Govt. Women Engineering College, Ajmer

B.Tech VIII Semester I Mid Term Examination – 2018

Subject :MOBILE COMPUTING

Branch :CSE

Q 1: What do you mean by mobile computing? Explain it's with various adaptability issues

(2+4=6)

Q 2: What is mobility management? Describe mechanism for adaptation.

(2+4=6)

Q 3: Discuss principles and techniques of location management in regards of mobile computing (8)

OR

Q 3: What do you mean by data dissemination and explain its model.

<u>SOLUTION</u>

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Mobile Computing : Mobile Computing is a technology that allows transmission of data, voice and video via a computer or any other wireless enabled device without having to be connected to a fixed physical link.Mobile computing involves mobile communication, mobile hardware, and mobile software. Communication issues include ad hoc networks and infrastructure networks as well as communication properties, protocols, data formats and concrete technologies. Hardware includes mobile devices or device components.

Adaptability issues in mobile computing :

a) Transparency : Transparency means that any form of distributed system should hide its distributed nature from its users, appearing and functioning as a normal centralized system.

Types of transparency

Transparency means that any form of distributed system should hide its distributed nature from its users, appearing and functioning as a normal centralized system.

There are many types of transparency:

- Access transparency – Regardless of how resource access and representation has to be performed on each individual computing entity, the users of a distributed system should always access resources in a single, uniform way.
- Location transparency – Users of a distributed system should not have to be aware of where a resource is physically located.
- Migration transparency – Users should not be aware of whether a resource or computing entity possesses the ability to move to a different physical or logical location.
- Relocation transparency – Should a resource move while in use, this should not be noticeable to the end user.
- Replication transparency – If a resource is replicated among several locations, it should appear to the user as a single resource.
- Concurrent transparency – While multiple users may compete for and share a single resource, this should not be apparent to any of them.
- Failure transparency – Always try to hide any failure and recovery of computing entities and resources.
- Persistence transparency – Whether a resource lies in volatile or permanent memory should make no difference to the user.
- Security transparency – Negotiation of cryptographically secure access of resources must require a minimum of user intervention, or users will circumvent the security in preference of productivity.[1]

b).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

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.

Constraints of mobile computing environments – Mobile computers can be expected to be more resource-poor than their static counterparts: e.g., battery – Mobile computers are less secure and reliable. – Mobile connectivity can be highly variable in terms of its performance (bandwidth and latency) and reliability

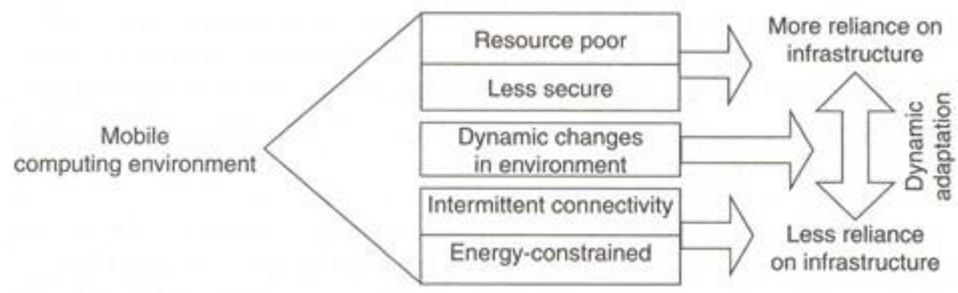


Figure 1.1 Need for dynamic adaptation in mobile computing environments.

c) Application-aware adaptation : *application-aware adaptation* as an essential capability of mobile clients, and provides an overview of *Odyssey*, an architecture that supports this capability. Functionality that has hitherto been implemented monolithically must now be split between the operating system and individual applications. The role of the operating system is to sense external events, and to monitor and allocate scarce resources. In contrast, the role of individual applications is to adapt to changing conditions by using the information and resources provided by the operating system

Application-transparent (the system is fully responsible for adaptation) – Laissez-faire (the system provides no support at all)

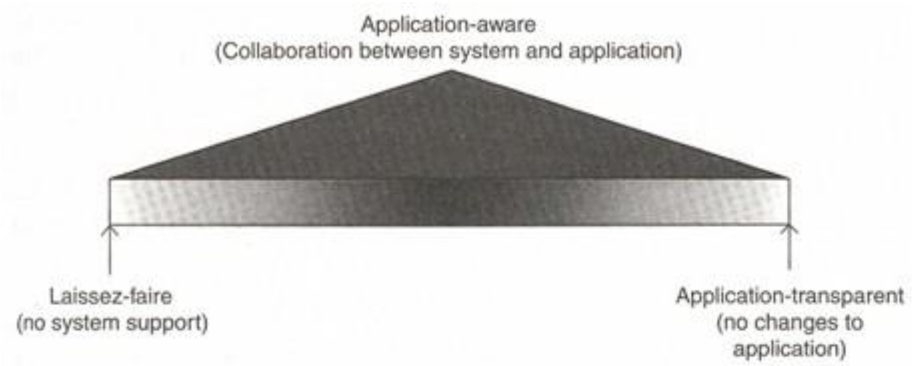


Figure 1.2 The spectrum of adaptation strategies (Satyanarayanan, 1996a).

ANS 2)

Mobility Management: Mobility management is one of the major functions of a GSM or a UMTS network that allows mobile phones to work. The aim of mobility management is to track where the subscribers are, allowing calls, SMS and other mobile phone services to be delivered to them.

Enables users to support mobile users, allowing them to move, while simultaneously offering them incoming calls, data packets, and other services.

Types of mobility:

1. Terminal mobility: ability of terminal to retain connectivity with the network so that all on-going communication services remain active despite terminal’s migration.

2. Personal mobility: disassociates user from the terminal (e.g. in GSM a mobile station = mobile terminal + smart card with subscriber identification module (SIM)).

3. Service mobility: provides continuous service to mobile clients across multiple administrative domains. – Consists of: 1. Location management: tracking mobiles and locating them prior to establishing incoming calls (deliverying pending messages). 2. Handoff management (a.k.a. automatic link transfer): rerouting connections with minimal degradation of QoS.

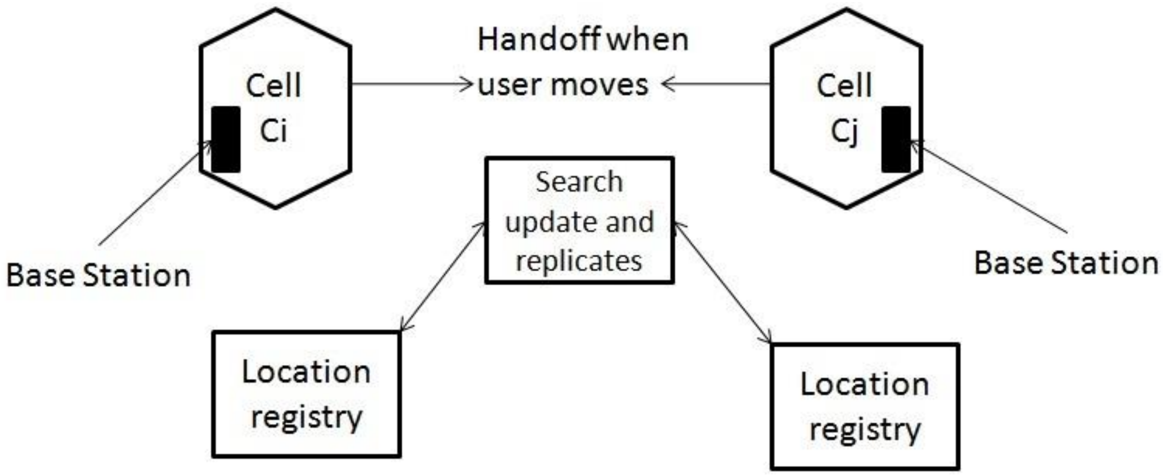


fig. By:
http://rtmnumobile.blogspot.com

Mechanisms for Adaptation:

Adaptation Architecture

The different types of devices, network connection, and execution context of mobile systems when compared to fixed ones insert many constraints in the mobile environment not present in the fixed one. Due to those constraints, when defining an adaptation architecture in mobile computing, various aspects should be observed: data, security, quality of service, available resources, costs, performance, and broadcast and multicast issues.

It is also important to consider whether or not the adaptation architecture is addressed to a specific application. Architectures addressed to specific applications often achieve better results, since the target application is known, and the designer may focus on its main characteristics and propose the best adaptation techniques for that application. However, those adaptation architectures can only be used for that target application. Other applications running upon this architecture will not benefit from it.

Generic architectures, on the other hand, do not address a target application. Instead, some general adaptation techniques are implemented. When an application is running upon a generic architecture, it will benefit only from the adaptation techniques that can be applied to it. Since these techniques were not designed specifically for this application, they often will not achieve the best possible adaptation level. However, they will be able to achieve good adaptation levels with many applications.

There is a trade off between generic and specific adaptation architectures. The most generic the architecture is, the most applications it can run. On the other hand, the most specific it is, the better results can be achieved for that specific application.

3.2.1. Target Applications

Handheld devices computing capabilities have been growing. Some of them already have colored screens. It is already possible to access the Internet through them. Moreover, new transmission technologies providing higher bandwidth have been developed, and some of them, such as UMTS and Wi-Fi, are already in use. When defining target applications for an adaptation architecture, these facts must be considered.

Video on demand is a target application for this work. Users will be able to watch music and news clips, or even movies in their handheld devices. In video on demand, the aspects to be adapted are the video and the audio. Synchronization between the video and the audio is an important issue. In addition, the delay must be constant.

A target application similar to video on demand is video conference. Instead of making a phone conference with only voice, users will be able to see each other while talking. The aspects to be adapted in this case are the same of video on demand. However, in this case, the delay must

be minimum. Another target application is audio on demand. Users could listen to Internet radio stations live, or even request songs to listen from audio on demand servers. In this case, the aspect to be adapted is the own audio. Again, there may be a delay, but it must be constant. A last target application for this work is some common Internet services, such as e-mail, ftp, or the world wide web (www). Users will eventually access the Internet for checking their e-mails, reading the news, downloading files, or visiting web pages. Each one of these services have different characteristics that must be addressed. E-mails and ftp files can be compressed. In www pages, images can be adapted, and texts compressed. There is no need for synchronization between them, and the delay may be variable.

3.2.2. Adaptation Techniques

There are many techniques to adapt each one of the aspects described previously. The best ones to be used depend on the users' handheld devices, and the level of adaptation required.

Video may be adapted in various ways. First of all, it can be colored or in gray scale. Another aspect that can be adapted in a video flow is the quality of the video. Some frames may be discarded. Also, its resolution may be set lower. On the other hand, it is not possible to discard packets while leading with audio. Broken audio is hard to understand. In this case, the aspects to be adapted are the quality of the audio and its sample rate.

Images have a different approach to be adapted. The delay here is not an issue. Nevertheless, customers would not like to wait minutes for an image to load (unless they really want that image in its higher resolution). The adaptation for images can be done in three ways: reduce the number of colors, reduce the sample of the image, or reduce its quality.

A last approach that can be used to decrease the amount of data to be sent over the wireless link is compressing texts before sending them. HTTP has an extensive header, which can also be compressed. Although compression is not considered an adaptation technique, it may be useful sometimes.

3.2.3. Functionalities and Services

Once the target applications and the adaptation techniques for those applications are defined, it is possible to specify the functionalities the adaptation architecture will provide: image resolution modification, image number of colors decrease, video packets discard, video resolution modification, video quality modification, video conversion to black and white, audio sample ratio modification, audio quality reduction, text compression, and HTTP header compression.

The adaptation architecture also provides some services to the applications: gather data location, increase or decrease quality an application quality level, increase or decrease an application priority, and enable or disable the security tools provided by the architecture.

Client-server (CS) model: The client–server model is a distributed application structure that partitions tasks or workloads between the providers of a resource or service, called servers, and service requesters, called clients.Often clients and servers communicate over a computer network on separate hardware, but both client and server may reside in the same system. A server host runs one or more server programs which share their resources with clients. A client does not share any of its resources, but requests a server's content or service function. Clients therefore initiate communication sessions with servers which await incoming requests.

client and server role

The *client-server* characteristic describes the relationship of cooperating programs in an application. The server component provides a function or service to one or many clients, which initiate requests for such services. Servers are classified by the services they provide. For example, a web server serves web pages and a file server serves computer files. A shared resource may be any of the server computer's software and electronic components, from programs and data to processors and storage devices. The sharing of resources of a server constitutes a *service*.

Whether a computer is a client, a server, or both, is determined by the nature of the application that requires the service functions. For example, a single computer can run web server and file server software at the same time to serve different data to clients making different kinds of requests. Client software can also communicate with server software within the same computer.

Ans 3)

Location management In PCS, location management enables the network to determine the Mobile terminal current LA for call delivery. It is a two-phase process implying location update and location search. Location update occurs when the MT enters a new LA and notifies the network of its new location. Location search occurs when an MT is called; in which case the network database is queried in order to determine the Mobile terminal current LA. Currently, there are two commonly used standards for location management: Interim

Standard-41 (IS-41) and the Global System for Mobile (GSM)]. Both standards employ a two-level database architecture consisting of one Home Location Register (HLR) and many Visitor Location Registers (VLRs), referred to as HLR/VLR(s) architecture in this study and shown in . In this architecture, the HLR serves the entire network and is considered the centralized database of the network. It permanently stores the location profile and subscriber parameters of its assigned MT. The VLR serves one or more LA and stores all the relevant parameters of the MTs that roam within the LA that it controls. The VLR is usually collocated with an MSC. In order to deliver the calls correctly we need to maintain the location management. Looking at the need of efficient location management, this paper attempts to propose a modification in conventional HLR/VLR scheme so that location management cost can be reduced. The remaining part of this paper has been organized as follows. Section II gives an overview of conventional HLR/VLR scheme used in IS-41 and GSM, section III sheds light on proposed modified of HLR/VLR scheme. A comparative analysis has been carried out in section IV which is followed by results in section V and conclusion in section VI.

Home Location Register (HLR):

The HLR in telecom is the reference database for subscriber parameters. Actually HLR Having all the detail like customer ID, customer number, billing detail and for prepaid with IN intelligent network its has detail of current recharge of prepaid user.The HLR in telecom database contains the master database of all the subscribers to a GSM PLMN.

The Basic Parameters stored in the HLR in telecom are listed below:

1. Subscriber ID (IMSI and MSISDN)
2. Current Subscriber VLR (Current Location)
3. Supplementary Services Subscriber to (Caller Tone, Missed Call Alert, Any Other Services etc.)
4. Subscriber Status (Registered or Deregistered)
5. Authentication Key and AUC Functionality
6. Mobile Subscriber Roaming Number

Visitor Location Register (VLR):

The VLR contains a copy of most of the data stored at the HLR. It is, however, temporary data which exists for only as long as the subscriber is “active” in the particular area covered by the VLR.

The additional data stored in the VLR in telecom is listed below:

1. Location Area Identity (LAI).
2. Temporary Mobile Subscriber Identity (TMSI).
3. Mobile Station Roaming Number (MSRN).
4. Mobile status (busy/free/no answer etc.).

Location Area Identity in Both VLR and HLR in TELECOM

Cells within the Public Land Mobile Network (PLMN) are grouped together into geographical areas. Each area is assigned a Location Area Identity (LAI), a location area may typically contain 30 cells.

Each VLR controls several LAIs and as a subscriber moves from one LAI to another, the LAI is updated in the VLR. As the subscriber moves from one VLR to another, the VLR address is updated at the HLR.

Mobility Management Basics

Update Schemas

– Selection of designated reporting cells • Mobile must update in some designated cells • Dynamic – based only on user's activity – Distance based • Updates when Euclidean distance crosses a threshold D • Distance can be specified in terms of cells covered – Movement based • Updates when number of cell boundaries crossed reaches a threshold M – Time based • Mobile sends periodic updates

Selection of LM Schemes

• Cost of location updates and lookups • Maximum service capacity of each location database = – the maximum rate of updates and lookups that each database can service • Space restrictions (size of the location database) • Type and relative frequency of call to move operations (call-to-mobility ratio (CMR))

Location Databases

• Distributed DBs used to store the location of mobile users • Types of Architectures – Two-tier – Hierarchical – Regional Directories

Selective Broadcast

With this method a message is sent to all network cells asking the mobile computer to reply with its current address. This scheme may be too expensive in large networks. However, if the mobile computer is known to be in one of a few cells a message is sent out to the selected cells. A disadvantage with selective broadcast is that it can only be used when we have enough information about current location.

1 Central Services

The current address for each mobile user is kept in a centralized database. When a mobile computer changes its address it also updates the central database by sending a message containing its new address.

2 Home Bases

With this method the location of a given mobile computer is known by a single server (MSS), often called the *Home Location Server*. The user is permanently registered under this server and it keeps track of where the mobile computer is. To send a message to a mobile user , the home location server has to be contacted first to obtain the users' current address.

The main disadvantage with this scheme is that the way a message must travel may be much longer than the real distance. For example, two mobile computers, A and B, which are registered under two different home location servers in two different areas, may be currently in the same area. For A to contact B it has to first contact B's home location server which then contacts B. If A and B are likely to be in the same area, this scheme could be modified to first broadcast a message to all MSSs in that local area. If B is not currently located there a message is then sent to B's home location server.

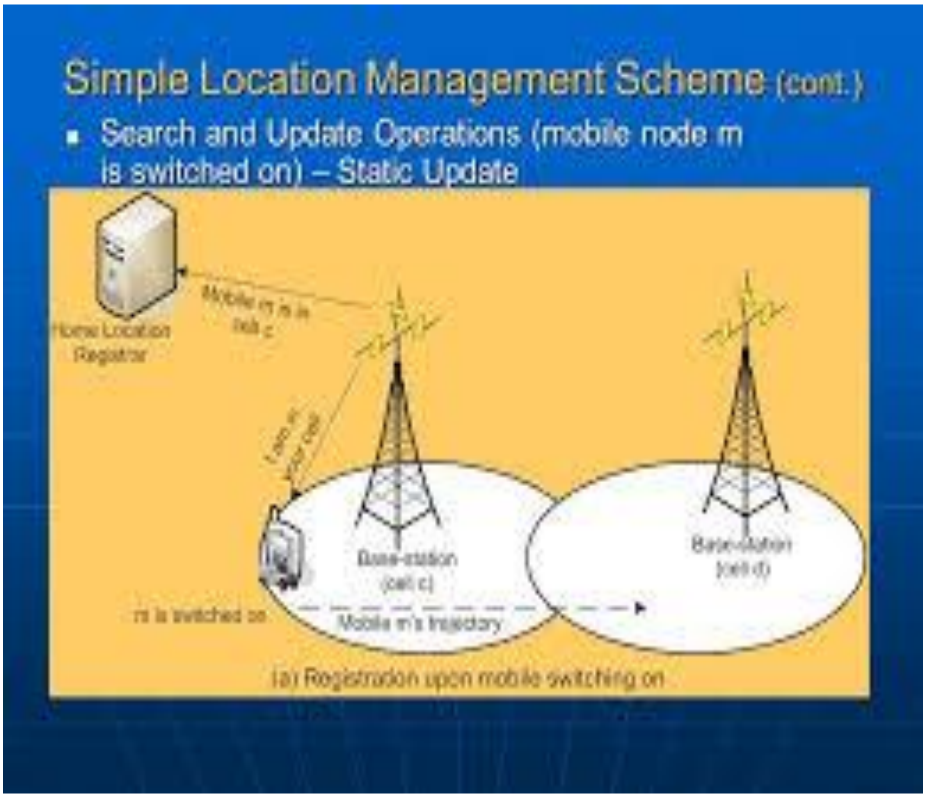
This scheme can also lead to low availability of information. The home location server may be down or inaccessible which makes it impossible to track the requested mobile user.

3 Forwarding Pointers

This method is probably one of the fastest. Each time a mobile computer changes its address, a copy of the new address is added at the old location. The message sent is then forwarded along the chain of pointers until the mobile computer is reached. The pointer chain will be made longer every time the mobile computer changes location and this may lead to inefficient routing. To solve this the pointers at the message forwarders can be updated to contain more recent addresses.

Even though this method is among the fastest it suffer from failure anywhere along the chain of pointers. Another problem is associated with deleting pointers which cannot be done before all message sources have been updated.

The forwarding pointer method can be hard to implement. It does not fit standard networking models since it must have an active entity at the old address to receive and forward messages.



ANS)

Data dissemination on the internet is possible through many different kinds of communications protocols. The internet protocols are the most popular non-proprietary open system protocol suite in the world today. They are used in data dissemination through various communication infrastructures across any set of interconnected networks. Despite the name internet protocol, they are also well suited for local area networks (LAN) and wide area network (WAN) communication.

Using the internet, there are several ways data can be disseminated. The World Wide Web is an interlinked system where documents, images and other multimedia content can be accessed via the internet using web browsers. It uses a markup language called hyper text markup language (HMTL) to format disparate data into the web browser.

The Email (electronic mail) is also one of the most widely used systems for data dissemination using the internet and electronic medium to store and forward messages. The email is based on the Simple Mail Transfer Protocol (SMTP) and can also be used by companies within an intranet system so that staff could communicate with other.

The more traditional ways for data dissemination which are still in wide use today are the telephone systems which include fax systems as well. They provide fast and efficient ways to communicate in real time. Some telephone systems have been simulated in internet applications by using the voice over internet protocol (VoIP).

Through this protocol, hundreds of free or minimally charge international phone calls are already available. This simulated phone call is possible using the computer with microphone and speaker system or headphones. When a video camera is used, it could be possible to have video conferencing.

Of course, the use of non digital materials for data dissemination can never be totally eliminated despite the meteoric rise of electronic communication media. Paper memos are still widely used to disseminate data. The newspaper is still in wide circulation to communicate vital everyday information in news and feature items.

Despite the efficiency of electronic means of data dissemination, there are still drawbacks which may take a long time to overcome, if at all. Privacy is one of the most common problems with electronic data dissemination. The internet has thousands of loop holes where people can peep into the private lives of other people. Security is also a related problem with electronic data

dissemination. Every year, millions of dollars are lost to electronic theft and fraud. Every time a solution is found for a security problem, another malicious programs spring up somewhere in the globe.

Many companies set up precautionary measures against security invasion in their information systems. Some set up user accounts with varying privileges to data access. Many set up internet firewalls and antivirus software on their computers to prevent intrusions.

Data dissemination is a very substantial aspect of business operation. Most of today's businesses are data driven. It is a common scenario where business organizations invest millions for data warehouses including hardware, software and manpower costs, to make data dissemination fast, accurate and timely. Information gathered from disseminated data form as basis for spotting industry trends and patterns and decision making in companies.

Data dissemination in asymmetrical communication environment, where the downlink communication capacity is much greater than the uplink communication capacity, is best suited for mobile environment. In this architecture there will be a stationary server continuously broadcasting different data items over the air. The mobile clients continuously listen to the channel and access the data of their interest whenever it appears on the channel and download the same. The typical applications of such architecture are stock market information, weather information, traffic information etc. The important issue that is to be addressed in this type of data dissemination is – how quickly the mobile clients access the data item of their interest i.e. minimum access time so that the mobile clients save the precious battery power while they are on mobile. There are two fundamental information delivery methods for wireless data applications: Point-to-Point access and Broadcast. Compared with Point-to-Point access, broadcast is a more attractive method. A single broadcast of a data item can satisfy all the outstanding requests for that item simultaneously. As such, broadcast can scale up to an arbitrary number of users.

There are three kinds of broadcast models, namely push-based broadcast, On-demand (or pullbased) broadcast, and hybrid broadcast. In push based broadcast, the server disseminates information using a periodic/aperiodic broadcast program (generally without any intervention of clients). In on demand broadcast, the server disseminates information based on the outstanding requests submitted by clients; In hybrid broadcast, push based broadcast and on demand data deliveries are combined to complement each other. Consequently, there are three kinds of data scheduling methods (i.e., push based scheduling, on demand scheduling, and hybrid scheduling) corresponding to these three data broadcast models.

1. Push based data scheduling

In push based data broadcast, the server broadcasts data proactively to all clients according to the broadcast program generated by the data scheduling algorithm. The broadcast program essentially determines the order and frequencies that the data items are broadcast in. The scheduling algorithm may make use of precompiled access profiles in determining the broadcast program. In the following, two typical methods for push based data scheduling are described, namely flat broadcast and broadcast disks. Flat Broadcast The simplest scheme for data

scheduling is flat broadcast. With a flat broadcast program, all data items are broadcast in a round robin manner. The access time for every data item is the same, i.e., half of the broadcast cycle. This scheme is simple, but its performance is poor in terms of average access time when data access probabilities are skewed. Broadcast Disks Hierarchical dissemination architecture, called Broadcast Disk (Bdisk), was introduced in. Data items are assigned to different logical disks so that data items in the same range of access probabilities are grouped on the same disk. Data items are then selected from the disks for broadcast according to the relative broadcast frequencies assigned to the disks.

This is achieved by further dividing each disk into smaller, equal size units called chunks, broadcasting a chunk from each disk each time, and cycling through all the chunks sequentially over all the disks. A minor cycle is defined as a sub cycle consisting of one chunk from each disk. Consequently, data items in a minor cycle are repeated only once. The number of minor cycles in a broadcast cycle equals the Least Common Multiple (LCM) of the relative broadcast frequencies of the disks. Conceptually, the disks can be conceived as real physical disks spinning at different speeds, with the faster disks placing more instances of their data items on the broadcast channel. However, if the number of minor cycles in a broadcast cycle is not equal the Least Common Multiple (LCM) of the relative broadcast frequencies of the disks, dividing precisely the desired number of chunks, is a problem. addressed this problem by suggesting to fill up the disk with other information and making it divisible so that the number of minor cycles is equal to the LCM of relative broadcast frequencies.

2. On-demand data scheduling

Push based wireless data broadcasts are not tailored to a particular user's needs but rather satisfy the needs of the majority. Further, push-based broadcasts are not scalable to a large database size and react slowly to workload changes. To alleviate these problems, many recent research studies on wireless data dissemination have proposed using on-demand data broadcast. A wireless on demand broadcast system supports both broadcast and on demand services through a broadcast channel and a low bandwidth uplink channel. The uplink channel can be a wired or a wireless link. When a client needs a data item, it sends to the server an on demand request for the item through the uplink. Client requests are queued up (if necessary) at the server upon arrival. The server repeatedly chooses an item from among the outstanding requests, broadcasts it over the broadcast channel, and removes the associated request(s) from the queue. The clients monitor the broadcast channel and retrieve the item(s) they require. The data-scheduling algorithm in on demand broadcast determines which request to service from its queue of waiting requests at every broadcast instance.

3. Hybrid data scheduling

Push-based data broadcast cannot adapt well to a large database and a dynamic environment. Ondemand data broadcast can overcome these problems. However, it has two main disadvantages: i) more uplink messages are issued by mobile clients, thereby adding demand on the scarce uplink bandwidth and consuming more battery power on mobile clients

ii) if the uplink channel is congested, the access latency will become extremely high. A promising approach, called hybrid broadcast, is to combine push-based and on-demand techniques so that they can complement each other.

In the design of a hybrid system, one of the main issues is the assignment of a data item to pushbased broadcast, on-demand broadcast or both. Concerning this issue, there are different proposals for hybrid broadcast in the literature. In the following, we introduce the techniques for balancing push and pull and adaptive hybrid broadcast. Balancing Push and Pull:

Hybrid architecture was first investigated in. In that model, items are classified as either frequently requested (frequest) or infrequently requested (irequest). It is assumed that clients know which items are frequests and which are irequests. The model services frequent using a broadcast cycle, and irequests using on-demand. In the downlink scheduling, the server makes consecutive transmissions of frequented items (according to a broadcast program), followed by the transmission of the first item in the irequest queue (if at least one such request is waiting).

Data allocation over multiple broadcast channels

Multiple physical channels have capabilities and applications that cannot be mapped on to single channels. As stated in some example advantages include better fault tolerance, configurability and scalability. By having access to multiple physical channels fault tolerance is improved. For example if a server broadcasting on a certain frequency crashes, its work must be migrated to another server. If this server is already broadcasting on another frequency it can only accept the additional work if it has the ability to access multiple channels. More flexibility is allowed in configuring broadcast servers. Assume that there are two contiguous cells, which contain broadcast servers that transmit at different channels. A single server that wishes to take over the responsibility of transmitting in both cells can only do so if it can transmit over multiple channels. Finally, being able to transmit over multiple channels has scalability benefits.