ACOS 6.0.7

System Configuration and Administration Guide

March, 2025

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System Overview

This chapter provides a brief overview of the A10 Thunder Series systems and features.

The following topics are covered:

ACOS Architecture

The following topics are covered:

Details

A10 ThunderÆ Series and AX™ Series devices use embedded Advanced Core Operating System (ACOS) architecture. ACOS is built on top of a set of Symmetric Multi-Processing CPUs and uses shared memory architecture to maximize application data delivery.

ACOS is designed to handle high-volume application data with integrated Layer 2 / Layer 3 processing and integrated SSL acceleration built into the system. In addition, ACOS incorporates the A10 Networks customizable aFleX scripting language, which provides administrators with configuration flexibility for application data redirection.

ACOS inspects packets at Layers 2, 3, 4, and 7 and uses hardware-assisted forwarding. Packets are processed and forwarded based on ACOS configuration.

You can deploy the ACOS device into your network in transparent mode or gateway (route) mode.

- Transparent mode – The ACOS device has a single IP interface. For multinetted environments, you can configure multiple Virtual LANs (VLANs).
- Route mode – Each ACOS interface is in a separate IP subnet.

ACOS Software Processes

The ACOS software performs its many tasks using the following processes:

- a10mon – Parent process of the ACOS device. This process is executed when the system comes up. The a10mon process does the following:

  - Brings user-space processes up and down.
  - Monitors all its child processes and restarts a process and all dependent processes if any of them die.

- syslogd – System logger daemon that logs kernel and system events.
- a10logd – Fetches all the logs from the ACOS Log database.
- a10timer – Schedules and executes scheduled tasks.
- a10stat – Monitors the status of all the main processes of the ACOS device, such as a10switch and a10lb. Also probes every thread within these processes to ensure that they are responsive. If a thread is deemed unhealthy, a10stat kills the process, after which a10mon restarts the process and other processes associated with it.
- a10switch – Contains libraries and APIs to program the Switching ASIC to perform Layer 2 and Layer 3 switching at wire speed.
- a10hm – Performs health-checks for real servers and services. This process sends pre-configured requests to external servers at pre-defined intervals. If a server or individual service does not respond, it is marked down. Once the server or service starts responding again, it is marked up.
- a10rt – Routing daemon, which maintains the routing table with routes injected from OSPF, as well as static routes.
- a10rip – Implements RIPv1 and v2 routing protocols.
- a10ospf – Implements the OSPFv2 routing protocol.
- a10snmpd – SNMPv2c and v3 agent, which services MIB requests.
- a10wa – Embedded Web Server residing on the ACOS device. This process serves the Web-based management Graphical User Interface (GUI).
- a10gmpd – Global SLB (GSLB) daemon.
- a10snpm_trapd – Handles SNMP traps initiated by a10lb.
- a10lb – The heart of the ACOS device. This process contains all the intelligence to perform Application Delivery Control.
- rimacli – This process is automatically invoked when an admin logs into the ACOS device through an interface address. The admin is presented a Command Line Interface (CLI) that can issue and save commands to configure the system.

Memory Pre-allocation

As part of normal operation, ACOS pre-allocates memory. For this reason, memory utilization can be high even when the device first boots up. The system allocates more memory if needed for burst conditions. In this case, the additional memory is freed only slowly, in case further burst conditions occur.

Hardware Interfaces

See the Installation Guide for your A10 Thunder Series model.

Software Interfaces

The following topics are covered:

User Interfaces

The ACOS device can be configured by using the following user interfaces:

- Graphical User Interface (GUI).

  For help using the GUI, refer to the online help available directly from the GUI.

- Command Line Interface (CLI) accessible using console, Telnet, or Secure Shell (v1 and v2).

  For additional information, refer to the *Command Line Interface Reference* guide, or the CLI reference chapters in some of the configuration guides.

- Simple Network Management Protocol (SNMP) v1, v2c, and v3.

NOTE: For additional information, see *SNMP MIB Reference Guide*.

- XML Application Programming Interface (aXAPI)

  For more information, refer to the *aXAPI Reference*, available as part of the documentation library.

Data Interfaces and IP Subnet Support

The ACOS device has a management interface and data interfaces. The management interface is a physical Ethernet port. A data interface is a physical Ethernet port, a trunk group, or a Virtual Ethernet (VE) interface.

The management interface can have a single IPv4 address and/or a single IPv6 address.

An ACOS device deployed in transparent mode (Layer 2) can have a single IP address for all data interfaces. The IP address of the data interfaces must be in a different subnet than the management interface's address.

An ACOS device deployed in route mode (Layer 3) can have separate IP addresses on each data interface. No two interfaces can have IP addresses that are in the same subnet. This applies to the management interface and all data interfaces.

Application Delivery Control

Application Delivery Control (ADC) is a suite of resource management features that make server farms more reliable, more efficient, and help optimize performance.

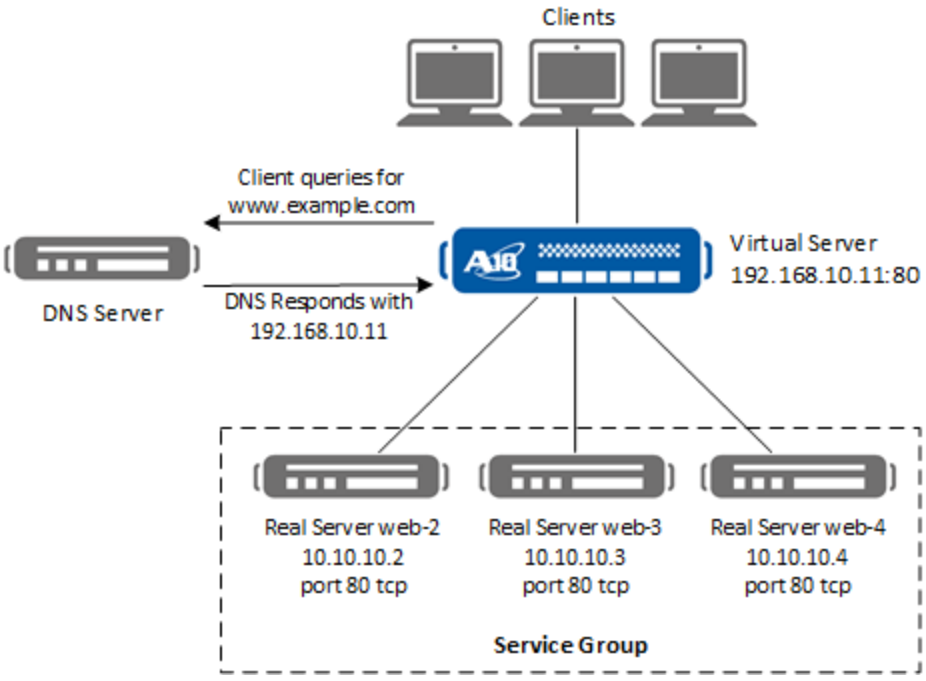
The following topics are covered:

Details

You can easily grow server farms in response to changing traffic flow, while protecting the servers behind a common virtual IP address. From the perspective of a client who accesses services, requests go to and arrive from a single IP address. The client is unaware that the server is in fact multiple servers managed by an ACOS device. The client simply receives faster, more reliable service.

Moreover, you do not need to wait for DNS entries to propagate for new servers. To add a new server, you simply add it to the configuration for the virtual server, and the new real server becomes accessible immediately.

Figure 1 : SLB Example



Intelligent Server Selection

The services managed by the ACOS device are controlled by service groups. A service group is a set of real servers. The ACOS device selects a real server for a client's request based on a set of tunable criteria including server health, server response

time, and server load. These criteria can be tuned for individual servers and even individual service ports.

The ACOS device picks a server based on the load balancing algorithms and template once the client requests hits the service group.

The ACOS device provides a robust set of configurable health monitors for checking the health (availability) of servers and individual services.

SLB Configuration Templates

SLB configuration is simplified by the use of templates. Templates simplify configuration by enabling you to configure common settings once and use them in multiple service configurations. The ACOS device provides templates to control server and port configuration parameters, connectivity parameters, and application parameters.

The following topics are covered:

Server and Port Configuration Templates

The ACOS device provides the following types of server and port configuration templates:

- Server – Controls parameters for real servers
- Port – Controls parameters for service ports on real servers
- Virtual server – Controls parameters for virtual servers
- Virtual port – Controls parameters for service ports on virtual servers

Connectivity Templates

The ACOS device provides the following types of connectivity templates:

- TCP-Proxy – Controls TCP/IP stack parameters such as transmit, buffer, and so on
- TCP – Controls TCP connection settings such as the idle timeout for unused sessions, and specifies whether the ACOS device sends TCP Resets to clients or servers after a session times out
- UDP – Controls UDP connection settings such as the idle timeout for unused sessions, and specifies how quickly sessions are terminated after a server response is received

Application Templates

The following types of application templates are provided:

- DBLB – MS-SQL and MySQL database load balancing.
- Diameter – Provides proxy service and load balancing for Diameter AAA
- DNS – Provides DNS security and optimization
- HTTP – Provides a robust set of options for HTTP header manipulation and for load balancing based on HTTP header content or the URL requested by the client, and other options
- FTP – Provides load balancing for FTP traffic
- Policy – Uses Policy-based SLB (PBSLB) to permit or deny clients, or direct them to service groups, based on client black/white lists
- External-service – Adds capabilities needed for intelligently steering traffic based on application (example: Internet Content Adaptation Protocol [ICAP]).
- Cache – Caches web content on the ACOS device to enhance website performance for clients
- Client SSL – Offloads SSL validation tasks from real servers
- Server SSL – Validates real servers on behalf of clients
- Cipher – Contains a set of SSL ciphers that can be applied to a client-SSL or server-SSL template.
- Connection reuse – Reduces overhead from TCP connection setup by establishing and reusing TCP connections with real servers for multiple client requests

- Cookie persistence – Inserts a cookie into server replies to clients, to direct clients to the same service group, real server, or real service port for subsequent requests for the service
- Source-IP persistence – Directs a given client, identified by its IP address, to the same service port, server, or service group
- Destination-IP persistence – Configures persistence to real servers based on destination IP address
- FIX – Configures Financial Information eXchange load balancing.
- Logging – Configures logging to external servers over TCP.
- SSL session-ID persistence – Directs all client requests for a given virtual port, and that have a given SSL session ID, to the same real server and real port
- SIP – Customizes settings for load balancing of Session Initiation Protocol (SIP) traffic
- SMPP – Configures load balancing for Short Message Peer to Peer (SMPP).
- SMTP – Configures STARTTLS support for Simple Mail Transfer Protocol (SMTP) clients
- Streaming-media – Directs client requests based on the requested content

Where applicable, the ACOS device automatically applies a default template with commonly used settings. For example, when you configure SLB for FTP, the ACOS device automatically applies the default TCP template. If required by your application, you can configure a different template and apply that one instead. The configuration examples in this guide show how to do this.

Outbound Next Hop Load Distributor

Outbound Next Hop Load Distributor (NHLD) balances client-server traffic across a set of WAN links. With outbound NHLD, the clients are located on the internal side of the network. The servers are located on the external side of the network.

Transparent Cache Switching

Transparent Cache Switching (TCS) enables you to improve server response times by redirecting client requests for content to cache servers containing the content.

Firewall Load Balancing

Firewall Load Balancing (FWLB) maximizes throughput through firewall bottlenecks by load balancing server-client sessions across the firewalls.

Where Do I Start?

- To configure basic system settings, see Common Setup Tasks.
- To configure network settings, see the *Network Configuration Guide*.
- To configure management access security features, see the *Management Access Security* guide.
- To configure and secure application delivery and load balancing features, see the *Application Delivery Controller Guide*.

FIPS Support

The A10 Thunder Series supports the National Institute of Standards and Technology (NIST) Federal Information Processing Standards (FIPS) Publication 104-2 for Security Level 2.

FIPS 140-2 Level 2, also referred to as FIPS Level 2, improves on Level 1 and extends the physical security boundary to encompass the entire appliance, not just its internal components. To learn more about the FIPS 140-2 requirements and specifications, see Cryptographic Module Validation Program.

The following sections describe the FIPS Level 2 support in A10 Thunder Series devices with fourth-generation SSL modules:

- FIPS Level 2 ACOS Models
- FIPS Compliance for Hardware
- FIPS Compliance for Software
- FIPS Compliance Usage Guidelines
- SSL/TLS Data Plane Support in FIPS Mode
- IPSec Support in FIPS Mode
- Configuration Support in FIPS Mode
- Web Server Support in FIPS Mode

FIPS Level 2 ACOS Models

The list of ACOS models that are already certified or are in the process of undergoing certification review by NIST is detailed in Product and Company Certifications.

The following ACOS models are compliant with FIPS Level 2 and the contemporary requirements for FIPS Level 2 validation and certification. They are in process and undergoing certification review by NIST.

- Thunder 1040 (with 1 fourth generation SSL engine)
- Thunder 3350S (with 6 fourth generation SSL engines, including 1 SSL card)
- Thunder 6655S (with 9 fourth generation SSL engines, including 1 SSL card)
- Thunder 7655S (with 18 fourth generation SSL engines, including 2 SSL cards)

ACOS 5.2.1 continues to support previously certified FIPS devices with third generation SSL devices for operations compliant with FIPS Level 2. A10 Thunder models with second generation SSL devices are not supported.

For more information about the FIPS support for second and third generation SSL devices, see the ACOS 4.1.4-GR1 *System Configuration and Administration Guide*.

NOTE: FIPS Stock Keeping Units (SKUs) of the ACOS models listed above, referred to as “FIPS devices or ACOS FIPS devices,” must be ordered and shipped directly from A10 Networks. Converting or upgrading a standard (non-FIPS) ACOS unit to a FIPS unit (through the field upgrade process) is not supported.

FIPS Compliance for Hardware

This section describes the changes to the ACOS device hardware for FIPS devices to enhance device security and achieve FIPS compliance.

The following topics are covered:

SSL Modules

The ACOS FIPS devices come with a preset number of SSL modules. The option to add SSL modules ("cards") in the available expansion slots is not supported.

Tamper-Proof Seals

The ACOS FIPS devices have one or more tamper-evident labels[1] with a serial number and company ID affixed to the chassis before delivering to the customers. (See Figure 2)

Tamper-evident seals are used to indicate when the packaging has been deliberately altered or adulterated. These delicate seals are affixed to the ACOS device chassis in several places to make it apparent when someone opens the box or disturbs any removable components.

Figure 2 : A10 FIPS-approved Tamper-proof Labels

Figure 3 to Figure 5 illustrate the tamper-evident seals affixed to the ACOS device in the following locations:

- On the chassis side
- On the fan units

[1] Novavision U3-VRS-08 labels

Figure 3 : Position of Tamper-proof Labels on Thunder 1040

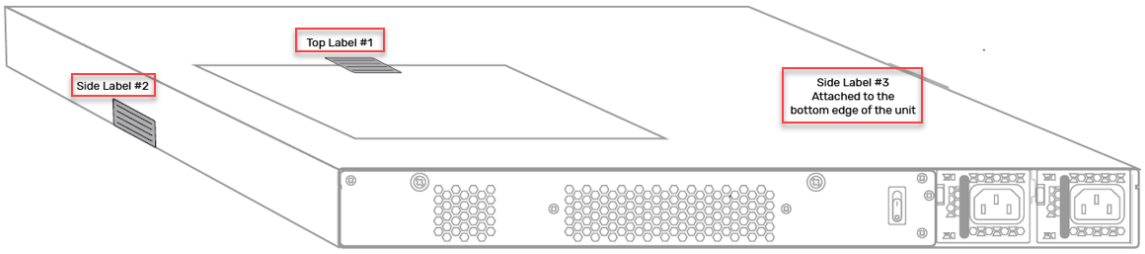


Figure 4 : Position of Tamper-proof Labels on Thunder 3350S

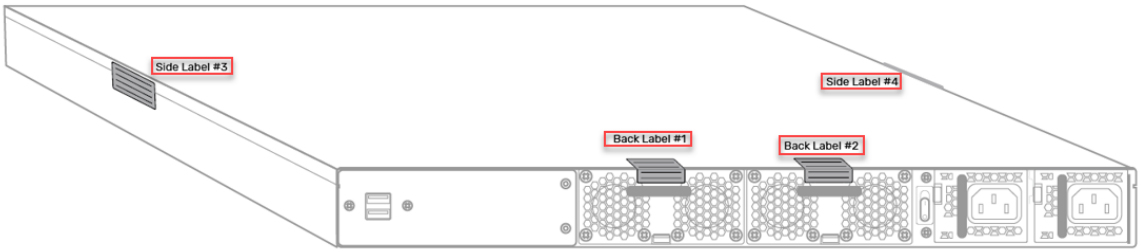
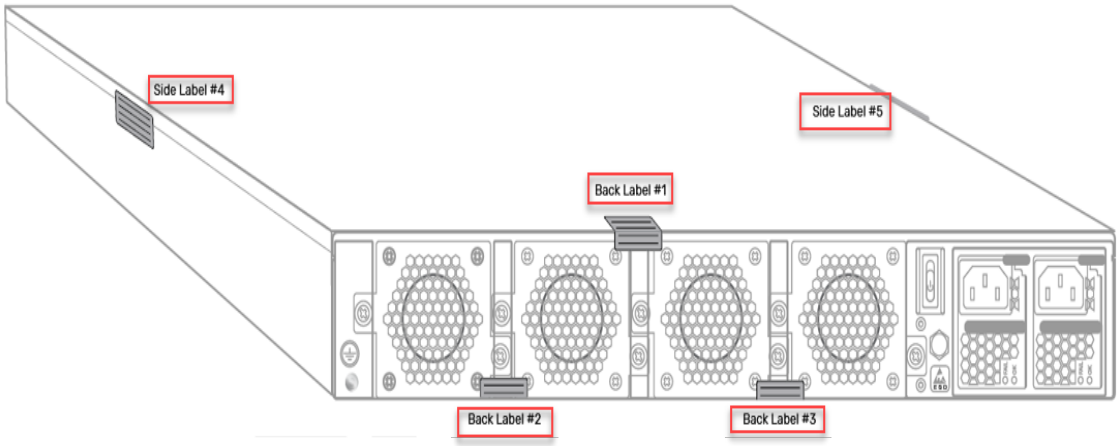


Figure 5 : Position of Tamper-proof Labels on Thunder 6655S and Thunder 7655S



NOTE: For tamper label placement on the ACOS FIPS devices with third generation SSL modules, see ACOS 4.1.4-GR1 product documentation.

ACOS Device Chassis

For the ACOS FIPS devices, identifying information printed on the internal components is not visible through ventilation or other openings.

FIPS Compliance for Software

To achieve FIPS compliance, the following system-level changes are in effect from the ACOS 5.2.1-P5 release for the ACOS FIPS devices configured for the FIPS mode of operation.

- Software Upgrade Image
- Return Merchandise Authorization
- Recover Passwords

Software Upgrade Image

ACOS upgrade images have a digital signature to support the FIPS compliant software updates. The upgrade image is verified using the digital signature before the software updates. Upgrade image integrity is verified for both FIPS and non-FIPS modes of operation for the ACOS system.

Return Merchandise Authorization

Before returning an ACOS device configured for the FIPS mode of operation to A10 Networks using the standard Return Merchandise Authorization (RMA) process, you must first use the **`security-reset system`** command to destroy all the encryption keys. This command is only available through access to the console port of the ACOS device.

After entering the command, the “The next reboot would fail due to zeroization” is prompted by ACOS. Then, physically power off or remove power from the ACOS device.

CAUTION:	Running the **`system-reset`** command will remove all sensitive information from the system, including that used for image integrity during bootup. After this procedure, the ACOS device will not boot again.

Recover Passwords

Password recovery is not supported for the FIPS compliant ACOS models. If the password is forgotten, follow the guidelines provided in the Return Merchandise Authorization section.

FIPS Compliance Usage Guidelines

The following guidelines are recommended for using the ACOS FIPS devices:

- SNMP Version 3
- Keys and Certificates
- DNS Security Extensions
- VCS Management
- Loadable GUI Image
- ACOS Software Updates
- ACOS Configurations Backup and Restore
- TLS 1.3 - ACOS Dataplane
- IPsec GCM Algorithms

SNMP Version 3

When configuring Simple Network Management Protocol version 3 (SNMPv3) in ACOS, use "sha1" as the method for authentication and "aes" as the method for encryption in the CLI and GUI configurations.

For more information about SNMPv3 (**`snmp-serve SNMPv3`**) configuration, see the *Command Line Interface Reference* document.

Keys and Certificates

Device Key Generation

- To generate a public and private key pair for the ACOS FIPS device, use the following commands or GUI equivalent operations:
  - `pki create csr`
  - `pki create certificate`
  - `sshd key generate`
  - `sshd key regenerate`
- When generating RSA or ECDSA public and private key pairs with the `pki create csr` or `pki create certificate` commands, the specified `digest-type` must be SHA-256 or stronger.
- When generating RSA public and private key pairs with `sshd key generate` or `sshd key regenerate` commands, the key size specified must be 2048 bits, and the digest-type must be SHA-256.
- When generating ECDSA public and private key pairs with `sshd key generate` or `sshd key regenerate` commands, the key size specified must be 4096 bits, and the digest-type can be SHA-256, SHA-384, or SHA-521.

RSA Key Generation and Certificate Import

- When importing the Rivest-Shamir-Adleman (RSA) keys or certificates, ensure they are validly formed and comply with the following constraints:
  - The key size for private keys must be 2048 bits or greater.
  - The key size for public keys must be 1024 bits or greater.
  - The signature format must comply with SHA-2.
- The above constraints apply to the following commands and the corresponding GUI operations used for importing RSA keys and certificates:
  - `import key`
  - `import cert`
  - `web-service secure private-key load`

- `web-service secure certificate load`
- `import glm-cert`
- `sshd key load`
- `ssh-pubkey import`
- `import dnssec-dnskey`

ECDSA Key and Certificate Import

- When importing the Elliptic Curve Digital Signature Algorithm (ECDSA) keys or certificates, ensure that they are validly formed and comply with the following constraints:
  - The key size for private and public keys must be 2048 bits or greater.
  - The EC Parameter group must be prime256v1 or secp384r1.
  - The signature format must comply with SHA-2.
- The above constraints apply to the following commands and the corresponding GUI operations used for importing ECDSA keys and certificates:
  - `import key`
  - `import cert`
  - `web-service secure private-key load`
  - `web-service secure certificate load`
  - `sshd key load`
  - `ssh-pubkey import`

DNS Security Extensions

When configuring DNS Security Extensions (DNSSEC) for validating the integrity of each DNS response, use the following as the cryptographic algorithms for encrypting DNSSEC keys:

- **`RSASHA256`**
- **`RSASHA512`**

VCS Management

The Virtual Chassis System (VCS) feature supported by the ACOS management plane is outside the scope of compatibility for FIPS compliance.

Do not configure or enable VCS when using the ACOS FIPS devices configured for the FIPS mode of operation.

Loadable GUI Image

The Loadable GUI Image feature supported by the ACOS management plane is outside the scope of compatibility for FIPS compliance.

Do not use the Loadable GUI Image when using the ACOS FIPS devices configured for the FIPS mode of operation.

ACOS Software Updates

When updating ACOS FIPS devices supporting the FIPS mode of operation to an updated version of ACOS software, ensure that FIPS mode is enabled during the ACOS upgrade operation.

If an upgrade operation to any ACOS software version is performed in the non-FIPS mode of operation, an RMA of the ACOS FIPS device to restore the device to factory defaults is necessary to ensure NIST FIPS-140-2 compliance for subsequent operations in FIPS mode.

ACOS Configurations Backup and Restore

When ACOS is operating with the FIPS mode enabled, only perform a system restore operations using the ACOS system backups saved with the FIPS mode enabled.

Similarly, when ACOS is operating with the FIPS mode disabled, only perform a system restore operations using ACOS system backups saved with the FIPS mode disabled.

TLS 1.3 - ACOS Dataplane

TLS Version 1.3 feature supported by the ACOS data plane are outside the scope of compatibility for FIPS compliance.

Do not configure or enable TLS 1.3 when using the ACOS FIPS devices configured for the FIPS mode of operation.

IPsec GCM Algorithms

IPsec GCM algorithms feature supported by the ACOS management and data planes are outside the scope of compatibility for FIPS compliance.

Do not configure or enable IPsec GCM algorithms when using the ACOS FIPS devices configured for the FIPS mode of operation.

SSL/TLS Data Plane Support in FIPS Mode

The following SSL/TLS data plane changes are in effect from the ACOS 5.2.1-P5 release for ACOS FIPS devices configured for the FIPS mode of operation:

- SSL/TLS versions not supported are as follows:
  - TLS 1.0
  - TLS 1.1
- TLS cipher families not supported are as follows:
  - TLS_RSA
  - TLS_DHE
  - GMSSL
  - 3DES
  - Chacha20-Poly1305
- For TLS, random number generation is implemented based on the Deterministic Random Bit Generator (DRBG) with counter mode. When a random number is

generated, the value is compared with the last number generated to ensure it is not the same.

- RSA certificates must have at least 2048 bits.
- Only certificates with SHA-2 authentication are supported.
- In client or server-TLS exchanges, the RSA certificate or key that the ACOS system receives must have at least 2048 bits and SHA-2 authentication.
- For RSA configurations, only 2048 bits or greater configured keys are supported.
- Keys can only be exported through secure protocols such as HTTPS, SCP, or SFTP.

IPsec Support in FIPS Mode

The following IPsec changes are in effect from the ACOS 5.2.1-P5 release for the ACOS FIPS devices:

- The Diffie-Hellman (DH) groups supported are 14 (Default), 15, 16, 18, 19, and 20.
- The Diffie-Hellman (DH) groups not supported are 0, 1, 2, and 5.
- Only Internet Key Exchange version 2 (IKEv2) is supported.
- Data Encryption Standard (DES), 3DES, Message Digest Algorithm 5 (MD5), Null-encryption, and Null-hash algorithm selections are disabled and not available.
- The `eap-radius` and `eap-tls` options for IKE authentication are disabled and not available.
- The Pre-shared key (PSK) strings configured for IKE authentication must be greater than or equal to 8 characters.

Configuration Support in FIPS Mode

The following topics are covered:

Enable and Disable FIPS Mode

You can enable or disable the FIPS mode for the ACOS devices.

The CLI commands are only available from the console of the ACOS system. The commands will reset the system to factory configuration defaults, followed by a reboot of the ACOS device before entering the requested new mode of operation.

To enable the FIPS mode, use the following command:

```
ACOS(config)# system fips enable
FIPS support will be enabled when the system comes back up after reboot.
Please reboot the system when you are ready.
```

To disable the FIPS mode, use the following command:

```
ACOS(config)# system fips disable
FIPS support will be disabled when the system comes back up after reboot.
Please reboot the system when you are ready.
```

Routing Configuration

Routing protocols support the MD5 hashing algorithm for authentication. In FIPS mode, options to enable the MD5 authentication configurations are disabled and not available. It includes the following protocols and indicated configuration options and commands:

Table 1 : Protocols, Configuration Options, and Commands

Protocol	Command or Option
Border Gateway Protocol (BGP)	`neighbor password` command is disabled.
Open Shortest Path First Version 2 (OSPFv2)	`area area-id authentication` command's `message-digest` option is disabled.
OSPFv2/OSPFv3	`area area-id virtual link` command's `message-digest-key` option is disabled.
OSPFv2/OSPFv3	• `ip ospf` command's `authentication message-digest` option is disabled. • `ip ospf` command's `message-digest-key` option is disabled.
Intermediate System to Intermediate System (ISIS)	• `authentication mode` command's `md5` option is disabled.

Table 1 : Protocols, Configuration Options, and Commands

Protocol	Command or Option
	• `isis authentication mode` command's `md5` option is disabled.
Routing Information Protocol (RIP)/RIPv2	`ip rip authentication` command's `md5` option is disabled.
Bidirectional Forwarding Detection (BFD)	• `bfd authentication` command's `md5` and `meticulous-md5` options are disabled. • `fall-over bfd authentication` command's `md5` and `meticulous-md5` options are disabled.

For more information about the configuration options and commands, see the *Command Line Interface Reference* document.

Key Configuration

The RSA or ECDSA keys are generated using the CLI command or Windows (PuTTy Key Generator). Once generated, they can be imported to the ACOS device.

The following topics are covered:

Generating a Key using Remote Client

The administrator can access CLI (remote client) and generate the RSA or ECDSA key pairs using the SSH client. The key pair consists of both a public and a private key. These keys are saved in the `ssh_config` and `sshd_config` files. These files are configuration files used by the SSH protocol for client-side and server-side configuration.

- `ssh_config` - ACOS acts as the 'client.'
- `sshd_config` - ACOS acts as the 'server.'

NOTE: When an ACOS system reboots (**`reboot`**) for the first time or after a **`system-reset`** (FIPS-mode change), the default SSH key-pair generated is a 2048-bit RSA key with SHA-256 digest.

1. Before generating the key, you can view the list of supported keys using Shell.

```
ssh -Q key
ssh-ed25519
ssh-ed25519-cert-v01@openssh.com
sk-ssh-ed25519@openssh.com
sk-ssh-ed25519-cert-v01@openssh.com
ecdsa-sha2-nistp256
ecdsa-sha2-nistp256-cert-v01@openssh.com
ecdsa-sha2-nistp384
ecdsa-sha2-nistp384-cert-v01@openssh.com
ecdsa-sha2-nistp521
ecdsa-sha2-nistp521-cert-v01@openssh.com
sk-ecdsa-sha2-nistp256@openssh.com
sk-ecdsa-sha2-nistp256-cert-v01@openssh.com
ssh-dss
ssh-dss-cert-v01@openssh.com
ssh-rsa
ssh-rsa-cert-v01@openssh.com
```

2. Add the key to the `ssh_config` or `sshd_config` files using Shell.

   This allows the administrator to log in or copy the files to the ACOS device using the respective algorithm. This requires the client or server to support RSA or ECDSA.

   - The following example shows how to add an RSA key using the **`ssh-keygen -t rsa`** command.

```
# ssh-keygen -t rsa
Generating public/private rsa key pair.
Enter file in which to save the key (/root/.ssh/id_rsa): rsa_key
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in id_rsa.
Your public key has been saved in id_rsa.pub.
The key fingerprint is:
16:0d:b5:95:76:51:86:2d:2c:28:2b:06:a8:e6:4f:c0 root@user-VirtualBox
The key's randomart image is:
+--[ RSA 2048]----+
```

```
|    .     .....o.=o|
|  . .    .o.o+ =..|
|..    .  .oo. o . |
|.E     o ..       |
|o .   . .S        |
| . .    .         |
|  o               |
|   .              |
|                  |
+------------------+
```

- The following example shows how to add an ECDSA key using the **`ssh-keygen -t ecdsa`** shell command.

```
# ssh-keygen -t ecdsa
Generating public/private ecdsa key pair.
Enter file in which to save the key (/root/.ssh/id_ecdsa): ecdsa_key
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /root/.ssh/id_ecdsa
Your public key has been saved in /root/.ssh/id_ecdsa.pub
The key fingerprint is:
SHA256:E9KhaAfXIAtNrifKE09+uF4qNP9IF+3KDdfb4AvG0jI root@user-
VirtualBox
The key's randomart image is:
+---[ECDSA 256]---+
|  .o+ oo.        |
|   o.* o..       |
|    = + o        |
|   o ... .       |
| .o... .S        |
|.+=o. = ..       |
|ooo= E B o       |
| .o.O X o +      |
|  o=.+ . +..     |
+----[SHA256]-----+
```

NOTE:

- By default, the ECDSA 256 algorithm is generated. If you want to use another algorithm, such as ECDSA 384 or 521, specify it separately. For example, `ssh-keygen -t ecdsa -b 384 -m pem` or `ssh-keygen -t ecdsa -b 521 -m pem`. To ensure that the key is loaded successfully, it is required to use the `pem` format.
- For each algorithm type, you need to generate a separate key on the server, and then load the key on the ACOS device. See Regenerating a Key using CLI.

3. After generating the private/public key, it must be copied to a server as an `authorized_keys` file.

```
ssh-copy-id -i  /root/.ssh/id_rsa/id_rsa.pub user@host
```

OR

```
ssh-copy-id -i  /root/.ssh/id_ecdsa/id_ecdsa.pub user@host
```

4. Log in to the ACOS device using CLI in privilege mode.

The ACOS device will be logged in using the RSA or ECDSA algorithm.

```
ACOS# ssh use-mgmt-port 10.10.10.1 admin
```

5. Optionally, you can log in to the ACOS device using Shell.

The ECDSA-256 algorithm is used to login.

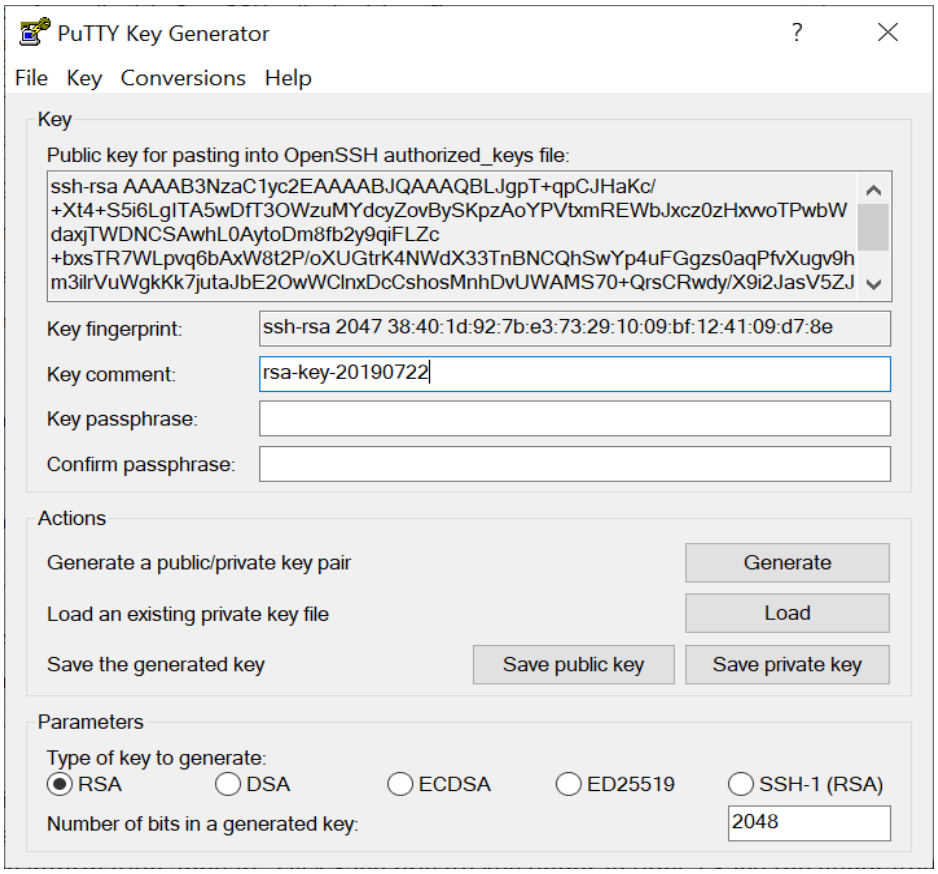
```
ssh -o "HostKeyAlgorithms ecdsa-sha2-nistp256" admin@10.10.10.1
The authenticity of host '10.10.10.1 (10.10.10.1)' can't be
established.
ECDSA key fingerprint is
SHA256:OMhF6LOYt5laawn7t4wBYPMdTCOivLZOZvOK232KQoY.
ECDSA key fingerprint is
MD5:00:0b:ac:78:1b:51:2b:47:d8:13:7c:e2:c9:58:a4:e2.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '10.10.10.1' (ECDSA) to the list of known
hosts.
Password:
Last login: Mon Jul  3 17:40:23 2023 from 172.20.20.20

System is ready now.

[type ? for help]

ACOS>
```

Generating a Key using Windows

The administrator can launch the PuTTY application from the Windows Programs list and generate an RSA or ECDSA key pair.

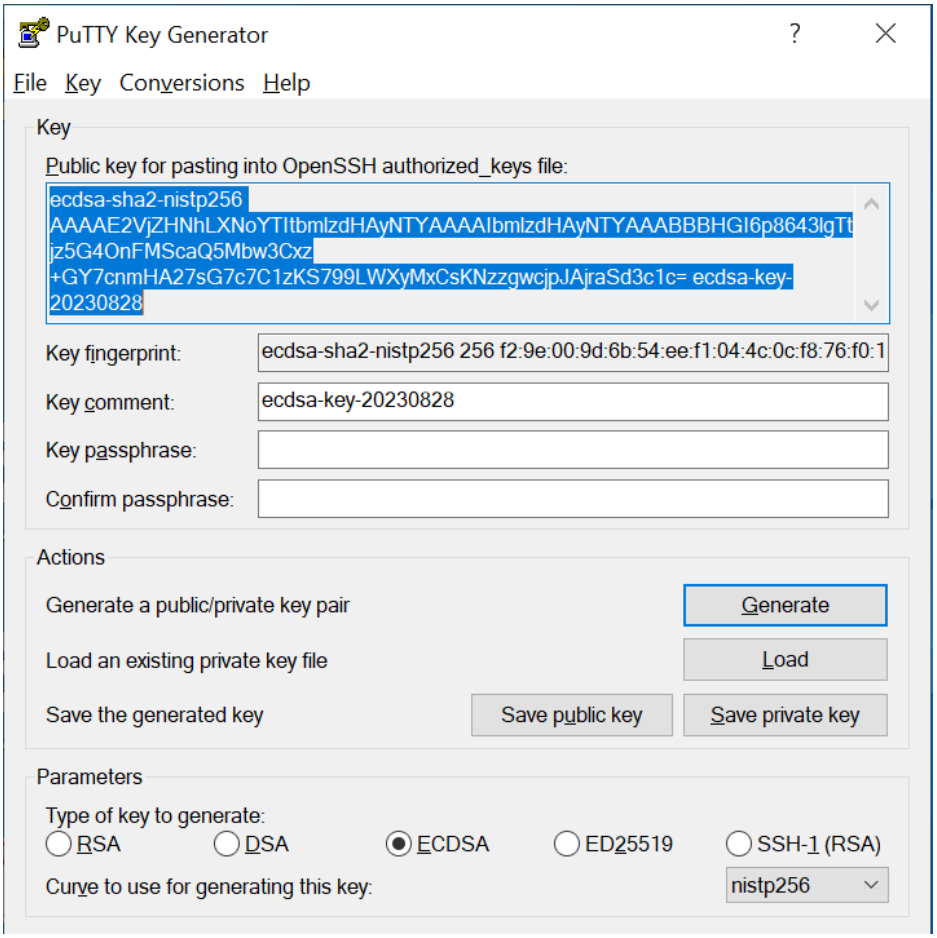
1. Launch the PuTTYgen application.
2. For generating the RSA key pair, select the **RSA** radio button and enter 2048 in the **Number of bits in a generated key** field.

Figure 6 : RSA Key Generator



3. For generating the ECDSA key pair, select the **ECDSA** radio button and nistp256, nistp384, or nistp521 option from the **Curve to use for generating the key** drop-down list.

Figure 7 : ECDSA Key Generator



NOTE: You will be instructed to move the mouse cursor around within the PuTTY Key generator window as a randomizer to generate the private key.

4. Click **Save public key** and **Save private key** to the desktop as **id_rsa.ppk** or **id_ecdsa.ppk**.
5. Load the key using the **`sshd key load`** command. See Loading the Key using CLI.

Importing the Key to ACOS Device

After the keys are generated and saved, you can import public/private keys in separate files or group in one file. Perform the following steps to import the private key to the ACOS device:

1. Log in to the ACOS device as a root user having global read-write privileges.
2. Access the configuration level for the administrator account.
3. Import the private key using the following command:

```
ACOS(config)# import key <key name> overwrite use-mgmt-port
scp://user:<username>@<ip address>/< Key path>
```

OR

```
ACOS(config)# import class-list <key name> use-mgmt-port
scp://user:<username>@<ip address>/< Key path>
```

NOTE: The import may fail if the server's SSH key is changed. In this case, use the **sshd re-add-rsa** command to remove the SSH public key for a specific host from ACOS.

Regenerating a Key using CLI

When you upgrade the ACOS device version, you can regenerate the key if required using the CLI. Then verify the generated key on the server using the Shell.

1. Regenerate the key on the ACOS device using the CLI in the configuration mode.

```
ACOS(config)# sshd key regenerate
```

2. Log in to the server and verify the generated key using Shell.

```
ssh-keygen -R 10.10.10.1
ls -lrt /etc/ssh/
moduli                    ssh_host_ecdsa_key        ssh_host_key
      ssh_host_rsa_key.pub
ssh_config                ssh_host_ed25519_key      ssh_host_key.pub
      sshd_config
ssh_host_dsa_key          ssh_host_ed25519_key.pub  ssh_host_rsa_key
      sshd_config_aws
```

```
ls -lrt /etc/ssh/ -lrt
total 116
-rwxr-xr-x 1 root root     98945 Jun 28 11:29 moduli
-rwxr-xr-x 1 root root      3046 Jun 28 13:16 sshd_config_aws
-rwxr-xr-x 1 root root      1656 Jul  3 17:41 ssh_config
-rw------- 1 root root      3161 Jul  3 17:42 sshd_config
-rw-r--r-- 1 root root       630 Jul  3 17:43 ssh_host_key.pub
-rw------- 1 root root       965 Jul  3 17:43 ssh_host_key
-rw-r--r-- 1 root root        82 Jul  3 17:43 ssh_host_ed25519_key.pub
-rw-r----- 1 root ssh_keys   387 Jul  3 17:43 ssh_host_ed25519_key
-rw------- 1 root root      1675 Jul  3 17:43 ssh_host_rsa_key
-rw------- 1 root root       227 Jul  3 17:43 ssh_host_ecdsa_key
-rw------- 1 root root       672 Jul  3 17:43 ssh_host_dsa_key
-rw-r--r-- 1 root root       395 Jul  3 17:43 ssh_host_rsa_key.pub
```

3. Log in to the ACOS device with the generated key using Shell.

```
ssh -o "HostKeyAlgorithms ecdsa-sha2-nistp256" admin@10.10.10.1
The authenticity of host '10.10.10.1 (10.10.10.1)' can't be
established.
ECDSA key fingerprint is
SHA256:OMhF6LOYt5laawn7t4wBYPMdTCOivLZOZvOK232KQoY.
ECDSA key fingerprint is
MD5:00:0b:ac:78:1b:51:2b:47:d8:13:7c:e2:c9:58:a4:e2.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '10.10.10.1' (ECDSA) to the list of known
hosts.
Password:
Last login: Mon Jul  3 17:40:23 2023 from 172.20.20.20

System is ready now.

[type ? for help]

vThunder>
```

Loading the Key using CLI

After regenerating the key, you can optionally load the generated RSA or ECDSA key from another server to the ACOS device using the CLI.

When one key is loaded, it will overwrite the current key. For example, if you load an ECDSA key, it will overwrite the current RSA key.

1. Load the key on the ACOS device using the CLI in the configuration mode.

   The file path is the server's location where the key file is available.

```
ACOS(config)# sshd key load use-mgmt-port
scp://user@172.20.20.20/home/user/ecdsa_key
```

2. Log in to the ACOS device with the loaded key using Shell.

```
ssh-keygen -R 10.10.10.1
ssh -o "HostKeyAlgorithms ecdsa-sha2-nistp256" admin@10.10.10.1
The authenticity of host '10.10.10.1 (10.10.10.1)' can't be
established.
ECDSA key fingerprint is
SHA256:OMhF6LOYt5laawn7t4wBYPMdTCOivLZOZvOK232KQoY.
ECDSA key fingerprint is
MD5:00:0b:ac:78:1b:51:2b:47:d8:13:7c:e2:c9:58:a4:e2.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '10.10.10.1' (ECDSA) to the list of known
hosts.
Password:
Last login: Mon Jul  3 17:40:23 2023 from 172.20.20.20

System is ready now.

[type ? for help]

vThunder>
```

Other Configuration Differences

The following are other differences or constraints for ACOS devices when operating in FIPS mode:

- Telnet services are not available under the **`enable-management service`** command.
- The tftp:, ftp:, and http: methods for transferring the files to and from the ACOS device are not supported.
- The RSA key exchange key sizes must be at least 2048 bits.
- User passwords must be greater than or equal to 8 characters.
- The default ACOS device password is “a10$pass”, rather than “a10” in non-FIPS mode.

Web Server Support in FIPS Mode

The ACOS web server for GUI and aXAPI management access is FIPS compliant. The following Cryptographic Algorithms are supported for FIPS enabled configurations:

- Advanced Encryption Standard (AES) and AES-GCM for encryption or decryption.
- Secure Hash Algorithm 1 (SHA-1) and SHA-2 for hashing and authentication of hashed messages.
- ECDSA and RSA for authentication.
- Elliptic Curve Diffie Hellman Ephemeral (ECDHE) for key exchange.
- NIST SP-800-90A for DRBG.
- Transport Layer Security (TLS) 1.2.

For ACOS FIPS devices configured in non-FIPS mode, RSA is additionally supported for key exchange.

Jumbo Frames

The following topics are covered:

Overview of Jumbo Frames on ACOS Devices

The following topics are covered:

Details

A jumbo frame is an Ethernet frame that is more than 1522 bytes long. Support for jumbo frames is offered on Layer 4 VIPs.

By default, the maximum transmission unit (MTU) on all physical Ethernet interfaces is 1500 bytes. The default Ethernet frame size is 1522 bytes, which includes 1500 bytes for the payload, 14 bytes for the Ethernet header, 4 bytes for the CRC, and 4 bytes for a VLAN tag. Jumbo support is disabled by default.

Additional Notes

- Jumbo frame support is not available on all platforms. See the *Release Notes* for a list of supported platforms.
- Jumbo frame support is disabled by default. You can enable jumbo frame support on a global basis for the device.
- The maximum transmission unit (MTU) is not automatically changed on any of the interfaces and must be explicitly configured on those interfaces that will be used for jumbo frames; this can be done using either the GUI or the CLI.
- On non-FTA models, you can increase the MTU on individual Ethernet interfaces up to 9216 bytes.
- Jumbo frames (L4) are supported on most 64-bit models and are not supported on 32-bit models.
- If your configuration uses VEs, you must enable jumbo on the individual Ethernet ports first, then enable it on the VEs that use the ports. If the VE uses more than port, the MTU on the VE should be the same or smaller than the MTU on each port.

- It is not recommended to enable jumbo frame support on 10/100 Mbps ports.
- Setting the MTU on an interface indirectly sets the frame size of incoming packets to the same value. (This is the maximum receive unit [MRU]).

Configuring Jumbo Frame Support

This section describes how to configure jumbo frame support on your ACOS device:

The following topics are covered:

Configuring Jumbo Frame Support Using the GUI

The following topics are covered:

Changing the MTU on an Interface

To change the MTU on an interface:

1. Hover over **Network** in the navigation bar, and select **Interfaces**.
2. Check the menu bar to confirm you're on the LAN page.
3. Click **Edit** in the Actions column for any interface you choose to apply the jumbo frame config.
4. In the General Fields section, edit the value in the **MTU** field.
5. Click **Update**.

Disabling Jumbo Support

To disable jumbo frame support:

1. Hover over **Network** in the navigation bar, and select **Interfaces**.
2. Check the menu bar to confirm you're on the LAN page.
3. Click **Edit** in the Action column for the interface number. The configuration page for the interface appears.
4. Edit the value in the MTU field to be 1500 (or less).
5. Click **Update**.
6. Repeat for each interface on which the MTU is greater than 1500 bytes.
7. On non-FTA platforms, you must also save your configuration and reboot the device:
   a. Hover over **System** in the navigation bar, and select **Settings**.
   b. Click **Actions** on the menu bar.
   c. In the Action field, select **Reboot** from the drop-down list.
   d. In the Save configuration field, select **Yes** from the drop-down list.
   e. Click **OK**.

CAUTION: On non-FTA models, you must save the configuration and reboot after changing the MTU settings to disable jumbo frame support. If you reload or reboot without first saving the configuration, the feature cannot be re-enabled until you first repeat the procedure above to disable it. Then, you can re-enable the feature.

Configuring Jumbo Frame Support Using the CLI

The following topics are covered:

Globally Enable Jumbo Frame Support on your ACOS Device

This section describes how to globally enable jumbo frame support. This can only be done via the CLI and not through the GUI.

This topic has the following sections:

- Enabling Jumbo Frame Support (FTA Models)
- Enabling Jumbo Support (Non-FTA Models)

Enabling Jumbo Frame Support (FTA Models)

To enable jumbo frame support on FTA models, use the following command:

```
ACOS(config)# system-jumbo-global enable-jumbo
```

Enabling Jumbo Support (Non-FTA Models)

To enable jumbo frame support on a non-FTA model, enter the following series of commands:

```
ACOS(config)# system-jumbo-global enable-jumbo
ACOS(config)# write memory
Building configuration...
Write configuration to primary default startup-config
[OK]
ACOS(config)# reboot
```

Changing the MTU on an Interface

To change the MTU on an interface, use the **mtu** command at the configuration level for the interface. For example:

```
ACOS(config)# interface ethernet 1
ACOS(config-if:ethernet:1)# mtu 1500
```

Creating a TCP-proxy Template and Apply to VIP

To create a TCP-proxy template and apply is to a VIP, use the following commands:

```
ACOS(config)# slb template tcp-proxy mss-size
```

```
ACOS(config-tcp proxy)# mss 1460
ACOS(config)# slb virtual-server vs1
ACOS(config-slb vserver)# port 80 tcp
ACOS(config-slb vserver-vport)# template tcp-proxy mss-size
```

Disabling Jumbo Frame Support

This section describes how to globally disable jumbo frame support.

This topic has the following sections:

- Disabling Jumbo Frame Support (FTA Models)
- Disabling Jumbo Support (non-FTA Models)

Disabling Jumbo Frame Support (FTA Models)

To disable jumbo frame support on FTA models, use the following command:

```
ACOS(config)# no system-jumbo-global enable-jumbo
```

Disabling Jumbo Support (non-FTA Models)

To disable jumbo frame support on a non-FTA model, enter the following series of commands:

```
ACOS(config)# no system-jumbo-global enable-jumbo
ACOS(config)# write memory
Building configuration...
Write configuration to primary default startup-config
[OK]
ACOS(config)# reboot
```

CAUTION: On non-FTA models, you must save the configuration and reboot after entering the **`no system-jumbo-global enable-jumbo`** command. If you reload or reboot without first saving the configuration, the feature can not be re-enabled until you first repeat the procedure above to disable it. Then, you can re-enable the feature.

Viewing MTU Interface Settings

The following commands show detailed information for the interfaces, which includes the MTU settings:

```
ACOS(config)# show interface ve 10
VirtualEthernet 10 is up, line protocol is up
  Hardware is VirtualEthernet, Address is 001f.a004.c0e2
  Internet address is 110.10.10.1, Subnet mask is 255.255.255.0
  IPv6 address is 2001:10::241 Prefix 64 Type: unicast
  IPv6 link-local address is fe80::21f:a0ff:fe04:c0e2 Prefix 64 Type:
unicast
  Router Interface for L2 Vlan 10
  IP MTU is 1500 bytes
  28 packets input  2024 bytes
  Received  0 broadcasts, Received 24 multicasts, Received 4 unicasts
  10 packets output  692 bytes
  Transmitted  8 broadcasts, Transmitted 2 multicasts, Transmitted 0
unicasts
  300 second input rate: 48 bits/sec, 0 packets/sec
  300 second output rate: 16 bits/sec, 0 packets/sec

ACOS(config)# show interface ethernet 15
  Ethernet 15 is disabled, line protocol is down
  Hardware is GigabitEthernet, Address is 001f.a005.53e0
  Internet address is 0.0.0.0, Subnet mask is 0.0.0.0
  Configured Speed auto, Actual unknown Configured Duplex auto, Actual
unknown
  Member of L2 Vlan 300, Port is Tagged
  Flow Control is disabled, IP MTU is 6000 bytes
  Port as Mirror disabled, Monitoring this Port disabled
  0 packets input,  0 bytes
  Received 0 broadcasts,  Received 0 multicasts,  Received 0 unicasts
  0 input errors,  0 CRC  0 frame
  0 runts  0 giants
  0 packets output  0 bytes
  Transmitted 0 broadcasts  0 multicasts  0 unicasts
  0 output errors  0 collisions
  300 second input rate: 0 bits/sec, 0 packets/sec, 0% utilization
  300 second output rate: 0 bits/sec, 0 packets/sec, 0% utilization
```

```
ACOS(config)# show interface ethernet 16
  Ethernet 16 is disabled, line protocol is down
  Hardware is GigabitEthernet, Address is 001f.a005.53e1
  Internet address is 0.0.0.0, Subnet mask is 0.0.0.0
  Configured Speed auto, Actual unknown Configured Duplex auto, Actual
unknown
  Member of L2 Vlan 300, Port is Tagged
  Flow Control is disabled, IP MTU is 6000 bytes
  Port as Mirror disabled, Monitoring this Port disabled
  0 packets input,  0 bytes
  Received 0 broadcasts,  Received 0 multicasts,  Received 0 unicasts
  0 input errors,  0 CRC  0 frame
  0 runts  0 giants
  0 packets output  0 bytes
  Transmitted 0 broadcasts  0 multicasts  0 unicasts
  0 output errors  0 collisions
  300 second input rate: 0 bits/sec, 0 packets/sec, 0% utilization
  300 second output rate: 0 bits/sec, 0 packets/sec, 0% utilization
```

Common Setup Tasks

This part of the document describes how to log onto the ACOS device, how to configure the following basic system parameters, and applicable examples:

- Logging On
- Configuring Basic System Parameters
- Deployment Examples (For reference and examples of configuration and deployment)
- vThunder (For more information on the virtual ACOS devices)

Logging On

The following topics are covered:

User Interfaces

ACOS devices provide the following user interfaces:

- Command-Line Interface (CLI) – Text-based interface in which you type commands on a command line. You can access the CLI directly through the serial console or over the network using either of the following protocols:
  - Secure protocol – Secure Shell (SSH) (versions 1 and 2)
  - Unsecure protocol – Telnet (if enabled)
- Graphical User Interface (GUI) – Web-based interface in which you click to access configuration or management pages and type or select values to configure or manage the device. You can access the GUI using either of the following protocols:
  - Secure protocol – Hypertext Transfer Protocol over Secure Socket Layer (HTTPS)
  - Unsecure protocol – Hypertext Transfer Protocol (HTTP)
- aXAPI – XML Application Programming Interface based on the Representational State Transfer (REST) architecture. The aXAPI enables you to use custom third-party applications to configure and monitor Application Delivery Controller (ADC) parameters on the ACOS device, and to monitor Ethernet interfaces. (For more information, see the aXAPI Reference.)

NOTE: By default, Telnet access is disabled on all interfaces, including the management interface. SSH, HTTP, HTTPS, and SNMP access are enabled by default on the management interface only, and disabled by default on all data interfaces.
The maximum number of CLI, GUI, and aXAPI sessions that can be opened simultaneously on an ACOS device depends on the specific device.

Logging to the CLI

NOTE: ACOS devices provide advanced features for securing management access to the device. This section assumes that only the basic security settings are in place.

To log into the CLI using SSH:

1. On a PC connected to a network that can access the ACOS device's management interface, open an SSH connection to the IP address of the management interface.
2. If it is the first time the SSH client has accessed the ACOS device, the SSH client displays a security warning. Read the warning carefully, then acknowledge the warning to complete the connection. (Press Enter.)
3. At the `login as:` prompt, enter the admin username.

   NOTE: The default admin username and password are "admin" and "a10".

4. At the `Password:` prompt, enter the admin password.
   A message is displayed to change the default password.
5. At the `Please enter your password:` prompt, enter the new password.
6. At the `Please re-enter your password:` prompt, re-enter the new password for verification.

   NOTE: You will only be prompted to change the default password when you log in for the first time on a new device or if the device is reset using the `system-reset` command. Starting with ACOS 6.0.0, any release that supports enforcing default password change will not prompt you to change the password again.
   The default password must not be set back as an admin password.

   If the default password is changed successfully, the command prompt for the User EXEC level of the CLI appears:

```
ACOS>
```

The User EXEC level allows you to enter a few basic commands, including some **show** commands as well as **ping** and **traceroute**.

NOTE: The "ACOS" in the CLI prompt represents the host name configured on the device; "ACOS" is the default host name used in all technical publications. The host name on your device may be different. The default host name on a system represents the system type; for example, on an A10 Thunder Series 5435 device, the default prompt is: `TH5435>`.

7. To access the Privileged EXEC level of the CLI and allow access to all configuration levels, enter the **enable** command.

   At the `Password:` prompt, enter the enable password. (This is not the same as the admin password, although it is possible to configure the same value for both passwords.

   For more information on System Password Policy Complexity, see the *Management Access and Security Guide*.

   If the enable password is correct, the command prompt for the Privileged EXEC level of the CLI appears:

   ```
   ACOS#
   ```

8. To access the global configuration level, enter the **configure** command. The following command prompt appears:

   ```
   ACOS(config)#
   ```

Logging to the GUI

Web access to the ACOS device is supported on the Web browsers listed in the Table 2.

Table 2 : GUI Browser Support

Browser	Windows	Linux	MAC
Firefox 40.0.3 and higher	Supported	Supported	N/A

Table 2 : GUI Browser Support

Browser	Windows	Linux	MAC
Safari 3.0 and higher	Not Supported	N/A	Supported
Chrome 45.0.2454.93 and higher	Supported	Supported	Supported
Microsoft Edge 44.18362.387.0 and higher	Supported	N/A	N/A

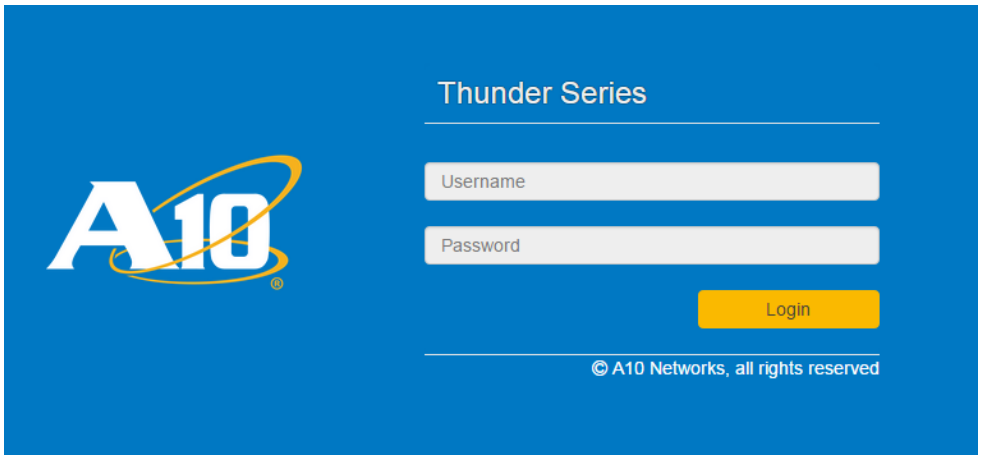
A screen resolution of at least 1024x768 is recommended.

1. Open a supported Web browser.
2. In the URL field, enter the IP address of the ACOS device's management interface.
3. If the browser displays a certificate warning, select the option to continue to the server (the ACOS device).

NOTE: To prevent the certificate warning from appearing in the future, you can install a certificate signed by a Certificate Authority. For more information, see Replacing the Web Certificate.

A log in page is displayed in the Figure 8. The name and appearance of the dialog depends on the browser you are using and the specific device which you are trying to access.

Figure 8 : Example GUI Login Dialog

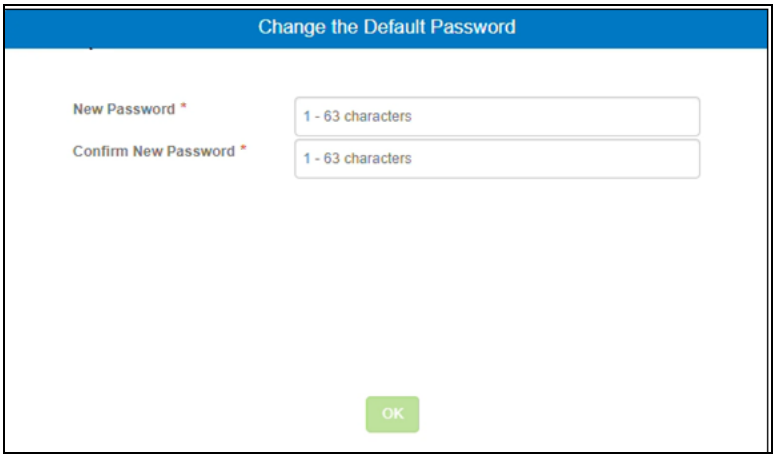


4. Enter your admin username and password and click **Login**.

NOTE: The default admin username and password are “admin”, “a10”.

5. The Change the Default Password page is displayed as shown in Figure 9.

Figure 9 : Change the Default Password



6. Enter the new password as per the Default Password-Policy Complexity Criteria, re-enter the new password for verification, and click **OK**.

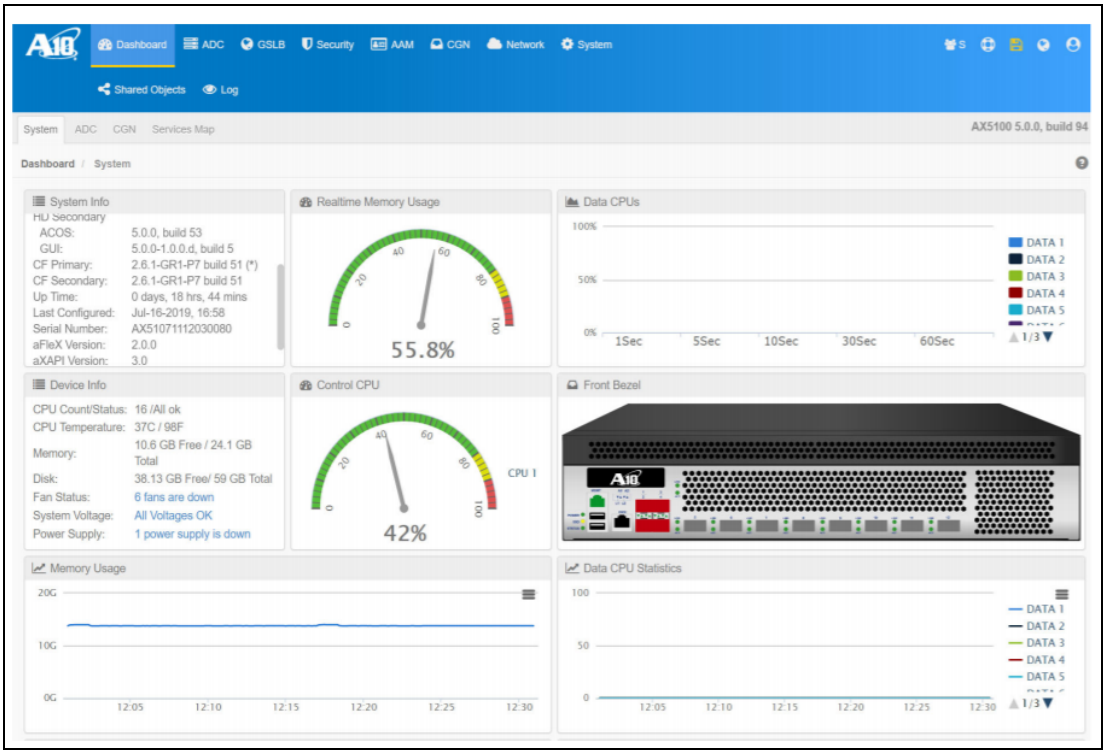
NOTE: You will only be prompted to change the default password when you log in for the first time on a new device or if the device is reset using the `system-reset` command. Starting with ACOS 6.0.0, any ACOS release that supports enforcing default password change will not prompt you to change the password again.
The default password must not be set back as an admin password.

The Dashboard (As in the Figure 10) appears, showing at-a-glance information for your ACOS device.

You can access this page again at any time while using the GUI by selecting **Dashboard**.

NOTE: For a detailed information about this option and all other GUI screens, see the latest version of the **GUI Online Help**.

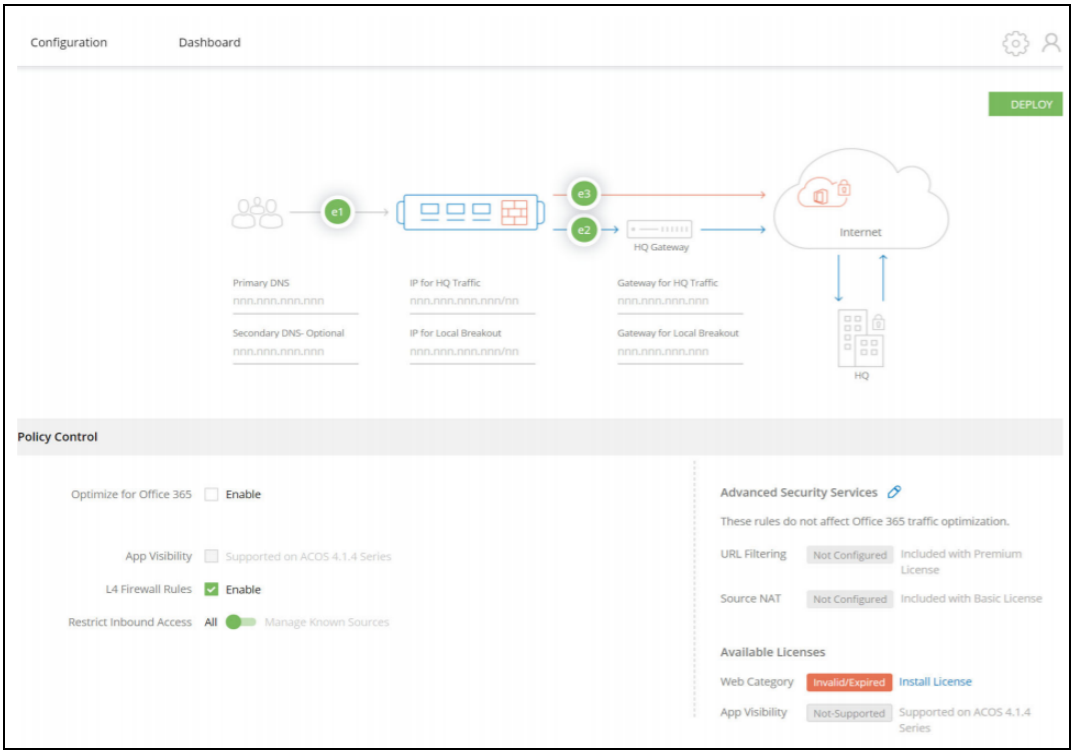
Figure 10 : Dashboard



NOTE: GUI management sessions are not automatically terminated when you close the browser window. The session remains in effect until it times out. To immediately terminate a GUI session, click the Sign Out icon in the menu bar.

7. If the ACOS is a CPE device, the user will redirect to the CPE web page instead of the ACOS Dashboard (Figure 10).
   For more information about the CPE web page, see the latest version of the **GUI Online Help (System > APP Template)**.

Figure 11 : Dashboard



Default Password-Policy Complexity Criteria

As per the default password-policy complexity, the following criteria should be met:

- The password length should be at least nine characters.
- The password should contain at least one number, an uppercase letter (English), a lowercase letter (English), and a special character.
- The password should have at least one letter or number different from the previous password.
- The password should not contain its corresponding username with the same capitalization of letters.
- The password should not contain consecutive repeated characters of the same letter or number with the same capitalization of letters.
- The password should not contain the sequential row keyboard input of four letters or numbers with the same capitalization of letters.

For more information, see *Management Access and Security Guide*.

Console Restart

Use the **clear console** command to terminate the current login process and start a new one:

```
ACOS(config)# clear console
```

Use this command if you notice that SSH and data traffic still appear to be operational, though the console session is hung. This may be caused if rimacli is in a hung state. rimacli is the process that is automatically invoked when an admin logs into the ACOS device through an interface address. This process provides admins access to the Command Line Interface (CLI) to be able to issue and save commands to configure the system.

To resolve the issue of the hung console due to an underlying hung `rimacli` process, use the **clear console** command. After the hung login process is terminated, the console will revert to the login prompt.

Configuring ADC and CGN on the Same Device

ACOS 4.x software supports both ADC and CGNv6 configuration. Either one may be configured in any partition but they may not be configured together in the same partition.

When you login to the device using the CLI, all ADC and CGN options are available by default in the shared partition (see the *Configuration Application Delivery Partitions* guide for more information about partitions). When an ADC object is configured (for example, an SLB server), all CGN options are automatically disabled until all ADC objects are removed. Similarly, if a CGN object is configured, then all ADC options are disabled until the CGN objects are all removed.

When an L3V partition is created, the behavior is the same as the shared partition. All ADC and CGN objects are available until either one is configured.

While creating partitions, you can use the `application-type` command to explicitly specify the type of objects that are available in any partition, before any objects are configured. For example, the following command creates an L3V partition called “PART-ADC” which will only have ADC options available:

```
```

```
ACOS(config)# partition PART-ADC id 1 application-type adc
```

The behavior in the GUI is slightly different. The GUI menu options are static and will not make ADC or CGN objects unavailable based on the existing configuration. Therefore, it is up to the user to maintain records about which types of objects are configured in each partition. If an attempt is made to use the GUI to configure a CGN object in a partition that already contains ADC objects, the user will see an error message.

Configuring Basic System Parameters

This chapter describes the basic system parameters and provides CLI and GUI steps for configuring them.

The following topics are covered:

NOTE:

- The only basic parameters that you are required to configure are date/time settings. Configuring the other parameters is optional.
- This chapter does not describe how to access the serial console interface. For that information, see the installation guide for your specific ACOC device.

Setting the System Time and Date

This section provides instructions for setting the time and date on your system.

The following topics are covered:

Setting the Clock

The time and date are not set at the factory. Therefore, you must manually set them or configure NTP (see Setting the NTP Server).

The following topics are covered:

Using the GUI to Set the Clock

To set the clock using the GUI:

1. Navigate to **System > Settings > Time**.
2. In the Clock section, you can:
   - Set the date and time. Click in the Date/Time field to select the date from the pop-up calendar.
   - Set the timezone.
   - Select whether or not you want to enable or disable daylight savings time.

NOTE: When you change the ACOS timezone, the statistical database is cleared. This database contains general system statistics (performance, CPU, memory, and disk utilization) and SLB statistics.

By default, daylight savings is enabled on the ACOS device. The ACOS device automatically adjusts the time for Daylight Savings Time based on the timezone you select. The UTC time standard does not observe daylight savings time.

3. Click **OK** to save your changes.

Using the CLI to Set the Clock

To set the clock using the CLI:

1. From Privileged EXEC mode, use the **clock set** command to set the time. This command must be run in Privileged EXEC mode.

   The following example sets the time to 10:31 AM on February 13, 2015:

   ```
   ACOS# clock set 10:31:00 February 13 2015
   ```

   The following example sets the time to 7:15 PM and 33 seconds on December 17, 2015 (for times beyond 12:00 PM, use the 24-hour notation):

   ```
   ACOS# clock set 19:15:33 December 17 2015
   ```

2. Enter Global configuration mode to use the **timezone** command to set the time zone.

   The following example sets the timezone to America/Los_Angeles:

   ```
   ACOS# configure
   ACOS(config)# timezone America/Los_Angeles
   ```

3. To verify your settings, use the **show clock** command:

   ```
   ACOS# show clock
   .08:43:07 PDT Thu Oct 2 2015
   ACOS#
   ```

If you manually set the time or the time comes from the NTP configuration on the server, there will not be an extra dot (.) in the display when you use the `show clock`

command. If, however, the NTP configuration does not work properly, the time displays an extra dot as shown in the example above. An extra dot also displays if there is neither an NTP configuration nor a manual configuration.

Setting the NTP Interface

NTP listens on the management port, data port, and virtual Ethernet (VE) interface by default.

Setting the NTP Server

The following topics are covered:

Using the GUI to Set the NTP Server

To configure an NTP server using the GUI:

1. Navigate to **System > Settings > Time**.
2. In the NTP Servers section:
   - Configure an NTP hos with either an IP or hostname.
   - Select **Enable** in the status field to enable the server.
   - To designate this server as the preferred server, select the **Preferred** checkbox.

     This option allows you to specify a preferred NTP server. You now direct ACOS to use the prioritized NTP server by default and rely on additional NTP servers as backups if the preferred NTP server becomes unavailable.

NOTE: It is recommended that you enable the **Preferred** option for a single NTP server only. If the preference is selected for more than one NTP server, the prioritized NTP server is determined by an internal calculation.

3. Click **OK** to save your changes. The new server is added to the NTP Server table below the configuration fields.

Using the CLI to Set the NTP Server

To configure a preferred NTP server using the CLI, use the **ntp server** command from Global Configuration mode, then use the **prefer** command to make this the preferred server:

```
ACOS(config)# ntp server 216.171.124.36
ACOS(config-ntpsvr:216.171.124.36)# prefer
```

Use the **show running-config** command to verify your configuration:

```
ACOS(config-ipv4-serveraddr:216.171.124.36)# show run | begin ntp server
ntp server 207.69.131.204
!
ntp server 207.69.131.205
!
ntp server 216.171.124.36
  prefer
!
...
```

Setting the NTP Server Authentication

The following topics are covered:

Details

NTP server authentication keys are stored using a special A10 Networks encryption algorithm to conceal the clear-text form of the authentication key. You can add the ID numbers of encrypted authentication keys to a list of trusted keys, and apply the trusted keys to one or more NTP servers.

An NTP server can operate in either an authentication or a non-authentication mode. If an authentication key is specified in the client's NTP request, the NTP server appends a message authentication code (MAC) to the response packet header, using the authentication key. The NTP client compares the MAC of the NTP server against the specified authentication key and accepts the packet from the NTP server if the MAC matches.

Configuring NTP Server Authentication

1. Create a list of authentication keys, which are stored on the ACOS device.
2. Add the identification numbers of one or more authentication keys to the list of trusted keys. Only keys from the trusted key list are valid for NTP server authentication.
3. Configure an NTP server and apply a trusted authentication key.

NOTE:

- The NTP server and NTP client must reference the same authentication key ID number. If the NTP server and NTP client are configured with different authentication key ID numbers, NTP server authentication will always fail.
- Currently, aXAPI is not supported for SHA and SHA1 authentication of NTP servers.

Using the GUI to Set NTP Server Authentication

To set up NTP server authentication in the GUI:

1. Navigate to **System > Settings > Time**.
2. In the NTP Keys section:
   - Enter a Key ID.
   - Configure the encryption type and ASCII or Hex key parameters.
3. Click **OK** to save your configuration.

You can add multiple trusted keys using this screen. After you create the keys, you can then configure an NTP server in the NTP section (see Setting the NTP Server),

then select one of the trusted authentication keys from the drop-down menu to assign to the NTP server. Keys created here can be used while creating NTP servers.

Using the CLI to Set NTP Server Authentication

The example in this section shows how to configure NTP server authentication.

1. Create two authentication keys (13579 and 24680). Both keys use MD5 encryption and ASCII key strings:

```
ACOS(config)# ntp auth-key 13579 M ascii XxEnc192
ACOS(config)# ntp auth-key 24680 M ascii Vke1324as
```

2. Add keys 13579 and 24680 to the list of trusted keys.

```
ACOS(config)# ntp trusted-key 13579
ACOS(config)# ntp trusted-key 24680
```

3. Configure the NTP server at 207.69.131.204 to use trusted key 13579.

```
ACOS(config)# ntp server 207.69.131.204
AOCS(config-ipv4-serveraddr:207.69.131.204)# key 13579
```

4. You can verify the NTP server and authentication key configuration with the **show running-config** command. The following example includes an output modifier to display only NTP-related configuration:

```
ACOS(config)# show running-config | include ntp
ntp auth-key 13579 M ascii encrypted
zIJptJHuaQaw/5o10esBTDwQjLjV2wDnPBCMuNXbAOc8EIy41dsA5zwQjLjV2wDn
ntp auth-key 24680 M ascii encrypted
FSNiuf10Dtzc4aY0tk2J4DwQjLjV2wDnPBCMuNXbAOc8EIy41dsA5zwQjLjV2wDn
ntp trusted-key 13579
ntp trusted-key 24680
ntp server 207.69.131.204
ntp server 207.69.131.205
ntp server 216.171.124.36
ACOS(config)#
```

Setting the Hostname and DNS Parameters

The following topics are covered:

NOTE: Do not use a period (.) in the hostname. The ACOS device will interpret text that appears after the period as the DNS suffix instead of the DNS suffix you configure.

Using the GUI to Set the Hostname and DNS Parameters

To use the GUI to set the hostname and DNS parameters:

1. Navigate to **System > Settings > DNS**.
2. On the Configure DNS screen, you can specify:
   - Host name (required)
   - Domain suffix (domain name to which the host belongs)
   - Primary IP
   - Secondary IP
3. Click **Update DNS** to store your changes.

Using the CLI to Set the Hostname and DNS Parameters

This section provides an example of how to use the CLI to change the name and DNS parameters on your device. You must be in the global configuration mode:

1. To begin using the CLI, make sure you are in the Global Configuration mode.
2. Use the **hostname** command to change the hostname to “ACOS-SLB2”:”

```
ACOS(config)# hostname ACOS-SLB2
ACOS-SLB2(config)#
```

After you enter this command, note that the command prompt is changed to reflect the new hostname.

NOTE: The ">" or "#" character and characters in parentheses before "#" indicate the CLI level you are on and are not part of the hostname.

3. Use the **ip dns suffix** command to set the default domain name (DNS suffix) for host names on the ACOS device. The suffix "a10networks.com" is used in this example:

```
ACOS(config)# ip dns suffix a10networks.com
```

4. Use the **ip dns primary** command to set the primary DNS server (10.10.128.101 in this example) for resolving DNS requests:

```
ACOS(config)# ip dns primary 10.10.128.101
```

5. Use the **ip dns secondary** command to set the secondary DNS server (10.10.128.102 in this example) for resolving DNS requests:

```
ACOS(config)# ip dns secondary 10.10.128.102
```

6. Use the **show running-config** command to view your configuration:

```
ACOS-SLB2(config)# show running-config | include dns
ip dns primary 10.10.128.101
ip dns secondary 10.10.128.102
ip dns suffix a10networks.com
ACOS-SLB2(config)#
```

Setting the CLI Banners

The following topics are covered:

Details

The CLI displays banner messages when you log onto the CLI. By default, the messages shown in bold type in the following example are displayed:

```
login as: admin

Welcome to ACOS
Using keyboard-interactive authentication.
Password:
Last login: Thu Feb  7 13:44:32 2008 from 192.168.1.144

[type ? for help]
```

You can format banner text as a single line or multiple lines.

If you configure a banner message that occupies multiple lines, you must specify the end marker that indicates the end of the last line. The end marker is a simple string up to 2-characters long, each of the which must be an ASCII character from the following range: 0x21-0x7e.

The multi-line banner text starts from the first line and ends at the marker. If the end marker is on a new line by itself, the last line of the banner text will be empty. If you do not want the last line to be empty, put the end marker at the end of the last non-empty line.

Using the GUI to Set the CLI Banners

To set the CLI banners using the GUI:

1. Navigate to **System > Settings > Terminal**.
2. On the Terminal page:
   - Configure the **Login** banner.
   - Configure the **EXEC** banner.
3. Click **OK** to save your changes.

Using the CLI to Set the CLI Banners

This section describes how to change the CLI banners using CLI commands.

1. Use the **banner login** command to set the login banner. This is the banner that will be seen after you enter the admin username and password. This example sets the banner to “welcome to login mode:”

```
ACOS(config)# banner login “welcome to login mode”
```

2. Use the **banner exec** command to set the exec banner to “welcome to exec mode.” This banner is displayed after you enter the admin password:

```
ACOS(config)# banner login “welcome to exec mode”
```

To use blank spaces within the banner, enclose the entire banner string with double quotation marks.

Replacing the Web Certificate

The following topics are covered:

Details

You can replace the web certificate shipped with the ACOS device. Replacing the certificate with a CA-signed certificate prevents the certificate warning from being displayed by your browser when you log in to the GUI.

Use the GUI to Replace the Web Certificate

1. Select Config Mode > System > Settings > Web Certificate.
2. Select the location(s) of the certificate and key files to be imported:
   - Local – The file is on the PC you are using to run the GUI, or is on another PC or server in the local network. Go to step 3.

- Remote – The file is on a remote server. Go to step 5.
- Likewise, to import certificate chains, select the location.

3. Click Browse and navigate to the location of the class list.
4. Click Open. The path and filename appear in the Source field. Go to step 11.
5. To use the management interface as the source interface for the connection to the remote device, select Use Management Port. Otherwise, the ACOS device will attempt to reach the remote server through a data interface.
6. Select the file transfer protocol: FTP, TFTP, RCP, SCP, or SFTP.
7. In the Host field, enter the directory path and filename.
8. Specify the Key Source.
9. If needed, change the protocol port number n the port field. By default, the default port number for the selected file transfer protocol is used.
10. In the User and Password fields, enter the username and password required for access to the remote server.
11. Click OK.

Using the CLI to Replace the Web Certificate

Use the following command at the global configuration level of the CLI:

```
ACOS(config)# web-service secure wipe
ACOS(config)# web-service secure certificate load [use-mgmt-port]
tftp/ftp/scp/sftp
ACOS(config)# web-service secure private-key load [use-mgmt-port]
tftp/ftp/scp/sftp
```

Configuring Increased I/O Buffer Support

On some higher-end models only, you can enable the **`big-buff-pool`** option to expand support from 4 million to 8 million buffers and increase the buffer index from 22 to 24 bits.

NOTE: Some models may require 96 GB of memory to support this feature. Please check that your system meets this requirement by using the **show memory system** command and checking the output.

Enter the following command to enable more I/O buffers for the system:

```
ACOS(config)# big-buff-pool
```

Use the **no** version of the command to remove a larger buffer for the system:

```
ACOS(config)# no big-buff-pool
This will modify your boot profile to disable big I/O buffer pool.
It will take effect starting from the next reboot.
Please confirm: You want to disable the big I/O buffer pool(N/Y)?:
```

Use the **show system platform buffer-stats** command to view statistics for the I/O buffer pool:

```
ACOS(config)# show system platform buffer-stats
Buffers available in various states/threads...
-------------------------------------------------
Thread       Cache        App   AppQueue       Misc
-------------------------------------------------
Q0          136034          0          0          0
Q1          127873          0          0          0
Q2          154496          0          0          0
Q3          154515          0          0          0
Q4          154511          0          0          0
Q5          153147          0          0          0
Q6          154511          0          0          0
Q7          153147          0          0          0
Q8          153829          0          0          0
Q9          153147          0          0          0
Q10         154511          0          0          0
Q11         153147          0          0          0
Approximate # buffers in App      0
Approximate # buffers in App_cp   0
Approximate # buffers in Cache_cp 1024
Approximate # buffers in Cache    1802868
Approximate # buffers in Queue    0
Approximate # buffers in misc     0
Approximate # buffers in dfree    745472
```

```
Approximate # buffers free        2391436
Approximate # buffers avail in HW 1639073
# Capsules in per thread pool:
          t00 t01 t02 t03 t04 t05
  FPGA0:   9  11  11  11  11  11
  FPGA1:  21  15  15  15  15  15
  FPGA2:  10  19  19  19  19  19
  FPGA3:  21  22  22  22  22  22
          t06 t07 t08 t09 t10 t11
  FPGA0:   5  16  16  16  16  16
  FPGA1:  17  17  17  17  17  17
  FPGA2:  12  12  11  11  11  11
  FPGA3:  21  22  22  22  22  22
Approximate # of operations on Global buffer pool:
             GetsD0     PutsD0     GetsD1     PutsD1
  FPGA0: 0x00000016 0x00000052 0x00000000 0x00000037
  FPGA1: 0x00000000 0x00000033 0x00000000 0x00000032
  FPGA2: 0x00000000 0x0000003d 0x00000016 0x0000004a
  FPGA3: 0x00000000 0x00000010 0x00000000 0x00000013
Approximate # buffers in total    4194304
```

Configuring Single Management Interface

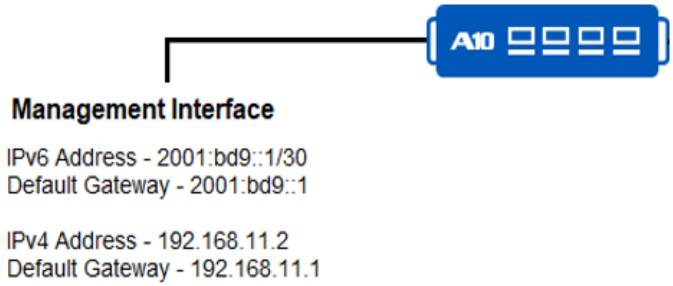
The following topics are covered:

Overview

The management interface (MGMT) is an Ethernet interface to which you can assign a single IPv4 address and a single IPv6 address. The management interface is separate from the Ethernet data interfaces.

The following Figure 12 shows an example of the management interface on a Thunder Series device.

Figure 12 : ACOS Deployment Example – Single Management Interface



By default, the ACOS device attempts to use a route from the main route table for management connections originated on the ACOS device. You can enable the ACOS device to use the management route table to initiate management connections instead. (For information, see Source Interface for Management Traffic.)

NOTE: ACOS allows the usage of the same IP address for both the mgmt IP address and the NAT pool address. However, in Layer 2 (transparent) deployments, if you do configure the same address in both places, and later delete one of the addresses, a reload is required for the changes to take effect.

CLI Configuration

The following commands configure access to the management interface:

1. Use the **interface management** command to enter the interface management mode and to continue the management interface configuration.

```
ACOS(config)# interface management
```

2. Use the **ipv6** commands to configure IPv6 access.

```
ACOS(config-if:management)# ipv6 address 2001:db9::1/30
ACOS(config-if:management)# ipv6 default-gateway 2001:db9::1
```

3. Use the **ip** commands to configure IPv4 access.

```
ACOS(config-if:management)# ip address 192.168.11.2 /21
ACOS(config-if:management)# ip default-gateway 192.168.11.1
```

4. Use the **show interfaces management** command to verify the configuration.

```
ACOS(config-if:management)# show interfaces management
Management 0 is up, line protocol is up.
 Hardware is 10Gig, Address is 001f.a044.7167
 Internet address is 192.168.11.2, Subnet mask is 255.255.255.0
 Internet V6 address is 2001:db9::1/30
 Configured Speed auto, Actual 1000, Configured Duplex auto, Actual fdx
 Flow Control is disabled, IP MTU is 1500 bytes
 781 packets input,  58808 bytes
 Received 33 broadcasts,  Received 66 multicasts,  Received 662
unicasts
 0 input errors,  0 CRC  0 frame
 0 runts  0 giants
 924 packets output 3549 bytes
 Transmitted 157 broadcasts  7 multicasts  770 unicasts
 0 output errors  0 collisions
```

GUI Configuration

This section describes how to use the GUI to configure a single management interface.

NOTE: Unless you have already configured an IP interface, navigate to the default IP address: http://172.31.31.31.

1. Navigate to **Network > Interfaces > Management**.
2. On the Management page:
   - Configure the duplexity of the management interface.
   - Configure the speed of the management interface.

     NOTE: The available selection of speeds in this field depends on the device you are configuring. Devices with no 1G interface, for example, will not have a 1G option in this field.

   - Configure the IPv4, IPv6, and LLDP settings.
3. Click **Configure** to save your changes.

Configuring Dual Management Interface

The following topics are covered:

Overview

The dual management interfaces enhance reliability. They are supported only on the Thunder 8665S platform. Each port can be configured separately and operates independently of the other.

The second management interface (management2) is an Ethernet interface to which you can assign a single IPv4 address and a single IPv6 address.

NOTE: The second management interface is referred to as management2 or mgmt2.

The following Figure 13 shows an example of the management2 interface on an Thunder Series device.

Figure 13 : ACOS Deployment Example – Dual Management Interfaces

By default, the ACOS device attempts to use a route from the main route table for management connections originated on the ACOS device. You can enable the ACOS device to use the management route table to initiate management connections instead. (For information, see Source Interface for Management Traffic.)

NOTE: The `dac-link-training-enable` command enables the Direct Attach Copper (DAC) cable link training to establish a link with the interface. This command is recommended only when the ACOS device is connected to the 400G DAC Copper cable and must interoperate with the Dell Fabric switch. It is not required for other switches.

CLI Configuration

The following commands configure access to the second management interface:

1. Use the **`interface management2`** command to enter the interface management mode and to continue the management interface configuration.

```
ACOS(config)# interface management2
```

2. Use the **`ipv6`** commands to configure IPv6 access.

```
ACOS(config-if:management2)# ipv6 address 2001:db8::2/32
ACOS(config-if:management2)# ipv6 default-gateway 2001:db8::1
```

3. Use the **`ip`** commands to configure IPv4 access.

```
ACOS(config-if:management2)# ip address 192.168.10.2 /24
ACOS(config-if:management2)# ip default-gateway 192.168.10.1
```

NOTE: The `duplexity`, `flow control`, `speed`, `sampling-enable`, `bcast-rate-limit`, and `lldp` commands are unavailable in both the management interface and the second management interface mode.

4. Use the **`show interfaces management2`** command to verify the configuration:

```
ACOS(config-if:management2)# show interfaces management2
Management 2 is up, line protocol is up
 Hardware is 10Gig, Address is 001f.a044.7166
 Internet address is 192.168.10.2, Subnet mask is 255.255.255.0
 Internet V6 address is 2001:db8::2/32
 IPv6 link-local address is fe80::200:ff:fe00:0/64
 Configured Speed N/A, Actual 1000, Configured Duplex N/A, Actual Full
 Flow Control is disabled,IP MTU is 1500 bytes
 23922 packets input,  2448254 bytes
```

```
 Received 21648 broadcasts,  Received 602 multicasts,  Received 1672
unicasts
 0 input errors,  0 CRC  0 frame
 0 runts  0 giants
 1690 packets output  214668 bytes
 Transmitted 12 broadcasts  24 multicasts  1654 unicasts
 0 output errors  0 collisions
```

Limitations

- The following features or commands are not supported for the second management - 'management2' interface:
  - Logging
  - SNMP
  - Licensing
  - GSLB
  - Event Notification
  - Web Services
  - Visibility
  - LLDP
  - Enable or disable Management services such as ping, telnet, traceroute, and ssh
  - Network Time Protocol (NTP)
  - Management interface as the source interface for the connection to the remote device (use-mgmt-port)
  - Management interface as the source interface for the automated traffic (ip control-apps-use-mgmt-port)
- The dual management interface can be configured only through CLI.
- The **`show management`** command does not support the second management interface (mgmt2), on TH8665 device.
- `use-mgmt-port` support across all applications (For example, ping/ssh/telnet/import/export and so on).

Disabling the Deletion of Referenced Objects

This section provides the instructions for disabling the deletion of referenced Server Load Balancer (SLB) objects.

The following topics are covered:

Using the CLI to Disable the Deletion of Referenced Objects

To disable the deletion of referenced objects using CLI:

```
ACOS(config)# system config-mgmt delete-referenced-tagged-objects disable
```

The **system config-mgmt** command provides **delete-referenced-tagged-objects** option for automatic and manual deletion.

- When this option is enabled and if an attempt is made to delete, the referenced objects are deleted directly without any prompt message, which is the legacy and default behaviour. This applies to SLB real server, service-group, virtual server, and SLB template within Shared and L3V partition.
- When this option is disabled and if an attempt is made to delete, a message is displayed indicating that the object has tagged references that must be removed first. These references must be manually deleted before the object can be successfully removed. This applies to SLB real server, service-group, virtual server, and SLB template within Shared and L3V partition.

The following example shows an attempt to delete a referenced real server named 's1' in the Shared partition:

```
ACOS(config)# system config-mgmt delete-referenced-tagged-objects disable
ACOS(config)# no slb server s1
This object has other objects referencing this. Please remove references
first.
```

For more information about the configuration options and commands, see Command Line Interface Reference.

Deployment Examples

The following topics are covered:

Deployment Modes

You can deploy the ACOS device into your network as a Layer 2 switch (transparent mode) or a Layer 3 router (route mode). In either of the deployment modes, the ACOS device has a dedicated Ethernet management interface, different from the Ethernet data interfaces. You can assign an IPv4 address and/or an IPv6 address to the management interface.

For network deployment examples, see the following:

- Transparent Mode Deployment
- Routed Mode Deployment

Transparent Mode Deployment

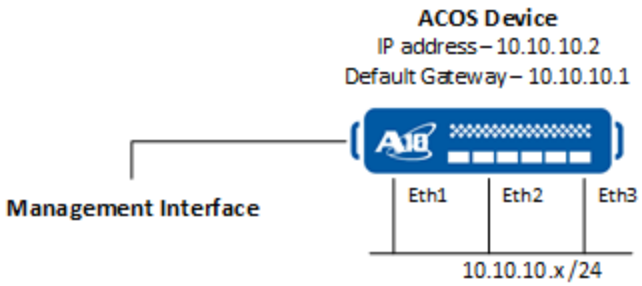
The following topics are covered:

NOTE: In Transparent Mode, the L3V partition is not supported.

Deployment Examples

The following Figure 14 shows an example of an Thunder Series device deployed in transparent mode.

Figure 14 : ACOS Deployment Example – Transparent Mode



NOTE:

- For simplicity, this example and the other examples in this chapter show the physical links on single Ethernet ports. Everywhere a single Ethernet connection is shown, you can use a trunk, which is a set of multiple ports configured as a single logical link.
- Transparent mode deployments are not valid for CGNv6 configurations. CGNv6 is only supported in Routed Mode Deployment.

Configuration Example

This section describes the GUI screens and CLI commands needed to deploy the ACOS device as shown in the ACOS Deployment Example – Transparent Mode.

The following topics are covered:

Using the GUI

1. Hover over **Network** in the navigation bar, and select **Interfaces**.
2. Click on **Transparent** on the menu bar.
3. Enter the IP Address, IP Mask, and Default Gateway, or alternatively, the IPv6 address and gateway.
4. Click **Configure**.
5. The data interface is added to the table, which can be seen if you click LAN in the menu bar.
6. Select the checkbox next to each Ethernet data interface you wish to enable, and click **Enable**.

Using the CLI

The following commands configure the global IP address and default gateway:

```
ACOS(config)# ip address 10.10.10.2 /24
```

```
ACOS(config)# ip default-gateway 10.10.10.1
```

The following commands enable the Ethernet interfaces used in the example:

```
ACOS(config)# interface ethernet 1
ACOS(config-if:ethernet:1)# enable
ACOS(config-if:ethernet:1)#  interface ethernet 2
ACOS(config-if:ethernet:2)# enable
ACOS(config-if:ethernet:2)# interface ethernet 3
ACOS(config-if:ethernet:3)# enable
ACOS(config-if:ethernet:3)# exit
```

Routed Mode Deployment

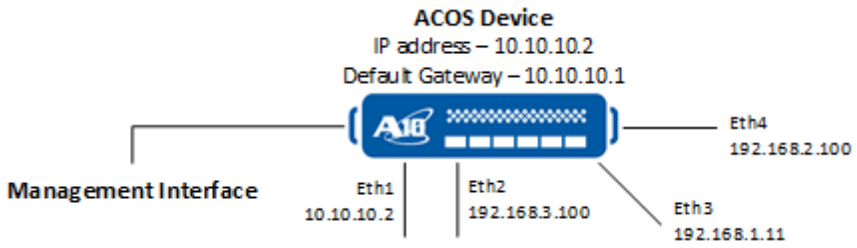
The following topics are covered:

Deployment Example

The following Figure 15 shows an example of an ACOS device deployed in route mode.

NOTE: Route mode is also called "**gateway**" mode.

Figure 15 : ACOS Deployment Example – Route Mode



In this example, the ACOS device has separate IP interfaces in different subnets on each of the interfaces connected to the network. The ACOS device can be configured

with static IP routes and can be enabled to run OSPF and IS-IS. In this example, a static route is configured to be used as the default route through 10.10.10.1.

Although this example illustrates single physical links, you could use trunks as physical links. You also could use multiple VLANs. In this case, the IP addresses would be configured on Virtual Ethernet (VE) interfaces, one per VLAN, instead of being configured on individual Ethernet ports.

Since the ACOS device is a router in this deployment, downstream devices can use the ACOS device as their default gateway. For example, devices connected to Ethernet port 2 would use 192.168.3.100 as their default gateway, devices connected to port 3 would use 192.168.1.111 as their default gateway, and so on.

If multiple ACOS devices in a VRRP-A high availability configuration is used, the downstream devices will use a floating IP address shared by the two ACOS devices as their default gateway.

NOTE: For more information, see the *Configuring VRRP-A High Availability* guide.

Configuration Example

This section shows the GUI screens and CLI commands needed to implement the configuration shown in the this figure.

The following topics are covered:

Using the GUI

1. Hover over **Network** in the navigation bar and select **Interfaces**.
2. If you are not already on the LAN index page, click **LAN** on the menu bar.
3. Click **Edit** in the Actions column for the interface number (for example, Interface “e1”). The configuration page appears.

a. To assign an IPv4 address, locate the “IP” section and then click the plus symbol ( ) to display the configuration fields for that section, and enter the address information.

b. To assign an IPv6 address, locate the “IPv6” section and then click the plus symbol ( ) to display the configuration fields for that section, and enter the address information.

c. Click **Update**.

Configuring the Default Route

1. Hover over **Network** in the navigation bar and select **Routes**.
2. Select either the IPv4 Static Routes or IPv6 Static Routes tab, then click **Create**.
3. Complete the IP Dest Address and IP Mask fields.

NOTE: For a detailed information about these configuration and other fields on this page, see the latest version of the **Online Help**.

4. Click **Create Route**.

Using the CLI

The following commands enable the Ethernet interfaces used in the example and configure IP addresses on them:

```
ACOS(config)# interface ethernet 1
ACOS(config-if:ethernet:1)# enable
ACOS(config-if:ethernet:1)# ip address 10.10.10.2 /24
ACOS(config-if:ethernet:1)# interface ethernet 2
ACOS(config-if:ethernet:2)# enable
ACOS(config-if:ethernet:2)# ip address 192.168.3.100 /24
ACOS(config-if:ethernet:2)# interface ethernet 3
ACOS(config-if:ethernet:3)# enable
ACOS(config-if:ethernet:3)# ip address 192.168.1.111 /24
ACOS(config-if:ethernet:3)# interface ethernet 4
ACOS(config-if:ethernet:4)# enable
ACOS(config-if:ethernet:4)# ip address 192.168.2.100 /24
ACOS(config-if:ethernet:4)# exit
ACOS(config)#
```

The following command configures the default route through 10.10.10.1:

```
ACOS(config)# ip route 0.0.0.0 /0 10.10.10.1
```

vThunder

vThunder is a fully operational software-only version of A10 Networks' line of Thunder Series Application Delivery Controllers.

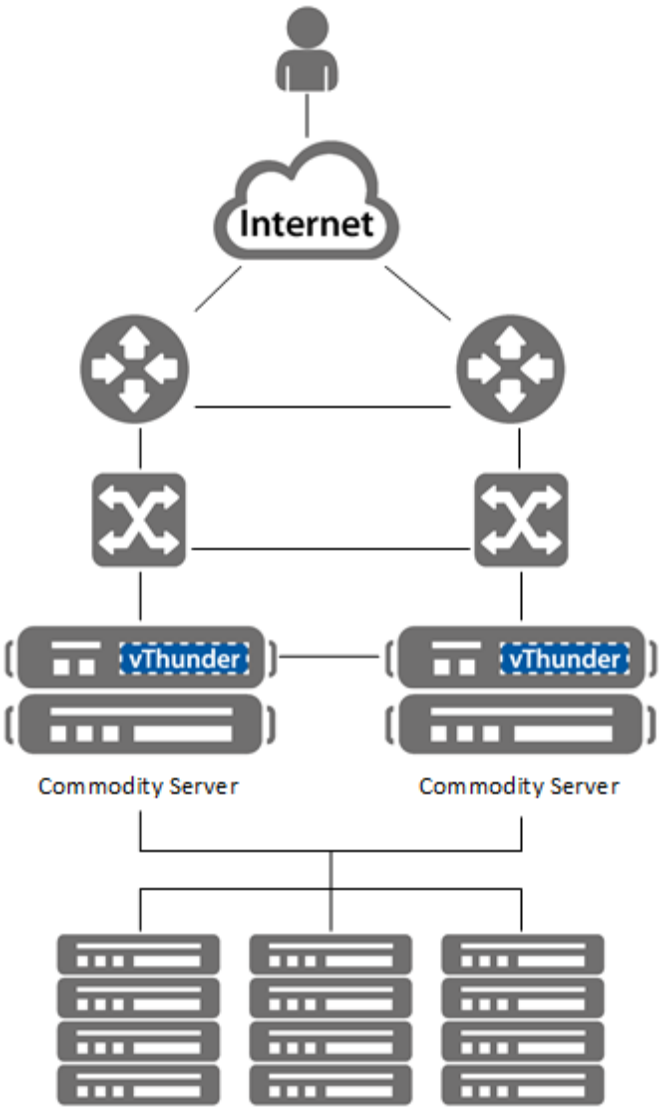
The following topics are covered:

vThunder for Multiple Hypervisors

vThunder is supported on multiple hypervisors. See the *Release Notes* for a complete list of supported hypervisors for this release.

The following Figure 16 shows a network topology in which a vThunder can be installed on a supported hypervisor.

Figure 16 : vThunder for Multiple Hypervisors



The hypervisor is installed on top of the commodity hardware. The virtualized vThunder instance sits on top of the hypervisor layer. Functionality of vThunder is, for the most part, the same as a hardware-based ACOS device.

vThunder Installation

The following topics are covered:

Installation Details

Multiple vThunder instances can be installed in a single hardware platform, such as a PC, with each instance running independently from the others.

NOTE:

- For specific installation instructions, see the *vThunder Installation Guide* for your hypervisor. All installation instructions are available for download on the Support Portal.
- To locate the Installation Guide, see https://documentation.a10networks.com/Install/Software/A10_ACOS_Install/vThunder.html.

Management of vThunder

vThunder can be managed from the ACOS CLI or GUI, which is the same as any standard hardware-based ACOS device.

vThunder Feature Support

vThunder supports many of the same features as the A10 Thunder Series and hardware-based models. The exact set of supported features varies and is based on

whether vThunder is running an ADC (SLB) release or a CGN (IPv6 Migration) release.

NOTE: For more information on *vThunder Datasheet,* see https://www.a10networks.com/sites/default/files/A10-DS-vThunder.pdf.

Application Delivery Partition Support

Up to 32 L3V partitions can be created for each vThunder instance.

NOTE: For more information on this topic, see the *Configuration Application Delivery Partitions* Guide.

Configuration Management

This part of the document describes how to configure the following management features for ACOS devices:

Manually Synchronizing Configurations of All Partitions Between ACOS Devices

The `configure sync` command is used to manually synchronize the configuration commands running-config and startup-config of all or specific partitions such as Shared Partition, L3V Partitions, and Service Partitions from one ACOS device to another ACOS device.

This feature is supported for the ACOS devices that are deployed in VRRP-A or non-VRRP-A environments.

The synchronization is possible only between specific partitions. For example, consider a scenario with Thunder devices T1 and T2 in a VRRP-A environment.

Configuration synchronization is permitted in the following scenarios:

- From T1 Shared partition to T2 Shared/L3V/Service partition
- From T1 all partitions including shared to T2 all partitions including shared partitions
- From T1 L3V partition to and the same T2 L3V partition
- From T1 Service partition to the same T2 Service partition

NOTE: Only running and startup configurations are synchronized; while the device-specific configurations, such as interface configurations, are not synchronized.

For more information about configuration options, see configure sync in the *Command Line Interface Reference.* For information on configuration objects that are included or not included in a manual synchronization, see the appropriate topic below.

NOTE: Manual configuration is not necessary for running ACOS Virtual Chassis System (aVCS). For more information, see the Configuration Synchronization without Reload section in the *Configuring ACOS Virtual Chassis Systems* Guide.

The following topics are covered:

Requirements for Synchronization Link

Following are the pre-requisites for configuration synchronization:

- SSH management access must be enabled on both ends of the link before performing a manual synchronization.
- The destination device must be reachable and route-able from the current partition.
- Before synchronizing the Active and Standby ACOS devices, verify that both are running the same software version. Configuration synchronization between two different software versions is not recommended, since some configuration commands in the newer version might not be supported in the older version.
- While performing synchronization, you must have write privileges on the destination node.
- The configuration synchronization process does not check user privileges on the Standby ACOS device and will synchronize to it using read-only privileges. However, you must be logged onto the Active ACOS device with configuration (read-write) access.
- If the configuration includes Policy-based SLB (black/white lists), the time it takes for synchronization depends on the size of the black/white-list file. This is because the synchronization process is blocked until the files are transferred from active to standby mode.
- Do not make other configuration changes to the Active or Standby ACOS device during synchronization.
- Data that is synchronized from a Standby ACOS device to an Active ACOS device is not available on the Active ACOS device until that device is rebooted or the software is reloaded.
- The **`configure sync`** command will not function if **`vcs enabled`** is active.

NOTE: In 4.x, the reload action is not allowed.

Configuration Items That Are Backed Up

The following configuration items are backed up during the configuration synchronization:

NOTE: The objects backed up in 4.x is the same as 2.7.x.

• Admin accounts and settings
• AAA settings
• ACLs
• CGN
• DDoS protection settings
• Floating IP addresses
• FW
• Health Monitors
• IPsec
• ICMP rate limiting
• IP NAT configuration, including LSN and DS-Lite
• IP limiting settings
• PBSLB settings
	• SLB
	• RAM caching
	• DNS security and caching
	• FWLB
	• GSLB
	• Data Files:
	  ◦ aFleX files
	  ◦ External health check files
	  ◦ SSL certificates, private-key files, and CRLs
	  ◦ Class-list files
	  ◦ Black/white-list files

NOTE: The order of Firewall rule-set is not synced during the configuration synchronization. If you want to sync the order of Firewall rule-set, you must use the aVCS as an alternative.

Configuration Items That Are Not Backed Up

The following configuration items are *not* backed up during the configuration synchronization:

NOTE: The objects *not* backed up in 4.x is the same as 2.7.x.

• Interface-specific management access settings • Hostname • MAC addresses • Management IP addresses • Static Trunks or VLANs	• LACP settings • Interface settings • OSPF or IS-IS settings • ARP entries or settings

NOTE: On multi-PU platforms, the partitions on PU2 do not get synchronized.

Performing Configuration Synchronization

To synchronize the ACOS device configurations, use the steps described below.

Using the CLI

The **`configure sync`** commands are available at the global configuration level of the CLI.

- To synchronize the running-config and startup-config, use the **`configure sync all`** command. This will also sync data files in addition to the local running configuration and startup configuration to the peer device.
- The following example of a command synchronizes both the running configuration and startup configuration from the shared partition of the local device to the shared partition on the peer device with IP address 192.168.105.127.

```
ACOS(config)# configure sync all auto-authentication 192.168.105.127
```

- To synchronize the running-config of the Active ACOS device to the running-config of the Standby ACOS device, use the configure sync running command. This syncs the data files, in addition to the running configuration to the peer device.
- The following example of a command synchronizes only the running configuration

from the shared partition of the local device to the shared partition on the peer device with IP address 192.168.105.127.

```
ACOS(config)# configure sync running auto-authentication 192.168.105.127
```

- To synchronize the running-config from a specific L3V partition of one device to the L3V partition on the peer ACOS device, use the **configure sync running** command.

  The following example of a command synchronizes the running configuration from the p1 partition of the local device to the p1 partition on the peer device with IP address 192.168.105.127.

```
ACOS(config)# configure sync running auto-authentication 192.168.105.127
```

For more detailed information, see `configure sync` in the *Command Line Interface Reference*.

NOTE: Synchronization of just the data files is not available in 4.x.

Using the GUI

1. Select **System > Settings > Sync Settings.**
2. In the User, Password, and Destination IP Address fields, enter the admin username, password credentials, and IP address of the peer device.
3. Configure the other fields on this page as desired; refer to the GUI online help for more information about each field.
4. Click **OK**.

Displaying the Configure Sync State

Introduced in 4.x, the synchronization state for running and startup configurations can be viewed by using the CLI command **show config-sync**.

An example output is shown from the source device.

```
vThunder-Active(config)# show config-sync
Partition Name   Sync Status for running-config and startup-config
-------------------------------------------------------------
```

```
shared           (running-config) sync to ip 192.168.105.127 at 20:04:04
IST Thu Jul 17 2008
shared           (startup-config) sync to ip 192.168.105.127 at 20:04:04
IST Thu Jul 17 2008
```

An example output is shown from the destination device.

```
vThunder-standby# show config-sync
Partition Name   Sync Status for running-config and startup-config
-------------------------------------------------------------
shared           (running-config) is synced from ip 192.168.105.120 at
06:25:19 GMT Mon Nov 27 2017
shared           (startup-config) is synced from ip 192.168.105.120 at
06:25:20 GMT Mon Nov 27 2017
```

Performing a write operation, or modifying a configuration will change the sync status for the modified configuration.

For example, running the **write memory** command will change the start-up config state from “sync” to “not-synced”.

```
vThunder-Active# write memory
Building configuration...
Write configuration to profile "conn_40"
[OK]
vThunder-Active#show con
vThunder-Active#show config-s
vThunder-Active# show config-sync
Partition Name   Sync Status for running-config and startup-config
-------------------------------------------------------------
shared           (running-config) sync to ip 192.168.105.127 at 20:04:04
IST Thu Jul 17 2008
shared           (startup-config) not synced because write memory at
20:09:25 IST Thu Jul 17 2008
```

If the running configuration is modified, the running-config state will change from “sync” to “not-synced”.

For example, the following configuration is added to the running configuration.

```
vThunder-Active(config)# cgnv6 nat pool a 1.1.1.1 netmask /24
```

Now, running the **show config-sync** command, the running configuration is no longer synced.

```
vThunder-Active(config)# show config-sync
Partition Name   Sync Status for running-config and startup-config
-------------------------------------------------------------
shared           (running-config) not synced because it's changed at
07:02:33 GMT Mon Nov 27 2017
shared           (startup-config) not synced because write memory at
06:30:24 GMT Mon Nov 27 2017
```

Monitor Multi-PU Synchronization

In a multi-PU environment, Processing Unit 1 (PU1) acts as the primary PU and Processing Unit 2 (PU2) as the secondary PU. Any configuration changes on PU1 are automatically propagated to PU2.

To monitor the synchronization status of PU2 with PU1 periodically, you can use the `system config-mgmt pu-sync-detection` command. This command allows you to enable, disable, or set the interval for detecting the status of configuration synchronization between PU1 and PU2.

You can also view inconsistency in the configuration and associated warning message using the `show log` command.

NOTE:

- This command applies only to the multi-PU platform.
- By default, the detection is disabled. If enabled, it may affect the control place performance and CPU usage, especially if a large configuration is applied or too many partitions are configured.

CLI Configuration

- To enable or disable the detection of configuration synchronization between PU1 and PU2:

```
ACOS(config)# system config-mgmt pu-sync-detection
ACOS(config-pu-sync-detection)# enable | disable
```

- To set an interval to detect configuration synchronization between PU1 and PU2:

```
ACOS(config)# system config-mgmt pu-sync-detection
ACOS(config-pu-sync-detection)# interval <30-86400>
```

Show Command

To view the warning message on configurations that are not synchronized between PU1 and PU2, use the `show log` command.

```
Nov 27 2024 12:18:04 Info    [CFGMGR]: - PU1 - Partition 'shared' is in
sync now in PU2.
Nov 27 2024 12:17:04 Warning   [CFGMGR]: - PU1 - Partition 'shared' has
2 objects out of sync in PU2, including slb.server(s4,s5).
Nov 27 2024 12:11:45 Warning   [CFGMGR]: - PU1 - Partition 'shared' has
2 objects out of sync in PU2, including slb.server(s4,s5).
```

Backing Up System Information

The following topics are covered:

Details

By default, when you click the **Save** button in the GUI or enter the `write memory` command in the CLI, all unsaved configuration changes are saved to the startup-config. The next time the ACOS device is rebooted, the configuration is reloaded from this file.

In addition to these simple configuration management options, the ACOS device has advanced configuration management options that allow you to save multiple configuration files. You can save configuration files remotely on a server and locally on the ACOS device itself.

NOTE:

- For information about managing configurations for separate partitions on an ACOS device, see the *Configuring Application Delivery Partitions* guide.
- For information about synchronizing configuration information between multiple ACOS devices configured for VRRP-A high availability, see the *Configuring VRRP-A High Availability* Guide.
- For upgrade instructions, see the *Release Notes* for the ACOS release to which you plan to upgrade.

Overview of System Backup

The ACOS device allows you to back up the system, individual configuration files, and log entries onto remote servers. You can use any of the following file transfer protocols:

- Trivial File Transfer Protocol (TFTP)
- File Transfer Protocol (FTP)
- Secure Copy Protocol (SCP)
- SSH File Transfer Protocol (SFTP)

NOTE: Backing up system from one hardware platform and restoring it to another hardware platform is not supported.

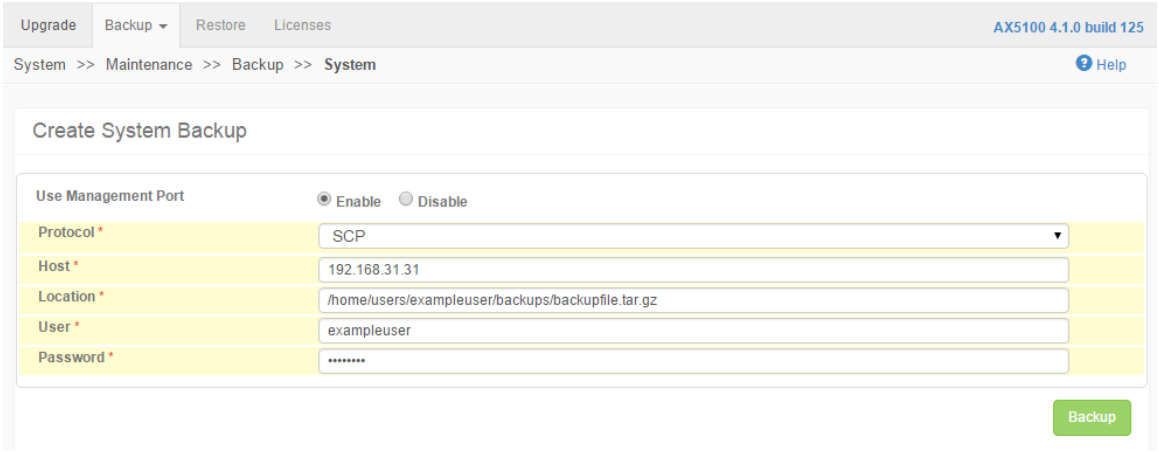
The following topics are covered:

Using the GUI to Perform a Backup

To configure backup using the GUI:

1. Navigate to **System > Maintenance**.
2. In the menu bar, click **Backup**. From the drop-down menu that appears, select one of the following:
   - System — This option performs an immediate backup of the configuration file (s), aFleX scripts, and SSL certificates and keys.
   - Log — This option perform an immediate backup of the log entries in the ACOS device's syslog buffer (along with any core files on the system).
   - Periodic Backup — This option performs a scheduled backup of either the system or log files.
3. Complete your backup configuration by specifying any necessary information (for example, the remote host and port, file transfer protocol, location and name of the backup file, and remote system access information).

The following example shows an example of a system backup:



Using the CLI to Perform a Backup

This section provides examples of how to back up your system using the CLI.

The following example creates a backup of the system (startup-config file, aFleX scripts, and SSL certificates and keys) on a remote server using SCP.

```
ACOS(config)# backup system
scp://exampleuser@192.168.3.3/home/users/exampleuser/backups/backupfile.tar.gz
```

The following example creates a daily backup of the log entries in the syslog buffer. The connection to the remote server will be established using SCP on the management interface (**use-mgmt-port**).

```
ACOS(config)# backup log period 1 use-mgmt-port
scp://exampleuser@192.168.3.3/home/users/exampleuser/backups/backuplog.tar.gz
```

Restoring from a Backup

You can use a saved backup to restore your current system; for example, if you are upgrading the devices in your network to the newer A10 Thunder Series devices.

This section contains some important things to consider before performing a restore operation:

- System Memory
- FTA versus Non-FTA
- L3V Partitions
- Port Splitting
- Port Mapping
- What is Not Restored?
- Restore Example

System Memory

If your current device has less memory than the backup device (for example, 16 GB on the current device but 32 GB on the previous device), this can adversely affect system performance.

FTA versus Non-FTA

If you are restoring from an FTA device to a non-FTA device, for example, some commands may not be available after the restore operation. This command is lost and cannot be restored.

L3V Partitions

L3v partitions and their configurations are restored; however, if you are restoring to a device which supports a fewer number of partitions (for example, 32) than you have configured from the backup device (for example, 64) then any partitions and corresponding configuration beyond 32 are lost.

Port Splitting

If you are restoring between devices with various 40 GB port splitting configurations, see the following Table 3 for more information.

Table 3 : Restore Behavior for Port Splitting Combinations

Backup Device	Current Device	Behavior During the Restore Operation
Port splitting disabled.	Port splitting disabled.	Allow user to perform port mapping (See Port Mapping.)
Port splitting	Port splitting	Allow user to perform port mapping (See Port

Table 3 : Restore Behavior for Port Splitting Combinations

Backup Device	Current Device	Behavior During the Restore Operation
enabled.	enabled.	Mapping.)
Port splitting enabled.	Port splitting disabled.	Ask the user if they want to perform port mapping. If yes, enable port splitting, reboot the device, then perform the restore operation again, where port mapping will be enabled.
Port splitting disabled.	Port splitting enabled.	Exit the restore operation. The user will have to perform a `system-reset` or disable port splitting, reboot the system, and then perform the restore operation again.

Port Mapping

When restoring from a device that has a different number of ports, or even the same number of ports, you can map the port number from the previous configuration to a new port number (or same port number) in the new configuration.

In cases where the original number of ports is greater than the number of ports on the new system, some configuration may be lost.

If you choose to skip port mapping (see the example below) then the original port numbers and configurations are preserved. If the original device had ports 1-10 configured, and the new device only has ports 1-8, and you skip port mapping, then ports 9 and 10 are lost. If you choose port mapping, you can decide which 8 out of the original 10 ports you want to preserve during the port mapping process.

What is Not Restored?

The following items are not restored:

- VLAN configurations.
- VCS configurations are not supported; to perform a restore and preserve VCS configurations, perform the restore using the GUI. This operation completely overwrites the configuration on the target system and does not provide the options available in the CLI (see the example below).

Restore Example

This section provides an example of a restore operation:

- Restore from version 4.1.1-P1 to 4.1.1-P2
- The system memory on the original device is 8 GB, but is 16GB on the new device.
- Number of interfaces on the original device is 10, but the new device has 12.

See the other highlighted lines in the example output along with the corresponding comments, which are preceded by th e “<--“characters:

```
ACOS(config)# restore use-mgmt-port
scp://root@192.168.2.2/root/user1/backup1
Password []?

A10 Product:
    Object                Backup device        Current device
-----------------------------------------------------------------------
    Device                TH1030               TH3030
    Image version         4.1.1-P1             4.1.1-P2
System memory:
    Object                Backup device        Current device
-----------------------------------------------------------------------
    Memory (MB)           8174                 16384

Checking memory: OK.
Ethernet Interfaces:
    Object                Backup device        Current device
-----------------------------------------------------------------------
    Total                 10                    12
    1 Gig                 1-10                  1-12
Do you want to skip port map?(Answer no if you want port mapping
manually.)
[yes/no]: no

Please specify the Current device to Backup device port mapping
1-10 : a valid port number in backup device.
0    : to skip a port
-1   : to restart port mapping.
```

```
Current Port:    Backup device port
Port 1  :            2 <-- port 2 on the backup device is re-numbered to 1
Port 2  :            1 <-- port 1 on the backup device is re-numbered to 2
Port 3  :            0
Port 4  :            0
Port 5  :            0
Port 6  :            0
Port 7  :            0
Port 8  :            0
Port 9  :            0
Port 10 :            0
The current startup-configuration will be replaced with the new
configuration that was imported.
Do you wish to see the diff between the updated startup-config and the
original backup configuration?
[yes/no]: yes

Modified configuration begin with "!#"

!Current configuration: 277 bytes
!Configuration last updated at 05:38:18 UTC Fri Mar 17 2017
!Configuration last saved at 05:38:19 UTC Fri Mar 17 2017
!64-bit Advanced Core OS (ACOS) version 4.1.1-P2, build 112 (Mar-13-
2017,15:41)
!
interface management
  ip address 192.168.210.24 255.255.255.0
  ip default-gateway 192.168.210.1
!#interface management
!#  ip address 192.168.210.24 255.255.255.0
!#  ip default-gateway 192.168.210.1
!#  exit-module
!
interface ethernet 2
!#interface ethernet 1 <-- original port 1 is now port 2
  exit-module
!
interface ethernet 1
!#interface ethernet 2 <-- original port 2 is now port 1
  exit-module
```

```
!
!#interface ethernet 3
!#  exit-module
!
!#interface ethernet 4
!#  exit-module
!
!#interface ethernet 5
!#  exit-module
!
!#interface ethernet 6
!#  exit-module
!
!#interface ethernet 7
!#  exit-module
!
!#interface ethernet 8
!#  exit-module
!
!
end
Complete the restore process?
[yes/no]: yes

Please wait restore to complete: .
Restore successful. Please reboot to take effect.
```

Enhancing the Dynamic Port Breakout Support for Thunder 7x50 Series

The following topics are covered:

Introduction

This feature helps in enhancing the dynamic port splitting/breakout support for the **Thunder 7x50** series.

Overview

The third generation **Thunder xx30** series and the fourth generation Thunder series, such as *TH4440*, *TH5440*, and *TH5840*, supports the breaking out 40G interfaces into 4x10G using the command "`system-4x10g-mode`".

The dynamic port breakout was first extended to the port-level configuration on the **Thunder 5x50** platform, and now this feature is also supported on the **Thunder 7x50** platform.

Feature Description

The following topics are covered:

Implementing the Dynamic Port Breakout Support

This feature helps the user to perform and understand the following tasks:

1. Adding support of interface level CLI command "`port-breakout`" on the **Thunder 7x50** platform.
2. Supporting and generating the dynamic **`plat_if`** table, which defines the front ports to and/or from Broadcom chipset internal mapping along with the total number of interfaces.
3. Supporting dynamic generation of Broadcom chipset configuration, which defines total numbers of its internal ports along with per-port parameters, such as speed.

4. Supporting dynamic parse of ACOS startup configuration file to support the above-mentioned task items 2 and 3.

Implementing the Logical Port Mapping Support

The logical port mapping helps in redirecting the various communication request from multiple sources.

For the reference, Broadcom SDK uses a configuration text file for logical ports management.

The following is a synopsis of its Syntax:

```
portmap_logical_port.unit=physical_port:speed
```

Supporting the Dynamic Port Breakout

The following are the steps and representations to support the dynamic port breakout feature:

1. The CLI validates the users entered port breakout command, corresponding messages are shown which could be rejected or a prompt for saving the configuration before it can be applied on the next reload or reboot.
2. At the system initialization phase, startup configuration is parsed for per-physical port breakout and per-platform **`plat_if`** table generation.
3. The configuration file is generated before the control is passed to Broadcom SDK, per-platform.

Example for the Port Mapping Implementation

The following is an example of a partial of port mapping scenario:

```
# port breakout begin
portmap_5.1=5:25
portmap_6.1=6:25
portmap_7.1=7:25
portmap_8.1=8:25
portmap_13.1=13:100
portmap_21.1=21:50
portmap_23.1=23:50
portmap_29.1=29:50
portmap_31.1=31:50
```

```
portmap_41.1=41:25
portmap_42.1=42:25
portmap_43.1=43:25
portmap_44.1=44:25
portmap_49.1=49:50
portmap_51.1=51:50
portmap_57.1=57:25
portmap_58.1=58:25
portmap_59.1=59:25
portmap_60.1=60:25
portmap_61.1=61:25
portmap_62.1=62:25
portmap_63.1=63:25
portmap_64.1=64:25
portmap_67.1=65:100
portmap_71.1=69:100
portmap_79.1=77:100
portmap_87.1=85:100
portmap_99.1=97:100
portmap_107.1=105:100
portmap_115.1=113:100
portmap_123.1=121:100
```

Applying the Feature Details

The following topics are covered:

Port Numbering

In the **Thunder Series 7650**, there are **16x100G** physical front ports. The port numbering is illustrated as the following:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Important Points for the Breakout Feature

The following is a list of important points for applying this feature:

- As each lane of a Falcon chip can optionally run in a flexible speed of **10G**, the port-level command "`speed-forced-40g`" can be applied.
- With ACOS implementation, all the front ports of **Thunder 7650** are "`speed-forced capable`", while only the front ports from one to eight are "`breakout capable`."
- The "***speed-forced***" feature can be applied without even a system reload or reboot on-the-go.

  But the "***breakout***" feature must be reloaded for configuration to take effect.

  This could create a configuration event issue among the threads or the processes.
- This implies, enabling both features simultaneously on the same front ports is not presently supported.

  Only one feature can be enabled at a time on a given physical port.
- To enable the port breakout feature on a given physical interface, the cited `port-breakout` command can be issued with a mandatory keyword to specify the desired breakout mode.

  Presently, **4x25G** and **2x50G** are two breakout modes that are supported.
- When a physical front port is breaking out into two or four logical ones, the physical port number of it stays unchanged while one or three logical ports are augmented after the last physical one.

Example of the Feature Implementation

The following is an example scenario for this feature implementation:

When *port one* is in the **4x25G** *breakout mode*, it becomes ports [**1, 17, 18, 19]** after a system reboot or reload. At this time, if *port breakout mode* **4x25G** is also enabled on *port three*, it then results into a total of *22 front ports* with *two ports breakout* [**1, 17, 18, 19]** and **[3, 20, 21, 22**].

This is reflected in the startup configuration and can be realized with the command "`show startup-config`". Only the first *eight front ports* can be broken out into

4x25G or **2x50G** mode, the combination of total numbers of ports is illustrated in the following table, where only *39 front ports* are not possible from the range **[16 to 40]**.

Table 4 : Feature Implementation - Dynamic Port Breakout Support - Combination of Total Numbers of Ports

Number of Non-Breakout Capable Port	***Number of 4x25G Ports, Denoted by: Q [0 to 8]***	***Number of 2x50G Ports, Denoted by: B [0 to (8 - Q)]***	***Total Number of Ports***	***8 + (4xQ) + (2xB) + (8 - Q - B), (Q + B) < = 8***
8	8	0	40	8 + (4x8) + (2x0) + 0
8	7	1	38	8 + (4x7) + (2x1) + 0
8	7	0	37	8 + (4x7) + (2x0) + 1
8	6	2	36	8 + (4x6) + (2x2) + 0
8	6	1	35	8 + (4x6) + (2x1) + 1
8	6	0	34	8 + (4x6) + (2x0) + 2
8	5	3	34	8 + (4x5) + (2x3) + 0
8	5	2	33	8 + (4x5) + (2x2) + 1
8	5	1	32	8 + (4x5) + (2x1) + 2
8	5	0	31	8 + (4x5) + (2x0) + 3
8	4	4	32	8 + (4x4) + (2x4) + 0
8	4	3	31	8 + (4x4) + (2x3) +

Table 4 : Feature Implementation - Dynamic Port Breakout Support - Combination of Total Numbers of Ports

Number of Non-Breakout Capable Port	*Number of 4x25G Ports, Denoted by: Q [0 to 8]*	*Number of 2x50G Ports, Denoted by: B [0 to (8 - Q)]*	*Total Number of Ports*	*8 + (4xQ) + (2xB) + (8 - Q - B), (Q + B) < = 8*
				1
8	4	2	30	8 + (4x4) + (2x2) + 2
8	4	1	29	8 + (4x4) + (2x1) + 3
8	4	0	28	8 + (4x4) + (2x0) + 4
8	3	5	30	8 + (4x3) + (2x5) + 0
8	3	4	29	8 + (4x3) + (2x4) + 1
8	3	3	28	8 + (4x3) + (2x3) + 2
8	3	2	27	8 + (4x3) + (2x2) + 3
8	3	1	26	8 + (4x3) + (2x1) + 4
8	3	0	25	8 + (4x3) + (2x0) + 5
8	2	6	28	8 + (4x2) + (2x6) + 0
8	2	5	27	8 + (4x2) + (2x5) + 1
8	2	4	26	8 + (4x2) + (2x4) + 2

Table 4 : Feature Implementation - Dynamic Port Breakout Support - Combination of Total Numbers of Ports

Number of Non-Breakout Capable Port	***Number of 4x25G Ports, Denoted by: Q [0 to 8]***	***Number of 2x50G Ports, Denoted by: B [0 to (8 - Q)]***	***Total Number of Ports***	***8 + (4xQ) + (2xB) + (8 - Q - B), (Q + B) < = 8***
8	2	3	25	8 + (4x2) + (2x3) + 3
8	2	2	24	8 + (4x2) + (2x2) + 4
8	2	1	23	8 + (4x2) + (2x1) + 5
8	2	0	22	8 + (4x2) + (2x0) + 6
8	1	7	26	8 + (4x1) + (2x7) + 0
8	1	6	25	8 + (4x1) + (2x6) + 1
8	1	5	24	8 + (4x1) + (2x5) + 2
8	1	4	23	8 + (4x1) + (2x4) + 3
8	1	3	22	8 + (4x1) + (2x3) + 4
8	1	2	21	8 + (4x1) + (2x2) + 5
8	1	1	20	8 + (4x1) + (2x1) + 6
8	1	0	19	8 + (4x1) + (2x0) + 7
8	0	8	24	8 + (4x0) + (2x8) +

Table 4 : Feature Implementation - Dynamic Port Breakout Support - Combination of Total Numbers of Ports

Number of Non-Breakout Capable Port	***Number of 4x25G Ports, Denoted by: Q [0 to 8]***	***Number of 2x50G Ports, Denoted by: B [0 to (8 - Q)]***	***Total Number of Ports***	***8 + (4xQ) + (2xB) + (8 - Q - B), (Q + B) < = 8***
				0
8	0	7	23	8 + (4x0) + (2x7) + 1
8	0	6	22	8 + (4x0) + (2x6) + 2
8	0	5	21	8 + (4x0) + (2x5) + 3
8	0	4	20	8 + (4x0) + (2x4) + 4
8	0	3	19	8 + (4x0) + (2x3) + 5
8	0	2	18	8 + (4x0) + (2x2) + 6
8	0	1	17	8 + (4x0) + (2x1) + 7
8	0	0	16	8 + (4x0) + (2x0) + 8

Impact Details for the Feature

The following is a list of important points regarding the impact of this feature:

- There must be no impact on fast path traffic after the breakout is enabled.
- The control CPUs may experience minor higher usage because of the augmented front ports.
- The details regarding the configuration to breakout ports cannot be preserved before or after the feature is enabled or disabled.

- The LED microprocessor does not need to be reprogrammed to reflect the link or activity status of the newly acquired breakout ports.

NOTE:

- For more information on this feature, see *Dynamic Port Breakout Support* or *Port Splitting Support* under the various guides from the *Hardware or Platform Documents* section.
- The CLI/command details are also available in the *Command Line Interface Reference* and *aXAPI Reference Guide* for this feature.
- This feature can also be referred from the earlier *Thunder and AX Series Release GUI Reference - ACOS 2.7.2*.

Saving Multiple Configuration Files Locally

The ACOS device has CLI commands that enable you to store and manage multiple configurations on the ACOS device.

NOTE: Unless you plan to locally store multiple configurations, you do not need to use any of the advanced commands or options described in this section. You can enter the **`write memory`** command in the CLI to save configuration changes. These simple options replace the commands in the startup-config stored in the image area the ACOS device booted from with the commands in the running-config.

The following topics are covered:

Understanding Configuration Profiles

Configuration files are managed as configuration profiles. A configuration profile is simply a configuration file. You can locally save multiple configuration profiles on the ACOS device. The configuration management commands described in this section enable you to do the following:

- Save the startup-config or running-config to a configuration profile.
- Copy locally saved configuration profiles.
- Delete locally saved configuration profiles.
- Compare two configuration profiles side by side to see the differences between the configurations.
- Link the command option “startup-config” to a configuration profile other than the one stored in the image area used for the most recent reboot. (This is the profile that “startup-config” refers to by default.) This option makes it easier to test a configuration without altering the configuration stored in the image area.

NOTE: Although the enable and admin passwords are loaded as part of the system configuration, they are not saved in the configuration profiles. Changes to the enable password or to the admin username or password take effect globally, regardless of the values that were in effect when a given configuration profile was saved.

Using the CLI to Save Configurations

To manage multiple locally stored configurations, use the **`write memory`** or **`write force`** commands (available at the global configuration level of the CLI).

- If you enter **`write memory`** without additional options, the command replaces the configuration profile that is currently linked to by startup-config with the commands in the running-config. If startup-config is set to its default (linked to the configuration profile stored in the image area that was used for the last reboot), then **`write memory`** replaces the configuration profile in the image area with the running-config.

- If you enter **`write force`**, the command forces the ACOS device to save the configuration regardless of whether the system is ready.
- If you enter **`write memory primary`**, the command replaces the default configuration profile of the primary image area with the running-config. Likewise, if you enter **`write memory secondary`**, the command replaces the default configuration profile of the secondary image area with the running-config.
- If you enter **`write memory`** *`profile-name`*, the ACOS device replaces the commands in the specified *`profile-name`* with the running-config.
- You can also specify a specific L3V partition or **`all-partitions`** with the **`write memory`** and **`write force`** commands; these options save the configuration changes in your L3V partitions. Without either option, only the configuration in the shared partition is saved.

NOTE: For CLI syntax information about write memory and write force, see the *Command Line Interface Reference* Guide.

Using the CLI to View Configurations

To view locally stored configuration information, use the **`show startup-config`** command.

- To display a list of the locally stored configuration profiles, use the **`show startup-config all`** command.
- The **`show startup-config all-partitions`** command shows all resources in all partitions. In this case, the resources in the shared partition are listed first, followed by the resources in each L3V partition. You can also specify a single partition instead of **`all-partitions`** to view the startup-config for the specified partition only.
- The **`show startup-config profile`** *`profile-name`* command displays the commands that are in the specified configuration profile.

NOTE: For CLI syntax information about show startup-config, see the *Command Line Interface Reference* Guide.

Using the CLI to Copy Configurations

To copy configurations, use the **copy** command.

- The **copy startup-config** *profile-name* command copies the configuration profile that is currently linked to "startup-config" and saves the copy under the specified profile name.
- The **copy startup-config running-config** command copies the configuration profile that is currently linked to "startup-config" and replaces the current running-config.
- The **copy running-config startup-config** command copies the running-config and saves it to the configuration profile currently linked to the startup-config.

NOTE: You cannot use the profile name "default". This name is reserved and always refers to the configuration profile that is stored in the image area from which the ACOS device most recently rebooted.

- For all commands, specify the *url* to the remote device where you want to back up the configuration. See Backing Up System Information.)

NOTE: For CLI syntax information about the copy command, see the *Command Line Interface Reference* Guide.

Using the CLI to Compare Configurations

To view a side-by-side comparison of configurations, use the **diff** command.

- The **diff startup-config running-config** command compares the configuration profile that is currently linked to "startup-config" with the running-config. Similarly, the **diff startup-config** *profile-name* command compares the configuration profile that is currently linked to "startup-config" with the specified configuration profile.
- To compare any two configuration profiles, enter their profile names.

  For example: **diff** *profile-name1 profile-name2*

In the CLI output, the commands in the first profile name you specify are listed on the left side of the terminal screen. The commands in the other profile that differ from the commands in the first profile are listed on the right side of the screen, across from the commands they differ from. The following Table 5 describes the flags indicating how the two profiles differ:

Table 5 : Description of the Flags in the diff Command Output

Flag	Description
|	Indicates that the corresponding command has different settings in each profile.
>	Indicates that the corresponding command is in the second profile, but not the first.
<	Indicates that the corresponding command is in the first profile, but not the second.

Using the CLI to Link Configuration Profiles

Use the **link** command to link configuration profiles. By default, “startup-config” is linked to “default”, which means the configuration profile stored in the image area from which the ACOS device most recently rebooted.

This command enables you to easily test new configurations without replacing the configuration stored in the image area. For example, the following command links the startup-config to a new profile called as the **test_profile**:

```
ACOS(config)# link startup-config test-profile primary
```

You can specify the **primary** or **secondary** option to indicate an image area; if you omit this option, the image area last used to boot is selected.

The profile you link to must be stored on the boot device you select. For example, if you use the default boot device selection (hard disk), the profile you link to must be stored on the hard disk. (To display the profiles stored on the boot devices, use the **show startup-config all** command.)

After you link “startup-config” to a different configuration profile, configuration management commands that affect “startup-config” affect the linked profile instead of affecting the configuration stored in the image area. For example, if you enter the **write memory** command without specifying a profile name, the command saves the

running-config to the linked profile instead of saving it to the configuration stored in the image area.

Likewise, the next time the ACOS device is rebooted, the linked configuration profile is loaded instead of the configuration that is in the image area.

To relink “startup-config” to the configuration profile stored in the image area, use the default option:

```
ACOS(config)# link startup-config default
```

Using the CLI to Delete a Profile

Use the **delete startup-config** command to remove a specific configuration profile.

For example:

```
ACOS(config)# delete startup-config slb_profile1
```

Although the command uses the **startup-config** option, the command only deletes the configuration profile linked to “startup-config” if you enter that profile’s name. The command deletes only the profile you specify.

If the configuration profile you specify is linked to “startup-config”, “startup-config” is automatically relinked to the default. (The default is the configuration profile stored in the image area from which the ACOS device most recently rebooted).

CLI Example of Configuration Profile Management

The following command saves the running-config to a configuration profile named “**slbconfig2**”:

```
ACOS(config)# write memory slbconfig2
```

The following command shows a list of the configuration profiles locally saved on the ACOS device. The first line of output lists the configuration profile that is currently linked to “startup-config”. If the profile name is “default”, then “startup-config” is linked to the configuration profile stored in the image area from which the ACOS device most recently rebooted.

```
ACOS(config)# show startup-config all
Current Startup-config Profile: slb-v6
```

```
Profile-Name                                Size    Time
-------------------------------------------------------------
1210test                                    1957    Jan 28  18:39
ipnat                                       1221    Jan 25  10:43
ipnat-l3                                    1305    Jan 24  18:22
ipnat-phy                                   1072    Jan 25  19:39
ipv6                                        2722    Jan 22  15:05
local-bwlist-123                            3277    Jan 23  14:41
mgmt                                        1318    Jan 28  10:51
slb                                         1354    Jan 23  18:12
slb-v4                                     12944    Jan 23  19:32
slb-v6                                     13414    Jan 23  19:19
```

The following command copies the configuration profile currently linked to “startup-config” to a profile named “slbconfig3”:

```
ACOS(config)# copy startup-config slbconfig3
```

The following command compares the configuration profile currently linked to “startup-config” with configuration profile “testcfg1”. This example is abbreviated for clarity. The differences between the profiles are shown in this example in bold type.

```
ACOS(config)# diff startup-config testcfg1
!Current configuration: 13378 bytes                              (
!Configuration last updated at 19:18:57 PST Wed Jan 23 2008      (
!Configuration last saved at 19:19:37 PST Wed Jan 23 2008        (
!version 1.2.1                                                   (
!                                                                (
hostname ACOS (
!                                                                (
clock timezone America/Tijuana                                   (
!                                                                (
ntp server 10.1.11.100 1440                                      (
!                                                                (
...
!                                                                (
interface ve 30                                                  (
 ip address 30.30.31.1 255.255.255.0                             |  ip
address 10.10.20.1 255.255.255.0
 ipv6 address 2001:144:121:3::5/64                               |  ipv6
address fc00:300::5/64
!                                                                (
```

```
!                                                                    (
> ip nat range-list v6-1 fc00:300::300/64 2001:144:121:1::900/6
!                                                                    (
ipv6 nat pool p1 2001:144:121:3::996 2001:144:121:3::999 netm <
!                                                                    <
slb server ss100 2001:144:121:1::100                                 <
   port 22  tcp                                                      <
--MORE--
```

The following command links configuration profile "**slbconfig3**" with "**startup-config**":

```
ACOS(config)# link startup-config slbconfig3
```

The following command deletes configuration profile "**slbconfig2**":

```
ACOS(config)# delete startup-config slbconfig2
```

Source Interface for Management Traffic

By default, the ACOS device uses data interfaces as the source for management traffic. This chapter describes how you can configure the management interface and loopback interfaces to act as the source for management traffic instead of using data interfaces.

The following topics are covered:

Using the Management Interface as the Source for Management Traffic

The following topics are covered:

Understanding Route Tables

By default, the ACOS device attempts to use a route from the main route table for management connections originated on the ACOS device. You can enable the ACOS device to use the management route table to initiate management connections instead.

This section describes the ACOS device's two route tables, for data and management traffic, and how to configure the device to use the management route table.

The ACOS device uses separate route tables for management traffic and data traffic.

- Management route table – Contains all static routes whose next hops are connected to the management interface. The management route table also contains the route to the device configured as the management default gateway.
- Main route table – Contains all routes whose next hop is connected to a data interface. These routes are sometimes referred to as data plane routes. Entries in this table are used for load balancing and Layer 3 forwarding on data ports.

You can configure the ACOS device to use the management interface as the source interface for automated management traffic. In addition, on a case-by-case basis, you

can enable the use of the management interface and management route table for various types of management connections to remote devices.

The ACOS device automatically uses the management route table for reply traffic on connections initiated by a remote host that reaches the ACOS device on the management port. For example, this occurs for SSH or HTTP connections from remote hosts to the ACOS device.

Keeping the Management and Data Interfaces in Separate Networks

The management interface and the data interfaces must be in separate networks. If both tables have routes to the same destination subnet, some operations (for example, **`ping`**) may have unexpected results. An exception is the default route (0.0.0.0/0), which can be in both tables.

To display the routes in the management route table, use the **`show ip route mgmt`** command.

To display the data plane routes, use the **`show ip route`** or **`show ip fib`** commands.

Management Routing Options

You can configure the ACOS device to use the management interface as the source interface for the following management protocols, used for automated management traffic:

- SYSLOG
- SNMPD
- NTP
- RADIUS
- TACACS+
- SMTP

For example, when use of the management interface as the source interface for control traffic is enabled, all log messages sent to remote log servers are sent

through the management interface. Likewise, the management route table is used to find a route to the log server. The ACOS device does not attempt to use any routes from the main route table to reach the server, even if a route in the main route table could be used.

In addition, on a case-by-case basis, you can enable use of the management interface and management route table for the following types of management connections to remote devices:

- Upgrade of the ACOS software
- SSH or Telnet connection to a remote host
- Import or export of files
- Export of **`show techsupport`** output
- Reload of black/white lists
- SSL loads (keys, certificates, and Certificate Revocation Lists)
- Copy or restore of configurations
- Backups

Configuring the Management Interface as Source for Automated Management Traffic

By default, use of the management interface as the source interface for automated management traffic is disabled.

To enable it, use the **`ip control-apps-use-mgmt-port`** command at the configuration level for the management interface:

```
ACOS(config)# interface management
ACOS(config-if:management)# ip control-apps-use-mgmt-port
```

To ensure the TACACS authorization traffic follows the intended management plane route, configure either of the following option:

- Set the management interface as the source IPv6 address in the TACACS server configuration:

```
ACOS(config)# tacacs-server host <tacacs-server_host_name> secret
encrypted  <encrypted-secret-string> source ipv6 <ipv6_address>
```

- Add a static route through the management interface:

```
ACOS(config)# interface management
ACOS(config-if:management)# ipv6 address <ipv6_address>
ACOS(config-if:management)# exit
.
.
.
ACOS(config)# ipv6 route <tacacs-server_host_name> <ipv6_address>
```

Configuring the Management Interface as Source Interface for Manually Generated Management Traffic

To use the management interface as the source interface for manually generated management traffic, use the **use-mgmt-port** option as part of the command string. This option is available with certain file management commands, including the **import** command:

```
ACOS(config)# import ssl-cert-key bulk ?
  use-mgmt-port      Use management port as source port
  tftp:              Remote file path of tftp: file system(Format:
tftp://host/file)
  ftp:               Remote file path of ftp: file system(Format:
                     ftp://[user@]host[:port]/file)
  scp:               Remote file path of scp: file system(Format:
                     scp://[user@]host/file)
  sftp:              Remote file path of sftp: file system(Format:
                     sftp://[user@]host/file)
  NAME<length:1-31>  profile name for remote url
```

Using a Loopback or Virtual Ethernet Interface as the Source for Management Traffic

You can configure the ACOS device to use a loopback or virtual Ethernet interface IP address to be used as the source interface for management traffic originated by the device.

The following topics are covered:

Loopback Interface Management Traffic Types

You can enable use of a specific loopback interface as the source for one or more of the following management traffic types:

- FTP
- NTP
- RCP
- SNMP
- SSH
- SYSLOG
- Telnet
- TFTP
- Web

FTP, RCP, and TFTP apply to file export and import, such as image upgrades and system backups.

Telnet and SSH apply to remote login from the ACOS device to another device. They also apply to RADIUS and TACACS+ traffic. SSH also applies to file import and export using SCP.

Web applies to GUI login.

Loopback Interface Implementation Notes

Some notes to consider for loopback interfaces:

- Loopback interface IP address – The loopback interface you specify when configuring this feature must have an IP address configured on it. Otherwise, this feature does not take effect.
- Management interface – If use of the management interface as the source for management traffic is also enabled, the loopback interface takes precedence over the management interface. The loopback interface's IP address will be used instead of the management interface's IP address as the source for the management traffic. In conjunction, the **`use-mgmt-port`** CLI option will have no effect.
- Ping traffic – Configuration for use of a loopback interface as the source for management traffic does not apply to ping traffic. By default, ping packets are sourced from the best interface based on the ACOS route table. You can override the default interface selection by specifying a loopback or other type of interface as part of the **`ping`** command. (See the *Command Line Interface Reference* for syntax information.)

Loopback Interface Limitations

The current release has the following limitations related to this feature:

- Floating loopback interfaces are not supported.
- IPv6 interfaces are not supported.

Configuring a Loopback Interface for Management Traffic

The following commands configure an IP address on loopback interface 2 in the shared partition:

```
ACOS(config)# interface loopback 2
ACOS(config-if:loopback:2)# ip address 10.10.10.66 /24
ACOS(config-if:loopback:2)# exit
```

The following command configures the device to use loopback interface 2 as the source interface for management traffic of all types:

```
ACOS(config)# ip mgmt-traffic all source-interface loopback 2
```

Configuring a Virtual Ethernet Interface for Management Traffic

The following commands configure virtual Ethernet interface 2 in the L3V partition called p1:

```
ACOS[p1](config)# vlan 2
ACOS[p1](config-vlan:2)# router-interface ve 2
ACOS[p1](config-if:ve2)# ip address 10.1.1.254 /24
ACOS[p1](config-if:ve2)# exit
```

The following command configures the device to use ve 2 as the source interface for management traffic in the p1 partition:

```
ACOS[p1](config)# ip mgmt-traffic traffic-type source-interface ve 2
```

NOTE:

- If the virtual Ethernet interface belongs to the shared vlan, then the shared virtual Ethernet interface IP address will be used. For example, if `vlan 2` above is also in the shared partition, the IP address `10.1.1.254 /24` will not be used for management traffic, but the IP address as configured for the virtual Ethernet in the shared partition will be used.
- See the *Configuring Application Delivery Partitions* guide for more information about partitions.

Dynamic and Block Configuration

In the classical (default) mode of the CLI, configuration commands take effect as they are entered. For example, `slb server s1 10.10.10.1` creates an SLB server "s1" with an IP address of 10.10.10.1 without having to take any further action.

Using the CLI or aXAPI, block configuration modes allow you to update portions of your configuration without having to take your ACOS device off-line or disrupting live traffic.

The following topics are covered:

Overview of Dynamic and Block Configuration

The Configuration Management Database (CMDB) allows for dynamic changes to be made to the running configuration using either the CLI or the aXAPI using the `cli.deploy` method. You enter a block configuration mode to create a new configuration file in the CMDB. ACOS compares the existing running configuration with this new file (your new configuration), which is considered the primary configuration. ACOS parses the commands in the new configuration file and rearranges them into an order in which the new commands will be applied so that live traffic is not disturbed.

For replicated configurations, the old configuration is left in place rather than removed and then re-entered.

During this process, some dependency checks may be disabled. After parsing the new configuration, ACOS will ensure that all dependency checks are passed and all configurations are complete and valid.

NOTE: This feature is not supported in the GUI. Multiple users cannot configure ACOS through the CLI. Concurrent aXAPI calls are possible although they will be queued.

Block Configuration Modes for CMDB

The following topics are covered:

Block-Merge Mode

In block-merge mode, existing elements edited in block-merge mode are replaced with your new definitions and then merged with the remaining configuration with **`block-merge-end`**.

If the running configuration is not committed before entering “block-merge” mode, then all changes made before and after “block-merge” mode are committed when you end “block-merge” mode.

NOTE: In this release, a setting to control the behavior of block-merge mode called merge mode is supported. In the merge mode, any child instances of the old configuration are retained if not present in the new configuration. The merge mode can be accessed using the merge-mode-add command from the Global configuration mode.

The following is an example showing how block-merge mode works. First, view the existing SLB configuration:

```
ACOS(config)# show run | sec slb
slb server s1 2.2.2.2
  port 80 tcp
    sampling-enable all
slb virtual-server vip1 1.1.1.1
  port 80 tcp
    sampling-enable curr_conn
    sampling-enable total_conn
ACOS(config)#
```

Next, edit the SLB server configuration to exclude the baselining configuration (**sampling-enable** command):

```
ACOS(config)# block-merge-start
Beginning merge mode. Enter configuration followed by 'block-merge-end' to
merge configuration into running.
ACOS(config)# slb server s1 2.2.2.2
ACOS(config-real server)# port 80 tcp
ACOS(config-real server-node port)# exit
ACOS(config-real server)# exit
ACOS(config)# block-merge-end
Configuration merged into running.
ACOS(config)#
```

View the running configuration again:

```
ACOS(config)# show run | sec slb
slb server s1 2.2.2.2
  port 80 tcp
```

```
slb virtual-server vip1 1.1.1.1
  port 80 tcp
    sampling-enable curr_conn
    sampling-enable total_conn
ACOS(config)#
```

The changes are merged into the existing running-config so that "**sampling-enable all**" is no longer part of the SLB real server configuration.

Block-Replace Mode

In block-replace mode, instead of individual SLB configuration elements, the entire SLB configuration gets discarded and replaced when the new configuration is committed with **block-replace-end**. The rest of the configuration remains intact.

All configurations before entering "block-replace" mode, whether committed or not, are removed unless they also are configured in "block-replace" mode.

Below is an example showing how block-replace mode works. First, view the existing SLB configuration:

```
ACOS(config)# show run | sec slb
slb server s1 2.2.2.2
  port 80 tcp
    sampling-enable all
slb virtual-server vip1 1.1.1.1
  port 80 tcp
    sampling-enable curr_conn
    sampling-enable total_conn
ACOS(config)#
```

Next, edit the SLB server configuration to exclude the SLB virtual server:

```
ACOS(config)# block-replace-start
Beginning replace mode. Enter configuration followed by 'block-replace-
end' to apply diff and replace configuration into running.
ACOS(config)# slb server s1 2.2.2.2
ACOS(config-real server)# port 80 tcp
ACOS(config-real server-node port)# sampling-enable all
ACOS(config-real server-node port)# exit
ACOS(config-real server)# exit
ACOS(config)# block-replace-end
```

```
Configuration replaced into running.
ACOS(config)#
```

View the running configuration again:

```
ACOS(config)# show run | sec slb
slb server s1 2.2.2.2
  port 80 tcp
    sampling-enable all
ACOS(config)#
```

The changes have completely replaced the existing SLB configuration; there is no longer an SLB virtual server configured.

Expected Behaviors in Block Mode

ACOS parses the configurations entered in block mode before it commits those changes. Any invalid command that results in a configuration error will void all of the block-mode configurations, and none of those changes will be made. The configuration will revert to the original running configuration. All configurations done in a block mode must succeed or else none of the configurations take effect.

If an undesired command or an erroneous command is entered in block mode, most of those can be removed using the **no** form of the command. However, using the CLI only, syntax errors will be ignored when the “block-replace” mode configuration is committed. If you run into a syntax error but still enter the **block-replace-end** command, then all valid configurations made in “block-replace” mode, prior to the syntax error, will still be committed and entirely replace the old running configuration. Using the aXAPI, if there is an error in both syntax and configuration while using the cli.deploy method, then ACOS will rollback to the original configuration. If an error is detected and ACOS reverts to the old running configuration, the configuration entered in block mode will be cleared.

To avoid erasing the old running configuration with an erroneous configuration entered in block mode, exit block mode using the **block-abort** command. This will erase all configuration commands entered in block mode and retain the old running configuration.

In block mode, you can view the current running configuration with the **show config** command. This is the same as the **show running-config** command in the classical

mode of the CLI. The changes you are currently making in block mode are not visible in the output of this command.

To view the configuration you are making in either “block-merge” or “block-replace” mode, enter the **`show config-block`** command.

Block Configuration Modes for aFleX

aFleX can also be configured in-line within block-merge and block-replace mode. Within the CLI, you enter the command **`aflex-scripts start`** to enter the aFleX configuration mode. aFleX commands should be entered in-line following that. When you are finished, simply enter a period (.) to indicate the end of the aFleX commands to be committed. All of these commands should be entered within the “block-merge” or “block-replace” mode in order for the aFleX commands to take effect.

Like the “block-merge” and “block-replace” mode in the CLI, the application of the aFleX commands is dependent on all features passing. One failed command will mean that not of the commands are entered into the running configuration.

To enter aFleX commands in-line within “block-merge” or “block-replace” mode, enter the following command at the block configuration level:

```
aflex-scripts start
```

Each aFlex can then be entered using the convention where the header contains `<aflex-script aflexName`, followed by the actual aFleX and then a closing bracket (>). A period is used to indicate the end of all scripts.

```
<aflex-script aflexName
aflex code {
...
}
>
```

To indicate the end of all the aFleX commands, enter the following symbol at the end of the aFleX commands:

```
.
```

To view all aFleX commands as part of the running configuration, enter the `running-config display aflex` global configuration command in the CLI, then enter the `show running-config` command.

Boot Options

This chapter describes how to display or change the storage area from which the ACOS device boots.

The following topics are covered:

NOTE: This chapter does not describe how to upgrade the system image. For upgrade instructions, see the "*Release Notes*" for the release to which you plan to upgrade.

Storage Areas

The following topics are covered:

Details

The ACOS device has four storage areas (also called “image areas”) that can contain software images and configuration files:

- Primary storage on the Solid State Drive (SSD) or disk
- Secondary storage on the SSD or disk
- Primary storage on the compact flash (CF)
- Secondary storage on the compact flash

NOTE: Not all storage areas are available on all devices.

The SSD or disk storage areas are used for normal operation. The compact flash storage areas are used only for system recovery.

NOTE: In this document, references to SSD can refer to the hard disk in some older ACOS devices.

Normally, each time the ACOS device is rebooted, the device uses the same storage area that was used for the previous reboot. For example, if the primary storage area of the SSD or disk was used for the previous reboot, the system image and startup-config from the primary storage area are used for the next reboot.

Unless you change the storage area selection or interrupt the boot sequence to specify a different storage area, the ACOS device always uses the same storage area each time the device is rebooted.

NOTE: The ACOS device always tries to boot using the SSD or disk first. The compact flash is used only if the SSD or hard disk is unavailable. If you need to boot from compact flash for system recovery, contact A10 Networks.

Displaying Current Storage Information

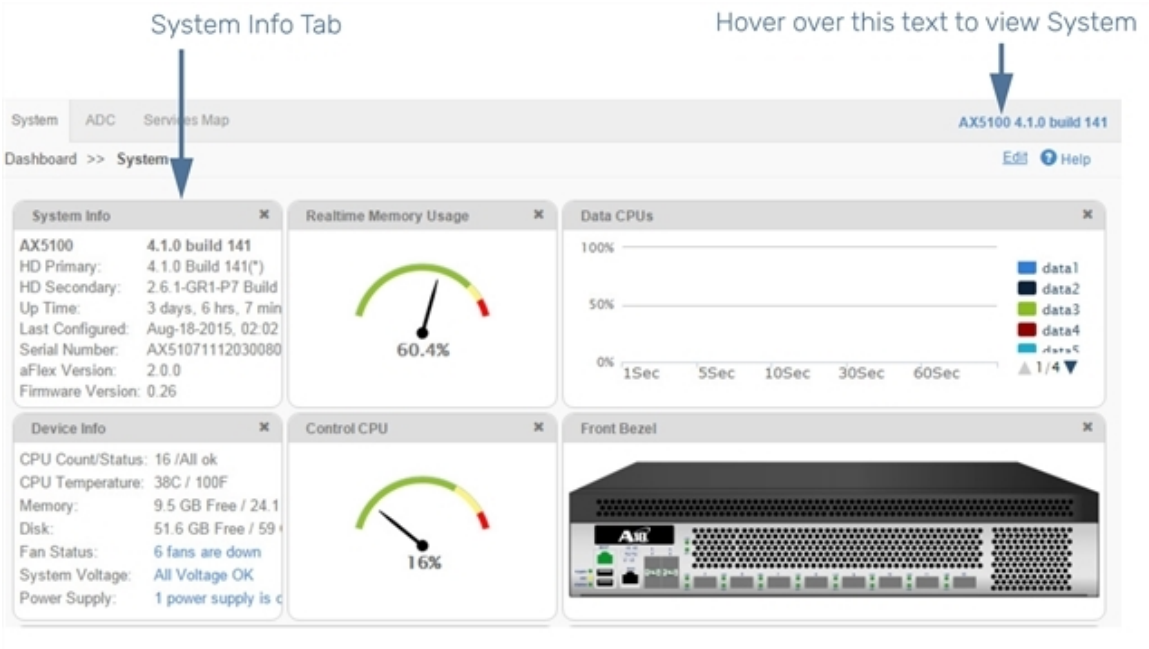
To display the software images installed in the ACOS storage areas, and the currently running software version, use either of the following methods:

The following topics are covered:

Using the GUI to View Storage Information

Navigate to **System > Dashboard** in the GUI (see the Figure 17).

Figure 17 : System Dashboard in the GUI



The field at upper left, in the System Info area, shows the software version that is currently running.

The system info is also displayed in the top right corner of every page. Hover over the link to display the same system info as shown on the Dashboard.

Using the CLI to View Storage Information

The **show version** command shows storage area information. The command also lists other information, including the currently running software version.

```
ACOS# show version
AX Series Advanced Traffic Manager AX5100
  Copyright 2007-2015 by A10 Networks, Inc.  All A10 Networks products are
  protected by one or more of the following US patents:
  8977749, 8943577, 8918857, 8914871, 8904512, 8897154, 8868765, 8849938
  8826372, 8813180, 8782751, 8782221, 8595819, 8595791, 8595383, 8584199
  8464333, 8423676, 8387128, 8332925, 8312507, 8291487, 8266235, 8151322
  8079077, 7979585, 7804956, 7716378, 7665138, 7647635, 7627672, 7596695
  7577833, 7552126, 7392241, 7236491, 7139267, 6748084, 6658114, 6535516
  6363075, 6324286, 5931914, 5875185, RE44701, 8392563, 8103770, 7831712
  7606912, 7346695, 7287084, 6970933, 6473802, 6374300

      64-bit Advanced Core OS (ACOS) version 4.1.0, build 141 (Aug-17-
2015,08:03           )
        Booted from Hard Disk primary image

      Serial Number: AX51071112030080
      Firmware version: 0.26
      aFleX version: 2.0.0
      aXAPI version: 3.0
     Hard Disk primary image (default) version 4.1.0, build 141
     Hard Disk secondary image version 2.6.1-GR1-P7, build 51
      Compact Flash primary image (default) version 2.6.1-GR1-P7, build 51
      Last configuration saved at Aug-18-2015, 02:02
      Hardware: 16 CPUs(Stepping 5), Single 62G Hard disk
      Memory 24677 Mbyte, Free Memory 9797 Mbyte
      Hardware Manufacturing Code: 120311
      Current time is Aug-21-2015, 08:09
      The system has been up 3 days, 6 hours, 5 minutes
ACOS#
```

Displaying the Storage Location for Future Reboots

To display the storage area that will be used for the future reboots, use either of the following methods.

NOTE: The ACOS device always tries to boot using the SSD or disk first. The compact flash is used only if the SSD or hard disk is unavailable. If you need to boot from compact flash for system recovery, contact A10 Networks.

The following topics are covered:

Using the GUI to View the Storage Location for Future Reboots

1. Hover over **System** in the navigation bar, and select **Settings**.
2. Click **Boot Image** on the menu bar.

Using the CLI to View the Storage Location for Future Reboots

Use the **`show bootimage`** command to view the storage location for future reboots.

In the following example, the ACOS device is configured to boot from the primary storage area on the SSD or disk:

```
ACOS# show bootimage
(* = Default)
                          Version
-----------------------------------------------
Hard Disk primary         4.1.0.141 (*)
Hard Disk secondary       2.6.1-GR1-P7.51
Compact Flash primary     2.6.1-GR1-P7.51 (*)
```

Booting from a Different Storage Area

The following topics are covered:

Details

The ACOS device allows you to change the boot device from the primary image to the secondary image on a single storage device, either the SSD, hard disk, or the CF. You can use the CLI or the GUI to make the change from the primary image to the secondary image or vice versa. However, if you are choosing to change the boot device from the SSD (hard disk) to the CF (Compact Flash) you have to interrupt the boot sequence to do so. Both boot devices, SSD (hard disk) and CF, contain their own primary and secondary boot locations.

To reboot from a different image within the same storage device (SSD or CF), do one of the following:

- Interrupt the boot sequence and use the bootloader menu to temporarily select the other storage area.
- Configure the ACOS device to use the other storage area for all future reboots, then reboot.

Temporarily Changing the Boot Image for the Next Reboot

To temporarily change the storage location within the same boot device (SSD or CF) from the primary to the secondary image, interrupt the boot sequence to access the bootloader menu.

To access the bootloader menu, reboot the ACOS device, then press Esc within 3 seconds when prompted.

When the bootloader menu appears, use the Up and Down arrow keys to select the image area from which to boot, and press Enter. The menu does not automatically time out. You must press Enter to reboot using the selected image.

CAUTION: Each storage area has its own version of the startup-config. When you save configuration changes, they are saved only to the startup-config in the storage area from which the ACOS device was booted.

CAUTION: If you plan to reboot from a different storage area, but you want to use the same configuration, first save the configuration to the other storage area. (The procedures in Permanently Changing the Storage Location for Future Reboots include steps for this.)

NOTE: The bootloader menu is available on all new ACOS devices later than release 2.6.1. However, the bootloader menu is not automatically installed when you upgrade from a release earlier than 2.6.1. To install the bootloader menu on upgraded devices, see the AX Release 2.6.1 release notes, or the description of the **boot-block-fix** command in the *Command Line Interface Reference* for 2.6.1 or later.

```
ACOS# reboot
Rebooting System Now !!!
Proceed with reboot? [yes/no]:yes
INIT:

Shutting down.........Restarting system.
Press `ESC' to enter the boot menu... 1
  Admin presses Esc within 3 seconds.


   #       #      ###      #      #
  # #     ##     #   #     ##     # ###### ##### #     #  ####  #####  #     #
####
 #   #  # #   #      #   # #   # #         #   #     # #    # #    # #   #  #
#     #   #   #      #   #  #  # #####     #   #     # #    # #    # ####
####
#######   #   #      #   #   # # #         #   # ## # #    # #####  #  #
   #
#     #   #    #   #    #    ## #         #   ##  ## #    # #   #  #   #  #
   #
#     # #####   ###      #     # ######    #   #    #  ####  #    # #    #
####
```

```
Copyright 2005-2015 by A10 Networks, Inc.  All A10 Networks products are
protected by one or more of the following US patents and patents pending:
7716378, 7675854, 7647635, 7552126, 20090049537, 20080229418, 20080040789,
20070283429, 20070271598, 20070180101
------------------------------------------------------------------------
 0: ACOS (Primary Image)
 1: ACOS (Secondary Image)
------------------------------------------------------------------------

Use the Up and Down arrow keys to select the image from which to boot.
Press enter to boot the selected image.

  Admin presses down arrow to select 1.

    Highlighted entry is 1:

  Admin presses Enter to reboot using the selected image.

Booting 'ACOS (Secondary Image)'
Please wait while the system boots...

Booting.....................[OK]

ACOS login:
```

Permanently Changing the Storage Location for Future Reboots

This section describes how to change the storage area that will be used for future reboots:

NOTE: The procedures in this section change the storage area selection for all future reboots (unless you later change the selection again). If you only need to temporarily override the storage area selection for a single reboot, see Temporarily Changing the Boot Image for the Next Reboot.

CAUTION: Each storage area has its own version of the startup-config. When you save configuration changes, they are saved only to the startup-config in the storage area from which the ACOS device was booted.

CAUTION: If you plan to reboot from a different storage area, but you want to use the same configuration, first save the configuration to the other storage area. The procedures in this section include a step for this.

The following topics are covered:

Using the GUI to Change the Location for Future Reboots

To change the location that will be used for future reboots from the GUI:

1. Hover over **System** in the menu bar, then select **Settings**.
2. Select the **Boot Image** tab.
3. On the Boot Image page, select the location from which the device will be rebooted in the future.
4. Click **OK**.

Using the CLI to Change the Location for Future Reboots

In this example, the ACOS device was booted from the primary storage area, and will be configured to use the secondary image area for future reboots.

1. Use **`show bootimage`** to view the current storage area being used for reboots:

```
ACOS# show bootimage
(* = Default)
                            Version
-----------------------------------------------
Hard Disk primary         4.1.0.141 (*)
Hard Disk secondary         2.6.1-GR1-P7.51
Compact Flash primary       2.6.1-GR1-P7.51 (*)
```

The asterisk (*) indicates that when the system is booted from the hard disk, version 4.1.0.141 will be loaded.

2. Use the **write memory** command to save the configuration, then use the **write memory secondary** command to copy it to the secondary storage area:

```
ACOS(config)# write memory
Building configuration...
Write configuration to primary default startup-config
[OK]
ACOS(config)# write memory secondary
Building configuration...
Write configuration to secondary default startup-config
[OK]
```

3. Use **bootimage** to set the secondary storage area on the SSD or hard drive for future reboots, and verify the setting:

```
ACOS(config)# bootimage hd sec
Secondary image will be used if system is booted from hard disk
ACOS(config)# show bootimage
(* = Default)
                          Version
-----------------------------------------------
Hard Disk primary         4.1.0.141
Hard Disk secondary       2.6.1-GR1-P7.51 (*)
Compact Flash primary     2.6.1-GR1-P7.51 (*)
```

The asterisk (*) now indicates that the device will be booted from the secondary image on the hard disk.

Power On Auto Provisioning

The following topics are covered:

Power On Auto Provisioning Overview

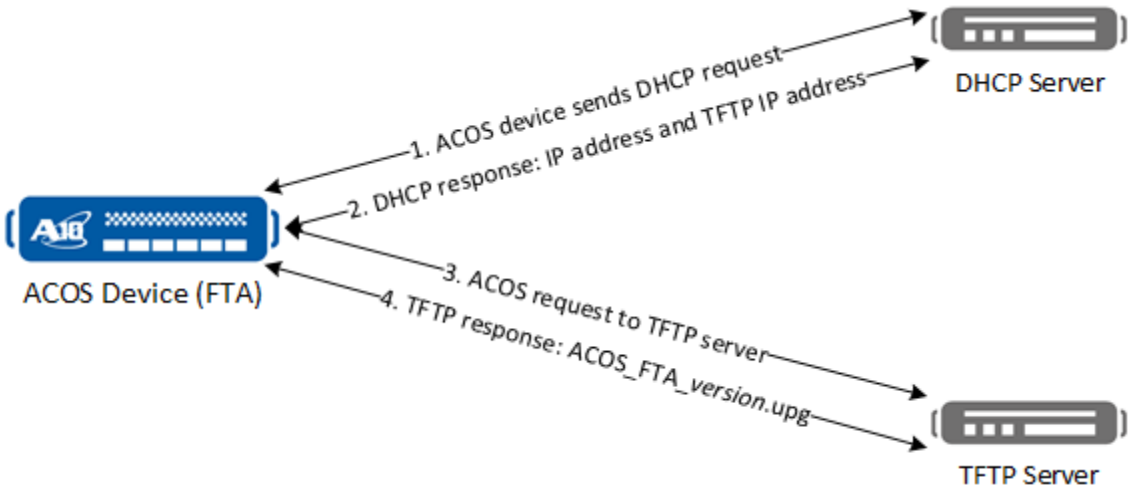
The ACOS Power On Auto Provisioning (POAP) feature offers an efficient way to automate the process of upgrading software images or config file across many ACOS devices on the network.

Use of this feature requires a DHCP server and a TFTP server that has been pre-configured with the proper ACOS software image and config file. The ACOS device must have access to the management port on a DHCP server and access to the TFTP server.

Power On Auto Provisioning Process

The following Figure 18 shows how the POAP process works.

Figure 18 : Power On Auto Provisioning Process



1. The ACOS device boots and sends a broadcast request to the DHCP server.
2. The DHCP server sends a response that includes an IP address for the ACOS device, and an IP address where the TFTP server can be reached.
3. The ACOS device attempts to locate the TFTP server at the IP address it just received from the DHCP server by sending a request to that address.

4. The TFTP server responds to the request from the ACOS device by sending the upgrade file (ACOS_FTA_*version*.upg for FTA devices, or ACOS_non_FTA_ *version*.upg for non-FTA devices).

   Once the ACOS device receives the upgrade file, it performs the following operations:

   - Extracts the upgrade image and configuration file.
   - Upgrades its software using the new image.
   - Links to the configuration file.
   - Then, the ACOS device reboots.

Feature Description

POAP features and the use cases are as follows:

1. POAP is enabled at power on by default

   The customer orders 10 new devices and wants to install them in remote facilities. The customer doesn't have staff at the facility and is relying on the “smart-hands” service. Configuring POAP and power on enables the customer to have the smart-hands rack and connect the box.

2. Capability for referencing configuration and image files by name

   Customer has a pair of FTA devices and a pair of FTA3 devices. Each device requires a new “poap_startup” script and at least one upgrade image “swap”. On the other hand, if devices can POAP and request specific startup scripts and upgrade images based on a unique device ID (such as a serial number), then all files can be prepared (built or linked) in advance allowing all devices to POAP simultaneously.

3. Verbose console logging

   Dropbox is changing their workflow to use significantly more automatic provisioning. Part of the auto-provisioning is automated inspection of the onlining of new devices to determine success or failure of provisioning. Dropbox is currently using a monitoring process that inspects mirrored console output

and determines success status. The console output is used as a success or a failure flag.

4. DHCP client functionality from all interfaces at power on

   The customer does not want to pay for design with a separate management network. The customer also wants to use POAP which requires DHCP. Customer may not know the ports that gets connected to the network in advance. Therefore, POAP can act as a DHCP client on all the interfaces.

5. Multiple file transfer protocol support

   Devices in several remote Data Centers need to be POAP provisioned from a server located at a central location (i.e. HQ) potentially traversing firewalls. TFTP would be non-trivial to make work in this setting.

   Use of this feature requires a DHCP server and a TFTP server that has been pre-configured with the proper ACOS software image and config file. The ACOS device must have access to the management port on a DHCP server and access to the TFTP server.

Configuring Power On Auto Provisioning Process

The following are the prerequisites before using POAP:

- Create an upgrade package named "**acos_upg.tgz**".

  The package may contain one or both of the following optional files:

  - Image file: "**sto.tar.gz**"
  - Config file: "**poap_startup**"

- Save this upgrade package on a TFTP server that can be accessed by the ACOS device. This package should be stored in the working directory of the TFTP server, (for example, "**tftpboot**").
- To enter POAP mode, the current startup-config file on the ACOS device must be empty; if the startup-config file is not completely empty then the POAP install will fail.

- At the end of the installation process, POAP links to the new startup-config file, which is a text file named "**poap_startup**".

NOTE:

- The POAP installation process does not erase an existing startup-config file, but as a precaution, you can save an existing startup-config file by creating a backup prior to enabling POAP.
- If the ACOS device encounters an existing file named "**poap_startup**" on the ACOS device (perhaps a remnant left over from a prior attempt to enable the feature), the POAP installation process will rename this existing file "**poap_startup.original**".

By default, the POAP Mode is disabled on all physical devices.

NOTE: POAP Mode is not available on the virtual platform.

To enable POAP mode on a physical device, use the **poap enable** command at the Global configuration level of the CLI.

Use the **poap disable** command to disable the feature.

You can use the **show poap** command to show the status (enabled or disabled) of POAP mode:

```
ACOS# show poap
POAP Mode Enabled
ACOS#
```

System Logs and Error Messages

System logs and error messages appear in the following scenarios:

- The startup-config profile "**poap_startup**" exists and new "**poap_startup**" gets installed with the POAP package.
- The link fails or the link is successful.
- The upgrade fails or the upgrade is successful.

Fail-Safe Automatic Recovery

Fail-safe automatic recovery detects critical hardware and software error conditions. The feature also automatically takes action to recover the system if any of these errors occurs, so that the ACOS device can resume service to clients.

Fail-safe automatic recovery is disabled by default, for both hardware and software errors. You can enable the feature for hardware errors, software errors, or both.

The following topics are covered:

Error Types Monitored by Automatic Recovery

Fail-safe automatic recovery monitors and recovers from the following types of system error conditions:

- Hardware Errors
- Software Errors
- Recovery Timeout
- Total Memory Decrease

Hardware Errors

When fail-safe monitoring is enabled for hardware errors, the following types of errors are detected:

- SSL processor stops working – Fail-safe is triggered if an SSL processor stops working.
- Compression processor stops working – Fail-safe is triggered if an HTTP compression processor stops.
- FPGA stops working – Fail-safe is triggered if either of these internal queues stops working.

If any of these types of errors occurs, the ACOS device captures diagnostic information, then reboots.

NOTE: Fail-safe recovery also can be triggered by a “PCI not ready” condition. This fail-safe recovery option is enabled by default and can not be disabled.

Software Errors

When fail-safe monitoring is enabled for software errors, the following types of errors are detected:

- FPGA I/O buffer shortage – The number of free (available) packet buffers is below the configured threshold. By default, at least 512 packet buffers must be free for new data. (Monitoring for this type of FPGA error is applicable to all ACOS device models.)

  On ACOS device models that use FPGA hardware, the FPGA is logically divided into 2 domains, which each have their own buffers. If an FPGA buffer shortage triggers fail-safe, recovery occurs only after both domains have enough free buffers.

- Session memory shortage – The amount of system memory that must be free for new sessions is below the configured threshold. By default, at least 30 percent of the ACOS device's session memory must be free for new sessions.

In VRRP-A deployments, fail-safe recovers from software errors by triggering failover to a standby device. To trigger the failover, fail-safe enables the force-self-standby option.

NOTE: Fail-safe temporarily enables the force-self-standby option. The **`vrrp-a force-self-standby`** command is not added to the running-config.

If VRRP-A is not enabled, fail-safe reloads the ACOS device.

Recovery Timeout

The recovery timeout is the number of minutes the ACOS device waits after detecting one of the hardware or software errors above before recovering the system.

- Recovery timeout for hardware errors – By default, the ACOS device reboots as soon as it has gathered diagnostic information. Typically, this occurs within 1 minute of detection of the error (no timeout). You can change the recovery timeout for hardware errors to 1-1440 minutes.
- Recovery timeout for software errors – Fail-safe waits for the system to recover through normal operation, before triggering a recovery. The default recovery timeout for software errors is 3 minutes. You can change it to 1-1440 minutes.

Total Memory Decrease

At device reload or reboot, the fail-safe feature provides a mechanism to check the total memory decrease when the ACOS device boots up and loads the startup configuration. If the total memory size has decreased, and if the size is less than the configured memory size, a message will be logged (if you have configured the **log** option) or the ACOS device will shut down after logging a message (if you have configured the **kill** option).

When the configured expected physical memory size is larger than the current memory size, a reboot or log message recording the discrepancy will be triggered. The device will remain always in a “loading” state after it reboots or reloads.

Configuring Fail-Safe Automatic Recovery

The following CLI commands configure some fail-safe settings and verify the changes.

Trigger the fail-safe recovery if the amount of free memory on your system remains below 30% long enough for the recovery timeout to occur:

```
ACOS(config)# fail-safe session-memory-recovery-threshold 30
```

Trigger the fail-safe recovery if the number of free (available) FPGA buffers drops below 2 long enough for the recovery timeout to occur:

```
ACOS(config)# fail-safe fpga-buff-recovery-threshold 2
```

Trigger the fail-safe recovery if a software error remains in effect for longer than 3 minutes:

```
ACOS(config)# fail-safe sw-error-recovery-timeout 3
```

Verify the configuration:

```
ACOS(config)# show fail-safe config
fail-safe session-memory-recovery-threshold 30
fail-safe fpga-buff-recovery-threshold 2
fail-safe sw-error-recovery-timeout 3
```

The **show fail-safe** command output differs between models that use FPGAs in hardware and models that do not. The following command shows fail-safe settings and statistics on an ACOS device model that uses FPGAs in hardware:

```
ACOS(config)# show fail-safe information
Total Session Memory (2M blocks):                    1012
Free Session Memory (2M blocks):                     1010
Session Memory Recovery Threshold (2M blocks):       809
Total Configured FPGA Buffers (# of buffers):        4194304
Free FPGA Buffers in Domain 1 (# of buffers):        507787
Free FPGA Buffers in Domain 2 (# of buffers):        508078
Total Free FPGA Buffers (# of buffers):              1015865
FPGA Buffer Recovery Threshold (# of buffers):       256
Total System Memory (Bytes):                         2020413440
```

The Table 6 describes the fields in the command output.

Table 6 : show Fail-safe Information Fields (FPGA Models)

Field	Description
Total Session Memory	Total amount of the ACOS device's memory that is allocated for session processing.
Free Session Memory	Amount of the ACOS device's session memory that is free for new sessions.
Session Memory Recovery Threshold	Minimum percentage of session memory that must be free before fail-safe occurs.
Total Configured FPGA Buffers	Total number of configured FPGA buffers the ACOS device has. These buffers are allocated when the ACOS device is booted. This number does not change during system operation. The FPGA device is logically divided into 2 domains, which each have their own buffers. The next two counters are for these logical FPGA domains.
Free FPGA Buffers in Domain 1	Number of FPGA buffers in Domain 1 that are currently free for new data.
Free FPGA Buffers in Domain 2	Number of FPGA buffers in Domain 2 that are currently free for new data.
Total Free FPGA Buffers	Total number of free FPGA buffers in both FPGA domains.
FPGA Buffer Recovery Threshold	Minimum number of packet buffers that must be free before fail-safe occurs.

Table 6 : show Fail-safe Information Fields (FPGA Models)

Field	Description
Total System Memory	Total size the ACOS device's system memory.

The following command shows fail-safe settings and statistics on an ACOS device model that does not use FPGAs in hardware. (The FPGA buffer is an I/O buffer instead.)

```
ACOS(config)# show fail-safe information
Total Session Memory (2M blocks):                    1018
Free Session Memory (2M blocks):                     1017
Session Memory Recovery Threshold (2M blocks):       305
Total Configured FPGA Buffers (# of buffers):        2097152
Free FPGA Buffers (# of buffers):                    2008322
FPGA Buffer Recovery Threshold (# of buffers):       1280
Total System Memory (Bytes):                         4205674496
```

The Table 7 describes the fields in the command output.

Table 7 : show Fail-safe Information Fields (non-FPGA models)

Field	Description
Total Session Memory	Total amount of the ACOS device's memory that is allocated for session processing.
Free Session Memory	Amount of the ACOS device's session memory that is free for new sessions.
Session Memory Recovery Threshold	Minimum percentage of session memory that must be free before fail-safe occurs.
Total Configured FPGA Buffers	Total number of configured FPGA buffers the ACOS device has. These buffers are allocated when the ACOS device is booted. This number does not change during system operation.
Free FPGA Buffers	Number of FPGA that are free for new data.
FPGA Buffer Recovery Threshold	Minimum number of packet buffers that must be free before fail-safe occurs.
Total System Memory	Total size the ACOS device's system memory.

Example of Fail-safe for Total Memory Decrease

In the following example, the fail-safe feature will be triggered when the total memory size is less than 5 GB. When this happens, this event will be logged:

```
ACOS(config)# fail-safe total-memory-size-check 5 log
```

The following example helps you decipher if you have a problem with your system memory.

Use the **show version** command to see the current memory size of your system. The current memory is shown as highlighted:

```
ACOS# show version
AX Series Advanced Traffic Manager AX1030
  Copyright 2007-2015 by A10 Networks, Inc.  All A10 Networks products are
                       protected by one or more of the following US
patents:
                      8918857, 8914871, 8904512, 8897154, 8868765, 8849938,
8826372, 8813180
    8782751, 8782221, 8595819, 8595791, 8595383, 8584199, 8464333, 8423676
    8387128, 8332925, 8312507, 8291487, 8266235, 8151322, 8079077, 7979585
    7804956, 7716378, 7665138, 7647635, 7627672, 7596695, 7577833, 7552126
    7392241, 7236491, 7139267, 6748084, 6658114, 6535516, 6363075, 6324286
    5931914, 5875185, RE44701, 8392563, 8103770, 7831712, 7606912, 7346695
    7287084, 6970933, 6473802, 6374300

      64-bit Advanced Core OS (ACOS) version 4.1.0, build 182 (Sep-21-
2015,05:20)
        Booted from Hard Disk primary image

      Serial Number: AX10B33012260039
      aFleX version: 2.0.0
      aXAPI version: 3.0
      Hard Disk primary image (default) version 4.1.0, build 182
      Hard Disk secondary image version 2.7.2-P4-SP1, build 2
      Compact Flash primary image (default) version 2.6.1-GR1, build 107
      Last configuration saved at Oct-2-2015, 06:37
      Hardware: 8 CPUs(Stepping 7), Single 39G Hard disk
     Memory 18155 Mbyte, Free Memory 12551 Mbyte
      Hardware Manufacturing Code: 122600
```

```
      Current time is Oct-8-2015, 19:11
      The system has been up 17 days, 0 hour, 12 minutes
```

The current system memory is shown as 12G. In case you configure the fail-safe memory monitoring to be 5G, as shown below, your system will continue to operate normally, since 5G of memory is less than the 12G of memory that your device has at its disposal:

```
ACOS(config)# fail-safe total-memory-size-check 5 kill
```

However, if you use the above command and configure a memory size of 14G (and you save your configuration by issuing the **`write memory`** command) since 14G exceeds your current device memory size of 12G, your device will experience a problem. When the device reloads, the fail-safe mechanism will be triggered, traffic will be stopped, and the device will be shut down. The abnormal state of the device will be evident in the following log message:

```
[SYSTEM]:Current memory size 12G, less than monitor number 14G. Please
check memory.
```

To correct this issue, use the **`fail-safe total-memory-check`** *`size`* **`kill`** command and specify a memory size that is less than or equal to the current memory size. The next time your device reloads, it will operate normally.

Upgrading ACOS Images

The Thunder device is provided with preinstalled ACOS software along with the purchased license. When you power ON the device, it boots up with the preinstalled software. To access the new features, security patches, and software fixes as they become available, you must upgrade the ACOS software.

The upgrade process involves selecting the upgrade method, defining the target partition, and specifying additional options based on your environment:

1. Select the upgrade method:
   - Graphical User Interface (**gui**)
   - Hard Disk (**hd**)
2. Define the target partition:
   - Primary partition (**pri**)
   - Secondary partition (**sec**)
3. Specify additional options:
   - Install an image from a local directory (**local** *image-name*)
   - Display upgrade progress (**show-percentage**)
   - Specify the source IP (**source-ip-address** *<ip-address>*)
   - Use the management port for the upgrade (**use-mgmt-port**)
   - Retrieve the upgrade image from a remote source (**url**)

     The supported protocols for remote upgrades are:
     - Trivial File Transfer Protocol (tftp://)
     - File Transfer Protocol (ftp://)
     - Secure Copy Protocol (scp://)
     - Hypertext Transfer Protocol (http://)

- Secure HTTP (https://)
- Secure FTP (sftp://)

For release-specific upgrade instructions, see the Release Notes.

Configuring Multi-Factor Authentication

ACOS supports Multi-Factor Authentication (MFA) mechanism for upgrading ACOS software image. This enhances security by ensuring that only authorized users can perform upgrades.

If a multi-factor authentication is set up, then ACOS can automatically detect whether the authentication server enforces an additional verification step. This feature applies to all A10 products running ACOS.

Supported MFA

ACOS currently supports only Cisco Duo MFA for SCP-based upgrades.

Supported Duo MFA Authentication Methods

Duo MFA provides three authentication methods for SCP-based ACOS upgrades:

- Direct Passcode: A 6-digit passcode is generated in the Duo mobile app.
- Duo Push Notification: A push notification is sent to the Duo mobile app for approval.
- SMS Passcode: A passcode is sent to the registered phone number via SMS.

NOTE: Some authentication methods may not be available depending on the Duo configuration of the remote server.

Pre-requisites

Before starting an SCP-based upgrade with Duo MFA, ensure the following:

- Set up Duo Unix on the authentication server. For more information, see Duo Unix Get Started and Enable Password Login.
- Perform an SSH/SCP login test to confirm whether the authentication method is configured for direct passcodes, push notifications, or SMS passcodes.

Enabling Duo MFA for SCP-based Upgrades

To enable Duo MFA for SCP-based Upgrades, perform the following steps:

1. Initiate the upgrade process, using the following command.

```
ACOS(config)# upgrade hd pri use-mgmt-port scp://root@path_to_ACOS_
image.upg
Password []?
```

   ACOS prompts you to enter a password.

2. Enter the password for SCP authentication.
3. Enter **yes** to reboot the system immediately after the upgrade.

```
Do you want to reboot the system after the upgrade?[yes/no]: yes
Getting upgrade package ...
```

   The device attempts to download the upgrade package from the SCP server.

4. If Duo Unix is enabled, ACOS detects the additional authentication requirement and displays the Duo MFA prompt:

```
Duo two-factor login for root
Enter a passcode or select one of these options:
1. Duo Push to iOS
2. SMS passcodes to XXX-XXX-6097
```

   At this stage, proceed with Direct Passcode, Duo Push Notification, or SMS Passcode Authentication.

Authenticate Using Direct Passcode

   a. Open the Duo mobile app.

   b. Enter the 6-digit passcode generated in the app (this code refreshes periodically).

```
Passcode or option (1-2): XXXXXX
```

Option 1: Authenticate Using Duo Push Notification

   a. Select option 1.

```
Passcode or option (1-2): 1
```

A push notification is sent to your configured Duo mobile app.

b. Approve the notification on your mobile device.

Option 2: Authenticate Using SMS Passcode

a. Select option 2.

```
Passcode or option (1-2): 2
```

A one-time passcode via SMS is sent on your registered mobile number.

b. Enter the received passcode when prompted again.

```
Duo two-factor login for root

Enter a passcode or select one of the following options:

 1. Duo Push to iOS
 2. SMS passcodes to XXX-XXX-6097 (next code starts with: 1)

Passcode or option (1-2): 656155
```

5. Once the authentication is successful, ACOS proceeds with the upgrade.

```
Authentication successful!
..................
Done (0 minutes 27 seconds)
Decrypting upgrade package...
```

Installing the Systems Center Virtual Machine Manager Gateway Plugin

This chapter describes how to install the A10 SCVMM (Systems Center Virtual Machine Manager) Gateway plugin.

This procedure adds a gateway to the resources in VMM.

The following topics are covered:

Prerequisites

Before you begin, ensure that your system meets the requirements described in this section.

- Windows Server 2012 R2

NOTE: For more information, see: http://technet.microsoft.com/en-us/library/hh801901.aspx

- .NET Framework 4.0 or higher

NOTE: For more information, see: http://www.microsoft.com/en-us/download/details.aspx?id=22

- SCVMM 2012 R2

  To install SCVMM 2012 R2:

  - Visit the VMM main page at: http://technet.microsoft.com/en-us/library/gg610610.aspx
  - To download an evaluation version of SCVMM 2012 R2, see: http://technet.microsoft.com/en-US/evalcenter/hh505660.aspx?wt.mc_id=TEC_103_1_33
  - For installation instructions, see: http://technet.microsoft.com/en-us/library/gg610656.aspx.

- An ACOS device with version 2.7.2 installed.

Installing the Gateway Plugin

This section describes how to install the A10 Network SCVMM Gateway Plugin.

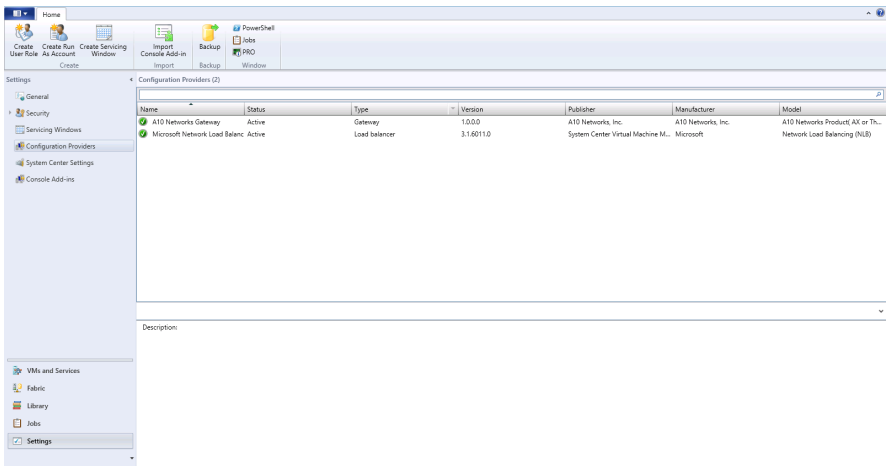
1. Launch the SCVMM Gateway installer.

   Click **Next** to navigate your way through the screens until the installation is complete.

2. Restart the System Center Virtual Machine Manager service.

   From a Windows command prompt or PowerShell window, run the **`net stop scvmmservice`** and **`net start scvmmservice`** commands.

After the restart is complete, the A10 Networks Gateway provider is visible in configuration provider windows.



Configuring the A10 Networks Overlay Gateway Interface in the VMM

Follow the instruction in this section to add the gateway for A10 Networks:

NOTE: Additional instructions for this procedure can be found at http://technet.microsoft.com/en-us/library/dn249416.aspx.

- Verifying Configuration Prerequisites
- Configuring the A10 Networks Gateway
- Verifying the Configuration

Verifying Configuration Prerequisites

Verify that your network configuration meets the requirements described in this section.

1. Verify the configuration requirements on your system, in accordance with the documentation at this location: http://technet.microsoft.com/en-us/library/e73bfafa-6b57-4a5b-9f15-1cf9befa082b#BKMK_gateways.
2. Configure the logical network that will be the foundation for the VM network that will use the gateway, and ensure that network virtualization is enabled on the logical network.
3. Create an IP address pool on the logical network, and ensure that the pool includes the address that you intend to use on the gateway provider IP.
4. Ensure that the gateway is configured with an IP address that is in the IP address pool that you created. Make a note of the IP address so that you can specify it when you use the following procedure to add the gateway to VMM.

Refer to the following for additional network resource information:

- Configuring Networking in VMM: http://technet.microsoft.com/en-us/library/gg610596.aspx.
- Configuring Logical Network in VMM Overview:

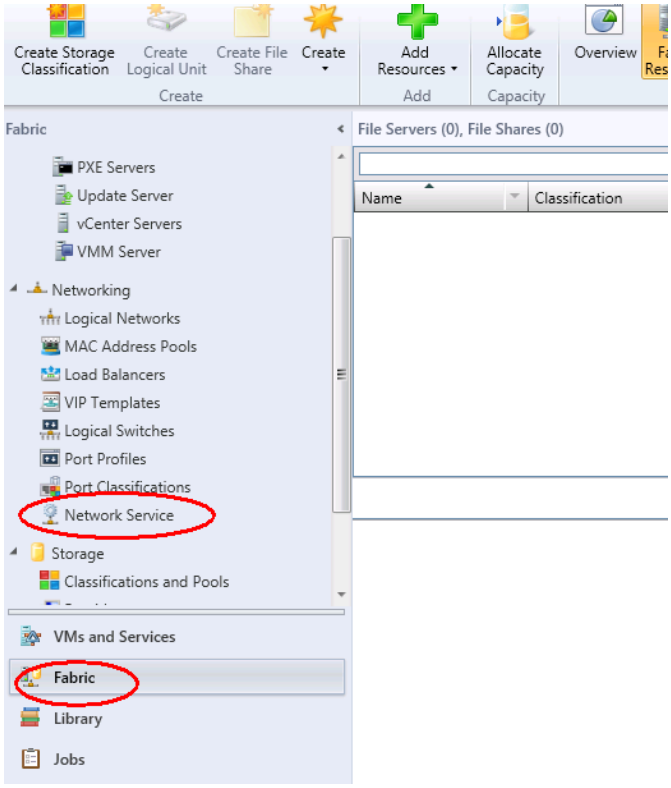
  http://technet.microsoft.com/en-us/library/jj721568.aspx
- How to Create a Logical Network in VMM:

  http://technet.microsoft.com/en-us/library/gg610588.aspx

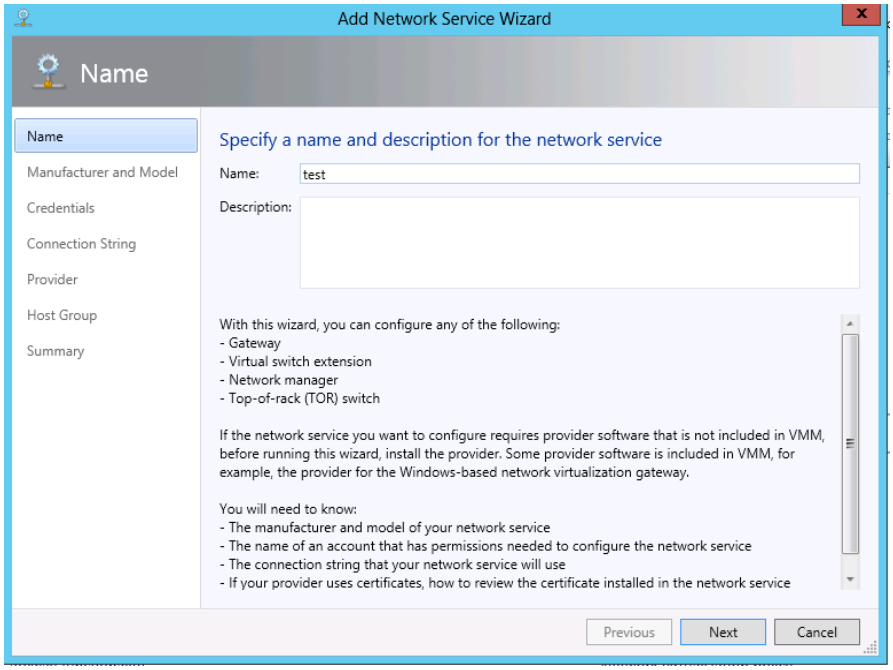
Configuring the A10 Networks Gateway

Follow the instructions in this section to add the gateway.

1. Open the **Fabric** workspace in VMM.
2. In SCVMM, right-click **Network Service** and select **Add Network Service**.



The Add Gateway Wizard opens.



On this screen:

a. On the Name page, enter a name and optional description for the gateway, then click **Next**.

b. On the Manufacturer and Model page, in the **Manufacturer** list, select **A10 Networks**, and in the **Model** list, select a model, then click **Next**.

c. On the **Credentials** page, select the account you want to use for the ACOS device:

- Select an existing account (click **Browse**, then click **Select a Run As Account** and select an account)
- Create a new account (click **Create Run As Account**) and specify the username and password for the account.
- Click **Next** when you are finished.

d. On the Connection String page, specify the connection string in the following format.

```
IPAddress=ip-address;VTEPPartitionName=vtep-partition-
name;InstanceName=instance-name;[UnderlayEthernet=gateway-ethernet-
index;][UnderlayVirtualEthernet=gateway-virtual-ethernet-index;]
[LifSubnet=lif-subnet;][WriteMemory=False;]
```

Table 8 : Connection String Parameters

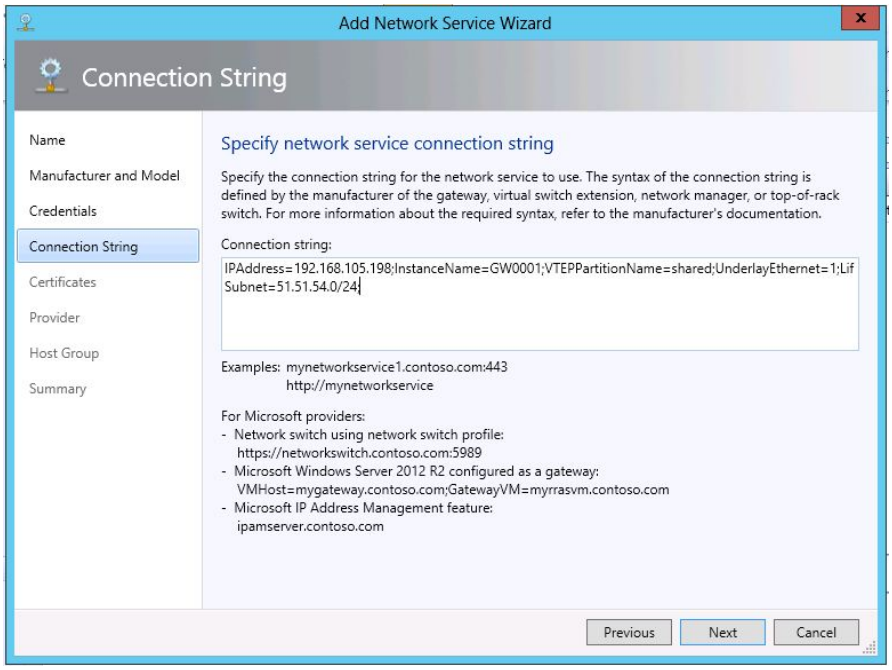
Parameter	Description
ip-address	IP address on the A10 device providing the Overlay Gateway functionality.
vtep-partition-name	Overlay tunnel VTEP partition name of the gateway; this partition must be configured before you reach this point in the process.
instance-name	Unique identifier for this instance in the SCVMM.
gateway-ethernet-index	Optional parameter indicating the index of the gateway ethernet interface. This interface must be properly configured before you reach this point in the procedure.

Table 8 : Connection String Parameters

Parameter	Description
gateway-virtual-ethernet-index	Optional parameter indicating the index of the gateway virtual ethernet interface. This interface must be properly configured before you reach this point in the procedure.
lif-subnet	The subnet in which the LIF will be configured. Any subnet is valid as long as there is no conflict with the VM subnets. By default, the second IP of that subnet is chosen as the IP of the lif interface which serves as the gateway interface for the overlay (VM) network.
WriteMemory=False	This parameter causes the gateway plugin to save the config to disk on the ACOS device. Setting it to false will disable saving the config to disk.

Below is an example:

```
IPAddress=192.168.105.198;InstanceName=GW0001;VTEPPartitionName=sha
red;Underlay
Ethernet=1;LifSubnet=51.51.54.0/24;WriteMemory=False;
```



e. On the Provider page, in the **Configuration provider** list, select an available provider, click **Test** to run basic validation against the gateway using the selected provider, then click **Next**.

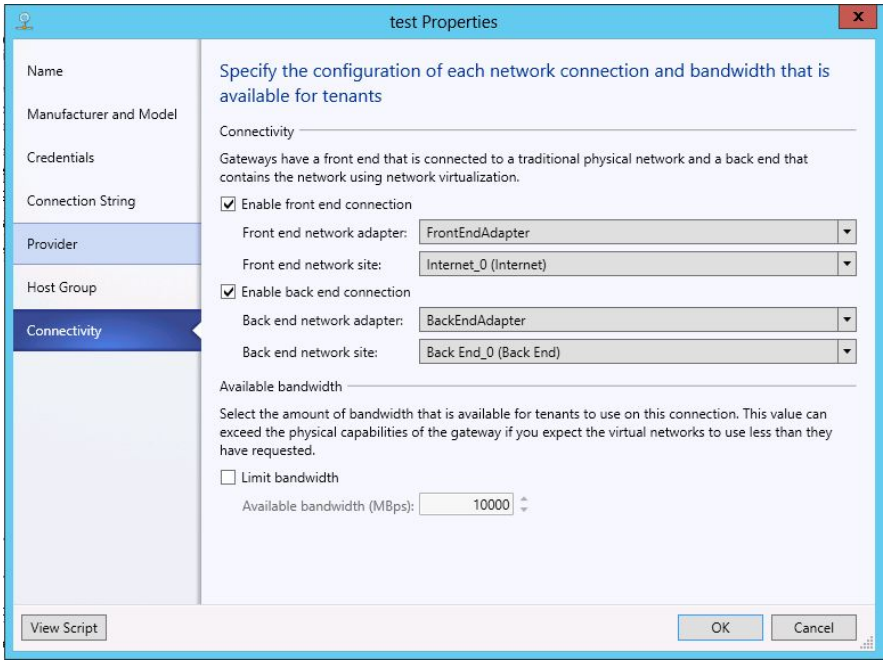
f. On the Host Group page, select the host group for which you want this network service to be available, then click **Next**.

g. On the Summary page, review and confirm the settings, then click **Finish**.

   The gateway will be added in SCVMM.

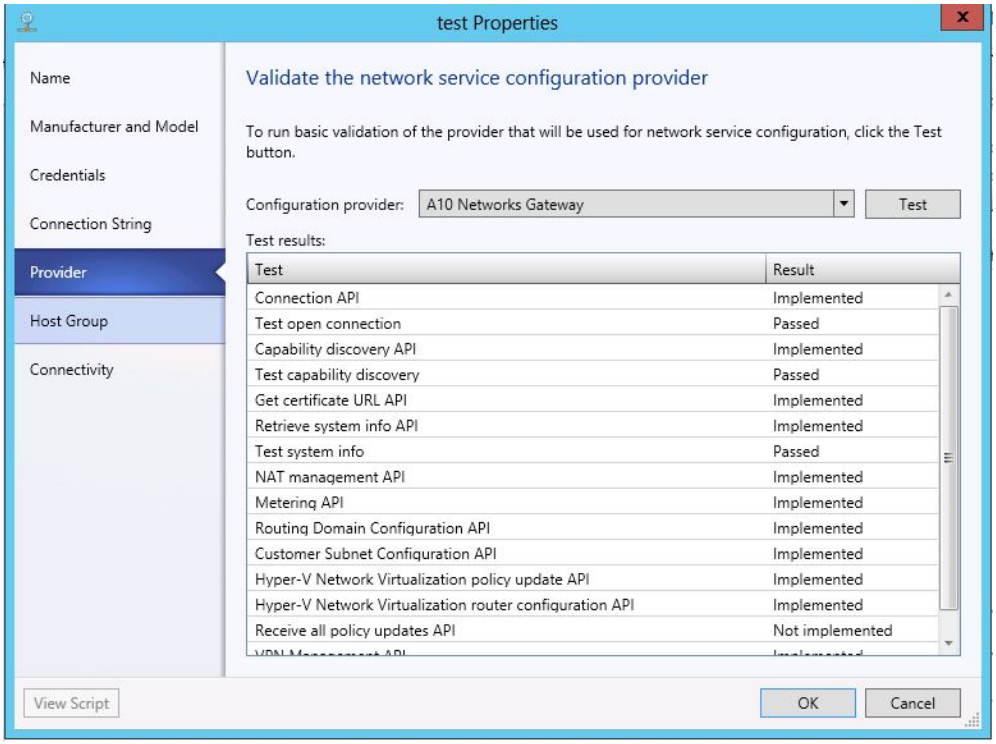
h. After the gateway is added, find the listing for the gateway under **Network Services**, right-click the listing, select **Properties**, then select **Connectivity**, and:

- Select **Enable front end connection**, and then select the gateway network adapter and the network site that provide connectivity outside the hosting-provider or enterprise data center. the network site must have a static IP address pool.
- Select **Enable back end connection**, and then select a gateway network adapter and network site in a logical network within the hosting-provider or enterprise data center. The logical network must have Hyper-V network virtualization enabled. Also, the network site must have a static IP address pool.



Verifying the Configuration

To verify the configuration, click the **Test** button on the Provider page.



In the Result column, look for "**Implemented**" or "**Passed**" to verify that the specified portion of the configuration is operating correctly.

Monitoring Tools

This part of the document describes about monitoring tools for the ACOS devices.

The ACOS device can send alerts to administrators through the following methods:

System Log Messages

Emailing Log Messages

In order to monitor the health of the network and its nodes, you can implement the following monitoring tools:

Link Monitoring

ACL on Interface Monitoring

ACE Monitoring and Analytics

Gateway Health Monitoring

Multiple Port-Monitoring Mirror Ports

sFlow

ACOS Event - Hashing

Call Home

NOTE: For information about monitoring network components in ADC configurations, see the Application Delivery Controller Guide.

System Log Messages

The ACOS device logs system events with system log (Syslog) messages.

The following topics are covered:

Destinations for Syslog Messages

The ACOS device can send Syslog messages to the following places:

- Local buffer (default level: Debugging - 7)
- Console CLI session (default level: Error - 3)
- Console SSH and Telnet sessions
- External Syslog server
- Syslog server in another partition
- Email address(es)
- SNMP servers (for events that are logged by SNMP traps)

Logging to the local buffer and to CLI sessions is enabled by default. Logging to other places requires additional configuration.

Syslog Message Severity Levels

The standard Syslog message severity levels are supported:

- Emergency – 0
- Alert – 1
- Critical – 2
- Error – 3
- Warning – 4
- Notification – 5
- Information – 6
- Debugging – 7

Configurable Syslog Parameters

The following topics are covered:

System Log Settings

The following Table 9 lists the configurable Syslog parameters.

Table 9 : Configurable System Log Settings

Parameter	Description	Supported Values
Disposition (message target)	Output options for each message level. For each message level, you can select which of the following output options to enable: • Console – Messages are displayed in Console sessions. • Buffered – Messages are stored in the system log buffer. • Email – Messages are sent to the email addresses in the Email To list. (See below.) • SNMP – SNMP traps are generated and sent to the SNMP receivers. • Syslog – Messages are sent to the external log servers specified in the Log Server fields. (See below.) • Monitor – Messages are displayed in Telnet and SSH sessions.	The following message levels can be individually selected for each output option: • Emergency (0) • Alert (1) • Critical (2) • Error (3) • Warning (4) • Notification (5) • Information (6) • Debug (7) Only Emergency, Alert, and Critical can be selected for SNMP. Only Emergency, Alert, Critical, and Notification can be selected for Email.

Table 9 : Configurable System Log Settings

Parameter	Description	Supported Values
	NOTE: For information about emailing log messages, see Emailing Log Messages.	
Logging Email Filter	Settings for sending log messages by email.	See Emailing Log Messages.
Logging Email Buffer Number		
Logging Email Buffer Time		
Facility	Standard Syslog facility to use.	Standard Syslog facilities listed in RFC 3164.
Log Buffer Entries	Maximum number of log entries the log buffer can store.	10000 to 50000 entries Default: 30000
Log Server/Host	IP addresses or fully-qualified domain names of external log servers. Only the message levels for which Syslog is selected in the Disposition list are sent to log servers.	Any valid IP address or fully-qualified domain name. Default: None configured

Table 9 : Configurable System Log Settings

Parameter	Description	Supported Values
	NOTE: By default, the ACOS device can reach remote log servers only if they are reachable through the ACOS device's data ports, not the management port. To enable the ACOS device to reach remote log servers through the management port, see Source Interface for Management Traffic.	
Log Server Port	Protocol port to which log messages sent to external log servers are addressed.	Any valid protocol port number Default: 514
Email To	Email addresses to which to send log messages. Only the message levels for which Email is selected in the Disposition list are sent to log servers.	Valid email address. Click the down arrow next to the input field to add another address (up to 10). Each email address can be a maximum of 31 characters long.
SMTP Server	IP address or fully-qualified domain name of an email server using Simple Message Transfer Protocol.	Any valid IP address or fully-qualified domain name. Default: None configured

Table 9 : Configurable System Log Settings

Parameter	Description	Supported Values
	NOTE: By default, the ACOS device can reach SMTP servers only if they are reachable through the ACOS device's data ports, not the management port. To enable the ACOS device to reach SMTP servers through the management port, see Source Interface for Management Traffic.	
SMTP Server Port	Protocol port to which email messages sent to the SMTP server are addressed.	Any valid protocol port number Default: 25
Mail From	Specifies the email From address.	Valid email address Default: Not set
Need Authentication	Specifies whether access to the SMTP server requires authentication.	Selected (enabled) or unselected (disabled) Default: disabled
Username	Username required for access to the SMTP server.	Valid username Default: Not set
Password	Password required for access to the SMTP server.	Valid password Default: Not set

Operational Logging

The following Table 10 lists the types of operational events that are logged.

Table 10 : LSN Operational Logs

Severity Level	Event	Message String
Critical	User-quota creation failure	LSN: User-quota creation failed (out of memory) for pool...
	Full-cone session creation failure	LSN: Full-cone session creation failed (out-of-memory) for pool...
Warning	New inside user unable to get NAT IP	LSN: New user could not get a NAT IP on pool..
	Current inside user on NAT IP can not get new NAT port	LSN: NAT port usage exceeded on pool...
Notice	User quota exceeded	LSN: ICMP user-quota exceeded on pool... LSN: UDP user-quota exceeded on pool... LSN: TCP user-quota exceeded on pool...
	Extended user quota exceeded	LSN: UDP extended user-quota exceeded on pool... LSN: TCP extended user-quota exceeded on pool...

Configuring Single-Priority Logging

Single-priority logging allows you to identify one specific severity level to be logged from among the standard syslog message severity levels (See Syslog Message Severity Levels).

This allows you to remove excess data so that you can see a desired subset of log messages at your target severity level.

In prior releases, when you specify a severity level to be logged, the selected level becomes the “basement level”, or the most trivial level that will appear along with the more important messages. For example, if you specify level 3 (error), you would also get severities 2, 1, and 0, but 3 would be the most trivial severity level to be included in the log messages.

Prior releases did not offer a way for you to single out a particular subset of log messages at a singular severity level; for example, there was no way to display severity level 5 log messages without also seeing messages from severity levels 4–0.

Single-priority logging offers more granular control of syslog messages.

To configure single-priority logging, use the `logging single-priority` command.

The following example logs only error (level 3) messages:

```
ACOS(config)# logging single-priority error
```

Configuring Log Rate Limiting

The following topics are covered:

Details

The ACOS device uses a log rate limiting mechanism to ensure against overflow of external log servers and the internal logging buffer.

The rate limit for external logging is 15,000 messages per second from the device.

The rate limit for internal logging is 32 messages per second from the device.

- If the number of new messages within a one-second interval exceeds 32, then during the next one-second interval, the ACOS device sends log messages only to the external log servers.
- If the number of new messages generated within the new one-second interval is 32 or less, then during the following one-second interval, the ACOS device will again send messages to the local logging buffer as well as the external log server. In any case, all messages (up to 15,000 per second) get sent to the external log servers.

Configuring Log Rate Limiting Using the GUI

To configure log rate limiting using the GUI:

1. Hover over **System** in the navigation bar, and select **Settings**.
2. Click **Logging** on the menu bar.
3. Change settings as needed. (For descriptions of the settings, see Configurable System Log Settings.)
4. Click **OK**.

Configuring Log Rate Limiting Using the CLI

Use the `logging` command to configure log rate limiting using the CLI.

For example, to change the severity level of messages logged in the local buffer to "warning" (level 4):

```
ACOS(config)# logging buffered warning
```

Replace buffered with a different destination, as desired (see Destinations for Syslog Messages).

NOTE: Only severity levels **`emergency`**, **`alert`**, **`critical`**, and **`notification`** can be sent by email. Sending log messages by email requires additional configuration. See Emailing Log Messages.

To configure the ACOS device to send log messages to an external Syslog server, use the **`logging host`** command to specify the server:

```
ACOS(config)# logging host 20.20.10.8
```

The following topics are covered:

Specifying Multiple Syslog Servers

To specify multiple server names or IP addresses, use multiple commands. The following example configures 20.20.10.8, 30.30.10.5, and “loghost1” as syslog servers:

```
ACOS(config)# logging host 20.20.10.8
ACOS(config)# logging host 30.30.10.5
ACOS(config)# logging host loghost1
```

Specifying Protocol Ports

You can also specify a protocol port. The default port is 514. If you specify multiple servers, then all servers specified must use the same protocol port to listen for syslog messages; you can only specify one protocol port per command.

The following example configures 20.20.10.8 and 30.30.10.5 as syslog servers listening on port 515, and 40.40.5.9 as a syslog server listening on port 517:

```
ACOS(config)# logging host 20.20.10.8 port 515
ACOS(config)# logging host 30.30.10.5 port 515
ACOS(config)# logging host 40.40.5.9 port 517
```

Sending the Syslog Over TLS/SSL

For sending the syslog over TLS/SSL to the remote server, perform the followings steps:

1. Configuring the logging using syslog over TLS:

   To configure remote logging over TLS use the `over-tls` parameter in `logging host` command. Following is the example CLI command.

   ```
   ACOS(config)# logging host <host-ip> use-mgmt-port port <port-no> tcp over-tls
   ```

   - The `over-tls` parameter is available only if `tcp` parameter is used in `logging host` command.
   - When the port number is not configured by default port 514 is used, similar to syslog over TLS.

2. Creating the template for logging using syslog over TLS

The `syslog-over-tls` template command is used to configure the self signed CA root certificate for TLS handshake. This template is shared across all the configured syslog servers. Following are the example CLI command.

```
ACOS(config)# template syslog-over-tls
ACOS(config)# ca-cert <CAcert-name>
```

3. Creating the CA root self signed certificate

   a. Generating RSA private key for CA root:

   ```
   ACOS(config)# openssl genrsa -des3 -out <key-name.key> 2048
   ```

   b. Generating self-signed CA root certificate.

   ```
   ACOS(config)# openssl req -x509 -new -nodes -key <key-name.key> -
   sha256 -days 1825 -out <CAroot-name.pem>
   ```

   c. Generating certificate signing request.

   ```
   ACOS(config)# openssl req -out <csr-name.csr> -new -newkey rsa:2048 -
   nodes -keyout <server-keyname.key>
   ```

   d. Signing and creating certificate using '.csr' and CA root.

   ```
   ACOS(config)# openssl x509 -req -days 360 -in <csr-name.csr> -CA
   <CAroot-name.pem> -CAkey <CAkey key> -CAcreateserial -out <cert-
   name.crt>
   ```

   NOTE: Different common name should be mentioned for CA root and certificate signing request.

4. Deleting the configuration of logging using syslog over TLS.

   ```
   ACOS(config)# no logging host <host-ip> use-mgmt-port port <port-no> tcp
   over-tls
   ```

5. Deleting the syslog over TLS template.

   The template can be deleted in one of the following ways:

   ```
   ACOS(config)# no template syslog-over-tls
   ACOS(config-syslog-over-tls template)# no ca-cert <CA certificate name>
   ```

NOTE: For receiving messages over TLS/SSL socket, OpenSSL provides the socket listening API

```
ACOS(config)# openssl s_server -accept <port> -cert <server-certificate> -key <server-key>
```

Sending Log Messages to a Server in Another Partition

The following example configures a a log server in the shared partition:

```
ACOS(config)# logging host 44.3.2.1
```

The following commands configured a logging server 45.3.2.1 in partition LOG1, and also sends logging information to the shared partition:

```
ACOS[LOG1](config)# logging host 45.3.2.1
ACOS[LOG1](config)# logging host partition shared
```

In partition LOG2, a third syslog server 46.3.2.1 is configured, and log messages are sent to the syslog server configured in partition LOG1:

```
ACOS[LOG2](config)# logging host 46.3.2.1
ACOS[LOG2](config)# logging host partition LOG1
```

Sending Log Messages by Email

To configure the ACOS device to send log messages by email, use the following commands to specify the email server and the email addresses:

```
ACOS(config)# smtp 10.10.10.5
ACOS(config)# logging syslog@myexamplecompany.com
```

The `smtp` command specifies the mail server. By default, it uses port 25 to send email. You can customize this with the optional `port` parameter.

To send event messages to an external SNMP server, see *SNMP MIB Reference Guide*.

Configuring Alerts for Modular License

ACOS supports monitoring and alert management of the modular license (software-driven license) bandwidth usage for Thunder or vThunder devices. This feature provides SNMP messages and Syslog logging when the device's bandwidth usage

exceeds the configurable threshold. The `axSystemBandwidthThresholdAlert` trap is provided to support this feature.

If you have modular license enabled on the device and the ACOS software image is upgraded to 6.0.4, the following threshold is set by default.

- Warning Threshold: When bandwidth usage reaches 75% and persists for 7 consecutive days, the SNMP and Syslog messages are triggered.
- Critical Threshold: When bandwidth usage reaches 95% and persists for two consecutive days, the SNMP and Syslog messages are triggered.

These threshold can be customized based on your business need.

An emergency alert is generated when bandwidth usage hits 100%, which is regarded as an emergency threshold and its value cannot be modified. The system will send a message every time the bandwidth hits 100% at a rate of one message per hour at most.

Let's say the modular license bandwidth utilization over the next 7 days is as follows:

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
73%	77%	97%	97%	83%	62%	103%

- Monday shows a 77% bandwidth utilization. However, it does not qualify as a critical, warning, or emergency alert.
- Tuesday and Wednesday show 97% bandwidth utilization for two consecutive days. Therefore, the system triggers a critical message and sends the Syslog and SNMP traps to alert the user.
- Saturday shows 103% bandwidth utilization. Therefore, the system triggers an emergency message and sends the Syslog and SNMP trap to alert the user.

Configuration Overview

1. Setup event logging infrastructure. See Event Logging Guide.
2. Enable and configure SNMP service, traps, and client. See SNMP MIB Reference.
3. Modify the bandwidth threshold at the system-level, if required.

When the bandwidth exceeds the threshold, an event is triggered.

4. Check the logs using the **show varlog** command.

Configuration Example

- To modify the default warning threshold percentage, use the following command:

```
ACOS(config)# system bandwidth warning-threshold <50-80>
```

- To modify the critical threshold percentage, use the following command:

```
ACOS(config)# system bandwidth critical-threshold <81-99>
```

NOTE: You cannot remove these configurations from the system using **no system bandwidth {warning-threshold | critical-threshold}** command. Instead, the system will revert to the default threshold values 75% and 95% respectively.

Log Example

The alert messages only display the time of the threshold being exceeded and the percentage of bandwidth consumption.

```
ACOS#show varlog | inc BANDWIDTH
Jun  4 00:00:02 localhost a10lb[4832]: BANDWIDTH EMERGENCY - Bandwidth has
reached 100 percent of the license capacity (51200000000 bits). Current
usage is 100.
Jun  4 00:00:02 localhost a10lb[4832]: BANDWIDTH CRITICAL - Bandwidth has
reached 95 percent of the license capacity (51200000000 bits) or greater
for the past two days. Current usage is 100.
Jun  4 01:00:06 TH1-L3V a10lb[4832]: BANDWIDTH WARNING - Bandwidth has
reached 75 percent of the license capacity (51200000000 bits) or greater
for the past seven days. Current usage is 80.
```

ACOS Event - Hashing

The following topic is covered:

Hashing Support for ACOS Event

When multiple external log servers are configured under a collector group, each log is forwarded to only one of the log servers. You can select the log server from the following methods:

- Round-Robin (Default)
- Hashing

The following topics are covered:

Log Distribution by Round-Robin Method

By default, the log messages are forwarded to the external log servers using the round-robin method. The round-robin method distributes the log messages evenly across all log servers. For example, if there are two log servers (LS1 and LS2) in the collector group, the log servers are selected in sequence and the logs are forwarded as follows:

- The first log is sent to LS1
- The second log is sent to LS2
- The third log is sent to LS1
- The fourth log is sent to LS2, and so on

Use the following command to configure the round-robin method in the collector group for distributing the logs (Round-Robin is configured by default):

```
ACOS(config-collector-group:c1)#log-distribution round-robin
```

In the following example, as the log-distribution is not configured, the logs are distributed using the round-robin method by default:

```
ACOS(config)#acos-events message-selector m1
ACOS(config-msg-selector:m1)#rule 1
ACOS(config-msg-selector:m1-rule:1)#message-id slb all
ACOS(config-msg-selector:m1-rule:1)#exit
ACOS(config-msg-selector:m1)#exit
ACOS(config)#acos-events log-server 11 11.11.11.5
ACOS(config-log-server)#port 514 udp
ACOS(config-log-server-logging port)#exit
ACOS(config-log-server)#exit
ACOS(config)#acos-events collector-group c1 udp
ACOS(config-collector-group:c1)#log-server 11 514
ACOS(config-collector-group:c1)#exit
ACOS(config)#acos-events template t1
ACOS(config-template:t1)#message-selector m1
ACOS(config-template:t1-selector:m1)#collector-group c1
ACOS(config-template:t1-selector:m1-colle...)#exit
ACOS(config-template:t1-selector:m1)#exit
ACOS(config-template:t1)#exit
ACOS(config)(NOLICENSE)#
```

Log Distribution by Hashing Method

The log messages can also be forwarded to the external log servers based on hashing. It provides a consistent hashing framework where some logs that are to be sent to the same log server (For example, Session creation and session deletion for the same session or all logs from the same session or connection) are sent to the same external log server rather than randomly selecting the server through Round-Robin.

Use the following command to configure the hashing method in the collector group for distributing the logs:

```
ACOS(config-collector-group:c1)#log-distribution hashing
```

Though hashing is enabled, it is considered only when the generated log is in context within a connection. If not, it will fall back to the Round-Robin method because the hash is calculated based on the destination IP address on the connection. All the logs

generated from the connections with the same destination IP address are sent to the same external log servers.

The log's hash, which is based on the destination IP address, matches the configured log servers and one server out of multiple configured servers is selected. If many log servers are contending for the same hash, then the source IP of the connection is used to break the discrepancy.

When there are any changes to the configured log servers (such as servers going down, coming up, adding, or deleting servers), the mapping of logs to the log servers is preserved on a best effort basis. For example, if the log L1 is sent to the log server s1 based on hashing, while the log server s1 goes down, the log L1 is sent to another log server s2. When the log server s1 is up, the log L1 and the similar logs (with hash L1) must be sent to s1 again.

When the logs servers are down or not usable or due for maintenance, you can perform one of the following:

- Remove the log server from the configuration without replacing the log server – logs are distributed among other log servers.
- Replace a log server with a new log server with the same IP address – logs sent to the old log server are sent to the new log server (Refer to the configuration below).
- Replace a log server with a new log server with the same name – logs sent to the old log server are sent to the new log server (Refer to the configuration below).
- Replace a log server with a new log server with a different name and IP address – Consistency is not maintained (logs sent to the old log server might not be sent to the new log server).

To provide consistent hashing with changes, use the following commands to configure the hashing method as either Name or IP tuple in the collector group:

- Name – Set the hashing method as Name when you always replace the server that is down with the same name but a different IP.

  Use the following command to configure the hashing method as Name in the collector group for distributing the logs:

```
ACOS(config-collector-group:c1)#server-distribution-hash name
```

- IP tuple – Set the hashing method as an IP tuple if you want the log distribution to be consistent based on the log-server IP.

  Use the following command to configure the hashing method as an IP tuple in the collector group for distributing the logs:

```
ACOS(config-collector-group:c1)#server-distribution-hash ip-tuple
```

NOTE:

For an active template, you cannot change:

- log-distribution method from round-robin to hash or vice-versa.
- server-distribution-hash from name to IP-tuple or vice versa.

In the following example, hashing method is configured for distributing the logs:

```
ACOS(config)#acos-events message-selector m1
ACOS(config-msg-selector:m1)#rule 1
ACOS(config-msg-selector:m1-rule:1)#message-id slb all
ACOS(config-msg-selector:m1-rule:1)#exit
ACOS(config-msg-selector:m1)#exit
ACOS(config)#acos-events log-server l1 11.11.11.5
ACOS(config)#port 514 udp
ACOS(config)#acos-events collector-group c1 udp
ACOS(config-collector-group:c1)#log-distribution hashing
ACOS(config-collector-group:c1)#log-server l1 514
ACOS(config-collector-group:c1)#exit
ACOS(config)#acos-events collector-group c2 udp
ACOS(config-collector-group:c2)#log-distribution hashing
ACOS(config-collector-group:c2)#log-server l1 514
ACOS(config-collector-group:c2)#exit
ACOS(config)#acos-events template t1
ACOS(config-template:t1)#message-selector m1
ACOS(config-template:t1-selector:m1)#collector-group c1
ACOS(config-template:t1-selector:m1-colle...)#collector-group c2
ACOS(config-template:t1-selector:m1-colle...)#exit
ACOS(config-template:t1-selector:m1)#exit
ACOS(config-template:t1)#exit
```

Emailing Log Messages

The following topics are covered:

Overview of Email Logging

You can configure the ACOS device to email log messages, using email log filters. By default, emailing of log messages is disabled.

Log email filters consist of the following parameters:

- Filter ID – Filter number, 1-8.
- Conditions – One or more of the following:
  - Severity – Severity levels of messages to send in email. If you do not specify a message level, messages of any severity level match the filter and can be emailed.
  - Software Module – Software modules for which to email messages. Messages are emailed only if they come from one of the specified software modules. If you do not specify a software module, messages from all modules match the filter and can be emailed.
  - Regular Expression (Patterns and Operators) – Message text to match on. Standard regular expression syntax is supported. Only messages that meet the criteria of the regular expression can be emailed. The regular expression can be a simple text string or a more complex expression using standard regular expression logic. If you do not specify a regular expression, messages with any text match the filter and can be emailed.

    The operators (AND, OR, NOT) specify how the conditions must be compared. (See Boolean Operators.)
- Trigger option – Specifies to send the matching messages immediately.

Boolean Operators

A logging email filter consists of a set of conditions joined by Boolean expressions (AND / OR / NOT).

The CLI Boolean expression syntax is based on Reverse Polish Notation (also called Postfix Notation), a notation method that places an operator (AND, OR, NOT) after all of its operands (in this case, the conditions list).

After listing all the conditions, specify the Boolean operator(s). The following operators are supported:

- AND – All conditions must match in order for a log message to be emailed.
- OR – Any one or more of the conditions must match in order for a log message to be emailed.
- NOT – A log message is emailed only if it does not match the condition

NOTE: For more information about Reverse Polish Notation, see the link: http://en.wikipedia.org/wiki/Reverse_Polish_notation.

Configuring Email Log Settings

The following topics are covered:

Using the GUI to Configure Email Logging Settings

To configure Email logging settings in the GUI:

1. Hover over **System** in the navigation bar, and click **Settings**.
2. Click **Logging** in the menu bar.
3. In the Level field, select the log level you want to enable.
4. The Buffer field contains two optional configuration choices:
   a. To change the maximum number of log messages to buffer before sending them in email, edit the number in the field on the left. You can specify 16-256 messages. The default is 50.
   b. To change the number of minutes the ACOS device waits before sending all

buffered messages, edit the number in the field on the right. This option takes effect if the buffer does not reach the maximum number of messages allowed. You can specify 10-1440 minutes. The default is 10.

5. In the Email Addresses field, specify the Email addresses to which the log files will be sent.
6. In the Filters section:
   a. Specify a filter ID (1-8) and regular expression filter in the Filter section.
   b. To immediately send matching messages in an email instead of buffering them, select Trigger. Otherwise, matching messages are buffered until the message buffer becomes full or the send timer for emailed log messages expires.
   c. Click **Save Filter**.
   d. Repeat the process if you want to create multiple filters.
7. When finished configuring log settings, click the **OK** button at the bottom of the page.

Using the CLI to Configure Email Logging Settings

This section contains CLI examples of Email logging configuration.

The following command configures the ACOS device to buffer log messages to be emailed. Messages will be emailed only when the buffer reaches 32 messages, or 30 minutes passes since the previous log message email, whichever happens first.

```
ACOS(config)# logging email buffer number 32 time 30
```

The following command resets the buffer settings to their default values.

```
ACOS(config)# no logging email buffer number time
```

The following command configures a filter that matches on log messages if they are information-level messages and contain the string “abc”. The **trigger** option is not used, so the messages will be buffered rather than emailed immediately.

```
ACOS(config)# logging email filter 1 "level information pattern abc and"
```

The following command reconfigures the filter to immediately email matching messages.

```
ACOS(config)# logging email filter "1 level information pattern abc and"
trigger
```

ACL on Interface Monitoring

Access Control Lists (ACLs) are used to permit or deny incoming traffic on interfaces. They can be applied to both data and management interfaces. ACL provides visibility through the following capabilities:

- Logging – Logs are generated whenever an ACL is hit.
- Hit count – Tracks the number of times an ACL rule (permit or deny) is hit.

The management hit count is displayed only when:

- The ACL is bound to the management interface.
- The `enable-management` command is used to bind the ACL to the management interface.

NOTE:

- Ethernet information is only retrieved from the `enable-management` service and not from the access-list.
- For access-list configurations, only the `eq` operator is supported for IP ports. Currently, operators such as `lt` or `gt` are not supported and will be ignored.

Handling ACLs on Data and Management Interfaces

ACLs applied on data and management interfaces support logging and hit count. The logs can be viewed using the `show log` command and the hit count can be viewed using the `show access-list` command. For more information, see *Command Line Interface Reference*.

Example of `show log` for data interface:

```
ACOS(config)#show log
Sep 24 2024 11:30:13 Notice       [ACOS]:[eth 2] ICMP type 3 code 3
66.66.66.105 > 66.66.66.96  ACL rule permitted this packet (ACL 5)
Sep 24 2024 11:30:13 Notice       [ACOS]:[eth 2] ICMP type 8 code 0
66.66.66.105 > 66.66.66.96  ACL rule permitted this packet (ACL 5)
```

Example of `show access-list` for data interface:

```
ACOS(config)#show access-list
access-list 5 4 permit host 66.66.66.105 log Data plane hits: 37
```

When ACLs are applied to the management interface, the hit counts are generated. This helps to monitor both permitted and denied traffic, track the total number of hits, and evaluate the effectiveness of ACLs.

Example of `show log` for management interface:

```
ACOS(config)#show log
Sep 24 2024 11:27:53 Notice      [ACOS]: TCP 192.30.8.183:54420 >
10.64.19.96:22  ACL rule permitted this packet (ACL team_1)
Sep 24 2024 11:27:52 Notice      [ACOS]: TCP 192.30.8.183:54420 >
10.64.19.96:22  ACL rule permitted this packet (ACL team_1)
Sep 24 2024 11:27:52 Notice      [ACOS]: TCP 192.30.8.183:54420 >
10.64.19.96:22  ACL rule permitted this packet (ACL team_1)
Sep 24 2024 11:27:51 Notice      [ACOS]: TCP 192.30.8.183:54420 >
10.64.19.96:22  ACL rule permitted this packet (ACL team_1)
```

Example of `show access-list` for management interface:

```
ACOS# show access-list ipv4 50
Management hit count: 175
access-list 50 permit 198.162.12.0 0.0.0.255 Data plane hits:
0, Management plane hits: 175
```

Simple Network Management Protocol (SNMP)

For more information on Simple Network Management Protocol, see *SNMP MIB Reference*.

Link Monitoring

The ACOS device supports link monitoring with automated link disable or session clear.

The following topics are covered:

Overview of Link Monitoring

This feature monitors the link state of Ethernet data interfaces. You can monitor Ethernet data interfaces for the following types of events:

- Link up
- Link down

The feature monitors the link state on a set of Ethernet data interfaces. If the monitored event is detected, the ACOS device evaluates current link status for all the bound monitors and applies the specified action to another set of interfaces.

This feature is especially useful in cases where you want to disable both ACOS interfaces used by traffic flows through the ACOS device, if the link on either interface goes down.

NOTE:

- For an example, see "LACP Passthrough" in the *Network Configuration Guide*.
- You can configure the feature for individual Ethernet data ports. Configuration of the feature for logical interfaces such as Virtual Ethernet (VE) interfaces is not supported.

Link Monitoring Actions

You can configure the ACOS device to take one of the following actions when the specified event type (link up or link down) is detected on a monitored Ethernet data interface:

- Clear sessions
- Disable the link on one or more other interfaces
- Enable the link on one or more other interfaces

The clear session option removes sessions from the session table. You can configure the feature either to clear data sessions only, or to clear sessions of all types.

Link Monitor Template Sequence Numbers

Each monitor template can contain the following types of entries:

- Monitoring entries – A monitoring entry monitors for a specific event type (link up or link down) on a specific Ethernet data interface.
- Action entries – An action entry specifies the action to take when monitored events are detected.

When you configure an entry of either type, you must specify a sequence number, 1-16. The sequence numbers assigned to monitoring entries specify the order in which to check the monitored ports for the specified event type.

Likewise, the sequence number assigned to action entries specify the order in which to apply the actions.

The sequence number can be important in cases such as the following:

- The order in which link state changes take place can affect whether traffic loops occur.
- The template contains action entries that clear sessions and that disable or enable links. In this case, the sequence number controls whether the sessions are cleared before or after the link states are changed. Normally, it is recommended to clear the sessions first, before changing the link states.

The monitor with the lowest sequence number is performed first, then the monitor with the next lowest sequence number is performed, and so on. For example, monitor 1 is performed first, monitor 2 is performed second, and so on. Likewise, if the monitored events are detected, action 1 is performed first, then action 2, and so on.

Link Monitor Template Logical Operators

Each monitor template uses one of the following logical operators:

- **AND** – The actions are performed only if all the monitored events are detected. (This is the default).
- **OR** – The actions are performed if any of the monitored events is detected.

The logical operator applies only to monitor entries, not to action entries. For example, if the logical operator is OR, and at least one of the monitored events occurs, all the actions configured in the template are applied.

You can configure the entries in any order. In the configuration, the entries of each type are ordered based on sequence number.

Configuring Link Monitor

To configure link monitoring with automated link disable or session clear:

1. Configure a monitoring template. Within the template, specify the following parameters:

- Links (Ethernet data ports) to monitor
- Actions to perform on other links, if the monitored event is detected:
  - Clear sessions
  - Disable links
  - Enable links
- (Optional) Set the comparison operator for the monitoring entries:
  - AND – The actions are performed only if all the monitored events are detected.
  - OR – The actions are performed if any of the monitored events is detected.

    Link monitoring template commands are available through global configuration mode (See the *Command Line Interface Reference* guide). A similar set of commands are available through slb template monitor mode (See the *Command Line Interface Reference* guide).

2. Active the monitoring template.

You can configure and activate up to 16 monitor templates. A monitor template does not take effect until you activate it.

The following commands configure monitor template 1 and the physical data interfaces and events to monitor:

```
ACOS(config)# system mon-template monitor 1
ACOS(config-monitor)# monitor link-down eth 5 sequence 1
```

```
ACOS(config-monitor)# monitor link-down eth 6 sequence 2
ACOS(config-monitor)# monitor link-down eth 9 sequence 3
ACOS(config-monitor)# monitor link-down eth 10 sequence 4
```

The following commands configure the actions to take when a monitored event is detected.

```
ACOS(config-monitor)# action clear sessions sequence 1
ACOS(config-monitor)# action link-disable eth 5 sequence 2
ACOS(config-monitor)# action link-disable eth 6 sequence 3
ACOS(config-monitor)# action link-disable eth 9 sequence 4
ACOS(config-monitor)# action link-disable eth 10 sequence 5
ACOS(config-monitor)# exit
```

The following command activates the template, to place it into effect:

```
ACOS(config)# system template-bind monitor 1
```

Based on this configuration, when a link-down event is detected for Ethernet port 5 OR 6 OR 9 OR 10, sessions are cleared first. Then the remaining links are disabled, in the following sequence: 5 AND 6 AND 9 AND 10.

NOTE: The **clear session** command clears only data sessions. To clear all sessions, use **clear sessions all**.

ACE Monitoring and Analytics

The ACE (Analytics Computing Engine) implements visibility and analytics as a base ACOS function. ACE collects data from counter library metrics per connection for statistical analysis.

Visibility of anomalies like traffic spikes and traffic failures, provides some guidance on seasonality of traffic to help the user with resource assignment.

The following topics are covered:

ACE Monitoring and Show Command Options

ACE monitoring options can be configured in Visibility Configuration mode in CLI using the **visibility** command.

The following topics are covered:

Discovery Monitoring

Monitoring samples are collected for every ACOS partition receiving and generating the samples, creating keys as specified in the partition configuration.

Related Commands

Example of monitoring commands in CLI:

- Monitor x-flow source information:

```
ACOS(config-visibility)# monitor xflow source
```

Granularity

The granularity can be configured by the user for all rate based calculations. Granularity is the time selection interval specified, for example, a default value of 5 seconds. to collect monitoring information for each monitoring parameter. Supported values are 1 to 300 seconds.

Using the **granularity** command.

```
ACOS (config-visibility)# granularity 60
```

Cumulative Updates

This is a feature that can be enabled when creating the ACE monitor. the statistics counter library on if sends cumulative updates from ACOS .

Collection of Statistics

The following values are calculated and the data is further used for analysis:

- **Minimum**
- **Maximum**
- **Mean**
- **Standard deviation**
- **Threshold**: The highest value that was observed for the given metric that was not an anomaly.
- **Continuous learning**: Through continuous monitoring of data or x-flow traffic, A sample is considered if it is not anomalous. Also, when 3 consecutive spikes, are detected, it is considered an anomaly.

Anomaly Detection

Sensitivity settings help in anomaly detection. 3 consecutive spikes mean the monitored parameter is anomalous. There are two settings:

- **Low sensitivity**: This is what the system defaults to. In this case, any sample that is greater than 2 times the threshold is a spike.
- **High sensitivity**: Any sample that is greater than 2 times the standard deviation mean is a spike.

Related CLI Commands

The important anomaly detection related CLI commands are as follows:

- Enable anomaly detection in Visibility Configuration mode:

```
ACOS(config-visibility)# anomaly-detection
```

- Configure sensitivity for anomaly detection

```
ACOS(config-visibility-anomaly-detection)# sensitivity high
```

Notification Templates

The following topics are covered:

Details

ACE supports for primary and secondary level monitoring. Primary and Secondary key types can be specified from CLI. The module creates monitoring entities based on these keys. ACOS evaluates these baseline metric values. The base line values calculated are **minimum**, **maximum**, **mean** and **standard deviation**. Using these baseline values, 'anomalies are detected or cleared.

This feature adds support to send notifications on different events. The host that should receive these notifications can be configured from the CLI.

Notification Events

Notifications are sent for the following events:

- Monitoring entity creation
- Monitoring entity deletion

- Anomaly detection
- Anomaly clear

Notification Data

The notification data contains:

- Parameter name.
- The type of information (source / destination/ service / Source NAT IP)
- Notification type (entity created / entity deleted /anomaly detected / anomaly cleared)
- Processed metric values (minimum, maximum, current, threshold, mean)
- Anomaly status for every metric.
- Entity type (primary / secondary)

Notification Template Properties

A maximum of 8 notification templates can be configured on ACOS. These templates are global, and can be bound to any partition. Notification templates have the following properties:

- By default, a template is active after creation.
- An incomplete template cannot be bound to a partition.
- Template must be disabled before modification, unless it is not bound.
- Template cannot be deleted when it is bound.

Notification Template Examples

The following topics are covered:

Creating a Notification Template

- Configure visibility reporting

```
ACOS(config-visibility-reporting)# template notification user1
```

- Configure the host with an IPv4 address

```
ACOS(config-visibility-reporting-notifica...)#host ip 1.1.1.1
!
```

- Use the management port option for notifications

```
ACOS(config-visibility-reporting-notifica...)# host ip 1.1.1.1 use-mgmt-
port
```

- To use IPv6 address as host

```
ACOS(config-visibility-reporting)# template notification ipv6
ACOS(config-visibility-reporting-notification)# host ip6 1::1 use-mgmt-
port
```

Verifying the Configuration

```
ACOS(config-visibility-reporting)#show run visibility
!Section configuration: 94 bytes
!
visibility
  reporting
    template notification ipv6
      host ip6 1::1 use-mgmt-port
```

```
!
```

To use URI as a host, use the command:

```
ACOS(config-visibility-reporting-notifica...)#host host-name
a10networks.com
ACOS(config-visibility-reporting-notifica...)#protocol http 80
```

NOTE: The default protocol is HTTPS and port 443.

Verifying the Configuration

```
ACOS(config-visibility-reporting)#show run visibility
!Section configuration: 106 bytes
!
visibility
  reporting
    template notification user1
      host ip 1.1.1.1
      protocol http 80
!
```

Deleting a Template

```
ACOS(config-visibility-reporting)#no template notification user1
ACOS(config-visibility-reporting)#sh run visibility
!Section configuration: 0 bytes
!
```

Enabling a Template

Enable or bind a complete template

```
ACOS(config-visibility-reporting-notifica...)#host ip 1.1.1.1
ACOS(config-visibility-reporting-notifica...)#enable
ACOS(config-visibility-reporting-notifica...)#show run visibility
!Section configuration: 82 bytes
!
visibility
  reporting
    template notification test
      host ip 1.1.1.1
```

NOTE: Host details are must to enable any template. Incomplete templates cannot be enabled.

Disabling a Template

Disable template using:

```
ACOS(config-visibility-reporting-notifica...)#disable
ACOS(config-visibility-reporting-notifica...)#show run visibility
```

```
!Section configuration: 97 bytes
!
visibility
  reporting
    template notification user1
      host ip 1.1.1.1
      disable
!
```

Binding a Template

To bind a template, enable monitoring and notifications for the template.

```
ACOS(config-visibility)# monitor traffic dest
ACOS(config-visibility-monitor:traffic)# template notification user1
ACOS(config-visibility-monitor:traffic)# show run visibility
!Section configuration: 138 bytes
!
visibility
  reporting
    template notification test
      host ip 1.1.1.1
  monitor traffic dest
    template notification test
!
```

Configuring Visibility on ACOS

To configure a new notification template for visibility on vThunder, configure IPv6 AAAA using and then the visibility reporting notifications using the following commands:

```
ACOS(config)# visibility
ACOS(config-visibility)# reporting
ACOS(config-visibility-reporting)# notification-template user1
!
```

1. Template host configuration for IPV6 AAAA.
2. Configure the host IPv6 address.

```
ACOS(config-visibility-reporting-notifica...)# host ip 6.6.6.6 use-
mgmt-port
```

3. Protocol to use. Configure the http port to use <1-65535>:

```
ACOS(config-visibility-reporting-notifica...)# protocol http 8080
```

4. Relative URI.

```
ACOS(config-visibility-reporting-notifica...)# relative-uri companyuri/
```

5. Enable / disable a template.
6. The show command for operation support.

```
ACOS# show run visibility
!Section configuration: 167 bytes
!
visibility
  monitor dest
  reporting
    notification-template test
      host ip 6.6.6.6 use-mgmt-port
      protocol http 8080
      relative-uri testuri/
```

Visibility and Analytics Monitoring

ACOS users with critical infrastructure can monitor network resources through visibility and analytics. ACOS supports a logging system to monitor resources like system interface statistics, virtual server, remote server, and virtual port.

All ACOS 5.2.0 platforms, ACOS Thunder, vThunder, and Thunder Container, have native support for Prometheus. A Prometheus server can query various stats and rate metrics for analysis as specified in its configuration.

Functionalities

Users and systems can use the following functionalities:

- Create and view dashboards to communicate with the Prometheus server using a Visualization and Analytics tool, like Grafana.
- Query any API statistics configured in the Prometheus server's YAML file.
- View the default metrics logged, when no filters are specified:
  - All Interface Metrics
  - CPU Usage
  - Memory Usage

Configuration Example

For example, to monitor a particular object or class of objects, add that object or class of objects to the parameters (params) in the Prometheus YAML file as follows.

Sample prometheus.yml Configuration Snippet

```
global:
  scrape_interval: 5s
  evaluation_interval: 5s

scrape_configs:
  - job_name: 'prometheus_job_fetch_metrics'
    scheme: 'https'
        tls_config:
                insecure_skip_verify: true
        static_configs:
        - targets: ["10.65.22.161:443"]
        metrics_path: '/metrics'
        params:
                username:["username"]
                password:["password"]
        api_endpoint: ["/slb/virtual-server/vs1/stats","/slb/service-
group/stats", "/slb/virtual-server/vs1/rate"]
```

The descriptions for the parameters are as follows:

Parameter	Description
scrape_interval	Time intervals for querying the statistics fields.

Parameter	Description
target	Hostname and port that the Exporter is running on and port must be the same as the port number of the webserver on ACOS Prometheus client.
api_endpoint	URI endpoint that the Exporter intercepts to invoke the appropriate aXAPI. (A comma-separated list of APIs can be provided here for a single host.)

In this scenario, once the Prometheus server is up and running, it invokes the query every 15 seconds, as specified in the “scraping interval.api_endpoint”. The API names are passed to them as parameters. The ACOS Prometheus client creates the gauge metrics for each statistics field and exposes the metrics to the Prometheus server.

NOTE: To enable the Prometheus support and learn about the endpoints that are supported, refer to ACOS Prometheus Exporter.

Secondary Monitoring on ACOS

The following topics are covered:

Details

Primary key type for ACE monitoring can be specified from ACOS CLI. A secondary level entity can be configured to monitor each entity. Traffic anomalies can be detected using these baseline values.

User can specify the secondary level key type from CLI. Secondary level entities are created under the primary to help investigate further on primary entity. You can analyze which secondary entity is responsible for the anomaly. Configure using the **`secondary-monitor`** command.

```
vThunder(config-visibility)# monitor traffic dest
vThunder(config-visibility-monitor:traffic)# secondary-monitor service
```

Anomaly Detection Example

When a visibility is enabled on a sample SLB SSL template:

```
!
visibility
  monitor Service secondary-monitor source
  granularity 1 !
```

If anomaly is caused at client side on the secondary entity, the following show output displays the secondary entity responsible for the anomaly.

```
ACOS# show visibility monitored-entity detail
Entity: ip 12.12.12.203
metric-name    min     max      mean    threshold    error         anomaly
Fwd pkts       126     140      133     140          2.581687      No
Rev pkts       125     140      133     140          2.637233      No
Fwd Bytes      11264   12544    11987   12544        232.692383    No
Rev bytes      14625   16380    15652   16380        308.556244    No
64B_pkt        151     168      160     168          3.108687      No
64-512B_pkt    100     112      107     112          2.109786      No
connections    25      28       26      28           0.527446      No
```

```
sec-entities
Entity: ip 12.12.12.49
metric-name   min    max      mean     threshold   error          anomaly
Fwd pkts      126    140      133      140         2.581687       No
Rev pkts      125    140      133      140         2.637233       No
Fwd Bytes     11264  12544    11987    12544       232.692383     No
Rev bytes     14625  16380    15652    16380       308.556244     No
64B_pkt       151    168      160      168         3.108687       No
64-512B_pkt   100    112      107      112         2.109786       No
connections   25     28       26       28          0.527446       No
```

Session Indexing

The following topics are covered:

Details

When “Session Indexing” is enabled for an application, administrators can view the sessions that are uploading data to the monitoring entities. The primary use case of “Session indexing” is to make the debugging easier for the administrators.

CLI Configuration

To enable session indexing, use the following CLI command:

```
ACOS(config)# visibility
ACOS(config-visibility)# monitor traffic dest
ACOS(config-visibility-monitor:traffic)# index-sessions
```

To enable per CPU list for session indexing, use the following CLI command:

```
ACOS(config-visibility-monitor:traffic)# index-sessions per-cpu
```

To disable session indexing, use the following CLI command:

```
ACOS(config-visibility-monitor:traffic)# no index-sessions
```

To disable per CPU list, use the following CLI command:

```
ACOS(config-visibility-monitor:traffic)# no index-sessions per-cpu
```

Gateway Health Monitoring

This chapter describes how to configure gateway health monitoring.

The following topics are covered:

NOTE: For information about health monitoring of servers in load balancing configurations, see the "**Health Monitoring**" chapter in the Application Delivery Controller Guide.

Gateway Health Monitoring Overview

Gateway health monitoring uses ARP to test the availability of nexthop gateways. When the ACOS device needs to send a packet through a gateway, the ACOS device begins sending ARP requests to the gateway.

- If the gateway replies to any ARP request within a configurable timeout, the ACOS device forwards the packet to the gateway.
- The ARP requests are sent at a configurable interval. The ACOS device waits for a configurable timeout for a reply to any request. If the gateway does not respond to any request before the timeout expires, the ACOS device selects another gateway and begins the health monitoring process again.

The following items clarify the implementation of gateway health monitoring on your ACOS device:

- Gateway health monitoring is useful in cases where there is more than one route to a destination. In this case, the ACOS device can discard the routes that use unresponsive gateways. If there is only one gateway, this feature is not useful.
- Gateway health monitoring and SLB server health monitoring are independent features. If a gateway fails its health check, a server reached through the gateway is not immediately marked down. The status of the server still depends on the result of the SLB server health check.
- If you plan to use gateway health as a failover trigger for VRRP-A high availability, a different configuration option is required.

NOTE: For more information, see "**Dynamic Priority Reduction**" in *Configuring VRRP-A High Availability*.

Gateway Health Monitoring Configurable Parameters

The following parameters are used for gateway health monitoring:

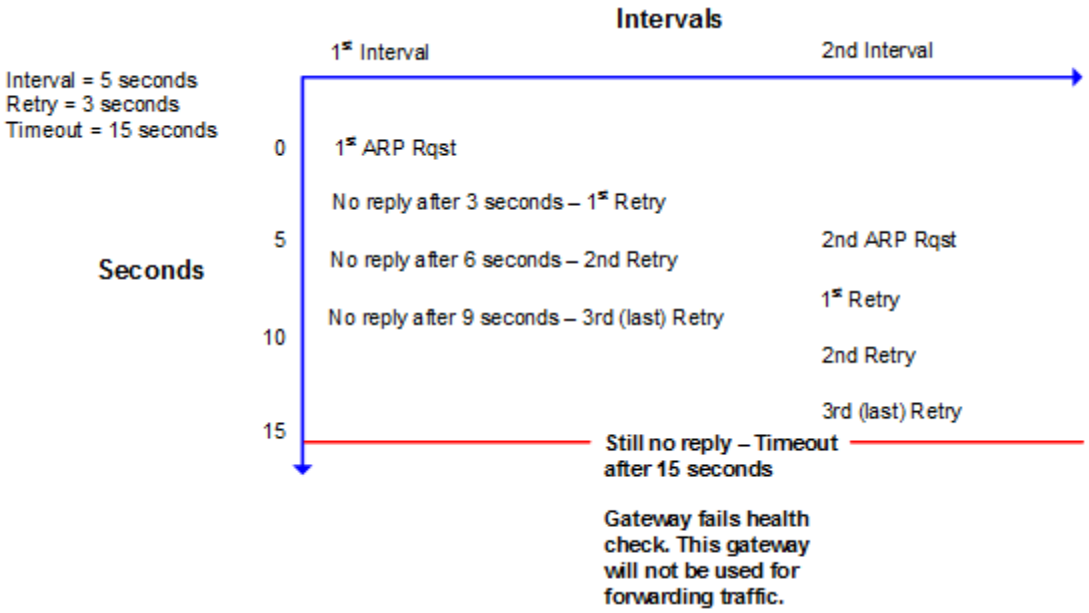
- Interval – The interval specifies the amount of time between health check attempts (ARP requests), and can be 1-180 seconds. The default is 5 seconds.

- Timeout – The timeout specifies how long the ACOS device waits for a reply to any of the ARP requests, and can be 1-60 seconds. The default is 15 seconds.

Using the default gateway health monitoring settings, a gateway must respond to a gateway health check within 15 seconds. The following Figure 19 shows how a gateway health check times out using the default settings.

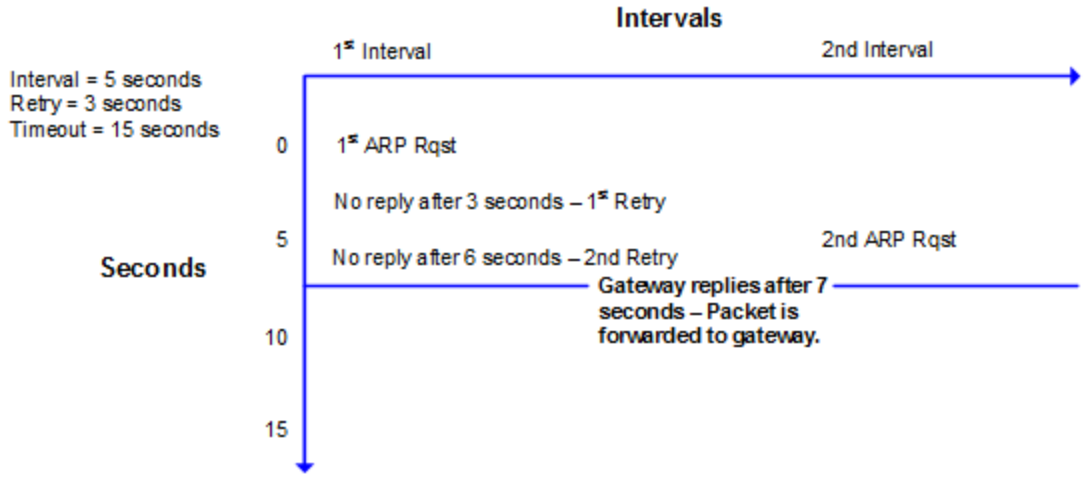
NOTE: It is recommended not to use a timeout value smaller than 3 times the interval value. This is especially true for short interval values.

Figure 19 : Gateway Health Check Using Default Settings – Timeout



The following Figure 20 shows an example in which a gateway responds before the timeout.

Figure 20 : Gateway Health Check Using Default Settings – Gateway Responds



Configuring Gateway Health Monitoring

The following topics are covered:

Gateway health monitoring is disabled by default.

Using the GUI to Configure Gateway Health Monitoring

To enable gateway health monitoring from the GUI:

1. Navigate to **ADC > SLB > Global**.
2. Select the checkbox in the Gateway Health Check field.
3. Configure the interval and timeout values as desired.
4. Click **Update**.

Using the CLI to Configure Gateway Health Monitoring

To enable gateway health monitoring from the CLI, use the **gateway-health-check** command at the SLB common configuration level of the CLI. The following command enables gateway health monitoring with the default settings:

```
ACOS(config)# slb common
ACOS(config-common)# gateway-health-check
```

The following command displays gateway health monitoring statistics:

```
ACOS(config)# show health gateway
Gateway health-check is enabled
Interval=5, Timeout=15
Total health-check sent         :  10
Total health-check retry sent   :  2
Total health-check timeout      :  1
```

Multiple Port-Monitoring Mirror Ports

The following topics are covered:

Overview of Port Mirroring

Port mirroring is used to send copies of network packets (inbound, outbound, or both) from a monitored port to a separate port for monitoring. This is often used for the purpose of troubleshooting, debugging, and for analyzing traffic.

Up to four physical Ethernet data interfaces can be configured as mirror ports.

L3V port mirroring can be based on the port and optionally, the VLAN ID.

NOTE: The port mirroring and monitoring feature is supported on all A10 Thunder Series devices that are supported with this software release; it is NOT supported on vThunder platforms.

- In earlier 2.7.2.x releases, this feature is supported on A10 Thunder Series and FTA-enabled models only.
- Since mirrored packets are handled by the switching ASIC directly, not the CPU, do not use the **debug packet** command to test packet mirroring on FTA devices.
- Instead, verify that packets are received on the neighboring devices.

Configuring Mirror Ports

To configure mirror ports, use the **mirror-port** command at the global configuration level:

The following commands configure four mirror ports:

```
ACOS(config)# mirror-port 1 ethernet 4
ACOS(config)# mirror-port 2 ethernet 7 output
ACOS(config)# mirror-port 3 ethernet 9
ACOS(config)# mirror-port 4 ethernet 3 input
```

The **output** and **input** parameters used in these commands must match the ones you use when configuring the monitor port. The **output** parameter enables outbound traffic on the monitored port to be copied and sent out on the mirror port. The **input** parameter enables inbound traffic on the monitored port to be copied and sent out on the mirror port.

The **show mirror** command verifies the mirror configuration:

```
ACOS(config)# show mirror
Mirror Ports 1:          Input = 4        Output = 4
Mirror Ports 2:          Input = None     Output = 7
Mirror Ports 3:          Input = 9        Output = 9
Mirror Ports 4:          Input = 3        Output = None
```

At this point, monitoring is not yet enabled on any ports. The next step is to access the configuration level for Ethernet interface 1 and enable monitoring of its traffic. For example:

```
ACOS(config)# interface ethernet 1
ACOS(config-if:ethernet:1)# monitor input 1
```

The following command displays the mirror configuration:

```
ACOS(config-if:ethernet:1)# show mirror
Mirror Ports 1:          Input = 4        Output = 4
 Ports monitored at ingress : 1
Mirror Ports 2:          Input = None     Output = 7
Mirror Ports 3:          Input = 9        Output = 9
Mirror Ports 4:          Input = 3        Output = None
```

The output now lists the monitoring configuration on port 1, which uses mirror 1.

The following commands attempt to enable monitoring of ingress traffic on port 2, using mirror 2. However, this configuration is not valid because mirror 2 can accept egress traffic only.

```
ACOS(config)# interface ethernet 2
ACOS(config-if:ethernet:2)# monitor input 2
Please configure mirror port first.
```

Likewise, the **both** option is not valid in this case:

```
ACOS(config-if:ethernet:2)# monitor both 2
Please configure mirror port first.
```

The following configuration is valid, since mirror 2 is configured to accept only the egress traffic of monitored ports:

```
ACOS(config-if:ethernet:2)# monitor output 2
```

Here is the mirror configuration now:

```
ACOS(config-if:ethernet:2)# show mirror
Mirror Ports 1:          Input = 4        Output = 4
 Ports monitored at ingress : 1
Mirror Ports 2:          Input = None     Output = 7
 Ports monitored at egress  : 2
Mirror Ports 3:          Input = 9        Output = 9
Mirror Ports 4:          Input = 3        Output = None
```

The ingress traffic received on port 2 can be monitored, if a mirror that accepts ingress traffic is used. In this example, mirrors 1, 3, and 4 can accept ingress traffic. The following command configures use of mirror 4 for ingress traffic received on port 2:

```
ACOS(config-if:ethernet:2)# monitor input 4
```

The following is the mirror configuration after this change:

```
ACOS(config-if:ethernet:2)# show mirror
Mirror Ports 1:          Input = 4        Output = 4
 Ports monitored at ingress : 1
Mirror Ports 2:          Input = None     Output = 7
 Ports monitored at egress  : 2
Mirror Ports 3:          Input = 9        Output = 9
Mirror Ports 4:          Input = 3        Output = None
 Ports monitored at ingress : 2
```

For brevity, this example does not show configuration of monitoring using mirror 3. Likewise, the example does not show that a mirror can accept monitored traffic from more than one interface, but this is supported.

Port Monitoring and Mirroring for aVCS Devices

Port mirroring and monitoring is supported in an aVCS setup. For example:

```
ACOS-11-Active-vMaster[1/1](config)# mirror-port 2 ethernet 13 ?
  device   Device
  input    Mirror incoming packets to this port
  output   Mirror outgoing packets to this port
```

The only distinction from the base command is that in an aVCS scenario, you must specify the device ID.

In the monitoring mode, you can specify the device to which the Ethernet belongs:

```
ACOS-11-Active-vMaster[1/1][p1]# show mirror ?
  active-vrid  VRRP-A vrid
  device       Device
  |            Output modifiers
```

The following output displays that Ethernet 2 resides on device 1:

```
interface ethernet 1/2
 cpu-process
 monitor both 1 vlan 3
```

NOTE: For more information about configuring aVCS, see *Configuring ACOS Virtual Chassis Systems*.

Removing Mirror Port Configuration

To properly remove mirror port configuration, you must remove both the monitor configuration at the interface configuration level, and also the mirror-port configuration. Removing one without the other does not completely remove the mirror port configuration and may cause problems if you try to re-configure mirror ports at a later time.

An example of removing the monitor configuration:

```
ACOS(config)# interface ethernet 2
ACOS(config-if:ethernet:2)# no monitor output 2
```

An example of removing the mirror port configuration:

```
ACOS(config)# no mirror-port 2 ethernet 7 output
```

sFlow

The following topics are covered:

sFlow Overview

ACOS can act as an sFlow agent by sampling random packets and sending statistics in an sFlow datagram to an external sFlow collector for analysis.

Some important implementation notes:

- sFlow data collection is supported only for individual Ethernet data ports and VE interfaces. Data collection cannot be performed on trunk interfaces, loopback interfaces, or on the management interface of ACOS.
- Host resource sampling is not supported:
- Application behavior sampling is not supported
- Configuration of sFlow agent behavior using SNMP is not supported

sFlow Sampling Types

sFlow supports two types of sampling. One type of sampling uses a time-based approach to retrieve statistics for a specific interface, while the other approach samples information from the packet header of every Nth packet.

The following topics are covered:

Details

- You can enable one or both sampling types on a single Ethernet data port – the sampling types are not mutually exclusive.
- The sFlow datagram includes information about the incoming interface but not the outgoing interface where sampling occurred.

- sFlow data can be exported to up to 4 sFlow collectors. This offers the benefit of redundancy, as well as the ability to send sFlow datagrams to different destinations.
- By default, the sFlow datagrams use the management IP of ACOS as the source address, but you can modify the exported sFlow datagrams to the source address of your choice.

Counter Polling Interval

This is a counter sampling method that is based on time. Statistics for an interface are gathered periodically and sent to the sFlow collector. You can specify the time interval (frequency) with which the counter interfaces statistics are gathered and sent. This global configuration will apply to all interfaces where sFlow is enabled unless a more granular value is configured at the interface level. You can enter a value ranging from 1–200 seconds. By default, this interval is set to 20 seconds.

Once ACOS has sampled statistics from a target interface, the information is collected and sent in an sFlow datagram to one or more sFlow collectors. The sFlow datagrams are listed in the Received and Transmitted counter fields in `show interface` CLI output, or on the **Network** > **Interface** page of the GUI.

Packet Sampling Rate

This is a sampling method that is based on the number of incoming packets. This sampling rate value essentially means that one packet is sampled out of every N packets. When expressed as a ratio, the packet sampling rate looks like 1/N. You can enter a value for N (the denominator) ranging from 10–1000000 packets. By default, N is equal to 1000, meaning that one packet is sampled out of every 1000 packets arriving at that interface. This global configuration will apply to all interfaces where sFlow data is collected, unless a more granular value has been configured at the interface level.

Unlike the other time-based sampling method, which gathers counter statistics for an interface, this packet-volume sampling approach gathers data about specific packets arriving at an interface. Information is extracted from the first 128 bytes in the header of the sampled packet, beginning with the MAC header. Once ACOS has

sampled packets from a specified target interface, the information is collected and sent in an sFlow datagram to one or more sFlow collectors.

Information Included in sFlow Datagrams

The following information is included in sFlow datagrams:

- Discarded packets

  Information about the discarded packets is included in the sFlow datagrams.

  For a list of Destination Unreachable codes associated with discarded packets, see section "**Input/Output Port Information**" in the following RFC: http://sflow.org/sflow_version_5.txt.

- Export CPU and Memory information

  CPU and memory information are included in the "Processor information" section of the exported sFlow datagram.

sFlow Configuration

The following topics are covered:

Configuring the sFlow Data Collection

The following list summarizes the high-level steps involved in configuring the sFlow data collection feature on an ACOS device:

1. Specify the sFlow collector where data will be exported.
2. (Optional) Enable use of the management interface's IP as the source address for outbound sFlow packets. This may be beneficial for filtering at the collector or to maintain consistency in the source address of the sFlow packets.
3. Specify the individual Ethernet data interfaces that will be sampled.
4. (Optional) Change the default data sampling rate or polling interval.

Using the GUI to Configure sFlow

1. Hover over **System** in the navigation bar, and select **Monitoring**.
2. Click **sFlow** on the menu bar. The sFlow update page appears.
3. Enter an IP address for the sFlow agent. By default, the management IP of ACOS is used, but you may enter a different address if desired.

NOTE: This information will appear in the Layer 4 information section of the sFlow datagram. Although the information is "textual" and is not used for routing decisions, it may be helpful in identifying which sFlow agent a particular packet came from, particularly in complex networks that have more than one sFlow agent.

4. (Optional) Enable Source IP use mgmt if you wish to use the ACOS device's management IP as the source address for exported sFlow datagrams. This changes the source address on the sFlow datagrams but has no effect on which interface the ACOS device selects for exporting sFlow datagrams.
5. (Optional) In the **Counter Polling Interval** field, specify the time interval at which the counter of interface statistics will be sampled. (See Counter Polling Interval for more information.)
6. (Optional) In the **Packet Sampling Rate** field, alter the default value if desired. Smaller numbers increase the sampling frequency, and larger numbers decrease the sampling frequency. (See Packet Sampling Rate for more information.)
7. (Optional) In the **Max Header** field, specify the number of bytes, from 14-512, that should be copied from a sampled packet.
8. (Optional) Select **Enable** in the CPU Usage field to enable CPU utilization monitoring.

9. (Optional) Select **Enable** in the Enable HTTP field to enable sFlow counter polling on HTTP interfaces.
10. In the Collector section:
    a. Select the **IPv4** or **IPv6** radio button for Type.
    b. Enter an IPv4 or IPv6 address in the Address field, depending on which IP protocol version was selected for Type.
    c. Enter a value in the **Port** field. This is the port on the collector where sFlow traffic will be sent. By default, traffic is sent to UDP port 6343.
    d. Click **Add** to add the sFlow collector's information
11. To enable time-based sFlow sampling, specify polling interfaces in the Polling Ethernet and/or Polling VE fields.
12. To enable packet volume-based sFlow sampling, specify sampling interfaces in the Sampling Ethernet and/or Sampling VE fields.
13. Click **Configure** to save your changes.

Using the CLI to Configure sFlow

This section contains CLI sFlow configuration examples.

The following commands specify the sFlow collector through port 5, and enable use of the management interface's IP as the source IP for the data samples sent to the sFlow collector:

```
ACOS(config)# sflow collector ip 192.168.100.3 5
ACOS(config)# sflow setting source-ip-use-mgmt
```

The following command enables counter polling for several Ethernet data interfaces, and uses the globally configured sampling rate by default:

```
ACOS(config)# sflow polling ethernet 1 to 8
```

The following command enables packet sampling for a range of Ethernet interfaces:

```
ACOS(config)# sflow sampling ethernet 3 to 5
```

The following command displays sFlow data collection statistics:

```
ACOS(config)# show sflow statistics
Interface      Packet Sample Records      Counter Sample Records
```

```
-----------------------------------------------------------------
1               3461                            81
2               20801                           81
3               0                               81
4               0                               81
5               0                               81
6               0                               81
7               0                               81
8               0                               81
9               0                               81
10              0                               81
11              0                               81
12              0                               81
-----------------------------------------------------------------
sflow total statistics
   Packet sample records:          24262
   Counter sample records:         972
   Sflow packets sent:             16257
```

sFlow Config Snippets for GUI Support

To support GUI functionality, small blocks of sFlow CLI config snippets have been added to the config beginning with ACOS 4.1.4. These sFlow snippets (below) may even appear in the config for users who are NOT using sFlow.

NOTE: If you see the sFlow config snippets below, it is recommended that you do NOT delete them, as deleting them may block access to the statistics that the GUI needs to generate certain charts.

Starting with the 4.1.4 release, the following sFlow configuration snippets may appear in the shared partition:

```
sflow setting local-collection
sflow collector ip 127.0.0.1 6343
```

And starting with the 4.1.4-P2 release, the following config snippet may appear in an L3V partition:

```
sflow collector ip 127.0.0.1 6343
```

The GUI requires presence of these sFlow snippets to display statistics in the charts that appear in the Dashboards panels (for example, FW Dashboard and SSLi Dashboard).

ACOS automatically adds these snippets to provide a better user-experience. The sFlow snippets enable local statistics collection, without which the charts in the GUI would appear blank.

Other Details

- These sFlow snippets are configured on a per-partition basis. If they are not already present, they will be automatically configured each time a user logs into the GUI and switches to that partition.
- If these sFlow config snippets are manually removed, they will be automatically added the next time a user logs into the GUI.
- The reason that the shared partition has one more command than the L3V is that the additional command “sflow setting local-collection” is only supported in the shared partition by design.

Call Home

The following topics are covered:

Overview

Call Home enables ACOS devices to send diagnostic information securely to the A10 Product Research team. The diagnostic information includes configuration and environmental data such as the ACOS device, it's form factor, deployment location, number of interfaces, L3V partitions, VLANs, and more. It also collects information on the ACOS licenses activated on the device. All the information collected is used to improve the quality of the product.

NOTE: Call Home is enabled by default from ACOS 5.2.1-P8 and 6.0.2 versions onwards. You can choose to manually disable the Call Home feature on your ACOS device.

For Call Home to work, the following conditions must be met:

- **Internet Connection** — The ACOS device must be able to reach the internet for Call Home to send diagnostic data to the A10 end-point. This feature does not work with proxy server configuration.
- **Port** — The Call Home data from your ACOS device is sent over TLS protocol using port 443 by default.

Enable Call Home

To enable Call Home, verify the internet connectivity and configure the call-home profile on the ACOS device.

```
ACOS(config)# call-home profile
ACOS(config-profile)# register
```

The `register` command enables the Call Home service. Once enabled, the Call Home data is collected from the ACOS device every 24 hours at midnight.

Disable Call Home

To disable Call Home, enter the following commands and save your configurations:

```
ACOS(config)# call-home profile
```

```
ACOS(config-profile)# deregister
```

The `deregister` command disables the Call Home service and stops the ACOS device from sending data to A10.

Verify Call Home Registration

To verify if Call Home is enabled successfully, run the following command:

```
ACOS(config)# show run call-home
!Section configuration: 33 bytes
!
call-home profile
register
!
```

Information Collected Using Call Home

The following Table 11 lists the diagnostic information collected using Call Home:

Table 11 : Diagnostic Information Collected Using Call Home

Parameter	Description
Registration Data	
Host Name	Unique name configured on the device.
UUID/Host-ID	Unique number to identify the device.
Hardware Platform	Device hardware platform such as Thunder 3350S, Thunder 7655S, vThunder, Thunder Container, and so on.
Product Model/Series-name	Model or series name provided to the device.
Platform Info	Device form factor such as hardware, Virtual Machine (VM), Bare Metal, or Container.
Virtualization Type	Device VM hypervisor type such as KVM, VMware, and so on.
Environmental Data	

Table 11 : Diagnostic Information Collected Using Call Home

Parameter	Description
CPUs	Number of physical cores.
Data CPUs	Number of data CPUs.
CPU Utilization	Each CPU average utilization. For example, {cpu1 – 50%, cpu2 – 60%, cpu3 – 40%}.
Deployment Location	Device deployment location such as on-prem, public, or private.
Public Cloud Type	Device deployed public cloud type such as AWS, Azure, OCI, and so on.
Memory Usage	Total memory utilization in the device.
SSL Cards	Number of SSL cards on the device.
GLM License Module	Information on the configured GLM license on the device such as SLB, GSLB, NGWAF, and so on.
Configuration Data	
Number of interfaces	Number of interfaces in the device.
Number of L3V partitions	Number of L3V partitions configured on the device.
Number of VLANs	Number of VLANs configured on the device.
Number of trunks	Number of trunks configured on the device.
VRRP-A state	VRRP-A state of the device.
VCS state	VCS state of the device.
Number of GLIDs	Number of GLIDs configured on the device.
Harmony Controller State	Number of Harmony Controllers configured on the device.
Number of class-lists	Number of class-lists configured on the device.
Number of access-lists	Number of access-lists configured on the device.
Number of routes	Number. of IP routes configured on the device
Number of LIFs	Number of Logical Interfaces (LIFs) configured on the device.

Table 11 : Diagnostic Information Collected Using Call Home

Parameter	Description
DNS Configured	DNS configured on the device.
Number of NTP server	Number of NTP server configured on the device.
Number of health monitors	Number of health monitors configured on the device.
Time zones	Time zone information configured on the device.
Number of IPv4 NAT pools	Number of IPv4 NAT pools configured on the device.
Number of IPv6 NAT pools	Number of IPv6 NAT pools configured on the device.
Number of real serv-ers	Number of SLB real serves configured on the device.
Number of virtual severs	Number of SLB virtual serves configured on the device.
Number of virtual ports	Number of SLB virtual ports configured on the device.
Number of templates	Number of SLB templates configured on the device.

Network Address Translation (NAT)

This part of the document describes about the Network Address Translation (NAT) and how to configure it. NAT translates the source or destination IP address of a packet before forwarding the packet.

The ACOS device supports traditional, Layer 3 IP source NAT. The IP source NAT translates internal host addresses into routable addresses before sending the host's traffic to the Internet. When reply traffic is received, the ACOS device then re-translates addresses back into internal addresses before sending the reply to the client.

The chapters in this section provide additional information about NAT features and configuration:

Configuring Dynamic NAT

Configuring Static NAT

NAT ALG Support for PPTP

Additional NAT Configuration Features

This section does not include information about NAT features for load balancing or IPv6 migration.

Configuring Dynamic NAT

This chapter describes how to configure static source NAT, in which internal addresses are dynamically translated into external addresses from a pool.

The following topics are covered:

Configuration Elements for Dynamic NAT

Dynamic NAT uses the following configuration elements:

- Access Control List (ACL) – to identify the inside host addresses to be translated
- Pool – to identify a contiguous range of external addresses into which to translate inside addresses
- Optionally, pool group – to use non-contiguous address ranges. To use a non-contiguous range of addresses, you can configure separate pools, then combine them in a pool group and map the ACL to the pool group. The addresses within an individual pool still must be contiguous, but you can have gaps between the ending address in one pool and the starting address in another pool. You also can use pools that are in different subnets.

  Pool group members must belong to the same protocol family (IPv4 or IPv6) and must use the same VRID. A pool can be a member of multiple pool groups. Up to 200 NAT pool groups are supported.

  If a pool group contains pools in different subnets, the ACOS device selects the pool that matches the outbound subnet. For example, if there are two routes to a given destination, in different subnets, and the pool group has a pool for one of those subnets, the ACOS device selects the pool that is in the subnet for the outbound route.

  The ACOS device searches the pools beginning with the first one added to the group, and selects the first match. If none of the pools are in the destination subnet, the ACOS device uses the first pool that has available addresses.
- Inside NAT setting on the interface connected to the inside host.
- Outside NAT setting on the interface connected to the Internet. Inside host addresses are translated into external addresses from a pool before the host traffic is sent to the Internet.

NOTE: The ACOS device enables you to specify the default gateway for an IP source NAT pool to use.

However, the pool's default gateway can be used only if the data route table already has either a default route or a direct route to the destination of the NAT traffic.

In this case, the pool's default gateway will override the route, for NAT traffic that uses the pool.

If the data route table does not have a default route or a direct route to the NAT traffic destination, the pool's default gateway can not be used. In this case, the NAT traffic can not reach its destination.

Configuring Dynamic IP Source NAT

The following topics are covered:

Details

To configure dynamic source NAT:

1. Configure an Access Control List (ACL) to identify the inside addresses that need to be translated.
2. Configure a pool of external addresses to use for translation. To use non-contiguous ranges of addresses, configure multiple pools and add them to a pool group.
3. Enable inside source NAT and map the ACL to the pool.
4. Enable inside NAT on the interfaces connected to the inside hosts.
5. Enable outside NAT on the interfaces connected to the Internet.

NOTE:

- In addition, on some ACOS device models, if Layer 2 IP NAT is required, you also must enable CPU processing on the NAT interfaces. (On these models, this option will be visible at the interface configuration level.)
- When configuring a NAT pool, an interface IP address cannot be included as part of the pool if `source-nat auto` is configured on the device. Additionally, if an existing NAT pool already includes an IP address that is configured on one of the interfaces on the device and the `source-nat auto` configuration is being added, it will be rejected.

Using the GUI to Configure Dynamic IP Source NAT

To configure an access list to identify the inside addresses that need to be translated:

1. Hover over **Security** in the navigation bar, and select **Access List** from the drop-down menu.
2. Select the access list type (Standard, Extended, IPv4 or IPv6) on the menu bar.
3. Click **Create**.
   a. Specify an access list number.
   b. Enter the values to filter for Remark. Otherwise, select **Entry** to select values to filter. For example, Network > Access List > Extended > Create shows the configurable fields for an Extended Access List when **Entry** is selected.
   c. Click **Create**. The new access list appears in the table of configured access lists of that type.

To configure a pool of external addresses to use for translation:

1. Hover over **ADC** in the navigation bar, and select **IP Source NAT** from the drop-down menu.
2. Select IPv4 Pool or IPv6 Pool on the menu bar.

3. Click **Create**.
    a. Enter a name for the pool.
    b. Enter the start and end addresses.
    c. Enter the network mask.
    d. If the ACOS device is deployed in transparent mode, enter the default gateway to use for NATted traffic.
    e. To use session synchronization for NAT translations, select the VRID.
    f. If the device is part of a Scaleout cluster configuration, specify the Scaleout device ID.
    g. Optionally, enable IP-RR. For information about this feature, see Mapping Allocation Method.
    h. Click **Create**.

To enable inside source NAT and map the access list to the pool:

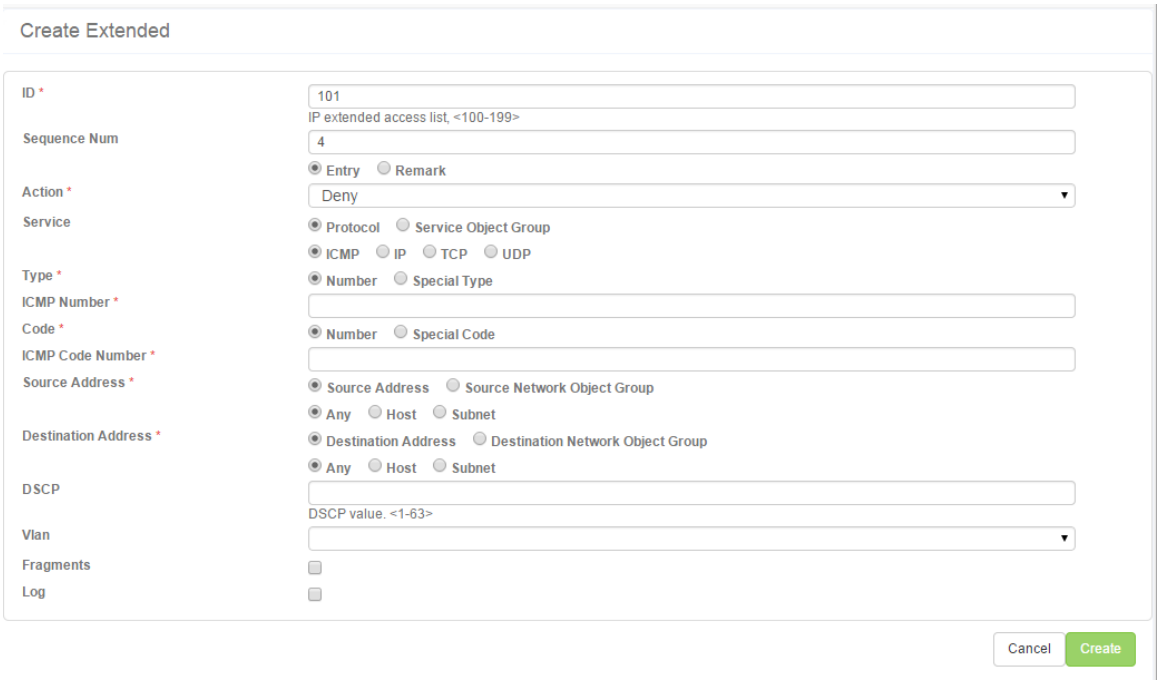
1. Hover over **ADC** in the navigation bar, and select **IP Source NAT** from the drop-down menu.
2. Select ACL Bind on the menu bar, then select IPv4 or IPv6.
3. Click **Create**.
    a. Select the access list number from the **ACL** drop-down list.
    b. Select the pool name from the **Pool** drop-down list. For IPv4 ACL Bind, select an IPv4 pool; for IPv6 ACL Bind, select an IPv6 pool.
    c. Optionally, specify a TCP Maximum Segment Life (MSL) of 1-1800 seconds for NATted session.
    d. Click **Create**. The new binding appears in the table of configured access lists of that type.

To enable inside an/or outside NAT on interfaces connected to inside hosts, the Internet or both:

1. Hover over **ADC** in the navigation bar, and select **IP Source NAT** from the drop-down menu.

2. Select NAT Interfaces on the menu bar, then select Ethernets or Virtual Ethernets.
   a. Click **Edit** in the Actions column for the interface.
   b. To enable inside NAT on the interface, select **Inside** for the IPv4 Direction and/or IPv6 Direction.
   c. To enable outside NAT on the interface, select **Outside** for the IPv4 Direction and/or IPv6 Direction.
   d. To enable both inside and outside NAT on the interface, select **Both** for the IPv4 Direction and/or IPv6 Direction.
   e. Click **Update**.
   f. Repeat for each interface connected to the internal hosts, the Internet or both.

Figure 21 : Network > Access List > Extended > Create



Using the CLI to Configure Dynamic IP Source NAT

The following command configures an ACL to specify the internal hosts to be NATted. In this example, all hosts in the 10.10.10.x subnet are to receive NAT service for traffic

to the Internet.

```
ACOS(config)# access-list 1 permit 10.10.10.0 0.0.0.255
```

The following command configures an IPv4 pool of external addresses to use for the NAT translations. In this example, 10.10.10.x addresses will be translated into 192.168.1.1 or 192.168.1.2:

```
ACOS(config)# ip nat pool pool1 192.168.1.1 192.168.1.2 netmask /24
```

The following command enables inside source NAT and associates the ACL with the pool:

```
ACOS(config)# ip nat inside source list 1 pool pool1
```

The following commands enable inside source NAT on the interface connected to the internal hosts:

```
ACOS(config)# interface ethernet 4
ACOS(config-if:ethernet:4)# ip nat inside
ACOS(config-if:ethernet:4)# exit
```

The following commands enable source NAT on the interface connected to the external hosts:

```
ACOS(config)# interface ethernet 6
ACOS(config-if:ethernet:6)# ip nat outside
```

Configuring Static NAT

This chapter describes how to configure static source NAT, in which internal addresses are explicitly mapped to external addresses.

The following topics are covered:

Configuration Elements for Static NAT

Static NAT uses the following configuration elements:

- Static mappings or an address range list – A static mapping is a one-to-one mapping of an inside address to an external address. An address range list is a contiguous range of inside addresses and external addresses to translate them into.
- Inside NAT setting on the interface connected to the inside host.
- Outside NAT setting on the interface connected to the Internet. Inside host addresses are translated into external addresses from a static mapping or a range list before the host traffic is sent to the Internet.

Configuring Static IP Source NAT

The following topics are covered:

Details

You can configure individual static source NAT mappings or configure a range of static mappings.

After configuring the static source NAT mappings, do the following:

- Enable inside NAT on the interfaces connected to the inside hosts.
- Enable outside NAT on the interfaces connected to the Internet.

Using the GUI to Configure Static IP Source NAT

To configure an individual static source NAT mapping:

1. Hover over **ADC** in the navigation bar and select **IP Source NAT**.
2. Select **Static NAT** on the menu bar.
3. Click **Create**.
    a. Enter the external address into which to translate the inside host address.
    b. Enter the inside host address to be translated.
    c. To apply VRRP-A to the address, select the VRID.
    d. Click **Create**.

To configure the static translations of a range of internal host addresses to external addresses:

1. Hover over **ADC** in the navigation bar and select **IP Source NAT**.
2. Select **NAT Range** on the menu bar.
3. Click **Create**.
    a. Enter a name for the range.
    b. Select the address type (IPv4 or IPv6).
    c. In the Local IP Address field, enter the first (lowest numbered) address in the range of inside host addresses to be translated.
    d. In the Local Netmask field, enter the network mask in the range of inside host addresses.
    e. In the Global IP Address field, enter the first (lowest numbered) address in the range of external addresses to which to translate the inside host addresses.
    f. In the Global Netmask field, enter the network mask in the range of external addresses to which to translate the inside host addresses.
    g. In the Count field, enter the number of addresses to be translated.
    h. To apply VRRP-A to the addresses, select the VRID group.
    i. Click **Create**.

To enable inside an/or outside NAT on interfaces connected to inside hosts, the Internet or both:

1. Hover over **ADC** in the navigation bar and select **IP Source NAT**.
2. Select **NAT Interfaces** on the menu bar, then select the interface type from the drop-down list.
3. Click **Edit** in the Actions column for the interface.
    a. To enable inside NAT on the interface, select Inside for the IPv4 Direction and/or IPv6 Direction.
    b. To enable outside NAT on the interface, select Outside for the IPv4 Direction and/or IPv6 Direction.
    c. To enable both inside and outside NAT on the interface, select Both for the IPv4 Direction and/or IPv6 Direction.
    d. Click **Update**.
    e. Repeat for each interface connected to the internal hosts, the Internet or both.

Using the CLI to Configure Static IP Source NAT

The following commands enable static NAT, configure an IP address range named “nat-list-1” that maps up to 100 local addresses starting from 10.10.10.97 to Internet addresses starting from 192.168.22.50, set Ethernet interface 2 as the inside NAT interface, and set Ethernet interface 4 as the outside NAT interface.

```
ACOS(config)# ip nat range-list nat-list-1 10.10.10.97 /16 192.168.22.50
/16 count 100
ACOS(config)# interface ethernet 2
ACOS(config-if:ethernet:2)# ip nat inside
ACOS(config-if:ethernet:2)# exit
ACOS(config)# interface ethernet 4
ACOS(config-if:ethernet:4)# ip nat outside
```

Support for Inter-Partition Static NAT and Overlapping IP Addresses

ACOS release 4.1.0 provides support for inter-partition routing with static NAT, similar to inter-partition routing for fixed NAT.

NOTE: For more information on **L3V Inter-partition Routing for Fixed-NAT**, see the *IPv4-to-IPv6 Transition Solutions Guide*.

To accomplish this, configure a static route in the private partitions pointing to the shared partition. This enables static NAT traffic to be routed from private partitions to the shared partition.

The **cgnv6 nat range-list** and **cgnv6 nat inside source** CLI commands are enhanced to configure this feature:

```
cgnv6 nat range-list list_name inside_start_address inside_netmask
partition inside_partition_name nat_start_address nat_netmask count num

cgnv6 nat inside source static source_address
partition inside_partition_name nat_ip_address [vrid vrid_num]
```

The **partition** *inside_partition_name* parameter is introduced to these existing commands.

This feature also adds support for overlapping addresses in the private partitions. For example – 10.10.10.1 from private partition P1 can be mapped to a NAT address 20.20.20.1 and 10.10.10.1 from private partition P2 can be mapped to a NAT address 20.20.20.2.

NAT ALG Support for PPTP

This chapter describes NAT Application Layer Gateway (ALG) support for the Point-to-Point Tunneling Protocol (PPTP):

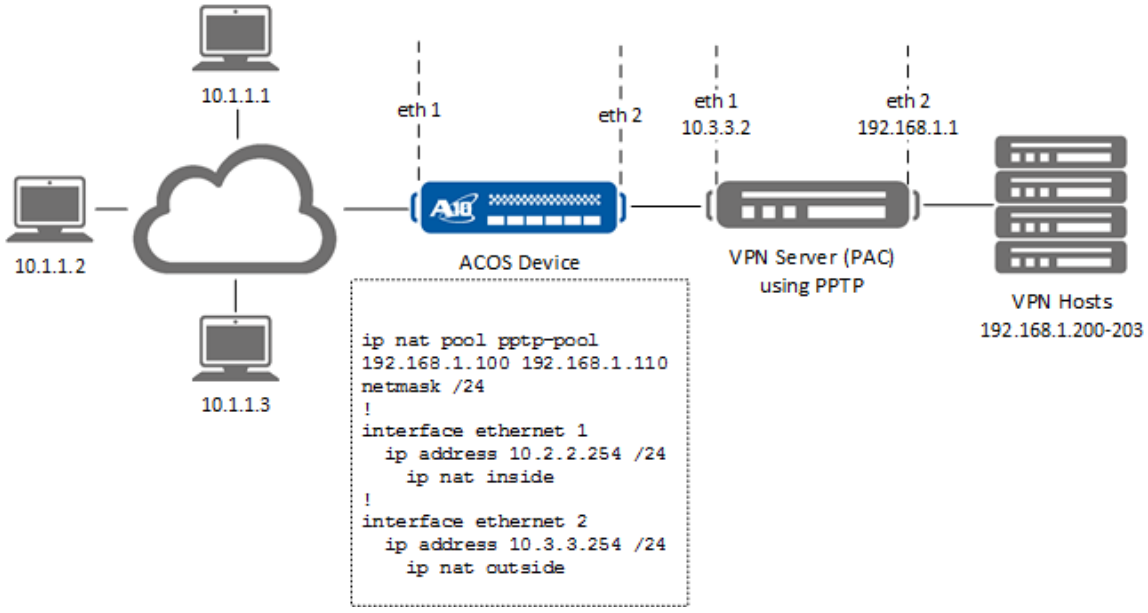
The following topics are covered:

Overview of NAT ALG Support for PPTP

NAT Application Layer Gateway (ALG) support for the Point-to-Point Tunneling Protocol (PPTP) enables clients and servers to exchange Point-to-Point (PPP) traffic through the ACOS device over a Generic Routing Encapsulation (GRE) tunnel.

PPTP is used to connect Microsoft Virtual Private Network (VPN) clients and VPN hosts. The following Figure 22 shows an example.

Figure 22 : NAT ALG for PPTP



The ACOS device is deployed between PPTP clients and the VPN server (VPN Server using PPTP). The ACOS device interface connected to the PPTP clients is enabled for inside source NAT. The ACOS device interface connected to the VPN server is enabled for outside source NAT.

Each client runs a PPTP Network Server (PNS). To set up a VPN session, the PNS sends an Outgoing-Call-Request to the PPTP Access Concentrator (PAC), which is the VPN server. The destination TCP port is the PPTP port (1723 by default). The request includes a Call that the PNS chooses.

Because multiple clients may share the same NAT address, the ACOS device must ensure that clients do not share the same Call ID as well. Therefore, the ACOS device assigns to each client a NAT Call ID (analogous to a NAT source port for TCP) and modifies the Outgoing-Call-Request to use the NAT Call ID instead.

The PAC replies to the Outgoing-Call-Request with a Call ID of its own. This is like a TCP destination port. The ACOS device does not change the PAC's Call ID. The PAC then assigns to the client an IP address belonging to the VPN subnet.

On the ACOS device, the GRE session is created after the PNS sends its reply. In the GRE session, the Call ID is used as the Layer 4 port, instead of a TCP/UDP port number.

In the NAT ALG for PPTP , client (PNS) 10.1.1.1 wants to connect to a VPN through the VPN Server (PAC) 10.3.3.2, which is using PPTP. Client 10.1.1.1 establishes a PPTP control session (on port 1723) with 10.3.3.2. When the client sends the Outgoing-Call-Request over that TCP session with its desired Call ID, the ACOS device will translate the Call ID into a unique Call ID for NAT. Once the VPN server replies with its own Call ID, the ACOS device will establish the GRE session.

After the Call IDs are exchanged, the client and server encapsulate VPN subnet traffic in a GRE tunnel. The GRE tunnel packets are sent under normal IP between 10.1.1.1 and 10.3.3.2. A GRE packet for PPTP uses a Call ID in the same way as a TCP or UDP destination port. Therefore, GRE packets from the server (10.3.3.2) will use the NAT Call ID. The ACOS device translates the NAT Call ID back into the client's original Call ID before sending the packet to the client.

NOTE: One GRE session is supported per control session, which means one call at a time is supported. In practice, PPTP is used only for VPNs, in which case multiple concurrent calls do not occur.

Configuring NAT ALG Support for PPTP

To configure an ACOS device to support NAT ALG for PPTP:

- Configure dynamic IP source NAT:
  - Configure an ACL that matches on the PPTP client subnet(s).
  - Configure an IP source NAT pool that contains the range of IP addresses into which to translate client addresses.
  - Configure an inside source NAT list, using the ACL and pool.
  - Enable inside IP source NAT on the ACOS device interface connected to the VPN clients.
  - Enable outside IP source NAT on the ACOS device interface connected to the VPN server.
- If NAT ALG support for PPTP is disabled, enable it. (The feature is enabled by default.)

NOTE: In the current release, NAT ALG support for PPTP is not supported with static NAT or NAT range lists.

The following example implements the NAT ALG for PPTP configuration shown in NAT ALG for PPTP .

The following commands configure dynamic inside source NAT.

```
ACOS(config)# access-list 1 permit 10.1.1.0 0.0.0.255
ACOS(config)# ip nat pool pptp-pool 192.168.1.100 192.168.1.110 netmask
/24
ACOS(config)# ip nat inside source list 1 pool pptp-pool
```

The following commands specify the inside NAT interface and the outside NAT interface.

```
ACOS(config)# interface ethernet 1
ACOS(config-if:ethernet:1)# ip address 10.2.2.254 255.255.255.0
ACOS(config-if:ethernet:1)# ip nat inside
ACOS(config-if:ethernet:1)# interface ethernet 2
ACOS(config-if:ethernet:2)# ip address 10.3.3.254 255.255.255.0
ACOS(config-if:ethernet:2)# ip nat outside
```

The following command displays session information:

```
ACOS(config-if:ethernet:2)# show session
```

```
Prot Forward Source          Forward Dest            Reverse Source
Reverse Dest           Age Hash

--------------------------------------------------------------------------------
---------------------------------

Gre  10.1.1.1:49152       10.3.3.2:32799      10.3.3.2:32799
192.168.1.100:2109           240 1

Tcp  10.1.1.1:2301        10.3.3.2:1723       10.3.3.2:1723
192.168.1.100:2109           240 2
```

This example shows the GRE session and the TCP session over which the GRE session is transported. For the GRE session, the number following each IP address is the PPTP Call ID. For the TCP session, the number is the TCP protocol port.

The following command displays PPTP NAT ALG statistics.

```
ACOS(config-if:ethernet:2)# show ip nat alg pptp statistics
Statistics for PPTP NAT ALG:
----------------------------
Calls In Progress:               0
Call Creation Failure:           0
Truncated PNS Message:           0
Truncated PAC Message:           0
Mismatched PNS Call ID:          0
Mismatched PAC Call ID:          0
Retransmitted PAC Message:       0
Truncated GRE Packets:           0
Unknown GRE Packets:             0
No Matching GRE Session:         0
```

Additional NAT Configuration Features

This chapter describes additional NAT configuration options available on an ACOS device:

The following topics are covered:

Faster Timeout for TCP/UDP IP NAT Translations

The current release supports faster timeout for TCP and UDP IP NAT translations. You can set the timeout for TCP or UDP sessions to a value in one of the following ranges:

- 2-31 seconds – The timeout takes place very rapidly, as close to the configured timeout as possible.
- 32-12000 seconds – The timeout value must be divisible by 60, and can be a minimum of 1 minute. If the timeout is set to a value in the range 32-59, the timeout value is rounded up to 60. Values in the range 61-11999 are rounded down to the nearest multiple of 60.

There are no GUI or CLI changes for this enhancement. The only change is in the supported ranges.

Mapping Allocation Method

The following topics are covered:

Details

By default, the ACOS device creates NAT translations by using all the protocol ports of the first IP address in a pool, then using all the ports of the next IP address, and so on.

Optionally, you can change the allocation method to IP round robin. The IP round robin allocation method provides a more even distribution of address selection, by selecting pool IP addresses in round robin fashion.

The mapping allocation method is configurable on an individual pool basis.

Using the GUI

On the configuration page for the pool, enable the IP-RR option.

Using the CLI

When configuring the pool, use the ip-rr option.

Fast Aging for IP NATted ICMP and DNS Sessions

The following topics are covered:

Details

The ACOS device uses application-aware aging for IP NATted sessions, in cases where the ACOS device performs IP NAT translation of the internal client IP addresses.

The default timeout for IP NATted ICMP sessions, as well as UDP sessions on port 53 (DNS), is set to the SLB maximum session life (MSL), which is 2 seconds by default.

NOTE: Fast aging applies to sessions between internal clients and external resources, in cases where the ACOS device performs IP NAT translation of the client addresses. This type of traffic is not SLB traffic between clients and a VIP configured on the ACOS device. For SLB DNS traffic, short aging based on the MSL time is the default aging mechanism.

The following Table 12 summarizes the session timeouts and how to configure them.

Table 12 : Session Timeout for IP NATted ICMP and UDP Sessions

Default Timeout for IP NATted ICMP or DNS Sessions	Method To Change Timeout
SLB MSL timeout (2 seconds by default) Note: For DNS, this is the default only for the default DNS port (53).	You can use either of the following methods: • Change the SLB MSL timeout. • Change the IP NAT translation timeout: ◦ ICMP – Change the IP NAT translation ICMP timeout, by specifying the number of seconds for the timeout, instead of “fast”. To be able to specify a faster timeout value, refer to Faster Timeout for TCP/UDP IP NAT Translations. ◦ DNS – Change the IP NAT translation UDP timeout for the DNS port, by specifying the number of seconds for the timeout, instead of “fast”. The timeout is configurable for individual UDP ports. To be able to specify a faster timeout value, refer to Faster Timeout for TCP/UDP IP NAT Translations.

Using the GUI

1. To change the IP NAT translation timeout for ICMP or UDP:
   a. Hover over ADC in the navigation bar, and select IP Source NAT.
   b. Select NAT Global on the menu bar.
   c. To change the IP NAT translation timeout for ICMP timeout, specify Custom or Fast for the ICMP Timeout field. If you specify custom, choose 2-1500 seconds.
   d. To change the IP NAT translation timeout for a UDP port, use the Service Timeout field. Specify UDP for the Service Type, a port number for Port, Fast or Age for Timeout Type. If you specify Fast, it will be set to the SLB MSL timeout value. If you specify Age, specify a value in one of the following

ranges:

- 2-31 seconds – The timeout takes place very rapidly, as close to the configured timeout as possible.
- 32-12000 seconds – The timeout value must be divisible by 60, and can be a minimum of 1 minute. If the timeout is set to a value in the range 32-59, the timeout value is rounded up to 60. Values in the range 61-11999 are rounded down to the nearest multiple of 60.

Using the CLI

To display the timeout that will be used for IP NATted sessions, use the following command:

```
show ip nat timeouts
```

To change the IP NAT translation timeout for ICMP, use the following command:

```
[no] ip nat translation icmp-timeout {seconds | fast}
```

To change the IP NAT translation timeout for a UDP port, use the following command:

```
[no] ip nat translation service-timeout udp  port-num {seconds | fast}
```

The port-num option specifies the UDP port number.

The fast option sets the timeout to the SLB MSL timeout, for the specified UDP port.

You can set the timeout for UDP sessions to a value in one of the following ranges:

- 2-31 seconds – The timeout takes place very rapidly, as close to the configured timeout as possible.
- 32-12000 seconds – The timeout value must be divisible by 60, and can be a minimum of 1 minute. If the timeout is set to a value in the range 32-59, the timeout value is rounded up to 60. Values in the range 61-11999 are rounded down to the nearest multiple of 60.

CLI Example

The following command displays the current IP NAT translation timeouts:

```
ACOS#show ip nat timeouts
NAT Timeout values in seconds:
TCP    UDP    ICMP
-----------------------
300    300    fast
Service 53/udp has fast-aging configured
```

In this example, the output indicates that fast aging is used for IP NATted ICMP sessions, and for IP NATted DNS sessions on port 53.

The message at the bottom of the display indicates that the fast aging setting (SLB MSL timeout) will be used for IP NATted UDP sessions on port 53. If the message is not shown in the output, then the timeout shown under “UDP” will be used instead.

Client and Server TCP Resets for NATted TCP Sessions

You can enable the ACOS device to send TCP resets to the client and server when a NATted TCP session becomes idle.

The following topics are covered:

Using the GUI

1. To enable this option:
    a. Hover over ADC in the navigation bar, and select IP Source NAT.
    b. Enable the Reset Idle TCP Conn option.

Using the CLI

To enable this option, use the following command at the global configuration level of the CLI:

```
ACOS(config)#ip nat reset-idle-tcp-conn
```

Requirements for Translation of DNS Traffic

If you plan to use IP NAT for DNS traffic, make sure the configuration includes the following:

- Both the DNS request from the inside client, and the response from the external DNS server, must pass through the IP NAT outside interface.
- If an ACL is configured on the interface that will receive the DNS responses (the IP NAT outside interface), the ACL must include a permit rule that allows traffic from the DNS server. Otherwise, the traffic will be denied by the implicit (non-visible) deny any rule at the end of the ACL.

Pool-specific TCP Maximum Segment Life

The following topics are covered:

Details

You can customize the Maximum Segment Life (MSL) for source-NAT connections.

The MSL is the maximum number of seconds a TCP segment (packet) is allowed to remain in the network. When one of the endpoints in a TCP connection sends a FIN to close the connection, that endpoint then enters the TIME-WAIT state.

During the TIME-WAIT state, the endpoint is not allowed to accept any new TCP connections. This behavior is meant to ensure that the TCP endpoint does not receive a segment belonging to a previous connection after the endpoint enters a new connection.

The TIME-WAIT state lasts up to twice the MSL. On some older TCP/IP stacks, this can result in a wait of up to 240 seconds (4 minutes) after a FIN before the endpoint can enter a new connection.

To help reduce the time between connections for these endpoints, you can set the MSL on individual source NAT pools. You can set the MSL to 1-1800 seconds.

NOTE:

- The current release supports this feature for IPv4 source NAT pools, and for virtual ports on IPv4 or IPv6 VIPs.
- For more information about configuring this feature for virtual ports, see the **Network Address Translation for SLB** chapter in the Application Delivery and Server Load Balancing Guide.

Using the GUI

1. To set the MSL for system-level source NAT:
   a. Hover over ADC in the navigation bar, and select IP Source NAT.
   b. Click ACL Bind on the menu bar.
   c. Enter the MSL value in the MSL field.

Using the CLI

To set the MSL for system-level source NAT, use the msl option when configuring the ACL binding. To configure the ACL binding, use the following command at the global configuration level of the CLI:

```
[no] ip nat inside source list acl-name pool pool-or-group-name msl
seconds
```

CLI Example

The following commands configure custom MSL values for system-level source NAT:

```
ACOS(config)#access-list 123 permit tcp host 192.168.20.102 any eq 22
ACOS(config)#access-list 124 permit tcp host 192.168.20.102 any eq 80
```

```
ACOS(config)#ip nat pool ronpool 192.168.20.105 192.168.20.105 netmask /24
ACOS(config)#ip nat inside source list 123 pool ronpool msl 23
ACOS(config)#ip nat inside source list 124 pool ronpool msl 48
```

IP NAT Use in Transparent Mode in Multi-netted Environment

If the ACOS device is deployed in transparent mode, the device uses NAT IP addresses to perform health monitoring on servers that are outside the IP subnet or VLAN of the ACOS device. If there are multiple IP addresses in the NAT pool, the ACOS device uses only the last IP address in the pool for the health checks. Also, the ACOS device only responds to control traffic (for example, management and ICMP traffic) on the last IP address in the pool.

In the following example, the ACOS device's IP address is on the 172.168.101.0/24 subnet. A NAT pool has been configured to reach servers outside of that subnet/VLAN.

```
ACOS#show ip
System is running in Transparent Mode
IP address:                   172.168.101.4 255.255.255.0
IP Gateway address:           172.168.101.251
SMTP Server address:          Not configured

ACOS#show ip nat pool
Total IP NAT Pools: 4
Pool Name     Start Address    End Address      Mask            Gateway
Group
-------------------------------------------------------------------------
--
Pool-A        173.168.10.20    173.168.10.25    /24   173.168.10.250 0
```

In this configuration, the ACOS device will initiate health checks using the last IP address in the pool as the source IP address. In this example, the ACOS device will use IP address 173.168.10.25. In addition, the ACOS device will only respond to control traffic directed to 173.168.10.25 from the 173.168.10.0/24 subnet.

NAT Range List Requires ACOS Device Interface or Route Within the Global Subnet

In an IP source NAT configuration, return UDP or ICMP traffic may not be able to reach the ACOS device. This can occur under the following circumstances:

- IP source NAT is configured using a NAT range list.
- The ACOS device does not have any data interfaces or routes that contain an address within the subnet of the range list's global address(es).

To work around this issue, configure an IP interface that is within the NAT range list's global subnet. You can configure the address on any active data interface on the ACOS device.

This issue does not affect NATted traffic other than ICMP or UDP traffic, or use of an ACL with a NAT pool.

IP NAT in HA Configurations

The following topics are covered:

Details

If you are using IP source NAT or full NAT in an HA configuration, make sure to add the NAT pool or range list to an HA group. Doing so allows a newly Active ACOS device to properly continue management of NAT resources following a failover.

Using the GUI

In the GUI, you can select the VRID group from the HA Group drop-down list on the following configuration tabs:

- ADC > IP Source NAT > IPv4 Pool
- ADC > IP Source NAT > IPv6 Pool
- ADC > IP Source NAT > NAT Range

Using the CLI

In the CLI, the ha-group-id option is supported with the following NAT commands:

```
[no] ip nat pool pool-name start-ipaddr end-ipaddr
netmask {subnet-mask | /mask-length} [gateway ipaddr]
[ha-group-id group-id]
```

```
[no] ipv6 nat pool pool-name start-ipv6-addr
end-ipv6-addr netmask mask-length [gateway ipaddr]
[ha-group-id group-id]
```

```
[no] ip nat range-list list-name
source-ipaddr /mask-length nat-ipaddr /mask-length count number [ha-group-
id group-id]
```

System Geo-location Mappings

This part of the document describes about the Geo-location mapping and filtering at system-level and how to configure it. The Geo-location IP mapping provides abilities to ACOS to filter based on user's Geo-location and function according to the settings assigned to the Geo-location. It can be used in firewall rule-set to allow or disallow access to users from certain countries or cities.

The Geo-location is now supported throughout the ACOS system for firewall and CGN.

Refer to the Geo-location Mappings chapter for further details.

Geo-location Mappings

You can configure geo-location mappings to ACOS manually or by loading the mappings from a file. Configuring the geo-location mappings manually might not be practical, unless you have only a few sites.

The geo-location configuration options are described in detail below.

To skip the descriptions and go directly to configuration instructions, see one of the following sections. Each section provides the procedure for one of the approaches to configuring geo-location mappings.

The following topics are covered:

Loading or Configuring Geo-location Mappings

The following topics are covered:

Geo-location Mappings Overview

A geo-location mapping consists of a geo-location name and an IP address or IP range.

- If you manually map a geo-location to a global site.
- If a service-ip cannot be mapped to a geo-location, the site ACOS device is mapped to a geo-location.

If more than one geo-location matches a client's IP address, the most specific match is used.

For example, if a client is in the same city as a site ACOS, that site will be preferred. If the client and site are in the same state but in different cities, the site in that state will be preferred.

Use the related "load" command to load databases to synchronize the start-up configuration on ACOS system or group members.

There is full parity in the synchronization, so the process works in reverse also. Unloading a geo-location database from a configuration, or deleting a geo-location database, will remove that database from all ACOS group members.

Geo-location Database Files

You can load the geo-location database (which contains the geo-location mappings) from one of the following types of files:

- **MAXMIND database** – We have built-in databases from a third-party provider MAXMIND named **GeoLite2-Country** and **GeoLite2-City**.
- **Internet Assigned Numbers Authority (IANA) database** – The IANA database contains geographic locations of IP address ranges and subnets assigned by the IANA. This database is loaded by default.
- **Custom database in CSV format** – You can load a custom geo-location database from a file in comma-separated-values (CSV) format. However, before loading the file, you must first configure a CSV template on the ACOS device because the data in the file is formatted by the template.

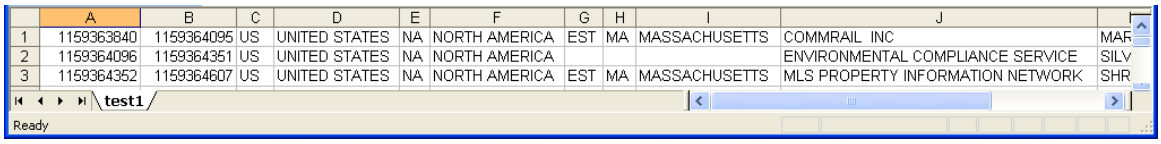
Geo-location Database File Example

An example of a database file is shown below. Each paragraph is actually a single line in the file, but they are displayed here in multiple lines due to the limited width of the page. (Note that lines in the database file should not have spaces between the paragraphs. This was done to improve readability.)

```
"119363840","11936409","US","UNITED STATES","NA","NORTH
AMERICA","EST","MA","MASSACHUSETTS", "COMMRAIL
INC","MARLBOROUGH","MIDDLESEX","42.3495","-71.5482"

"1159364096","1159364351","US","UNITED STATES","NA","NORTH
AMERICA","","","","ENVIRONMENTAL COMPLIANCE
SERVICE","SILVER","","32.0708","-100.682"

"1159364352","1159364607","US","UNITED STATES","NA","NORTH
AMERICA","EST","MA","MASSACHUSETTS", "MLS PROPERTY INFORMATION
NETWORK","SHREWSBURY","WORCESTER","42.2959","-71.7134"
...
```

The example above shows how the CSV file appears when displayed in a text editor. If the same data were displayed in a spreadsheet application, it appears like the following Figure 23.

Figure 23 : CSV File in Spreadsheet Application



	A	B	C	D	E	F	G	H	I	J	K
1	1159363840	1159364095	US	UNITED STATES	NA	NORTH AMERICA	EST	MA	MASSACHUSETTS	COMMRAIL INC	MAR
2	1159364096	1159364351	US	UNITED STATES	NA	NORTH AMERICA				ENVIRONMENTAL COMPLIANCE SERVICE	SILV
3	1159364352	1159364607	US	UNITED STATES	NA	NORTH AMERICA	EST	MA	MASSACHUSETTS	MLS PROPERTY INFORMATION NETWORK	SHR

test1

Ready

The database file can contain more types of information (fields, or columns) than are required for the Geo-location database. When you load the CSV file into the geo-location database, the CSV template on the ACOS device filters the file to extract the required data, while ignoring the rest of the data. In the example below, only the fields shown in bold type will be extracted and placed into the geo-location database:

```
"1159363840","1159364095","US","UNITED STATES","NA","NORTH
AMERICA","EST","MA","MASSACHUSETTS","COMMRAIL
INC","MARLBOROUGH","MIDDLESEX","42.3495","-71.5482"
```

These fields contain the following information:

```
From IP address (starting IP address in range), To IP address (ending IP
address in range, or subnet mask), Continent, Country
```

The IP addresses in this example are in bin4 format. Dotted decimal format (for example: 69.26.125.0) is also supported. If you use bin4 format, the ACOS device automatically converts the addresses into dotted decimal format when you load the database into ACOS.

Creating and Loading a Custom Geo-location Database

The following topics are covered:

Details

To create and load a custom geo-location database:

1. Prepare the database file. (This step requires an application that can save to text for CSV format, and it cannot be performed on the ACOS device.)
2. Configure a CSV template on the ACOS device. The CSV template specifies the field positions (or columns) in the database that should be extracted, such as IP address and location information.
3. Import the CSV file onto the ACOS device.
4. Load the CSV file.
5. Display the geo-location database.

Configuring the CSV Template (CLI Procedure)

On the ACOS device, you must configure a CSV template for the database file. When you load the file onto the ACOS system, the ACOS device uses the template to extract the data and load it into the
system database.

1. Use the **`system template csv`** command to create the template.
2. Use the **`field`** command to identify the field positions for the geo-location data.
3. The CSV file uses commas to delimit fields. Use the "`delimiter`" command to specify the delimiter.

```
ACOS(config-csv:1)# delimiter {<number> | <name> }
  <0-255>           enter a delimiter number, default 44 (",")
  NAME<length:1-1>  enter a delimiter character, default ","
```

CSV File Field Delimiter

CSV file fields must be separated by a delimiter. By default, the ACOS device interprets commas as delimiters. When configuring a CSV template on the ACOS device, the delimiter can be set to any valid ASCII character.

Importing the CSV File (CLI Procedure)

To import the CSV file onto the ACOS device, use the **`import geo-location`** command at the privileged EXEC or global configuration level of the CLI:**`period`** *num*]

You can enter the entire URL on the command line or press Enter to display a prompt for each part of the URL.If you enter the entire URL and a password is required, you

will still be prompted for the password. To enter the entire URL:

- **tftp://host/file**
- **ftp://[user@]host[:port]/file**
- **scp://[user@]host/file**
- **disk:path**
- **sftp://[user@]host/file**

NOTE: For more information about the **use-mgmt-port** option, see the **Using the Management Interface as the Source for Management Traffic** chapter in the System Configuration and Administration Guide.

Loading the CSV File Data into the Geo-location Database (CLI Procedure)

To load the CSV file, use the **system geo-location load** command at the global configuration level of the CLI.

Use the file name you specified when you imported the CSV file, and the name of the CSV template to be used for extracting data from the file.

To display information about CSV files as they are being loaded, use the **show geo-location** command.

Manually Configuring Geo-location Mappings

The following topics are covered:

Details

To manually configure a geo-location mapping:

1. Configure each geographic location (geo-location) as a named range of client IP addresses at system level.
2. To configure a geo-location, use the `system geo-location` **`entry`** command at the global configuration level or from remote system.

Displaying the Geo-location Database (CLI Procedure)

To display the geo-location database and to search for an entry in the geo-location database that is based on client IP address, use the **`show geo-location`** command.

Displaying the Geo-location Database (CLI Example)

The commands in this example load a custom geo-location database from a CSV file called “test.csv”, and then display the database. The test.csv file is shown in Geo-location Database File Example.

First, the following commands configure the CSV template:

```
ACOS(config)# template csv test1-template
ACOS(config template csv)# field 1 ip-from
ACOS(config template csv)# field 2 ip-to-mask
ACOS(config template csv)# field 5 continent
ACOS(config template csv)# field 3 country
ACOS(config template csv)# exit
```

The following command imports the file onto the ACOS device:

```
ACOS(config)# import geo-location test1.csv
ftp://1.0.0.100/BaseConfig/Test1.csv
User name []?admin2
Password []?*******
Done.
```

The following commands initiates loading the data from the CSV file into the geo-location database, and display the status of the load operation:

```
ACOS(config)# geo-location load test1.csv test1-template
ACOS(config)# show geo-location file
                Per = Percentage of loading, Err/W = Error or Warning
                T = T(Template)/B(Built-in)

Filename                T Template              Per  Lines    Success
Err/W
```

```
------------------------------------------------------------------------
------
iana*                    B                          100% 77        77        0
test1.csv                T test1-template           100% 5         5         0

ACOS(config)#
```

The following command displays the geo-location database extracted from the CSV file.

```
ACOS(config)# show geo-location db NA
                  Last = Last Matched Client, Hits = Count of Client
matched
                  Sub = Count of Sub Geo-location
                  T = Type, P-Name = Policy name
                    G(global)/P(policy), S(sub)/R(sub range)
                    M(manually config)/B(built-in)

Geo-location: NA
From             To/Mask          Last             Hits      Sub    T    P-Name
------------------------------------------------------------------------
------
                                                   0         1      G
```

Configuring Geo-location Entry through CLI

1. Configure geo-location using CLI, using the **system geo-location entry** command, and set the IP mask, for example:

```
ACOS(config)# system geo-location entry GEO_APAC1
ACOS(config-geo-location:GEO_APAC1)#ip 111.13.100.0 mask /24
```

2. Verify with the **show geo-location** command to verify if the geo-location is added, with the following options:

```
show geo-location [db/file/ip/ipv6]
```

Loading Geo-location Database to ACOS

The following topics are covered:

Details

The steps to configure user-defined geo-location database on ACOS are:

1. Prepare the CSV database file. including converting third-party database file into CSV format. Refer to Preparing the CSV File.
2. Import the CSV database file into ACOS. Refer to Importing User Defined CSV Geo-location File into ACOS.

NOTE: Load the MAXMIND database using **`system geo-location load`** command as specified in Loading MAXMIND Database.

Loading MAXMIND Database

MAXMIND is a third party provider that provides IP geo-location accuracy and services. ACOS provides built-in MAXMIND databases.

The geo-location databases can be downloaded from MAXMIND and loaded onto ACOS.

NOTE: Use the GeoLite2 databases from MAXMIND, available at: http://www.maxmind.com.

Geo-location based list feature provides the following important options:

1. By default, the IANA database is loaded. Use the built-in MAXMIND database by loading it to ACOS.

```
ACOS(config)# system geo-location load GeoLite_Country2
```

NOTE: `GeoLite2_Country` and `GeoLite2_City` are the MAXMIND databases loaded to ACOS.
By default, only the IANA database is loaded. To unload the default database, use the `nosystem geo-location load` command.

2. To load built-in `GeoLite2-Country` database from MAXMIND, use.

```
ACOS(config)# system geo-location load GeoLite2-Country
```

3. In order to use ipv6 address, add include-ipv6 behind the database name.

```
ACOS(config)# system geo-location load GeoLite2-City include-ipv6
ACOS(config)# system geo-location load GeoLite2-Country include-ipv6
```

NOTE: The limitations on loading the MAXMIND database are:
- GeoLite2-City and GeoLite2 Country cannot be loaded at the same time.
- GeoLite2-City has city level geo-location IP mappings.
- GeoLite2-Country only have country level geo-location IP mappings.

Preparing the CSV File

1. Prepare the CSV database file. This is required if we are using third-party database file, convert it into CSV file.
2. Define the CSV template.

```
AX(config)# template csv
  field 1 ip-from
  field 2 ip-to-mask
  field 3 continent
  field 4 country
  field 5 state
  field 6 city
```

3. Prepare geo-location CVS file. Import the file using **`import geo-location`** command as follows: **`ACOS(config)# import geo-location`** `GEO_APAC1`

Importing User Defined CSV Geo-location File into ACOS

There are two methods to import a user-defined geo-location CSV file.

- import geo-location: Import CSV file directly into ACOS.
- import-periodic geo-location: Import CSV file into ACOS with periodic refresh.

To import geo-location file manually, use the option, use the `import-periodic geo-location` command.

```
AX(config)# import geo-location USER_DB scp://userdb.csv
```

OR

To import geo-location file with periodic refresh option through a new system template or geo-location import, use the `import-periodic geo-location` command.

```
ACOS(config)# import-periodic geo-location USER_DB use-mgmt-port
tftp://host/user_db.csv period 1200
```

Provide system wide CLI to define the configuration of geo-location database that can be later used in a firewall rule-set.

NOTE: For details on geo-location list configuration through CLI, see CLI Configuration Options for Geo-location Lists.

Verifying Geo-location Configuration

1. Verify if all the geo-location entries are loaded by using **`show system geo-location`** command and **`show running-config sec geo`** command.

   ```
   ACOS(config)# show system geo-location
   ```

2. Multiple database files can also be loaded. Verify using the `show running-config sec geo` command.

   ```
   ACOS(config)# show running-config sec geo
   system geo-location load USER_DB
   system geo-location load GeoLite_Country2
   ```

```
system geo-location load GEO_APAC1
```

Geo-location Lists

This chapter describes the fundamentals and configuration options for Geo-location database loading, mapping, lists setup, and so on through ACOS CLI and GUI:

The following topics are covered:

Details

Geo-location IP mapping provides abilities to ACOS to filter based on user's geo-location and function according to the settings assigned to the geo-location. It can be used in firewall rule-set to allow or
disallow access to users from certain countries or cities.

The following options and add-ons are available on ACOS:

- ACOS provides a pre-installed internal geo-location database (MAXMIND) and an option to switch to the database.
- User can import third party geo-location database.
- User can configure a geo-location list that consists of geo-location names.
- The geo-location-list can be bound to firewall rule-list as source or destination filters.

CLI Configuration Options for Geo-location Lists

The following topics are covered:

Details

The following configuration options are available for Geo-location List settings through ACOS CLI. The Geo-location list settings can be configured once geo-location database is loaded to ACOS system.

NOTE: For details on loading the databases, see Loading or Configuring Geo-location Mappings.

Configuration Example for Geo-location List

CLI configuration for Geo-location List setup. Geo-location list can be configured as specified in the following example:

1. Configure geolocation-name in geolocation-list using the `system geoloc-list list` command and include or exclude the required geo-locations as follows. The options listed are depending on the geo-location database loaded onto system.

```
ACOS(config)# system geoloc-list list
ACOS(config-geoloc-list:list)# include ?
  "Asia"
  "Asia.?
  "Oceania"
  "Oceania.?
  "ripe"
  "lacnic"
  "apnic"
  "afrinic"
  "arin"
  "default"

ACOS(config-geoloc-list:list)#include"Asia.?
"Asia.China"
  "Asia.China.?
ACOS(config-geoloc-list:list)#include "Asia.China.?
  "Asia.China.Fujian"
  "Asia.China.Fujian.?
```

```
ACOS(config-geoloc-list:list)#include "Asia.China.Fujian.?
  "Asia.China.Fujian.Fuzhou"
ACOS(config-geoloc-list:list)#include "Asia.China.Fujian.Fuzhou"
```

2. The configuration is displayed as follows:

```
ACOS(config-geoloc-list:list)#show running-config | sec geoloc-list
system geoloc-list list
  shared
  include Asia.China.Beijing
  include "Europe.San Marino.Castello di Domagnano.Domagnano"
  include "Asia.Qatar.Baladiyat az Za'ayin.Az Za`ayin"
  include Asia.China.Jiangxi.Longnan
  include "Oceania.Australia.Victoria.Fountain Gate"
  include Asia.China.Fujian.Fuzhou
```

Geo-location Name Active/Inactive

Every geo-location name in the geo-location list must be added into the search tree. When the geo-location name is added into the search tree, we call it "active". In order to let geo-location name work, it must be active on the geo-location list.

Use the following CLI to check if the geo-location name is active or not.

```
ACOS(config-geoloc-list:list)# show geoloc-list list
system geoloc-list list
  include Asia.China | status:Active. hit:516
  include Asia.China.Beijing.Haidian | status:Active. hit:0
  include North America.United States | status:Active. hit:4
  include Asia.a.donot.exists | status:Inactive. hit:0
  exclude Asia.China.Beijing | status:Active.
  --------------------
  Total hit: 520
  Total geolocation name: 5
  Total active: 4
```

The geo-location names in a list are set to active when the geo-location list is in use and bound to a firewall rule set. If a geo-location list is not in use, all the geo-location names are inactive.
If a geo-location name in a list is not recognized by the geo-location database, the name is inactive.

Geo-location Lists on Shared Partitions

Geo-location lists can be configured per partition. Geo-location list in shared partition can be used by private partition.

Configuration example for geo-location lists on shared partition:

1. Configure geo-list for shared partition

```
system geoloc-list geo-list-share
shared
   include "Asia.China"
   include "North America.United States"
```

2. Associate with a rule on partition:

```
rule 1
    source geo list geo-list-share shared
    source ipv4-address any
```

Hit Counter

The hit counter provides the following options:

- Hit counters can be setup for geo-location list per geo-location name.
- If one geo-location list is bound to more than one firewall rules, the hit counter of each
  geo-location name is an aggregate value for all the attached firewall rules.
- If two geo-location lists have the same geo-location name, they use separate hit counters.
- By default, the geo-location-list hit counter is not updated into geo-location database, but it can be enabled by "`system geo-db-hitcount-enable`"

A maximum of 2048 geo-location lists are supported on ACOS platform. 1024 geo-location names (type include) and 1024 geo-location name (type excluded). Also, the total number of geo-location name that can be configured under geo-location list and under all rule-set is 4096.

Configuration Output Examples

System wide CLI to show geo-location lists loaded and related statistics.

```
ACOS(config)# show geoloc-list list
```

```
system geoloc-list list
  include Asia.China | status:Inactive. hit:652
  include Asia.China.Beijing.Haidian | status:Inactive. hit:0
  include North America.United States | status:Inactive. hit:4
  include Asia.a.donot.exists | status:Inactive. hit:0
  exclude Asia.China.Beijing | status:Inactive.
  --------------------
  Total hit: 656
  Total geolocation name: 5
  Total active: 0
```

Show the geo-location list settings on running system configuration.

```
ACOS(config-geoloc-list:list)#show running-config | sec geoloc-list
system geoloc-list client
  include Asia.Home.Yxiong
system geoloc-list list
  shared
  include Asia.China
  include Asia.China.Beijing.Haidian
  include "North America.United States"
  include Asia.a.donot.exists
  exclude Asia.China.Beijing
```

GUI Configuration Options for Geo-location Lists

The following topics are covered:

Details

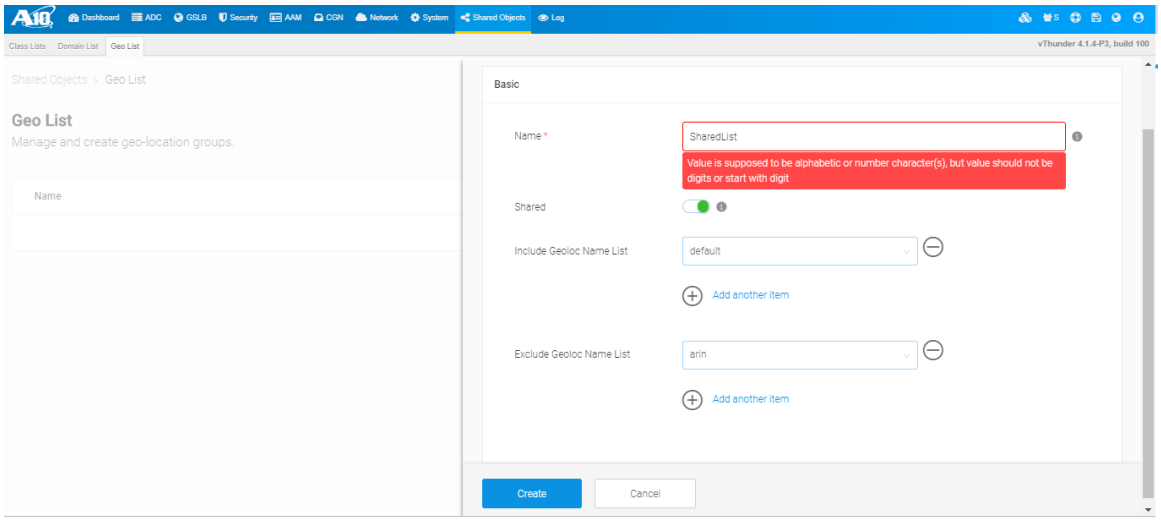
The following important GUI pages are available to configure geo-location list through ACOS GUI. This section provides the details on some important GUI screens required to configure Geo-location lists.

Geo List Page

To create a Geo-List navigate to **Shared Objects > Geo List** page

1. Click **+ New Geo List** to create a new geo-location list.
2. This opens up a **Create New Geo List** page with a **Basic** section.
3. Create a new Geo-list by defining a name with alphanumeric characters.
4. Select **Shared** option if this geo-location list is going to be used by any private partition.
5. Select **Geo-location Name** and add it into include or exclude list. Select predefined geo-location Add multiple list names to be included or excluded with the **Add another item** option.
6. Click **Create** to create a geo-location list.

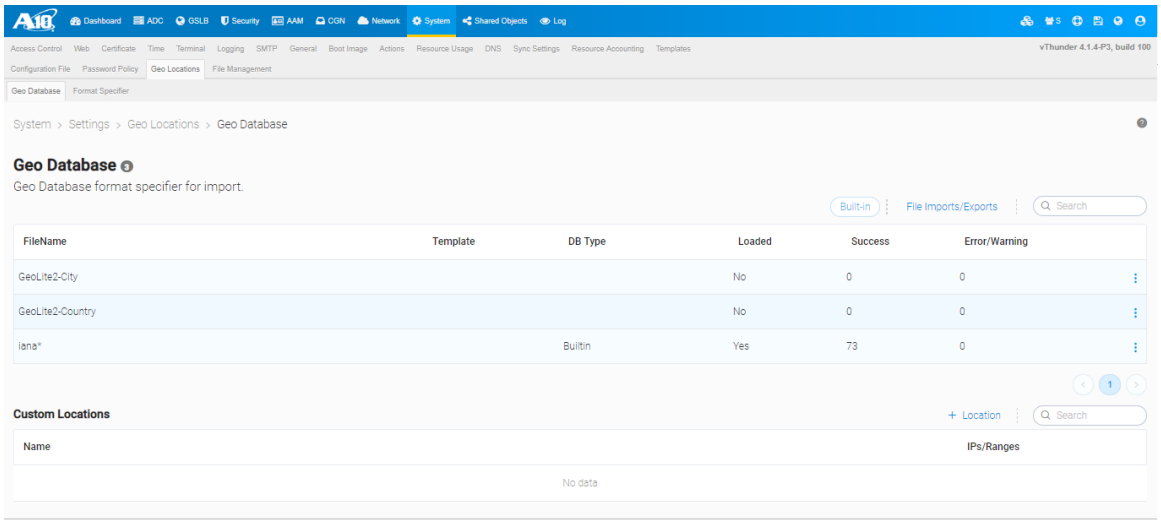
Figure 24 : New Geo List Page



Geo Database

Navigate to **System > Settings > Geo Database** page.

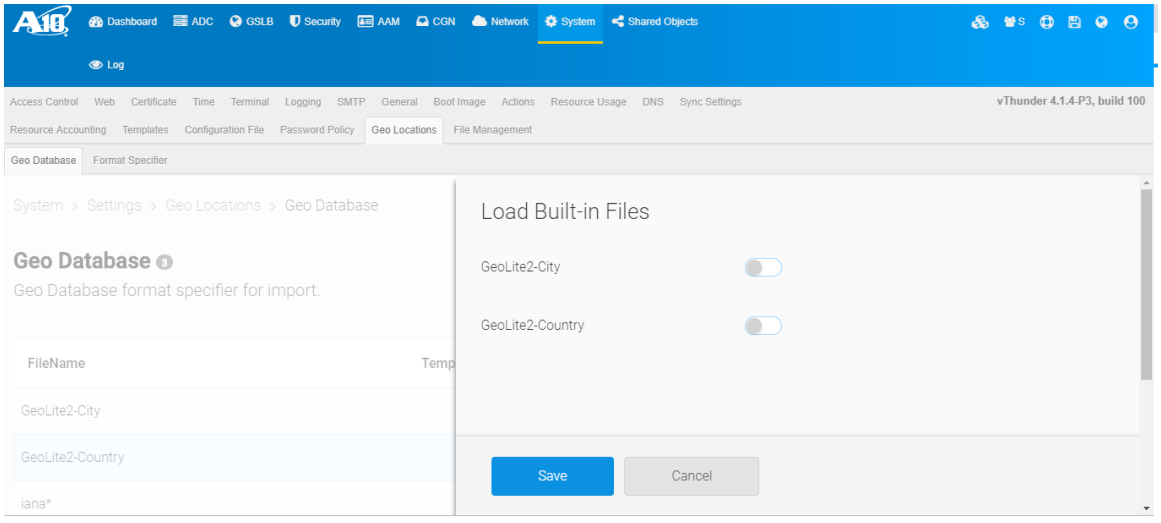
Figure 25 : Geo Database Page



The following options are available:

1. Click **Built-In** option to load or unload built-in MAXMIND database, GeoLite2-City and GeoLite2-Country.
2. Click **Save** to load or unload the selected geo-databases.

Figure 26 : Load Built-in Geo Database

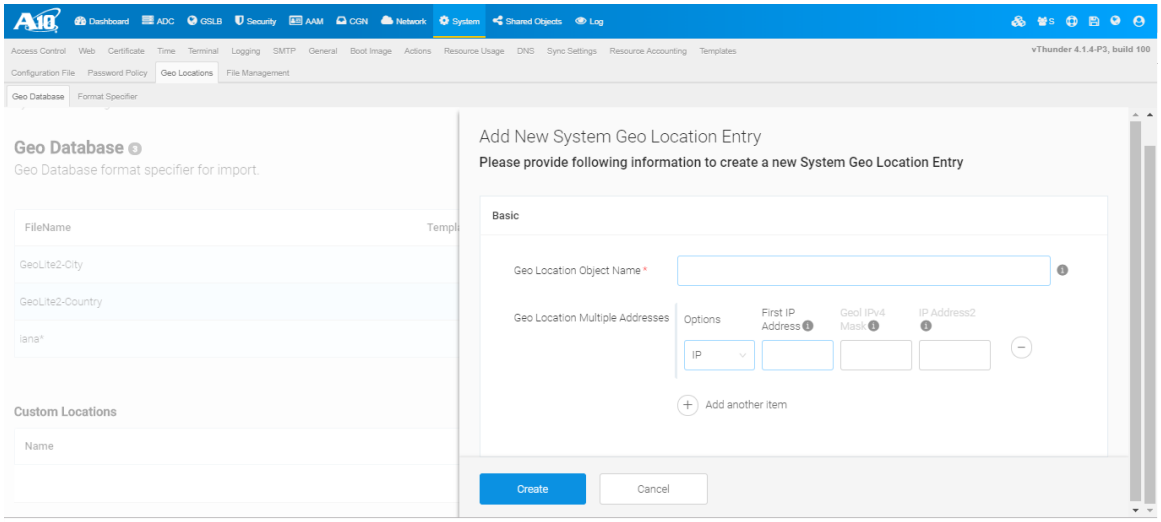


Adding a New System Geo Location Entry

To add a custom Geo-location:

1. Click **+ Locations** under **Custom Locations**
2. Enter **Geo Location Object Name**
3. Add **IP addresses, IP Mask,** and **Secondary IP Addresses** in IPv4 or IPv6 format.
4. Click **Create** to create new custom geo-location.

Figure 27 : Add New Geo-location Entry



File Management

1. Click **File Imports/Exports** option on Geo-Database page to open **File Management** page.
2. **The Systems > Settings > File Management** page has all the file management options, and users can manage the geo-location files through this page.
3. Select a Class List file, Geo-database or any other file. Click **Delete** to delete the file from ACOS system.

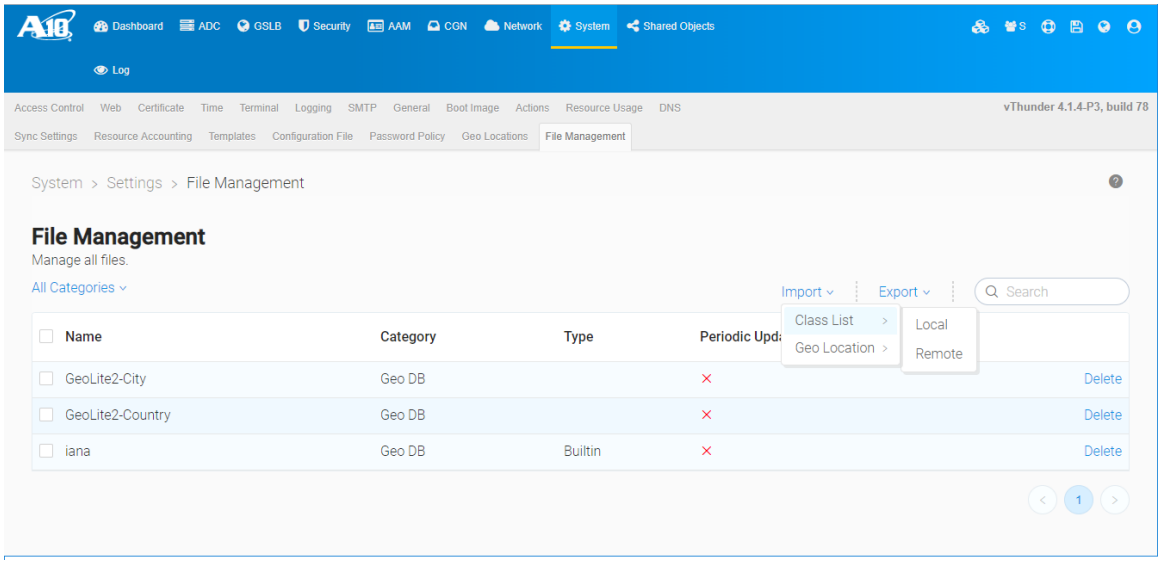
The other important options available under **All Categories** are: **Class List**, **Geo Location**, and **All**. The **Import** and **Export** options for files including geo-location files are available through the File Management page as displayed in the image.

The following options are available on the File Management page:

- Import Local Class List
- Import Remote Class List

- Export Local Class List
- Export Remote Class List
- Import Local Geo-location Database
- Import Remote Geo-location Database
- Export Local Geo-location Database
- Export Remote Geo-location Database

Figure 28 : File Management

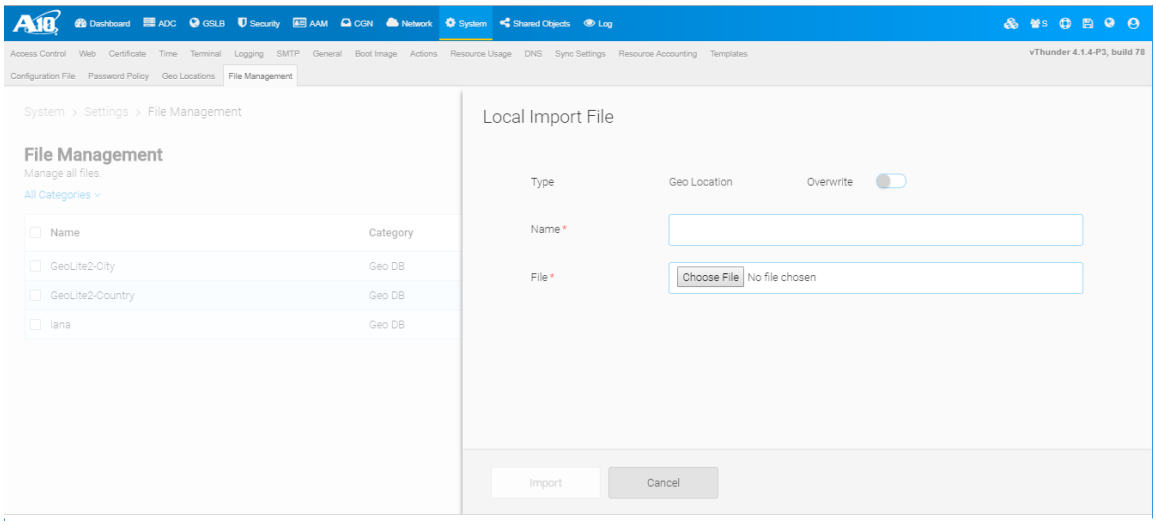


Importing Geo-location Database from a Local Page

The following configuration options are available on **Import Geo-location Database from Local** page.

1. Click **Import > Geo-location > Local** to open the page.
2. Choose the geo-location database from local.
3. Click **Import** to import the geo-location database file from local system.

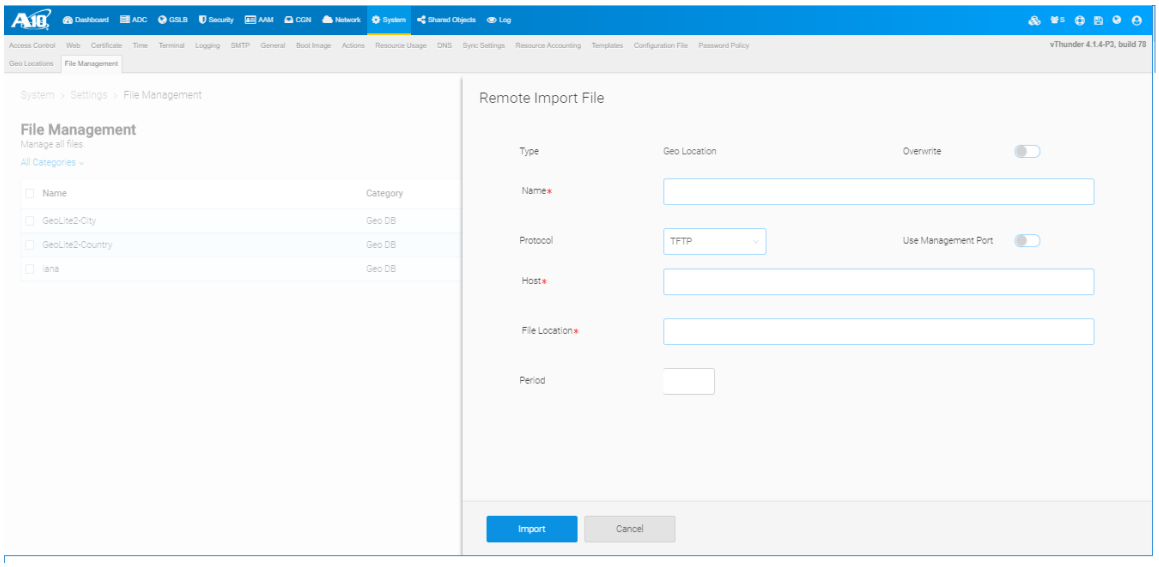
Figure 29 : Import Geo-location Database from Local Page



Importing Geo-location Database from a Remote Server Page

1. Click **Import > Geo-location > Remote** to open Remote Import page.
2. Enter the **Name** of geo-location file in CSV format, **Host address** of Remote system, **File location** name, file transfer **Protocol** like TFTP, HTTP, SCTP, options and so on.
3. Select **Use Management Port** if required.
4. Enter value in seconds in the **Period** field for periodic import. Additional details are specified in the GUI Online Help.

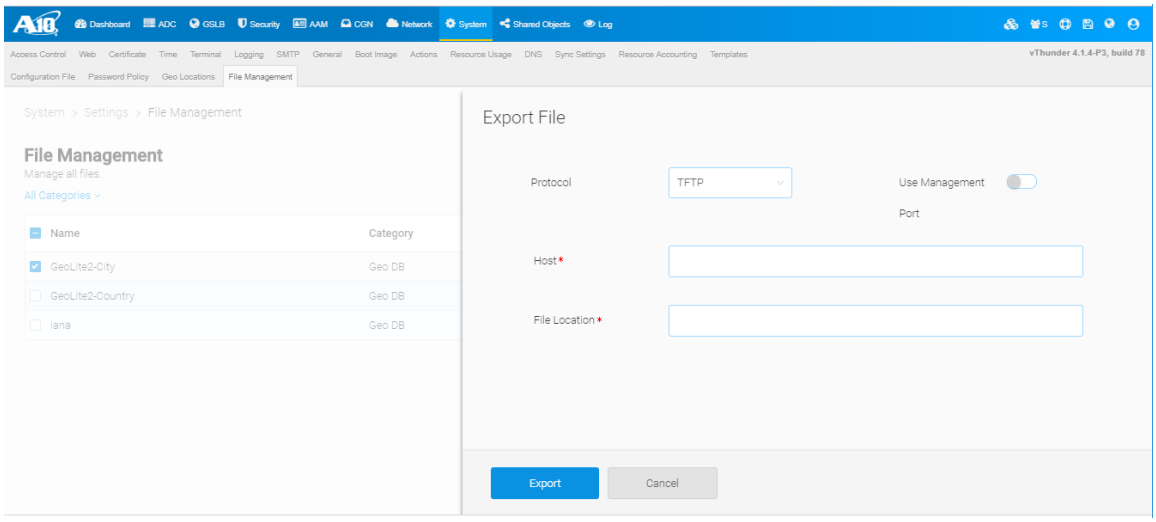
Figure 30 : Import Geo-location Database from Remote Server Page



Exporting Geo-location Database into Remote Server Page

1. Select the geo-location lists to be exported from the File Management page and then export.
2. The following configuration options are available on **Export Geo-location Database into Remote Server** page.

Figure 31 : Export Geo-location Database into Remote Server Page



Exporting Geo-location Database into a Local Drive

1. Select the geo-location database to be exported from the **File Management** page and then export.
2. The geo-location database is downloaded to local system in **.tar.gz** format.

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