

# Security guide

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Use this guide to reduce risk and mitigate threats to Java Agent security.



## **Threats**

Understand and address security threats.



## **Operating Systems**

Secure your operating systems.



## **Connections**

Secure network connections.



## **Access**

Remove non-essential access and features, update patches, and manage cookies.



## **Keys and Secrets**

Manage keys and secrets.



## **Audit Trails**

Audit events in your deployment.

Ping Identity Platform serves as the basis for our simple and comprehensive Identity and Access Management solution. For more information, visit <https://www.pingidentity.com> . The common REST API provides Ping Identity Platform software common ways to access web resources and collections of resources.

# Threats

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The following sections describe some possible threats to Java Agent, which you can mitigate by following the instructions in this guide.

## Out-of-date software

Prevent the exploitation of security vulnerabilities by using up-to-date versions of the agent and third-party software.

Review and follow the Ping Identity security advisories. Follow similar lists from all of your vendors.

## Cached pages in browsers and web proxies

When browsers and web proxies cache pages that are accessed by a user, the cache can include sensitive information. Caching pages in browsers and web proxies increases risk of unwanted disclosure, especially in shared browsing environments.

Similarly, when web server responses are cached, sensitive information can be accessed by attackers. Caching web server responses is a common method to improve loading times and reduce server load.

To manage caching, set [Custom Response Header Map](#) so that HTTP responses generated by the agent include the Cache-Control HTTP header. This header tells browsers and web proxies whether they can be cached. For example, clients can set the following value clear existing cache responses, force the cache to revalidate with the server, and prevent new responses from being cached:

```
org.forgerock.agents.response.header.map[Cache-Control]=max-age=0, no-store
```

In your decision to set this property, consider the impact on the performance of customer applications. Setting this property can reduce performance because browser pages aren't cached.

Learn more in [HTTP caching](#) .

## Reconnaissance

The initial phase of an attack sequence is often reconnaissance. Limit the amount of information available to attackers during reconnaissance, as follows:

- Avoid using words that identify Java Agent in error messages.

When AM isn't available, the related error message contains the agent profile name. Consider this in your choice of agent profile name.

- Configure [Agent Debug Level](#) to use the lowest level of logging necessary. For example, consider logging at the ERROR or WARNING level, instead of TRACE or MESSAGE .
- In custom login redirects, calls to the custom login URL include the parameter [Login Reason Parameter Name](#) to indicate why authentication is required, such as NO\_TOKEN and TOKEN\_EXPIRED . To reduce the risk of leaking useful information, use alternative strings for the authentication reason by configuring [Login Reason Value Map](#).

## Cross-site scripting

### WARNING

Cross-site request forgery attacks (CSRF or XSRF) can be a cause of serious vulnerabilities in web applications. It is the responsibility of the protected application to implement countermeasures against such attacks, because Java Agent cannot provide generic protection against CSRF. Follow the latest guidance from the [OWASP CSRF Prevention Cheat Sheet](#) <sup>↗</sup>.

When POST data preservation is enabled, captured POST data that is replayed appears to come from the same origin as the protected application, not from the site that originated the request. Therefore, CSRF defenses that rely solely on checking the origin of requests, such as SameSite cookies or Origin headers, are not reliable. Ping Identity strongly recommends using token-based mitigations against CSRF, and relying on other measures only as a defense in depth, in accordance with OWASP guidance.

Configure the following properties to protect against cross-site scripting attacks:

- [Enable Composite Advice Encoding](#)
- [XSS Redirect URI Map](#)
- [XSS Code Element List](#)

## Client IP addresses

The agent doesn't have access to client side IP addresses at the TCP/IP level. Instead, it accesses client IP addresses from the address of the last proxy or client.

You can change the HTTP header used to identify the client IP address by setting the [Client IP Address Header](#) property. If you set this property, make sure you use a trusted header. For example, there are security and privacy concerns associated with using the X-Forwarded-For HTTP header. Learn more in the MDN Web Docs [X-Forwarded-For](#) <sup>↗</sup>.

Security issues can occur if the client IP address is spoofed, particularly if the spoofed IP address is included in a [not-enforced rule](#). Learn more about IP spoofing in OWASP's [IP Spoofing via HTTP Headers](#).

To protect your deployment, you should only set the [Not-Enforced Client IP List](#) property if you have considered the risks of client IP address spoofing and mitigated for them. Typically, you would only specify IP addresses from a private network that you have control over.

## POST data preservation

By default, POST data is stored in the in-memory cache. Consider the following points if you configure [POST Data Preservation in Files or Cache](#) to store POST data in the file system:

- Payloads from unauthenticated users are stored in the agent file system. If your threat evaluation does not accept this risk, store the data in the cache, or set [POST Data Preservation in Files or Cache](#) to `false`.
- Restrict access to the [POST Data Preservation File Directory](#), to mitigate the risk of permissive access or leakage of personally identifiable information (PII).
- Limit the amount of stored POST data to mitigate the risk of DoS attacks, by configuring [POST Data Preservation Storage Size](#) or [Max Entries in POST Data Preservation Storage](#).
- Remove expired POST data as soon as possible by configuring the [POST Data Preservation Directory Sweep Interval](#).
- Identify threats in POST data before it is deleted, by making sure that Intrusion Detection Systems inspect the data within the time specified by [POST Data Preservation Directory Sweep Interval](#).

Learn more in [POST data preservation](#).

## Compromised passwords

Use secure passwords for server administration.

You can find information on creating the agent password in [Preinstallation tasks](#). The encrypted password is stored in the [AgentPassword.properties](#) file.

### TIP

Although the agent accepts any password length and content, you are strongly encouraged to generate secure passwords. This can be achieved in various ways, for example using a password manager or by using the command line tool `agentadmin --key`.

## Misconfiguration

Misconfiguration can arise from bad or mistaken configuration decisions, and from poor change management. Depending on the configuration error, features can stop working in obvious or subtle ways, and potentially introduce security vulnerabilities.

For example, if a configuration change prevents the server from making HTTPS connections, many applications can no longer connect, and the problem is detected immediately. However, if a configuration change allows insecure TLS protocol versions or cipher suites for HTTPS connections, some applications negotiate insecure TLS but appear to continue to work properly.

- Access policy isn't correctly enforced.

Incorrect parameters for secure connections and incorrect Access Control Instructions (ACI) can lead to overly permissive access to data and potentially to a security breach.

- The server fails to restart.

Although failure to start a server isn't directly a threat to security, it can affect service availability.

To guard against bad configuration decisions, implement good change management:

- For all enabled features, document why they are enabled and what your configuration choices mean. This implies a review of configuration settings, including default settings that you accept.
- Validate configuration decisions with thorough testing.
- Maintain a record of your configurations and the changes applied.

For example, use a filtered audit log. Use version control software for any configuration scripts and to record changes to configuration files.

- Maintain a record of external changes to the system, such as changes to operating system configuration and updates to software, such as the JVM that introduces security changes.

## Path traversal attempts

Bad actors attempt to access protected resources using a number of different techniques that typically involve path traversal. For example, if a not-enforced rule exists that allows access to everything under `/public`, they will attempt to access protected resources using paths, such as `/public/../../private/secret.html`, `/public/;../private/secret.html` or `/public%2F%2e.%2fprivate/secret.html`, where the path traversal attempt is disguised as a path parameter or by encoding characters within the URL.

Java Agent rejects incoming request URLs with an HTTP 400 in the following scenarios by default:

- One or more of the following characters exist in the URL path or path parameters:
  - %2E (encoded period character)
  - %2F (encoded forward slash)
  - %3B (encoded semicolon)
  - %5C (encoded backslash)
  - \ (unencoded backslash)
- The incoming URL path contains encoded control characters. These are characters in the range %00 to %1F inclusive, and %7F .
- The incoming URL path contains invalid encodings, such as %G1 .
- The incoming URL path doesn't conform with the rules in the Jakarta Servlet Specification [Request URI Path Processing](#) section.

#### NOTE

Encoded characters are case-insensitive. For example, %2E and %2e are handled in the same way.

You can change this default behavior by configuring the URL handling properties. Learn more in [URL handling](#).

## Unauthorized access

Data theft can occur when access policies are too permissive and when the credentials to gain access are too easily cracked. It can also occur when the data isn't protected, when administrative roles are too permissive, and when administrative credentials are poorly managed.

## Poor risk management

Threats can arise when plans fail to account for outside risks. To mitigate risk, develop appropriate answers to at least the following questions:

- What happens when a server or an entire data center becomes unavailable?
- How do you remedy a serious security issue in the service, either in the Java Agent software or the connected systems?
- How do you validate mitigation plans and remedial actions?
- How do client applications work when the Java Agent is offline?

If client applications require always-on services, how do your operations ensure high availability, even when a server goes offline?

For critical services, test expected operation and disaster recovery operation.

## Denial of service

To prevent memory exhaustion DOS attacks, configure [Maximum Decompression Size](#) to limit the maximum size to which a compressed JWT can be decompressed. This property reduces the risk of a decompressed JWT consuming too much available memory.

## Log overflow attacks

To prevent log overflow attacks, add a custom `agent-logback.xml` with a `DuplicateMessageFilter`. This filter detects duplicate messages, and after the specified number of repetitions, drops repeated messages. Learn more in [Limiting repetitive log messages](#).

## Operating systems

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When you deploy Java Agent, familiarize yourself with the recommendations for the host operating systems that you use. For comprehensive information about securing operating systems, refer to the [CIS Benchmark](#) <sup>↗</sup> documentation.

## System updates

Over the lifetime of a deployment, the operating system might be subject to vulnerabilities. Some vulnerabilities require system upgrades, whereas others require only configuration changes. All updates require proactive planning and careful testing.

For the operating systems used in production, put a plan in place for avoiding and resolving security issues. The plan should answer the following questions:

- How does your organization become aware of system security issues early?

This could involve following bug reports, mailing lists, forums, and other sources of information.

- How do you test security fixes, including configuration changes, patches, service packs, and system updates?

Validate the changes first in development, then in one or more test environments, then in production in the same way you would validate other changes to the deployment.

- How do you roll out solutions for security issues?

In some cases, fixes might involve both changes to the service, and specific actions by those who use the service.

- What must you communicate about security issues?
- How must you respond to security issues?

Software providers often do not communicate what they know about a vulnerability until they have a way to mitigate or fix the problem. Once they do communicate about security issues, the information is likely to become public knowledge quickly. Make sure that you can expedite resolution of security issues.

To resolve security issues quickly, make sure that you are ready to validate any changes that must be made. When you validate a change, check that the fix resolves the security issue. Validate that the system and Java Agent software continue to function as expected in all the ways they are used.

## System audits

System audit logs make it possible to uncover system-level security policy violations that are not recorded in Java Agent, such as unauthorized access to Java Agent files. Such violations are not recorded in Java Agent logs or monitoring information.

Also consider how to prevent or at least detect tampering. A malicious user violating security policy is likely to try to remove evidence of how security was compromised.

## Unused features

By default, operating systems include many features, accounts, and services that Java Agent software does not require. Each optional feature, account, and service on the system brings a risk of additional vulnerabilities. To reduce the surface of attack, enable only required features, system accounts, and services. Disable or remove those that are not needed for the deployment.

The features needed to run and manage Java Agent software securely include the following:

- A Java runtime environment, required to run Java Agent software.
- Software to secure access to service management tools; in particular, when administrators access the system remotely.
- Software to secure access for remote transfer of software updates, backup files, and log files.
- Software to manage system-level authentication, authorization, and accounts.
- Firewall software, intrusion-detection/intrusion-prevention software.
- Software to allow auditing access to the system.
- System update software to allow updates that you have validated previously.

- If required for the deployment, system access management software such as SELinux.
- Any other software that is clearly indispensable to the deployment.

Consider the minimal installation options for your operating system, and the options to turn off features.

Consider configuration options for system hardening to further limit access even to required services.

For each account used to run a necessary service, limit the access granted to the account to what is required. This reduces the risk that a vulnerability in access to one account affects multiple services across the system.

Make sure that you validate the operating system behavior every time you deploy new or changed software. When preparing the deployment and when testing changes, maintain a full operating system with Java Agent software that is not used for any publicly available services, but only for troubleshooting problems that might stem from the system being *too* minimally configured.

## Network connections

Protect network traffic by using HTTPS where possible.

### *Recommendations For Incoming Connections (From Clients to Java Agent)*

Protocol	Recommendations
HTTP	<p>HTTP connections that are not protected by TLS use cleartext messages. When you permit insecure connections, you cannot prevent client applications from sending sensitive data. For example, a client could send unprotected credentials in an HTTP Authorization header. Even if the server were to reject the request, the credentials would already be leaked to any eavesdroppers.</p> <p>Always use HTTPS for connections up to a load-balancer or proxy in front of the web application or server.</p>

Protocol	Recommendations
HTTPS	<p>Use HTTPS for secure connections. Follow industry-standard TLS recommendations for <a href="#">Security/Server Side TLS</a>.</p> <p>When using an HTTP connection handler, use HTTPS to protect client connections.</p> <p>Some client applications require a higher level of trust, such as clients with additional privileges or access. Client application deployers might find it easier to manage public keys as credentials than to manage username/password credentials. Client applications can use TLS client authentication.</p>

### *Recommendations For Outgoing Connections (From Java Agent to Another Service)*

Client	Recommendations
Common Audit event handlers	Configure Common Audit event handlers to use HTTPS when connecting to external log services.
AM	Connect to AM over HTTPS, and use Web Socket Secure (WSS) for notifications. When AM listens on HTTPS, by default the agent uses WSS. Otherwise, by default, the agent uses Web Sockets (WS).
Custom login pages	Connect to custom login pages over HTTPS.

## Message-level security

Server protocols such as HTTP, LDAP, and JMX rely on TLS to protect connections. To enforce secure communication, refer to [Secure communication between the agent and AM](#).

Communication between the agent and clients is managed by the web application container in which the agent runs. See the web application container documentation for information about how to secure those connections.

## Access

The following sections describe how to restrict non-essential access to your deployment, and reduce the amount of non-essential information that it provides.

### Remove non-essential features

The more features you have turned on, the more features you need to secure, patch, and audit. If something is not being used, uninstall it, disable it, or protect access to it.

## Remove non-essential access

Make sure that only authorized people can access your servers and applications through the appropriate network, using the appropriate ports, and presenting strong-enough credentials.

Make sure that users connect to systems through the latest versions of TLS, and audit system access periodically.

Protect read-access to endpoints that monitor Common REST, Prometheus, CSV file-based metrics. For Common REST and Prometheus endpoints:

- Name exposed base endpoints to prevent them from being easily associated with an application.
- Set up strict not-enforced rules, to minimize unauthenticated access.

For information, refer to [Manage endpoints for Common REST and Prometheus metrics](#).

## Update patches

Prevent the exploitation of security vulnerabilities by using up-to-date versions of the agent and third-party software.

Review and follow the Ping Identity security advisories. Follow similar lists from all of your vendors.

## Manage Java Agent sessions

On startup, Java Agent uses the following properties to obtain a session from AM:

- [Agent Profile Name](#)
- [Encrypted Agent Password](#)
- [Agent Profile Realm](#)

The session lifetime is defined by the AM version and configuration, and is essentially indefinite. Consider the following points when you configure the agent session lifetime in AM:

- If the lifetime is too short, the agent has to re-authenticate with AM too frequently, using network bandwidth and delaying user requests.
- If the lifetime is too long, the CTS can be cluttered with zombie sessions that are no longer in use.

- A value between 60 minutes and 1440 minutes (24 hours) is suitable for many use cases.

To set the agent session lifetime in AM, add the property `com.ipplanet.am.session.agentSessionIdleTime` to the JVM properties in the container where the agent runs, and restart the container. The following example sets the agent session lifetime to 1440 minutes (24 hours):

```
JAVA_OPTS="$JAVA_OPTS -  
Dcom.ipplanet.am.session.agentSessionIdleTime=1440"
```

## Expire Advanced Identity Cloud and AM sessions

To minimize the time an attacker can attack an active session, set expiration timeouts for every Advanced Identity Cloud and AM session. Set timeouts according to the context of the deployment, balancing security and usability, so that the user can complete operations without the session frequently expiring.

For more information, refer to OWASP's [Session Management Cheat Sheet](#).

### *Set a maximum session lifetime and idle time in Advanced Identity Cloud:*

- In the Advanced Identity Cloud admin UI, select  **Native Consoles > Access Management**.
- In the AM admin UI, select **Services > Add a Service** and add a **Session** service.
- Specify the following properties in minutes:
  - **Maximum Session Time**
  - **Maximum Idle Time**

### *Set a maximum session lifetime and idle time in AM:*

- In the AM admin UI, select **Services > Add a Service** and add a **Session** service.
- Specify the following properties in minutes:
  - **Maximum Session Time**
  - **Maximum Idle Time**

## Manage cookies

Increase the security of cookies generated by Java Agent or the protected application in the following ways:

- To prevent cookies from being easily associated with an application, change the default name of key cookies. For example, change pre-authentication cookies in Pre-Authentication Cookie Name, and JWT cookies in JWT Cookie Name.

- To transmit securely all cookies written by the agent, set [Transmit Cookies Securely](#).
- To reduce the risk of cross-site request forgery (CSRF) attacks, set the SameSite attribute of cookies in [Set-Cookie Internal Map](#) or [Set-Cookie Attribute Map](#).
- To ensure that cookies cannot be accessed through client-side scripts, and to mitigate any XSS attacks, set [Enable HTTP Only Cookies](#) to create cookies with the `httpOnly` flag.
- To make cookies accessible only from HTTPS sites, prefix the cookie name with `__Secure-`. A forged insecure site cannot overwrite a secure cookie.
- To make cookies accessible only on the same host where they are set, prefix the cookie name with `__Host-`. A subdomain cannot overwrite the cookie value.
- To protect the CDSSO session cookie from hijacking, configure AM as described in [Enabling restricted tokens for CDSSO session cookies](#) in *AM's Security guide*.

## Keys and secrets

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Java Agent uses cryptographic keys for encryption, signing, and securing network connections, and passwords. The following sections discuss how to secure keys and secrets in your deployment.

### Use strong keys

Small keys are easily compromised. Use at least the [recommended key size](#) <sup>↗</sup>.

In JVM, the default ephemeral Diffie-Hellman (DH) key size is 1024 bits. To support stronger ephemeral DH keys, and protect against weak keys, installations in Tomcat 8.5.37 and later versions use the Tomcat default DH key size of 2048-bit.

Increase the DH key size to protect against weak keys. For more information, refer to [Customizing Size of Ephemeral Diffie-Hellman Keys](#) <sup>↗</sup>

### Create and rotate keys

Rotate keys regularly to:

- Limit the amount of data protected by a single key.
- Reduce dependence on specific keys, making it easier to migrate to stronger algorithms.
- Prepare for when a key is compromised. The first time you try key rotation shouldn't be during a real-time recovery.
- Conform to internal business compliance requirements.

## Rotate the agent profile password

During installation, the agent requests the path to a file containing the agent profile password. The agent then uses the following properties to encrypt and store the password:

- `am.encrypted.pwd` in the `AgentKey.properties` file
- `Encrypted Agent Password` in the `AgentPassword.properties` file

If the path is empty, the installation terminates with a configuration error.

The following steps describe how to rotate the agent profile password:

1. Change the profile password for your agent instance. For example, in the AM admin UI, change the password as follows:
  - a. Select **Realms** > *Realm Name* > **Applications** > **Agents** > **Java**.
  - b. Select your agent.
  - c. In the **Global** tab, enter a new password in the **Password** field.
2. Generate an encryption key for the agent profile password, using the `agentadmin --getEncryptKey` command:

```
$ agentadmin --getEncryptKey
```

3. In `AgentKey.properties`, set the value of `am.encrypted.pwd` to the new value.
4. Encrypt the agent profile password, using the `agentadmin --encrypt` command:

```
$ agentadmin --encrypt agent-instance password-file
```

The agent encrypts the password by using the value of `Encryption Key/Salt` from `AgentKey.properties`.

5. In `AgentKey.properties`, set the value of `Encrypted Agent Password` to the new value.
6. Restart the agent instance.

## Create a cookie signing key

During installation, the agent requests the path to a file containing the cookie signing key, and then uses the key to configure the property `org.forgerock.agents.cookie.signing.value` in `AgentKey.properties`. If the path is empty, cookie signing is disabled.

The key must be at least 64 characters long. If it is shorter, the agent rejects it and leaves cookies unsigned. For security, use a key of at least 80 characters.

1. Generate an 80-character key, using the `agentadmin --key` command:



The screenshot shows a terminal window with two tabs: 'Unix' and 'Windows'. The 'Unix' tab is active. The terminal displays the command `$ agentadmin --key 80` and the output `ZRY...xX0`.

### *Rotate cookie signing keys*

1. Create a cookie signing key.
2. In `AgentKey.properties`, set the value of `org.forgerock.agents.cookie.signing.value` to the key value.
3. Restart the agent instance.

## Audits and logs

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### Audit trails

For security, troubleshooting, and regulatory compliance, agents are able to audit information for allowed and/or denied requests.

The agent audit logging service adheres to the log structure common across the Ping Identity Platform. For information, refer to [Audit the deployment](#).

Java Agent supports propagation of the transaction ID across the Ping Identity Platform, using the HTTP header `X-ForgeRock-TransactionId`. Consider configuring this header to prevent malicious actors from flooding the system with requests using the same transaction ID header to hide their tracks. For information, refer to [Trust transaction headers](#) in AM's *Security guide*.

### Log files

Agent logs can contain informational, error, and warning events, to troubleshoot and debug transactions and events that take place within the agent instance.

Protect logs from unauthorised access, and make sure they contain a minimum of sensitive or personally identifiable information that could be used in attacks.

Use the lowest level of logging necessary. For example, consider logging at the `ERROR` or `WARNING` level, instead of `TRACE` or `MESSAGE` . For more information, refer to [logging configuration properties](#).

Was this helpful?  

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