# Choosing a Cellular Solution for Connecting Devices to a WWAN

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Recent developments in the wireless and industrial automation fields have spurred businesses to consider using wireless technologies to connect remote devices. In the past, using wireless for communicating between remote devices or remote offices and the central office was not feasible due to problems with cost, speed, and reliability. However, wireless technologies have already reached a level of sophistication that makes wireless technology a feasible solution for a variety of applications.

## Cellular Technology for WWAN Applications

Cellular technology is currently the most popular choice for implementing wireless WAN applications. This is because of the extended range and coverage that cellular technology offers.

Cellular technology is usually classified into the two standards that are widely used in various parts of the world today—GSM/GPRS and CDMA. Current estimates put the global market shares for GSM/GPRS and CDMA at 80% and 20%, respectively. The GSM/GPRS standards comprise several generations, with each generation offering higher data rates than the previous one.

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The following table lists the various GSM/GPRS generations, and the data rates supported by each generation.

|  | **2G** | **2.5G** | **3G** | **3.5G** |
|---|---|---|---|---|
| **GSM Standard** | GSM | GPRS/EDGE | UMTS (WCDMA) | HSDPA/HSUPA |
| **Data Rate (Kbps)** | 9.6 | 54.2/237 | 384 | >1800 |

With the increase in data rates and reliability that cellular technologies (especially GSM/GPRS) now offer, they are becoming the primary data communication method for a number of industrial automation applications.

## Types of Cellular Products for WWAN Applications

To understand which cellular solution you need for your wireless WAN application, you need to know what options are available in the market and the specific applications or environments they were designed for.

### Cellular Modules

A cellular module is a supplementary module (or add-on) that provides a device with basic cellular capability. The module enables the attached device to connect to the cellular network using simple AT commands. Cellular modules are primarily used to enable host devices to send data back to the central office. In real-world applications, cellular modules are used as a backup data communication channel that can be used if the telephone service is unavailable or disconnected.

Cellular modules are developed by companies such as Siemens, Wavecom, and Telit, and are used by hardware vendors that want to add basic cellular capability to their own devices, such as machines, gateway devices, and routers. The modules usually come with a serial interface to support 2G and 2.5 standards, or a USB interface to support 3G and 3.5G standards.

### Cellular Modems

A cellular modem is a device that connects to intelligent serial devices to enable them to send and receive data over the cellular network (typically GSM/GPRS). Smart vending machines and automated teller machines (ATMs) are examples of intelligent serial devices that use cellular modems to send data back to and receive commands from a remote host.

Some cellular modems also support short message service (SMS) mode for data acquisition or simple control. For example, a machine operator can configure a device to send an SMS message when its status changes, or an engineer can change the LED display on a highway by sending an SMS message to the device.

Cellular modems operate in the voice channel and use one of two available data modes—Circuit Switched Data (CSD) and Packet Switched Data (PSD).

- CSD was traditionally used for data exchange, and works the same as dial-up modem-to-modem communication. With CSD, once a circuit connection is made, the connection is reserved exclusively for its users, and charges are based on the duration of the connection. This can be both inefficient and costly for some data applications. With Internet connections, for example, more time is spent reading information than is spent exchanging data, but you are still billed for the time spent reading. Many corporate email services address this problem by charging users only for the time they are downloading data, after which the user works offline.
- PSD is a technology where the communication "pipe" is shared by multiple users. Data is sent to a specific address after a short delay, in which the delay depends on the number of users as well as the level of priority requested for the information. Billing is based on the volume of data rather than the duration of the connection. PSD is the same method used for Internet communication. Since it

maximizes the use of the network, it will eventually be used even for voice communication, with high priority assigned to that form of traffic.

### Cellular IP Modems

In addition to intelligent serial devices, other simpler devices such as meters, LED displays, and detectors, may also need to send and receive data through the cellular network. However, since these are so-called "dumb" devices, they cannot be programmed to send and receive data automatically, and they cannot initiate TCP/IP connections. Non-intelligent devices such as these can still be connected to the cellular network using a cellular IP modem.

Cellular IP modems are similar to cellular modems in that they can enable devices to transmit data over a cellular network. However, whereas cellular modems can only connect devices to the cellular network, cellular IP modems come with a full TCP/IP stack that allows them to connect to other TCP/IP devices and networks, and also have an embedded operating system that allows them to be programmed to perform automated tasks. Simply put, IP modems provide non-intelligent devices with dialup capability, and allow the devices to initiate a data connection to the cellular network to send and receive data from the device. By using cellular IP modems, even non-IP serial devices, such as utility meters, can exchange data with IP-based devices and networks.

Advanced cellular IP modems also come with a number of operation modes that enable users to integrate these modems quickly and easily into their applications without needing to modify their software. Operation modes such as TCP server, TCP client, and RealCOM give users a great deal of flexibility by allowing them to enable only the modes that their applications require.

### Cellular Routers

Cellular routers, also known as 3G routers, are devices that connect remote LANs and remote Ethernet devices to the cellular network. Cellular routers are similar to cellular IP modems in that they come with a full TCP/IP stack that enables connected IP-based devices to be integrated with other IP-based devices and networks across the cellular network.

Cellular routers are typically deployed as the primary WAN link in areas or applications (such as environmental monitoring) where using wired connections is costly or not feasible. In areas that can be wired, cellular routers can also be installed as a backup communication link in case the primary cabled link fails. Since these cellular routers are typically deployed at remote gateways, some advanced models also provide built-in network security features, such as VPN and firewalls, that are integrated into gateway devices.

NOTE: Moxa provides several wireless products for industrial applications. For details, please visit our website at www.moxa.com, or contact the author, Dana Lee, at support@moxa.com.