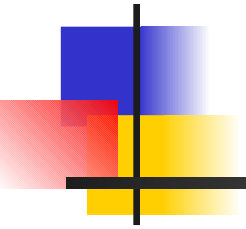
Workflow Concepts and Techniques



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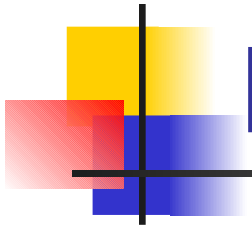
- Conclusion

Where to get more information?

- http://www.wfmc.org
  - **W**orkflow **M**anagement **C**oalition (WfMC):
  - non-profit, International Organization of Workflow vendors, users and analysts..
  - Define standards for the workflow system
  - Reference model
  - 300 Members: Adobe, Sun Microsystems, Oracle, Action Technology, DST Systems Inc, IBM, ILOG, SAP AG, NEC ….

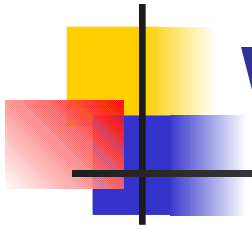
Where to get more information?

- Tutorials:
  - Workflow and Workflow management system, P. Peretti (Altan Group), Globecom Rio de Janeiro 1999
  - Workflow Management in the Internet Age, C. Mohan (IBM Almaden Research Center), école d'été objets répartis, Grenoble 1999.
- Books
  - Production Workflow: Concepts and techniques, by F. Leymann (IBM) and D. Roller (IBM), Prentice Hall, 1999
  - Workflow management, Models, Methodes and Systems, Wil van der Aalst and Kees van Hee 2002
  - Workflow Technology in Computer supported Co-coperative Work, edited by Michel Beaudouin-Lafon
- On the Web
  - www.w4.fr
  - www.workflowcours.com



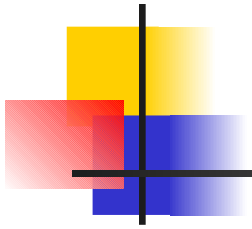
Business Process

- Procedures within an organization…
- A sequence of activities performed by various persons, the visible result being various pieces of paper.
- Examples:
  - loan process in a bank
  - claims processing in an insurance company...
  - travel authorization ☺



Workflow

- 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 (WFMC)..
  - Ensure that the right work is done at the right time by the right people, in the right order.



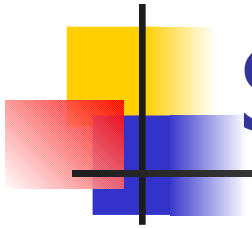
Workflow

- We call the operational aspects of a business process-the sequence of **tasks** and **who** performs them, the **information** flow to support the tasks, and the tracking and reporting mechanisms that measure and control them-the workflow (Mohan99)

Workflow (Wikipedia)

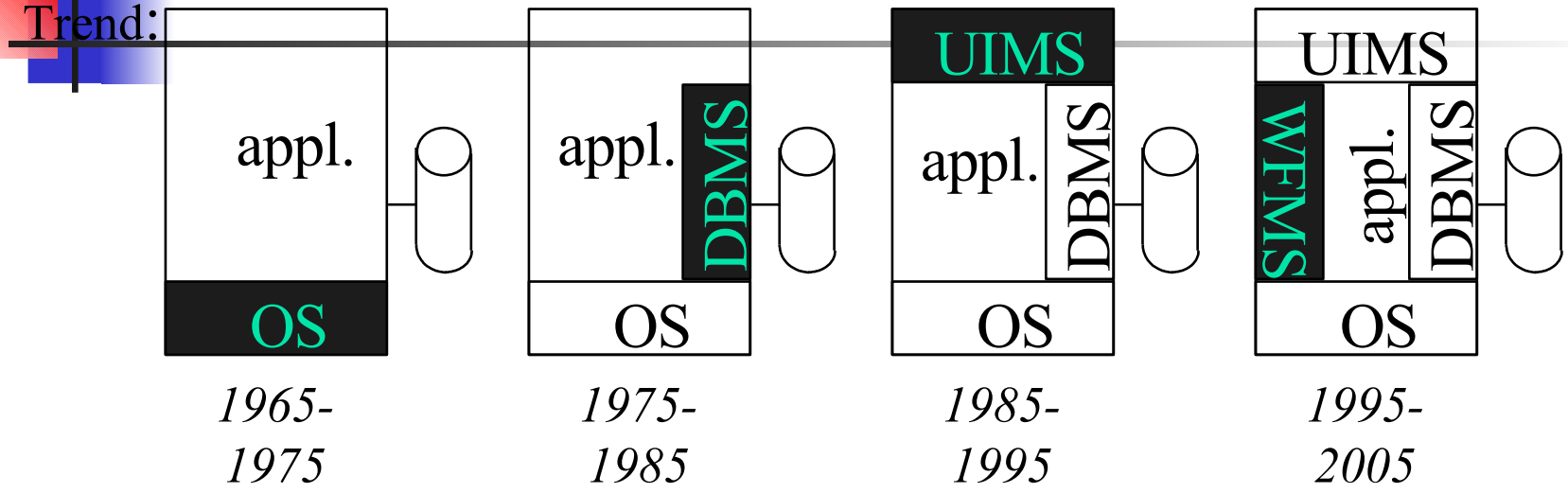
- A **workflow** is a reliably repeatable pattern of activity enabled by a systematic organization of resources, defined roles and mass, energy and information flows, into a *work process* that can be documented and learned. Workflows are always designed to achieve processing intents of some sort, such as physical transformation, service provision, or information processing.

Workflow Management System



- A system that completely defines, manages and executes « workflow » through the execution of software whose order of execution is driven by a computer representation of the workflow logic [WFMC]..

Relevance of workflow management systems

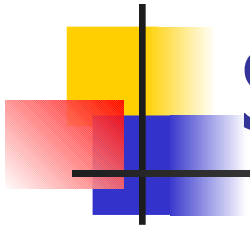


Processes:

- are becoming more important (BPR)
- are subject to frequent changes
- are becoming more complex
- are increasing in number

$\Rightarrow$ **Workflow Management System**

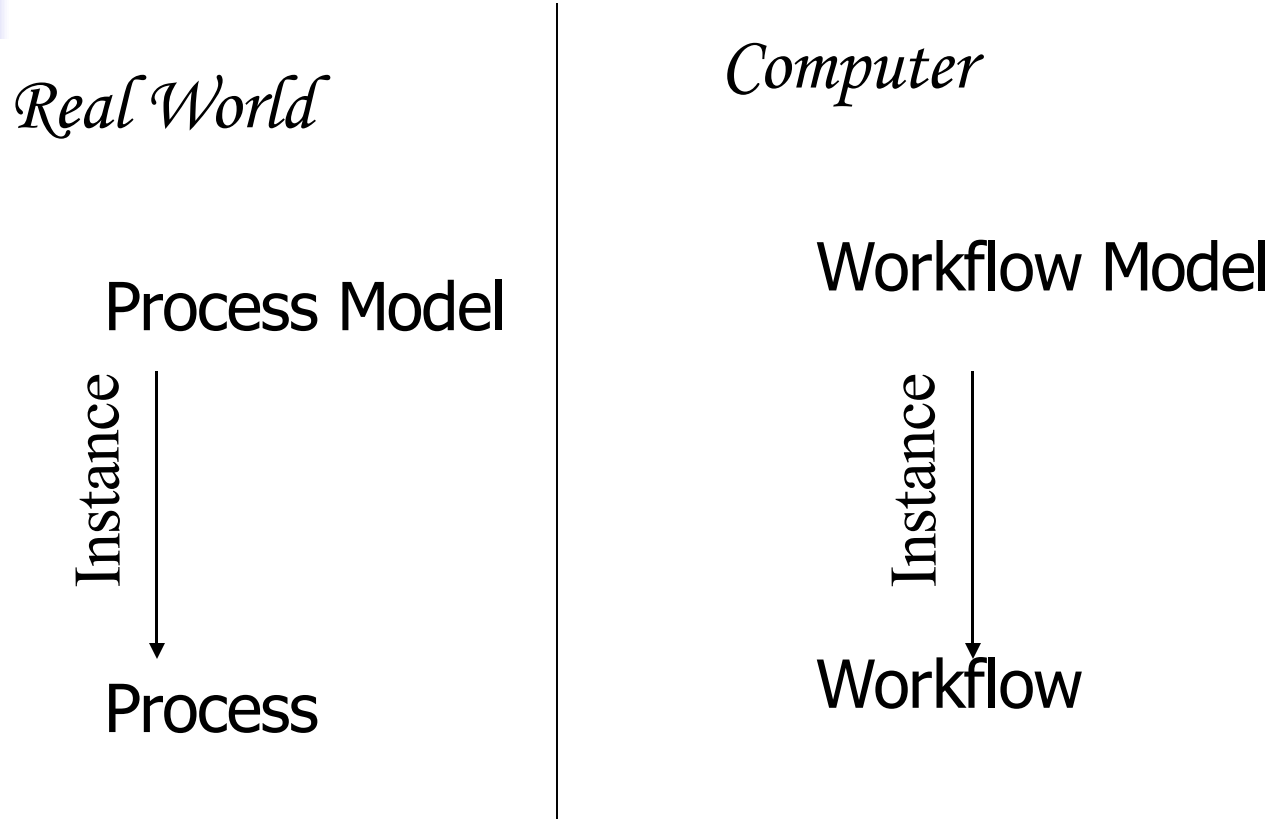
From: www.workflowcourse.com



Starting Point

- Business Process Reengineering at 1970
  - re-conception of enterprises processes
  - Better performance
    - Reducing the cost, execution time
    - Better quality
  - Be more productive, more attractive
  - Zero paper ..
- Modeling, monitoring, optimization of enterprises processes

Processes and Workflow

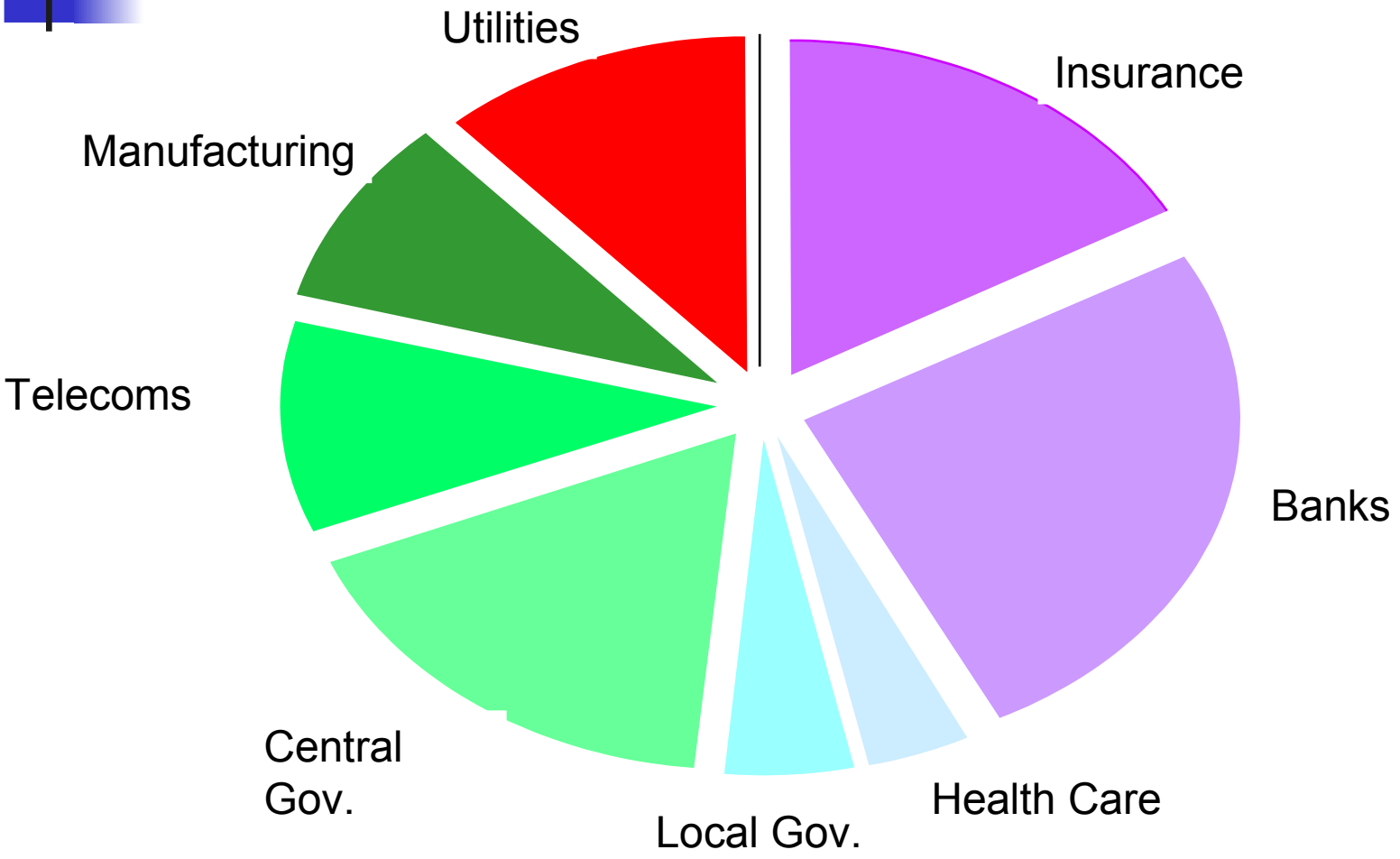


Applications Examples

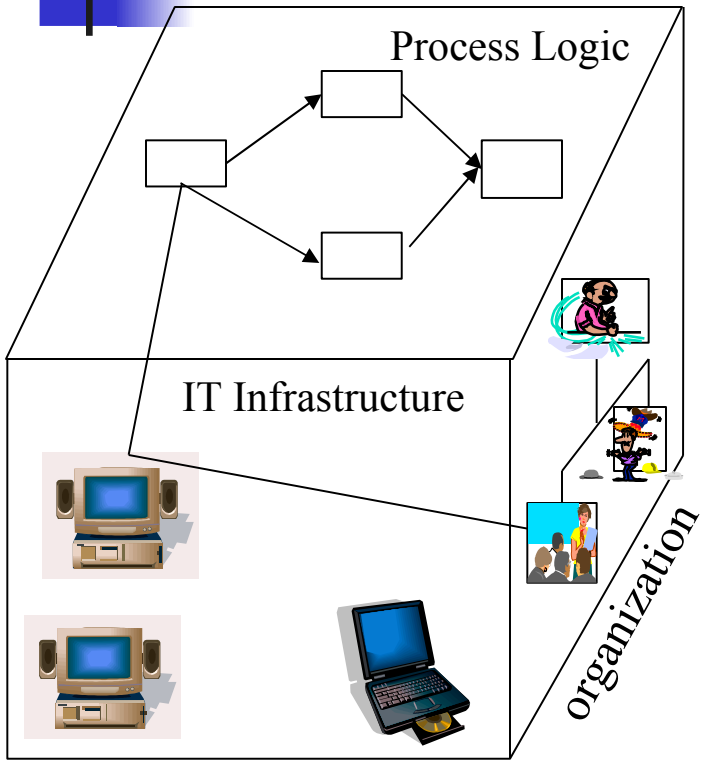
Every time individuals co-operate to achieve a common goal according to a predefined procedure workflow management is the appropriate tool.

- Insurance policy/claims processing (AVECOM)
- **Loan request handling**
- System administration (e.g. BDA activities)
- Healthcare claims (Empire Blue Cross Blue Shield)
- Order management (Microsoft)
- Travel expense approvals..
- Technical documentation creation…
- Quality management
- Concurrent Engineering

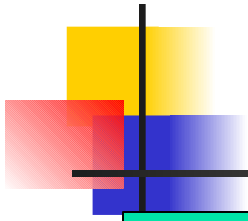
Users (USA 1998)



Dimensions of Workflow

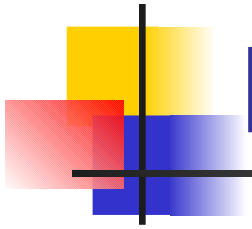


- Three dimensions:
  - Process Logic
    - Which Activities ?
    - In which Order ?
  - Organization dimension
    - Who ?
  - IT infrastructure ..
    - What ?



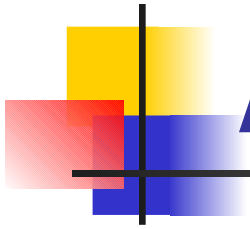
Business Logic

- Process
- Activities
- Control flow
- Data flow



Process

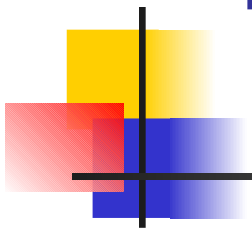
- Network of activities and their relationships
- Description the order of the execution of the activities to achieve common objective



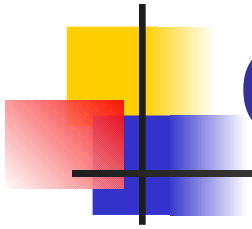
Activity

- A logical, self-contained unit of work within the process.
- A step in the process, each:
  - name,
  - type,
  - pre- and post-condition,
  - input container and output container

Ex: Loan Request Handling

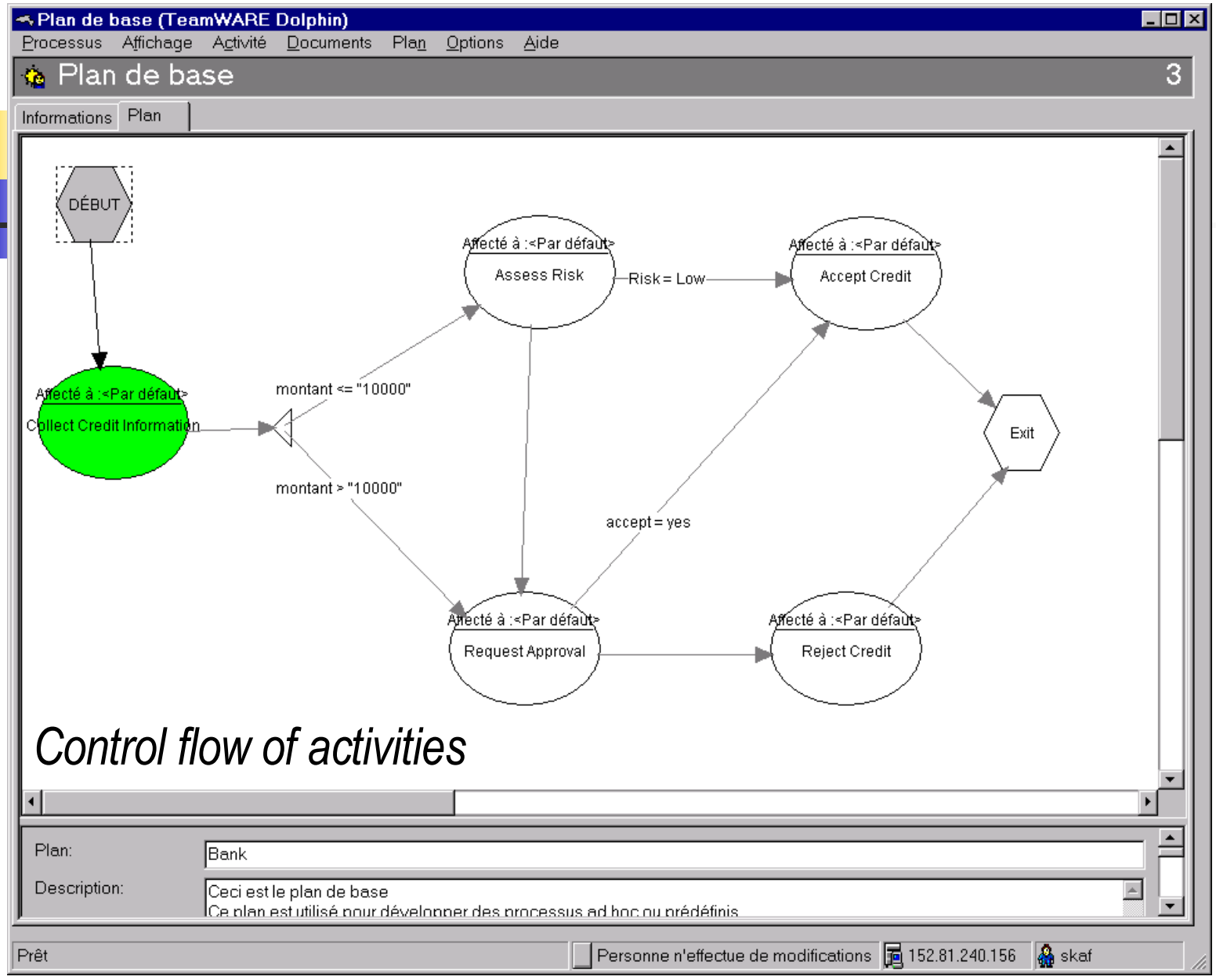


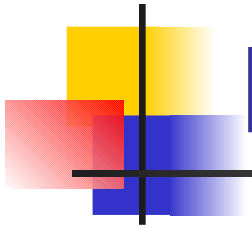
- Activities
  - Collect Credit Information
  - Assess Risk (amount <= 10 000 FF)
  - Request Approval (amount > 10 000 FF or High Risk)
  - Accept Credit
  - Reject Credit



Control flow

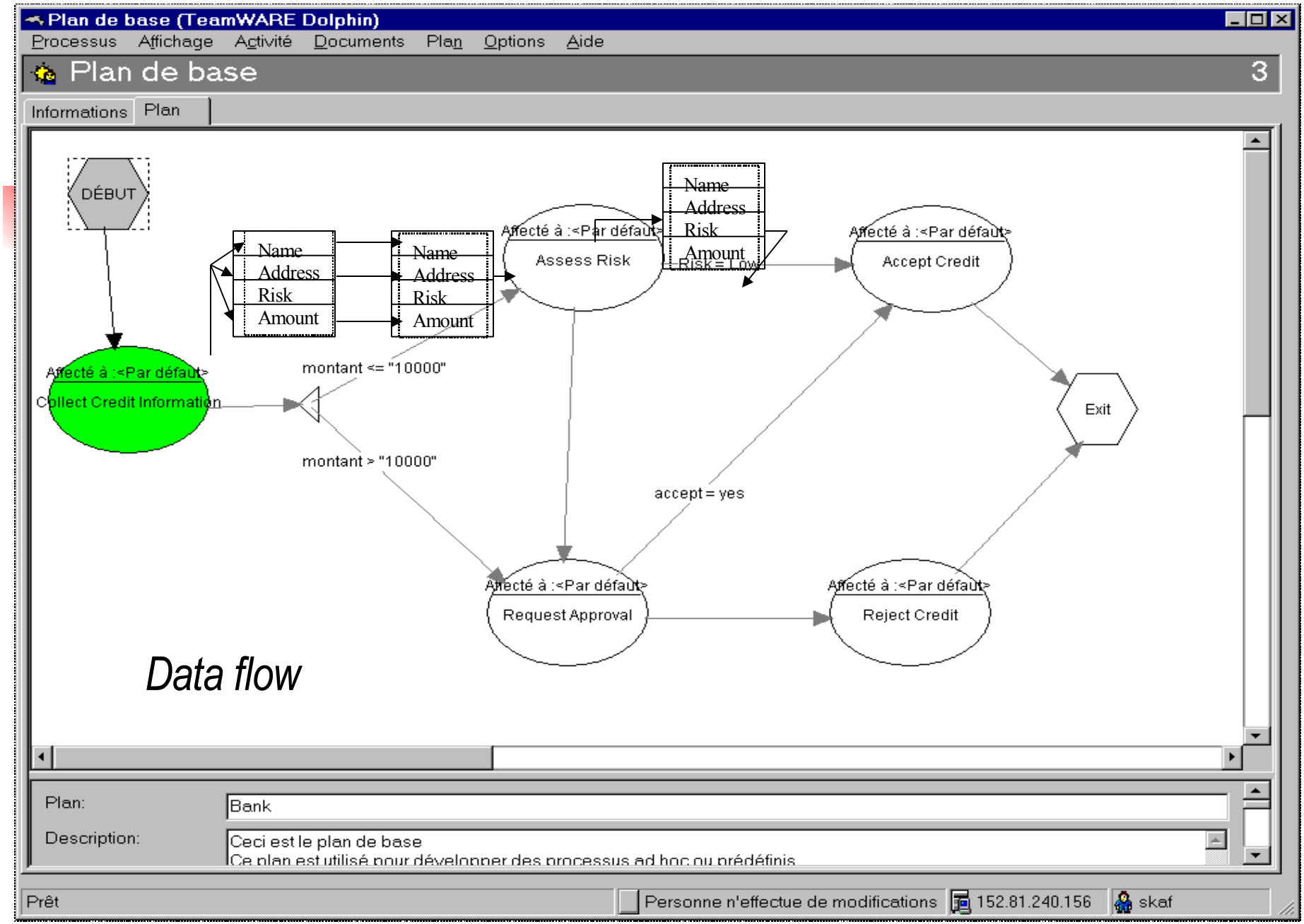
- Activities are related to one another via flow control conditions (transition information).
- Each individual transition has three elementary properties:
  - the from-activity,
  - the to-activity
  - and the condition under which the transition is made.


Plan de base (TeamWARE Dolphin)
Processus Affichage Activité Documents Plan Options Aide
Plan de base 3
Informations Plan
DÉBUT
Affecté à :<Par défaut>
Collect Credit Information
montant <= "10000"
montant > "10000"
Affecté à :<Par défaut>
Assess Risk
Risk = Low
Affecté à :<Par défaut>
Accept Credit
Exit
accept = yes
Affecté à :<Par défaut>
Request Approval
Affecté à :<Par défaut>
Reject Credit
Control flow of activities
Plan: Bank
Description: Ceci est le plan de base
Ce plan est utilisé pour développer des processus ad hoc ou prédéfinis
Prêt
Personne n'effectue de modifications
152.81.240.156
skaf



Data Flow

- Input Container
  - List of typed variables used as an input for the activity
- Output Container
  - List of typed variables resulted by the activity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Plan de base
3
Informations
Plan
DÉBUT
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Address
Risk
Amount
Name
Address
Risk
Amount
Affecté à :<Par défaut>
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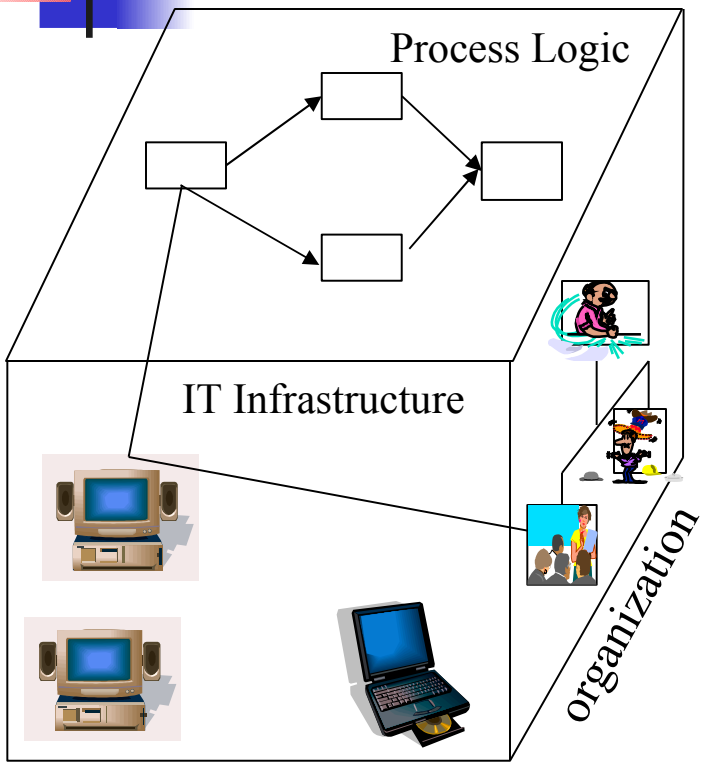

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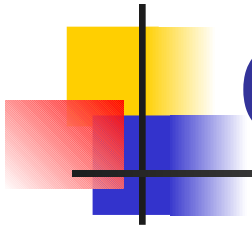
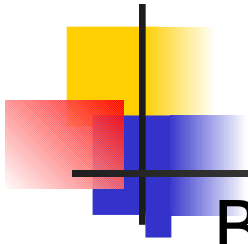


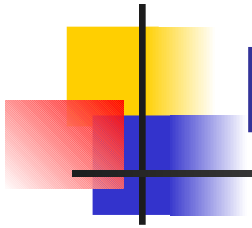
Organizational Dimension

- The structure of the organization
  - Interne Database
  - Shared database with another tool
- A request about the persons associated with each activity
  - a set of people of appropriate skill or responsibility
  - Role….



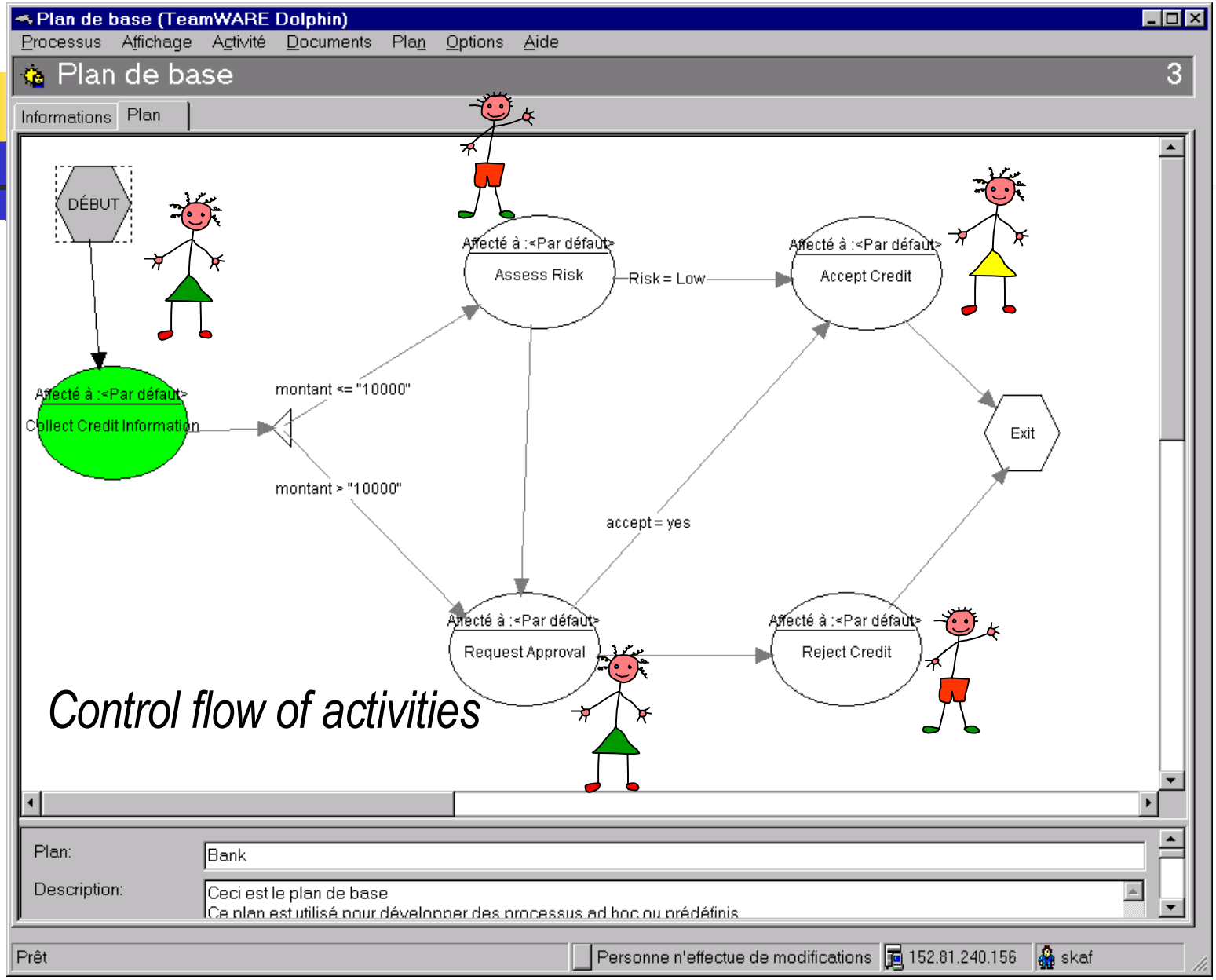
Role

- Basis for access control and execution control.
- The execution of activities is associated with roles rather than end-user => flexibility; handle exception..
- Ex: “Accept Credit” is executed by the administrator (not by Micheal :-)
- Role: associated with an actor; a group of actors..
- Ex: administrators; «send to all»



Participant

- A person, program, group or entity that can fulfill roles to execute, to be responsible for…
- Human participant is an actor...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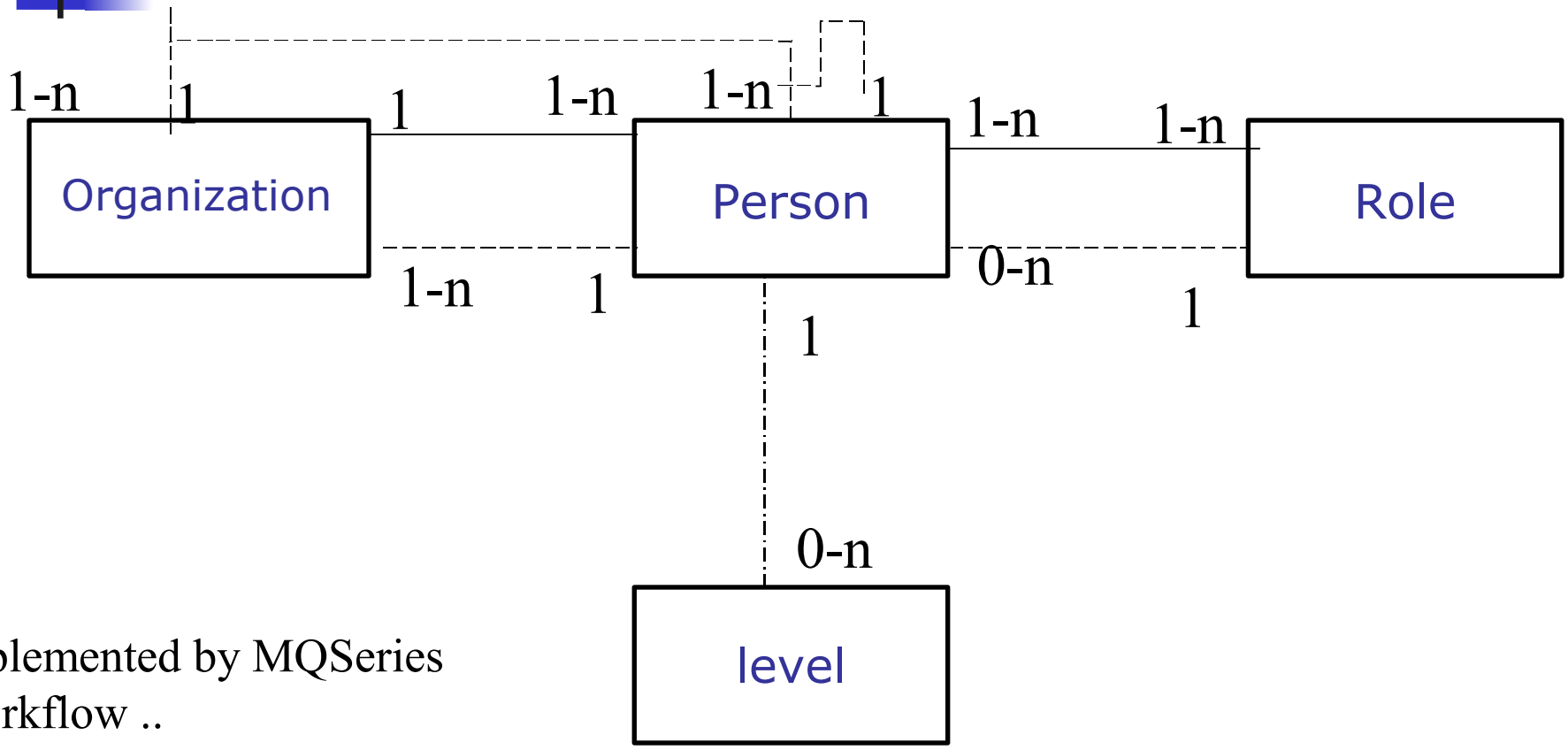
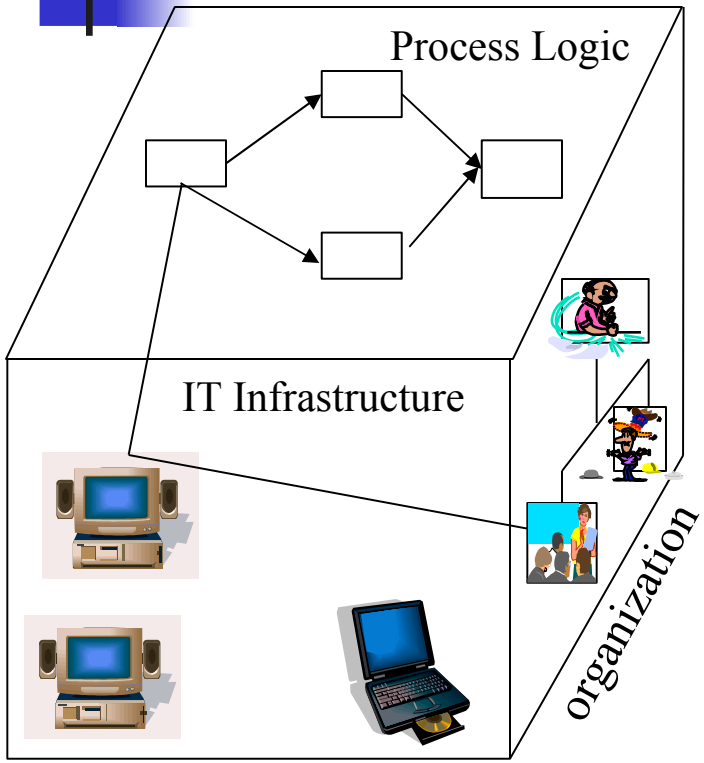
Organization Metamodel



Implemented by MQSeries Workflow ..

Dimensions of Workflow



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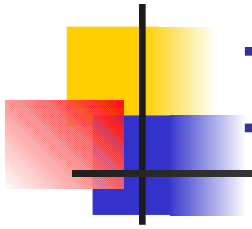
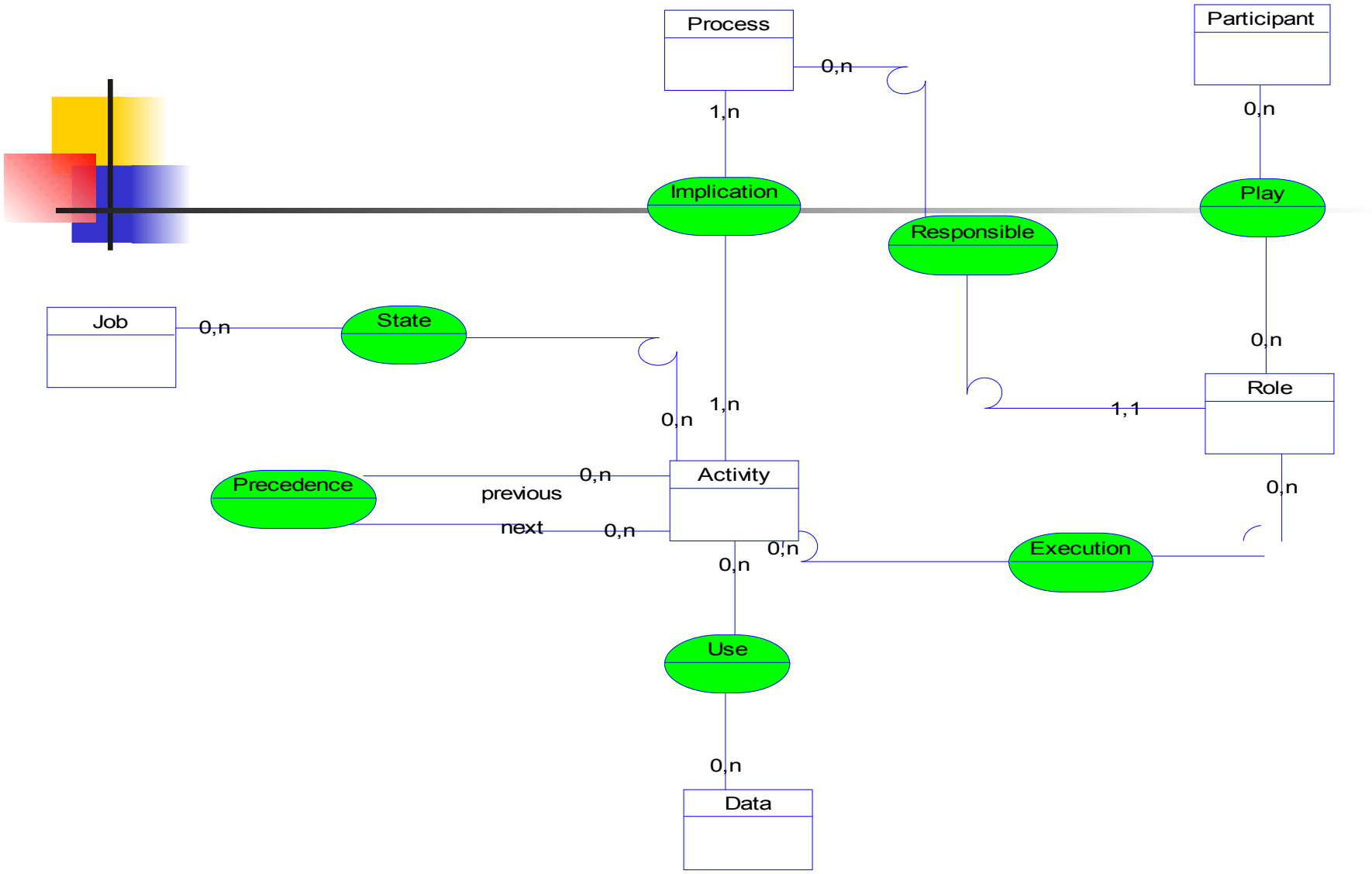


IT Dimension

- Programs that implement the activities
  - OS
  - Network
  - Distributed or not ??
  - Data bases access



Workflow Conceptual Architecture

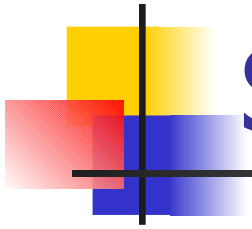
Workflow Concepts

A lot of words around workflow

Activity	process	role
Operation	Flow of control	actor
task	transation	position
step	route	user
work	path	group
job	procedure	resource
		staff
		Organizational unit

What is done ***Relationships among things done*** **Who does**

Workflow Management System

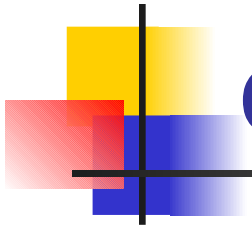


- A system that completely defines, manages and executes « workflow » through the execution of software whose order of execution is driven by a computer representation of the workflow logic [WFMC]..
- Common characteristics:
  - basis for developing integration
  - interoperability

Workflow system's components

- **Flow modeling component** (specification module or the build time system)
  - administrators and analysts to define processes (procedure) and activities
  - analyze and simulate them
  - assign to people
  - view work process statistics
  - make change to process

Workflow system's components



- **Workflow execution (enactment) component (run-time system):**
  - end user interface
  - workflow engine
    - execution environment;
    - coordinating activities and processes
    - unit of work to flow from on user's workstation to another

Workflow system's components

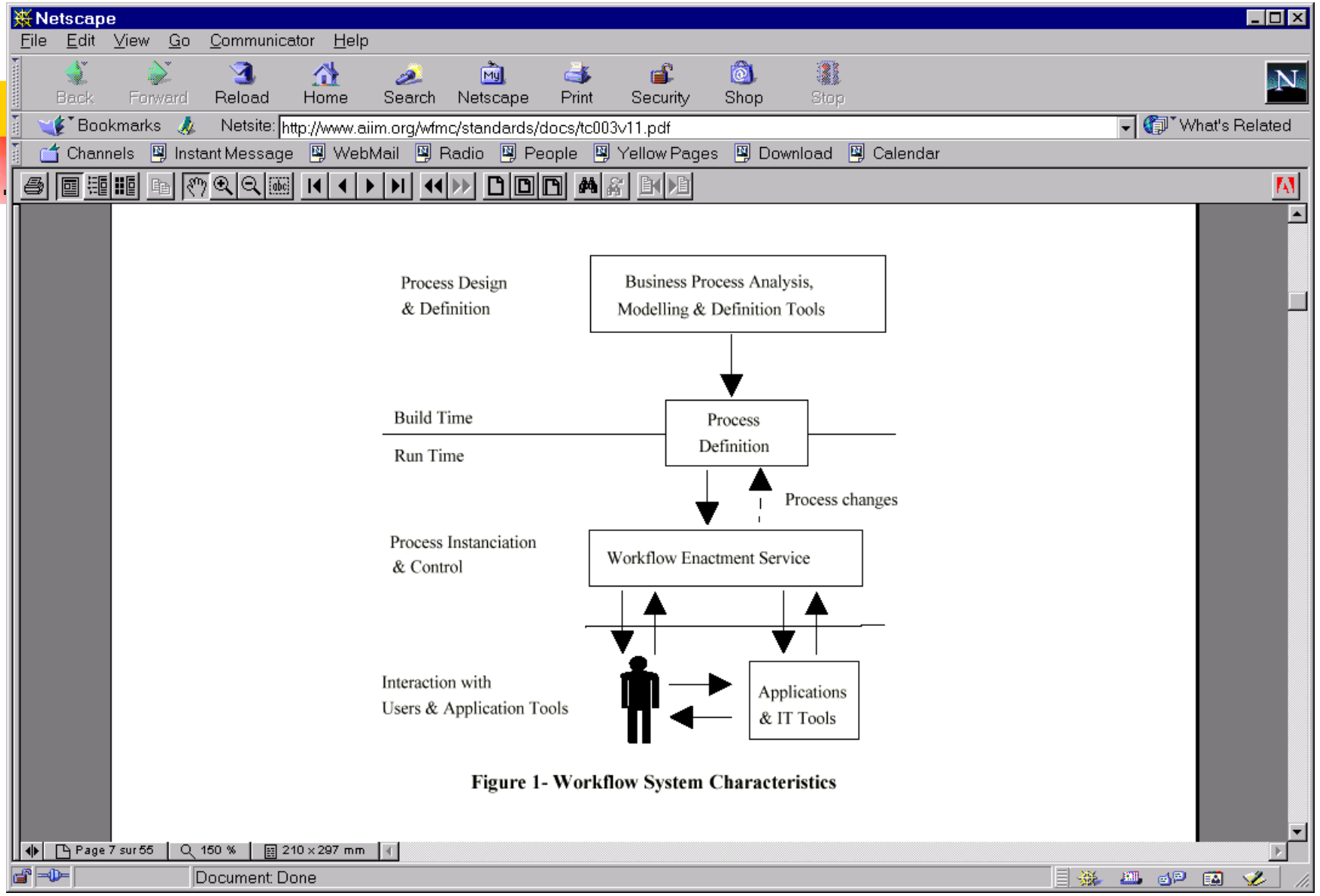
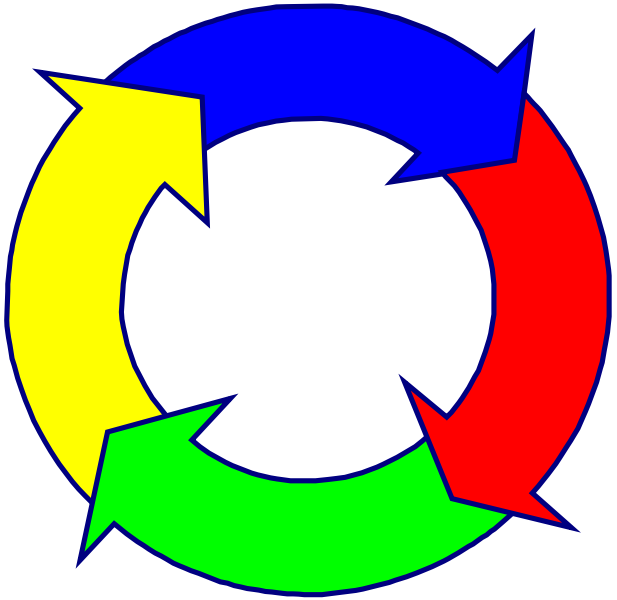


Figure 1- Workflow System Characteristics

In practice :The BPM life-cycle

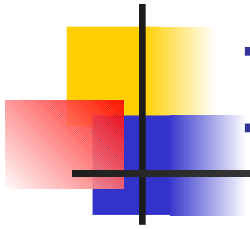
diagnosis

process enactment



process design

implementation/ configuration



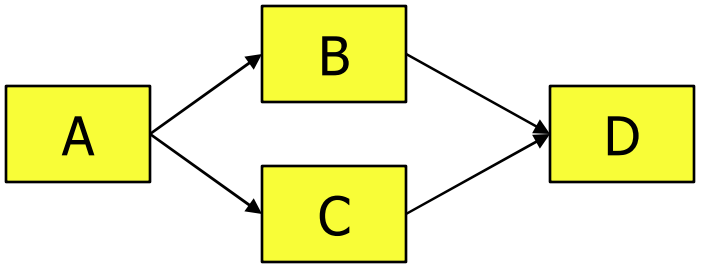
In practice

- Step 1:
  - Process Modeling
- Step 2:
  - Process Execution

Process modeling

- Graphical Visual representation
  - Based on Petri nets (XPDL : XML process definition language)
- Other approaches
  - Actives rules, state-transition diagram,

Graph based modeling



Rules based modeling

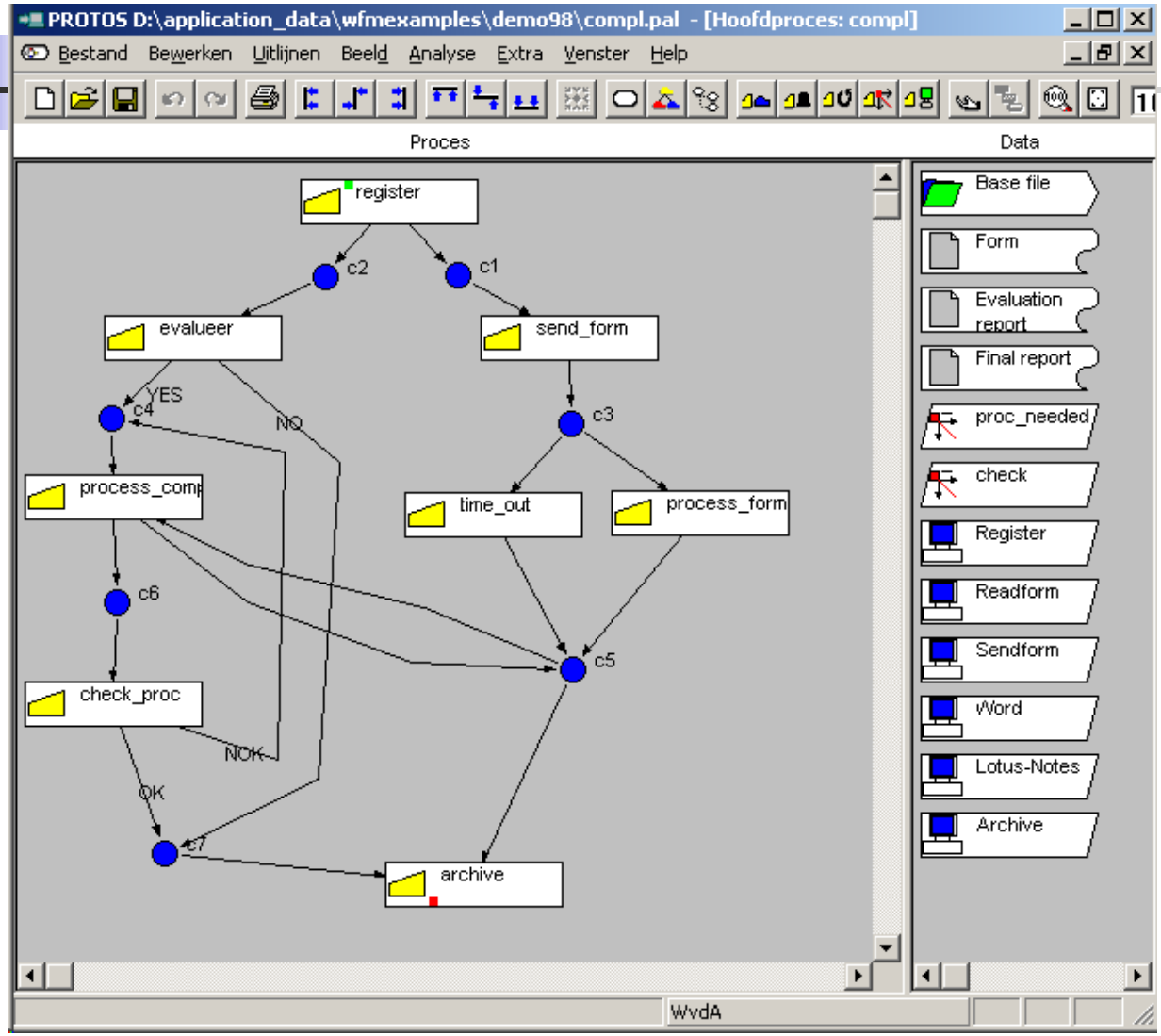
[A, done] enables [B, start]

[A, failed] enables [C, start]

[B, failed | C, failed] enables [WF, abort]

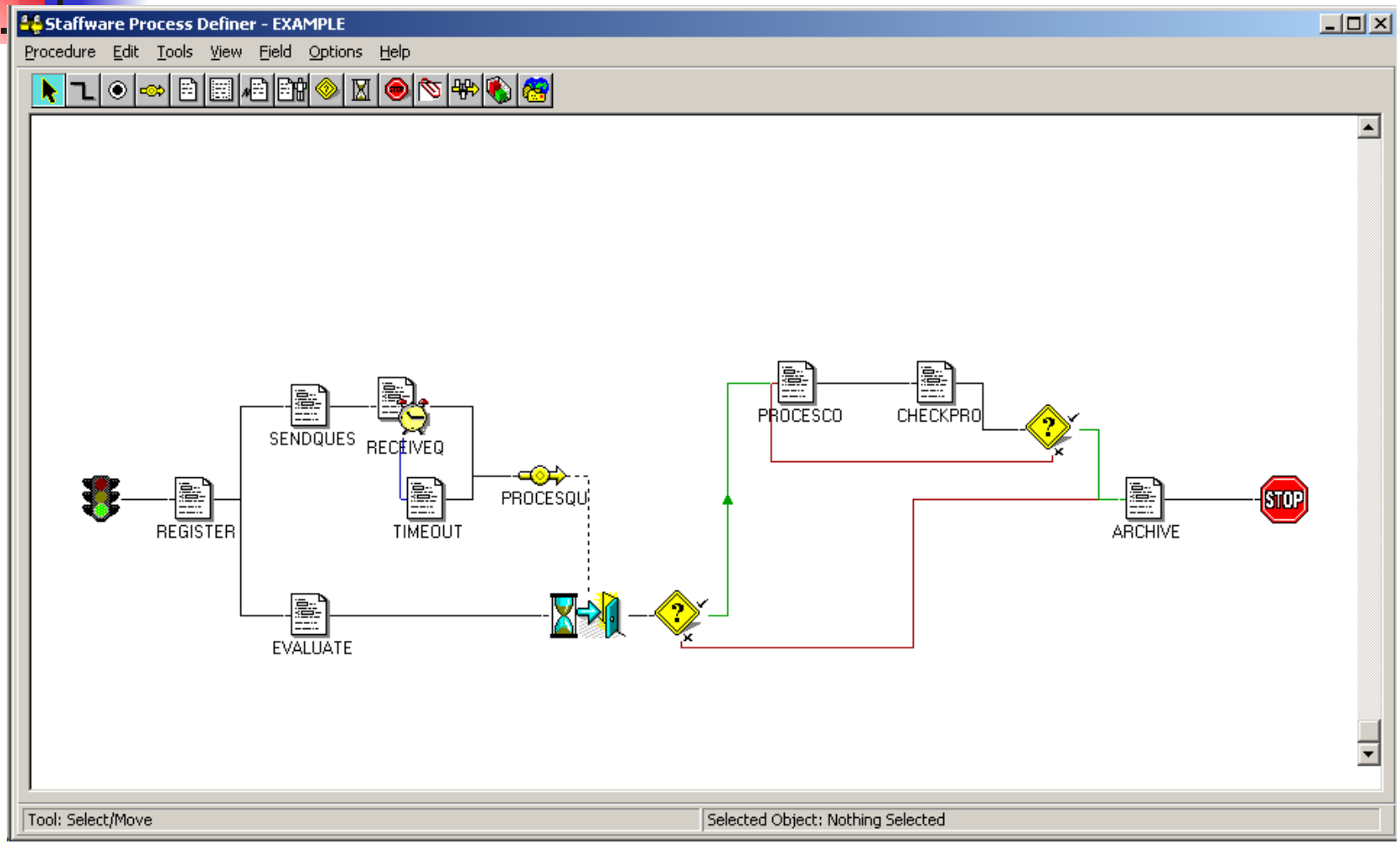
…

Protos (extended Petri nets)



From: www.workflowcourse.com

Staffware



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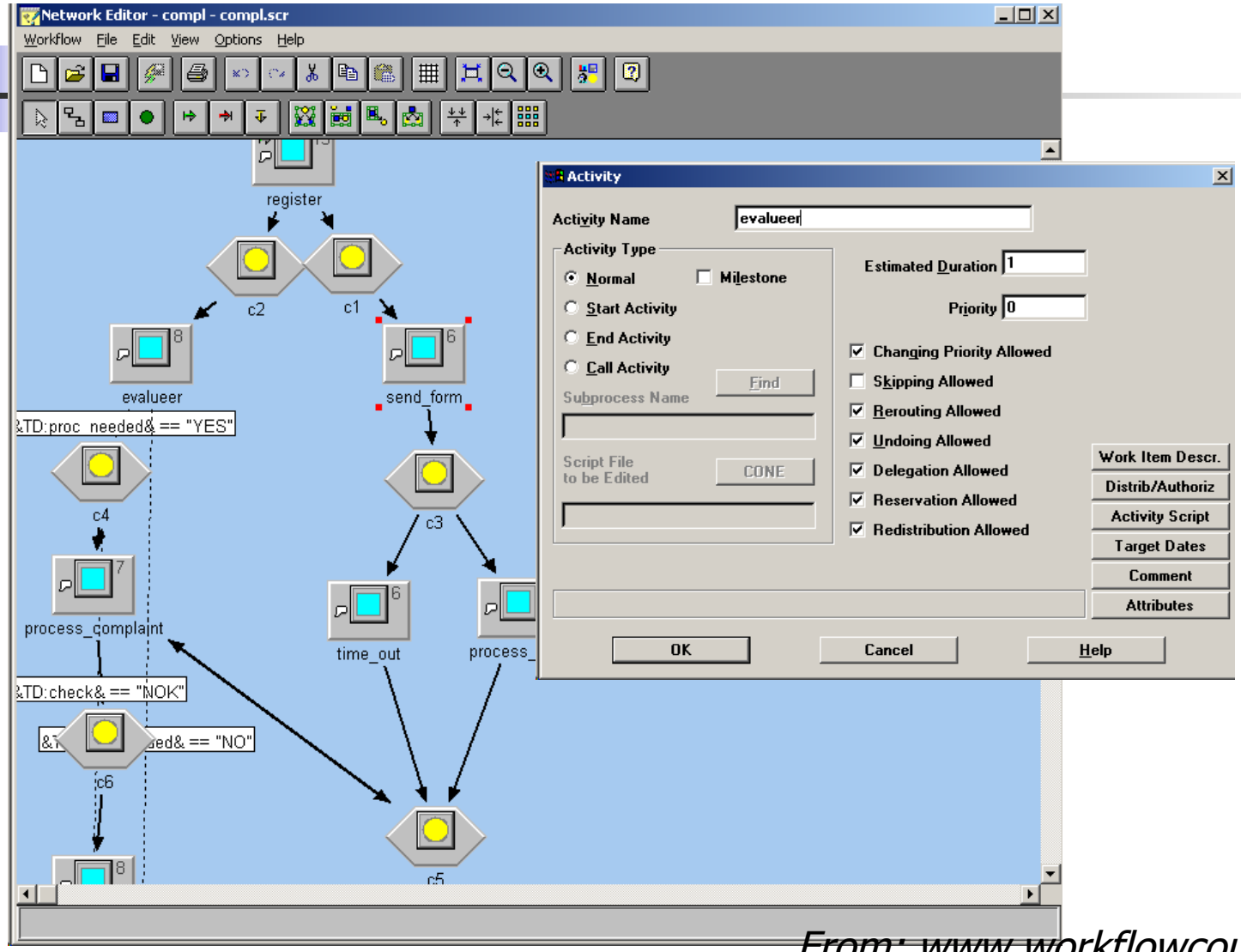
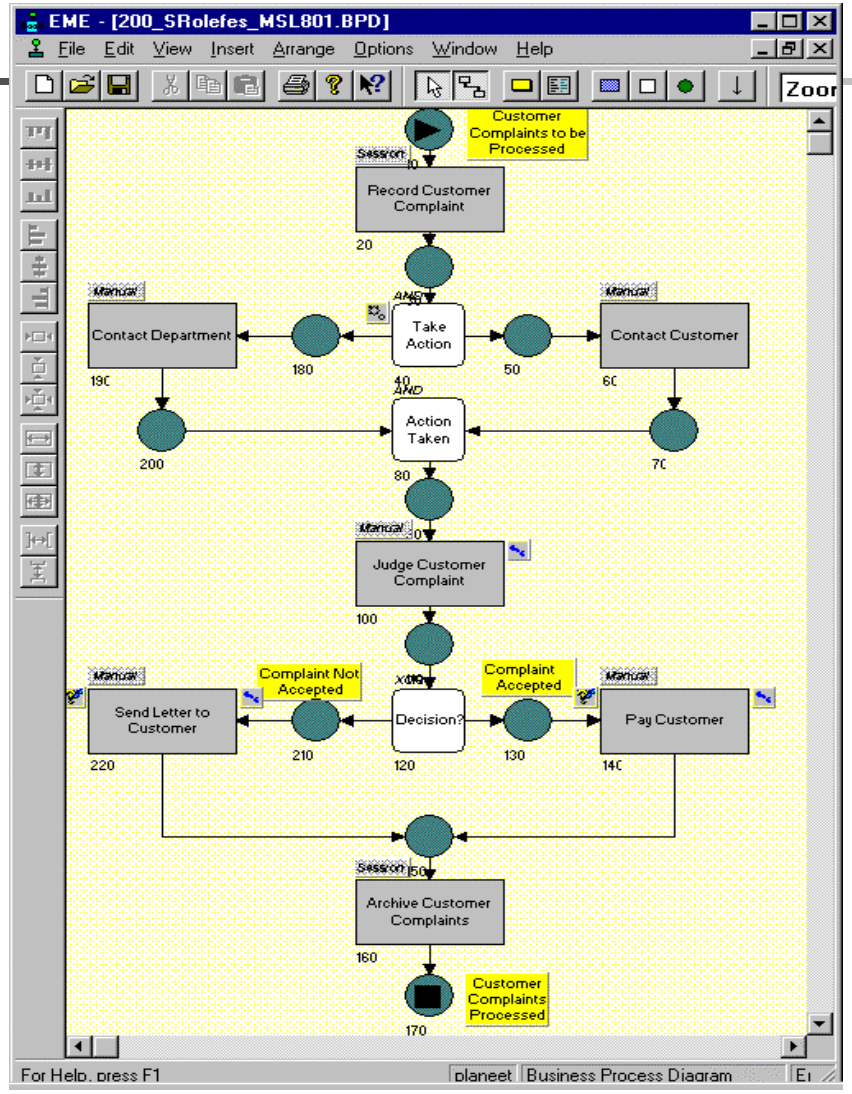
COSA (Petri nets)

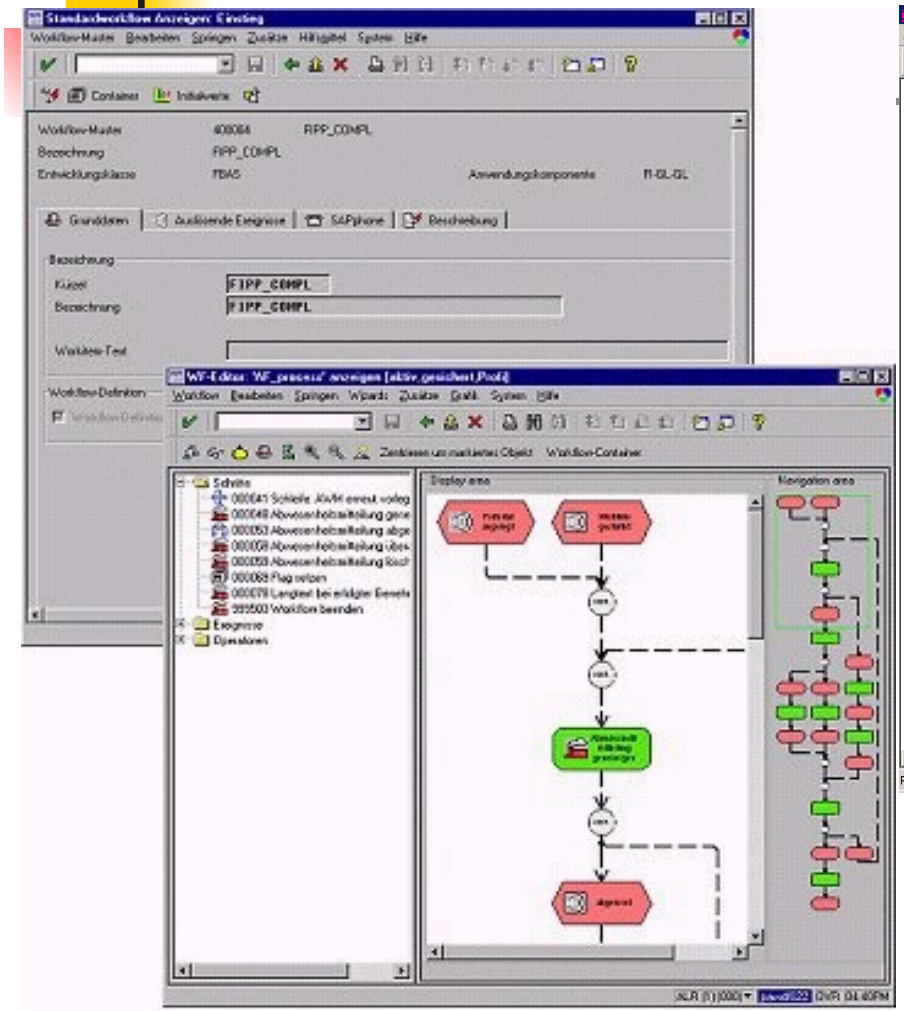


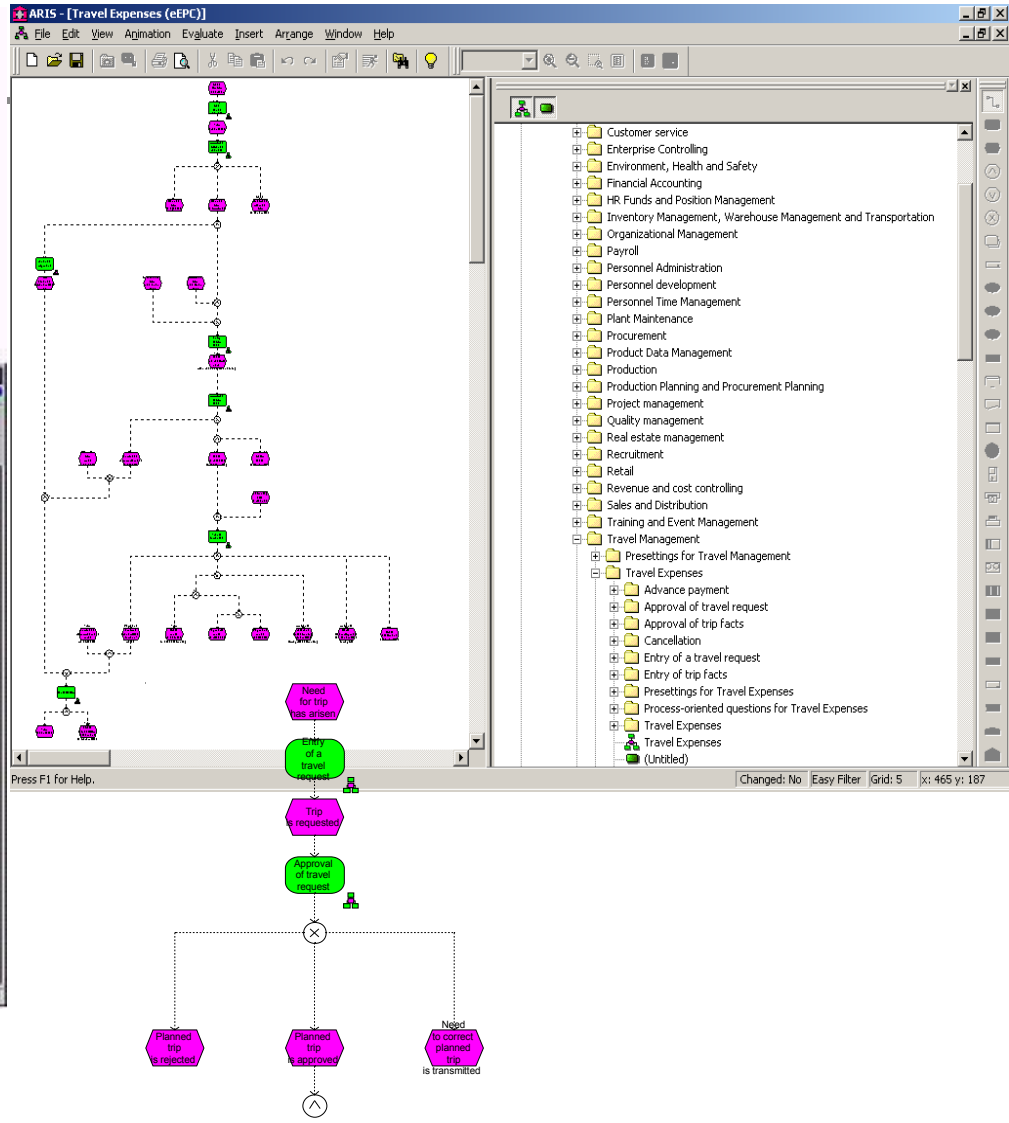
From: www.workflowcourse.com

Baan DEM

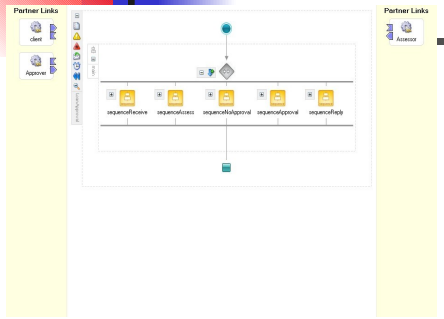

EME - [200_SRolefes_MSL801.BPD]
File Edit View Insert Arrange Options Window Help
Customer Complaints to be Processed
Record Customer Complaint
20
Contact Department
180
Take Action
50
Contact Customer
Action Taken
80
Judge Customer Complaint
100
Complaint Not Accepted
Complaint Accepted
Send Letter to Customer
210
Decision?
120
130
Pay Customer
220
140
Archive Customer Complaints
160
Customer Complaints Processed
170
For Help, press F1
planeet
Business Process Diagram

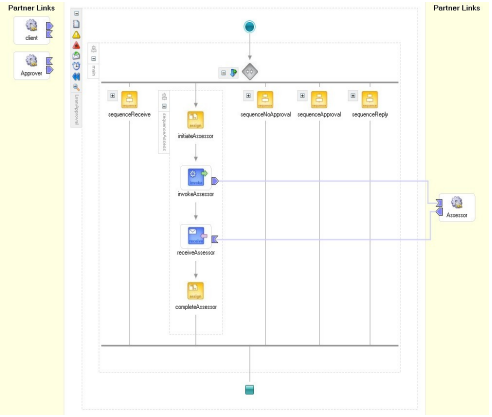
Event driven process chains (ARIS/SAP)





(Oracle) BPEL



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  <flow name="Flow_1">
    <links>
      <link name="receive-to-assess"/>
      <link name="receive-to-approval"/>
      <link name="approval-to-reply"/>
      <link name="assess-to-setMessage"/>
      <link name="setMessage-to-reply"/>
      <link name="assess-to-approval"/>
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transitionCondition="bpws:getVariableData('inputVariable','payload','/client:LoanApprovalProcessRequest/client:amount') &lt; 10000"/>
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transitionCondition="bpws:getVariableData('inputVariable','payload','/client:LoanApprovalProcessRequest/client:amount') &gt;= 10000"/>
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createInstance="yes"/>
    </sequence>
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      <source linkName="assess-to-approval" transitionCondition="bpws:getVariableData('risk') != 'low'"/>
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        <copy>
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        </copy>
        <copy>
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variable="receiveAssessor_onResult_InputVariable" createInstance="no"/>
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    <sequence name="sequenceNoApproval">
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      <source linkName="setMessage-to-reply"/>
      <assign name="setAccepted">
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        </copy>
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    </sequence>
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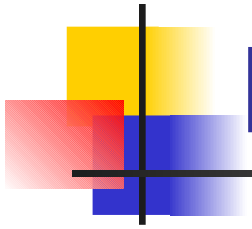
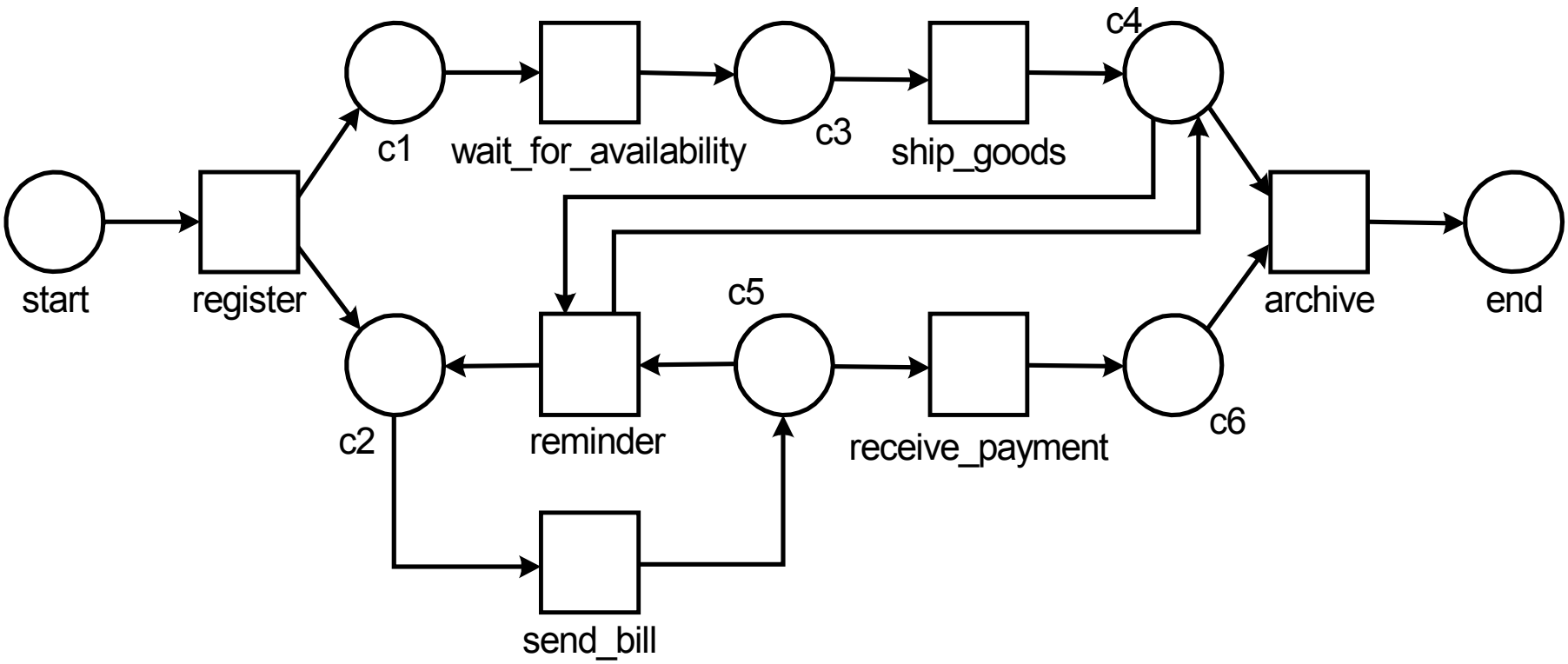
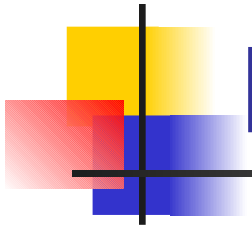


Petri nets as a basis

- There are many modeling techniques and tools
  - BPEL, BPMN, DFD, ISAC, SADT, PN, HLPN, PA, FC, UML, ...
  - Simulation tools, design tools, CASE tools, WFMS, Focus on the essential concepts rather than (system-)specific languages.

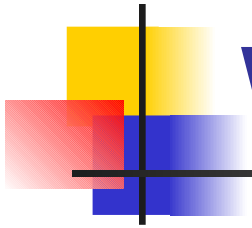
Example of a process model: A Petri net modeling order processing





Process Optimization

- Analysis tool
  - Cost and time estimation
  - Based on the process model and/or real (statistic/process discovery)
- Simulation
- Based on analysis and simulation
  - Detection on expensive activities (time, ..)
  - Redefining of the process
- Process is ready



Work case (Job)

- An instance of the process
- Has its own data
- Example:
  - 2 loans request from Micheal, Jean

  => 2 work cases
  - Micheal Loan request
  - Jean Loan request..

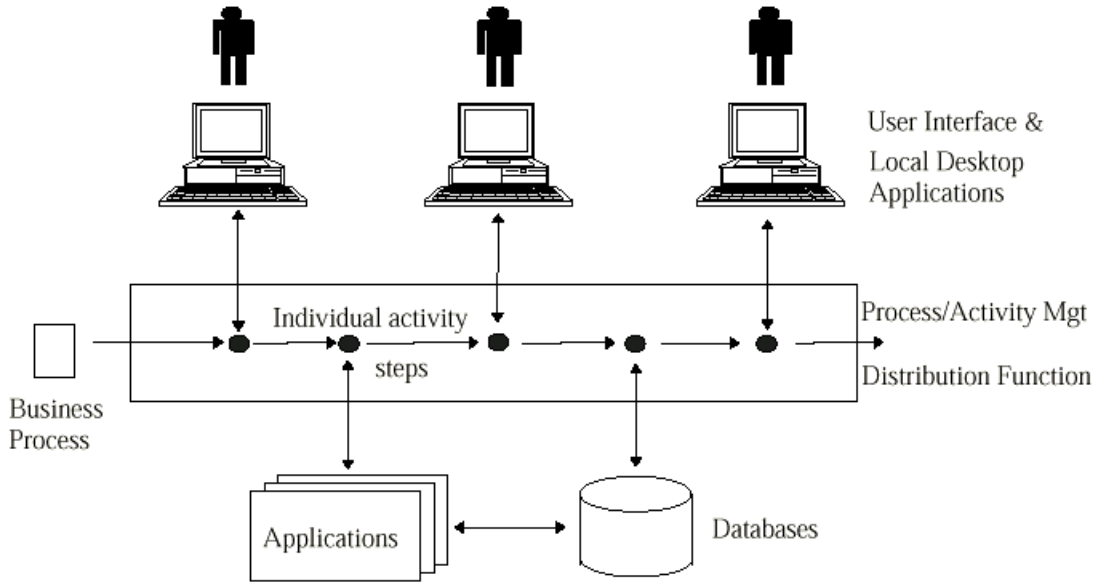
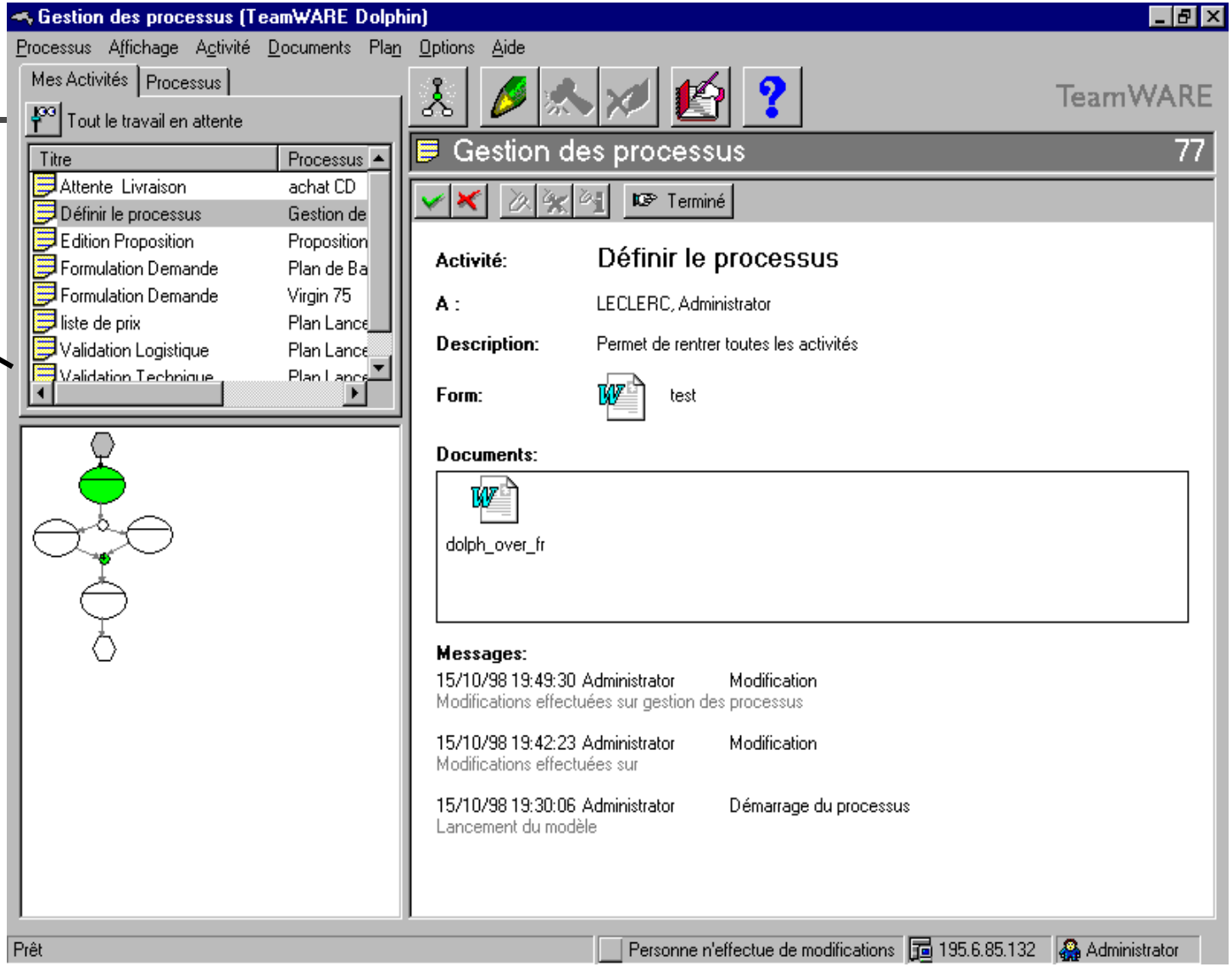
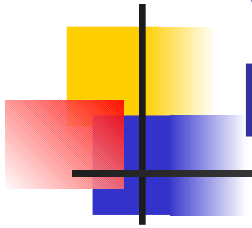


Fig 2 - Distribution within the workflow enactment service

Work List

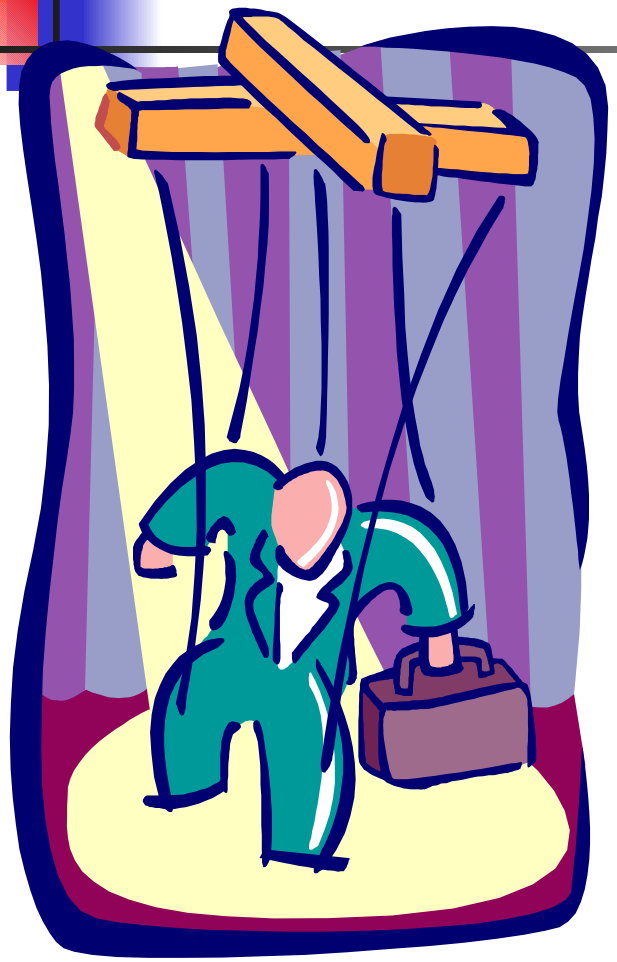

Gestion des processus (TeamWARE Dolphin)
Processus Affichage Activité Documents Plan Options Aide
Mes Activités
Processus
Tout le travail en attente
Titre
Processus
Attente Livraison
achat CD
Définir le processus
Gestion de
Edition Proposition
Proposition
Formulation Demande
Plan de Ba
Formulation Demande
Virgin 75
liste de prix
Plan Lance
Validation Logistique
Plan Lance
TeamWARE
Gestion des processus
77
Terminé
Activité:
Définir le processus
A :
LECLERC, Administrator
Description:
Permet de rentrer toutes les activités
Form:
test
Documents:
dolph_over_fr
Messages:
15/10/98 19:49:30 Administrator
Modification
Modifications effectuées sur gestion des processus
15/10/98 19:42:23 Administrator
Modification
Modifications effectuées sur
15/10/98 19:30:06 Administrator
Démarrage du processus
Lancement du modèle
Prêt
Personne n'effectue de modifications
195.6.85.132
Administrator

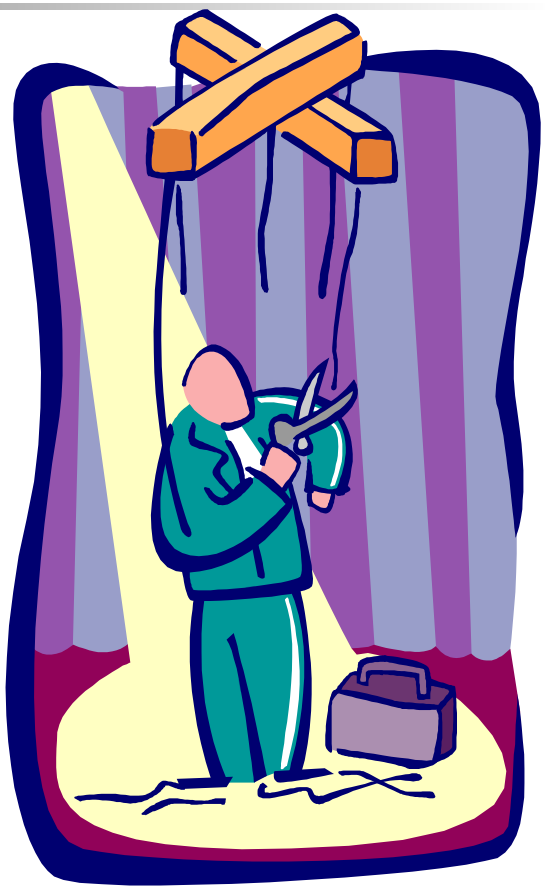
Work List : Work distribution needs to be described: Who is doing what?



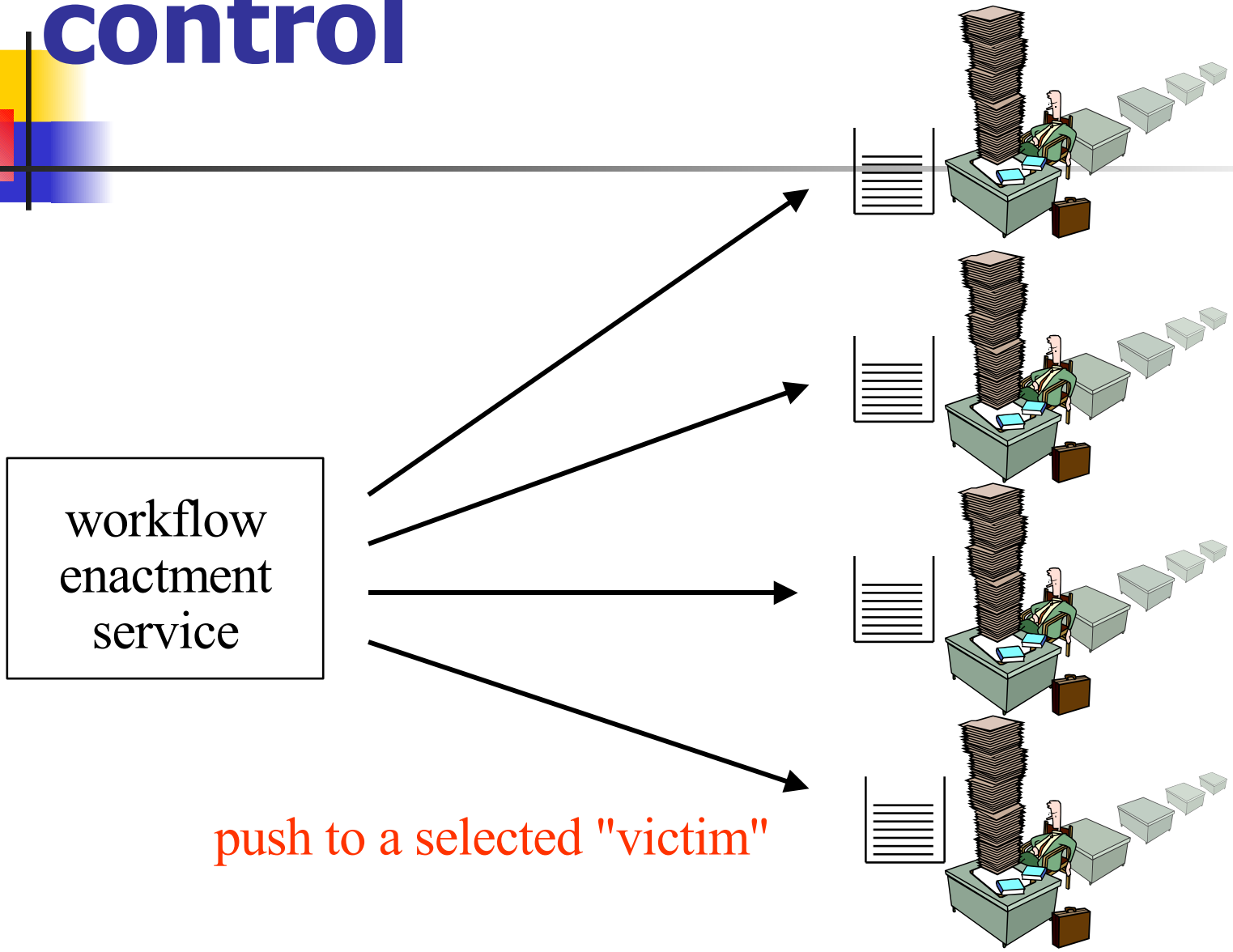
- *Pull mode*
  - User asks for new tasks
- *Push mode*
  - New tasks are forwarded immediately to corresponding role
- *Grab* mode
  - The system forward the tasks: after the termination of a task the following task is activated
  - Useful for a group To-DO List

Push versus pull

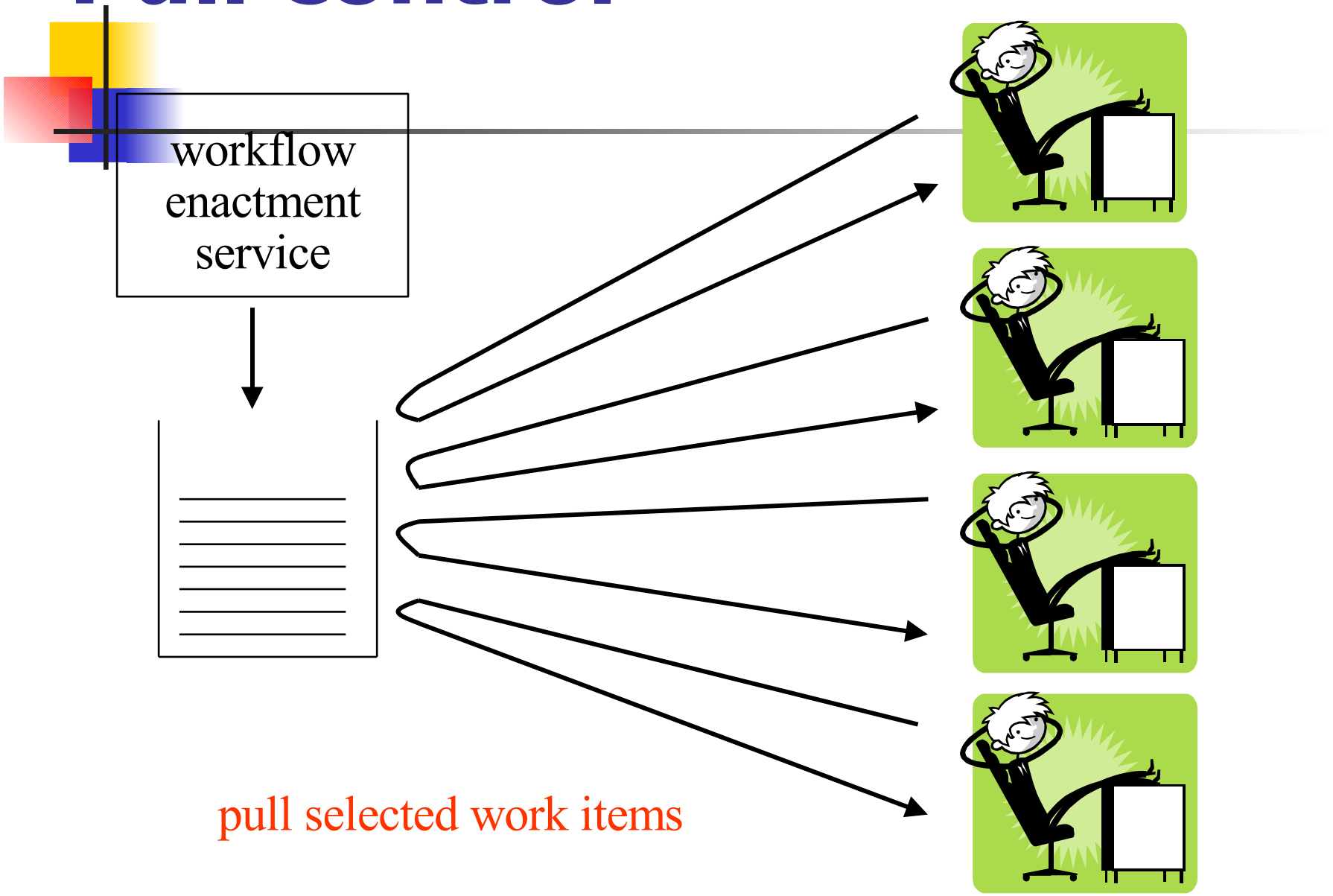




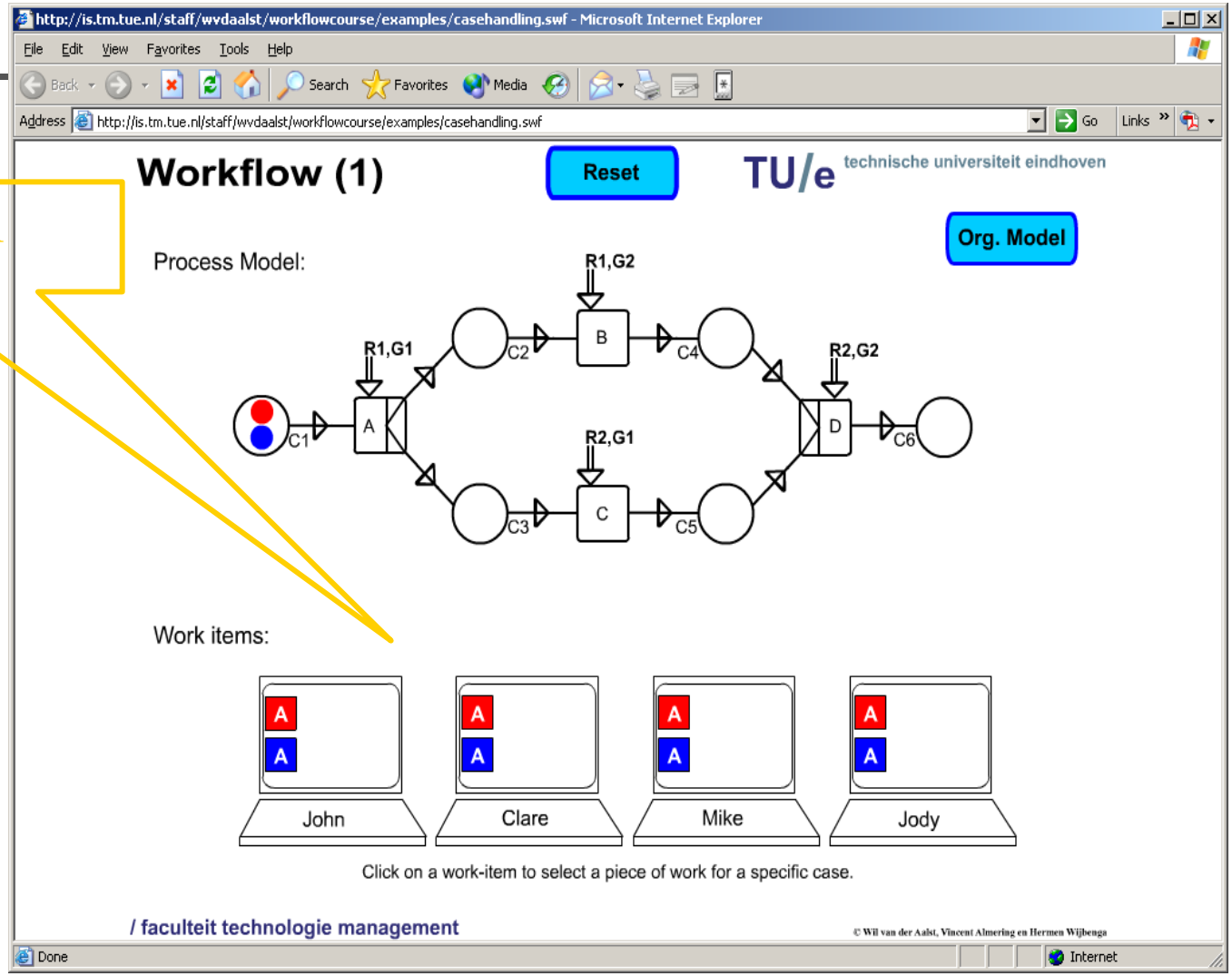
Push control



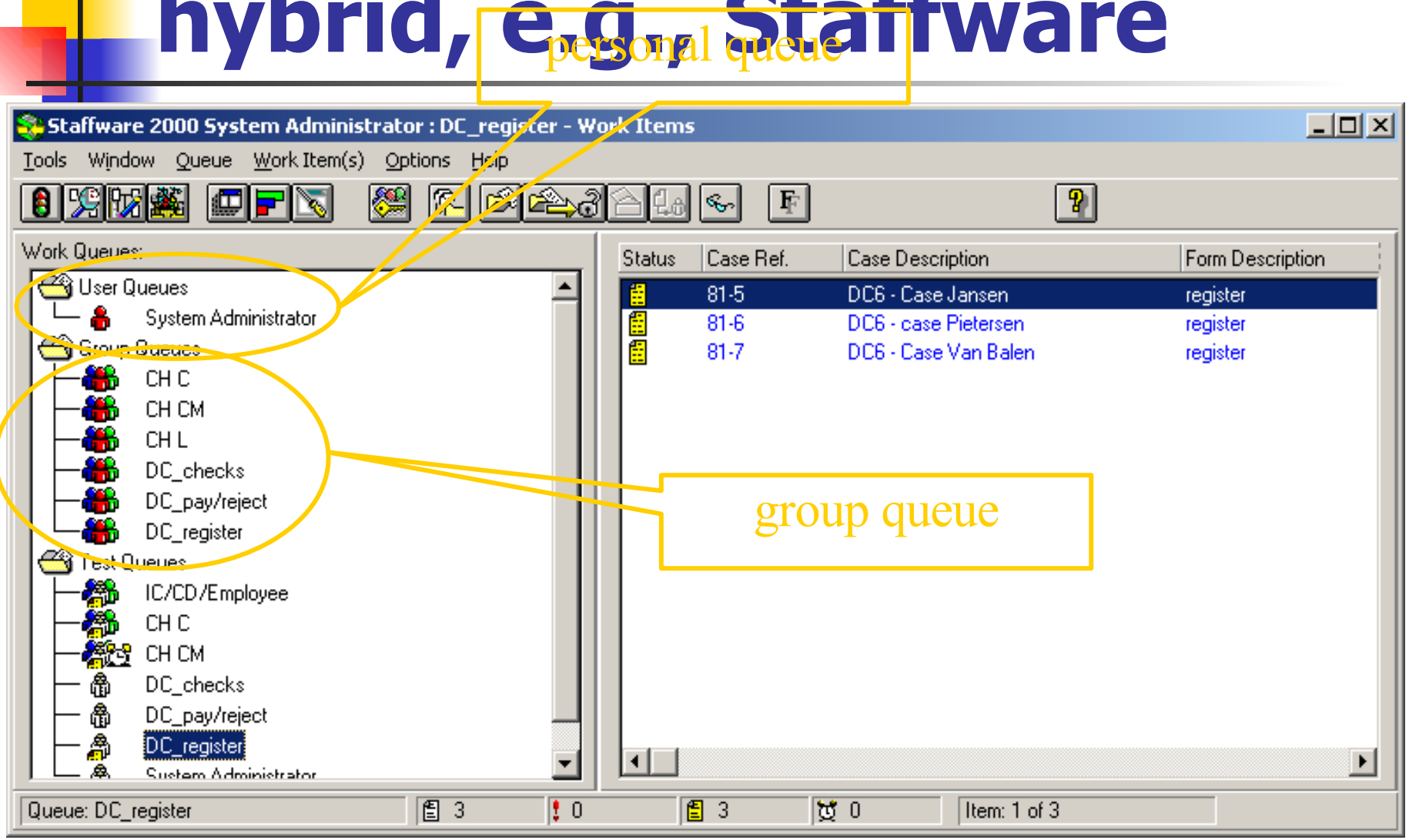
Pull control

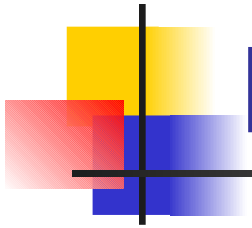


pull control



Mosts WFM systems are hybrid, e.g., Staffware

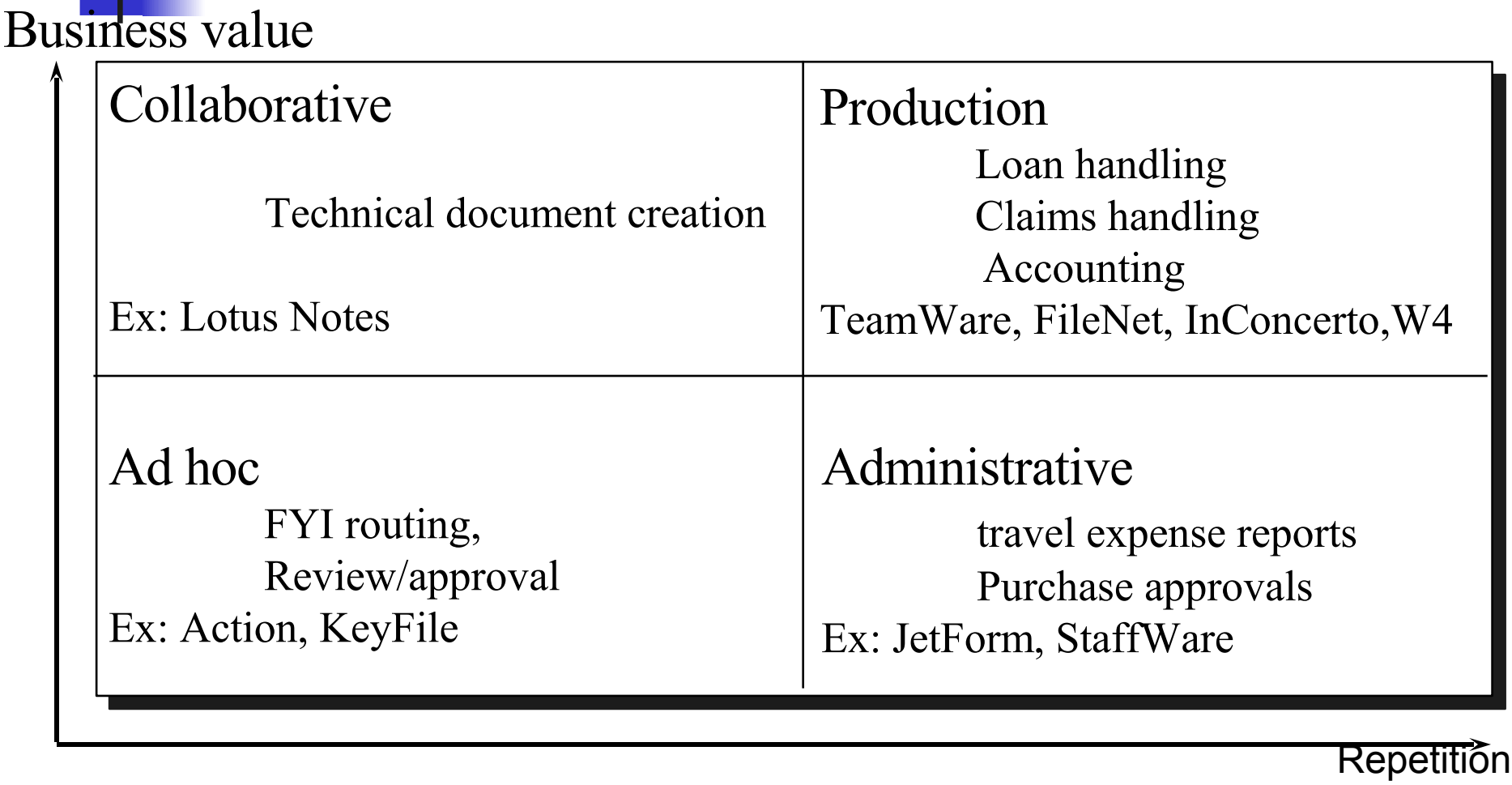




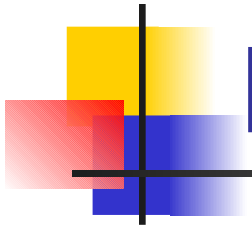
Products

- Bizflow 2000 (Handysoft)
- COSA Workflow (COSA Solutions)
- DOLPHIN (Fujitsu)
- Eastman Software Enterprise Workflow
- InTempo (JetForm)
- MQ/Series Workflow (IBM)
- SERfloware (SER)
- Staffware (Staffware Corp.)
- TeamWARE Flow (Fujitsu)
- TIB/InConcert (TIBCO)
- Visual and Panagon Workflow (FileNet)
- W4 (W4)
- WFX (Eastman Software)
- BONITA (NOUS +BULL) ..

Categories of Workflow

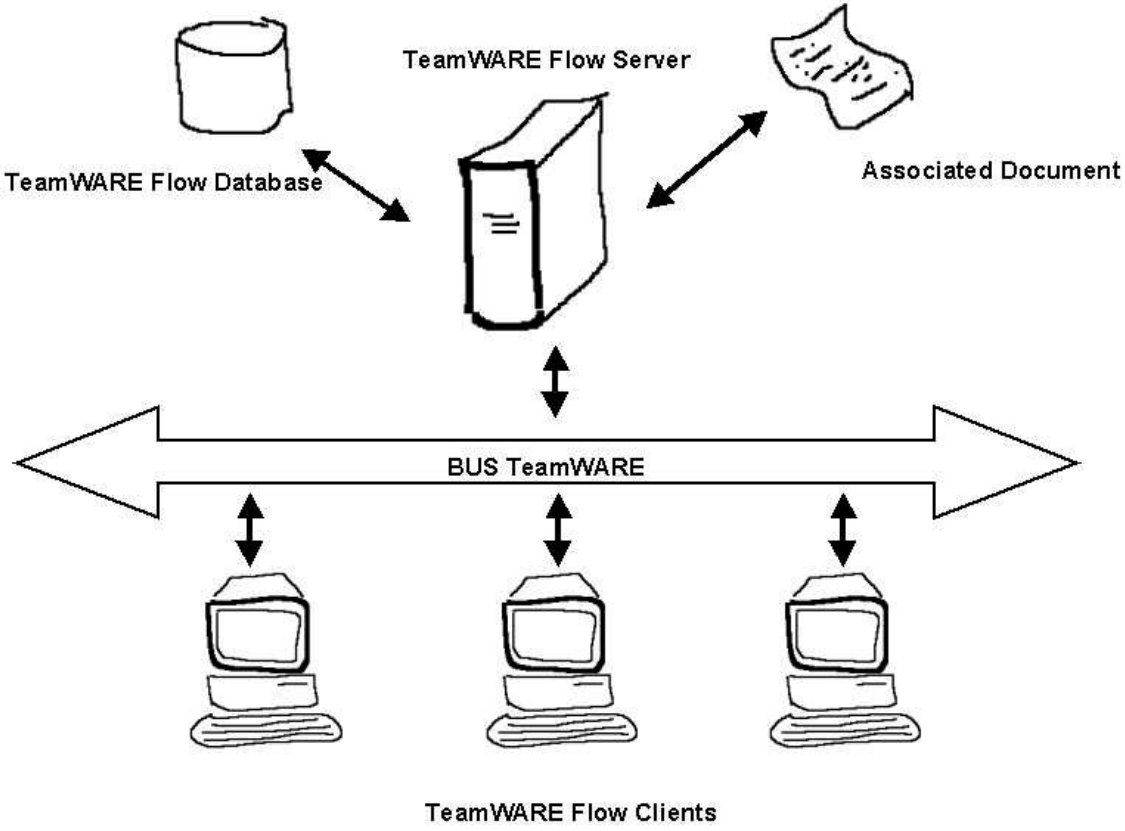


Exemple : TeamWare Flow

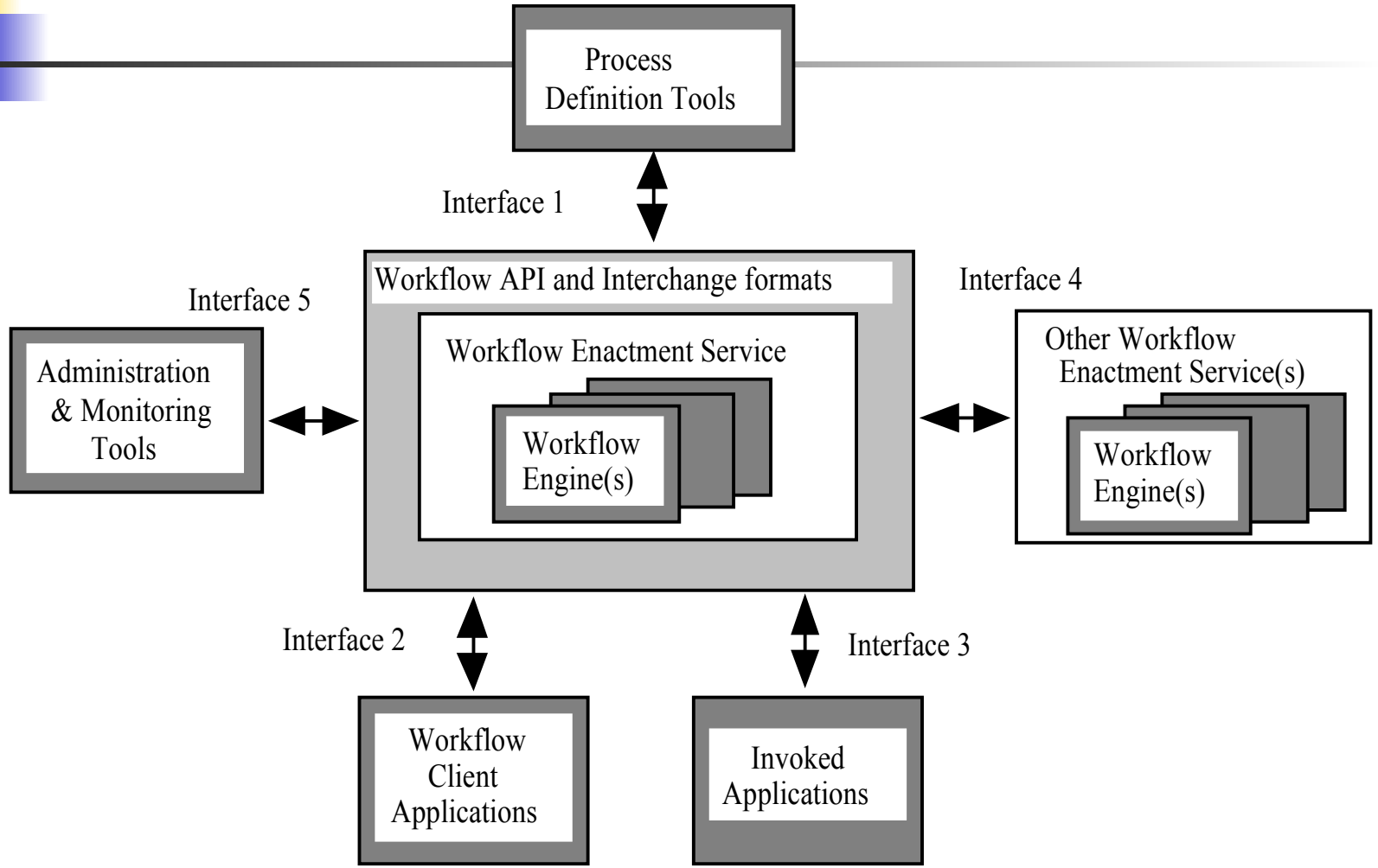


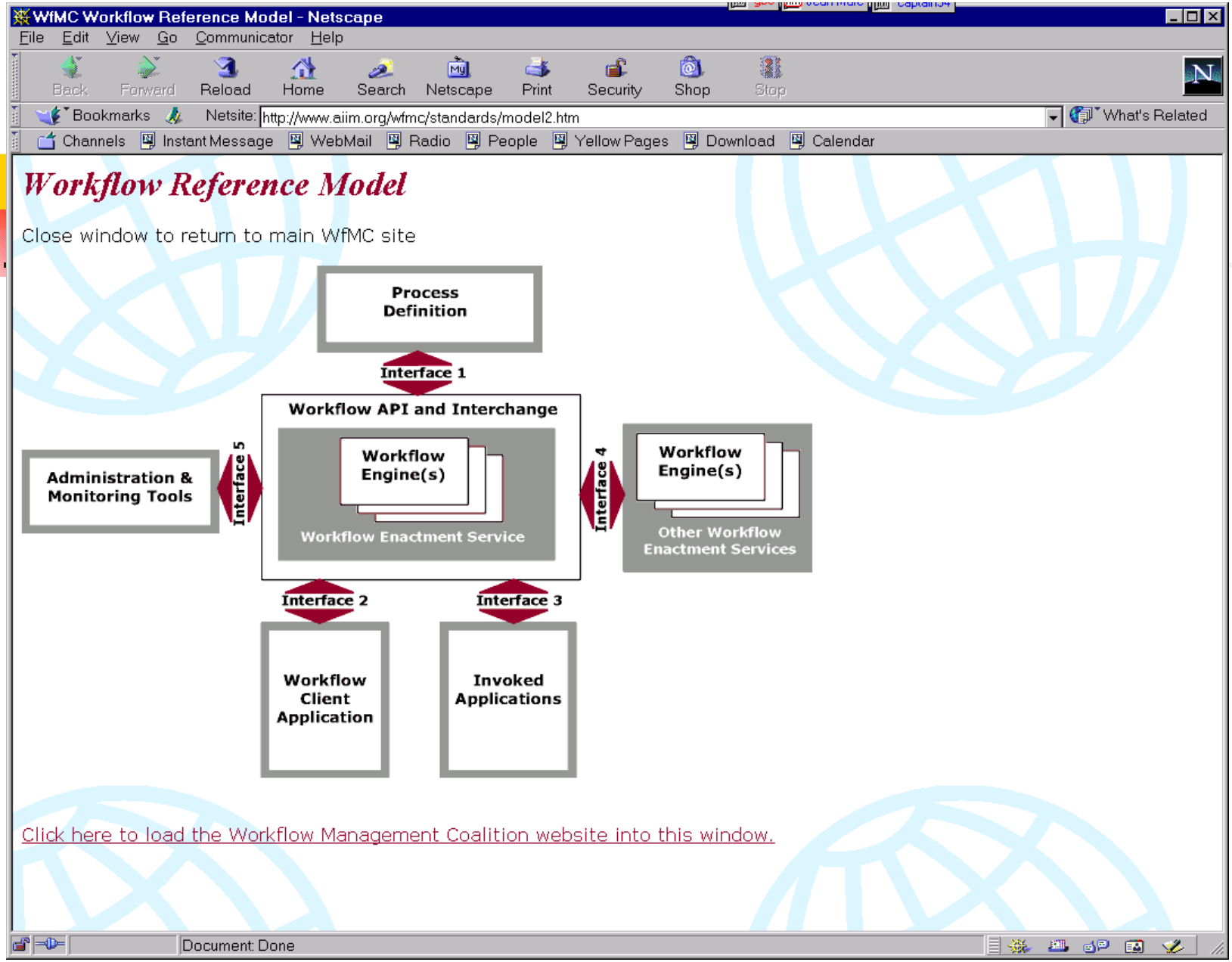
- Client/Server
- TeamWARE Flow:
  - Server : data base (SQL Server, Oracle, Sybase), Document management systems (documents attached to the process), Application Programming Interface API .

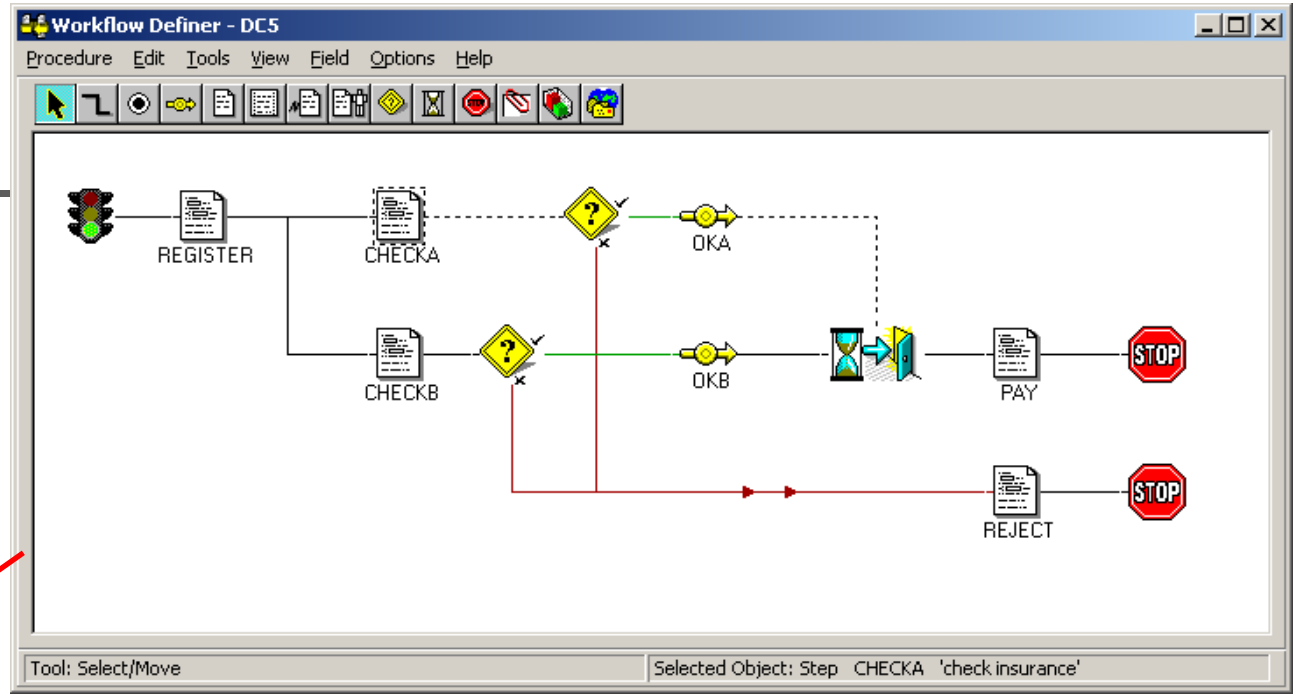
Architecture

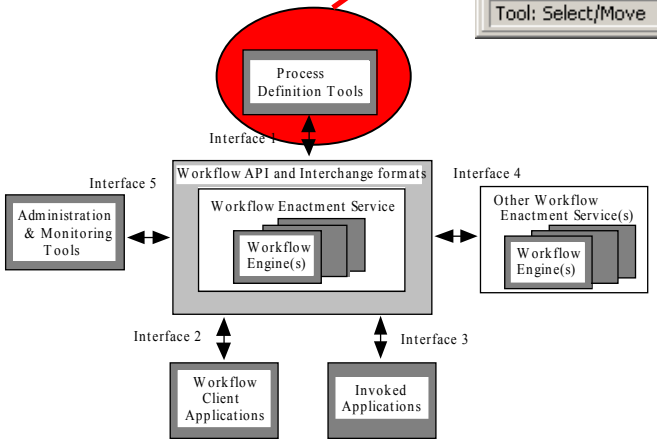


Reference model of the Workflow Management Coalition

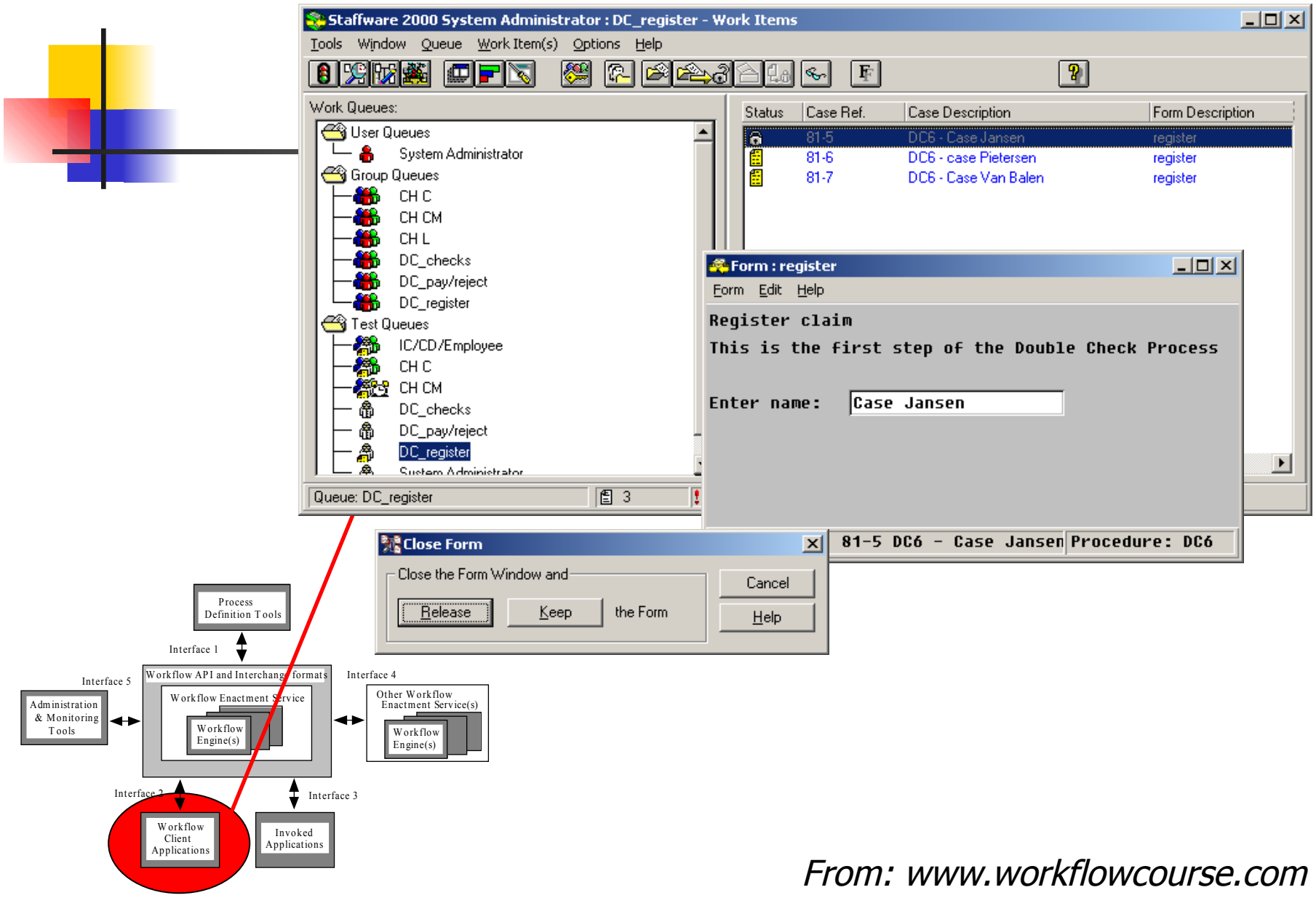



WfMC Workflow Reference Model - Netscape
File Edit View Go Communicator Help
Back Forward Reload Home Search Netscape Print Security Shop Stop
Bookmarks Netsite: http://www.aiim.org/wfmc/standards/model2.htm
What's Related
Channels Instant Message WebMail Radio People Yellow Pages Download Calendar
Workflow Reference Model
Close window to return to main WfMC site
Process Definition
Interface 1
Workflow API and Interchange
Workflow Engine(s)
Workflow Enactment Service
Administration & Monitoring Tools
Interface 5
Interface 4
Workflow Engine(s)
Other Workflow Enactment Services
Interface 2
Interface 3
Workflow Client Application
Invoked Applications
Click here to load the Workflow Management Coalition website into this window.
Document: Done





From: www.workflowcourse.com



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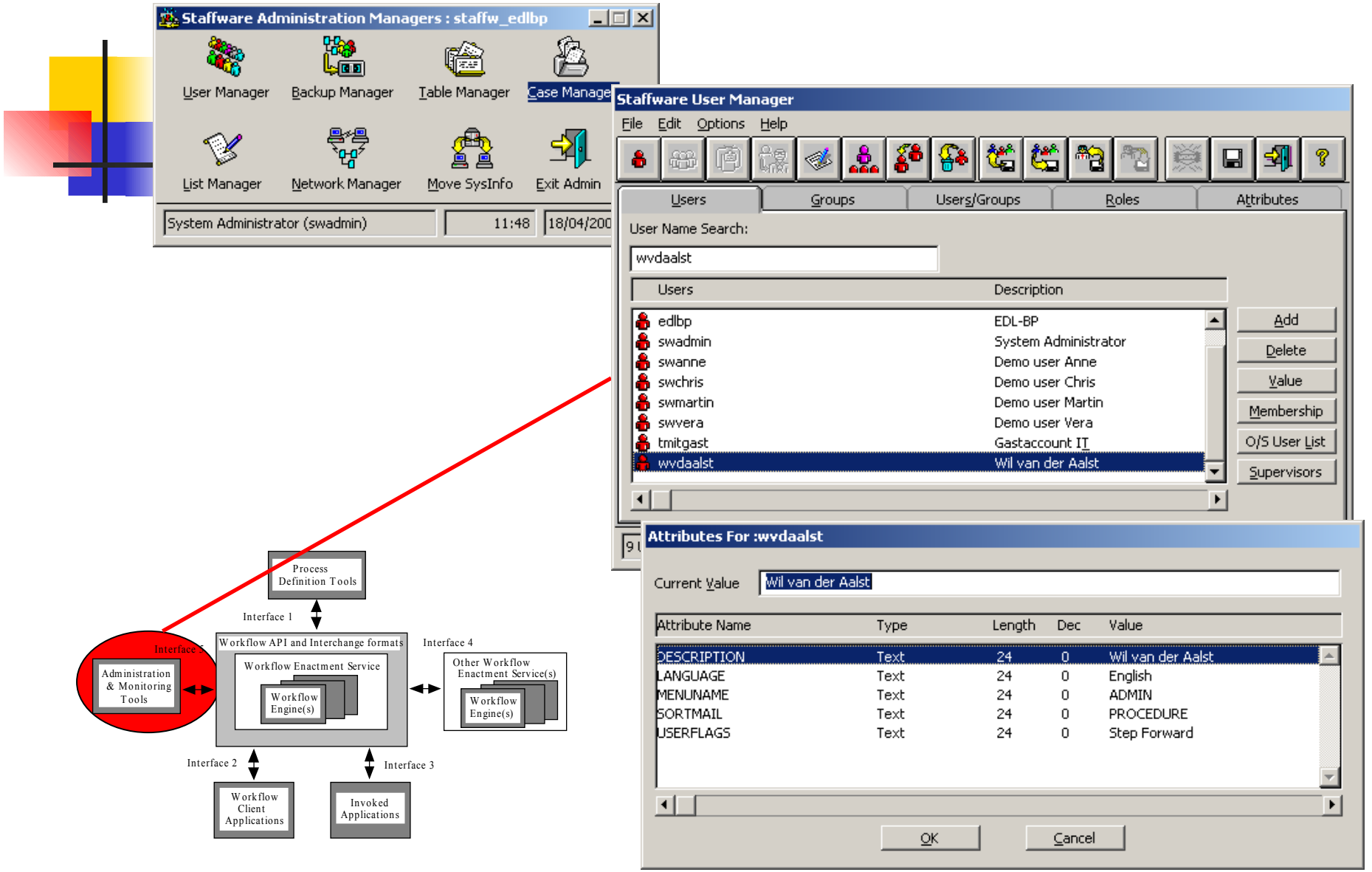

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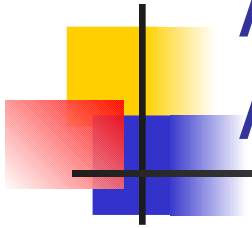
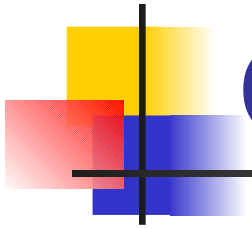
Comparison Criteria (WARIA :Workflow And Reengineering International Association)

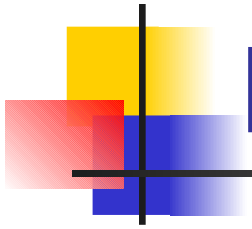


- Efficient of execution engine
  - Number of instances executed at the same time, cluster of servers
- Process complexity
- Programmingg activities
  - API, date-limit, events
- Organizational dimension
  - Role, access rights



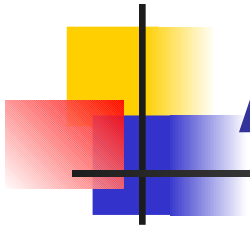
Comparison criteria (WARIA)

- Distribution
  - Cooperation between several engines
- Web client
- Dynamic changes
- Process definition
  - Graphical tool
- Activities definition
  - Library of defined activities, formularies generator
- Predefined Agents
  - No programming efforts to execute the process



More About Activity

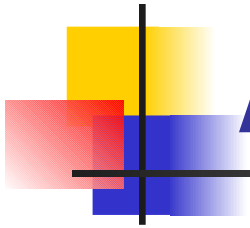
- A logical, self-contained unit of work within the process.
- The body of a work step of a process.
  - Compound activity: An activity may be a subflow:
  - Elementary activity: a basic set of work; sequential set of primitive actions executed by a signal participant..
- 3 modes: automatic, manual, mixed..



Activity Example

- Process: «order equipment» has 3 work steps:
  1. Order entry
  2. Credit check
  3. Billing

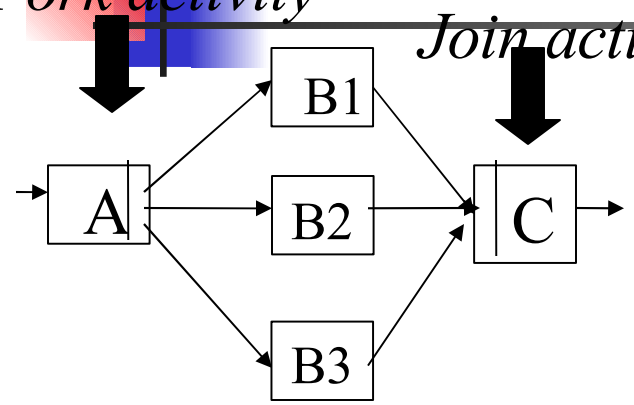
1. automatic; 2. manual; 3. automatic;



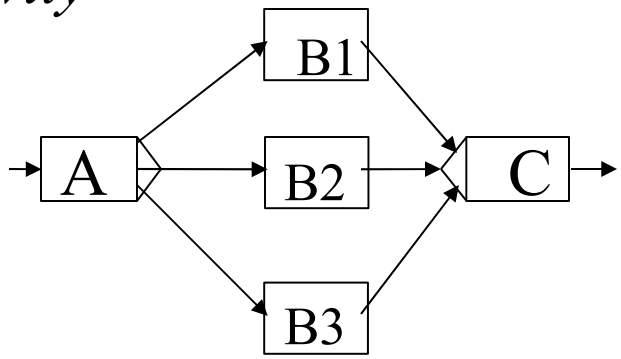
Activity and Flow Control

- **AND Join** parallel activities converges into single activity **with** synchronization..
- **OR join** parallel activities converges into single activity **without** synchronization..
- **AND Split** single activity splits into two or more parallel activities **..**
- **Or Split** single activity makes a decision upon which branch to take when encountered with multiple branches
- start, end...

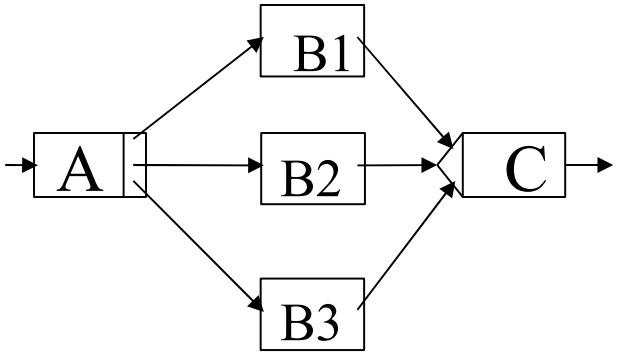
Activity and Flow Control



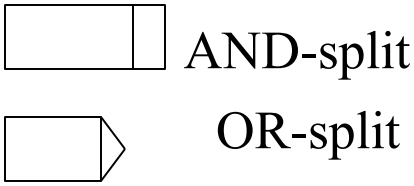
Parallel Processing



Conditional Branching



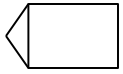
Parallel Branching with final selection



AND-split

OR-split

AND-join



OR-join

Example: Make some coffee

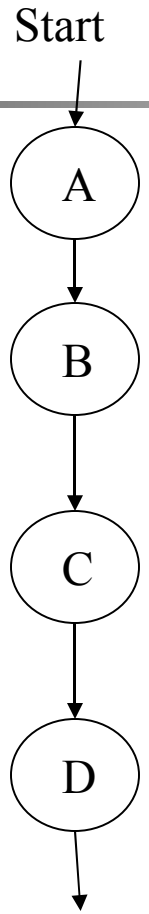
A. Fill the kettle (Remplir la bouilloire)

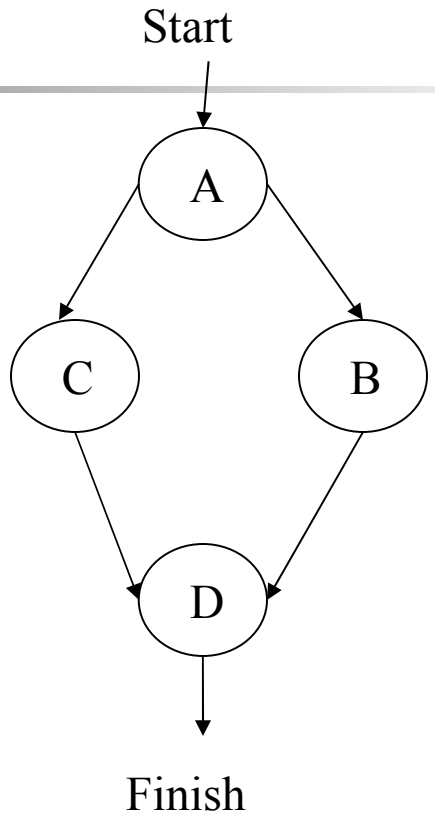
B. Place coffee in cups

C. Heat the water

D. Pour hot water on coffee

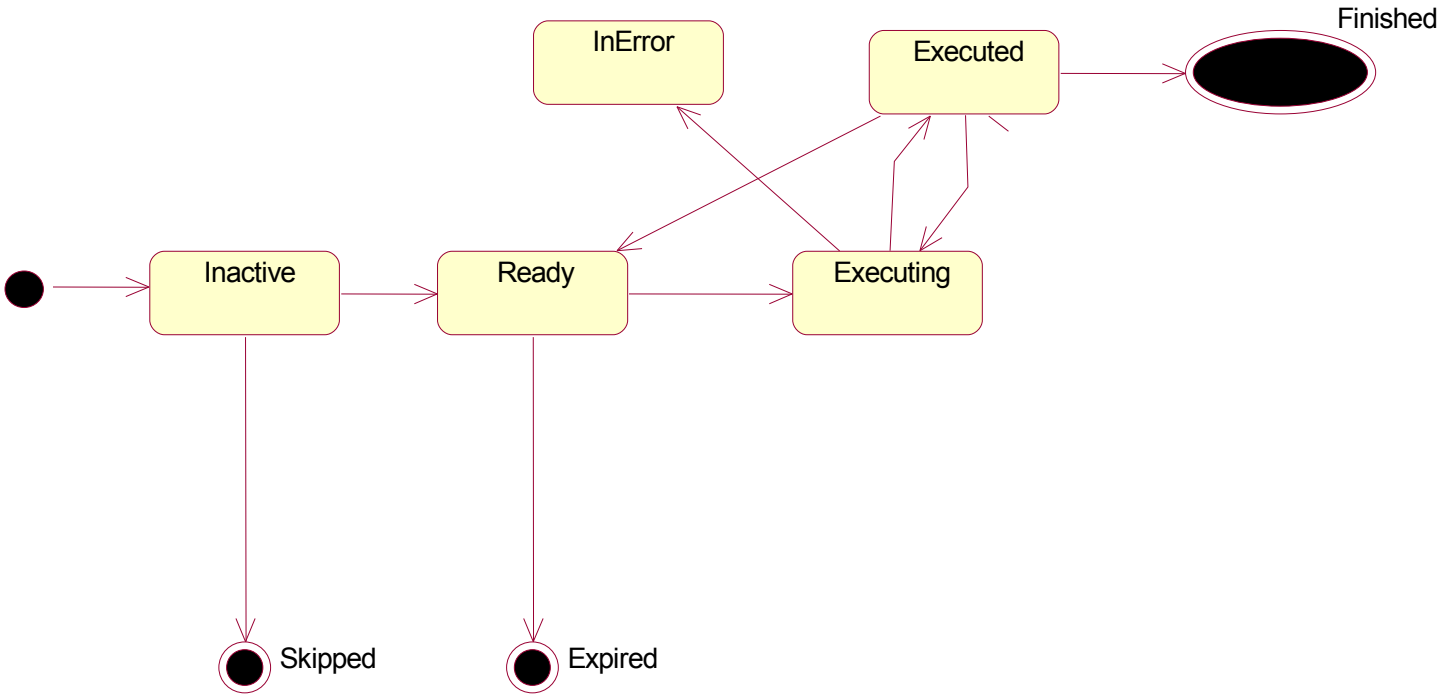
A, B, C, D are activities

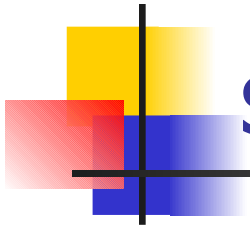




Plans

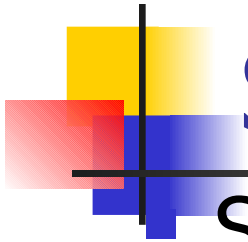
Activity state transition diagram





subprocess

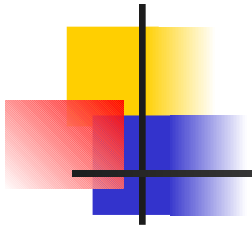
- An activity may be a subflow:
  - Local subprocess
  - Remote subprocess (same or different vendor WF)
- Activity is a container for the execution of a (separately specified) process definition, which may be executed locally within the same workflow service, or (possibly using the process interoperability interface) on a remote service.



Subprocess

- Subprocess behaves w.r.t its parent:
  - Autonomy model …
  - Connected discrete Model
  - hierarchical Model

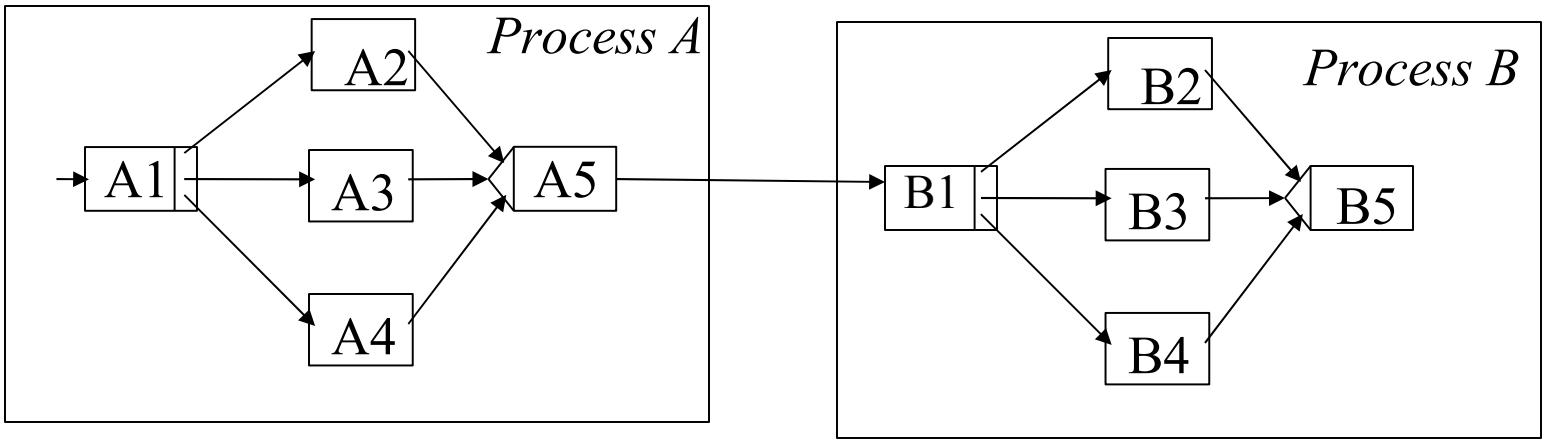
Autonomy model



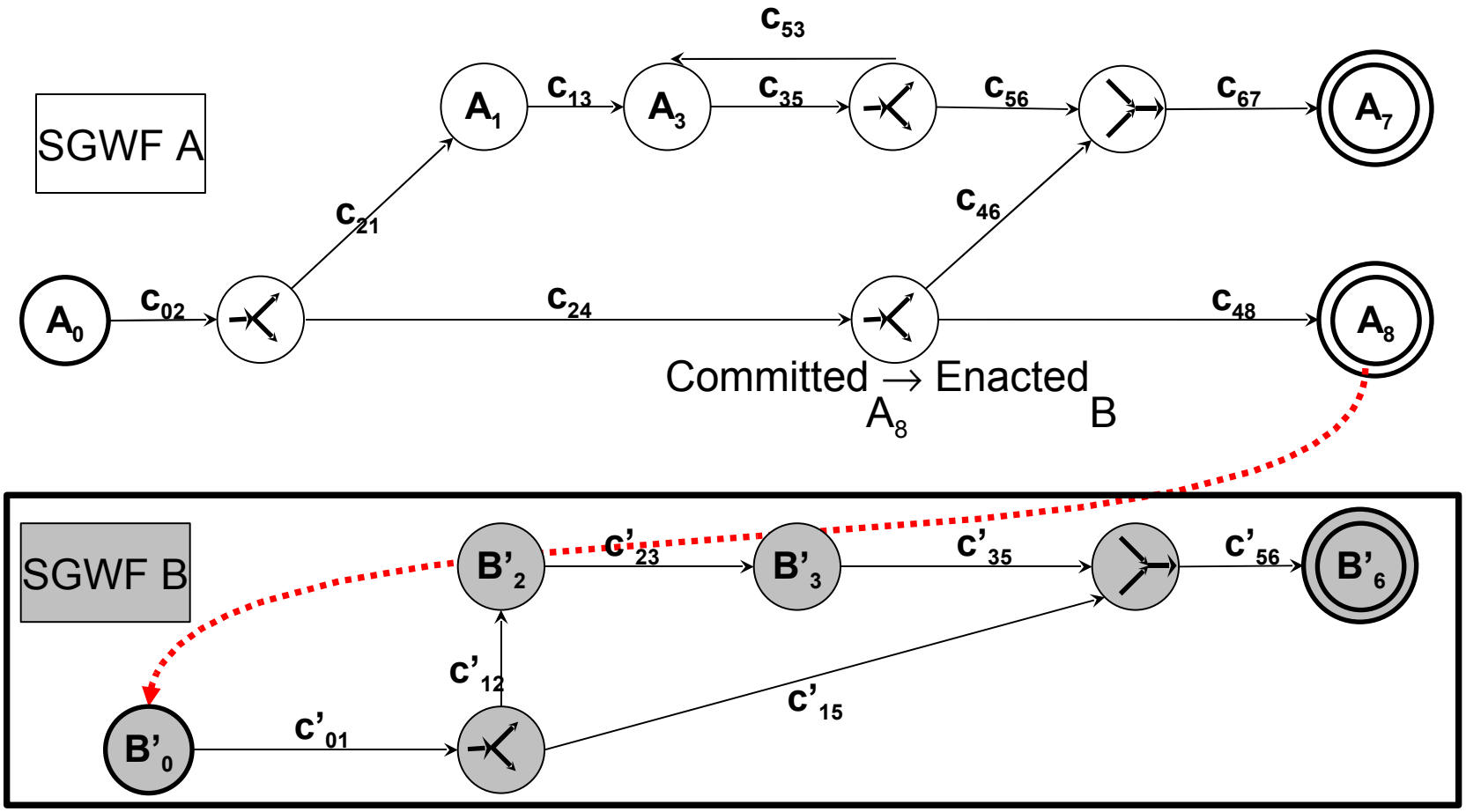
- Has his own life
- Autonomy rules define relation with parent
- if completely autonomous then parent termination does not affect the subprocess

Connected Discrete Model

- Two processes A, B..
- An activity of A causes the creation of an instance of B
- A and B are independent ...
- Chained services model



Chaînage de workflow (chained model)



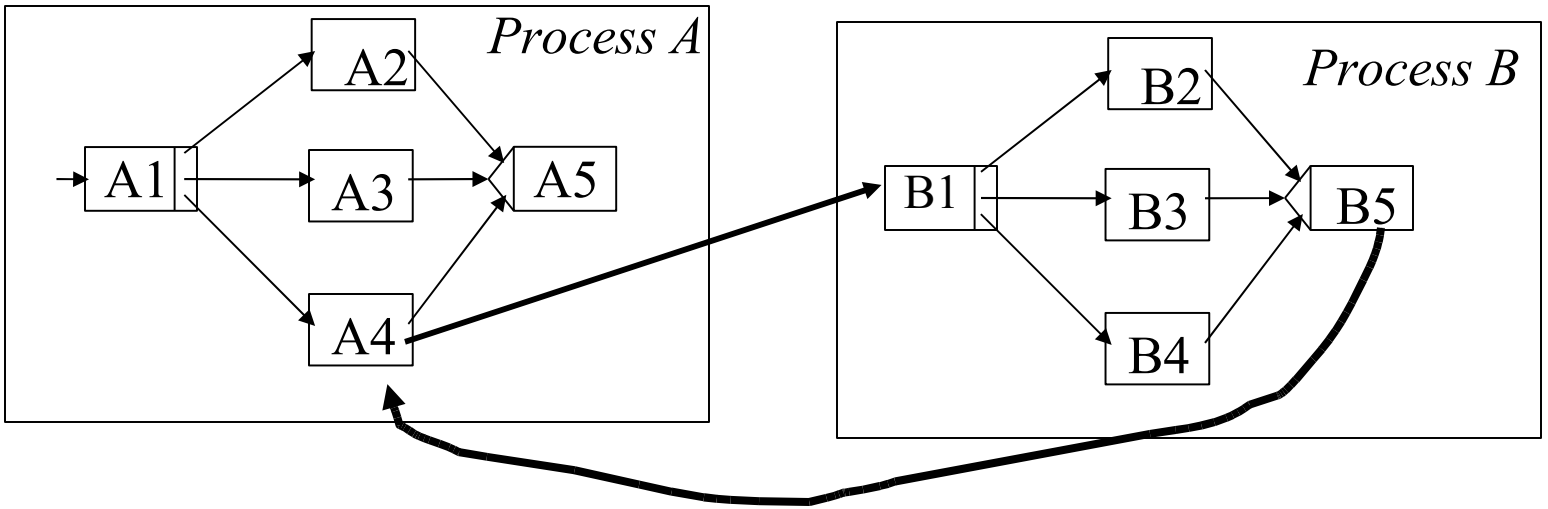
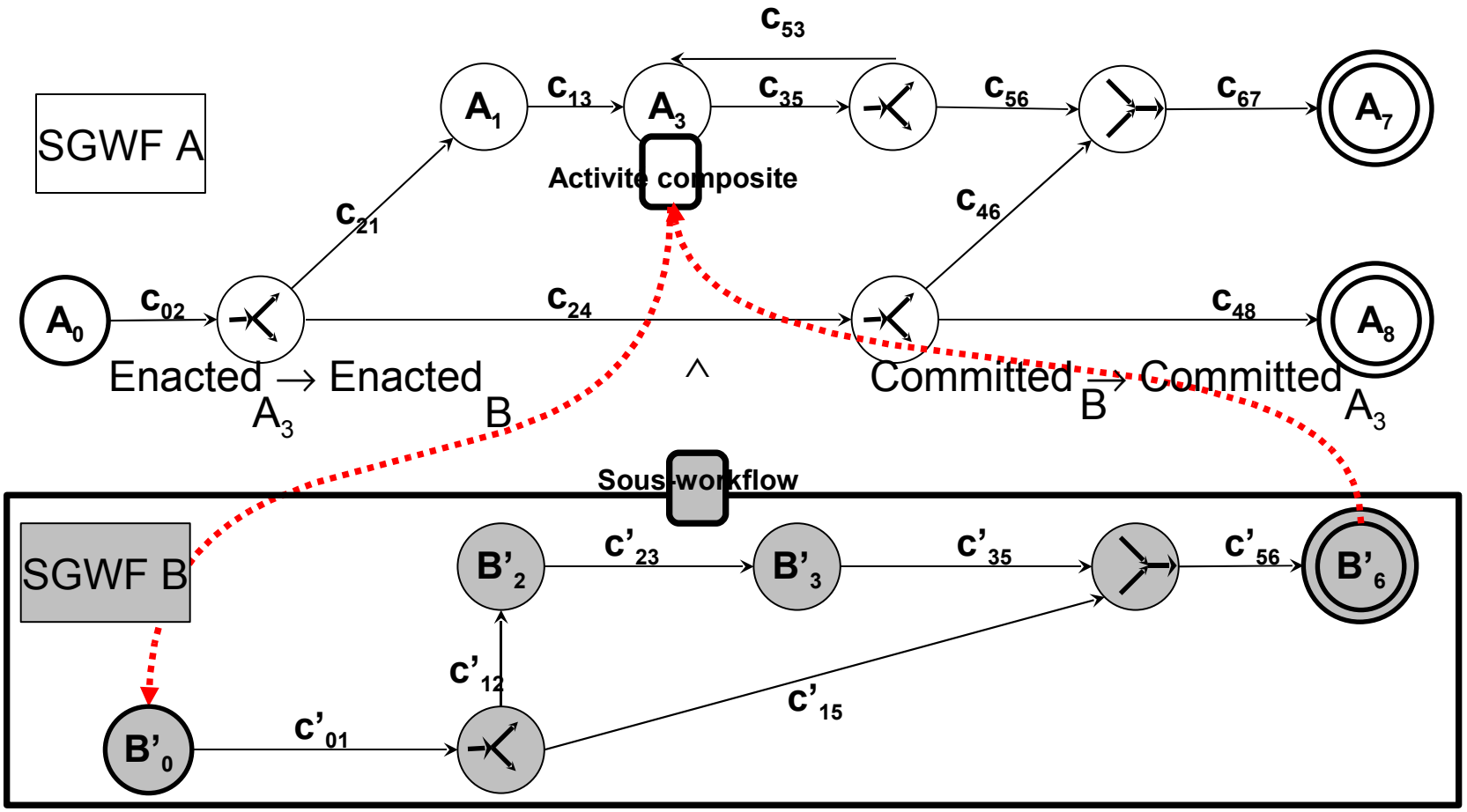
Hierarchical Model

Two processes A, B..

An activity of A causes creation of an instance of B

A waits B

Nested Model



Nested model