InfoPlus

Session Manager

"How is my SIP Network Routing Policy configured?"

Produced For

Avaya Aura Session Manager Demo

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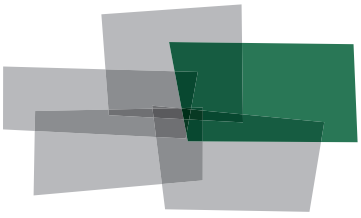

Inventory
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Regardless of the size or type of organization, there are a few basic concerns of every communications manager. InfoPlus services help address those various concerns through an integrated suite of reports and analyses.

Configuration – This document, the InfoPlus Session Manager Book, details how Session Manager's SIP Network Routing Policy is programmed to meet your organization's needs. It provides both a high-level overview of your SIP network and the components within it, as well as an understandable explanation of how individual calls are routed. The numerous complexities of Session Manager routing behavior have been distilled into straightforward descriptions of where specific calls are sent, and which types of calls are routed to a particular destination. Graphical depictions of your entire SIP network and changes to routing preferences over the course of a week help illustrate Session Manager's behavior. The Session Manager Book is an excellent tool for the day-to-day management and administration of enterprise network routing, ensuring accuracy and uniformity.

A next logical step in gaining additional control over your telecommunications resources might be an InfoPlus Communication Manager SourceBook. The CM SourceBook defines all the Communication Manager programming that makes your system uniquely yours. Graphics of every set, identification of each software group (Call Pick-up, Intercom, etc.), Trunk Groups, calling privileges, and even our service improving Action Items are assembled uniquely for your system.

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- Each analysis consists of a feature description, the security concerns and recommended changes in programming
- One hour of personal consultation is included

Backup – InfoPlus Backup Service
- Off-site backup of your Communication Server's configuration
- Available at any time for restoration through the Internet

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Table of Contents

1. SIP Network Information

The Session Initiation Protocol (SIP) Network section of this report will help you understand and visualize the configuration and topology of your SIP infrastructure, and the routing of sessions (calls) within it.

The SIP Network is comprised of multiple elements, both physical and logical, which work together to establish SIP media sessions (e.g. an audio call) among two or more participants. At a high level, the SIP network is arranged into logical constructs - Domains and Locations - for the purposes of organization and precise control. The 'nodes' of the network, referred to as SIP Entities, are the hardware and software elements among which SIP sessions are routed to connect individual users and provide calling features. Examples of these SIP Entities include instances of both Session Manager and Communication Manager, other non-Avaya PBX systems in your enterprise, as well as Session Border Controllers, Trunking gateways, and Messaging/Voicemail applications. The users of the network then establish new calls by issuing or responding to session creation requests with one or more individuals, either inside or outside the network.

At the heart of the SIP Network lives Avaya's Session Manager, whose primary role is to route these session creation requests among the various elements. As this implies, Session Manager maintains and orchestrates an entire routing infrastructure that is separate from the traditional call routing performed by Communication Manager. This includes Routing Policies, SIP Adaptations and Digit Conversions, Dialing Patterns, Time-of-Day routing, and more. In a large, multi-location network, Session Manager provides 'Enterprise-wide Routing' among a collection of PBX systems, and enables advanced routing features like centralized trunking and 'tail end hop off' of long distance calls to reduce costs.

As the responsibility for routing calls in an Avaya Aura deployment shifts from Communication Manager to Session Manager, it's important to understand the critical role that Session Manager and SIP Network routing play. In addition to explaining the overall structure, relationships and routing of the SIP Network, this section of the report will provide related configuration details for documentation and evaluation.

1.1. Network Routing Domains

Within the SIP network, Domains (and sub-Domains) are defined to partition the entire enterprise network into segments for the purpose of routing. These network routing "Domains" are domains in the Domain Name System (DNS) sense. For example, "sip.some-company.com" represents a sub-domain, "sip", in the domain "some-company.com". When a session request is examined, the relevant domains are used to determine if the SIP network dial plan can be used to route the request. Avaya encourages the use of sub-domains to impose geographical or logical organization for domain-based routing. For example, separate domains might be used for different types of calls, or for distinct groups of users, depending upon your needs.

In Avaya Aura, only domains of type 'SIP' are used for domain-based routing, while other types of domains may be configured for non-routing purposes. The 'SIP' domains thus constitute the set of 'Authoritative Domains' when describing routing within the SIP network.

Format

All Domains configured in the SIP network are displayed below, grouped by domain type. The name and optional explanatory notes for each domain are shown, and when applicable, the default domain for the network will be indicated.

Use

As Domains are the largest logical elements in the SIP network, this section provides a high-level view and understanding of the organizational layout of the network. The domains of type 'SIP' are used for domain-based routing, as covered in the upcoming topics. Different routing rules can be applied depending on the destination domain of a particular session request. Thus, the configured domains should divide the enterprise network into meaningful segments that can be used to control the flow of a session. Ensure the domains defined provide an adequate level of detail for your high-level routing needs, and the related notes properly explain the intended purpose of each domain.

SIP Domains

Name	Notes
sip.infoplus.net	InfoPlus SIP Domain

1.2. Network Routing Locations

Locations are organizational elements within the SIP network that most often represent a physical area of servers, gateways or users. Similar to Domains, they are used to partition the SIP network into segments for precise administrative control. Whether an individual Location represents a single floor of a building or an entire campus is a function of the degree of control that is necessary within the network.

It is the unique subset of IP addresses assigned to a Location that defines the logical segment of that Location within the enterprise-wide IP Address space. The precise set of IP addresses covered by a Location can be specified in a variety of ways (with subnets, ranges of addresses, patterns with wildcard characters, etc.), but each Location is assigned a unique subset. If the IP address of a network element (e.g. a user's SIP phone) is within the set of addresses assigned to a particular Location, then the device is considered to be 'in' that Location. For example, Session Manager uses the originating Location of a session creation request to determine which dial patterns are applicable when routing the call.

Locations are also used as the defining regions for implementing bandwidth management policies within Session Manager. Call Admission Control (CAC) is a form of preventative bandwidth management in which Session Manager considers the current bandwidth being consumed by a particular Location, and prevents additional calls to the Location if they would exceed the prescribed bandwidth limits set for it. Overall Managed Bandwidth settings define an upper limit on the total bandwidth consumed by a Location, while Per-Call Bandwidth Limits restrict individual calls. Together they determine the maximum number of simultaneous calls permitted to a Location, and help prevent degradation of audio and video* quality due to an IP network facility being asked to carry more calls than it was engineered for.

Format

Each Location defined in the SIP network is presented below, in alphabetical order by Location name. For each Location, the list of rules defining the subset of IP addresses handled is presented as a table, with each rule being translated into a range of IP addresses (when possible) for convenience. Following that is a summary and explanation of the bandwidth management rules in effect for the Location, if any. Finally, a list of the SIP Entities that exist in the Location are presented in a table with the Entities' name, type, IP address and explanatory notes.

Use

When Locations are configured, as suggested by Avaya, to correspond to physical areas, this section provides an overview of the geographic locales in the SIP network, and the services running at each one. As Locations can also play a major role in the routing of sessions, it's important to verify that the Locations defined adequately provide the necessary level of detail to make routing decisions. Finally, when the users in a Location share a network connection to the larger SIP network, e.g. in a branch office, the bandwidth management settings should reflect the capacity of the Location's network link to help prevent call quality problems.

** For simplicity, the term 'video' used in this report refers to elements labeled 'Multimedia' in the Session Manager UI.*

Location: Chicago

Administrative Notes: Loop Office

Location IP Address Pattern Matching

The following IP Patterns define this Location in the SIP Core Network IP address space:

IP Pattern	Range	Notes
192.168.21.*	192.168.21.0 - 192.168.21.255	Chicago IP Range

Bandwidth Management

Overall Bandwidth Settings

Maximum Total Bandwidth: 2048 Kbit/sec
Can Audio Use Bandwidth Reserved For Video: Yes
Maximum Audio Bandwidth: 2048 Kbit/sec (Limited by Maximum Total Bandwidth)
Maximum Video Bandwidth: 1024 Kbit/sec
Assumed Audio Bandwidth Per-Call: 80 Kbit/sec

Per-Call Bandwidth Limits

Minimum Acceptable Video Bandwidth: 64 Kbit/sec
Maximum Intra-location Video Bandwidth: 1000 Kbit/sec
Maximum Inter-location Video Bandwidth: 1000 Kbit/sec

SIP Entities in this Location

Type	Name	IP or Hostname	Notes
CM	Chicago CM	192.168.21.16	Secondary Communication Manager
SM	Chicago Session Manager	192.168.21.15	SM in Downtown Loop

See Common SIP Entity Types for entity type descriptions.

Location: Denver

Administrative Notes: Downtown Denver Office

Location IP Address Pattern Matching

The following IP Patterns define this Location in the SIP Core Network IP address space:

IP Pattern	Range	Notes
192.168.22.*	192.168.22.0 - 192.168.22.255	Denver IP Range

Bandwidth Management

NOTE: *This Location is configured to only support audio calls.*

Overall Bandwidth Settings

Maximum Total Bandwidth: 2048 Kbit/sec
Can Audio Use Bandwidth Reserved For Video: No
Maximum Audio Bandwidth: 2048 Kbit/sec (Limited by Maximum Total Bandwidth)
Maximum Video Bandwidth: 0 Kbit/sec (Left Blank in UI)
Assumed Audio Bandwidth Per-Call: 80 Kbit/sec

SIP Entities in this Location

Type	Name	IP or Hostname	Notes
CM	Denver CM	192.168.22.16	Main Communication Manager
MM	Enterprise Messaging	192.168.22.17	Primary Messaging Server
SM	Denver Session Manager	192.168.22.15	SM in Denver Data Center

See Common SIP Entity Types for entity type descriptions.

Location: New York

Administrative Notes: Manhattan Facilities

Location IP Address Pattern Matching

The following IP Patterns define this Location in the SIP Core Network IP address space:

IP Pattern	Range	Notes
192.168.20.*	192.168.20.0 - 192.168.20.255	New York IP Range

Bandwidth Management

Overall Bandwidth Settings

Maximum Total Bandwidth: 1024 Kbit/sec
Can Audio Use Bandwidth Reserved For Video: No
Maximum Audio Bandwidth: 768 Kbit/sec (1024 Total BW - 256 Video BW)
Maximum Video Bandwidth: 256 Kbit/sec
Assumed Audio Bandwidth Per-Call: 80 Kbit/sec

Per-Call Bandwidth Limits

Minimum Acceptable Video Bandwidth: 64 Kbit/sec
Maximum Intra-location Video Bandwidth: 384 Kbit/sec
Maximum Inter-location Video Bandwidth: 384 Kbit/sec

SIP Entities in this Location

Type	Name	IP or Hostname	Notes
GW	NY SBC	192.168.20.17	Session Border Controller for NY SIP Trunks
SIP Trk	NY SIP Trunks	192.168.20.16	AT&T SIP Trunks

See Common SIP Entity Types for entity type descriptions.

Location: Philadelphia

Administrative Notes: Downtown Philly

Location IP Address Pattern Matching

The following IP Patterns define this Location in the SIP Core Network IP address space:

IP Pattern	Range	Notes
192.168.24.*	192.168.24.0 - 192.168.24.255	Philly IP Range

Bandwidth Management

Overall Bandwidth Settings

Maximum Total Bandwidth: 4096 Kbit/sec
Can Audio Use Bandwidth Reserved For Video: Yes
Maximum Audio Bandwidth: 4096 Kbit/sec (Limited by Maximum Total Bandwidth)
Maximum Video Bandwidth: 4096 Kbit/sec (Limited by Maximum Total Bandwidth)
Assumed Audio Bandwidth Per-Call: 80 Kbit/sec

Per-Call Bandwidth Limits

Minimum Acceptable Video Bandwidth: 64 Kbit/sec
Maximum Intra-location Video Bandwidth: 1000 Kbit/sec
Maximum Inter-location Video Bandwidth: 1000 Kbit/sec

SIP Entities in this Location

Type	Name	IP or Hostname	Notes
CM	Philly CM	192.168.24.16	Downtown Philly CM
SIP Trk	Philly SIP Trunks	192.168.24.17	Philly SIP Trunks
SM	Philly Session Manager	192.168.24.15	SM in Philly

See Common SIP Entity Types for entity type descriptions.

Location: San Francisco

Administrative Notes: Nob Hill Branch Office

Location IP Address Pattern Matching

The following IP Patterns define this Location in the SIP Core Network IP address space:

IP Pattern	Range	Notes
192.168.23.*	192.168.23.0 - 192.168.23.255	San Fran IP Range

Bandwidth Management

Overall Bandwidth Settings

Maximum Total Bandwidth: 4096 Kbit/sec
Can Audio Use Bandwidth Reserved For Video: Yes
Maximum Audio Bandwidth: 4096 Kbit/sec (Limited by Maximum Total Bandwidth)
Maximum Video Bandwidth: 4096 Kbit/sec (Limited by Maximum Total Bandwidth)
Assumed Audio Bandwidth Per-Call: 80 Kbit/sec

Per-Call Bandwidth Limits

Minimum Acceptable Video Bandwidth: 64 Kbit/sec
Maximum Intra-location Video Bandwidth: 1000 Kbit/sec
Maximum Inter-location Video Bandwidth: 1000 Kbit/sec

SIP Entities in this Location

Type	Name	IP or Hostname	Notes
VP	West Coast IVR	192.168.23.16	IVR for Customer Service
OTHER	SF CS1K	192.168.23.15	Upgraded CS1000E in SF

See Common SIP Entity Types for entity type descriptions.

Location: South Atlanta

Administrative Notes: Old Office

Location IP Address Pattern Matching

NOTE: *There are no IP Patterns defined for this Location.*

Bandwidth Management

NOTE: *Bandwidth Management is not enabled for this Location.*

SIP Entities in this Location

Type	Name	IP or Hostname	Notes
There are no SIP Entities in this Location.			

NOTE: *This Location appears to be 'empty' and therefore may have no functional purpose. See the Empty Location Action Item for a summary of all empty Locations detected in your Session Manager.*

1.3. SIP Entities

SIP entities are the major hardware and software elements within the SIP Network, among which SIP sessions are routed to connect individual users and provide calling features. Examples of these SIP Entities include instances of both Session Manager and Communication Manager, other non-Avaya PBX systems in your enterprise, as well as Session Border Controllers, Trunking gateways, and Messaging/Voicemail applications. The table below lists the common types of SIP Entities, along with the acronyms that will be used to refer to them:

Common SIP Entity Types

Acronym	Entity Type	Acronym	Entity Type
BSM	Branch Session Manager	PS	Presence Services
CE	Collaboration Environment	SIP Trk	SIP Trunk
CM	Communication Manager	SM	Session Manager
ELIN	Emergency Location Identification Number	SS	Survivability Server
GW	Gateway	SVCPRO	Service Provider
MM	Modular Messaging	VP	Voice Portal
MMCS	Conference Services	OTHER	Other App or Server
Msg	Messaging		

SIP Entities are the endpoints of the routing rules that are configured for the SIP Network, and define the destinations for SIP requests to reach a particular user. Each Entity can be assigned a Location to determine where it physically exists, as well as a Time Zone that establishes the Entity's local time with respect to the entire network. These parameters can affect the routing of session requests, as different destinations can be selected based on the originating Location of a request, as well as the current time of day. As previously discussed, the Location to which an Entity belongs also determines the bandwidth management policies that are in effect for sessions directed to the Entity.

The SIP Entities are linked together to define the SIP Network topology. For Session Manager to route a SIP request to a destination Entity, there must exist an Entity Link between the Session Manager and the destination Entity. Each Link defines the IP protocol and IP port numbers used to communicate between two devices on the network, and can include parameters for validation and trust. Thus, these links establish or define the available session routing paths within the SIP Network.

As one of the main features of Session Manager is to unify a diverse network of communications devices, each Entity can be assigned an Adaptation that provides the necessary translations to ensure all of the devices can communicate via a common, enterprise-wide dial plan. In addition, the Adaptations can normalize any differences in the SIP protocol spoken by the devices, due to the unique implementations by a variety of manufacturers and products. The implementation details of these Adaptations will be covered in the next section.

Format

This section will provide a comprehensive view of the SIP Entities and SIP Entity Links defined in Session Manager. It begins with a brief reference table listing all of the SIP Entities defined, followed by a graphical depiction of these Entities with regard to their Location and the Entity Links defined among them. This illustration depicts the enterprise-wide SIP routing network as understood by Session Manager, which occupies the central role of 'SIP Core Network' in the diagram. Each Location and Entity in the network is labeled by name, and Entities are badged with an icon describing their type. The defined Entity Links, which establish the available paths for routing SIP sessions, are shown as dotted or dashed lines between the Entities.

Following the SIP Routing diagram is a detailed documentation of the Entities, grouped by type. For each Entity, this documentation includes the critical configuration parameters (Location, Time Zone, IP Address, etc.), a list of other Entities to which it can route SIP sessions via a Link, and a list of the Routing Policies that the Entity is a destination for. SIP session routing will be explained more fully in the subsequent sections.

Use

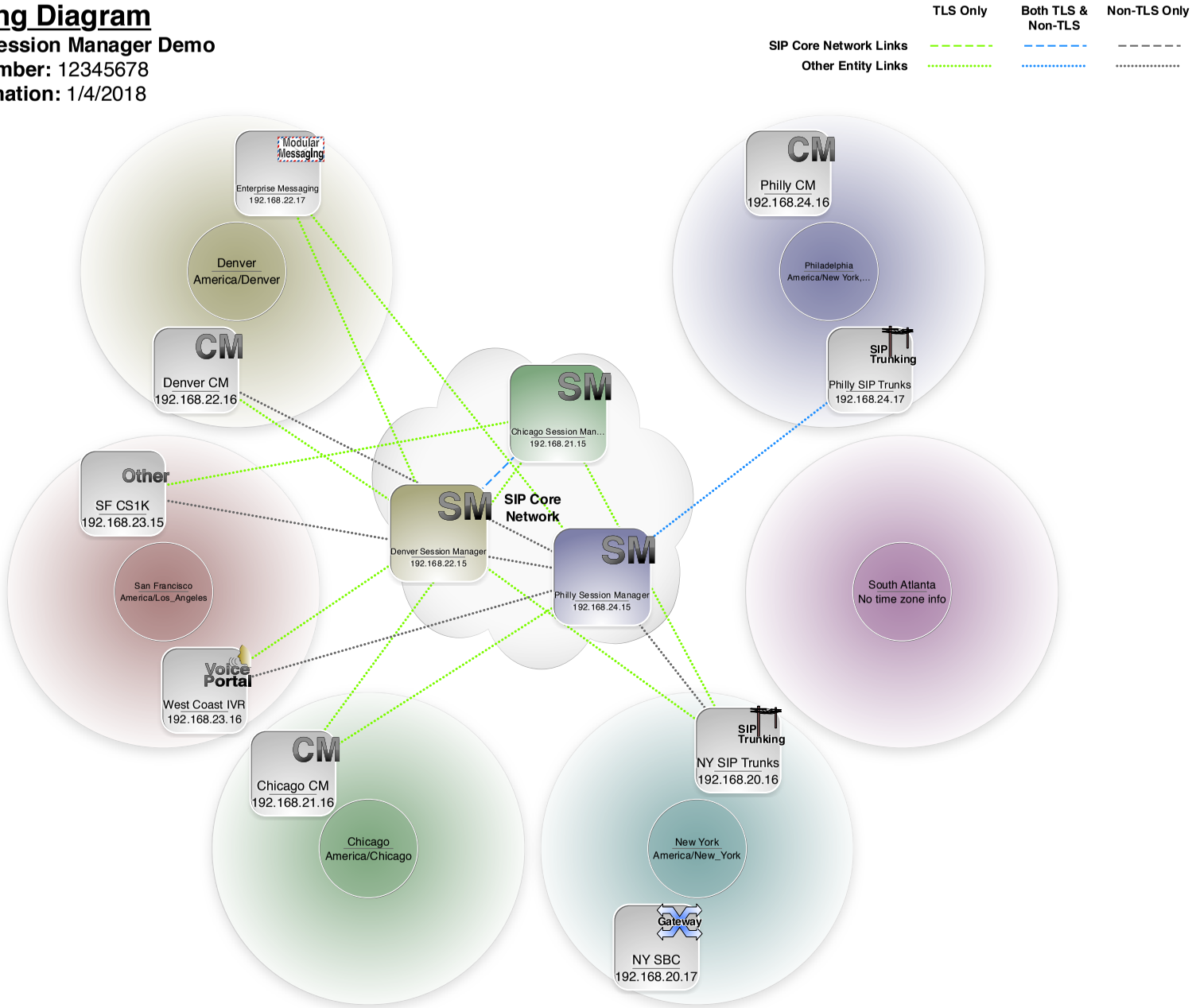
The cost efficiencies of SIP-based communications can best be realized with an accurate knowledge of the SIP network. This section will provide you with a detailed understanding of the topology of the SIP Network, its principal components, and how they are configured. This information is required to implement an effective enterprise-wide dial plan and trunking policy within Session Manager. For example, visualizing where PSTN Trunking resources exist in the enterprise network allows you to design an efficient 'Tail End Hop Off' strategy, and identifying the location of shared resources such as SIP Trunking and messaging will help you achieve a proper redundancy plan. Regular updates to this information will help ensure your SIP routing policies are cost-effective and up to date.

SIP Entity Reference

Type	Name	Location	Notes
CM	Chicago CM	Chicago	Secondary Communication Manager
CM	Denver CM	Denver	Main Communication Manager
CM	Philly CM	Philadelphia	Downtown Philly CM
GW	NY SBC	New York	Session Border Controller for NY SIP Trunks
MM	Enterprise Messaging	Denver	Primary Messaging Server
SIP Trk	NY SIP Trunks	New York	AT&T SIP Trunks
SIP Trk	Philly SIP Trunks	Philadelphia	Philly SIP Trunks
SM	Chicago Session Manager	Chicago	SM in Downtown Loop
SM	Denver Session Manager	Denver	SM in Denver Data Center
SM	Philly Session Manager	Philadelphia	SM in Philly
VP	West Coast IVR	San Francisco	IVR for Customer Service
OTHER	SF CS1K	San Francisco	Upgraded CS1000E in SF
Total SIP Entities: 12			

SIP Routing Diagram

Avaya Aura Session Manager Demo
Customer Number: 12345678
Date of Information: 1/4/2018



NOTE: Please refer to the sections 'SIP Entities' and 'Network Routing Locations' for details if any information appears unclear.

Communication Manager Entities (CM)

Entity: Chicago CM

Administrative Notes: Secondary Communication Manager

Entity Properties

Location: Chicago
Time Zone: America/Chicago
IP Address: 192.168.21.16
Assigned Adaptation: Chicago to 11 Digit Dialing
Override Port & Transport with DNS Service: No
CDR Monitoring: Outbound Calls Only
Entity Link Monitoring: Use Session Manager Configuration

Linked Entities

The following SIP Entities are linked to the 'Chicago CM' SIP Entity:

Type	Name	Protocol(s)	Notes
SM	Chicago Session Manager	TLS	SM in Downtown Loop
SM	Philly Session Manager	TLS	SM in Philly

Routing Policies

This SIP Entity is the destination of the following Routing Policies:

Name	Is Disabled	Notes
Chicago Far Away		Distant calls from Chicago
Chicago Long Distance		LD Calls from Chicago
Chicago Regional		Regional calls to the Chicago area

NOTE: *For the routing analysis of calls destined for this SIP Entity, refer to the section Destination Entity: 'Chicago CM'.*

Entity: Denver CM

Administrative Notes: Main Communication Manager

Entity Properties

Location: Denver
Time Zone: America/Denver
IP Address: 192.168.22.16
Assigned Adaptation: Denver to 11 Digit Dialing
Override Port & Transport with DNS Service: No
CDR Monitoring: Both Inbound and Outbound Calls
Entity Link Monitoring: Use Session Manager Configuration

Linked Entities

The following SIP Entities are linked to the 'Denver CM' SIP Entity:

Type	Name	Protocol(s)	Notes
SM	Denver Session Manager	TLS	SM in Denver Data Center
SM	Philly Session Manager	TCP	SM in Philly

Routing Policies

This SIP Entity is the destination of the following Routing Policies:

Name	Is Disabled	Notes
Denver Far Away		Distant calls from Denver
Denver Long Distance		LD calls from Denver
Denver Regional		Regional calls to the Denver area

NOTE: *For the routing analysis of calls destined for this SIP Entity, refer to the section Destination Entity: 'Denver CM'.*

Entity: Philly CM

Administrative Notes: Downtown Philly CM

Entity Properties

Location: Philadelphia
Time Zone: America/New York
IP Address: 192.168.24.16
Assigned Adaptation: Philly to 11 Digit Dialing
Override Port & Transport with DNS Service: No
CDR Monitoring: Both Inbound and Outbound Calls
Entity Link Monitoring: Use Session Manager Configuration

Linked Entities

NOTE: *This SIP Entity is not linked to a Session Manager, but it is the destination of 2 Routing Policies and 1 Dial Pattern and/or Regular Expression. Because there are no SIP Entity Links from Session Manager to this SIP Entity, calls matching any of the Dial Patterns or Regular Expressions will likely fail. To correct this, add a link between Session Manager and this SIP Entity. See the Unreachable SIP Entities Action Item to learn more about what this means, and to see a list of all unreachable SIP Entities.*

Routing Policies

This SIP Entity is the destination of the following Routing Policies:

Name	Is Disabled	Notes
Philly - Downtown		Routing for Philly
Philly - Suburbs		Alt Routing for Philly

NOTE: *For the routing analysis of calls destined for this SIP Entity, refer to the section Destination Entity: 'Philly CM'.*

Gateway Entities (GW)

Entity: NY SBC

Administrative Notes: Session Border Controller for NY SIP Trunks

Entity Properties

Location: New York
Time Zone: America/New_York
IP Address: 192.168.20.17
Override Port & Transport with DNS Service: No
CDR Monitoring: Both Inbound and Outbound Calls

Entity Link Monitoring: Yes

Linked Entities

NOTE: *This SIP Entity is not linked to Session Manager and cannot receive any calls being routed by the Network Routing Policy (NRP) programming. This does not appear to be an immediate problem because this SIP Entity is not a destination for any of the Routing Policies defined. Before using this SIP Entity as the destination of a Routing Policy, make sure to add a SIP Entity Link between it and at least one instance of Session Manager.*

Modular Messaging Entities (MM)

Entity: Enterprise Messaging

Administrative Notes: Primary Messaging Server

Entity Properties

Location: Denver
Time Zone: America/Denver
IP Address: 192.168.22.17
Assigned Adaptation: MM Digit Conversion
Override Port & Transport with DNS Service: No
CDR Monitoring: Outbound Calls Only
Entity Link Monitoring: Yes

Linked Entities

The following SIP Entities are linked to the 'Enterprise Messaging' SIP Entity:

Type	Name	Protocol(s)	Notes
SM	Denver Session Manager	TLS	SM in Denver Data Center
SM	Philly Session Manager	TLS	SM in Philly

Routing Policies

This SIP Entity is the destination of the following Routing Policies:

Name	Is Disabled	Notes
Route To Messaging		Modular Messaging

NOTE: *For the routing analysis of calls destined for this SIP Entity, refer to the section Destination Entity: 'Enterprise Messaging'.*

SIP Trunk Entities (SIP Trk)

Entity: NY SIP Trunks

Administrative Notes: AT&T SIP Trunks

Entity Properties

Location: New York
Time Zone: America/New_York
IP Address: 192.168.20.16
Assigned Adaptation: NY SIP Trunk Support
Override Port & Transport with DNS Service: No

CDR Monitoring: Both Inbound and Outbound Calls
Entity Link Monitoring: Use Session Manager Configuration

Linked Entities

The following SIP Entities are linked to the 'NY SIP Trunks' SIP Entity:

Type	Name	Protocol(s)	Notes
SM	Chicago Session Manager	TLS	SM in Downtown Loop
SM	Denver Session Manager	TLS	SM in Denver Data Center
SM	Philly Session Manager	TCP	SM in Philly

Routing Policies

This SIP Entity is the destination of the following Routing Policies:

Name	Is Disabled	Notes
International VoIP		International ITSP
NY SIP Trunking		Free Nights & Weekends, Inexpensive Other Times
New York Dial Patterns (Unused)	✓	Old DP Routing for NY

NOTE: *For the routing analysis of calls destined for this SIP Entity, refer to the section Destination Entity: 'NY SIP Trunks'.*

Entity: Philly SIP Trunks

Administrative Notes: Philly SIP Trunks

Entity Properties

Location: Philadelphia
Time Zone: America/New_York
IP Address: 192.168.24.17
Override Port & Transport with DNS Service: No
CDR Monitoring: Both Inbound and Outbound Calls
Entity Link Monitoring: Use Session Manager Configuration

Linked Entities

The following SIP Entities are linked to the 'Philly SIP Trunks' SIP Entity:

Type	Name	Protocol(s)	Notes
SM	Philly Session Manager	TCP, TLS	SM in Philly

Routing Policies

This SIP Entity is the destination of the following Routing Policies:

Name	Is Disabled	Notes
Philly - SIP		Philly SIP

NOTE: *For the routing analysis of calls destined for this SIP Entity, refer to the section Destination Entity: 'Philly SIP Trunks'.*

Session Manager Entities (SM)

Entity: Chicago Session Manager

Administrative Notes: SM in Downtown Loop

Entity Properties

Location: Chicago
Time Zone: America/Chicago
IP Address: 192.168.21.15
Outbound Proxy: Denver Session Manager
Override Port & Transport with DNS Service: No
CDR Monitoring: Outbound Calls Only
Entity Link Monitoring: Use Session Manager Configuration

Listen Ports

This entity listens for connections on the following ports:

Port	Transport	Default Domain	Notes	SIP Endpoint
5060	UDP	sip.infoplus.net	Non-TLS Listen Port (UDP)	
5060	TCP	sip.infoplus.net	Non-TLS Listen Port (TCP)	
5061	TLS	sip.infoplus.net	SM Listen Port	

Linked Entities

The following SIP Entities are linked to the 'Chicago Session Manager' SIP Entity:

Type	Name	Protocol(s)	Notes
CM	Chicago CM	TLS	Secondary Communication Manager
SIP Trk	NY SIP Trunks	TLS	AT&T SIP Trunks
SM	Denver Session Manager	TCP, TLS	SM in Denver Data Center
OTHER	SF CS1K	TLS	Upgraded CS1000E in SF

Entity: Denver Session Manager

Administrative Notes: SM in Denver Data Center

Entity Properties

Location: Denver
Time Zone: America/Denver
IP Address: 192.168.22.15
Override Port & Transport with DNS Service: No
CDR Monitoring: Outbound Calls Only
Entity Link Monitoring: Use Session Manager Configuration

Listen Ports

This entity listens for connections on the following ports:

Port	Transport	Default Domain	Notes	SIP Endpoint
5060	UDP	sip.infoplus.net	Non-TLS Listen Port (UDP)	
5060	TCP	sip.infoplus.net	Non-TLS Listen Port (TCP)	

Port	Transport	Default Domain	Notes	SIP Endpoint
5061	TLS	sip.infoplus.net	SM Listen Port	

Linked Entities

The following SIP Entities are linked to the 'Denver Session Manager' SIP Entity:

Type	Name	Protocol(s)	Notes
CM	Denver CM	TLS	Main Communication Manager
MM	Enterprise Messaging	TLS	Primary Messaging Server
SIP Trk	NY SIP Trunks	TLS	AT&T SIP Trunks
SM	Chicago Session Manager	TCP, TLS	SM in Downtown Loop
VP	West Coast IVR	TLS	IVR for Customer Service
Total Linked Entities: 5			

Entity: Philly Session Manager

Administrative Notes: SM in Philly

Entity Properties

Location: Philadelphia
Time Zone: America/New_York
IP Address: 192.168.24.15
Override Port & Transport with DNS Service: No
CDR Monitoring: Outbound Calls Only
Entity Link Monitoring: Use Session Manager Configuration

Listen Ports

This entity listens for connections on the following ports:

Port	Transport	Default Domain	Notes	SIP Endpoint
5060	UDP	sip.infoplus.net	Non-TLS Listen Port (UDP)	
5060	TCP	sip.infoplus.net	Non-TLS Listen Port (TCP)	
5061	TLS	sip.infoplus.net	SM Listen Port	

Linked Entities

The following SIP Entities are linked to the 'Philly Session Manager' SIP Entity:

Type	Name	Protocol(s)	Notes
CM	Chicago CM	TLS	Secondary Communication Manager
CM	Denver CM	TCP	Main Communication Manager
MM	Enterprise Messaging	TLS	Primary Messaging Server
SIP Trk	NY SIP Trunks	TCP	AT&T SIP Trunks
SIP Trk	Philly SIP Trunks	TCP, TLS	Philly SIP Trunks
VP	West Coast IVR	TCP	IVR for Customer Service
OTHER	SF CS1K	TCP	Upgraded CS1000E in SF
Total Linked Entities: 7			

Voice Portal Entities (VP)

Entity: West Coast IVR

Administrative Notes: IVR for Customer Service

Entity Properties

Location: San Francisco
Time Zone: America/Los_Angeles
IP Address: 192.168.23.16
Override Port & Transport with DNS Service: No
CDR Monitoring: Inbound Calls Only
Entity Link Monitoring: Use Session Manager Configuration

Linked Entities

The following SIP Entities are linked to the 'West Coast IVR' SIP Entity:

Type	Name	Protocol(s)	Notes
SM	Denver Session Manager	TLS	SM in Denver Data Center
SM	Philly Session Manager	TCP	SM in Philly

Routing Policies

This SIP Entity is the destination of the following Routing Policies:

Name	Is Disabled	Notes
Route to IVR		Customer Service IVR

NOTE: *For the routing analysis of calls destined for this SIP Entity, refer to the section Destination Entity: 'West Coast IVR'.*

Other Entities

Entity: SF CS1K

Administrative Notes: Upgraded CS1000E in SF

Entity Properties

Location: San Francisco
Time Zone: America/Los_Angeles
IP Address: 192.168.23.15
Assigned Adaptation: San Fran to Enterprise Dial Plan
Override Port & Transport with DNS Service: No
CDR Monitoring: None
Entity Link Monitoring: Use Session Manager Configuration

Linked Entities

The following SIP Entities are linked to the 'SF CS1K' SIP Entity:

Type	Name	Protocol(s)	Notes
SM	Chicago Session Manager	TLS	SM in Downtown Loop
SM	Philly Session Manager	TCP	SM in Philly

Routing Policies

This SIP Entity is the destination of the following Routing Policies:

Name	Is Disabled	Notes
San Fran Far Away		Distant Calls From San Fran, Business Line
San Fran Long Distance		LD Calls From San Fran, Business Line
San Fran Regional		Local Business Line - Expensive on Weekends

NOTE: *For the routing analysis of calls destined for this SIP Entity, refer to the section Destination Entity: 'SF CS1K'.*

1.4. SIP Entity Link Analysis

Session Manager is the heart of the routing infrastructure in the Avaya Aura SIP Network architecture. Logically, SIP Entities representing Session Manager are situated in the center of the network and form what is called the "SIP Core Network". Other components such as Communication Manager, Aura Messaging, SIP Trunks, etc. are logically situated outside of the SIP Core Network and are represented by the appropriate non-Session Manager SIP Entity types. SIP Entities outside the SIP Core Network send their session requests to the core, where a Session Manager instance will determine the request's destination and route.

For Session Manager to be able to route session requests to and from other entities in the network, routing/communication paths must be established. A routing path is established by building a SIP Entity Link between two SIP Entities. For typical session request routing, SIP Entity Links are established between the SIP Core Network and any non-Session Manager SIP Entity that needs to send or receive calls. If for some reason one of these links cannot be used, Session Manager has the ability to route the session request over alternate or fallback routes.

To establish alternate routes, SIP Entity Links are created *between* Session Manager entities within the SIP Core Network. This is referred to as Session Manager interlinking. These alternate routes make the Avaya Aura SIP network fault tolerant.

In addition to defining the routing paths within the Avaya Aura SIP Network, SIP Entity Links also define key communication characteristics. They establish whether a link is implicitly trusted or not, the protocol (UDP, TCP, TLS) used for communication, and the port on which communication occurs.

Format

The following analysis is broken down into three sections:

Alternate Route/Fallback Routing:

The analysis of the SIP Core Network interlinking determines its redundancy and resiliency. This is done by examining the extent to which the Session Manager instances within the Core are linked to one another. From this analysis, an assessment is made regarding the availability of alternate/fallback routing within your SIP network.

Signaling Encryption Analysis:

The SIP Core Network encryption analysis determines how widespread the use of encryption is within the SIP Core Network. Encryption is used to to make sure the signaling data used by Session Manager to set up and tear down calls is not exposed to others.

Entity Link Analysis:

The network-wide SIP Entity Link analysis provides a holistic view of how the network is interconnected. It provides a summary of how each SIP Entity is linked to the SIP Core Network, and whether or not it can reach every other entity. Any entities that are not reachable through the network of SIP Entity Links are identified.

Use

Whether you are attempting to assess the redundancy of call routing or the level of security used when those calls are routed, this section will help you understand how your SIP Network is configured by way of its SIP Entity Links. This information is essential to properly integrate new SIP Entities, modify an already complex network, or troubleshoot why calls aren't routing where they're supposed to route.

Due to the complexity of enterprise-level communications, it is not easy to get a good, comprehensive picture of how your system is configured without our report. This section will help you understand key aspects of your Avaya Aura SIP network that are vital to troubleshooting and maintenance.

SIP Core Network Interlinking

Session Manager (SM) interlinking provides alternate/fallback routes to use when either direct, or secure routes are unavailable. The following analyses provide insight into two critical aspects of SM interlinking: how many alternate routes are available, and whether all alternate routes are equally secure. Making sure there are adequate alternate routes ensures that SM can 'reach' all destination entities under adverse network conditions. Evaluating their security helps you to understand the security implications of your alternate routing.

Alternate Route/Fallback Routing

- **All** Session Manager entities have at least one SIP Entity Link connecting them to entities outside of the SIP Core Network.
- If appropriate, having each of the **3** Session Manager instances interlinked provides you with significant benefits such as SIP Core Network redundancy during adverse network conditions.
- With the current Session Manager interlinking, **some** alternate/fallback routing is provided, but it is **not** completely redundant.
- Adding an additional **2** SIP Entity Links will establish all possible alternate routes through the SIP Core Network. Refer to the SIP Routing Diagram to examine existing links.

Signaling Encryption Analysis

Keeping signaling data in the SIP Core Network secure can be critical to some organizations. Secure SIP Entity Links use the encrypted TLS protocol. Insecure links use the TCP or UDP protocols. A review of the encryption used by SIP Entity Links between Session Manager instances will help to ensure the security of the SIP Core Network is meeting design objectives.

Keep the following points in mind when reviewing the analysis in the table below:

- If possible, add TLS links to at least make encryption available.
- Evaluate whether or not Non-TLS links can be removed, or replaced with TLS links to make encryption mandatory.

SIP Core Network Encryption State

The following table summarizes the overall use of TLS encryption throughout your SIP Core Network:

Current Configuration	SIP Core Network Encryption Level
	1. TLS encryption is **mandatory** on all signaling paths at all times. Signaling data is always encrypted.
✓	2. TLS encryption is **available** on all signaling paths, but is not mandatory on all paths. Signaling paths where TLS is not mandatory can fall back to insecure links which transmit signaling data unencrypted.
	3. TLS encryption is **mandatory** on some signaling paths, but is **unavailable** on others. Signaling data is always encrypted between certain Session Manager entities, but is never encrypted between others.
	4. TLS encryption is **available** on some signaling paths, but is **unavailable** on others. There are no signaling paths on which encryption is mandatory. Signaling paths where TLS is available can fall back to insecure links which transmit signaling data unencrypted.
	5. TLS encryption is **unavailable** on all signaling paths. All signaling data is always transmitted unencrypted.

Please refer to the SIP Routing Diagram for details about SIP Entity Links and the protocols used.

Entity Link Analysis

Session Manager (SM) routes session requests to and from SIP Entities over the network topology created by SIP Entity Links. Calls can only be routed to entities when there is a 'path' of links between SM and the entity. Determining which entities can 'reach' one another is not always easy, especially for complex networks.

The Entity Link Analysis examines all linked entities. For each entity listed, all links are followed and any entities which cannot be reached are listed. In addition, the number of links between each entity and the SIP Core Network is calculated. This metric provides an indication of redundancy to the SIP Core.

The following table provides a summary of how your network of SIP Entities is linked:

SIP Entity	Entity Type	Links To SIP Core Network	Can Reach All Entities
Chicago CM	CM	2	✓
Denver CM	CM	2	✓
Enterprise Messaging	MM	2	✓
NY SIP Trunks	SIP Trk	All	✓
Philly SIP Trunks	SIP Trk	**1 ***	No - See Below
Unreachable Entities:			
Chicago Session Manager	SM		
Denver Session Manager	SM		
Chicago Session Manager	SM	N/A	No - See Below
Unreachable Entities:			
Philly SIP Trunks	SIP Trk		
Philly Session Manager	SM		
Denver Session Manager	SM	N/A	No - See Below
Unreachable Entities:			
Philly SIP Trunks	SIP Trk		
Philly Session Manager	SM		
Philly Session Manager	SM	N/A	No - See Below
Unreachable Entities:			
Chicago Session Manager	SM		
Denver Session Manager	SM		
West Coast IVR	VP	2	✓
SF CS1K	OTHER	2	✓

**NOTE:* Having more than one SIP Entity Link between the SIP Core Network and an entity provides redundant paths for routing. If possible, add additional SIP Entity Links between the SIP Core Network and any entities connected by only one link. Refer to the SIP Routing Diagram to examine existing links.*

1.5. Session Manager Adaptations

Session Manager Adaptations allow you to integrate the various components that make up an Avaya Aura installation by A) translating between disparate, local dial plans and the enterprise-wide dial plan, and B) altering the SIP messages entering or leaving Session Manager to compensate for any implementation differences among the varying equipment manufacturers and service providers.

Adaptations provide the opportunity to modify call processing at critical points in the life cycle of a SIP session request - namely when entering or leaving the SIP 'Core Network' of Session Managers. Access at these key points allows SIP call headers and dial plans to be altered as they proceed, Inbound to Session Manager or Outbound from Session Manager, thus adapting the SIP messages for the components they are coming from or going to. Although when building SIP Entities you assign an Adaptation to the Entity being built, *the Inbound and Outbound directionality referred to in this section is always from the perspective of Session Manager*.

All Adaptation modules provide a base set of modifications that can be applied to SIP messages, such as digit conversion, modification of the Inbound and Outbound domains specified in the headers of a SIP message, and the ability to append parameters to the Outbound SIP request. This set of SIP message modification tools is what facilitates dial plan transparency and enterprise-wide control by Avaya Aura.

In addition to the base functionality provided by all Adaptations, vendor-specific Adaptation modules can perform modifications which normalize the SIP messages to conform to the same IETF standards used by Avaya Aura. This allows seamless integration between Avaya Aura and the proprietary SIP implementations of disparate manufacturers and service providers. This behavior is implicit to the specific Adaptation module being applied, and is not configured by the End User.

Format

Each Adaptation defined in Session Manager's Network Routing will be reviewed and presented, ordered by Adaptation name. All base functionality will be detailed or summarized, and when possible interpreted to provide a high-level explanation of the affects the Adaptation has on SIP messages. This includes domain modifications, the addition of SIP URI parameters, and various digit conversion rules. When an Adaptation is integrating third-party hardware into the enterprise network, it will be noted.

Although a specific SIP Entity can have but one Adaptation assigned, once defined an Adaptation can be used by multiple SIP Entities. SIP Entities using the same Adaptation will all have the same modifications applied to their SIP messages. To help understand which SIP Entities have these common needs, a list of SIP Entities to which an Adaptation is assigned is provided for each Adaptation listed.

Use

Adaptations play a key role in Avaya Aura by implementing the translation rules of the enterprise-wide dial plan. Incorrect configuration of Adaptations could lead to dropped calls or widespread incompatibilities between components. A thorough understanding of the Adaptations covered in this section is required for troubleshooting, expanding the enterprise network, or simply maintaining the dial plan.

Adaptation: Chicago to 11 Digit Dialing

Administrative Notes: Converts local 7-digit dialing to 11-digit for CHI
Module Type: DigitConversionAdapter
Module Summary: Provides digit conversion and domain override capabilities.

This Adaptation applies the following SIP header modifications:

- For **outbound** calls, the **destination** domain is overridden and changed to **sip.infoplus.net**.

This Adaptation does not append any Request-URI parameters to outbound calls.

Inbound to SM Digit Conversion Rules - Destination

These digit conversion rules modify **only the Destination** address:

Digit Pattern	Min	Max	Context	Del	Insert	Notes
x	7	7		0	1312	Add Chicago Area Code

xxx-xxxx becomes 1-312-xxx-xxxx

SIP Entities

The following SIP entities are using this Adaptation:

Type	Name	Notes
CM	Chicago CM	Secondary Communication Manager

Adaptation: Denver to 11 Digit Dialing

Administrative Notes: Converts local 7-digit dialing to 11-digit for DEN
Module Type: InfoPlusAdapter

NOTE: *This Adaptation's Module type, InfoPlusAdapter, is unknown. If an Adaptation's Module type is unknown or omitted, the Adaptation won't function properly. To review other Adaptations whose functionality is questionable, refer to the Unknown or Omitted Adaptation Module Type Action Item.*

This Adaptation does not apply any inbound or outbound SIP header modifications.

This Adaptation appends the following parameters to the outbound Request-URI:

- domain=sip1.infoplus.net custApp=teller

NOTE: *The Request-URI parameter string for this Adaptation, 'domain=sip1.infoplus.net custApp=teller', is not properly formatted according to the SIP technical specification (As described in RFC3261). A properly formatted Request-URI parameter string is a list of <key>=<name> separated by ';'. See the Malformed Adaptation Request-URI Parameters Action Item for a summary of all unknown Request-URI parameters detected in your Session Manager.*

Inbound to SM Digit Conversion Rules - Destination

These digit conversion rules modify **only the Destination** address:

Digit Pattern	Min	Max	Context	Del	Insert	Notes
x	7	7		0	1303	Add Denver Area Code

xxx-xxxx becomes 1-303-xxx-xxxx

SIP Entities

The following SIP entities are using this Adaptation:

Type	Name	Notes
CM	Denver CM	Main Communication Manager

Adaptation: MM Digit Conversion

Administrative Notes: DP Conversions for Messaging
Module Type: DigitConversionAdapter
Module Summary: Provides digit conversion and domain override capabilities.

This Adaptation applies the following SIP header modifications:

- For **inbound and outbound** calls, the **destination** domain is overridden and changed to **sip.infoplus.net**.

This Adaptation does not append any Request-URI parameters to outbound calls.

Inbound to SM Digit Conversion Rules - Destination

These digit conversion rules modify **only the Destination** address:

Digit Pattern	Min	Max	Context	Del	Insert	Notes
1	11	11		1		Remove Leading 1 from MM
1-xxx-xxx-xxxx becomes xxx-xxx-xxxx						

Outbound from SM Digit Conversion Rules - Origination

These digit conversion rules modify **only the Origination** address:

Digit Pattern	Min	Max	Context	Del	Insert	Notes
303456	10	10		0	1	Add Leading 1
303-456-xxxx becomes 1-303-456-xxxx						
5	4	4	sip.infoplus.net	0	+1303456	Add NPA/NXX for 5xxx
5xxx becomes +1-303-456-5xxx Calls enter the E.164 domain						

SIP Entities

The following SIP entities are using this Adaptation:

Type	Name	Notes
MM	Enterprise Messaging	Primary Messaging Server

Adaptation: NY SIP Trunk Support

Administrative Notes: Fixes SIP Headers for AT&T SIP Trunks
Module Type: AttAdapter
Module Summary: Removes SIP headers not supported by AT&T from outbound calls.

This Adaptation applies the following SIP header modifications:

- The **From** and **To** call headers will NOT be modified. *

NOTE: *It appears as though this Adaptation is attempting to enable From/To SIP header modifications by adding the 'fromto=y' module parameter. However, to enable From/To SIP header modification, this parameter's value must be set to lowercase 'true'; this is strictly required. To review other Adaptations which have questionable module parameter programming, refer to the Improperly Programmed Adaptation Module Parameters Action Item.*

This Adaptation appends the following parameters to the outbound Request-URI:

- custApp=1

This Adaptation does not have digit conversion rules defined.

SIP Entities

The following SIP entities are using this Adaptation:

Type	Name	Notes
SIP Trk	NY SIP Trunks	AT&T SIP Trunks

Adaptation: Philly to 7 Digit Dialing

Module Type: DigitConversionAdapter
Module Summary: Provides digit conversion and domain override capabilities.

This Adaptation does not apply any inbound or outbound SIP header modifications.

The following is a list of **unknown** module parameter pairs:

- **Parameter:** sip, **Value:** true

NOTE: *Unknown Adaptation module parameters are parameters that are not defined in Avaya's documentation. See the Unrecognized Adaptation Module Parameters Action Item for a summary of all unknown adaptation module parameters detected in your Session Manager.*

This Adaptation does not append any Request-URI parameters to outbound calls.

This Adaptation does not have digit conversion rules defined.

SIP Entities

Type	Name	Notes
No SIP Entities are using this Adaptation.		

NOTE: *There are no SIP Entities using this Adaptation. See the Unused Adaptations Action Item for a summary of all Adaptations that do not have any SIP Entities using them.*

Adaptation: Philly to 11 Digit Dialing

Module Type: DigitConversionAdapter
Module Summary: Provides digit conversion and domain override capabilities.

No user-configured SIP header modifications, outbound Request-URI parameters, or digit conversion rules exist for this Adaptation.

NOTE: *For information about Adaptations with no user-configured rules and modifications, and to see a summary of all Adaptations like this found in your Session Manager programming, refer to the Adaptations With No Effect Action Item.*

SIP Entities

The following SIP entities are using this Adaptation:

Type	Name	Notes
CM	Philly CM	Downtown Philly CM

Adaptation: San Fran to Enterprise Dial Plan

Administrative Notes: Converts SF Local DP to Enterprise DP
Module Type: CS1000Adapter
Module Summary: Translates between legacy Nortel and Avaya SIP header formats, and adds support for CS1000 origination based routing.

This Adaptation does not apply any inbound or outbound SIP header modifications.

The following is a list of **unknown** module parameter pairs:

- **Parameter:** caller, **Value:** phone

NOTE: *Unknown Adaptation module parameters are parameters that are not defined in Avaya's documentation. See the Unrecognized Adaptation Module Parameters Action Item for a summary of all unknown adaptation module parameters detected in your Session Manager.*

This Adaptation does not append any Request-URI parameters to outbound calls.

Inbound to SM Digit Conversion Rules - Destination

These digit conversion rules modify **only the Destination** address:

Digit Pattern	Min	Max	Context	Del	Insert	Notes
6	3	3		0	4	SF DP -> 46XX
6xx becomes 46xx						
x	7	7	sip.infoplus.net	0	1415	Add SF Area Code
xxx-xxxx becomes 1-415-xxx-xxxx						

Outbound from SM Digit Conversion Rules - Destination

These digit conversion rules modify **only the Destination** address:

Digit Pattern	Min	Max	Context	Del	Insert	Notes
46	4	4		1		46XX -> SF DP 6XX
46xx becomes 6xx						

SIP Entities

The following SIP entities are using this Adaptation:

Type	Name	Notes
OTHER	SF CS1K	Upgraded CS1000E in SF

1.6. Session Manager Time Ranges

Time Ranges are used in Session Manager to implement Least Cost Routing based on the day of the week and the time of day at which a call is placed. This section documents and explains all of the Time Ranges that are defined in Session Manager.

Once defined, Time Ranges are associated with Routing Policies to implement Least Cost Routing. The administrator can specify a unique cost, or 'rank', for a Routing Policy during each Time Range defined, indicating how expensive or desirable it is to use that Routing Policy on the days and hours defined in the Time Range. Thus, the defined Time Ranges should reflect the periods of the week during which the system needs to alter the priority of one route over another. To provide predictable routing behavior, it's important to ensure that enough Time Ranges are defined to cover all days and all hours of the entire week.

Format

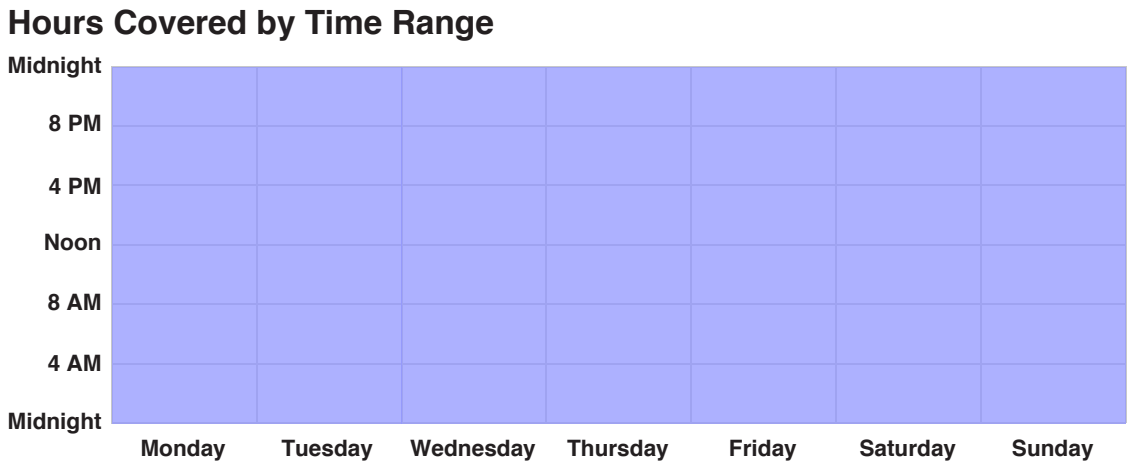
All the Time Ranges defined in Session Manager will be listed here as a reference, detailing the hours and days of the week covered by each. They will be ordered by the name given to them when administered.

Use

When building new routing rules in Session Manager, or troubleshooting Session Manager's routing decisions, this section can be helpful to determine what Time Ranges have been defined, and to verify that the days and hours specified in a given Time Range are accurate. Make sure that every minute of the week is covered by at least one Time Range, and that the ranges are specific enough to implement the necessary Time-of-Day routing decisions when configuring Routing Policies.

24/7

Administrative Notes: Time Range 24/7
Days: All Week
Time: 12:00 AM - 11:59 PM

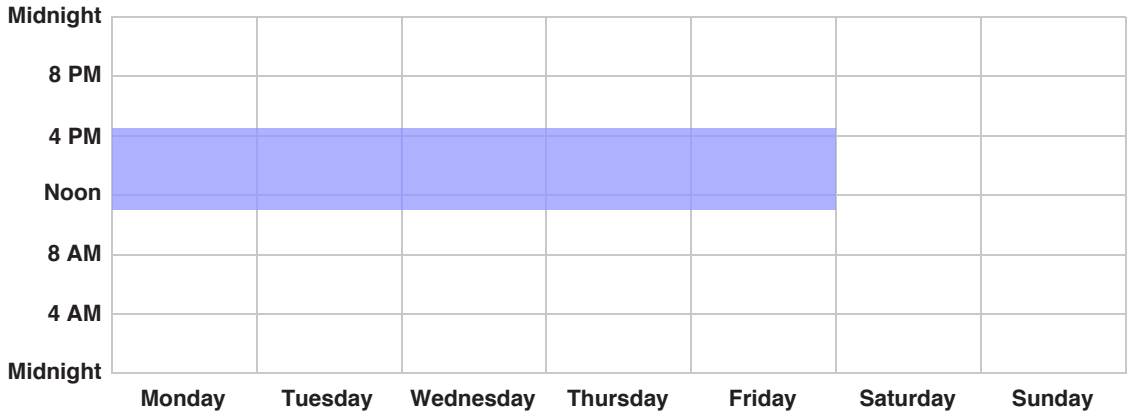


NOTE: *This Time Range is not being used by any Routing Policies. If it is no longer needed, it should be removed to simplify maintenance or prevent inadvertent use. See the Unused Time Ranges Action Item for a summary of all unused time ranges detected in your Session Manager.*

Alternate Coverage

Administrative Notes: Temporary Alternate Time Schedule
Days: Weekdays (M-F)
Time: 11:00 AM - 4:30 PM

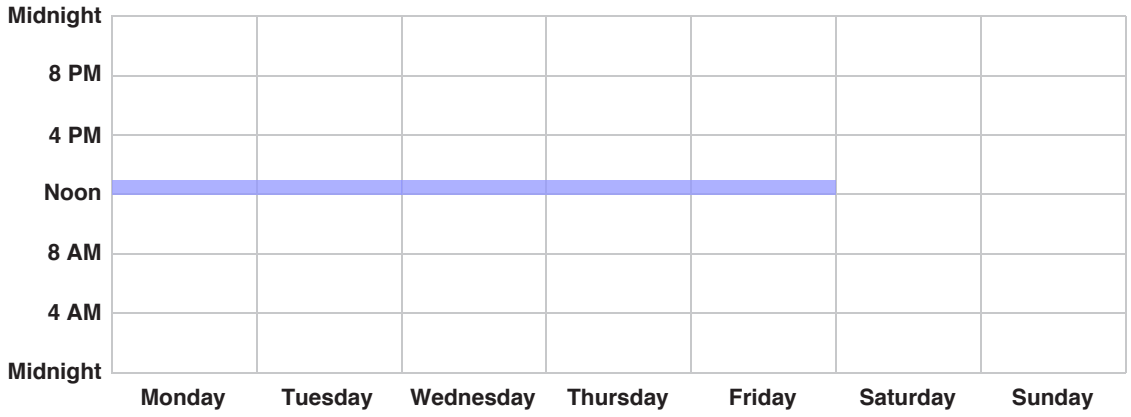
Hours Covered by Time Range



Lunch Hour

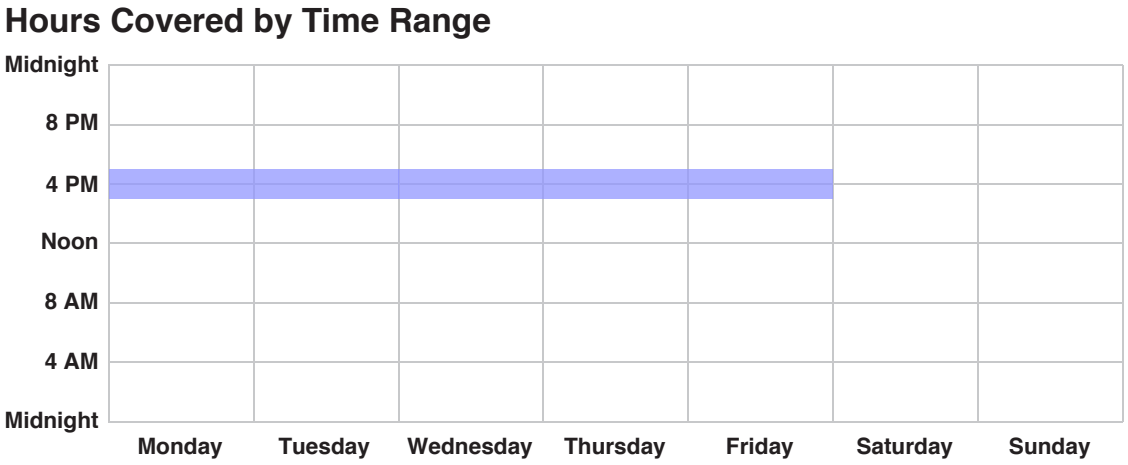
Administrative Notes: Lunch Break
Days: Weekdays (M-F)
Time: 12:00 PM - 1:00 PM

Hours Covered by Time Range



SanFran Peak Hours

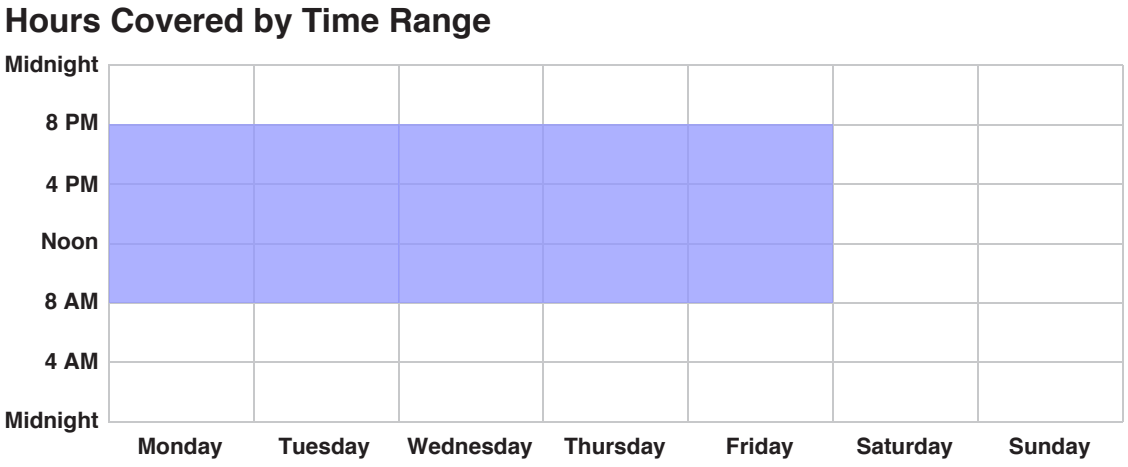
Days: Weekdays (M-F)
Time: 3:00 PM - 5:00 PM



NOTE: *This Time Range is not being used by any Routing Policies. If it is no longer needed, it should be removed to simplify maintenance or prevent inadvertent use. See the Unused Time Ranges Action Item for a summary of all unused time ranges detected in your Session Manager.*

Weekday Business Hours

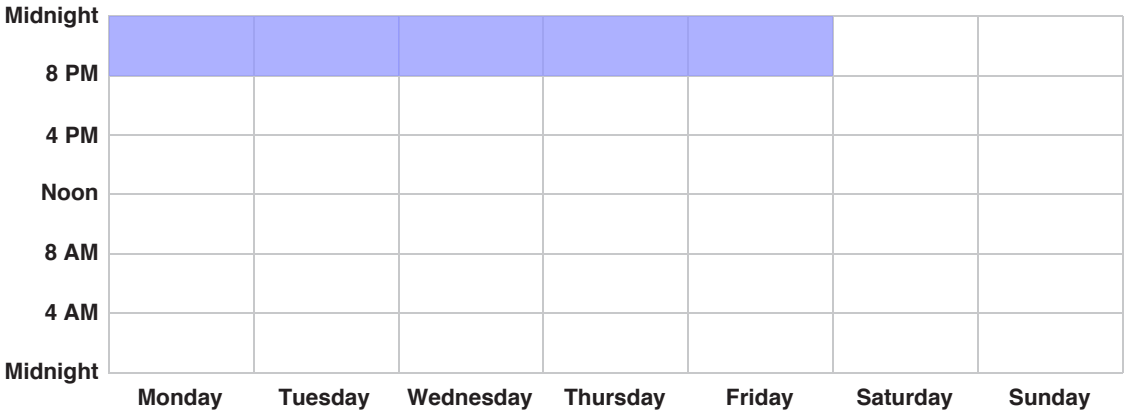
Administrative Notes: Normal Business Hours
Days: Weekdays (M-F)
Time: 8:00 AM - 7:59 PM



Weekday Evenings

Administrative Notes: After Business Hours, Weekdays
Days: Weekdays (M-F)
Time: 8:00 PM - 11:59 PM

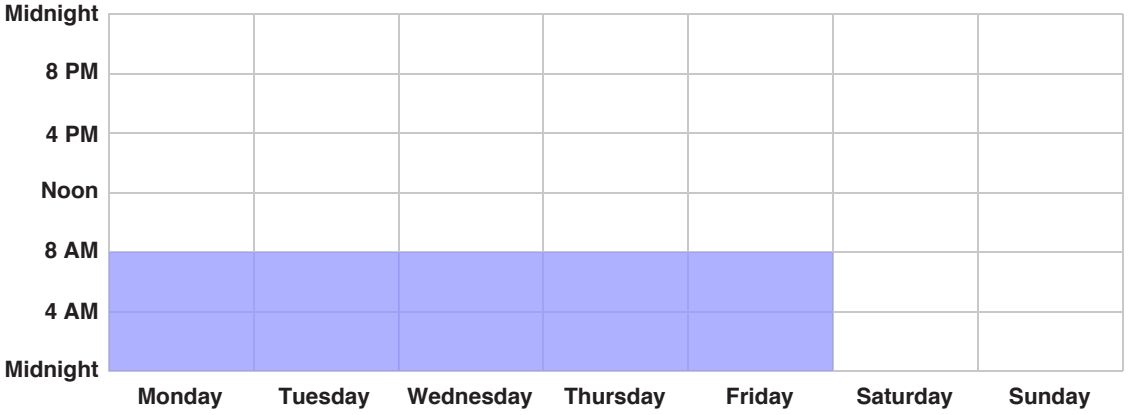
Hours Covered by Time Range



Weekday Mornings

Administrative Notes: Before Business Hours, Weekdays
Days: Weekdays (M-F)
Time: 12:00 AM - 7:59 AM

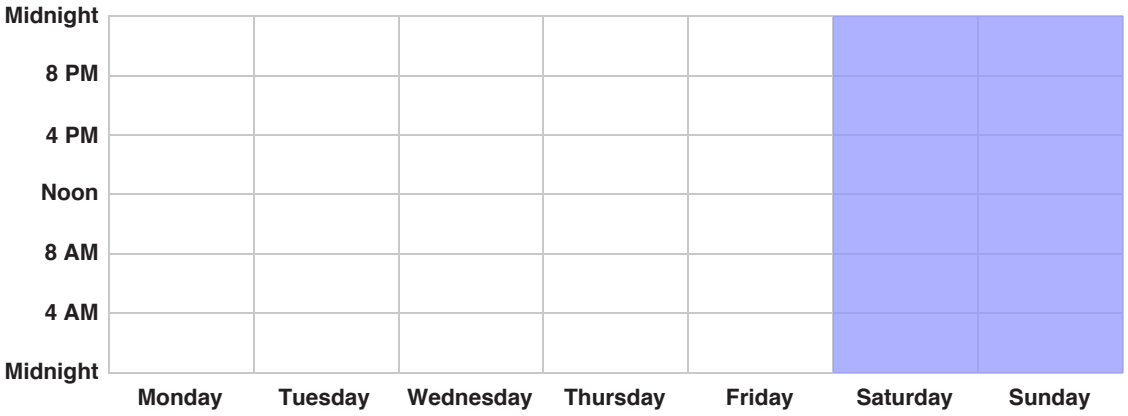
Hours Covered by Time Range



Weekends

Administrative Notes: Saturday & Sunday
Days: Weekends
Time: 12:00 AM - 11:59 PM

Hours Covered by Time Range



1.7. Session Manager Routing Policies

Routing Policies define the possible destinations for the routing decisions that Session Manager must make. Each Routing Policy specifies a particular SIP Entity as its destination, and indicates the relative cost of sending SIP sessions to that Entity during various times of the week. To be more precise, Routing Policies associate one or more Time Ranges with a SIP Entity, and define the relative 'rank' of that Entity during each Time Range. During routing decisions, Session Manager selects the Routing Policy with the lowest 'rank' at the current moment. Thus, varying the 'rank' of a particular Entity during different Time Ranges allows the routing decisions to change as a function of time.

As stated above, varying the 'rank' of a Routing Policy will give Session Manager a set of criteria it can use to favor one Routing Policy over another. Therefore, it is critical that one and only one Time Range is in effect for each Routing Policy at any one moment in time. If two or more Time Ranges associated with a Routing Policy each define a 'rank' for the same moment in time, an 'Overlap' is said to have occurred. Similarly, if there are moments in time that are not covered by any of the Time Ranges associated with a given Routing Policy, there is no 'rank' information available, and a 'Gap' is said to have occurred. Both of these situations, Overlaps and Gaps, create ambiguity when deciding which Routing Policy Session Manager will select. The outcome is said to be undefined, and Session Manager's selection may not be consistent.

Format

This section starts off by presenting a list of the unique costs used by Session Manager to impose a rank ordering on Routing Policies when deciding which policy should handle a given call at a given time. Showing the 'in use' costs as a unique list will highlight the overall implementation of relative cost-based routing for Session Manager.

Routing Policies will be presented ordered by their name. To give a sense of how important a given Routing Policy is to the overall routing design of the SIP Core Network, a summary of how many Dial Patterns and Regular Expressions use a given Routing Policy will be provided. In the SIP Network Routing Chapter, Dial Patterns and Regular Expressions will be explored in depth and on an individual basis. Finally, the cost, or 'rank', of the Policy at each defined Time Range will be displayed. Any Overlaps or Gaps in the associated Time Ranges will be pointed out so they can be addressed.

Use

This section can be used to assess the Routing Policies and their destinations within the SIP Core Network, including the establishment of Least Cost, or Time-of-Day routing patterns. The cost, or 'rank', of a Routing Policy is only relative to the costs assigned to other Routing Policies. Comparing the costs assigned to multiple Policies allows you to determine which Policy will be selected by Session Manager during routing decisions. A more detailed documentation of how these Policies are used to route calls appears in the next chapter.

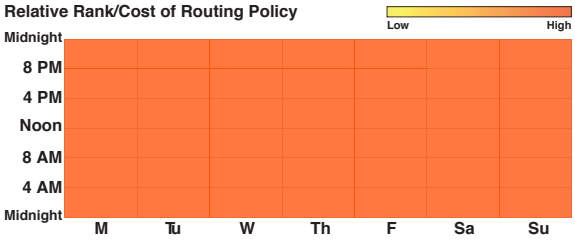
Time-of-Day/Least Cost Routing Values

The following list summarizes the 'Time-of-Day'/'Least Cost Routing' values used by the Routing Policies defined in Session Manager.

Unique Policy Cost Values In Use: 0, 2, 4, 6, 8 and 10
Minimum Policy Cost In Use: 0
Maximum Policy Cost In Use: 10

Routing Policy: Chicago Far Away

Administrative Notes: Distant calls from Chicago
Destination: Chicago CM (CM)
Destination Notes: Secondary Communication Manager
Associated Dial Patterns: 0
Associated Regular Expressions: 1



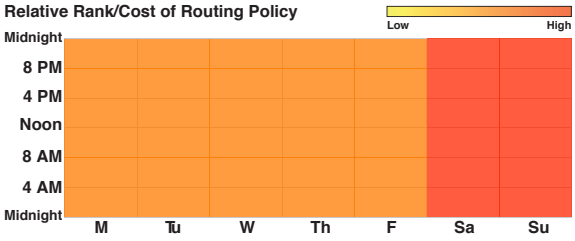
Time Ranges

Actual Rank/Cost of Routing Policy by Time Range:

Name	Notes	Cost
Weekday Mornings	Before Business Hours, Weekdays	8
Weekday Business Hours	Normal Business Hours	8
Weekday Evenings	After Business Hours, Weekdays	8
Weekends	Saturday & Sunday	8

Routing Policy: Chicago Long Distance

Administrative Notes: LD Calls from Chicago
Destination: Chicago CM (CM)
Destination Notes: Secondary Communication Manager
Associated Dial Patterns: 3
Associated Regular Expressions: 1



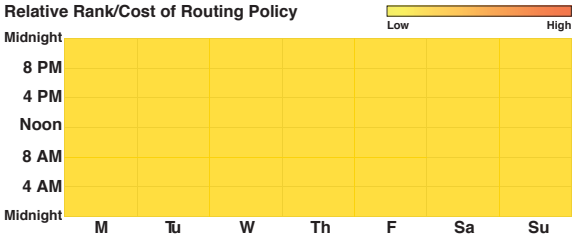
Time Ranges

Actual Rank/Cost of Routing Policy by Time Range:

Name	Notes	Cost
Weekday Mornings	Before Business Hours, Weekdays	6
Weekday Business Hours	Normal Business Hours	6
Weekday Evenings	After Business Hours, Weekdays	6
Weekends	Saturday & Sunday	10

Routing Policy: Chicago Regional

Administrative Notes: Regional calls to the Chicago area
Destination: Chicago CM (CM)
Destination Notes: Secondary Communication Manager
Associated Dial Patterns: 5
Associated Regular Expressions: 0



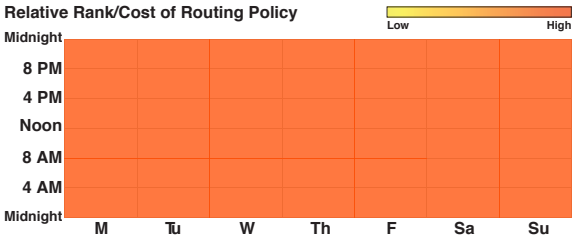
Time Ranges

Actual Rank/Cost of Routing Policy by Time Range:

Name	Notes	Cost
Weekday Mornings	Before Business Hours, Weekdays	2
Weekday Business Hours	Normal Business Hours	2
Weekday Evenings	After Business Hours, Weekdays	2
Weekends	Saturday & Sunday	2

Routing Policy: Denver Far Away

Administrative Notes: Distant calls from Denver
Destination: Denver CM (CM)
Destination Notes: Main Communication Manager
Associated Dial Patterns: 0
Associated Regular Expressions: 1



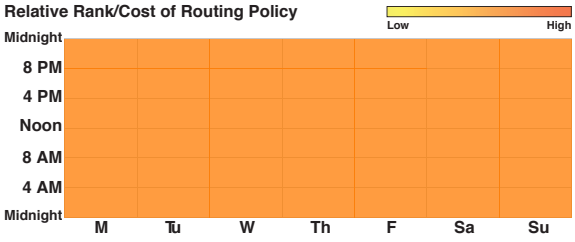
Time Ranges

Actual Rank/Cost of Routing Policy by Time Range:

Name	Notes	Cost
Weekday Mornings	Before Business Hours, Weekdays	8
Weekday Business Hours	Normal Business Hours	8
Weekday Evenings	After Business Hours, Weekdays	8
Weekends	Saturday & Sunday	8

Routing Policy: Denver Long Distance

Administrative Notes: LD calls from Denver
Destination: Denver CM (CM)
Destination Notes: Main Communication Manager
Associated Dial Patterns: 5
Associated Regular Expressions: 1



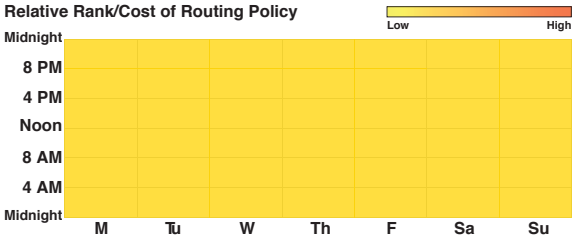
Time Ranges

Actual Rank/Cost of Routing Policy by Time Range:

Name	Notes	Cost
Weekday Mornings	Before Business Hours, Weekdays	6
Weekday Business Hours	Normal Business Hours	6
Weekday Evenings	After Business Hours, Weekdays	6
Weekends	Saturday & Sunday	6

Routing Policy: Denver Regional

Administrative Notes: Regional calls to the Denver area
Destination: Denver CM (CM)
Destination Notes: Main Communication Manager
Associated Dial Patterns: 5
Associated Regular Expressions: 0



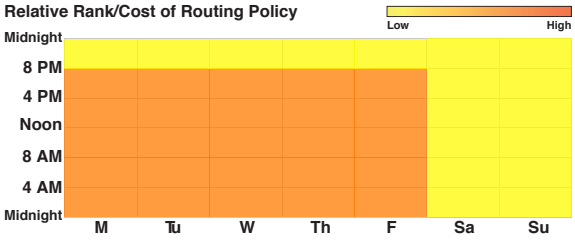
Time Ranges

Actual Rank/Cost of Routing Policy by Time Range:

Name	Notes	Cost
Weekday Mornings	Before Business Hours, Weekdays	2
Weekday Business Hours	Normal Business Hours	2
Weekday Evenings	After Business Hours, Weekdays	2
Weekends	Saturday & Sunday	2

Routing Policy: International VoIP

Administrative Notes: International ITSP
Destination: NY SIP Trunks (SIP Trk)
Destination Notes: AT&T SIP Trunks
Associated Dial Patterns: 0
Associated Regular Expressions: 0



NOTE: *This Routing Policy is not being used by any Dial Patterns or Regular Expressions. See the Unused Routing Policies Action Item for a summary of all unused Routing Policies in your Session Manager.*

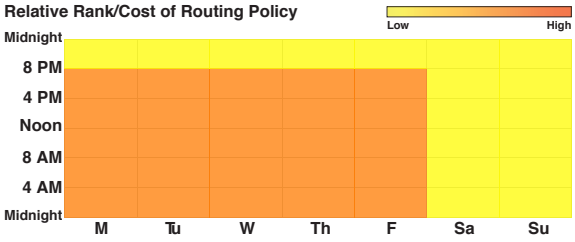
Time Ranges

Actual Rank/Cost of Routing Policy by Time Range:

Name	Notes	Cost
Weekday Mornings	Before Business Hours, Weekdays	6
Weekday Business Hours	Normal Business Hours	6
Weekday Evenings	After Business Hours, Weekdays	0
Weekends	Saturday & Sunday	0

Routing Policy: New York Dial Patterns (Unused)

Administrative Notes: Old DP Routing for NY
Destination: NY SIP Trunks (SIP Trk)
Destination Notes: AT&T SIP Trunks
Status: Disabled
Associated Dial Patterns: 1
Associated Regular Expressions: 0



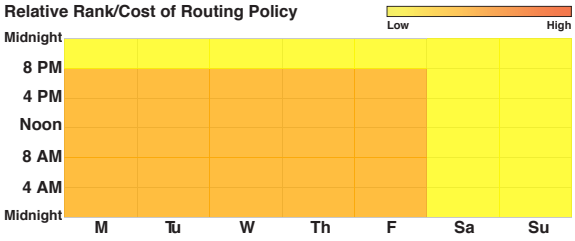
Time Ranges

Actual Rank/Cost of Routing Policy by Time Range:

Name	Notes	Cost
Weekday Mornings	Before Business Hours, Weekdays	6
Weekday Business Hours	Normal Business Hours	6
Weekday Evenings	After Business Hours, Weekdays	0
Weekends	Saturday & Sunday	0

Routing Policy: NY SIP Trunking

Administrative Notes: Free Nights & Weekends, Inexpensive Other Times
Destination: NY SIP Trunks (SIP Trk)
Destination Notes: AT&T SIP Trunks
Associated Dial Patterns: 9
Associated Regular Expressions: 2



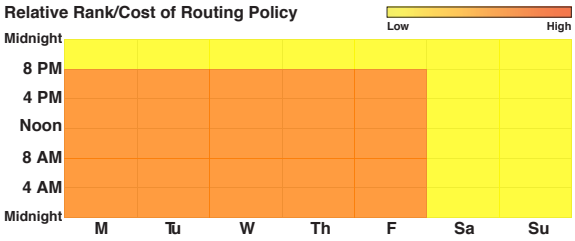
Time Ranges

Actual Rank/Cost of Routing Policy by Time Range:

Name	Notes	Cost
Weekday Mornings	Before Business Hours, Weekdays	4
Weekday Business Hours	Normal Business Hours	4
Weekday Evenings	After Business Hours, Weekdays	0
Weekends	Saturday & Sunday	0

Routing Policy: Philly - Downtown

Administrative Notes: Routing for Philly
Destination: Philly CM (CM)
Destination Notes: Downtown Philly CM
Associated Dial Patterns: 1
Associated Regular Expressions: 0



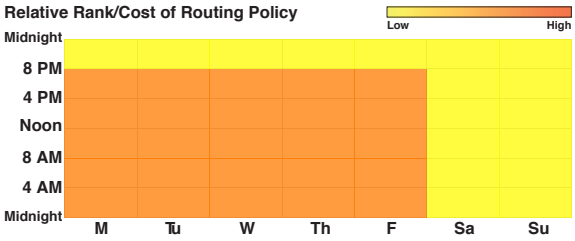
Time Ranges

Actual Rank/Cost of Routing Policy by Time Range:

Name	Notes	Cost
Weekday Mornings	Before Business Hours, Weekdays	6
Weekday Business Hours	Normal Business Hours	6
Weekday Evenings	After Business Hours, Weekdays	0
Weekends	Saturday & Sunday	0

Routing Policy: Philly - SIP

Administrative Notes: Philly SIP
Destination: Philly SIP Trunks (SIP Trk)
Destination Notes: Philly SIP Trunks
Associated Dial Patterns: 1
Associated Regular Expressions: 0



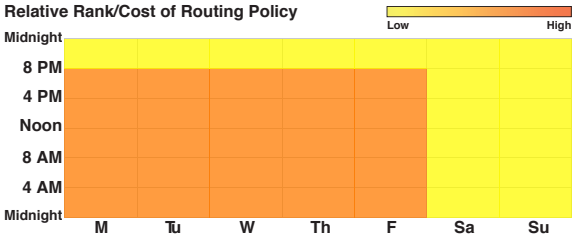
Time Ranges

Actual Rank/Cost of Routing Policy by Time Range:

Name	Notes	Cost
Weekday Mornings	Before Business Hours, Weekdays	6
Weekday Business Hours	Normal Business Hours	6
Weekday Evenings	After Business Hours, Weekdays	0
Weekends	Saturday & Sunday	0

Routing Policy: Philly - Suburbs

Administrative Notes: Alt Routing for Philly
Destination: Philly CM (CM)
Destination Notes: Downtown Philly CM
Associated Dial Patterns: 0
Associated Regular Expressions: 0



NOTE: *This Routing Policy is not being used by any Dial Patterns or Regular Expressions. See the Unused Routing Policies Action Item for a summary of all unused Routing Policies in your Session Manager.*

Time Ranges

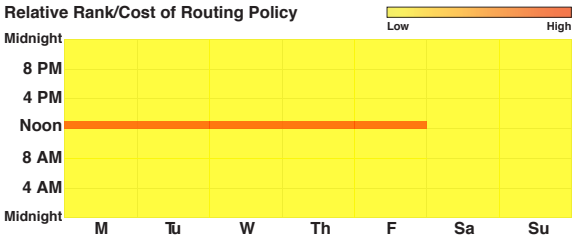
Actual Rank/Cost of Routing Policy by Time Range:

Name	Notes	Cost
Weekday Mornings	Before Business Hours, Weekdays	6
Weekday Business Hours	Normal Business Hours	6
Weekday Evenings	After Business Hours, Weekdays	0

Name	Notes	Cost
Weekends	Saturday & Sunday	0

Routing Policy: Route to IVR

Administrative Notes: Customer Service IVR
Destination: West Coast IVR (VP)
Destination Notes: IVR for Customer Service
Associated Dial Patterns: 1
Associated Regular Expressions: 0



Time Ranges

Actual Rank/Cost of Routing Policy by Time Range:

Name	Notes	Cost
Weekday Mornings	Before Business Hours, Weekdays	0
Weekday Business Hours	Normal Business Hours	0
Lunch Hour	Lunch Break	8
Weekday Evenings	After Business Hours, Weekdays	0
Weekends	Saturday & Sunday	0
Total Time Ranges assigned: 5		

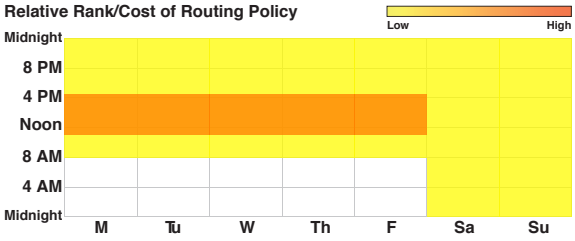
Overlaps in Time Range Coverage

The following table lists any overlaps in the Time Ranges used by this Routing Policy:

Days	Overlap Time Range	Time Range Names	Costs	Conflict
Weekdays (M-F)	12:00 PM - 1:00 PM	Weekday Business Hours	0	✓
		Lunch Hour	8	

Routing Policy: Route To Messaging

Administrative Notes: Modular Messaging
Destination: Enterprise Messaging (MM)
Destination Notes: Primary Messaging Server
Associated Dial Patterns: 1
Associated Regular Expressions: 0



Time Ranges

Actual Rank/Cost of Routing Policy by Time Range:

Name	Notes	Cost
Weekday Business Hours	Normal Business Hours	0
Alternate Coverage	Temporary Alternate Time Schedule	6

Name	Notes	Cost
Weekday Evenings	After Business Hours, Weekdays	0
Weekends	Saturday & Sunday	0

Overlaps in Time Range Coverage

The following table lists any overlaps in the Time Ranges used by this Routing Policy:

Days	Overlap Time Range	Time Range Names	Costs	Conflict
Weekdays (M-F)	11:00 AM - 4:30 PM	Weekday Business Hours	0	✓
		Alternate Coverage	6	

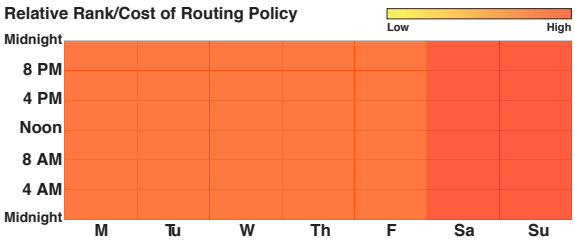
Gaps in Time Range Coverage

The following table lists any gaps in the Time Ranges used by this Routing Policy:

Days	Gap Time Range
Weekdays (M-F)	12:00 AM - 7:59 AM

Routing Policy: San Fran Far Away

Administrative Notes: Distant Calls From San Fran, Business Line
Destination: SF CS1K (OTHER)
Destination Notes: Upgraded CS1000E in SF
Associated Dial Patterns: 3
Associated Regular Expressions: 2



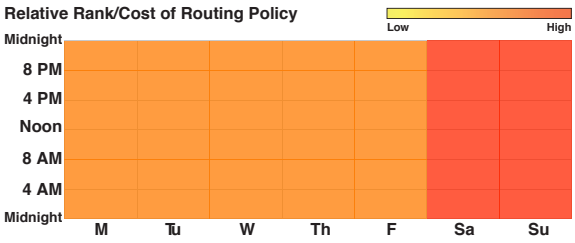
Time Ranges

Actual Rank/Cost of Routing Policy by Time Range:

Name	Notes	Cost
Weekday Mornings	Before Business Hours, Weekdays	8
Weekday Business Hours	Normal Business Hours	8
Weekday Evenings	After Business Hours, Weekdays	8
Weekends	Saturday & Sunday	10

Routing Policy: San Fran Long Distance

Administrative Notes: LD Calls From San Fran, Business Line
Destination: SF CS1K (OTHER)
Destination Notes: Upgraded CS1000E in SF
Associated Dial Patterns: 5
Associated Regular Expressions: 0



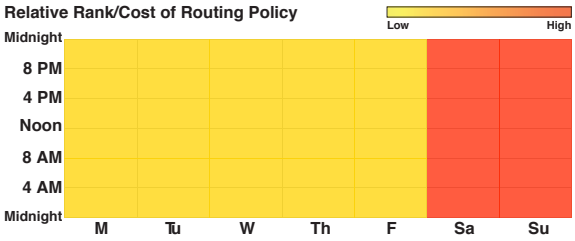
Time Ranges

Actual Rank/Cost of Routing Policy by Time Range:

Name	Notes	Cost
Weekday Mornings	Before Business Hours, Weekdays	6
Weekday Business Hours	Normal Business Hours	6
Weekday Evenings	After Business Hours, Weekdays	6
Weekends	Saturday & Sunday	10

Routing Policy: San Fran Regional

Administrative Notes: Local Business Line - Expensive on Weekends
Destination: SF CS1K (OTHER)
Destination Notes: Upgraded CS1000E in SF
Associated Dial Patterns: 1
Associated Regular Expressions: 1



Time Ranges

Actual Rank/Cost of Routing Policy by Time Range:

Name	Notes	Cost
Weekday Mornings	Before Business Hours, Weekdays	2
Weekday Business Hours	Normal Business Hours	2
Weekday Evenings	After Business Hours, Weekdays	2
Weekends	Saturday & Sunday	10

2. SIP Network Routing - Dial Patterns and Regular Expressions

Whereas the previous chapter covered the major Session Manager elements related to network routing, this chapter will provide an analysis of the remaining critical pieces that define the actual routing of individual calls - Dial Patterns and Regular Expressions.

When Session Manager is asked to route a SIP request, for example an incoming or outgoing audio call, its function is to select the most appropriate SIP Entity that can handle the request, and pass the request on to it for processing. The most obvious question that must be answered to make that decision is "Who is trying to be contacted?". The answer might be an internal extension number, an external E.164 phone number on the PSTN, or any SIP URI with a 'user handle' such as sip:john@somecompany.com. Mapping these various destinations to an appropriate Routing Policy is the job of Dial Patterns and Regular Expressions. Session Manager uses the following basic process when routing calls:

1. *Session Manager determines if it is authoritative for the call's destination domain. If so, the routing process continues with Step 2 below. Otherwise, the request is immediately sent to an Outbound Proxy (Step 4).*
2. *Session Manager compares the 'dialed digits' of the call against its list of Dial Patterns, and routes/denies the call if a matching rule is found.*
3. *If no matching Dial Pattern was found, Session Manager compares the 'user handle'/'dialed digits' of the call against its list of Regular Expressions, and routes/denies the call if a matching rule is found.*
4. *Calls that did not match a defined Dial Pattern or Regular Expression, or calls for which Session Manager is not authoritative, are sent to Session Manager's Outbound Proxy, if one is configured.*
5. *If there is no Outbound Proxy configured, Session Manager attempts to route the call using the destination IP address or hostname in the call's Request-URI.*
6. *If the Request-URI's destination cannot be resolved to an IP address, or there is no IP route to the destination's network, the call fails.*

Both Dial Patterns and Regular Expressions can be used to match the destination of a SIP request in order to select the proper destination to route the call. Dial Patterns are used to match traditional digit-based dialing, while Regular Expressions can handle any form of SIP URI. As many Dial Patterns and/or Regular Expressions as necessary can be defined to select an appropriate destination for every SIP request that might be encountered. The number of patterns necessary to accomplish this task is a function of the complexity of the overall SIP network, and the role that Session Manager is engineered to play within it.

To help provide clarity and understanding of the network routing configuration, this chapter is going to focus on answering two primary questions - "Which SIP Entities in my network handle calls of a particular type?", and conversely "What types of calls are sent to a particular SIP Entity?". In a relatively small network, the answers to these questions may be very straightforward. However, in a configuration involving Time-of-Day routing, Tail End Hop Off routing, and alternate fallback options to route a call, the answers to these seemingly simple questions can become quite complex indeed.

This chapter will attempt to suppress or summarize this complexity when possible, allowing the focus to remain on the high-level understanding of the network routing configuration and how it functions.

2.1. Call Routing By Dialed Pattern

This section analyzes Session Manager's routing from the perspective of the defined Dialing Patterns and Regular Expressions. It answers the question, "Where will a particular type of call be routed?", based on the digits dialed or the destination SIP address. Note that all routing rules are *defined in the enterprise-wide dial plan*, after Entity-specific Adaptations have been applied.

When Session Manager begins to route a call, one of the first things it does is to examine the 'Dialed Digits', user handle, and domain of the called party. To recognize specific types of calls, and thus determine where they should be routed, Session Manager attempts to match the destination address against the defined Dial Patterns, followed by the defined Regular Expressions if no Dial Pattern matched. Session Manager will select the single best (i.e. most specific) rule from all matching Dial Patterns or Regular Expressions. Once the best matching Dial Pattern or Regular Expression is selected, the Routing Policies (perhaps more than one) assigned to that rule are considered as possible destinations of the call.

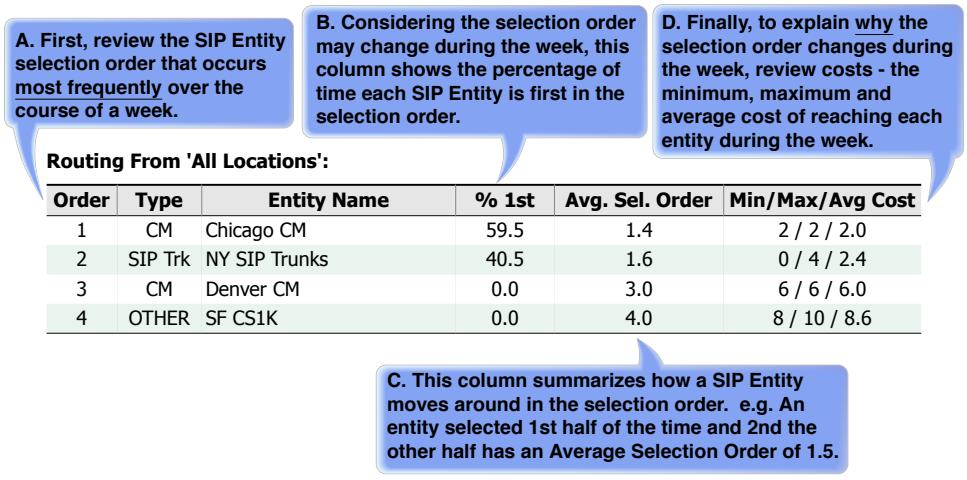
At this point, Session Manager may have to select the best destination from a list of multiple Routing Policies, to which it should route the call. In this scenario, Session Manager uses the current 'rank', or cost information associated with each applicable Routing Policy to determine the order in which they should be selected.

Because the 'rank' of a Routing Policy can change based on the time of day, this can result in one or more distinct orderings for the possible list of destinations over the span of a week. If a SIP Entity is consistently the first choice destination for a particular Dial Pattern or Regular Expression, it indicates that Entity is always the most desirable destination for calls of that type. Conversely, if a SIP Entity is never the first choice for a particular Dial Pattern or Regular Expression, it is clearly a fallback or alternate destination for those calls. When the first choice destination for a particular Dial Pattern or Regular Expression fluctuates over the course of the week, Time-of-Day routing is being used to select the best destination depending on what time it is.

Format

This section presents an analysis for each defined Dial Pattern and Regular Expression, summarizing the possible SIP Entity destinations to which matching calls may be routed, and with what percentage they are selected. The Dial Patterns are listed in order by their leading digits, but in decreasing specificity - with more specific patterns appearing before less specific patterns. This approximates the order in which Session Manager would select a Dial Pattern to match an individual call. Similarly, the Regular Expressions are listed in order of increasing 'Rank', the same order in which Session Manager evaluates each Regular Expression and picks the first match.

For each Dial Pattern, and then each Regular Expression, we'll briefly describe the rule and attempt to summarize and explain the types of calls that match it, when possible. Then, we'll display a list of all possible SIP Entities to which matching calls could be routed. The annotated example below provides a brief overview of the information presented for each Dial Pattern and Regular Expression, followed by a more in-depth explanation of the tables' content.



Using the Routing Policy 'ranks' and Time-of-Day routing information, the Entity destinations will be listed in the order in which they are selected most frequently by Session Manager over the course of a week. The ordering displayed reveals important information about how Session Manager is routing calls of a particular type, but it does not tell the whole story - as there may be alternate orderings in which Session Manager may select the list of possible destinations, depending on the time or day of the week.

The '% 1st' column will display the percentage of time throughout a week that the specific SIP Entity is the first choice (i.e. lowest cost) for routing calls of the particular Dial Pattern or Regular Expression. To provide further insight into the variability of the order in which Session Manager may rank the SIP Entities, the 'Average Selection Order' and 'Min/Max/Average Cost' information will be included for each possible destination. When there was a tie in the cost information of multiple Routing Policies, a 'load-balancing' methodology was employed to approximate how Session Manager behaves in ambiguous situations.

When 'Origination Based Routing' is being used, the Location of the party initiating the call is taken into consideration when selecting a Routing Policy. When applicable, separate tables will be displayed for each Location that has specific routing rules for the current Dial Pattern or Regular Expression.

Use

This section will help you understand where calls of a particular type are routed throughout your enterprise network. Due to the complexities of Time-of-Day routing, and multiple fallback options, the answer can be complicated. This section is designed to keep the answer as simple as possible, while providing increasing levels of detail when necessary: The list of destination Entities is sorted in the *most common* order the Entities are selected for the pattern. For increasing detail, '% 1st' column indicates whether the *first choice* ever varies over time, the 'Average Selection Order' column helps explain *how much* the order can change, and finally the 'Min/Max/Average Cost' column summarizes *why* the order changes.

There are many different aspects to consider when designing and engineering routing for the enterprise-wide network. The following list includes some common routing designs for which this section can improve the understanding of your Session Manager programming:

Fallbacks and Alternate Routing

Fallbacks or alternate routing provides redundancy at times when a particular resource is unavailable, or other constraints such as bandwidth limitations prevent a given route from being used. Multiple Entity destinations for a single Dial Pattern or Regular Expression are indicative of an alternate routing design.

Least Cost Routing

Least Cost Routing may use Time-of-Day or some other mechanism to route calls to different destinations based on how much the call will cost, or otherwise how desirable a particular destination is. If more than one Entity in a list has a '% 1st' value greater than 0, this indicates that Time-of-Day routing is being used to select a different 'first choice' route depending on the time or day.

Tail End Hop Off

In Tail End Hop Off (TEHO), calls are routed such that they stay on the enterprise-wide network as long as possible before hitting the PSTN. Enterprise-wide routing of external calls for a specific Area Code to an Entity located in that Area Code suggests TEHO is being used.

Examining the list of Entity destinations for each Dial Pattern or Regular Expression will help you confirm whether or not the above strategies are being employed, and how effectively.

Alert: Time-of-Day Routing Conflicts

NOTE: *Time-of-Day policy-based routing conflicts were detected. When conflicts in Time-of-Day routing exist, Session Manager's behavior is unpredictable. Because of these conflicts, the routing statistics calculated in this section may be affected. For details on which Routing Policies and Time Ranges are causing the conflicts, review the Time-of-Day Routing Gaps and Overlaps Action Item.*

Routing By Dialed Patterns

Dial Pattern: 011 **Min Digits:** 3 **Max Digits:** 36

Administrative Notes: Control International Calling
Recognized as: NANP international dialing
Associated Routing Policies: 0
Emergency Call: No

Routing From: 'All Locations'

Order	Type	Entity Name	% 1st	Avg. Sel. Order	Min/Max/Avg Cost
Denied					

Dial Pattern: 1xxx976 **Min Digits:** 11 **Max Digits:** 11

Administrative Notes: Deny 976 Calls
Formatted Pattern: 1-xxx-976-xxxx
Recognized as: High Toll exchange calling
Associated Routing Policies: 0
Emergency Call: No

Routing From: 'All Locations'

Order	Type	Entity Name	% 1st	Avg. Sel. Order	Min/Max/Avg Cost
Denied					

Dial Pattern: 1215 **Min Digits:** 11 **Max Digits:** 11

Administrative Notes: City of Philadelphia
Formatted Pattern: 1-215-xxx-xxxx
Recognized as: North American Area Code 215
Overlay Area Codes: 267
Areas Covered: Pennsylvania, Philadelphia and some surrounding areas
Associated Routing Policies: 1
Emergency Call: No

Routing From: 'All Locations'

Order	Type	Entity Name	% 1st	Avg. Sel. Order	Min/Max/Avg Cost
1	CM	Philly CM	100.0	1.0	0 / 6 / 3.6

Dial Pattern: 1303 **Min Digits:** 11 **Max Digits:** 11

Administrative Notes: Denver, Boulder
Formatted Pattern: 1-303-xxx-xxxx
Recognized as: North American Area Code 303
Overlay Area Codes: 720
Areas Covered: Central Colorado, Denver, Boulder and surrounding areas
Associated Routing Policies: 3

Emergency Call: No

Routing From: 'All Locations'

Order	Type	Entity Name	% 1st	Avg. Sel. Order	Min/Max/Avg Cost
1	CM	Denver CM	59.5	1.4	2 / 2 / 2.0
2	SIP Trk	NY SIP Trunks	40.5	1.6	0 / 4 / 2.4
3	OTHER	SF CS1K	0.0	3.0	6 / 10 / 7.1

Dial Pattern: 1312 **Min Digits:** 11 **Max Digits:** 11

Administrative Notes: Chicago Downtown & Loop
Formatted Pattern: 1-312-xxx-xxxx
Recognized as: North American Area Code 312
Overlay Area Codes: 872
Areas Covered: Illinois, downtown Chicago and the Chicago Loop
Associated Routing Policies: 3
Emergency Call: No

Routing From: 'All Locations'

Order	Type	Entity Name	% 1st	Avg. Sel. Order	Min/Max/Avg Cost
1	CM	Chicago CM	59.5	1.4	2 / 2 / 2.0
2	SIP Trk	NY SIP Trunks	40.5	1.6	0 / 4 / 2.4
3	CM	Denver CM	0.0	3.0	6 / 6 / 6.0

Dial Pattern: 1708 **Min Digits:** 11 **Max Digits:** 11

Administrative Notes: Chicago Suburbs
Formatted Pattern: 1-708-xxx-xxxx
Recognized as: North American Area Code 708
Areas Covered: Northeastern Illinois, mostly Chicago's Southern suburb
Associated Routing Policies: 4
Emergency Call: No

Routing From: 'All Locations'

Order	Type	Entity Name	% 1st	Avg. Sel. Order	Min/Max/Avg Cost
1	CM	Chicago CM	59.5	1.4	2 / 2 / 2.0
2	SIP Trk	NY SIP Trunks	40.5	1.6	0 / 4 / 2.4
3	CM	Denver CM	0.0	3.0	6 / 6 / 6.0
4	OTHER	SF CS1K	0.0	4.0	8 / 10 / 8.6

Dial Pattern: 1719 **Min Digits:** 11 **Max Digits:** 11

Administrative Notes: Area Code 719
Formatted Pattern: 1-719-xxx-xxxx
Recognized as: North American Area Code 719
Areas Covered: Southeastern Colorado
Associated Routing Policies: 4
Emergency Call: No

Routing From: 'All Locations'

Order	Type	Entity Name	% 1st	Avg. Sel. Order	Min/Max/Avg Cost
1	CM	Denver CM	59.5	1.4	2 / 2 / 2.0
2	SIP Trk	NY SIP Trunks	40.5	1.6	0 / 4 / 2.4

Order	Type	Entity Name	% 1st	Avg. Sel. Order	Min/Max/Avg Cost
3	OTHER	SF CS1K	0.0	3.5	6 / 10 / 7.1
4	CM	Chicago CM	0.0	3.5	6 / 10 / 7.1

Dial Pattern: 1720 **Min Digits:** 11 **Max Digits:** 11

Administrative Notes: Denver, Boulder
Formatted Pattern: 1-720-xxx-xxxx
Recognized as: North American Area Code 720
Overlay Area Codes: 303
Areas Covered: Central Colorado, Denver, Boulder and surrounding areas
Associated Routing Policies: 3
Emergency Call: No

Routing From: 'All Locations'

Order	Type	Entity Name	% 1st	Avg. Sel. Order	Min/Max/Avg Cost
1	CM	Denver CM	59.5	1.4	2 / 2 / 2.0
2	SIP Trk	NY SIP Trunks	40.5	1.6	0 / 4 / 2.4
3	OTHER	SF CS1K	0.0	3.0	6 / 10 / 7.1

Dial Pattern: 1773 **Min Digits:** 11 **Max Digits:** 11

Administrative Notes: Chicago, not Downtown
Formatted Pattern: 1-773-xxx-xxxx
Recognized as: North American Area Code 773
Overlay Area Codes: 872
Areas Covered: Illinois, surrounding areas of Chicago
Associated Routing Policies: 4
Emergency Call: No

Routing From: 'All Locations'

Order	Type	Entity Name	% 1st	Avg. Sel. Order	Min/Max/Avg Cost
1	CM	Chicago CM	59.5	1.4	2 / 2 / 2.0
2	SIP Trk	NY SIP Trunks	40.5	1.6	0 / 4 / 2.4
3	CM	Denver CM	0.0	3.0	6 / 6 / 6.0
4	OTHER	SF CS1K	0.0	4.0	8 / 10 / 8.6

Dial Pattern: 1872 **Min Digits:** 11 **Max Digits:** 11

Administrative Notes: All of Chicago
Formatted Pattern: 1-872-xxx-xxxx
Recognized as: North American Area Code 872
Overlay Area Codes: 312 and 773
Areas Covered: Illinois, Chicago
Associated Routing Policies: 4
Emergency Call: No

Routing From: 'All Locations'

Order	Type	Entity Name	% 1st	Avg. Sel. Order	Min/Max/Avg Cost
1	CM	Chicago CM	59.5	1.4	2 / 2 / 2.0
2	SIP Trk	NY SIP Trunks	40.5	1.6	0 / 4 / 2.4
3	CM	Denver CM	0.0	3.0	6 / 6 / 6.0
4	OTHER	SF CS1K	0.0	4.0	8 / 10 / 8.6

Dial Pattern: 1914 **Min Digits:** 11 **Max Digits:** 11

Administrative Notes: Westchester County
Formatted Pattern: 1-914-xxx-xxxx
Recognized as: North American Area Code 914
Areas Covered: New York, Westchester County
Associated Routing Policies: 1
Emergency Call: No

Disabled Routing Destinations

NOTE: *Disabled Routing Policies prevent routing to the following destinations for this Dial Pattern:*

Routing From Location	By Routing Policy	To SIP Entity
All Locations	New York Dial Patterns (Unused)	NY SIP Trunks

Dial Pattern: 1970 **Min Digits:** 11 **Max Digits:** 11

Administrative Notes: NW Colorado
Formatted Pattern: 1-970-xxx-xxxx
Recognized as: North American Area Code 970
Areas Covered: Western and Northern Colorado
Associated Routing Policies: 4
Emergency Call: No

Routing From: 'All Locations'

Order	Type	Entity Name	% 1st	Avg. Sel. Order	Min/Max/Avg Cost
1	CM	Denver CM	59.5	1.4	2 / 2 / 2.0
2	SIP Trk	NY SIP Trunks	40.5	1.6	0 / 4 / 2.4
3	OTHER	SF CS1K	0.0	3.5	6 / 10 / 7.1
4	CM	Chicago CM	0.0	3.5	6 / 10 / 7.1

Dial Pattern: 1 **Min Digits:** 11 **Max Digits:** 11

Administrative Notes: Default LD
Formatted Pattern: 1-xxx-xxx-xxxx
Associated Routing Policies: 4
Emergency Call: No

Routing From: 'All Locations'

Order	Type	Entity Name	% 1st	Avg. Sel. Order	Min/Max/Avg Cost
1	SIP Trk	NY SIP Trunks	100.0	1.0	0 / 4 / 2.4
2	CM	Denver CM	0.0	2.7	6 / 6 / 6.0
3	CM	Chicago CM	0.0	3.1	6 / 10 / 7.1
4	OTHER	SF CS1K	0.0	3.1	6 / 10 / 7.1

Dial Pattern: 4500 **Min Digits:** 4 **Max Digits:** 4

Administrative Notes: Internal IVR Ext
Associated Routing Policies: 1
Emergency Call: No

Routing From Location: 'New York'

Order	Type	Entity Name	% 1st	Avg. Sel. Order	Min/Max/Avg Cost
			Denied		

Routing From: 'All Other Locations'

Order	Type	Entity Name	% 1st	Avg. Sel. Order	Min/Max/Avg Cost
1	VP	West Coast IVR	100.0	1.0	0 / 0 / 0.0

Dial Pattern: 5500 **Min Digits:** 4 **Max Digits:** 4

Administrative Notes: Internal Messaging Ext
Associated Routing Policies: 1
Emergency Call: No

Routing From Location: 'New York'

Order	Type	Entity Name	% 1st	Avg. Sel. Order	Min/Max/Avg Cost
			Denied		

Routing From: 'All Other Locations'

Order	Type	Entity Name	% 1st	Avg. Sel. Order	Min/Max/Avg Cost
1	MM	Enterprise Messaging	100.0	1.0	0 / 0 / 0.0

Dial Pattern: 6xx5 **Min Digits:** 7 **Max Digits:** 7

Administrative Notes: Enterprise 7 digit dialing
Formatted Pattern: 6xx-5xxx
Associated Routing Policies: 1
Emergency Call: No

NOTE: *This Dial Pattern was assigned to all 6 of your Locations individually instead of being assigned to 'All Locations'. Therefore, this Dial Pattern will NOT automatically route to any new Locations added to Session Manager. For more details and to review other Dial Patterns configured this way, refer to the Dial Pattern Location Assignments Action Item.*

Routing From Location: 'Chicago'

Order	Type	Entity Name	% 1st	Avg. Sel. Order	Min/Max/Avg Cost
1	SIP Trk	Philly SIP Trunks	100.0	1.0	0 / 6 / 3.6

Routing From Location: 'Denver'

Order	Type	Entity Name	% 1st	Avg. Sel. Order	Min/Max/Avg Cost
1	SIP Trk	Philly SIP Trunks	100.0	1.0	0 / 6 / 3.6

Routing From Location: 'New York'

Order	Type	Entity Name	% 1st	Avg. Sel. Order	Min/Max/Avg Cost
1	SIP Trk	Philly SIP Trunks	100.0	1.0	0 / 6 / 3.6

Routing From Location: 'Philadelphia'

Order	Type	Entity Name	% 1st	Avg. Sel. Order	Min/Max/Avg Cost
1	SIP Trk	Philly SIP Trunks	100.0	1.0	0 / 6 / 3.6

Routing From Location: 'San Francisco'

Order	Type	Entity Name	% 1st	Avg. Sel. Order	Min/Max/Avg Cost
1	SIP Trk	Philly SIP Trunks	100.0	1.0	0 / 6 / 3.6

Routing From Location: 'South Atlanta'

Order	Type	Entity Name	% 1st	Avg. Sel. Order	Min/Max/Avg Cost
1	SIP Trk	Philly SIP Trunks	100.0	1.0	0 / 6 / 3.6

Dial Pattern: 911 **Min Digits:** 3 **Max Digits:** 3

Administrative Notes: Emergency 911
Recognized as: Emergency Services
Associated Routing Policies: 3
Emergency Call: Yes

Routing From Location: 'Chicago'

Order	Type	Entity Name	% 1st	Avg. Sel. Order	Min/Max/Avg Cost
1	CM	Chicago CM	100.0	1.0	2 / 2 / 2.0

Routing From Location: 'Denver'

Order	Type	Entity Name	% 1st	Avg. Sel. Order	Min/Max/Avg Cost
1	CM	Denver CM	100.0	1.0	2 / 2 / 2.0

Routing From Location: 'San Francisco'

Order	Type	Entity Name	% 1st	Avg. Sel. Order	Min/Max/Avg Cost
1	OTHER	SF CS1K	100.0	1.0	2 / 10 / 4.3

Dial Pattern: x **Min Digits:** 7 **Max Digits:** 7

Administrative Notes: 7-Digit Dialing - Should never reach SM
Formatted Pattern: xxx-xxxx
Associated Routing Policies: 0
Emergency Call: No

Routing From: 'All Locations'

Order	Type	Entity Name	% 1st	Avg. Sel. Order	Min/Max/Avg Cost
			Denied		

Routing By Regular Expression

Regular Expression: 0

Administrative Notes: New York Regional Calls
Pattern: ^sip:\+?1(212|516|631|646|718|845|914|917)[0-9]{7}.*
Associated Routing Policies: 3

Routing Destinations

Order	Type	Entity Name	% 1st	Avg. Sel. Order	Min/Max/Avg Cost
1	SIP Trk	NY SIP Trunks	100.0	1.0	0 / 4 / 2.4
2	CM	Chicago CM	0.0	2.3	6 / 10 / 7.1
3	CM	Denver CM	0.0	2.7	8 / 8 / 8.0

Regular Expression: 1

Administrative Notes: San Fran Regional Calls
Pattern: ^sip:\+?1(415|510|650|831|408|669|925|707|209|916)[0-9]{7}.*
Associated Routing Policies: 4

Routing Destinations

Order	Type	Entity Name	% 1st	Avg. Sel. Order	Min/Max/Avg Cost
1	OTHER	SF CS1K	59.5	2.0	2 / 10 / 4.3
2	SIP Trk	NY SIP Trunks	40.5	1.6	0 / 4 / 2.4
3	CM	Denver CM	0.0	2.7	6 / 6 / 6.0
4	CM	Chicago CM	0.0	3.7	8 / 8 / 8.0

Regular Expression: 3

Administrative Notes: Deny 976 numbers
Pattern: ^sip:\+?1[0-9]{3}976[0-9]{7}.*
Associated Routing Policies: 0

Routing Destinations

Order	Type	Entity Name	% 1st	Avg. Sel. Order	Min/Max/Avg Cost
			Denied		

Regular Expression: 20

Administrative Notes: Bill Remote Office
Pattern: ^sip:bill_downs@sip.infoplus.net
Associated Routing Policies: 1

NOTE: *The Domain specified by this Regular Expression contains unescaped wildcards. See the Unescaped Wildcards in Regular Expression Domains Action Item for a summary of all unescaped wildcards in Regular Expression domains detected in your Session Manager.*

Routing Destinations

Order	Type	Entity Name	% 1st	Avg. Sel. Order	Min/Max/Avg Cost
1	OTHER	SF CS1K	100.0	1.0	8 / 10 / 8.6

Regular Expression: 21

Administrative Notes: Jamie Remote Office
Pattern: ^sip:jamie_howser@sip[.]infoplus[.]net
Associated Routing Policies: 1

Routing Destinations

Order	Type	Entity Name	% 1st	Avg. Sel. Order	Min/Max/Avg Cost
1	OTHER	SF CS1K	100.0	1.0	8 / 10 / 8.6

2.2. Call Routing By SIP Entity

This section analyzes Session Manager's routing from the perspective of Routing Policy destinations, i.e. SIP Entities. It answers the question, "What types of calls are routed to a particular SIP Entity in my network?", described by the digits dialed or the destination SIP address.

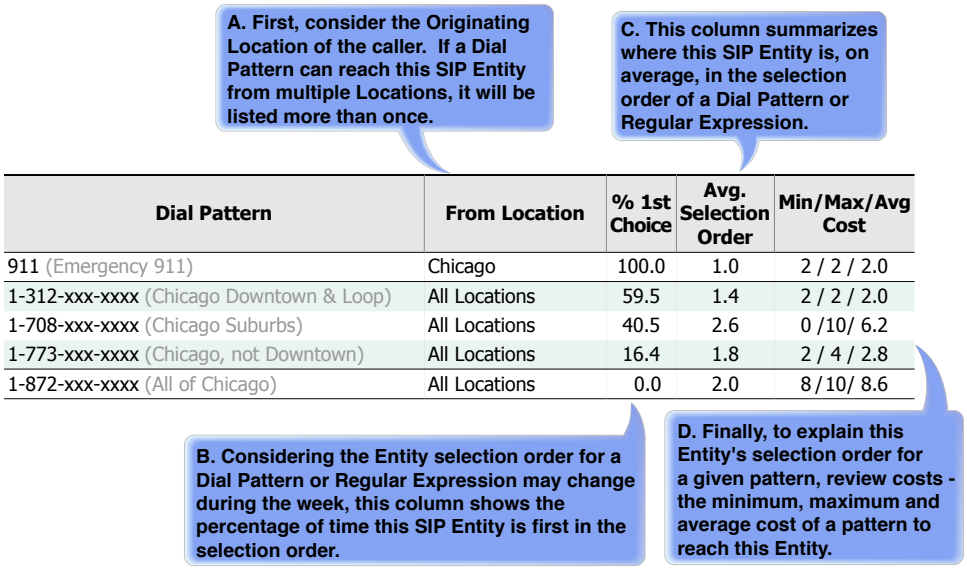
When routing a particular call, Session Manager selects one of the SIP Entities listed in this section by examining the dialed digits or the user handle and domain of a SIP address, matching them against the defined Dial Patterns and/or Regular Expressions. This process can result in more than one SIP Entity being selected as a possible destination for the call, if the best-matching rule is a member of more than one Routing Policy. From this list of possible destinations, a single SIP Entity is selected by comparing the current 'rank', or cost, of each possible Routing Policy and selecting the lowest one.

Because the cost of a Routing Policy can change based on the time or day of the week, the SIP Entity selected for a particular Dial Pattern or Regular Expression can vary over time. Furthermore, a particular Entity may *never* be selected as the first choice destination of a pattern, yet the Entity may still be part of the possible selection order for the pattern. This results in three broad possibilities for describing whether a particular Dial Pattern or Regular Expression is routed to a particular SIP Entity:

1. The SIP Entity is **always** the first choice for the pattern, i.e. the call is always routed to the Entity when available.
2. The SIP Entity is **sometimes** the first choice destination (and sometimes not), i.e. the Entity is part of a Time-of-Day routing strategy.
3. The SIP Entity is **never** the first choice for the pattern, i.e. the Entity is a fallback destination.

Format

This section lists all SIP Entities that are the destination of at least one Routing Policy. The SIP Entities are listed in order of their Location, and then by SIP Entity name within a Location. A brief summary of each Entity is presented, followed by one or two tables displaying all of the Dial Patterns and/or Regular Expressions that could possibly be routed to the Entity. The annotated example below provides a brief overview of the routing information presented for each Entity, followed by a more in-depth explanation of the tables' content.



When 'Origination Based Routing' is being used, the Location of the party initiating the call is taken into consideration when selecting a Routing Policy. The 'From Location' column in the Dial Pattern tables will indicate whether the Entity is a destination for all calls matching the pattern ('All Locations'), or only those originating from a specific Location.

As previously discussed, the question of whether a particular Dial Pattern or Regular Expression is routed to a specific Entity may not be an "all or nothing" answer. The '% 1st Choice' column will display the percentage of time throughout a week that the SIP Entity is the first choice (i.e. lowest cost) for routing calls of the particular Dial Pattern or Regular Expression. To provide further insight into the variability of the order in which Session Manager selects the SIP Entities, the 'Average Selection Order' and 'Min/Max/Average Cost' information will be included for each Dial Pattern or Regular Expression. The 'Average Selection Order' indicates how far down in the list of possible alternatives the particular Entity is, on average, as the destination of calls matching the pattern. When there was a tie in the cost information of multiple Routing Policies, a 'load-balancing' methodology was employed to approximate how Session Manager behaves in ambiguous situations.

Use

This section provides a convenient way to determine which Area Codes, internal extensions, or SIP addresses are routed to a particular SIP Entity. Due to the complexities of Time-of-Day routing, and multiple fallback options, the full explanation can be complicated. If the '% 1st Choice' column is 100%, all calls matching the pattern are routed to the Entity when it's available. If '% 1st Choice' is 0%, the Entity is strictly a fallback option for the calls in the event that their first-choice option is unavailable. Finally, a value between 0 and 100% indicates that Time-of-Day routing is in effect, and the first-choice destination for the calls varies between the current Entity and others.

Similarly, the 'Average Selection Order' column explains where the current Entity appears in the list of possible destinations for a certain type of call. A value of 1.0 indicates that the Entity is always the first-choice for the pattern. A value of 2.0 or greater indicates that, on average,there is at least one Entity that is preferred over the current one for the specific pattern. Greater values indicate the current Entity is further down on the list of possible destinations for the pattern.

Finally, the 'Min/Max/Average Cost' column helps summarize *why* the current Entity is or is not the consistent first choice for the pattern.

Ensuring that the right calls are routed to the correct SIP Entity is crucial when maintaining and engineering the most cost-effective and efficient enterprise-wide SIP Core Network. For example, if a particularly expensive, congested, or distant facility should only be used as a fallback for a certain type of call, ensure that the '% 1st Choice' is 0% for that combination of Entity and pattern. Otherwise, there is at least some period of time during the week in which calls matching the pattern are routed to the undesirable Entity first. Similarly, to implement an effective Tail End Hop Off (TEHO) strategy at a particular SIP Entity, ensure that all applicable Dial Patterns and/or Regular Expressions for local calls are included in the tables for the Entity, and that their 'Average Selection Order' within the Entity is close to 1.0 (i.e. first choice all the time).

Alert: Time-of-Day Routing Conflicts

NOTE: *Time-of-Day policy-based routing conflicts were detected. When conflicts in Time-of-Day routing exist, Session Manager's behavior is unpredictable. Because of these conflicts, the routing statistics calculated in this section may be affected. For details on which Routing Policies and Time Ranges are causing the conflicts, review the Time-of-Day Routing Gaps and Overlaps Action Item.*

Destination Entity: 'Chicago CM'

Administrative Notes: Secondary Communication Manager
Entity Type: Communication Manager
Location: Chicago
Time Zone: America/Chicago
IP Address: 192.168.21.16

Dial Patterns

Dial Patterns that route to SIP Entity 'Chicago CM':

Dial Pattern	From Location	% 1st Choice	Avg. Selection Order	Min/Max/Avg Cost
911 (Emergency 911)	Chicago	100.0	1.0	2 / 2 / 2.0
1-312-xxx-xxxx (Chicago Downtown & Loop)	All Locations	59.5	1.4	2 / 2 / 2.0
1-708-xxx-xxxx (Chicago Suburbs)	All Locations	59.5	1.4	2 / 2 / 2.0
1-773-xxx-xxxx (Chicago, not Downtown)	All Locations	59.5	1.4	2 / 2 / 2.0
1-872-xxx-xxxx (All of Chicago)	All Locations	59.5	1.4	2 / 2 / 2.0
1-719-xxx-xxxx (Area Code 719)	All Locations	0.0	3.5	6 / 10 / 7.1
1-970-xxx-xxxx (NW Colorado)	All Locations	0.0	3.5	6 / 10 / 7.1
1-xxx-xxx-xxxx (Default LD)	All Locations	0.0	3.1	6 / 10 / 7.1

Regular Expressions

Regular Expressions that route to SIP Entity 'Chicago CM':

Regular Expression	R.E. Rank	% 1st Choice	Avg. Selection Order	Min/Max/Avg Cost
^sip:\+?1(212|516|631|646|718|845|914|917)[0-9]{7}.* (New York Regional Calls)	0	0.0	2.3	6 / 10 / 7.1
^sip:\+?1(415|510|650|831|408|669|925|707|209|916)[0-9]{7}.* (San Fran Regional Calls)	1	0.0	3.7	8 / 8 / 8.0

Destination Entity: 'Denver CM'

Administrative Notes: Main Communication Manager
Entity Type: Communication Manager
Location: Denver
Time Zone: America/Denver
IP Address: 192.168.22.16

Dial Patterns

Dial Patterns that route to SIP Entity 'Denver CM':

Dial Pattern	From Location	% 1st Choice	Avg. Selection Order	Min/Max/Avg Cost
911 (Emergency 911)	Denver	100.0	1.0	2 / 2 / 2.0
1-303-xxx-xxxx (Denver, Boulder)	All Locations	59.5	1.4	2 / 2 / 2.0
1-719-xxx-xxxx (Area Code 719)	All Locations	59.5	1.4	2 / 2 / 2.0
1-720-xxx-xxxx (Denver, Boulder)	All Locations	59.5	1.4	2 / 2 / 2.0
1-970-xxx-xxxx (NW Colorado)	All Locations	59.5	1.4	2 / 2 / 2.0
1-312-xxx-xxxx (Chicago Downtown & Loop)	All Locations	0.0	3.0	6 / 6 / 6.0
1-708-xxx-xxxx (Chicago Suburbs)	All Locations	0.0	3.0	6 / 6 / 6.0
1-773-xxx-xxxx (Chicago, not Downtown)	All Locations	0.0	3.0	6 / 6 / 6.0
1-872-xxx-xxxx (All of Chicago)	All Locations	0.0	3.0	6 / 6 / 6.0
1-xxx-xxx-xxxx (Default LD)	All Locations	0.0	2.7	6 / 6 / 6.0

Regular Expressions

Regular Expressions that route to SIP Entity 'Denver CM':

Regular Expression	R.E. Rank	% 1st Choice	Avg. Selection Order	Min/Max/Avg Cost
^sip:\+?1(212|516|631|646|718|845|914|917)[0-9]{7}.* (New York Regional Calls)	0	0.0	2.7	8 / 8 / 8.0
^sip:\+?1(415|510|650|831|408|669|925|707|209|916)[0-9]{7}.* (San Fran Regional Calls)	1	0.0	2.7	6 / 6 / 6.0

Destination Entity: 'Enterprise Messaging'

Administrative Notes: Primary Messaging Server
Entity Type: Modular Messaging
Location: Denver
Time Zone: America/Denver
IP Address: 192.168.22.17

Dial Patterns

Dial Patterns that route to SIP Entity 'Enterprise Messaging':

Dial Pattern	From Location	% 1st Choice	Avg. Selection Order	Min/Max/Avg Cost
5500 (Internal Messaging Ext)	All Locations	100.0	1.0	0 / 0 / 0.0

No Regular Expressions route to this SIP Entity.

Destination Entity: 'NY SBC'

Administrative Notes: Session Border Controller for NY SIP Trunks
Entity Type: Gateway
Location: New York
Time Zone: America/New_York
IP Address: 192.168.20.17

This SIP Entity is not a destination for any Routing Policy. Therefore, no Dial Pattern or Regular Expression can be routed to it.

Destination Entity: 'NY SIP Trunks'

Administrative Notes: AT&T SIP Trunks
Entity Type: SIP Trunk
Location: New York
Time Zone: America/New_York
IP Address: 192.168.20.16

Dial Patterns

Dial Patterns that route to SIP Entity 'NY SIP Trunks':

Dial Pattern	From Location	% 1st Choice	Avg. Selection Order	Min/Max/Avg Cost
1-xxx-xxx-xxxx (Default LD)	All Locations	100.0	1.0	0 / 4 / 2.4
1-303-xxx-xxxx (Denver, Boulder)	All Locations	40.5	1.6	0 / 4 / 2.4
1-312-xxx-xxxx (Chicago Downtown & Loop)	All Locations	40.5	1.6	0 / 4 / 2.4
1-708-xxx-xxxx (Chicago Suburbs)	All Locations	40.5	1.6	0 / 4 / 2.4
1-719-xxx-xxxx (Area Code 719)	All Locations	40.5	1.6	0 / 4 / 2.4
1-720-xxx-xxxx (Denver, Boulder)	All Locations	40.5	1.6	0 / 4 / 2.4
1-773-xxx-xxxx (Chicago, not Downtown)	All Locations	40.5	1.6	0 / 4 / 2.4
1-872-xxx-xxxx (All of Chicago)	All Locations	40.5	1.6	0 / 4 / 2.4
1-970-xxx-xxxx (NW Colorado)	All Locations	40.5	1.6	0 / 4 / 2.4

Disabled Dial Patterns

NOTE: *Disabled Routing Policies may prevent calls matching the following Dial Patterns from reaching this entity:*

Routing Policy	From Location	Dial Pattern
New York Dial Patterns (Unused)	All Locations	1-914-xxx-xxxx (Westchester County)

Regular Expressions

Regular Expressions that route to SIP Entity 'NY SIP Trunks':

Regular Expression	R.E. Rank	% 1st Choice	Avg. Selection Order	Min/Max/Avg Cost
^sip:\+?1(212|516|631|646|718|845|914|917)[0-9]{7}.* (New York Regional Calls)	0	100.0	1.0	0 / 4 / 2.4

Regular Expression	R.E. Rank	% 1st Choice	Avg. Selection Order	Min/Max/Avg Cost
^sip:\+?1(415|510|650|831|408|669|925|707|209|916)[0-9]{7}.* (San Fran Regional Calls)	1	40.5	1.6	0 / 4 / 2.4

Destination Entity: 'Philly CM'

Administrative Notes: Downtown Philly CM
Entity Type: Communication Manager
Location: Philadelphia
Time Zone: America/New York
IP Address: 192.168.24.16

Dial Patterns

Dial Patterns that route to SIP Entity 'Philly CM':

Dial Pattern	From Location	% 1st Choice	Avg. Selection Order	Min/Max/Avg Cost
1-215-xxx-xxxx (City of Philadelphia)	All Locations	100.0	1.0	0 / 6 / 3.6

No Regular Expressions route to this SIP Entity.

Destination Entity: 'Philly SIP Trunks'

Administrative Notes: Philly SIP Trunks
Entity Type: SIP Trunk
Location: Philadelphia
Time Zone: America/New_York
IP Address: 192.168.24.17

Dial Patterns

Dial Patterns that route to SIP Entity 'Philly SIP Trunks':

Dial Pattern	From Location	% 1st Choice	Avg. Selection Order	Min/Max/Avg Cost
6xx-5xxx (Enterprise 7 digit dialing)	Chicago	100.0	1.0	0 / 6 / 3.6
6xx-5xxx (Enterprise 7 digit dialing)	Denver	100.0	1.0	0 / 6 / 3.6
6xx-5xxx (Enterprise 7 digit dialing)	New York	100.0	1.0	0 / 6 / 3.6
6xx-5xxx (Enterprise 7 digit dialing)	Philadelphia	100.0	1.0	0 / 6 / 3.6
6xx-5xxx (Enterprise 7 digit dialing)	San Francisco	100.0	1.0	0 / 6 / 3.6
6xx-5xxx (Enterprise 7 digit dialing)	South Atlanta	100.0	1.0	0 / 6 / 3.6

No Regular Expressions route to this SIP Entity.

Destination Entity: 'SF CS1K'

Administrative Notes: Upgraded CS1000E in SF
Entity Type: Other
Location: San Francisco
Time Zone: America/Los_Angeles
IP Address: 192.168.23.15

Dial Patterns

Dial Patterns that route to SIP Entity 'SF CS1K':

Dial Pattern	From Location	% 1st Choice	Avg. Selection Order	Min/Max/Avg Cost
911 (Emergency 911)	San Francisco	100.0	1.0	2 / 10 / 4.3
1-303-xxx-xxxx (Denver, Boulder)	All Locations	0.0	3.0	6 / 10 / 7.1
1-708-xxx-xxxx (Chicago Suburbs)	All Locations	0.0	4.0	8 / 10 / 8.6
1-719-xxx-xxxx (Area Code 719)	All Locations	0.0	3.5	6 / 10 / 7.1
1-720-xxx-xxxx (Denver, Boulder)	All Locations	0.0	3.0	6 / 10 / 7.1
1-773-xxx-xxxx (Chicago, not Downtown)	All Locations	0.0	4.0	8 / 10 / 8.6
1-872-xxx-xxxx (All of Chicago)	All Locations	0.0	4.0	8 / 10 / 8.6
1-970-xxx-xxxx (NW Colorado)	All Locations	0.0	3.5	6 / 10 / 7.1
1-xxx-xxx-xxxx (Default LD)	All Locations	0.0	3.1	6 / 10 / 7.1

Regular Expressions

Regular Expressions that route to SIP Entity 'SF CS1K':

Regular Expression	R.E. Rank	% 1st Choice	Avg. Selection Order	Min/Max/Avg Cost
^sip:bill_downs@sip.infoplus.net (Bill Remote Office)	20	100.0	1.0	8 / 10 / 8.6
^sip:jamie_howser@sip[.]infoplus[.]net (Jamie Remote Office)	21	100.0	1.0	8 / 10 / 8.6
^sip:\+?1(415|510|650|831|408|669|925|707|209|916)[0-9]{7}.* (San Fran Regional Calls)	1	59.5	2.0	2 / 10 / 4.3

Destination Entity: 'West Coast IVR'

Administrative Notes: IVR for Customer Service
Entity Type: Voice Portal
Location: San Francisco
Time Zone: America/Los_Angeles
IP Address: 192.168.23.16

Dial Patterns

Dial Patterns that route to SIP Entity 'West Coast IVR':

Dial Pattern	From Location	% 1st Choice	Avg. Selection Order	Min/Max/Avg Cost
4500 (Internal IVR Ext)	All Locations	100.0	1.0	0 / 0 / 0.0

No Regular Expressions route to this SIP Entity.

2.3. Summary of Denied Calls

Session Manager can be configured to deny certain calls, either by Dial Pattern or Regular Expression matching. Although either method can be used to deny a call, only Dial Patterns can consider the originating Location of a call to narrow its scope, while Regular Expressions are applied to all calls regardless of the originating Location. In addition, it's important to remember that Dial Patterns are evaluated *before* Regular Expressions, and a matching (allowed) Dial Pattern could mask a denied Regular Expression for the same dialed sequence. Understanding these differences will help when analyzing the Session Manager deny rules listed in this section.

Format

This section will present all the Dial Pattern and Regular Expression deny rules, in two separate tables. The entries in the Dial Pattern table are ordered by their leading digits, but in decreasing specificity - with more specific patterns appearing before less specific patterns. Regular Expressions are ordered by their 'Rank' - the order in which they're evaluated during routing decisions.

Use

This section can be used as a reference to quickly determine which dialable sequences in the enterprise-wide dial plan are explicitly denied by Session Manager. The content should be updated and reviewed on a regular basis to ensure that all applicable numbers are being properly denied.

Dial Pattern Deny Rules

The following table lists the Dial Patterns used to explicitly deny calls:

Dial Pattern	Denied From (Location)
011 min:3 max:36 (Control International Calling)	All Locations
1-xxx-976-xxxx (Deny 976 Calls)	All Locations
4500 (Internal IVR Ext)	New York
5500 (Internal Messaging Ext)	New York
xxx-xxxx (7-Digit Dialing - Should never reach SM)	All Locations

Regular Expression Deny Rules

The following table lists the Regular Expressions used to explicitly deny calls:

R.E. Rank	Pattern
3	^sip:\+?1[0-9]{3}976[0-9]{7}.* (Deny 976 numbers)

3. Action Items

Action Items highlight inconsistent or questionable Network Routing Policy programming.

This chapter identifies Session Manager programming discovered during the course of analyzing the Network Routing Policy data that can either cause Session Manager to behave in an unpredictable manner, is inconsistent with other Session Manager programming, or appears to be superfluous with regard to how Session Manager functions.

Addressing the issues presented in this chapter can resolve inconsistent or unpredictable behavior - resulting in clean Session Manager programming, and making it easier to maintain the enterprise-wide Network Routing Policy.

3.1. Service Affecting Issues

The following Session Manager programming issues may be service-affecting:

Improperly Programmed Adaptation Module Parameters

When reviewing Session Manager's Adaptation programming, the following Adaptations were found to have improperly programmed module parameters. For certain Adaptation module parameters, Avaya's documentation states that there are very specific values which are required.

Each of the Adaptations listed below was found to have one or more module parameters that do not adhere to Avaya's Adaptation programming documentation. Each Adaptation listed should be examined to determine if its module parameters are preventing expected results. Any module parameters that do not adhere to Avaya's documentation should be updated and tested. By making sure that your Adaptation module parameter programming adheres to Avaya's documentation, you are reducing the risk of unexpected or incorrect behavior when routing calls through Session Manager.

Adaptations Module Parameter: fromto

According to Avaya's documentation, the only valid value to enable the 'fromto' module parameter is lowercase 'true'. The documentation states that all other values disable the fromto behavior. It is recommended that the following Adaptations be reviewed to determine if the fromto SIP header modifications are behaving as expected:

- NY SIP Trunk Support

See Section 1.5, "Session Manager Adaptations" for additional details.

Malformed Adaptation Request-URI Parameters

When reviewing Session Manager's Adaptation programming, the following Adaptations were encountered with Request-URI parameters which are not formatted according to the SIP technical specification as described in RFC3261. Please review the Adaptation programming in Session Manager and confirm that the Request-URI parameters for these Adaptations are valid.

Improperly formatted Request-URI parameters will at best be ignored, and at worst could cause unexpected behavior. If the Request-URI parameters are malformed and rejected because of operator input error, it is likely that the desired effect of the Request-URI parameters are not being realized by the Adaptation for which they are programmed.

Adaptations to Review

- Denver to 11 Digit Dialing

See Section 1.5, "Session Manager Adaptations" for additional details.

Time-of-Day Routing Gaps and Overlaps

When analyzing the following Routing Policies, gaps, overlaps or both were detected in the associated Time Ranges used to define their Time-of-Day policy-based routing.

Each of the Routing Policies listed below should be examined, along with their associated Time Ranges, to determine if they are susceptible to inconsistent, ambiguous or undefined routing behavior.

In particular, if Time Ranges which overlap have different costs associated with them, it is unclear which of the costs Session Manager will choose to determine how the call is routed. Additionally, if there are gaps in the times

of day covered by the associated Time Ranges, or there are no Time Ranges associated with a Routing Policy, Session Manager has no way of determining the cost to use for those gaps in time. Both of these circumstances can lead to unpredictable routing which may affect service, monetary costs or the reliability of your SIP call routing.

NOTE: *A Routing Policy with both gaps and overlaps will appear in both of the following lists.*

Routing Policies with Time Range Gaps

- Route To Messaging

Routing Policies with Time Range Overlaps

- Route to IVR
- Route To Messaging

See Section 1.7, "Session Manager Routing Policies" for additional details.

Unescaped Wildcards in Regular Expression Domains

The following Regular Expressions do not properly escape the period character, '.', used to separate the components of domains. e.g. my.domain.com should be expressed as my[.]domain[.]com or my\.domain\.com to identify a specific domain. Failure to properly escape the period character will cause a Regular Expression to match domains that were not intended to be matched. This could cause Session Manager to accept and route calls that should have been rejected or sent to an outbound proxy for routing.

The following Regular Expressions should be reviewed to determine if their domains are escaped properly.

Regular Expressions

- Regular Expression: 20

See Section 2.1, "Call Routing By Dialed Pattern" for additional details.

Unknown or Omitted Adaptation Module Type

When reviewing Session Manager's Adaptation programming, the Module type assigned to the following Adaptations was either not recognized as one of the Avaya-supplied Module types, or was omitted entirely.

The Module type for each Adaptation listed should be checked to make sure it is valid. If the module type is invalid or omitted, some or all of the Adaptation's functionality is prevented from being applied to SIP messages. For instance, Digit conversion rules, Request-URI parameters and other valid programming will not have any effect. By making sure that your Adaptation Module types are valid and defined according to Avaya's documentation, you can eliminate inconsistent and unexpected behavior when routing calls through Session Manager and reduce the amount of time required to troubleshoot routing problems.

Unknown Adaptation Module Type

The Adaptation Module type for the following Adaptations was not recognized:

- Denver to 11 Digit Dialing

See Section 1.5, "Session Manager Adaptations" for additional details.

Unreachable SIP Entities

The Avaya Aura SIP Core Network consists of one or more Session Manager SIP Entities (SM) which route calls to one or more non-Session Manager SIP Entities (SIP Entity). To route a call to or from a SIP Entity, it must have a SIP Entity Link to at least one SM *. SIP Entities without any links to a Session Manager instance are considered to be unreachable through the Network Routing Policy (NRP) programming.

When reviewing the SIP Entities built in your NRP programming, the following SIP Entities did not have any SIP Entity Links to any instance of Session Manager. Please review how this system's Avaya Aura SIP Core Network is designed to determine if it is appropriate that these SIP Entities are not reachable through the NRP rules.

SIP Entities to Review

- Philly CM

NOTE: *There are concerns about only having a single link to Session Manager that are not addressed here, like redundancy and end-to-end routing across the entire Avaya Aura SIP Core Network. Refer to the SIP Routing Diagram or the SIP Entity Link Analysis to explore these concerns, and for more details about how the SIP Entities in your Avaya Aura SIP Core Network are linked together.*

See Section 1.3, "SIP Entities" for additional details.

Unrecognized Adaptation Module Parameters

When reviewing Session Manager's Adaptation programming, the following Adaptations were encountered with unknown module parameters. Please review the Adaptation programming in Session Manager, and confirm that these are indeed valid Adaptation module parameters.

Unknown or invalid Adaptation module parameters will at best be ignored, and at worst could cause unexpected behavior. If the parameters are unknown because of operator input error, it is questionable if the Adaptation will have the desired effect.

Adaptations to Review

- Philly to 7 Digit Dialing
- San Fran to Enterprise Dial Plan

See Section 1.5, "Session Manager Adaptations" for additional details.

3.2. Clean Up Issues

The following Session Manager programming inconsistencies may require clean-up:

Adaptations With No Effect

When analyzing the following Adaptations, they were found to have no user-configured 'effect' on the SIP messages they process. For more information about Adaptation modules, refer to the documentation in the Session Manager Adaptations section of this report.

Each of the Adaptations listed below should be examined to determine if it has a functional purpose. If they are found to be unnecessary and serve no purpose, they should be removed. Removing any unnecessary programming from Session Manager will simplify day-to-day maintenance of the Avaya Aura SIP Core Network and prevent common errors attributed to unnecessary or stale programming.

Adaptations to Review

The following Adaptations have no user-programmed rules or SIP header modifications:

Adaptation	Module	Assigned SIP Entities
Philly to 11 Digit Dialing	DigitConversionAdapter	1

See Section 1.5, "Session Manager Adaptations" for additional details.

Dial Pattern Location Assignments

When reviewing Session Manager's Dial Pattern programming, the following Dial Patterns were found to be assigned the same Routing Policy from every Location individually, instead of being assigned to 'All Locations'. This can be problematic when adding new Locations as each Dial Pattern will need to be updated in order to maintain an association with every Location. Alternatively, if the Dial Patterns were assigned to 'All Locations', they would automatically route, using the existing Routing Policy, from any new Locations added to Session Manager.

Each of the Dial Patterns listed below should be reviewed to determine if it should be updated to use the 'All Locations' functionality. Programming Dial Patterns to use 'All Locations' can save time and prevent hard-to-track-down routing problems when administering new Locations in Session Manager.

Dial Patterns to Review

- 6xx-5xxx

See Section 2.1, "Call Routing By Dialed Pattern" for additional details.

Empty Locations

When analyzing the following Locations, they were found to have no SIP Entities, IP Address Patterns, or Bandwidth Management settings. Locations without any of these attributes are most likely non-functional.

Each of the Locations listed below should be examined to determine if it is functional. If these Locations are found to be unnecessary and serve no purpose, they should be removed. Removing any empty or unused Locations will simplify day-to-day maintenance of the Avaya Aura SIP Core Network and prevent common errors attributed to unnecessary or stale programming.

Locations to Review

- South Atlanta

See Section 1.2, "Network Routing Locations" for additional details.

Unused Adaptations

When reviewing Session Manager's Adaptation programming, the following Adaptations were not referenced by any SIP Entities.

Each of the Adaptations listed below should be examined to determine if they have a functional purpose. If they are found to be unnecessary and serve no purpose, they should be removed. Removing any unnecessary programming from Session Manager will simplify day-to-day maintenance of the Avaya Aura SIP Core Network and prevent common errors attributed to unnecessary or stale programming.

Adaptations to Review

- Philly to 7 Digit Dialing

See Section 1.5, "Session Manager Adaptations" for additional details.

Unused Routing Policies

When reviewing Session Manager's Routing Policy programming, the following Routing Policies did not have any Dial Patterns or Regular Expressions associated with them. It can therefore be assumed that these Routing Policies are no longer serving any functional purpose.

If a Routing Policy is no longer actively being used to route calls, it should be removed. Making sure that your Session Manager programming only contains elements that are actively being used will simplify day-to-day maintenance of the Avaya Aura SIP Core Network, and prevent common errors attributed to unnecessary or stale programming.

Routing Policies To Review

- International VoIP
- Philly - Suburbs

See Section 1.7, "Session Manager Routing Policies" for additional details.

Unused Time Ranges

When reviewing Time-of-Day Routing data programmed in Session Manager, it was discovered that the following Time Ranges are not being used by any Routing Policies. Programming that is not being used can safely be removed, making maintenance and troubleshooting tasks easier to perform.

If the Time Ranges listed here are not going to be used and are no longer required, removing them will improve efficiency when performing maintenance tasks. In addition, removing stale programming can reduce errors; the programming is no longer available and cannot be inadvertently referenced.

Time Ranges to Review

- 24/7
- SanFran Peak Hours

See Section 1.6, "Session Manager Time Ranges" for additional details.

Glossary

Adaptation
A software module which allows Session Manager to perform modifications to SIP messages as they arrive at or leave SIP Entities. Modifications include traditional digit manipulation, as well as the ability to alter SIP headers. Modification of the SIP message headers facilitates third-party integration.

Call Admission Control (CAC)
A feature allowing call rejection during the routing process. Rejection is based on predefined limits of maximum allowable bandwidth or maximum number of calls. The purpose of CAC is to maintain the fidelity of audio and video transmissions that have already been established. Ideally, the rejected call would be re-routed over an alternate facility.

Dial Pattern
A Dial Pattern allows Session Manager to route calls based on the dialed digits and originating Location. Calls matching the Dial Pattern can either be routed according to the pattern's assigned Routing Policies, or they can be explicitly denied.

Domain (Name)
A domain name is a human readable identification string with a hierarchical structure that defines a realm of authority within an IP network. Its structure follows the guidelines defined for the Domain Name System (DNS). For example, the domain name "sip.some-company.com" has three levels, and might be used to identify the realm of SIP resources within a company.

Domain Name System
The Domain Name System (DNS) is a hierarchical, distributed naming system used to organize and interconnect computers within an IP network. Each Domain name can be mapped to an IP address that identifies a specific 'device' by querying a Domain Name Service.

E.164
The E.164 standard is a recommendation that defines both the international numbering plan used in the PSTN, as well as the format of the telephone numbers themselves. E.164 numbers can have a maximum of fifteen digits and are usually written with a "+" prefix.

Extension
A dialable number in a private network assigned to a station, data module, hunt group, terminating extension group, vector, etc.

FQDN
A Fully Qualified Domain Name (FQDN) is a domain name that specifies the exact position of a resource in the Domain Name System (DNS) hierarchy.

IETF
The Internet Engineering Task Force is a standards body that develops, maintains and promotes protocol standards for the Internet (e.g. TCP/IP). The ITEF mission is to make the internet work better by influencing its design, use, and management.

Internet Protocol (IP)
A popular protocol used for communicating data across a packet-switched network, such as the Internet.

Least Cost Routing
Least Cost Routing is a design in which calls are dynamically routed to different resources based on the costs that placing the call would incur. Typically, cost varies by time of the day or day of the week. Thus, Time-of-Day routing is often used to implement Least Cost Routing and is somewhat synonymous, although it has other uses.

Location
A logical division of System Manager resources, usually along geographic boundaries. Bandwidth management for IP communications is usually applied on a per-Location basis. Locations can also contain time-zone information to aid in efficient and cost-effective call routing.

Regular Expression
A Regular Expression allows Session Manager to route calls based on the call's Request-URI. Matching calls can either be routed according to the Regular Expression's assigned Routing Policies, or they can be explicitly denied. Regular Expressions have the ability to match complex alphanumeric patterns, and are thus more expressive than Dial Patterns.

Request-URI
For a SIP call, the Request-URI indicates the user or service to which the request is addressed. It follows the general format of 'user_handle'@'some.domain.com'. More information about the format of a SIP Request-URI can be found in the IETF RFCs 3261 and 2396.

Routing Policy
A Routing Policy specifies a SIP Entity destination, and the Time-of-Day parameters for routing calls to that destination. By linking Dial Patterns and Regular Expressions to a Routing Policy, you define which calls Session Manager will route to its destination, and the relative preference of sending those calls to that destination.

Session Manager
Session Manager is a SIP-based software session management and routing application. It provides a centralized point to define enterprise-wide routing. This enables converged communications, and improvements in scalability and redundancy.

SIP
Session Initiation Protocol (SIP) is a popular signaling protocol used to setup and tear down two-party or multi-party communication sessions: voice, video, etc.

SIP Core Network
The logical part of the SIP network consisting exclusively of Session Manager SIP Entities. This is said to be the Core of the Avaya Aura SIP network because it is where all session requests are sent for routing.

SIP Entity
SIP Entities are Session Manager's software representations of the major components that make up the Avaya Aura SIP Network. e.g. Session Managers, Communication Managers, Session Border Controllers, SIP trunks, etc. The routing rules of Session Manager specify that calls of a certain pattern should be directed to a particular SIP Entity.

SIP Entity Link
SIP Entity Links define the communication pathways within the SIP network. Session Manager cannot send or receive messages from any SIP Entity to which it is not linked. SIP Entity Links allow configuration of these pathways (port, transport protocol, etc.) which further determines the behavior of the network.

Tail End Hop Off (TEHO)
Tail End Hop Off is a cost-saving design in which calls are routed such that they stay on the flat-rate enterprise network as long as possible before 'hopping off' to the more expensive PSTN. This design can reduce or eliminate long distance charges when internal users call public numbers that are local to an existing facility on the enterprise network.

Transmission Control Protocol (TCP)
A protocol for sending data packets over an IP network, often referred to as TCP/IP. It provides a reliable mechanism for the ordered transmission of data through error checking and retransmission of bad or lost data packets.

Transport Layer Security (TLS)
A cryptographic protocol that provides secure communications at the transport layer of an IP network.

Trunk
A dedicated communications link between two facilities, whether owned/controlled by the organization or not.

Trunk Group
A collection of similar Trunks performing an identical function. For example, all DID Trunks for the main telephone number would be members of a single Trunk Group.

User Datagram Protocol (UDP)
A protocol for sending data packets over an IP network. It only provides a simple checksum of the data packets, and does not support retransmission of bad or lost data packets.