

An Uneventful Event



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During the 16-month period ending in April 1995, the 1A central processors in the 135 No. 4ESS™ switches that constitute the backbone of AT&T's network were replaced with new, more powerful 1B processors. To the uninformed, this does not sound like an extraordinary accomplishment. In

reality, however, each individual processor upgrade was the equivalent of a delicate brain transplant operation. Anything less than faultless execution of the "operations" could have created a serious network incident, thereby damaging the track record of reliability that is so important to both AT&T and our customers. In addition, had the new software not been exhaustively tested, an unusual network condition could have triggered a service problem after the initial cutovers. None of these possibilities came to pass. From the standpoint of our customers and of the news media, all of what took place was a non-event. Precisely for that reason, within AT&T it was a big event indeed—one whose full story is worth telling in this special issue of the *AT&T Technical Journal*.

The great success described above was a direct result of the hard work and outstanding teamwork among many individuals in AT&T's Communications Services Group (CSG) and Network Systems Group (NSG). As the Group Technical Officer for CSG, I would like to

express my gratitude to everyone who played a part in making this possible. Having begun with the happy ending, I would like to go back and provide a brief perspective on some of the events that led up to this success, as well as some of the challenges that lie ahead.

The first 4ESS switch, placed into service in January 1976, was at that time the highest capacity digital switch in existence. It was able to terminate 107,000 trunks and was conservatively rated to handle half a million calls per hour, capabilities made possible by its state-of-the-art 1A processor. The 1A processor had a 700-ns cycle time—unheard of 19 years ago! Throughout the next decade, the 4ESS switch proved its mettle. It became the great workhorse of the network, always able to accommodate any new service, always there with capacity to spare.

In the last half of the 1980s, this began to change. Coincident with the divestiture of AT&T's local operating companies, this period also brought the hot breath of long distance competition and increasingly sophisticated customer needs. Spurred by these pressures and by advancing technology, in the mid-1980s AT&T introduced a rich array of new services and capabilities. These advanced services and capabilities—among which were dynamic non-hierarchical routing (DNHR), advanced 800 features, and Software-Defined Networks—raised the average amount of processing required for each call and reduced the effective number of trunk terminations and busy-hour calls

that the 4ESS switch could handle. Suddenly its inexhaustible capacity was challenged! Indeed, a single new class of services—Positive Call Processing (PCP) services, which first began to be studied in the late 1980s—threatened to use up all the remaining data storage capacity of the 4ESS switch.

As the processing resources of the 4ESS switch became scarce, and as competition required increasingly rapid development of new services, the need for a significant increase in capability became urgent. A variety of alternatives were considered for dealing with the problem, as described by J. C. Hsu and L. A. Seese in the paper that follows. The debate was intense, and it included changes that could have been extreme. Ultimately, the development and deployment of the new 1B processor became the agreed-upon solution, and the rest became the history recorded in this issue of the *AT&T Technical Journal*.

The last 1B processor retrofit in the AT&T network took place in late April 1995, when the 4ESS switch in Reno, Nevada, was upgraded. With this last link in place, customers are able to enjoy many benefits. For example, the increased real-time capability that the 1B processor provides will again enable us to use all 107,000 of the 4ESS trunk terminations. Additional real-time capability will allow database queries to be made for more calls, accommodating new services and offering existing services to more customers. Increased data storage capacity will extend capabilities such as customer account codes and geographic dialing restrictions to more business customers. Finally, the additional memory of the 1B processor will support a variety of new features and services, including more announcement and speech recognition capabilities.

The full deployment of the 1B processor is indeed an event to celebrate. As usual in competitive

markets, however, the celebration must be short, for even bigger challenges lie ahead. As the telecommunications industry prepares for additional massive restructuring, the AT&T network will undergo its own extensive change. New technologies—such as asynchronous transfer mode, synchronous optical network (SONET), wireless, and others—will be essential to the vitality of the network. AT&T is already planning to meet these needs, and the impact will fall not just on the 4ESS switch and its eventual successor, but also on every element and operating system in the AT&T network. These are daunting challenges indeed. Fortunately, the key to success is nothing more than the kind of diligence, dedication, and teamwork that resulted in the development and faultless deployment of the 1B processor. As you read the papers in this issue, I think you will see what I mean.

