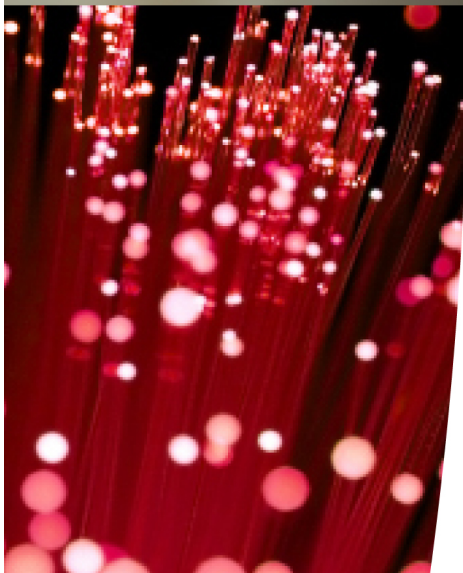
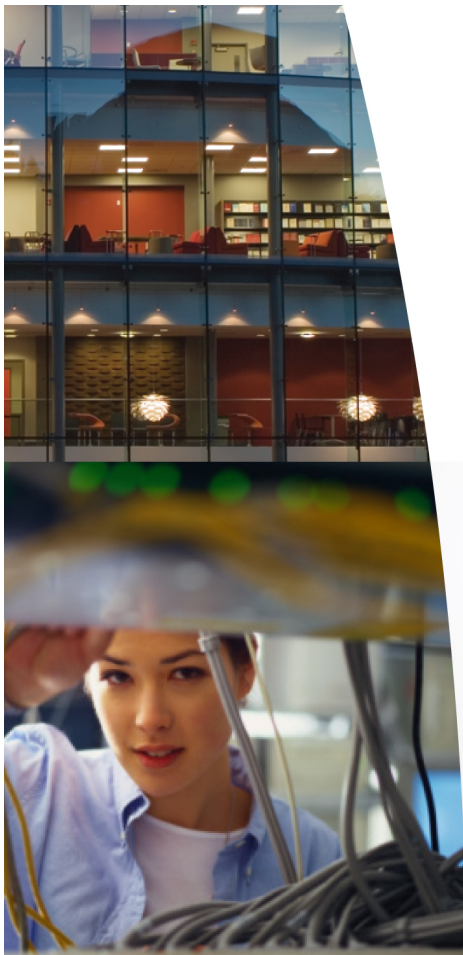




# The role of the Session Border Controller in a GENBAND SIP Business Trunking Solution



“SIPCONNECT is a certification mark of the SIP Forum, LLC.”



*White Paper  
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## Introduction

Today's businesses must compete in an increasingly globalized marketplace. Round the clock operations, distributed national and international locations, and a growing remote and mobile workforce – all require organizations to adopt technologies that improve productivity and reduce operation cost. Businesses now seek to IP-enable their communication infrastructure and leverage their investments to converge voice and data networks. Enterprises of all sizes - including government organizations, universities, and contact centers - are migrating to IP-enabled PBXs. As reported by Infonetics, 53 percent of PBXs shipped in 2009 were IP-enabled, and that share is projected to grow to 84% by 2014.

While IP based PBXs have overtaken legacy PBXs, most enterprises are using IP PBXs primarily to IP-enable their internal network. Yankee Group estimate that over 90 percent of corporate VoIP deployments terminate IP at the enterprise edge and convert to TDM to connect to the PSTN, an approach which does not provide the cost benefits or the enhanced functionalities offered by IP based services.

## Service Providers – Opportunity and Challenges

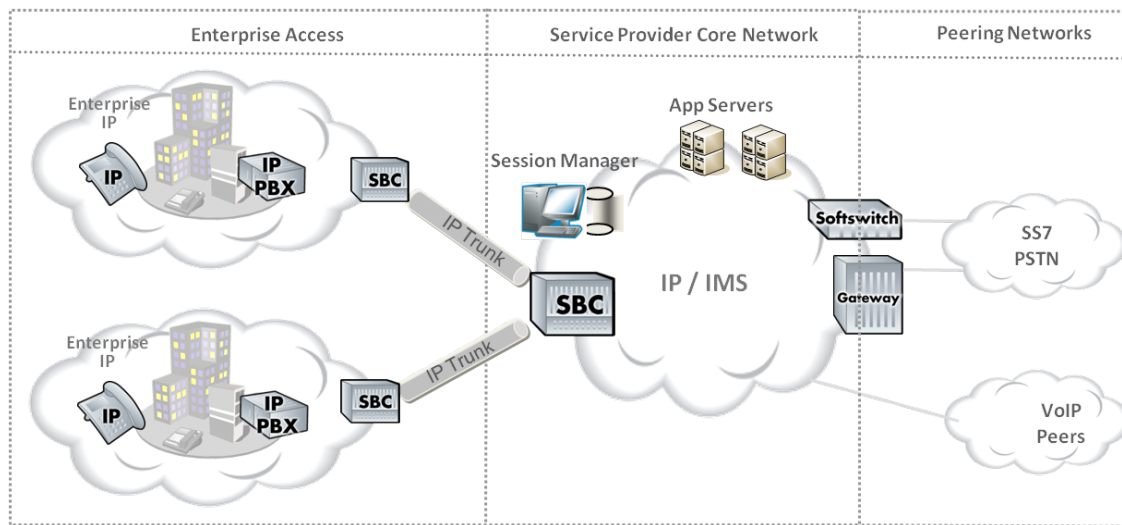
Convergence in the enterprise network presents a unique opportunity for the carriers to play a significant role in this ongoing evolution. The increased use of IP networking and IP-PBXs for voice communications by enterprises opens up doors for the service provider to offer a secure and converged access to the enterprise.

Business Trunking (also known as SIP Trunking) is a disruptive technology that enables service providers to offer business customers cost-effective and efficient Public Switch Telephone Network (PSTN) termination and multimedia services by replacing TDM interconnects to PBXs with an IP based interface. Service providers who IP-enable this network access will be poised to not only capitalize on the convergence trends at the enterprise by capturing both voice and data spends, but to also offer new multi-media based real-time services to increase ARPU and decrease churn rate.

## SIP Business Trunking Architecture

IP based core networks are transforming the design and operations of service provider network. To provide end-to-end business trunking solutions to enterprises, service providers have to manage three important IP network borders:

1. Enterprise network border: at the edge of a enterprise private network, connecting the enterprise to the service provider's IP network
2. Access network border: at the edge of a service provider's core IP network, connecting the service provider to the enterprise
3. Interconnect network border: at the edge of service provider's IP network, connecting the service provider to the VoIP peer network



**Figure 1 - SIP Business Trunking Solution Architecture**

### **Enterprise Network Borders**

Traditionally, the customer premise has a clear demarcation point between on-site service provider facilities and customer facilities. PSTN gateways with single line, T1, or DS-3 interfaces are used on the customer side of the ‘demarc’ to interface back to a carrier’s central office facilities. For the past decade of IP Telephony in the enterprise, IP phones have been connected to the PSTN via Media Gateways, where VoIP is converted to TDM using digital signaling processors (DSPs). With the introduction of VoIP Business Trunk offerings from service providers, the enterprise communications architecture has changed significantly. Intelligent VoIP session-aware border controllers, deployed at the network edge, have replaced “dumb” multiplexes and firewalls.

Although service providers traditionally deploy SBCs only at the access network borders, they are now also deploying SBCs at the enterprise premise to assure service level agreements, interoperability, and to protect enterprise networks from new IP threats.

IP-PBX manageability is yet another major challenge that service providers must solve for enterprises. Connecting each IP-PBX to assure interoperability in a multi-IP-PBX enterprise can be a significant administrative burden. Features such as Least Cost Routing (LCR) that are supported in some IP-PBXs are locally applied and do not translate seamlessly across the enterprise network. In a distributed environment, such features may need to be applied across all sites.

In addition to reliable trunking services, the GENBAND S-series SBC enables service providers to offer enterprise customers a number of additional managed services, including:

- Centralized inter-PBX dial plan management
- Multi-vendor IP-PBX interoperability
- Aggregation of Session Detail Records
- Proactive voice quality monitoring / reporting / notification
- Least cost routing (LCR) for intra-enterprise calling
- Policy decision-based routing – LCR Override
- Centralized Call Admission Control for all employees including remote employees and teleworkers

## **Service Provider Network Borders**

The rapid growth of VoIP traffic provides new service and network deployment opportunities for service providers. More and more service providers are IP enabling their core network. The VoIP architecture - consisting of session border controller, application servers, soft-switches, and media gateways - offers service providers a quick and flexible way to deliver a seamless user experience wherever and however the service is accessed. The new IP-based architecture encompasses both access network and interconnect network boundaries.

### ***Access Network Borders***

Service providers must manage the critical access network border, where enterprise subscribers connect with the service provider's core network using SIP trunks. To successfully deliver hosted services via SIP trunks, today's service provider is confronted by a far broader and increasingly challenging set of network-based risks. These risks include attacks directed at the enterprise subscriber, against the network itself, and against the applications - all with the intention of bringing down the network or controlling its resources.

Besides dealing with traditional issues such as service delivery and managing traffic congestion for the PSTN, service providers also have to assure seamless interconnection with enterprise devices and high availability of network & resources to ensure timely recovery from any disasters and outages.

### ***Interconnect Network Borders***

To gain real economies from emerging IP networks, service providers are migrating from IP-TDM interconnects to pure IP-IP interconnects with their peering partners. These IP-IP interconnects enable service providers to cost-effectively terminate local PSTN, domestic long distance, and international long distance traffic, to leverage new service offerings by interconnecting with other ASPs, and improve call quality by eliminating the need to translate traffic from IP to TDM and vice versa. This interconnect network border also acts as a logical point for the service provider to add IP-based session routing and policy enforcement. IP-based routing allows service providers to create least-cost route connections to peering partners, to adapt new routing policies, and to re-route sessions via alternate quality-based pathways.

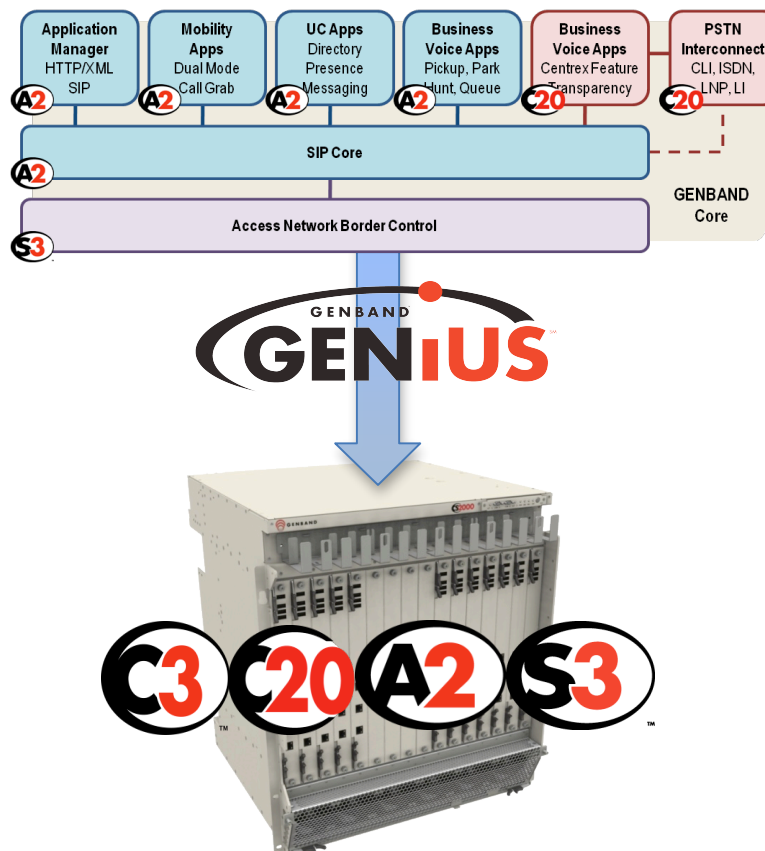
Though there are many benefits of IP enabling the peering interconnects, these peering points are also IP borders, and therefore create a point from which malicious attacks can be directed at the service provider network. H.323 networks are prevalent across international boundaries. To ensure seamless operation with peering partners, service providers must ensure device, protocol, and application interoperability. To manage the VoIP service, service providers must address the complexity of Service Level Agreements (SLAs) and capacity across these network integration points.

The GENBAND SBC provides a robust and highly programmable session routing engine that directs real-time sessions over network interconnects, while offering service providers advanced session routing capabilities such as dynamic route hunting, adaptive routing, and least cost routing. This session routing engine is unique to GENBAND, allowing service providers to dynamically route traffic to other service provider partners based on call completion rates, route profit, and route availability. The sophisticated call routing intelligence of the GENBAND SBC greatly reduces the complexity of IP-IP session routing and management, allowing faster delivery of real-time IP services such as voice, video, and multimedia.

## The GENBAND SIP Trunking Solution

With its IP-to-TDM and IP-to-IP Gateway technologies, GENBAND maintains a comprehensive portfolio of products & solutions that can be leveraged to implement a complete business trunking solution.

Consisting of the GENBAND C- series C20 or the C3 Softswitch, A2 application server, G-Series gateways and S-Series session border controllers, coupled with the industry leading management platforms, GENBAND is the only supplier that can offer such a flexible range of solutions. GENBAND is in a unique position to offer the complete set of required technology components at a range of differing scaling points under a common management umbrella.



“GENBAND GENiUS™” is an all-IP platform that encompasses GENBAND’s application, call control, session border and security product lines. The platform is designed to simplify and fuel the transformation and convergence of fixed and mobile networks. GENBAND GENiUS is being deployed as the common platform for many GENBAND products within the A-series (A2, A6), the C-series (C3, C20) and the S-series (S3 SBC, S2 SeG). With GENiUS, service providers are able to design their networks with the latest in state-of-the-art IP technology which has unmatched scale, flexibility and cost. As the industry’s only universal IP Switching and Networking platform supporting multi-purpose IP solutions, GENiUS allows carriers to mix and match applications and services.

## Role of the SBC in GENBAND’s SIP Business Trunking Solution

The management of disparate IP network borders presents new challenges and unique requirements for service providers, such as:

- **Security**- how to protect the core network, applications, and enterprises from malicious attacks and theft of service
- **Interoperability** – how to assure seamless service enablement with multiple vendor platforms, signaling and transport protocols, network characteristics, security constraints such as encryption, and proprietary feature support
- **Regulatory compliance** – with new IP infrastructure, how to comply with regulatory and standards requirements such as emergency calling and lawful intercept
- **SLA assurance and management** – how to monitor packet latency, jitter, and packet loss on a real time basis to meet service level agreements and achieve a high quality customer experience
- **Enhanced IP-IP session routing** – how to leverage IP technology to route sessions at a lower cost with better call completion success rates.

To meet these challenges, service providers are deploying Session Border Controllers (SBC) as a key component in SIP trunking architecture. GENBAND’s S3 Session Border Controller (SBC) can be deployed at enterprise network border (E-SBC), at the edge of service provider’s core network (A-SBC), and at VoIP peering border (I-SBC) to address critical security, interoperability, service level assurance, regulatory, and standards compliance requirements of IP trunking solution.

### Security

Service provider and enterprise IP networks can often be exposed to external threats which can compromise critical network resources. To protect key assets such as soft-switches, application servers, IP-PBXs, and SIP proxies, service providers can deploy GENBAND’s SBC security architecture at the IP network borders.

Features	Benefits
Access control firewall, including signaling control and media pin holes, packet filtering	<ul style="list-style-type: none"> <li>▪ Prevents unauthorized access to SBC, and to service provider and enterprise networks</li> <li>▪ Prevents service theft</li> <li>▪ Detects malicious sources</li> </ul>
Multi-stage signaling rate limiting (layer 2, 3 & 5) - TCP, SYN, ICMP, SIP methods	<ul style="list-style-type: none"> <li>▪ Prevents service outages caused by DoS/DDoS attacks, flood attacks, or SIP signaling attacks</li> <li>▪ Protects core infrastructure from security threats</li> <li>▪ Increases efficiency of core network elements such as application servers and media gateways by protecting any signaling overload</li> </ul>
Registration rate limiting	<ul style="list-style-type: none"> <li>▪ Increases efficiency of service provider’s core network elements by reducing re-registration load on application server</li> </ul>
Topology hiding	<ul style="list-style-type: none"> <li>▪ Protects service provider’s and enterprise infrastructure by screening information that could allow direct access to core network elements</li> </ul>



Privacy	<ul style="list-style-type: none"> <li>Provides confidentiality and protects enterprise users from fraud and identity theft by screening user's identity</li> </ul>
RTP injection & Rogue RTP detection and prevention	<ul style="list-style-type: none"> <li>Provides protection against various form of media vulnerabilities such as RTP overload attack and malicious RTP injection</li> <li>Assures SLAs by protecting bandwidth theft</li> </ul>
Encryption (IPSec & TLS)	<ul style="list-style-type: none"> <li>Allows service providers to protect network infrastructure at both ends by providing secure trunking over the broadband IP network</li> <li>Provides data protection and privacy by encrypting all multimedia signaling between enterprise and service provider network</li> <li>Prevents loss of revenue by assuring call completion and call continuity in situations when TLS connection fail at setup or in middle of the call</li> </ul>

### ***Interoperability and interworking***

To assume seamless operations with enterprise networks and VoIP peers, service providers must be able to interoperate and interwork with multiple networks, multiple protocols, multiple devices, and multiple codecs. GENBAND S3 SBC is SIP Connect 1.1 certified and enables quick network implementation and rapid speed to revenue.

<b>Features</b>	<b>Benefits</b>
Protocol (SIP/H323, UDP/TCP, IPSec/TLS/TCP) and multi-vendor device interoperability and interworking	<ul style="list-style-type: none"> <li>Allows service providers to increase service outreach without worrying about interoperability issues with other network elements</li> <li>Provides large community of leading interoperability partners ensuring compatibility across network devices (Firewall, NAT device, IP-PBX, IP-Phones, Application Server, Media Gateway, Softswitch)</li> </ul>
Hosted NAT traversal	<ul style="list-style-type: none"> <li>Performs network address normalization for end user devices behind enterprise NAT</li> <li>Improves service assurance and ASR by resolving service blocking issues caused by non-conforming SIP ALG and NAT devices in the enterprise access network</li> </ul>
SIP timers and media inactivity timers	<ul style="list-style-type: none"> <li>Ensures better utilization of resources by detection and clean-up of inactive signaling sessions and media streams between the endpoint and the SBC</li> </ul>
802.1q VLAN tagging	<ul style="list-style-type: none"> <li>Enables service providers to provide secure VPN services to enterprise consumers</li> </ul>
Application server and media gateway availability detection	<ul style="list-style-type: none"> <li>Detects network elements failure (such as application server, media, soft-switch, VoIP peering gateway) and optimizes call routing to available device</li> </ul>

	<ul style="list-style-type: none"> <li>Increases call completion rates, thus preventing revenue loss</li> </ul>
Overlapping realm and IP signaling address (secure VPN services)	<ul style="list-style-type: none"> <li>Supports and maximizes use of overlapping IP addresses</li> </ul>
DTMF translation and interworking	<ul style="list-style-type: none"> <li>Provides a cost effective and scalable DTMF conversion/translation solution that does not require expensive transcoding resources</li> <li>Reduces the cost of media ports required on Application Servers to interpret in band DTMF tones</li> <li>Adds minimal latency and provides effective call quality by doing DTMF translation on the onboard media processing card</li> <li>Supports conversion between media, as well as signaling DTMF methods</li> </ul>

### ***Regulatory Compliance***

Service providers need to comply with both public safety and law enforcements regulations for VoIP networks. GENBAND's S3 SBC enables service providers to meet these critical requirements.

<b>Features</b>	<b>Benefits</b>
Lawful intercept	<ul style="list-style-type: none"> <li>Supports access intercept function for signaling and media</li> <li>Enables compliance with global regulatory requirements</li> </ul>
E911	<ul style="list-style-type: none"> <li>Prioritizes routing of emergency calls</li> </ul>

### ***Enhanced Session Routing***

Rapid migration to IP-IP networks requires enhanced routing capabilities to minimize cost and optimize route decisions. GENBAND provides a very comprehensive IP-IP session routing capability that enables maximum flexibility, route choice, and business analysis.

<b>Features</b>	<b>Benefits</b>
Multisite dial plan management and policy enforcement	<ul style="list-style-type: none"> <li>Provides optimized route choices between enterprises</li> </ul>
ENUM	<ul style="list-style-type: none"> <li>Supports E.164 phone number routing decisions based on external ENUM database, enabling VoIP routing end-to-end, LNP, CNAM services</li> </ul>
Routing options	<ul style="list-style-type: none"> <li>Supports ANI/DNIS, To: Header, Domain name, trunk group, diversion header longest length of matched digits, and time of day</li> </ul>
Call admission control	<ul style="list-style-type: none"> <li>Controls rate limit call volume per end point, virtual port or region</li> </ul>
Adaptive routing	<ul style="list-style-type: none"> <li>Supports routing based on bandwidth and QoS</li> </ul>
Route hunting	<ul style="list-style-type: none"> <li>Allows route hunting based on priority and utilization</li> </ul>



## ***Session Visibility***

Real time voice, video, and multimedia delivery requires end-to-end visibility of the session. Interconnection to enterprise VoIP networks requires policy enablement and enforcement and real time session management utilizing key metrics such as latency, packet loss, and jitter metrics. The GENBAND S3 SBC and GenView Realtime Session Management (RSM) provide the management and reporting functionality that allows service providers to achieve SLA and QoS requirements.

<b>Features</b>	<b>Benefits</b>
Session admission control	<ul style="list-style-type: none"> <li>▪ Prevents unauthorized access and service theft by managing network access via multilayered (ingress, transit, and egress) admission control policies</li> <li>▪</li> </ul>
Per-flow RTP bandwidth policing	<ul style="list-style-type: none"> <li>▪ Prevents bandwidth theft</li> <li>▪ Assures voice quality by regulating bandwidth consumption between networks</li> </ul>
Local media routing between endpoints behind same NAT	<ul style="list-style-type: none"> <li>▪ Provides the flexibility to configure policies to locally route media between endpoints behind the same NAT</li> <li>▪ Saves bandwidth and increases quality of service by avoiding network delay</li> </ul>
QoS marking Diffserv/802.1p	<ul style="list-style-type: none"> <li>▪ Shapes and prioritizes traffic to maintain call quality for tiered services</li> </ul>
Separate signaling & media ports	<ul style="list-style-type: none"> <li>▪ Improves call quality by reducing bandwidth consumption of signaling messages on media interface</li> <li>▪ Prevents media packet loss that may be caused due to signaling spikes and bursts</li> </ul>
Comprehensive Session Detailed Records for billing and reporting	<ul style="list-style-type: none"> <li>▪ Provides session visibility into each IP session</li> </ul>
QoS metrics & reports including (jitter, packet loss, delay, r-factor latency, ASR)	<ul style="list-style-type: none"> <li>▪ Provides service providers with a mechanism to monitor voice quality in the network.</li> <li>▪ Helps network administrators troubleshoot and isolate quality issues, and plan and manage network capacity</li> <li>▪ Eliminates the need for expensive QoS probes and additional network traffic for the purpose of benchmarking network and service performance</li> <li>▪</li> </ul>
EMS with FCAPS capability	<ul style="list-style-type: none"> <li>▪ Provides easy to use EMS solution with threshold based actionable alarms, session analytics engine, business and engineering report, and provisioning and administration tools</li> </ul>

## ***Real Time Service Visibility***

Finally, there is the application layer session manager - the GENBAND Genview- Real-Time Session Management, which complements the GENBAND SBC by providing automatic feedback of network behavior. This feedback provides service providers with a highly predictive, scalable service architecture for session based applications. In addition, the RSM is designed to provide the network administrators with a single point to access and control the performance of sessions traversing the GENBAND SBC.

The RSM is supported by a web-based RSM client. The RSM web-services API also provides northbound interface for programmatic flow-through provisioning as well as integration with Operation Support Systems (OSS), and business support systems (BSS). Service operators and Network Operations Center (NOC) personnel can use their browsers to remotely manage the GENBAND solutions or to integrate with existing management tools via the web services API.

The GENBAND RSM supports these session management tasks:

- Policy and route management for Call Admission Control (CAC)
- Quality of Service and Service Level Management
- Service visibility and performance records
- Alarms and Events affecting the service
- Centralized Provisioning and maintenance
- Generating reports for business and network planning tasks
- SDR management

The GenView RSM also provides the following task-specific Reporting and Analytics modules:

**Route Analysis Module (RAM)** – The RAM running on the RSM server processes SDRs in real time from multiple SBC platforms to determine QoS. This is the fundamental component by which the RSM Agent communicates the SBC. The RAM provides a basic set of engineering reports, including the Answer Seizure Ratio (ASR) and a listing of 200 most recent calls, while also supporting customized reports.

**Events and Statistics Module (ESM)** – The ESM facilitates syslog- or SDR based alarming. SBC log files are parsed for specific error codes to trigger alarms. Similarly, SDR information (e.g. error response, ASR threshold, total number of minutes, etc.) is used to assess event and alarm generation. Action taken includes logging the error to a file, generating an email to the network administrator, or blocking a particular endpoint via the Adaptive Routing Module.

**Business Analysis Module (BAM)** – The BAM processes SDRs from the RSM database to produce on-demand business reports. These include usage and cost by route, sector, etc. The RSM provides hooks to external billing and accounting systems via its Web Services (WSDL) interface.

**Web Interface Module (WIM)** – The WIM provides authorized web-based user access. Subscribers may be set up with portal access for self-care purposes, and controlled and secured by group or department. In cases where the RSM is shared between multiple groups, known as partitioning, the WIM restricts user views to their respective partitions. There is no limit to the number of user per partition or number of access lists which can be supported by the WIM.

### *Advanced Dynamic Routing*

Beyond basic routing capability, the GenView RSM offers these Routing specific modules:

**Adaptive Routing Module (ARM)** – The ARM provides a set of actions to change the route table configuration on the SBC. The ARM provides a mechanism to disable calls at endpoint ingress or egress, based on alarm conditions and network capacity states.

**Least Cost Routing Module (LCR)** – The LCR generates routing rules based on BAM rating information. The LCR-generated routes are then used to reconfigure the route tables in the SBC to effect the required changes.

**Third Party SDR Support Module (TCS)** – The TCS enables importing of third-party SDRs into the RSM for reporting/rating and exporting to third-party database directly from the RSM. Under partitioned conditions, only SDRs that belong to that partition are streamed.

## ***Carrier Class Performance, Scale, and Reliability***

The GENBAND SBC is designed to provide industry-leading performance and reliability. The exceptional performance of the GENBAND SBC is due to a unique architecture that separates signaling and media ports. This approach provides exceptional signaling performance and flexibility, thus enabling the GENBAND SBC to sustain high call rates, registration rates, and excellent call quality.

The GENBAND SBC is available in a 2U carrier grade NEBS certified COTS hardware configuration with inter chassis redundancy, and 14 slot ATCA hardware configuration with intra chassis redundancy to best suit a service provider's operational environment. This device is provisioned with a hot standby configuration for redundancy and high availability with state full migration of active sessions in less than 200 milliseconds. This carrier-class device can seamlessly scale from 500 to 25,000 sessions on the same chassis on a 2U platform and up to 108K sessions on a 14U ATCA platform.

## **Conclusion**

GENBAND IS the market leader in carrier VoIP offering Hosted lines for both residential and business users, SIP business trunks, IP interconnect solutions for global carriers. The GENBAND Session Border Controller exceeds the requirements for service provider's networks, providing security, interoperability, regulatory compliance, session visibility, and enhanced routing.

In addition, the GENBAND S3 SBC is the ONLY session border controller that:

- Is fully integrated into market leading Access and Interconnect solutions
- Provides real-time visibility into carriers' networks
- Offers Advanced Dynamic Routing based on the real time visibility of the carriers' networks
- Scales to address the exponential growth of SIP business trunking services

GENBAND's SIP Business Trunking solution is targeted to help service providers intelligently leverage direct IP based SIP and H.323 interworking to the enterprise IP-based voice networks. GENBAND's solution allows service providers multiple plays – first as a PRI replacement for PSTN termination, and subsequently leveraging it as a service delivery mechanism for new SIP applications such as hosted unified communications, hosted call centers, and hosted conferencing.