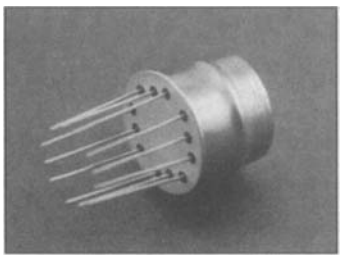
AT&T INNOVATION BRIEFS

The briefs in this section are summaries of recent discoveries and developments within AT&T Bell Laboratories. AT&T readers who would like to contribute future items, and readers who would like further information as well, are encouraged to contact the AT&T Technical Journal *editor.*

Frame Relay Backbone Service Gets Upgrade, Engineering Guidelines

AT&T's Frame Relay Backbone Service (FRBBS) is being offered by AT&T Business Communications Services as a new high-speed packet service for internal AT&T business units. The service is based on the AT&T BNS-2000 fast-packet switch that is designed and manufactured by AT&T Network Systems. The BSN-2000 switches are domestically deployed and interconnected by ACCUNET® T45 (45 Mb/s) trunks. AT&T's InterSpan® Information Access Service, one of the first customers for this network, uses the FRBBS for transport between its dial service complexes. Located in AT&T central offices, these complexes support communications between local dial-in users and host computer services that reside on customer premises in various parts of the country. They accept ASCII/SLIP (American Standard Code for Informtion Interchange/Serial Line Internet Protocol) information, encapsulate it in frame relay frames, and send it over the network to a host site that supports the user session. Upon analyzing the FRBBS network performance, AT&T Bell Laboratories researchers discovered that response-time delays exceeded the maximum delay that some specialized customer applications could tolerate. Enhancements were made to two interrelated scheduling algorithms to achieve lower delay characteristics that met the applications' requirements. Additional analysis led to engineering guidelines for maintaining the network, managing congestion, and determining when new facilities are needed.

New Breakthroughs for Thin-Film Transistors



Packaged organic thin-film transistor

Thin-film transistors (TFTs) with organic active layers have recently become very interesting for a number of applications such as low-cost digital circuits and active matrix displays. This interest is chiefly stimulated by the low costs associated with the fabrication of systems based on such devices. Organic active layers are also inherently more compatible with plastic substrates than their inorganic counterparts. Recent breakthroughs by AT&T Bell Laboratories researchers have improved the performance of organic transistors to levels that warrant their serious consideration for the above applications. With the organic compound α-hexathienylene, TFTs with field-effect

mobilities of 1-4 x 10^{-2} cm^2/V-s and *on/off* current ratios of $>10^6$ (the highest for any organic TFT) have been obtained. A high *on/off* ratio, an important requirement in most applications, has been one of the biggest challenges in the emerging field of organic TFT technology. The researchers have also demonstrated the first organic complementary transistors. These devices, which operate as either *n*-channel or *p*-channel transistors depending *only* on the sign of the gate-source voltage, utilize two organic active materials in a unique device structure. When fully developed, this technology is expected to simplify the realization of organic TFT-based digital solid state circuits.

Advances in Digital Coding of Audio Signals

The perceptual audio coder (PAC) developed at AT&T Bell Laboratories provides CD-quality stereo at compression rates in the range of 10:1 and constitutes the basis for AT&T proposals for the technology of digital audio broadcasting. Recently, PAC technology has been extended to the compression of five-channel audio, which is expected to be prevalent in advanced television and in movie-theater audio systems. As in stereo-PAC technology, the multichannel PAC (MPAC) system uses the statistical and perceptual dependencies among the five channels (*left*, *right*, *center*, *left surround*, and *right surround*) to achieve CD-quality audio together with spatial realism with compression ratios in the range of 10:1. In a 1993-94 international contest for multichannel coding, MPAC was judged the best-performing algorithm, based on judgments of 45 expert listeners drawn from the BBC and Deutsche Telekom. MPAC provided transparent compression (a score of 4.5 or higher on a 5-point scale) of 5 out of 10 highly critical signals, at the coding rate of 320 kb/s. Corresponding scores for the Dolby algorithm (the proposed audio standard for HDTV in the United States) and the Philips algorithm (an early Motion Picture Experts Group, or MPEG, standard) were 1 out of 10 and 0 out of 10, respectively. As a result of this success, the AT&T-MPAC algorithm is expected to play a prominent role in a multichannel audio coding standard to be recommended by MPEG in 1996-97.