MOXA®

Application Blueprint

Electronic Toll Collection

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Background

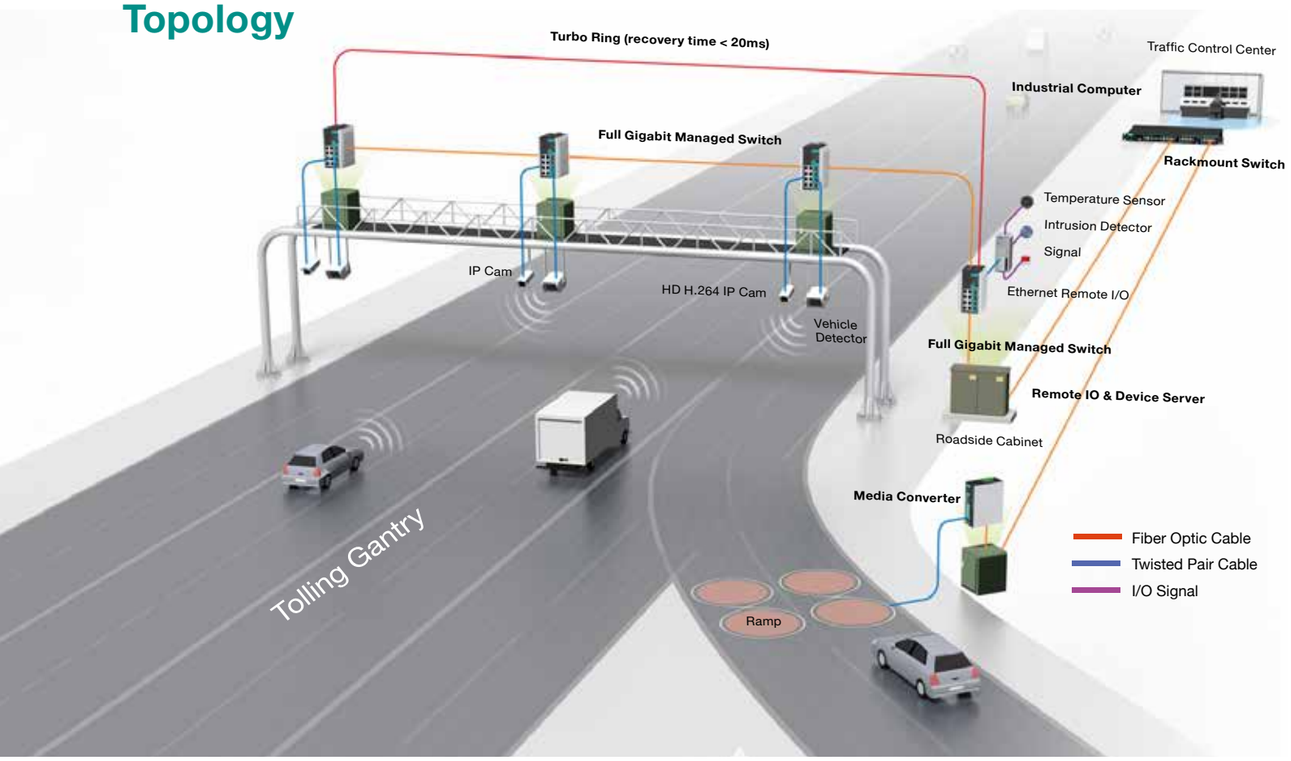
Electronic Toll Collection (ETC) systems play a crucial role in easing traffic congestion, reducing accidents, and decreasing environmental pollution. Despite high initial deployment costs, a lot of governments strongly support acceleration of electronic toll collection systems due to greater convenience, flexibility of cashless payments, and increased use of advanced technologies in transportation infrastructure.

Moreover, ETC allows for vehicle tracking and provides valuable data on road usage, which could reveal patterns for traffic management. As more useful information becomes available, operators can monitor traffic loads and set flexible tolling to improve traffic efficiency.

To get each part of the ETC system connected and working smoothly, reliable connectivity plays a central role in collecting critical and confidential data and transmitting the real-time information between the operation center and toll roads. In addition to having a solid and stable connection, security of data transmission also needs to be ensured, especially when cashless, electronic payment schemes are in place.

RWIS Topology & System Requirements

Topology



System Requirements

High-performance and reliable network backbone to allow transmission of large volumes of data back to the traffic control center. With multiple vehicles entering toll roads every second at high speed, network latency and packet loss are unacceptable. Large amounts of traffic data from sophisticated gantry, roadway, and gate devices, such as cameras, scanners, and sensors, which require Gigabit transmission speeds across the ETC network. This is especially true for the transmission of high-resolution images from multiple cameras atop the gantries, at the entry to toll lanes, as well as at the gates themselves. Therefore, sufficient transmission bandwidth, distance, and a backup path or network redundancy mechanism are necessary

Secure critical data during transmissions is the trend. As ETC systems are part of public transportation infrastructure, the networking devices of choice should meet cybersecurity standards such as NIST or IEC 62443 to protect transportation facilities worldwide and to minimize any risks to the system's integrity.

Support for Multiple OT and IT protocols. ETC systems have an ID reader to detect vehicle presence and sensors to detect vehicles that trigger cameras for number plate snapshots as they pass through the gate. These sensors can be serial, I/O, or even Ethernet-based and all of them are required to connect into the IP network and transmit back to SCADA, and potentially police systems.

Peer-to peer functionality is important. It is often advantageous for I/O devices at each toll point to be able to co-ordinate actions, especially for safety reasons, without the need of returning data to the control center. This can be when a gate is opened but the vehicle is very slow to move off or remains stationary. Or it may be necessary to keep the gate open for a longer time without recourse for the control center or a local computer making that decision.

IIoT plays a very important role in ETC when collecting road traffic data from distributed E-toll sensors systems and store in the cloud platform for centralized monitoring and controlling, device management and get business insights such as traffic management, identifying traffic flows on different roads over the different time interval. For such a system, a robust IIoT edge gateway is required which securely and reliably connects sensors from ETC systems to the private/public cloud platform. However, sending enormous amounts of data being collected from vehicles to the cloud is not a cost-effective solution. An IIoT edge gateway is required to process real-time vehicle data locally and sends only relevant information to the cloud. This not only reduces the bandwidth usage but also reduces costs incurred on the cloud platform. For a continuous operation, an IoT edge gateway must have the capability to store data locally in the event of connection failures and sends the stored data after connection being re-establish again.

Compact size, rugged and reliable solutions are required for roadside cabinets. The surge and intrusion detectors, voltage, temperature, wind speed, humidity sensors, and cameras are deployed in various road weather information systems. These need to be connected to the network in order to transmit data to the control center. In this context, the size, mounting types, level of functional integration and reliability of communication devices to be installed in the space-limited roadside cabinets, must be carefully considered. A durable system reduces operating costs throughout the lifecycle as equipment is deployed mostly in harsh outdoor environments.

Moxa Solution

IO Products peer2peer Capability

Moxa Remote IO products have the peer2peer capability without the need for a host computer, saving cost and space for the remote alarm to local indicator.

Secure Transmission Solution

Moxa has various secure transmission solutions, Wi-Fi, wired and cellular to meet live video and data transmission needs anytime, anywhere.

Arm-Based Computers

Moxa arm-based computers are designed for long-term operation and come with both a 5-year hardware warranty and 10-year support for Moxa's Industrial Linux. Easily upgrade the operating system with OTA (Over-The-Air), robust filesystem, microSD socket for storage expansion and preventing data loss, and much more.

Central Supervision Network Management Software

Moxa has a central supervision network management software called MXview, which monitors all Moxa devices and supported 3rd party devices. This is done through SNMP MIB files, offering control centers the capability to monitor and visualize the connection status of networks within visibility via topology and multiple notifications. The control center can use this software for proactive monitoring, integration into IT/OT systems, maintenance (firmware upgrade and configuration change), failure troubleshooting, and network overview for operational use.

Flexible Redundancy Technology

Moxa's proprietary Turbo Chain provides flexible redundancy technology for use on a wide distributed network and Moxa's Turbo Ring is one of the most effective solutions to avoid network downtime.

Built-in Security Features Based On IEC 62443-4-2

Staying at the cutting edge of market trends, most of Moxa's products have built-in security features based on IEC 62443-4-2 and a well-established security reporting and warning process/mechanism in place.

Cloud Software Solution

Moxa's Cloud Software solution ThingsPro Edge running on Moxa Embedded Computers ARM CPU architecture enables easy connection to private and public cloud providers with precious data instantly processed and analyzed, allowing the owners to make the right decision on how to proceed.

Gigabit Fiber Network Backbone

Moxa has Gigabit fiber network backbone for efficient massive video and data transmissions over long distances.

Compact And Rugged Designed Products

Moxa devices, especially switches also support methods of debugging at device and system level, aiding the user to **quickly overcome any issues** that develop within the topology. Such facilities include port mirroring and event logging as well as internal tables for connection and redundancy port control monitoring.

Success Story

The tax payment of each HGV will be determined by the onboard GPS devices. When a HGV is not compliant with the tax program, a separate system will capture a snapshot of the license plate and send it back to the traffic control center for toll enforcement.

Transportation authorities in France have instituted an environmental tax for all Heavy Goods Vehicles (HGVs) traveling on a national highway network that stretches over 1,500 km.

To collect data from numerous vehicle detectors and cameras of over 150 toll gantries, Moxa's EDS-G509-T and EDS-510A-3GT-T Gigabit managed switches are deployed to transmit large volumes of images and transaction data to the traffic control center.

Developing Gigabit Fiber Networks for Toll Enforcement

Location: France

- Gigabit fiber network backbone for massive video and data transmissions over long distances
- Rugged design: -40 to 75°C wide temperature range
- Space-limited cabinet: Moxa has palm-size remote I/O product for environmental monitoring in cabinet.

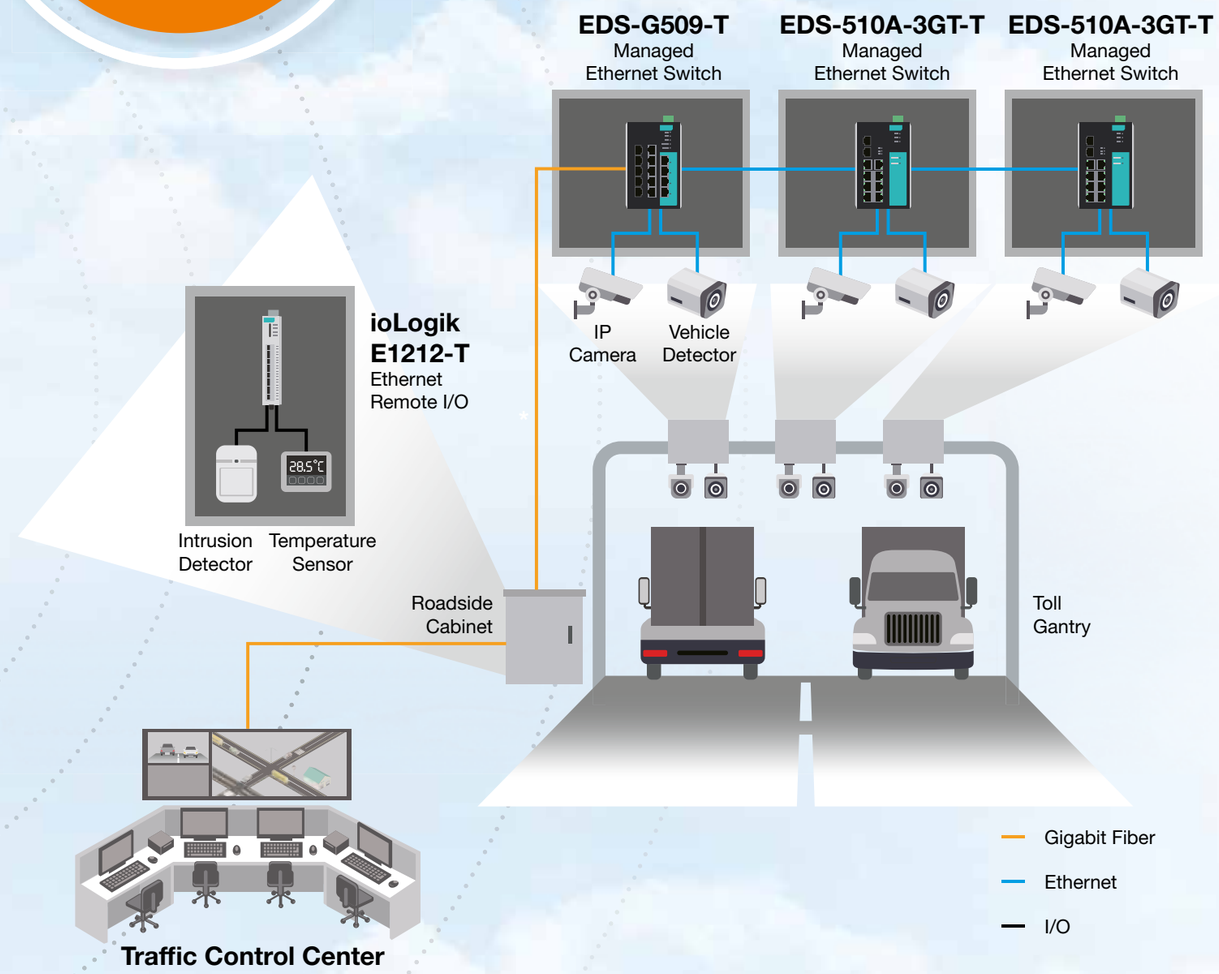
The EDS-G509-T is also equipped with 5 fiber ports to enable long-distance transmissions along national highways.

EDS-G509-T
Managed Ethernet Switches

EDS 510A-3GT-T
Managed Ethernet Switches

ioLogik E1212-T
Ethernet Remote I/O

Inside roadside cabinets, our compact ioLogik E1212-T remote I/O connects to temperature sensors and intrusion detectors for monitoring the cabinet conditions to enhance equipment safety and reliability.



Your Trusted Partner in Automation

Moxa is a leading provider of edge connectivity, industrial computing, and network infrastructure solutions for enabling connectivity for the Industrial Internet of Things (IIoT). With over 30 years of industry experience, Moxa has connected more than 65 million devices worldwide and has a distribution and service network that reaches customers in more than 80 countries. Moxa delivers lasting business value by empowering industries with reliable networks and sincere service. Information about Moxa's solutions is available at **www.moxa.com**.

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