PACKET

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TECH

Where Streams Converge

If you want to catch the hot new trends in networking, poke around MAE West.

Walk into the generic office tower at 55 Market Street in downtown San Jose and take the elevator to the 11th floor. If you can get past security, you'll find yourself standing at one of the busiest thoroughfares on the Internet.

This is MAE West, the Internet Metropolitan Area Exchange point for the Western United States, operated by Metropolitan Fiber Systems. At the end of August, I took a field trip to MAE West and brought along my Epson PhotoPC digital camera to bring you this rare inside look.

MFS is what telco insiders used to call a "cream-skimmer." Founded in 1988, the company zeroed in on one of the most lucrative and fast-growing segments of the telecom industry: high-speed data circuits. Companies use these circuits for their internal voice and data traffic, to connect LANs, and to bypass the Baby Bells and connect directly to long-distance carriers such as Sprint and MCI.

As a result, the company's growth has been nothing less than meteoric. In less than seven years, MFS has laid 3,183 miles of fiber-optic cable to more than 5,720 buildings in 52 metropolitan areas around the country. The day I began this article, MFS announced that it was merging with Worldcom Communications to create a new nationwide business offering local dial tone, metropolitan phone service, and nationwide dialing. The result is an infrastructure much like the old Bell System, but entirely digital.

The MAEs got their start late in 1992, explains MFS network architect Steve Feldman: "A group of network providers in the Virginia area got together over beer one night and decided to connect their networks." But rather than buying a big router and putting it in the middle, like the Commercial Internet Exchange, the companies bought their own routers and

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enough current to kill everybody in HotWired's offices.

put them all on the same network - a virtual Ethernet, a metropolitan high-speed LAN interconnect over DS3 provided by MFS.

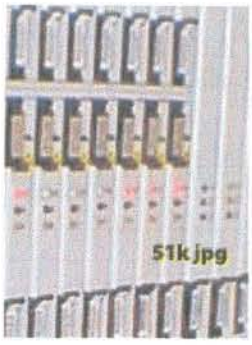
"The idea was that we would put a drop - it looked like an Ethernet plug - into each of their premises. To them, it would look like one big Ethernet," says Feldman.

That was MAE East, still the largest MAE of them all, with more than 80 ports on three virtual LANs. The MAE system gives the Internet service providers a single relay point where they can exchange packets. It's a sensible alternative to the system that preceded it - a series of expensive point-to-point connections between the backbones of the various Internet providers. But buying membership into the virtual LAN doesn't guarantee that the other members will accept your packets, an arrangement known as "peering."

"The peering policy at the MAEs is pretty much that there is no policy," says Feldman. Once you buy your space at the MAE, you still need to make individual arrangements with all of the players to exchange packets with them. Increasingly, the larger providers are only exchanging packets with their own customers.

And oh, what a customer list! The MAE West connectivity map reads like a *Who's Who* of the Internet. Of course you'll find the giants: MCI, Sprintlink, BBN Planet, CERFnet, and PSInet. There are regional providers like Whole Earth Networks and Internex. What I found especially interesting, though, was the list of providers that I had never heard of: EuroNet, Exodus Communications, and NSN.NET (which specializes in satellite-based Internet communications). If you want to predict hot new trends in Internet infrastructure, you should poke around the MAEs.

MFS actually has two major facilities on the 11th floor. Financially, the more important one is the MFS node, a termination point for hundreds of fiber bundles that wrap around the entire San Jose area. The fibers run SONET, an ultra-high-speed protocol that uses a pair of fiber rings to create a fault-tolerant network. Rings from 55 Market Street stretch to many of the buildings in the area and to other nodes in Palo Alto, San Francisco, Oakland, and Foster City. The company's fiber-optic bundles literally ring the bay.



My guide, Andrew Wong, wouldn't let me take a picture of the entire node: The amount of rack space would tip competitors off to MFS's fiber capacity in the San Jose area. But he did let me snap a photograph of an electronic cross-connect, which allows engineers to electronically unplug a fiber-bundle from one ATM switch and plug it into another. It's great for testing. The red lights indicate circuits that are having problems. Next to the cross-connect were several racks of Fujitsu FLM 2400 HS switches.

The MFS node can handle circuits as slow as a T1, and as fast as OC48 - a whopping 2.6 gigabytes per second traveling over single-mode fiber. With signals like that, the MFS engineers must do their utmost to limit the amount of electrical noise in the room, which is about the size of a small coffee shop. Alternating current is a no-no - it generates too much interference - so all of the switching equipment is powered with 48-volt direct current. Wong let me snap a photograph of the DC distribution system. Each of the red cables in the photo is thicker than a carrot, and carries enough current to kill everybody in HotWired's offices. (Not that this would ever cross my mind.)

Security at MAE West is good, but not great. All of the doors are locked, with a card key needed for entry. But there was nary a keypad nor fingerprint scanner in sight: a stolen card key would work just as well to get you in. Nobody searched my backpack or even bothered to ask me for identification. Some luddite terrorist using my name could easily have called MFS, arranged the tour, and then blown up the gigaswitch with a pipe bomb. (Not that this would ever cross my mind either.)

The equipment inside the MFS co-location cages is owned by UUNET Communications, which was one of MFS's customers until MFS bought the company for US$2 billion in stock. Other companies can buy space as well. A chain-link fence keeps curious fingers (like mine) away from this mission-critical equipment. Cables for power and data travel over the top.

MAE West actually started out in one of these 5-square-meter cages. Today the MAE spreads between two of them.

MAE West actually consists of two networks: an ATM network that can switch a billion bits per second, and an FDDI ring that's limited to 100 Mbits per second. Companies connect to these networks by Ethernet, FDDI, or ATM over OC3.

Today the MAEs are nowhere being overwhelmed by Internet traffic. But don't take my word for it. Every night, MFS posts a graph on its Web site that shows the total amount of traffic the MAEs passed in the last five days. The day I visited, the MAE West gigaswitch was zipping along at a perky 240 Mbits per second, and the FDDI ring was packing

40 Mbits per second. That's nowhere near capacity.

MFS now has MAEs in Chicago, Dallas, Houston, and Los Angeles, with Paris, Frankfurt, and New York coming up soon. Regional Internet exchanges are a good idea, and sooner or later every city will probably have its own.

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