AT&T's Global Intelligent Network Architecture

Herbert W. Kettler
Gautham Natarajan
Ecaterina W. Scher
Phillip Y. Shih
Peggy Marr Wainscott

Increased international business competition, combined with the worldwide proliferation of multinational corporations, has accelerated the demand for universal, uniform, global telecommunications services. AT&T has designed an intelligent network platform that facilitates consolidating various national networks into a global system that will provide advanced universal network-based services on a worldwide basis. This platform will permit global carriers to offer multinational business customers a full portfolio of global information movement and management services. Based on International Telephone and Telegraph Consultative Committee (CCITT) recommendations, the architecture is flexible and evolvable and offers telecommunications carriers the capability to connect with one another and provide functionally equivalent services on a worldwide basis. This architecture can accommodate the many types of possible national network infrastructures and configurations, ranging from networks offering only basic telephone service to those offering the advanced capabilities of an intelligent network.

Introduction

AT&T's global Intelligent Network (IN) architecture can meld various national INs into a global network that can provide advanced network-based services. This platform enables global carriers to provide corporate users the global information movement and management (IM&M) capabilities they require. The strength of this architecture lies in its ability to permit carriers with different levels of network sophistication to participate in the global IN immediately. At the same time, it provides an avenue for evolving their networks to meet customer needs. Using interfaces and protocols based on CCITT recommendations, the global IN architecture supports a multivendor environment, enabling telecommunications equipment from different vendors to coexist in the network. Furthermore, the architecture can accommodate different national network configurations. Finally, as telecommunications networks evolve, the global IN platform is designed to meet changing customer service requirements, networking capabilities, industry trends, and CCITT recommendations.

Some of the advanced IN services currently supported by this platform include global virtual network service (GVNS), international Freephone service (IFS), and international credit card validation (ICCV) service.

Intelligent Network Benefits

Many telephone administrations and telecommunications companies are seeking technology that will permit rapid introduction of advanced services without extensive rearrangement of existing networks or disruption to customer service. Ideally, this technology would provide a modular network that can incorporate future services without major architectural changes to the network. This is now possible with intelligent network technology. The IN provides flexible service logic and centralized administration. It permits carriers to quickly and economically offer advanced, network-based services. It also allows independent service providers to use the carrier's IN to deliver advanced services to their subscribers.

IN Architecture. Figure 1 shows how the various elements of the IN fit together.

These elements are:

- *Service Switching Point* (SSP)—detects events, or triggers, that signal when an IN call is being placed. It does this by separating basic call control from IN-based service control. Upon detecting an IN trigger, the SSP queries the SCP for information needed to route the call.
- *Service Control Point* (SCP)—provides centralized IN call management. This database contains the processing logic for the IN services, as well as subscriber data for each IN service subscriber. In response to queries from the SSP, it executes the appropriate call processing logic and sends call processing instructions to the SSP.
- *Intelligent Peripheral* (IP)—provides assistance for IN calls, such as playing prerecorded announcements or prompting callers for information. Information can be provided either as dialed, dual tone multi-frequency digits or predefined spoken digits through automatic speech recognition. This information is then sent to the SCP for interpretation.
- *Service Creation Environment* (SCE)—an interactive system that enables carrier administrators to create, customize, and provision new services.
- *Service Management System* (SMS)—where subscriber records are created, validated, modified, and loaded into the SCPs.
- *Operations Systems* (OS)—provide centralized operations, administration and maintenance, including service provisioning, billing, network and service maintenance, alarm processing, traffic measurement, and network management.
- *Signaling Transfer Points* (STP)—nodes in the Signaling System No. 7 (SS7) network that route signaling messages between switches and between SSPs and SCPs in the IN.
- *Gateway Exchange Switches* (GW)—provide the necessary interworking functions between national and international signaling and also support international transit traffic.

Modern switching technology allows the integration of multiple network functions into a single-switching system. For example, any combination of GW, SSP, and STP functions can be combined in a single exchange. This helps simplify network topology, reduce capital investment for network hardware, and lower operations and maintenance costs.

Panel 1 Abbreviations, Acronyms and Terms in This Paper

CCITT — International Telephone and Telegraph Consultative Committee
GW — Gateway Switch
GVNS — Global Virtual Network Service
ICCV — International Credit Card Validation
IM&M — Information Movement & Management
IN — Intelligent Network
IP — Intelligent Peripheral
OA&M — Operations, Administration & Maintenance
POTS — Plain Old Telephone Service
PSTN — Public Switched Telephone Network
SCE — Service Creation Environment
SCP — Service Control Point
SMS — Service Management System
SS7 — Signaling System No. 7
SSP — Service Switching Point
STP — Signaling Transfer Point

Global Intelligent Network Architecture

As business operations become increasingly global, corporations experience greater demand for services like free, convenient telephone access to a sales support office, or use of a single global telephone number. They also need to provide uniform telecommunications capabilities and services across all office and plant locations. One possibility is use of a virtual corporate network that provides the look and feel of a private network by uniting distant sites around the world.

While certain IN domestic services are currently offered in some countries, they are still not widely offered. The challenge, then, is to make IN services ubiquitous and ensure uniform service functionality around the world. Not only can the AT&T global IN architecture meet this challenge, it also has the flexibility to evolve to provide new services and capabilities.

AT&T's global IN architecture supports a diverse range of network configurations and can also provide global interconnections between these networks. From the simple Public Switched Telephone Network (PSTN) offering basic services, to sophisticated networks with advanced signaling and IN capabilities, the various

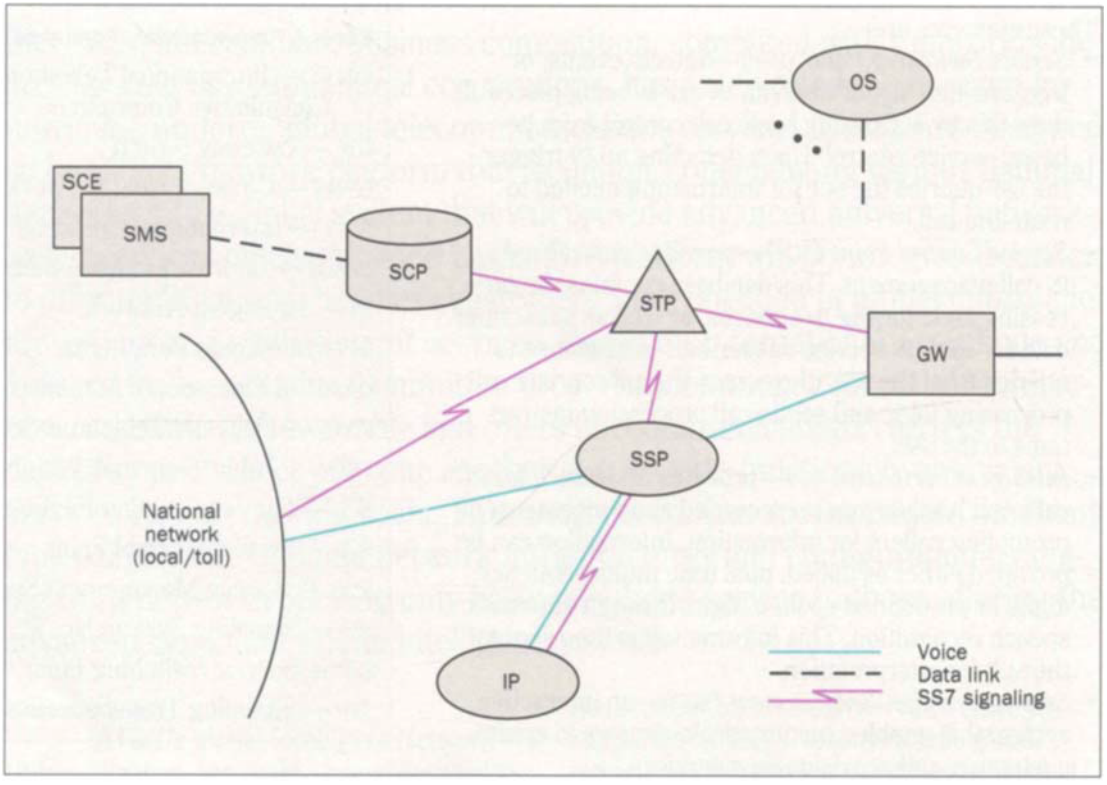

Figure 1. In a global IN, the Service Switching Point (SSP) and the Signaling Transfer Point (STP) are the interfaces between the national network and gateway switch (GW). They are supported by the Service Control Point (SCP) and Intelligent Peripherals (IP). The Service Creation Environment (SCE) and Service Management System (SMS) enable provisioning of services and maintenance of subscriber records. Centralized operations, administration and maintenance are provided by Operations Systems (OS).

network configurations are classified with respect to the presence or absence of IN capabilities in the network. Three broad classifications are used:

- A full IN containing the capabilities described previously
- A partial IN with SSP functionality and/or switch-based service logic but not SCP functionality
- A non-IN without SCP-based, switch-based service logic, or SSP functionality, and only providing Plain Old Telephone Service (POTS).

Partial SSP functionality allows a network to access the service logic functionality resident in another carrier network's SCP.

Switch-based service logic enables a partial IN network to support basic number translation services using switch-resident service logic. However, advanced routing features are not available with this configuration. As service demand and service logic sophistication grow, switch-based intelligence will become less attractive functionally (due to processor usage, memory consumption, etc.). Complications arise from an administrative standpoint as well. Administering multiple databases in a single switch, synchronizing data updates in multiple switches, and other administrative functions eventually make this a less desirable solution. The services can then be transitioned from the switch-based IN architecture to a full IN architecture, with an SCP.

Although the non-IN network configuration does not provide SCP-based or switch-based service logic or SSP functionality, the AT&T global IN architecture allows these network carriers to reap the benefits of global IN services by using a carrier with full IN. Thus, the full IN carrier can serve as a regional IN carrier for those networks with partial or no IN.

Key Architectural Concepts. Two key architectural concepts enable IN services to be extended globally. These are:

- SCP-to-SCP communication
- Regional IN node.

SCP-to-SCP Communication. The capability for databases in different carrier networks to communicate directly with one another to provide global IN services in concert is also known as *internetworking*. By allowing network intelligence to be shared, internetworking

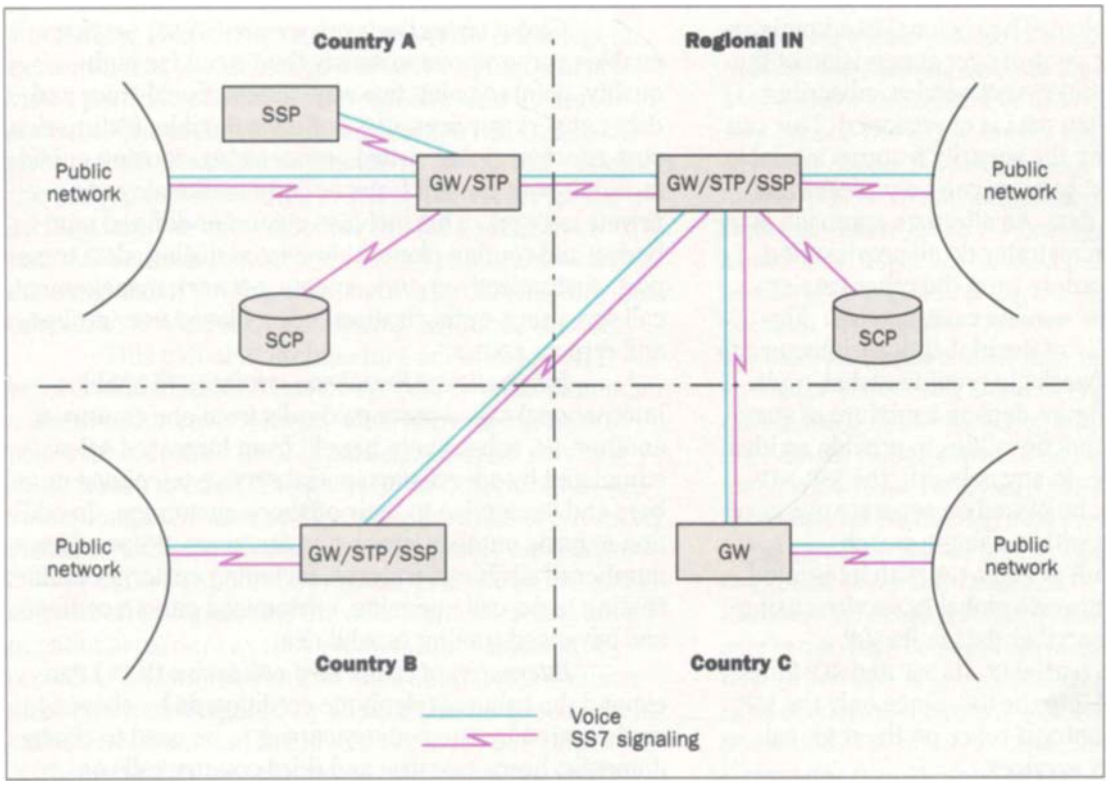

Figure 2. A stand-alone regional IN node can provide global services to many different levels of national networks. It can support those with full IN capabilities (Country A), as well as those with partial IN capabilities (Country B), or those providing only basic service (Country C).

permits carriers to make the most effective use of their INs. In addition,it simplifies the administration and maintenance of subscriber databases since each service provider needs to provision the SCPs with its subscriber data only.

When an international IN call is originated, the SCP uses the signaling network to query the terminating network SCP. Call processing is then suspended until the remote or terminating SCP responds. While this may seem to add to call set-up time, the impact is really minimal since the query/response takes place over the signaling network. The SCP being interrogated responds with call routing, call disposition, and call logging information. With this, the originating IN is able to route the call. If, however, the terminating network does not accept the IN call request, the originating network can still clear the call. The result is more efficient use of international transmission facilities. This type of communication is used for GVNS and ICCV services.

Regional IN Node. As stated earlier, corporations are rapidly globalizing, resulting in a growing demand for advanced, global telecommunications services. However, carriers in some countries where these companies have locations may not have the infrastructure in place to begin offering advanced services immediately. Such a carrier can access a regional IN node in another country to provide advanced services to their multinational corporate customers. A region can span several countries or even an entire continent.

There are two ways to implement a regional IN. The first is sole ownership, in which the regional IN is owned and administered by a single carrier who then sells or leases IN capabilities to other carriers. The second alternative is joint ownership, in which a group of neighboring carriers purchase and jointly deploy an IN. The IN may be situated within one participant carrier's network, with that carrier serving as administrator. Another option is to place the IN as a stand-alone facility administered by one of the parties. Either option benefits the participating carriers, since IN resources, including the SCP database, are shared, resulting in reduced capital cost.

Since the regional IN database contains the service subscriber records for all carriers, its administration

must be carefully controlled. The regional IN administrator should have ultimate control over supervision of the SCP and should ensure the correct service subscriber records are accessed when data is provisioned. This can be accomplished by using the security features available on the SMS to ensure that carriers can only access and modify their subscriber data. An alternate approach is to have the regional IN administrator do all provisioning upon receiving change orders from the other carriers.

Support of Multiple Network Configurations. Figure 2 illustrates the ability of the global IN architecture to interconnect diverse networks to provide global, multilateral IN services. The figure depicts a mixture of stand-alone and integrated IN functionalities to provide an idea of the flexibility available. In any network, the SSP, STP, and GW functionality can be placed on separate pieces of equipment or integrated within a single switch.

Country A has full IN and a GW with integrated STP functionality. It can provide global IN services using the service logic and subscriber data in its SCP.

Country B has a partial IN. Its SSP and STP functionalities are integrated into the GW. Since only the SSP function is available, Country B relies on the regional node to provide global IN services.

Country C has no IN capability. It uses the regional IN to offer IN services to its subscribers. In this case, an actual voice path has to be established over international facilities to the regional IN, whose SSP would then provide querying and routing capabilities.

Although Figure 2 shows the regional IN as a stand-alone facility, any full IN network can serve as a regional node. As the figure shows, the AT&T global IN architecture would enable carriers with widely differing network configurations to offer global IN services.

Global Intelligent Network Services

There are a growing number of IN services that can be supported by the global IN architecture. Some of these are already available as national IN services; however, they are not universally available in all carriers' networks. In addition, where they are available, there are likely to be operational differences due to variations in implementation. The global IN architecture can make these services ubiquitous around the world, and can also provide a platform for uniform service functionality at a global level. Among these services are:

Global virtual network service (GVNS) service enables corporations to satisfy their need for high-quality, point-to-point, two-way, transnational voice and data network services. GVNS offers a flexible, feature-rich, cost-effective global virtual private network using public facilities, with the full features and functionality of a private network. This includes customer-defined numbering and routing plans, abbreviated dialing, data transport, customized announcements, network management, call screening, authorization codes, closed user groups, and remote access.

International Freephone service (IFS) enables international called-party paid calls from one country to another. IFS subscribers benefit from increased sales stimulated by advertising special service telephone numbers and IFS service to their offshore customers. In addition to basic number translation functions, IFS provides a number of advanced features, including customer-defined routing logic, call queueing, customized announcements, and advanced routing capabilities.

International credit card validation (ICCV) can expand the value of telephone credit cards by allowing cards issued by one country carrier to be used to charge domestic, home country, and third-country calls on another carrier's network. The call originating carrier uses the signaling network to validate the card through the card issuer database.

Universal personal telecommunications is based on association of telecommunications services with a person, as opposed to a station or other fixed, physical network termination. This includes a universal personal number capability, as well as interworking with wireless networks to provide Personal Communications Network service.

International premium charging service can be extended to enterprises that offer value-added premium services (e.g., tax or investment consultancy). With premium service, the caller is charged for both the connection and the service or information provided. In some cases, the charge may be partly or wholly transferred to the service subscriber.

These are some examples of the services currently enabled by the architecture discussed in this article.

Conclusion

AT&T's global IN architecture is designed to meet the evolving needs of telecommunications carriers

worldwide. This architecture melds various intelligent networks into a seamless global network that can provide a portfolio of advanced, network-based customer services. The architecture's capabilities will enable carriers around the world to provide multinational customers the IM&M capabilities they require. The AT&T global IN architecture can accommodate the full spectrum of national network infrastructures and configurations that currently exist, ranging from networks offering only basic telephone service to those offering advanced services.

This global IN architecture adheres to CCITT recommendations and has the flexibility to accommodate a multivendor environment, while allowing carriers to select their desired level of participation and services they choose to offer. The global IN architecture can provide a comprehensive and growing portfolio of advanced global services demanded by multinational enterprises.

AT&T supports the global IN architecture and is committed to supporting the telecommunications needs of national carriers as they strive for globalization. By providing a platform that can offer ubiquitous, uniform global services required by all users in the telecommunications environment, the global IN moves one step further in addressing the expanding global needs of telecommunication users worldwide.

Acknowledgments

The authors would like to express their sincere appreciation to H. A. Bonuccelli, E. E. Grijalva, R. Lo, and P. B. Shanghavi for their consultation during the preparation of the paper and for reviewing the final manuscript.

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(Manuscript received March 30, 1992)

Herbert W. Kettler *is head of the International Intelligent Network and Gateway Systems Engineering and Product Management Department of AT&T Bell Laboratories, Naperville, Illinois. The department is responsible for identifying customer needs, product planning, and product requirements for the AT&T International Intelligent Network and Gateway products. Kettler joined the company as a member of technical staff in 1966. He received a B.S. in Engineering Physics and an M.S. in Electrical Engineering from the University of Michigan, Ann Arbor.*

Gautham Natarajan *is a member of the technical staff in the International Switching Systems Engineering and Product Development Department of AT&T Bell Laboratories, Naperville, Illinois. Natarajan works on Intelligent Network Architecture and Services. He joined AT&T in 1986 and holds a B.S. in Mechanical Engineering from the Indian Institute of Technology, Madras, and an M.S. in Mechanical Engineering from Ohio State University, Columbus.*

Ecaterina W. Scher *is a district manager for interentity planning in the AT&T Communication Services Group, Morristown, New Jersey. She is responsible for joint strategic and business development planning with AT&T Network Systems. She joined AT&T in 1977. Scher holds an M.S. in Electrical Engineering from Cornell University, Ithaca, New York.*

Phillip Y. Shih *is a member of technical staff in the International Switching Systems Engineering and Product Development Department of AT&T Bell Laboratories, Naperville, Illinois. Shih is working on 5ESS® Gateway Switch and International Advanced Services. He joined AT&T in 1984. He holds a B.S. in Engineering from the National Taiwan University, Taipei, and an M.S. in Electrical Engineering from the University of Southern California, Los Angeles.*

Peggy Marr Wainscott *is a senior product manager, International Switching Communications Management department, AT&T Network Systems, Naperville, Illinois. She is responsible for promotions management of the AT&T Intelligent Network product line in international markets. She joined AT&T in 1985. She received a B.S. in Computer Science Engineering from the University of Illinois, Champaign/Urbana.*