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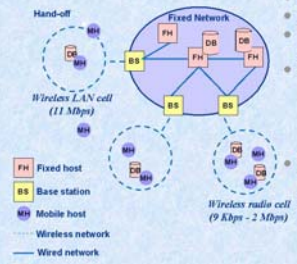
Defining an Adaptable Mobile Transaction Service

Context

Abstract

- Mobile environments are characterized by frequent variations in connection and bandwidth rates as well as by restrained resources on portable devices. This variability complicates data management and in particular, transaction execution. We consider that to deal with environment variability it is necessary to be adaptable. This poster introduces both a Mobile Transaction Service (MTS) and an Adaptable Mobile Transaction model (AMT) which offer environment awareness and transaction execution adaptability. The MTS is a middleware that besides coordinating the execution of mobile transactions, supports mobile environment awareness. The AMT allows the description of different semantical equivalent ways of executing mobile transactions. Thus, depending on the environment mobile transactions will be executed.

Mobile environment



- Frequent disconnections
- Bandwidth variations
- High communication costs
- Limited resources on MH
  - battery life
  - processing capacity
  - storage capacity
- Mobile data management must take these characteristics into account !

Motivation

Motivation

Requirements for supporting:

- Mobile environment variations and mobile constraints
  - How transactions could survive to mobile environments variations?
- Several execution models at the same time:
  1. The MT is initiated by an MH and entirely executed on FHs
  2. The MT execution is distributed between an MH and FHs
  3. The MT execution is distributed among several MHs
  4. The MT is entirely executed on the MH

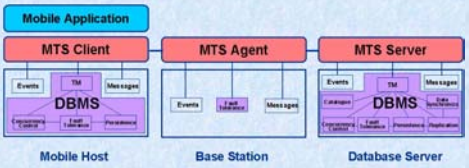
The Mobile Transaction Service (MTS)

A mobile transaction service (MTS)

A Mobile Transaction (MT), is a transaction where at least one mobile host takes part in its execution

- It is a generic service which coordinates the execution of mobile transactions
- It provides support to the four execution models of MTs
- It adapts the MT execution to the mobile environment variations
  - Going from an execution model to another depending on mobile environment variations
- Environment awareness with events
- It provides disconnection process

MTS global architecture



Mobile environment characteristics

- Environment Descriptor

ED = *{Characteristic – value(s)}*

	Characteristic	Values	Unit
WN	Connection-state	Connected, disconnected	--
	Bandwidth-rate	High, medium, low	Kbytes/s
	Communication-cost	Free, cheap, expensive	Euros/time
MH	Available-battery	Full, half, low	hh:mm:ss
	Available-cache	Full, half, low	Kbytes
	Available-persistent-memory	Full, half, low	Kbytes
	Processing-capacity	High, medium, low	Mips
	Estimated-connection-time	t	hh:mm:ss

An Adaptable Mobile Transaction Model (AMT)

Adaptable mobile transaction model

AMT = (T, CT, ES)

- ES = $\langle EA_k \rangle = \langle (ED_k, EP_k) \rangle = \langle (ED_k, \{T_s, coord\}) \rangle$
- RD relationship dependence over EP_k
- T = $\{T_i\}$ = ACID component transactions
- CT = $\{CT_j\}$ = Compensating transactions $j \leq i$

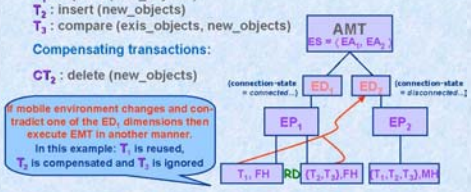
AMT example

Component transactions:

T_1 : capture (new_objects)
T_2 : insert (new_objects)
T_3 : compare (exis_objects, new_objects)

Compensating transactions:

CT_2 : delete (new_objects)



AMT= { $\{T_1, T_2, T_3\}$, CT_1,⟨ (ED_1, { (T_1, MH) RD ($\{T_2, T_3\}$, FH) }),(ED_2, $\{T_1, T_2, T_3\}$, MH)⟩ }

ACID properties?

- AMT with execution models 1 and 4 guarantee ACID properties (since component transactions are ACID)
  - As we consider local data (stocked on MHs) as replicas, in 4, after disconnection, a synchronization process with FHs must be executed. We think that this issue is more a replication problem than a transaction problem
- Problems to provide ACID properties in 2 and 3:
  - Global commitment
  - Global serializability

Related works and conclusions

Related works

Mobile transactions

- *Research works:* Clustering, Two-tier replication, Pro-motion, Reporting, Semantics-based, Prewrite, Kangaroo transactions, MDSTP, Moflex transactions…
- *Commercial solutions:* Oracle Lite, DB2 Every Place, Sybase iAnywhere solutions…

Execution alternatives & contingency transactions

- DOM transaction model
- Flex transaction model

Conclusions

The contributions of our research are:

- Adaptability of MT execution based on mobile environment awareness
- Proposition of an adaptable mobile transaction model which:
  - supports different MT execution models
  - allows to describe necessary ME characteristics
  - allows the description of semantically equivalent alternatives

Ongoing works

Ongoing and future works

- Specification of MTS's interfaces
  - transaction manager, event service, message service
- Detailed description of disconnection and handoff process
- Conception of MTS communication protocols
  - Client - Agent - Server
- Coordination structures and message types
- Global commitment
- Correctness criteria
  - from serializability to eventual consistency?
- Prototype implementation
  - Wireless LAN (IEEE 802.11), laptops, PDAs

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