VMware Tunnel on Linux

VMware Workspace ONE UEM 1905
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VMware Tunnel

Workspace ONE UEM powered by AirWatch provides you with VMware Tunnel that offers secure method for individual applications to access corporate resources. VMware Tunnel authenticates and encrypts traffic from individual applications on compliant devices to the back-end system they are trying to reach. VMware Tunnel serves as a relay between your mobile devices and enterprise systems by authenticating and encrypting traffic from individual applications to back-end systems.

Supported Platforms for VMware Workspace ONE Tunnel App

VMware Workspace ONE Tunnel app is supported by iOS, macOS, Android and Windows 10.

Key Concepts

When configuring and deploying the VMware Tunnel, you must learn the VMware Tunnel terminology. Understanding the functionality that these components reference will aid your comprehension of this product. For more information, see Chapter 2 Key Concepts.

Architecture and Deployment Model

The VMware Tunnel is a product you can install on physical or virtual servers that reside in either the DMZ or a secured internal network zone. VMware Tunnel comprises two separate components, proxy and Per-App Tunneling, each with their own architecture and security features. For more information, see Chapter 3 VMware Tunnel Architecture and Deployment Model.

VMware Tunnel Pre-Deployment Configuration

Preparing for your VMware Tunnel installation ensures a smooth installation process. Installation includes performing preliminary steps in the Workspace ONE UEM console, and setting up a server that meets the listed hardware, software, and network requirements. For more information, see Chapter 4 Configure VMware Tunnel.

VMware Tunnel offers two architecture models for deployment, that is single-tier and multi-tier. For more information on deployment models and components, see VMware Tunnel Deployment Model.
Deploy VMware Tunnel with Unified Access Gateway

VMware offers a hardened virtual appliance (Unified Access Gateway) that hosts Workspace ONE services like Per-app Tunnel, and is the preferred method for deployment. Deploying Tunnel on Unified Access Gateway can be done from either vSphere or Hyper-V and can be automated using PowerShell. The Tunnel service on Unified Access Gateway is same as what the Linux installer provides. For more information, see Chapter 6 VMware Tunnel Deployment with Unified Access Gateway.

Deploy VMware Tunnel on a Linux Server

For customers who do not want to use the Unified Access Gateway deployment, Workspace ONE UEM offers the Linux installer so you can configure, download, and install VMware Tunnel onto a server. The Linux installer has different prerequisites than the Unified Access Gateway method. To run the Linux installer, you must meet specific hardware, software, and general requirements before you can begin installation. For information see, Chapter 7 VMware Tunnel Deployment on a Linux Server.

VMware Tunnel Management

Consider configuring additional functionality to enhance your VMware Tunnel deployment. These features allow you more control over device access and networking support. For more information, see Chapter 9 VMware Tunnel Management.

VMware Tunnel Troubleshooting

The VMware Tunnel supports troubleshooting logs to aid in diagnosing issues in your deployment. For more information, see Chapter 11 VMware Tunnel Troubleshooting and Support.

This chapter includes the following topics:

- Supported Platforms for VMware Workspace ONE Tunnel

Supported Platforms for VMware Workspace ONE Tunnel

Read through the following section to know more about the supported platforms and considerations of each of the platforms.

Supported Console Versions

VMware Workspace ONE Tunnel works with all the supported versions of VMware Workspace ONE UEM.

Supported Platforms

VMware Workspace ONE Tunnel supports iOS, macOS, Android, and Windows 10. The following table outlines the requirements for each of the supported platforms.
<table>
<thead>
<tr>
<th>Platform</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>iOS</td>
<td>iOS 9.3+</td>
</tr>
<tr>
<td>macOS</td>
<td>macOS 10.12+</td>
</tr>
<tr>
<td>Android</td>
<td>Android 5.0+</td>
</tr>
<tr>
<td>Windows 10</td>
<td>Windows 10 Build 17.04+</td>
</tr>
</tbody>
</table>

**Android Considerations**

- After installing VMware Workspace ONE Tunnel for Android, end users must run the application at least once and accept the connection request.
- The key icon in the notification center displays on the device because there is an application installed that uses the Per application VPN functionality. This icon does not indicate an active connection or session with the VMware Tunnel server. The key icon displays even if you are not actively browsing.
- Certain Android devices allow end users to disable the VPN on an OS level. This prevents the VMware Tunnel from working on the device.

**Windows 10 Considerations for the UWP application**

- After installing VMware Workspace ONE Tunnel for Windows 10, end users must accept an alert the first time they start an application that triggers VMware Tunnel.
- When using Windows 10 devices, ensure that your DNS server does not use 192.168.x.x IP as this address is used by the VMware Tunnel Server to assign the IPs to clients (mobile devices). This setting is a configurable setting in server.conf.
- VMware Tunnel shows as configured when the profile or certificates are successfully installed on Desktop for user profiles. Device profiles for desktop and Windows Phones rely on the successful installation of a profile certificate only.

**Windows 10 Considerations for the Desktop application**

- Make sure that the Windows desktop application either uses Workspace ONE Intelligent Hub for enrollment or is pushed down from the UEM console. For more information, see Workspace ONE Intelligent Hub for Windows enrollment documentation.
- Windows 10 desktop application requires device traffic rules for defining managed applications and domain filtering.
iOS and macOS Considerations

End users who are using the VMware Workspace ONE Tunnel on iOS and macOS must download and install VMware Workspace ONE Tunnel from the application Store. After installing it, end users have to run it at least once and accept the User Permission prompt.

**Note**  Make sure that you enforce a strong device passcode and device encryption on all your devices. These settings provide an added layer of security. For more information on configuring these settings on each of the platforms, refer to the platform-specific guides.
Key Concepts

Understanding the key concepts that are used throughout VMware Tunnel helps you make most of your enterprise mobility experience with enhanced security architecture, simplified management and a greater emphasis on the end-user VPN connectivity experience.

Read through the key concepts to become familiar with the VMware Tunnel technologies and features.

This chapter includes the following topics:

- App Tunnel and Secure Browsing
- Per-App Tunnel Component
- Proxy Component
- VMware Tunnel and Unified Access Gateway
- Load Balancing
- App Certificate Authentication and Encryption

App Tunnel and Secure Browsing

App tunnel is a generic term used to describe the act of creating a secure "tunnel" through which traffic can pass between an end-user device and a secure internal resource, such as a website or file server.

By using the VMware Workspace ONE Tunnel with Workspace ONE Web, you can provide secure internal browsing to any intranet site and web application that resides within your network. Because Workspace ONE Web is designed with application tunneling capabilities, all it takes to enable mobile access to your internal websites is to enable a setting from the Workspace ONE UEM console. By doing so, Workspace ONE Web establishes a trust with VMware Tunnel using a Workspace ONE UEM issued certificate and accesses internal websites by proxying traffic through the VMware Tunnel over SSL encrypted HTTPS. IT can not only provide greater levels of access to their mobile users, but also remain confident that security is not compromised by encrypting traffic, remembering history, disabling copy/paste, defining cookie acceptance, and more.

Per-App Tunnel Component

Per-App Tunnel uses the native platform (Apple, Google, Microsoft) APIs to provide a seamless experience for users. The Per-App Tunnel provides most of the same functionality of the Proxy component without the need for additional configuration that Proxy requires.
The Per App Tunnel component and VMware Workspace ONE Tunnel apps for iOS, Android, Windows Desktop, and macOS allow both internal, public, and purchased (iOS) applications to access corporate resources that reside in your secure internal network. They allow this functionality using per app tunneling capabilities. Per app tunneling lets certain applications access internal resources on an app-by-app basis. This restriction means that you can enable some apps to access internal resources while you leave others unable to communicate with your back-end systems.

It is considered to be a best practice to use the Per-App Tunnel component as it provides the most functionality with easier installation and maintenance.

Proxy Component

Proxy is the VMware Tunnel component that handles securing traffic between an end-user device and a website through the Workspace ONE Web mobile application. VMware Tunnel Proxy is also available on Windows.

To use an internal application with VMware Tunnel Proxy, then ensure the VMware Workspace ONE SDK is embedded in your application, which gives you tunneling capabilities with this component.

VMware Tunnel and Unified Access Gateway

VMware offers a hardened virtual appliance platform known as Unified Access Gateway that hosts Workspace ONE services like Per-App Tunnel, and is the preferred method for deployment. Deploying VMware Tunnel on Unified Access Gateway can be done on ESXi, Hyper-V, AWS or Azure and can be automated using PowerShell.

From an architecture and networking perspective, Unified Access Gateway and the stand-alone Linux installer are the same. The Tunnel service on Unified Access Gateway is same as what the Linux installer provides.

Load Balancing

The VMware Tunnel can be load balanced for improved performance and faster availability. Using a load balancer requires additional considerations.

VMware Tunnel requires authentication of each client after a connection is established. Once connected, a session is created for the client and stored in memory. The same session is then used for each piece of client data so the data can be encrypted and decrypted using the same key. When designing a load balancing solution, the load balancer must be configured with an IP or session-based persistence enabled. The load balancer sends data from a client to the same server for all its traffic during the connection. An alternative solution might be to – on the client side – use a DNS round robin, which means the client can select a different server for each connection. VMware Tunnel requires a TCP/UDP pass-through configuration on the load balancer for the per-app VPN capabilities. The VMware Tunnel Proxy
authenticates devices based on the HTTP header information in the request and ensures that the load balancer is configured to Send Original HTTP Headers so that these headers are not removed when going through the load balancer to VMware Tunnel. VMware Tunnel Proxy supports SSL offloading, bridging, and TCP pass-through.

**DTLS and TLS Connection for UDP and TCP traffic**

You can open a TCP port and a UDP port on the VMware Tunnel server to support TCP and UDP traffic. VMware Tunnel client seamlessly sends the UDP traffic over DTLS and TCP over TLS. After the TLS channel is established, the VMware Tunnel client establishes a secondary DTLS channel.

If the traffic is UDP, a new UDP datagram flow is created to carry the traffic. The flow is transmitted through the new DTLS channel to the VMware Tunnel server. From the server, a UDP connection is established to the UDP host, and the data in the flow is delivered to the UDP host through the connection and conversely.

Similarly, if the traffic is TCP, a new TCP flow is created to carry the traffic. The flow is transmitted through the original TLS channel to the VMware Tunnel Server. From the server, a TCP connection is created to the TCP host and the data is transmitted through the connection to the TCP host and conversely.

**Firewall and Load Balancer Configuration**

Since DTLS is transmitted on the top of UDP Protocol, the firewall and the load balancer must be configured to allow the UDP traffic to pass through.

To allow the VMware Tunnel client to establish a DTLS connection to the VMware Tunnel server, the firewall must allow the UDP traffic in and out of the VMware Tunnel Server UDP listing port. For example, if the VMware Tunnel server is setup to listen on port 443, the UDP port 443 must be opened at the firewall to allow all the incoming connection from the devices.

In addition, if a load balancer is used to distribute loads between multiple VMware Tunnel servers, the load balancer must be setup so that the UDP traffic from the device must always go to the same VMware Tunnel server.

For information on load balancing with Unified Access Gateway appliances, see Unified Access Gateway Load Balancing Topologies in the [Unified Access Gateway Documentation](https://www.vmware.com/support/um/doc/unified_access_gateway/).

**App Certificate Authentication and Encryption**

When you whitelist an application for corporate access through the VMware Tunnel, Workspace ONE UEM automatically deploys a unique X.509 certificate to enrolled devices. This certificate can then be used for mutual authentication and encryption between the application and the VMware Tunnel.

Unlike other certificates used for Wi-Fi, VPN, and email authentication, this certificate resides within the application sandbox and can only be used within the specific app itself. By using this certificate, the VMware Tunnel can identify and allow only approved, recognized apps to communicate with corporate systems over HTTP(S), or, for Per-App Tunneling, TCP/UDP and HTTP(S).
VMware Tunnel Architecture and Deployment Model

The VMware Tunnel is a product you can install on physical or virtual servers that reside in either the DMZ or a secured internal network zone. VMware Tunnel comprises two separate components, Proxy and Per-App tunneling, each with their own features.

Consider using the Per-App Tunnel component as it provides the most functionality with easier installation and maintenance. Per-App Tunnel uses the native platform (Apple, Google, Microsoft) APIs to provide a seamless experience for users.

The Proxy component provides most of the same functionality of Per-App Tunnel with the need for additional configuration. This component can be leveraged only by the applications having the Workspace ONE (AirWatch) SDK implemented or using the App Wrapping. This includes most of the VMware productivity applications.

VMware Tunnel offers single-tier and multi-tier deployment models. Both the configurations support load-balancing for faster availability. The Proxy component supports SSL offloading, while Per-App tunneling cannot be SSL-offloaded.

This chapter includes the following topics:

- Per-App Tunnel Architecture
- Proxy (SDK/Browser) Architecture
- Managing VMware Tunnel Certificates
- VMware Tunnel Deployment Model

Per-App Tunnel Architecture

The per app tunneling solution implements app-level access controls to your network. VMware Tunnel routes traffic from apps through the native framework to the VMware Tunnel client as data streams.

The data streams pass through the same channel as a full-device VPN does and arrive at the Tunnel server. On the server side, the server opens a TCP/UDP connection for each data stream and the data is sent to the destination host through the data stream. Once a connection is made, data can continuously flow between the client and host until either side drops the connection.

Proxy (SDK/Browser) Architecture

The VMware Tunnel Proxy component uses HTTPS tunneling to use a single port to filter traffic through an encrypted HTTPS tunnel for connecting to internal sites such as SharePoint or a wiki.
When accessing an end site, such as SharePoint, an intranet, or wiki site, traffic is sent through an HTTPS tunnel, regardless of whether the end site is HTTP or HTTPS. For example, if a user accesses a wiki site, whether it is http://<internalsite>.wiki.com or https://<internalsite>.wiki.com, the traffic is encrypted in an HTTPS tunnel and sent over the port you have configured. This connection ends once it reaches the VMware Tunnel and is sent over to the internal resource as either HTTP or HTTPS.

HTTPS Tunneling is enabled by default. Enter your desired port for the Default HTTPS Port during VMware Tunnel configuration, as described in VMware Tunnel Configuration.

The current authentication scheme requires the use of a chunk aggregator of fixed size. A low value puts restrictions on the amount of data that is sent from the devices in a single HTTP request. By contrast, a faster value causes extra memory to be allocated for this operation. Workspace ONE UEM uses a default optimum value of 1 MB, which you can configure based on your maximum expected size of upload data. Configure this value in the proxy.properties file on the VMware Tunnel Proxy server in the /conf directory.

**Managing VMware Tunnel Certificates**

VMware Tunnel uses certificates to authenticate communication among the Workspace ONE UEM console, VMware Tunnel, and end-user devices. The following workflows show the initial setup process and certificate integration cycle.

**Initial Setup Workflow**

1. VMware Tunnel connects to the Workspace ONE UEM API and authenticates with an **API Key** and a **Certificate**.
   - Traffic requests are SSL encrypted using HTTPS.
   - Setup authorization is restricted to admin accounts with a role enabled for the VMware Tunnel setup role (see preliminary steps).

2. Workspace ONE UEM generates a unique identity certificate pair for both the Workspace ONE UEM and VMware Tunnel environments.
   - The Workspace ONE UEM certificate is unique to the group selected in the Workspace ONE UEM console.
   - Both certificates are generated from a trusted Workspace ONE UEM root.

3. Workspace ONE UEM generates a unique self-signed certificate to be used as the server certificate. Optionally, you can also use your own Public SSL certificate instead of the self-signed certificate on the Front-end VMware Tunnel server (if VMware Tunnel is deployed using the cascade mode) or on the backend server (if VMware Tunnel is deployed using the basic mode).

4. Workspace ONE UEM sends the unique certificates and trust configuration back to the VMware Tunnel server over HTTPS.
   - The VMware Tunnel configuration trusts only messages signed from the Workspace ONE UEM environment. This trust is unique per group.
Any additional VMware Tunnel servers set up in the same Workspace ONE UEM group as part of a highly available (HA) load-balanced configuration are issued the same unique VMware Tunnel certificate.

For more information about high availability, refer to the **VMware Workspace ONE UEM Recommended Architecture Guide**.

**Certificate Integration Cycle**

1. Workspace ONE UEM generates Device Root Certificates that are unique to every instance during the installation process.

   **For Proxy:** The VMware Tunnel Device Root Certificate is used to generate client certificates for each of the applications and devices.

   **For Per-App Tunnel:** The Device Root Certificate is used to generate client certificates for each of the devices.

2. **For Proxy:** The certificate an application uses to authenticate with the VMware Tunnel is only provided after the application attempts to authenticate with the Workspace ONE UEM enrollment credentials for the first time.

   **For Per-App Tunnel:** The certificate is generated at the time of profile delivery.

3. VMware Tunnel gets the chain during installation. The VMware Tunnel installer is dynamically packaged and picks these certificates at the time of download.

4. VMware Tunnel makes an outbound call to the AWCM/API server to receive updated details on the device and certificates. The following details are exchanged during this process: DeviceUid, CertThumbprint, applicationBundleId, EnrollmentStatus, complianceStatus.

5. VMware Tunnel maintains a list of devices and certificates and only authenticates the communication if it sees a certificate it recognizes.

   X.509 (version 3) digitally signed client certificates are used for authentication.

**VMware Tunnel Deployment Model**

The VMware Tunnel supports deploying a single-tier model and a multi-tier model. Both SaaS and on-premises Workspace ONE environments support the single-tier and multi-tier models. You can use the deployment model that best fits your needs.

**Single-Tier Deployment Model**

Single-tier models have a single instance of VMware Tunnel configured with a public DNS. In the Workspace ONE UEM console and the installer, this deployment model uses the basic-endpoint model.
Multi-Tier Deployment Model

Multi-tier networks have a separation between servers with firewalls between the tier. Typical Workspace ONE multi-tier deployments have a DMZ that separates the Internet from the internal network. VMware Tunnel supports deploying a front-end server in the DMZ that communicates with a back-end server in the internal network. The multi-tier deployment model includes two instances of the VMware Tunnel with separate roles. The VMware Tunnel front-end server resides in the DMZ and can be accessed from public DNS over the configured ports. The servers in this deployment model communicate with your API and AWCM servers. For SaaS deployments, Workspace ONE hosts the API and AWCM components in the cloud. For an on-premises environment, the AWCM component is typically installed in the DMZ with the API.

The cascade deployment model architecture includes two instances of the VMware Tunnel with separate roles. In cascade mode, the front-end server resides in the DMZ and communicates to the back-end server in your internal network.

If you are using a multi-tier deployment model and the Proxy component of the VMware Tunnel, use the relay-endpoint deployment mode. The relay-endpoint deployment mode architecture includes two instances of the VMware Tunnel with separate roles. The VMware Tunnel relay server resides in the DMZ and can be accessed from public DNS over the configured ports.

Single-Tier Deployment Model

If you are using the single-tier deployment model, use the basic-endpoint mode. The basic endpoint deployment model of VMware Tunnel is a single instance of the product installed on a server with a publicly available DNS.

Basic VMware Tunnel is typically installed in the internal network behind a load balancer in the DMZ that forwards traffic on the configured ports to the VMware Tunnel, which then connects directly to your internal Web applications. All deployment configurations support load balancing and reverse proxy.

The basic endpoint Tunnel server communicates with API and AWCM to receive a whitelist of clients allowed to access VMware Tunnel. Both proxy and Per-App Tunnel components support using an outbound proxy to communicate with API/AWCM in this deployment model. When a device connects to VMware Tunnel, it is authenticated based on unique X.509 certificates issued by Workspace ONE UEM. Once a device is authenticated, the VMware Tunnel (basic endpoint) forwards the request to the internal network.

If the basic endpoint is installed in the DMZ, the proper network changes must be made to allow the VMware Tunnel to access various internal resources over the necessary ports. Installing this component behind a load balancer in the DMZ minimizes the number of network changes to implement the VMware Tunnel and provides a layer of security because the public DNS is not pointed directly to the server that hosts the VMware Tunnel.
Cascade Mode Deployment

The cascade deployment model architecture includes two instances of the VMware Tunnel with separate roles. In cascade mode, the front-end server resides in the DMZ and communicates to the back-end server in your internal network.

Only the Per-App Tunnel component supports the cascade deployment model. If you use only the Proxy component, you must use the Relay-Endpoint model. For more information, see Relay-Endpoint Deployment.

Devices access the front-end server for cascade mode using a configured hostname over configured ports. The default port for accessing the front-end server is port 8443. The back-end server for cascade mode is installed in the internal network hosting your intranet sites and web applications. This deployment model separates the publicly available front-end server from the back-end server that connects directly to internal resources, providing an extra layer of security.

The front-end server facilitates authentication of devices by connecting to AWCM when requests are made to the VMware Tunnel. When a device makes a request to the VMware Tunnel, the front-end server determines if the device is authorized to access the service. Once authenticated, the request is forwarded securely using TLS over a single port to the back-end server.

The back-end server connects to the internal DNS or IP requested by the device.
Cascade mode communicates using TLS connection (or optional DTLS connection). You can host as many front-end and back-end servers as you like. Each front-end server acts independently when searching for an active back-end server to connect devices to the internal network. You can set up multiple DNS entries in a DNS lookup table to allow load balancing.

Both the front-end and back-end servers communicate with the Workspace ONE UEM API server and AWCM. The API server delivers the VMware Tunnel configuration and the AWCM delivers device authentication, whitelisting, and traffic rules. The front-end and back-end server communicates with API/AWCM through direct TLS connections unless you enable outbound proxy calls. Use this connection if the front-end server cannot reach the API/AWCM servers. If enabled, front-end servers connect through the back-end server to the API/AWCM servers. This traffic, and the back-end traffic, route using server-side traffic rules. For more information, see Configure Network Traffic Rules for the Per-App Tunnel.

The following diagram illustrates the Multi-Tier deployment for the Per-App Tunnel component in cascade mode:

Relay-Endpoint Deployment

If you are using a multi-tier deployment model and the Proxy component of the VMware tunnel, use the relay-endpoint deployment mode. The relay-endpoint deployment mode architecture includes two
instances of the VMware Tunnel with separate roles. The VMware Tunnel relay server resides in the DMZ and can be accessed from public DNS over the configured ports.

If you are only using the Per-App Tunnel component, consider using a cascade mode deployment. For more information, see Cascade Mode Deployment.

The ports for accessing the public DNS are by default port 8443 for Per-App Tunnel and port 2020 for proxy. The VMware Tunnel endpoint server is installed in the internal network hosting intranet sites and Web applications. This server must have an internal DNS record that is resolved by the relay server. This deployment model separates the publicly available server from the server that connects directly to internal resources, providing an added layer of security.

The relay server role includes communicating with the API and AWCM components and authenticating devices when requests are made to VMware Tunnel. In this deployment model, communication to API and AWCM from the relay server can be routed to the Outbound Proxy via endpoint server. The Per-App Tunnel service must communicate with API and AWCM directly. When a device makes a request to the VMware Tunnel, the relay server determines if the device is authorized to access the service. Once authenticated, the request is forwarded securely using HTTPS over a single port (the default port is 2010) to the VMware Tunnel endpoint server.

The role of the endpoint server is to connect to the internal DNS or IP requested by the device. The endpoint server does not communicate with the API or AWCM unless Enable API and AWCM outbound calls via proxy is set to Enabled in the VMware Tunnel settings in the Workspace ONE UEM console. The relay server performs health checks at a regular interval to ensure that the endpoint is active and available.

These components can be installed on shared or dedicated servers. Install VMware Tunnel on dedicated Linux servers to ensure that performance is not impacted by other applications running on the same server. For a relay-endpoint deployment, the proxy and Per-App Tunnel components are installed on the same relay server.
Figure 3-1. On-premises configuration for Relay-Endpoint deployments

Browser (Proxy) traffic is sent over ports you define. See the “HTTPS Tunneling” section in the Tunnel Admin Guide for more information.

Tunnel for Linux Only: Per App Tunnel traffic is sent over TCP (8443).

Proxy traffic (Default port: 2020)
- AirWatch MDM traffic HTTPS(433)
- Certificate Traffic HTTPS (433)
Figure 3-2. SaaS configuration for Relay-Endpoint deployments

Browser (Proxy) traffic is transported over a port of your choosing and set in the AirWatch Admin Console.

Browser (Proxy) traffic is sent over ports you define. See the "HTTPS Tunneling" section in the Tunnel Admin Guide for more information.

Tunnel for Linux Only: Per App Tunnel traffic is sent over TCP (8443).

Proxy traffic (Default port: 2020)
AirWatch MDM traffic HTTPS(433)
Certificate Traffic HTTPS (433)
Configure VMware Tunnel

Preparing for your VMware Tunnel installation ensures a smooth installation process. Installation includes performing preliminary steps in the Workspace ONE UEM console, and setting up a server that meets the listed hardware, software, and network requirements.

Before deploying the VMware Tunnel, you must complete the following pre-deployment configurations:

1. Before you begin installing VMware Tunnel, you have to ensure that the API and AWCM are installed correctly, running, and communicating with the Workspace ONE UEM without any errors. For more information, see Configure AWCM Server and Enable API Access.

2. After completing AWCM Server configuration, you can configure VMware Tunnel settings per your deployment's configuration and functionality needs in the Workspace ONE UEM console. For more information, see Configure VMware Tunnel and Chapter 5 Configure VMware Tunnel Proxy.

3. After you complete the VMware Tunnel configuration, you also must configure various settings to enable the VMware Web and Per-App Tunnel-enabled apps to use VMware Tunnel. Doing so ensures all HTTP(S) and TCP/UDP traffic for the specified applications is routed through the VMware Tunnel. For more information, see Chapter 9 VMware Tunnel Management.

4. You can configure more settings that are optional for the VMware Tunnel deployment. Except where noted, you can configure these settings before or after installation. For more information, see Configure Advanced Settings for the Proxy.

This chapter includes the following topics:

- Configure AWCM Server and Enable API Access
- Configure VMware Tunnel
- Configure Network Traffic Rules for the Per-App Tunnel

Configure AWCM Server and Enable API Access

Before you begin installing VMware Tunnel, you have to ensure that the API and AWCM are installed correctly, running, and communicating with the Workspace ONE UEM without any errors. Read through the following topic to configure the AWCM server.

**Important** If you are an on-premises customer, do not configure VMware Tunnel at the Global organization group level. Configure VMware Tunnel at the Company level or Customer type organization group. The REST API key can only be generated at a Customer type organization group.
Procedure

1. Navigate to **Groups & Settings > All Settings > System > Advanced > API > REST API** and select the **Override** radio button.

2. Ensure that the **Enable API Access** check box is selected and an API Key is displayed in the text box.

3. Select **Save**.

**Configure VMware Tunnel**

You can configure the fundamental VMware Tunnel architecture to establish connectivity and trust within your environment with the Per-App Tunnel.

**Procedure**

1. Navigate to **Groups & Settings > All Settings > Configurations > Tunnel**. Select a Current Setting of **Override** to make new settings for the child.

2. Under **Deployment Details**, select whether you are deploying VMware Tunnel in **Basic** or **Cascade** mode.

   When deploying in **Basic** mode, supply the public-facing **Hostname** and the **Port** number that is assigned for communication with the VMware Tunnel component.

   When deploying in Cascade mode, enter the **Hostname** of the back-end server and the **Port** number.

   **Note** Make sure you configure Per-App Tunnel and Tunnel Proxy with different ports.

3. Under **Server Authentication**, select the SSL provider of your choice.

   By default, AirWatch provides a certificate, however third-party certificates are also supported. When using a third-party certificate, make sure to include both public and private keys in either .PFX or .P12 format. Currently, server authentication does not support SAN certificates. All certificates must be either issued to the VMware Tunnel hostname or be a valid wildcard certificate for the corresponding domain.

4. Under **Client Authentication**, select either **AirWatch** or a **Third Party CA** as the authentication provider for VMware Tunnel users.

   To use a third-party certificate authority, select the **Certificate Authority** and **Certificate Template** that are used to request a certificate from the CA.

   In order for the VMware Tunnel gateway to trust certificates issued by a third-party CA, **Upload** the full chain of the public key of your certificate authority to the configuration wizard.

   The CA template must contain CN=UDID in the subject name.

   Certificates auto-renew based on your CA template settings.
5 Under **Networking**, define how VMware Tunnel communicates with Workspace ONE UEM and how the device traffic flows through your network.

a Select **Manage Server Traffic Rules with VMware Tunnel PAC Reader** if you are using the PAC Reader to manage the traffic rules.

b Select **Default AWCM + API traffic via Server Traffic Rules** if the communication between the VMware Tunnel and Workspace ONE UEM API or AWCM uses outbound proxy. For more information see, **Configure Server Traffic Rules from the UEM Console**.

6 Under **Logging**, you can configure settings related to the server logs.

a Select the level of logging for the VMware Tunnel from the **Service Logs** drop-down menu. It is considered to be a best practice to select the **Service Logs** as **Error** or **Info** unless you are troubleshooting.

b **Access Logs** provide a high-level record of users and devices using VMware Tunnel. These logs are not available locally and must be pushed to a syslog server over UDP. In a cascade deployment, the back-end server performs the syslog transport. When you turn on **Access Logs**, you are prompted to enter the **Syslog Hostname** which is the URL of your syslog host and the **Port** over which you want to communicate.

There is no correlation between this syslog integration and the integration accessed on **Groups & Settings > All Settings > System > Enterprise Integration > Syslog**.

7 Select **Save**.

**What to do next**

After completing your VMware Tunnel configuration, you can take the following actions:

- **Edit**, **Disable**, or **Delete** the VMware Tunnel configuration.

  **Note** You cannot delete the VMware Tunnel configuration if a VMware Tunnel Proxy configuration exists. You are notified with a warning message.

- Download the **Installer** and **XML** to complete the setup.

- **Test Connection** to verify the server reachability.

You can now configure your advanced settings for the VMware Tunnel component. For more information, see **Configure Network Traffic Rules for the Per-App Tunnel**.

---

**Configure Network Traffic Rules for the Per-App Tunnel**

Network traffic rules allow you to set granular control over how the VMware Tunnel directs traffic from devices. Using the Per-App Tunnel of VMware Tunnel, create device traffic rules to control how devices handle traffic from specified applications and server traffic rules to manage network traffic when you have third-party proxies configured.
Device traffic rules force VMware Tunnel to send traffic through the tunnel, block all traffic to specified
domains, bypass the internal network straight to the Internet, or send traffic to an HTTPS proxy site. The
device traffic rules are created and ranked to give an order of execution. Every time a specified app is
opened, VMware Tunnel checks the list of rules to determine which rule applies to the situation. If no set
rules match the situation, VMware Tunnel applies the default action. The default action, set for all
applications except for safari, applies to domains not mentioned in a rule. If no rules are specified, the
default action applies to all domains. The device traffic rules created apply to all VPN VMware Tunnel
profiles in the organization group the rules are created in.

Server traffic rules enable you to manage the network traffic when you have third-party proxies configured
in your network. These rules apply to traffic originating from the VMware Tunnel. The rules force the
VMware Tunnel to send traffic for specified destinations to either use the proxy or bypass it.

**Supported Platforms**

VMware Tunnel supports Network Traffic rules for the following platforms:

- iOS devices with VMware Workspace ONE Tunnel for iOS.
- macOS devices with VMware Workspace ONE Tunnel for macOS. VMware Tunnel only supports
  network traffic rules for the Safari app for macOS devices.
- Android devices with VMware Workspace ONE Tunnel for Android.
- Windows desktop devices with VMware Workspace ONE Tunnel desktop application.

VMware Tunnel supports enforcing the Per-App VPN rules configured in the Windows Desktop and
Windows Phone VPN profiles.

**Create Device Traffic Rules**

Add rules for VMware Tunnel to control how traffic is directed through the VMware Tunnel when using the
Per-App Tunnel component. These rules allow you to tunnel, block, or bypass traffic as needed.

**Prerequisites**

- Configured VMware Tunnel with the Per-App Tunnel component enabled.
- For iOS and Android, applies to mobile applications configured for Per App VPN for VMware Tunnel.
  For more information, see Configure Public Apps to Use Per App Profile

Watch a tutorial video explaining how to create device traffic rules: Configure the network traffic rules for
Per-App Tunnel.

**Procedure**

1. Navigate to **Groups & Settings > Configurations > Tunnel**.
2. By default, the **Device Traffic Rules** settings of the Child OG is set to **Override** which allows you to
   **Edit** the settings of the current OG. Based on your configuration needs, you can also choose to select
   **Clear Override** if you wish to inherit the **Device Traffic Rules** settings of the current organization
group’s parent OG.
3 Configure the Device Traffic Rules settings.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add Device Traffic Rule</td>
<td>Select Add Device Traffic Rule to create a rule.</td>
</tr>
<tr>
<td></td>
<td>These rules are only applicable to the Per-App Tunnel component of VMware Tunnel for Android, iOS, macOS, and Windows Desktop devices. For iOS, use the Workspace ONE Tunnel client application from the App store; for macOS, only Safari Domains are supported; for Windows Desktop, use the Workspace ONE Tunnel Desktop application.</td>
</tr>
<tr>
<td></td>
<td>To add Device Traffic Rules for Windows application, select Add Windows App and enter the following details:</td>
</tr>
<tr>
<td></td>
<td>a Enter a Friendly Name for the application.</td>
</tr>
<tr>
<td></td>
<td>b Select the App Type.</td>
</tr>
<tr>
<td></td>
<td>c Enter the App Identifier.</td>
</tr>
<tr>
<td></td>
<td>The App Identifier is the path or the package family name (PFN) of the application. For a Store App, the Package Friendly Name (PFN) is used and can be found using the PowerShell command Get-AppxPackage <em>&lt;app_name&gt;</em>. For a Desktop App, the filepath is used. For example, you can use C:\Program Files (x86)\acme\app.exe.</td>
</tr>
<tr>
<td>Rank</td>
<td>Select-and-drag the rule to rearrange the ranking of your network traffic rules. You can also.</td>
</tr>
<tr>
<td>Application</td>
<td>Select Add to add a triggering application for the network rule. This drop-down menu is populated with applications with Per App VPN enabled and Safari for macOS. If you configure rules for the Safari app for macOS, the traffic rules override and disable any domain rules configured in existing profiles.</td>
</tr>
<tr>
<td>Setting</td>
<td>Description</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td><strong>Action</strong></td>
<td>Select the action from the drop-down menu that VMware Tunnel applies to all network traffic from the triggering app when the app starts.</td>
</tr>
<tr>
<td><strong>Tunnel</strong></td>
<td>Sends app network traffic for specified domains through the tunnel to your internal network. All apps, except Safari, on the device configured for Per App VPN send network traffic through the tunnel. For example, set the <strong>Action</strong> to <strong>Tunnel</strong> to ensure all configured apps without a defined traffic rule use the VMware Tunnel for internal communications.</td>
</tr>
<tr>
<td><strong>Block</strong></td>
<td>Blocks all apps, except Safari, on the device configured for Per App VPN from sending network traffic. For example, set the Default Action to <strong>Block</strong> to ensure that all configured apps without a defined traffic rule cannot send any network traffic regardless of destination.</td>
</tr>
<tr>
<td><strong>Bypass</strong></td>
<td>Bypasses all apps, except Safari, on the device configured for Per App VPN bypass the tunnel and connect to the Internet directly. For example, set the Default Action to <strong>Bypass</strong> to ensure all configured apps without a defined traffic rule bypass the VMware Tunnel to access their destination directly.</td>
</tr>
<tr>
<td><strong>Proxy</strong></td>
<td>Redirect traffic to the specified HTTPS proxy for the listed domains. The proxy must be HTTPS and must follow the correct format: <a href="https://example.com:port">https://example.com:port</a></td>
</tr>
<tr>
<td><strong>Destination</strong></td>
<td>Enter the hostname applicable to the action set for the rule. For example, enter all the domains to block traffic from accessing using the <strong>Block</strong> action. Use a comma (,) to distinguish between hostnames. You may use wildcard characters for your hostnames. Wildcards must follow the format:</td>
</tr>
<tr>
<td><em>.&lt;domain&gt;.</em></td>
<td></td>
</tr>
<tr>
<td><em>&lt;domain&gt;.</em></td>
<td></td>
</tr>
<tr>
<td><em>.</em> — You cannot use this wildcard for Safari domain rules.</td>
<td></td>
</tr>
<tr>
<td>* — You cannot use this wildcard for Safari domain rules.</td>
<td></td>
</tr>
</tbody>
</table>

**Note**  
Currently for all the iOS devices only the default traffic rule is supported for IPs as we do not consider IP based connections for evaluating the traffic rules. For Windows Desktop devices, the domains added to the destination must be added to the **DNS Resolution via Tunnel Gateway** section in the Windows Desktop device profile as well.

4  Select **Save** to save your changes.

5  Select **Save and Publish** to update your applicable VMware Tunnel device profiles to a new version with the new network traffic rules. The updated device profiles publish to the assigned smart groups.

**Configure Server Traffic Rules**

You can configure server traffic rules for the VMware Tunnel to manage how traffic is directed through a third-party proxy. These rules allow you to bypass the proxy or send traffic through it. You can either add rules manually in the UEM console or via PAC files by using the VMware Tunnel PAC Reader.

**Configure Server Traffic Rules using Outbound Proxy**

Many organizations use outbound proxies to control the flow of traffic to and from their network. Outbound proxies can also be used for performing traffic filtering, inspection, and analysis.
It is not mandatory to use outbound proxies with VMware Tunnel, but your organization may choose to deploy them behind one or more VMware Tunnel servers based on recommendations from your security and network teams. For VMware Tunnel on Linux, Workspace ONE UEM supports outbound proxies for the two VMware Tunnel components: Proxy and Per-App Tunnel.

Only the basic and cascade deployment models support outbound proxies for the Per-App Tunnel through server traffic rules.

The following table illustrates outbound proxy support for the VMware Tunnel Per-App Tunnel on Linux:

<table>
<thead>
<tr>
<th>Proxy Configuration</th>
<th>Supported?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outbound Proxy with no auth</td>
<td>✓</td>
</tr>
<tr>
<td>Outbound Proxy with basic auth</td>
<td>✓</td>
</tr>
<tr>
<td>Outbound Proxy with NTLM auth</td>
<td>✓</td>
</tr>
<tr>
<td>Multiple Outbound Proxies</td>
<td>✓</td>
</tr>
<tr>
<td>PAC Support</td>
<td>✓</td>
</tr>
</tbody>
</table>

Configure the rules for sending traffic to your outbound proxies using the server traffic rules. For more information, see [Configure Server Traffic Rules from the UEM Console](#).

If you want to send the requests to the API/AWCM servers through your outbound proxy as well, then you must enable the Default AWCM + API traffic via Server Traffic Rules Networking settings under Groups & Settings > All Settings > Configurations > Tunnel. Once enabled, add the respective web proxies for API/AWCM hostnames on the server traffic rules page.

**Configure Server Traffic Rules from the UEM Console**

Add rules for the VMware Tunnel to manage how traffic is directed through a third-party proxy. These rules allow you to bypass the proxy or send traffic through it.

The server traffic rules only apply to VMware Tunnel servers using the Per-App Tunnel component.

**Procedure**

1. Navigate to Groups & Settings > Configurations > Tunnel.
2. Select Configure.
3. In the Outbound Proxies section, select Edit and the select Add Outbound Proxy to add a third-party outbound proxy. You may add additional outbound proxies by selecting Add Outbound Proxy again.

<table>
<thead>
<tr>
<th>Settings</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Host</td>
<td>Enter the proxy hostname.</td>
</tr>
<tr>
<td>Port</td>
<td>Enter the port the third-party proxy uses to listen to the VMware Tunnel.</td>
</tr>
<tr>
<td>Authentication</td>
<td>Select the proxy authentication method used. Select Basic or NTLM.</td>
</tr>
</tbody>
</table>
### Settings | Descriptions
--- | ---
User name | Enter the *User name* for proxy authentication.
Password | Enter the *Password* for proxy authentication.

4. Select **Save** to save your changes.

5. In the Server Traffic Rules section, you can configure the server traffic rule settings.

6. Select **Edit**.

7. Select **Add Server Traffic Rule** to add a new server traffic rule. Enter the following information:

<table>
<thead>
<tr>
<th>Settings</th>
<th>Descriptions</th>
</tr>
</thead>
</table>
| Destination | Enter the destination hostname that triggers the traffic rule. Rules for applications on Windows 10 and macOS (except Safari) devices must use IP address as the hostname. You cannot use regular expressions except specific wildcard characters. Windows 10 and macOS devices support using the following wildcards:

- 10.10.*
- 10.10.0.0/16

If you are entering multiple hostnames, separate them by commas. For domains you want to resolve on Windows 10 devices through the VMware Tunnel server, you must add the domains to the Windows Desktop VPN profile for VMware Tunnel.

<table>
<thead>
<tr>
<th>Action</th>
<th>Select the action that the VMware Tunnel applies to server traffic for the destination hostname.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bypass</td>
<td>Bypass the proxy and send all traffic directly to the destination hostname.</td>
</tr>
<tr>
<td>Proxy</td>
<td>Send server traffic through the outbound proxy. Selecting Proxy displays the Outbound Proxy menu.</td>
</tr>
</tbody>
</table>

| Proxy | Select the Outbound proxy to handle server traffic for the destination hostname. If you select multiple outbound proxies, the proxies are used in a round-robin format. The proxies that populate this menu are those proxies added in the **Outbound Proxies** section. |

8. (Optional) Select **Add Server Traffic Rule** if you wish to add any additional server traffic rules.

9. Select **Apply** to save your changes.

10. Select **Close**.

### Configure Server Traffic Rules using VMware Tunnel PAC Reader

The VMware Tunnel PAC Reader allows you to use PAC files to configure outbound proxies for the Per-App Tunnel component.
Prerequisites

- Download the PAC Reader bundle from the Workspace ONE UEM Resources Portal. Install the PAC Reader on any Linux server such as your VMware Tunnel server. Installation requires extracting the PAC Reader and running the install script. If the PAC file contains DNS resolution rules such as `dnssrolve()` or `isInNet()`, change the value of `traffic_rule_post_dns` in `server.conf` to 1 on your VMware Tunnel server.

Note  Currently the PAC Reader has the following limitations:

- Currently, the PAC Reader only supports Linux servers.
- The PAC Reader currently does not support the following rules:
  - Nested `if` statements. Try to put the inner logic above the outer logic. This change makes the outer logic lower ranked than the inner logic.
  - `else-if` statements. Try to convert these rules to `if` statements.
  - Regex
  - `myapaddress()`
  - Generic use of the AND operator
- The PAC Reader only supports limited use of variable declaration and use.

Before you configure Outbound Proxy using VMware Tunnel PAC Reader, make sure that you meet the following network requirements:

- Access to the Workspace ONE UEM API server: The PAC Reader requires access to the Workspace ONE UEM API server. The server is typically accessed over port 443. Consider installing the PAC Reader on your VMware Tunnel server as the server already has access to the Workspace ONE UEM API server.
- Access to the PAC file. If you are hosting your PAC file on a Web server, the PAC Reader must have access to that server.
- Python 2.7 installed on the server.
- RHEL 7 as the server OS.

Procedure

1. On the Linux server, extract the PAC Reader bundle from the Workspace ONE UEM Resources Portal.
   
   The extract creates the `pacreader` folder.

2. Open the `pacreader` folder.

3. To install the PAC Reader in the `pacreader` folder, run the install script.

   ```bash
   sudo ./install.sh
   ```
4 Configure the necessary properties in the pacreader.properties file.

<table>
<thead>
<tr>
<th>Property</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>API_SERVER_URL</td>
<td>Enter the API server URL.</td>
</tr>
<tr>
<td>API_KEY</td>
<td>Enter the API key for the API server. Find this key by navigating to Groups &amp; Settings &gt; All Settings &gt; System &gt; Advanced &gt; API &gt; REST API &gt; API Key.</td>
</tr>
<tr>
<td>OG_ID</td>
<td>Enter the Organization Group ID for the OG in which the VMware Tunnel is configured.</td>
</tr>
<tr>
<td>PAC_LINK</td>
<td>Enter the URL of the PAC file if you host it on a Web server. If you configure PAC_LINK, do not configure PAC_PATH.</td>
</tr>
<tr>
<td>PAC_PATH</td>
<td>Enter the file path to the PAC file on the server. If you configure PAC_PATH, do not configure PAC_LINK.</td>
</tr>
</tbody>
</table>

5 Start the PAC Reader.

    ./pacreader.sh start
Configure VMware Tunnel Proxy

Configure VMware Tunnel Proxy using the configuration wizard. The options configured in the wizard are packaged in the installer, which you can download from the Workspace ONE UEM console and move to your Tunnel servers.

Configure the VMware Tunnel Proxy in the UEM console under Groups & Settings > All Settings > System > Enterprise Integration > VMware Tunnel > Proxy. The wizard walks you through the installer configuration step-by-step. The options configured in the wizard are packaged in the installer, which you can download from the Workspace ONE UEM console and move to your Tunnel servers. Changing the details in this wizard typically requires a reinstall of the VMware Tunnel with the new configuration.

To configure the VMware Tunnel Proxy, you need the details of the server where you plan to install. Before configuration, determine the deployment model, one or more hostnames and ports, and which features of VMware Tunnel to implement, such as access log integration, SSL offloading, enterprise certificate authority integration, and so on.

**Note** The wizard dynamically displays the appropriate options based on your selections, the configuration screens may display different text boxes and options.

**Procedure**

1. Navigate to Groups & Settings > All Settings > System > Enterprise Integration > VMware Tunnel > Proxy.
   - If this is your first time configuring VMware Tunnel, then select **Configure** and follow the configuration wizard screens.
   - If this is not your first time configuring VMware Tunnel, select **Override**, then select **Enabled VMware Tunnel** toggle switch, and then select **Configure**.

2. On the Deployment Type screen, select **Enable Proxy (Windows & Linux)** toggle switch, and then select the components that you want to configure using the **Proxy Configuration Type** drop-down menu.

3. In the drop-down menus that display, select whether you are configuring a **Relay-Endpoint**, or the **Proxy Configuration Type** deployment. Select the information icon to see an example for the selected type.

4. Select **Next**.
On the **Details** screen, configure the following settings. The options that are displayed on the **Details** screen depends on the configuration type you have selected in the the **Proxy Configuration Type** drop-down menu.

- **Basic Proxy Configuration Type**, enter the following information:

<table>
<thead>
<tr>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hostname</td>
<td>Enter the FQDN of the public host name for the Tunnel server, for example, tunnel.acmemdm.com. This hostname must be publicly available as it is the DNS that devices connect to from the Internet.</td>
</tr>
<tr>
<td>Relay Port</td>
<td>The proxy service is installed on this port. Devices connect to the &lt;relayhostname&gt;:&lt;port&gt; to use the VMware Tunnel proxy feature. The default value is 2020.</td>
</tr>
<tr>
<td>Relay Host Name</td>
<td>(Relay-Endpoint Only). Enter the FQDN of the public host name for the Tunnel relay server, for example, tunnel.acmemdm.com. This hostname must be publicly available as it is the DNS that devices connect to from the Internet.</td>
</tr>
<tr>
<td>Enable SSL Offloading</td>
<td>Select this checkbox if you want to use SSL Offloading to ease the burden of encrypting and decrypting traffic from the VMware Tunnel server.</td>
</tr>
<tr>
<td>Use Kerberos Proxy</td>
<td>Enable Kerberos proxy support to allow access to Kerberos authentication for your target back end Web services. This feature does not currently support Kerberos Constrained Delegation (KCD). For more information, see Enable Kerberos Proxy Settings for the Proxy. The Endpoint server must be on the same domain as KDC for the Kerberos Proxy to communicate successfully with the KDC.</td>
</tr>
</tbody>
</table>

- If you choose **Relay-Endpoint Proxy Configuration Type**, enter the following information:

<table>
<thead>
<tr>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relay Host Name</td>
<td>(Relay-Endpoint Only). Enter the FQDN of the public host name for the Tunnel relay server, for example, tunnel.acmemdm.com. This hostname must be publicly available as it is the DNS that devices connect to from the Internet.</td>
</tr>
<tr>
<td>Endpoint Host Name</td>
<td>The internal DNS of the Tunnel endpoint server. This value is the hostname that the relay server connects to on the relay-endpoint port. If you plan to install the VMware Tunnel on an SSL offloaded server, enter the name of that server in place of the Host Name. When you enter the Host Name, do not include a protocol, such as http://, https://, etc.</td>
</tr>
<tr>
<td>Relay Port</td>
<td>The proxy service is installed on this port. Devices connect to the &lt;relayhostname&gt;:&lt;port&gt; to use the VMware Tunnel proxy feature. The default value is 2020.</td>
</tr>
<tr>
<td>Endpoint Port</td>
<td>(Relay-Endpoint only). This value is the port used for communication between the VMware Tunnel relay and VMware Tunnel endpoint. The default value is 2010. If you are using a combination of Proxy and Per-App Tunnel, the relay endpoint installs as part of the Front-End Server for Cascade mode. The ports should be different values.</td>
</tr>
</tbody>
</table>
6 Select Next.

7 On the SSL screen, you can configure Public SSL Certificate that secures client-server communication from enabled application on a device to the VMware Tunnel. By default, this setup uses a AirWatch certificate for secure server-client communication.
   a Select Use Public SSL Certificate option if you prefer to use a third-party SSL certificate for encryption between Workspace ONE Web or SDK-enabled apps and the VMware Tunnel server.
   b Select Upload to upload a .PFX or .P12 certificate file and enter the password. This file must contain both your public and private key pair. CER and CRT files are not supported.

8 Select Next.

9 On the Authentication screen, configure the following settings to select the certificates that devices use to authenticate to the VMware Tunnel.
   By default, all the components uses AirWatch issued certificates. To use Enterprise CA certificates for client-server authentication, select the Enterprise CA option.
   a Select Default to use AirWatch issued certificates. The default AirWatch issued client certificate does not automatically renew. To renew these certificates, re-publish the VPN profile to devices that have an expiring or expired client certificate. View the certificate status for a device by navigating to Devices > Device Details > More > Certificates.
   b Select Enterprise CA in place of AirWatch issued certificates for authentication between the Workspace ONE Web, Per-App Tunnel-enabled apps, or SDK-enabled apps and the VMware Tunnel requires that a certificate authority and certificate template are set up in your Workspace ONE UEM environment before configuring VMware Tunnel.
   c Select the Certificate Authority and Certificate Template that are used to request a certificate from the CA.
   d Select Upload to upload the full chain of the public key of your certificate authority to the configuration wizard.

   The CA template must contain CN=UDID in the subject name. Supported CAs are ADCS, RSA, and SCEP.

   Certificates auto-renew based on your CA template settings.

10 Click Add to add an Intermediate Certificate.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enable SSL Offloading</td>
<td>Select this checkbox if you want to use SSL Offloading to ease the burden of encrypting and decrypting traffic from the VMware Tunnel server.</td>
</tr>
<tr>
<td>Use Kerberos Proxy</td>
<td>Enable Kerberos proxy support to allow access to Kerberos authentication for your target back end Web services. This feature does not currently support Kerberos Constrained Delegation (KCD). For more information, see Enable Kerberos Proxy Settings for the Proxy. The Endpoint server must be on the same domain as KDC for the Kerberos Proxy to communicate successfully with the KDC. In the Realm field, enter the Realm of the KDC server.</td>
</tr>
</tbody>
</table>
11 Select Next.

12 On the Miscellaneous screen, you can enable access logs for the proxy or Per-App Tunnel components. Enable Access Logs toggle switch to configure the feature.

   If you intend to use this feature you must configure it now as part of the configuration, as it cannot be enabled later without reconfiguring Tunnel and rerunning the installer. For more information on these settings, see Access Logs and Syslog Integration and Configure Advanced Settings for the Proxy.

   a Enter the URL of your syslog host in the Syslog Hostname field. This setting displays after you enable Access Logs.
   
   b Enter the port over which you want to communicate with the syslog host in the UDP Port field.

13 Select Next, review the summary of your configuration, confirm that all hostnames, ports and settings are correct, and select Save.

   The installer is now ready to download on the VMware Tunnel Configuration screen.

14 On the Configuration screen, select the General tab. The General tab allows you to do the following:

   a You can select Test Connection to verify the connectivity.
   
   b You can select Download Configuration XML to retrieve the existing VMware Tunnel instance configuration as a XML file.
   
   c You can select the Download Unified Access Gateway hyperlink. This button downloads the non-FIPS OVA file. The download file also includes the PowerShell script and .ini template file for the PowerShell deployment method. You must download the VHDX or FIPS OVA from My Workspace ONE.
   
   d For legacy installer methods, you can select Download Windows Installer.

      This button downloads a single BIN file used for deploying the VMware Tunnel server. Configuration XML file required for installation can be downloaded from the Workspace ONE UEM console after confirming the certificate password.

15 Select Save.

**Configure Advanced Settings for the Proxy**

The Advanced on the Configuration screen lets you configure more settings that are optional for the VMware Tunnel Proxy. Except where noted, you can configure these settings before or after installation.

**Procedure**

1 Navigate to Groups & Settings > All Settings > System > Enterprise Integration > VMware Tunnel > Configuration and select the Advanced tab.
2 Configure the following VMware Tunnel Proxy settings.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RSA Adaptive Auth Integration</td>
<td>Enable this setting if you want to integrate VMware Tunnel Proxy with RSA authentication for comprehensive Web browsing security. For more information, see Configure RSA Authentication in the UEM Console.</td>
</tr>
<tr>
<td>Access Logs</td>
<td>Enable this setting to tell VMware Tunnel to write access logs to syslog for any of your own purposes. These logs are not stored locally. They are pushed to the syslog host over the port you define. Communication to the syslog server occurs over UDP, so ensure that UDP traffic is allowed over this port. In relay-endpoint deployments, the relay server writes the access logs and in a basic deployment, the basic server writes the access logs. There is no correlation between this syslog integration and the integration accessed on Groups &amp; Settings &gt; All Settings &gt; System &gt; Enterprise Integration &gt; Syslog. This feature can be enabled during initial configuration in the Advanced settings tab in the Workspace ONE UEM console. If configured after installation, you must re-install VMware Tunnel. Syslog Hostname: Enter the URL of your syslog host. This setting displays after you enable Access Logs. UDP Port: Enter the port over which you want to communicate with the syslog host. This setting displays after you enable Access Logs.</td>
</tr>
<tr>
<td>API and AWCM outbound calls via proxy</td>
<td>Enable this option if the communication between the VMware Tunnel and Workspace ONE UEM API or AWCM is through an outbound proxy.</td>
</tr>
<tr>
<td>Show detailed errors</td>
<td>Enable this option to ensure client applications (for example, Workspace ONE Web) are informed when the VMware Tunnel fails to authenticate a device.</td>
</tr>
<tr>
<td>Log Level</td>
<td>Set the appropriate logging level, which determines how much data is reported to the LOG files.</td>
</tr>
<tr>
<td>Authentication</td>
<td>Maintain your SSL certificates. If you are using AirWatch SSL, select Regenerate to regenerate the certificates.</td>
</tr>
</tbody>
</table>

3 If you are using a AirWatch certificate and not a public SSL certificate, then you can export the SSL certificate. Select Export if you choose to export the certificate.

4 Select View Configuration XML to view the configuration XML. You can also Download a local copy if required.

5 If applicable, configure the Relay-endpoint authentication credentials settings, which are used for authentication between the relay and endpoint servers. These text boxes are pre-populated for you after configuration, but you can change them, for example, to meet your organization password strength requirements.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Username</td>
<td>Enter the user name used to authenticate the relay and endpoint servers.</td>
</tr>
<tr>
<td>Password</td>
<td>Enter the password used to authenticate the relay and endpoint servers. Select Change if you choose to change your password credentials.</td>
</tr>
</tbody>
</table>
Select **Save**.

**Enable Kerberos Proxy Settings for the Proxy**

Kerberos KDC Proxy is supported for the VMware Tunnel Proxy that supports Kerberos authentication in the requesting application. Kerberos KDC proxy (KKDCP) is installed on the endpoint server. Workspace ONE UEM KKDCP acts as a proxy to your internal KDC server. Workspace ONE UEM-enrolled and compliant devices with a valid Workspace ONE UEM issued identity certificate can be allowed to access your internal KDC. For a client application to authenticate to Kerberos-enabled resources, all the Kerberos requests must be passed through KKDCP.

The basic requirement for Kerberos authentication is to make sure that you install the Endpoint with the Kerberos proxy setting enabled during configuration in a network where it can access the KDC server.

**Prerequisites**

- For HTTPS sites, Workspace ONE Web for Android supports Kerberos authentication only when the site also has NTLM authentication enabled. This requirement is because the Android WebView, on which the Workspace ONE Web is built, does not support Kerberos authentication natively.
- HTTP Sites do not require NTLM authentication as the VMware Tunnel can perform Kerberos authentication without NTLM being enabled.
- Currently, this functionality is only supported with the Workspace ONE Web v2.5 and higher for Android.

**Procedure**

1. During the configuration, check the box **Use Kerberos proxy** and enter the **Realm** of the KDC server.
2. If the Realm is not reachable, then you can configure the **KDC server IP** on the **Advanced** settings tab in system settings.

Only add the IP if the Realm is not reachable, as it takes precedence over the Realm value entered in the configuration.

By default the Kerberos proxy server uses port 2040, which is internal only. Therefore, no firewall changes are required to have external access over this port.

3. Save the settings and download the installer to install VMware Tunnel Proxy.
4. Enable Kerberos from the SDK settings in the Workspace ONE UEM console so the requesting application is aware of the KKDCP.
   a. Navigate to **Groups & Settings > All Settings > Apps > Settings And Policies** and select **Security Policies**.
   b. Under Integrated Authentication, select **Enable Kerberos**.
   c. Save the settings.
Configure Kerberos Proxy Settings
Configure Kerberos KDC Proxy for the proxy component.

Procedure
1. Navigate to Groups & Settings > All Settings > System > Enterprise Integration > VMware Tunnel > Configuration and select the Advanced tab to configure the Kerberos Proxy settings, which display only if you select Use Kerberos Proxy during the VMware Tunnel configuration.

2. If the realm info you entered during configuration does not work properly, you can enter the KDC IP address here, which overrides the information that you provided during configuration. You must reinstall the VMware Tunnel after changing these settings. A restart does not work.

3. Complete the following settings to configure Kerberos proxy settings.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>KDC Server IP</td>
<td>Enter your KDC Server IP address. This text box displays only if you select Use Kerberos Proxy during VMware Tunnel configuration.</td>
</tr>
<tr>
<td>Kerberos Proxy Port</td>
<td>Enter the port over which VMware Tunnel can communicate with your Kerberos Proxy. This text box displays only if you select Use Kerberos Proxy during VMware Tunnel configuration.</td>
</tr>
</tbody>
</table>

Configure Outbound Proxy for the Proxy

Many organizations use outbound proxies to control the flow of traffic to and from their network. Outbound proxies can also be used for performing traffic filtering, inspection, and analysis.

It is not mandatory to use outbound proxies with VMware Tunnel, but your organization may choose to deploy them behind one or more VMware Tunnel servers based on recommendations from your security and network teams. For VMware Tunnel on Linux, Workspace ONE UEM supports outbound proxies for the two VMware Tunnel components: Proxy and Per-App Tunnel.

The following table illustrates outbound proxy support for the VMware Tunnel Proxy on Linux:

<table>
<thead>
<tr>
<th>Proxy Configuration</th>
<th>Supported?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outbound Proxy with no auth</td>
<td>✔</td>
</tr>
<tr>
<td>Outbound Proxy with basic auth</td>
<td>✔</td>
</tr>
<tr>
<td>Outbound Proxy with NTLM auth</td>
<td>✔</td>
</tr>
<tr>
<td>Multiple Outbound Proxies</td>
<td>✔ (Use Proxy Tool)</td>
</tr>
<tr>
<td>PAC Support</td>
<td>✔ (Use Proxy Tool)</td>
</tr>
</tbody>
</table>

During installation, the installer prompts you whether to use an outbound proxy. For relay-endpoint configurations, the outbound proxy communication is configured on the endpoint server that resides in your internal network and can communicate with the outbound proxy.
Outbound Proxy with Authentication

If you want to use an outbound proxy, then enter ‘Yes’ when prompted during Tunnel installation, which then prompts you for the following information:

- Proxy Host
- Proxy Port
- Whether the proxy requires any authentication (Basic/NTLM) and appropriate credentials

Entering this information and completing the installer enables outbound proxy support. This sends all traffic from the VMware Tunnel Proxy server – except requests to the Workspace ONE UEM API/AWCM servers – to the outbound proxy you configure. If you want to send the requests to the API/AWCM servers through your outbound proxy as well, then you must enable the Enable API and AWCM outbound calls via proxy setting on the VMware Tunnel > Advanced settings page.

PAC Files and Multiple Outbound Proxies

A PAC file is a set of rules that a browser checks against to determine where traffic is routed. If you want to use a proxy auto configuration (PAC) file, then provide the path to the PAC file location when prompted during Tunnel installation. If you want to use a PAC file for an outbound proxy that requires authentication, or if you want to use multiple proxies with different hostnames, or if some proxies require authentication (basic/NTLM) and some do not, then use the Proxy Tool for PAC Files and Multiple Outbound Proxies.

Use the Proxy Tool for PAC Files and Multiple Outbound Proxies for VMware Tunnel Proxy

You can use the proxy tool if VMware Tunnel routes its outbound requests through an outbound proxy that has rules set in a PAC file that also requires authentication.

Prerequisites

If you are deploying VMware Tunnel with Unified Access Gateway, complete the following steps:

- To use the PAC file, edit the proxy.properties file and change the PROXY_SEARCH_STRATEGY to 2.
- Uncomment the PAC_URL and enter the PAC file URL or the absolute path of the PAC file on the VMware Tunnel server.

Procedure

1. Within Linux CLI mode, navigate to /opt/vmware/tunnel/proxy/tools.
2. Convert the proxy tool to an executable file by using the following command:
   ```
   chmod a+x proxytool.sh
   ```
3. Run proxy-tools by using the following command:
   ```
   sudo sh Proxytools.sh
   ```
4  Select your authentication method, which can be **None**, **Basic**, or **NTLM** for a single service account. Also enter your credentials, if applicable, and the **URI** of the proxy for testing.

5  Select **Save**.

6  To restart the Proxy service, run the following command: `sudo systemctl restart proxy.service`.

**What to do next**

After saving, run the following command to check if the proxy settings is updated correctly:

```bash
cat /opt/vmware/tunnel/proxy/conf/proxy-credentials.xml
```

**VMware Tunnel Proxy Tools**

The Proxy Tool is an application you can run to configure multiple outbound proxies for the VMware Tunnel.

For more information on configuring the outbound proxy, see **Use the Proxy Tool for PAC Files and Multiple Outbound Proxies for VMware Tunnel Proxy**.

Use the following commands to navigate the application:

- Use arrows, tab, shift+tab to navigate.
- Use Enter or spacebar to select/deselect a proxy.
- Use Alt+Enter to see details of the highlighted proxy.
- Use Ctrl+V to paste on text controls.
- Use F1 to invoke context-sensitive help.
- Use Esc to exit a window.
SSL Offloading the Proxy

Use SSL Offloading to ease the burden of encrypting and decrypting traffic from the VMware Tunnel server. Only the VMware Tunnel Proxy supports SSL Offloading.

SSL Offloading and SSL re-encryption is not supported for the Per-App Tunnel because it uses SSL certificate pinning on the client and server side, creating an end-to-end encrypted tunnel. No SSL manipulation is supported for the Per-App Tunnel because it uses SSL certificate pinning between the client and server side. This creates an end-to-end encrypted tunnel that can only be decrypted by the server itself. All traffic to the Per-App Tunnel on port 8443 must be allowed to pass through to the VMware Tunnel server.

The Tunnel Proxy encrypts traffic to HTTP endpoints using HTTP tunneling with an SSL certificate and sends that traffic over port 2020 as HTTPS. To enable SSL Offloading, enable SSL Offloading in the VMware Tunnel console configuration and select SSL Offloading during installation on the Relay server. Enabling this setting ensures the relay expects all unencrypted traffic to the port you configured. The original host headers of the request must be forwarded to the tunnel server from wherever traffic is SSL off loaded.

You can perform SSL offloading with products such as F5’s BIG-IP Local Traffic Manager (LTM), or Microsoft Forefront Unified Access Gateway, Threat Management Gateway (TMG) or Internet Security and Acceleration Server (ISA) solutions. Support is not exclusive to these solutions. VMware Tunnel Proxy is compatible with general SSL offloading solutions if the solution supports the HTTP CONNECT method. In addition, ensure that your SSL offloading solution is configured to forward original host headers to the VMware Tunnel relay server. The SSL Certificate configured in the Workspace ONE UEM console for the Tunnel Proxy must be imported to the SSL Termination Proxy.

Ensure settings are configured properly in the UEM console, VMware Tunnel server, and your SSL Offloading solution in order to successfully implement SSL Offloading for the Tunnel Proxy.

SSL Offloading Requirements

- HTTP CONNECT method supported by SSL offloading solution
- SSL Offloading solution configured to forward original host headers
- VMware Tunnel Proxy SSL certificate installed on your SSL termination proxy.

If you are using a Workspace ONE UEM Certificate and not a public SSL certificate, then you can export the SSL certificate from the UEM console by navigating to Settings > System > Enterprise Integration > VMware Tunnel > Configuration then selecting the Advanced tab and selecting the Export Certificate button under Authentication.

The following diagram illustrates how SSL offloading affects traffic in a relay-endpoint configuration.
Note SSL offloading for basic configuration has communication from the SSL termination proxy going directly to the VMware Tunnel endpoint.

SSL Offloading Traffic Flow

1. A device requests access to internal resources from AirWatch Software Development Kit enabled application, which can be either an HTTP or HTTPS endpoint.
   - Requests to HTTP and HTTPS endpoints are sent over port 2020 by default, which is the port you configure in the Workspace ONE UEM console during VMware Tunnel Proxy configuration.

2. The traffic reaches an SSL Termination Proxy (customers use their own SSL termination proxy), which must meet the SSL Offloading requirements.

   If you are using a Workspace ONE UEM Certificate and not a public SSL certificate, then you can export the SSL certificate from the UEM console by navigating to Settings > System > Enterprise Integration > VMware Tunnel > Configuration then selecting the Advanced tab and selecting the Export Certificate button under Authentication.

3. Requests to HTTP(S) endpoints have their SSL certificate offloaded and are sent to the relay server unencrypted over port 2020 by default. Traffic sent to the endpoint over port 2010 is encrypted with the UEM issued Tunnel certificate. SSL Offloading between the Relay and Endpoint is not supported for VMware Tunnel Proxy.

4. The traffic continues from the relay server to the endpoint server on port 2010 by default.

5. The endpoint server communicates with your back end systems to access the requested resources.
VMware Tunnel Deployment with Unified Access Gateway

VMware offers a hardened virtual appliance deployment known as Unified Access Gateway that hosts Workspace ONE services like Per-App Tunnel, and is the preferred method for deployment. Deploying Tunnel on Unified Access Gateway can be done from either vSphere or Hyper-V and can be automated using PowerShell.

Note Unified Access Gateway offers a FIPS appliance where only VMware Tunnel is available. Tunnel Proxy is not available on this version of the appliance.

For more information on Unified Access Gateway, see Deploying and Configuring Unified Access Gateway documentation on Unified Access Gateway Documentation.

This chapter includes the following topics:

- System Requirements for Deploying VMware Tunnel with Unified Access Gateway
- Installing VMware Tunnel with Unified Access Gateway
- Configure VMware Tunnel Settings in the Unified Access Gateway UI
- Upgrade VMware Tunnel Deployed with Unified Access Gateway Using vSphere
- Upgrade VMware Tunnel Deployed with Unified Access Gateway Using PowerShell Script

System Requirements for Deploying VMware Tunnel with Unified Access Gateway

To deploy VMware Tunnel with Unified Access Gateway, ensure that your system meets the following requirements:

Hypervisor Requirements

Unified Access Gateway that deploys the VMware Tunnel requires a hypervisor to deploy the virtual appliance. You must have a dedicated admin account with full privileges to deploy the OVF.

Supported Hypervisors:

- VMware vSphere 6.0+ web client.
- Microsoft Hyper-V on Windows Server 2012 R2 or Windows Server 2016.
Software Requirements

Ensure that you have the most recent version of Unified Access Gateway. VMware Tunnel supports backwards compatibility between Unified Access Gateway and the Workspace ONE UEM console. The backward compatibility allows you to upgrade your VMware Tunnel server shortly after upgrading your Workspace ONE UEM console. To ensure parity between Workspace ONE UEM console and VMware Tunnel, consider planning an early upgrade.

Hardware Requirements

The OVF package for Unified Access Gateway automatically selects the virtual machine configuration that VMware Tunnel requires. Although you can change these settings, do not change the CPU, memory, or disk space to smaller values than the default OVF settings.

To change the default settings, power off the VM in vCenter. Right-click the VM and select **Edit Settings**.

The default configuration uses 4 GB of RAM and 2 CPUs. You must change the default configuration to meet your hardware requirements. To handle all the device loads and maintenance requirements, consider running a minimum of two VMware Tunnel servers.

<table>
<thead>
<tr>
<th>Number of Devices</th>
<th>Up to 40,000</th>
<th>40,000-80,000</th>
<th>80,000-120,000</th>
<th>120,000-160,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Servers</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>CPU Cores</td>
<td>4 CPU Cores*</td>
<td>4 CPU Cores each</td>
<td>4 CPU Cores each</td>
<td>4 CPU Cores each</td>
</tr>
<tr>
<td>RAM (GB)</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Hard Disk Space (GB)</td>
<td>10 GB for distro (Linux only)</td>
<td>400 MB for installer</td>
<td>~10 GB for log file space**</td>
<td></td>
</tr>
</tbody>
</table>

*It is possible to deploy only a single VMware Tunnel appliance as part of a smaller deployment. However, consider deploying at least two load-balanced servers with four CPU Cores each regardless of the number of devices for uptime and performance purposes.

**10 GB for a typical deployment. Scale the log file size based on your log use and requirements for storing the logs.

Network Requirements for VMware Tunnel

For configuring the ports listed below, all the traffic is uni-directional (outbound) from the source component to the destination component.
### Table 6-1. VMware Tunnel Basic Endpoint Configuration

<table>
<thead>
<tr>
<th>Source Component</th>
<th>Destination Component</th>
<th>Protocol</th>
<th>Port</th>
<th>Verification</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Devices (from Internet and Wi-Fi)</td>
<td>VMware Tunnel Proxy</td>
<td>HTTPS</td>
<td>2020*</td>
<td>After installation, run the following command to validate: ```netstat -tlpn</td>
<td>grep [Port]```</td>
</tr>
<tr>
<td>Devices (from Internet and Wi-Fi)</td>
<td>VMware Tunnel Per-App Tunnel</td>
<td>TCP/UDP</td>
<td>8443*</td>
<td>After installation, run the following command to validate: ```netstat -tlpn</td>
<td>grep [Port]```</td>
</tr>
<tr>
<td>Admin UI</td>
<td>Unified Access Gateway</td>
<td>TCP</td>
<td>9443</td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>VMware Tunnel</td>
<td>Workspace ONE UEM REST API Endpoint SaaS: <a href="https://asXXX.awmdm.com">https://asXXX.awmdm.com</a> On-Prem: Most commonly your DS or Workspace ONE UEM console</td>
<td>HTTP or HTTPS</td>
<td>SaaS: 443 On-Prem: 80 or 443</td>
<td>curl -Ivv https://&lt;API URL&gt;/api/mdm/ping</td>
<td>5</td>
</tr>
<tr>
<td>VMware Tunnel</td>
<td>Internal resources</td>
<td>HTTP, HTTPS, or TCP/UDP</td>
<td>80, 443, Any TCP/UDP</td>
<td>Confirm that the VMware Tunnel can access internal resources over the required port.</td>
<td>4</td>
</tr>
<tr>
<td>VMware Tunnel</td>
<td>Syslog Server</td>
<td>UDP</td>
<td>514*</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Workspace ONE UEM console</td>
<td>VMware Tunnel Proxy</td>
<td>HTTPS</td>
<td>2020</td>
<td>On-premises customers can test the connection using the following telnet command: <code>&lt;Tunnel Proxy URL&gt; &lt;Port&gt;</code></td>
<td></td>
</tr>
</tbody>
</table>

### Table 6-2. VMware Tunnel Cascade Configuration

<table>
<thead>
<tr>
<th>Source Component</th>
<th>Destination Component</th>
<th>Protocol</th>
<th>Port</th>
<th>Verification</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>VMware Tunnel Front-End</td>
<td>AirWatch Cloud Messaging Server**</td>
<td>TLS v1.2</td>
<td>SaaS: 443 On-Prem: 2001*</td>
<td>Verify by using wget to https://&lt;AWCM URL&gt;:&lt;port&gt;/awcm/status and ensure that you receive HTTP 200 response.</td>
<td>2</td>
</tr>
<tr>
<td>VMware Tunnel Front-End</td>
<td>VMware Tunnel Back-End</td>
<td>TLS v1.2</td>
<td>8443*</td>
<td>Telnet from VMware Tunnel Front-End to the VMware Tunnel Back-End server on port.</td>
<td>3</td>
</tr>
</tbody>
</table>
### Table 6-2. VMware Tunnel Cascade Configuration (continued)

<table>
<thead>
<tr>
<th>Source Component</th>
<th>Destination Component</th>
<th>Protocol</th>
<th>Port</th>
<th>Verification</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>VMware Tunnel Back-End</td>
<td>Internal websites/web apps</td>
<td>TCP/UDP</td>
<td>80 or 443</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>VMware Tunnel Back-End</td>
<td>Internal resources</td>
<td>TCP/UDP</td>
<td>80, 443, Any TCP</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>VMware Tunnel Front-End and Back-End</td>
<td>Workspace ONE UEM REST API Endpoint</td>
<td>TLS v1.2</td>
<td>80 or 443</td>
<td>5</td>
<td><code>curl --ipv https://&lt;API URL&gt;/api/mdm/ping</code> The expected response is HTTP 401-unauthorized.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Source Component</th>
<th>Destination Component</th>
<th>Protocol</th>
<th>Port</th>
<th>Verification</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>VMware Tunnel Relay</td>
<td>AirWatch Cloud Messaging Server**</td>
<td>HTTP or HTTPS</td>
<td>SaaS: 443</td>
<td>2</td>
<td><code>curl --ipv https://&lt;AWCM URL&gt;:&lt;port&gt;/awcm/status</code> The expected response is HTTP 200-OK.</td>
</tr>
<tr>
<td>VMware Tunnel Endpoint and Relay</td>
<td>Workspace ONE UEM REST API Endpoint</td>
<td>HTTP or HTTPS</td>
<td>80 or 443</td>
<td>5</td>
<td><code>curl --ipv https://&lt;API URL&gt;/api/mdm/ping</code> The expected response is HTTP 401-unauthorized. The VMware Tunnel Endpoint requires access to the REST API Endpoint only during the initial deployment.</td>
</tr>
<tr>
<td>VMware Tunnel Relay</td>
<td>VMware Tunnel Endpoint</td>
<td>HTTPS</td>
<td>2010*</td>
<td>3</td>
<td>Telnet from VMware Tunnel Relay to the VMware Tunnel Endpoint server on port.</td>
</tr>
<tr>
<td>VMware Tunnel Endpoint</td>
<td>Internal resources</td>
<td>HTTP, HTTPS, or TCP</td>
<td>80, 443, Any TCP</td>
<td>4</td>
<td>Confirm that the VMware Tunnel can access internal resources over the required port.</td>
</tr>
<tr>
<td>VMware Tunnel</td>
<td>Syslog Server</td>
<td>UDP</td>
<td>514*</td>
<td>6</td>
<td>On-premises customers can test the connection using the telnet command: <code>&lt;Tunnel Proxy URL&gt; &lt;Port&gt;</code></td>
</tr>
<tr>
<td>Workspace ONE UEM console</td>
<td>VMware Tunnel Proxy</td>
<td>HTTPS</td>
<td>2020</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>
*This port can be changed if needed based on your environment's restrictions.

**Note Reference:**

1. Devices connect to the public DNS configured for VMware Tunnel over the specified port. If 443 is used, Per-App Tunnel component listens on port 8443.
2. For the VMware Tunnel to query the Workspace ONE UEM console for compliance and tracking purposes.
3. For VMware Tunnel Relay topologies to forward device requests to the internal VMware Tunnel endpoint only.
4. For applications using VMware Tunnel to access internal resources.
5. The VMware Tunnel must communicate with the API for initialization. Ensure that there is connectivity between the REST API and the VMware Tunnel server. Navigate to **Groups & Settings > All Settings > System > Advanced > Site URLs** to set the REST API server URL. This page is not available to SaaS customers. The REST API URL for SaaS customers is most commonly your Console or Devices Services server URL.
6. This is required for a successful "Test Connection" to the VMware Tunnel Proxy from the Workspace ONE UEM console. The requirement is optional and can be omitted without loss of functionality to devices. For SaaS customers, the Workspace ONE UEM console must already have inbound connectivity to the VMware Tunnel Proxy on port 2020 due to the inbound Internet requirement on port 2020.

**Network Interface Connection Requirements**

You can use one, two, or three network interfaces, and the VMware Tunnel virtual appliance requires a separate static IP address for each. Many DMZ implementations use separated networks to secure the different traffic types. Configure the virtual appliance according to the network design of the DMZ in which it is deployed. Consult your network admin for information regarding your network DMZ.

- One network interface is appropriate for POCs (proof of concept) or testing. With one NIC, external, internal, and management traffic is all on the same subnet.
- With two network interfaces, external traffic is on one subnet, and internal and management traffic are on another subnet.
- With a third NIC, external, internal, and management traffic all has their own subnets.

**Installing VMware Tunnel with Unified Access Gateway**

After configuring your VMware Tunnel settings, deploy VMware Tunnel as an edge service on the VMware Unified Access Gateway appliance to simplify the installation process. VMware supports installation using either VMware vSphere and Unified Access Gateway Admin UI or PowerShell scripting.
Install VMware Tunnel using vSphere

After configuring the VMware Tunnel in the Workspace ONE UEM console and downloading the VMware Unified Access Gateway OVA file, use VMware vSphere to install the Unified Access Gateway onto your server. The Unified Access Gateway simplifies installation of the VMware Tunnel.

Important VMware Tunnel Unified Access Gateway deployment does not support the VMware vSphere desktop client. You must use the VMware vSphere web client or the PowerShell deployment method.

Prerequisites
- Dedicated vSphere Admin Account with full privileges to deploy OVF
- Communication between the Windows machine used to deploy the OVA and your vSphere instance
- vSphere 6.0+.
- vSphere ESX host with a vCenter Server.

Determine the number of network interfaces and static IP addresses to configure for the Unified Access Gateway appliance.

Procedure
1. Log in to the vSphere Web client.
2. Navigate to VMs and Templates.
3. Select the folder where you want to deploy the Unified Access Gateway OVA file. Right-click the file and select Deploy OVF Template.
4. Select the OVA file on your local machine or enter the URL for the OVA file. Click Next.
5. Review the template details and select Next.
6. Enter a unique Name for the deployment, and then select the folder or data center to hold the OVA file and select Next.
7. Select the number of Network Interface Controllers (NICs) you want to associate with the appliance for your deployment configuration. Click Next. For more information, see the Unified Access Gateway Documentation Center at Unified Access Gateway Documentation.
8. On the Select a Resource screen, select a location to run the template.
9. Select the storage and disk format options. When finished, select Next.

<table>
<thead>
<tr>
<th>Settings</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Virtual Disk Format</td>
<td>For evaluation and testing, select the Thin Provision format. For production environments, select one of the Thick Provision formats</td>
</tr>
<tr>
<td>VM Storage Policy</td>
<td>The values in this text box are defined by your vSphere administrator.</td>
</tr>
</tbody>
</table>
10 Configure the **Network Mapping** settings. Enter the vSphere network names. The network protocol profiles associated with every referenced network name determine the DNS servers, gateway, and subnet mask. If it is absent, you must enter the values in the next step. When finished, select **Next**.

11 Configure the **Properties** settings.

These settings include the **Network Properties** and the **Password Options**.

a  Customize the **Network Properties** as they relate to your VMware Tunnel network configuration.

b  Configure the password for the root user of the VM.

c  Configure the password for the REST API access.

The REST API password is the password for the admin UI. You must follow the password requirements:

- The password must be 8 characters long.
- The password must contain at least one special character which includes !@#$*().
- The password must contain at least one lowercase character.
- The password must contain at least one uppercase character.

**Caution**  If you do not properly follow the password requirements, installation fails without explanation. There is no validation at the end of this deployment. If you mistakenly enter in the wrong password, there is no warning informing you of an incorrect password.

d  When finished, select **Next**.

12 Review the OVA settings and select the **Power on after deployment**.

13 Select **Finish** to deploy the Unified Access Gateway.

**What to do next**

To complete the configuration of the VMware Tunnel, you must log into the Unified Access Gateway admin UI to customize your settings.

**Install VMware Tunnel using PowerShell Script**

As an alternative to using the vSphere client to deploy the VMware Tunnel OVA file, you can use a PowerShell script. The PowerShell method provides settings validation checks to prevent errors during deployment. PowerShell enables you to deploy multiple instances of VMware Tunnel quickly and easily. Use the same .ini template to run the script multiple times.

The PowerShell method requires adding your VMware Tunnel configuration settings to the .ini template and running the script. When the script runs, it prompts the user for necessary authentication to appliance root user, REST API (admin UI), Workspace ONE UEM administrator, optional outbound proxy password, and vCenter. Each password is then validated so you can easily troubleshoot why the deployment failed.
Configure the vSphere .INI Template

After configuring the VMware Tunnel in the Workspace ONE UEM console and downloading the OVA file, configure the vSphere template.ini file with your Unified Access Gateway settings. The PowerShell script uses the template to configure your Unified Access Gateway deployment.

Procedure

1. Download the Unified Access Gateway Using vSphere ZIP from Workspace ONE UEM Resources.
2. Unzip the file and locate the template.ini file.
3. Right click the file and select Open With. Select notepad or your preferred file editor.
4. Configure the template.ini settings.

<table>
<thead>
<tr>
<th>Settings</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>name=&lt;VIRTUAL_MACHINE_NAME&gt;</td>
<td>Enter the Unified Access Gateway unique name. Example: name=TunnelAppliance</td>
</tr>
<tr>
<td>source=&lt;OVA_FILE_PATH&gt;</td>
<td>Enter the full file path to the OVA file on your local machine. Example: source=C:\access-point.ova</td>
</tr>
<tr>
<td>target=vi://&lt;USERNAME&gt;:PASSWORD@&lt;VSPHERE_DOMAIN&gt;/&lt;LOCATION/TO/PLACE/APPLIANCE/IN/VSPHERE&gt;</td>
<td>Enter the vCenter user name and address/hostname. Then enter the location to place the appliance in vSphere. Do not remove the PASSWORD. PASSWORD in uppercase results in a password prompt during deployment so that passwords do not need to be specified in this INI file. Example: target=vi://admin@vmware.com:<a href="mailto:PASSWORD@vsphere.com">PASSWORD@vsphere.com</a>/MyMachines/host/Development/Resources/MyResourcePool</td>
</tr>
<tr>
<td>deploymentOption=&lt;NUMBER_OF_NICS&gt;</td>
<td>Enter the number of Network Interface Controllers you want to associate with the appliance for your deployment configuration. Your options are: onenic, twonic, threenic. Then enter the address for each NIC you are using. Delete the excess lines if you are not using all three. The different IP addresses entered change based on your NIC settings. If you use one NIC, then the IP address is used for all communications. If you use two NICs, then ip0 is for external communications and ip1 is for internal communications. If you use three NICs, then ip0 is for external communications. Ip1 is for the admin UI only and ip2 is for internal communications. For best results, consult your network admins. Example: deploymentOption=threenic For dns=, enter the DNS server address to configure the appliance resolv.conf file. If you use multiple DNS servers, enter the addresses separated by a space value. Do not use commas.</td>
</tr>
<tr>
<td>ds=&lt;DATA_STORE_NAME&gt;</td>
<td>Enter the name of your vSphere datastore.</td>
</tr>
<tr>
<td>Settings</td>
<td>Descriptions</td>
</tr>
<tr>
<td>------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>netInternet=&lt;NIC1_IP_NETWORK_NAME&gt;</td>
<td>Enter the vSphere network names. If you are not using network profiles, manually enter the netmask or prefix for the respective NICs and the IPv4/IPv6 default gateway. This specifies network settings such as IPv4 subnet mask, gateway etc.</td>
</tr>
<tr>
<td>netManagementNetwork=&lt;NIC2_IP_NETWORK_NAME&gt;</td>
<td></td>
</tr>
<tr>
<td>netBackendNetwork=&lt;NIC3_IP_NETWORK_NAME&gt;</td>
<td></td>
</tr>
<tr>
<td>netmask0=&lt;NIC1_NETMASK&gt;</td>
<td>Enter the subnet mask for the networks added when configuring the netInternet, netManagementNetwork, and netBackendNetwork settings.</td>
</tr>
<tr>
<td>netmask1=&lt;NIC2_NETMASK&gt;</td>
<td></td>
</tr>
<tr>
<td>netmask2=&lt;NIC3_NETMASK&gt;</td>
<td></td>
</tr>
<tr>
<td>defaultGateway</td>
<td>Enter the gateway for the network added when configuring the netInternet setting.</td>
</tr>
<tr>
<td>honorCipherOrder=&lt;true_or_false&gt;</td>
<td>Enter true to force the TLS cipher order to be the order specified by the server.</td>
</tr>
<tr>
<td>tunnelGatewayEnabled=&lt;true_or_false&gt;</td>
<td>Enter true if you are using the VMware Tunnel- Proxy. Example: tunnelGatewayEnabled=true</td>
</tr>
<tr>
<td>apiServerUrl=&lt;API_SERVER_URL&gt;</td>
<td>Enter the API server URL. To find the URL, navigate to Groups &amp; Settings &gt; All Settings &gt; Advanced &gt; Site URLs &gt; REST API URL.</td>
</tr>
<tr>
<td>apiServerUsername=&lt;API_SERVER_USERNAME&gt;</td>
<td>Enter the user name of an Workspace ONE UEM console admin user account. This user is an admin user with API permissions. Consider using an account with Console Administrator privileges.</td>
</tr>
<tr>
<td>organizationGroupCode=&lt;ORGANIZATION_GROUP_CODE&gt;</td>
<td>Enter the Organization Group ID the VMware Tunnel is configured for.</td>
</tr>
<tr>
<td>airwatchServerHostname= &lt;HOSTNAME&gt;</td>
<td>Enter the hostname or IP address for the Unified Access Gateway. Ensure that this field matches what is entered in the Workspace ONE UEM console to prevent installation issues.</td>
</tr>
<tr>
<td>outboundProxyPort=&lt;OUTBOUND_PROXY_PORT&gt;</td>
<td>Enter the outbound proxy port if you use an outbound proxy for the initial setup API call or for tunnel traffic. This field is commented out by default.</td>
</tr>
<tr>
<td>outboundProxyHost=&lt;OUTBOUND_PROXY_HOST&gt;</td>
<td>Enter the outbound proxy host if you use an outbound proxy for the initial setup API call or for tunnel traffic. This field is commented out by default.</td>
</tr>
<tr>
<td>airwatchOutboundProxy=&lt;true or false&gt;</td>
<td>Enter true to use these proxy settings as the outbound proxy for your VMware Tunnel - Proxy deployment. This field is commented out by default.</td>
</tr>
<tr>
<td>ntlmAuthentication=&lt;true or false&gt;</td>
<td>Enter true if you use NTLM authentication for the initial setup API call or for tunnel traffic. This field is commented out by default.</td>
</tr>
</tbody>
</table>
Configure the Hyper-V .INI Template

After configuring the VMware Tunnel in the Workspace ONE UEM console, download and configure the Hyper-V template.ini file with your Unified Access Gateway settings. The PowerShell script uses the template to configure your Unified Access Gateway deployment.


Procedure

1. Download the Unified Access Gateway Using Hyper-V ZIP from Workspace ONE UEM Resources.
   - Workspace ONE UEM Resources are available at VMware Tunnel on Unified Access Gateway v3.3 (Using HyperV).
2. Unzip the file and locate the template.ini file.
3. Right click the file and select Open With. Select notepad or your preferred file editor.
4. Configure the template.ini settings.

<table>
<thead>
<tr>
<th>Settings</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>hostEntry1=&lt;HOSTNAME&gt;</td>
<td>Enter additional host entries for the appliance. You can add multiple host entries. Increase the number for each entry. For example hostEntry2, hostEntry3, and so on. This field is commented out by default.</td>
</tr>
<tr>
<td>trustedCert1=&lt;CERT_FILE_PATH&gt;</td>
<td>Enter the file path for the trusted certificates. You can add multiple trusted certificates. Increase the for each entry. For example, trustedCert2, trustedCert3, and so on. This field is commented out by default.</td>
</tr>
</tbody>
</table>

5. Save the file in the same folder as the PowerShell script and run the PowerShell script.
### Settings

<table>
<thead>
<tr>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>deploymentOption=&lt;NUMBER_OF_NICS&gt;</td>
<td>Enter the number of Network Interface Controllers you want to associate with the appliance for your deployment configuration. Your options are:</td>
</tr>
<tr>
<td>dns=&lt;DNS_IP&gt;</td>
<td>onenic</td>
</tr>
<tr>
<td>ip0=&lt;NIC1_IP_ADDRESS&gt;</td>
<td>twonics</td>
</tr>
<tr>
<td>ip1=&lt;NIC2_IP_ADDRESS&gt;</td>
<td>threenics</td>
</tr>
<tr>
<td>ip2=&lt;NIC3_IP_ADDRESS&gt;</td>
<td>Then enter the address for each NIC you are using. Delete the excess lines if you are not using all three. The different IP addresses entered change based on your NIC settings.</td>
</tr>
<tr>
<td></td>
<td>If you use one NIC, then the IP address is used for all communications.</td>
</tr>
<tr>
<td></td>
<td>If you use two NICs, then ip0 is for external communications and ip1 is for internal communications.</td>
</tr>
<tr>
<td></td>
<td>If you use three NICs, then ip0 is for external communications. Ip1 is for the admin UI only and ip2 is for internal communications.</td>
</tr>
<tr>
<td></td>
<td>For best results, consult your network admins.</td>
</tr>
<tr>
<td></td>
<td>Example: deploymentOption=threenic</td>
</tr>
<tr>
<td>dns=</td>
<td>For dns=, enter the DNS server address to configure the appliance resolv.conf file. If you use multiple DNS servers, enter the addresses separated by a space value. Do not use commas.</td>
</tr>
<tr>
<td>ds=&lt;DATA_STORE_NAME&gt;</td>
<td>Enter the name of your Hyper-V datastore.</td>
</tr>
<tr>
<td>netInternet=&lt;NIC1_IP_NETWORK_NAME&gt;</td>
<td>Enter the virtual switch names. A virtual switch must to be created for the referenced networks.</td>
</tr>
<tr>
<td>netManagementNetwork=&lt;NIC2_IP_NETWORK_NAME&gt;</td>
<td>Enter the subnet mask for the networks added when configuring the netInternet, netManagementNetwork, and netBackendNetwork settings.</td>
</tr>
<tr>
<td>netBackendNetwork=&lt;NIC3_IP_NETWORK_NAME&gt;</td>
<td>Enter the gateway for the network added when configuring the netInternet setting.</td>
</tr>
<tr>
<td>netmask0=&lt;NIC1_NETMASK&gt;</td>
<td>Enter true to force the TLS cipher order to be the order specified by the server.</td>
</tr>
<tr>
<td>netmask1=&lt;NIC2_NETMASK&gt;</td>
<td>tunnelGatewayEnabled=&lt;true_or_false&gt;</td>
</tr>
<tr>
<td>netmask2=&lt;NIC3_NETMASK&gt;</td>
<td>Enter true if you are using the VMware Tunnel - Proxy. Example: tunnelGatewayEnabled=true</td>
</tr>
<tr>
<td>defaultGateway</td>
<td>Enter the API server URL. To find the URL, navigate to Groups &amp; Settings &gt; All Settings &gt; Advanced &gt; Site URLs &gt; REST API URL.</td>
</tr>
<tr>
<td>honorCipherOrder=&lt;true_or_false&gt;</td>
<td>Enter the user name of an Workspace ONE UEM console admin user account. This user is an admin user with API permissions. Consider using an account with Console Administrator privileges.</td>
</tr>
<tr>
<td>apiServerUsername=&lt;API_SERVER_USERNAME&gt;</td>
<td>Enter the Organization Group ID the VMware Tunnel is configured for.</td>
</tr>
<tr>
<td>airwatchServerHostname= &lt;HOSTNAME&gt;</td>
<td>Enter the hostname or IP address for the Unified Access Gateway. Ensure that this field matches what is entered in the Workspace ONE UEM console to prevent installation issues.</td>
</tr>
</tbody>
</table>
VMware Tunnel on Linux

<table>
<thead>
<tr>
<th>Settings</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>outboundProxyPort=&lt;OUTBOUND_PROXY_PORT&gt;</td>
<td>Enter the outbound proxy port if you use an outbound proxy for the initial setup API call or for tunnel traffic. This field is commented out by default.</td>
</tr>
<tr>
<td>outboundProxyHost=&lt;OUTBOUND_PROXY_HOST&gt;</td>
<td>Enter the outbound proxy host if you use an outbound proxy for the initial setup API call or for tunnel traffic. This field is commented out by default.</td>
</tr>
<tr>
<td>airwatchOutboundProxy=&lt;true or false&gt;</td>
<td>Enter true to use these proxy settings as the outbound proxy for your VMware Tunnel - Proxy deployment. This field is commented out by default.</td>
</tr>
<tr>
<td>ntlmAuthentication=&lt;true or false&gt;</td>
<td>Enter true if you use NTLM authentication for the initial setup API call or for tunnel traffic. This field is commented out by default.</td>
</tr>
<tr>
<td>hostEntry1=&lt;HOSTNAME&gt;</td>
<td>Enter additional host entries for the appliance. You can add multiple host entries. Increase the number for each entry. For example, hostEntry2, hostEntry3, and so on. This field is commented out by default.</td>
</tr>
<tr>
<td>trustedCert1=&lt;CERT_FILE_PATH&gt;</td>
<td>Enter the file path for the trusted certificates. You can add multiple trusted certificates. Increase the for each entry. For example, trustedCert2, trustedCert3, and so on. This field is commented out by default.</td>
</tr>
</tbody>
</table>

5 Save the file in the same folder as the PowerShell script and run the PowerShell script.

Run the VMware Tunnel PowerShell Script

After configuring the .ini template file, run the PowerShell script to configure the OVA and deploy VMware Tunnel. The PowerShell script provides validation checks that are not available when deploying the OVA using vSphere.

Prerequisites

Configure the INI file to pass the VMware Tunnel configuration to the OVA file.

The following tools are required:

- Windows administrator privileges
- PowerShell 4
  - The PowerShell script runs on Windows 8.1 or later machines or Windows Server 2008 R2 or later.
  - The machine can also be a vCenter Server running on Windows or a separate Windows machine.
- VMware OVF Tool 4.1 (available on my.vmware.com)
- Configured .ini template file to pass the configuration values to the appliance (part of the OVA download package available on Workspace ONE UEM Resources at https://resources.air-watch.com/view/sbfsfykltpqfxhvg9tpy/en)
PowerShell script to configure the appliance (part of the OVA download package available on Workspace ONE UEM Resources at https://resources.air-watch.com/view/sbfsyktpqf9hvg9t9yen)

Communication between the Windows machine used to deploy the OVA and your vSphere instance

Supported Hypervisor:
- vSphere v5, 5.1, 5.5, or 6 - vSphere ESX host with a vCenter Server
- Microsoft Hyper-V - Windows Server 2012 R2 or Windows Server 2016

Procedure

1. Open PowerShell as an administrator.
2. Navigate to the folder containing your PowerShell script and modified .ini template.
3. Enter the following command:
   a. For vSphere deployments: `.\uagdeploy.ps1 <Ini file name>
   b. For Hyper-V: `.\uagdeployhv.ps1 <Ini file name>

   `.\uagdeploy.ps1 AWTunnel.ini

4. Enter the password for each prompt:

<table>
<thead>
<tr>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appliance Password</td>
<td>Enter password for the root user.</td>
</tr>
<tr>
<td>REST API</td>
<td>Enter the admin UI password.</td>
</tr>
<tr>
<td>API server password</td>
<td>Enter the API server password.</td>
</tr>
<tr>
<td>Outbound proxy</td>
<td>Optional. If using a proxy with authentication, enter outbound proxy.</td>
</tr>
<tr>
<td>vSphere User password</td>
<td>If using vSphere, enter the password for the vSphere User that can deploy VMs.</td>
</tr>
</tbody>
</table>

After entering each password, PowerShell validates the entered password.

Once all passwords are entered, the Unified Access Gateway uploads to the hypervisor and the machine configures itself and installs. You must wait for the script to finish for the network to initialize. Progress can be tracked by viewing the machine from vSphere or Hyper-V.

Running the PowerShell with the values matching an existing instance in vSphere destroys the existing appliance and deploys a new instance instead. You cannot run the same INI template for Hyper-V. The Unified Access Gateway name must be different each time you deploy through PowerShell.

After a successful deployment, the Workspace ONE UEM Appliance Agent starts immediately and the monitoring services for VMware Tunnel start after 60 seconds.
Configure VMware Tunnel Settings in the Unified Access Gateway UI

After deploying the VMware Tunnel on the VMware Unified Access Gateway, you must configure the custom VMware Tunnel settings to meet your organizational needs. Configure these settings in the Unified Access Gateway admin UI hosted on your Unified Access Gateway.

Procedure

1. Navigate to the URL of your Unified Access Gateway admin UI. The url uses this format: https://[IP ADDRESS]:9443/admin/.
2. Enter "admin" as the username.
3. Enter your admin UI password. Select Login.
4. Select Configure Manually.
5. Next to Edge Service Settings, select Show.
6. Next to VMware Tunnel Settings, select the settings icon ( ) to configure your VMware Tunnel deployment.
7. Customize VMware Tunnel Settings.

<table>
<thead>
<tr>
<th>Settings</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enable VMware Tunnel Settings</td>
<td>Set to Yes to use the configured VMware Tunnel settings. After configuration, setting this option to No does not disable the VMware Tunnel.</td>
</tr>
<tr>
<td>API Server URL</td>
<td>Enter the URL to your Workspace ONE UEM API server. To find the URL, navigate to Groups &amp; Settings &gt; All Settings &gt; Advanced &gt; Site URLs &gt; REST API URL. The appliance contacts the Workspace ONE UEM API server to fetch your VMware Tunnel configuration. For example, <a href="https://asXXX.example.com">https://asXXX.example.com</a>.</td>
</tr>
<tr>
<td>API Server Username</td>
<td>Enter the user name of an Workspace ONE UEM console admin user account. You must have Console Administrator privileges at a minimum.</td>
</tr>
<tr>
<td>API Server Password</td>
<td>Enter the password of an Workspace ONE UEM console admin user account. You must have Console Administrator privileges at a minimum.</td>
</tr>
<tr>
<td>Organization Group ID</td>
<td>Enter the Group ID for the organization group the VMware Tunnel is configured.</td>
</tr>
<tr>
<td>Tunnel Server Hostname</td>
<td>Enter the hostname for your VMware Tunnel configuration. The hostname must match the hostname entered in the VMware Tunnel configuration wizard. The Unified Access Gateway configures the instance as a relay server or an endpoint server based on the hostname. Ensure that you properly enter the hostname to avoid any issues in deployment. This is the Tunnel server hostname.</td>
</tr>
</tbody>
</table>
8  (Optional) Select the More drop-down menu to configure additional settings including Workspace ONE UEM Outbound Proxy Settings if you use an outbound proxy to make the initial call to the API server.

<table>
<thead>
<tr>
<th>Settings</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outbound Proxy Host</td>
<td>Enter the outbound proxy hostname.</td>
</tr>
<tr>
<td>Outbound Proxy Port</td>
<td>Enter the outbound proxy port.</td>
</tr>
<tr>
<td>Outbound Proxy User</td>
<td>Enter the user name if you proxy requires authentication.</td>
</tr>
<tr>
<td>Outbound Proxy Password</td>
<td>Enter the password for your outbound proxy if your proxy requires authentication.</td>
</tr>
<tr>
<td>NTLM Authentication</td>
<td>Enable if your proxy requires NTLM authentication.</td>
</tr>
<tr>
<td>Use for VMware Tunnel Proxy</td>
<td>Enable to use these proxy settings as the outbound proxy for your VMware Tunnel-Proxy deployment.</td>
</tr>
<tr>
<td>Host Entries</td>
<td>Enter the host entries for the server. You can enter multiple host entries separated by commas. They must follow this format: IP address hostname hostname alias (optional). For example, 10.192.168.1 example1.com, 10.192.167.2 example2.com. Use this option if your DNS is not publicly available or accessible from the DMZ.</td>
</tr>
<tr>
<td>Trusted Certificates</td>
<td>Select Select to upload a PEM certificate to add to the trusted store. Select the plus icon to upload additional certificates. This feature only supports PEM certificates.</td>
</tr>
</tbody>
</table>

9  (Optional) On the Support Settings screen on this page, download the Log Archive and export your custom settings using the Export Access Point Settings option.

10 To finish, select Save.

The Workspace ONE UEM Appliance Agent starts immediately and the monitoring services for VMware Tunnel start after 60 seconds.

**Upgrade VMware Tunnel Deployed with Unified Access Gateway Using vSphere**

VMware Tunnel is backwards compatible with updated versions of the Workspace ONE UEM console. Upgrade the VMware Tunnel product whenever you perform any major version upgrades.

The Unified Access Gateway appliance supports a Zero Downtime Upgrade process. For more information, see the Unified Access Gateway Documentation.

**Procedure**

1  Access the Unified Access Gateway admin UI from a browser.

2  Select Configure Manually.

3  Scroll down to the bottom and select Export Unified Access Gateway Settings.
Download the new OVA package from Workspace ONE UEM Resources.
Workspace ONE UEM Resources are available at Download Unified Access Gateway.

Deploy the new OVA in place of the existing OVA. Follow the steps you used before. See Install VMware Tunnel using vSphere.

Instead of manually configuring the settings, select Import Settings.

Browse for the downloaded export JSON file.

Select Import.

Upgrade VMware Tunnel Deployed with Unified Access Gateway Using PowerShell Script

Procedure

1. Download the new OVA package from Workspace ONE UEM Resources.
   Workspace ONE UEM Resources are available at Download Unified Access Gateway.

2. Use the same .ini template from your previous deployment with the PowerShell script.

3. Follow the steps you use before.
   See Run the VMware Tunnel PowerShell Script.
VMware Tunnel Deployment on a Linux Server

For customers who do not want to use the Unified Access Gateway deployment, Workspace ONE UEM offers the Linux installer so you can configure, download, and install VMware Tunnel onto a server. The Linux installer has different prerequisites than the Unified Access Gateway method. To download the available Linux installer, go to Groups & Settings > All Settings > System > Enterprise Integration > VMware Tunnel Proxy.

To run the Linux installer, you must meet specific hardware, software, and general requirements before you can begin installation. It is considered to be a best practice to use the Unified Access Gateway method as it simplifies the requirements and installation process.

**Note** For information on installing the legacy VMware Tunnel Windows server, see the VMware Tunnel for Windows Installation Guide.

This chapter includes the following topics:

- System Requirements for Deploying VMware Tunnel on a Linux Server
- Single-Tier VMware Tunnel Installation
- Multi-Tier VMware Tunnel Installation
- Upgrade VMware Tunnel Deployed on a Linux Server
- Uninstall VMware Tunnel

**System Requirements for Deploying VMware Tunnel on a Linux Server**

To deploy VMware Tunnel for Linux, ensure that your system meets the requirements. Use the following requirements as a basis for creating your VMware Tunnel server.

**Hardware Requirements for VMware Tunnel**

Ensure your VMware Tunnel server meets all the following hardware requirements.

- VM or Physical Server (64-bit)
Hardware Sizing

<table>
<thead>
<tr>
<th>Number of Devices</th>
<th>Up to 5,000</th>
<th>5,000 to 10,000</th>
<th>10,000 to 40,000</th>
<th>40,000 to 100,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU Cores</td>
<td>1 server with 2 CPU Cores*</td>
<td>2 load-balanced servers with 2 CPU Cores each</td>
<td>2 load-balanced servers with 4 CPU Cores each</td>
<td>4 load-balanced servers with 4 CPU Cores each</td>
</tr>
<tr>
<td>RAM (GB)</td>
<td>4</td>
<td>4 each</td>
<td>8 each</td>
<td>16 each</td>
</tr>
<tr>
<td>Hard Disk Space (GB)</td>
<td>10 GB for distro (Linux only)</td>
<td>400 MB for installer</td>
<td>~10 GB for log file space**</td>
<td></td>
</tr>
</tbody>
</table>

*It is possible to deploy only a single VMware Tunnel server as part of a smaller deployment. However, consider deploying at least 2 load-balanced servers with 2 CPU Cores each regardless of number of devices for uptime and performance purposes.

**About 10 GB is for a typical deployment. Log file size should be scaled based on your log usage and requirements for storing logs.

Software Requirements for VMware Tunnel

Ensure your VMware Tunnel server meets all the following software requirements.

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red Hat Enterprise Linux 7.x</td>
<td>(Recommended UI-less)</td>
</tr>
</tbody>
</table>
| Pre-Installation Package      | The VMware Tunnel Linux installer automatically downloads required packages when it is connected to the Internet. If your server is offline or has restricted outbound access, then you must run the following commands on your VMware Tunnel server before you install.  
  * Openssl: `sudo yum -y install openssl`  
  * Haveged: `sudo yum -y install haveged*`  
  * Nscd: `sudo yum -y install nscd`  
  * Json-c: `sudo yum -y install json-c`  
  * Libxml2: `sudo yum -y install libxml2`  
  * Log4cpp: `sudo yum -y install log4cpp*`  
  * Protobuf: `sudo yum -y install protobuf*`  
| Internally registered DNS record | (Optional): For a basic endpoint deployment, register the internal DNS record  
  * Relay-endpoint: Register the internal DNS entry for the endpoint server.  
| Externally registered DNS record | Basic endpoint: Register the public DNS record for the basic tunnel server.  
  * Relay-endpoint: Register the public DNS record for the relay server.  

VMware Tunnel on Linux
You must have the most recent version of the VMware Tunnel installer. The VMware Tunnel supports backwards compatibility between the installer and the UEM console. This backwards compatibility provides a small window to allow you to upgrade your VMware Tunnel server shortly after upgrading your UEM console. Consider upgrading as soon as possible to bring parity between the UEM console and the VMware Tunnel.

**Network and Security Requirements for VMware Tunnel**

For configuring the ports listed below, all the traffic is uni-directional (outbound) from the source component to the destination component.

<table>
<thead>
<tr>
<th>Source Component</th>
<th>Destination Component</th>
<th>Protocol</th>
<th>Port</th>
<th>Verification</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Devices (from Internet and Wi-Fi)</td>
<td>VMware Tunnel Proxy</td>
<td>HTTPS</td>
<td>2020*</td>
<td>After installation, run the following command to validate: <code>netstat -tlpn https://&lt;VMware_Tunnel_Host&gt;:&lt;port&gt;</code></td>
<td>1</td>
</tr>
<tr>
<td>Devices (from Internet and Wi-Fi)</td>
<td>VMware Tunnel Per-App Tunnel</td>
<td>TCP/UDP</td>
<td>8443* (for Per-App Tunnel)</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>VMware Tunnel – Basic Endpoint Configuration</td>
<td>AirWatch Cloud Messaging Server**</td>
<td>HTTPS</td>
<td>SaaS: 443 On-Prem: 2001*</td>
<td>Verify by using wget to <code>https://&lt;AWCM_URL&gt;:&lt;port&gt;/awcm/status</code> and ensuring you receive an HTTP 200 response.</td>
<td>2</td>
</tr>
<tr>
<td>VMware Tunnel</td>
<td>Internal Web sites / Web apps</td>
<td>HTTP or HTTPS</td>
<td>80 or 443</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>VMware Tunnel</td>
<td>Internal resources</td>
<td>HTTP, HTTPS, or TCP/UDP</td>
<td>80, 443, Any TCP/UDP</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Source Component</td>
<td>Destination Component</td>
<td>Protocol</td>
<td>Port</td>
<td>Verification</td>
<td>Note</td>
</tr>
<tr>
<td>------------------</td>
<td>-----------------------</td>
<td>----------</td>
<td>------</td>
<td>--------------</td>
<td>------</td>
</tr>
<tr>
<td>VMware Tunnel</td>
<td>Workspace ONE UEM</td>
<td>HTTP or HTTPS</td>
<td>SaaS: 443 On-Prem: 80 or 443</td>
<td>curl -Ivv https://&lt;API URL&gt;/api/mdm/ping</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>REST API Endpoint</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>SaaS:</strong> <a href="https://asXXX.awmdm.com">https://asXXX.awmdm.com</a> or <a href="https://asXXX.airwatchportals.com">https://asXXX.airwatchportals.com</a></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>On-Prem:</strong> Most commonly your DS or Console server</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Console Server</td>
<td>VMware Tunnel Proxy</td>
<td>HTTPS</td>
<td>On-Prem: 2020</td>
<td>Verify after installation using telnet command from the console server to the Tunnel Proxy on port 2020 (On-Premesis only).</td>
<td>6</td>
</tr>
</tbody>
</table>

**VMware Tunnel — Cascade Configuration**

| VMware Tunnel Front-End | AirWatch Cloud Messaging Server** | TLS v1.2 | SaaS: 443 On-Prem: 2001* | Verify by using wget to https://<AWCM URL >:<port >/awcm/status and ensuring you receive an HTTP 200 response. | 2 |
| VMware Tunnel Front-End | VMware Tunnel Back-End          | TLS v1.2 | 8443* | Telnet from VMware Tunnel Front-End to the VMware Tunnel Back-End server on port | 3 |
| VMware Tunnel Back-End | Internal Web sites / Web apps   | TCP/UDP  | 80 or 443 |  | 4 |
| VMware Tunnel Back-End | Internal resources              | TCP/UDP  | 80, 443, Any TCP/UDP |  | 4 |
| VMware Tunnel Front-End and Back-End | Workspace ONE UEM REST API Endpoint | TLS v1.2 | 80 or 443 | curl -Ivv https://<API URL>/api/mdm/ping | 5 |
|                  | **SaaS:** https://asXXX.awmdm.com or https://asXXX.airwatchportals.com |          |      |              |      |
|                  | **On-Prem:** Most commonly your DS or Console server |          |      |              |      |

**VMware Tunnel – Relay Endpoint Configuration**

| VMware Tunnel Relay | AirWatch Cloud Messaging Server** | HTTP or HTTPS | SaaS: 443 On-Prem: 2001* | Verify by using wget to https://<AWCM URL >:<port >/awcm/status and ensuring you receive an HTTP 200 response. | 2 |

**VMware Tunnel on Linux**
Single-Tier VMware Tunnel Installation

After ensuring that your server meets all the proper requirements, configuring VMware Tunnel settings in the Workspace ONE UEM console, and downloading the installer to your Linux server, you can run the installer to enable the service.

---

<table>
<thead>
<tr>
<th>Source Component</th>
<th>Destination Component</th>
<th>Protocol</th>
<th>Port</th>
<th>Verification</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>VMware Tunnel Relay</td>
<td>VMware Tunnel Endpoint</td>
<td>HTTPS</td>
<td>2010*</td>
<td>Telnet from VMware Tunnel Relay to the VMware Tunnel Endpoint server on port</td>
<td>3</td>
</tr>
<tr>
<td>VMware Tunnel Endpoint</td>
<td>Internal Web sites / Web apps</td>
<td>HTTP or HTTPS</td>
<td>80 or 443</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>VMware Tunnel Endpoint</td>
<td>Internal resources</td>
<td>HTTP, HTTPS, or TCP</td>
<td>80, 443, Any TCP</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>VMware Tunnel Endpoint and Relay</td>
<td>Workspace ONE UEM REST API Endpoint</td>
<td>HTTP or HTTPS</td>
<td>80 or 443</td>
<td>curl -Ivv https://&lt;API URL&gt;/api/mdm/ping</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>The expected response is HTTP 401 – unauthorized.</td>
<td></td>
</tr>
<tr>
<td>Console Server</td>
<td>VMware Tunnel Proxy</td>
<td>HTTPS</td>
<td>On-Prem: 2020</td>
<td>Verify after installation using telnet command from the console server to the Tunnel Proxy on port 2020 (On-Premises only).</td>
<td>6</td>
</tr>
</tbody>
</table>

*This port can be changed if needed based on your environment's restrictions.

1. For devices attempting to access internal resources.
2. For the VMware Tunnel to query the UEM console for compliance and tracking purposes.
3. For VMware Tunnel Relay topologies to forward device requests to the internal VMware Tunnel endpoint only.
4. For applications using VMware Tunnel to access internal resources.
5. The VMware Tunnel must to communicate with the API for initialization. Ensure that there is connectivity between the REST API and the VMware Tunnel server.
6. This is required for a successful "Test Connection" to the VMware Tunnel Proxy from the UEM console. This requirement is optional and can be omitted without loss of functionality to devices.
Prerequisites

- Download the installer onto the server. The link in the Workspace ONE UEM console directs you to Workspace ONE UEM Resources to download the installer.
- Download the config.xml file from the Workspace ONE UEM console onto the server.

Procedure

1. Create a dedicated install directory for the installer on the back-end server (for example, /tmp/Install/) and copy the BIN file to this location.
   
   You can use file transfer software such as FileZilla or WinSCP to perform the action.
   
   If this server is also being used for Content Gateway, the dedicated install directory for Proxy must be different than the install directory for Content Gateway.

2. Once on the Linux server, navigate to the folder you copied the file to and then run the BIN file by using the following command.

   ```
   $ sudo ./VMwareTunnel.bin
   ```

   If you are installing for the first time, the following screen displays:

   ```
   Preparing to install...
   Extracting the JRE from the installer archive...
   Unpacking the JRE...
   Extracting the installation resources from the installer archive...
   Configuring the installer for this system's environment...
   Launching installer...
   `-------------------------------------------------------------
   AirWatch Tunnel (created with InstallAnywhere)
   `-------------------------------------------------------------
   Preparing CONSOLE Mode Installation...
   `-------------------------------------------------------------
   Introduction
   `-------------------------------------------------------------
   InstallAnywhere will guide you through the installation of AirWatch Tunnel.
   It is strongly recommended that you quit all programs before continuing with this installation.
   Respond to each prompt to proceed to the next step in the installation. If you want to change something on a previous step, type 'back'.
   You may cancel this installation at any time by typing 'quit'.
   PRESS <ENTER> TO CONTINUE:
   ```

3. Press **Enter**.

4. Read and accept the licensing agreement by entering 'y'.
5 After accepting the licensing agreement, you must choose your installation method.

---

**Tunnel Installation Setup**

- 1- Provide API Server Information
- 2- Import Config.xml file

Select the installation type: 

- Provide API Server information.
  - a Enter the following information. After entering each value, the system dialog asks you to confirm the entry.
    - Workspace ONE UEM API URL
    - Organization Group Code
    - Console Server Username
    - Console Server Password
  - b Enter the hostname of the Tunnel server.
    - The installer chooses the components to install based on the Workspace ONE UEM console configuration.
  - c Press **Enter**.

- Import Config.xml file.
  - a Select the components you want to install.
  - b Enter the file path of the configuration file.
  - c Enter the VMware Tunnel certificate password as entered in the Workspace ONE UEM console.

6 Enter Y to grant the installer firewall permissions needed for VMware Tunnel.

**Note** The ports you see may differ from the ones shown because the installer shows the values you set during VMware Tunnel configuration.
7 Review and verify the summary information.

```
Pre-Installation Summary

Please Review the Following Before Continuing:

Product Name: VMware Tunnel
Install Folder: /opt/vmware/tunnel
Product Features:
  VMware Per-App Tunnel,
  VMware Proxy
Disk Space Information (for Installation Target):
  Required: 111.9 Megabytes
  Available: 31,767.58 Megabytes

Press <ENTER> TO CONTINUE:  
```

8 When the installer finishes, press Enter to exit the installer.

The product begins installation. If there were any errors, the installer displays an error message with details and logs the error in the installation log file. The log file is saved in the directory that you installed the VMware Tunnel in.

**Multi-Tier VMware Tunnel Installation**

Multi-tier installation requires the installation of two or more servers. Before you begin a multi-tier installation, review your architecture.

During a Linux installation, you specify whether you are installing proxy, Per-App Tunnel, or both. If you install both, they share a front-end and back-end servers. If you are installing Per-App Tunnel as part of a relay-endpoint configuration, then the Linux versions of the Proxy component must be installed as well. You cannot install the VMware Tunnel Proxy for Windows version of proxy and the VMware Tunnel Per-App Tunnel component in a relay-endpoint configuration.

**Install the VMware Tunnel Front-End Server (Linux)**

After ensuring that your servers meets all the proper requirements, configuring VMware Tunnel settings in the Workspace ONE UEM console, and downloading the installer to your Linux server, you can run the installer to enable the service.

**Note** If you are installing the Proxy component either alone or in combination with the Per-App Tunnel component, the installer refers to the front-end server as the relay server. Proxy uses the relay-endpoint mode for communication. The relay-endpoint deploys alongside the cascade mode services on the same server. Consider using just the Per-App Tunnel component for your VMware Tunnel solution as it has additional features and functionality that the Proxy component does not.
Prerequisites

- Download the installer and transfer to the server. The link in the Workspace ONE UEM console directs you to Workspace ONE UEM Resources to download the installer.
- If you are using the API method, the installer prompts for the necessary configuration information. You do not need to download the vpn_config.xml file.
- If you are using the configuration file method, download the vpn_config.xml (per-app config) file and config.xml (proxy config) file from the Workspace ONE UEM console and transfer to the server.

Procedure

1. Create a dedicated install directory for the installer on the front-end server (for example, /tmp/Install/) and copy the BIN file to this location.

   You can use file transfer software such as FileZilla or WinSCP to perform the action.

2. Once on the Linux server, navigate to the folder you copied the file to and then run the BIN file by using the required command.

   ```bash
   $ sudo ./VMwareTunnel.bin
   ```

   If you are installing for the first time, the following screen displays:

   ```
   Preparing to install...
   Extracting the JRE from the installer archive...
   Unpacking the JRE...
   Extracting the installation resources from the installer archive...
   Configuring the installer for this system's environment...
   Launching installer...
   AirWatch Tunnel
   (created with InstallAnywhere)
   Preparing CONSOLE Mode Installation...
   ```

   3. Press Enter.

   4. Read and accept the licensing agreement by entering 'y'.
5 After accepting the licensing agreement, you must choose your installation method.

Tunnel Installation Setup

1- Provide API Server Information
2- Import Config.xml file

Select the installation type:  

- Option 1: Provide API Server Information
  a Enter the following information. After entering each value, the system dialog asks you to confirm the entry.
    - Workspace ONE UEM API URL
    - Organization Group Code
    - Console Server Username
    - Console Server Password
  b Enter the hostname of the Tunnel server.
    The installer chooses the components to install based on the Workspace ONE UEM console configuration.

Feature Selection Summary

Please Review the Following Before Continuing:

Product Name:
  VMware Tunnel

Product Features:
  VMware Per-App Tunnel,
  VMware Proxy

PRESS <ENTER> TO CONTINUE:  

- Option 2:
  a Download and copy the Tunnel Proxy and Per-app VPN configuration files to a single directory on the server.
b Confirm that the Proxy and Per-app VPN configuration file names are not modified from their original config.xml and vpn_config.xml names, respectively.

1 If they have been modified, rename the files to match these names when copied into the common directory on the Linux server.

2 If you are installing one of the Tunnel services, copy the respective configuration file.

c Enter the directory path that contains both configuration files.

d Enter the certificate password for both configuration files when prompted.

6 Enter the hostname of the Tunnel server.

The hostname must match the hostname that is used to configure VMware Tunnel in Workspace UEM.

For example, if your VMware Tunnel Front end server is configured to use tunnel.acme.com, enter the same address.

7 Enter Y to grant the installer firewall permissions needed for VMware Tunnel.

**Note**  Note: The ports you see may differ from the ones shown because the installer shows the values you set during VMware Tunnel configuration.

8 Review and verify the summary information.

```
Pre-Installation Summary
------------------------------

Please Review the Following Before Continuing:

Product Name:  
VMware Tunnel

Install Folder:  
/opt/vmware/tunnel

Product Features:  
VMware Per-App Tunnel,  
VMware Proxy

Disk Space Information (for Installation Target):  
Required: 111.9 Megabytes  
Available: 31,767.58 Megabytes
```

PRESS <ENTER> TO CONTINUE:  

9 When the installer finishes, press **Enter** to exit the installer.

The product begins installation. If there were any errors, the installer displays an error message with details and logs the error in the installation log file. The log file is saved in the directory that you installed the VMware Tunnel in.

**What to do next**

To complete your installation, see Install the VMware Tunnel Back-End Server (Linux).
Install the VMware Tunnel Back-End Server (Linux)

After installing the front-end server, install the back-end server.

In multi-tier configurations, you install the back-end server after installing the front-end server. If you have not already, perform the steps described in Install the VMware Tunnel Front-End Server (Linux).

**Note**  If you are installing the Proxy component either alone or in combination with the Per-App Tunnel component, the installer refers to the back-end server as the endpoint server. Proxy uses the relay-endpoint mode for communication. The relay-endpoint deploys alongside the cascade mode services on the same server. Consider using just the Per-App Tunnel component for your VMware Tunnel solution as it has additional features and functionality that the Proxy component does not.

**Prerequisites**

- Download the installer onto the server. The link in the Workspace ONE UEM console directs you to Workspace ONE UEM Resources to download the installer.

- Download the config.xml file from the Workspace ONE UEM console onto the server.

**Procedure**

1. Create a dedicated install directory for the installer on the back-end server (for example, `/tmp/Install/`) and copy the BIN file to this location.
   
   You can use file transfer software such as FileZilla or WinSCP to perform the action.

2. Once on the Linux server, navigate to the folder you copied the file to and then run the BIN file by using the following command. Press **Enter**.
   
   ```
   $ sudo ./VMwareTunnel.bin
   ```

   If you are installing for the first time, the following screen displays:

   ```
   Preparing to install...
   Extracting the JRE from the installer archive...
   Unpacking the JRE...
   Extracting the installation resources from the installer archive...
   Configuring the installer for this system's environment...
   Launching installer...
   
   AirWatch Tunnel
   (created with InstallAnywhere)
   
   Preparing CONSOLE Mode Installation...
   
   Introduction
   
   InstallAnywhere will guide you through the installation of AirWatch Tunnel.
   It is strongly recommended that you quit all programs before continuing with this installation.
   Respond to each prompt to proceed to the next step in the installation. If you want to change something on a previous step, type 'back'.
   You may cancel this installation at any time by typing 'quit'.
   
   PRESS <ENTER> TO CONTINUE:
   ```

3. Read and accept the licensing agreement by entering 'y'.

VMware, Inc.
After accepting the licensing agreement, you must choose your installation method.

---
Tunnel Installation Setup
---

1- Provide API Server Information
2- Import Config.xml file

Select the installation type: [ ]

- Option 1: Provide API Server Information
  a. Enter the following information. After entering each value, the system dialog asks you to confirm the entry.
     - Workspace ONE UEM API URL
     - Organization Group Code
     - Console Server Username
     - Console Server Password
  b. Enter the hostname of the Tunnel server.
     The installer chooses the components to install based on the Workspace ONE UEM console configuration.
  c. Press **Enter**.

- Option 2: Import Config.xml file
  a. Download and copy the Tunnel Proxy and Per-app VPN configuration files to a single directory on the server.
  b. Confirm that the Proxy and Per-app VPN configuration file names are not modified from their original config.xml and vpn_config.xml names, respectively.
     If they have been modified, rename the files to match these names when copied into the common directory on the Linux server.
     If you are installing one of the Tunnel services, copy the respective configuration file.
  c. Enter the directory path that contains both configuration files.
  d. Enter the certificate password for both configuration files when prompted.

5. Enter the hostname of the Tunnel server.
   The hostname must match the hostname that is used to configure VMware Tunnel in Workspace UEM. For example, if your VMware Tunnel Back-End server is configured to use tunnel.acme.com, enter the same address.

6. Enter **Y** or **N** for whether you want to use an outbound proxy as part of your VMware Tunnel configuration.
   This option only displays if you are installing the Proxy component.
7 Enter Y to grant the installer firewall permissions needed for VMware Tunnel.

**Note** The ports you see may differ from the ones shown because the installer shows the values you set during VMware Tunnel configuration.

8 Review and verify the summary information.

```markdown
Pre-Installation Summary

Please Review the Following Before Continuing:

**Product Name:** VMware Tunnel

**Install Folder:** /opt/vmware/tunnel

**Product Features:**
- VMware Per-App Tunnel,
- VMware Proxy

**Disk Space Information (for Installation Target):**
- Required: 111.9 MegaBytes
- Available: 31,767.58 MegaBytes

PRESS <ENTER> TO CONTINUE:
```

9 When the installer finishes, press Enter to exit the installer.

The product begins installation. If there were any errors, the installer displays an error message with details and logs the error in the installation log file. The log file is saved in the directory that you installed the VMware Tunnel in.

### Upgrade VMware Tunnel Deployed on a Linux Server

VMware Tunnel is backwards compatible with updated versions of the Workspace ONE UEM console. Upgrade the VMware Tunnel product whenever you perform any major version upgrades.

**Prerequisites**

To upgrade an existing VMware Tunnel, download the latest version of the installer from the UEM console. Load the installer onto one or more VMware Tunnel servers and run the installer based on your deployment model. Any custom changes made to configuration files following the original installation will be overridden, and must be manually updated after the upgrade is complete.

Create a back-up of any custom configuration files that you might want to reference after the upgrade and create a snapshot of each VMware Tunnel server before the upgrade.

**Procedure**

1 Log in to the UEM console and navigate to **Groups & Settings > All Settings > System > Enterprise Integration > VMware Tunnel**.
2 Select the **General** tab and then select the **Download Linux Installer** hyperlink which redirects you to Workspace ONE UEM Resources to download the installer.

3 Create a directory for the Tunnel installer and copy the VMwareTunnel.bin file to this location.

4 Continue with the steps for Install the VMware Tunnel Front-End Server (Linux) or Install the VMware Tunnel Back-End Server (Linux)

The installer detects the existing VMware Tunnel instance running on the server and prompts you to confirm the upgrade.

### Uninstall VMware Tunnel

Uninstall VMware Tunnel from your servers when needed. The uninstallation process is simple.

This method of uninstallation only applies to servers installed using the legacy installer workflow and not servers install with the Unified Access Gateway workflow. Perform the following steps on your VMware Tunnel servers to remove the component.

**Procedure**

1 Navigate to the `/opt/vmware/tunnel/_tunnel_installation/` directory.

   ```
   cd /opt/vmware/tunnel/_tunnel_installation/
   ```

2 Execute **Uninstall_Tunnel**.

   ```
   sudo ./Uninstall_Tunnel
   ```

3 Review installer logs at `/opt/vmware/tunnel/_tunnel_installation/Logs`, if necessary.
Migrating to VMware Tunnel

The sample scenarios described in this chapter offer a few different possibilities for migrating to VMware Tunnel. These scenarios are general examples and might not exactly capture your situation, it is expected that VMware Tunnel can be implemented with little to no downtime for users.

**Migrating from a Third-Party Full Device VPN to Per-App VMware Tunnel**

As VMware Tunnel is a per-app VPN provider, it always take precedence over full-device VPNs configured on the device. Once VMware Tunnel is configured on the device, it is recommended to remove all the other configurations.

**Migrating from a Third-Party Per-App VPN to Per-App VMware Tunnel**

If you are using another per-app VPN provider, then all the applications need to be migrated over from the previous provider to VMware Tunnel. Once VMware Tunnel is configured and the profiles are pushed to the devices, you can flip the assignment to switch users from the previous VPN provider to VMware Tunnel.

**Migrating from Proxy App Tunnel to Tunnel SDK**

If you are migrating from VMware Tunnel- Proxy to Tunnel SDK (Per-App Tunnel) and want to retain the domains that are configured for tunneling, then configure the same domains in the Device Traffic Rules for VMware Tunnel. For more information, see [Configure App Tunnel for the Default SDK Profile](#).
VMware Tunnel Management

Consider configuring additional functionality to enhance your VMware Tunnel deployment. These features allow you more control over device access and networking support.

For instance the following additional functionalities allows you to maintain and manage your deployment:

- RSA authentication controls access to internal resources through two-factor authentication.
- Configure to rotate public SSL certificates to maintain the end-user service experience.
- Use Workspace ONE Web to control how the end users access internal sites by configuring communication between the application and VMware Tunnel.

This chapter includes the following topics:

- Deploying Per-App Tunnel to devices
- VMware Tunnel SSL Certificate Life Cycle Management
- Integrating VMware Proxy Tunnel with RSA
- Using VMware Tunnel with Workspace ONE Web and other SDK-Built Apps

Deploying Per-App Tunnel to devices

After configuring and installing VMware Tunnel with the Per-App Tunnel component, the workflow to enable and use per app tunneling in Workspace ONE UEM includes:

Procedure

1. Create a VPN profile for your end-user devices.
   These profiles depend on your device platform.
   If your platform uses user profiles and device profiles, such as Windows Desktop and Android, you must create user profiles.

2. After creating a VPN profile, push the profiles and the apps to the devices.
   a. For iOS and Android platforms, enable the **Use VPN** check box on the Deployment tab of the Add Application page to use app tunneling.
   b. Because Windows Desktop devices use the native Per-App VPN functionality, add the apps to the VPN profile to enable Per-App Tunnel functionality.
An on-demand feature lets you configure apps to connect automatically using VMware Tunnel when launched. The connection remains active until a time-out period of receiving no traffic, then it is disconnected. When using VMware Tunnel, no IP address is assigned to the device, so you do not need to configure the network or assign a subnet to connected devices.

In addition, iOS apps can use the iOS DNS Service to send DNS queries through the VMware Tunnel server to the DNS server on a corporate network. This service allows applications such as Web browsers to use your corporate DNS server to look up the IP address of your internal Web servers.

**VMware Tunnel Privacy Dialog**

VMware privacy practices within the Workspace ONE productivity apps including VMware Tunnel provide a privacy dialog for all existing and new users. The dialog includes an overview of the data collected by the app and Workspace ONE services and the permissions that the app requests on the device to enable certain functionality.

**Privacy Dialog**

VMware Workspace ONE Tunnel supports a privacy dialog that displays information regarding the application an admin configures. VMware Workspace ONE Tunnel only supports the privacy dialog for iOS and Android devices. You must deploy the VMware Workspace ONE Tunnel app to devices using Application Configurations during device assignment.

The dialog displays the following information to end users:

<table>
<thead>
<tr>
<th>Table 9-1. Privacy Dialog Information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Information</strong></td>
</tr>
<tr>
<td>Data collected by the application</td>
</tr>
<tr>
<td>Device permissions</td>
</tr>
<tr>
<td>Company’s privacy policy</td>
</tr>
</tbody>
</table>

**Admin Configuration Settings**

To configure the privacy dialog for VMware Workspace ONE Tunnel on iOS and Android devices, you must deploy the VMware Workspace ONE Tunnel app to your devices with Application Configurations. For more information on what Application Configurations do to devices, see Application Configurations.

You must use the following key-value pairs:
Table 9-2. VMware Tunnel Privacy Dialog Key-Value Pairs

<table>
<thead>
<tr>
<th>Configuration</th>
<th>Key-Value Pair</th>
</tr>
</thead>
</table>
| Company Privacy Policy URL                         | Key: PrivacyPolicyLink  
Value Type: String  
Values:  
  - https://www.company.com/privacypolicy  
This policy changes the default company privacy policy text to allow the user to view a specific privacy disclosure web page directly within the application |
| VMware Feature Usage Analytics                     | Key: PolicyAllowFeatureAnalytics  
Value Type: Integer  
Values:  
  - 0 - Disabled  
  - 1 - Enabled  
This policy controls whether end users will see the Data Sharing opt-in during configuration of the apps. When disabled, data sharing is forced off for all users. Feature analytics data is collected to allow VMware to improve existing product features and invent new ones to make users even more productive |
| Diagnostics Data through VMware Intelligence and Apteligent | Key: PolicyAllowCrashReporting  
Value Type: Boolean  
Values:  
  - false - Disabled  
  - true - Enabled  
This policy controls whether applications will report diagnostic data to Apteligent which is used to provide troubleshooting and support, for example, in the event of a crash. Disabling this setting may significantly impact the efficiency of investigating and resolving any issues with the application |

Example Configuration:

```
{"PolicyAllowFeatureAnalytics":1,  
"PrivacyPolicyLink":"https://www.company.com/privacypolicy",  
"PolicyAllowCrashReporting":true}
```

Application Configurations

Application configurations are key-value pairs that you deploy with the application to preconfigure features for users. You can enter supported pairs when you upload applications to the Workspace ONE UEM console and you can code them into your applications.

Currently, application configurations are available for Android and iOS. You must know the supported key-value pairs for your application to deploy them and to code them. To find supported application configurations, review the listed resources.
Find Supported Configurations

The application vendor sets the supported configurations for the application, so you can contact the vendor or visit other sites with information about application configurations.

- To find the supported application configurations, contact the application vendor.
- See these resources with information about application configurations.
  - AppConfig Community at https://www.appconfig.org/

Workspace ONE UEM Articles on Adding Application Configurations

The Workspace ONE UEM knowledge base has articles about working with application configurations when you develop applications. See Workspace ONE UEM Managed App Configuration at https://support.air-watch.com/articles/115006248807.

Configure Per-App Tunnel Profile for iOS

Configure Per-App Tunnel for iOS to allow those devices to connect to internal sites you define through VMware Tunnel. Using this functionality requires you to configure and install the Per-App Tunnel component as part of your VMware Tunnel installation.

Procedure

1. Navigate to Devices > Profiles & Resources > Profiles > List View > Add and select iOS.
2. Configure the profile's General settings. Consider setting the Deployment type for this profile to Auto so end-users receive it automatically.
3. Select the VPN payload from the list.
4. Enter a Connection Name, which is the name that displays on the user's device in the VMware Tunnel application, and select Workspace ONE Tunnel as the Connection Type.
   The Server text box populates automatically with your VMware Tunnel component server URL.
5. Select Enable VMware Tunnel to always push the VMware Workspace ONE Tunnel version of the profile to device. Do not use this option if you have devices in the assignment group that do not have the VMware Workspace ONE Tunnel app but still use the legacy AirWatch Tunnel App.
6. Verify or select AppProxy as the Provider Type.
7. Select Save & Publish.

What to do next

Configure an internal or public app to use the profile when making connections to the domains you specified.
Configure Per-App Tunnel Profile for Android

Configure Per-App Tunnel for Android to allow those devices to connect to internal sites you define through the VMware Tunnel. Using this functionality requires you to configure and install the Per-App Tunnel component as part of your VMware Tunnel installation.

Procedure

1. Navigate to Devices > Profiles > List View > Add and select Android or Android for Work. For a Samsung Knox deployment, select Android and then select Container.

2. Configure the profile's General settings.

3. Select the VPN payload from the list.

4. Enter a Connection Name and select Workspace ONE Tunnel as the Connection Type.

   The Server text box populates automatically with your VMware Tunnel component server URL. If this component is not configured, you see a message and hyperlink to the system settings page where you can configure it.

5. Select Save & Publish.

What to do next

Configure an internal or public app to use the profile when making connections.

Configure VPN Profile for Workspace ONE Tunnel Universal Windows Platform (UWP) app

Configure VPN Profile for Windows platform (UWP) app to allow devices to connect to internal sites you define through the VMware Tunnel. Using this functionality requires you to configure and install the Per-App Tunnel component as part of your VMware Tunnel installation.

Procedure

1. Navigate to Devices > Profiles > List View > Add and select Windows. Then select Windows Desktop and User Profile or Device Profile.

2. Configure the profile's General settings.

3. Select the VPN payload from the list.

4. Enter a Connection Name and select Workspace ONE Tunnel as the Connection type.

   The Server text box populates automatically with your VMware Tunnel component server URL. If this component is not configured, you see a message and hyperlink to the system settings page where you can configure it.

5. Configure the Per App VPN rules.
Configure the relevant **Policies** settings.

<table>
<thead>
<tr>
<th>Settings</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Always On</strong></td>
<td>Enable to force the VPN connection to be always on.</td>
</tr>
<tr>
<td><strong>VPN Lockdown</strong></td>
<td>Enable to force the VPN to always be on, never disconnect, disable any network access if the VPN is not connected, and prevent other VPN profiles from connecting on the device. A VPN profile with VPN Lockdown enabled must be deleted before you push a new VPN profile to the device. This feature only displays if the profile is set to Device context.</td>
</tr>
<tr>
<td><strong>Trusted Network Detection</strong></td>
<td>Enter comma separated trusted networks (For example, acme.com, abc.net and so on). Tunnel fails to connect when the device is on a trusted network.</td>
</tr>
<tr>
<td><strong>DNS Resolution via Tunnel Gateway</strong></td>
<td>In the DNS Resolution via Tunnel Gateway section, select Add New Domain to add domains to resolve through the VMware Tunnel server. Any domains added resolve through the VMware Tunnel server regardless of the app originating the traffic. For example, vmware.com will resolve through the VMware Tunnel server if you use the whitelisted Chrome or the non-whitelisted Edge apps.</td>
</tr>
</tbody>
</table>

Select **Save & Publish**.

**Configure Per-App Tunnel Profile for macOS**

Configure Per-App Tunnel for macOS to allow macOS devices to connect to internal sites you define through the VMware Tunnel. This functionality requires you to configure and install the Per-App Tunnel component as part of your VMware Tunnel installation.

**Procedure**

1. Navigate to Devices > Profiles > List View > Add and select macOS. Then select User.
2. Configure the General settings.
3. Select the VPN payload from the list.
4. Enter a Connection Name and select Workspace ONE Tunnel as the Connection Type.
   The **Server** text box populates automatically with your VMware Tunnel component server URL. If this component is not configured, you see a message and hyperlink to the system settings page where you can configure it.
5. Enable **App Mapping**.
6. Add the **Bundle ID** for each application you want to use with Per-App Tunnel.
   To find the Bundle ID for a macOS application, see Extract macOS Bundle ID for Per-App Tunnel.
7. Select **Save & Publish**.

**What to do next**

To configure the Safari domains, see [Configure Network Traffic Rules for the Per-App Tunnel](#).
Extract macOS Bundle ID for Per-App Tunnel

To use non-native Per-App Tunnel functionality on macOS devices, you must extract the app Bundle ID. Extract the Bundle ID before pushing the VPN profile to macOS devices.

Procedure

1. On a macOS device, find the file path for the app you want to flag for Per-App Tunnel.
   
   `/Applications/Google\ Chrome.app/`

   **Note** Extracting the macOS Bundle ID for Per-App Tunnel does not work with the native MacOS system applications, if the Application Bundle ID begins with `com.apple.*`

2. Open the terminal.

3. Run the following command to get the Application Bundle ID.
   
   `codesign -dv --entitlements - /Applications/Google\ Chrome.app/`

4. Review the output.

   Executable=/Applications/Google Chrome.app/Contents/MacOS/Google Chrome
   Identifier=com.google.Chrome Format=app bundle with Mach-O thin (x86_64) CodeDirectory
   v=20200 size=273 flags=6x800(restrict) hashes=3+3 location=embeddedSignature size=8949
   Timestamp=Mar 20, 2018 at 2:23:20 AM Info.plist entries=36 TeamIdentifier=EQHXZ8M8AV
   Sealed Resources version=2 rules=7 files=203 Internal requirements count=1 size=240

5. Copy the Application Bundle ID from the output.

   The Bundle ID follows `identifier`. In the above example it is `com.google.Chrome`.

6. Run the following command to get the Designated Requirement.

   `codesign -d -r- /Applications/Google\ Chrome.app/`

7. Review the output.

   Executable=/Applications/Google Chrome.app/Contents/MacOS/Google Chrome designated =>
   (identifier "com.google.Chrome" or identifier "com.google.Chrome.beta" or identifier
   "com.google.Chrome.dev" or identifier "com.google.Chrome.canary") and (certificate leaf =
   H"85cee8254216185620ddc8851c7a9fc4dfe120ef" or certificate leaf =
   H"c9a99324ca3fcb23dbcc36bd5fd4f9753305130a")

8. Copy the Designated Requirement from the output.

   Designated Requirement is the entire string followed by "designated =>". In the above example, it is
   (identifier "com.google.Chrome" or identifier "com.google.Chrome.beta" or identifier
   "com.google.Chrome.dev" or identifier "com.google.Chrome.canary") and (certificate leaf =
   H"85cee8254216185620ddc8851c7a9fc4dfe120ef" or certificate leaf =
   H"c9a99324ca3fcb23dbcc36bd5fd4f9753305130a")
To whitelist Chrome, enter the Application Bundle ID and Designated Requirement in the UEM console Tunnel profile.

For example, from the above sample output, enter the following settings.

<table>
<thead>
<tr>
<th>Settings</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application Bundle ID</td>
<td>com.google.Chrome</td>
</tr>
<tr>
<td>Designated Requirement</td>
<td>(identifier &quot;com.google.Chrome&quot; or identifier &quot;com.google.Chrome.beta&quot; or identifier &quot;com.google.Chrome.dev&quot; or identifier &quot;com.google.Chrome.canary&quot;) and (certificate leaf = H&quot;85cee8254216185620ddc8815c7a9fc4dfe120ef&quot; or certificate leaf = H&quot;c9a99324ca3fcb23dbcc36bd5fd4f975305130a&quot;)</td>
</tr>
</tbody>
</table>

Configure Public Apps to Use Per App Profile

After you create a per app tunnel profile you can assign it to specific apps in the application configuration screen. This tells that application to use the defined VPN profile when establishing connections.

For additional instructions on adding or editing apps, please see the VMware Workspace ONE UEM Mobile Application Management Guide.

This workflow only applies to Android and iOS devices.

Procedure

1. Navigate to Apps & Books > Applications > Native.
2. Select the Public tab.
3. Select Add Application to add an app or Edit an existing app.
4. On the Deployment tab, select Use VPN and then select the profile you created.
5. Select Save and publish your changes.

Configure Internal Apps to Use Per App Profile

After you create a per app tunnel profile you can assign it to specific apps in the application configuration screen. This tells that application to use the defined VPN profile when establishing connections.

For additional instructions on adding or editing apps, please see the VMware Workspace ONE UEM Mobile Application Management Guide.

This workflow only applies to Android and iOS devices.

Procedure

1. Navigate to Apps & Books > Applications > Native.
2. Select the Internal tab.
3. Select Add Application and add an app.
4. Select Save & Assign to move to the Assignment page.
5. Select Add Assignment and select Per-App VPN Profile in the Advanced section.
6 Save & Publish the app.

**VMware Tunnel SSL Certificate Life Cycle Management**

VMware Tunnel supports rotating your public SSL certificates with zero downtime for end users. Rotating your public SSL certificate and the profile grace period ensures that your end users do not experience a service interruption.

To rotate your public SSL certificates, you must upload a new certificate to the Workspace ONE UEM console. Adding a new certificate enables you to prepare new VPN profiles configured for VMware Tunnel before rotating the certificate on the server.

To prepare the end-user devices for rotation, you must add a new version of the VPN profiles configured for VMware Tunnel. The new profile version contains the new public SSL certificate. Before rotating the server certificate, you must push the new profile version to devices.

When the certificate is close to expiring or is compromised, the UEM console notifies the user and you can activate the new public SSL certificate to trigger the rotation and maintain the service. After you activate the certificate, VMware Tunnel server requires clients to have the new certificate to authenticate.

**Rotate the Public SSL Certificate**

Configure VMware Tunnel to rotate public SSL certificates to maintain the end-user service experience. VMware Tunnel only supports rotating public SSL certificates.

**Note** For immediate certificate rotation, your front-end and back-end servers must be able to communicate with AWCM. Otherwise the rotation might take up to four hours.

**Procedure**

1. Navigate to Groups & Settings > Configurations > Tunnel.
2. Select Edit to change the configuration settings.
3. In the *Server Authentication* section, you can configure Third Party SSL Certificate that secures client-server communication from enabled application on a device to the VMware Tunnel. By default, this setup uses a *AirWatch* certificate for secure server-client communication.
   a. Select *Third Party* option if you prefer to use a third-party SSL certificate for encryption between Workspace ONE Web or SDK-enabled apps and the VMware Tunnel server.
   b. Select *Add Certificate* to upload a .PFX or .P12 certificate file and enter the password. This file must contain both your public and private key pair. CER and CRT files are not supported.
4. Select Save to add the certificate to the database.
5. In the UEM console, publish a new version of your VPN profiles configured for VMware Tunnel to devices.
What to do next

After all the end-user devices have the new profile version, select Activate Certificate to use the new certificate. If you have uploaded an incorrect certificate and wish to remove the certificate from the database, select Remove.

Integrating VMware Proxy Tunnel with RSA

VMware Tunnel integrates with RSA Adaptive Authentication to allow end users to access internal endpoints using step-up authentication. This integration applies only to the VMware Tunnel Proxy component.

RSA Adaptive Authentication studies user and device patterns, such as location, and then determines whether or not to prompt users to log in based on its algorithm. For example, if end users attempt to access an intranet site and are prompted to authenticate, then they may not be asked to authenticate an hour later if no other device attributes have changed significantly. However, if end users travel to another country or state, then the system may prompt them to authenticate again to access the same site.

RSA Adaptive Authentication Requirements

Before you begin the integration between VMware Tunnel and RSA Adaptive Authentication, ensure that you have read and understood the requirements.

Prerequisites

- Access to RSA Adaptive Authentication server v7.0.
  Authentication Manager integrated with the RSA SecurID plug-in to validate the SecurID tokens.
- This integration is limited to the use of the RSA SecurID plug-in, along with the RSA Adaptive Authentication service. A Question-Answer based implementation of step-up authentication is not supported with this release.
- VMware Tunnel Proxy component installed. Currently, this integration works only with the Proxy component of VMware Tunnel.

Client Compatibility

- Workspace ONE Web for iOS v4.5+
- Workspace ONE Web for Android v3.1+
- VMware AirWatch Software Development Kit for iOS v5.5+
- VMware AirWatch Software Development Kit for Android v15.11+

Configuring RSA Authentication

VMware Tunnel integrates with RSA Adaptive Authentication to allow end users to access internal endpoints using step-up authentication.
There are two main workflows to consider when using step-up authentication with this integration:

- Users who have not set their SecurID PIN
- Users who have set their SecurID PIN

**For users who have not set their SecurID PIN**

In this scenario, when a user initiates a connection with the VMware Tunnel for the first time (for example, when attempting to access an internal Web site), the VMware Tunnel automatically enrolls the user in the RSA Adaptive Authentication database with the **Adaptive Auth User identifier** value set in the Workspace ONE UEM console. Next, the user is prompted to set the SecurID PIN. The user must remember this PIN, because it is the combination of this PIN and the SecurID token number that makes the final passcode that is required to authenticate against the authentication manager to get intranet access. On subsequent requests, users are asked to enter their passcode (PIN + token).

After the user sets the SecurID PIN for the first time and authenticates against the manager, RSA Adaptive Authentication may or may not challenge the user again for several hours. The RSA Adaptive Authentication algorithm decides when to challenge users after the initial authentication. This system is adaptive and studies the user and device patterns. Based on the data that it collects about the user and device, it then decides whether or not to challenge users on subsequent access attempts.

**For users who have set their SecurID PIN**

Users who have set their SecurID PIN are not asked to set their PIN again and can continue using their existing PIN. The VMware Tunnel enrolls such users in the RSA Adaptive Authentication database, and they are prompted to enter their passcode (a combination of their PIN + token).

**Configure RSA Authentication in the UEM Console**

In the UEM console, you must enter some of the basic information related to your RSA Adaptive Authentication environment, such as host names, admin credentials, and an Adaptive Auth user identifier, which is a unique identifier for every user in your Active Directory and Authentication Manager.

**Procedure**

1. Navigate to **Groups & Settings > All Settings > System > Enterprise Integration > VMware Tunnel > Configuration** and select the **Advanced** tab.

2. Configure the following RSA Adaptive Authentication settings.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RSA Adaptive Auth Integration</td>
<td>Enable this setting if you want to integrate the Proxy component with RSA authentication for comprehensive Web browsing security.</td>
</tr>
<tr>
<td>Adaptive Auth Server URL</td>
<td>Enter your RSA Adaptive Auth server URL. This setting displays after you enable RSA Adaptive Auth Integration.</td>
</tr>
<tr>
<td>Adaptive Auth Admin Username</td>
<td>Enter the RSA admin account user name. This setting displays after you enable RSA Adaptive Auth Integration.</td>
</tr>
<tr>
<td>Adaptive Auth Admin Password</td>
<td>Enter the RSA admin account password for the user name you entered. This setting displays after you enable RSA Adaptive Auth Integration.</td>
</tr>
</tbody>
</table>
Setting | Description
--- | ---
Adaptive Auth Version | Enter your RSA Adaptive Authentication version. This setting displays after you enable RSA Adaptive Auth Integration.
Adaptive Auth User Identifier | Enter the RSA Adaptive Auth user identifier. This setting displays after you enable RSA Adaptive Auth Integration.

3. Select **Save**.

### Using VMware Tunnel with Workspace ONE Web and other SDK-Built Apps

Using Workspace ONE Web for VMware Tunnel controls how the end users access internal sites by configuring communication between the application and the VMware Tunnel. Once configured, access to URLs you specify (using Workspace ONE Web) goes through the VMware Tunnel.

**Note** Consider using Workspace ONE Web with the Per-App Tunnel component of VMware Tunnel. The Per-App Tunnel component provides better performance and functionality than the Proxy component. Workspace ONE Web with the Per-App Tunnel component does not require additional configuration.

Caveats and Known Limitations - For VMware Tunnel, the current authentication scheme requires the use of a chunk aggregator of fixed size. A low value puts restrictions on the amount of data that is sent from the devices in a single HTTP request. By contrast, a high value causes extra memory to be allocated for this operation. Workspace ONE UEM uses a default optimum value of 1 MB, which you can configure based on your maximum expected size of upload data. Configure this value in the proxy.properties file on the VMware Tunnel server in the `/conf` directory.

### Procedure

1. Navigate to **Groups & Settings > All Settings > Apps > Settings and Policies > Security Policies**.
2. Select **Enabled** for **AirWatch App Tunnel** and specify the **App Tunnel Mode** as **VMware Tunnel – Proxy**.
3. (Optional) Enable the split tunnel for iOS devices by entering URLs into the **App Tunnel Domains** text box. Leave the text box empty to send all requests through the VMware Tunnel.

   If a URL that is about to be invoked contains a domain that matches the list in the settings, this URL request goes through the VMware Tunnel.

   If the URL domain does not match the domain in the list, it goes directly to the Internet.

4. Select **Save**.

5. Ensure the Workspace ONE Web is using the Shared SDK profiles for iOS and Android by navigating to **Groups & Settings > All Settings > Apps > Workspace ONE Web** and selecting them under **SDK Profile**.
Health and Monitoring

Basic health check lets you analyze whether your VMware Tunnel is operating within the acceptable performance limits. Use the following sections to monitor and assess the health of your VMware Tunnel service.

This chapter includes the following topics:
- Access Logs and Syslog Integration
- Monitor and Analyze VPN Report

Access Logs and Syslog Integration

Workspace ONE UEM supports exporting access logs to the syslog server for the Proxy and the Per-App Tunnel components of VMware Tunnel.

Access logs are generated in the standard HTTP Apache logs format and directly transferred to the syslog host you defined. They are not stored locally on the VMware Tunnel server.

In relay-endpoint deployments, the relay server writes the access logs, in a cascade deployment, the back-end server writes the access logs and in a basic deployment, the basic server writes the access logs.

For instructions on enabling access log and syslog integration, see Configure Advanced Settings for the Proxy and the networking section under Configure VMware Tunnel.

Under high loads and peak hours, average of 10,000 devices for an hour roughly generates around 0.5 GB of logs to the syslog server. However, your mileage might depend on the load that you might have on your VMware Tunnel server. For additional support, contact your syslog administrator.

**Important** You must enable access logs before you install any of the components. Any changes you make to the access logs configuration on the Workspace ONE UEM console require reinstallation of the VMware Tunnel server.

**KKDCP Access Logs**

The path for KKDCP logs for VMware Tunnel for Linux is: `/var/log/vmware/proxy/proxy.log`.

**Monitor and Analyze VPN Report**

VPN report gives detailed statistics on the VPN use. Network administrators can monitor the activities being performed over the VPN and use the statistical report during troubleshooting.
There are two types of statistical reports administrators can run to get information about the VPN:

- VPN Whitelist Report that fetches the Whitelist information.
- VPN Statistics Report to get statistical information about the number of connected devices, downstream traffic, service synchronization time and so on.

Run VPN Whitelist Report

Network administrators can run the `vpnreport whitelist` to get the whitelist information report for the devices.

The whitelist report allows administrators to complete the following actions:

- Print the report in an XML format.
- Get the whitelist information for a device with UDID.
- Print the help information.
- Get the verbose output.

You can run the `vpnreport whitelist` from the command line.

Procedure

1. Navigate to the `vpnd` folder.
2. Run the `./vpnreport whitelist` as root.
3. (Optional) Run the commands that are supported by the VPN report.

<table>
<thead>
<tr>
<th>Command</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>-x, --xml</td>
<td>Print whitelist in an XML format.</td>
</tr>
<tr>
<td>-u, --udid=&lt;udid&gt;</td>
<td>Get the whitelist information for the device with UDID.</td>
</tr>
<tr>
<td>-h, --help</td>
<td>Print the help information.</td>
</tr>
<tr>
<td>-v, --verbose</td>
<td>View the verbose output.</td>
</tr>
</tbody>
</table>

Run VPN Statistics Report

Administrators can run the VPN Statistics report to get statistical information about the number of connected devices, downstream traffic, service synchronization time and so on. The report displays interactive graphs that visually represent statistical information.

You can run the `vpnreport stat` from the command line using the following steps:

1. Navigate to the `vpnd` folder.
2. Run the `./vpnreport stat` as root.
   
   You can add `--json` to create a JSON output and `--text` to create a text output.

   Here's a screen shot that shows the visual representation of the usage statistics about the number of connected devices, downstream traffic, service synchronization time and so on:
What to Do Next

You can use the following menu options while working with the report:
### Menu Options | Descriptions
--- | ---
Tab | Select graph
Up/Down | Select field
+/- | Scale up/down
Left/Right | Adjust refresh rate
C | Clear screen
Q | Quit

You can use the following legend to analyze the report:

| Legend | Descriptions |
--- | --- |
Last digit 0 | empty |
Last digit 1 | . |
Last digit 2 to 4 | | |
Last digit 5 to 9 | * |
Any value larger or equal to 10 | # |
VMware Tunnel Troubleshooting and Support

Read through the VMware Tunnel Troubleshooting and Support section if you encounter issues with your VMware Tunnel deployment.

This chapter includes the following topics:

- Troubleshooting using the Tunnel_snap Utility
- Upgrade Java Without Reinstalling Tunnel Proxy
- Troubleshooting Per-App Component
- Troubleshooting Proxy Component
- Troubleshooting Common Errors

**Troubleshooting using the Tunnel_snap Utility**

The tunnel_snap utility collects all the necessary diagnostic data that might be required for troubleshooting your VMware Tunnel deployment. This utility helps troubleshooting by reducing the back and forth communication with support and saves time.

The utility captures data from the following files:

- awcm.dat
- ca.pem
- device.xml
- dh2048.pem
- server.conf
- tunnel_init.log
- tunnel.log
- tunnel.log.1
- version.info
- vpn.dat

Use this utility while troubleshooting any issue related to the VMware Tunnel. You must run the utility on each VMware Tunnel server separately.
Run the utility in the following folder:

```
/opt/vmware/tunnel
```

Use the following command to run the utility:

```
sudo ./tunnel_snap.sh
```

The utility collects the diagnostic data in:

```
_/opt/vmware/tunnel/tunnel_snap.tar _
```

Send the collected data to UEM Support for help in troubleshooting.

## Upgrade Java Without Reinstalling Tunnel Proxy

When a new version of Java releases, you must update the server hosting the Tunnel Proxy server. VMware Tunnel supports a method that does not require reinstalling the Tunnel Proxy component.

**Procedure**

1. Download the latest RPM package for Java from the official Oracle site.
2. Upload the RPM package to your Linux server.
3. Install the RPM package.
   
   ```
sudo rpm -1 jdk8u112-linux-x64.rpm
   ```
4. Run the following command to ensure Java is upgraded correctly.
   
   ```
ls -la /usr/java/latest
   ```
5. Restart the Tunnel Proxy service.

## Troubleshooting Per-App Component

Per-App Tunnel logs are stored in the native syslog system of Linux.

Logs are stored in `/var/log/vmware/tunnel` and can be sorted by the following command (as root):

```
tail -f /var/log/vmware/tunnel/vpnd/tunnel.log
```

### Commands Used to Troubleshoot Per-App Tunnel Component

The following table lists the commands that are used to troubleshoot Per-App Tunnel Component:
<table>
<thead>
<tr>
<th>Component</th>
<th>Function</th>
<th>Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unified Access Gateway/CentOS/RHEL 7.x</td>
<td>Start the Service</td>
<td>service vpnd start</td>
</tr>
<tr>
<td>Unified Access Gateway/CentOS/RHEL 7.x</td>
<td>Stop the Service</td>
<td>service vpnd stop</td>
</tr>
<tr>
<td>Unified Access Gateway/CentOS/RHEL 7.x</td>
<td>Restart the Service</td>
<td>Service vpnd restart</td>
</tr>
</tbody>
</table>

**Access Unified Access Gateway Logs**

You can access the VMware Tunnel logs from the Unified Access Gateway without logging into the appliance by accessing a specific URL based on your deployment. To download a ZIP file that contains your logs, enter the following URL in a browser: https://<virtual appliance domain name>:9443/rest/v1/monitor/support-archive.

**Enable Debug in rsyslog**

You can enable Debug in rsyslog in the Workspace ONE UEM console by navigating to Groups & Settings > All Settings > System > Enterprise Integration > VMware Tunnel > Configuration > Advanced.

**Procedure**

1. Edit rsyslog.conf as root.
2. Change log_level <VALUE> to log_level 4 and Save.
3. Stop and Start the service.
4. Revert changes and restart both services when finished.

**Troubleshooting PAC Reader**

If you have any issues with the VMware Tunnel PAC Reader, check the status and the logs of the PAC Reader to help troubleshoot any issues.

Before contacting Workspace ONE UEM Support, consider checking the PAC Reader logs for any issues. The logs are located in the home folder of the PAC Reader. This folder is the pacreader folder.

The following table lists the commands that are used to troubleshoot PAC Reader:

<table>
<thead>
<tr>
<th>Function</th>
<th>Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start the PAC Reader</td>
<td>./pacreader.sh start</td>
</tr>
<tr>
<td>Stop the PAC Reader</td>
<td>./pacreader.sh stop</td>
</tr>
<tr>
<td>Check the PAC Reader status</td>
<td>/pacreader status</td>
</tr>
<tr>
<td>Run the PAC Reader in validation mode</td>
<td>./pacreader.sh validate</td>
</tr>
</tbody>
</table>

This command tells the PAC Reader to fetch and parse the PAC file but does not push the rules to the Workspace ONE UEM console.
Troubleshooting Proxy Component

Proxy logs are stored in the native syslog system of Linux.

Logs are stored in `/var/log/vmware/proxy` and can be sorted by the following command (as root):

```
tail -f /var/log/vmware/proxy/proxy.log
```

Commands Used to Troubleshoot Proxy Tunnel Component

The following table lists the commands that are used to troubleshoot Proxy Tunnel Component:

<table>
<thead>
<tr>
<th>Component</th>
<th>Function</th>
<th>Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proxy – Any CentOS/RHEL version/Virtual Appliance</td>
<td>Start the Service</td>
<td><code>sudo service proxy start</code></td>
</tr>
<tr>
<td>Proxy – Any CentOS/RHEL version/Virtual Appliance</td>
<td>Stop the Service</td>
<td><code>sudo service proxy stop</code></td>
</tr>
<tr>
<td>Proxy – Any CentOS/RHEL version/Virtual Appliance</td>
<td>Restart the Service</td>
<td><code>sudo service proxy status</code></td>
</tr>
</tbody>
</table>

Access Unified Access Gateway Logs

You can access the VMware Tunnel logs from the Unified Access Gateway without logging into the appliance by accessing a specific URL based on your deployment. To download a ZIP file that contains your logs, enter the following URL in a browser:

https://<virtual appliance domain name>:9443/rest/v1/monitor/support-archive

Change Proxy Log Level

You can change the log levels for the Proxy component in the Workspace ONE UEM console by navigating to Groups & Settings > All Settings > System > Enterprise Integration > VMware Tunnel > Configuration > Advanced. In cases where communication between the VMware Tunnel and AWCM or API breaks, you can still change the log level.

Procedure

2. Change `<root>log-level=VALUE` to `DEBUG` and Save on file.
3. Stop and Start the service.
4. Revert changes and restart the proxy service when finished.

Verify Proxy Connectivity

Verifying Proxy connectivity post-installation can help determine whether your installation was successful.

Procedure

1. Navigate to Groups & Settings > All Settings > System > Enterprise Integration > VMware Tunnel - Proxy.
2 Select **Test Connection**.

The page displays version info, connectivity through HTTP/S, and certificate chain validation.

### Proxy Component Error Codes

The following sections list out the error codes or messages for the VMware Tunnel Proxy component. You can use these error codes and message to better monitor your Workspace ONE UEM deployment.

<table>
<thead>
<tr>
<th>Code</th>
<th>Name</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>UNKNOWN</td>
<td>Unknown error. A runtime exception while processing the request</td>
</tr>
<tr>
<td>1</td>
<td>MISSING_HEADER</td>
<td>Headers are missing. This can include headers such as &quot;Proxy-Authorization&quot;. Possible Cause: The request was stripped in transit or a bad request was sent from the app. Possible Solution: Check all hops between the device and VMware Tunnel to see if another network component (e.g. proxy, VPN) stripped the header.</td>
</tr>
<tr>
<td>2</td>
<td>WRONG_ENCODING</td>
<td>Proxy-Authorization header value is not Base64 encoded. Possible Cause: The request was stripped in transit or a bad request was sent from the app. Possible Solution: Check all hops between the device and VMware Tunnel to see if another network component (e.g. proxy, VPN) stripped the header.</td>
</tr>
<tr>
<td>3</td>
<td>TOKENS_DONT_MATCH</td>
<td>Client identification tokens in Proxy-Authorization header do not follow alg:%s;uid:%s;bundleid:%s format. ID_FORMAT should contain encryption algorithm, uid and bundleID in a specific format. One or more of these is not present. Possible Cause: The request was stripped in transit or a bad request was sent from the app. Possible Solution: Check all hops between the device and VMware Tunnel.</td>
</tr>
<tr>
<td>4</td>
<td>INVALID_ALGO</td>
<td>The algorithm in the Proxy-Authorization token is not supported</td>
</tr>
<tr>
<td>5</td>
<td>EMPTY_CERT_CHAIN</td>
<td>There is no certificate present in the digital signature passed in the Proxy-Authorization header Possible Solution: Check all hops for a stripped certificate.</td>
</tr>
<tr>
<td>6</td>
<td>SINGLE_SIGNER</td>
<td>Error thrown if there are multiple signers found in the certificate chain. The request is expected to be signed by only one entity. Possible Cause: A bad certificate. Possible Solution: Create another certificate with a single signer.</td>
</tr>
<tr>
<td>7</td>
<td>SINGLE_SIGNER_CERT</td>
<td>Error thrown if there are multiple certificates for signers. The VMware Tunnel expects only one signer. The request signer should sign it with only one certificate. Possible Cause: A bad certificate. Possible Solution: Create another certificate with a single signer.</td>
</tr>
<tr>
<td>8</td>
<td>INVALID_SIGN</td>
<td>The signer information could not be verified. Possible Solution: Import the signer into the trusted certificate store on the server.</td>
</tr>
<tr>
<td>9</td>
<td>UNTRUSTED_ISSUER</td>
<td>The certificate used for signing wasn't issued by Device-Root of the given OG. Possible Cause: Workspace ONE UEM device root is different for enrolled OG and the OG on which VMware Tunnel is configured. Possible Solutions: (1) Override the Workspace ONE UEM device root certificate and regenerate the VMware Tunnel certificate. (2) Export the Workspace ONE UEM certificate from the Console or reinstall the VMware Tunnel.</td>
</tr>
<tr>
<td>Code</td>
<td>Name</td>
<td>Meaning</td>
</tr>
<tr>
<td>------</td>
<td>------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>10</td>
<td>MISSING_SIGN_TIME</td>
<td>The signing time attribute which is used to determine potential replay attack is missing in the signature</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Possible Cause:</strong> A bad certificate.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Possible Solution:</strong> Determine which certificate is bad in a request log. Create a correct certificate (if the cert is not a Workspace ONE UEM certificate). Re-run the VMware Tunnel installer.</td>
</tr>
<tr>
<td>11</td>
<td>POTENTIAL_REPLAY</td>
<td>There is more than a 15 minute interval between signature creation by the requester (AW Browser, Wrapping, etc) and verification by VMware Tunnel</td>
</tr>
<tr>
<td>12</td>
<td>INVALID_SIGN_DATA</td>
<td>There is discrepancy in the data that was signed by the requester (AW Browser, Wrapping, etc) and what was expected to be signed by VMware Tunnel. Any method other than the &quot;CONNECT&quot; request is sent to the VMware Tunnel and is rejected.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Possible Cause:</strong> An invalid request.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Possible Solution:</strong> Check all hops for what changed with the request at each hop.</td>
</tr>
<tr>
<td>13</td>
<td>DATA_UNAVAILABLE</td>
<td>The requester’s (AW Browser, Wrapping, etc) related data is not available with VMware Tunnel even after making an API call. No data available for Udid: ######, Bundfield: ####.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Possible Cause:</strong> VMware Tunnel does not have device details.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Possible Solutions:</strong> Check the VMware Tunnel to API connection. Restart the VMware Tunnel service.</td>
</tr>
<tr>
<td>14</td>
<td>INVALID_THUMBPRINT</td>
<td>The thumbprint of the certificate used by the requester (AW Browser, Wrapping, etc) for signing and the one expected by VMware Tunnel is different. Invalid SHA-1 thumbprint. Udid: ######, Bundfield: ####. VMware Tunnel expected: XYZ, Found:ABC</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Possible Cause:</strong> Occurs only when device is re-enrolled.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Possible Solutions:</strong> Re-install the Client (AWB, Wrapped App). Check the VMware Tunnel to AWCM connection. Restart VMware Tunnel Service.</td>
</tr>
<tr>
<td>15</td>
<td>NOT_COMPLIANT</td>
<td>The device making the request is not compliant (Must be in compliance states of 'Compliant' or 'Not Available').</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Possible Cause:</strong> VMware Tunnel expected: X,Y, Found: Z</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Possible Solution:</strong> Check the compliance status in the Device Dashboard.</td>
</tr>
<tr>
<td>16</td>
<td>NOT_MANAGED</td>
<td>The device is not managed by Workspace ONE UEM.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Possible Cause:</strong> The device is not enrolled.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Possible Solution:</strong> Enroll the device.</td>
</tr>
<tr>
<td>17</td>
<td>INVALID_CERT</td>
<td>The certificate used by the requester (AW Browser, Wrapping, etc) for signing is not valid (ex. signing time does not fall in the certificate lifetime).</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Possible Solution:</strong> Identify the invalid certificate.</td>
</tr>
<tr>
<td>18</td>
<td>NEED_CHUNK_AGGREGATION</td>
<td>Chunk aggregation is not enabled in MAG.properties file</td>
</tr>
<tr>
<td>19</td>
<td>HOST_DISCREPANCY</td>
<td>Host name in the URI does not match the one in the host header, deemed as a potential replay attack</td>
</tr>
</tbody>
</table>

**Troubleshooting Common Errors**

This section covers common error messages that you may encounter while working with VMware Tunnel and the procedure to fix the root cause of the problem.
Device configuration error

When the Tunnel VPN profile is not installed on the device, end users might see Device Not Configured when they try to open a Tunnel client.

Solution

1. In the Workspace ONE UEM console, navigate to the Device Detail page of the affected device and click the Profiles tab to confirm if the Tunnel VPN profile is installed.

2. For all the Android devices, open the Workspace ONE Intelligent Hub and under the Profiles section, check if the Tunnel VPN profile exists.

3. For all iOS devices, navigate to Settings > VPN and verify the VPN configuration details.

TLS Handshake Failure

You encounter this error if the SSL certificate present on the device does not match with the certificate on the server or if the certificate is not valid.

Solution

1. In the Workspace ONE UEM console, navigate to the Tunnel configuration page and verify the Front-End Certificate Thumbprint under server Authentication.

2. For all the Android devices, open the Workspace ONE Intelligent Hub and under the Profiles section, verify the certificate thumbprint for the Type.cer.
   a. For all the iOS devices, navigate to Settings > General > Device Management > Device Manager.
   b. Click More Details and under the Certificate section, click the certificate with the Tunnel hostname.

3. Scroll down to the SHA-1 text box and verify the certificate thumbprint.


5. Verify if the thumbprint on the device, server, and the Workspace ONE UEM console is the same. If not, restart the vpnd service on the Workspace ONE UEM console and republish the VPN profile.

DNS Resolution Failure

You might encounter DNS resolution error if the Tunnel server FQDN does not get resolved to an IP address.

Solution

1. From the device connected network, ensure that the Tunnel server FQDN resolves to an IP address.

2. In the command prompt, enter the following command: nslookup <Tunnel_Server_FQDN>. Tunnel server FQDN resolves to an IP address.
Gateway Unreachable

You encounter this error when the device is not able to communicate with the Tunnel server on the mentioned port.

Problem

Cause

Solution

1. From the device connected network, ensure that the device can connect to the Tunnel server on the port mentioned in the tunnel configuration.

2. From the terminal on the network device, enter the following command `openssl s_client -connect <dest_fqdn>:<port> -servername <server_fqdn>`.

   The device is connected and displays the Tunnel server Front-end SSL certificate.

3. From the server enter the following command: `Netstat -tlpn`

   The device displays the port mentioned in the Tunnel configuration.

4. If the Tunnel port is not seen, then verify the service status using the following command: `Systemctl status vpnd`

   **Note**
   - Ensure to verify the Firewall and Load balancer rules.
   - SSL Offloading and SSL bridging is not supported for the Per-App Tunnel component.

Access Denied

You may encounter this error when the device is not complaint or when the device information is not present on the Tunnel server.

Solution

1. From the device, open Workspace ONE Intelligent Hub complaint status and check if the device is complaint.

2. From the Workspace ONE UEM console navigate to the Device Details page for the affected device and check the complaint status.

3. From the server, enter the following command: `/vpnreport whitelist --udid=<Device_udid>` in the `/opt/vmware/tunnel/vpnd` directory.

   **Solution**

   In result xml, the `ComplianceStatusId` should be 3 or 5.
No Apps Assigned

You encounter this error when the managed internal or public application is not mapped with the Tunnel VPN profile.

Solution

1. Navigate to Apps & Books > Applications > Native and select the Internal/ Public tab.
2. Check for the device in the assignment group where the App Tunneling is enabled.