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## WIRELESS DATA SERVICES

*This document describes various aspects of wireless data services. It provides only a “snapshot” of wireless data services today; recognizing that technology is evolving, and industry is introducing new services and capabilities at a rapid pace. This document is not intended to reflect a government position or endorse a particular service provider or service. Rather, it is provided to offer broad industry information on commercial wireless data services. We invite comments to ensure that the most current information is included in our analyses.*

*If you have comments regarding the information contained in this document, please contact the Public Safety Wireless Network (PSWN) Program Management Office (PMO) at 800-565-PSWN or access the PSWN Program Home Page at <http://www.pswn.gov>*

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Public safety agencies rely heavily on their land mobile radio (LMR) networks for communications and coordination within and among organizations. In the past few years, commercial services such as cellular and paging have provided powerful capabilities that complement existing public safety wireless networks. It is important that public safety communities carefully evaluate, assess, and maintain current information on the expanding commercial wireless marketplace. This allows informed, objective decisions to be made regarding the use of commercial services to meet public safety mission requirements.

### **The Increasing Importance of Data Services**

Data applications, such as electronic mail and database lookups (e.g., name searches or license plate queries), are becoming increasingly important for public safety users. Commercial carriers have developed a variety of wireless data services to meet this growing need. This report describes wireless data services, discusses some

of the key wireless data service performance characteristics, provides sample costs, lists some considerations in selecting wireless data services, and provides a checklist to assist in determining whether wireless data meets user needs.

### **What Are Wireless Data Services?**

Wireless data services allow users to exchange data while they are away from their wireline connected computer terminals (fixed or portable). Wireless data service providers operate their networks using radio frequency (RF) instead of wired infrastructure to transmit data. Using a mobile data terminal and a radio modem, mobile users can access the Public Switched Network (PSN) and the Internet via wireless transmission.

Mobile data services offer functions similar to those a user can get from wireline data services. The functions include electronic mail, Internet access, remote database lookups, and PSTN access. Users can access these services because most wireless data providers support a data

format similar to the one used for Internet communications. However, wireless data networks operate using proprietary protocols, which makes service and equipment integration difficult.

The following sections discuss specific characteristics of wireless data services. These characteristics and their definitions are listed in Exhibit 1.

<b>Availability</b>	<ul style="list-style-type: none"> <li>Identifies whether wireless data services can be acquired from a carrier in a given region</li> </ul>
<b>Mobility</b>	<ul style="list-style-type: none"> <li>Identifies whether wireless data services can be obtained while the the user is in motion</li> </ul>
<b>Coverage</b>	<ul style="list-style-type: none"> <li>Identifies whether wireless data services can reach users in a given service area</li> </ul>
<b>Accessibility</b>	<ul style="list-style-type: none"> <li>Identifies whether wireless data service users can access and use services during peak use periods or network disruption</li> </ul>
<b>Transmission Speed</b>	<ul style="list-style-type: none"> <li>Describes the actual end-to-end data speed, or throughput</li> </ul>
<b>Security</b>	<ul style="list-style-type: none"> <li>Describes the level of inherent security of the service and the capability to add security measures</li> </ul>
<b>Cost</b>	<ul style="list-style-type: none"> <li>Characterizes the typical costs of wireless data services</li> </ul>

**Exhibit 1**  
**Key Wireless Data Service Characteristics**

**Availability**

Like other commercial service providers, wireless data service providers deploy networks where they expect demand to exist to establish a good customer base. As a result, wireless data services are limited mainly to urban communities. As demand grows in surrounding areas, providers usually extend their network coverage to serve these areas.

Though no wireless data service provider currently offers service to the entire nation, several providers offer extensive coverage in select areas throughout the United States.

**Mobility**

Users who are accustomed to obtaining mobile voice and data services may find that certain wireless data services do not meet their mobility needs. Some wireless data services allow subscribers to obtain service only at fixed

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locations or in limited service areas. Users on these networks are limited to obtaining service at specific locations or in specific geographic areas.

Other service providers allow subscribers to receive service while travelling within a service area. They allow subscribers to pass from cell site to cell site while maintaining connectivity with the data network. Subscribers who wish to obtain service outside of their home area or in a mobile environment should check with their provider to ensure that these services can be obtained.

### **Coverage**

Like cellular service providers, wireless data carriers typically deploy networks in areas with high population density, such as metropolitan areas and along major roads. Consequently, carriers may not provide full coverage in rural areas or beyond major highways. This is a key consideration for users who expect and need contiguous service beyond those selected areas of coverage. Users should ask providers for detailed coverage maps.

As a result of the vendor's deployment strategy, wireless data service subscribers may experience coverage gaps as they roam outside of their region. These gaps often occur in less populated areas or away from major roads. They are also due to "dead spots" in a region, where the carrier's signal is too weak to communicate or non-existent.

RF transmissions are susceptible to interference from rough terrain or structure density (e.g., buildings, towers). Therefore, users in pronounced geographic regions or urban areas may have trouble maintaining connectivity. Users should match their operational requirements against the coverage provided by wireless data providers to ensure that the service is available where they need it.

### **Accessibility**

Users of commercial systems share the airwaves and compete for access with one another. If demand exceeds capacity, congestion may occur. Congestion in wireless data networks causes delays in getting initial access to the system, setting up a connection, and transmitting information. Some wireless data service providers allocate only one channel in each metropolitan area they serve. They may add channels only when demand exceeds capacity for an extended period [1]. Some wireless data service providers operate proprietary networks. Users on these systems compete for network access with other users on the same network. Data channels may have less traffic than those that carry both voice and data, depending on system loading.

### **Transmission Speed**

For wireless data services, transmission speed has three aspects, data transmission rate and call setup time. Generally, wireless data services

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provide a maximum link data rate of 19.2 kilobits per second (kbps). Actual user transmission rates are typically less. Speeds generally range from 1.2 kbps to 9.6 kbps on most wireless data networks [2].

Exact data speed varies among vendors. In fact, transmission speed may vary among metropolitan areas in the same network. For example, a carrier may offer a 19.2 kbps link data rate in certain cities and 9.6 kbps link data rate in others.

Additionally, transmission speed varies based on the services and mobility offered by the network. Wireless data networks with fixed access to online services, the Internet, and electronic mail may provide a maximum link data rate of 100 kbps. Although these networks offer users high data speeds, their subscribers lose the option of sending and receiving data while mobile.

Call setup time is the time it takes to begin transmitting information after the user pushes the transmit button. Most wireless data networks are not connection oriented. Therefore, a radio modem is ready to receive data as long as it is turned on. Call setup times for wireless data services range from less than 1 second up to 10 seconds [3]. Call set-up times also vary depending on the user terminal processing speed and the network conditions.

## **Privacy and Security**

Wireless data providers typically institute privacy features to limit unauthorized access to the network. These features include authentication and the use of passwords. Security features are also offered by some providers for the data transmission link. Users should ask carriers specifically about existing security measures in their networks.

Users with security requirements should consider end-to-end encryption schemes. They should assess the security practices of the service provider, with respect to physical, operational, and information security.

## **User Equipment**

Wireless data service users require two pieces of equipment to operate through wireless data services: RF modems and data terminals.

### *RF Modems*

RF modems are external equipment connected to a standard serial port or internal devices. Users must ensure that the RF modem they buy will operate on a provider's network. Because most wireless data networks are proprietary, only certain equipment is compatible with each network. Therefore, RF modems that work with one wireless data service may or may not work with another wireless data service.

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Modem prices range from \$100 to \$600, depending on what features the modem supports and whether the modem is purchased in conjunction with the establishment of service [4]. Several providers allow users to rent modems [5].

#### *User Terminal*

Most computers that support Internet Protocol (IP), a protocol that provides service across multiple packet-switched networks, can be used on wireless data networks. However, because some wireless data networks operate using proprietary protocols, conflicts may arise. Users should check with service providers to ensure that the network supports these devices.

Business users employ various types of user terminals, which differ in size and utility: notebook or laptop personal computers (PCs), handheld workstations, pen-based computers, personal digital assistants, and wireless handsets. User terminal costs vary significantly based on the levels of functionality, processing power, display characteristics, and vendor.

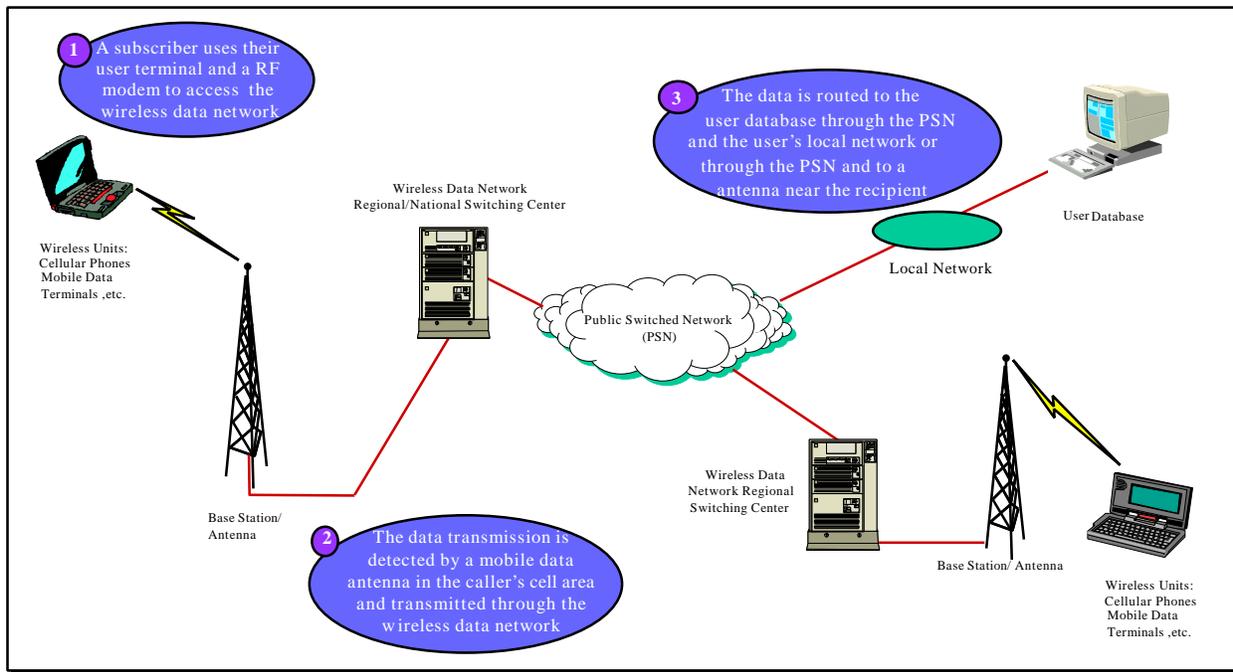
Key factors for mobile subscribers to consider when purchasing RF modems and user terminals include functionality, device ruggedness, ease of use, battery life, computational power, display quality, warranty, and cost.

#### **Wireless Data Services From a Network Perspective**

Most wireless data service providers operate in the 800-900 megahertz range using packet radio transmission. Similar to cellular service networks, wireless data networks are constructed in a grid-like pattern of adjacent service areas. Each service area has a transmitter that serves users in the area. As users travel from one area to the next, their sessions are “handed off” to the transmission equipment in the neighboring service area.

Exhibit 2 depicts the transmission of information from a mobile user device to a database located in the user's office or directly to another user on the network. When the user hits the transmit button, the information is sent over the airwaves and received by a nearby wireless data antenna, where it enters the PSN via a regional or national wireless data switching center.

From this point, the information is routed to a regional wireless data switch or the user's local network and, eventually, to the target database. If the information is intended for a user on the network, the regional switch transmits the data to a local switch and on to the intended recipient.



**Exhibit 2**  
**Wireless Data Services from a Network Perspective**

**Wireless Data Service Costs**

Service pricing structure and rates vary by carrier and pricing plan. Different user requirements and individually negotiated contracts may affect pricing. Wireless data service purchasers should ask carriers about volume discounts that may not be outlined in standard pricing plans. There are currently two major types of pricing plans: flat rate and usage based.

With flat rate pricing plans, users pay a set amount for unlimited usage. This pricing plan is advantageous for those who expect to make heavy use of wireless data services. Wireless data service providers are more likely to offer flat

rate pricing for Internet access and connectivity to online services.

Charges for most data network services are based upon the amount of data a user sends or receives. Carriers usually develop a two-tiered pricing plan. Users pay a set monthly price that allows a fixed level of usage, and then they pay incrementally, on a per-kilobyte-transmitted basis, for usage beyond the fixed limit. A typical pricing plan is shown in Exhibit 3 [6].

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	A	B	C	D
Monthly Charge	\$19.95	\$49.95	\$99.95	\$189.95
Maximum Kilobytes (Kb)	20	150	350	750
Additional Kilobyte	\$0.54	\$0.54	\$0.54	\$0.54

**Exhibit 3**  
**Example Per Kilobyte Pricing Plan**

Flat rate and two-tiered pricing plans are the most common ways carriers charge wireless data subscribers. However, wireless data providers may also charge strictly on a per kilobyte basis with no set monthly charge. Charges typically range from \$.20 to \$.25 per kilobyte [7]. Using a per kilobyte plan, a one page e-mail without an attachment would cost approximately .20 to send, while a compressed mug shot would cost approximately .62.

A broad range of prices exists for wireless data terminals. Prices range from the low \$300 range for personal digital assistants to \$2,000 - \$4,000 for notebook computers.

**Wireless Data Service Considerations**

Users should think carefully about what commercial services may meet their operational requirements. Exhibit 4 provides some considerations in selecting wireless data services. Wireless data packages and billing structures are likely to vary among carriers. Before acquiring these services, potential users may use the checklist in Exhibit 5 to help determine whether wireless data services meet their needs.

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## *Wireless Data Considerations*

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- **Cost**— Wireless data service prices are generally based on the amount of data communicated rather than the length of time a connection is sustained. Therefore, a user can maintain access to the network and still incur charges only for the data transmitted. This is important if an ongoing connection must be maintained.
- **Accessibility**—Wireless data service subscribers must contend with other voice and/ or data subscribers for access to the network. However, certain providers may dedicate channels for data transmission, which may allow greater accessibility to channels than those that share resources with voice channels.
- **Mobility**— Most wireless data services allow some degree of movement while using the service. Other service providers provide only fixed wireless data service.
- **Lack of Voice Service**— Most wireless data providers offer data services exclusively. If users need voice services, they must use another network.
- **Lack of Standard Equipment** —Equipment for proprietary networks may be incompatible with other networks.
- **Coverage Gaps**— Some wireless data networks may have gaps in coverage, depending on geographic terrain, shadowing from buildings, and network buildout.
- **Transmission Speed**— The typical data link speeds that users encounter in the field range from 4.8 to 9.6 kbps.
- **Roaming**— Wireless data services typically allow users to access services while away from their home region.

### **Exhibit 4**

### **Considerations in Adopting Wireless Data Services**

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**WIRELESS DATA SERVICES**  
**CHECKLIST**

- Do I need a wireless data service?
- Where do I need wireless data services? Locally? Regionally? Nationally?
- What data services are available to meet my needs? Will this work in my current operational environment?
- Will it support mission-critical requirements?
- What is the coverage of the carrier's wireless data network?
- Do known coverage gaps exist? Where?
- Will the provider address my coverage gaps in areas where I know I will need wireless data services?
- Is there regional or nationwide roaming within the network?
- Are there additional costs for regional or nationwide roaming within the network?
- What types of modems work on a proprietary network?
- What is the average transmission speed?
- What maximum delay in accessing the network will the carrier guarantee?
- What type of service and pricing plans are offered?
- How do the service plans rate against my needs?
- Are volume discounts or flat-rate pricing plans available?
- Are there other wireless data services that better meet my needs?
- What software would best meet my requirements?
- Are specific data terminals I want to use supported by the provider?
- Is leasing available, or must equipment be purchased?
- Is the service intended for mobile or fixed wireless data?

**Exhibit 5**  
**User Checklist of Questions to Better Understand Wireless Data Services**

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**APPENDIX A**  
**LIST OF ACRONYMS**

Kbps	Kilobits Per Second
LMR	Land Mobile Radio
PCMCIA	Personal Computer Message Card Industry Association
PSTN	Public Switched Telephone Network
PSWN	Public Safety Wireless Network
RF	Radio Frequency

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**APPENDIX C**  
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