EXECUTIVE SUMMARY

Ringback tones and other audio streaming applications are a rich source of recurring monthly revenues for service providers. Service providers looking to deploy such applications must balance the need to maintain reliability and responsiveness with the imperative to grow their profitably. **TelcoB**ridges™ has developed a carrier-grade solution, combining hardware and software, that offers the density, high-availability, flexibility and ease of use that service providers require to profitably deploy ringback tones and other advanced audio-streaming applications.

INTRODUCTION

Service providers are always looking for new and innovative opportunities to increase their revenues. They are particularly interested in recurring revenues such as subscriptions, where the subscriber pays an ongoing monthly fee to access a service. Over the years, one of the more successful value-added subscription services has been ringback tones. Widely deployed in Asia and Europe, ringback tones are increasingly being offered by service providers in other regions, including North America, that see them as a significant revenue enhancing opportunity.

RINGBACK TONES AND OTHER AUDIO STREAMING APPLICATIONS

A ringback tone is the tone a caller hears when he or she places a call to another fixed line number or mobile device. It is generated by a signaling capability at the called party's network service provider, and not by the called party's terminal or handset, which is what happens with ring tones. However, the attraction of a ringback tone lies in the fact that, like a ring tone, it can be customized to fit the unique personality of the subscriber. A ringback tone selection can include a particular song, sound effects, bars of music, voice or multi-media message, and even one or more images. Ringback tones are under the complete control of the network operator and are considered an audio streaming application.

At the heart of a ringback tone system is the ability to perform audio streaming, which occurs between a database containing the audio files, and the service provider's telephony interface. While ringback tones are best used over mobile connections where there is often enough delay between a call being dialed and being picked up for the audio to play, they can also be used in VoIP and wireline TDM contexts.

Other applications that require audio streaming capabilities include:

Voicemail: A centralized system that stores recorded messages for each subscriber. Subscribers can listen to their voice messages at any time, from anywhere, using the phone. In this case, audio is recorded to, and played from, a hard drive-based audio database.

Prompts Playback: Voice messages, music or sound effects played to callers. Prompt playbacks are generally used to implement automated answering systems that play voice messages, background music, or messages that guide callers through the multiple 'menu' options that they can choose from. Audio prompts are streamed from pre-loaded RAM buffers, or from a hard drive.

Text-to-Speech: This type of application converts plain text to audio via a speech generation engine that plays the texted message back to the caller's phone. This application allows subscribers to 'listen' to a text message, or to any 'text-based' information available from a database or other source. In this example, audio is generated by text-to-speech engines and streamed from RAM buffers.

Speech Recognition: Words or sentences spoken by the caller are first recognized then used to perform the appropriate action. Here audio is streamed to a speech recognition engine.

Each of these applications, although they all have different hardware requirements, is based on audio streaming technology. **TelcoB**ridges' audio streaming solution, based on its *T*dev™ family of multi-service application platforms and *T*media™ family of media gateways, has the reliability, flexibility and performance required to address the needs of each of these types of applications.

From the service provider's perspective, flexibility and low cost are key to the successful introduction and adoption of any 'value-added' service such as ringback tones . During the early phases of subscriber adoption, the service provider's systems must scale easily and gracefully, adapting without problem to the requirements of increasing numbers of subscribers to the service. However, integrating new service offerings into existing networks generally requires a significant upfront as well as recurring investment in terms of time and money. As a result, keeping monthly fees low to attract subscribers during the initial rollout of this type of value-added service is a challenge for most service providers, and has to a certain extent hampered their adoption.

AUDIO STREAMING APPLICATION CONSIDERATIONS

To meet the twin constraints of flexibility and low-cost when designing and deploying an audio streaming application such as ringback tones, there are a number of considerations that need to be addressed. Unfortunately, many audio streaming solutions, as they are currently designed, face challenges in meeting those requirements. Typical audio streaming systems are limited by technical issues such as the low performance inherent in a PCI bus chassis, limited multi-chassis or multi-unit solutions, and the lack of low-cost, high-performance host processing. Many systems rapidly become very complex, costly, and require a high level of maintenance. All of which increase the overall cost and profitability, which has a significant impact on the financial viability of these "value-added" applications.

To meet these challenges, **TelcoB**ridges has developed a reliable, flexible, and scalable solution based on its *T*dev family of multi-service application platforms that enables service providers to integrate ringback tones into their existing networks easily and cost-effectively. We will examine the TelcoBridges offering in greater detail later in this document. First, we will explore each consideration and examine how the TelcoBridges family of products addresses it.

In general the considerations that should be addressed when designing an audio streaming solution are:

High Density. To be cost-effective, an audio streaming system must support high-density implementation; this reduces the overall cost per port. A high-density system also simplifies the integration of the new system alongside existing equipment, without requiring a major reorganization of available floor or rack space. Many audio streaming systems currently available only support a small number of trunks per board, meaning that multiple boards and rack/floor space are required to achieved the desired level of capacity.

TelcoBridges' solution meets the need for density with the *T*dev TMP6400™ multi-service application platform. It offers the highest density for a 1U form factor in the market, supporting up to 64 E1/T1/J1 trunks in a single unit to provide simultaneous delivery of 2,048 ringback tones per unit. Sixteen units can be arrayed to provide even higher capacity. Audio streams are generated by standard, low-cost server computers (CPUs running Windows, Linux, or Solaris)

using the **TelcoB**ridges TB StreamServer™ software. TB StreamServer is an application that manages audio files and audio prompts. Both types can be played over an Ethernet-based LAN to a TMP6400. The TMP6400 devices and the instances of the TB StreamServer application are controlled using TelcoBridges' message-based API, *T*oolpack™.

As an example of the type of density and capacity achievable with **TelcoB**ridges products, China Mobile, the world's largest mobile operator with over 300 million subscribers in 2008, has deployed a ringback tone solution using 4,000 E1 lines with total simultaneous capacity of 128,000 ringback tones.

High Availability. An audio streaming system must not compromise the stability of the existing voice network nor the corresponding service to subscribers. As system density increases, it becomes increasingly important to reduce the risks of a system failure. Many currently shipping audio streaming systems have a single point of failure, such as the PCI bus of a compactPCI chassis, which is shared by all of the system boards within the chassis. If a single board or the CPU should fail, the entire chassis may also fail.

To meet the requirements for high-availability, the TMP6400 and its application software are designed to work in a dual redundant subnet environment. The TB StreamServer and application servers, as well as the TMP6400 platforms, are connected together through Gigabit Ethernet switches. In addition, TMP6400 devices can be configured in an "N+1" high availability configuration where a secondary TMP6400 is used as a standby system that can rapidly replace any TMP6400 that has malfunctioned or failed[1]. TB StreamServers™ can also be combined to provide load sharing and redundancy by distributing the load from a failed server to other available servers[2].

In this scenario, there will be zero loss of control messages, or streamed audio in the case of failure of one of the network paths between application hosts and TMP6400 systems (failed Ethernet switch, cable, or network adapter for example). Network redundancy is transparent to the host applications, thus developers using the TMP6400 do not need to worry about it.

Scalability. If the service provider's marketing department is successful, value-added services often become rapidly popular with subscribers. Thus, service providers must be ready to scale their systems quickly to respond to increased demand. Many audio streaming systems are unable to meet this requirement as they suffer from low density and poor scalability options. As an example of this challenge, a given single ringback tone file may need to be routed to multiple incoming calls simultaneously, so specific tone files cannot be bound to a limited number of trunks.

A TelcoBridges-based audio streaming solution meets the requirement for scalability on a number of fronts. First, its switched Ethernet network allows for an increase in the number of TMP6400 devices, while the number of servers running the TB StreamServers application can be increased in order to augment the total number of simultaneous channels supported by the system. For example, a well-balanced TelcoBridges-based ringback tone system can combine up to four

[1] In the current iteration of the TMP6400, the switchover must be handled manually by the controlling application (the application must manually reconfigure the spare blade like the failed blade). Automatic and transparent switchover will be implemented in a future release.

[2] The controlling applications need to manually redistribute the audio streams of the failed server to the other available servers. This process is not automated, but can at least be implemented easily.

TMP6400s with a single 1U chassis host running TB StreamServer with its ringback tone application software. Such a system supports 8,000 independent simultaneous audio playback channels.

Second, any TB StreamServer-equipped server can stream audio to any channel in a multi-chassis system, allowing load balancing and redundancy across the multiple elements of the system. Third, the number of files served can also scale by using one, or multiple Redundant Array of Independent Disks (RAID) arrays to store many terabytes of ringback tone audio files. Finally, the modularity of components—TMP6400 devices, TB StreamServers and main application servers, interconnected through an expandable Ethernet network—allows the system to scale gracefully[3].

Flexibility. Newly deployed services most always require some adjustment and fine-tuning to closely match subscriber requirements and preferences. To increase revenues an audio streaming system must be flexible enough to adjust rapidly to market expectations as well as fuel the interest of a wider range of subscribers. Most audio streaming systems have fixed specifications that do not adjust easily to the variable requirements of the service provider.

With **TelcoB**ridges' architecture for audio streaming, a service provider can implement a wide variety of applications such as ringback tones, prompts playback, voicemail, text-to-speech, and voice recognition. By combining the trunk, switching, voice processing[4], audio streaming and signaling features of the TMP6400, developers can build applications that have not been previously feasible, or that previously required large systems from different vendors. The TMP6400 also allows for flexible sizing of the components of the system (number of TMP6400 units, amount of RAM, number of hard drives, number of CPUs and servers, size of the Ethernet network) according to the type of application to be deployed and the specific characteristics of the targeted subscribers. This flexibility in the choice of system components allows the service provider to take a cost-effective approach to provisioning each application.

Ease of Integration. Service subscribers typically have a significant portion of their investment in installed equipment. New equipment and software must therefore integrate with this existing legacy equipment in order to minimize any additional investment. Moreover, to maintain a competitive advantage, service providers also need to launch new services rapidly in order to keep customers from defecting to the competition. They also require a lot of space, cooling and maintenance due to their low density. Finally, many audio streaming systems often require dedicated applications running on dedicated platforms; always a challenge when integrating with existing applications running on other components of the network.

Service providers looking to ensure ease of integration are well-served by **TelcoB**ridges, which offers a complete audio streaming solution from a single source covering both hardware and software. Developers building applications using **TelcoB**ridges TMP6400 are provided with the bundled, ready-to-use *T*oolpack™ development environment. It includes sample code and tools that allow developers to rapidly familiarize themselves with most features of the TMP6400 and the TB StreamServer. The optional ExpresSCE+™ service creation tool (sold separately) features a graphical user interface that uses visual authoring to build out application services. It includes a series of pre-built applications, such as conferencing, tandem switching, and pre-paid/post-paid calling, that can be modified and rapidly put into production.

[3] The number of channels in a system is limited only by the bandwidth of the Ethernet switch used.
[4] Tone detection/suppression/generation, voice activity detection, noise suppression, automatic gain control, conferencing, μ-Law to A-Law conversion.

On the hardware front, **TelcoB**ridges offers a complete, carrier-grade hardware solution. Therefore, integrating ringback tones or other applications within a standard PSTN or IP-based network is very easy, without the need for additional third-party TDM switches, gateways or external voice processing resources.

Other technical considerations

A ringback tone application can be one of the most demanding value-added applications for any carrier or service provider to provide. Requirements include large amounts of hard drive space to store one or multiple customized ringback tones per subscriber, and fast hard drives (7200 RPM or better) to support a higher-than-usual number of calls per second; this is due to shorter average call duration, estimated to be around 20 per second on mobile networks.

Significant quantities of RAM are also necessary in such systems, due to multiple channels being played simultaneously, with each additional channel demanding additional buffering space.

THE TELCOBRIDGES SOLUTION

TelcoBridges has developed a dynamic, flexible, reliable system architecture using its award-winning *T*dev TMP6400 Multi-service Application Platform and the TB StreamServer application server to meet the needs of developers offering ringback tones and other audio streaming applications. It has the reliability, flexibility and performance required to address each of the ringback tone application considerations discussed earlier.

Each component of **TelcoB**ridges' audio streaming solution has been optimized for high performance:

TMP6400 Multi-Service Application Platform

> Simultaneous delivery of 2,048 ringback tones per TMP6400 unit
> Unlimited scalability through the addition of TMP6400 units
> Up to 64 T1/E1/J1, 3 DS3, or 1 OC3/STM-1 per TMP6400 unit for connection to the network
> Integrates with an NGN architecture where TMP6400 units can stream the ringback tone content over IP (up to 2,048 universal VoIP channels per unit)
> High-performance SS7 signaling supporting more than 1,000 calls per second per Tdev TMP6400 unit

TB-StreamServer

> High-performance audio streaming supporting more than 20,000 simultaneous audio streams per TB StreamServer
> Unlimited content storage and playback using multiple TB StreamServers
> 2000 calls per second using prompts playback[5] from memory
> 150 calls per second per hard drive using Ringback tone audio files[6]

Ethernet Network

> Any TB StreamServer-equipped server can individually route any tone to any channel in any TMP6400 device through the switched Ethernet network.

---

[5] prompts pre-loaded in RAM (equivalent to 66 hours of prompts).
[6] rmance hard drives (15K RPM Ultra-SCSI). No limit on the length of the audio files, no limit on the size of the hard drive. es linearly with the number of installed hard drives.

The figure below shows a typical ringback tone architecture that combines multiple TMP6400 multi-service application platform chassis running with the TB StreamServer application that provides ringback tones for up to 64 E1/T1/J1 trunks per TMP6400 chassis.

SUMMARY

Solution providers looking to launch advanced value-added services such as ring-back tones would do well to consider **TelcoB**ridges' solution for audio streaming application. With its TMP6400 Multi-Service Application Platform and its TB StreamServer™ application software, **TelcoB**ridges offers a straightforward and innovative approach to the audio streaming requirements needed for a successful and scalable ringtone system. **TelcoB**ridges' carrier-grade solutions can range from small, cost-effective trial systems, to high-density, fully-redundant, platforms serving hundreds of thousands of end-users. For more information, please visit www.telcobridges.com.

ABOUT TELCOBRIDGES

TelcoBridges is clearly defining the future of communications technologies. By supplying the industry's best telecom platform, **TelcoB**ridges is helping telecom developers and integrators of VoIP and TDM solutions realize their bright ideas. **TelcoB**ridges' customers develop and deploy carrier-grade telecom solutions for some of the world's largest operators in over 45 countries. These solutions include: mobile value-added services, location-based services, video calling applications, network monitoring, media gateways, switching, IVR, unified communications solutions, and more. For additional information, please visit www.telcobridges.com

###