

Databases

Lesson 05

Power and Context Aware Computing

Power Aware Computing

- Computing processes must be energy efficient as the power resources at mobile devices limited due size constraints and mobility requirements
- Power-aware computing takes into account these constraints and devises methods to cut down the energy requirements of computing processes in mobile devices

Power Aware Computing Methods

1. Data caching at the devices conserves power as multiple requests (for data) made by up linking need more energy
 - The server's power not limited so the server can advertise the data records for the device caches

Power Aware Computing Methods

2. The cache invalidation mechanism conserves power as compared to other cache consistency maintenance mechanisms
 - The server advertises the invalidation reports to let the devices know about the invalidation of hoarded data

Power Aware Computing Methods

3. Records aggregated at the server or at the mobile device before transmission
 - Duplicate records can be suppressed and not transmitted
 - The state-information (unmodified) for a group of records transmitted

Power Aware Computing Methods

- When a record modified, only the addition or deletion in a previously transmitted record is transmitted
- The CRC information transmitted

Power Aware Computing Methods

4. Data sent by the number of sensor-devices clustered and aggregated at a server-node
 - The clustered data record server communicates the aggregated data to a base station.
 - Aggregation reduces the power requirements as it reduces the number of packets or packet size

Power Aware Computing Methods

5. Protocol optimization

- Optimized protocols use smaller size headers and need less frequent round trips than un-optimized protocols

Context

- Dictionary meaning— the circumstances that form the setting of an event, statement, or idea, and in terms of which it can be fully understood
- Context refers to the interrelated conditions in which a collection of elements, records, components, or entities exists or occurs

Context

- Each message, data record, element, or entity has a meaning
- But when these are considered along with the conditions that relate them to each other and to the environment, then they have a wider meaning

Necessity of Context Aware Computing

- Understanding of the context in which a device meant to operate, results in better, more efficient computing strategies

Context Aware Computing

- Context of a mobile device represents the circumstances, situations, applications, or physical environment under which the device being used
- For example, the context is *student* when the device used to download faculty lectures or PowerPoint slides

Context Types in Context-aware Computing

- Physical context
- Computing context
- User context
- Temporal context
- Structural context

Physical Context Aware Computing

- Assume that a mobile phone operating in a busy, congested area
- The device is *aware* of the surrounding noises, then during the conversation, it can raise the speaker volume by itself and when the user leaves that area, the device can again reduce the volume

Physical Context Aware Computing

- When there is intermittent loss of connectivity during the conversation
- The device can introduce background noises by itself so that the user does not feel discomfort due to intermittent periods of silence

Context-aware computing system

- Has user, device, and application interfaces such that, using these, the system remains aware
- Aware of the past and present surrounding situations, circumstances, or actions
- Aware of such as the present mobile network, surrounding devices or systems,
- Aware of changes in the state of the connecting network

Context-aware computing system

- Aware of physical parameters such as present time of the day, presently remaining memory and battery power, presently available nearest connectivity, past sequence of actions of the device user, past sequence of application or applications, and previously cached data records, and takes these into account during computations

Structural Context

- Consider example of structural context
- Résumé — The fields for name, address, experience, and achievements of a person have an individual meaning. However, when put in a résumé, these fields acquire a significance beyond their individual meanings

Context Significance

- This significance comes from the fact that data fields are now arranged in a structure which indicates an interrelationship between them
- The structure of the résumé includes the records and their interrelationship and thus defines a context for these records

Structural context

- Context from the structure or format in which the records in a database are organized

Implicit Context

- Implicit context provides for omissions by leaving out unimportant details, takes independent world-views, and performs alterations in order to cope with incompatible protocols, interfaces, or APIs by transparently changing the messages

Implicit context in 'Contacts' Database

- Uses history to examine call history
- Manages omissions
- Determine recipients
- Performs contextual message alterations
- Provides for and manages transitions at the boundaries between world-views where contextual dispatches occur

Implicit context in 'Contacts' Database

- The name, e-mail ID, and telephone number
- When a computing device uses a contact to call a number using a name record, the system takes independent view and uses the telephone number implicitly and deploys CDMA or GSM protocols for connecting to the mobile network implicitly
- Context CDMA is implicit in defining the records 'Contact'.

Implicit context in 'Contacts' Database

- When a computing system uses a contact to send an e-mail using a name record, the use of the e-mail ID record implicit to the system and the use of SMTP (simple mail transfer protocol) or other mail sending protocol is also implicit
- The context of the mobile service protocol, mail transfer protocol, and use of specific interfaces and software also implicit

Explicit Context for ‘document’

- Contact or personal information is an extrinsic context
- In context to processing of a document, the existence of document author contact information extrinsic
- The *contacts* context is imported into the *document* context to establish interrelationship between document and *contact*

Context-aware Computing

- Leads to application-aware computing
- This is so because the APIs are part of the context (implicit or explicit contexts)
- For example, when using an e-mail ID, a mail receiving or mail sending application software is used for computing

Context-aware Computing

- An application can adapt itself to the context
- For example, if context is a contact, the phone-talk application will adapt itself to use of the telephone number from the 'contact' and to the use of GSM or CDMA communication

Context-aware computing and pervasive or ubiquitous computing

- Consider the computing context during mobile device data-communication
- Computing context includes the existence of the service discovery protocol, radio-interface, and corresponding protocol

Use of context in computing

- Helps in reducing possibility of errors
- Helps in reducing the ambiguity in the action(s)
- Helps in deciding the expected system response on computations

Context-aware computing and pervasive or ubiquitous computing

- Suppose service discovery protocol senses the context and finds that communication protocol is Bluetooth then the device uses Bluetooth to communicate
- When it finds the protocol is 802.11 WiFi LAN, it uses the WiFi for communication

Use of context in computing

- For example, if *name* is input in personal biodata context, then the *address*, *experience* and *achievements*, which correspond to that name, are also required for computations
- When *name* is input in telephone directory context, then the *address* and which one correspond to that name, are also required for computations

Summary

- Power aware computing methods
- Data caching in place of pulls
- Cache Invalidation mechanism
- Aggregation, clustering, transmitting only changes or modifications

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- Context aware computing
- Physical context
- Computing context
- User context
- Temporal context
- Structural context

End of Lesson 05

Power and Context Aware Computing