No. 202
APPLICATION NOTES

Sonus + Riverstone
SOLUTION

Bringing IP Networking to Local Voice Switching

Abstract

Local telephone networks are finally being affected by developments in IP networking technology. Voice over IP (VoIP) and SoftSwitch technology offers the promise of adding capacity to local voice networks in a very cost-effective manner, diminishing reliance on class-4 and -5 switches, and establishing a technological base for long distance toll-bypass. Until recently, though, there has been some question as to whether IP-based technology can offer the reliability, low latency, and massive scalability required in the telecom environment.

This paper presents a joint Sonus Networks/Riverstone Networks local voice switching solution that aims to answer the questions surrounding VoIP and to demonstrate that VoIP not only meets the stringent requirements of the world's largest carriers, but delivers far more capability than the traditional circuit-switched infrastructure. The Sonus Networks/Riverstone Networks solution provides a fully NEBS-level 3 compliant VoIP architecture that can serve either as a dialup Internet offload solution, or as a full replacement for local switching architectures.

Compared with installing additional class-5 switches for local voice or modem carriage, this solution offers a substantial cost advantage. Most dramatically, maintenance costs can be reduced by up to 90 percent, while initial equipment costs can be cut in half. The solution, moreover, can easily scale to handle a greater number of local voice customers at low cost. But of equal importance is the future to which this solution points. The local packet telephony solution described here offers a base for an IP long-distance network for toll-bypass, eliminating reliance on class-5 switches and long distance carriers.

The Architecture

The Present: Local Voice Switching
The following is a high-level and simplified description of the Sonus Networks/Riverstone Networks VoIP local voice switching solution ("the VoIP Switch"). For more details and information on packet telephony, please visit http://www.sonusnet.com.

The physical configuration of the VoIP Switch is simple. Two Riverstone RS 8600s connect three Sonus GSX9000 open services switches with two servers: a Sonus PSX6000 SoftSwitch and a Sonus SGX2000 SS7 Signaling Gateway, as pictured in Figure 1.

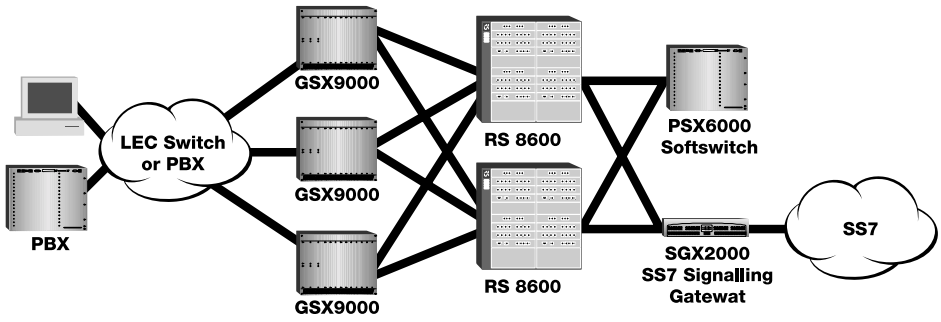

Figure 1 – The VoIP Switch Network Architecture

A few details round out the picture. First, the incoming voice traffic shown as a single line is actually eight DS-3 lines; one fully configured GSX9000 is capable of terminating up to 8,064 voice calls. Second, in addition to the Time Division Multiplexing interfaces, each GSX9000 carries two Packet Network Server cards, each with four Fast Ethernet ports, and one Management Network Server card, with two ports. All of the packet connections are 10/100 Fast Ethernet lines.

The Riverstone RS Routers create three separate VLANs out of this physical architecture: (1) Two Management Network Server networks ("MNS"), for redundant access to the SoftSwitch and SS7, and (2) a bearer network, for voice switching between the GSX9000s.

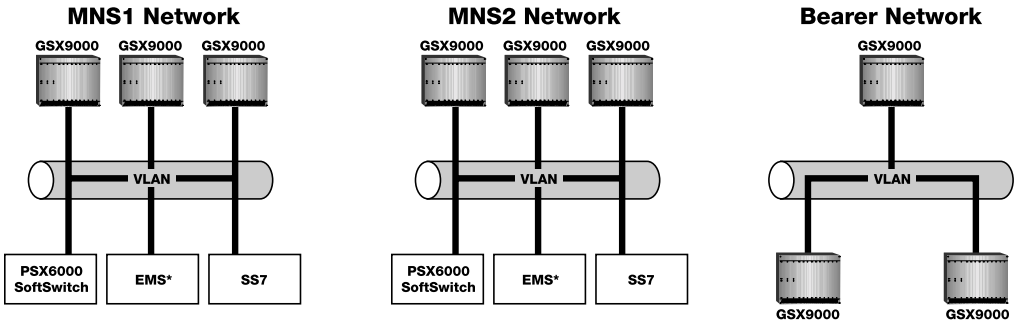

Figure 2 – Three VLANs

** The EMS (Element Management System) manages a network of multiple devices and is not the focus of this solution paper*

Once this network architecture is understood, grasping the operation of the VoIP Switch is simple. The following is a simplification of the operation. When a call comes into the GSX9000, it immediately uses the main or redundant MNS network to notify the SoftSwitch, providing the relevant calling information: called number, calling number, carrier, trunk group, and other information. The SoftSwitch is the site of telecom intelligence in this network, and it is at this point that various external policies and enhanced data services can be implemented. But the focus for this discussion is on connecting the call.

Based on the called number, at the most basic level, the SoftSwitch can instruct the GSX9000 to either:

1. Connect with a line terminated at that GSX9000;
2. Use the bearer network to create a packet connection with a line terminated at another GSX9000; or
3. Use the SGX2000 SS7 Gateway to connect with a line terminated on legacy switching equipment, or at another central office (including long distance)

Based on these needs, the low-latency RS 8600 switches the voice call over to the appropriate Ethernet network to complete the call. The non-blocking architecture of the RS 8600 ensures a packet network latency of less than 35 milliseconds.

The result is a simple, packet-based local switching solution.

The Future: Toll-bypass

The network just described sets the stage for an even more enticing use of VoIP technology: Toll-bypass.

The network just described relies on legacy PSTN (Public Switch Telephone Network) networks for long distance calls, ultimately relying on a long-haul network owned by long distance carriers. However, there is no reason that the owner of a national set of VoIP local switches could not, relying on the capabilities of Riverstone's routers, simply set up their own packet backbone for long distance connections between their central offices.

Riverstone offers an easy, modular solution for toll-bypass. Adding toll-bypass capability to the local VoIP Switch described here requires only the addition of a WAN linecard to the RS 8600: a POS OC-12 or OC-48 module. At the logical level, the switch routers can configure another VLAN for long-distance calls that can be connected using the carrier's packet-based long distance solution. The toll-bypass-ready central office then looks as follows:

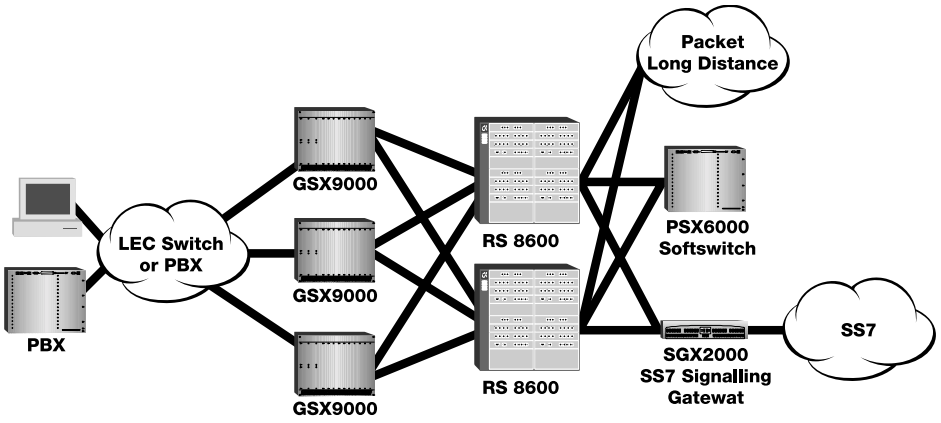

Figure 3 – Central Office Equipped for Toll-Bypass

By connecting the Riverstone switch router at these WAN-equipped central offices, the carrier can create their own proprietary long-distance network, with a minimal amount of equipment changes. The resulting long distance network would look as follows:

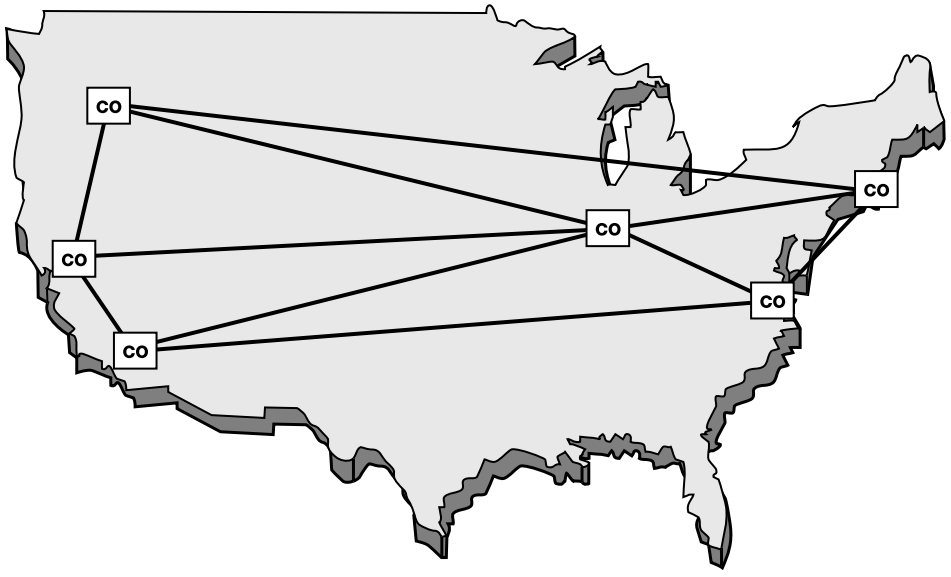

Figure 3 – Central Office Equipped for Toll-Bypass

The Architecture

Features and Benefits of the Sonus Networks/Riverstone Networks Solution
The local VoIP Switch is an attractive investment. For less money per line than a traditional class-5 switch, a carrier gets a giant reduction of maintenance costs and real-estate costs without the need to abandon any non-depreciated legacy equipment, nor any sacrifice in voice quality or call connection time. This alone justifies the investment. In addition to savings, the carrier also gets the opportunity to develop two new revenue streams. First, by developing an IP-based long distance network based on Riverstone's WAN capabilities, the local carrier can earn revenue for long distance carriage. Second, thanks to the intelligence built into the Sonus SoftSwitch, the carrier can add and charge for new value-added services possible only with VoIP. These enhanced data services include voice activated email, click-to-talk, Internet call waiting, etc.

This forms the central justification for the Sonus Networks/Riverstone Networks solution. But the details are important, and the solution described here has the following important features:

1. Carrier-Class Hardware
Sonus Networks. All of the hardware that comprise the local VoIP Switch is carrier grade. The Sonus GSX9000 is engineered to the same standards as traditional circuit switches. It is designed for 99.999 percent availability, and is fully NEBS-level 3 compliant. It provides equal or better voice quality than the PSTN; and in conjunction with the low-latency Riverstone packet network, can provide end-to-end call delays even lower than those of the PSTN. The Sonus SoftSwitch and SS7 Gateways are similarly NEBS-level 3 compliant.

Riverstone Networks. The Riverstone RS8600, the heart of the voice packet network, is itself NEBS-level 3 compliant. It is one of the few NEBS-compliant switch routers available, and the only platform with a long track record with modular WAN connectivity.

2. Value Added Services via the Sonus SoftSwitch
The Sonus PSX6000 SoftSwitch offers the capacity to build a virtually unlimited number of value-added services into local carriage, using applications from multiple vendors. It goes without saying that this is where some of the greatest profit opportunities lay.

Unlike the more static development of features for PSTN switching equipment, service development for a PSX6000 gives developers all the advantages of a standard UNIX/IP environment. The result is competitive service development on "Internet time," where carriers can choose only the very best service vendors. Examples of services are limited only by the imagine, but includes the chance to choose advanced implementations of familiar services like voice mail, directory services, and conference calling, along with new applications like fax store-and-forward, call intercept completion, and others.

3. Low Latency WAN Routing with the Riverstone Switch Router
The Riverstone RS 8600 provides the interfaces and performance needed to build a low-latency IP-based long distance solution. Riverstone is the market leader in Layer-3 WAN connectivity (with an 89 percent market share) and it brings this expertise to bear in the design of a packet-based long distance network.

The special properties of Riverstone's switch routers play an essential role in creating a long distance WAN. Their particular non-blocking architecture secures the lack of latency that is a must for the voice environment. For purposes of a toll-bypass network, Riverstone's platform carries the necessary interfaces and wire-speed routing performance needed to make that solution practical. Finally, the Riverstone switch router is the only router with a long track record in the modular WAN environment that offers NEBS-level 3 compliance. These features combine to make Riverstone's RS the clear choice for the "packet" in packet telephony.

Conclusion

Increases in voice and data communications are requiring service providers to expand and upgrade their networks. Developments in VoIP technology have created attractive alternatives to traditional telephony infrastructure solutions. New hardware solutions, such as the Sonus Networks/Riverstone Networks solution described in this paper, offer NEBS-level 3 compliance and class-5-like reliability while reducing network costs and increasing capacity.

But this is just the beginning of the story. The Sonus Networks/Riverstone Networks solution brings IP intelligence to a network, enabling a services creation engine. New services, such as voice activated email, click-to-talk, video telephony, etc., are limited only by creativity. Furthermore, with the Sonus Networks/Riverstone Networks solution, toll-bypass and convergence, once considered far-fetched ideas of the future, are right around the corner.

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