

Cisco Intelligent Roadways Integrates Systems to Increase Security, Improve Operations, and Reduce Costs

Cisco® Intelligent Roadways increases operational efficiency, improves traffic flow, and enhances security by providing a highly responsive, service-centric environment based on a flexible, scalable, intelligent information network. Cisco Intelligent Roadways consists of a secure unified intelligent network and application-enabling network services designed to securely connect intelligent transportation systems.

Challenge

According to the U.S. Conference of Mayors, traffic congestion on the four million miles of highways and roadways in the United States results in more than 3.6 billion hours of delay, and the consumption of 5.7 billion gallons of excess fuel on an annual basis. Average drivers lose more than 62 hours a year sitting in gridlock, with the typical cost of congestion per peak-time road traveler reaching \$1160 a year.

The dramatic increase of traffic on the roadways today is in and of itself a major challenge for those who are responsible for monitoring and managing traffic. However, it is only one of many issues that traffic management executives must deal with on a daily basis. Other challenges include:

- **Government mandates for security:** Many bridges, tunnels, and other critical transportation infrastructure have been raised to high alerts for terrorist activities, requiring states to find ways to monitor those facilities.
- **Amber Alert:** Many states have been mandated to implement the “Amber Alert”, an emergency response system designed to quickly recover kidnapped children.
- **Incident Response:** Studies have shown that during peak rush hours there is a four-to-one relationship for an accident to congestion. For every minute it takes to clear an accident from the roadways, there is a four-minute delay to get traffic moving again.
- **Safety:** Clearing an accident in a timely manner reduces the incident of secondary accidents resulting from the primary accident. Studies have shown that secondary accidents can often be worse and take longer to clear.
- **Pollution Levels:** States must comply with Environmental Protection Agency (EPA) regulations for acceptable levels of air pollution. Implementing intelligent transportation system (ITS) solutions can help meet that goal by keeping traffic moving.

All of these challenges put even greater demands on the performance requirements of existing ITS networks. Addressing these challenges requires a network that integrates real-time interoperability between public safety and public service agencies; bandwidth optimization that enables mission-critical data to coexist on the same network as



lower priority monitoring data; information that can be transmitted to multiple points of contact immediately; and network security and partitioning that allows appropriate levels of information to be shared with multiple end users.

Although many traditional ITS solutions consist of standalone systems with minimal communications capabilities that impose limitations on operational efficiency, transportation departments now recognize the need for networked solutions that enable more rapid integration of various ITS solutions and address the challenges they face on a daily basis.

Solution

Cisco Systems® has teamed up with leading highway technology providers and network integrators to deliver a core infrastructure that enables administrators to take advantage of high-performing applications that improve the overall efficiency of roadways. Cisco Intelligent Roadways, an integrated, scalable, converged voice and data network, also delivers the lowest total cost of ownership (TCO) in the industry.

Cisco Intelligent Roadways consists of an intelligent information network that connects disparate network systems to improve the flow of traffic, reduce and minimize roadside incidents, and provide operators with a central view of the highway system, including road conditions, traffic, vehicle crews, and transit information.

Cisco Intelligent Roadways also provides a resilient and responsive environment based on open standards, which takes full advantage of an organization's existing infrastructure. The solution enables operators to access critical information as it arrives in order to streamline operational efficiency, safeguard assets, accelerate decision making, and extend roadside services. This highly scalable network can be deployed today for any single emerging technology need, while providing a foundation for future growth.

The Cisco Intelligent Roadway solution comprises three areas:

- **Advanced Traffic Management Solutions (ATMS)**^{3/4} For roadside data collection, management, and surveillance, the Cisco Intelligent ATMS network solution allows city, state, and county Departments of Transportation (DOTs) to share information on a real-time basis with one other, with incident response agencies, and with other government agencies. Providing real-time information to these agencies helps ensure that they can act on the information and make the best decision for the situation immediately after an incident.

Cisco supports ATMS by providing a unified infrastructure for video surveillance to monitor traffic and enhance security and traffic-management applications. A video surveillance solution displays live video images of traffic to the operations center, enabling managers to monitor roadways and traffic and make informed decisions about traffic flow. The operator can quickly detect an incident, dispatch the correct response, and speed up incident recovery. Cisco IP provides quality of service (QoS) which assures that data can be prioritized on the network to prevent interruption of video surveillance feeds. QoS also helps ensure that voice-over-IP applications have call clarity. Cisco wireless and mobile solutions also allow DOTs to extend their network where fiber cannot be installed.



- **Traffic Management Center (TMC)**^{3/4}The TMC collects all information from the ATMS system and analyzes it to provide motorists with a faster and safer trip on metro-area freeways by using cutting-edge technology, progressive programs, and an intelligent information delivery system. Cisco Intelligent Roadways enables communication that is immediately accessible to first responders, transit authorities, and DOTs, all of whom can work using the same network.
- **Advanced Traveler Information System (ATIS)**—In order to reduce road congestion and improve the traveler experience it is important that travelers have the information they need to make better travel decisions. Transportation departments now use Websites, phone service, and message boards to keep motorists informed of transportation issues and to provide many alternatives. The Cisco ATIS infrastructure allows DOTs to use their existing network infrastructure and gives traffic managers the ability to disseminate information to the public and to other agencies. With the growing use of 511, many DOTs are looking for a more efficient way to use this service to disseminate traffic information. Using Cisco infrastructure for 511 enables traffic managers to build upon existing network infrastructure to deploy 511 solutions.

A multiservice network enables more efficient and cost-effective operations when consolidated over a converged network. The Cisco solution for ITS allows DOTs to be ready for future applications, such as receiving information from vehicles, sending information to vehicles, and providing video streams of incidents to responders on handheld devices.

Business Benefits

Traffic management administrators need tools that enable them to increase operational efficiency and improve the usage of such resources as emergency and transit crews, and safety transport vehicles.

Cisco Real-Time Roadway solutions provide a number of critical benefits, including:

- **Improved Resource Utilization**—Cisco Real-Time Roadway solutions collect information at the point of origin, delivers it in real-time to traffic managers and public safety personnel simultaneously, and allows operators to shift from reactive to proactive road management by quickly assessing the raw data and turning it into intelligence that will facilitate appropriate action.
- **Reduced Costs**—These solutions lower TCO by converging voice, data, security, and wireless services within a single-vendor solution and onto a single network, reducing infrastructure costs, and reducing network support headcount.
- **Increased Operational Efficiencies**—Cisco Real-Time Roadway solutions improve traffic flow by enabling operators to access multi-sourced information quickly enough to anticipate and respond to road conditions, traffic congestion, and emergency situations.
- **Enhanced Security and Safety**—Integrated video surveillance and network security solutions from Cisco Systems protect both physical premises and networks on the roadway and in the traffic management center from internal and external threats, preventing a security breach, and helping ensure business continuity.



- **Greater Collaboration**—These solutions enable transparent, reliable communication amongst transportation agencies and other important municipal, emergency, and transit authorities in neighboring jurisdictions by linking together a system of disparate networks.
- **Expanded Services and Revenue Opportunities**—Cisco Real-Time Roadway solutions enable transportation operators to provide innovative roadside services—such as up-to-date information on road conditions—that allow drivers to plan ahead by taking an alternate route or assessing wait-times. Travelers can also use the network to access the Internet in designated locations, such as rest stops, restaurants, and roadside cafes.

Architecture

The network architecture in most transportation organizations is based on a variety of independent solutions from a multitude of vendors. Although these solutions were originally deployed to address a specific business need, the end result was often a disparate communications environment that could not keep pace with changing customer and operational requirements.

In addition, many vendors often lacked the breadth of networking expertise necessary to enable truly interoperable communications between the various agencies who needed access to the information being transmitted over the network.

Figure 1 demonstrates the typical network architecture described in the example above. Each segment was developed for different purposes and required separate strategies for maintenance and management.

Cisco has established its network as the platform of choice for the transportation industry. Based on a three-part strategy that enables scalability, works with industry-leading partners, and adheres to standards, the Cisco converged voice and data network integrates existing networks to protect and extend customer investment.

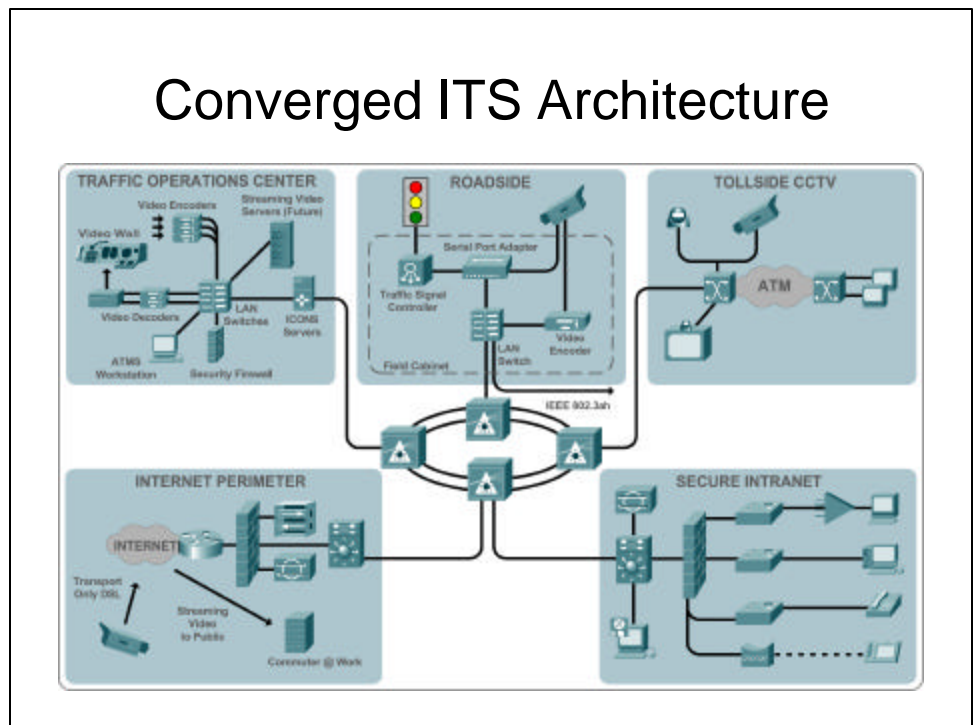


FIGURE 1



The Cisco intelligent information network and application-enabling network services securely connect intelligent transportation systems and provide a resilient and responsive environment based on open standards that enables operators to access vital information in order to streamline operations, safeguard assets, accelerate decisions, and extend roadside services.

Intelligent End-to-End Architecture

Transportation agencies today cannot afford to take significant business risks due to fluctuating budgets, physical space limitations, and the sizable investments they have already made in network infrastructure. However, if the existing infrastructure consists of disparate IT network elements, the ability to improve is significantly inhibited, creating the following challenges:

- Functional silos of information
- Redundant applications
- Proprietary systems
- Different network protocols
- Costly, complicated network design and deployment

To gain the benefits of integrated resources without the setbacks that can result with multi-vendor point solutions, Cisco enables the convergence of disparate networks onto an intelligent information infrastructure. The Cisco network architecture for the transportation management industry is a cohesive, resilient, and responsive foundation that lets administrators centrally provision, deploy, and maintain advanced transportation applications.

This integrated network supports voice, video, and data, so that agencies can take full advantage of their existing networks while they are deploying and integrating new applications. Converging network resources also improves operational efficiency and support for innovative customer services that create new revenue streams. Finally, this approach also minimizes an agency's TCO because common network standards require fewer resources for management and maintenance than multiple networks.

Supporting Solutions or Products

Cisco Network Security Solutions: Using advanced encryption and tunneling, Cisco network security solutions enable secure, end-to-end, private network connections over third-party networks—such as the Internet or extranets—and provides wireless protection software and intrusion detection systems. Security is built into the hardware, allowing embedded protection throughout the entire network and providing greater security than standalone point-product solutions. Effective security solutions provide DOTs with the safeguard mechanisms they need to keep unauthorized users out of the network, protect critical data, and keep traffic operation centers running smoothly.

- **Cisco Core and Edge Network Solutions:** Cisco wide-area network (WAN) core solutions tightly integrate IP and (Asynchronous Transfer Mode) ATM technologies through tag switching, which allows IP and ATM services to be delivered on a single infrastructure with dynamic bandwidth-sharing between services.



- **Cisco Wireless Solutions**: The Cisco Aironet® Series of wireless local-area network (LAN) solutions integrates transparently into an existing network as a wireless overlay, or creates freestanding all-wireless networks, enabling mobility and increasing productivity quickly and cost-effectively. The Cisco Aironet Series of solutions sets the enterprise standard for high-performance, secure, manageable, and reliable wireless LANs (WLANs).
- **Cisco IP Communications Solutions**: A comprehensive system of enterprise-class solutions, Cisco IP Communications solutions—including IP telephony, unified communications, IP video and audio conferencing, and contact center—facilitate more engaging and efficient interactions among employees, partners, and customers and provide the foundation for a collaborative workforce. Cisco IP Telephony solutions extend the capabilities of the transportation network to include voice services. By bringing together data, voice, and video, DOTs can use the same network for video surveillance to also deliver roadside telephony services. IP telephony solutions minimize disruption of communication services in the event of a disaster and enhance readiness for emergencies.
- **Cisco CWDM/DWDM Optical Solutions**: Course/Dense wavelength division multiplexing (CW/DWDM) employs multiple light wavelengths to transmit signals over a single optical fiber. Today, CW/DWDM is a crucial component of optical networks because it maximizes the use of installed fiber cable and allows new services to be quickly and easily provisioned over existing infrastructure. Flexible add and drop modules allow individual channels to be dropped and inserted along a route. An open-architecture system allows a variety of devices to be connected, including SONET terminals, ATM switches, and IP routers. CWDM technology is based on the same WDM concept as DWDM technology. The two technologies differ primarily in the spacing of the wavelengths, number of channels, and the ability to amplify signals in the optical space.
- **Cisco Mobile Access Router**: Optimized for mobile vehicular applications, this solution pioneers a shift in the way organizations communicate and share information across wireless networks. The Cisco 3200 Series Mobile Access Router, designed for “always-on” connectivity, facilitates the mobility of entire networks of communication devices in moving vehicles such as trucks, light rail, emergency vehicles, and automobiles.

Why Cisco?

Too often, point players offer discrete niche products that solve a specific problem on the network. As a result, organizations experience less consistent network and application performance, and must pay more for system maintenance because the lack of rich, integrated network features and services and network intelligence prevents the network from operating as a unified system. Point systems also suffer from other challenges, including:

- Difficulty in protecting the entire network from outages, service degradation, and security breaches.
- Inability to adapt to existing infrastructure or offer the scalability necessary to meet changing business requirements.
- Lack of a “best practices” track record in network deployment and management, which increases cost and complexity.
- Difficult and costly to upgrade, modify, manage, and support.



Although traditional networking vendors boast an end-to-end solution made up of interconnected boxes, it is typically an outgrowth of their traditional systems. The challenge of this approach is that the performance and availability are typically set by the weakest network component.

In contrast, Cisco delivers an intelligent, integrated (both wired and wireless), end-to-end network solution that enables the network to work as a unified whole, with consistency in both features and quality, improved reliability, an enhanced user experience, and high-quality performance. Network elements are interlocked through integrated network protocols and network intelligence.

Equally important, a Cisco converged network provides the lowest TCO through:

- **Reduced hardware costs.** A highly optimized network reduces the need for multiple proprietary networks, reducing hardware costs as a result. For example, a single Ethernet card can replace three separate cards, reducing cost and complexity.
- **Reduced software and training costs.** Expanding intelligent network services paves the way for innovative transportation applications to be deployed without having to replace or learn new operating software, reducing both software and training costs.
- **Reduced troubleshooting.** Multilayered security closely aligns people, procedures, and technology with business goals, which reduces troubleshooting due to security breaches. In addition, a highly reliable network reduces administrative troubleshooting and down-time costs.

The Cisco intelligent information network is built on a solid architecture that protects the network from unplanned outages, slow service, and security breaches and is based on advanced technologies which have been embedded into Cisco IOS® Software—the network infrastructure software and the “brains of the network”. These technologies include high availability, advanced quality of service, and embedded security and management, along with scalability features that deliver consistent network performance and an enhanced user experience. Open standards-based optical transport such as ATM, SONET, and IP video solutions allow easy integrations, upgrades, and easy migration of analog to digital ITS solutions.

With the Cisco networked highway architecture, DOTs can create a secure, scalable, and reliable communications infrastructure for all of their data, voice, and video communications. Cisco offers a secure intelligent information network supporting Intelligent Transportation Systems which maximizes existing network investments. The network delivers a resilient and responsive solution based on open standards that enables operators to gather, assess, and use vital transportation information in order to better manage and monitor today’s roadways.

Cisco has worked closely with a wide range of transportation agencies to develop the right solutions for the industry. As a result, Cisco network architectures support today’s ITS applications, making it easy to implement future ITS solutions, and helping to increase safety, security, and real-time communications for highway systems.



For More Information

For more information about Cisco Intelligent Transportation Solutions, contact your local account representative or visit www.cisco.com for more information.

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