



Yealink Technical White Paper

**Virtual Private Network
(VPN)**

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About VPN

VPN (Virtual Private Network) is a network that uses a public telecommunication infrastructure, such as the Internet, to provide remote offices or traveling users with secure access to a central organizational network. VPN gives the organization the advantage of creating secure channels of communication, while at the same time reducing costs, improving security and increasing performance.

There are two types of VPN access: remote-access and site-to-site.

Types of VPN Access

Remote-access VPN, also called a virtual private dial-up network (VPDN), is a user-to-LAN connection used by a company that has employees who need to connect to the private network from various remote locations.

Site-to-site VPN connects entire networks to each other, that means, site-to-site VPN can be used to connect a branch or remote office network to a company headquarters network. Each site is equipped with a VPN gateway, such as a router, firewall, VPN concentrator or security appliance.

VPN Technology

VPN technology is based on the idea of tunneling. VPN tunneling involves establishing and maintaining a logical network connection (that may contain intermediate hops). On this connection, packets constructed in a specific VPN protocol format are encapsulated within some other bases or carrier protocols, then transmitted between the VPN client and the server, and finally de-encapsulated on the receiving side.

Several computer network protocols have been implemented specifically for use with VPN tunnels. The most two popular VPN tunneling protocols are: SSL (Security Socket Layer) and IPSec (Internet Protocol Security). VPN can be classified by the protocols used to tunnel the traffic.

SSL VPN

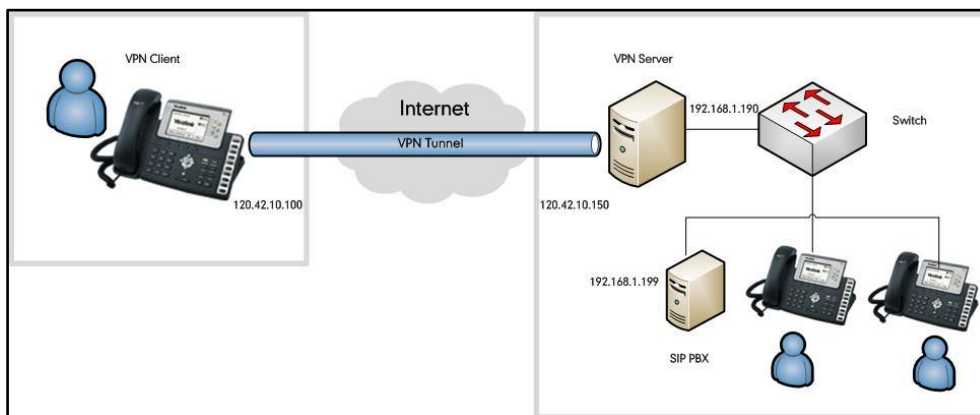
SSL VPN uses SSL protocol and Transport Layer Security (TLS) protocol to provide a secure connection between remote users and internal network resources. It can be used with a standard web browser, and does not require the installation of specialized client software on the end user's device. An SSL VPN offers versatility, ease of use and granular control for a range of users on a variety of devices, accessing resources from many locations.

IPSec VPN

An IPSec VPN uses the standard IPSec mechanism to establish a VPN connection over the public Internet. IPSec is a framework for a set of protocols for security at the network or packet processing layer of network communication. IPSec VPN requires installation of the IPSec client software on a client device before a connection can be established. IPSec can meet most security goals: authentication, integrity and confidentiality.

Example Use of a VPN Tunnel

An employee has an IP phone with a public IP address 120.42.10.100 that wishes to connect to the SIP server inside a company network. The SIP server has an internal IP address 192.168.1.199 and is not reachable publicly. Before reaching this server, the IP phone needs to go through a VPN server that has a public IP address 120.42.10.150 and an internal address 192.168.1.190. All data between the IP phone and the SIP server will need to be kept confidential, hence a secure VPN is used.



The following steps illustrate the principles of a VPN client-server interaction:

1. The VPN client connects to a VPN server via an external network interface.
2. The VPN server assigns an IP address to the VPN client from the VPN server's subnet. The client gets an internal IP address 192.168.1.192, for example, and creates a virtual network interface through which it will send encrypted packets to the other tunnel endpoint (the device at the other end of the tunnel).
3. When the VPN client wishes to communicate with the SIP server, it prepares a packet addressed to 192.168.1.199, encrypts it and encapsulates it in an outer VPN packet. This packet is then sent to the VPN server at IP address 120.42.10.150 over the public Internet. The inner packet is encrypted so that even if someone intercepts the packet over the Internet, they cannot get any information from it. The inner encrypted packet has source address 192.168.1.192 and destination address 192.168.1.199. The outer packet has source address 120.42.10.100 and destination address 120.42.10.150.
4. When the packet reaches the VPN server from the Internet, the VPN server de-encapsulates the inner packet, decrypts it, finds the destination address to be

- 192.168.1.199, and forwards it to the intended SIP server at 192.168.1.199.
5. After some time, the VPN server receives a reply packet from 192.168.1.199, intended for 192.168.1.192. The VPN server consults its routing table, and knows this packet is intended for a remote device (IP phone) that must go through VPN.
 6. The VPN server encrypts this reply packet, encapsulates it in a VPN packet and sends it out over the Internet. The inner encrypted packet has a source address 192.168.1.199 and a destination address 192.168.1.192. The outer VPN packet has a source address 120.42.10.150 and a destination address 120.42.10.100.
 7. The VPN client receives and de-encapsulates the packet, decrypts the inner packet and passes it to the appropriate software at upper layers.

Yealink IP Phones Compatible with VPN

Yealink SIP-T28P, SIP-T26P, SIP-T22P, SIP-T20P, SIP-T21P, SIP-T38G, SIP-T32G, SIP-T46G, SIP-T42G, SIP-T41P, W52P and VP530 IP phones support OpenVPN feature. OpenVPN is a remote-access VPN and is designed to work with the TUN/TAP virtual networking interface that exists on most platforms (e.g., Linux, Windows). TAP simulates an Ethernet device and operates with layer 2 packets such as frames. TUN simulates a network layer device and operates with layer 3 packets such as IP packets. Packets sent by an operating system via a TUN/TAP device are delivered to a user-space program that attaches itself to the device. A user-space program may also pass packets into a TUN/TAP device.

OpenVPN operates as a client-server application. After enabling the OpenVPN feature on IP phones, the IP phones act as VPN clients and use pre-shared secret keys, certificates, or user name/password to authenticate the OpenVPN server.

Installing the OpenVPN Server

OpenVPN server is a set of installation and configuration tools that simplifies the rapid deployment of a VPN remote access solution. It's supported on Linux, Windows, and MAC platforms.

Before using the OpenVPN feature on IP phones, you must make sure the OpenVPN server is prepared properly, otherwise you need to install and configure the OpenVPN server. This chapter provides you on how to install and configure the OpenVPN server and create the OpenVPN Tar file on Linux and Windows platforms.

Installing and Configuring the OpenVPN Server on the Linux Platform

The OpenVPN server software is available for free. This section provides you on how to install the OpenVPN server (e.g., `openvpn-2.1.4.tar.gz`) on the Linux platform (e.g., Centos 5.8 and kernel: `2.6.18-308.el5-i686`).

Before the installation, make sure the hardware and system meet the following requirements:

- Dual network cards.
- The system kernel supports the Universal TUN/TAP device driver (kernel 2.6.0 above) and the TUN/TAP module is loaded into the kernel.
- Install the required modules "OpenSSL and LZO".

To check if the TUN/TAP module is loaded into the kernel:

1. Open a terminal window.
2. Enter the following command.

```
[root@localhost~]# cat /dev/net/tun
```

- If the return information is "cat: /dev/net/tun: File descriptor in bad state", it means that the TUN/TAP module has been loaded into the kernel.
- If the return information is "cat: /dev/net/tun: No such device", you need to execute the following commands to load the TUN/TAP module.

```
[root@localhost~]# cd /usr/src/kernels/2.6.18-308.el5-i686/
```

```
[root@localhost 2.6.18-308.el5-i686]# make menuconfig
```

In the pop-up configuration screen, select **Device Drivers->Network device support->Universal TUN/TAP device driver support** and set **Universal TUN/TAP device driver support** to **M**.

You can download the OpenSSL module online: <http://www.openssl.org/>. The following takes "openssl-1.0.0e.tar.gz" as an example. Download and put it in the root directory.

To install the OpenSSL module:

1. Open a terminal window.
2. Extract the installation package to the /etc directory.

```
[root@localhost~]# cd /etc/
```

```
[root@localhost etc]# tar zvxf /openssl-1.0.0e.tar.gz
```

3. Enter into the extracted directory.

```
[root@localhost etc]# cd openssl-1.0.0e
```

4. Enter the following commands to install the package.

```
[root@localhost openssl-1.0.0e]# ./config
```

```
[root@localhost openssl-1.0.0e]# make
```

```
[root@localhost openssl-1.0.0e]# make install
```

You can download the LZO module online:

<http://www.oberhumer.com/opensource/lzo/download/>. The following takes “lzo-2.02.tar.gz” as an example. Download and put it in the root directory.

To install the LZO module:

1. Open a terminal window.
2. Extract the installation package to the /etc directory.

```
[root@localhost~]# cd /etc/
```

```
[root@localhost etc]# tar zvxf /lzo-2.02.tar.gz
```

3. Enter into the extracted directory.

```
[root@localhost etc]# cd lzo-2.02
```

4. Enter the following commands to install the package.

```
[root@localhost lzo-2.02]# ./configure
```

```
[root@localhost lzo-2.02]# make
```

```
[root@localhost lzo-2.02]# make install
```

You can download the OpenVPN software online:

<http://openvpn.net/index.php/open-source/downloads.html>. Download and put it in the root directory.

To install the OpenVPN server:

1. Open a terminal window.
2. Extract the installation package to the /etc directory

```
[root@localhost~]# cd /etc/
```

```
[root@localhost etc]# tar zvxf /openvpn-2.1.4.tar.gz
```

3. Enter into the extracted directory.

```
[root@localhost etc]# cd openvpn-2.1.4
```

4. Enter the following commands to install the package.

```
[root@localhost openvpn-2.1.4]# ./configure
```

```
[root@localhost openvpn-2.1.4]# make
```

```
[root@localhost openvpn-2.1.4]# make install
```

If the header and library files are not found, you should use the following command instead of the command “./configure” mentioned above.

```
./configure-prefix=/usr/local --with-lzo-headers=/usr/local/include
```

```
--with-lzo-lib=/usr/local/lib --with-ssl-headers=/usr/local/include/openssl
```

```
--with-ssl-lib=/usr/local/lib
```

5. Add the OpenVPN service.

```
[root@localhost openvpn-2.1.4]# cp -p sample-scripts/openvpn.init
```

```
/etc/init.d/openvpn
```

```
[root@localhost openvpn-2.1.4]# chkconfig --add openvpn
```

To generate certificate files for the OpenVPN server and IP phones:

1. Enter into the directory used to generate the certificate files (may vary between different versions).

```
[root@localhost ~]# cd /etc/openvpn-2.1.4/easy-rsa/2.0
```

2. Enter the following commands.

```
[root@localhost 2.0]# export D=`pwd`
```

```
[root@localhost 2.0]# export KEY_CONFIG=$D/openssl.cnf
```

```
[root@localhost 2.0]# export KEY_DIR=$D/keys
```

```
[root@localhost 2.0]# export KEY_SIZE=1024
```

```
[root@localhost 2.0]# export KEY_COUNTRY=CN
```

```
[root@localhost 2.0]# export KEY_PROVINCE=FJ
```

```
[root@localhost 2.0]# export KEY_CITY=XM
```

```
[root@localhost 2.0]# export KEY_ORG="yealink.com"
```

```
[root@localhost 2.0]# export KEY_EMAIL="admin@yealink.com"
```

3. Generate a CA certificate.

```
[root@localhost 2.0]# ./clean-all
```

```
[root@localhost easy-rsa]# ./build-ca
```

The screen prompts the following information (if you don't want to change the default settings, press the ENTER key, else enter the desired value and then press the ENTER key):

```
Generating a 1024 bit RSA private key
```

```
.....+++++
```

```
.....+++++
```

```
writing new private key to 'ca.key'
```

```
-----
```

```
You are about to be asked to enter information that will be incorporated
into your certificate request.
```

```
What you are about to enter is what is called a Distinguished Name or a DN.
```

```
There are quite a few fields but you can leave some blank
```

```
For some fields there will be a default value,
```

```
If you enter '.', the field will be left blank.
```

```
-----
```

```
Country Name (2 letter code) [CN]:
```

```
State or Province Name (full name) [FJ]:
```

```
Locality Name (eg, city) [XM]:
```


Organization Name (eg, company) [yealink.com]:

Organizational Unit Name (eg, section) []:yealink.com

Common Name (eg, your name or your server's hostname) [yealink.com CA]:server

Name []:

Email Address [admin@yealink.com]:

4. Generate a certificate for the OpenVPN server.

```
[root@localhost 2.0]# ./build-key-server server
```

The screen prompts the following information (if you don't want to change the default settings, press the ENTER key, else enter the desired value and then press the ENTER key):

Generating a 1024 bit RSA private key

.....++++++

...++++++

writing new private key to 'server.key'

You are about to be asked to enter information that will be incorporated into your certificate request.

What you are about to enter is what is called a Distinguished Name or a DN.

There are quite a few fields but you can leave some blank

For some fields there will be a default value,

If you enter '.', the field will be left blank.

Country Name (2 letter code) [CN]:

State or Province Name (full name) [FJ]:

Locality Name (eg, city) [XM]:

Organization Name (eg, company) [yealink.com]:

Organizational Unit Name (eg, section) []:yealink.com

Common Name (eg, your name or your server's hostname) [server]:server

Name []:

Email Address [admin@yealink.com]:yealink.com

Please enter the following 'extra' attributes

to be sent with your certificate request

A challenge password []:abcd1234

An optional company name []:yealink.com

Using configuration from /root/openvpn-2.1.4/easy-rsa/2.0/openssl.cnf

Check that the request matches the signature

```
Signature ok
The Subject's Distinguished Name is as follows
countryName           :PRINTABLE:'CN'
stateOrProvinceName   :PRINTABLE:'FJ'
localityName          :PRINTABLE:'XM'
organizationName      :PRINTABLE:'yealink.com'
organizationalUnitName:PRINTABLE:'yealink.com'
commonName            :PRINTABLE:'server'
emailAddress          :IA5STRING:'yealink.com'
Certificate is to be certified until May 18 11:53:36 2023 GMT (3650 days)
Sign the certificate? [y/n]:y
1 out of 1 certificate requests certified, commit? [y/n]y
Write out database with 1 new entries
Data Base Updated
```

5. Generate a certificate for the client.

```
[root@localhost 2.0]# ./build-key client
```

The screen prompts the following information (if you don't want to change the default settings, press the ENTER key, else enter the desired value and then press the ENTER key):

```
Generating a 1024 bit RSA private key
.....++++++
...++++++
writing new private key to 'client.key'
-----

You are about to be asked to enter information that will be incorporated
into your certificate request.

What you are about to enter is what is called a Distinguished Name or a DN.
There are quite a few fields but you can leave some blank
For some fields there will be a default value,
If you enter '.', the field will be left blank.
-----

Country Name (2 letter code) [CN]:
State or Province Name (full name) [FJ]:
Locality Name (eg, city) [XM]:
Organization Name (eg, company) [yealink.com]:
Organizational Unit Name (eg, section) []:yealink.com
Common Name (eg, your name or your server's hostname) [client]:server
```

```

Name []:
Email Address [admin@yealink.com]:
Please enter the following 'extra' attributes
to be sent with your certificate request
A challenge password []:abcd1234
An optional company name []:yealink.com
Using configuration from /root/openssl-2.1.4/easy-rsa/2.0/openssl.cnf
Check that the request matches the signature
Signature ok
The Subject's Distinguished Name is as follows
countryName      :PRINTABLE:'CN'
stateOrProvinceName :PRINTABLE:'FJ'
localityName     :PRINTABLE:'XM'
organizationName  :PRINTABLE:'yealink.com'
organizationalUnitName:PRINTABLE:'yealink.com'
commonName       :PRINTABLE:'server'
emailAddress      :IA5STRING:'admin@yealink.com'
Certificate is to be certified until May 18 11:57:27 2023 GMT (3650 days)
Sign the certificate? [y/n]:y
1 out of 1 certificate requests certified, commit? [y/n]y
Write out database with 1 new entries
Data Base Updated

```

6. Generate a dh1024.pem file for the server.

```
[root@localhost 2.0]# ./build-dh
```

The screen prompts the following information:

```

Generating DH parameters, 1024 bit long safe prime, generator 2
This is going to take a long time

```

If the screen prompts “./build-dh: line 7: dhparam: command not found”, you need to edit the file “build-dh” in the /etc/openssl-2.1.4/easy-rsa/2.0 directory. Set “\$OPENSSL” to “openssl” and save the file.

All the certificate files are generated in the directory “/openssl-2.1.4/easy-rsa/2.0/keys”.

To configure the server's configuration file:

1. Create a new directory “openssl” located in the path /etc.

```
[root@localhost ~]# mkdir /etc/openssl
```

2. Create a new directory “keys” located in the path /etc/openssl.

```
[root@localhost ~]# mkdir /etc/openssl/keys
```

3. Enter into the installation directory of the OpenVPN server.

```
[root@localhost ~]# cd /etc/openvpn-2.1.4
```

4. Copy the certificate files required for the server to the directory "keys" created above.

```
[root@localhost openvpn-2.1.4]# cp easy-rsa/2.0/keys/ca.crt /etc/openvpn/keys/
```

```
[root@localhost openvpn-2.1.4]# cp easy-rsa/2.0/keys/dh1024.pem
```

```
/etc/openvpn/keys/
```

```
[root@localhost openvpn-2.1.4]# cp easy-rsa/2.0/keys/server.crt /etc/openvpn/keys/
```

```
[root@localhost openvpn-2.1.4]# cp easy-rsa/2.0/keys/server.key
```

```
/etc/openvpn/keys/
```

5. Copy the file "server.conf" in the sample-config-files directory to the directory "openvpn" created above.

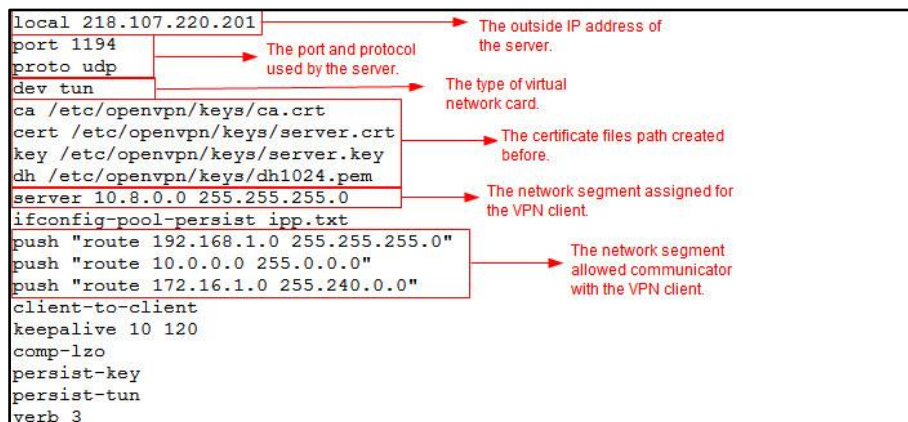
```
[root@localhost openvpn-2.1.4]# cp sample-config-files/server.conf /etc/openvpn
```

6. Edit the file "server.conf" according to your actual network environment and save the change.

```
[root@localhost ~]# vi /etc/openvpn/server.conf
```

Press "i" to enter into the Insert Mode and modify the desired parameters, and then press "Esc" to return to the Command Mode and enter "wq!".

The following shows an example:



According to the actual network environment, configure the network settings of the server, such as the TCP/IP forwarding feature and routing entries between the VPN clients and the Intranet. For more information, contact your network administrator.

To enable the TCP/IP forwarding:

1. Open a terminal window.
2. Edit the file "sysctl.conf" in the /etc directory and save the change.

```
[root@localhost ~]# vi /etc/sysctl.conf
```

Press "i" to enter into the Insert Mode and Set "`net.ipv4.ip_forward`" to 1, and then press "Esc" to return to the Command Mode and enter "wq!".

To start the OpenVPN service:

1. Enter into the installation directory of the OpenVPN server.

```
[root@localhost ~]# cd /etc/openvpn-2.1.4
```

2. Start the OpenVPN service.

```
[root@localhost openvpn-2.1.4]# service openvpn start
```

Creating the OpenVPN Tar File for the VPN Client on the Linux Platform

OpenVPN requires using certificates to help establish the authenticity of clients connecting to an OpenVPN server. You need to obtain the files: ca.crt, client.crt, client.key and vpn.cnf from the system, and then package these files to tar format.

To configure the client's configuration file:

1. Create a new directory "client" located in the path /etc/openvpn.

```
[root@localhost ~]# mkdir /etc/openvpn/client
```

2. Create a new directory "keys" located in the path /etc/openvpn/client.

```
[root@localhost ~]# mkdir /etc/openvpn/client/keys
```

3. Enter into the installation directory of the OpenVPN server.

```
[root@localhost ~]# cd /etc/openvpn-2.1.4
```

4. Copy the certificate files required for the client to the directory "/etc/openvpn/client/keys" created before.

```
[root@localhost openvpn-2.1.4]# cp easy-rsa/2.0/keys/ca.crt  
/etc/openvpn/client/keys/
```

```
[root@localhost openvpn-2.1.4]# cp easy-rsa/2.0/keys/client.crt  
/etc/openvpn/client/keys/
```

```
[root@localhost openvpn-2.1.4]# cp easy-rsa/2.0/keys/client.key  
/etc/openvpn/client/keys/
```

5. Copy the file "client.conf" in the sample-config-files directory to the directory "client" created above and rename it to vpn.cnf.

```
[root@localhost openvpn-2.1.4]# cp sample-config-files/client.conf  
/etc/openvpn/client/vpn.cnf
```

6. Edit the file "vpn.cnf" and save the change.

```
[root@localhost openvpn-2.1.4]# cd /etc/openvpn/client
```

```
[root@localhost client]# vi vpn.cnf
```

Press "i" to enter into the Insert Mode and modify the desired parameters, and then press "Esc" to return to the Command Mode and enter "wq!".

The following parameters should be configured as the same as that of the server.

```
remote 218.107.220.201 1194 udp
```

```
dev tun
```

```
dev-type tun
```

The following defines OpenVPN certificate files for Yealink IP phones:

```
ca /config/openvpn/keys/ca.crt
```

```
cert /config/openvpn/keys/client.crt
```

```
key /config/openvpn/keys/client.key
```

The certificate directories for some IP phone models with previous firmware may vary. The following provides information for SIP-T2xP and SIP-T3xG IP phone models with firmware version prior to version 71 or firmware released before November 2013.

For SIP-T2xP IP phones:

```
ca /yealink/config/openvpn/keys/ca.crt
```

```
cert /yealink/config/openvpn/keys/client.crt
```

```
key /yealink/config/openvpn/keys/client.key
```

For SIP-T3xG IP phones:

```
ca /phone/config/openvpn/keys/ca.crt
```

```
cert /phone/config/openvpn/keys/client.crt
```

```
key /phone/config/openvpn/keys/client.key
```

SIP-T2xP and SIP-T3xG IP phones with the latest V71 firmware (or later) are compatible with above information. We recommend you to use the unified `"/config/openvpn/keys/"`.

The following figure shows a portion of the `vpn.cnf` file for reference:

```
client
setenv SERVER_POLL_TIMEOUT 4
nobind
remote 218.107.220.201 1194 udp
dev tun
dev-type tun
ns-cert-type server
reneg-sec 604800
sndbuf 100000
rcvbuf 100000
auth-retry nointeract
comp-lzo no
verb 3
ca /config/openvpn/keys/ca.crt
cert /config/openvpn/keys/client.crt
key /config/openvpn/keys/client.key
```

To package the tar file on the Linux platform:

1. Enter the following commands to package the tar file.

```
[root@localhost ~]# cd /etc/openssl/client
```

```
[root@localhost client]# tar -cvpf openssl.tar *
```

An openssl.tar file is generated in the client directory.

Installing and Configuring the OpenVPN Server on the Windows Platform

The OpenVPN server software is available for free. You can download it for your Windows platform online: <http://openvpn.net/index.php/open-source/downloads.html>.

This section provides you on how to install the OpenVPN server (e.g., openssl-2.1.1-install.exe) on the Windows XP platform.

Before the installation, make sure the hardware and system meet the following requirements:

- Dual network cards.
- The system kernel supports the TUN/TAP module.

To install the OpenVPN server on the Windows XP platform:

1. Double click the installation file on the local system.
2. Follow the prompts to finish the installation.

The default installation directory is C:\Program Files\OpenVPN\.

To generate certificate files for the OpenVPN server and IP phones:

1. Enter into the installation directory of the OpenVPN server.
2. Open the file vars.bat in the easy-rsa folder and edit the following parameters:

```
set KEY_COUNTRY=US
```

```
set KEY_PROVINCE=CA
```

```
set KEY_CITY=SanFrancisco
```

```
set KEY_ORG=OpenVPN
```

```
set KEY_EMAIL=mail@host.domain
```

The following shows an example of configuring these parameters:

```
set KEY_COUNTRY=CN
```

```
set KEY_PROVINCE=FJ
```

```
set KEY_CITY=XM
```

```
set KEY_ORG=Yealink
```

```
set KEY_EMAIL=admin@yealink.com
```

3. Click **Start->Run**.
4. Enter **cmd** in the pop-up dialogue box and click **OK** to open a command prompt screen.

5. Enter into the directory `easy-rsa` located in the installation directory of the OpenVPN server.

```
C:\Documents and Settings\Administrator>cd \Program Files\OpenVPN\easy-rsa
```

6. Enter the following commands.

```
C:\Program Files\OpenVPN\easy-rsa>init-config.bat
```

```
C:\Program Files\OpenVPN\easy-rsa>vars
```

```
C:\Program Files\OpenVPN\easy-rsa>clean-all.bat
```

7. Generate a CA certificate.

```
C:\Program Files\OpenVPN\easy-rsa>build-ca.bat
```

The screen prompts the following information (if you don't want to change the default settings, press the ENTER key, else enter the desired value and then press the ENTER key):

```
Loading 'screen' into random state - done
```

```
Generating a 1024 bit RSA private key
```

```
.....++++++
```

```
.....++++++
```

```
writing new private key to 'keys\ca.key'
```

```
-----
```

```
You are about to be asked to enter information that will be incorporated into your certificate request.
```

```
What you are about to enter is what is called a Distinguished Name or a DN.
```

```
There are quite a few fields but you can leave some blank
```

```
For some fields there will be a default value,
```

```
If you enter '.', the field will be left blank.
```

```
-----
```

```
Country Name (2 letter code) [CN]:
```

```
State or Province Name (full name) [FJ]:
```

```
Locality Name (eg, city) [XM]:
```

```
Organization Name (eg, company) [Yealink]:
```

```
Organizational Unit Name (eg, section) []:
```

```
Common Name (eg, your name or your server's hostname) []: CA
```

```
Email Address [admin@yealink.com]:
```

8. Generate a `dh1024.pem` file for the server.

```
C:\Program Files\OpenVPN\easy-rsa>build-dh.bat
```

The screen prompts the following information:

```
Loading 'screen' into random state - done
```

```
Generating DH parameters, 1024 bit long safe prime, generator 2
```

```
This is going to take a long time
```


9. Generate a certificate for the OpenVPN server.

```
C:\Program Files\OpenVPN\easy-rsa>build-key.bat client
```

The screen prompts the following information (if you don't want to change the default settings, press the ENTER key, else enter the desired value and then press the ENTER key):

```
Loading 'screen' into random state - done
```

```
Generating a 1024 bit RSA private key
```

```
.....+++++
```

```
.....+++++
```

```
writing new private key to 'keys\server.key'
```

```
-----
```

You are about to be asked to enter information that will be incorporated into your certificate request.

What you are about to enter is what is called a Distinguished Name or a DN.

There are quite a few fields but you can leave some blank

For some fields there will be a default value,

If you enter '.', the field will be left blank.

```
-----
```

```
Country Name (2 letter code) [CN]:
```

```
State or Province Name (full name) [FJ]:
```

```
Locality Name (eg, city) [XM]:
```

```
Organization Name (eg, company) [Yealink]:
```

```
Organizational Unit Name (eg, section) []:
```

```
Common Name (eg, your name or your server's hostname) []: Server
```

```
Email Address [admin@yealink.com]:
```

Please enter the following 'extra' attributes to be sent with your certificate request

```
A challenge password []:serverpwd
```

```
An optional company name []:
```

```
Using configuration from openssl.cnf
```

```
Loading 'screen' into random state - done
```

```
Check that the request matches the signature
```

```
Signature ok
```

```
The Subject's Distinguished Name is as follows
```

```
countryName          :PRINTABLE:'CN'
```

```
stateOrProvinceName  :PRINTABLE:'FJ'
```

```
localityName         :PRINTABLE:'XM'
```

```
organizationName     :PRINTABLE:'Yealink'
```

```

organizationalUnitName:PRINTABLE:'EMB'
commonName          :PRINTABLE:'Server'
emailAddress        :IA5STRING:'admin@yealink.com'
Certificate is to be certified until Jan 20 13:10:22 2023 GMT (3650 days)
Sign the certificate? [y/n]:y
1 out of 1 certificate requests certified, commit? [y/n]y
Write out database with 1 new entries
Data Base Updated

```

10. Generate a certificate for the client.

```
C:\Program Files\OpenVPN\easy-rsa>build-server.bat client
```

The screen prompts the following information (if you don't want to change the default settings, press the ENTER key, else enter the desired value and then press the ENTER key):

```
Loading 'screen' into random state - done
```

```
Generating a 1024 bit RSA private key
```

```
.....++++++
```

```
.....++++++
```

```
writing new private key to 'keys/client.key'
```

```
-----
```

You are about to be asked to enter information that will be incorporated into your certificate request.

What you are about to enter is what is called a Distinguished Name or a DN.

There are quite a few fields but you can leave some blank

For some fields there will be a default value,

If you enter '.', the field will be left blank.

```
-----
```

Country Name (2 letter code) [CN]:

State or Province Name (full name) [F]:

Locality Name (eg, city) [XM]:

Organization Name (eg, company) [Yealink]:

Organizational Unit Name (eg, section) []:

Common Name (eg, your name or your server's hostname) []: **Client**

Email Address [admin@yealink.com]:

Please enter the following 'extra' attributes to be sent with your certificate request

A challenge password []: **clientpwd**

An optional company name []:

Using configuration from openssl.cnf

```

Loading 'screen' into random state - done
Check that the request matches the signature
Signature ok
The Subject's Distinguished Name is as follows
countryName      :PRINTABLE:'CN'
stateOrProvinceName :PRINTABLE:'FJ'
localityName     :PRINTABLE:'XM'
organizationName  :PRINTABLE:'Yealink'
organizationalUnitName:PRINTABLE:'EMB'
commonName       :PRINTABLE:'Client'
emailAddress      :IA5STRING:'admin@yealink.com'
Certificate is to be certified until Jan 20 13:10:22 2023 GMT (3650 days)
Sign the certificate? [y/n]:y
1 out of 1 certificate requests certified, commit? [y/n]y
Write out database with 1 new entries
Data Base Updated

```

To configure the server's configuration file:

1. Enter into the installation directory of the OpenVPN server.
2. Create a new folder "serverconfig" in the directory.
3. Copy the file "server.ovpn" in the sample-config folder to the serverconfig folder created above.
4. Edit the file "server.ovpn" according to your actual network environment and save the change.

The following shows an example:

```

local 218.107.220.201
port 1194
proto udp
dev tun
ca /etc/openvpn/keys/ca.crt
cert /etc/openvpn/keys/server.crt
key /etc/openvpn/keys/server.key
dh /etc/openvpn/keys/dh1024.pem
server 10.8.0.0 255.255.255.0
ifconfig-pool-persist ip.txt
push "route 192.168.1.0 255.255.255.0"
push "route 10.0.0.0 255.0.0.0"
push "route 172.16.1.0 255.240.0.0"
client-to-client
keepalive 10 120
comp-lzo
persist-key
persist-tun
verb 3

```

The image shows a terminal window with the configuration file content. Red arrows point from text boxes to specific lines in the configuration:

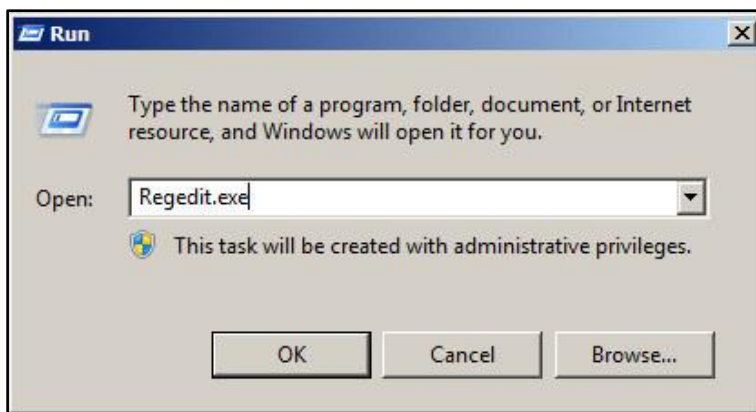
- Arrow from "The outside IP address of the server." points to `local 218.107.220.201`
- Arrow from "The port and protocol used by the server." points to `port 1194`
- Arrow from "The type of virtual network card." points to `dev tun`
- Arrow from "The certificate files path created before." points to `ca /etc/openvpn/keys/ca.crt`, `cert /etc/openvpn/keys/server.crt`, `key /etc/openvpn/keys/server.key`, and `dh /etc/openvpn/keys/dh1024.pem`
- Arrow from "The network segment assigned for the VPN client." points to `server 10.8.0.0 255.255.255.0`
- Arrow from "The network segment allowed communicator with the VPN client." points to `push "route 10.0.0.0 255.0.0.0"`

According to the actual network environment, configure the network settings of the server, such as the TCP/IP forwarding feature, Internet connection sharing feature and routing entries between the VPN clients and the Intranet. For more information, contact

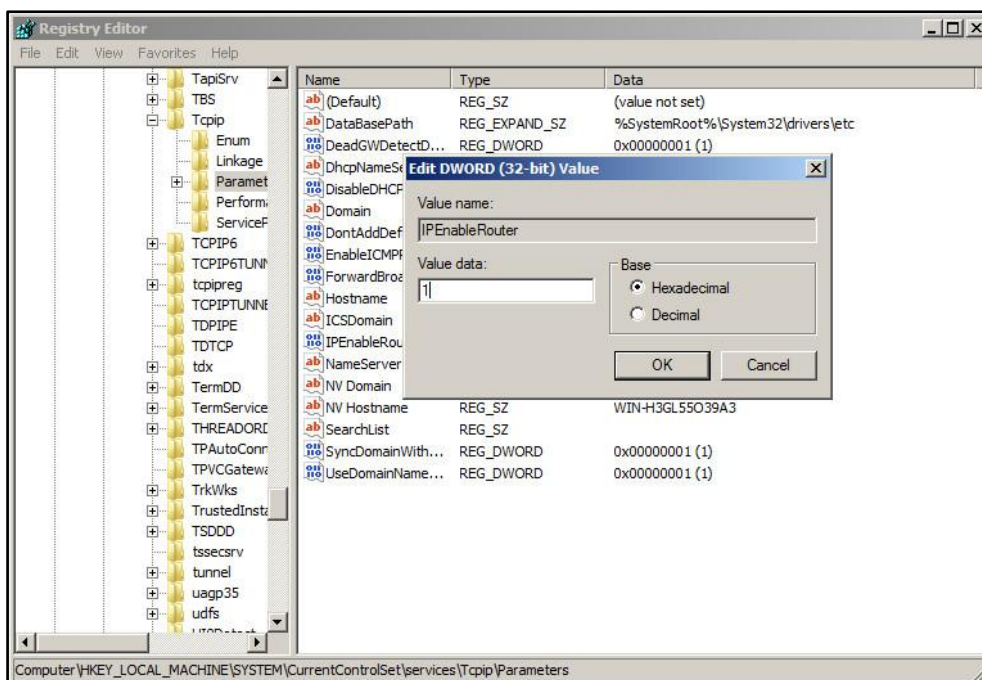
your network administrator.

To enable the TCP/IP forwarding:

1. Click **Start->Run**.
2. Enter **Regedit.exe** in the pop-up dialogue box and click **OK**.



3. Click on **HKEY_LOCAL_MACHINE->SYSTEM->CurrentControlSet->Services->Tcpip->Parameters**.
4. Set **"IPEnableRouter"** to 1.



To enable Internet connection sharing for inside network card:

1. Open network connections.
2. Right click the local area network for the inside network card and select **Properties**.
3. On the **Advanced** tab, check the **Allow other network users to connect through this computer's Internet connection** check box.

4. Select the virtual network card of the server from the pull-down list of **Home networking connection**.
5. Click **OK** to save the change.

Creating the OpenVPN Tar File for the VPN Client on the Windows Platform

You can package the tar file on the Windows platform using the tool 7-Zip or GnuWin32. You can download 7-Zip online: <http://www.7-zip.org/> and GnuWin32 online: <http://gnuwin32.sourceforge.net/packages/gtar.htm>.

This section provides you on how to package the tar file using 7-Zip on the Windows XP platform.

To configure the client's configuration file:

1. Create a new folder "openvpn" in the directory C:/.
2. Copy the file client.ovpn in the sample-config folder to the openvpn folder.
3. Rename the file client.ovpn to vpn.cnf.
4. Create a new folder "keys" in the openvpn folder.
5. Copy vpn.cnf, ca.crt, client.crt and client.key files to the keys folder created above.
6. Edit the file vpn.cnf.

The following parameters should be configured as the same as that of the server.

```
remote 218.107.220.201 1194 udp
```

```
dev tun
```

```
dev-type tun
```

The followings define OpenVPN certificate files for Yealink IP phones:

```
ca /config/openvpn/keys/ca.crt
```

```
cert /config/openvpn/keys/client.crt
```

```
key /config/openvpn/keys/client.key
```

The certificate directories for some IP phone models with previous firmware may vary. The following provides information for SIP-T2xP and SIP-T3xG IP phone models with firmware version prior to version 71 or firmware released before November 2013.

For SIP-T2xP IP phones:

```
ca /yealink/config/openvpn/keys/ca.crt
```

```
cert /yealink/config/openvpn/keys/client.crt
```

```
key /yealink/config/openvpn/keys/client.key
```

For SIP-T3xG IP phones:

```
ca /phone/config/openvpn/keys/ca.crt
```

```
cert /phone/config/openvpn/keys/client.crt
```

```
key /phone/config/openvpn/keys/client.key
```

SIP-T2xP and SIP-T3xG IP phones with the latest V71 firmware (or later) are compatible with above information. We recommend you to use the unified `"/config/openvpn/keys/"`.

The following figure shows a portion of the `vpn.cnf` file for reference:

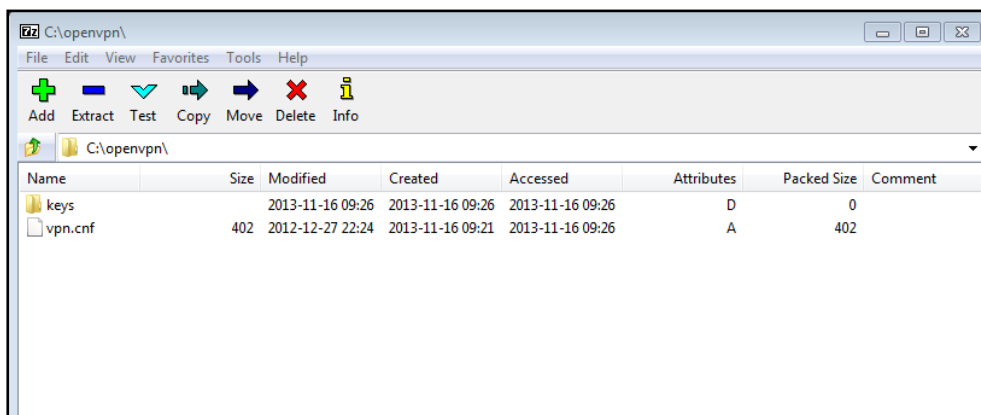
```
client
setenv SERVER_POLL_TIMEOUT 4
nobind
remote 218.107.220.201 1194 udp
dev tun
dev-type tun
ns-cert-type server
reneg-sec 604800
sndbuf 100000
rcvbuf 100000
auth-retry nointeract
comp-lzo no
verb 3
ca /config/openvpn/keys/ca.crt
cert /config/openvpn/keys/client.crt
key /config/openvpn/keys/client.key
```

7. Save the change.

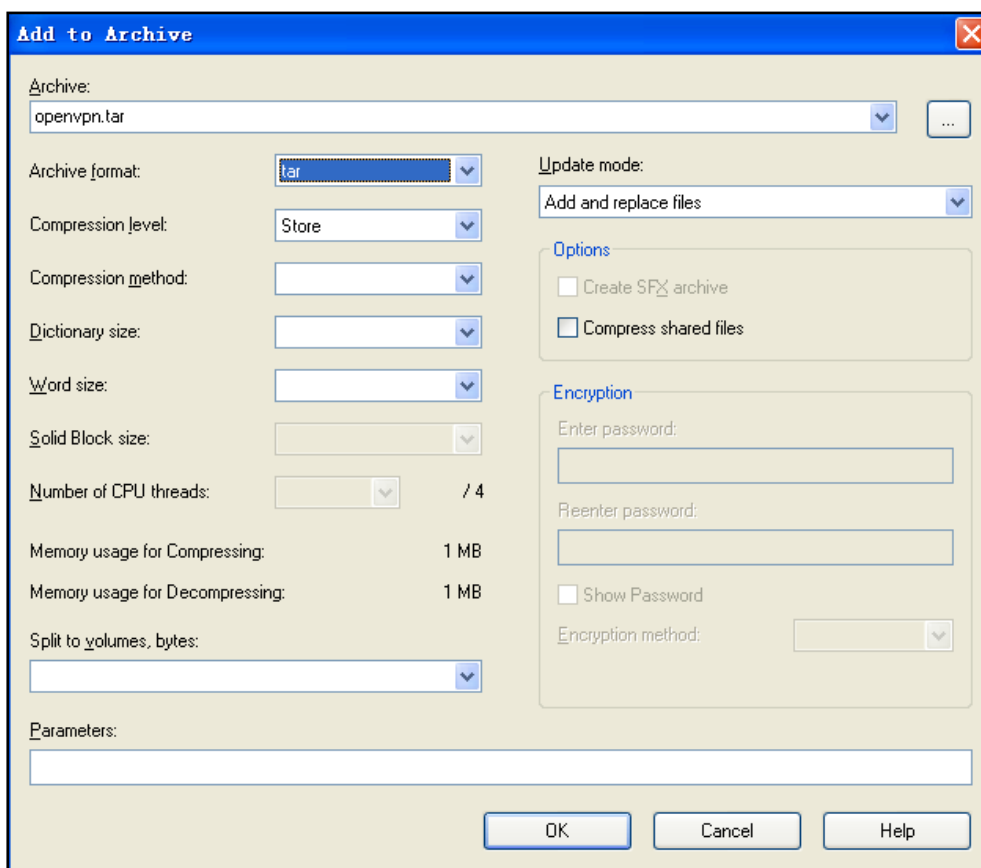
To package a tar file using the tool 7-Zip on the Windows platform:

1. Download and install 7-Zip on the local system.
2. Start the 7-Zip file manager application.

3. Locate the `openvpn` folder from the local system.



4. Click the **Add** button.
5. Select **tar** from the pull-down list of **Archive format**.



6. Click the **OK** button.
An `openvpn.tar` file is generated in the directory `C:/openvpn`.

Configuring OpenVPN Feature on IP Phones

OpenVPN feature is disabled on IP phones by default. You can enable the OpenVPN feature using configuration files, via web user interface or phone user interface. To use the OpenVPN feature, you also need to upload the OpenVPN tar file to the IP phones.

The configurations described in this section apply to the following IP phones:

- SIP-T28P, SIP-T26P, SIP-T22P and SIP-T20P IP phones running firmware version 70 or later.
- SIP-T21P IP phones running firmware version 71 or later
- SIP-T38G and SIP-T32G IP phones running firmware version 70 or later
- SIP-T46G, SIP-T42G and SIP-T41P IP phones running firmware version 71 or later
- W52P IP DECT phones running firmware version 30 or later
- VP530 IP video phones running firmware version 70 or later

The followings take configurations of a SIP-T28P IP phone running firmware version 71 as examples.

Note

For Yealink IP phones running firmware version prior to 71, configuration files of VPN client for different phone models may be a little different. Please upload the proper TAR files to IP phones.

To configure the OpenVPN feature using configuration files:

1. Add/Edit OpenVPN parameters in configuration files.

The following table lists the OpenVPN parameters:

Parameter	Description	Valid Value	Default Value
network.vpn_enable	Enables or disables the VPN feature on the IP phone. 0 -Disable 1 -Enable	Boolean	0
openvpn.url	Specifies the access URL of the OpenVPN tar file.	URL	Blank

The following shows an example of configuring the OpenVPN feature in configuration files:

```
network.vpn_enable = 1
openvpn.url = http://192.168.1.20/openvpn.tar
```

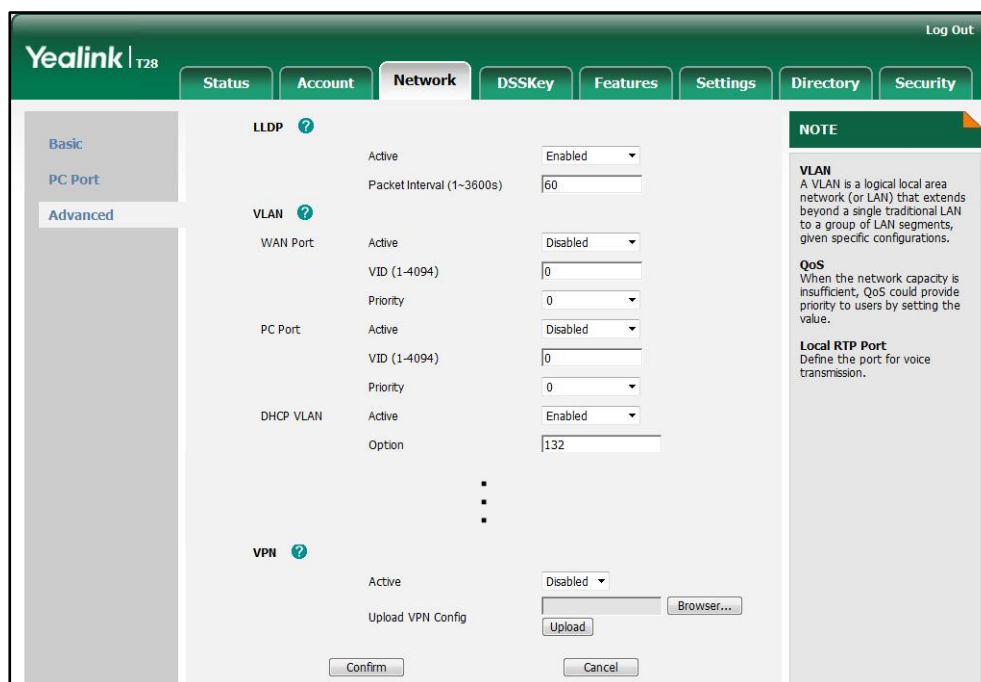
2. Upload configuration files to the root directory on the provisioning server and

trigger IP phones to perform an auto provisioning for configuration update.

For more information on auto provisioning, refer to Yealink IP Phones Auto Provisioning Guide.

To configure the OpenVPN feature via web user interface (take T28P as an example):

1. Press the **OK** key on the phone when it is idle to obtain the IP address.
2. Enter the IP address (e.g., http://192.168.0.10 or 192.168.0.10) in the address bar of web browser on your PC and then press **Enter**.
3. Enter the user name and password in the login page.
The default login user name is admin (case-sensitive) and the password is admin (case-sensitive).
4. Click on **Network->Advanced**.
5. In the **VPN** block, click **Browse** to locate the OpenVPN tar file from the local system and then click **Upload** to upload it.



6. In the **VPN** block, select **Enabled** from the pull-down list of **Active**.
7. Click **Confirm** to save the change.

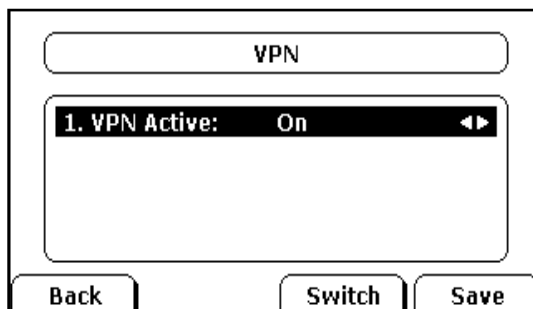
The web user interface prompts the warning "Some settings you changed take effect when you restart your machine! Do you want to reboot now?".

8. Click **OK** to reboot the IP phone.

To enable the OpenVPN feature via phone user interface (take T28P as an example):

1. Press **Menu->Settings->Advanced Settings** (password: admin) ->**Network->VPN**.

- Press ◀ or ▶, or the **Switch** soft key to select **On** from the **VPN Active** field.
You must upload the OpenVPN tar file using configuration files or via web user interface in advance.



- Press the **Save** soft key to save the change.
The IP phone reboots automatically to make the settings take effect.

Note

On the phone user interface, you can only enable or disable OpenVPN feature.

After the OpenVPN feature is configured successfully, the phone LCD screen displays the VPN icon. The IP phone can access the resources in the company's intranet from home or outside the office.



Glossary

IPSec – a protocol suite for securing IP communications by authenticating and encrypting each IP packet of a communication session.

TLS/SSL – cryptographic protocols that provide communication security over the Internet. TLS and SSL encrypt the segments of network connections at the Application Layer for the Transport Layer, using asymmetric cryptography for key exchange, symmetric encryption for confidentiality, and message authentication codes for message integrity.

TAR – a file format (in the form of a type of archive bit stream) and the name of a program used to handle such files.

Pre – shared Key – a shared secret which was previously shared between the two

parties using some secure channel before it needs to be used.

7-Zip – a free and open source file archiver. It operates with the 7z archive format, but can read and write several other archive formats.

GnuWin32 – provides native ports in the form of runnable computer programs, patches, and source code for various GNU and open source tools and software, much of it modified to run on the 32-bit Windows platform.

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