



# In-Vehicle Network Solutions

IT Buyers' Guide

## WHAT YOU'LL GET:

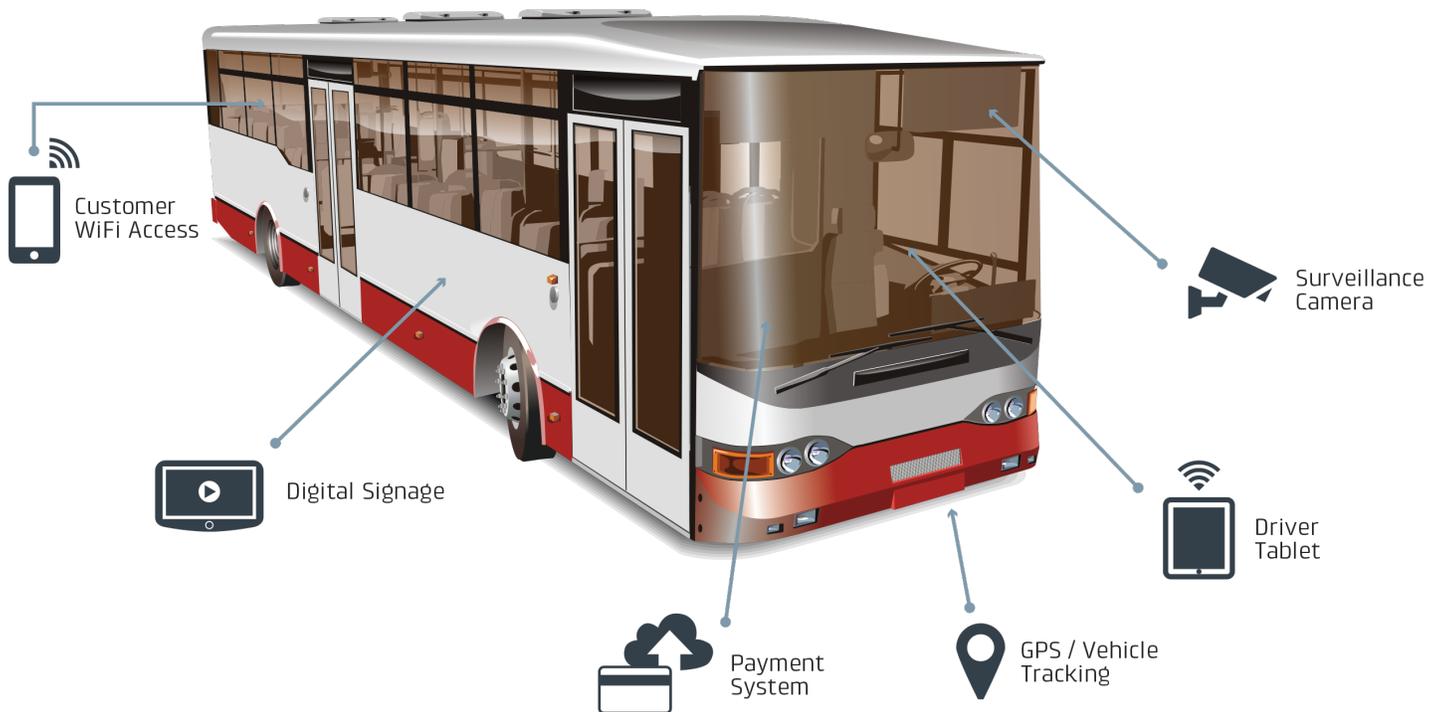
- + A comprehensive overview of solutions and options for network connectivity for road or rail.
- + The pros and cons for these networking options.
- + Items to consider when evaluating network solutions.
- + Challenges and solutions for in-vehicle networks.

## OVERVIEW

Transportation technology has developed rapidly over the past decade, and wireless connectivity has played a large role in this. Fleets now require reliable and always-available Internet connectivity to keep up with these innovations; and to enable improved productivity, fleet management, and extended services for passengers and public servants.

The benefits delivered by an in-vehicle network are diverse and numerous. These applications can lead to value-added passenger services, streamlined work processes, increased fleet security, and access to essential information on the road or rail.

There are a multitude of connectivity options available for in-vehicle networking solutions. This buyers' guide will help you understand the options so you can make an informed buying decision for your organization.



## CHOOSING THE RIGHT SOLUTION

The right mobile connectivity solution can enable:

- + A high-speed 3G/4G/LTE network with WiFi connectivity both inside and outside the vehicle.
- + Location tracking to provide real-time passenger information, increased fleet security and management, digital signage, and convenience for passengers.
- + Passenger WiFi for leading-edge customer services and engagement.
- + Security/CCTV footage on the go for instant and remote access to footage when you need it.
- + Connectivity to central dispatch or HQ, electronic reporting, ticketing, and Point-of-Sale solutions.

### NETWORK SOLUTION OPTION 1: USB MODEMS

These devices provide the user with plug and play access to 3G/4G/LTE wireless connectivity. Sold as part of a mobile data contract, they are widely available for both consumers and businesses from all network carriers.

#### Pros:

- + Plug and play: Instant connectivity, just plug the USB modem into your device and you are good to go.
- + Low cost: Simply choose a pre-packaged data plan to suit your needs.
- + Short lead-time: Order online and get connectivity-in-a-box, or go into a store and get your device instantly.
- + Portable – the USB modem transfers between devices easily.

#### Cons:

- + Built for consumers: As consumer-grade products, USB modems are not built to deliver 24/7 connectivity.
- + Temperature restricted: USB modems are not ruggedized, so these devices fail in extreme temperatures.



**USB MODEMS  
ARE NOT  
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CONNECTIVITY**

- + Vibration damage: USB modems are not built for vehicular use, so they break constantly due to vibration.
- + Environmental damage: These devices are prone to environmental damage because they are not dust or splash resistant.
- + Single host connectivity: USB Modems only connect one device at a time and have limited configuration options.
- + Requires host computing device: A USB modem cannot provide stand-alone connectivity and has to be connected to another computing device to work.
- + Internal antenna: USB modems have limited options for external antenna connections.
- + Small size: Tiny USB modems have little space for antennas, leading to a poor and unreliable signal.
- + Security: Consumer-grade USB modems only have basic security features and do not offer the enterprise-grade security required by many applications, such as payment or CCTV. USB modems are usually unsuitable for handling sensitive data that needs to be IT and PCI policy compliant. They are also vulnerable to breaches.
- + No cloud management: Each device must be individually managed, configured, and updated; a process that is extremely labor intensive and unrealistic for fleet management.

## Conclusion

While a USB modem is a fast and affordable option for providing in-vehicle connectivity, it does not provide a reliable cellular connection and is not designed to work inside harsh transportation environments where a more rugged solution is necessary.

For the best 3G/4G/LTE experience, MIMO antennas should be mounted with the proper amount of separation. The lack of external antennas on a USB modem means that performance will never be optimal, resulting in a poor signal.

Security issues are the largest concern with USB modems, especially for organizations that require secure connectivity to manage their data transactions from the road or rail.

The lack of cloud management also means that deploying firmware patches, updates, and configuring changes to the fleet is a manual process and cannot be achieved remotely, making USB modems impractical to manage and maintain.

## NETWORK SOLUTION OPTION 2: MIFI

MiFi devices (personal WiFi hotspots) are primarily consumer products which enable the user to create their own personal wireless WiFi hotspot. These devices typically allow users to connect up to five devices to the Internet at the same time over a 3G/4G/LTE connection.

### Pros:

- + Plug and play: Connects your device to the Internet at the press of a button.
- + Low cost: Simply choose a pre-packaged data plan to suit your needs.
- + No host computing device required: MiFi devices can provide stand-alone connectivity.
- + Short lead-time: Order online and get connectivity-in-a-box, or go into a store and get a MiFi device instantly.
- + Small and portable: MiFi devices fit easily in a pocket or briefcase, making them easy to use on the go.
- + WiFi connection: Connect multiple devices to the Internet at the same time.

### Cons:

- + Built for consumers: As a consumer-grade product, these devices are not as reliable as other connectivity solutions.
- + Temperature restricted: Personal hotspots cannot perform under extreme temperatures, often melting in heat or dying in the cold.
- + Vibration damage: MiFis break consistently due to vibrations from vehicle movement over rugged terrain.
- + Environmental damage: These devices are not dust or splash resistant, so they are prone to environmental damage.
- + Limited antenna options: MiFis have limited connection options for antennas, so they often suffer from poor signal strength.
- + Limited connectivity: MiFis only allow you to connect up to five devices, making them unsuitable where more connections are required.
- + Limited WiFi features: MiFis only provide basic WiFi and do not support advanced features such as WiFi portal integration or WiFi as WAN.



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- + Security: These devices only have basic security features and do not offer the enterprise-grade security required by many applications, such as payment and CCTV. They are unsuitable for handling sensitive data that must be IT policy and PCI compliant. They are also vulnerable to breaches.
- + No cloud management: Each device must be individually managed, configured, and updated, which is both time and labor intensive plus unrealistic for fleet management.

### Conclusion

While a MiFi can provide a fast and affordable option for creating an in-vehicle network, and it allows you to connect multiple devices, client device support is limited. Personal hotspots are also unreliable and they are not designed for an in-vehicle environment.

The inability to deliver security compliance to the vehicle network also makes MiFi devices unsuitable for organizations where security is paramount. The lack of cloud management means that MiFis are also difficult and impractical to maintain.

### NETWORK SOLUTION OPTION 3: 3G/4G/LTE ENTERPRISE-GRADE ROUTERS

Wireless routers provide a secure, reliable, and super-fast connectivity over a choice of cellular networks, enabling extended features and capabilities. They offer enterprise-grade mobile connectivity anywhere, anytime.

#### Pros:

- + Plug and play: Fast speed to deployment with “zero-touch” configuration.
- + Multi WAN support: These devices frequently support Ethernet, WiFi as WAN, Satellite networks, etc.
- + Remote access: Remotely access, manage, send, and retrieve data in real-time.
- + Ruggedized options: Ruggedized routers are protected from vibration, dust, splash, and extreme temperatures.
- + WiFi connections: Wireless routers allow multiple devices to connect, some allowing up to 128 connections at one time.



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- + **Simple integration:** The compact size and capabilities of advanced routers allow easy integration with other in-vehicle technologies.
- + **Antenna connection:** Wireless routers connect to an external antenna, which can be positioned to optimize coverage.
- + **Commercial warranties:** As enterprise-grade products, these devices typically come with enterprise-grade warranties.
- + **Extended power options:** Most ruggedized routers allow direct installation into a vehicle's electrical system.
- + **Stand-alone connectivity:** Wireless routers do not need to be connected to a host-computing device to provide connectivity.
- + **Designed to be deployed by IT professionals:** IT professionals can use routers to seamlessly extend their existing corporate networks and support critical functions.
- + **Secure connectivity:** Mobile routers offer enterprise-grade security with advanced security, VPN, and stateful firewalls to protect sensitive data. They are also designed for PCI compliant network architectures.
- + **Multi-carrier support:** Multi-carrier routers prevent companies from being "locked in" to a particular carrier which provides "future proofing" in fleet management.
- + **Cloud management:** Cloud management means you can easily monitor your entire fleet, configure multiple routers at one time, and deploy updates within seconds. Cloud management also provides access to reporting, analytics, diagnostics, security applications, and alerting. Use this to monitor data usage and avoid overages.
- + **Lower cost of ownership:** Ability to remotely manage and configure mobile routers through cloud management reduces total cost of ownership by decreasing technician time required in the field.
- + **Extended capabilities:** A wireless router's connectivity solution can be used for GPS location tracking, CCTV data retrieval, digital signage, electronic and mobile ticketing, and Point-of-Sale transactions.

**Cons:**

- + **Cost:** Enterprise-grade wireless routers are a more expensive hardware investment than USB devices and personal hotspots.
- + **Requires IT professionals to setup and maintain:** For some smaller businesses without internal IT teams, a router-based network may be a difficult option to implement without a managed services provider partner.

## Conclusion

3G/4G/LTE wireless routers provide the most reliable and secure solution for connectivity. Remote access and cloud management also makes them easy to implement and maintain – with enhanced capabilities that go far beyond consumer-grade options.

Although they are the most costly initial hardware investment, in-vehicle routers deliver the greatest return as a long-term solution. These routers offer increased functionality that delivers on your existing needs, while still offering a viable connectivity solution for future expansion. While other options may have a smaller initial cost, they are more expensive in the long term because of the need for constant hardware replacements, engineer adjustments, and in-person troubleshooting.

Overall, enterprise-grade wireless routers offer a complete, secure, reliable, and always-available connectivity solution.

## SELECTING THE RIGHT SOLUTION

Within the router market, there are products designed for a variety of industry applications, so you must understand the features you are looking for in a connectivity solution.

For example, a non-ruggedized router intended for application within retail environments may perform excellently within a retail store, but it would not be suitable for the rigors of the transportation sector.

When selecting a router for your in-vehicle network you should look for the following:

- + Certified 3G/4G/LTE enterprise-grade internal modem
- + Dual-band, dual concurrent WiFi (802.11 a/b/g/n/ac)
- + Ruggedized for vibration, shock, dust, splash, and humidity (look for products with the certifications to support this)
- + Built-in transient and reverse polarity voltage protection
- + 9-36 DC voltage input range
- + Integrated temperature sensor

- + Operating temperature withstanding -30°C to 70°C (-22 °F to +158 °F) and storage temperature withstanding -40 °C to 85 °C (-40 °F to +185 °F) with a temperature sensor that triggers alerts and automatic shutoff
- + Active GPS support
- + Cloud-managed configuration, maintenance, and firmware upgrades
- + Mounting integrated into the hardware for optimal placement and shock resistance is preferable
- + Supports Ethernet (T1, DSL, Cable, MetroE), WiFi as WAN, and Metro WiFi
- + Ignition sensing
- + Software-defined radio that supports multiple carriers (Gobi)

The above set of features will ensure that you select a device that is perfectly built for in-vehicle networking.

## CHALLENGES & SOLUTIONS

In addition to selecting the best possible device for your in-vehicle network, it is important to understand some of the challenges associated with implementation.

**Challenge #1:** Optimal operation of wireless routers requires monitoring, regular firmware updates, configuration, maintenance, and troubleshooting, yet most organizations cannot dock their fleets just for these purposes.

*Solution:* Cloud-based remote management software can enable these tasks from a central location while ensuring sensitive data stays safe. This solution offers 1-2-many management, zero-touch deployment, and group configurations to save time, money, and resources.

**Challenge #2:** Wireless routers use the vehicle's battery as a power source. This leaves the router susceptible to destructive electrical spikes, and it can flatten the battery without warning.

*Solution:* Identify a router that features a 9-36 DC voltage input range, has built-in transient and reverse polarity voltage protection, and uses ignition sensing for an optimal in-vehicle network.

**Challenge #3:** Reliable connectivity depends on optimal positioning of the router and antenna, and positioning needs will vary by vehicle and terrain. The level of usage will also have impact on the reliability of the router.

*Solution:* Be sure to understand the physical and virtual barriers that might negatively affect or deny connectivity so that each router can be placed correctly and installed for maximum connectivity. Antenna placement should ideally be outside the vehicle, ensuring the best connectivity available at each location. Always calculate the number of devices that will be connected to the network to support the anticipated usage as well. For example, large public transport vehicles with high demand for passenger WiFi will most likely require multiple networked devices.

**Challenge #4:** Weather conditions and temperature fluctuations, as well as day-to-day vehicular temperature conditions, can impact sensitive router hardware and damage it irreparably.

*Solution:* Select a ruggedized solution that can withstand extreme weather conditions and temperatures during operation and storage. Typically, your device should be able to withstand temperatures between -30° and 85° Celsius and it should be ruggedized for humidity, dust, and splash.

**Challenge #5:** High levels of vibration are commonplace in in-vehicle environments, so your router must be able to withstand rough terrain and varying speeds without coming loose or breaking.

*Solution:* Select installation brackets that are designed to handle rough terrain, and ensure that your router has been tested and certified to MIL STD 810G and SAE J1455 standards. Alternatively, select a solution that has mounting integrated into the hardware, optimizing it for placement and shock resistance.

**Challenge #6:** Choosing a network provider can be confusing. There are many different networks, with varying levels of coverage in the locations that your fleet will travel through.

*Solution:* Unique reception should be studied and evaluated prior to selecting your network provider, including a service analysis, route maps, and test drive. A pre-sales site survey should be used to gather reception data and help you to evaluate and pick the best network carrier for reliable coverage.

In addition to these general challenges, your organization may also face unique challenges that you need to be aware of. For example, your organization might have specific security requirements for your in-vehicle network. Routers can be selected and configured to overcome these challenges, but it is advisable that you partner with a knowledgeable and experienced hardware provider who can help to design a solution that is tailor-made for your needs.

## INTRODUCING THE CRADLEPOINT COR IBR1100

### HIGHLY AVAILABLE CLOUD-MANAGED NETWORKING FOR TRANSPORTATION

The ruggedized COR IBR1100 has been purposely built for in-vehicle networking, delivering the latest and best mobile technology features that an organization may need.

The COR IBR1100 brings with it a new age of rugged 3G/4G/LTE in-vehicle networking, with an industry-leading feature set that includes:

**Super-Tough & Fully Ruggedized:** Boasting an extensive list of safety and hardening certifications, the Cradlepoint COR IBR1100 is engineered to protect against extreme temperatures, humidity, shocks, vibrations, dust, water splash, reverse polarity and transient voltage. This solution is the most rugged router on the market today.

**Enhanced WiFi:** Offering the latest 802.11ac WiFi and allowing up to 128 devices to connect at one time, the COR IBR1100 offers the best possible WiFi connectivity both inside and outside the vehicle. You can easily cloud-configure your network to make it as secure or as open as needed.

**Cloud-Managed:** Monitor, configure, and upgrade geographically dispersed systems without requiring on-site technical resources. Improve productivity, reduce costs, and enhance the intelligence of your network – Cradlepoint helps you maximize the benefits of the cloud without losing your Internet connection when you need it the most.



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