



**Technical Solutions**

**Commercial Services**

**THIS COMMERCIAL SERVICES ANALYSIS HIGHLIGHTS THE FOLLOWING**

- Technical descriptions and conceptual drawings
- Appropriate uses
- Advantages and disadvantages
- Costs
- Spectrum requirements
- Management issues
- Security and standards issues
- Implementations

## **THE COMMERCIAL SERVICES SOLUTION AUGMENTS PUBLIC SAFETY LAND MOBILE RADIO (LMR) NETWORKS AND CAPABILITIES**

- LMR systems are the core wireless capability for most public safety agencies
- LMR systems meet the emergency and tactical communications needs of public safety users because they offer the following characteristics
  - Reliability
  - Availability
  - Accessibility
  - Control
  - Security
  - Functionality
- Although commercial services do not replicate LMR systems' reliability, availability, security, and functionality, these services can provide key enhancements and capabilities for public safety wireless users
  - For example, commercial services can be used to meet communications needs for agencies with increasing numbers of users until their systems can be expanded
  - Commercial services can also be used as a risk management tool to determine adoption and usage levels for new applications before including these capabilities in an agency's LMR system
- Commercial services offer a range of functions, performance, and price packages that can support voice and data applications and requirements

## **TYPES OF COMMERCIAL WIRELESS VOICE APPLICATIONS AVAILABLE TO PUBLIC SAFETY AGENCIES VARY DEPENDING ON THE SERVICE AND SERVICE PROVIDER**

- Commercial wireless voice networks allow users to communicate when they travel away from a fixed location or operate in a mobile environment
- Most commercial voice networks connect to the public switched telephone network (PSTN), allowing users to interoperate with other users on the PSTN
- Users can make local and long distance calls and use a variety of advanced features like call forwarding, call waiting, caller identification (ID), and voice mail
- Users can typically operate outside their local calling area
- Commercial wireless voice services include—
  - Cellular
  - Personal communication services (PCS)
  - Mobile satellite services (MSS)
  - Specialized mobile radio (SMR)
  - Enhanced specialized mobile radio (ESMR)

## **TYPES OF COMMERCIAL WIRELESS VOICE APPLICATIONS AVAILABLE TO PUBLIC SAFETY AGENCIES VARY DEPENDING ON THE SERVICE AND SERVICE PROVIDER (CONTINUED)**

- Cellular—
  - Resembles the wireline voice service provided by local and long distance carriers
  - Uses network antennas, or base stations, located in small geographic areas called cells, to provide mobile communications to users in that cell
  - Is provided by both analog networks, which generally provide voice services, and digital networks, which provide additional features such as enhanced voice quality, paging, caller ID, and text messaging
  - Operates in the 800 megahertz (MHz) frequency band
  - Is the most widely used commercial wireless service
  
- PCS—
  - Is an all-digital service with features similar to wireline voice and cellular services
  - Often integrates other commercial services such as paging, data, and electronic mail (e-mail) access
  - Operates in three different spectrum categories
    - Narrowband (930–931 MHz)—Primarily paging services
    - Unlicensed (1910–1930 MHz)—Primarily short-range communications (e.g., data networking in office buildings with wireless local area networks [LAN] and wireless private branch exchanges [PBX])
    - Broadband (1850–1910, 1930–1990 MHz)—Primarily integrated voice, data, and video

## **TYPES OF COMMERCIAL WIRELESS VOICE APPLICATIONS AVAILABLE TO PUBLIC SAFETY AGENCIES VARY DEPENDING ON THE SERVICE AND SERVICE PROVIDER (CONTINUED)**

- MSS—
  - Is a telecommunications service delivered via satellite to, or from, mobile users
  - Uses three types of systems
    - Geosynchronous Earth orbit (GEO) systems, which—
      - Orbit approximately 22,300 miles from Earth
      - Provide coverage primarily to large regional areas
      - Have inherent transmission time delays
    - Medium Earth orbit (MEO) systems, which—
      - Orbit 3,125 to 9,375 miles from Earth
      - Require about 12 satellites to provide global coverage
      - Are unlikely to experience transmission time delays
    - Low Earth orbit (LEO) systems, which—
      - Orbit 500 to 1,250 miles from Earth
      - Require about 20 to 100+ satellites to provide global coverage
      - Include "little" LEO systems that provide only low-speed data services and "big" LEO systems that provide voice, data, and video services
      - Are unlikely to experience transmission time delays

## **TYPES OF COMMERCIAL WIRELESS VOICE APPLICATIONS AVAILABLE TO PUBLIC SAFETY AGENCIES VARY DEPENDING ON THE SERVICE AND SERVICE PROVIDER (CONTINUED)**

- SMR—
  - Provides mobile dispatch service, which allows users to communicate with a single radio, with all radios in a group simultaneously, or with a subgroup of radios in the group
  - Resembles traditional LMR services because it offers voice dispatch service within a local area
  - Operates in three different frequency bands
    - 220 MHz
    - 800 MHz
    - 900 MHz
  
- ESMR—
  - Provides digital dispatch, cellular, and paging services through a single network
  - Is the product of infrastructure upgrades by numerous SMR providers that enable them to offer advanced digital technologies and thus deliver a relatively comprehensive, integrated suite of wireless services

## **TYPES OF COMMERCIAL WIRELESS DATA APPLICATIONS AVAILABLE TO PUBLIC SAFETY AGENCIES VARY DEPENDING ON THE SERVICE AND SERVICE PROVIDER**

- Commercial wireless data networks allow users to communicate from a fixed location and, occasionally, in a mobile environment
- Most commercial data networks connect to wireline resources, such as databases, and access the Internet
- Some commercial wireless data networks offer low bandwidth data services such as short message service (SMS) and small file transfers
- Other services allow users to transmit high-bandwidth data such as large files, images, and videos
- Access typically occurs via a wireless modem
- Commercial wireless data services include—
  - Cellular
  - PCS
  - Paging
  - MSS
  - Cellular digital packet data (CDPD)
  - Wireless data services

## **TYPES OF COMMERCIAL WIRELESS DATA APPLICATIONS AVAILABLE TO PUBLIC SAFETY AGENCIES VARY DEPENDING ON THE SERVICE AND SERVICE PROVIDER (CONTINUED)**

- Cellular—
  - Requires users to dial in to the network using their cellular telephone and modem
  - Uses the same cellular network for both voice and data services
  
- PCS—
  - Requires users to dial in to the network using their PCS telephone and modem
  - Supports file exchange and PSTN access
  - Uses Global System for Mobile Communications (GSM) air interface technology, which supports large and small file transfers and PSTN access or Time Division Multiple Access (TDMA) and Code Division Multiple Access (CDMA) technologies. TDMA and CDMA support only SMS
  
- Paging—
  - Allows users to transmit messages to paging subscribers
  - Allows pages to be broadcast in voice, numeric, or text format to an individual subscriber or simultaneously to a selected group of users
  - Uses the most advanced text units to receive—
    - SMS
    - E-mail
    - Voice mail notification
    - Media content

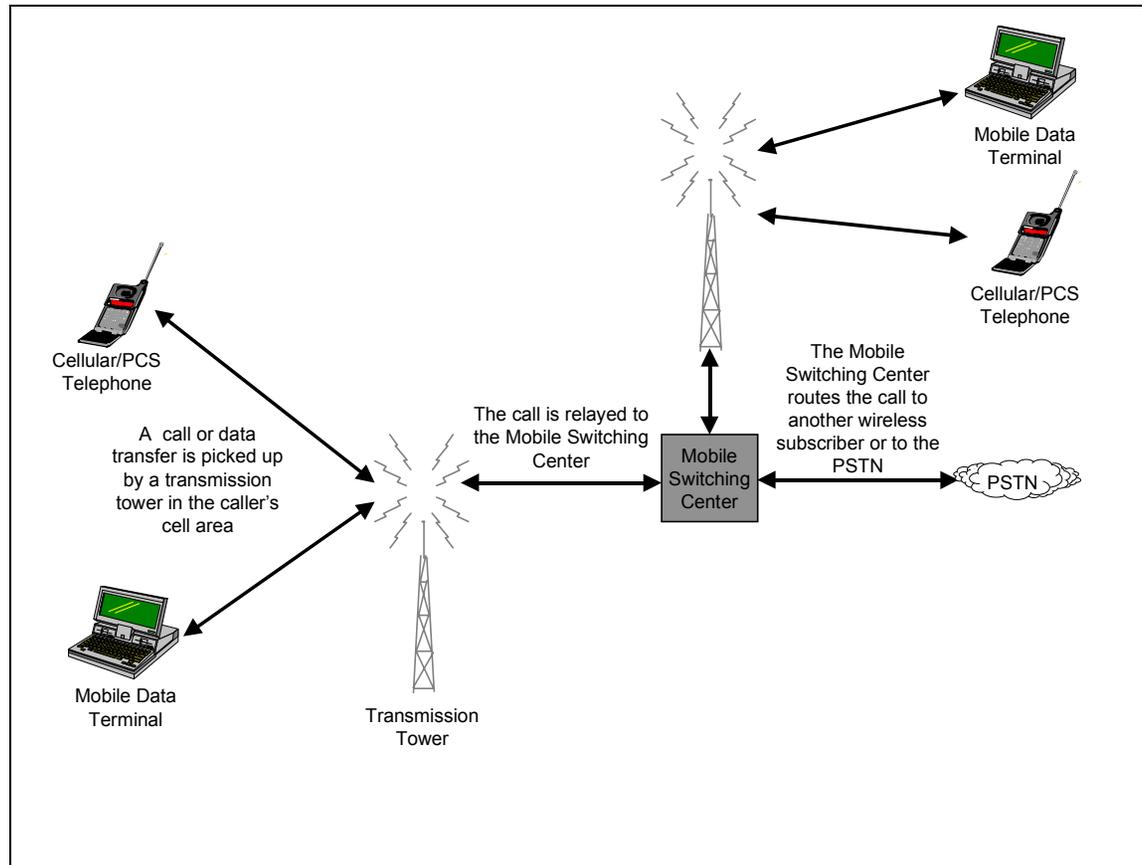
## **TYPES OF COMMERCIAL WIRELESS DATA APPLICATIONS AVAILABLE TO PUBLIC SAFETY AGENCIES VARY DEPENDING ON THE SERVICE AND SERVICE PROVIDER (CONTINUED)**

- MSS—
  - Connects users to a network by using a mobile computer attached to a wireless satellite telephone
  - Provides communications in most areas where terrestrial networks are unavailable
  
- CDPD—
  - Allows users to perform various functions, such as accessing remote database and transferring files
  - Uses a data format similar to the one used for Internet communications
  - Uses channel hopping or dedicated channels on the cellular network to provide packet data capabilities
    - Channel-hopping CDPD transmits information on the unused capacity of the cellular voice network. Data users on a channel-hopping network compete with cellular voice users, sometimes causing congestion
    - Dedicated CDPD sets aside certain channels for CDPD traffic. CDPD capacity does not vary as cellular voice calls increase or decrease, but users must still compete with other CDPD users for call setup and channel capacity

**TYPES OF COMMERCIAL WIRELESS DATA APPLICATIONS AVAILABLE TO PUBLIC SAFETY AGENCIES VARY DEPENDING ON THE SERVICE AND SERVICE PROVIDER (CONTINUED)**

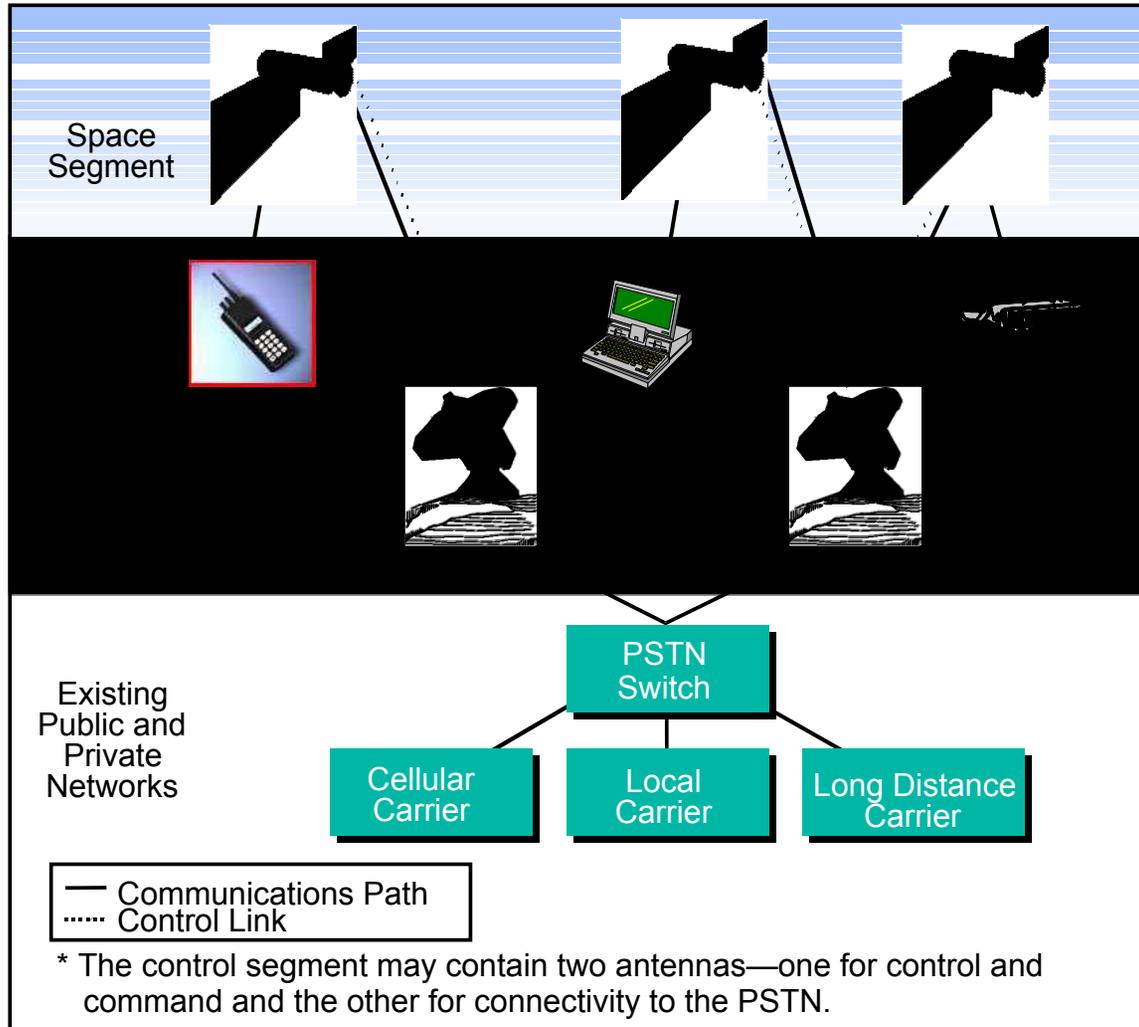
- Wireless data services—
  - Allow users access to the Internet, remote wireless and wireline databases, and the PSTN via a mobile data terminal and a radio modem
  - Sometimes allow users to exchange data while moving within the network coverage area. Some providers require users to access the network from a fixed location

**THE DRAWING BELOW ILLUSTRATES THE CONCEPT OF CELLULAR AND PCS SERVICES, BOTH VOICE AND DATA, AT A NETWORK LEVEL**

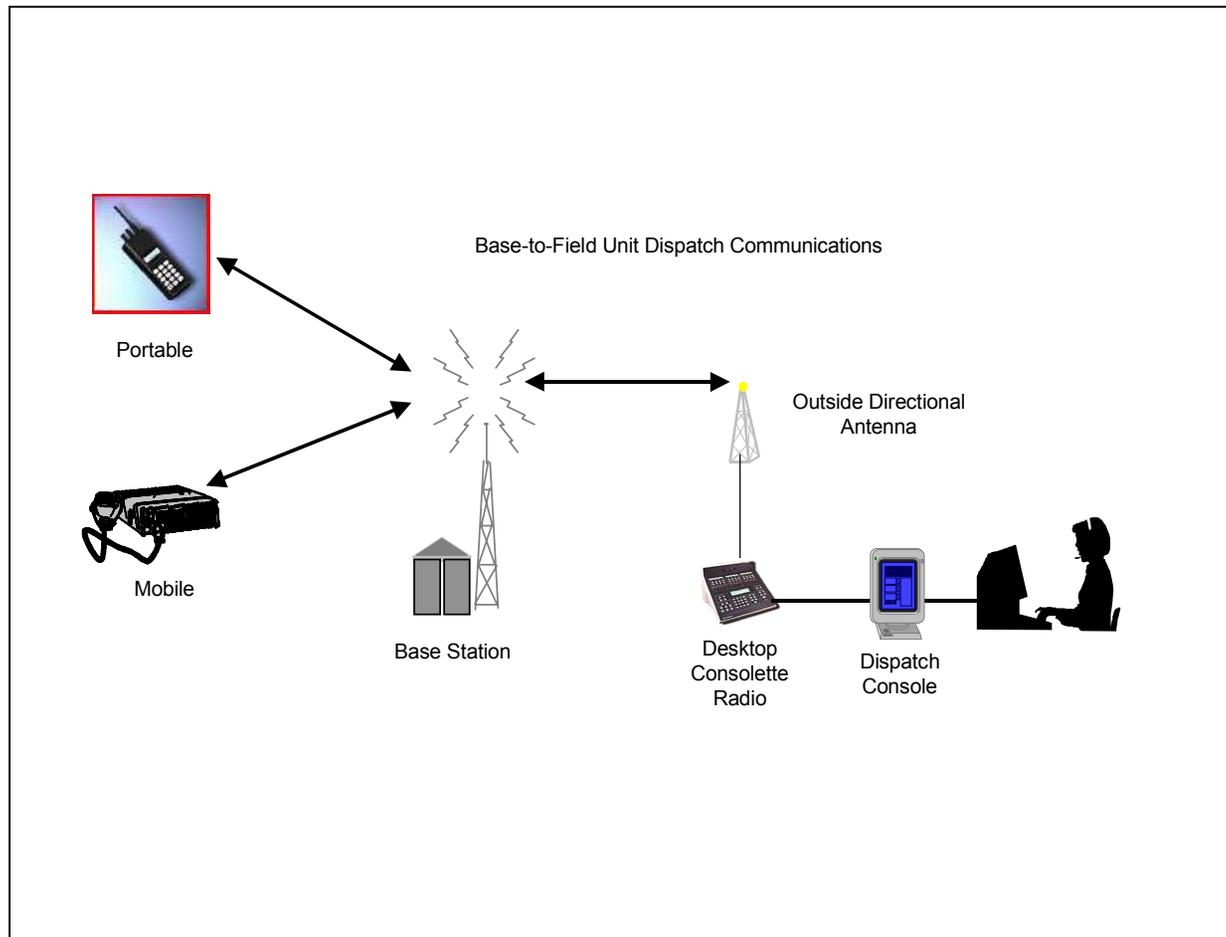


Commercial Services Solution...Conceptual Drawings...Voice and Data Services...

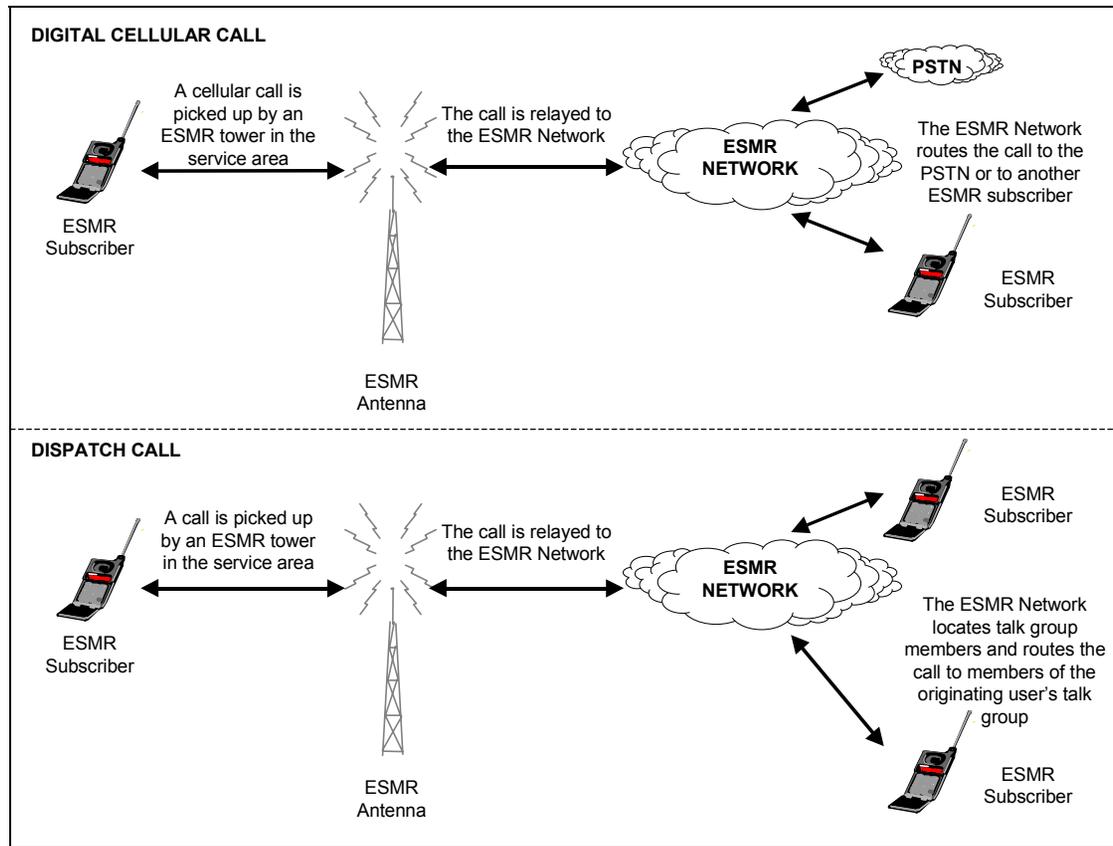
**THE DRAWING BELOW ILLUSTRATES THE CONCEPT OF THE BASIC MSS SYSTEM FOR BOTH VOICE AND DATA SERVICES**



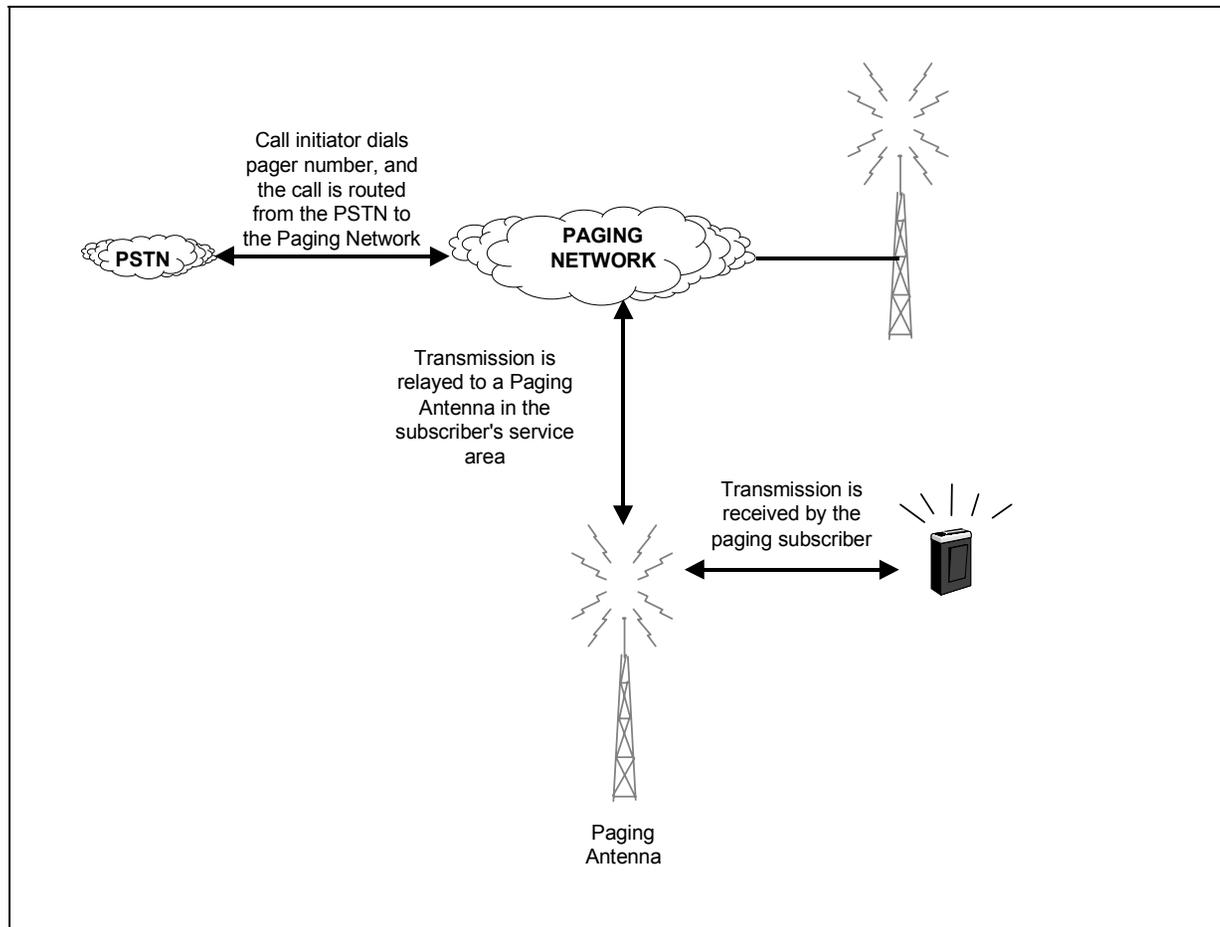
**THE DRAWING BELOW ILLUSTRATES THE CONCEPT OF SMR VOICE SERVICES AT A NETWORK LEVEL**



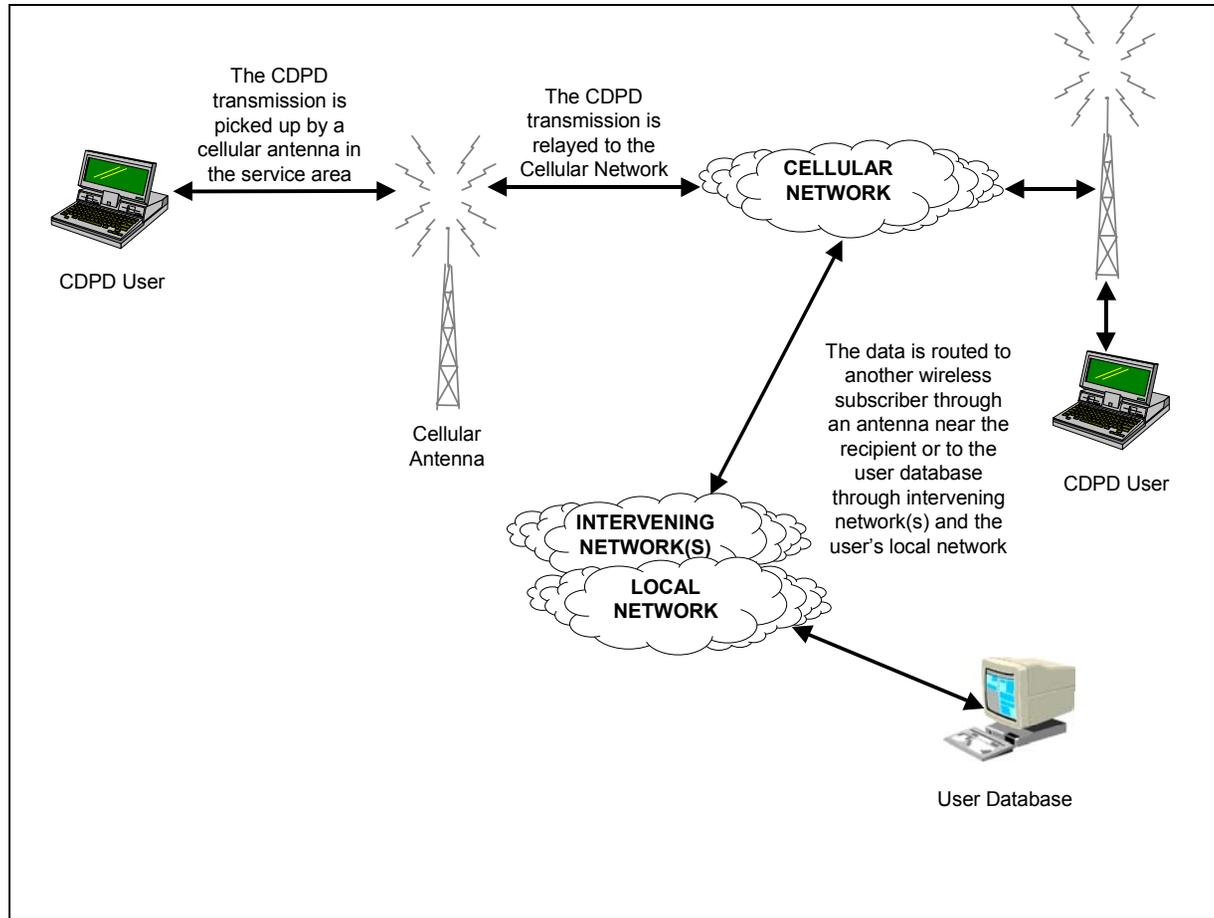
### THE DRAWING BELOW ILLUSTRATES THE CONCEPT OF AN ESMR DIGITAL CELLULAR CALL AND AN ESMR DISPATCH CALL AT A NETWORK LEVEL



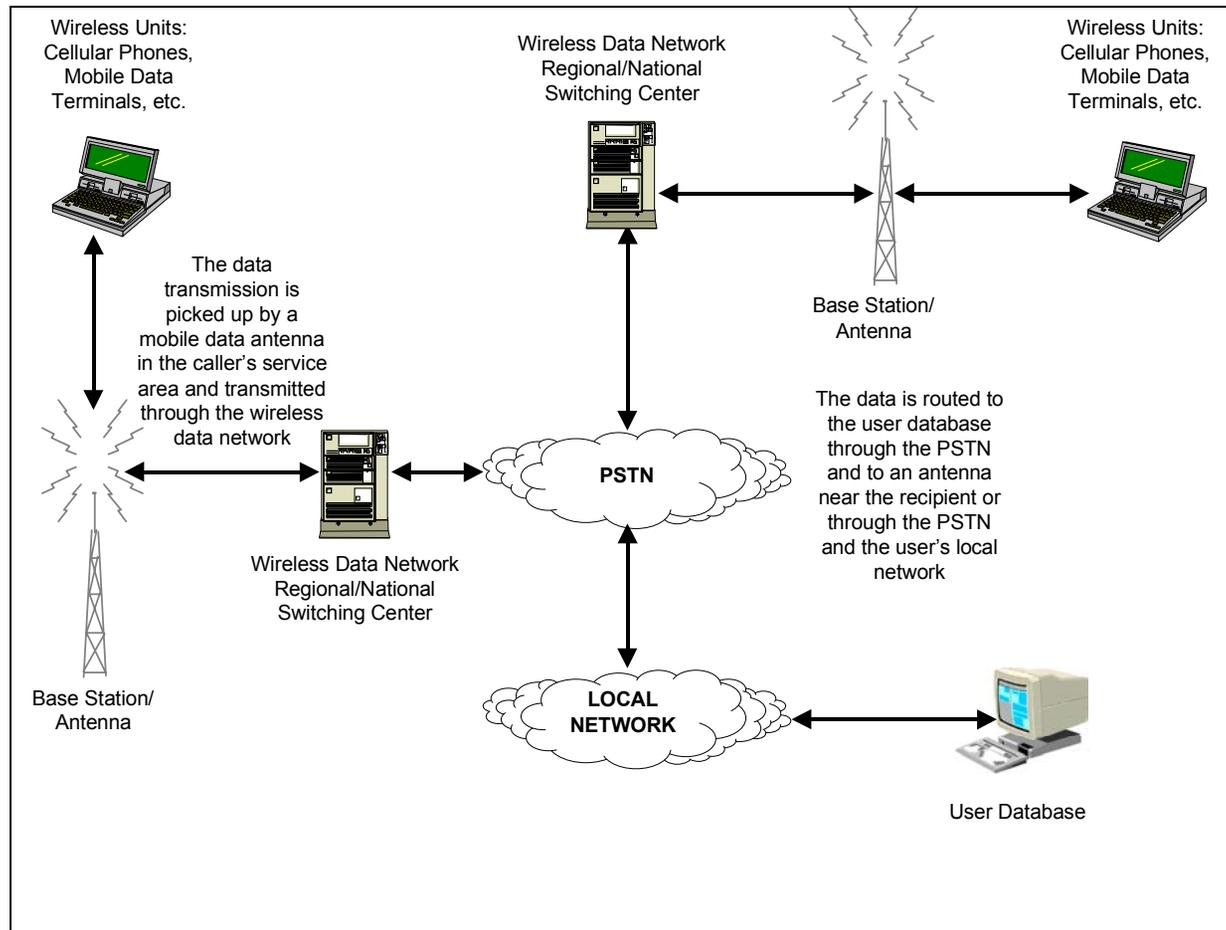
**THE DRAWING BELOW ILLUSTRATES THE CONCEPT OF PAGING (DATA) SERVICES AT A NETWORK LEVEL**



**THE DRAWING BELOW ILLUSTRATES THE CONCEPT OF CDPD AT A NETWORK LEVEL**



### THE DRAWING BELOW ILLUSTRATES THE CONCEPT OF WIRELESS DATA SERVICES AT A NETWORK LEVEL



## **THE USE OF COMMERCIAL SERVICES IS A VIABLE SOLUTION TO SUPPORT PUBLIC SAFETY AGENCIES COMMUNICATIONS NEEDS**

- PSWN case studies indicate that agencies use commercial services to—
  - Provide communications in areas where an LMR infrastructure does not exist
  - Support emerging applications, such as wireless data, to minimize the risks associated with accommodating uncertain capacity requirements in an existing LMR system
  - Minimize capital investment for wireless capability to meet nontactical or day-to-day administrative requirements
  - Add to the subscriber functionality currently offered by the LMR system
  - Interoperate with each other when the agencies use different systems and either the same frequency band or different frequency bands
- Agencies must be willing to use services that are separate from their own private LMR systems and controlled by other entities, and they must be willing to share these services with the public

**EACH COMMERCIAL VOICE SERVICE IMPLEMENTATION HAS ADVANTAGES**

<b>Advantage</b>	<b>Cellular</b>	<b>PCS</b>	<b>MSS</b>	<b>SMR</b>	<b>ESMR</b>
Available in most areas throughout the United States	✓ <sup>1</sup>		✓ <sup>2</sup>		
Coverage in urban areas and major highways	✓ <sup>3</sup>		✓		
Not widely used by the general public and therefore relatively protected from congestion			✓	✓	✓
Push-to-talk and dialing capabilities				✓	✓
One-to-one voice and enhanced calling features	✓	✓	✓		✓
Dispatch and broadcast capabilities			✓	✓	✓
Inexpensive handsets	✓	✓			✓

<sup>1</sup> Available to more than 95 percent of U.S. population.

<sup>2</sup> Global coverage except for the north and south poles; poor in-building coverage.

<sup>3</sup> Covers more than 70 percent of U.S. landmass.

**EACH COMMERCIAL VOICE SERVICE IMPLEMENTATION ALSO HAS DISADVANTAGES**

<b>Disadvantage</b>	<b>Cellular</b>	<b>PCS</b>	<b>MSS</b>	<b>SMR</b>	<b>ESMR</b>
Available only in specific regions or selected markets		✓		✓	✓
Coverage limited to mainly urban areas		✓ <sup>1</sup>		✓ <sup>2</sup>	✓ <sup>1</sup>
Subscribers compete with the general public for accessibility, potentially causing congestion and hence call setup delays or inability to place calls	✓	✓			
Lack of availability during times of major incidences (i.e. fire, flood, accidents) for first responders (initial 24-48 hours)	✓	✓	✓	✓	✓
User must know receiver's phone number	✓	✓	✓		
PSTN access limited				✓	
Relatively expensive handsets			✓	✓	
Coverage gaps result from geographic impediments, low demand, or building interference	✓	✓		✓	✓

<sup>1</sup> Mainly covers urban areas although the network is expanding and becoming more widely available in small cities and rural areas.

<sup>2</sup> Numerous local and regional service providers exist, but no roaming agreements have been established. Therefore, coverage is limited to a user's local network service area.

**EACH COMMERCIAL DATA SERVICE IMPLEMENTATION HAS ADVANTAGES**

<b>Advantage</b>	<b>Cellular</b>	<b>PCS</b>	<b>Paging</b>	<b>MSS</b>	<b>CDPD</b>	<b>Wireless Data</b>
Available in most areas throughout the United States	✓ <sup>1</sup>		✓ <sup>2</sup>	✓ <sup>3</sup>		✓
Coverage in urban areas and major highways	✓ <sup>4</sup>		✓ <sup>5</sup>	✓	✓	✓
Not widely used by the general public and therefore relatively protected from congestion				✓	✓ <sup>6</sup>	✓
Minimal call setup delay					✓	✓
Supports SMS, low-bandwidth file transfer applications, and PSTN access	✓ <sup>7</sup>	✓			✓	✓
Dispatch capability				✓		
Inexpensive subscriber units	✓	✓	✓			✓ <sup>8</sup>

<sup>1</sup> Available to more than 95 percent of U.S. population.

<sup>2</sup> Some providers have service areas that reach more than 90 percent of U.S. population.

<sup>3</sup> Global coverage except for the north and south poles; poor in-building coverage.

<sup>4</sup> Covers more than 70 percent of U.S. landmass.

<sup>5</sup> Incomplete coverage in rural areas and limited roaming capabilities for terrestrial pagers, but global coverage for satellite pagers.

<sup>6</sup> Dedicated-channel CDPD networks are less likely to be congested than channel-hopping CDPD networks.

<sup>7</sup> Also supports high-bandwidth transfer.

<sup>8</sup> Modem costs only.

**EACH COMMERCIAL DATA SERVICE IMPLEMENTATION ALSO HAS DISADVANTAGES**

<b>Disadvantage</b>	<b>Cellular</b>	<b>PCS</b>	<b>Paging</b>	<b>MSS</b>	<b>CDPD</b>	<b>Wireless Data</b>
Limited availability		✓			✓ <sup>1</sup>	
Covers mainly urban areas through service providers who offer GSM air interface technology		✓				
Subscribers compete with the general public for access, potentially causing congestion and hence call setup delays or inability to place calls	✓	✓	✓		✓ <sup>2</sup>	
Lack of availability during times of major incidences (i.e. fire, flood, accidents) for first responders (initial 24-48 hours)	✓	✓	✓	✓	✓	✓
Delay for call setup	✓	✓	✓	✓		
Expensive subscriber units				✓	✓	
Coverage gaps result from geographic impediments, low demand, building interference, or weakness of a carrier's signal	✓	✓	✓	✓	✓	✓

<sup>1</sup> Covers more than half of the geographic area of the United States and more than 30 international markets.

<sup>2</sup> Channel-hopping CDPD networks are more likely to be congested than dedicated-channel CDPD networks.

**COSTS OF EACH COMMERCIAL VOICE SERVICES SOLUTION VARY DEPENDING ON THE IMPLEMENTATION SELECTED**

<b>Cost</b>	<b>Cellular</b>	<b>PCS</b>	<b>MSS</b>	<b>SMR</b>	<b>ESMR</b>
Many service plans available	✓	✓			
Primarily usage-based pricing	✓	✓			✓ <sup>1</sup>
Flat-rate pricing available		✓		✓	✓ <sup>2</sup>
Users pay for incoming and outgoing calls	✓	✓	✓ <sup>3</sup>		✓
Users charged for landline telephone call completion	✓	✓			
Additional fees may be charged for additional services	✓	✓			✓

<sup>1</sup> Cellular ESMR services priced based on use.

<sup>2</sup> Dispatch service is typically flat rate.

<sup>3</sup> Pricing is relatively high compared to other cellular services.

**COSTS OF THE COMMERCIAL DATA SERVICES SOLUTION VARY DEPENDING ON THE IMPLEMENTATION SELECTED**

<b>Disadvantage</b>	<b>Cellular</b>	<b>PCS</b>	<b>Paging</b>	<b>MSS</b>	<b>CDPD</b>	<b>Wireless Data</b>
Many service plans available	✓	✓	✓		✓	✓
Usage-based pricing billed by the time connected	✓	✓		✓ <sup>1</sup>		
Usage-based pricing billed by the amount of data communicated					✓	✓
Flat-rate pricing available			✓			✓
Users pay for incoming and outgoing data transfers	✓	✓				
Users charged for landline telephone call completion	✓	✓				

<sup>1</sup> Pricing is relatively high compared to other cellular services.

Commercial Services Solution...Spectrum Requirements...

**THE COMMERCIAL SERVICES SOLUTION GENERALLY REQUIRES NO ADDITIONAL SPECTRUM**

This solution typically uses previously licensed commercial spectrum resources

## **PUBLIC SAFETY MANAGERS NEED TO CONDUCT CAREFUL, ONGOING EVALUATIONS OF COMMERCIAL SERVICES**

- Managers can use the following considerations to analyze commercial service characteristics and evaluate each service's applicability to specific public safety communications needs
  - Availability—Whether a service can be acquired from a provider in a given region
  - Coverage—Whether communication transmissions can reach users in a given service area
  - Accessibility—Whether a service is accessible and usable on demand, even during peak periods or network disruption
  - Security and Privacy—Level of inherent security and privacy of a service and capability to add security measures
  - Transmission Speed—Actual rate of successful transmission
  - Addressing Functionality—Method by which a service is accessible (i.e., push-to-talk, dial-in, modem)
  - Cost—Handset and service costs
  - Type of Applications Supported—Range of communications offered, including one-to-one calling, conference calling, broadcast messaging, and dispatch services
- Managers need to continue to use these considerations to evaluate the ongoing applicability and utility of commercial services for public safety applications

## **MOST COMMERCIAL SERVICES DO NOT SECURE COMMUNICATIONS**

- Most services are susceptible to unauthorized monitoring and fraudulent use
- Some services can apply encryption to the end user handset
- ESMR, paging, CDPD, and wireless data services incorporate privacy features such as personal identification numbers (PIN), automatic identification and authorization, and the use of passwords to limit unauthorized access
- Digital service is not secure in itself. Encryption must be incorporated to provide secure communications
- This solution does not raise standards issues; its objective is to circumvent system incompatibility

Commercial Services Solution...Implementations...

**COMMERCIAL SERVICES HAVE BEEN IMPLEMENTED IN LOCAL, STATE, AND FEDERAL PUBLIC SAFETY ENVIRONMENTS**

Approximately 80 percent of the public safety agencies interviewed by the Public Safety Wireless Network (PSWN) program in three metropolitan areas (Pittsburgh, San Diego, and Washington, DC) use commercial services to support nontactical and nonemergency communications or to support emerging applications such as data communications