MICROWAVE: TIMELY, LOW COST, HIGH SPEED LINK TO UCPATH CENTER

“The microwave link from UCPC to the UCR campus has proven to be a stable, reliable high-performance backup link for the UC Path Center offices in Riverside. Joint testing by UCOP and UCR Network shows that the failover is seamless and effective. I commend the UCR Network team for the low-cost and useful design, solid installation and their ongoing maintenance and management of the link.

-Erik Frietag, Network Manager, UCOP

A huge success for UCR C&C, a great benefit to the UC PATH Project, and to future University sites located off main campus with requirements for high speed.

BACKGROUND

In January of 2012, UC Riverside was selected to host the UC PATH Center, the new University wide shared service center. An off campus building was purchased to house the service center at 14350 Meridian Pkwy, Riverside County. This building is located approximately five miles southeast of UC Riverside’s main campus in an industrial complex. Initial timelines indicated that UCR would need to get voice and data communications to this site by January of 2013 and provide infrastructure to conduct in-depth training for the Center’s staff by April 2013. Research, discovery and development of several options were performed through summer of 2012. An implementation plan and budget were provided in September 2012.
INNOVATIVE

From the start, UCR intended to install a dark fiber 10Gbps connection to this site with a reliable diverse path redundant link. The initial plans for the redundant link considered three options: Vendor provided Metro Ethernet, diverse City Fiber with a Microwave last hop, and a double hop microwave solution from Box Springs Mountain. The team’s highest priority was to find the best redundant solution that maximizes bandwidth and availability at the lowest cost. The non-negotiable objective was to provide 10Gbps over UCR controlled fiber purchased from the City of Riverside utilities with a reliable high-speed, low-cost backup link.

In the short term, the team was asked to provide voice, network and wireless services on the 1st floor until the UC PATH Center moved to the third floor in addition to maintaining the original objective to provide 10Gbps with a backup link by Spring 2013. The same team that was responsible for bringing the Network to the site was also involved in the planning and provisioning of communications infrastructure for the inside and outside plant as well as the voice and data services to the Center.

PERSISTANT

Initial “line of sight” surveys for microwave from Box Springs to UC PATH did not appear promising and were more complicated because they required two microwave hops. However, the team continued to pursue the other two options for a backup link (Metro Ethernet and diverse City Fiber). Thus, the Box Springs microwave link was considered a last resort.

In November 2012 we received word from Verizon that their lead-time on Metro Ethernet was a minimum of five months and the City fiber to Orange Terrace would cost over $170,000, not including the microwave equipment for the last hop. As the high cost of the other backup options became apparent and the aggressive due date for the redundant path loomed, the team decided to take another look at the microwave Box Springs solution. A more precise line of sight survey from the roof of the UC PATH CENTER confirmed the microwave solution was a viable option. In the meantime, the team provided voice and data connectivity via temporary vendor services for staff that were now to occupy the building in January 2013 rather than April 2014.
COLLABORATIVE

The team demonstrated extraordinary innovation and teamwork for the UC Path Microwave Project. Together they planned, coordinated, ordered or constructed cables, connectors, pulley systems, power cables, power sources, microwave frames, testers, etc. They engineered and configured the network and then physically installed the network electronics. The team climbed the 80’ tower on Box Springs Mountain, installed cables and handcrafted microwave stands on the roof of the UCPATH Center building, C&C building and the Box Springs Tower. They worked together to troubleshoot intermittent bandwidth, power and sustainability issues. On May 21st, 2013 the team performed a cut over of the UC Path Center network from the Verizon provided 3Mbps to the UCR C&C provided microwave service at 370Mbps.
OPERATIONALLY EFFICIENT

In summary, the project was a huge success for UCR C&C, a benefit to the UC PATH Project, and a blueprint for future “hard to reach” University sites with requirements for high speed. Although, the dark fiber project was completed on time and very close to budget projections, the backup link was operational prior to the primary link and significantly under its projected budget. The estimated costs of the various backup solutions are provided in the table below. The microwave solution provided substantial cost savings to the University for years to come.

<table>
<thead>
<tr>
<th>Backup Link</th>
<th>Bandwidth</th>
<th>Installation Costs</th>
<th>Recurring Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carrier MetroEthernet</td>
<td>10Gbps</td>
<td>$5,000</td>
<td>$10,000</td>
</tr>
<tr>
<td>Diverse City Fiber with 1 Microwave Hops</td>
<td>700Mbps</td>
<td>$110,000</td>
<td>$500</td>
</tr>
<tr>
<td>Box Spring 2 Microwave Hops + (UCR Labor)</td>
<td>340Mbps</td>
<td>$10,000</td>
<td>$0</td>
</tr>
</tbody>
</table>

Intellicenter/UCPath Connectivity to UCR

![Intellicenter/UCPath Connectivity to UCR Diagram]
SHAREABLE

Due to this very successful implementation, the network team has assessed several other sites for network link upgrades. They have implemented the same solution at two additional sites achieving the same benefits of high bandwidth and low start-up cost with cost savings over the long haul. Currently, they are reviewing feasibility options for the UCR Art Studio which is now located off campus.

<table>
<thead>
<tr>
<th>Organization</th>
<th>Before Microwave Bandwidth</th>
<th>Before Costs</th>
<th>Microwave Bandwidth</th>
<th>After Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atlanta Printing</td>
<td>2x DS1 1.544 Mbps</td>
<td>$516.00</td>
<td>700Mbps</td>
<td>$0.00</td>
</tr>
<tr>
<td>UCR Baseball</td>
<td>1.544Mbps</td>
<td>$177.00</td>
<td>500Mbps</td>
<td>$0.00</td>
</tr>
<tr>
<td>AgOps (in progress)</td>
<td>1.544Mbps</td>
<td>$177.00</td>
<td>500-700Mbps</td>
<td>$0.00</td>
</tr>
</tbody>
</table>

Testimonials

“\textit{I watched the progress of the UCR Microwave implementation and am very impressed with the out-of-the box thinking the team engaged in to create this incredibly low cost and comparitively high-bandwidth solution. Traditionally we have used vendor’s leased lines for backup links and these have a substantial ongoing monthly cost. UCR has already used this technology to upgrade the speed of other off-campus locations while simultaneously reducing cost. This is a great solution for last-mile connectivity}”

--- Bob Grant, Executive Director and CTO, UCR Computing and Communications

For years we used a rather expensive T-1 line to send and receive files and run email systems at the plant. At first this worked pretty well. Initially files were five to six gigabytes in size which worked fine with the T-1 line, but as designers increased the complexities of their designs, the file sizes grew to 200 gigabytes and more. As you can imagine, sending these large files using our old method became unmanageable, so we looked into the possibility of hooking up our off-site operation using fiber optics. It quickly became clear that we could never afford this since the City told us just to start the connection they would need more than $50,000. Since we are a self-support department this wasn’t in the cards, so we asked your operation for help and you came up with a very creative microwave solution. Admittedly I don’t even begin to understand what you went through or the technical aspects of how it works, all I can tell you is that we now can send files back and forth to the campus at speeds unimaginable before this solution was put into place.

\textit{The best part of this story is that not only can we transfer files much faster, we are also paying less than we did for the old T-1 lines per month! How often does that happen where you get more for less!}

--- Dallas Johnson, Service Enterprise Director
Atlanta Printing Facility

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