

Unit-4

Mobile Agents in Mobile Computing

In Mobile Computing, Mobile Agents are the composition of computer software and data that can autonomously move from one computer to another computer and continue its execution on the destination computer.

In other words, you can say that An Mobile Agent is an autonomous program that is capable of moving from host to host in a network and interact with resources and other agents. In this process, the chance of data loss is scarce because the state of the running program is saved and then transported to the new host. It allows the program to continue execution from where it left off before migration. The most significant advantage of mobile agents is the possibility of moving complex processing functions to the location where you have enormous amounts of data and that have to be processed.

Mobile Agents are also called as transportable agents. They are classified into two types:

- **Mobile Agents with pre-defined path:** They have a static migration path.
Mobile Agents with undefined path i.e., Roamer: They have dynamic migration paths. The mobile agents choose their path according to the present network condition.

Features of Mobile Agents

The mobile agents are autonomous with intelligence, social ability, learning, and the most important feature is their mobility. They are independent in nature, self-driven and do not require a corresponding node for communication. They can work efficiently even after the user gets disconnected from the network.

Intelligence

Mobile Agents are capable of learning and searching for knowledge about their domain. That's why they are called intelligent agents because they possess a degree of domain knowledge. They can also transport their state from one environment to another without disturbing the previous holding data and be capable of performing appropriately in the new environment.

Autonomous

The Mobile Agents are Autonomous. It means the agents are not only motivated by the outside actions initiated by the users or system but also they have internal

events that decided their performance and behavior. The mobile agents can also take an autonomous decision while selecting a node.

Mobility

Mobile Agents contain some degree of mobility. The agent is not limited to its home node only. They can migrate from one node to another and can carry out tasks along with them. This feature distributes the processing and balancing of the load. Another benefit of this capability is that when the user goes offline, the agents will still keep functioning.

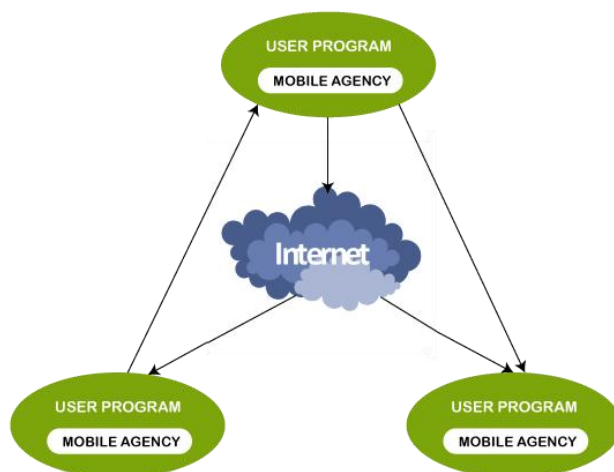
Communicative

Mobile Agents can communicate effectively with other agents, users and systems. The mobile agents use a communication language for inter-agent communication.

Life Cycle of Mobile Agents

The life cycle of mobile agents ensures the following conditions:

- They can adapt to the environment. For example, either home or foreign environment.
- They are capable of switching among the positions of one node to another.
- They are autonomous and focused on the final output.



Advantages of Mobile Agents

The following are some advantages of mobile agents over conventional agents:

- Mobile Agents are autonomous and self-driven in nature.
- They are maintenance-friendly or easily maintainable.

- They are Fault-tolerant. It means they are able to operate without an active connection between client and server.
- They reduce the compilation time.
- They provide less delay in the network.
- They provide fewer loads on the network.
- They facilitate parallel processing. It means they can be asynchronously executed on multiple heterogeneous network hosts.
- They provide dynamic adaptation in which their actions are dependent on the state of the host environment.

Disadvantages of Mobile Agents

The following are some disadvantages of mobile agents:

- The most significant disadvantage of mobile agents is their security. They are less secured

Applications of Mobile Agents

Mobile agents are used in the following applications:

- Mobile Agents are applied in a wide range of domains such as E-commerce, traffic control, network management, robotics, data-intensive applications etc.
- They are also used in grid computing, parallel computing, distributed computing and mobile computing etc.

Transaction Processing in Mobile Environment

Computing Technologies are the technologies that are used to manage, process, and communicate data. In this article, we will learn about Transaction Processing in [Mobile Computing](#). A transaction processing system allows application programmers to concentrate on writing code that will allow users to perform transactions simultaneously without bothering about what other users may be doing with their transactions at the same time:

- It manages the concurrent processing of transactions.
- It enables the sharing of data.
- It ensures the integrity of data.

Issues in Transaction Processing

Database applications are normally structured into transactions. The transaction is a type of operation that makes sure that database does not change into an inconsistent state to disrupt the transactions.

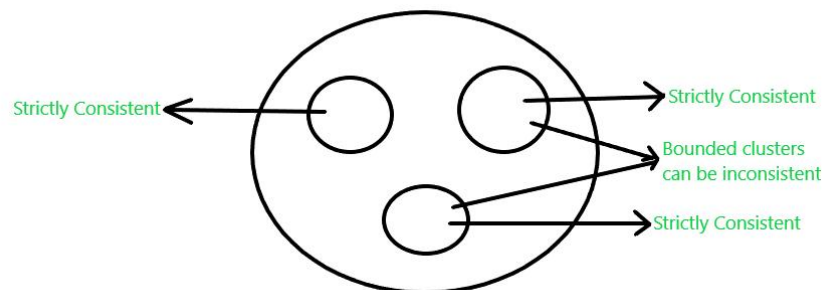
One important aim in the design of any database system is to maximize the number of transactions that can be active at a time. DBMS ensures serializability using ACID constraints:

- Atomicity
- Consistency
- Isolation
- Durability

ACID properties have been redefined to support transactions in the mobile environment are:

Atomicity Relaxation: Mobile Host is allowed to submit pieces of the transaction from different cells according to the movement. It requires the ability to break a transaction into many sub-transactions that can be concurrently executed.

Consistency Relaxation: The database is logically partitioned into “clusters” based on some attributes. Data in the same cluster must be strictly consistent. Although the bounded degree of inconsistency is tolerated among the clusters.



The above figure describes three clusters inside a bounded region.

Isolation Relaxation: The intermediate results of a transaction can be observed by other concurrent transactions. For example, if T1 is a transaction process and T2 is another transaction process then T1 should not be visible to T2.

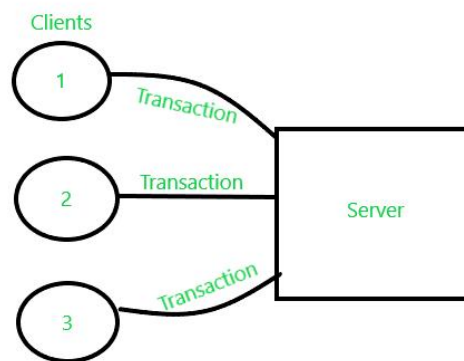
T1	
	T2

T1 and T2 are two transaction processes where the operation of T1 is not seen by T2.

Durability Relaxation: A disconnected Mobile Host can only commit a transaction locally if this transaction does not conflict with other transactions executed on the same HOST while HOST was disconnected.

Transaction Processing Environment

1. **Centralized Environment:** Single user system executes all the transactions.
2. **Client Server Environment:** Transaction and transaction initiation are done by the server and client respectively. Many clients can send transactions to servers simultaneously.



3. **Distributed Environment:** Data is distributed over a network. The transaction can occur fully on a node or partially on a different node.
4. **Mobile Environment:** Special type of distributed environment can accommodate user movements while processing transactions.

Issues in Mobile Environment

- **User Movement:** Tracking users, and data recovery are complicated. LOG location determination is complex.
- **Disconnections:** There may be temporary disconnections due to noise, fading of signal, handoff, etc. If there are planned disconnections, then the mobile user can perform some operations by downloading data beforehand. It can be referred to as data hoarding. Another way to deal with disconnection is by migrating transaction processing to a non-mobile computer. One more approach is maintaining proxy agents at MSS(Mobile Satellite Service). The process includes representing Mobile Host(MH) during its absence and participating in communication and finally handing over control to MH as it reappears.

- **Poor Communication Media-** Bandwidth allocated to mobile users could be very low. Interference from other traffic, noise, etc may corrupt data. MH tends to disconnect from the network whenever there is no data to send or receive in the near future.
- **Processing Power-** With a less powerful CPU, database server operation is difficult.
- **Memory-** Memory availability is limited.
- **Battery Power-** Like memory, battery power is also limited.
- **User Interface-** It should be designed keeping in mind resource restrictions.
- **Security-** Chances of data theft and unauthorized access increases while MH moves from one cell to another.