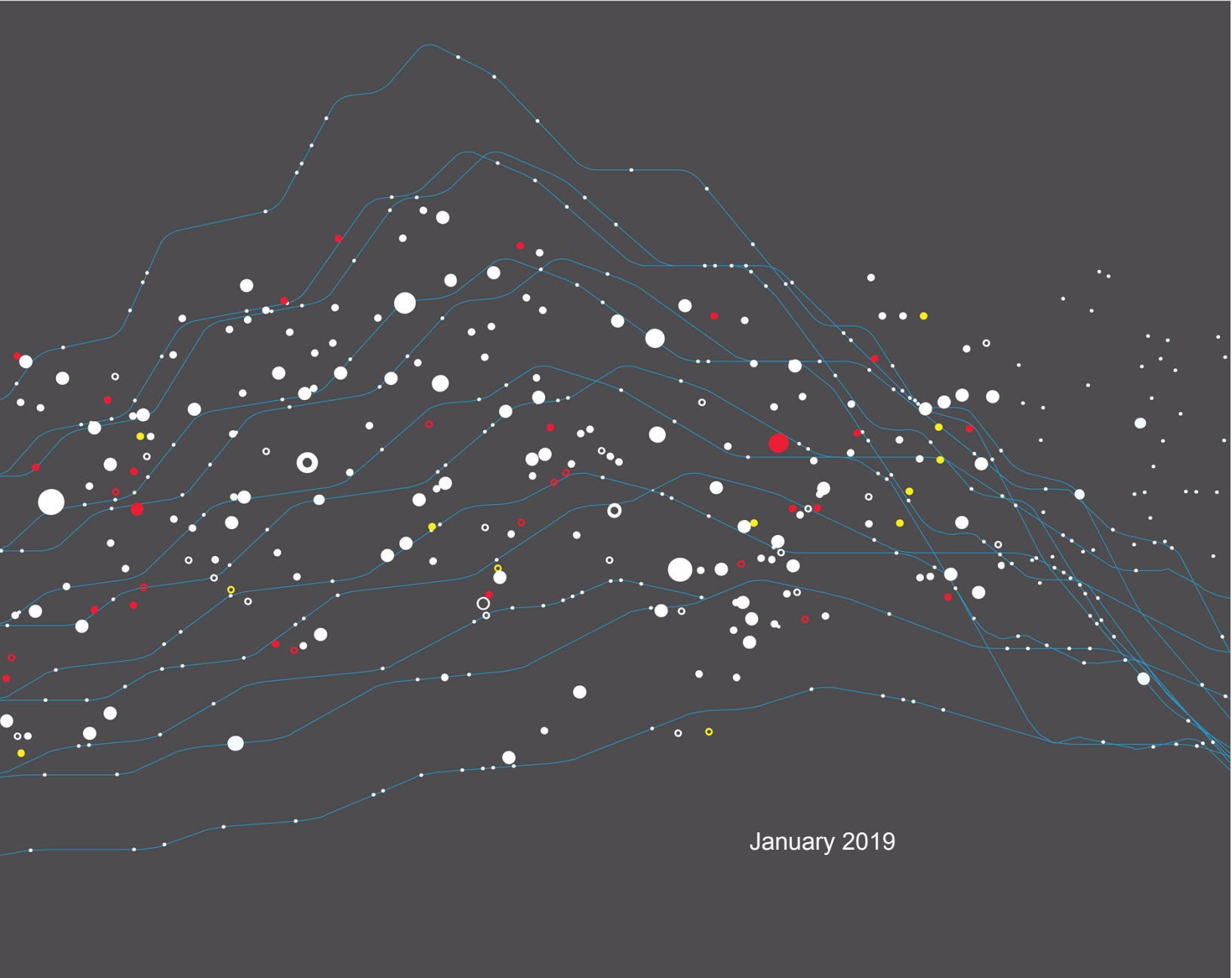




RECOMMENDED DEPLOYMENT PRACTICES

The F5 SSL Orchestrator and Palo Alto Networks Next-Gen Firewall Solution: SSL Visibility with Service Chaining



January 2019

Contents

Introduction	3
The Integrated Solution	3
Best Practices for the Joint Solution	7
Initial Setup	9
SSL Orchestrator Configuration.....	10
Guided configuration.....	11
Guided configuration workflow.....	12
Topology properties	12
SSL configuration.....	13
Create the Palo Alto Networks NGFW service	14
Configuring as an L2 service	15
Configuring as an L3 service	16
Configuring as a TAP service	18
Configuring service chains.....	19
Security policy	20
Interception rules	20
Egress setting	21
Configuration summary and deployment	21
Handling NAT	23
Testing the Solution	24

Introduction

The Secure Sockets Layer (SSL) protocol and its successor, Transport Layer Security (TLS), are being widely adopted by organizations to secure IP communications. While SSL provides data privacy and secure communications, it also creates challenges to inspection devices in the security stack. In short, the encrypted communications cannot be seen as clear text and are passed through without inspection, becoming security blind spots. This creates serious risks for businesses: What if attackers are hiding malware inside the encrypted traffic?

However, performing decryption of SSL/TLS traffic on the security inspection devices, with native decryption support, can tremendously degrade the performance of those devices, especially given the demands of stronger, 2048-bit certificates.

An integrated F5 and Palo Alto Networks solution solves these two SSL/TLS challenges. F5® SSL Orchestrator™ centralizes SSL inspection across complex security architectures, enabling flexible deployment options for decrypting and re-encrypting user traffic. It also provides intelligent traffic orchestration using dynamic service chaining and policy-based management. The decrypted traffic is then inspected by one or more Palo Alto Networks next-generation firewalls (NGFWs), which can prevent previously hidden threats and block zero-day exploits. This solution eliminates the blind spots introduced by SSL and closes any opportunity for adversaries.

This overview of the joint solution describes different deployment modes with reference to service chain architectures, recommends practices, and offers guidance on how to handle enforcement of corporate Internet use policies.

The Integrated Solution

The F5 and Palo Alto Networks integrated solution enables organizations to intelligently manage SSL while providing visibility into a key threat vector that attackers often use to exploit vulnerabilities, establish command and control channels, and steal data. Without SSL visibility, it is impossible to identify and prevent such threats at scale.

Key highlights of the joint solution include:

- **Flexible deployment modes** that easily integrate into even the most complex architectures, consolidate the security stack to reduce complexity, and deliver SSL visibility across the security infrastructure.
- **Centralized SSL decryption/re-encryption** with best-in-class SSL hardware acceleration, eliminating the processing burden of multiple decryption/re-encryption workloads on every security inspection hop in the stack, which reduces latency while improving the user experience.
- **Dynamic security service chaining**, which provides policy-based traffic management, thus determining whether traffic should be allowed to pass or be decrypted and sent through a security device or service.
- **An industry-leading application delivery controller** that load balances traffic to multiple devices in the security services, enabling effortless scaling and growth.
- **Built-in health monitors** that detect security service failures and shifts or bypasses loads in real time to provide reliability and fault tolerance.
- **Full cipher support**, including support for the PFS-enabled ciphers, to ensure full traffic visibility.

- **Natively integrated security technologies** that leverage a single-pass prevention architecture to exert positive control based on applications, users, and content to reduce the organization’s attack surface.
- **Automated creation and delivery of protection mechanisms** to defend against new threats to network, cloud, and endpoint environments.
- **Threat intelligence sharing** that provides protection by taking advantage of the network effects of a community of comprehensive, global threat data to minimize the spread of attacks.

SSL visibility: How do we do it?

F5’s industry-leading full proxy architecture enables F5 SSL Orchestrator to install a decryption/clear text zone between the client and web server, creating an aggregation (and disaggregation) visibility point for security services. The F5 system establishes two independent SSL connections—one with the client and the other with the web server. When a client initiates an HTTPS connection to the web server, SSL Orchestrator intercepts and decrypts the client-encrypted traffic and steers it to a pool of Palo Alto Networks NGFWs for inspection before re-encrypting the same traffic to the web server. The return HTTPS response from the web server to the client is likewise intercepted and decrypted for inspection before being sent on to the client.

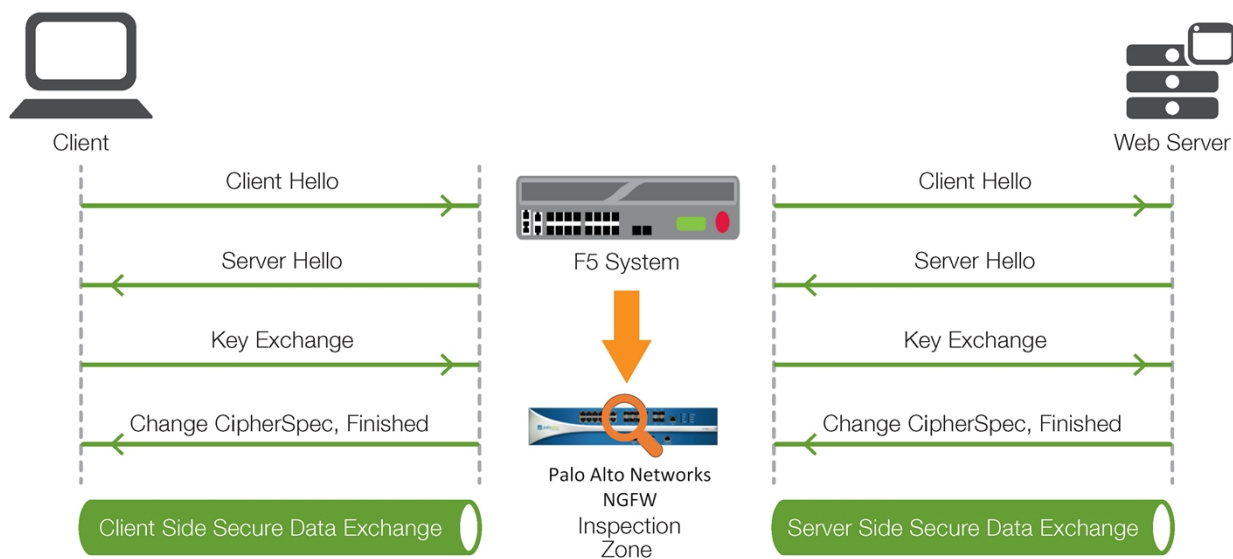


Figure 1: The F5 full proxy architecture

Dynamic service chaining

A typical security stack often consists of more than advanced anti-malware protection systems, with additional components such as a firewall, intrusion detection or prevention systems (IDS/IPS), web application firewalls, malware analysis tools, and more. To solve specific security challenges, administrators are accustomed to manually chaining these point security products. In this model, all user sessions are provided the same level of security, as this “daisy chain” of services is hard-wired.

F5 SSL Orchestrator not only decrypts the encrypted traffic, it also load balances, monitors, and dynamically chains security services, including next-generation firewalls, DLPs, IDS/IPSs, web application firewalls, and anti-virus/anti-

RECOMMENDED DEPLOYMENT PRACTICES

F5 and Palo Alto Networks SSL Visibility with Service Chaining

malware systems. It does this by matching user-defined policies, which determine what to intercept and whether to send data to one set of security services or another based on context. This policy-based traffic steering enables better utilization of existing security investments and helps reduce administrative costs.

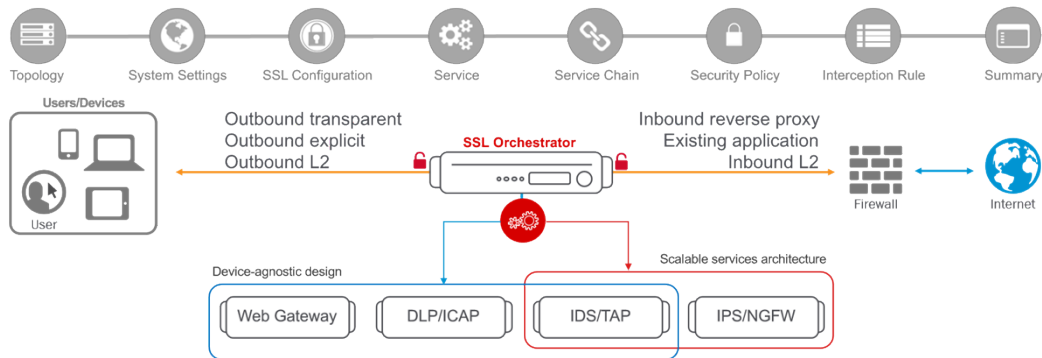


Figure 2: A service chain

SSL Orchestrator's powerful classification engine applies different service chains based on context derived from:

- Source IP/subnet.
- Destination IP/subnet.
- An F5® IP Intelligence category subscription.
- IP geolocation.
- Host and domain name.
- An F5 URL filtering category subscription.
- Destination port.
- Protocol.

Topologies

Different environments call for different network implementations. While some can easily support SSL visibility at layer 3 (routed), others may require these devices to be inserted at layer 2. SSL Orchestrator can support all these networking requirements with the following topology options:

- Outbound transparent proxy
- Outbound explicit proxy
- Outbound layer 2
- Inbound reverse proxy
- Inbound layer 2
- Existing application

License components

The [F5 SSL Orchestrator](#) product line—the i2800, i5800, i10800, i11800, i15800, and Virtual Edition High Performance (HP)—supports this joint solution. SSL Orchestrator devices ship with an installed base module that provides both SSL interception and service chaining capabilities. Please contact your local F5 representative to further understand the licensing and deployment options.

Unless otherwise noted, references to SSL Orchestrator and the F5® BIG-IP® system in this document (and some user interfaces) apply equally regardless of the F5 hardware used. The solution architecture and configuration are identical.

Optionally, customers can add the functionality of:

- **An F5 URL filtering (URLF) subscription** to access the URL category database.
- **An F5 IP Intelligence (IPI) subscription** for IP reputation service.
- **A network hardware security module (HSM)** to safeguard and manage digital keys for strong authentication.
- **F5® Secure Web Gateway (SWG) Services** to filter and control outbound web traffic using a URL database.
- **F5® BIG-IP® Access Policy Manager® (APM)** to authenticate and manage user access.
- **An F5 BIG-IP® Local Traffic Manager™ (LTM) add-on software license mode.** This solution is supported on all F5 BIG-IP iSeries and older F5 hardware platforms and has no specific restrictions on additional F5 software modules (including the above software services). This option is suited for environments that need to deploy SSL Orchestrator on an existing BIG-IP device or have other functions that must run on the same device.

The following Palo Alto Networks products and subscriptions are needed for deploying the solution:

- **A Palo Alto Networks Next-Generation Firewall** for policy-based control of applications, users, and content
- **A Threat Prevention subscription** that includes malware, command-and-control, and vulnerability and exploit protection with IPS capabilities
- **A WildFire subscription** that expedites the response to threats by automatically detecting unknown malware and generating and distributing protections to subscribers.

Refer to the Palo Alto Network [technical documentation](#) for complete guidance. (Administrators may need to be registered with appropriate privileges to access this resource.)

Sizing

The main advantage of deploying SSL Orchestrator in the corporate security architecture is that the wire traffic now can be classified as “interesting” traffic, which needs to be decrypted by SSL Orchestrator for inspection by a Palo Alto Networks NGFW, and “uninteresting” traffic, which is allowed to pass through or be processed differently according to other corporate policy requirements. This selective steering of only the interesting traffic to the Palo Alto Networks

RECOMMENDED DEPLOYMENT PRACTICES

F5 and Palo Alto Networks SSL Visibility with Service Chaining

NGFW conserves its valuable resources (as it need not inspect the entire wire traffic), maximizing performance.

As a result, it is important to consider the entire wire traffic volume to calculate the appropriate F5 system size. The NGFW will require two interfaces on the F5 system (or one 802.1q VLAN tagged interface) to allow traffic flow through logical inbound and outbound service interfaces.

Refer to the [SSL Orchestrator Datasheet](#) and consider the following factors when sizing the F5 system for the integrated solution:

- Port density
- SSL bulk encryption throughput
- System resources
- The number of security services and devices in service chain

Traffic exemptions for SSL inspection

As noted, the F5 system can be configured to distinguish between interesting and uninteresting traffic for the purposes of security processing. Examples of uninteresting traffic (including those types that cannot be decrypted) to be exempted from inspection may include:

- Guest VLANs.
- Applications that use pinned certificates.
- Trusted software update sources like those for Microsoft Windows updates.
- Trusted backup solutions, such as a crash plan.
- Any lateral encrypted traffic to internal services that should be exempted.

Administrators can also exempt traffic based on domain names and URL categories. The policy rules of SSL Orchestrator enable administrators to enforce corporate Internet use policies, preserve privacy, and meet regulatory compliance.

Traffic exemptions based on URL category might include bypasses (and thus no decryption) for traffic from known sources of these types of traffic:

- Financial
- Health care
- Government services

Best Practices for the Joint Solution

A number of best practices can help optimize the performance and reliability, as well as the security, of the joint solution.

Architecture best practices

A number of best practices can help ensure a streamlined architecture that optimizes performance and reliability as well as security. F5 recommendations include:

- Deploy inline. Any SSL visibility solution must be inline to the traffic flow to decrypt PFS cipher suites such as ECDHE (elliptic curve Diffie-Hellman encryption).
- Deploy SSL Orchestrator in a device sync/failover device group (S/FDG) that includes the high-availability (HA) pair with a floating IP address.
- Use dual-homing. The NGFWs must be dual-homed on the inward and outward VLANs with each F5 system in the device S/FDG.
- Achieve further interface redundancy with the Link Aggregation Control Protocol (LACP). LACP manages the connected physical interfaces as a single virtual interface (aggregate group) and detects any interface failures within the group.

Security best practices

SSL orchestration generally presents a new paradigm in the typical network architecture. Previously, client/server traffic passed encrypted to inline security services, which then had to perform their own decryption if they needed to inspect that traffic. When SSL Orchestrator is integrated into the security architecture, *all* traffic to a security device is decrypted—including user names, passwords, and social security and credit card numbers. It is therefore highly recommended that security services be isolated within a private, protected enclave defined by SSL Orchestrator. It is technically possible to configure SSL Orchestrator to send decrypted traffic anywhere that can be reached by the routing setup, but this is a high-risk practice that should be avoided.

Certificate requirements

Different certificate requirements apply depending on the direction of traffic flow.

Outbound traffic flow (internal client to Internet)

An SSL certificate and associated private key—preferably a subordinate certificate authority (CA)—on the F5 system are needed to issue certificates to the end host for client-requested external resources that are being intercepted. To ensure that clients on the corporate network do not encounter certificate errors when accessing SSL-enabled websites from their browsers, this issuing certificate must be locally trusted in the client environment.

Inbound traffic flow (Internet users to internal applications)

Inbound SSL orchestration is similar to traditional reverse web proxy SSL handling. At minimum, it requires a server certificate and associated private key that matches the host name that external users are trying to access. This may be a single instance certificate or a wildcard or subject alternative name (SAN) certificate if inbound SSL orchestration is defined as a gateway service.

IP addressing

When a Palo Alto Networks firewall is deployed as an L3/routed hop, F5 recommends configuring its IP addresses for connected inward and outward VLANs from default fixed addressing subnets. These subnets are provided by SSL Orchestrator and derived from a RFC2544 CIDR block of 198.19.0.0 to minimize the likelihood of address collisions.

For example, a firewall can be configured to use the IP address 198.19.0.61/25 on the inward VLAN and 198.19.0.161/25 on the outward VLAN pointing to the SSL Orchestrator-connected interfaces. Static routes also need to be configured to the internal networks on the firewall inward VLAN and a default route to the Internet on the outward VLAN. The table below explains the necessary IP addresses to configure when deploying multiple firewalls in the service pool.

Palo Alto Networks NGFW	Inward Interface IP	Inward/Internal Gateway	Outward Interface IP	Outward/Default Gateway
Palo Alto Networks NGFW-1	198.19.0.61/25	198.19.0.10/25	198.19.0.161/25	198.19.0.245/25
Palo Alto Networks NGFW-2	198.19.0.62/25		198.19.0.162/25	
Palo Alto Networks NGFW-n <i>n</i> <= 8	198.19.0.6 <i>n</i> /25		198.19.0.16 <i>n</i> /25 <i>n</i> <= 8	

Initial Setup

Complete these initial steps before performing detailed configuration of SSL Orchestrator. When upgrading from a previous version of the SSL Orchestrator, refer to the [SSLO setup guide](#) for the recovery procedure.

Configure the VLANs and self-IPs

For deployment in a layer 3 (routed or explicit proxy) topology, the F5 system must be configured with appropriate client-facing, outbound-facing VLANs plus self-IPs and routes. The VLANs define the connected interfaces, and the self-IPs define the respective IPv4 and/or IPv6 subnets. Refer to the F5 [Routing Administration Guide](#) for configuration steps to set up the VLANs and self-IPs.

Import a CA certificate and private key

For SSL orchestration in an outbound traffic topology, a local CA certificate and private key are required to re-sign the remote server certificates for local (internal) clients. For an inbound traffic topology, remote clients terminate their TLS sessions at the F5 system, so it must possess the appropriate server certificates and private keys. Refer to the F5 support article on [managing SSL certificates for F5 systems](#) to understand the procedure.

Update the SSL Orchestrator version

Periodic updates are available for SSL Orchestrator. To download the latest:

1. Visit downloads.f5.com and log in with registered F5 credentials.
2. Click **Find a Download**.
3. Scroll to the **Security** product family, select **SSL Orchestrator**, and click the link.

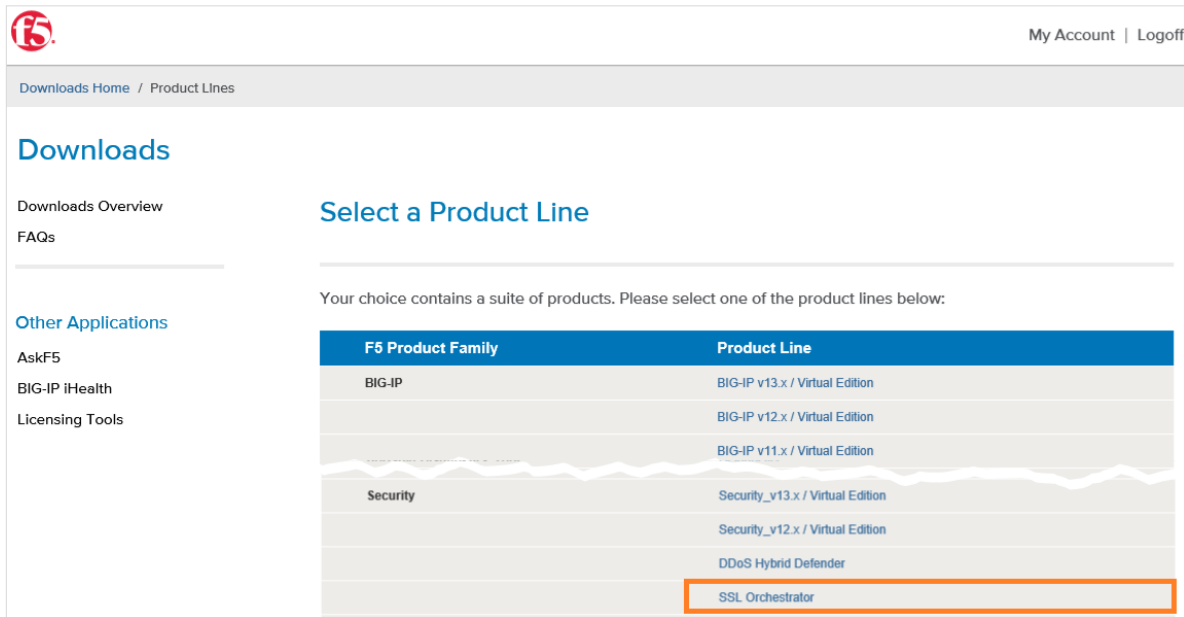


Figure 3: The F5 product download web page

4. Select and download the latest version of the SSL Orchestrator .rpm file.
5. Read the appropriate [Release Notes](#) before attempting to use the file.
6. Log into the F5 system. On the F5 Web UI in the **Main** menu, navigate to **SSL Orchestrator > Configuration** and click **Upgrade SSL Orchestrator** in the upper right.
7. Click **Choose File** and navigate to the downloaded .rpm file. Select it and click **Open**.
8. Click **Upload and Install**.

Detailed configuration can now proceed.

SSL Orchestrator Configuration

A Palo Alto NGFW can be configured as a layer 3 (L3), layer 2 (L2), or TAP service in SSL Orchestrator. The sample configuration below focuses on a traditional outbound (forward proxy) use case with Palo Alto Networks NGFWs configured as an L2 service. (See Figure 4.) SSL Orchestrator steers the unencrypted and decrypted web traffic through the NGFW pool, which is part of one or more service chains of security devices.

RECOMMENDED DEPLOYMENT PRACTICES

F5 and Palo Alto Networks SSL Visibility with Service Chaining

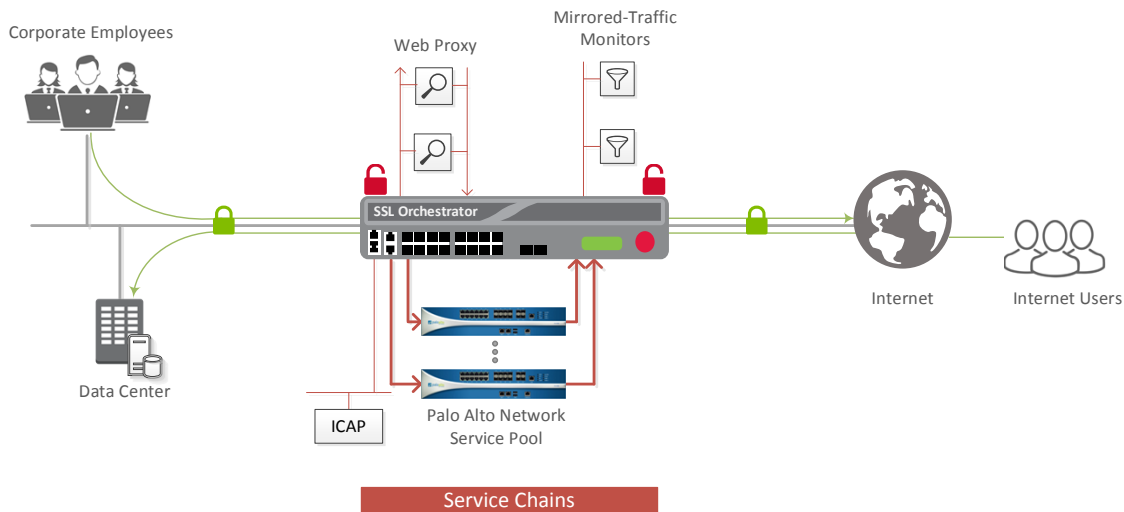


Figure 4: A sample inline deployment architecture

Guided configuration

The SSL Orchestrator 5.0 guided configuration presents a completely new and streamlined user experience. This workflow-based architecture provides intuitive, reentrant configuration steps tailored to a selected topology.

The steps below will walk through the guided configuration to build a simple transparent forward proxy.

1. Once logged into the F5 system, on the F5 Web UI **Main** menu, click **SSL Orchestrator > Configuration**.
2. Take a moment to review the various configuration options.
3. (Optional.) Satisfy any of the **DNS**, **NTP** and **Route** prerequisites from this initial configuration page. Keep in mind, however, that the SSL Orchestrator guided configuration will provide an opportunity to define DNS and route settings later in the workflow. Only NTP is not addressed later.

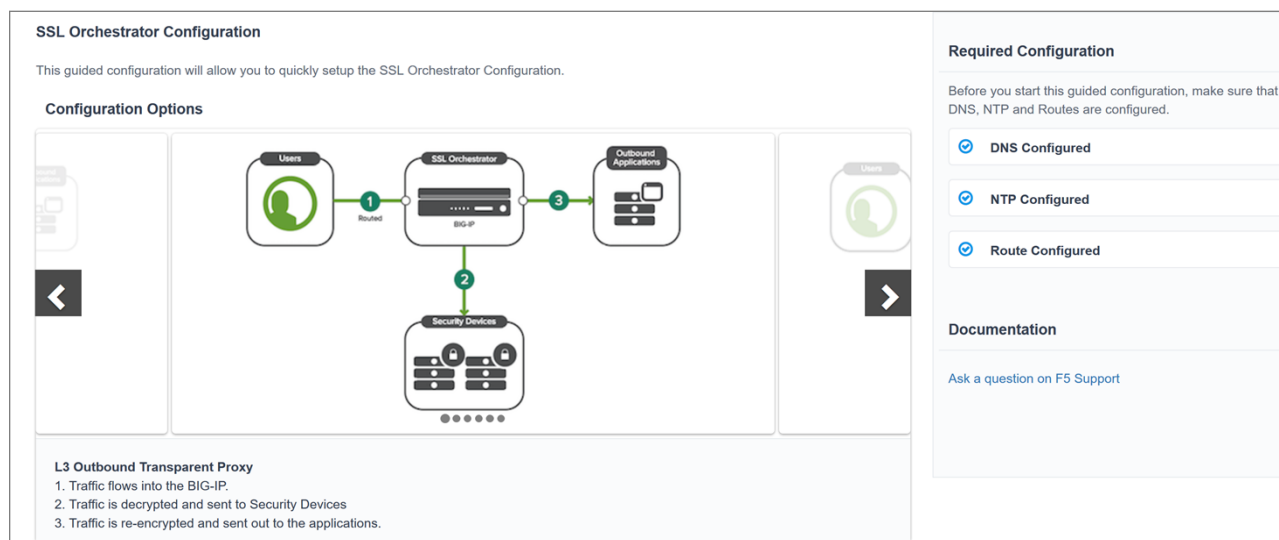


Figure 5: The initial guided configuration page

4. No other configurations are required in this section, so click **Next**.

Guided configuration workflow

The first stage of the guided configuration addresses topology.



Figure 6: The guided configuration workflow

Topology properties

1. SSL Orchestrator creates discreet configurations based on the selected topology. An explicit forward proxy topology will ultimately create an explicit proxy listener. Make appropriate selections in the **Topology Properties** section of the configuration, using the guidance below.

Topology Properties	User Input
Name	Type a Name for the SSL Orchestrator deployment.
Description	Type a Description for this SSLO deployment
Protocol	<p>The Protocol option presents four protocol types:</p> <ul style="list-style-type: none"> • TCP: Creates a single TCP wildcard interception rule for the L3 inbound, L3 outbound, and L3 explicit proxy topologies. • UDP: Creates a single UDP wildcard interception rule for L3 inbound and L3 outbound topologies. • Other: Creates a single “any protocol” wildcard interception rule for L3 inbound and L3 outbound topologies. Typically used for non-TCP/UDP traffic flows. • Any: Creates the TCP, UDP and non-TCP/UDP interception rules for outbound traffic flows. The sample configuration here demonstrates this option.
IP Family	Specify whether the configuration should support IPv4 addresses or IPv6 addresses.
SSL Orchestrator Topologies	<p>The SSL Orchestrator Topologies option page presents six topologies:</p> <ol style="list-style-type: none"> 1. L3 Explicit Proxy: The traditional explicit forward proxy. The sample configuration presented here uses this topology. 2. L3 Outbound: The traditional transparent forward proxy. 3. L3 Inbound: A reverse proxy configuration. 4. L2 Inbound: Provides a transparent path for inbound traffic flows, inserting SSL Orchestrator as a bump-in-the-wire in an existing routed path, where SSL Orchestrator presents no IP addresses on its outer edges. 5. L2 Outbound: Provides a transparent path for outbound traffic flows, inserting SSL Orchestrator as a bump-in-the-wire in an existing routed path, where SSL Orchestrator presents no IP addresses on its outer edges. 6. Existing Application: Designed to work with existing BIG-IP LTM applications that already perform their own SSL handling and client-server

RECOMMENDED DEPLOYMENT PRACTICES

F5 and Palo Alto Networks SSL Visibility with Service Chaining

	<p>traffic management. The Existing Application workflow proceeds directly to service creation and security policy definition, then exits with an SSL Orchestrator-type access policy and per-request policy that can easily be consumed by a BIG-IP LTM virtual server.</p> <p>The sample configuration presented here deploys SSL Orchestrator as an L3 explicit proxy for decrypting outbound TLS/SSL traffic. See Figure 7.</p>
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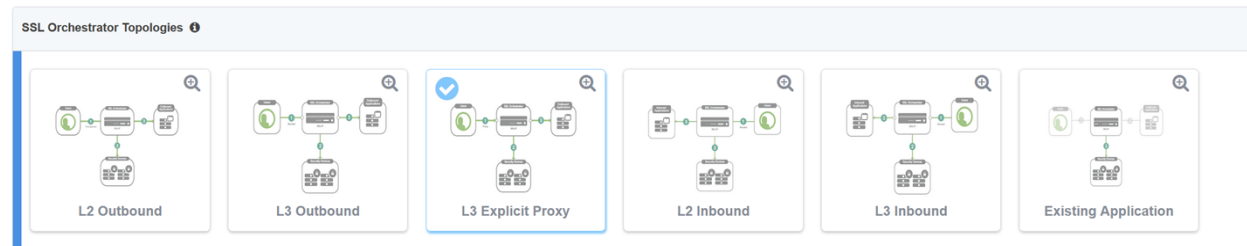


Figure 7: Sample topology configuration

2. Click **Save & Next**.

SSL configuration

This section defines the specific SSL settings for the selected topology (a forward proxy in this example) and controls both client-side and server-side SSL options. If existing SSL settings are available from a previous workflow, they can be selected and reused. Otherwise, the **SSL Configuration** section creates new SSL settings.

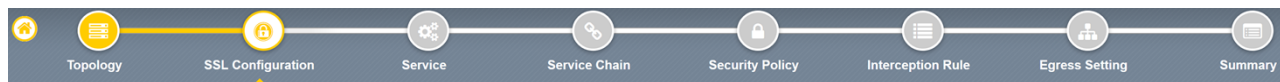


Figure 8: SSL configuration in the workflow

1. Click **Show Advanced Settings** on the right.
2. Make appropriate **SSL Configuration** selections using the guidance below.

SSL Configuration	User Input
SSL Profile	
Name	Enter a Name for the SSL profile.
Description	Enter a Description for this SSL profile.
Client-Side SSL	
Cipher Type	<p>The cipher type can be a Cipher Group or Cipher String. The latter is recommended.</p> <ul style="list-style-type: none"> • For Cipher Group, select a previously-defined cipher group (which can be defined if necessary by navigating to Local Traffic > Ciphers > Groups). • When Cipher String is selected, a field will be populated with the DEFAULT option, which is optimal for most environments. (Otherwise, users could also enter a cipher string that appropriately represents the client-side TLS requirement.

RECOMMENDED DEPLOYMENT PRACTICES

F5 and Palo Alto Networks SSL Visibility with Service Chaining

Certificate Key Chains	<p>The certificate key chain represents the certificate and private key used as the template for forged server certificates. While reissuing server certificates on the fly is generally easy, private key creation tends to be a CPU-intensive operation. For that reason, the underlying SSL forward proxy engine forges server certificates from a single defined private key. This setting gives administrators the opportunity to apply their own template private key and to optionally store that key in a FIPS-certified HSM for additional protection. The built-in default certificate and private key uses 2K RSA and is generated from scratch when the F5 system is installed.</p> <p>Select the default.crt certificate, default.key key, and default.crt chain. Leave the Passphrase field empty and click Add.</p>
CA Certificate Key Chains	<p>an SSL forward proxy must re-sign or forge a remote server certificate to local clients using a local CA certificate, and local clients must trust this local CA. This setting defines the local CA certificate and private key used to perform the forging operation.</p> <p>Specify one or more configured subordinate CA certificates and keys that were imported, then click Add.</p>
Server-Side SSL	
Cipher Type	Select Cipher String for the default cipher list.
Ciphers	Uses the ca-bundle.crt file, which contains all well-known public CA certificates, for client-side processing
Expired Certificate Response Control	Select whether to drop or ignore the connection even if the specified certificate response control (CRL) file has expired.
Untrusted Certificate Response Control	Select drop or ignore the connection even if the specified CRL file is not trusted.
OCSP	Specify the supported OCSP .
CRL	Specify the supported CRL .

3. Click **Save & Next**.

Note: SSL settings minimally require an RSA-based template and CA certificates but can also support elliptic curve (ECDSA) certificates. In this case, SSL Orchestrator would forge an EC certificate to the client if the TLS handshake negotiated an ECDHE_ECDSA cipher. To enable EC forging support, add both an EC template certificate and key, and an EC CA certificate and key.

Create the Palo Alto Networks NGFW service

The Palo Alto Networks NGFW can be configured either in inline mode as an L2 or L3 hop, or in TAP mode.

Configuring as an L2 service

The **Services List** section defines the security services that interact with SSL Orchestrator. The guided configuration includes a services catalog that contains common product integrations. Beneath each of these catalog options is one of

RECOMMENDED DEPLOYMENT PRACTICES

F5 and Palo Alto Networks SSL Visibility with Service Chaining

the five basic service types: layer 3, layer 2, ICAP, TAP, and HTTP service.

The service catalog also provides “generic” security services. (It may be necessary to scroll down to see additional services.)



Figure 9: Service configuration

To configure the service:

1. Under **Service List**, click **Add Service**.
2. In the service catalog, double click **Palo Alto Networks NGFW** service. (If the SSL Orchestrator version in use doesn't have this option, use the generic L2 service.) The **Service Properties** page displays.
3. Configure the service using the guidance below, which shows L2 service configuration. To configure either as a L3 or TAP service, refer the next two sections of this document.

Service Properties	User Input
Service Settings	
Name	Enter a Name for the Palo Alto Network NGFW service. This name can contain 1-15 alphanumeric or underscore characters but must start with a letter. Letters are not case sensitive.
Description	Enter a Description for the Palo Alto Network Service.
Network Configuration	<p>Click Add.</p> <p>Then, create the From VLAN and To VLAN pairs (inward and outward VLANs) by entering a name and selecting the interface. These VLAN pairs and the associated interfaces define the network connectivity between SSL Orchestrator and the inline security device.</p> <p>If SSL Orchestrator systems have been configured in a sync/failover device group for HA, then the VLAN pairs must be connected to the same layer 2 virtual network from every device.</p> <p>If multiple Palo Alto Networks NGFWs are involved, choose the respective VLAN pair and click Add. Enter the desired ratio for every NGFW in the pool to control the load it receives.</p>
Service Down Action	<p>Specify how the system should handle a failure of the L2 service or times when it is otherwise unavailable.</p> <ul style="list-style-type: none">• Ignore: Specifies that the traffic to the service is ignored and is sent to the next service in the chain.• Drop: Specifies that the system initiates a close on the client connection.• Reset: Specifies that the system immediately sends an RST on the client connection for TCP traffic. For UDP traffic, this action is the same.
Enable Port Remap	Select Enable Port Remap .

RECOMMENDED DEPLOYMENT PRACTICES

F5 and Palo Alto Networks SSL Visibility with Service Chaining

Remap Port	For the NGFW to recognize that the steered traffic has been decrypted, it needs to be sent on a non-443 TCP port. Select a non-443 port.
iRules	Additional iRules are not required, but SSL Orchestrator allows for the insertion of additional F5 iRules® logic at different points. An iRule defined at the service only affects traffic flowing across this service. It is important to understand, however, that these iRules must not be used to control traffic flow (for example, pools, nodes, or virtual servers), but rather should be used to view/modify application layer protocol traffic. For example, an iRule assigned here could be used to view and modify HTTP traffic flowing to/from the service. Leave this field empty to configure without iRules.

- Click **Save** to return to the **Service List** section. To configure additional services, click **Add Service** to access the service catalog again.
- Once all the desired services are created, click **Save & Next** to move on to service chain setup.

Configuring as an L3 service

When the Palo Alto Networks NGFW is configured as an L3 service as shown in Figure 10, SSL Orchestrator routes the unencrypted and decrypted web traffic through the Palo Alto Networks NGFW pool, which is part of the service chain(s) of security devices.

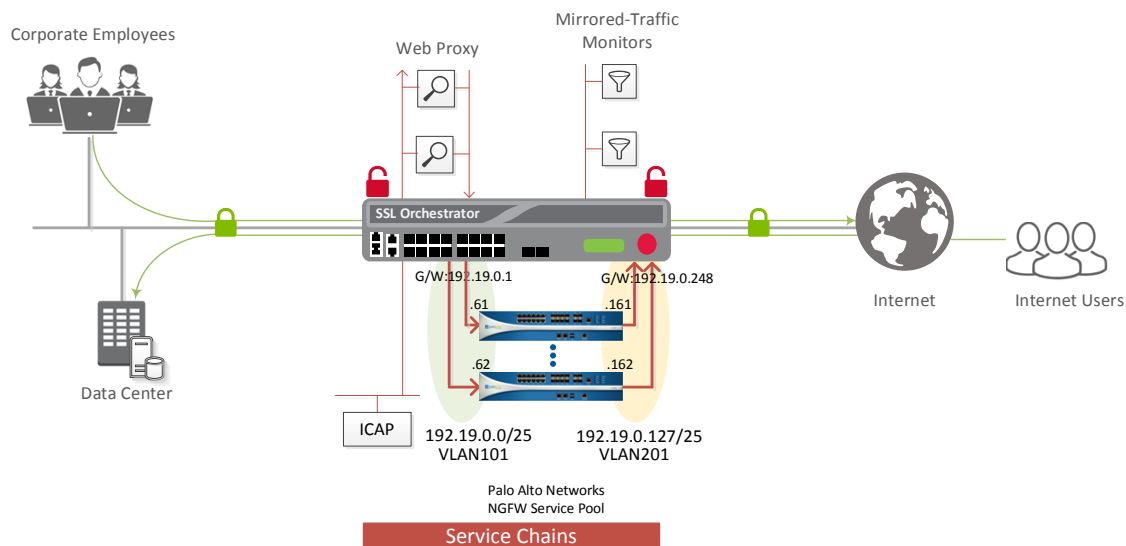


Figure 10: L3 service deployment architecture

- On the **Service Properties** page (refer to the previous procedure if necessary), configure the service using the guidance below:

Service Properties	User Input
Service Settings	
Name	Enter a Name for the Palo Alto Network NGFW service. This name can contain 1-

RECOMMENDED DEPLOYMENT PRACTICES

F5 and Palo Alto Networks SSL Visibility with Service Chaining

	15 alphanumeric or underscore characters but must start with a letter. Letters are not case sensitive.
Description	Type a Description for the Palo Alto Network Service.
Service Definition	Click Auto Manage Addresses .
To Service Configuration	Click Create New . Configure the To Service VLAN (outward VLAN) by entering a name and selecting the interface. The VLAN and the associated interface define the network connectivity from SSL Orchestrator to the inline security device.
Service Down Action	Specify how the system should handle a failure of the L2 service or times when it is otherwise unavailable. <ul style="list-style-type: none"> • Ignore: Specifies that the traffic to the service is ignored and is sent to the next service in the chain. • Drop: Specifies that the system initiates a close on the client connection. • Reset: Specifies that the system immediately sends a RST on the client connection for TCP traffic. For UDP traffic, this action is the same.
Security Devices	Click Add and enter the IP address of the inward VLAN configured on the NGFW and connected to SSL Orchestrator. Then click Add . If multiple NGFWs are involved, add the IP address of the inward VLAN on each NGFW. SSL Orchestrator will create a load balancing pool of NGFWs.
From Service Configuration	Click Create New . Configure the From Service VLAN (Inward VLAN) by entering a name and selecting the interface. The VLAN and the associated interface define the network connectivity to SSL Orchestrator from the inline security device.
Remap Port	For the Palo Alto Networks NGFW to recognize that the steered traffic has been decrypted, it needs to be sent on a non-443 TCP port. Select and enter a non-443 port.
Manage SNAT settings	Choose whether to use network addresses translation.

RECOMMENDED DEPLOYMENT PRACTICES

F5 and Palo Alto Networks SSL Visibility with Service Chaining

Resources	
iRules	Additional iRules are not required, but SSL Orchestrator allows for the insertion of additional F5 iRules® logic at different points. An iRule defined at the service only affects traffic flowing across this service. It is important to understand, however, that these iRules must not be used to control traffic flow (for example, pools, nodes, or virtual servers), but rather should be used to view/modify application layer protocol traffic. For example, an iRule assigned here could be used to view and modify HTTP traffic flowing to/from the service. Leave this field empty to configure without iRules.

2. Click **Save**.

Configuring as a TAP service

As shown in Figure 11, in a TAP service mode, the F5 system copies the unencrypted and decrypted web traffic to the Palo Alto Network NGFW pool, which is part of the service chain(s) of security devices.

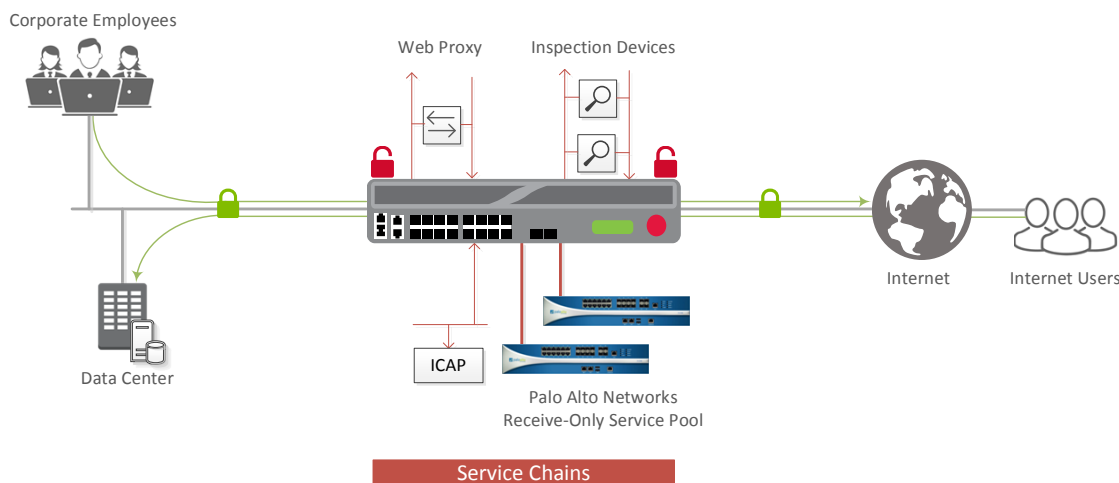


Figure 11: TAP service deployment architecture

1. On the TAP **Service Properties** page, configure the service using the guidance below:

Configuration Field	User Input
Name	Enter a Name for the TAP service.
TAP Service	
MAC Address	Type the MAC Address of the receiving interface of the NGFW. This address must be reachable by an F5 system VLAN.
VLAN	Click Create New and specify the VLAN where the NGFW device resides.
Interface	Select the associated F5 system interface.
Service Down Action	Specify how the system should handle a failure of the TAP service or when it is

RECOMMENDED DEPLOYMENT PRACTICES

F5 and Palo Alto Networks SSL Visibility with Service Chaining

	<p>otherwise unavailable.</p> <ul style="list-style-type: none"> • Ignore: Specifies that the traffic to the service is ignored and is sent to the next in chain. • Drop: Specifies that the system initiates a close on the client connection. • Reset: Specifies that the system immediately sends an RST on the client connection for TCP and UDP traffic.
Port Remap	For the NGFW to recognize that the steered traffic has been decrypted, it needs to be sent on a non-443 TCP port. Select a non-443 port.

Configuring service chains

Service chains are arbitrarily ordered lists of security devices. Based on the ecosystem's requirements, different service chains may contain different, reused sets of services, and different types of traffic can be assigned to different service chains. For example, HTTP traffic may need to go through all of the security services while non-HTTP traffic goes through a subset of those services and traffic destined to a financial service URL can bypass decryption and still flow through a smaller set of security services.

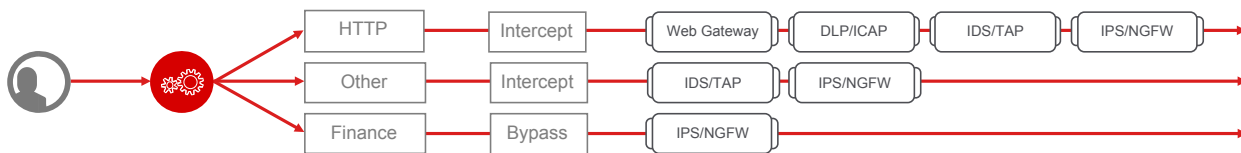


Figure 12: Different traffic flowing through chains of different security services

Each service chain is linked to service chain classifier rules and processes specific connections based on those rules, which look at protocol, source, and destination addresses. Service chains can include each of the three types of services (inline, ICAP, or receive-only), as well as decryption zones between separate ingress and egress devices.

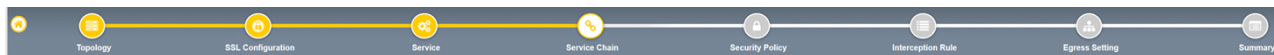


Figure 13: Configuring service chains

To create a new service chain containing all of the configured security services:

1. Under **Services List**, click **Add Service**. Make selections using the guidance below.

Service Chain Properties	User Input
Name	Type a Name for the per-request service chain.
Description	Provide a Description for this service chain
Services	Select any number of desired service from the Services Available list and move them into the Selected Service Chain Order column. Optionally, order them as

	required.
--	-----------

- Click **Save & Next**.

Security policy

Security policies are the set of rules that govern how traffic is processed in SSL Orchestrator. The actions a rule can require include:

- Whether or not to allow the traffic indicated in the rule.
- Whether or not to decrypt that traffic.
- Which service chain (if any) to pass the traffic through.



Figure 14: Configuring security policy

SSL Orchestrator’s guided configuration presents an intuitive rule-based, drag-and-drop user interface for the definition of security policies. In the background, SSL Orchestrator maintains these security policies as visual per-request policies. If traffic processing is required that exceeds the capabilities of the rule-based user interface, the underlying per-request policy can be managed directly.

- To create a rule, click **Add**.
- Create a security rule as required.
- Click **Add** again to create more rules, or click **Save & Next**.

Rules						Add
Name	Conditions	Action	SSL Forward Proxy Action	Service Chain		
Pinners_Rule	SSL Check and SNI Category is Pinners	Allow	Bypass	-		
All Traffic	All	Allow	Intercept	-		

Figure 15: Configuring security policy

Interception rules

Interception rules are based on the selected topology and define the listeners (analogous to BIG-IP LTM virtual servers) that accept and process different types of traffic, such as TCP, UDP, or other. The resulting BIG-IP LTM virtual servers will bind the SSL settings, VLANs, IPs, and security policies created in the topology workflow.

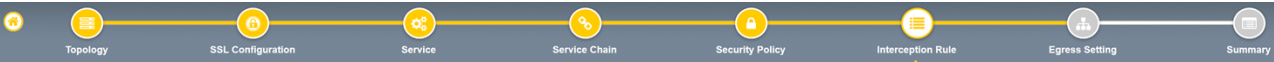


Figure 16: Configuring interception rules

- To configure the interception rule, follow the guidance below.

RECOMMENDED DEPLOYMENT PRACTICES

F5 and Palo Alto Networks SSL Visibility with Service Chaining

Intercept Rule	User Input
Label	Enter a Name for the label
Description	Enter a Description for this rule.
Proxy Server Settings This setting, which displays when configuring an explicit proxy, defines the SSL Orchestrator explicit proxy listening IP address and proxy port. For explicit proxy authentication, this section also allows for the selection of a BIG-IP APM SWG-explicit access policy.	
IPv4 Address	Specify the explicit proxy listening IP address.
Port	Specify the port number.
Access profile	Specify the access policy (optional).
Ingress Network	
VLANs	This defines the VLANs through which traffic will enter. For a forward proxy topology (outbound), this would be the client-side VLAN (intranet).

2. Click **Save & Next**.

Egress setting

The **Egress Setting** section defines topology-specific egress characteristics.



Figure 17: Configuring egress settings

1. To configure these characteristics, follow the guidance below.

Egress Settings	User Input
Manage SNAT Settings	Define if and how source NAT (SNAT) is used for egress traffic.
Gateways	Enter the IP address of next hop route for traffic. For an outbound configuration, this is usually a next hop upstream router.

2. Once done, click **Save & Next**.

Configuration summary and deployment

The configuration summary presents an expandable list of all of the workflow-configured objects.

1. To review the details for any given setting, click the corresponding arrow icon on the far right.
2. To edit any given setting, click the corresponding pencil icon to display the settings page in the workflow.

RECOMMENDED DEPLOYMENT PRACTICES

F5 and Palo Alto Networks SSL Visibility with Service Chaining

3. When the desired settings have been defined, click **Deploy**. Upon successfully deployment of the configuration, SSL Orchestrator will display a dashboard. See Figure 18.

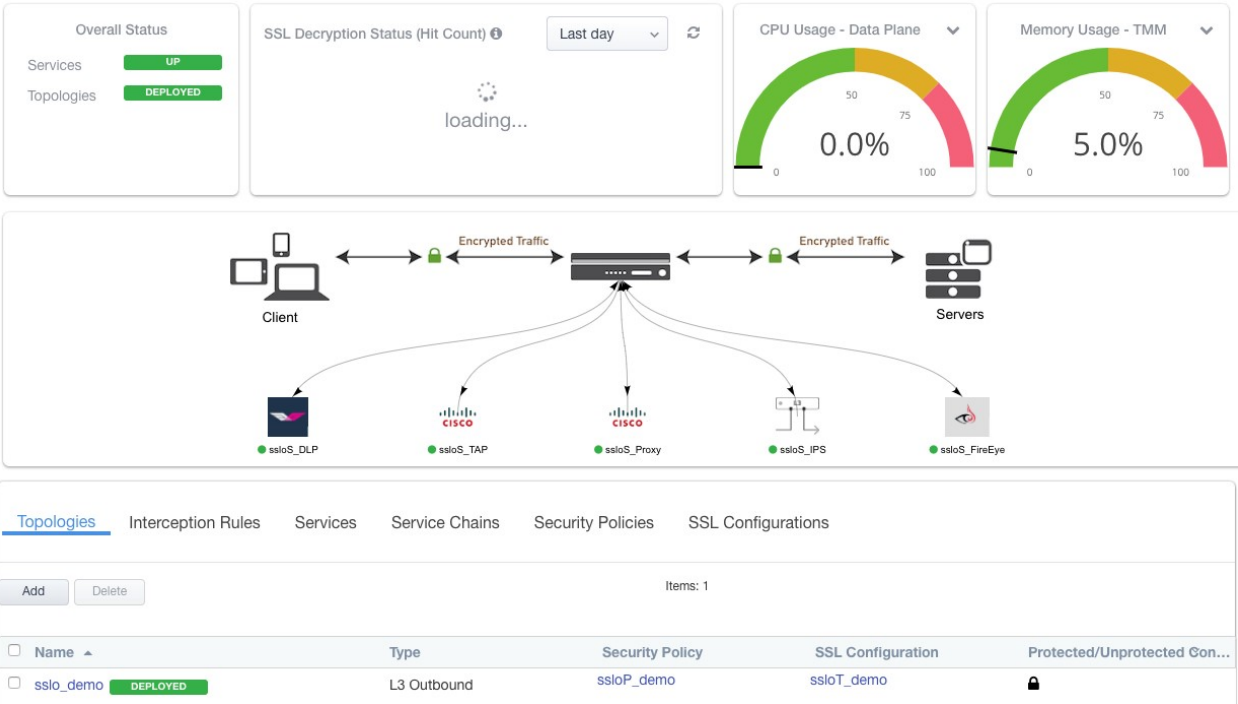


Figure 18: The configuration dashboard after deployment

4. Click the **Interception Rules** tab to display the listeners created per the selected topology.

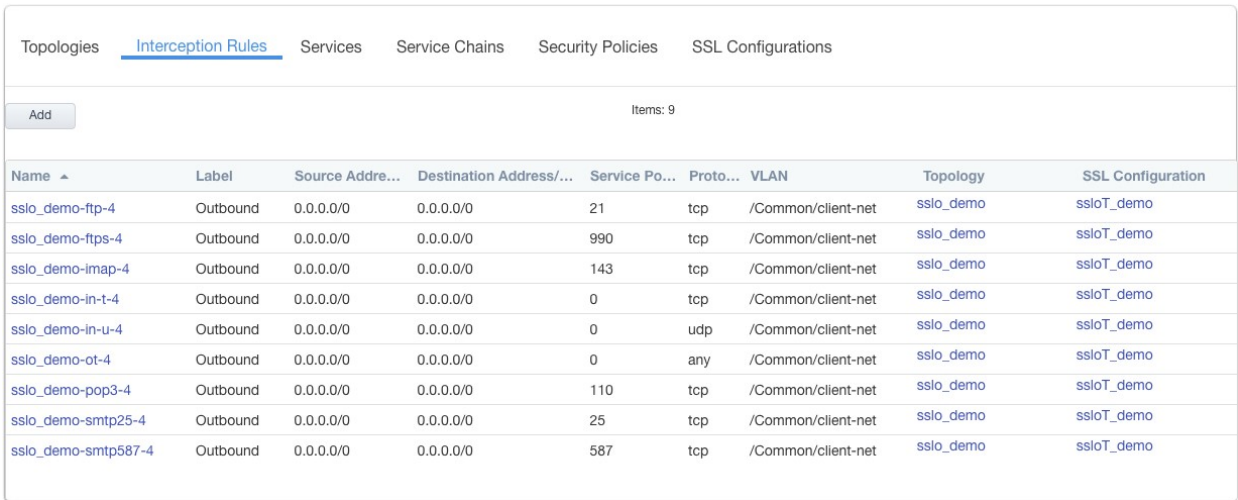


Figure 19: The dashboard's Interception Rules tab

This completes configuration of SSL Orchestrator as a forward proxy. At this point an internal client should be able to browse to external (Internet) resources, and decrypted traffic will flow across the security services.

Handling NAT

When a firewall is deployed as a service in an SSL Orchestrator service chain, it is no longer the Internet edge device. Therefore, performing network address translation (NAT) on this firewall is no longer advisable. It is also important to perform NAT of the client's outbound traffic after the firewall default routes to the F5 device for re-encryption. There are two ways to handle this:

- Option A:** Implement NAT on the F5 system using the SNAT pool feature. (See Figure 20.). In this case the NAT will be performed for the client's outbound traffic on the egress of the F5 system. When firewalls are deployed as a sandwich pool using two F5 systems, NAT should be implemented on the egress F5 system.

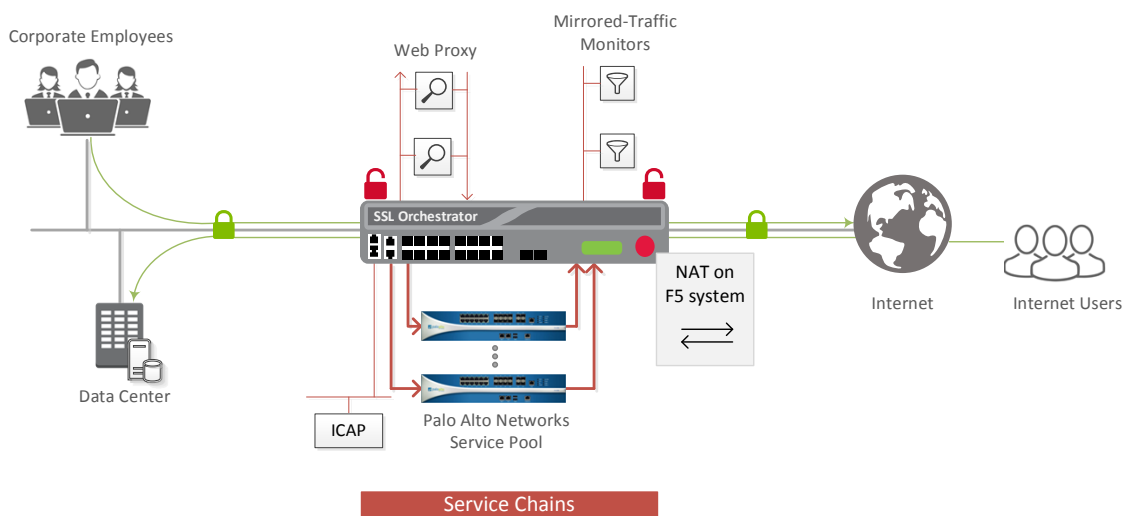


Figure 20: NAT on the F5 system (Option A)

Traditionally, an edge firewall is often implemented on the perimeter to inspect/control access to multiple protocols, and not all of these protocols are supported by SSL Orchestrator. When this firewall is moved from the edge and configured in the service chain to inspect decrypted traffic, any unsupported protocol traffic that goes around SSL Orchestrator is not inspected and therefore potentially vulnerable. The second option, Option B below, recommends the needed design change to overcome this challenge, as well as NAT recommendations.

- Option B:** A Palo Alto Networks NGFW platform can perform more than firewall functions; it can also inspect and protect from threats. Segregate the firewall and inspection functionalities of the NGFW onto two different physical or virtual systems (vsys), and implement NAT post re-encryption on the edge firewall while the inspection modules (IPS and WildFire) remain part of the system in the service chain. (See Figure 21.) In this case, the F5 system can either hand off the re-encrypted packets to the edge firewall, or forward and reroute the traffic from the edge firewall to the gateway.

RECOMMENDED DEPLOYMENT PRACTICES

F5 and Palo Alto Networks SSL Visibility with Service Chaining

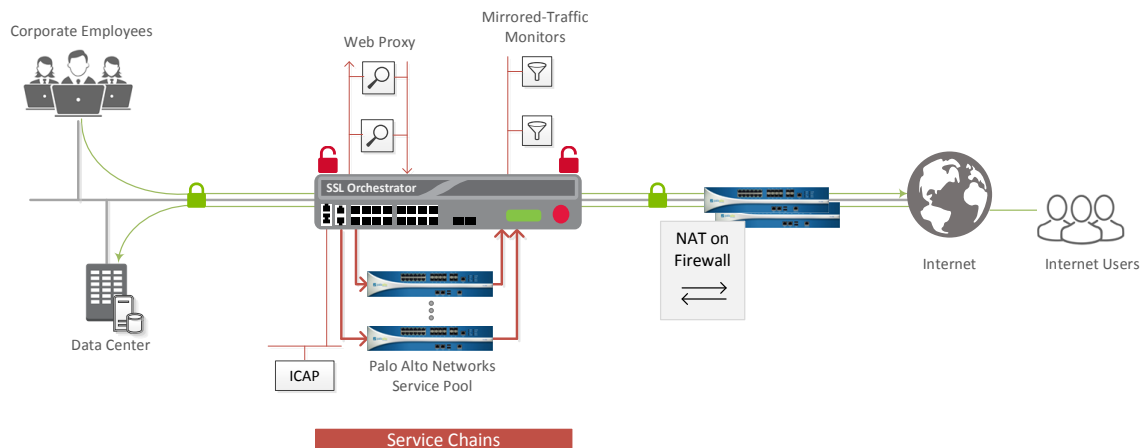


Figure 21: NAT on the Palo Alto Networks NGFWs (Option B)

Testing the Solution

Test the deployed solution using the following options:

- **Server certificate test**

Open a browser on the client system and navigate to an HTTPS site, for example, <https://www.google.com>. Once the site opens in the browser, check the server certificate of the site and verify that it has been issued by the local CA set up on the F5 system. This confirms that the SSL forward proxy functionality enabled by SSL Orchestrator is working correctly.

- **Decrypted traffic analysis on the F5 system**

Perform a TCP dump on the F5 system to observe the decrypted clear text traffic. This confirms SSL interception by the F5 device.

```
tcpdump -lnni eth<n> -Xs0
```

- **Decrypted traffic analysis on the Palo Alto Networks NGFW**

From the web UI, go to **Monitoring > Packet Capture > Create**, and enable a **Packet Filter**. Create stages to capture packets, specify file names, and then click **OK**. Download the captured file(s) and analyze the HTTP packets. The packet header and payload should be in clear text, indicating SSL decryption. It is very important to turn off packet capture once the job completes.

US Headquarters: 401 Elliott Ave W, Seattle, WA 98119 | 888-882-4447

// Americas: info@f5.com // Asia-Pacific: apacinfo@f5.com // Europe/Middle East/Africa: emeainfo@f5.com // Japan: f5j-info@f5.com

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