THE COMING OF TRUE CONVERGENCE

Why SERVICE PROVIDERS can finally TURN OUT THE LIGHTS on the OLD PSTN

A WHITE PAPER BY SYNDEO CORP.

Only now can carriers start to entertain deployments of next-generation broadband services that demonstrate the power of a truly converged, IP-based voice/data network.

As the Internet and e-commerce roared into prominence during the 1990s, the Holy Grail - true convergence of voice and data networks - continued to elude the network industry despite impressive levels of research and development spending.

To be sure, there were a couple of flashes of what convergence could offer. Users found there was money to be saved by putting voice calls onto data networks, especially for high-priced international calls. And at the end of the decade, there was the initial foray of the incumbent local exchange carriers (ILECs) into voice over DSL. ILECs began offering a few basic features, such as dial tone and call waiting, over what had been data-only DSL lines.

But the ILECs' first-generation DSL solution is only "converged" in the sense that it lets the expensive - and, more importantly to the ILECs, already installed - Class 5 switches talk to POTS phones across a DSL link. The problem with this approach, which is based on the GR303 protocol, is it virtually ignores every other type of device a subscriber has access to apart from a Touch Tone phone.

The resulting services delivered over DSL using the Class 5 switch/GR303 model are thus completely unaware of PCs running voice-over-IP (VoIP) applications such as NetMeeting or IP phones from companies such as 3Com. As with so many other attempts at convergence, under the covers, there are still two networks - one for data (and its terminals) and one for voice (and its terminals).

But the 1990s are over, and the year 2000 is a different story entirely. It is only this year that we are seeing the maturation of next-generation call control protocols, such as the Session Initiation Protocol (SIP) and Media Gateway Control Protocol (MGCP). The protocols are now finding their way into IP-based terminals - IP phones, soft phones, soft PBXs - and network hardware, including access gateways, integrated access devices, media gateways, DSL access multiplexers, cable modem termination systems and cable headends.

What this means is that now - and only now - can carriers start to entertain deployments of next-generation broadband services that demonstrate the power of what a truly converged, IP-based voice/data network can offer residential and business subscribers. This raises the issue of exactly what "convergence" really means.

Just what is convergence, anyway?

The real definition of "convergence" is straightforward. In a converged network environment, a user's voice network should work in the same manner as their data network, and vice versa. In other words, the way a user performs actions with familiar tools in the data world should not change as voice services are added into an IP or ATM network.

For example, how do business people add new names to their PC-based contact managers? Often, they enter the new contact onto their Palm

personal information manager, cradle it when they get back to the office and their contact database is automatically updated.

But what happens when voice services enter into this equation? To date, they have been administered separately. Convergence should bring the two together.

Syndeo Corp., for example, has added new fields to the Palm that work with Syndeo's Broadband Services System™ (BSS), a carrier-class softswitch. When a new contact is added, there are additional tick boxes for items like Call Screening and Priority Ringing. If the new contact is a salesperson, the Palm user may want to tick the Call Screening box. When the Palm is cradled, in addition to updating the user's contact database, the user's phone service is automatically updated as well. The next time that contact calls, the Call Screening feature will kick in, diverting the call to voice mail.

This is what convergence should mean.

A recent confluence of events is finally making possible such applications that represent true convergence. Intelligent user phones, terminals and IP-based gateways are coming to market, sporting industry-standard call control protocol stacks, such as SIP and MGCP. They make it possible for competitive carriers to offer not only next-generation services that literally are not possible in the existing PSTN, like the Palm example, but also new "interpretations" of existing Custom Local Area Signaling Services (CLASS). Such services, including Caller ID, Call Waiting and Call Forwarding, take advantage of features in these new subscriber devices that, again, are unavailable in the PSTN. (See Table 1).

The key to this new paradigm is that IP is finally being delivered

TABLE 1

Broadband Class 5 features supported by the Syndeo BSS

- Dial tone.
- CLASS 5 calling, including Caller ID, three-way calling, call waiting and call forwarding.
- PBX replacement, including auto-attendant, call hold, call transfer, hunt groups and four-digit dialing.
- Lifeline services (911).
- 411 services.
- Unified Messaging: voice, fax, and e-mail integration on a single, Unix and IP-based message repository.
- CALEA support for compliance with federal wiretap regulations.
- IP Enhanced Services: features not possible with legacy, narrowband Class 5 equipment, such as feature mobility, CD quality voice, PC phone calls and IP terminal support.
- Subscriber Control Tools: Web- and Palm-based applications and e-mail plug-ins for self-provisioning and management of call and messaging features and related usage/billing information.

over broadband pipes, directly to the subscriber. It is this end-to-end-IP-over-broadband architecture that will finally deliver the elusive Holy Grail of telecommunications - true carrier-grade voice/data convergence.

Broadband Services System basics

The Syndeo BSS is a true carrier-grade next-generation services platform, based on an open, standards-based architecture, with integrated softswitch call control. It supports a comprehensive list of Class 5 services to any broadband IP-connected endpoint, regardless of whether that endpoint is attached to a DSL, cable or wireless service. Indeed, the BSS obviates the need for traditional - or so-called next-generation - PSTN Class 5 switches.

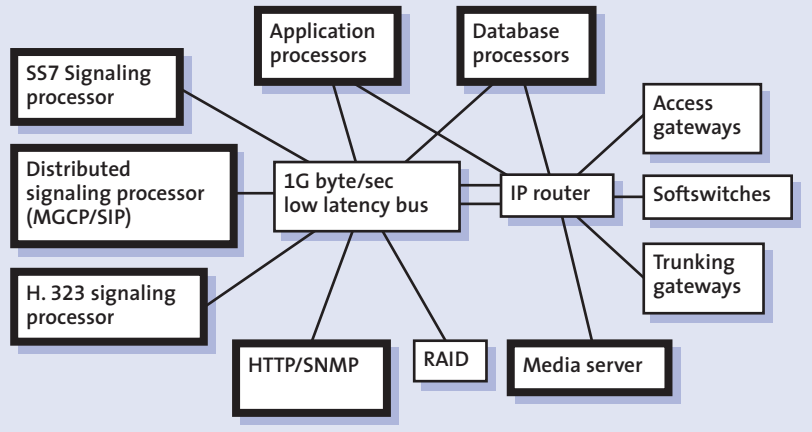
Notice that the features listed in Table 1 are a superset of existing narrowband Class 5 switches. The end game for carriers, then, is not to achieve parity with the PSTN, but to greatly exceed it by delivering dynamic, end-to-end, IP-driven applications and control into the hands of subscribers.

The features and functions any given traditional Class 5 switch supports are dictated by the switch manufacturer. Thus service providers have always been at the mercy of their equipment vendors for new features or functions. Carriers using switches from multiple vendors may be constrained to offering only those services that are common to all the switches.

To address the problem of vendor lock-down, Syndeo's architecture is based on open computing platforms, including fault-tolerant Sun servers running the Solaris operating system and Oracle databases. Components are connected via a 1G byte/sec ultra-low latency IEEE-standard bus that is eight times faster than Gigabit Ethernet (see Figure 1). Every hardware and software component is fault-tolerant and telco-grade, with no single point of failure. The system delivers 99.999% reliability

FIGURE 1

Broadband Services System architecture



The BSS runs on a Sun Cluster 2.2 network running Oracle Parallel Server with an ultra-low latency interconnect bus. It scales to 256 processors per node to support millions of subscribers. All Syndeo components are software fault tolerant and the system delivers 99.999% availability.

and scales to support millions of subscribers on a global basis.

The applications layer of the Syndeo BSS is likewise built around an open architecture. It starts with an off-the-shelf object request broker (ORB), from which Syndeo stripped extraneous functions to improve performance. Features critical to service providers, such as distributed multicast and reliable name service, were added. The result is the first carrier-class, CORBA-compliant ORB.

Instead of custom APIs, the BSS uses CORBA's Interface Definition Language (IDL). A de facto industry standard, IDL allows developers to write applications in any language, including Java and C++, which has an IDL compiler that works with Syndeo's ORB. The IDL for Syndeo's objects is available to third parties.

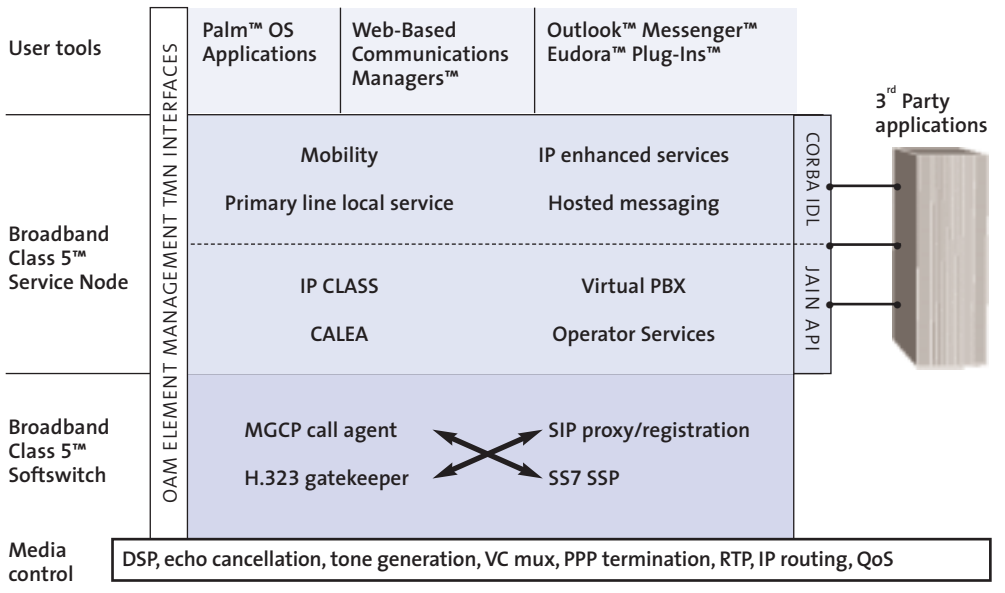
The BSS also supports the Java Advanced Intelligent Network (JAIN) API, a framework for creating intelligent, converged network applications in evolving circuit- and packet-switched networks using Sun's JavaBeans component architecture. The JAIN interface enables the BSS to support applications, service creation engines and GUIs that work with this standards-based API (see Figure 2).

This adherence to industry standards means any service provider or third party can add features and functions to the BSS, not just Syndeo - an important distinction from traditional Class 5 switch vendors.

FIGURE 2

BSS—an exercise in openness

Open interfaces including the COBRA IDL and JAIN API make it possible for service providers and third parties to add applications to the BSS, all of which are independent of the underlying transport infrastructure.



Whether written to IDL or JAIN, applications are independent of the underlying network infrastructure, so they work over the legacy PSTN as well as any IP network, regardless of Layer 1 or Layer 2 technology. That means the BSS can deliver services over xDSL, cable, xMDS, optical, SONET, T-1, ATM, Ethernet, wireless and any other medium.

Furthermore, the BSS architecture is hardware-independent. Any media gateway or end terminal conforming to open standard call control protocols (MGCP, SIP, H.323, SS7) can be integrated into the BSS quickly and painlessly. The interworking of all these signaling and call control protocols allows the BSS to simultaneously look like a Gatekeeper (from an H.323 perspective), a Signaling Point (from an SS7 perspective), a Call Agent (from an MGCP perspective) and a Proxy and Redirect Server (from a SIP viewpoint). Indeed, a key capability of the BSS is to act as an any-to-any protocol gateway, connecting heterogeneous VoIP and TDM networks and clients. For example, the BSS could sit between a legacy H.323 VoIP network and a SIP network and enable calls to flow seamlessly between the two.

It's all about the applications

While the BSS architecture is important in that it is open, reliable and scalable, the real value of the system is in the applications it enables. Fundamentally, the BSS allows service providers to compete on features and total customer experience, not just cents per minute.

Service providers are leaving money on the table because they are unable to offer many of the services they have at their disposal. The BSS opens up these potential revenue streams by simplifying access to advanced applications.

With traditional Class 5 switches, the vast majority of advanced features and functions go unused because it is simply too difficult for users to control or access them from a telephone keypad.

Consider just one such service, *69, which allows you to place a call to the last person who called you. Service providers were forced to spend millions on marketing campaigns to get users to remember the *69 combination. The number of such combinations customers can be expected to remember is limited. And if customers have to refer to an instruction sheet every time they use a service, not many will bother.

Service providers are leaving money on the table, then, because they are unable to offer many of the services they have at their disposal. By some estimates, there are more than 100 advanced calling features available in a typical Class 5 switch, perhaps 10 of which are widely used.

The BSS opens up these potential revenue streams by simplifying access to advanced applications. Instead of using a telephone keypad, users employ Syndeo's Personal Communications

Manager™, a Web-based tool that allows simple point-and-click control over calling services.

Business users likewise use the Business Communications Manager™ (BCM) to perform control functions that traditionally required carrier intervention. The BCM allows for the instantaneous provisioning of new lines as well as simplified moves adds and changes.

The BCM also takes some administrative burden off of service providers, who can provide a generic service template that customers then tailor for their own needs. Carriers also have access to the Service Provider Communications Manager™ to administer accounts for their users.

An examination of each of the Communications Managers in more depth provides an indication of what the BSS can do.

FIGURE 3

Personal Communications Manager

- Mimics familiar remote control interface to promote ease of use, unleashing new revenue potential from enhanced, IP-enabled telephony service providers
- Enables subscriber services not possible with the PSTN and legacy circuit switched equipment
- Delivers Integrated command & control of telephony and messaging services

Empowering the user — the Personal Communications Manager

The Personal Communications Manager is built to mimic a device that any end user will be familiar with - the remote control. Rather than force users to remember arcane sequences of numbers and symbols to control their voice services, the PCM allows point-and-click simplicity from a Web interface (see Figure 3). Furthermore, the PCM delivers command-and-control over any type of subscriber terminal, whether it is PSTN- or IP-based.

Consider the task of forwarding your phone calls. With traditional PSTN services, you press 7, 2, #, then enter the number to be dialed. Then someone has to pick up that phone or the whole process must be repeated. It's cumbersome and hardly intuitive.

To forward their phone using the PCM, a user merely clicks on Call Forwarding, then enters the number he wants the call forwarded to or chooses it from a directory. Options are included for how to handle calls when the forwarded number is busy or doesn't answer.

Users can similarly control other services, including:

- **Mobility.** The user can register with the BSS system over the

Internet in a secure Web session and have network-based features follow him anywhere. He can work out of any office, plug in his laptop and designate the phone number for that office as his primary number. All other services he normally has access to, such as Caller ID and Call Forwarding, will be available from the PCM applet.

- **Unified messaging.** Via plug-ins to Microsoft Outlook, Eudora and Netscape Messenger, users can access voice mail, fax and e-mail from a single, familiar interface with support for standard Internet protocols such as POP3, IMAP4 and MIME.

- **CLASS.** Syndeo has chosen to implement the most popular services offered by a Class 5 switch, including conference calling, call forwarding, call waiting, caller ID, call blocking and others that represent 95% to 99% of the revenue-generating Class 5 services, according to the ILECs. However, these provided Class 5 services have been reinterpreted for their implementation in a converged IP-based broadband network to take advantage of the full capabilities of IP phones and other next-generation user terminals.

- **Black list and white list.** The BSS can be programmed to connect certain numbers and send others to voice mail. This is an example of simplified manipulation of CLASS services.

- **Privacy.** All calls are sent to voice mail or e-mail, or play a constant ring.

- **Conferencing.** A simplified service that lets users set up conferences by dragging names from an address book and dropping them in a conference space. This works with multimedia conferences as well as voice-only.

- **Personal address book.** The user's address book can hot-sync with the Palm PIM and includes support for nicknames.

- **List manager.** This is a mechanism for reviewing call history, including searching by called parties, time of day and other criteria. It also includes bill review features.

- **Online bill retrieval and payment.** The subscriber himself can review and pay for telephony services, freeing the service provider from the overhead associated with printing and mailing invoices.

- **Group ring.** The user can program the same phone number to ring multiple devices, including a cell phone, home phone, soft-phone and NetMeeting client. The user can then choose which phone to answer; when one is picked up, all others stop ringing.

Simplicity drives new business

From the user perspective, the beauty of the PCM is simplified control over their calling services. The expectation is that users will change their options in the PCM frequently, perhaps several times per day, as needs dictate.

But the PCM also has inherent benefits for service providers because it gives customers the option of using services that may not be part of their

existing calling package. Perhaps a user has an emergency situation that requires a conference call with three other people. He can establish that call and be charged "by the drink" by the service provider.

Carriers can also track when users employ services that are not part of their basic package and offer incentives to upgrade package options, driving new revenue. A push feature allows service providers to inform customers of such incentives via the PCM. Service providers can also customize the PCM with their logo.

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Another key from the user perspective is they can continue to use the tools they are familiar with, whether it's Outlook, Netscape Messenger or Eudora for e-mail or auto-dialing from an address book on a Palm device.

The BSS operates at a level that is entirely separate from the type of terminal it is dealing with. All services and user interface tools can therefore be accommodated, whether the endpoint is a POTS, SIP, MGCP or H.323 endpoint or access gateway. The call waiting feature, for example, is not aware of the type of end device it is dealing with. Rather, it passes instructions to send the call-waiting tone to a call-flow applet that implements the function in a manner appropriate for the end device in use.

While applets can be created for virtually any type of end device, the first devices Syndeo is addressing are Palm PIMs, Web applications and leading e-mail clients, namely Outlook, Eudora and Messenger. The intention is for users to be able to employ all the same features and functions they are used to with their existing devices and applications when they are communicating with the Syndeo BSS. For example, an Outlook user will be able to manage voice mail in the same way he or she manages e-mail today. This delivers on the promise of convergence: making the voice network look the same to the subscriber as the data network looks.

Business Communications Manager

IT or telecom managers at small to midsize businesses will likewise welcome the features the BSS provides.

Today customers rely wholly on their service providers to perform virtually any kind of change to their voice or data services. If a Centrex line is to be brought online or disabled, it takes a call or a fax to the telco to make it happen, followed by a potentially long waiting period.

The Business Communications Manager works much like the PCM to give managers more immediate control over their services. Service providers can give a customer a block of lines and a series of phone

numbers, and let the customer take it from there. Using the BCM, the customer can dole out phone numbers to end users and detail the service package each user should get. Essentially, the BCM functions like a Centrex administration tool.

Service provisioning is greatly simplified because the customer will use the BCM to do the detailed configuration work.

Among its features are:

- **Voice VPN configuration.**
- **Hunt group configuration.**
- **Auto-attendant capabilities,** including automated routing of incoming phone calls.
- **User types and authorizations:** line rules that detail what users can or cannot do, such as blocking calls to 900 numbers or limiting after-hours long-distance calls.
- **Moves, adds and changes:** the ability to assign phone numbers and IP addresses, for both POTS phones and IP phones.
- **Call logging.**
- **Trunk usage.**
- **Call screening.**

Capabilities such as these put providers in a position to offer services that are more viable alternatives to products including PBXs, auto-attendants and stand-alone voice mail systems. All features can be driven by the BSS, and easily accessed and controlled by customers.

Service Provider Communications Manager

Service providers likewise get their own version of the Communications Manager that allows them to create service profiles for customers. With it, providers can easily configure basic service options for each customer, working off predefined templates. Service provisioning is greatly simplified, however, because the customer will use the BCM to do the detailed configuration work. Providers merely provision a group of phone numbers, SIP addresses and associated characteristics such as message box size and server data.

The BSS also comes with its own element management system, which supports SNMP and Web-based access. The Carrier Operations, Administration and Management (OA&M) system allows for system configuration and supports system monitoring with alarm and reporting functions.

The management tool can be launched from Hewlett-Packard's OpenView or viewed from any Web browser. It can also be integrated with higher-level Telecommunications Network Management (TNM) systems from vendors such as Syndesis that handle network provisioning and order entry.

All components of the BSS take advantage of the fault-tolerant infrastructure on which the system is built. The system's Sun Cluster architecture means every component of the BSS runs with an active backup so that if one processor fails, all active calls are maintained.

This architecture extends even to capabilities such as voice mail,

which traditionally have not incorporated redundancy or reliable transport. Syndeo's implementation is carrier-class in every respect.

Summary

Converged networks that deliver IP services over broadband connections to the subscriber enable competitive local-exchange carriers to make new inroads against their incumbent competitors. The ability to offer new kinds of service packages with simplified control and configuration features makes a compelling story to both residential users and small to midsize businesses.

But providers have to be able to differentiate themselves from the pack while at the same time remaining nimble enough to create new applications on demand and respond to competitive threats.

The Syndeo BSS meets these challenges on all fronts. Its Communications Manager components give end users, business customers and service providers unprecedented control over an array of features using existing, well-understood interfaces. The ease with which end users can get access to new features and functions will encourage them to use these services, creating new revenue streams for service providers. Given that more profit is made on local voice services than from all data services combined, the potential is considerable.

At the same time, the open, JAIN- and CORBA-compliant architecture allows for speedy development of new applications by Syndeo as well as service providers and third-party partners. Similarly, it gives end users the freedom to use the full features and functions of their favored communications devices.

And it's all delivered on a cost-effective, software-based platform with the kind of reliability and scalability service providers demand.

Is convergence possible? Is it worthwhile? With the kind of carrier-grade applications and call control provided by the Syndeo BSS it is.

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