



MAKING THE CONNECTION IN TRANSPORTATION

How Transit Operators Can Consolidate
Cellular Connectivity for Smarter,
Safer, and More Efficient Operations

THE EXPANDING MISSION FOR TRANSIT AUTHORITIES

As Jim boards the bus for his morning commute to his downtown office, he pays his \$2.00 fare by swiping his debit card in the fare reader. An onboard passenger counter ensures the vehicle remains within capacity limits. Meanwhile, a separate system provides the central dispatcher with the bus's location, speed and schedule status. And a wireless vehicle bus adapter monitors and reports the engine's performance, fuel usage, idle time and even diagnostic engine codes.

Jim quickly settles into his seat beneath a digital advertisement that changes every 60 seconds. At the back of the bus, a surveillance video camera helps the transit authority security team monitor the safety of the vehicle and passengers from its central headquarters. Jim takes out his smartphone, connects to the vehicle's passenger Wi-Fi hotspot, starts his music-streaming service and gets a head start on his email for the busy day ahead.

Whether it's by rail or by road, in public transit today, sophisticated cellular connectivity has rapidly become a mandatory requirement for creating a safe, comfortable and timely travel experience for riders of trains, buses and other passenger vehicles, while rider expectations are on the rise as well.

Transit agencies are struggling with a rapidly growing number of applications and how to economically implement all of them:

- Fare collection and payment terminal backhaul
- Computer-aided dispatch and automatic vehicle location(CAD/AVL)
- High-speed passenger Internet access
- Passenger counters
- Closed-circuit security cameras
- Remote engine diagnostics and fuel consumption
- Driver performance, including speed and idle time
- Digital maps, signage and advertising



The Digi WR64 cellular router offers an all-in-one mobile communications solution for secure high-speed cellular connectivity between vehicles and a central operations center.

These intelligent applications and subsystems—some of which have already been implemented by most transit agencies—can provide a broad range of highly valuable data, services and ROI. But they can present their own set of unique implementation, management and maintenance challenges.

MOVING BEYOND STOVEPIPE CONNECTIVITY

Over many years, transit agencies have gradually added different applications and systems to their fleets of vehicles—each of which uses its own independent methods for Internet connectivity. It usually started with GPS navigation and vehicle tracking CAD/AVL systems. Soon after, there were on-board payment systems (and even ticket kiosks in terminals and stations) that all needed backhaul to the central office. Then came passenger Internet, digital signs, cameras and more.

The result? A classic “stovepipe” situation with a multitude of different systems, data types, priorities, hardware and software. And, of course, each system had its own connectivity requirements and methods, deployments and installations, carriers, and other complexities. For transit agencies already burdened with countless vehicles plus IT infrastructure to maintain, and strapped by severe budget constraints... that’s a recipe for failure. And with even more hardware, software and connectivity to maintain and manage, the risk of system failure only increases.

For many transit systems, the better answer is to consolidate all vehicle connectivity through a single,

robust connection platform. The Digi WR64 cellular router offers an all-in-one mobile communications solution for secure high-speed cellular connectivity between vehicles and a central dispatch/data center. Ideal for challenging transportation and mobile environments, the Digi WR64 is a dual module LTE-Advanced router with true enterprise-class routing, security, firewall and integrated VPN. Future-built with a quad-core 1.91 GHz CPU and PCIe 2.0 internal bus, it offers a flexible interface design with an integrated Wi-Fi access point, USB, serial and four-port wired Ethernet switch, as well as GPS and Bluetooth.

Internet access for riders is managed securely and without impact to onboard bus systems. Triple carrier aggregation on each cellular interface can be combined to deliver up to 1.2 Gbps to passengers. Onboard systems retain priority and any remaining bandwidth is made available to Internet traffic. Dual cellular and Wi-Fi modules provide true segmented traffic flow of private and public data for fare collection, CAD/AVL data, camera log backhaul and passenger Wi-Fi access. What’s more, integration with a Digi Wireless Vehicle Bus Adapter lets you monitor engine diagnostics and vehicle performance from afar.

By consolidating vehicle connectivity for all your applications and subsystems, Digi WR64 can improve operational efficiency, increase on-time schedule performance and extend the life of your vehicle fleet.

For implementers, consolidated connectivity offers three distinct advantages:

1 SECURE AND NON-SECURE APPLICATION DATA THROUGH A SINGLE ROUTER

Most transit authorities want to ensure that data from their high-security applications, such as fare readers and payment systems, are segregated from less-critical applications, such as digital advertising. Those critical applications require three important characteristics:

- Encryption to prevent unauthorized viewing of your data
- Message integrity to ensure data hasn't been tampered with en route from the vehicle to the central office
- Authentication to verify the message is from a valid source

Traditionally, the practice was to deploy a separate, dedicated router for each application or subsystem. Digi WR64, as a single router, changes this with its encryption, authentication and message integrity features. The result is unified, secure and isolated traffic.

The key technology that makes this happen: IPsec, a protocol for securing Internet communications through authentication and data encryption. Using IPsec, the router can establish a virtual private network (aka a “tunnel”) using the public networking infrastructure.

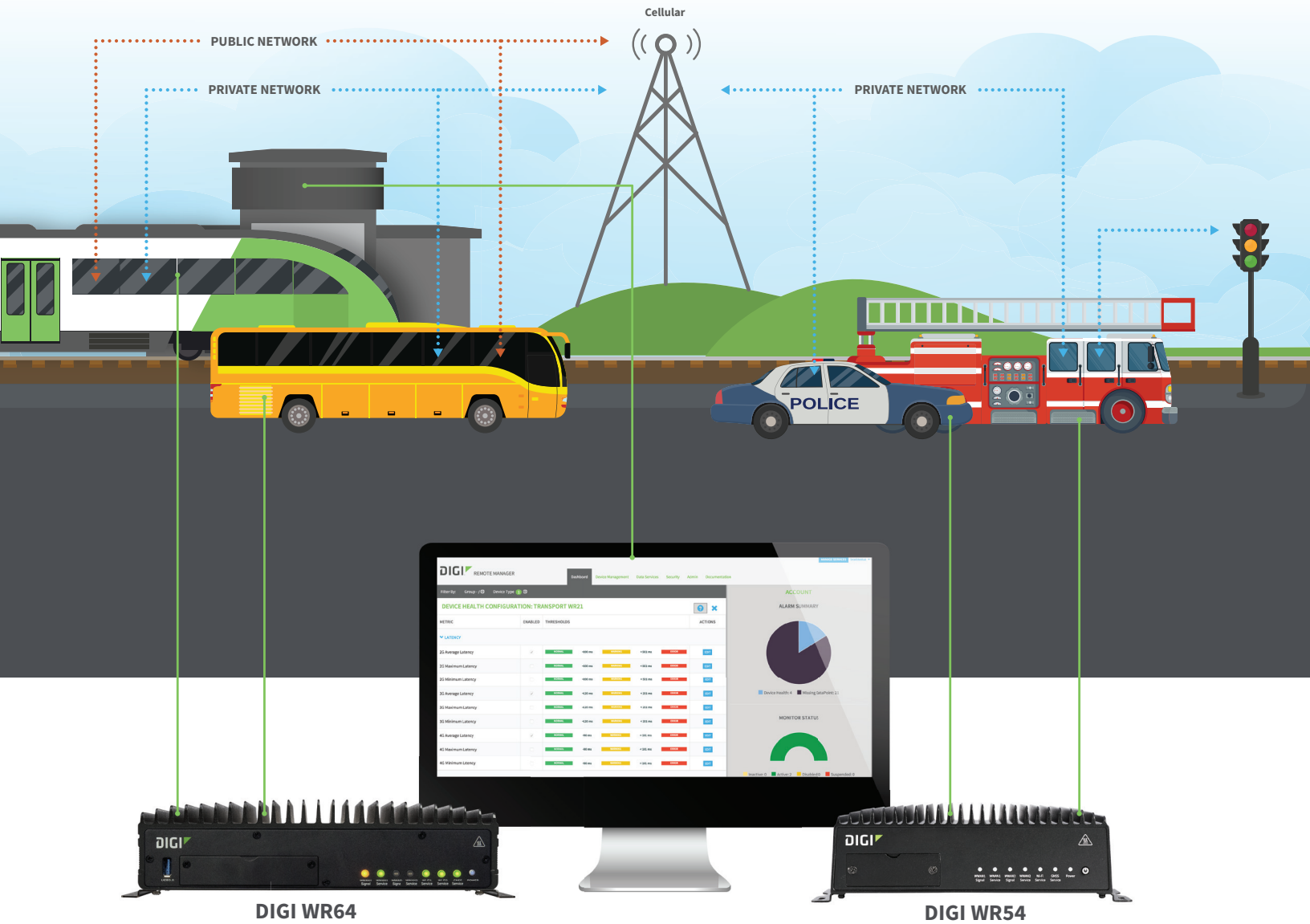
Digi employs this feature in the Digi WR64 router to enable transit authorities to create multiple separate, autonomous and simultaneous VPN tunnels from a single router—one tunnel for each application or subsystem’s traffic. In this manner, high-security payment data can travel on its own protected VPN tunnel without impacting—or being impacted by—other data traffic.

2 PRIORITIZING TRAFFIC

Of course, even when you route all of your wireless connectivity through a single device, that doesn't mean all data traffic has the same value. Certain subsystems—such as payment terminals or bus-engine data—must take priority, while passenger Wi-Fi



Versatile on-board public and private data connectivity.



DIGI WR64

DIGI WR54

DIGI WR64

PUBLIC TRANSPORT APPLICATIONS

- High-speed passenger Wi-Fi
- On-board security video
- Infotainment and digital signage
- Operator VoIP
- Fare collection
- Automated passenger counter
- Computer-Aided Dispatch (CAD)
- Automated Vehicle Locations (AVL)

DIGI WR54

PUBLIC SAFETY APPLICATIONS

- Body worn camera
- Automated license plate reader
- Delayed shutdown
- Mobility tablet
- Personal alert safety system
- Vehicle CAN bus
- Vehicle camera
- Location (GPS)



and digital signage are less important. For example, you don't want your payment transactions blocked because a passenger is streaming a music video.

The goal is to ensure that the high-priority traffic has the lowest latency.

This is achieved through the IETF standard for differentiated services, an enhancement to the Internet Protocol (IP) that lets you configure bits in the IP packet header to designate the priority of the traffic. Using quality of service (QoS) settings at the router, you can specify the importance of the data in that packet. This method is universal, so that IP packet receives priority throughout its journey—all the way to the back office or data center. In this manner, you ensure that your connectivity prioritizes the data traffic that matters most.

This is particularly relevant with mission-critical communications used by first responders, including the Nationwide Public Safety Broadband Network for emergency group communications, interagency communications and location tracking.

3 HIGHLY RELIABLE CELLULAR CONNECTIVITY

City officials and residents expect their regional transit systems to be safe and run on schedule—and that onboard systems such as fare collection and Internet access be fully operational. This requires a cellular communication link that is fail-safe and secure, with high bandwidth and low latency. Digi WR64 is purpose-built for such a task:

- Dual independent cellular interfaces can be configured for automatic failover
- Both cellular interfaces include dual SIM support to enable multiple network operator service
- Advanced cybersecurity features keep hackers out and the system running
- Each cellular interface supports the latest high-speed Cat 11 with 600 Mbps

The combination of the Digi WR64 advanced technology, fault tolerant architecture, high performance CPU and internal data bus lets onboard systems operate at their best. The outcome? A more efficient and friendly transit service for the community served.

AUTOMATIC FAILOVER MAINTAINS UPTIME

Modern transit requires equipment that leverages robust and resilient connectivity. This implies three careful design considerations:

- Dual redundant communications
- Complete cellular connectivity— with failover between carriers
- LTE coverage for faster connectivity

Digi WR64 relies on Qualcomm’s GOBI LTE technology, providing dual SIM cards. That means a vehicle can use its router to connect over two different wireless carriers, such as Verizon and AT&T. If one carrier goes down (or out of range), Digi WR64 auto-switches to another carrier across dual 600 Mbps CAT 11 cellular modules. And, since the device is no longer tied to a specific carrier, you can switch carriers without a truck roll or field-service call requiring a technician to physically access the device.



THE NEW STANDARD FOR DUAL REDUNDANT COMMUNICATIONS

Passengers today demand a faultless onboard Internet experience. And with so many transportation options, transit agencies that are unable to provide seamless Wi-Fi will struggle to grow or even retain their ridership. Meanwhile, agencies must also be able to integrate vehicle data from engines, logistics programs, fare collection, cameras, even digital signage, all while maintaining the highest level of security.

The new Digi WR64 meets these complex simultaneous needs with dual 600 Mbps CAT 11 cellular modules and dual high-speed Wi-Fi radios so that transit organizations can securely segment private data from public data. Internet access for riders is managed separately without impact to onboard communications systems.

- Video and vehicle data offload over 1.7 Gbps 802.11ac Wi-Fi backhaul: vehicles can offload data quickly at a depot and return to service as fast as possible
- Passenger Wi-Fi over 867 Mbps 802.11ac access point: Digi WR64 supports all IP-enabled passenger devices with the most recent technology
- Wired Gigabit Ethernet (4-port) for onboard systems: eliminate need for a separate network switch on board
- Quad-core 1.91GHz, 64-bit CPU: future-built high-speed architecture supports higher 5G network speeds as infrastructure is updated
- Digi Remote Manager: web-based management tool monitors both device and network health in mobile locations with automated updates to minimize service disruptions

PCI COMPLIANCE FOR TRANSIT AUTHORITIES

The payment card industry (PCI) standard for security is an important consideration for transit authorities that accept fare payments using debit or credit cards because PCI compliance is required for processing card-based payments.

This involves not only securing components, but also the entire process. The Digi WR64 is ideal for achieving PCI compliance because all of the requirements can be incorporated into the router:

- Stateful firewall
- Encryption
- Network segmentation
- Event logging
- User authentication



CONCLUSION

The future of transit belongs to agencies, operators and authorities that can leverage smart, secure and cost-efficient connectivity to improve the rider experience, lower costs and improve safety and performance. With cellular routers like Digi WR64, they can consolidate remote connectivity and simplify their infrastructures.

ABOUT DIGI INTERNATIONAL

Digi International is your mission critical IoT solutions expert, with the broadest range of wireless transit products, a cloud computing platform tailored for devices, and development services to help customers get to market faster with wireless devices and IoT applications. The entire Digi solution set is tailored to allow any device to communicate with any application, anywhere in the world. Look to Digi for what's next to keep you up to speed and up to date.

Key Takeaways:

- A proliferation of subsystems has created a hodgepodge of stovepipe applications that all use independent connectivity strategies.
- Agencies can move beyond connectivity and consolidate their communication through a single on-board cellular router that supports everything from CAD/AVL and fare-card swiping to passenger Internet and digital advertising signage.
- A single router can manage traffic for both secure and non-secure applications using IPsec and VPNs for separate, autonomous protected data streams.
- Passenger payments and other critical applications can be prioritized by configuring IP packet headers.
- Carrier redundancies can minimize the risk of downtime and give transit authorities more flexibility in their choice of carriers.

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