A system for analyzing and structuring business processes implemented in software provides businesses with tools to manage business processes. The system i) notifies the user that he or she has a step to begin or to complete; ii) provides the user with the proper tools to complete a task; iii) provides the user with the proper information to complete a task; iv) allows the user to see where a task fits in the overall process; v) manages proper reminders and alerts, and follow-ups to keep the process moving; vi) automates certain standard procedures; vii) integrates with the organization’s existing business systems; and viii) provides application program interfaces that allow developers to develop applications that are workflow-enabled. The system utilizes a workflow server including a transactions manager and a database.
Fig. 4a
FIG. 4b
COMPUTERIZED METHOD AND SYSTEM
FOR MANAGING BUSINESS PROCESSES
USING LINKED WORKFLOWS

This is a continuation of application Ser. No. 08/624,206 filed Apr. 3, 1996, now abandoned which is a continuation of application Ser. No. 08/014,796 filed Feb. 8, 1993, now abandoned.

BRIEF SUMMARY OF THE INVENTION

Businesses are demanding new systems that directly support the management of business processes, systems that bring order and coordination to the flow of work. They are seeking to automate that part of office work that has been impervious to conventional data processing and information processing systems, which were now designed for business process management and are not well-suited to help with it.

The present invention is a system for analyzing and structuring business processes that, when implemented in software, provides businesses with the tools they need to manage business processes efficiently and cost-effectively.

The invention can be applied to all business processes from simple applications, such as intelligent forms routing, to sophisticated mission-critical enterprise-wide systems that integrate all marketing, production, and customer fulfillment processes.

The resulting system enables users of the system to take coordinated action quickly and to manage processes painlessly. The results are increased productivity, reduced cycle time and hence, improved customer satisfaction.

Workflow-enabled systems facilitate business processes. To do so, a workflow management system performs eight key functions:

- Notifies the user that he or she has a step to begin or to complete.
- Provides the user with the proper tools to complete a task.
- Provides the user with the proper information to complete a task.
- Allows the user to see where a task fits in the overall process.
- Manages the proper reminders, alerts, and follow-ups to keep the process moving.
- Automates certain standard procedures.
- Integrates with the organization’s existing business systems.
- Provides simple application program interfaces (APIs) that allow developers to develop new custom applications that are workflow-enabled.

The workflow system’s architecture is designed to fit within a variety of computer systems, collecting around itself not only specific applications, but also system enhancements and utilities from users and third-party developers. In addition, the architecture is designed to allow for interoperability among different applications and across diverse platforms.

A fundamental concept of a workflow system is that any business process can be interpreted as a sequence of basic transactions called workflows. Every workflow has a customer, a performer, and conditions of satisfaction. The customer and performer are roles that participants can take in workflows. In addition, each workflow can have observers.

In a workflow, the customer is the person for the sake of whom the work is done, either because they made a request or accepted an offer. It is customers who are responsible for evaluating performed work and determining whether this work meets their conditions of satisfaction.

The performer is the person who is responsible for completing the work and for declaring to the customer when the work is done.

Requests and Offers are the two basic types of workflows. There are other workflow types such as Question, Inform and Note that are simplified derivations of Request and Offer. The conditions of satisfaction specify the work to be performed by the performer. In a request, the customer specifies the conditions of satisfaction, and in an offer the performer specifies them. (Then, of course, the two can enter into negotiation about the work to be done.)

For example, given the sentence:

"John asked Frank to prepare the report and deliver it by noon on Friday."

John is the customer for this workflow, Frank is the performer, and the conditions of satisfaction are "prepare the report and deliver it by noon on Friday." Further, Because John asked for the report rather than Frank offering it, this workflow is of the type Request.

Given the sentence:

"John proposed to prepare the report and deliver it by noon on Friday for Frank."

John is the performer for this workflow, Frank is the customer, and the conditions of satisfaction are still "prepare the report and deliver it by noon on Friday." Further because John proposed the report rather than Frank asking for it, this workflow is of the type Offer.

Observers of workflows take no direct action; they usually observe for management or training purposes.

Business process maps display the workflows as loops, and display the relevant information about each workflow—the customer, the performer, the conditions of satisfaction and the cycle time. FIG. 1 is a business process map having a primary workflow 11, conditional workflows 13 and 15, a conditional link 17, parallel workflows 19 and 21, serial workflows 23 and 25. In a workflow system according to the present invention, associated with each workflow: are various parameters such as roles, cycle time, conditions of satisfaction or associate semantics to the links that imply automated action or provide the framework for application building, all of which are necessary to create a useful business process representation. Each workflow has four phases. The first phase is called the proposal phase during which a request is made of the prospective performer by a customer or an offer to a customer is made by a prospective performer. The second phase is called the agreement phase during which the offer is accepted by the customer or the request is agreed to by the performer and conditions of satisfaction are identified. Of course, during the agreement phase the original conditions of satisfaction can be negotiated by the customer and performer until an agreement is reached. The third phase is called the performance phase during which the performer undertakes to meet the agreed to or accepted conditions of satisfaction. When the performer believes that the conditions of satisfaction have been met, the performer declares completion. The last phase is the satisfaction phase during which the customer determines whether or not the conditions of satisfaction have been met by the performer, and if so, declares satisfaction.

In U.S. Ser. No. 07/600,144 filed Oct. 17, 1990, now U.S. Pat. No. 5,216,603, and U.S. Ser. No. 07/368,179 filed Jun. 19, 1989, now U.S. Pat. No. 5,208,748, both owned by Action Technologies, Inc., the assignee of the present application, methods and systems for managing workflows,
called conversations in the referenced applications, are described. However, the teachings in the cited references are limited to single workflows no capability for mapping business processes made up of a number of workflows linked together. In U.S. Ser. No. 08/005,236 filed Jan. 15, 1993, now U.S. Pat. No. 5,630,069, a method and apparatus are disclosed for creating and modifying business process maps which is a desirable but not necessary component of the invented system. This component is referred to as the workflow analyst.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is pictorial representation of a business process, i.e., a set of linked workflows.

FIG. 2 is a block overview diagram of a complete workflow system.

FIG. 3 is pictorial representation showing the phases of a single workflow.

FIG. 4a is a transaction manager control flow when it detects the initiation of a new business process or workflow.

FIG. 4b is a transaction manager control flow when it detects a change in the transactions database that indicates that a user (or an agent) has taken an act in a workflow.

FIG. 4c is a transaction manager control flow when it processes the workflow events of a workflow.

DETAILED DESCRIPTION OF THE INVENTION

Overview
The present invention is a method and apparatus which is used to enable application developers to generate workflow-enabled applications that request services from the workflow server. These applications are used by users to act and participate in business processes and enable managers to observe and query the status of workflows and business processes.

Definitions
In describing the invention, the following terms with their indicated definitions are used:

Act
Basic linguistic occurrence by which people intervene in moving a workflow towards completion.

Agreement
The outcome of the negotiation phase, in which two parties come to a common agreement of the conditions of satisfaction.

Business Process
A network of workflows linked together that represent the recurrent process by which an organization performs and completes work, delivers products and services and satisfies customers.

Business Process Map
This is a graphical representation of business process, which shows its workflows and their relationship.

Primary workflow
This is the first workflow which is initiated when a business process is initiated. Its condition of satisfaction represent the condition of satisfaction of the business process.

Conditional Link
A link that indicates that only one of a group of workflows will be triggered based on some condition.

Conditions of Satisfaction
Conditions declared by or agreed to by a customer. The fulfillment of which is the purpose of a workflow.

Customer
The role in a workflow who takes a request or accepts and offer.

Customer Satisfaction
The objective of a workflow, the accomplishment of which is declared by the customer when the conditions of satisfaction in the workflow have been fulfilled.

Cycle time
A measure of the time from initiation to successful completion of a workflow phase, a complete workflow or a business process.

Exception flow
The path in the business process workflow man which is followed if a customer cancels or a performer revokes or declines.

Link
A defined dependency between two workflows and the mechanism by which dependencies between workflows is established.

Loops (Workflow)
A workflow is represented graphically my an elliptical loop with arrows shown in a clockwise direction wherein each quadrant of the ellipse signifies different phases of the workflow.

Normal flow
This is the path followed in a business process map when workflows complete with customer satisfaction.

Observer
A role in a workflow who cannot perform acts in the workflow, but is informed of acts in the workflow, and has access to the information and data associated with the workflow.

Offer
The act by which the performer can initiate a workflow, specifying conditions of satisfaction that he is willing to satisfy for a customer.

Organization roles
Named positions in an organization who are authorized to make certain requests, agreements, take certain actions, set certain policies, and make certain decisions. The kind of roles will be accountant, office manager, etc.

Performer
One of the principal roles in a workflow: the role that commits to complete the conditions of satisfaction.

Phase
A characterization of the status of a workflow based on the acts that have happened and the acts that are permitted. Each workflow has four phases namely, the proposal phase, the agreement phase, the performance phase and the satisfaction phase.

Request
A customer does this act to initiate a workflow and declare conditions of satisfaction.

Trigger
An action in a workflow which causes an action in some other workflow.

Triggered
Action in a workflow based on certain conditions/status in some other workflow.

Workflow
A structured set of acts between customers and performers organized to satisfy a customer's conditions of satisfaction.
Workflow Activation
A triggered action that enables the customer or performer of the workflow to take the initial act of the workflow.

Workflow Initiation
An act of request or offer initiates a workflow.

Workflow Roles
The association of participants in the workflows that take the acts in workflows; three roles are distinguished in workflows: customer, performer, and observer.

Workflow Type
This indicates whether the workflow is of request, offer or note type.

Services Provided By A Workflow System
The following describes the services provided by a workflow system. These services are provided to applications via calls to the workflow server APIs. These workflow server APIs provide the main mechanism to interface and get access to the services provided by the server. In an alternate embodiment, these services can be provided via updates to the workflow server databases rather than via calls to the workflow server APIs.

Transaction Services
Transaction services are those related to initiating and acting in workflows by users and agents. These services are provided to workflow enabled applications via the transaction API. Alternatively, the services may be provided to workflow enabled applications through updates to the workflow transaction database. These services are also provided through the functions of the workflow language specified in the definition of workflows.

The services provided are as follows:
a) Initiate a Workflow
   Through this function, an application requests the server to start a new workflow. For example, if a user fills an expense report form, when it is saved, the resulting record or document represents the initiation of a workflow, the application will use this service to start the workflow.

   For example, in a workflow enabled application in the Lotus Notes environment, available and Lotus Corporation, users initiate a new business process by composing a NOTES form in the transactions database. Users initiate workflows by editing and selecting options in forms. In other environments users fill in proper forms and the applications request the services via calls to the Transactions API.

b) Act in a Workflow
   Through this function, an application can take action on an existing workflow. For example, a manager’s approval of an expense report indicates the fact the manager took an act in the workflow.

c) Workflow status and available acts
   The workflow server updates and maintains the status of the workflow after each act is taken in a workflow. The server also updates the corresponding database records to reflect status and the available acts for the customer and performer such that users can see the workflow status and the available acts (given their role in the workflow) when they open the workflow transaction record of the transactions database or when they request such status from the server through one of the transactions API functions.

d) Bind and read process specific data (bound data)
   Through this function, an application binds application specific data to a workflow transaction. That is, this function allows applications to read and modify the process specific data (bound data) that the workflow server keeps in the workflow transaction document. The specification of the bound data (field names and their data types) are defined through definition services. This data is directly accessible to the application through transactions database forms. The server modifies the form specification to provide different display attributes of fields in forms depending on the status of a workflow.

e) Workflows with pending actions
   Users can request to see a list of workflows with pending actions of the ongoing business process, given the role that the user has in the different workflows of the process. In the NOTES environment implementation, these lists are available through a set of views of the transaction database.

f) Available Business Process
   These appear as a functional capability of a workflow enabled application. The workflow server reports the available processes that a workflow enabled application can initiate.

Definition Services
Definition services are those related to defining the elements of a business process and its workflows and workflow links.

a) Define a Business Process
   Using the workflow application builder (or other design application that uses the workflow: definitions API which is the way the application builder interacts with the workflow server), users can define the workflows and links that constitute a business process. In this connection, references to the workflow application builder should be understood as a reference to any design application which defines the workflows, links, conditional links and workflow language scripts that constitute a business process. The details for accessing the services provided by the server so that a suitable design application can be constructed should be apparent to persons skilled in the art based upon the descriptions contained herein.

b) Define a workflow
   Using the workflow application builder (or other design application), users can define the structure of particular workflows that belong to the business process being defined through a set of structure definitions (specification of records of the workflow definitions database) and enable the application builder (or other design application) to create, modify and delete definition documents in the database.

Using the workflow application builder (or other design application), users can specify the:

business processes
links and workflows and all their elements
conditional links between workflows
bound data
follow-up and reminder specification
automated action to be taken by the server

Names and Routing Services
Names and routing services are those related to defining organizational roles and identities. The names and routing services allow an authorized user to create, modify and delete names and routing records in the names/routing database. These records contain the organizational roles and identities of the organization serviced by the server. They also contain the routing information for each identity that allows the server to queue notifications and reports for the proper STF processor. These services are specified through the user interface of the application builder or other design application that uses the names/routings API of the workflow server.

a) Define organization roles
   Using the workflow application builder (or other design application) and a set of APIs from the workflow library, users can define roles used in the organization where the workflow system is implemented.
b) Define identities

Using the workflow application builder (or other design application) and a set of workflow definitions APIs from the workflow library, users can define identities in the organization where the workflow system is implemented.

STF Processing Services

The STF processing services are provided by the server to STF processors (described below) through an STF queue database. The database contains records of pending notifications and reports to be given to specific users in applications that the STF processors process. STF processors process and delete these records once they are processed.

Configuration Services

The configuration services are provided to the system administrator through a specific configuration database. Through a workflow server manager which is a user interface that uses the server administration API, the system administrator can define the network configuration of the system, the version of the servers, register STF processors, define the authorized users, specify the log database and the level of logging required.

Scheduling Services

Scheduling services allow an authorized user to create, modify and delete records of scheduled business processes. These records specify the date/time when the server must initiate a business process as well as the recurrence in which this initiation should happen. These services are specified through the user interface in the application builder.

External Interfaces

External interfaces provide services that are used by end-user applications, the workflow application builder, the workflow reporter and the STF processors. Some of these services, such as configuration services, are provided through specific user interfaces; others are provided by the workflow APIs. In an environment like NOTES (available from Lotus Corporation), where the client interfaces interact with the databases directly, client workflow-enabled applications access the databases directly to obtain workflow services. They do not use a programmatic API; instead they read and write workflow structures that are interpreted by the workflow server. In other environments workflow-enabled applications access the workflow services through the workflow APIs.

Network Architecture

The workflow server component of a workflow system is designed to be installed at a single site, managing a single set of databases. It can manage one or many business processes, and, as noted above, each business process can contain one or many workflows.

The workflow server is configured through a configuration database. When the workflow server starts, it begins to monitor and update the workflow databases as appropriate. Each workflow server can monitor multiple definitions, transactions, or scheduling databases, as specified in the configuration database.

In the NOTES environment distributed access to business process databases is achieved through the replication mechanisms of NOTES.

The transactions database managed by the workflow server can be replicated through the standard mechanisms of NOTES. In this way, distributed access for viewing and changing business process status is achieved.

A scheduling process is designed in such a way that all the workflows that are part of the business process are stored and managed in a single NOTES (or other workflow enabled application) database. This database is then managed by a single workflow server for agent processing and workflow language interpretation.

As a stand-alone server in the Microsoft Windows environment, a special version of the workflow server having a restricted functionality of services allows users of workflow-enabled applications to take action and route workflows to completion, but does not include the services of automated agents or of execution of workflow language scripts.

Components of a Workflow System

A workflow system incorporates the following components which are shown in FIG. 2, a workflow server and databases, application program interfaces (APIs) and workflow server manager. In addition, a complete workflow system of the type in which the present invention may be utilized includes an application builder, analyst, standard transaction format (STF) processors, workflow enabled applications and reporter components. The application builder, analyst, standard transaction format (STF) processors, workflow enabled applications and reporter components, while useful components of a complete workflow system, do not form part of the present invention and details concerning such components are set forth herein only as needed for an understanding of the invention.

The following is a brief overview description of the workflow server, databases, APIs and workflow server manager which is followed by a detailed description of these components. Details concerning the remaining components are provided only as needed for a complete understanding of the invention. In the preferred embodiment as set forth below, the invented system is implemented using the Model, View, Class (MVC) paradigm of object oriented programming.

Workflow Server

The workflow server is the center of a workflow system. The workflow system concentrates workflow operations in the workflow server rather than in the end user applications. By using this client/server design, applications do not need to have the intelligence about workflows as part of their design. Application developers can concentrate on their particular application development not having to worry about workflow logic and overhead because such functionality is handled at the server.

FIG. 2 shows the major components of the workflow server in relation to other components of a workflow system. These components are referred to as processes and modules.

All work done by the server is performed by one of four processes which are referred to as the transaction manager, follow-up manager, date/time schedule manager and STF schedule manager. Processes are software components or tasks that are architected to run as separate entities from each other. The workflow server controls the four basic processes based upon workflow system server administration data in a configuration database in the following manner. First, it determines what STF processors need to run and spawns those processes. Second, it determines when to run the transaction manager and spawms that process. Third, it determines when to run the follow-up manager and spacers that process.

These processes may be separate executables or simply separate tasks within the body of the workflow system server.

Workflow server modules are software components that provide a specific type of functionality. Modules are used by the above processes and also among themselves.

Organizationally the modules can be thought of as separate libraries. These modules are the workflow processor,
workflow updater, the workflow instantiator, the workflow language interpreter, the workflow event handler, the agent actions manager, and the STF router/enqueue manager.

Databases
The workflow system utilizes the following databases:
- Definitions Database
  The definitions database contains records of the definitions of the organizations, business processes, workflows, roles and acts. These records contain the instructions of what needs to be done in a workflow in a given instance. These records are used by the workflow updater and workflow processor to determine new workflow states and available actions.
- Transactions Database
  The transaction database contains records of the enactment of workflows. Each time a workflow is initiated or an action taken within a workflow, a corresponding record is made in the transactions database. These records include the workflow instances, the action transactions, the current inceptions, and the relationships between different workflows.
- Names/Routings Database
  The Names/Routings database contains records of the roles and the rules of the organization where the workflow system is installed. It records the existing organizational roles, the current identities, and the authorizations to act in one or more roles.
- Schedule Database
  The schedule database stores the date and time when a business process must be initiated. The date/time schedule manager reads this database.
- Administration/Configuration Database
  This database stores information needed by the workflow server to operate.
- STF Queue Database
  This database stores the records of notifications to be sent to users that interact with the workflow system through an STF processor interface.

Workflow APIs
The workflow APIs provide a programming interface to access the services of the workflow server. Workflow enabled applications, STF processors (described below) and the application builder are all developed using these APIs. APIs of the intended system are as follows: transaction API, definitions API, properties API, names and routings API, schedule API and administration API.

Workflow Server Manager
The workflow server manager is a component of the workflow system that provides a user interface for specific services of the workflow server such as:
- Server Management
- Authorization Maintenance
- Business Process Maintenance
- Workflow Maintenance
- STF Processor Maintenance
- Configuration
- Transaction Log Maintenance
- Business Process Scheduling and Organizational Calendar

The WSM uses the workflow APIs to implement the functions and services it provides to users. Through the use of the WSM, a user selects the scheduling function which provides the user interface to specify the recurrent scheduling of business processes as well as the specification of the organizational calendar as specified by the schedule manager.

Workflow Application Builder
The workflow application builder is a Graphical User Interface (GUI) application that allows a business process designer to specify the business process design with its network of workflows. The application builder, in turn, creates or edits the workflow definitions databases that define the business process and that will be used by the workflow server. The functions performed by the workflow application builder can alternatively be performed by a design application that uses the workflow definitions API of the workflow server.

Workflow Analyist
The workflow analyst is a GUI application that allows a business process analyst to specify the map of business processes with its network of workflows. Its output is readable by the application builder or equivalent which will update the definitions database of the server. Details concerning the workflow analyst may be found in co-pending U.S. Ser. No. 68/005,236 filed Jan. 15, 1993, now U.S. Pat. No. 5,630,069.

Workflow Reporter
The workflow reporter is a GUT application that provides an interface to the transaction databases through the workflow reporter API of the system. It allows the observation of the status of current transactions as well as the history and performance of past transactions. Further details concerning the workflow reporter are not needed for a complete understanding of the present invention. Alternatively, such reports can be provided by an application that uses the workflow reporter API.

STF Processors
An additional set of mechanisms for developing workflow-enabled applications are provided in a workflow system through the definition of a standard transaction format (STF). This format defines the semantics for accessing the workflow services through different types of interfaces: messaging, databases and inter-process communication.

For each one of these types of interfaces there is a syntactic definition that specifies the specific format for the representation of the workflow data and the process specific data in that medium. This syntax definition constitutes an STF API that a particular application will then use.

The communication and interface between workflow-enabled applications that do not use the workflow APIs and the server is provided by STF processors. These STF processors map and translate between a workflow-enabled application’s data format and the workflow APIs data elements.

STF processors provide a layer for integration of many different protocols and technologies. STF processors can be constructed for any message transport environment protocol, database technology, and inter-process communication protocol.

The interface from STF processors to the server is accomplished through the workflow APIs. From the point of view of workflow services, the STF processors appear to the server as additional applications.

A standard transaction format (STF) processor is an application whose job is to interface external systems to the workflow system. There is one STF processor for each different type of system that interfaces to the workflow system.

Workflow-Enabled Applications
A workflow-enabled application interfaces to the server via the workflow APIs or via direct access to the transactions database of the workflow server, or via the use of an STF processor which can use different interfacing mechanisms such as messaging, database or inter-process communication.
A WORKFLOW SERVER

The workflow server is a set of processes, modules, databases and APIs as set forth above. The following is a description for implementing the processes, modules, databases and APIs of the workflow server. Also described is a workflow server manager which provides a user interface for specific services of the workflow server.

Processes

Transaction Manager (TM)

The TM starts all the actions that must happen when there is a change in the transaction database. The TM is the driver for processing requests made by users through workflow-enabled applications. The transaction manager determines what changes in the transaction database have occurred. Records that have changed in the database are detected by the TM. The transaction manager manages a transaction queue and services queued transactions in FIFO order. Transactions may be entered directly by a user via forms available in workflow-enabled applications, which use the workflow transactions APIs to request the services of the workflow server, or they may be requested via an STF Process.

A workflow record that has changed, falls into one of several different categories. It may be:

- A request for initiation of a new business process;
- A request for initiation of a new workflow within a business process; or
- A request for an act within a workflow.

Each of the different types is dealt with differently.

When there is a business process or workflow initiation figure 4a shows the control flow of the transaction manager when it detects the initiation of a new business process or workflow. In this case the transactions database will contain the record for the business process or the workflow being initiated.

In Flow #1 the transaction manager detects the initiation of a new workflow in the workflow database.

In Flow #2 the transaction manager calls the Initiator Module, which will instantiate the workflow record based on the definition of the business process.

In Flow #3 the Initiator Module reads the definition of the business process or workflow from the definitions database.

In Flow #4 the Initiator Module creates all the new transaction records for the corresponding workflow or the business process.

Figure 4b shows the control flow of the transaction manager when it detects a change in the database that indicates that a user (or an agent) has taken an act in a workflow.

In Flow #1 the transaction manager detects the workflow act being taken in the activities database.

In Flow #2 the transaction manager calls the workflow updater to begin processing this newly updated transaction record.

In Flow #3 the workflow processor calculates the next available acts, new completions, etc.

In Flow #4 the next available actions, incompletion, etc. are written to the transaction records.

In Flow #5 the workflow updater checks the names database to see if any of the identities participating in the workflow being processed needs to be notified via an STF processor.

In Flow #6 if an identity has been identified in Flow #5 that needs to be notified via an STF processor, then the transaction is queued in the STF queue database.

FIG. 4c shows the control flow of the transaction manager when it processes the act and state events, which are also referred to herein as workflow events, of a workflow. In the definitions database, each workflow definition includes workflow language segments (scripts) that are associated with each act and state of the workflow.

In Flow #1 the transaction manager invokes the workflow event handler indicating the workflow, act and state that should be processed.

In Flow #2 the workflow event handler reads the script for the act from the definitions database.

In Flow #3 the workflow event handler invokes the workflow language interpreter to process the script.

In Flow #4 if the script indicates that an action needs to be taken, the workflow language interpreter calls the agent actions manager to take the workflow act on behalf of the user.

In Flow #5 the agent actions manager updates the transactions database to reflect that an act has been taken.

The workflow event handler then repeats Flow #2, but in this case reads the script for the state of the workflow. The process continues to Flow #3 with respect to the state.

The workflow event handler repeats Flow #2 and Flow #3 for the script that corresponds to the current state of the primary workflow of the business process.

In the preferred embodiment, the transaction manager is implemented as follows. The transaction manager identifies changes that have taken place in the workflow database and invokes the proper server modules to provide the services that have been requested or that those changes represent. The transaction manager queues and services incoming transactions by instantiating a transaction-type-specific object.

The date/time the transaction was entered is given along with its type and id. This date/time field is used to do FIFO (first-in-first-out) queue retrievals. The earliest date/time will always be retrieved first.

ITXID is the id of a transaction in the Transaction Database. These ids are xtype dependent and can be used to access transactions directly from the database.

The following is a description of pseudo-code for implementing the transaction manager process. This implementation is described in terms of a MAIN function or routine which includes a call to a loop (MainLoop) which executes continuously.

MAIN

The MAIN function connects to the Virtual Database (VDB), performs the primary activity of the transaction manager and disconnects from the Virtual Database.

The primary activity of the transaction manager is checking the workflow transactions database for requests to process. It performs this primary activity by a call to the function MainLoop.

In case of an error, the MAIN function performs a write to an error log, giving the error code and the message. The flow of the MAIN function is as follows:

1. Connect to the Virtual Database.
2. If connection is successful write a message to a log provided by the workflow server manager described below.
3. If connection is not successful, write a message to the log and return.
4. Call function MainLoop.
5. Disconnect from the Virtual Database.
6. If disconnection is successful write a message to the log.
7. If disconnection is not successful, write a message to the log and return.

MainLoop
This function performs the primary activity of the transaction manager. In an unconditional loop, it checks if any message has been sent from the workflow server manager (WSM) and processes it. It then performs the main activity of checking for workflow requests and invokes either the workflow updater or the agent/action manager.

1. Check for any message for the transaction manager from the WSM. To retrieve messages, the method bfnGetMessage of class MESSAGEQ is called. In case of any error, the error is written into the log file.
2. Depending on the message, the message is processed differently, according to steps 3 and 4 below.
3. If the message is to terminate the transaction manager, the function is terminated.
4. If the message is to indicate that the configuration has changed then do the following:
5. The new configuration is retrieved using method bfnGetConfigInfo of class CONFIGINFO. The new configuration contains all the configuration information. In case of error in retrieving the configuration information, the error is written in the log file.
6. The configuration database specifies the polling interval and the log verbosity options. The polling interval is the time the transaction manager sleeps between processing cycles. The log verbosity option specifies the amount of information that gets written into the log file. The function AWSWriteToLog is used to log activities into the log file.
7. Invoke workflow updater.
8. Invoke the agent actions manager.
9. Sleep for a time interval of duration PollInterval.

Follow Up Manager
The follow-up manager runs periodically, scheduled per workflow server administration tables in the administration/configuration database. It can run asynchronously to the transaction manager. It determines when notifications, either follow up or reminders, are to be sent and sends them.

The follow-up manager detects transactions in which a participant has an overdue commitment and, depending on the workflow definition stored in the definitions database, will execute a script, send a mail message, or take other actions that are defined. The follow-up manager interacts with a Workflow Incompletion Transaction class which is part of the transaction database, which furnishes follow up and reminder times, in order to select workflows requiring notification.

Follow up is specified in the workflow definition, this specification is done through the application builder or equivalent. For each workflow, a follow up specification can be made for each one of the roles of the workflow as follows: Specify when the follow up will be done:
First and last valid times
Recurrence interval
Holidays on which not to follow-up (Optional)
Days of week on which to follow-up (Optional)
Time ranges in which to follow-up (Optional)
How many times to follow-up before stopping
Specify incompletion to be followed up on
Customer response due
Performer response due
Performer fulfillment due
Specify the type of check
Will be coming due (reminder) and how soon
Is past due (follow-up) by how much
Specify what to do for the follow-up
In each workflow transaction, the current incompletion for each role are kept as indexed records. In addition to the date for the incompletion, the record will contain a field for the next date and time for follow up as well as the next date and time for reminder. The records will be indexed on these two date fields as well. The follow-up manager works off these incompletion records.

The follow-up manager checks if the first follow-up or reminder date/time is due “now” and that “now” is not a restricted date/time according to the organizational calendar, and if so, retrieves the workflow language script and passes it to the Workflow Language Interpreter for processing. The follow-up manager deals appropriately with the case that the server has been down and processes all entries that are past due.

The following is a description in pseudo-code for implementing the follow-up manager process. This implementation is described in terms of a MAIN function or routine which includes a call to a loop (MainLoop) which executes continuously.

MAIN
The MAIN function connects to the Virtual Database (VDB), performs the primary activity of the follow-up manager and then disconnects from the VDB.

The primary activity of the follow-up manager is checking for overdue commitments and then sending reminders or follow-up messages. It performs this primary activity by a call to the function MainLoop.

In case of an error, the MAIN function performs a write to an error log, giving the error code and the message. The flow of the MAIN function is as follow:
1. Connect to the Virtual Database.
2. If connection is successful write a message to the log.
3. If connection is not successful, write a message to the log and return.
4. Call function MainLoop.
5. Disconnect from the Virtual Database.
6. If disconnection is successful write a message to the log.
7. If disconnection is not successful, write a message to the log and return.

MainLoop
This function performs the primary activity of the follow-up manager. In an unconditional loop, it checks if any message has been sent from the workflow server manager (WSM) using the workflow administration API, and processes it. It then checks for commitments due and sends follow-up and reminder messages if required. The flow of MainLoop is as follows:
1. Check for any message for the follow up manager from the (WSM). To retrieve messages, the method bfnGetMessage of class MESSAGEQ is called. In case of any error, the error is written into the log file.
2. Depending on the message, the message is processed differently, according to steps 3 and 4 below.
3. If the message is to terminate the follow-up manager, the function is terminated.
4. If the message is to indicate that the configuration has changed, then do the following:
5. The new configuration is retrieved using method bfnGetConfigInfo of class CONFIGINFO. The new
configuration is returned in a structure that contains all configuration information. In case of error in retrieving the configuration information, the error is written to the log file.

6. The configuration database specifies the polling interval and the log verbosity options. The polling interval is the time the follow-up manager sleeps between processing cycles. The log verbosity option specifies the amount of information that gets written into the log file.

7. The function FollowUp is called to perform the main activity of the follow-up manager.

8. Sleep for a time interval of duration PollInterval.


FollowUp

The FollowUp function scans the Incompletions table of the transactions database and determines which incompletions are due for reminder or follow-up. The processing is done in two passes, one for reminders and the other for follow-ups.

1. Set a flag to indicate if it is a reminder or follow-up pass.

2. Get the current time. This time will be the basis for selecting incompletions which are due. If the incompletions are prior to the current date then the incompletions are processed. In case of error in getting the current time, log an error and return.

3. Using methods of class TXWINCOMPLETION from the transactions database, the incompletions due for processing are retrieved. Methods bfnGetFirstIncompletion and bfnGetNextIncompletion retrieve the incompletions that are due.

4. If an incompletion is due (reminder or follow-up), methods of class TXWINCOMPLETION are called to get the Business Process Id (IBPTId), the Workflow Id (IWFTid) and the Incompletion type (Incld). The following methods are used:

<table>
<thead>
<tr>
<th>Value</th>
<th>Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBPTId</td>
<td>bfnGetIBPTId</td>
</tr>
<tr>
<td>IWFTid</td>
<td>bfnGetIWFTId</td>
</tr>
<tr>
<td>Incld</td>
<td>bfnGetIncld</td>
</tr>
</tbody>
</table>

5. The workflow associated with the incompletion is retrieved from the VDB. An instance of the class TXWINSTANCE is created. The IBPTId and the IWFTid are passed as parameters.

6. Depending on the incompletion, the workflow participant is determined. The logic for determining the workflow participant is as follows:

<table>
<thead>
<tr>
<th>Notification Type</th>
<th>Incompletion Type</th>
<th>Workflow Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reminder</td>
<td>Customer His Completion</td>
<td>Performer</td>
</tr>
<tr>
<td>Follow-up</td>
<td>Customer His Response</td>
<td>Performer</td>
</tr>
<tr>
<td>Follow-up</td>
<td>Customer His Completion</td>
<td>Performer</td>
</tr>
<tr>
<td>Follow-up</td>
<td>Performer His Response</td>
<td>Customer</td>
</tr>
</tbody>
</table>

7. Check if the Identity needs notification. The Identity attributes are retrieved from the VDB. These are stored in table NRDFIDENTITY. If the Notification flag is set then the follow-up/reminder information is sent to the workflow participant. The notification information is retrieved using method bfnGetNotify.

8. If notification is required, then retrieve the STF Processor Id, by using method lfnGetSTFProcId of class NRDFIDENTITY. The notification is placed in the STF queue of this STF processor.

9. The notification event is determined by the following table:

<table>
<thead>
<tr>
<th>Incompletion Type</th>
<th>Event Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer His Completion</td>
<td>Performer Completion coming due</td>
</tr>
<tr>
<td>Customer His Response</td>
<td>Performer Response past due</td>
</tr>
<tr>
<td>Customer His Completion</td>
<td>Performer Completion past due</td>
</tr>
<tr>
<td>Performer His Response</td>
<td>Customer Response past due</td>
</tr>
</tbody>
</table>

10. Get the time when the incompletion was due i.e. the Completion Time (this is not to be confused with the completion time of the workflow).

11. Get the reminder or follow-up time, i.e. the time this notification was due. (Note: It is important to distinguish between incompletion due time and reminder and follow-up due time).

12. Dispatch notification. The notification is placed in the STF Queue. Method bfnPutEvent of class TXSTF-QUEUE places the notification.

13. Determine when the next notification is to be sent. Get the workflow notification definition. This contains recurring information. The next follow-up time is determined and written to the incompletion table via method vfrPutFollowUpTime.

14. Get the next incompletion to be processed. If present, proceed to step 4.

15. Return, processing is complete.

Date/Time Schedule Manager

The date/time scheduled manager detects events which are to be executed at a particular time. The scheduled events are kept in the schedule database. The events are placed in the database by the workflow server manager user interface via calls to the schedule API and are processed by the schedule manager. The scheduled events are kept in the database in chronologically increasing order.

A schedule database entry specifies when the event will be done as well as the first and last valid times for the entry, indicating the first time it should happen and when it should stop happening. If the first and last valid times are the same, the schedule entry is executed once.

A recurrence interval for a schedule entry is "how often" the schedule entry is executed. Recurrence intervals may be every X minutes, every hour, every day, every month, the third Thursday of every month, and so forth.

An organizational calendar is connected to the schedule manager, so that entries may be tagged to not happen on specific days (such as weekends or holidays like Labor Day).

The schedule entry may be filtered to happen only on particular days of the week (such as Monday through Friday).

The schedule entry may be filtered to happen only during particular time intervals (such as any time between 8–12 or 1–5).

The first thing that the schedule manager does in a cycle is to find events that are due now (or which are past due). This is done by finding those with a time-out time that is less than "now".

For each of the found entries, the schedule manager then brings the time-out forward to "now", even if it is currently
set in the past. This function should deal properly with the case when the server has been down.

For each of the found entries, the schedule manager then passes the business process initiation script to the Workflow Language Interpreter for processing.

After the schedule entry is processed, the schedule manager updates the schedule entry record for the next time out based on the parameter set for it. If the entry needs not be executed again, it is then removed from the schedule database.

The following is a description in pseudo-code for implementing the schedule manager process. This implementation is described in terms of a MAIN function or routine which includes a call to a loop (MainLoop) which executes continuously.

MAIN

The MAIN function connects to the Virtual Database (VDB), performs the primary activity of the Scheduler and disconnects from the Virtual Database.

The primary activity of the schedule manager is to find business processes that are scheduled for initiation and start them.

In case of an error the MAIN function performs a write to an error log, giving the error code and the message. The flow of the MAIN function is as follows:

1. Connect to the Virtual Database.
2. If connection is successful, write a message to the log.
3. If connection is not successful, write a message to the log and return.
4. Call function MainLoop.
5. Disconnect from the Virtual Database.
6. If disconnection is successful, write a message to the log.
7. If disconnection is not successful, write a message to the log and return.

MAINLOOP

This function performs the primary activity of the schedule manager. In an unconditional loop, it checks if any message has been sent from the workflow server manager (WSM) using the workflow administration API, and processes it. It then performs the main activity of scheduling business processes at the scheduled time.

1. Check for any message for the schedule manager from the WSM. To retrieve messages, the method bfnGetMessage of class MESSAGE is called. In case of any error, the error is written into the log file.
2. Depending on the message, the message is processed differently, according to steps 3 and 4 below.
3. If the message is to terminate the schedule manager, the function is terminated.
4. If the message is to indicate that the configuration has changed, then do the following:
5. The new configuration is retrieved using method bfnGetConfigInfo of class CONFIGINFO. The new configuration is returned in a structure that contains all configuration information. In case of error in retrieving the configuration information, the error is written in the log file.
6. The configuration constitutes the polling interval and the log verbosity options. The polling interval is the time the Scheduler sleeps between processing cycles. The log verbosity option specifies the amount of information that get written into the log file.
7. The function Scheduler is called, this performs the main activity of the schedule manager.
8. Sleep for a time interval of duration PollInterval.

Scheduler

The Scheduler function scans the scheduler table of the schedule database and determines which business processes are ready to be scheduled.

1. Get the current time. This time will be the basis for selecting business processes which are due to be started. If the initiate time of the business process is after the current date then the business process is initiated.
2. Using methods of class SCBPSCHEDULE the business processes due for initiating are retrieved. Methods bfnGetFirstIncomplete and bfnGetNextIncomplete retrieve the business processes that are due.
3. Get the Business Process Definition Id (BPID). Use method bfnGetBPID of class SCBPSCHEDULE.
4. Get the Business Process Definition. Create an instance of class DFBP for definition id BPID.
5. Get the Business Process Name. Use method vfnGetBPN of class DFBP.
6. Initiate the business process. Transactions API call AWSTINITBPN is called. The Business Process Name is a parameter to this call.
7. Determine the next ti-Le the Business Process needs to be scheduled. The Recurring Offset is retrieved using methods bfnGetRecTime of class SCBPSCHEDULE.
8. If the Recurring Offset is specified, the next initiate time is computed by adding the recurring offset to the current initiate time.
9. If the Recurring Offset is not specified, the scheduling entry is deleted from the table.
10. Get next Business Process to be initiated. If present proceed to step 3.
11. Return, processing is complete.

Modules

Workflow Processor

The workflow processor is the brain of the workflow system. The workflow processor is analogous to the central processor unit (CPU) in a computer. Both processors receive inputs in the form of events, and both carry out logic computations. The CPU embodies a logic processor, while the workflow processor embodies the logic of workflows with phases, cycle times, actions and roles. It contains the structures and Finite State Machines (FSMs) that specify the acts and actions that are available. This module is database independent, and provides an API through which the rest of the system interfaces with it. It is furnished with in-memory structures providing complete act/state data of a workflow, from which it derives updated status information returned via these structures. The workflow processor embodies the logic of workflows with phases, actions, roles and dates of completion and reply.

The basic logic of the workflow server is very similar to that used by a human manager. It asks:

What actions have happened and not happened?
What data has changed?
What amount of time has elapsed?
The workflow updater module of the workflow server asks the workflow processor:

What are the available acts for the customer and performer given the current state and the type of the workflow?

Given an act, what is the new state of the workflow and what incompletion change?
The workflow processor then answers with the state of the workflow and gives the answer to the workflow updater which updates databases, and changes the state of the workflow.

These tasks would be impossibly complex if the number of states were large and the possible actions infinite. The present invention addresses this problem by defining a business model that intelligently defines a few conditions and actions as building blocks, but from which thousands of permutations can be constructed.

A complete description of a suitable workflow processor which may be used with this workflow processor may be found in U.S. Ser. No. 600,144 filed Oct. 17, 1990 and U.S. Ser. No. 07/368,179 filed Jun. 19, 1989, both owned by Action Technologies, Inc., the assignee of the present application.

Workflow Updater

The workflow updater module processes requests made by users via API calls, changes to the transaction database or by agent actions. This module processes workflow transactions that have been modified, updating them with the new workflow status information returned by the workflow processor.

The workflow updater module updates the data bound in the business process, based on the data that was provided as part of the act that is being taken. If other scopes are defined for a workflow, then the bound data is updated in the scope of the workflow in which the act was taken.

The workflow updater calls the workflow processor passing to it the workflow identification, the act being taken, the workflow role that is taking the act and the current state. The workflow processor returns to the workflow updater the new state of the workflow, the completion transitions which incompletions need to be set, and which ones need to be removed, the set of available acts for each act of the workflow roles and the times that can/must be specified by the users when taking each one of these available acts.

The workflow updater maintains and updates the workflow transaction database. It uses the workflow processor to determine the status of workflows and the set of possible actions for each one of the roles.

The workflow updater processes an act taken by a workflow participant i.e., the Customer or Performer. This act could have been taken through a call to the proper transactions API function, through a direct modification of the transactions database or by the agent actions manager upon request of the workflow language interpreter. When an act is taken, it is recorded in a act taken database record of the transactions database. The server sequentially processes all acts. The following is a description in pseudo-code for implementing the workflow updater module:

1. Use AWSWriteToLog method of the Translog class of the Administration database to log the act taking activity.
2. Check whether there are acts to take by calling method bpmGetFirstInQueue of class TwfWFActs in the VDB.
3. Check if the act is a valid act and the act is present in the list of available acts for a workflow participant by invoking method bfnCheckValidAct of class TwfWFActs in the VDB.
4. Find out the current state, WF type, WF role, and the Act by invoking respectively the methods fnGetWFState, fnGetWFType, fnGetWFRole, and fnGetAct of class TwfWFActs in the VDB.
5. Check with the workflow processor to determine if the act taken is consistent with the current state of the workflow and the role of the act taker (Customer/Performer) by invoking method bfnCheckValidAct of the class TwfWFActs.
6. Determine the new state of the workflow by calling the workflow processor.
7. Compute the new set of incompletions by calling the workflow processor.
8. Compute the new set of acts and the date prompts for the customer and performer using function AWSTAvailableActs of the workflow processor. If any acts are disabled then those are removed from this new set of acts using the method bfnIsDisabled of class DWFWDisabledActs of the VDB.
9. Invoke the workflow event handler to interpret the scripts associated with the act, state, and the primary workflow.
10. Send notifications the workflow participants informing the completion of the act by invoking the STF Router/Enqueuer.

Classes and the methods invoked by the workflow updater module:

<table>
<thead>
<tr>
<th>Methods</th>
<th>Class</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>bfnCheckValidActs</td>
<td>TwfWFActs</td>
<td>check if act is in Available Acts Table</td>
</tr>
<tr>
<td>fnGetCompletionTime</td>
<td>TwfWFIstance</td>
<td>From VDB retrieve the Completion time</td>
</tr>
<tr>
<td>fnGetIncompleteTime</td>
<td>TwfWFActs</td>
<td>From VDB retrieve the Incompletion Time</td>
</tr>
<tr>
<td>AWSTAvailableActs</td>
<td></td>
<td>compute available acts for both customer and performer.</td>
</tr>
</tbody>
</table>

Workflow Instantiator

The workflow instantiator module is called by the transaction manager when it detects a request to initiate an instance of a business process or a workflow. The workflow instantiator instantiates business process and workflow records into the transactions database. This module creates workflow transaction records as specified in business process definitions whenever a workflow is initiated.

If the transaction manager detects a change in the transactions database that indicates a request for initiation of a new business process, the instantiator reads the business process definition and creates the transaction records for the business process and for the primary workflow of the business process according to the definition.

If the transaction manager detects a change in the transactions database that indicates a request for initiation of a new workflow, the instantiator reads the workflow definition and creates the transaction record for the workflow according to the definition.

The instantiator also performs the role to identity mapping so that the roles that are specified in the workflow definition are mapped to the proper identities in the transaction record of the workflow.

The following is a description of the steps for implementing the workflow instantiator module.

The instantiator creates an instance of a business process.

It makes a copy of the definition.

1. Check the length of the Business Process Name (szBPName) is within limits. If beyond limits, return error.
2. Validate the Instantiator Identity. Check if the name length is within limits.
3. Check if Instantiator Identity is a valid user and registered. Method InquireAuthorization from class.
AuthMaint is used to determine if the user is valid and registered. This function accesses the Names/Routings database for validation, it calls the constructor of class NRDIDENTITY.

4. Check if the Instantiator Identity is authorized to instantiate business processes. It checks the authorities table in the names/routings database to check if this identity is authorized to instantiate business processes. The authorization method InquireAuthorization from class AuthMaint is called to determine the authorization.

5. If the Customer name is specified, check if the name length is within limits.

6. If the Customer name is specified, check that this name is valid and registered. Method InquireAuthorization from class AuthMaint is used to determine if the user is valid and registered. This function accesses the Names/Routings database for validation, it calls the constructor of class NRDIDENTITY.

7. If the Performer name is specified, check if the name length is within limits.

8. If the Performer name is specified, check that this name is valid and registered. Method InquireAuthorization from class AuthMaint is used to determine if the user is valid and registered. This function accesses the Names/Routing databases for validation, it calls the constructor of class NRDIDENTITY.

9. If the Completion date is specified, check if the date string length is within limits.

10. If the Completion date is specified, convert the date string to long format.

11. If the Reply date is specified, check if the date string length is within limits.

12. If the Reply date is specified, convert the date string to long format.

13. If the Initiate date is specified, check if the date string length is within limits.

14. If the Initiate date is specified, convert the date string to long format.

15. If Completion and Reply dates are specified, the Reply date should be before the Completion date.

16. If the Initiate date, if specified, it should be the earliest of all specified dates.

17. Create an instance of this business process. The constructor for class TXBPINSTANCE is called for this purpose.

18. The central workflow instance is created. The constructor for class TXWFINSTANCE is called for this purpose.

19. Check for each organization role to identity any mapping which is specified at the time of initiation which overrides the mapping specified in the definition of the workflow, that the organization role and identity do exist. To verify that the organization role is present, the constructor for class NRDFORGROLE is called. To verify that the identity is present, the constructor for class NRDIDENTITY is called.

20. Store the organization role in classes TXBPASSIGN and TXWPASSIGN from the transaction database classes to identity overrides. The constructors are called for these two classes.


Workflow Language Interpreter

Workflow definitions are stored in the definitions database. Included in these workflow definitions are conditions under which workflows become active and inactive, and the conditions under which the workflow server should take specific actions. These conditions and instructions are expressed in the workflow language.

The workflow language interpreter interprets workflow language scripts. These scripts or workflow language segments contain workflow commands, such as the initiation or taking an act in a workflow. These scripts are part of the business process definition. These scripts are automatically generated by the application builder or equivalent design application.

The following is a description of the steps and syntax for implementing the workflow language interpreter module.

The workflow language interpreter interprets both user defined and system generated scripts, and performs the corresponding function defined in the script. The user can perform the following functions on a workflow. The workflow language interpreter interprets user-defined as well as system generated scripts, and performs tests, functions, and assignments as presented in either kind of script. The syntax and capability of the ActionWorkflow scripting language are the same for the two kinds of scripts and is described as follows:

Language Syntax

A statement of the language is either an If Statement, an Action Statement or an Assignment Statement. An If Statement is either:

```
If <boolean expression> statement 1 . . . statement n endif
```

or

```
If <boolean expression> statement 1 . . . statement n else statement s+1 . . . . statement n endif
```

where <boolean expression> is:

- TRUE
- FALSE
- <boolean expression> AND <boolean expression>
- <boolean expression> OR <boolean expression>
- <bound data name> OPERATION <numeric term>
- ISINSTANCE (workflow name, state name)
- ISNOTINSTANCE (workflow name, state name)

where OPERATION is equal to, not equal to, greater than, greater than or equal to, less than or equal to.

An Action Statement is either:

```
INITIATE workflow name, ACTIVATE workflow name, or ACT workflow name, act name
```

An Assignment Statement is either:

```
<bound data name> = <bound data name>
```

or

```
<bound data name> = <numeric term>
```

2. Capability

The above-described syntax enables a script writer to start workflows, to act in workflows, to change bound data associated with a workflow, to test sound data associated with a workflow and conditional upon the results follow one or another distinctly different course of action.

The workflow language interpreter can be divided into the following functional modules:

1. The Lexical Analyzer which defines the Workflow Language grammar.
2. The Parser which parses the workflow scripts and invokes the corresponding semantic routines associated with the commands in the script.
The main implementation details are as follows:

1. The workflow event manager calls the workflow language interpreter and passes to it the Business Process Transaction ID, the Workflow Transaction ID, and the Script Type to be executed.

2. Using this information the workflow language interpreter retrieves the appropriate workflow script from the definitions database using method bfnGetScriptName of the class DFWFACState.

3. For the command Instantiate, the instantiator is invoked.

4. For the command Activate, the workflow updater is invoked.

5. For the command TakeAnAct, the workflow updater is invoked.

6. For external functions, the workflow language interpreter invokes the external function passing the specified parameters.

Workflow Event Handler

The workflow event handler is called by the transaction manager to process the actions associated to acts and states in the workflow definition which are specified for a given workflow when an action is taken or a state reached in the workflow. It accomplishes this by reading the business process definition and by reading the workflow status information from the workflow transaction.

The workflow event handler also locks in the definitions database for the workflow language scripts associated with acts and states of the workflow. The workflow event handler retrieves the language script corresponding to the act that was taken and passes the script to the workflow language interpreter for processing. The workflow event handler retrieves the language script corresponding to the state of the workflow and passes the script to the workflow language interpreter for processing. Then the workflow event handler retrieves the appropriate scripts associated with the states of the workflow and passes them to the workflow language interpreter. Finally, the workflow event handler retrieves the language script for the primary workflow of the business process for the current state of that workflow and passes that script to the workflow language interpreter for processing.

The following is a description of the steps for implementing the workflow event handler module. The module event handler invokes the method AWS::ScriptToExecute of the workflow language interpreter to execute the following scripts associated with a workflow:

1. The system generated act script
2. The user generated act script
3. The system generated state script
4. The user generated state script
5. The system generated state script of all the connected workflows
6. The system generated state script of all the connected workflows

The following is a description of the steps for implementing the agent actions manager module:

The agent actions manager is invoked by the workflow language interpreter when it finds a workflow action or external function to be performed in a workflow language script. If the workflow needs to be instantiated the instantiation is done by the workflow instantiator module. After instantiation a flag is set to indicate if activation or initiation is required. The agent action manager scans for all workflows which have this flag set and processes them. The process is described below.

1. Log the activity using the method AWS::WriteToLog.
2. Obtain the current date and time.
3. Get the next workflow to act on by using method TxWINSTANCE of class TXWFINSTANCE, which is the act to take queue.
4. If the workflow to be processed is the primary workflow then change the Business Process status to "IN PROGRESS". The methods to use are bfnCentralWF and bfnSetInst.
5. If the Customer, Performer and Observer(s) are not specified, then pick up defaults and assign all the workflow participants. The methods to use are InfnGetCustld, InfnGetPerId, InfnPutCustld and InfnPutPerId.
6. Specify the default Reply and Completion time using methods InfnGetReplyDate and InfnGetCompletionTime of class TxWINSTANCE. If these times are not present, obtain them through the definition defaults by using methods bfnGetCycleTimes of class DFWFCYCLETIMES in the VDB. Assign the default using the methods bfnPutReplyDate and bfnPutCompletionTime of class TxWINSTANCE.
7. Set up environment for first act to be taken. The act is dependent on the workflow type, request act in a workflow of type request and offer act in a workflow of type offer.
8. Make an entry in the Available Acts Table using method bfnPutAct of the class obAVActs.
9. Take the first act if the workflow is to be Initiated. The act to be taken is placed in the act to process queue using method obTxWFacts of class TXWDACTS. Log the message using AWS::LogMessage.
10. The flag is reset to indicate that the processing is complete using method bfnResetInstantate of class obTxWINSTANCE.

Methods and Modules invoked by Agent Actions Manager Module

<table>
<thead>
<tr>
<th>Methods</th>
<th>Class</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>InfnGetActId</td>
<td>TXWFINSTANCE</td>
<td>get the BP Transaction Id</td>
</tr>
<tr>
<td>InfnGetWFId</td>
<td>TXWFINSTANCE</td>
<td>get the WF Transaction Id</td>
</tr>
<tr>
<td>bfnSetInst</td>
<td>TXWFINSTANCE</td>
<td>set the status of BP instance</td>
</tr>
<tr>
<td>InfnGetPerId</td>
<td>TXWFINSTANCE</td>
<td>get the performer Id</td>
</tr>
<tr>
<td>InfnGetCustId</td>
<td>TXWFINSTANCE</td>
<td>get the customer Id</td>
</tr>
<tr>
<td>InfnGetCompletionTime</td>
<td>TXWFINSTANCE</td>
<td>get cycle time of the WF queue the act to be taken</td>
</tr>
<tr>
<td>bfnPutAct</td>
<td>TXWFINSTANCE</td>
<td></td>
</tr>
</tbody>
</table>

STF Router/Engineer

The STF Router/Engineer module is called by the workflow updater to determine if the workflow currently being processed has a participant who must be notified in this workflow via an STF Processor. The router queues such
transactions in the STF queue database for the appropriate STF processor to process.

The following is a description of the steps for implementing the STF router/enqueuer module.

1. The STF router/enqueuer first retrieves the BP and WF definition given the current WF transaction instance by using the methods TXBPINSTANCE and obTxWFINSTANCE of classes TXBPINSTANCE and TXWFINSTANCE.

2. Using the BP and WF IDs, the follow-up definition is retrieved from the definitions database using method DFWSFOLLOWUP of class DFWSFOLLOWUP. If no notification required, just return.

3. Get the notification status by using method NRDOIDENTITY of class NRDOIDENTITY. If there is no need to do notification, just return. This is achieved through the method fnGetNotify of class NRDOIDENTITY in the VDB.

4. Get the STFProcId using method fnGetSTFProcId of class NRDOIDENTITY.

5. Write the Notification event in the STF database using method fnPutEvent of class TxSTFQUEUE. The date and time is computed.

Databases

Virtual Database

The present invention utilizes a Virtual Database for implementing the databases used by the system. The Virtual Database (VDB) is designed to be a collection of classes and methods. “Virtual” because it is DBMS independent. The VDB contains all the necessary storage structures to support the operations of the Workflow Server. More importantly, it defines a collection of methods for the manipulation of these structures and their instances. The basic domain as well as the classes for workflow definitions, transactions, schedules, names and routing, STF queue and server administration and configuration are described below. These classes define the attributes and methods for the data manipulation supporting the Workflow Server.

Basic Domain Classes

The basic domain classes used in the server are listed here in alphabetic order.

act

datetimeoffset

datetimeoffset is a unit of time. Its value can range from seconds, days, weeks, and months, but is expressed in seconds.

incompletion

The various incompletions that need to be managed for the Customer and Performer in terms of Completions and Responses.

incompletion=[CMC, CMR, CHC, CHR, PMC, PNR, PHC, PHR]

1st letter—C for Customer, P for Performer
2nd letter—M for My, H for His
3rd letter—C for Completion, R for Response notification

This domain class specifies the events which require notification.

notification=[PerformerResponsePastDue, PerformerCompletionPastDue, PerformerCompletionComingDue, CustomerResponsePastDue, Act]

objecttype

objecttype=[BP, WF, STFProcessor]

privileges

privileges=[create, delete, modify, activate, schedule, assign privileges]

state

state = [request, offer, inactive, initial(after activation)

agreement, completion, satisfaction, counter, decline, cancel, revoke ]

string

String is defined to be a character string which varying length.

tstatus

Status of the a transaction.

tstatus=[pending, inprogress, complete]

ttype

List of various types of transactions processed by the server.

ttype=[initbp, initwf, actinwf, bindupdata, getbounddata, getbounddatafieldattributes, status, availableacts, querywf, availablebp, schhistory, notificationstring ]

wffrole

wffrole=[customer, performer, observer ]

wfobjecttype

wfobjecttype=[request, offer, note]

Definitions Database

DBP

This class contains the Business Process (BP) definitions which includes information such as the BP Name, the BP Version, The person (ID) who created the BP, The date when this information was last modified, The Server ID which is the Home Server of this BP and the name of the file which contains the mapping of this BP.
DFFW

This class contains the Workflow definitions which include information such as the a Name, the WFId, the BPId to which this workflow belongs, the type of workflow (primary or non primary), the default IDs of the customer and performer for this WF, the Repeat IF adn factor in case of repetitive WFs, the form names and the Conditions of satisfaction

DFWOBS

This class contains the workflow observer definitions which includes information such as the WFId, the BPId to which this workflow belongs, the Observer ID for the WF.
DFBPCONTAINER

This class contains the Business Process Container Information (the Container ID for a particular BP).

Attributes:
- IDEN
- IBPDId
- IContainerId

Methods:
- DFBPCONTAINER (Attributes)
  Returns the Number of Observers defined for the workflow (in context of the Class Attributes)
- IDEN
 Defines the Container Definition for a BP with the given parameters (in context of the Class Attributes). It also inserts a record in another table (DFCONTAINER) with the Container ID and the number of fields.
- IDEN IfnGetContainerId
  Returns the Container ID (in context of the Class Attributes)

DFFIELD

This class contains the Container Field Information which includes the Container ID to which the field belongs, the Field ID, the data type of the field, its maximum length, its attributes, and its initial Value.

Attributes:
- IDEN
- IContainerId
- IDEN
- IBPDId
- INT
- IDDataType
- INT
- IMaxLen
- ATTRIBUTES
- Char
- sFnVal

Methods:
- DFFIELD
  Creates a new Container field record with the given parameters. It also inserts a record in another table (DFBIDFIELDLIST) with the IBPDId, the Field ID and the field name.

DFLINK

This class contains the Workflow Link Information which includes the IBPDId to which this LINK belongs, the ID of the workflow from which the LINK starts, whether the link starts from an act or from a state, the act/state IDs from which the Link starts and at which link ends, and the Destination State ID.

Attributes:
- IDEN
- IBPDId
- IDEN
- IFromWFId

Methods:
- DFLINK
  The Constructor for this Class that creates a new Link record with the given parameters. Using WFName WFID is first got from DFWF
- BOOL bFnGetWFLinks
  Returns all the links to a given WFID

DFBPASSIGN

This class contains all the Identity to Organization role mappings at the Business process level.

Attributes:
- IDEN
- IBPDId
- IDEN
- IIdentityId
- IDEN
- IOgRole

Methods:
- DFBPASSIGN
  The constructor of this class that depending on its first parameters creates a new BP assignment in a given IBPDId with the given parameters or returns the first record from the table which matches the predicate
- IDEN IfnGetIdentity
  Returns the Identity ID (in context of the Class attributes)

DFWFASSIGN

This class contains all the Identity to Organization role mappings at the Workflow level.

Attributes:
- IDEN
- IBPDId
- IDEN
- IWFId
- IDEN
- IOgRole
- WROLE
- WFRole

Methods:
- DFWFASSIGN
  The constructor of this class that depending on its first parameter it creates a new workflow assignment in a given WFOId and IBPDId with the given parameters or returns the first record from the table which matches the predicate
- IDEN IfnGetIdentity
  Returns the Identity ID (in context of the Class attributes)
DFBPNOTIFICATION
This class contains all notification string information at BP Level.

Attributes:
- IDEN [IDBPDid]
- NOTIFICATION [NEvent]
- CHAR [szNotification[NSTRING_LEN]]

Methods:
- DFBPNOTIFICATION
  - This is the constructor for this class that creates a new BP notification for a given BP Did
  - Retrieves the BP notification string of an event in a BP
- BOOL bfnGetEventString

DFWFACTSTATE
This class contains all the definitions of the workflow acts and States (their names and IDs) for all business processes and their workflows.

Attributes:
- IDEN [IDBPDid]
- IDEN [WFDid]
- INT [ActOrState]
- CHAR [szActDefName[USERDEF_STRING_LEN]]
- CHAR [szGetScript[BLOBNAME_LEN]]
- CHAR [szUserScript[BLOBNAME_LEN]]

Private Methods:
- BOOL bfnIsAvail
- BOOL bfnGetScriptName

Methods:
- DFWFACTSTATE
  - This is the constructor for this class that creates a new record with the given Act/State, and user defined name for a given Workflow the ActState and the type of script (User Defined or System Generated) required.
  - Returns whether an Act/State is Available for a given Workflow.
  - Returns the Script Name given the BP and WF Did the Act/State and the type of script (User Defined or System Generated) required.

DFWFCONTAINER
This class contains the Workflow Container Information (the Container ID for a particular workflow in a given BP).
DFWFOLLOWUP
This class contains all the Follow-up information of a workflow.

Attributes:
- IDEN
- IBPIDId
- IWFDid
- IContainerId

Methods:
- DFWFCONTAINER
  - Creates a new Container
  - Definition for a workflow with the given parameters (in context of the Class Attributes)
  - IDEN ibGetContainerId
    - Returns the Container ID (in context of the Class Attributes)

DFWFACSTATEDBDEF
This Class contains the workflow Act/State Bound Data reference information.

Attributes:
- IDEN
- IBPIDId
- IWFDid
- BOOL
  - bActOrState
- INT
  - ActOrStateId
- WFORE
  - WFRole
- IDEN
  - IContainerId

Methods:
- DFWFACTSTATEDBDEF
  - The Constructor for this Class that inserts a record in the FollowUp Table with the given parameters
  - IDEN ibGetContainerId
    - Returns the Container ID (in context of the Class Attributes)
  - BOOL bfnGetFieldAttrList
    - Returns the list of Field Attributes for the given conditions (parameter values)
  - BOOL bfnGetNumFieldAttrList
    - Returns the number of Field Attributes for the given conditions (parameter values)

DFBFIELDLIST

Methods:
- No Methods

Transactions Database
TXBPINSTANCE
This Class contains information of all instances of Business Process Transactions. This information consists of the Transaction ID of the Business Process (BPId), the Business Process definition ID (IBPID), the BP Status and whether the BP Instance is active or not.

Attributes:
- IDEN
- IBPIDId
- IDEN
- IBPIDId
- BOOL
- bActive
- BFSTATUS
- BPStatus

Methods:
- TXBPINSTANCE
  - The Constructor for this Class that inserts the first record from the table which matches the predicate
  - CreateInstance
    - Creates an instance of the given BP in the Transactions Database table (TXBPINSTANCE) bIsActive will still be FALSE
  - BOOL bfnActivate
    - Changes the Status (bActive) of the current BP (in context to the Class Attributes) from FALSE to TRUE
  - BOOL bfnSetBpStatus
    - Sets the BPStatus to the given status ID (in context to the Class Attributes)
former for this workflow Instance, the conditions of satisfaction for this workflow and whether this workflow instance has been instantiated or not

<table>
<thead>
<tr>
<th>Attributes:</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDEN: IBPTid</td>
</tr>
<tr>
<td>IDEN: IWFTid</td>
</tr>
<tr>
<td>BOOL: bcCentralWFFlag</td>
</tr>
<tr>
<td>IDEN: IWFTid</td>
</tr>
<tr>
<td>DATETIMET: lReplyDate</td>
</tr>
<tr>
<td>DATETIMET: lCompletionTime</td>
</tr>
<tr>
<td>DATETIMET: lInitDate</td>
</tr>
<tr>
<td>IDEN: l CustId</td>
</tr>
<tr>
<td>IDEN: l PerfId</td>
</tr>
<tr>
<td>BOOL: bcContFlag</td>
</tr>
<tr>
<td>CHAR: szCondOfInstIn[lBLOBNAME, LEN]</td>
</tr>
<tr>
<td>BOOL: bInstantanate</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Methods:</th>
</tr>
</thead>
<tbody>
<tr>
<td>TXWFINSTANCE: The Constructor for this Class that returns the first record from the table which matches the predicate</td>
</tr>
<tr>
<td>BOOL: bInstantanateCentralWF</td>
</tr>
<tr>
<td>TXWFINSTANCE: Creates an Instance of the Primary workflow of a BP Instance, given the BPDocId and BPTid with the given parameters. For the given BPDocId, the workflow with CWF Flag TRUE is fetched from the DWF table to create this CWF instance. A new WFTid for this workflow instance is returned</td>
</tr>
<tr>
<td>BOOL: bfnCreateInstance</td>
</tr>
<tr>
<td>TXWFINSTANCE: Creates an Instance of the non Primary workflow of a BP Instance, given the BPDocId and BPTid with the given parameters. A new WFTid for this workflow instance is returned</td>
</tr>
<tr>
<td>BOOL: bfnSetState</td>
</tr>
<tr>
<td>TXWFINSTANCE: Sets the STATE of the given workflow instance to the state specified.</td>
</tr>
<tr>
<td>BOOL: bfnGetInstantanaate</td>
</tr>
<tr>
<td>TXWFINSTANCE: Returns the Status of the Instantiate flag for the given workflow Instance (In context of the Class Attributes). This indicates if the specified workflow instance has been instantiated or not.</td>
</tr>
<tr>
<td>BOOL: bfnModify</td>
</tr>
<tr>
<td>TXWFINSTANCE: Modifies the specified parameters in the WFInstance (In context of the Class Attributes) and returns the WFTid.</td>
</tr>
<tr>
<td>IDEN: l fnGetContId</td>
</tr>
<tr>
<td>TXWFINSTANCE: Returns the Customer ID for the given workflow Instance (In context of the Class Attributes)</td>
</tr>
<tr>
<td>IDEN: l fnGetPerfId</td>
</tr>
<tr>
<td>TXWFINSTANCE: Returns the Performer ID for the given workflow Instance (In context of the Class Attributes)</td>
</tr>
<tr>
<td>BOOL: bfnGetStateName</td>
</tr>
<tr>
<td>TXWFINSTANCE: Returns the User Defined State Name corresponding to the current state of the workflow instance. (In context of the Class Attributes)</td>
</tr>
<tr>
<td>IDEN: l fnGetFormName</td>
</tr>
<tr>
<td>TXWFINSTANCE: Returns the form name (corresponding to the WFRole) of the workflow instance. (In context of the Class Attributes)</td>
</tr>
</tbody>
</table>

TXBPASSIGN
This class contains all the Identity to Organization role mappings at the BP level for BP Transaction. These mappings if present override the corresponding DFBPASSIGN mapping for a given BPDocId for that particular instance of the BP (BPTid).

<table>
<thead>
<tr>
<th>Attributes:</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDEN: IBPTid</td>
</tr>
<tr>
<td>IDEN: lOrganRole</td>
</tr>
<tr>
<td>IDEN: lIdentityId</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Methods:</th>
</tr>
</thead>
<tbody>
<tr>
<td>TXBPASSIGN: The constructor of this class that depending on its first parameter creates a new BP assignment in a given BPTid with the given parameters or returns the first record from the table which matches the predicate</td>
</tr>
<tr>
<td>IDEN: l fnGetIdentity</td>
</tr>
<tr>
<td>TXBPASSIGN: Returns the Identity ID (In context of the Class attributes)</td>
</tr>
</tbody>
</table>

TXWFINSTANCE
This Class contains information of all instantiated Workflows. This information consists of the Transaction ITDs of the Workflow (WFTid) and the Business Process (BPTid) to which it belongs, whether it is a Primary workflow or not, the Workflow definition ID (WFDocId), the reply, completion and initiate date, the present State, the Customer and Per-
-continued

| BOOL , bfaIsCentalWF | Returns TRUE if the current WF is a primary WF |
| IDEN , lnfGetBPTid | Returns the BPTid for the given workflow instance (In context of the Class Attributes) |
| IDEN , lnfGetWFTid | Returns the WFTid for the given workflow instance (In context of the Class Attributes) |
| BOOL , bfnResetInstanti | Sets the Instantiate Flag to FALSE |
| IDEN , lnfGetWFTid | Returns the WFTid for the given workflow instance (In context of the Class Attributes) |
| STATE , lnfGetState | Returns the current State of the given workflow instance (In context of the Class Attributes) |
| BOOL , bfaGetPending | Return whether or not an act is pending for this Workflow instance |
| BOOL , bfaPutCOS | Creates/AppendTo the Blob file of the workflow Instance, the COS data in memory |
| BOOL , bfaGetCOS | If the COSFlag is TRUE it retrieves the specified number of bytes from the Blob file of this workflow Instance containing the Conditions of Satisfaction else the COS is retrieved from the workflow Definitions table |
| BOOL , bfaPutCustom | Modifies the Customer ID for this WF instance to the given ID (in context of the Class attributes) |
| BOOL , bfaPutPerfId | Modifies the Performer ID for this WF Instance to the given ID (in context of the Class attributes) |
| LONG , lnfGetReplyDate | Returns the Reply date for this workflow instance (in context of the Class attributes) |
| LONG , lnfGetCompletionTime | Returns the Completion date for this workflow instance (in context of the Class attributes) |
| BOOL , bfaPutReplyDate | Modifies the Reply date for this WF Instance to the given date (in context of the Class attributes) |
| BOOL , bfaPutCompletionTime | Modifies the Completion date for this WF Instance to the given date (in context of the Class attributes) |
| BOOL , bfaSetCOSFlag | Returns the COS Flag for this workflow Instance (in context of the Class attributes) |
| BOOL , bfaPutCOSFlag | Modifies the COS Flag for this WF Instance to the given value (in context of the Class attributes) |

**Attributes:**

| Methods: |
| TXWFOBS | The constructor of this class that depends on its first parameter it creates a new Workflow Observer Transaction in the Table with the given parameters or returns the first record from the table which matches the predicate |

**Methods:**

| TXWFASSIGN | This class contains all the Identity to Organization role mappings at the Workflow level for Workflow Instances. |

| Attributes: |
| Methods: |
| TXWFOBS | The constructor of this class that depending on its first parameter returns the first record from the table which matches the predicate or creates a new workflow assignment in a given WF Instance (WFId) for a BP Instance (BPTid) with the given parameters |
| WFOLE , faGetWFRole | Returns the WFOLE (in context of the Class attributes) |
| IDEN , lnfGetIdentity | Returns the Identity ID (in context of the Class attributes) |

**Methods:**

| TXWFINCOMPLETION | This class contains the Incompletions information for all Instantiated workflow |

| Attributes: |
| Methods: |
| TXWFINCOMPLETION | The Constructor for this class that returns the first record from the table which matches the predicate or inserts a new workflow |

**TXWFOBS**

This class contains the Workflow Observer Transactions information which includes information such as the WFTid, the BP Instance (BPTid) to which this workflow belongs, and the Observer ID for the workflow instance.
Incompletion for a given workflow Instance (WFTid) for a BP Instance (BPTid) with the given parameters.

IDEN IfnGetBPTid
Returns the BPTid for the workflow Instance (in context of the Class attributes).

IDEN IfnGetWFTid
Returns the WFTid for the workflow Instance (in context of the Class attributes).

INCOMPLETION fnGetIncomld
Returns the Incompletion ID for the WF Instance (in context of the Class attributes).

DATETIME fnGetCompletionTime
Returns the Completion Time for the WF Instance (in context of the Class attributes).

VOID fnPutCompletionTime
Modifies the Completion time for this workflow Instance to the given time (in content of the Class attributes).

DATETIME fnGetFollowUpTime
Returns the FollowUp Time for the WF Instance (in context of the Class attributes).

VOID fnPutFollowUpTime
Modifies the follow up time for this workflow Instance to the given time (in context of the Class attributes).

DATETIME fnGetReminderTime
Returns the Reminder Time for the workflow Instance (in context of the Class attributes).

VOID fnPutReminderTime
Modifies the Reminder Time for the workflow Instance to the given time (in context of the Class attributes).

BOOL bfnGetFirstIncomplation
Returns TRUE if a record for the given reminder/followup prior to the given time is available and the Incompletion information is made available in the Class Attributes.

BOOL bfnGetNextIncomplation
Returns TRUE if the next record for the given reminder/followup prior to the given time is available and the Incompletion information is made available in the Class Attributes.

LONG fnGetCount
Returns the Count (number of Incompletions) for the workflow Instance (in context of the Class attributes).

VOID fnIncCount
Increments the count.

Method:

TXWFAVAILACTS
The constructor for this Class that returns the first record from the table which matches the predicate or inserts a new Available Act for a given workflow Instance (WFTid) for a BP Instance (BPTid) with the given parameters.

BOOL bnNumAvailActs
Returns the number of Acts available for a given WFRole in a WFInstance. The Impure Flag indicates whether an Act is waiting to be processed by the Transaction Manager.

BOOL bnList
Returns the list of Acts available for a given WFRole in a WFInstance. The Impure Flag indicates whether an Act is waiting to be processed by the Transaction Manager.

BOOL bnDeleteAllActs
Deletes all the Acts for a given workflow Instance from the Available Acts table.

BOOL bnGetReplyFlag
Returns the value of the Reply Flag for the WF Instance (in context of the Class attributes).

BOOL bnGetCompletionFlag
Returns the Completion Flag for the workflow Instance (in context of the Class attributes).

TXWFACTS
This class contains information of Acts that are to be taken (Queue) in all Workflow instances (Acts taken by the client but not yet processed by the Server).

Attributes:

IDEN
IDEN
IDEN
IDEN
ACT
WFRULE
WFRole
LONG
LONG
LONG
IDEN
DATETIME
DATETIME
BOOL
LONG

Methods:

TXWFACTS
The Constructor for this Class that or Inserts a new WF Act into the table (Actld) for a given Workflow Instance (WFTid) in a BP Instance (BPTid) with the given parameters or inserts a new WF Act into the table (Actld) for a given Workflow Instance (WFTid) in a BP Instance (BPTid) with the given parameters. It also inserts a record in the table.
<table>
<thead>
<tr>
<th>Attributes</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDEN</td>
<td>STFEditMode</td>
</tr>
<tr>
<td>IDEN</td>
<td>SBFEvent</td>
</tr>
<tr>
<td>IDEN</td>
<td>SBFProcessId</td>
</tr>
<tr>
<td>IDEN</td>
<td>STFId</td>
</tr>
<tr>
<td>IDEN</td>
<td>STFProcessId</td>
</tr>
<tr>
<td>IDEN</td>
<td>STFId</td>
</tr>
<tr>
<td>IDEN</td>
<td>STFId</td>
</tr>
<tr>
<td>IDEN</td>
<td>STFId</td>
</tr>
<tr>
<td>IDEN</td>
<td>STFId</td>
</tr>
</tbody>
</table>

**TXSTFADDDINFO**

This class contains additional information for all transactions which come via the STF Processor.

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDEN</td>
<td>ITXId</td>
</tr>
<tr>
<td>IDEN</td>
<td>STFId</td>
</tr>
<tr>
<td>IDEN</td>
<td>STFProcId</td>
</tr>
<tr>
<td>IDEN</td>
<td>STFId</td>
</tr>
<tr>
<td>IDEN</td>
<td>STFId</td>
</tr>
</tbody>
</table>

**TXSTFQUEUE**

This class contains information of all outgoing Transactions via the STF Processor.

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDEN</td>
<td>SBFThreadId</td>
</tr>
<tr>
<td>IDEN</td>
<td>SBFFieldId</td>
</tr>
<tr>
<td>IDEN</td>
<td>SBFId</td>
</tr>
<tr>
<td>CHAR</td>
<td>szValue [INIT_.VAL_.LEN]</td>
</tr>
</tbody>
</table>
NRDFORGROUP

This Class contains the Organization Role ID to Organization Role Name mapping.

Methods:

NRDFORGROUP

The Constructor for this Class that returns the first record from the table which matches the predicate or inserts a Record in the NRDFORGROUP table containing the IdentityId, the corresponding Identity Name, and other Identity information obtained from the given parameters.

IDIEN
CHAR
szOrgRole
szOrgName[ORGROLE_LEN]

Attributes:

NRDFORGROUP

The Constructor for this Class that returns the first record from the table which matches the predicate or inserts a Record in the NRDFORGROUP table containing the OrgRole ID and the corresponding Name.

IDIEN
szOrgRole

Attributes:

NRDFORGROUP

This method returns TRUE if there are no acts pending in the TXWFFACTS Queue for the given WF Instance in the specified BP Transaction. If there are acts in the Queue then it returns FALSE.

IDIEN

Attributes:

NRDFORGROUP

This class contains information related to all the Identities including their Name, Network Address, Postal Address, Phone/Fax and other information.

Methods:

NRDFORGROUP

The Constructor for this class that returns the first record from the table which matches the predicate or inserts a Record in the NRDFORGROUP table containing the IdentityId, the corresponding Identity Name, and other Identity information obtained from the given parameters.

IDIEN

Attributes:

NRDFORGROUP

This class contains information related to all the Identities including their Name, Network Address, Postal Address, Phone/Fax and other information.

Methods:

NRDFORGROUP

The Constructor for this class that returns the first record from the table which matches the predicate or inserts a Record in the NRDFORGROUP table containing the OrgRole ID and the corresponding Name.

IDIEN
szOrgRole

Attributes:

NRDFORGROUP

This method returns TRUE if there are no acts pending in the TXWFFACTS Queue for the given WF Instance in the specified BP Transaction. If there are acts in the Queue then it returns FALSE.

IDIEN

Attributes:

NRDFORGROUP

This class contains information related to all the Identities including their Name, Network Address, Postal Address, Phone/Fax and other information.

Methods:

NRDFORGROUP

The Constructor for this class that returns the first record from the table which matches the predicate or inserts a Record in the NRDFORGROUP table containing the IdentityId, the corresponding Identity Name, and other Identity information obtained from the given parameters.

IDIEN

Attributes:
NRDFGROUP
This class contains all the GroupId to Group Name mapping.

Attributes:

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDEN</td>
<td>GroupId</td>
</tr>
<tr>
<td>CHAR</td>
<td>GroupName</td>
</tr>
</tbody>
</table>

Methods:

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NRDFGROUP</td>
<td>The constructor for this class that returns the first record from the table which matches the predicate or inserts a new record in the NRDFGROUP table containing the GroupId and the corresponding Group name.</td>
</tr>
<tr>
<td>BOOL bfnDelete</td>
<td>Deletes the record from the NRDFGROUP table whose values are in context of the class attributes.</td>
</tr>
<tr>
<td>IDEN lfnGetGroupId</td>
<td>Returns the Group ID in context of the Class attributes.</td>
</tr>
</tbody>
</table>

NRDFGROUPASSIGN
This class contains all the GroupId to IdentityId mapping.

Attributes:

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDEN</td>
<td>GroupId</td>
</tr>
<tr>
<td>IDEN</td>
<td>IdentityId</td>
</tr>
</tbody>
</table>

Methods:

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NRDFGROUPASSIGN</td>
<td>The constructor for this class that returns the first record from the table which matches the predicate or inserts a new record in the NRDFGROUPASSIGN table containing the GroupId, and the IdentityId.</td>
</tr>
<tr>
<td>BOOL bfnDelete</td>
<td>Deletes the record from the NRDFGROUPASSIGN table whose values are in context of the class attributes.</td>
</tr>
<tr>
<td>BOOL bfnNumListGroup</td>
<td>Returns the number of Groups which contain the given IdentityId as a member.</td>
</tr>
<tr>
<td>BOOL bfnListGroup</td>
<td>Returns information of all Groups which contain the given IdentityId as a member, to file or memory as specified.</td>
</tr>
<tr>
<td>BOOL bfnNumListId</td>
<td>Returns the number of Identifiers in the specified GroupID.</td>
</tr>
<tr>
<td>BOOL bfnListId</td>
<td>Returns information of all Identifiers which belong to the specified group, to file or memory as specified.</td>
</tr>
</tbody>
</table>

NRDFIDENROLEASSIGN
This class contains all the IdentityId Organization Role mapping.

Attributes:

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDEN</td>
<td>IdentityId</td>
</tr>
<tr>
<td>IDEN</td>
<td>Org Role</td>
</tr>
</tbody>
</table>

Methods:

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NRDFIDENROLEASSIGN</td>
<td>The constructor for this class that returns the first record from the table which matches the predicate or inserts a new record in the NRDFIDENROLEASSIGN table containing the IdentityId and the Organization Role.</td>
</tr>
<tr>
<td>BOOL bfnDelete</td>
<td>Deletes the record from the NRDFIDENROLEASSIGN table whose values are in context of the class attributes.</td>
</tr>
<tr>
<td>BOOL bfnNumListRole</td>
<td>Returns the number of Org. Roles which contain the given IdentityId as the Identity Id.</td>
</tr>
<tr>
<td>BOOL bfnListRole</td>
<td>Returns information of all Org. Roles which contain the given IdentityId as the specified GroupID.</td>
</tr>
<tr>
<td>BOOL bfnNumListIdentity</td>
<td>Returns the number of Identifiers with the specified Org. Role.</td>
</tr>
</tbody>
</table>
Schedule Database

This class contains all the Business Process schedule information including time when it has to be next initiated and the Recurring period of that BP

SCBPSCHEDULE

Attributes:

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDEN</td>
<td>IBPId</td>
</tr>
<tr>
<td>DATETIMET</td>
<td>InitTime</td>
</tr>
<tr>
<td>DATETIMET</td>
<td>RecPeriod</td>
</tr>
</tbody>
</table>

Methods:

- SCBPSCHEDULE
  - The Constructor for this class that inserts a Record in the SCBPSCHEDULE table for the given STF Processor Name and Network Address. It generates the STFProcId and returns it or returns the first record from the table which matches the predicate. Deletes the record from the SCBPSCHEDULE table whose values are in context of the class attributes.
- DATETIMET InitGetInitTime
  - Returns the Initialization Time of the BP (in context of the Class attributes).
- DATETIMET InitGetRecPeriod
  - Returns the Recurring period of the BP (in context of the Class attributes).
- IDEN InitGetBPId
  - Returns the BP ID (in context of the Class attributes).
- VOID vfnPutInitTime
  - Updates the Initialization Time for the BP with the specified time (in context of the Class attributes).
- BOOL bfnGetFirstBPSchedule
  - Returns the first BP scheduled to be Initiated (Where the InitTime is less than the specified time) (the Class attributes are updated).
- BOOL bfnGetNextBPSchedule
  - Returns the next BP scheduled to be Initiated (Where the InitTime is less than the specified time) (the Class attributes are updated).

AWSAUTH

This class contains information related to each Identities database access privileges.

Attributes:

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDEN</td>
<td>IdentityId</td>
</tr>
<tr>
<td>OBJECT_TYPE</td>
<td>ObjectId</td>
</tr>
<tr>
<td>PRIVILEGES</td>
<td>Privilege</td>
</tr>
</tbody>
</table>

CONFIGINFO

This Class contains the configuration information of a particular installation including the path and file name of the Logfile, the interval of the Server polling, the path of the Blob file and the maximum number of BP instances.

Attributes:

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHAR</td>
<td>szLogFilePath[LOGFILEPATH_LEN]</td>
</tr>
<tr>
<td>CHAR</td>
<td>szLogFileName[LOGFILENAME_LEN]</td>
</tr>
<tr>
<td>INT</td>
<td>iPollInterval</td>
</tr>
<tr>
<td>CHAR</td>
<td>szBlobFilePath[LIBFILEPATH_LEN]</td>
</tr>
<tr>
<td>INT</td>
<td>iMaxBPInst</td>
</tr>
<tr>
<td>LOGOPTIONS</td>
<td>LogOpts</td>
</tr>
</tbody>
</table>

Methods:

- BOOL bfnSetConfigInfo
  - Sets the configuration of an installation to the specified values.
- BOOL bfnGetConfigInfo
  - Returns the Configuration of the Installation.

ERRMSG

Contains the Error code to error Number mapping.

Attributes:

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>INT</td>
<td>ErrNo</td>
</tr>
<tr>
<td>LONG</td>
<td>ErrCode</td>
</tr>
</tbody>
</table>

Methods:

- ERMMSG
  - The Constructor for this Class.
- BOOL bfnPutErrNo
  - Inserts a record with an ErrNo and the corresponding ErrCode.
- INT ifoGetErrNo
  - Gets the ErrNo corresponding to the specified ErrCode.

MESSAGEQ

This Class contains the Message Queue which is used by the components of the Server for internal communication.

Attributes:

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROCESS</td>
<td>Sender</td>
</tr>
<tr>
<td>PROCESS</td>
<td>Recipient</td>
</tr>
<tr>
<td>MESSAGE</td>
<td>Message</td>
</tr>
<tr>
<td>LONG</td>
<td>iParam1</td>
</tr>
<tr>
<td>LONG</td>
<td>iParam2</td>
</tr>
<tr>
<td>LONG</td>
<td>iParam3</td>
</tr>
<tr>
<td>LONG</td>
<td>iParam4</td>
</tr>
<tr>
<td>CHAR</td>
<td>szParam[PARAM_LEN]</td>
</tr>
</tbody>
</table>
Syntax

VOID FAR PASCAL AWSTINITBF(STRING szBPNName, STRING szInitName, STRING szPerformName, STRING szCustomerName, DATETIMESTRING szCompletionDate, DATETIMESTRING szResponseDate, DATETIMESTRING szInitDate, INT iCount, LPORG2ID lpIOPr, LPERRCODE lpError)

Parameters

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>szBPNName</td>
<td>STRING</td>
<td>Business Process Name. This BP must have previously been defined and the name known to the server.</td>
</tr>
<tr>
<td>szInitName</td>
<td>STRING</td>
<td>Name of the person or identity initiating the business process. The identity must be authorized to activate the business process.</td>
</tr>
<tr>
<td>szPerformName</td>
<td>STRING</td>
<td>Customer Identity Name.</td>
</tr>
<tr>
<td>szCustomerName</td>
<td>STRING</td>
<td>Performer Identity Name.</td>
</tr>
<tr>
<td>szCompletionDate</td>
<td>DATETIMESTRING</td>
<td>The date by which the primary workflow must be completed.</td>
</tr>
<tr>
<td>szResponseDate</td>
<td>DATETIMESTRING</td>
<td>The date by which the workflow to be initiated. The primary workflow can be initiated prior to an initiation date specified in the AWSINITBF function, or a previously specified initiation date changed using this function by specifying the name of the primary workflow. If the specified workflow is not the primary workflow, then the Business Process this workflow belongs to must have already been initiated. The Identity Name of the person initiating the workflow. The workflow will be initiated only if the identity has the authorization.</td>
</tr>
<tr>
<td>szInitDate</td>
<td>DATETIMESTRING</td>
<td>The date when this workflow is to be initiated by the server. If this date is not specified then the Business Process is initiated immediately.</td>
</tr>
<tr>
<td>iCount</td>
<td>INT</td>
<td>The number of Organization Role to Identity mapping entities. Pointer to an array of structures which contains the mapping of Organization Role to Identities. In the structure ORG2ID, the application must set the GLOBAL or LOCAL flag to identify whether the ORG2ID overriding is at BP level or at WF level.</td>
</tr>
<tr>
<td>lpIOPr</td>
<td>LPORG2ID</td>
<td>The function returns the Business Process Instance Id, BPId and Primary WF name, szCWFName.</td>
</tr>
<tr>
<td>szCWFName</td>
<td>STRING</td>
<td>The return value of the function. Returns the name of the Primary Workflow.</td>
</tr>
<tr>
<td>lpError</td>
<td>LPERRCODE</td>
<td>Error Code.</td>
</tr>
</tbody>
</table>

The function returns the Business Process Instance Id, BPId and Primary WF name, szCWFName.

AWSTINITWF

Description

The business process this workflow belongs to must have been instantiated. The application must supply the Business Processes’ Business Process Transaction Id. The Identity Names of the Customer and Performer are optional if defaults have been specified. The dates for completion and reply arc optional. If these dates are NULL values, the defaults specified by the workflow’s definition (if any) will be used. The Initiate date is optionally specified only for the primary workflow to initiate it at a later date. Optionally the mapping of Organization Roles to Identity Names may be passed. These override the default mapping if any.

Syntax

VOID FAR PASCAL AWSTINITWF(BPTID BPTId, STRING szWFName, STRING szInitName, STRING szPerformName, STRING szCustomerName, DATETIMESTRING szCompletionDate, DATETIMESTRING szResponseDate, DATETIMESTRING szInitDate, INT iCount, LPORG2ID lpIOPr, LPERRCODE lpError)

Return Value

None

AWSTACTINWF

Description

This function instructs the workflow server to perform the act specified in the specified workflow of a specific business process. The Business Process Transaction ID and Workflow Name must be specified. The identity mapping the act must be specified. The server records the act to be taken and updates the workflow. The server may take an unspecified time to take the act because of the queuing of the acts to be taken. If the client application issues a query when the act is pending, the application will receive status values which are
not updated and this will be indicated by CLEAR or PENDING flag of the query APIs.

Syntax

VOID FAR PASCAL AWSTACTINWF (STRING szSTFProcName, STRING szSTFTxName, STRING szSTFUserName, BPTID IBPTId, STRING szWFName, ACT Act, DATETIMESTRING szCompletionDate, DATESTRING szReplyDate, STRING szParticipantName, LPIDEN lpTxId, LPERRCODE lpError)

Return Value

The unique transaction Id generated by the server is returned. The application calling the transaction API, AWSTACTINWF can use this Id to inquire about the status of the Act. The API call to be used is AWSTACTSTATUSQUERY. AWSTACTSTATUSQUERY Description

This function gets the status of the Act requested by the AWEA via the transaction API call AWSTACTINWF. The Status indicates whether the act was taken successfully or an error occurred. In case of an error, a diagnostic error code will be returned.

Syntax

VOID FAR PASCAL AWSTACTSTATUSQUERY (IDEN ITxId, STRING szSTFProcName, STRING szSTFTxName, STRING szSTFUserName, LPERRCODE lpError)
Return Value
Data is bound to the workflow.

**AWSTGETAPPDATA**

Description
A set of data fields and values are returned corresponding to the data fields bound to a workflow instance. The number of fields and for each field the name, type, and its valid value are returned.

Syntax

```pascal
VOID FAR PASCAL AWSTGETAPPDATA (BPTID IBPTid, STRING szWfName, STRING szFormName, WROLE WfRole, STRING szParticipantName, LPINT lpIfieldsPtr, BOOL bFileOrMemory, LPADFIELDSTRUCT lpAdFieldStructPtr, STRING szFileName, LPERRCODE lpError)
```

Parameters

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>szWfName</td>
<td>STRING</td>
<td>Id of a previously instantiated BP. The name of the workflow in which to bind the data. The workflow name should be set to &quot;GLOBALBPDATA&quot; to retrieve business process bound data.</td>
</tr>
<tr>
<td>szParticipantName</td>
<td>STRING</td>
<td>Identity of the person requesting binding of application data.</td>
</tr>
<tr>
<td>iFields</td>
<td>INT</td>
<td>The number of fields to bind with the workflow</td>
</tr>
<tr>
<td>lpTxBDFieldStructPtr</td>
<td>LPTXBDFIELDSTRUCT</td>
<td>A pointer to an array of structures containing the field name, type, size and the field value. The structure BDFIELDSTRUCT contains an element of type ATTRIBUTES. This parameter will be ignored by the API.</td>
</tr>
<tr>
<td>lpError</td>
<td>LPERRCODE</td>
<td>Error code returned by the server.</td>
</tr>
<tr>
<td>szFileName</td>
<td>STRING</td>
<td>File name where the API should deposit the results of the call if the flag bFileOrMemory is ITS_FILE.</td>
</tr>
</tbody>
</table>

Parameters

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>WfRole</td>
<td>WROLE</td>
<td>The WfRole of the participant. This need only be specified if the participant has more than one role in the workflow.</td>
</tr>
<tr>
<td>szParticipantName</td>
<td>STRING</td>
<td>The name of the person or identity requesting Application Data associated with the workflow.</td>
</tr>
<tr>
<td>lpIfieldsPtr</td>
<td>LPINT</td>
<td>The number of bound data field to be retrieved. Flag to indicate File or Memory mode of receipt of data from the API.</td>
</tr>
<tr>
<td>bFileOrMemory</td>
<td>BOOL</td>
<td>A pointer to an array of structures, where the field name, type and the field values are returned. The structure ADFIELDSTRUCT contains an element of type ATTRIBUTES. This parameter is to be ignored by the Application. The API returns the list of attributes if bFileOrMemory is ITS_MEMORY. Application Data fields defined as HIDDEN for the particular WfRole, requesting Participant, and current workflow state are returned as NULL strings. File name where the API should deposit the results of the call if the flag bFileOrMemory is ITS_FILE.</td>
</tr>
</tbody>
</table>

Return Value

lpIfields contains the number of fields retrieved. BDFieldStruct contains the field name, field type and field value for all the fields retrieved.

**AWSTGETAPPDATAFIELDATTRIBUTES**

Description

This functions returns the list of application data field names and their attributes for a specified act or state for a specific workflow of a Business Process. The attributes returned are Read-Only, Editable and Hidden. These attributes are Boolean.

Syntax

```pascal
VOID FAR PASCAL AWSTGETAPPDATAFIELDATTRIBUTES(BPTID IBPTid, STRING szWfName, BOOL bActORSstate, ACTSTATE ActOrState, STRING szFormName, STRING szParticipantName, WROLE WfRole, LPINT lpIfields, LPFDLNAMEATTR lpFldNameAttr, BOOL bFileOrMemory, STRING szFileName, LPERRCODE lpError)
```
<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBPTid</td>
<td>BPTID</td>
<td>Business Process Transaction Id. The Id of a previously instantiated BP.</td>
</tr>
<tr>
<td>szWFName</td>
<td>STRING</td>
<td>The workflow name whose status is desired</td>
</tr>
<tr>
<td>bActOrState</td>
<td>BOOL</td>
<td>The status of the workflow is returned with respect to this Identity.</td>
</tr>
<tr>
<td>ActOrState</td>
<td>ACTSTATE</td>
<td>The workflow role of the participant. This field is only required if the participant is both customer and performer.</td>
</tr>
<tr>
<td>szFormName</td>
<td>STRING</td>
<td>The form name is returned. This was stored along with the bound data.</td>
</tr>
<tr>
<td>szParticipantName</td>
<td>STRING</td>
<td>The name of the person or identity requesting Field Attributes of the Application Data associated with the workflow.</td>
</tr>
<tr>
<td>WFRole</td>
<td>WFROLE</td>
<td>The number of bound data fields for which the attributes are returned.</td>
</tr>
<tr>
<td>lpFieldsPtr</td>
<td>LPINT</td>
<td>A pointer to a array of structures containing the field name and field attributes.</td>
</tr>
<tr>
<td>lpWFMomentBDField</td>
<td>LPWFMOMENTBDFIELDLDSSTRUCT</td>
<td>Structures containing the field name and field attributes.</td>
</tr>
<tr>
<td>bFileOrMemory</td>
<td>BOOL</td>
<td>Flag to indicate file or Memory mode of receipt of data from the API.</td>
</tr>
<tr>
<td>szFileName</td>
<td>STRING</td>
<td>File name where the API should deposit the results of the call if the flag bFileOrMemory is ITS_FILE.</td>
</tr>
<tr>
<td>lpError</td>
<td>LPERRCODE</td>
<td>Error code returned by the server.</td>
</tr>
</tbody>
</table>

Return Value

The lpFieldsPtr is updated with the number of fields for which the field attribute is returned.

FieldStruct contains the field attributes for the specified act.

AWSTSTATUS

Description

This function returns status of the workflow instance for a specific participant. The state of the workflow, the current incompletes with the dates, etc. Information is returned in the STATUS structuer.

Syntax

```pascal
VOID FAR PASCAL AWSTSTATUS(BPTID IBPTid, STRING szWFName, STRING szParticipantName, WFROLE WFRole, LPINT lpCurrent, LPSTATUS lpStatusPtr, LPERRCODE lpError)
```
-continued

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>szParticipantName</td>
<td>STRING</td>
<td>participant is both customer and performer in the workflow. The name of the person or identity for which the list of available acts is returned.</td>
</tr>
<tr>
<td>cDialog</td>
<td>BOOL</td>
<td>If cDialog is TRUE, then a dialog box is presented to the user to select a specific act. In this case, the list of available acts returned by this function will be the selected one. If cDialog is FALSE, then no dialog box is presented and all available acts are returned.</td>
</tr>
<tr>
<td>bFileOrMemory</td>
<td>BOOL</td>
<td>Flag to indicate File or Memory mode of receipt of data from the API.</td>
</tr>
<tr>
<td>lpCountPtr</td>
<td>LPINT</td>
<td>Number of acts returned in the structure.</td>
</tr>
<tr>
<td>szFileName</td>
<td>STRING</td>
<td>File name where the API should deposit the results of the call if the flag bFileOrMemory is IT'S_FILE.</td>
</tr>
<tr>
<td>lpActPtr</td>
<td>LPACTINFO</td>
<td>A pointer to an array of structures which contains the list of acts, i.e., Act Names, user-defined names for the acts.</td>
</tr>
<tr>
<td>lpError</td>
<td>LPERRCODE</td>
<td>Error code returned by the server.</td>
</tr>
</tbody>
</table>

Return Value

lpCountPtr is updated with the number of possible acts.

The Identity can take in the current workflow. The structure array passed is filled with the Acts Names and user-defined names.

**AWSTQUERYW**

Description

This function returns the list of workflows that the named person or identity has as a specific Organization Role. The list of workflows is selected from the set of instantiated business processes that have the same business process name. The workflow status for each workflow is returned.

Syntax

```pascal
VOID FAR PASCAL AWSTQUERYW(STRING szParticipantName, STRING szOrgRole, WFRole, STRING szBPNme, DATETIMESTRING szStartDate, DATETIMESTRING szEndDate, BOOL bPending, BOOL cDialog, BOOL bFileOrMemory, LPINT lpCount, STRING szFileName, LPWFSNAPSHOT lpWFSnapshot, LPERRCODE lpError)
```

-continued

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>szParticipantName</td>
<td>STRING</td>
<td>The participant for which the list of workflows is returned. The organization role of the participant. Only workflows that have this specific OrgRole are selected. If OrgRole is specified as NULL then all workflows are selected regardless of the role.</td>
</tr>
<tr>
<td>szOrgRole</td>
<td>STRING</td>
<td></td>
</tr>
</tbody>
</table>

Return Value

lpCount, the number of workflows in the list.

lpWFList points to a list of WFList structures.

The structure returns several dates depending on role of the Identity.
Not all dates are returned, depending on the present state of the workflow the relevant dates are returned.

**AWSTAVAILABLEBP**

**Description**

This function returns a list of BP Names.

**Syntax**

```pascal
VOID FAR PASCAL AWSTAVAILABLEBP(STRING szParticipantName, BOOL cDialog, INT iBPStatus, LPINT lpiCount, BOOL bFileOrMemory, LPPBINFOR lpBPInfo, STRING szFileName, LPERRCODE lpError)
```

**Parameters**

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>szParticipantName</td>
<td>STRING</td>
<td>The participant for which the list of BPs is returned.</td>
</tr>
<tr>
<td>cDialog</td>
<td>BOOL</td>
<td>If cDialog is TRUE, then a dialog box is presented to the user to select a specific BP. In this case, the list of BPs returned by this function will be the selected one. If cDialog is FALSE, then no dialog box is presented and all available BPs are returned.</td>
</tr>
<tr>
<td>iBPStatus</td>
<td>INT</td>
<td>Indicates the BPStatus required. ACTIVE_BPS select only active BPs. The flag INACTIVE selects all BPs in the definition database.</td>
</tr>
<tr>
<td>lpiCount</td>
<td>LPINT</td>
<td>The number of BPs returned.</td>
</tr>
<tr>
<td>bFileOrMemory</td>
<td>BOOL</td>
<td>Flag to indicate file or memory mode of receipt of data from the API.</td>
</tr>
<tr>
<td>lpBPInfo</td>
<td>LPPBINFOR</td>
<td>A pointer to an array of BINFOR structures that contain the business process name and id.</td>
</tr>
<tr>
<td>szFileName</td>
<td>STRING</td>
<td>File name where the API should deposit the results of the call if the flag bFileOrMemory is TRUE.</td>
</tr>
<tr>
<td>lpError</td>
<td>LPERRCODE</td>
<td>Error code returned by the server.</td>
</tr>
</tbody>
</table>

**Return Value**

- lpiCount, the number of workflows in the list.
  - BPListPtr points to a linked list of BINFOR structures that contain the Business Process Name & id.

**AWSTACHTHISTORY**

**Description**

This call returns a list of Acts taken in the specified business process for a specific workflow. If workflow name is NULL, then the history of the entire business process, i.e., list of all acts taken of all workflows is returned.

**Syntax**

```pascal
VOID FAR PASCAL AWSTACHTHISTORY(STRING szParticipantName, BPTID BPBaseID, STRING szWFName, LPINT lpiCount, BOOL bFileOrMemory, STRING szFileName, LPACTSTAKENLIST lpActsList, LPERRCODE lpError)
```

**Parameters**

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPBaseID</td>
<td>BPTID</td>
<td>Business Process id</td>
</tr>
<tr>
<td>szWFName</td>
<td>STRING</td>
<td>Workflow name.</td>
</tr>
<tr>
<td>NotificationEvent</td>
<td>EVENT</td>
<td>This parameter specifies the event.</td>
</tr>
<tr>
<td>szNotificationString</td>
<td>STRING</td>
<td>The notification string returned.</td>
</tr>
<tr>
<td>lpError</td>
<td>LPERRCODE</td>
<td>Error code returned by the server.</td>
</tr>
</tbody>
</table>

**Notification Events**

- Performer Response past due
  - Follow-up
- Performer Completion past due
  - Follow-up
- Performer Completion coming due
  - Reminder
- Customer Response past due
  - Follow-up
- Act taken
  - Act
Return Value

szNotificationString will contain the notification string

AWSTPOLLSTFQUEUE

Description

This call returns the notification event to the STF Processor. If the notification event is "Act Taken", then the parameter lpTxd will contain the transaction id of the Act.

Syntax

VOID FAR PASCAL AWSTPOLLSTFQUEUE(String
szSTFProcessorName, LPDEN lpBPTid, STRING
szWFName, LPINT lpEvent, LPDEN lpTxd, STRING
szParticipantName, DATETIME STRING
szCompletionTime, DATETIME STRING
szNotificationTime, LPERRCODE lpError)

______________

Parameters

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>szSTFProcessorName</td>
<td>STRING</td>
<td>STF Processor Name</td>
</tr>
<tr>
<td>lpBPTid</td>
<td>LPDEN</td>
<td>BPTid of the BP instance which has some</td>
</tr>
<tr>
<td></td>
<td></td>
<td>notification to be sent to the application.</td>
</tr>
<tr>
<td>szWFName</td>
<td>STRING</td>
<td>WFName of the WF instance</td>
</tr>
<tr>
<td>lpEvent</td>
<td>LPINT</td>
<td>The Event Id is returned here.</td>
</tr>
<tr>
<td>lpTxd</td>
<td>LPDEN</td>
<td>TxdId of the Act if Event is &quot;Act Taken&quot;</td>
</tr>
<tr>
<td>szParticipantName</td>
<td>STRING</td>
<td>The participant's name is returned.</td>
</tr>
<tr>
<td>szCompletionTime</td>
<td>DATETIME STRING</td>
<td>Completion date &amp; time is returned. This is the date and time when the event was due. For example, the instance when Performer Response is due.</td>
</tr>
<tr>
<td>szNotificationTime</td>
<td>DATETIME STRING</td>
<td>Notification date &amp; time is returned. This is the instant when this notification was placed in the STF queue. Error code returned by the server.</td>
</tr>
<tr>
<td>lpError</td>
<td>LPERRCODE</td>
<td></td>
</tr>
</tbody>
</table>

Notification Events

<table>
<thead>
<tr>
<th>Event</th>
<th>Notification Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performer Response</td>
<td>Follow-up</td>
</tr>
<tr>
<td>Performer completion</td>
<td>Follow-up</td>
</tr>
<tr>
<td>Performer completion</td>
<td>Reminder</td>
</tr>
<tr>
<td>Customer Response</td>
<td>Follow-up</td>
</tr>
<tr>
<td>Act taken</td>
<td></td>
</tr>
</tbody>
</table>

Parameter Description

- **IBPTid**: BPTID - Business Process Transaction Id. The Id of a previously instantiated BP.
- **szWFName**: STRING - The name of the workflow whose status is desired.
- **WFRole**: WFROLE - The workflow role of the identity.
- **szParticipantName**: STRING - The participant for which the list of available acts is returned.
- **lpCountPtr**: LPINT - Number of acts returned in the structure.
- **lpError**: LPERRCODE - Error code returned by the server.

Return Value

IpiCount is updated with the number of possible acts the Identity can take in the current workflow.

AWSTGETNUMAPPDATA

Description

Number of data fields are returned corresponding to the data fields bound to a workflow instance.

Syntax

VOID FAR PASCAL AWSTGETNUMAPPDATA (BPTID
IBPTid, STRING szWFName, WFROLE WFRole, STRING szParticipantName, LPINT IpiFieldsPtr, LPERR-
CODE lpError)

______________

Parameters

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBPTid</td>
<td>BPTID</td>
<td>Business Process Transaction Id. The Id of a previously instantiated BP.</td>
</tr>
<tr>
<td>szWFName</td>
<td>STRING</td>
<td>The name of the workflow from which to retrieve bound data. The transaction id should be null to retrieve business process bound data.</td>
</tr>
<tr>
<td>WFRole</td>
<td>WFROLE</td>
<td>The WFRole of the Identity Requesting Application Data associated with the workflow.</td>
</tr>
<tr>
<td>szParticipantName</td>
<td>STRING</td>
<td>The name of the person or identity requesting Application Data associated with the workflow.</td>
</tr>
<tr>
<td>IpiFieldsPtr</td>
<td>LPINT</td>
<td>The number of bound data fields retrieved.</td>
</tr>
<tr>
<td>lpError</td>
<td>LPERRCODE</td>
<td>Error code returned by the server.</td>
</tr>
</tbody>
</table>

Return Value

IpiFields contains the number of fields retrieved.

AWSTNUMAVAILABLEBP

Description

This function returns the number of BPs that satisfy a query.

Syntax

VOID FAR PASCAL AWSTNUMAVAILABLEBP
(String szParticipantName, INT iBPreq, LPINT
lpCount, LPERRCODE lpError)
<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>szParticipantName</td>
<td>STRING</td>
<td>The participant for which the list of BPs is returned.</td>
</tr>
<tr>
<td>iBPSstatus</td>
<td>INT</td>
<td>Indicate the IBPSstatus required. ACTIVE_BPS only can be selected or all BPs in the definition could be selected.</td>
</tr>
<tr>
<td>iPCount</td>
<td>LPINT</td>
<td>The number of BPs returned.</td>
</tr>
<tr>
<td>lpError</td>
<td>LPERRCODE</td>
<td>Error code returned by the server.</td>
</tr>
</tbody>
</table>

Return Value

*iPCount*, the number of workflows in the list.

**AWSNUMACTHISTORY**

**Description**

This call returns the number of Acts taken in the specified business process for a specific workflow. If Workflow Id is NULL, then the history of the entire business process, i.e., the number of all acts taken of all workflows is returned.

**Syntax**

```pascal
VOID FAR PASCAL AWSNUMACTHISTORY(STRING szParticipantName, BPTID iBPTid, STRING szWFName, LPINT iPCount, LPERRCODE lpError)
```

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>szParticipantName</td>
<td>STRING</td>
<td>The participant for which the list of Acts taken is returned.</td>
</tr>
<tr>
<td>iBPTid</td>
<td>BPTID</td>
<td>Business Process id for which the list of acts taken is returned.</td>
</tr>
<tr>
<td>szWFName</td>
<td>STRING</td>
<td>Name of Workflow Process for which the list of acts taken is returned.</td>
</tr>
<tr>
<td>iPCount</td>
<td>LPINT</td>
<td>Pointer to an integer. The function returns number of Acts returned.</td>
</tr>
<tr>
<td>lpError</td>
<td>LPERRCODE</td>
<td>Error code returned by the server.</td>
</tr>
</tbody>
</table>

Return Value

*iPCount*, the number of Acts in the list.

**AWSNUMQUERYWF**

**Description**

This function returns number of workflows that a participant is a member of as a specific Organization Role.

**Syntax**

```pascal
VOID FAR PASCAL AWSNUMQUERYWF(STRING szParticipantName, STRING szOrgRole, STRING szBPNName, STRING szStartDate, STRING szEndDate, BOOL bPending, LPINT iPCount, LPERRCODE lpError)
```

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>szParticipantName</td>
<td>STRING</td>
<td>Completion requested</td>
</tr>
<tr>
<td>szOrgRole</td>
<td>STRING</td>
<td>Completion due</td>
</tr>
<tr>
<td>szBPNName</td>
<td>STRING</td>
<td>Completion due by Customer</td>
</tr>
<tr>
<td>szStartDate</td>
<td>STRING</td>
<td>Reply due to Customer</td>
</tr>
<tr>
<td>szEndDate</td>
<td>STRING</td>
<td>Reply due to Customer</td>
</tr>
<tr>
<td>bPending</td>
<td>BOOL</td>
<td>Reply due by Customer</td>
</tr>
<tr>
<td>iPCount</td>
<td>LPINT</td>
<td>Error code returned by the server.</td>
</tr>
</tbody>
</table>

Not all dates are returned, depending on the present state of the workflow the relevant dates are returned.

**AWSSETCOS**

**Description**

This function specifies the Conditions of Satisfaction (COS) associated with a workflow of a Business Process Instance. The COS is inserted as a series of memory blocks. This function requires the Business Process context and workflow to be setup before execution.

**Syntax**

```pascal
VOID FAR PASCAL AWSSETCOS (IDEN iBPTid, STRING szJFName, LPMEM lpCOS, LPINT
```
Return Value

AWSGETCOS

Description

The function gets the COS associated with the specified workflow of a Business Process. The COS is returned as a series of memory blocks. The memory block pointer and the block size allocated is passed to this function and the number of bytes actually written in the memory block is returned. For the first call, the contents of the variable pOfset must be set to zero (0). This indicates the start of the memory block transfers. The caller will be notified with a negative value in the Offset variable to indicate end of the block transfers.

Syntax

VOID FAR PASCAL AWSGETCOS (IDEN IBPTid, STRING szWFName, LPMEM lpCOS, LPINT lpMemBlockSize, LPLONG lpOffset, LPERRCODE lpError)
Note: AWSDENDBP should be called only after an AWSDENDWF call has been made.

**Syntax**

```pascal
VOID FAR PASCAL AWSDENDBP(LPERRCODE lpError)
```

**Parameters**

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>lpError</td>
<td>LPERRCODE</td>
<td>Error code returned.</td>
</tr>
</tbody>
</table>

**Return Value**

Error code is returned.

**AWSDELETEBP**

*Description*

Deletes a Business Process. The delete is successful only if the Business Process has no active instances in the activity database. This function is used to remove business processes no longer in use. This function is called only if the business process is not in progress.

**Syntax**

```pascal
VOID FAR PASCAL AWSDELETEBP(STRING szBPName, IDEN IBPAdmin, LPERRCODE lpError)
```

**Parameters**

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>szBPName</td>
<td>STRING</td>
<td>The name of the business process to delete. There should be no active instances for this BPName.</td>
</tr>
<tr>
<td>IBPAdmin</td>
<td>IDEN</td>
<td>The Identity of the person deleting this business process. The Identity should have the rights to delete this business processes.</td>
</tr>
<tr>
<td>lpError</td>
<td>LPERRCODE</td>
<td>Error code returned.</td>
</tr>
</tbody>
</table>

**Return Value**

Error code is returned.

**AWSDSETBFPOUNDDATA**

*Description*

Define the list of bound data fields associated with the business process. The field name, type, size, attributes and initial value, if any, are specified.

**Syntax**

```pascal
VOID FAR PASCAL AWSDSETBFPOUNDDATA(INT iFields, LPBDFIELDSTRUCT lpBDFieldStructPtr, LPERRCODE lpError)
```

**Parameters**

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>iFields</td>
<td>INT</td>
<td>The number of fields to attach with the business process.</td>
</tr>
<tr>
<td>lpBDFieldStructPtr</td>
<td>LPBDFIELDSTRUCT</td>
<td>A pointer to an array of structures containing field name, type, size, attributes and initial value, if any.</td>
</tr>
<tr>
<td>lpError</td>
<td>LPERRCODE</td>
<td>Error code returned.</td>
</tr>
</tbody>
</table>

**Return Value**

Error code is returned.

**AWSDSETWFINFO**

*Description*

Specify workflow information. The workflow type, the organization role for the customer and performer, the time offsets for completion and reply are specified. This call must be made only after AWSBEGINWF is called.

**Syntax**

```pascal
VOID FAR PASCAL AWSDSETWFINFO(WFType WFType, BOOL bCentralWF, IDEN iCustomer, IDEN iPerformer, LPERRCODE lpError)
```

**Parameters**

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>lpError</td>
<td>LPERRCODE</td>
<td>Error Code returned.</td>
</tr>
</tbody>
</table>
Return Value
Error code is returned.

AWSDDISABLEWFFACT
Description
Disable a set of workflow acts for a specific workflow role. By default all acts are enabled for a workflow. This call facilitates disabling specific acts. This call must be made only after a call to AWSDBEGINWF.

Syntax
VOID FAR PASCAL AWSDDISABLEWFFACT(WFROLE WFRole, INT iCount, LPACTINFO ActPtr, LPERRCODE lpError)

Parameters

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>WFType</td>
<td>WTYPE</td>
<td>This specifies the type of workflow, i.e., Request or Offer or Note.</td>
</tr>
<tr>
<td>bCentralWF</td>
<td>BOOL</td>
<td>Flag to indicate if this workflow is the central workflow of the Business Process. This flag is TRUE if it is the central workflow, FALSE otherwise.</td>
</tr>
<tr>
<td>iCustomer</td>
<td>ORGROLEID</td>
<td>The Organization Role of the Customer.</td>
</tr>
<tr>
<td>iPerformer</td>
<td>ORGROLEID</td>
<td>The Organization Role of the Performer.</td>
</tr>
<tr>
<td>lpError</td>
<td>LPERRCODE</td>
<td>Error code returned.</td>
</tr>
</tbody>
</table>

Return Value
Error code is returned.

AWSDSETWFCYCLETIME
Description
Set the various cycle times associated with the workflow. Depending on the workflow type—Request or Offer, the response time for each act of the workflow may be specified. The table below enumerates the various times that can be stored.

Read table below as:

\[<\text{OrgRole1}> \text{ Action1} \ ] \text{ [after} \ <\text{OrgRole2}> \ <\text{Action2}> \text{ within time} \ \text{ cycle}]\]

<table>
<thead>
<tr>
<th>S1. OrgRole1</th>
<th>Action1</th>
<th>OrgRole2</th>
<th>Action2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Customer</td>
<td>Request</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Performer</td>
<td>Respond</td>
<td>Customer</td>
<td>Request</td>
</tr>
<tr>
<td>3 Performer</td>
<td>Complete</td>
<td>Customer</td>
<td>Request</td>
</tr>
<tr>
<td>4 Customer</td>
<td>Respond</td>
<td>Performer</td>
<td>Declares completion</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>For Offer type workflow:</td>
</tr>
<tr>
<td>1 Performer</td>
<td>Offer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Customer</td>
<td>Respond</td>
<td>Performer</td>
<td>Offer</td>
</tr>
<tr>
<td>3 Performer</td>
<td>Complete</td>
<td>Customer</td>
<td>Agreement</td>
</tr>
<tr>
<td>4 Customer</td>
<td>Respond</td>
<td>Performer</td>
<td>Declares completion</td>
</tr>
</tbody>
</table>

Note: The call must be made only after function AWSDSETWFINFO is called.

Syntax
VOID FAR PASCAL AWSDSETWFCYCLETIME(LPCYCLETIME lpCycleTime, LPERRCODE lpError)

Parameters

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>WFRole</td>
<td>WFROLE</td>
<td>The Workflow Role for which the acts are to be disabled.</td>
</tr>
<tr>
<td>iCount</td>
<td>INT</td>
<td>The number of acts to disable.</td>
</tr>
<tr>
<td>ActPtr</td>
<td>LPACTINFO</td>
<td>A pointer to an array of structures which contains the list of acts to disable. The number of acts is specified by parameter iCount.</td>
</tr>
<tr>
<td>lpError</td>
<td>LPERRCODE</td>
<td>Error code returned.</td>
</tr>
</tbody>
</table>

Return Value
Error code is returned.

AWSDSETACTUSERDEFINEDNAME
Description
Set the user-defined description for the workflow Acts. The list of acts and the equivalent user-defined names are provided. This call must be made only after a call to AWSDBEGINWF.

Syntax
VOID FAR PASCAL AWSDSETACTUSERDEFINEDNAME(INT iCount, LPACTINFO ActPtr, LPERRCODE lpError)

Parameters

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>iCount</td>
<td>INT</td>
<td>The number of acts for which the user-defined name has been provided.</td>
</tr>
<tr>
<td>ActPtr</td>
<td>LPACTINFO</td>
<td>A pointer to an array of structures which contains the list of acts, i.e., Act Names and user-defined Names for the acts.</td>
</tr>
<tr>
<td>lpError</td>
<td>LPERRCODE</td>
<td>Error code returned.</td>
</tr>
</tbody>
</table>

Return Value
Error code is returned.

AWSDSETSTATEUSERDEFINEDNAME
Description
Set the User-defined description for the workflow states. The list of states and the equivalent user-defined names are provided. This call must be made only after a call to AWSDBEGINWF.

Syntax
VOID FAR PASCAL AWSDSETSTATEUSERDEFINEDNAME(INT iCount, LPSTATEINFO StatePtr, LPERRCODE lpError)

Parameters

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>lpError</td>
<td>LPERRCODE</td>
<td>Error code returned.</td>
</tr>
</tbody>
</table>
Return Value
Error code is returned.

AWSDDSETACTSCRIPT
Description
Set the workflow script for an Act. The act and the script text are the parameters to this function. This call must be made only after a call to AWSDBEGINWF.
Syntax
VOID FAR PASCAL AWSDDSETACTSCRIPT(ACT Act, LPMEM lpActScript, BOOL bScriptType, LPINT lpMemBlockSize, INT iPositionNotify, ERRORCODE &lpError)

Return Value
Error code is returned.

AWSDDSETFBOUNDDATAFIELDS
Description
Define the list of bound data fields associated with the workflow. The field name, type, size, default attributes and initial value, if any, are specified.
Syntax
VOID FAR PASCAL AWSDDSETFBOUNDDATAFIELDS(INT iFields, LPBDFIELDSTRUCT *lpBDFieldStructPtr, LPERRORCODE lpError)

Return Value
Error code is returned.

AWSDDSETWFBDATAFIELD
Description
Define the field attributes of bound data fields associated with the workflow. The field attributes, Read-only, Editable, Hidden and MustFill, may be specified for each Act and/or State for a specific workflow role. A call to AWSDDSETWFBDATAFIELD must be made only after calling AWSDDSETWFBOUNDDataFields.
Syntax
VOID FAR PASCAL AWSDDSETWFBDATAFIELD(INTEGER iFields,
LPWFMOMENTBDFIELDSTRUCT
lpWFMomentBDFieldStruct, LPERRCODE lpError)

Parameters

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>iFields</td>
<td>INT</td>
<td>The number of fields to attach with the workflow.</td>
</tr>
<tr>
<td>lpWFMomentBDFieldStruct</td>
<td>LPWFMOMENTBDFIELDSTRUCT</td>
<td>A pointer to an array of structures containing field name, Act or State, Workflow Role and attributes. The attributes are: Read-only, Editable, Hidden and MustFill. Error code returned.</td>
</tr>
<tr>
<td>lpError</td>
<td>LPERRCODE</td>
<td>Error code returned.</td>
</tr>
</tbody>
</table>

Return Value

Error code is returned.
The attributes of the bound data fields are attached to the workflow.

AWSDSETFORMINFO

Description
Specify workflow form names for Customer, Performer and Observer.

Syntax

VOID FAR PASCAL AWSDSETFORMINFO(STRING szCusForm, STRING szPerForm, STRING szObsForm, STRING szInitForm, LPERRCODE lpError)

Parameters

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>szCusForm</td>
<td>STRING</td>
<td>Form name for Customer of workflow</td>
</tr>
<tr>
<td>szPerForm</td>
<td>STRING</td>
<td>Form name for Performer of workflow</td>
</tr>
<tr>
<td>szObsForm</td>
<td>STRING</td>
<td>Form name for Observer of workflow</td>
</tr>
<tr>
<td>szInitForm</td>
<td>STRING</td>
<td>Init form name of the workflow</td>
</tr>
<tr>
<td>lpError</td>
<td>LPERRCODE</td>
<td>Error code returned.</td>
</tr>
</tbody>
</table>

Return Value

Error code is returned.
Form names attached to the workflow

AWSDSETFOLLOWUP

Description
Set up follow-up information associated with the workflow. The follow-up time offsets for Completion, Reply and Reminder are specified.

A follow-up is sent after the Completion is past due. It is sent at the specified time interval after it is past due. If the recurring flag for Completion is set, then till Completion, follow-up messages are sent at every time interval specified. The maximum number of times a follow-up notification is sent could be set using this call.

A follow-up is sent after the Reply is past due. It is sent at the specified time interval after it is past due. If the recurring flag for Reply is set, then till Reply has been sent, follow-up messages are sent at every time interval specified. The maximum number of times a follow-up notification is sent could be set using this call.

bPCFUFlag bPCUOFset bPRUFRecur bPRUFoffset bPRUCount

VOID FAR PASCAL AWSDSETFOLLOWUP(BOOL bPCFUFlag, TIMEOFFSET PCFUOffset, BOOL bPCUOFRecur, INT iPCUFCount, BOOL bPRUFFlag, TIMEOFFSET PRUFOffset, BOOL bPRUFRecur, INT iPRUFCount, BOOL bCRUFFlag, TIMEOFFSET CRUFOffset, BOOL bCRUFRecur, INT iCRUFCount, TIMEOFFSET PCRemOffset, BOOL bPCRemFlag, BOOL bActNotifyFlag, LPERRCODE lpError)

Parameters

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bPCFUFlag</td>
<td>BOOL</td>
<td>Performer completion follow-up flag. Performer completion follow-up flag.</td>
</tr>
<tr>
<td>PCFUOffset</td>
<td>TIMEOFFSET</td>
<td>A follow-up message is sent at an interval, specified by PCFUOffset, after performer completion is past due. If enabled, recurring notifications are sent at every PCFUOffset interval as many as PCUFCount times.</td>
</tr>
<tr>
<td>bPCUOFRecur</td>
<td>BOOL</td>
<td>Number of times the follow-up notifications should be sent after performer completion is past due. If this parameter is not specified, and PCUFFlag is set, then notifications are sent till performer completes.</td>
</tr>
<tr>
<td>bPRUFFlag</td>
<td>BOOL</td>
<td>Performer response follow-up flag. Performer response follow-up flag.</td>
</tr>
<tr>
<td>PRUFoffset</td>
<td>TIMEOFFSET</td>
<td>A follow-up message is sent at an interval, specified by this parameter after Performer reply is past due. If enabled, recurring notifications are sent at every PRUFOffset interval as many as PRUFCount times. If PRUFFlag is set TRUE and PRUFCount is not specified, then follow-up messages are sent until performer replies.</td>
</tr>
<tr>
<td>bPRUFRecur</td>
<td>BOOL</td>
<td>Number of times the follow-up notifications should be sent after performer Completion is past due.</td>
</tr>
<tr>
<td>PRUCount</td>
<td>INT</td>
<td>Number of times the follow-up notifications should be sent after performer completion is past due.</td>
</tr>
</tbody>
</table>

A reminder may be sent before Completion or Reply is due. The reminder is sent at a time interval specified before
### Parameters

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>past_due</td>
<td></td>
<td>If this parameter is not specified, and PRUFFlag is set, then notifications are sent till performer completes.</td>
</tr>
<tr>
<td>bCRFUFlag</td>
<td>BOOL</td>
<td>Customer response follow-up flag</td>
</tr>
<tr>
<td>CRFUOffset</td>
<td>TIMEOFFSET</td>
<td>A follow-up message is sent at an interval, specified by this parameter after customer reply is past due.</td>
</tr>
<tr>
<td>bCRFURes</td>
<td>BOOL</td>
<td>If enabled, recurring notifications are sent at every CRFUOffset interval as many as CRFUCount times.</td>
</tr>
<tr>
<td>iCRFUCount</td>
<td>INT</td>
<td>Number of times the follow-up notifications should be sent after Customer Completion is past due. If this parameter is not specified, and CRFUFFlag is set, then notifications are sent till customer replies.</td>
</tr>
<tr>
<td>PCRemOffset</td>
<td>TIMEOFFSET</td>
<td>A reminder is sent at an interval PCRemOffset before Completion or Reply is due. If this flag is enabled, reminders are sent. If disabled, no reminders are sent.</td>
</tr>
<tr>
<td>bPCRemFlag</td>
<td>BOOL</td>
<td>Indicates notification status. If set to TRUE, notification is enabled else if set to FALSE, it is disabled.</td>
</tr>
<tr>
<td>bActNotifyFlag</td>
<td>BOOL</td>
<td>Indicates notification status. If set to TRUE, notification is enabled else if set to FALSE, it is disabled.</td>
</tr>
<tr>
<td>lpError</td>
<td>LPERRCODE</td>
<td>Error code returned.</td>
</tr>
</tbody>
</table>

Return Value

Error code is returned.

**AWSDPUTMAP**

**Description**

Associates a map file with the specified Business Process. The map file is inserted as a series of memory blocks. This function requires the business process context to be setup before execution.

**Syntax**

```pascal
VOID FAR PASCAL AWSDPUTMAP (LPMEM lpMapMemPtr, LPINT lpMapBlockSize, INT iPositionNotify, LPERRCODE lpError)
```

### Parameters

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>lpMapMemPtr</td>
<td>LPMEM</td>
<td>Pointer to a memory block containing map.</td>
</tr>
<tr>
<td>lpMapBlockSize</td>
<td>LPINT</td>
<td>Size of the memory block in bytes.</td>
</tr>
<tr>
<td>iPositionNotify</td>
<td>INT</td>
<td>This variable identifies the first map buffer, subsequent map buffers and the last one. It should be set to 0 to identify first map buffer, 1 to identify subsequent map buffers.</td>
</tr>
<tr>
<td>lpError</td>
<td>LPERRCODE</td>
<td>Error code returned.</td>
</tr>
</tbody>
</table>

Return Value

Error code is returned.

**AWSGETMAP**

**Description**

Get the map file associated with the specified Business Process. The map file is returned as a series of memory blocks. The memory block pointer and the block size allocated is passed to this function and the number of bytes actually written in the memory block is returned. Initially, the caller must pass a zero in the Offset variable to indicate start of the block transfers. The caller will be notified with a negative value in the Offset variable to indicate end of the block transfers.

**Syntax**

```pascal
VOID FAR PASCAL AWSGETMAP (STRING szBName, LPMEM lpMapMemPtr, LPINT lpMapMemBlockSize, LPLONG lpOffset, LPERRCODE lpError)
```

### Parameters

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>szBName</td>
<td>STRING</td>
<td>The source or “from” workflow name. The name of the workflow where a link is anchored.</td>
</tr>
<tr>
<td>bFactStart</td>
<td>BOOL</td>
<td>Flag to indicate if it is an Act or State link at source.</td>
</tr>
</tbody>
</table>
### Syntax

**VOID FAR PASCAL AWSDGETBPVERSION (IDEN lIdentity, STRING szBPName, LPINT lpVersion, LPERRCODE lpError)**

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>szBPName</td>
<td>STRING</td>
<td>Business Process Name with which to associate the map.</td>
</tr>
<tr>
<td>lpMapMemPtr</td>
<td>LPMEM</td>
<td>Pointer to a memory block where map can be returned.</td>
</tr>
<tr>
<td>lpMemBlockSize</td>
<td>LPINT</td>
<td>Size of the memory block in bytes.</td>
</tr>
<tr>
<td>lpOffset</td>
<td>LONGLONG</td>
<td>Initially, the caller must set this to zero. Each block transfer changes the value contained in this variable and the caller can only check the value returned here. This will be negative if end is reached.</td>
</tr>
<tr>
<td>lpError</td>
<td>LPERRCODE</td>
<td>Error code returned.</td>
</tr>
</tbody>
</table>

**Return Value**

- Number of bytes actually written.
- Error code is returned.

**AWSDBPADDROLEASSIGNMENT**

**Description**

Sets the Organization Role to Identity mapping at the Business Process level.

**Syntax**

```pascal
void FAR PASCAL AWSDBPADDROLEASSIGNMENT (IDEN lIdentity, IDEN lOrgRoleId, LPERRCODE lpError)
```

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>lIdentity</td>
<td>IDEN</td>
<td>Organization Role Id.</td>
</tr>
<tr>
<td>lOrgRoleId</td>
<td>IDEN</td>
<td>Identity Id to be mapped with OrgRole.</td>
</tr>
<tr>
<td>lpError</td>
<td>LPERRCODE</td>
<td>Error code returned.</td>
</tr>
</tbody>
</table>

**Return Value**

**AWSDFWADDROLEASSIGNMENT**

**Description**

Sets the Organization Role to Identity mapping at the workflow level.

**Syntax**

```pascal
void FAR PASCAL AWSDFWADDROLEASSIGNMENT (IDEN lIdentity, IDEN lOrgRoleId, WFROLE WFRole, LPERRCODE lpError)
```

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>lIdentity</td>
<td>IDEN</td>
<td>Identity Id to be mapped with OrgRole.</td>
</tr>
<tr>
<td>lOrgRoleId</td>
<td>IDEN</td>
<td>Organization Role Id.</td>
</tr>
<tr>
<td>WFRole</td>
<td>WFROLE</td>
<td>Workflow role of the identity.</td>
</tr>
<tr>
<td>lpError</td>
<td>LPERRCODE</td>
<td>Error code returned.</td>
</tr>
</tbody>
</table>

**Return Value**

**AWSDGETLASTMODIFIEDDATE**

**Description**

This function returns the last modified date of the Business Process specified.

**Syntax**

```pascal
void FAR PASCAL AWSDGETLASTMODIFIEDDATE (STRING szBPName, LPDATETIME pdtLastModified, LPERRCODE lpError)
```

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>szBPName</td>
<td>STRING</td>
<td>The name of the BP for which the last modified date is requested</td>
</tr>
<tr>
<td>lpdtLastModified</td>
<td>LPDATETIME</td>
<td>The pointer to the DATETIME type which holds the last modified date of the Business Process.</td>
</tr>
<tr>
<td>lpError</td>
<td>LPERRCODE</td>
<td>Error code returned.</td>
</tr>
</tbody>
</table>

**Return Value**

**AWSDSETBPNOTIFICATION**

**Description**

The notification string for the event is set with respect to the current BP context.

**Syntax**

```pascal
void FAR PASCAL AWSDSETBPNOTIFICATION (EVENT NotificationEvent, STRING szNotificationString, LPERRCODE lpError)
```

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NotificationEvent</td>
<td>EVENT</td>
<td>This parameter notifies the event</td>
</tr>
<tr>
<td>szNotificationString</td>
<td>STRING</td>
<td>The notification string.</td>
</tr>
<tr>
<td>lpError</td>
<td>LPERRCODE</td>
<td>Error code returned.</td>
</tr>
</tbody>
</table>

**Notification Events**

- Performer Response past due
- Performer Completion past due
- Performer Completion coming due
- Customer Response past due
- Act taken

**Event**

**Notification Type**

- Follow-up
- Reminder
- Follow-up
- Act
Return Value
AWSDSETFLOWNOTIFICATION
Description
The notification string for the event is set with respect to the current WF context.
Syntax
void FAR PASCAL AWSDSETFLOWNOTIFICATION (EVENT NotificationEvent, STRING szNotificationString, LPERRORCODE lpError)

<table>
<thead>
<tr>
<th>Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
</tr>
<tr>
<td>NotificationEvent</td>
</tr>
<tr>
<td>szNotificationString</td>
</tr>
<tr>
<td>lpError</td>
</tr>
</tbody>
</table>

Notification Events

<table>
<thead>
<tr>
<th>Event</th>
<th>Notification Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performer Response past due</td>
<td>Follow-up</td>
</tr>
<tr>
<td>Performer Completion past due</td>
<td>Follow-up</td>
</tr>
<tr>
<td>Performer Completion coming due</td>
<td>Reminder</td>
</tr>
<tr>
<td>Customer Response past due</td>
<td>Follow-up</td>
</tr>
<tr>
<td>Act taken</td>
<td>Act</td>
</tr>
</tbody>
</table>

Return Value
AWSDSETCOS
Description
This function specifies COS associated with a workflow of a Business Process. The COS is inserted as a series of memory blocks. This function requires the Business Process context and workflow to be set up before execution.
Syntax
VOID FAR PASCAL AWSDSETCOS (LPMEM lpCOS, LPINT lpMemBlockSize, INT iPositionNotify, LPERRORCODE lpError)

<table>
<thead>
<tr>
<th>Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
</tr>
<tr>
<td>lpCOS</td>
</tr>
<tr>
<td>lpMemBlockSize</td>
</tr>
<tr>
<td>iParamNotify</td>
</tr>
<tr>
<td>lpError</td>
</tr>
</tbody>
</table>

Return Value
AWSDSGETCOS
Description
The function gets the COS associated with the specified workflow of a Business Process. The COS is returned as a series of memory blocks. The memory block pointer and the block size allocated is passed to this function and the number of bytes actually written in the memory block is returned. For the first call, the contents of the variable pOffset must be set to zero (0). This indicates the start of the memory block transfers. The caller will be notified with a negative value in the Offset variable to indicate end of the block transfers.
Syntax
VOID FAR PASCAL AWSDSGETCOS (STRING szBPName, STRING szWFName, LPMEM lpCOS, LPINT lpMemBlockSize, LPLONG lpOffset, LPERRORCODE lpError)

<table>
<thead>
<tr>
<th>Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
</tr>
<tr>
<td>szBPName</td>
</tr>
<tr>
<td>szWFName</td>
</tr>
<tr>
<td>lpCOS</td>
</tr>
<tr>
<td>lpMemBlockSize</td>
</tr>
<tr>
<td>lpOffset</td>
</tr>
<tr>
<td>lpError</td>
</tr>
</tbody>
</table>

Return Value
AWSDFWADDROSBROLE
Description
Sets the Observer Organization Role(s) at the workflow level.
Syntax
VOID FAR PASCAL AWSDFWADDROSBROLE (IDEN IOrgRoleId, LPERRORCODE lpError)

<table>
<thead>
<tr>
<th>Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
</tr>
<tr>
<td>IOrgRoleId</td>
</tr>
<tr>
<td>lpError</td>
</tr>
</tbody>
</table>

Return Value
AWSDFWDELETEORESROLE
Description
Deletes the Observer Organization Role(s) at the workflow level.
Syntax
VOID FAR PASCAL AWSDFWDELETEORESROLE (IDEN IOrgRoleId, LPERRORCODE lpError)

<table>
<thead>
<tr>
<th>Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
</tr>
<tr>
<td>IOrgRoleId</td>
</tr>
<tr>
<td>lpError</td>
</tr>
</tbody>
</table>

Return Value
Names and Routings API
AWSNADDORGROLE
Description
Add a new Organization Role name to the server. This name should be unique. The Organization Role Id is returned.
Syntax
VOID FAR PASCAL AWSNADDORGROLE (STRING szOrgRoleName, LPIDEN lpOrgRoleId, IDEN
### AWSNINQUIREORGROLE

#### Description
Inquire if a specified Organization Role is present in the server database. If present, the Organization Role Id is returned.

#### Syntax
```pascal
VOID FAR PASCAL AWSNINQUIREORGROLE(STRING szOrgRoleName, LIPDEN lpOrgRoleId, IDEN lAuthorizeIdentity, LPERRCODE lpError)
```

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>szOrgRoleName</td>
<td>STRING</td>
<td>The Organization Role name that needs to be searched. If present, the Id associated with the name is returned.</td>
</tr>
<tr>
<td>lpOrgRoleId</td>
<td>LIPDEN</td>
<td>The OrgRoleId is returned. Identity of the person inquiring the presence of the name in the server database. The Identity must be authorized to inquire.</td>
</tr>
<tr>
<td>lAuthorizeIdentity</td>
<td>IDEN</td>
<td></td>
</tr>
<tr>
<td>lpError</td>
<td>LPERRCODE</td>
<td>This is set to a non-zero value on error</td>
</tr>
</tbody>
</table>

#### Return Value
The Organization Role Id, OrgRoleId, is returned by the function.

### AWSDELETEORGROLE

#### Description
Delete an Organization Role name from the server.

#### Syntax
```pascal
VOID FAR PASCAL AWSDELETEORGROLE(STRING szOrgRoleName, LIPDEN lpOrgRoleId, IDEN lAuthorizeIdentity, LPERRCODE lpError)
```

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>szOrgRoleName</td>
<td>STRING</td>
<td>The Organization Role name that needs to be deleted. Name should be unique.</td>
</tr>
<tr>
<td>lpOrgRoleId</td>
<td>LIPDEN</td>
<td>The OrgRoleId is returned on successful addition of Organization role name to the server.</td>
</tr>
<tr>
<td>lAuthorizeIdentity</td>
<td>IDEN</td>
<td>Identity of the person adding the name to the server. The Identity must be authorized to add names.</td>
</tr>
<tr>
<td>lpError</td>
<td>LPERRCODE</td>
<td></td>
</tr>
</tbody>
</table>

#### Return Value
The Operation Role Id, OrgRoleId, is returned by the function.
### Syntax

**VOID FAR PASCAL AWSNINQUIREIDENTITY (STRING szIdentityName, LPIDENT lIdentity, IDEN lAuthorizedIdentity, LPERRCODE lpError)**

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>szIdentityName</td>
<td>STRING</td>
<td>The IdentityName that needs to be searched. If present, the Id associated</td>
</tr>
<tr>
<td></td>
<td></td>
<td>with the name is returned.</td>
</tr>
<tr>
<td>lIdentity</td>
<td>LPIDENT</td>
<td>Identity Id is returned.</td>
</tr>
<tr>
<td>lAuthorizedIdentity</td>
<td>IDEN</td>
<td>Identity of the person inquiring the presence of the name in the server</td>
</tr>
<tr>
<td></td>
<td></td>
<td>database. The Identity must be authorized to inquire.</td>
</tr>
<tr>
<td>lpError</td>
<td>LPERRCODE</td>
<td>This is set to a non-zero value on error</td>
</tr>
</tbody>
</table>

#### Return Value

The Identity Id is returned by the function.

**AWSNDELETEIDENTITY**

**Description**

Delete an Identity name from the server database.

**Syntax**

**VOID FAR PASCAL AWSNDELETEIDENTITY(IDEN lIdentityId, IDEN lAuthorizedIdentity, LPERRCODE lpError)**

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>lIdentityId</td>
<td>IDEN</td>
<td>The Identity Id that needs to be deleted from the server database.</td>
</tr>
<tr>
<td>lAuthorizedIdentity</td>
<td>IDEN</td>
<td>Identity of the person removing the name from the server database. The</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Identity must be authorized to delete names.</td>
</tr>
<tr>
<td>lpError</td>
<td>LPERRCODE</td>
<td>This is set to a non-zero value on error</td>
</tr>
</tbody>
</table>

#### Return Value

Identity deleted from the server database.

**AWSNADDGROUP**

**Description**

Add a new Group to the server. The Group name should be unique. The Group id is returned.

**Syntax**

**VOID FAR PASCAL AWSNADDGROUP (STRING szGroupName, LPIDENT lpGroupId, IDEN lAuthorizedIdentity, LPERRCODE lpError)**

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>szGroupName</td>
<td>STRING</td>
<td>The name of the Group to add to the server database. The name should be</td>
</tr>
<tr>
<td></td>
<td></td>
<td>unique. The Group id is returned.</td>
</tr>
<tr>
<td>lpGroupId</td>
<td>LPIDENT</td>
<td></td>
</tr>
<tr>
<td>lAuthorizedIdentity</td>
<td>IDEN</td>
<td></td>
</tr>
<tr>
<td>lpError</td>
<td>LPERRCODE</td>
<td>This is set to a non-zero value on error</td>
</tr>
</tbody>
</table>

#### Return Value

The Group Id is returned by the function.

**AWSNDELETEGROUP**

**Description**

Delete a Group from the server database.

**Syntax**

**VOID FAR PASCAL AWSNDELETEGROUP(IDEN lpGroupId, IDEN lAuthorizedIdentity, LPERRCODE lpError)**

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>lpGroupId</td>
<td>LPIDENT</td>
<td>The Group Id that needs to be deleted from the server database.</td>
</tr>
<tr>
<td>lAuthorizedIdentity</td>
<td>IDEN</td>
<td>Identity of the person removing the name from the server database. The</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Identity must be authorized to delete names.</td>
</tr>
<tr>
<td>lpError</td>
<td>LPERRCODE</td>
<td>This is set to a non-zero value on error</td>
</tr>
</tbody>
</table>
Return Value
Group deleted from the server database.
AWSNADDGROUPASSIGNMENT
Description
Add an Identity to a Group. An Identity may be a member of several groups. To each group the Identity has to be assigned separately. The Identity inherits the rights a Group has.
Syntax
VOID FAR PASCAL AWSNADDGROUPASSIGNMENT
(IDEN IGroupId, IDEN IGroupMemberId, IDEN IAuthorizeIdentity, LPERRCODE lpError)

Parameters

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IGroupId</td>
<td>IDEN</td>
<td>The Group Id of the group, the GroupMember wishes to be a member of.</td>
</tr>
<tr>
<td>IGroupMemberId</td>
<td>IDEN</td>
<td>The Identity of the person being assigned to the Group, identified by GroupId.</td>
</tr>
<tr>
<td>IAuthorizeIdentity</td>
<td>IDEN</td>
<td>The Identity of the person assigning GroupMember to Group. The person must have the authority to make this assignment.</td>
</tr>
<tr>
<td>lpError</td>
<td>LPERRCODE</td>
<td>This is set to a non-zero value on error</td>
</tr>
</tbody>
</table>

Return Value
GroupMember added to Group.
AWSNINQUIREGROUPASSIGNMENT
Description
Verify if an identity is a member of a group.
Syntax
BOOLEAN FAR PASCAL AWSNINQUIREGROUPASSIGNMENT
(IDEN IGroupId, IDEN IGroupMember, IDEN IAuthorizeIdentity, LPERRCODE lpError)

Parameters

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IGroupId</td>
<td>IDEN</td>
<td>The GroupId of the group to verify if GroupMember a member of.</td>
</tr>
<tr>
<td>IGroupMember</td>
<td>IDEN</td>
<td>The Identity of the person being verified if member of the group, identified by GroupId.</td>
</tr>
<tr>
<td>IAuthorizeIdentity</td>
<td>IDEN</td>
<td>The Identity of the person inquiring. The person must have the authority to inquire.</td>
</tr>
<tr>
<td>lpError</td>
<td>LPERRCODE</td>
<td>This is set to a non-zero value on error</td>
</tr>
</tbody>
</table>

Return Value
The function returns TRUE if the Identity is a member of the group.
AWSNDELETEGROUPASSIGNMENT
Description
Remove an identity from the membership of a group. The identity ceases to be a member of the specified group.
Syntax
VOID FAR PASCAL AWSNDELETEGROUPASSIGNMENT
(IDEN IGroupId, IDEN IGroupMemberId, IDEN IAuthorizeIdentity, LPERRCODE lpError)

Parameters

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IGroupId</td>
<td>IDEN</td>
<td>The GroupId of the group from which to remove GroupMember.</td>
</tr>
<tr>
<td>IGroupMemberId</td>
<td>IDEN</td>
<td>The Identity of the person being removed from the Group, identified by GroupId.</td>
</tr>
<tr>
<td>IAuthorizeIdentity</td>
<td>IDEN</td>
<td>The Identity of the person deleting. The person must have the authority to delete.</td>
</tr>
<tr>
<td>lpError</td>
<td>LPERRCODE</td>
<td>This is set to a non-zero value on error</td>
</tr>
</tbody>
</table>

Return Value
The Identity is removed from the group.
AWSNGETGROUPLIST
Description
Determine the list of groups an Identity is a member of. This function returns a list and a count.
Syntax
VOID FAR PASCAL AWSNGETGROUPLIST
(IDEN IGroupId, LPINT lpCount, BOOL bFileOrMemory, LPGENERALINFO lpGroupInfoArray, STRING szFileName, IDEN IAuthorizeIdentity, LPERRCODE lpError)

Parameters

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IGroupId</td>
<td>IDEN</td>
<td>The GroupId of the person being assigned to the Group, identified by GroupId.</td>
</tr>
<tr>
<td>lpCount</td>
<td>LPINT</td>
<td>Pointer to a counter. The number of groups GroupMember is a member of. This value is returned.</td>
</tr>
<tr>
<td>bFileOrMemory</td>
<td>BOOL</td>
<td>Flag to indicate File or Memory mode of receipt of data from the API.</td>
</tr>
<tr>
<td>lpGroupInfoArray</td>
<td>LPGENERALINFO</td>
<td>The list of groups GroupMember is a member of. For each group, the Group Id and Group Name are returned. A pointer to an array of GroupIds and Group Names is returned.</td>
</tr>
<tr>
<td>szFileName</td>
<td>STRING</td>
<td>File name where the API should deposit the results of the call if the flag bFileOrMemory is FT_FILE.</td>
</tr>
<tr>
<td>IAuthorizeIdentity</td>
<td>IDEN</td>
<td>The Identity of the person inquiring. The person must have the authority to inquire.</td>
</tr>
<tr>
<td>lpError</td>
<td>LPERRCODE</td>
<td>This is set to a non-zero value on error</td>
</tr>
</tbody>
</table>

Return Value
The count of groups and a list of GroupId and GroupName returned.
AWSNGETGROUPMEMBERS
Description
Get the list of all members in a group. The IdentityName of each member in a group is returned. The IdentityName is also returned.
Syntax

void FAR PASCAL AWSNGETGROUPMEMBERS(IDEN lGroupId, LPINT lpiCount, BOOL bFileOrMemory, LPGENERALINFO lpMemberInfoArray, STRING szFileName, IDEN lAuthorizeIdentity, LPERRCODE lpError)

---continued---

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>lGroupId</td>
<td>IDEN</td>
<td>The GroupId of the group from which to retrieve list of members.</td>
</tr>
<tr>
<td>lpiCount</td>
<td>LPINT</td>
<td>Pointer to cCount, the number of members in the Group.</td>
</tr>
<tr>
<td>bFileOrMemory</td>
<td>BOOL</td>
<td>Flag to indicate File or Memory mode of receipt of data from the API.</td>
</tr>
<tr>
<td>lpGeneralInfoArray</td>
<td>LPGENERALINFO</td>
<td>A list of members in the group is returned. The list contains the</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IdentityId and IdentityName of each member.</td>
</tr>
<tr>
<td>szFileName</td>
<td>STRING</td>
<td>File name where the API should deposit the results of the call if the flag bFileOrMemory is</td>
</tr>
<tr>
<td>lAuthorizeIdentity</td>
<td>IDEN</td>
<td>The Identity of the person inquiring. The person must have the authority to inquire.</td>
</tr>
<tr>
<td>lpError</td>
<td>LPERRCODE</td>
<td>This is set to a non-zero value on error</td>
</tr>
</tbody>
</table>

Return Value
List of members returned.

AWSNINQUIREROLEASSIGNMENT
Description
Verify if a specific Identity is associated with an Organization Role. The function returns a flag. The Identity is first checked if it is associated with the Organization Role. If no association is found, then a check is made if an association exists with any of the groups Identity is a member of.

Syntax

BOOL FAR PASCAL AWSNINQUIREROLEASSIGNMENTEXTENDED(BOOL bGroupOrIdentity, IDEN lAssignee, IDEN lOrgRoleId, IDEN lAuthorizeIdentity, LPERRCODE lpError)

---continued---

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bGroupOrIdentity</td>
<td>BOOL</td>
<td>Flag to indicate if Assignee is an identity or a Group. If GroupOrIdentity is TRUE, then Assignee contains a GroupId, otherwise it is an Identity.</td>
</tr>
<tr>
<td>lAssignee</td>
<td>IDEN</td>
<td>The id of the Identity or Group being assigned the Organization Role. If a Group is being assigned, then all members of the group inherit the role.</td>
</tr>
<tr>
<td>lOrgRoleId</td>
<td>IDEN</td>
<td>The Organization Role the Identity or Group will be assigned.</td>
</tr>
<tr>
<td>lAuthorizeIdentity</td>
<td>IDEN</td>
<td>The Identity of the person assigning role. The person must have the authority to make this assignment.</td>
</tr>
<tr>
<td>lpError</td>
<td>LPERRCODE</td>
<td>This is set to a non-zero value on error</td>
</tr>
</tbody>
</table>

Return Value
The function returns a TRUE if the association is present, FALSE otherwise. If the association exists then the Follow-up flags are also returned.

AWSNDELETEROLEASSIGNMENT
Description
Disassociate an Identity or Group from a specific Organization Role. The Identity or all members of the group cease to be associated with the Organization Role.

Syntax

VOID FAR PASCAL AWSNDELETEROLEASSIGNMENT(BOOL bGroupOrIdentity, IDEN lAssignee, IDEN lAuthorizeIdentity, LPERRCODE lpError)
### Parameters

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bGroupOrIdentity</td>
<td>BOOL</td>
<td>Flag to indicate if Assignee is an Identity or a Group. If GroupOrIdentity is TRUE, then Assignee contains a GroupId, otherwise it is an Identity.</td>
</tr>
<tr>
<td>lAssignee</td>
<td>IDEN</td>
<td>The id of the Identity or Group being dissociated.</td>
</tr>
<tr>
<td>lAuthorizedIdentity</td>
<td>IDEN</td>
<td>The Identity of the person deleting the association. The person must have the authority to delete.</td>
</tr>
<tr>
<td>IpError</td>
<td>LPERRCODE</td>
<td>This is set to a non-zero value on error</td>
</tr>
</tbody>
</table>

**Return Value**

AWSNGETROLELIST

**Description**

Determine the list of Identities that are assigned to a specific Organization Role. This function returns a list of Identities and their names.

**Syntax**

```pascal
VOID FAR PASCAL AWSNGETIDENASSIGNEEIST( IDEN lOrgRoleId, LPINT lpCount, BOOL bFileOrMemory, LPASSIGNEE lpIdenInfoArray, STRING szFileName, IDEN lAuthorizeIdentity, LPERRCODE lpError)
```

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>lOrgRoleId</td>
<td>IDEN The Organization Role for which list of Assignees is being returned.</td>
</tr>
<tr>
<td>lpCountPtr</td>
<td>LPINT Pointer to a counter. The number of Assignees (Identities or Groups) associated with the Organization Role OrgRole</td>
</tr>
<tr>
<td>bFileOrMemory</td>
<td>BOOL Flag to indicate File or Memory mode of receipt of data from the API.</td>
</tr>
<tr>
<td>lpIdenInfoArray</td>
<td>LASSIGNEE List of Identities who are associated with a specific organization role. The bNotify flag associated with the Identity is also returned. A pointer to a list is returned.</td>
</tr>
<tr>
<td>szFileName</td>
<td>STRING File name where the API should deposit the results of the call if the flag bFileOrMemory is ITS_FILE.</td>
</tr>
<tr>
<td>lAuthorizeIdentity</td>
<td>IDEN The Identity of the person requesting the list. The person must have the authority to inquire.</td>
</tr>
<tr>
<td>IpError</td>
<td>LPERRCODE This is set to a non-zero value on error</td>
</tr>
</tbody>
</table>

**Return Value**

List and Count returned.

AWSNGETGROUPASSIGNEEIST

**Description**

Determine the list of Identities and Groups that are assigned to a specific Organization Role. This function returns a list of Identities and Group and their names.

**Syntax**

```pascal
VOID FAR PASCAL AWSNGETGROUPASSIGNEEIST( IDEN lOrgRoleId, LPINT lpCount, BOOL bFileOrMemory, LPGENERALINFO lpOrgRoleInfoArray, STRING szFileName, IDEN lAuthorizeIdentity, LPERRCODE lpError)
```

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>lOrgRoleId</td>
<td>ORGROLEID The Organization Role for which list of Assignees is being returned.</td>
</tr>
<tr>
<td>lpCountPtr</td>
<td>LPINT Pointer to a counter. The number of Assignees (Identities or Groups) associated with the Organization Role OrgRole</td>
</tr>
</tbody>
</table>

**Return Value**

List and Count returned.
### Parameters

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bFileOrMemory</td>
<td>BOOL</td>
<td>Flag to indicate File or Memory mode of receipt of data from the API.</td>
</tr>
<tr>
<td>lpGroupInfoArray</td>
<td>LPGENERALINFO</td>
<td>List of groups who are associated with a specific organization role. A pointer to a list is returned.</td>
</tr>
<tr>
<td>szFileName</td>
<td>STRING</td>
<td>File name where the API should deposit the results of the call if the flag bFileOrMemory is its_FILE.</td>
</tr>
<tr>
<td>lAuthorizeIdentity</td>
<td>IDEN</td>
<td>The Identity of the person requesting the list. The person must have the authority to inquire.</td>
</tr>
<tr>
<td>lpError</td>
<td>LPERRCODE</td>
<td>This is set to a non-zero value on error.</td>
</tr>
</tbody>
</table>

#### Return Value

**List and Count returned.**

**AWSNCREATESTFDEFN**

Description

Create an entry in the STF Processor table. The processor name and the network address is maintained. The STF Processor Id is returned.

Syntax

```pascal
VOID FAR PASCAL AWSNCREATESTFDEFN(string szSTFProcName, string szNetAddress, LPIDEN lpSTFProcId, IDEN lAuthorizeIdentity, LPERRCODE lpError)
```

### Parameters

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>szSTFProcName</td>
<td>STRING</td>
<td>The name of the STF Processor.</td>
</tr>
<tr>
<td>szNetAddress</td>
<td>STRING</td>
<td>The network address of the location of the STF Processor. The processor must exist for this call to return successfully.</td>
</tr>
<tr>
<td>lpSTFProcId</td>
<td>LPIDEN</td>
<td>The STFProc Id is returned.</td>
</tr>
<tr>
<td>lAuthorizeIdentity</td>
<td>IDEN</td>
<td>The Identity of the person creating the STF definition. The identity must be authorized to create STF definition.</td>
</tr>
<tr>
<td>lpError</td>
<td>LPERRCODE</td>
<td>This is set to a non-zero value on error.</td>
</tr>
</tbody>
</table>

#### Return Value

**STFProcessorId returned.**

**AWSNGETSTFDEFN**

Description

Get the STF definition from the STF Processor table for a specific STF Processor Id. The processor name and the network address are returned.

Syntax

```pascal
VOID FAR PASCAL AWSNGETSTFDEFN(IDEN lSTFProcId, STRING szSTFProcName, STRING szNetAddress, IDEN lAuthorizeIdentity, LPERRCODE lpError)
```

### Parameters

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>lGroupMemberId</td>
<td>IDEN</td>
<td>The Identity of the person being assigned to the Group, identified by GroupId.</td>
</tr>
<tr>
<td>lpCount</td>
<td>LPINT</td>
<td>Pointer to a counter. The number of groups GroupMember is a member of. This value is returned.</td>
</tr>
<tr>
<td>bFileOrMemory</td>
<td>BOOL</td>
<td>Flag to indicate File or Memory mode of receipt of data from the API.</td>
</tr>
</tbody>
</table>

#### Return Value

**STFProcessor name and net address returned.**

**AWSNGETNUMGROUPLIST**

Description

Determine the number of groups an Identity is a member of. This function returns a count.

Syntax

```pascal
VOID FAR PASCAL AWSNGETNUMGROUPLIST(IDEN lGroupMemberId, LPINT lpCount, BOOL bFileOrMemory, LPGENERALINFO lpGroupInfoArray, IDEN lAuthorizeIdentity, LPERRCODE lpError)
```
Return Value
The count of groups is returned.

AWSNGETNUMGROUPMEMBERS
Description
Get the number of all members in a group.

Syntax
void FAR PASCAL AWSNGETNUMGROUPMEMBERS
     (IDEN lGroupId, LPINT lpICount, IDEN
      lAuthorizeIdentity, LPERRCODE lpError)

Return Value
Number of members returned.

AWSNGETNUMROLELIST
Description
Determine the number of Roles that are assigned to a specific Identity or Group.

Syntax
VOID FAR PASCAL AWSNGETNUMROLELIST(BOOL
     bGroupOrIdentity, IDEN lAssignee, LPINT lpICount,
     IDEN
     lAuthorizeIdentity, LPERRCODE lpError)
Return Value
Schedule API

The following is a description of the functions performed by the components of the Schedule API for implementation of the Schedule API.

AWSDELETEBPSCHEDULE
Description
The schedule information associated with a business process is removed. However, currently active instances of the business process remain unaffected.

Syntax
VOID FAR PASCAL AWSDELETEBPSCHEDULE (STRING szBPName, DATETIMET InitTime, DATETIMET lRecurPeriod, IDEN lAuthorizeIdentity, LPERRCODE lpError)

Return Value
Schedule information stored in the server.

AWSGETBPSCHEDULE
Description
The schedule information associated with a business process is returned. The initiation time and recurrence information are returned.

Syntax
VOID FAR PASCAL AWSGETBPSCHEDULE (STRING szBPName, IDEN lAuthorizeIdentity, LPERRCODE lpError)
Syntax
void FAR PASCAL AWSSetServer
Parameters
None.
Return Value
Success—AWSError=0
Failure—AWSError<>0
AWSGrant
This call grants the specified privileges to the user by
creating an authorization record for the user, object and the
action in the privileges table. The granted privileges can be
revoked by calling AWSRevoke function.
Syntax
void FAR PASCAL AWSGrant(IDENUserId, eObject, eAction)

Parameters
<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDENUserId</td>
<td>IDENTITY</td>
<td>Id of the user who is being granted with the privilege.</td>
</tr>
<tr>
<td>eObject</td>
<td>OBJECT</td>
<td>Object on which privilege is being granted.</td>
</tr>
<tr>
<td>eAction</td>
<td>ACTION</td>
<td>Action for which the privileges are being granted.</td>
</tr>
</tbody>
</table>

Return Value
Success—AWSError=0
Failure—AWSError<>0
AWSRevoke
This call revokes the privileges granted to the user with
a previous call to AWSGrant by deleting the record for user,
object, and action form authorization table.
Syntax
void FAR PASCAL AWSRevokePrivilege(IDENUserId, eObject, eAction)

Parameters
<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDENUserId</td>
<td>IDENTITY</td>
<td>Id of the user whose privilege is being revoked.</td>
</tr>
<tr>
<td>eObject</td>
<td>OBJECT</td>
<td>Object on which privilege is being revoked.</td>
</tr>
<tr>
<td>eAction</td>
<td>ACTION</td>
<td>Action for which the privileges are being revoked.</td>
</tr>
</tbody>
</table>

Return Value
Success—AWSError=0
Failure—AWSError<>0
AWSDeleteBP
This call deletes specified business process instance from
transaction database.
Syntax
void FAR PASCAL AWSDeleteBP(lpszBPTId)

Parameters
<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>lpszBPTId</td>
<td>STRING</td>
<td>Instance of the Business Process that has to be aborted.</td>
</tr>
</tbody>
</table>

Return Value
Success—AWSError=0
Failure—AWSError<>0
AWSsuspendBP
This call suspends the execution of specified business
process instance by changing the status of BP transaction
instance class (TxBPInstance). No transactions can take place
on the business process till it is restarted again by a call to
AWSRestartBP.
Syntax
void FAR PASCAL AWSSuspendBP(lpszBPTId)

Parameters
<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>lpszBPTId</td>
<td>STRING</td>
<td>Instance of the Business Process that has to be suspended.</td>
</tr>
</tbody>
</table>

Return Value
Success—AWSError=0
Failure—AWSError<>0
AWSAbortBP
This call marks specified business process instance in
transaction database as aborted by changing the status of BP
Transaction instance class (TxBPInstance).
Syntax
void FAR PASCAL AWSAbortBP(lpszBPTId)
<table>
<thead>
<tr>
<th>Parameters</th>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>lpszBPId</td>
<td>STRING</td>
<td>Instance of the Business Process that has to be restarted.</td>
</tr>
</tbody>
</table>

Return Value

Success—AWSError=0
Failure—AWSError<>0

AWSArchiveBP
This call archives a business process or all completed business processes on the specified media. The archived business processes are deleted from the database. This function will in turn use AWSBackup function for backing up the data on a different media.

Syntax
void FAR PASCAL AWSArchiveBP(lpszBPName, eArchiveMedia, ArchiveTime, ArchiveDate)

Parameters
None.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>lpszBPName</td>
<td>STRING</td>
<td>The Business Process name. This name should be unique. If a business process with the same name is present, the current definition is over-written as a new version. There should be no active instances of the current definition for this to occur.</td>
</tr>
<tr>
<td></td>
<td>eArchiveMedia</td>
<td>ENUM</td>
<td>The media to which the business process is to be archived.</td>
</tr>
<tr>
<td></td>
<td>ArchiveDate</td>
<td>TIME</td>
<td>The date on which archiving is done.</td>
</tr>
<tr>
<td></td>
<td>ArchiveTime</td>
<td>TIME</td>
<td>The time on which archiving is done.</td>
</tr>
</tbody>
</table>

Return Value

Success—AWSError=0
Failure—AWSError<>0

AWSListActiveWFs
This call lists all active workflows in the specified business process by using VDB method ListBP of class TxBPInstance.

Syntax
void FAR PASCAL AWSListActiveWF(lpszBPName)

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>lpszBPName</td>
<td>STRING</td>
<td>Name of the Business Process whose active workflows are to be listed.</td>
</tr>
</tbody>
</table>

Return Value

Success—AWSError=0
Failure—AWSError<>0

AWSRegister
This call registers the new STF Processor name in the Names and Routing database by using VDB method CreateSTFDefn.

Syntax
void FAR PASCAL AWSRegister(lpszSTFProcessorName)

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>lpszSTFProcessorName</td>
<td>STRING</td>
<td>The STF Processor name.</td>
</tr>
</tbody>
</table>

Return Value

Success—AWSError=0
Failure—AWSError<>0

AWSDeregister
This call deregisters an STF Processor name from the server Names and Routing database, previously registered by AWSRegister call.

Syntax
void FAR PASCAL AWSDeregister (lpszSTFProcessorName)
### Parameters

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Return Value

- **Success**—AWSErrorCode=0
- **Failure**—AWSErrorCode<>0

AWSCheck

This call checks a particular workflow server database for consistency and integrity. The API will in turn use appropriate database APIs to provide the functionality.

**Syntax**

```pascal
void FAR PASCAL AWSCheck(Params)
```

**Parameters**

- Name: None.

#### Return Value

- **Success**—AWSErrorCode=0
- **Failure**—AWSErrorCode<>0

AWSIndex

This call reindexes a particular workflow server database. The API will in turn use appropriate database APIs to achieve the functionality.

**Syntax**

```pascal
void FAR PASCAL AWSIndex(Params)
```

**Parameters**

- Name: None.

#### Return Value

- **Success**—AWSErrorCode=0
- **Failure**—AWSErrorCode<>0

AWSReorganize

This call reorganizes a particular workflow server database, to permanently remove the records marked for deletion. The API will in turn use appropriate database APIs to achieve the functionality.

**Syntax**

```pascal
void FAR PASCAL AWSReorganize(Params)
```

**Parameters**

- Name: None.

#### Return Value

- **Success**—AWSErrorCode=0
- **Failure**—AWSErrorCode<>0

AWSSetConfiguration

This call updates the configuration information in the parameter file. The information can later be retrieved by making a call to AWSGetConfiguration.

**Syntax**

```pascal
void FAR PASCAL AWSSetConfiguration(iMaxBPCount, pszVersion, pszLogFile, pszLogPath)
```

**Parameters**

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>iMaxBPCount</td>
<td>INT</td>
<td>Maximum number of active business processes on the server.</td>
</tr>
<tr>
<td>pszVersion</td>
<td>STRING</td>
<td>Version number.</td>
</tr>
<tr>
<td>pszLogFile</td>
<td>STRING</td>
<td>Transaction log file name.</td>
</tr>
<tr>
<td>pszLogPath</td>
<td>STRING</td>
<td>Path where transaction log file will be written.</td>
</tr>
</tbody>
</table>

#### Return Value

- **Success**—AWSErrorCode=0

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6,073,109

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Failure—AWSErrorCode<>0

AWSGetConfiguration

This call reads the configuration information from the parameter file, earlier written by calling AWSSetConfiguration.

**Syntax**

```pascal
void FAR PASCAL AWSGetConfiguration(iMaxBPCount, pszVersion, pszLogFile, pszLogPath)
```

**Parameters**

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>iMaxBPCount</td>
<td>INT</td>
<td>Maximum number of active business processes on the server.</td>
</tr>
<tr>
<td>pszVersion</td>
<td>STRING</td>
<td>Version number.</td>
</tr>
<tr>
<td>pszLogFile</td>
<td>STRING</td>
<td>Transaction log file name.</td>
</tr>
<tr>
<td>pszLogPath</td>
<td>STRING</td>
<td>Path where transaction log file will be written.</td>
</tr>
</tbody>
</table>

#### Return Value

- **Success**—AWSErrorCode=0
- **Failure**—AWSErrorCode<>0

AWSWriteToLog

This call causes transaction information to be written to the workflow server log file.

**Syntax**

```pascal
void FAR PASCAL AWSWriteToLog(pszTransInfo)
```

**Parameters**

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>pszTransInfo</td>
<td>STRING</td>
<td>Transaction information to be written to log.</td>
</tr>
</tbody>
</table>

#### Return Value

- **Success**—AWSErrorCode=0
- **Failure**—AWSErrorCode<>0

---

### Reporter API

Get all the BP Names

**Input Parameters:** None.

**Output Parameters:**

- Array of BP Names and their versions existing in the database
  - Get BP information using BP name
  - Input Parameters:
    - BP Name
    - BP Version
  - Output Parameters:
    - BP Name
    - Primary Workflow Name
    - Projected cycle time
    - Get BP Instance ids of a BP
  - Input Parameters:
    - BP name
  - Output Parameters:
    - Array of BP instance ids.
    - Get Workflow Names of a BP
  - Input Parameters:
    - BP name
  - Output Parameters:
    - List of workflow names
    - Get BP Instance data
Input Parameters:
BP instance id
Output Parameters:
BP instance status
BP name
Primary workflow instance id
List of workflow instance ids
Get Workflow Instance Ids of a Workflow
Input Parameters:
Workflow name
List of workflow instance ids along with its BP instance ids.
Get Workflow Definitional Data
Input Parameters:
BP name
Workflow name
Output Parameters:
Workflow computed cycle time
Workflow type
Customer’s organization role
Performer’s organization role
Observers’ organization roles
Customer’s default identity
Performer’s default identity
Observers’ default identities
time1 (Customer request cycle time)
time2 (Performer response cycle time)
time3 (Performer completion cycle time)
time4 (Customer declare satisfaction cycle time)
Conditions of satisfaction
Get Workflow Instance Data
Input Parameters:
BP instance id.
Workflow instance id.
Output Parameters:
The current workflow state
Workflow name
Customer identity
Performer identity
Observer identities
Workflow starting time
User specified completion time
Workflow actual completion time
User specified cycle time of phase1
User specified cycle time of phase2
User specified cycle time of phase3
User specified cycle time of phase4
Actual cycle time of phase1
Actual cycle time of phase2
Actual cycle time of phase3
Actual cycle time of phase4
Get Workflow Summary Historical Data
Input Parameters:
BP name
Workflow name
Output Parameters:
Average completion time of a workflow
Best completion time of a workflow
Worst completion time of a workflow
Average cycle time for the customer request of a workflow
Best cycle time for the customer request of a workflow
Worst cycle time for the customer request of a workflow
Average cycle time for the performer response of a workflow
Best cycle time for the performer response of a workflow
Worst cycle time for the performer response of a workflow
Average cycle time for the customer declare-satisfaction of a workflow
Best cycle time for the customer declare-satisfaction of a workflow
Worst cycle time for the customer declare-satisfaction of the workflow
Total number of instances of a workflow
Number of workflow instances which were delayed
Average delay of delayed workflow instances
Maximum delay of the workflow
Number of workflow instances which were canceled
Number of workflow instances which were revoked
Number of workflow instances which were declined
Number of workflow instances with customer request phase delayed
Average delay in customer request phase
Maximum delay in customer request phase
Number of workflow instances with performer response phase delayed
Average delay in performer response phase
Maximum delay in performer response phase
Number of workflow instances with performer completion phase delayed
Average delay in performer completion phase
Maximum delay in performer completion phase
Number of workflow instances with customer declare-satisfaction phase delayed
Average delay in customer declare-satisfaction phase
Maximum delay in customer declare-satisfaction phase
Get Acts Taken in a Workflow instance
Input Parameters:
BP instance id
Workflow instance id
Output Parameters:
The following details of acts taken:
Act Taken
Identity who took the act
When the act was registered
Complete by time of the act
Respond by time of the act
When the act was performed
Get BP Names of a BP Collection
Input Parameters:
Selection criteria based on (refer BP Collection query dialog box in section 6.3.1):
BP Name
Customer, performer and observer organizational roles
Customer, performer and observer default identities
Check primary/all workflow(s) flag
Include all/latest version(s) flag
Output Parameters:
The following details of selected BPs:
BP Name
BP Version
BP Owner
BP Administrator
Primary Workflow Name
Get BP Instance ids of a BP
Input Parameters:
BP name
Selection criteria based on (refer BP Instance Selection
dialog box in section 6.3.3):
From and To Dates
Customer, performer, observer identities
Check primary/all workflow(s) flag
Include exceptions(Delay/Cancel/Revoke/Decline/
Normal) flag
Output Parameters:
Array of BP instance ids.
C. WORKFLOW SERVER MANAGER (WSM)
The following is a description of the workflow server
manager (WSM) component of the workflow system. The
WSM uses the workflow APIs to implement the functions
and services it provides to users. The WSM is a component
of the workflow system that provides a user interface for
specific services of the workflow server such as:
Server Management
Authorization Maintenance
Business Process Maintenance
Workflow Maintenance
STF Processor Maintenance
Configuration
Transaction Log Maintenance
Business Process Scheduling and Organizational Calen-
dar
Through the use of the WSM, a user selects the scheduling
function which provides the user interface to specify the
recurrent scheduling of business processes as well as the
specification of the organizational calendar as specified by
the schedule manager.
Workflow Server Manager classes
The following is a description of the WSM classes with
their attributes and methods.
Server Management
This class handles server management activities, such as
server startup, shutdown, etc. Startup establishes a workflow
server session with the underlying database server and starts
up transaction manager activities.

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>InputServerID</td>
<td>string</td>
</tr>
<tr>
<td>AWSStartServer</td>
<td>The method starts the server operations by opening a session with the underlying database server and starts Transaction Manager operations.</td>
</tr>
<tr>
<td>AWSStopServer</td>
<td>The method notifies all active users about the shutdown, disconnects from database server, and shuts down the Transaction Manager operations.</td>
</tr>
</tbody>
</table>

Authorization Maintenance Object
This class provides methods to create objects.

<table>
<thead>
<tr>
<th>Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>ObjectId</td>
</tr>
<tr>
<td>eObjectType</td>
</tr>
<tr>
<td>Enumeralons of Object are</td>
</tr>
</tbody>
</table>

Authorization
This class provides methods to grant/revoke authorities to
users to act on objects.

<table>
<thead>
<tr>
<th>Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDENUser</td>
</tr>
<tr>
<td>ObjectId</td>
</tr>
<tr>
<td>eAction</td>
</tr>
<tr>
<td>Enumeralons for Actions are</td>
</tr>
<tr>
<td>bGrantOption</td>
</tr>
</tbody>
</table>

AWSGrant
The method grants authority to a user to make the specified act on the specified object.

AWSRevoke
The method revokes a previously granted authority from the user.

AWSInquire
The method is used to inquire whether user has authority to make specified act on the specified object.

Business Process Maintenance
BPMaint
This class provides methods to maintain business pro-
cesses in definitions and transactions databases. It provides
methods for archiving all completed business processes.

<table>
<thead>
<tr>
<th>Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWSAbortBP</td>
</tr>
<tr>
<td>AWSDeleteBP</td>
</tr>
<tr>
<td>AWSsuspendBP</td>
</tr>
<tr>
<td>AWSResumeBP</td>
</tr>
<tr>
<td>AWSArchiveBP</td>
</tr>
<tr>
<td>AWSListAvailableBPs</td>
</tr>
</tbody>
</table>
Workflow Maintenance
WFMaint
This class handles housekeeping of workflows in a business process.

Methods

AWSListActiveBP
The method lists all BP active in transactions database.

AWSDeleteBPDefinition
The method deletes a BP definition from definitions database.

STF Processor Maintenance
STFProcessor
This class handles registration and deregistration of STF Processors in Names and Routing database.

Methods

AWSRegister
The method registers an STF Processor in Names and Routing database.

AWSDeregister
The method deregisters an STF Processor from Names and Routing database.

Database Management
DBMgmt
This class handles various database management functions, such as checking a particular workflow server database for integrity, reindexing the database, and reorganizing the database.

Methods

AWSCheck
The method checks the database for consistency and coherency.

AWSIndex
The method reindexes the database.

AWSReorganize
The method reorganizes the database.

Configuration
Config
This class provides methods to set and inquire various configurable parameters.

Attributes

MaxOpenBps int
lpwVersion string

Transaction Log Maintenance
TransLog
This class provides methods to maintain transaction log. The workflow processor uses this method to write all changes in the workflow status to the log.

Methods

AWSWriteToLog
The method writes the specified string to the transaction log.

We claim:
1. A computer system for managing a plurality of business processes, each business process having a business process definition with a plurality of linked workflows, each workflow having a corresponding workflow definition, said workflow definition representing commitments that a user having a predetermined role makes and completes to satisfy a customer of the workflow comprising:
   a) workflow server means for providing services to workflow enabled applications that allow users to act taking one of a plurality of available acts defined in one of said business processes, said workflow server means including a transaction manager providing for each of said business processes:
      transaction services for
      1. receiving instructions to initiate and initiating workflows of said business processes;
      2. taking actions in said workflow initiated business processes;
      3. updating and maintaining workflow status after each act is taken in each of said initiated workflows of said business process and keeping track of pending workflow activities, wherein said taken act is one of an act of a user and an act automatically taken by the transaction manager based on said business process definition and said workflow definition of a predetermined one of said workflows of said business process, wherein said workflow status represents all acts that are pending for said user having a predetermined role in said initiated workflow;
   b) database means for storing records of business process transactions.
2. The system defined by claim 1 wherein said database means is for storing records of the date and time when a business process must be initiated.
3. The system defined by claim 1 wherein said database means is for storing configuration information used by the workflow server means.

4. The system defined by claim 1 wherein said database means is for storing notifications to be sent to users that interact with the workflow system through a standard transaction format processor interface.

5. The system defined by claim 1 further comprising application program interface means for providing an interface to the server means to enable workflow enabled applications to obtain access to the services provided by the server means.

6. The system defined by claim 1 wherein said workflow server means provides transaction services for binding application specific data to a workflow transaction.

7. The system defined by claim 1 wherein said business process includes a plurality of workflows with workflow links coupling predetermined ones of said plurality of workflows and said workflow server means provides definitions services for defining elements of a business process, its workflows and workflow links.

8. The system defined by claim 1 wherein said workflow server means provides definitions services for defining structures for the workflows of a business process.

9. The system defined by claim 1 wherein said workflow server means provides names and routing services for defining roles, defining assignments, defining identities and defining the assignment of identities to roles.

10. The system defined by claim 1 wherein said workflow server means provides configuration services for defining a network configuration of the workflow system, the version of the server means, registering standard transaction format processors, defining users and roles, specifying a log database and a level of logging required.

11. The system defined by claim 1 wherein said workflow server means provides scheduling services for allowing an authorized user to create, modify and delete records of scheduled business processes.

12. The system defined by claim 1 further comprising means for updating the workflow server databases as an interface to the server means to enable workflow enabled applications to obtain access to services provided by the server means.

13. The system defined by claim 1 wherein a predetermined workflow script is executed when at least one of i) an act is taken by an individual; ii) an act is taken by the system; and iii) a workflow entering a predetermined state occurs, said predetermined workflow script being part of said business process definition.

14. A computer system for managing business processes, each business process including a plurality of linked workflows, by providing services that allow designers to analyze and design business processes and applications comprising:

a) workflow server means for providing:

i) definitions services for:

1. defining elements of a business process, its workflows and workflow links;
2. defining structures for the workflows of the business process;

ii) names and routing services for:

1. defining at least two roles associated with each of the workflows;
2. defining identities associated with said defined roles;

b) database means for storing records of:

i) definitions of an organization, business processes of the organization, workflows of the business processes, said roles and acts associated with the workflows;

ii) the defined roles and defined identities within an organization utilizing the workflow system.

15. A computer system for managing business processes, each business process including a plurality of linked workflows, comprising:

a) workflow server means for providing services to workflow enabled applications that allow users to act and participate in said business processes, said workflow server means including a transaction manager, said transaction manager providing:

transaction services for

1. receiving requests for new workflows and initiating the requested new workflows;
2. taking actions in workflows initiated by said transaction services of said workflow server means;
3. updating and maintaining workflow status after each act of a user is taken in a predetermined one of said initiated workflows and keeping track of pending workflow activities;
4. making available to said workflow enabled applications available business processes that a predetermined one of said workflow enabled applications can initiate;

b) database means for storing records of:

i) definitions of an organization, business processes of the organization, workflows of the business processes, roles and acts associated with the workflows, said workflow definitions representing commitments that users having predetermined roles make and complete to satisfy customers of the workflows;

ii) workflow transactions;

iii) the defined roles and defined identities of customers, performers and observers utilizing the workflow system.

16. The system defined by claim 15 wherein said database means is further for storing records of incompletions.

17. A computer implemented method for managing a plurality of business processes, each business process having a business process definition with a plurality of linked workflows, each workflow having a corresponding workflow definition, said workflow definition representing commitments that a user having a predetermined role makes and completes to satisfy a customer of the workflow, said method comprising the steps of:

a) providing services to workflow enabled applications that allow users to act taking one of a plurality of available acts defined in one of said business processes, said workflow server means including a transaction manager providing for each of said business processes:

transaction services for

1. receiving instructions to initiate and initiating workflows of said business processes;
2. taking actions in said workflow initiated business processes;
3. updating and maintaining workflow status after each act is taken in each of said initiated workflows of said business process and keeping track of pending workflow activities, wherein said taken act is one of an act of a user and an act automatically taken by the transaction manager based on said business process definition and said workflow definition of a predetermined one of said workflows of said business process, wherein said workflow status represents all acts that are pending for said user having a predetermined role in said initiated workflow;
4. making available to said workflow enabled applications available business processes that a predeter-
minded one of said workflow enabled applications can initiate and specifying available acts that a user of said predetermined workflow enabled application can take in each of the initiated workflows of each of the available business processes;

b) storing records of business process transactions.

18. The system defined by claim 1 further comprising a schedule manager providing schedule services for
1. determining which business processes are due to be initiated;
2. sending instructions to said transaction manager to initiate said determined business processes.

19. The system defined by claim 1 further comprising a follow-up manager providing follow-up services for:
1. determining when follow-up or reminder notifications are to be sent to a user;
2. sending said notifications.

* * * * *