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## Denial of Service

### Objectives

- Identify a DoS attack
- Configure a DoS policy

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

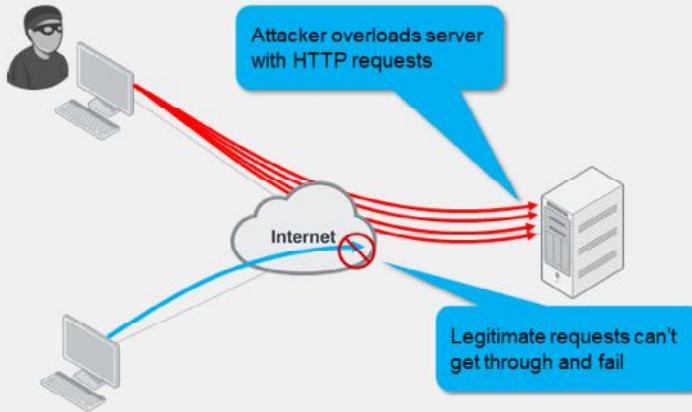
By demonstrating competence in Denial of Service (DoS), you should be able to protect your network from common DoS attacks.

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### DoS Attacks

- Attacker sessions consume all resources—RAM, CPU, port numbers
- Slows down or disables the target until it can't serve legitimate requests



So far, you have learned about signatures that match illegal commands and invalid protocol implementations. Those are easy to confirm as attacks.

What about attacks that function by exploiting asymmetric processing or bandwidth between clients and servers?

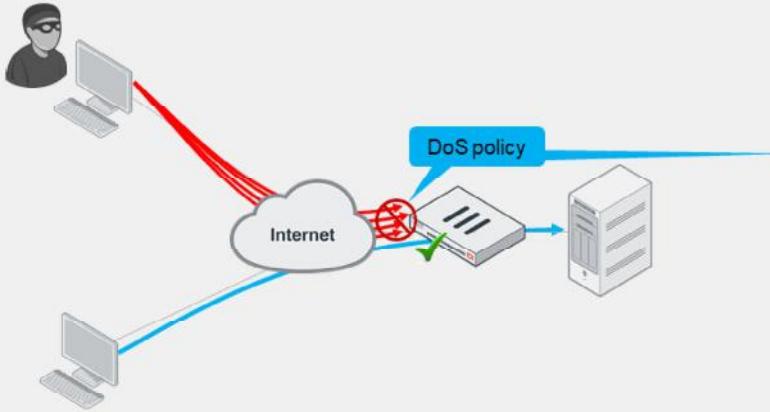
The goal of a DoS attack is to overwhelm the target—to consume resources until the target can't respond to legitimate traffic. There are many ways to accomplish this. High-bandwidth use is only one type of DoS attack. Many sophisticated DoS attacks, such as Slowloris, don't require high bandwidth.

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### DoS Policy

- DoS policies apply the action when the configured threshold is exceeded
  - Half-open connections, source address, destination address, ports, and so on
- Multiple sensors can detect different anomalies



#### Policy & Objects > IPv4 DoS Policy

| New Policy          |         |         |         |         |         |
|---------------------|---------|---------|---------|---------|---------|
| Name                | Logging | Action  | Disable | Block   | Monitor |
| DoS_Policy          |         | Disable |         |         |         |
| Intalling Interface |         | port1   |         |         |         |
| Source Address      |         | all     | *       |         |         |
| Destination Address |         | all     | *       |         |         |
| Service             |         | ALL     | *       |         |         |
| L3 Anomalies        |         |         |         |         |         |
| Name                | Logging | Action  | Disable | Block   | Monitor |
| ip_src_session      |         | Disable | Block   | Monitor | 5000    |
| ip_dst_session      |         | Disable | Block   | Monitor | 5000    |
| L4 Anomalies        |         |         |         |         |         |
| Name                | Logging | Action  | Disable | Block   | Monitor |
| tcp_syn_flood       |         | Disable | Block   | Monitor | 2000    |
| tcp_port_scan       |         | Disable | Block   | Monitor | 1000    |
| tcp_src_session     |         | Disable | Block   | Monitor | 5000    |
| tcp_dst_session     |         | Disable | Block   | Monitor | 5000    |
| udp_flood           |         | Disable | Block   | Monitor | 2000    |
| udp_scan            |         | Disable | Block   | Monitor | 2000    |
| udp_src_session     |         | Disable | Block   | Monitor | 5000    |
| udp_dst_session     |         | Disable | Block   | Monitor | 5000    |

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To block DoS attacks, apply a DoS policy on a FortiGate that is located between attackers and all the resources that you want to protect.

DoS filtering is done early in the packet handling process, which is handled by the kernel.

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## Types of DoS Attacks

- TCP SYN flood
  - Attacker floods victim with incomplete TCP/IP connection requests
  - The victim's connection table becomes full, so legitimate clients can't connect
- ICMP sweep
  - Attackers sends ICMP traffic to find targets
  - Attacker then attacks hosts that reply
- TCP port scan
  - Attacker probes a victim by sending TCP/IP connection requests to varying destination ports
  - Based on replies, attacker can map out which services are running on the victim system
  - Attacker then targets those destination ports to exploit the system



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In TCP, the client sends a SYN packet to initiate a connection. The server must respond with a SYN/ACK packet, and save the connection information in RAM while it waits for the client to acknowledge with an ACK packet. Legitimate clients ACK quickly and begin to transmit data. But malicious clients continue to send more SYN packets, half-opening more connections, until the server's connection table is full. Once the server's table is full, it can't accept more connections and begins to ignore all new clients.

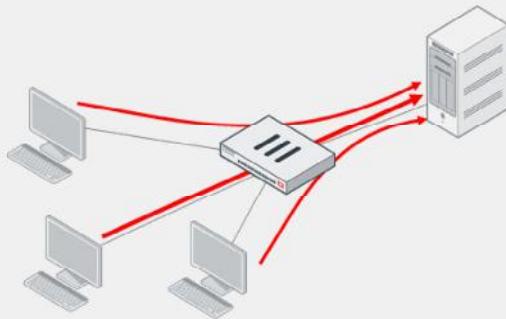
ICMP is used during troubleshooting: devices respond with success or error messages. However, attackers can use ICMP to probe a network for valid routes and responsive hosts. By doing an ICMP sweep, the attacker can gain information about your network before crafting more serious exploits.

Attackers use port scanning to determine which ports are active on a system. The attacker sends TCP SYN requests to varying destination ports. Based on the replies, the attacker can map out which services are running on the system, and then proceed to exploit those services.

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## Types of DoS Attacks (Contd)

- **Distributed DoS**
  - Many of the same characteristics of an individual DoS attack
  - However, attack originates from multiple sources



An individual DoS attack is a flood of traffic coming from a single address. It can originate from the internet, or even from your internal network. Typically, a single device makes many connections or sessions, and possibly uses much bandwidth to connect to a single location. A variation of this is the distributed denial of service attack, or DDoS. It has many of the same characteristics as an individual DoS attack, but the main difference is that multiple devices are all attacking one destination at the same time.

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## DoS Policy Configuration

- Can apply multiple DoS policies to any physical or logical interface
- Types
  - Flood
    - Detects a large volume of the same type of traffic
  - Sweep/scan
    - Detects probing attempts
  - Source (SRC)
    - Detects a large volume of traffic from an individual IP
  - Destination (DST)
    - Detects a large volume of traffic destined for an individual IP

### Policy & Objects > IPv4 DoS Policy

| Name           | Logging | Action  | Disable | Block   | Monitor | Threshold |
|----------------|---------|---------|---------|---------|---------|-----------|
| ip_src_session | On      | Disable | Block   | Monitor |         | 5000      |
| ip_dst_session | On      | Disable | Block   | Monitor |         | 5000      |

| Name            | Logging | Action  | Disable | Block   | Monitor | Threshold |
|-----------------|---------|---------|---------|---------|---------|-----------|
| tcp_syn_flood   | On      | Disable | Block   | Monitor |         | 2000      |
| tcp_port_scan   | On      | Disable | Block   | Monitor |         | 1000      |
| tcp_src_session | On      | Disable | Block   | Monitor |         | 5000      |
| tcp_dst_session | On      | Disable | Block   | Monitor |         | 5000      |
| udp_flood       | On      | Disable | Block   | Monitor |         | 2000      |
| udp_scan        | On      | Disable | Block   | Monitor |         | 2000      |

You can apply DoS protection to four protocols: TCP, UDP, ICMP, and SCTP. And, you can apply four different types of anomaly detection protocols:

- A flood sensor detects a high volume of that specific protocol, or signal in the protocol.
- A sweep/scan detects probing attempts to map which of the host ports respond and, therefore, might be vulnerable.
- Source signatures look for large volumes of traffic originating from a single IP address.
- Destination signatures look for large volumes of traffic destined for a single IP address.

When you implement DoS for the first time, if you don't have an accurate baseline for your network, be careful not to completely block network services. To prevent this from happening, configure the DoS policy initially to log, but not block. Using the logs, you can analyze and identify normal and peak levels for each protocol. Then, adjust the thresholds to allow normal peaks, while applying appropriate filtering.

The threshold for flood, sweep, and scan sensors are defined as the maximum number of sessions or packets per second. The thresholds for source and destination sensors are defined as concurrent sessions.

Thresholds that are too high can exhaust your resources before the DoS policies trigger. Thresholds that are too low will cause FortiGate to drop normal traffic.

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## Knowledge Check

1. Which DoS anomaly sensor can be used to detect and block the probing attempts of a port scanner?
  - A. tcp\_syn\_flood
  - B. tcp\_port\_scan
  
2. Which behavior is a characteristic of a DoS attack?
  - A. Attempts to exploit a known application vulnerability
  - B. Attempts to overload a server with TCP SYN packets

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## Lesson Progress



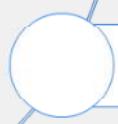
Intrusion Prevention System



Denial of Service



Best Practices



Troubleshooting

Good job! You now understand how to protect your network from DoS attacks on FortiGate.

Now, you will learn about IPS best practices.

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## Best Practices

### Objectives

- Identify the IPS implementation methodology
- Enable full SSL inspection for IPS-inspected traffic
- Identify hardware acceleration components for IPS

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

By demonstrating competence in identifying IPS implementation best practices, you should be able to deploy an IPS solution on FortiGate that is efficient and effective. You should also be able to apply full SSL inspection for IPS-inspected traffic, as well as identify hardware acceleration components for IPS.

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## IPS Implementation

- Analyze requirements
  - Not all policies require IPS
    - Start with the most business-critical services
  - Avoid enabling IPS on internal-to-internal policies
- Evaluate applicable threats
  - Create IPS sensors specifically for the resources you want to protect
- Maintain IPS continuously
  - Monitor logs for anomalous traffic patterns
  - Tune IPS profiles based on observations



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Before you implement IPS, you must analyze the needs of your network. Enabling the default profiles across all policies quickly causes issues, the least of which are false positives. Performing unnecessary inspections on all network traffic can cause high resource utilization, which can hamper the ability of FortiGate to process regular traffic.

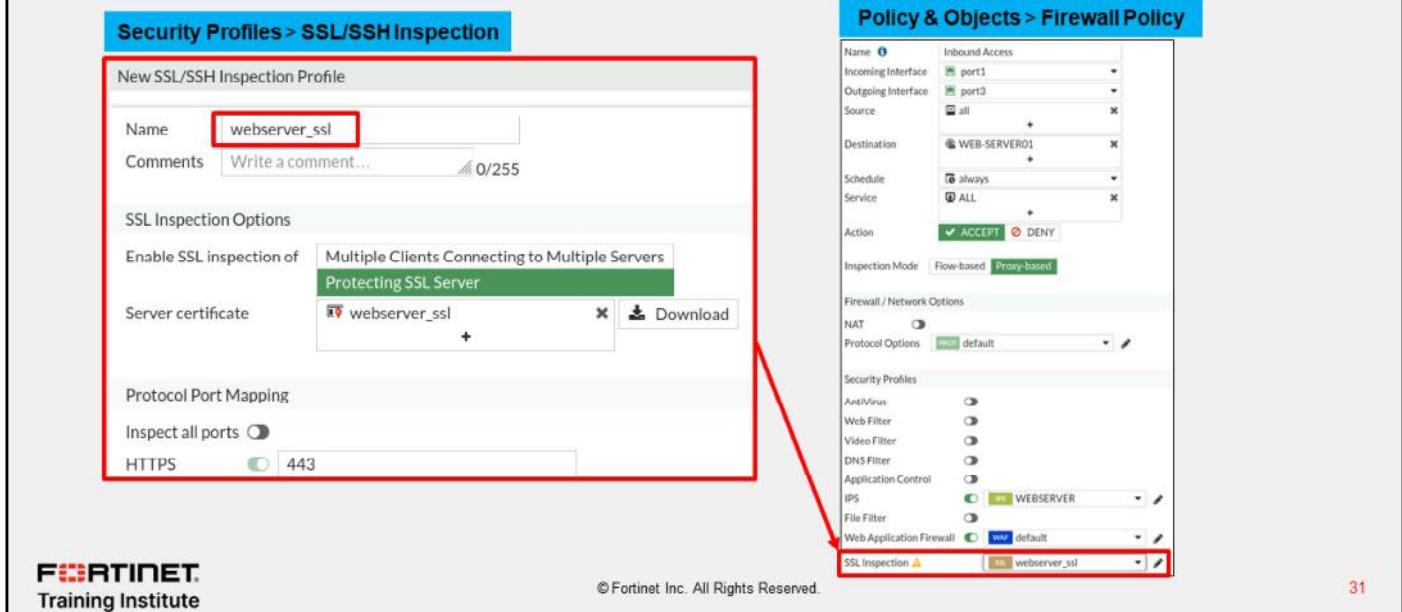
You must also evaluate applicable threats. If your organization runs only Windows, there is no need to scan for Mac OS vulnerabilities. It is also important to consider the direction of the traffic. There are many IPS signatures that apply only to clients, and many signatures that apply only to servers. Create IPS sensors specific to the resources you want to protect. This makes sure that FortiGate is not scanning traffic with irrelevant signatures.

Lastly, IPS is not a *set-and-forget* implementation. You must monitor logs regularly for anomalous traffic patterns, and adjust your IPS profile configuration based on your observations. You should also audit your internal resources regularly to identify if certain vulnerabilities still apply to your organization.

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## Full SSL Inspection

- Enable a full SSL inspection profile to ensure you're inspecting encrypted traffic



The screenshot displays two main sections of the FortiGate management interface:

**Security Profiles > SSL/SSH Inspection**

This section shows the configuration of a new SSL inspection profile named "webserver\_ssl". It includes fields for Name (webserver\_ssl), Comments (Write a comment...), and SSL Inspection Options (Protecting SSL Server). A red box highlights the "Name" field and the "Protecting SSL Server" button.

**Policy & Objects > Firewall Policy**

This section shows a detailed view of a firewall policy. The policy settings include:

- Name:** webserver\_ssl
- Inbound Access:** port1, port2, port3
- Source:** all
- Destination:** WEB-SERVER01
- Schedule:** always
- Action:** ACCEPT (selected)
- Inspection Mode:** Flow-based
- Protocol Options:** default
- Security Profiles:** An arrow points from the "SSL Inspection" section in the left panel to this list, highlighting the "SSL Inspection" profile assigned to the policy.

At the bottom of the interface, there is a Fortinet Training Institute logo and a copyright notice: © Fortinet Inc. All Rights Reserved.

Certain vulnerabilities apply only to encrypted connections. In some of these cases, FortiGate can't identify the threat reliably if it can't parse the payload. For this reason, you must use an SSL inspection profile if you want to get the maximum benefit from your IPS and WAF features.

The example on this slide shows an SSL inspection profile configured to protect a server. This policy, when applied to inbound traffic, can apply IPS and WAF inspection on encrypted traffic reliably, because FortiGate can decrypt encrypted sessions and inspect all parts of the packet.

It's important to note that DoS policies do not have the ability to assign SSL inspection profiles. This is because DoS does not require SSL inspection to maximize its detection ability, because it does not inspect the packet payload. DoS inspects only specific session types and their associated volume.

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## Hardware Acceleration

- FortiGate models with NP6, NP7, and SoC4 can benefit from NTurbo acceleration (np-accel-mode)
- FortiGate models with CP8 or CP9 support offloading of IPS pattern matching to the content processor (cp-accel-mode)

```
fgt # get hardware status
Model name: FortiGate-300D
ASIC version: CP8
ASIC SRAM: 64M
CPU: Intel(R) Core(TM) i3-3220 CPU @ 3.30GHz
Number of CPUs: 4
RAM: 7996 MB
Compact Flash: 15331 MB /dev/sda
Hard disk: 114473 MB /dev/sdb
USB Flash: not available
Network Card chipset: Intel(R) Gigabit Ethernet
Network Driver (rev. 0003)
Network Card chipset: FortiASIC NP6 Adapter (rev.)
```

```
# config ips global
# set np-accel-mode [ basic | none ]
# set cp-accel-mode [ basic | advanced | none ]
# end
```

### np-accel-mode

- basic: offloads IPS processing to NP

### cp-accel-mode

- basic: offloads basic IPS pattern matching to CP8 or CP9
- advanced: offloads more types of IPS pattern matching
  - Only available on devices with two or more CP8s or one or more CP9s



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Usually, traffic requiring inspection, such as antivirus or IPS, is handled by the CPU on FortiGate. However, there are specialized chips on specific FortiGate models that can offload these inspection tasks. This frees up CPU cycles to manage other tasks, and also accelerates sessions requiring security inspection.

FortiGate models that support a feature called NTurbo can offload IPS processing to NP6, NP7, or SoC4 processors. If the command np-accel-mode is available under config system global, the FortiGate model supports NTurbo.

Some FortiGate models also support offloading IPS pattern matching to CP8 or CP9 content processors. If the command cp-accel-mode is available under config ips global, the FortiGate model supports IPS pattern matching acceleration to its CP8 or CP9 processor.

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## Knowledge Check

1. Which chipset uses NTurbo to accelerate IPS sessions?  
 A. CP9  
 B. SoC4
  
2. Which feature requires full SSL inspection to maximize its detection capability?  
 A. WAF  
 B. DoS

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## Lesson Progress



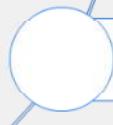
Intrusion Prevention System



Denial of Service



Best Practices



Troubleshooting

Good job! You now understand some best practices for IPS implementation on FortiGate.

Now, you will learn about IPS troubleshooting.

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## Troubleshooting

### Objectives

- Troubleshoot FortiGuard IPS updates
- Troubleshoot IPS high-CPU usage
- Manage IPS fail-open events
- Investigate false-positive detection

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

By demonstrating competence in troubleshooting, you should be able to identify, investigate, and manage some common issues with IPS deployments on FortiGate.

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## FortiGuard IPS Troubleshooting

- All IPS update requests are sent to `update.fortiguard.net` on TCP port 443
  - Can be configured to connect through a web proxy (CLI only):
    - `config system autoupdate tunneling`
- Verify update status on GUI



The screenshot shows the 'System > FortiGuard' section of the FortiGate interface. It displays a table of FortiGuard components and their versions. A red box highlights the 'Licensed (Expiration Date: 2023/01/18)' status for the 'Intrusion Prevention' row.

| Category             | Item                                   | Version          | Action  |
|----------------------|--|------------------|---------|
| Intrusion Prevention | Licensed (Expiration Date: 2023/01/18) | Version 18.00052 | Actions |
| IPS Definitions      | Version 7.00018                        | View List        |         |
| IPS Engine           | Version 2.00970                        | View List        |         |
| Malicious URLs       | Version 7.01436                        | View List        |         |
| Botnet IPs           | Version 2.00721                        | View List        |         |
| Botnet Domains       |  |                  |         |

- Enable real-time debug on CLI

```
# diagnose debug application update -1
# diagnose debug enable
# execute update-now
```

After enabling real-time debugging, force a manual update of all FortiGuard packages

FortiGate IPS update requests are sent to `update.fortiguard.net` on TCP port 443. You can also configure FortiGate to connect through a web proxy for updates.

You should check the last update timestamp regularly. You can verify it on the GUI. If there is any indication that the IPS definitions are not updating, you should investigate. Always make sure FortiGate has proper DNS resolution for `update.fortiguard.net`. If, by chance, there are any intermediary devices between the FortiGate and the internet, make sure the correct firewall rules are in place to allow traffic on port443. Any intermediary devices performing SSL inspection on this traffic can also cause issues with updates.

Finally, you can use the FortiGuard update debug to monitor update events in real time.

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## IPS and High-CPU Use

```
# diagnose test application ipsmonitor <Integer>

1: Display IPS engine information
2: Toggle IPS engine enable/disable status
3: Display restart log
4: Clear restart log
5: Toggle bypass status
6: Submit attack characteristics now
10: IPS queue length
11: Clear IPS queue length
12: IPS L7 socket statistics
13: IPS session list
14: IPS NTurbo statistics
15: IPSA statistics
...
97: Start all IPS engines
98: Stop all IPS engines
99: Restart all IPS engines and monitor
```

The diagram shows three highlighted command options with associated callout boxes:

- Option 2: "Toggle IPS engine enable/disable status" is connected to a blue box containing the text "Shuts down IPS engine completely".
- Option 5: "Toggle bypass status" is connected to a blue box containing the text "IPS engine remains active, but does not inspect traffic".
- Option 99: "Restart all IPS engines and monitor" is connected to a blue box.

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Short spikes in CPU usage by IPS processes can be caused by firewall policy or profile changes. These spikes are usually normal. Spikes might happen when FortiGate has hundreds of policies and profiles, or many virtual domains. Continuous high-CPU use by the IPS engines is not normal, and you should investigate it. You can use the command shown on this slide, along with displayed options, to troubleshoot these issues.

If there are high-CPU use problems caused by the IPS, you can use the `diagnose test application ipsmonitor` command with option 5 to isolate where the problem might be. Option 5 enables IPS bypass mode. In this mode, the IPS engine is still running, but it is not inspecting traffic. If the CPU use decreases after that, it usually indicates that the volume of traffic being inspected is too high for that FortiGate model.

If the CPU use remains high after enabling IPS bypass mode, it usually indicates a problem in the IPS engine, which you must report to Fortinet Support. You can disable the IPS engine completely using option 2. If you want to restore IPS inspection of traffic after you finish troubleshooting, use option 5 again.

Another recommendation to keep in mind: if you need to restart the IPS, use option 99, as shown on this slide. This guarantees that all the IPS-related processes restart properly.

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### IPS Fail Open

- Fail open is triggered when the IPS socket buffer is full and new packets can't be added for inspection

```
config ips global  
set fail-open <enable|disable>  
...  
end
```

- IPS fail open entry log:

```
date=2021-04-21 time=09:07:59 logid=0100022700 type=event subtype=system  
level=critical vd="root" logdesc="IPS session scan paused" action="drop"  
msg="IPS session scan, enter fail open mode"
```

- When troubleshooting IPS fail-open events, try to identify a pattern
  - Has the traffic volume increased recently?
  - Does fail open trigger at specific times during the day?
- Create IPS profiles specifically for the traffic type
  - An IPS sensor configured to protect Windows servers doesn't need Linux signatures
  - Disable IPS on internal-to-internal policies

Packets dropped!

IPS goes into fail-open mode when there is not enough available memory in the IPS socket buffer for new packets. What happens during this state depends on the IPS configuration. If the `fail-open` setting is enabled, some new packets (depending on the system load) will pass through without being inspected. If it is disabled, new packets are dropped.

Frequent IPS fail open events usually indicate that IPS can't keep up with the traffic demands. So, try to identify patterns. Has the traffic volume increased recently? Have throughput demands increased? Does fail open trigger at specific times during the day?

Tune and optimize your IPS configuration. Create IPS profiles specific to the type of traffic being inspected, and disable IPS profiles on policies that don't need them.

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## Knowledge Check

1. Which FQDN does FortiGate use to obtain IPS updates?  
 A. update.fortiguard.net  
 B. service.fortiguard.com
  
2. When IPS fail open is triggered, what is the expected behavior, if the IPS fail-open option is set to enabled?  
 A. New packets pass through without inspection  
 B. New packets are dropped

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## Lesson Progress



Intrusion Prevention System



Denial of Service



Best Practices



Troubleshooting

Congratulations! You have completed this lesson.

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

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## Review

- ✓ Manage FortiGuard IPS updates
- ✓ Configure an IPS sensor
- ✓ Apply IPS to network traffic
- ✓ Identify a DoS attack
- ✓ Configure a DoS policy
- ✓ Identify the IPS implementation methodology
- ✓ Troubleshoot common IPS issues



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

By mastering the objectives covered in this lesson, you gained the skills and knowledge you need to configure, maintain, and troubleshoot the FortiGate IPS solution.

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## FortiGate Security

Security Fabric



Last Modified: 23 August 2022

In this lesson, you will learn about the Fortinet Security Fabric.

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## Lesson Overview



Introduction to the Fortinet Security Fabric



Deploying the Security Fabric



Extending the Security Fabric and Features



Security Fabric Rating and Topology View

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

By demonstrating competence in deploying the Fortinet Security Fabric, using and extending the Security Fabric features, and understanding its topology, you will be able to use the Fortinet Security Fabric effectively in your network.

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## Introduction to the Fortinet Security Fabric

### Objectives

- Define the Fortinet Security Fabric
- Identify why the Security Fabric is required
- Identify the Fortinet devices that participate in the Security Fabric, especially the essential ones

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

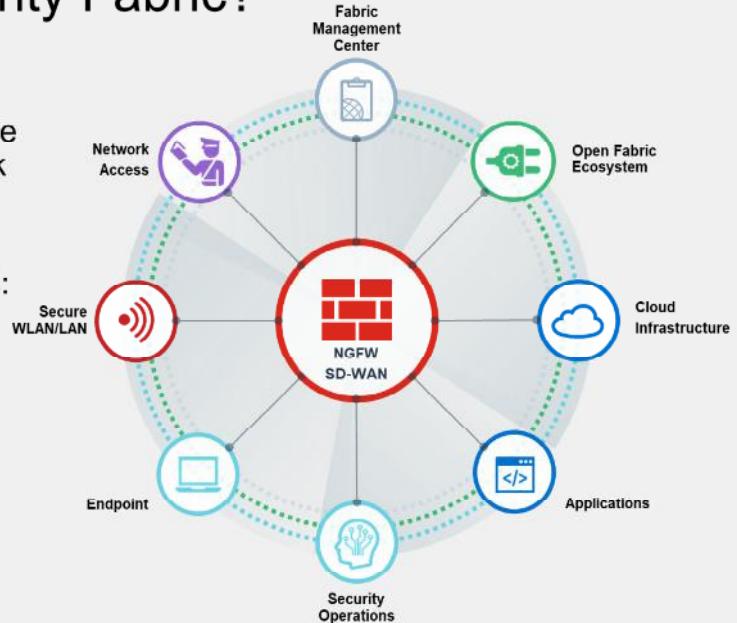
By demonstrating competence in understanding key concepts of the Fortinet Security Fabric, you will better understand the value of the Security Fabric, the servers that comprise it, and how to deploy it.

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### What is the Fortinet Security Fabric?

- An enterprise solution that enables a holistic approach to network security, whereby the network landscape is visible through a single console and all network devices are integrated into a centrally managed and automated defence
- The Security Fabric has these attributes:
  - Broad
  - Integrated
  - Automated
- The API allows for third-party device integration



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#### What is the Fortinet Security Fabric?

It is a Fortinet enterprise solution that enables a holistic approach to network security, whereby the network landscape is visible through a single console and all network devices are integrated into a centrally managed and automated defence.

The network devices include all components, from physical endpoints to virtual devices in the cloud. Because devices are centrally managed and are sharing threat intelligence with one another in real time, and are receiving updates from Fortinet at the macro level, your network can quickly identify, isolate, and neutralize threats as they appear.

The Security Fabric has the following attributes:

- Broad:** It provides visibility of the entire digital attack surface to better manage risk
- Integrated:** It provides a solution that reduces the complexity of supporting multiple point products
- Automated:** Threat intelligence is exchanged between network components in real-time allowing for automated response to threats

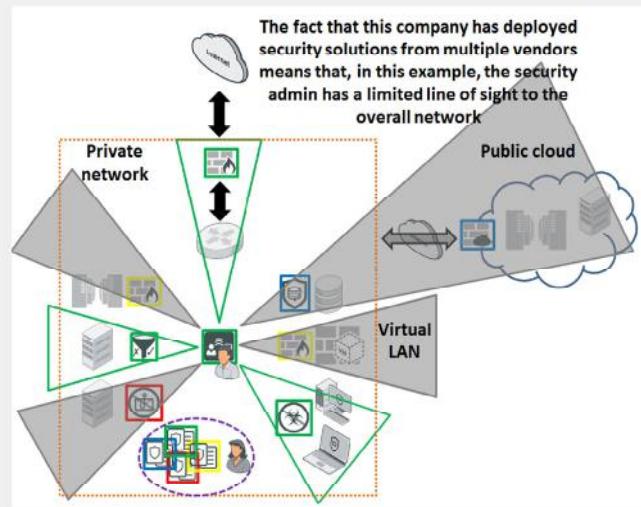
A fourth attribute could be added to this description of the Security Fabric: *open*. The API and protocol are available for other vendors to join and for partner integration. This allows for communication between Fortinet and third-party devices.

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### Why a Security Fabric?

- Many administrators lack visibility of their network defences, making their networks more susceptible to undetected network infiltration
- Network complexity and sophisticated malware (soon to be augmented by AI), necessitates a centralized and holistic approach to security



Why has Fortinet deemed the Security Fabric an essential solution for a robust network defence?

As networks evolved and various new types of threats surfaced, point security products were deployed to address these emerging threats. Often, these piecemeal solutions were effective, but deploying products using different standards and protocols meant that defence assets could not be effectively coordinated.

The illustration on the right side of the slide tells a story of a network that has deployed security solutions from four different vendors. The administrator at the center, working from the security console, has visibility into only some of the security solutions. This lack of visibility of the entire network defence is a serious flaw, and could allow a foreign infiltrator to breach network defences undetected.

The sheer complexity of today's networks compounds this problem. In addition, increasingly sophisticated malware has an expanding attack surface on which to exploit, because networks have broken out of the confines of a traditional network perimeter and have expanded to virtualized networks and public clouds. Add to this mix, the ever growing numbers of unmanaged devices, as a result of BYOD programs, and you have the perfect security storm.

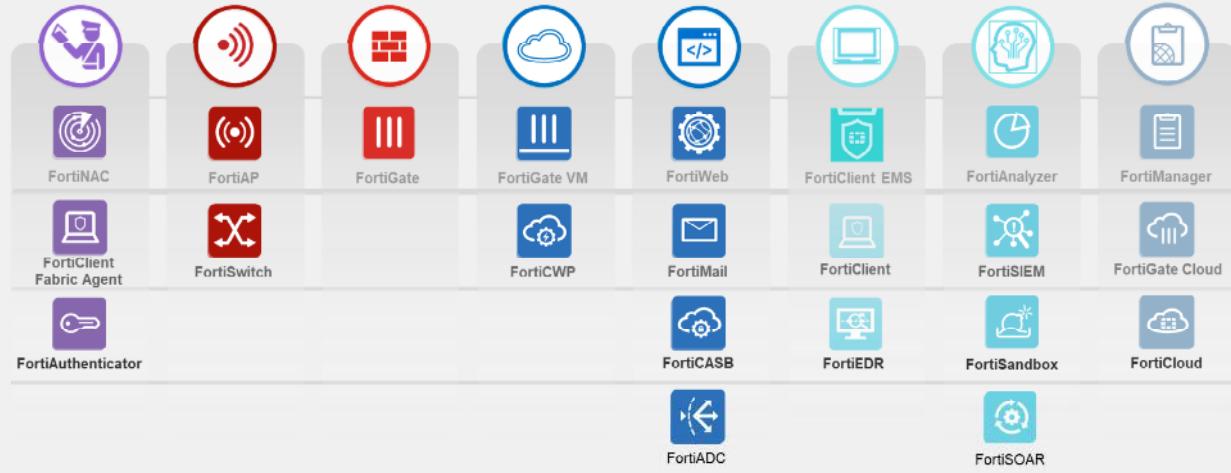
The most feasible solution is to build a centrally managed, holistic approach to security, whereby you have a clear line of sight to all potential infiltration points and can coordinate defences to contain and neutralize network breaches.

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## Security Fabric Products

- Different consumption models available



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As shown on this slide, the Fortinet Security Fabric offers eight solutions: network access, security WLAN/LAN, public and private cloud infrastructure, applications, endpoint, security operations, open fabric ecosystem, and fabric management center. Each of these solutions is based on specific use cases and involve the integration of specific Fortinet products.

The Fortinet Security Fabric offers network security with FortiGate, IPS, VPN, SD-WAN. It also offers multi-cloud strategy across public clouds, private clouds, hybrid clouds, and software as a service (SaaS). It also offers quite a sophisticated endpoint offering ranging from the Fabric Agent all the way up to full endpoint protection, email security, web application security, secure access across distributed enterprises and SD-WAN environments, advanced threat protection, management and analytics, and security information and event management (SIEM).

All of these are underscored and supported by FortiGuard Services, which deliver AI-powered intelligence and protection across the Security Fabric.

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## Devices That Comprise the Security Fabric



- Core:
  - Minimum of two FortiGate devices: one root, and one or more downstream
  - At least one of: FortiAnalyzer, FortiAnalyzer Cloud, or FortiGate Cloud
- Recommended—Adds significant visibility or control:
  - FortiManager, FortiAP, FortiSwitch, FortiClient, FortiClient EMS, FortiSandbox, FortiMail, FortiWeb, FortiNDR, FortiDeceptor
- Extended—Integrates with fabric, but may not apply to everyone:
  - Other Fortinet products and third-party products using the API

You must have a minimum of two FortiGate devices at the core of the Security Fabric, plus one FortiAnalyzer or cloud logging solution. FortiAnalyzer Cloud or FortiGate Cloud can act as the cloud logging solution. The FortiGate devices must be running in NAT mode.

To add more visibility and control, Fortinet recommends adding FortiManager, FortiAP, FortiClient, FortiClient EMS, FortiSandbox, FortiMail, FortiWeb, FortiNDR, FortiDeceptor, and FortiSwitch.

The solution can be extended by adding other network security devices, including several third-party products.

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## Knowledge Check

1. What is the Fortinet Security Fabric?

- A. A Fortinet solution that enables communication and visibility among devices of your network
- B. A device that can manage all your firewalls

2. Which combination of devices must participate in the Security Fabric?

- A. A FortiAnalyzer and two or more FortiGate devices
- B. A FortiMail and two or more FortiGate devices



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## Lesson Progress



Introduction to the Fortinet Security Fabric



Deploying the Security Fabric



Extending the Security Fabric and Features



Security Fabric Rating and Topology View

Good job! You now understand the basics of the Fortinet Security Fabric.

Next, you'll learn how to deploy the Security Fabric in your network environment.

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## Deploying the Security Fabric

### Objectives

- Understand how to implement the Security Fabric
- Configure the Security Fabric on root and downstream FortiGate devices
- Understand how device detection works
- Understand how to extend your existing Security Fabric

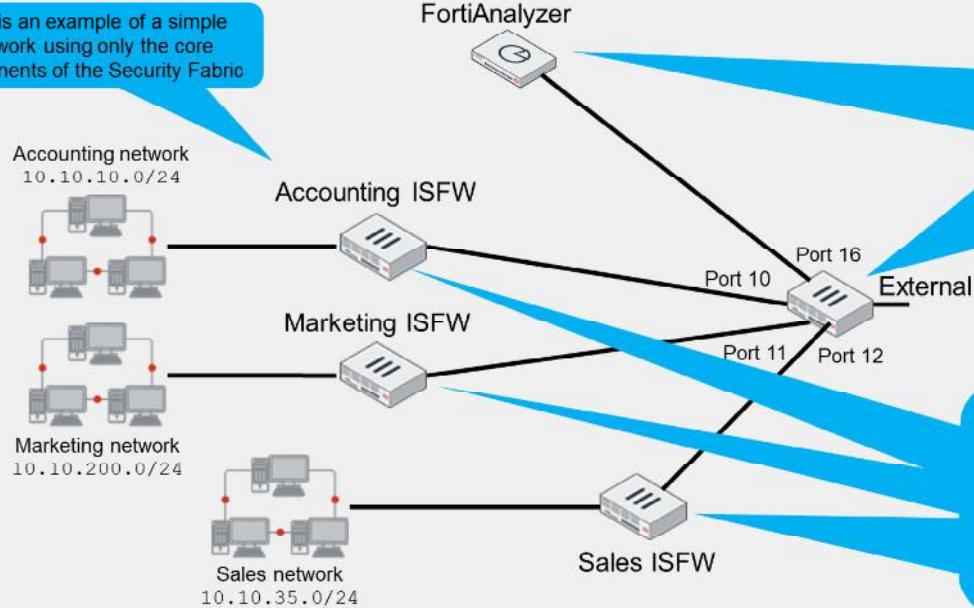
After completing this section, you should be able to achieve the objectives shown on this slide.

By demonstrating competence in the deployment of the Fortinet Security Fabric, you will better understand the value of the Security Fabric and how it helps to manage all your network devices more efficiently.

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## How Do You Implement the Security Fabric?

This is an example of a simple network using only the core components of the Security Fabric



There is a FortiAnalyzer and one next-generation firewall (NGFW). This FortiGate is configured as the *root* firewall. In this example, the alias for the firewall is *External*.

There are three internal segmentation firewalls (ISFWs) that segregate the WAN into logical components and allow your network to contain a threat, should a breach occur.

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This simple network that comprises only the core devices of a Security Fabric includes one FortiAnalyzer and four next-generation firewall (NGFW) FortiGate devices.

The FortiGate device named External is acting as the edge firewall and is configured as the *root* firewall within the Security Fabric.

Downstream from the root firewall, three internal segmentation firewalls compartmentalize the WAN in order to contain breaches and to control access to various LANs. This example uses Accounting, Marketing, and Sales LANs.

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## General Steps to Configure the Security Fabric

- On the root FortiGate:
  - Enable **Security Fabric Connection** on the required interfaces
  - Enable **Security Fabric** connector and select **Serve as Fabric Root**
  - Configure FortiAnalyzer or cloud logging. You can configure FortiAnalyzer in advance
  - (Optional) Preauthorize downstream devices
- On the downstream devices
  - Enable **Security Fabric Connection** on the required interfaces
  - Enable **Security Fabric Connection** and select **Join Existing Fabric**
  - Specify the IP address of the root device
- On the root FortiGate:
  - Authorize all downstream devices



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To configure a new security fabric, follow these general steps:

First, on the root FortiGate, you must enable **Security Fabric Connection** on the interfaces that face any downstream FortiGate. Then, enable the Security Fabric connector, and select **Serve as Fabric Root**. You also need to configure FortiAnalyzer or a cloud logging solution. This logging configuration will be pushed to all the downstream FortiGate devices.

Optionally, you can preauthorize your downstream devices by adding their serial numbers. When you add the serial number of a Fortinet device to the trusted list on the root FortiGate, the device can join the Security Fabric as soon as it connects. After you authorize the new FortiGate, additional connected FortiAP and FortiSwitch devices automatically appear in the topology tree. On the topology tree, it's easier for you to authorize them with one click.

The second step in implementing the Security Fabric is configuring the downstream Fortinet devices. On the downstream FortiGate devices, you must enable **Security Fabric Connection** and **Device Detection** on the interfaces facing the downstream FortiGate devices. On the **Fabric Connectors** page, select **Join Existing Fabric** and add the root (upstream) FortiGate IP address.

The third step in implementing the Security Fabric is to authorize the downstream FortiGate devices on the root FortiGate.

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## Synchronizing Objects Across the Security Fabric

- By default, object synchronization is enabled in fabric settings

```
config system csf
set status enable
set configuration-sync default
set fabric-object-unification default
end
```

- If set fabric-object-unification is set to local on the root FortiGate device, global fabric objects are not synchronized to downstream FortiGate devices

```
config system csf
set status enable
set group-name "fortinet"
set fabric-object-unification local
```

- If set configuration-sync is set to local, the downstream device does not participate in synchronization

```
config system csf
set status enable
set configuration-sync local
end
```

- Select per object option to synchronize or not on the root FortiGate

- If this option is disabled (default configuration), objects created on the root FortiGate are kept as local objects that are not synchronized to downstream FortiGate devices



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When the Security Fabric is enabled, settings to sync various objects, such as addresses, services, and schedules, from the upstream FortiGate to all downstream FortiGate devices is enabled by default.

Synchronization always happens from the root FortiGate to downstream FortiGate devices. Any object that can be synced will be available on downstream FortiGate devices after synchronization.

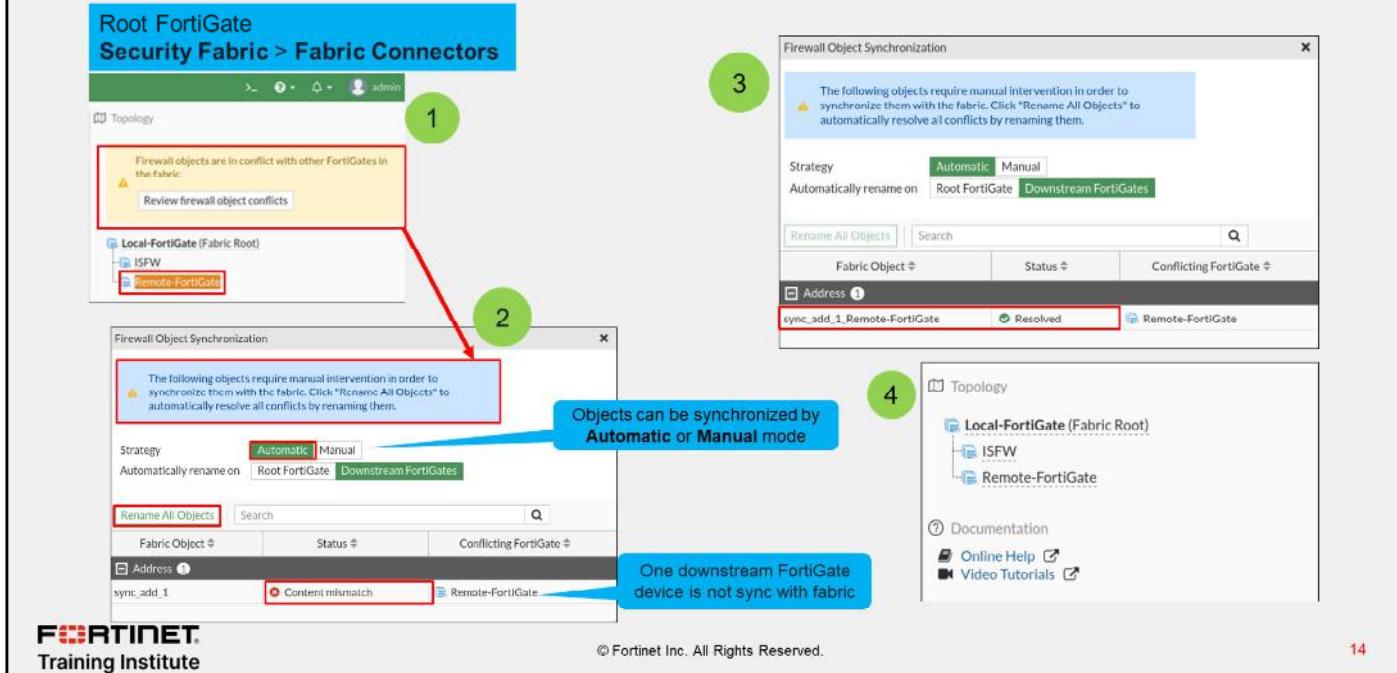
The CLI command `set fabric-object-unification` is only available on the root FortiGate. When set to local, global objects will not be synchronized to downstream devices in the Security Fabric. The default value is default.

The CLI command `set configuration-sync local` is used when a downstream FortiGate doesn't need to participate in object synchronization. When set to local on a downstream FortiGate, the device does not synchronize objects from the root, but will still participate in sending the synchronized object downstream.

You can also enable or disable per object synchronization in the Security Fabric. This option is not available for objects you create on a downstream FortiGate. Fabric synchronization is disabled by default for supported fabric objects, and these fabric objects are kept as locally created objects on all the FortiGate devices in the Security Fabric. If object synchronization is disabled on the root FortiGate, using the command `set fabric-object disable`, firewall addresses and address groups will not be synchronized to downstream FortiGate devices.

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## Synchronizing Objects Across the Security Fabric (Contd)



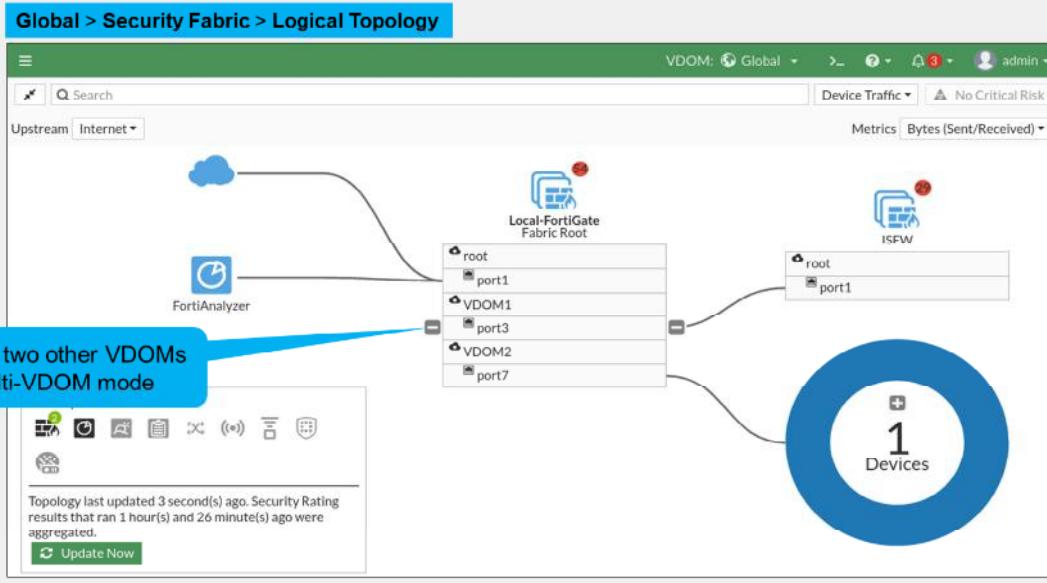
If an object conflict occurs during synchronization, you'll get a notification in the topology tree.

The process to resolve a syncing conflict is as follows:

1. The notification icon displays this message: **Firewall objects are in conflict with other FortiGates in the fabric. Remote-FortiGate** is highlighted in amber. Click **Review firewall object conflicts**.
2. On the **Firewall Object Synchronization** page, you can see that both the root FortiGate and downstream FortiGate devices contain the **syncn\_add\_1** object (with a different IP address/subnet schema on each device), causing a status of **Content mismatch**. In the **Strategy** field, there are two options to resolve the conflict: **Automatic** and **Manual**. If you select **Automatic**, as shown in this example, you can then click **Rename All Objects**.
3. **Remote-FortiGate** is appended to the name of the downstream FortiGate device **sync\_Add\_1** address object and the status changes to **Resolved**.
4. In the topology tree, none of the FortiGate devices are highlighted because there is no conflict.

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## Multi-VDOM in the Security Fabric



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When you configure FortiGate devices in multi-vdom mode and add them to the Security Fabric, each VDOM with its assigned ports is displayed when one or more devices are detected. Only the ports with discovered and connected devices appear in the Security Fabric view and, because of this, you must enable **Device Detection** on ports you want to have displayed in the **Security Fabric**. VDOMs without ports with connected devices are not displayed. All VDOMs configured must be part of a single **Security Fabric**. In the example shown on this slide, the Local-FortiGate is configured in multi-VDOM mode, and has three VDOMs (root, VDOM1, and VDOM2), each with ports that have connected devices.

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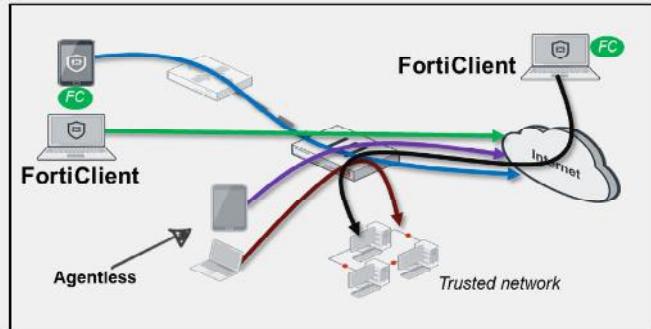
### Device Identification—Agentless vs. Agent

#### Agentless

- Useful feature for the Security Fabric topology view
- Requires direct connectivity to FortiGate
- Detection methods:
  - HTTP user agent
  - TCP fingerprinting
  - MAC address vendor codes
  - DHCP
  - Microsoft Windows browser service (MWBS)
  - SIP user agent
  - Link Layer Discovery Protocol (LLDP)
  - Simple Service Discovery Protocol (SSDP)
  - QUIC
  - FortiOS-VM detection
    - FortiOS-VM vendor ID in IKE messages
    - FortiOS-VM vendor ID in FortiGuard web filter and spam filter requests

#### Agent (FortiClient)

- Location and infrastructure independent



Device identification is an important component in the Security Fabric. FortiGate detects most of the third-party devices in your network and add them into the topology view in the Security Fabric. There are two device identification techniques: with an agent and without an agent (agentless).

Agentless identification uses traffic from the device. Devices are indexed by their MAC address and there are various ways to identify devices, such as HTTP user-Agent header, TCP fingerprint, MAC address OUI, and FortiOS-VM detection methods, to name a few. Agentless device identification is only effective if FortiGate and the workstations are directly connected network segments, where traffic is sent directly to FortiGate, and there is no intermediate router or Layer 3 device between FortiGate and the workstations.

Note that FortiGate uses a *first come, first served* approach to determine the device identity. For example, if a device is detected by the HTTP user agent, FortiGate updates its device table with the detected MAC address and scanning stops as soon as the type has been determined for that MAC address.

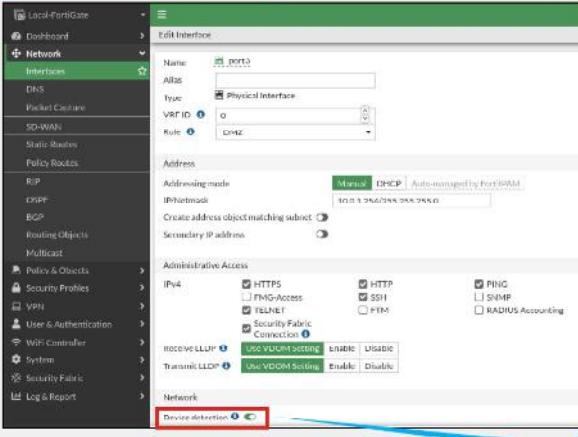
Agent-based device identification uses FortiClient. FortiClient sends information to FortiGate, and the device is tracked by its unique FortiClient user ID (UID).

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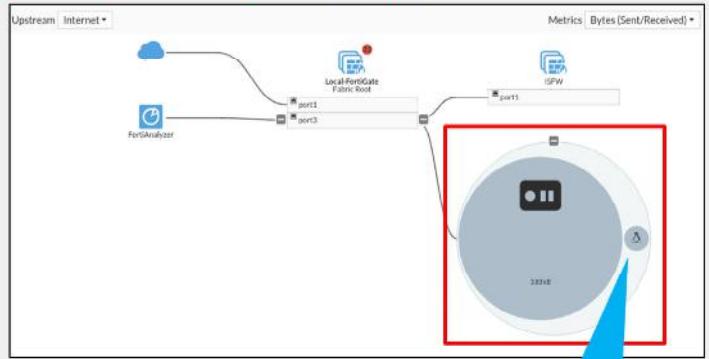
## Device Identification

Enable **Device Detection** on interface(s)



**Network > Interfaces**

**Enable Device Detection**



**Security Fabric > Logical Topology**

Ubuntu machine detected upon traffic from the PC to the FortiGate

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By default, FortiGate uses device detection (passive scanning), which runs scans based on the arrival of traffic.

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## Knowledge Check

1. What are the two mandatory settings of the Security Fabric configuration?

- A. Fabric name and Security Fabric role
- B. Fabric name and FortiManager IP address

2. From where do you authorize a device to participate in the Security Fabric?

- A. From the downstream FortiGate
- B. From the root FortiGate



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## Lesson Progress



Introduction to the Fortinet Security Fabric



Deploying the Security Fabric



Extending the Security Fabric and Features



Rating Service and Topology View

Good job! You now know how to deploy the Security Fabric.

Next, you'll learn about Security Fabric features and how to extend the Security Fabric in your network environment.

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## Extending the Fabric and Features

### Objectives

- Extend the Security Fabric across your network
- Understand automation stitches
- Configure external connectors
- Understand the Security Fabric status widgets

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

By demonstrating competence in extending the Fortinet Security Fabric, you will better understand the value of the Security Fabric and how it helps to manage all your network devices from a single point of device.

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## Extending the Fabric

- Central management integration
  - FortiManager
- FortiMail integration
  - FortiMail
- Web application integration
  - FortiWeb
- FortiClient integration
  - FortiClient
  - FortiClient EMS
- Advanced threat protection integration
  - FortiSandbox
- Access device integration
  - FortiAP
  - FortiSwitch
- AI-driven breach protection
  - FortiNDR
- Advanced Threat Deception
  - FortiDeceptor
- Other optional devices
  - FortiADC
  - FortiDDoS
  - FortiWLC
  - FortiAuthenticator
  - FortiSIEM
  - FortiCache
  - FortiToken



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The slide shows the list of products that Fortinet recommends to extend the Security Fabric.

For example, Fortinet recommends using a FortiManager for centralized management of all FortiGate devices and to access devices in the Security Fabric. You can also extend the Security Fabric down to the access layer by integrating FortiSwitch and FortiAP devices.

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## Automation Stitches

AUTOMATION STITCHES



- Consist of a trigger and one or more configurable actions
- Can be created only on the root FortiGate in the Security Fabric
- Are available as predefined stitches, or you can create custom ones
- Can run actions sequentially or in parallel
- Some actions include a minimum **Minimum interval** setting to make sure they don't run more often than needed

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Administrator-defined automated workflows (called stitches) cause FortiOS to automatically respond to an event in a preprogrammed way. Because this workflow is part of the Security Fabric, you can set up automation stitches for any device in the Security Fabric. However, the Security Fabric is not required to use stitches.

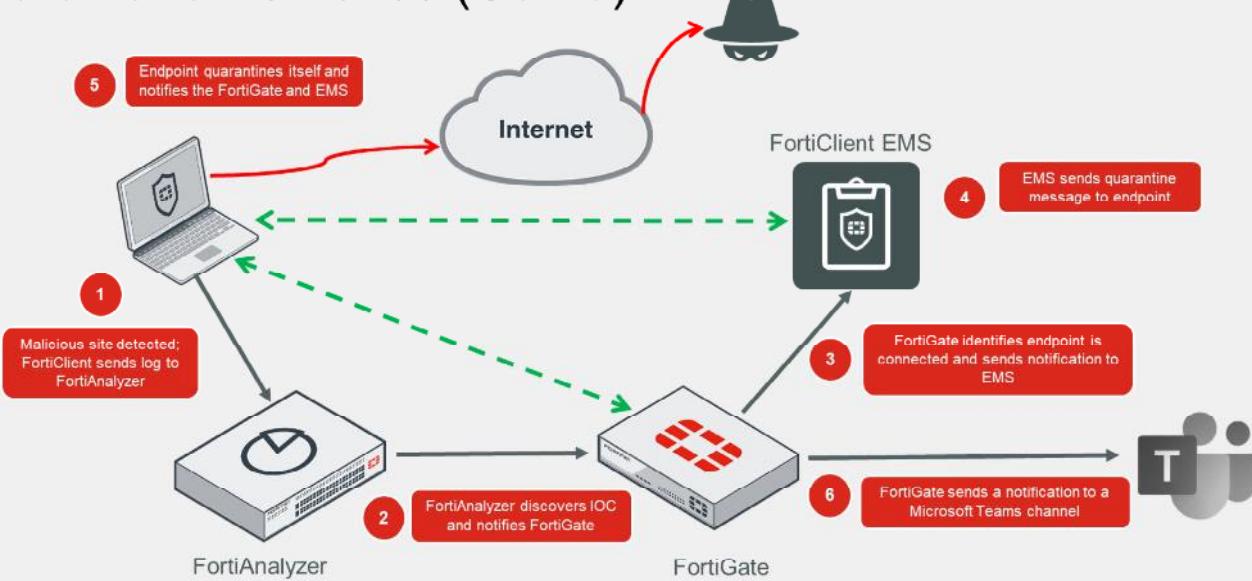
Each automation stitch pairs a trigger and one or more actions. FortiOS has several predefined stitches, triggers and actions. However, you can create custom automation based on the available options.

Automation stitches allow you to monitor your network and take appropriate action when the Security Fabric detects a threat. You can use automation stitches to detect events from any source in the Security Fabric and apply actions to any destination.

You can configure the **Minimum internal (seconds)** setting on some of the available actions to make sure they don't run more often than needed.

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## Automation Stitches (Contd)



This slide shows an example of how automation stitches can be configured to work in the Security Fabric:

1. FortiClient sends logs to FortiAnalyzer.
2. FortiAnalyzer discovers IoCs in the logs and notifies FortiGate.
3. FortiGate identifies whether FortiClient is a connected endpoint, and whether it has the login credentials for the FortiClient EMS that FortiClient is connected to. With this information, FortiGate sends a notification to FortiClient EMS to quarantine the endpoint.
4. FortiClient EMS searches for the endpoint and sends a quarantine message to it.
5. The endpoint receives the quarantine message and quarantines itself, blocking all network traffic. The endpoint notifies FortiGate and EMS of the status change.
6. FortiGate sends a notification to a Microsoft Teams channel to alert the administrators about the event.

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## External Connectors

- Security Fabric multi-cloud support adds external connectors to the Security Fabric configuration
- Allow you to integrate, among others:
  - Amazon Web Services (AWS)
  - Microsoft Azure
  - Oracle Cloud Infrastructure (OCI)
  - Google Cloud Platform (GCP)

The screenshot shows the FortiGate Security Fabric interface. On the left, there's a navigation bar with various icons and sections like Local-FortiGate, Dashboard, Network, Policy & Objects, Security Profiles, VPN, User & Authentication, WiFi Controller, System, Security Fabric, and External Connectors (which is highlighted). Below the navigation is a search bar and a message about Asset Identity Central.

The main area is titled "Security Fabric > External Connectors". It has two sections: "Public SDN" and "Private SDN". In the "Public SDN" section, there are icons for AWS, Microsoft Azure, Google Cloud Platform (GCP), Oracle Cloud Infrastructure (OCI), IBM Cloud, and AllCloud. The AWS icon is highlighted with a red box and has a red arrow pointing to it. In the "Private SDN" section, there are icons for Kubernetes, VMware ESKI, VMware NSX, OpenStack (Horizon), Application Centric Infrastructure (ACI), Magma VNF-based Service Platform, and Nutanix.

To the right of the AWS icon, a detailed configuration window titled "New External Connector" is displayed. It shows the "Amazon Web Services (AWS)" connector settings. The "Name" field is set to "AWS", "Status" is "Enabled" (checked), and "Update interval" is set to "Use Default". Under the "AWS Connector" section, the "Access key ID" is "AKIxxxxxxxxxxxxxx", the "Secret access key" is masked as "\*\*\*\*\*", the "Region name" is "US-East", and the "VPC ID" is "vpc-e315g651".

At the bottom of the interface, there's a copyright notice: "© Fortinet Inc. All Rights Reserved." and the number "24".

External connectors allow you to integrate multi-cloud support, such as Microsoft Azure and AWS, among others.

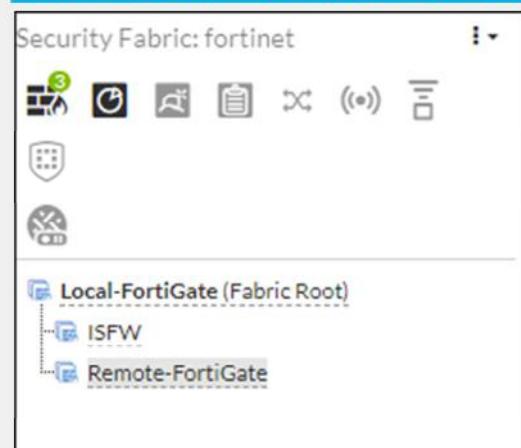
In an application-centric infrastructure (ACI), the SDN connector serves as a gateway bridging SDN controllers and FortiGate devices. For example, the SDN connector can register itself to APIC in the Cisco ACI fabric, polls objects of interest, and translates them into address objects. The translated address objects and associated endpoints populate on FortiGate.

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## The Security Fabric Status Widget

- The name of your Security Fabric
- Icons indicating the other devices in the Security Fabric
- The names of the FortiGate devices in the Security Fabric

Dashboard > Status > Security Fabric widget



The **Security Fabric Status** widget shows a visual summary of the devices in the Security Fabric.

You can hover over the icons at the top of the widget to display a quick view of their statuses. From here, you can click to authorize FortiAP and FortiSwitch devices that are connected to an authorized FortiGate.

Icons represent the other Fortinet devices that can be used in the Security Fabric:

- Devices in blue are connected in your network.
- Devices in gray are not configured, or not detected in your network.
- Devices in red are no longer connected, or not authorized in your network.

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## Knowledge Check

1. Why should an administrator extend the Security Fabric to other devices?

- A. To provide a single pane of glass for management and reporting purposes
- B. To eliminate the need to purchase licenses for FortiGate devices in the Security Fabric

2. What is the purpose of Security Fabric external connectors?

- A. External connectors allow you to integrate multi-cloud support with the Security Fabric
- B. External connectors allow you to connect the FortiGate command line interface (CLI)

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## Lesson Progress



Introduction to the Fortinet Security Fabric



Deploying the Security Fabric



Extending the Security Fabric and Features



Rating Service and Topology View

Good job! You now know how to extend the Security Fabric and its features.

Next, you'll learn about the Security Fabric Rating service and topology view.

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## Rating Service and Topology View

### Objectives

- Understand the Security Fabric rating service
- View and run the Fortinet Security rating service
- Understand the differences between physical and logical topology views

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

By demonstrating competence in the Fortinet Security rating service and topology views, you should be able to have clear visibility of your network devices.

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## Security Fabric Rating

- Three major scorecards:
  - Security Posture**
  - Fabric Coverage**
  - Optimization**
- Provide executive summaries of the three largest areas of security focus
- Clicking a scorecard drills down to a report of itemized results and compliance recommendations
- In multi-VDOM mode, reports can be generated in the Global VDOM for all the VDOMs



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Security rating is a subscription service that requires a security rating license. This service provides the ability to perform many *best practices*, including password checks, to audit and strengthen your network security.

The **Security Rating** page is separated into three major scorecards: **Security Posture**, **Fabric Coverage**, and **Optimization**.

These scorecards provide executive summaries of the three largest areas of security focus in the Security Fabric.

The scorecards show an overall letter grade and breakdown of the performance in subcategories. Click a scorecard to drill down to a detailed report of itemized results and compliance recommendations. The point score represents all passed and failed items in that area. The report includes the security controls that were tested, linking them to specific FSBP or PCI compliance policies. You can click **FSBP** and **PCI** to reference the corresponding standard.

In multi-VDOM mode, administrators with read/write access can generate security rating reports in the Global VDOM for all the VDOMs on the device. Administrators with read-only access can view the report, but not generate it.

On the scorecards, the **Scope** column shows the VDOM or VDOMs that the security rating checked. On checks that support **Easy Apply**, you can run the remediation on all the associated VDOMs.

The security rating event log is available on the root VDOM.

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## Security Posture

The **Security Rating** Score helps you to identify the security issues in your network and to prioritize your tasks.

Security issues that are labelled **EZ** can be resolved immediately.

Identifies critical security gaps.

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Click the **Security Posture** scorecard on the **Security Rating** page to expand the scorecard and see more details.

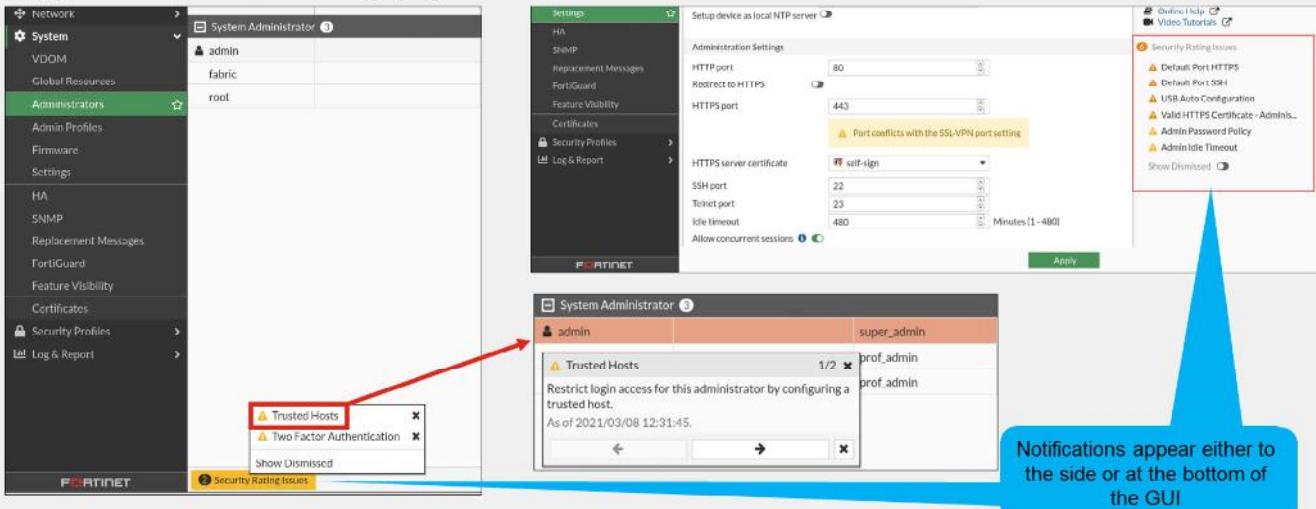
The security posture service now supports the following:

- Customer rankings by percentile using security audit (FortiGuard data): Security rating now supports sending results to FortiGuard, and receiving statistics from FortiGuard. Results are displayed to customer in the form of percentile.
- Security audits running in the background, not just on demand, when an administrator is logged in to the GUI. When you view the security audit page, the latest saved security audit data is loaded. From the GUI, you can run audits on demand and view results for different devices in the Security Fabric. You can also view all results or just failed test results.
- New security checks that can help you make improvements to your organization's network. These results include enforcing password security, applying recommended login attempt thresholds, encouraging two-factor authentication, and more.

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## Security Rating Notifications

- Display recommendations determined by security rating
- Appear on various setting pages



Notifications appear either to the side or at the bottom of the GUI

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Security rating provides recommendations and highlights issues with the configuration of the FortiGate settings. These recommendations and issues appear as notifications on the **Settings** page.

Click a notification to display the page where the setting needs to be fixed. This prevents you from having to go back and forth between the **Security Fabric > Security Rating** page and the various settings pages.

Notifications appear either to the side or at the bottom of the GUI. You can also dismiss the notifications.

In the example shown on this slide, some of the issues found are that FortiGate is using the default HTTPS and SSH ports, and that the administrator password policy is not enabled. The security rating check also recommends that you configure trusted hosts and two-factor authentication.

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## Security Rating Check Schedule

- Security checks by default are scheduled to run automatically every 4 hours
- Enable or disable security checks using the CLI:

```
#config system global  
(global)# set security-rating-run-on-schedule [enable/disable]  
(global)# end
```

- Manually run a rating check using the CLI:

```
#diagnose report-runner trigger
```



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Security rating checks by default are scheduled to run automatically every four hours.

Use the following commands to enable or disable security checks using the CLI:

```
#config system global  
(global)# set security-rating-run-on-schedule [enable/disable]  
(global)# end
```

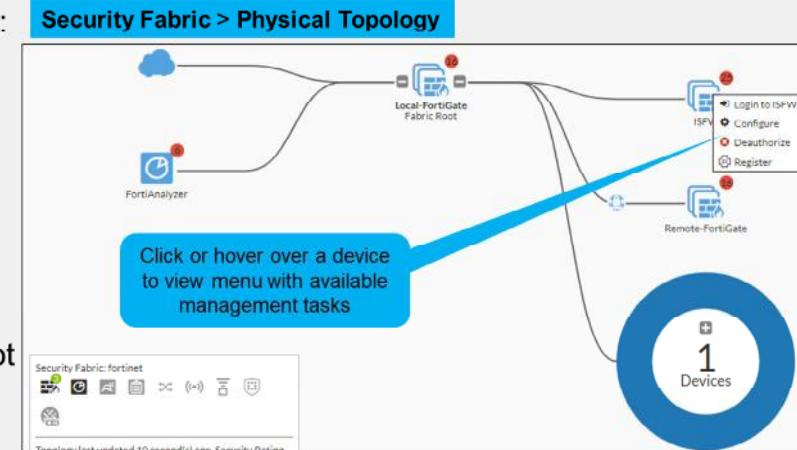
Use the following command to manually run a rating check using the CLI:

```
#diagnose report-runner trigger
```

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## Topology Views

- Some device management tasks:
  - Login
  - Configure devices
  - Authorize or deauthorize devices
  - Register devices
  - Ban compromised clients
  - Quarantine hosts
  - Create address objects
- Full view available only at the root FortiGate



You can view the Security Fabric topology on the FortiGate GUI, from the **Security Fabric** menu. You can select the **Physical Topology** or **Logical Topology** view. To view the complete network, you must access the topology views on the root FortiGate in the Security Fabric.

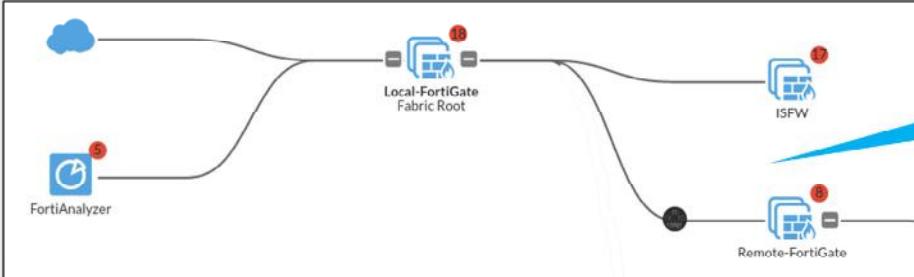
The **Physical Topology** view displays your network as a bubble chart of interconnected devices. These devices are grouped based on the upstream device they are connected to. The bubbles appear smaller or larger, based on their traffic volume. You can double-click any bubble to resize it and view more information about the device.

The **Logical Topology** view is similar to the **Physical Topology** view, but it shows the network interfaces, logical or physical, that are used to connect devices in the Security Fabric.

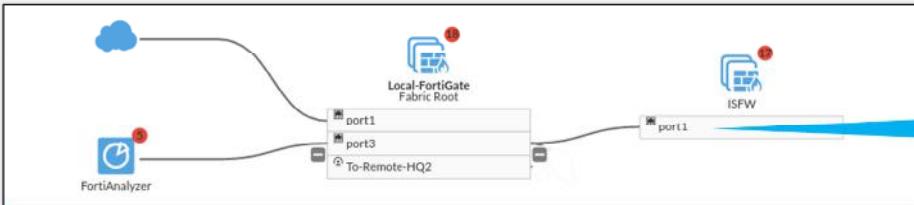
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## Topology Views (Contd)

### Security Fabric > Physical Topology



### Security Fabric > Logical Topology



This slide shows the difference between the **Physical Topology** view and the **Logical Topology** view.

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## Knowledge Check

1. Which one is a part of the Security Rating scorecard?
  - A. Firewall Policy
  - B. Optimization
  
2. From which view can an administrator deauthorize a device from the Security Fabric?
  - A. From the physical topology view
  - B. From the FortiView



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## Lesson Progress



Introduction to the Fortinet Security Fabric



Deploying the Security Fabric



Extending the Security Fabric and Features



Rating Service and Topology View

Congratulations! You have completed this lesson.

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

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## Review

- ✓ Define the Fortinet Security Fabric
- ✓ Identify why the Security Fabric is required
- ✓ Identify the Fortinet devices that participate in the fabric, especially the essential ones
- ✓ Understand how to implement the Security Fabric
- ✓ Configure the Security Fabric on the root and downstream FortiGate
- ✓ Understand how device detection works
- ✓ Understand how to extend your existing Security Fabric
- ✓ Extend the Security Fabric across your network
- ✓ Understand automation stiches and threat responses
- ✓ Configure fabric connectors
- ✓ Understand the Security Fabric status widgets
- ✓ Understand the Security Fabric Rating service
- ✓ View and run the Security Rating service
- ✓ Understand the differences between the physical and logical topology view



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

By mastering the objectives covered in this lesson, you learned how to configure and use the Fortinet Security Fabric.



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