Next Stop, Updating Communications Technology!

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It's not every day that you think of a bus station as a hotbed for advanced technology, but in today's Internet accessible, communications-driven world, all modern buildings, even bus stations, utilize systems and technology that rival the latest office buildings and retail spaces.

The bus system in Grand Rapids, MI, had been expanding for decades, yet they were still utilizing a small, outdated bus transit station downtown as the main distribution point for buses throughout the city. ITP knew it was time to grow, so they identified a building site adjacent to their existing administrative offices.

With the completion of the land acquisition, ITP planned the new Central Station to be comprised of two structures. The first would be a covered bus transfer platform that would allow up to 17 buses to pick-up and drop-off passengers at numerous times throughout the day. The second would be a multi-use building that would serve as the ticketing area, vendor area, waiting area, meeting space and eventual offices for ITP staff. This building would also be built to accommodate the Grand Rapids Greyhound station.

"We knew that they had the opportunity to build a facility that would serve Grand Rapids into the next century. We also knew that we needed a partner that could help us achieve that goal, and we chose Progressive AE as the design architect," said ITP CEO Peter Varga. Progressive AE would provide architectural, civil, electrical and communications engineering services to the process. This included properly identifying all aspects of the bus transfer platform and the Central Station building, along with engineering solutions that would keep everyone on the platform and in the building both secure and informed. ITP knew that they would have a state-of-the-art facility, but they didn't know how much technology would play a part in the daily use of the spaces.

Design Process

The Rapid had previously operated out of two downtown locations - the bus maintenance facility on Wealthy Avenue and the administrative building on Ellsworth Avenue.

The site of the two new Central Station structures would be contiguous to the administrative office building, to create a consolidated campus with their only outlying building being the maintenance facility.

At the early stage in the design most of the emphasis

Structured Cabling Systems

was on what the platform and building would look like and how each would function. As the design moved along, Progressive continually met with ITP staff to determine how technology and communications could help provide a better environment for employees and passengers.

"We had numerous meetings where we went through different technologies such as telephone systems, data networking, signage, security, and audio/video solutions. Each of these technologies was found to have a place either in the central station building or on the platform." noted Jim Vander Molen, project architect for Progressive AE.

The two existing buildings, approximately three blocks apart, were tied together by a fiber backbone that carried the telephone, data, and video signal originating in the administrative building. The fiber backbone had two divergent paths to guarantee reliability in the event one of the fibers was damaged or cut.

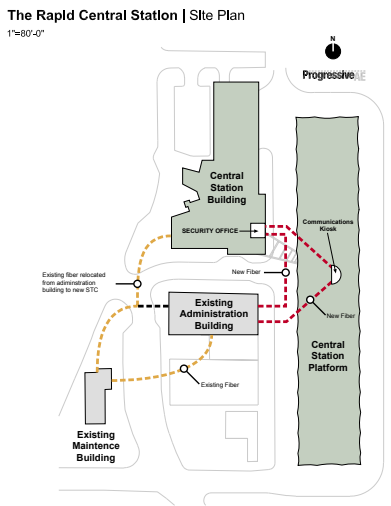
"We knew that we had an existing telephone system and data network that we could extend to the new Central Station. We also wanted to take this opportunity to invest in some new technologies that would not only serve the Central Station but could be extended back into the administrative and maintenance buildings, observed Kathy Anderson, director of technology for ITP.

Central Station: Transfer Platform

The transfer platform would be an open-air steel structure measuring 560' x 100', completely covered by a long-life tensioned fabric membrane canopy. It would accommodate 17 buses parked around its perimeter and serve as the main transfer point for all city buses. Over 30 times each day the platform will be full of people transferring buses.

"With the continuous change of people on the platform, information and security were determined to be of primary importance. Riders need information that allows them to easily navigate from bus to bus and they need to be safe while they wait on the platform or in the central station building," said Varga.

Central Station:



Multi-Use Building

The Central Station building would be a multi-floor, multi-use facility that would serve the needs of the riders of the city buses, as well as housing the downtown Greyhound station.

The core of the building would be a large open space, which would contain waiting areas, vendor space, ticket booths for local bus passes and a separate Greyhound waiting area and ticket area. The upper floors would contain future office space, restrooms, and a large community room that would be used as a meeting room for the ITP board, as well as, rented out to groups for their meetings or gatherings.

Technology Choices

Once the structure and requirements of the Central Station buildings were defined, the communications engineer could put together the detailed design of the technology systems that would serve the employees and the riders.

"With information and security being the main factors influencing the building design and technology, it became apparent that the communications system design would entail multiple systems," said Vander Molen. Through meetings and discussions with staff, stakeholders, and management, the following systems were determined:

- Intrusion detection and access control with proximity ID cards;
- Video security including digital video recording;
- Audio paging/background music on the platform and throughout the Central Station building;
- Extension of the existing telephone system, Ethernet network, and video distribution system into the Central Station buildings;
- Voice and data backbone cable for future office spaces;
- Specialized audio and video for the community room; and
- LED signage for bus routes and schedules.

With the overabundance of communications technologies required to keep everyone informed and secure, the design had to be all-encompassing as well as being detailed enough to provide bidders with accurate information from which they could generate their bid.

Since the communications engineers worked directly with the architect, it was logical to include the specifications and drawings for the communications systems into the overall building package that was sent out for bid. All communications equipment and installation requirements were written into Division 17000 of the CSI-based specifications. This allowed the owner to get multiple contractor bids for the communications and security work. Securalarm was selected to complete the security systems while working with two

subcontractors, Shareco to install the communications cabling and Central Interconnect to complete the A/V installation. All contractors and subcontractors were from Grand Rapids.

"We were lucky to get a security contractor that had such a good reputation and brought on subcontractors that really worked hard to provide a first-class installation throughout all the buildings," stated Vander Molen.

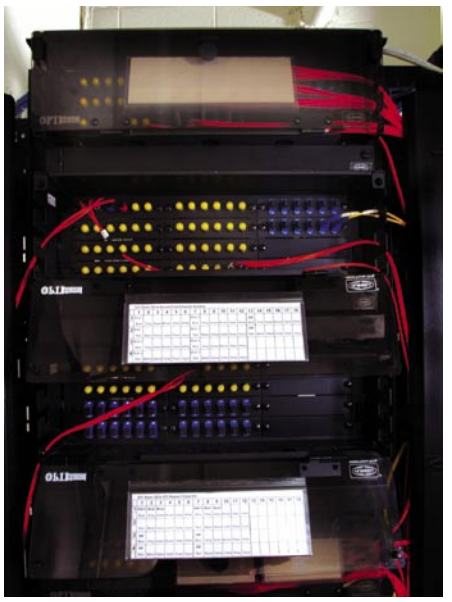
Connecting the Buildings

To transmit these signals and systems between the Central Station, administration, and the maintenance buildings, ITP took advantage of the existing fiber backbone.

The existing fiber backbone between the buildings consisted of 24 singlemode strands installed in a loop between the two buildings. This provided fault tolerance in the event that one of the fiber links got cut. With the construction of the new Central Station building, adjacent to the administration building, it provided an opportunity to open up the fiber loop and insert the new building as a third fiber termination point. The additional wide area fiber backbone was set to match the 24-strand singlemode fiber while adding some multimode fiber strands between the administration building and the Central Station. The multimode was installed to transmit the video and control signal for the security cameras and transmit the 10/100/1000 Mb/s Ethernet signal between all the buildings.

The extended fiber loop allows communications between the three buildings, while continuing to provide fault tolerance in the event of the ever-possible "fiber-seeking backhoe."

In addition to the wide area loop, a smaller fiber loop was installed to connect the administration building with the the Central Station complex.



Front view of local and wide area fiber patch panels in the communications room of the Central Station building

This fiber loop allows communications and management of systems on the platform from anywhere on the

network, while also providing physical redundancy.

"The Ethernet network was already being run over the wide area fiber backbone. The expansion of the fiber to the Central Station allows connection of users in the new building, as well as, connectivity for future ticket vending machines on the platform," noted Anderson.

The existing telephone system in the administration building was installed a few years prior to current construction and had room for expansion. ITP decided to leverage their investment and add station cards to provide telephones in the Central Station. To connect these telephones, a 50-pair copper cable was installed from the administration building to the Central Station building. Another 50-pair cable was installed from the administration building to the platform to provide for any telephones, payphones, LED signage control and the possibility of future vendor credit card machines on the platform.

The Communications Systems: Access Control/ Intrusion Detection

"Rider safety is one of our primary goals throughout the bus system. By starting from scratch with the Central Station structures, we knew we would have the opportunity to introduce new security systems into the new buildings and hoped we could also add them into our existing buildings," said Varga.

By utilizing the new and existing fiber backbone, everyone realized that it would be possible to install a centralized access control/intrusion detection system that could be extended to all the buildings.

The access control system was integrated closely with the intrusion detection system. By linking the two systems to act as one, the security personnel are able to monitor entrances and prepare records to see where most of the employees enter each building.

All proximity cards are custom printed with the picture and name of each employee. These cards would originally be used for access control only, but could later be used as timecards and will integrate with the future installation of the smart transportations system that ITP plans to implement over the next few years.

With the access control and intrusion detection systems, ITP can set schedules for locking and unlocking doors while granting access to spaces that in the past might not have been accessible without a key. With the dynamic use of the new Central Station building, including Greyhound and other leased tenants, the ability to remotely lock all the doors and monitor who enters the building is a huge leap in the level of security.

Video Security

Since one of the main goals in dealing with riders and employees is security, one of the best ways to provide that security is through video monitoring of the public spaces. ITP wanted to utilize video monitoring to allow review and response to incidents that may take place inside and around the platform, Central Station building, administration building and maintenance building. Once again, the project would allow ITP to extend a new technology into the existing buildings.

Through numerous meetings, it was determined exactly what spaces were to be monitored, and in turn, where cameras would be installed. This included fixed and Pan/Tilt/Zoom (PTZ) cameras under the platform canopy, PTZ cameras on light poles around the canopy and PTZ cameras inside and outside the Central Station and maintenance buildings.

All the camera signals are routed back to the security office in the Central Station for recording and monitoring by the security staff. To get the signals from the platform to the maintenance building and light poles around the administration building, the design called for utilizing the multimode and singlemode fiber backbone. The video and control signals from the cameras are multiplexed onto fiber transceivers, sent to the Central Station, and then broken out to coax connections before routing into the recording devices.

The recording of the images was discussed in the design phase. With up to 48 cameras throughout the entire system, digital recording was the only viable alternative. Thus, the design included three 16-port Digital Video Recorders (DVRs) for recording and control of all the cameras. The DVRs are installed in the security office of the Central Station and allow security officers to monitor and control all the cameras.

An added benefit of the chosen DVRs was their network connectivity

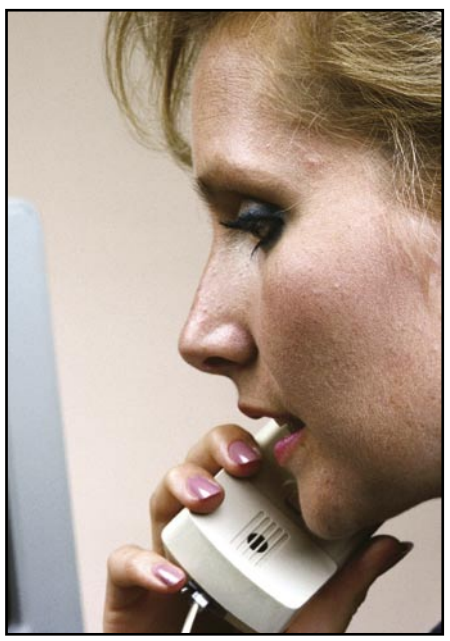
and ability to allow administrators to view the images and control the PTZ cameras from PCs already connected to the Ethernet network. This allows monitoring, review and configuration to be completed at the security office or from the desk of any administrator that was granted rights to connect to the DVRs.

With cameras watching most public spaces, ITP feels that they can provide a safe and enjoyable environment for all their riders and employees.

Audio Paging/ Background Music

The audio paging system throughout the Central Station serves two purposes. The first is to disseminate information from ITP staff to riders, in the case of a late change in bus routes or numbers, and the second as a gesture by ITP of providing background music for those waiting for the next bus on the platform.

The paging system was zoned so that announcements could be either sent to the platform only or the platform and the building. The audio paging system on the platform allows managers to immediately inform riders of any changes in bus routes or bus numbers. The system had to be designed to fit into the environment of the platform. This included water-resistant speakers installed on every other column and four ambient noise microphones installed to automatically raise or lower the announcements/ background music volume based on the sound levels on the platform. For example, when 17 buses are parked and idling, it is quite loud on the platform. With the ambient noise microphones and electronics, the volume is raised and everyone is still able to hear important announcements.



The paging system was also connected to a microphone at the ticket counter of the Central Station building and the telephone system to allow access for anyone who is provided with the paging code.

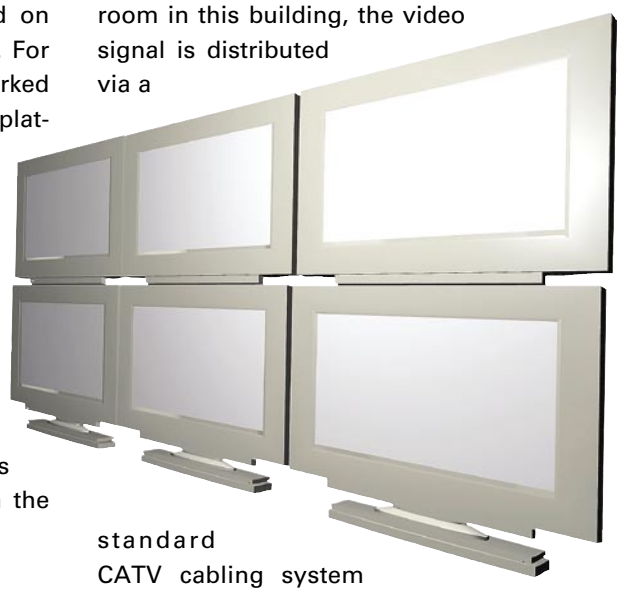
Cabling for the Telephone System and Data Network

Category 6 cable was chosen as the primary user cable for data, telephone and low-voltage connectivity. By installing the highest grade, standards-compliant user communications cable available, Category 6 cables meet their needs today and in the foreseeable future.

Through effective use of backbone cabling, ITP did not have to invest in a new PBX or VoIP (Voice over Internet Protocol) system or establish an entirely new data network including servers. The existing telephone system and data network were each expanded to serve the Central Station structures. The new copper and fiber backbone cables provide easy connection of new Ethernet switches and telephone sets back to the existing systems in the Administration building. By utilizing and expanding these existing systems, more funds were available for other technology systems and services.

Specialized Audio and Video

Video signals for cable TV, a DVD player and other in-house generated video are modulated in the basement of the administration building. This video signal is extended via an RG-11 coax cable routed through underground conduits to the Central Station building. From the communications room in this building, the video signal is distributed via a standard CATV cabling system utilizing an RG-11 backbone, taps and RG-6 user cables.



The premier room inside the Central Station building is the community room. This is a 40' x 60' room that was designed to have multiple uses. Primarily, it serves as the meeting room for the ITP board of directors. It is also to be used as a meeting place for other government agencies and a community room for any local group for meetings or presentations.

To make sure that the room was useful well into the future, the room was technology heavy in regards to its audio and video systems. The systems in the community room include:

- Drop-down overhead projector;
- Eight microphone connections at the board table and wireless microphones for speakers in the audience;
- Ceiling-mounted microphone for recording of general comments from an audience;
- 10 ceiling speakers throughout the room;
- VGA inputs from the board table and a lectern to allow PC presentations through the overhead projector;

(continued on page 59)

recorder, DVD/VCR, CD player, audio tuner, and all the other AV equipment;
- Audio mixer and digital signal processor to provide mixing, delay, echo cancellation, and feedback elimination;
- Wireless touch-panel control system.

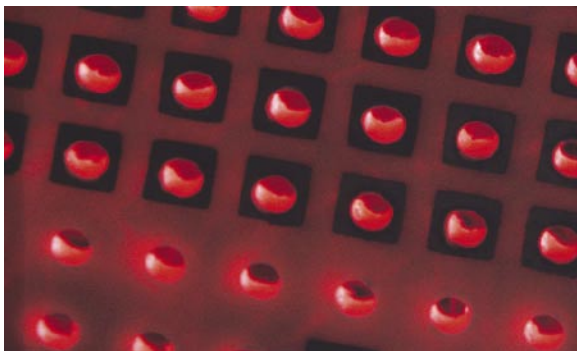
Since so many different groups will be using the room, the control of the technology had to be easy-to-understand. The wireless touch-panel control system allows any group using the room to turn it on and utilize the technology to provide a more sophisticated and meaningful meeting. By spending the money for a control system during the installation, ITP can save money in the future by not requiring that the technology staff be present for every meeting in the room.

LED Signage

As people transfer from bus to bus and migrate from the building to the platform, bus schedule information is paramount. This can change on a moment's notice, based on weather, traffic or any number of other factors. Therefore, ITP selected an efficient LED signage system.

Each bus slip has an LED sign that is able to show the bus number, the local time and the route that the bus was serving. They are all connected to a control system that allows managers to make changes and updates as required. In addition to the LED signs at each bus slip, a multi-line LED sign is installed at the central kiosk to list the route numbers and arrival times of all the buses that stop at the platform.

The control system for the LED signs is a hub and spoke, RS-485 link that was connected using underground-rated Category 5e cable routing from each sign to the central kiosk. From the central kiosk, another Category 5e cable was installed to the ticket area inside the building. The control PC sits in this room, where the staff is able to change the LED sign schedule while also making changes on the fly for emergency situations.



Converging Technologies

The ITP Central Station project required careful consideration of all the possibilities today's technology provides. With the overriding project goals being to keep employees and riders informed and safe, the technology was tailored to meet these objectives.

A strong design was crucial to this project. Installing new systems into both existing and new buildings took the efforts of the architects, communications engineer, and the ITP staff. By utilizing the existing fiber backbone, telephone, data, and video distribution systems, ITP was able to extend these systems into the new buildings and save the cost of starting from scratch. Consequently, they were able to add new systems such as access control, video security, paging, LED signage, and specialized audio and video in the new building and bus platform.

More and more building owners realize the importance of hiring an architect and engineer who provide communications engineering and design. The communications systems are not merely add-ons to the structure and are inherent in the day-to-day usefulness of each space. Where communications systems used to just "appear" in the building towards the end of each project, they are now fully designed and integrated systems to work with the building and provide a more useful and secure environment. ■

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