City of Irvine Converges all ITS Communications to Common Network

Southern California City migrates dissimilar communications systems to an Ethernet-based solution using Cisco Catalyst Switches.

EXECUTIVE SUMMARY

City of Irvine, Signal Operations and Maintenance

Irvine, California, United States

CHALLENGE

- Converging disparate systems into an open standards-based communication network
- Increasing operational efficiencies in the traffic management system
- Improving redundancy and disaster recovery
- Maximizing investment protection
- Reducing installation and maintenance costs

SOLUTION

Cisco IE 3000 Series switches, Catalyst 2955 switches and the Catalyst 3750 switches.

RESULTS

- Ease of installation, management, and replacement with one network from edge to core
- Improved scalability and reduced network node cost
- Improved bandwidth with gigabit links at the core

Challenge

The City of Irvine, California is a relatively new city, incorporated in 1971 and formed primarily from farmland. With little existing infrastructure, and a rapidly expanding population, most public services had to be created from a small base. The city covers 65 square miles, with an extensive road system, including several highways which bisect the area.

Irvine is committed to implementation of a traffic management system utilizing advanced communication technologies to maximize traffic flow and minimize the impact of traffic-impeding incidents. The core of this system is a network capable of dissemination of comprehensive information, including real-time intersection controller status and surveillance video, from multiple sites to multiple clients. This information keeps traffic engineers apprised on citywide road conditions and enables remote actions to re-route traffic and maintain maximum flow.

The focus of this effort is the Irvine Traffic Research and Control (ITRAC) center. Constructed in 1992, this center serves as both a live traffic-monitoring facility and a developmental lab for future system experimentation. Since 1991, when the first two cameras transmitting analog video cameras were installed, communicating over six miles of fiber, their system has grown to include 155 cameras and over 100 miles of fiber cable, using both analog and digital transmission formats, with an 176 x 64 central CCTV video matrix switcher. The ultimate system deployment will include over 200 CCTV cameras for monitoring traffic flow throughout the city.

Solution

The traffic signal systems planners for Irvine realized early on that dissimilar communication systems were not the best long-term solution. Taking queues from the information technology and communications sectors, the planners decided to pursue a converged network-based platform in the late 1990s. The initial implementation was a hybrid Ethernet and asynchronous transfer mode (ATM) solution. Later the ATM portion of the network was replaced with Gigabit Ethernet to improve performance and reduce cost. The IP-based platform proved highly resilient, manageable, and cost effective.

Meanwhile, the intelligent traffic systems (ITS) industry had been slow to adopt Ethernet connectivity. Initial applications were only in the head-end servers and central control systems, but as new generations of applications and systems were developed, Ethernet connectivity proliferated. Most manufacturers of ITS hardware and software now have Ethernet ports and IP communications as an option, and some have moved completely to this platform.

After successful field testing of all critical applications on the network communications platform, Irvine has undertaken a five-year program to completely overhaul its ITS infrastructure, basing it all on a Cisco® switched Ethernet architecture. Central traffic control systems run on standard servers attached to Cisco Catalyst® 3750 switches. Traffic signal controllers at each intersection connect to IE-3000 or Catalyst 2955 switches. CCTV cameras are integrated via MPEG 2 and 4 video equipment from Optelecom-NKF. When completed, the entire MPEG video system will be controlled by a PC application-based camera selection and control system accessing individual cameras through a web-based application. Other ITS applications, such as emergency vehicle preemption (EVP), variable message signs (VMS), video vehicle detection, highway advisory systems, and traffic data collection are also currently able to directly interface with the network. Complete convergence of the traffic control signal system into the Ethernet IP video distribution network will achieve the ultimate goal of a unified system concept.

> "Converging all of our communications requirements onto a common platform presented a real challenge. The benefits of our Ethernet-based system have far exceeded our expectations in terms of performance, reliability, redundancy, and expandability. Irvine believes that its Ethernet network architecture will provide unparalleled expandability and freedom from proprietary solutions, and will ease integration of future technologies. The ITS industry in general is quickly realizing what IT professionals discovered long ago: Ethernet and IP make a perfect platform for converging disparate communications systems into a unified, manageable, open solution."
>
> **— Thomas Roberts, Senior Project Manager, City of Irvine**

Results

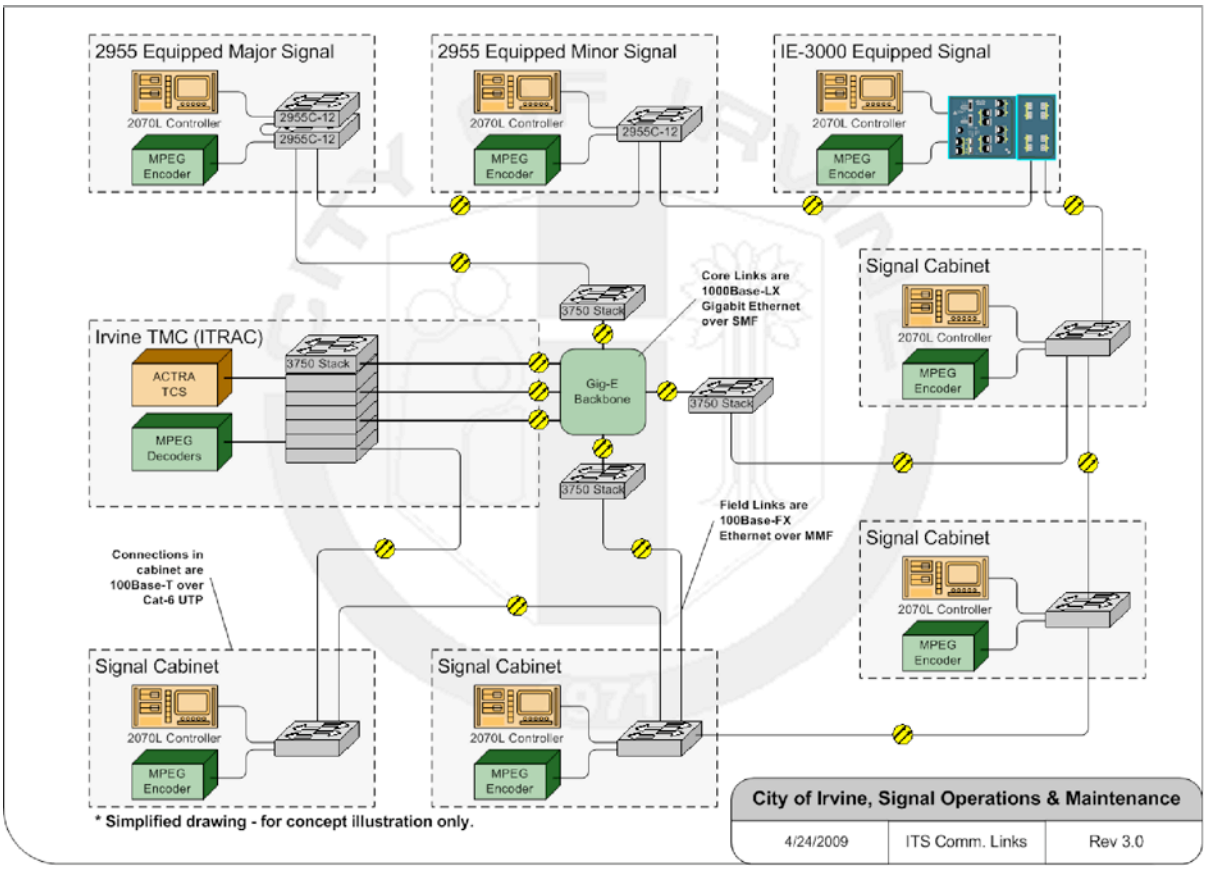
The Cisco IE 3000 platform's flexibility and modularity is a significant benefit for City of Irvine Intelligent Transportation Systems. The switches provide options for both twisted pair and fiber connectivity, and the team is able to add modules as needed. The gigabit uplinks provide backhauling of bandwidth intensive MPEG-2 and MPEG-4 video streams back to ITRAC, the City of Irvine traffic research and control center.

One highly beneficial feature is the IE Swap Drive. The Zero Configuration Replacement reduces the traffic and network downtime with fast switch replacement in the absence of network expertise. The field technician can quickly pull out the flash memory drive with all of the critical switch attributes and plug it into the new switch without having to reconfigure anything. New switch deployments also benefit, easing implementation of systems upgrades and new traffic signal installations. The Swap Drive feature represents a significant advantage to helping optimize the traffic signal operations.

The Small Form-Factor Pluggable (SFP) uplinks provide flexibility in selecting single-mode/multi-mode (SM/MM) fiber and also help to leverage the legacy fiber infrastructure. Cisco IE-3000-8FM satisfies additional fiber requirements in T topologies/intersections as opposed to using media converters.

The standards-based Ethernet infrastructure enables the real-time, centralized monitoring of all critical traffic signal components. If an issue arises that requires a technician, the central monitoring software can alert a technician, an engineer, or even an outside vendor for collaborative troubleshooting. Remote access capabilities minimize physical site visits, reduce mean time to repair, and ultimately, increase traffic operations availability.

Figure 1. City of Irvine Architecture



These technical benefits have helped the City of Irvine to improve the operational efficiency of the Intelligent Transportation Systems through the ease of use features and reduction in management, operation, and training expenses with standardized communication infrastructure.

PRODUCT LIST
Cisco IE 3000 Series switches
Cisco Catalyst 2955 switches
Cisco Catalyst 3750 switches

For More Information

To find out more about Cisco solutions and services, visit: www.cisco.com.

To learn more about City of Irvine, visit www.ci.irvine.ca.us

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