EXECUTIVE SUMMARY

Service providers looking to drive network convergence, cost-effectively expand their network footprints, and reduce their operating costs are turning to media gateways. There are a number of important considerations to take into account when choosing a media gateway platform. Those organizations looking to adopt a media gateway would do well to consider TelcoBridges' Tmedia™ family of media gateways.

INTRODUCTION

Service providers are adding VoIP capabilities to their networks, whether to reduce costs when interconnecting with other carriers, to cost-effectively build out their network footprints, or simply to transport voice traffic across their IP backbones. This is best accomplished using a media gateway, which enables the delivery of VoIP services by bridging voice traffic between the public switched telephone network (PSTN)—based on time-division multiplexing (TDM)—and IP networks such as the Internet.

PRODUCT FAMILY OVERVIEW

Interesting fact:

The Tmedia family of media gateways comprises four models in all, ranging in capacity from 256 to 32,768 channels. Tmedia device such as the TMG3200 and the TMG5800 represent the highest density media gateways in the market today.

Offering the industry-leading highest port density and the lowest operating costs, Tmedia is a carrier-grade family of media gateways that meet the needs of service providers looking to drive convergence between TDM and IP networks, replacing multiple devices for signaling, connectivity, and media transcoding with a single device. Whether sitting at the network core or at the edge, Tmedia media gateways enable service providers to introduce VoIP into their networks while maintaining the quality and the reliability of traditional TDM networks.

Table 1 highlights a number of features and benefits provided by Tmedia media gateways. Individual Tmedia models are discussed later in this document, with a summary table provided at the end.

Table 1: Features and benefits of Tmedia media gateways

F E A T U R E S	B E N E F I T S
• Up to 64 x T1/E1/J1, or 3 x DS-3 or 1 x OC3/STM-1 in a single 1U or 2U chassis	• Highest system density in the market means the lowest cost per port; up to 66% rack and space cost savings
• Support for SS7, ISDN PRI, CAS R2, SIP, and SIGTRAN signaling simultaneously in the same device	• Flexibility to interface with any TDM equipment and/or service provider
• SS7 link redundancy, dual power supply support, field-upgradable components	• Increased system up-time
• Low power consumption (150 watts for the TMG3200 at full capacity)	• Low OPEX – up to 80 % cost savings – significantly improves ROI
• Extensive media handling support for wireline, wireless and fax codecs	• Connect with confidence to diverse VOIP endpoints and IP Fax

CHOOSING A MEDIA GATEWAY

There are a number of considerations to take into account when choosing a media gateway platform. As we discuss these key selection criteria, which include such items as TDM interface choice and capacity, support for multiple signaling and control protocols, and extensive media handling capabilities, we will also examine how the Tmedia family of media gateways addresses those requirements. In addition, we will consider core benefits of the Tmedia family of gateways such as system density, energy efficiency, carrier-grade availability and dependability, and provisioning and maintenance capabilities.

TDM interfaces

Service providers, whether providing local, long-distance or international voice services, are interconnected with a multitude of other providers using T1/E1/J1, DS3 or STM-1 links. It is critical for service providers to be able to rapidly establish new interconnections without having to always deploy new devices. A media gateway should therefore offer flexibility in selection of the type and deployment of the number of TDM interfaces, based on evolving capacity requirements.

Interesting fact:
Tmedia media gateways offer individual configuration of T1, E1, and J1 interfaces on the same device. Each interface can be configured separately to achieve the mix of interfaces you require.

With the exception of the entry-level Tmedia TMG800, which supports up to 8 T1/E1/J1 interfaces, each Tmedia gateway can be configured to support T1/E1/J1, DS-3 or STM-1 interfaces; these are delivered via mezzanine cards. While these mezzanines feature 16 or 64 T1/E1/J1, 3 DS-3 or 1 STM-1 links—offering the highest system density in a 1U or 2U form factor—it is, with the exception of STM-1, possible to activate and only pay for capacity lower than that which is physically supplied. Tmedia gateways support remote upgrade up to and including installed physical capacity on the basis of a software key. This enables initial purchase and deployment flexibility while preserving the ability to rapidly adapt to future capacity requirements. As carrier interconnection needs change over time, it is also possible to swap interface mezzanine cards in the field, with no need to return the device to the factory.

Signaling and control protocols

Just as flexibility in the selection and deployment of TDM links is a key requirement for service providers, the need to support multiple signaling protocols across various carrier partners is just as important. These include both TDM protocols such as ISDN, SS7/C7, or CAS (R2), as well as IP telephony signaling protocols such as SIP, H.323 and SIGTRAN. The ability to provide both switching and conversion across multiple TDM and IP signaling protocols at once is paramount to enabling the operational flexibility and cost savings that drive service providers to expand their carrier relationships and converge their networks.

Each Tmedia media gateway—from the entry-level TMG800 to the workhorse TMG3200 and TMG5800 devices through to the highest-capacity TMG7800—provides support for the concurrent use of ISDN, SS7/C7, CAS (R2), SIP, and SIGTRAN signaling in the same device. This support for multiple concurrent signaling protocols with no impact on system performance is made possible by the non-blocking architecture that underlies all Tmedia devices (*see "Spotlight" at the end of this document*). Signaling protocols can be allocated per network interface dynamically with no need to reboot; this delivers operational flexibility as traffic requirements change, and not just when maintenance windows permit. Twenty SS7/C7 variants and over a dozen ISDN variants are supported out of the box, while TelcoBridges' unique implementation of CAS (R2) signaling capabilities enables service providers to quickly support national, regional or local variants of this still popular signaling protocol.

H.323 signaling support is provided by a dedicated member of the Tmedia family, the H.323 Signaling Converter (TMG8300); this sits between a Tmedia media gateway and the cloud,

whether it is the public internet or a private connection to an H.323-enabled internet telephony service provider.

In parallel with the TDM and IP signaling protocols mentioned above, Tmedia devices also support the H.248 media gateway control protocol, which enables any H.248-compliant 3rd-party softswitch to control a media gateway. While the softswitch manages call control interactions, the Tmedia handles transmission of call media as well as any required transcoding.

Media handling

A wide variety of end-points—wireline, mobile, and IP-enabled handsets and soft-phone clients—must be supported in order to offer the benefits of network convergence to end-users. While a voice stream over a wireline connection (Pulse Code Modulation (PCM) @ 64 kbps) requires little-to-no conversion across TDM networks, voice may be encoded using a wide variety of audio techniques and rates on VoIP or mobile networks. These codecs (also known as voice encoders or vocoders) provide various advantages in terms of bandwidth, voice quality, and resilience to network degradation. Service providers will use one or more codecs on their VoIP networks according to their desire to save bandwidth, to provide a certain level of voice quality, or simply to interoperate with other VoIP devices or providers. The ability to support multiple different concurrent codecs and to allocate them in real time based on traffic is the key to delivering true network convergence.

Interesting fact

A Tmedia TMG3200 or a TMG5800 gateway configured with 2 DS-3 interfaces can provide over 1300 simultaneous T.38 fax connections.

Tmedia media gateways feature extensive support for various wireline, mobile and IP telephony audio formats, delivering seamless transcoding in real-time. Tmedia media gateways ship with support for G.711, G723.1, G.726, and G.729ab right out of the box, with no additional license fee required. They also offer optional support for mobile and IP vocoders such as AMR, AMR-WB (G.722.2), GSM-FR/GSM-EFR, EVRC/QCELP, G.728, G.729eg, and iLBC. Tmedia gateways offer independent dynamic codec selection per channel. This means that it is possible to assign different vocoders to different channels, on a channel-by-channel basis. Tmedia devices can then run all of these codecs concurrently and do so with no impact on system performance. This is another benefit of the non-blocking architecture we previously alluded to and which is described at the end of this document.

Tmedia media gateways also provide unparalleled support for Internet-based fax, also known as Fax over IP or Fax relay, using the T.38 protocol, which is used to carry fax communications over an IP network. (They also support the T.30 protocol for fax over the PSTN.) When combined with support for up to 3 DS-3 of capacity in a single device and for transmission using the v.34 standard (33.6 kbps), Tmedia enables truly large-scale fax gateway applications, without compromising quality. In tests by a leading Internet fax solution provider, Tmedia showed superior T.38 performance, when compared to the company's existing fax hardware partner. Field tests proved less than a 2% fax error rate for Tmedia, while competing products showed error rates of 5% or more.

System density

New telecom network capabilities typically require more devices to be installed and the space and power consumed usually increase as well. However, more and more service providers are confronted with structural challenges such as a lack of vacant data centre space or the inability to bring sufficient power in to existing facilities. The ability to deploy devices featuring higher port densities enables service providers at a single stroke to purchase less devices—thus reducing their capital expenditures–and to minimize their ongoing operating expenses—aside from energy and collocation fees, having fewer devices to manage simplifies maintenance operations, enabling significant additional recurring savings.

Tmedia gateways feature the industry's highest system density in a 1U or a 2U form factor. This density is made possible by the way that TelcoBridges designs its products, in particular through the use of custom designed integrated circuits known as field programmable gate arrays (FPGAs). This density means that multiple devices and associated rack space can be collapsed into as little as 1U or 2U of space. Beside the capital savings achieved by purchasing less units of equipment, system density also provides operational cost savings in the form of reduced co-location fees as well as lower power and cooling costs.

Energy efficiency

For many, if not most, service providers, the payoff from reducing energy use can be particularly impressive; typically, for every watt of power required to operate a device, another watt is required to cool it.

Tmedia media gateways can play a major role in reducing energy costs, with an average two-thirds less power consumption than competing products of similar capacity. By focusing on system functionality that adds value to service provider efforts, by designing its own FPGAs, and by using a modular approach, TelcoBridges has been able to craft media gateways that run much cooler and use significantly less power for processing than competing products.

Carrier-grade platform

Customer satisfaction is the key to success in any business and service providers must perform to subscriber expectations for high reliability and seamless integration. To meet their service level commitments, service providers demand that their equipment deliver the highest levels of availability, dependability and scalability. Achieving such levels requires products that have been architected to provide fault tolerance and redundancy, to scale gracefully as capacity requirements changes, and to minimize downtime following a system fault.

Carrier-grade from the outset, Tmedia devices are designed to meet the needs of the most demanding service providers. They offer multiple levels of hardware, software and link redundancy, covering system elements such as power supplies, mezzanines, gateway applications, configuration databases, and signaling protocols among others. Tmedia's modular design supports field upgrades and field repairs, while the ability to increase TDM, VOIP and DSP capacity via software license supports efforts to maximize system uptime.

Provisioning and maintenance

For network convergence efforts to contribute positively to revenue and profitability, service providers must maintain their reputation for uptime and availability during the introduction, operation, and maintenance of new services.

Keeping these challenges in mind, TelcoBridges has designed Toolpack OAMP, an operations, administration, maintenance, provisioning (OAM&P) solution. Packaged in an intuitive yet powerful user environment, Toolpack OAMP enables the service provider to perform the initial set-up of the Tmedia media gateway and any subsequent maintenance operations. These range from the simple, such as the collection of statistics and alarms, to the more complex, such as system configuration changes, the addition of new hardware or software components, and the application of software patches or software upgrades.

In addition, Tmedia's unified architectural platform—featuring common hardware and software components that enable service providers to deploy the same system configuration across all Tmedia devices—means that service providers deploying Tmedia gateways also save on provisioning and maintenance costs.

Interesting fact
A TMG3200 media gateway configured with 64 T1/E1/J1 interfaces, representing 2048 channels, requires only 150 watts at full capacity.

Interesting fact
Tmedia gateways have been certified for NEBS and other industry standards for deployment in operator production environments.

Spotlight on Tmedia's non-blocking architecture

The unrivalled performance of Tmedia media gateways operating at full capacity, while maintaining full availability of call channels and other system resources, is a direct result of the non-blocking architecture that underpins all Tmedia devices. By non-blocking, we mean that the use of the gateway device in one capacity does not preclude it from functioning in others. Consequently, it is possible to run multiple TDM and VOIP signaling protocols in parallel on the same device. It is also possible to access full media transcoding capabilities, including the most complex audio codecs, as well as IVR, tone detection and G.168 echo cancellation, while at full call capacity. Finally, it means that is possible to offer non-blocking switching between TDM and VOIP channels in true any-to-any fashion. This non-blocking architecture is made possible by three factors:

Field programmable gate arrays (FPGAs): designed by TelcoBridges to specifically enable non-blocking functionality at full system capacity, something that was not easily achievable with commercially available off-the-shelf TDM networking chips.

Real-time operating system: OSE, an embedded operating system from Enea, is a compact, robust, high-performance real-time operating system optimized for distributed, fault-tolerant systems like those developed by TelcoBridges.

TMS: TelcoBridges' backplane for any-to-any switching for TDM voice traffic can be found on mid-range and high-capacity Tmedia media gateways, where performance is considered most critical.

TMEDIA FAMILY OF MEDIA GATEWAYS: FOUR DISTINCT OFFERINGS

TMG800: An entry-level device, the TMG800 is targeted at smaller points of presence (or POPs). It can also be used for the purpose of trialing new service deployments. The Tmedia TMG800 provides for between 24 and 256 universal voice channels, across either 1 to 8 T1/E1/J1 TDM ports or equivalent VOIP capacity. The TMG800 is available in a 1U form factor and while it offers both AC and DC power capabilities, it is not available with redundant power supplies.

TMG3200: A mid-range media gateway, equally applicable at the network edge or closer to the network core. Like all Tmedia devices, it can be used as a full media gateway, or solely for the purposes of signaling, transcoding, Fax over IP, or call routing. The TMG3200 extends T1/E1/J1 support to up to 64 interfaces, and adds support for 3 DS-3 interfaces or 1 STM-1 interface, for a total of 2048 TDM or universal VOIP channels. With its support for multiple connectivity options, and multiple TDM and IP signaling protocols and a broad variety of voice compression schema, the TMG3200 is an ideal platform for delivering on network convergence efforts. Due to its high density, it is also an effective choice for device replacement efforts.

TMG5800: A high performance media gateway offering over twice the calls per second performance of the TMG3200, the TMG5800 features similar network interface capacity and choices, support for multiple concurrent signaling protocols, and extensive media handling capabilities. The TMG5800 is targeted at device consolidation efforts, specifically situations where there may be multiple existing devices running SS7 signaling, VOIP signaling, and transcoding, as well as softswitches.

TMG7800: TelcoBridges' highest capacity media gateway offering, supporting up to 32,768 channels. Comprised of up to 16 individual gateway units in a 42U cabinet, the TMG7800 supports the combination of network interface types within a given cabinet. A service provider could deploy the TMG7800 with a mix of T1/E1/J1, DS-3 and STM-1 interfaces, and then modify those interface choices over time as business requirements evolve. With its combination of redundancy for all hardware components as well as software application and database instances,

the TMG7800 is targeted at the network core where it can be used as part of extensive network convergence or device consolidation efforts.

Table 2: Comparison of different Tmedia media gateway models

Tmedia model	TMG800	TMG3200	TMG5800	TMG7800
Channel capacity	256	2048	2048	32,768
Connectivity				
T1/E1/J1	1-8	8-64	8-64	Mix and match up to 1024 T1/E1/J1, 48 DS-3, or 16 STM-1 interfaces
DS-3	--	1-3	1-3	
STM-1	--	1	1	
Protocols	ISDN, SS7/C7, CAS (R2), SIP, SIGTRAN, H.248, H.323*			
Media support	G.711, G.723.1, G.726, G.729ab, AMR, AMR-WB (G.722.2), GSM-FR/GSM-EFR, EVRC/QCELP, G.728, G.729eg iLBC, T.38			
Power supply (AC/DC)	Single	Optional redundant	Redundant	Redundant
Call records	Text-based call-detail records (CDRs) and RADIUS (accounting)			
OAM&P	Toolpack OAMP, Toolpack Web Portal			
Form factors	1U	1U / 2U	2U	42U rack

SUMMARY

The complexity of bridging legacy wireline and mobile networks with IP telephony and new IP end-points, means that service providers considering network convergence projects must take into consideration factors such as support for different TDM interfaces, multiple TDM and IP signaling and control protocols, and the ability to convert to and from various audio formats as well as fax. While media gateways were designed to address such challenges, they vary in the scale and scope of their abilities to meet all of these requirements.

TelcoBridges' Tmedia family of media gateways meet the needs of service providers looking to drive network convergence, with a single integrated device offering media connectivity, signaling, and transcoding. Tmedia devices offer support for multiple TDM network interfaces; provide concurrent signaling across ISDN, SS7/C7, CAS R2, SIP, and SIGTRAN; and deliver transcoding across all major wireline, wireless and IP telephony audio formats, while operating at full system capacity. Offering the industry-leading highest port density and the lowest operating costs, Tmedia media gateways enable service providers to introduce VoIP into their networks while maintaining the quality and the reliability of traditional TDM networks.

For more information on how the carrier-grade Tmedia family of media gateways can help transform your service offerings, please visit www.telcobridges.com.

ABOUT TELCOBRIDGES
TelcoBridges is clearly defining the future of telecommunications technologies. With the industry's premier unified hardware platform for network convergence, value-added services, and performance management, TelcoBridges is enabling service providers to meet and exceed their service goals while ensuring exceptional operating cost-efficiency. TelcoBridges' channel partners, including value-added resellers, system integrators and solution developers, have delivered and deployed carrier-grade solutions in over 50 countries around the world. These include VoIP gateways, mobile value-added services, unified communications, network monitoring, lawful intercept, location-based services, and many others.