VPN Support Configuration Guide, 17.2.0

November 2017

Supporting AT&T Vyatta Network Operating System

Contents

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About This Guide

This guide describes all of the available documentation guides for AT&T Vyatta Network Operating System, plus the guides that apply specifically to AT&T Vyatta vRouter, Services platform, and Distributed Services.

VPN Support Overview

Supported VPN deployments

The following table shows the VPN deployment options that are supported by the AT&T Vyatta vRouter.

Table 1: Site-to-site solutions

Solution Type	Ease of Configurabil	Level of Security	Requires Public Key Infrastructur	Configurable Routable Interface	Bridgeable	Interoperabi with Third-Party Solutions	Comments
IPsec (pre-shared keys)	Moderate	Good	No	No	No	Very common	
IPsec (RSA digital signatures)	Moderate	Good	No	No	No	Very common	
Elaborate	Very good	Yes	No	No	No	Common	Provides a very secure but more involved configuration.
VTI	Similar to underlying IPsec	Same as underlying IPsec	No	Yes	No	Common	Adds an interface that can be configured, routed, or both to an IPsec solution and operates with a variety of third-party equipment.
GRE over IPsec	Similar to underlying IPsec	Same as underlying IPsec	No	Yes	Yes	Common	Adds an interface that can be configured, routed, or both to an IPsec solution and operates with a variety of third-party equipment.

Solution Type	Ease of Configurabil	Level of Security	Requires Public Key Infrastructur	Configurable Routable Interface	Bridgeable	Interoperabi with Third-Party Solutions	Comments
DMVPN	Adds some complexity to underlying IPsec	Same as underlying IPsec	No	Yes	No	Common	Provides the ability to easily scale a hub-and-spoke multipoint GRE over IPsec solution. This solution limits the number of subnets required, reduces the configuration complexity at the hub, and reduces traffic at the hub by providing dynamic spoke-to-spoke tunnels.
OpenVPN (pre-shared secret)	Easy	Good	No	Yes	Yes	Uncommon	Provides a highly flexible and resilient VPN protocol, which is recommended for AT&T Vyatta vRouter to AT&T Vyatta vRouter VPN connectivity.
OpenVPN (TLS)	Elaborate	Very good	Yes	Yes	Yes	Uncommon	

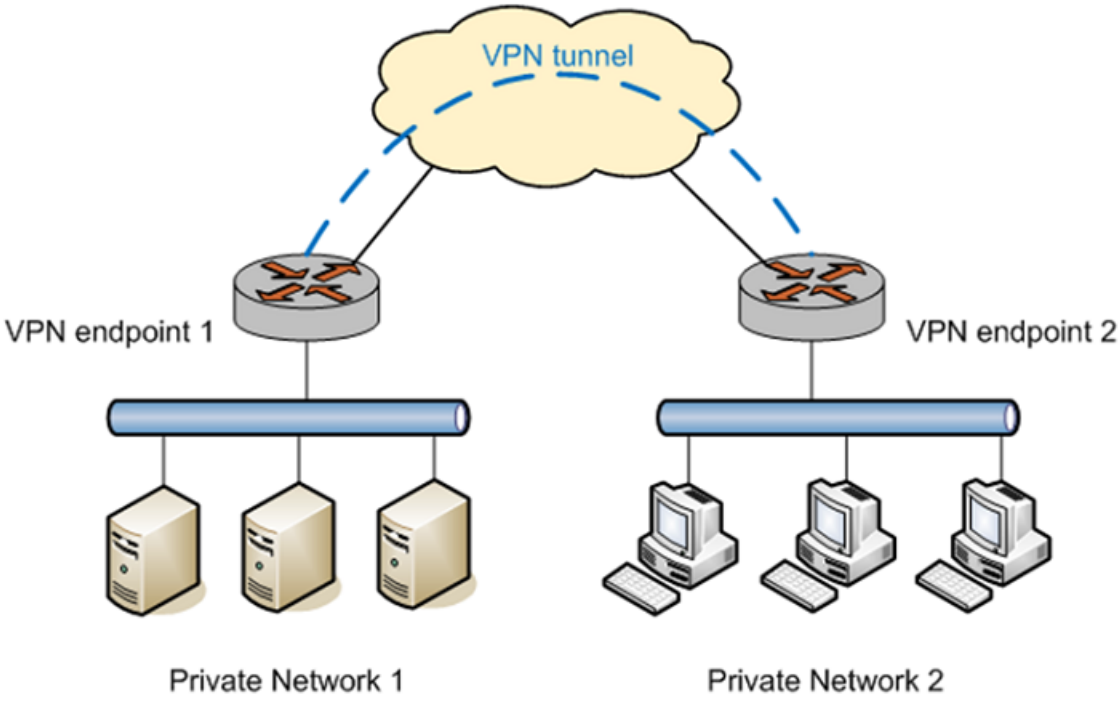
Table 2: Remote access solutions

Solution Type	Ease of Configurabil	Level of Security	Requires Public Key Infrastructur	Configurable Routable Interface	Bridgeable	Interoperabi with Third-Party Solutions	Comments
RA (L2TP / IPsec – pre-shared keys)	Easy	Good	No	N/A	No	Very common	Provides an easy way to configure Windows clients to connect remotely.
RA (L2TP / IPsec – X.509 certificates)	Elaborate	Very good	Yes	N/A	No	Common	Provides a more involved way to configure Windows clients to connect remotely.
OpenVPN (TLS)	Elaborate	Elaborate	Yes	N/A	No	Uncommon	Provides a more involved way to configure Windows clients to connect remotely.

Site-to-site IPsec VPN

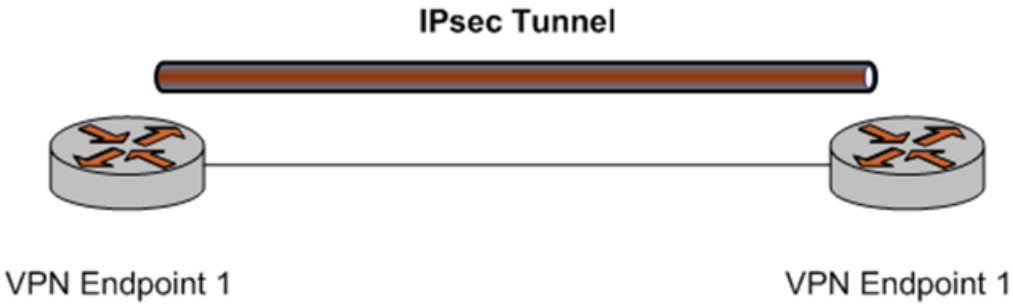
A site-to-site VPN that allows you to connect two or more sites separated by a wide area network (WAN) such that they appear to be on a single private network. The following figure shows a site connected by a tunnel.

Figure 1: Site-to-site IPsec VPN



The following figure shows how the AT&T Vyatta vRouter supports IPsec-protected site-to-site tunnels.

Figure 2: IPsec tunnel



For site-to-site IPsec tunnels, the AT&T Vyatta vRouter supports a special kind of interface—a virtual tunnel interface—that provides a routable interface at the endpoints of the tunnel.

For information about site-to-site VPN deployment and virtual tunnel interfaces, see AT&T Vyatta Network Operating System IPsec Site-to-Site VPN Configuration Guide.

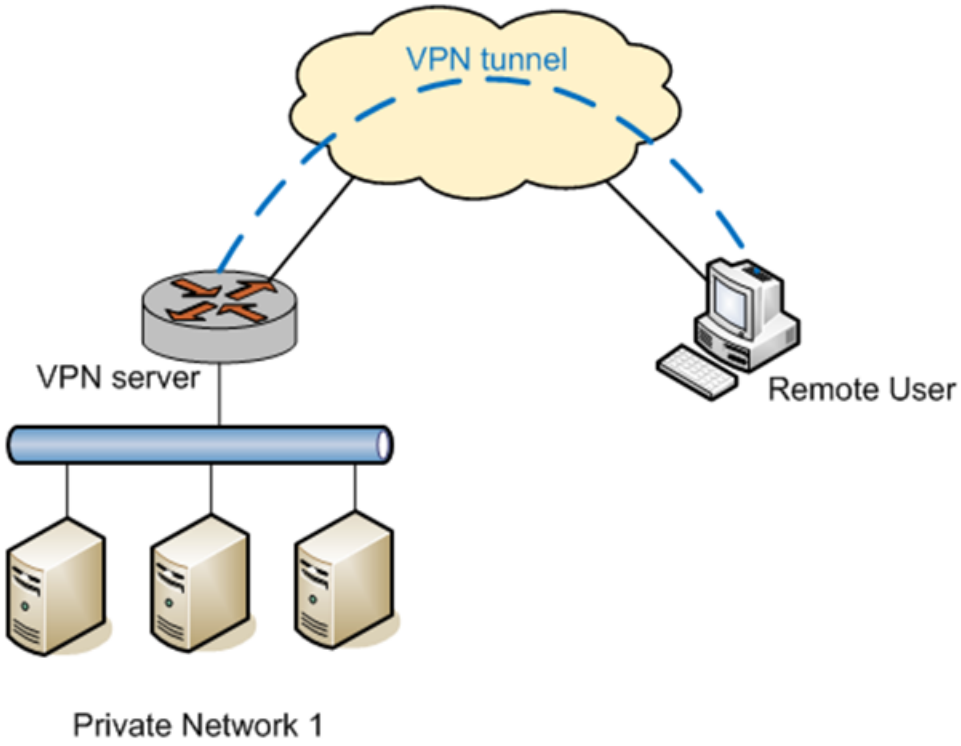
Remote access VPN

A remote access VPN allows a VPN tunnel to be established between a remote user and a VPN server. For example, a remote access VPN allows a remote user to access the company network from home.

Conceptually, site-to-site VPN and remote access VPN are similar in that they both use a tunnel to make the two endpoints appear to be on the same network. The solutions vary in the way that the tunnel is established.

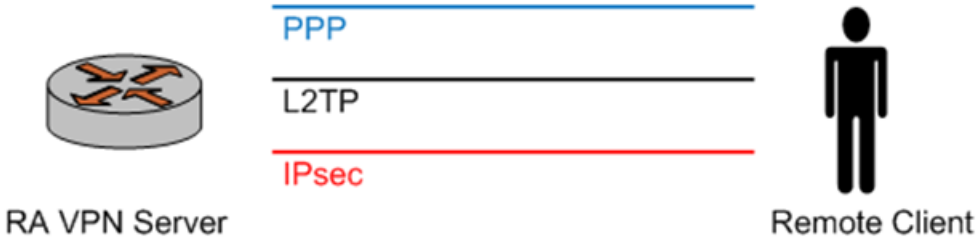
The following figure shows the general remote access scenario.

Figure 3: Remote access VPN



The following figure shows the one way option to implement a remote access VPN is by using Layer 2 Tunneling Protocol (L2TP) and IPsec.

Figure 4: Remote access VPN using L2TP and IPsec



In L2TP- and IPsec-based remote access VPN:

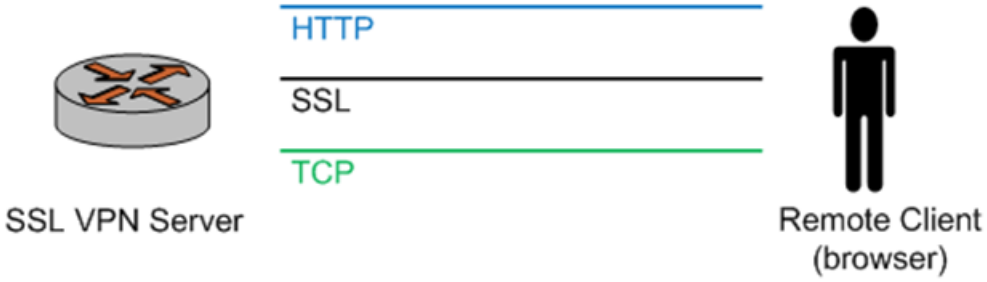
1. The remote host first establishes an IPsec tunnel with the VPN server.
2. The L2TP client and server then establish an L2TP tunnel on top of the IPsec tunnel.
3. Finally, a PPP session is established on top of the L2TP tunnel; that is, the PPP packets are encapsulated and sent and received inside the L2TP tunnel. The AT&T Vyatta vRouter supports L2TP/IPsec-based remote access VPN. This deployment is described in AT&T Vyatta Remote Access VPN Reference Guide.

OpenVPN

OpenVPN is an open-source VPN solution that employs the Secure Sockets Layer (SSL)protocol for security. OpenVPN supports both site-to-site and remote access modes of operation.

Because OpenVPN employs SSL in one mode of operation, and because it makes use of the open-source OpenSSL library, OpenVPN is sometimes referred as an SSL VPN solution. However, it should not be confused with SSL VPN as commonly understood to be a browser-based VPN product. They are quite different, and there is no interoperability between them. The following figure shows, a high level, browser-based SSL VPN works.

Figure 5: Browser based SSL VPN

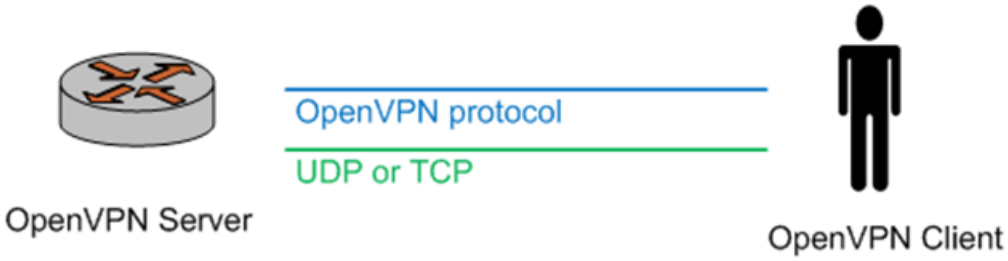


On the client side, the remote user points the web browser to a secure (HTTPS) web site. The browser establishes a TCP connection to the server, then an SSL protocol session within this connection, and finally an HTTP session on top of the SSL session. The SSL session provides a secure tunnel for authentication of the HTTP session, similar to logging into the secure web site of a bank.

In most such solutions, after the user has been authenticated, the browser dynamically downloads a fragment of code (for example, an ActiveX component) to be run on the host of the client. Such code can then, for example, create a virtual interface, so that VPN traffic can be routed through the tunnel. The application of the name SSL VPN to this solution refers to the fact that security is provided by the SSL protocol.

In contrast, OpenVPN implements its own communication protocol. This protocol is transported on top of UDP or TCP and provides a secure tunnel for VPN traffic. By default, UDP is used for better performance. In an OpenVPN solution, OpenVPN must be used on both tunnel endpoints. The following figure shows this scenario.

Figure 6: OpenVPN



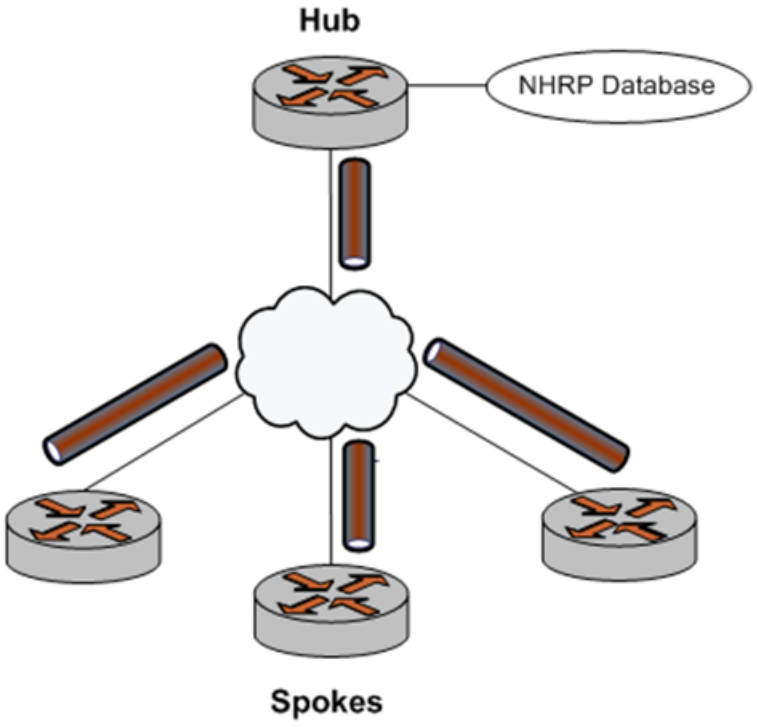
OpenVPN supports both site-to-site and remote access modes of operation. Support for OPENVPN on the AT&T Vyatta vRouter is described in *AT&T Vyatta OpenVPN Reference Guide*.

Dynamic multipoint VPN

Dynamic multipoint VPN (DMVPN) is a VPN architecture that makes it easier to configure topologies in which many sites need to interconnect. Scaling an ordinary site-to-site IPsec VPN for such a network would be operationally complex: the tunnels between the sites would need to be fully meshed. In addition, each pair of endpoints requires its own network, which causes high IP address space consumption.

DMVPN uses multipoint Generic Routing Encapsulation (mGRE) tunnels with the Next Hop Reachability Protocol (NHRP) addressing service to allow a dynamic mesh of VPN tunnels that do not need to be statically configured. The following figure shows that the tunnels are protected using IPsec.

Figure 7: DMVPN



For more information about DMVPN, refer to AT&T Vyatta Network Operating System DMVPN Configuration Guide.

Comparing VPN Solutions

Each VPN solution has advantages and disadvantages. For example, IPsec-based solutions have various issues when NAT is involved; in addition, IPsec is complex and can be hard to troubleshoot. This section presents some deployment issues for the different solutions.

L2TP/IPsec

When an L2TP server is started, it listens on UDP port 1701 for incoming L2TP connections on the external interface of the VPN server. In the normal mode of operation, a VPN client establishes an IPsec session with the VPN server first, and then the L2TP connection is established within the IPsec tunnel.

Because the L2TP server is listening on port 1701, the server also accepts incoming L2TP connections that are not tunneled in IPsec. This acceptance may be an issue, for example, if a user establishes an L2TP VPN connection without the IPsec tunnel (note that the Windows VPN client does not allow this), in which case all the traffic from the user is in the clear; that is, not encrypted.

In a production environment, it is recommended that you prevent L2TP-only connections (L2TP connections not tunneled in IPsec). Depending on the setup, there are different ways to achieve this. For example:

- If the VPN server is deployed in a demilitarized zone (DMZ) and has a firewall in front of it, then the firewall can be configured to allow only IPsec traffic to the VPN server (in other words, UDP port 1701 is not allowed). This way, L2TP/IPsec connections can be established, but L2TP-only connections will be blocked.

If the VPN server is directly exposed, the firewall on the VPN server should be configured to disallow L2TP-only connections. For example, the following rule can be defined and applied to local on the external interface to allow L2TP/IPsec connections. (L2TP-only connections can be blocked by the default-drop rule.)

```
rule 10 {
                action accept
                       destination {
                              port 1701
                       }
                       ipsec {
                             match-ipsec
                       }
                       protocol udp
        }
```

Pre-shared keys (L2TP/IPsec)

Pre-shared keys (PSKs) for L2TP/IPsec are easy to configure, both on the VPN server and on all the VPN clients. However, the same PSK must be used for all remote VPN users for the IPsec part of their VPN connections. The use of the same PSK can be a problem-for example when VPN access needs to be revoked for a particular user. Although access can be revoked at higher-level user authentication, the user still has the IPsec PSK and can still establish an IPsec session, which may not be desirable. To prevent the establishment of an IPSec session, a new PSK needs to be configured on the VPN server and all VPN clients.

X.509 certificates (L2TP/IPsec)

Using X.509 certificates with L2TP/IPsec avoids the issue with the PSK solution described in the preceding section. However, its usage presents its own challenges. Here are several examples.

- X.509 certificates must be generated using a Public Key Infrastructure (PKI) with a particular certificate authority (CA). This PKI can be either a commercial PKI (for example, VeriSign) or an in-house PKI established using either a commercial product (for example, a PKI appliance) or open-source software (for example, OpenSSL). Setting up an in-house PKI involves complex security issues.

- After the certificates are obtained, there remains the problem of securely distributing the user certificate to each of the remote VPN users. This distribution may involve, for example, physically taking a USB flash drive to the machine of each user and manually transferring the certificate.
- When using X.509 certificates with L2TP/IPsec, the configuration for the Windows VPN client becomes much more complicated than configuration using a pre-shared key. For this reason and the certificate-distribution problem, IT personnel may need to preconfigure user machines for remote access.