

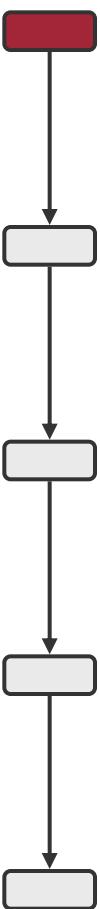
Process and Data: Two Sides of the Same Coin?

Manfred Reichert

University of Ulm
Databases and Information Systems Institute

manfred.reichert@uni-ulm.de

Agenda



Backgrounds

Data as Driver of Large Processes

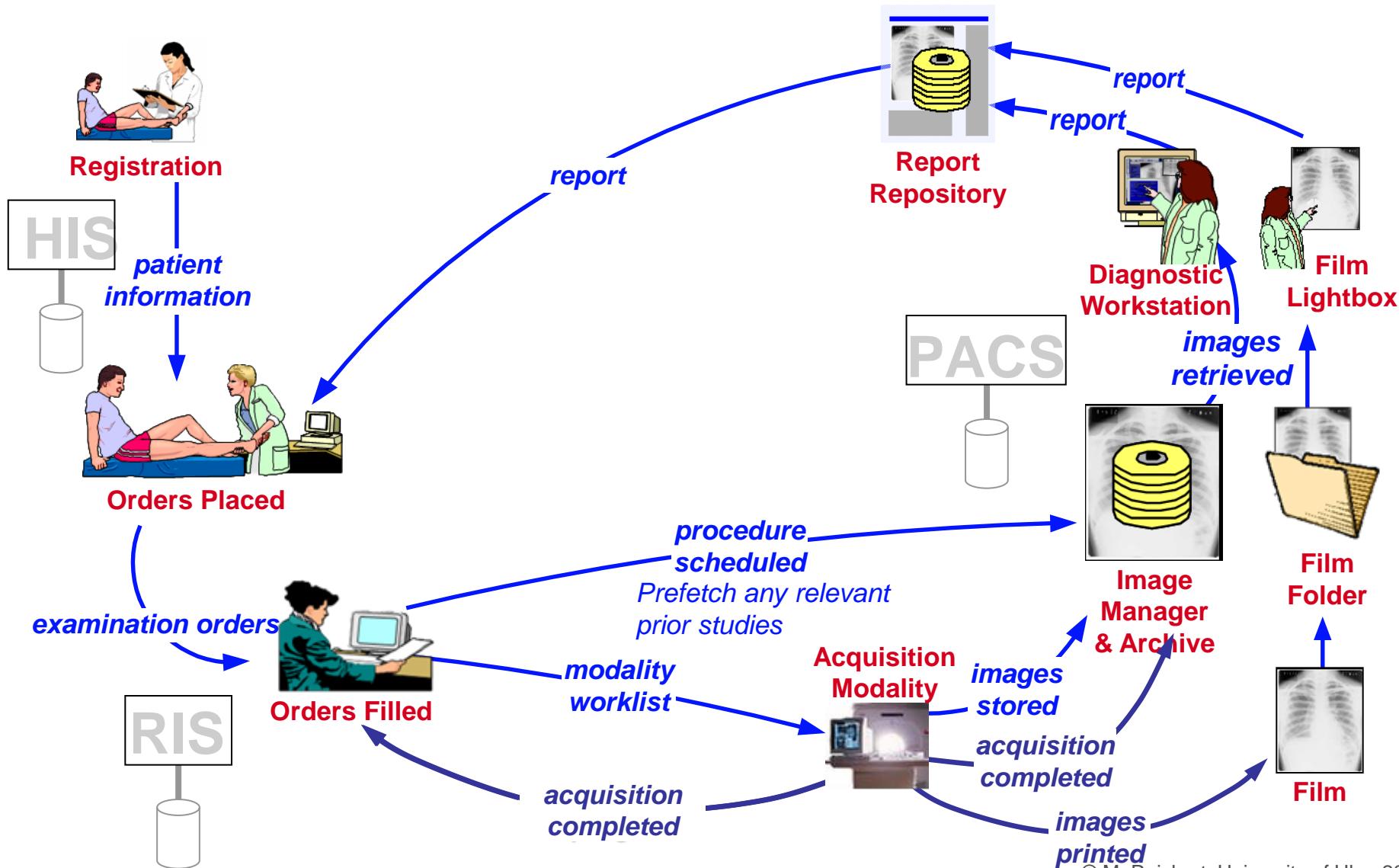
Object-Aware Processes

The PHILharmonicFlows Framework

Summary

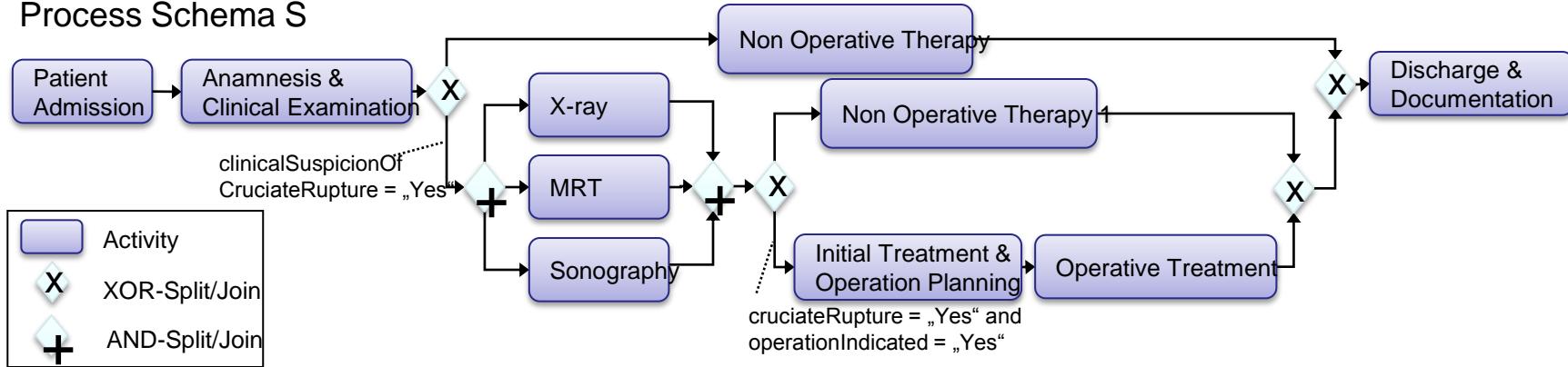
Backgrounds

Process-Aware Information System (PAIS)

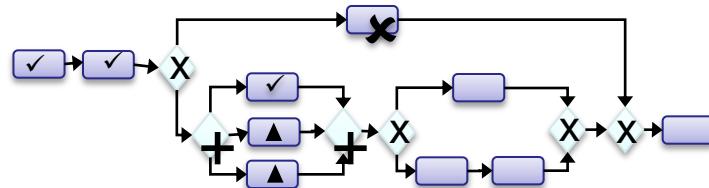




Process Schema S



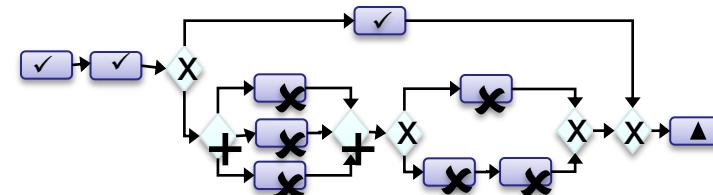
Process Instance I1



Execution Trace:

 $\sigma_1 = \langle \text{„Patient Admission“}, \text{„Anamnesis & Clinical Examination“}, \text{„X-ray“} \rangle$

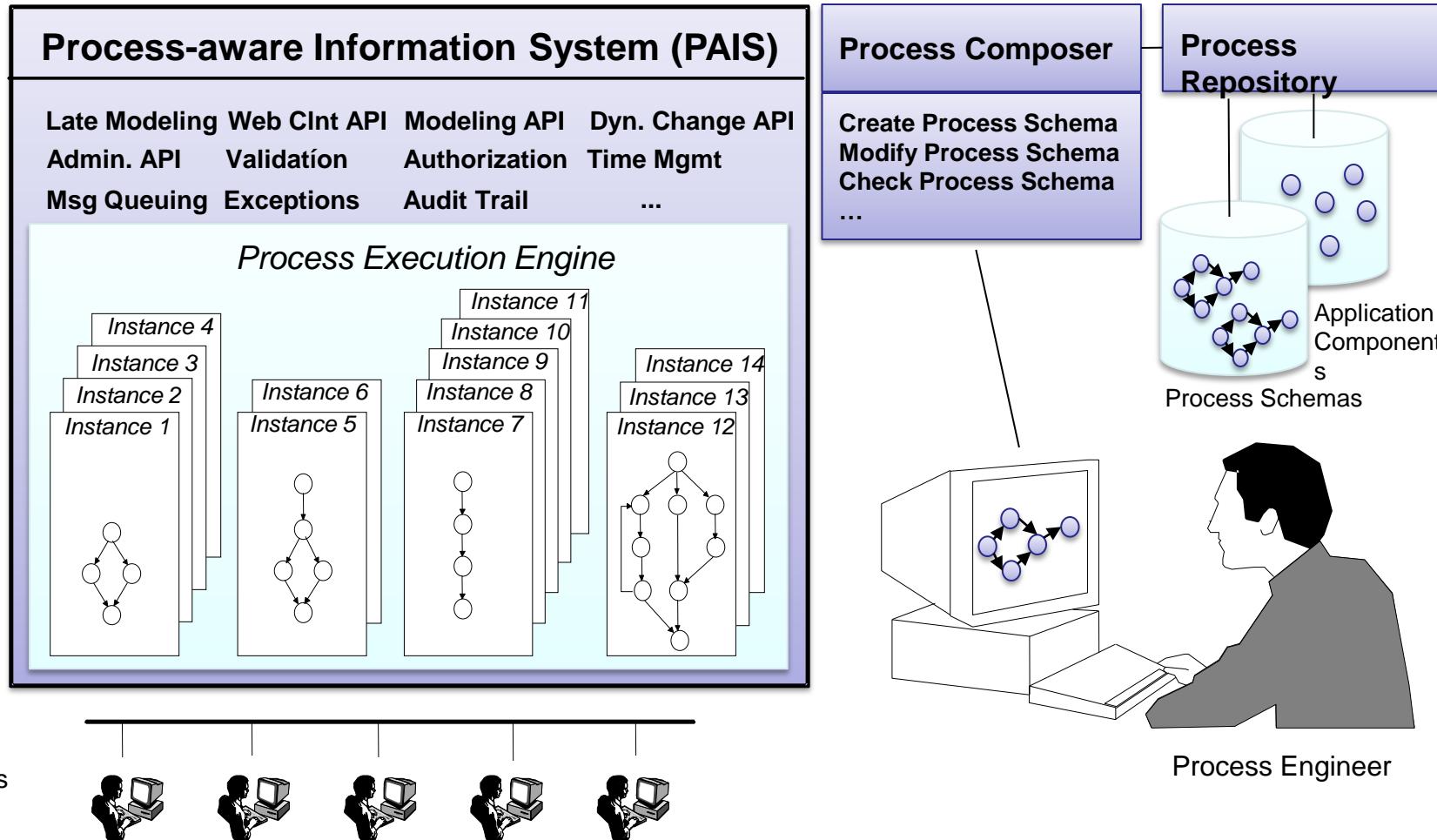
Process Instance I2



Execution Trace:

 $\sigma_2 = \langle \text{„Patient Admission“}, \text{„Anamnesis & Clinical Examination“}, \text{„Non Operative Therapy“} \rangle$

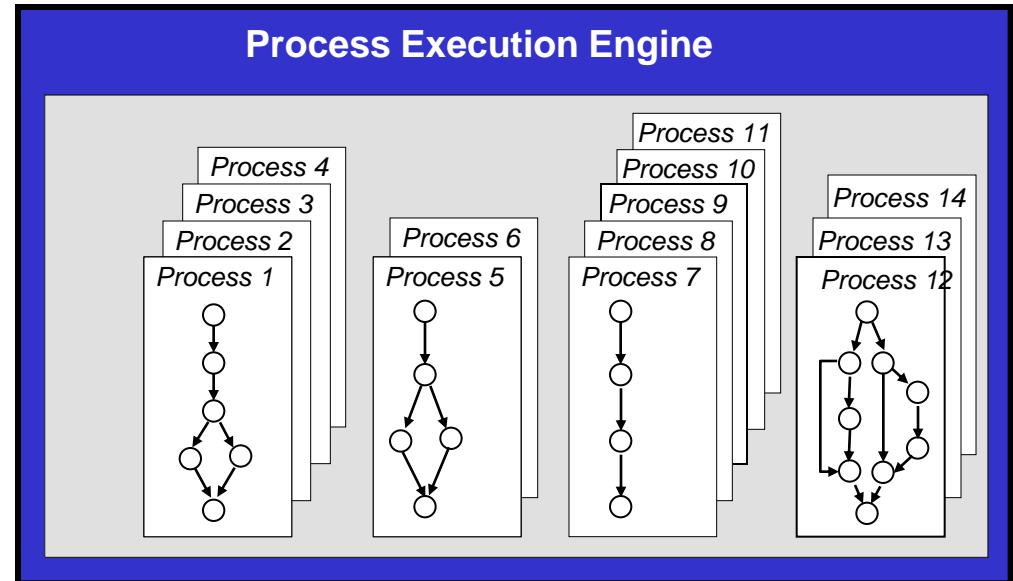
Activity States: ▲ Activated ✓ Completed ✗ Skipped





ADEPT

Individually adaptable
Process Instances



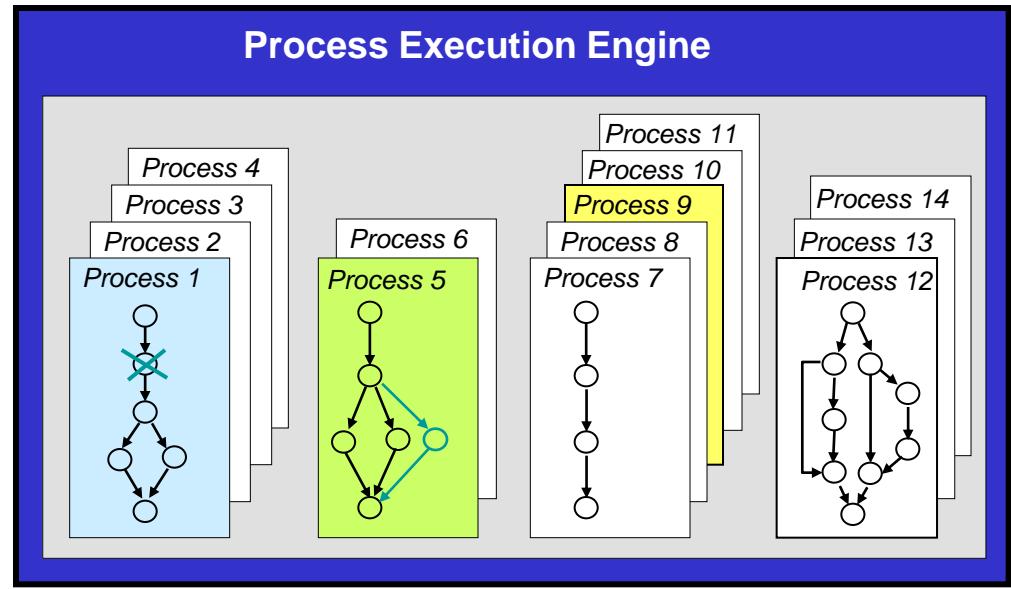
Enabling Flexibility in PAIS

Backgrounds



ADEPT

Individually adaptable
Process Instances



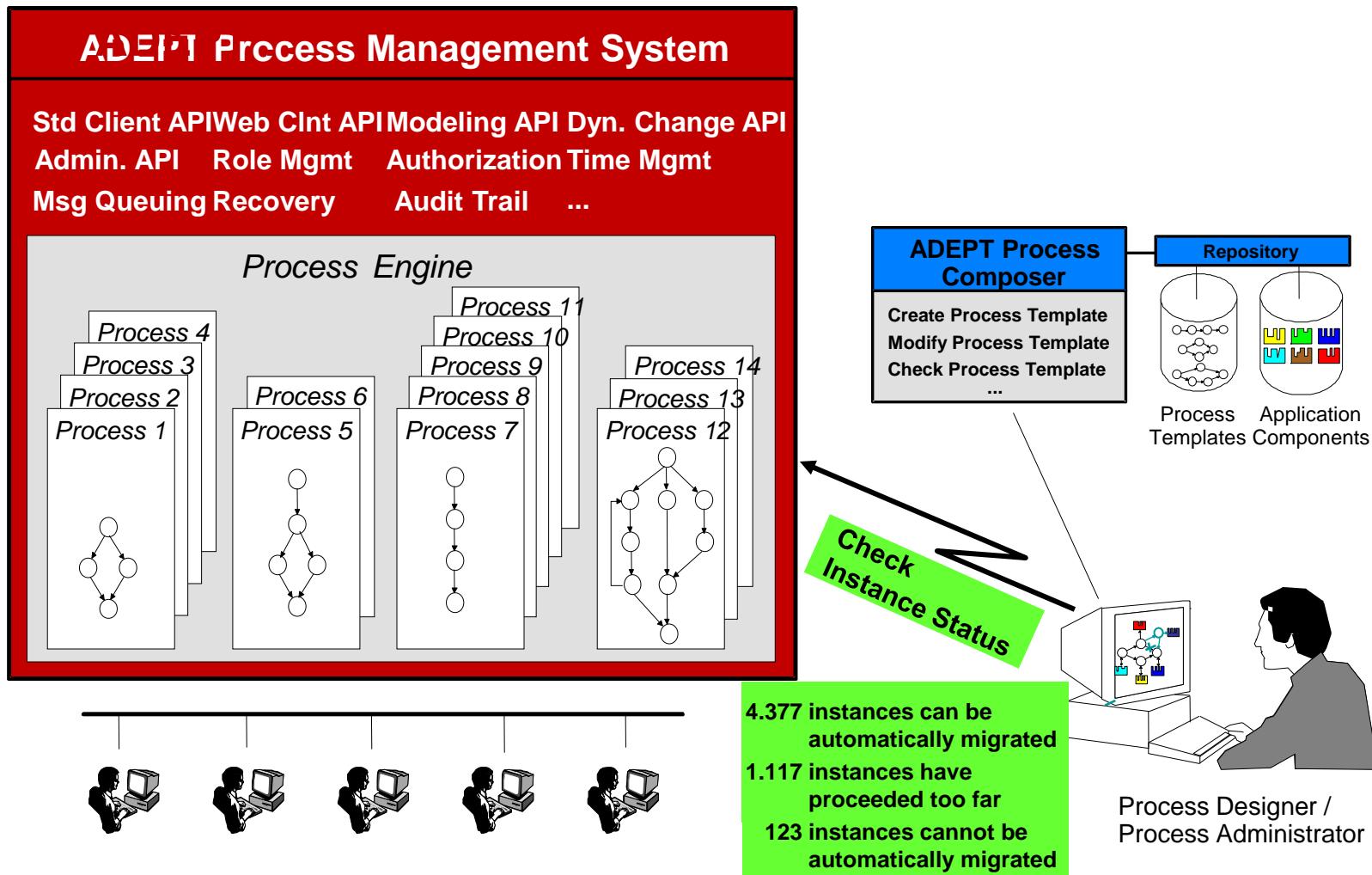
Achievements:

- Formal and expressive process meta model
- Formal Criteria for Change Correctness
- Efficient, build-in consistency checks („no bad surprise“)
- Support of a high number of change patterns
- API for accomplishing ad-hoc changes

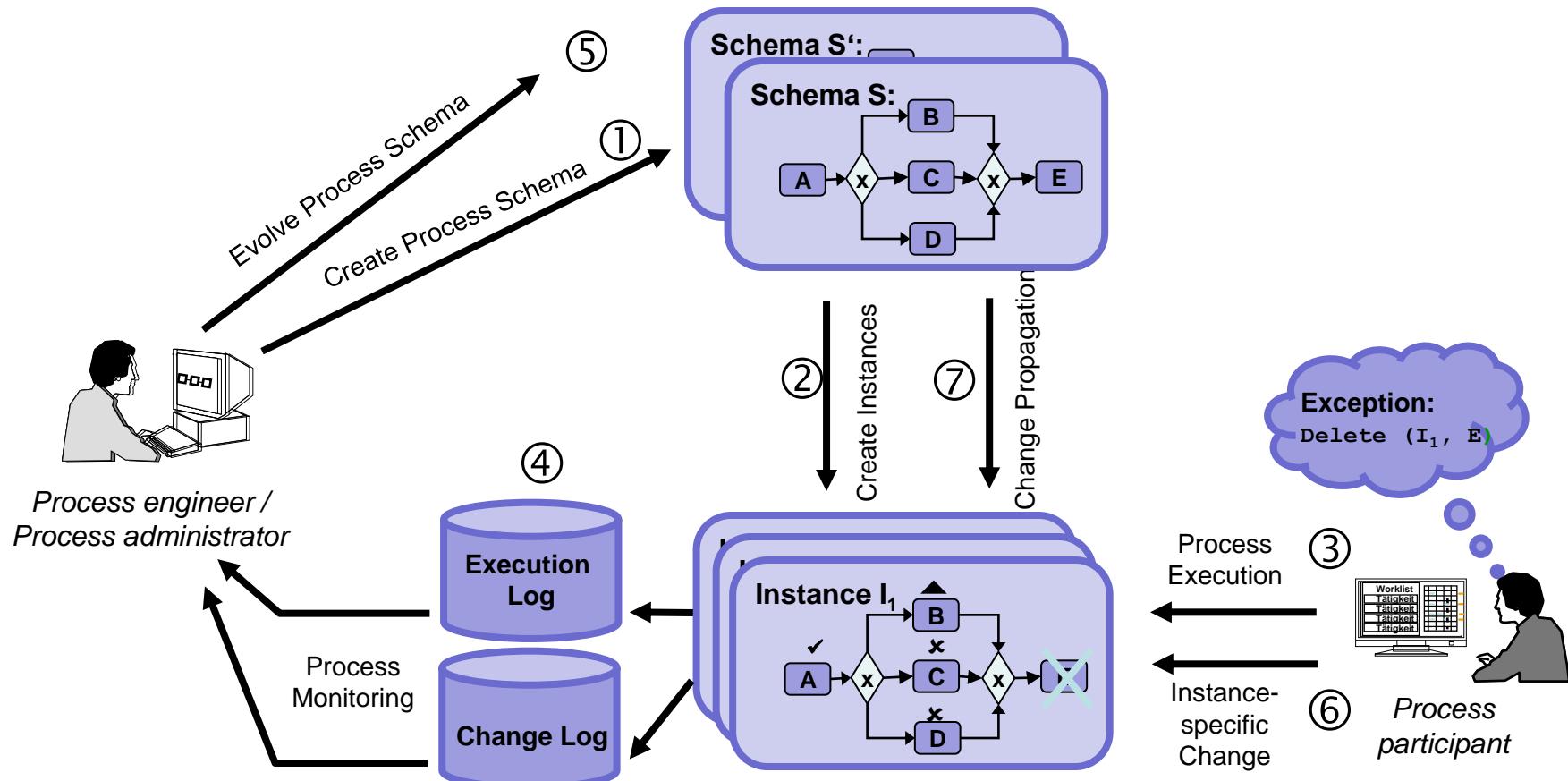
Enabling Flexibility in PAIS

Backgrounds

Process Schema Evolution in ADEPT



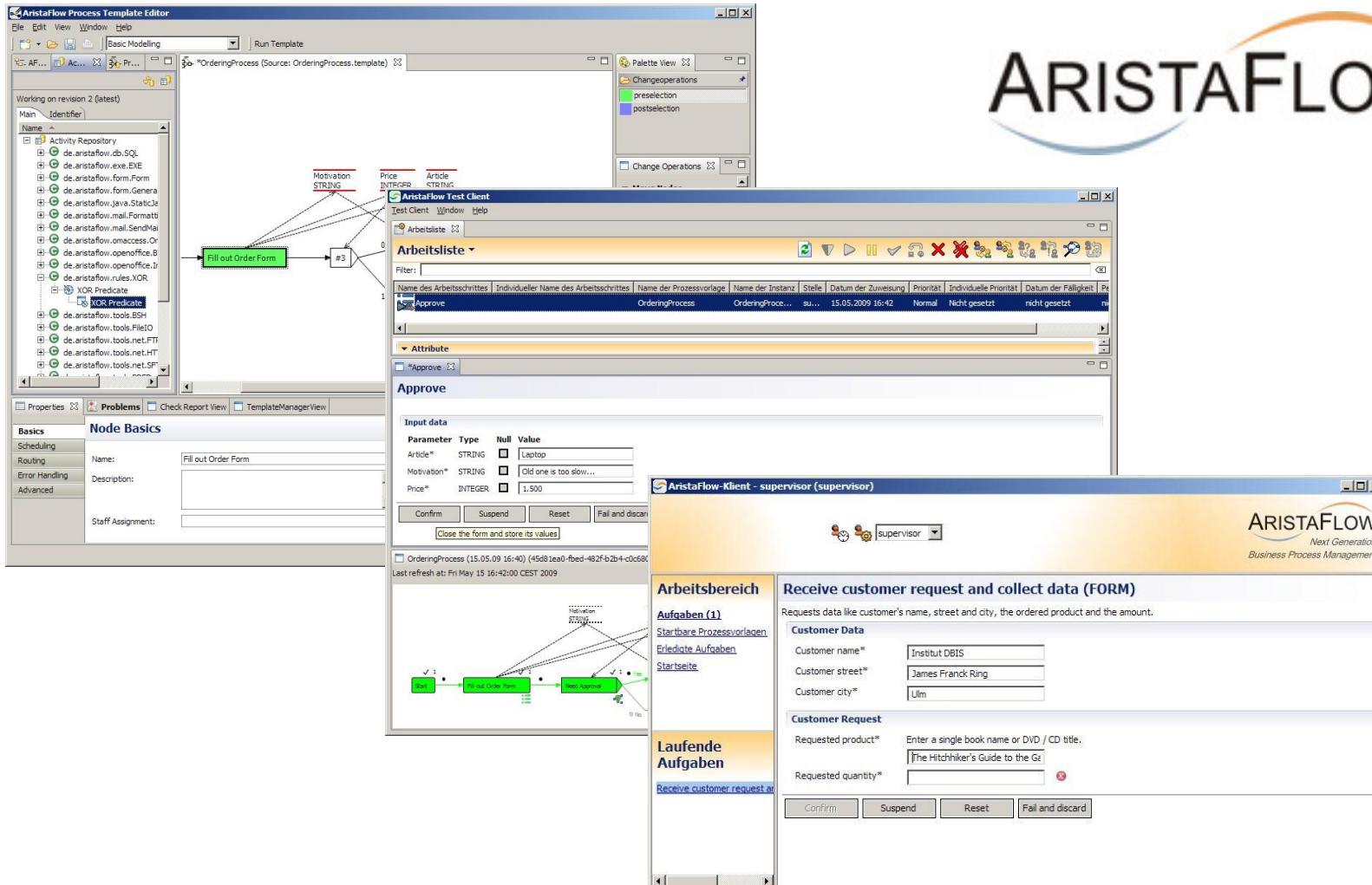
The Extended Process Lifecycle



Enabling Flexibility in PAIS

Backgrounds

Transferring ADEPT to Industrial Practice



www.aristaflow-forum.de



Reichert · Weber

Manfred Reichert
Barbara Weber



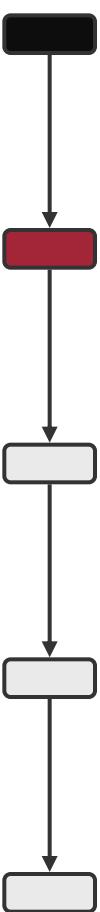
Enabling Flexibility in Process-Aware Information Systems

Enabling Flexibility in Process-Aware Information Systems

Challenges, Methods, Technologies

Springer

Agenda



Backgrounds

Data as Driver of Large Processes

Object-Aware Processes

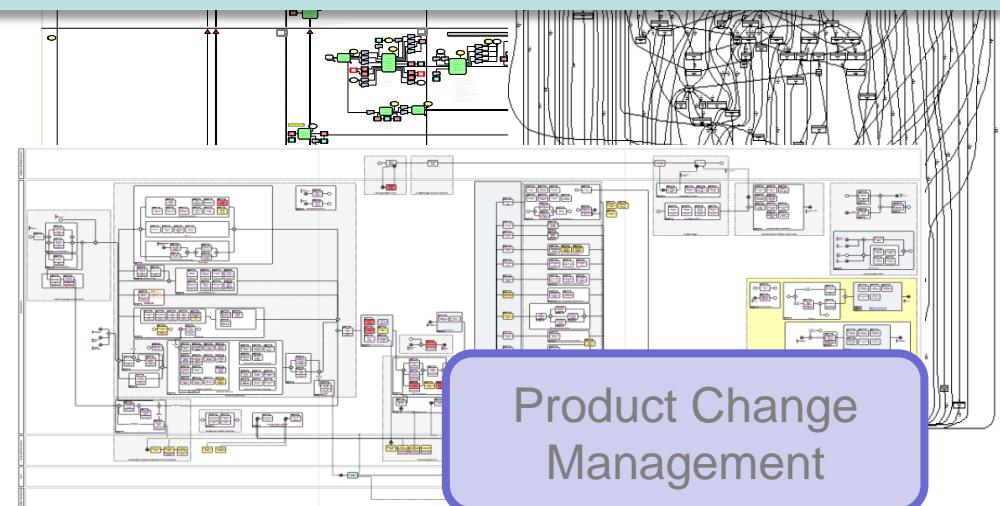
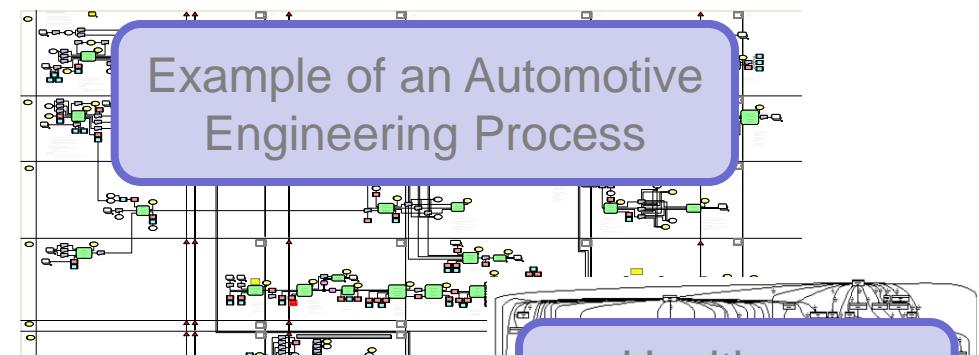
The PHLharmonicFlows Framework

Summary



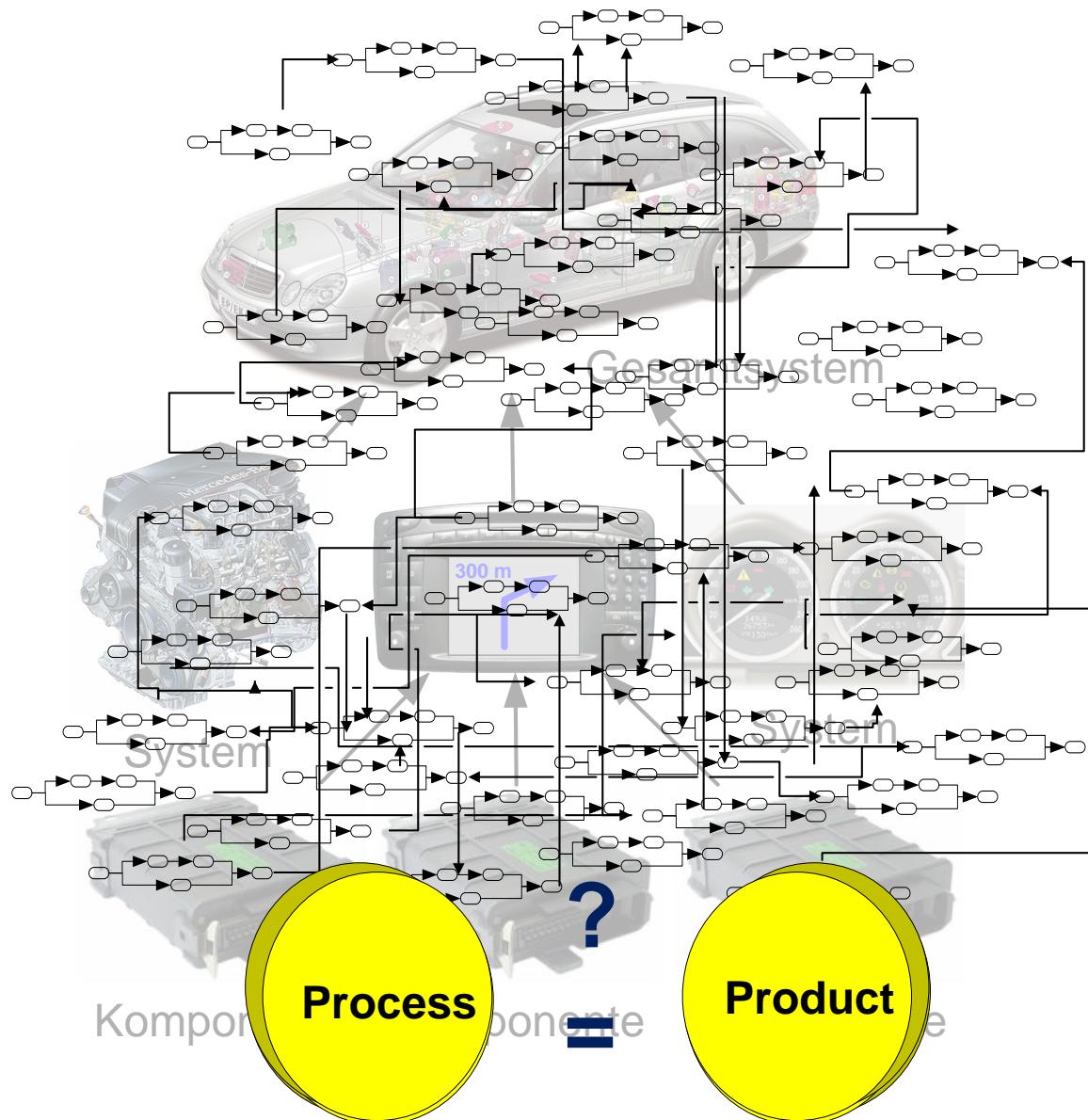
Processes in the Wild World:

- Business processes can be very large and complex
- Thousands of concurrently executed process instances
- But: What are the drivers of these large processes?
- Comprehensibility and usability are crucial factors
- PAIS correctness and robustness are fundamental



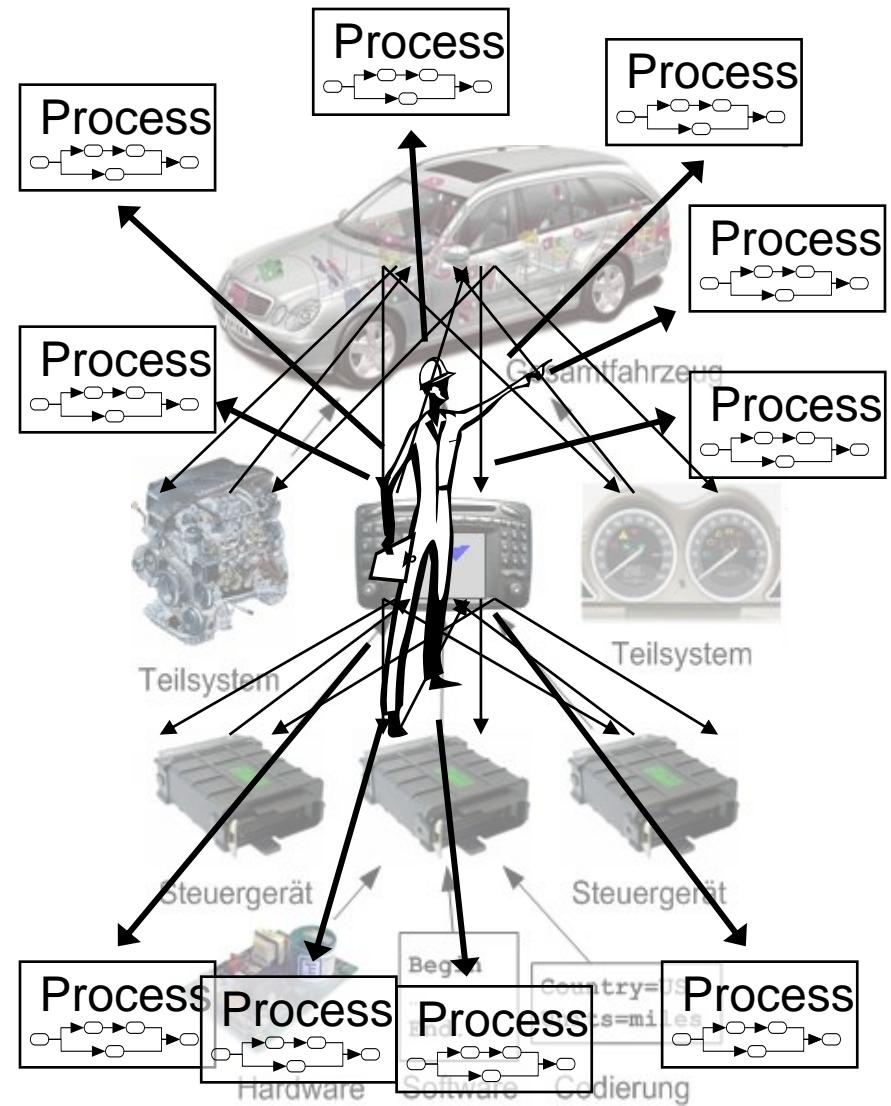
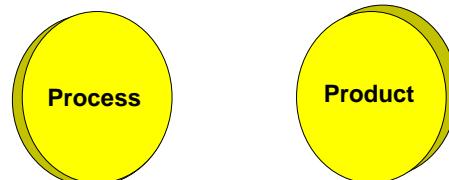
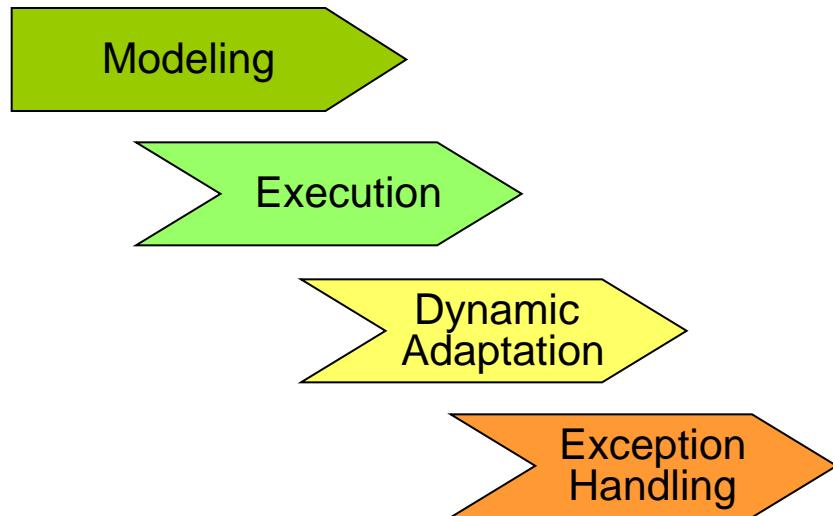
Data as Driver of Large Processes

Large Process Structures



Drivers of Large Process Structures

Data as Driver of Large Processes



The Corepro Approach

Data as Driver of Large Processes



M o d e l l e b e n e

Datenmodell

Data
Model

Life Cycle Coordination
Model

Object Life Cycles /
Life Cycle Coordination Model

I n s t a n z e b e n e

Datenstruktur

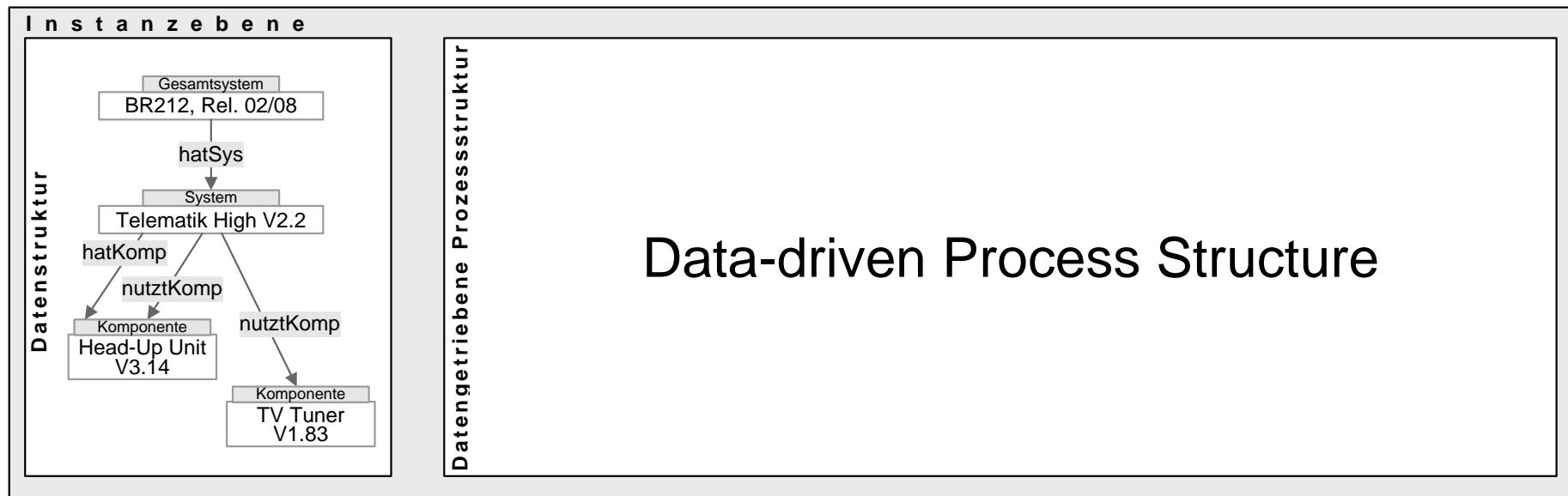
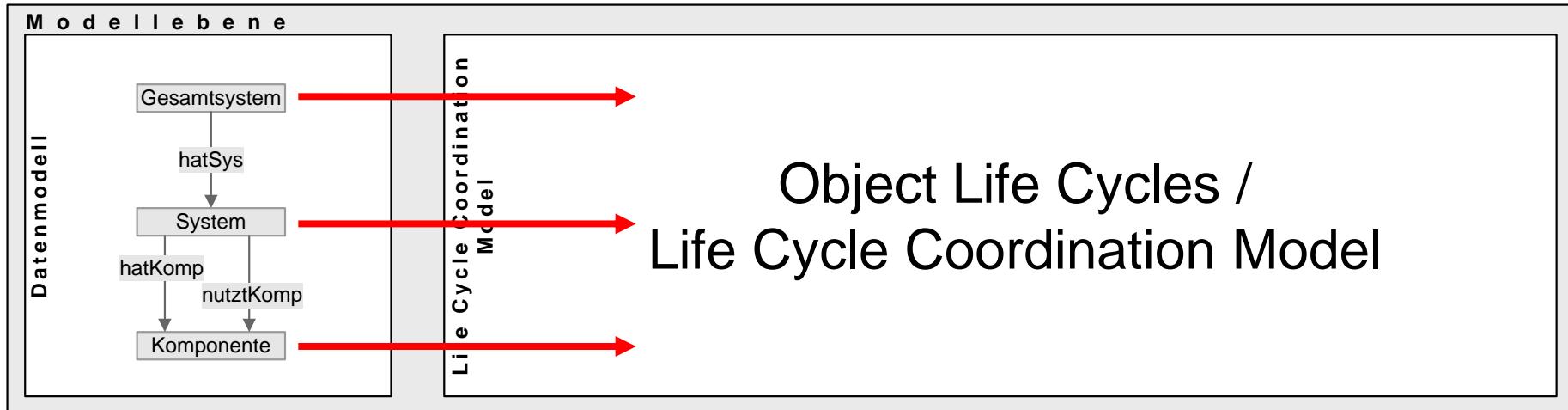
Data
Structure

Datengetriebene Prozessstruktur

Data-driven Process Structure

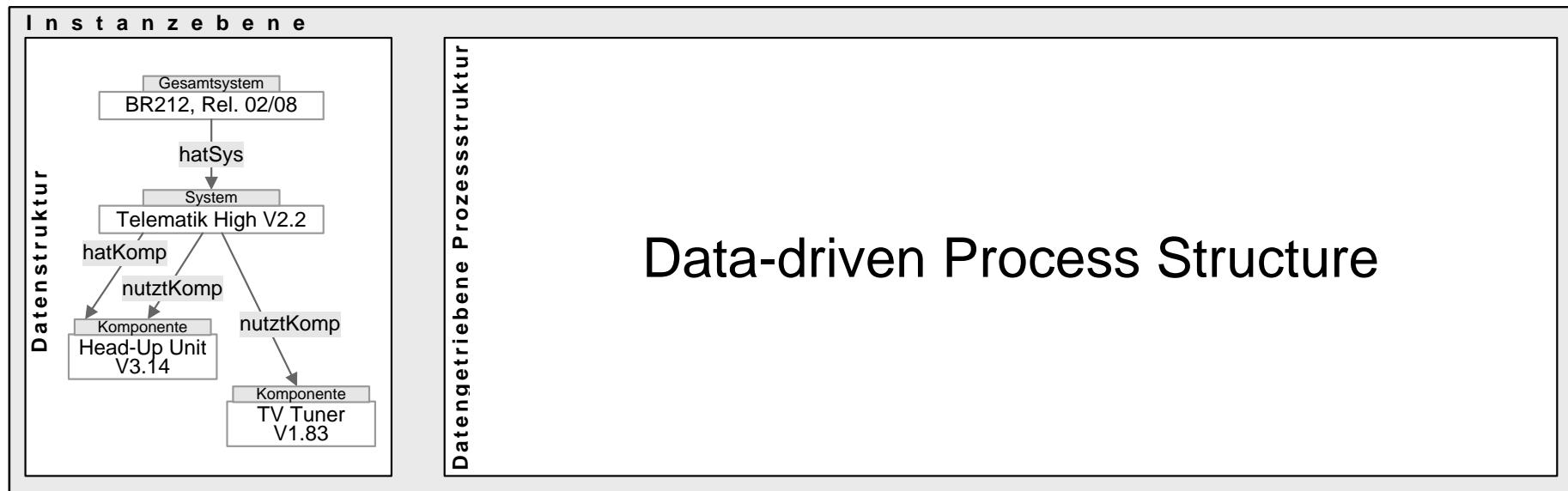
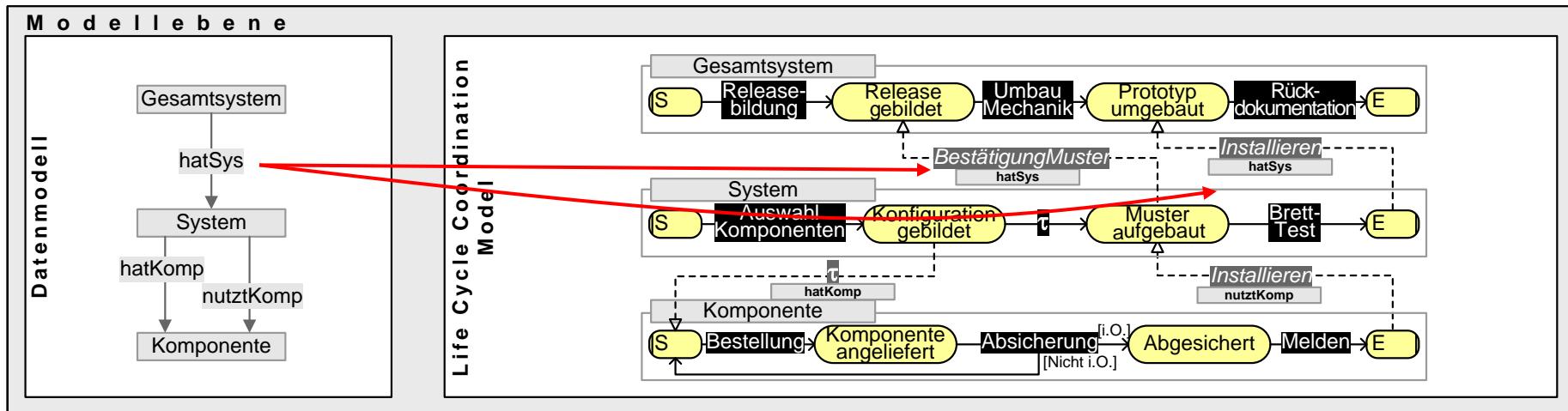
The Corepro Approach

Data as Driver of Large Processes



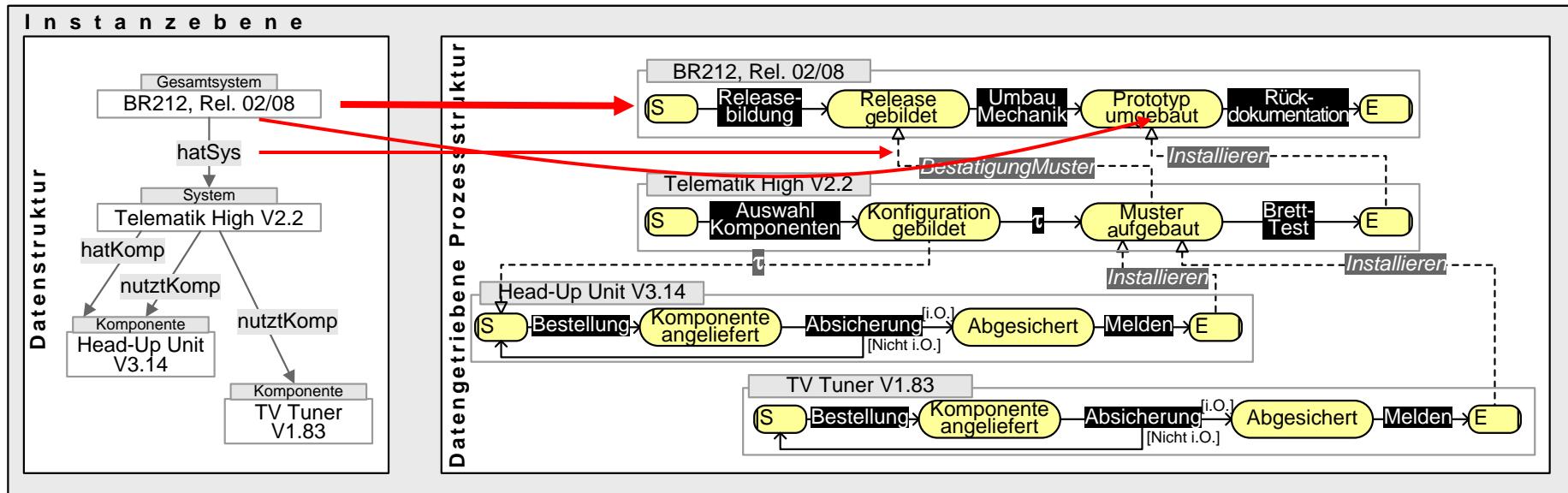
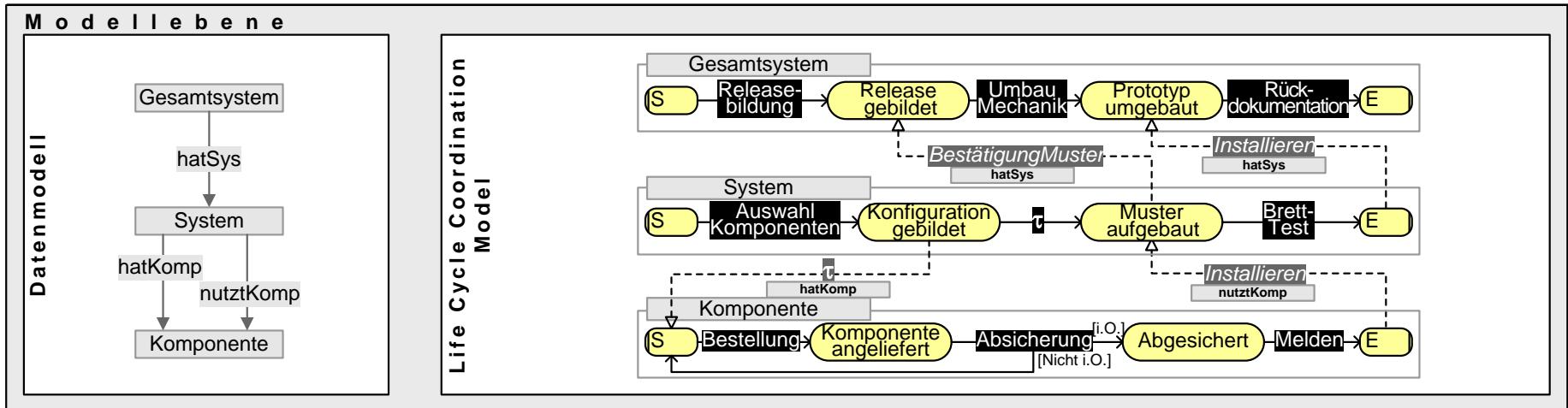
The Corepro Approach

Data as Driver of Large Processes

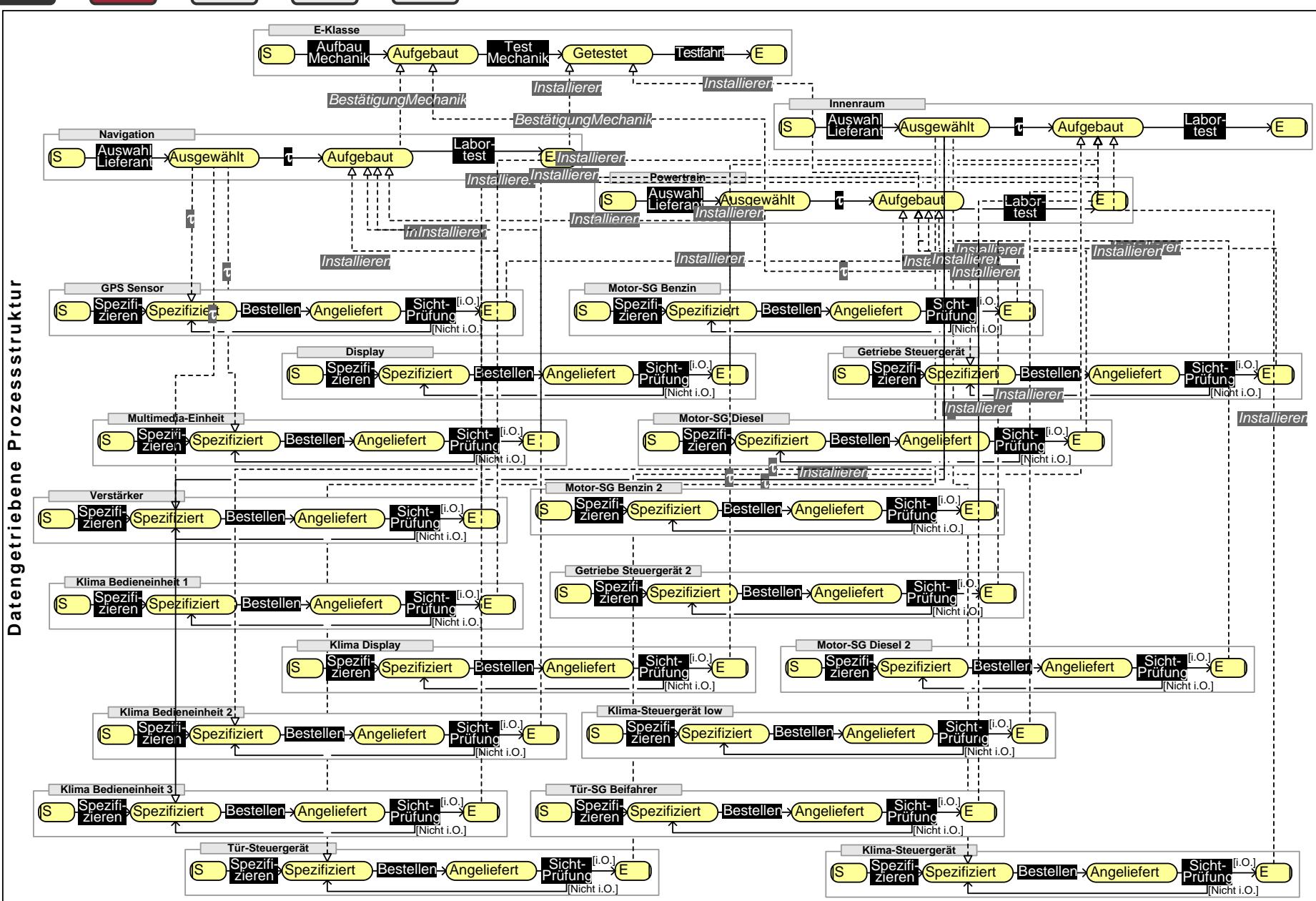
The Corepro Approach

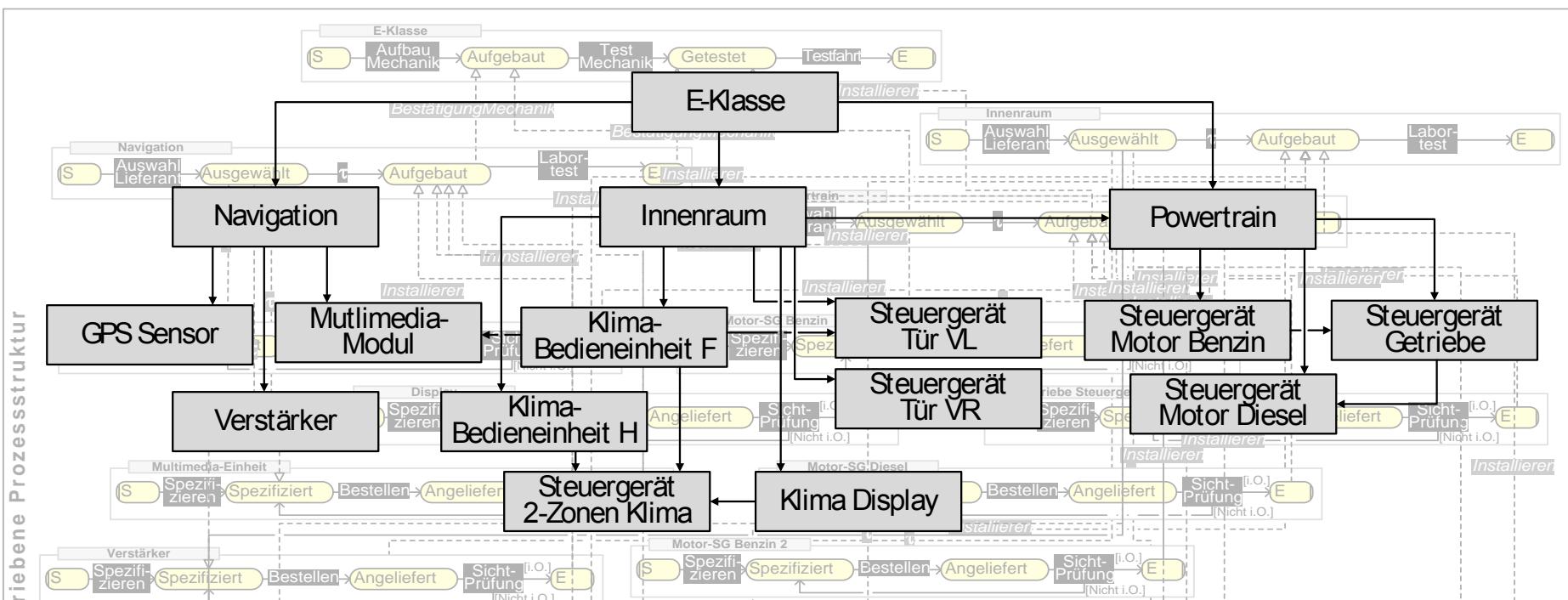
Data as Driver of Large Processes

Data as Driver of Large Processes

The Corepro Approach





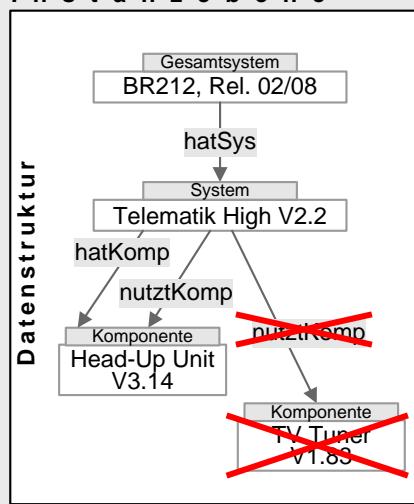
- Significant reduction of modeling efforts for process engineers
- Formal operational semantics allows for correct executability
- Soundness can be guaranteed on an abstracted level



Change Operation (Data Structure)

- 1) removeRelation(Telematik High V2.2, TV Tuner V1.83, nutztKomp);
- 2) removeObject(TV Tuner V1.83);

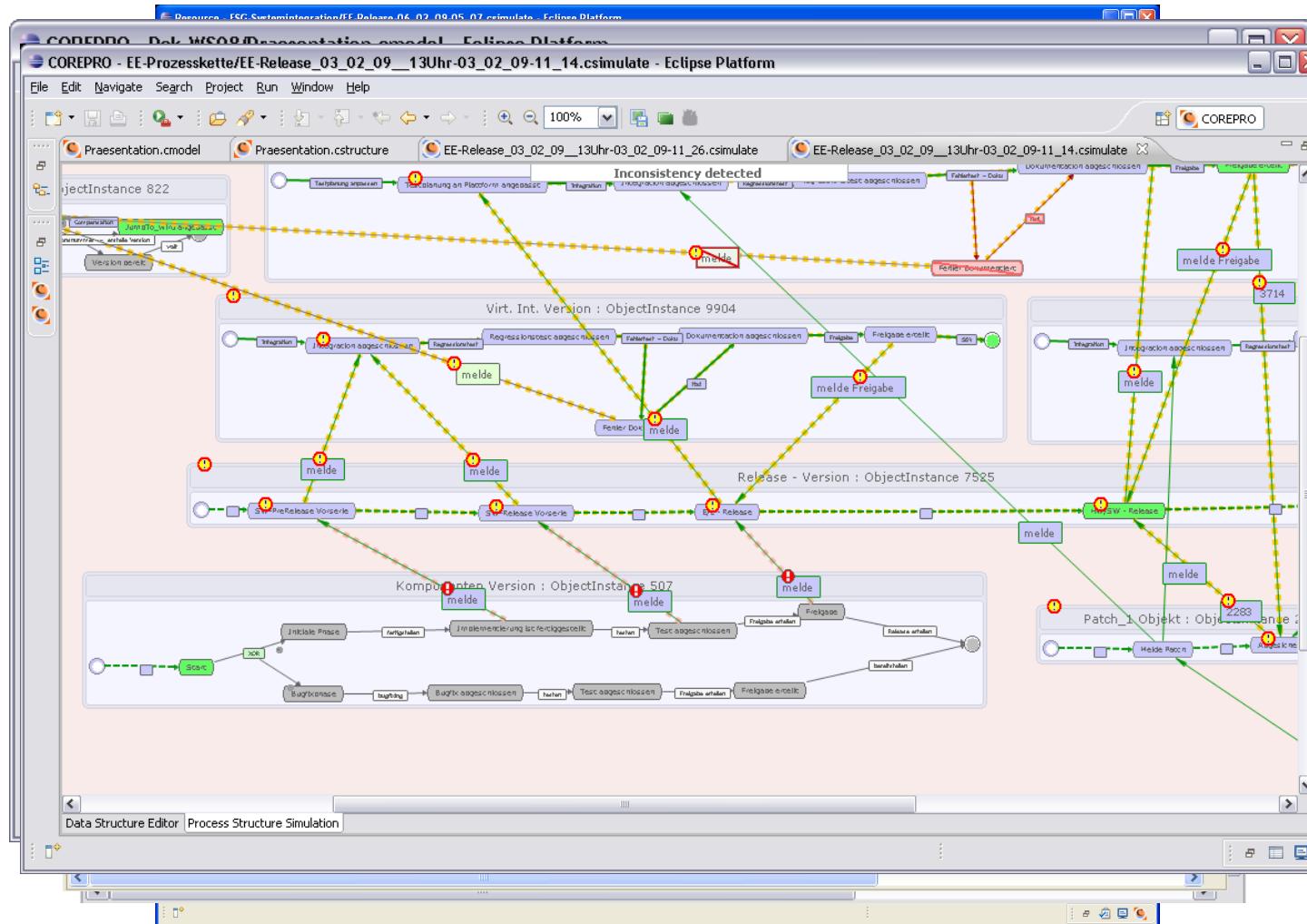
Datenstruktur



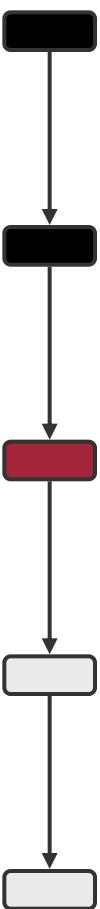
Change Operation (Process Structure)

- 1) removeExtTrans(Telematik High V2.2 . Muster Aufgebaut, Installieren, TV Tuner V1.83 . E);
- 2) removeOLC(Tuner V1.83);

AuDefDing optimal Management of Large Processes - Expressive Structure



Agenda



Backgrounds

Data as Driver of Large Processes

Object-Aware Processes

The PHLharmonicFlows Framework

Summary

Object-Awareness

Object-Aware Processes



Data Model

Job Offer
identifier
description
vacant from
vacant until

Application
name
e-mail
appl. letter
decision
evaluation

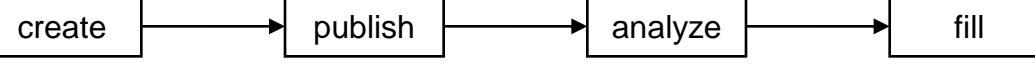
Review

priority
return date
remark
proposal
evaluation
reason
comment
committed

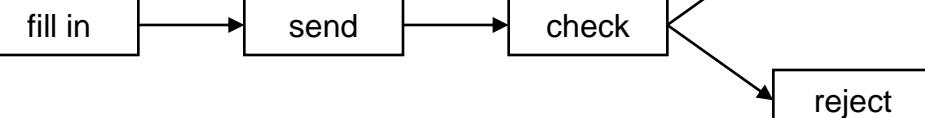
Interview
date
time
location

Process Model

Job Offer



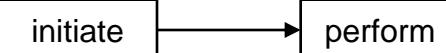
Application



Review



Interview



Object-Aware Processes



Object Behavior

User Integration



staff member
department



personnel officer
human resources

Object Instance

Review

remark	
return date	
priority	
proposal	
evaluation	
reason	
comment	
committed	

priority:

return date:

remark:

proposal:

evaluation:

reason:

comment:

priority: *

return date: *

remark:

priority:

return date:

remark:

proposal: *

evaluation: *

reason: *

comment:

remark:

proposal:

evaluation:

reason:

comment:

remark:

proposal:

evaluation:

reason:

comment:

committed: *

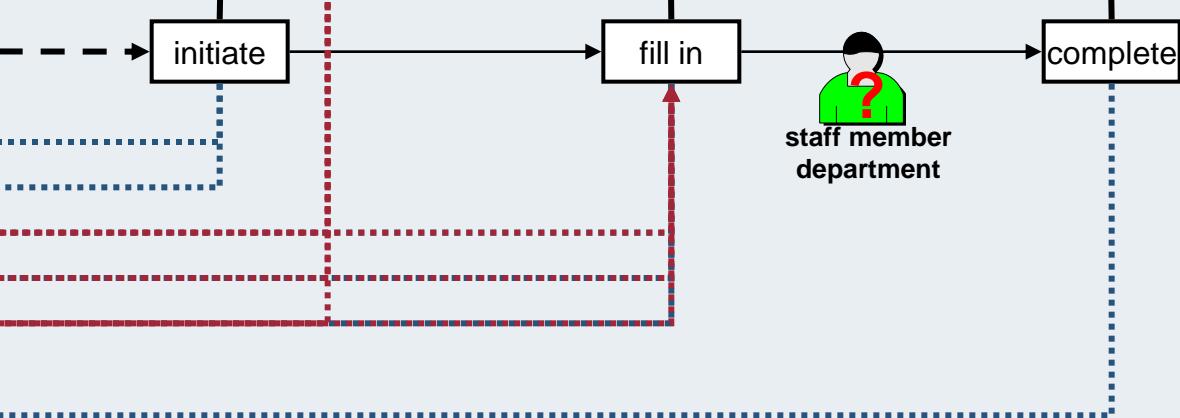
Process Instance

initiate

fill in



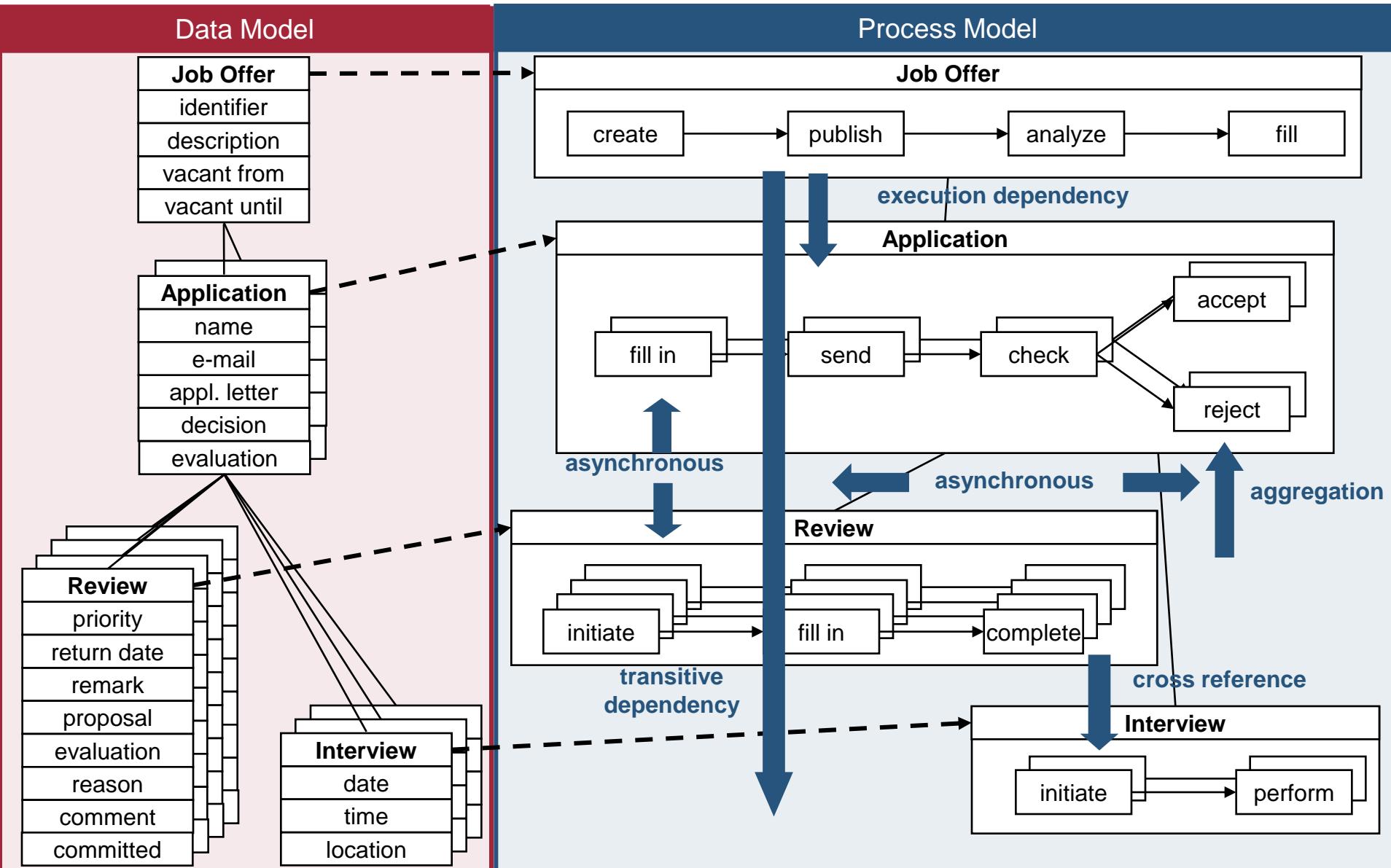
complete



Object-Aware Processes



Object Interactions



Flexible Activity Execution

Object-Aware Processes



User Integration



context-sensitive activity

Job Offer

identifier: salesman
description:
vacant from: 10.09.2011
vacant until: 01.01.2012

Application

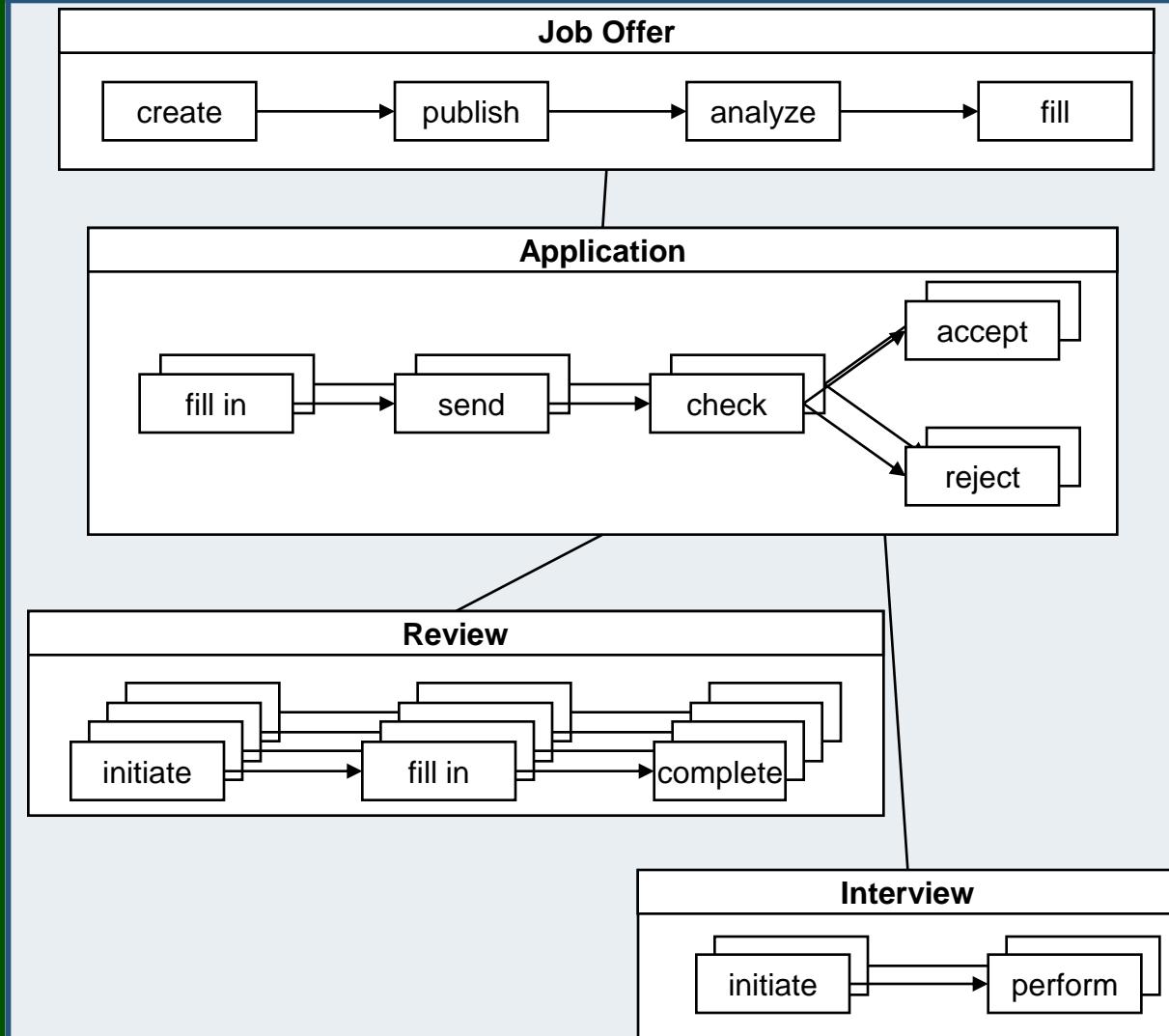
batch activity

decision:

Review

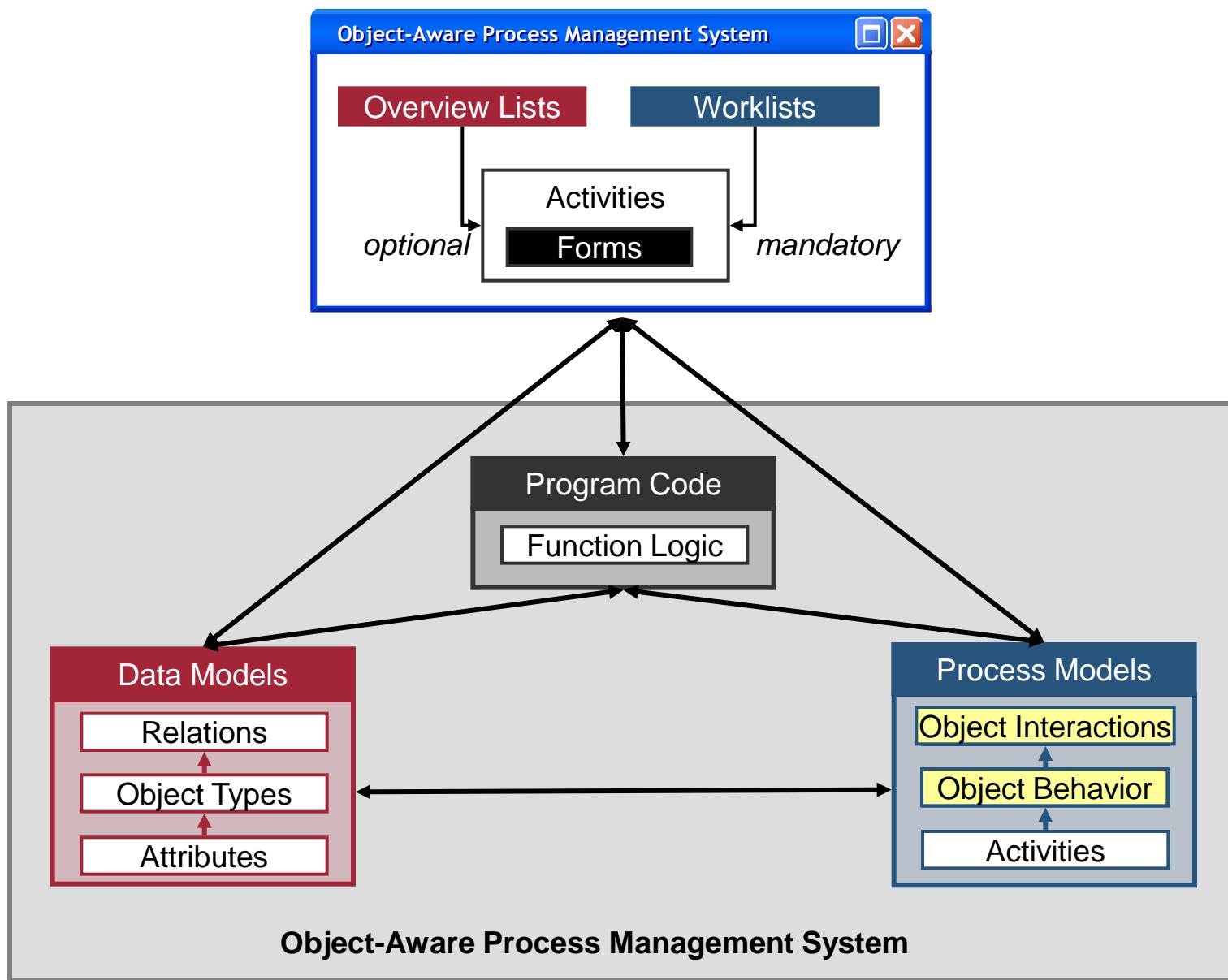
priority: high
return date: 12.12.2011
remark: complete soon
proposal:
evaluation: very good
reason:
comment: many competencies

Process Model



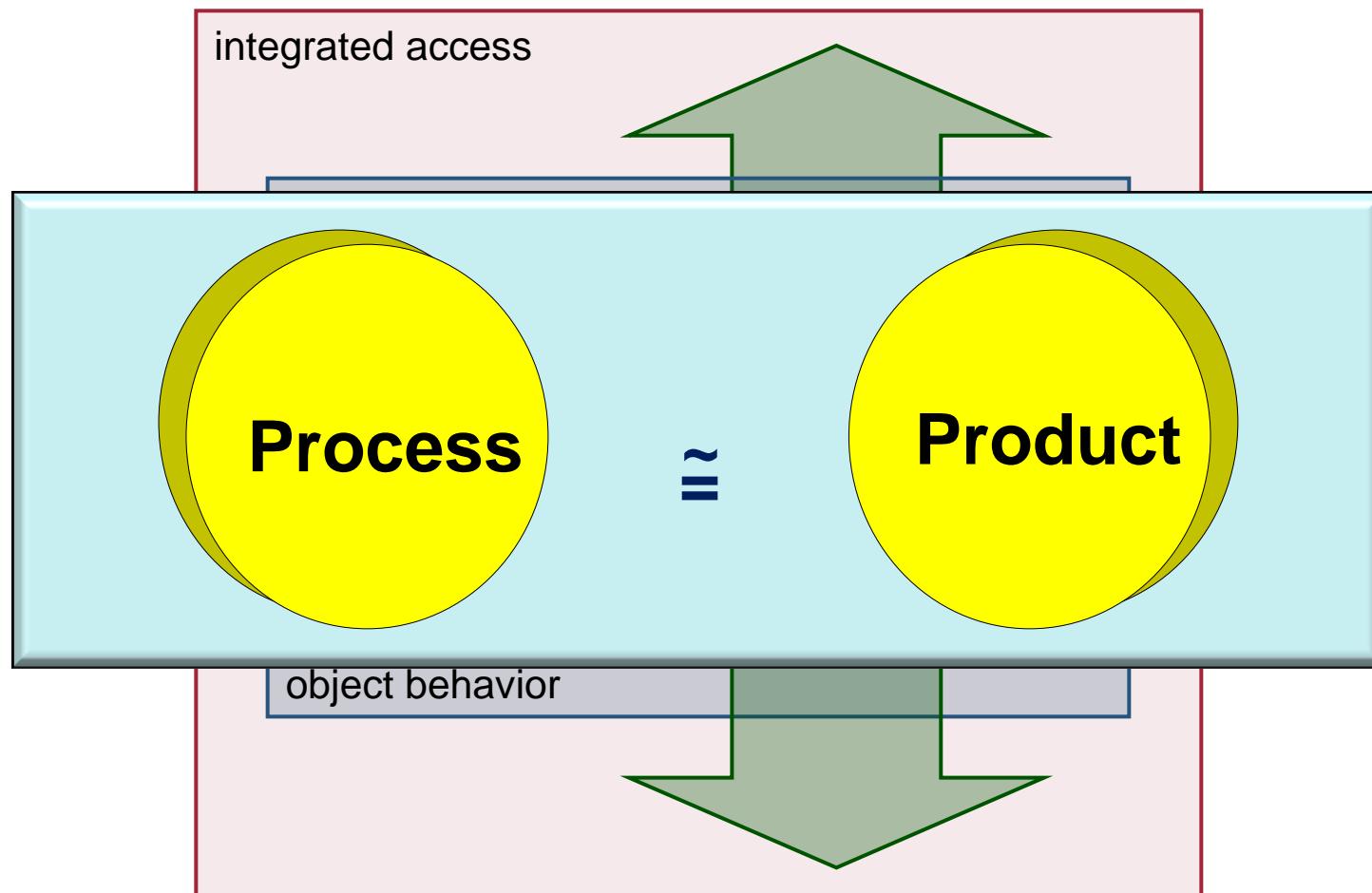
Object-Aware Process Management

Object-aware Processes



Characteristics of Object-aware Processes

Object-aware Processes



Activities do not coincide to particular process steps!

Existing Approaches

Object-aware Processes



Object-aware Process Management



Data-Driven Coordination
Corepro
University of Ulm

Overview Lists

optional

Worklists

mandatory

Case Handling
TU Eindhoven
Hasso Plattner Institute
Pallas Athena

Product-based Supplementation
TU Eindhoven

Batch Activities
Queensland University
Brisbane, Australia

Activities

Forms

Program Code

Function Logic

Case Handling

TU Eindhoven
Hasso Plattner Institute
Pallas Athena

Proclets

TU Eindhoven
Colorado Campinas

Artifact-centric Modeling
IBM Research USA

Data Models

Relations

Object Types

Attributes

Process Models

Object Interactions

Object Behavior

Datenbedingungen

Object-Aware Process Management System

Data-centric Process Models
Queensland University
Brisbane, Australia



Existing Approaches

	object behavior	object interactions	data-driven execution	activity granularity	integrated access
Proclcts (1)		X		(X)	
Case Handling (2)	X		(X)		(X)
Business Artifacts (3)	X	(X)	(X)		
Data-driven Coordination (4)	(X)	X	(X)		
Data-centric Process Models (5)		X			
Product-based Workflow Support (6)	X		(X)		
Batch Activities (7)				X	

(1) van der Aalst, W.M.P., Weske, M., Grünbauer, D.: Case Handling: A new Paradigm for Business Process Support. *DKE* 53(2) (2005) 129-162

(2) van der Aalst, W.M.P., Barthelmess, P., Ellis, C.A., Wainer, J.: Workow Modeling using Proclcts. In: Proc. CoopIS'00. (2000) 198-209

(3) Bhattacharya, K., Hull, R., Su, J. In: A Data-Centric Design Methodology for Business Processes. *IGI Global* (2009) 503-531

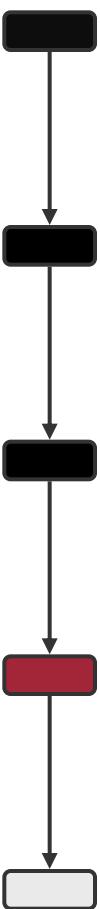
(4) Müller, D., Reichert, M., Herbst, J.: Data-Driven Modeling and Coordination of Large Process Structures. In: Proc. CoopIS'07. LNCS 4803 (2007) 131-149

(5) Redding, G.M., Dumas, M., ter Hofstede, A.H.M., Iordachescu, A.: A flexible, object-centric approach for business process modelling. *Service Oriented Computing and Applications* (2009) 1-11

(6) Vanderfeesten, I., Reijers, H.A., van der Aalst, W.M.P.: Product-based Workow Support. *Information Systems* 36(2) (2011) 517-535

(7) Sadiq, S.W., Orlowska, M.E., Sadiq, W., Schulz, K.: When workows will not deliver: The case of contradicting work practice. In: Proc. BIS'05. (2005)

Agenda



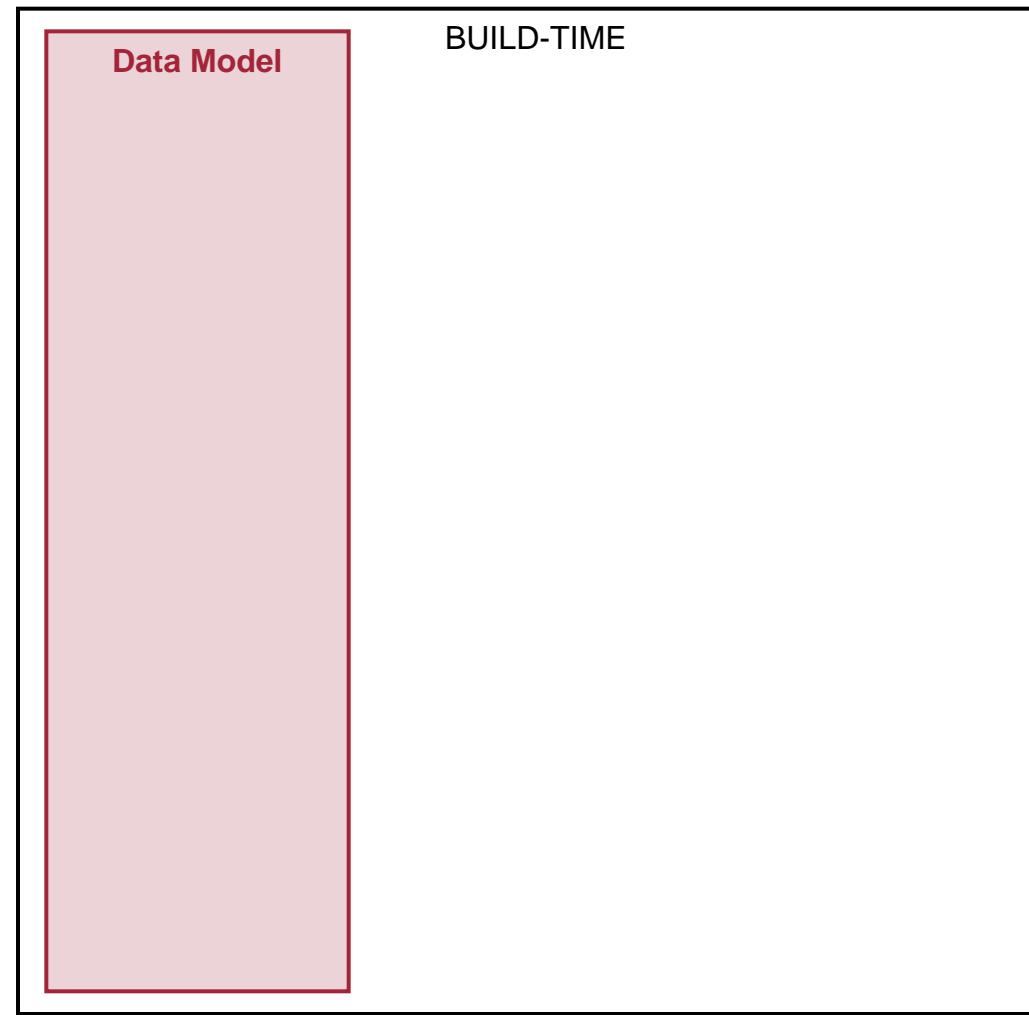
Backgrounds

Data as Driver of Large Processes

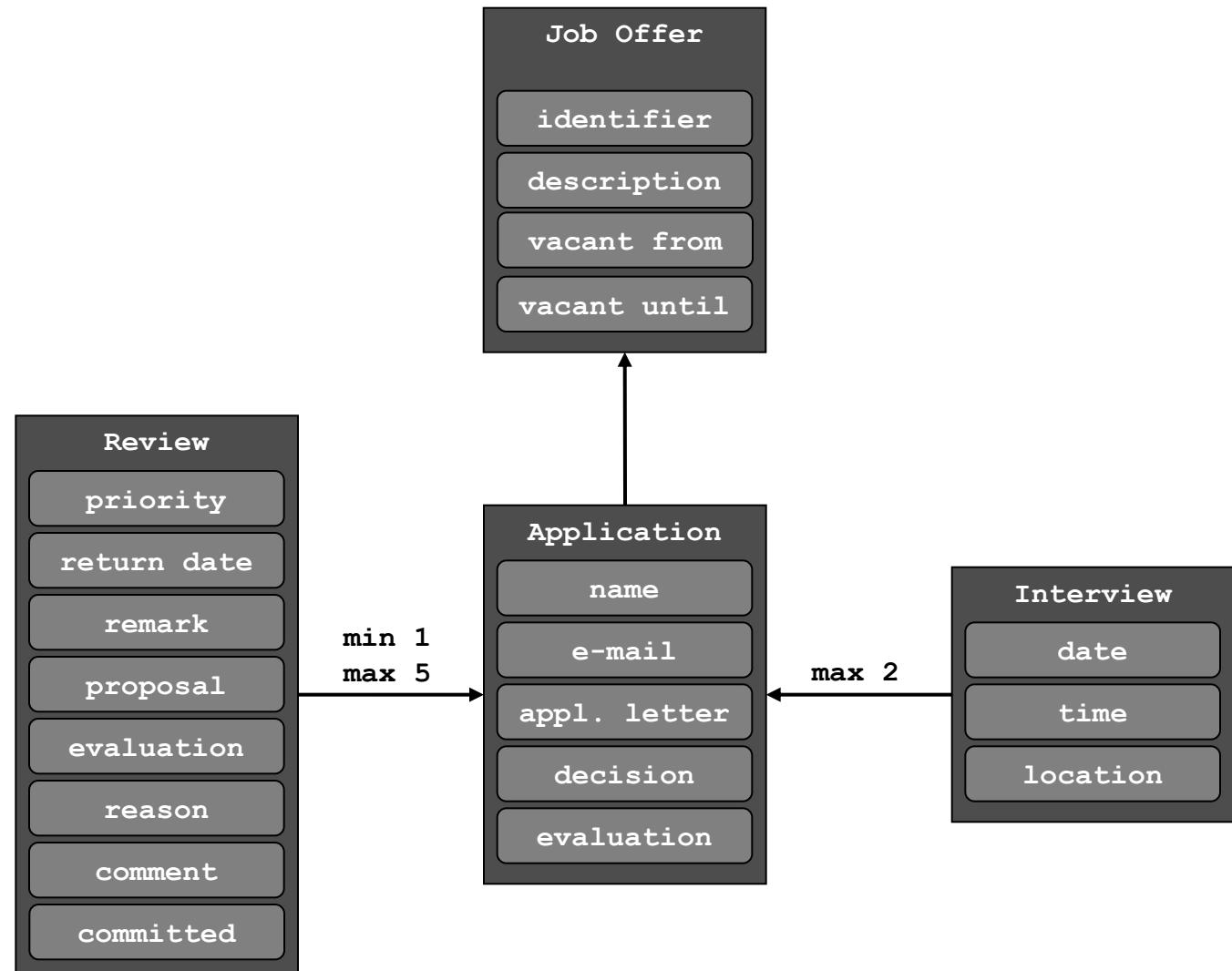
Object-Aware Processes

The PHILharmonicFlows Framework

Summary



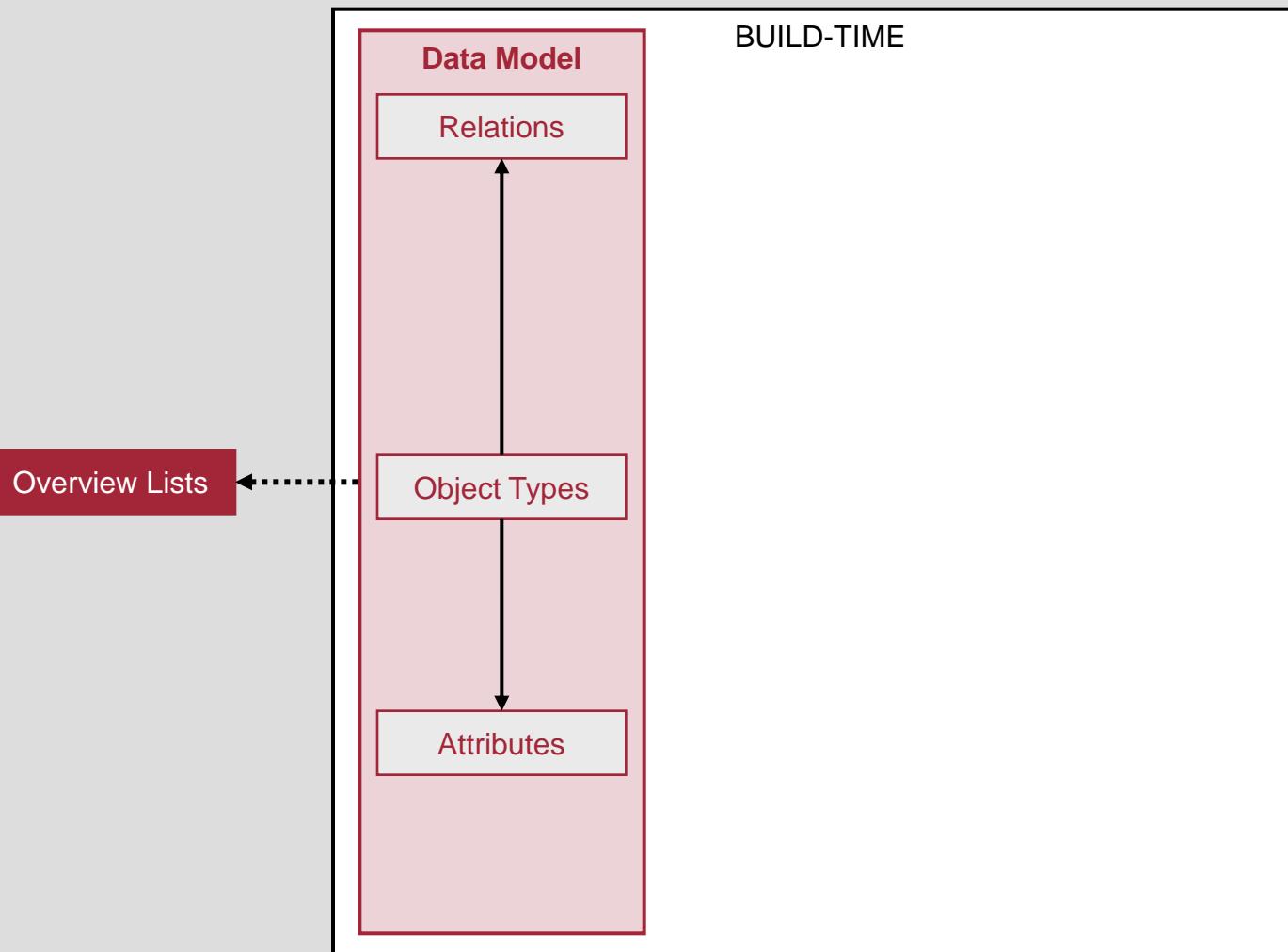
Data Model





RUN-TIME

BUILD-TIME



Overview Lists

PHILharmonicFlows

The screenshot shows the PHILharmonicFlows application interface. At the top, there is a navigation bar with a logo and a search bar. Below the navigation bar, the main area is divided into sections: 'Tasks' (with a red arrow pointing to it), 'Data' (selected), and 'Monitoring'. The 'Data' section contains a list of objects: Applicant (161), Application (91), Employee (23), Interview (44), Job Offer (7), Participant (14), and Review (73). A 'Select activity' dropdown and an 'Execute' button are highlighted with a red box. Below this, a table lists 'Job Offer' details: Marketing Director (Ulm, 11. October 2010), Product Designer (undefined, 28. October 2010), Project Manager (Berlin, no privilege), and Web Developer (Berlin, 07. July 2010). To the right of the table, a context menu is open, also highlighted with a red box. The menu includes options like 'Display', 'Edit', 'Delete' (which is selected), and various process-related actions such as 'Set data-context', 'Assign new Employee', 'Create new Review', etc. At the bottom of the screen, there are status indicators for monitoring.

	Title	Location	Date
Marketing Director	Ulm	11. October 2010	
Product Designer	undefined	28. October 2010	
Project Manager	Berlin	no privilege	
Web Developer	Berlin	07. July 2010	

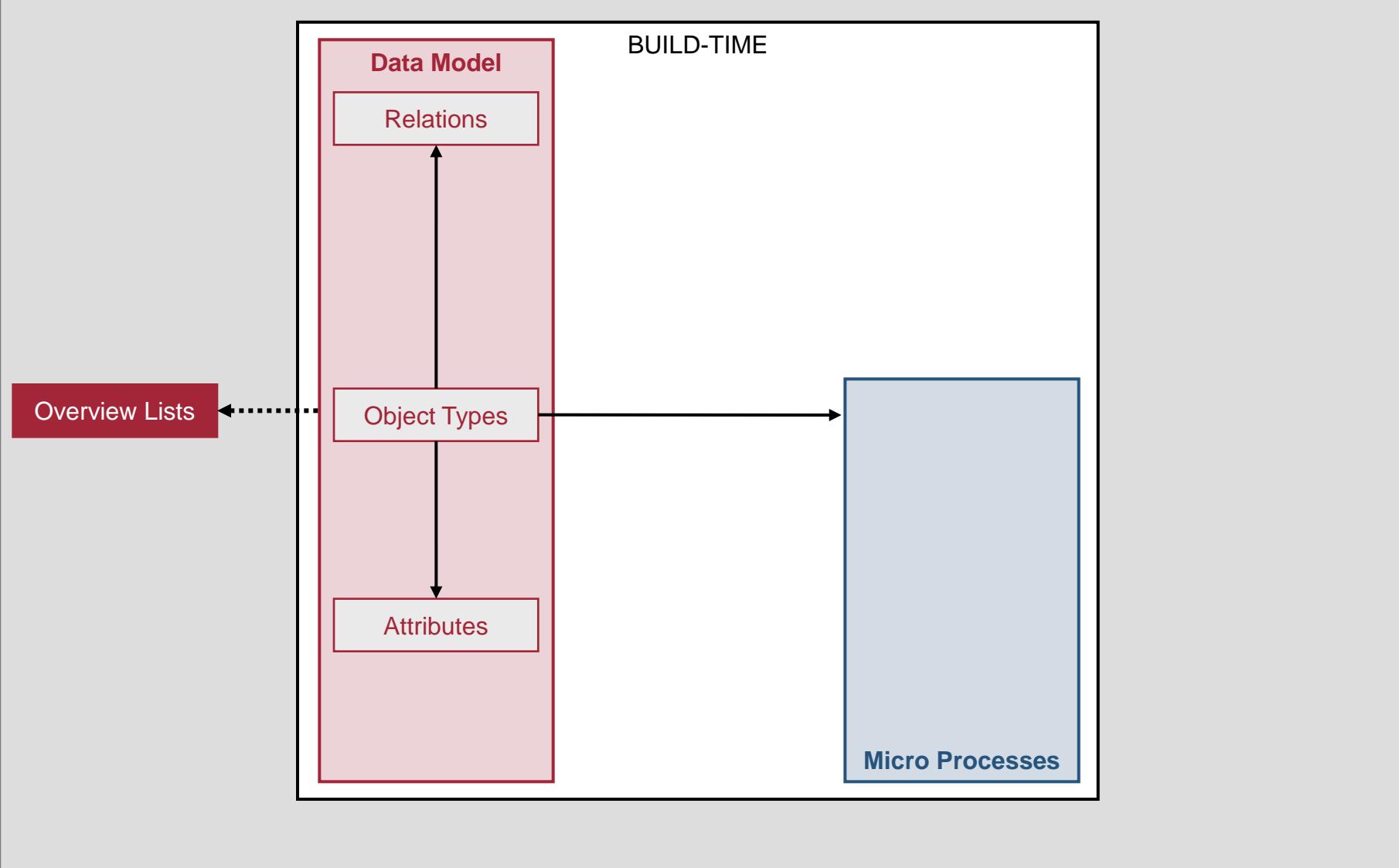
Context menu options:

- Display
- Edit
- Delete
- Set data-context
- Assign new Employee
- Create new Review
- Run blackbox activity
- Handle inconsistency
- Cancel process
- Continue process
- Execute backjump
- Display Job Offer process

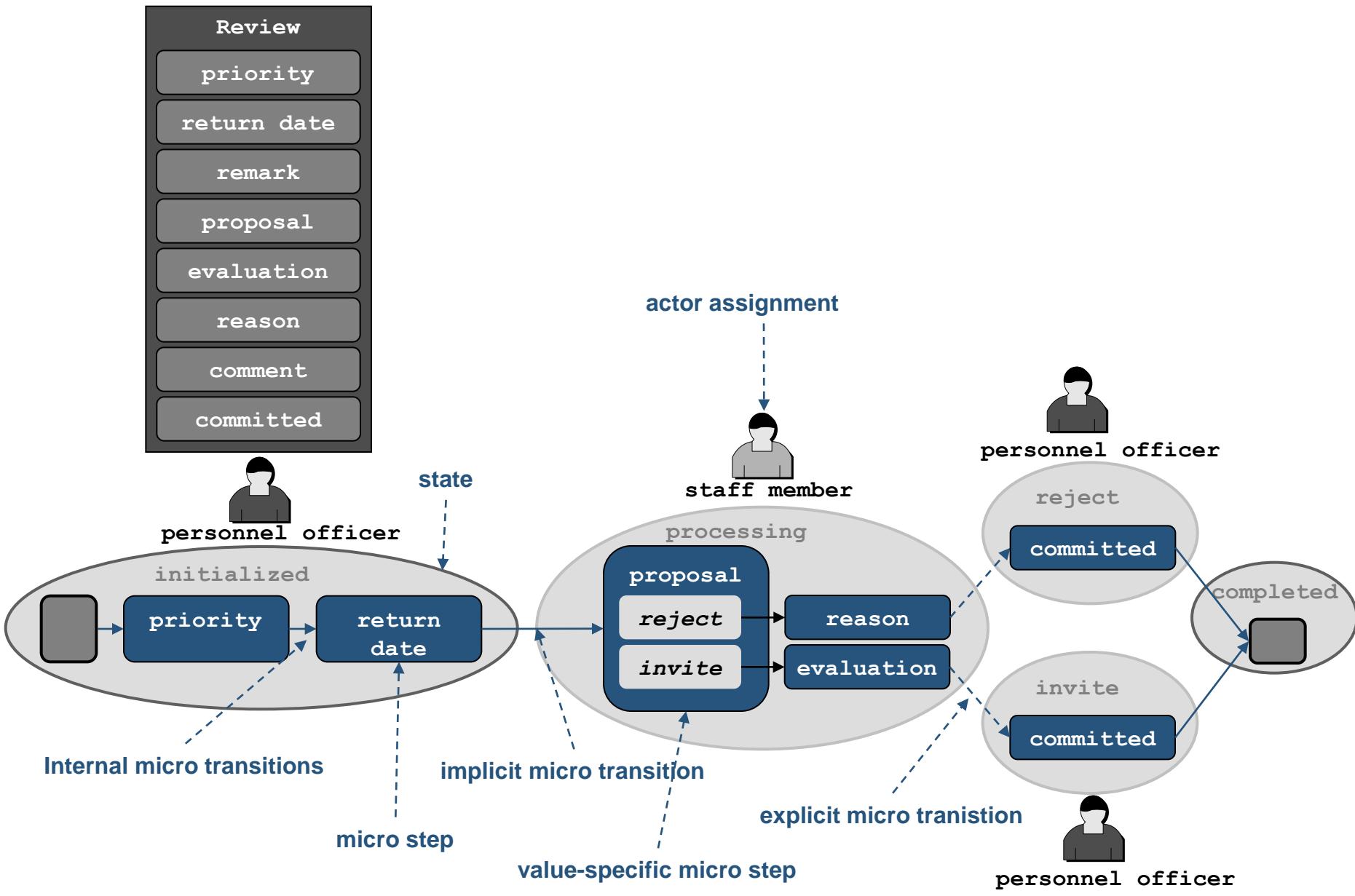


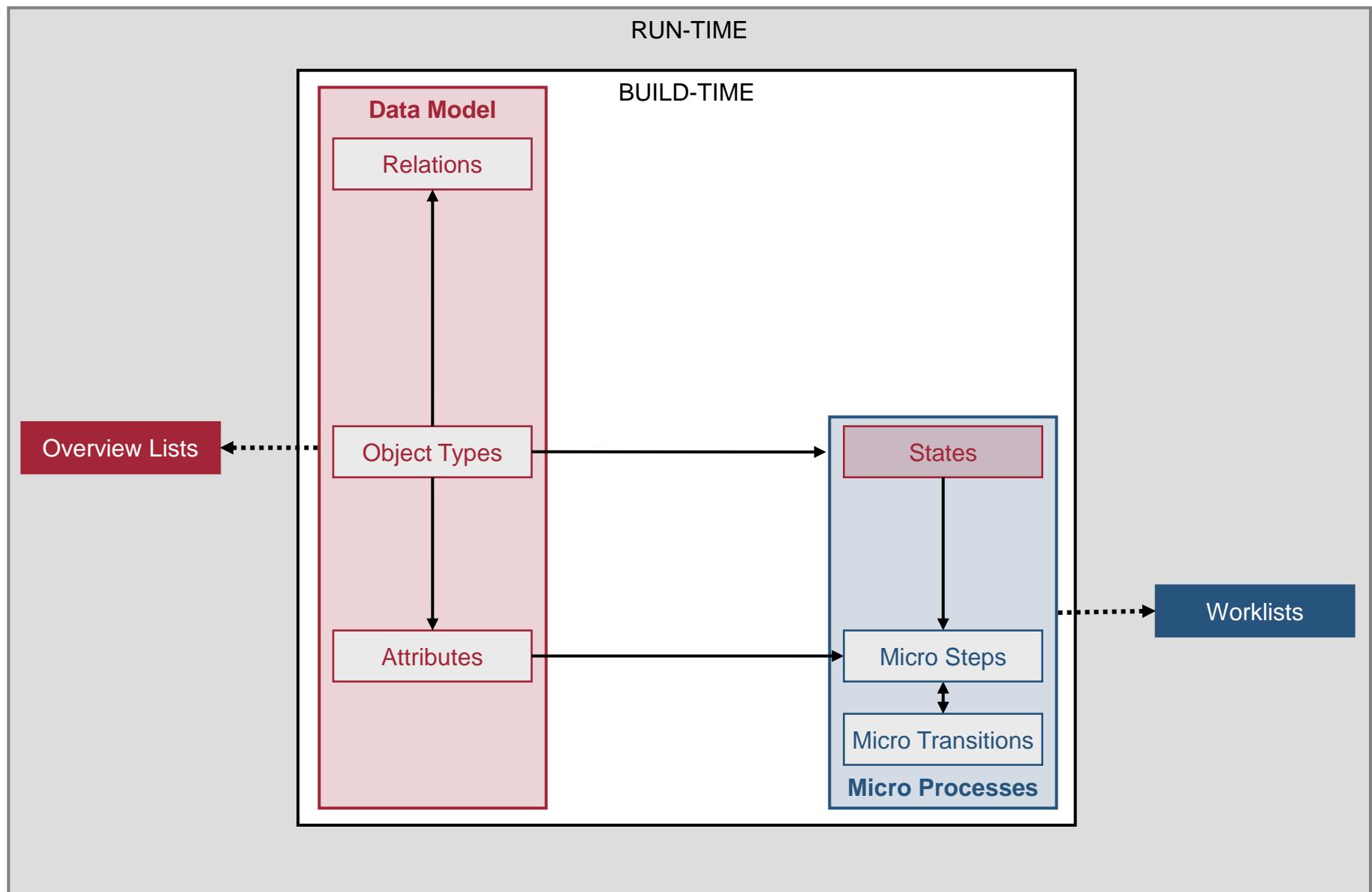
RUN-TIME

BUILD-TIME



Micro Processes





Worklists

PHILharmonicFlows

The screenshot shows the PHILharmonicFlows application interface. At the top, there is a navigation bar with a logo and a search bar. Below the navigation bar, the main content area is divided into several sections:

- Tasks:** A table showing task counts for different categories: Application (4 Todo, 34 Responsible, 3 Errors), new (3 Todo, 25 Responsible, 1 Error), reviewed (1 Todo, 9 Responsible, 2 Errors), and Job Offer (3 Todo, 0 Responsible, 0 Errors). A blue box labeled "form" is positioned next to the Job Offer section.
- Todo in Job Offer:** A table listing three job offers with their details: Marketing Director (Ulm, 11. October 2010), Product Designer (undefined, 28. October 2010), and Project Manager (Berlin, no privilege).
- Activities:** A sidebar containing icons for creating, deleting, and modifying activities, along with dropdown menus for activities, mandatory activities, and optional activities.

Annotations are present in the bottom right corner of the screenshot:

- A dashed arrow points from the "state changel" icon in the Activities sidebar to the "Job Offer" section in the Tasks table.
- Dashed arrows point from the "mandatory activities" and "optional activities" labels to their respective icons in the Activities sidebar.

At the bottom of the interface, there are links for Data and Monitoring, and a footer with a copyright notice.

	Todo	Responsible	Error
Application	4	34	3
new	3	25	1
reviewed	1	9	2
Job Offer	3	0	0

Marketing Director: Ulm, 11. October 2010
Product Designer: undefined, 28. October 2010
Project Manager: Berlin, no privilege

Activities

state changel

mandatory activities

optional activities

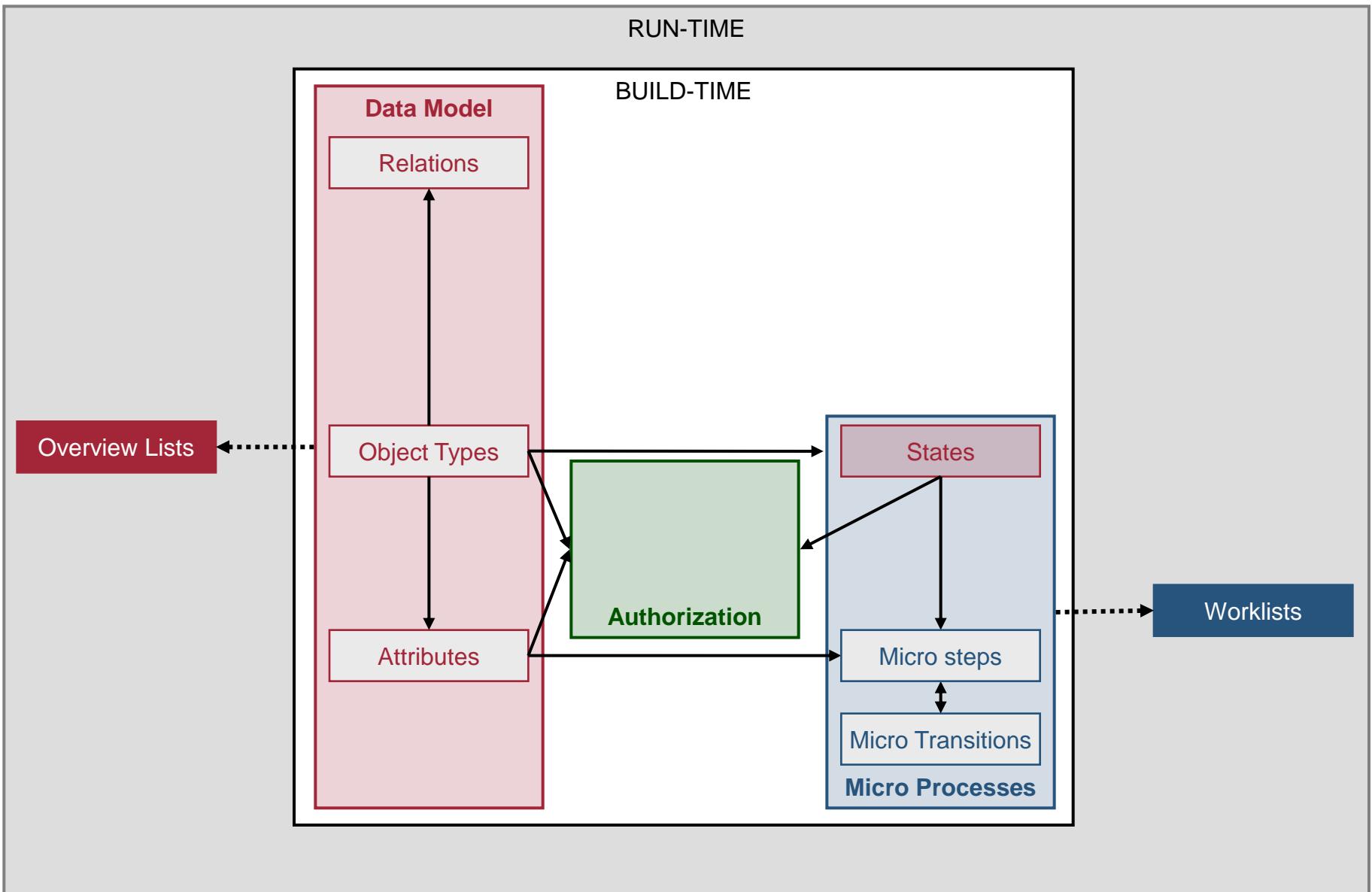
Welcome, Hans Meyer! Logout
Activated roles: Administrator +3

9 41 3

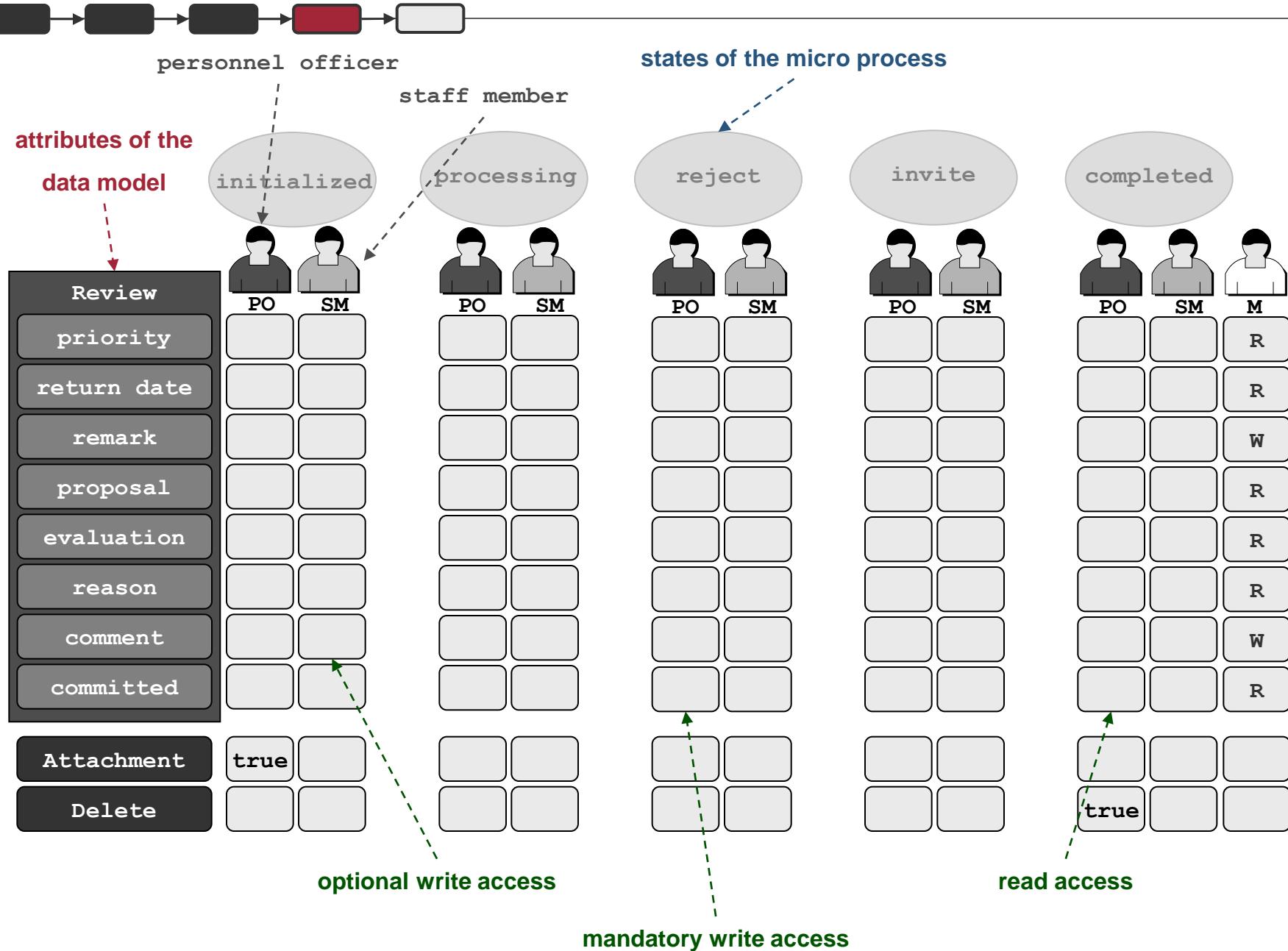
Data

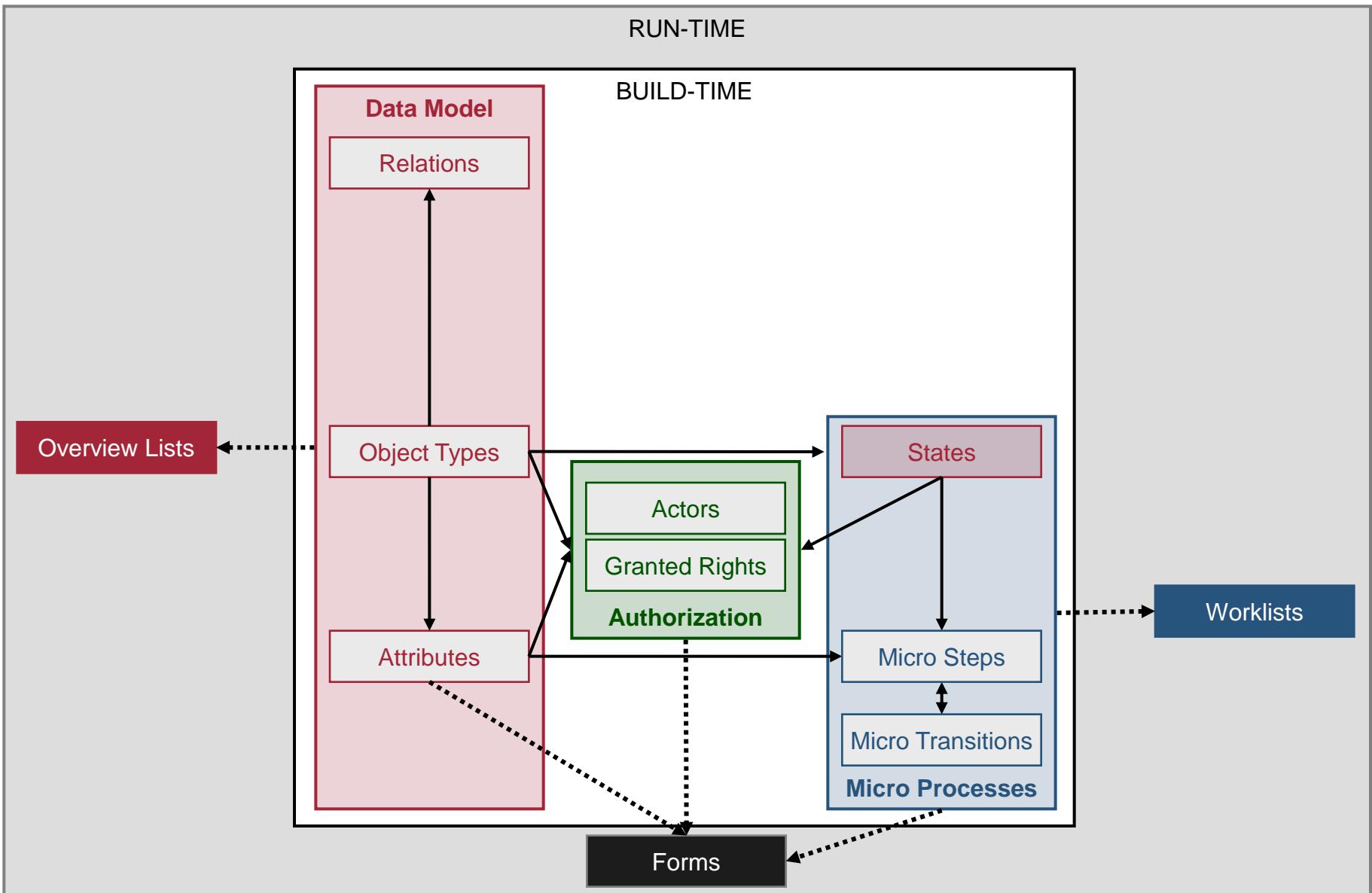
Monitoring

41 3

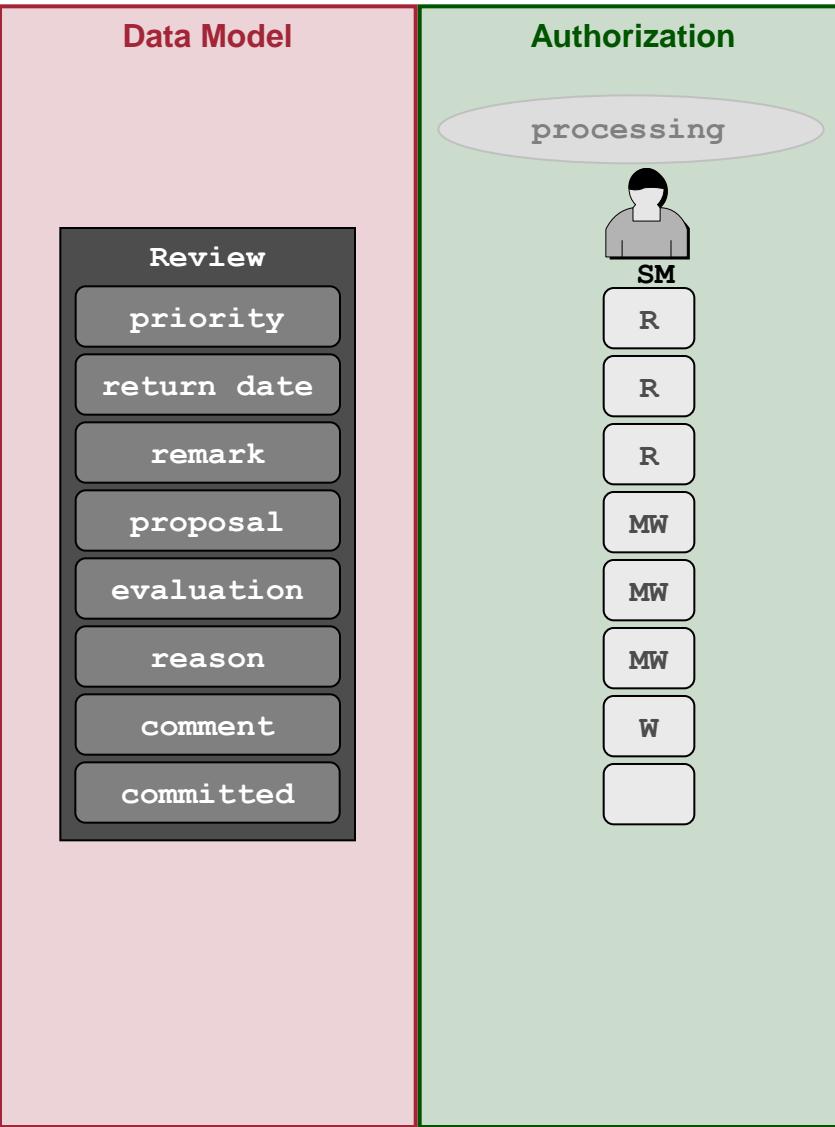
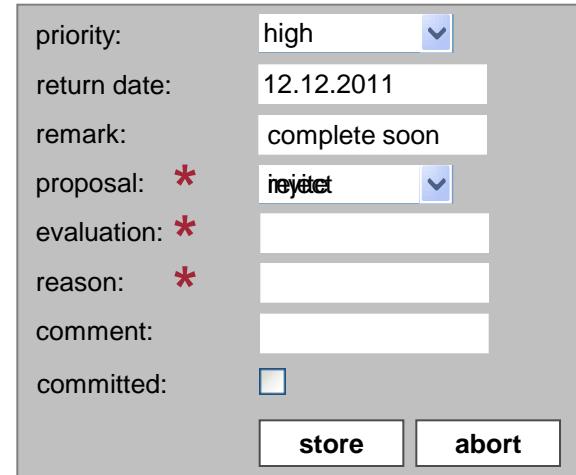


Authorization Table





Form Generation

SM

priority: high

return date: 12.12.2011

remark: complete soon

proposal: *****

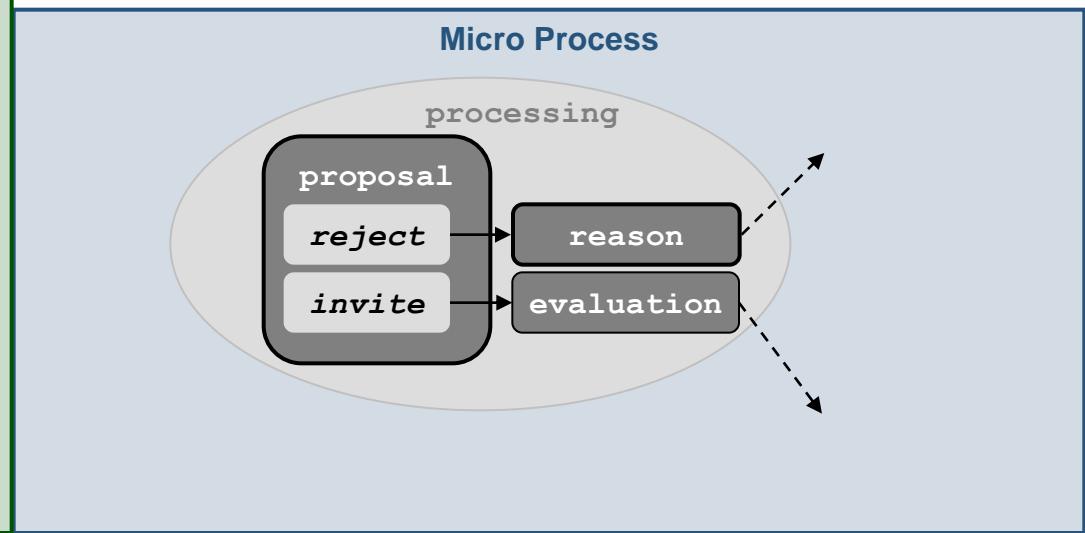
evaluation: *****

reason: *****

comment:

committed:

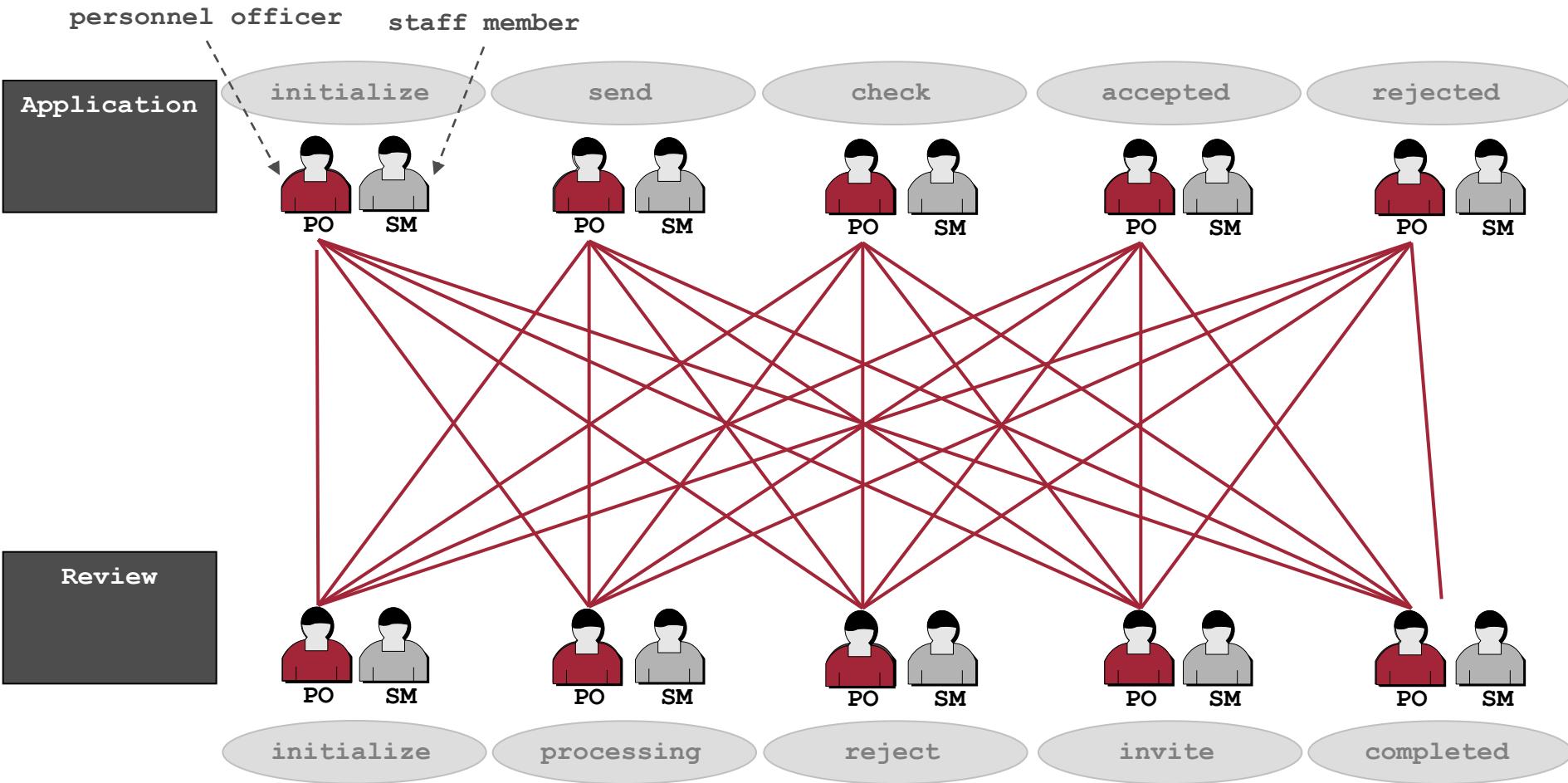
store **abort**



Flexibility of Activities



personnel officer staff member

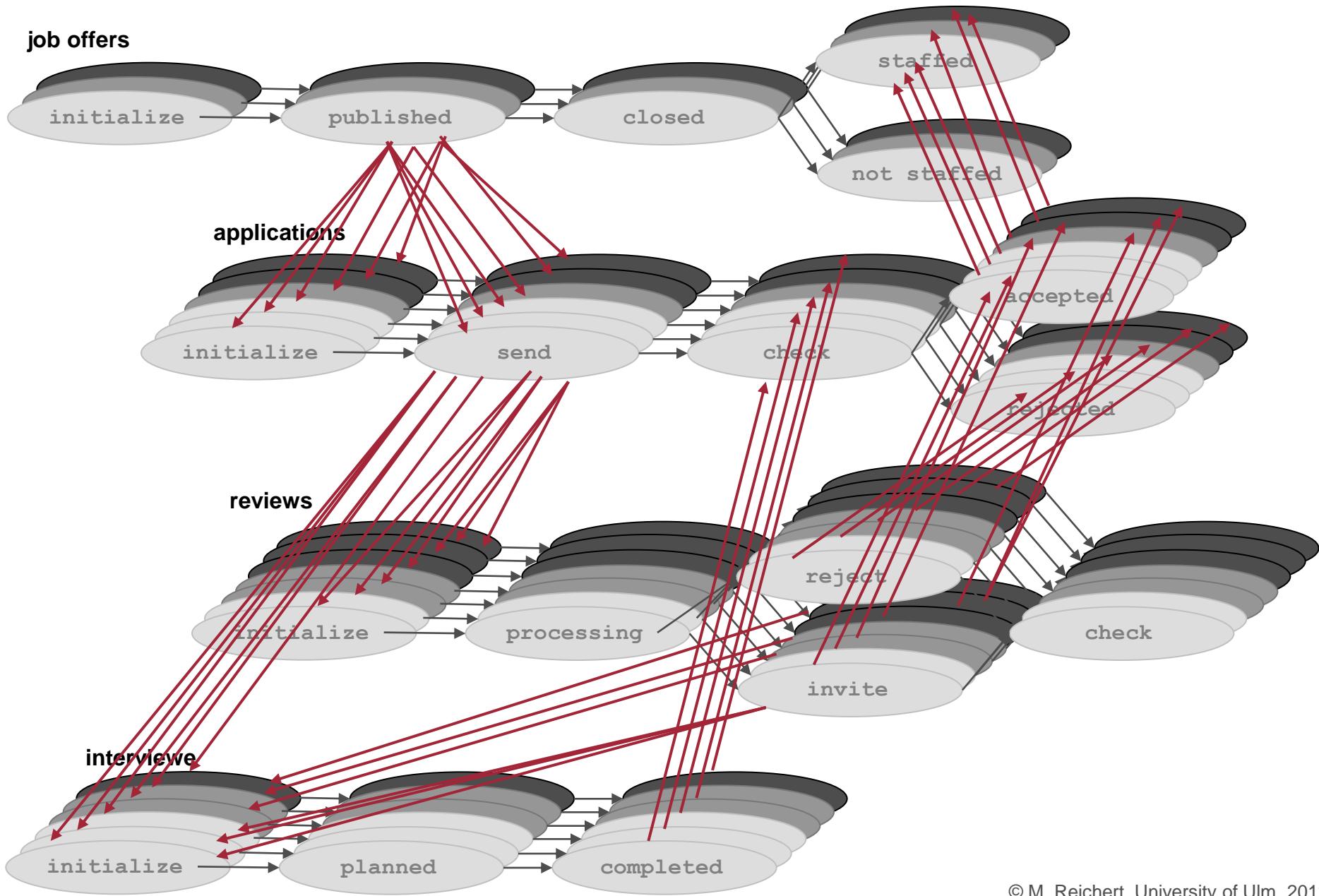


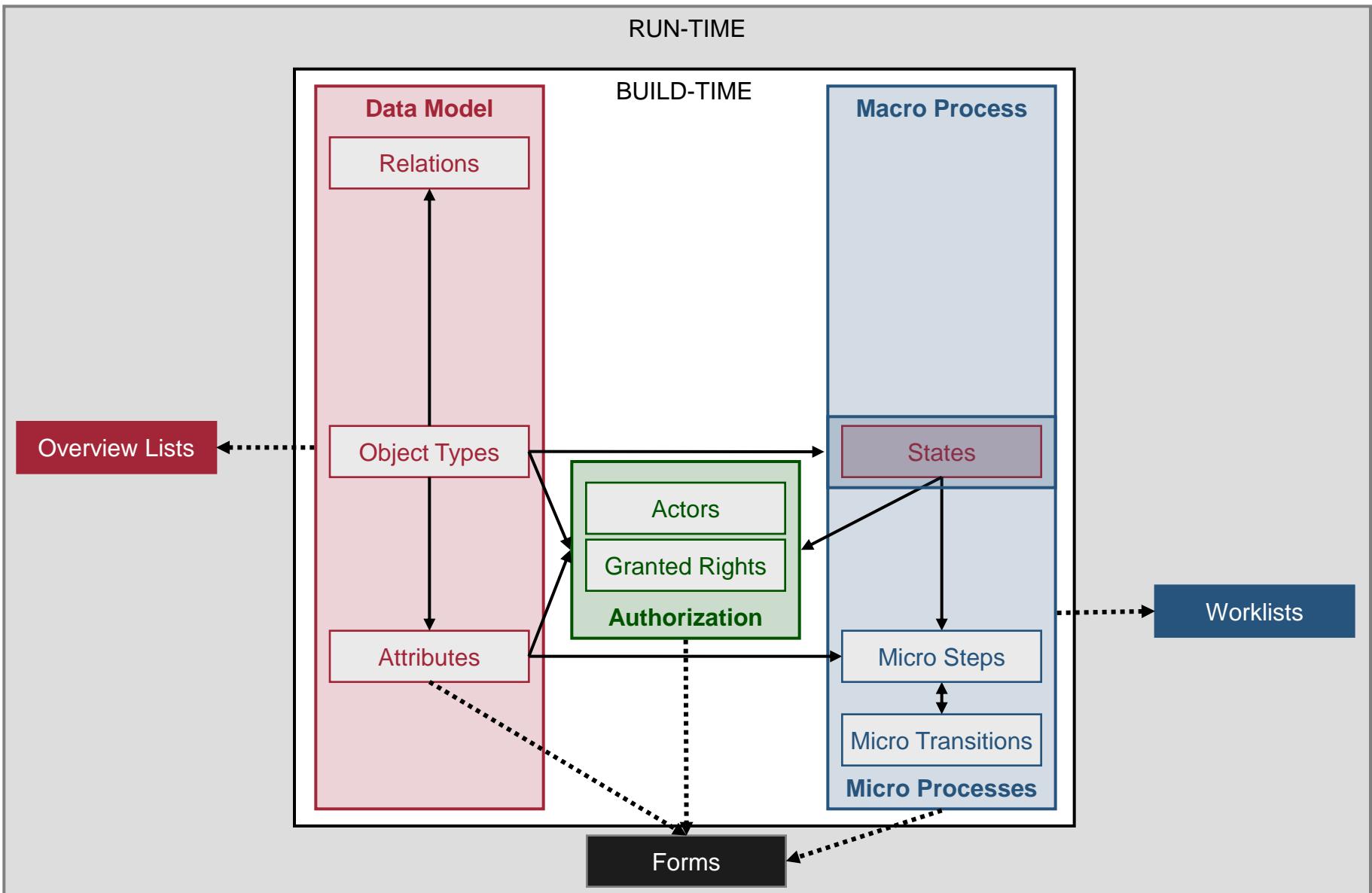
Complex Process Structure

PHILharmonicFlows

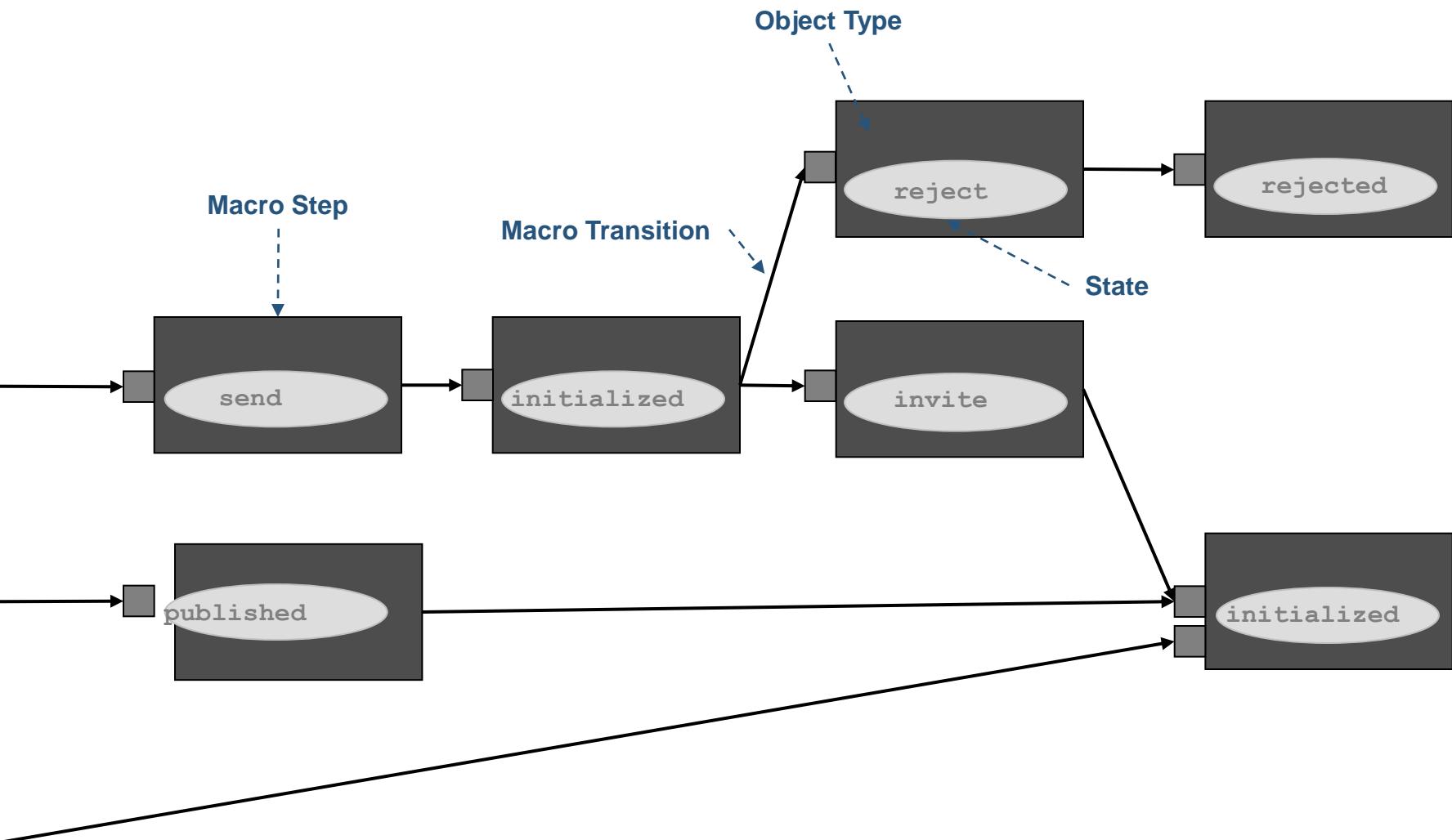


job offers

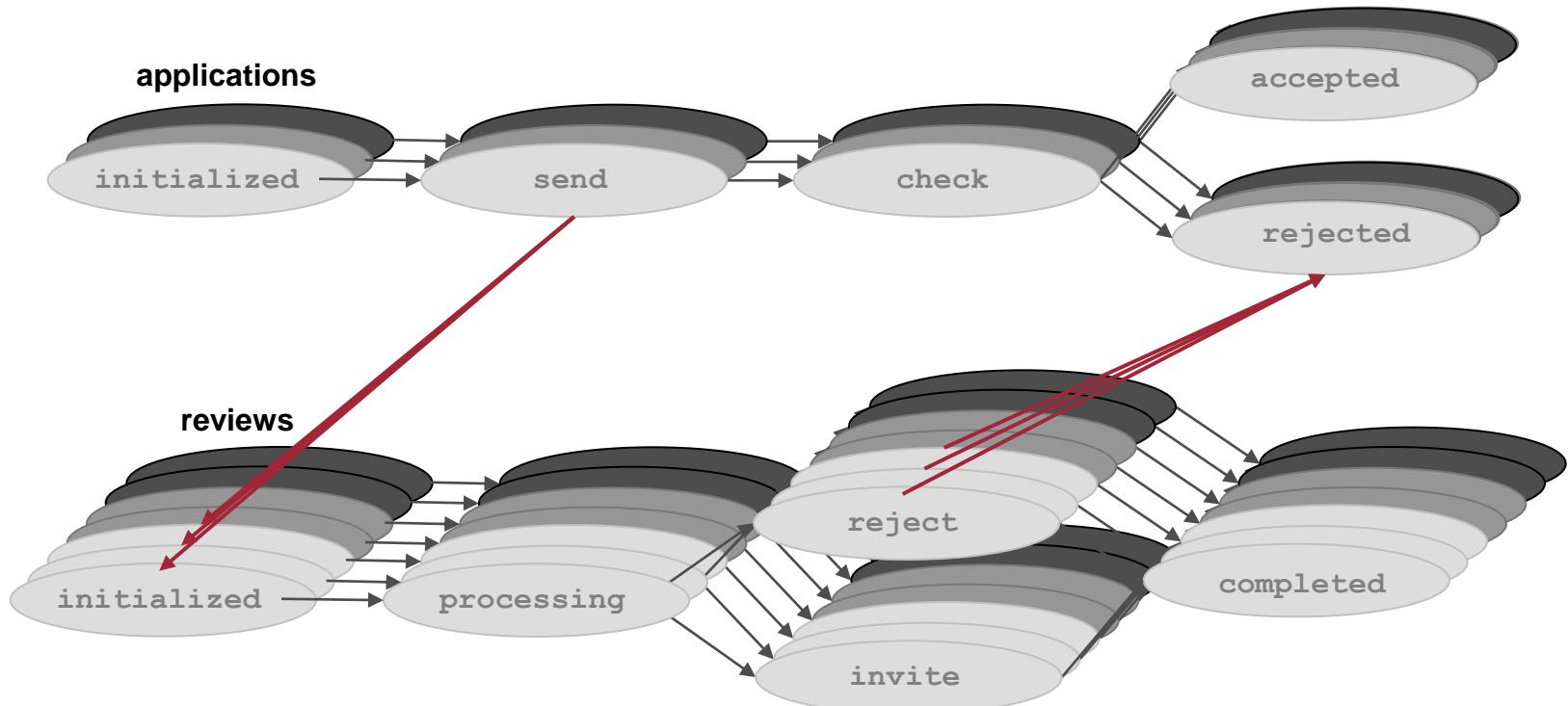
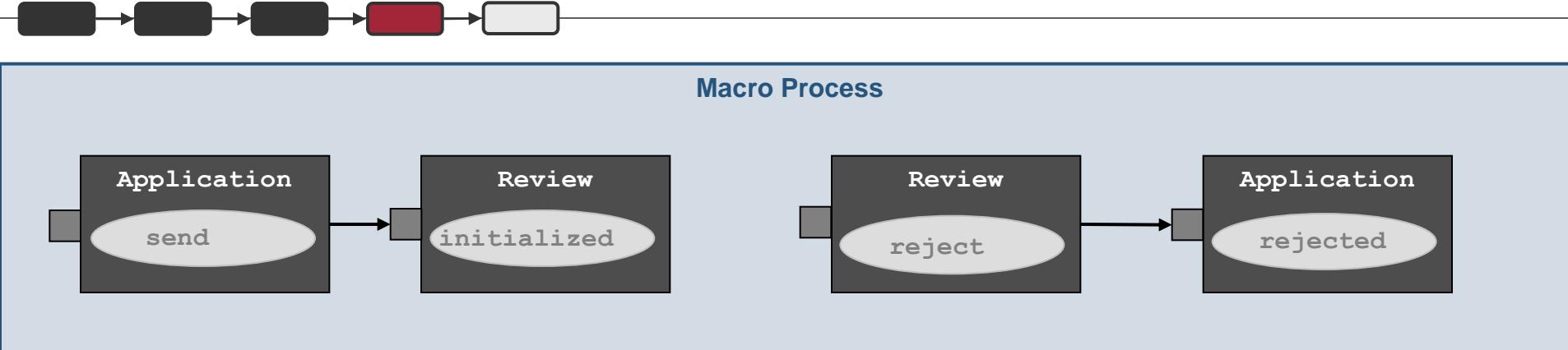


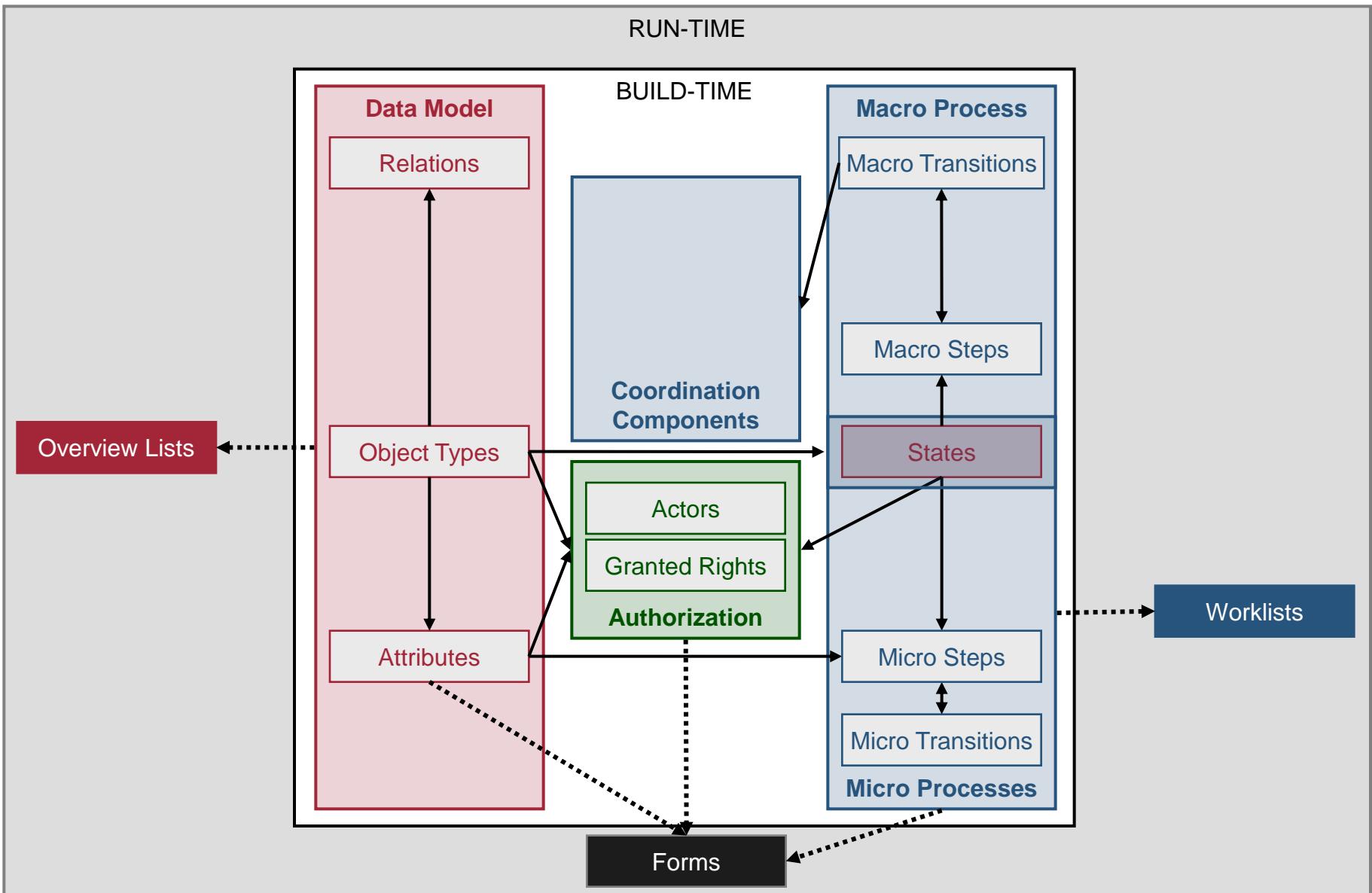


Macro Process



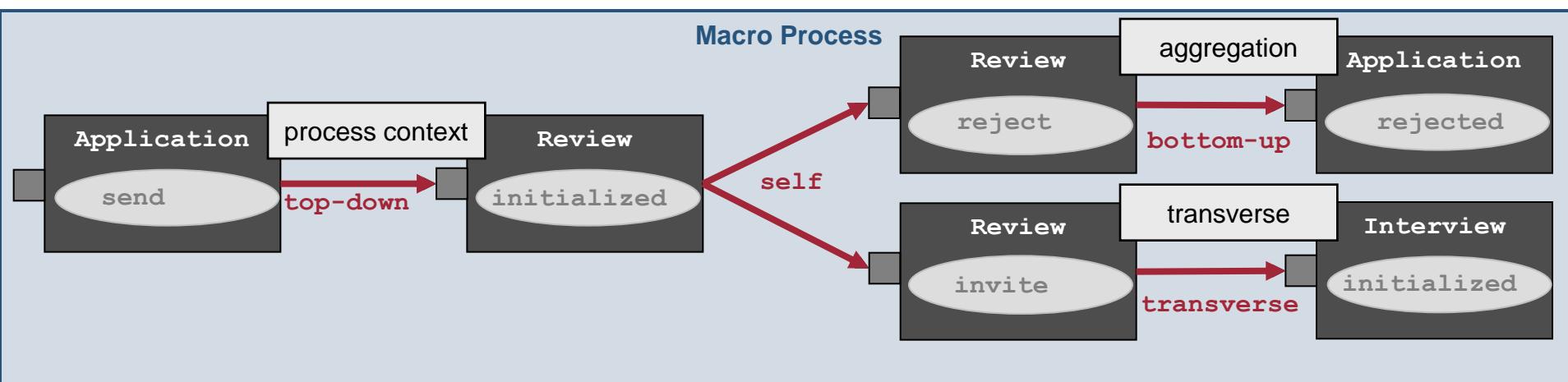
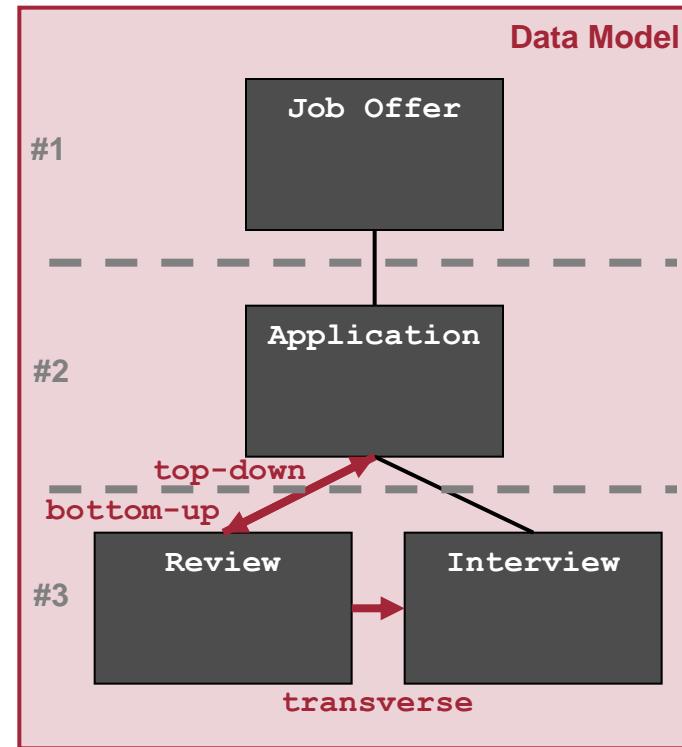
Set Relations in a Macro Process



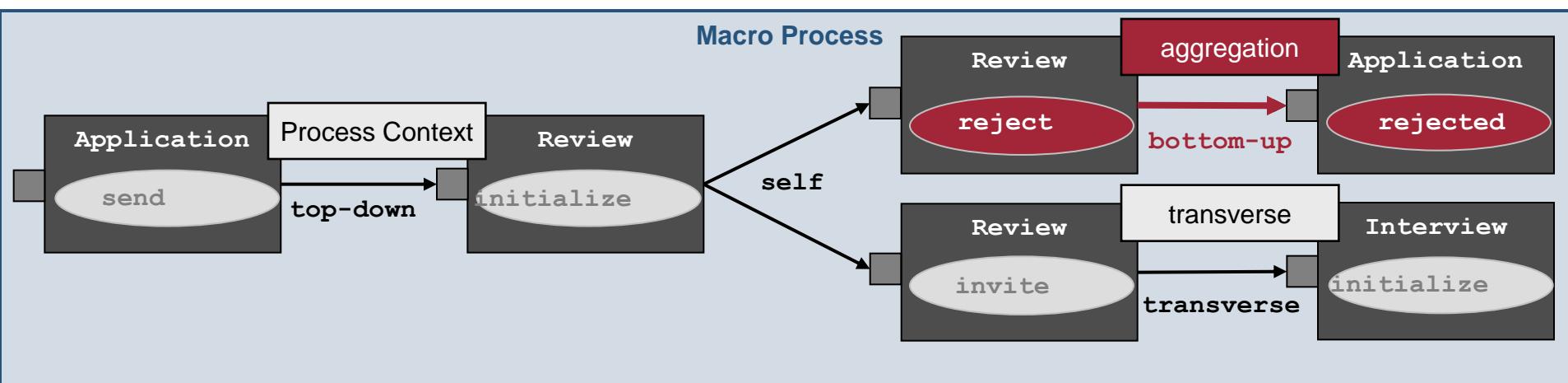
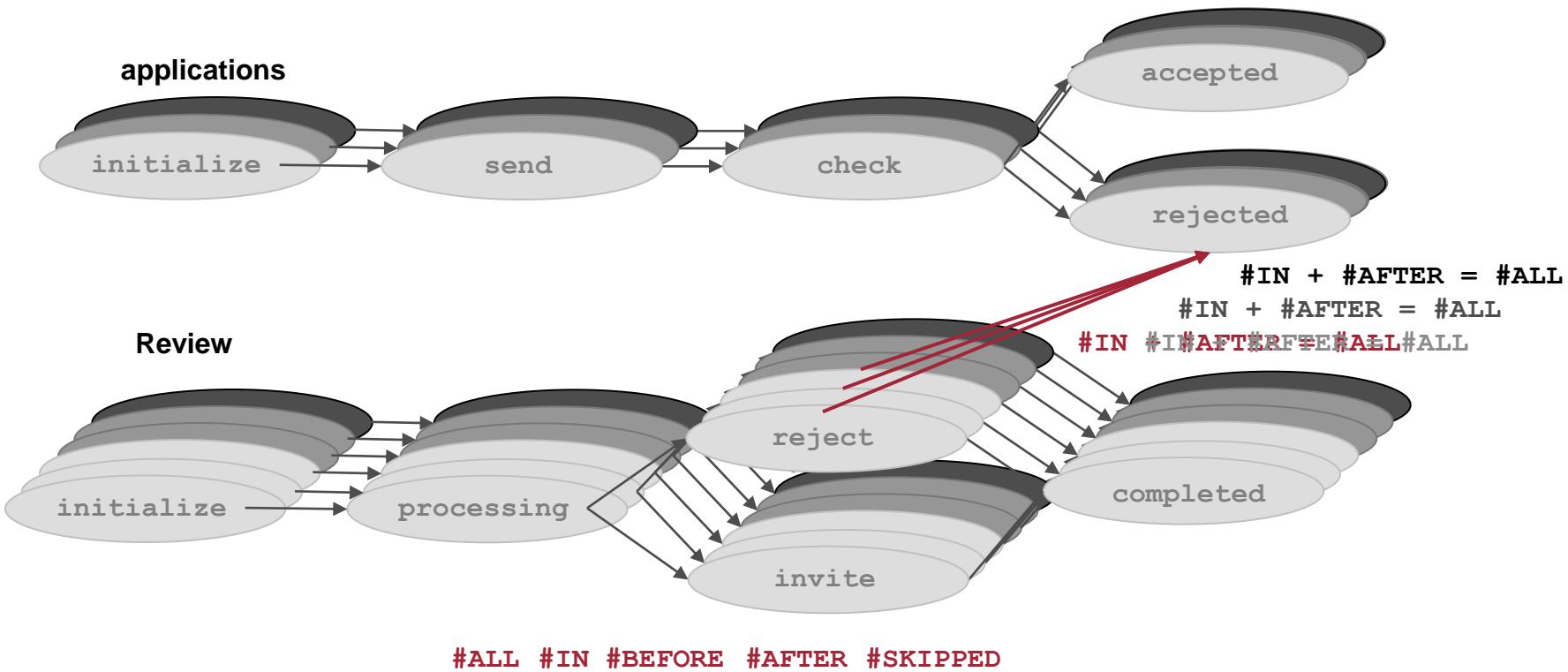


Defining Coordination Components

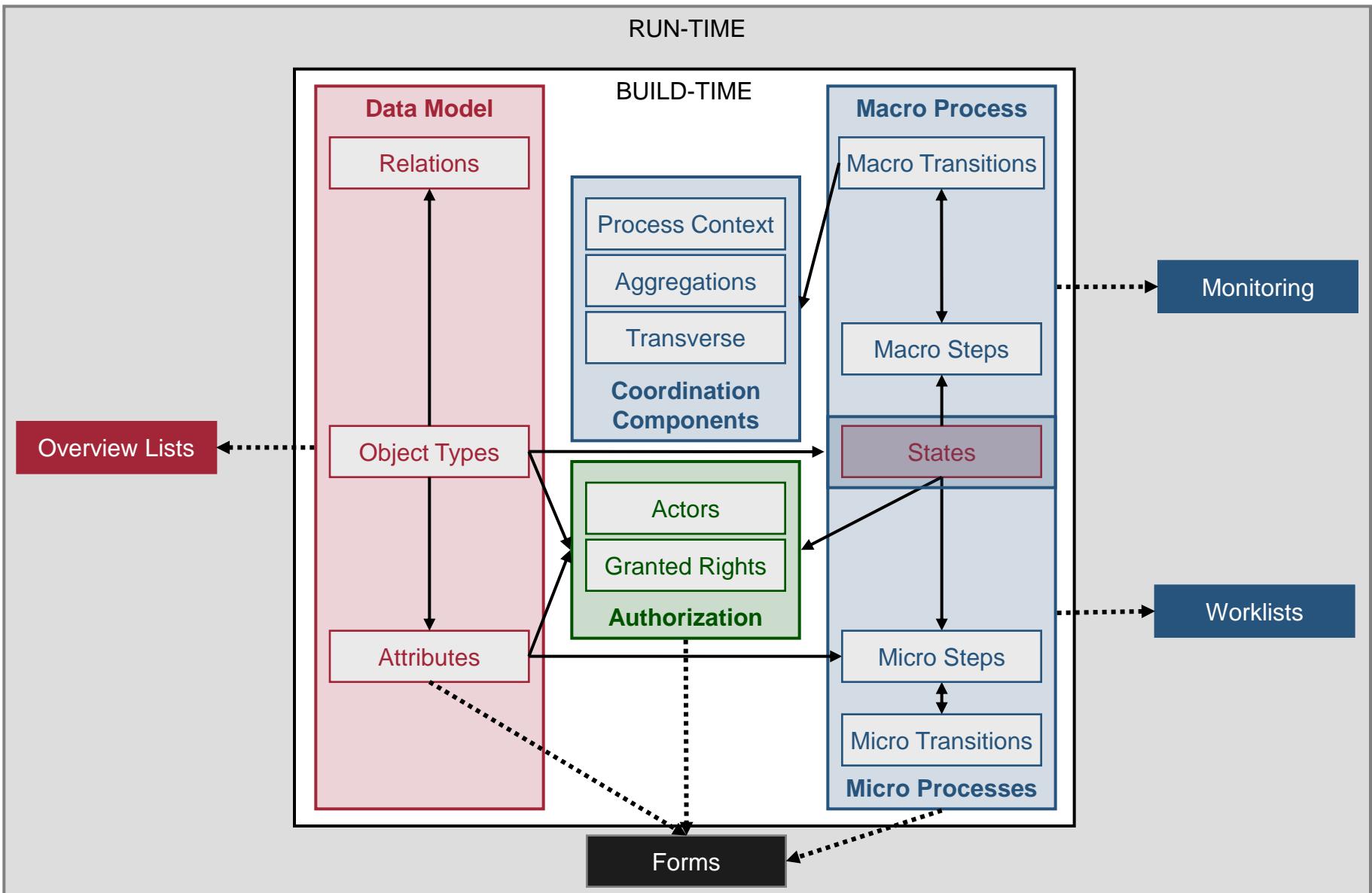
PHILharmonicFlows



Aggregations



Meta Model



The screenshot shows the PHILharmonicFlows application interface with the title "Monitoring". At the top, there is a navigation bar with "Welcome, Hans Meyer!" and "Logout" buttons, and a status bar indicating "Activated roles: Administrator +3". Below the navigation bar, there are tabs for "Tasks", "Data", and "Monitoring". The "Monitoring" tab is selected, showing a breadcrumb trail: "All processes > Recruitment > Running > Project Manager > Review".

Below the breadcrumb trail, there are filter options for "State" (three dropdown menus), "Runtime-marking" (three dropdown menus), and "Data-context" (one dropdown menu). There is also an "Add attribute filter" section with a dropdown menu and a "Remove filter" button.

The main area displays a table of review tasks:

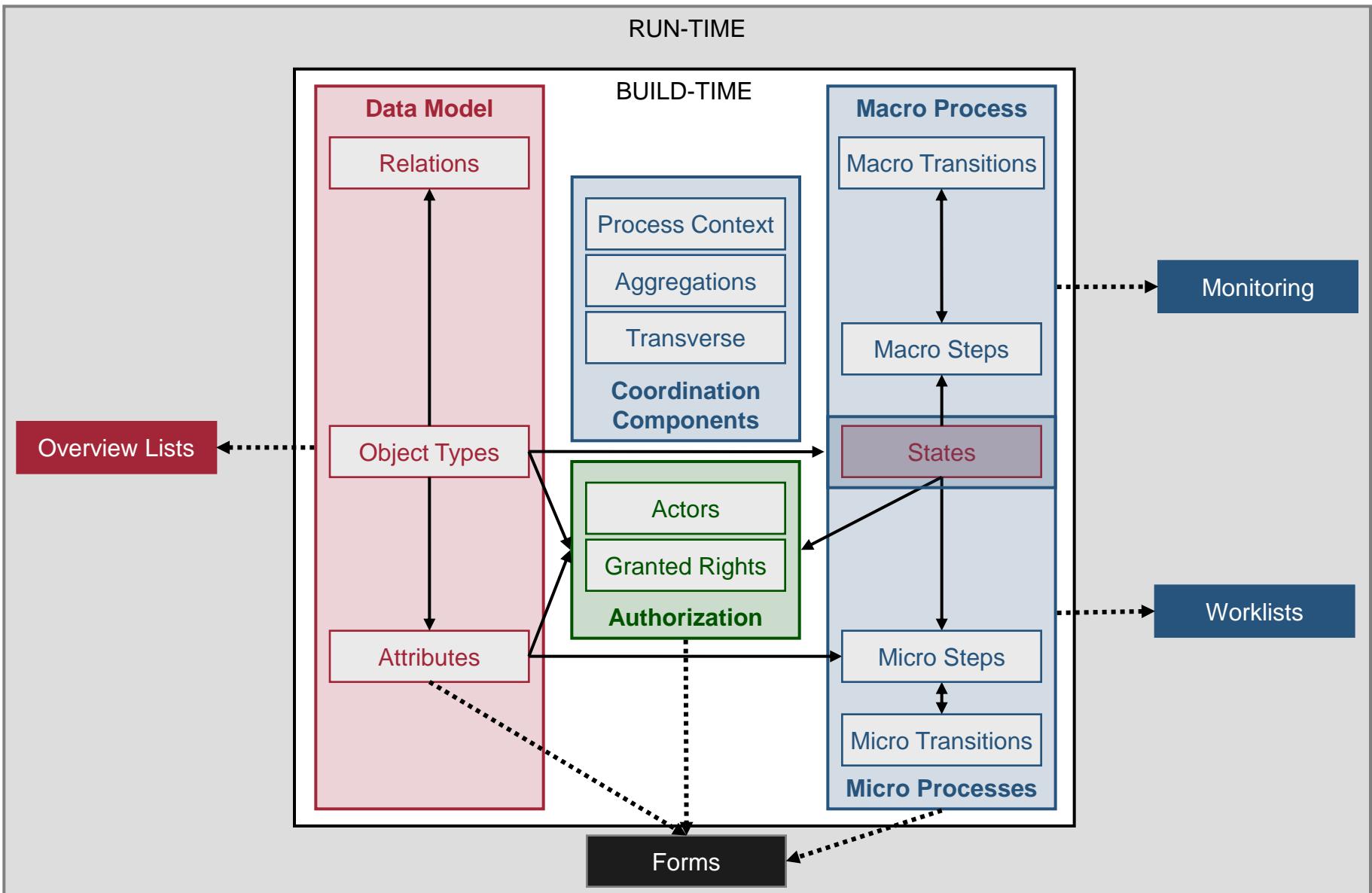
Title	Runtime marking	State	Proposal	Conclusion	Activities
Review by Hanna Jung	Running	initiated	undefined	undefined	
Review by Hans Meyer	Running	initiated	undefined	undefined	
Review by Mia Moon	Finished	completed	reject	Insufficient	
Review by Sonja Sun	Finished	completed	invite	Good	

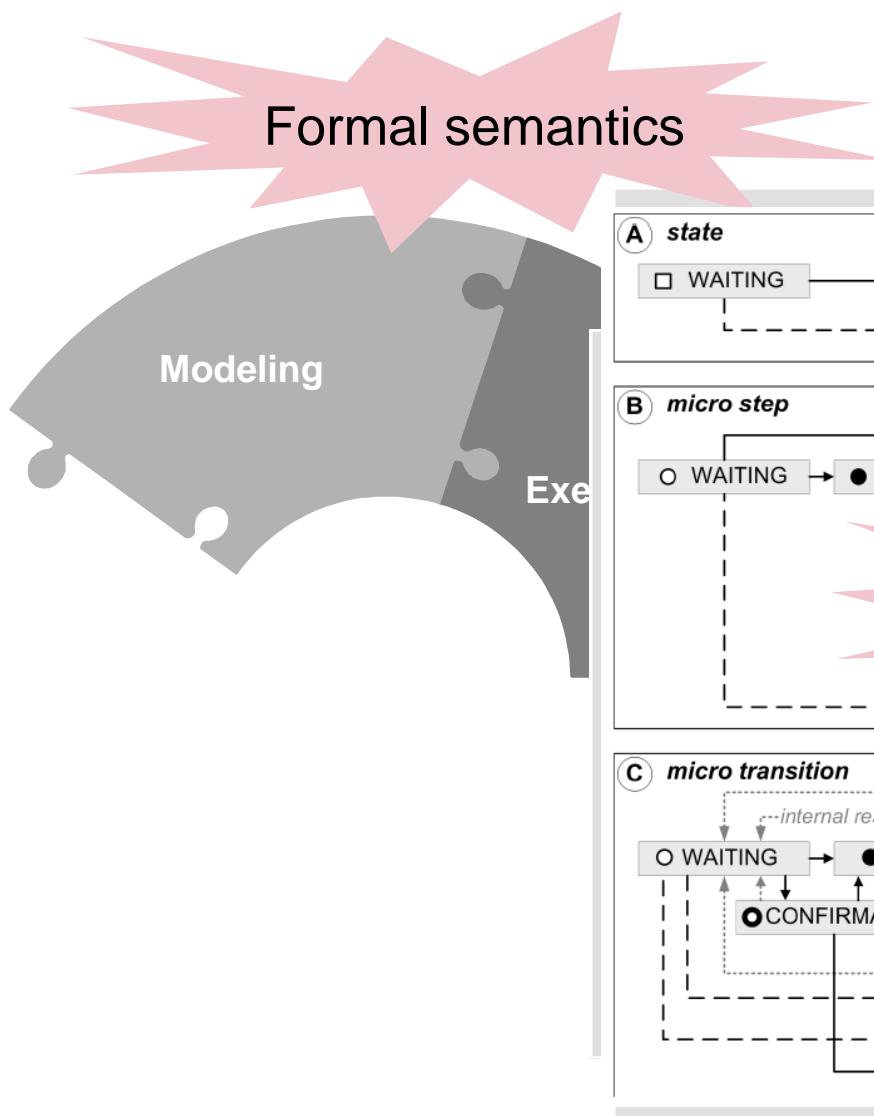
At the bottom of the interface, there is a process diagram illustrating the workflow:

```
graph LR; Start(( )) --> Initiated[initiated  
User-role]; Initiated --> HandedOut[handed out  
User-role]; HandedOut --> Returned[returned  
User-role]; HandedOut --> Invite[invite  
User-role]; Returned --> Completed[completed  
User-role]; Invite --> Completed;
```

The "initiated" state is highlighted with a yellow background and a checkmark icon. The "User-role" icon is present in each state box. A hand cursor icon is positioned above the "handed out" state, and a red minus sign icon is positioned above the "returned" state.

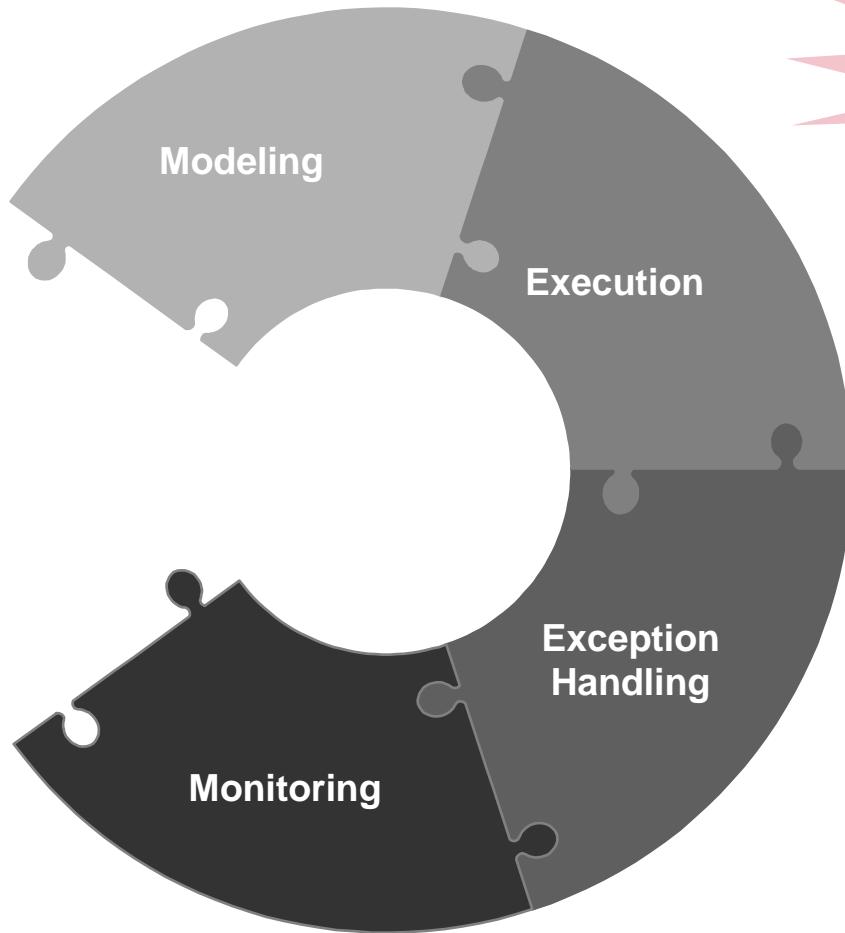
Meta Model





Covering all Phases of the Process Lifecycle

PHILharmonicFlows



Deadlocks

Abstraction & Aggregation
(for concurrent micro processes)

Ev

Agenda



Backgrounds



Data as Driver of Large Processes



Object-Aware Processes



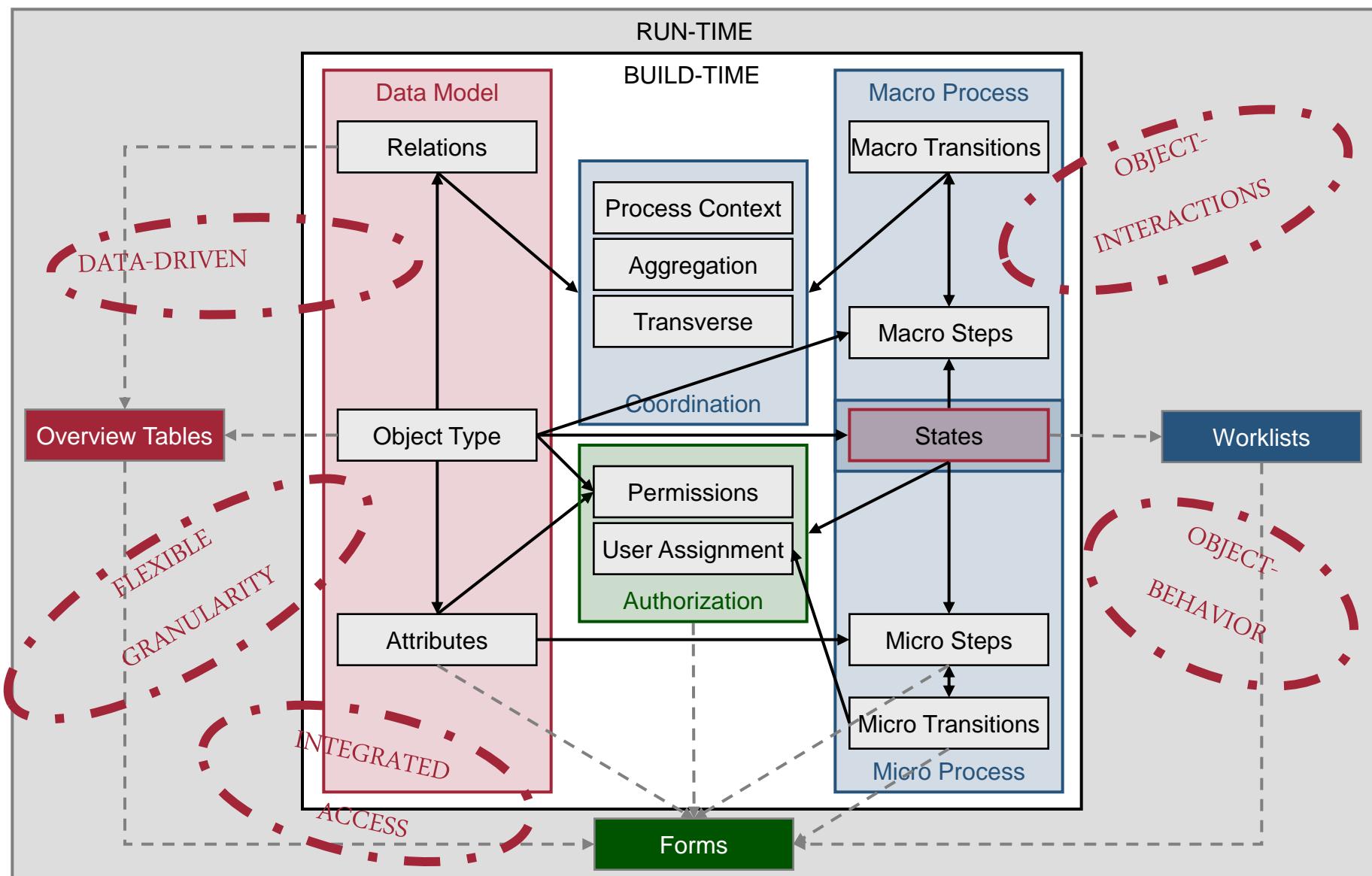
The PHILharmonicFlows Framework



Summary

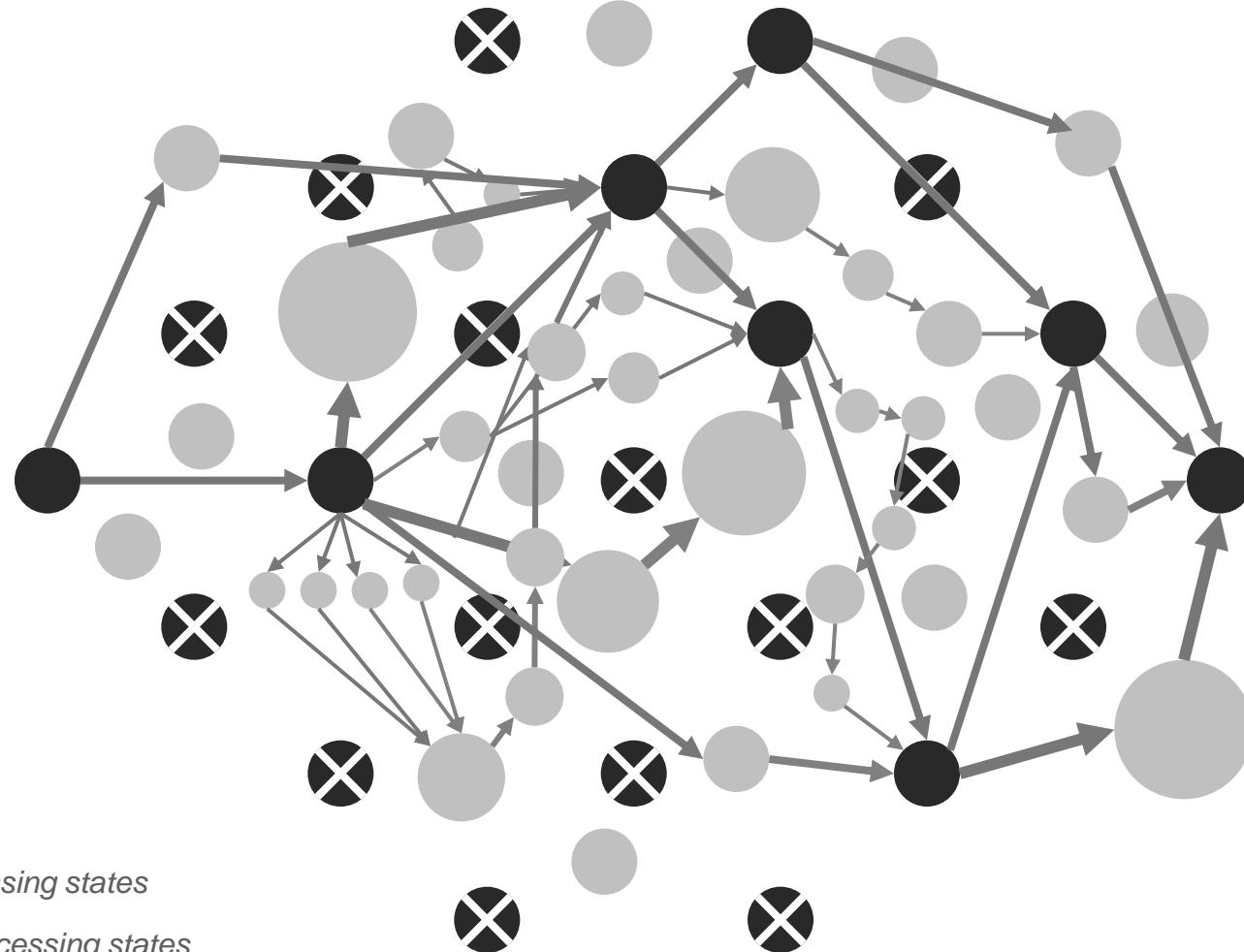
Object-Aware Processes in PHILharmonicFlows

Summary



Benefit: Increased User Flexibility

Summary



● *Defined processing states*

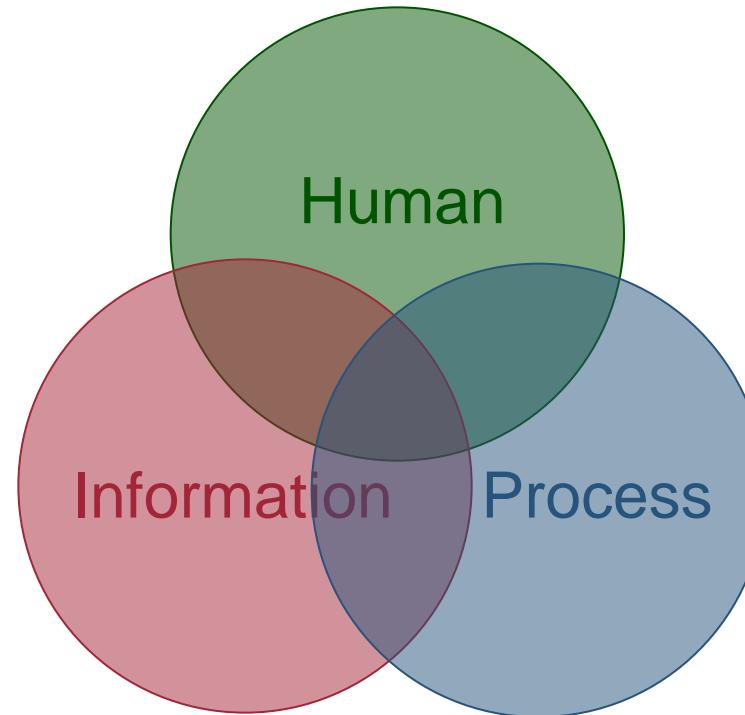
✗ *Disallowable processing states*

○ *Optional processing states*

→ *Activities*

Research Contribution

Summary



PHILharmonicFlows

Process, Humans and Information Linkage for harmonic Business Flows

<http://www.uni-ulm.de/in/iui-dbis/forschung/projekte/phiharmonic-flows.html>