AT&T Switching Systems: An Overview

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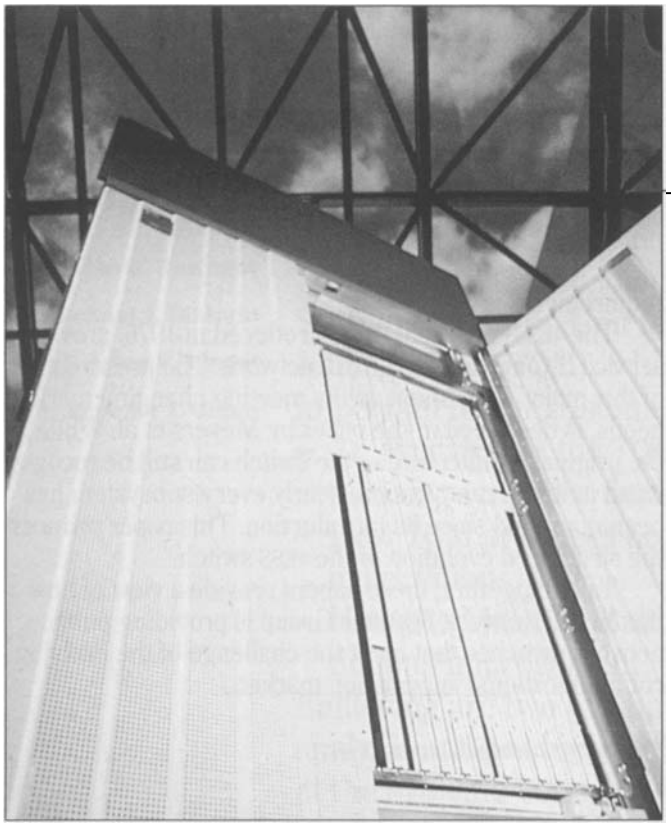
The state of switching in AT&T reflects the state of the business in telecommunications. Both have been transformed by the effects of globalization, deregulation, the merging of technologies and industries, and the growing demand for customized solutions and rapid response to customer needs. When AT&T installed the first 5ESS® digital switch in 1982, the role of that state-of-the-art system was local switching of voice over wireline loops. Today, the traffic handled by the 5ESS switch includes data, graphic images, and video as well as voice, and the system's role has broadened to include local/toll, operator services, international gateway, intelligent network, and wireless communications applications. Another instance of an industry trend reflected directly in AT&T switching is the GlobeView™-2000 Broadband System, the asynchronous transfer mode (ATM) system introduced by AT&T in 1993. ATM embodies the merging of computer and communications technology, and it enables network providers to meet the new demands of converging markets by handling high-quality video, high-speed data, multimedia, and voice on a single platform. This issue of the *AT&T Technical Journal*, dedicated entirely to switching, provides a snapshot of the state of the art and insight into the state of the business.

Introduction

In the last decade, new forces have emerged to challenge traditional telecommunications solutions. One of these is the merging of computers, communications, and entertainment; another is the deregulation or privatization of national telecommunications networks. Customers around the world face unprecedented choices in their information sources. The telecommunications industry must benefit users everywhere, independent of their home network or home nation. This global imperative has emerged as businesses have grown from national to multinational and as customer focus has grown from domestic to international. New technologies and operational paradigms are emerging to help satisfy the customers' needs. Switching systems supporting this increasingly sophisticated and more global market must provide capabilities for increasingly complex and customized services. They must do this with ever higher quality and lower cost. Response to customers' needs must be increasingly quick, and reliability cannot be compromised.

A primary business driver is the ever-increasing importance of information in giving a commercial enterprise an advantage against its competitors. This is true both for network service providers and for their customers. As new services become ubiquitous, they can no longer provide differential competitive advantage. Thus, forward-looking enterprises require the continual introduction of new communications/information capabilities to maintain competitive advantage. These capabilities must be specific to the customer's needs and must be available on a timely basis.

The solution to meeting these needs can be characterized in many dimensions. Bandwidth requirements range from narrowband to wideband to broadband. Mobility requirements extend from fixed to low-



mobility to full-mobility. The size of solutions to meet customers' needs ranges from small to very large, and the complexity of services that must be provided ranges from plain old telephone service to data, image, and multimedia. In developing nations, the introduction of digital switching may be the essential component of the solution.

A successful public network switch supplier must make available rapidly to the service provider a solution customized to the end-user's needs. Because the solution is essential to the enterprise's success, it must have very high reliability. Flexibility, speed of response, cost-effectiveness, quality, and reliability are major drivers in the trend to more modularity and a layered, distributed architecture. They also are major drivers toward the use of service creation in network architectures and the separation of the service-control and connection-control functions. The emergence of ATM switching is placing greater emphasis on, and is engendering changes in, such functions as routing, signaling, and billing.

In This Issue

Papers in this theme issue deal primarily with the challenges associated with the switched public networks, and describe the manner in which the AT&T Network Systems Group meets these challenges.

The customer-driven integrated approach to Total Quality Management (TQM) described in the paper by Urban et al. makes it possible to achieve and maintain the required very high levels of quality and reliability. An overview of the TQM system, identifying eight system elements and focusing on policy deployment and process management as key elements for driving improvement, is presented. Two examples of process quality improvement are provided, as is a discussion of the Customer Value Added (CVA) concept.

The paper by Sneed et al. defines the functional components of a switching system, examines the architectural choices for implementing them, and presents a historical perspective of various switch architectures. The 5ESS switching system, the flagship of AT&T's line of switching products, is shown to have an architecture that is both evolvable and maintainable. This means that the architecture allows the addition of new technology and new development processes within the overall structure, while allowing us the continuous addition of new functionality without rapidly escalating development cost.

Holland et al. describe the 5ESS-2000 platform. This platform not only supports today's service needs, but at the same time supports future applications requiring enhanced processing capacity, performance, reliability, and OAM&P (operations, administration, maintenance and provisioning). Development process improvements yielding shortened product realization intervals and improved product quality are discussed.

Crabill and Kukla focus on service processing, explaining how market forces are driving toward increasing use of service processing systems to provide telecommunications services. Their paper highlights the intelligent network, voice recognition, and service creation technologies available now, and it describes how these technologies can help meet the service processing needs of telecommunications service providers and their customers.

It is expected that the evolution of broadband switching will be driven by consumer as well as business broadband applications. Yoder et al. describe how broadband functionality can be realized by the economical and timely introduction of ATM-based networks and services into traditional and new markets. The ATM platform building blocks are presented, together with a description of how these can be implemented economically in both new and existing networks. The authors further discuss how ATM will allow the merging of voice, data, and video into one homogeneous network.

Wilson and MacNamara survey the use of the 5ESS switch in key wireless applications throughout the world.

Their paper explains how the 5ESS distributed modular architecture provides a mobile switching center platform for wireless applications, including digital cellular and personal communications services (PCS). Current and projected views of the U.S. wireless market are provided. Particular emphasis is given to the provision of code-division multiple access (CDMA) Advanced Mobile Phone Service on the 5ESS-2000 switch.

Switch manufacturing has become highly customer focused because of the nature of both the market and the product line. Arms et al. explain the use of customer satisfaction metrics to drive manufacturing processes, presenting examples of manufacturing for quality and reliability. Manufacturing for the global customer also is discussed.

Hinterlong and Hall examine the use of photonics to relieve the electronic interconnection bottleneck in future large broadband switching systems. Photonics allows chip-to-chip and board-to-board communications at high rates to support building large switching fabrics. The authors discuss the use of state-of-the-art photonics in a switch capable of routing, in real time, ATM cells received from 622 megabits per second (Mbit/s) lines transmitted through a switching fabric that has 256 inputs and outputs.

An overview of the new generation of multimedia applications being planned and deployed is provided in the paper by Katkar et al. These applications are broadly categorized as multimedia collaboration, multimedia information services, video-on-demand, and multimedia messaging. The characteristics of these business and consumer applications are analyzed in terms of bandwidth, performance and functional requirements. A comparison of switching techniques for meeting these requirements is provided.

The 4ESS™ switch, first introduced in 1976, provides service throughout the AT&T network. The preservation of this major investment, while meeting changing market needs, is described in the paper by Meyers et al. While the original architecture of the switch can still be recognized in its current version, nearly every subsystem has been upgraded since its introduction. This paper retraces the structured evolution of the 4ESS switch.

Taken together, these papers provide a view of how the AT&T Network Systems Group is providing public network switches that meet the challenge of the evolving communications/information market.

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