Mobile Computing

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Abstract—
This paper presents the Mobile Computing Research. Mobile computing plays a Significant Role in our Life Recent developments in device and high bandwidth ubiquitous wireless networks have made mobile computing a reality. Indeed, it is widely predicted that within the next few years access to Internet services will be primarily from wireless devices, with desktop browsing the exception. Such predictions are based on the huge growth in the wireless phone market and the success of wireless data services. This Research will help in understanding fundamental concepts, current developments in mobile communication systems and wireless computer networks.

1. Introduction

The rapidly expanding technology of cellular communication, wireless LANs and satellite services will make information accessible anywhere and at any Time. In the near future, tens of millions of people will carry a portable palmtop or laptop computer. Smaller units, often called personal digital assistants or personal communicators, will run on . batteries and may have only a small memory; larger ones will be powerful laptop computers with large memories and powerful processors. Regardless of size, most mobile computers will be equipped with a wireless connection to the fixed part of the network, and, perhaps, to other mobile computers. The resulting computing environment, which is often referred to as *mobile* or *nomadic* computing, no longer requires users to maintain a fixed and universally known position in the network and enables almost unrestricted mobility. Mobility and portability will create an entire new class of applications and, possibly, new massive markets combining personal computing and consumer electronics.

Not only will information be easily accessible from virtually any place and time, but also, it will be stored in a highly decentralized, distributed information infrastructure often termed the "information superhighway." A wide variety of information servers (both public and proprietary) will be accessible to mobile computers. We are already seeing the beginnings of this with the rapidly growing
popularity of the World-Wide Web across a broad range of computer users. As the mobile infrastructure develops, it will become what is referred to as the "first wireless mile" or "wireless on-ramp" for the information superhighway. In some applications, mobile computers themselves may contain data, or data may be stored on flash-memory "smart cards."

2. Cellular Communications

A cellular mobile communications system uses a large number of low-power wireless transmitters to create cells—the basic geographic service area of a wireless communications system. Variable power levels allow cells to be sized according to the subscriber density and demand within a particular region. As mobile users travel from cell to cell, their conversations are "handed off" between cells in order to maintain seamless service. Channels (frequencies) used in one cell can be reused in another cell some distance away. Cells can be added to accommodate growth, creating new cells in unserved areas or overlaying cells in existing areas.

2.1 Mobile Communications Principles

Each mobile uses a separate, temporary radio channel to talk to the cell site. The cell site talks to many mobiles at once, using one channel per mobile. Channels use a pair of frequencies for communication—one frequency, the forward link, for transmitting from the cell site, and one frequency, the reverse link, for the cell site to receive calls from the users. Radio energy dissipates over distance, so mobiles must stay near the base station to maintain communications. The basic structure of mobile networks includes telephone systems and radio services. Where mobile radio service operates in a closed network and has no access to the telephone system, mobile telephone service allows interconnection to the telephone network (see Figure 1).

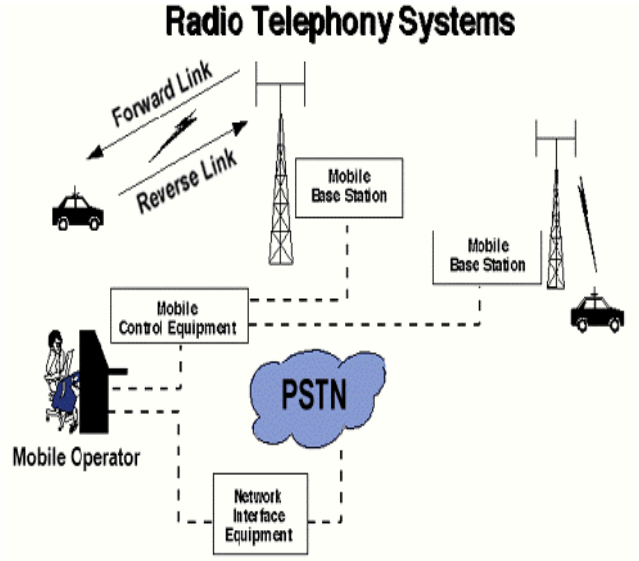

Figure1: Early Mobile Telephone System Architecture

Traditional mobile service was structured similar to television broadcasting: One very powerful transmitter located at the highest spot in an area would broadcast in a radius of up to fifty kilometers. The cellular concept" structured the mobile telephone network in a different way. Instead of using one powerful transmitter, many low-power transmitters were placed throughout a coverage area. For example, by dividing a metropolitan region into one hundred different areas (cells) with low-power transmitters using twelve conversations (channels) each, the system capacity theoretically could be increased from twelve conversations—or voice channels using one powerful transmitter—to twelve hundred conversations (channels) using one hundred low-power transmitters. Figure 2 shows a metropolitan area configured as a traditional mobile telephone network with one high-power transmitter.

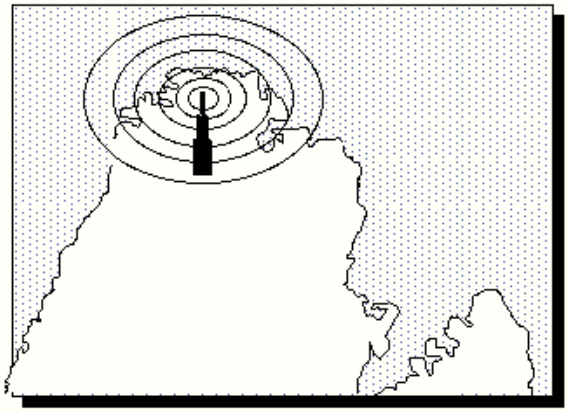

Figure 2: Early Mobile Telephone System Architecture

2. 2 Mobile Telephone System Using the Cellular Concept

Interference problems caused by mobile units using the same channel in adjacent areas proved that all channels could not be reused in every cell. Areas had to be skipped before the same channel could be reused. Even though this affected the efficiency of the original concept, frequency reuse was still a viable solution to the problems of mobile telephony systems. Engineers discovered that the interference effects were not due to the distance between areas, but to the ratio of the distance between areas to the transmitter power (radius) of the areas. By reducing the radius of an area by fifty percent, service providers could increase the number of potential customers in an area fourfold. Systems based on areas with a one-kilometer radius would have one hundred times more channels than systems with areas ten kilometers in radius. Speculation led to the conclusion that by reducing the radius of areas to a few hundred meters, millions of alls could be served.The cellular concept employs variable low-power levels, which allows cells to be sized according to the subscriber density and demand of a given area. As the population grows, cells can be added to accommodate that growth. Frequencies used in one cell cluster can be reused in other cells. Conversations can be handed off from cell to cell to maintain constant phone service as the user moves between cells (see Figure 3).

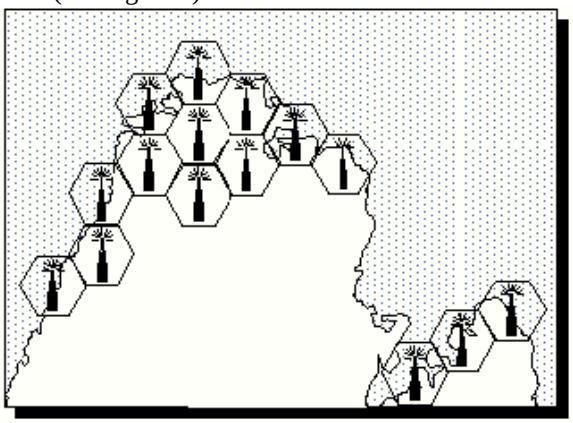

Figure 3 :Mobile Telephone System Using the Cellular Concept

The cellular radio equipment (base station) can communicate with mobiles as long as they are within range. Radio energy dissipates over distance, so the mobiles must be within the operating range of the base station. Like the early mobile radio system, the base station communicates with mobiles via a channel. The channel is made of two frequencies, one for transmitting to the base station and one to receive information from the base station.

2.3 Cellular System Architecture

Increases in demand and the poor quality of existing service led mobile service providers to research ways to improve the quality of service and to support more users in their systems. Because the amount of frequency spectrum available for mobile cellular use was limited, efficient use of the required frequencies was needed for mobile cellular coverage. In modern cellular telephony, rural and urban regions are divided into areas according to specific provisioning guidelines. Deployment parameters, such as amount of cell-splitting and cell sizes, are determined by engineers experienced in cellular system architecture. Provisioning for each region is planned according to an engineering plan that includes cells, clusters, frequency reuse, and handovers.

Cells

A cell is the basic geographic unit of a cellular system. The term cellular comes from the honeycomb shape of the areas

into which a coverage region is divided. Cells are base stations transmitting over small geographic areas that are represented as hexagons. Each cell size varies depending on the landscape. Because of constraints imposed by natural terrain and man-made structures, the true shape of cells is not a perfect hexagon.

Clusters

A cluster is a group of cells. No channels are reused within a cluster. Figure 4 illustrates a seven-cell cluster.

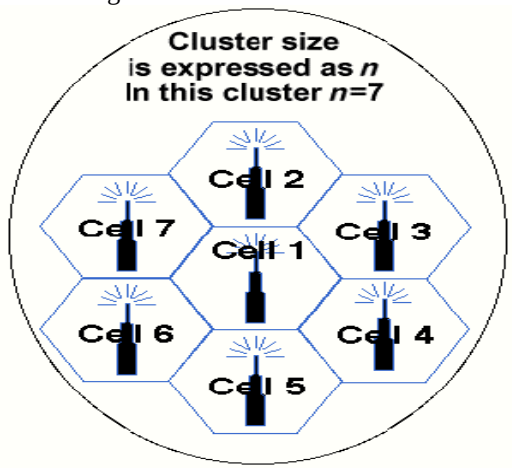

Figure 4: A Seven-Cell Cluster

4. Frequency Reuse

Because only a small number of radio channel frequencies were available for mobile systems, engineers had to find a way to reuse radio channels in order to arry more than one conversation at a time. The solution the industry adopted was called frequency planning or frequency reuse. Frequency reuse was implemented by restructuring the mobile telephone system architecture into the cellular concept. The concept of frequency reuse is based on assigning to each cell a group of radio channels used within a small geographic area. Cells are assigned a group of channels that is completely different from neighboring cells. The coverage area of cells are called the footprint. This footprint is limited by a boundary so that the same group of channels can be used in different cells that are far enough away from each other so that their frequencies do not interfere (see Figure 5).

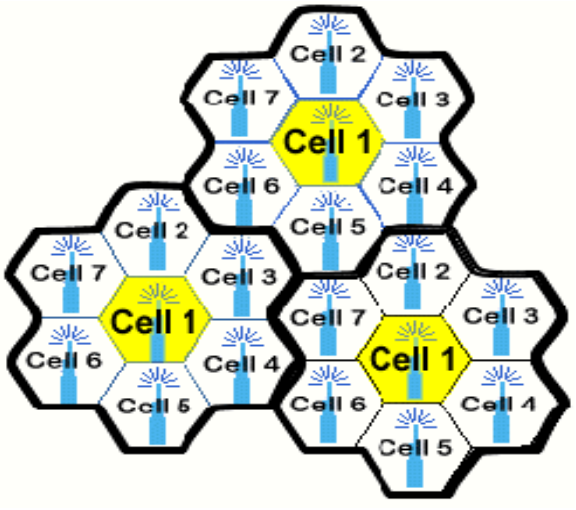

Figure 5: Frequency Reuse

Cells with the same number have the same set of frequencies. Here, because the number of available frequencies is 7, the frequency reuse factor is 1/7. That is, each cell is using 1/7 of available cellular channels.

5. Cell Splitting

Unfortunately, economic considerations made the concept of creating full systems with many small areas impractical. To overcome this difficulty, system operators developed the idea of cell splitting. As a service area becomes full of users, this approach is used to split a single area into smaller ones. In this way, urban centers can be split into as many areas as necessary in order to provide acceptable service levels in heavy-traffic regions, while larger, less expensive cells can be used to cover remote rural regions (see Figure 6)

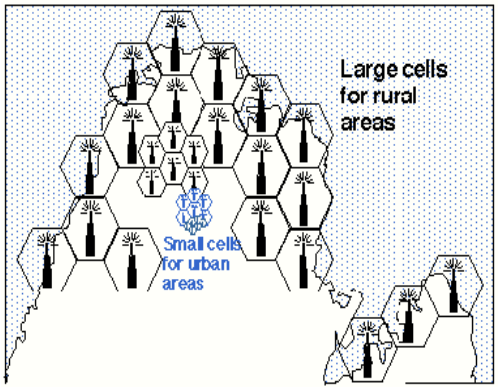

Figure 6: Cell Splitting

6. Handoff

The final obstacle in the development of the cellular network involved the problem created when a mobile subscriber traveled from one cell to another during a call. As adjacent areas do not use the same radio channels, a call must either be dropped or transferred from one radio channel to another when a user crosses the line between adjacent cells. Because dropping the call is unacceptable, the process of handoff was created. Handoff occurs when the mobile telephone network automatically transfers a call from radio channel to radio channel as mobile crosses adjacent cells (see Figure 7).

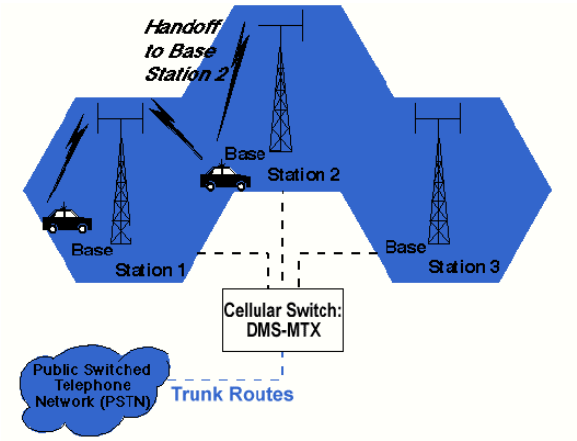

Figure 7: Handoff between Adjacent Cells

Moves out of the coverage area of a given cell site, the reception becomes weak. At this point, the cell site in During a call, two parties are on one voice channel. When the mobile unit use requests a handoff. The system switches the call to a stronger-frequency channel in a new site without interrupting the call or alerting the user. The call continues as long as the user is talking, and the user does not notice the handoff at all.

7. Conclusions

Mobile computing and wireless networks are new and dynamic areas of research and development. The rapid advances in miniaturization of computing devices and "undeterred" communication technology, together with the increasing demands for ubiquitous access to information, have introduced new challenges as well as new opportunities in many traditional areas of computer science and engineering. In this Research will help students to l have a comprehensive overview of mobile computing and wireless networks.

8. Acknowledgments

This paper is the result of efforts done by us to know and understand the mobile computing engineering.

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