Workflow Management Coaliti

The Workflow Management Coalition Specification

Workflow Management Coalition The Workflow Reference Model

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This draft document is being circulated for wider comment for the purpose of changing and improving it. It has not been adopted by the Workflow Management Coalition as an official document. Reviewers of this document should understand that this document may go through significant changes in the future, and no commitment of any kind is made to the current form.

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1. Introduction

1.1. Background

Work Flow Management is a fast evolving technology which is increasingly being exploited by businesses in a variety of industries. Its primary characteristic is the automation of processes involving combinations of human and machine-based activities, particularly those involving interaction with IT applications and tools. Although its most prevalent use is within the office environment in staff intensive operations such as insurance, banking, legal and general administration, etc, it is also applicable to some classes of industrial and manufacturing applications .

Many software vendors have WFM products available today which involve WFM technology and there is a continual introduction of more products into the market. The availability of a wide range of products within the market has allowed individual product vendors to focus on particular functional capabilities and users have adopted particular products to meet specific application needs. However, there are, as yet, no standards defined to enable different WFM products to work together, which is resulting in incompatible "islands" of process automation.

The WFM Coalition is a grouping of companies who have joined together to address the above situation. It has been recognised that all work flow management products have some common characteristics, enabling them potentially to achieve a level of interoperability through the use of common standards for various functions. The WFM Coalition has been established to identify these functional areas and develop appropriate specifications for implementation in workflow products. It is intended that such specifications will enable interoperability between heterogeneous workflow products and improved integration of workflow applications with other IT services such as electronic mail and document management, thereby improving the opportunities for the effective use of workflow technology within the IT market, to the benefit of both vendors and users of such technology.

1.2. Purpose

The purpose of this document is to provide a framework to support the development of the various specifications described above. It provides a common "Reference Model" for workflow management systems identifying their characteristics, terminology and components, enabling the individual specifications to be developed within the context of an overall model for workflow systems. The detailed specifications will be developed as separate documents.

1.3. Scope

This document covers the concepts, terminology, general structure of a workflow management system, its major functional components and the interfaces and information interchange flows between them. It identifies the areas appropriate for standardisation and illustrates the potential interoperability scenarios which may be supported through the use of common standards. It also discusses, where appropriate, the applicability of existing standards to workflow management systems and their integration with other standard IT services. It does not cover wider aspects of business process engineering which lie outside the use of information technology to support the business process.

1.4. Audience

The intended audience of this document is the work flow coalition membership as well as others that are interested in the efforts of the coalition and wish to understand the top level technical architecture which underpins the work of the Coalition. The document is intended for a moderately technical audience but extensive prior knowledge of workflow systems is not assumed.

1.5. How to read this document

Chapter 2 provides a general introduction to the concepts of workflow systems technology, its evolution, the business context and background on the types of systems which may incorporate this type of technology. If you are unfamiliar with workflow technology you should start here; if you are already familiar with workflow management systems, consider starting at Chapter 3.

Chapter 3 discuses the internal structure of workflow systems, the major functional components and the nature of their interactions. It introduces the top level architecture and identifies the various interfaces which may be used to support interoperability between different system components and integration with other major IT infrastructure components.

Chapter 4 provides a general overview of the workflow application programme interface (WAPI), comments on the necessary protocol support for open interworking and discusses the principles of conformance to the specifications. It identifies those aspects of the specifications which are required to support various classes of interoperability. The detailed WAPI specifications are published as separate specification documents (see cross references below).

1.6. Cross References

WFMC SC00 - 1002	WFM Coalition Proposal Information
WFMC SC00 - 1006	WFM Coalition Technical Committee Operations
WFMC TC00 - 1008	Interoperability White Paper
WFMC TC00 - 1009	Client application API descriptions
WFMC TC00 - 1010	Workflow Definition Read/Write Descriptions
WFMC TC00 - 1011	Terminology and Glossary
WFMC TC00 - 1013	Workflow APIs - Naming Conventions

1.7. Revision History

This issue (1.1) is the second major version, incorporating the following changes from the previous version (0.6):

- Incorporation of updated terminology and glossary
- Incorporation of monitoring and metrics interface within the reference model
- Updated material on workflow interoperability (derived from the Coalition work on the Workflow Interoperability White Paper) and its associated interface operations, clarifying the various interoperability scenarios and proposed areas for open interoperability
- Incorporation of comments on the (optional) use of organisational roles within the basic model

- Incorporation of comments clarifying the use of workflow relevant data within the basic model
- Incorporation of minor changes to align with the output of other Coalition Working Groups, particularly the initial API specifications
- Improvements in clarification and consistency in various areas throughout the text, including amended document structure

Version 1.1 incorporates minor editorial changes as a result of the TC meeting in Vienna (10th Nov 94), plus revisions to improve consistency with other Coalition documentation.

2. Workflow Systems Overview

2.1. What is Workflow?

Workflow is concerned with the automation of procedures where documents, information or tasks are passed between participants according to a defined set of rules to achieve, or contribute to, an overall business goal. Whilst workflow may be manually organised, in practice most workflow is normally organised within the context of an IT system to provide computerised support for the procedural automation and it is to this area that the work of the Coalition is directed.

> Definition - Workflow
>
> The computerised facilitation or automation of a business process, in whole or part.

Workflow is often associated with Business Process Re-engineering, which is concerned with the assessment, analysis, modelling, definition and subsequent operational implementation of the core business processes of an organisation (or other business entity). Although not all BPR activities result in workflow implementations, workflow technology is often an appropriate solution as it provides separation of the business procedure logic and its IT operational support, enabling subsequent changes to be incorporated into the procedural rules defining the business process. Conversely, not all workflow implementations necessarily form part of a BPR exercise, for example implementations to automate an existing business procedure.

A Workflow Management System is one which provides procedural automation of a business process by management of the sequence of work activities and the invocation of appropriate human and/or IT resources associated with the various activity steps.

> Definition - Workflow Management System
>
> A system that completely defines, manages and executes “workflows” through the execution of software whose order of execution is driven by a computer representation of the workflow logic.

An individual business process may have a life cycle ranging from minutes to days (or even months), depending upon its complexity and the duration of the various constituent activities. Such systems may be implemented in a variety of ways, use a wide variety of IT and communications infrastructure and operate in an environment ranging from small local workgroup to inter-enterprise. The WFMC Reference Model thus takes a broad view of workflow management, which is intended to accommodate the variety of implementation techniques and operational environments which characterise this technology.

Despite this variety, all WFM systems exhibit certain common characteristics, which provide a basis for developing integration and interoperability capability between different products. The Reference Model describes a common model for the construction of workflow systems and identifies how it may be related to various alternative implementation approaches.

At the highest level, all WFM systems may be characterised as providing support in three functional areas:

- the Build-time functions, concerned with defining, and possibly modelling, the workflow process and its constituent activities
- the Run-time control functions concerned with managing the workflow processes in an operational environment and sequencing the various activities to be handled as part of each process
- the Run-time interactions with human users and IT application tools for processing the various activity steps

Figure 1 illustrates the basic characteristics of WFM systems and the relationships between these main functions.

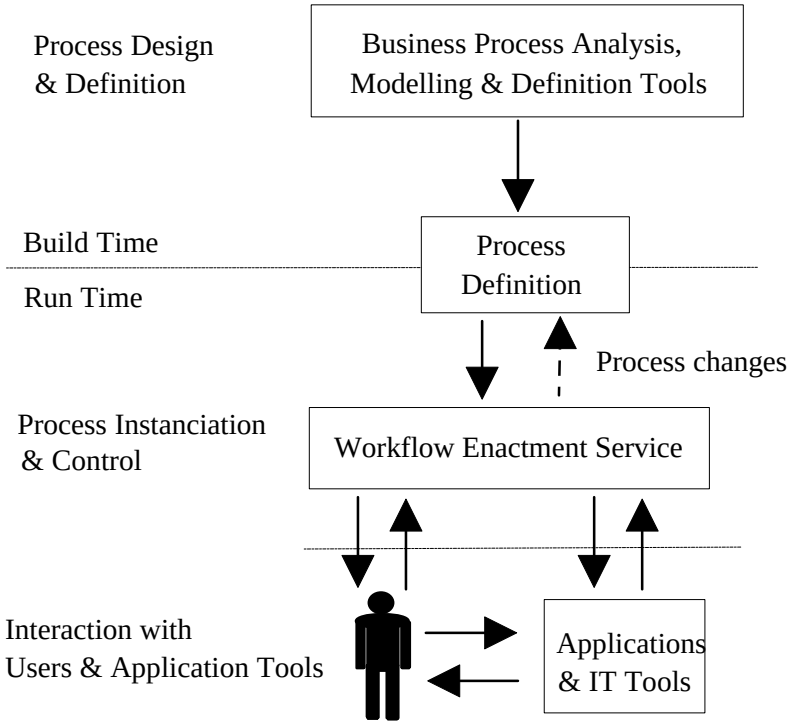

Figure 1- Workflow System Characteristics

2.1.1. Build-time Functions

The Build-time functions are those which result in a computerised definition of a business process. During this phase, a business process is translated from the real world into a formal, computer processable definition by the use of one or more analysis, modelling and system definition techniques. The resulting definition is sometimes called a process model, a process template, process metadata, or a process definition. For purposes of this document, the term 'process definition' will be used.

Definition - Process Definition

The computerised representation of a process that includes the manual definition and workflow definition.

A process definition normally comprises a number of discrete activity steps, with associated computer and/or human operations and rules governing the progression of the process through the various activity steps. The process definition may be expressed in textual or graphical form or in a formal language notation. Some workflow systems may allow dynamic alterations to process definitions from the run-time operational environment, as indicated by the feed-back arrow in the above diagram.

Coalition members do not consider the initial creation of process definitions to be an area of standardisation. Rather, this is considered to be a major distinguishing area between products in the marketplace. However, the result of the Build-time operation, the process definition, is identified as one of the potential areas of standardisation to enable the interchange of process definition data between different build-time tools and run-time products.

2.1.2. Run-time Process Control Functions

At run-time the process definition is interpreted by software which is responsible for creating and controlling operational instances of the process, scheduling the various activities steps within the process and invoking the appropriate human and IT application resources, etc. These run-time process control functions act as the linkage between the process as modelled within the process definition and the process as it is seen in the real world, reflected in the runtime interactions of users and IT application tools. The core component is the basic workflow management control software (or "engine"), responsible for process creation & deletion, control of the activity scheduling within an operational process and interaction with application tools or human resources. This software is often distributed across a number of computer platforms to cope with processes which operate over a wide geographic basis.

2.1.3. Run-time Activity Interactions

Individual activities within a workflow process are typically concerned with human operations, often realised in conjunction with the use of a particular IT tool (for example, form filling), or with information processing operations requiring a particular application program to operate on some defined information (for example, updating an orders database with a new record). Interaction with the process control software is necessary to transfer control between activities, to ascertain the operational status of processes, to invoke application tools and pass the appropriate data, etc. There are several benefits in having a standardised framework for supporting this type of interaction, including the use of a consistent interface to multiple workflow systems and the ability to develop common application tools to work with different workflow products.

2.1.4. Distribution & System Interfaces

The ability to distribute tasks and information between participants is a major distinguishing feature of workflow runtime infrastructure. The distribution function may operate at a variety of levels (workgroup to inter-organisation) depending upon the scope of the workflows; it may use a variety of underlying communications mechanisms (electronic mail, messaging passing, distributed object

technology, etc). An alternative top-level view of workflow architecture which emphasises this distribution aspect is shown in figure 2 on the following page.

The workflow enactment service is shown as the core infrastructure function with interfaces to users and applications distributed across the workflow domain. Each of these interfaces is a potential point of integration between the workflow enactment service and other infrastructure or application components.

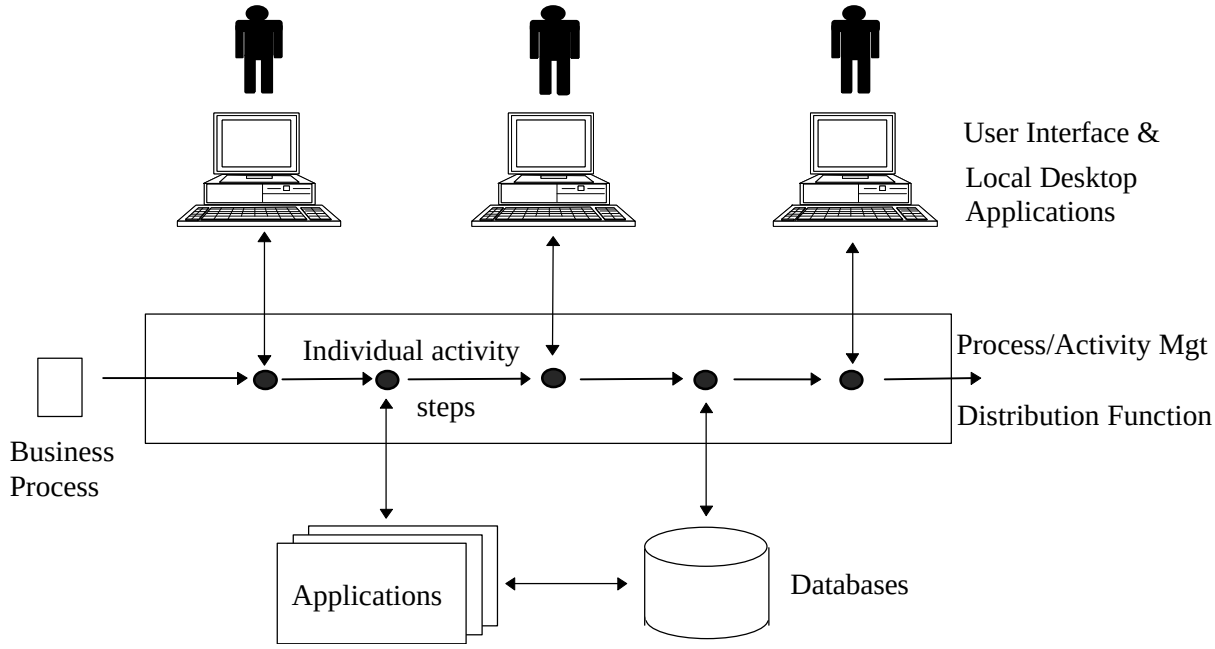

Fig 2 - Distribution within the workflow enactment service

The flow of work may involve the transfer of tasks between different vendors workflow products to enable different parts of the business process to be enacted on different platforms or sub-networks using particular products suited to that stage of the process. In this scenario the flow within the central box passes between two or more workflow products - for example activities 1,2 and 5 may be executed by one workflow system and activities 3 and 4 by a different system, with control passed between them at appropriate points within the overall workflow. Standards to support this transfer of workflow control enable the development of composite workflow applications using several different workflow products operating together as a single logical entity.

The full range of interfaces being defined by the WFM Coalition therefore covers:

- specifications for process definition data and its interchange
- interfaces to support interoperability between different workflow systems
- interfaces to support interaction with a variety of IT application types
- interfaces to support interaction with user interface desktop functions
- interfaces to provide system monitoring and metric functions to facilitate the management of composite workflow application environments

These are further developed in Section 3.

2.2. The Evolution of Workflow

Many types of product in the IT market have supported aspects of workflow functionality for a number of years, yet it is only comparatively recently that its importance has been recognised in its own right. The evolution of workflow as a technology has thus encompassed a number of different product areas.

2.2.1 Image Processing

Workflow has been closely associated with image systems and many image systems have workflow capability either built-in or supplied in conjunction with a specific workflow product. Many business procedures involve interaction with paper-based information, which may need to be captured as image data as part of an automation process. Once paper based information has been captured electronically as image data, it is often required to be passed between a number of different participants for different purposes within the process, possibly involving interaction with other IT applications, thereby creating a requirement for workflow functionality.

2.2.2 Document Management

Document management technology is concerned with managing the lifecycle of electronic documents. Increasingly, this is including facilities for managing document repositories distributed within an organisation as a shared resource with facilities for routing documents (or even separate parts of documents) to individuals for information access or updating according to their specific roles relating to a specific document. The document may form part of a particular business procedure which requires access to the document by individual staff undertaking separate activities according to a particular sequence according to some procedural rules - i.e. a document-centric form of workflow.

2.2.3 Electronic Mail & Directories

Electronic mail provides powerful facilities for distributing information between individuals within an organisation or between organisations; the use of directory mechanisms not only provides a way of identifying individual participants within an email domain but also potentially recording information about individual user attributes, such as organisation roles or other attributes relating to business procedures. Thus electronic mail systems have themselves been progressing towards workflow functionality through the addition of routing commands to define a sequence of recipients for particular types of mail items in response to some form of identified business procedure.

2.2.4 Groupware Applications

The groupware industry has introduced a wide range of software applications designed to support and improve the interactions between groups of individuals. Initially many of these applications supported improvements in group working via informal processes, accessing group bulletin boards or diary/scheduling applications on an ad-hoc basis. As the scope of such applications has spread towards more formal business focussed group interactions there has been an increasing requirement to provide a more formal and controllable procedural framework to support the use of groupware applications. Workflow technology provides a solution to this type of requirement.

2.2.5 Transaction-based Applications

For many years applications to support certain classes of business procedures ("transactions") have been developed using transaction management facilities within TP monitors and/or Database Management software. From the initial centralised style of working, such application software has increasingly enabled the distribution of transaction based applications across a number of computer platforms. Transaction based applications typically exhibit important characteristics of robustness and support for "atomic" properties of the transaction; however, they do not typically exhibit a separation between the business procedure logic and the invocation of the various application tools which may be required to support individual activities within the business process. Over time, this is leading to a requirement to consolidate workflow capabilities to control the business procedures with the ability to invoke traditional transaction application programs for appropriate parts of the business process, as well as other types of application (document or office based, etc..) for other parts of the business process.

2.2 5 Project Support Software

Software to handle complex IT application project development (eg IPSEs - "Integrated Project Support Environments") has often provided a form of workflow functionality within the project environment, for "transferring" development tasks between individuals and routing information between individuals to support these tasks. In some cases this type of software has been generalised to support a wider, business-oriented view of process and a wider range of application tools - offering a more general workflow capability.

2.2.6 BPR and Structured System Design Tools

Business Process Re-engineering tools have provided IT based support for the activities of analysing, modelling and (re-)defining the core business processes of an organisation and the potential effects of change in such processes or organisational roles and responsibilities associated with such processes. This may include analysis of the process structure and information flows supporting it, the roles of individuals or organisational units within the process and actions taken in response to different events, etc. A natural extension of such tools is to facilitate the implementation of the process with IT support infrastructure to control the flows of work and associated activities within the business process.

2.2.7 Separation of workflow functionality

The market for workflow has evolved from requirements across a spectrum of the IT industry and is likely to continue to do so, with a wide range of products focussed on one or more particular aspects of the overall workflow requirement. Some may be provided in conjunction with other areas of technology, such as image processing or document management, others may be more general purpose. This multiplicity of products will allow wide choice for individual implementation circumstances and is recognised as something to be encouraged. However, it also increases the need for standards within the industry to enable different products to work together and integrate within a consistent overall architecture.

The reference architecture described in this document provides a framework which separates the various functions within a workflow environment and identifies various interface points at which product integration and interworking may be accomplished. It forms the template within which the individual interfaces and interchange specifications are being developed by the Coalition..

2.3. Product Implementation Model

Overview

Despite the variety in workflow products in the market, it has proved feasible to construct a general implementation model of a workflow system which can be matched to most products in the marketplace thereby providing a common basis for developing interoperability scenarios.

This approach identifies the main functional components within a workflow system and the interfaces between them as an abstract model. It is recognised that many different concrete implementation variants of this abstract model will exist and therefore the interfaces specified may be realised across a number of different platform and underlying distribution technologies. Furthermore not all vendors may choose to expose every interface between the functional components within the model; this will be dealt with by the specification of a variety of conformance levels which will identify the particular interworking functions where open interfaces are supported for multivendor integration.

The main functional components of a generic workflow system are illustrated in figure 3.

The generic model has three types of component:

- software components which provide support for various functions within the workflow system (shown in dark fill)
- various types of system definition and control data (shown unfilled) which are used by one or more software components
- applications and application databases (shown in light fill) which are not part of the workflow product, but which may be invoked by it as part of the total workflow system

The roles of the major functional components within this system are described below.

Process Definition Tool

The process definition tool is used to create the process description in a computer processable form. This may be based on a formal process definition language, an object relationship model, or in simpler systems, a script or a set of routing commands to transfer information between participating users. The definition tool may be supplied as part of a specific workflow product or may be part of a business process analysis product, which has other components to handle analysis or modelling of business operations. In this latter case there must be a compatible interchange format to transfer the process definitions to/from the run-time workflow software.

Process Definition

The process definition contains all necessary information about the process to enable it to be executed by the workflow enactment software. This includes information about its starting and completion conditions, constituent activities and rules for navigating between them, user tasks to be undertaken, references to applications which may to be invoked, definition of any workflow relevant data which may need to be referenced, etc.

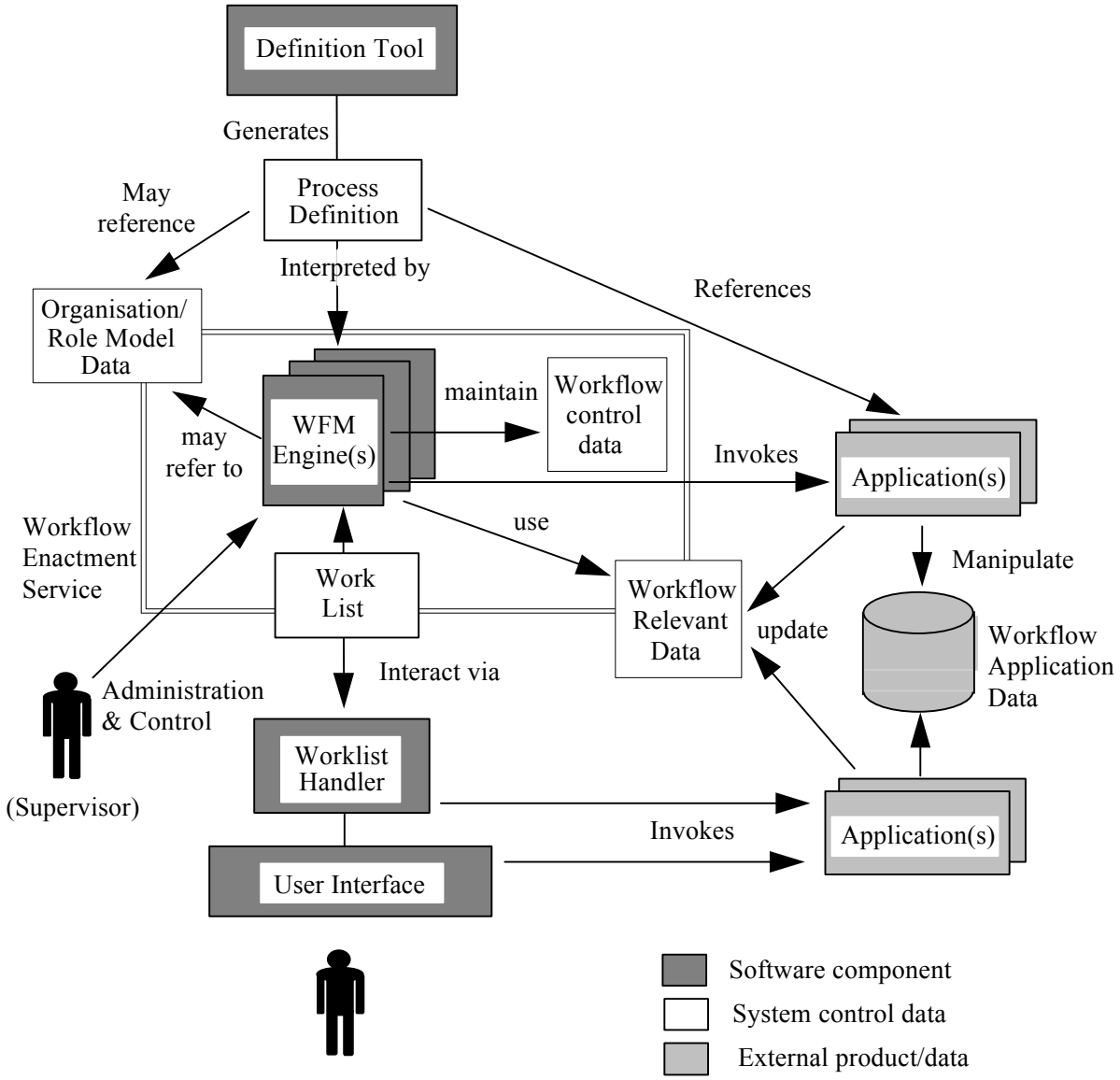

Figure 3 - Generic Workflow Product Structure

The process definition may refer to an Organisation / Role model which contains information concerning organisational structure and roles within the organisation (eg an organisational directory). This enables the process definition to be specified in terms of organisational entities and role functions associated with particular activities or information objects, rather than specific participants. The workflow enactment service then has the responsibility of linking organisational entities or roles with the specific participants within the workflow runtime environment.

Workflow Enactment Service

The workflow enactment software interprets the process description and controls the instantiation of processes and sequencing of activities, adding work items to the user work lists and invoking application tools as necessary. This is done through one or more co-operating workflow management

engines, which manage(s) the execution of individual instances of the various processes. The workflow enactment service maintains internal control data either centralised or distributed across a set of workflow engines; this workflow control data includes the internal state information associated with the various process and activity instances under execution and may also include checkpointing and recovery/restart information used by the workflow engines to co-ordinate and recover from failure conditions.

The process definition, in conjunction with any (run-time) workflow relevant data is used to control the navigation through the various activity steps within the process, providing information about the entry and exit criteria for individual activity steps, parallel or sequential execution options for different activities, user tasks or IT applications associated with each activity, etc. This may require access to organisation / role model data, if the process definition includes constructs relating to these entity types.

The workflow engines also include some form of application tool invocation capability to activate applications necessary to execute particular activities. The generality of such mechanisms may vary greatly, with some simple systems only offering support of a single fixed tool such as a form or document editor, whereas others may provide methods for the invocation of a wider range of tools, both local and remote to the Workflow engine.

Workflow Relevant Data and Application Data

Where process navigation decisions, or other control operations within the workflow engine, are based on data generated or updated by workflow application programs, such data is accessible to the workflow engine and termed workflow relevant data (also known as "case data"); this is the only type of application data accessible to the workflow engine. Workflow application data is manipulated directly (and only) by the invoked applications, although the workflow engines may be responsible for transferring such data between applications (if necessary), as different applications are invoked at different activity points within the workflow process.

Worklists

Where user interactions are necessary within the process execution, the workflow engine(s) place items on to worklists for attention by the worklist handler, which manages the interactions with the workflow participants. This process may be invisible to the workflow participants with the worklist maintained within the workflow software and the user being presented sequentially with the next task to be performed. On other systems the worklist may be visible to the user, who has the responsibility of selecting individual items of work from the list and progressing them independently, with the worklist being used to indicate task completions.

Worklist Handler & User Interface

The worklist handler is a software component which manages the interaction between workflow participants and the workflow enactment service. It is responsible for progressing work requiring user attention and interacts with the workflow enactment software via the worklist. In some systems, this may be little more than a desktop application providing a simple in-tray of work items awaiting user attention. In other systems this may be far more sophisticated, controlling the allocation of work amongst a set of users to provide facilities such as load balancing and work reassignment. In addition to these worklist handling functions, workflow engines typically support a wider range of interactions

with client applications, including sign-on and -off of workflow participants, requesting the commencement of an instance of particular process types, requesting workitems queued for particular participants, etc. Within the reference model the term workflow client application is used in preference to "worklist handler" to reflect this wider range of potential usage, which includes process control functions as well as worklist manipulation.

In the diagram the User Interface is shown as a separate software component, responsible for the look and feel of the user dialogue and control of the local interface with the user. In certain systems this may be combined with the Worklist Handler into a single functional entity. It also expected that some client applications will interact with several different workflow services, enabling workitems from such services to be consolidated into a unified task list for presentation to participants via a common user interface.

Invocation of local applications may be necessary to support the user in the particular tasks to be undertaken. This may be done by the Worklist Handler, for example at the time of presenting workitems to the user, or may be the responsibility of the user, using general facilities available at the User Interface software to load appropriate supporting applications. There is a distinction between application invocation at the Worklist Handler/User Interface (which is not directly controlled from the workflow engine and may not be visible to it) and direct application invocation by the workflow enactment software.

Supervisory Operations

Within a workflow system there are a number of supervisory functions which are normally provided; these are typically supported on the basis of supervisory privilege to a particular workstation or user(s). These functions may enable supervisors to alter work allocation rules, to identify participants for specific organisational roles within a process, to track alerts for missed deadlines or other forms of event, to trace the history of a particular process instance, to enquire about work throughput or other statistics, etc. Where distributed workflow engines are used there may need to be specific commands to transfer such control operations or (partial) responses between different workflow engines to provide a single administrative interface.

Exposed and Embedded Interfaces

Whilst the majority of workflow products can be related to the above structure, not all products offer exposed interfaces between the various individual system functional components; some products may implement several functional components together as a single logical entity with the interfaces embedded within the software component and not available for third party product use. The WFM specifications will identify, for each interface, the role of that interface in achieving interoperability, so that individual products can identify conformance against particular interoperability criteria. (For example, a particular product might offer an exposed interface for worklist manipulation but not for process definition interchange.)

2.4 Alternative Implementation Scenarios

The structural model of a generic workflow product identifies a series of software components and interfaces. In a concrete product implementation this structure may be realised in a variety of different ways; this is an important area of product differentiation. Major distinguishing factors between products include choice of platform and network infrastructure, as well as the inherent functionality

of the workflow software itself. This section illustrates how the generic model copes with this variety of implementation approach, whilst retaining visible interfaces to facilitate multi-vendor product interworking.

A full discussion of all potential implementation design issues lies outside the scope of this document. Amongst the main alternatives considered are:

- centralised or distributed workflow enactment service
- worklist handler location(s) and distribution mechanism

*Workflow Enactment Software - A*lternative Approaches

The workflow enactment software consists of one or more workflow engines, which are responsible for managing all, or part, of the execution of individual process instances. This may be set up as a centralised system with a single workflow engine responsible for managing all process execution or as a distributed system in which several engines cooperate, each managing part of the overall execution.

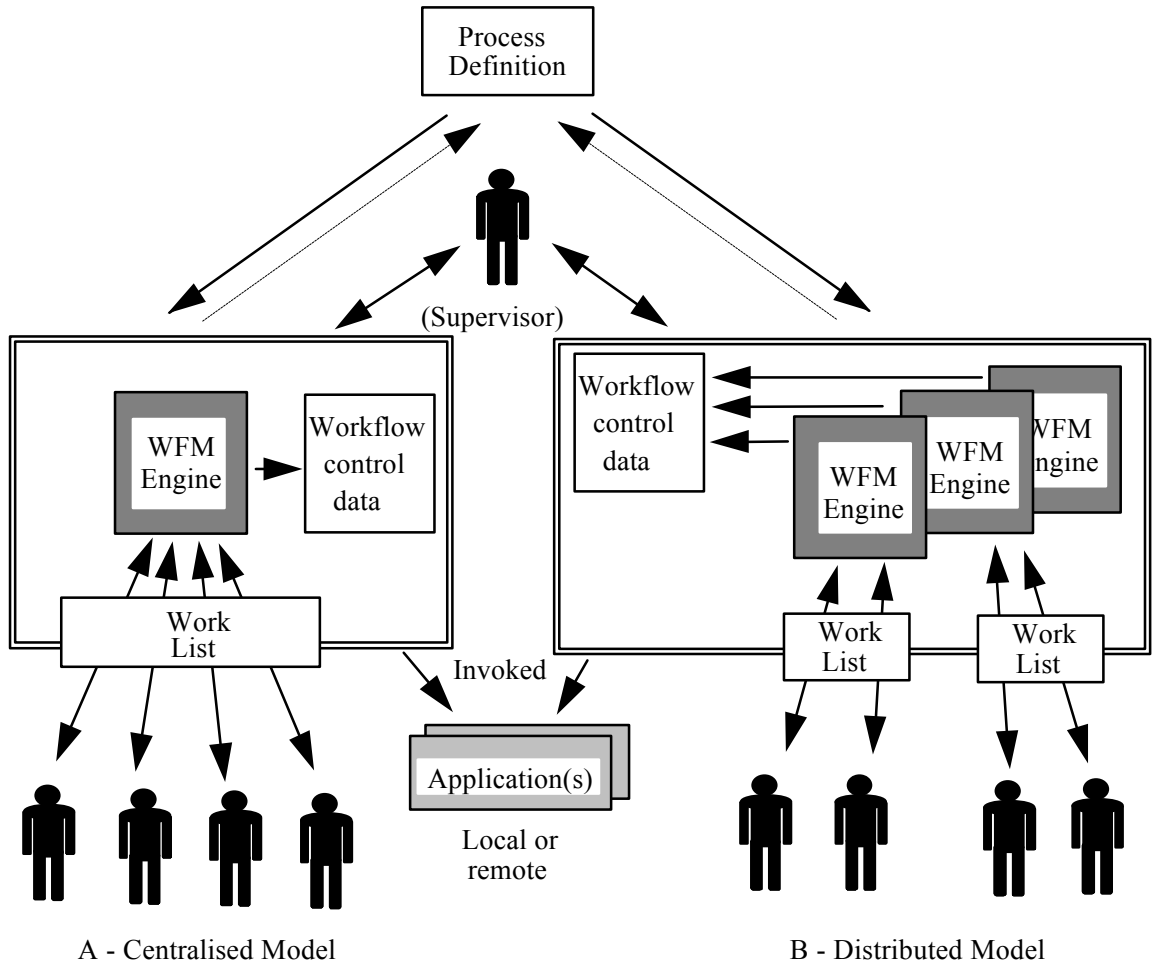

Figure 4 - Standard workflow enactment service boundary

In the above scenario the two workflow services exhibit common properties at the boundary but follow different internal implementation architectures, whose characteristics may be product dependent.

Where several workflow engines cooperate in the execution of a process instance, the control data associated with the process instance must be accessible to the different engines. This workflow control data may be distributed across the engines, located at a master engine or held as a shared filestore resource, or some combination of these. The particular implementation approaches by which this data is made available to the engines is considered to be outside the current scope for standardisation. Similarly, the process definition data may be distributed across all engines or parts transferred to individual engines from some master source during process execution. Interfaces to handle supervisory operations or application invocation may be supported as distributed features or localised to particular engines. The implementation approaches to manage distribution of workflow across multiple engines are thus complex and numerous.

The approach taken by the Coalition is to define a boundary around the workflow enactment service, which exhibits various standard functional attributes accessible via a set of common APIs. The internal mechanisms by which the enactment service delivers this capability are not defined and may include one or more homogenous workflow engines, communicating in a variety of ways.

To support interworking between different products, interfaces are defined for specific co-operative functions between different enactment services so that a composite multi-vendor workflow application may execute parts of a particular process on different enactment services (each comprising one or more specific vendors workflow engines). This is considered a more realistic approach (except perhaps in the long term) than attempting to standardise the internal interfaces and state data of a distributed workflow service.

Workflow Client Applications - Alternative Approaches

In the workflow model interaction occurs between the worklist handler and a particular workflow engine through a well defined interface embracing the concept of a worklist - the queue of work items assigned to a particular user (or, possibly, group of common users) by the workflow enactment service. At the simplest level the worklist is accessible to the workflow engine for the purposes of assigning work items and to the worklist handler (ie the workflow client application) for the purpose of retrieving work items for presentation to the user for processing.

There are various possible product implementations of this worklist interaction model depending upon the nature of the product implementation and, in particular, on the type of infrastructure used to support the distribution of worklist handling.

Four possible approaches are illustrated in the following diagram, one supporting centralised worklist handling and three using a distributed worklist handler function.

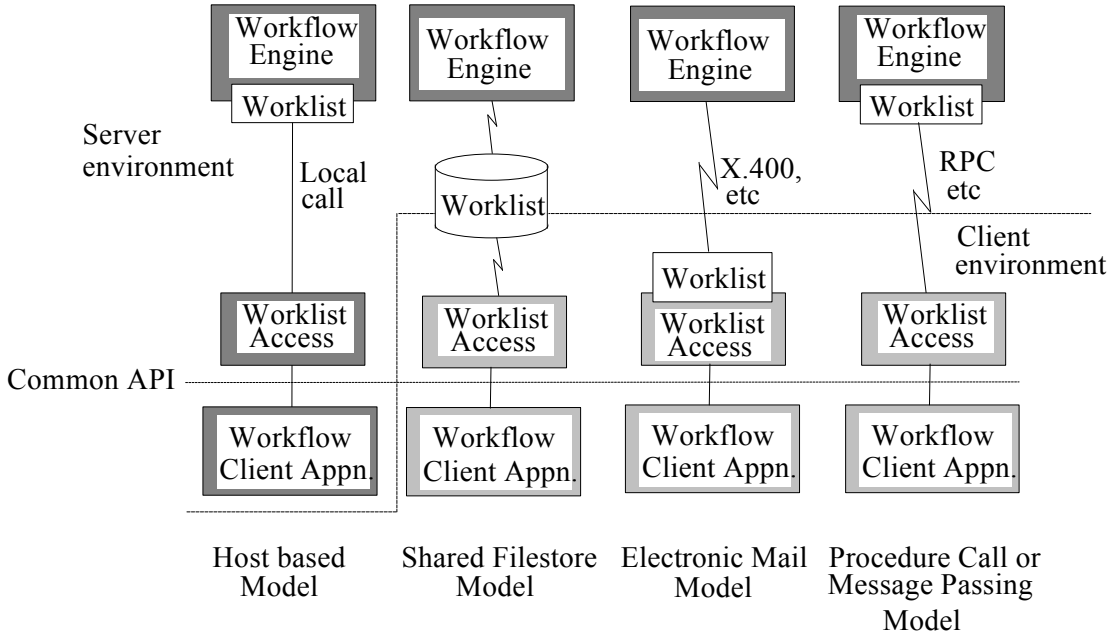

Figure 5 - Alternative client worklist handler implementations

The four example scenarios are as follows:

- Host based Model - the client worklist handler application is host based and communications with the worklist via a local interface at the workflow engine. In this case the user interface function may be driven via a terminal or a remote workstation MMI.
- Shared filestore model - the worklist handler application is implemented as a client function and communication is via a shared filestore, which lies on the boundary between host and client platform environments and is accessible to both.
- Electronic mail model - communication is via electronic mail, which supports the distribution of work items to individual participants for local processing. In this scenario the worklist would normally lie at the client.
- Procedure Call or Message Passing model - communication is via procedure call, or other message passing mechanism. In this scenario the worklist may be physically located on the workflow engine or at the worklist handler according to the particular implementation characteristics.

In each case it is feasible to construct a common API, which supports worklist handler access to the worklist and workflow engine functions, but which is located behind a specific worklist access function appropriate to the product implementation style.

2.5. The Need for Standardisation

The basic rationale to achieve standardisation of important workflow functional interfaces is driven by two major considerations:

- Ongoing support for business re-engineering & operational flexibility
- Integration requirements resulting from product specialisation and market variety

Business re-engineering & operational flexibility

The strategic importance of business process re-engineering and associated workflow implementations will lead to the requirement for sufficient flexibility of product to cope with ongoing business change, indeed this is one of the key motivations behind the use of the technology. This will include cases where several separate business processes have been implemented using different workflow products, and require to be re-engineered into a single composite process involving interaction between existing workflows. These requirements may arise due to reorganisation, legislative changes, changing business objectives, etc. As the use of electronic data interchange develops, these workflows are likely to embrace inter-organisation communications as well as those internal to a single organisation.

In these situations it is extremely likely that different products will be in use within different organisations or departments and the inability of such products to interoperate will cause a significant potential problem in coping with business change. The market projections for the penetration of workflow technology suggest very widespread adoption during the next 5-10 years, leading to the potential incompatibility problems seen in previous generations of information technology unless appropriate interworking standards are developed.

The early availability of such standards with subsequent product implementations will provide a degree of confidence to the market critical to the effective take up of workflow technology.

Specialisation and market variety

There are currently estimated to be in excess of a hundred different workflow (and related) products in the market, focussed on different aspects of functionality and data/application integration. The development of interworking standards will allow application choice of "best of breed" products for individual aspects of a workflow implementation. This may embrace process analysis and definition products from one vendor, coupled with workflow engine software from a different vendor, integrated with a client worklist handling application from a third.

An individual workflow may conveniently be broken down into several sub-processes each enacted on a specialist product suited to the specific data type, platform or network environment related to that particular sub-process. The availability of interworking standards will provide the opportunity to implement composite solutions to business process requirements, linking several such specialist products to meet the precise needs of the process.

Furthermore, many workflow applications require to integrate with other, existing or emerging applications, ranging from desktop office functions to corporate transaction processing / database. The provision of a standard interface to support this will reduce product complexity and the amount of specialist integration skills necessary during implementation.

Members of the Coalition, both vendors and users, recognise the potential importance of standards in all these areas and are co-operating in their definition.

3. Workflow Reference Model

3.1. Overview

The Workflow Reference model has been developed from the generic workflow application structure by identifying the interfaces within this structure which enable products to interoperate at a variety of levels. All workflow systems contain a number of generic components which interact in a defined set of ways; different products will typically exhibit different levels of capability within each of these generic components. To achieve interoperability between workflow products a standardised set of interfaces and data interchange formats between such components is necessary. A number of distinct interoperability scenarios can then be constructed by reference to such interfaces, identifying different levels of functional conformance as appropriate to the range of products in the market.

3.2. The Workflow Model

Figure 6 illustrates the major components and interfaces within the workflow architecture.

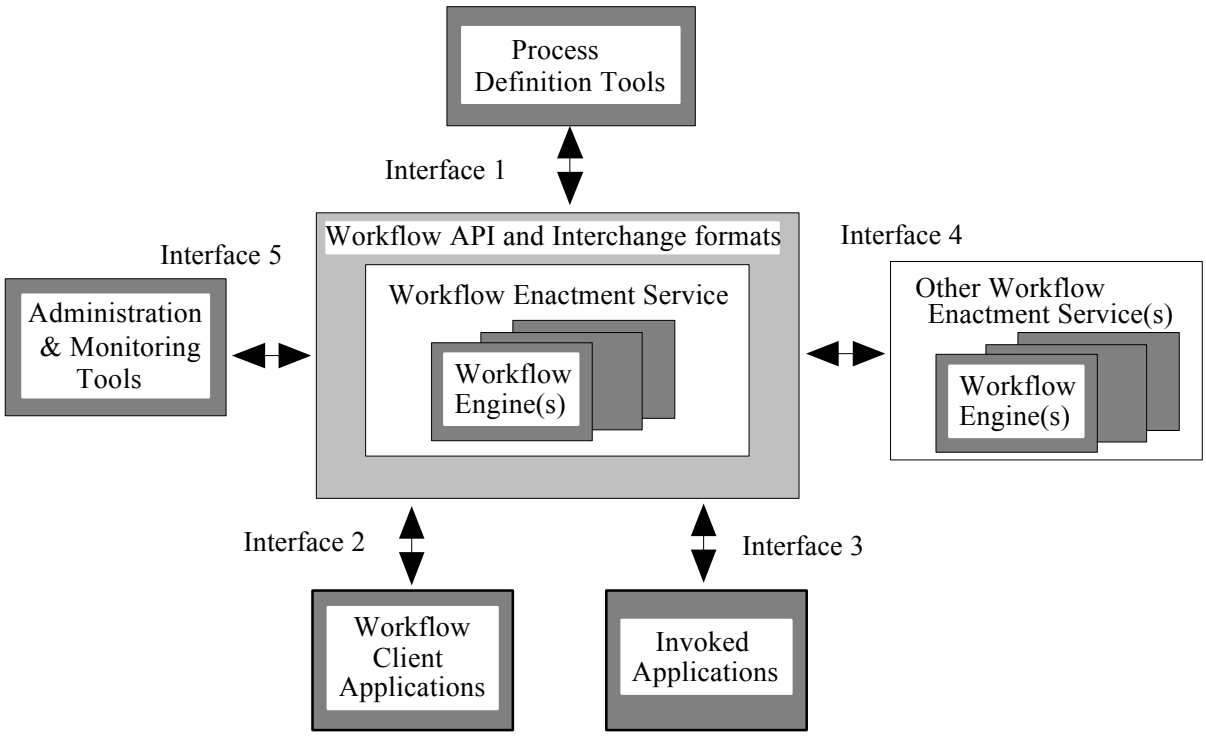

Fig 6 Workflow Reference Model - Components & Interfaces

The architecture identifies the major components and interfaces. These are considered in turn in the following sections. As far as possible, the detail of the individual interfaces (APIs and interchange formats) will be developed as a common core set using additional parameters as necessary to cope with individual requirements of particular interfaces.

The interface around the workflow enactment service is designated WAPI - Workflow APIs and Interchange formats, which may be considered as a set of constructs by which the services of the