Lesson 02
Data Synchronization Types, Formats and Usage Models in Mobile Computing Systems
Data synchronization Needs

- Required between the mobile device and service provider
- Between the device and personal area computer
- With nearby wireless access point (in WiFi connection)
- Another nearby device
1. Two-way synchronization of partial or full copies of data

- Between mobile-device and personal-area computer
- For example, whenever the list of contacts and personal information manager data is modified at any of them, it is made consistent after synchronization
2. Server-alerted synchronization

- The server alerts the client the data modification or additions
- The client synchronizes the modified or new data by pull request
- For example, alerting new e-mail and the device pulling that
3. One-way server-initiated synchronization

- Server initiates synchronization of any new modification since communication of last modification
- Sends modified data copies to the client
- When a new email arrives at a server, it initiates the synchronization as and when the device connects to the server and pushes the mail
4. Client initiated refresh synchronization

- The client initiates synchronization with the server for refreshing its existing data copies
- For refreshing the configuration parameters saved at the server for it
4. Client initiated refresh synchronization—Example

- For example, a computer or mobile device initiates refreshing of the hoarded contacts and personal information data either at periodic intervals or as and when it connects.
4. Client initiated refresh synchronization — Example

• if the device configuration changes or a new device connects to a server, then the configuration parameters sent earlier refresh at the server
5. Client-initiated synchronization

- With the server for sending its modifications, for example, device configuration for the services.
- For example, a client mobile device initiates synchronization of the mails or new ring tones or music files available at the server either at periodic intervals or as and when it connects to it.
6. Refresh from client for backup and update synchronization

- The client initiates synchronization
- Sends backup to the server for updating its data
- For example, a computer or mobile device initiates refreshing of the hoarded contacts and personal information data either at periodic intervals or as and when it connects to the server
7. Slow (full data copy and thorough) synchronization

- Client and server data compared for each data field and are synchronized as per conflict resolution rules
- Full copy synchronization usually takes place in idle state of the device
- Not immediately on connecting to the server, that’s why called **slow**
Formats of Synchronized Data Copies

- Can be different from each other at client and server
- When the data at a source synchronizes with the data at other end, it does so as per the format specified at that end
Formats of Database records

- The records indexed enabling search by querying using the indexes, for example, the relational database records
- The database record retrieved by sending a query specifying the entries in these indexes
- Format DB2 at server and DB2e Every place at the mobile device
Flat file Synchronization

• Data can be interpreted only if the file is read from beginning to end and that data cannot be picked from anywhere within the file
• For example, an XML or html file at the server synchronizes with the file at the device which is in text format or is a binary file depending upon the information format
Flat file Synchronization—Example

- Information format in mobile computing XML document format
- For transmission it is WBXML (WAP Binary XML) content format
- Address book data at a mobile device with the data transmitted in WBXML format
Device-specific storage Format

• AAC (Apple Audio Communication) files used for audio communication with an Apple iPhone
• A file in AAC format synchronizes with music files in some other format at a computer or remote website serving the music files
Device-specific storage Format

- At a mobile device the *Contacts* information in vCard format
- Calendar, tasks-to-do list, and journal information are in vCalendar, vToDo, and vJournal formats, respectively
Usage Models for Synchronization in Mobile Applications

- Four usage models employed for synchronization in mobile computing systems
1. Synchronization between two APIs within a mobile computing system
Synchronization between two APIs

- The data generated by an application synchronized and used in another application
- An API running at the device synchronizes data with another application on the same or another device or computer
Example of synchronization between APIs

- Data records at personal information manager (PIM) API synchronized with the email API
- When email from a new source retrieves at the email API in the device, the name and email address data fields at the application saved as new data record at PIM API
Example of synchronization between APIs

- When an email is to be sent to the same person, the email API uses the same data record from the PIM API
2. Synchronization between the device and nearby device

For example, iPod or Nokia → Data synchronization

PocketPC or computer connected to device by a cradle, wireless Bluetooth, IrDA, or ZigBee protocol

Device-specific platform, OS and data format at each device

Computer-specific platform, OS and data formats
Synchronization between the device and nearby device

- Device and computer synchronize their data
- Also called personal area synchronization (PAS)
- Using PAS software, for example, HotSync or ActiveSync
Examples of PAS

- Synchronization with nearby PC through a serial port using a cradle and wired connection to PC through the cradle
- Synchronization with the nearby computer through a wireless personal area network (WPAN) using ZigBee or Bluetooth
3. Synchronization between remote systems and device

Data copy sent from a system to another

Data synchronizes between the systems in client-server architecture

Mobile computing system or device 1

Downlink

Uplink

Mobile service provider or remote system

Data synchronization

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Synchronization between remote systems and device

- The device data records synchronize with the mobile service provider server records.
- The remote server or systems synchronize their data with the mobile device.
- The device connects to remote systems on Internet through the wired, wireless mobile service provider, or WiFi network.
Example of Synchronization between remote systems and device

- Wireless email synchronization using Intellisync between the device and remote server using SyncML language
4. Synchronization through a local pass-through system
Using local pass through computer or system

- Device data records synchronize with the records of remote system, for example, an enterprise server, through a local computer system
Example of Using local pass through computer or system

- The device first synchronizes through ActiveSync or HotSync or Intellisync or Bluetooth to local computer connected by personal area synchronizer
- Then the computer synchronizes to Internet through WLAN, WiFi, or wired network
Summary

- Two way synchronization
- Server alerted synchronization
- One way server initiated
- Client initiated Refresh
- Client initiated synchronization
- Refresh from client for backup and update

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Summary

- Slow thorough synchronization when idle
- Database formats
- Flat files
- Device specific storage files
- Synchronization between two APIs
- Personal Area synchronization
- Remote direct or through local pass through system
End of Lesson 02

Data Synchronization Types, Formats and Usage Models in Mobile Computing Systems