### Business Process Technology

- **Topics**
  - Process Orientation
  - Workflow Defined
  - Workflow Classification
  - Terminology

- **Readings**
  - Lecture Notes

### History of Process Orientation

- **The age of the Crafts Worker**
  - Industrial Revolution
  - Divide and Conquer
  - Specialization, Productivity, Scale

- **The age of the Factory**
  - Post Industrial Revolution
  - Service based industries
  - Management, Control, White-collar workers, Bureaucracy
  - High efficiency within functional divisions

- **The age of the Specialist**
  - Highly fragmented processes made it difficult to view, measure or improve the overall process
  - Due to inward focus, activities and methods that benefited the functional division, but produced no value for, and in some cases negated the overall process
  - A function's practice that increased efficiency, such as batching, re-entering the data, caused delay, error and expense on the overall process

- **Process Orientation**
  - 1980s – Reference to cross-functional Business Processes
  - Process: "A complete end-to-end set of activities that together create value for a customer"

- **Process Re-engineering**
  - Enter: 1985–1990
  - Reengineering: Application of IT, Downsizing and Outsourcing

### Process Orientation

- Re-engineering didn’t survive, but process orientation did!
- Merging of process management methods
  - Continuous Process Improvement (CPI)
  - Total Quality Management (TQM)
  - Business Process Re-engineering (BPR)

Closer integration of business process management with process support systems
Elements of Process Analysis

- Business mission, strategy, and goals
- Business process
- Information Systems
  - Presentation
  - Application logic
  - Data management

Process Design Methodology

- A methodology for process (re)design
  - Frame the process
  - Understand the current (as-is) process
  - Design the new (to-be) process
  - Develop use-case scenarios

Process Enablers

- What are the factors that will help a process
  - achieve intended results
  - meet performance targets
  - within application constraints

Process Modelling Context

- Business Issues!
- Workflow Systems

A Workflow is defined as the automation of a business process, in whole or part, during which documents, information or tasks are passed from one participant to another for action, according to a set of procedural rules

(Workflow Management Coalition)

What’s New

- Flow of work (workflow) already exists in most business processes...nothing new
- Integration of the critical factors of an enterprise: people, infrastructure, processes...already recognized
- Binding the “Islands of Automation”...next logical step after advances in computing power, connectivity and global shift towards integrated solutions
- Workflow systems provide a “Process-Centric” approach...introduces a new quality in workflow management

- DBMS takes data management functionality out of application programs
- WFMS takes process logic out of application logic
What is the “Process”

- Material Processes
  - Move, store, transform, measure and assemble physical objects
  - Implement Manual tasks
- Information Processes
  - Create, process, manage and provide information
  - Implement automated and partially automated tasks
- Business Processes
  - Fulfil a business contract or satisfy a specific customer need
  - Description of an organization’s activities implemented (primarily) as information processes

Definitions

- “Workflow software is designed to improve business processes by providing the technology enabler for automating these aspects of the workflow: routing work in the proper sequence, providing access to the data and documents required by the individual work performers, and tracking all aspects of the process execution.”
- “… (workflow) works hand in glove with business process improvements to automate, trace, and control processes and enable collaboration in the workplace.”
- “We call the operational aspects of a business process - the sequence of tasks and who performs the tasks, the information flow to support the tasks, and the tracking and reporting mechanisms that measure and control them - the workflow.”
- “The main purpose of a workflow tool is to allow the process logic to be modified separately from the task logic embedded in the user applications.” (BIS Strategic Decisions)

Origins of Workflow Systems

- Office Automation
- Database Management
- E-Mail
- Document Management
- Software Process Management
- Business Process Modelling
- Enterprise Modelling and Architecture

Example Applications

- Insurance policy/claims processing (AVEMCO)
- Loan request handling
- Travel expense approvals
- Bug reporting and resolution
- Project proposal preparation
- System monitoring and exception handling
- System administration (e.g., DBA activities)
- Call centre management

Not just business processes!
Workflow Application Segments

<table>
<thead>
<tr>
<th>High Volume</th>
<th>Low Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collaborative</td>
<td>Ad hoc</td>
</tr>
<tr>
<td>Production</td>
<td>Administrative</td>
</tr>
<tr>
<td>Static Structure</td>
<td>Non-critical</td>
</tr>
<tr>
<td>Insurance Claims</td>
<td>Document Processing</td>
</tr>
</tbody>
</table>

Workflow Classification

- **Ad-hoc workflows** do not have a well-defined process model to follow. The execution path is more or less determined at runtime, and is basically controlled by humans. These are generally not mission critical, and accomplish the flow of information among people within the organization.

- **Production workflows** are also predictable and repetitive. They have well defined process models. These usually involve a number of information systems that may be heterogeneous and distributed. Production workflow management systems are thus, more complex and critical than ad-hoc or administrative.

- **Administrative workflows** are based on simple, repetitive and predictable processes. The ordering and coordination of tasks can thus be automated. However, these too, like ad-hoc workflows, do not involve complex information processing systems, and are generally not mission critical.

- **Collaborative workflows** are characterized by high mission criticality. They are mostly controlled by humans, and lack a well-defined process model. Thus most of the task ordering and coordination is determined at runtime by the workflow participants.

Factors and Technologies

- Communication Systems
- Video Conferencing
- Email
- Bulletin Board
- Shared Data spaces
- Distributed Hypertext
- Workgroup Computing
- Group Editor
- Meeting Support
- Planning System
- System Meeting Support
- Group
- Editor

Technology Aspects

Workflow Systems incorporate many technologies

- Database management
- Client server computing
- Heterogeneous distributed computing
- Mobile computing
- Graphical user interfaces
- Application (legacy and new) and subsystem integration
- Messaging
- Document management

Workflow Technology Solutions

- A new solution for business process automation
- Many products on the market in last few years
- Not all business processes suitable for WFMS
- The recent change of the underlying concepts moving towards light weight solutions
- Great prospects within B2B and e-business solutions

Technical Challenges

- Provide a mechanism to support process modifications allowing for collaborative style of work
- Consider collaboration between heterogeneous systems at the process level and WFMS level
- Provide better monitoring functions and tools to oversee many different views on the process
- Consider novel applications for web based IS systems with business process semi-automation
Success Factors

• Reliability
• Scalability (# of clients, # of processes, # of instances, ...)
• Cultural and human aspects

Business Activities

Any (business) activity has 3 dimensions:

– Intelligence (< 20 % of total costs)
  – market segmentation; competitive positioning; pricing strategy;
  – service quality benchmarking; identifying potential customers

– Operational (~ 10 % of total costs)
  – core business tasks; invoicing; sales transactions; accounting;
  – purchasing; inventory control

– Production (Up to 85 % of total costs)
  – Handling insurance claims; reviewing applications; meeting with
    potential customers; writing proposals; ordering goods and
    services

Hand-in-hand with ERP and KM

• Knowledge Management (KM): Provide the way to share and organize strategies, research and development

• Enterprise Resource Planning (ERP): Applications for traditional business activities like accounting, inventory, procurement, sales etc.

• Work Management: Assist in day-to-day production work, enhance productivity and quality of work

Terminology

• Workflow Model
• Workflow Instance
• Workflow Management System (WFMS)
• Workflow Activity
• Workflow Participant
• Workflow State

Workflow Model

• A business process model is a description of an organization's activities in terms of tasks, agents, rules and procedures and is engineered to fulfill a business goal

• A workflow model is a mapping of the business process into a form which supports automated manipulation
  – The workflow model is a definition of the tasks, ordering of the tasks, other resources and other aspects of the process
  – This is also referred to as the workflow schema or type

• Most, if not all, workflow models are defined as graphs which depict the flow or ordering of the tasks involved in the process, together with a description of other task properties
  – A workflow model is defined in a workflow modelling tool. Also known as process definition tool.

Workflow Instance

• A workflow instance denotes a particular occurrence of the business process as defined by the workflow model

• For example, we can define an admission workflow that handles student admission applications in a university. A particular application for admission represents an instance of the admission workflow.

• Different instances of the same workflow may perform a different subset of workflow tasks, i.e. they may have different execution paths in the workflow graph.

• An instance type is the set of instances that follow the same execution path through the workflow model.
Workflow Execution

- Workflow execution refers to
  1. The creation of workflow instances
  2. The scheduling of workflow activities
  3. The invocation of workflow applications

- Terms associated with workflow execution
  - Workflow Management System
  - Workflow Engine
  - Workflow Scheduler
  - Workflow Enactment Service

Workflow Management System

A system that defines, creates and manages the execution of workflows through the use of software, running on one or more workflow engines, which is able to interpret the process definition, interact with workflow participants and, where required, invoke the use of IT tools and applications.

Constituents of WF Management

- Workflow Management System
  - Workflow Model
  - Workflow Language
    - Syntax
    - Semantics
    - Editor
    - Simulator
    - Debugger
    - Build Time Tools
  - Implementation Model
    - Functional Components
    - Processes
    - Communication
    - Work List
    - Enactment Tools
    - Monitor
    - Analyzer
    - Administrator
    - Configurator
  - Run Time Tools
    - Implementation Architecture
    - Implementation Model
    - Processes
    - Databases
    - Communication

Workflow Management Data

- Process Definition
- Workflow Control Data
- Workflow Relevant Data
- Workflow Application Data
- Organizational Data

Workflow Activity

- Description of a unit of work that forms a logical step within a process
  - Manual Activity (send an email, dispatch items, visit a site, …)
  - Automated Activity (execute a database transaction, invoke application, …)
- The WFMS initiates the workflow activity
- The workflow activity notifies the WFMS upon completion
- What the activity actually does is beyond the scope of the WFMS

Workflow Participant

- A resource that performs the work represented by a workflow activity
- Generally applied to human resource, but may also refer to a machine based resource, such as an underlying application

Processing Entity  User
Agent
Client
Performer
Actor
Activity Work Item

The representation of the work to be processed by an activity within a workflow instance.
- Once initiated within an instance, an activity becomes a work item
- Activity and work item are representations of the same unit of work but at build and run time respectively
- An activity may generate one or more work items which together represent the work to be undertaken

Related terms:
- Work list
- Work list Handler

Workflow State

- A representation of the internal conditions defining the status of a process instance at a particular point in time
- WFMS maintains this status as part of the workflow control data

Activity State

- A representation of the internal conditions defining the status of an activity instance at a particular point in time
- Also maintained by WFMS as part of the workflow control data

State Transition

- A movement from one internal state (of a process or activity instance) to another within a workflow, reflecting a change in the status of the workflow.
- A state transition may be in response to an external event, a user call, a routing decision, …
- State transitions are recorded in the workflow logs and represent data useful for audit, archiving & process improvement

Relationships between Terms

Life of a Workflow

Conception to Evolution

- Process (Re)engineering
- Workflow Modelling
  - Process modelling
  - Resource mapping
- Product Evaluation
  - Enabling technologies
  - Existing infrastructure
- WFMS configuration
  - Workflow interfaces
  - Application integration
- Workflow Definition
- Enactment
- Archiving and Monitoring
- Exception Handling
- Process Evolution
Workflow Implementation Process

- Business Process Engineering
- Strategic Planning
- Project Planning
- Conceptual Design
- Developing WF Interfaces
- Implementing WF Test System
- Production Phase
- Workflow Test Run
- Implementing Production System
- Maintenance Improvement

Source: Scheer, 2000

Process Execution

- User initiates instance
- The next activity(s) in the control flow is scheduled
- Activity appears on the work list of the designated workflow performer
- Performer starts the activity
- WFMS is notified on completion
- Completion of the activity triggers subsequent activity(s) in accordance with the control flow logic of the workflow model

Activity Execution

- User starts activity.
- Activity describes program to be executed,
- Registered program is called,
- Program takes process relevant data from “in” and puts data into “out” data containers,
- Program communicates with user and processes the data,

Next
Workflow Modeling & Verification