IMS: A Dream Deferred?

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Most deployments are for fixed-line VOIP, FMC and mobile video sharing—but where are the new applications?

IMS has received more than its fair share of ink in the trade press. Nonetheless, it remains a key—some say the essential key—to operator network evolution. In part, IMS (the Internet Multimedia Subsystem) promises to fulfill fundamental requirements for a trusted all-IP service environment. Ultimately, however, IMS offers broader benefits to service providers, ranging from rapid application integration to consolidation of duplicative functional silos.

Beyond noting its role in serving up fundamental building blocks for cost-effective, IP-based service architectures, network equipment vendors heralded IMS as a catalyst for whiz-bang applications expected to draw fixed and mobile subscribers who were willing to pay for new and compelling functionality. After more than seven years of standards specification and product development, however, IMS has not fulfilled either the building block or the application expectations yet, and operators continue to search for revenue-generating applications beyond variations of voice call processing.

Adding to the network operators' woes, Web 2.0 applications based on Asynchronous JavaScript and XML (AJAX) have popped onto the scene. The potential for these over-the-top (of the network) applications to pre-empt the possibilities for similar operator services, casts a chill on business cases built around IMS platforms and applications.

Yet, despite the slow momentum behind native IMS applications and the threat of over-the-top services, operators are deploying the architecture—albeit in limited configurations delivering basic voice and the occasional mobile application. The original vision of a broad application suite delivered via mobile clients has faded. Taking its place is a pragmatic goal of cost efficiency benefits coupled with the occasional IMS-based voice, video sharing and mobility application.

It is, nonetheless, still clear that IMS has a role to play in evolving networks. It may take a lot longer to occur, and ultimately may serve a less comprehensive role, but it still will be critical to the operators' success.

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Why IMS? A Service Deja Vu

As an initiative with origins in the 3GPP mobility standards process that defined GSM and

IMS Architecture: A Brief Review

At the heart of the IMS communications model is the session: a telephone call, a video share, an Internet chat. The Internet Multimedia Subsytem (IMS) delivers session control using the native IP protocol known as Session Initiation Protocol (SIP).

SIP quickly emerged as the obvious signaling protocol of choice, as 3GPP standards architects evaluated requirements and solutions supporting an all-IP service network. Driven (for IMS) by 3GPP's telephony requirements, and designed by the IETF, SIP provides an extensible session control facility capable of supporting a wide range of communications activities.

A flexible protocol, SIP required extensions for mobility support. Beyond extensions to the information sent in SIP requests, 3GPP developed an architectural blueprint supporting complex roaming cases.

At the heart of the 3GPP IMS architecture is the Call State Control Function (CSCF). More than a basic switch engine, the CSCF is itself split into three logical elements:

- A proxy (or P-CSCF) to serve as a logical extension of the subscriber's CSCF in the home or visited network.
- A serving (or S-CSCF), which is used to provide session control.
- An interrogating (or I-CSCF) to provide a well-known (via DNS) destination for registration requests that ultimately go to one of many S-CSCFs in a network.

To meet the needs of mobility, a consistent and easily detectable P-CSCF interface is available in all networks encountered by a subscriber. In the case of a purely fixed subscriber with a VOIP terminal, this would only be the home network. For mobility, however, a subscriber handset may appear in a

WCDMA, IMS describes a comprehensive framework for delivery of chargeable services over an all-IP infrastructure. The service drivers behind IMS are nothing new. Indeed, we saw the same evolution of services 20+ years ago, when digital circuit switches swept old electromechanical switches from telephone central offices around the world.

Not only did the COs get quieter, but new services emerged, beyond basic voice. However, it took years for the majority of subscribers to sign on for these services, which included voice mail, call forwarding, call waiting and others. With the new services, eventually, came higher revenue.

Today, a comparable requirement and subscriber acceptance horizon exists for enhanced operator data services—such as instant messaging, video sharing, and navigation—this time over an IP network. As IP takes on the role of providing dial tone for data, IMS provides a well-defined environment, supporting terminal-based applications (e.g., voice calling and video share) and network-based applications (e.g., voice mail and click-to-conference) with tightly-controlled quality of service, security, mobility, charging and network-to-network interconnections (see "IMS Architecture: A Brief Review").

Perhaps the key debate in the industry today is the extent to which tightly-controlled IMS applications have a role in emerging broadband networks, and whether subscribers will prefer them to the over-the-top Web-based alternatives. The

Operators are deploying IMS, but in more limited configurations than was expected

visited network. In both cases, the subscriber's interface to the P-CSCF is identical.

Call Completion

When appearing for the first time in an IMS network, the subscriber terminal is required to register. A SIP REGISTER request is transmitted to the P-CSCF in the local network. The P-CSCF dispatches the registration request to the I-CSCF associated with the subscriber's home network as determined by a DNS lookup matching the subscriber's home network with an I-CSCF.

Upon receipt of the registration request, the I-CSCF forwards the request to one of many S-CSCFs as indicated by the Home Subscriber Services (HSS) database. The selected S-CSCF then establishes a secure channel to the subscriber, after which the process continues with transmission of information needed to complete authentication.

Once registered in a network, sessions can begin. A SIP INVITE request is transmitted to the P-CSCF in the local network. The request is handed off through the IMS core until it reaches another subscriber (in the case of a peer-to-peer phone call or video share) or an application server (in the case of a network-based service).

As an example, a SIP INVITE is sent from the P-CSCF to the subscriber's S-CSCF detected during registration. If the call is to another IMS subscriber, the calling subscriber's S-CSCF will identify the right I-CSCF for the called subscriber and forward the request. The called I-CSCF will perform a lookup in the HSS to determine if the called subscriber is registered and, if the subscriber can be located, will forward the request to the called subscriber's S-CSCF. The last link is from the called subscriber's S-CSCF to the subscriber's current P-CSCF, which may be in yet another network should the subscriber be roaming.

Authentication, Authorization and Accounting

Traditional tariffed communications services in the U. S. and other countries require authentication and authorization (two of the three A's in AAA) before a subscriber is granted the right to initiate a session. In the IMS architecture, subscriber data—including identity, rights and session state—is maintained in the Home Subscriber Service (HSS).

The HSS is an evolution of mobile telephony's Home Location Register (HLR) used to store subscriber privileges and location in a cellular network. In an IMS network, the HSS provides a generic data store available to IMS session control and applications via defined interfaces.

Likewise, traditional tariffed communications services also require a charging capability to account for usage of the network (the third A in AAA). In the IMS framework, charging capabilities are standardized with open interfaces based on DIAMETER, an IP-based AAA protocol. Consistent charging interfaces enable a single charging solution for all IMS-based applications.

Policy And Security

Another key attribute of IMS is its support of service aware networking and quality of service. IMS provides policy control mechanisms giving operators control over scarce resource utilization.

For example, if a subscriber requests a second video session over a physical interface that only supports a single video stream, s/he will get an explicit rejection of the session attempt. A standard set of IP-based interfaces and protocols are used to check on subscriber rights.

IMS also provides for policy enforcement in the access network. Packets are marked to identify the purpose of the traffic or its needs for differentiated service quality, then they are prioritized and subscriber traffic is limited based on the markings.

Service delivery in an all-IP network exposes operators to significant security threats. As the old telephony world discovered in the 1960s, mixing user traffic with signaling traffic creates fertile ground for mischief. For example, phone phreaks figured out that blowing a whistle with certain tones could give access to free long distance calls. SS7 helped solve this problem by isolating the signaling network from subscribers, except through well defined and secure interfaces.

To guard against some threats, IMS applies cryptography to secure signaling channels. Other, network-based mechanisms serve to protect the network against vulnerabilities at the access and trunk edges. Network elements such as session border controllers and border gateways stand at the edge, protecting network assets□

Full-function IMS infrastructure solutions are available from all the major suppliers

market could take years to settle that debate, so we will set it aside for the moment, in order to answer a more focused question: To what extent have network equipment providers and network operators actually embraced IMS, and why?

IMS Realities

Today, all three major network equipment providers (NEPs)—that is, Ericsson, Alcatel-Lucent and Nokia Siemens Networks (NSN)—are shipping full-function IMS infrastructure solutions, and all three can claim commercial deployments. In that sense, IMS has transitioned from a hypothetical framework to a commercial reality, albeit a weak one.

The portfolios of these three, as well as the other IMS vendors, incorporate their own IMS components for fundamental session control and application support, as well as partner-provided elements. For example, NSN provides a Home Subscriber Server (HSS) from Apertio, and many vendors provide telephony application servers from BroadSoft, session border controllers (SBCs) from Acme Packet, and Ubiquity's SIP Application Server (Ubiquity is now owned by Avaya). Other vendors also are supplying application servers and applications, some of which are getting deployed by operators.

The prevalence of partner and independent supplier activity validates an important premise of IMS: The power of modularity and standard interfaces as a means to decompose a large problem into manageable pieces. By leveraging partners, the vendors have succeeded in accelerating time to market by focusing on their own core competencies in telephony switching and end-to-end integration, leaving secondary functions to specialized partners. Likewise, operators can expect to take advantage of open interfaces to flexibly mix and match portfolios from multiple vendors.

Since June 2005, operators have been deploying revenue-generating IMS applications. Telefonica (Spain) was the first, using Ericsson's Core IMS platform and applications to support residential and enterprise IP-telephony. To date, operators have launched at least 11 commercial service deployments, delivering essentially two types of applications—fixed VOIP telephony services and mobile applications.

The fixed VOIP telephony services essentially replace Class 5 applications and leverage the IMS infrastructure for session control and subscriber data management. While these operators could have deployed the solutions using pre-IMS infrastructure components (e.g., SIP, softswitches and media gateways), IMS lets them more easily add support for fixed/mobile convergence (FMC) as well as for location and presence.

The mobile applications deployed today over IMS include video share, push to talk and FMC. Video share has completed several years of extensive proof-of-concept testing by the GSM Association, and now delivers a consistent user experience regardless of roaming from network to network. To operate the capability, subscribers in the midst of a switched voice call activate a camera on their IMS handset, and an IMS SIP session launches back to the subscriber's home CSCF, ultimately connecting to another IMS handset or PC terminal. Hong Kong CSL has deployed video share using the Nokia Siemens Networks solution, while AT&T plans to launch in the second half of 2007 using the Alcatel-Lucent solution.

According to this author's informal survey of the three major NEPs, 32 percent of 68 IMS deployments include plans for IP-Centrex service (e.g., Telefonica), and 26 percent include plans for residential IP-telephony (e.g. KPN). Other applications cited by the operators as part of their rationale for the first set of IMS procurements included push-to-talk (cited by 13 percent), FMC (8 percent) and messaging (3 percent).

Bear in mind that the informal survey does not represent a comprehensive view of deployments—after all, 32 percent of the deployments failed to indicate intended applications. Also, these data were gathered only in regard to purchased systems. Both vendors and operators still expect applications to emerge for conferencing, IPTV and femtocells (an emerging low-power residential wireless base station technology that would be backhauled over the broadband IP connection).

As for the original IMS notion of exotic service blending that pulls together presence, location, preferences, subscriber state and multiple applications into a single well-coordinated user experience, this is looking less likely. As attractive as were the fictional dramatizations intended to whet the appetite of operators and the public, real-world deliverables have yet to materialize. Other, more fundamental benefits of IMS also remain unproven (see "IMS's Other Benefits").

Transcending basic telephony with compelling applications that drive revenue remains the leading IMS driver for the NEPs and the operators, but complexity and doubt continue to stand between success and failure. The network operators have heard a lot of hype about IMS, but they don't see the result in actual feature sets they can sell as revenue-generating services. For all the vaunted capabilities promised by IMS, the reality so far is that many have unfulfilled expectations.

IMS Disconnects

IMS challenges operators with questions including business case justification, lagging application progress and incomplete integration with legacy applications. Add the looming threat from "over-the-top applications" delivered by Web 2.0 innovators, and operators have good reason to question the wisdom of rapid IMS investment.

While IMS business case justification may be a no-brainer for VOIP greenfields and "newly arrived" voice over broadband operators (such as DSL operator Arcor in Germany), the established service providers struggle to achieve cost savings. In part, the struggle comes from the existence of operational, and paid-for silos. Dismantling these silos (e.g., different voice mail systems) entails cost and risk, leading operators to initially deploy IMS itself as a silo.

Another promise of IMS, that operators will be able to build a business case around new revenue from IMS applications, also has been slow to pan out. A few IMS-based applications—notably video share, push to talk, IM, and conferencing—have appeared on the scene, but the operators have very slow internal processes for approving and deploying these applications, whether they are developed internally or externally.

An IMS application developer must first clear the hurdle of testing with different IMS environments supplied by the major network equipment providers. Once proven, the developer must approach skeptical operators—one at a time—in order to sell its application. If the developer gets this far, and makes the sale, an operator deploys the application and enough subscribers sign up to generate a profit. Nevertheless, the costs to get to that point are beyond the resources of most small application developers—resulting in few developers working to deliver novel IMS applications.

While new applications are vital for growing average revenue per unit (ARPU), old applications continue to deliver services (such as voice mail). Replacing these with new, IMS-based versions constitutes a significant financial and operational burden. Because the IMS standards envision an all-IP world—with little consideration for traditional telephony and Intelligent Network (IN) applications deployed today—operators need

Operators are still looking for IMS feature sets that they can sell as revenue-generating services

IMS's Other Benefits

The scope of IMS standards is significant, representing a major feat for standards bodies, and the promise of substantial future benefits to operators. These benefits will include faster deployment time, capex and opex cost reductions, architectural flexibility and a rich environment driving innovative applications.

The IMS solutions available today encompass virtually all the facets of operator requirements for telecommunications services. For greenfield VOIP providers (such as cable television MSOs), IMS stands as the most logical solution offering rapid deployment with off-the-shelf components.

Greenfield and existing service providers alike can benefit from another significant IMS advantage: The elimination of silo service deployments.

Traditionally, network operators have launched new services as independent silos of equipment, databases and charging infrastructure, duplicating capex and opex costs with each additional service offer. By decomposing session control, subscriber databases and applications, IMS provides reusable building blocks that subsequent network-based applications can share.

As a case in point, subscriber data used to be stored in application-specific databases. With IMS, the operator can turn to the HSS as a unified store of subscriber information. Instead of adding a subscriber database for each new application, the operator can deploy one HSS, translating into lower capex costs. Adding to the benefit, operating a single subscriber database translates into lower opex costs due to savings from lower power consumption, streamlined network interconnection and element management efficiencies.

Despite these compelling efficiencies, however, little evidence suggests that deployments have occurred solely to capture such benefits. At this time, IMS deployments are touted strictly as vessels for service deployments, and any efficiency gains remain shielded from view.

Another IMS benefit is the freedom to mix and match components provided by the architecture's open interfaces. Unlike traditional telephony architectures, which promoted vendor lock-in, IMS promotes substantial flexibility in vendor selection. The operators can select either a single network equipment provider (which can speed time-to-market and reduce risks) or select IMS elements from a variety of suppliers (to achieve best of breed components, performance gains and potential negotiating advantages).

Finally, operators continue to look to IMS as fertile ground for new applications, revenue, growth and increasing customer loyalty. Supporting an open standards IP-based application framework, IMS presents both in-house and third-party application developers with fewer barriers to entry than traditional telephony environments based on obscure older protocols such as PARLAY and CAMEL.

If operators are supportive, standardized Java client environments and well-defined application server interfaces might unleash creative energy yielding compelling new services. Examples of new applications include control of IPTV, "click to conference" enterprise communications, location-based services and others□

Can operators and vendors team up to provide a neutral IMS ecosystem?

non-standard interface mechanisms to tie IMS services into their existing applications. They are getting these mechanisms from the NEPS, and from the service delivery platforms supplied by IBM, BEA, Microsoft and others.

But perhaps the greatest applications issue facing operators is one of relevance. Web-based applications leveraging AJAX techniques are already delivering user experiences as satisfying as many dedicated applications installed on a PC, while development for IMS terminals languishes. A basic Web browser has more functionality than an IMS-based terminal (and the latter are few and far between), and AJAX offers a presentation engine that is familiar to Web developers.

Recently, Nokia extended its Series 60 mobile handset platform with Widgets, so that the handset can support standards-based Web technologies, including AJAX. These "over-the-top" applications have the potential to rival operator applications offered as a premium service. Ultimately, the argument goes, operators are destined to revert to the role of a pipe, a prospect poorly aligned with investors' expectations. This has worried NEPs and operators since the advent of IMS, but the rapid spread of AJAX and Web 2.0 is further fueling their worries (see this issue, pp. 10–12).

In contrast to ponderous operator application deployments, an over-the-top model proceeds without cooperation or approval of network equipment vendors, operators or regulators. Innovation accelerates in an environment with few constraints, although the results may be uneven, and the applications may lack quality.

The fact that there are still few AJAX-capable browsers on terminal equipment is stifling the potential. Furthermore, some mobile operators have a history of restricting access to such Web-based applications by limiting device functionality (e.g., forcing handset vendors to strip wireless LAN or SIP capabilities from smartphone models sold by an operator's stores), or of restricting best-effort IP traffic. This makes an over-the-top application a potentially hit-and-miss proposition, yet operators remain vexed by the challenge of creating high-value IP-based applications in a world where alternatives and subscriber expectations are ratcheting up higher and higher.

Conclusion

IMS deployments, including some commercial rollouts, point to increasing momentum—if not an established presence—in operator networks today. Its evolution represents a significant investment by vendors and operators alike. Yet the future of IMS will be turbulent.

Clearly, greenfield VOIP deployments and IP-Centrex applications benefit the most from the ready availability of IMS designs. Likewise, incumbent operators are expected to turn to IMS as a cost-reduction strategy for expanding capacity after capping circuit switch ports.

In contrast, broad realization of the IMS application vision is looking increasingly unlikely. Cumbersome application approvals, and competition from over-the-top Web applications, will prevent widespread IMS application adoption.

That said, IMS is poised to play a key role in new applications that require tight linkage between service establishment and resource availability. IPTV is a case in point, and IMS presents an attractive case for integrating IPTV sessions with telephony and mobility services.

Getting the most out of IMS investments requires nimble and creative thinking by operators. In particular, operators need to focus on their unique core values, including their established billing relationships with customers and their access to status information for subscribers on the move. IMS applications built around these values stand the greatest chance for success.

Furthermore, operators and vendors need to team up and create a neutral and trusted ecosystem for IMS application distribution. They could learn from Qualcomm's BREW experience. Qualcomm helped reduce some of the key barriers to developers for its client platform by supplying a handset application ecosystem. Included were device APIs, a distribution system for easy shopping/download/install, and a one-stop "True Brew" certification testing process.

If the operators and vendors would develop such a model for IMS, perhaps based on the IMS APIs described in JAVA Specification Request 281 (see http://jcp.org/en/jsr/detail?id=281), it would help ease barriers to IMS developers.

IMS is here to stay, but the degree to which it creates value remains firmly in the hands of the operators□

Companies Mentioned In This Article

Acme Packet (www.acmepacket.com)
Alcatel-Lucent (www.alcatel-lucent.com)
Apertio (www.apertio.com)
Arcor (www.arcor.de)
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