ADTRAN

Configuration Guide

IPv6 SIP in AOS

This guide describes the specifics of using Session Initial Protocol (SIP) over Internet Protocol version 6 (IPv6) in ADTRAN Operating System (AOS) products. Included in this guide are the AOS platforms that support IPv6 SIP, the special considerations for IPv6 SIP configuration, the specific requirements for configuring particular SIP applications in AOS, and the command changes that occurred in order to support IPv6 SIP.

This guide contains the following sections:

IPv6 Overview

IPv6 is the next generation of Internet protocols designed to replace IPv4. Both IPv4 and IPv6 are packet protocols designed to pass data, voice, and video over digital networks. IPv4 is the current standard used for Internet communication, however, its available address space is quickly diminishing. As new global markets gain access to the Internet and as new devices, particularly mobile devices, are connected to the Internet, IPv4 32-bit addressing limits the number of available IP addresses for these new markets and new devices. To combat the IP address crisis, IPv6 provides IP addresses based on 128 bits (rather than the 32-bit IPv4), providing enough IP addresses for the foreseeable future. IPv6 not only provides many more addresses than IPv4, it also restores end-to-end communication because the use of network address translation (NAT) is unnecessary, provides more efficient packet forwarding, and contains within itself support for Internet security and mobility. IPv6 also provides improved option support and mandated security for Internet traffic when compared with IPv4. The push for IPv6 deployment has taken a much stronger turn in the past few years, and although the switch from IPv4 to IPv6 will be a lengthy process, IPv6 is quickly becoming an affordable option for replacing IPv4 in many networks.

Although IPv6 is similar to IPv4, changes in the basic packet structure have been made between IPv4 and IPv6. IPv6 packets have a simpler header construction than IPv4, which provides more routing efficiency, performance, and forwarding rate scalability. IPv6 also functions in a slightly different manner than IPv4, replacing Address Resolution Protocol (ARP) with neighbor discovery (ND) protocols in Internet Control Management Protocol version 6 (ICMPv6), reducing the need for NAT, and using different addressing schemes, terminology, and routing processes.

For details about IPv6, the difference between IPv4 and IPv6, and the configuration of IPv6 in AOS products, refer to the configuration guide *Using IPv6 in AOS*, available online at http://supportforums.adtran.com. A background in IPv6 fundamentals is necessary to configure IPv6 SIP.

Hardware and Software Requirements and Limitations

As of firmware release R10.8.0, SIP over IPv6 is supported in numerous AOS products. In AOS, however, there are several interactions between other features and IPv6 SIP. Eventually all IPv4 SIP functionality will be supported on AOS products, but for firmware R10.8.0, keep the following factors in mind:

- AOS does not currently support calls between any IPv4 SIP endpoint and an IPv6 SIP endpoint without having media anchoring enabled.

> *User Datagram Protocol (UDP) header checksums are required in IPv6, but not in IPv4. Because of this requirement, performance may be affected when performing IPv4 to IPv6 media anchoring.*
> — NOTE

- Voice quality monitoring (VQM) for IPv6 is not currently supported. This includes monitoring IPv6 RTP packets as well as reporting findings to an IPv6 collector.
- Simple Network Management Protocol (SNMP) management information bases (MIBs) pertaining to SIP do not currently provide IPv6 address values. Instead, null addresses are reported.
- The SIP proxy does not support IPv6.

In firmware release R10.8.0, the following products support IPv6 SIP operation:

- NetVanta 644
- NetVanta 3430 with the Session Border Controller (SBC) feature pack
- NetVanta 3448 with the SBC feature pack
- NetVanta 4430 with the SBC feature pack
- NetVanta 6240
- NetVanta 6310/6330
- NetVanta 6355
- Second generation Total Access 900e

For specific information about each platform, refer to the *AOS Feature Matrix*, available online at http://supportforums.adtran.com.

IPv6 SIP Media Gateway Considerations

The following are considerations for configuring IPv6 media gateway addresses.

- AOS allows IPv6 media gateway configuration on any IPv6-capable interface, except loopback interfaces.
- AOS does not support a link-local IPv6 address as a media gateway address. Therefore, IPv6 SIP messages cannot be sent to or received from a link-local address.
- An interface can be configured to allow all configured IPv6 addresses to be used as media gateway addresses or to use one specific media gateway addresses. Available settings are all addresses, a specific IPv6 address, and a loopback interface.

   If a specific address is configured as the media gateway, AOS listens for IPv6 SIP traffic on that address. IPv6 must be enabled and a static address configured on the interface to configure an IPv6 media gateway on that interface. In addition, only one specific media gateway address can be specified on the interface. When a static IPv6 address is removed from the interface, the media gateway address of the same value is also removed. If IPv6 is disabled on the interface, the IPv6 media gateway is also removed. When a specific address is configured on the interface, and AOS must send an IPv6 SIP request, the packet is sourced from the static address.

   Only one loopback interface can be specified as a media gateway on an interface that supports IPv6. However, multiple interfaces can specify one loopback media gateway. For a loopback media gateway to function properly on an interface, the loopback interface can only specify one static IPv6 address. When a loopback interface is configured as an IPv6 media gateway, the system listens for SIP traffic on the configured IPv6 address of the loopback interface. Link-local addresses are not supported. When AOS must send an IPv6 SIP request, the packet is sourced from the IPv6 address of the loopback interface.

- When AOS must send an IPv6 SIP response (100, 180, 200, etc.) on an interface, the packet is sourced from the same address on which it arrived.
- When the IPv6 media gateway configuration is modified, all existing IPv6 media gateway configuration is removed.
- AOS allows 16 IPv6 media gateway addresses to be configured, with no limit per interface. An attempt to configure a media gateway after this limit has been met is rejected with an error. If addresses that are supposed to be media gateways are discovered after the limit has been reached,

an error is logged and the addresses are discarded.

IPv6 SIP Trunk Considerations

The following are considerations for configuring IPv6 SIP trunks:

- A SIP trunk can be configured for either IPv4 and/or IPv6.
- T.38 faxing is supported over IPv6 for appropriate analog and TDM endpoints.
- When an INVITE is received on an IPv6 trunk, and it is routed to an IPv4 SIP endpoint without media anchoring enabled, the system rejects the call.
- Registration is supported when using IPv6.
- IPv6 loopback calls are supported.
- Calls between IPv6 trunks (with and without media anchoring) are supported.
- IPv6 to IPv6 and IPv4 to IPv6 media anchoring are supported.
- IPv6 to IPv6 and IPv4 to IPv6 transcoding are supported.

Domain Naming Service Considerations

The following are considerations for configuring domain naming service (DNS) for IPv6 SIP:

- When resolving a FQDN, AOS first sends an SRV query to the DNS server. If it responds with a no name error to the SRV query, AOS simultaneously initiates authentication, authorization, accounting, and auditing (AAAA) and address (A) queries.
- When a DNS query returns a service record (SRV), the priorities and weights in the response are used to determine which server to use. A and AAAA records can be referenced from the same SRV record.
- If a DNS server responds positively to both the AAAA and A queries for the same host name, AOS will prefer the AAAA record.

Firewall Considerations

The following are firewall considerations for configuring IPv6 SIP:

- The firewall configuration must permit IPv6 SIP messages. For example, configuring a SIP trunk with an IPv6 address will not implicitly allow traffic from that address through the firewall.
- When IPv6 RTP must be received from an external endpoint, AOS dynamically allows RTP and RTCP traffic through the firewall based on the ports specified in Session Description Protocol (SDP).

SIP User Considerations

The following are SIP user considerations for configuring IPv6 SIP:

- IPv6 endpoints can register and place calls.
- All functionality supported by SIP trunks is available to SIP users. For example, media anchoring between IPv6 and IPv4 is available for SIP users.
- Static SIP location configuration is not supported for IPv6.

Miscellaneous Considerations

The following are additional considerations for configuring IPv6 SIP:

- AOS accepts and processes all unsolicited SIP messages for IPv6 that are currently supported for IPv4 (such as message waiting indication).
- The RTP symmetric filter is used to determine whether IPv6 RTP packets are accepted or rejected.
- IPv6 SIP is supported on a nondefault virtual routing and forwarding (VRF) instance.

Configuring IPv6 SIP Using the CLI

IPv6 SIP is configured on an AOS product using the command line interface (CLI). IPv6 SIP cannot be configured using the web-based graphical user interface (GUI). When IPv6 SIP was introduced, the command syntax of many SIP commands was changed. If a command supports the configuration of both IPv4 and IPv4, there is no **ip** or **ipv6** in the base command. If a command is for IPv6 only, it will have the **ipv6** keyword. If a command is for IPv4 only, the syntax will contain the **ip** keyword. The following sections outline the command changes for IPv6 SIP support. For detailed information about these commands, refer to the *AOS Command Reference Guide*, available online at https://supportforums.adtran.com.

Specific SIP Commands

For IPv6 SIP support, the two commands **ip sip** and **ip sdp** are now entered as **sip** and **sdp**. The **ip** parameter has been removed because these commands can be used to configure either IPv4 or IPv6 functionality.

IPv6 Media Gateway Commands

Media gateways are configured in IPv6 in the same way they are for IPv4. The IPv6 media gateway command mirrors that of the IPv4 command, except it uses the **ipv6** keyword. Use the **media-gateway ipv6 [**<*ipv6 address*> | **loopback** <*interface id*>**]** to configure a media gateway. The optional <*ipv6 address*> parameter specifies the single IPv6 address to use. IPv6 addresses are specified in colon hexadecimal format, for example, **2001:DB8:1::1**. The optional **loopback** <*interface id*> parameter specifies an IPv6 address statically defined to a loopback interface. Valid range for loopback interface IDs is **1** to **1024**. Using the **no** form of this command removes the media gateway from the interface's configuration. By default, the media gateway is not configured.

To configure all IPv6 addresses on an interface to be eligible to be used as media gateway addresses, enter the command from the interface's configuration mode as follows:

```
(config)#interface ethernet 0/1
(config-eth 0/1)#media-gateway ipv6
```

IPv6 SIP Access Control List Commands

Standard IPv6 access control lists (ACLs) can be used when configuring IPv6 SIP in AOS. In addition, standard IPv4 ACLs are also supported in SIP configuration. The command used to apply an ACL to SIP configuration is **sip access-class [ip | ipv6]** <*acl name*> **in**. The **ip** keyword specifies an IPv4 ACL is used, and the **ipv6** keyword specifies an IPv6 ACL is used. Using the **no** form of this command removes the ACL from the SIP configuration.

To apply an IPv6 ACL to the SIP stack, enter the command from the Global Configuration mode as follows:

(config)#**sip access-class ipv6 IPV6ACL in**
(config)#

> *For more information about configuring IPv6 ACLs, refer to either the Using IPv6 in AOS configuration guide, or the AOS Command Reference Guide, both available online at https://supportforums.adtran.com.*

IPv6 SIP Trunk Commands

There are no changes to the SIP trunk configuration commands for IPv6 support. SIP trunk commands are entered from the SIP Trunk Configuration mode, and do not require that you specify IPv4 or IPv6.

Troubleshooting

IPv6 SIP troubleshooting is accomplished using **show** and **debug** commands. The same commands are used for IPv6 SIP troubleshooting as are for IPv4 SIP troubleshooting, with a few minor changes. These changes occurred with the implementation of AOS firmware R10.8.0, and are outlined in *Table 1*.

Table 1. Command Syntax Changes for R10.8.0

Command Syntax Prior to R10.8.0	Command Syntax for R10.8.0 or Later
show sip	show sip
show rtp	show rtp
show ip rtp	show rtp
clear sip	clear sip
debug ip sip	debug sip
debug ip rtp	debug rtp
show run ip sip	show run sip
show run ip sdp	show run sdp

> *The command syntax prior to release R10.8.0 is still accepted to maintain compatibility.*

In addition to the command syntax changes, some troubleshooting commands have been updated to display IPv6 address values. These commands are outlined in Table 2.

Table 2. Commands that Display IPv6 Address Values

Command
show sip trunk-registration registrar
show sip user-registration
show sip location
show sip secure remote-user blacklist
show rtp media sessions
show media-gateway session
show voip name-service cache
show voice quality-stats