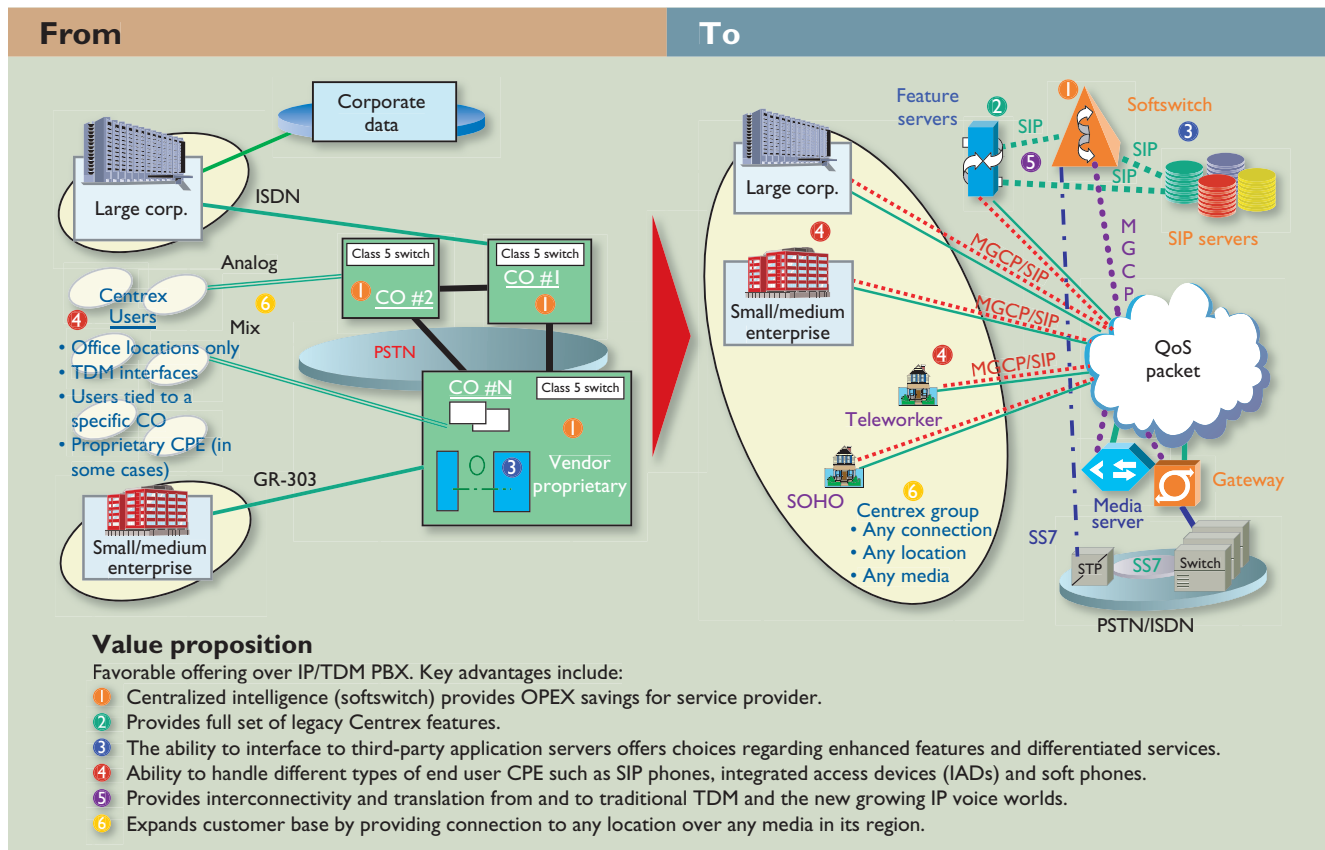


## IP Centrex comes of age

*How to extend cable's residential reach into the deep pockets of business*



**Figure 1: IP Centrex is not just Centrex voice services over IP, but a whole new set of services that can take advantage of voice and data convergence. What's more, its converged, IP-based architecture allows tremendous flexibility and cost-savings to businesses deploying it, while offering new revenue opportunities for cable companies.**

By Derrick Richburg, Senior Solution Architect, Siemens Information and Communication Networks Inc.

With \$65 billion recently invested in bi-directional, digital hybrid fiber/coax (HFC) network upgrades, cablecos have good reason to look for new revenue-bearing network services such as fast Internet access and voice-over-cable. Now comes a new potential revenue blockbuster that combines both voice and

data in ways that business may well buy: Managed IP services, especially IP Centrex.

### Centrex: An outsourced solution

For almost 40 years, telephone features like four- or five-digit extension dialing, call-forwarding, call-hold, three-way calling, and so forth came either from a private branch exchange (PBX), if your company is large enough to cost-justify one, or from the local telco's Centrex service if not.

Until recently, PBXs have been relatively expensive and required internal facilities, including a voice network with support

staff. They gave companies much more control over their telephony services. Intra-company calls among employees—the bulk of a large firm's calls—were “free” (not counting the network and support costs) and out-bound local and long-distance calls could be aggregated for substantial discounts.

Centrex, on the other hand, doesn't require a lot of upfront costs such as the actual cost of the PBX, its installation, and the personnel to support and maintain it. Additionally, with Centrex, most all the voice features a business might need reside on a Class 5 switch in the telco's central of-

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## Standards future shock

BY WALTER S. CICIORA, PH.D., RECOGNIZED INDUSTRY EXPERT ON CABLE AND CONSUMER ELECTRONICS ISSUES

**T**he struggle over the interface between cable systems and consumer electronics is several decades old. It started with analog problems. Cable operators sought to get the in-home hardware off their balance sheets and avoid the problems of maintenance and loss of the set-top boxes. Consumer electronics manufacturers felt threatened by the emasculating impact of the set-top box on consumer electronics devices. The set-top box left the TV with only a monitor function. All of the features implemented in the tuner and its control systems were frozen when the TV's tuner was set to channel 3 or 4 and the set-top box did the tuning.

VCR features were similarly invalidated. Such functions as "watch any one channel while recording any different channel" could only be done with two set-top boxes or by restricting one of those channels to the set of unscrambled channels. And even then, massive consumer confusion over which remote control to use when frustrated customers of both industries. The situation only got more difficult in the digital era.

We finally appear to be on track for an agreement on one-way digital video on cable. The remaining big hurdle appears to be getting the blessing of the Federal Communications Commission. Once that is done, work on a two-way version can be continued with a bit more confidence that something will come of it. The timing of the FCC's action is disappointing. Its delay is likely to cause missing an important holiday buying season.

But will it come in time to be useful? By that I mean, will the technology change so much in the meantime that the victory will be less than significant? Three trends seem a threat: more efficient compression, more efficient modulation and IP transport.

I attended the National Association of Broadcaster's convention in Las Vegas earlier this year and saw an amazing demonstration of H.264, MPEG-4 related video compression by Didier LeGall, LSI Logic, Milpitas, Calif. (see <http://www.lsi-logic.com/products/islands/h264.html>). This URL lists more details. Using the session's big screen, he demonstrated live compression of analog video into standard definition television at 1.5 Mbps. The result was very good.

Another speaker demonstrated non-real time MPEG-4 compression at around 700 kbps. These demonstrations are both impressive and disturbing. They are impressive because it is amazing technology. They are disturbing because of the questions they raise. Interestingly, there was little analysis or comment on the significance of this for the broadcast industry and the broadcast standard. So this gives us more video per megabit (or fraction thereof).

But that's not the end of it. Others are working on more efficient modulation that can get even more bits into 6 MHz. There is reason to expect higher levels of QAM beyond 256. Broadband Physics is proposing a modulation method based on Wavelets and the application of advanced mathematics. (See <http://www.broad->

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face, which attends 24x7 to alarms and network glitches.

### VoIP changes the equation

For the telcos, Centrex has become a lucrative part of their business, making up as much as 17 percent of revenues, by some accounts. But in recent years these revenues have come under attack as companies have started investing in so-called IP-PBXs that enable them to provide voice services via IP packets over their data networks and eliminate the cost of running separate voice networks. Plug-and-play IP phones also greatly simplify moves, adds and changes while dramatically lowering the associated costs.

What's more, by converging voice and data, users and administrators alike can take advantage of both multimedia applications and interfaces on their PCs. For example, IP-based applications are now possible that can integrate with a user's desktop PC environment such as a Microsoft Outlook's messaging features as well as with a company's directory services, enabling users to click on a name and dial a phone number.

Making matters worse for Centrex providers today are mini-IP-PBXs that enable even small businesses to provide voice services over their local area networks (LANs) and further undermine the Centrex franchise. Telecom research firm RHK found that since 2000, telcos have lost 1.8 million Centrex lines and more than \$1 billion in associated revenues.

Given all this, could the new-found benefits of IP telephony inside companies be combined with the outsourced benefits of traditional Centrex to create an even more compelling offering than converging voice/data networks yourself?

In a word, yes. The technical maturation of carrier-grade, packet-based softswitches with the reliability and quality-of-service people take for granted when they pick up the phone, has come none too soon. These softswitches are entirely software (as the generic name suggests) hosted on commercial computing platforms, and enable service providers to provide IP-based Centrex services that go far beyond traditional Centrex and can effectively compete with, or even complement, IP-PBXs.

Small wonder then that IP Centrex is one of the hottest areas of interest for telcos today. It's also an opportunity for cable companies to increase the proportion of business accounts in their revenue mix. That's because the advantages of IP Centrex can make a lot of economic sense for the rising number of employees and virtual call center agents working from home, smaller corporate sites and branches without IT resources, small-office/home-office businesses, and many other situations.

### VoIP: How IP Centrex works

At a fundamental architectural level, the biggest difference between traditional Centrex and IP Centrex is that the former needs dedicated copper-pair wiring for each phone that, when on-hook, is the equivalent of an unused network asset.

IP Centrex, on the other hand, uses voice-over-IP (VoIP) technologies, via IP phones (or PC-based "soft phones"), a firm's LAN, and a broadband access facility to provide signaling and transport of calls into and out of the company. Inside the company, packetized intracompany calls become mere packets on the company's data networks—just like e-mails or database lookups.

**IP/LAN phones.** On the customer premise at the user's desktop, either analog or new IP phones can be used. The advantage of analog phones is that they're cheap, if not paid for, in most companies, while IP phones require a new investment.

Usually featuring a dial-pad with multiple feature buttons and LCD displays, IP phones have Ethernet ports to interface with the LAN, instead of the RJ-11 outlets of analog phones. The phones digitize and packetize their user's voice, then create the required IP signaling for far-end connections and transporting the call.

Some IP phones have an integrated passive hub that enables the user's PC to plug into it, allowing both devices to share the same LAN connection and avoiding the need for separate wiring for the IP phone. Other IP phones can contain an integrated Ethernet switch providing not only the same connectivity as the hub, but also supporting QoS protocols that keep the PC's data traffic from affecting voice calls.

If a user's PC has a microphone and speakers or headset, it can be used as a "soft" telephone by adding software to it; or it can be used as a "firm" telephone by adding a dedicated hardware card that maintains call quality when the PC's operating system is busy doing other chores.

IP phones are available based on the established H.323 standard, the more recent Session Initiation Protocol (SIP) standard, or Media Gateway Control Protocol (MGCP) standard, which is more akin to the cable industry's own use of MGCP. In fact, MGCP analog adapters are available that can lower the per-port cost of such an approach to below \$50.

**Customer gateways, terminal adapters and IADs.** If analog phones and fax machines are left in a company's mix of end-user devices, a customer gateway is needed to turn analog signals into IP packets. The new IP phones typically have the customer gateway built-in. The gateway will usually serve a number of devices and reside in a telephone closet where it can connect with a building's telephone wiring.

A terminal adapter is similar to a customer gateway, but it only supports one station (or a few at most) and can be found near the user. An example of a terminal adapter is enabling a common fax machine to be part of an IP Centrex group.

Integrated access devices (IADs) combine the customer gateway function with an IP router, Ethernet hub or switch, and a broadband access device like a cable modem. These combo devices are a cost-effective means of leveraging a single broadband pipe throughout a small- to medium-sized business.

**Off premise.** At the central office, two approaches exist for providing IP Centrex. One is to use legacy Class 5 switches that can support IP Centrex along with both POTS (Plain Old Telephone Service) and ISDN lines by means of a network gateway.

This device connects to the switch and mimics a digital loop carrier (DLC), translating any signaling data from the customer gateway into an understandable switch protocol as well as depacketizing the voice stream. Conversely, it converts the switch's signaling messages and voice streams into packets for transport to the customer gate-

way. The benefit of this approach is it can deliver a rich feature set without upgrading the Class 5 switch.

The alternative to the Class 5 switch is to deploy a carrier-grade softswitch, which provides external call control and service logic just like the Class 5 does. But in contrast, the softswitch does not take part in transport or switching of the voice streams. That's because the softswitch and the customer premise equipment signal each other directly over the service provider's packet network using IP telephony protocols such as H.323, SIP or MGCP to route the packets.

If a call is to another member of the IP Centrex group, then the originating and terminating customer gateways or IP phones route the voice packets straight to the far end.

Of course, often the called party's phone won't be part of a Centrex group and will be connected to the Public Switched Telephone Network (PSTN). In these cases, the softswitch controls both a trunk gateway and a signaling gateway to handle the PSTN connections and SS7 message exchange, respectively.

In effect, the caller's customer gateway sends the voice packets to a trunk gateway that converts them to an analog voice stream and provides interoffice connections to PSTN Class 4 or 5 switches. Calls from the PSTN to an IP phone, in turn, go through the same process in the other direction.

### IP adds customer benefits

In addition to the previously mentioned outsourcing benefits from traditional Centrex, the IP-based version provides several added advantages.

- **Anyone, anywhere.** One is that multiple locations can be tied into a single Centrex group, regardless of distance. Branch offices, home workers and road warriors can all enjoy the same intra-office communications services and features like abbreviated dialing no matter where they're located, without toll charges when calling among themselves.

- **Easier, cheaper administration.** This geographic independence can simplify work for administrators, too, since it's easier to oversee a single Centrex group than

several separate ones. In addition, so-called “moves, adds and changes” can be made by simply moving the IP phone elsewhere in the physical or virtual network. With traditional Centrex, these changes can cost from \$100 to \$150 each. What’s more, existing Centrex management tools can be used for many, if not all IP-Centrex administrative tasks.

- **Voice/data convergence.** Another big advantage is that businesses can converge their voice and data onto a single internal data network with external broadband access to the service provider packet network. This enables not only the cost-savings of tending just a single network, but also the productivity gains from applications that blend voice and data—

especially useful for call center applications or multi-party conferencing.

- **Easy migration.** Since IP-Centrex is fully compatible with traditional Centrex services, users of analog, ISDN, and IP-Centrex can all be part of the same Centrex group. As such, traditional Centrex users can add or convert lines to IP-Centrex as they see fit.

## Ciciora’s corner

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bandphysics.com/.) This URL also provides loads of details including a tutorial (“Wavelets for Dummies”) and a comparison of QAM, OFDM and Wavelets. The Wavelet approach allows sharper band edge spectral skirts which reduce the amount of spectrum lost to “guard bands” between 6 MHz slots. There is also a questioning of the sanctity of 6 MHz. If larger chunks of spectrum are swallowed, the lost capacity between chunks is reduced. So this gives us more megabits per megahertz.

The third trend is the move to the Internet Protocol, IP. There is interest in doing nearly everything over IP. Voice-over-IP has been a hot topic for several years and is gaining traction. Video-over-IP may be next. This has its worries as well. If the cable system becomes just a bit pipe, how might we avoid becoming just a carrier? To some extent, we’re headed that way with high-speed cable modems. It is now difficult to tell what the bits are carrying. While it is not impossible, there are challenges. The fear and the danger is that creators of video can bypass the cable operator and use the cable operator’s massive investment without paying to support it. Encrypted bit streams of modest size can carry video of very good quality provided by others who haven’t suffered the investment to build the big pipe. Proposals for caps have been made. Some advocate monthly “Byte caps” which would limit the total amount of data downloaded by a customer for each step in a schedule of charges. Others propose bit rate caps

which are hoped to preclude real-time video transport of entertainment-quality, particularly big screen-worthy, video.

These, of course, are business decisions more than technology issues. But it is good to keep a wary eye out for strategic implications. The telco industry has been making fiber-to-the-home noises again. They are asking for tax benefits to support a cost that is likely unsupportable otherwise. While they have a long shot at this, consumers frustrated by Byte caps or bit rate caps could form a political base.

Do we need the increased capacity that these techniques will provide? Apparently so. In all the years cable has been upgrading plant, it has always hoped that the current upgrade would be the last. It has hoped that sufficient bandwidth will have been attained and capital expenditures will finally slow. But it has never happened that way. There have always been new services and larger quantities of existing services. Voice, data and digital video keep up the pressure on capacity. The urge to “recapture” analog spectrum and apply it to digital frees up a lot of capacity, but by surrendering one of cable’s sustainable competitive advantages, the ability to serve the large number of existing analog television sets and VCRs. That’s something that neither satellite nor digitized broadcast can do. It’s a shame to give that up.

Perhaps most troubling, what do we do now that we have deployed tens of millions of digital set-top boxes and have an agreement with the consumer electronics industry?

## Next steps for cable providers

When Sam Walton built his Wal-Mart empire, he didn’t start by taking on big-city department stores first. He went to small towns where people understood value and where the Bloomingdales weren’t.

That’s not to suggest cable companies should focus on small towns. It does suggest they focus on where they can find growing needs for an IP-Centrex offering and concede large enterprises and institutions to their incumbent solutions—at least for now.

One such sweet spot would be the growing number of home-based workers, whether in small enterprises of their own or as part a larger company’s tele-workforce. Other potential targets are branch offices, virtual call centers (where call agents work from home), and sites without IT resources. Obviously, greenfield opportunities with new business parks, office buildings, and urban redevelopments should not be overlooked.

Eventually multiprotocol VoIP networks should help bridge the either/or divide between customer-premise or outsourced solutions. Large-scale deployments of VoIP managed services over a large but widely dispersed enterprise would require both approaches. And any service provider who can help large businesses capitalize on a blended solution would certainly differentiate itself in today’s market.

After years of development and testing, and despite all the hype that’s now somewhat muted, multiprotocol softswitch and gateway technologies have indeed matured enough to provide the most needed features, plus the kind of QoS and reliability required for business class communications solutions like IP-Centrex. And, with all the enterprise interest in converged networks, it’s an opportunity for cable companies to add another key revenue stream to their income statements. ■