



Avaya Aura® Scalability and Reliability Overview

Deploying SIP Reliably at Scale for Large Corporate Communication Networks

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The IT industry is entering a new era of communications. It's an era marked by mobile, tablet and cloud computing. This new structure has redistributed IT investments, enhanced application delivery and provided rich communications that leverage voice, video and text to speed business processes. The business benefit is a more dynamic, agile and responsive enterprise that's in tune with market changes and opportunities. At the center of this communications industry evolution is Session Initiation Protocol (SIP). SIP is a bridge to the future of real time voice and video collaboration, both adding value to legacy voice systems and delivering a platform to a new era in communications enabled applications.

Australian National University, a top ranked world university with over 16,000 students and nearly 4,000 staff implemented an Avaya SIP infrastructure to both consolidate legacy voice systems and introduce new best-of-breed video and multi-media technologies and applications.

Deutsche Bank, the fourth largest global bank on the planet headquartered in Frankfurt, Germany and employing over 80,000, deployed an Avaya SIP based communications architecture. The project, started in 2009, enables the bank to provide telecommunications for 3,100 buildings in 72 countries. Fundamental to Deutsche Bank's decision was the need to connect their legacy voice communication endpoints into a single infrastructure and provide a pathway to the future of mobile communications; collaboration plus communications enabled business applications.

Avaya SIP architecture scales to support mobile, fixed and video endpoints

With 100,000 SIP endpoints supported today and further capacity increases in the future, an Avaya SIP communications network can address the needs of large global 2000 multi-national corporations in terms of the number of SIP endpoints required per employee.

Such enterprises can create an Avaya IMS (IP Multimedia Subsystem) communications infrastructure deployment and thereby support all employees with a combination of both SIP and non-SIP endpoints. Avaya offers a SIP based communications and collaboration architecture that scales to the highest number of endpoints supported reliably in the industry.

For large corporations there is a mix of SIP and non-SIP endpoints driving requirements that an IMS based communications architecture must support both. This requirement will not abate anytime soon as the number of SIP enabled endpoints continues to increase thanks to mobile devices and video communications. Even if IT executive management mandated an all SIP endpoint strategy, a merger or acquisition could increase the mix instantly. According to Thomson Reuters preliminary Q1 data shows \$717 billion in 2011 Mergers and Acquisition (M&A) activity through March of 2011, which represents a 58% increase over the same period in 2008.

In addition to mobile and fixed line SIP endpoint support, an IMS communications architecture needs to scale in performance as well. The Avaya Aura® Session Manager scales to support enterprises with over 970 calls per second (CPS). This translates to over 500,000 users with an extremely heavy call rate of 6 calls per hour each. This total capacity of 3.5 million calls per hour meets the needs of the largest enterprises in the world.

For a more detailed technical overview of SIP scalability and reliability, please see the Avaya Aura Session Initiation Protocol (SIP) Scalability and Reliability Technical Guide.

Session Initiation Protocol or SIP: An International Standard

SIP is a set of Internet standards that enable voice, video and multimedia communications to operate over TCP/IP protocols. The core SIP standard was ratified in June of 2002 and thus has benefited from years of technical contribution from nearly every communications equipment supplier and service provider during its development as an Internet standard. SIP enjoys wide acceptance and deployment both within service provider and enterprise networks.

The Avaya Aura Architecture

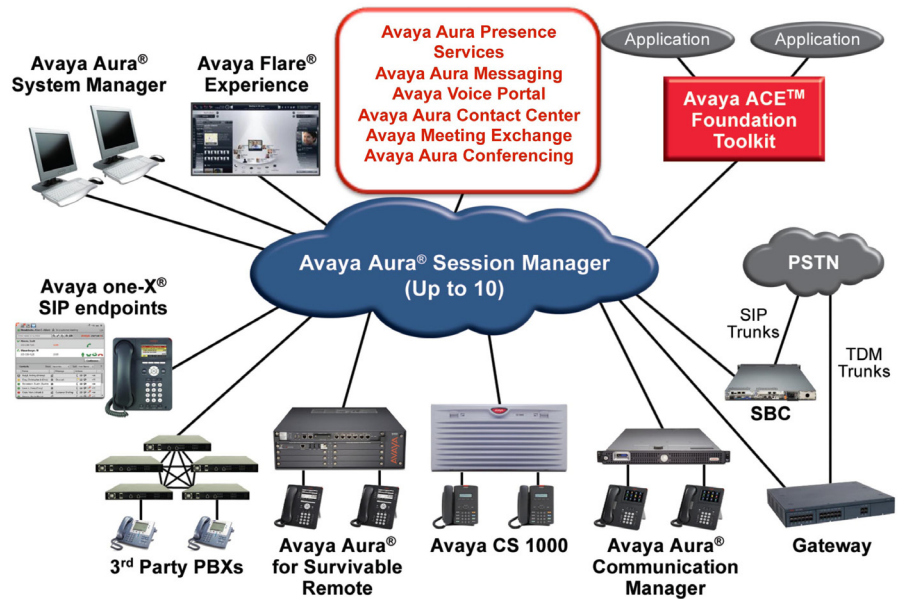


Figure 1: General Enterprise Configuration

IP Multimedia Subsystem: Service Provider Power to the Enterprise

The principles of an IP Multimedia Subsystem, or “IMS” is a growing part of nearly every Service Provider network in the world, adding value by building on SIP principles. IMS enables service providers to implement new services for their subscribers quickly, efficiently, and without relying on single sources for application “enhancements” or “upgrades”. Building on this, for the very first time enterprises can now create communications architectures based on the same proven IMS principles Service Provider networks rely on by implementing Avaya Aura® Session Management at the enterprise core.

The greatest value of the IMS architecture is its ability to separate a network into 3 layers or “strata”: access, connection and applications as shown in figure 1 above.

The flexibility of this architecture means that the Enterprise of figure 1 accommodates a variety of different configurations - a set of physical locations connected by the enterprise network, typified by three scenarios:

- Large locations with or without a “data center” equipment configuration
- Remote locations that rely on the data centers for normal service
- Sites with entire PBXs dominated by either non-SIP or non-Avaya type equipment but still part of the Enterprise and the core SIP design.

The key is the connection layer where Avaya Aura Session Manager “binds” users to devices in the access layer, and users to the services they need and are allowed to use at the applications layer.

Android, iPhone and SIP Endpoints

SIP and IMS are the international standards for real-time communications and are available within most IP Phones, smartphones and tablets. Smartphone and tablet markets are excellent proxies to the growth of IMS based communications as these devices are inherently IMS compatible thanks to their SIP support. For example, the smartphone market nearly doubled year-over-year in Q4 2010 to about 101 million units, according to Canalys. According to BUISNESS INSIDER*, only 0.3% of the Earth’s inhabitants owned a tablet at the end of 2010 and a vast market is projected for these devices. Combined, the smartphone and tablet user base is approximately 394 million worldwide versus other markets, such as TV subscriptions (600 million), total PCs (1.3 billion), and mobile subscribers (5.1 billion). According to RBC there will be more than 400 million tablet users worldwide by 2014, including 185 million tablets sold in 2014.

Tablets and Video SIP Endpoints

Tablets such as the Avaya Flare Desktop Video Device are SIP endpoints providing a rich communications and video collaboration experience. Mobile endpoints and video communications are SIP based communications. Even during the most difficult recession in decades, videoconferencing endpoint unit shipments increased according to Frost and Sullivan. In fact, unit and revenue growth rates are projected to climb steeply with a compound annual growth rate of 18.3% and 16.5%, respectively, between 2009 and 2015.

Since IMS has been standardized for over nine years, the service provider communications industry has been building larger and larger SIP based communications networks based on IMS principles. In fact, today Avaya’s SIP implementation with its Avaya Aura® Session Manager (SM) and System Manager (SMGR) solution can support 100,000 SIP users and is planned to support 250,000 in the future. The Avaya Aura Communication Manager currently scales to 36,000 SIP users and 41,000 non-SIP users or a combination of 41,000 total users. Avaya customers’ SIP communications infrastructure can scale up reliably to address the needs of global 2000 concerns.

Availability %	Downtime per year	Downtime per month*	Downtime per week
90% (“one nine”)	36.5 days	72 hours	16.8 hours
95%	18.25 days	36 hours	8.4 hours
98%	7.30 days	14.4 hours	3.36 hours
99% (“two nines”)	3.65 days	7.20 hours	1.68 hours
99.5%	1.83 days	3.60 hours	50.4 minutes
99.8%	17.52 hours	86.23 minutes	20.16 minutes
99.9% (“three nines”)	8.76 hours	43.2 minutes	10.1 minutes
99.95%	4.38 hours	21.56 minutes	5.04 minutes
99.99% (“four nines”)	52.56 minutes	4.32 minutes	1.01 minutes
99.999% (“five nines”)	5.26 minutes	25.9 seconds	6.05 seconds
99.9999% (“six nines”)	31.5 seconds	2.59 seconds	0.605 seconds

Reliability at Scale

As IT business leaders implement a communication system at the scale discussed above, reliability or availability become paramount to assure no interruption of business processes. Availability is often expressed in terms of the number of 9s, that being “one 9” or 90% available through “six nines” or 99.9999% available to measure downtime. The matrix below breaks out downtime per year, month and week against the number of nines of availability.

Network or communication availability is a function of device and network reliability. Communication device availability can be calculated as the product of its hardware and software availability. For the Avaya Aura® Session Manager, its combined availability is 99.9677%. A network of Aura® Session Managers creates the core communications infrastructure controlling sessions between users. Availability of the core can be increased to six nines or greater than 99.9999% by adding a small number of redundant Avaya Aura® Session Managers where SIP entities, such as the Avaya Communications Manager, are cross connected to an Aura® core infrastructure as shown in figure 2 below.

In short, IT architects can design as much redundancy as needed to achieve the desired level of core infrastructure availability. The technical elegance of the Avaya approach is that the Aura® Session Manager and Communications Manager are high availability devices with low Mean Time Between Outage (MTBO) ratings that can be deployed in N+M configurations

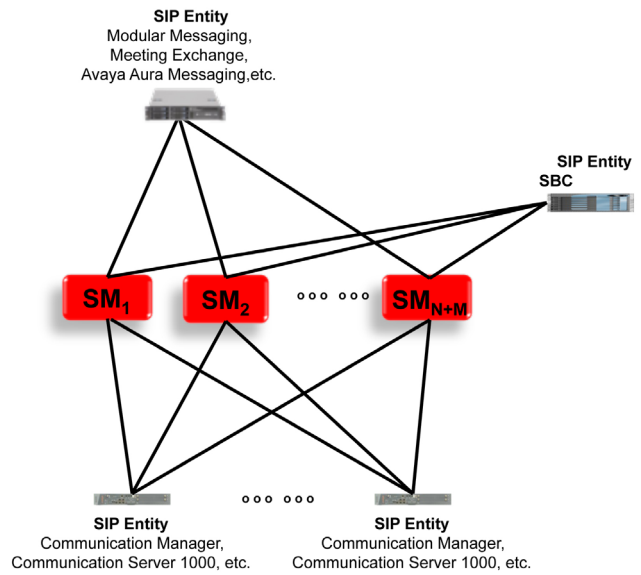


Figure 2: Session Manager N+M Availability

where “N” is the minimum number of resources needed to function, and “M” represents the additional capacity for redundancy. Active-active N+M configurations offer superior redundancy at lower cost than traditional 1+1 active standby architectures.

With this level of redundancy a SIP network of Avaya Aura Session Managers and Communication Managers can handle multiple failures of more than two Session Managers and more than two Communication Managers and continue to provide service at full enterprise capacity.

Protecting SIP Endpoint Availability

Availability is important to maintain basic dial-tone service, but in modern enterprise communication systems, applications are layered on top of the voice system such as voice mail and interactive voice response systems which are only as reliable as the SIP infrastructure. To assure high availability of SIP endpoints, the ability to simultaneously register with at least three session managers assures that in the case of a down Session Manager the SIP endpoint will continue to be operational. With Avaya Aura® Session Manager, such redundancy is available. SIP endpoints can register simultaneously with three Avaya Aura® Session Managers. Therefore, proper redundancy at the core infrastructure helps ensure that a failure of any random Session Manager will not cause loss of service to any endpoint or user.

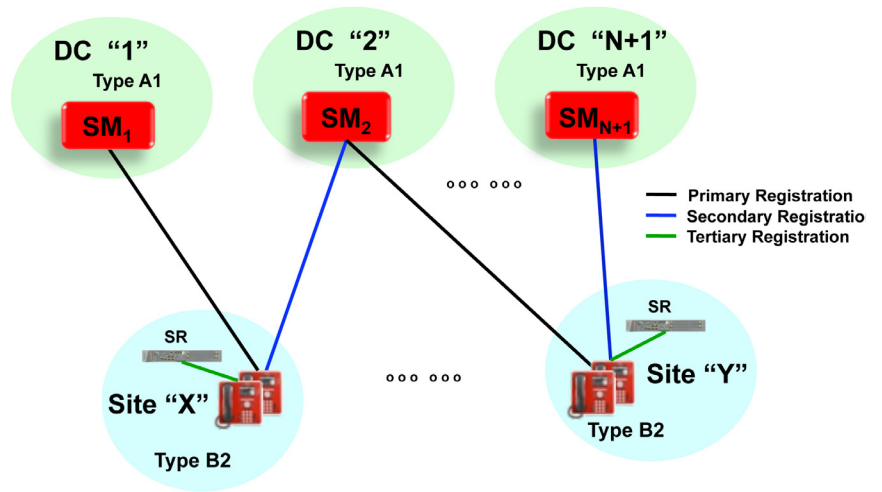


Figure 3: Session Manager N+1 Configuration

Remote Branch Office Survivability

With remote or branch offices usually being void of IT support and closest to customers, their availability and survivability is unique and requires special attention. In the case of a remote office or branch facility being separated from its wide area networking links, one of the three connections that a SIP endpoint registers with should be a Survivable Remote.

A survivable remote maintains operation when and if the primary and secondary Avaya Aura® Session Manager becomes unreachable. While overall availability for the branch is strongly associated with Wide Area Network (WAN) availability, adding a Survivable Remote to each branch office is an industry best practice as it increases system availability to between 5 and 6 nines with reasonable WAN availability assumptions. This level of availability depends upon the number of redundant Aura® Session Managers implemented in the core infrastructure which are usually placed within a data center.

Another best practice to increase system availability is to pair Aura® Session Managers within data centers while deploying Survivable Remotes within branch and remote offices as illustrated in figure 4.

This design allows each SIP endpoint to be registered with a Survivable Remote and two Aura® Session Managers that are physically separated. This structure provides the highest availability with the lowest number of components.

“Avaya is by far the leader in SIP based communication with a proven track record of delivering solutions that scale to global 2000 concerns reliably. SIP is the standard for real time communications that IT business leaders will rely upon to integrate mobile and tablet computing into enterprise collaboration services.”

-Nick Lippis, publisher of The Lippis Report; A Resource for IT & Network Business Decision Makers

Alternative Communication Architectures

From a competitive architecture point of view there are two alternative approaches to that taken by Avaya. One is from a large software manufacturer that recently

entered the unified communications market.

Their approach is centered on desktop software with presence to enable communications within office productivity applications. This approach offers value but does not offer the expertise to reliably deliver a wide range of voice, video and text based communications at scale. In addition this approach is neither open nor flexible enough to integrate applications from other vendors, thereby restricting its utility. An IMS architecture is standards based and supported by all service and application providers offering a wider range of application-communication integration.

A second alternative is available from a large data networking concern that has approached the communications market from their strength in data networking. Their approach is rooted in forwarding packets in a best effort manner, however much has been added to data networking to differentiate traffic to offer quality of service. However this approach is operationally tedious and does not always scale resulting in a poor communications experience. In addition, increasingly adding network services to differentiate and prioritize traffic comes at the expense of continued investment in switching and routing, its core business. Further, this alternative approach has only reluctantly and narrowly embraced SIP as a trunking protocol to service providers leaving its IP Phones, tablet and video conferencing system endpoints to utilize proprietary protocols, thus locking out competitors and locking in customers.

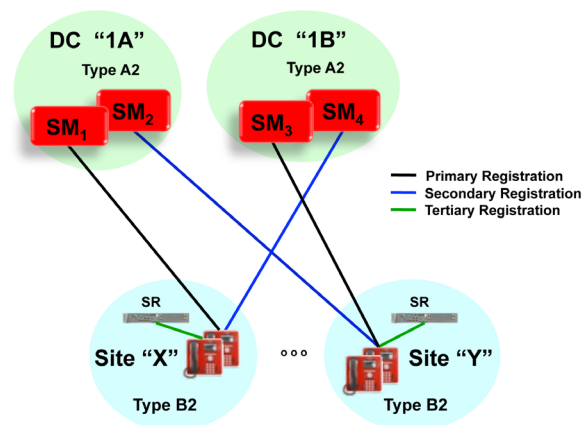


Figure 4: Session Manager Dual Data Center Configuration

The scale and reliability of the Avaya SIP architecture is unique in the industry, as Avaya possesses communication assets and expertise that span over multiple generations and business cycles. Avaya has been in the business of providing communication systems for demanding enterprises and governments across the globe for over 100 years. Avaya possesses the largest share of enterprise customers and the proven know-how to deliver the high-end multi-national communication solutions demanded by the business critical needs of the largest FORTUNE 2000 companies.

About Avaya

Avaya is a global provider of business collaboration and communications solutions, providing unified communications, contact centers, data solutions and related services to companies of all sizes around the world. For more information please visit www.avaya.com.

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