Intelligent Networks

by Thomas Magedanz and Radu Popescu-Zeletin

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Multimedia communications and global information connectivity are becoming prerequisites for the society in the next century. So Intelligent Network services are moving from beyond technical and market trials into full production and revenue generation ( ) and this book covers the essentials in the area (basic technology, standards and evolution).

One of the authors, Thomas Magedanz ( ) is assistant professor at the Department for Open Communication Systems of the Technical University Berlin, whose research interests are in distributed computing and telecommunications sciences. He has been involved in several international research studies and projects related to intelligent networks, as a representative of Deutsche Telekom BERKOM. He is also active in the fields of personal communications and intelligent agents. Since 1996, Dr. Magedanz has been Head of the "Intelligent Communication Environments (ICE)" Department of GMD- Research Center for Open Communication Systems (FOKUS) in Berlin.

The other author, Radu Popescu-Zeletin ( ) is a worldwide authority in the area of intelligent networks.

He is Professor of Open Communication Systems at the Technical University Berlin and Director of the GMD Research Center for Open Communication Systems (FOKUS) in Berlin. His professional activities have focussed on computer networks, protocols development, distributed systems and network technologies. Since 1986 his main research and development activities have concentrated on data communications in ISDN and Broadband ISDN. He is leading the Department for scientific projects at Deutsche Telekom BERKOM, which aims at the development of end-systems, platforms, and integrated multimedia teleservices in a Broadband ISDN environment. Professor Popescu-Zeletin published many papers on distributed computing systems, networks and applications and provided consultancy in data communications to national and international companies and organizations. He was active in standardization committees (DIN, ISO) and contributed to the development of the ISO/OSI reference model and related standards.

Before discussing about anything else, a very comprehensive definition of the Intelligent Network concept would be welcomed.

An Intelligent Network is a **service-independent** telecommunications network: that is the intelligence is taken out of the switch and placed in computer nodes that are distributed throughout the network ( ). This provides the means to develop and control services more efficiently. New capabilities can be rapidly introduced into the network. Once introduced, services are easily customized to meet individual customer's needs.

The book is divided into six Chapters and has two Appendices which include the CS-1 services, service features, SIB-s (**Appendix A**), and the CS-2 service categories and service features (**Appendix B**) respectively.

Chapter 1 is an introductory chapter. It stretches out the aims of the book and briefly presents the topics to be discussed in the book.

As the authors said, this book has been thought as a tutorial on intelligent networks. The main aims are to provide an overall understanding of the basic principles and to be an overview of the state-of-the-art.

Chapter 2 covers the basic principles.

First of all, business drivers and objectives are emphasized and the driving forces claiming

Intelligent Network solutions are outlined.

The traditional telecommunications environment and the way in which services are provided within it lead to the reality of monopolies. Public organizations act as both network operators and service providers. Services provided are driven mostly by available technologies rather than by customer demand. The reason for this is quite obvious: the existing telecommunications infrastructure is mostly based on vendor-specific equipment with proprietary interfaces, usually limited in its capabilities. Each network platform provides a specific, functionally limited set of services. There is no common methodology for the introduction of new services across multiple platforms. Consequently, it takes usually a long time, and requires huge investment to develop a new service.

Nowadays the telecommunications environment undergoes dramatic changes. The authors identify the following as driving forces:

⇒ *Technological progress*

⇒ *Deregulation*

⇒ *Customer demands*

Progress in computing and telecommunications technologies knows an increasingly fast pace and these technologies converge, due to the increasing role reserved for the software in telecommunications environment. The telecommunications environment is expected to move toward a distributed processing system, in which the services can be regarded as distributed applications. So it can be said that the network will become a programmable entity.

The progression of deregulation on an open scale, driven by the concept known as open network architecture/provision is reshaping the whole telecommunications sector. The existing monopolies will disappear as new players enter the scene, pushing for an open market of services.

Customers are no longer driven by available service offers, but are playing a more and more active role, demanding for new and sophisticated telecommunications services. Personalization of services has become an important market demand.

Consequently the Intelligent Network architecture has three major goals:

⇒ *Service independence*

⇒ *Network independence*

⇒ *Vendor independence*

In the context of Intelligent Network the concept of service independence is a subtle one. The idea is to enable an open set of services, based on a common frame of **generic service building blocks**. So the functionality will be no more limited to the one of today's existing services. Instead it will be able to support future customer demands. Other consequence is the ability of supporting a multi-player environment: a variety of services will be offered by a variety of providers, in a competitive way.

These three goals lead to a unique target: the creation of a general platform for the uniform provision of current and future telecommunication services on a global scale.

As all these considerations lead to the obvious idea of a net difference between traditional and Intelligent Network structured environments, to identify correctly the roles and stakeholders for the new context becomes essential for building an architecture.

The four stakeholders are:

⇒ *Network operators*

⇒ *Service providers*

⇒ *Service subscribers*

⇒ *Service users*

It is important to note that the Intelligent Network infrastructure comprises resources (for the execution of services) that have to be implemented above bearer networks, such as the *public switched telephone, the integrated services digital, or the broadband integrated services digital* networks.

It is also important to note that the roles of the stakeholders lead to two major architectural aims:

⇒ *The facility of "**plug-in**" for new services*

⇒ *Deregulation by providing platforms which offer functionality at the same price for all.*

To state the services required in an Intelligent Network architecture, a hierarchical model is adopted, with its clear notions of protocols and services, and two classes are identified:

⇒ *Call related service elements, such as call forwarding, call screening, and time dependent routing*

⇒ *Management service elements, such as billing, statistics, and service customization.*

Examples of services issued by inheriting these classes are freephone, televoting, premium rate, card calling, virtual private networks, and universal personal telecommunications.

The rest of the Chapter illustrates the historical evolution of telecommunications environment from the "plain old telephone services" toward today's Intelligent Network structures. This recourse to history allows illustrating the evolution of the Intelligent Network concepts themselves, and so the Chapter can conclude by introducing the Intelligent Network conceptual model, which constitutes the current framework for the development of Intelligent Network architectures.

Chapter 3 is devoted to the international Intelligent Network standards.

The main focus is on the ITU / ETSI (European Telecommunications Standard Institution) standards. After considering the CS-1 capability set the authors analyze in more detail the envisioned Intelligent Network services and their realization within a distributed architecture. Service creation is addressed briefly further and four examples illustrate the implementation:

⇒ *Freephone*

⇒ *Premium rate*

⇒ *Televoting*

⇒ *Card calling*

Generally speaking, the categories of services defined by CS-a are as follows:

⇒ *number translation:*

- abbreviated dialing
- call forwarding
- call rerouting distribution
- call volume distribution
- destination call routing
- freephone
- follow-me forwarding
- premium rate
- selective call forwarding (or busy/don't answer me)
- universal access number
- user – defined routing

⇒ *alternate billing*

- account card calling
- automatic alternative billing
- credit card calling
- split charging
- premium rate

⇒ *screening*

- originating call screening
- security screening
- terminating call screening

⇒ *others*

- completion of call to busy subscribers
- conference calling

These two last services are only partially supported by CS-1, as they require additional capabilities:

⇒ *malicious call identification*

⇒ *mass calling*

⇒ *televoting*

⇒ *virtual private network.*

Further in the Chapter the main enhancements to the CS-1 (the CS-2 set of capabilities) are presented. In general, the CS-2 services and service features are based on CS-1 ones, taking into account certain aspects of mobile communication (including both personal and terminal mobility) and of Broadband ISDN. In addition, internetwork signaling aspects required for the provision of international services across multiple platforms have been incorporated. Also it is worth mentioning that the distinction between call control and connection control is another important aspect of CS-2 in the light of emerging multimedia and mobile communications services. So the following service categories are specific for CS-2:

⇒ internet working services *(Internet freephone, Internetwork premium rate, Internet televoting, Global virtual network)*

⇒ *call party handling services*

⇒ *mobility services*

⇒ *broadband and bearer services*

The CS-2 architectural model comprises four hierarchic planes:

⇒ *the service plane*

⇒ *the global function plane*

⇒ *the distributed functional plane*

⇒ *the physical plane*

Each plane finds its place in the chapter economy, and this very systematic approach allows some considerations regarding the future of capability sets (the CS-3).

Summarizing, we can relate broadly the CS-1 to PSTN and ISDN, the CS-2 to B-ISDN, and the CS-3 to the fixed and mobile networks.

The remainder of this Chapter is devoted to the US standards, respectively to the Advanced Intelligent Network specifications.

Chapter 4 addresses the future of Intelligent Network and outlines the relationships between this domain and other major telecommunication topics, such as telecommunications management network standards, broadband ISDN, as well as mobile communications.

Regarding the TMN (Telecommunications Management Network), after presenting its architecture and applications, the authors consider the integration Intelligent Networks / TMN, outlining two steps that can be identified:

⇒ *medium term TMN - based management of Intelligent Networks*

⇒ *long term integration of Intelligent Networks and TMN into a single platform.*

Further in the Chapter the mobile/personal communications aspects are addressed. The authors firstly provide an introduction in the area, then look at the existing mobile communications systems and finally take into consideration the relationship between these systems and the Intelligent Networks. We can quote, "In the long term, integration of all mobile radio applications (cordless, cellular, and paging systems), including mobile satellite systems, into one universal system is necessary to support worldwide roaming. The reason for integrating satellite systems into the target system is that satellite systems could complement terrestrial systems in low-density areas," and, "For completeness it has to be said that in addition to the mobile/personal communications systems discussed above, new advanced communication systems are emerging driven by the general convergence of computing and telecommunications, and particularly by the convergence of mobile computing and personal telecommunications. In contrast to the above systems, which primarily support mobility, the basic new attributes of these new intelligent communications systems are their support of service personalization and service internetworking."

And the authors state that the Intelligent Network concept is "the necessary ... platform in the fixed network part of the mobile communications systems."

Finally the authors consider the relationship between Intelligent Network and Broadband ISDN. The two main aspects to discuss are as follows:

⇒ *new services to be supported by Intelligent Networks in a Broadband ISDN context (broadband video conference, multimedia, video on demand)*

⇒ *the necessary separation between call and bearer (connection) control.*

Chapter 5 looks beyond Intelligent Network to new information networking architectures aimed at the integration of Intelligent Network, TMN, and OPD (Open Distributed Processing) concepts. The INA (Information Networking Architecture) is presented first, followed by TINA (Telecommunications Information Networking Architecture), intended to be used for any type of network (PSTN, ISDN, B-ISDN), for both telecommunications and operations applications. The aim is that all applications (telecommunications, operations, and management) are easier to develop and maintain within an environment in which global aspects have to be increasingly taken into account.

Basically the TINA concepts are founded on the ODP (Open Distributed Processing) principles, which are actually the principles of *concurrent engineering*, taking into consideration the *Enterprise*, *Information*, *Computation*, *Engineering*, *Technology* viewpoints.

In order to handle all this complexity the overall TINA is structured into four areas:

⇒ *Computing architecture*

⇒ *Service architecture*

⇒ *Network architecture*

⇒ *Management architecture*

The Chapter presents each area of TINA and finally emphasizes the evolution of Intelligent

Network to TINA. This evolution is actually a shift from function-modelling approach toward object-oriented modelling concepts. The advantages result from the possibility of fully using such software tools as the n-tier architecture (CORBA for instance), or the intelligent agents.

Chapter 6 summarizes the content of the book.

Some time ago, at an international conference devoted to Integrated Management Systems, a lecturer, who had been referring to trends for the century to come, faced the audience with the dilemma of "how to prepare ourselves, to choose the right direction as a driving force, or to expect the unexpected?"

Well, this book has made the choice: "the right direction as a driving force." Being exceptionally well-written as it is, and with a material very clearly presented, the book lets the reader feel at once the teaching experience of the authors, and their supreme competence.

The reviewer is most grateful to Professor Popescu-Zeletin, for having offered a copy of the book, so giving him the opportunity to take a deep look into one of the most important technical topics of nowadays.

Pierre Radulescu- Banu