Executive Brief

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Connected Railways Bring New Efficiencies and Amenities

As workers across the globe flock to urban centers where roads are heavily congested, railroads have a unique opportunity to attract new customers. But they're held back by aging, unreliable equipment and systems that don't communicate with one another, causing maintenance problems and delays that frustrate passengers and employees.

A secure, end-to-end communications system that connects trains, equipment, tracks, stations, and the operations center on a single network solves many of these problems.

It lets maintenance staff know about vulnerabilities in advance, so they can schedule maintenance before a breakdown occurs. It also lowers operational and IT costs and gives riders the fast, reliable Wi-Fi they expect.

Perhaps best of all, it brings railroads a whole new line of revenue opportunities.

Here's a look at how a connected rail system works to meet the needs of today's railroads and passengers.

Why Rail Systems Need to Modernize Quickly

As the world's population shifts to urban centers, where highways are overcrowded, polluted, and unpleasant, passenger railway is needed more than ever. A report published by SCI Verkehr expects global passenger rail to grow at an average rate of 3.75% a year up to 2025.

Increased traffic, while bringing welcome revenue, is putting even more pressure on railroads' already-strained infrastructure. That's especially true for communications systems, which in many cases have remained unchanged for years. As the world around them has moved to fast Wi-Fi and seamless connectivity, railways remain stuck with a mishmash of aging proprietary networks, each with its own operating system and maintenance requirements.

These networks are complex and expensive to maintain. Even when they're in top condition, they don't communicate well with one another, leaving employees in the dark about problems that could have been fixed sooner with better coordination.

"Say you have a safety valve on a train that's made by a manufacturer using its own proprietary system. That part may be likely to fail in two weeks, but if there's no sensor connected to that part, no one would know there's a diagnostic issue," said Matt Veltmann, global marketing manager for Cisco Connected Transportation solutions. The result could be a breakdown en route or a last-minute fix that puts the train out of service when it's needed most.

Passengers who need to get to work on time won't tolerate unforeseen delays. Their frustration is exacerbated when their Wi-Fi connection keeps cutting out, preventing them from getting work done on the trip. They don't understand why they can't listen to music or watch a movie, either—as they can on an airplane traveling 600 miles an hour.

The lack of connectivity isn't just a passenger inconvenience—it impedes efficiency throughout the railway and can affect safety. Locomotive operators often have trouble getting information about track conditions, which may warrant a change of route. Broken rails, for example, are a leading cause of derailments.

Poor connectivity also impacts stationmasters, who have trouble locating trains and equipment in maintenance yards. Operations center managers receive spotty dispatches from disparate sources and lack a clear picture of overall performance.

All of these problems entail costs and service problems that railroads can ill afford. To move toward a smarter future, operators need a fully connected, secure railway system.

Connected Rail Changes the Picture

One example of this new approach is Cisco Connected Rail. By taking advantage of scalable, secure, end-to-end Intel® technology, Cisco's platform provides a single, standards-based network that relays voice, video, and internet data to support a host of operations throughout the railway **(Figure 1)**.

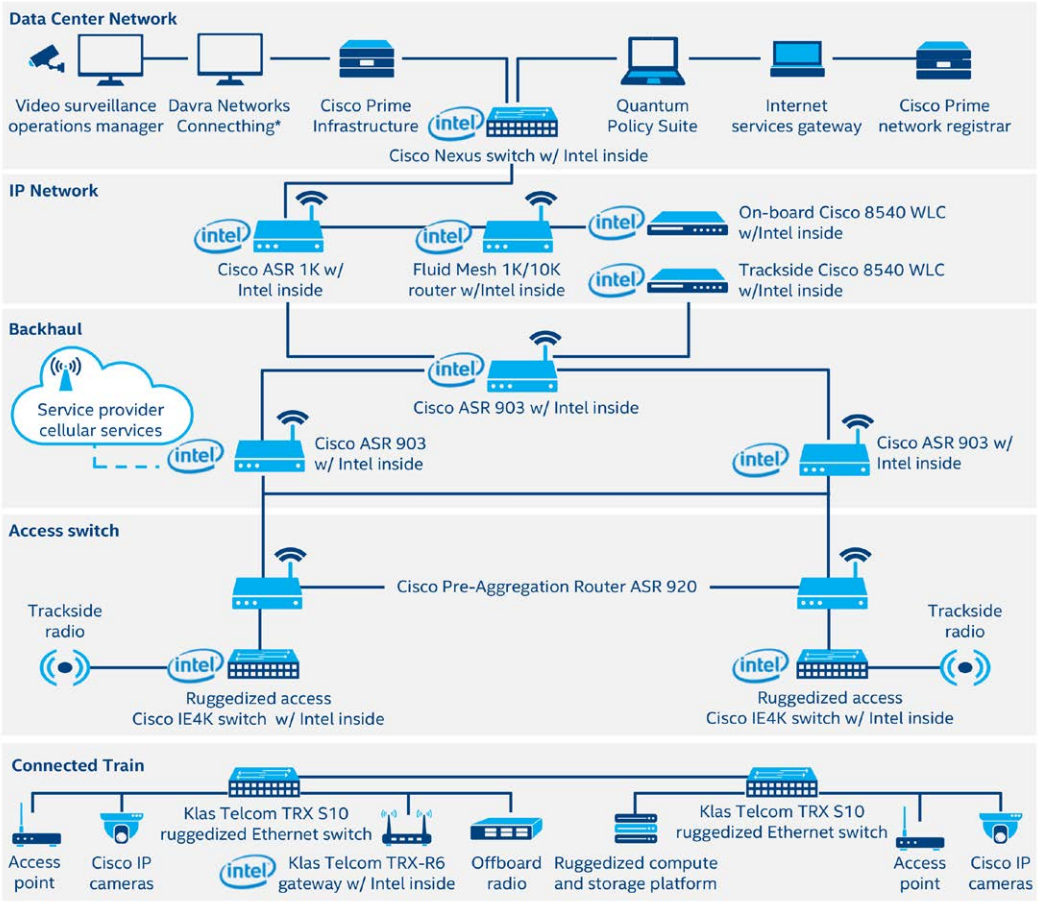

Figure 1. Cisco Connected Rail links operations throughout the railway. (Source: Cisco)

The unified network gives passengers the seamless Wi-Fi connection they expect. It also opens the door to new revenue opportunities for railroads.

The same high-speed network connects trains, tracksides, and stations, providing everyone the updated information they need to work together with maximum efficiency. Here's an overview of how it works in each phase of railway operations.

20%

Operational cost reduction after implementation

21%

Capital cost reduction after implementation

The Connected Train

Better connectivity improves operations on the train from start to finish, saving railroads money. GPS tracking lets operations managers know where trains are at all times. Using high-speed Wi-Fi, locomotive operators can communicate in real time with the operations center to ask questions or notify managers of problems.

Parts and equipment are tagged with sensors that tell the maintenance department when they need to be serviced or replaced, eliminating downtime and lowering service costs. By using Cisco Connected Rail, one European rail company reduced operational costs by more than 20% and capital costs by 21%.

High-speed communications improve security, too. Smart video cameras can identify problems and generate alerts in real time, enabling staff to contact emergency responders immediately. Footage is also tagged automatically so staff can easily review incidents later.

Video surveillance also provides valuable information for advertisers. If ticketholders agree to share their information, rail operators can display digital ads reflecting the train's changing demographics. If a girls' basketball team boards for a trip to the game, an advertiser can flash an ad for women's razors. At a different stop where a contingent of businessmen boards, the display might switch to a car commercial.

In addition to improving operations and adding revenue for railways, the connected train vastly improves the passenger experience. With uninterrupted high-speed Wi-Fi, they can stay connected for the entire journey. They can even watch a movie on seat-back screens. "Cisco and Intel have the bandwidth to provide streaming video and music to 500 passengers, even in remote places," Veltmann said.

Passengers who sign onto a commercial rail's Wi-Fi system or purchase digital tickets and agree to share their information can provide a gold mine of data to advertisers, who pay railways handsomely to collect the information. The more riders are drawn to the improved rail experience, the more advertisers will pay to reach them.

The Connected Trackside

Railroads have multiple maintenance yards scattered along hundreds of miles of track. Because the cars lack geofencing technology, operators have trouble tracking the cars with precision. Lost rail cars can sometimes take up to 18 months to find, Veltmann said. With Cisco Connected Rail, all rail cars contain Cisco routers with location-based sensors plus Intel technology-based routers with built-in location tracking, so workers always know exactly where each car is and no longer have to waste time searching for them.

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>
> **Matt Veltmann, Global Marketing Manager for Cisco Connected Transportation Solutions**

Thanks to ruggedized trackside gateways built with Intel processors, the same reliable connectivity that works on the train extends to the field. That means a maintenance technician in the middle of nowhere can use a two-way radio or a tablet to ask a supervisor back in the office about parts and installation.

Tracks themselves are equipped with sensors, cueing operators in to the condition of the steel. If it starts to buckle in the summer heat, service can be stopped until a maintenance crew corrects the problem. At level crossings, event-triggered video monitors provide advance notice of activity. If supervisors see a hazard ahead, they can immediately notify the locomotive operators to take action. "If a car gets stuck there, the train operator would know in real time," Veltmann said.

The Connected Station

A fast, unified network allows stations to speed service, improve security, and explore new revenue-generating opportunities.

Instead of waiting in line, passengers in a hurry can purchase tickets at digital kiosks, where they get real-time updates on arrivals, and can interact with a representative if they need help.

System-wide video surveillance automates the tracking of suspicious behavior in the station—such as someone who loiters along the tracks or leaves a package behind—and immediately brings it to the monitor's attention on a single screen that changes to display out-of-the-ordinary activity.

That's a big improvement over the siloed systems most railways have, which force monitors to watch multiple screens with separate feeds from various trains, stations, and tracks. A smart security system ensures that suspicious incidents don't get lost in the shuffle.

Connected stations are equipped with digital billboards, bringing in money from advertisers who bid for the opportunity to reach people in the busy hub. Advertisers also pay to send personalized ads and discounts to passengers using railway Wi-Fi. At noon, a station coffeehouse may offer a discount to passengers who visit within five minutes. A passenger who arrives at a stop near a retailer at 6 p.m. every day may be alerted to a short-term sale.

A station that provides passengers with a modern, efficient, enjoyable, and personalized experience encourages regulars to stick around and newcomers to visit. A new ecosystem of stores and advertisers can spring up within and around the station, bringing railways an enhanced image, more customers, and a diversified revenue base.

As railway managers analyze a trove of data from their connected systems, they will gain new insights that can improve every aspect of operations, from keeping up with changing passenger needs to improving routes and safety. Simply by connecting their communications effectively, railways can transform their business model to serve a new generation of customers.

Learn more about the Cisco Connected Rail and other Cisco Connected Transportation IoT solutions.