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processes for a flexible world

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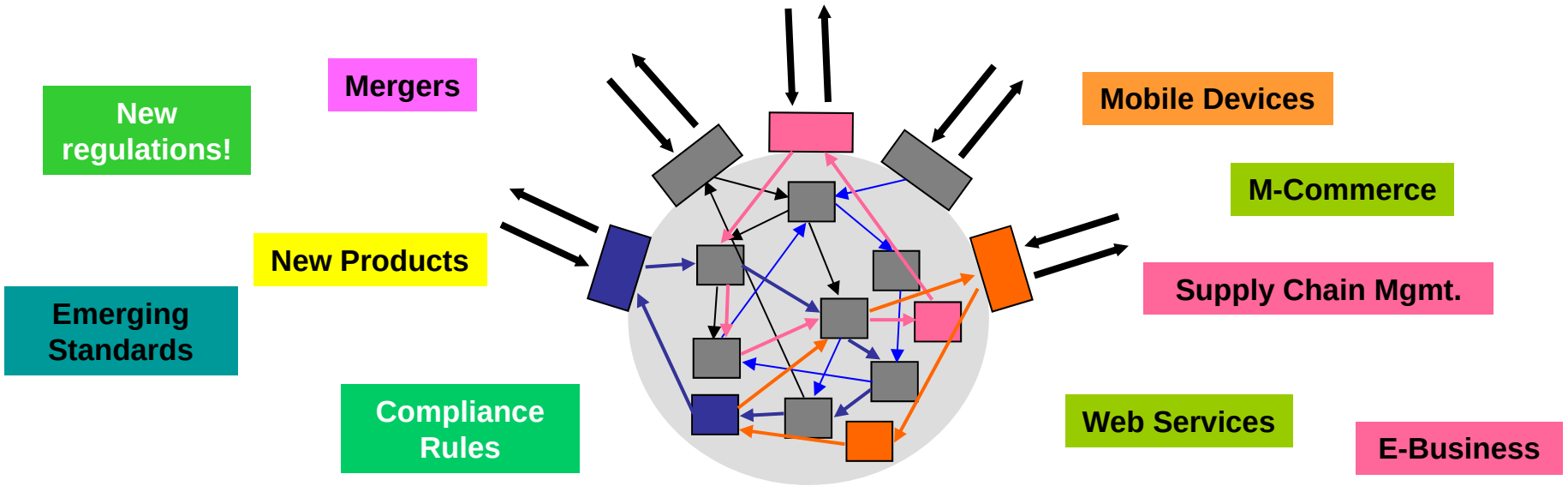
A Decade of Research on "Fluid" Processes:
Beyond Rigidity in Business Process Support

Manfred Reichert

Motivation

Permanent new "trends" – require new or adapted services ... which must be integrated

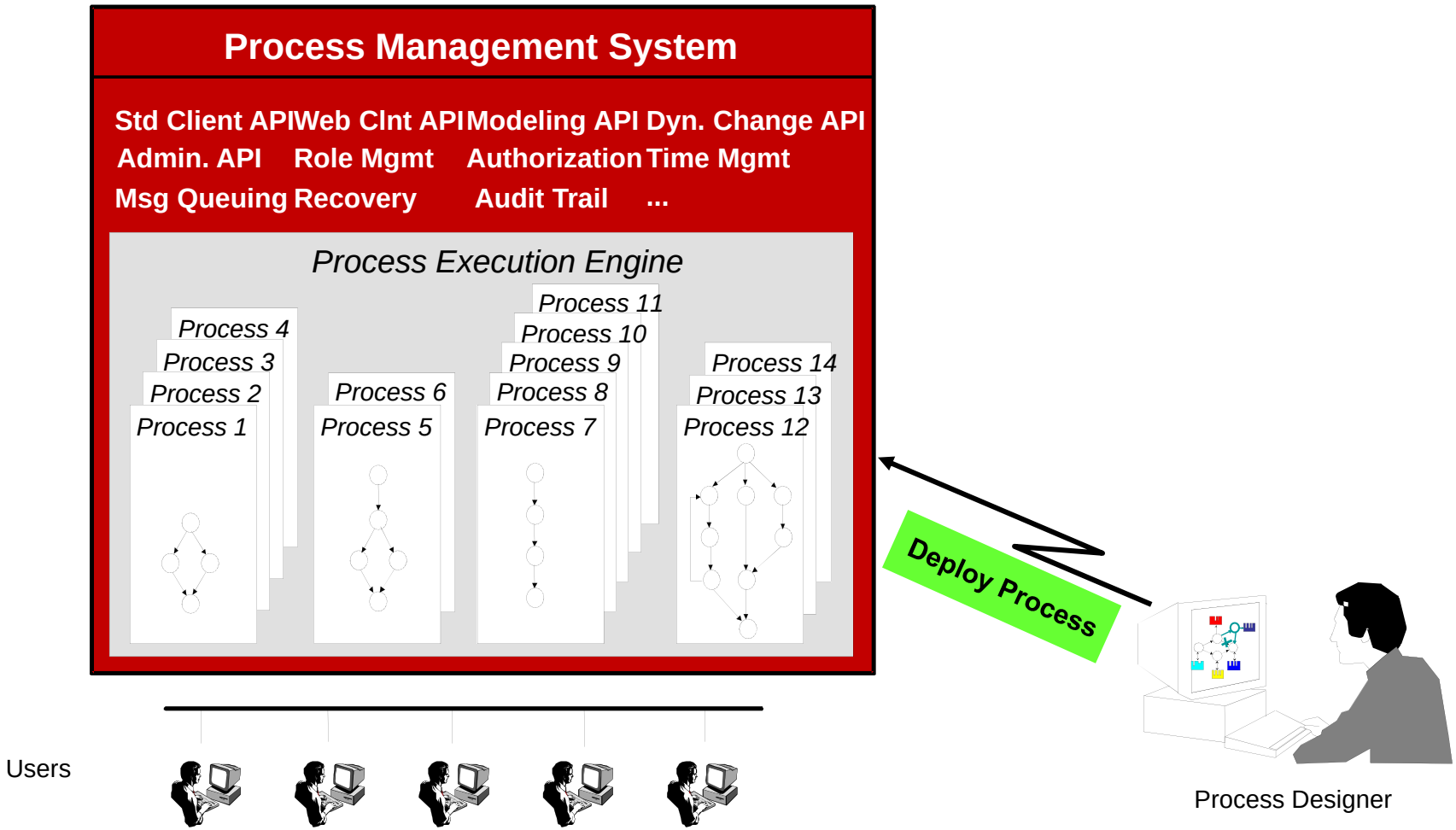


Issues:

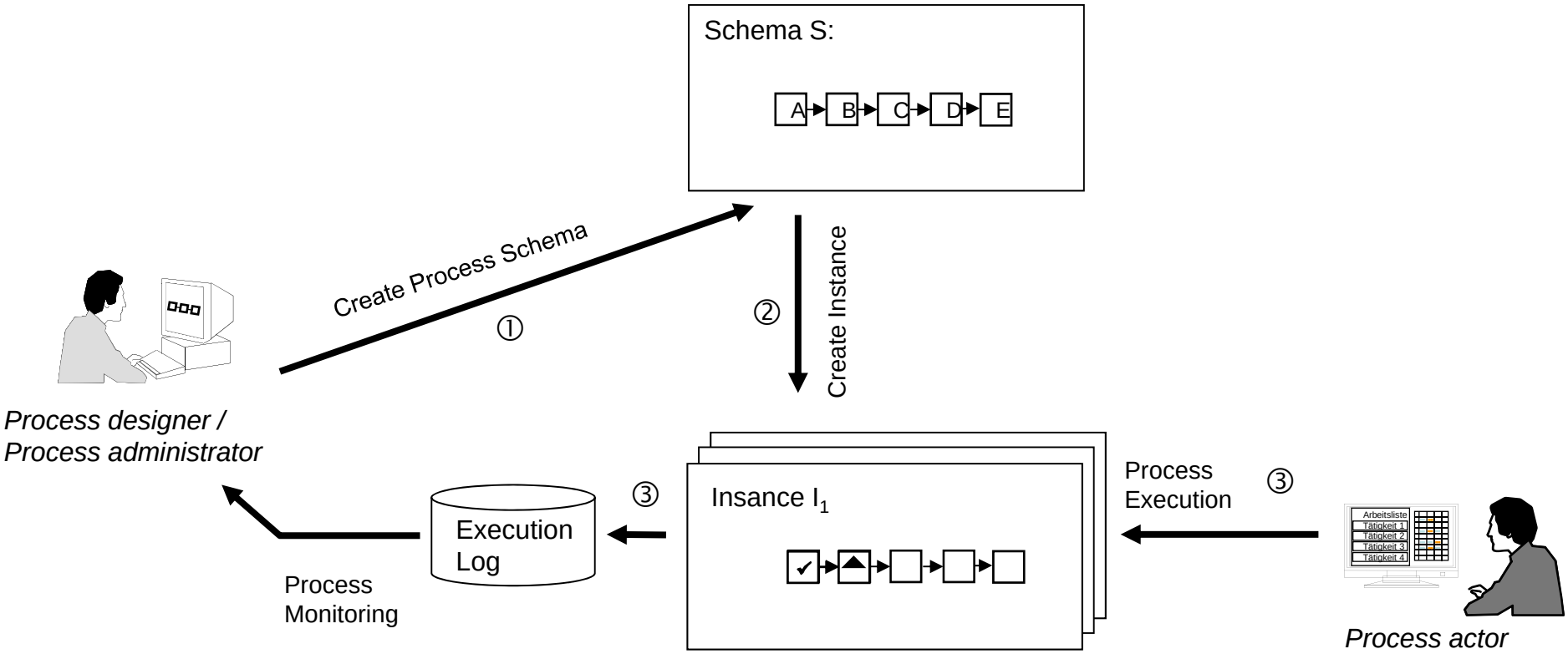
- How quickly can processes be implemented?
- At which costs? – With which error risks?
- How expensive will later process changes be?
- How to avoid high maintenance efforts?

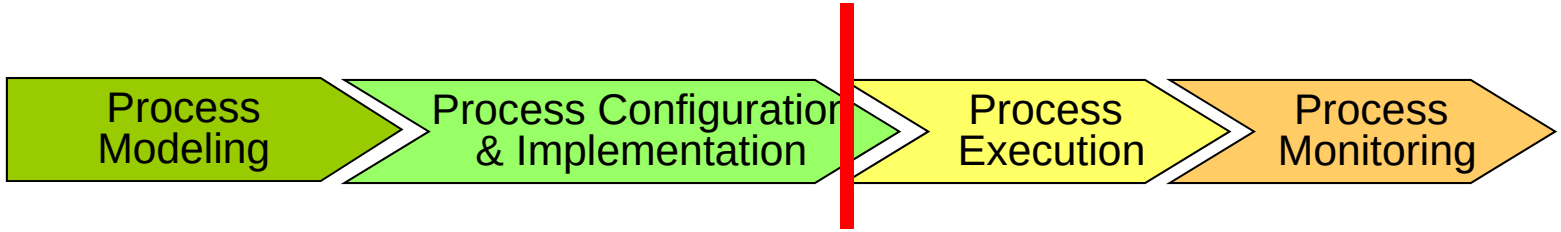
⇨ ***Need for Process-awareness***

Motivation


Process Management System
Std Client API
Web Clnt API
Modeling API
Dyn. Change API
Admin. API
Role Mgmt
Authorization
Time Mgmt
Msg Queuing
Recovery
Audit Trail
...
Process Execution Engine
Process 1
Process 2
Process 3
Process 4
Process 5
Process 6
Process 7
Process 8
Process 9
Process 10
Process 11
Process 12
Process 13
Process 14
Deploy Process
Users
Process Designer

Motivation

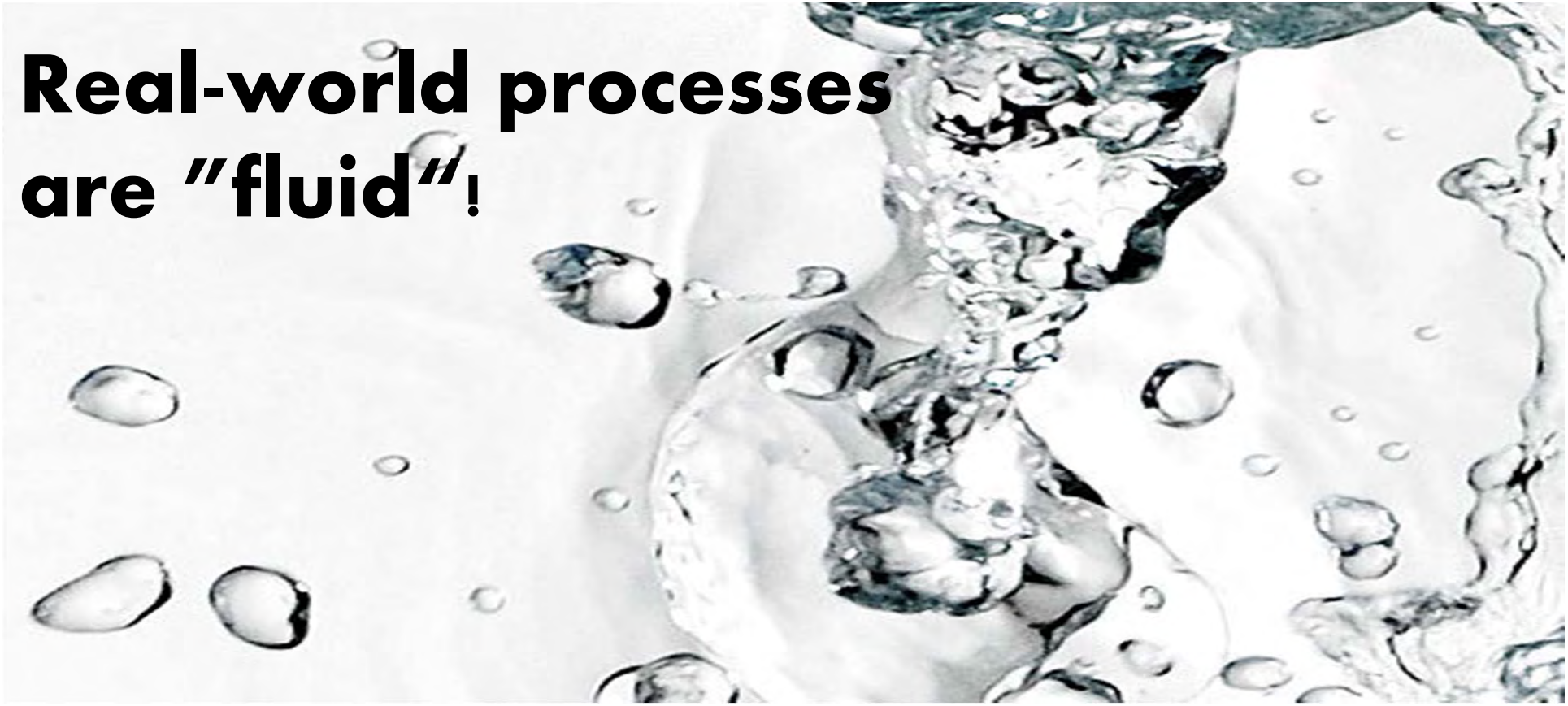

Schema S:
A
B
C
D
E
Create Process Schema
①
②
Create Instance
Process designer /
Process administrator
③
Execution
Log
Process
Monitoring
Insance I_1
Process
Execution
③
Arbeitsliste
Tätigkeit 1
Tätigkeit 2
Tätigkeit 3
Tätigkeit 4
Process actor


Process
Modeling
Process Configuration
& Implementation
Process
Execution
Process
Monitoring

Motivation

- Today's BPM tools are ill equipped to enable **agile enterprises** due of their **inherent brittleness** and **inflexibility**
- Current tool generation implicitly embraces the **"engineer – use " dichotomy** inherited from traditional SE approaches; i.e., systems are first "engineered" and then "used" (or "operated")
- **Maintenance** and **evolution** are not regarded as part of operation, but rather as interruptions to the "in use" state
- **Role of end users** is not well understood!

Real-world processes are "fluid"!

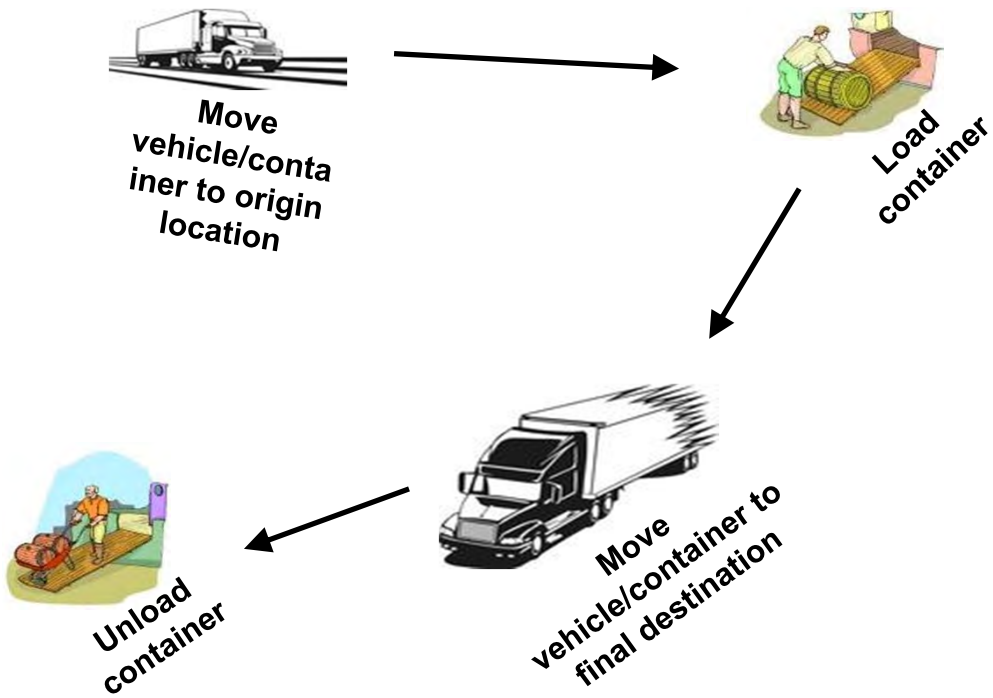


Why process instances dynamically evolve …

Why Process Instances Dynamically Evolve …

Example: Transportation Domain

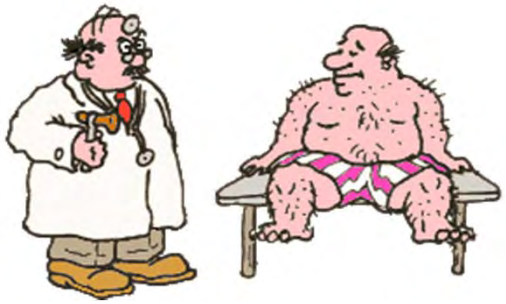
- processes cannot be completely pre-modeled



Why Process Instances Dynamically Evolve …

Example: Healthcare Domain

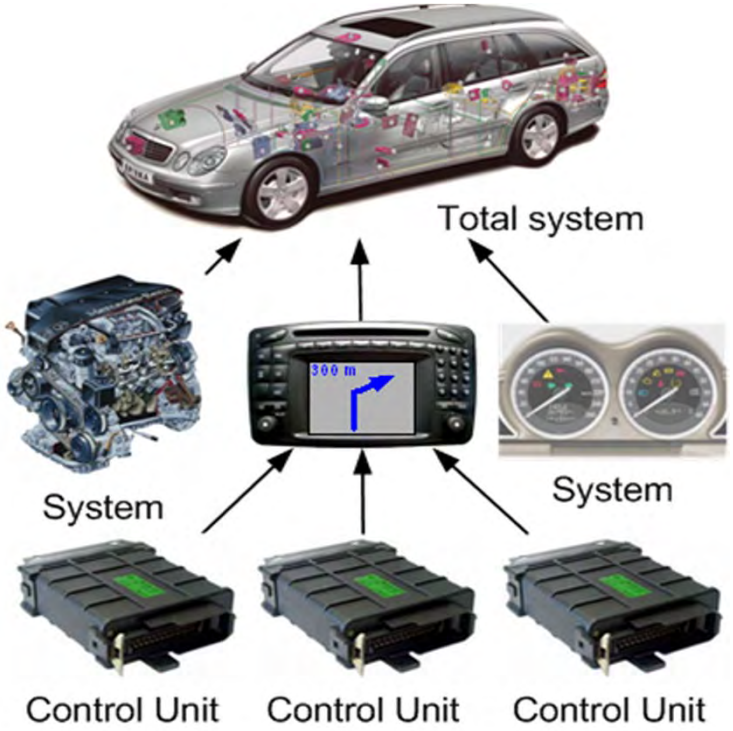
- Process-aware information systems must not prescribe to physicians how to treat their patients?



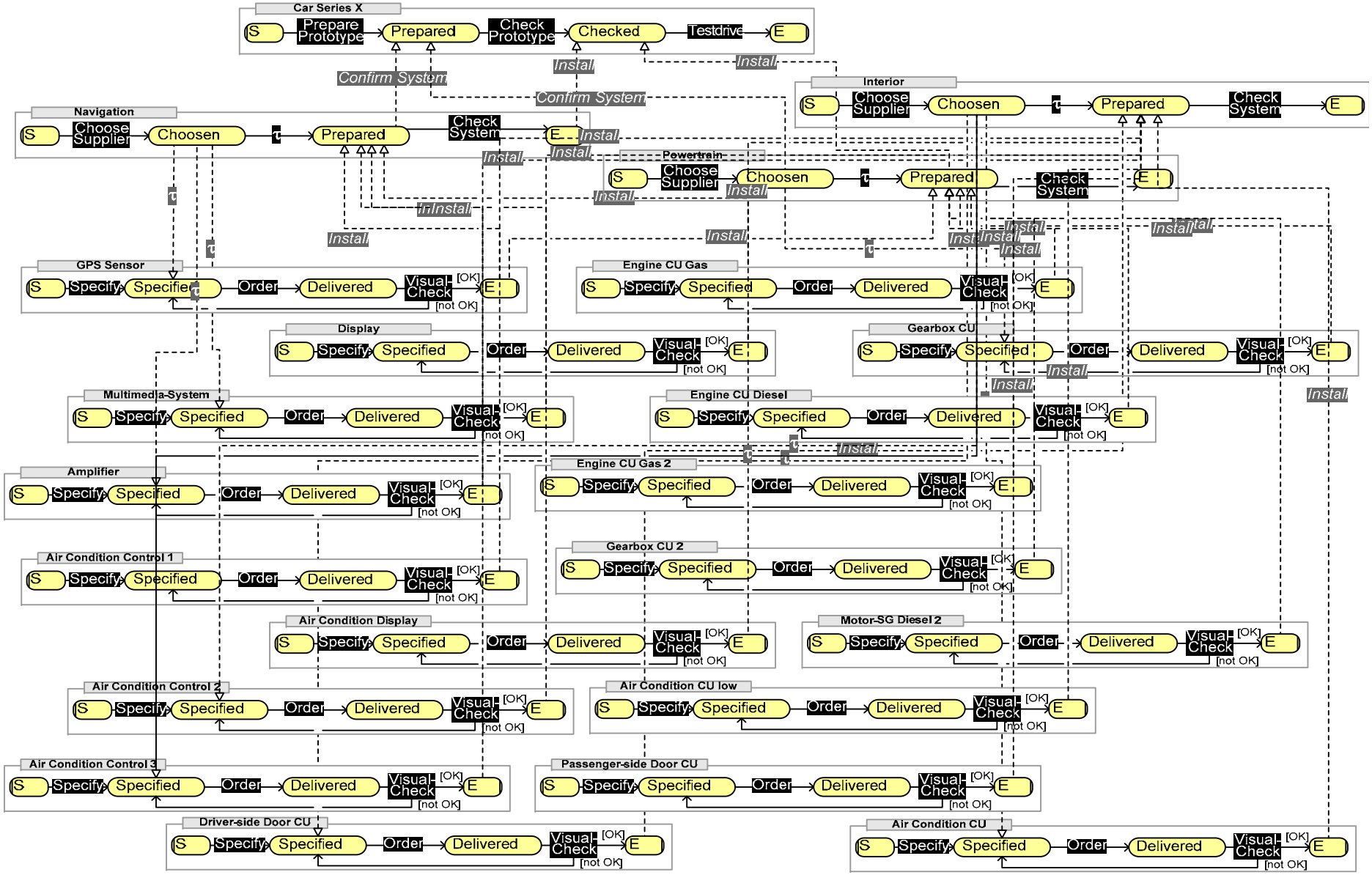
Why Process Instances Dynamically Evolve …

Example: Automotive Engineering

- long-running engineering processes cannot be completely pre-modeled



- Example: Release management for E/E-systems in a car
- 200 - 300 control devices to be systematically tested and released
- Requires the execution of hundreds or thousands of process instances
- Concurrent engineering ⇨ complex dependencies have to be considered


Car Series X
S
Prepare Prototype
Prepared
Check Prototype
Checked
Testdrive
E
Confirm System
Install
Navigation
Choose Supplier
Choosen
Prepared
Check System
Interior
Powertrain
GPS Sensor
Specify
Specified
Order
Delivered
Visual Check
[OK]
[not OK]
Engine CU Gas
Display
Gearbox CU
Multimedia-System
Engine CU Diesel
Amplifier
Engine CU Gas 2
Air Condition Control 1
Gearbox CU 2
Air Condition Display
Motor-SG Diesel 2
Air Condition Control 2
Air Condition CU low
Air Condition Control 3
Passenger-side Door CU
Driver-side Door CU
Air Condition CU

Why Process Instances Dynamically Evolve …

- Requires to **dissolve the fundamental distinction between "engineering" and "use"**; i.e., end users must be empowered to dynamically evolve processes

- This will lead us to a new class of processes whose "engineering" and "use" is intervoven ☞ **fluid processes**

- *Fluid processes are continually **adapted** and reformed to **fit the actual needs and constraints** of the situation in hand and to fulfill the overall goals of the involved organizations in the best possible way.*

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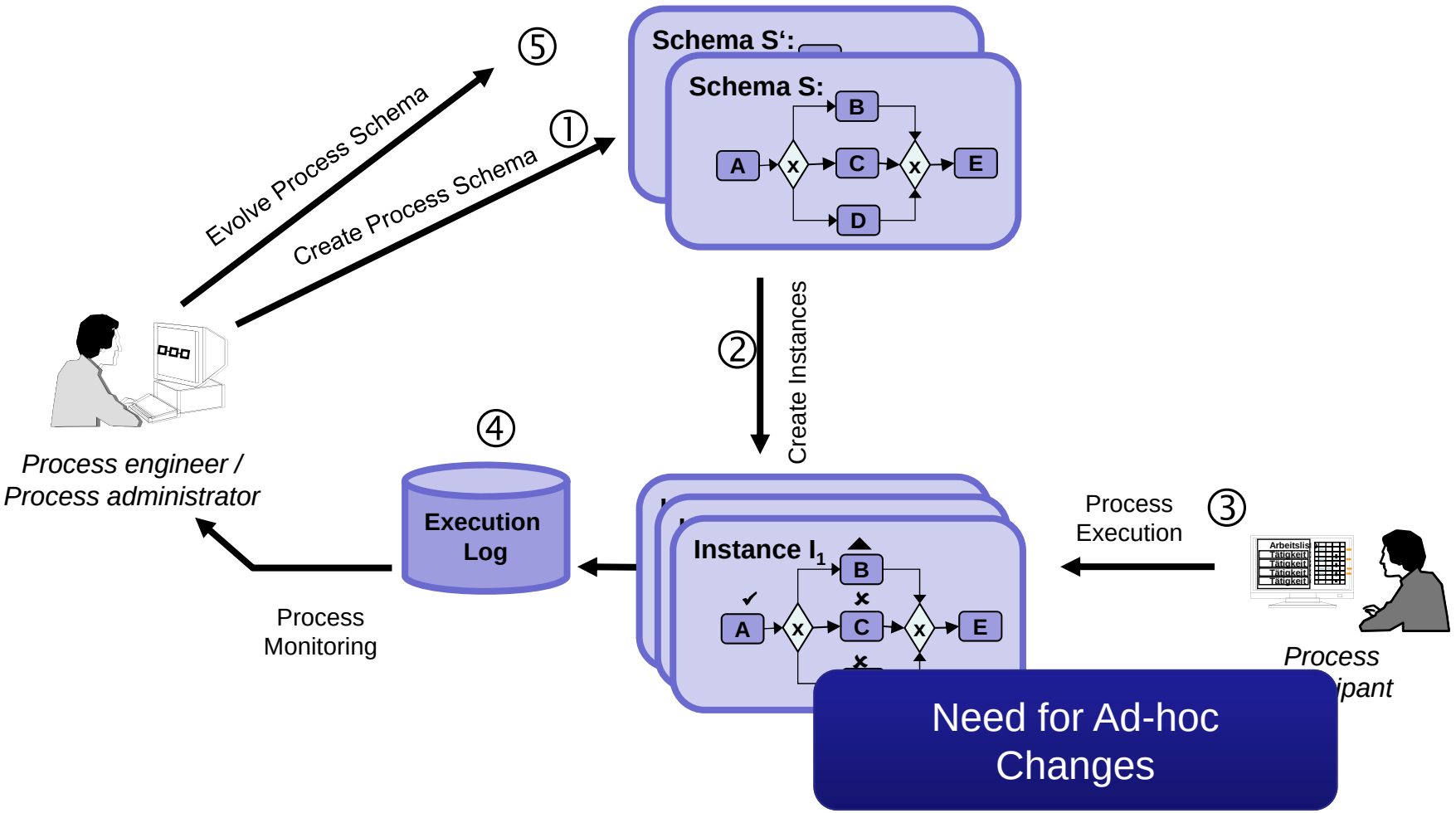
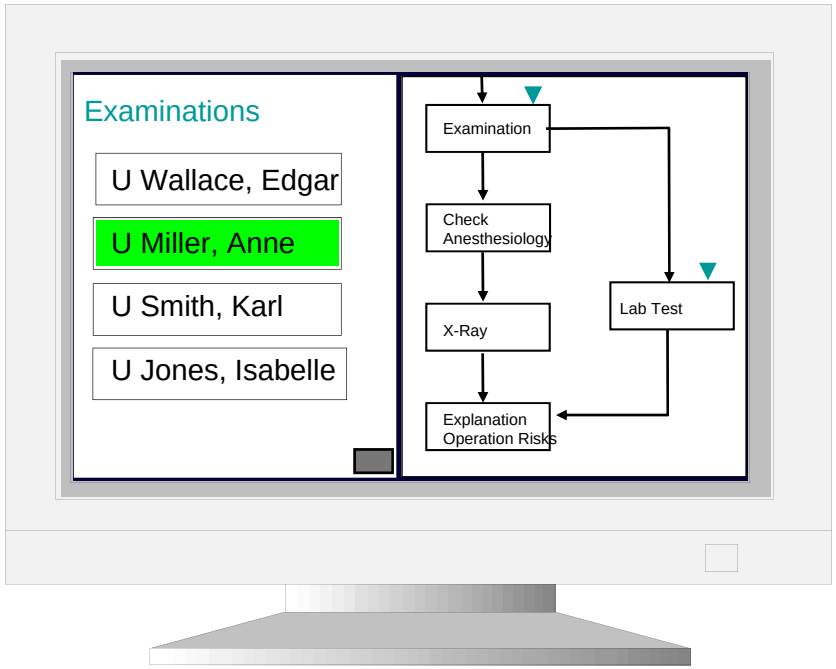
Adaptive Process-Aware Information Systems: Enabling Fluid Processes at Runtime

Adaptive PAIS: Ad-hoc Changes



Ad-hoc Changes



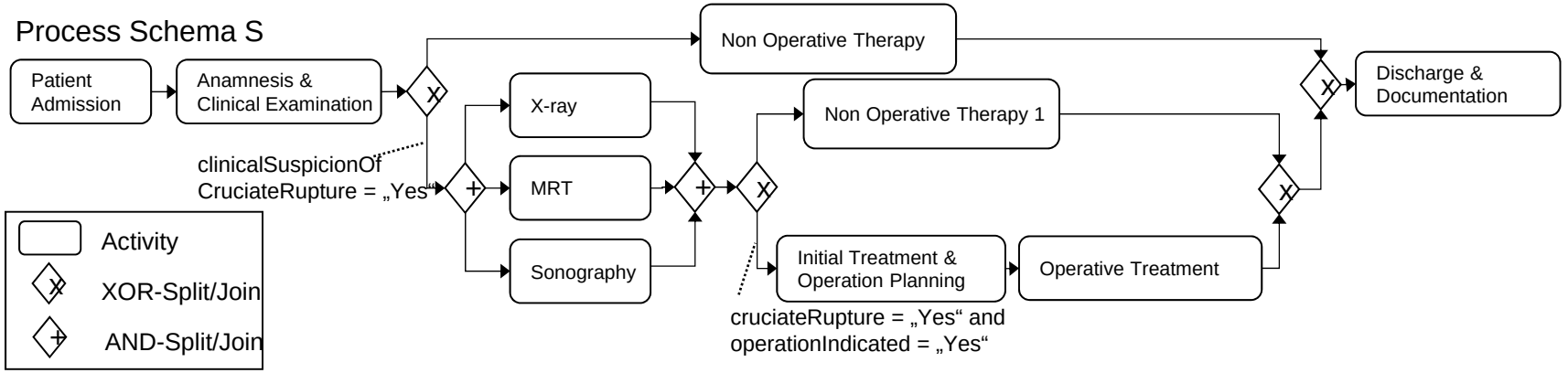
The Users' View

Reichert, Manfred and Dadam, Peter (1998) *ADEPTflex-Supporting Dynamic Changes of Workflows Without Losing Control.* Journal of Intelligent Information Systems, Special Issue on Workflow Management Systems, 10(2): 93-129, Kluwer

Ad-hoc Changes

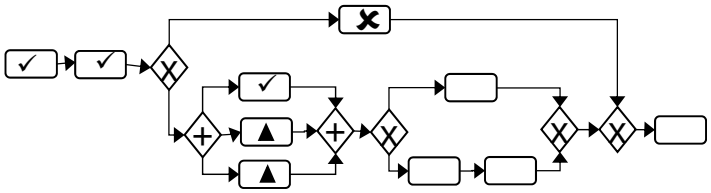
Ad-hoc Flexibility: Deviations, Change

Process Type Level



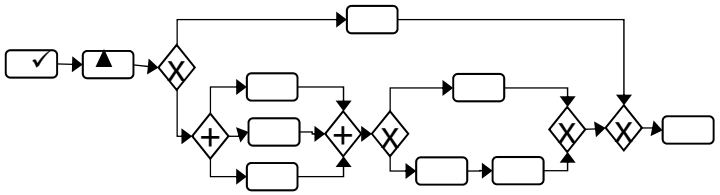
Process Instance Level

Process Instance I1



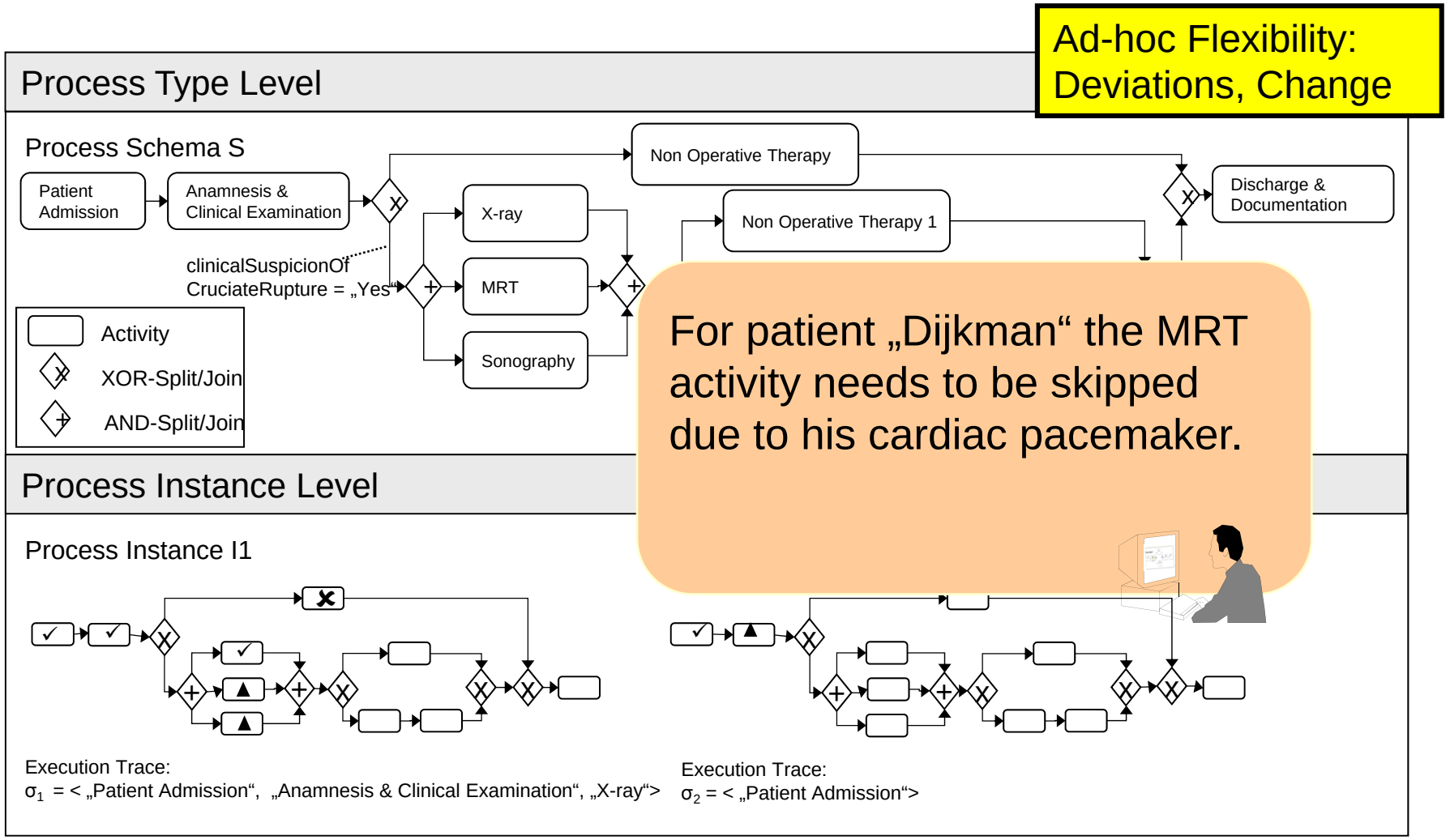
Execution Trace:
σ_1 = < „Patient Admission“, „Anamnesis & Clinical Examination“, „X-ray“>

Process Instance I2



Execution Trace:
σ_2 = < „Patient Admission“>

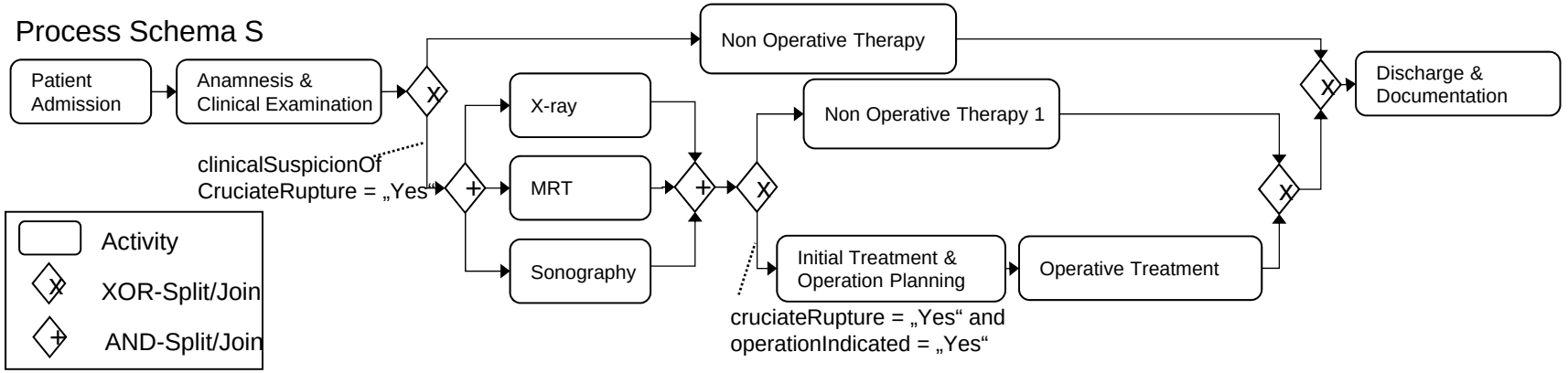
Ad-hoc Changes



Ad-hoc Changes

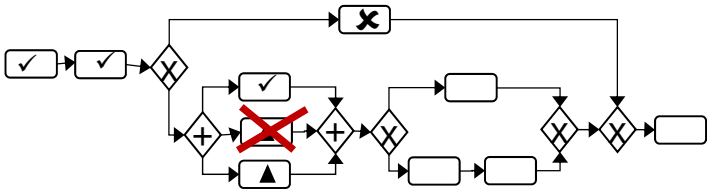
Ad-hoc Flexibility: Deviations, Change

Process Type Level



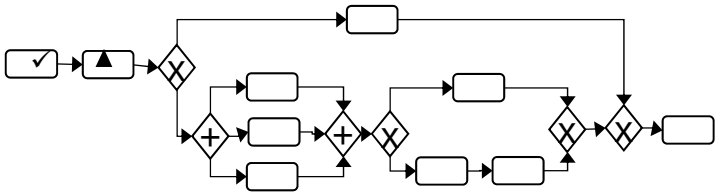
Process Instance Level

Process Instance I1



Execution Trace:
σ_1 = < „Patient Admission“, „Anamnesis & Clinical Examination“, „X-ray“>

Process Instance I2

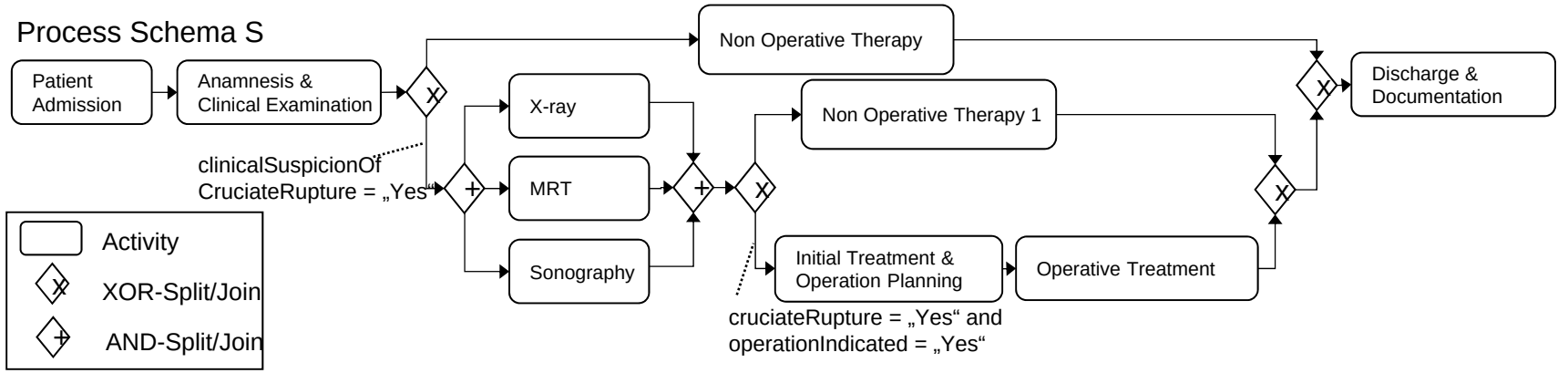


Execution Trace:
σ_2 = < „Patient Admission“>

Ad-hoc Changes: State Compliance

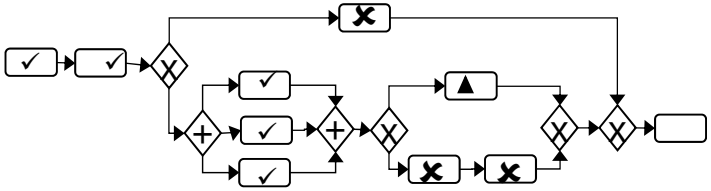
Process Type Level

Process Schema S



Process Instance Level

Process Instance I3

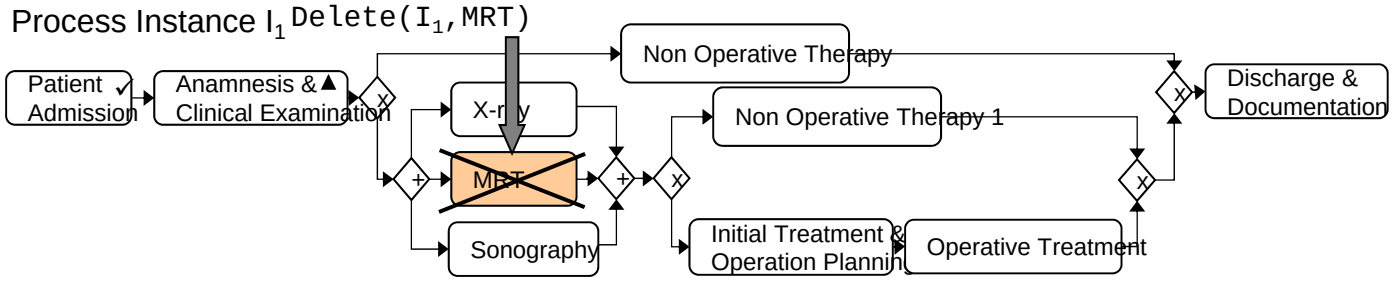


Execution Trace:
σ_3 = < „Patient Admission“, „Anamnesis & Clinical Examination“, „MRT“, „X-ray“, „Sonography“>

I3 is not compliant with change Delete (I3, MRT)

Ad-hoc Changes: User Assistance

- Annotating changes with information about the reasons for the change
- Retrieval of similar past changes based on context information
- Reuse of changes through PAIS



pd_{c_1} = The treatment of cruciate ruptures routinely includes a magnetic resonance tomography (MRT), an X-ray and a sonography. However, for a particular patient the MRT may have to be skipped as the respective patient has a cardiac pacemaker.

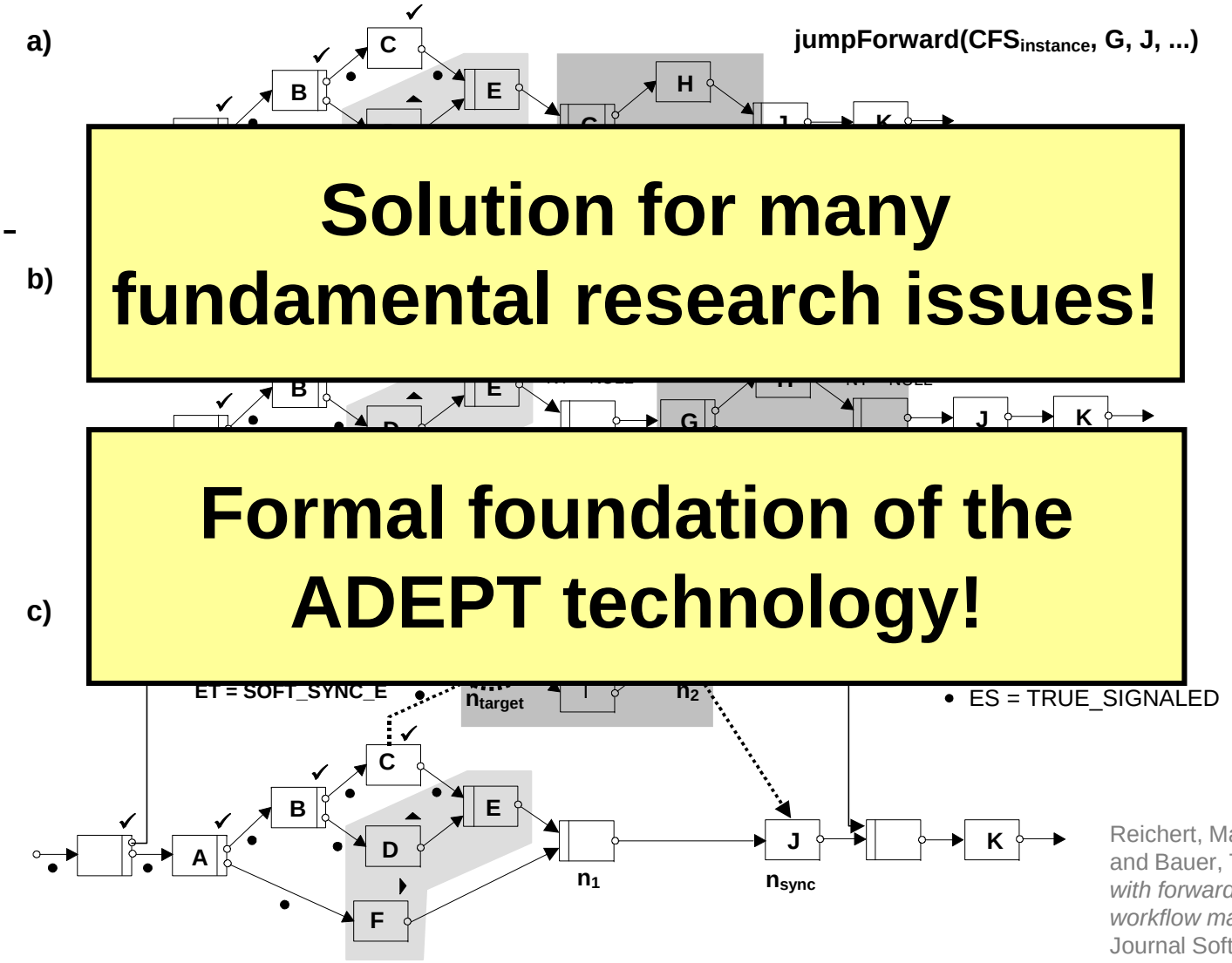
qaSetc1 = {(Does the patient have a cardiac pacemaker?, Patient.problemList.hasPacemaker = 'Yes')}

sol_{c_1} = <Delete(S_I,MRT)>

$freq_{c_1}$ = 1

Case c_1

Ad-hoc Changes: The ADEPT Framework



Solution for many fundamental research issues!

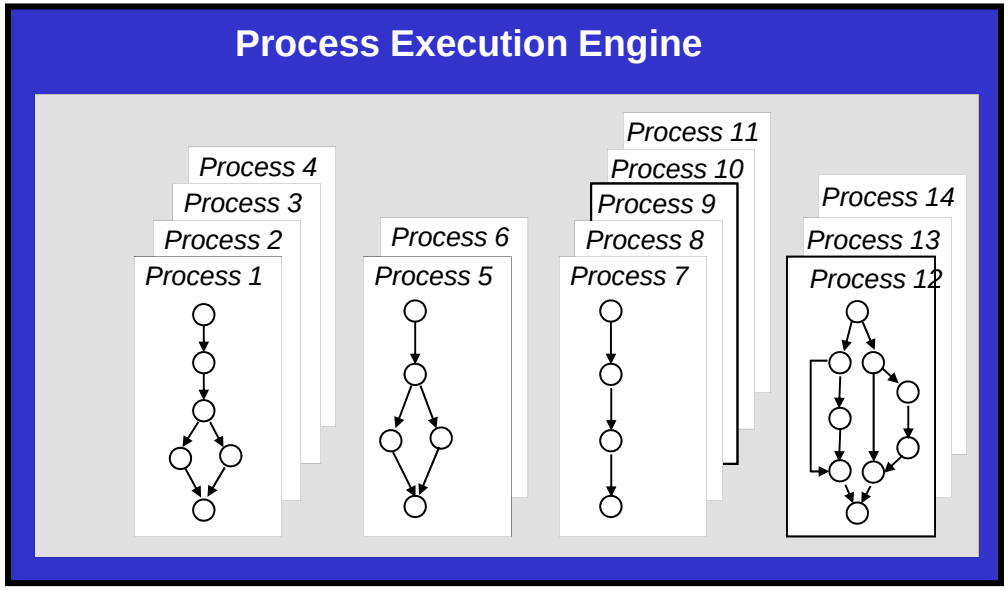
Formal foundation of the ADEPT technology!

Reichert, Manfred and Dadam, Peter and Bauer, Thomas (2003) *Dealing with forward and backward jumps in workflow management systems.* Int'l Journal Software and Systems Modeling (SOSYM), 2(1): 37-58

Ad-hoc Changes: The ADEPT Framework

ADEPT :

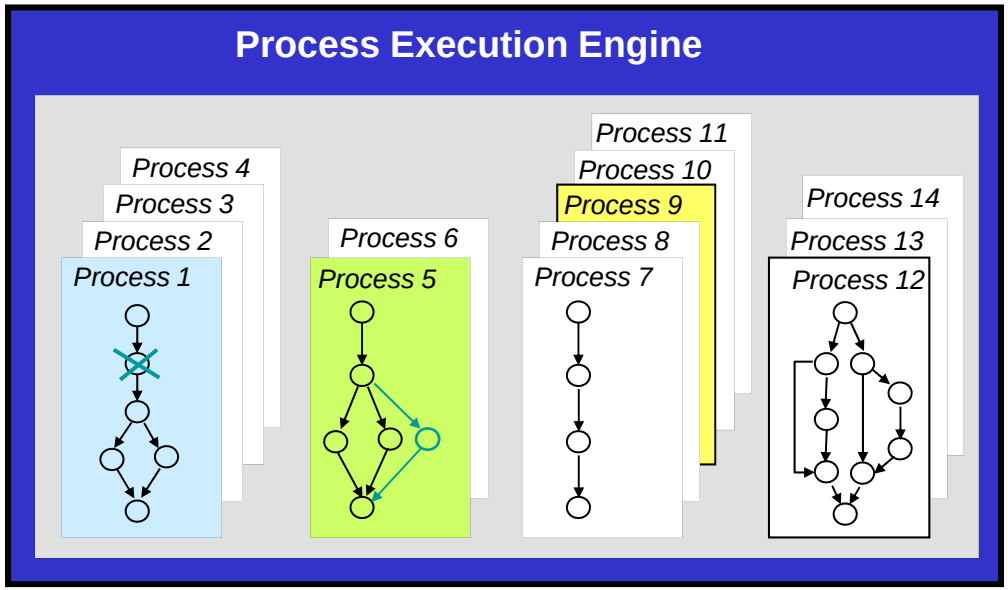
Individually adaptable Process Instances



Ad-hoc Changes: The ADEPT Framework

ADEPT :

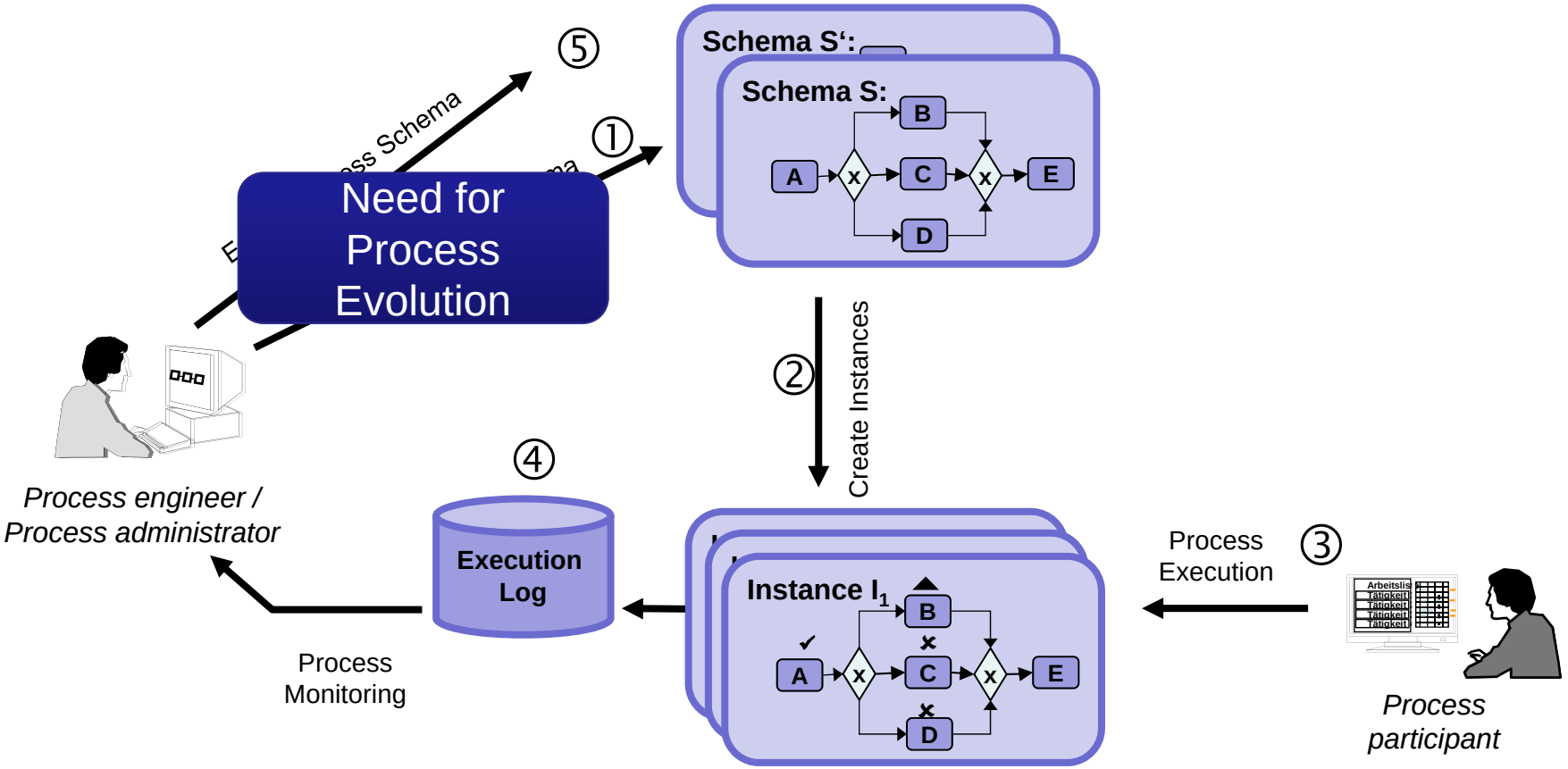
Individually adaptable Process Instances



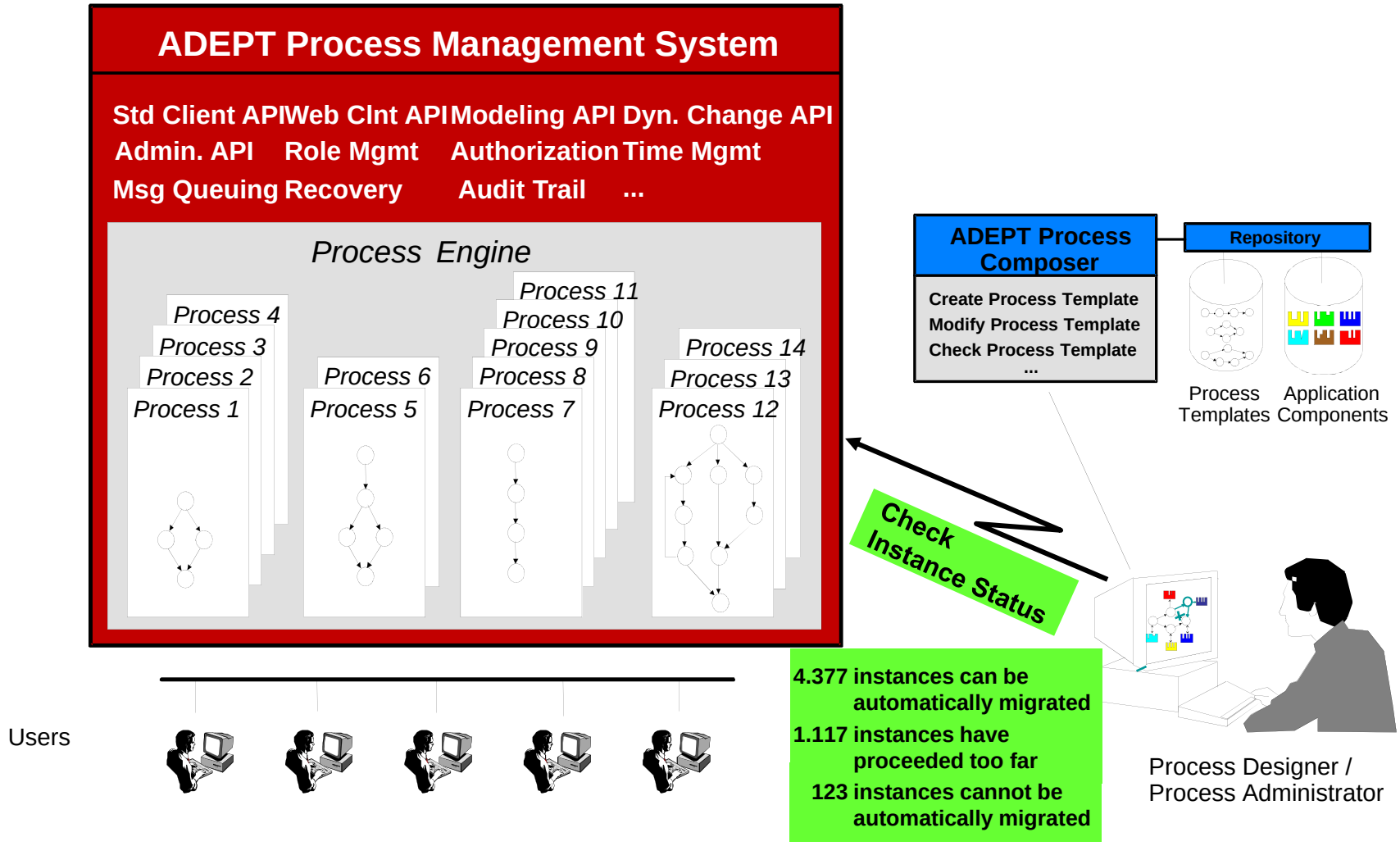
Achievements:

- **Formal process meta model** (expressive + restricted enough)
- **Formal Criteria for Change Correctness** (incl. „Theorems & Proofs")
- **Efficient, build-in consistency checks** („no bad surprise")
- **Support of a high number of change patterns**
- **API for accomplishing ad-hoc changes**

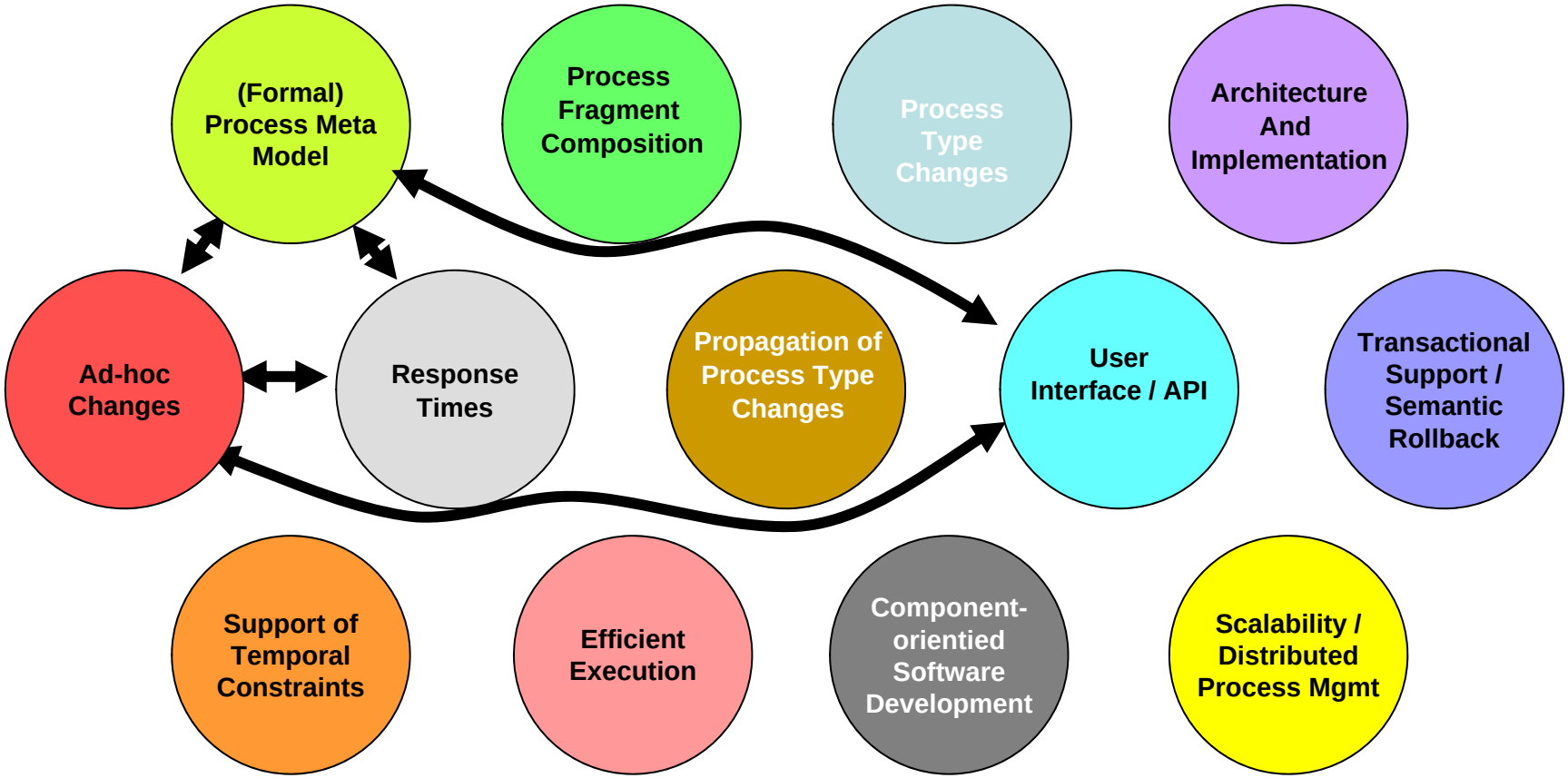
Adaptive PAIS: Process Schema Evolution



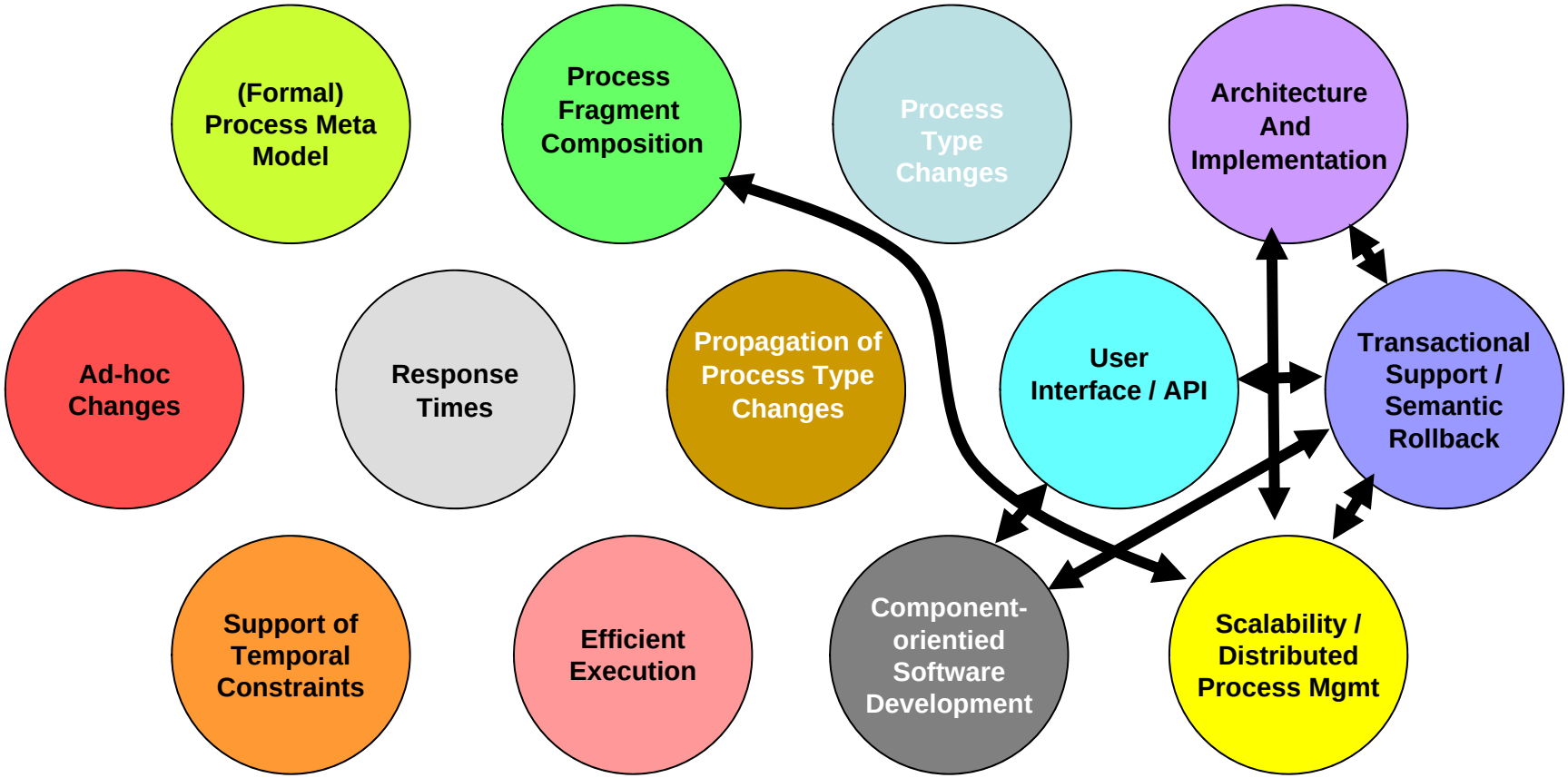
Process Schema Evolution



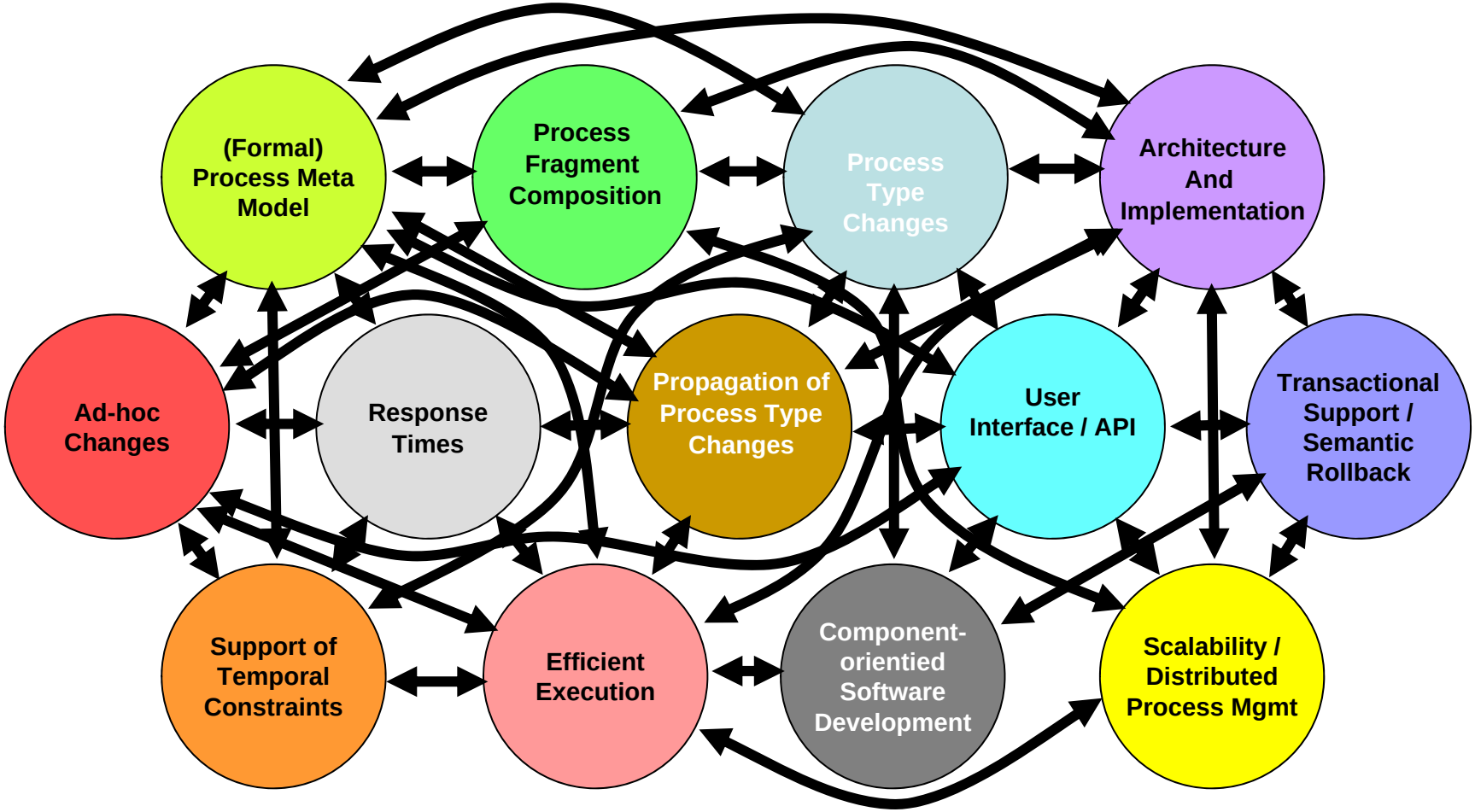
The ADEPT Approach



The ADEPT Approach



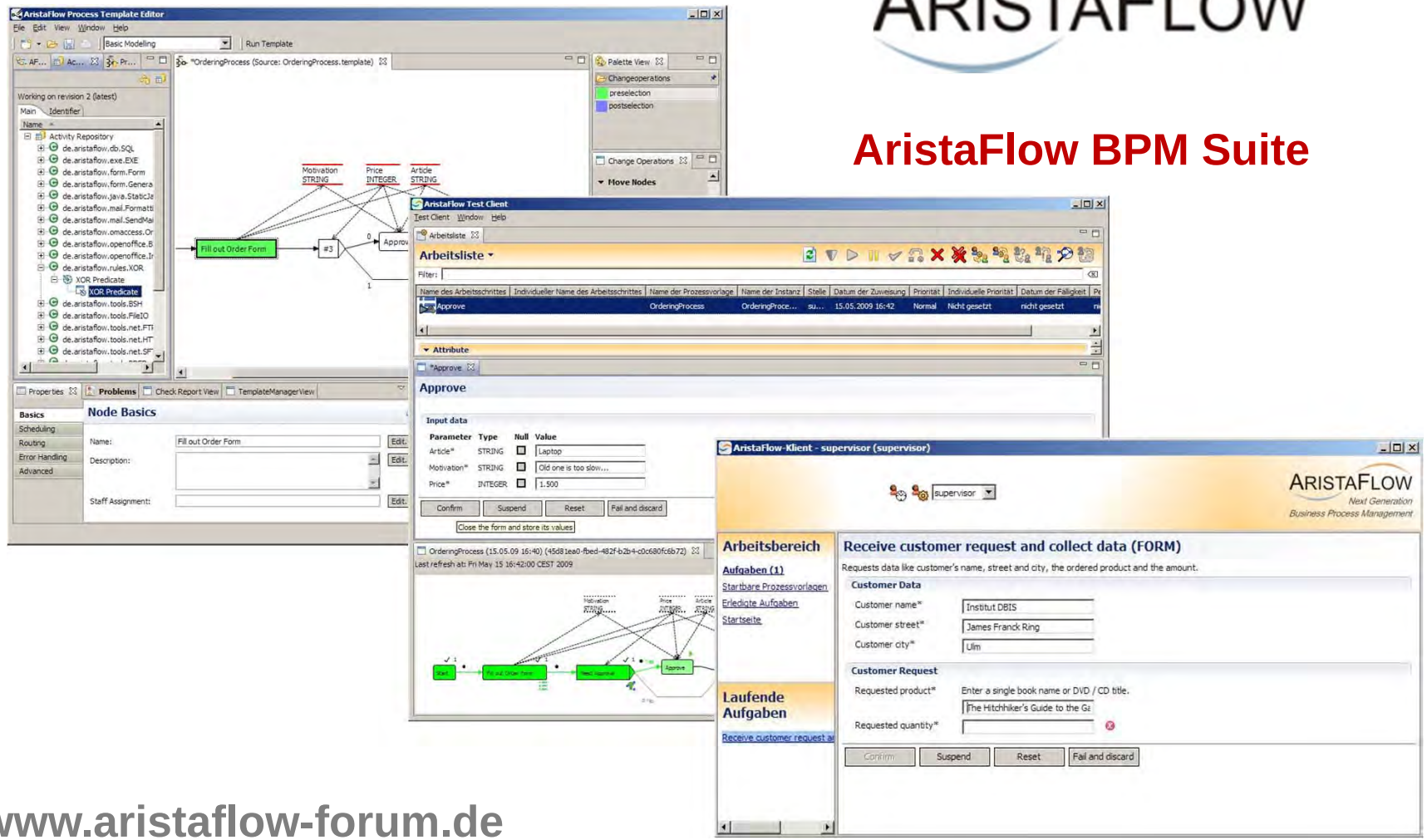
The ADEPT Approach



Transferring Adept to Practice

ARISTAFLOW

AristaFlow BPM Suite



www.aristaflow-forum.de

Adaptive PAIS: Comparing Flexibility Frameworks

- Ability to deal with process changes is among the critical success factors for any process-aware information system (Mutschler et al. 2008)
- Several competing approaches to foster flexibility in process-aware information systems
  - Adaptive workflows (e.g., Reichert & Dadam 1998)
  - Case handling (e.g., van der Aalst et al. 2005)
  - Declarative processes (e.g., Pesic et al. 2007)
  - Late binding / Late Modeling (e.g., Sadiq et al. 2001)

☞ Lack of methods for a systematic comparison

Weber, Barbara and Reichert, Manfred (2008) Change Patterns and Change Support Features - Enhancing Flexibility in Process-Aware Information Systems . Data and Knowledge Engineering, 66(3): 438-466,

Adaptive PAIS: Comparing Flexibility Frameworks

Change Patterns

Pattern AP5: SWAP Process Fragment

Description Two existing process fragments are swapped in process schema S.

Example Regarding a particular delivery process the order in which requested go
delivered to two customers has to be swapped

Problem

Implementation

Related Patterns

Pattern AP1: INSERT Process Fragment

Description A process fragment X is added to a process schema S.

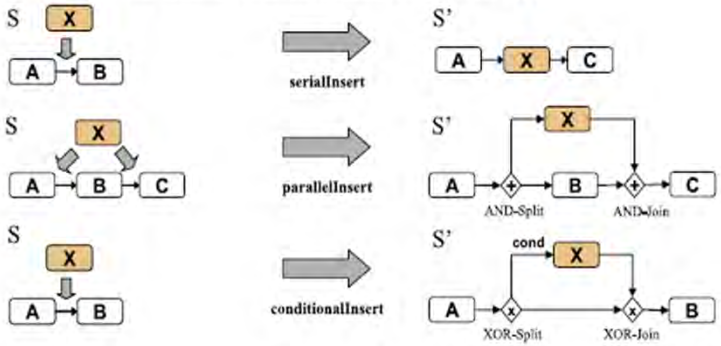
Example For a particular patient an allergy test has to be added to his treatment process due to a drug incompatibility.

Problem In a real world process a task has to be accomplished which has not been modeled in the process schema so far.

Design Choices (in addition to those described in Fig. 6)

C. How is the new process fragment X embedded in the process schema?

1. X is inserted between two directly succeeding activities (`serial insert`)
2. X is inserted between two activity sets (`insert between node sets`)
   a) without additional condition (`parallel insert`)
   b) with additional condition (`conditional insert`)



Implementation This adaptation pattern can be realized by transforming the high level insertion operation into a sequence of low level change primitives (e.g., add node, add edge).

Pattern PP3: Late Composition of Process Fragments

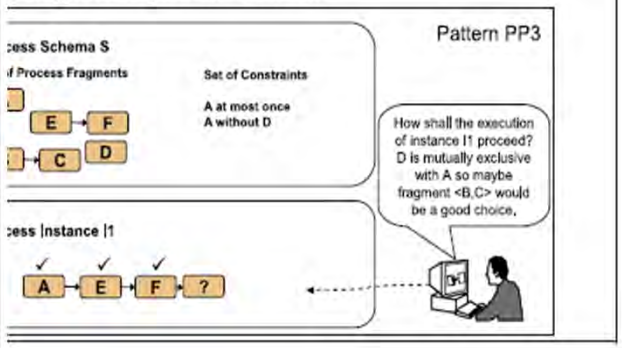
Description At build-time a set of process fragments is defined from which the schema of a concrete process instance can be composed during run time. This can be achieved by dynamically
nd by specifying the control dependencies between them on the fly.

:dical examinations are accomplished in a hospital. The exact
plied to a particular patient and the order in which they are performed are
nt individually depending on his/her medical problems.

ariants of how process fragments can be composed. To reduce the number
be specified by the process engineer during build time, process instances
posed from a given set of fragments.

sic building blocks for late modeling?
fragments from the repository can be chosen.
t-based subset of the process fragments from the repository can be

ies or process fragments can be defined.



Adaptive PAIS: Comparing Flexibility Frameworks

Change Support Features

- Schema Evolution, Version Control and Instance Migration
- Support for Instance-Specific Changes
- Correctness of Changes
- Traceability and Analysis of Changes
- Access Control of Changes
- Change Reuse
- Change Concurrency Control
- Refactoring Support for Process Models

Adaptive PAIS: Comparing Flexibility Frameworks

Primitive / Pattern	Academic								Commercial	
	ADEPT2 / CBRFlow	CAKE 2	HOON	MOVE	PoF	WASA2	WIDE	YAWL + Worklets / Exlets	Flower	Staffware
Change Primitives										
PR1 – Add Node	–	+	+	+	+	+	+	+	+	+
PR2 – Remove Node	–	+	+	+	+	+	+	+	+	+
PR3 – Add Edge	–	+	+	+	+	+	+	+	+	+
PR4 – Remove Edge	–	+	+	+	+	+	+	+	+	+
PR5 – Move Edge	–	+	–	–	–	–	–	+	–	–
Adaptation Patterns										
AP1 – Insert Fragment	A[1, 2], B[1,2,3], C [1, 2]	–	–	–	–	–	A[2], B[1], C[1,2]	–	–	–
AP2 – Delete Fragment	A[1, 2], B[1,2,3]	–	–	–	–	–	A[2], B[1]	–	–	–
AP3 - Move Fragment	A[1, 2], B[1,2,3], C[1,2]	–	–	–	–	–	–	–	–	–
AP4 – Replace Fragment	–	–	–	–	–	–	A[2], B[1]	–	–	–
AP5 – Swap Fragment	–	–	–	–	–	–	–	–	–	–
AP6 – Extract Fragment	A[1,2], B[3]	–	–	–	–	–	–	–	–	–
AP7 – Inline Fragment	A[1,2], B[2]	–	–	–	–	–	–	–	–	–
AP8 – Embed Fragment in	A[1,2], B[1,2,3]	–	–	–	–	–	–	–	–	–
AP9 – Parallelize Activities	A[1,2], B[1,2,3]	–	–	–	–	–	–	–	–	–
AP10 - Embed Fragment in Conditional Branch	–	–	–	–	–	–	A[2]	–	–	–
AP11 – Add Control Dependency	A[1,2]	–	–	–	–	–	–	–	–	–
AP12 – Remove Control Dependencies	A[1,2]	–	–	–	–	–	–	–	–	–
AP13 – Update Condition	A[1,2]	–	–	–	–	–	A[2]	–	–	–
AP14 – Copy Fragment	–	–	–	–	–	–	–	–	–	–

Weber, Barbara and Rinderle, Stefanie and Reichert, Manfred (2007) *Change Patterns and Change Support Features in Process-Aware Information Systems.* In: CAiSE'07, Trondheim, Norway, LNCS 4495, pp. 574-588.

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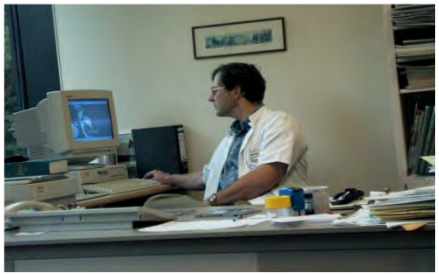
Applying the ADEPT Technology in Practice

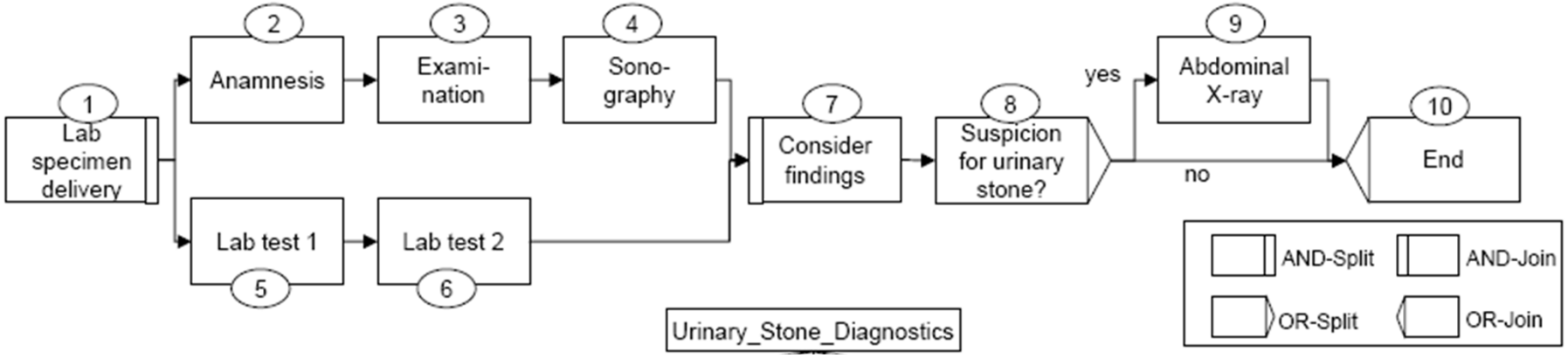
Enabling “Fluid Processes” with ADEPT: The Spot Project



Flexible Support of Clinical Pathways with ADEPT

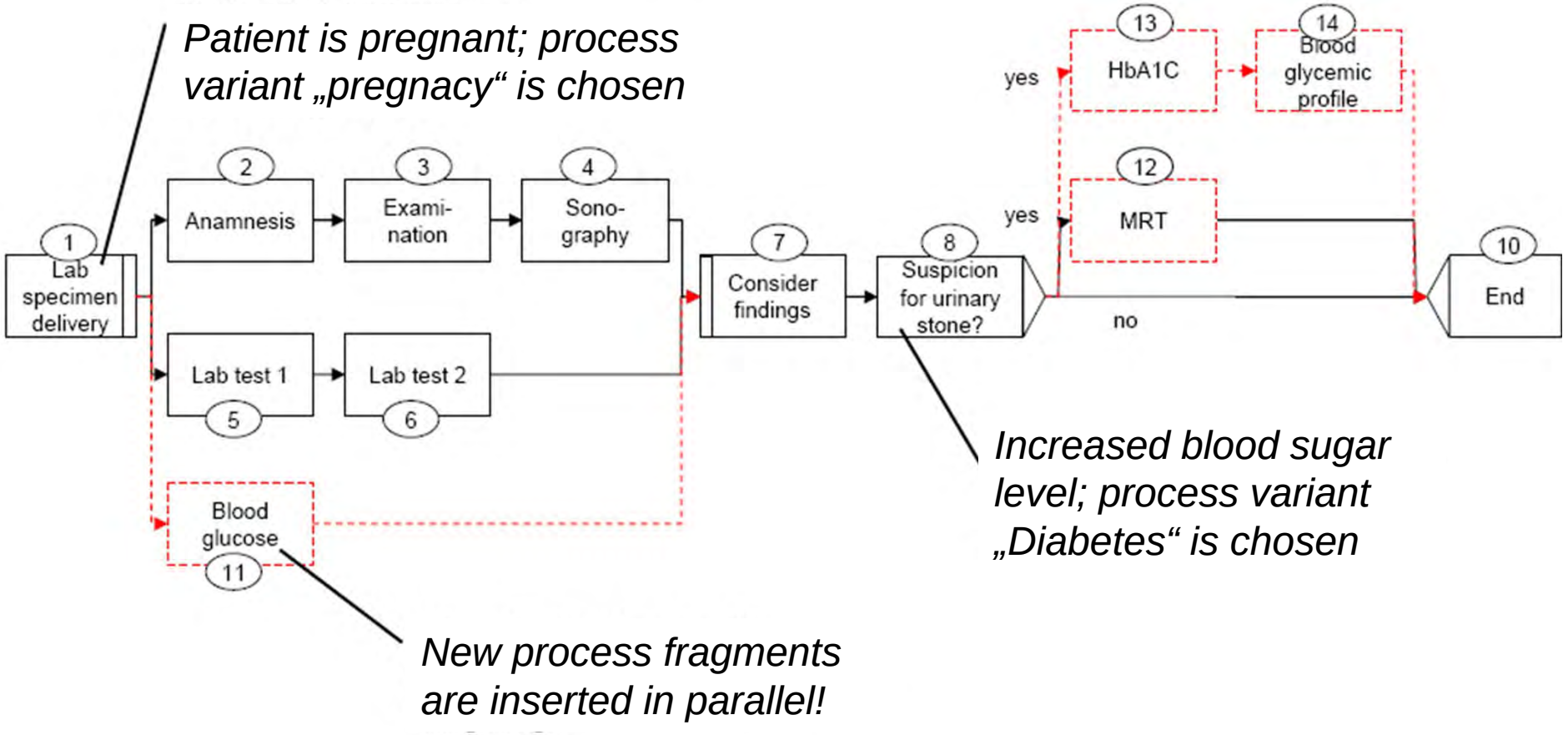
Partners:

Jan Neuhaus, Claudia Reuter
Fraunhoferinstitut Dortmund



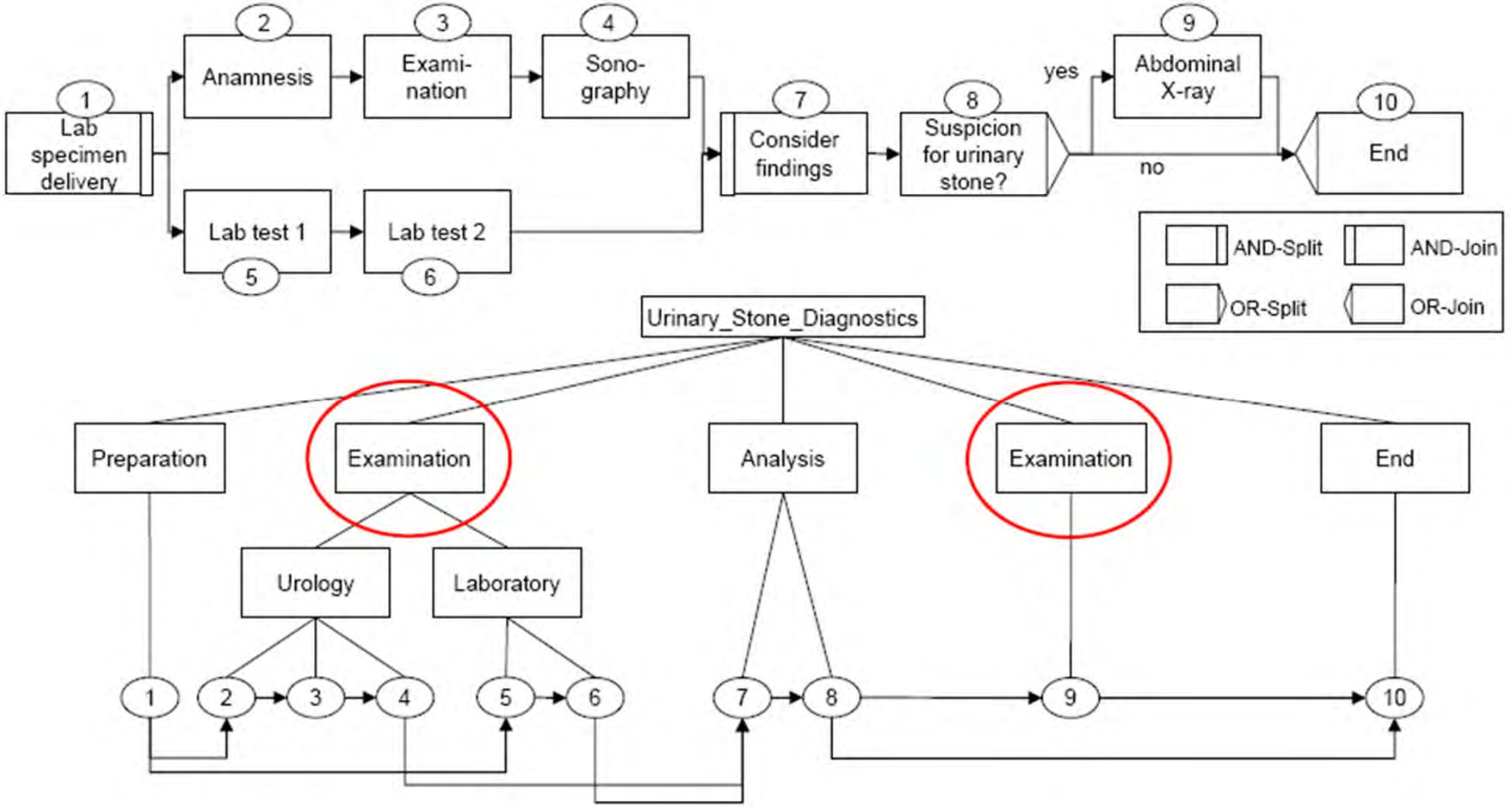
Enabling “Fluid Processes” with ADEPT: The Spot Project

Clinical pathways constitute “Fluid Processes” which need to be statically and/or dynamically configured to fit to the patient’s current situation!



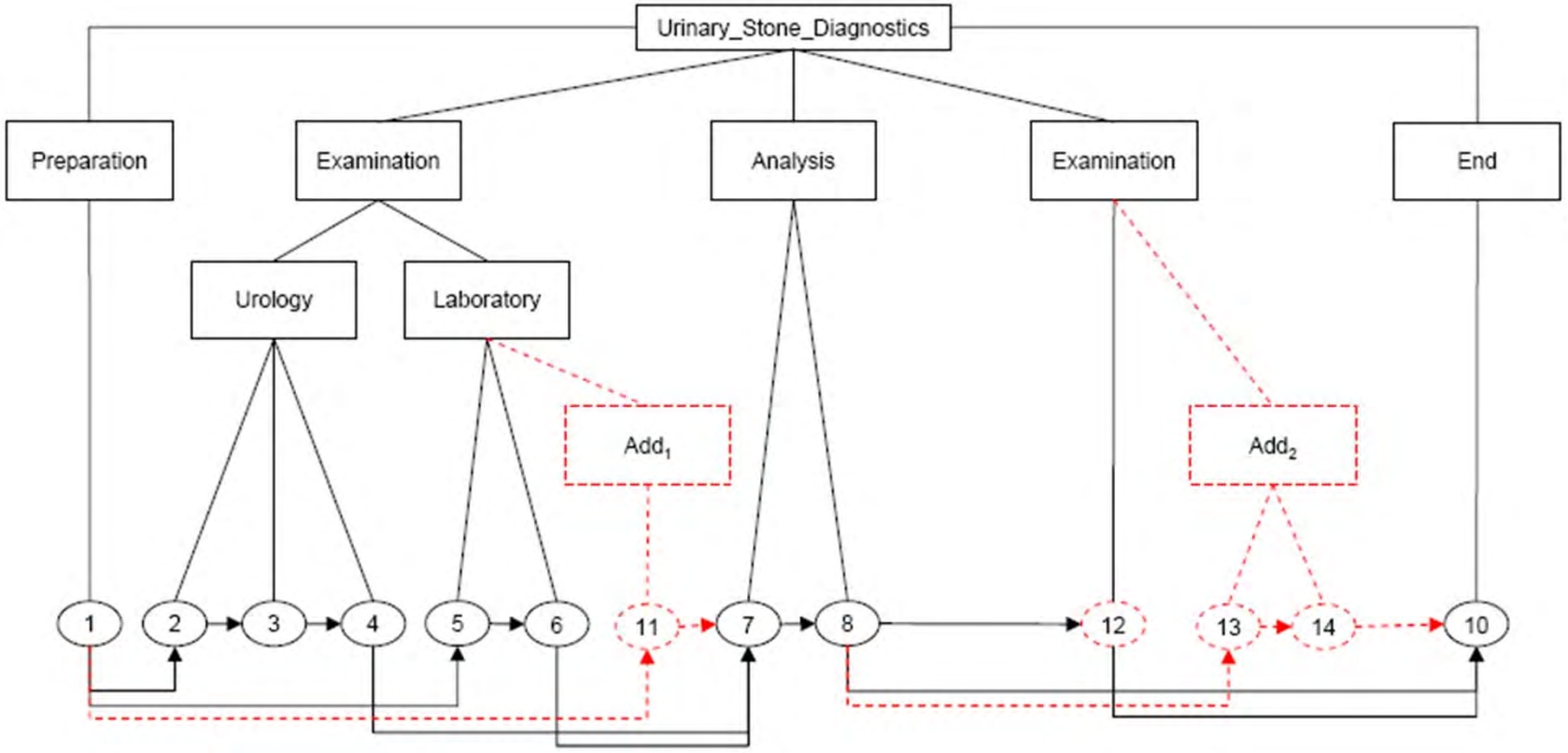
Enabling “Fluid Processes” with ADEPT: The Spot Project

The *Process Structure Tree* - Providing abstraction to end users



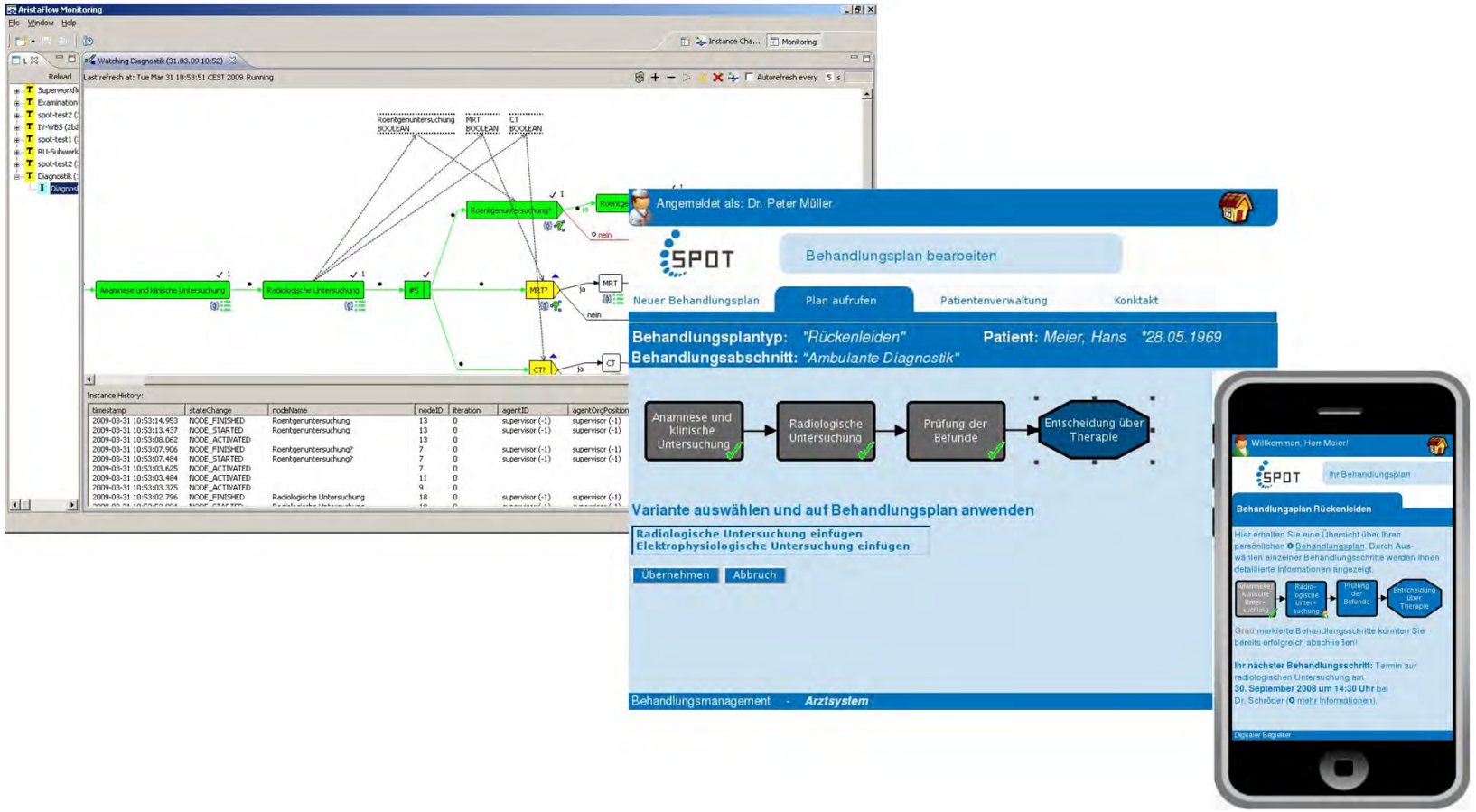
Enabling “Fluid Processes” with ADEPT: The Spot Project

The *Process Structure Tree* representing the patient-specific pathway!



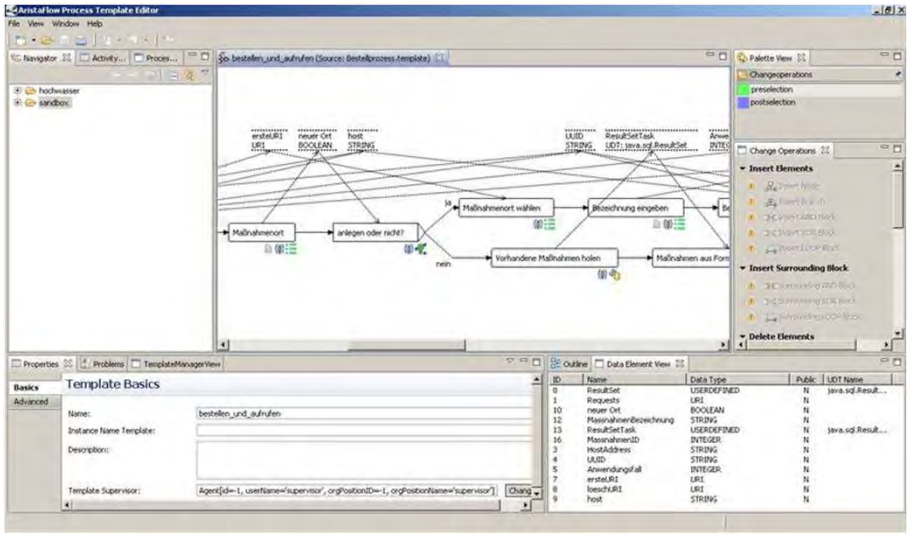
Enabling “Fluid Processes” with ADEPT: The Spot Project

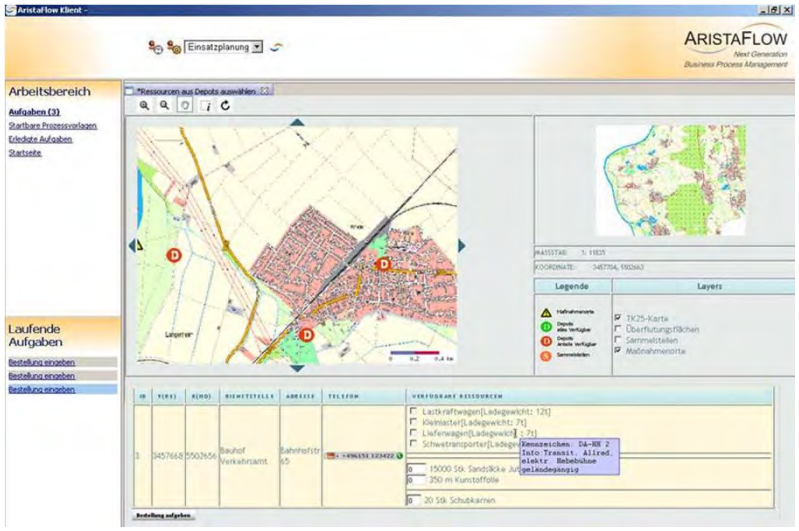
Proof-of-Concept Implementation Based on the ADEPT System



Enabling “Fluid Processes” with ADEPT: Disaster Management

Process-aware, Cooperative Emergency Management for Water Infrastructures
Partner: TU Darmstadt





A. Wagenknecht; U. Rüppel: Improving Resource Management In Flood Response With Process Models and Web GIS. In: 16th TIEMS Conf., 2009

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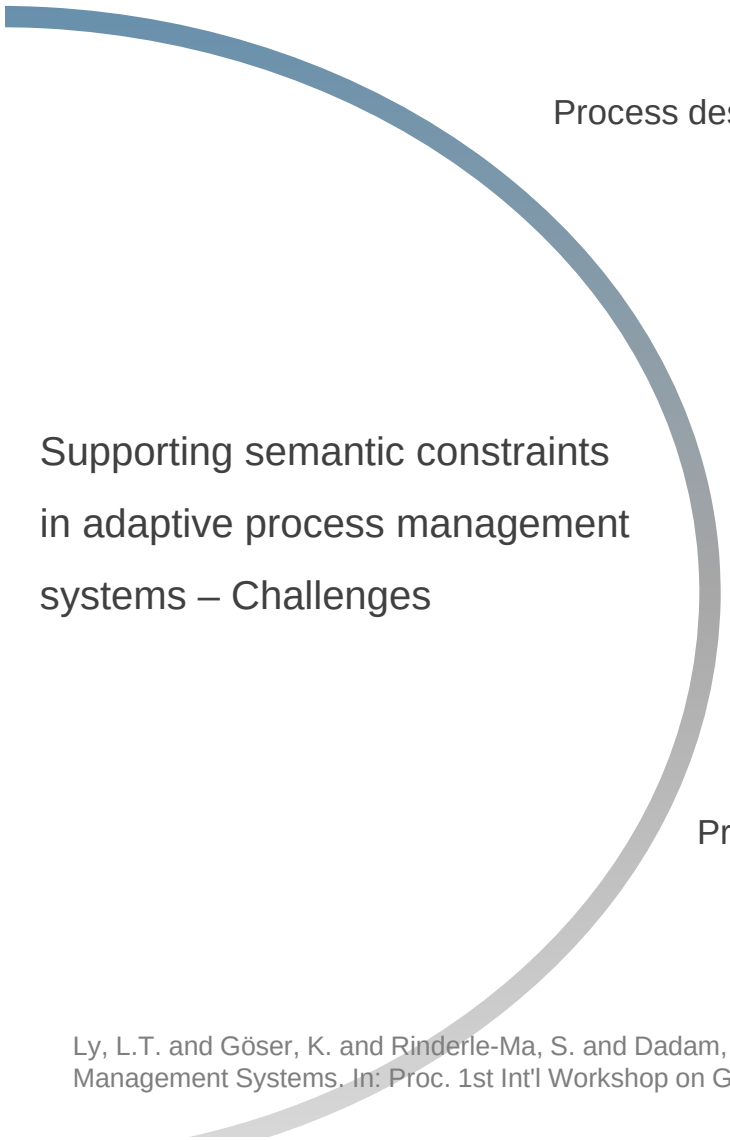
Semantically Constraining Possible Adaptations in Fluid Processes



Supporting semantic constraints in adaptive process management systems – Challenges

Constraint modeling

How to model semantic constraints, such as compliance rules, adequately?

Process design

How to ensure that process models meet compliance requirements?

Process execution

How to ensure that flexible ad-hoc process adaptations do not introduce incompliance?

Process evaluation

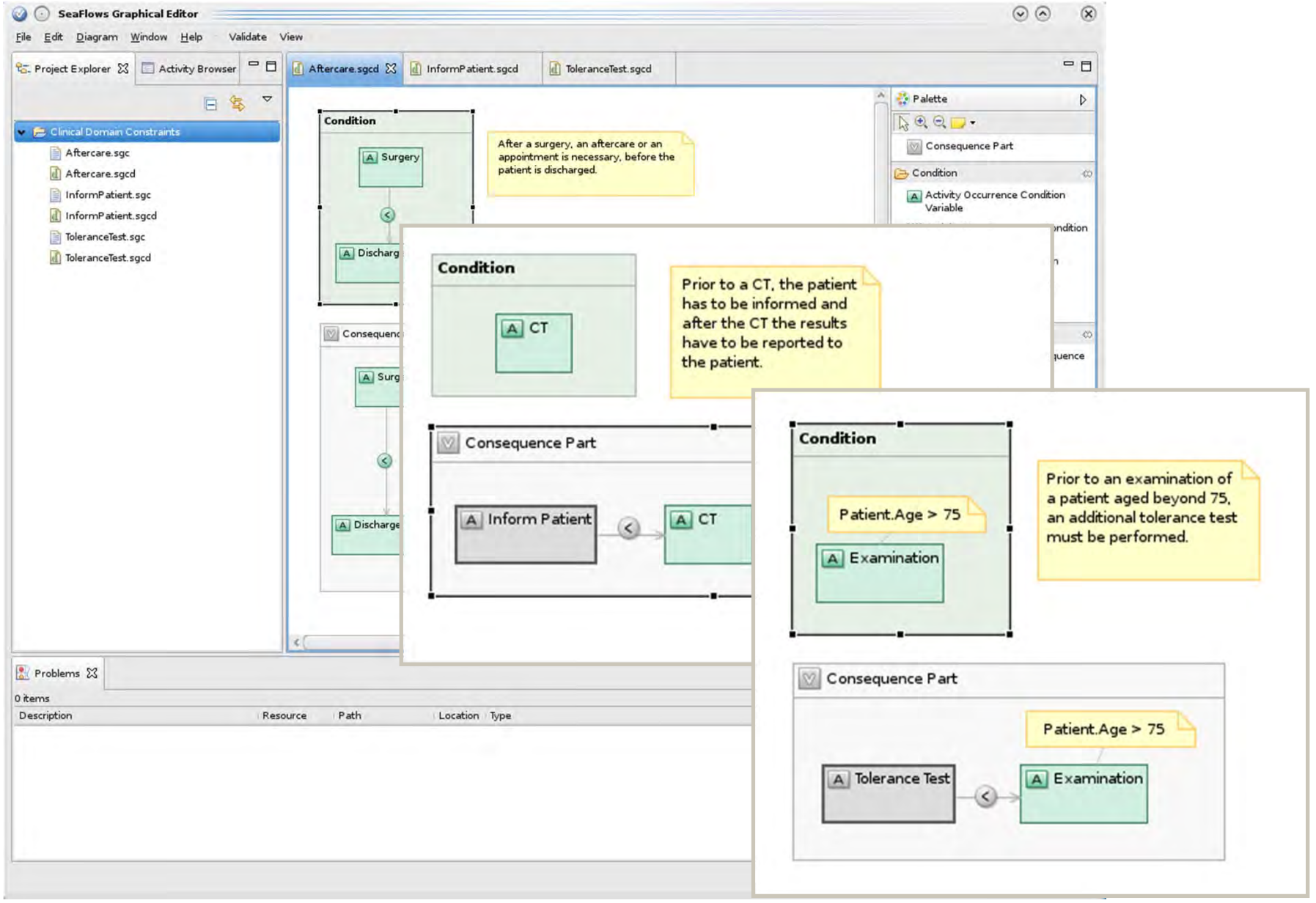
How to trace compliance violations and benefit from past process executions?

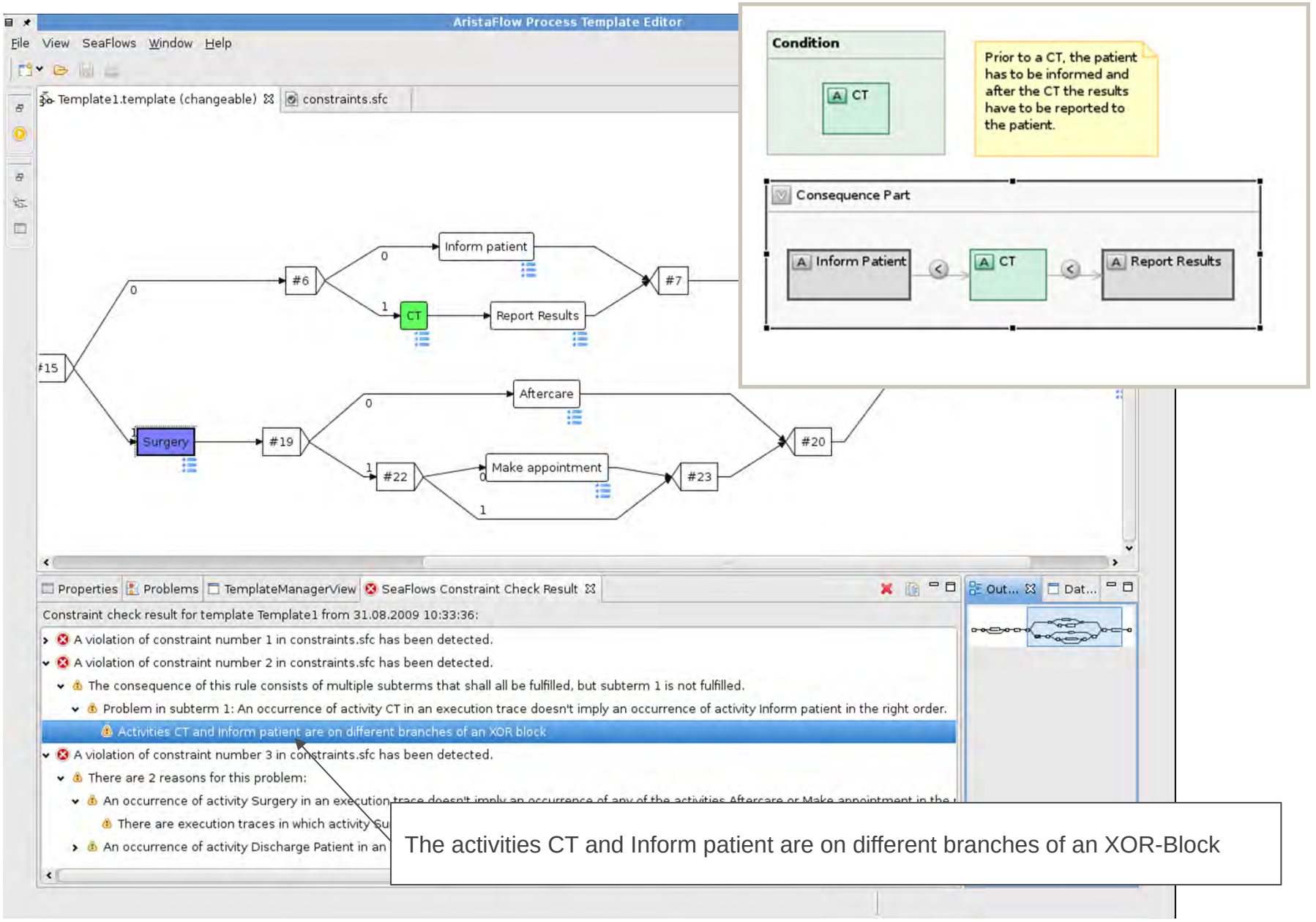
Ly, L.T. and Göser, K. and Rinderle-Ma, S. and Dadam, P. (2008) Compliance of Semantic Constraints - A Requirements Analysis for Process Management Systems. In: Proc. 1st Int'l Workshop on Governance, Risk and Compliance GRCIS'08), Montpellier, France.

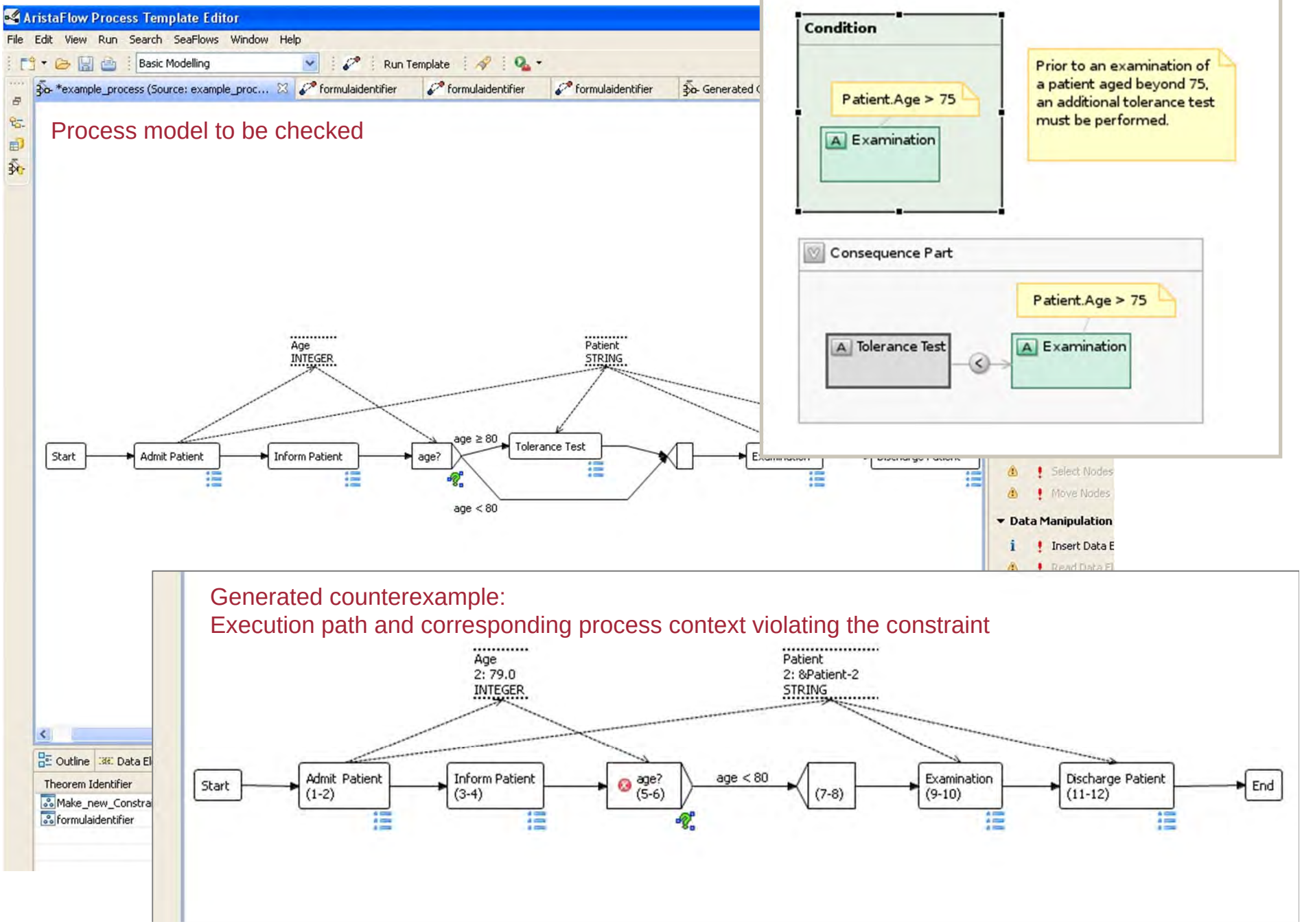
Constraint modeling	Intuitive modeling of semantic constraints using a visual logic-based formalism
Process design	Enrichment of process models with semantic constraints
	Verification of process models against imposed constraints using graph algorithms and model checking (static verification)
	Helpful validation reports and visualization of counterexamples
Process execution	Runtime verification of dynamic constraints (dynamic verification)
	Integrated verification of ad-hoc process changes with regard to compliance
	Flexible overriding of constraints if necessary
Process evaluation	Documentation of constraint violations and constraint overriding enables traceability and process mining

some impressions

Ly, Linh Thao and Rinderle-Ma, Stefanie and Göser, Kevin and Dadam, Peter (2009) On Enabling Integrated Process Compliance with Semantic Constraints in Process Management Systems. Information Systems Frontiers
Ly, Linh Thao and Rinderle, Stefanie and Dadam, Peter (2008) Integration and verification of semantic constraints in adaptive process management systems. Data and Knowledge Engineering , Vol. 64, No. 1, pp. 3-23


SeaFlows Graphical Editor
File Edit Diagram Window Help Validate View
Project Explorer
Activity Browser
Aftercare.sgcd
InformPatient.sgcd
ToleranceTest.sgcd
Clinical Domain Constraints
Aftercare.sgc
Aftercare.sgcd
InformPatient.sgc
InformPatient.sgcd
ToleranceTest.sgc
ToleranceTest.sgcd
Palette
Consequence Part
Condition
Activity Occurrence Condition Variable
Condition
Surgery
After a surgery, an aftercare or an appointment is necessary, before the patient is discharged.
Condition
CT
Prior to a CT, the patient has to be informed and after the CT the results have to be reported to the patient.
Consequence Part
Inform Patient
CT
Condition
Patient.Age > 75
Examination
Prior to an examination of a patient aged beyond 75, an additional tolerance test must be performed.
Consequence Part
Patient.Age > 75
Tolerance Test
Examination
Problems
0 items
Description
Resource
Path
Location
Type


AristaFlow Process Template Editor
File View SeaFlows Window Help
Template1.template (changeable)
constraints.sfc
Inform patient
#6
#7
CT
Report Results
#15
Surgery
#19
Aftercare
#20
#22
Make appointment
#23
Properties
Problems
TemplateManagerView
SeaFlows Constraint Check Result
Constraint check result for template Template1 from 31.08.2009 10:33:36:
A violation of constraint number 1 in constraints.sfc has been detected.
A violation of constraint number 2 in constraints.sfc has been detected.
The consequence of this rule consists of multiple subterms that shall all be fulfilled, but subterm 1 is not fulfilled.
Problem in subterm 1: An occurrence of activity CT in an execution trace doesn't imply an occurrence of activity Inform patient in the right order.
Activities CT and Inform patient are on different branches of an XOR block
A violation of constraint number 3 in constraints.sfc has been detected.
There are 2 reasons for this problem:
An occurrence of activity Surgery in an execution trace doesn't imply an occurrence of any of the activities Aftercare or Make appointment in the
There are execution traces in which activity Su
An occurrence of activity Discharge Patient in an
Condition
CT
Prior to a CT, the patient has to be informed and after the CT the results have to be reported to the patient.
Consequence Part
Inform Patient
CT
Report Results
The activities CT and Inform patient are on different branches of an XOR-Block


AristaFlow Process Template Editor
File Edit View Run Search SeaFlows Window Help
Basic Modelling
Run Template
*example_process (Source: example_proc...
formulaidentifier
formulaidentifier
formulaidentifier
Process model to be checked
Condition
Patient.Age > 75
Examination
Prior to an examination of a patient aged beyond 75, an additional tolerance test must be performed.
Consequence Part
Patient.Age > 75
Tolerance Test
Examination
Age
INTEGER
Patient
STRING
Start
Admit Patient
Inform Patient
age?
age ≥ 80
Tolerance Test
age < 80
Select Nodes
Move Nodes
Data Manipulation
Insert Data E
Outline
Data El
Theorem Identifier
Make_new_Constra
formulaidentifier
Generated counterexample:
Execution path and corresponding process context violating the constraint
Age
2: 79.0
INTEGER
Patient
2: &Patient-2
STRING
Start
Admit Patient
(1-2)
Inform Patient
(3-4)
age?
(5-6)
age < 80
(7-8)
Examination
(9-10)
Discharge Patient
(11-12)
End

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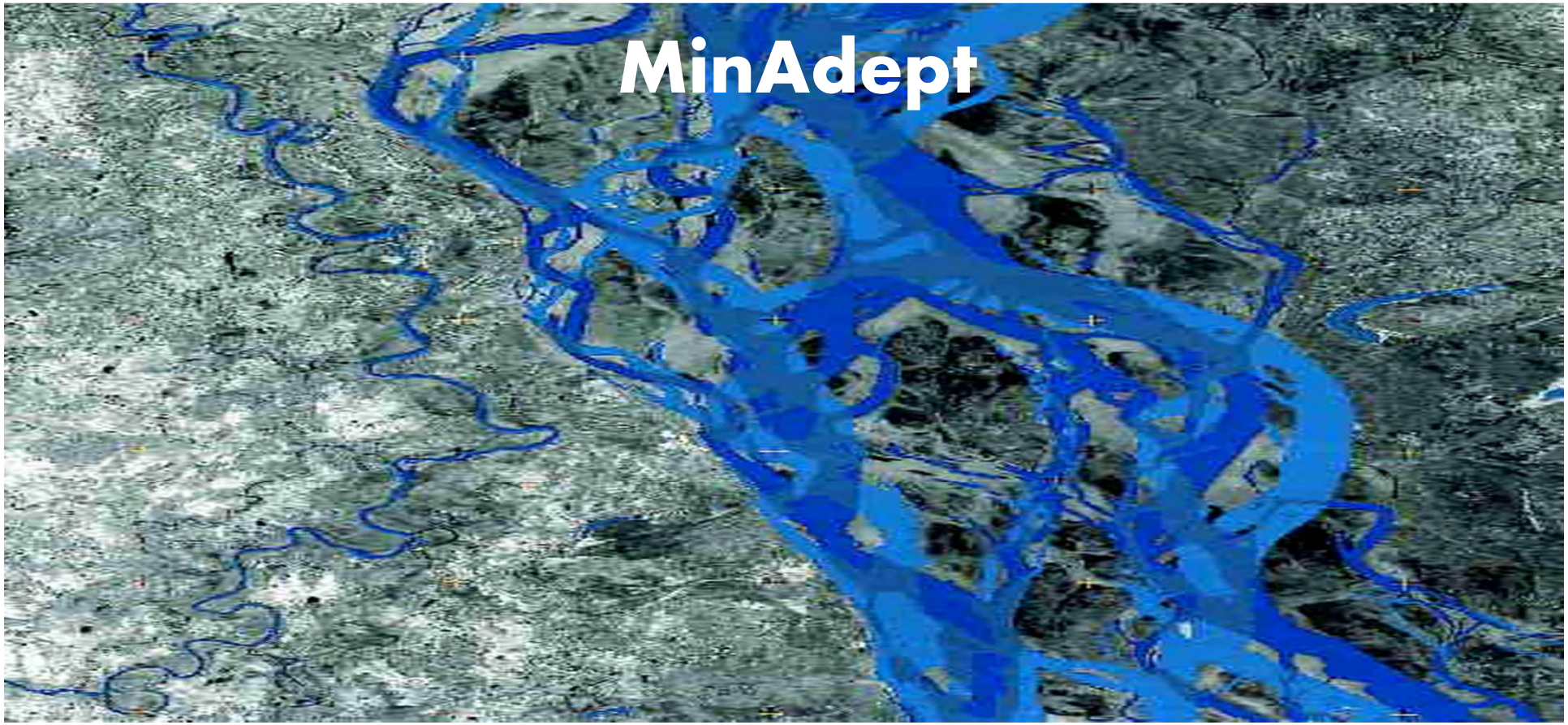
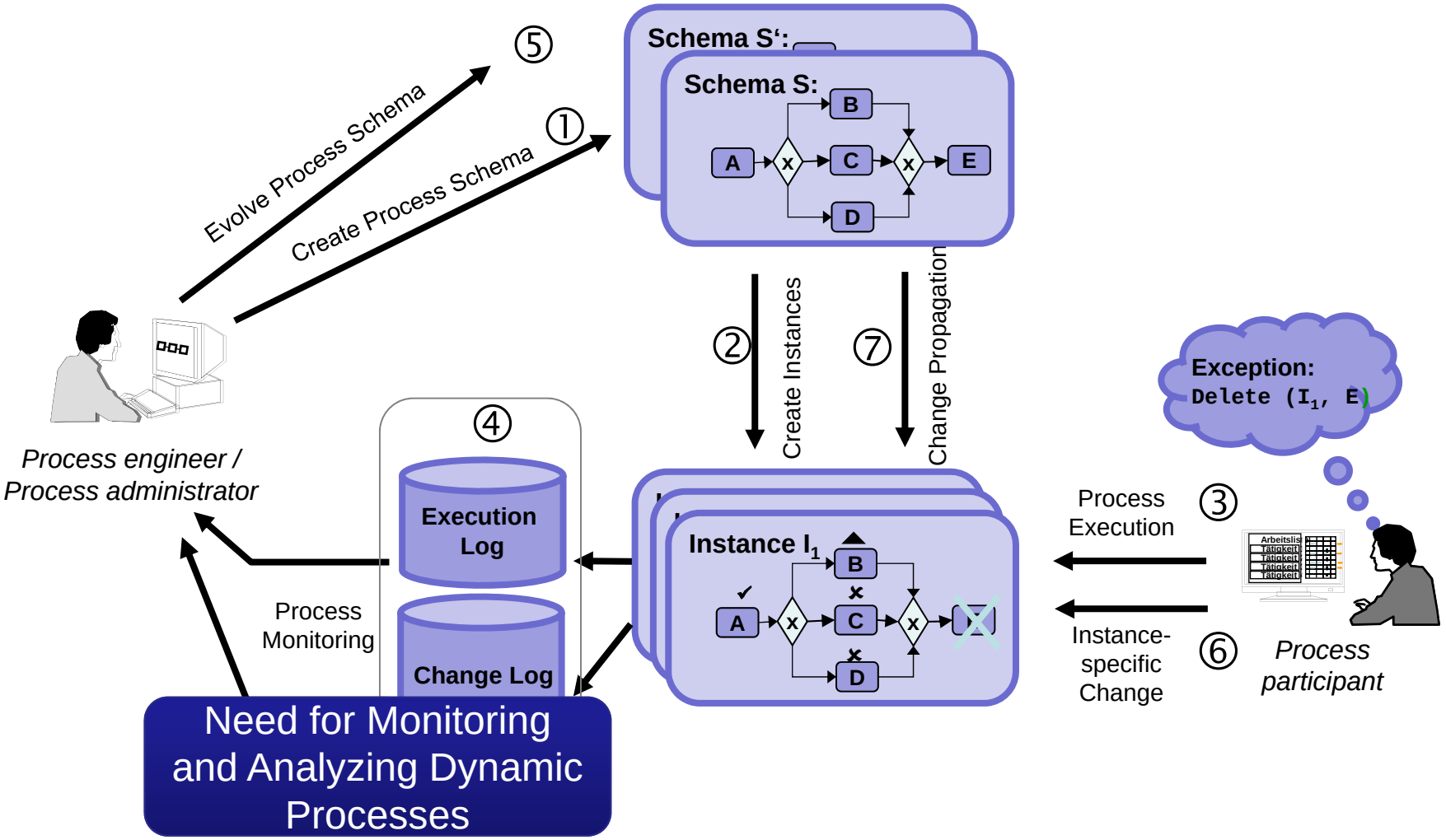


Changes in the Jamuna river (a branch of the Brahmaputra) in Bangladesh between March 1987 (shown in dark blue) and March 1989 (shown in light blue) and superimposed on a SPOT satellite basemap. Change monitoring made it possible to model the river's course and behaviour and to undertake preliminary studies to control flooding.

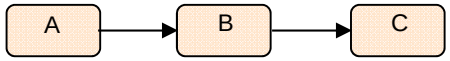
Monitoring and Mining Fluid Processes

Monitoring and Mining „Fluid“ Processes



Execution and Change Logs of “Fluid Processes”

Original Schema S

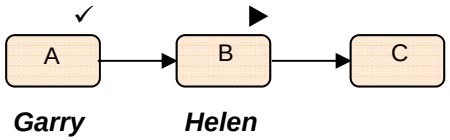



```
Instance 4711
Activity  Event             User    Timestamp
          Instance Started  Garry   2007/09/08 15:00
A         Started           Garry   2007/09/08 15:30
A         Completed         Garry   2007/09/08 15:45
B         Started           Helen   2007/09/10 11:00
X         Started           Fritz   2007/09/11 09:01
```

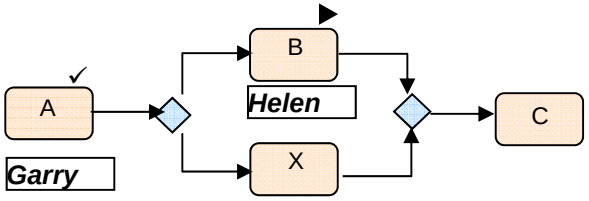
```
Change Log Instance 4711 on Schema S

Change TX Applied Changes : User:Timestamp

001 InsertFragment[S;X,A,C]:Helen:2007/09/10 12:02
002 ReplaceFragment(S;C,Z):Jim:2007/09/11 09:31
```

Process Instance 4711

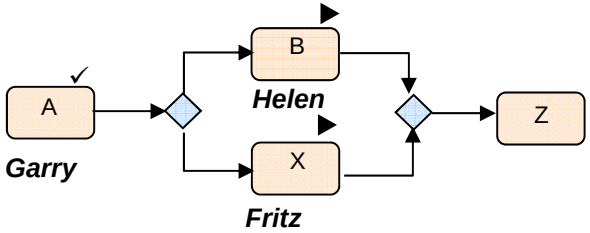
2007/09/10 11:00



2007/09/10 13:00



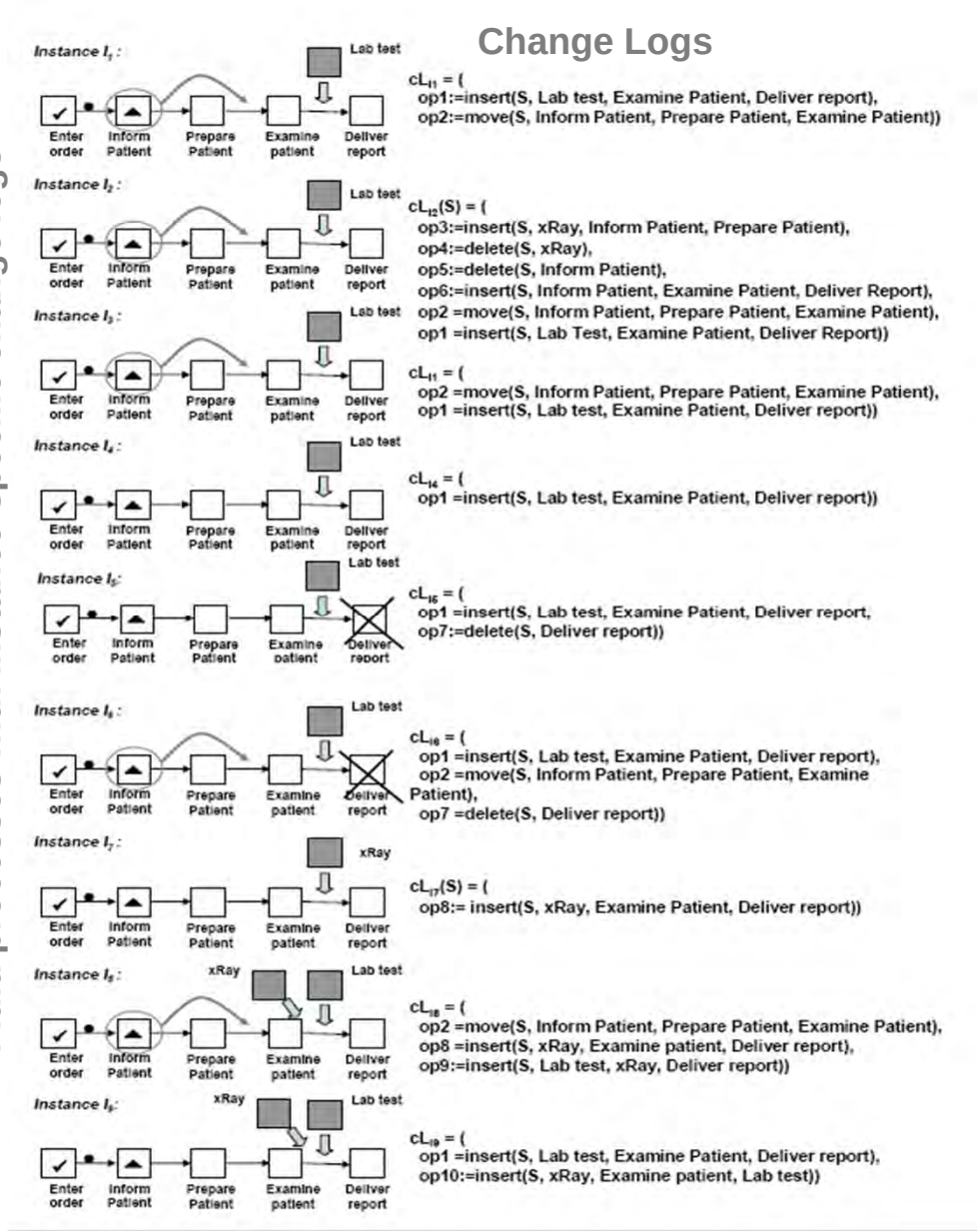
2007/09/11 10:00



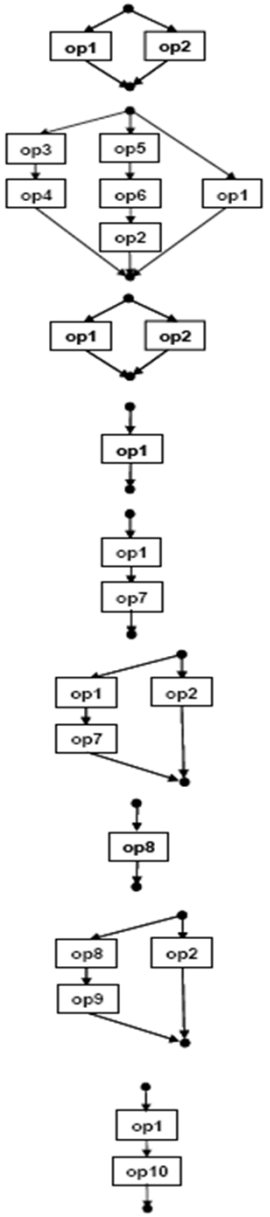
Change Analysis – A Simple Approach

Fluid processes with instance-specific change logs

Change Logs

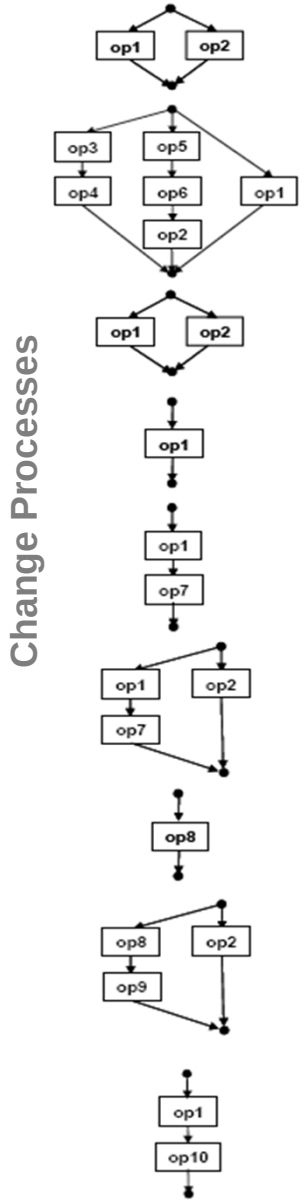


Phase I

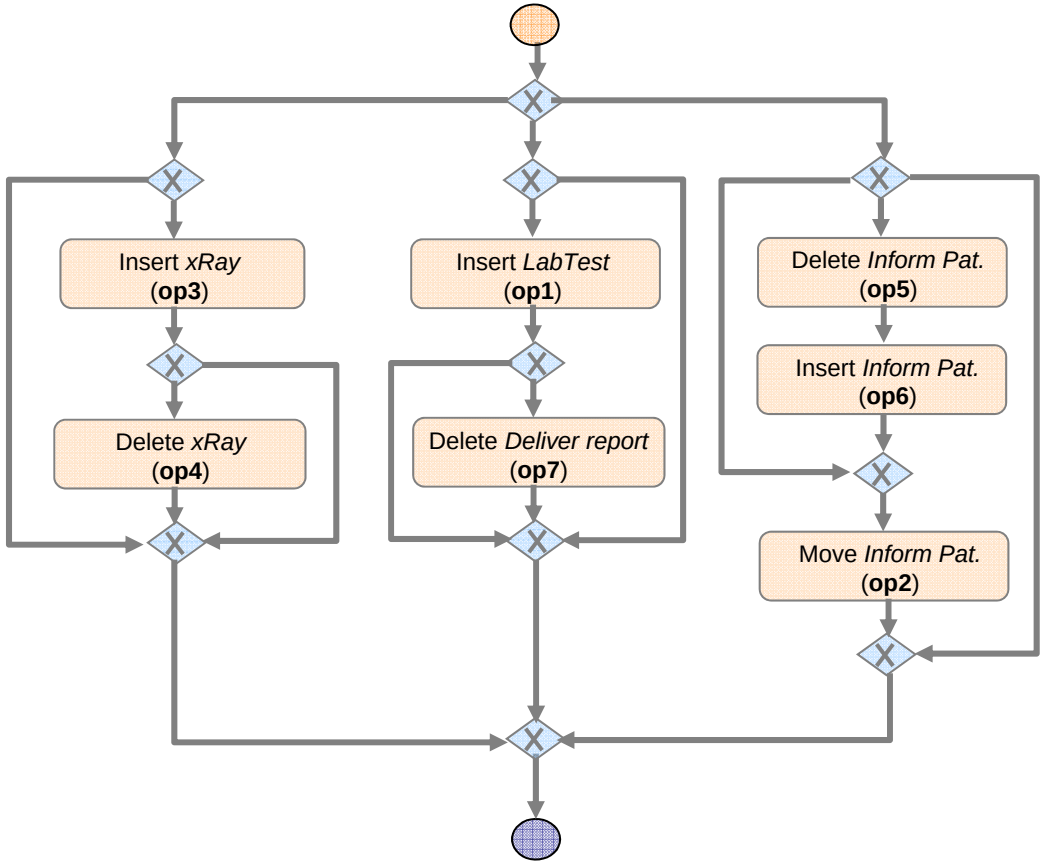


Change Processes

Change Analysis – A Simple Approach



Phase II

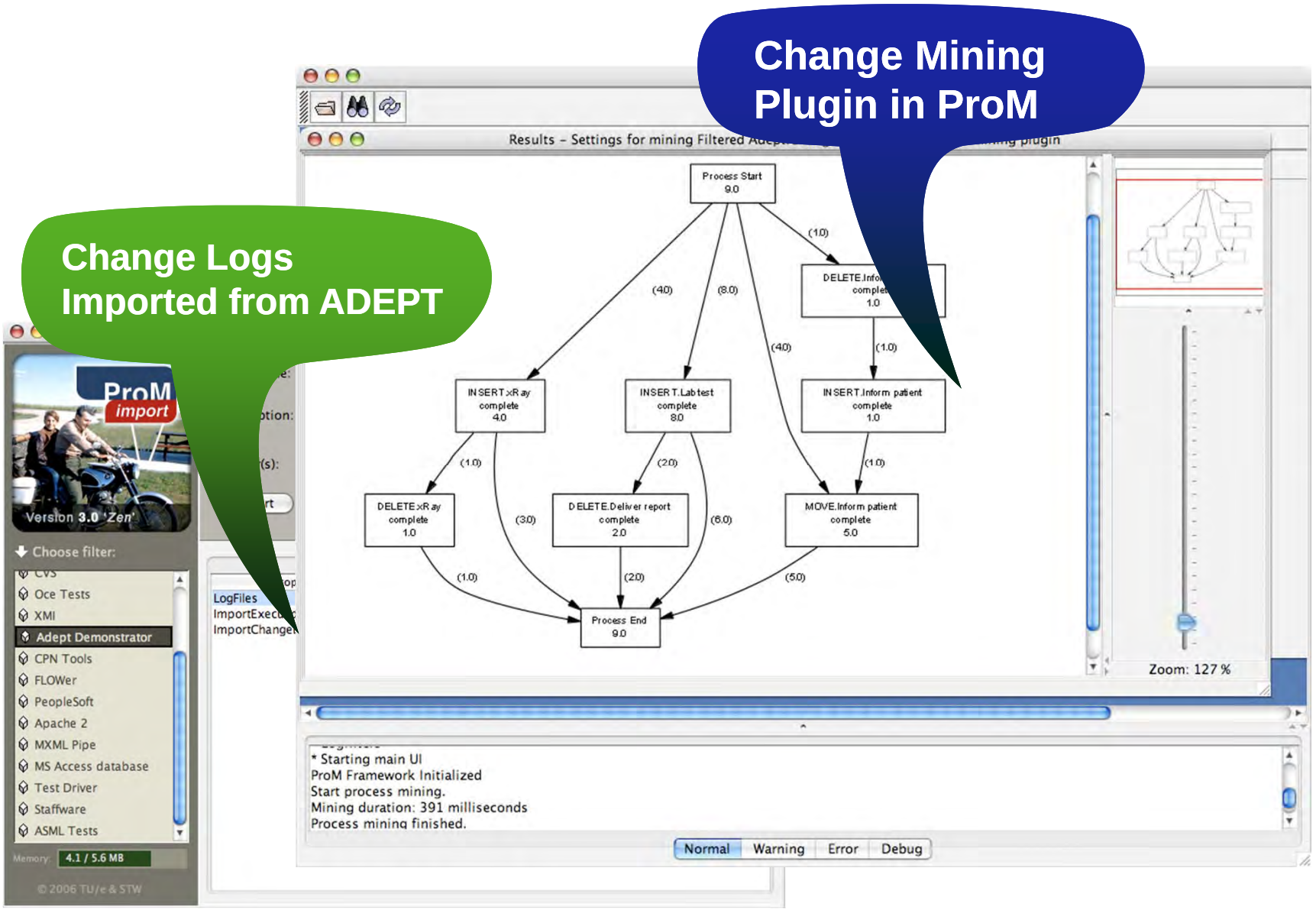


The discovered meta change process covers all changes applied to at least one of the given fluid process instances.

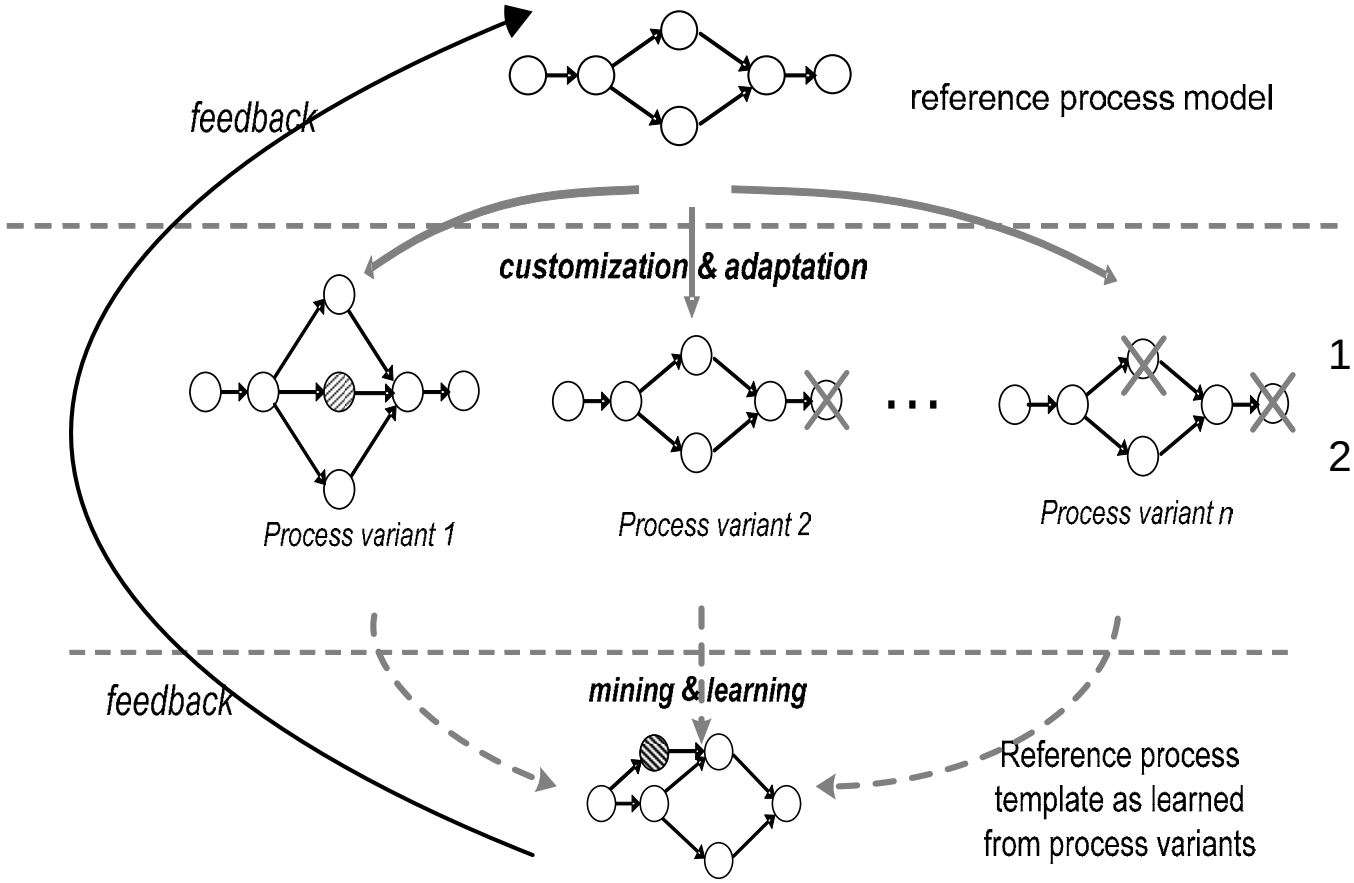
Günther, C.W.; Rinderle, S.; Reichert, M.; van der Aalst, W.M.P (2006): Change Mining in Adaptive Process Management Systems. *Proc. CoopIS'06,* LNCS 4275.

Günther, C.W.; Rinderle, S.; Reichert, M.; van der Aalst, W.M.P.; Recker, J. (2008): Using Process Mining to Learn from Process Changes in Evolutionary Systems. *Int'l J of Business Process Integration and Management*, 3(1):61-78

Change Analysis – A Simple Approach (Proof-of-Concept Prototype)



Process Variants Mining

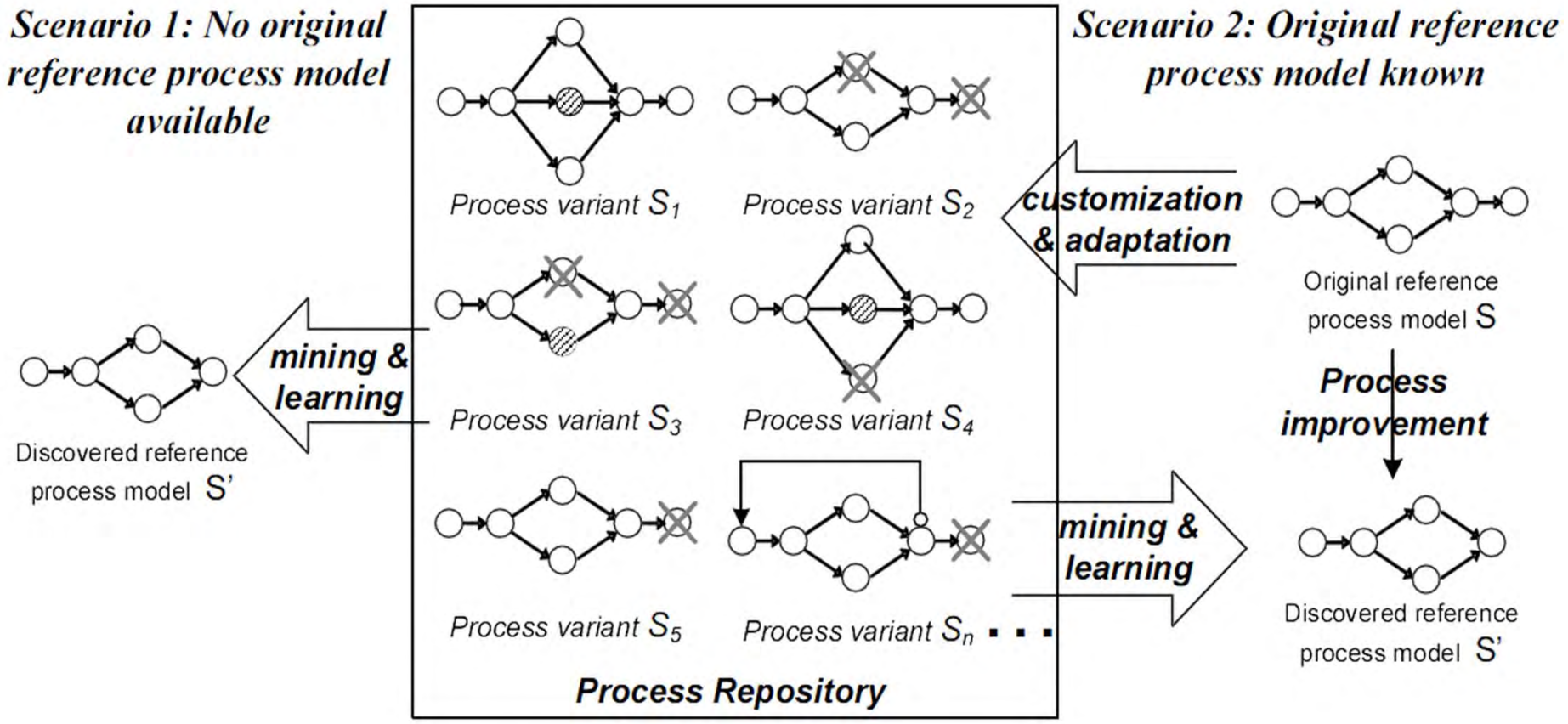


1. Configurations are very costly
2. Variants are difficult to maintain

Derive a new reference process model from the the variants such that:
Less adaptations are needed in future!

Li, C.; Reichert, M.; Wombacher, A. (2008): Mining Based on Learning from Process Change Logs. *Proc. 4th Int'l Workshop on Business Process Intelligence*, Milan, LNBIP 17

Process Variants Mining: Scenarios



Goal: *Discover a (new) reference process model which requires less configuration efforts*

Process Variants Mining: Basic Goal

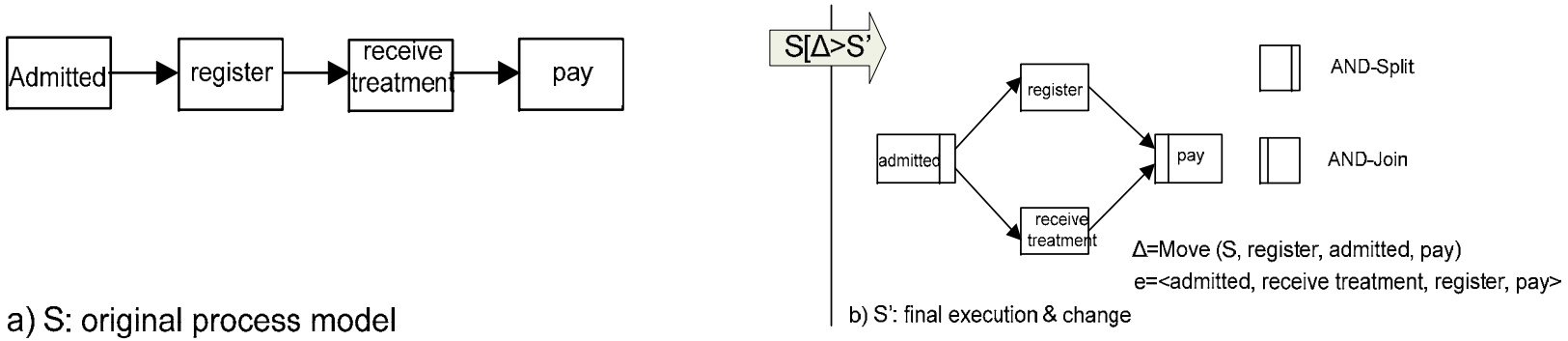
How to **discover a reference process model**

by mining a collection of **process (instance) variants**

in order to

reduce the need of future process adaptations?

Process Variants Mining: Bias and Distance



- Process Bias: Minimal set of high-level change operations needed to transform a given process model S into another model S'
- Process Distance: # change operations of any bias between S and S'; can be used to measure the complexity for process change

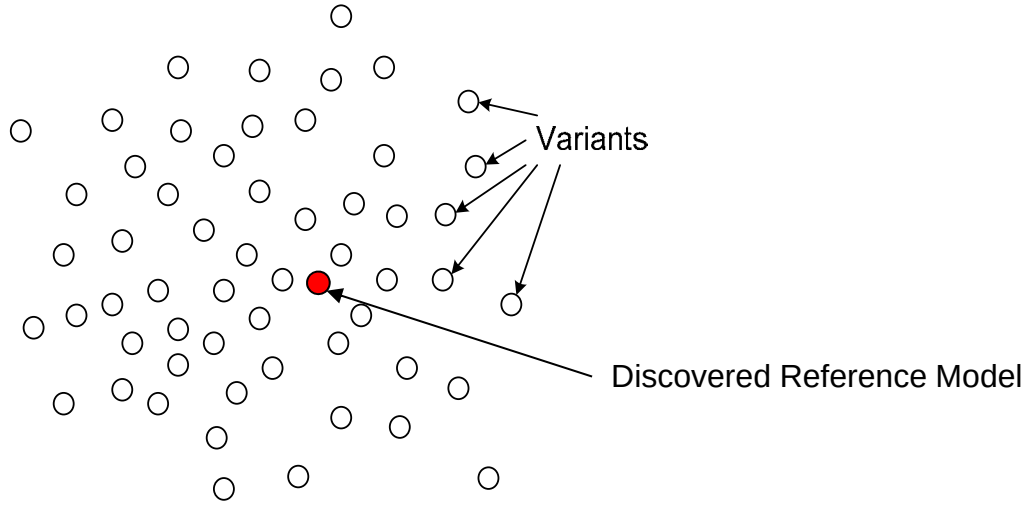
Li, C.; Reichert, M.; Wombacher, A. (2008) On Measuring Process Model Similarity based on High-level Change Operations. Proc. ER'08, Barcelona, LNCS 5231

Process Variant Mining: Reformulated Goal

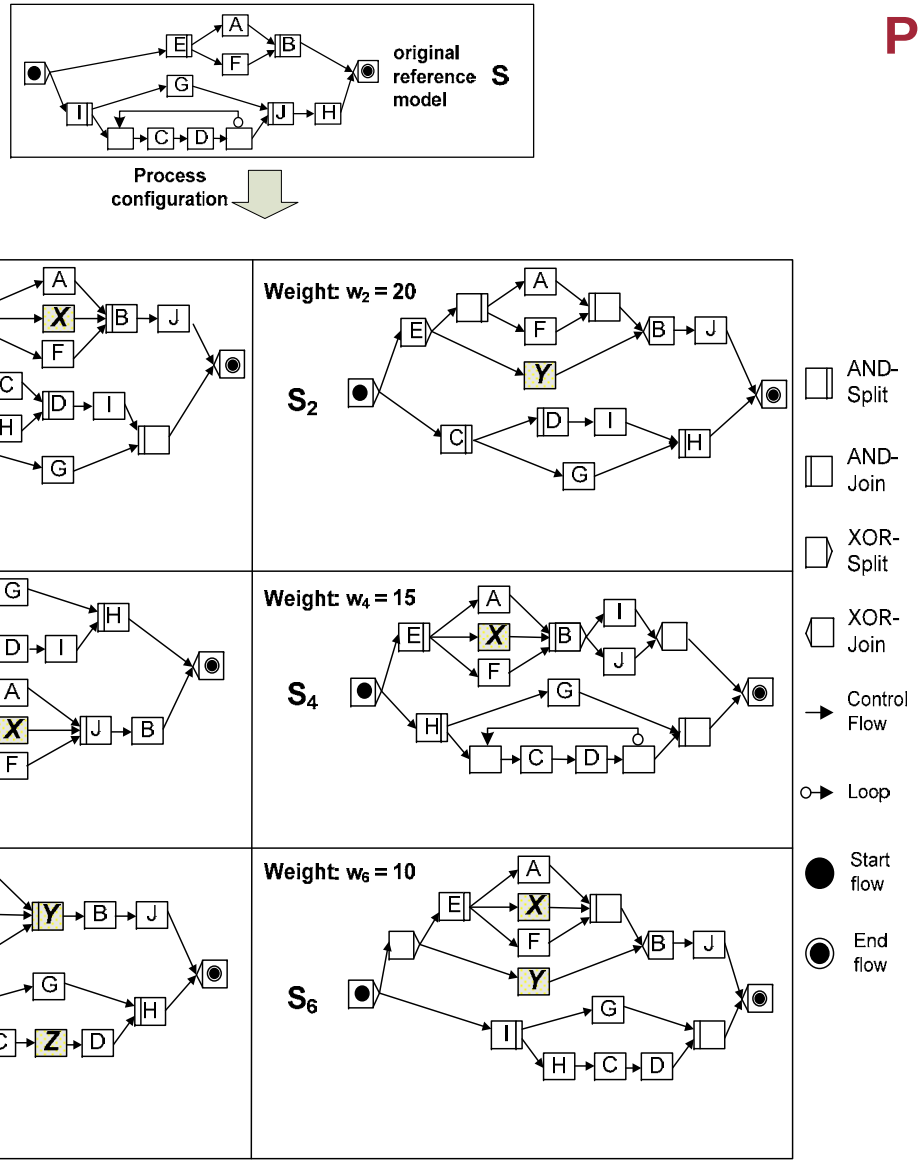
How to **discover a reference process model**

by mining **a collection of process variants**

such that this model has minimum **average distance to the process variants?**



Process Variant Mining: Illustrating Example



Process variants:

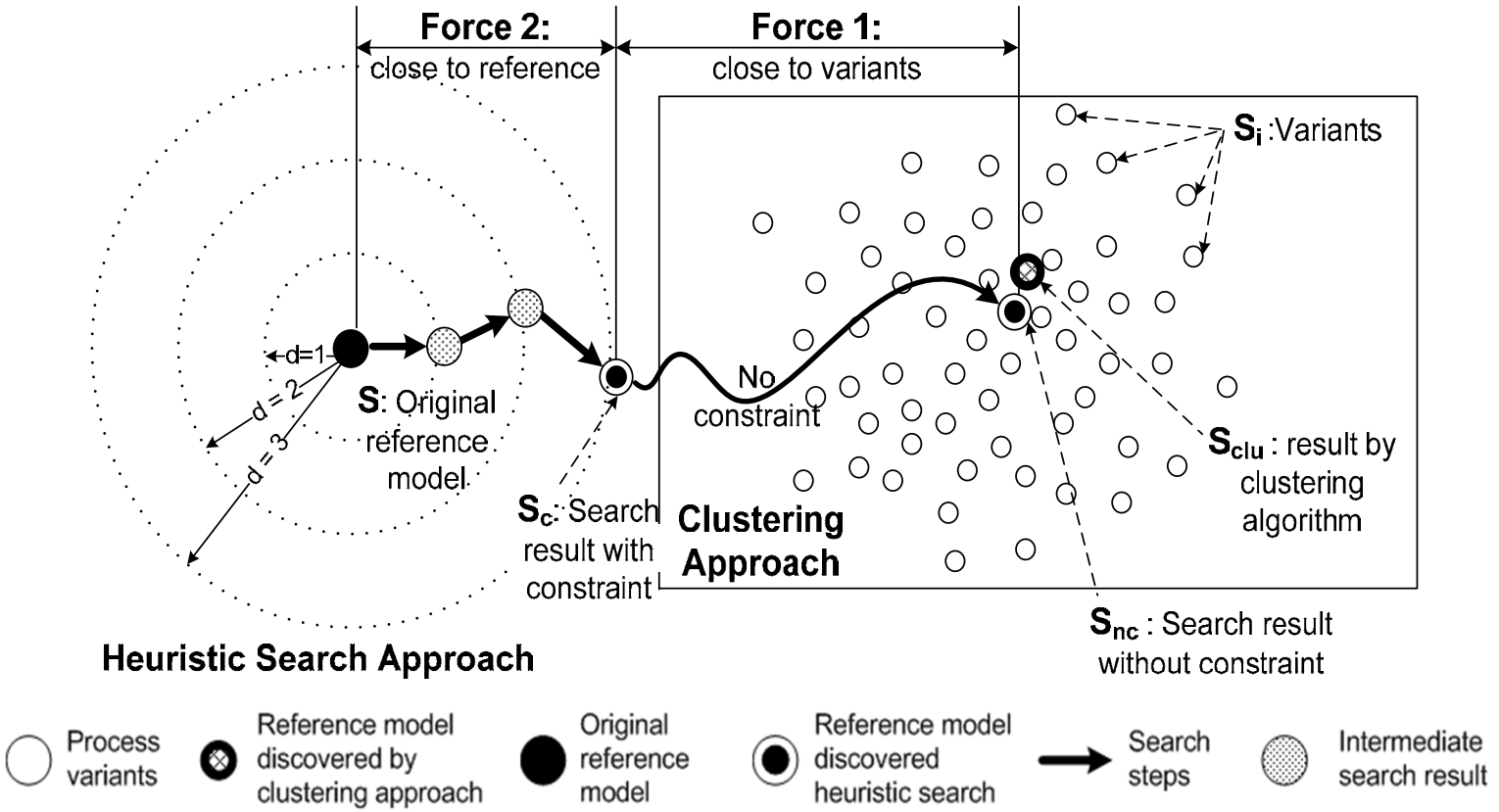
- Differ in activity sets
- Differ in process structure and used process patterns
- Differ in relative importance

Average weighted distance between S and variant models: 4,85

Goal: Can we find a process model which is *closer to the variants* than S?

Li, Chen and Reichert, Manfred (2011) *Mining Business Process Variants: Challenges, Scenarios, Algorithms.* Data & Knowledge Engineering, 70(5): 409-434.

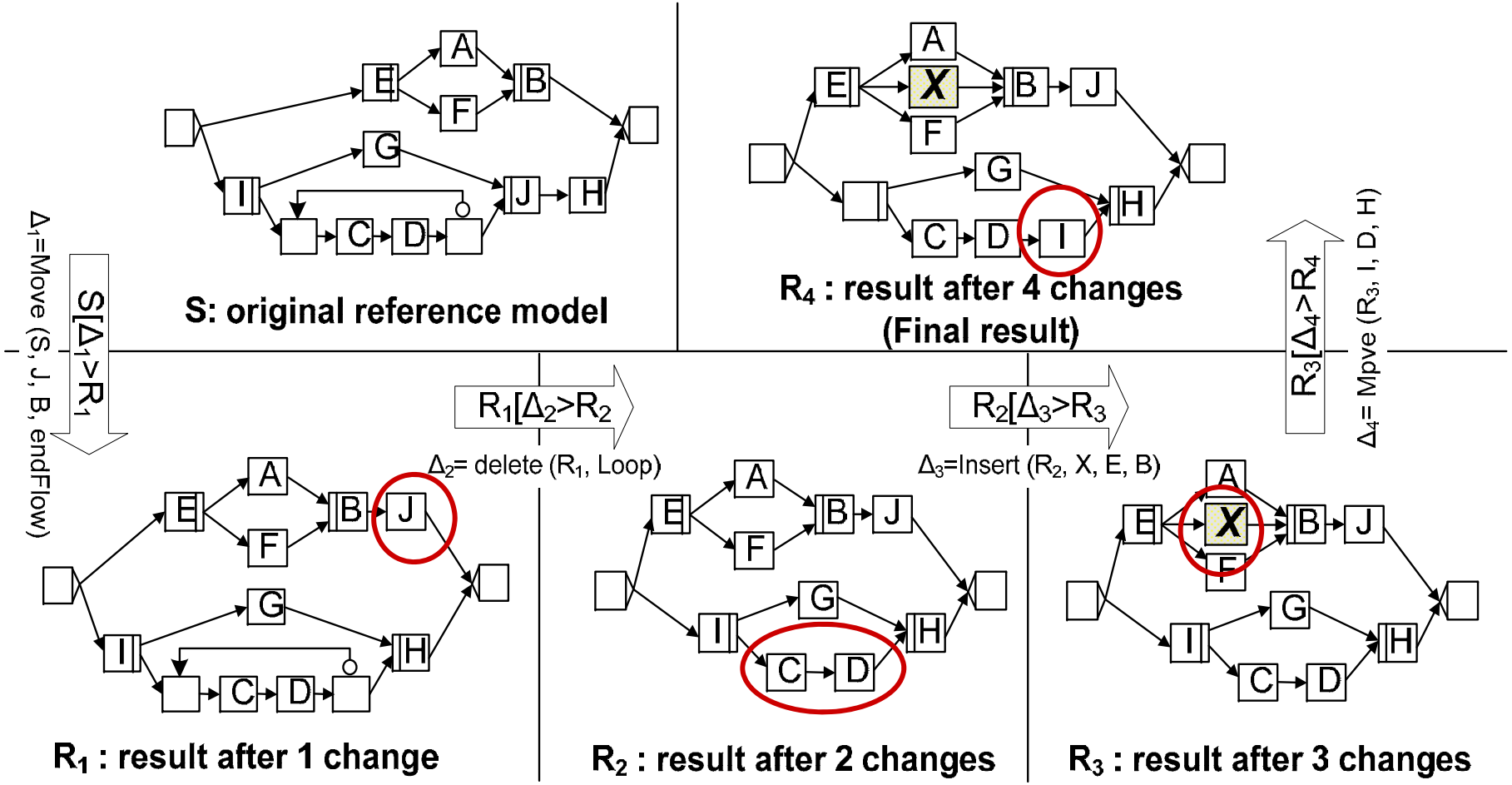
Process Variant Mining: Scenarios



Li, C., Reichert, M., Wombacher, A. (2009) *Discovering Reference Models by Mining Process Variants Using a Heuristic Approach.* In: 7th Int'l Conf. Business Process Management (BPM'09), LNCS 5701, pp. 344-362

Li, C., Reichert, M. (2008) *Discovering Reference Process Models by Mining Process Variants.* Proc. 6th Int'l Conf. on Web Services, Beijing,

Process Variant Mining: Back to our Illustrating Example

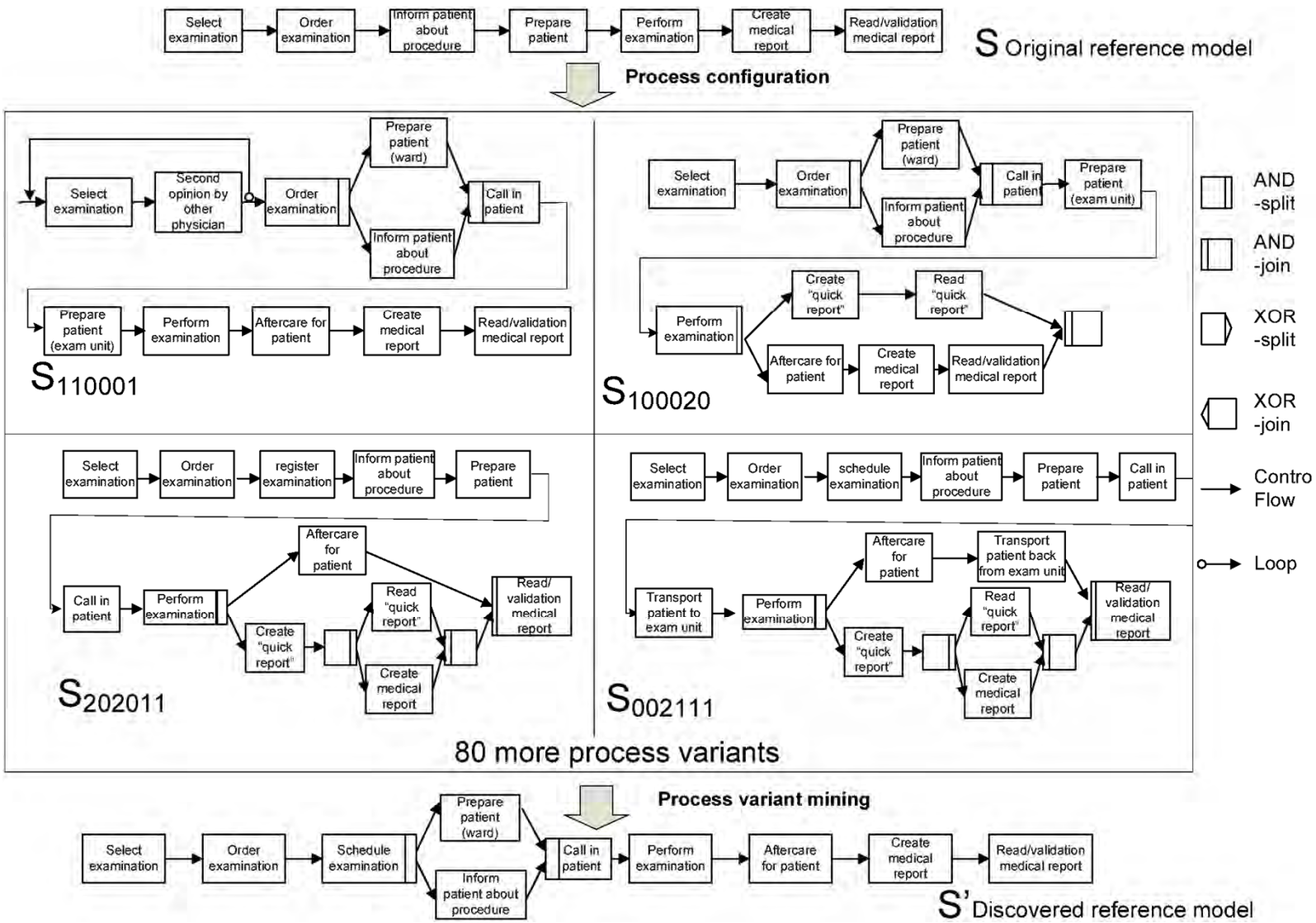


Process Variant Mining: Evaluation of Search Result

	S (reference model)	R_1 (After 1 change)	R_2 (After 2 changes)	R_3 (After 3 changes)	R_4 (After 4 changes)
Fitness	**0.543**	**0.687**	**0.805**	**0.844**	**0.859**
Average distance	**4.85**	**3.95**	**3.25**	**2.65**	**2.4**
Change operation		**Move**	**Delete**	**Insert**	**Move**
Delta fitness		**0.143**	**0.118**	**0.039**	**0.009**
Delta distance		**0.9**	**0.7**	**0.6**	**0.25**

Oberservation:

1. Discovered reference model is getting better with each search step.
2. Most relevant changes are performed at beginning.


Select examination
Order examination
Inform patient about procedure
Prepare patient
Perform examination
Create medical report
Read/validation medical report
S Original reference model
Process configuration
Second opinion by other physician
Prepare patient (ward)
Call in patient
Prepare patient (exam unit)
Aftercare for patient
S110001
Create "quick report"
Read "quick report"
S100020
register examination
schedule examination
Call in patient
Transport patient to exam unit
Transport patient back from exam unit
Read/ validation medical report
S202011
S002111
AND -split
AND -join
XOR -split
XOR -join
Contro Flow
Loop
80 more process variants
Process variant mining
Schedule examination
S' Discovered reference model

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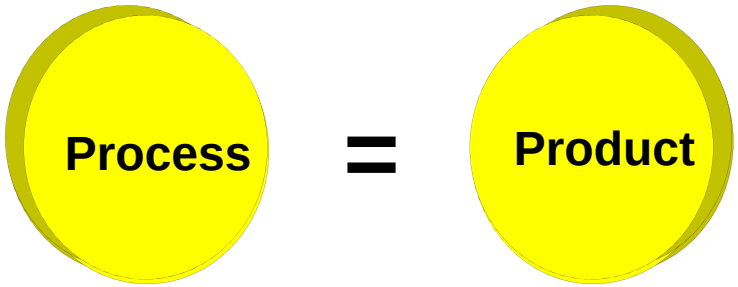
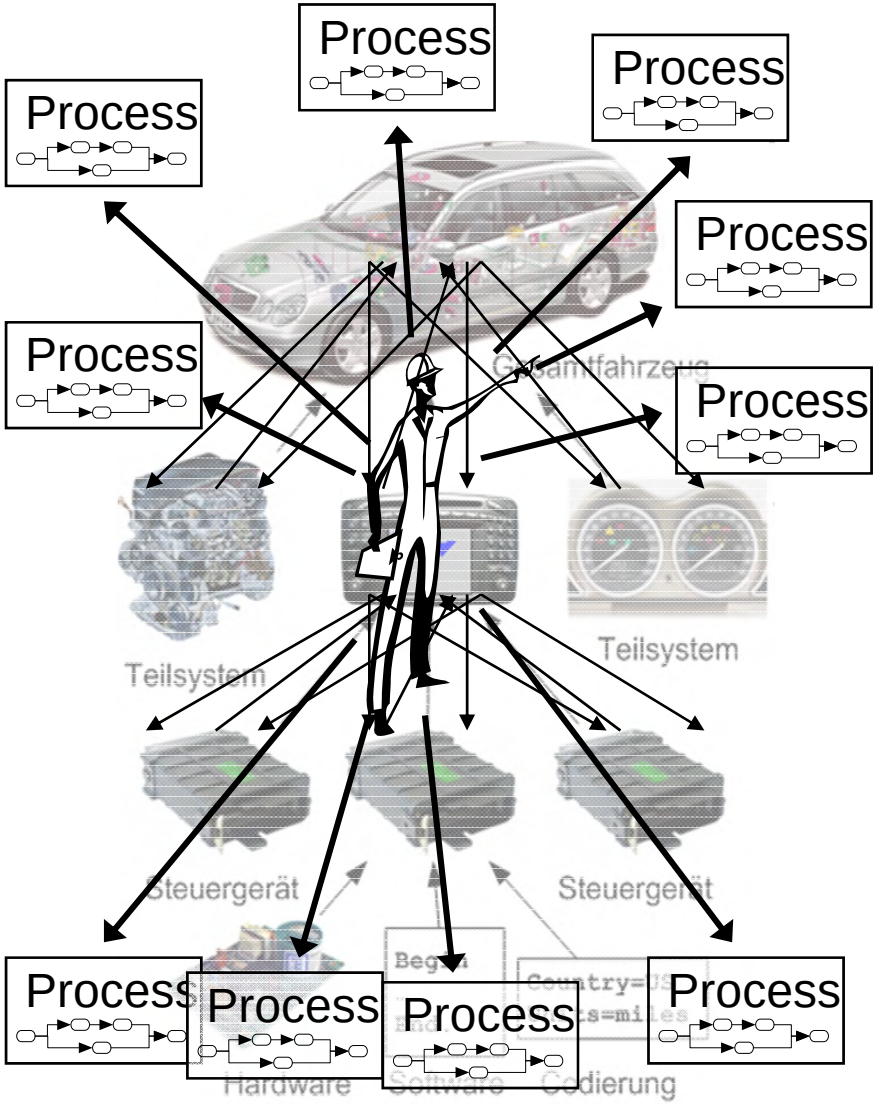
Enabling Data-driven Process Structures with COREPRO

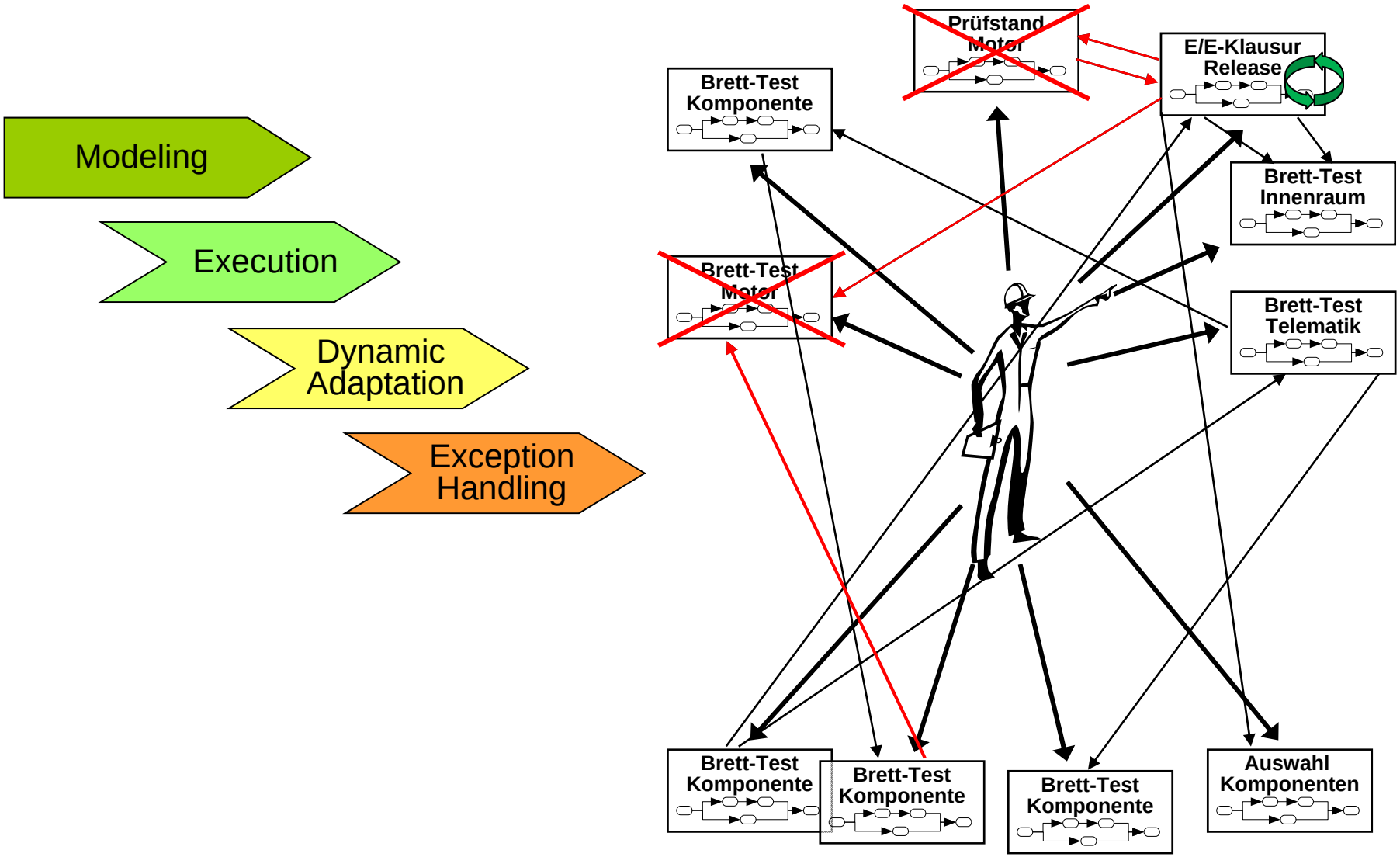
The COREPRO Approach: Motivation



Process structure needs to be adapted when product structure changes!



The COREPRO Approach: Motivation



The COREPRO Approach: Motivation

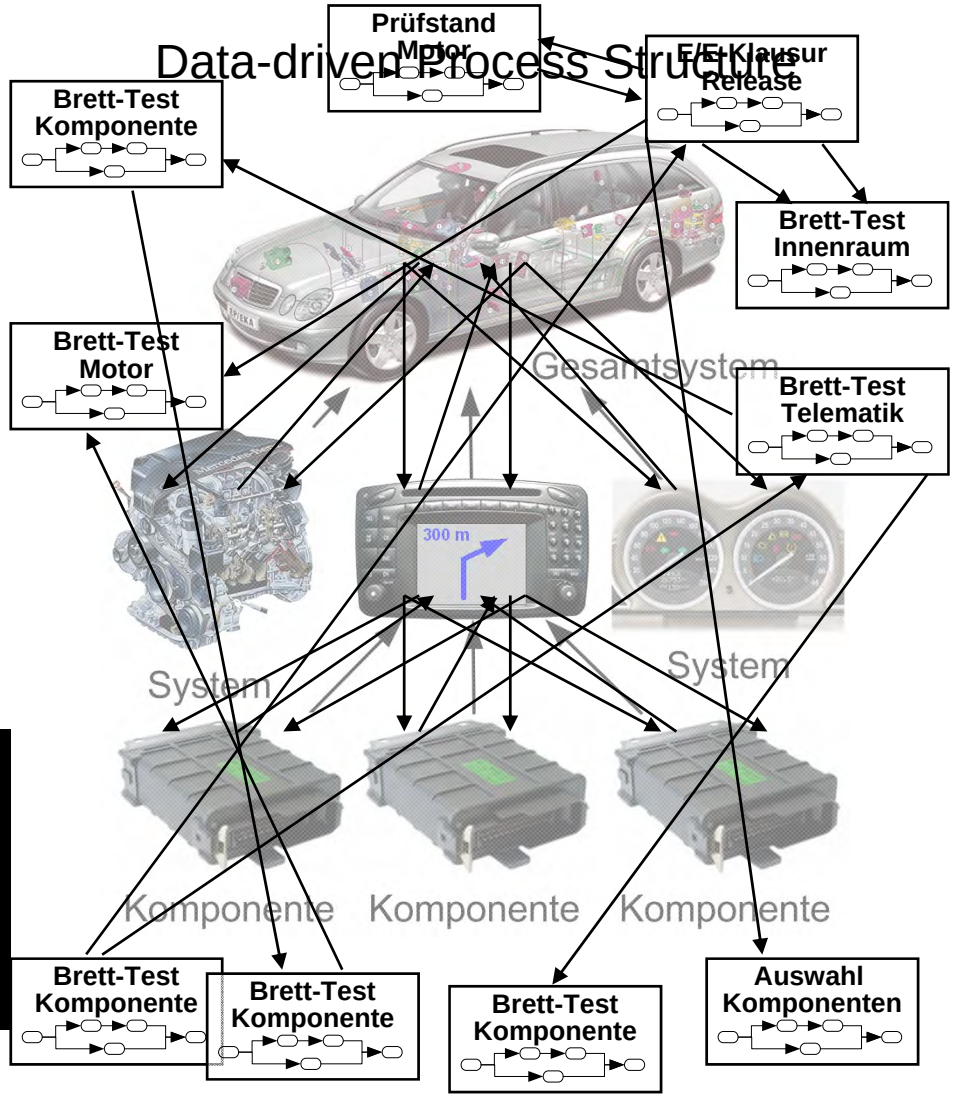
Modeling

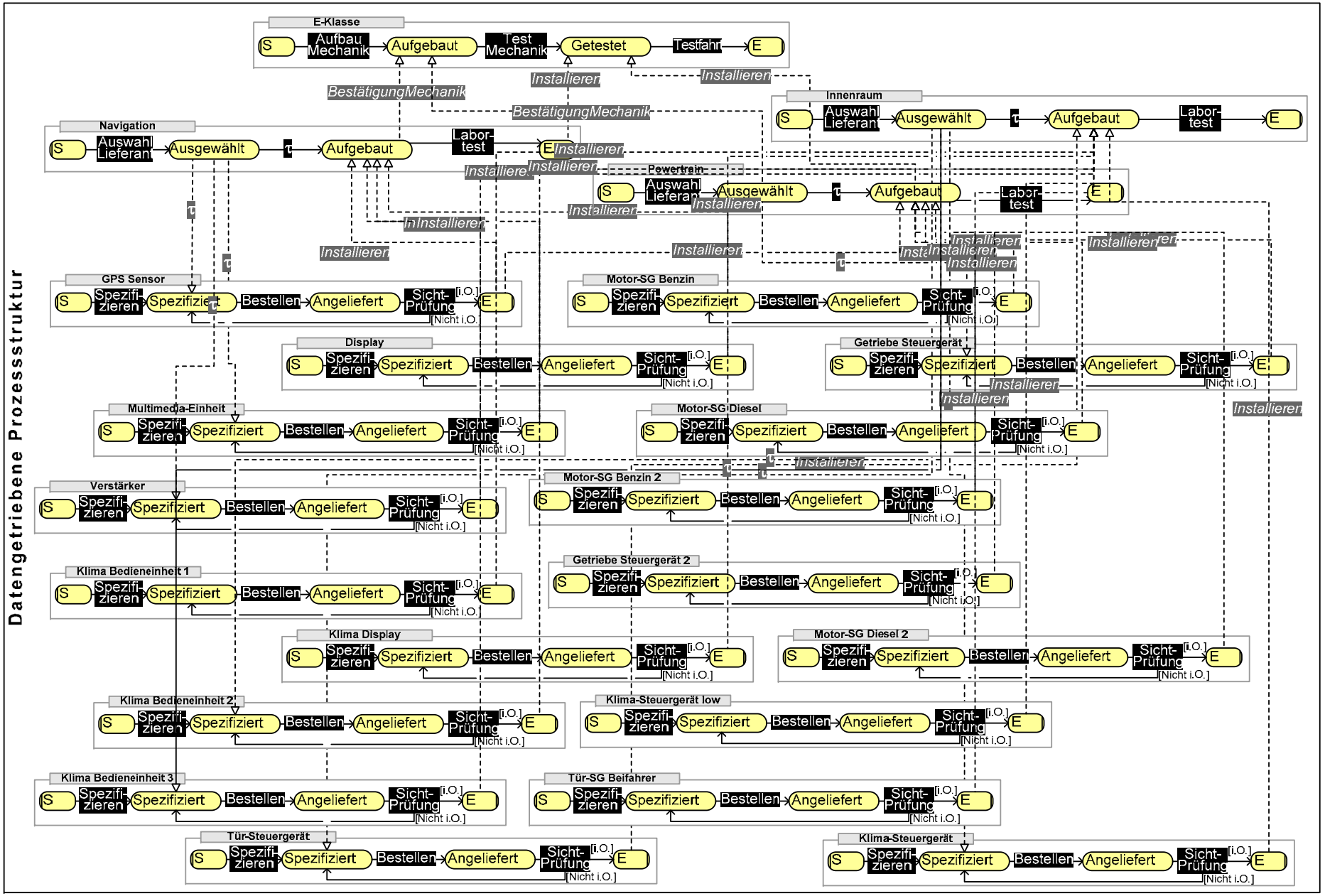
Execution

Dynamic Adaptation

Exception Handlung

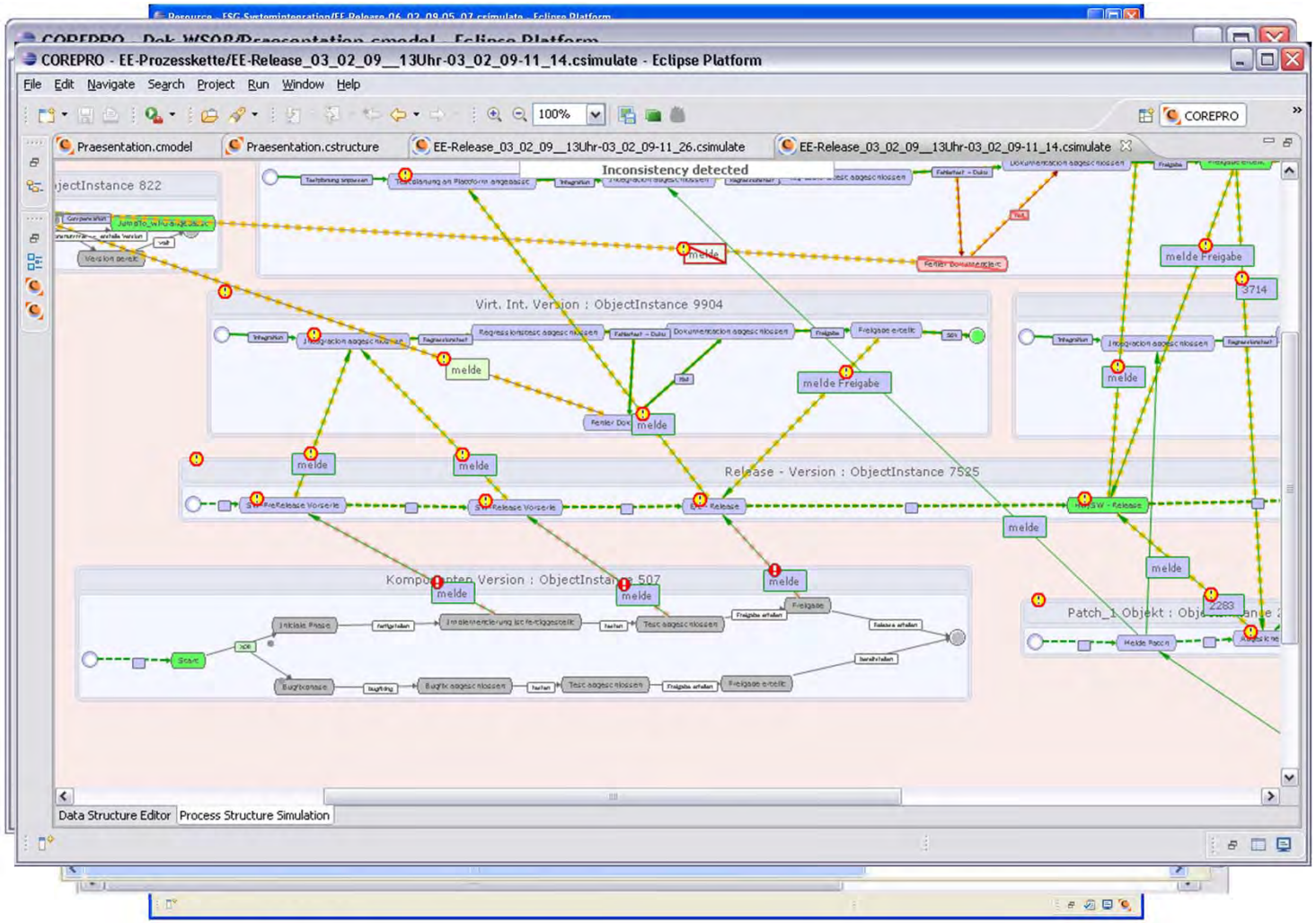
Corepro: Integrated Support of Data-driven Process Structures




Datengetriebene Prozessstruktur
E-Klasse
S
Aufbau Mechanik
Aufgebaut
Test Mechanik
Getestet
Testfahrt
E
BestätigungMechanik
Installieren
Navigation
Auswahl Lieferant
Ausgewählt
Aufgebaut
Labor-test
Innenraum
Powertrain
GPS Sensor
Spezifi-zieren
Spezifiziert
Bestellen
Angeliefert
Sicht-Prüfung
[i.O.]
[Nicht i.O.]
Motor-SG Benzin
Display
Getriebe Steuergerät
Multimedia-Einheit
Motor-SG Diesel
Verstärker
Motor-SG Benzin 2
Klima Bedieneinheit 1
Getriebe Steuergerät 2
Klima Display
Motor-SG Diesel 2
Klima Bedieneinheit 2
Klima-Steuergerät low
Klima Bedieneinheit 3
Tür-SG Beifahrer
Tür-Steuergerät
Klima-Steuergerät

The COREPRO Approach: Proof-of-Concept Implemenation

Au[illegible]sture



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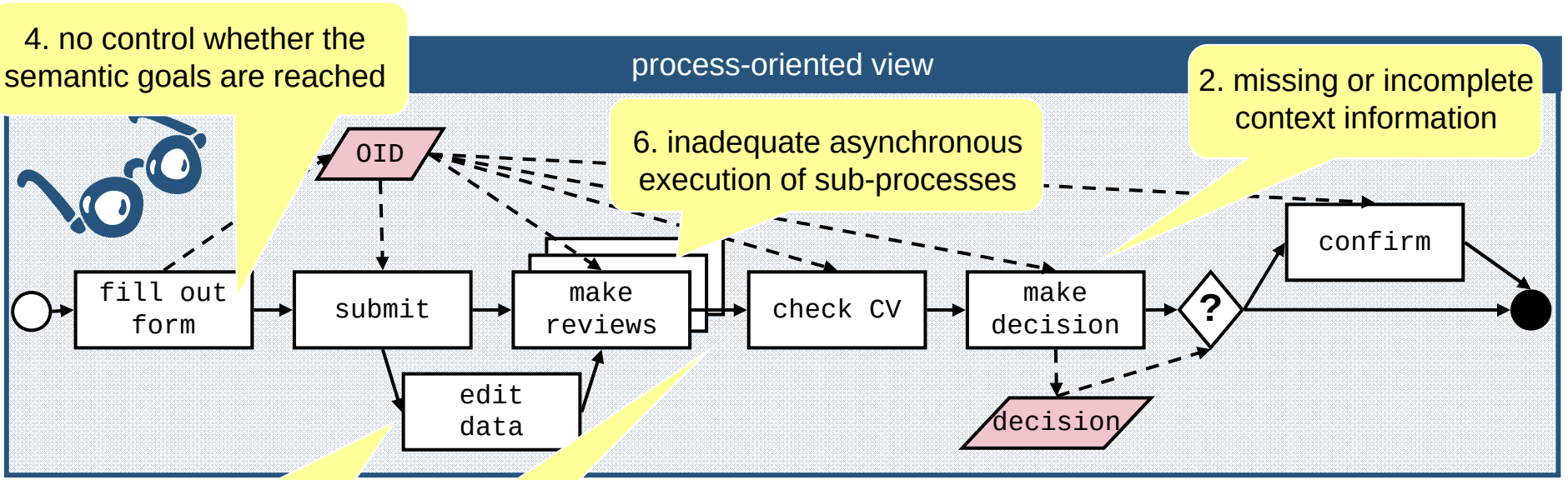
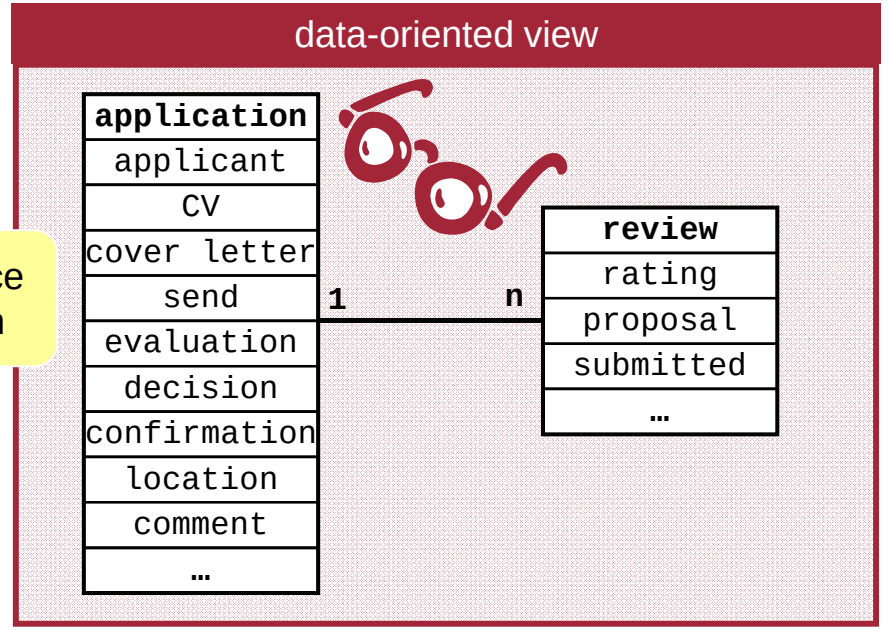
Object-aware Processes

Data Handling in Existing WfMS

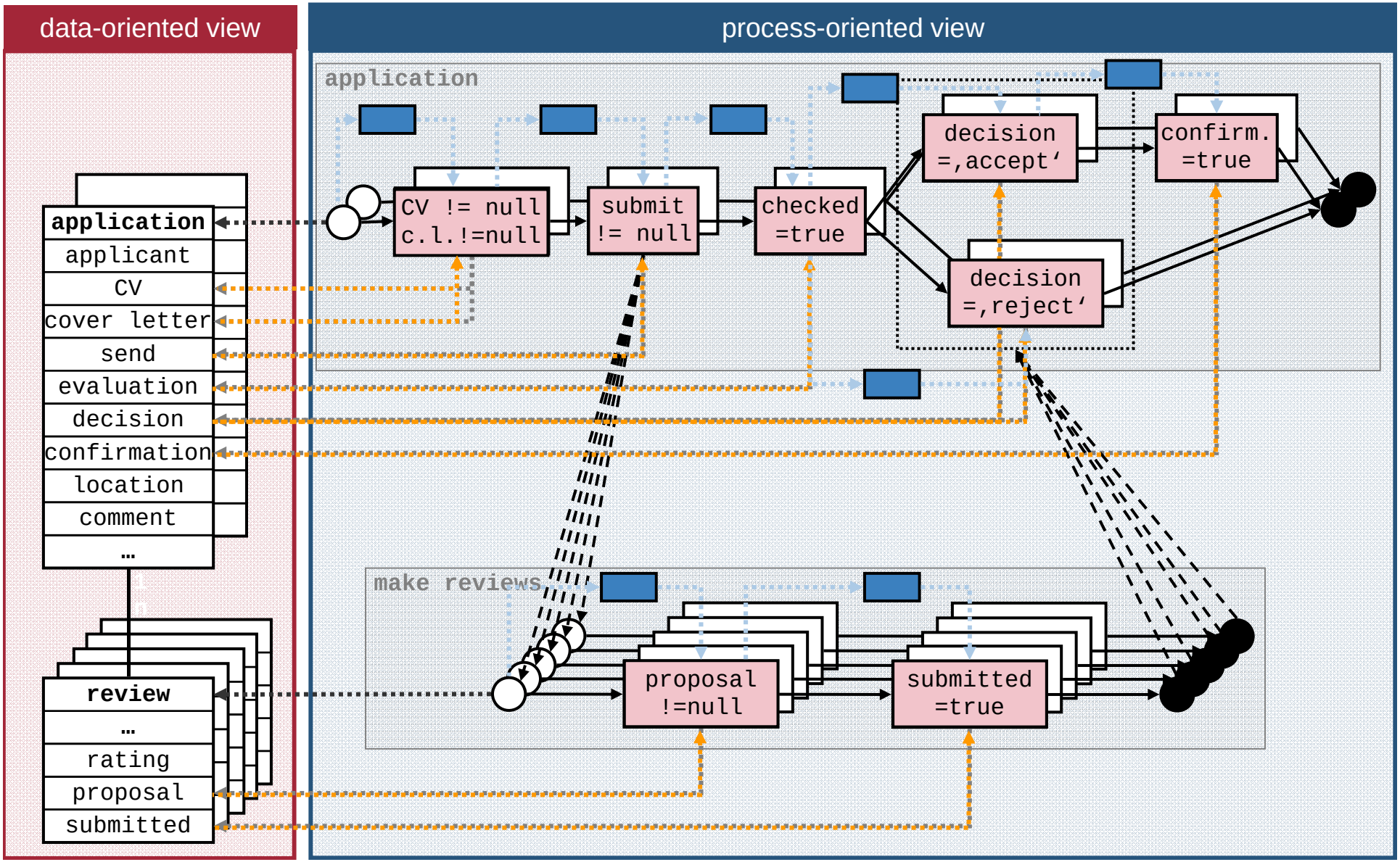


- generic functions
- comprehensive lifecycle support
- missing data-oriented view

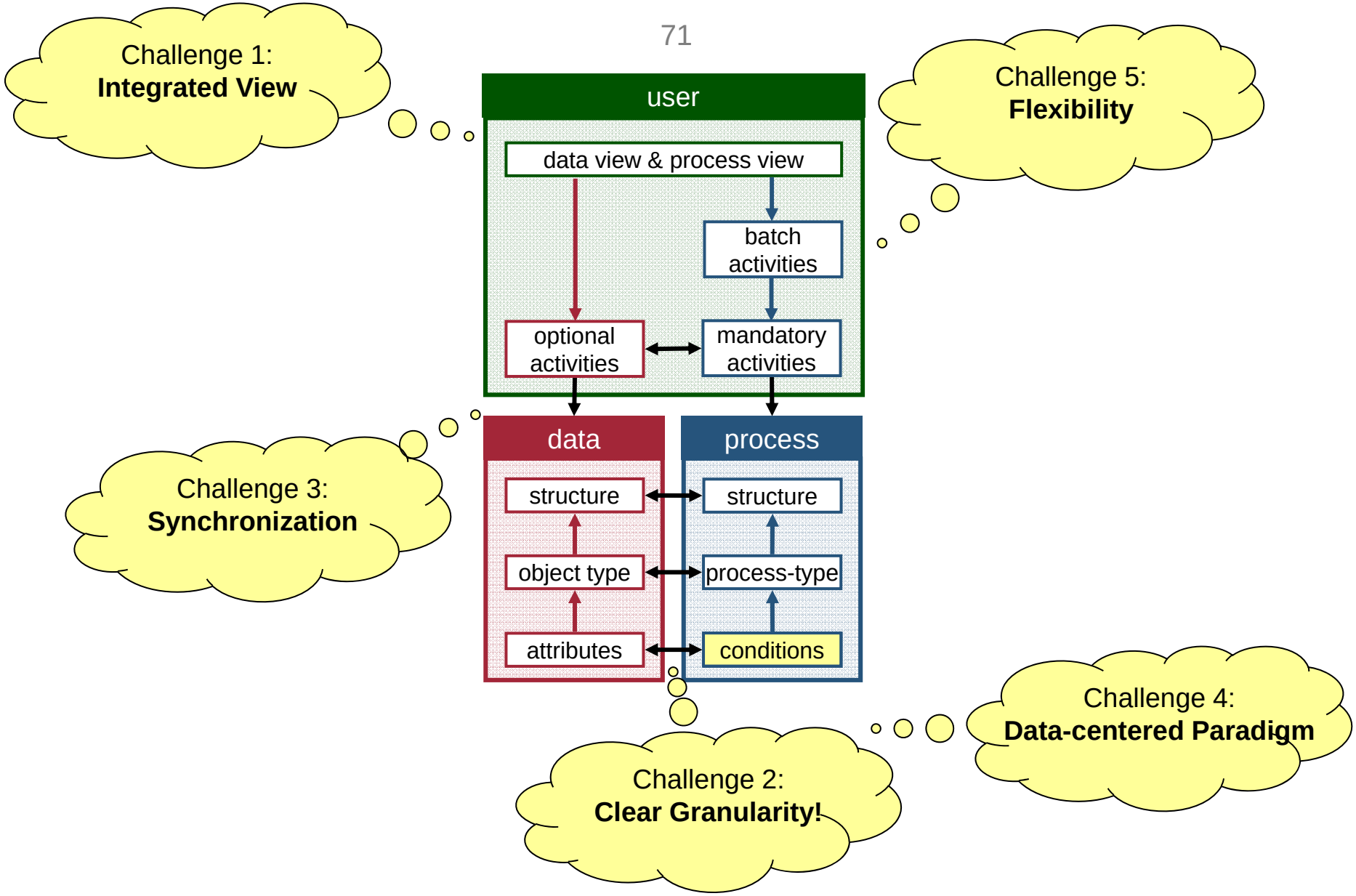
5. each process instance is executed in isolation



Philharmonic Flows: Object-aware Process Management



Philharmonic Flows: Object-aware Process Management



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Summary & Outlook

Summary & Outlook

business conditions vary with innovation pressure

business objectives vary with business conditions

business processes vary with business objectives

changing business processes will be a common business process in the future

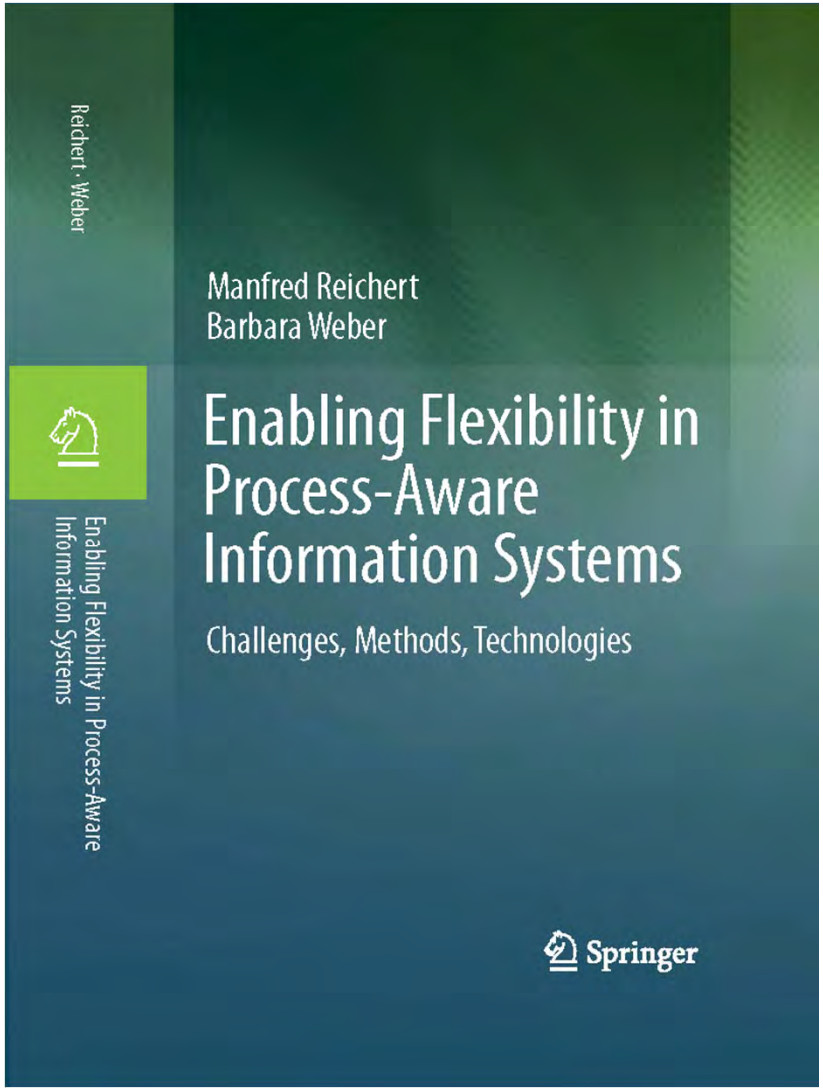
Summary & Outlook

Flexibility Support in most existing PAIS is like Teenager Sex!!

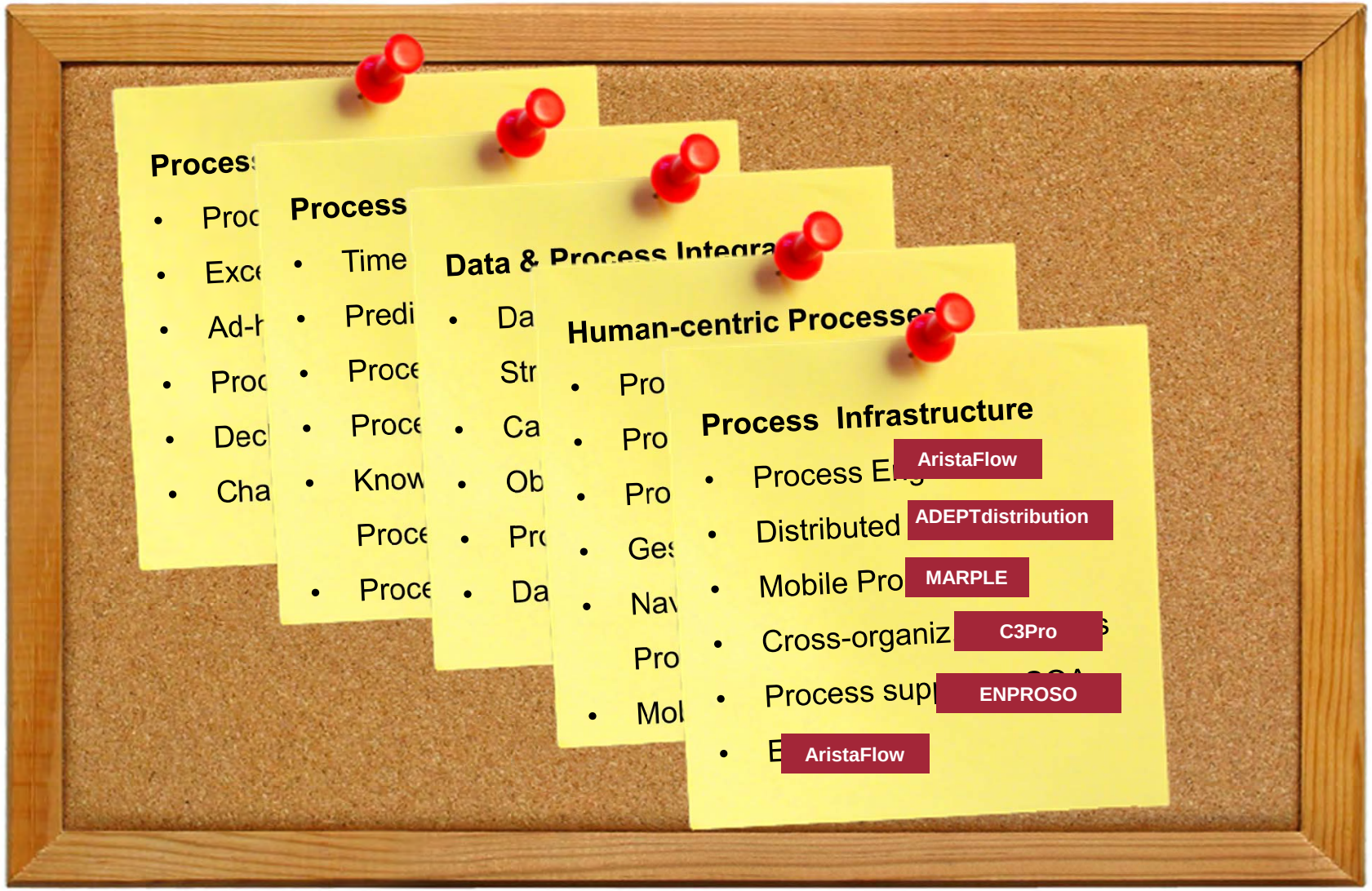
It's on everyone's mind all the time.
Everyone's talking about it all the time
Everyone's thinks everyone is doing it.
Almost no one is really doing it.
The few who are doing it:
Do it poorly
Think "sure it will be better the next time".
Are not practicing it safely

Everyone is bragging about their successes all the time, although very few have actually had any success

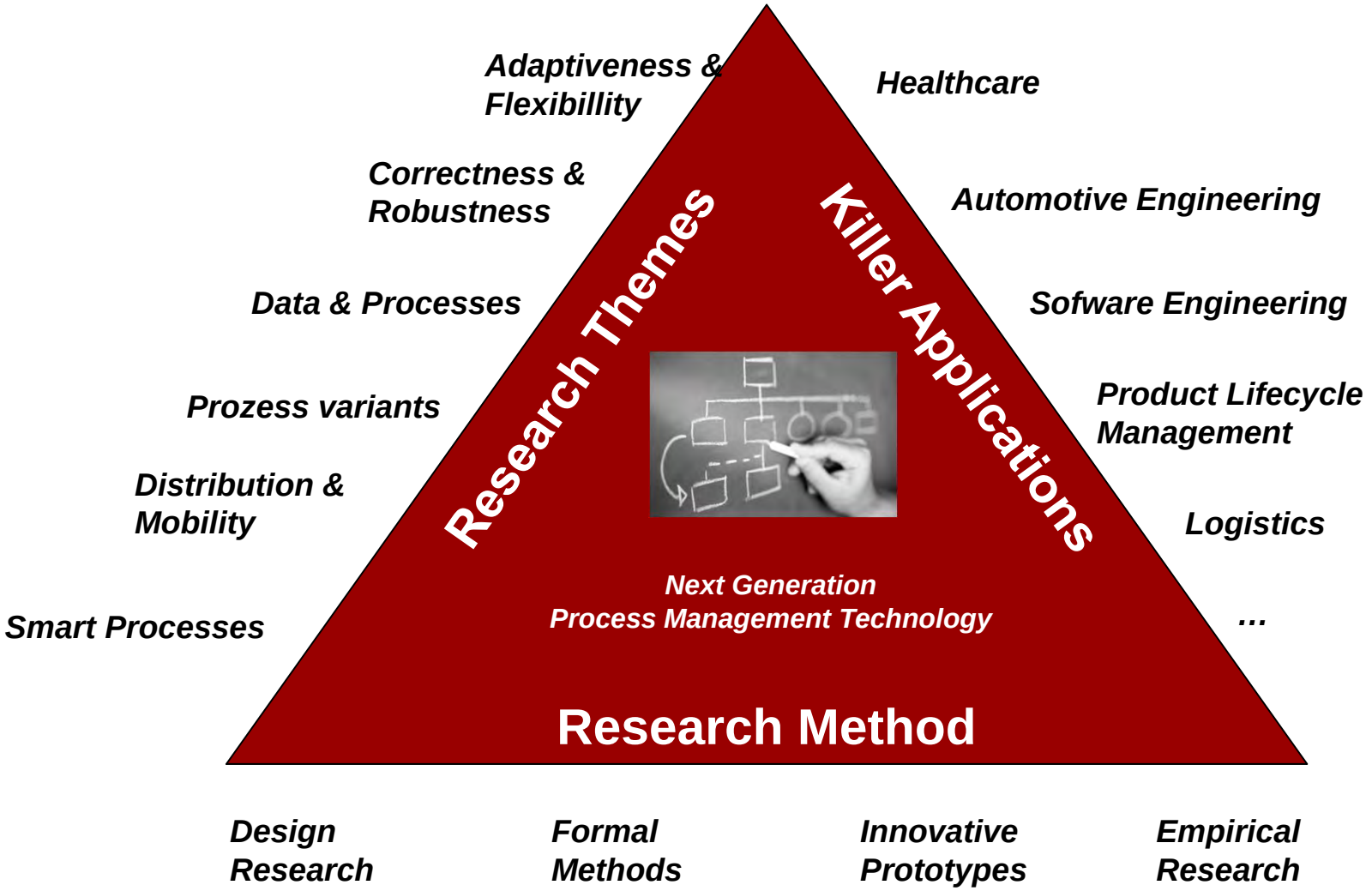
Anonymous


Reichert · Weber
Manfred Reichert
Barbara Weber
Enabling Flexibility in Process-Aware Information Systems
Challenges, Methods, Technologies
Springer
Enabling Flexibility in Process-Aware Information Systems

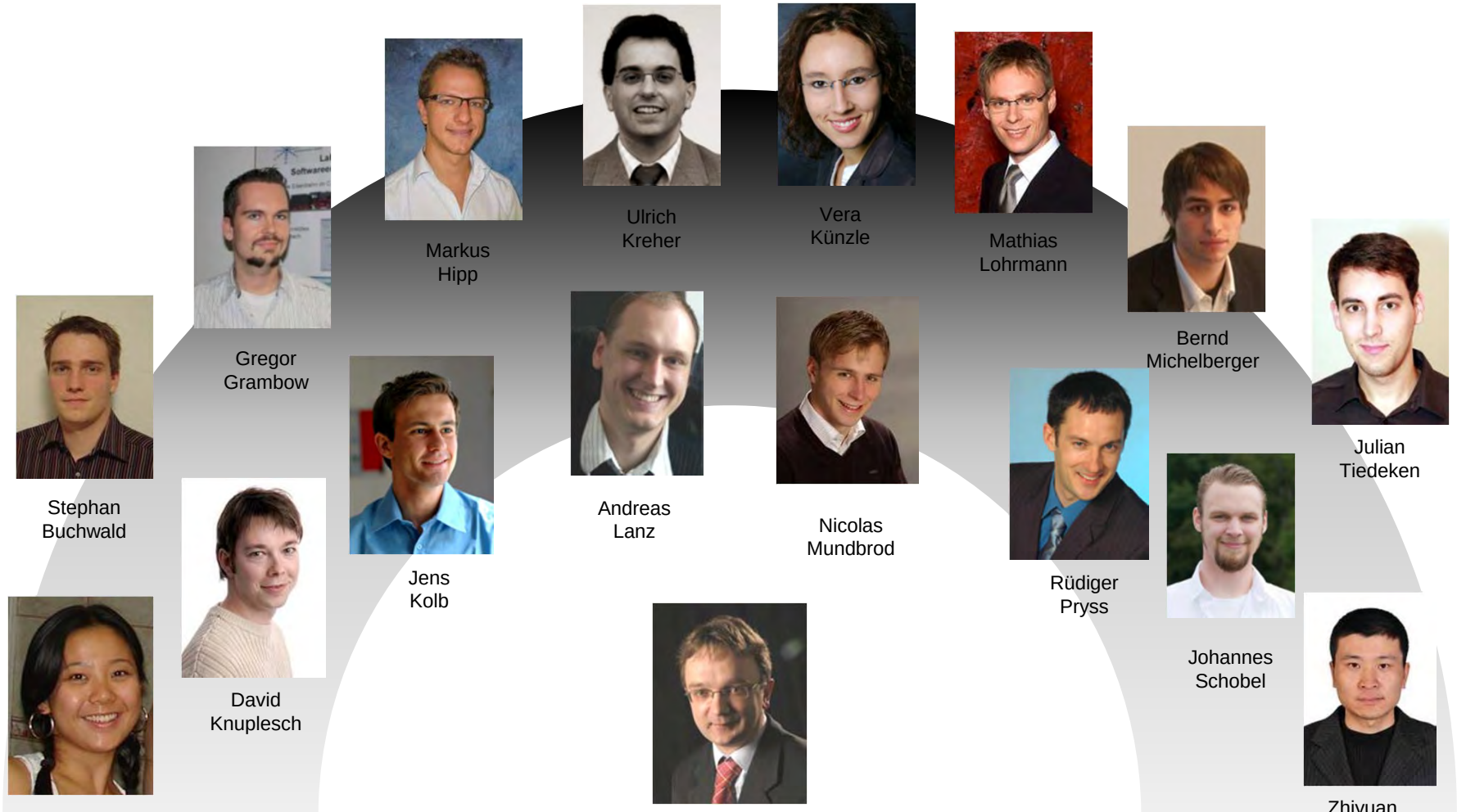
Summary & Outlook: Projects



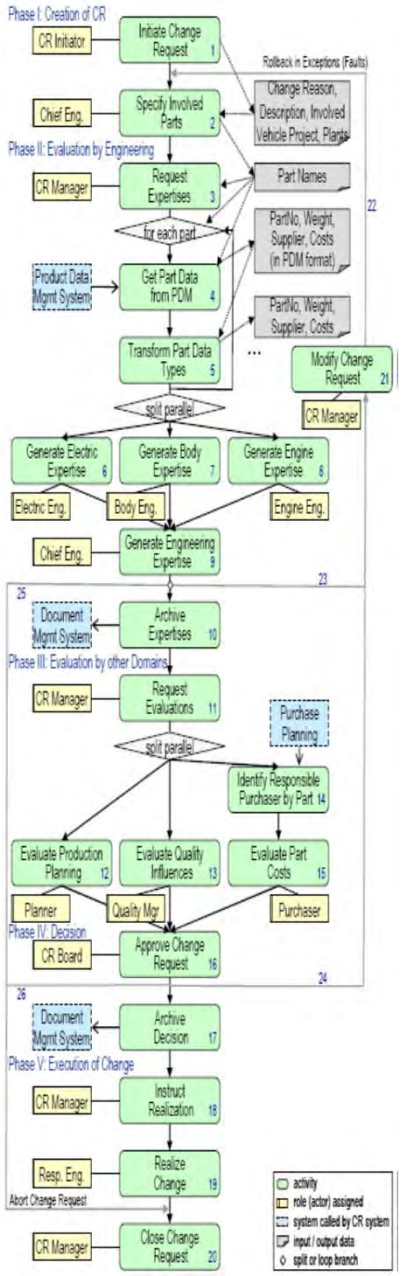
Summary


Adaptiveness & Flexibillity
Correctness & Robustness
Data & Processes
Prozess variants
Distribution & Mobility
Smart Processes
Research Themes
Killer Applications
Healthcare
Automotive Engineering
Sofware Engineering
Product Lifecycle Management
Logistics
...
Next Generation Process Management Technology
Research Method
Design Research
Formal Methods
Innovative Prototypes
Empirical Research

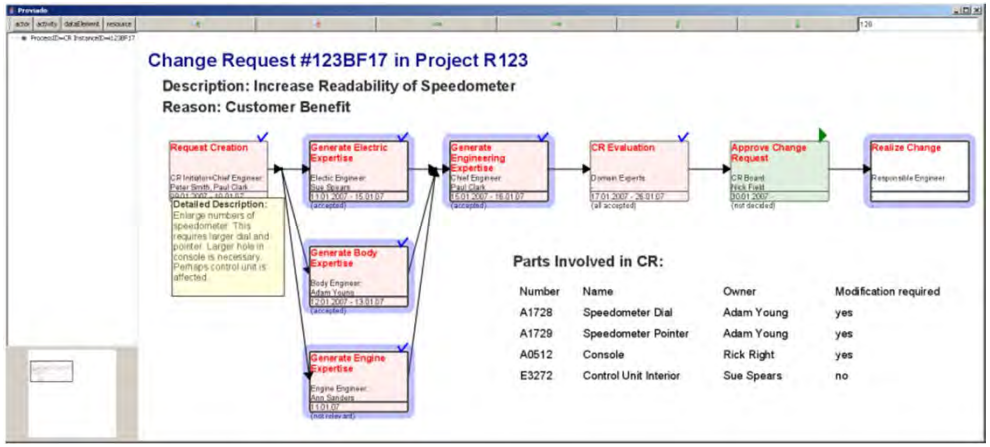
My team


Markus Hipp
Ulrich Kreher
Vera Künzle
Mathias Lohrmann
Gregor Grambow
Bernd Michelberger
Julian Tiedeken
Stephan Buchwald
Jens Kolb
Andreas Lanz
Nicolas Mundbrod
Rüdiger Pryss
Johannes Schobel
David Knuplesch
Carolina Chiao
Zhiyuan Sui
Prof. Dr. Manfred Reichert

Process Visualization & Abstraction

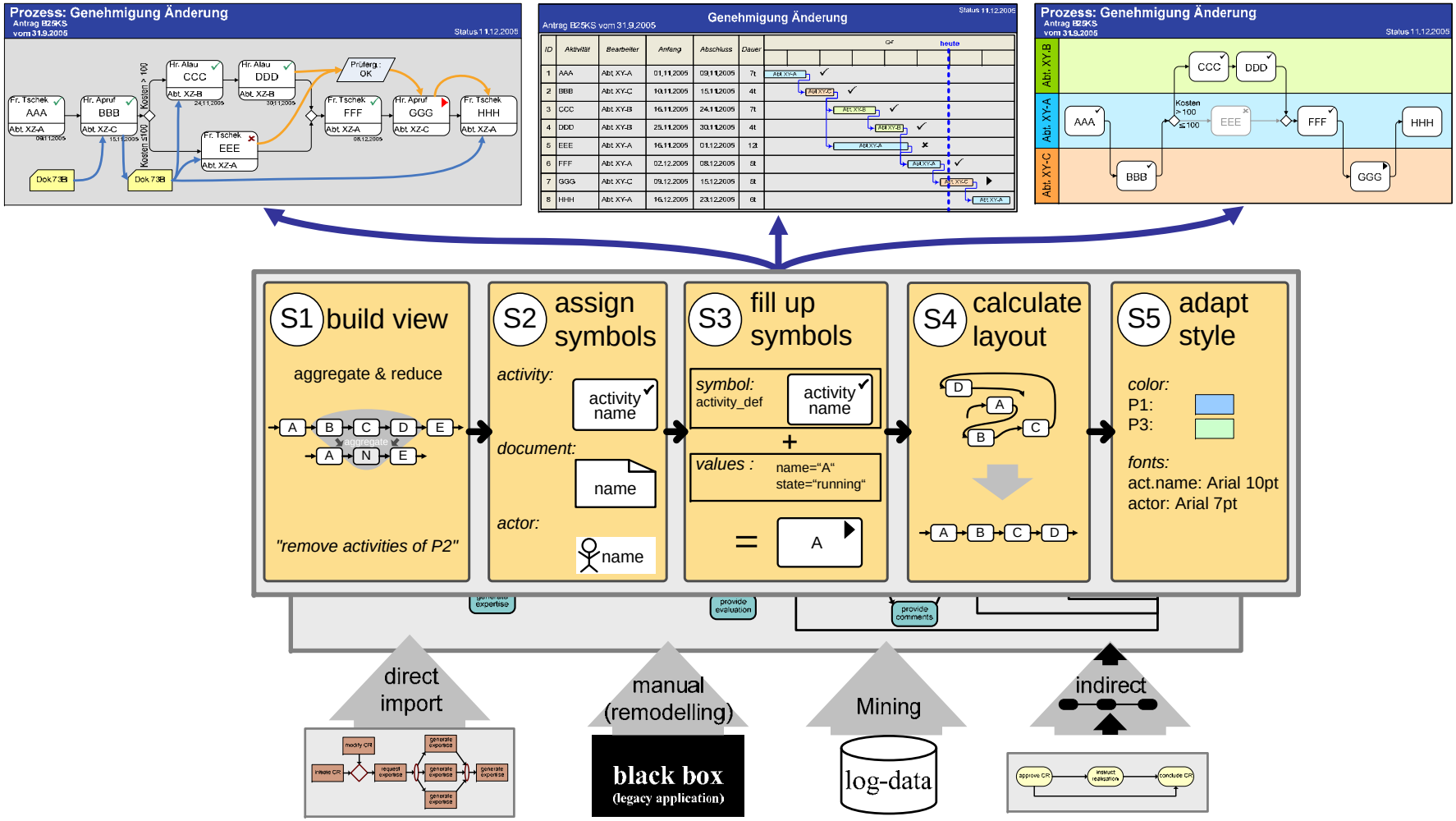


Personalized Visualization

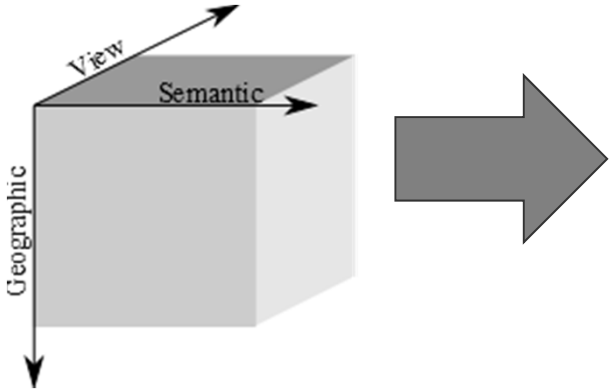


Process Visualization

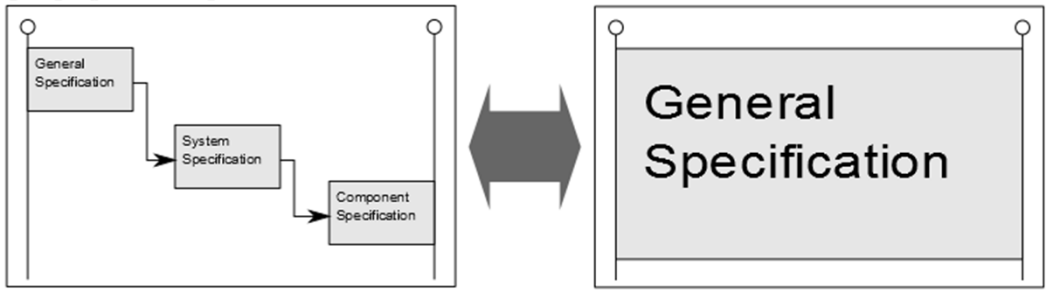
Summary: What we achieved in Proviado?



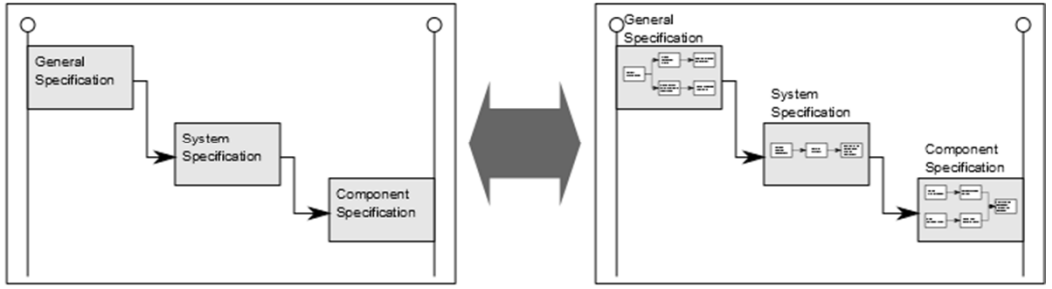
Navigating in Complex Business Processes



(a) geographic navigation dimension

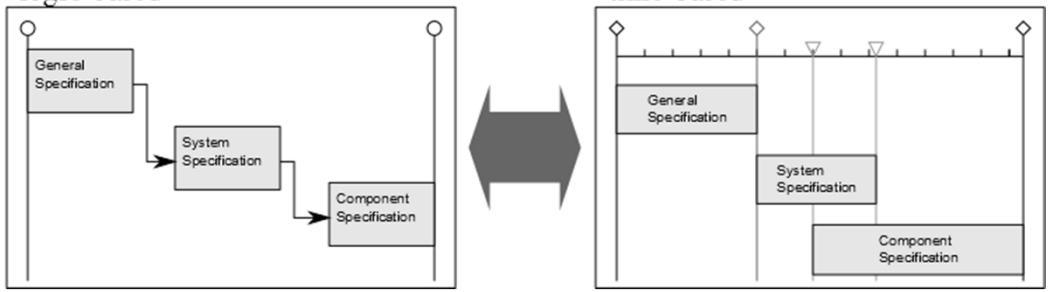


(b) semantic navigation dimension



(c) view navigation dimension

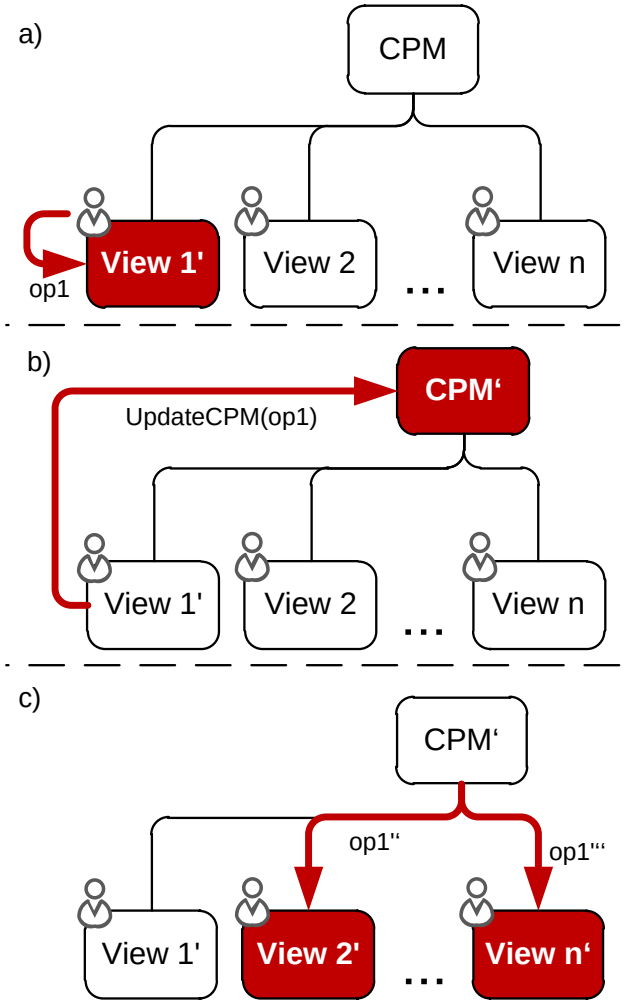
"logic-based" "time-based"



Updatable Process Model Abstractions (Process Views)

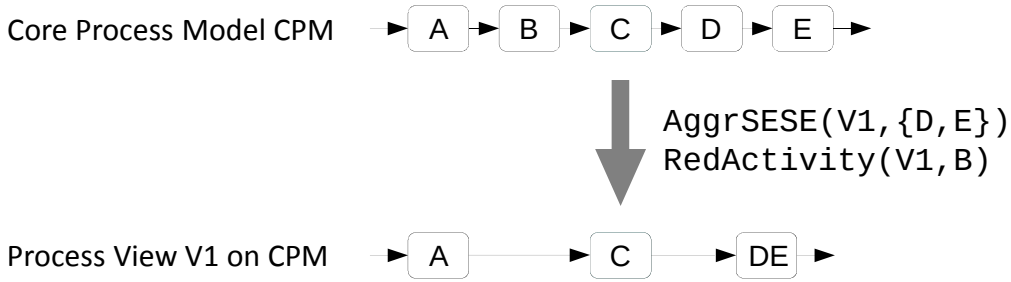
proViewW

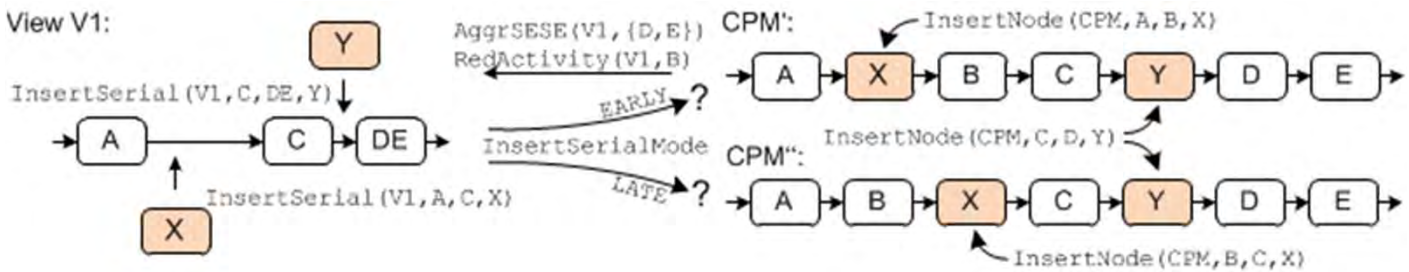
- Basic Idea: Using process views not only for visualization purpose, but also as interface for changing the underlying core process model (CPM)
- Updates of a process view then have to be correctly propagated to its CPM as well as all other views on this CPM
- Necessitates a formal foundation



Updatable Process Model Abstractions (Process Views)

proViewW





Ambiguities when propagating view changes to the CPM

Updatable Process Model Abstractions (Process Views)

proViewW

Updating a CPM and related views after a view update!