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The IP Revolution in Mobile Messaging

IP-enabled SS7/C7 applications yield significant gains in bandwidth and greatly reduced operations costs.

BY GREG WALKER

IN THE MOBILE WIRELESS ENVIRONMENT, THE phenomenon of mobile text messaging can easily be characterized as one of the most intriguing success stories of the past decade. Short message service (SMS) was never formally planned, designed, or marketed, yet millions of people all over the world adopted SMS—and changed the mobile world in the process. Today, many carriers worldwide recognize between 5 to 20 percent of their total revenue from person-to-person SMS text messages. This contribution, in turn, has initiated a drive to introduce additional, more advanced revenue-generating services. The common denominator for these advanced services is IP.

While the de facto bearer for SMS has traditionally been Signaling System 7 (SS7)/C7, the ongoing need to grow average revenue per user (ARPU) and average revenue per message (ARPM), while maintaining an optimal quality of service (QoS) and significantly reducing infrastructure costs, has pointed to IP as the logical next step. Taking their cues from customers and the marketplace, Cisco and LogicaCMG (logicacmg.com) recognized this need early on and have jointly developed an IP-based next-generation messaging architecture.

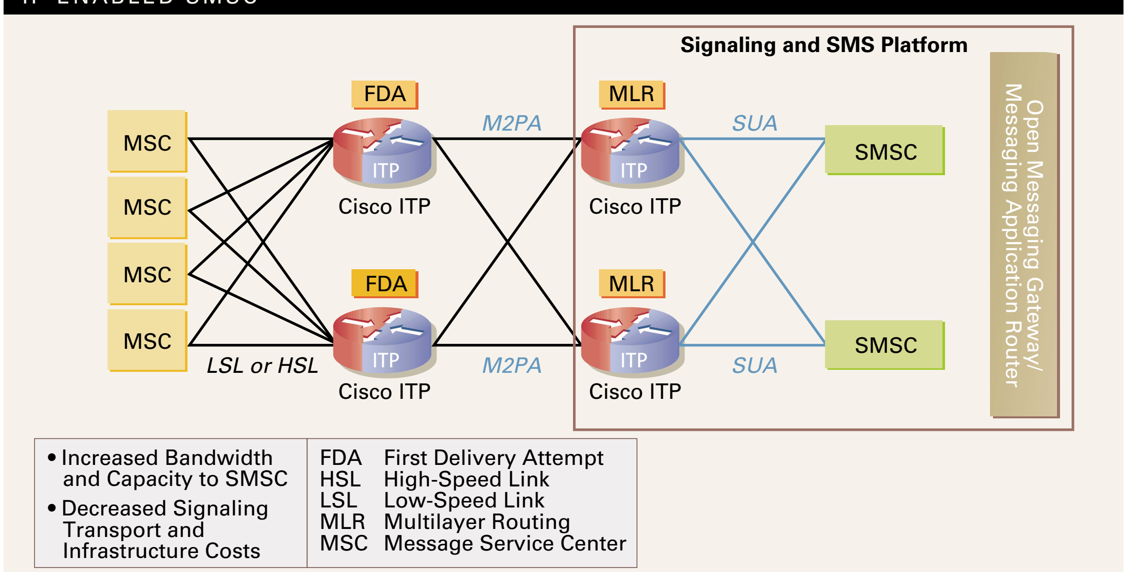
Meanwhile, with Cisco's participation, the Internet Engineering Task Force (IETF) has defined a set of standards for transporting SS7 traffic over IP networks (SS7overIP). As part of this effort, specialized protocols were developed to IP-enable traditional SS7 end-node applications, generically referred to as signaling control points (SCPs). Typical SS7 end-node applications include network elements such as home location registers (HLRs), and billing applications and service delivery platforms such as short message service centers (SMSCs). By IP-enabling these traditionally circuit-based nodes, tremendous gains in bandwidth and capacity are achieved along with greatly reduced infrastructure capital and operational costs.

Benefits Realized

Replacing rigidly defined, costly low-speed SS7 link limitations with cost-effective IP bandwidth—SS7overIP—will yield gains in end-node processing and transaction capacity. Consider an HLR, which is essentially a large database and computing platform. With limited SS7 connectivity options, using traditional SS7 design, one could connect up to 16 low-speed SS7 links at

For greater detail on SS7overIP, the SIGTRAN protocols, and Cisco ITP, check out the white paper, *Next-Generation SS7 Networks with the Cisco IP Transfer Point*, at cisco.com/packet/161_8d2.

IP-ENABLED SMSC



HERCULEAN BENEFITS: The IP-enabled LogicaCMG SMSC connects to a mated pair of Cisco ITPs using the SIGTRAN SUA protocol. These ITPs, which can also perform MLR, transport SS7overIP using the M2PA protocol to distributed ITPs, which function in the network as STPs and SMS FDA nodes. Connectivity to the legacy MSCs is accomplished via traditional TDM low-speed links or high-speed links.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56/64K, for a total bandwidth to the end node of 896/1024K. With some creativity in the application of SS7 point codes, one might even deploy up to 32 low-speed SS7 links to the end node (for a total bandwidth of 1792/2048K). However, this multiple point-code approach quickly becomes fraught with network complexity. What's more, with the SS7-defined requirement for complete redundancy, half of this limited bandwidth must be set aside and reserved for failover, thereby effectively cutting the available bandwidth in half. In the case of large, centrally located SS7 end nodes, which must process high volumes of transactions, this limited bandwidth constrains the node and results in an inability to effectively use the inherent processing/transaction capacity of modern computing platforms.

Compare this to the bandwidth available via Fast Ethernet and Gigabit Ethernet, and the possibilities are enticing. An IP-enabled node supporting 10, 100, or even 1000 MB of bandwidth can fully realize its inherent processing/transaction capacity, often increasing existing transaction capacity by a factor of 3 to 5-plus times. Investment in existing SS7 end-node applications can thus be preserved and extended simply by implementing a client-stack IETF Signaling Transport (SIGTRAN) protocol and a signaling gateway function.

Equally important, this IP bandwidth is achieved at a fraction of the cost of dedicated leased lines, both from a capital and operational cost perspective. For instance, consider a traditional end node with SS7 connectivity. This node would require both expensive SS7 hardware and expensive, typically third-party, SS7 protocol stacks. But using IP and widely available SIGTRAN client stacks, these nodes can be IP-enabled for a fraction of the cost. These reduced product costs, in turn, allow for a more competitive product offering in the marketplace.

Additionally, from an operating cost perspective, expensive leased-line time-division multiplexing (TDM) connectivity is removed and replaced with cost-effective IP bandwidth. When the benefits are analyzed, this reduction in TDM leased lines *alone* provides a significant, compelling cost benefit.

SIGTRAN Standards

The IETF SIGTRAN standards were developed to preserve the reliability and redundancy characteristics demanded by an SS7 network, and benefit from the simplicity and cost effectiveness of IP. Each standard has been designed for specific functionality. Stream Control Transmission Protocol (SCTP), for instance, serves as the foundation reliable transport layer for SIGTRAN "adaptation-layer" protocols, such as MTP2-User Peer-to-Peer Adaptation Layer (M2PA), Message Transfer Part Layer 3 User Adaptation (M3UA), and Signaling Connection Control Part (SCCP) User Adaptation (SUA).

Using SCTP's reliable transport, the M3UA and SUA protocols provide an internetworking function between IP and SS7 networks while preserving the redundancy and reliability features associated with SS7 (see cisco.com/packet/161_8d2 for a graphic representation of the SS7 protocol stack). In a client-server architecture, M3UA provides an internetworking function at the MTP3 layer, and SUA provides this function at the SCCP layer. Using SS7overIP internetworking/adaptation layer protocols, higher-layer SS7 protocols are transported unaltered as payload across the IP network. IP-enabled end nodes and applications can thus seamlessly interwork with existing SS7 network elements. Examples of higher-layer SS7 protocols include ISDN User Part (ISUP), Transaction Capabilities Application Part (TCAP), Mobile Application Part (MAP), and IS-41.

The Cisco IP Transfer Point

The Cisco IP Transfer Point (ITP) is a truly flexible platform for SS7 transport. For legacy SS7 routing and transport, Cisco ITP incorporates the functionality of a TDM-based signaling transfer point (STP). Leveraging the SIGTRAN protocols, the ITP also functions as a next-generation STP, supporting SS7overIP and legacy SS7overTDM simultaneously. Using the SIGTRAN M3UA and SUA protocols, Cisco ITP performs as a classic SS7/IP signaling gateway with advanced QoS and load-balancing features. Additionally, GSM MAP and IS-41 upper-layer services have been implemented to enable wireless LAN subscriber identity mobile (WLAN SIM) authentication, SMS Multilayer Routing (MLR), spam filtering, and distributed SMS first delivery attempt (FDA) functionality.

With a flexible approach to implementing SS7overIP, mobile operators can migrate to next-generation signaling networks at a manner and pace consistent with their business requirements and goals. For instance, some operators might choose to begin migrating to SS7overIP by IP-enabling legacy SS7 nodes in their network. Another less invasive step for many operators involves offloading SMS traffic to IP. Having gained sufficient comfort and experience with the technology,

Continued on page 89

FURTHER READING

- **Cisco ITP home page: cisco.com/packet/161_8d1**

Mobile Messaging, Continued from page 74

operators can move all SS7 traffic, including ISUP, to proven, robust SS7overIP networks. In doing so, operators can completely control their transition to next-generation networks.

LogicaCMG IP-Enabled Messaging Architecture

LogicaCMG is the worldwide leader for SMS, with more than 55 percent of the market using their systems. The close integration and cooperation of LogicaCMG and Cisco has led to a surge in uptake of SS7overIP technology, enabling increased bandwidth (transactions) to SS7 applications and dramatically reducing product (CapEx) and operational (OpEx) costs. And perhaps equally important, by moving or "offloading" this SS7 traffic to IP networks, additional benefits are realized as the traffic burden on existing, expensive legacy SS7 networks is alleviated—effectively freeing up ports and capacity on the SS7 transport infrastructure.

The growing trend toward IP-enabled SMSCs offers a perfect example of the benefits that can be realized. SMSCs are the SS7 network elements that provide SMS, also known as text messaging. On an SS7 network for transport and delivery of SMS messages, these nodes have traditionally used SS7 connectivity.

With the Cisco ITP Signaling Gateway as a component of its messaging architecture, LogicaCMG's SMSC connects via the SIGTRAN SUA protocol (IP) to the ITP, which connects to the SS7 network via traditional low-speed or high-speed SS7 links as well as SIGTRAN/IP (see figure, page 73). Providing not only traditional SS7 redundancy characteristics to the SMSC, the ITP also provides load-balancing services across multiple SMSCs. With its MLR capability, the ITP can also be used to customize traffic flows to and from specific SMSCs, or voting applications based on a multitude of TCAP, SCCP, and MAP/IS-41 layer parameters. Formally released to the market in mid-2003, this IP-based messaging solution has gained broad acceptance among mobile operators and is being deployed worldwide.

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With ever increasing momentum, mobile wireless and wireline operators are recognizing the benefits of SS7overIP in their networks. Dramatic capital and operational costs savings, coupled with increased capacity and bandwidth, provide compelling motivation for deploying these industry-hardened solutions. ▲▲

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