

## Where's the Value in Your 4G Data Network?



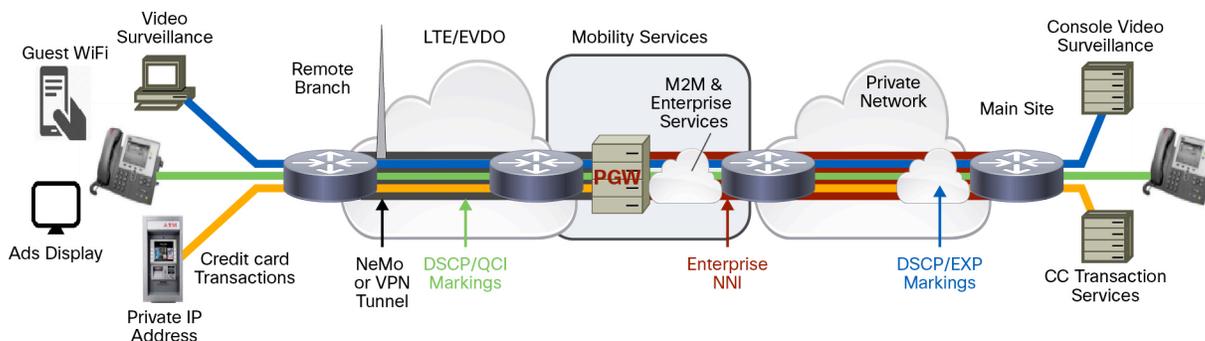
In today's fast-paced network world, the one constant is change. In the current network transition, we are moving away from traditional slow, time-division multiplexed (TDM) circuits to higher-speed virtual circuits via cellular. The benefits seem to be endless, from quick activation and deployment to lower cost, greater flexibility, and speed. Cellular is offering networks abilities they've never had before. The speed of cellular offers businesses the ability to run their operations over what was typically their out-of-band management link. This would include a backup for voice and video over cellular, in the event of a primary network outage. The coverage of cellular enables businesses to take the network into geographic locations never available via wired connections. The quick activation of cellular allows businesses to bring locations and services online in days or even hours instead of weeks or months. Cisco® 4G/LTE platforms combine the advantages that cellular offers inside an industry-leading router platform.

Gaining the most value from 4G LTE as a last-mile access for your network has the same general considerations as wireline last-mile access. The value is in the security, quality, and manageability of your network. This is key to ensuring that the services you can add on top of the transport have the performance, security, and availability the business needs.

The value of a 4G router is not just that it supports 4G; it is in how the router uses 4G with its networking functions. If a router supports 4G in a way that is fully integrated with security, quality of service (QoS), and manageability, the full business value is achieved; if the 4G support is an add-on, you could end up shortchanging your network. Cisco is fully committed to the cellular platform for machine-to-machine (M2M) and Internet of Things (IoT), with routers that include dual SIM, dual packet data network (PDN) connections, dual carrier, and up to four cellular connections in a single module chassis. Our portfolio covers a broad range of router platforms, from the fixed chassis ISR800 Series to Integrated Services Routers Generation 2 (ISR G2) and the Cisco 4000 Series ISRs. Support is coming for the Cisco ASR 1000 Series Aggregation Services Routers in the near future as well.

The old adage “your network is only as secure as its weakest link” should have you asking yourself what traffic is crossing the 4G link and how you can secure it. Is data on the 4G network susceptible to a man-in-the-middle attack? How do you engineer diverse paths for backup? If there’s a performance issue, can you get detailed information, logs, or even traces to resolve? Does the router provide the ability for granular QoS that works seamlessly with an LTE QoS subscription to provide business prioritization similar to a wireline connection? (See Figure 1.) Questions you consider for a wireline connection are also valid regarding a 4G connection.

**Figure 1.** LTE QoS for Enterprise and IoT



Source: PMIPv6 installation Guide:

[http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/mob\\_pmip6/configuration/15-mt/mob-pmip6-15-mt-book.html](http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/mob_pmip6/configuration/15-mt/mob-pmip6-15-mt-book.html)

**Security:** Not all VPN tunnel techniques are the same; there are different types for different needs. Having varied options such as IP Security (IPsec), IPsec with generic routing encapsulation (GRE), Dynamic Multipoint VPN (DMVPN), Group Encrypted Transport VPN (GETVPN), Network Mobility (NeMo), and Proxy Mobile IPv6 (PMIPv6) allows you to make the best choice for your environment. It’s easier to support just one or two tunnel choices, but does it meet the business need? 4G is sometimes viewed as more of a commodity connection, with any value functions added over the top. This may not provide the best protection for valuable corporate data. For example, if a pass-through device is put in front of the router, can that device be hacked and data or metadata be taken and misused? Can a denial-of-service (DoS) attack affect the site without ever being visible to your management system?

**Manageability:** If pass-through devices are put in front of the router, can the device provide recovery via the router’s console port, or does it depend on Telnet? If the latter, can the pass-through device recover a router in all circumstances? If the main router becomes inoperative, can the pass-through device take over all the major functions? The key question is, if a second device for 4G is preferred, should it be put in front of or next to the main router (providing link and router backup)? If the highest availability is not a consideration, or if 4G is the primary or only connection, how can a router manage the LTE connection if the 4G interface is on a pass-through device?

---

Can performance, retransmissions, or drops in a traffic class be resolved if the router has no visibility into the actual 4G connection?

**QoS:** Providing appropriate bandwidth, priority, and control for particular applications has long been implemented in networks. If a pass-through device front-ends a router, how does the router know when to engage QoS? Often prioritization is enabled during times of congestion. But the router does not see the 4G interface, only an Ethernet interface, and is blind to a pass-through device and any potential back pressure sent from the network.

Let's look at what is happening in the market to address these issues and see where and how to add value to your new 4G remote access network. It will in turn add value to your corporate network.

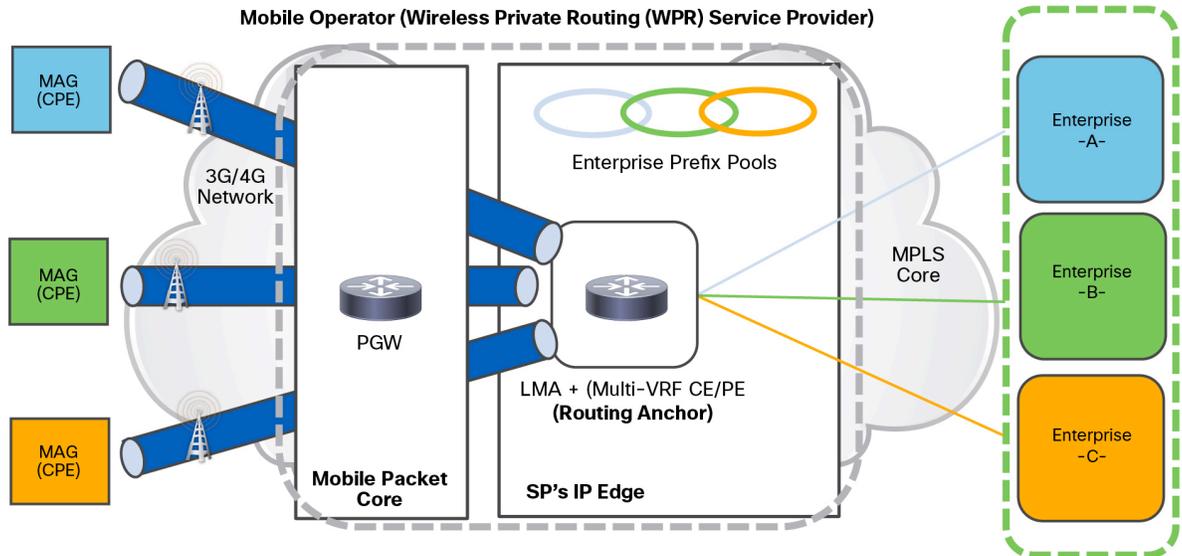
## Expanding the Network Edge

The rapid growth of the smartphone is due not to the speed of LTE, but more to the functionality of the phone's platform itself. The access that a cellular radio gives you enables you to access a resource at the exact time you need it. The same is true in the 4G/LTE router world. Simply adding a 4G access point by itself doesn't mean much if you can't run the application you need or access the data you need when you need it. The Cisco ISR platforms offer unparalleled options in the 4G/LTE transport environment. The 800 Series fixed chassis (C819G-LTE-MNA-K9), the ISR G2s (EHWIC-4G-NA-K9), and the new 4000 Series ISRs all support 4G/LTE as an interface (NIM-4G-NA-K9), but the platforms offer so much more. Cisco has been a router company for the last 32 years, so when it comes to understanding routing protocols we have the experience. We have brought Border Gateway Protocol (BGP), Intermediate System-to-Intermediate System (ISIS), Enhanced Interior Gateway Routing Protocol (EIGRP), and others to every transport medium. From the origins of TDM and T1 circuits to dense wavelength-division multiplexing (DWDM), Cisco has brought its Layer 3 expertise to each access medium.

Today's cellular data world is no different: a simple Layer 1 access medium is not really enough to compete in the mobile world. The concept of IP pass-through or bridging, as it was originally developed by DEC in the 1980s, has gone by the wayside in favor of more intelligent ways of exchanging routes. Merely passing packets through a device blindly is a security vulnerability. The reason a device would offer IP pass-through or bridging would be to let another device handle security. In most cases the device passing the traffic is passing it to a Cisco router to handle the security. When the requirement is IPsec, DMVPN, Dynamic Mobile Network Routing (DMNR), or PMIPv6, you go with a Cisco cellular-based router. Cisco was part of the international team that developed RFC standards as Mobile IP (MIP) and PMIPv6. These protocols were built for and around the new mobile world.

Figure 2 shows the WPR service logic tied to the gateways in the service provider IP edge. This approach is an overlay service built on top of the mobile network. Mobile Operator is the managed service provider.

**Figure 2.** Service Logic in IP Edge Routers



## Intelligence at the Edge

As you look to bring new devices to the enterprise network, you need to consider how you manage your network today and what is best for tomorrow. If you have a need to extend your corporate network outside the data center, and you need to do so in a secure way, why reinvent the wheel? Adding another management platform to manage a bridging device that the rest of the network is blind to is adding complexity to the overall task of managing the network. It also limits the network's ability to intelligently manage data flows. If your routing platform is blind to a 4G device that you have placed on the back side of your router to cheaply add 4G to your network, how do you expect the routing platform to intelligently make routing decisions based on congestion or best path? You are handcuffing your router platform from doing for your business what you need it to do—make smart routing decisions based on the environment and all paths at its disposal.

Let's look at the use case of replacing POTS lines and ISDN with 4G. To start with, a 4G out-of-band connection has the bandwidth to act as an alternate path for your data, which historically out-of-band connections could not do. Now, with the capacity to route traffic intelligently over this new 4G connection, the router must have access to data by which to make decisions. MIP and PMIPv6 can be used to turn that old out-of-band connection that carried only management traffic into a link that can sustain business continuity. So let's add that to its list of added business value. Cisco's complete portfolio of cellular platforms, from modular to fixed, brings to bear the complete Cisco IOS® Software routing feature set—a feature set that is more trusted, envied, and copied than the features of any other router in history. As with all Cisco devices, it is fully Simple Network Management Protocol (SNMP) manageable via your existing management platform. Why would you want to limit that environment by taking away a view to the network from the routing decision maker while also adding another management platform to manage that blind spot?

## Flexibility

While the competition is looking to build support for BGP or MIP, Cisco is leading the way with newer protocols such as PMIPv6, a lightweight security protocol built for the mobile environment. Although some take the easy route (pun intended) by offering bridging between the cellular interface and an existing access router, Cisco has led the development of new protocols such as PMIPv6. PMIPv6 is built on top of RFC standards based on MIP, which makes it an open standards-based protocol that any vendor can write to. Cisco allows you to build DMVPN, IPsec, etc. tunnels over the newest cellular technology (Cat 3, Cat 4, and Cat 6) while still maintaining manageability. The Cisco set of SNMP-compliant MIBs for the cellular environment is unequalled in the mobile access market. So as you look to secure the traffic on your cellular access router, you have the flexibility to use the more traditional modes and migrate to newer, lighter-weight protocols when desired.

All vendors are tied to the Third-Generation Partnership Project (3GPP) standard, and it puts most players on a commodity-type playing field. Cisco is compliant with the 3GPP standards while also offering best-in-class routing platform features. Cisco's scripting ability allows you to manage your environment via its application interface in a manner that affords greater flexibility.

**Figure 3.** Costs of Not Having Branch Flexibility

Costs of Not Having Branch Flexibility		
<b>New market opportunity</b>	<b>Remote management: Cost savings</b>	<b>Current cost optimization</b>
Expanding geography	Centralized monitoring	Wireline T1 vs 4G LTE
Temporary branches	Theft protection	Satellite vs 4G LTE
Location based services	Process optimization	Full branch backup

## The Importance of Being Compliant

Take the 3G fallback requirements of 3GPP. All compliant devices must be able to fail back to 3G and 2G in order to maintain a connection to the network. Everybody does this. However, when recovering back from 3G to 4G, to be compliant you must have 7 seconds of silence in both directions before the 4G modem will idle and search for a better connection. Obviously, if the 3G signal is degraded they can recover to 4G, but what if the 3G signal never degrades? Having encrypted tunnels up could delay an idle event that would trigger a move back to 4G. However, with Cisco IOS Embedded Event Manager (EEM) scripting, you can periodically check for the type of connection you have and run applets according to your desired radio access technology. This applet has been posted to Cisco.com, at <http://www.cisco.com/go/4g>. Cisco has posted this and a lot of other applets that can offer real advantages to your 4G deployment.

---

## Application vs. Applet

What is the value of a dual-core processor if your operating system can't use it? The next real innovation in access routing is the concept of fog computing. How close to the edge of the network can we push some compute power to make business decisions closer to where the data is gathered? The concept of fog computing is to enable full applications to gather data and match business processes against that data in the field, without having to bring it all the way back to the data center. The Cisco 800 Series fixed-chassis routers are cellular enabled and can run IOX. IOX is a combination of the envied Cisco IOS Software and a Linux container. The routers have a dual-core processor that allows us to devote a full core to the Linux process. Cisco also offers, via EEM scripting, the ability to run tickle scripts and add value to your network by automating functions that now can take place in real time. So whether you need a script to trigger an event or have the need for a full-fledged application to run at the edge, the Cisco 800 Series ISRs can accomplish that today.

Cisco 4G apps:

[http://www.cisco.com/c/dam/en/us/td/docs/routers/access/interfaces/software/deployment/guide/lte\\_access\\_011414.pdf](http://www.cisco.com/c/dam/en/us/td/docs/routers/access/interfaces/software/deployment/guide/lte_access_011414.pdf)

## SMS as a Network

While a lot of vendors support Short Message Service (SMS), for them it's merely a box they need to check off. Supporting a few commands to see the signal strength and then reboot the router isn't really much help in diagnosing a problem at the edge. Cisco offers the ability to run our full line of Cisco IOS commands over SMS. When the service providers of the world have stopped supporting the last-mile TDM circuit (basic telephone service, ISDN, T1/E1), and your primary connection is a wireless last mile, (cellular), how do you plan for out-of-band management? The SMS radio network is a separate network from your LTE radio network. So the ability to run the full command line set via SMS would definitely save a number of service calls. When you can see the local Ethernet interface status and change the configuration of an interface or routing process, you have given yourself the ability to recover from an outage with much more grace and accuracy than simply sending a reboot text to the router.

Cisco's SMS app:

[http://www.cisco.com/c/dam/en/us/td/docs/routers/access/interfaces/software/deployment/guide/guide\\_isr\\_lte\\_sms.pdf](http://www.cisco.com/c/dam/en/us/td/docs/routers/access/interfaces/software/deployment/guide/guide_isr_lte_sms.pdf)

---

## Summary

While our competitors are still learning how to stabilize their DMVPN tunnels or create BGP flows—things Cisco has been doing for the past 32 years—we are leading the way in this new world of the wireless last mile, virtual local loop access. When choosing your new or next access platform, make sure the decisions being made are for the right business reasons, and not out of fear. Don't back into the future of access routing by choosing access methods based on three-decade-old bridging technology because routing is too hard. While other vendors are trying to figure out how to make a stable routing platform, Cisco is advancing what cellular can bring to the table with strategic partnerships with service providers to streamline the activation process. From advances in antenna technology to an enhanced SNMP MIB, Cisco is offering advantages far greater than simple IP connectivity over cellular. Be a forward thinker: think not what could go wrong, but how much farther you can go with the right platform. Cisco cellular platforms offer cost-effective value at every level: the 800 Series ISRs, the ISR G2s, and the new 4000 Series ISRs. Security, routing, SMS, fog—Cisco has combined 32 years of routing and security experience and matched it with the newest protocols (PMIPv6) and the architecture of fog to create a platform to give you a real cost and business advantage.



---

**Americas Headquarters**  
Cisco Systems, Inc.  
San Jose, CA

**Asia Pacific Headquarters**  
Cisco Systems (USA) Pte. Ltd.  
Singapore

**Europe Headquarters**  
Cisco Systems International BV Amsterdam,  
The Netherlands

Cisco has more than 200 offices worldwide. Addresses, phone numbers, and fax numbers are listed on the Cisco Website at [www.cisco.com/go/offices](http://www.cisco.com/go/offices).

Cisco and the Cisco logo are trademarks or registered trademarks of Cisco and/or its affiliates in the U.S. and other countries. To view a list of Cisco trademarks, go to this URL: [www.cisco.com/go/trademarks](http://www.cisco.com/go/trademarks). Third party trademarks mentioned are the property of their respective owners. The use of the word partner does not imply a partnership relationship between Cisco and any other company. (1110R)