Install the ExtraHop session key forwarder on a Linux server

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Perfect Forward Secrecy (PFS) is a property of secure communication protocols that enables short-term, completely private session key exchanges between clients and servers. ExtraHop offers session key forwarding software that can send session keys to the ExtraHop system for SSL/TLS decryption. There is no limit to the number of session keys that the ExtraHop system can receive.

You must configure the ExtraHop system for session key forwarding and then install the forwarder software on the Windows and Linux servers that have the SSL/TLS traffic that you want to decrypt.

Before you begin

- Read about SSL/TLS decryption and review the list of supported cipher suites.
- Make sure that the ExtraHop system is licensed for SSL Decryption and SSL Shared Secrets.
- Make sure that your server environment is supported by the ExtraHop session key forwarder software:
  - Microsoft Secure Channel (Schannel) security package
  - Java SSL/TLS (Java versions 8 through 13). Do not upgrade to this version of the session key forwarder if you are currently monitoring Java 6 or Java 7 environments. Version 7.9 of the session key forwarder supports Java 6 and Java 7, and is compatible with the latest ExtraHop firmware.
  - Dynamically linked OpenSSL (1.0.x and 1.1.x) libraries. OpenSSL is only supported on Linux systems with kernel versions 4.4 and later and RHEL 7.6 and later.

  Important: The ExtraHop system cannot decrypt TLS-encrypted TDS traffic through session key forwarding. Instead, you can upload an RSA private key.
- Install the session key forwarder on RHEL, CentOS, Fedora, or Debian-Ubuntu Linux distributions. The session key forwarder might not function correctly on other distributions.
- The session key forwarder has not been extensively tested with SELinux and might not be compatible when enabled on some Linux distributions.

Enable the SSL session key receiver service

You must enable the session key receiver service on the ExtraHop system before the system can receive and decrypt session keys from the session key forwarder. By default, this service is disabled.

1. Log in to the Administration settings on the ExtraHop system through `https://<extrahop-hostname-or-IP-address>/admin`.
2. In the Appliance Settings section, click **Services**.
3. Select the **SSL Session Key Receiver** checkbox.
4. Click **Save**.

Add a global port to protocol mapping

Add each protocol for the traffic that you want to decrypt with your session key forwarders.

1. Log in to the Administration settings on the ExtraHop system through `https://<extrahop-hostname-or-IP-address>/admin`.
2. In the System Configuration section, click **Capture**.
3. Click **SSL Decryption**.
4. In the Private Key Decryption section, clear the Require Private Keys checkbox.

5. In the Global Protocol to Port Mapping section, click **Add Global Protocol**.
6. From the Protocol drop-down list, select the protocol for the traffic that you want to decrypt.
7. In the Port field, type the number of the port. Type `0` to add all ports.
8. Click **Add**.

Install the software

RPM-based distributions

Tip: You can install the forwarder without user interaction by specifying environment variables in the installation command.

1. Log in to your RPM-based Linux server.
2. Download the latest version of the ExtraHop session key forwarder software.
3. Open a terminal application and run the following command:

```
sudo rpm --install <path to installer file>
```

4. Open the initialization script in a text editor (vi or vim, for example).

```
sudo vi /opt/extrahop/etc/extrahop-key-forwarder.conf
```

5. Depending on how your sensors are managed, choose one of the following options:
   - For self-managed sensors, remove the hash symbol (#) before the EDA_HOSTNAME field and type the fully qualified domain name of your sensor, similar to the following example.

     ```
     EDA_HOSTNAME=discover.example.com
     ```

   - For ExtraHop-manged sensors, remove the hash symbol (#) before the `EDA_HOSTED_PLATFORM` field and type `aws`, similar to the following example.

     ```
     EDA_HOSTED_PLATFORM=aws
     ```

6. Optional: The key forwarder receives session keys locally from the Java environment through a TCP listener on localhost (127.0.0.1) and the port specified in the `LOCAL_LISTENER_PORT` field. We recommended that this port remain set to the default of 598. If you change the port number, you must modify the `-javaagent` argument to account for the new port.
7. Optional: If you prefer that syslog writes to a different facility than `local3` for key forwarder log messages, you can edit the `SYSLOG` field.
   For a self-managed sensor, the contents of the `extrahop-key-forwarder.conf` file should appear similar to the following example:

```
#EDA_HOSTED_PLATFORM=aws
EDA_HOSTNAME=sensor.example.com
LOCAL_LISTENER_PORT=598
SYSLOG=local3
ADDITIONAL_ARGS=''
```

8. Save the file and exit the text editor.
9. Start the `extrahop-key-forwarder` service:

```
sudo service extrahop-key-forwarder start
```

Debian-Ubuntu distributions

Tip: You can install the forwarder without user interaction by specifying environment variables in the installation command.

1. Log in to your Debian or Ubuntu Linux server.
2. Download the latest version of the ExtraHop session key forwarder software.
3. Open a terminal application and run the following command.

```
sudo dpkg --install <path to installer file>
```

4. Depending on how your sensors are managed, choose one of the following options:
   - 1. For self-managed sensors, select **direct** and then press ENTER.
     2. Type the fully qualified domain name or IP address of the ExtraHop system where session keys will be forwarded and then press ENTER.
   - For ExtraHop managed sensors, select **hosted** and then press ENTER.

   Tip: You can configure optional parameters LOCAL_LISTENER_PORT, SYSLOG, and ADDITIONAL_ARGS by editing the `/opt/extrahop/etc/extrahop-key-forwarder.conf` file.
5. Ensure that the `extrahop-key-forwarder` service started:

```
sudo service extrahop-key-forwarder status
```

The following output should appear:

```
extrahop-key-forwarder.service - LSB: ExtraHop Session Key Forwarder
Loaded: loaded (/etc/rc.d/init.d/extrahop-key-forwarder; bad; vendor
 preset: disabled)
Active: active (running) since Tue 2018-04-10 10:55:47 PDT; 5s ago
```

If the service is not active, run the following command:

```
sudo service extrahop-key-forwarder start
```

Integrate the forwarder with the Java-based SSL application

The ExtraHop session key forwarder integrates with Java applications through the `-javaagent` option. Consult your application's specific instructions for modifying the Java runtime environment to include the `-javaagent` option.

As an example, many Tomcat environments support customization of Java options in the `/etc/default/tomcat7` file. In the following example, adding the `-javaagent` option to the JAVA_OPTS line causes the Java runtime to share SSL session secrets with the key forwarder process, which then relays the secrets to the ExtraHop system so that the secrets can be decrypted.

```
JAVA_OPTS="... -javaagent:/opt/extrahop/lib/exagent.jar
```

Validate and troubleshoot your installation

If your Linux server has network access to the ExtraHop system and the server SSL configuration trusts the certificate presented by the ExtraHop system that you specified when you installed the session key forwarder, then the configuration is complete.

In cases where you might have problems with the configuration, the session key forwarder binary includes a test mode you can access from the command-line to test your configuration.

1. Log in to your Linux server.
2. To validate your installation, perform an initial test by running the following command:

   ```
   /opt/extrahop/sbin/extrahop-agent -t=true -server <eda hostname>
   ```

   The following output should appear:

   ```
   <timestamp> Performing connectivity test
   <timestamp> No connectivity issues detected
   ```

   If there is a configuration issue, troubleshooting tips appear in the output to help you correct the issue. Follow the suggestions to resolve the issue and then run the test again.
3. You can optionally test the certificate path and server name override by adding the following options to the command above.
   - Specify this option to test the certificate without adding it to the certificate store.

     ```
     -cert <file path to certificate>
     ```
   - Specify this option to test the connection if there is a mismatch between the ExtraHop system hostname that the forwarder knows (SERVER) and the common name (CN) that is presented in the SSL certificate of the ExtraHop system.

     ```
     -server-name-override <common name>
     ```

(Optional) Configure a server name override

If there is a mismatch between the ExtraHop system hostname that the forwarder knows (SERVER) and the common name (CN) that is presented in the SSL certificate of the ExtraHop system, then the forwarder must be configured with the correct CN.

We recommend that you regenerate the SSL self-signed certificate based on the hostname from the SSL Certificate section of the Administration settings instead of specifying this parameter.

1. Log in to your Linux server.
2. Open the configuration file in a text editor.

   ```
   vi /opt/extrahop/etc/extrahop-key-forwarder.conf
   ```
3. Add a `SERVER_NAME_OVERRIDE` parameter with a value of the name found in the ExtraHop system SSL certificate, similar to the following example:

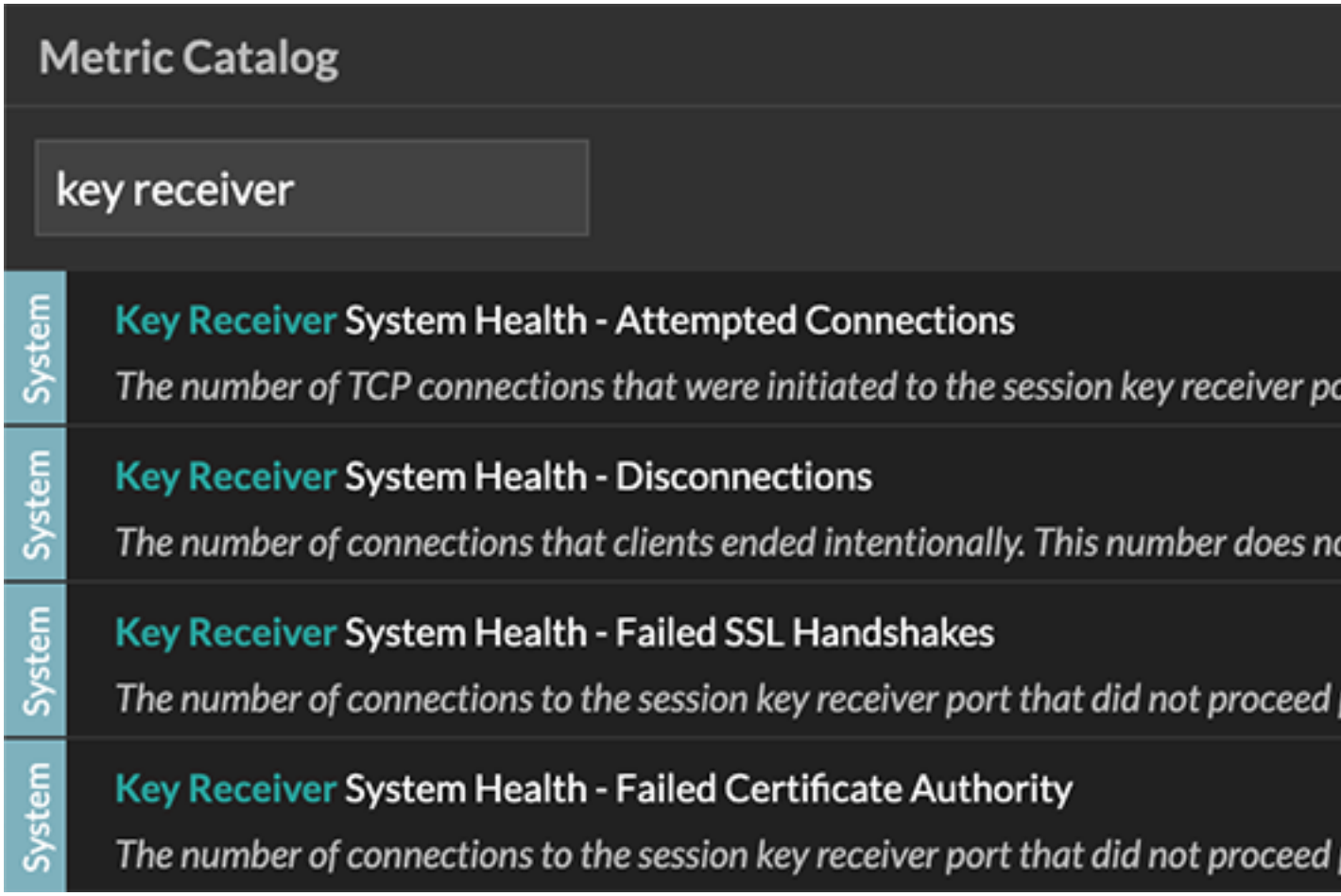
   ```
   SERVER_NAME_OVERRIDE=altname.example.com
   ```
4. Save the file and exit the text editor.
5. Start the `extrahop-key-forwarder` service.

   ```
   sudo service extrahop-key-forwarder start
   ```

Key receiver system health metrics

The ExtraHop system provides key receiver metrics that you can add to a dashboard chart to monitor key receiver health and functionality.

To view a list of available metrics, click the System Settings icon and then click **Metric Catalog**. Type `key receiver` in the filter field to display all available key receiver metrics.



Tip: To learn how to create a new dashboard chart, see Edit a chart with the Metric Explorer.

View connected session key forwarders

You can view recently connected session key forwarders after you install the session key forwarder on your server and enable the SSL session key receiver service on the ExtraHop system. Note that this page only displays session key forwarders that have connected over the last few minutes, not all session key forwarders that are currently connected.

1. Log in to the Administration settings on the ExtraHop system through `https://<extrahop-hostname-or-IP-address>/admin`.
2. In the System Configuration section, click **Capture**.
3. Click **SSL Shared Secrets**.

Uninstall the software

If you no longer want the ExtraHop session key forwarder software installed, complete the following steps.

1. Log in to the Linux server.
2. Open a terminal application and choose one of the following options to remove the software.
   - For RPM-based servers, run the following command:

     ```
     sudo rpm --erase extrahop-key-forwarder
     ```

- For Debian and Ubuntu servers, run the following command:

  ```
  sudo apt-get --purge remove extrahop-key-forwarder
  ```

  Type Y at the prompt to confirm the software removal and then press ENTER.

3. Click **Yes** to confirm.
4. After the software is removed, click **Yes** to restart the system

Common error messages

Errors created by the session key forwarder are logged to the Linux system log file.

Message	Cause	Solution
`connect: dial tcp <IP address>:4873: connectex: A connection attempt failed because the connected party did not properly respond after a period of time, or established connection failed because connected host has failed to respond`	The monitored server cannot route any traffic to the Discover appliance.	Ensure firewall rules allow connections to be initiated by the monitored server to TCP port 4873 on the Discover appliance.
`connect: dial tcp <IP address>:4873: connectex: No connection could be made because the target machine actively refused it`	The monitored server can route traffic to the Discover appliance, but the receiving process is not listening.	Ensure that the Discover appliance is licensed for both the SSL Decryption and SSL Shared Secrets features.
`connect: x509: certificate signed by unknown authority`	The monitored server is not able to chain up the Discover appliance certificate to a trusted Certificate Authority (CA).	Ensure that the Linux certificate store for the computer account has trusted root certificate authorities that establish a chain of trust for the Discover appliance.
`connect: x509: cannot validate certificate for <IP address> because it doesn't contain any IP SANs`	An IP address was supplied as the SERVER parameter when installing the forwarder, but the SSL certificate presented by the Discover appliance does not include an IP address as a Subject Alternate Name (SAN).	Select from the following three solutions. • Replace the IP address for the SERVER value in the `/etc/init.d/extrahop-key-forwarder` file with a hostname. The hostname must match the subject name in the Discover appliance certificate. • If the server is required to connect to the Discover appliance by IP address, uninstall and reinstall the forwarder, specifying the

Message	Cause	Solution
		subject name from the Discover appliance certificate as the value of `server-name-override`.
		• Re-issue the Discover appliance certificate to include an IP Subject Alternative Name (SAN) for the given IP address.

Supported SSL/TLS cipher suites

The ExtraHop system can decrypt SSL/TLS traffic that has been encrypted with PFS or RSA cipher suites. All supported cipher suites can be decrypted by installing the session key forwarder on a server and configuring the ExtraHop system.

Cipher suites for RSA can also decrypt the traffic with a certificate and private key—with or without session key forwarding.

Decryption methods

The table below provides a list of cipher suites that the ExtraHop system can decrypt along with the supported decryption options.

- **PFS + GPP**: the ExtraHop system can decrypt these cipher suites with session key forwarding and global protocol to port mapping
- **PFS + Cert**: the ExtraHop system can decrypt these cipher suites with the session key forwarding and the certificate and private key
- **RSA + Cert**: the ExtraHop system can decrypt these cipher suites without session key forwarding as long as you have uploaded the certificate and private key.

Hex Value	Name (IANA)	Name (OpenSSL)	Supported Decryption
0x04	TLS_RSA_WITH_RC4_128_MD5	RC4-MD5	PFS + GPP PFS + Cert RSA + Cert
0x05	TLS_RSA_WITH_RC4_128_SHA	RC4-SHA	PFS + GPP PFS + Cert RSA + Cert
0x0A	TLS_RSA_WITH_3DES_EDE_CBC_SHA	DES-CBC3-SHA	PFS + GPP PFS + Cert RSA + Cert
0x16	TLS_DHE_RSA_WITH_3DES_EDE_CBC_SHA	EDH-RSA-DES-CBC3-SHA	PFS + GPP PFS + Cert
0x2F	TLS_RSA_WITH_AES_128_CBC_SHA	AES128-SHA	PFS + GPP PFS + Cert RSA + Cert
0x33	TLS_DHE_RSA_WITH_AES_128_CBC_SHA	DHE-RSA-AES128-SHA	PFS + GPP PFS + Cert
0x35	TLS_RSA_WITH_AES_256_CBC_SHA	AES256-SHA	PFS + GPP PFS + Cert RSA + Cert

Hex Value	Name (IANA)	Name (OpenSSL)	Supported Decryption
0x39	TLS_DHE_RSA_WITH_AES_256_CBC_SHA	DHE-RSA-AES256-SHA	PFS + GPP PFS + Cert
0x3C	TLS_RSA_WITH_AES_128_CBC_SHA256	AES128-SHA256	PFS + GPP PFS + Cert RSA + Cert
0x3D	TLS_RSA_WITH_AES_256_CBC_SHA256	AES256-SHA256	PFS + GPP PFS + Cert RSA + Cert
0x67	TLS_DHE_RSA_WITH_AES_128_CBC_SHA256	DHE-RSA-AES128-SHA256	PFS + GPP PFS + Cert
0x6B	TLS_DHE_RSA_WITH_AES_256_CBC_SHA256	DHE-RSA-AES256-SHA256	PFS + GPP PFS + Cert
0x9C	TLS_RSA_WITH_AES_128_GCM_SHA256	AES128-GCM-SHA256	PFS + GPP PFS + Cert RSA + Cert
0x9D	TLS_RSA_WITH_AES_256_GCM_SHA384	AES256-GCM-SHA384	PFS + GPP PFS + Cert RSA + Cert
0x9E	TLS_DHE_RSA_WITH_AES_128_GCM_SHA256	DHE-RSA-AES128-GCM-SHA256	PFS + GPP PFS + Cert
0x9F	TLS_DHE_RSA_WITH_AES_256_GCM_SHA384	DHE-RSA-AES256-GCM-SHA384	PFS + GPP PFS + Cert
0x1301	TLS_AES_128_GCM_SHA256	TLS_AES_128_GCM_SHA256	PFS + GPP PFS + Cert
0x1302	TLS_AES_256_GCM_SHA384	TLS_AES_256_GCM_SHA384	PFS + GPP PFS + Cert
0x1303	TLS_CHACHA20_POLY1305_SHA256	TLS_CHACHA20_POLY1305_SHA256	PFS + GPP PFS + Cert
0xC007	TLS_ECDHE_ECDSA_WITH_RC4_128_SHA	ECDHE-ECDSA-RC4-SHA	PFS + GPP
0xC008	TLS_ECDHE_ECDSA_WITH_3DES_EDE_CBC_SHA	ECDHE-ECDSA-DES-CBC3-SHA	PFS + GPP
0xC009	TLS_ECDHE_ECDSA_WITH_AES_128_CBC_SHA	ECDHE-ECDSA-AES128-SHA	PFS + GPP
0xC00A	TLS_ECDHE_ECDSA_WITH_AES_256_CBC_SHA	ECDHE-ECDSA-AES256-SHA	PFS + GPP
0xC011	TLS_ECDHE_RSA_WITH_RC4_128_SHA	ECDHE-RSA-RC4-SHA	PFS + GPP PFS + Cert
0xC012	TLS_ECDHE_RSA_WITH_3DES_EDE_CBC_SHA	ECDHE-RSA-DES-CBC3-SHA	PFS + GPP PFS + Cert
0xC013	TLS_ECDHE_RSA_WITH_AES_128_CBC_SHA	ECDHE-RSA-AES128-SHA	PFS + GPP PFS + Cert
0xC014	TLS_ECDHE_RSA_WITH_AES_256_CBC_SHA	ECDHE-RSA-AES256-SHA	PFS + GPP PFS + Cert

Hex Value	Name (IANA)	Name (OpenSSL)	Supported Decryption
0xC023	TLS_ECDHE_ECDSA_WITH_AES_128_CBC_SHA256	ECDHE-ECDSA-AES128-SHA256	PFS + GPP
0xC024	TLS_ECDHE_ECDSA_WITH_AES_256_CBC_SHA384	ECDHE-ECDSA-AES256-SHA384	PFS + GPP
0xC027	TLS_ECDHE_RSA_WITH_AES_128_CBC_SHA256	ECDHE-RSA-AES128-SHA256	PFS + GPP PFS + Cert
0xC028	TLS_ECDHE_RSA_WITH_AES_256_CBC_SHA384	ECDHE-RSA-AES256-SHA384	PFS + GPP PFS + Cert
0xC02B	TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256	ECDHE-ECDSA-AES128-GCM-SHA256	PFS + GPP
0xC02C	TLS_ECDHE_ECDSA_WITH_AES_256_GCM_SHA384	ECDHE-ECDSA-AES256-GCM-SHA384	PFS + GPP
0xC02F	TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256	ECDHE-RSA-AES128-GCM-SHA256	PFS + GPP PFS + Cert
0xC030	TLS_ECDHE_RSA_WITH_AES_256_GCM_SHA384	ECDHE-RSA-AES256-GCM-SHA384	PFS + GPP PFS + Cert
0xCCA8	TLS_ECDHE_RSA_WITH_CHACHA20_POLY1305_SHA256	ECDHE-RSA-CHACHA20-POLY1305	PFS + GPP PFS + Cert
0xCCA9	TLS_ECDHE_ECDSA_WITH_CHACHA20_POLY1305_SHA256	ECDHE-ECDSA-CHACHA20-POLY1305	PFS + GPP
0xCCAA	TLS_DHE_RSA_WITH_CHACHA20_POLY1305_SHA256	DHE-RSA-CHACHA20-POLY1305	PFS + GPP PFS + Cert

Session key forwarder options

You can configure the session key forwarder by editing the `/opt/extrahop/etc/extrahop-key-forwarder.conf` file.

The table below lists all of the configurable options.

Important: If you add options to `extrahop-key-forwarder.conf` that do not have dedicated variables, they must be in the `ADDITIONAL_ARGS` field. For example:

```
ADDITIONAL_ARGS="-v=true -libcrypto=/some/path/libcrypto.so
-libcrypto=/some/other/path/libcrypto.so"
```

Option	Description
`-cert <path>`	Specifies the path to the server certificate. Only specify this option if the server certificate is not signed by a trusted certificate authority.
`-elevated`	Runs the key forwarder with elevated privileges.
`-hearbeat-interval`	Specifies the time interval in seconds between heartbeat messages. The default interval is 30 seconds.
`-libcrypto <path>`	Specifies the path to the OpenSSL library, `libcrypto`. This option can be specified multiple times if you have multiple installations of OpenSSL.
`-openssl-discover`	Automatically discovers `libcrypto` implementations. The default value is "true". You must type `-openssl-discover=false` to disable OpenSSL decryption.
`-pidfile <path>`	Specifies the file where this server records its process ID (PID).
`-port <value>`	Specifies the TCP port that the Discover appliance is listening on for forwarded session keys. The default port is 4873.
`-server <string>`	Specifies the fully qualified domain name of the ExtraHop Discover appliance.
`-server-name-override <value>`	Specifies the subject name from the Discover appliance certificate. Specify this option if this server can only connect to the Discover appliance by IP address.
`-syslog <facility>`	Specifies the facility sent by the key forwarder. The default facility is local3.
`-t`	Perform a connectivity test. You must type `-t=true` to run with this option.
`-tcp-listen-port <value>`	Specifies the TCP port that the key forwarder is listening on for forwarded session keys.
`-username <string>`	Specifies the user that the session key forwarder runs under after the forwarder software is installed.
`-v`	Enable verbose logging. You must type `-v=true` to run with this option.

Linux environment variables

The following environment variables enable you to install the session key forwarder without user interaction.

Variable	Description	Example
`EXTRAHOP_CONNECTION_MODE`	Specifies the connection mode to the session key receiver. Options are `direct` for self-	`sudo EXTRAHOP_CONNECTION_MODE=hosted rpm --install extrahop-key-forwarder.x86_64.rpm`

Variable	Description	Example
	managed sensors and `hosted` for ExtraHop-managed sensors.	
`EXTRAHOP_EDA_HOSTNAME`	Specifies the fully qualified domain name of the self-managed sensor.	`sudo EXTRAHOP_CONNECTION_MODE=direct EXTRAHOP_EDA_HOSTNAME=host.example.c dpkg --install extrahop-key-forwarder_amd64.deb`
`EXTRAHOP_LOCAL_LISTENER_PORT`	The key forwarder receives session keys locally from the Java environment through a TCP listener on localhost (127.0.0.1) and the port specified in the `LOCAL_LISTENER_PORT` field. We recommended that this port remain set to the default of 598. If you change the port number, you must modify the `-javaagent` argument to account for the new port.	`sudo EXTRAHOP_CONNECTION_MODE=direct EXTRAHOP_EDA_HOSTNAME=host.example.c EXTRAHOP_LOCAL_LISTENER_PORT=900 rpm --install extrahop-key-forwarder.x86_64.rpm`
`EXTRAHOP_SYSLOG`	Specifies the facility, or machine process, that created the syslog event. The default facility is `local3`, which is system daemon processes.	`sudo EXTRAHOP_CONNECTION_MODE=direct EXTRAHOP_EDA_HOSTNAME=host.example.c EXTRAHOP_SYSLOG=local1 dpkg --install extrahop-key-forwarder_amd64.deb`
`EXTRAHOP_ADDITIONAL_ARGS`	Specifies additional key forwarder options.	`sudo EXTRAHOP_CONNECTION_MODE=hosted EXTRAHOP_ADDITIONAL_ARGS="-v=true -libcrypto=/some/path/libcrypto.so libcrypto=/some/other/path/libcrypto.so" rpm --install extrahop-key-forwarder.x86_64.rpm`