From Softswitching To IMS: Are We There Yet?

Bob Bellman

IMS may look like a whole new thing, but in reality it's an incremental upgrade to proven VOIP technology.

By now, you've probably heard about IMS, the IP Multimedia Subsystem that is designed to replace the "smokestack" architecture of traditional service provider networks. IMS decouples application services from network control and network control from network transport (Figure 1).

In theory at least, the IMS architecture will make it easier to develop new services and will allow any service, regardless of media type, to work across any type of network, be it fixed or mobile, IP or TDM. Proponents of IMS also promise a flood of new multimedia services that will make subscribers more productive, make mobile carriers more competitive, and rescue wireline providers from the slow death of commodity bit hauling.

As its name implies, IMS relies on standard IP-family protocols: SIP for signaling, Diameter for authentication, IPSec for encryption and so on. But carriers worldwide have already installed equipment to support their VOIP offerings, including thousands of IP softswitches, media gateways, session border controllers and application servers. Now what? Will they be able to reuse this VOIP gear in IMS, or must they scrap it and start over? Are their equipment suppliers building IMS solutions from scratch or enhancing existing technology? And will the move to IMS create opportunities for new equipment vendors, or have incumbents already locked up the market?

Softswitching And Friends

Softswitching is well established as the basis of carrier VOIP services worldwide. All the major telco equipment suppliers, including Lucent Technologies, Nortel Networks, Ericsson, Nokia, Alcatel and Siemens, as well as smaller vendors like Sonus Networks and sentitO Networks, have softswitching product lines.

Most softswitching systems comprise three types of network elements (Figure 2): media gateways (MGWs), signaling gateways (SGWs) and media gateway controllers (MGCs). The MGW translates voice traffic from TDM format to IP packets and vice versa. In a VOIP trunking (Class 4) application, the MGW sits between a local PSTN and a long-distance IP backbone. In a local switching (Class 5) application, it's the inter-

Bob Bellman has more than 35 years of engineering, sales and marketing experience in the computer and communications industry. As an independent consultant since 1994, he has provided marketing and writing assistance to dozens of successful equipment vendors and service providers. Bob can be reached at 508/ 720-0620 or bob@brooktrail.com

FIGURE 1 IMS Decouples Services From Control And Control From Transport

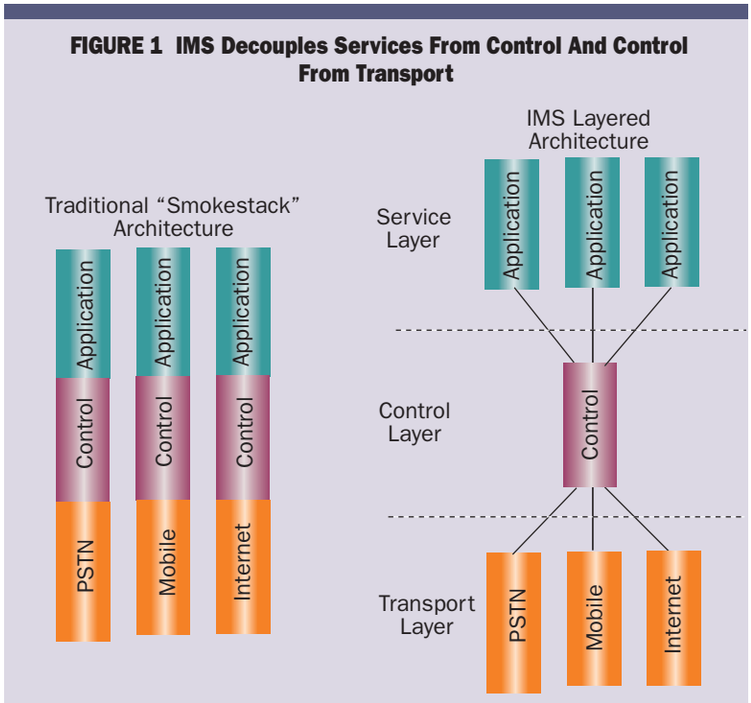
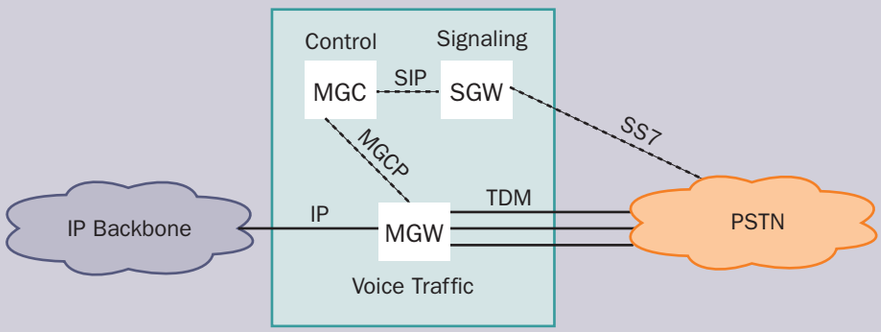


FIGURE 2 Most Softswitching Systems Comprise Three Elements



Like IMS, softswitching once promised clear separation between the application, control and transport layers

face between TDM access lines and the VOIP network. In an overlay service like Vonage, it's the VOIP router or residential gateway.

The SGW, which is often built into the MGC, translates signaling messages between PSTN protocols on the TDM side and H.323 or SIP on the IP side. Based on these messages, the MGC instructs the MGW, media servers and application servers to set up and tear down calls, play recorded messages, and perform application functions like call forwarding, call waiting, find me/follow me, etc. MGCs are also known as softswitches, call agents or call controllers.

Many softswitching installations are supplemented by session border controllers (SBCs) from companies like Acme Packet and Newport Networks. There are two types of SBCs: Access SBCs sit between enterprise and service provider IP networks, while interconnect SBCs sit at service provider peering points. In both locations, they handle signaling and media flows in order to protect MGCs, application servers and other network elements from unauthorized use, media fraud, QOS abuse, denial of service attacks and more.

Unlike softswitching systems, which process signaling and media separately, SBCs create a control point through which both types of traffic must pass. This allows SBCs to validate media flows against associated signaling messages and prevent, for example, an end system from stealing bandwidth by signaling for a voice call but transmitting video.

Additional SBC capabilities include user authentication, encryption, NAT traversal, topology hiding, admission control and protocol interworking, e.g. between SIP and H.323. A related access product, the Eclipse from Covergence, also includes application-level safeguards like URL filtering, file transfer control, virus scanning and media recording.

While not yet generating the $11 billion–$13 billion per year in equipment sales that carrier-level circuit switching equipment pulled down in the late 1990s, softswitching is a healthy industry. Stéphane Téral, directing analyst at Infonetics Research, totals VOIP carrier equipment at $2.5 billion for 2005, with $2.2 billion attributable to MGWs and MGCs. According to Téral, 25 to 30 percent of softswitch sales in 2005 were for Class 4 replacement; the remainder, for Class 5 and hosted PBX applications.

Keith Nissen, senior analyst at In-Stat, puts total MGW and MGC sales in 2005 at $3.2 billion, with over 40 percent going to Class 4 applications. Sales of other VOIP elements are less. For 2005, Infonetics estimates $150 million for application servers and another $150 million for SBCs, media servers and other products combined.

Meanwhile, all the network equipment suppliers that sell into the softswitch market have announced IMS products. Most of the vendors are in active trials, and some already have signed contracts. If the trials succeed and the number of contracts grows, what happens to service providers' existing softswitches and SBCs? Are they suddenly obsolete? And how about carriers that are still building out "pre-IMS" VOIP networks? Are they on the right track or headed for a dead end?

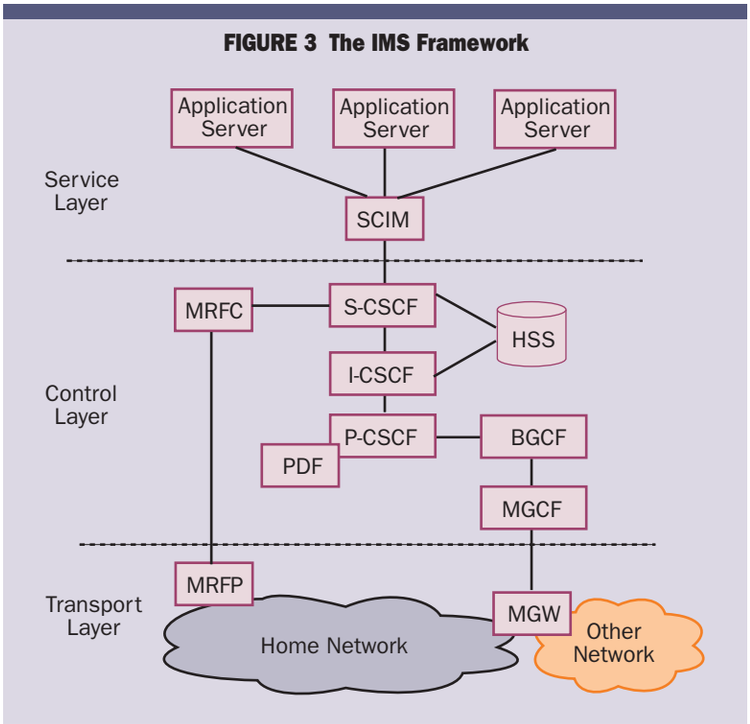
The Same, But Different

In fact, softswitching and IMS have a lot in common. Although the IMS framework is more complex, it can be considered an architectural clean-up of softswitching. When first conceived, softswitching promised a clear separation between applications and control—a horizontal layering similar to IMS—that would both promote scalability and free applications from lower-layer dependencies. BroadSoft's BroadWorks application platform is a successful example of this layering. Its VOIP applications and standard SIP signaling are compatible with any number of softswitching solutions. But many other vendors' softswitches, like the Alcatel 5020 Media Gateway Controller, have Class 5 switching or IP-PBX applications built in, and all softswitches combine call routing with gateway control.

IMS picks apart softswitching into its many distinct functions (and acronyms), typically shown on a framework diagram (Figure 3).

The initial goal of IMS was to bring IP softswitching benefits to mobile carriers

FIGURE 3 The IMS Framework



Application Servers host services like Class 5 switching and IP-PBX, while the Call Session Control Functions (CSCFs) handle routing, and the Media Gateway Control Function (MGCF) controls the Media Gateway Function (MGW). SIP, MGCP and other standard signaling protocols are used to tie the functions together.

IMS also picks apart session border controllers: The Proxy-CSCF (P-CSCF) authenticates incoming call requests; the Policy Decision Function (PDF) allocates network resources, and so on.

The initial goal of this dissection was to bring the flexibility, economy and application potential of IP softswitching to mobile communications by accommodating cellular networks' existing control mechanisms. The IMS Home Subscriber Server (HSS), for example, provides a central repository of subscriber information, much like cellular networks' Home Location Register (HLR). And decomposing the IMS CSCF into P-CSCF (proxy), I-CSCF (interrogating) and S-CSCF (serving) breaks up the functions that identify mobile users—even when they're roaming—and passes control to their home networks.

Another goal was to reinforce the separation between applications and network technology, to allow all types of applications to work across all types of networks. An added goal—the one that lured wireline providers onto the IMS bandwagon—is fixed-mobile convergence (FMC). If IMS and FMC succeed, someday you'll be able to maintain a voice or video connection while wandering among coverage zones supported by various carriers' wireline, cellular and even Wi-Fi or WiMAX networks.

The ultimate reality of the IMS vision is still to be determined, in terms of both nailing down the standards and completing the products. Will incumbent equipment suppliers expose themselves to increased competition by moving existing softswitch-based services into separate application servers? Will they agree to integrate competing third-party applications into their IMS solutions? Or will they aspire instead to owning the whole enchilada?

Many service provider trials are focused on interoperability, and equipment vendors are certainly talking the talk. "Our services business is a multi-vendor business," said Lucent's Mike Cooper, director of marketing and strategy. "We integrate other vendors' products to meet customer requirements." Ericsson marketing manager Oscar Gestblom also took the high road. "A service provider needs lots of services to get in the black," said Gestblom, "so you need an open application layer to foster lots of applications."

Time will tell if vendors will actually walk the walk of interoperability. Meanwhile, because IMS recycles softswitching and mobile network functions, many carrier equipment suppliers have discovered that they already support IMS.

IMS? Yeah, We've Got That

In fact, some vendors have been supporting IMS for years—in the sense that they already offer some IMS functions—they just didn't know it. That's one reason why equipment suppliers are already participating in IMS trials and signing IMS contracts.

For example, as of February, Ericsson counted 18 IMS installations and 37 trials. Lucent boasted eight IMS contracts and 77 trials involving "elements of its IMS solution" at 16 service providers.

AT&T/SBC has a contract with Lucent for pretty much its entire IMS product line. Cingular, another Lucent contract, is starting with just the Session Manager (which includes six IMS functions) and the HSS. In general, according to Lucent, carriers seeking to provide data or video services are starting with CSCF and HSS functions. Carriers seeking to provide basic VOIP are starting with CSCF, MGW and MGCF, which is just the IMS spin on softswitching.

For most equipment suppliers, the first step in IMS development has been to associate their existing products with elements of the IMS framework and to make any changes needed to claim IMS compliance, e.g., updating SIP with IMS extensions. Since most of their products predate IMS and their feature lists don't necessarily map cleanly onto IMS functions, their product managers have to decide: Which IMS functions does my old product most resemble? Or more importantly, which IMS functions will make my new product most appealing?

There's also the target market issue: Wireline and wireless operators need different IMS functions, at least to start. Big incumbents and little CLECs need similar feature sets but with different capacities and packaging.

Most softswitch and session border controller manufacturers are at the second step in IMS development, which is to separate formerly integrated functions and add standard protocols in between. For example, Acme Packet and Newport Networks are both splitting their SBC code to allow signaling and media proxies to run on separate boxes.

"IMS is clear," said Guy Reiffer, Newport's product marketing director. "Signaling is completely separate from transport, and media functions tend to be at the borders while signaling is controlled centrally. So you need to have a separable architecture that allows one signaling proxy to control multiple media proxies." Covergence already allows separate proxies.

The final step on the road to IMS, for both large incumbents and smaller equipment providers, is to add functions—through development, acquisition or partnering—that cannot be derived from existing products. So while the big equipment vendors are romancing the service providers, they're also being romanced by specialty vendors like Acme and Newport.

In the end, although they all espouse the same IMS architecture, each vendor's product line will be unique. IMS does not dictate how functions should be bundled into products, and every manufacturer has its own opinions, history and design constraints. Lucent, for example, tends towards centralization. The Lucent Session Manager incorporates Serving, Proxy and Interrogating CSCFs, a Service Capabilities Interaction Manager (SCIM), a Policy Decision Function (PDF) and a Breakout Gateway Control Function (BGCF) on a single platform.

Sonus is moving in the opposite direction. Its IMS suite includes at least seven different products, with the S-CSCF, P/I-CSCF and BGCF each packaged separately. "IMS doesn't forbid you from combining functions," said Bob Dye, vice president of strategy at Sonus, "but you need to have a good reason to do it." Sonus feels that modularity promotes resource sharing, more efficient trade-offs between distribution and centralization, and incremental migration.

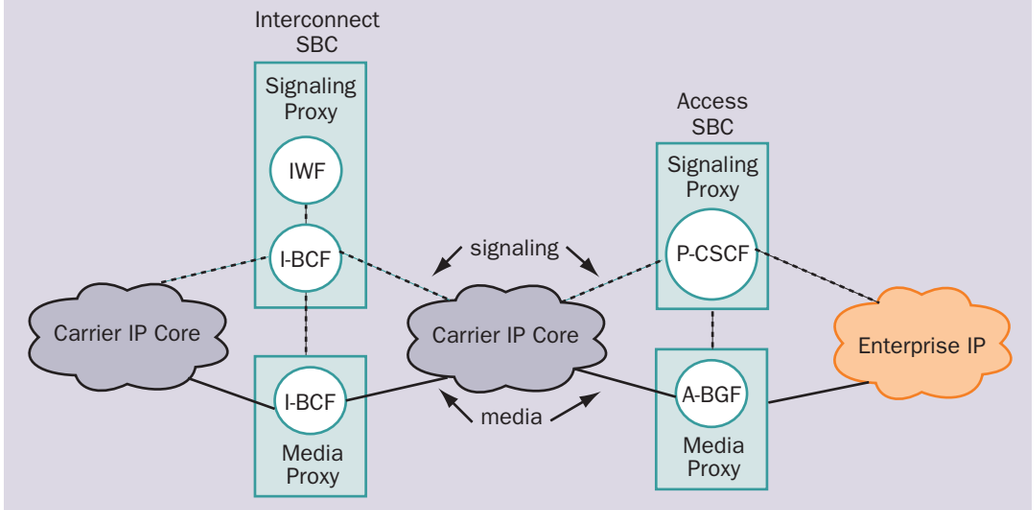
SBC vendors exhibit less variation. Acme, Covergence and Newport, for example, all agree that control functions like the P-CSCF and bearer path functions like the Border Gateway Function (BGF), should reside in separate physical devices (Figure 4). (The BGF is part of TISPAN, a more generalized version of IMS that includes wireline environments.)

Some vendors offer elements of IMS in their softswitching products

You Can Get There From Here

Because IMS has so much in common with softswitching, service providers will be able to reuse much of their existing hardware, although there are some exceptions. "If you buy Ericsson IMS, you buy new IMS nodes," said Ericsson's

FIGURE 4 Typical Assignment Of IMS/TISPAN Functions To Session Border Controllers With Signaling And Media Proxies In Separate Physical Devices



Most believe that an IMS overlay will gradually evolve to replace the PSTN

Gestblom. "Our existing products are optimized for telephony traffic. IMS is built on a new platform optimized for SIP."

Most manufacturers, however, will offer IMS to their customers as a software upgrade. Nortel, for example, is upgrading its Communication Server 2000 and Multimedia Communication Server 5200 from softswitching to IMS. "The bulk of purchases this year will be for softswitched VOIP based on the CS 2000 and MCS 5200," said Rob Scheible, senior marketing manager at Nortel. Customers will be able to upgrade to IMS when they're ready, he added.

At some point, Scheible predicted, separate functions will be supported on separate cards, not separate boxes. "We'll be able to do 'IMS-in-a-box' with each function on a card," he said. Customers will also be able to mix and match different cards to address their specific distribution or centralization requirements.

Acme Packet tells a similar story. "To get to IMS, we are doing software upgrades to existing boxes," said Seamus Hourihan, Acme's vice president of marketing and product management. "For example, we're adding support for IMS SIP headers and IPSec on access connections."

In short, although service providers will need additional boxes to support new or decomposed functions, and they'll have to deploy more hardware as traffic grows, they won't have to write off their entire investment in VOIP gear. Softswitching MGCs and MGWs, for example, can live on as IMS MGCFs and MGWs. SBCs can live on as P-CSCFs or BGFs. "Anything you deploy today must be reusable in an IMS context," said Newport's Guy Reiffer.

In any case, the transition to IMS won't happen overnight. For the foreseeable future, most service providers will continue to deliver POTS and VOIP over their existing circuit and packet networks. An exception or two, like BT with its 21st Century Network initiative, may convert all at once. But the rest of the industry will deploy IMS as a network overlay and expand the overlay only when it makes business sense to offer a new service or to accelerate convergence.

"IMS will replace the PSTN gradually," said Tom Anderson, chief technology office director at Lucent. "In the U.S., you're more likely to see IMS arrive with new broadband services like IPTV." Mobile carriers will be the last to convert, even to plain VOIP, since they have the least access bandwidth to play with. "Even some new 3G technologies are not sufficient for VOIP," said Andy Williamson, market manager at Ericsson. "IP-telephony will be an extra-cost value-added [mobile] service. There won't be a wholesale move [by mobile carriers] to IP for a long time."

In addition, each service provider will follow its own migration path. Some will approach IMS from the supply side, seeking to cut costs through convergence. Others will come from the demand side, hoping to grow revenue with new services. Wireline providers, eager to stem mobile substitution, will go after fixed-mobile convergence. Mobile carriers will fight churn with value-added service bundles. "There are lots of ways to get to IMS," said Lucent's Cooper. "You don't need to put down all the elements at once."

Whatever the angle of approach, the overlay will eventually become the main network. But identifying the tipping point will be like deciding when a man has gone from balding to bald. Which lost hair or which new network element made the transition official?

And The Winner Is...

The slow but steady adoption of IMS is reflected in market forecasts. Nikos Theodosopoulos, an analyst at UBS Securities, expects annual IMS equipment sales in the U.S. and Europe to grow to as much as $5.1 billion by 2009. But he also expects familiar softswitching gear—MGCs and MGWs—to account for at least half that amount. After 2009, Theodosopoulos predicts, softswitching products will taper off as a percentage of total sales in favor of application and services gear.

Theodosopoulos also expects IMS to change equipment providers' pricing structures. "Integration costs will go up," Theodosopoulos said, "because IMS is more complex than VOIP and because equipment providers will have to include third-party gear in their IMS solutions." He expects integration costs, which now range from 10 to 20 percent of equipment costs, to rise to a range of 20 to 25 percent, plus another 5 to 30 percent for applications.

Big equipment suppliers view the integration challenge as an opportunity for differentiation and account control. "Sprint is using lots of IMS elements from different vendors," said Ericsson's Williamson, "but they're using Ericsson to integrate the solution. Our integration experience and knowledge are very valuable."

Still, most IMS implementations will be dominated by a single equipment supplier. "Because vendors won't cut up the IMS architecture the same way, multi-vendor solutions won't happen," said In-Stat's Keith Nissen. Moreover, that single supplier is likely to be an incumbent vendor. 'It's not an open competition," continued Nissen. "Carriers need support for legacy as well as future technology, so it's hard to displace incumbent equipment suppliers."

Nissen expects Sonus and other relative newcomers to be relegated to Class 4 replacement and CLEC systems, areas where Class 5 incumbency doesn't matter. One non-incumbent exception may be Cisco, with its IP expertise and endless marketing resources.

Of course, this doesn't make multi-vendor compatibility a non-issue. A mobile user must be able to roam between carriers, which means different carriers' IMS systems have to talk to each

other. And there are openings for specialty vendors, as long as they're flexible. Acme Packet, for example, will offer two IMS versions of its Net-Net access SBC, one with the P-CSCF function and one without. According to Seamus Hourihan, the P-CSCF really belongs at the network edge, but since Lucent would be a desirable partner, and Lucent already includes a P-CSCF in its centralized Session Manager, Acme Packet plans to offer a compatible SBC.

Plus Ça Change...

Service providers will find they can incrementally upgrade and recycle their way to IMS, but they also will find that this gradual migration could bind them to incumbent equipment suppliers, with new vendors limited primarily to the application layer. No surprises here, although newcomers may have a better shot this time, thanks to the general consensus that the interface between the application and control layers must remain open.

A rich portfolio of new applications is key to the success of equipment suppliers and service providers alike. Consequently, a thousand flowers are blooming already in the application layer: FMC products from companies like NewStep Networks, BridgePort Networks and LongBoard, VOIP platforms from companies like BroadSoft and Sylantro Systems and so on. The best long-term hope—and tacit plan—for most of these organizations is acquisition by a major vendor□

Companies Mentioned In This Article

Acme Packet (www.acmepacket.com)
Alcatel (www.alcatel.com)
BridgePort Networks (www.bridgeport-networks.com)
BroadSoft (www.broadsoft.com)
BT (www.bt.com)
Cisco (www.cisco.com)
Covergence (www.covergence.com)
Ericsson (www.ericsson.com)
Infonetics Research (www.infonetics.com)
In-Stat (www.instat.com)
LongBoard (www.longboard.com)
Lucent Technologies (www.lucent.com)
Newport Networks (www.newport-networks.com)
NewStep Networks (www.newstep.com)
Nokia (www.nokia.com)
Nortel Networks (www.nortel.com)
sentitO Networks (www.sentito.com)
Siemens AG (www.siemens.com)
Sonus Networks (www.sonusnet.com)
Sylantro (www.sylantro.com)
UBS Securities (www.ubs.com)
Vonage (www.vonage.com)

Many young companies are vying for the incumbents' attention at the application layer