

Digital Transformation in Train and Railway Communications

Challenge

The railway industry is undergoing a major change. Passenger demand is increasing due to a growing population and a rising preference for environmentally friendly travel options, making public transport more essential than ever. Non-passenger railways are also evolving thanks to infrastructure investments and state-led initiatives. These changes are accompanied by digital transformation, which, in turn, affects this industry's communications infrastructure. RAD's solutions support existing infrastructure and provide innovative products for a seamless migration to packet, cellular and wireless networks.



Your Network's Edge®



Solution Brief

Digital Transformation in Train and Railway Communications

Reliable and efficient communications are crucial when it comes to the smooth operation of railways. This might seem obvious. However, there are challenges as many railway systems still rely on legacy infrastructure which means they use outdated technology. This limits the speed at which data can be transferred, along with reliability and scalability. In addition, modern railways are complex as they have trains, stations, control centers, and when each uses a different communication system, it causes breakdowns.

Cyber security is also a growing concern, as it can cause equipment and infrastructure to come to a halt, resulting in severe service interruptions. Furthermore, regulatory bodies are constantly updating standards for railway communication systems, requiring ongoing upgrades and adaptations.

Next-Gen Networks

Next-generation network technologies include various technologies:

- **Packet networks:** 10G/100G/400G high-capacity alternative to the outdated SONET/SDH networks
- **Fiber:** High-speed fiber-optic networks significantly enhance communication capabilities.
- **Licensed and Unlicensed Ethernet Radio:** Broadband radios allow high capacity for traffic delivery when fiber isn't available.
- **Future Railway Mobile Communication System (FRMCS):** Ensures continuity with GSM-R networks and supports digitalization.
- **LTE-R (LTE for Railways):** Specifically designed for rail networks, LTE-R enhances connectivity. This means that LTE-R enables high-speed wireless voice and data communications inside trains, between trains and ground control, and from train to train
- **5G:** With its high bandwidth and extremely low latency, 5G meets the demands of new real-time and other demanding applications.

These technologies are essential for real-time, high volume data transmission and maintaining operational reliability in rail systems.

Integrating systems with existing infrastructure ensures a smooth foundation for future scalability and technological advancements. Moreover, it assists in staying ahead of regulatory changes and developing solutions that comply with the latest standards. This proactive approach ensures that railway operators remain compliant while leveraging new technologies to optimize operations.

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RAD Solutions for Railways Connectivity Challenges

RAD solutions address all communication needs in the railway sector with always-on reliability and mission-critical protection. We provide cutting-edge tools for cyber-secure asset monitoring. In addition, Edge Computing, and critical infrastructure deployments, while ensuring seamless legacy interface migration to packet-switched communication technologies.

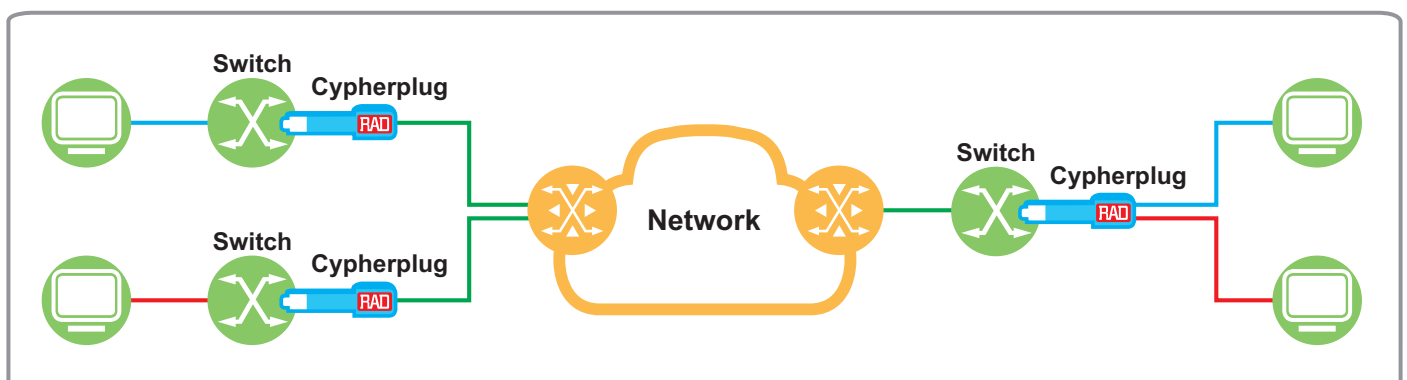
Megaplex

Megaplex, as part of multi-service platform, offers unique capabilities for migration scenarios:

- **Low latency:** FPGA-based design supports latency-sensitive services and ensuring end-to-end delay of less than 2msec
- **Hitless recovery:** Network failure recovery with zero bit errors at the TDM level, using a hardware-based redundancy mechanism that allows service recovery without downtime.
- **Traffic duplication:** Traffic delivery is protected by using multiple routes over different network technologies (for example, SDH/SONET + Packet).
- **Multiple protection levels:** Including path redundancy and port redundancy (equivalent to Path Protection and APS)
- **Interval-based counters for end-to-end pseudowire service:** Allow long term monitoring of the service, similar to SDH/SONET.
- **Adaptive clock recovery:** With accuracy of ± 0.016 ppm.

CypherPlug®

RAD's CypherPlug encrypts all data without needing to change existing equipment. With a simple plug and play installation, this miniature device is capable of hosting any standard MSA compatible 100 Mbps or 1 Gbps SFP.





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Secflow-1p

RAD's SecFlow-1p secure gateway is ideal for the following use cases:

- Railway supervision in suspected areas or secure crossings with CCTV backhauling via LTE network, including auto live feed of the crossing towards the train operator.
- Passenger services including WiFi and cellular network coverage.

SecFlow-1p Benefits:

- **Cybersecurity:** Advanced security features to protect communication channels from cyber threats and unauthorized access, ensuring the integrity and privacy of data.
- **Encryption:** End-to-end encryption of data in transit, safeguarding sensitive information related to train operations.
- **Real-time data transmission:** For mission-critical data such as train control signals, passenger information, and operational status updates.
- **Redundancy and failover:** Ensures continuous communication through redundant communication paths and automatic failover mechanisms.
- **Interoperability:** Compatible with existing railway communication infrastructure, allowing for seamless integration without the need for a complete overhaul.
- **Diagnostics and maintenance:** Facilitates proactive maintenance through diagnostic tools, helping to identify and resolve issues before they impact operations.
- **Sensor integration:** Enables the integration of IoT sensors and devices, providing valuable data for predictive maintenance, asset management, and operational efficiency.
- **Data analytics:** Collects and transmits data for analysis, helping to optimize train operations, improve safety, and enhance the passenger experience.

Airmux Wireless Solutions

Where fiber isn't available, RAD's Airmux Ethernet radios provide high-bandwidth connectivity in unlicensed spectrum:

- Point-to-Point up to 2.5 Gbps
- Point-to-Multipoint:
 - » Base stations up to 750 Mbps, dual up to 1.5 Gbps
 - » Subscriber units up to 500 Mbps



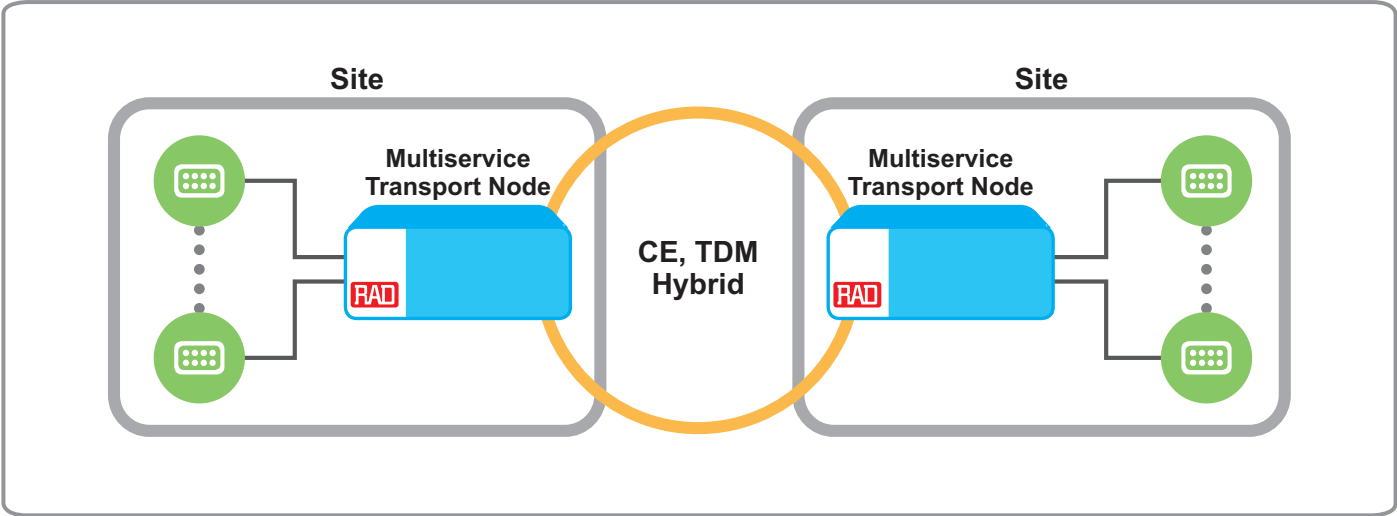
TerraBridge by Radwin

This solution provides onboard connectivity where there are inter-carriage link challenges or limited to no connectivity:

- 1.5 Gbps aggregated throughput
- Designed specifically for installation on trains:
 - » Railway certified, IP69K
 - » Minimal footprint

All the above provide high scalability with a wide range of port counts, starting at a single serial port (SecFlow) up to 160 serial ports (Megaplex). In addition, they address specific needs of railway communications:

Railway signaling systems based on legacy interfaces: Controlling railway traffic requires communication systems which includes modern and legacy equipment. RAD's Megaplex solutions provides the perfect fit for allowing communication of all interface types.





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Interference management: Railway environments are susceptible to interference from nearby tracks, tunnels, and other sources. RAD's SecFlow has the required certifications to be installed in challenging environments.

Security and privacy: Protecting communication channels from unauthorized access and ensuring passenger privacy are paramount. For new installations, RAD's SecFlow solutions offer robust security features.

Mission-critical data transmission: Real-time transmission of mission-critical data, such as train control signaling, demands robust communication solutions. RADWin offers reliable wireless communication solutions that ensure uninterrupted transmission of critical operational data, maintaining safety and efficiency.

By addressing these challenges comprehensively, RAD's solutions empower railway operators with reliable, secure, and future-proof communication systems. This not only enhances operational efficiency and safety but also positions the railway industry for continued growth and innovation in the digital age.

To learn more about RAD's solutions for railways, visit: market@rad.com.



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