

# California City Uses FSO to Bridge 200-foot Gap

New free space optics connection cut cost, reduced user complaints in City of Beaumont

By Jonathan Amir ■ *MRV Communications*

**P**ushed to expand network services while keeping costs and taxes under control, many cities are taking a look at wireless technologies to boost bandwidth when local conditions make fiber tough to install and where buying bandwidth from incumbents is expensive. The backbone network, connecting users in multiple facilities, is often particularly tough. Users from multiple facilities must access centralized servers, but workers are often concentrated in areas that by definition are congested and heavily built-over.

Cities are also looking to Voice over IP to cut their phone bills while improving productivity. Incumbents are sensitive about VoIP, and realize that leasing bandwidth to cities may result in loss of switched telephone revenue. So cities have seen the price of leased circuits from their local telephone company rise dramatically. And, obviously, as the LANs in each building move to Fast Ethernet or even Gigabit Ethernet, relying on a 1.54 Mbps T1 circuit – or less – to link to the outside world is a recipe for user complaints.

This was the situation for the City of Beaumont. Located in the beautiful San Geronio Mountain Pass in Southern California, City of Beaumont boasts rural beauty and charm, combined with planned growth and abundant recreational opportunities. It's located between Los Angeles and Palm Springs and has a population of about 19,000.

In early 2005, Brian Modrak, the city's information systems manager, was fac-

ing a number of challenges. Beaumont's two main city facilities, city hall and the police department, were connected using a single leased T1 line. "Users were constantly complaining about network timeout and latency," he said. "Dealing with the bandwidth limitation between the two sites was hampering everyone's work."

The IT department was challenged to find a cost-effective way to upgrade network speed between the two main sites. The solution had to meet several stringent criteria set by the city:

*High Bandwidth:* The city needed to increase bandwidth to between 4 Mbps and 10 Mbps at a minimum. There are 50 users at each location; with plans for a rollout of VoIP and for additional IP-based security cameras, increasing bandwidth was critical.

*Security:* As the connection is between two sites that maintain very sensitive personal data on citizens, it was critical that the link be secure from snooping.

*Cost:* The solution needed to be no more expensive than the city's current

leased line network.

The IT department also hoped to complete the project with minimum interruption to all the other city departments.

## Solution

Todd McFarland, president of TMac Consulting, was selected by the Beaumont IT department to propose a solution. After weighing several options, he recommended free space optics (FSO) for the link. McFarland has been working with FSO supplier MRV Communications for several years and had successfully deployed FSO for other customers.

## What is FSO?

Laser FSO provides a communication link without having to lease a hardwired line. Furthermore, this technology does not require a license from the FCC. Additional benefits include quick deployment and reasonably high capacity, as much as 1.25 Gbps. There are many applications suitable for FSO, including campus networks, backup support, rural

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or congested-urban first-mile access, and disaster recovery. FSO can make fiber networks more cost-effective by bridging tough terrain such as the urban landscape, where digging can be disruptive and prohibitively expensive.

The city deployed a pair of 100 Mbps units with an integrated radio frequency (RF) backup. The distance between the two buildings is a short 200 feet. The 100 Mbps FSO is the main link and the 11 Mbps RF is the backup connection. This improves the reliability to 99.999 percent availability, because of the complementary nature of each technology: FSO is susceptible to interference from fog, but not from rain. The RF is susceptible to rain, but not to fog.

Connecting city hall to the police department at high speed allowed Modrak's IT team to move the bulk of its traffic-generating servers to one location. The benefits were substantial; it eliminated the need to travel from site to site, it increased the physical security of the servers because they were now located inside the police building, and it reduced cost since now the team needed to provide backup power to only one location instead of two.

FSO is a secure communication method by its nature. The infrared laser beam that transmits the data is narrow and invisible, making it nearly impossible to intercept. To tap into the data, a hacker must place himself between the two units and have a similar device that can receive the optical signal. This task is almost impossible and if tried would break the link anyway. RF radio's transmission, on the other hand, covers a wide area and anyone with a laptop and a wireless card can tap into the information being transmit-

ted. To overcome this problem many RF users are required to deploy expensive encryption appliances behind every RF device. This, of course, increases the cost of the entire project.

#### **Network Alternatives**

The city looked at a number of alternatives before deciding to deploy the FSO link. The most obvious alternative was to lease additional T1 circuits for data between the city hall and the police department. This option turned out to be too expensive – tripling the monthly operating expenses – while still not providing enough bandwidth for growth.

The city also looked at pulling fiber cables between the two buildings and constructing a high-speed backbone. This option, however, carried an extra price tag for trenching the streets, laying the fiber and resurfacing the roads. In the end, it was the inconvenience of shutting down the main street that tipped the scales against this solution.

“The idea of closing down a road that leads to the police department and is used by school buses ... was not favored

by many at the city,” Modrak said.

Within the next five years the city plans to relocate the police department to a different building. “If we had gone with fiber, the cost of installing it would be lost. With FSO, all I have to do is make sure I have power and fiber to the roof. Connecting the new building to the network is going to be very easy and will require only a minimal expense,” he added.

That's when he began to focus on a wireless solution. FSO was always on the table, but 802.11 Wi-Fi also seemed like a good alternative at first. But after carefully studying this option, the IT staff determined that the bandwidth from an 802.11 network was not sufficient for all of the city's needs.

Modrak said the analysis concluded that Wi-Fi could handle voice, but adding video and data traffic would overwhelm the network. And, the security standards available for Wi-Fi are not sufficient for sensitive city data.

#### **Installation Details**

FSO requires a line of sight between transmitter and receiver to operate. To achieve line of site at the City of Beaumont, the FSO unit was installed on a 40-foot tower at city hall. From this tower, the FSO unit is shooting down to the police department building at an angle.

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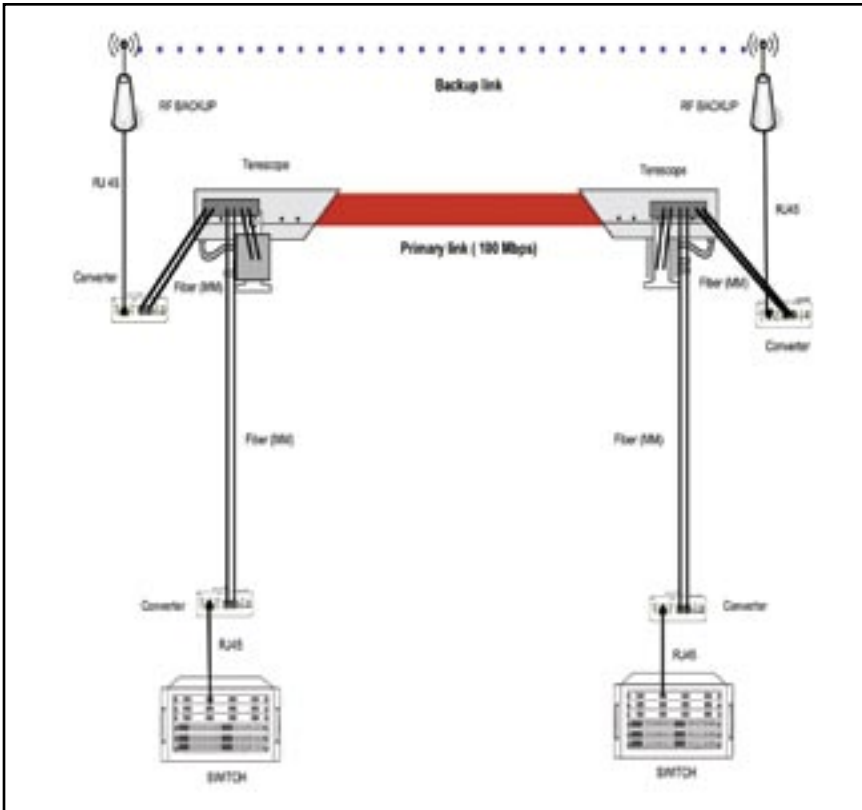


Diagram shows details of City of Beaumont's FSO and RF link. At city hall, the devices are tower-mounted. At the police station, they are on the roof.

### Detailed Engineering

The installation took two days. The first items installed were the mounting brackets provided by MRV. The mounts were installed at the exact spot marked by TMac engineers during the site survey. Next to the mounts the team installed a watertight enclosure to house the fiber and power cables. After that, the crew pulled power and fiber cables from the network closet inside each of the two buildings to the roof through an opening in the wall. They pulled three multimode fiber pairs, which were terminated in a small patch panel inside the enclosure.

The MRV FSO unit that was installed at the city has two optical ports in the back

(see diagram). One was connected to the fiber leading back to the network closet and connecting the network and another port used to connect the radio frequency backup. Because the radio unit has a copper RJ-45 port, the installers used a copper-to-fiber converter mounted inside the enclosure to convert the fiber cable from the FSO unit to the RF unit. The converter was plugged into a power outlet inside the enclosure and feeds power to the RF radio through the Cat 5 cable.

To run the power and fiber cables from the enclosure to the FSO and RF units, the TMac crew used seal-tight conduits, which are flexible and watertight. One conduit was used for the fiber connecting

the FSO unit, a second for carrying AC 110V power to the FSO unit and a third for Cat 5 cable to the RF radio. The same setup was repeated at the installation on the other building.

In addition to using a copper-to-fiber converter on the roof, they installed another converter at the network closet. This converter was used to connect the FSO unit on the roof to the network switches that didn't have an optical port.

### Savings

The FSO link helps save the city about \$1,000 a month in T1 lease charges – \$300 for the city's existing T1 service, and the \$700 budgeted to pay for a separate data-oriented T1 service.

"The FSO has given us much more bandwidth than we could have ever afforded by leasing T1s. Having that expanded bandwidth opened up the door to many new services we never thought of," Modrak said.

The city is now adding security cameras so that personnel can monitor city hall. Having a big pipe is critical for real-time video. In the future, the city will use its FSO link to connect a VoIP phone system for both buildings, and also for backing up data to a disaster recovery site, as well as having two redundant networks to that site.

"The day we turned the laser on the complaints we had to deal with regarding the slow network were gone. No one says to me anymore: 'the network is too slow,'" Modrak said.

"Other than the fact that it saved us costs and improved productivity, we like it because we like to talk about it. It's a cool device. We tell our vendors that we have a laser and all of them want to see it," Modrak said.

"The performance is phenomenal and is close to perfect as possible. We are very happy with these units because they have opened doors to opportunities we didn't have before as IT people." **BBP**

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