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**Autor:** Magnin, Jean-Claude

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**Exploration Programmes:**  
**Corporate Technology Explores Future Telecommunications**

# **From the PBX to the Enterprise Communication Portal**

Selecting a PBX phone system remains one of the most important decisions faced by businesses today because a PBX serves as the nerve centre for communicating with customers, suppliers and employees alike. With the new Internet era where voice, data and video converge into a single streamlined network, traditional phone systems will become obsolete and be superseded by IT/IP-based communication systems, hereafter referred to as the Enterprise Communication Portal. The basic PBX functions will not disappear, they will, however, be completed with multimedia communication and interaction servers that will dramatically improve communication within an organisation as well as with its customers.

Convergence between Internet and telecommunication technologies represents a fruitful area for innovation. The Exploration Programme "Advanced and Value-Added Communication Services" addresses these emerging technologies, and through the underlying projects, sets a special focus on the following hot topics: voice over IP, multimedia communication & services, interaction & mobility services, innovation in voice services, and virtual-commerce portals.

With its Exploration Programmes, Corporate Technology is exploring telecommunication technologies and new service possibilities with a long-term view of 2-5 years. Further, the expertise built up in the course of this activity enables active support of business innovation projects.

**A**s the Internet becomes ubiquitous and the society is moving towards an e-society, new business and society models are emerging. The Internet is actually changing the way

JEAN-CLAUDE MAGNIN, BERNE

that people and businesses communicate. Therefore, businesses need new solutions, services and systems to handle and manage their evolving communication requirements. Business-to-business and business-to-consumer interactions remain important issues and the underlying communication will be routinely handled by communication systems and networks. But these networks and communication systems will increasingly be based on open standards, enabling the integration of applications and communication systems to provide new additional features.

In future, businesses and individuals will be able to manage their communication

What new services and applications are enabled by the emerging media technologies and how do we create differentiation?

Taking advantage of the new Internet and Information technologies, such as Voice over IP and Computer Telephony, as well as of the increasing availability of network capacity at an affordable price, new advanced media services are becoming possible and are gaining momentum. We have entered the era of open communications, in which computing technologies enable the creation of new communication services and value-added services providing more human-like and user-friendly interactions.

electronic, digital and finally computer-based, integrating fix and cordless telephones. With the Internet, the PBX will have to mutate once again. But with Internet and Information technologies, the switch is in the network and the intelligence moves into the computer.

Will the PBX disappear overnight? Not likely. Just as the PC revolution did not kill the mainframe market overnight, the next generation of PBX replacements will be hybrid devices integrating the best features of both, telephone and computer systems. Just as the mainframe evolved into a computer system comprising the best of mainframe and PC features, the same development can be expected for the PBX. This article describes how the PBX is evolving in the Internet era to become the future Enterprise Communication Portal.

Within its Exploration Programme "Advanced and Value-Added Communication Services", Corporate Technology is exploring the possible use of new technologies such as Voice over IP, Web, WAP, Computer Telephony, as well as Speech Recognition, Speech Synthesis, Web casting and multimedia mediation for the development of new services. Corporate Technology has been an early adopter of the new generation of PBX

needs in a more personalised way, anywhere, anytime, and through any type of access including: phone, e-mail, Web, chat, WAP, Instant Messaging and Interactive Voice Response (IVR) systems. The Enterprise Communication Portal, illustrated in figure 1, will be the mediation system between business applications and the access channels, and will help enterprises to manage and control their contacts, content, computing and communication.

Since its first introduction in 1911 in Switzerland, the Private Branch Exchange (PBX), depicted in figure 2 in one of its smallest size and most modern version, went over several technology evolutions. Being an electro-mechanical switch in its early age, it has become successively

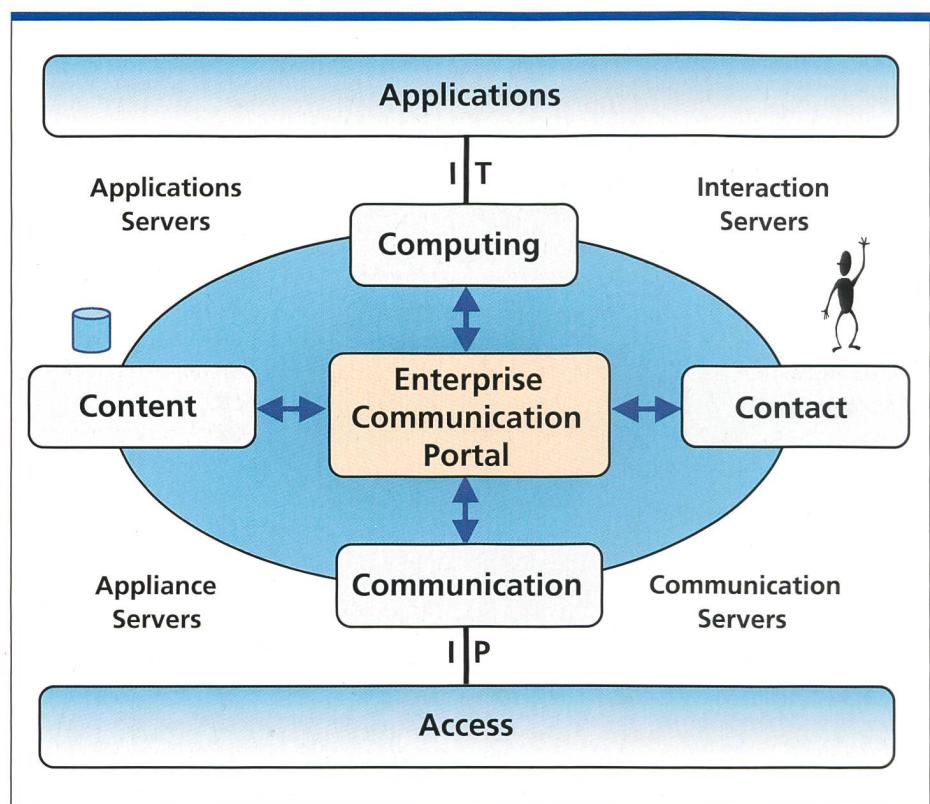


Fig. 1. The Enterprise Communication Portal.



Fig. 2.  
A traditional PBX.

based on IT/IP technologies and has implemented several related services, such as Surfcall (a PC-to-Phone Internet Telephony service) and Push and Talk (a Web-based call centre service). By using modern programming languages like Java™, as well as open architectures and standards, we integrate systems and create innovative services to demonstrate the benefits of these new technologies.

#### Disruptive Technologies: Internet, Voice over IP and Computer Telephony

##### Internet

The Internet has proved to be the most disruptive technology as its quality improves and its ease of use increases. What happens when the Internet meets the telephone network and what happens when it meets broadband networks, such as cable television? First, the Internet will turn these services into applications. Second, the Internet will evolve into a next generation network, able to provide broadband services in a high-quality, reliable and efficient manner. This next generation network embodies two fundamental characteristics:

- It is a high-speed packet- or cell-based network capable of transporting and routing a multitude of services including voice, data and video.
- It is a common platform for both, applications and services, accessible across the entire network as well as outside the network by users.

The major physical components in the next generation network will be data switches, servers and edge devices at the customer premises. Traditional telephony switches will be unnecessary, with anybody being on the network able to offer

a service by providing a server on the network. Consequently, telephony will become one among many other potential services which can be offered on the network.

##### Voice over IP

Voice over IP is the technology which enables the delivery of telephony services, usually called IP Telephony or Internet Telephony services, on an IP network. It brings the possibility to merge voice, video and data networks into one unified multimedia or multi-services network. Possible applications for IP telephony include telecommuting, real-time document collaboration, distance learning, employee training, video conferencing, video mail, and video on demand.

This technology offers more flexibility by enabling a capacity increase or the plugin of Voice over IP terminals on the network without having to add new hardware in the server. Furthermore, it enables the use of advanced compression algorithms for coding the voice signal, using about 4 to 8 times less bandwidth than traditional telephony which uses 64 kbit/s for a normal call.

To place a telephone call over a next generation network, the customer will dial the number the same way as today. The edge device will communicate the dialled number to a telephony server, where a call control software determines the appropriate IP address for the call and returns the address to the edge device. The edge device converts the voice signal to the IP format with the given address and sends it to the destination. If a service, such as call waiting, caller ID or conference calling is used, the call agent or call manager software can be called

back into action to perform the needed functions.

Currently several open standards are competing and co-operating to provide IP telephony,

- the ITU-T H.323 and the IETF SIP standards for the end-user terminals,
- the IETF MGCP and the ITU-T H.248/IETF Megaco standards for the control of media gateways.

##### Computer Telephony

Computer Telephony is the technology enabling a telecommunication equipment to be controlled by a computer as with the Intelligent Network (IN) concept. But while, in the IN model, the possible actions on the public telephony switches are quite restricted and the access to these functions is not standardised, in Computer Telephony almost all the possible functions of the telecommunication equipment are available and made accessible to any application via an open standardised interface.

When not provided directly by the telecommunication equipment, this interface is provided by a Computer Telephony Integration (CTI) server which offers an open application programming interface (API) and performs the mediation between the open and the proprietary interface. Currently, there are two major standards

- the Telephony Application Programming Interface (TAPI) from Microsoft and
- the JAVA-based version JTAPI, the Java Telephony Application Programming Interface.

These APIs enable service providers and third parties to develop applications that make use of the system's communication capabilities. This open standard API allows rapid development and deployment of new services in next generation networks, and its applications can make use of core functions provided by the telecommunication server, including the ability to set up a call, perform voice recognition or to set up a conference call.

With computer telephony, the PBX has become a telephony portal, delegating processing and routing to specific applications, such as call centres, automated and personal attendants, or unified messaging. New applications such as screen-based telephony, name dialling, call monitoring and web-based administration become possible.

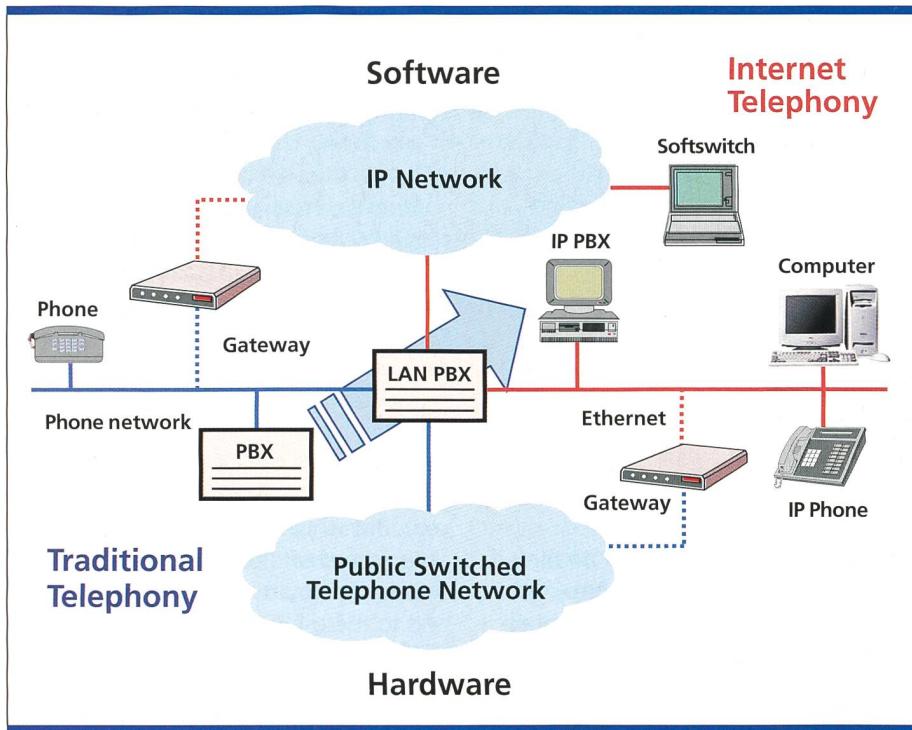


Fig. 3. The PBX migration towards Internet Telephony.

### The PBX Mutation

The role of the next generation PBX will not be anymore to only route and handle enterprise telephony calls. The PBX, although remaining the Private Branch Exchange, will mutate one more time and inherit new names characterising its architecture and/or the supported features, such as Lan PBX, IP PBX, Call Manager, Softswitch, or Communication Server. Several types of communication systems, illustrated in figure 3, have emerged in the early migration towards the Enterprise Communication Portal:

- Voice over IP gateways enabling a traditional PBX to be interconnected to an IP-based network.
- LAN PBX, a traditional PBX with integrated gateways for IP/PC Telephones and/or trunk gateways for IP network interconnection. A LAN PBX can be hybrid and integrate router capabilities.
- IP PBX, Call Agents or Call Managers being pure software PBX solutions providing the control for IP telephony calls on switched LAN networks, and using PSTN/ISDN gateways for accessing the traditional telephony networks.
- Softswitches and Media Gateway Controllers, network and software based systems that control any type of media communication over IP and use gateways for the interconnection with traditional networks or for integrating traditional telephones. Softswitches will

be the brains of the multimedia IP networks.

Whatever name or architecture it will have, integrated as a standalone communication system or distributed over several computer servers within the network, the next generation PBX will become the Enterprise Communication Portal. Built on a directory-enabled architecture and linked with network application servers (E-Mail, Web, IVR servers), contact interaction servers and applications servers, the next generation PBX will be the mediation system between communication channels and applications, and will handle contacts and content of an enterprise, supporting the creation of communities and facilitating collaboration between users.

### Conclusions

The shape of the city is moving faster than the heart of a human being. In the Internet age, the whole business environment of an enterprise is changing. Today, businesses need a scalable, feature-rich communication system that enables them to compete effectively, along with the flexibility to easily add more advanced capabilities as the business needs change.

Following the technology trends and replaying the historical battle of the personal computer against the mainframe, a new generation of communication sys-

tems will replace the traditional telephony switches. Based on open architectures, these communication systems are more computer- and software-based than traditional hardware telephony switches.

Integrated with business applications like Customer Relationship Management (CRM), Enterprise Resource Planning (ERP), Supply Chain Management (SCM), Enterprise Relationship Management (ERM) and E-Commerce applications, PBX and its next generation will remain the nerve communication centre of the Enterprise.

### Outlook

More than a passing fad, IP Telephony and Computer Telephony are definitely bringing radical changes in voice communication. Not only will these technologies affect the way companies treat voice and data communications, they will additionally be a driving force towards true voice-data integration, and therefore they will radically change the way people commu-

### Computer Telephony

TAPI: [www.microsoft.com](http://www.microsoft.com)  
JTAPI: [java.sun.com/products/jtapi](http://java.sun.com/products/jtapi)

### Standardisation Organisations

ITU-T: [www.itu.ch](http://www.itu.ch)  
IETF: [www.ietf.org](http://www.ietf.org)  
ECT Forum: [www.ectf.org](http://www.ectf.org)  
Parlay: [www.parlay.org](http://www.parlay.org)

### Abbreviations

|       |  |
|-------|--|
| AIN   | Advanced Intelligent Network                     |
| API   | Application Programming Interface                |
| CTI   | Computer Telephony Integration                   |
| IP    | Internet Protocol                                |
| IT    | Information Technology                           |
| IVR   | Interactive Voice Response                       |
| JAIN  | Java Advanced Intelligent Network                |
| JTAPI | Java Telephony Application Programming Interface |
| LAN   | Local Area Network                               |
| PBX   | Private Branch Exchange                          |
| TAPI  | Telephony Application Programming Interface      |
| UMS   | Unified Messaging System                         |
| WAP   | Wireless Application Protocol                    |

nicate. The need for instant information and intelligent contact management will change the role of telephones, computers and personal digital assistants from dedicated devices to network access devices. New information technologies will continue to appear, and we actually barely begin to understand how these technologies will change our daily life.

As the technologies and the management of all these new IT and IP systems become increasingly complex over time, some of the functions and some of the applications will return to the network or be outsourced and managed by a new category of service providers, the Application Service Providers (ASP). The so-called Advanced Intelligent Network

(AIN) architectures, such as Parlay and Java Advanced Intelligent Networks (JAIN), will provide the ability to smoothly integrate business applications with private and public communication systems.

Corporate Technology is currently extending the development of its open communication platform for the development of new services including voice, video, WAP and instant messaging. 10

## Résumé

Avec la convergence de la voix, des données et de la vidéo sur un réseau unique, les systèmes téléphoniques traditionnels qu'on appelle auto-commutateurs d'usagers (ACU), vont rapidement devenir obsolètes et être remplacés par une nouvelle génération de systèmes de communication utilisant les nouvelles technologies de l'Information et de l'Internet, telles que la voix sur IP et le couplage téléphonie-informatique (CTI). L'ACU est en phase de migration pour devenir le portail de communication de l'entreprise, appelé à gérer les contacts et les flux d'informations de l'entreprise, jouant le médiateur entre les applications et les différents canaux de communication, tels que le téléphone, le Web, le courrier électronique ou le WAP. De nouveaux systèmes de communication intégrés ou distribués se profilent à l'horizon, ils portent le nom de Lan PBX, IP PBX, Call Manager, Softswitch ou Media Gateway Controller selon l'architecture et leur rôle. Ces systèmes qui se diffèrent des PBX traditionnels par leur support de la téléphonie sur Internet, et surtout par leurs interfaces standardisées et ouvertes, facilitent l'intégration avec les applications Internet et les applications professionnelles.

**Jean-Claude Magnin** is Programme Manager of the Exploration Programme "Advanced and Value-Added Communications Services". Previously, he served as project co-ordinator at Siemens Suisse, in the areas of mobile communication (GSM) and Telecommunications Management Networks (TMN). Jean-Claude Magnin holds a MSCE in Computer Engineering from the Swiss Federal Institute of Technology in Lausanne (EPFL) and a MBA from the International Institute in Management of Telecommunications (IIMT) in Fribourg.

## Eine rein grüne Leuchtdiode...

...hat die Japan Energy Corp. aus Zink-Tellur-Kristallen hergestellt. Die Kristallzüchtung dieser Verbindung und die Realisierung eines stabilen p-n-Übergangs gilt als schwierig. Jetzt hat das Unternehmen aber Einkristalle mit 8 cm Durchmesser herstellen können. Muster der LEDs sind bereits erhältlich, die Massenfertigung soll im nächsten Jahr aufgenommen werden.

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Minato-ku  
Tokyo 105  
Japan  
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ster Schritt sein auf dem Weg zu Color-displays aus flexiblem Kunststoff, die dann im Jahr 2004 in Produktion gehen werden. Monochrome kleine Bildschirme für Mobilfunkgeräte und andere tragbare Geräte werden bereits gefertigt. Man rechnet in Zukunft aber durch die Internetfähigkeit der Mobilfunkgeräte mit einem rasch steigenden Markt und der Notwendigkeit, Farbdisplays anzubieten.

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Flat Display Systems  
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Fax +31-40-72 4438

bleme in den Griff zu bekommen, muss man einerseits die Leitfähigkeit der Vias auf dem Chip verbessern – das kann man durch Nutzung von Kupfer statt Aluminium. Andererseits muss man aber auch ein Isolationsmaterial mit kleinerer Elektrizitätskonstante suchen, damit nicht durch kapazitive Streuung die Grenzfrequenz verringert wird. Da hat man bisher nach glasähnlichen Substanzen Ausschau gehalten. IBM aber nutzt einen organischen Kunststoff. Mit den ersten Chipdesigns wird jetzt begonnen. Produkte in dieser Technologie sollen Anfang 2001 auf den Markt kommen. John Kelly, der Mikroelektronik-Chef von IBM meint, dass mit dieser Technik Arbeitsfrequenzen von mehr als 3 GHz möglich sind.

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USA  
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## Philips bringt farbige Kunststoff-LEDs

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