Application Research of Transaction Properties In Migrating Workflow

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***Abstract* - This article introduced the concept of migrating workflow and transaction, described the most critical atomicity and conformance requirements in the transaction properties, proposed the concept of transactional workflow and the four properties that need to meet, finally,analyzed the features of migrating workflow and the unique requirements of the transaction properties,and gave the transaction implementation model of migrating workflow.**

Keywords-- Transaction Properties; ***Migrating Workflow***; ***Transaction workflow***

I. THE OVERVIEW OF WORKFLOW AND MIGRATING WORKFLOW

Workflow Management Coalition (WfMC) is the workflow technology of Organization for Standardization, it provides the definition for workflow as : workflow is a kind of business process which can fully or partially utomate,and it It is based on a series of process rules that make documents,information and tasks pass and implement among different actors.The definition shows that workflow is a kind of computerized representation model of business process,the definition completes the the various parameters that the entire process needs; workflow is the computer implementation of business process,the business process aims to achieve the business objective of the enterprise,with part or all of the organization and the participation of staff,it uses Enterprise Resource including processing devices、communication devices、computer hardware、software, according to predetermined rules, it aslo transmits and processes documents、information and tasks between the participants and organizations, so that it can achieve the prescriptive business objectives.

Migrating workflow is the combination between of workflow technology and Mobile Agent Technology. Workflow completes some business process,which is made up of activities and dependencies between activities. The dependencies between activities include data dependence and control dependence.Activities include four parts:activity subject、activity object(task and data)、activity rules and external environment(provide data and function services for the activity subject, namely workflow services). Migrating workflow MWF includes four parts:(1) Migrating workflow logo; (2) The set of migrating instance;(3) The working position set of migrating instance forms a connected network in the topology;(4) The migrating workflow engine of workflow-oriented goals.

II. THE SYSTEM FRAMEWORK OF MIGRATING WORKFLOW

The migrating workflow management system includes three parts: migrating workflow management engine、migrating instance and working position.It is shown as Figure 1.

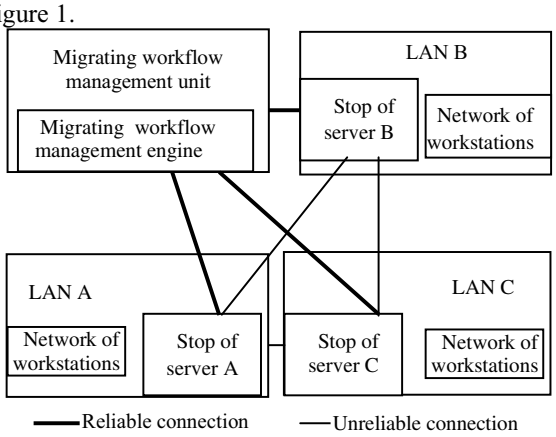

Figure 1 System Framework of Migrating workflow

The migrating workflow management engine defines and creates migrating instances according to workflow process, assigns tasks for the migrating instance and sends it to the initial position to start the implementation of the work.The management engine aslo includes tracking, recycling, job control and multiple migrating instances coordination of the migrating instances and other fuctions.

Working position is the execution venues of the migrating instances,it provides execution environment and workflow services for the migration instances. Working position includes stop of server and its associated network of workstations. Migrating instances migrate to a working position,which means migrating to stop of server of the working position,and then access services provided by network of workstations in the way of object reference by the stop of server.

III. TRANSACTION AND TRANSACTION WORKFLOW

The concept of transaction firtly originates from the Database Technology,it is the collection of data

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manipulation which constitutes a logical unit of work,whose correct implementation requires to meet four properties: (1)Atomicity,the operation on data is as the smallest unit of execution, or fully complete,or does not do that at all,or does not exist the implementation of the intermediate state; (2)Consistency,the results of concurrent access to data are correct, do not appear dirty read and lost、change data and other problems;(3)Isolated,the concurrent access to data is independent just like the operation is sequentially executed;(4) Durable,once the data is submitted, the results will be saved and can't lost.

Processing transaction aims to ensure the completeness and correctness of data manipulation,and then makes the result of the operation from a correct state to another correct state. Adding transaction properties to database management system improve stability and reliability of the system.With the development of dynamic, autonomous, heterogeneous, and distributed complex applications, the traditional transaction model no longer meet the demands, so people design a variety of advanced transaction model,such as Sagas model and Flexible model,they aim to implementation requirements of long transaction relaxing ACID properties of transactions. Based on the advanced transaction model,the transaction workflow is appeared. Transaction workflow is that adding to attribute transaction of the workflow. As the complexity of workflow applications increasingly,distributed and heterogeneous characteristics of the existing workflow system decide workflow transaction properties and ensure the difficulty of the features.

IV. THE MIGRATING WORKFLOW OF TRANSACTION PROPERTIES

A. The Migrating Workflow of Transaction Properties

The migrating workflow system is the workflow management system that uses mobile Agent technology,and the mobile Agent which represents the realization of the process is called as migration instances.The behavior of migrating instances are consistent with the computing model of mobile Agent. The migrating workflow system continues to migrate in the workflow position through migrating instances, and requests local service to complete the planning tasks, its executive features make system have the advantages which the traditional workflow system is not comparable with. If the migrating workflow system wants to run from the model stage to enterprise applications , the first problem to be solved is stability、reliability and robustness of system, however, the key to solve this problem is that how to ensure adding the transaction properties to the migrating workflow.

The basic properties that must be achieved in the migrating workflow are as followings:(1) Failure Atomicity. Failure atomicity is the feature that each task as an atomic unit is completely or not fully implemented in the process of workflow execution on the condition that failure is allowed to occur.(2)The integrity of migrating workflow process.It refers to the feature that the migrating workflow meets the failure atomicity ,achieves tasks and finally finishes tasks according to the workflow definition.It not only includes full implementation of main processes and sub-processes,but also the full implementation of each task.The integrity control of migrating workflow process starts from the two levels, first, solve the task sheet of the integrity control, and then achieve the integrity control of the entire process. Process integrity control contains two meanings:one is that it provides fault-tolerant recovery and ensure the full implementation of a single task;another is that it ensures task dependencies and the task is fully implemented according to the process definition.(3) Workflow Independence. It refers to the feature that different workflow or different instances of the same workflow do not interfere with each other when they are simultaneously implemented and need to meet serialization requirements when it access to shared resources. (4) Workflow data consistency. It refers to the feature that the data resources in different workflow have the same values when they are operated at the same time and completely and orderly reflect the operating results to the final state.

B. The Transaction Features of Migrating Workflow

Migrating workflow system is achieved by mobile computing model, whose unique enforcement mechanism decides that its transactional has different implementation requirements.(1)Migrating instances are the subject that ensure transaction properties.first, migrating instances are the subject of the Business Process Execution,Because they have environmentally-aware and decision-making functions,they have the main advantages of achieving transaction control;and the migrating instances are the subject of workflow and take with it, they are should be responsible for executing the integrity of the workflow process;so migrating workflow no longer adopts the way of ECA rules triggered to achieve a single anomaly detection and processing module, but the migrating instances determine an exception occurs, propose revocation and migration recovery request. (2)Formulating Compensation Action during recovering failed tasks is provided by the service components of working position.Because the way of achieving tasks in the migrating workflow system is that migrating instances submit a service request to the working position,and then the working position.verifies and forwards the request to the service agent(SA), the results of the implementation are retured to the migrating instances by SA. the migrating instances and the working position complete task interact through local news.If migrating instances do not know the details of task, they will not be able to know the corresponding compensation measures; only service providers know the concrete realization of tasks,so the service providers provide Compensation Action and the formulation of compensation is related to the specific implementation process.(3)Task sheet is the basic unit of transaction control. Multiple tasks that are consecutively implemented in the same working position are composed by the migrating workflow system,mission sheet is a Composite Services Unit.Usually, the business between tasks in the mission sheet has significant correlation, it is logically as a whole.(4)Ensuring data consistency is more

complex. There are competitive relationship and cooperative relationship between migrating instances, migrating instances implement sub-business process through deriving child migration instance, migrating instances constitute the derivation hierarchy; they may derive from the same parent migrating instance which shares business process data together,and ensure the consistent update of public data by cooperation; migrating instances may also access the data of working position through competing for resources to complete the calculation process, this competitive action must also satisfy the mutual exclusivity.

C. Ensuring the Migrating Workflow of Transaction Properties

In order to achieve failure atomicity and ensure the process integrity,first fault tolerance mechanism needs to be provided, when the intermediate link failures, making process continues to execute or making system restores the state before the failed node is executed through exception handling. The main and backup server policy can be adopted for the system abnormalities, the local can be recovered through the backward log-based recovery techniques;the task can be fallen back based on the way of compensation for Application Exception, then redo or ignore the task. Some application exception is not local recovery,for example, lack of commodity stocks, migration strategies must be restored;and task usually do not exist independently,but attached to a Composite Services Unit, the logical relationship of Composite Services may be broken when the task is revoked.So when the Composite Services are restarted in the new working position, rerun them starting with point for the greatest range of failure.Achieving the integrity control of the migrating workflow on the one hand needs fault tolerance mechanism provides the possibility of local recovery ,on the other hand needs the integrity of composite services unit to depend and control,and the Integrity Control of whole workflow.

In order to achieve workflow independence, a kind of method called global timestamp ordering is adopted to exclusively access data resources of the working position,after creating migrating instances, apply for the only time stamp of the system from the global services unit,different time stamp of migrating instances exist different order.The time stamp is not necessarily a specific time value, as long as the different migrating instances can sort in turn, the time stamp that the migrating instances get is shared by each task execution unit. When resource access requests is submitted, request scheduler will will sort by timestamp and control the access order acording to results.

In order to achieve migrating workflow data consistency,adopt the method of the results of merging migrating instances for the workflow data, that is the process which reflects implementation contents of parallel business process to consistent Data Status. Different Data Types have different requirements for combined strategy,they are divided into three types: restricted type, combined type and aggregate type. Restricted type is the default type,and aslo the most stringent compliance requirements.It is finally required that combined results are the same as the parallel process sequence; the combined type has a bit of flexibility, each parallel process operates data copy independently,writes operating history in the switching table, and determines which operations can be updated in the data based on switching table in the consolidation phase; the aggregate type is more flexible, system defines Aggregation Algorithm in the process definition stage,such as sum, average and so on, applying algorithm in consolidation phase reflects collection of information in parallel operation.

V. TRANSACTION IMPLEMENTATION MODEL OF MIGRATING WORKFLOW

Combining features of migrating workflow transaction properties with traditional transaction processing strategy, transaction implementation model of migrating workflow is shown as Figure 2.

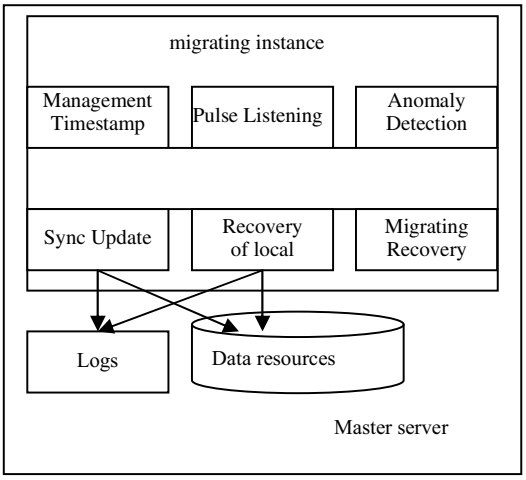

Figure 2 Transaction implementation model of migrating workflow

This model aims to provide the comprehensive implementation of basic transaction properties of the migrating workflow transaction, the basic idea is that transaction processing module is added to the the migrating instances, and combines redundant backup strategy to control transaction properties.This kind of model includes:(1)Management Module Timestamp, it is the only time stamp that the migratiing capabilities apply the global,show time stamp when request workflow services,and enter the service request waiting queue according to the time stamp order. Achieving workflow independence is through sorting the global time stamp.(2) Pulse Listening Module,it means that the server periodically listens whether the migrating instances activate or not. If the sever does not receive the response in the expected time,the migrating instance thread is interrupted, and take remedial measures,for eample,first try to restart this thread,if it fails, try to restart the server,if it still fails, report manager for system maintenance.(3)Anomaly Detection Module, according to the built-in anomaly detection program of migrating instances,the exception occurs is determined,which provides the diagnosis of abnormal

conditions of migrating instances together with the pulse listening.(4)Sync Update Module, it is used to synchronize migrating instances with other migrating instances for acessing and updating data resources, the process will be recorded in the log for audit and failure recovery. According to corresponding synchronous update strategy, workflow data consistency can be achieved. (5)Recovery of local module, it provides local recovery of failure task to ensure the failure atomicity of Task.When the task needs to be revoked, query task processing log, execute the compensation operation that has been submitted, and update the data resoures and make them roll back to the state before the tasks are executed.(6)Migrating Recovery Module,when the local recovery can not achieve the successful implementation of tasks, start migrating recovery, and achieve the integrity constraints of business process in the process.

VI. CONCLUSION

This article introduced the concept of migrating workflow and transactional workflow, describes the transaction properties of the most critical atomicity and conformance requirements, and analyzes and summarizes existing studies. The paper pointed out that exception handling is a strong guarantee for the realization of atomicity, highlighted the unusual classification, detection and implementation of exception handling, finally,analyzed the features of migrating workflow and the unique requirements of the transaction properties, and proposed transaction implementation model. The exception handling is not enough to achieve the integrity of the process, it needs to be restricted on the logical dependence, and implements integrity control from the perspective of entire process,so it also needs to design Process Integrity Control Algorithm of the migrating workflow, so that effectively solve the problem of integrity control and enhance stability and reliability of the system.

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