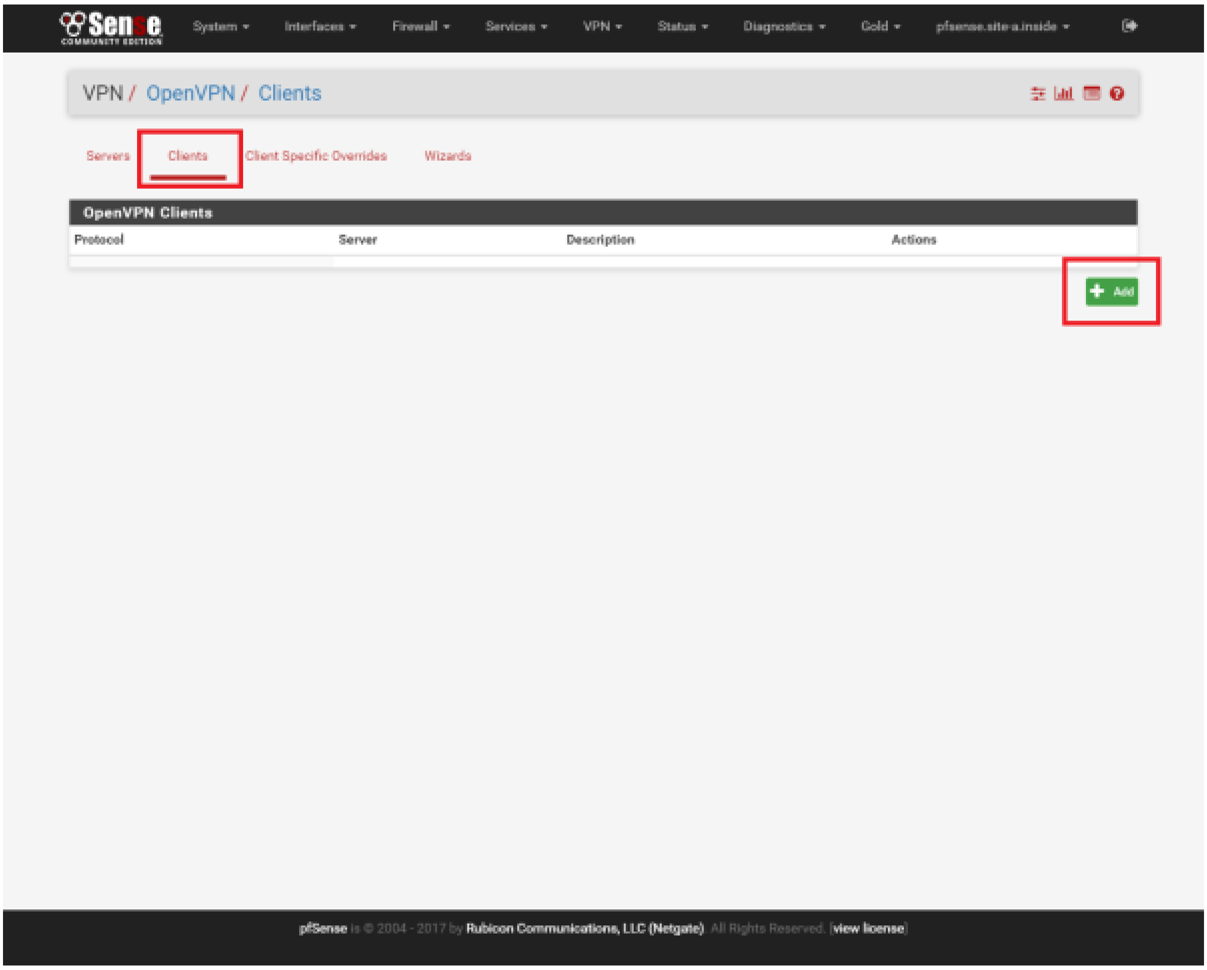
OpenVPN Servers

Protocol / Port	Tunnel Network	Crypto	Description	Actions
UDP / 1194	10.4.10.0/30	Crypto: AES-256-CBC/RSA-SHA512 D-H Params: 0 bits	Site_To_Site-SITE-A_SITE_B (tun)	

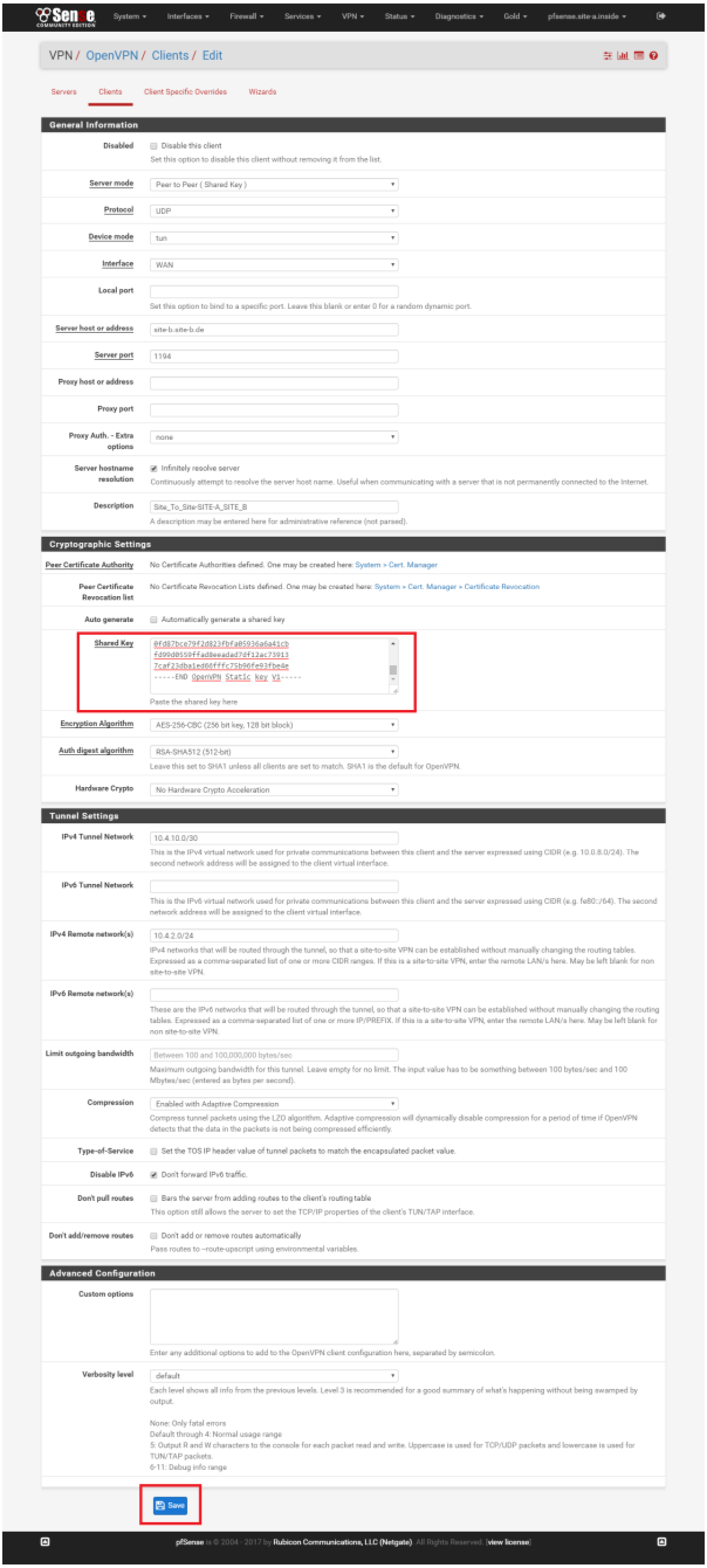
- Click on the ‘**Edit**‘-button (the pencil) and leave this window open because we will need to copy the ‘**Shared Key**‘ from this form later.

Configure the OpenVPN client on SITE-A router

- Navigate to ‘**VPN – OpenVPN**‘



- Click the ‘**Clients**‘-tab
- On the ‘**Clients**‘-tab click the ‘**+ Add**‘-button to add a new OpenVPN client



VPN / OpenVPN / Clients / Edit

General Information

Disabled: □ Disable this client
Set this option to disable this client without removing it from the list.

Server mode: Peer to Peer (Shared Key)

Protocol: UDP

Device mode: tun

Interface: WAN

Local port:
Set this option to bind to a specific port. Leave this blank or enter 0 for a random dynamic port.

Server host or address: site-b.site-b.de

Server port: 1194

Proxy host or address:

Proxy port:

Proxy Auth. - Extra options: none

Server hostname resolution: ☑ Infinitely resolve server
Continuously attempt to resolve the server host name. Useful when communicating with a server that is not permanently connected to the Internet.

Description: Site_To_Site-SITE-A_SITE_B
A description may be entered here for administrative reference (not parsed).

Cryptographic Settings

Peer Certificate Authority: No Certificate Authorities defined. One may be created here: System > Cert. Manager

Peer Certificate Revocation list: No Certificate Revocation Lists defined. One may be created here: System > Cert. Manager > Certificate Revocation

Auto generate: □ Automatically generate a shared key

Shared Key:

```
0fd87bce79f2d823fbfa05936a6a41cb
fd99d0559ffad8eeadad7df12ac73913
7caf23dba1ed60fffc75b96fe93fbe4e
-----END OpenVPN Static key V1-----
```

Paste the shared key here

Encryption Algorithm: AES-256-CBC (256 bit key, 128 bit block)

Auth digest algorithm: RSA-SHA512 (512-bit)
Leave this set to SHA1 unless all clients are set to match. SHA1 is the default for OpenVPN.

Hardware Crypto: No Hardware Crypto Acceleration

Tunnel Settings

IPv4 Tunnel Network: 10.4.10.0/30
This is the IPv4 virtual network used for private communications between this client and the server expressed using CIDR (e.g. 10.0.8.0/24). The second network address will be assigned to the client virtual interface.

IPv6 Tunnel Network:
This is the IPv6 virtual network used for private communications between this client and the server expressed using CIDR (e.g. fe80::/64). The second network address will be assigned to the client virtual interface.

IPv4 Remote network(s): 10.4.2.0/24
IPv4 networks that will be routed through the tunnel, so that a site-to-site VPN can be established without manually changing the routing tables. Expressed as a comma-separated list of one or more CIDR ranges. If this is a site-to-site VPN, enter the remote LAN/s here. May be left blank for non site-to-site VPN.

IPv6 Remote network(s):
These are the IPv6 networks that will be routed through the tunnel, so that a site-to-site VPN can be established without manually changing the routing tables. Expressed as a comma-separated list of one or more IP/PREFIX. If this is a site-to-site VPN, enter the remote LAN/s here. May be left blank for non site-to-site VPN.

Limit outgoing bandwidth: Between 100 and 100,000,000 bytes/sec
Maximum outgoing bandwidth for this tunnel. Leave empty for no limit. The input value has to be something between 100 bytes/sec and 100 Mbytes/sec (entered as bytes per second).

Compression: Enabled with Adaptive Compression
Compress tunnel packets using the LZO algorithm. Adaptive compression will dynamically disable compression for a period of time if OpenVPN detects that the data in the packets is not being compressed efficiently.

Type-of-Service: □ Set the TOS IP header value of tunnel packets to match the encapsulated packet value.

Disable IPv6: ☑ Don't forward IPv6 traffic.

Don't pull routes: □ Bars the server from adding routes to the client's routing table
This option still allows the server to set the TCP/IP properties of the client's TUN/TAP interface.

Don't add/remove routes: □ Don't add or remove routes automatically
Pass routes to --route-upscript using environmental variables.

Advanced Configuration

Custom options:
Enter any additional options to add to the OpenVPN client configuration here, separated by semicolon.

Verbosity level: default
Each level shows all info from the previous levels. Level 3 is recommended for a good summary of what's happening without being swamped by output.

None: Only fatal errors
Default through 4: Normal usage range
5: Output R and W characters to the console for each packet read and write. Uppercase is used for TCP/UDP packets and lowercase is used for TUN/TAP packets.
6-11: Debug info range

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- In the ‘**General Information**’-section:
  - Disable this client: □
  - Server mode: Peer to Peer (Shared Key)
  - Protocol: UDP
  - Device mode: tun
  - Interface: Set to whatever external interface you want your OpenVPN client connect to the OpenVPN server at SITE-B. In my case this is ‘WAN‘.
  - Local port: leave empty
  - Server host or address: Set to the FQDN or IP address of the external SITE-B Interface. In this example it is ‘site-b.site-b.de‘.
  - Server port: Set to the same port you have set in the server setup at SITE-B. Default is ‘1194‘.

Proxy host or address: leave empty

```
      Proxy port: leave empty
      Proxy Auth. – Extra options: none
      Infinitely resolve server: ????
      Description: Set an appropriate description e.g. ‘Site_To_Site-SITE-A_SITE_B‘
  In the ‘Cryptographic Settings‘-section:
      Peer Certificate Authority: nothing to do here
      Peer Certificate Revocation list: nothing to do here
      Automatically generate a shared key: □ – This will display a form field in which you can paste the key from the SITE-B server configuration.
```

Go back to SITE-B router. If you haven’t left the window open, navigate to ‘VPN – OpenVPN‘ and select the ‘Servers‘-tab, click on the ‘Edit‘-button (the pencil) next to the server you have created earlier