Cisco Web Security Appliance Best Practices Guidelines

For Network Design, Deployment, and Policy Configuration

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1. Introduction

This guide is intended as a reference for best practice configuration of the **Cisco® Web Security Appliance** (WSA). It addresses many aspects of a WSA deployment, including the supporting network environment, policy configuration, monitoring, and troubleshooting. While the best practices documented here are important for all administrators, architects, and operators to understand, they are only guidelines and should be treated as such. Each network will have its own specific requirements and challenges.

As a security device, the WSA interacts with the network in several unique ways. It is a both a source and destination of web traffic; it acts at the same time as a web server and a web client. At a minimum, it employs server-side IP address spoofing and man-in-the-middle techniques to inspect HTTPS transactions. It can also spoof client IP addresses, adding another layer of complexity to the deployment and imposing additional requirements on the supporting network configuration. This guide addresses the most common issues related to the surrounding network device configuration.

The WSA policy configuration has implications not only for security efficacy and enforcement, but also for the performance of the appliance. This guide will address how the complexity of a configuration impacts system resources. It will define complexity in this context and describe how to minimize it in policy design. There is also attention paid to specific features and how they should be configured to increase security, scalability, and efficacy.

The last section of this document will explain the most effective ways to monitor the appliance. That section will cover the monitoring of performance and availability, as well as system resource usage. It will also provide information useful in basic troubleshooting.

2. Network environment

2.1 ICMP

Path MTU Discovery, as defined in RFC 1191 (https://tools.ietf.org/html/rfc1918), is a mechanism for determining the maximum allowable size of a packet along an arbitrary path. In the case of IPv4, a device can determine the **Maximum Transmission Unit** (MTU) of any packet along a path by setting the **Don't Fragment** (DF) bit in the IP header of the packet. If, at some link along the path, a device cannot forward the packet without fragmenting it, an **Internet Control Message Protocol** (ICMP) **Fragmentation Needed** (Type 3, Code 4) message is sent back to the source. The client then resends a smaller packet. This continues until the MTU for the full path is discovered. IPv6 does not support fragmentation, and uses a **Packet Too Big** (Type 2) ICMPv6 message to indicate the inability to fit a packet through a given link.

Because the process of fragmenting packets can have severe impacts on the performance of a TCP flow, the WSA utilizes Path MTU Discovery. The abovementioned ICMP messages should be enabled in relevant network devices to allow the WSA to determine the MTU for its path through the network. This behavior can be disabled in the WSA using the **`pathmtudiscovery`** command-line interface (CLI) command. Doing this causes the default MTU to drop to 576 bytes (per RFC 879), severely impacting performance. The administrator should take the additional step of manually configuring the MTU in the WSA using the **`etherconfig`** CLI command.

In the case of the **Web Cache Communication Protocol** (WCCP), web traffic is redirected to the WSA from another network device along the client's path to the Internet. In this case, other protocols, such as ICMP, are not redirected to the WSA. There is a possibility that the WSA could trigger an ICMP **Fragmentation Needed** message from a router on the network, but the message would not be delivered to the WSA. If this is a possibility in the network, disabling Path MTU Discovery should be considered. As mentioned above, with this configuration, the additional step of manually setting the MTU on the WSA using the **`etherconfig`** CLI command is required.

Specific challenges surrounding WCCP and Path MTU Discovery are outlined in this document: https://www.cisco.com/c/en/us/support/docs/security/web-security-appliance/118843-technote-wsa-00.html.

2.2 Firewalls

In a default configuration, the WSA does not spoof the client IP address when proxying a connection. This means that all outbound web traffic will be sourced from the WSA IP address. It is necessary to ensure that **Network Address Translation** (NAT) devices have a large enough pool of external addresses and ports to accommodate this. Dedicating specific addresses for this purpose is a good idea.

Some firewalls employ **Denial-of-Service** (DoS) protections or other security features that trigger when large numbers of simultaneous connections are sourced from a single client IP address. When client IP spoofing is not enabled, the WSA IP address should be excluded from these protections.

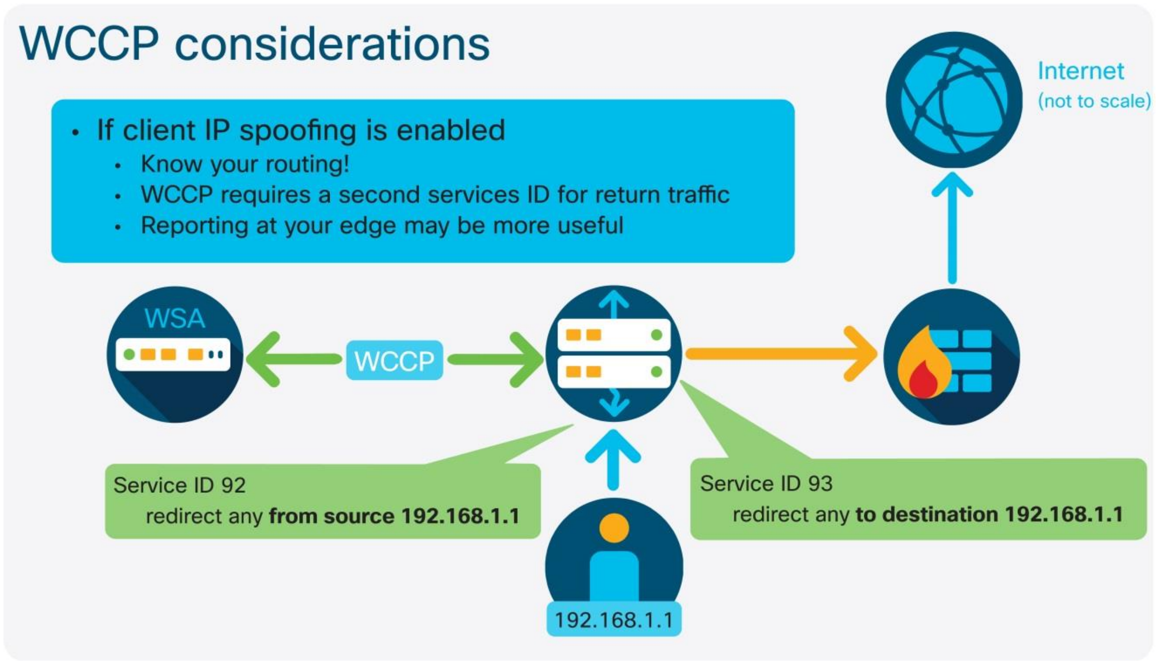
2.3 Unicast reverse path forwarding

The WSA spoofs the server IP address when communicating with a client, and optionally can be configured to spoof the client IP address when communicating with an upstream server. Protections such as **Unicast Reverse Path Forwarding** (uRPF) can be enabled on switches to ensure that an incoming packet matches the expected ingress port. These protections check the source interface of a packet against the routing table to ensure that it arrived on the expected port. The WSA needs to be exempted from these protections where appropriate.

2.4 IP spoofing with WCCP

When the IP Spoofing feature is enabled in the WSA, outbound requests leaving the appliance use the source address of the original client request. This requires additional configuration of the surrounding network infrastructure to ensure that return packets are routed to the WSA outbound interface, instead of the client that originated the request.

When WCCP is implemented on a network device (router, switch, or firewall), a service ID is defined that matches traffic based on an **Access Control List** (ACL). The service ID is then applied to an interface and used to match traffic for redirection. If IP spoofing is enabled, a second service ID must be created to ensure that return traffic is also redirected to the WSA.


WCCP considerations
• If client IP spoofing is enabled
• Know your routing!
• WCCP requires a second services ID for return traffic
• Reporting at your edge may be more useful
Internet
(not to scale)
WSA
WCCP
Service ID 92
redirect any **from source 192.168.1.1**
Service ID 93
redirect any **to destination 192.168.1.1**
192.168.1.1

3. WSA network configuration

3.1 Interfaces

The WSA has five usable network interfaces: **M1, P1, P2, T1,** and **T2**. Each of these should be leveraged for their specific purpose when possible. There are inherent benefits to using each port. The **M1** interface should be connected to a dedicated management network, and split-routing should be enabled to limit the exposure of administrative services. **P1** can be limited to client request traffic, while **P2** is restricted from accepting explicit proxy requests. This will decrease the amount of traffic on each interface and allow better segmentation in the network design.

The **T1** and **T2** ports are available for the **Layer 4 Traffic Monitor** (L4TM) feature. This feature monitors a mirrored layer 2 port and adds the ability to block traffic based on a blocked list of known malicious IP addresses and domain names. It does this by looking at the source and destination IP addresses of traffic and sending a TCP reset packet, or **Port Unreachable** message if the blocked list is matched. This feature has the advantage of blocking traffic that is sent using any protocol.

Even if the L4TM feature is not enabled, attaching the **T1** and **T2** ports to a mirrored port can enrich the transparent bypass feature when WCCP is in use. When using WCCP, the WSA only knows the source and destination IP address of an incoming packet and must make a decision to proxy it, or to bypass it based on that information. The WSA resolves any entries in the bypass settings list every 30 minutes, regardless of the record's **Time to Live** (TTL). However, if the L4TM feature is enabled, the WSA can use snooped DNS queries to update these records more frequently. This reduces the risk of a false negative in a scenario where the client has resolved a different address from the WSA.

3.2 Management network routing

If the dedicated management network does not have Internet access, each service can be configured to use the data routing table. This can be tailored to fit the network topology, but in general, it is suggested to use the management network for all system services and the data network for client traffic. As of AsyncOS® version 11.0, the services for which routing can be set are:

- External URL feeds
- Advanced Malware Protection (AMP) file reputation and analysis
- Updates and upgrades
- DNS
- Active directory

For additional egress filtering of management traffic, static addresses can be configured for use in the following services:

- External URL feeds:
  - **Custom depending on where they are hosted**
- AMP file reputation and analysis
  - **cloud-sa.amp.cisco.com (North America)**
  - **cloud-sa.eu.amp.cisco.com (Europe)**
  - **cloud-sa.apjc.amp.cisco.com (Asia Pacific)**
- Update and upgrades:
  - **downloads-static.ironport.com**
  - **208.90.58.105 (port 80)**
  - **updates-static.ironport.com**
  - **208.90.58.25 (port 80)**
  - **184.94.240.106 (port 80)**

3.3 TALOS telemetry

The Cisco Talos® group is well known for identifying new and emerging threats. All data sent to Talos is anonymized and stored in U.S. data centers. Participating in Sensorbase enhances the categorization and identification of web threats and leads to better protection from the WSA, as well as other Cisco security solutions.

Full details about what information is sent to Talos is documented in this white paper: https://www.cisco.com/c/en/us/products/collateral/security/web-security-appliance/white-paper-c11-738822.html.

3.4 DNS

Domain Name Server (DNS) security best practices suggest that every network should host two DNS resolvers: one for authoritative records from within a local domain, and one for recursive resolution of Internet domains. To accommodate this, the WSA allows DNS servers to be configured for specific domains. If only one DNS server is available for both local and recursive queries, consider the additional load that will be added by using it for all WSA queries. The better option may be to use the internal resolver for local domains and the root Internet resolvers for external domains. This is dependent on the administrator's risk profile and tolerance.

By default, the WSA will cache a DNS record for a minimum of 30 minutes, regardless of the record's TTL. Modern websites that make heavy use of **Content Delivery Networks** (CDNs) will have low TTL records as their IP addresses change frequently. This could result in a client caching one IP address for a given server and the WSA caching a different address for the same server. To counter this, the WSA default TTL can be lowered to five minutes using the following CLI commands:

```
dnsconfig
SETUP
'Enter the minimum TTL in seconds for DNS cache.'
```

Secondary DNS servers should be configured in case the primary is not available. If all servers are configured with the same priority, the server IP will be chosen at random. Depending on the number of servers configured, the timeout for a given server will vary. The timeout for a query is given below for up to six DNS servers:

Number of DNS servers	Query timeout (in sequence)
1	60
2	5, 45
3	5, 10, 45
4	1, 3, 11, 45
5	1, 3, 11, 45, 1
6	1, 3, 11, 45, 1, 1

There are also advanced DNS options available only through the CLI. These options are available using the **`advancedproxyconfig > DNS`** command.

```
Select one of the following options:
0 = Always use DNS answers in order
1 = Use client-supplied address then DNS
2 = Limited DNS usage
3 = Very limited DNS usage

For options 1 and 2, DNS will be used if Web Reputation is enabled.

For options 2 and 3, DNS will be used for explicit proxy requests, if there is no
upstream proxy or in the event the configured upstream proxy fails.

For all options, DNS will be used when Destination IP Addresses are used in
policy membership.
```

These options control how the WSA decides on the IP address to connect to when evaluating a client request. When a request is received, the WSA will see a destination IP address and a hostname. The WSA must decide whether to trust the original destination IP address for the TCP connection, or to do its own DNS resolution and use the resolved address. The default is **"0 = Always use DNS answers in order,"** which means the WSA does not trust the client to supply the IP address.

Option 1: The WSA tries the client-supplied IP address for the connection, but falls back to the resolved address if that fails. The resolved address is used for policy evaluation (web category, web reputation, etc.).

Option 2: The WSA only uses the client-supplied address for the connection and does not fall back. The resolved address is used for policy evaluation (web category, web reputation, etc.).

Option 3: The WSA only uses the client-supplied address for the connection and does not fall back. The client-supplied IP address is used for policy evaluation (web category, web reputation, etc.).

The chosen option depends on how much trust the administrator should place in the client when determining the resolved address for a given hostname. If the client is a downstream proxy, choose option 3 to avoid the added latency of unnecessary DNS lookups.

3.5 Load balancing

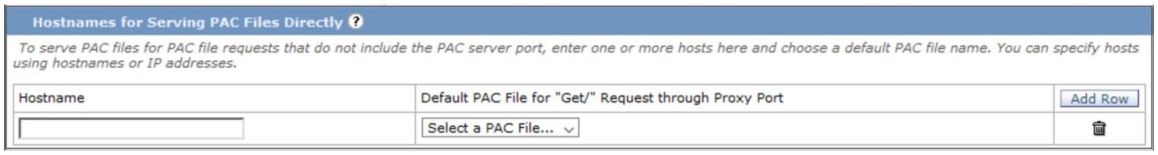
WCCP provides the best method of load balancing transparent traffic when using up to eight appliances. It allows for balancing traffic flows based on hash or mask, it can be weighted in case there is a mix of appliance models in the network, and devices can be added and removed from the service pool without downtime. Once the need exceeds what can be handled with eight WSAs, it is recommended to use a dedicated load balancer.

Specific best practices for WCCP configuration vary based on the platform used. For Cisco Catalyst® switches, best practices are documented here: https://www.cisco.com/c/en/us/products/collateral/switches/catalyst-6500-series-switches/white_paper_c11-629052.html.

WCCP has limitations when used with a Cisco **Adaptive Security Appliance** (ASA). Namely, client IP spoofing is not supported, and the clients and WSA must be behind the same interface. For this reason, it is more flexible to use a layer 4 switch or router to redirect traffic. WCCP configuration on the ASA platform is described in this document: https://www.cisco.com/c/en/us/support/docs/security/adaptive-security-appliance-asa-software/116046-config-wccp-asa-00.html.

For explicit deployments, a **Proxy Autoconfiguration** (PAC) file is the most widely deployed method, but it has many drawbacks and security implications that are beyond the scope of this document. If a PAC file is deployed, it is suggested to use **Group Policy Objects** (GPOs) to configure the location rather than relying on the **Web Proxy Autodiscover Protocol** (WPAD) that is a common target for attackers and can be exploited easily if misconfigured. The WSA can host multiple PAC files and control their expiration in the browser's cache.

A PAC file can be requested directly from the WSA using a configurable TCP port number (9001 by default). If a port is not specified, the request may be sent to the proxy process itself as though it were an outbound web request. In this case, it is possible to serve a specific PAC file based on the HTTP host header present in the request.


Hostnames for Serving PAC Files Directly

To serve PAC files for PAC file requests that do not include the PAC server port, enter one or more hosts here and choose a default PAC file name. You can specify hosts using hostnames or IP addresses.

Hostname	Default PAC File for "Get/" Request through Proxy Port	Add Row
	Select a PAC File...	

When using Kerberos in a high availability environment, additional configuration is required. The WSA provides support for keytab files, which allows for multiple hostnames to be associated with a **Service Principle Name** (SPN). The procedure for this configuration is documented in the user guide here: https://www.cisco.com/c/en/us/td/docs/security/wsa/wsa11-5/user_guide/b_WSA_UserGuide_11_5_1/b_WSA_UserGuide_11_5_1_chapter_0101.html#id_81819.

3.6 Active authentication

Kerberos is more secure and widely supported authentication protocol than **NT LAN Manager Security Support Provider** (NTLMSSP). The Apple OS X operating system does not support NTLMSSP, but can use Kerberos to authenticate if domain joined. Basic authentication should not be used, as it sends credentials unencrypted in the HTTP header and can be easily sniffed by an attacker on the network. If basic authentication must be used, credential encryption should be enabled to ensure that credentials are sent over an encrypted tunnel.

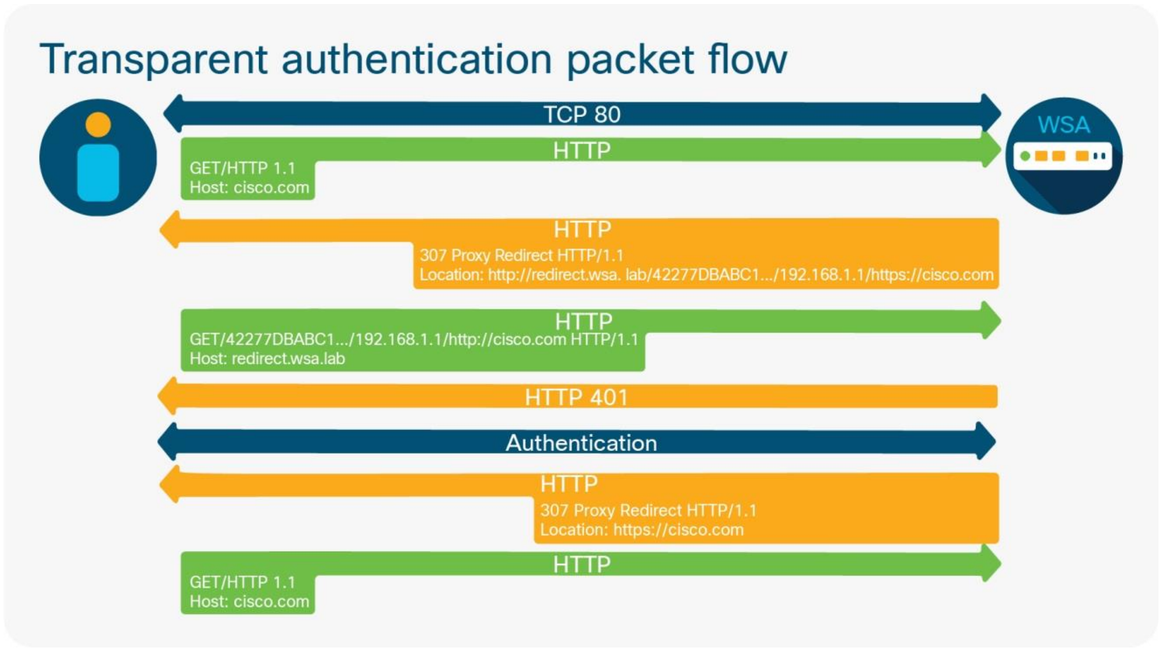
More than one domain controller should be added to the configuration to ensure availability, but there is no inherent load balancing of this traffic. The WSA will send a TCP **SYN** packet to all configured domain controllers and the first to respond will be used for authentication.

The “redirect hostname” that is configured in the authentication settings page determines where a transparent client is sent in order to complete authentication. For a Windows client to complete integrated authentication and achieve **Single Sign-On** (SSO), the redirect hostname must be in the “Trusted Sites” zone in the “Internet Options” control panel. The Kerberos protocol requires that the **Fully Qualified Domain Name** (FQDN) be used to specify a resource, which means the “shortname” (or “NETBIOS” name) cannot be used if Kerberos is the intended authentication mechanism. The FQDN will need to be manually added to the “Trusted Sites” (for example, via Group Policy). Additionally, the **Automatic login with username and password** should be set in the “Internet Options” control panel.

Additional settings are also required in Firefox in order for the browser to complete authentication with network proxies. Those settings can be configured in the **about:config** page. In order for Kerberos to complete successfully, the redirect hostname should be added to the **network.negotiate-auth.trusted-uris** option. For NTLMSSP, it should be added to the **network.automatic-ntlm-auth.trusted-uris** option.

Authentication surrogates are used to remember an authenticated user for a set duration after authentication has completed. IP surrogates should be used whenever possible to limit the number of active authentication events that occur. Actively authenticating a client is a resource-intensive task, especially when Kerberos is used. The surrogate timeout is 3600 seconds (one hour) by default and can be lowered, but the lowest recommended value is 900 seconds (15 minutes).

In the diagram below, “redirect.wsa.lab” is used as the redirect hostname.

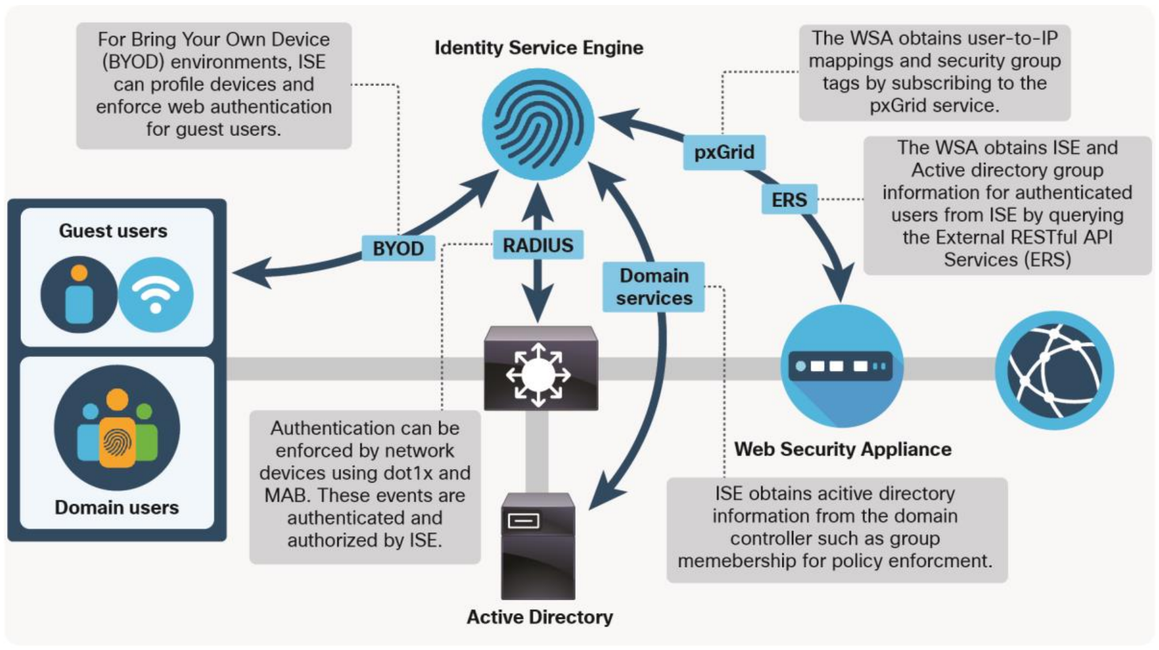

Transparent authentication packet flow
TCP 80
WSA
HTTP
GET/HTTP 1.1
Host: cisco.com
HTTP
307 Proxy Redirect HTTP/1.1
Location: http://redirect.wsa. lab/42277DBABC1.../192.168.1.1/https://cisco.com
HTTP
GET/42277DBABC1.../192.168.1.1/http://cisco.com HTTP/1.1
Host: redirect.wsa.lab
HTTP 401
Authentication
HTTP
307 Proxy Redirect HTTP/1.1
Location: https://cisco.com
HTTP
GET/HTTP 1.1
Host: cisco.com

3.7 Passive authentication

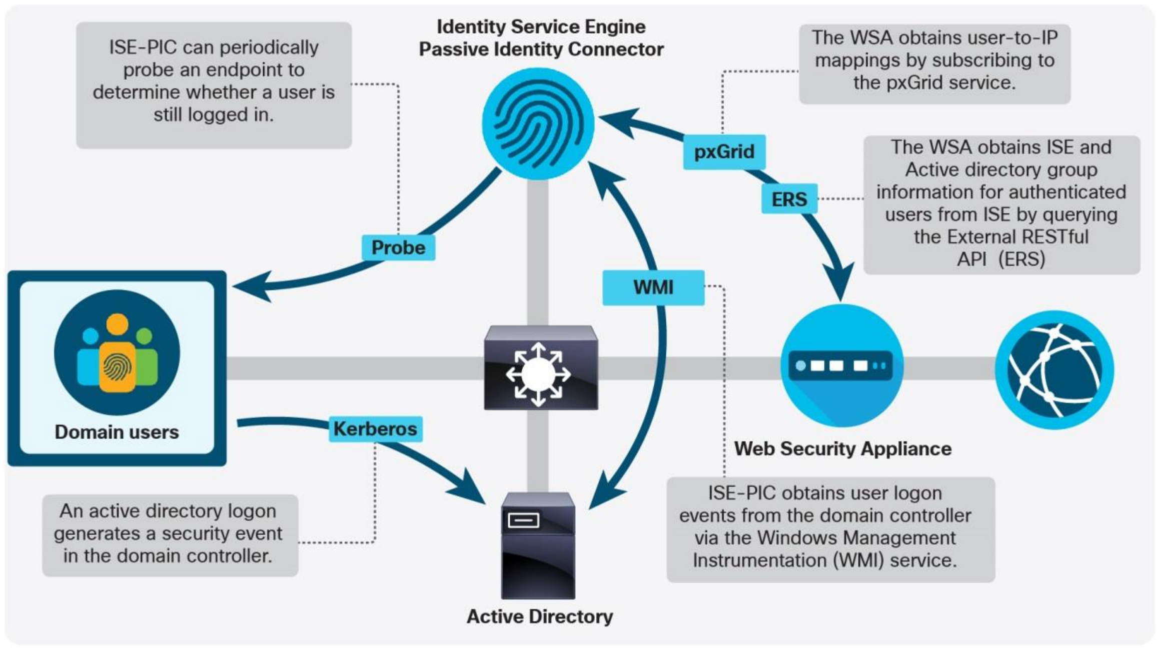
The WSA can leverage other Cisco security platforms to passively identify proxy users. Passively identifying users eliminates the need for a direct authentication challenge and any Active Directory communication from the WSA, which in turn reduces latency and resource usage on the appliance. The currently available mechanisms for passive authentication are via the **Context Directory Agent** (CDA), the **Identity Services Engine** (ISE), and the **Identity Services Connector Passive Identity Connector** (ISE-PIC).

ISE is a feature-rich product that helps administrators centralize their authentication services and leverage an extensive set of network access controls. When ISE learns about a user authentication event (either through Dot1x authentication or web authentication redirect), it populates a session database that contains information about the user and device involved in the authentication. The WSA connects to ISE over the **Platform Exchange Grid** (pxGrid) and obtains the user name, IP address, and **Security Group Tag** (SGT) associated with a proxy connection. Beginning in AsyncOS version 11.7, the WSA can also query the **External Restful Service** (ERS) on ISE to obtain group information.

At the time of the writing of this document, the suggested versions are ISE 2.4 and WSA 11.7. Full integration steps are documented here: https://www.cisco.com/c/en/us/products/collateral/security/web-security-appliance/guide-c07-741637.html.


For Bring Your Own Device (BYOD) environments, ISE can profile devices and enforce web authentication for guest users.
Identity Service Engine
The WSA obtains user-to-IP mappings and security group tags by subscribing to the pxGrid service.
pxGrid
The WSA obtains ISE and Active directory group information for authenticated users from ISE by querying the External RESTful API Services (ERS)
ERS
Guest users
BYOD
RADIUS
Domain services
Domain users
Authentication can be enforced by network devices using dot1x and MAB. These events are authenticated and authorized by ISE.
Web Security Appliance
ISE obtains acitive directory information from the domain controller such as group memebership for policy enforcment.
Active Directory

CDA is still available and, as of patch 6, is compatible with Microsoft Server 2016. However, administrators are actively encouraged to migrate their CDA deployments to ISE-PIC. Both solutions use WMI to subscribe to the Windows Security Event Log in order to generate user-to-IP mappings (known as “sessions”). In the case of CDA, these mappings are queried by the WSA using RADIUS. In the case of ISE-PIC, the same pxGrid and ERS connections are used as in the full ISE deployment. ISE-PIC functionality is available in a full ISE installation, as well as in a standalone virtual appliance.


ISE-PIC can periodically probe an endpoint to determine whether a user is still logged in.
Identity Service Engine Passive Identity Connector
The WSA obtains user-to-IP mappings by subscribing to the pxGrid service.
pxGrid
The WSA obtains ISE and Active directory group information for authenticated users from ISE by querying the External RESTful API (ERS)
ERS
Probe
WMI
Domain users
Kerberos
Web Security Appliance
An active directory logon generates a security event in the domain controller.
ISE-PIC obtains user logon events from the domain controller via the Windows Management Instrumentation (WMI) service.
Active Directory

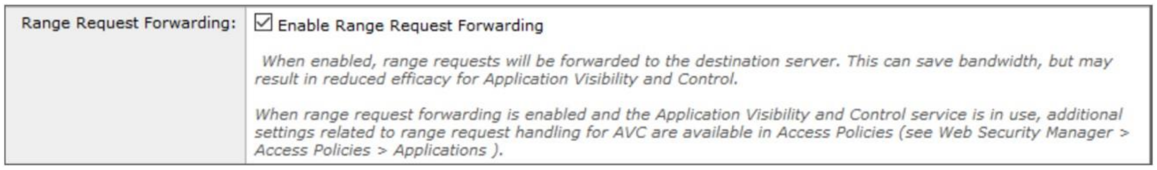
At the time of the writing of this document, the suggested versions are ISE-PIC 2.4 and WSA 11.7. Full ISE-PIC integration steps are documented here: https://www.cisco.com/c/en/us/products/collateral/security/web-security-appliance/guide-c07-741643.html.

4. Services configuration

4.1 Web proxy

Caching should be enabled in the web proxy configuration in order to save bandwidth and boost performance. This is becoming less important as the percentage of HTTPS traffic increases because the WSA does not by default cache HTTPS transactions. If the proxy is deployed to serve only explicit clients, forward mode should be specified in order to reject any traffic that isn't specifically destined for the proxy service. This reduces attack surface in the appliance and follows a good security principle: If you don't need it, turn it off.

Range request headers are used in HTTP requests to specify the byte range of a file to be downloaded. It is commonly used by operating system and application update daemons to transfer small portions of a file at a time. By default, the WSA will strip these headers so that it can obtain the entire file for the purposes of **Antivirus** (AV) scanning, file reputation and analysis, and **Application Visibility Control** (AVC). Enabling the forwarding of range request headers globally in the proxy settings will allow administrators to create individual access policies that forward or strip those headers. More information about this setting will be explained in section **5.4 Access policies**.

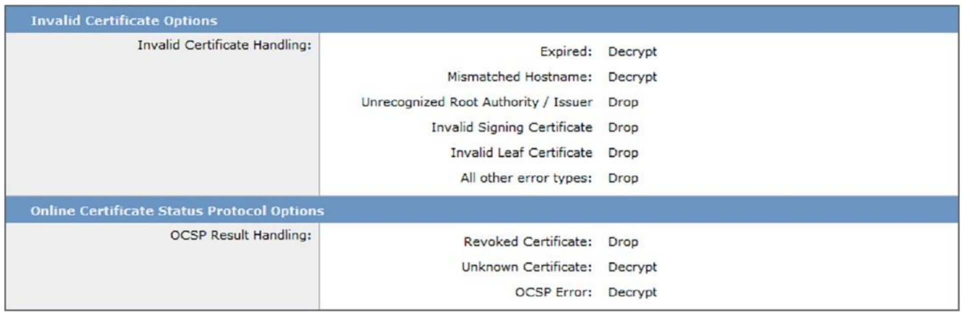


Range Request Forwarding:	☑ Enable Range Request Forwarding *When enabled, range requests will be forwarded to the destination server. This can save bandwidth, but may result in reduced efficacy for Application Visibility and Control.* *When range request forwarding is enabled and the Application Visibility and Control service is in use, additional settings related to range request handling for AVC are available in Access Policies (see Web Security Manager > Access Policies > Applications).*

4.2 HTTPS proxy

Security best practices suggest that private keys should be generated on the appliance where they are used and never be transported elsewhere. The HTTPS proxy wizard will allow the creation of the key pair and certificate used for decryption of **Transport Layer Security** (TLS) connections. The **Certificate Signing Request** (CSR) can then be downloaded and signed by an in-house **Certificate Authority** (CA). In an **Active Directory** (AD) environment, this is the best method because an AD-integrated CA will be trusted automatically by all members of the domain and will not require additional steps to deploy the certificate.

One security function of the HTTPS proxy is to validate server certificates. Best practices suggest that invalid certificates should result in the connection being dropped. Enabling **Decrypt for EUN** will allow the WSA to present a block page explaining the reason for the block. Without this enabled, any HTTPS sites that are blocked will result in a browser error. This will lead to increased help desk tickets and an assumption on the part of the user that something is broken, rather than the knowledge that the WSA has blocked the connection. All invalid certificate options should be set to at least **Decrypt**. Leaving any of these options as **Monitor** will not log useful error messages in the event that certificate problems prevent a site from loading.



Invalid Certificate Options		
Invalid Certificate Handling:	Expired:	Decrypt
	Mismatched Hostname:	Decrypt
	Unrecognized Root Authority / Issuer	Drop
	Invalid Signing Certificate	Drop
	Invalid Leaf Certificate	Drop
	All other error types:	Drop
Online Certificate Status Protocol Options		
OCSP Result Handling:	Revoked Certificate:	Drop
	Unknown Certificate:	Decrypt
	OCSP Error:	Decrypt

Similarly, **Online Certificate Services Protocol** (OCSP) checking should be left enabled and **Monitor** should not be used for any option. Revoked certificates should be dropped and all others should be at least set to **Decrypt** to allow logging of relevant error messages. **Authority Information Access Chasing** (AIA chasing) is a means by which a client can glean the signer of the certificate, and a URL from which additional certificates may be fetched. For example, if a certificate chain received from a server is incomplete (it is missing an intermediate or root certificate), the WSA can check the AIA field and use it to fetch the missing certificates and verify authenticity. This setting is only available in the CLI using the following commands:

```
dvancedproxyconfig
HTTPS
Do you want to enable automatic discovery and download of missing Intermediate
Certificates? [Y]
```

This setting is enabled by default and should not be disabled, as many modern servers will rely on this mechanism to provide a full trust chain to clients.

4.3 Layer 4 traffic monitor

The L4TM is a highly effective way to extend the reach of the WSA to include malicious traffic that does not traverse the proxy, including traffic on all TCP and UDP ports. The **T1** and **T2** ports are intended to be connected to either a network tap, or switch monitor session, which allows to WSA to passively monitor all traffic from clients. If traffic destined for a malicious IP address is seen, the WSA can terminate TCP sessions by sending an **RST** while spoofing the server IP address. For UDP traffic, it can send a **Port Unreachable** message. When configuring the monitor session, it is best to exclude any traffic destined for the management interface of the WSA to prevent the feature from potentially interfering with access to the device.

In addition to monitoring for malicious traffic, the L4TM also snoops DNS queries in order to update the **bypass settings** list. This list is used in WCCP deployments to return certain requests back to the WCCP router for direct routing to the web server. Packets that match the **bypass settings** list are not processed by the proxy. The list can contain IP addresses or server names. The WSA resolves any entries in the bypass settings list every 30 minutes, regardless of the record’s TTL. However, if the L4TM feature is enabled, the WSA can use snooped DNS queries to update these records more frequently. This reduces the risk of a false negative in a scenario where the client has resolved a different address from the WSA.

5. Policy configuration

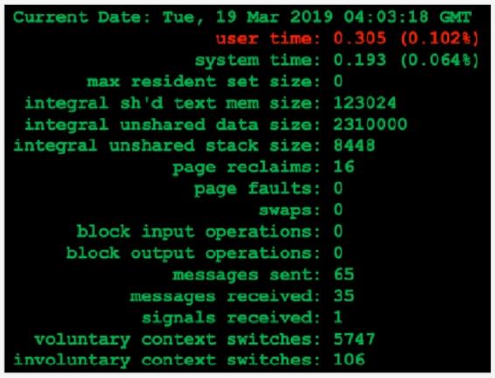
Correct policy configuration is central to the performance and scalability of the WSA. This is true not just because of the effectiveness of the policies themselves in protecting clients and enforcing company requirements. The way in which policies are configured has a direct impact on resource usage and the overall health and performance of the WSA. An overly complex or poorly designed set of policies can cause instability and slow responsiveness from the appliance.

5.1 Complexity

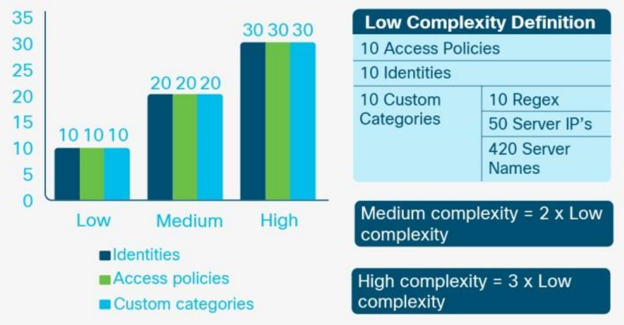
The WSA policies are built using various policy elements. The XML file that is generated from the configuration is used to create a number of back-end configuration files and access rules. The more complex the configuration, the more time the proxy process has to spend evaluating the various rule sets for each transaction. In benchmarking and sizing the WSA, a basic set of policy elements is created that represent three tiers of configuration complexity. Ten **Identity Profiles, Decryption Policies,** and **Access Policies,** along with 10 **custom categories** containing 10 regex entries, 50 server IP addresses, and 420 server hostnames, is considered a **Low Complexity** configuration. Multiplying each of those figures by two and three will result in a **Medium Complexity** and **High Complexity** configuration, respectively.

When a configuration becomes too complex, the first symptoms usually include slow response in the web interface and CLI. There may not be a significant impact to users at first. But the more complex the configuration is, the more time the proxy process must spend in **user mode**. Because of this, checking the percentage of time spent in this mode can be a useful way to diagnose an overly complex configuration as the cause of a slow WSA.

The CPU time, in seconds, is logged in the **track_stats** log every five minutes. This means that the user time percentage can be calculated as **(user time + system time)/300**. As the user time approaches **270**, the process is spending too many CPU cycles in user mode, and this is almost always because the configuration is too complex to be parsed efficiently.



```
Current Date: Tue, 19 Mar 2019 04:03:18 GMT
                       user time: 0.305 (0.102%)
                     system time: 0.193 (0.064%)
           max resident set size: 0
      integral sh'd text mem size: 123024
     integral unshared data size: 2310000
    integral unshared stack size: 8448
                   page reclaims: 16
                     page faults: 0
                           swaps: 0
          block input operations: 0
         block output operations: 0
                   messages sent: 65
               messages received: 35
                signals received: 1
      voluntary context switches: 5747
    involuntary context switches: 106
```



Low Complexity Definition	
10 Access Policies	
10 Identities	
10 Custom Categories	10 Regex
	50 Server IP's
	420 Server Names

Medium complexity = 2 x Low complexity

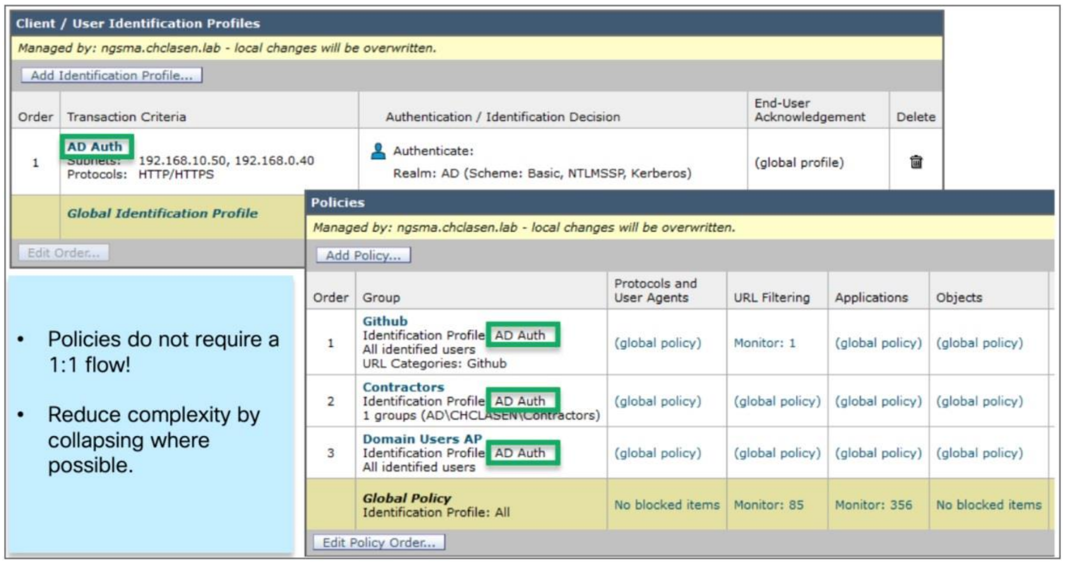
High complexity = 3 x Low complexity

5.2 Identification profiles

Identification (ID) profiles are the first policy elements that are evaluated when a new request is received. All the information configured in the first section of the **ID profile** is evaluated with a logical **AND**. This means that all criteria must match for the request to match the profile. When creating a policy, it should only be as specific as absolutely necessary. Profiles that include individual host addresses are almost never necessary, and can lead to sprawling configurations. Leveraging the **user-agent** string found in the HTTP headers, custom category list, or subnet is generally a better strategy to limit the scope of a profile.

In general, policies that require authentication are configured at the bottom and exceptions added above them. When ordering policies that do not require authentication, the most used policies should be the closest to the top as possible. Do not rely on failed authentication to restrict access. If a client on the network is known to be unable to authenticate to a proxy, it should be exempted from authentication and blocked in the **access policies**. Clients who cannot authenticate will repeatedly send unauthenticated requests to the WSA, which will use resources and can cause excessive CPU and memory utilization.

A common misconception for administrators is that there must be a unique **ID profile** and corresponding **decryption policy** and **access policy**. This is an inefficient strategy for policy configuration. When possible, policies should be “collapsed” so that a single ID profile can be associated with multiple decryption and access policies. This is possible because all of the criteria in a given policy must match in order for traffic to match the policy. Being more general in the authentication policy and more specific in the resulting policies allows for fewer policies as a whole.



Client / User Identification Profiles

Managed by: ngsma.chclasen.lab - local changes will be overwritten.

Order	Transaction Criteria	Authentication / Identification Decision	End-User Acknowledgement	Delete
1	AD Auth Subnets: 192.168.10.50, 192.168.0.40 Protocols: HTTP/HTTPS	Authenticate: Realm: AD (Scheme: Basic, NTLMSSP, Kerberos)	(global profile)	🗑
	Global Identification Profile			

Policies

Managed by: ngsma.chclasen.lab - local changes will be overwritten.

Order	Group	Protocols and User Agents	URL Filtering	Applications	Objects
1	Github Identification Profile AD Auth All identified users URL Categories: Github	(global policy)	Monitor: 1	(global policy)	(global policy)
2	Contractors Identification Profile AD Auth 1 groups (AD\CHCLASEN\Contractors)	(global policy)	(global policy)	(global policy)	(global policy)
3	Domain Users AP Identification Profile AD Auth All identified users	(global policy)	(global policy)	(global policy)	(global policy)
	Global Policy Identification Profile: All	No blocked items	Monitor: 85	Monitor: 356	No blocked items

- Policies do not require a 1:1 flow!
- Reduce complexity by collapsing where possible.

5.3 Decryption policies

As with the **ID profile**, the criteria set in the **decryption policy** is also evaluated as a logical **AND**, with one important exception when using information from the ISE. The policy-matching behavior is explained below, depending on what elements are configured (AD group, user, or SGT):

AD groups and users: No change to previous behavior; the policy will be matched if the user is a member of group, OR the user is specified in the policy.

SGT and AD groups and users: The policy will be matched if the user is associated with the SGT **AND** is a member of the AD group, **OR** the user is specified in the policy.

SGT and users: The policy will be matched if the user is associated with the SGT OR the user is specified in the policy.

Of all the services performed by the WSA, evaluation of HTTPS traffic is the most significant from a performance standpoint. The percentage of decrypted traffic has a direct impact on how the appliance should be sized. As of the writing of this document, an administrator can count on at least 75% of web traffic to be HTTPS.

After initial installation, the percentage of decrypted traffic should be determined to ensure that the expectations for future growth are accurately set. After deployment, this number should be checked once a quarter. Finding the percentage of HTTPS traffic that is decrypted by the WSA is easy to do with a copy of the **access_logs**, even without additional log management software. Simple Bash or PowerShell commands can be used to obtain this number. Below, the steps are described for each environment:

1. Find the number of total HTTPS connections (both explicit and transparent:

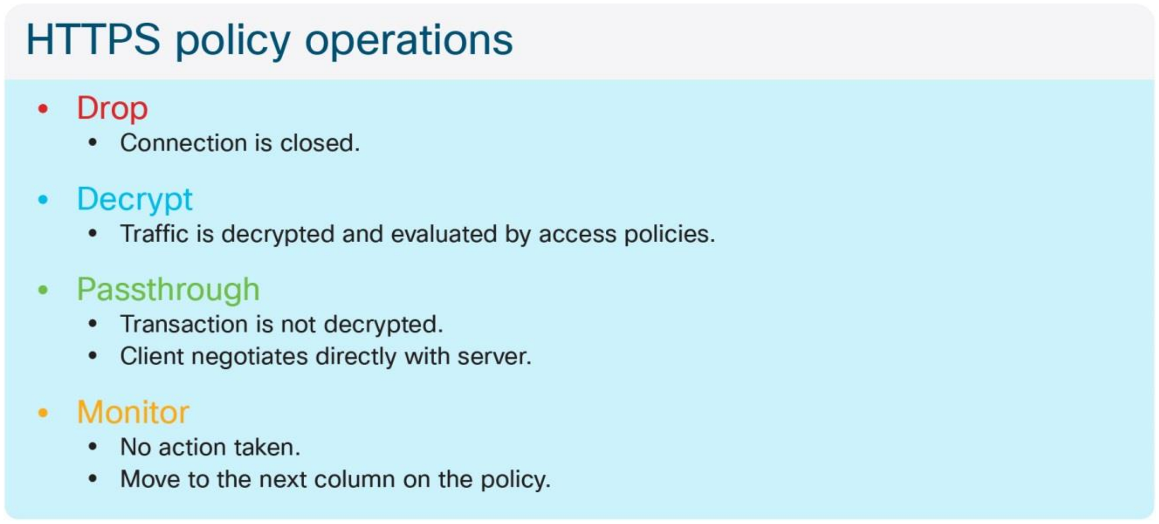
```
Bash:

grep -cE 'tunnel://|TCP_CONNECT' aclog.current


PowerShell:

(Get-Content aclog.current | Select-String -Pattern
'tunnel://|TCP_CONNECT').length
```

2. Find the number of decrypted HTTPS connections:

```
Bash:

grep -E 'tunnel://|TCP_CONNECT' aclog.current | grep -c DECRYPT


PowerShell:

(Get-Content aclog.current | Select-String -Pattern 'tunnel://|TCP_CONNECT'
| Select-String -Pattern ‘DECRYPT’).length
```

3. Divide the second value by the first value and multiply by 100.

When designing **decryption policies,** it is important to understand how the various actions listed in the policy cause the appliance to evaluate HTTPS connections. The **passthrough** action is used when the client and server should be allowed to terminate each end of their TLS session without the WSA decrypting every packet. Even if a site is set to **passthrough,** the WSA may still be required to complete one TLS handshake with the server. This is because the WSA may choose to block a connection based on the certificate validity and must initiate a TLS connection with the server to obtain the certificate. If the certificate is valid, the WSA will close the connection and allow the client to continue setting up the session directly with the server.

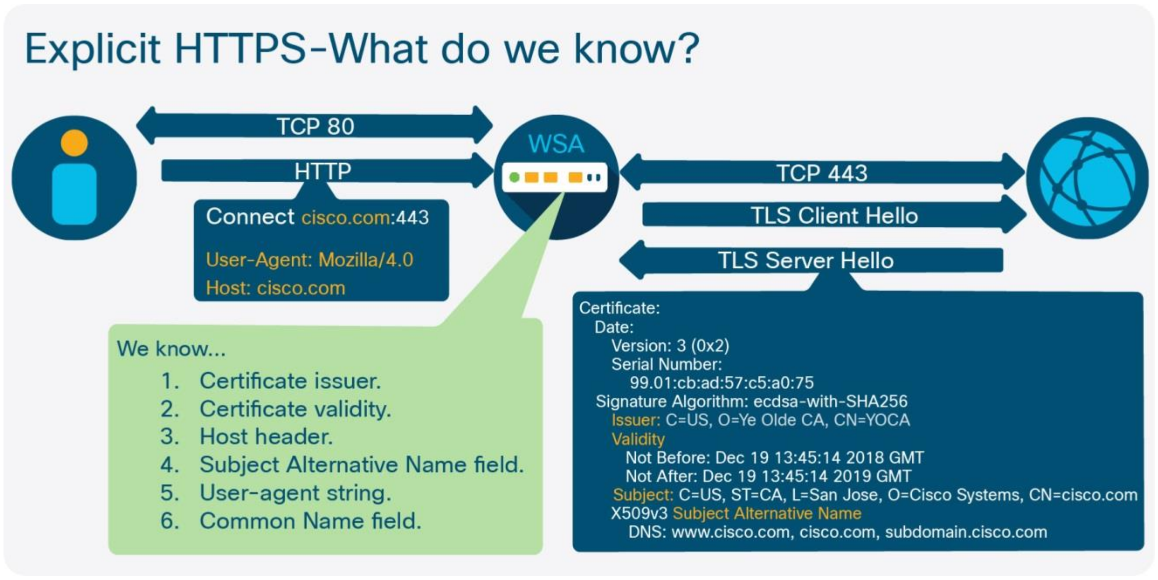


HTTPS policy operations

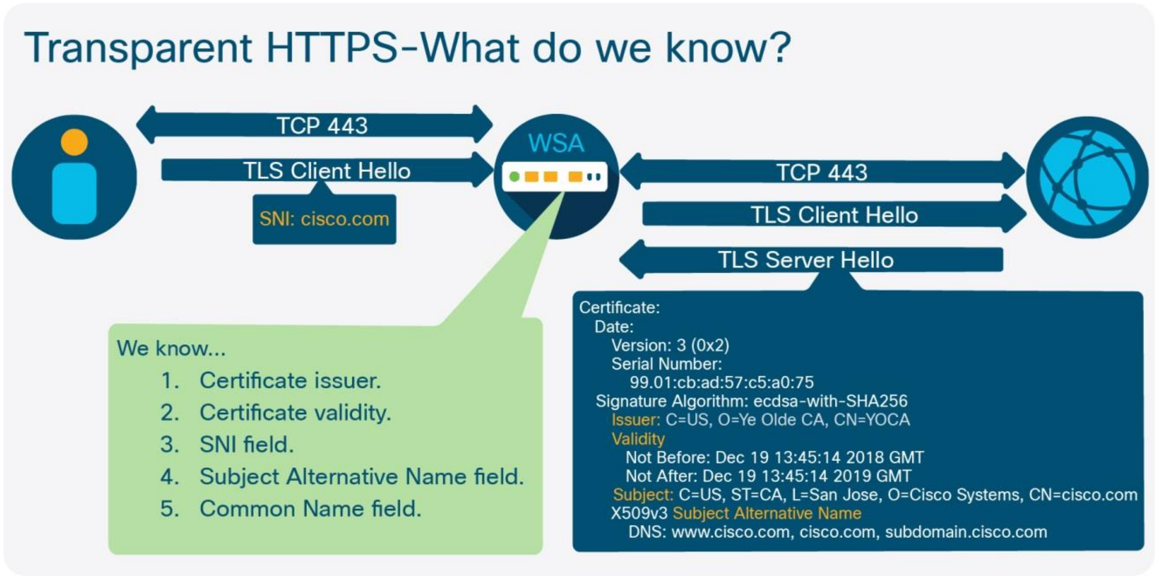
- Drop
  - Connection is closed.
- Decrypt
  - Traffic is decrypted and evaluated by access policies.
- Passthrough
  - Transaction is not decrypted.
  - Client negotiates directly with server.
- Monitor
  - No action taken.
  - Move to the next column on the policy.

The only case in which the WSA does not perform any TLS handshake is when the server's name or IP address is present in a **custom category,** which is set to **passthrough,** and the server name is available in either an HTTP **CONNECT** or TLS **Client Hello**. In an explicit scenario, the client provides the hostname of the server to the proxy prior to the TLS session initiation (in the **host** header), so this field is checked against the **custom category**. In a transparent deployment, the WSA will check the **Server Name Indication** (SNI) field in the TLS Client Hello message and evaluate it against the **custom category**. If the **host** header or SNI is not present, the WSA must continue the handshake with the server in order to check the **Subject Alternative Name** (SAN) and **Common Name** (CN) fields on the certificate, in that order.

What this behavior means for policy design is that the number of TLS handshakes can be reduced by determining well-known and internally trusted servers and setting them to **passthrough** using a **custom category** list, rather than relying on web category and reputation score, which will still require the WSA to complete a TLS handshake with the server. However, it is important to note that this will also prevent certificate validity checks.



```
Certificate:
  Date:
    Version: 3 (0x2)
    Serial Number:
      99.01:cb:ad:57:c5:a0:75
  Signature Algorithm: ecdsa-with-SHA256
    Issuer: C=US, O=Ye Olde CA, CN=YOCA
    Validity
      Not Before: Dec 19 13:45:14 2018 GMT
      Not After: Dec 19 13:45:14 2019 GMT
    Subject: C=US, ST=CA, L=San Jose, O=Cisco Systems, CN=cisco.com
    X509v3 Subject Alternative Name
      DNS: www.cisco.com, cisco.com, subdomain.cisco.com
```



```
Certificate:
  Date:
    Version: 3 (0x2)
    Serial Number:
      99.01:cb:ad:57:c5:a0:75
  Signature Algorithm: ecdsa-with-SHA256
    Issuer: C=US, O=Ye Olde CA, CN=YOCA
    Validity
      Not Before: Dec 19 13:45:14 2018 GMT
      Not After: Dec 19 13:45:14 2019 GMT
    Subject: C=US, ST=CA, L=San Jose, O=Cisco Systems, CN=cisco.com
    X509v3 Subject Alternative Name
      DNS: www.cisco.com, cisco.com, subdomain.cisco.com
```

With the speed at which new sites are appearing on the web, it is likely a number of sites will be found **uncategorized** by the web reputation and categorizations databases used by the WSA. This does not indicate that the site is necessarily more likely to be malicious, and additionally all of these sites will still be subjected to AV scanning, AMP file reputation and analysis, and any object blocking or scanning that is configured. For these reasons, it is not recommended to drop uncategorized sites in most circumstances. It is best to set them to be decrypted and scanned by the AV engines and evaluated by AVC, AMP, access policies, and so on. There is more information about uncategorized sites in the next section.

5.4 Access policies

As with the **ID profile,** the criteria set in the **decryption policy** is also evaluated as a logical **AND** with one important exception when using information from the ISE. The policy-matching behavior is explained below, depending on what elements are configured (AD group, user, or SGT):

AD groups and users: No change to previous behavior; the policy will be matched if the user is a member of group, **OR** the user is specified in the policy.

SGT and AD groups and users: The policy will be matched if the user is associated with the SGT **AND** is a member of the AD group, **OR** the user is specified in the policy.

SGT and users: The policy will be matched if the user is associated with the SGT **OR** the user is specified in the policy.

HTTP traffic is evaluated against the **access policies** immediately after being authenticated. HTTPS traffic is evaluated after being authenticated, and if the decrypt action is applied per the matching **decryption** policy. For decrypted requests, there will be two **access_log** entries. The first log entry will show the action applied to the initial TLS connection (**decrypt**), and a second log entry will show the action applied by the **access policy** to the decrypted HTTP request.

As explained in section **4.1 Web proxy,** range request headers are used to request a specific byte range of a file and are commonly used by OS and application update services. The WSA will, by default, strip these headers from outbound requests, because without the entire file, it is impossible to perform malware scanning or to utilize AVC features. If many hosts on the network are requesting small byte ranges frequently in order to retrieve updates, this can trigger the WSA to download the entire file several times simultaneously. This can quickly exhaust available Internet bandwidth and cause service outages. The most common causes of this failure scenario are Microsoft Windows update and Adobe software update daemons.

In order to mitigate this, the best solution is to steer this traffic around the WSA altogether. This is not always feasible for transparently deployed environments, and in these cases, the next best option is to create dedicated **access policies** for the traffic and enable range request header forwarding on those policies. It should be considered that AV scanning and AVC will not be possible for these requests, and so the policies should be carefully designed to only target the intended traffic. Often, the best way to accomplish this is by matching the user-agent string found in the request header. The user-agent string for common update daemons can be found online, or the requests can be captured by an administrator and examined. Most update services, including Microsoft Windows update and Adobe software updates, will not use HTTPS.

As is described in the previous section, it is not recommended to drop uncategorized sites in the decryption policies. For the same reasons, it is not recommended to block them in the **access policies.** The **Dynamic Content Analysis** (DCA) engine can use the content of a given site, along with other heuristic data to categorized sites that otherwise would be marked uncategorized by URL database lookups. Enabling this feature will reduce the number of uncategorized verdicts in the WSA.

In the **Object Scanning** settings of an access policy, there is the ability to inspect several types of archive files. If the network regularly downloads archive files as part of application updates, enabling this can significantly increase CPU usage. This traffic should be identified ahead of time and exempted if the intention is to inspect all archive files. The first place to investigate possible methods to identify this traffic is the user-agent string, as this may help avoid IP allowed lists that can become cumbersome to maintain.

5.5 Custom and external URL categories

Custom category lists are used to identify a server by IP address or hostname. It is possible to use **regular expressions** (regex) to specify patterns by which server names can be matched. It is much more resource intensive to use a regex pattern to match a server name than it is to use a substring match, and so they should only be used when absolutely necessary. A "." can be added to the beginning of a domain name in order to match a subdomain without the need for regex. For example, **".google.com"** will also match **"maps.google.com."**

As explained in the section **5.1 Complexity,** low complexity is defined as 10 custom category lists, medium complexity as 20, and high complexity as 30. Keeping this number to below 20 is recommended best practice, especially if the lists use regex patterns or contain a large number of entries. Refer to the abovementioned section for additional details on the number of entries for each type.

External URL feeds are much more flexible than static **custom category** lists, and leveraging them can have a direct impact on security because they remove the need for an administrator to manually maintain them. Because this feature can be used to retrieve lists that are not maintained or controlled by the WSA administrator, the ability to add individual exceptions to the downloaded addresses was added in AsyncOS version 11.8.

The Office365 API is especially useful for making policy decisions on this commonly deployed service and can be leveraged for individual applications (PowerPoint, Skype, Word, etc.). Microsoft recommends bypassing proxies for all Office365 traffic in order to optimize performance. Microsoft's documentation states the following:

> **"While SSL Break and Inspect creates the largest latency, other services such as proxy authentication and reputation lookup can cause poor performance and a bad user experience. Additionally, these perimeter network devices need enough capacity to process all of the network connection requests. We recommend bypassing your proxy or inspection devices for direct Office 365 network requests." https://docs.microsoft.com/en-us/office365/enterprise/managing-office-365-endpoints.**

It can be difficult to follow this guidance in a transparent proxy environment. Beginning in AsyncOS version 11.8, it is possible to use the dynamic category list retrieved from the Office365 API to populate the **bypass settings** list. This list is used to send transparently redirected traffic back to the WCCP device for direct routing.

Bypassing all Office365 traffic creates a blind spot for administrators who require some basic security controls and reporting for this traffic. If Office365 traffic is not bypassed by the WSA, it is important to understand the specific technical challenges that can arise. One of these is the number of connections that are required by the applications. Sizing must be appropriately adjusted to accommodate the additional persistent TCP connections required by Office365 applications. This can increase the total connection count by between 10 and 15 persistent TCP sessions per user.

The decrypt and re-encrypt actions performed by the HTTPS proxy will introduce a small amount of latency to the connections. Office365 applications can be very sensitive to latency, and if other factors such as slow WAN connection and disparate geographic location compound this, user experience can suffer.

Some Office365 applications employ proprietary TLS parameters that prevent the HTTPS proxy from completing a handshake with the application server. This is required in order to validate the certificate or retrieve the hostname. When this is combined with an application such as Skype for Business that does not send a **Server Name Indication** (SNI) field in its TLS **Client Hello** message, it becomes necessary to bypass this traffic entirely. AsyncOS 11.8 has introduced the ability to bypass traffic based on destination IP address only, without certificate checks to address this scenario.

6. Monitoring and alerting

6.1 CLI monitoring

The WSA CLI provides commands for real-time monitoring of important processes. Most useful are the commands that show statistics related to the **prox** process. The **status detail** command is a good source for a summary of resource usage and performance metrics, including uptime, bandwidth used, response latency, number of connections, and more. Below is example output from this command:

```
Status as of:                  Wed Dec 05 18:27:39 2018 GMT
Up since:                      Mon Dec 03 15:38:35 2018 GMT (2d 2h 49m 4s)
System Resource Utilization:
  CPU                                    30.1%
  RAM                                    72.6%
  Reporting/Logging Disk                 11.3%
Transactions per Second:
  Average in last minute                     1
  Maximum in last hour                      16
  Average in last hour                       1
  Maximum since proxy restart               16
  Average since proxy restart                1
Bandwidth (Mbps):
  Average in last minute                 0.273
  Maximum in last hour                   1.975
  Average in last hour                   0.128
  Maximum since proxy restart            1.975
  Average since proxy restart            0.142
Response Time (ms):
  Average in last minute                   123
  Maximum in last hour                    3026
  Average in last hour                         111
  Maximum since proxy restart                 3026
  Average since proxy restart                  114
Cache Hit Rate:
  Average in last minute                         0
  Maximum in last hour                           0
  Average in last hour                           0
  Maximum since proxy restart                    0
  Average since proxy restart                    0
Connections:
  Idle client connections                       94
  Idle server connections                        0
  Total client connections                      95
  Total server connections                      94
SSLJobs:
  In queue Avg in last minute                    0
  Average in last minute                       818
  SSLInfo Average in last min                   27
Network Events:
  Average in last minute                       1.2
  Maximum in last minute                         9
  Network events in last min                 13183
```

The **rate** command will show real-time information about the percentage of CPU used by the prox process, as well as the number of **Requests Per Second** (RPS) and cache statistics. This command will continue to poll and display new output until interrupted. Below is an example of output from this command:

```
Press Ctrl-C to stop.
  %proxy  reqs                       client    server    %bw  disk  disk
     CPU  /sec   hits blocks misses  kb/sec    kb/sec  saved   wrs   rds
  9.00    73       0      0    736   7184      7184     0.0      0     0
  8.00    73       0      0    739   7125      7125     0.0      0     0
  8.00    60       0      0    605   5884      5884     0.0      0     0
  7.00    72       0      0    720   6116      6116     0.0      0     0
  8.00    66       0      0    661   6341      6341     0.0      0     0
  7.00    75       0      0    756   7148      7148     0.0      0     0
  9.00    63       0      0    632   5147      5147     0.0      0     0
  7.00    67       0      0    676   6149      6149     0.0      0     0
 10.00    71       0      0    717   6418      6418     0.0      0     0
```

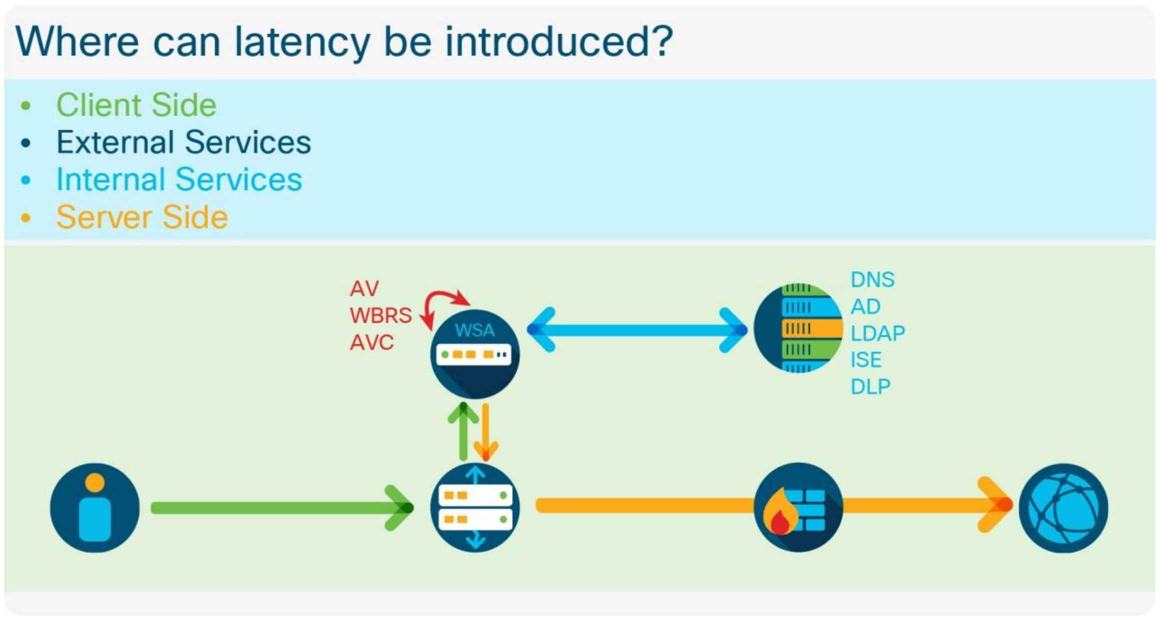
The **tcpservices** command displays information regarding selected process listening ports. An explanation of each process and the address and port combination is also displayed:

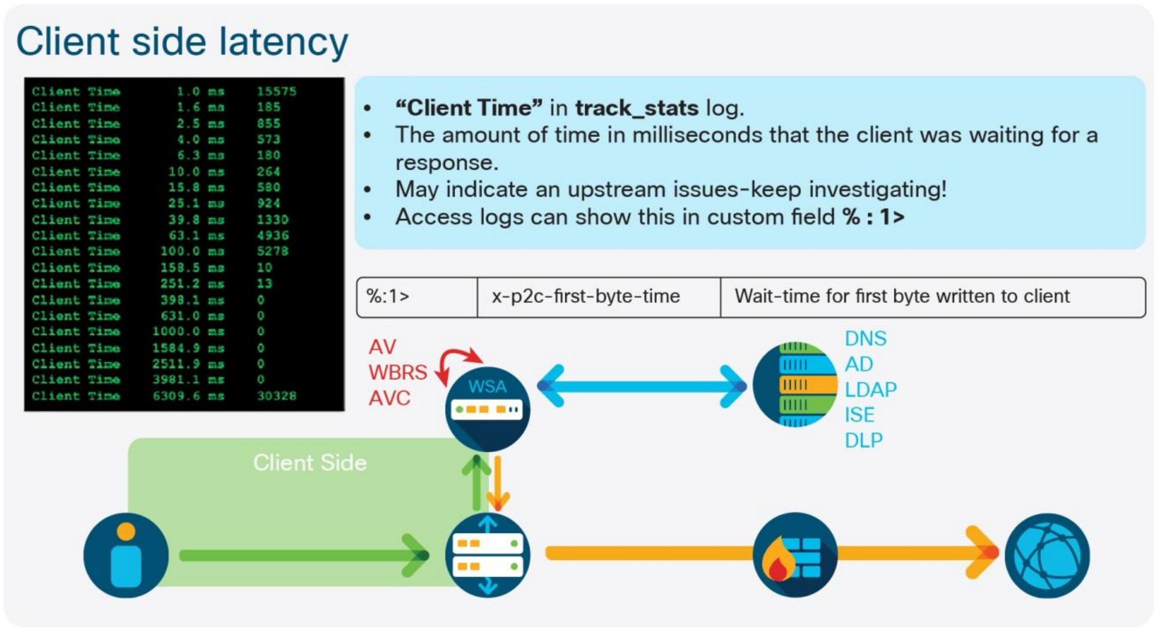
```
System Processes (Note: All processes may not always be present)
  ftpd.main     - The FTP daemon
  ginetd        - The INET daemon
  interface     - The interface controller for inter-process communication
  ipfw          - The IP firewall
  slapd        - The Standalone LDAP daemon
  sntpd        - The SNTP daemon
  sshd         - The SSH daemon
  syslogd      - The system logging daemon
  winbindd     - The Samba Name Service Switch daemon

Feature Processes
  coeuslogd    - Main WSA controller
  gui          - GUI process
  hermes       - Mail server for sending alerts, etc.
  java         - Processes for storing and querying Web Tracking data
  musd         - AnyConnect Secure Mobility server
  pacd         - PAC file hosting daemon
  prox         - WSA proxy
  trafmon      - L4 Traffic Monitor
  uds          - User Discovery System (Transparent Auth)
  wccpd        - WCCP daemon

COMMAND       USER          TYPE NODE   NAME
redis-ser     root          IPv4 TCP    127.0.0.1:6379
interface     root          IPv4 TCP    127.0.0.1:domain
gui           root          IPv4 TCP    192.168.0.165:8080
gui           root          IPv4 TCP    192.168.0.165:8443
ginetd        root          IPv4 TCP    192.168.0.165:ssh
java          root          IPv6 TCP    [::127.0.0.1]:18081
prox          root          IPv4 TCP    127.0.0.1:http
prox          root          IPv6 TCP    [::1]:http
prox          root          IPv4 TCP    192.168.0.165:http
prox          root          IPv4 TCP    192.168.10.165:http
prox          root          IPv4 TCP    127.0.0.1:3128
prox          root          IPv6 TCP    [::1]:3128
prox          root          IPv4 TCP    192.168.0.165:3128
prox          root          IPv4 TCP    192.168.10.165:3128
prox          root          IPv4 TCP    127.0.0.1:25255
prox          root          IPv4 TCP    127.0.0.1:ftp-proxy
prox          root          IPv6 TCP    [::1]:ftp-proxy
prox          root          IPv4 TCP    192.168.0.165:ftp-proxy
prox          root          IPv4 TCP    192.168.10.165:ftp-proxy
prox          root          IPv4 TCP    127.0.0.1:https
prox          root          IPv6 TCP    [::1]:https
prox          root          IPv4 TCP    192.168.0.165:https
prox          root          IPv4 TCP    192.168.10.165:https
```

6.2 Logging

Web traffic is highly dynamic and varied. After a proxy deployment is complete, it is important to regularly reassess the quantity and makeup of traffic being passed through the appliance. Checking the percentage of decrypted traffic on a regular basis (once a quarter) should be done to ensure sizing is consistent with the expectations and specifications of the initial installation. This can be done using a log management product such as **Advanced Web Security Reporting** (AWSR) or with simple Bash or PowerShell commands using the access logs. The number of RPS should also be reassessed on a regular basis to ensure that the appliance has enough overhead to account for spikes in traffic and possible failover in a high-availability, load-balanced configuration.

The **track_stats** log is appended every five minutes and includes several sections of output directly related to the **prox** process and its objects in memory. Most useful in performance monitoring are the sections that show the average latency for various request processes, including DNS lookup time, AV engine scan time, and many more useful fields. This log is not configurable using the GUI or the CLI and is only accessible via **Secure Copy Protocol** (SCP) or **File Transfer Protocol** (FTP). This is the most important log to have when troubleshooting performance so it should be polled frequently.



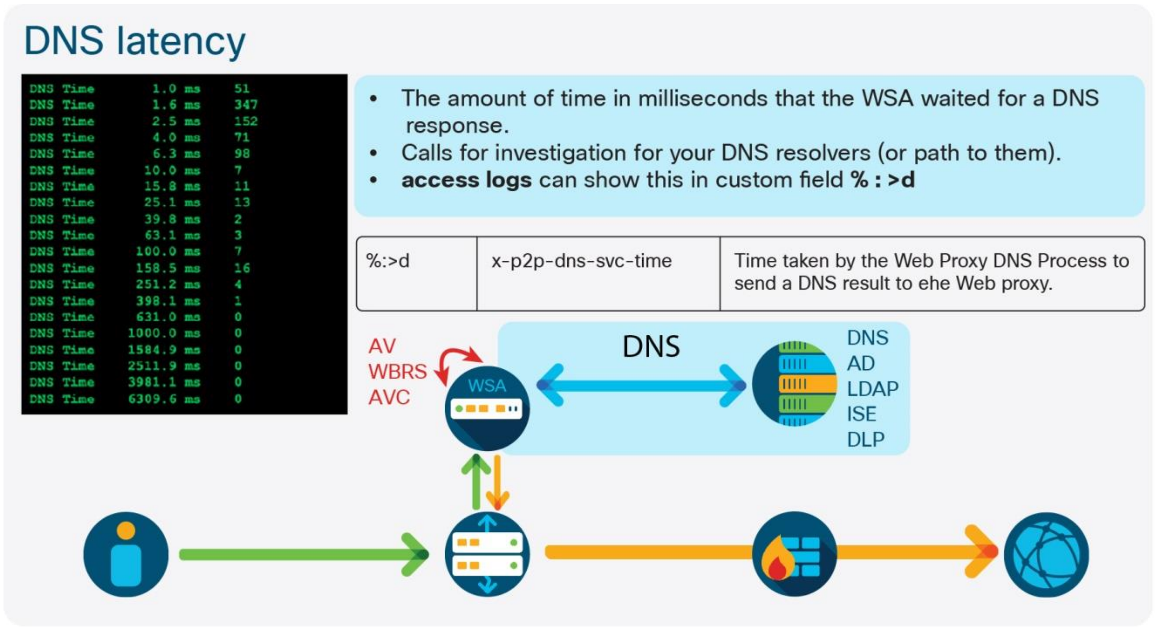


Client side latency

```
Client Time         1.0 ms    15575
Client Time         1.6 ms    185
Client Time         2.5 ms    855
Client Time         4.0 ms    573
Client Time         6.3 ms    180
Client Time        10.0 ms    264
Client Time        15.8 ms    580
Client Time        25.1 ms    924
Client Time        39.8 ms    1330
Client Time        63.1 ms    4936
Client Time       100.0 ms    5278
Client Time       158.5 ms    10
Client Time       251.2 ms    13
Client Time       398.1 ms    0
Client Time       631.0 ms    0
Client Time      1000.0 ms    0
Client Time      1584.9 ms    0
Client Time      2511.9 ms    0
Client Time      3981.1 ms    0
Client Time      6309.6 ms    30328
```

- **"Client Time"** in **track_stats** log.
- The amount of time in milliseconds that the client was waiting for a response.
- May indicate an upstream issues-keep investigating!
- Access logs can show this in custom field **% : 1>**

%:1>	x-p2c-first-byte-time	Wait-time for first byte written to client



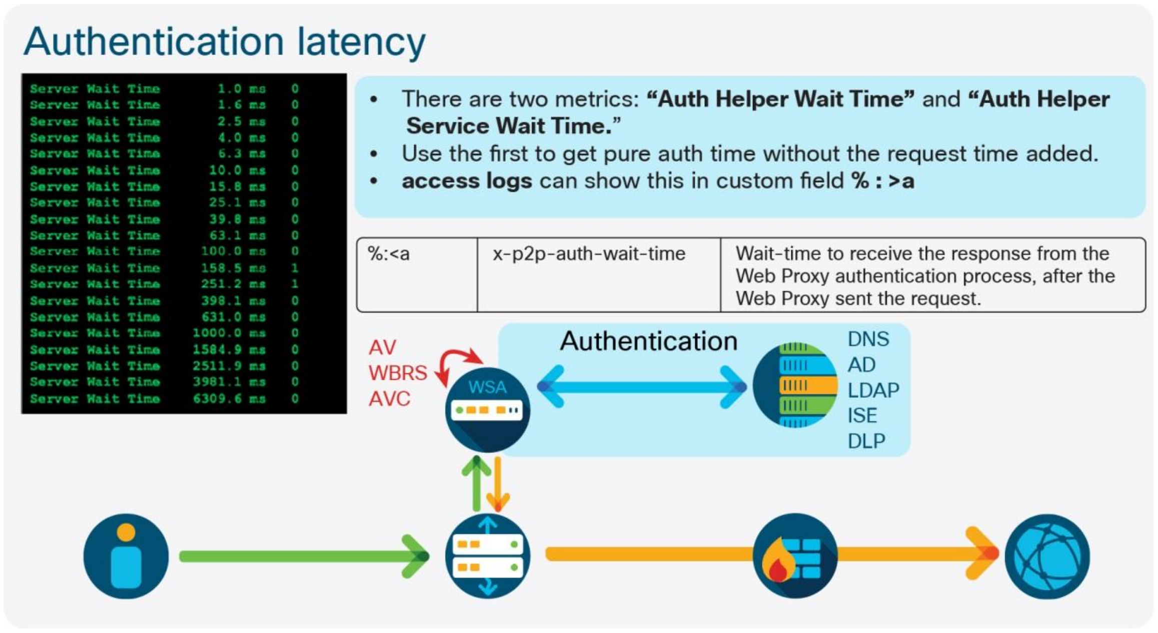
DNS latency

```
DNS Time         1.0 ms    51
DNS Time         1.6 ms    347
DNS Time         2.5 ms    152
DNS Time         4.0 ms    71
DNS Time         6.3 ms    98
DNS Time        10.0 ms    7
DNS Time        15.8 ms    11
DNS Time        25.1 ms    13
DNS Time        39.8 ms    2
DNS Time        63.1 ms    3
DNS Time       100.0 ms    7
DNS Time       158.5 ms    16
DNS Time       251.2 ms    4
DNS Time       398.1 ms    1
DNS Time       631.0 ms    0
DNS Time      1000.0 ms    0
DNS Time      1584.9 ms    0
DNS Time      2511.9 ms    0
DNS Time      3981.1 ms    0
DNS Time      6309.6 ms    0
```

- The amount of time in milliseconds that the WSA waited for a DNS response.
- Calls for investigation for your DNS resolvers (or path to them).
- **access logs** can show this in custom field **% : >d**

%:>d	x-p2p-dns-svc-time	Time taken by the Web Proxy DNS Process to send a DNS result to ehe Web proxy.

Authentication latency

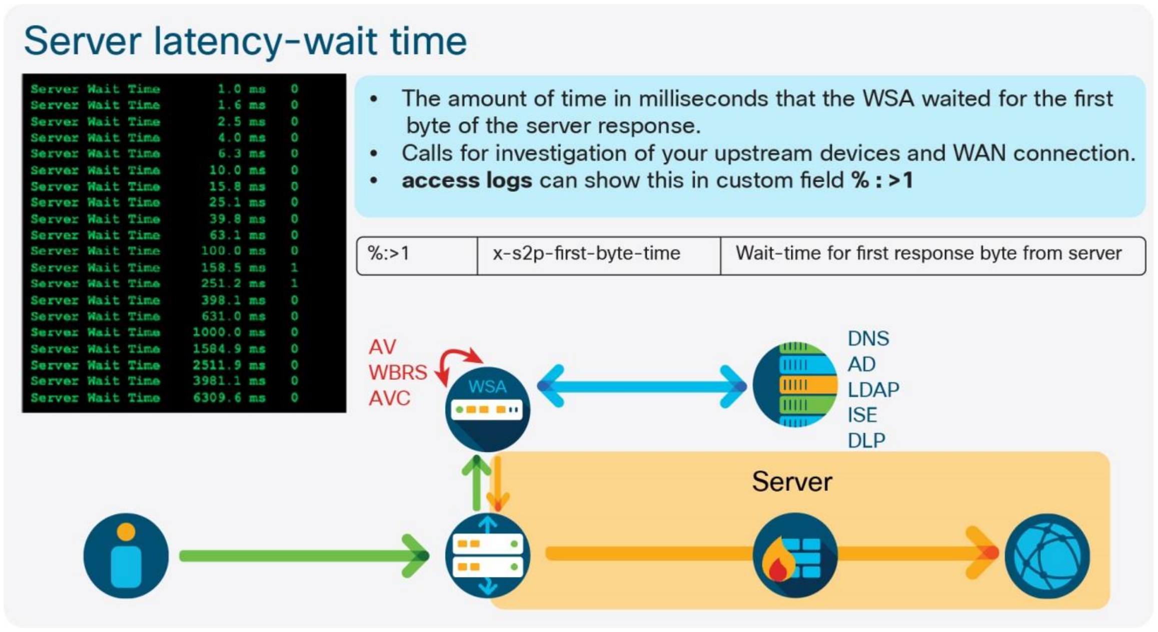


```
Server Wait Time        1.0 ms    0
Server Wait Time        1.6 ms    0
Server Wait Time        2.5 ms    0
Server Wait Time        4.0 ms    0
Server Wait Time        6.3 ms    0
Server Wait Time       10.0 ms    0
Server Wait Time       15.8 ms    0
Server Wait Time       25.1 ms    0
Server Wait Time       39.8 ms    0
Server Wait Time       63.1 ms    0
Server Wait Time      100.0 ms    0
Server Wait Time      158.5 ms    1
Server Wait Time      251.2 ms    1
Server Wait Time      398.1 ms    0
Server Wait Time      631.0 ms    0
Server Wait Time     1000.0 ms    0
Server Wait Time     1584.9 ms    0
Server Wait Time     2511.9 ms    0
Server Wait Time     3981.1 ms    0
Server Wait Time     6309.6 ms    0
```

- There are two metrics: **“Auth Helper Wait Time”** and **“Auth Helper Service Wait Time.”**
- Use the first to get pure auth time without the request time added.
- **access logs** can show this in custom field **% : >a**

%:<a	x-p2p-auth-wait-time	Wait-time to receive the response from the Web Proxy authentication process, after the Web Proxy sent the request.

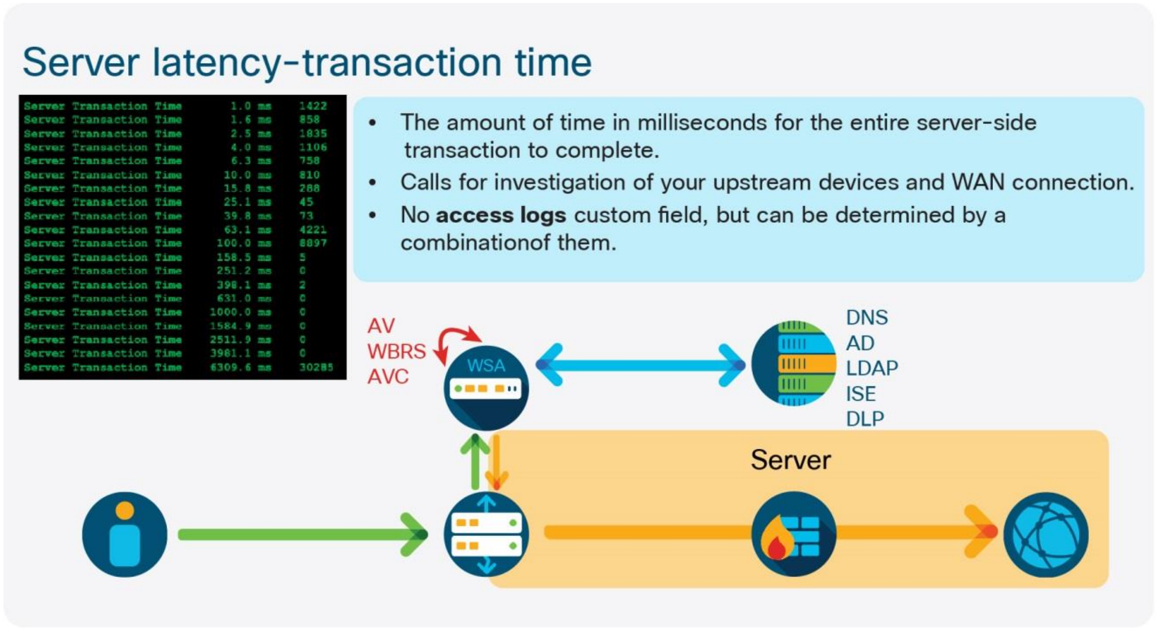
Server latency-wait time



```
Server Wait Time        1.0 ms    0
Server Wait Time        1.6 ms    0
Server Wait Time        2.5 ms    0
Server Wait Time        4.0 ms    0
Server Wait Time        6.3 ms    0
Server Wait Time       10.0 ms    0
Server Wait Time       15.8 ms    0
Server Wait Time       25.1 ms    0
Server Wait Time       39.8 ms    0
Server Wait Time       63.1 ms    0
Server Wait Time      100.0 ms    0
Server Wait Time      158.5 ms    1
Server Wait Time      251.2 ms    1
Server Wait Time      398.1 ms    0
Server Wait Time      631.0 ms    0
Server Wait Time     1000.0 ms    0
Server Wait Time     1584.9 ms    0
Server Wait Time     2511.9 ms    0
Server Wait Time     3981.1 ms    0
Server Wait Time     6309.6 ms    0
```

- The amount of time in milliseconds that the WSA waited for the first byte of the server response.
- Calls for investigation of your upstream devices and WAN connection.
- **access logs** can show this in custom field **% : >1**

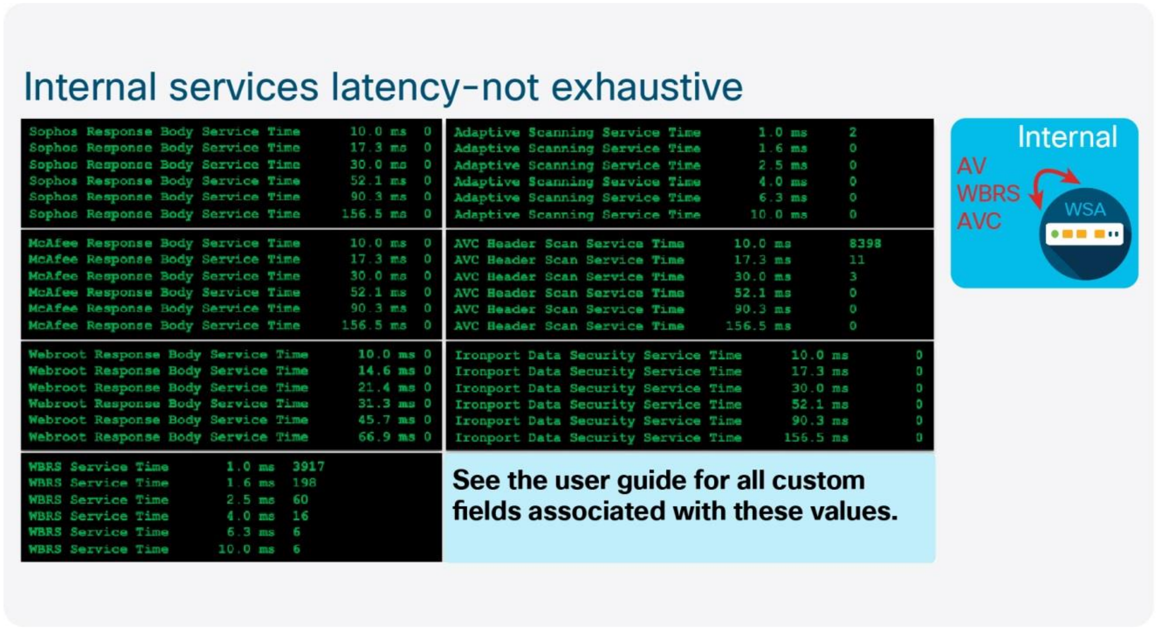
%:>1	x-s2p-first-byte-time	Wait-time for first response byte from server



Server latency-transaction time

```
Server Transaction Time         1.0 ms    1422
Server Transaction Time         1.6 ms    858
Server Transaction Time         2.5 ms    1835
Server Transaction Time         4.0 ms    1106
Server Transaction Time         6.3 ms    758
Server Transaction Time        10.0 ms    810
Server Transaction Time        15.8 ms    288
Server Transaction Time        25.1 ms    45
Server Transaction Time        39.8 ms    73
Server Transaction Time        63.1 ms    4221
Server Transaction Time       100.0 ms    8897
Server Transaction Time       158.5 ms    5
Server Transaction Time       251.2 ms    0
Server Transaction Time       398.1 ms    2
Server Transaction Time       631.0 ms    0
Server Transaction Time      1000.0 ms    0
Server Transaction Time      1584.9 ms    0
Server Transaction Time      2511.9 ms    0
Server Transaction Time      3981.1 ms    0
Server Transaction Time      6309.6 ms    30285
```

- The amount of time in milliseconds for the entire server-side transaction to complete.
- Calls for investigation of your upstream devices and WAN connection.
- No **access logs** custom field, but can be determined by a combinationof them.



Internal services latency-not exhaustive

```
Sophos Response Body Service Time       10.0 ms  0
Sophos Response Body Service Time       17.3 ms  0
Sophos Response Body Service Time       30.0 ms  0
Sophos Response Body Service Time       52.1 ms  0
Sophos Response Body Service Time       90.3 ms  0
Sophos Response Body Service Time      156.5 ms  0
```

```
McAfee Response Body Service Time       10.0 ms  0
McAfee Response Body Service Time       17.3 ms  0
McAfee Response Body Service Time       30.0 ms  0
McAfee Response Body Service Time       52.1 ms  0
McAfee Response Body Service Time       90.3 ms  0
McAfee Response Body Service Time      156.5 ms  0
```

```
Webroot Response Body Service Time       10.0 ms 0
Webroot Response Body Service Time       14.6 ms 0
Webroot Response Body Service Time       21.4 ms 0
Webroot Response Body Service Time       31.3 ms 0
Webroot Response Body Service Time       45.7 ms 0
Webroot Response Body Service Time       66.9 ms 0
```

```
WBRS Service Time          1.0 ms   3917
WBRS Service Time          1.6 ms   198
WBRS Service Time          2.5 ms   60
WBRS Service Time          4.0 ms   16
WBRS Service Time          6.3 ms   6
WBRS Service Time         10.0 ms   6
```

```
Adaptive Scanning Service Time        1.0 ms     2
Adaptive Scanning Service Time        1.6 ms     0
Adaptive Scanning Service Time        2.5 ms     0
Adaptive Scanning Service Time        4.0 ms     0
Adaptive Scanning Service Time        6.3 ms     0
Adaptive Scanning Service Time       10.0 ms     0
```

```
AVC Header Scan Service Time       10.0 ms        8398
AVC Header Scan Service Time       17.3 ms        11
AVC Header Scan Service Time       30.0 ms        3
AVC Header Scan Service Time       52.1 ms        0
AVC Header Scan Service Time       90.3 ms        0
AVC Header Scan Service Time      156.5 ms        0
```

```
Ironport Data Security Service Time       10.0 ms          0
Ironport Data Security Service Time       17.3 ms          0
Ironport Data Security Service Time       30.0 ms          0
Ironport Data Security Service Time       52.1 ms          0
Ironport Data Security Service Time       90.3 ms          0
Ironport Data Security Service Time      156.5 ms          0
```

See the user guide for all custom fields associated with these values.

An individual **SHD** log line is written every one minute and will contain many fields that are important for performance monitoring, including latency, RPS, and total client-side and server-side connections. Below is an example of an **SHD** log line:

```
Tue Nov 13 13:37:00 2018 Info: Status: CPULd 25.4 DskUtil 9.0 RAMUtil 58.6 Reqs
42 Band 0 Latency 300 CacheHit 0 CliConn 19 SrvConn 19 MemBuf 0 SwpPgOut 71671
ProxLd 1 Wbrs_WucLd 0.0 LogLd 0.0 RptLd 0.0 WebrootLd 0.0 SophosLd 0.0 McafeeLd
0.0 WTTLd 0.0
```

Additional custom fields can be added to the **access_logs** that denote latency information for individual requests. These fields include server response, DNS resolution, and AV scanner latency. The fields should be added to the log to glean valuable information for use in troubleshooting. The recommended custom field string to use is the following:

```
Request Details: ID = %I, User Agent = %u, AD Group Memberships = ( %m ) %g ] [
Tx Wait Times (in ms): 1st byte to server = %:<1, Request Header = %:<h, Request
to Server = %:<b, 1st byte to client = %:1>, Response Header = %:h>, Client Body
= %:b> ] [ Rx Wait Times (in ms): 1st request byte = %:1<, Request Header = %:h<,
Client Body = %:b<, 1st response byte = %:>1, Response header = %:>h, Server
response = %:>b, Disk Cache = %:>c; Auth response = %:<a, Auth total = %:>a; DNS
response = %:<d, DNS total = %:>d, WBRS response = %:<r, WBRS total = %:>r, AVC
response = %:A>, AVC total = %:A<, DCA response = %:C>, DCA total = %:C<, McAfee
response = %:m>, McAfee total = %:m<, Sophos response = %:p>, Sophos total =
%:p<, Webroot response = %:w>, Webroot total = %:w<, Anti-Spyware response =
%:<s, Anti-Spyware total = %:>s; Latency = %x; %L
```

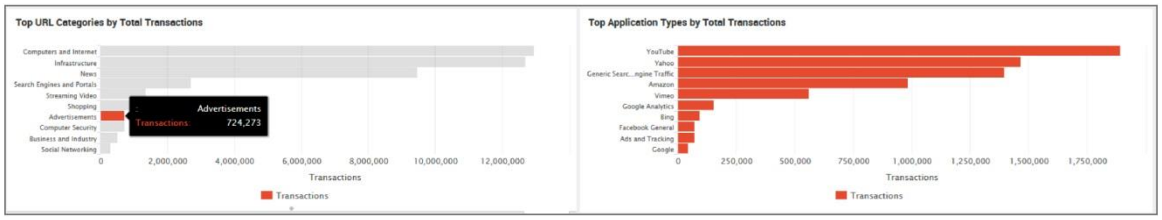
These values map to the following performance information:

Custom field	Description
%:<a	Wait time to receive the response from the Web Proxy authentication process, after the Web Proxy sent the request
%:<b	Wait time to write request body to server after header
%:<d	Wait time to receive the response from the Web Proxy DNS process, after the Web Proxy sent the request
%:<h	Wait time to write request header to server after first byte
%:<r	Wait time to receive the response from the Web Reputation Filters, after the Web Proxy sent the request
%:<s	Wait time to receive the verdict from the Web Proxy antispyware process, after the Web Proxy sent the request
%:>	Wait time for first response byte from server
%:>a	Wait time to receive the response from the Web Proxy authentication process, including the time required for the Web Proxy to send the request
%:>b	Wait time for complete response body after header received
%:>c	Time required for the Web Proxy to read a response from the disk cache
%:>d	Wait time to receive the response from the Web Proxy DNS process, including the time required for the Web Proxy to send the request
%:>h	Wait time for server header after first response byte
%:>r	Wait time to receive the verdict from the Web Reputation Filters, including the time required for the Web Proxy to send the request
%:>s	Wait time to receive the verdict from the Web Proxy antispyware process, including the time required for the Web Proxy to send the request
%:1<	Wait time for first request byte from new client connection
%:1>	Wait time for first byte written to client
%:b<	Wait time for complete client body
%:b>	Wait time for complete body written to client
%:h<	Wait time for complete client header after first byte
%:h>	Wait time for complete header written to client
%:m<	Wait time to receive the verdict from the McAfee scanning engine, including the time required for the Web Proxy to send the request
%:m>	Wait time to receive the response from the McAfee scanning engine, after the Web Proxy sent the request
%:w<	Wait time to receive the verdict from the Webroot scanning engine, including the time required for the Web Proxy to send the request
%:w>	Wait time to receive the response from the Webroot scanning engine, after the Web Proxy sent the request

The WSA licensing model allows for the reuse of physical appliance licenses for virtual appliances. This should be taken advantage of by deploying test WSAv appliances for use in lab testing. New features and configurations can be piloted this way to ensure stability and reliability without violating licensing terms.

6.3 Advanced web security reporting

AWSR should be leveraged to make the most of reporting data from the WSA. Especially in environments where many WSAs are deployed, this solution is many times more scalable than utilizing centralized reporting on a **Security Management Appliance** (SMA) and provides custom reporting attributes that add an immense amount of depth and customization to the data. Reports can be grouped and customized to meet any organization's need. Cisco's **Advanced Services** group should be leveraged in sizing for AWSR.



6.4 Email alerting

The built-in email alert system on the WSA is best leveraged as a base-line alert system. It should be tweaked appropriately to meet the needs of the administrator, as it can be very noisy if all informational events are enabled. It is more important to limit the alerts and actively monitor them than it is to alert on everything and ignore them as spam.

Alert Settings	
From Address to use when sending alerts:	Automatically Generated
Initial number of seconds to wait before sending a duplicate alert:	300
Maximum number of seconds to wait before sending a duplicate alert:	3600

6.5 Availability monitoring

There are two methods that can be employed to monitor availability of a web proxy. The first is **Layer 3** (L3) monitoring, which tests whether the appliance IP address is reachable on the network. The simplest way to test this is to send an ICMP **Echo** (ping) request to the address at regular intervals and check for a **Reply** packet. The attributes of the reply, such as TTL, and latency can be parsed to determine the health of the network layer.

It is possible that a device may be responsive to pings but that the proxy processes are unresponsive or intermittent. Because of this, it is advisable to employ a **Layer 7** (L7) monitor, which sends an explicit proxy request to the appliance and expects a **200 OK** HTTP response code. This tests not only the reachability of the network interface, but also the responsiveness of the proxy services and the viability of upstream services if an external resource is requested. This type of monitoring typically takes the form of an explicit HTTP **HEAD** request that asks the proxy to connect to a resource. The **HEAD** method requests the headers that would be returned should the client send a **GET** request, but includes only the response headers and no data.

If using an L7 monitoring tool or script, it is important to ensure that the traffic is exempted from authentication. Otherwise this could result in regular authentication failures and consumption of resources. Using a custom user-agent string in the monitoring tool should be employed to identify the traffic. Even though the traffic is exempted from authentication, it can still be restricted from unnecessary Internet access via the access policies.

Using one or more of these methods, an administrator should establish a baseline of acceptable metrics around the proxy response and use that to build alert thresholds. There should be some length of time dedicated to gathering the responses of such checks before deciding how to configure the thresholds and alerting.

6.6 SNMP monitoring

The **Simple Network Management Protocol** (SNMP) is the principle method for monitoring the health of the appliance. It can be used to receive alerts from the appliance (traps) or to poll various **Object Identifiers** (OIDs) to gather information. There are many OIDs available on the WSA that cover everything from hardware to resource usage to individual process information and request statistics.

There are a number of specific **Machine Information Base** (MIB) that should be monitored for both hardware and performance related reasons. The full list of MIBs can be found here: https://www.cisco.com/web/ironport/tools/web/asyncosweb-mib.txt.

Below is a list of the recommended MIBs to monitor. This is not an exhaustive list.

Hardware:

OID	Name
1.3.6.1.4.1.15497.1.1.1.18.1.3	raidID
1.3.6.1.4.1.15497.1.1.1.18.1.2	raidStatus
1.3.6.1.4.1.15497.1.1.1.18.1.4	raidLastError
1.3.6.1.4.1.15497.1.1.1.10	fanTable
1.3.6.1.4.1.15497.1.1.1.9.1.2	degreesCelsius

Performance:

The following OIDs map directly to the output of the **status detail** CLI command.

OID	Name	Status detail field
System resources		
1.3.6.1.4.1.15497.1.1.1.2.0	perCentCPUUtilization	CPU
1.3.6.1.4.1.15497.1.1.1.1.0	perCentMemoryUtilization	RAM
Transactions per Second		
1.3.6.1.4.1.15497.1.2.3.7.1.1.0	cacheThruputNow	Avg. in last minute
1.3.6.1.4.1.15497.1.2.3.7.1.2.0	cacheThruput1hrPeak	Max in last hour
1.3.6.1.4.1.15497.1.2.3.7.1.3.0	cacheThruput1hrMean	Avg. in last hour
1.3.6.1.4.1.15497.1.2.3.7.1.8.0	cacheThruputLifePeak	Max since proxy restart
1.3.6.1.4.1.15497.1.2.3.7.1.9.0	cacheThruputLifeMean	Avg. since proxy restart
Bandwidth		
1.3.6.1.4.1.15497.1.2.3.7.4.1.0	cacheBwidthTotalNow	Avg. in last minute
1.3.6.1.4.1.15497.1.2.3.7.4.2.0	cacheBwidthTotal1hrPeak	Max in last hour
1.3.6.1.4.1.15497.1.2.3.7.4.3.0	cacheBwidthTotal1hrMean	Avg. in last hour
1.3.6.1.4.1.15497.1.2.3.7.4.8.0	cacheBwidthTotalLifePeak	Max since proxy restart
1.3.6.1.4.1.15497.1.2.3.7.4.9.0	cacheBwidthTotalLifeMean	Avg. since proxy restart
Response time		
1.3.6.1.4.1.15497.1.2.3.7.9.1.0	cacheTotalRespTimeNow	Avg. in last minute
1.3.6.1.4.1.15497.1.2.3.7.9.2.0	cacheTotalRespTime1hrPeak	Max in last hour
1.3.6.1.4.1.15497.1.2.3.7.9.3.0	cacheTotalRespTime1hrMean	Avg. in last hour

OID	Name	Status detail field
1.3.6.1.4.1.15497.1.2.3.7.9.8.0	cacheTotalRespTimeLifePeak	Max since proxy restart
1.3.6.1.4.1.15497.1.2.3.7.9.9.0	cacheTotalRespTimeLifeMean	Avg. since proxy restart
Cache hit rate		
1.3.6.1.4.1.15497.1.2.3.7.5.1.0	cacheHitsNow	Avg. in last minute
1.3.6.1.4.1.15497.1.2.3.7.5.2.0	cacheHits1hrPeak	Max in last hour
1.3.6.1.4.1.15497.1.2.3.7.5.3.0	cacheHits1hrMean	Avg. in last hour
1.3.6.1.4.1.15497.1.2.3.7.5.8.0	cacheHitsLifePeak	Max since proxy restart
1.3.6.1.4.1.15497.1.2.3.7.5.9.0	cacheHitsLifeMean	Avg. since proxy restart
Connections		
1.3.6.1.4.1.15497.1.2.3.2.7.0	cacheClientIdleConns	Idle client connections
1.3.6.1.4.1.15497.1.2.3.3.7.0	cacheServerIdleConns	Idle server connections
1.3.6.1.4.1.15497.1.2.3.2.8.0	cacheClientTotalConns	Total client connections
1.3.6.1.4.1.15497.1.2.3.3.8.0	cacheServerTotalConns	Total server connections

7. Conclusion

This guide seeks to describe the most important aspects of WSA configuration, deployment, and monitoring. As a reference guide, its goal is to provide valuable information for those who wish to ensure the most effective use of the WSA. The best practices described here are important for the stability, scalability, and efficacy of the device as a security tool. It also seeks to remain as a relevant resource going forward and thus should be updated frequently to reflect changes in network environments and product feature sets.