

## Embedded and USB Solution Use Cases



There is a transition coming in which cellular is becoming a mainstream transport data technology. This paper will outline the two types of approaches to cellular data transport: as an embedded interface inside an enterprise-grade router, and as an “external add-on” to an existing router. Each has its place, but with definite use cases and caveats. The intended audience for this whitepaper is Enterprise CIOs, IT directors, and network managers with an interest in cellular transport.

Let’s start with the history of the USB modem. It was originally designed to enable connectivity for laptops while away from the office or home. Now that the smartphone has evolved into a personal computing device and mobile hotspot, how does the USB-based cellular modem remain relevant to the ever-shrinking non-cellular-enabled device market? USB-based cellular modems have helped address ad hoc needs to meet basic connectivity requirements. However, today enterprise customers also find multiple use cases and benefits in adopting cellular technology.

With this technology being increasingly relevant to enterprises, you also have to account for aspects such as security, manageability, etc. Plugging a USB aircard into a laptop can expose the corporate network, but by using VPN software you can secure the traffic. Typically, traffic was always one way, from the laptop in to the corporate network. However, with the Internet of Everything seeing explosive growth, we need to account for more two-way traffic as many sensors push their data into the cloud. These sensors will also be deployed in remote sites where using the cellular network is the only option to connect to the Internet.

In today’s fast-paced world, it is almost more important to receive the data instantly than for the received data to be 100 percent correct. Analytics and big data enable decisions to be made in seconds. How do you get that decision out to the field as quickly and securely as possible while maintaining security and manageability? In the past,

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security was left in the hands of the IT department, using dedicated routers with embedded interfaces that would have very strict controls. But not every installation can justify the expense of a router with tight controls. Some deployments require only basic connectivity using USB dongle cards at a low price without concerns about performance, security, or management. So where do you draw the line between security and flexibility? Every network is only as secure as its weakest point; therefore, protecting the edge of the corporate network remains a top priority. Let's take a look at where USB-based cellular modems can play a role in the Internet of Everything (IoE) and where it makes sense to stay with an embedded solution.

## Security

In order to secure any device, you must have total control over its physical access and configuration. Integrated interfaces (modems) offer much tighter controls, as they control the ingress point of the network, whether it's a card added to a router or a fixed-chassis router with built-in 4G. To comply with Payment Card Industry (PCI) standards, you must restrict access to all systems on a need-to-know basis and maintain separate usernames and passwords for tracking purposes. The use of a nonintegrated modem from your access router violates this regulation because it runs an OS that is outside of the control of the access router and doesn't restrict user access. In the mobility/Internet world, you can't control every device between the access router and your data center. But you should make reasonable efforts to mitigate man-in-the-middle attacks. The best way to secure an externally controlled USB-based cellular modem is to turn it off. Since it runs its own operating system without a management interface, the best way to connect it to your access router is to power it up only when it is needed for a short duration (for example, a backup situation). A standalone USB LTE modem, because of its nonintegrated OS, is capable of running nonsanctioned applications. These modems also have micro SD memory slots, which provide a safe haven for malware to hide (Figure 1). Integrated interfaces, in addition to supporting multiple packet data network (PDN) data calls, can use the dual SIM to support a recovery method in the event of a failed SIM. Additionally, you can use it to troubleshoot connection problems in case a single SIM is incorrectly provisioned.

**Figure 1.** USB-Based Mobile Modem



1. Micro SD memory slot, a perfect hiding spot for viruses and malware.
2. Two antenna ports to insert extended antennas, with no way to secure them to the modem to ensure a solid connection.

When you have to use USB-based devices, make sure your deployment includes securing every device. You should also use it only in temporary situations to limit the exposure to your company data. Remember: These

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devices were designed to be consumer equipment. This means they allow quick and temporary access to a single device (such as a laptop via a USB port).

## Management

How do you manage hundreds or thousands of devices that are all running an unmanaged OS? You put a lot of time into router selection and firewall evaluation, and in many cases the main decision point is the manageability. If you have spent significant time and effort to implement a fully end-to-end managed network, why would you let one element of that network remain unmanaged; a chain is as strong as the weakest link. You have taken the time to interview, select, and pay personnel to secure and manage your network. If you have four locations and can't afford a dedicated IT person at each site who can manage the network for you, it makes sense to find an easier way to manage your sites. Maybe you could invest in a cloud-managed solution so you don't have to run a dedicated management server. But don't forget: cloud managed really means that someone else is managing your server for you.

Troubleshooting your network requires total visibility into all systems and interfaces and the current status of the devices. Error logs and syslog messages will be critical for troubleshooting problems and finding the right solutions. When your cellular modems are embedded into your access routers, you will have detailed log files that will aid in the troubleshooting process. Without the ability to see details such as received signal strength indication (RSSI) values and noise levels, both current and historical values, you would be severely limited in your ability to determine what happened and how to fix it. Managing your network requires more than just a quick and easy web-based app to swipe and click.

## Dongle-Based Cellular Interfaces

You can enable an external interface to provide backup connectivity to your private network. This can provide a temporary outbound solution if, for example, you are in a disaster recovery situation and need to establish outbound connectivity. But this requires that you secure the external modem so that hackers don't get easy access. To achieve that, your internal IT staff needs to be able to manage the interface. Cellular allows for a quick deployment and very low cost during normal operations.

## The Embedded Solution

The embedded modem will solve the separate OS issue by running one OS to control all ingress points to the network. It also enables the better troubleshooting capabilities of the cellular connection. With the Cisco IOS<sup>®</sup> Software feature set, you also have the flexibility to troubleshoot remotely. Because the cellular modem supports Short Message Service (SMS), you are able to manage your router out of band (OOB) via SMS. You can even have a view into the entire access router, all interfaces and routing tables, etc. When you combine Cisco IOS Embedded Event Manager (EEM) scripts with SMS capability, you have an extremely flexible solution. You can select which radio technology should be used, or you can configure the router. An embedded solution offers the ability to troubleshoot a problem in minutes, whereas an external solution might take hours for a "truck roll" and in some cases a few days if the deployment is very remote or offshore.

The embedded solution also offers its own redundancy via dual SIM support. In short: An embedded cellular modem can act as a backup or primary path for corporate access and, via SMS, act as its own OOB platform.

Simple Network Management Protocol (SNMP) integration is far greater and more informative when using an embedded cellular modem. When you have the feature set of Cisco IOS Software and the SNMP 3G/4G MIB support, all facets of the router can be managed and tracked. When it comes to reactive management, embedded

cellular interfaces also have access to everything that happens inside the access router. An external modem would not be able to see a routing table issue, for example. The embedded interface will always give you tighter security and great functionality while maintaining the flexibility that any cellular device offers.

The embedded solution also offers a much wider variety of antenna solutions. Using industry-standard TNC connections, you will be able to select the right antenna for the solution you are providing. Whether directional antennas or outdoor antennas along with lightning arrestors, your solution will be safe, secure, and robust. Depending on the location of the data center, you might have to extend the antennas to get good signal coverage. If you need to extend 100 feet or farther, you'll need an interface that is capable of terminating a carrier-grade cable, such as LMR 240 or LMR 400. These cables are compatible only with TNC connections, which are typically not available on USB dongles. It is always better to extend an antenna than to move the router to gain a better signal.

The latest factor to emerge is the need for 4G plus Wi-Fi. Since 4G has become so robust that it is now playing the role of primary transport, and most client access has been Wi-Fi for some time now, the integration of these two technologies plays a critical role in the access layer of the future. An enterprise-class solution based on this technology has certain requirements, such as a rich routing feature set that you will get only with an embedded interface. Physical requirements will also be demanding, as these devices will not always be in environmentally controlled areas. To dissipate heat and protect from liquid damage, the 4G interface will require physical protection, which is inherited by an embedded solution.

Table 1 compares the features you can achieve with a dongle-based modem versus an embedded modem.

**Table 1.** Comparison of Features of Dongle-Based Modems and Embedded Modems

Feature	Dongle-Based Modem	Embedded Modem
Extended SNMP support	No	Yes
Multiple input, multiple output (MIMO)	No	Yes
Scripting support for interface	No	Yes
4G/LTE speeds	Yes	Yes
Data-only calls	Yes	Yes
Router configuration support via SMS	No	Yes
Syslog tracking of 4G interface events	No	Yes
Historical RSSI values	No	Yes ( up to 72 hours)
Multiple-antenna support	No	YES
Advanced DM logging	No	YES
Mean time between failures (MTBF) (in hours)	200,000	500,000
Integrated LTE hardware diagnostics and management	No	Yes
Quality of service (QOS) over LTE	No	Yes

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## Summary

The use of USB-based mobile devices such as the aircard can be part of your corporate infrastructure in the right situation. Considering that the service providers of today are moving away from the T1, ISDN, and plain old telephone service (POTs) line, where do you turn for a cost-effective backup solution? The USB modem, which was designed to be a consumer device, can provide cost-effective backup for your disaster recovery plan. USB-based external modems, with a monthly cost in the \$10 to \$20 range, are a very acceptable solution for worst-case, hope-it-never-happens purposes. When it comes to using cellular technology as the primary transport for business needs, an embedded solution will offer you the most flexibility, easier troubleshooting, and greater security, not to mention the use of performance routing over cellular or the use of Intelligent WAN designs using multiple cellular networks. While cellular speeds continue to increase, QoS and oversubscription will play an important role in network design. Let us not forget the durability of an embedded solution; embedded modems have an MTBF that extends the life of the device by more than a third. There is a need for both external and embedded cellular devices. The factors contributing to the decision as to where to use them are as diverse as the data they will carry.



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