

Toronto, 19.9.1999

Matthias Jarke

Networked Improvement Management

Matthias Jarke
Information Systems Group
RWTH Aachen



Lehrstuhl Informatik V
(Informationssysteme)
Prof. Dr. M. Jarke
15-MG-9705-1

Conceptual, informational, and technical networking of

- *people and computers*
- *producers and customers*

as a foundation of experience-based knowledge management

Outline

Matthias Jarke

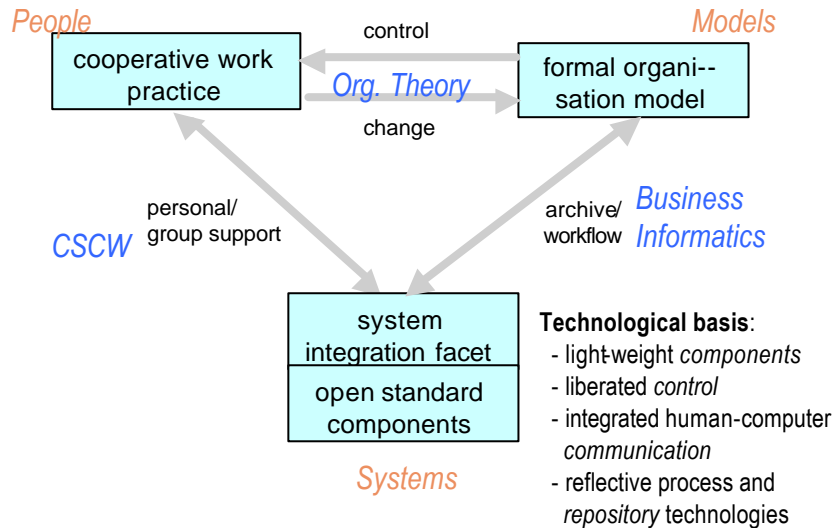
- The EUCAN Cooperative IS Framework
- Three Perspectives on KM (illustrated by project experiences)
 - the „American“ approach (CAPE-OPEN)
 - the „Teutonic“ approach (CREWS)
 - the „Japanese“ approach (FOQUS)
- Summary



Lehrstuhl Informatik V
(Informationssysteme)
Prof. Dr. M. Jarke
15-MG-9705-2

Three Facets of Cooperative Information Systems

Matthias Jarke

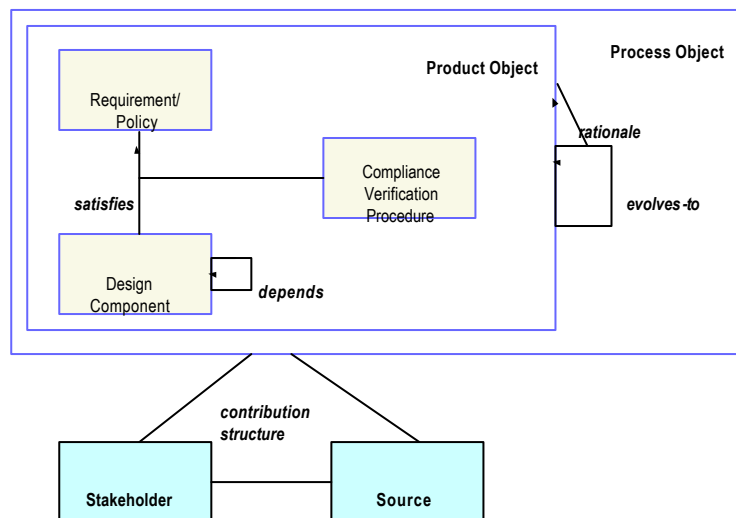


Lehrstuhl Informatik V
(Informationssysteme)
Prof. Dr. M. Jarke
15-MG-9705-3

[DeMichelis et al., CACM 12/98]

Traceability Metamodel Extracted from 26 US Software Organisations

Matthias Jarke

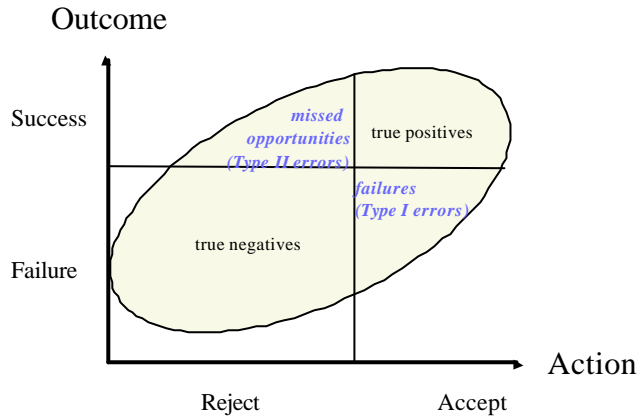


Lehrstuhl Informatik V
(Informationssysteme)
Prof. Dr. M. Jarke
15-MG-9705-4

[RameshJarke, IEEE-TSE 99]

Experienced-Based Knowledge Mgmt.: Statistics View

Matthias Jarke



Organizations recognize failures more easily (type I bias):

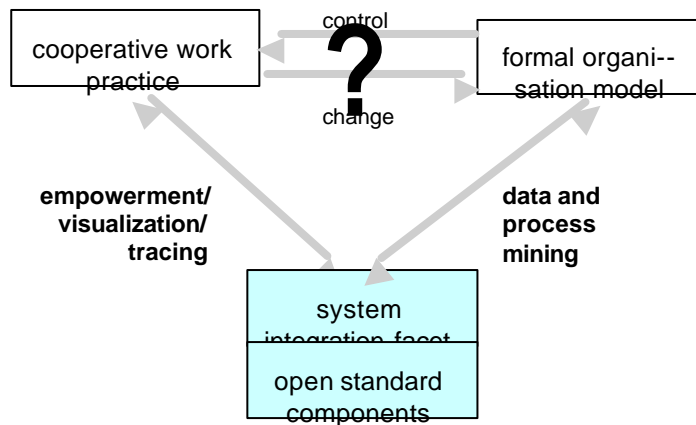
- > autonomy, creative chaos desirable
- > share experiences across boundaries
- > counterfactual data mining experiments



Lehrstuhl Informatik V
(Informationssysteme)
Prof. Dr. M. Jarke
15-MG-9705-5

Organizational KM: Pragmatic Technological View

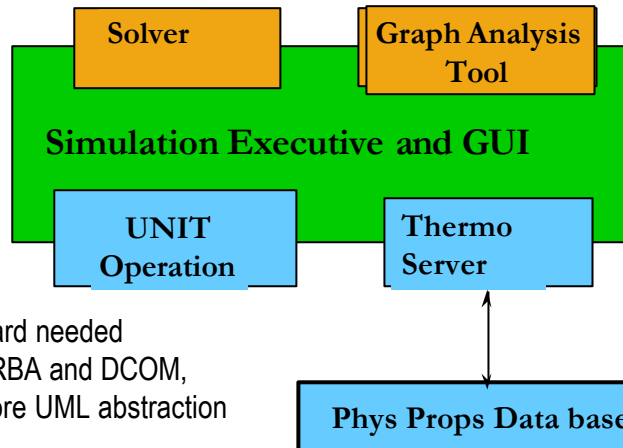
Matthias Jarke



Lehrstuhl Informatik V
(Informationssysteme)
Prof. Dr. M. Jarke
15-MG-9705-6

Example for techno-pragmatic KM: Coherent handling of many use cases

Example: CAPE-OPEN Simulation Standard for Chemical Engineering



Standard needed
in CORBA and DCOM,
therefore UML abstraction

Matthias Jarke



Lehrstuhl Informatik V
(Informationssysteme)
Prof. Dr. M. Jarke
15-MG-9705-7

Use Cases in CAPE-OPEN...

- present results of requirements analysis of major subsystems (Physical Properties, Unit Operations, Thermo, Numerical)
- are agreed-upon within the consortium
- form the basis for subsequent phases of the CAPE-OPEN process model, define boundaries for UML, CORBA, and DCOM standards
- **Problem:**
high number of collaborators, large use case corpus
⇒ danger of inconsistency, redundancy

Matthias Jarke



Lehrstuhl Informatik V
(Informationssysteme)
Prof. Dr. M. Jarke
15-MG-9705-8

Use Cases in CAPE-OPEN: Examples

Matthias Jarke

- More than 160 use cases in 4 groups were designed.
- Refined grouping was hand-crafted *a posteriori*.

Define Unit Report

Principle Actor: Flowsheet Builder

Description:

The model builder configures one or more available reports for the unit based on information made public by the unit. The Builder asks the Unit Manager to get the list of available report formats from the unit. If there are some available report formats the Units Manager displays it, so that, the user can select one of them and ask the unit to set it to be its output format. The unit sets this format as its output format.

Exceptions:

No report formats available

Check Public Variable

Principle Actor: Flowsheet Unit

Description:

The Unit checks that the given variable is recognised and can be got or set as required. If the variable is not recognised, an error message is returned. If the variable is recognised, the variable is checked against the required mode (i.e. get or set). In case the variable can not be used as requested, an error message is returned. Note: This facilitates use by systems / optimisers / controllers etc., which want to use the public variable and have no other means of performing this check ahead of a run-time use of the variable. Mode is Read or Write.

Exceptions:

Variable not recognised
Variable can not be used as requested



Lehrstuhl Informatik V
(Informationssysteme)
Prof. Dr. M. Jarke
15-MG-9705-9

Managing Documents in a Collaborative Workbench (BSCW)

Matthias Jarke

- shared WWW server
- not just outcomes, but also plans, minutes, ...
- folder hierarchy
- group awareness
- different visibility levels



Lehrstuhl Informatik V
(Informationssysteme)
Prof. Dr. M. Jarke
15-MG-9705-10

Automatically Derived Use Case Landscape for CAPE-OPEN

Matthias Jarke

document map of use cases

detail:
group of "Unit" use cases

- Compute Unit Derivatives
- Unit Provides Initial Estimates
- Unit Requests Solution of Unit Equations
- Unit Defines Linear Equations to be solved
- Unit Defines Non
- Unit Defines DAEs to be solved
- Unit Interrupts Calculations
- Unit Resumes Calculations
- Perturb Unit
- Save Unit
- Restore Unit
- Set Unit Specific Data
- Retrieve Flowsheet
- Create Unit
- Delete Unit
- Delete Unit From Flowsheet
- Delete Existing Port

Lehrstuhl Informatik V (Informationssysteme)

 Prof. Dr. M. Jarke

 IS-MG-9705-11

Hand-Crafted Grouping Compared to Automatic Structuring

Matthias Jarke

hand-crafted use case hierarchy

automatically derived structuring

CAPE-OPEN Use Cases

- GAT Use Cases**
 - GAT Configuration
 - GAT Initialisation
- Physical Properties**
 - Component Installation Package
 - Neutral File Interface
 - Physical Properties System
 - Simulator Package
 - Flowsheet Setup Package
 - Petroleum Pseudo Components
 - Runtime Package
- Solver Use Cases**
 - More Complex Use Cases
 - Solver Computing
 - Numeric Configuration
 - Solver Initialisation
- Unit Use Cases**
 - Creating a Flowsheet
 - Running a Flowsheet
 - Looking at Results

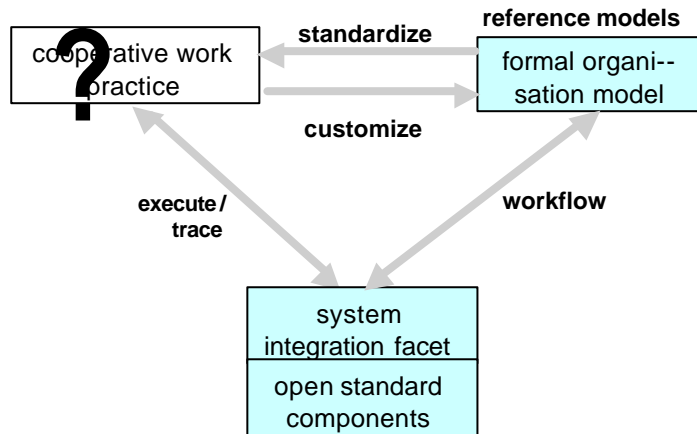
Lehrstuhl Informatik V (Informationssysteme)

 Prof. Dr. M. Jarke

 IS-MG-9705-12

Organizational KM: Model-Centric View (e.g. ARIS/SAP)

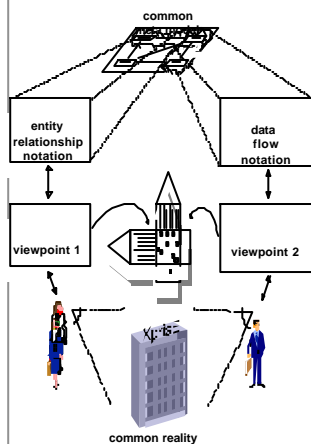
Matthias Jarke



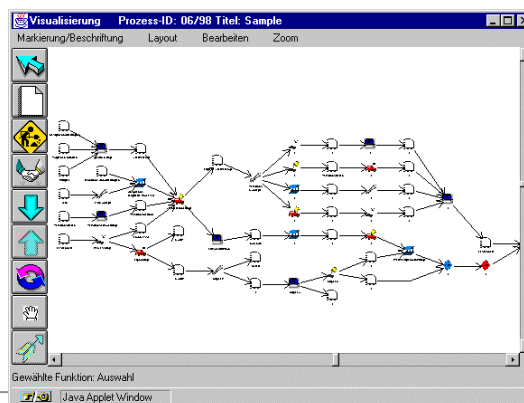
Lehrstuhl Informatik V
(Informationssysteme)
Prof. Dr. M. Jarke
IS-MG-9705-13

Multi-Perspective Cooperative Modeling : Metamodels as Goals

Matthias Jarke



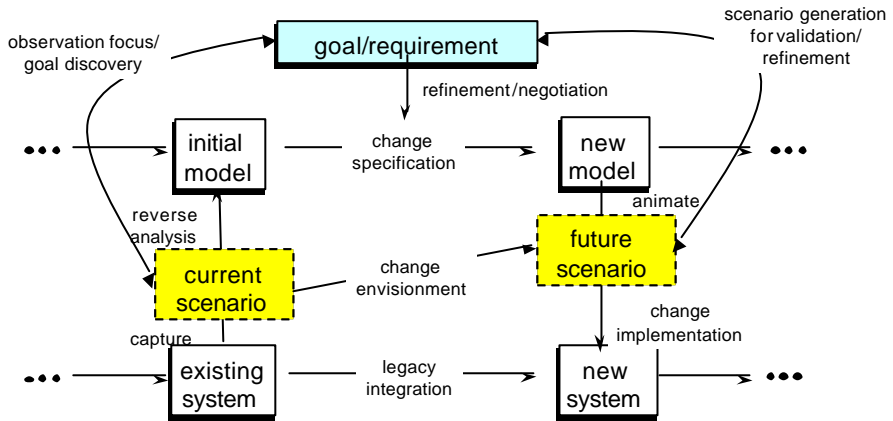
For small processes [Nissen et al.; IEEE SW 96]:
--> metaplan + repository formalization
For large processes [Rose, CACM 12/98]:
--> layout generation + synchronization analysis



Lehrstuhl Informatik V
(Informationssysteme)
Prof. Dr. M. Jarke
IS-MG-9705-14

Not just normal-case modelling: Goals drive scenarios and vice versa

Matthias Jarke



Scenarios as middle-ground abstractions for organizational memory::

- > focus on *use* and *differences*
- > delay *commitment* but increase *participation*
- > improve *memorization/ reuse*

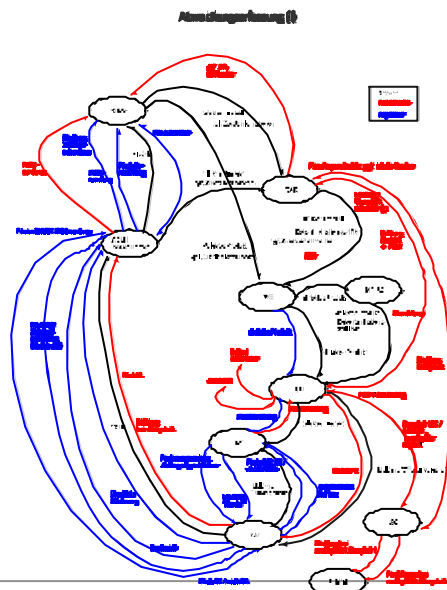
[Jarke et al., REJ 3/98]



Lehrstuhl Informatik V
(Informationssysteme)
Prof. Dr. M. Jarke
IS-MG-9705-15

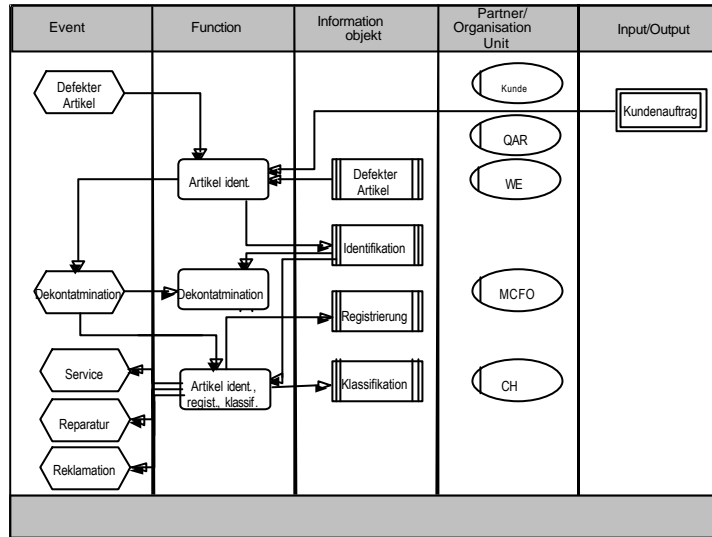
Abstracted workplace scenarios

Matthias Jarke



Lehrstuhl Informatik V
(Informationssysteme)
Prof. Dr. M. Jarke
IS-MG-9705-16

Abstraction according to ARIS

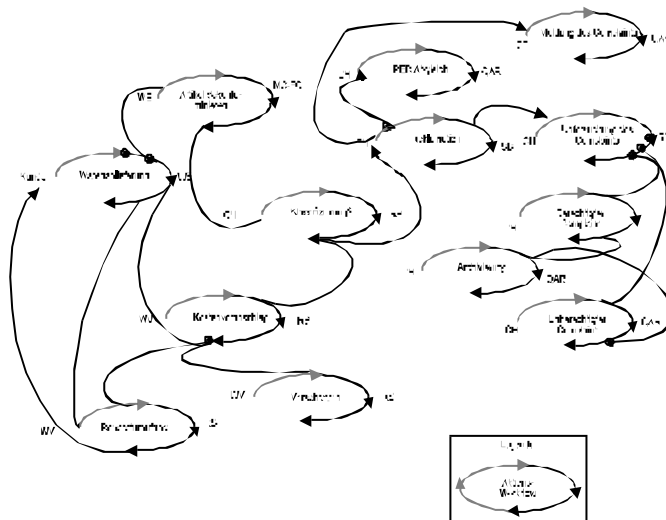


Matthias Jarke



Lehrstuhl Informatik V
(Informationssysteme)
Prof. Dr. M. Jarke
IS-MG-9705-17

Problems Clarified by Speech Act Abstraction



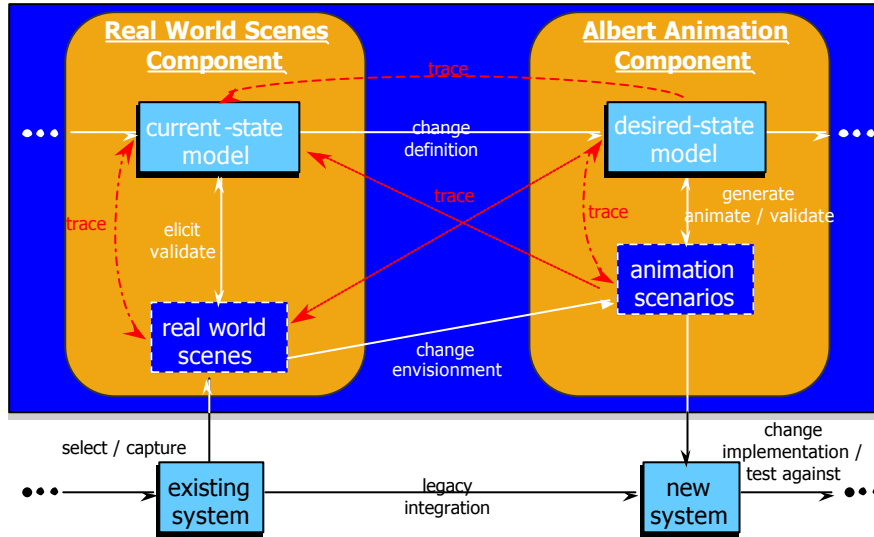
Matthias Jarke



Lehrstuhl Informatik V
(Informationssysteme)
Prof. Dr. M. Jarke
IS-MG-9705-18

CREWS Demonstrators (1): Media-Based Scenarios (CREWS-EVE)

Matthias Jarke



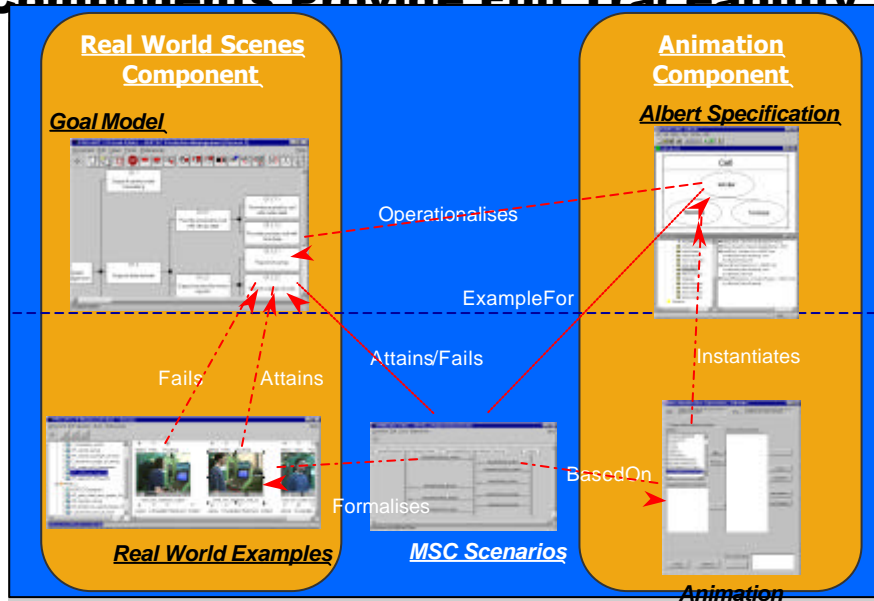
Evaluation



Lehrstuhl Informatik V
(Informationssysteme)
Prof. Dr. M. Jarke
IS-MG-9705-21

CREWS-EVE: Process-Integrated Tool Components Provide Full Traceability

Matthias Jarke



Evaluation



Lehrstuhl Informatik V
(Informationssysteme)
Prof. Dr. M. Jarke
IS-MG-9705-22

CREWS-EVE Example from Validation Study: Explaining Animation Steps with Video Fragments and Goals

Matthias Jarke

Evaluati



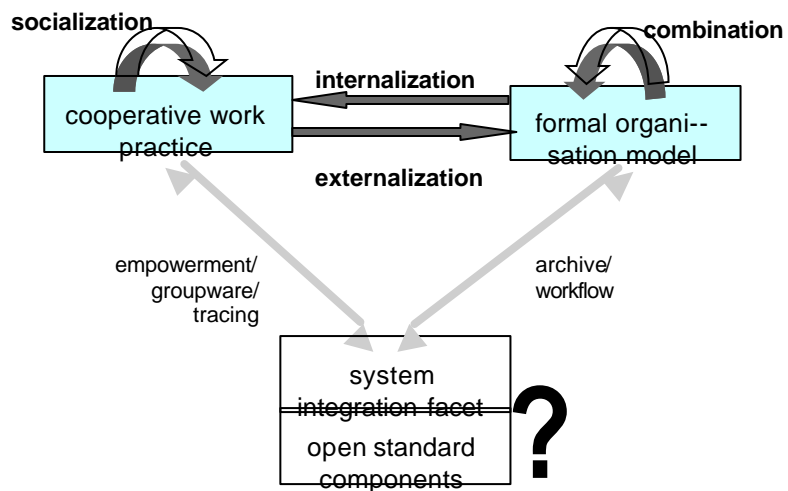
Lehrstuhl Informatik V
(Informationssysteme)
Prof. Dr. M. Jarke
IS-MG-9705-23

Organizational Knowledge Mgmt.: Process View [Nonaka]

Matthias Jarke



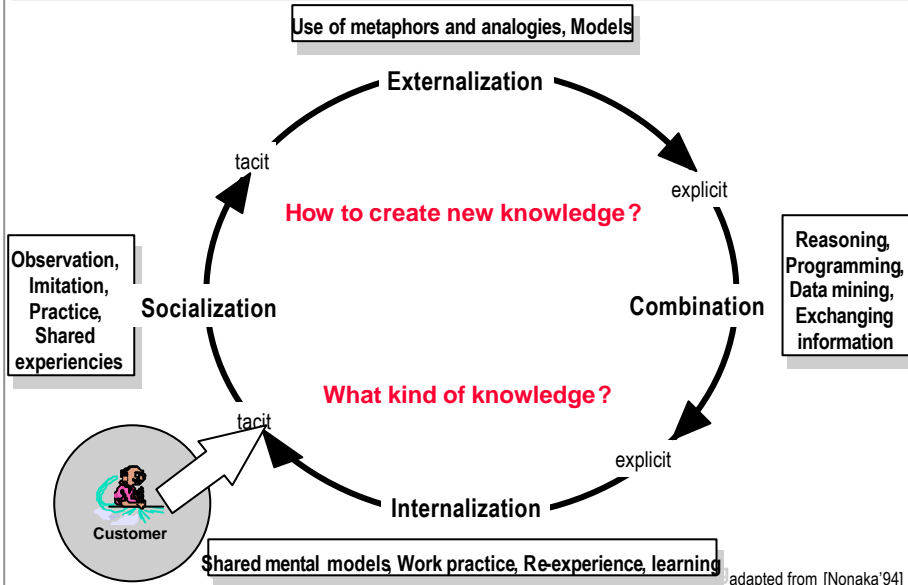
Lehrstuhl Informatik V
(Informationssysteme)
Prof. Dr. M. Jarke
IS-MG-9705-24



The Organizational Learning Cycle

[Nonaka/Takeuchi 95]

Matthias Jarke



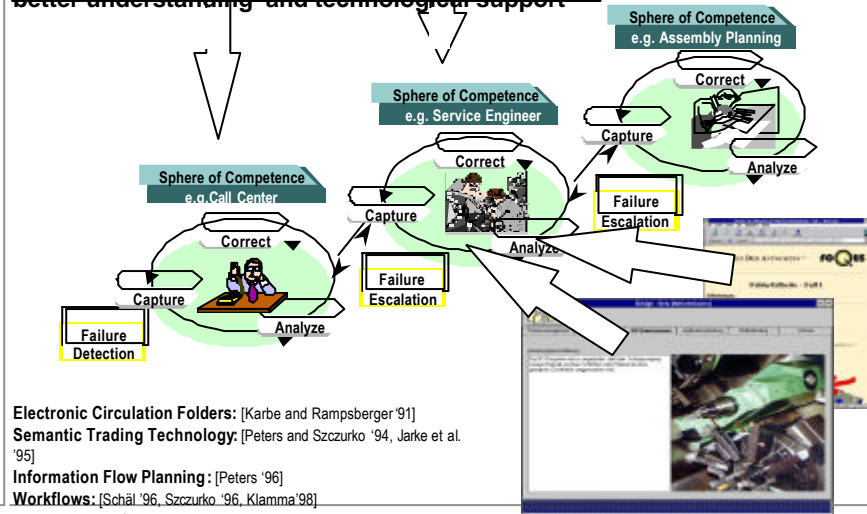
Lehrstuhl Informatik V
(Informationssysteme)
Prof. Dr. M. Jarke
IS-MG-9705-25

adapted from [Nonaka'94]

Socialization: Escalation of Failures

Matthias Jarke

CAFM: Utilization of OM to shorten processes by better understanding and technological support

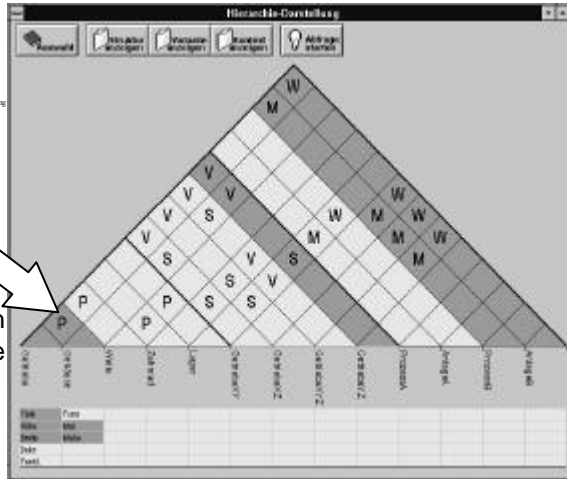
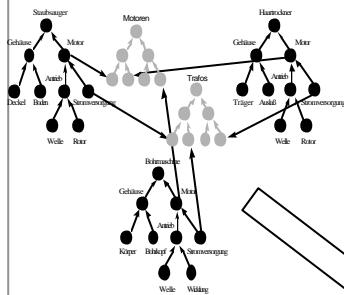


Lehrstuhl Informatik V
(Informationssysteme)
Prof. Dr. M. Jarke
IS-MG-9705-26

Electronic Circulation Folders: [Karbe and Rampsberger '91]
Semantic Trading Technology: [Peters and Szczurko '94, Jarke et al. '95]
Information Flow Planning: [Peters '96]
Workflows: [Schäl '96, Szczurko '96, Klamma '98]
Application in Quality Management: [Burgel '95, Fuchs '97]

Combination: Variant Rich Model Representation and Utilization

Matthias Jarke



Explicit (PPS) representation of product variant knowledge extended to errors in production and use

(complexity barrier)



Lehrstuhl Informatik V
(Informationssysteme)
Prof. Dr. M. Jarke
IS-MG-9705-27

PPS-Systems: [Anthony'65, Schneeweiß'87]
Richer models: [Jarke and Klamma '98]

Internalization: Use of OM Tools

Matthias Jarke

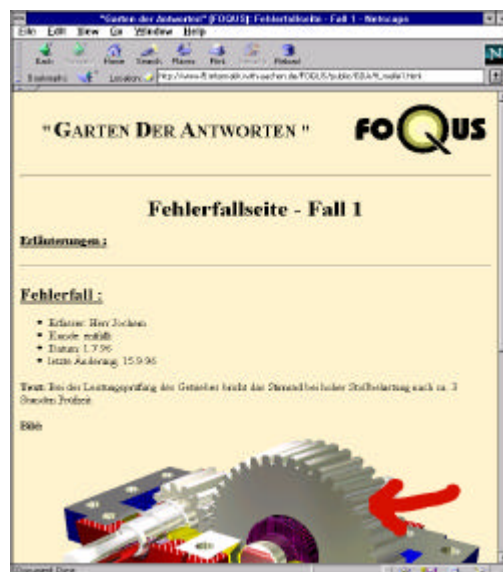
Case-based navigation of failures [Ackermann '92]

- Simple technology
- Ease-of-use
- Distribution of failure knowledge
- Construction of search paths & email

(informational and technological barriers)

Internet:

<http://www-i5.informatik.rwth-aachen.de/FOQUS>

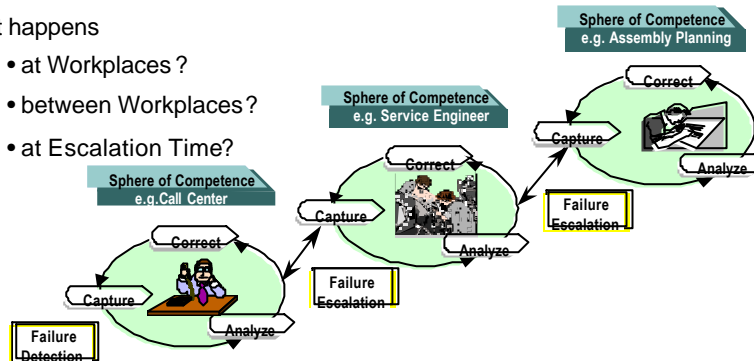


Lehrstuhl Informatik V
(Informationssysteme)
Prof. Dr. M. Jarke
IS-MG-9705-28

Operational Support for Failure Escalation Workflow

What happens

- at Workplaces?
- between Workplaces?
- at Escalation Time?



- *Experience-based Diagnosis* of Failures at Enriched Workplaces
- *Contract-based Planning* of Workflows and Information Flows
- *Negotiation-based Processes* about concrete Escalation Paths

➔ **Mix of Different Workflow Technologies**

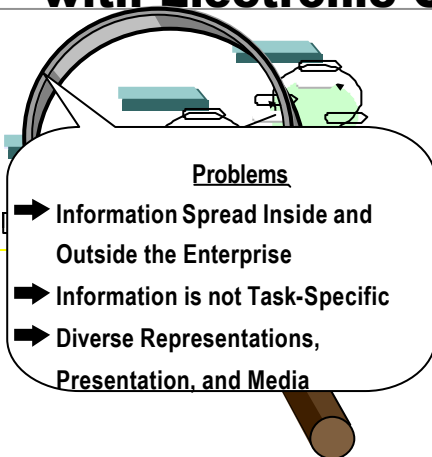
Matthias Jarke



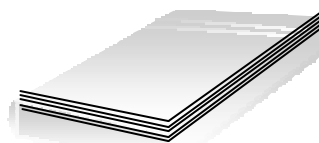
Lehrstuhl Informatik V
(Informationssysteme)
Prof. Dr. M. Jarke
15-MG-9705-29

Encapsulation of Problem Context with Electronic Circulation Folders

Matthias Jarke



- Store Available Information in a Single Meta-Document (ECF)
- Integrate Workflow Information into ECF
- Deal with Multi-Media Information to enrich Information Content of ECF
- Insert Links in ECF for Enterprise Information Systems



Electronic Circulation Folder

[Karbe, Ramsperger '91]

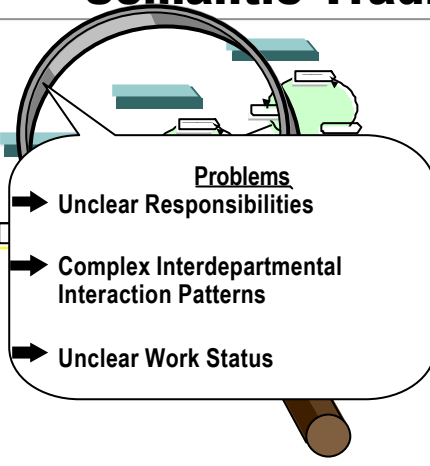
Electronic Circulation Folders: [Karbe and Ramsperger '91]
Application in Failure Management: [FOQUS '97]



Lehrstuhl Informatik V
(Informationssysteme)
Prof. Dr. M. Jarke
15-MG-9705-30

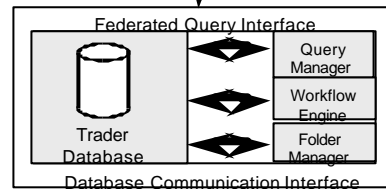
Routing Folders through Semantic Trading Mechanisms

Matthias Jarke



- Define Workflow and Information Flow for Interdepartmental Processes
- Define Negotiation Interfaces between Departments for Folder Transfer
- Monitor Folders

Heterogeneous Information Sources



Enriched Workplaces



Lehrstuhl Informatik V
(Informationssysteme)
Prof. Dr. M. Jarke
IS-MG-9705-31

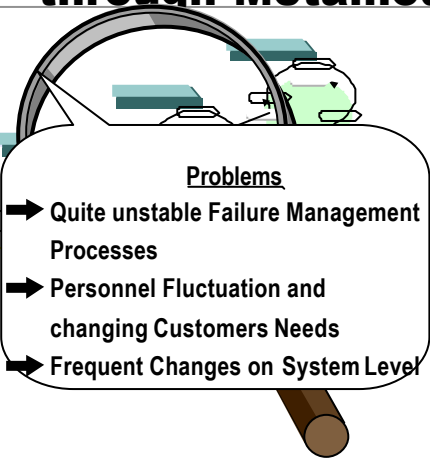
Semantic Trading Technology: [Peters and Szczurko '94, Jarke et al. '95]

Information Flow Planning: [Peters '96]

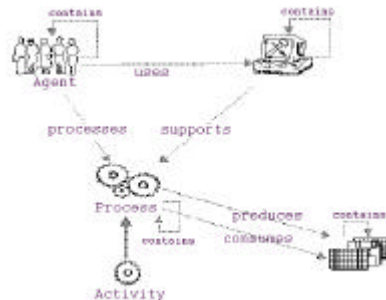
Workflows: [Schäl '96, Szczurko '96]

Dealing with Change through Metamodeling Techniques

Matthias Jarke



- Shareable and Extensible Background Knowledge
- Object-Oriented Repository *Concept-Base* for Model Storage and Evolution
- Modeling Workflows and Information Flows cooperatively with Knowledge Representation Language *TELOS*



Lehrstuhl Informatik V
(Informationssysteme)
Prof. Dr. M. Jarke
IS-MG-9705-32

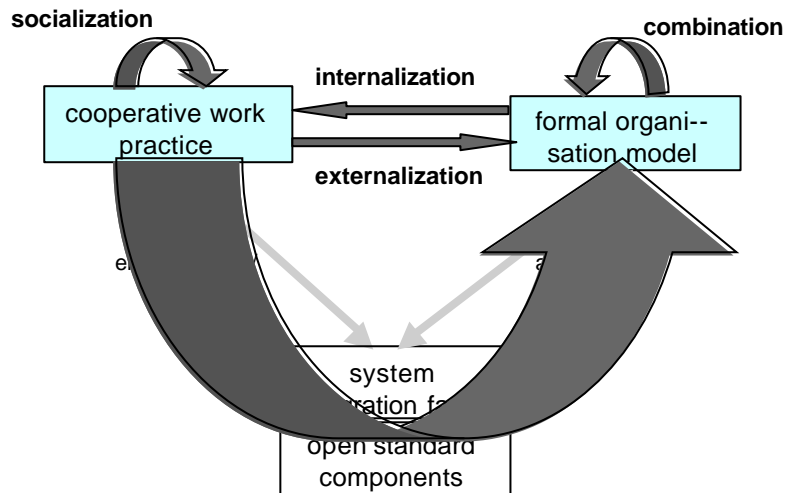
Telos: [Mylopoulos et al. '90]

ConceptBase: [Jarke et al. '95]

Cooperative Modeling [Jarke et al. '96]

IT-Supported Knowledge Mgmt.: Experience-Based Approach

Matthias Jarke



Lehrstuhl Informatik V
(Informationssysteme)
Prof. Dr. M. Jarke
15-MG-9705-33

Summary

Matthias Jarke

- Organizational learning demands diversity to detect Type II errors, thus autonomous networking
- Experience-based knowledge management as interplay between people, organization, and IT
 - integration of group support and data mining
 - exception scenarios in reference models
 - integration of full Nonaka cycle via OM/ WFMS
- operational or ongoing industry installations:
 - reclamation management in medical technology,
 - learning engineer's helpdesk in factory leitstand
 - OM + WFMS in gear production



Lehrstuhl Informatik V
(Informationssysteme)
Prof. Dr. M. Jarke
15-MG-9705-34

Ongoing Research

Matthias Jarke

- Stronger formalization/simulation/integration theory
 - TROPOS: agent-oriented Telos extension (SPP Sozionik)
 - PRIME: process-integrated multimedia workplaces (DFG, EU CREWS)
- refining application experiences
 - cooperative chemical engineering (SFB IMPROVE, EU Global Cape-Open)
 - cooperation in cultural-science projects (SFB ,Media and Cultural Communications‘)
 - b2b e-commerce (BMBF AdCo, EU-MEMO)



Lehrstuhl Informatik V
(Informationssysteme)
Prof. Dr. M. Jarke
15-MG-9705-35