

A Broad Path for Network Migration: BISDN Products and Services from AT&T

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The ultimate goal of AT&T's strategy for broadband products and services—an integrated communications infrastructure that will make multimedia communications as ubiquitous and easy to use as traditional telephone service—may be revolutionary in its effects on commerce, education, health care, entertainment, and many aspects of everyday life. But evolution, not revolution, is the path to that goal. Together with its leadership in asynchronous transfer mode (ATM) technology, the cornerstone of multimedia networking, AT&T offers realistic, flexible options for the evolution of today's heterogeneous networks—whether private or public, optimized for data, voice, or video—toward a future technology infrastructure of broadband integrated services digital networks (BISDNs) based on ATM. In surveying some of the major product and service plans of AT&T Network Systems Group (NSG) and AT&T Communications Services Group (CSG), this paper presents a broad evolutionary path for migration to BISDN.

Introduction

Broadband ISDN based on ATM is a part of the technological underpinning common to several of AT&T's strategic initiatives. For example, both high-bandwidth transport and service integration are key capabilities for the initiative in scalable computing, which combines open systems and networking technology to provide enterprise-wide solutions. Some aspects of the initiatives in data communications and in multimedia messaging require the same capabilities. And evolution to BISDN is essential to the fruition of the visual and multimedia communications initiative—a drive to enable inexpensive video communications, a range of interactive multimedia services, and high-definition television—no less essential than AT&T's leadership in digital video compression technology.

With the aim of providing not only the long-range vision but also a broad path for the gradual migration of today's networks toward BISDN/ATM, AT&T has created new internal organizations and forged external alliances that focus on this technology. AT&T Network Systems Group has pooled its prime competencies from its switching, transmis-

sion, and data networking experience to design an ATM-based product line to meet the needs of end users and service providers. A complementary thrust within AT&T Communications Services Group (CSG) has created a new organization to plan and implement a multimedia broadband network to offer multimedia services to business customers. AT&T-CSG is joining forces with new industry partners to address the near-future needs of the market for high-bandwidth connectivity and service offerings.

Network Systems Group: An Integrated Services Approach

AT&T Network Systems Group has introduced a set of products, designed with evolution in mind, which can meet customers' needs without jeopardizing their network investment. The GlobeView-2000™ Broadband System offers the elements needed to integrate the combination of data, images, video, and voice that will characterize communications traffic on the information superhighway. A modular digital system based on advanced cell-relay technology, the GlobeView-2000 Broadband System can

synthesize the elements in today's switching and transmission system environments.

The heart of the GlobeView-2000 System is its high-capacity, modular Service Node. This central element of the system consists of a high-performance ATM switching fabric, numerous network interfaces, and a local fault-tolerant controller. The switching fabric, which is the switching and data-storage core of the Service Node, serves as a shared memory, with a port buffer that is shared among multiple ports. Patented by AT&T, this switching fabric offers highly efficient data storage, exceptionally high reliability, and unmatched performance.

Depending on customer needs, the Service Node can be configured with a capacity of 2.4 or 20 gigabits per second (Gbits/s), with multiple priorities for cell loss and delay. AT&T's implementation of the shared-memory design makes the system extremely robust and ensures that combinations of bursty packet data traffic and circuit-oriented traffic can be carried at peak rates without degradation in performance. The modular design of the shared-memory switching fabric allows expansion beyond 80 Gbits/s.

The 2.4-Gbits/s configuration of a Service Node offers a low-cost alternative to enable service providers' entry into the high-speed data applications market. Using this configuration, innovative service providers can deploy a modular and cell-based access platform at the edge of the network, offering revenue-generating services to "early adopter" customers. The 2.4 Gbits/s configuration employs the same robust switching fabric and integrated network management features of the high-capacity Service Node 20-Gbits/s configuration. As demand for high-speed and multimedia services grows, investment in the Service Node 2.4 Gbits/s system is protected. To meet growing needs, the system can be easily upgraded with additional switching capacity. It can also be integrated with networks that are currently providing SMDS and frame-relay services.

For businesses that depend on information transfers, network reliability and performance are critical. In the Service Node, all elements that affect service are duplicated, including the shared-memory fabric and the node controller. This design ensures that service will continue regardless of any system problems.

The Service Node can support multiple circuit packs with various types of functions, interfaces, and protocols, including ATM user-network interfaces (UNIS)

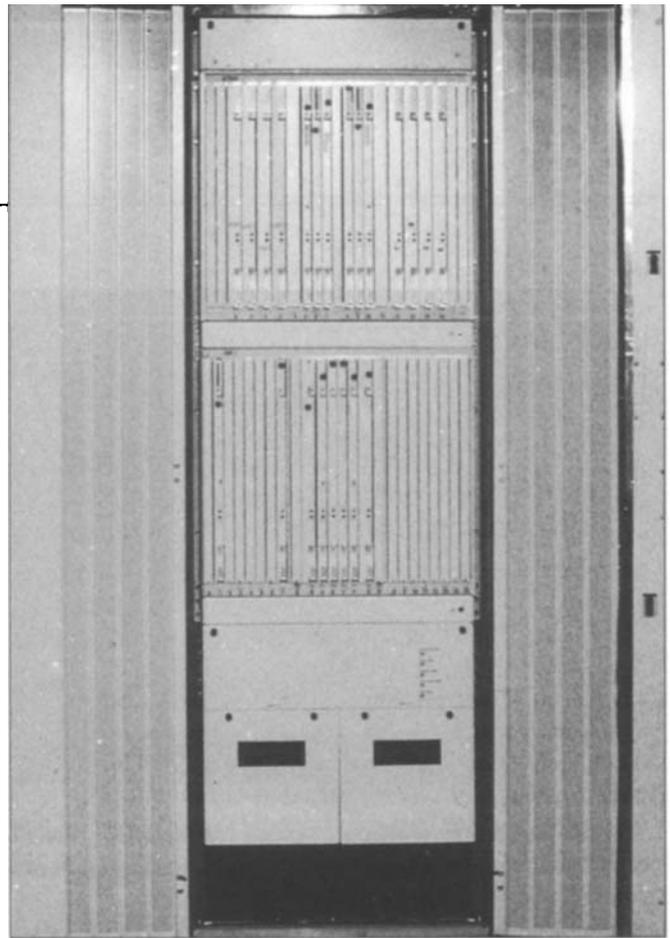


Figure 1. This Service Node fabric cabinet houses the GlobeView-2000 System's shared-memory fabric and interface cards.

and network-network interfaces (NNIs), high-speed interfaces—including DS3/E3, STM-1/1e, STM-4, OC-3, OC-12, and OC-48—as well as multimedia bridges, video servers, and data servers.

The module responsible for integrated network management in the GlobeView-2000 System is the Service Management Module. It offers an intuitive, customizable graphical user interface with advanced open-systems, object-oriented software and is based on Telecommunications Management Network (TMN) standards for operations, administration, maintenance, and provisioning. In addition to comprehensive management for the GlobeView-2000 System, this module provides fault tolerance that is scalable according to network size and needs.

The Service Management Module offers a range of traffic profile options that go beyond the policing parameters defined by the ATM Forum. Traffic policing is implemented using a virtual scheduling algorithm, which enables the service provider to allocate and manage the Service Node bandwidth in a cost-effective manner. Based on the UNIX® operating system and the BaseWorX™ applications platform, the Service Management Module



Figure 2. The GlobeView-2000 Service Management Module makes provisioning functions accessible through an easy-to-use, point-and-click graphical user interface.

offers standard interfaces to local exchange carriers' operations support systems.

The Service Management Module can be located with a Service Node or at a remote site. For a local Service Node, a Maintenance Module workstation provides special functions, such as node initialization and recovery; disk storage, backup, and failure recovery; and local troubleshooting. A local node is connected to either a Maintenance Module or to a Service Management Module, which can provide similar local functions as well as overall network management.

The Access Module can be configured to provide access and support for most major applications, including data networking services, entertainment video, and cost-effective network infrastructure solutions for ATM and STM in both synchronous optical network (SONET) and synchronous digital hierarchy (SDH) environments. A video multiplexer will terminate SONET OC3c channels and perform MPEG2 transport stream multiplexing for efficient distribution of entertainment video services.

The Switched Services Module supplies real-time call processing, signaling, and control for BISDN. This module offers rapid deployment of switched services, access to a full range of provisioned services, and integration with other intelligent network elements. Additional advantages include redundancy of hardware elements, fault-tolerant control, the ability to select levels

of capacity and service quality, and real-time status updates. In the future, switched services will make it as easy for a casual user to set up a multimedia call as it is to make a telephone call today.

A Portfolio of System Configurations

The GlobeView-2000 portfolio enables network and service providers to combine system modules in configurations tailored for specific types of applications and to deploy broadband and ATM capabilities with maximum effectiveness. All three configurations—the ATM high-speed data system and services configuration known as GCNS, the ATM bandwidth management system and services configuration known as AXC, and the ATM system for switched services known as BSS—fit smoothly into existing networks.

In keeping with the goals of the GlobeView-2000 System, all configurations are designed to preserve and extend the value of current network investments while allowing the simultaneous development of new services and capabilities. They allow the modular elements of the GlobeView-2000 System to be used as required to meet the needs of network operators and service providers around the world.

With the GlobeView-2000 System, all functionality can remain in place indefinitely or can evolve as the network evolves. In other words, functionality is not replaced, but enhanced, when and where the needs of the service provider require it. Unified OAM&P, ease of service creation, and the best-in-class technology are the qualities embodied in this AT&T product offering. Its evolutionary approach enables the rapid deployment of new services in a flexible and cost-effective manner. For example, the Switched Services Module can be easily added to an existing GCNS or AXC and networked to enhance service capabilities. This allows service providers to offer permanent virtual circuits (PVCs) today and a migration path to switched virtual circuits (SVCS) without compromising their investments.

Communications Services Group: Planned Evolution

To guide today's customers onto the evolutionary path to BISDN, AT&T-CSG plans to enhance its Inter-Span[®] services network to offer frame-relay services on ATM, as well as native ATM data services. At the same time, AT&T-CSG is deploying a new infrastructure network to provide future multimedia services.

AT&T-CSG is establishing strategic alliances and partnerships to implement and provide early BISDN/ATM services. AT&T-CSG and its industry partners consider ATM to be the fundamental technology for providing future high-speed, multimedia capabilities to users' local and wide-area networks. As in the approach taken by AT&T-NSG, ATM implementation will be through an evolutionary process providing investment protection for customers and a smooth transition, which will allow the migration of individual customer locations to ATM at a pace that is consistent with the customer's business needs.

AT&T-CSG and its partners are cooperating on the definition of standards and the specifications of products and services to support ATM. The first area of collaboration will be ATM-to-frame relay interworking, which will provide connectivity among frame-relay devices, native ATM devices, and an ATM wide-area network. AT&T-CSG and its partners recognize ATM-to-frame relay interworking as a key component in the development path to BISDN/ATM, and have begun working to specify, develop, and deliver this capability. ATM-to-frame relay interworking will permit users to continue deploying frame relay today without fear that their investments will become obsolete. Users will be able to add ATM connections to existing enterprise networks when and where they are justified. AT&T-CSG views ATM networking as a natural and graceful extension of the InterSpan Frame Relay Service.

Frame-relay services will be provided in a multi-band environment, with sufficient speed and bandwidths available for every application — from low-speed data through high-speed data. The fully evolved AT&T-CSG network will employ core ATM switching provided by AT&T Network Systems. AT&T and its partners will provide narrowband and broadband cell-relay switches with ATM and frame-relay capabilities. AT&T NCR will integrate ATM technology into the endpoint and intermediate system routers and bridges. AT&T NCR and AT&T Paradyne will provide the premises equipment. AT&T-CSG will integrate these technologies and provide end-to-end ATM network services and ATM-to-frame relay networking. AT&T Global Business Communications Systems (GBCS) will further enhance the capabilities of its PBXs to manage multimedia, voice, video, and data traffic.

The migration to BISDN is expected to start with higher bandwidths for existing services, accompanied by newer services that allow multipoint and multiconnection

communication. Additional work is in progress to finalize the standards for new services, as well as for voice and video support over ATM. Some of the technical issues facing such services, including echo cancellation, jitter, and synchronization between voice and video signals, have yet to be resolved. Nonetheless, to meet the needs of the market, AT&T-CSG is planning to implement a Multimedia Broadband Network (MMBN).

Due to a remarkable convergence of enabling technologies, the voice/e-mail/fax "call of today" will evolve to become the "multimedia call of the future." This multimedia call combines voice, video, image, text, data, and animation. Many companies believe multimedia will become the core communications vehicle of their firms. MMBN, using a new technology infrastructure, will support the multimedia call of the future. MMBN services will be based on an ATM platform that utilizes SONET transmission.

A Survey of MMBN Services

Multimedia Virtual Network (MVN) service allows AT&T to offer its business customers multimedia call functions and capabilities equivalent to those of a private network without requiring dedicated resources. The time sharing of network resources in a Multimedia Virtual Network results in overall savings due to the more efficient usage of facilities, the benefits of the combined engineering of facilities, and the economies of scale. These savings allow AT&T to offer MVN services at rates that are economically attractive to customers, with new revenue opportunities and a market alternative to private network offerings. The MVN approach also facilitates maintenance of network operations.

Multimedia Virtual Network service provides users with simplified dialing among themselves via a private numbering plan, and increased privacy in communications via appropriate blocking of calls. In addition, MVN service has the following potential benefits for the subscribing customer:

- reduced cost of service through volume discounts depending on the traffic committed to the MVN,
- increased flexibility in the configuration and reconfiguration of the MVN via a central operating point, which can be operated by the customer using a service-creation environment, and
- customized billing arrangements that include call-detail reporting.

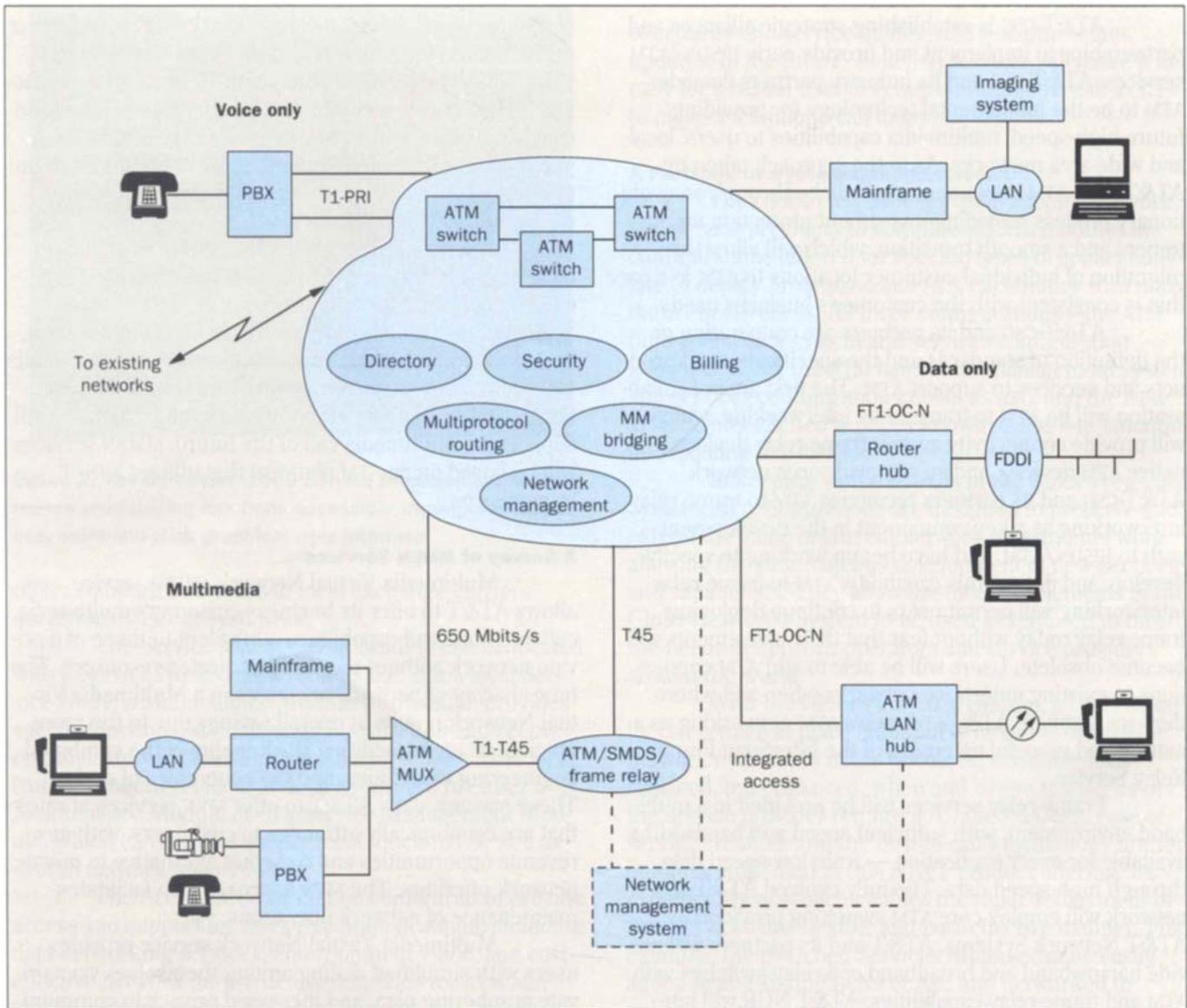


Figure 3. The Multimedia Broadband Network (MMBN) is a general architecture that offers a variety of types of access, and interaction with a variety of intelligent networking services, based on ATM switching and SONET transmission.

Service features provided by MVN—such as a private numbering plan, off-net calling, authorization codes, selective barring, and variable routing—apply to multimedia or single-medium calls including voice, video, and data. These features can be assigned line-by-line to users

on the basis of E.164 numbers identifying individual lines.

Virtual Meeting Service (VMS) is the equivalent of conference calling in the voice environment, augmented to support multimedia connections. The VMS provides a meeting environment similar to real face-to-face meetings. Based on a multimedia desktop conferencing system, VMS allows a group of people to hold real-time discussions in which they share voice, video, and data information over long distances. VMS provides call-management mechanisms for its users and coordinates

communications in various media during conferences. Participants can be added, dropped, or placed on hold during a conference. VMS can manage conferences with a mix of devices, including both computers and telephones. Conference participants with appropriate monitors may see each other and also share displays of visual information. Computer programs associated with VMS conferences produce identical displays on the computer screens of conference participants. Conference participants with conventional telephones can join the conference, sending and receiving only the voice signals.

Aspects of another MMBN service, known as Universal Messaging, already exist in the form of voice mail and electronic mail. The new ingredient that completes this service is video mail. Universal Messaging Service allows users to leave video messages for each other, including computer data and images. The Universal Messaging Service includes a database where subscribers will have a bin consisting of a certain amount of memory predetermined upon subscription. The memory size determines the maximum length of stored video messages and the number and resolution of stored images. The subscriber's bin is accessible via access codes and personal identification numbers (PINs). Messages can be routed to this database on the basis of a number of conditions that might exist at the time of an incoming multimedia call. The caller may choose to place a multimedia call in the called party's bin with a time stamp to be delivered at a specific time in the future. Under any conditions triggering Universal Messaging Service, the user should be informed about the presence of a multimedia message via either an audio or visual indication, depending on the type of terminal equipment used.

Multimedia 800 Service extends the voice 800 services to include multimedia calls. Initial Multimedia 800 services offered by MMBN will be less numerous and complex than current 800 services. They will include calls that are toll-free to the calling party, where the subscriber is billed a fee based on expected usage in terms of traffic, calling areas, and quality of service. Also, they will offer variable routing, in which incoming calls can be routed to different destinations nationwide on the basis of time of day, day of week, holidays, and calling party number identification. Calls can be single-medium (including voice, data, or video) or multimedia.

Customer Network Management Services allow the service subscriber to control and manage the differ-

ent services and features available to its multimedia stations. In the context of MVN, the service subscriber can assign features that are part of the MVN service to individual stations. These assignments can be updated as needed. The subscriber will have access to an operations and management center that provides on-line provisioning of services and trouble-tracking capabilities. Traditional network-management functions, such as testing and loopback, fault detection and isolation, and automatic restoration, are also provided to the customer. Network modeling, capacity planning, and service customization via a user-friendly service creation environment are also supported.

Finally, because it cannot exist in isolation from the present voice networks, MMBN is designed to interwork with them in supporting voice services. Users at MMBN stations must be able to communicate with users served by the current public switched telephone networks. Voice equipment, such as that used to provide echo cancellation, tones, and announcements, will be supported. Current voice services are numerous and will not be all supported in the initial implementation of the MMBN; however, the voice services that are most widely used will be supported. Services such as Call Forwarding, Call Transfer, Incoming Call Indication, Three-Way Calling, Call Hold, Call Pickup, Calling Card Service, Collect Calls, and Third Number Billing will be available, and not for voice calls alone. These services will also apply to multimedia calls when appropriate.

A Commitment to the Customer

The NSG and CSG product and service offerings surveyed here do not by any means represent AT&T's total contribution to ATM. They do, however, plainly illustrate AT&T's commitment to a broad, evolutionary path capable of accommodating diverse customer needs. They also demonstrate AT&T's understanding that the competitiveness of any customer's enterprise depends equally on preserving the value of present investment, introducing new capabilities in a timely manner, and building the advanced technological base it will need to compete successfully in the future.

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