University of California Upgrades with Air-Blown Fiber Communications Cabling System

Almost a decade ago, the telecommunications team at university of California, Riverside (UCR), determined that fiber optic cabling would be essential to provide the bandwidth needed to accommodate growth. One of the university of California's nine campuses, UCR's 1,200 acres lie at the foot of the Box Spring Mountains in Riverside, a city of 250,000 people in Southern California's Inland Empire. Today, UCR is experiencing the most dramatic growth in its history. With a current enrolment of 11,600 students, the university plans to accommodate 21,000 students by 2009 and is already laying the groundwork for its data LAN network to support that growth.

In the early 1990s, data communications were the immediate concern, with computer data transmissions and Internet connections on campus already beginning to skyrocket. However, there was also a growing interest in a variety of other potential applications, including a distributed telephone system, and video, security and facilities management systems.

UCR began its fiber optic cabling initiative, replacing its copper backbone with a fiber optic backbone and planning a conventional fiber optic campus network. Problems developed almost immediately, spurred by increasing demand and the complexity of the campus network configuration. In its serial bus topology, cables were installed serially from a centralized data hub in the Statistics and Computing building to 13 other key buildings requiring high-speed data support. As the cable passed through each building, strands could be dropped (for use in that building) or patched through to support downstream destinations. Unfortunately, the total number of strands was insufficient to keep pace with the rapid expansion of LAN connections. In addition, due to the large number of serial segments and subsequent patching requirements, performance problems began to occur - including aggregate signal loss, difficulty of diagnosis and repair, and excessive downtime.

UCR dramatically changed direction when the telecommunications department heard about Future FLEX, an innovative air-blown fiber (ABF) optic cabling system developed by Sumitomo Electric Lightwave Corp. Intrigued by the technology, UCR conducted extensive testing and detailed analysis before making the decision to switch over from a conventional fiber optic system to the newer, more flexible and less expensive ABF system. As a result of that decision, the university saved an estimated $2.5 million in construction and installation costs and realized up to $500,000 in additional savings over the next few years, said Michael Moreno, UCR's director of communications at that time.

The advantages of ABF According to Moreno, UCR's initial five ABF pilot projects were small-scale, providing an excellent environment for first-hand evaluation of the system. "Overall, in our test projects, the ABF system yielded about 44 per cent cost savings over conventional fiber optic system estimates," he explained. "Tests also revealed that the virtually stress-free air-blown installation process yielded superior results across the board in cable performance."

Once the pilot tests were completed, UCR committed to its first large-scale ABF deployment - replacing its conventional campus-wide fiber-optic backbone with ABF. This project was completed in four months instead of the twelve-month installation originally planned for conventional fiber. The cost savings for this project were equally impressive. Overall ABF costs reached $379,000, in stark contrast to the $3.5 million in expenditures forecast for a conventional fiber system.

Lower cost was not the only benefit of air-blown fiber. Performance improvements included better system reliability, reduced administrative time, and superior signal integrity resulting from point-to-point connectivity requiring no patching or splicing. UCR also realized dramatic increases in network flexibility and capacity.

Jill Hishmeh, UCR's current manager of communications, explains: "The ABF system includes important design features which, for us, resulted in 90 per cent surplus capacity to accommodate future growth. The system also provided for multiple routing paths to provide redundancy and virtually instant recovery if one route shuts down for any reason. With so much construction planned for the campus throughout the 1990s and beyond, this was a very desirable strategy that would have been far too costly to implement if conventional fiber had been deployed."

Efficient space utilization was another practical - and cost-saving - advantage provided by ABF technology. With the compact size of the cabling infrastructure, the FutureFLEX ABF system fit easily within the limited confines of UCR's existing conduit system. Because of this, the university was able to cancel plans for a costly and highly disruptive conduit system upgrade.

How ABF technology works The heart of the air-blown fiber optic cabling system is an infrastructure of rugged, flexible tube cables used in place of traditional innerduct. Each tube cable contains up to19 individually identified tube cells. The cells are joined in tube distribution units (TDUs) or junction boxes by using push-fit connectors to provide a direct route between the network hub and the application. The TDUs replace conventional fiber splice hardware at tube cable transitions and branching locations.

Once the network infrastructure has been placed, lightweight bundles of singlemode or multimode fiber are blown through a predefined route on a stream of compressed air or nitrogen, using a special blowing head device. Installation is fast and simple. The fiber is blown at speeds up to 150 feet per minute and can easily be accomplished by two trained technicians. Cable runs may exceed 6,000 feet, and the fiber path may traverse out door, riser and plenum tubes in a single run.

Since the fibers are blown and not pulled, no strain is exerted to cause immediate or future degradation. With point-to-point connectivity directly from the computer room or network hub to the application, ABF technology improves overall system reliability and provides optimum fiber performance.

At UCR, the tube cable was installed with more cells than currently required to ensure room for expansion. Unused cells are simply capped off within the TDUs. In this way, network expansion or reconfiguration can easily be accommodated by extending tube cables from the nearest TDU. Fiber changes are done by blowing cable through unused cells, or by blowing out old fiber (which can be reused) and blowing in new - all without disrupting the existing network.

UCR expands use of ABF Since the original installation, the university has added five new buildings on campus, run fiber to four more existing locations, and made numerous upgrades within existing networked buildings. Overall, UCR has increased its data transmission capacity by about 40 per cent - from a total of 64 to 150 fiber bundles, each holding two to 18 strands of fiber. With this expansion, the network is still only using about 25 per cent of available capacity.

Additional network upgrades have been implemented, as well. Aging shared 10 Mb hubs have been replaced with Cisco Systems' hubs to deliver full duplex 100 Mbps over the existing system. The LAN contains approximately 262 hubs and 7,000 networked devices. And, while only about one per cent of the system uses singlemode fiber, future upgrade plans call for using singlemode in all major node locations.

"One of the primary advantages of air-blown fiber technology is its ability to accommodate moves, additions and changes (MACs) that occur frequently in today's dynamic LAN," notes Hishmeh, "With that kind of flexibility, we have been able to build our network incrementally, expanding the system whenever and wherever we need. In this way, major design issues and capital investments can be deferred until actual needs materialize, and changes and additions can be made quickly and relatively inexpensively."

Cable reuse lowers the cost of MACs Since installing the ABF system, UCR's telecommunications department has been able to employ a cost-saving reuse policy. This policy consists of blowing fiber bundles out of the cable tubes to make way for new bundles. The previously deployed bundles are put on spools and saved for future use.

According to Hishmeh, this strategy continues to pay significant dividends. "We have a large amount of cabling recovered from a building being torn down that is now being used in another project to reroute cabling over four locations. Because of this surplus, we only had to buy new fiber cable for one of these runs. As a result, cable costs for the new project will be only about $5,000, as opposed to the $25,000 we would have had to spend for all new cable."

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