

Suddenly signal: AdvancedMC carries signaling gateway

By *Stuart Jamieson and Gareth Smith*

The authors make the case that signaling gateway design needs are well met by implementation on a single AdvancedMC module, an approach that can speed time to market.

Telephony is in the midst of a transition from the traditional Public Switched Telephone Network (PSTN) to packet-based networks using the Internet Protocol (IP). Bridging these two networks demands gateways for voice/media traffic and for the signals that establish, control, and bill for telephone. The MicroTCA and AdvancedMC architectures include features that can speed the development of stand-alone signaling gateways. These gateways meet reliability requirements and provide fine granularity for scaling as demand grows.

In telephony the media gateway handles voice, video, and data traffic and the signaling gateway handles call control signals. In some implementations in Europe the media and signal gateways can be the same device. However, on some networks in North America separating the media and signaling gateways is more appropriate. A stand-alone signaling gateway in AdvancedMC form can serve as a building block in both design approaches.

The signaling gateway transports the PSTN's SS7 call control signals over the IP network. This allows calls placed on one network, such as the IP network, to reach destinations on the other network – in this case the PSTN. In addition, it allows two PSTN networks to connect through an intervening IP network. The bridged network has the structure shown in Figure 1. Media Gateways (MGs) encapsulate and encode the media through the IP network to either other MGs or to an IP phone. The Signaling Gateways (SGs) transport SS7 signals across the IP network to other SGs or send them to Media Gateway Controllers (MGCs), also known as softswitches, which manage calls as they enter, exit, or originate within the IP network.

SIGTRAN carries SS7 upper layers

The PSTN's SS7 protocol has two elements: the Message Transfer Part (MTP) and higher-level protocols such as the ISDN User Part (ISUP). Message discrimination, distribution, and routing tasks are handled by the network protocol layer, which also takes care of link, route, and traffic management. Higher-level

protocols route call messages, control call connect and disconnect, and link cellular and PCS networks to the PSTN.

The SIGTRAN protocol stack prepares these SS7 signals for transport over the IP network. As shown in Figure 2, the SIGTRAN adaptation layer replaces the lower MTP layers with the Stream

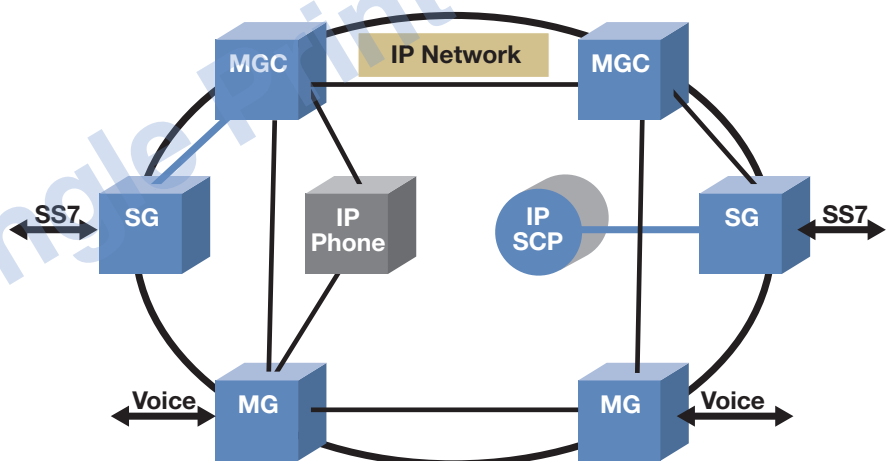


Figure 1

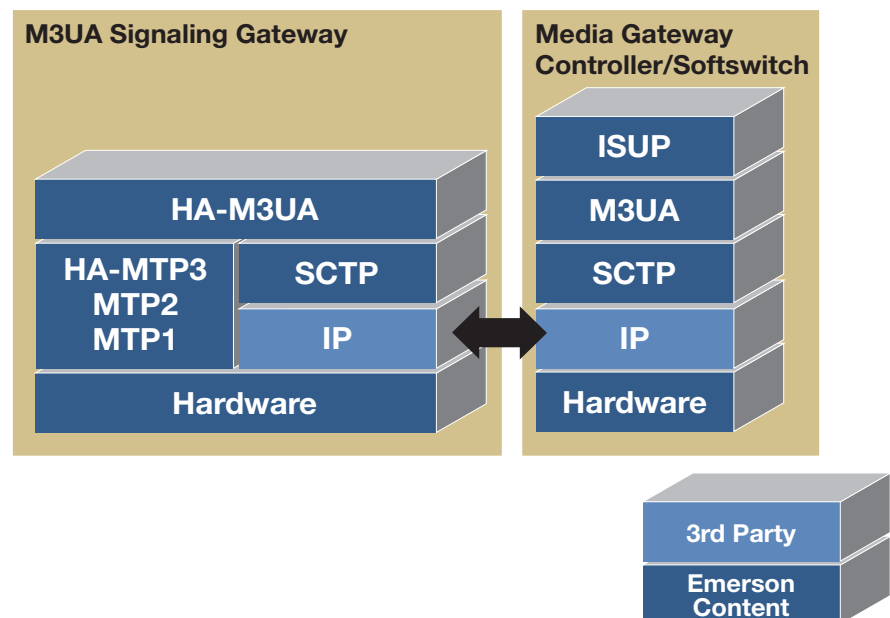


Figure 2

Control Transport Protocol (SCTP) running on IP providing the transport. The SIGTRAN adaptation layers mimic the missing MTP layer protocols to the upper protocols of SS7, thus keeping the high-level messages, hence the signaling, intact. This structure allows the SG to terminate the MTP layers in the signaling gateway and then transport the upper layers to the softswitch for processing.

To function adequately in a commercial setting, the signaling gateway design must meet a variety of requirements. It must have PSTN ports and at least two IP ports, such as Gigabit Ethernet connections, so that it has redundant links to the IP network. The gateway must also have a processor that can run both SIGTRAN for transporting the control signals and SS7 for termination to the appropriate SIGTRAN layer.

To achieve 5-nines availability the gateway must cope with both software and hardware failures and support the upgrade of hardware and software, all the while maintaining service. Because a signaling gateway commonly operates in the network as a *black box*, functioning without operator intervention, it also needs self-management capability for its hardware and protocol stack operations – including failure detection and response and a means for hot swap of equipment.

Along with the protocol stacks and high availability system software, users need configuration and management tools. These tools are particularly important for supporting effective use of the gateway. The MTP3 portion of SS7, for instance, has more than 600 parameters that need to be set to ensure proper system operation. Without system set-up wizards in the support software, installation of the gateway can become a major challenge. Similarly, GUI-based tools for network management can simplify system bring-up, shutdown, and test for the operators.

Single AdvancedMC holds stand-alone gateway

The MicroTCA architecture provides an excellent match to the design needs of a signaling gateway. AdvancedMCs are large enough to carry all the hardware needed for a multichannel gateway as well as providing room for multiple

front-panel connections to the PSTN. The MicroTCA backplane can support Gigabit Ethernet as its native signaling format, allowing the signaling gateway AdvancedMC to connect directly to an IP network without the need for additional conversion.

The hardware design of a signaling gateway can follow many approaches, but implementing it on a single AdvancedMC module offers several significant advantages. One is simple failover: two modules can load-share the SS7 signaling. When one module fails the system can simply switch all the traffic to the other. The single-module design also simplifies the hot swap replacement of the failed module by eliminating the need to re-initialize a partner module.

Another advantage of the single-module gateway design is that it offers fine granularity for system scaling. The relatively low bandwidth of SS7 signaling (64 Kbps) implies that a single-module design can handle a significant number of SS7 links. This means that a small signaling gateway can be created at minimal cost using just a few modules in a pico-sized MicroTCA chassis, perfect for the small gateway designs that currently dominate the market. As capacity demands increase, the system can readily expand in small steps at modest cost.

The single-module approach enables the AdvancedMC to operate as a fully functioning black-box signaling gateway, giving developers the flexibility to plug the single-card signaling gateway into an AdvancedTCA media gateway card design, creating a unified gateway. The signaling gateway AdvancedMC could also simply occupy an otherwise unused mezzanine card slot in an AdvancedTCA system to add this function to a CO at minimal cost.

Practical implementation

The practicality of stand-alone signaling gateway AdvancedMC module can be seen in the Emerson KSI8560. An I/O processor-based module, the KSI8560 uses a Freescale MPC8560 communications processor with a 1 GHz PowerPC core. The module offers an add-on interface for connecting to the PSTN. The augmented module provides four E1/T1/J1 signal

ports on the front panel, two 10/100/1000 Ethernet ports to the MicroTCA backplane, a 10/100 Ethernet port to the front panel, and x4 PCI Express fat pipes to the backplane. This wealth of I/O capacity ensures adequate link redundancy for high availability requirements. Other high availability support on the module includes dual boot flash banks and system SRAM with ECC.

Software support for the KSI8560 includes a carrier grade Linux operating system and SpiderWare SS7 and SIGTRAN signaling software. The signaling software comes with configuration wizards and a GUI-based set-up and control interface. High availability system software compatible with the KSI8560 is also available.

A MicroTCA system design based on the KSI8560 is easy to implement using a high availability chassis such as the EMC4000. The EMC4000 chassis provides dual MCH modules, redundant power supplies, and an optional redundant backplane fabric. It can hold as many as nine KSI8560 modules, supporting high-availability models such as 1-to-1 redundancy for four modules, 1-to-3 redundancy for eight modules, or nine modules in a load-sharing configuration with the ability to protect four cards.

This implementation example shows that the MicroTCA architecture can easily support the implementation of small-to-midsize signaling gateways with full redundancy and expansion capacity. These systems utilize modules that provide full stand-alone signaling gateway functionality on single AdvancedMC cards. Such signaling gateways will be essential in the communications industry's ongoing transition from the PSTN to IP-based networks. 🌐



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