Challenging Issues and Limitations of Mobile Computing

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Abstract

Mobile computing is becoming increasingly important due to the rise in the number of portable computers and the desire to have continuous network connectivity to the Internet irrespective of the physical location of the node. Mobile computing has fast become an important new paradigm in today's world of networked computing systems. Ranging from wireless laptops to cellular phones and WiFi/Bluetooth- enabled PDA's to wireless sensor networks, mobile computing has become ubiquitous in its impact on our daily lives. The goal of this paper is to point out some of the limitations, characteristics, applications and issues of mobile computing. In this paper the Section-I deals with Introduction to Mobile Computing, Section II deals with Characteristics and few of the technologies used for communication, Section-III deals with some of the Limitations, Section-IV deals with few Applications, Section-V deals with some of the Issues relating to Mobile computing and finally in Section-VI we have discussed few advantages followed by conclusion and references.

Keywords— Mobile, Mobile Computing.

I. INTRODUCTION

Mobile Computing [1]: "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.

Mobile computing is the discipline for creating an information management platform, which is free from spatial and temporal constraints. The freedom from these constraints allows its

users to access and process desired information from anywhere in the space. The state of the user, static or mobile, does not affect the information management capability of the mobile platform being constrained to a single location.

In mobile computing platform information between processing units flows through wireless channels. The processing units (client in client/server paradigm) are free from temporal and spatial constraints. That is, a processing unit (client) is free to move about in the space while being connected to the server. This temporal and spatial freedom provides a powerful facility allowing users to reach the data site (site where the desired data is stored) and the processing site (the geographical location where a processing must be performed) from anywhere. This capability allows organizations to set their offices at any location. The discipline of mobile computing has its origin in Personal Communications Services (PCS). PCS refers to a wide variety of wireless access and personal mobility services provided through a small terminal (e.g., cell phone), with the goal of enabling communications at any time, at any place, and

in any form. These PCS are connected to Public Switched Telephone Network (PSTN) to provide access to wired telephones.

II. CHARACTERISTICS OF MOBILE COMPUTING

Mobile computing [2] is accomplished using a combination of computer hardware, system and applications software and some form of communications medium. Powerful mobile solutions have recently become possible because of the availability of an extremely powerful and small computing devices, specialized software and improved telecommunication. Some of the characteristics of mobile computing is based on following:

1. Hardware: Here in this section a brief overview of the general types of hardware, software, and communications mediums that are commonly integrated to create mobile computing solutions are defined. The characteristics of mobile computing hardware are defined by the size and form factor, weight, microprocessor, primary storage, secondary storage, screen size and type, means of input, means of output, battery life, communications capabilities, expandability and durability of the device.

2. Software: Mobile computers make use of a wide variety of system and application software. The most common system software and operating environments used on mobile computers includes MSDOS, Windows 3.1/3.11/95/98/NT, Unix, android etc. These operating environments range in capabilities from a minimalist graphically- enhanced- pen-enabled DOS environment to the powerful capabilities of Windows NT. Each operating system/environment has some form of integrated development environment (IDE) for application development. Most of the operating environments provide more than one development environment option for custom application development.

3. Communication: The ability of a mobile computer to communicate in some fashion with a fixed information system is a defining characteristic of mobile computing. The type and availability of communication medium significantly impacts the type of mobile computing application that can be created.

The way a mobile computing device communicates with a fixed information system can be categorized as: (a) connected (b) weakly connected (c) batch and (d) disconnected. The connected category implies a continuously available high-speed connection. The ability to communicate continuously, but at slow speeds, allows mobile computers to be weakly connected to the fixed information system. A batch connection means that the mobile computer is not continuously available for communication with the fixed information system. In the batch mode, communication is established randomly or periodically to exchange and update information between the mobile computer and fixed information systems. Mobile computers may operate in batch mode over communication mediums that are capable of continuous operation, reducing the wireless airtime and associated fees. Disconnected mobile computers allow users to improve efficiency by making calculations, storing contact information, keeping a schedule, and other non-communications oriented tasks. This mode of operation is of little interest because the mobile device is incapable of electronically interacting and exchanging information with the fixed organizational information system. Exchange of information with a disconnected mobile computing device can only be accomplished by manually entering information into the device or copying from the device's screen and manually entering the information into the fixed information system. This mode of information exchange is no more efficient than using paper and is effectively nonexistent, since virtually all modern mobile computing hardware is capable of some form of native electronic data communications. Data Communications is the exchange of data using existing communication networks. The term data covers a wide range of applications including File Transfer, interconnection between Wide-Area-Networks (WAN), facsimile (fax), electronic mail, access to the internet and the World Wide Web (WWW).

There are many communications technologies available today that enable mobile computers to communicate. The most common of these technologies are: (a) Wireless Local Area Networks (WLANs) (b) Satellite (c) Cellular Digital Packet

Data (CDPD) (d) Personal Communications Systems (PCS) (e) Global System for Mobile communications (GSM) (f) RAM and ARDIS data networks (g) Specialized Mobile Radio (SMR) service (h) one and two-way paging (i) plain old telephone system (POTS) (j) Internet (k) infra-red (l) docking (serial, parallel, LAN) and (m) disk swapping.

III.LIMITATIONS OF 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 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 Virtual Private Network (VPN). Security is a major concern while concerning the mobile computing standards on the fleet. One can easily attack the VPN through a 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. Mobile computing should also look into Greener IT [3], in such a way that it saves the power or increases the 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: People who use mobile devices while driving are often distracted from driving are thus assumed more likely to be involved in traffic accidents. Cell phones may interfere with sensitive medical devices. There are allegations that cell phone signals may cause health problems.

6. Human interface with device: Screens and keyboards tend to be small, which may make them hard to use. Alternate input methods such as speech or handwriting recognition require training.

IV. 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 [4] has been highlighted in many fields of which a few are described below:

1. *For Estate Agents:*
 Estate agents can work either at home or out in the field. With mobile computers they can be more productive. They can obtain current real estate information by accessing multiple listing services, which they can do from home, office or car when out with clients. They can provide clients with immediate feedback regarding specific homes or neighborhoods, and with faster loan approvals, since applications can be submitted on the spot. Therefore, mobile computers allow them to devote more time to clients.

2. *Emergency Services*:
 Ability to receive information on the move is vital where the emergency services are involved. Information regarding the address, type and other details of an incident can be dispatched quickly, via a Cellular Digital Packet Data (CDPD) system using mobile computers, to one or several appropriate mobile units, which are in the vicinity of the incident.

3. *In courts*:
 Defense counsels can take mobile computers in court. When the opposing counsel references a case which they are not familiar, they can use the computer to get direct, real-time access to on-line legal database services, where they can gather information on the case and related precedents. Therefore mobile computers allow immediate access to a wealth of information, making people better informed and prepared.

4. *In companies*:

Managers can use mobile computers in, say, critical presentations to major customers. They can access the latest market share information. At a small recess, they can revise the presentation to take advantage of this information. They can communicate with the office about possible new offers and call meetings for discussing responds to the new proposals. Therefore, mobile computers can leverage competitive advantages.

5. *Credit Card Verification*:

At Point of Sale (POS) terminals in shops and supermarkets, when customers use credit cards for transactions, the intercommunication is required between the bank central computer and the POS terminal, in order to effect verification of the card usage, can take place quickly and securely over cellular channels using a mobile computer unit. This can speed up the transaction process and relieve congestion at the POS terminals.

V. ISSUES IN MOBILE COMPUTING

1. Security Issues

A.Confidentiality: Preventing unauthorized users from gaining access to critical information of any particular user.

B. *Integrity:* Ensures unauthorized modification, destruction or creation of information cannot take place.

C. *Availability*: Ensuring authorized users getting the access they require.

D. *Legitimate*: Ensuring that only authorized users have access to services.

E. *Accountability*: Ensuring that the users are held responsible for there security related activities by arranging the user and his/her activities are linked if and when necessary.

In this paper [6] the author had discussed various kinds of security issues and protocols that are used for securing the data when communicating between them. Mainly author has discussed on symmetric and asymmetric key encryption mechanisms for providing security to the data across the network.

2. **Bandwidth:**

Bandwidth utilization [5] can be improved by logging (bulk operations against short requests) and compression of data before transmission. Additionally, lazy write back and file prefetching can help the network in times of peak demands. Lazy write back is very helpful in the sense that the data to be written may undergo further modifications. The technique of caching frequently accessed data items can play an important role in reducing contention in narrow bandwidth wireless networks. The cached data can help improve query response time. Since mobile clients often disconnect to conserve battery power the cached data can support disconnected operations

3. **Location Intelligence:**

As the mobile computers move they encounter networks with different features. A mobile computer must be able to switch from infrared mode to radio mode as it moves from indoors to outdoors. Additionally it should be capable of switching from cellular mode of operation to satellite mode as the computer moves from urban and rural areas.

In mobile computing as computers are working in cells and are being serviced by different network providers, the physical distance may not reflect the true network distance. A small movement may result in a much longer path if cell or network boundaries are crossed. It will also lead to updating of the location dependent information as described above. This can increase the network latency as well as risk of disconnection. Service connections must be dynamically transferred to the nearest server. However, when load balancing is a priority this may not be possible.

4. **Power Consumption:**

Mobile Computers will rely on their batteries as the primary power source. Batteries should be ideally as light as possible but at the same time they should be capable of longer operation times. Power consumption should be minimized to increase battery life. Chips can be redesigned to operate at lower voltages. Power management can also help. Individual Components, be powered down when they are idle.

V*I*. ADVANTAGES AND CATEGORIES OF MOBILE COMPUTING

Computers are one of the major inventions of the world. The invention of computer has changed the world. During these days every field of life seems to be computerized. Later in the 21st century a new technology was introduced in the world known as mobile computing. Now-a-days computers are modified into mobile computers known as laptops. A small introduction of mobile computing is that you can do your work in motion. In simple words it means that you can do your work while sitting anywhere in the world. You do not have to sit at one place to do your work. The main challenge of Mobile computing is that, we can communicate with other people's while sitting anywhere in the world.

The name MOBILE [7] is derived from the first letter in each of the six categories that make up the framework. The six categories are:

M the need for *mobility*

O the need to improve *operations*

B the need to break business *barriers*

I the need to improve *information* quality

L the need to decrease transaction *lag*

E the need to improve *efficiency*

VII. 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. Here in this paper we have interm identified some of the challenging issues, applications of mobile computing along with few of the characteristics of Mobile computing.

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