Chapter 13

E-Business Transaction Management in Web-Integrated Network Environment

V. K. Murthy
University of New South Wales at ADFA, Australia

ABSTRACT

This chapter describes the Operational Models, Programming Paradigms and Software Tools needed for building a Web- integrated network computing environment. We describe the various interactive distributed computing models (client server-CS, code on demand, remote evaluation, mobile agents, three and N-tier system), different logical modes of programming (imperative, declarative, subjunctive, and abductive), transaction and workflow models (that relax atomicity, consistency, isolation, durability and serializability properties), new protocols, and software tools (PJava/JDBC) that are needed. Some important application areas of these models are for telediagnosis and cooperative problem solving.

INTRODUCTION

This chapter describes the issues involved in the design of online E-business Transaction Processing systems and the solutions available for these problems using the techniques of AI, logic, conventional database transaction processing methodology and protocol engineering principles. E-business transaction processing requires that all the parties (such as traders, customers, buyers, and sellers) involved in a transaction are in agreement before allowing the transaction to be committed; if any of the parties cannot complete its part of a transaction, the entire transaction has to be rolled back. Conventional online transaction processing (OLTP) semantics are met by the following requirements called "ACID requirements":

Atomicity (A): All changes are totally done (committed) or totally undone (rolled back).
Consistency (C): The effect of a transaction preserves the invariant properties of the system.

Isolation (I): Intermediate results are not visible to other transactions. Transactions have the effect of executing serially, although they act concurrently**.**

Durability (D): The effects of a transaction are persistent; changes are not lost except under catastrophic failure.

However, for e-business transaction processing we need to have:

(1)   long duration transactions that lack conventional ACID properties of transactions and need externalization of intermediate results, fault tolerance and recovery under failure;

(2)   location and disconnection- reconnection management for hand-held mobile devices; and

(3)   new logical modes and related protocols that provide rules for conducting "dialogue" among the parties so that each party can formally express what is to be communicated clearly and unambiguously.

The above requirements demand the design of a new Information architecture for e-business transaction processing systems. Further, an e-business Web-integrated network environment (INE) needs to be rich in its problem-solving capability, since it needs to serve as a virtual logical tool for the user. Such a tool is meant for effective decision making using different logical modes to cooperatively solve a business problem. In such a cooperative business environment, it is necessary to allow data exchange between some transactions during their execution, thereby necessitating the relaxation of the Isolation property used in conventional transactions. In a e-business environment, in addition to the conventional imperative programming mode of logic, we need two other logical modes - subjunctive (what if I do this? or speculative) and abductive (how did this happen? or diagnostic) programming features that add additional logical power to the user. This added power provides for various forms of reasoning to aid planning, acquiring and analysing information, arguing, and negotiation. In a negotiation, parties communicate with one another in order to reach mutually acceptable agreements on some matter of common value to them. These modes enable us to realise the following required properties for e-business transactions:

1.   Attribute-Sensitivity: The transactions are to be committed or aborted locally or globally depending upon their exact attribute values.

2.   Attribute Tolerance: The transactions can be permitted to be locally relaxed in terms of certain constraints on attributes, but globally consistent eventually.

3.   Time-criticality: These are transactions that possess Atomicity, Consistency, Isolation, and Durability (ACID) properties and are to be permanently committed, as soon as the transactions are completed to achieve local and global consistency.

4.   Time-tolerance and eventual consistency: Some transactions can wait until reconnection takes place, and are not time-critical in the sense they will not create global inconsistency, but are only necessary to provide an eventual consistency with respect to the user and the relevant database.

Hence in an e-business environment, the isolation property needs to be removed and intermediate results are made visible, and precedence order in execution and other dependencies are taken care of, thereby removing the atomicity restrictions. This model is called a workflow (which is a collection of tasks organized to accomplish some business activity) between the customer and the trader supported by suitable protocols. A workflow can be realised by mobile agents, which are autonomous objects that execute methods when they are deployed. Workflow-based mobile agents play an important role for E-business transaction processing.

In summary, for an e-business web - integrated environment, we require the following features:

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