



IT Buyers' Guide for In-Vehicle Network Solutions

A Comprehensive Comparison of Solutions for Mobile Networks

Overview

Wireless connectivity has played a large role in the rapid development of transportation technology. Fleets now require reliable and always-available Internet connectivity to keep up with in-vehicle innovations and to enable improved productivity, fleet management, and extended services for passengers and employees. The requirement for wireless WAN access has become even more acute with the proliferation of Internet of Things (IoT) devices and Internet-based applications.

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, improved public safety and response times for first responders, and access to essential information on the go.

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

Choosing the Right Solution

The right mobile connectivity solution can enable:

- A high-speed LTE network with WiFi connectivity both inside & outside the vehicle
- Flexibility in deployment with additional bandwidth or failover capability across multiple carriers
- Location tracking to provide real-time passenger information, increased fleet security & management, digital signage & convenience for passengers
- Passenger WiFi for leading-edge customer services & engagement
- Security / CCTV footage for instant & remote access to footage when you need it
- Connectivity to central dispatch or HQ, electronic reporting, ticketing & Point-of-Sale solutions
- The ability to upgrade solutions in the field for scalable network growth & future-proofing



Video Surveillance



Driver Tablet



GPS / Vehicle Tracking



Telematics



Point-of-Sale



Digital Signage



Custom Apps



Sensors



Passenger WiFi



Remote Management

Network Solution Option 1: USB Modems

These devices provide the user with plug-and-play access to LTE wireless connectivity. Sold as part of a mobile data contract, they're widely available for consumers and businesses from all network carriers.

Pros:

Ease

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

Cons:

Consumer Grade

- **Built for consumers:** As consumer-grade products, USB modems are not built to deliver 24x7 connectivity.
- **Temperature restricted:** USB modems are not ruggedized, so these devices fail in extreme temperatures.
- **Vibration damage:** USB modems are not built for vehicular use, so they may break or become damaged due to vibration and jostling.
- **Environmental damage:** These devices are prone to environmental damage because they are not dust- or splash-resistant.

Limited Capabilities

- **Single-host connectivity:** USB modems only connect one device at a time and have limited to no configuration options.
- **Small:** The USB modem's small size makes it very easy to lose. When used in a business setting, the loss of these modems can delay shifts and take IT staff's time to troubleshoot.
- **Requires host computing device:** A USB modem cannot provide stand-alone connectivity and has to be connected to another computing device to work.
- **No antenna:** USB modems have limited options for external antenna connections.
- **Security:** Consumer-grade USB modems only have basic security features and do not offer the enterprise-grade security required by many applications. USB modems are usually unsuitable for handling sensitive data that needs to be compliant. They also are vulnerable to malware and create a risk for security breaches.
- **No cloud management:** Each device used must be individually managed, configured, and updated — a process that is extremely labor intensive and unrealistic for fleet management.
- **No second modem:** USB modems have no capability for wireless-to-wireless failover or flexibility to utilize multiple carriers for additional bandwidth.



USB modems
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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 in harsh in-vehicle environments where a more rugged solution is necessary. Further, the lack of external antennas on a USB modem means that performance will never be optimal. Security issues are also of major concern with USB modems, especially for organizations that require secure connectivity to manage their network from the road.

The lack of cloud management also means that deploying firmware patches, updates, and configuration changes is a manual process and cannot be achieved remotely. This makes USB modems impractical — and ultimately expensive — to manage and maintain.

Network Solution Option 2: Single-Modem Mobile Router

Wireless routers provide 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.

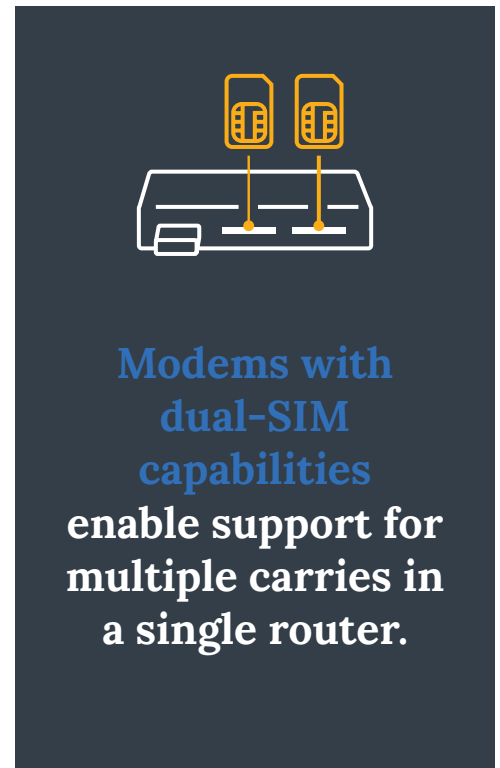
Pros:

Ease

- **Plug and play:** Fast speed-to-deployment with “zero-touch” configuration.
- **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, avoid overages, and roll out security or firmware updates en masse.
- **Simple integration:** The compact size and capabilities of advanced routers allow easy integration with other in-vehicle technologies.

Enterprise Grade

- **Antenna connection:** Wireless routers connect to external antennas, which can be positioned to optimize coverage.
- **Extended power options:** Most ruggedized routers allow direct installation into a vehicle’s electrical system.
- **WiFi connections:** Wireless routers allow multiple devices to connect, with some allowing at least 128 connections at one time.
- **Ignition sensing:** Set wireless devices to automatically turn on when the vehicle is turned on — and set a timer on each device to keep it running for a certain amount of time after the vehicle shuts off. Also, some solutions have built-in transient and reverse polarity voltage protection.
- **Active GPS:** Some wireless solutions support GPS and provide easy integration into AVL (Automatic Vehicle Location) systems.



Advanced Capabilities

- **Multi-carrier support:** Dual-SIM, multi-carrier routers prevent companies from being “locked in” to a particular carrier, which provides “future proofing” in fleet management.
- **Standalone connectivity:** Wireless routers do not need to be connected to a host-computing device to provide connectivity.
- **Unified Threat Management:** Unlike USB modems, some enterprise-grade routers can be secured with IPS / IDS (CJIS compliant), content filtering, multi-zone firewall, and Federal Information Processing Standard (FIPS) 140-2 support.
- **Multi-WAN support:** These devices frequently support WiFi-as-WAN, satellite networks, etc.
- **Extended capabilities:** A wireless connectivity solution can be used for CCTV data retrieval, digital signage, electronic and mobile ticketing, and Point-of-Sale transactions. A router designed specifically for vehicles is the only way for organizations to achieve GPS location tracking, AVL integration, and insights into actionable telematics data.

Cost

- **Lower total cost of ownership:** The ability to remotely manage and configure mobile routers through cloud management reduces total cost of ownership by decreasing technician time required in the field.

Conclusion:

Single-modem routers can be a good choice for in-vehicle connectivity. However, there are important requirements to keep in mind when exploring single-modem options. First, be sure to choose an enterprise-grade solution that comes with a commercial warranty and embedded modem.

The enterprise-grade router should also be built specifically for the demands of in-vehicle applications, which include an ability to withstand extreme temperatures, temperature fluctuations, power fluctuations, and vibration.

Further, if choosing a single-modem router, carefully consider whether there may someday be a need for dual modems; if so, choose a solution that allows for field upgradable dual-modem integration.

Cons:

Cost & Complexity

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

Limited Flexibility

- **Blind carrier switching:** Some single-modem routers are equipped with multiple SIM ports, which allows for switching between carriers as needs dictate. However, this process is far from seamless with a single-modem router. In the event of a signal disruption, it can take minutes to switch between carriers, and the only way to tell whether the second carrier will offer a better signal in that moment is to make the switch. If the second carrier doesn't offer a better signal, and going back to the first carrier is required, the vehicle could be offline for several minutes.
- **Limited bandwidth:** For some use cases, a greater-than-typical number of devices or high-bandwidth applications need to be enabled from time to time. Single-modem routers may not be able to provide sufficient bandwidth for such cases.

Network Solution Option 3: Dual-Modem, Dual-SIM Mobile Router

In addition to all the benefits of enterprise-grade, single-modem routers, some dual-modem routers can take advantage of Software-Defined WAN (SD-WAN), which enables a slate of features for in-vehicle applications with advanced requirements. Dual-modem solutions can also offer dual-SIM functionality, adding flexibility for load balancing, QoS, continuity, and multi-WAN functionality.

Pros:

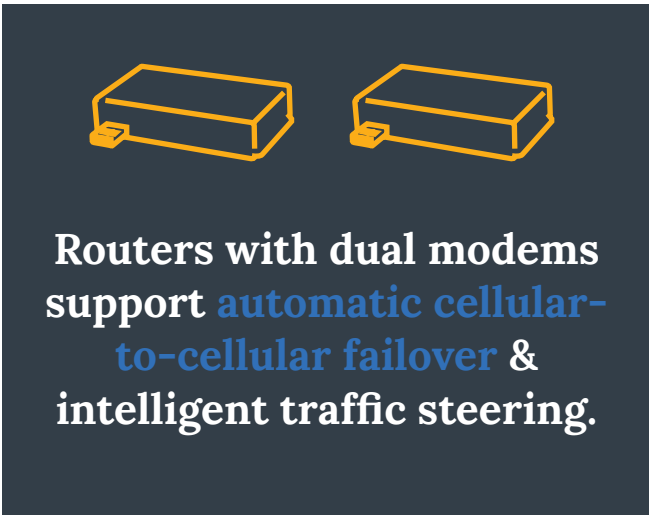
Flexibility & Reliability for Networks on the Move:

- **Cellular-to-cellular failover:** With dual modems, failover to a secondary carrier can take place instantly and automatically, which isn't possible with a single-modem configuration. The secondary modem, when paired with SD-WAN, allows both modem radios to constantly monitor both cellular connections for availability and signal strength and, if needed, intelligently fail over to a backup link in a matter of seconds, not minutes, ensuring that devices and applications that need constant connectivity never go offline.
- **Intelligent traffic steering:** A cloud-managed, software-defined dual-modem solution can bring the reliability and efficiency of Software-Defined WAN (SD-WAN) technology to mobile networking. This type of solution can optimize multi-link LTE connectivity and combine application-based visibility, security, and control with dynamic, policy-based traffic steering based on cellular signal strength, throughput, latency, and data plan consumption. In the case of a deteriorating signal, solutions with policy-based traffic steering capability can designate that business-critical traffic be sent over the stronger link while less important applications remain connected over the weaker cellular signal.

Cons:

Cost

- **Initial investment:** The near-term investment associated with dual-modem routers is often more costly than single-modem solutions. However, it is important to keep in mind the total cost of ownership and whether challenges associated with single-modem routers might ultimately cost more in the long term.



Conclusion:

Today's mobile enterprises require a network that can move, expand, contract, and change as organizational needs and environmental factors dictate. Mobile networks connecting people and things must become more scalable, secure, reliable, automated, and agile.

A dual-modem device will provide the most benefits to those use cases that require the highest levels of flexibility and reliability. A second modem can be used to augment bandwidth for applications such as passenger WiFi, video, or cloud access to ensure an ideal quality of experience, and solutions exist that make it easy to integrate a second modem.

Many of the most powerful benefits of dual-modem routers stem from the ability to take advantage of SD-WAN. If a dual-modem solution is best for your use case, it is crucial, then, to identify solution providers that can offer advanced SD-WAN capabilities without causing your organization to incur exorbitant cellular data costs.

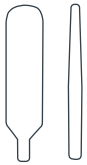
Purchasing Considerations: A Checklist for Selecting the Right In-Vehicle Solution

When selecting a solution for your in-vehicle network, look for the following features in software, purpose-built hardware, and support:

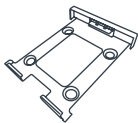
- Certified LTE enterprise-grade internal modem
- Dual-band, dual-concurrent WiFi
- Ruggedization for vibration, shock, dust, splash & humidity
- Built-in transient & reverse polarity voltage protection
- 9-36 DC voltage input range
- Integrated temperature sensor
- Dual-modem options with field upgrade capability
- Operating temperature withstanding -30C to 70C (-22F to 158F) with a temperature sensor that triggers alerts & automatic shutoff
- Storage temperature withstanding -40C to 85C (-40F to +185F)
- Mounting integrated into the hardware for optimal placement & shock resistance
- Supports Ethernet, WiFi-as-WAN, & MetroWiFi
- Ignition sensing
- Software-defined radio that supports multiple carriers
- Cloud-managed deployment, configuration, maintenance & firmware upgrades
- Ability to monitor device status in real time & set proactive alerts to optimize data usage & network uptime
- 24x7 support with emergency response
- Cloud-delivered Intrusion Protection System (IPS) & Intrusion Detection System (IDS) that defends against evasion attacks, improves network availability & protects sensitive data
- Direct-to-cloud security for filtering, intelligent routing & blocking access to unwanted sites
- Ability to set web filters to block unwanted content using predefined policy templates
- Active GPS support with ability to automatically map devices based on vehicle location & define a geofence perimeter

Deployment Considerations

It is important to understand the challenges that may arise during deployment, as well as how to mitigate them:



Antenna placement: Be sure to understand the physical and virtual barriers that might negatively affect or deny connectivity so each router can be placed correctly and installed for maximum connectivity. Antenna placement ideally should be outside the new 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. Also consider placement of other in-vehicle technologies with the antenna placement to ensure unobstructed connectivity.



Installation brackets: Select installation brackets designed to handle rough terrain, and ensure your router has been tested and verified to MIL STD 810G and SAE J1455 standards. Alternatively, select a solution that has mounting integrated into the hardware.



Choosing a provider: Unique reception should be studied and evaluated prior to selecting network providers. This study should include a service analysis, route maps, and testing in the field. A site survey can be used to gather reception and data and help you evaluate and pick the best network carrier for reliable coverage.

Introducing the Cradlepoint COR Series

Purpose-Built, Cloud-Managed Networking for First Responder Vehicles, Buses, Fleets & More

The ruggedized COR Series is purpose-built for in-vehicle networking, is designed to extend the value of SD-WAN to mobile networks in vehicles, and offers enterprise-grade ruggedization and processing power.



Key Benefits:

Three-carrier aggregation: The COR Series is the world's first LTE mobile router with three-carrier aggregation for best-in-class performance. It includes an embedded LTE-Advanced 600 Mbps modem.

Tough & fully ruggedized: Boasting an extensive list of ruggedization features, the Cradlepoint COR Series is engineered to protect against extreme temperatures, humidity, shocks, vibrations, dust, water splash, reverse polarity, and transient voltage. It is the most rugged router on the market today.

Field-upgradable: Offering a slot for a second modem, the COR Series offers the easiest way to add dual-modem capability. This allows organizations to future-proof network upgrades to the router without ripping and replacing equipment.

Dead reckoning: Precision GPS with dead-reckoning enables location-based applications even when the cellular connection has been interrupted.

Extensibility: Take advantage of GPIOs, Router SDK, NetCloud API for custom solutions, and more.

Cloud management: 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 enterprises maximize the benefits of the cloud.

IPS/IDS: These devices can take advantage of cloud-delivered comprehensive IPS/IDS that defends against evasion attacks, improves network availability, and protects sensitive data.

Product Comparison

Use this chart to distinguish between the main features offered by Cradlepoint’s in-vehicle routers and a USB modem.

Feature	IBR1700	IBR900 Series
Supports LTE-A	Yes, 600 Mbps	Yes, 600 Mbps
Cloud Management	Yes	Yes
Zone-Based Firewall	Yes	Yes
Zscaler Internet Security Support	Yes	Yes
CP Secure Threat Management Support	Yes	Yes (FW 6.3.2 and Later)
SIM-Based Auto-Carrier Selection	Yes	Yes
Ports (WAN/LAN switchable)	5 ports — GigE	2 ports — GigE, plus 2 10/100 with Extensibility Dock
Enterprise-Grade Modems	Certified embedded LTE	Certified embedded LTE
Wireless Broadband Technology	LTE / HSPA+	LTE / HSPA+ / EVDO, LTE / HSPA+
WiFi	Simultaneous tri-band 802.11 a/b/g/n/ac Wave 2 MU-MIMO	Dual-band, dual-concurrent 802.11 a/b/g/n/ac Wave 2 MU-MIMO
GPS	Active GPS/GNSS & dead reckoning	Active GPS with TAIP, NMEA
SIM Slots	2 (4 with second modem)	2 (4 with Extensibility Dock)
OBDII Support	Yes, with accessory cable	Yes, with dock serial cable & accessory cable
Housing	Ruggedized	Ruggedized
Operating Temperature	-22°F to 158°F (-30°C to 70°C)	-22°F to +158°F (-30°C to 70°C)
Dock Option	n/a	COR Extensibility Dock

About Cradlepoint

Cradlepoint is the global leader in cloud-delivered wireless edge solutions for branch, mobile, and IoT networks. The Cradlepoint Elastic Edge™ vision — powered by NetCloud services — provides a blueprint for agile, pervasive, and software-driven wireless WANs that leverage LTE and 5G services to connect people, places, and things everywhere with resiliency, security, and control. More than 27,000 enterprise and government organizations around the world, including 75 percent of the world’s top retailers, 50 percent of the Fortune 100, and first responders in 10 of the largest U.S. cities, rely on Cradlepoint to keep critical branches, points of commerce, field forces, vehicles, and IoT devices always connected and protected. Major service providers use Cradlepoint wireless solutions as the foundation for innovative managed network services. Founded in 2006, Cradlepoint is a privately held company headquartered in Boise, Idaho, with a development center in Silicon Valley and international offices in the UK and Australia.

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