

Packet Voice Solutions: IP Telephony finds its Market Calling

Abstract

In the past, voice was king. The telecommunications infrastructure had been built to deliver toll-quality dial tone to anywhere in the world. Data traffic was the unloved stepchild and was forced to fit into the existing voice infrastructure. Revenue generated from voice service far exceeded revenue from data. The Internet has changed all that. Now data has overtaken voice not only in bandwidth use on carrier networks, but also in revenue generated for operators. Revenue for voice is also being squeezed by other providers such as mobile and cable operators. New investments in network infrastructure are being targeted at data rather than the voice needs. This makes business sense given the shift in revenue patterns. There is also more potential for incremental revenue from new data services such as storage networking, application outsourcing, and rich content streaming.

In this Metro Solution Note we explore the opportunities that packet voice solutions can offer operators for new revenue-generating services. We will look at types of services that are possible and the key underlying technologies that can enable them. Finally, we will give some examples of how Riverstone Networks has worked with technology partners to provide innovative Packet Voice solutions to operators and carriers around the world.

The Market for Packet Voice

In the late 1990s, there was much talk of voice/data convergence, typically known as IP Telephony or Voice over IP (VoIP). Ambitious predictions were made that the corporate voice and data networks would coalesce into one consolidated network. Combined voice/data services, such as unified messaging and Internet phones, would become common. As with most predictions of the late '90s, things have not happened with the speed anticipated, as shown in Figure 1.

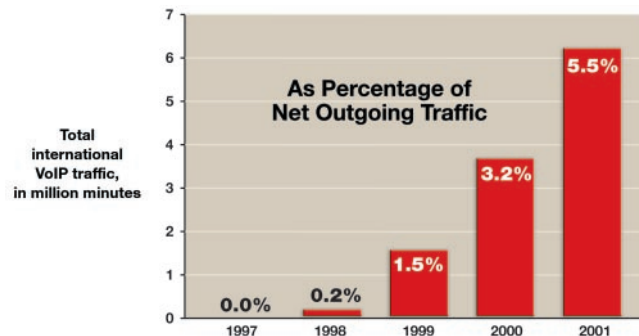


Figure 1. Growth in IP Telephony

Source: ITU/Telegeography 2001



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What has tempered these forecasts is old-fashioned business reality. In today's economic climate, no one is going to make extra investments unless there is a solid business case and a reasonable chance of a decent return on the investment. In real terms, the cost of both local and international voice services has fallen over the last 10 years. For example, in the last 5 years, the average price of an international call to the U.S. from different international locations has more than halved, as shown in Figure 2 based on data from the International Telecommunications Union (www.itu.org).

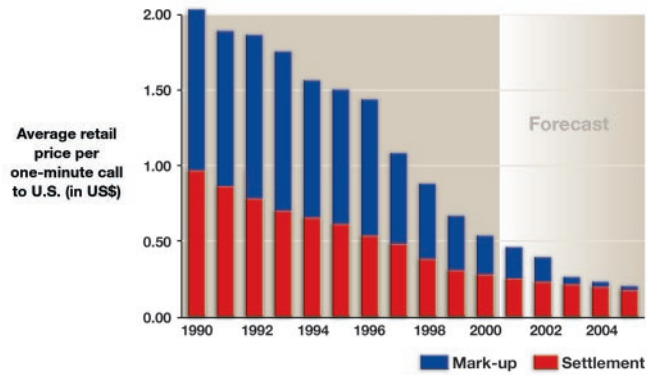


Figure 2. International call pricing
Source: ITU, 2001

In fact, in some countries, such as Switzerland, the price of an international call to the U.S. is nearly the same as a local call, as shown in Figure 3.

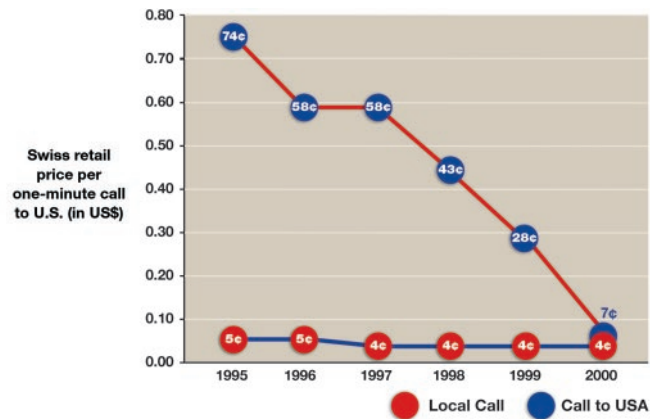


Figure 3. International vs. local pricing
Source: ITU, 2000

But if prices for international calls have fallen so dramatically, why hasn't traffic risen? One reason is because consumers have not necessarily increased the amount of time they spend making fixed-line calls. The stagnancy in the market for international telephone calls is dramatic when contrasted with other traffic streams, such as mobile communications or the Internet.

What these statistics tell us is that the savings predicted for voice/data convergence have been virtually wiped out by the reduction in pricing, especially for international traffic in the major industrialized and deregulated markets. Also, wireless has started to overtake landline



voice in many industrial countries, reducing the attention on landline services. In fact, the major landline service in some countries is now dial-up Internet access.

So what should be done with the good old phone network? One option is to leave it alone and implement data services in parallel either over a separate network infrastructure or by continuing to share the underlying network. Another option is to start to overlay the data and voice networks so that cost benefits can be accrued from consolidation and simplification. Convergence of both networks also opens up opportunities for combined voice and data services and some interesting new revenue-generating services.

Packet Voice Services

We have seen that the major market for IP Telephony will continue to be where international call charges are – expensive and controlled by a monopoly Public Telephone Operator (PTO). In this section, we examine the types of IP Telephony services that can be offered to address these market needs. We also look at other value-added services that are possible once a packet voice infrastructure has been put in place.

Toll-bypass

IP Telephony services for toll-bypass are currently the most popular packet voice services. They are predominantly used to cut the costs of long-distance and international phone calls. They can be used to set up calls between:

- PC-to-phone
- PC-to-PC
- Phone-to-phone

as shown in Figure 4.

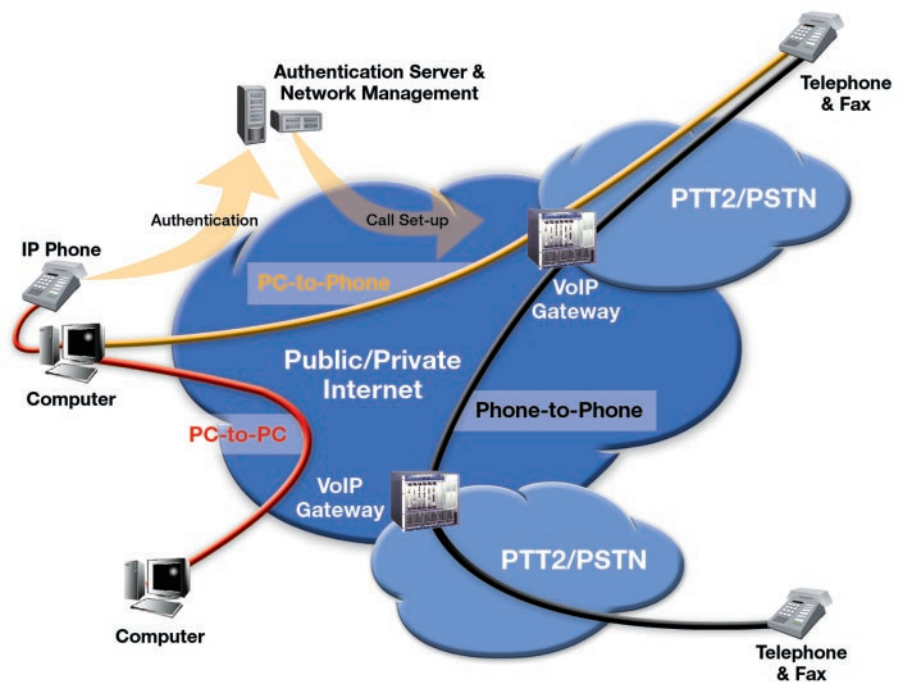


Figure 4. IP Telephony services



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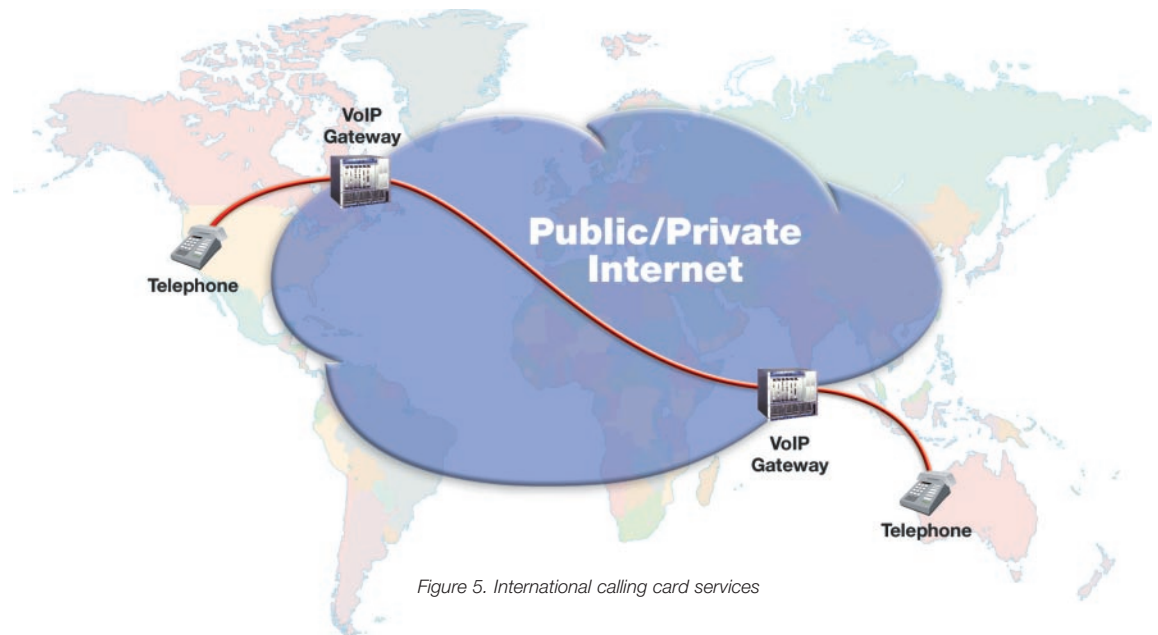
These services are popular with:

- People with relatives working abroad
- International travelers using Internet café facilities
- International FAX services

Savings of more than 50% are possible depending on the distance and local call charges for these services. There are many international operators such as Dialpad (www.dialpad.com), Net2Phone (www.net2phone.com), and PCCall (www.pccall.com).

International Calling Cards

Pre-paid and post-paid calling card services are specifically targeted at international travelers or foreign workers so that they can keep in touch with friends and family at home. The cards can be purchased either before or while traveling and use a local 800-style number to connect to the service provider's local VoIP gateway. The call is then connected over either private or public Internet links back to the destination country and the call completed locally. Since the local call is free to the user, the calling card operator only pays for the local 800 service and for the settlement charge at the destination allowing attractive rates to be offered.



Click-to-Talk

The popularity of sites such as Amazon.com and eBay.com has increased the usage and acceptance of Internet shopping. But if the customer has any questions on the purchase, they need to talk to a sales agent. In the past, the only option was to enter a bulletin board or email message or to make a telephone call to a central call center possibly in another country. With a Click-to-Talk service, online shoppers who need assistance during their purchase can speak directly to a sales agent through their PC. Using VoIP encapsulation between the shopper's PC and the e-tailer's call center, any final questions about the sales item can be answered and the transaction completed. This service can make a major difference in the number of completed sales transactions per customer visit to the site.



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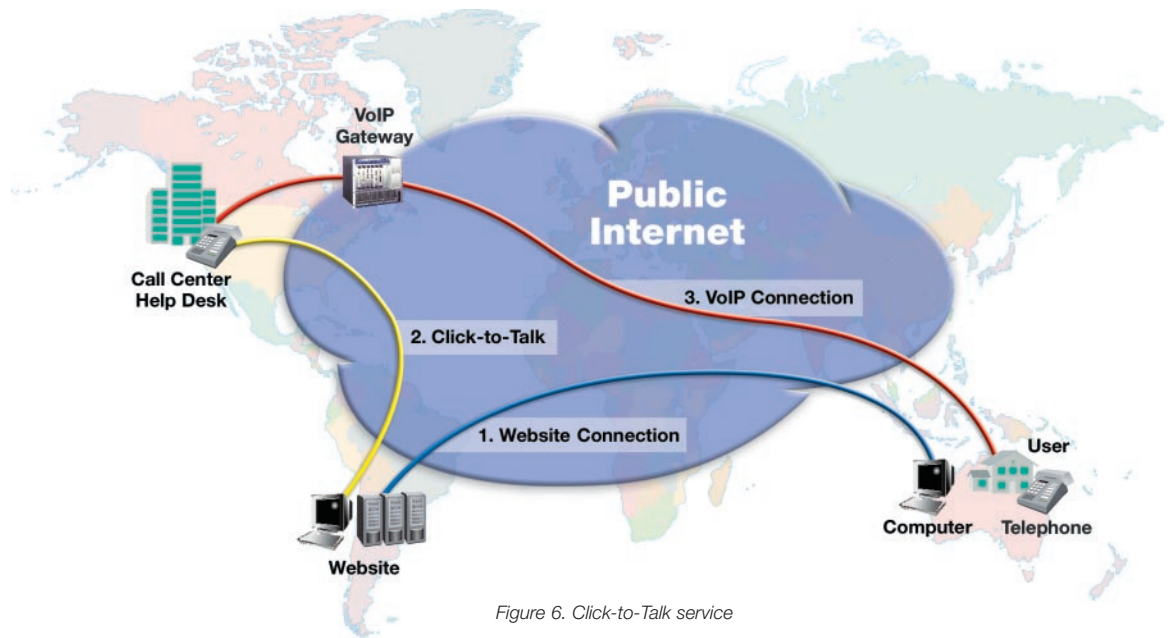


Figure 6. Click-to-Talk service

Key Technologies for Packet Voice Service Delivery

H.323

H.323 describes the family of ITU standards that specify how voice and video multimedia services operate over networks, which does not guarantee QoS such as LANs and the Internet. It is the basis for most Voice over IP solutions and includes the various options for compression, call control, and IP packet encapsulation. VoIP implementations based on H.323 standards include advanced features such as echo cancellation and voice activity/idle noise detection to ensure the quality of the voice call over the link. H.323 techniques are most appropriate where voice traffic transits over low bandwidth networks or the public Internet.

TDMoIP

Another method of encapsulating voice traffic in IP is by using circuit emulation or circuit extension. It allows existing equipment such as PBXs and TDM switches to be directly connected to an IP network so that all the features and signaling characteristics of the existing solution can be seamlessly transported over the drop-in IP network. However, timing is critical and if a global time reference is not available, local time clocks are required. TDMoIP is most appropriate for private networks with reasonable amounts of bandwidth such as ATM or Ethernet.

QoS

Whatever encapsulation technique is chosen (VoIP or TDMoIP), it is critical that the appropriate Quality of Service is provided for the transport link. This is more critical for TDMoIP as it is more sensitive to jitter and packet delays than H.323, which has some built-in resilience to reduction in quality. However, neither is immune to an outage such as a fiber cut or equipment failure. IP routing techniques will always route around such an outage, but the time to recover the network is often minutes rather than milliseconds. What is needed is a switching mechanism that has the resilience and restoration provided by the underlying SONET/SDH transport present in today's voice networks.



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Multi-Protocol Label Switching (MPLS) is the key technology to provide service quality and restoration required for transmitting voice or video traffic over IP packet networks. It provides traffic-engineering features that allow packets containing voice data to be allocated to the network links that have the right jitter and latency characteristics required for the embedded data. Paths or tunnels can be created over the underlying IP network analogous to an ATM virtual circuit. Traffic can be switched rapidly along these paths without the need for IP header analysis and routing table look-up. Redundant and back-up paths can be defined to provide path protection. And failover between MPLS paths can be accomplished in milliseconds rather than minutes, allowing faster recovery and better quality for voice calls.

MPLS is therefore the extra magic ingredient for reliable and predictable transportation of voice traffic, whether embedded in H.323 VoIP packets or TDMoIP packets.

Riverstone Packet Voice Solutions

Riverstone Networks is the market leader in metro edge and aggregation solutions. The combination of Riverstone's hardware-based routing and switching solutions with the best-of-class Packet Voice solutions from leading IP Telephony vendors can provide the end-to-end solution for all types of voice services.

Softswitch Solutions

Riverstone is a partner member of the Sonus Networks Open Service Partner Alliance (www.sonus.com). Sonus Networks is the market leader in the provisioning of carrier class full-function Class 4/5 softswitch replacement solutions. The Sonus platform is a NEBS-3 compliant VoIP solution that can serve as a dial-up Internet offload solution or as full replacement for local switching architectures as shown in Figure 7.

Riverstone's low-latency metro routers provide the voice switching between the Sonus devices. Traffic is segregated by building separate VLANs for each class of traffic. The non-blocking architecture of the RS 8600 ensures a packet network latency of less than 35 milliseconds. Long-distance toll-bypass traffic can be switched over the Wide Area Network with the addition of WAN interface cards.

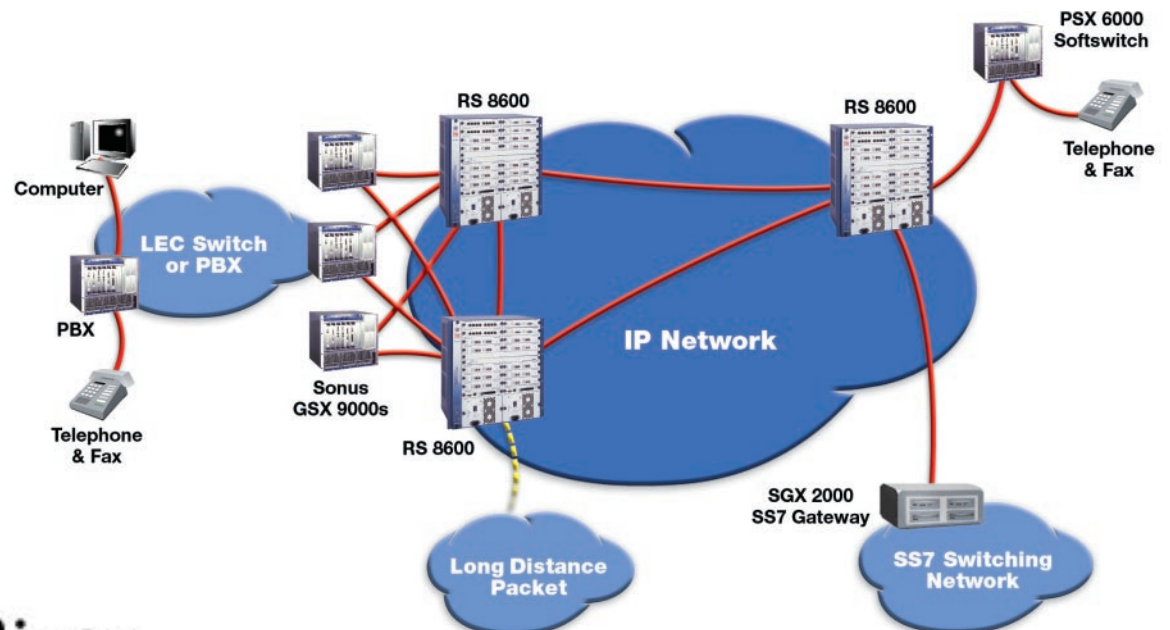


Figure 7. Softswitch solution



TDMoIP Solutions

The market leader in circuit extension devices is RAD Communications (www.rad.com). Riverstone Networks is a RAD partner providing the underlying robust IP transport for the RAD circuit emulation devices. TDMoIP packets generated by the RAD devices can be classified using the DiffServ or IP TOS field in the IP packet so that they can be given the appropriate QoS over the IP network as shown in Figure 8. In this example, MPLS traffic engineering is used to separate the bulk data traffic from the time-delay sensitive voice traffic over different links in the underlying IP network.

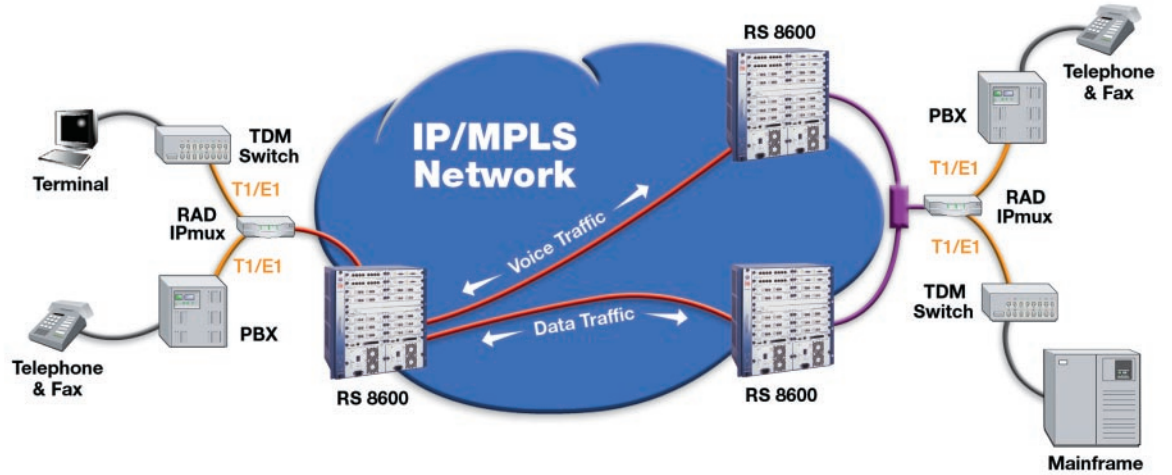


Figure 8. TDMoIP solution

Customer Deployment

TIME WARNER TELECOM

AOL/Time Warner Telecom has deployed a combined Sonus/Riverstone packet telephony package, including softswitches and media gateways, in 8 markets throughout the United States.

Time Warner Telecom needed a complete packet telephony solution that would allow the carrier to achieve the highest levels of scalability, performance, and reliability. Sonus teamed with Riverstone to provide Time Warner Telecom with a robust, NEBS Level 3-certified core network system, comprising Sonus' GSX9000 Open Services Switch, PSX6000 Softswitch, SGX2000 SS7 Signaling Gateway, and the Riverstone RS 8000 series of metro routers. This combination of products enabled Time Warner Telecom to deploy large switch sites rapidly and cost-effectively, each capable of handling more than 100,000 simultaneous telephone calls.

Time Warner Telecom is initially leveraging the Sonus-based network to augment its existing Class 5 circuit switches and offload modem-generated Internet traffic from its voice network. Time Warner Telecom also plans to use the Sonus infrastructure to deliver traditional local and long distance services, as well as new Voice over IP-based services such as unified communications, single number service, call centers, and more.



Summary

Full convergence of the voice and data networks is not going to happen as fast as originally predicted. However, there are sweet spots in the market that can be exploited by nimble operators. Healthy revenues can be made from IP Telephony solutions, which help travelers and people working abroad keep in touch with their friends and family. Large organizations will also benefit from toll-bypass solutions by converging their corporate voice/data networks. New Click-to-Talk applications can be added to further enhance the friendliness and effectiveness of e-commerce sites.

Riverstone Networks can provide the IP engine that has the performance, control, and resiliency needed to transport time-sensitive voice traffic.



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