A New Business Layer For IP Networks

Tom Nolle

With Alcatel and Cisco on board, the Infranet is now the IPsphere: an inter-carrier automation tool for policy, provisioning and billing settlement.

Two years ago on an investor call, Juniper CEO Scott Kriens called the Internet a "failed business experiment" and proposed a new concept for IP carrier network deployment, called "the Infranet." The idea was to create a more secure and better-performing IP network experience. Since then, the company has ceded control over and development of these concepts to a trade group called the "Infranet Initiative Council" or IIC.

At press time, the IIC had just announced a restructuring and a name change: Both the trade group organization and the Infranet itself will now be called IPsphere.

Although many of the founding members were Juniper partners, the body also attracted service providers, particularly from Europe. When working groups began to meet in 2004 to settle the concepts into a specific architecture, these carriers dominated the proceedings and have since driven the evolution of the IPsphere Reference Architecture and the Execution Framework, the latter being the description of how the architectural principles would work on a live network.

The IPsphere organization has committed to demonstrate this framework in public, and members' trials of the concept started in May. Despite this progress, little is known about the organization or the concept. The Infranet idea was criticized in the trade press (generally through "unattributed sources") as a flight from established standards, and it's difficult to refute this criticism without the details on what has been happening.

Now, however, with the IPsphere organization prepared to talk about—and later this year, to demonstrate—its concepts, there's finally enough real information to assess what "Infranets" or "IPspheres" are and how they'd work. But first, we need to back up a little and explain why they are needed.

What Problem, What Strategy?

IP starts with the Internet, literally. Despite the broad cultural success of the Internet, it's also been the source of a major profit problem. Think about it: If WorldCom, the largest Internet player in the period of greatest Internet growth, had really been making money hand over fist on profitable Internet service, it wouldn't have needed accounting gimmicks. The number-two player from those years, PSInet, is also gone, as are many others.

The Internet was, in fact, making many companies billions of dollars, and it still is—but they are equipment vendors, software vendors, advertisers, retailers—not carriers and IP service providers. Three problems seem to be the root of the Internet profit dilemma:

- The fixed-price model of Internet access, created when dialup connections limited how much traffic a user could generate or receive, makes it hard to charge more for new uses of the Internet. This has encouraged exploitation and expansion of Internet usage, but without a proportional increase in the revenues of those who must invest to expand the capacity of the Internet itself—and more capacity is needed to sustain more usage.
- The lack of commercial-grade interfaces between ISPs—i.e., interfaces that include guarantees of performance and settlement for service participation—has discouraged the deployment of enhanced features like quality of service (QOS). There are technical means to provide QOS between ISPs, but there's no legal requirement for inter-ISP settlement (like that for most PSTN common carriers), and no business-level solution from the Internet community.
- Adding capacity to an IP network means adding resources. While those resources can be offered for sale as "priority services" supporting a theoretical premium service class, they also generally make "best effort" services better, encouraging users to roll the dice on how good "best effort" might be, and making it harder to sell premium services.

The notion of "convergence," or the adoption of IP infrastructure as the universal basis for all services, brought all of this to a head, and perhaps created a fourth problem: If convergence on IP means convergence on the Internet, then the revenues for today's legacy services seem doomed to disappear. Since these services in the U.S.

Tom Nolle is president of CIMI Corp., a consulting firm that specializes in advanced computer and communications networks. He can be reached at tnolle@cimicorp.com, and he is a member of the BCR Board of Contributors.

Reprinted, with permission, from the July 2005 Issue of Business Comunications Review, 999 Oakmont Plaza Drive, Suite 100, Westmont, IL 60559, 630/986-1432, www.bcr.com.

currently constitute more than $240 billion in annual revenues, and the U.S. market for Internet services at full business and consumer penetration (including broadband modernization) is probably worth no more than between $50 billion and $80 billion in annual revenue, this would mean killing more than two-thirds of the current service provider revenues.

Convergence over IP also has opened anew the old "smart-versus-dumb" networks debate. Unless carriers are "smart" and host converged services in the infrastructure that they deploy to converge their networks, they risk the loss of customers as legacy carrier services become overlay services that customers can purchase from third parties or develop for themselves.

If current services, from voice to virtual private networks (VPNs), are created over the Internet by users themselves or by competing providers, portal players, etc., then how do the carriers earn enough money to continue to fund the build-out of the real network infrastructure needed to carry these overlays? If the carriers converge their legacy services (and the revenues they bring) onto the Internet, they will be investing to lose money. If they keep their networks "dumb," encouraging others to freely exploit their infrastructure, they also lose money.

Although convergence has gotten a lot of publicity, most coverage overlooks a central and critical truth: The service providers interested in convergence tend to be those with stuff to converge: legacy services and legacy networks. That makes them common carriers, not ISPs.

Beginning in about 2003, common carrier investment in IP infrastructure targeted at the convergence mission increased. By the end of 2004, CIMI Corp. research showed the total value of new equipment installed for this mission exceeded the value of new equipment installed for Internet missions (to become part of "the Internet" is an Internet mission). Given current trends in carrier consolidation, it should be clear that this shift in spending will never reverse.

The common carriers are now the IP deployment leaders, and they have non-Internet missions and issues. This creates immediate tension between the new leaders in IP spending and the Internet community, even in the standards area.

Bellhead vs. Nethead Redux

The Internet standardization process, hosted in the Internet Engineering Task Force (IETF), developed out of the research days of the Internet, and since then has sustained a pretty thoroughly non-commercial and non-regulatory posture. In 2001, the head of the IETF at the time said in an interview, "We at the IETF are definitely not good at regulation." True; the IETF simply won't take up regulatory and policy issues, including things like lawful intercept, commercial settlement and interconnect, etc.

To the common carriers, the IETF seems to be pushing a completely non-commercial agenda that is explicitly at odds with these carriers' status as public companies responsible for earning a profit. One carrier executive describes the IETF as "barking mad," a colloquial British expression used here to emphasize the complete disconnect between the carriers and this premier IP standards group.

To the carriers, the IETF seems to be pushing a completely non-commercial agenda

Tension between the "Internet people" and the "carrier people" isn't new, it's a reflection of the essential tension between technology and business, between standards and implementation. Efforts to bridge these gaps in the interest of earning a buck aren't new either—witness the many technology-specific forums specializing in frame relay, ATM, MPLS and metro Ethernet. The typical driver for these forums is the desire of the vendor organizers to stimulate customer interest in their products.

In contrast, carriers have traditionally taken their technology issues up with such standards bodies as the ITU and ETSI. However, these bodies are known for their slow processes. Recently, the chairmen of the IETF and the ITU appeared to be trying to reach a better working relationship, and over time this may happen. Unfortunately, the perceived and almost inherent conflict between the Internet and the common carriers seems likely to prevent the most difficult issues from being addressed.

Meanwhile, the common carriers aren't looking for more and different ways to build VPNs, pseudowires, or multimedia signaling systems. What they seek is a way to build services from those technical approaches that could be profitable and that could be interconnected using traditional common-carrier practices, including settlement among cooperating providers. The goals of "the Infranet" that Scott Kriens articulated two years ago apparently resonated with at least some of these common carriers: They have joined IPsphere and thrown themselves into the effort of developing a business architecture for IP services.

IPsphere As The Business Layer Of IP

No IPsphere forum meeting has ever expressed any desire to take a non-standard approach to IP networking or to needlessly duplicate or conflict with existing standards. The goal from the first has been to establish a *business layer* for IP networks that would supplement the current IP standards with the exchange of necessary *business policy data*. Underneath this new business layer, providers would be free to exercise whatever IP business model they choose, including the current Internet model, but they could also adopt whatever network-layer standards made sense to them and to their equipment vendors.

In other words: The IPsphere does not dictate business models or network architectures. It does provide mechanisms to link the two together

Templates will carry business information that current standards do not include

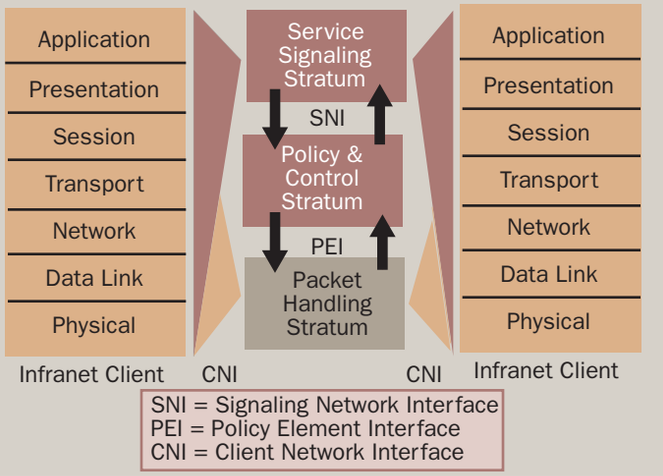
within a given service provider's environment, and mechanisms to facilitate business/technical linkages at domain boundaries between service providers. The benefits of making these linkages explicit are twofold:

1.) Better service quality and tighter performance controls, resulting in

2.) premium services that customers will pay premium prices to receive.

This business-to-network linkage is reflected in the Reference Architecture shown in Figure 1. The "new" concept is the Service Signaling Stratum (SSS) which overlays the traditional control plane (the Policy and Control Stratum) and data plane (the Packet Handling Stratum).

FIGURE 1 IPsphere Reference Architecture



In the early working group activity, the key element in the framework was defined—by a service provider. BT proposed that the process of business coordination of services be viewed as the exchange of an information "template" describing service requirements among the group of providers (or, in theory, within the single carrier's environment) that were needed to create the complete service as ordered. This template would carry all the data needed to create the service on each of the networks involved, and to interconnect the service across network-to-network interfaces (the InterCarrier Interface or ICI).

The template doesn't carry routing data, technical information, or anything relating to the specific network equipment. It carries *business information*, information that the current standards don't include and that the current standards bodies have been unable to incorporate. This business information would identify the customer order, the administrative owner of the service, and information about the service needed to create it on the network and bill it properly. This service-specific data might include peak and average data rate, availability, delay, packet loss rate, and cost metrics (cost per hour, packet, bit or whatever).

Because the template would have to be a flexible set of service information that evolves as services do, the working group agreed that the template should be based on XML, and that the service-oriented architecture (SOA) or Web services standards would govern the exchange of template information. This lets IPsphere adopt Web services capabilities for identity management, reliable messaging and resource management. The business template becomes, in effect, an application schema, no different from the XML format that IBM or Microsoft or SAP would create for their own Web-service-based applications.

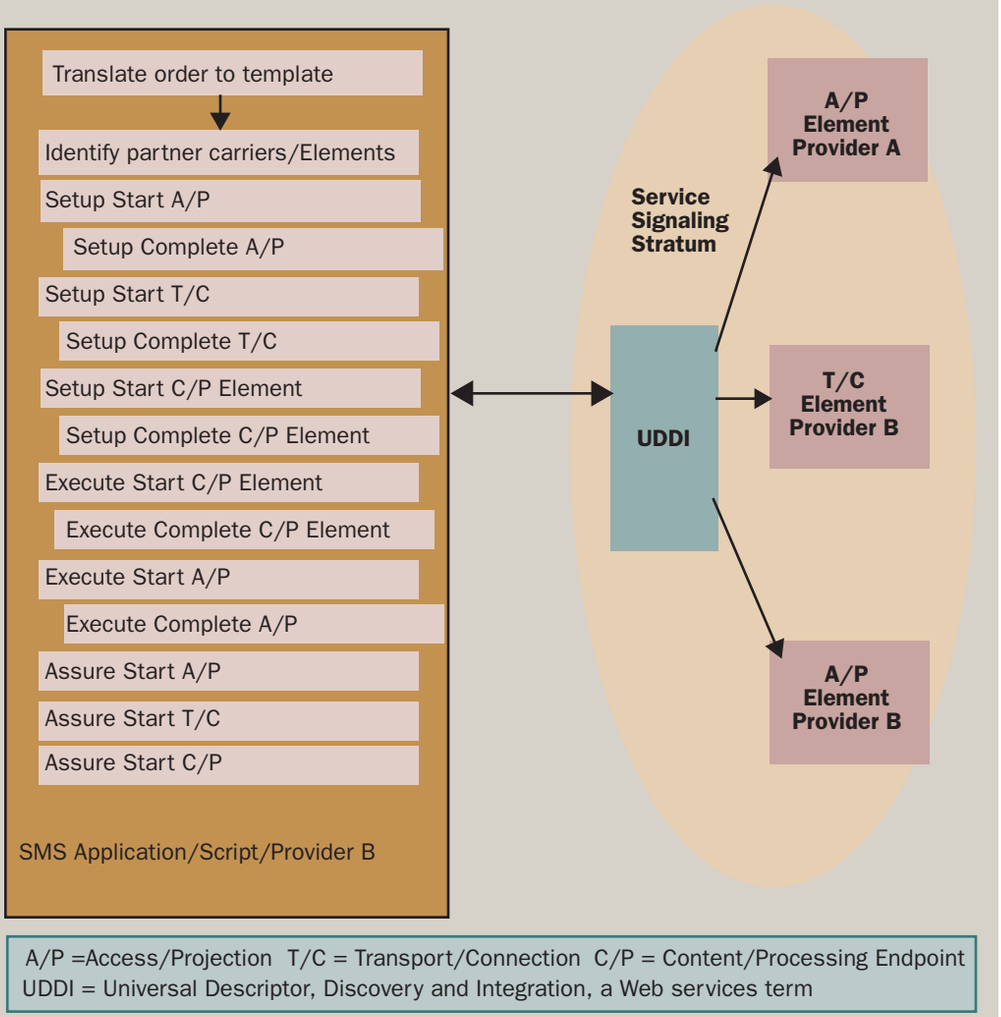
The linkage of the SSS messages to Web services is logical, given that business information exchange is more an IT or operations control process than a protocol or network process. Thus, the Infranet's SSS is a kind of VPN where carriers exchange business information about service orders, service status, network connectivity and settlements based on Web services standards. SSS controls the *business relationships*, not the network—at least, not directly.

The focus of the current workgroup activity has been on services that have to cross a provider boundary in some way, but carriers could (and probably will) adopt the same mechanism for services provisioned entirely on their own networks. Figures 2 and 3 show a simple example of how the concept would work in practice. Here two providers (A and B) are cooperating to create a VPN based on MPLS label-switched paths (LSPs). Figure 2 shows the Service Signaling Stratum portion of the creation of this service, and Figure 3 shows how the service is then created on the actual networks.

As shown in Figure 2, the customer order for the service is received by a provider (we'll assume it's Provider B in this case), presumably the one serving the headquarters location of the business placing the order. The service provider contacted for the order becomes the "administrative owner" of the service, and is responsible for maintaining control of the coordination of all the providers who are involved, collecting the fees, and settling with others.

The administrative owner uses a service management system (SMS, a software element) to "dissect" (or translate) the order into the IPsphere template format, and uses the SSS to parcel out the task of connecting sites and providing service elements to its own network and to partner providers. A form of "shopping list" divides the service into IPsphere Elements and assigns each Element to a particular provider to fulfill. These

FIGURE 2 The Service Signaling Stratum Exchanges For VPN Setup



Templates will be sent to the carrier partners to start a three-phased cycle of implementation

assignments are based on the business information that each provider has already supplied (indicating its connectivity, capacity and cost information).

Examples of Elements are the "Access/Projection" element that provides customer access, "Transport/Connection" that provides multipoint routing, and "Content/Processing Endpoint" that models not only service consumers but also information storage and application hosting. In the figure, the VPN will require Transport/Connection from Provider B and Access/Projection from both providers to serve all customer sites.

When the service order is dissected, the administrative owner sends the template to each of the Element contributors, filling in the service parameters in the template from the service order. These parameters include the service specifications, endpoints to be served, etc. The template exchange takes place in three distinct phases, called "Components" of the service elements:

■ The **Setup** phase, in which the administrative owner seeks a contractual agreement with each partner to participate in the service. During this phase, partners might negotiate parameters with the administrative owner if the exact service description cannot be met. When this phase is complete, the administrative owner has an agreement for the service from all involved providers.

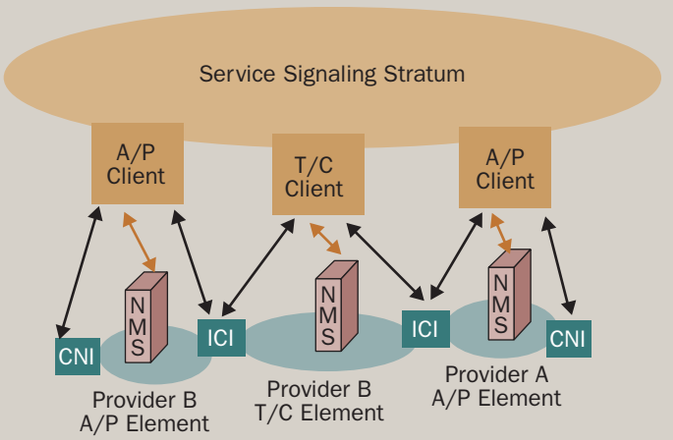
■ The **Execute** phase, in which the administrative owner signals each partner to provision/create the service on the network. During this phase, resources are allocated to support the service, policies and management settings are changed, and so forth. This is the phase where actual service creation takes place.

■ The **Assure** phase, in which the partner providers monitor their agreements on service behavior and report problems to the administrative owner via an "Alert" signal. When the service is cancelled or expires (if it is a time-delimited service such as a two-hour video connection) this phase ends.

The Execute phase is the boundary between the IPsphere activity and the role of existing network standards. If we look at Figure 3, reflecting the network configuration of this same scenario, we

After the Setup and Execute phases are complete, the partners monitor the service in the Assure phase

FIGURE 3 The Execute Component And Network Relationship



see three networks, two providing access and one providing interconnection. These networks are interconnected by routers at each of the ICI points; a pair of routers comprising one ICI block. In the normal (Internet) model of IP, the providers would signal across this interface using RSVP or LDP. However, the carrier receiving such a signal would have no way of knowing if the source provider had a *business relationship* in support of this request and *was agreeing to settlement* for the destination provider's role.

This is the primary improvement provided by the IPsphere model: It explicitly communicates carrier policy to the border routers on both sides of the domain boundary, informing them that the LSP setup is in fact sanctioned by a business relationship. Without this, the border routers would refuse the request for a path.

Figure 3 shows that the service management behavior of the Service Signaling Stratum is linked to the network via a software element called an "SMS Client". In the Execute phase, the service request template is translated into either network policies or provisioning commands by this SMS Client, and the result is then used to control underlying network elements through established standards like LDAP, COPS or SNMP, and by vendor-specific means such as a command-line interface (CLI) to routers or switches. A given SMS Client could control any number of devices, but it is likely that there will be an implementation of SMS Client software for each of the major vendors involved in a network, or at least for each network or policy management standards framework the network supports.

This SSS-to-control-plane relationship is the key concept of the IPsphere. Business exchanges and technical network control are separated so that the former can conform to IT business practices and the latter to protocol standards. They come together in the network policy and management elements, as the figure shows. This linkage can be based on any suitable standard protocol, including COPS, LDAP or even a command-line interface.

The relationship between these two figures is the key to understanding what the IPsphere is about. The Service Signaling Stratum is a *business exchange*, as much the creation of a kind of universal operations framework as about networking. The members of the SSS VPN are the SMS Clients, representing the service Elements contributed by co-operating service providers, and the SMS "Parents" that provide for order analysis and dissection, and whose "scripts" create the templates and drive the SMS Clients through the process of service creation. The language of this network is XML and the Web services SOAP protocol, and the business templates exchanged at this level are the standards that the IPsphere organization is creating. The relationship between the SMS Clients and the network can be based on any set of standards, and/or on vendor proprietary interfaces.

The IPsphere, Standards And the Internet

The framework shown in Figures 2 and 3 is being implemented today, including a live carrier trial (details undisclosed at press time), and it will be demonstrated publicly in 4Q05. For a standards process that has been under way less than a year in a detailed sense, that's astonishing progress.

One reason for this rapid progress is the involvement and support of the carriers. Besides BT, whose participation is mentioned above, additional carriers including France Telecom, Deutsche Telekom, Telenor, Orange, and Bezeq also have been attending the IPsphere Working Group meetings, providing considerable between-meetings support for the various activities, and promoting the concept with their current and prospective equipment vendors. Vendor contribution to specific IPsphere activities to date has been less than carrier contribution, and the key template concept itself was carrier-contributed.

Vendors began working on supporting IPsphere in their products in May, when the preliminary specifications for the Showcase of IPsphere operation was distributed. Fortunately, the concept requires relatively modest product additions or modifications, as follows:

- A service management system that can dissect service orders into an IPsphere Template contain-

ing the set of network Elements needed to fulfill the order. The Template and Element descriptions will be available from the working groups as IPsphere applications are completed, the first around mid-summer 2005.

■ A service management "Client" that can accept a template and translate its business behavior (QOS, endpoints, time to start and end the service, etc.) into network policies or network provisioning commands, workable for all the equipment in the network. This is a more-or-less standard Web services programming task in terms of the SSS interface. The network-side interface (to the network management or policy systems) depends on the protocol supported there, but is likely to be a simple exercise in an existing API, or even something available from open source code. The specific protocol(s) used would be the determining factor.

■ Membership in the Service Signaling Stratum, obtained by establishing contractual relationships with the other members and publishing the Elements that will be available to the Infranet community to build services, together with the financial and contractual terms under which these Elements will be offered.

There is no requirement that a given technical standard for QOS, or route selection, or VPN setup, or MPLS path creation, be supported. The IPsphere signals *business issues*, not *technology issues*. It *allows* the specification of QOS but doesn't dictate how that specification would be translated into network policy or provisioning. Because most networking standards activities are aimed at controlling the network, the IPsphere actually seems to fit well with other IP standards activity. Again: the purpose of the IPsphere is to automate the business aspects of network provisioning and interconnection—not to dictate how those business aspects are either negotiated or fulfilled.

All of this makes it important to clear up any misinformation about perceived collisions between "standards" and "the IPsphere." There is no real tension between the concept and the IP standards, no reason why "the IPsphere" should be viewed as proprietary or conflicting with other approaches to IP network building.

There is, however, a tension between the IPsphere concept and the Internet. It's not a tension of technology or approach as much as a philosophical difference.

A large number of earnest and thoughtful people believe that the Internet should be free, universal and open to exploitation by all. They see this kind of worldwide communications resource as a critical element in the progress of technology, culture, political expression and economic growth. Many have this view about other critical resources, including power, water, transportation, and so forth.

There is no question that a "free" resource encourages development of the things that exploit it and would otherwise be constrained by the cost. Would the IPsphere destroy that model? Only if that model can't defend itself in the real world.

The IPsphere is a mechanism to create common-carrier IP services. Certainly it could be used to create a completely different service and business model than the Internet currently poses. Is that bad? If multiple visions of the network of the future can be framed, then why not let each be developed and let the marketplace decide?

Conclusion

The commercial reality of the moment is that IP networking has to be deployed by someone with the money to buy the equipment, and the common carriers are the last people standing in the carrier market. SBC, Verizon and Qwest have absorbed or are trying to absorb interexchange carriers (IXCs), and the ISPs of old are either gone entirely or exist only as shadows of their past influential selves. It's just not rational to believe that somehow the massive common carrier markets that have survived, and which fostered the communications that built world economies, are somehow going to shrink down to a third or less of their current revenues and pay for the privilege through a major capital restructuring to IP. Show me the money.

The IPsphere is an attempt to bridge the gap between a technology based on a non-commercializable ideal and a common carrier infrastructure that is too service-specific to respond effectively to increasingly rapid changes in technology. It, or something very much like it, may be essential if we're going to see any real growth in public IP deployment, and any of the magic things that we hoped the Internet would eventually bring. They won't be free, any more than electricity or clean water or automobiles or cameras or burgers are free, but we'll have them□

Companies Mentioned In This Article

Bezeq (www.bezeq.com)
BT (www.bt.com)
Deutsche Telekom (www.telekom.de)
ETSI (www.etsi.org)
France Telecom (www.francetelecom.com)
IETF (www.ietf.org)
ITU (www.itu.int)
Juniper Networks (www.juniper.net)
Microsoft (www.microsoft.com)
Orange (www.orage.co.uk)
Qwest (www.qwest.com)
SAP (www.sap.com)
SBC (www.sbc.com)
Telenor (www.telenor.com)
Verizon (www.verizon.net)

Vendors will be able to get descriptions of some Templates and Elements this summer