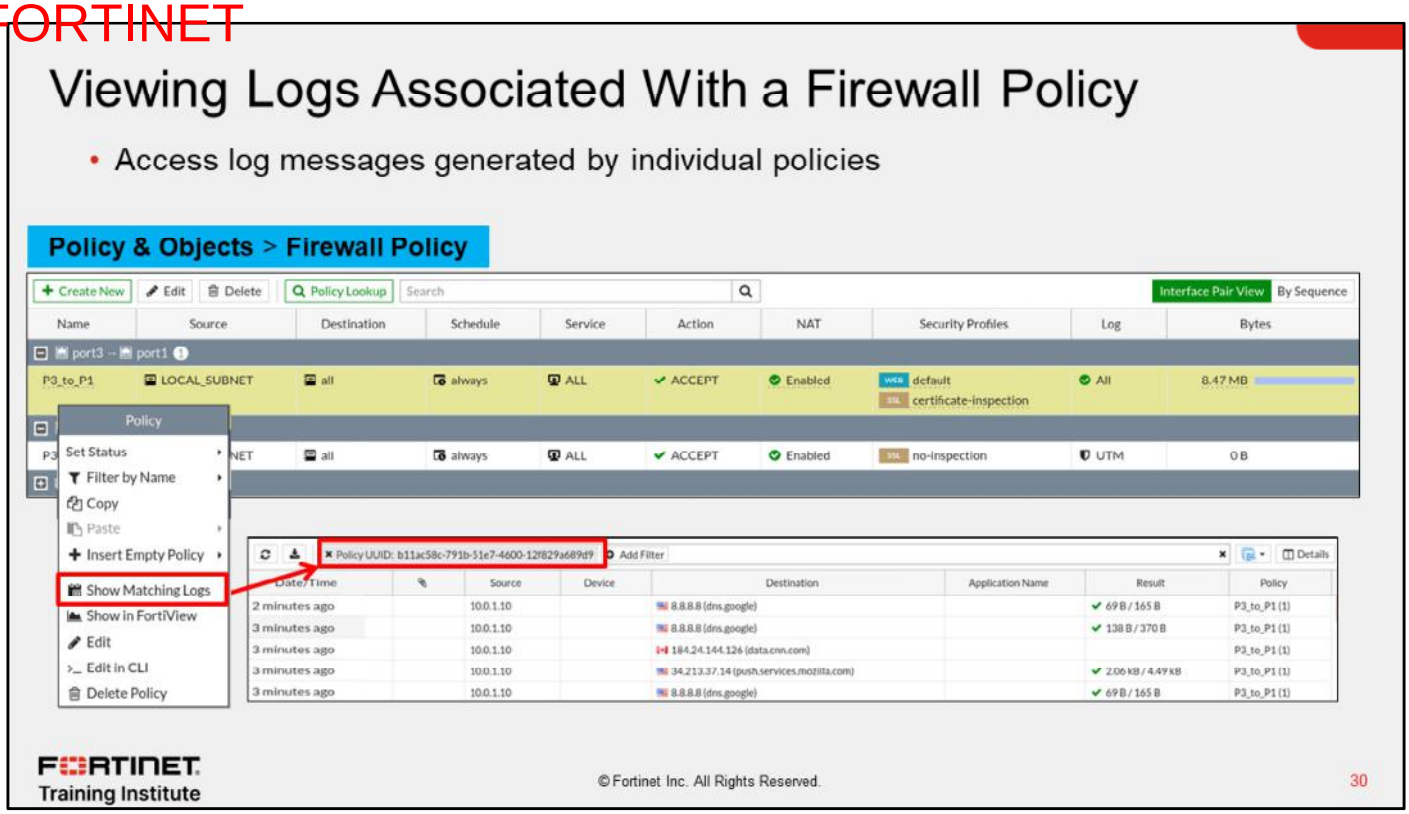
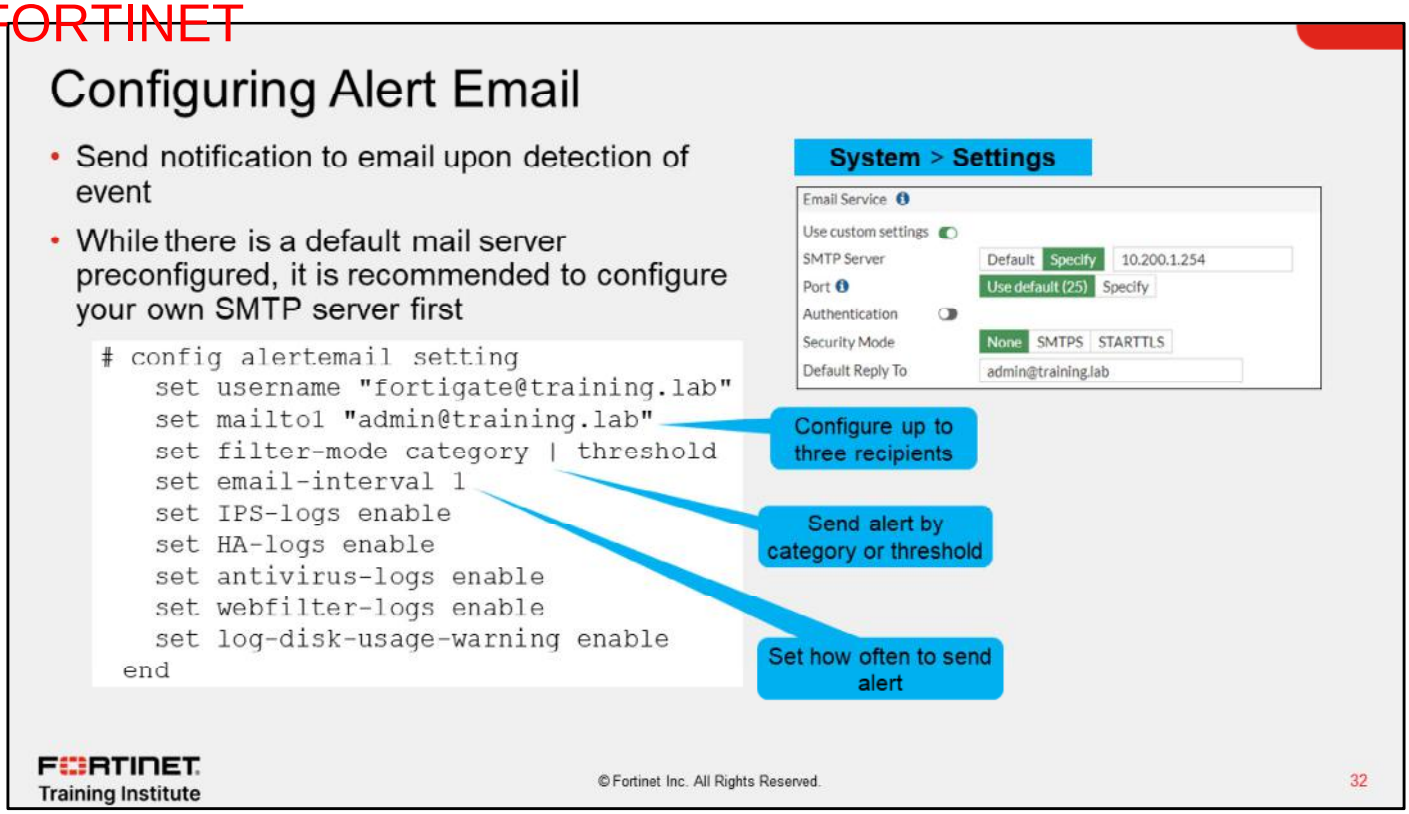


You can also access log messages generated by individual policies. Right-click the policy for which you want to view all associated logs and, in the pop-up menu, select **Show Matching Logs**. FortiGate takes you to the **Forward Traffic** page where a filter is automatically set based on the policy UUID.

You are not restricted from viewing log messages on the GUI. You can also view log messages on the CLI, using the `execute log display` command. This command allows you to see specific log messages that you already configured within the `execute log filter` command. The `execute log filter` command configures what log messages you will see, how many log messages you can view at one time (a maximum of 1000 lines of log messages), and the type of log messages you can view.

Logs appear in the raw format view. The raw format displays logs as they appear within the log file.

Similar to the GUI, if you have configured either a syslog or SIEM server, you will not be able to view log messages on the CLI.



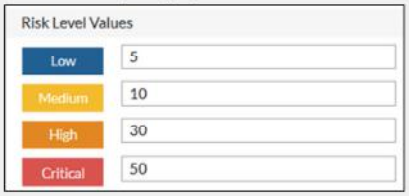
Because you can't always be physically watching the logs on the device, you can monitor events by setting up alert email. Alert emails provide an efficient and direct method of notifying an administrator of events.

Before you configure alert email, you should configure your own SMTP server on your FortiGate first. The FortiGate has an SMTP server preconfigured, but it is recommended that you use your internal email server if you have one.

You can configure alert emails using the CLI. You can trigger alert emails based on event (such as any time an intrusion is detected or the web filter blocked traffic), or on minimum log severity level (such as all logs at the Alert level or above). You can configure up to three recipients.

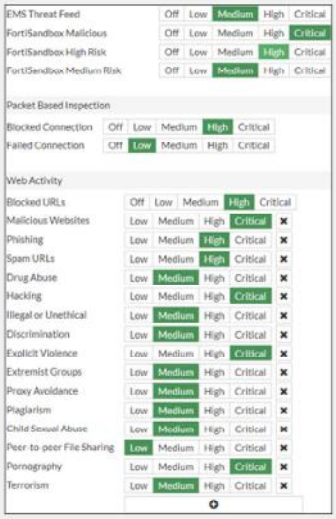
Configuring Threat Weight

- Prioritize solving the most relevant issues by configuring severity levels for IPS signatures, web categories, and applications with a threat weight
- Set risk level values for low, medium, high, and critical



- View detected threats from **Dashboard > Security**

Log & Report > Threat Weight



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In order to prioritize solving the most relevant issues easily, you can configure severity levels for IPS signatures, web categories, and applications that are associated with a threat weight (or score).

On the **Threat Weight** page, you can apply a risk value of either low, medium, high, or critical to each category-based item. Each of these levels includes a threat weight. By default, low = 5, medium = 10, high = 30, and critical = 50. You can adjust these threat weights based on your organizational requirements.

After threat weight is configured, you can view all detected threats on the **Security** page. You can also search for logs by filtering based on their threat score.

Note that threat weight is for informational purposes only. FortiGate will not take any action based on threat weight.

Knowledge Check

1. In your firewall policy, which setting must you enable to generate logs on traffic sent through that firewall policy?
   - ✓ A. Log Allowed Traffic
   - B. Event Logging

2. With email alerts, you can trigger alert emails based on _____ or log severity level.
   - ✓ A. event
   - B. threat weight

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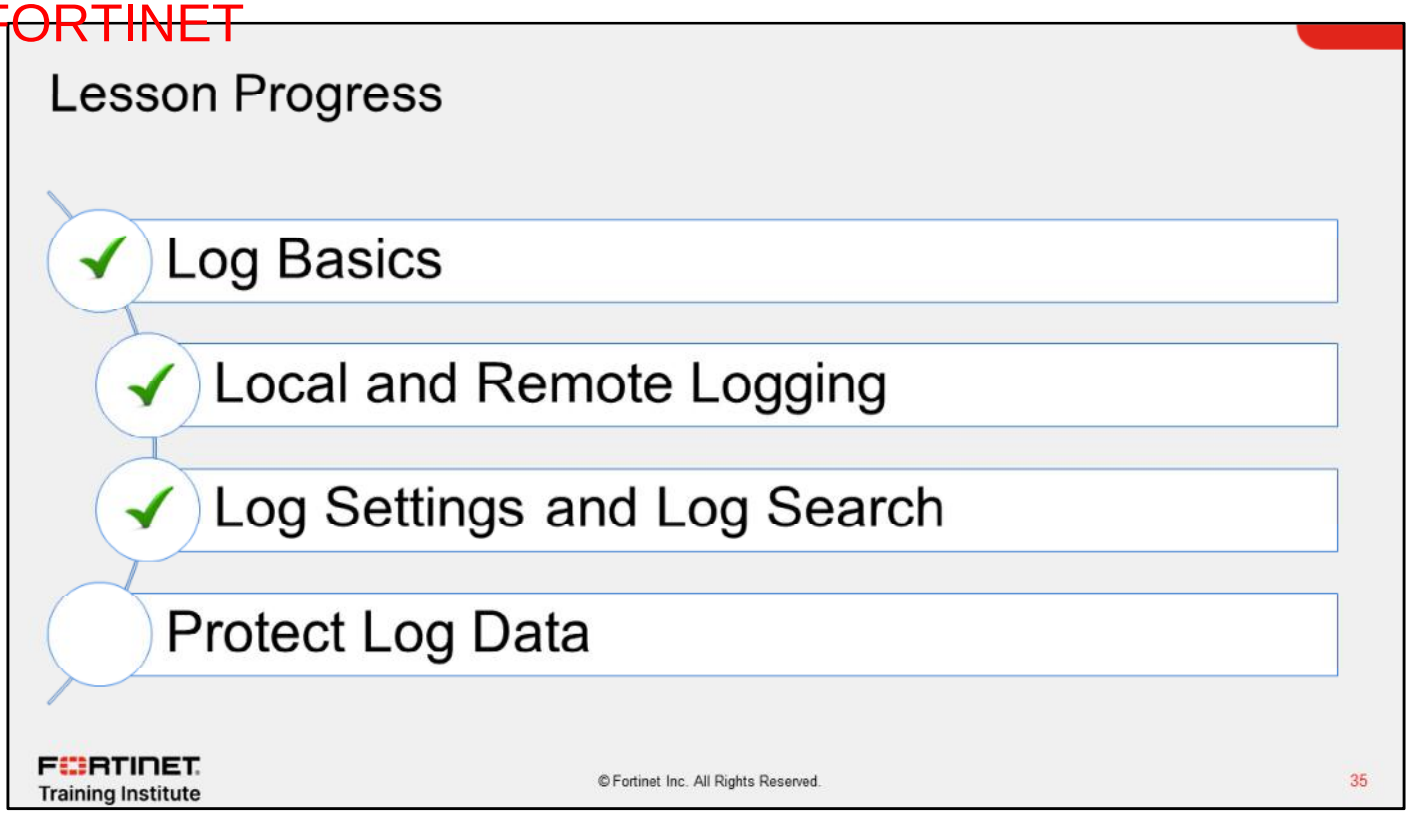
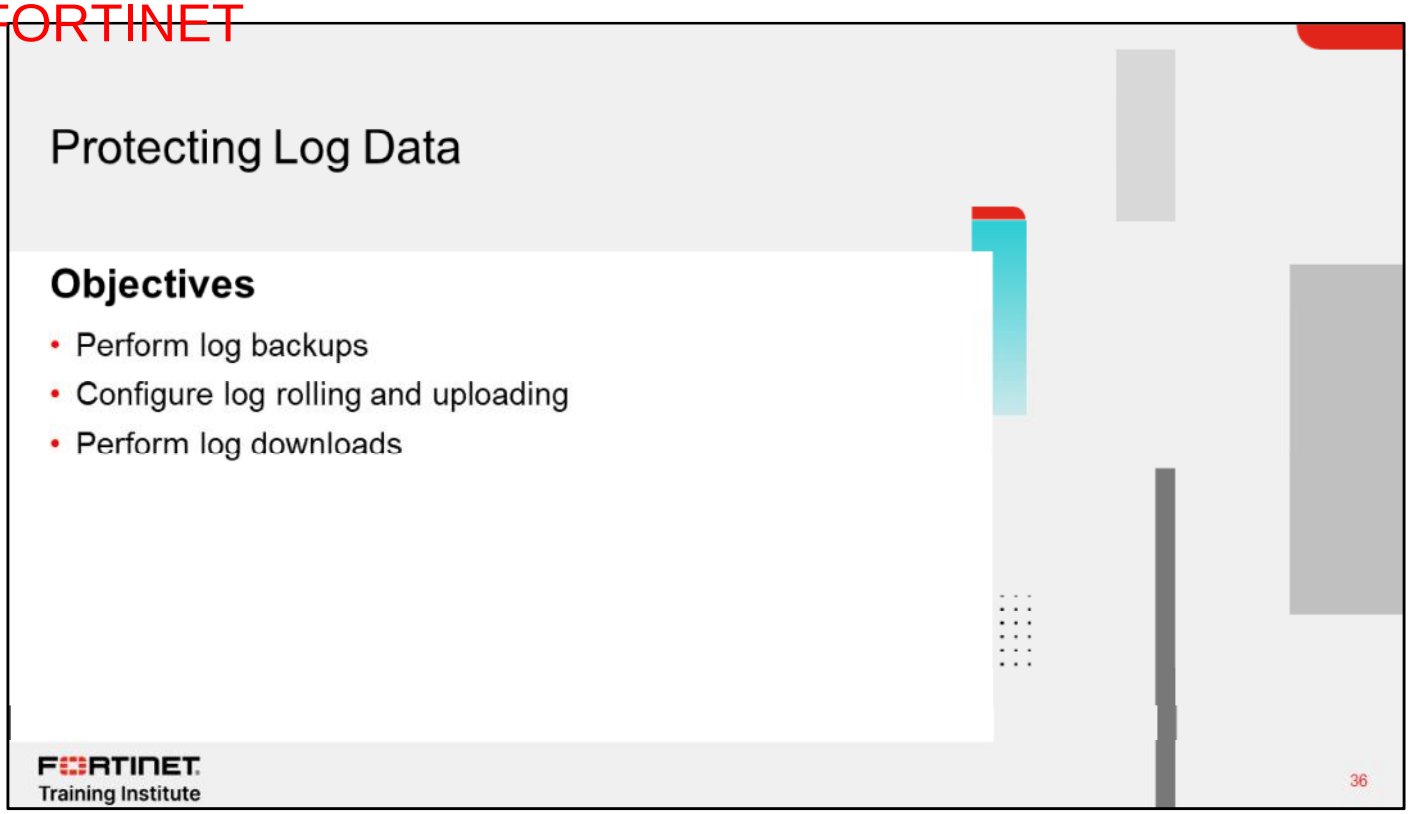


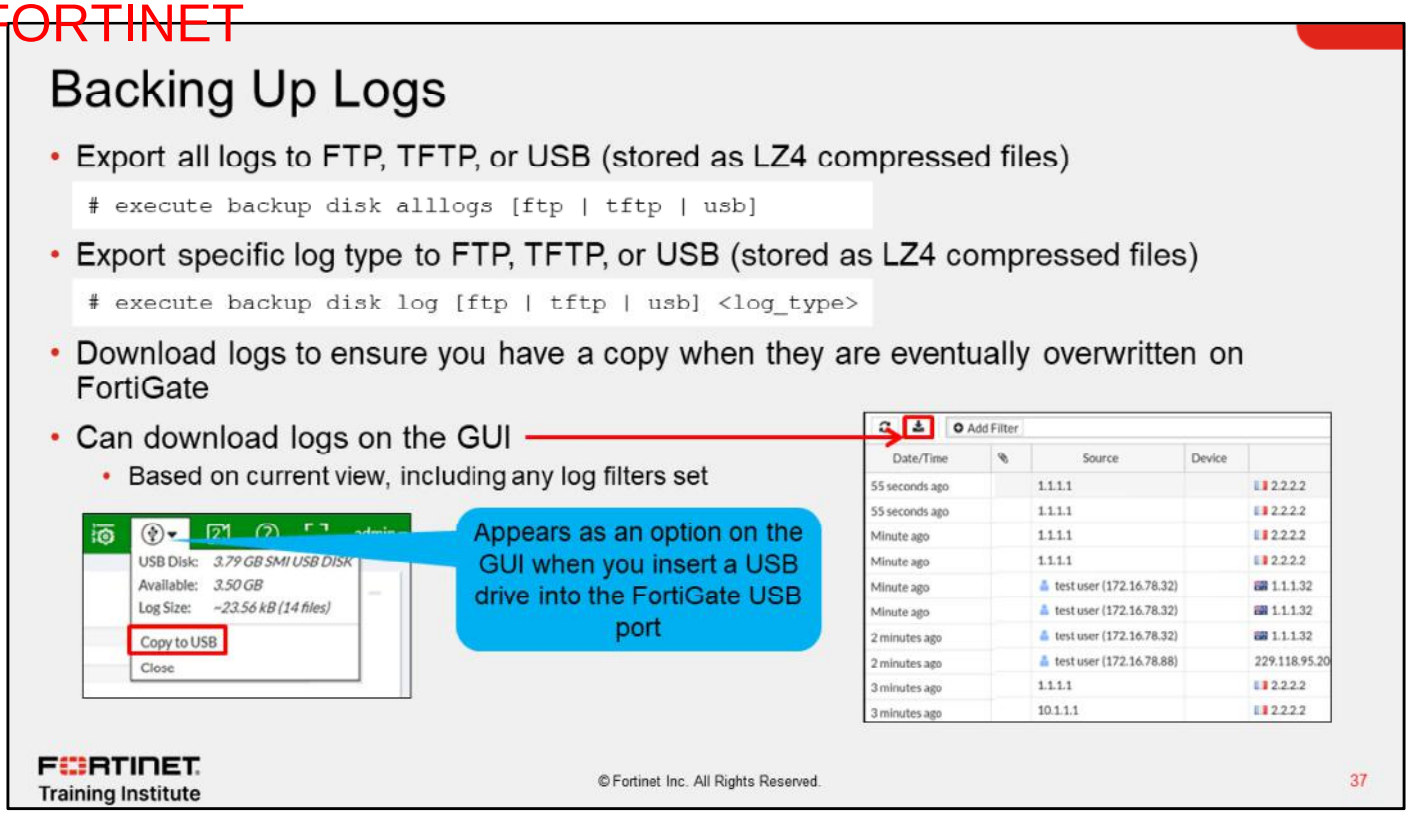
Good job! You now understand how to troubleshoot communication issues.

Now, you will learn how you can protect your log data.



After completing this section, you should be able to achieve the objectives shown on this slide.

By demonstrating competence in using various methods to protect your logs, you will be able to meet organizational or legal requirements for logs.

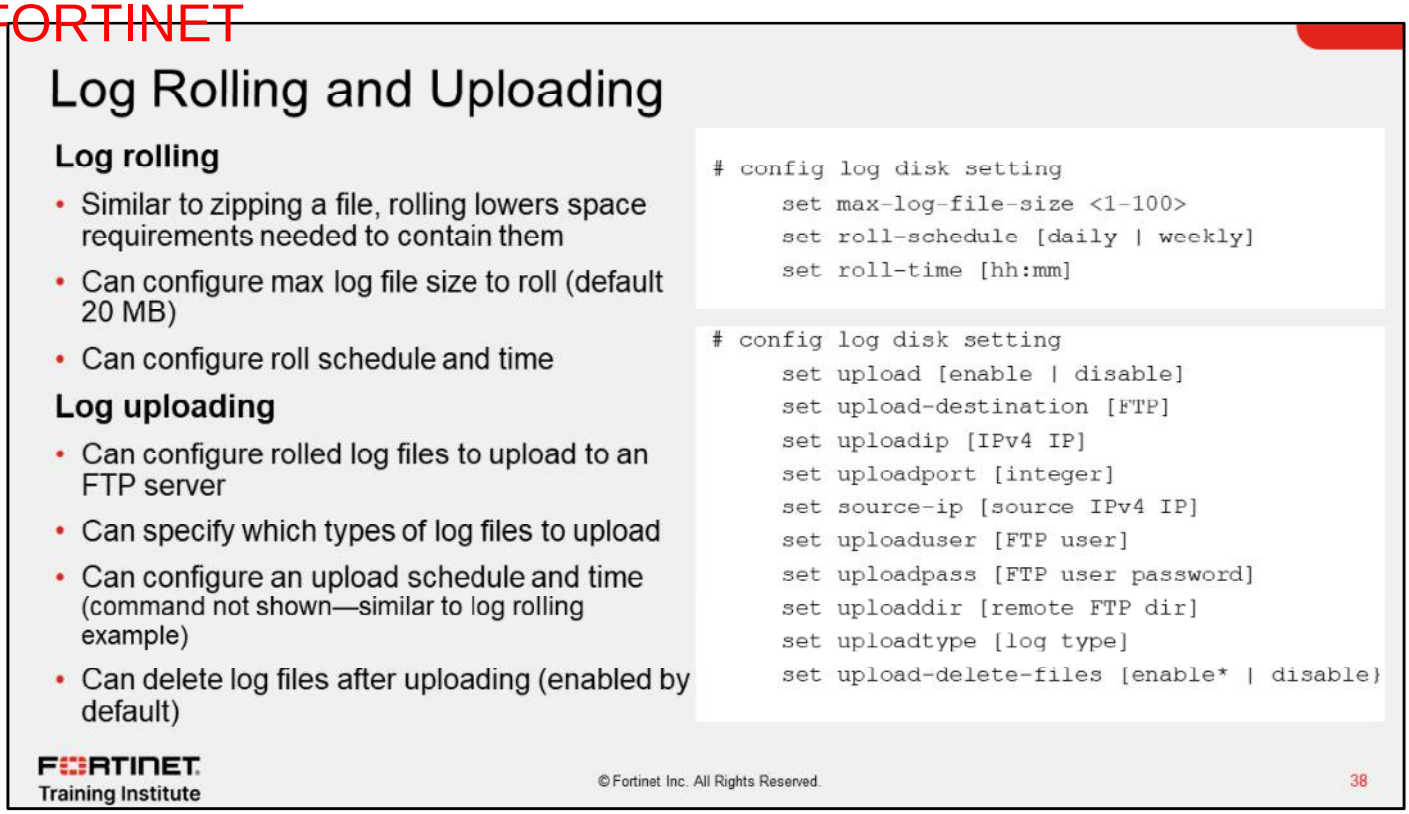


You can also protect your log data by performing log backups. A backup operation copies log files from the database to a specified location.

The `execute backup disk alllogs` command backs up all logs to FTP, TFTP, or USB, while the `execute backup disk log <log type>` command backs up specific log types (such as web filter or IPS) to FTP, TFTP, or USB. These logs are stored in LZ4 format.

You can also use the GUI to back up logs to a USB drive, or to your computer disk. This ensures that you still have a copy when the originals are eventually overwritten on FortiGate.

You can download logs by clicking the download icon on the associated log type page (for example, **Forward Traffic** or **Web Filter**). This downloads only the logs in the results table—not all logs on disk. As such, you can add log filters if you want to download only a subset of logs. When you download log messages from the GUI, you are downloading log messages in raw format.



Using the `config log disk setting` command, you can configure logs to roll (which is similar to zipping a file) to lower the space requirements needed to contain them so they don't get overwritten. By default, logs roll when they reach 20 MB in size. You can also configure a roll schedule and time.

Using the same CLI command, you can also configure rolled logs to upload to an FTP server to save disk space. You can configure which types of log files to upload, when, and whether to delete files after uploading.

Knowledge Check

1. What happens when logs roll?
   - ✓A. It lowers the space requirements needed to contain those logs.
   - B. They are uploaded to an FTP server.

2. When you download logs on the GUI, _____
   - A. all logs in the SQL database are downloaded.
   - ✓B. only your current view, including any filters set, are downloaded.

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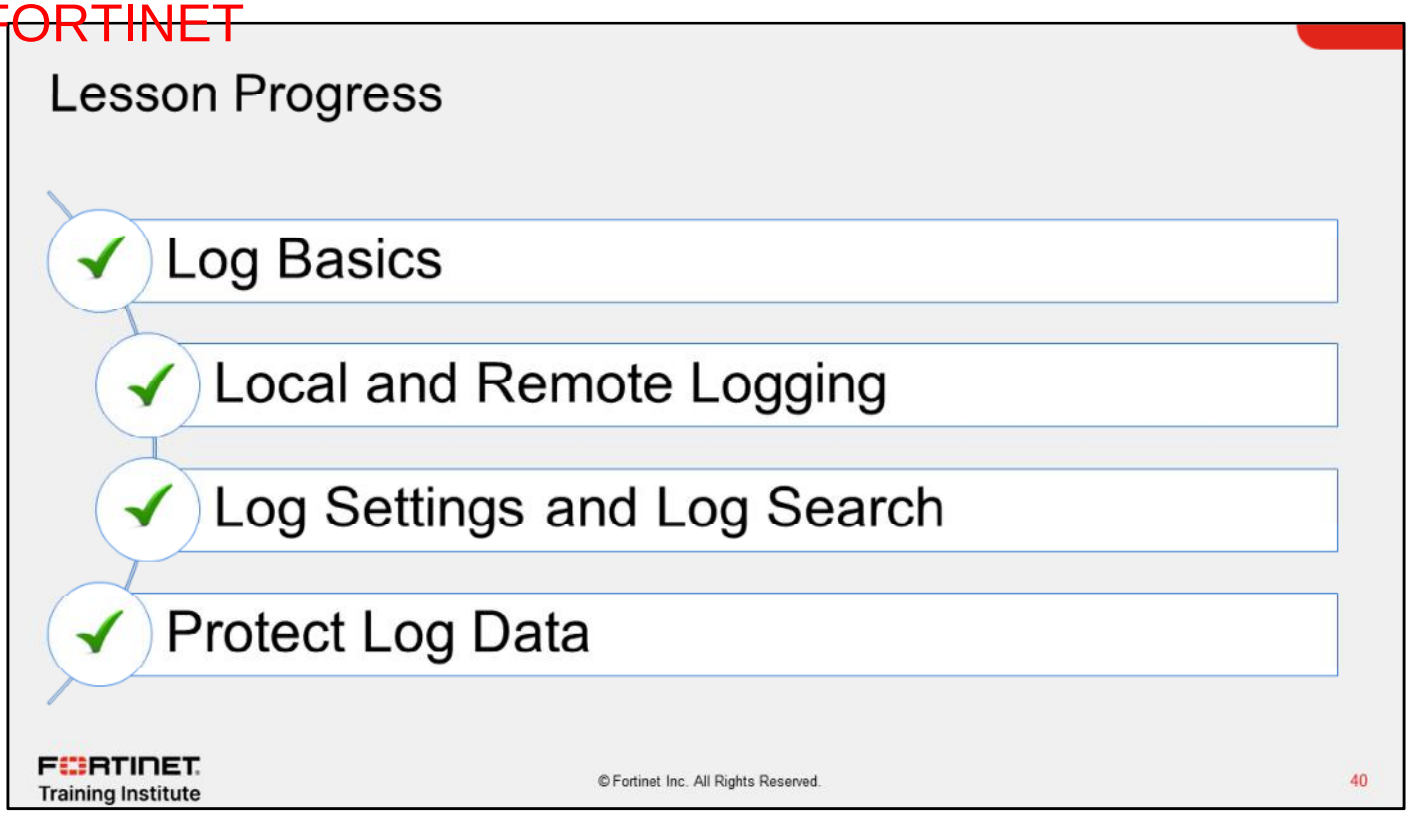
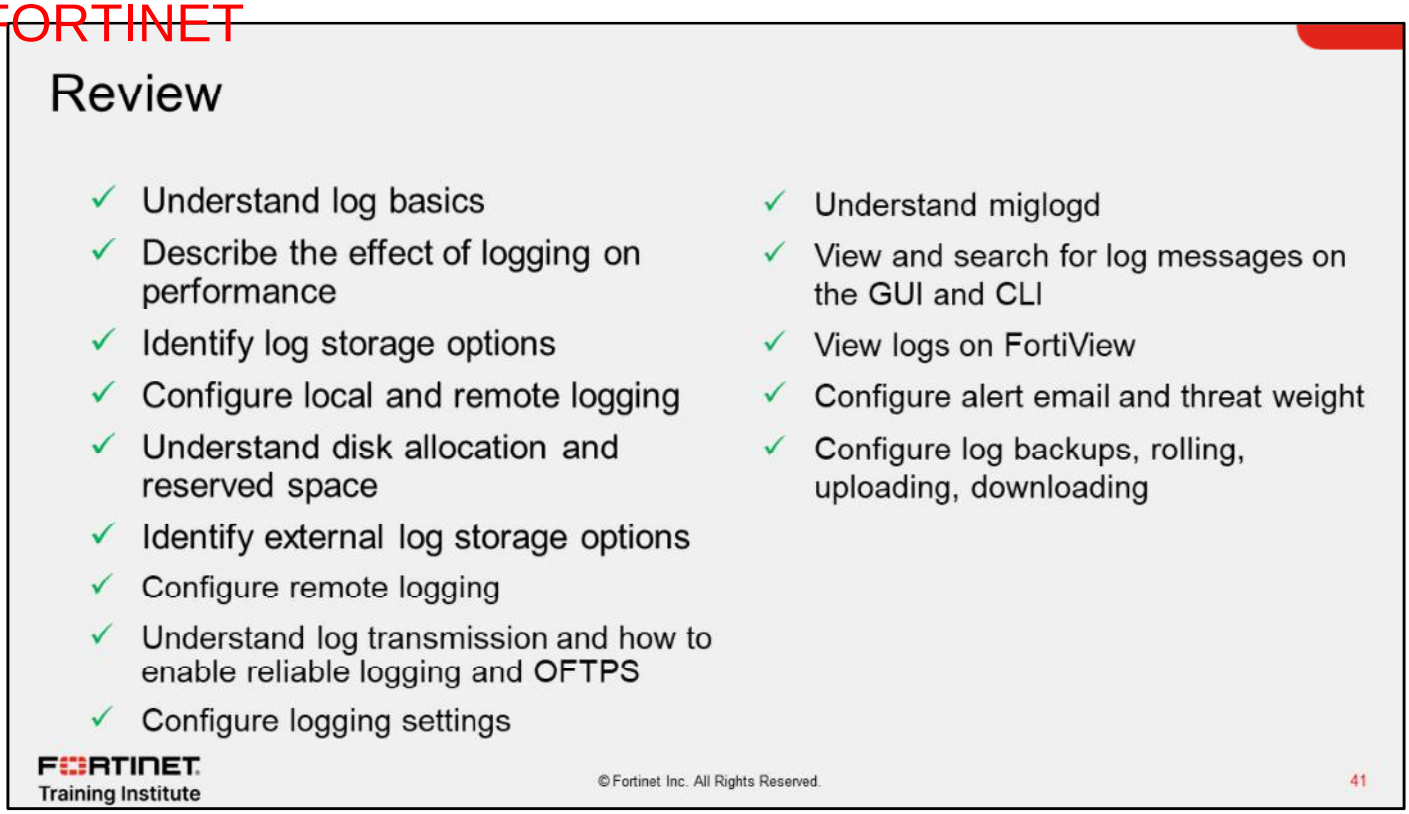
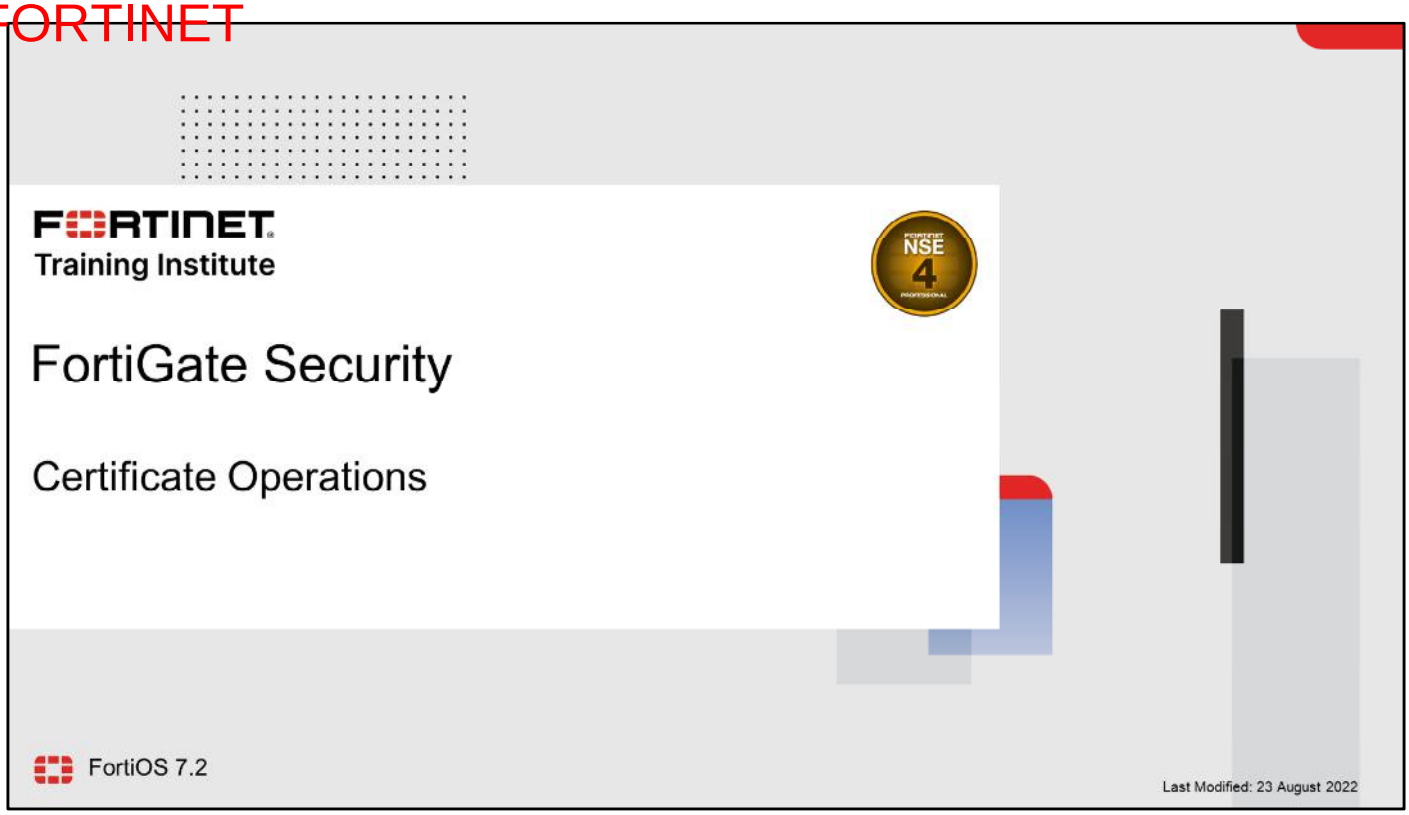


Congratulations! You have completed this lesson. Now, you will review the topics that you covered in this lesson.

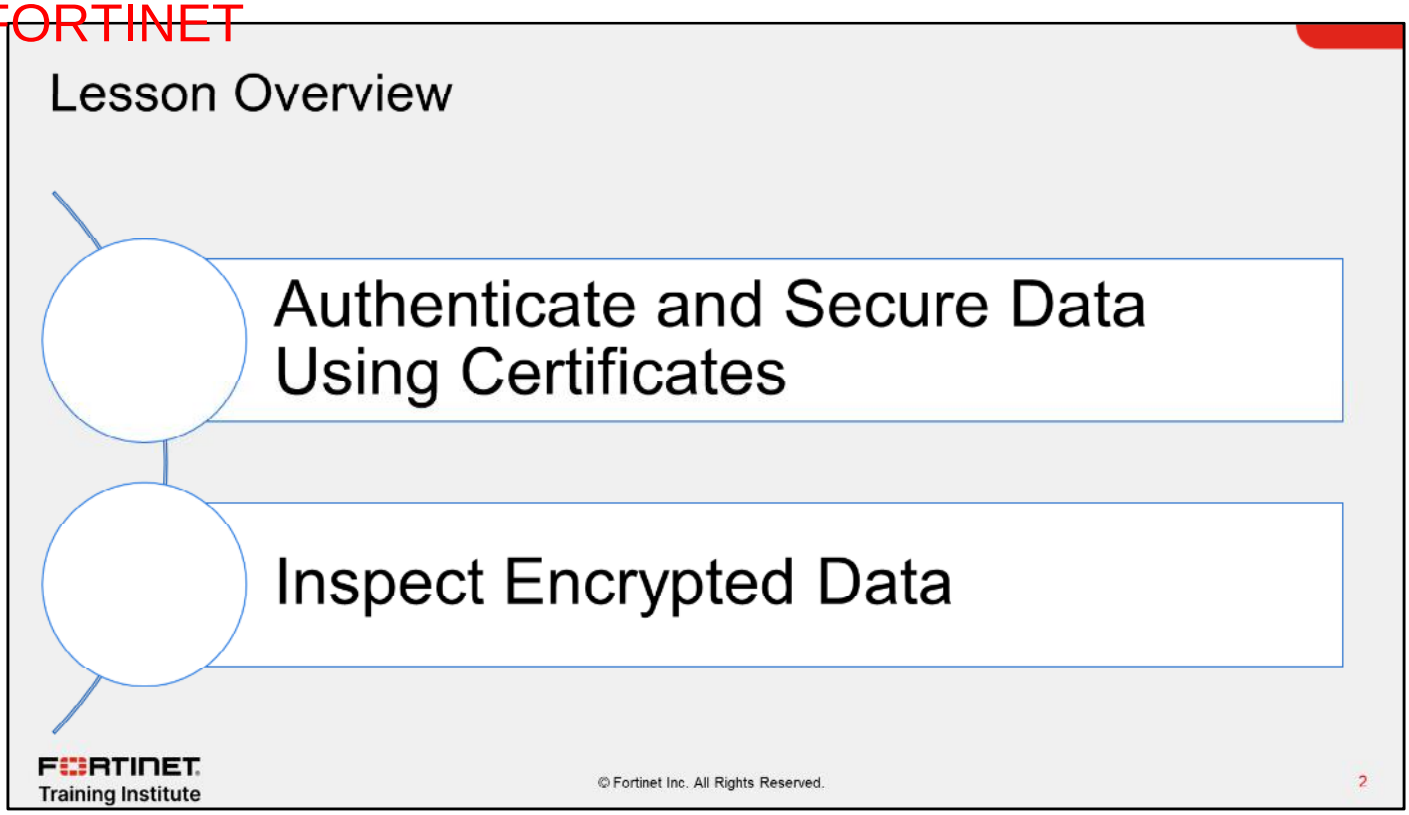


This slide shows the topics that you covered in this lesson.

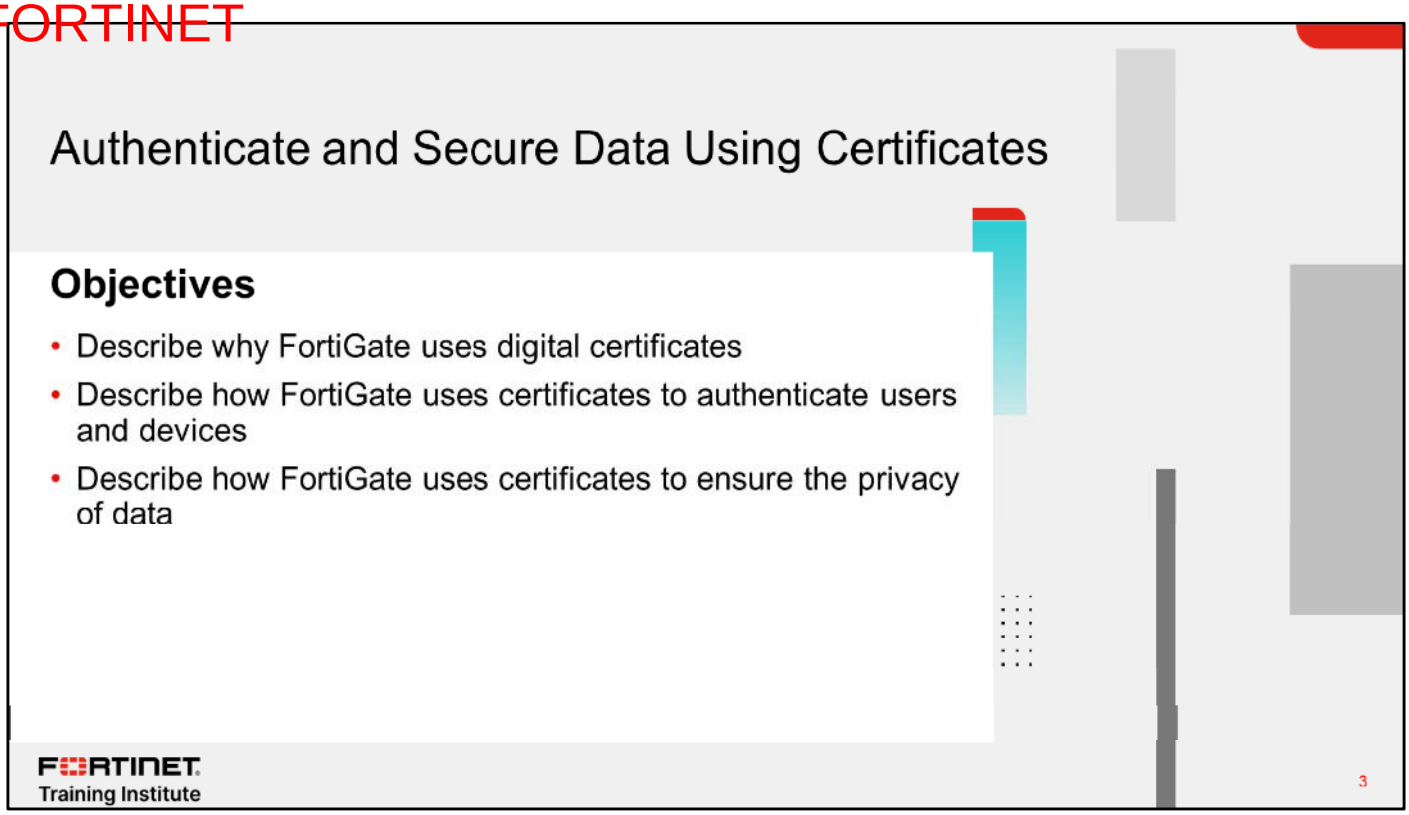
By mastering the topics covered in this lesson, you learned to configure local and remote logging, view logs, search logs, and protect your log data.



In this lesson, you will learn why FortiGate uses digital certificates and how to configure FortiGate to use certificates (including to inspect the contents of encrypted traffic).

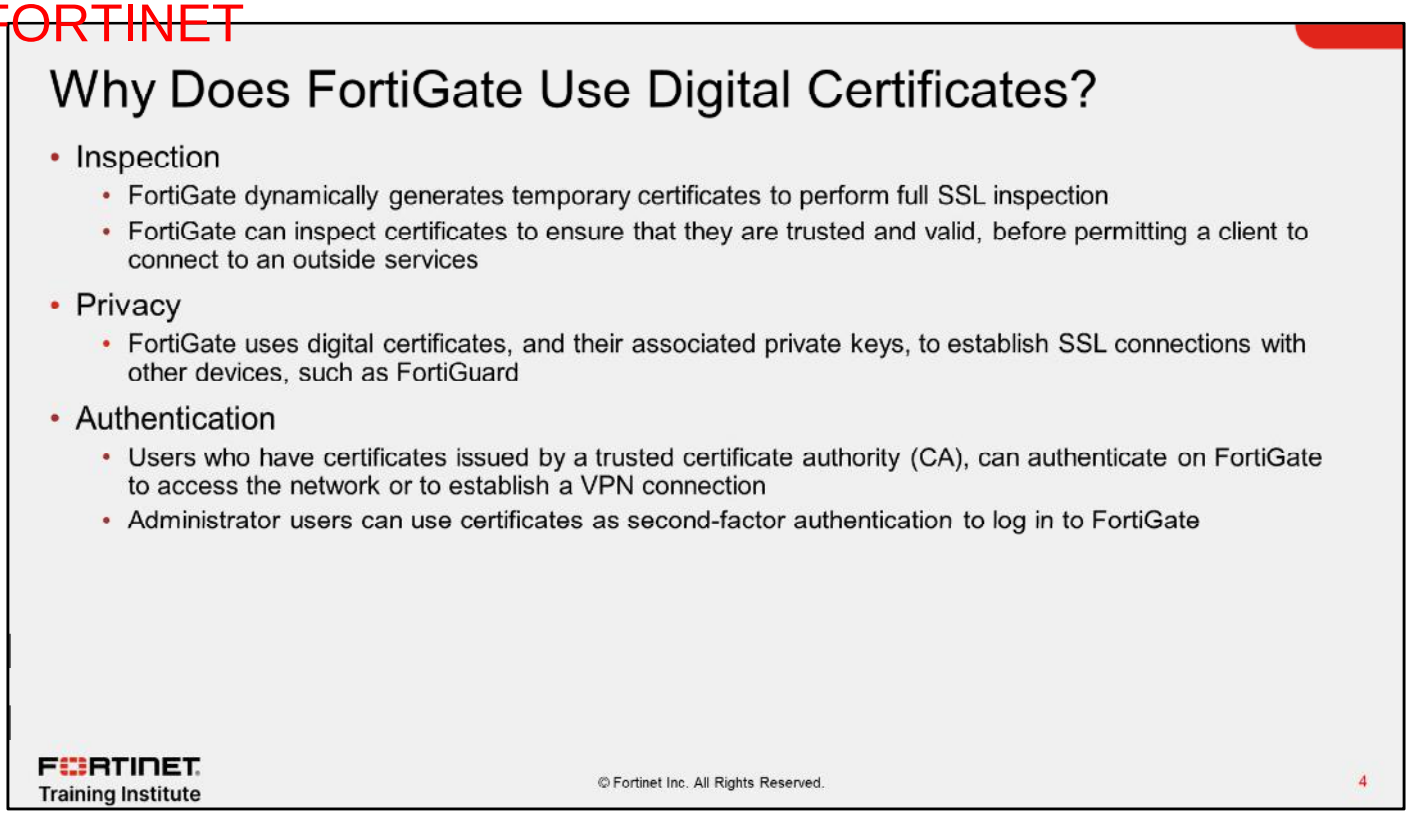


In this lesson, you will learn about the topics shown on this slide.



After completing this section, you should be able to achieve the objectives shown on this slide.

By demonstrating an understanding of how FortiGate uses certificates, you will be better able to judge how and when certificates could be used in your own networks.

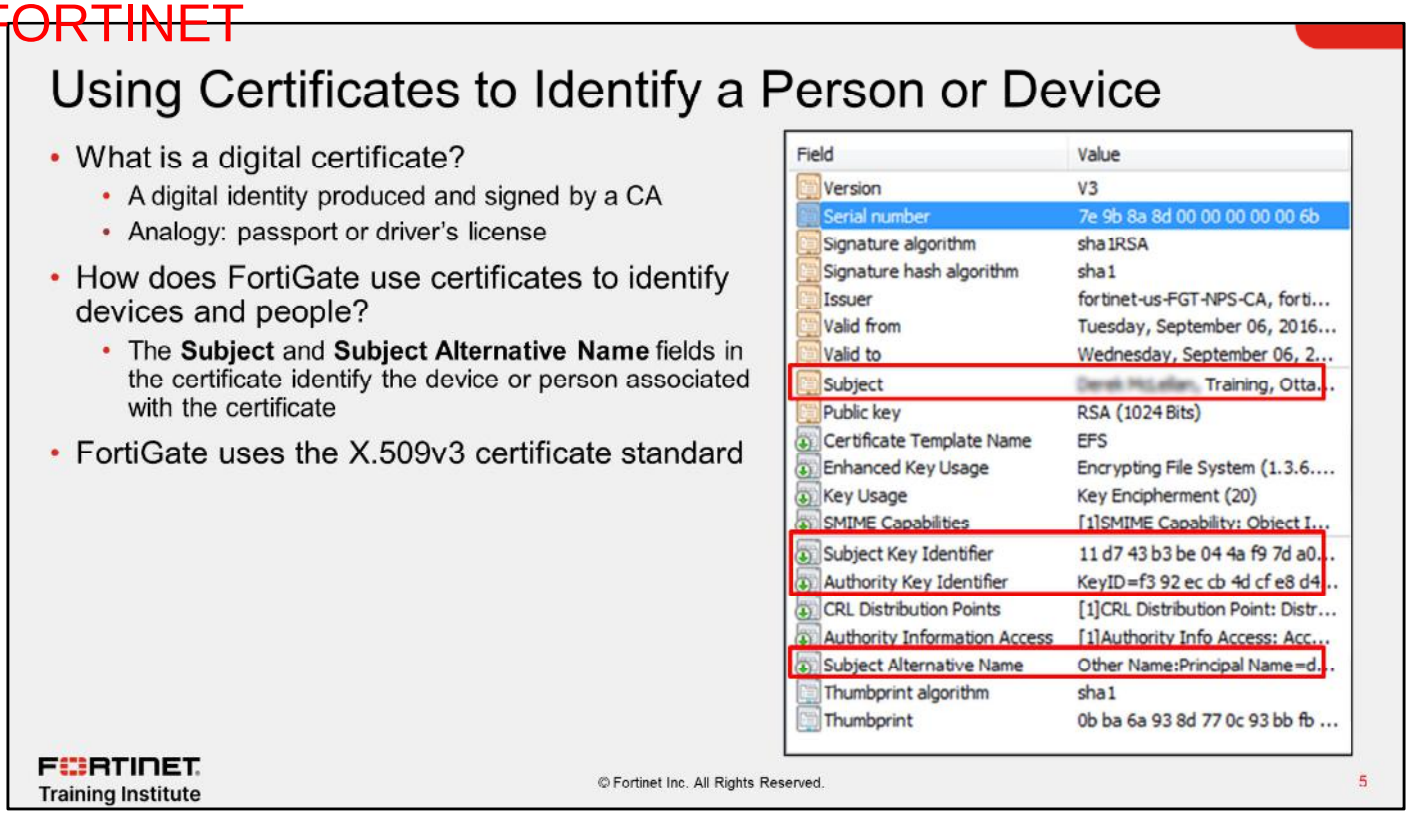


FortiGate uses digital certificates to enhance security.

FortiGate uses digital certificates for inspection. The device can generate certificates on demand for the purpose of inspecting encrypted data that is transferred between two devices; essentially, a man-in-the-middle (MITM) attack. FortiGate can also inspect certificates to identify people and devices (in the network and on the internet), before it permits a person or device to make a full connection to the entity that it is protecting. If FortiGate trusts the certificate, it permits the connection. But if FortiGate does not trust the certificate, it can prevent the connection. How you configure FortiGate determines the behavior; however, other policies that are being used may also affect whether connection attempts are accepted or rejected.

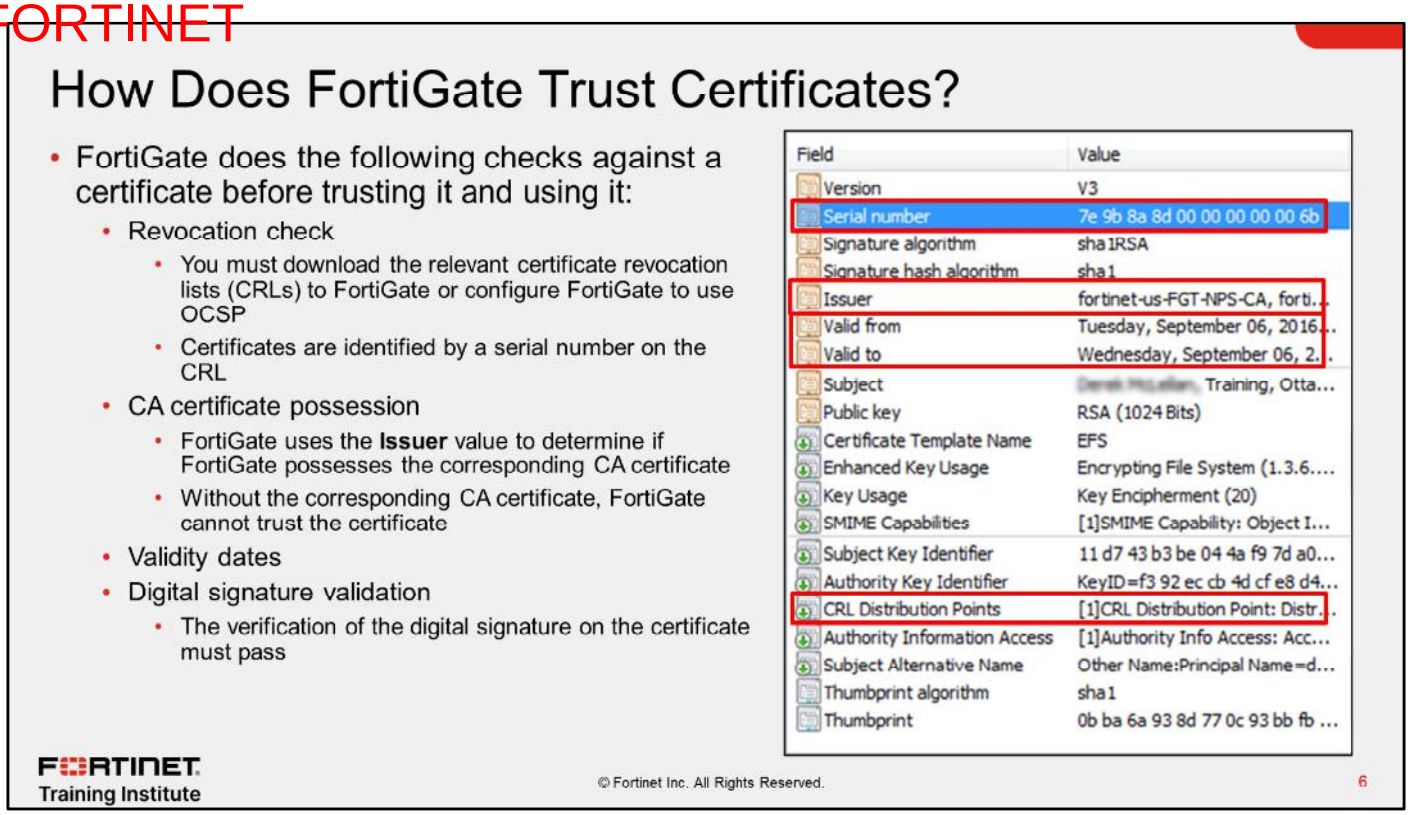
FortiGate uses digital certificates to enforce privacy. Certificates, and their associated private keys, ensure that FortiGate can establish a private SSL connection to another services, such as FortiGuard, a web browser, or a web server.

FortiGate also uses certificates for authentication. Users who have certificates issued by a known and trusted CA can authenticate on FortiGate to access the network or to establish a VPN connection. Administrator users can use certificates as a second-factor authentication to log in to FortiGate.



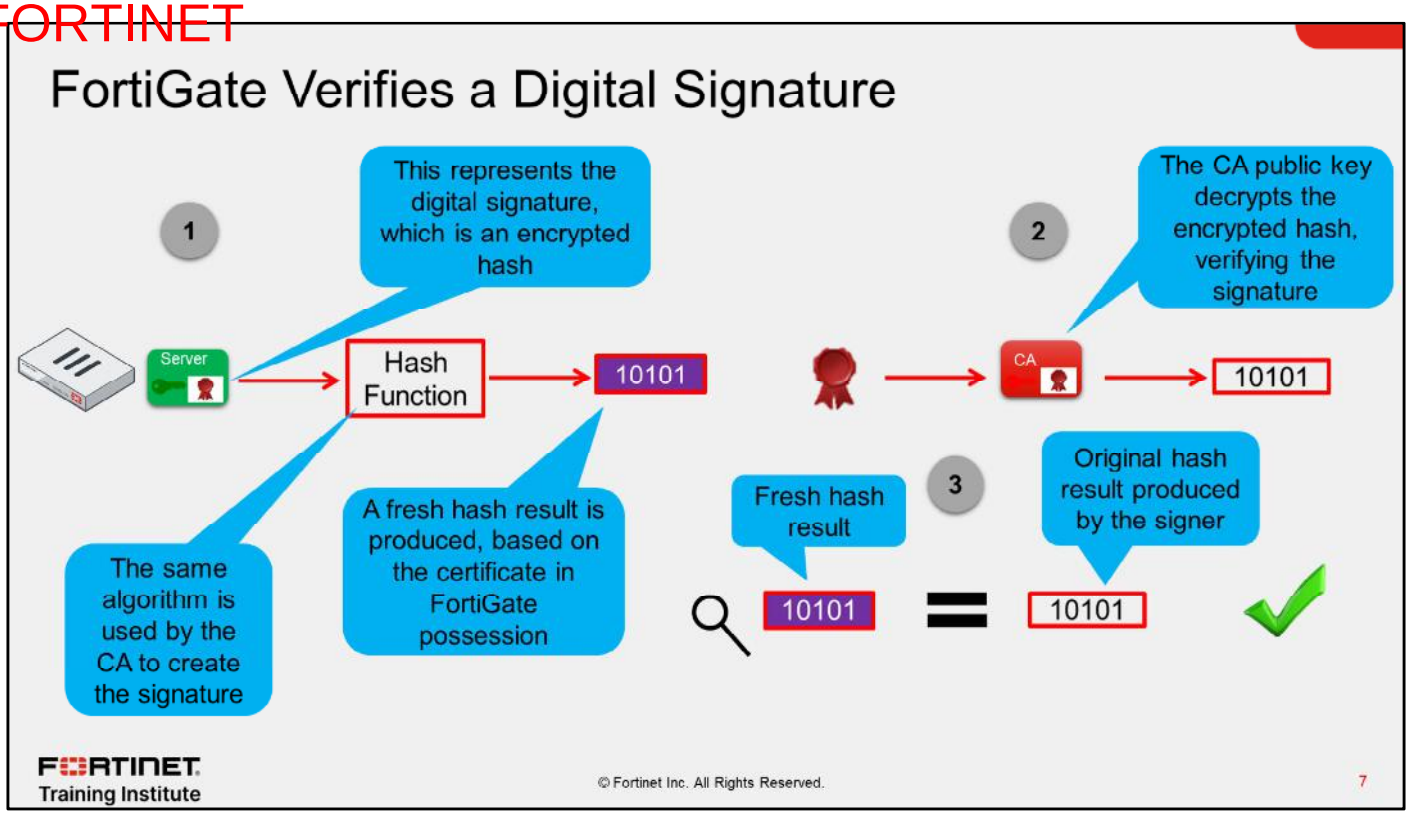
What is a digital certificate?

A digital certificate is a digital document produced and signed by a CA. It identifies an end entity, such as a person (example, Joe Bloggins), a device (example, webserver.acme.com), or thing (example, a certificate revocation list). FortiGate identifies the device or person by reading the value in the **Subject** field, which is expressed as a distinguished name (DN). FortiGate could also use alternate identifiers, shown in the **Subject Alternative Name** field, whose values could be a network ID or an email address, for example. FortiGate can use the **Subject Key Identifier** and **Authority Key Identifier** values to determine the relationship between the issuer of the certificate (identified in the **Issuer** field) and the certificate. FortiGate supports the X.509v3 certificate standard, which is the most common standard for certificates.



FortiGate runs the following checks before it trusts the certificate:

- Checks the CRLs locally (on FortiGate) to verify if the certificate has been revoked by the CA. If the serial number of the certificate is listed on the CRL, then the certificate has been revoked and it is no longer trusted. FortiGate also supports Online Certificate Status Protocol (OCSP), where FortiAuthenticator acts as the OCSP responder.
- Reads the value in the **Issuer** field to determine if it has the corresponding CA certificate. Without the CA certificate, FortiGate does not trust the certificate. FortiOS uses the Mozilla CA certificate store. You can view the list by clicking **Security Profiles** > **SSL Inspection** > **View Trusted CA List** > **Factory Bundles**.
- Verifies that the current date is between the **Valid From** and **Valid To** values. If it is not, the certificate is rendered invalid.
- Validates the signature on the certificate. The signature must be successfully validated. Because a valid signature is a critical requirement for trusting a certificate, it may be useful to review how FortiGate verifies digital signatures.

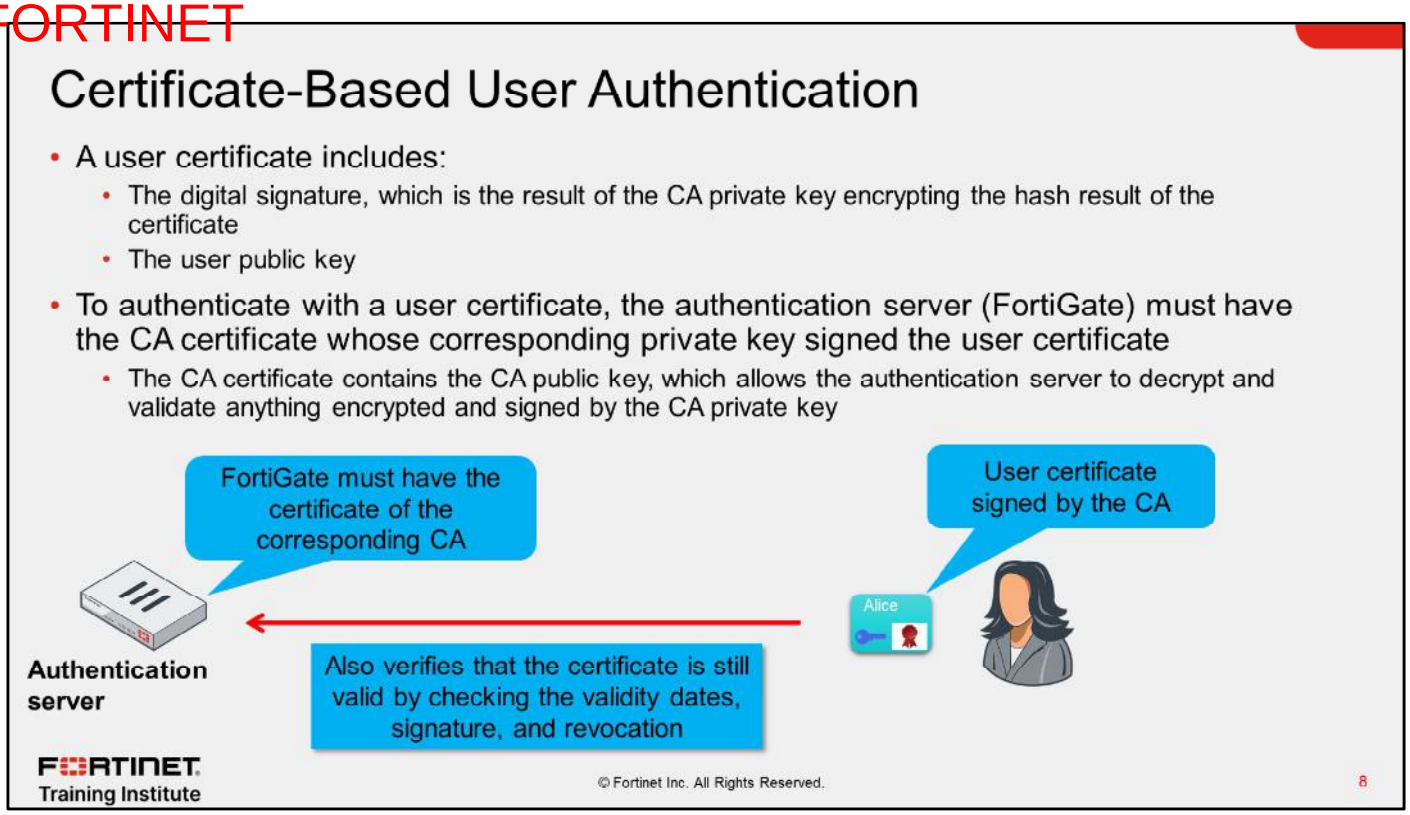


Before it generates a digital signature, the CA runs the content of the certificate through a hash function, which produces a hash result. The hash result, which is a mathematical representation of the data, is referred to as the *original hash result*. The CA encrypts the original hash result using its private key. The encrypted hash result is the digital signature.

When FortiGate verifies the digital signature, it runs the certificate through a hash function, producing a fresh hash result. FortiGate must use the same hash function, or hashing algorithm, that the CA used to create the digital signature. The hashing algorithm is identified in the certificate.

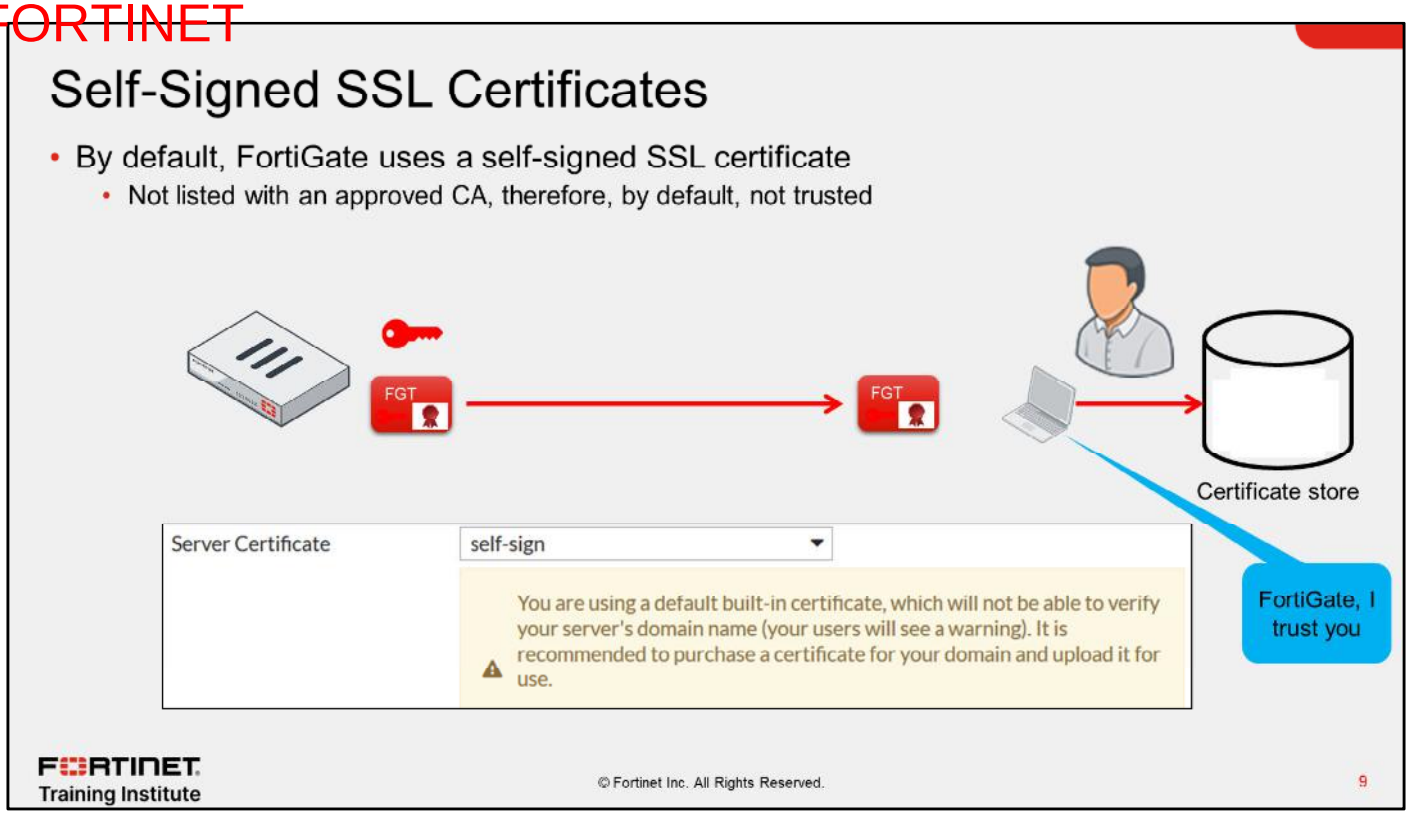
In the second part of the verification process, FortiGate decrypts the encrypted hash result (or digital signature) using the CA public key, and applying the same algorithm that the CA used to encrypt the hash result. This process verifies the signature. If the key cannot restore the encrypted hash result to its original value, then the signature verification fails.

In the third, and final, part of the verification process, FortiGate compares the fresh hash result to the original hash result. If the two values are identical, then the integrity of the certificate is confirmed. If the two hash results are different, then the version of the certificate that FortiGate has is not the same as the one that the CA signed, and data integrity fails.



Certificate-based user authentication uses an end-entity certificate to identify the user. This certificate contains the user public key and the signature of the CA that issued the certificate. The authentication server (for example, FortiGate) must have the CA certificate whose private key signed the user certificate. FortiGate verifies that the certificate signature is valid, that the certificate has not expired, and that the certificate hasn't been revoked. If any of these verifications fail, the certificate-based user authentication fails.

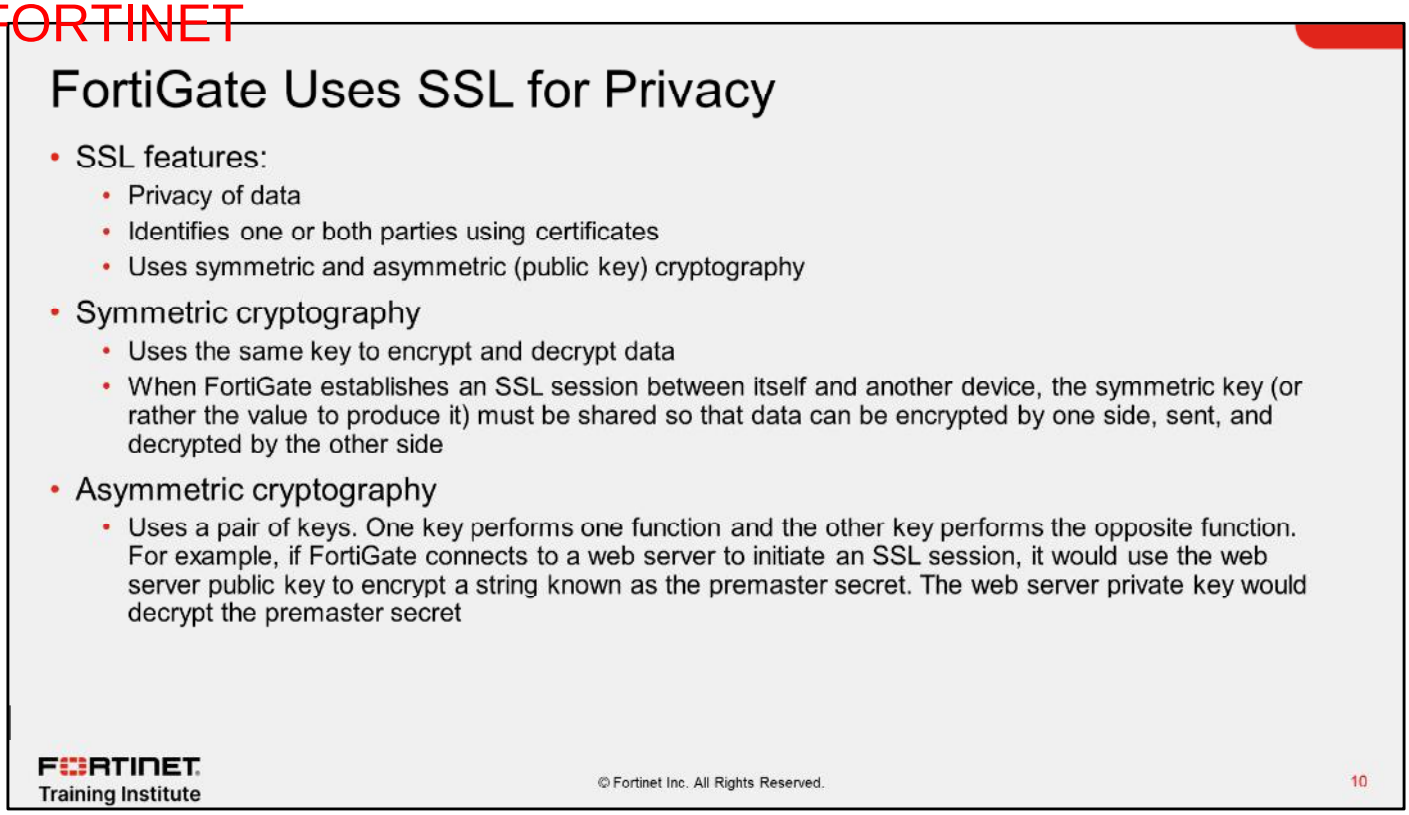
You can configure FortiGate to require that administrators use certificates for second-factor authentication. The process for verifying administrator certificates is the same.



As you can see in the example shown on this slide, trust in the web model is determined by whether or not your certificate store possesses the CA certificate that is required to verify the signature on the SSL certificate. Certificate stores come prepopulated with root and subordinate CA certificates. You can choose to add or remove the certificates, which will affect which websites you trust.

By default, FortiGate uses a self-signed certificate to authenticate itself to HTTPS clients.

You can configure self-signed certificates to establish SSL sessions, just like those certificates issued by Verisign, Entrust Datacard, and other certificate vendors. But, because self-signed certificates do not come prepopulated in client certificate stores, your end users get a security warning. You can choose to add the self-signed certificate to clients, or to purchase an SSL certificate from an approved CA vendor for your FortiGate device.

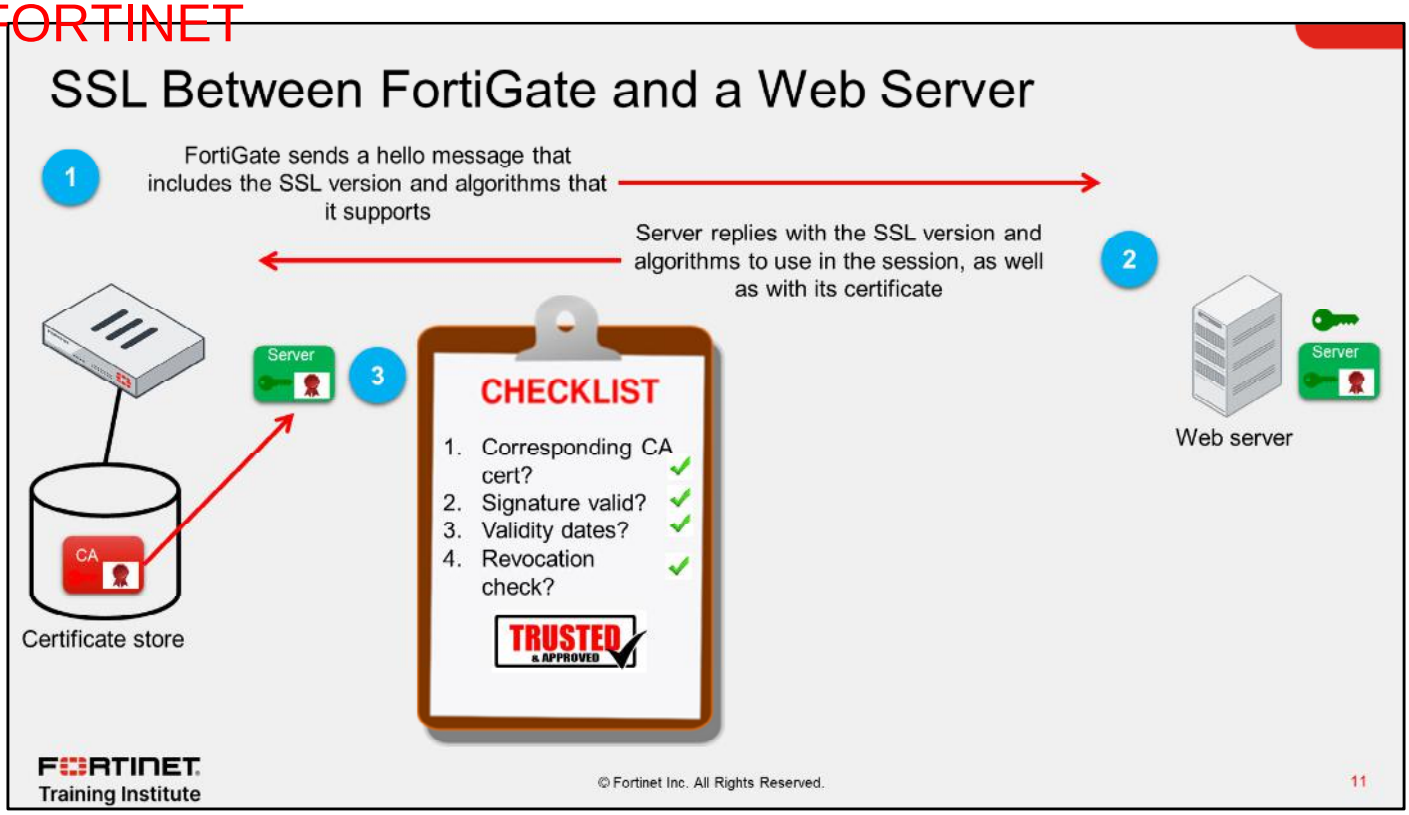


FortiGate uses SSL to ensure that data remains private when connecting with servers, such as FortiGuard, and with clients, such as a web browser. Another feature of SSL is that FortiGate can use it to identify one or both parties using certificates. SSL uses symmetric and asymmetric cryptography to establish a secure session between two points.

It is beneficial to understand the high-level process of an SSL handshake, in order to understand how FortiGate secures private sessions.

An important attribute of symmetric cryptography is that the same key is used to encrypt and decrypt data. When FortiGate establishes an SSL session between itself and another device it must share, the symmetric key (or rather the value required to produce it), so that data can be encrypted by one side, sent, and decrypted by the other side.

Asymmetric cryptography uses a pair of keys: one key performs one function and the other key performs the opposite function. When FortiGate connects to a web server, for example, it uses the web server public key to encrypt a string known as the premaster secret. The web server private key decrypts the premaster secret.

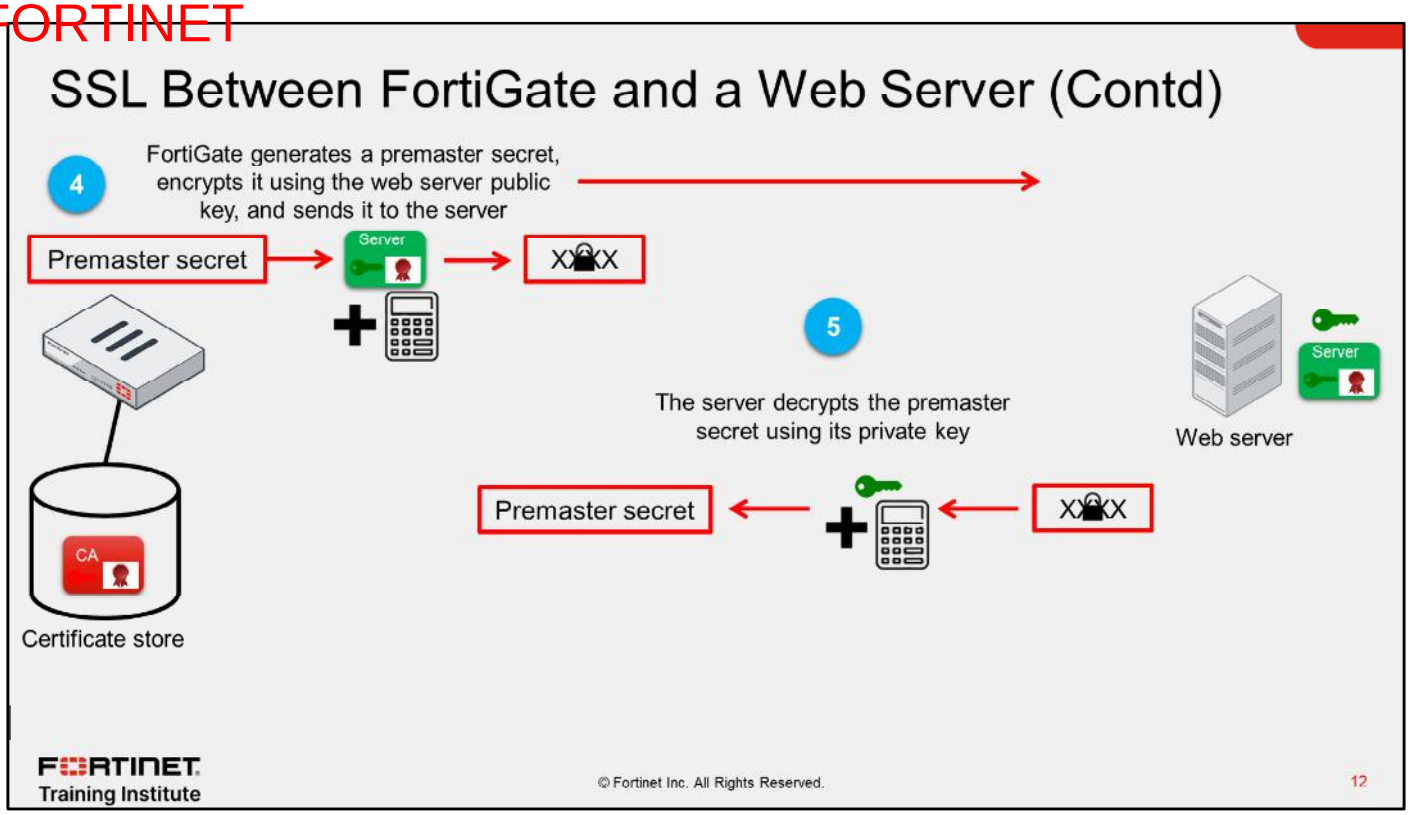


Now, you will learn more about the process of establishing an SSL session.

In the first step of the example shown on this slide, FortiGate connects to a web server that is configured for SSL. In the initial hello message, the browser provides critical information that is needed to communicate with the web server. This information includes the SSL version number and the names of the cryptographic algorithms that it supports.

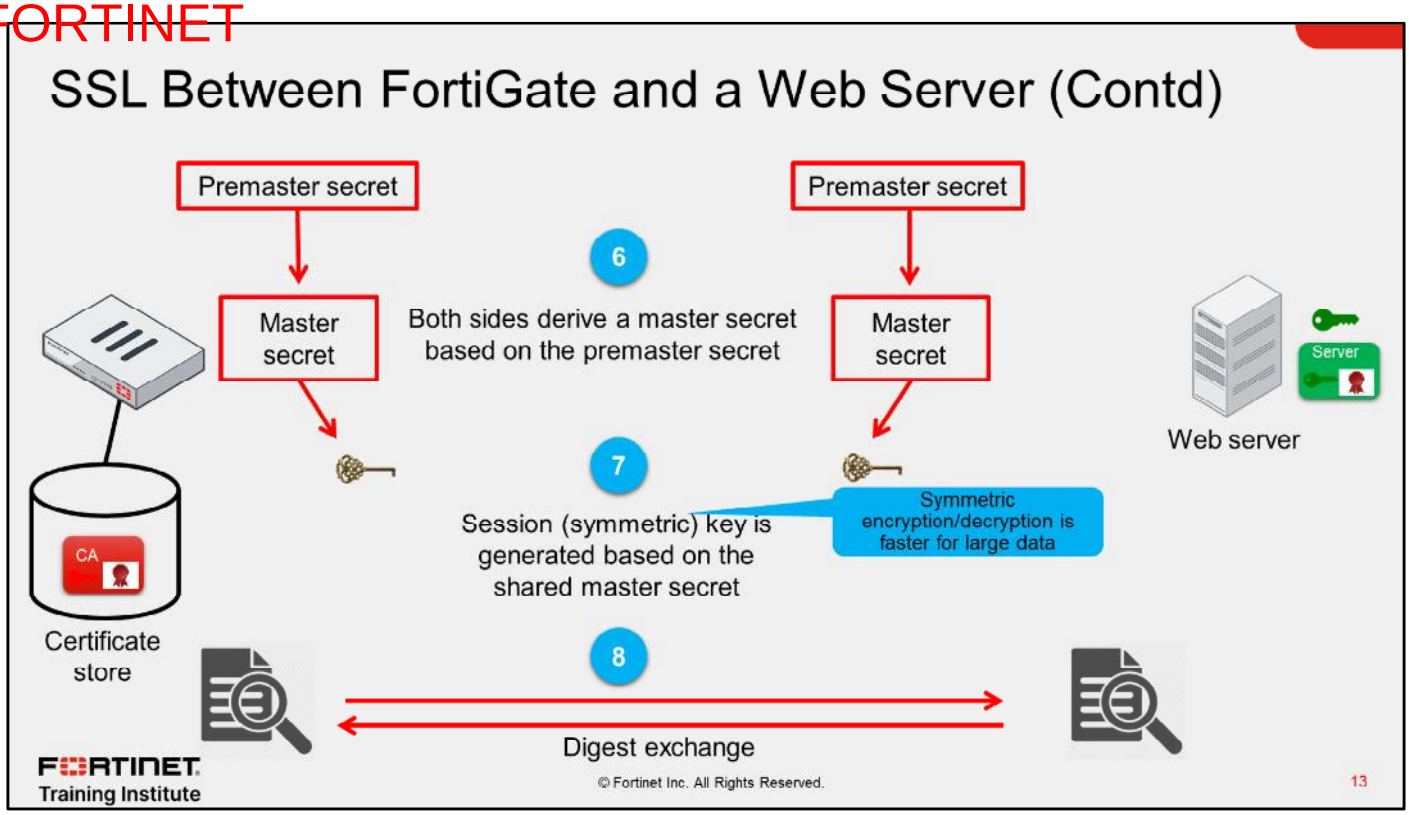
In the second step, the web server receives the message from FortiGate and chooses the first suite of cryptographic algorithms included in the message, and verifies that it is also supported by the web server. The web server replies with the chosen SSL version and cipher suite, and then sends its certificate to FortiGate. Note that the certificate information is passed as cleartext over the public network. The information contained in a certificate is typically public, so this is not a security concern.

In the third step, FortiGate validates the web server certificate. The checklist shown on this slide represents the checks that FortiGate performs on the certificate to ensure that it can be trusted. If FortiGate determines that the certificate can be trusted, then the SSL handshake continues.



In the fourth step, FortiGate generates a value known as the premaster secret. FortiGate uses the server public key, which is in the certificate, to encrypt the premaster secret. FortiGate then sends the encrypted premaster secret to the web server. If a third-party intercepted the premaster secret, they would be unable to read it, because they do not have the private key.

In the fifth step, the web server uses its private key to decrypt the premaster secret. Now, both FortiGate and the web server share a secret value that is known by only these two devices.



In the sixth step, both FortiGate and the web server derive the master secret based on the premaster secret.

In the seventh step, based on the master secret value, FortiGate and the web server generate the session key. The session key is a symmetric key. The main advantage of symmetric key over asymmetric keys is that it is fast and efficient for large amounts of data. It is required to encrypt and decrypt the data. Because both sides have the session key, both sides can encrypt and decrypt data for each other.

In the eighth and final step before these two entities establish the secure connection, both FortiGate and the web server send each other a summary (or digest) of the messages sent so far. The digests are encrypted with the session key. The digests ensure that none of the messages exchanged during the creation of the session have been intercepted or replaced. If the digests match, the secure communication channel is established.

The SSL handshake is now complete. Both FortiGate and the web server are ready to communicate securely, using the session keys to encrypt and decrypt the data they send over the network or internet.

Knowledge Check

1. Which attribute or extension identifies the owner of a certificate?
   - ✓ A. The subject name in the certificate
   - B. The unique serial number in the certificate

2. How does FortiGate determine if a certificate has been revoked?
   - ✓ A. It checks the CRL that resides on FortiGate.
   - B. It retrieves the CRL from a directory server.

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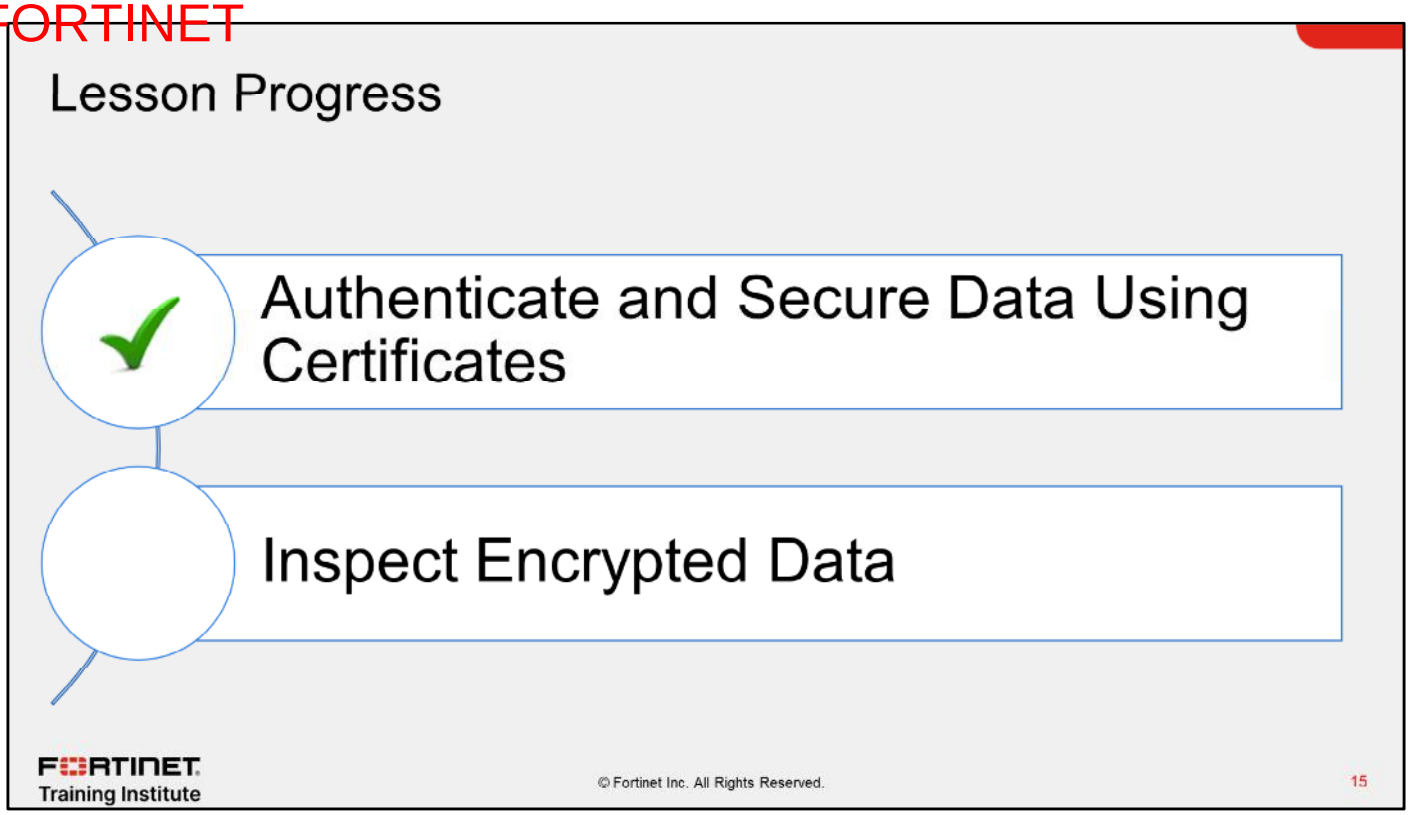
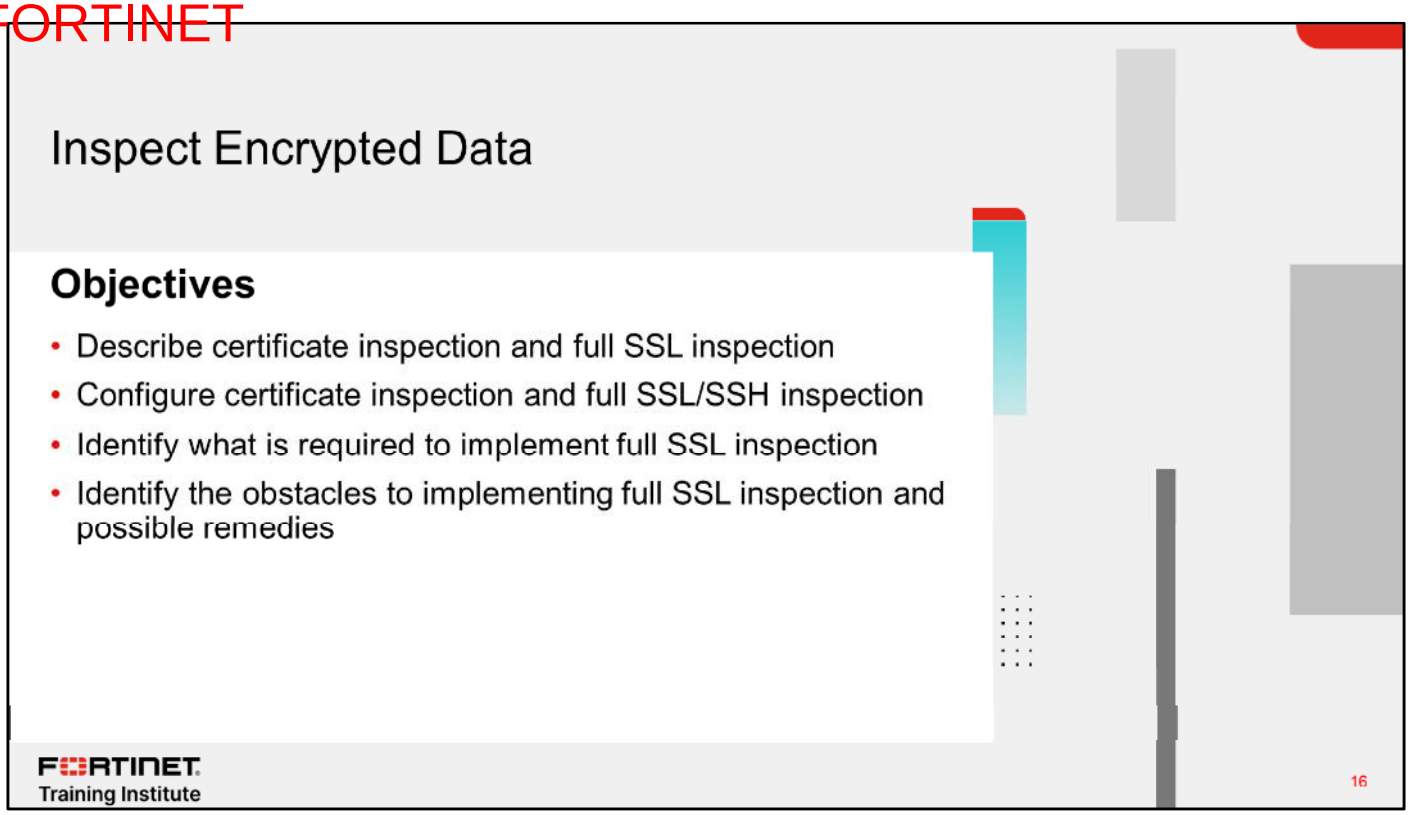


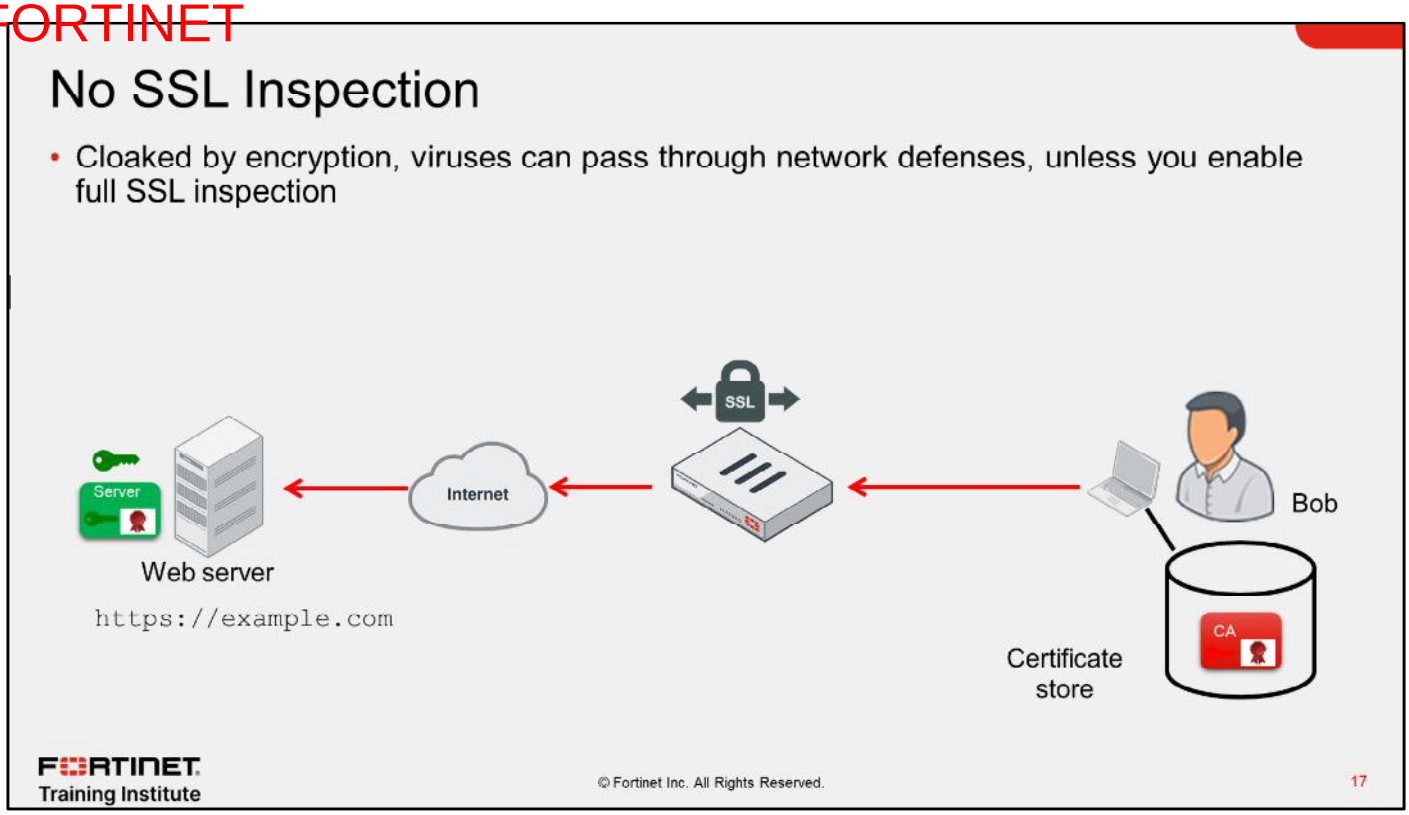
Good job! You now understand why and how FortiGate uses certificates to authenticate devices and people. You also understand how FortiGate uses certificates to ensure the privacy of data as it flows from FortiGate to another device, or from another device to FortiGate.

Now, you will learn how to inspect encrypted data.



After completing this section, you should be able to achieve the objectives shown on this slide.

By demonstrating competence in understanding and configuring full SSL inspection and certificate inspection, you will be able to implement one of these SSL inspection solutions in your network.

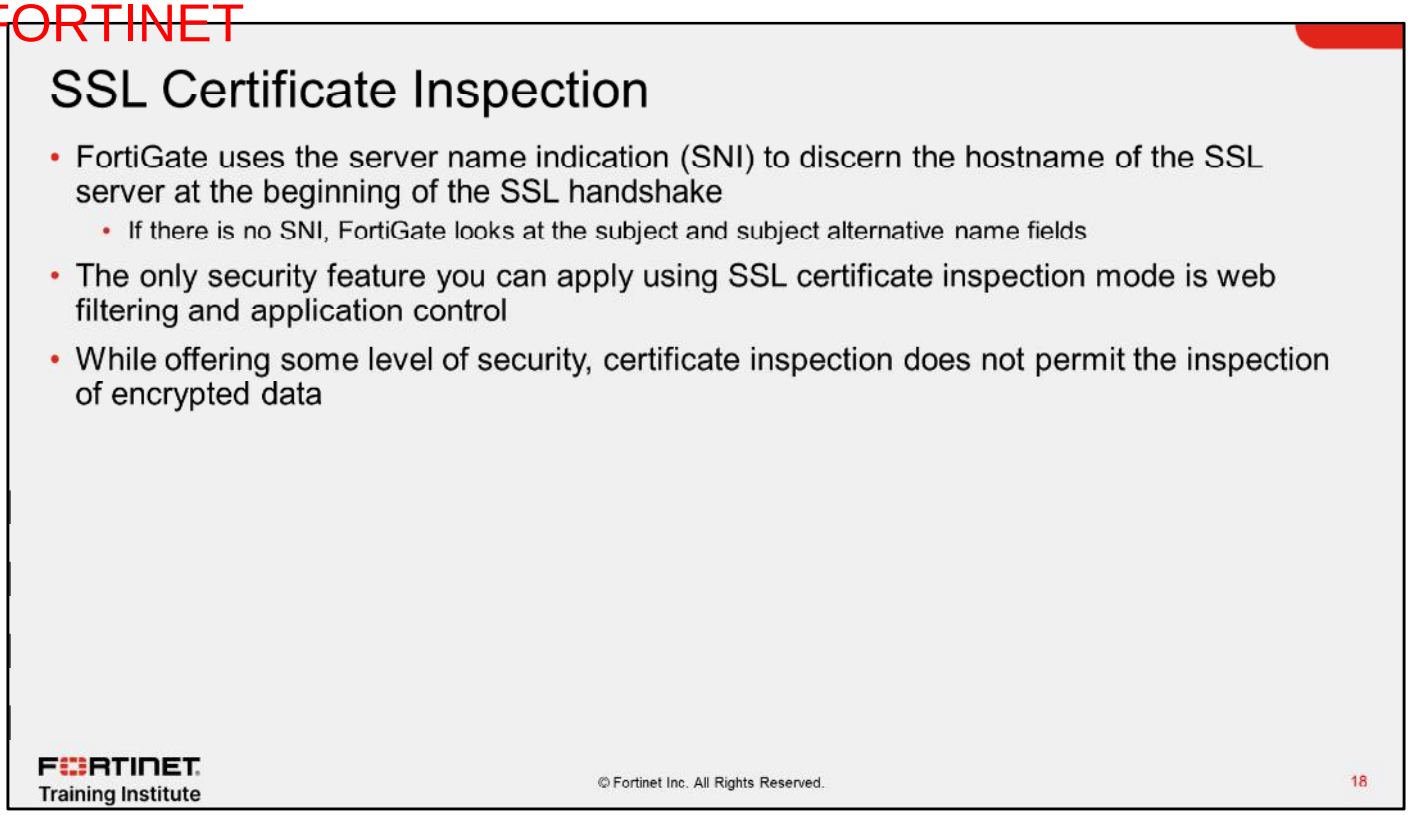


(slide contains animation)

While there are benefits to using HTTPS, there are risks associated with its use as well, because encrypted traffic can be used to get around normal defenses. For example, if a session is encrypted when you download a file containing a virus, the virus might get past your network security measures.

In the example shown on this slide, Bob connects to a site with a certificate issued by a legitimate CA. Because the CA is an approved CA, the CA verification certificate is in Bob's certificate store, and Bob's browser is able to establish an SSL session with the `example.com` site. However, unknown to Bob, the example.com site has been infected with a virus. The virus, cloaked by encryption, passes through FortiGate undetected and enters Bob's computer. The virus is able to breach security because full SSL inspection is not enabled.

You can use full SSL inspection, also known as deep inspection, to inspect encrypted sessions.

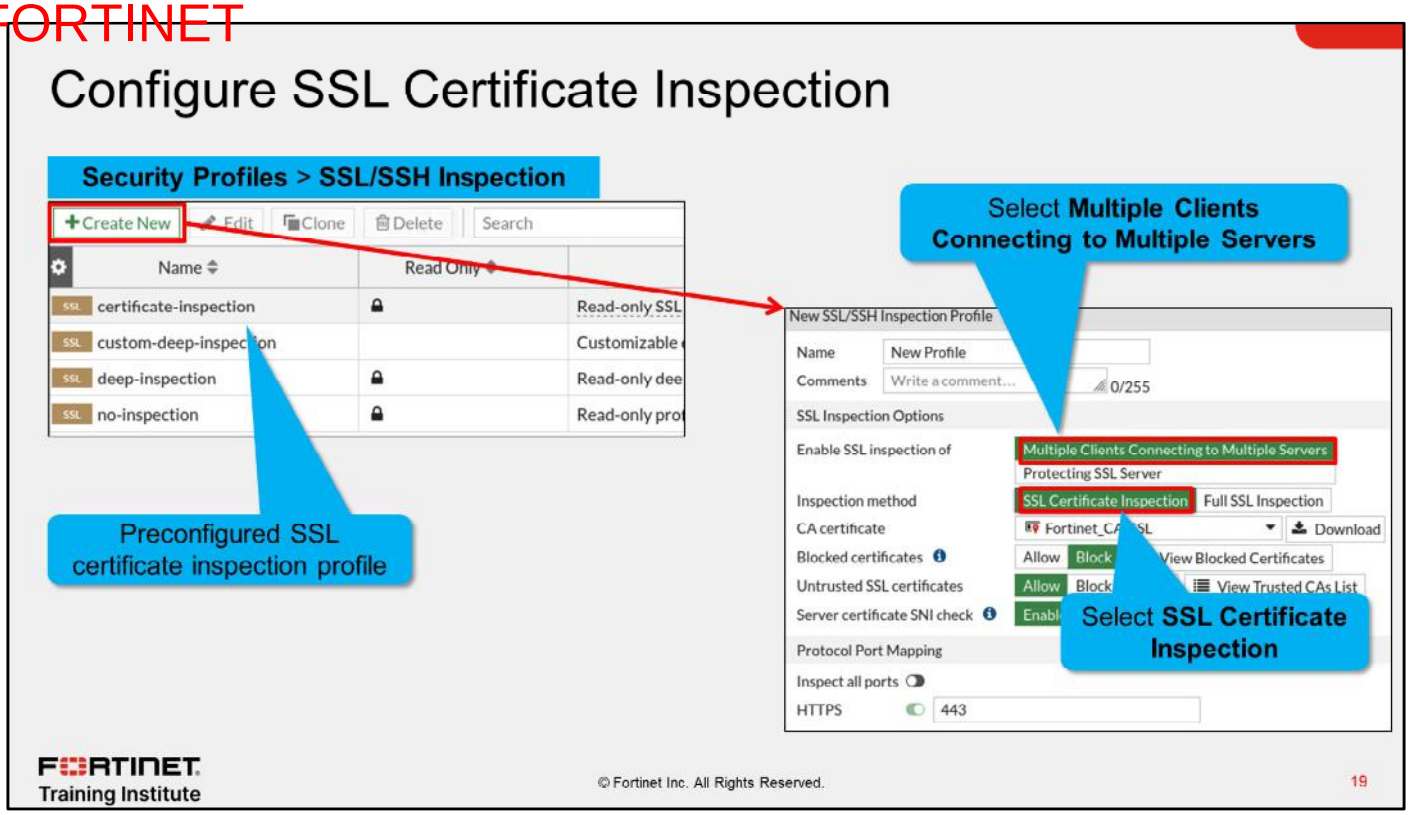


During the exchange of hello messages at the beginning of an SSL handshake, FortiGate parses server name indication (SNI) from client Hello, which is an extension of the TLS protocol. The SNI tells FortiGate the hostname of the SSL server, which is validated against the DNS name before receipt of the server certificate. If there is no SNI exchanged, then FortiGate identifies the server by the value in the **Subject** field or **SAN** (subject alternative name) field in the server certificate.

When you use certificate inspection, FortiGate inspects only the header information of the packets. You use certificate inspection to verify the identity of web servers. You can also use it to make sure that the HTTPS protocol isn't used as a workaround to access sites you have blocked using web filtering.

The only security feature that you can apply using SSL certificate inspection mode is web filtering and application control. However, since only the packet is inspected, this method does not introduce certificate errors and can be a useful alternative to full SSL inspection when you use web filtering.

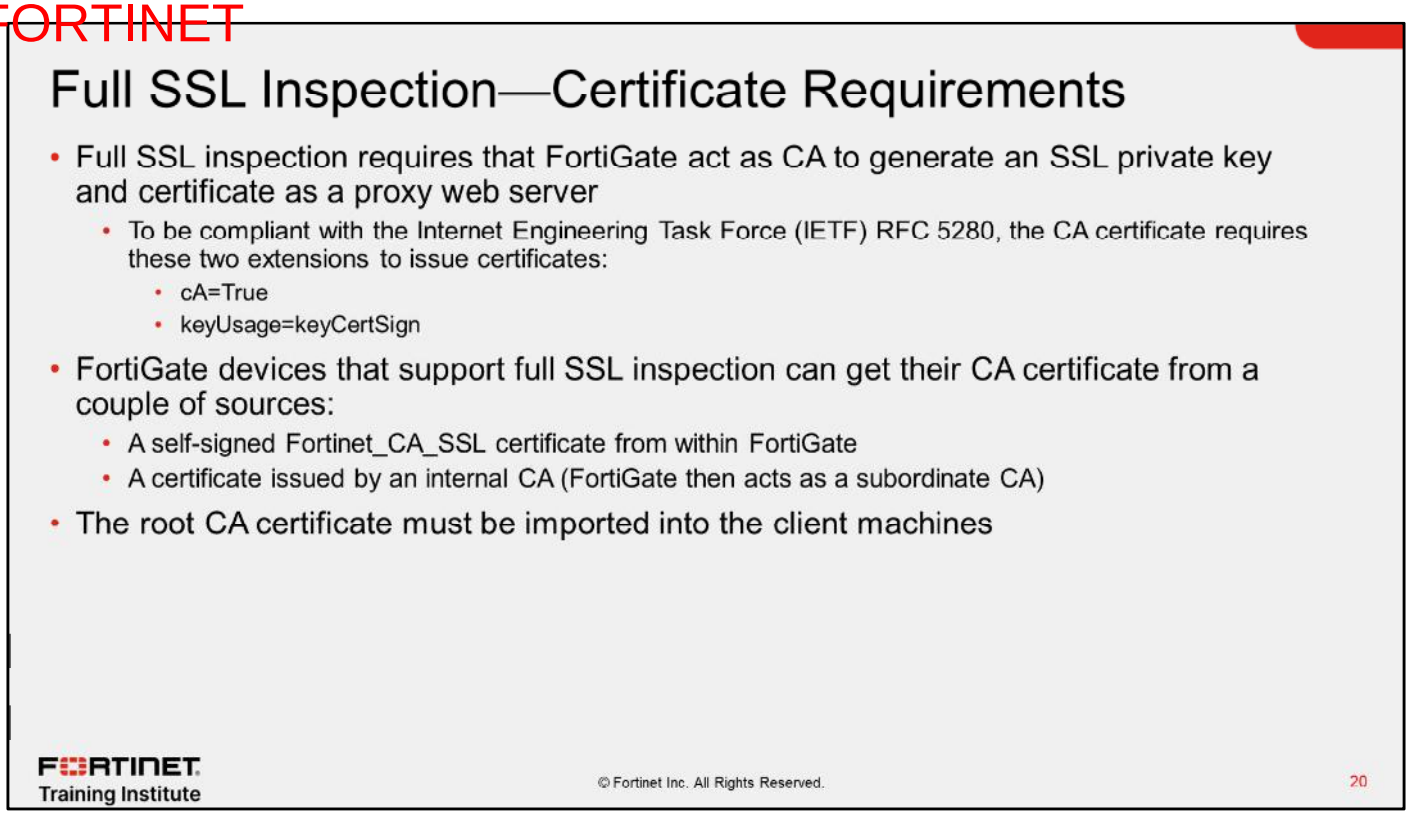
Certificate inspection offers some level of security, but it does *not* allow FortiGate to inspect the flow of encrypted data between the outside server and the internal client.



FortiGate has a read-only preconfigured profile for SSL certificate inspection named **certificate-inspection**. If you want to enable SSL certificate inspection, select this profile when configuring a firewall policy.

Alternatively, you can create your own profile for SSL certificate inspection by following the steps below:

1. On the FortiGate GUI, click **Security Profiles** > **SSL/SSH Inspection**.
2. Click **Create New** to create a new SSL/SSH inspection profile.
3. Select **Multiple Clients Connecting to Multiple Servers**, and click **SSL Certificate Inspection**.

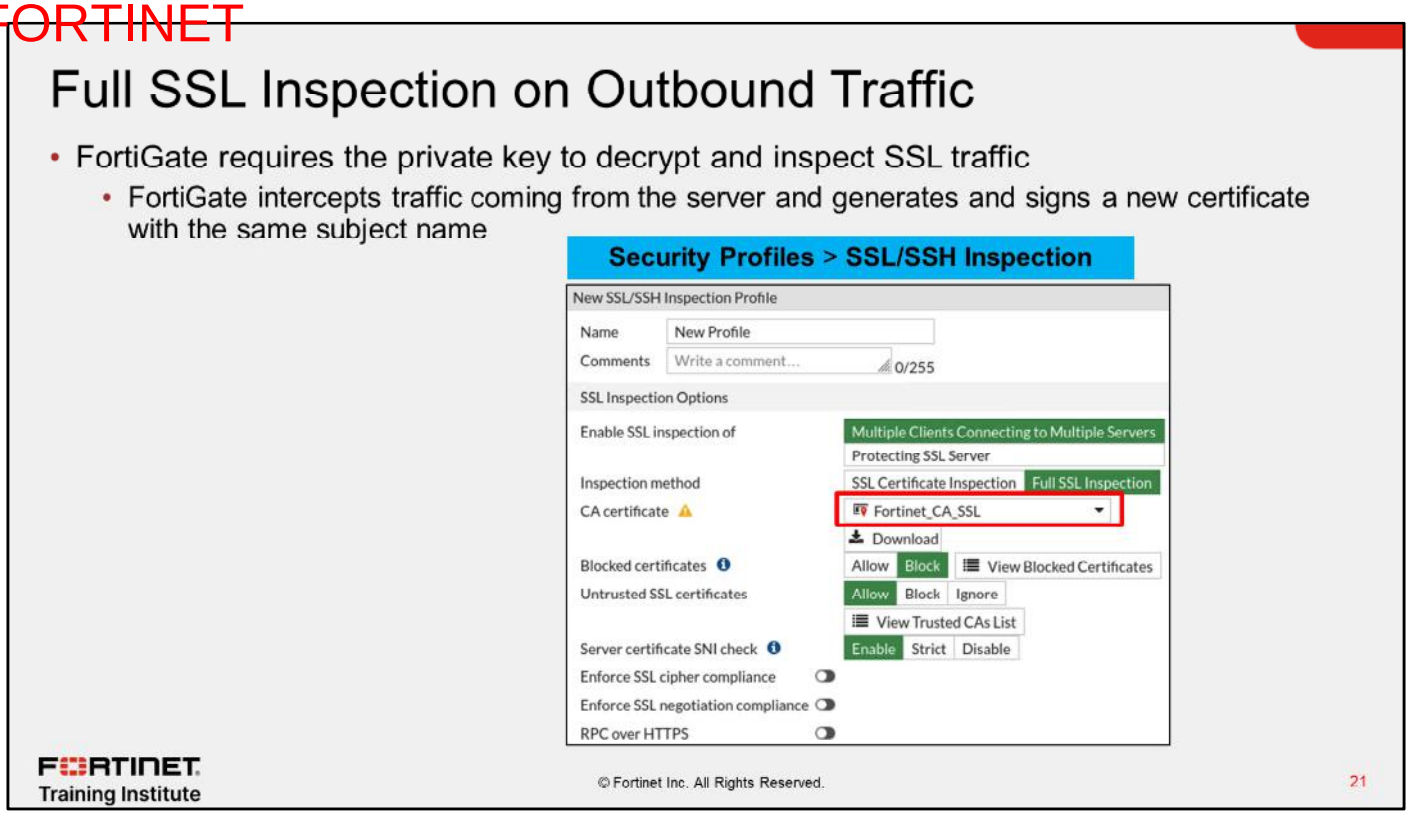


FortiGate performs web proxy and must act as a CA in order for it to perform full SSL inspection. The internal CA must generate an SSL private key and certificate each time an internal user connects to an external SSL server. The key pair and certificate are generated *immediately* so the user connection with the web server is not delayed.

Although it appears as though the user browser is connected to the web server, the browser is connected to FortiGate. FortiGate is acting as a proxy web server. In order for FortiGate to act in these roles, its CA certificate must have the basic constraints extension set to **cA=True** and the value of the **keyUsage** extension set to **keyCertSign**.

The **cA=True** value identifies the certificate as a CA certificate. The **keyUsage=keyCertSign** value indicates that the certificate corresponding private key is permitted to sign certificates. For more information, see *RFC 5280 Section 4.2.1.9 Basic Constraints*.

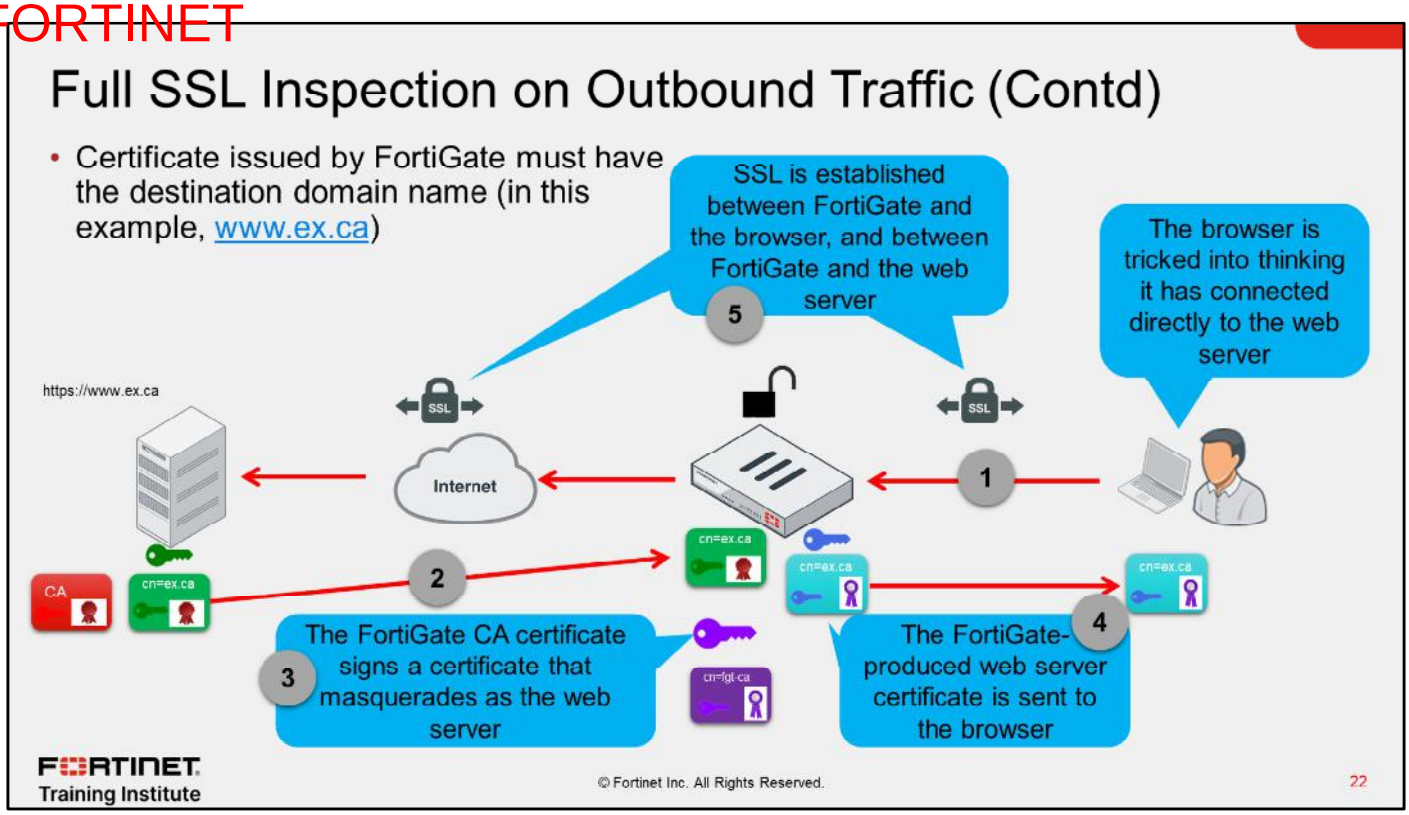
All FortiGate devices that support full SSL inspection can use the self-signed Fortinet_CA_SSL certificate that is provided with FortiGate, or an internal CA, to issue FortiGate a CA certificate. When FortiGate uses an internal CA, FortiGate acts as a subordinate CA. Note that your client machines and devices must import the root CA certificate, in order to trust FortiGate and accept an SSL session. You must install the chain of CA certificates on FortiGate. FortiGate sends the chain of certificates to the client, so that the client can validate the signatures and build a chain of trust.



Some FortiGate devices offer a mechanism to inspect encrypted data that flows between external SSL servers and internal clients. Without full SSL inspection, FortiGate cannot inspect encrypted traffic, because the firewall does not have the SSL key that is required to decrypt the data, and that was negotiated between client and server during the SSL handshake.

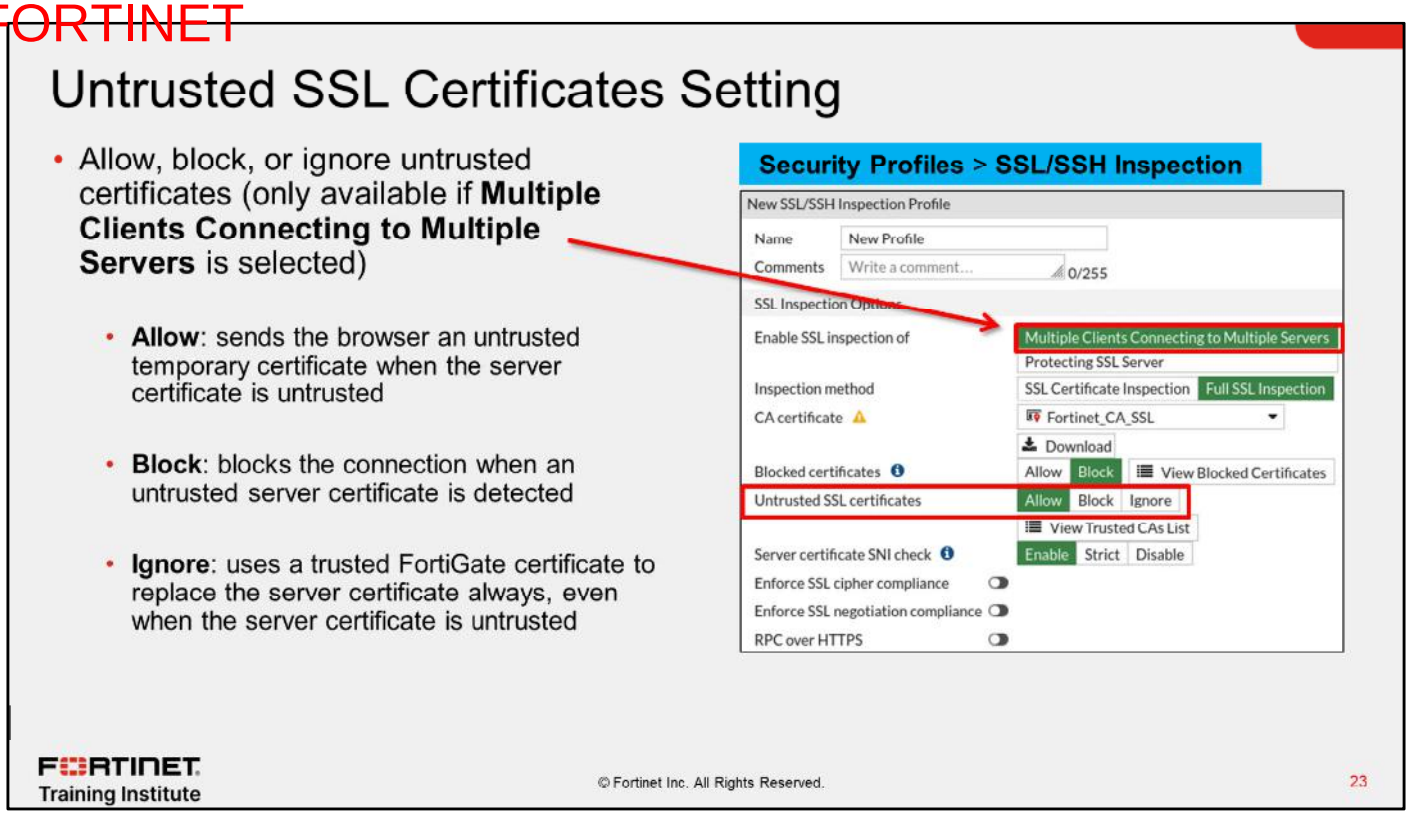
There are two possible configurations for full SSL inspection: one for outbound traffic and one for inbound traffic.

If the connection request is outbound (initiated by an internal client to an external server), you must select the option, **Multiple Clients Connecting to Multiple Servers**. Then, you must select the CA certificate that will be used to sign the new certificates. In the example shown on this slide, it is the built-in **FortiGate_CA_SSL** certificate, which is available on FortiGate devices that support SSL inspection. You will also learn about configuring full SSL inspection for inbound traffic in this lesson.



In step 1, an internal web browser connects to an SSL-enabled web server. Normally, when a browser connects to a secure site, the web server sends its certificate to the browser. However, in step 2, FortiGate intercepts the web server certificate. In step 3, the FortiGate internal CA generates a new key pair and certificate. The new certificate subject name must be the DNS name of the website (for example, `ex.ca`). In steps 4 and 5, the new key pair and certificate are used to establish a secure connection between FortiGate and the web browser. A new temporary key pair and certificate are generated each time a client requests a connection with an external SSL server.

Outward facing and included in step 5, FortiGate uses the web server certificate to initiate a secure session with the web server. In this configuration, FortiGate can decrypt the data from both the web server and the browser, in order to scan the data for threats before re-encrypting it and sending it to its destination. This scenario is, essentially, an MITM attack.

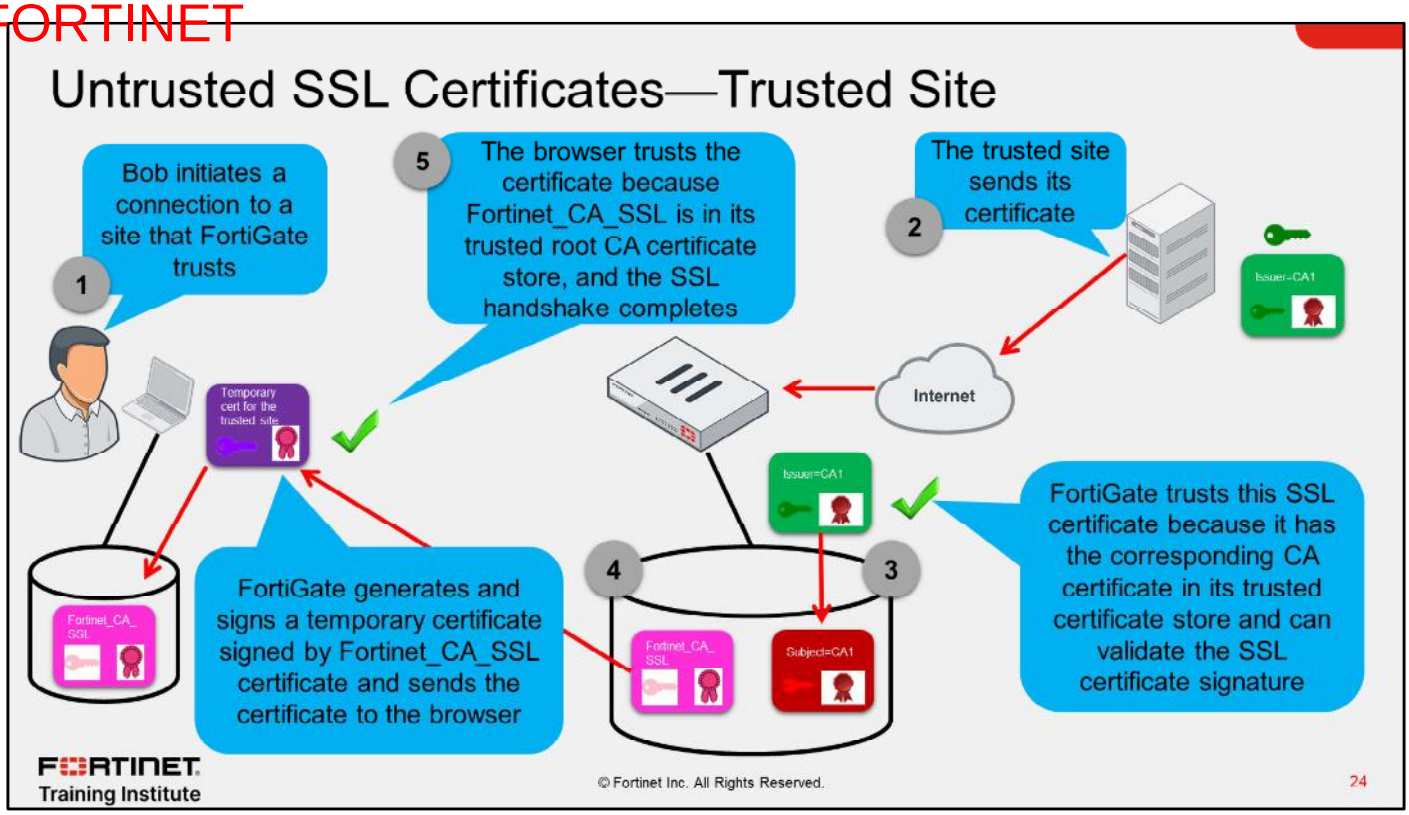


The browser presents a certificate warning when you attempt to access an HTTPS site that uses an untrusted certificate. Untrusted certificates include self-signed SSL certificates, unless the certificate is imported into the browser-trusted certificate store. FortiGate has its own configuration setting on the **SSL/SSH Inspection** page, which includes options to **Allow**, **Block**, or **Ignore** untrusted SSL certificates.

When you set the **Untrusted SSL certificates** setting to **Allow** and FortiGate detects an untrusted SSL certificate, FortiGate generates a temporary certificate signed by the built-in Fortinet_CA_Untrusted certificate. FortiGate then sends the temporary certificate to the browser, which presents a warning to the user indicating that the site is untrusted. If FortiGate receives a trusted SSL certificate, then it generates a temporary certificate signed by the built-in Fortinet_CA_SSL certificate and sends it to the browser. If the browser trusts the Fortinet_CA_SSL certificate, the browser completes the SSL handshake. Otherwise, the browser also presents a warning message informing the user that the site is untrusted. In other words, for this function to work as intended, you must import the Fortinet_CA_SSL certificate into the trusted root CA certificate store of your browser. The Fortinet_CA_Untrusted certificate must not be imported.

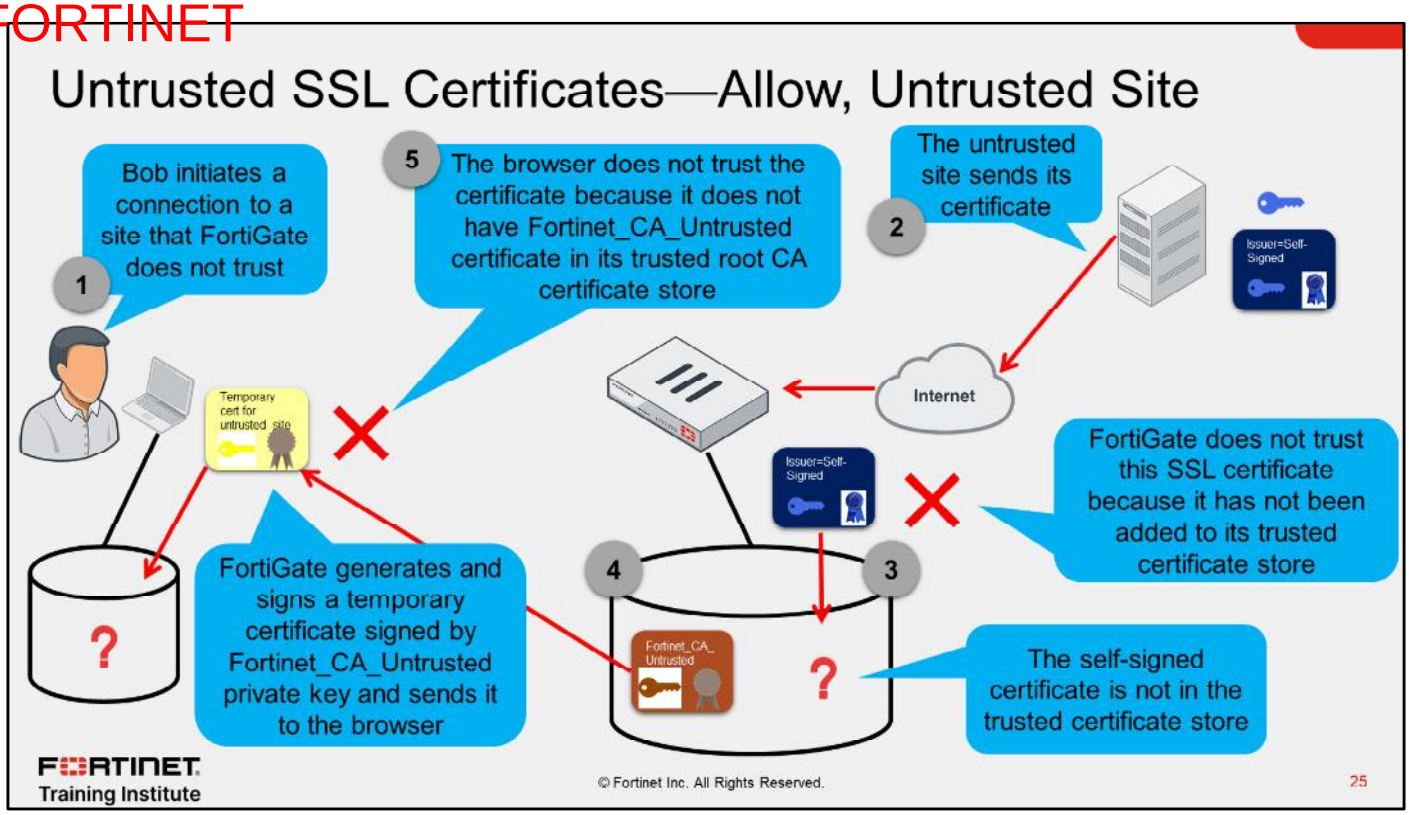
When the setting is set to **Block** and FortiGate receives an untrusted SSL certificate, FortiGate blocks the connection outright, and the user cannot proceed.

When the setting is set to **Ignore**, FortiGate sends the browser a temporary certificate signed by the Fortinet_CA_SSL certificate, regardless of the SSL certificate status—trusted or untrusted. FortiGate then proceeds to establish SSL sessions.



The scenario shown on this slide describes how FortiGate handles a trusted external site regardless of the **Untrusted SSL Certificate** setting.

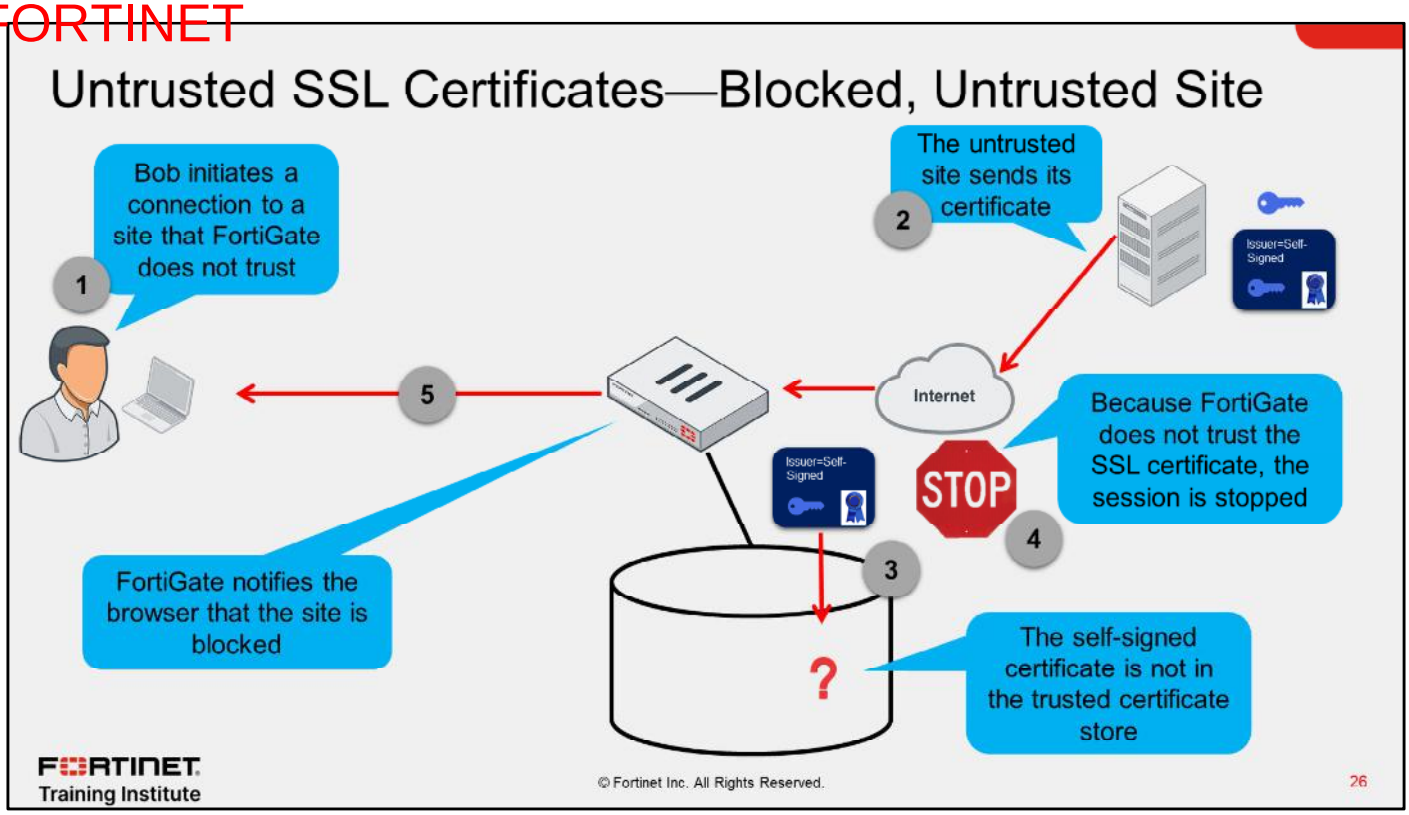
In step 1, the browser initiates a connection with an external site that is trusted by FortiGate. In step 2, the trusted server sends its SSL certificate to FortiGate. In step 3, FortiGate trusts the certificate because it has the corresponding CA certificate in its trusted certificate store. FortiGate can validate the signature on the SSL certificate. In step 4, because FortiGate trusts the SSL certificate, it generates a temporary certificate signed by the Fortinet_CA_SSL certificate. FortiGate sends the temporary certificate to the browser. Finally, in step 5, the browser trusts the temporary certificate because the Fortinet_CA_SSL certificate is in its trusted root CA store. After the browser finishes validating the certificate, it completes the SSL handshake with FortiGate. Next, FortiGate continues the SSL handshake with the trusted server.



The scenario shown on this slide describes how FortiGate handles an untrusted external site when **Untrusted SSL Certificate** is set to **Allow**.

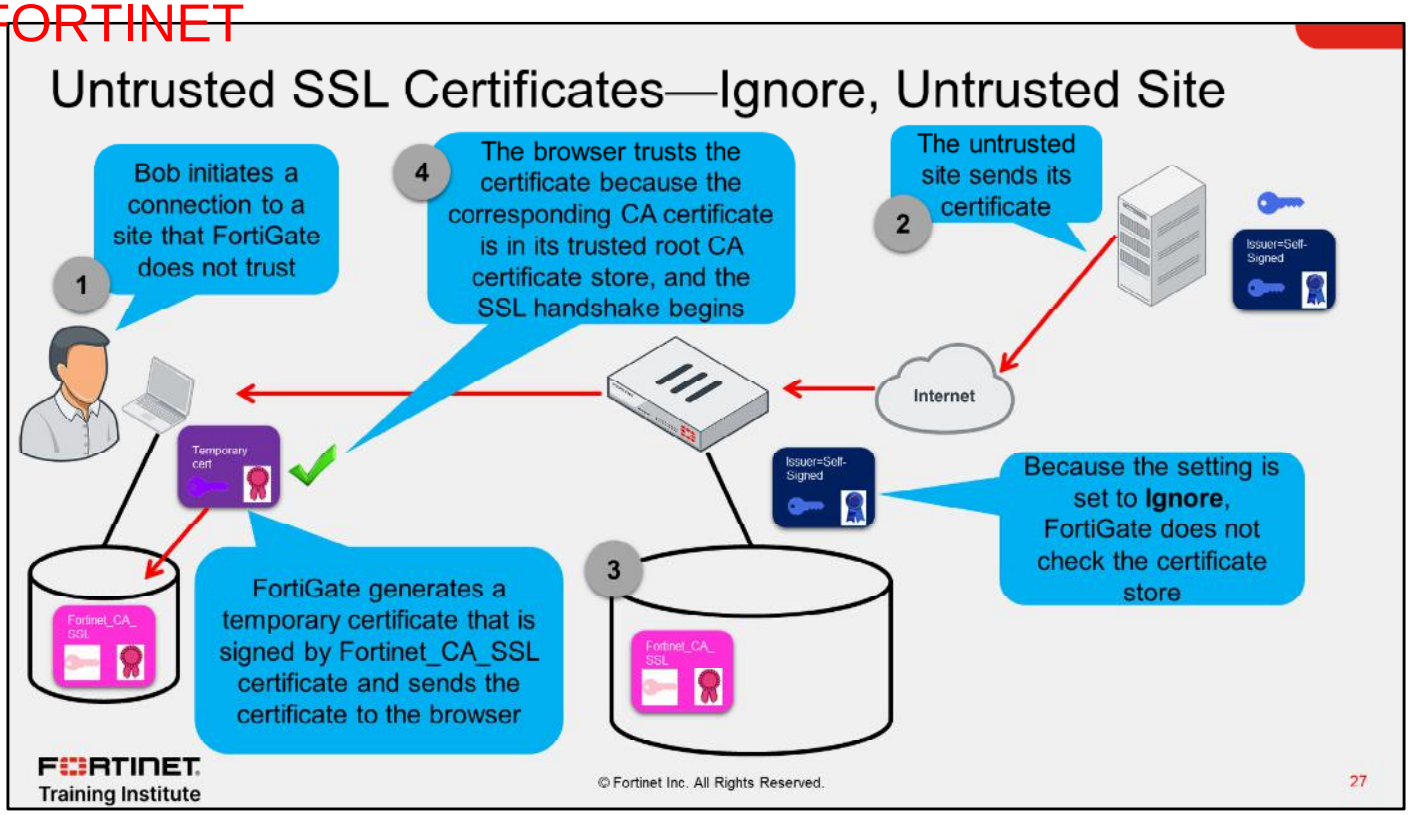
In step 1, the browser initiates a connection with an external site that is *not* trusted by FortiGate. In step 2, the untrusted server sends its self-signed SSL certificate to FortiGate. In step 3, FortiGate does not find a copy of the certificate in its trusted certificate store and, therefore, does not trust the SSL certificate. In step 4, because FortiGate does not trust the SSL certificate, it generates a temporary certificate signed by the Fortinet_CA_Untrusted certificate. This temporary certificate is sent to the browser. In step 5, the browser does not trust the temporary certificate because it does not have the Fortinet_CA_Untrusted certificate in its trusted root CA store. The browser displays a warning alerting the user that the certificate is untrusted. If the user decides to ignore the warning and proceed, the browser completes the SSL handshake with FortiGate. Next, FortiGate continues the SSL handshake with the untrusted server.

The user may have the option to write this temporary certificate to the browser trusted certificate store. However, this has no impact in the future. The next time the user connects to the same untrusted site, a new temporary certificate is produced for the session.



The scenario shown on this slide describes how FortiGate handles an untrusted external site when **Untrusted SSL Certificate** is set to **Block**.

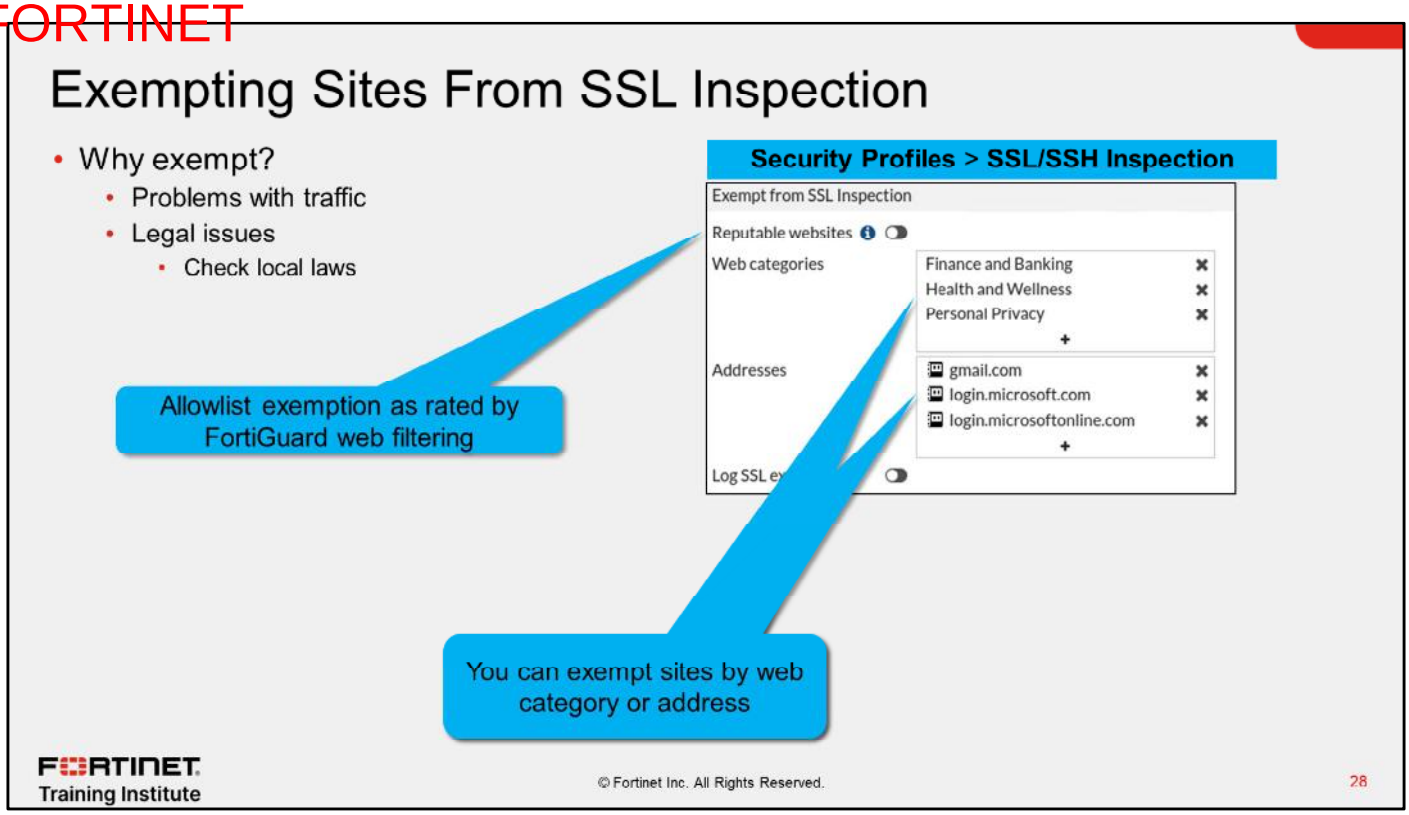
In step 1, the browser initiates a connection with an external site that is *not* trusted by FortiGate. In step 2, the untrusted server sends its self-signed SSL certificate to FortiGate. In step 3, FortiGate does not find the certificate in its trusted certificate store and, therefore, does not trust the SSL certificate. In step 4, because FortiGate does not trust the SSL certificate, it stops the session. In step 5, FortiGate notifies the browser that the site is blocked.



The scenario shown on this slide describes how FortiGate handles an untrusted external site when **Untrusted SSL Certificate** is set to **Ignore**.

In step 1, the browser initiates a connection with an external site that is *not* trusted by FortiGate. In step 2, the untrusted server sends its self-signed SSL certificate to FortiGate. Because the setting is set to **Ignore**, FortiGate does not check the certificate store. In step 3, FortiGate generates a temporary certificate signed by Fortinet_CA_SSL certificate, and sends the certificate to the browser. In step 4, the browser trusts the certificate because Fortinet_CA_SSL certificate is in its trusted root CA store. After the browser finishes checking the certificate, it completes the SSL handshake with FortiGate. Next, FortiGate continues the SSL handshake with the untrusted server.

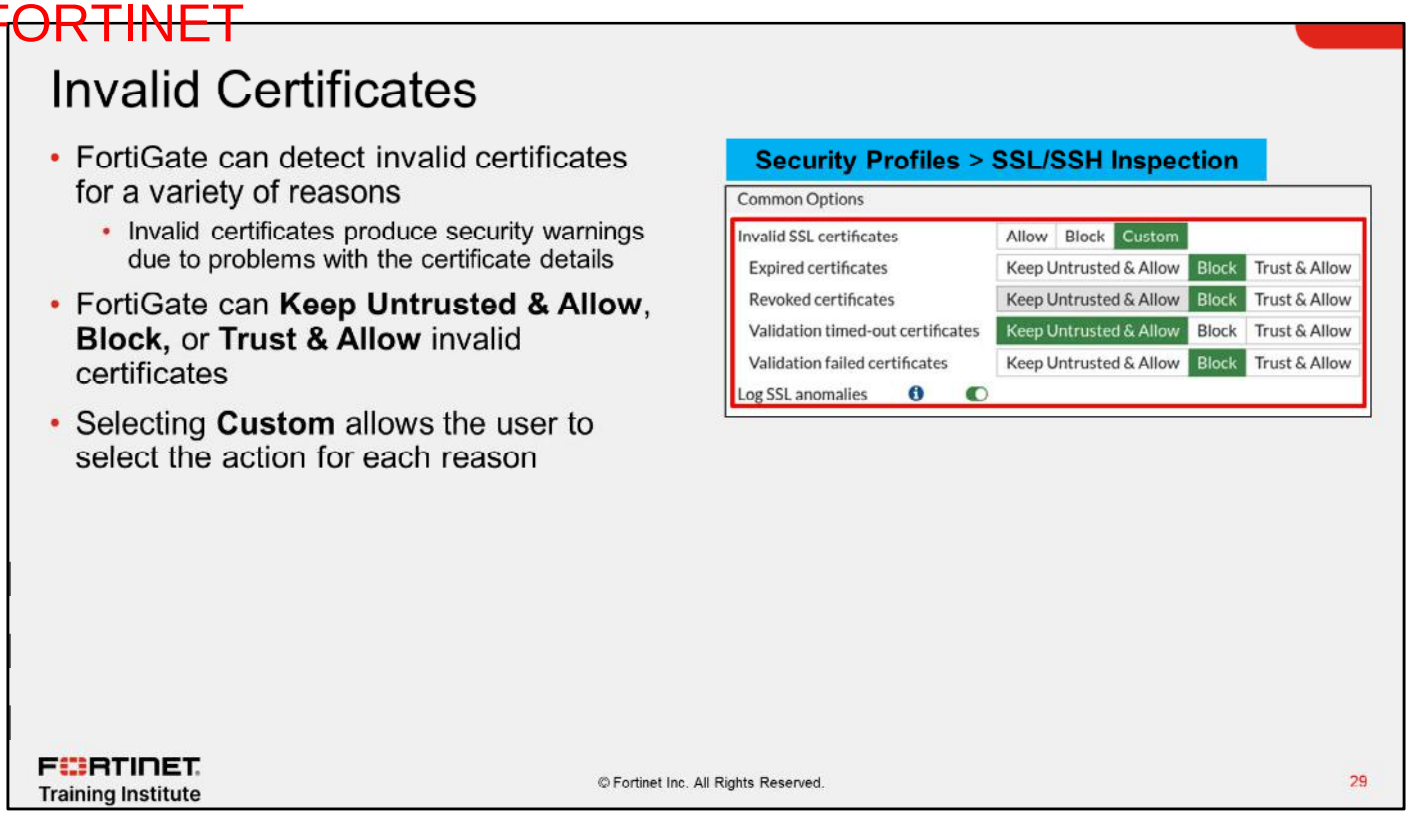
A connection to a trusted site is handled the same way.



Within the full SSL inspection profile, you can also specify which SSL sites, if any, you want to exempt from SSL inspection. You may need to exempt traffic from SSL inspection if it is causing problems with traffic, or for legal reasons.

Performing SSL inspection on a site that is enabled with HTTP public key pinning (HPKP), for example, can cause problems with traffic. Remember, the only way for FortiGate to inspect encrypted traffic is to intercept the certificate coming from the server, and generate a temporary one. After FortiGate presents the temporary SSL certificate, browsers that use HPKP refuse to proceed. The SSL inspection profile, therefore, allows you to exempt specific traffic.

Laws protecting privacy might be another reason to bypass SSL inspection. For example, in some countries, it is illegal to inspect SSL bank-related traffic. Configuring an exemption for sites is simpler than setting up firewall policies for each individual bank. You can exempt sites based on their web category, such as finance or banking, or you can exempt them based on their address. Alternatively, you can enable **Reputable websites**, which excludes an allowlist of reputable domain names maintained by FortiGuard from full SSL inspection. This list is periodically updated and downloaded to FortiGate devices through FortiGuard.



FortiGate can detect certificates that are invalid for the following reasons:

- Expired: The certificate is expired.
- Revoked: The certificate has been revoked based on CRL or OCSP information.
- Validation timeout: The certificate could not be validated because of a communication timeout.
- Validation failed: The certificate could not be validated because of a communication error.

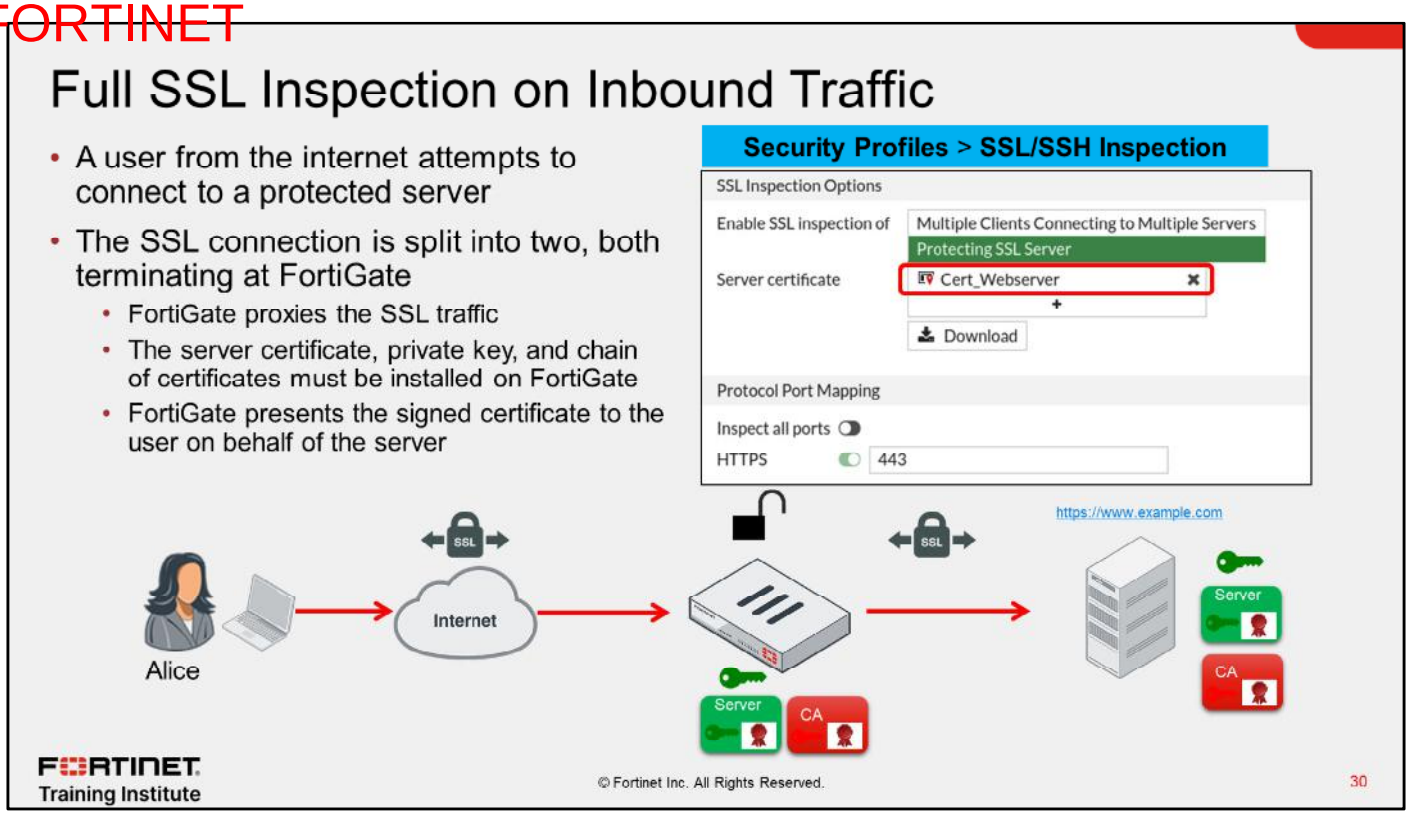
When a certificate fails for any of the reasons above, you can configure any of the following actions:

- **Keep untrusted & Allow**: FortiGate allows the website and lets the browser decide the action to take. FortiGate takes the certificate as *trusted*.
- **Block**: FortiGate blocks the content of the site.
- **Trust & Allow**: FortiGate allows the website and takes the certificate as *trusted*.

The certificate check feature can be broken down into two major checks, which are done in parallel:

- FortiGate checks if the certificate is invalid because of the four reasons described on this slide.
- FortiGate performs certificate chain validation based on the CA certificates installed locally and the certificates presented by the SSL server. This is described in this lesson.

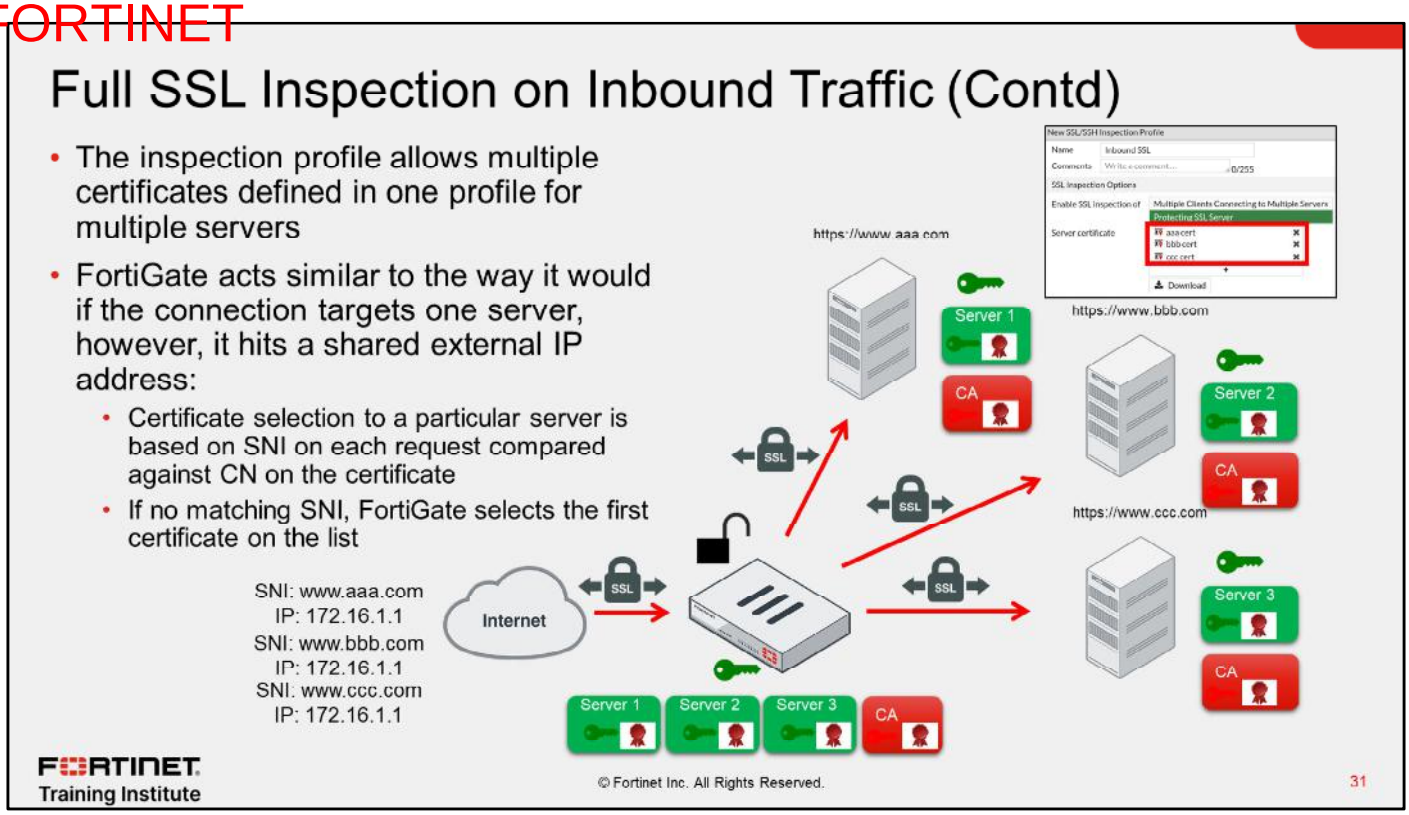
Based on the actions configured and the check results, FortiGate presents the certificate as either trusted (signed by Fortinet_CA_SSL) or untrusted (signed by Fortinet_CA_Untrusted), and either allows the content or blocks it. You can also track certificate anomalies by enabling the **Log SSL anomalies** option.



In the example shown on this slide, FortiGate is protecting a web server. This is the second configuration option for full SSL inspection. When configuring the SSL inspection profile for this server, you must select **Protecting SSL Server**, import the server key pair to FortiGate, and then select the certificate from the **Server Certificate** drop-down list.

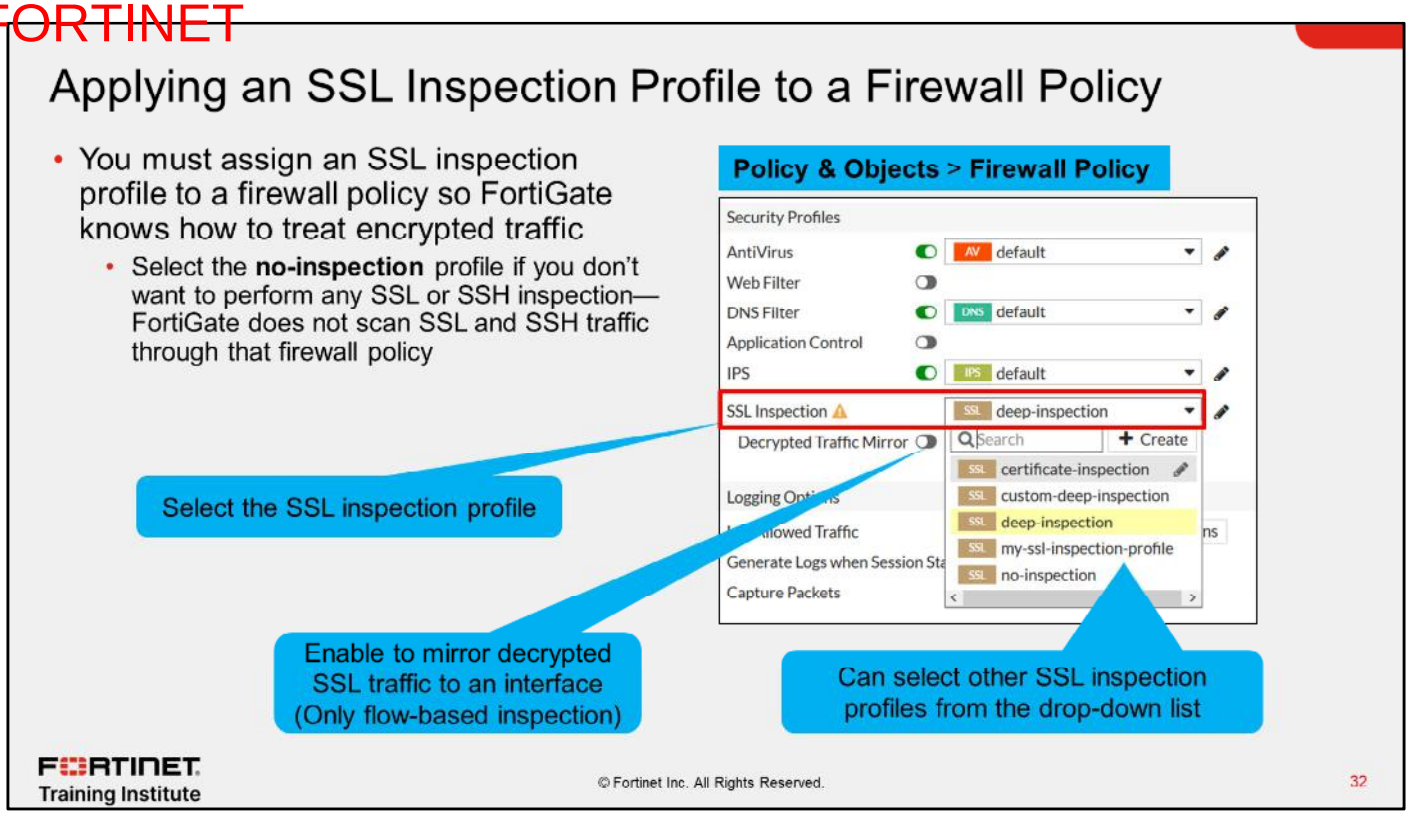
When Alice attempts to connect to the protected server, FortiGate becomes a surrogate web server by establishing the secure connection with the client using the server key pair. FortiGate also establishes a secure connection with the server, but acting as a client. This configuration allows FortiGate to decrypt the data from either direction, scan it, and if it is clean, re-encrypt it and send it to the intended recipient.

You must install the server certificate and private key plus the chain of certificates required to build the chain of trust. FortiGate sends the chain of certificates to the browser for this purpose.



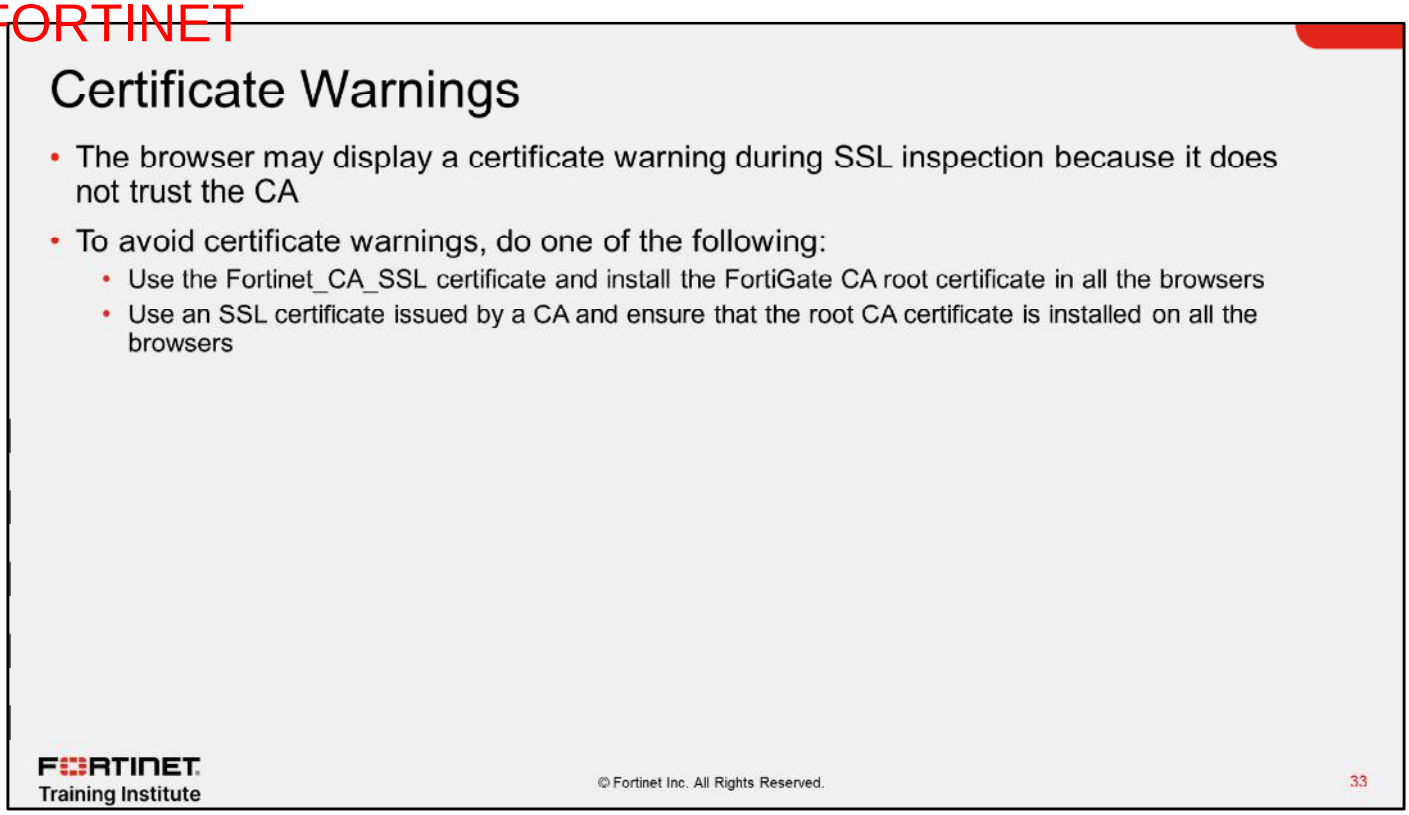
By creating a full SSL inspection profile on inbound traffic, you can configure the profile to use multiple web sites if they are approachable by the same external IP address. When FortiGate receives client and server hello messages, it selects the certificate to perform the full SSL inspection based on server name indication (SNI) value against the common name (CN) on the certificate part of the inspection profile. If a certificate CN matches the SNI on the request, FortiGate then selects this certificate to replace the original certificate and uses it to inspect the traffic.

If the SNI does not match the CN in the certificate list in the SSL profile, then FortiGate selects the first server certificate in the list.



After you create and configure an SSL inspection profile, you must assign it to a firewall policy so FortiGate knows how to inspect encrypted traffic. Most of the internet traffic is being encrypted nowadays. For this reason, you usually want to enable SSL inspection to protect your network from security threats transported over encrypted traffic. If you don't want to enable SSL or SSH inspection, select the **no-inspection** profile from the drop-down list. If SSL inspection is not enabled in a policy, FortiGate will not scan SSL or SSH encrypted traffic matching that policy.

If you select a profile with full SSL inspection enabled, the option **Decrypted Traffic Mirror** appears. Enable this option if you want FortiGate to send a copy of the decrypted SSL traffic to an interface, it only works with flow-based inspection. When you enable **Decrypted Traffic Mirror**, FortiGate displays a window with the terms of use for this feature. The user must agree with the terms before they can use the feature.

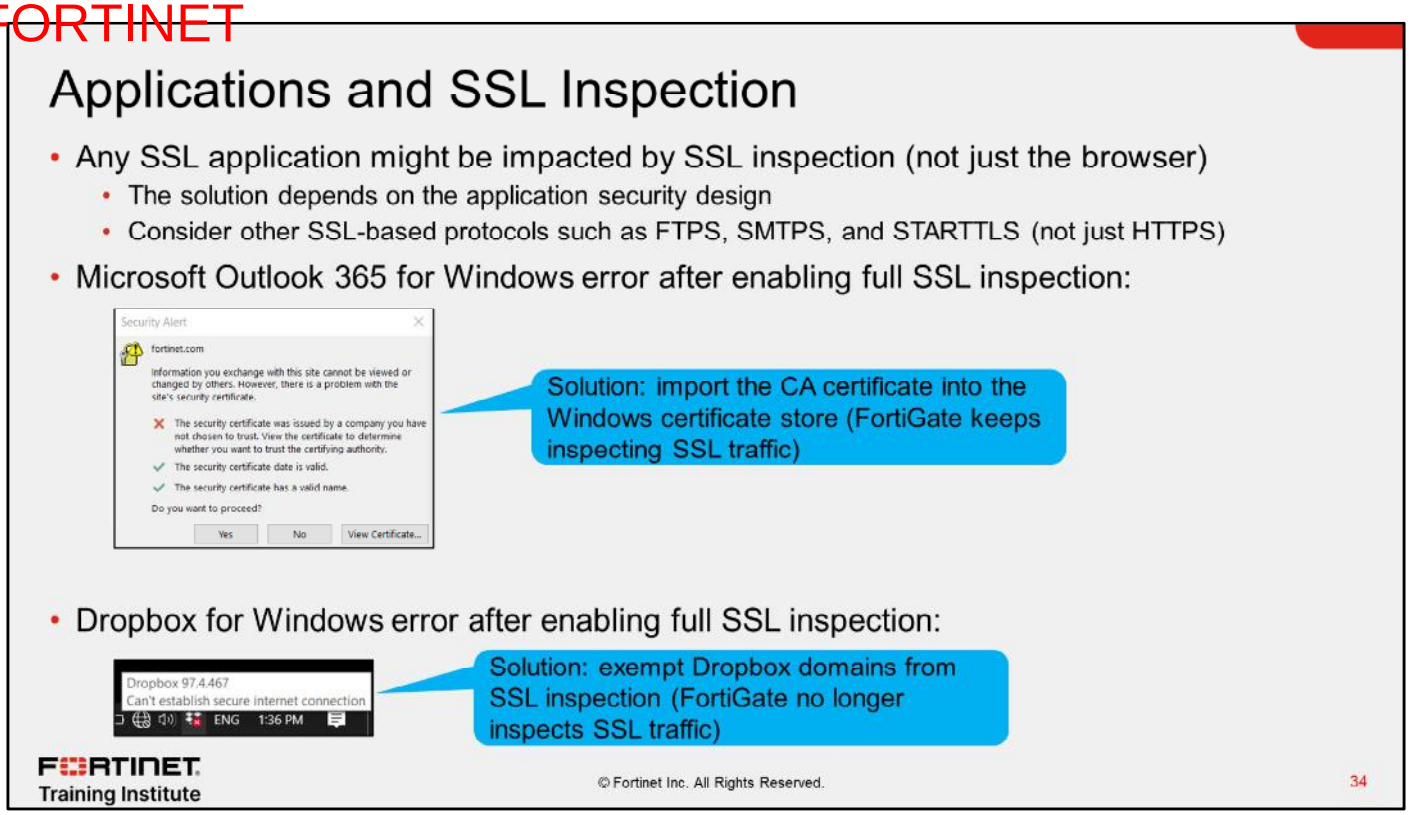


When doing full SSL inspection using the FortiGate self-signed CA, your browser displays a certificate warning each time you connect to an HTTPS site. This is because the browser is receiving certificates signed by FortiGate, which is a CA it does not know and trust. The browser also displays a certificate warning when performing SSL certificate inspection and an HTTPS website is blocked by FortiGate. Because FortiGate needs to present a replacement message to the browser, FortiGate performs MITM and signs the certificate with its self-signed CA as well.

You can avoid this warning by doing one of the following:

- Download the Fortinet_CA_SSL certificate and install it on all the workstations as a trusted root authority.
- Use an SSL certificate issued by a CA and ensure the certificate is installed in the necessary browsers.

You must install the SSL certificate on FortiGate and configure the device to use that certificate for SSL inspection. If the SSL certificate is signed by a subordinate CA, ensure that the entire chain of certificates—from the SSL certificate to the root CA certificate—is installed on FortiGate. Verify that the root CA is installed on all client browsers. This is required for trust purposes. Because FortiGate sends the chain of certificates to the browser during the SSL handshake, you do not have to install the intermediate CA certificates on the browsers.

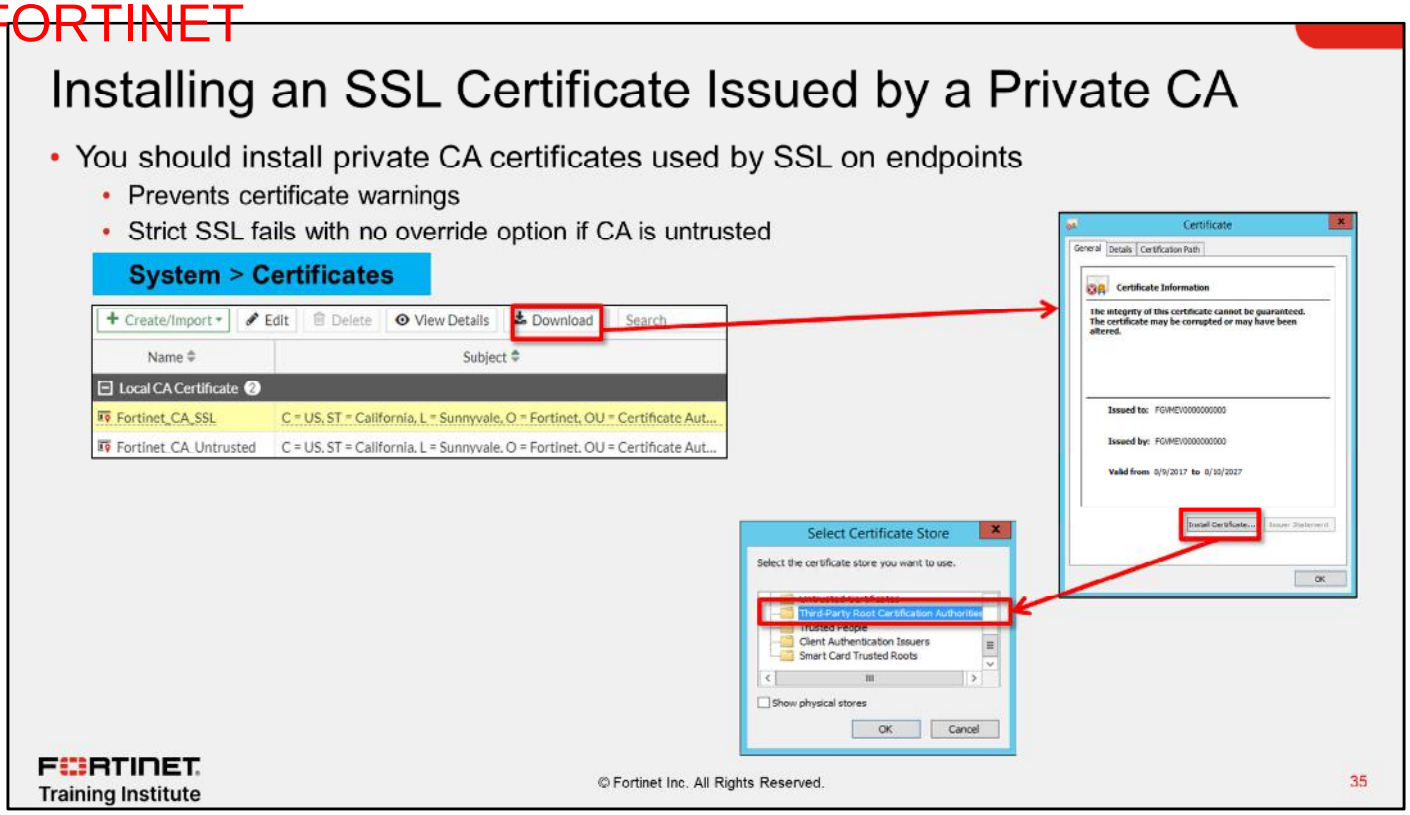


More and more applications are using SSL to securely exchange data over the internet. While most of the content in this lesson centers around the operation and impact of SSL inspection on browsers, the same applies to other applications using SSL as well. After all, the browser is just another application using SSL on your device.

For this reason, when you enable SSL inspection on FortiGate, you need to consider the potential impact on your SSL-based applications. For example, Microsoft Outlook 365 for Windows reports a certificate error when you enable full SSL inspection because the CA certificate used by FortiGate is not trusted. To solve this issue, you can import the CA certificate into your Windows certificate store as a trusted root certificate authority. Because Microsoft Outlook 365 trusts the certificates in the Windows certificate store, then the application won't report the certificate error anymore. Another option is to exempt your Microsoft Exchange server addresses from SSL inspection. While this prevents the certificate error, you are no longer performing SSL inspection on email traffic.

There are other applications that have built-in extra security checks that prevent MITM attacks, such as HPKP or certificate pinning. For example, Dropbox uses certificate pinning to ensure that no SSL inspection is possible on user traffic. As a result, when you enable full SSL inspection on FortiGate, your Dropbox client stops working and reports that it can't establish a secure connection. In the case of Dropbox, the only way to solve the connection error is by exempting the domains Dropbox connects to from SSL inspection.

In addition, remember that SSL is leveraged by different protocols, not just HTTP. For example, there are other SSL-based protocols such as FTPS, POP3S, SMTPS, STARTTLS, LDAPS, and SIP TLS. If you have an application using any of these SSL-based protocols, and you have turned on SSL inspection along with a security profile that inspects those protocols, then the applications may report an SSL or certificate error. The solution depends on the security measures adopted by the application.



If you are using an SSL certificate issued by a private CA, you must install the CA certificate in the list of trusted CAs. If you fail to do this, a warning message appears in your web browser any time you access an HTTPS website. Encrypted communications might also fail, simply because the CA that issued and signed the certificate is untrusted.

After you download the SSL certificate from FortiGate, you can install it on any web browser or operating system. Not all browsers use the same certificate repository. For example, Firefox uses its own repository, while Internet Explorer and Chrome store certificates in a system-wide repository. In order to prevent certificate warnings, you must install the SSL certificate as a trusted root CA.

When you install the certificate, make sure that you save it to the certificate store for root authorities.

Knowledge Check

1. Which certificate extension and value is required in the FortiGate CA certificate in order to enable full SSL inspection?
   - A. CRL DP=ca_arl.arl
   - ✓ B. cA=True

2. Which configuration requires FortiGate to act as a CA for full SSL inspection?
   - ✓ A. Multiple clients connecting to multiple servers
   - B. Protecting the SSL server

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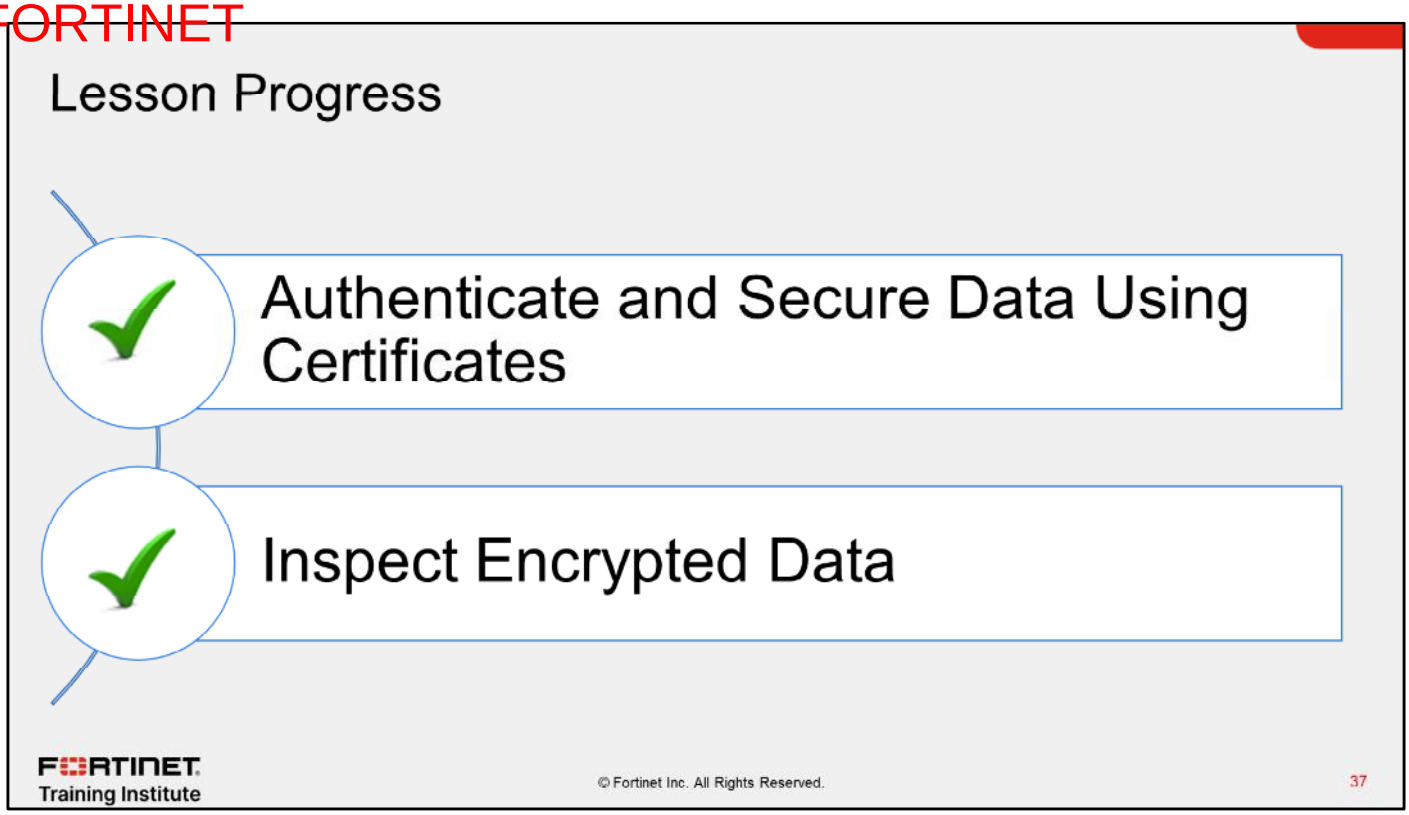
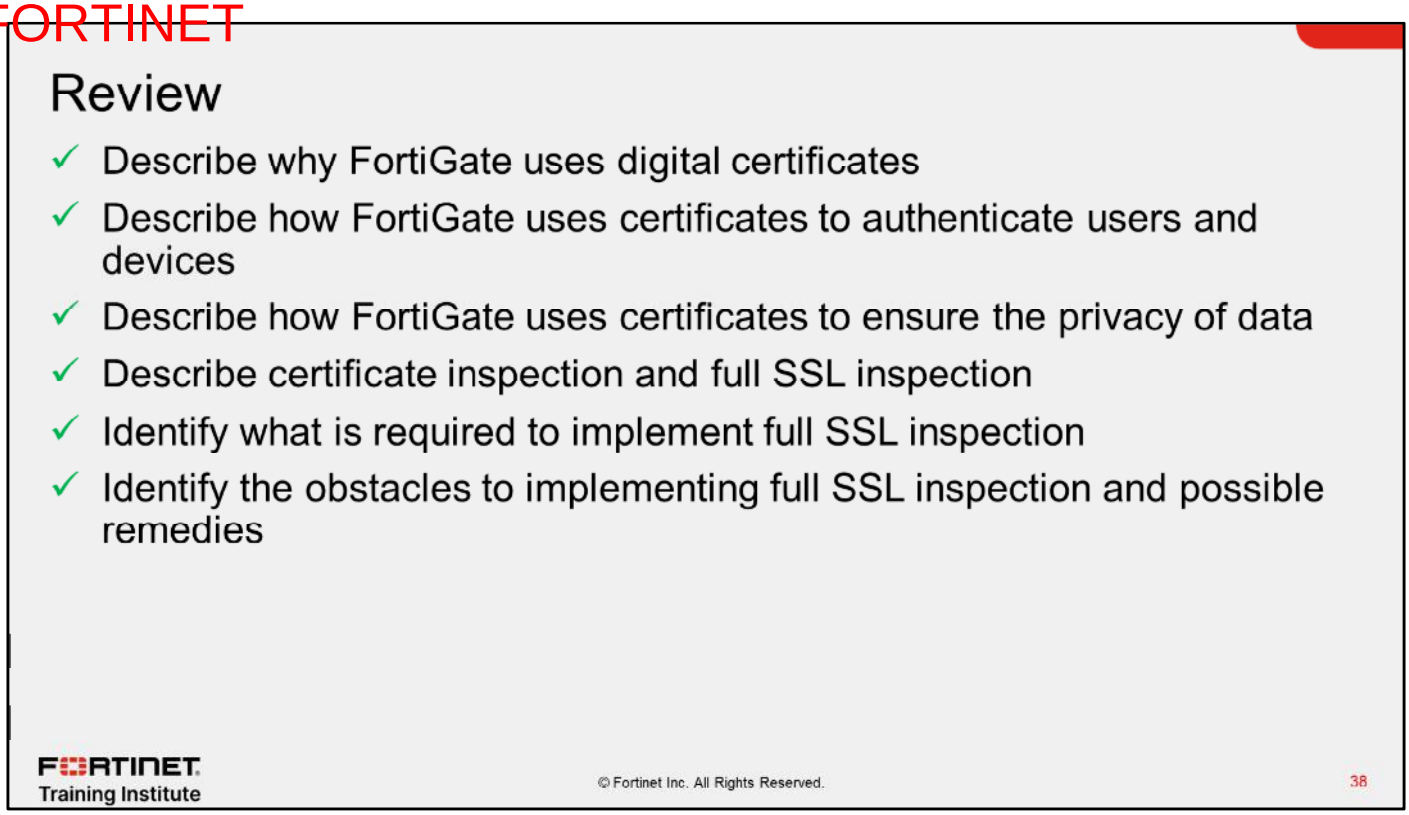


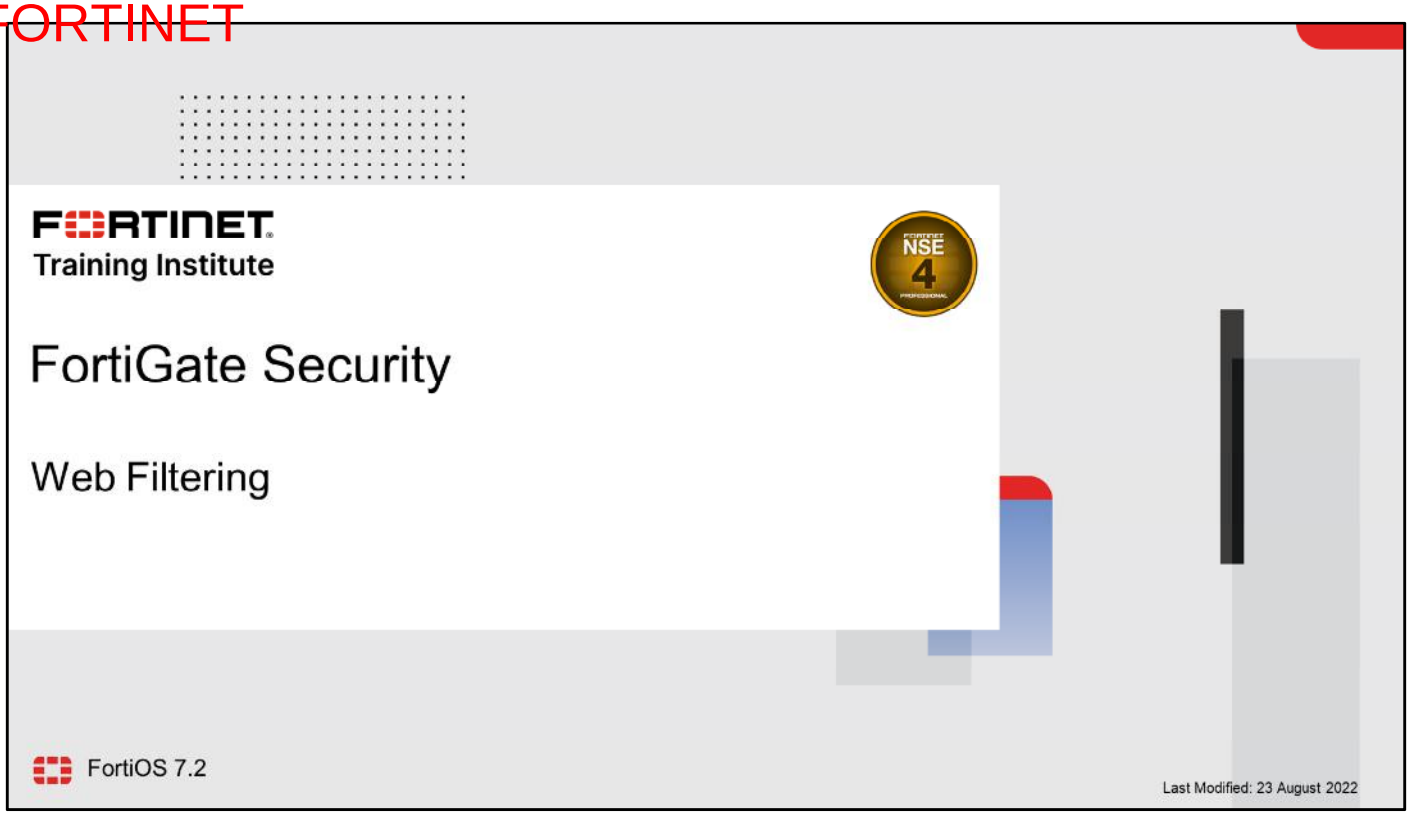
Congratulations! You have completed this lesson.

Now, you will review the objectives that you covered in this lesson.

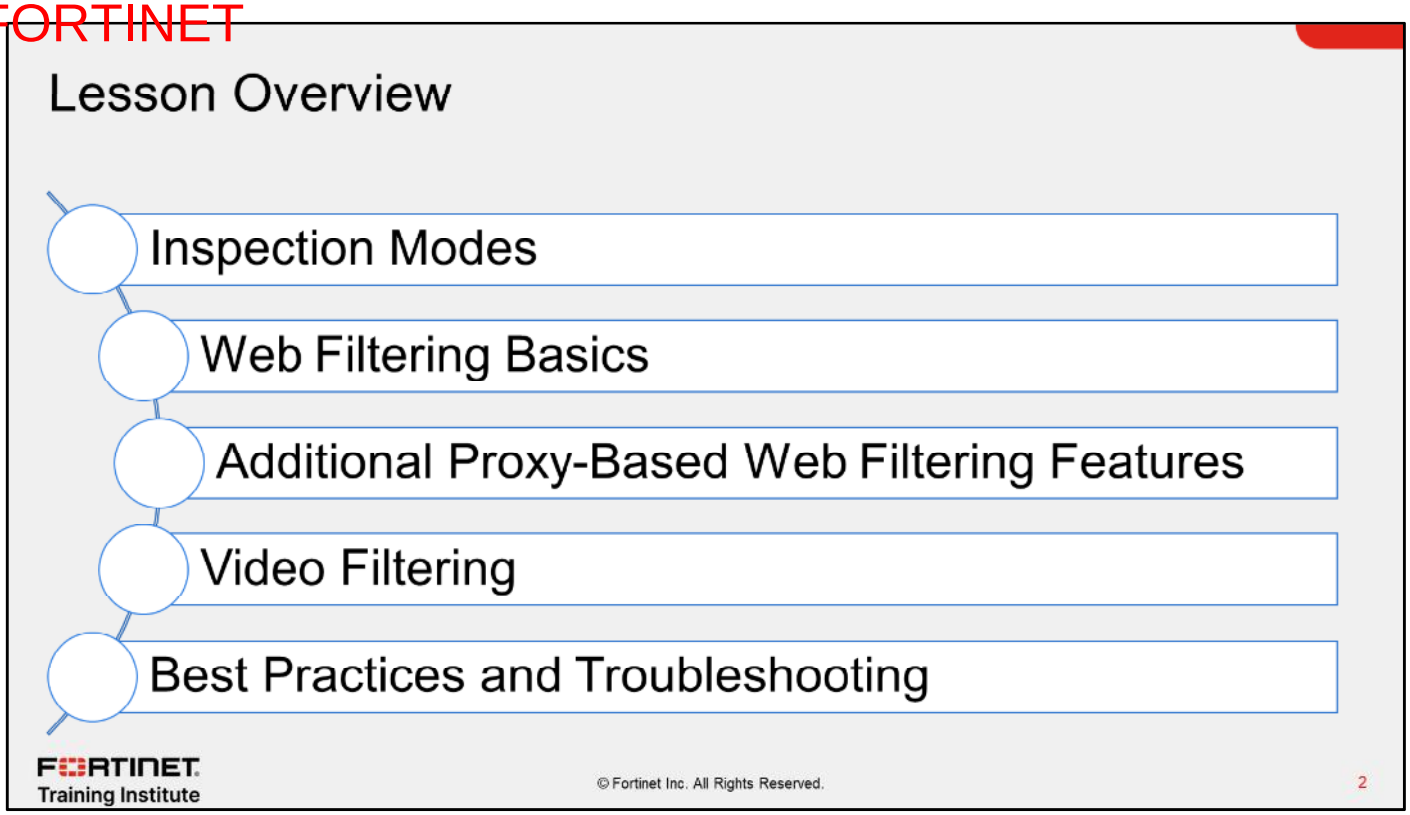


This slide shows the objectives that you covered in this lesson.

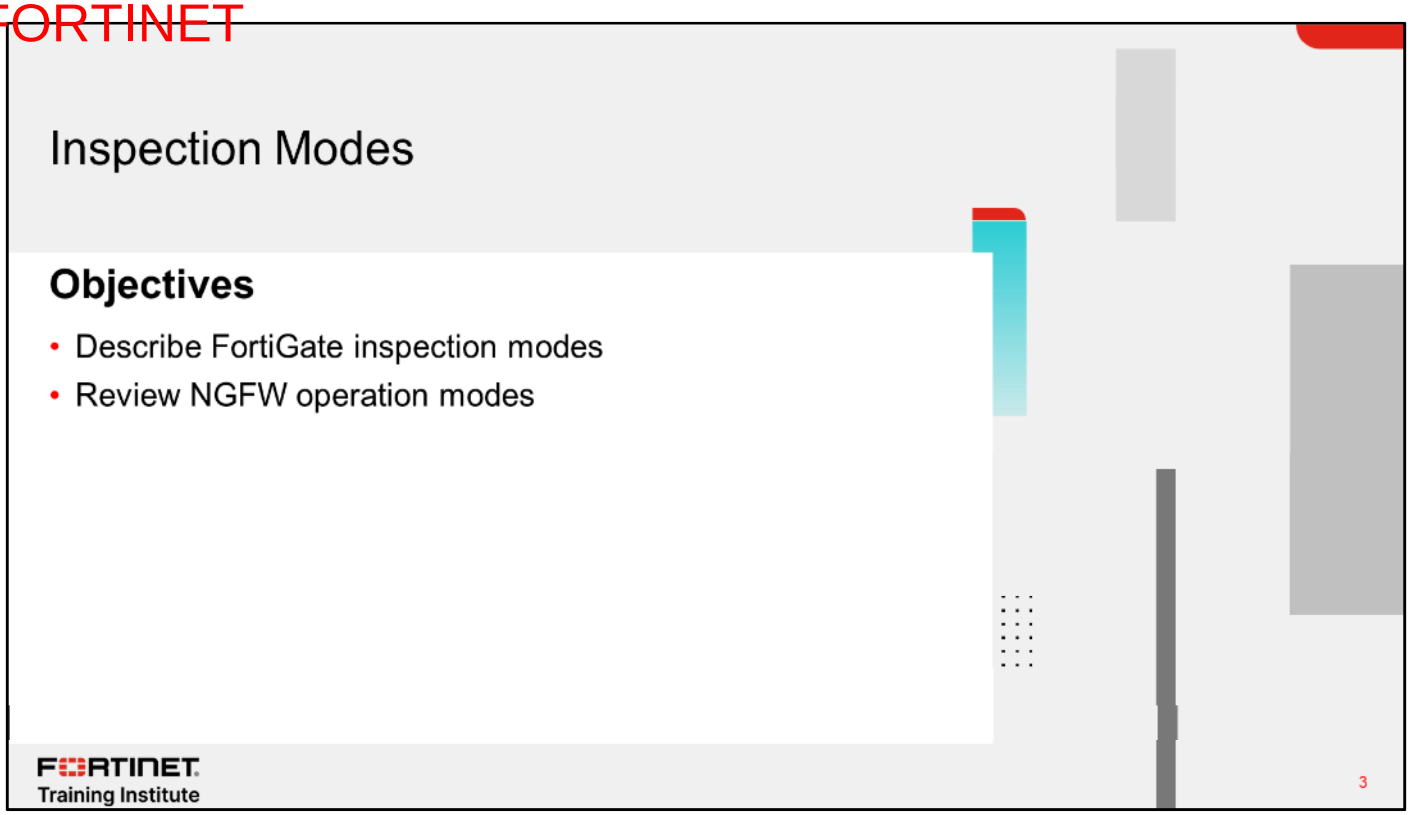
By mastering the objectives covered in this lesson, you learned how FortiGate uses certificates, and how to manage and work with certificates in your network.



In this lesson, you will learn how to configure web filtering on FortiGate to control web traffic in your network.

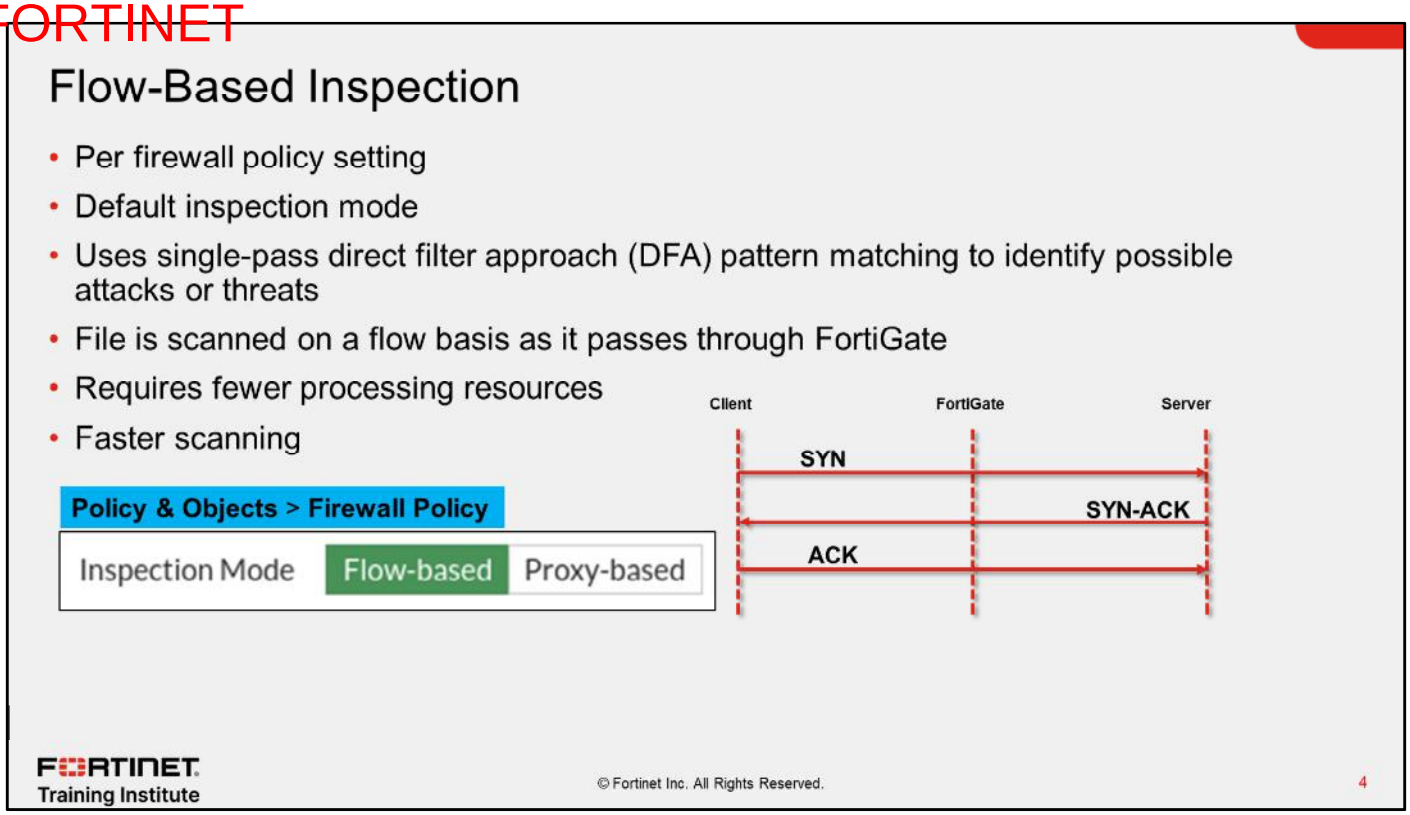


In this lesson, you will learn about the topics shown on this slide.



After completing this section, you should be able to achieve the objectives shown on this slide.

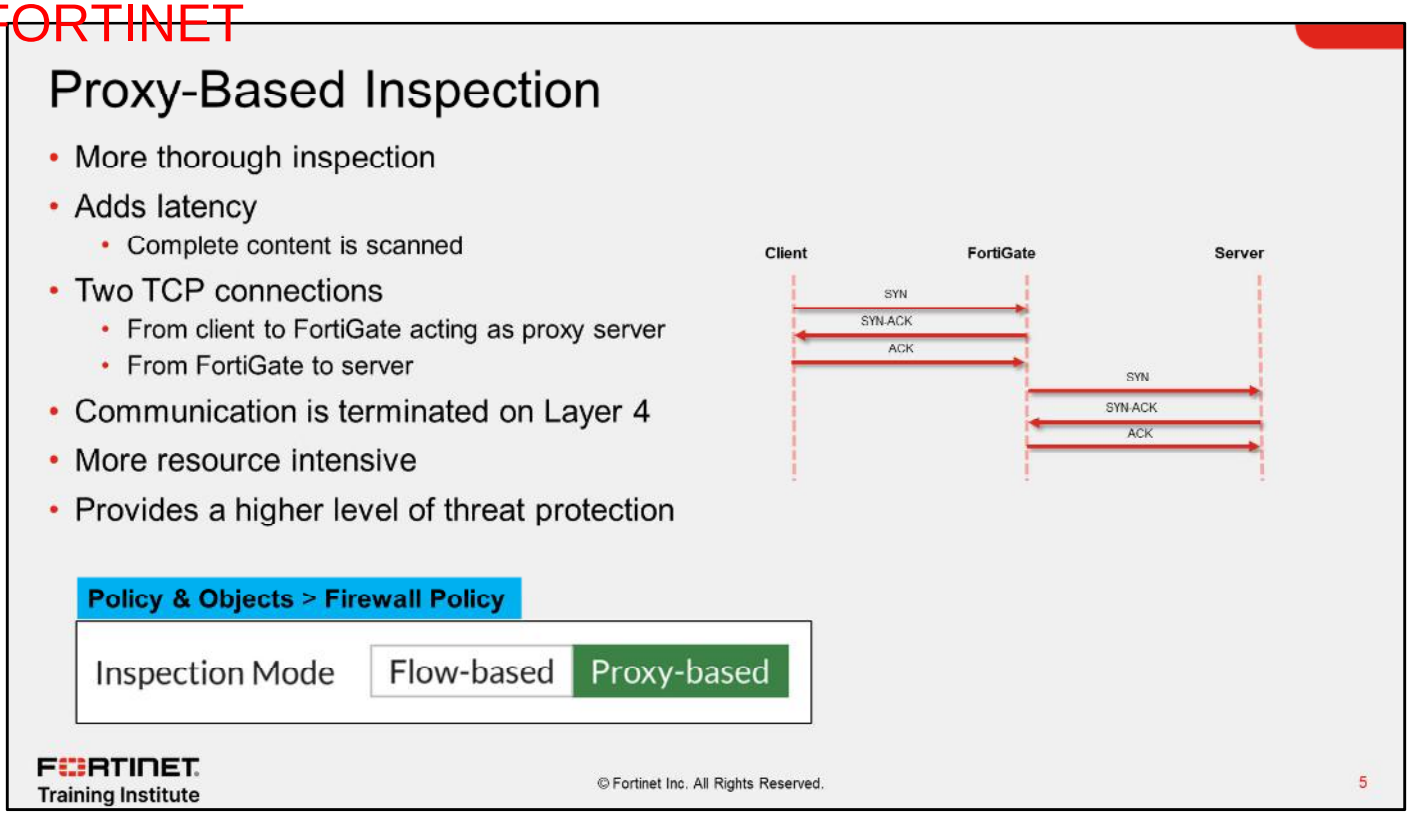
By demonstrating competence in understanding inspection modes, you will be able to implement the appropriate inspection modes to support the desired security profiles.



Flow-based inspection mode examines the file as it passes through FortiGate, without any buffering. As each packet arrives, it is processed and forwarded without waiting for the complete file or web page. If you are familiar with the TCP flow analysis of Wireshark, then that is essentially what the flow engine sees. Packets are analyzed and forwarded as they are received. Original traffic is not altered. Therefore, advanced features that modify content, such as safe search enforcement, are not supported.

The advantages of flow-based mode are:
- The user sees a faster response time for HTTP requests compared to proxy based
- There is less chance of a time-out error because of the server at the other end responding slowly

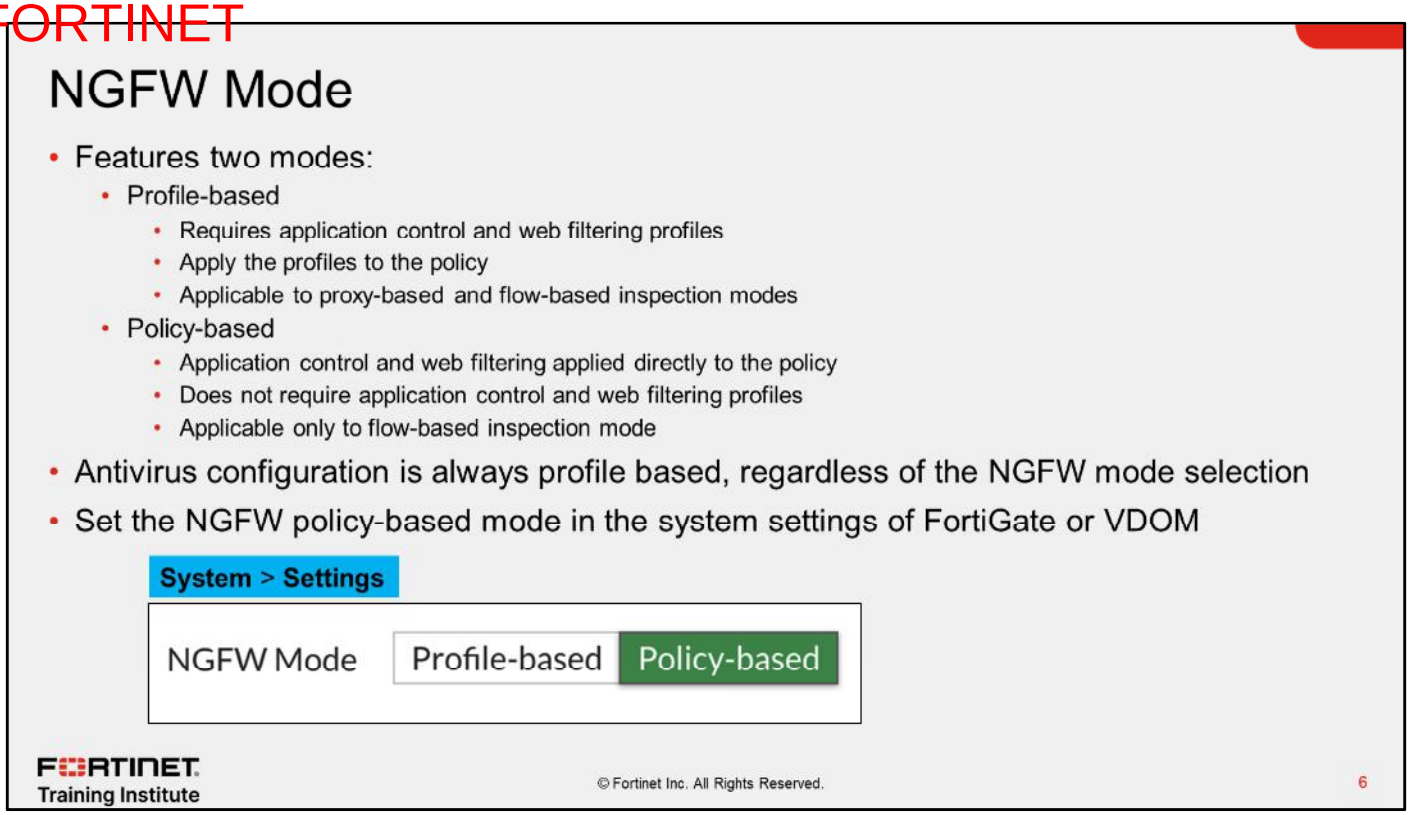
The disadvantages of flow-based mode are:
- A number of security features that are available in proxy-based mode are not available in flow-based mode
- Fewer actions are available based on the categorization of the website by FortiGuard services



Proxy-based scanning refers to transparent proxy. It's called transparent because, at the IP layer, FortiGate is not the destination address, but FortiGate *does* intercept the traffic. When proxy-based inspection is enabled, FortiGate buffers traffic and examines it *as a whole*, before determining an action. Because FortiGate examines the data as a whole, it can examine more points of data than it does when using flow-based inspection.

In TCP connections, the FortiGate proxy generates the SYN-ACK to the client, and completes the three-way handshake with the client, before creating a second, new connection to the server. If the payload is less than the oversize limit, the proxy buffers transmitted files or emails for inspection, before continuing transmission. The proxy analyzes the headers and may change the headers, such as HTTP host and URL, for web filtering. If a security profile decides to block the connection, the proxy can send a replacement message to the client. This adds latency to the overall transmission speed.

Proxy-based inspection is more thorough than flow-based inspection, yielding fewer false positives and negative results.

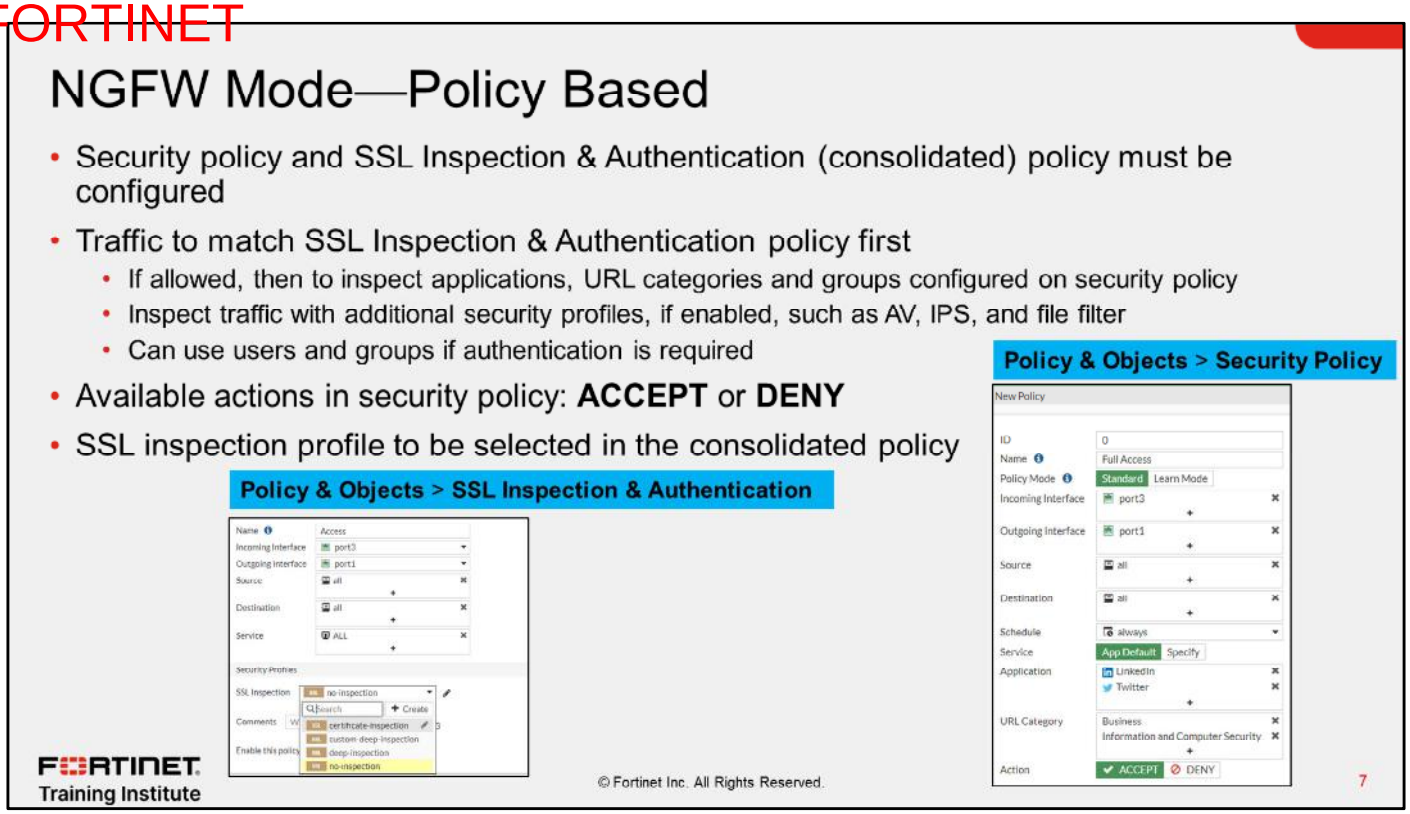


FortiGate, or the individual VDOM, has two next-generation firewall (NGFW) modes available:

1. Profile-based mode: Requires administrators to create and use application control and web filter profiles and apply them to a firewall policy. Profile-based mode is applicable to use flow-based or proxy-based inspection mode as per the policy.
2. Policy-based mode: Administrators can apply application control and web filter configuration directly to a security policy. Flow-based inspection mode is the only applicable process available in policy-based NGFW mode.

Antivirus scanning is available as a security profile that you can apply in a profile-based NGFW mode firewall policy or policy-based NGFW mode security policy.

You can change NGFW mode in the system settings of FortiGate or the individual VDOM. Note that the change will require you to remove all existing policies in either mode.



If you configured FortiGate to use NGFW policy-based mode or created a VDOM specifically to provide NGFW policy-based mode, you must configure a few policies to allow traffic.

SSL Inspection & Authentication (consolidated) policy: This policy allows traffic from a specific user or user group to match the criteria specified within the consolidated policy, and inspect SSL traffic using the SSL inspection profile selected. FortiGate can either accept or deny the traffic.

Security policy: If the traffic is allowed according to the consolidated policy, FortiGate then processes it based on the security policy to analyze additional criteria, such as URL categories, groups for web filtering, and application control. Also, if enabled, the security policy further inspects traffic using security profiles such as AV, IPS, and file filter.

Knowledge Check

1. How does NGFW policy-based mode differ from profile-based mode?
   - A. Policy-based flow inspection supports web profile overrides.
   - ✓ B. Policy-based flow inspection defines URL filters directly in the firewall policy.

2. Which statement about proxy-based web filtering is true?
   - ✓ A. It requires more resources than flow-based
   - B. It transparently analyzes the TCP flow of the traffic

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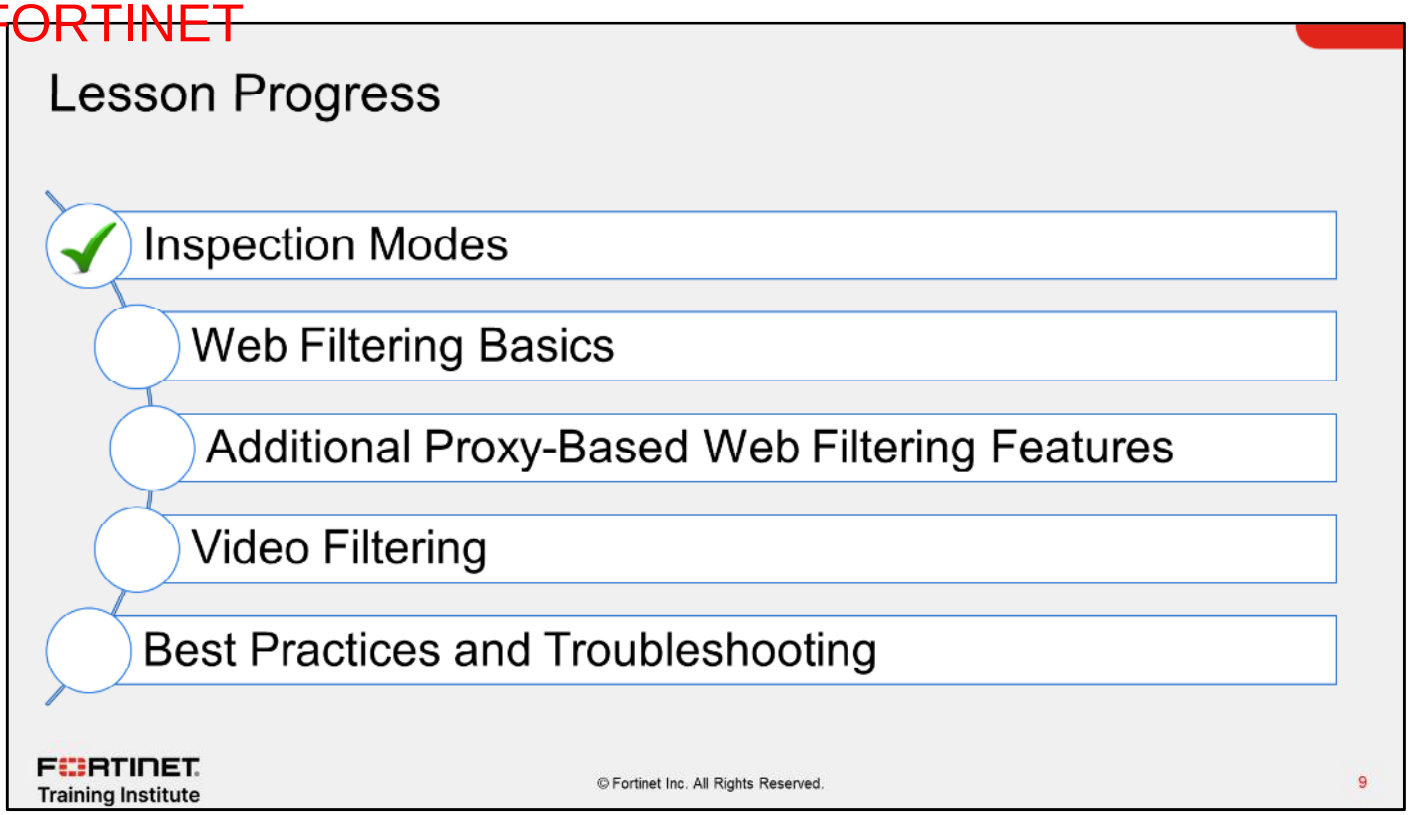
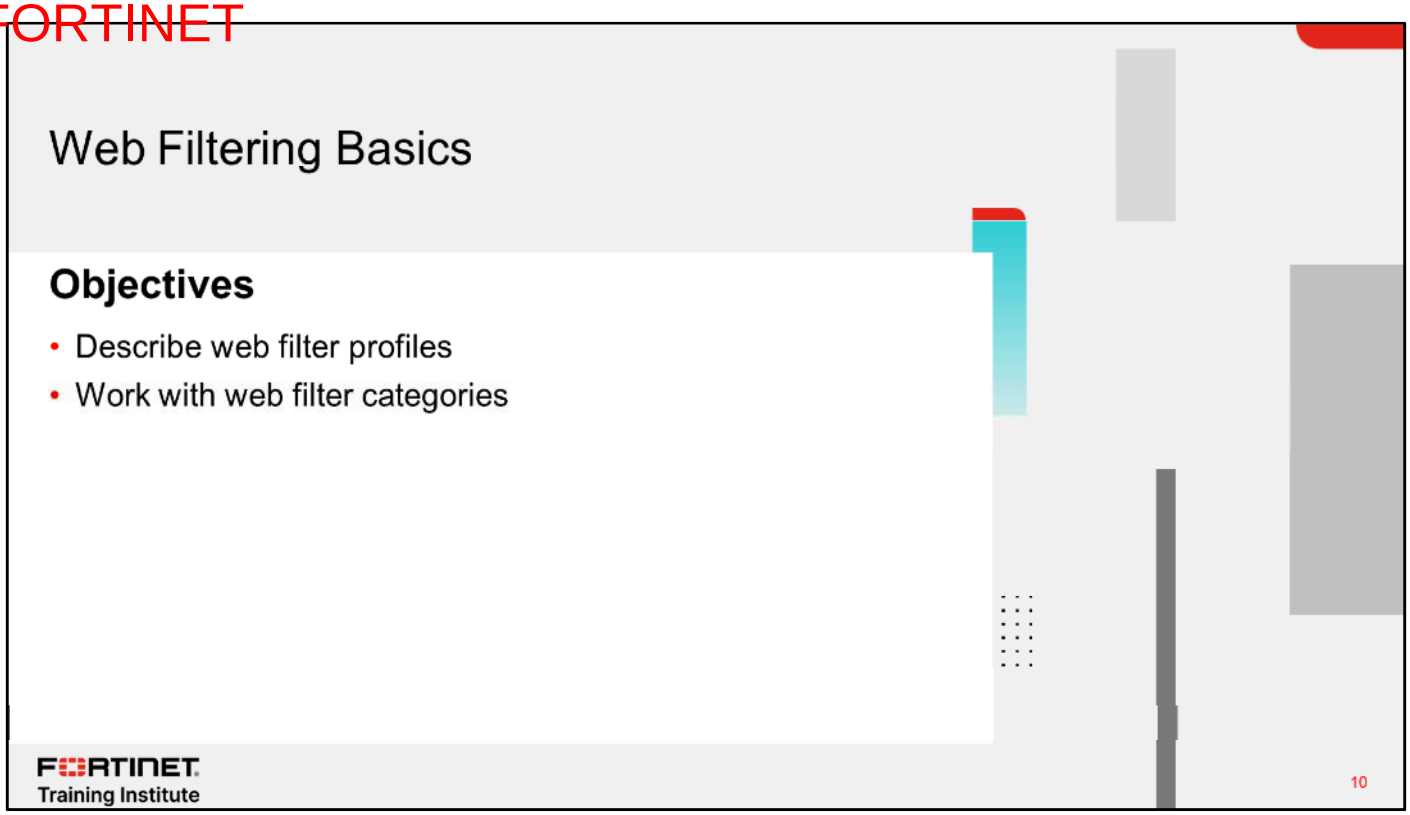


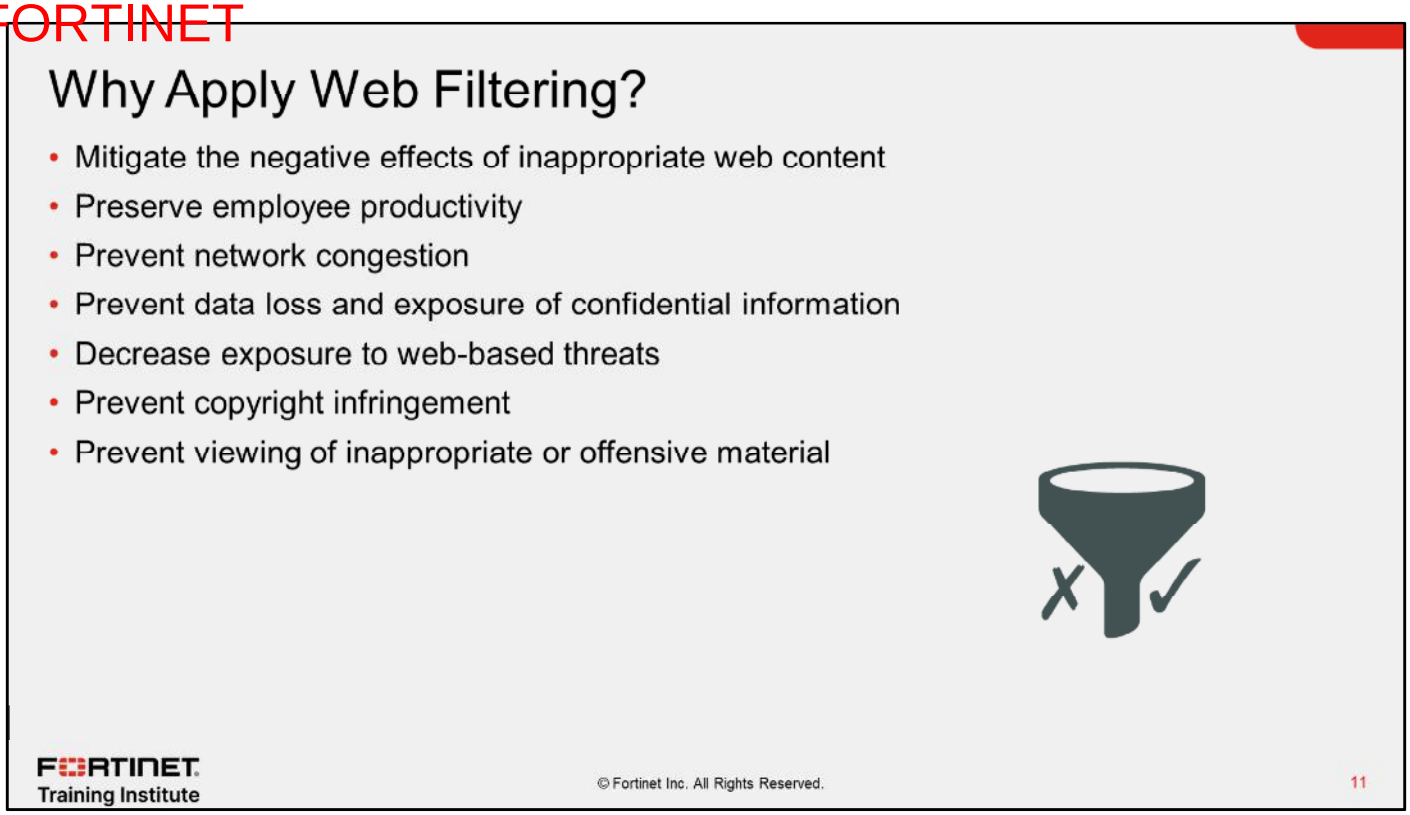
Good job! You now understand inspection modes.

Now, you will learn about web filtering basics.



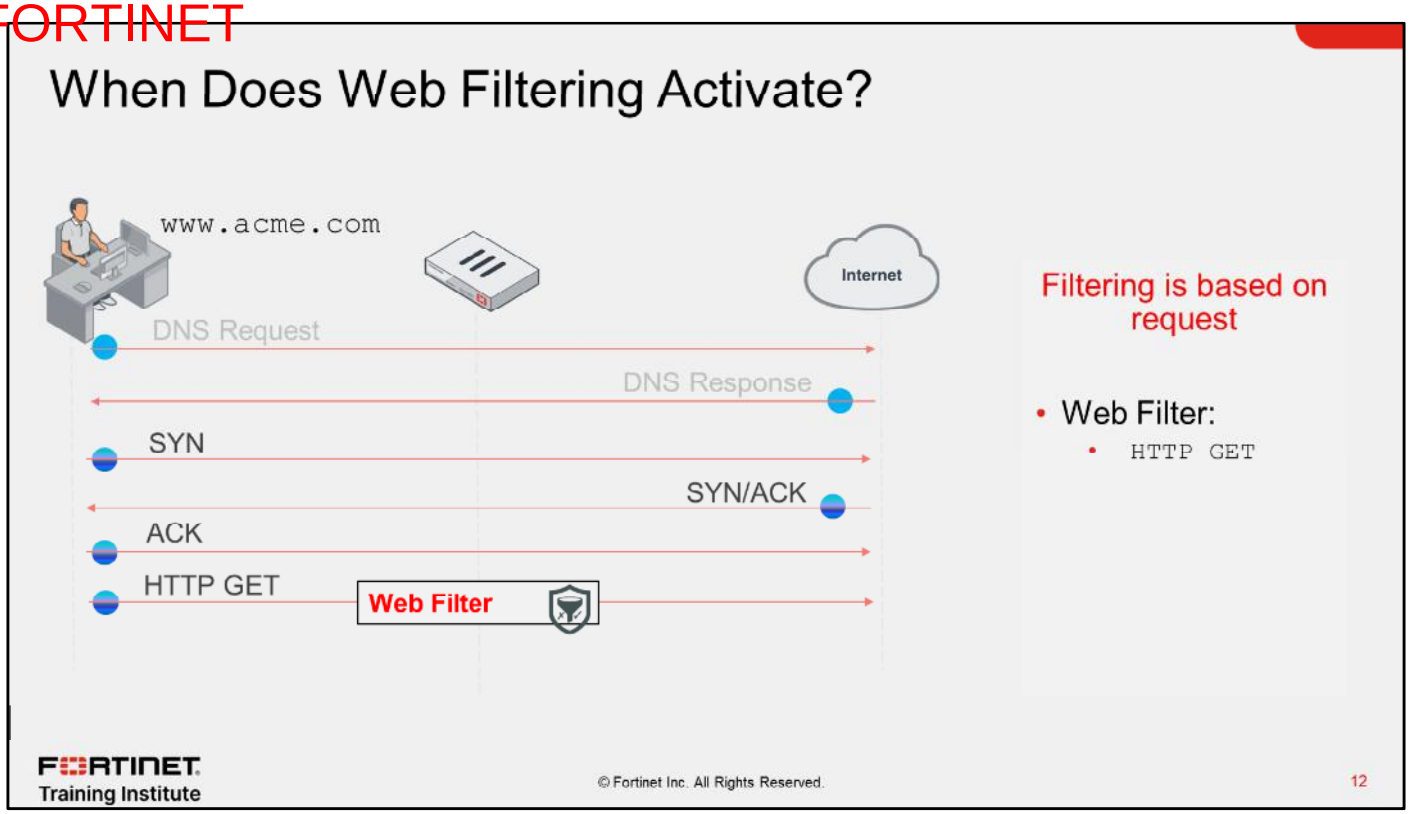
After completing this section, you should be able to achieve the objectives shown on this slide.

By demonstrating competence in web filtering basics, you will be able to describe web filter profiles and use FortiGuard web filter profiles.



Web filtering helps to control, or track, the websites that people visit. There are many reasons why network administrators apply web filtering, including to:

- Preserve employee productivity
- Prevent network congestion, where valuable bandwidth is used for non-business purposes
- Prevent loss or exposure of confidential information
- Decrease exposure to web-based threats
- Limit legal liability when employees access or download inappropriate or offensive material
- Prevent copyright infringement caused by employees downloading or distributing copyrighted materials
- Prevent children from viewing inappropriate material



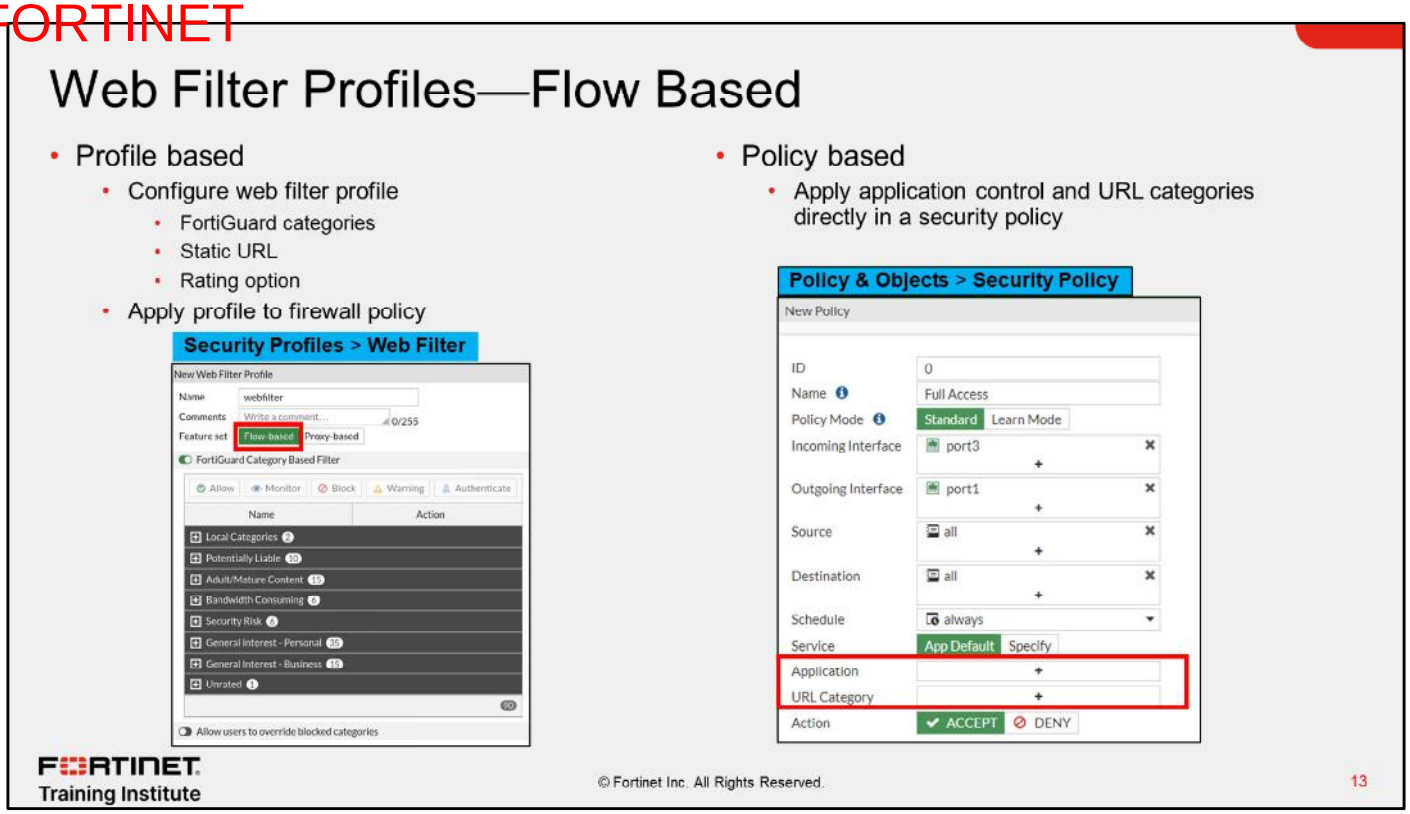
(slide contains animation)

The example on this slide shows the flow of an HTTP filter process.

FortiGate looks for the `HTTP GET` request to collect URL information and perform web filtering.

So, as shown, in HTTP the domain name and URL are separate pieces. The domain name might look like the following in the header: `Host: www.acme.com`, and the URL might look like the following in the header: `/index.php?login=true`.

If you filter by domain, sometimes it blocks too much. For example, the blogs on `tumblr.com` are considered different content, because of all the different authors. In that case, you can be more specific, and block by the URL part, `tumblr.com/hacking`, for example.

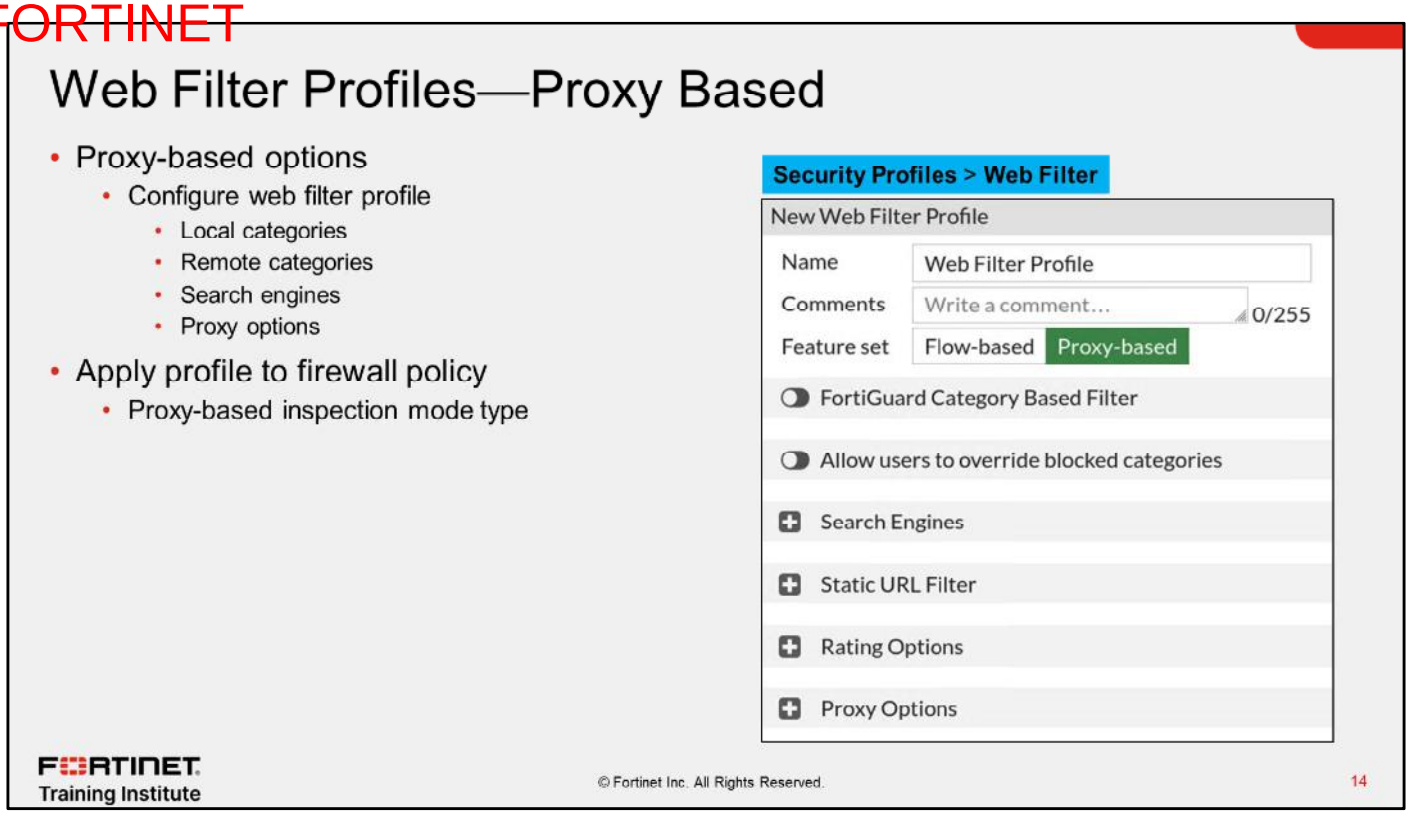


Now, you will look at the web filter profile.

You can configure this security profile to use a feature set for proxy-based or flow-based inspection modes. However, depending on the mode you select, the available settings are different. Flow-based inspection has fewer available options.

In the examples shown on this slide, the web filter profile has a FortiGuard category-based filter that categorizes the websites based on categories and subcategories by FortiGuard. FortiGate offers two NGFW options:

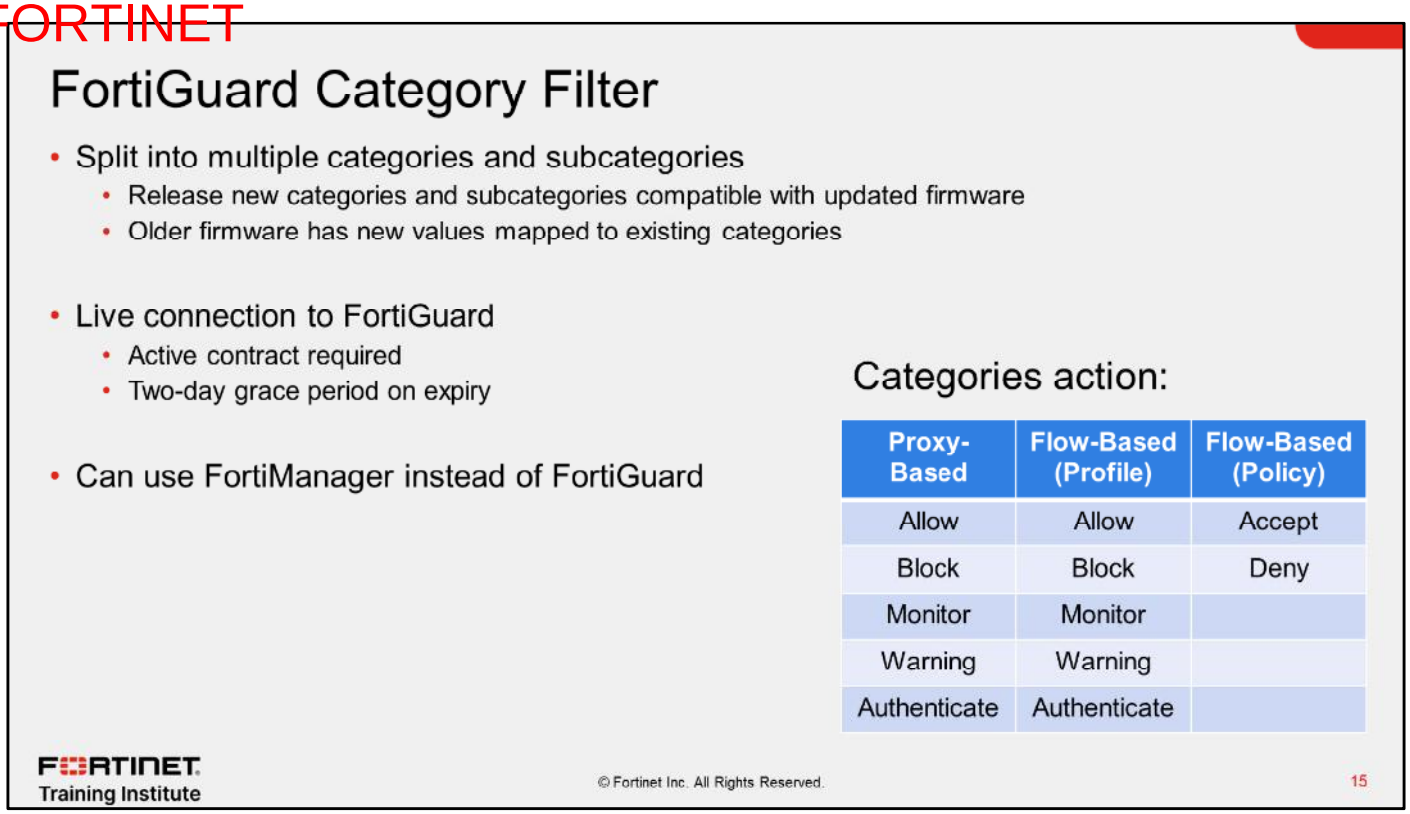
- **Profile-Based** (default)
  - Web filters are defined as security profiles and applied to the firewall policy
- **Policy-Based**
  - URL categories are defined directly under the firewall policy



In the example shown on this slide, the security profile is configured to use a proxy-based feature set. The profile is available to a firewall policy configured to use proxy-based inspection mode. Other local options include:

- **Search Engines**
- **Static URL Filter**
- **Rating Options**
- **Proxy Options**

After you configure your web filter profile, apply this profile to your firewall policy so the filtering is applied to your web traffic.



Rather than block or allow websites individually, FortiGuard category filtering looks at the category that a website has been rated with. Then, FortiGate takes action based on that category, not based on the URL.

FortiGuard category filtering is a live service that requires an active contract. The contract validates connections to the FortiGuard network. If the contract expires, there is a two-day grace period during which you can renew the contract before the service cuts off. If you do not renew, after the two-day grace period, FortiGate reports a rating error for every rating request made. In addition, by default, FortiGate blocks web pages that return a rating error. You can change this behavior by enabling the **Allow websites when a rating error occurs** setting. You will learn more about this setting in this lesson.

You can configure FortiManager to act as a local FortiGuard server. To do this, you must download the databases to FortiManager, and configure FortiGate to validate the categories against FortiManager, instead of FortiGuard.

You can enable the FortiGuard category filtering on the web filter. Categories and subcategories are listed, and you can customize the actions to perform individually.

The actions available depend on the mode of inspection:
- Proxy: Allow, Block, Monitor, Warning, and Authenticate
- Flow-based, profile-based: Allow, Block, Monitor, Warning, and Authenticate
- Flow-based, policy-based: Action defined in a security policy (accept or deny)

To review the complete list of categories and subcategories, visit `www.fortiguard.com/webfilter/categories`.

Web Filter FortiGuard Category Action—Warning

- Category Action =

- Exclusive for web filtering
  - Proxy mode
  - Flow mode (profile-based only)
  - Not available in:
    - Static URL filtering feature
- FortiGuard warning page
  - Customizable warning interval

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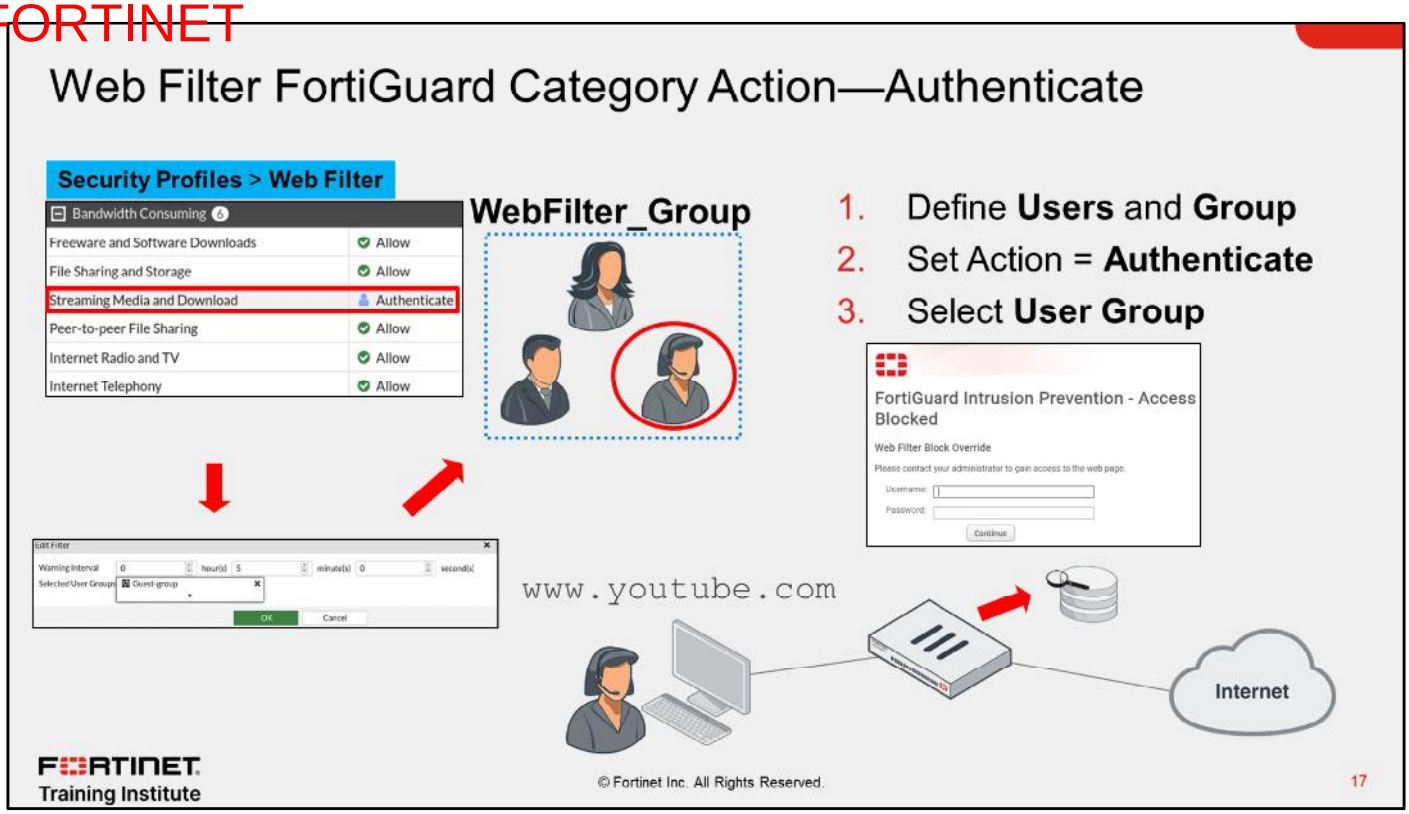
The warning action informs users that the requested website is not allowed by the internet policies. However, the action gives the user the option to proceed to the requested website, or return to the previous website.

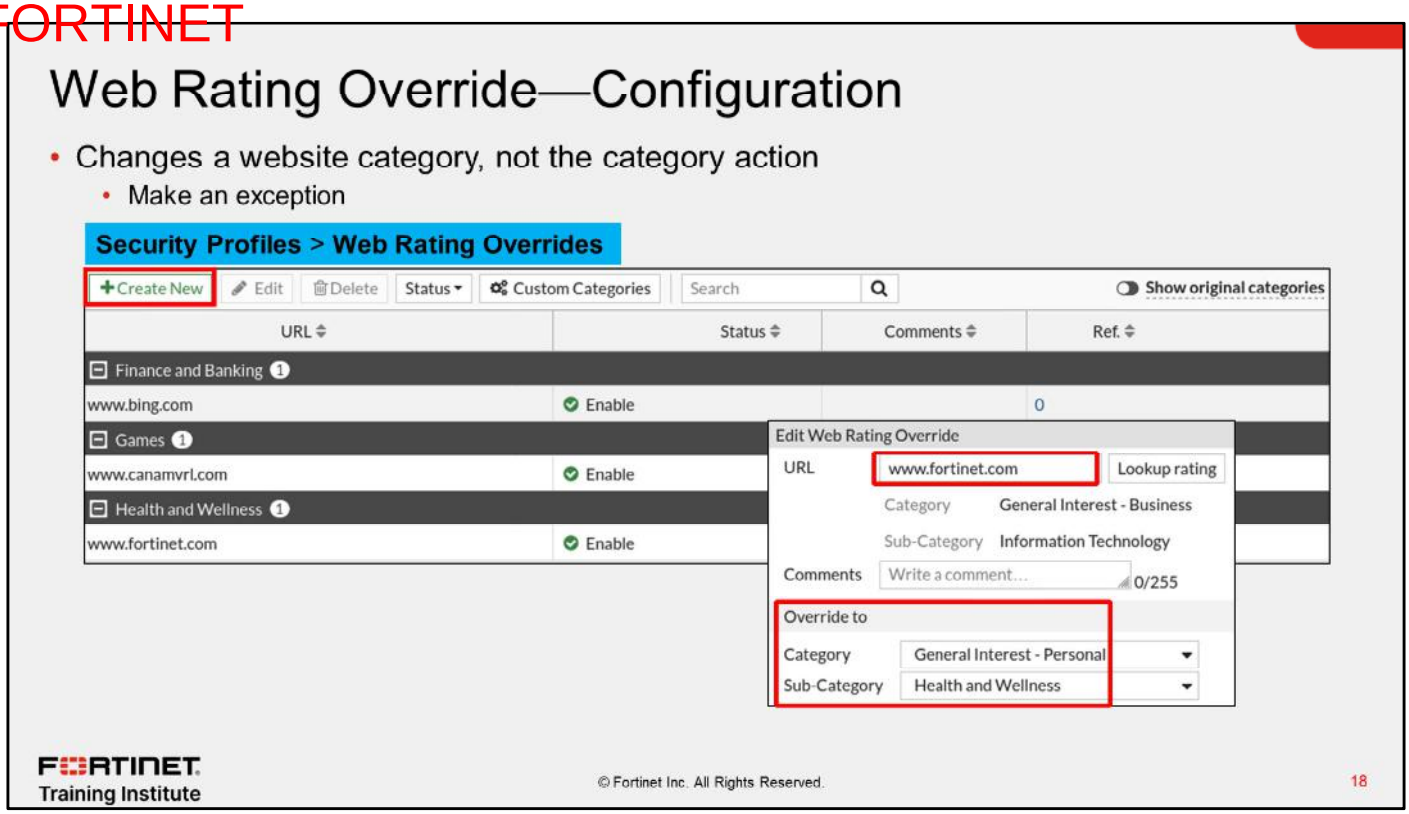
You can customize the warning interval, so you can present this warning page at specific times, according to the configured period.



The authenticate action blocks the requested websites, unless the user enters a successful username and password. Local authentication and remote authentication using LDAP, radius and so on are supported for web filtering authentication.

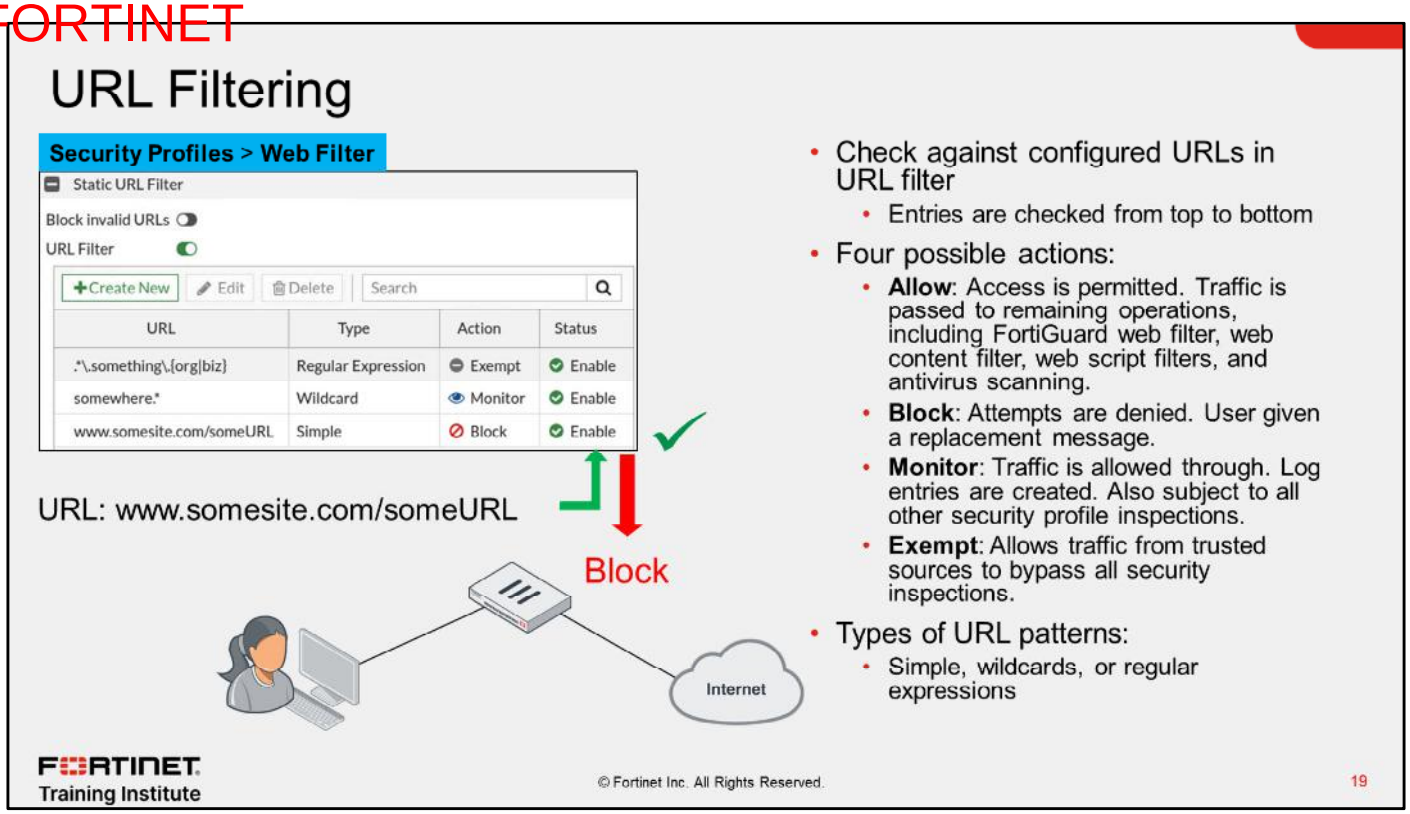
You can customize the interval of time to allow access. Users are not prompted to authenticate again if they access other websites in the same category until the timer expires.

Choosing this action prompts you to define user groups that are allowed to override the block.



If you want to make an exception, for example, rather than unblock access to a potentially unwanted category, change the website to an allowed category. You can also do the reverse. You can block a website that belongs to an allowed category.

Remember that changing categories does not automatically result in a different action for the website. This depends on the settings within the web filter profile.



Static URL filtering is another web filter feature. Configured URLs in the URL filter are checked against the visited websites. If a match is found, the configured action is taken. URL filtering has the same patterns as static domain filtering: simple, regular expressions, and wildcard.

Take a look at how it works.

When a user visits a website, FortiGate looks at the URL list for a matching entry. In the example shown on this slide, the website matches the third entry in the table, which is set as type **Simple**. This type means that the match must be exact—there is no option for a partial match with this pattern. Also, the action is set to **Block**, so FortiGate displays a block page message.

Knowledge Check

1. Which of the following can act as a local FortiGuard server?
   - ✓ A. FortiManager
   - B. FortiAnalyzer

2. Which action in URL filtering will bypass all security profiles?
   - ✓ A. Exempt
   - B. Allow

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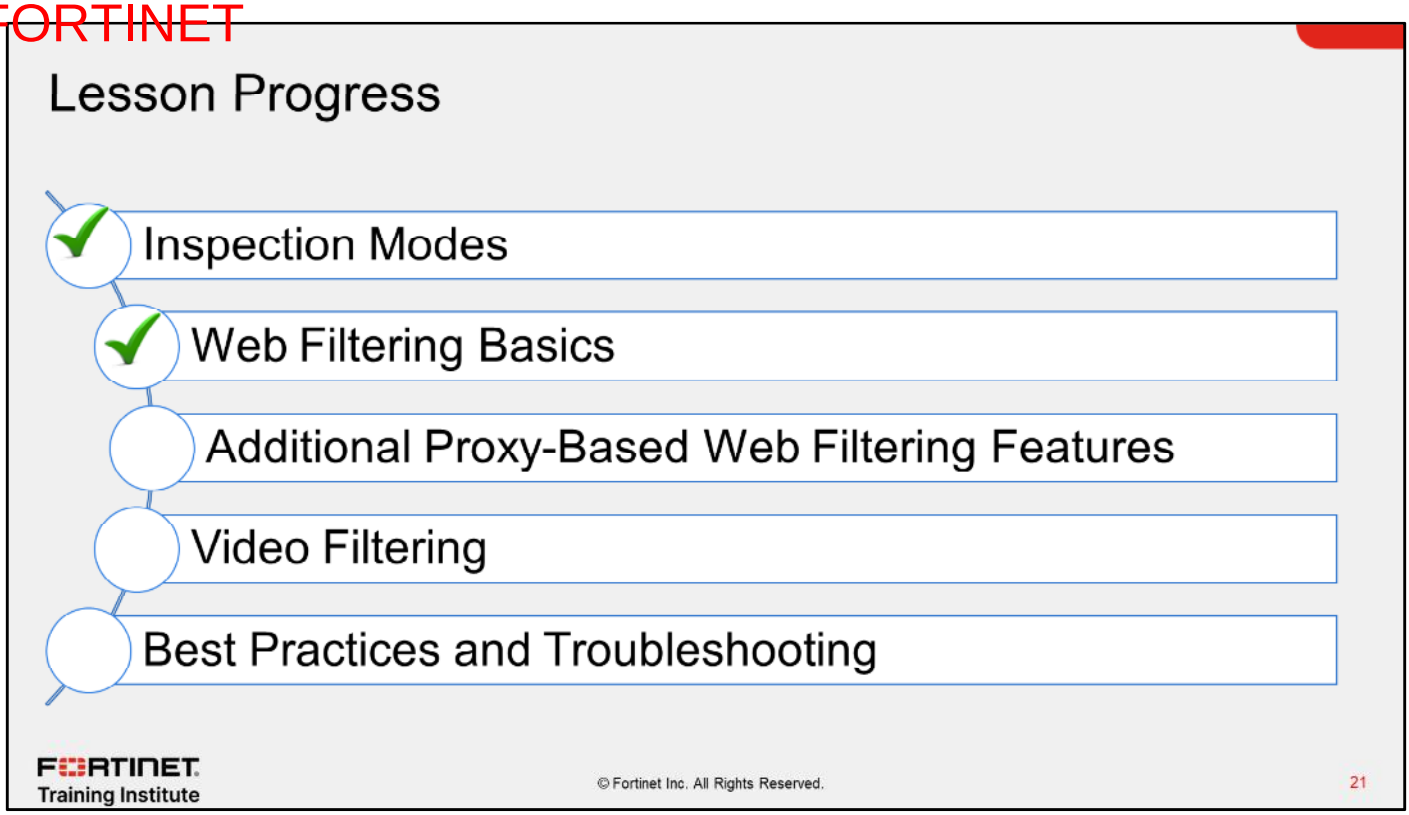
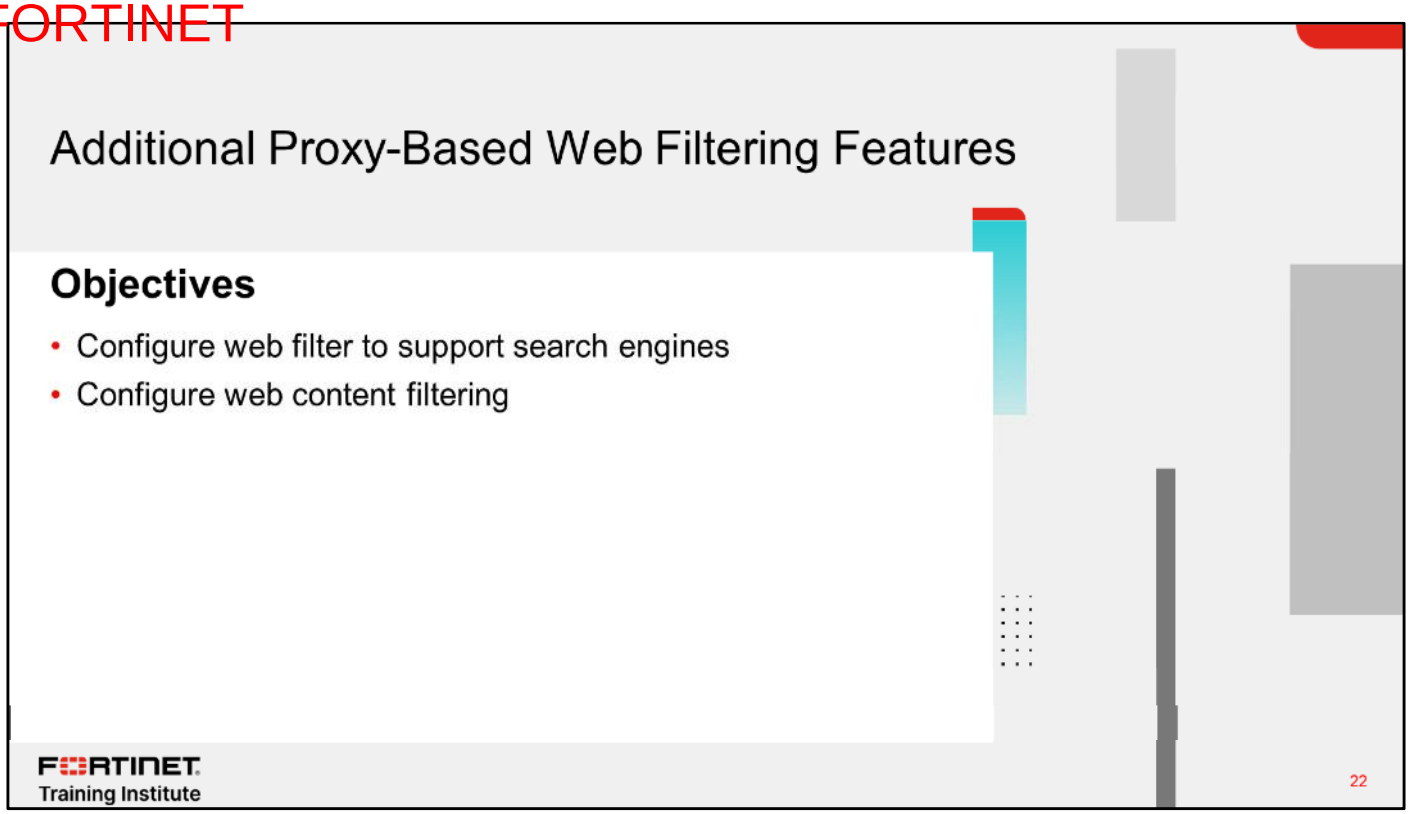


Good job! You now understand the basics of web filtering.

Now, you will learn about additional proxy-based web filtering features.

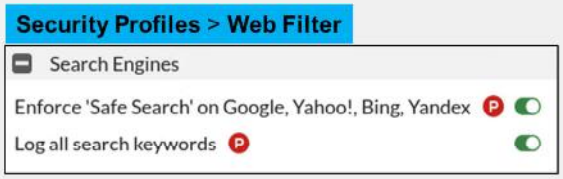


After completing this section, you should be able to achieve the objectives shown on this slide.

By demonstrating competence in additional proxy-based web filtering features, you will be able to search engine filters, and web content filtering.

Search Engine Filtering

- A proxy-based mode feature
- Requires FortiGate to use deep SSL inspection
  - Not supported when using certificate inspection
  - FortiGate requires full access to the application layer data
- Restricts websites or images from search results
  - Rewrites the search URL to enable safe search
    - For Google, Yahoo, Bing, and Yandex
- Logs all search keywords




```
config webfilter profile
    edit "default"
        config web
            set safe-search url header
        end
    next
end
```

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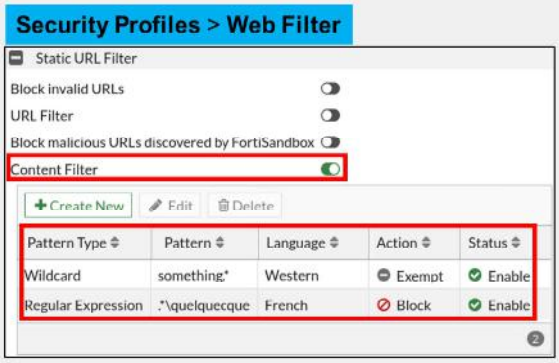
Search engine filtering is available when you configure a web filter profile while setting the feature set to proxy-based.

Safe search is an option that some browsers support. It applies internal filters to the search results. When you enable safe search for the supported search sites, FortiGate appends code to the URL to enforce the use of safe search. For example, on a Google search, FortiGate adds the string `&safe=active` to the URL in the search. So, even if it is not locally enabled in the browser, FortiGate applies safe search to the requests when they pass through. Safe search is supported for Google, Yahoo, Bing, and Yandex.

As a proxy-based web filter feature, search engine filtering is supported only when using full SSL inspection because FortiGate requires access to the full header.

Web Content Filtering

- Requires FortiGate to use SSL deep inspection
- Controls access to web pages containing specific patterns
- Scans the content of every website accepted by security policies
- Matches content from wildcards or Perl regular expressions
- The maximum number of web content patterns in a list is 5000
- Actions:
  - Exempt
  - Block



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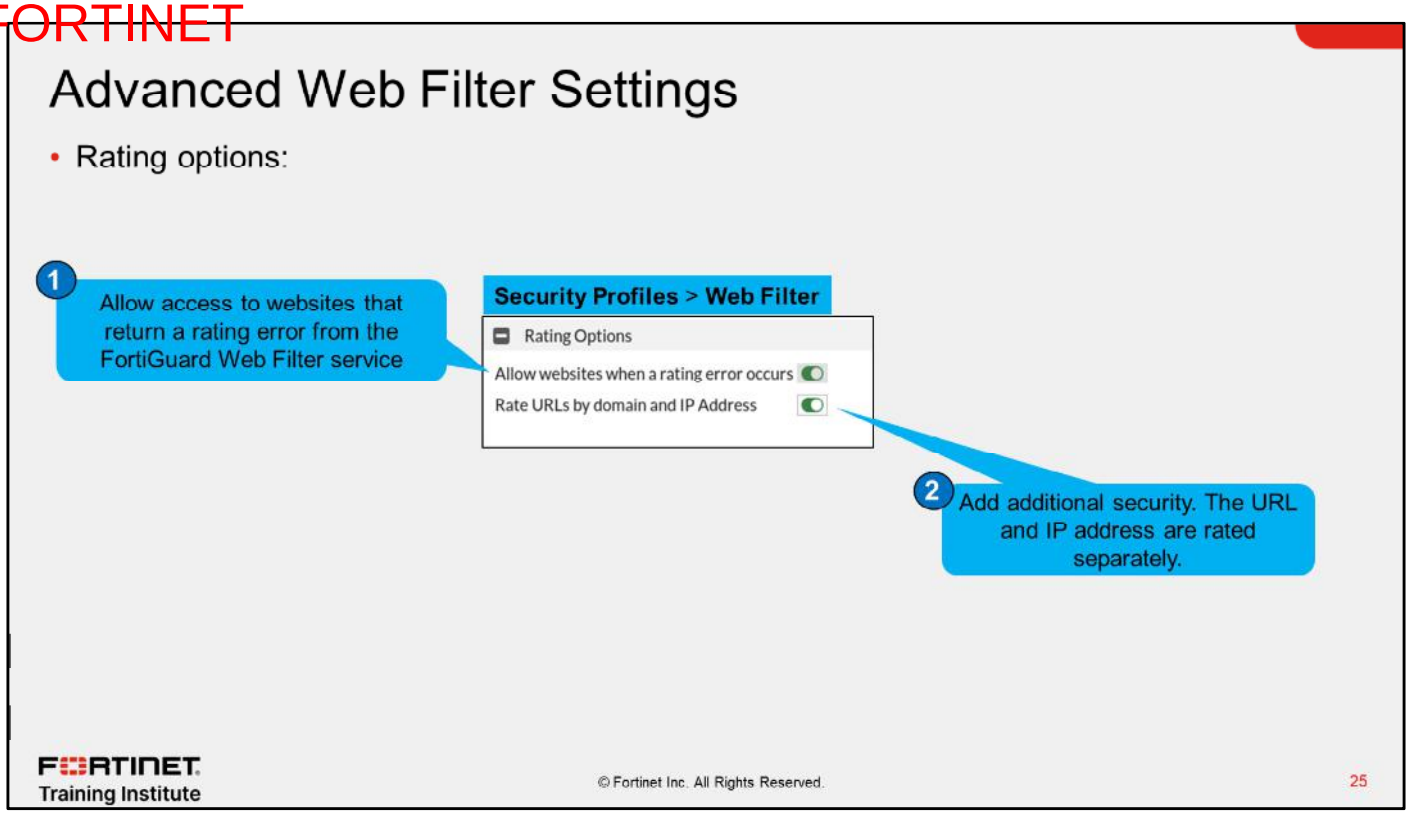
You can also control web content in the web filter profile by blocking access to websites containing specific words or patterns. This helps to prevent access to sites with questionable material.

You can add words, phrases, patterns, wildcards, and Perl regular expressions to match content on websites. You configure this feature on a per-web-filter-profile basis, not at the global level. So, it is possible to add multiple web content filter lists and then select the best list for each web filter profile.

The system administrator can specify banned words and phrases and attach a numerical value, or score, to the importance of those words and phrases. When the web content filter scan detects banned content, it adds the scores of banned words and phrases on the page. If the sum is higher than the threshold set in the web filter profile, FortiGate blocks the site.

The maximum number of web content patterns in a list is 5000.

Like search engine filtering, web content filtering requires that FortiGate uses deep SSL inspection because FortiGate requires full access to the packet headers.



You can use advanced web filtering settings to improve the web filter.

The rating options are as follows:

1. **Allow websites when a rating error occurs**. If a rating error occurs from the FortiGuard web filter service, users have full unfiltered access to all websites.
2. **Rate URLs by domain and IP Address**. This option sends both the URL and the IP address of the requested site for checking, providing additional security against attempts to bypass the FortiGuard system.

Knowledge Check

1. Which of the following is used for matching content in Web Content Filtering ?
   - ✓ A. Perl regular expressions
   - B. Boolean operators

2. Which feature can be used for restricting websites or images from search results ?
   - A. Web Content Filtering
   - ✓ B. Search Engine Filtering

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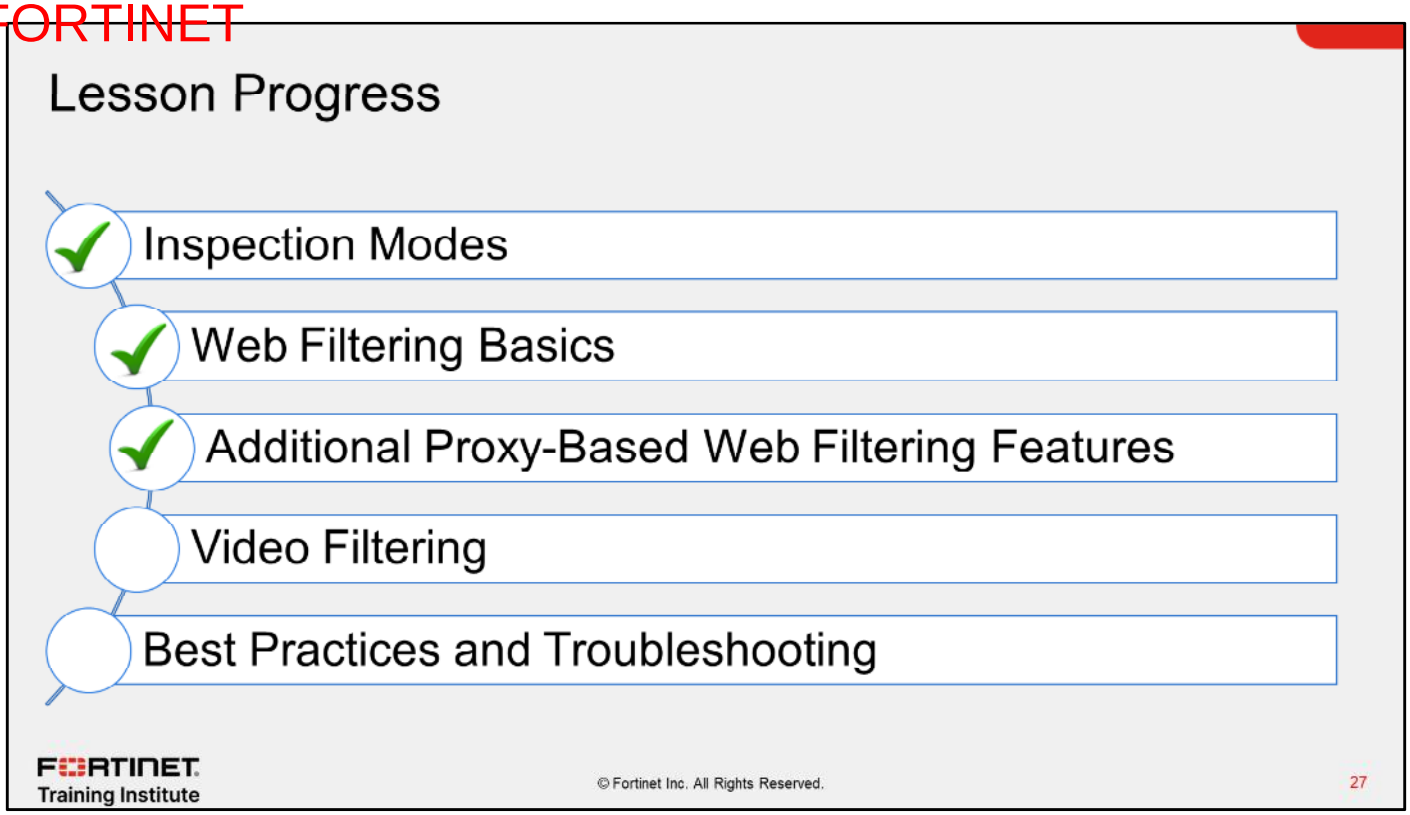
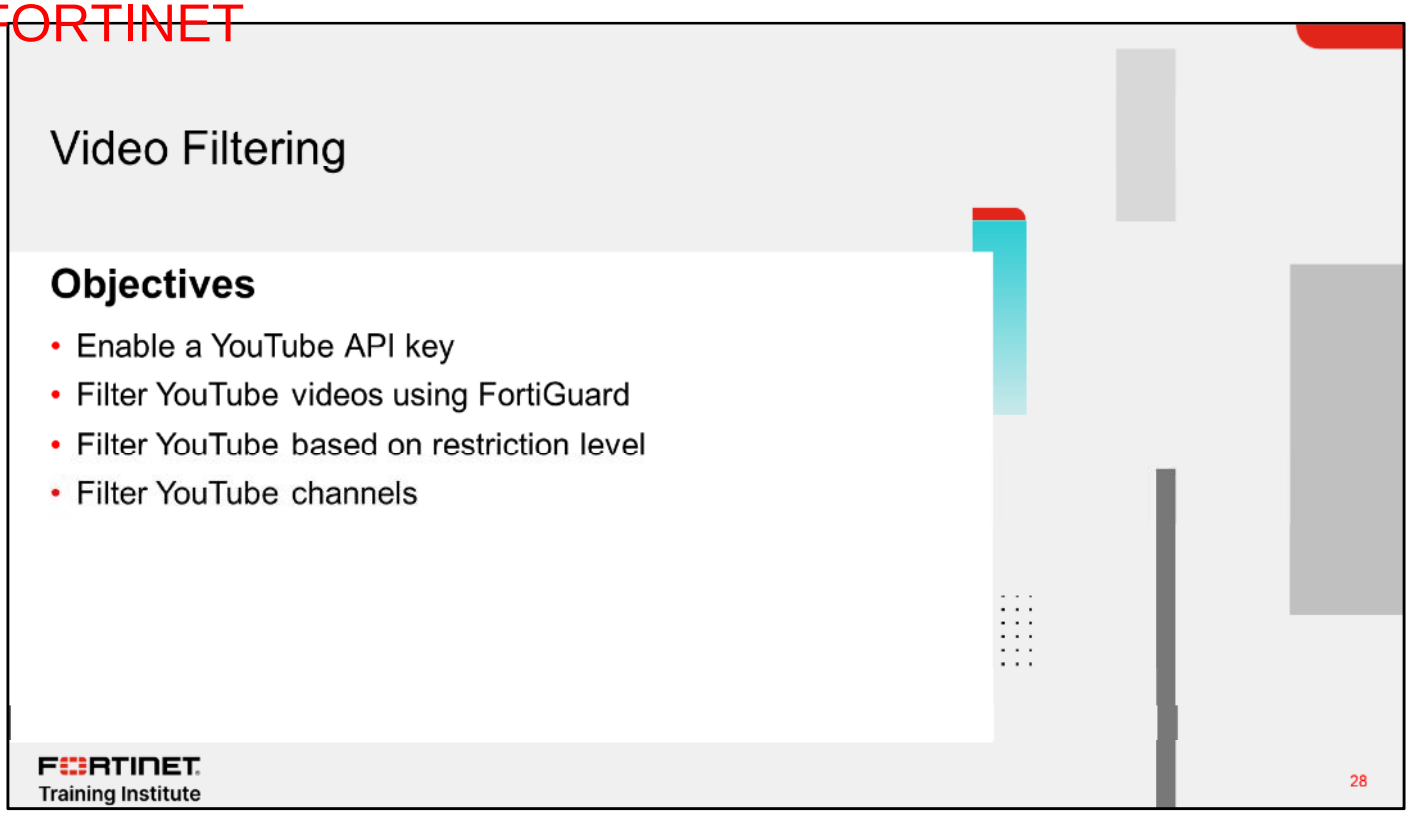


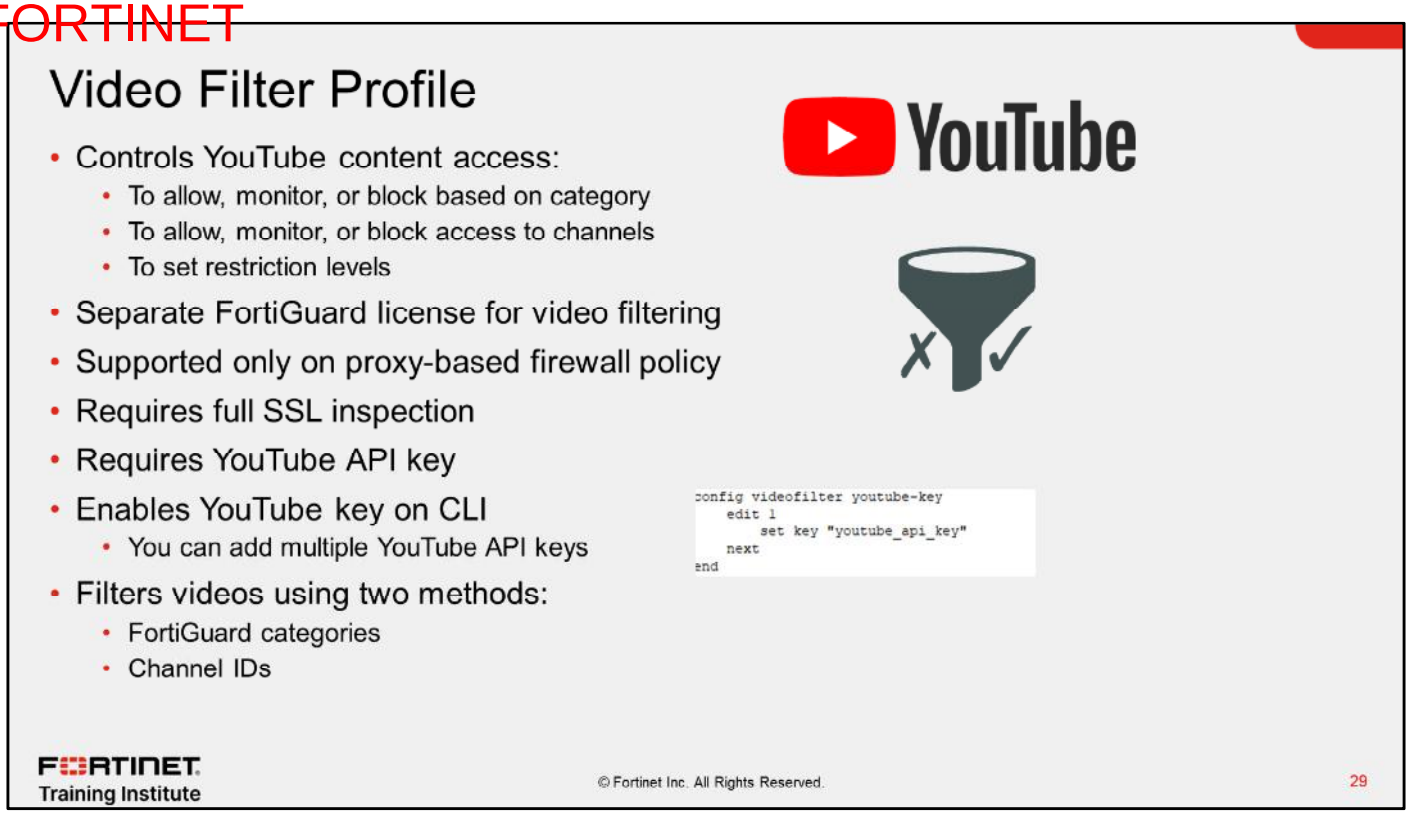
Good job! You now understand additional proxy-based web filtering features.

Now, you will learn about video filtering.



After completing this section, you should be able to achieve the objectives shown on this slide.

By demonstrating competence in video filtering, you will be able to control access to YouTube using FortiGuard categories and YouTube static IDs.



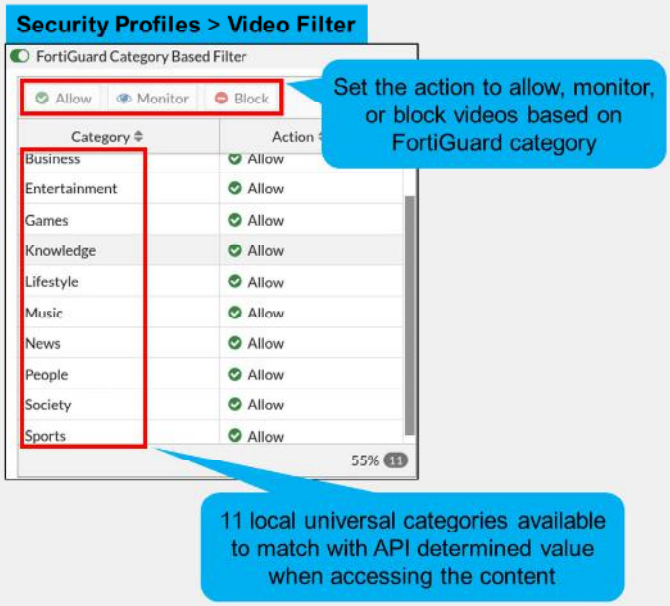
Video filtering allows you to control access to YouTube content using parameters that are associated with the video channel, video categories, or the video itself. It is part of the FortiGuard service, which requires a separate license bundled with the other FortiGuard security services.

To apply the video filter profile, proxy-based firewall polices currently allow you to enable the video filter profile. You must enable full SSL inspection on the firewall policy.

You must obtain a YouTube API key to use the video filter feature. The API key allows FortiGate to match parameters identified when users access YouTube content, and match the parameters with the local categories defined on the video filter.

Video Filter Profile—FortiGuard Categories

- FortiGuard categories for video filtering are based on universal classification:
  - Combine popular online video provider categories
- FortiGuard video categories:
  - Applicable to videos from YouTube, Vimeo, Dailymotion
  - Require API to determine category and match it on the video filter
  - Security action determines the flow of security checks:
    - If set to allow, bypass the rest of video filter profile
    - If set to monitor, log access and continue
    - If block, log and prevent playing the video



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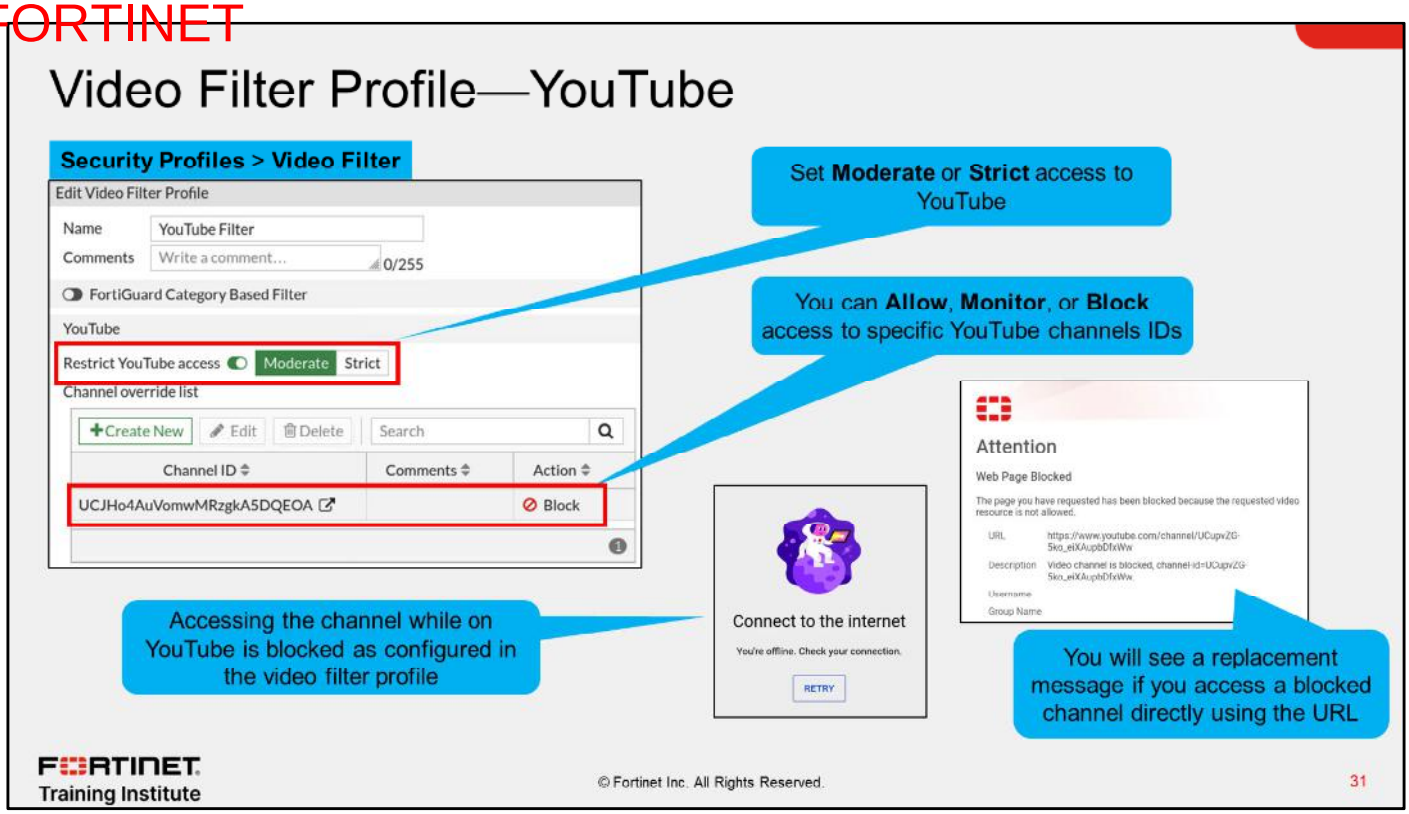
The video filter can identify videos using universal categories used by major online video content providers, such as YouTube. The generic classification combines multiple categories by these providers into one category. For example, the FortiGuard video category **Entertainment** includes YouTube categories, such as entertainment, comedy, movies, shows, and trailers.

The FortiGuard video categories are universal, to cover the common classifications used in the categories of online video content providers. Currently, it is applicable to content hosted by YouTube, Vimeo, and Dailymotion. Some of these providers offer API queries that enable FortiGate to identify the content and match it to local FortiGuard video categories.

In a video filter profile, if a FortiGuard category is allowed, the video content bypasses the rest of the security checks configured on the video profile, such as channel override and YouTube restriction level. If the action is set to monitor or block, then the video content undergoes further security checks configured on the video filter profile.



You can restrict YouTube access on a video filter by setting the restriction level to **Moderate** or **Strict**. When users access YouTube content using the firewall policy with the video filter profile applied, the users are given only content that is screened according to a filter applied by Google. Moderate restricted access is similar to strict but makes more videos available.

The YouTube channel ID is used to identify YouTube channels. It allows FortiGate to apply actions to access related content on the channel. These actions can allow, monitor, or block access to the channel. If a video filter has a channel override to block a specific YouTube channel, access to this channel is stopped only to this particular channel. If a user attempts to access the channel while surfing YouTube content, an error message appears telling the user that they must connect to the internet. If the user accesses the channel using the URL, a blocked replacement message shows up to confirm the reason why access is blocked.

Knowledge Check

1. Which is required by FortiGate to configure YouTube video filtering?
   - ✓ A. YouTube API key
   - B. Username

2. Which action in video filtering will prevent the videos from playing?
   - A. Deny
   - ✓ B. Block

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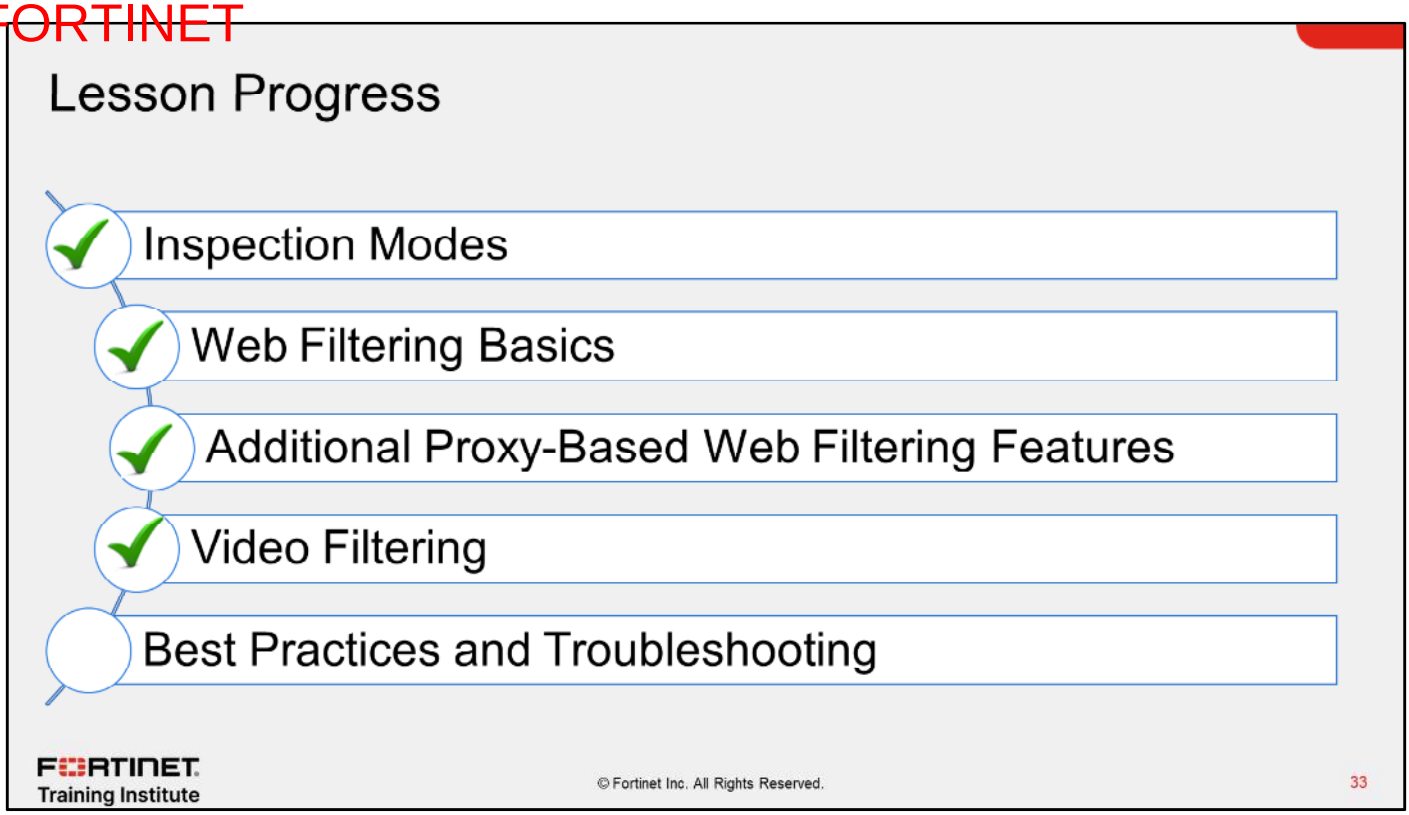
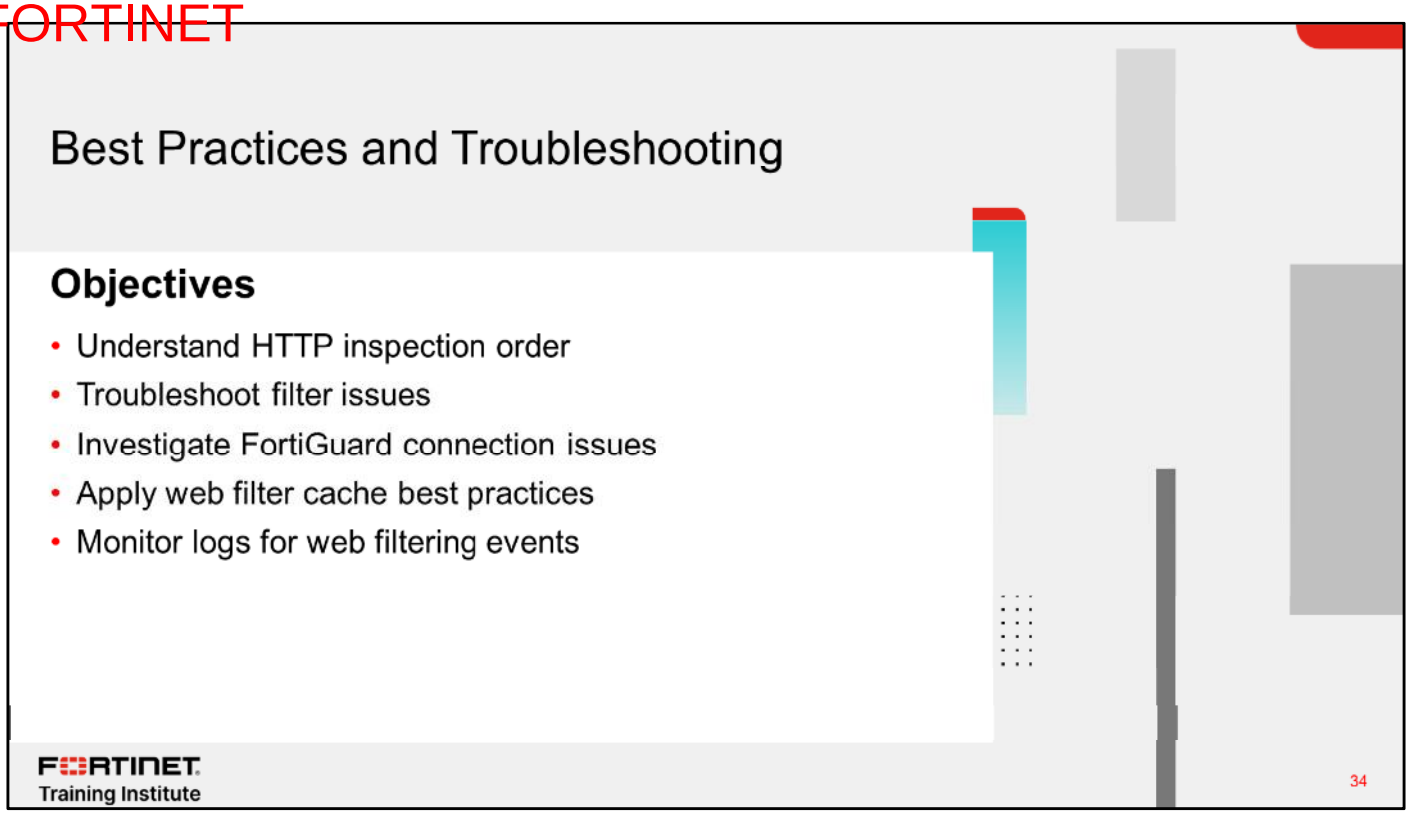


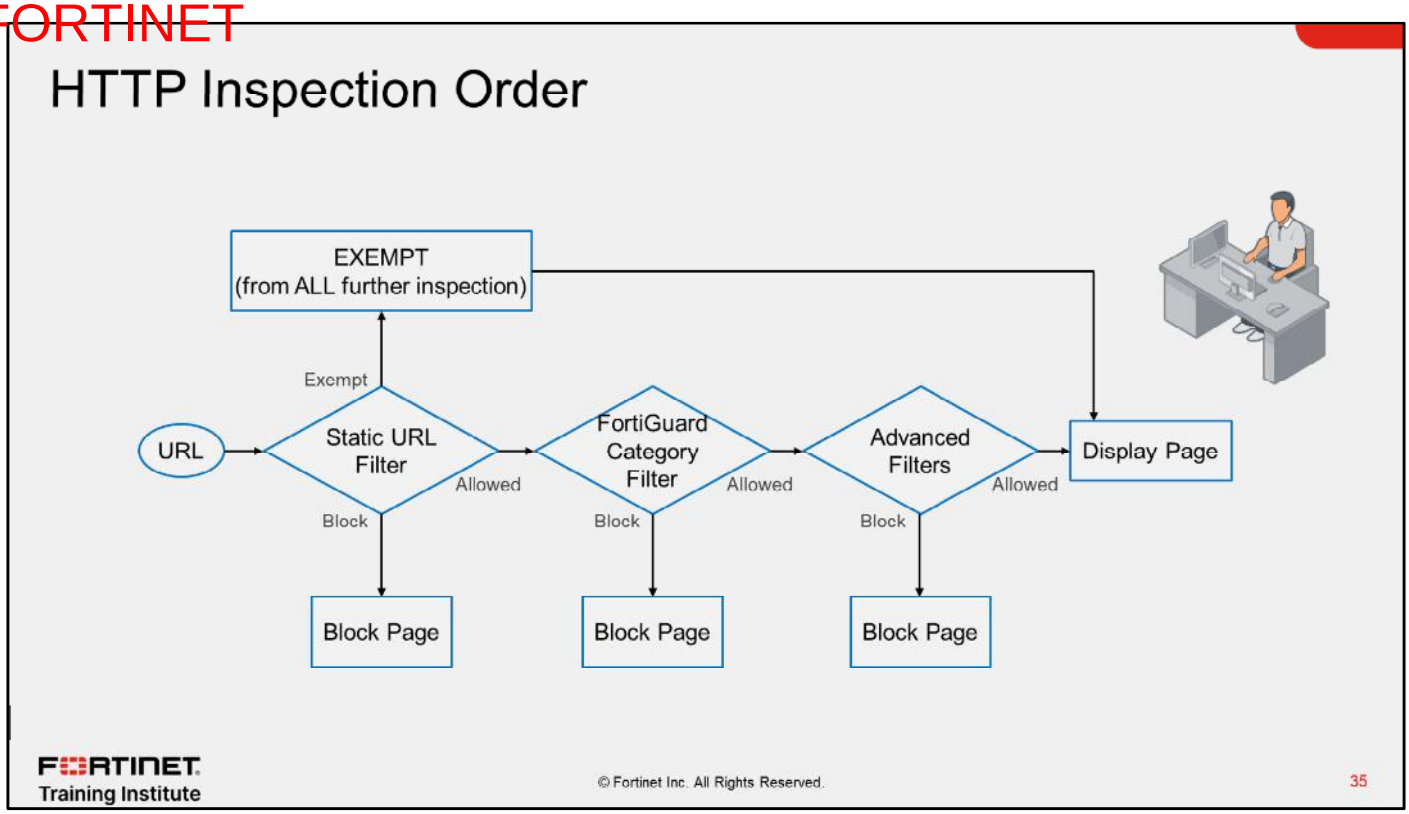
Good job! You now understand the video filtering feature.

Now, you will learn about best practices and troubleshooting.



After completing this section, you should be able to achieve the objectives shown on this slide.

By demonstrating competence in best practices and troubleshooting, you will be able to apply various best practices and troubleshooting techniques to avoid and investigate common issues.



Remember that the web filtering profile has several features. So, if you have enabled many of them, the inspection order flows as follows:

1. The local static URL filter
2. FortiGuard category filtering (to determine a rating)
3. Advanced filters (such as safe search or removing Active X components)

For each step, if there is no match, FortiGate moves on to the next check enabled.

Apply the Filters

- It's not working. Why?
  - Did you apply the security profiles to the firewall policies?
  - Did you apply the SSL inspection profile, if needed?


```
config firewall policy
 edit 1
 set webfilter-profile <profile>
 next
end

config firewall profile-group
 edit <group name>
    set webfilter-profile <profile>
 next
end
```

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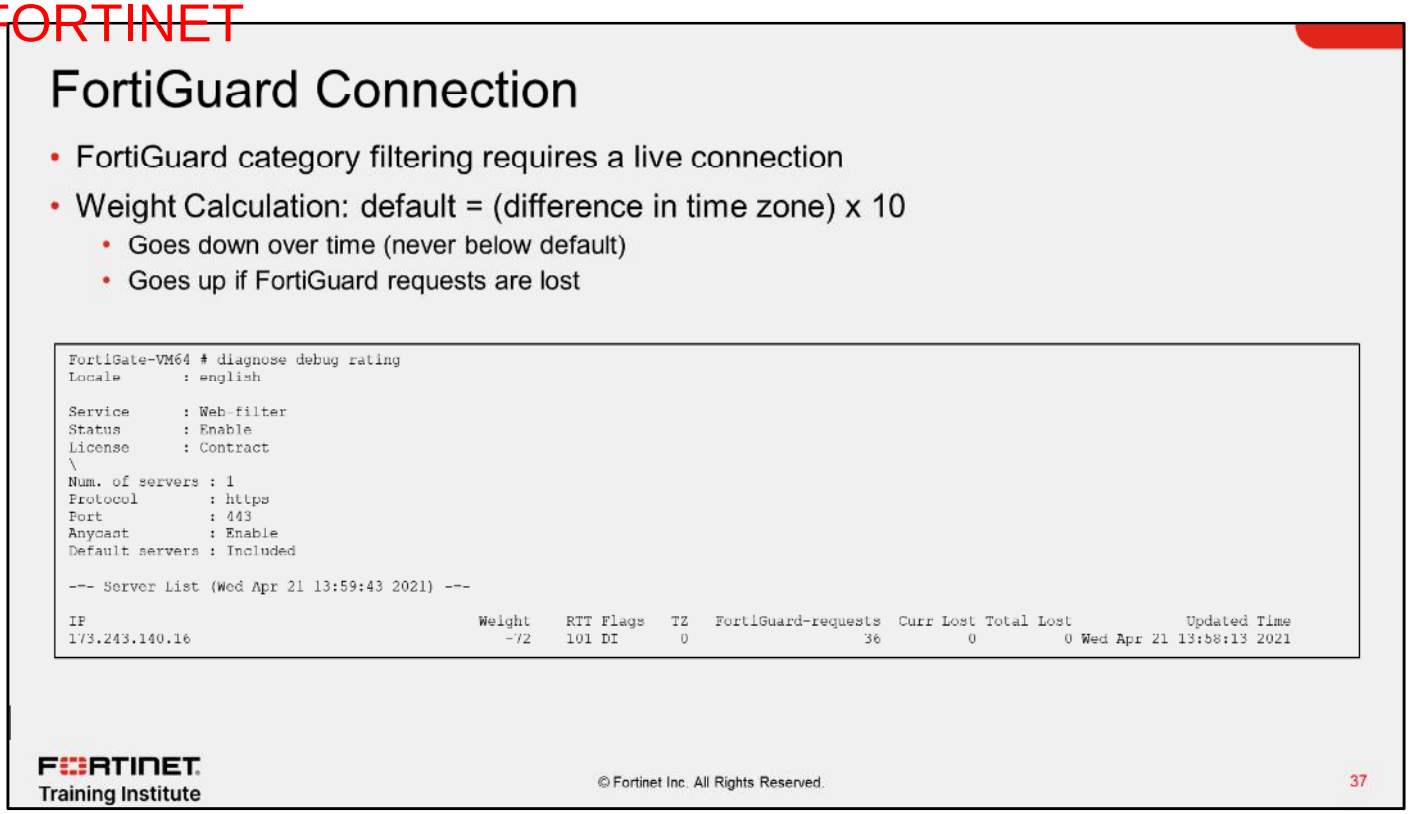
You have configured your security profiles, but they are not performing web inspection. Why?

Check to see if you have applied the security profiles to your firewall policies. Also, make sure that the SSL inspection profile is applied as needed.



Category-based filtering requires a live connection to FortiGuard.

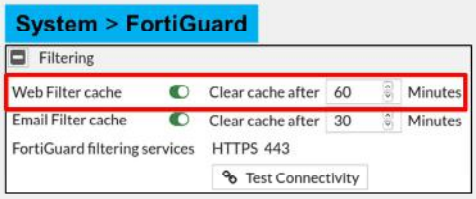
You can verify the connection to FortiGuard servers by running the `diagnose debug rating` CLI command. This command displays a list of FortiGuard servers you can connect to, as well as the following information:

- `Weight`: Based on the difference in time zone between FortiGate and this server (modified by traffic)
- `RTT`: Return trip time
- `Flags`: `D` (IP returned from DNS), `I` (Contract server contacted), `T` (being timed), `F` (failed)
- `TZ`: Server time zone
- `FortiGuard-requests`: The number of requests sent by FortiGate to FortiGuard
- `Curr Lost`: Current number of consecutive lost FortiGuard requests (in a row, resets to `0` when one packet succeeds)
- `Total Lost`: Total number of lost FortiGuard requests

The list is of variable length depending on the FortiGuard Distribution Network.

Web Filter Cache

- Improves performance by reducing requests to FortiGuard
- Cache is checked before sending a request to the FortiGuard server
  - FortiGate remembers response of visited websites
  - TTL settings control the number of seconds the query results are cached
  - Request is considered a rating error after timeout (15 seconds as default)
- HTTPS port 443 enforced by default FortiGuard or FortiManager communications
  - Disable FortiGuard anycast setting on CLI to use UDP ports 443, 53, or 8888
- Enabled by default—default TTL is 60 minutes (3600 seconds)




```
config system fortiguard
    set fortiguard-anycast {enable|disable}
    set protocol {udp|https}
    set port {8888|53|443}
    set webfilter-timeout {<1> - <30>}
end
```

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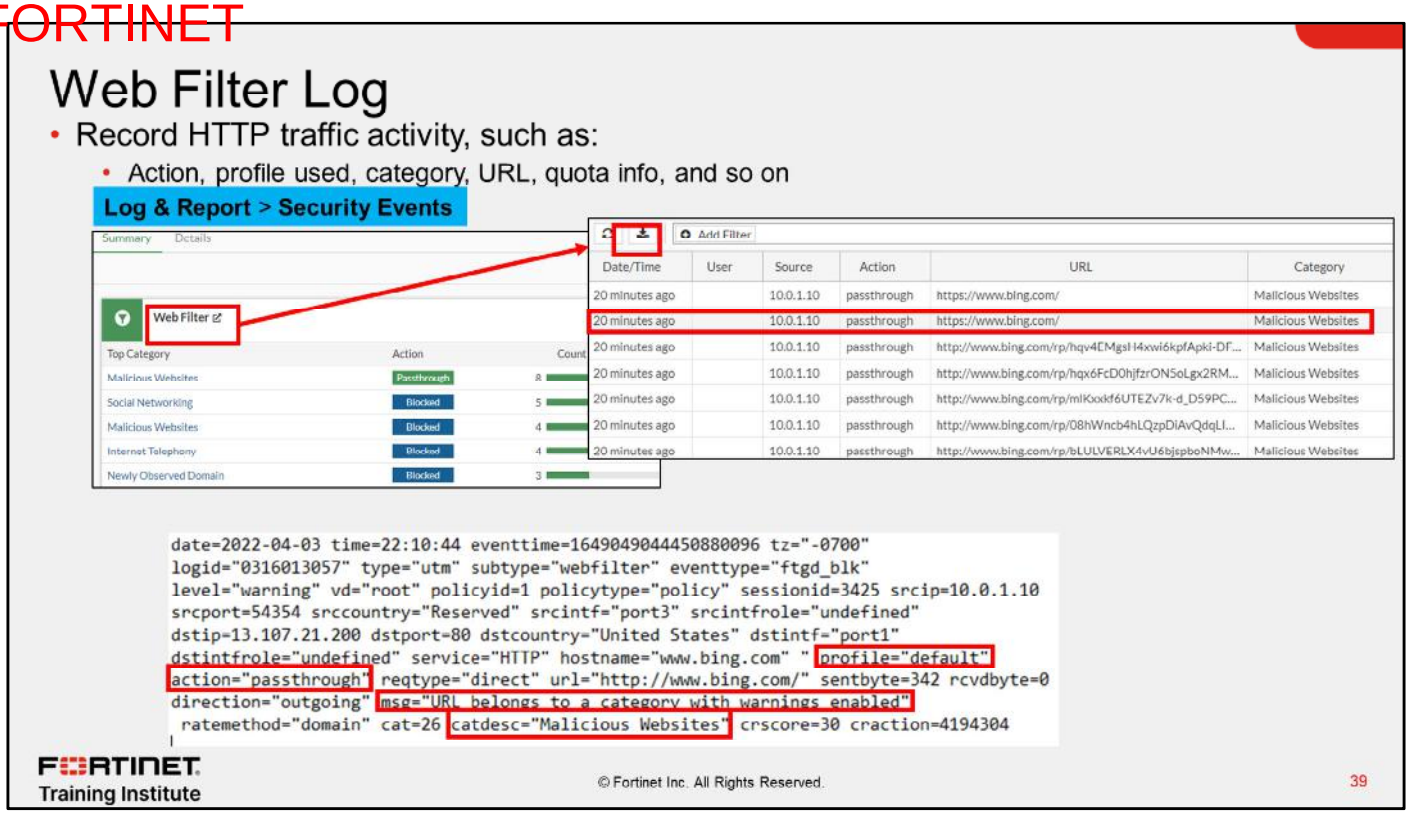
FortiGate can maintain a list of recent website rating responses in memory. So, if the URL is already known, FortiGate doesn't send back a rating request.

By default, FortiGate is configured to enforce the use of HTTPS port 443 to perform live filtering with FortiGuard or FortiManager. Other ports and protocols are available by disabling the FortiGuard anycast setting on the CLI. These ports and protocols to query the servers (FortiGuard or FortiManager) HTTPS port 53 and port 8888, UDP port 443, port 53, and port 8888. If you are using UDP port 53, any kind of inspection reveals that this traffic is not DNS and prevents the service from working. In this case, you can switch to the alternate UDP port 443 or port 8888, or change the protocol to HTTPS, but these ports are not guaranteed to be open in all networks, so you must check beforehand.

Caching responses reduces the amount of time it takes to establish a rating for a website. Also, memory lookup is much quicker than packets travelling on the internet.

The timeout defaults to 15 seconds, but you can set it as high as 30 seconds, if necessary.



Now, take a look at the web filter log and report feature.

This slide shows an example of a log message. Access details include information about the FortiGuard quota and category (if those are enabled), which web filter profile was used to inspect the traffic, the URL, and more details about the event.

You can also view the raw log data by clicking the download icon at the top of the GUI. The file downloaded is a plain text file in a syslog format.

Knowledge Check

1. You have configured your security profiles, but they are not performing web or DNS inspection. Why?
   - A. The certificate is not installed correctly.
   - ✓ B. The profile is not associated with the correct firewall policy.

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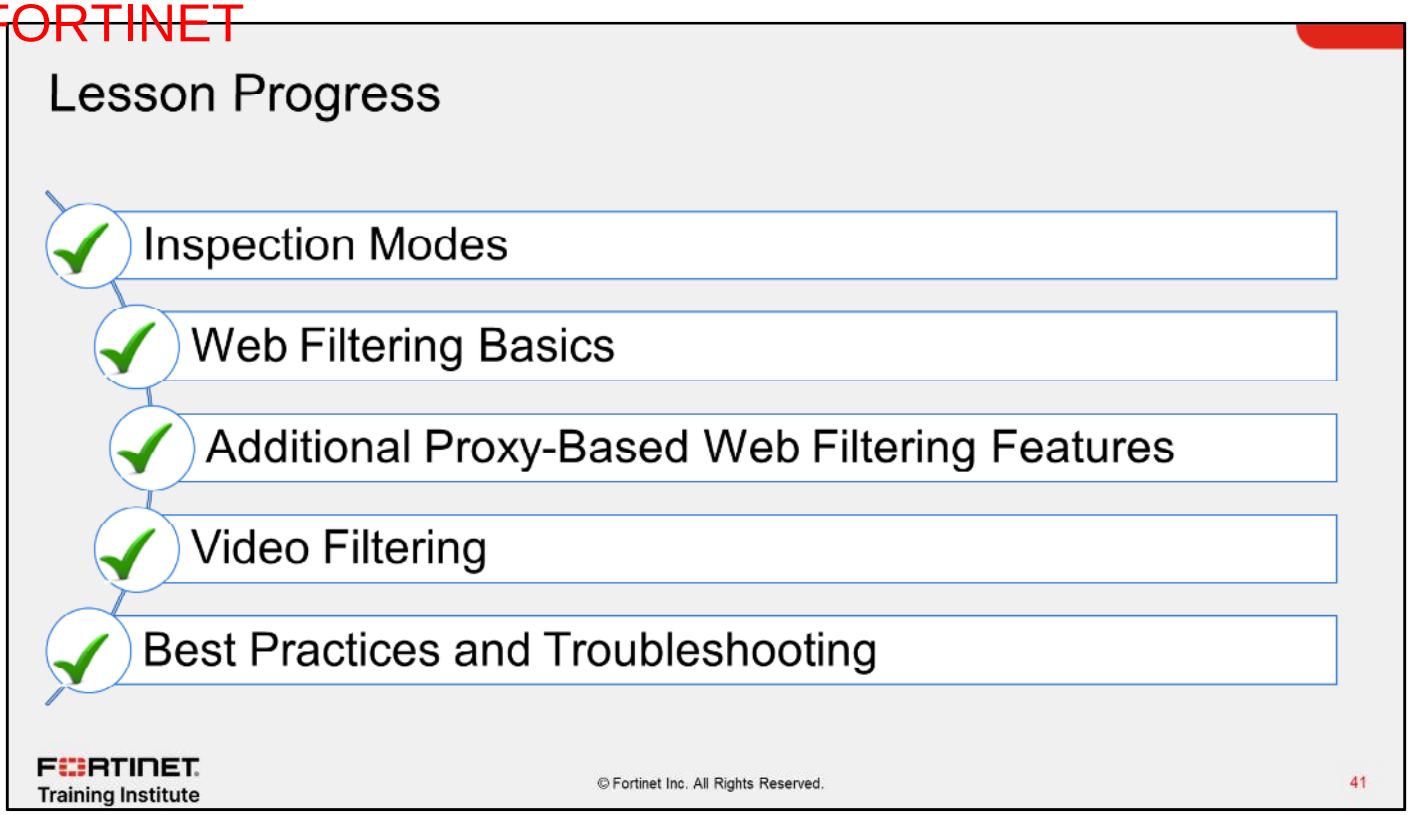
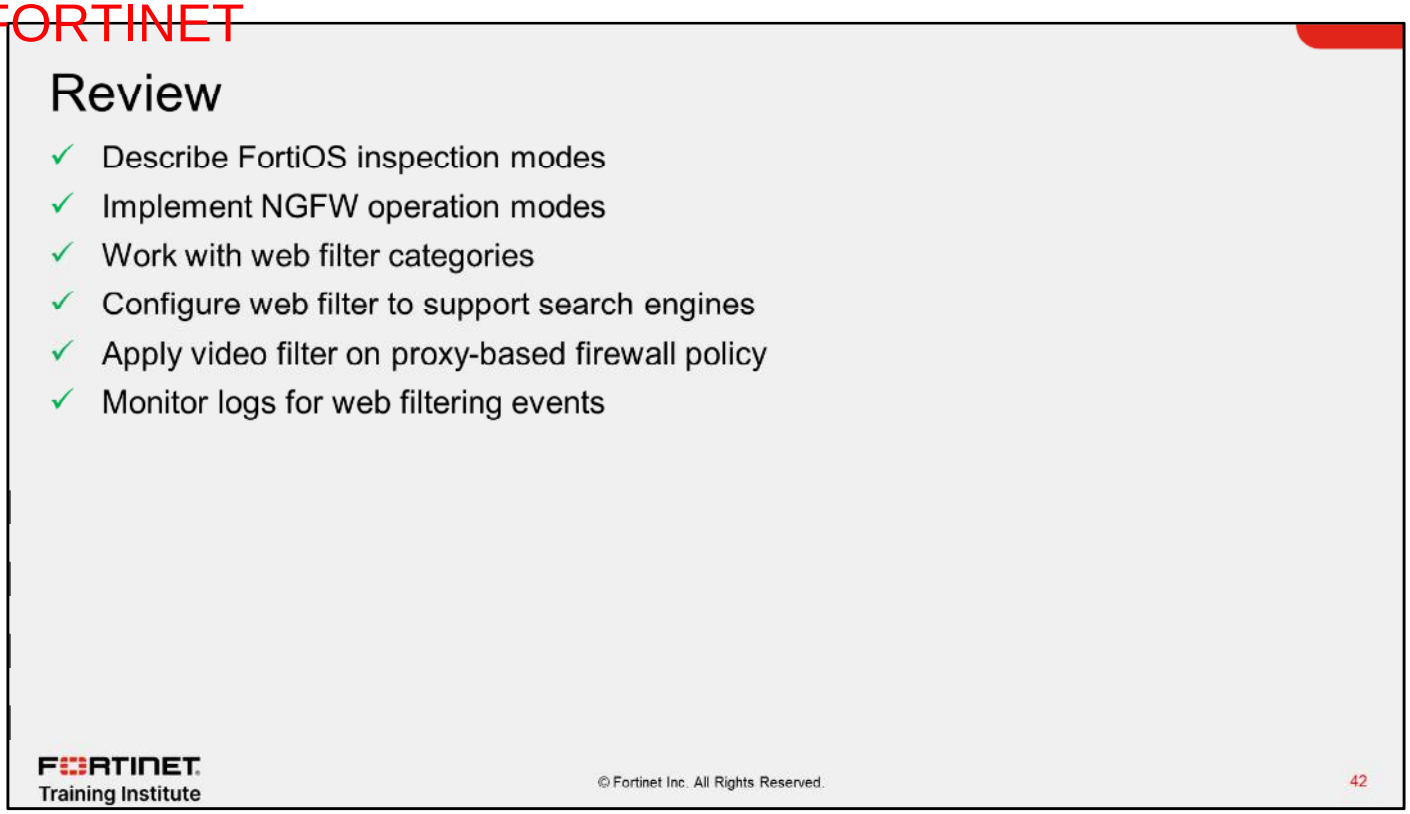


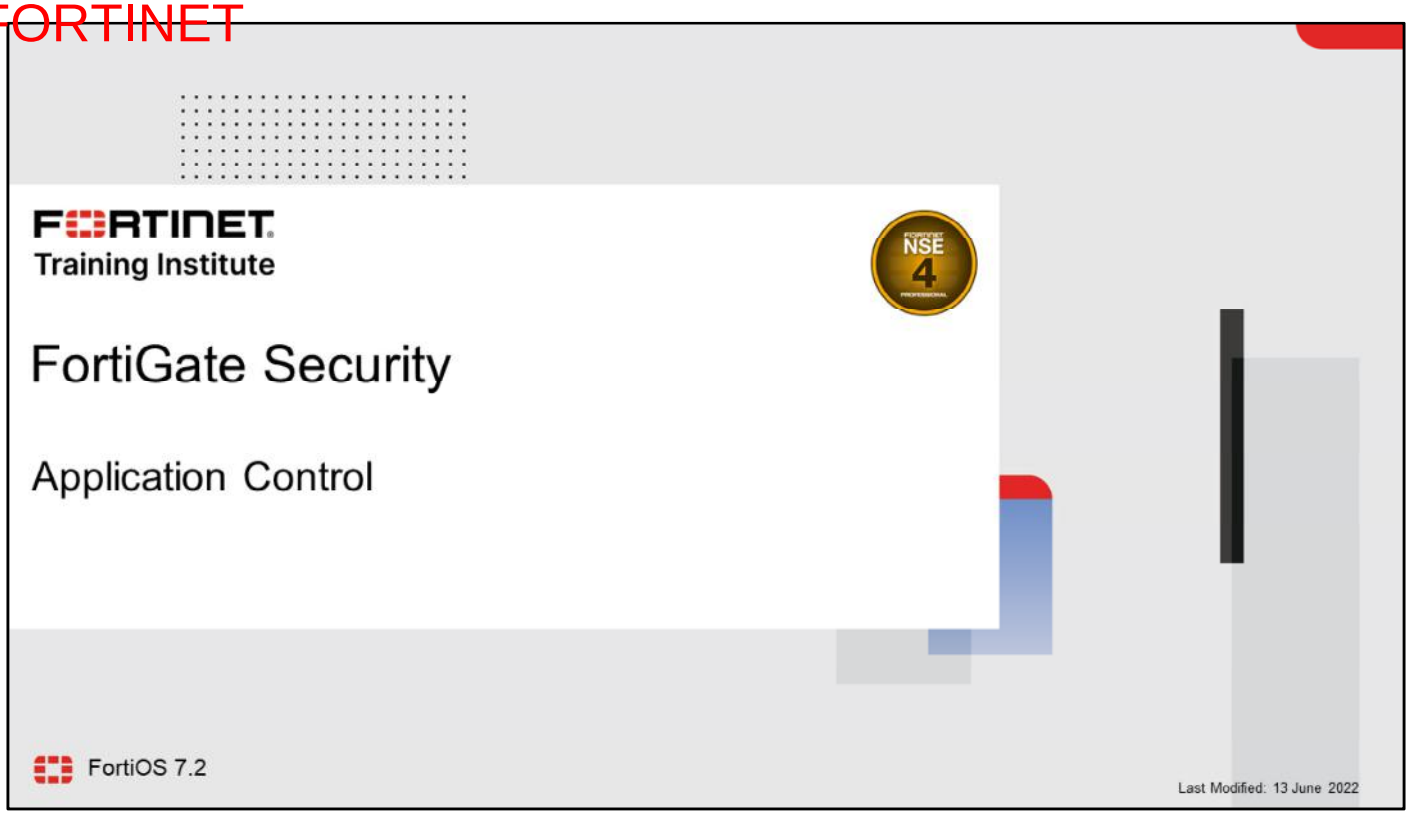
Congratulations! You have completed this lesson.

Now, you will review the objectives that you covered in the lesson.

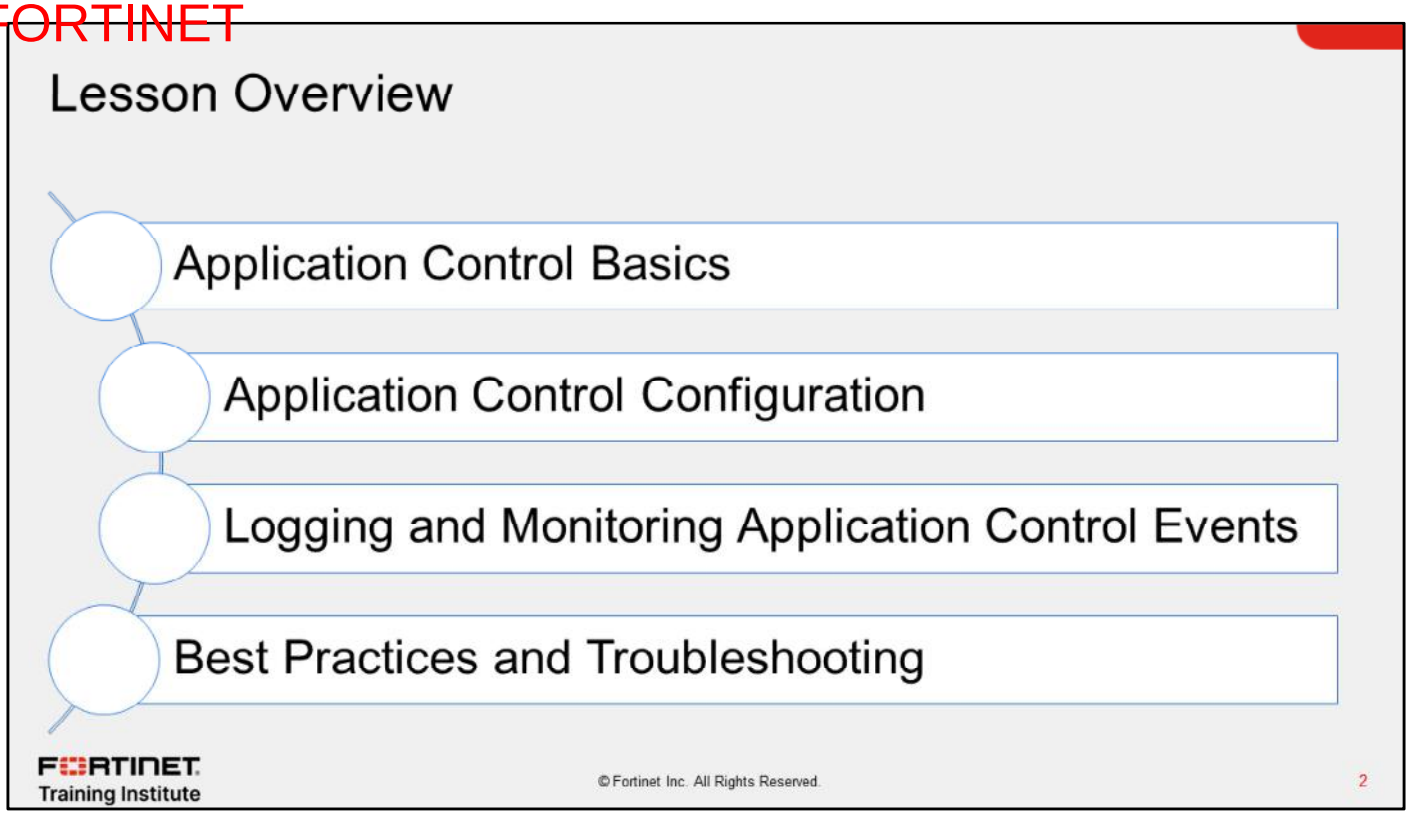


This slide shows the objectives that you covered in this lesson.

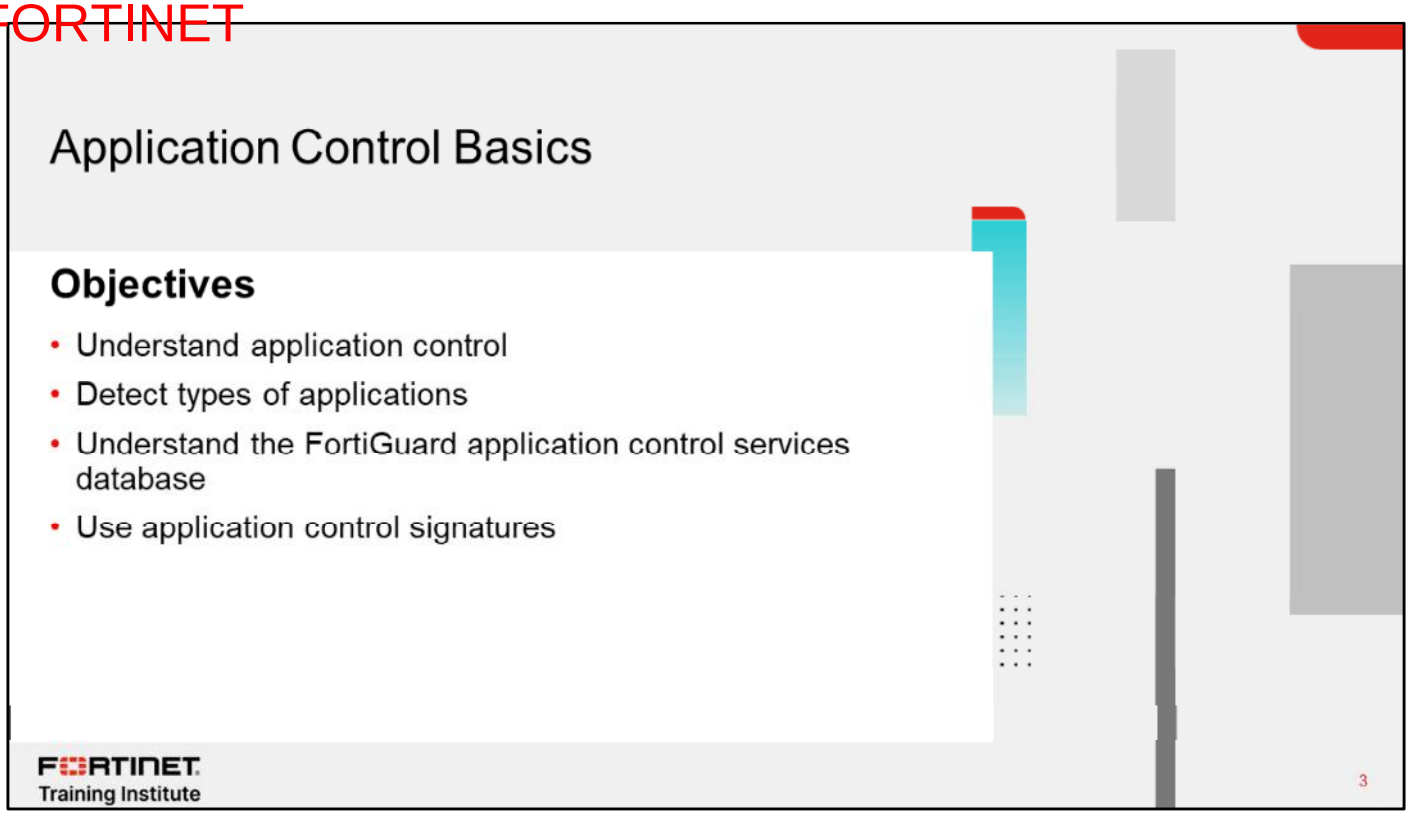
By mastering the objectives covered in this lesson, you learned how to configure web filtering on FortiGate to control web traffic in your network.



In this lesson, you will learn how to monitor and control network applications that may use standard or non-standard protocols and ports—beyond simply blocking or allowing a protocol, port number, or IP address.

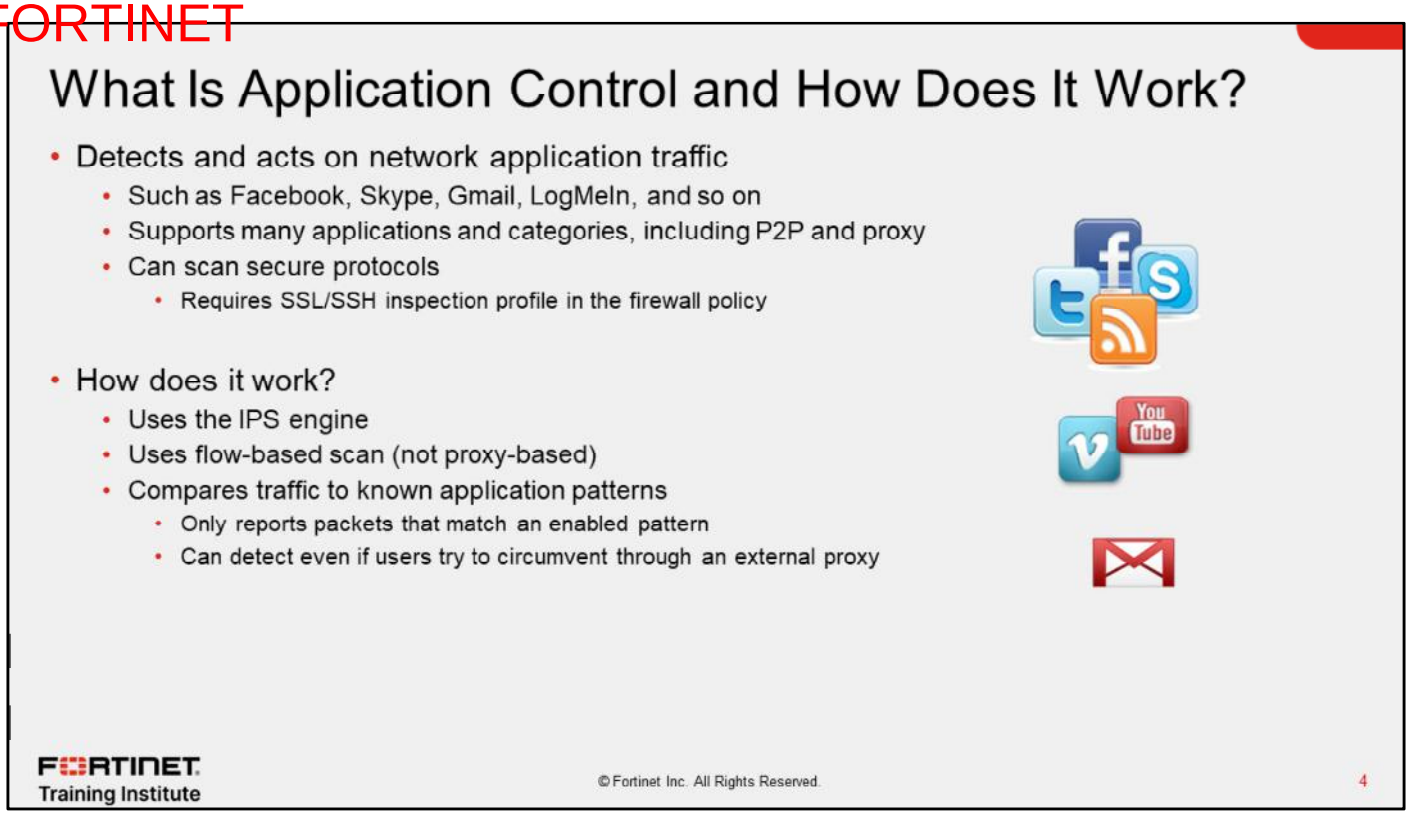


In this lesson, you will learn about the topics shown on this slide.



After completing this section, you should be able to achieve the objectives shown on this slide.

By demonstrating competence in application control basics, you will be able to understand how application control works on FortiGate.



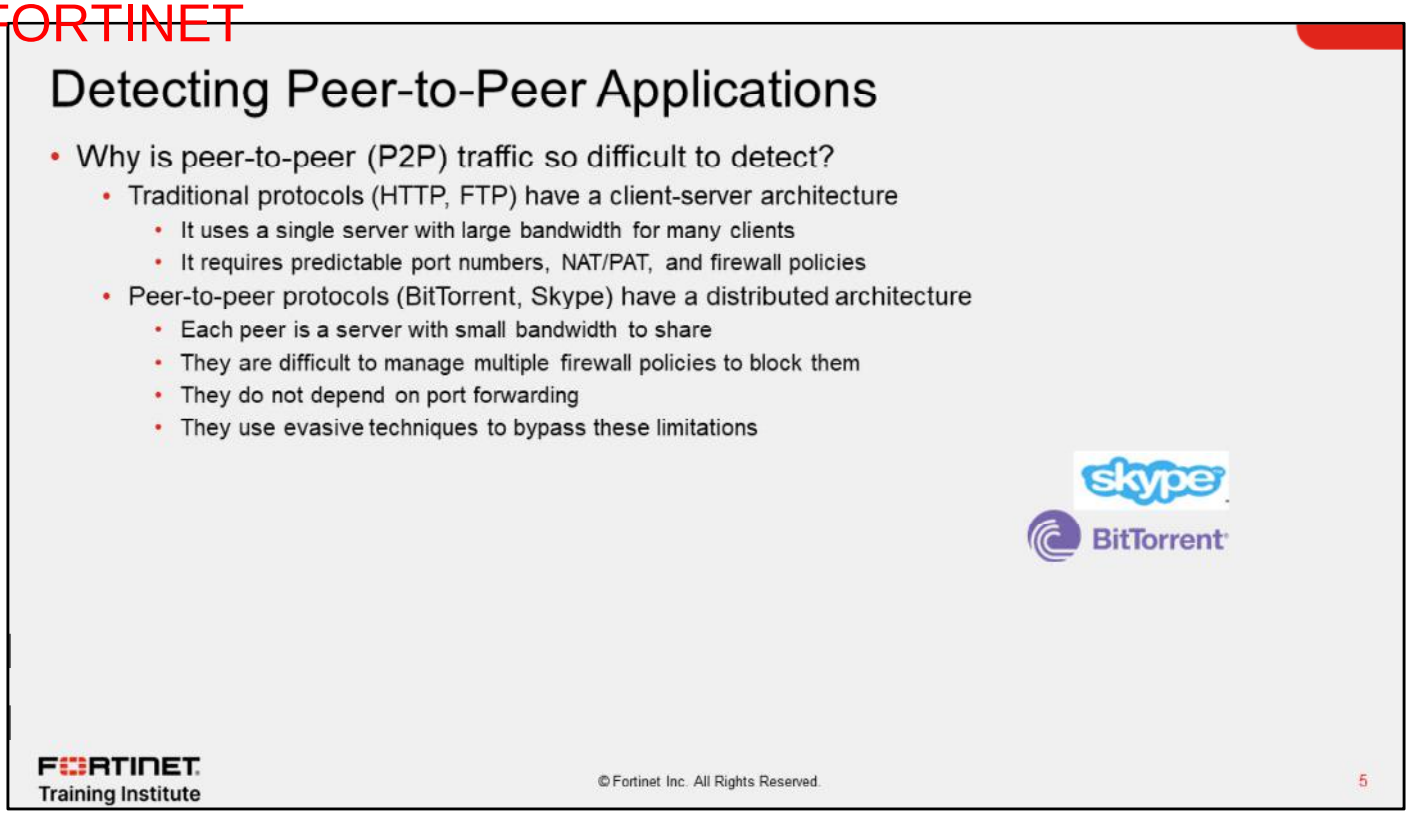
Application control detects applications—often applications that consume a lot of bandwidth—and allows you to take appropriate action related to application traffic, such as monitoring, blocking, or applying traffic shaping.

Application control identifies applications, such as Google Talk, by matching known patterns to the application's transmission patterns. Therefore, an application can be accurately identified, only if its transmission pattern is unique. However, not every application behaves in a unique way. Many applications reuse pre-existing, standard protocols and communication methods. For example, many video games, such as *World of Warcraft,* use the BitTorrent protocol to distribute game patches.

Application control can be configured in proxy-based and flow-based firewall policies. However, because application control uses the IPS engine, which uses flow-based inspection, inspection is always flow-based. By comparison, when applying web filtering and antivirus through an HTTP proxy, the proxy first parses HTTP and removes the protocol, and then scans only the payload inside.

Why does FortiGate use a flow-based scan for application control?

Unlike other forms of security profiles, such as web filtering or antivirus, application control is not applied by a proxy. It uses an IPS engine to analyze network traffic and detect application traffic, even if the application is using standard or non-standard protocols and ports. It doesn't operate using built-in protocol states. It matches patterns in the entire byte stream of the packet, and then looks for patterns.

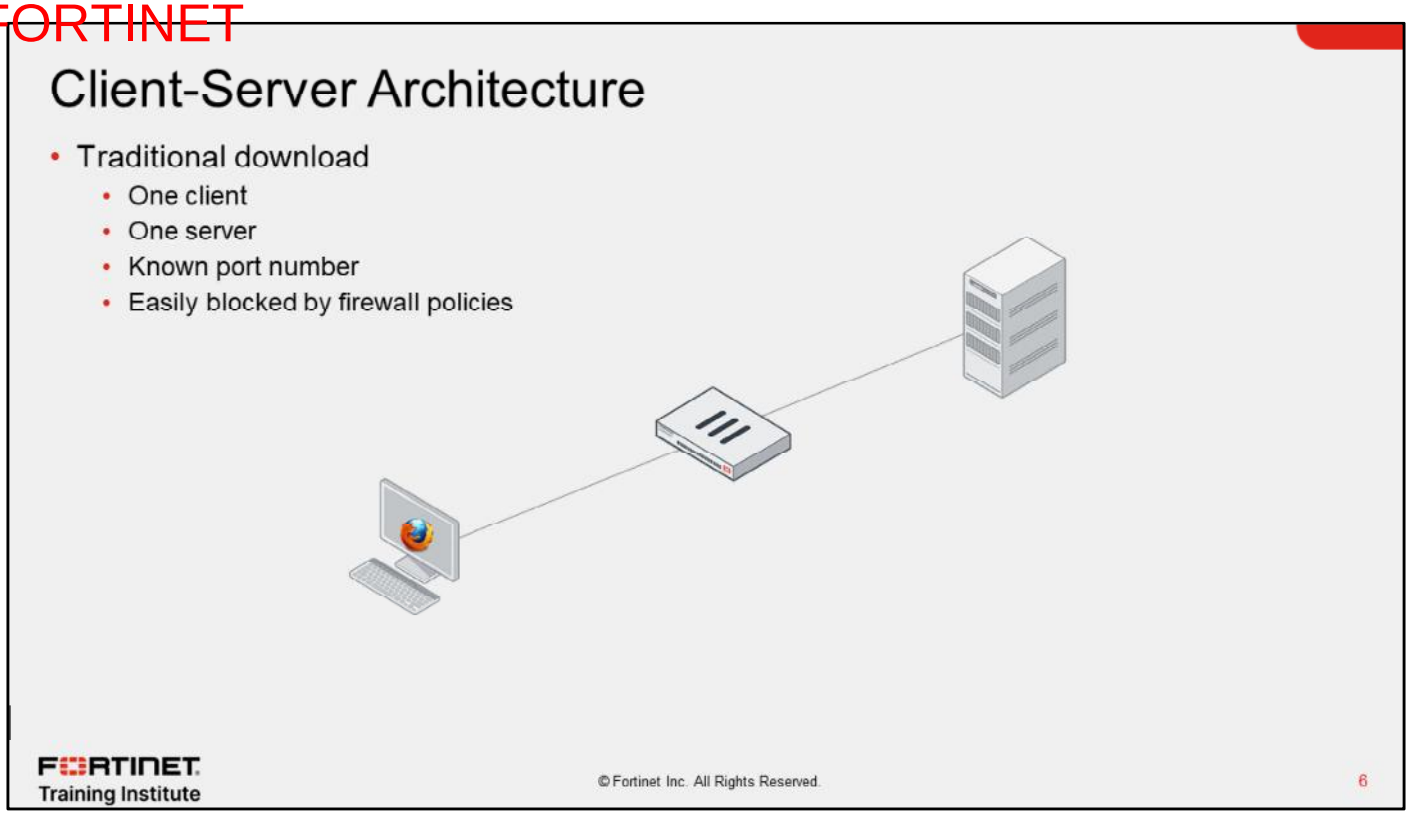


When HTTP and other protocols were designed, they were designed to be easy to trace. Because of that, administrators could easily give access to single servers behind NAT devices, such as routers and, later, firewalls.

But when P2P applications were designed, they had to be able to work without assistance—or cooperation—from network administrators. In order to achieve this, the designers made P2P applications able to bypass firewalls and incredibly hard to detect. Port randomization, pinholes, and changing encryption patterns are some of the techniques that P2P protocols use.

These techniques make P2P applications difficult to block using a firewall policy, and also make them difficult to detect by proxy-based inspection.

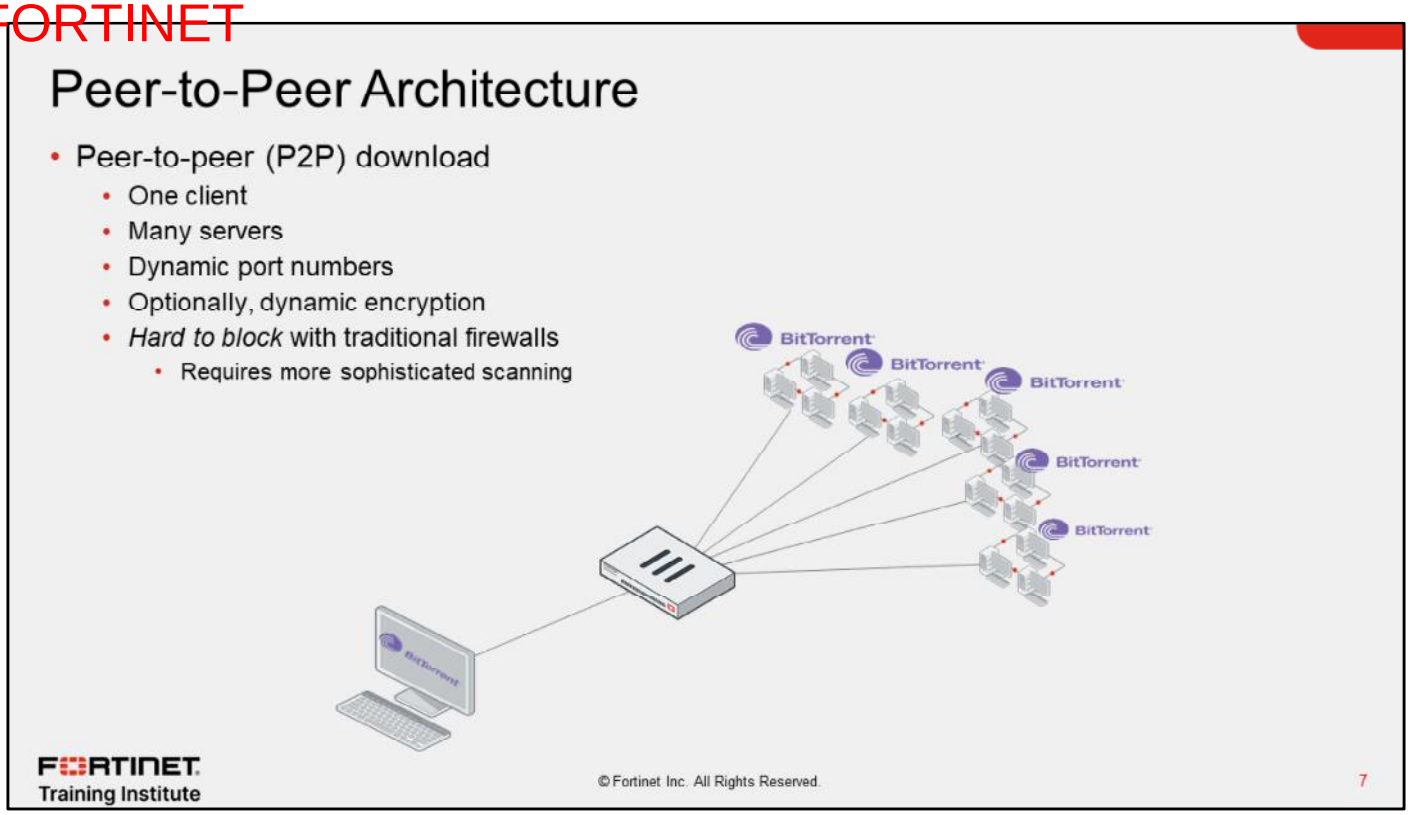
Flow-based inspection using the IPS engine can analyze packets for pattern matching, and then look for patterns to detect P2P applications.



This slide shows a traditional, client-server architecture. There may be many clients of popular sites, but often, such as with an office file server, it's just one client and one server.

Traditional downloads use a defined protocol over a standard port number. Whether it's from a web or FTP site, the download is from a single IP address, to a single IP address. So, blocking this kind of traffic is easy: you only need one firewall policy.

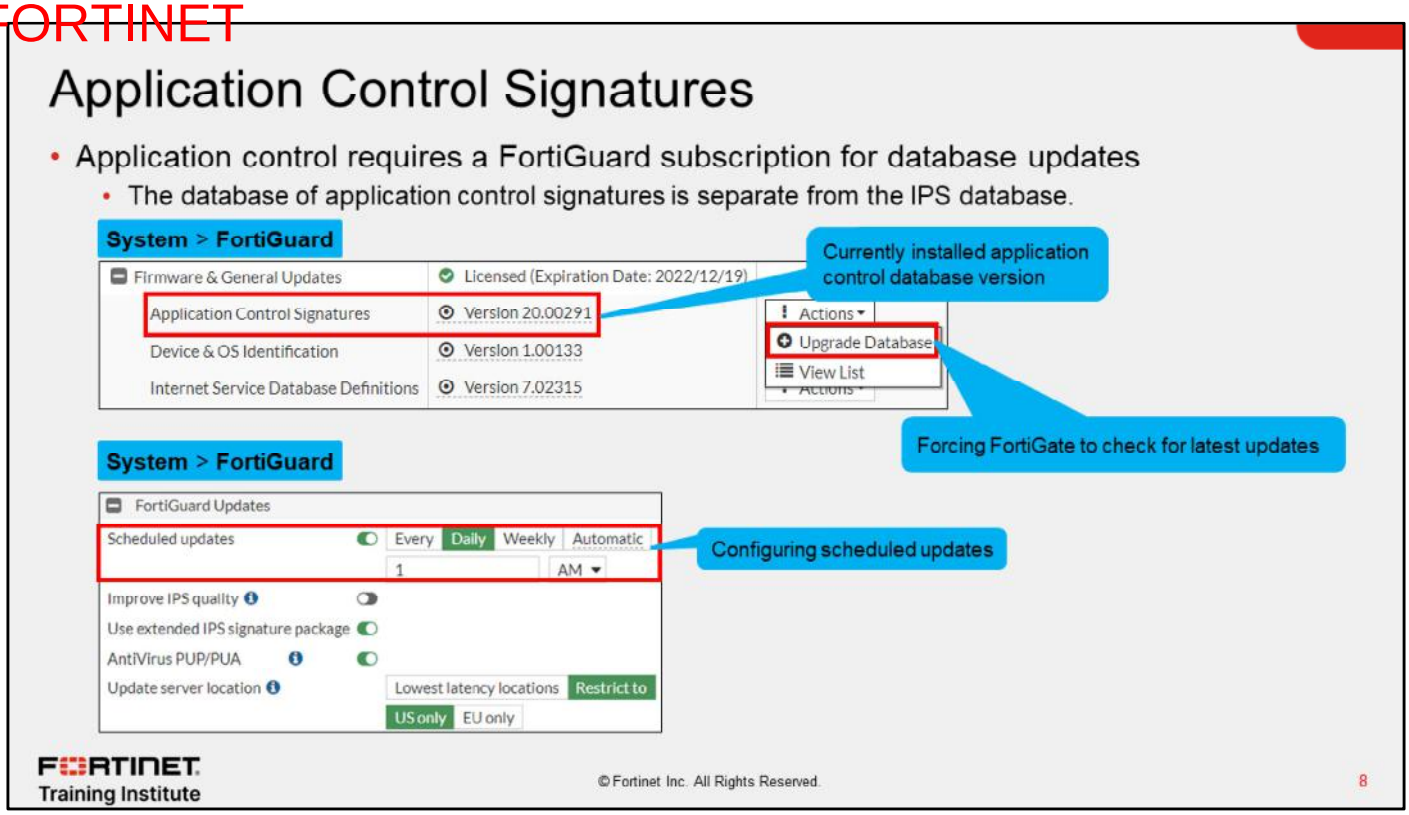
But, it's more difficult to block traffic from peer-to-peer downloads. Why?



Peer-to-peer (P2P) downloads divide each file among multiple (theoretically unlimited) peers. Each peer delivers part of the file. While having many clients is a disadvantage in client-server architectures, it is an advantage for P2P architecture because, as the number of peers increases to n, the file is delivered n times faster.

Because popularity increases the speed of delivery—unlike traditional client-server architecture where popularity could effectively cause a denial of service (DoS) attack on the server—some software, such as BitTorrent distributions of Linux, and games distributing new patches, leverage this advantage. Even if each client has little bandwidth, together they can offer more bandwidth for the download than many powerful servers.

Consequently, in order to download the file, the requesting peer can consume much more bandwidth per second than it would from only a single server. Even if there is only one peer in your network, it can consume unusually large amounts of bandwidth. Because the protocols are usually evasive, and there will be many sessions to many peers, they are difficult to completely block.



Before you try to control applications, it's important to understand the signatures used by application control.

How does application control detect the newest applications and changes to application protocols?

Application control updates come as part of the standard FortiCare support contract, but it requires a subscription for database updates. The database for application control signatures is separate from the intrusion prevention system (IPS) database. You can configure FortiGate to automatically update its application control signature database on the FortiGuard page. The application control signature database information is also displayed on the FortiGuard page.