

Mobile Computing

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Abstract

Advances in wireless networking have prompted a new concept of computing, called mobile computing in which users carrying portable devices have access to a shared infrastructure, independent of their physical location. This provides flexible communication between people and (ideally) continuous access to networked services. Mobile computing is revolutionizing the way computers are used and in the coming years this will become even more perceptible although many of the devices themselves will become smaller or even invisible (such as sensors) to users. This paper gives an overview of mobile computing and issues related to the field. The discussion starts with definitions of various terms associated with mobile computing. The diversity of mobile applications is explored to give readers an idea of what mobile computing has to offer, followed by a discussion on the limitations of wireless networks and the issues which have to be addressed in order to support roaming users.

Keywords: Mobile; Mobile computing; Wireless communication; Portable devices.

1. Introduction

Mobility originated from the desire to move either towards resources or away from scarcity. Mobile computing is about both physical and logical computing entities that move. Physical entities are computers that change locations. Logical entities are instances of a running user application or a mobile agent.

Mobile agents can migrate any where over internet. But active applications can only move to a local cluster of computers.

Mobile, ubiquitous, nomadic, untethered, pervasive and anytime, anywhere, any person computing are used by researchers to refer to computing that uses small portable devices and wireless communication n/w.

2. Mobile Computing

A technology that allows transmission of data, via a computer, without having to be connected to a fixed physical link.

The term "Mobile computing" is used to describe the use of computing devices, which usually interact in some fashion with a central information system--while away from the normal, fixed workplace. Mobile computing technology enables the mobile worker to create, access, process, store and communicate information without being constrained to a single location. By extending the reach of an organization's fixed information system, mobile computing enables interaction with organizational personnel that were previously disconnected. It provides the continuous access to the wireless network services and the flexible communication between the people. It provides the real-time business to employee communication, enhanced customers interactions, and fastest communication between the individuals. The communication occurs with the real-time wireless connection. It provides the data, audio and video access to any user, any time with a wireless enable device.

The wireless network may be WLAN, Wi-Fi, GSM, CDMA, Wimax or GPRS. There are many companies that provide the mobile computing solutions on contract and pay as you go mobile broadband plans to the home users and businesses. The cell phones and laptops are the most commonly used mobile computing devices. It can be referred to the two main fields portable and mobility.

Computing: It can be used to check the email via the mobile phones, sending SMS, accessing internet and sending MMS. This technology has enabled the users to remain connected while on the move and it provides all the benefits of the computer network but without the cables. There are many companies that provide the mobile computing solutions to the home users and businesses. The portable device that uses this technology is the laptop computers.

Mobile computing devices can access any type of wireless network such as Wi-Fi, Wimax and wireless conventional network to access the internet and the network.

Mobile computing services can be provided for the specific purposes and its cost varies from company to company. Additionally, there are customized mobile computing solutions that are designed for the different commercial fields like health care, business, education, pharmaceutical, IT and service providers.

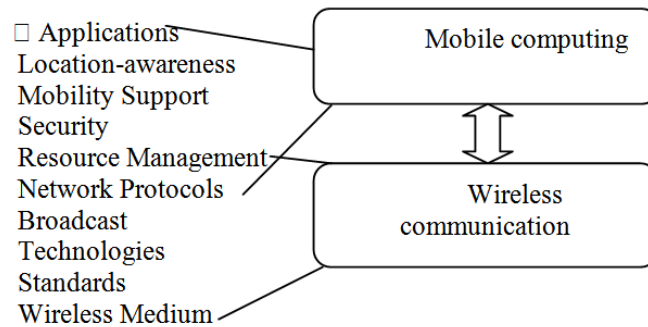


Fig .1: Relationship between mobile and wireless communication.

3. Components

Mobile computing is accomplished using a combination of:

- (a) Computer hardware;
- (b) System and applications software; and
- (c) Some form of communications medium.

Powerful mobile solutions have recently become possible because of the availability of:

- (a) Extremely powerful and small computing devices;
- (b) Specialized software; and
- (c) Improved telecommunications.

Characteristics

(a) Portability: The ability to move a device within a learning environment or to different environments with ease.

(b) Social interactivity: The ability to share data and collaboration between users.

(c) Context sensitivity: The ability to gather and respond to real or simulated data unique to a current location, environment, or time.

(d) Connectivity: The ability to be digitally connected for the purpose of communication of data in any environment.

(e) Individual: The ability to use the technology to provide scaffolding on difficult activities and lesson customization for individual learners.

4. Portable Computing Devices

A mobile device (also known as a handheld device, handheld computer or simply handheld) is a small, hand-held computing device, typically having a display screen with touch input and/or a miniature keyboard and weighing less than 2 pounds.

The following are devices that the mobile professional can use today:

- **Cell phones:** most cell phones on the market today offer some kind of data service. Most offer a short messaging service (SMS) and many also offer wire-less access protocol (WAP) services that allow a minimal form of Web access.

- **Personal digital assistants (PDAs):** we are now seeing a tremendous amount of advancement and market uptake in PDAs. Due to the small size and relatively high computing power of these devices, they are fast becoming a favorite among mobile professionals.

- **Smart Phones:** we are just now starting to see viable products that offer both the capabilities of cell phones and PDAs. This is a powerful combination whose proponents view it as the device to end all devices.

- **Tablet computers:** these are computers with a large screen and no built-in keyboard. Input is through a stylus. The idea is that using these computers is like using a tablet of paper.

- **Notebook computers:** so far these have been the portable computing device of choice. Many people have gotten rid of their desktop computer and now just use a notebook, which they can carry around outside of the office.

5. Technology

Data connections used in mobile computing take three general forms. Cellular data service uses technologies such as GSM, CDMA or GPRS, and more recently 3G networks such as W-CDMA, EDGE or CDMA2000. These networks are usually available within range of commercial cell towers. Wi-Fi connections offer higher performance, may be either on a private business network or accessed through public hotspots, and have a typical range of 100 feet indoors and up to 1000 feet outdoors. Satellite Internet access covers areas where cellular and Wi-Fi are not available and may be set up anywhere the user has a line of sight to the satellite's location, which for satellites in geostationary orbit means having an unobstructed view of the southern sky. Some enterprise deployments combine networks from multiple cellular networks or use a mix of cellular, Wi-Fi and satellite. When using a mix of networks, a mobile virtual private network (mobile VPN) not only handles the security concerns, but also performs the multiple network logins automatically and keeps the application connections alive to prevent crashes or data loss during network transitions or coverage loss.

6. Some Emerging Technologies

- Currently, there is keen interest in mobile applications that require faster networks that carry larger files, also known as “broadband” applications, which can transmit video, photos (including mug shots) and fingerprints. Law enforcement workers want instant access to complex data from any location.

- In response to 9/11, to acknowledge the need to allocate additional spectrum to support broadband data communications, the FCC designated the 50 MHz spectrum in the 4.9 GHz band entirely for public safety mobile data networks.
- Existing equipment and industry tested technical standards for broadband transmission speeds work well on this band.
- Hotspots, Wi-Fi, mesh networking (which uses repeaters), multi-path networks (which use multiple networking technologies to achieve best results), and faster networks under development by cellular companies are on the cutting edge of mobile computing.

7. Technologies Commonly Used Today

For the purposes of this summary, mobile computing is defined as the use of industry standard portable computers in law enforcement patrol vehicles.

There are three types of networks most commonly used for mobile computing in law enforcement today:

- Relatively slow networks that are built, administered, and maintained by the agency itself. This includes regional radio networks that use 800MHz trunked technology.
- Somewhat faster cellular data networks that the cellular carriers operate and maintain (includes a monthly access fee; good for small agency in a region with good coverage).
- Agency installed and maintained Wi-Fi networks that use computer-to-computer or computer-to-base technology. These offer full broadband speed but very limited range.

The three major categories for components that make up the mobile environment include hardware, software, and other associated technologies.

8. Limitations and Issues in Mobile Computing

1. **Insufficient bandwidth:** Mobile Internet access is generally slower than direct cable connections, using technologies such as GPRS and EDGE, and more recently HSDPA and HSUPA 3G networks. These networks are usually available within range of commercial cell phone towers. Higher speed wireless LANs are inexpensive but have very limited range.
2. **Security standards:** When working mobile one is dependent on public networks, requiring careful use of VPN. Security is a major concern while concerning the mobile computing standards on the fleet. One can easily attack the VPN for a very huge number of networks interconnected through the line.
3. **Power consumption:** When a power outlet or portable generator is not available, mobile computers must rely entirely on battery power. Combined with the compact size of many mobile devices, this often means unusually expensive batteries must be used to obtain the necessary battery life.

4. **Transmission interferences:** Weather, terrain, and the range from the nearest signal point can all interfere with signal reception. Reception in tunnels, some buildings, and rural areas is often poor.
5. **Potential health hazards:** More car accidents are related to drivers who communicate with mobile devices. Cell phones may interfere with sensitive medical devices. There are allegations that cell phone signals may cause health problems.

9. Benefits of Mobile Computing

- (a) Reduced radio congestion
- (b) Lighter dispatch workload
- (c) Easier resource management, allocation, and supervision
- (d) Cost savings by avoiding paper
- (e) Reduced data transformation time and improved record quality

10. Applications of Mobile Computing

Mobile working infrastructure can deliver real time business benefits, companies of all sizes are walking up to the fact that they can improve productivity and increase profits by giving employees remote access to mission critical corporate IT system. The importance of Mobile Computers has been highlighted in many fields of which a few are described below:

- Vehicles
 - Nomadic user
 - Smart mobile phone
 - Invisible computing
 - Wearable computing
 - Intelligent house or office
 - Meeting room/conference
 - Taxi/Police/Fire squad fleet
 - Service worker
 - Lonely wolf
 - Disaster relief and Disaster alarm
 - Games
 - Military / Security

Other benefits include improved intradepartmental communications, support for community-based policing, less expense when a report changes, lower training costs, increased officer confidence, and improved professional image for the department.

11. Conclusion

Mobile computing offers significant benefits for organizations that choose to integrate the technology into their fixed organizational information system. Mobile computing is made possible by portable computer hardware, software, and communications systems that interact with a non-mobile organizational information system while away from the normal, fixed workplace.

Mobile computing is a versatile and potentially strategic technology that improves information quality and accessibility, increases operational efficiency, and enhances management effectiveness.

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