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White Paper

The Continuing Need for SS7

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Executive Summary

Mobile Operators around the world have invested heavily in building up their SS7 networks and have successfully delivered value-add and enhanced services using SS7 networks. In fact, SS7 networks contribute heavily to the bottom line of most mobile operators.

SS7 is critical to the operation of telecommunications networks, including wireless, providing the necessary signaling – hence the name Signaling System #7. SS7 controls the setup of a call and enables value-added services (call waiting, caller ID, etc) as well as passing billing information between operators. Other SS7 functions in mobile networks include handles SMS messages and supporting roaming. Compared to landline networks, the SS7 mobile networks generate approximately seven times the number of transactions, due to the enhanced features and services and unique requirements of mobile networks.

When mobile operators roll out their 2.5G/3G (GPRS and WCDMA) mobile data services, ETSI 3GPP standards continue to specify the use of SS7 networks as the service delivery infrastructure for value-added services, especially to support roaming.

- Operators continue to, and need to, extract maximum value from their IN investments
- Operators need to continue supporting SS7 network and CAMEL if they want to allow service roaming
- IN and IP networks will coexist for the foreseeable future
- Competitive pressures mean that operators must continue to innovate and offer new revenue-generating services and capabilities
- Operators must leverage existing IN data to build data profiles and services for early adoption
- Operators must consider network efficiency and cost as it integrated IN and IP
- Operators must provide the foundation for building SCP-like capabilities in the IP data world.

Using IN to support IP services has many advantages:

- Prepaid GPRS Data using SS7: One way to support prepaid data services with GPRS is to use the SS7 prepaid infrastructure, by fooling the existing voice prepaid system into thinking that the data traffic is really a voice service. The mobile operator can therefore reuse the investment in the SS7 signaling infrastructure to support new prepaid data services. Additional functionality using this approach also includes the use of prepaid cards for data services
- Cost Effective Migration: Accepting that the operator will move from CAMEL2 to CAMEL3 at some point in the future, it is important that any solution we implement today to provide IN data services can be upgraded. The most logical and cost effective way to do this is through an IN (INAP, CAMEL2 or CAMEL3) interface from the mobile packet core to the SCP

- Intelligent Networks are Established and Proven: SS7 networks are critical to the operation of a wireless network and the carriers' revenues are directly tied to its capabilities. Mobile operators therefore usually take great care with the SS7 networks – a problem can lead to lost revenue totaling millions of dollars. The benefits of using a proven SS7 network architecture for mobile data services include: controlled migration; efficient use of network intelligence; the existing investment in SS7 can be further utilized; and minimal integration issues.

In summary, the converged voice and data networks are going to be in existence for some time. Leveraging the SS7 network to support data services not only reduces the time to market, but will also lead to faster revenues, and hence profitability.

Signaling, SS7 and CAMEL

The signaling or intelligent network (IN) within modern day telecommunications networks is called the Signaling System #7,or SS7 for short. The development of SS7 goes back to the days of analog communications, when it was first defined by the International Telecommunications Union (ITU). As analog network evolved to digital technologies, SS7 evolved as well, to maintain a digital-centric focus.

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SS7 operates over a separate network from the voice traffic. Consequently, voice circuits are not tied up with signaling traffic and other intelligent information. Prior to the deployment of SS7 and common channel signaling (CCS), a voice circuit was dedicated to a caller while they attempted to connect with another caller, regardless of whether or not the intended caller answered the phone. Furthermore, if the called phone was already being used, the busy signal tone was sent from the distant switch instead of from the switch assigned to the caller 's phone. With SS7, the voice circuit is not dedicated until after the recipient has answered the phone. Hence, the capacity of telecom networks with SS7 was increased significantly.

There are three basic signaling points in an SS7 network that provide signaling services:

- Messages originate at the Service Switching Point (SSP), which is used to send SS7 signals that set up calls and to forward requests, via STPs (Signal Transfer Points), to the various databases that contain subscriber information

- The Service Control Point (SCP) interfaces directly with various databases (Home Location and Visitor Location Registers, HLRs and VLRs) to access the required subscriber information

- The Signal Transfer Point (STP) routes signaling traffic through the SS7 network. For example, an SSP request for subscriber information is sent to the STP for further processing. The STP determines the appropriate database and routes the signal appropriately. STPs are also be used to measure traffic and can provide billing information, since most signaling information is routed through them.

In addition to supporting enhanced features on mobile networks, and in keeping pace with the more efficient (all IP) next-generation networks, SS7 is making its own transition to IP. This transition requires an SS7/IP gateway to encapsulate the SS7 signaling traffic onto an IP network. By using an IP network for signaling traffic, an operator's signaling transport costs can be reduced significantly. An IP network will also be able to more efficiently support the increased signaling requirements of a mobile network, such as the rapid growth of voice minutes and SMS messages that utilize the SS7 network.

Signaling is a critical component of telecommunication networks. The universal signaling system is SS7 (Signaling System Number 7). SS7 supports basic voice services and wireless-only requirements such as roaming and handoff, as well as advanced features including SMS. The majority of wireless operators have built SS7 networks as an overlay to the voice network, using STPs (signal transfer points), which are essentially SS7 routers.

Intelligent network applications were first developed for fixed line networks, under the heading INAP (Intelligent Network Application Part). IN applications enabled services such as caller ID, call forwarding, and voice dialing. In wireless networks, two protocols were developed, which essentially sit on top of SS7:

- CAMEL (Customized Applications for Mobile network Enhanced Logic) was developed by ETSI (European Telecommunications Standards Institute) to provide IN applications on GSM networks

- WIN ((Wireless Intelligent Networks) provides the same capabilities for IS-41 networks (namely AMPS, CDMA, and TDMA). WIN was developed through TIA/EIA.

The first CAMEL specification (Phase 1) was finished in 1997, while phase 2 was completed in 1998. As with WIN, the main component of any CAMEL implementation is the SCP (Service Control Point), which effectively hosts a database which holds the instructions needed for an intelligent application. When a subscriber starts to make a call, the call request is received by the mobile switch (Mobile Switching Center or MSC). The MSC then sends a message that interrogates the SCP's real-time database that stores customer records. When accessed by an inquiry, the SCP executes one of a range of software routines customized for particular applications. Following the execution of the code, the SCP sends instructions back to the MSC on how to process the call. The bulk of current IN transactions consists of translating the number dialed by the caller into another number, which is then used by the Signal Transfer Point and other switches to route the call as appropriate. The SCP may also be referred to as the Data Access Point or DAP.

CAMEL Phase 1 supports call screening and supervision services, number translation services, enhanced call forwarding and fraud information gathering services (FIGS). Phase 1 is therefore limited in scope and capability.

Phase 2 supports more advanced services, including private numbering plan (SPNP), Prepaid Card Service with Advice of Charge, free phone and Universal number.

Packet-switched Data Services are not supported until CAMEL Phase 3. Up until CAMEL 3, value-added services have been centered around circuit-switched voice/data services.

Implementation of CAMEL was slow at first, mainly due to the cost and because of the fact that a single operator cannot use it effectively in isolation – both networks in the roaming relationship must have CAMEL. However, once CAMEL adoption started, the operators quickly moved to support CAMEL Phase 2. Phase 3 will soon follow.

Benefits of Interconnection

Prepaid GPRS Data using SS7

One way to support prepaid data services with GPRS is to use the SS7-based prepaid infrastructure that operators have been using for pre-paid voice services. This can be achieved by fooling the existing voice prepaid system into thinking that the data traffic is really a voice service. Of course, to achieve this requires close integration of the mobile packet core network and the SCP. Since voice pre-paid system decrements usage based on time using a traditional model, an operator wishing to use the voice pre-paid service infrastructure for prepaid data must use a conversion engine to convert the packets used in the IP network to a time measurement for use in the billing system. This conversion is best achieved in a managed mobile packet core, since the mobile packet core can see all of the data traffic and provide the most complete conversion routines.

One of the main advantages of this approach is that the mobile operator can effectively reuse the investment in the SS7 signaling infrastructure and pre-paid system for voice to support new prepaid data services. Additional functionality using this approach also includes the use of prepaid cards for data services – since many operators already have a prepaid card distribution systems established for voice, being able to reuse this for data is a major bonus.

Also, to use one single pre-paid account for both voice and data services allows the operators to sell data services to existing prepaid voice customers. If post-paid data services were only possible, it is unlikely that prepaid customers would buy the new services. This is an important point for many operators, who get significant revenues from prepaid customers.

Cost Effective Migration

We must also accept that the operator will move from CAMEL2 to CAMEL3 at some point in the future when market requirements and economics dictate. It is therefore important that any solution we implement today to support value-added data services can be upgraded. The most logical and cost effective way to do this is through an interface from the mobile packet core to the SCP that supports both CAMEL 2 and CAMEL 3.

Intelligent Networks are Established and Proven

One of the major benefits of utilizing the existing SS7 infrastructure for data services is that the intelligent networks are well established and proven. In many cases, the expense of deployment has been already been covered and therefore the networks are a sunk-cost. SS7 networks are critical to the operation of a wireless network and the carriers' revenues are directly tied to its capabilities. Mobile operators therefore usually take great care with the SS7 networks – a problem can lead to lost revenue totaling millions of dollars.

The benefits of using a proven SS7 network architecture for mobile data services can be summed as follows:

- Controlled migration – the operator can carefully control which markets, and indeed which users, can benefit from the data services, since the SS7 network allows a highly granular level of control

- Efficient use of network intelligence – the data services we are discussing will not require any special modifications to the SS7 network, just an interface between the managed mobile packet core network and the SCP. Therefore, there is no additional investment required in the SS7 networks

- The existing investment in SS7 can be further utilized, so generating an improved ROI. This is an important factor when future upgrades and investments in the SS7 network are being considered

- Since the SS7 network is established and proven, there are likely to be minimal integration issues – we know the SS7 networks well and know their operating characteristics. This contrasts sharply with new protocols, with which the operators have little experience.

About *iGillott*Research

*iGillott*Research Inc is a market strategy consultancy *focused* on the wireless and mobile communications industry. Founded by Iain Gillott, one of the wireless industry's leading analysts, we research and analyze the impact new wireless and mobile technologies will have on the industry, on vendors' competitive positioning, and on our clients' strategic business plans.

Our clients typically include service providers, equipment vendors, mobile Internet software providers, wireless ASPs, mobile commerce vendors, and billing, provisioning, and back office solution providers. We offer a range of services to help companies improve their position in the marketplace, clearly define their future direction, and, ultimately, improve their bottom line.

A more complete profile of the company can be found at www.igillottresearch.com.

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