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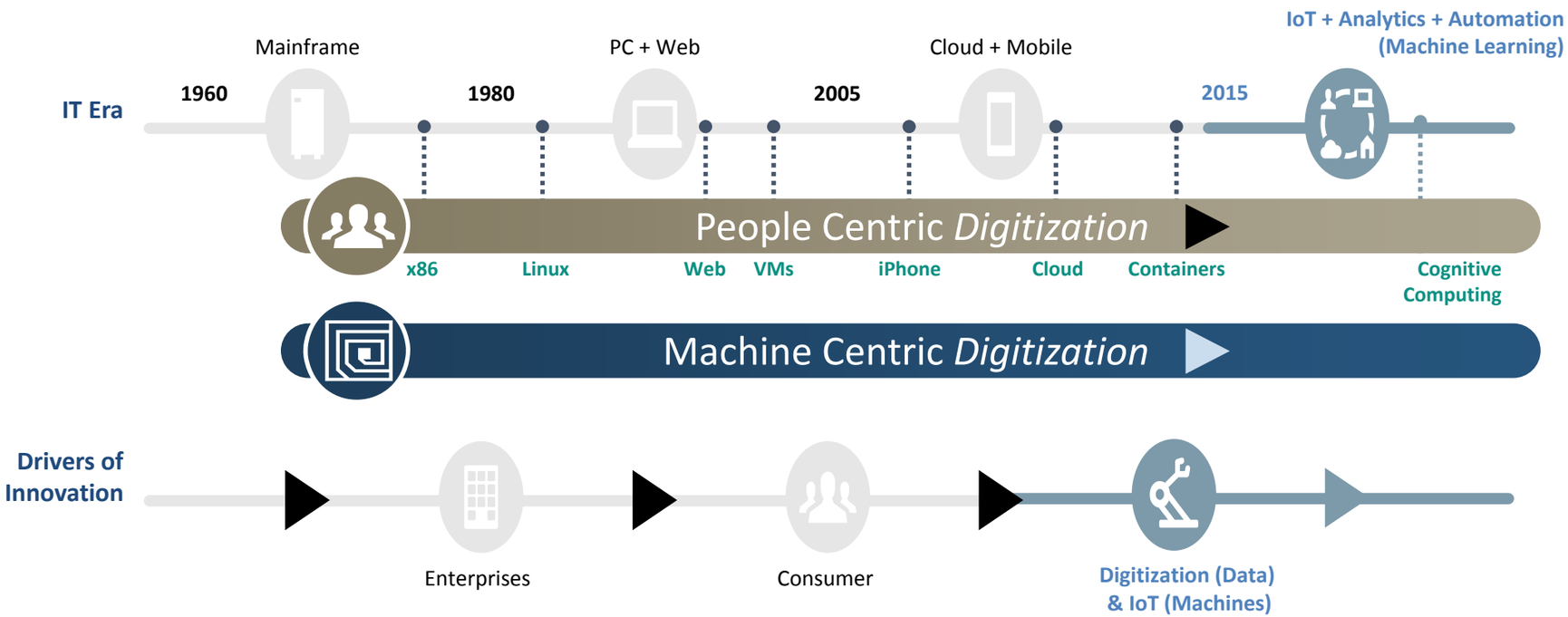
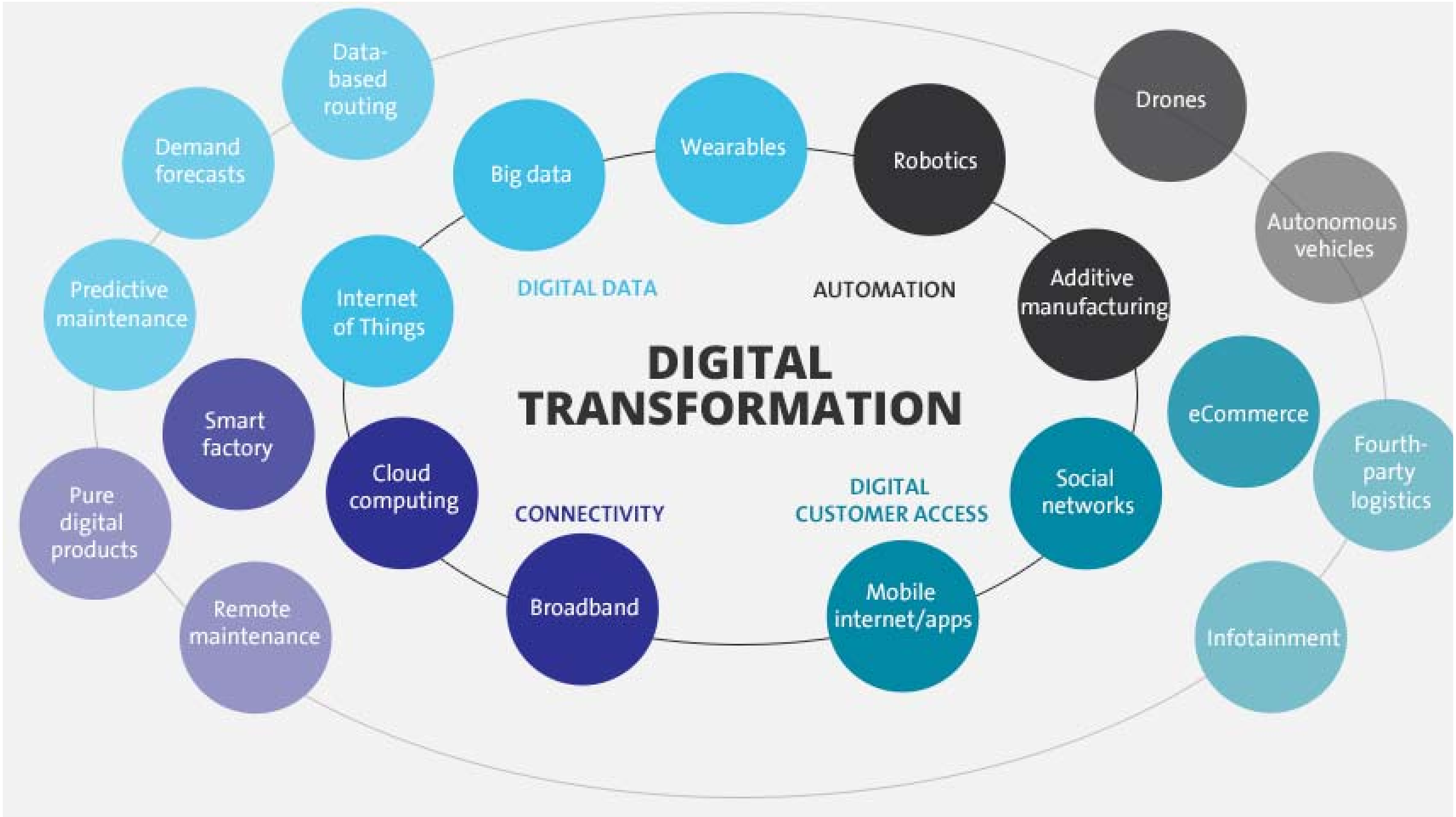
Business Process Management in the Digital Era:
Scenarios, Challenges, Technologies

Manfred Reichert

Motivation


IT Era
1960
Mainframe
1980
PC + Web
2005
Cloud + Mobile
2015
IoT + Analytics + Automation
(Machine Learning)
People Centric Digitization
x86
Linux
Web
VMs
iPhone
Cloud
Containers
Cognitive
Computing
Machine Centric Digitization
Drivers of
Innovation
Enterprises
Consumer
Digitization (Data)
& IoT (Machines)


DIGITAL TRANSFORMATION
DIGITAL DATA
AUTOMATION
CONNECTIVITY
DIGITAL CUSTOMER ACCESS
Data-based routing
Demand forecasts
Predictive maintenance
Smart factory
Pure digital products
Remote maintenance
Big data
Internet of Things
Cloud computing
Broadband
Wearables
Robotics
Drones
Autonomous vehicles
Additive manufacturing
eCommerce
Fourth-party logistics
Social networks
Mobile internet/apps
Infotainment

Motivation: Theses on the Digital Transformation

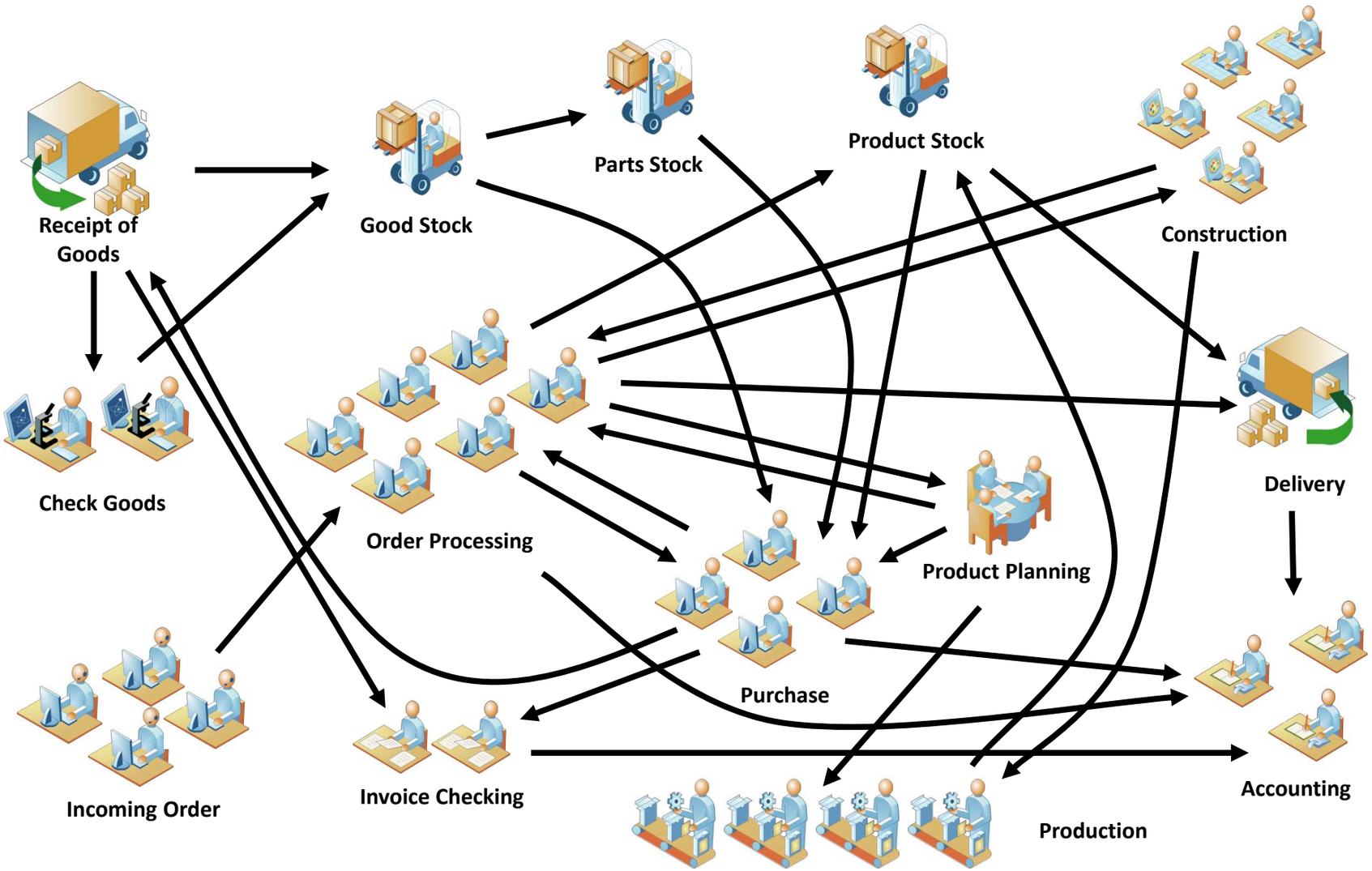
- **Thesis 1: Digital transformation is ubiquitous**
  - It goes over pervasively into our daily professional and private life.
- **Thesis 2: Digital transformation is unavoidable!**
  - Whatever can be digitalized will be digitalized in the long run.
  - Customers will demand for digitally enabled services and business.
- **Thesis 3: Digital transformation not only concerns Industry 4.0 (i.e. industrial production)**
  - For service providers, there exist similar potentials, e.g.,if the (digital) services refer to physical objects.
- **Thesis 4: Digital transformation is interdisciplinary and requires domain knowledge!**
- **Thesis 5: Digital transformation is more than automation!**
  - Enterprises that only want to reduce media disruptions with their digitalization projects will miss the real digitalization opportunities.

Motivation: Theses on the Digital Transformation

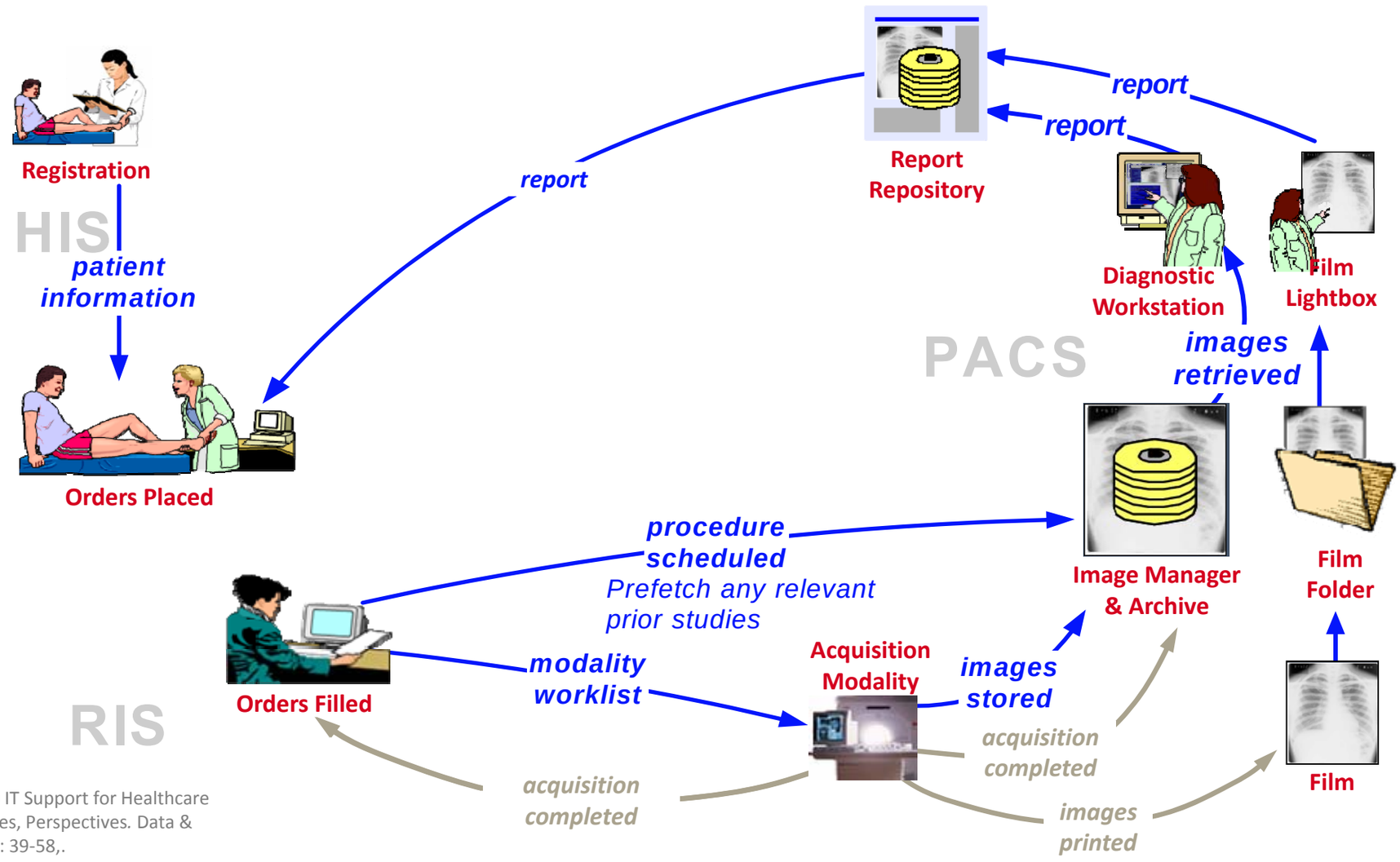
- **Thesis 6: Digital transformation often leads to new business models**
- **Thesis 7: Digital transformation leads to cyber-physical systems**
  - Real-world objects continously produce large amounts of data, notify the environment about their state, and communicate with each other.
  - As a result, cyber-physical systems are emerging whose interplay enables new (digital) services and business models.
- **Thesis 8: Digital transformation drives mobile work, mobile work drives digital transformation**
- **Thesis 9: Digital transformation requires comprehensive process knowledge and support**
  - Process knowledge is required in order to digitalize processes properly.
  - The digital processes need to be continuously aligned with the real-world ones. Otherwise, any process support will not be accepeted by the users!
  - One should not solely focus on business processes, but consider any kind of structured actions!
- **Thesis 10: Digital transformation requires elastic infrastructures**

BPM
as Enabler for Digital Transformation?

Scenario 1: Traditional Business Processes



Scenario 2: Healthcare Processes & Application Integration

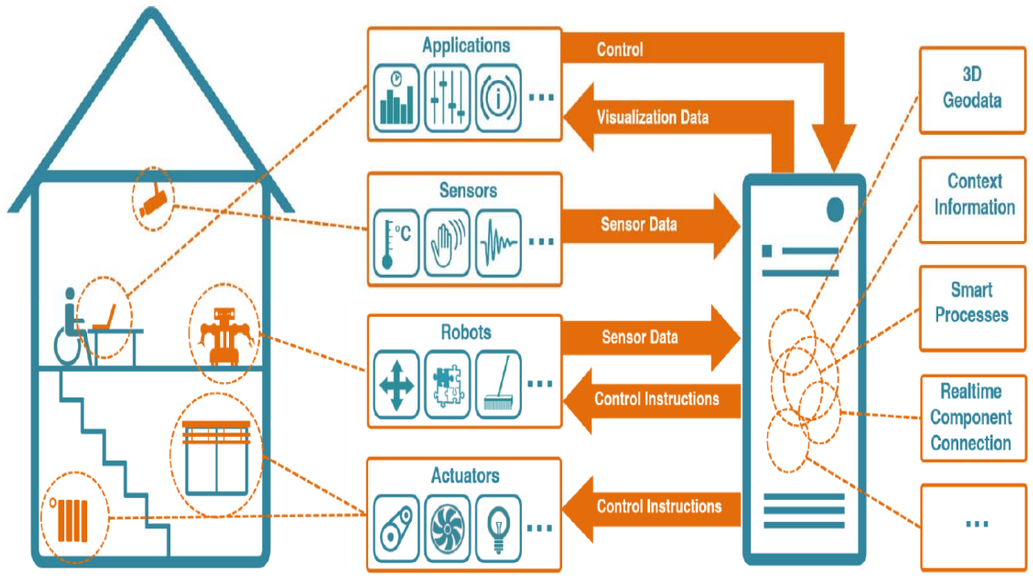


Lenz, R and Reichert, M (2007) IT Support for Healthcare Processes - Premises, Challenges, Perspectives. Data & Knowledge Engingeering 61(1): 39-58,.

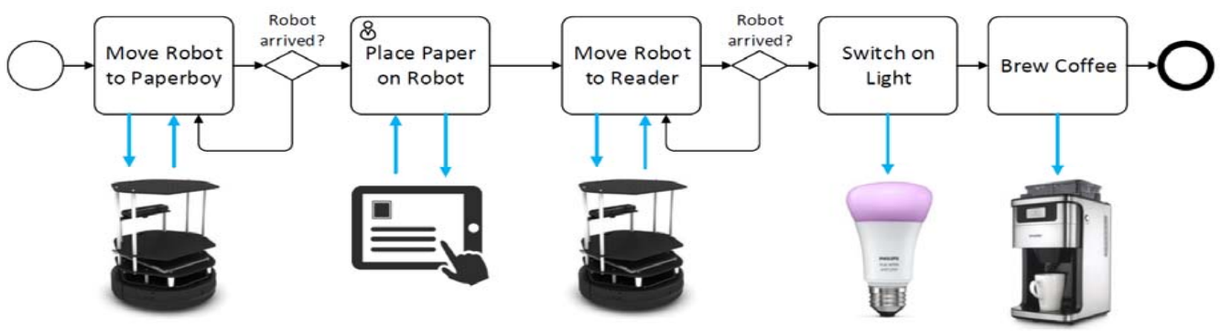
Scenario 3: Mobile Processes – Here, There and Everywhere

The full potential of labor can be utilized only if there is mobility in labor. *Paul Hoffman*

Scenario 4: Smart Processes

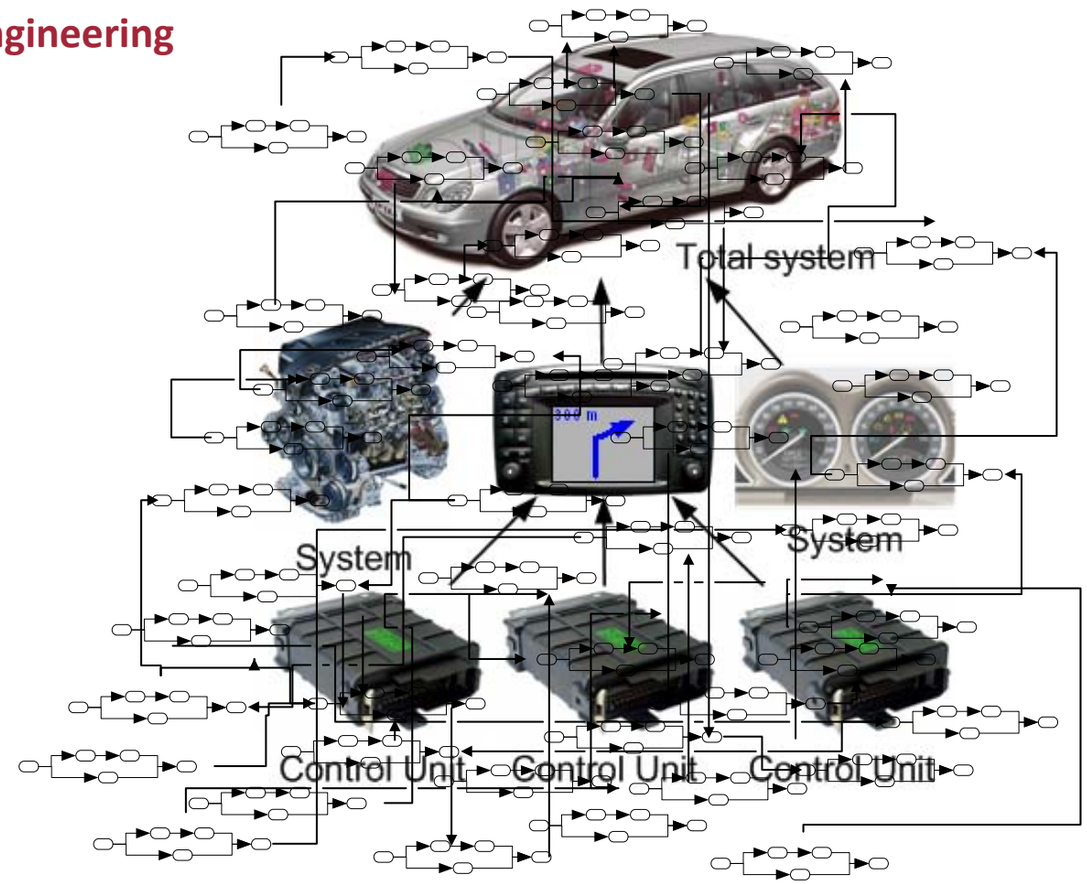


from https://vicci.inf.tu-dresden.de/



Scenario 5: Large Collective Process Structures

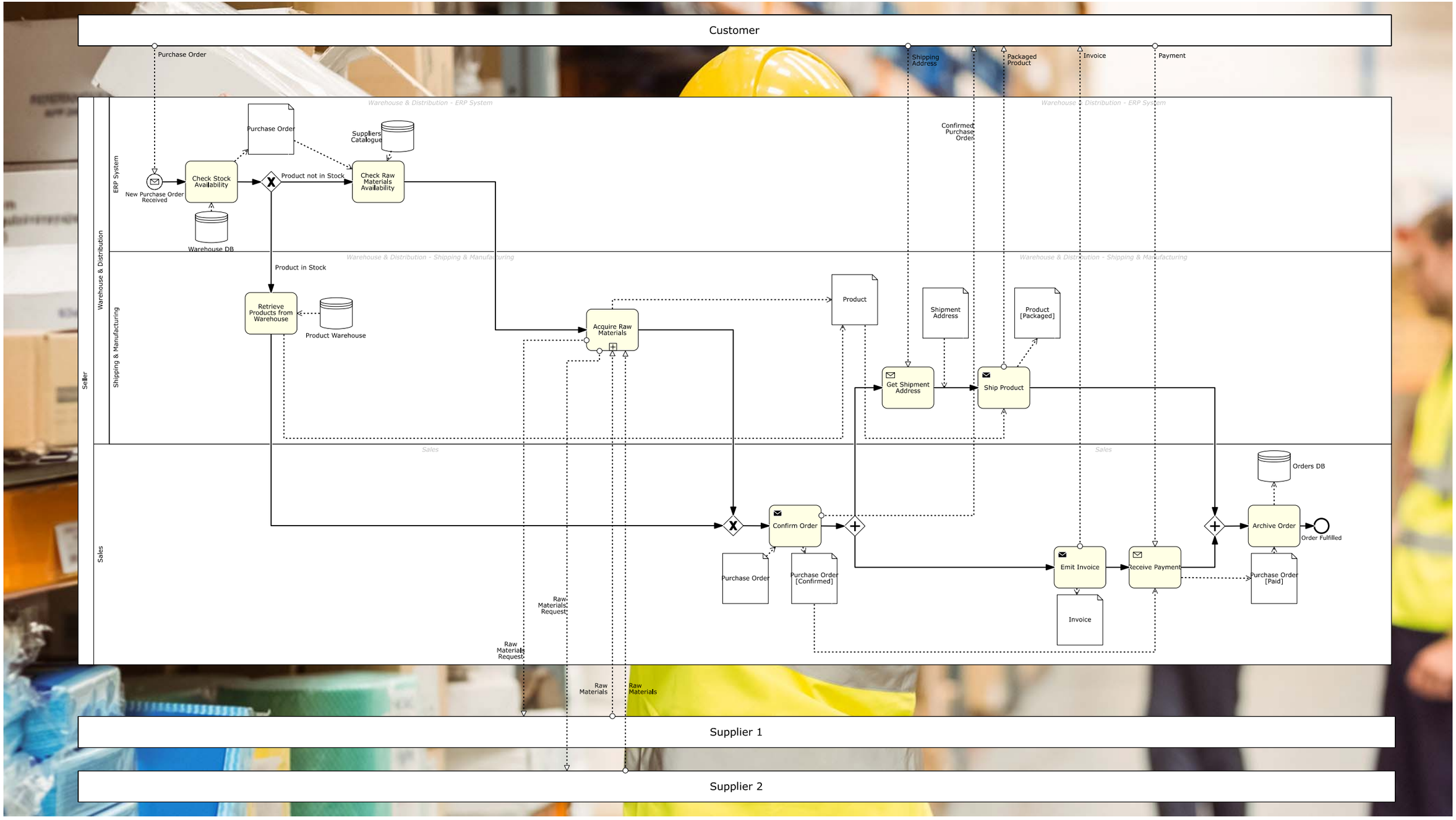
Automotive Engineering

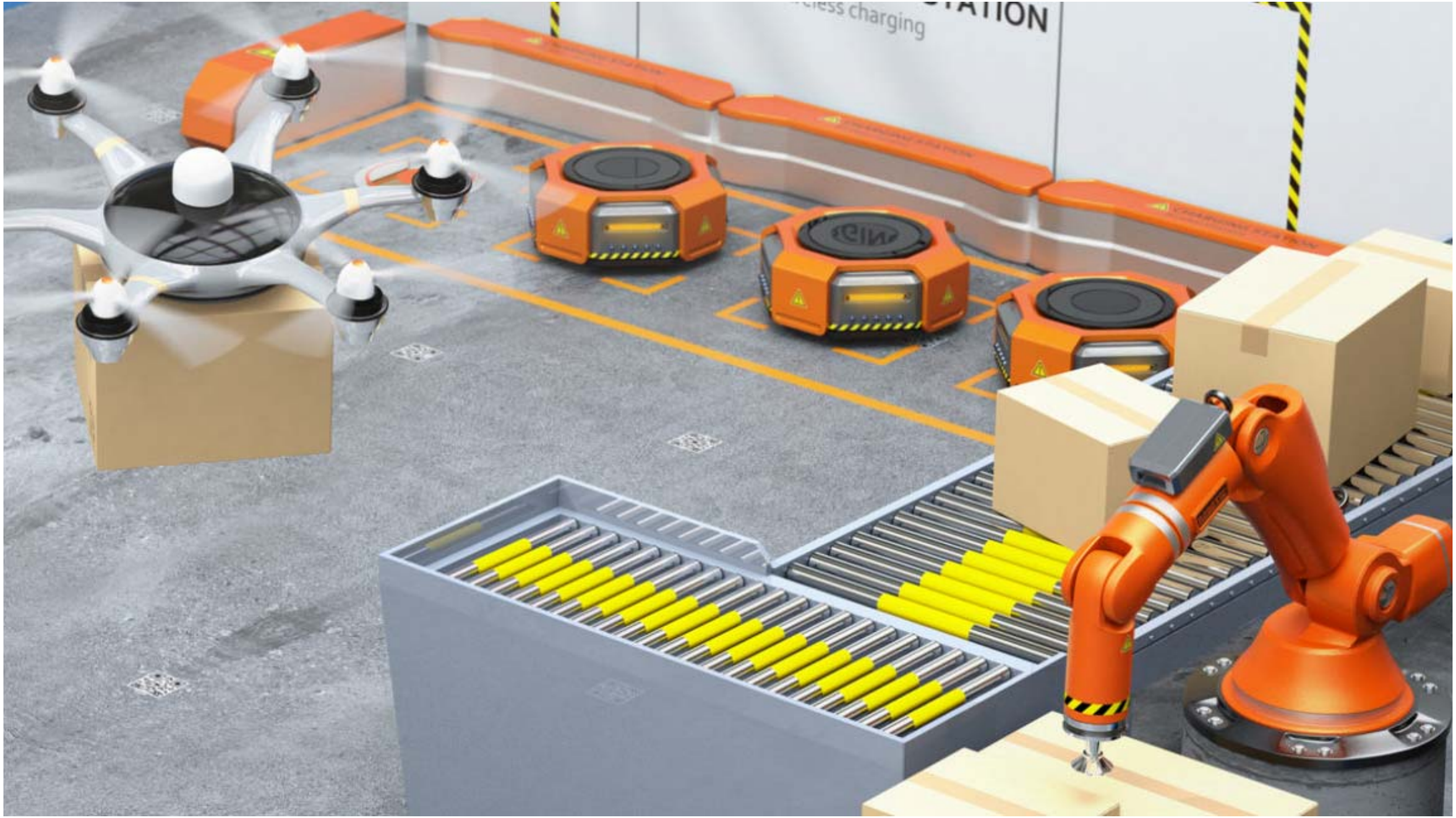


D. Müller, M. Reichert, J. Herbst: A New Paradigm for the Enactment and Dynamic Adaptation of Data-Driven Process Structures. CAiSE 2008: 48-63

Scenario 6:
Cyber-Physical Processes (Industry 4.0)


Scenario 7:
Logistics & Human /
Robot Integration


Customer
Purchase Order
Shipping Address
Packaged Product
Invoice
Payment
Seller
Warehouse & Distribution
ERP System
Warehouse & Distribution - ERP System
Purchase Order
Suppliers Catalogue
New Purchase Order Received
Check Stock Availability
Product not in Stock
Check Raw Materials Availability
Warehouse DB
Confirmed Purchase Order
Shipping & Manufacturing
Warehouse & Distribution - Shipping & Manufacturing
Product in Stock
Retrieve Products from Warehouse
Product Warehouse
Acquire Raw Materials
Product
Shipment Address
Product [Packaged]
Get Shipment Address
Ship Product
Sales
Orders DB
Confirm Order
Archive Order
Order Fulfilled
Purchase Order
Purchase Order [Confirmed]
Emit Invoice
Receive Payment
Purchase Order [Paid]
Invoice
Raw Materials Request
Raw Materials
Supplier 1
Supplier 2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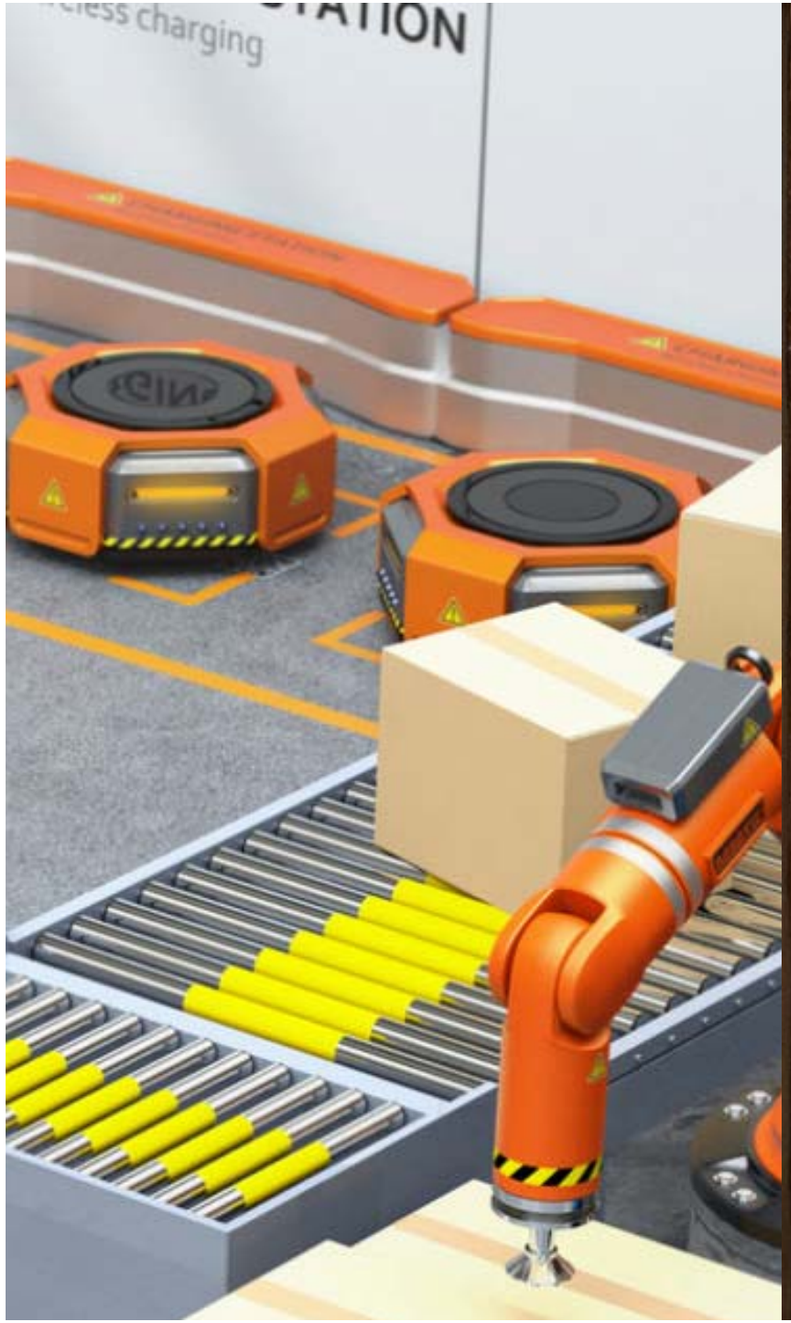

charging
ATION


BOUGHT
THIS MORNING.
BROUGHT
THIS EVENING.
FREE SAME-DAY
DELIVERY
amazon Prime
amazon.com/sameday
FREE SAME-DAY DELIVERY


CHALLENGES
AHEAD

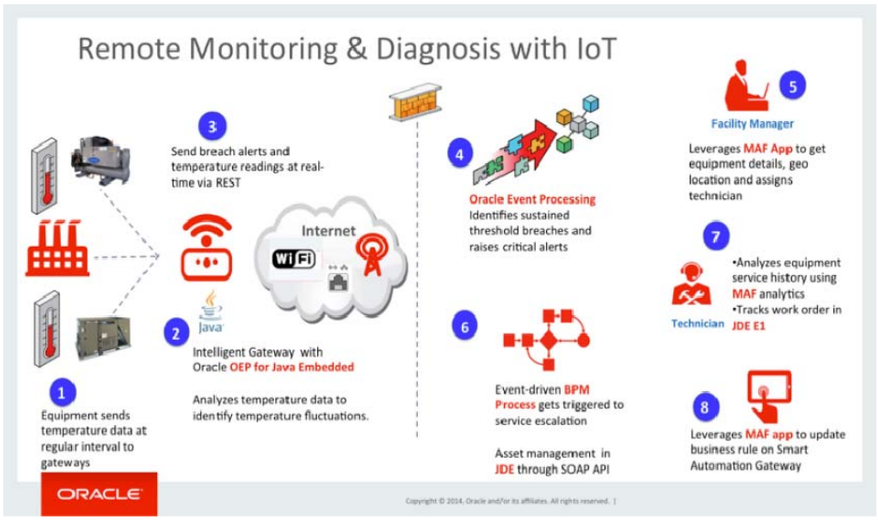
Motivation

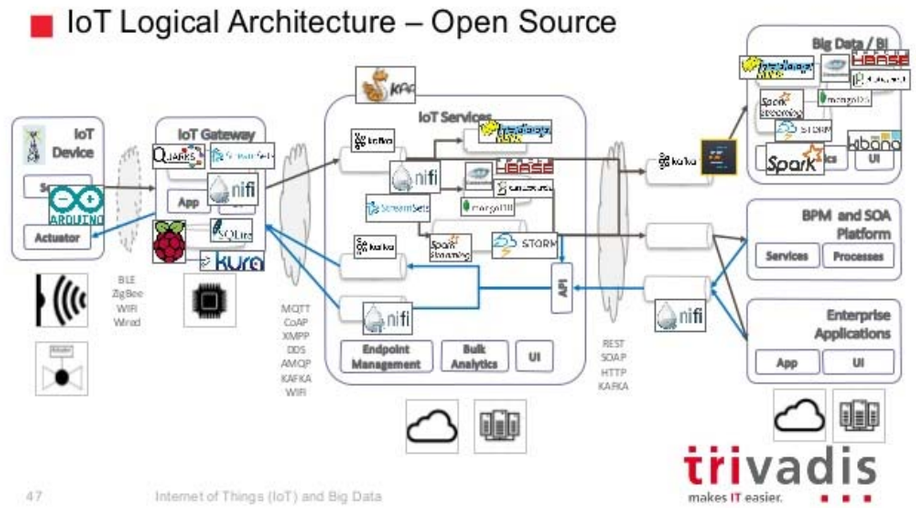
Business Process Management (BPM) is a **discipline** involving any combination of modeling, engineering, automation, execution, **control**, **measurement**, and **optimization** of business processes, in support of enterprise goals, spanning IT systems, employees, customers and partners within and beyond the enterprise boundaries.

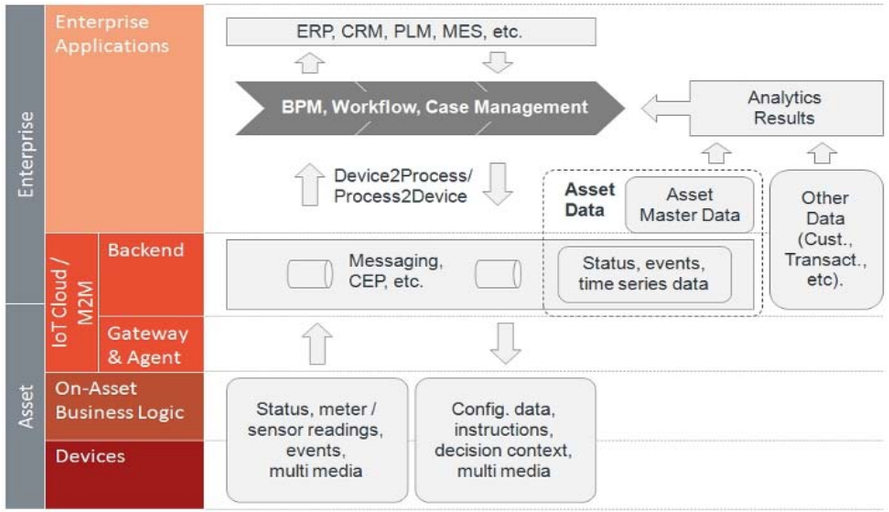
Adopted from K. Swenson, BPM'14 Keynote

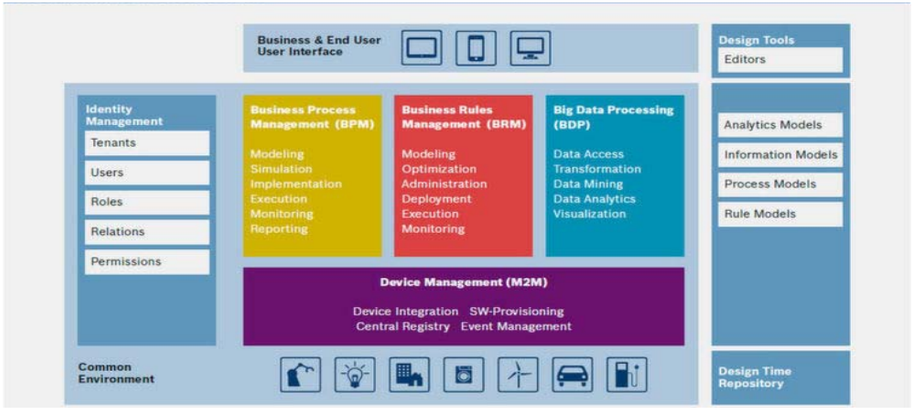

process
automation

Industry has Understood …









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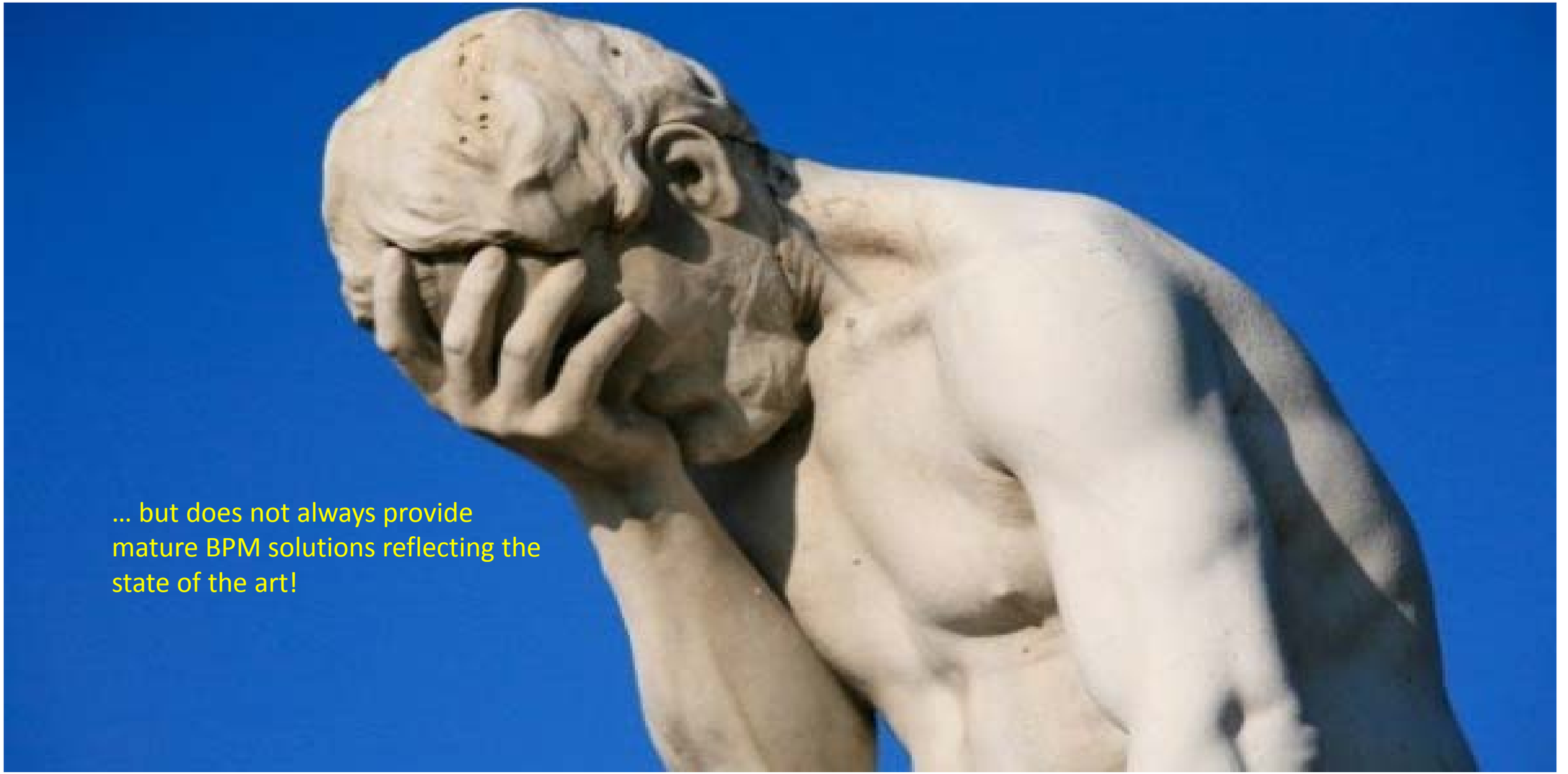
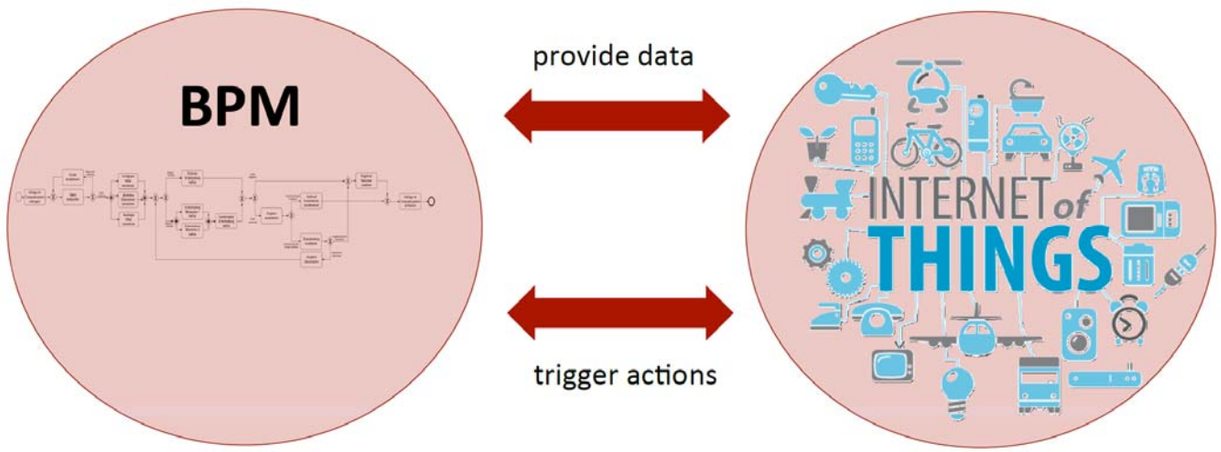


… whereas the BPM Community is at a rather early stage



IoT Meets BPM

The Internet-of-Things Meets Business Process Management: Mutual Benefits and Challenges

Christian Janiesch[1], Agnes Koschmider[2], Massimo Mecella[3*], Barbara Weber[4], Andrea Burattin[4], Claudio Di Ciccio[5], Avigdor Gal[6], Udo Kannengiesser[7], Felix Mannhardt[8], Jan Mendling[5], Andreas Oberweis[2], Manfred Reichert[9], Stefanie Rinderle-Ma[10], WenZhan Song[11], Jianwen Su[12], Victoria Torres[13], Matthias Weidlich[14], Liang Zhang[15]

Abstract
The Internet of Things (IoT) refers to a network of connected devices collecting and exchanging data over the Internet. These things can be artificial or natural, and interact as autonomous agents forming a complex system of interactions. Business Process Management (BPM) was established to identify, discover, analyze, design, implement, and monitor collaborative business processes within a single and across multiple organizations. Whereas the IoT and BPM have been so far regarded as separate topics in research and practice, we argue that there are multiple links to be explored. In this paper, we pose the question to what extent these two paradigms can be combined and we detail the challenges of the mutual combination. As a conclusion, this paper suggests areas for future research.

Keywords
IoT (Internet-of-Things) — BPM (Business Process Management) — Challenges — Manifesto

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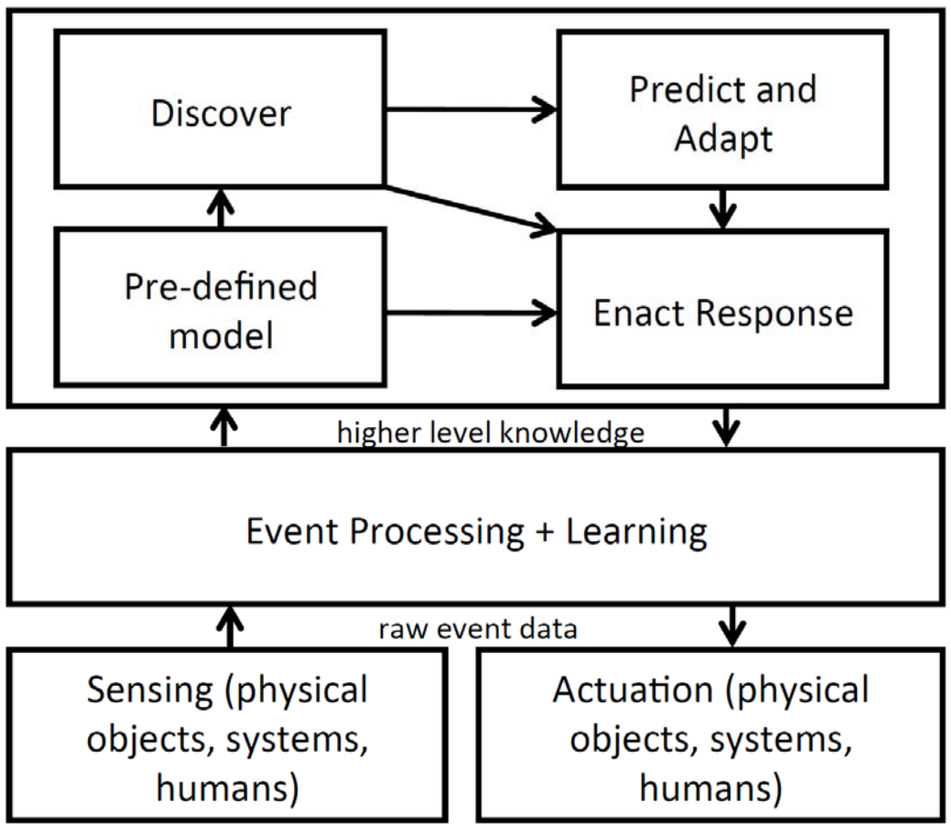

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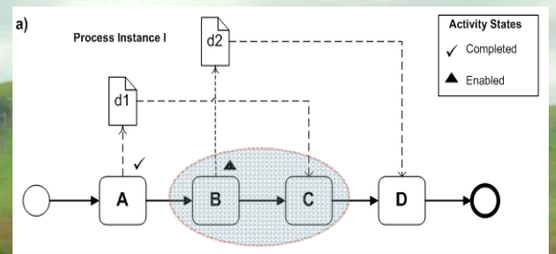
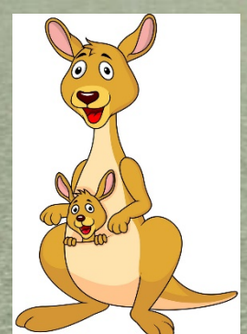
How BPM research can foster Digital Transformation

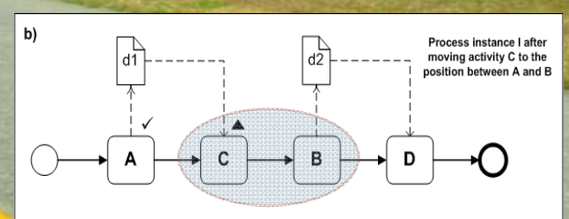
Process Automation with ADEPT / AristaFlow BPM Suite

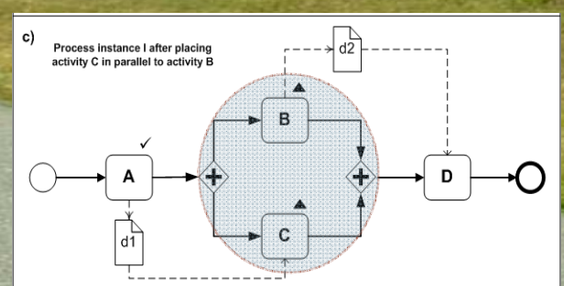
ADEPT / AristaFlow – Enforcement vs. Guidance + Flexibility

Enforcement: Guardrails (on a road) prevent deviation, but also prevent anything not predicted.



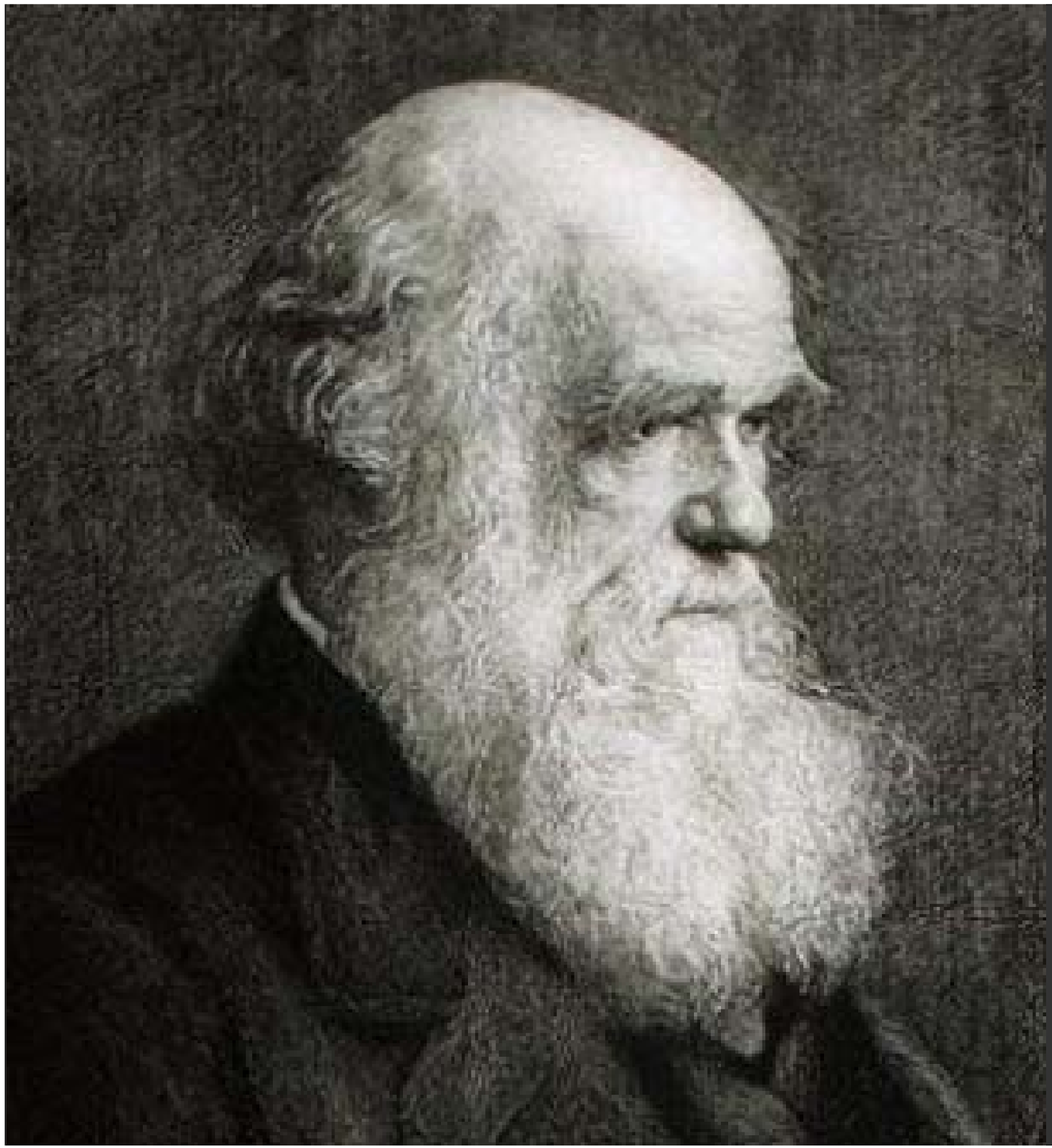






Guidance: Guidelines (on a road) show people where to go, but do not prevent deviations if they are necessary.

Weber B, Reichert M, Rinderle-Ma, S (2008) *Change Patterns and Change Support Features - Enhancing Flexibility in Process-Aware Information Systems* . Data and Knowledge Engineering, 66(3): 438-466



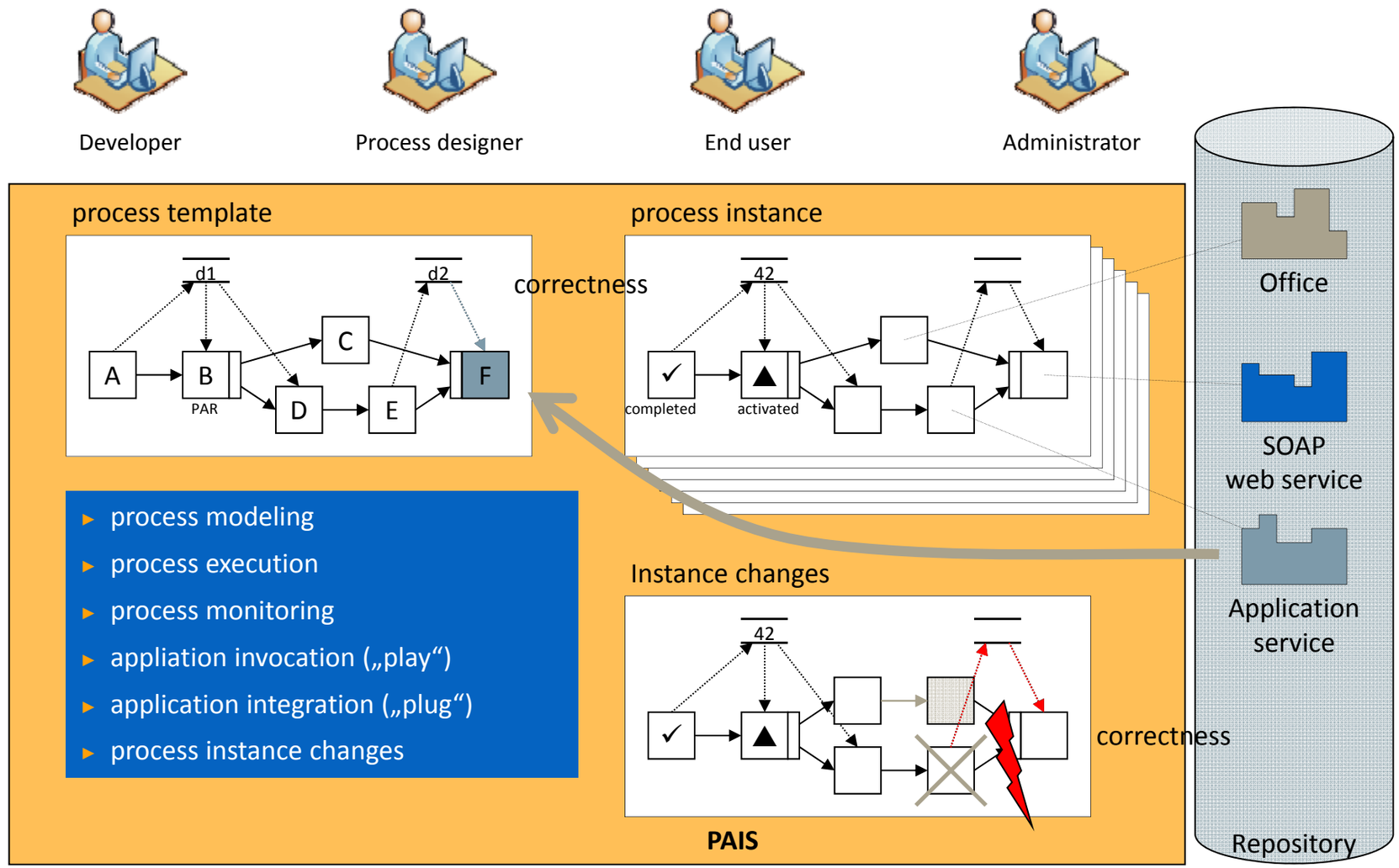
ADEPT / AristaFlow:
Process Evolution

Ability to quickly change the implemented process when the business process evolves

”It is not the strongest of the species that survives, not the most intelligent that survives. It is the one that is the most adaptable to change.“

Charles Darwin

ADEPT / AristaFlow – Basic Features

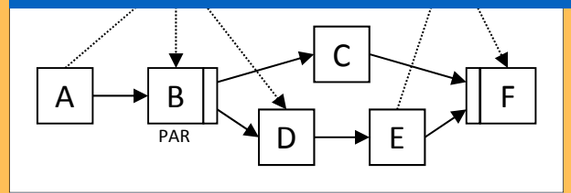


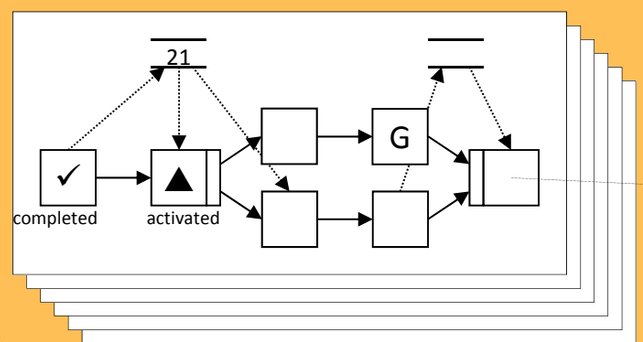
ADEPT / AristaFlow – Basic Features

- process modeling
- process execution
- process monitoring
- appliation invocation („play")
- application integration („plug")
- process instance changes
- **process schema evolution**

End user

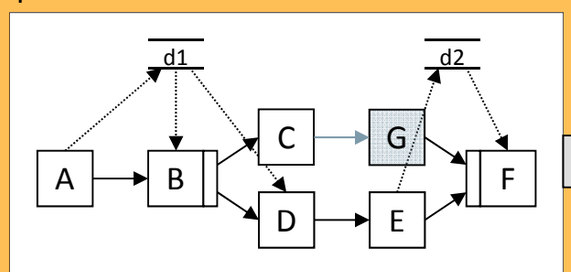
Administrator

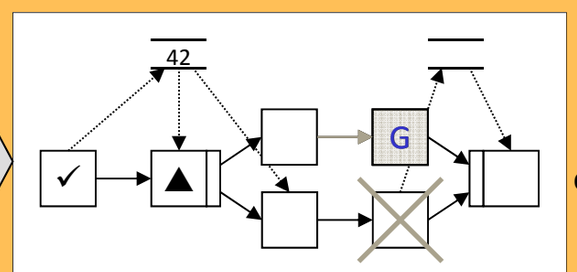




correctness

process schema evolution





correctness

template change

change propagation

PAIS

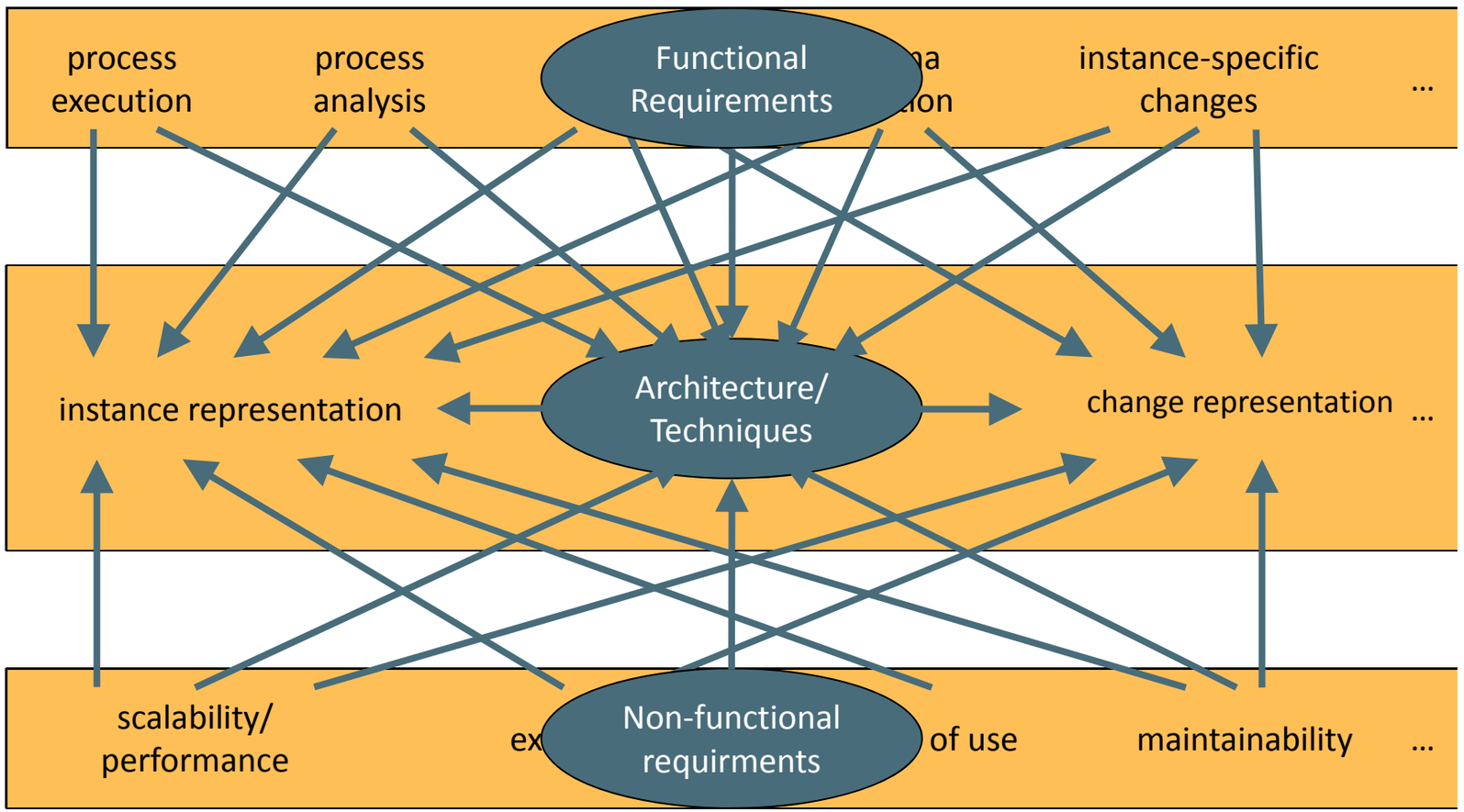
ADEPT / AristaFlow – Engineering the Framework

- FR 1 process execution
- FR 2 logging
- FR 3 resource modeling
- FR 4 worklist management
- FR 5 process monitoring
- FR 6 persistent storage
- FR 7 appliation invocation („play“)
- FR 8 process modeling
- FR 9 process adaptation
- FR 10 application integration („plug“)
- FR 11 process management & versioning
- FR 12 API & development framework

- NR 1 scalability/performance
- NR 2 robustness
- NR 3 extensibility
- NR 4 ease of use
- NR 5 independence/modularity
- NR 6 reuse/non-redundancy
- NR 7 maintainability
- NR 8 ability to evolve/flexibility

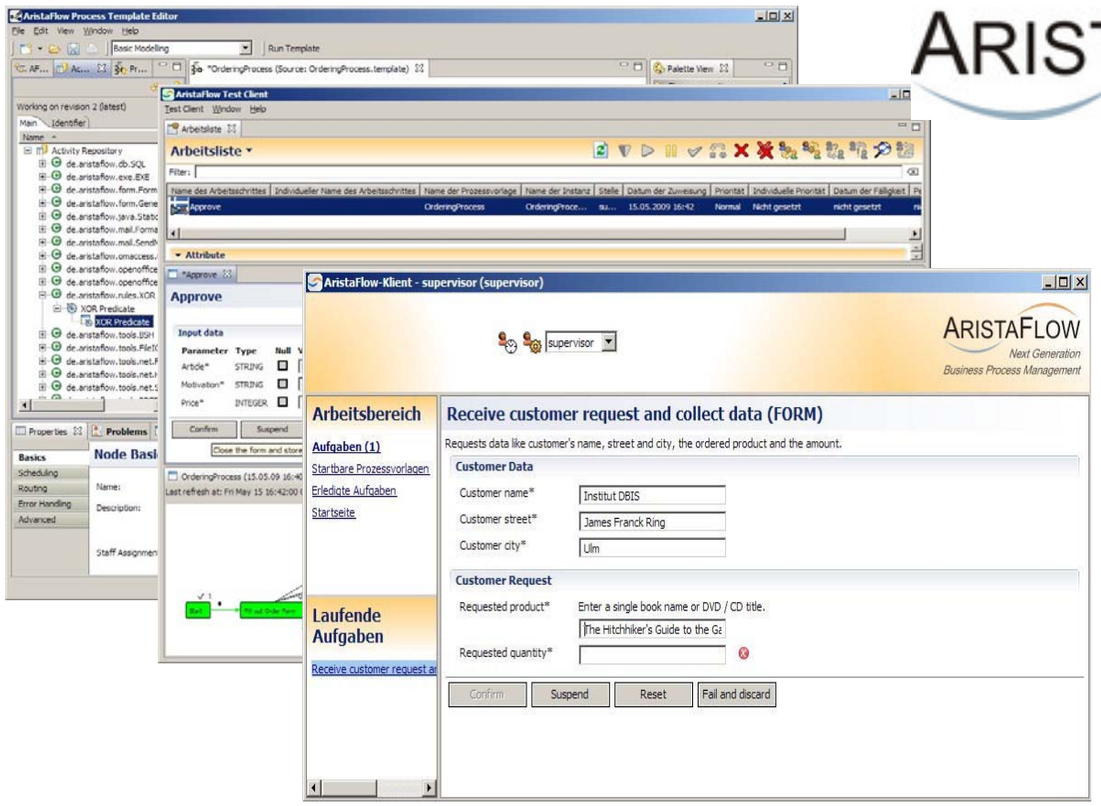
- DIN ISO 9126
  (software quality, product quality)

ADEPT / AristaFlow – Engineering the Framework



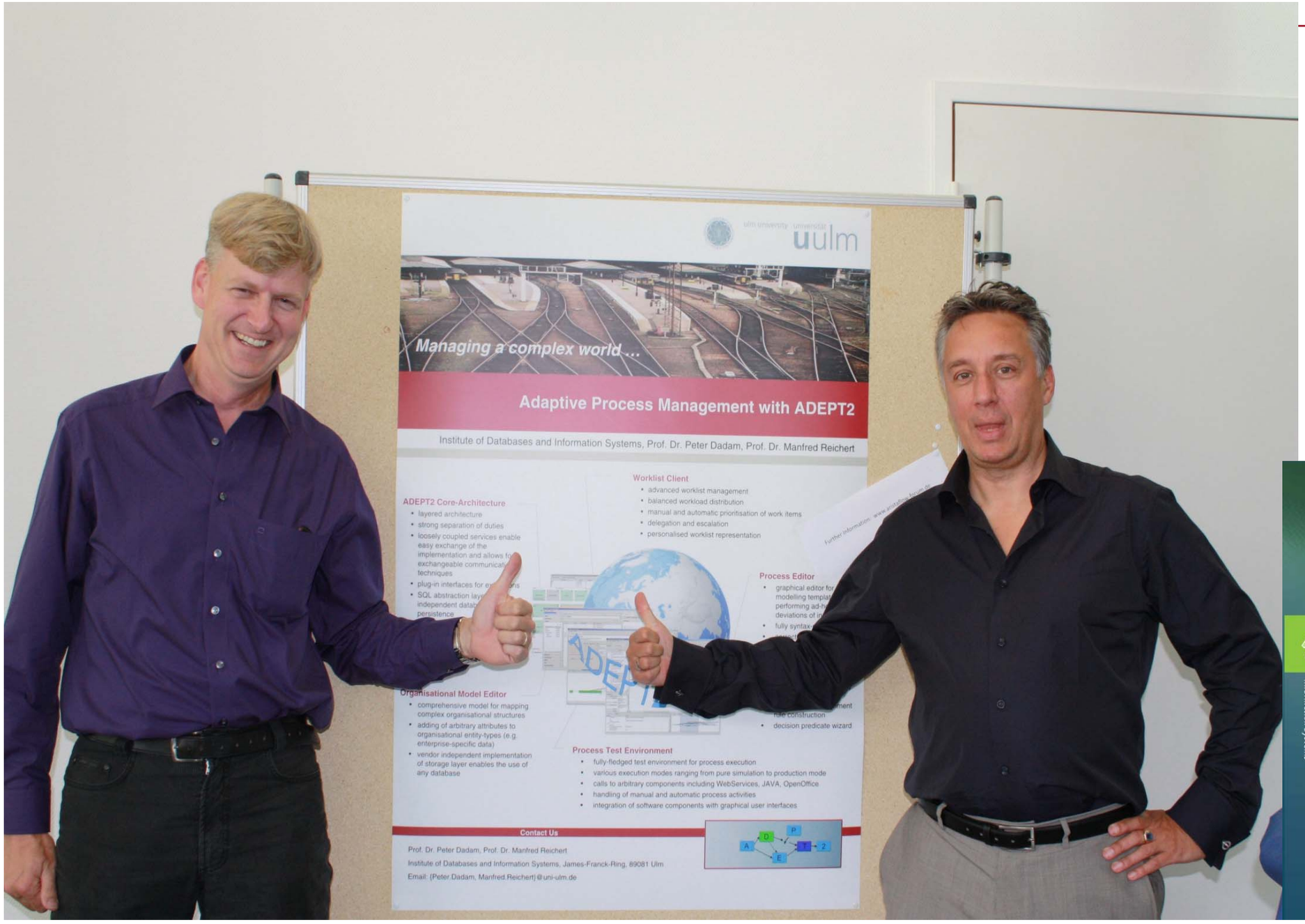
Engineering of the ADEPT Framework Architecture Design

ADEPT / AristaFlow – Industrial Transfer



ARISTAFLOW

Reichert, M. et al. (2009) *Enabling Poka-Yoke Workflows with the AristaFlow BPM Suite.* In: CEUR Workshop Proceedings 489.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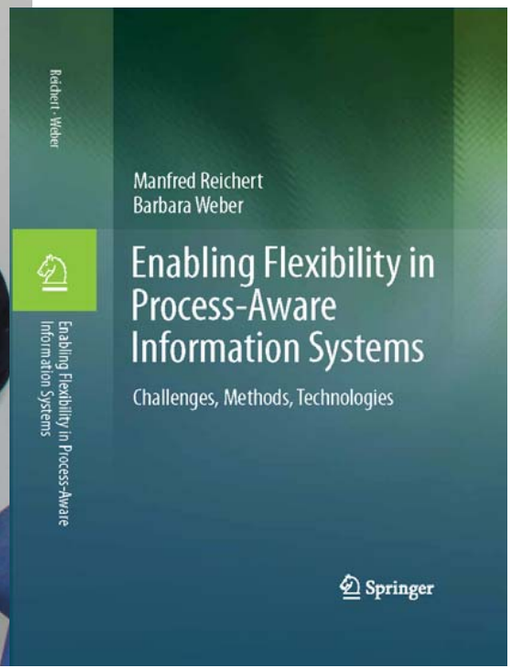
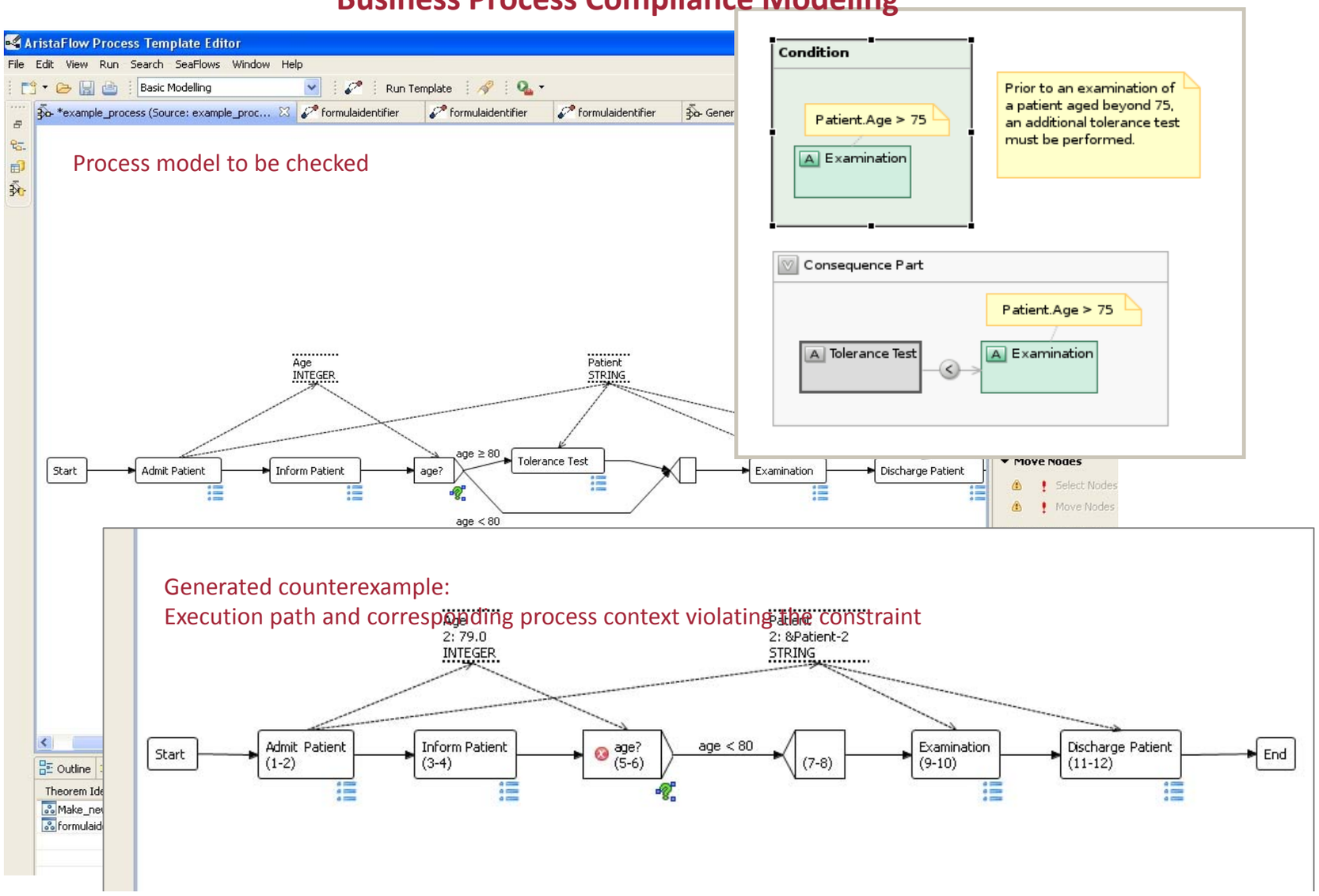
Managing a complex world ...
Adaptive Process Management with ADEPT2
Institute of Databases and Information Systems, Prof. Dr. Peter Dadam, Prof. Dr. Manfred Reichert
ADEPT2 Core-Architecture
layered architecture
strong separation of duties
loosely coupled services enable easy exchange of the implementation and allows for exchangeable communication techniques
plug-in interfaces for
SQL abstraction layer
Worklist Client
advanced worklist management
balanced workload distribution
manual and automatic prioritisation of work items
delegation and escalation
personalised worklist representation
Process Editor
graphical editor for
fully syntax-
decision predicate wizard
Organisational Model Editor
comprehensive model for mapping complex organisational structures
adding of arbitrary attributes to organisational entity-types (e.g. enterprise-specific data)
vendor independent implementation of storage layer enables the use of any database
Process Test Environment
fully-fledged test environment for process execution
various execution modes ranging from pure simulation to production mode
calls to arbitrary components including WebServices, JAVA, OpenOffice
handling of manual and automatic process activities
integration of software components with graphical user interfaces
Contact Us
Prof. Dr. Peter Dadam, Prof. Dr. Manfred Reichert
Institute of Databases and Information Systems, James-Franck-Ring, 89081 Ulm
Email: {Peter.Dadam, Manfred.Reichert}@uni-ulm.de


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

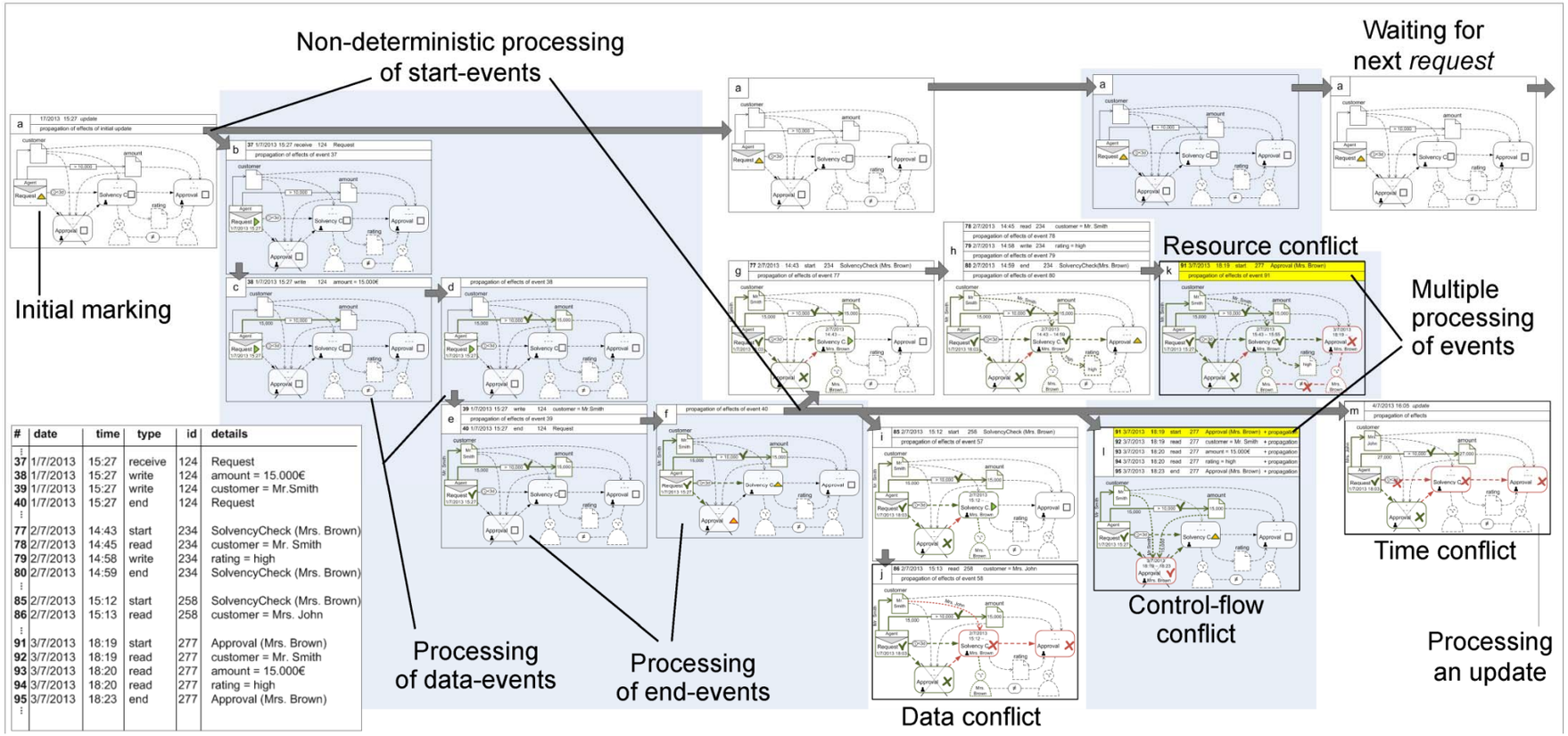
Enhancing AristaFlow BPM Suite with Advanced Features

Business Process Compliance Modeling



Enhancing AristaFlow BPM Suite with Advanced Features

Business Process Compliance Monitoring



D. Knuplesch, M. Reichert, A. Kumar (2015): Visually Monitoring Multiple Perspectives of Business Process Compliance. BPM 2015: 263-279

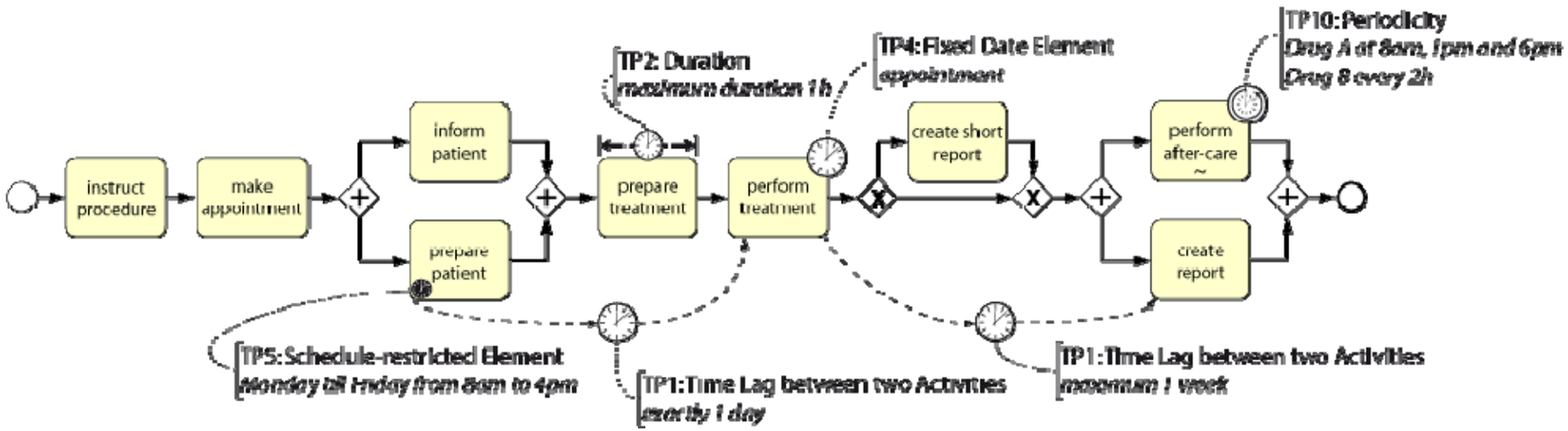
Knuplesch, David and Reichert, Manfred and Kumar, Akhil (2017) *A framework for visually monitoring business process compliance.* Information Systems, Elsevier, Vol. 64, pp. 381-409

Knuplesch, David and Reichert, Manfred (2017) *A Visual Language for Modeling Business Process Compliance Rules.* Software & Systems Modeling, Springer, Vol. 16, pp. 715-736

ATAPIS

Enhancing AristaFlow BPM Suite with Advanced Features

Integrating Temporal Constraints in the Process Lifecycle



Lanz A., Weber B., Reichert, M. (2014): Time-Patterns for Process-Aware Information Systems. Requirements Engineering, 19(2): 113-141

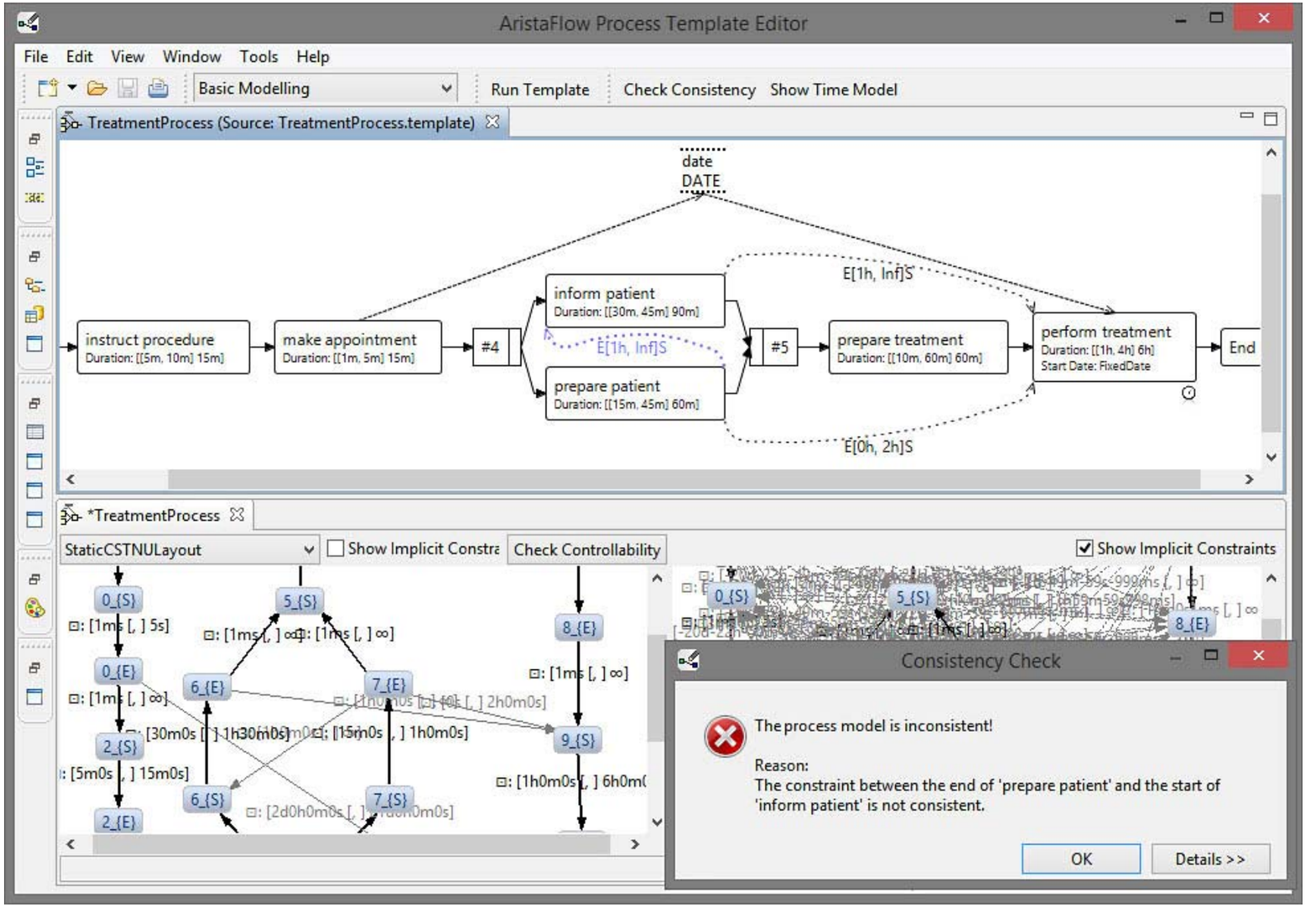
Lanz A., Reichert M., Weber B. (2016): Process Time Patterns – A Formal Foundation. Information Systems, 57:38-68

Lanz A., Reichert M. (2014) Dealing with Changes of Time-Aware Processes. BPM 2014, pp. 217-233

ATAPIS

Enhancing AristaFlow BPM Suite with Advanced Features

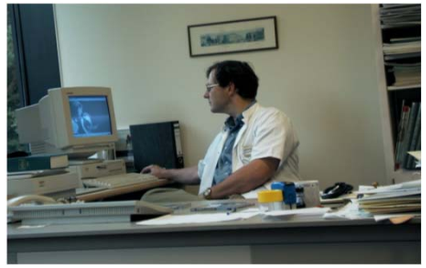
Integrating Temporal Constraints in the Process Lifecycle

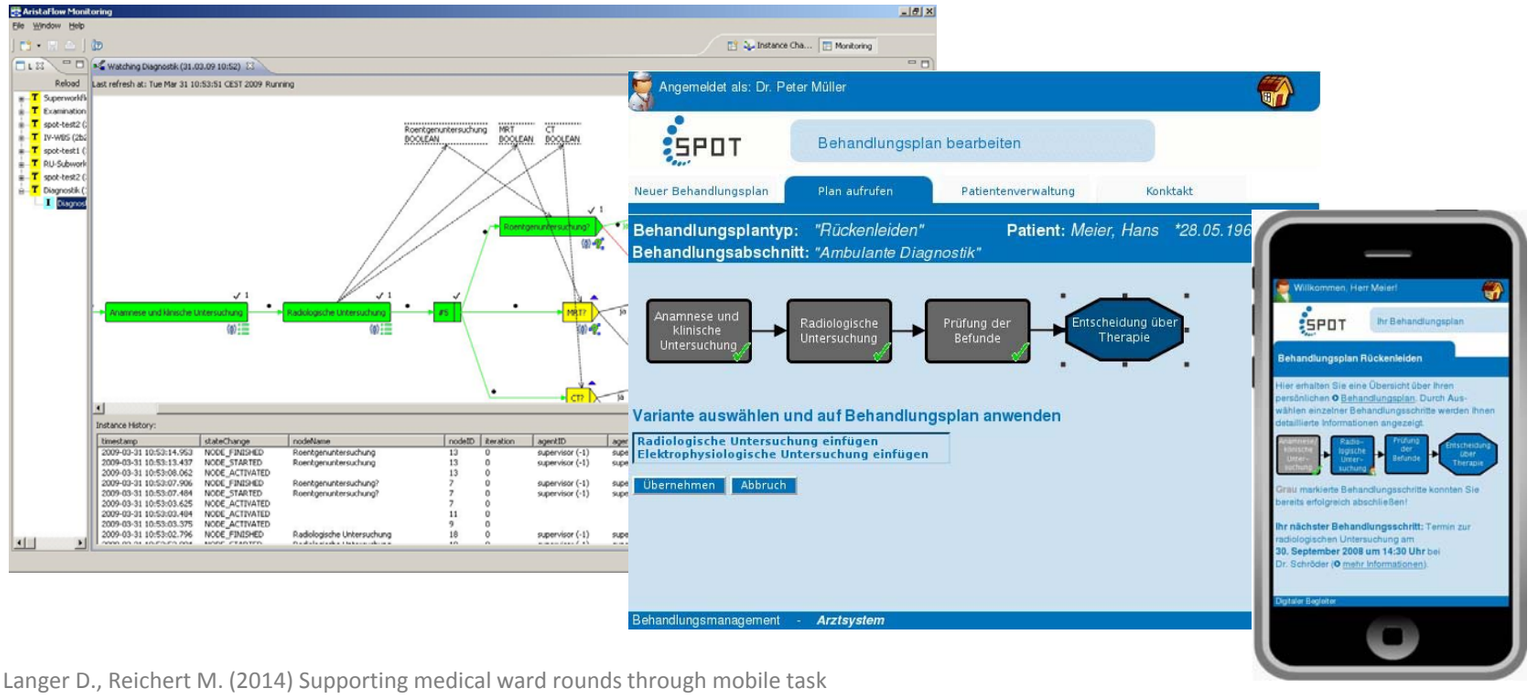


Lanz A., Posenato R., Combi C., Reichert, M. (2014): Controllability of Time-Aware Processes at Run-Time, Proc. CoopIS'14, pp. 39-56

Advanced Applications of the AristaFlow BPM Suite

Clinical Pathway Support

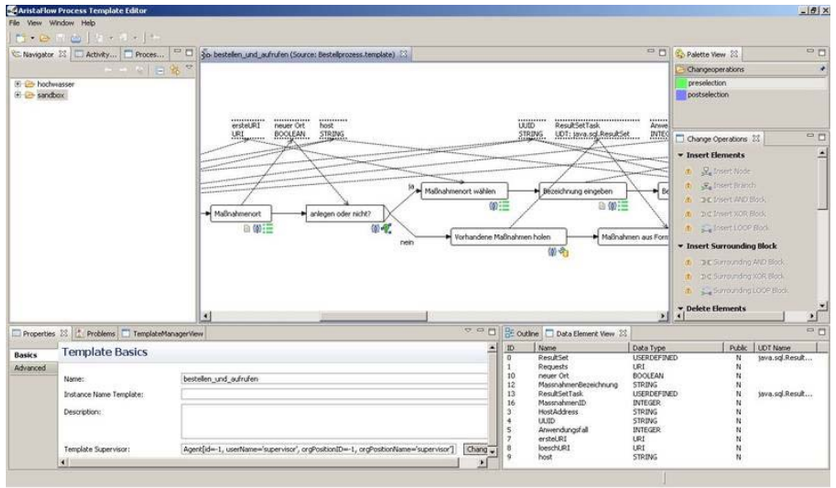


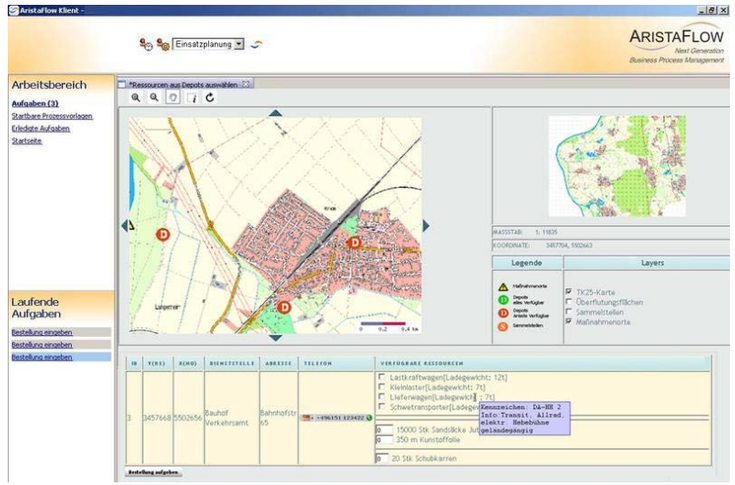



Pryss R., Mundbrod N., Langer D., Reichert M. (2014) Supporting medical ward rounds through mobile task and process management. Inf Sys and e-Business Management, Springer.

Advanced Applications of the AristaFlow BPM Suite

Process-driven Emergency Management for Water Infrastructures





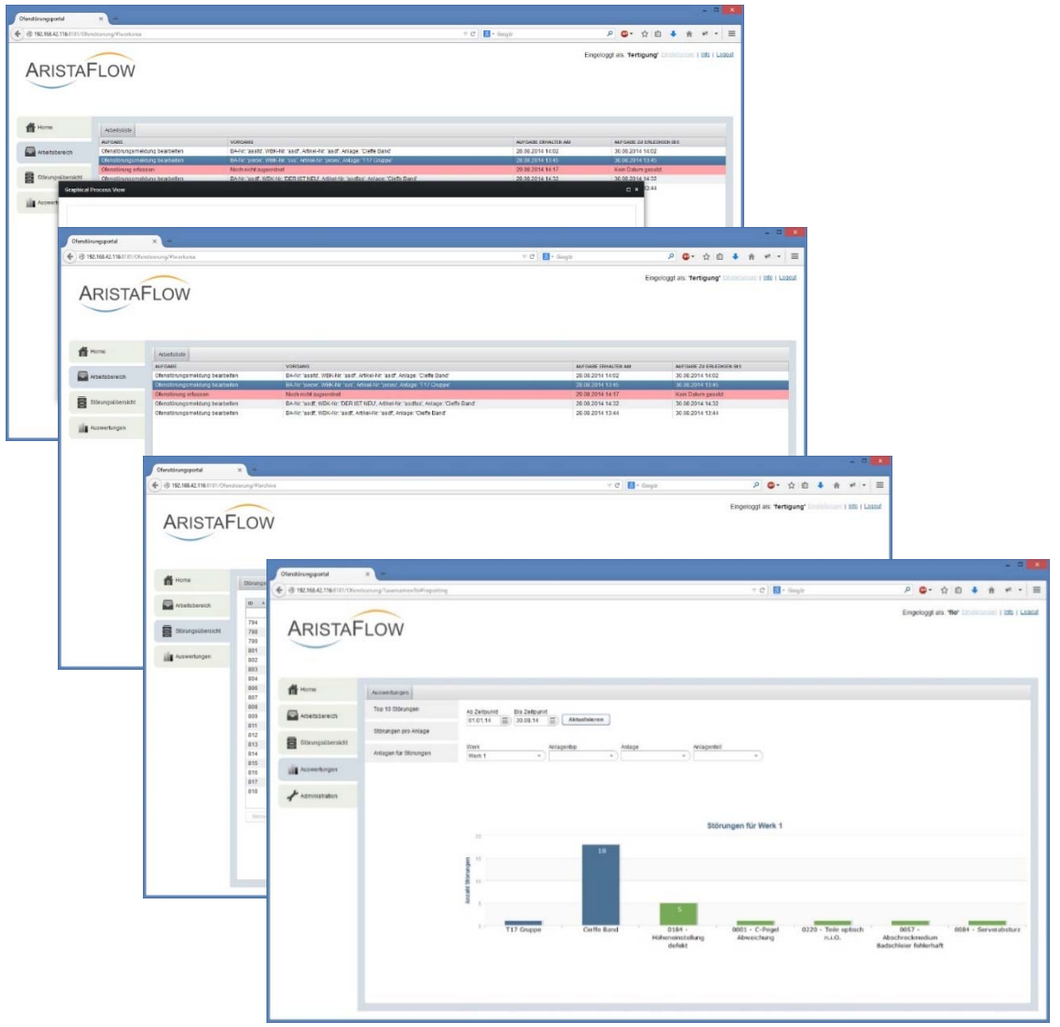
A. Wagenknecht; U. Rüppel: Improving Resource Management In Flood Response With Process Models and Web GIS. In: 16th TIEMS Conf., 2009

Advanced Applications of the AristaFlow BPM Suite

IIoT-Driven Processes for Handling Malfunctions and Breakdowns in Plants with Industrial Furnaces


Nitrating plant with industrial furnaces


Control station



Advanced Applications of the AristaFlow BPM Suite

Managing Freight Wagon / Car Management and Maintenance Processes

Advanced Applications of the AristaFlow BPM Suite

Enabling Track & Trace in Pharmaceutical Packaging

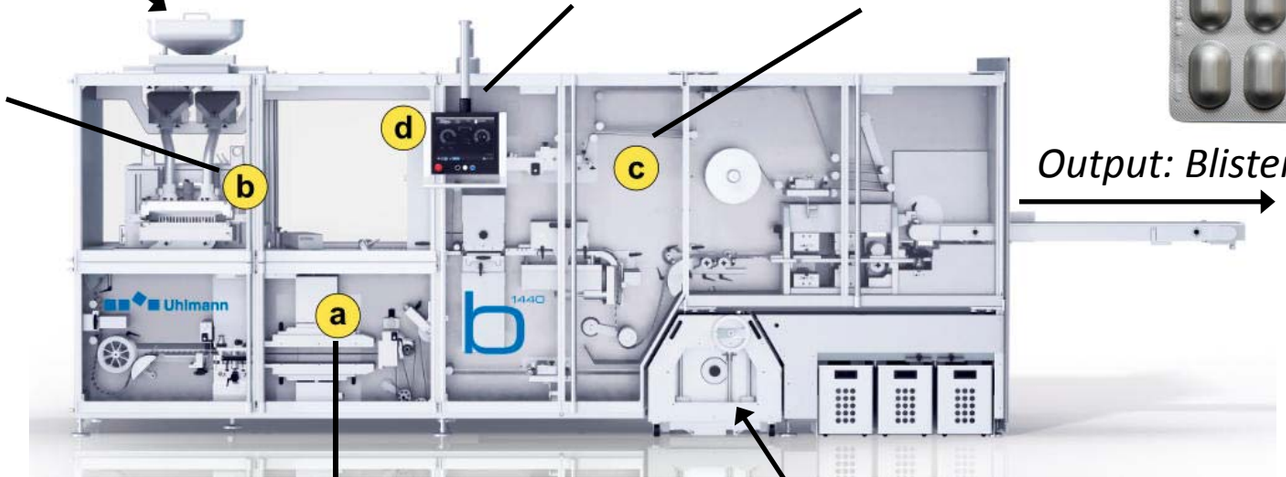
Uhlmann B1440 Blister Packaging Press Line

Input: Tablets

Touch-sensitive HMI

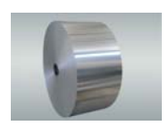
Deflection Pulley

Filling Station



Forming Station

Input: Aluminium/PVC/PC Foil



Output: Blisters

Box packing

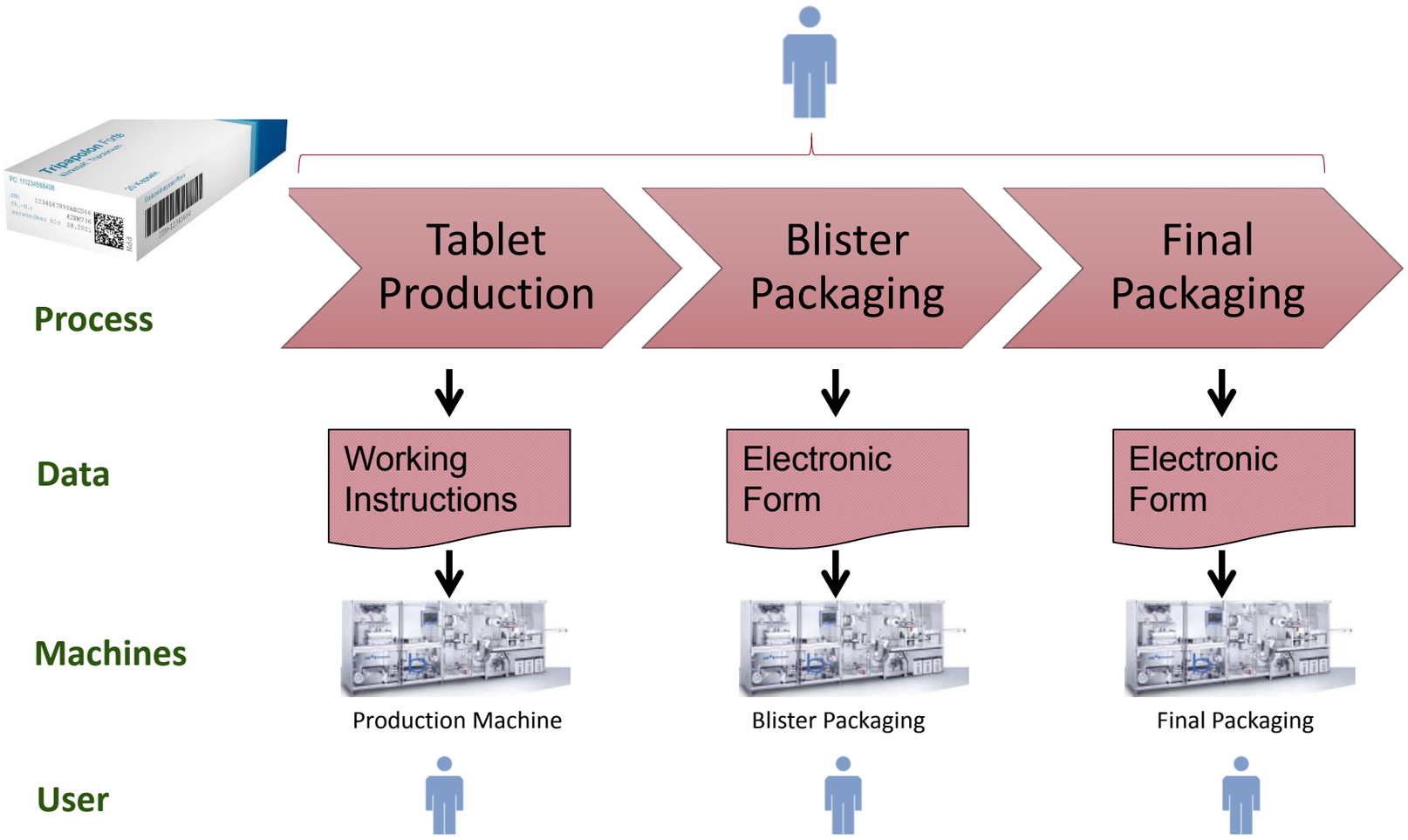
....

Carton packing

Advanced Applications of the AristaFlow BPM Suite

Enabling Track & Trace in Pharmaceutical Packaging

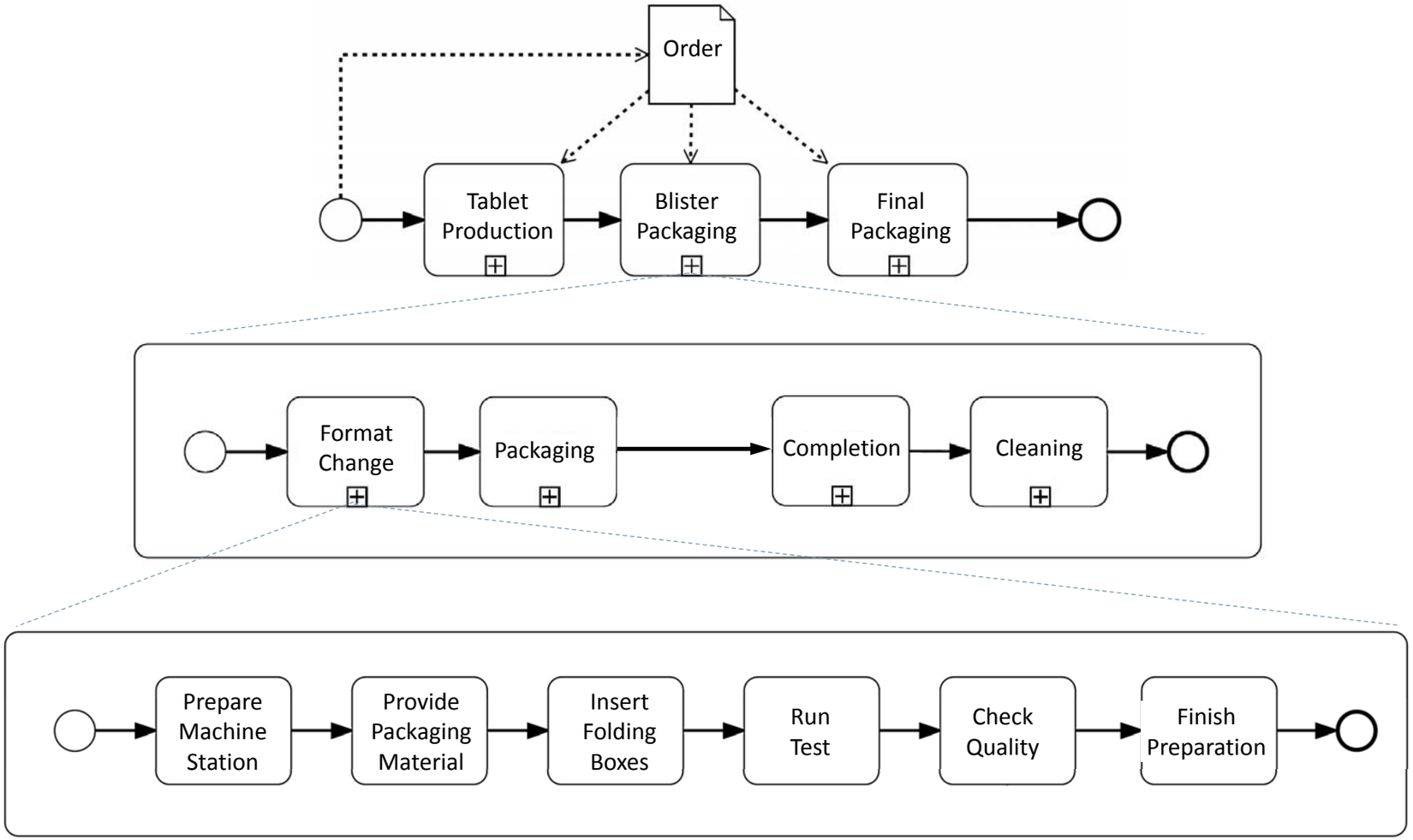
Electronic Batch Recording



Uhlmann

Advanced Applications of the AristaFlow BPM Suite

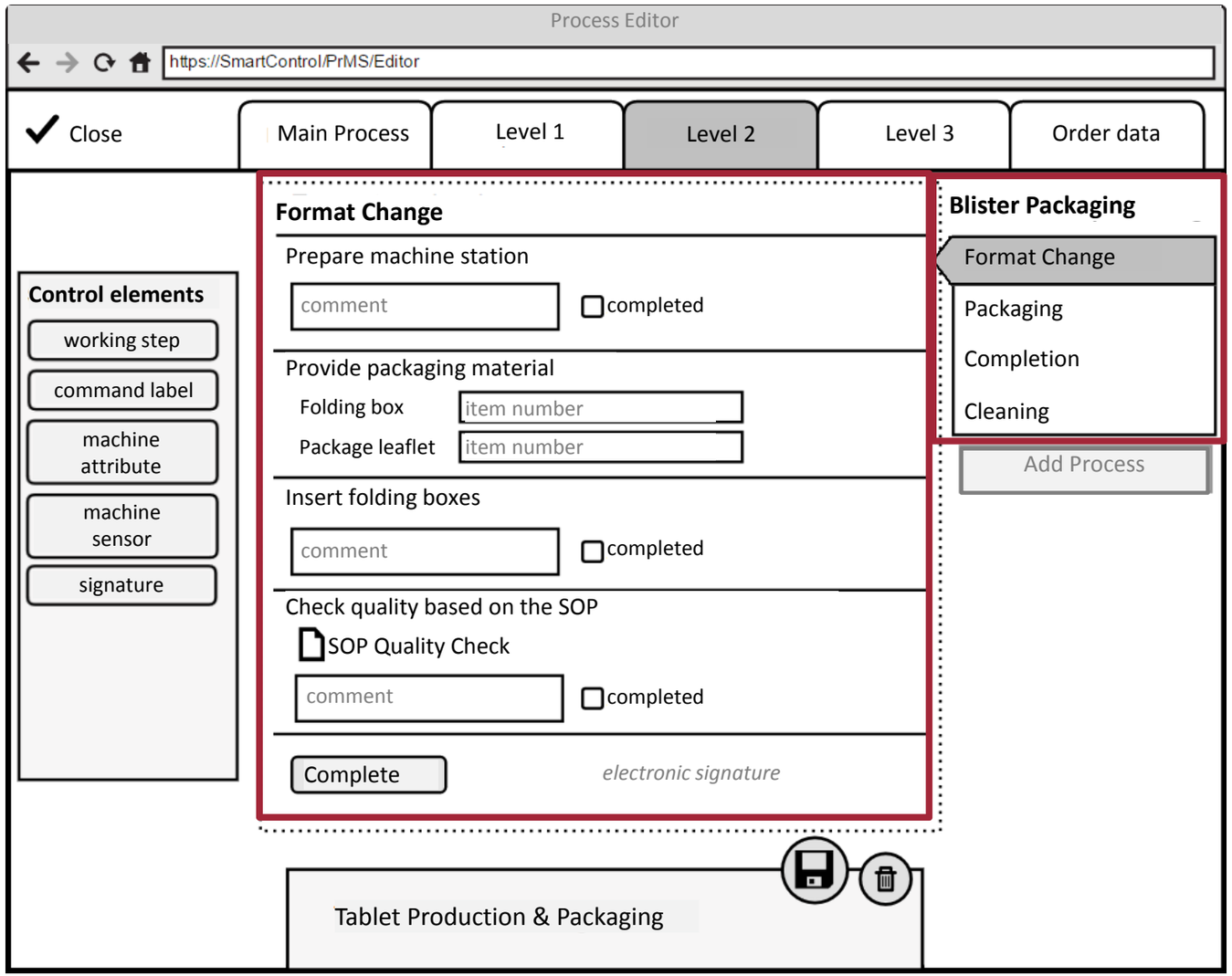
Enabling Track & Trace in Pharmaceutical Packaging

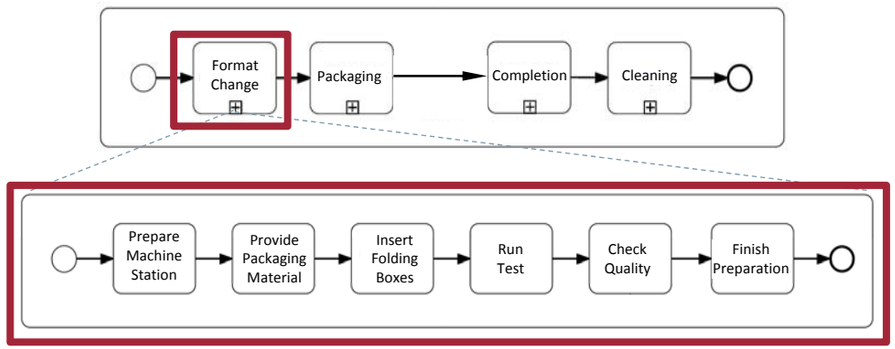


Uhlmann

Advanced Applications of the AristaFlow BPM Suite

Enabling Track & Trace in Pharmaceutical Packaging

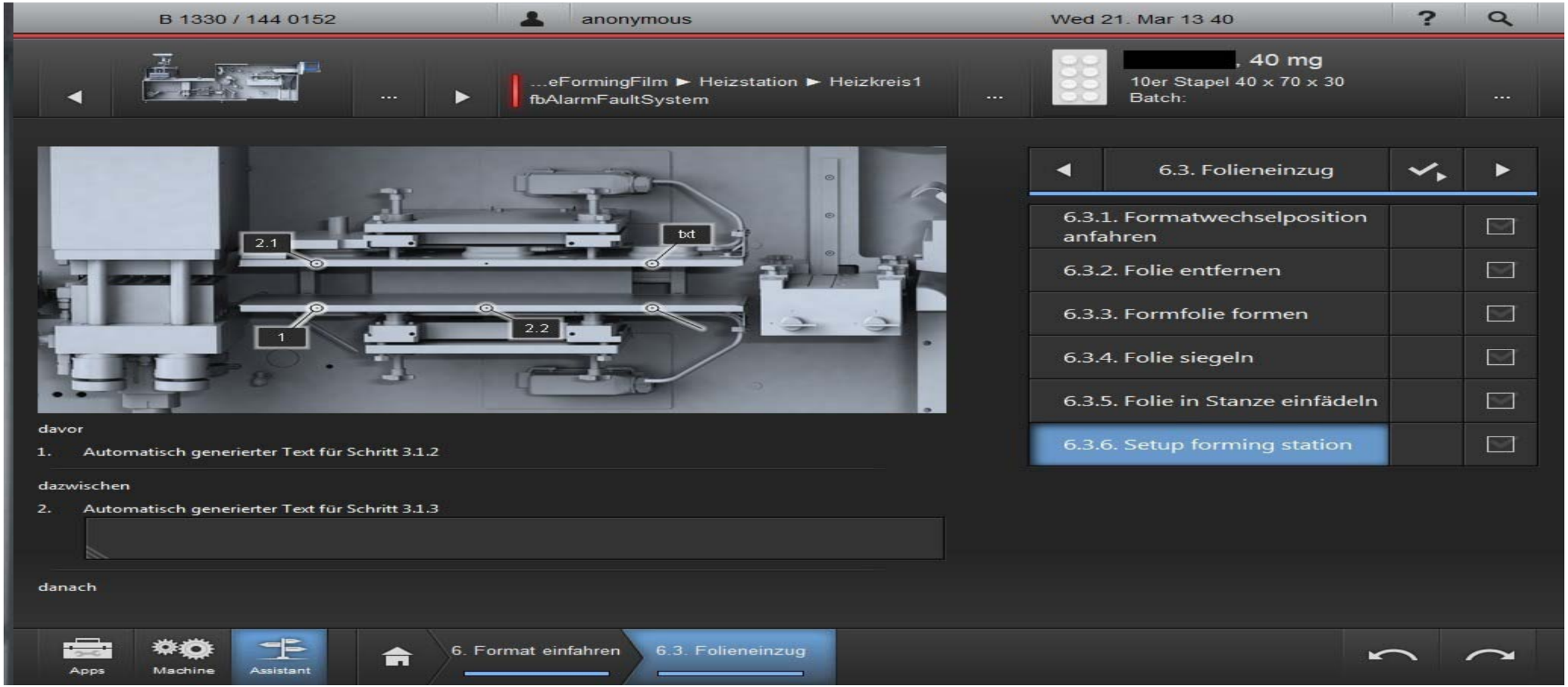




Uhlmann

Advanced Applications of the AristaFlow BPM Suite

Enabling Track & Track in Pharmaceutical Packaging

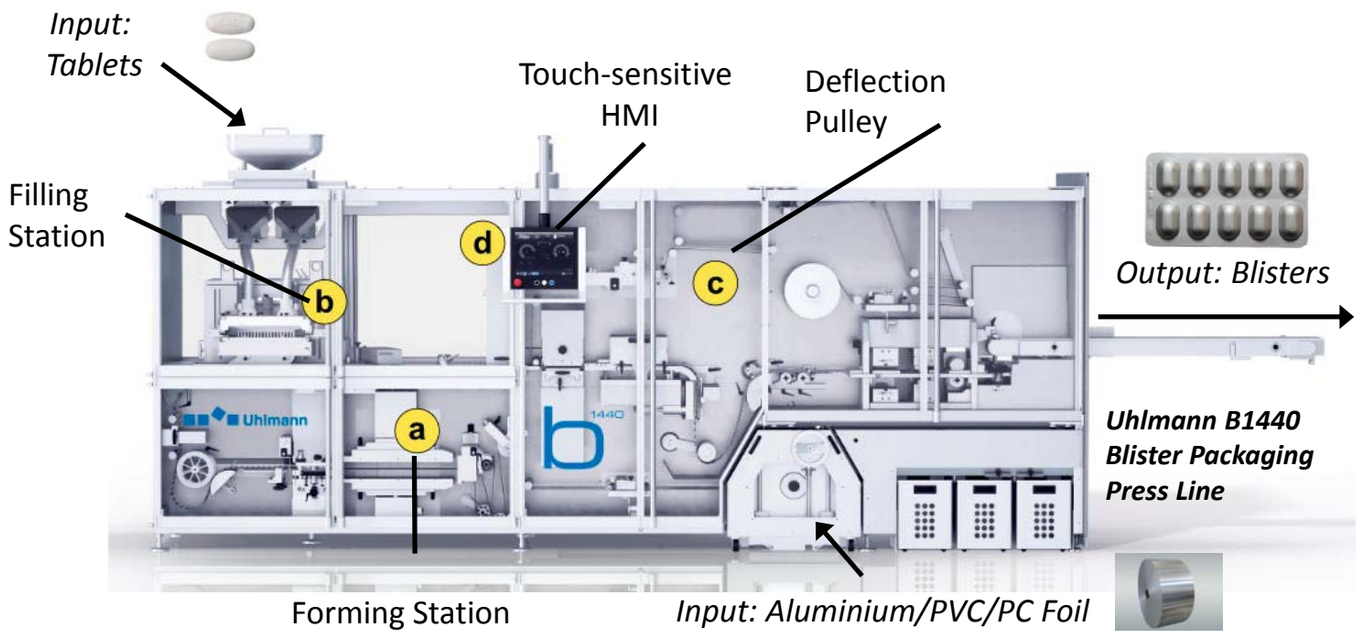


Advanced Applications of the AristaFlow BPM Suite

Smart Process Guidance with AristaFlow BPM Suite

Advanced Applications of the AristaFlow BPM Suite

Smart Process Guidance with AristaFlow BPM Suite



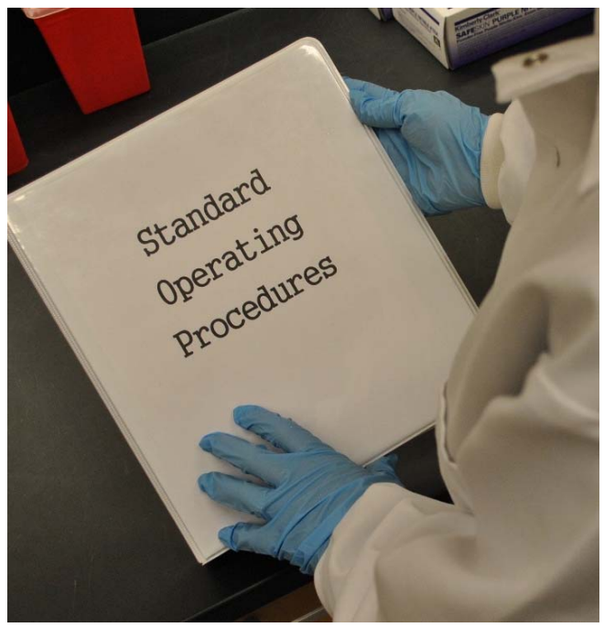
Maintenance & Service Processes:

- Triggered through events, e.g., *timer*, *errors* or *wear indicators*
- Hundreds of tasks to be executed, e.g.
  - Cleaning
  - Replacing Spare Parts
  - Adjusting configuration settings

- For each task, a specific handbook and/or checklist exists
- High process variability due to varying assemblies of press lines

Advanced Applications of the AristaFlow BPM Suite

Smart Process Guidance with AristaFlow BPM Suite



Smart Process Guidance

Target groups:

- Machine Operator
- Production Staff
- Maintenance Staff
- Service Technicans
- Quality Management

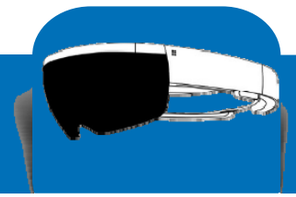
- Error-prone
- Inefficient and time consumable
- Not available for everyone
- Complicated

- Digital process management and guidance with Augmented Reality

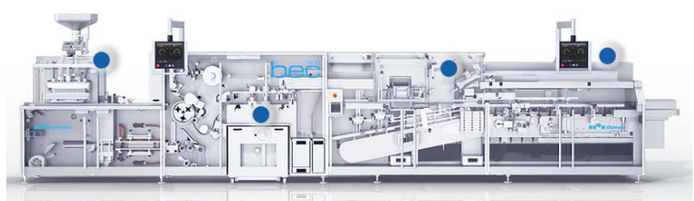
Advanced Applications of the AristaFlow BPM Suite

Smart Process Guidance with AristaFlow BPM Suite

KALUNA AR Client



- Interactive process execution on HoloLens
- Supports manual human tasks with augmented view
- Shows assets, task descriptions, SOP definitions



KALUNA Modeler

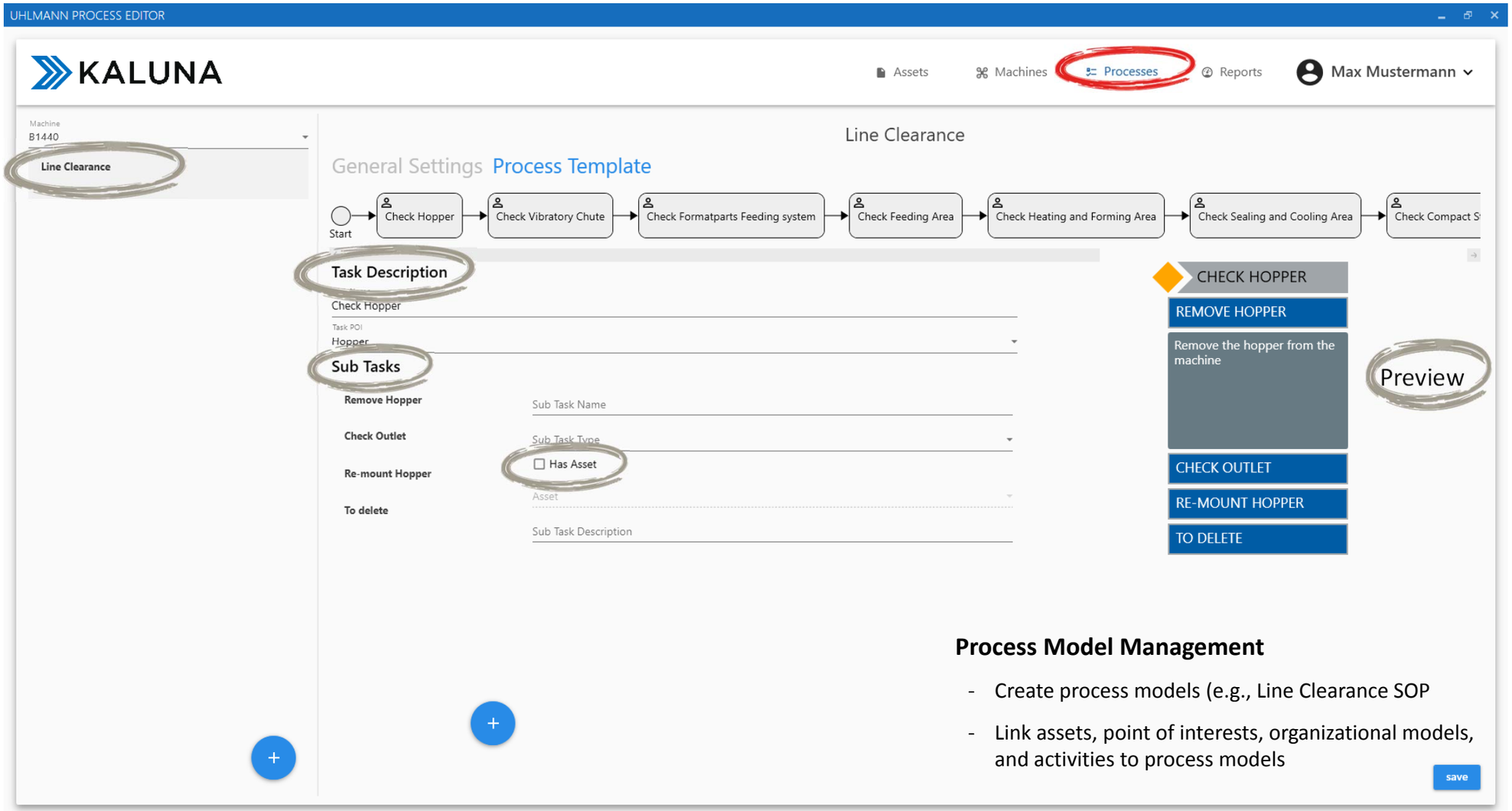
- Dynamic & interactive Process/SOP Modelling
- Machine and Point of Interest Setup
- Asset Management & Assignment
- User and Task Reporting

KALUNA Platform

AristaFlow process engine with modular execution environment

Advanced Applications of the AristaFlow BPM Suite

Smart Process Guidance with AristaFlow BPM Suite: KALUNA Modeler

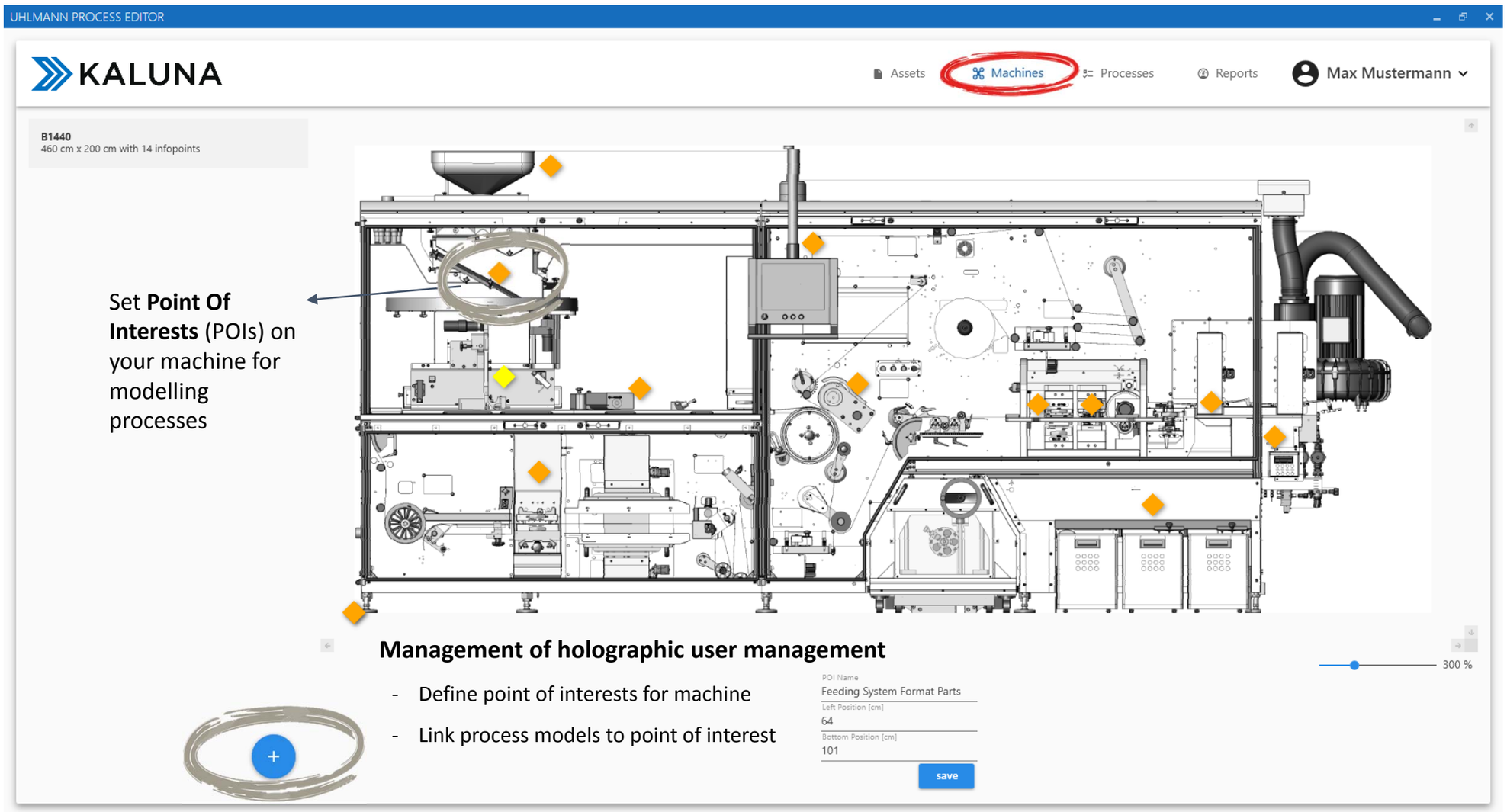


Process Model Management

- Create process models (e.g., Line Clearance SOP
- Link assets, point of interests, organizational models, and activities to process models

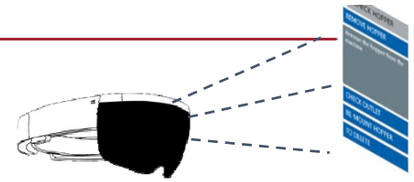
Advanced Applications of the AristaFlow BPM Suite

Smart Process Guidance with AristaFlow BPM Suite: KALUNA Modeler

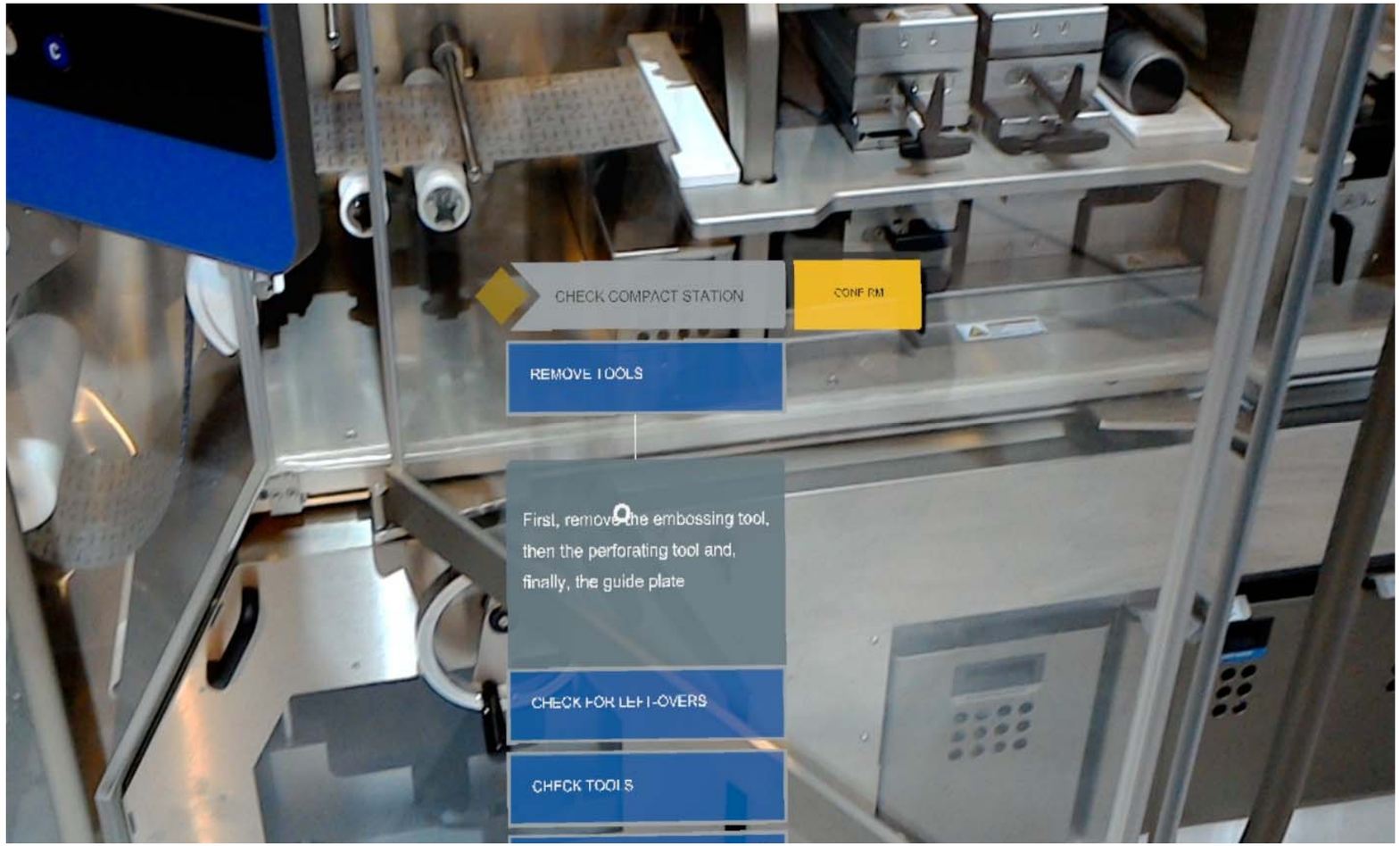


Advanced Applications of the AristaFlow BPM Suite

Smart Process Guidance with AristaFlow BPM Suite: KALUNA AR Client



- Enriches the user's view of the physical environment with virtual objects (e.g. checklists, videos).
- Process-oriented assistance supporting human tasks with an augmented view:
  - Digitalized Checklists
  - Task guidance
  - Displaying task-related assets (e.g. videos, SOPs)
  - Full traceability



Advanced Applications of the AristaFlow BPM Suite

Smart Process Guidance with AristaFlow BPM Suite: KALUNA AR Client

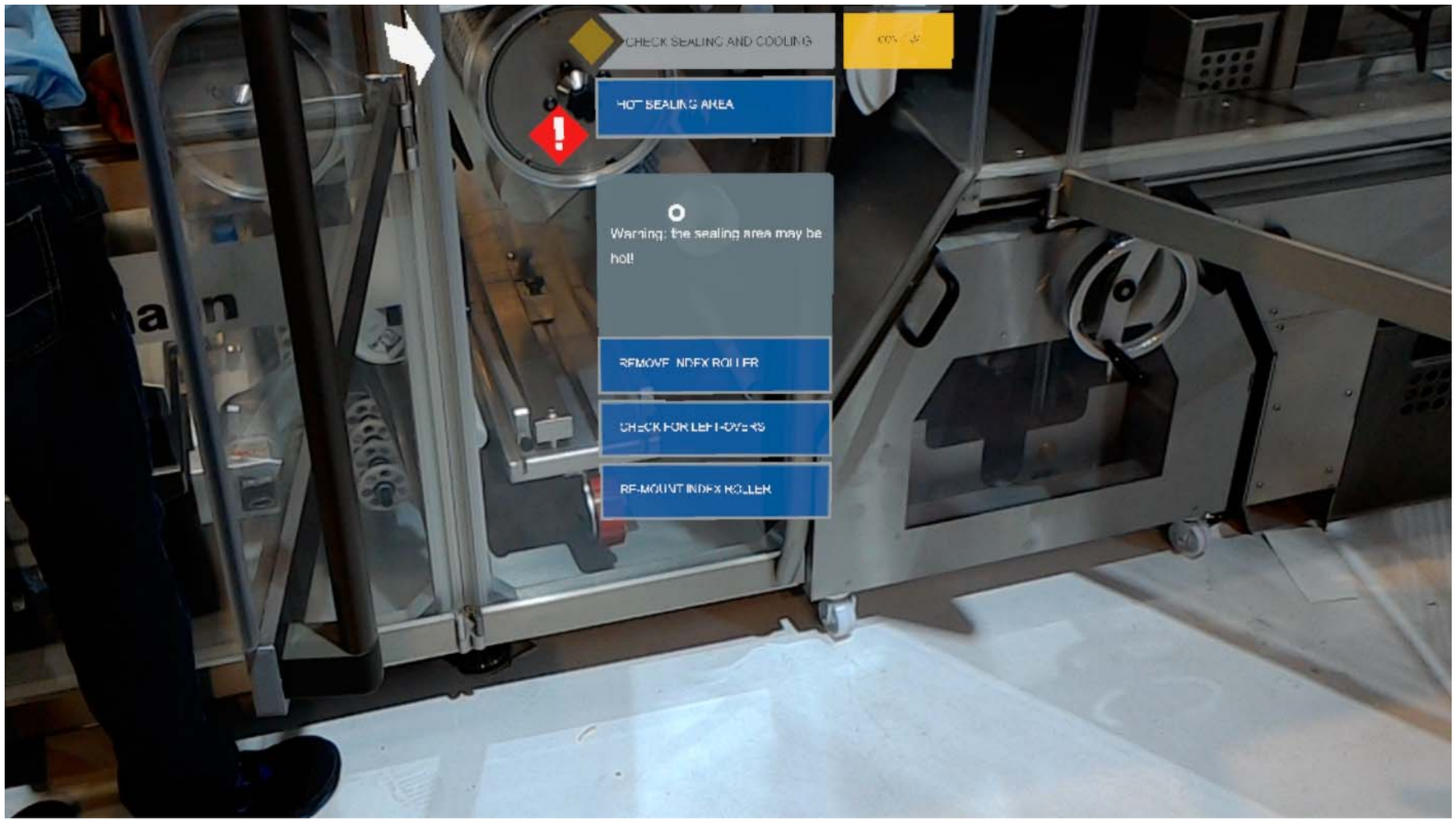
Advanced Applications of the AristaFlow BPM Suite

Smart Process Guidance with AristaFlow BPM Suite: KALUNA AR Client

Lab

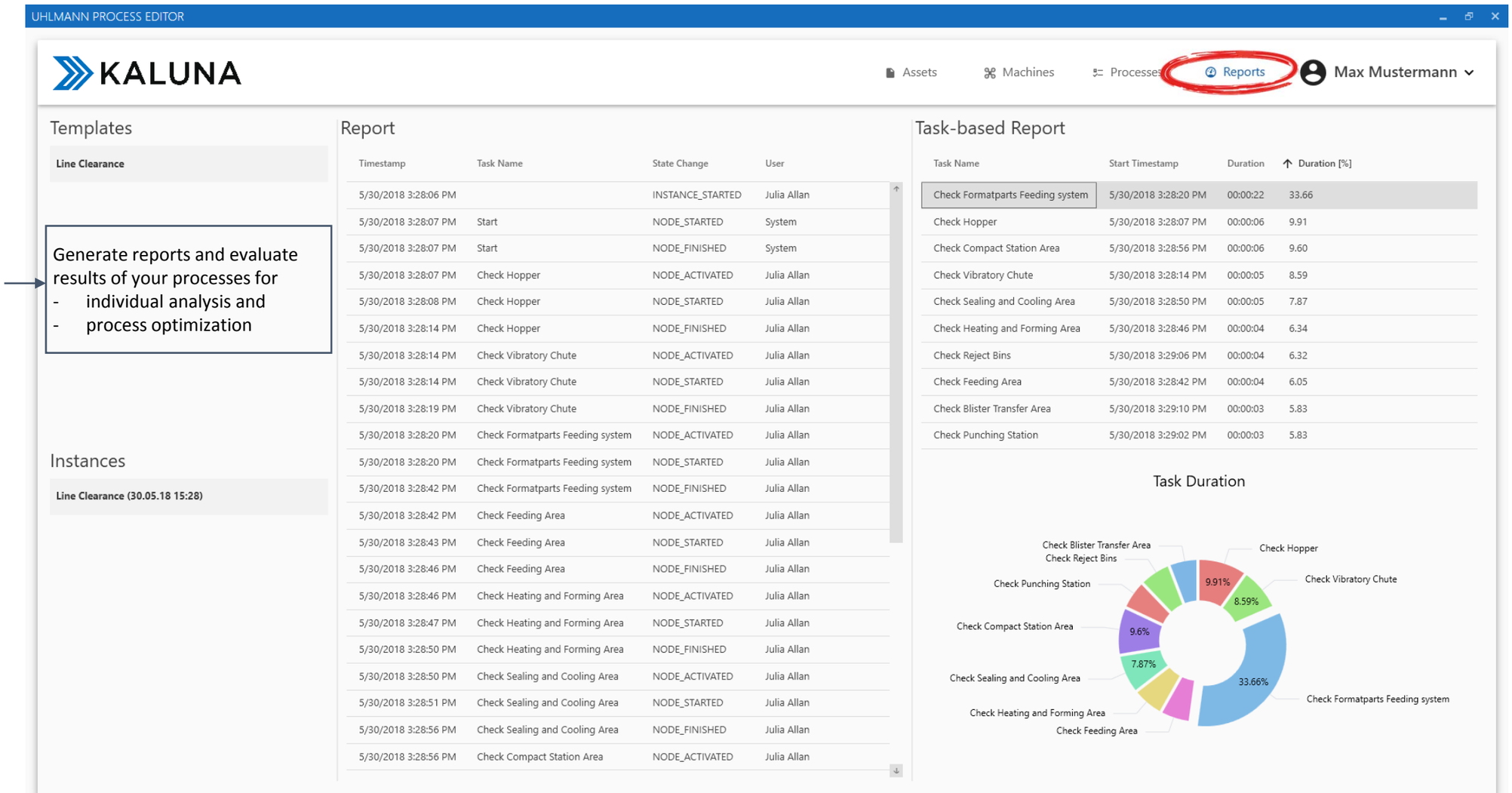
Advanced Applications of the AristaFlow BPM Suite

Smart Process Guidance with AristaFlow BPM Suite: KALUNA AR Client



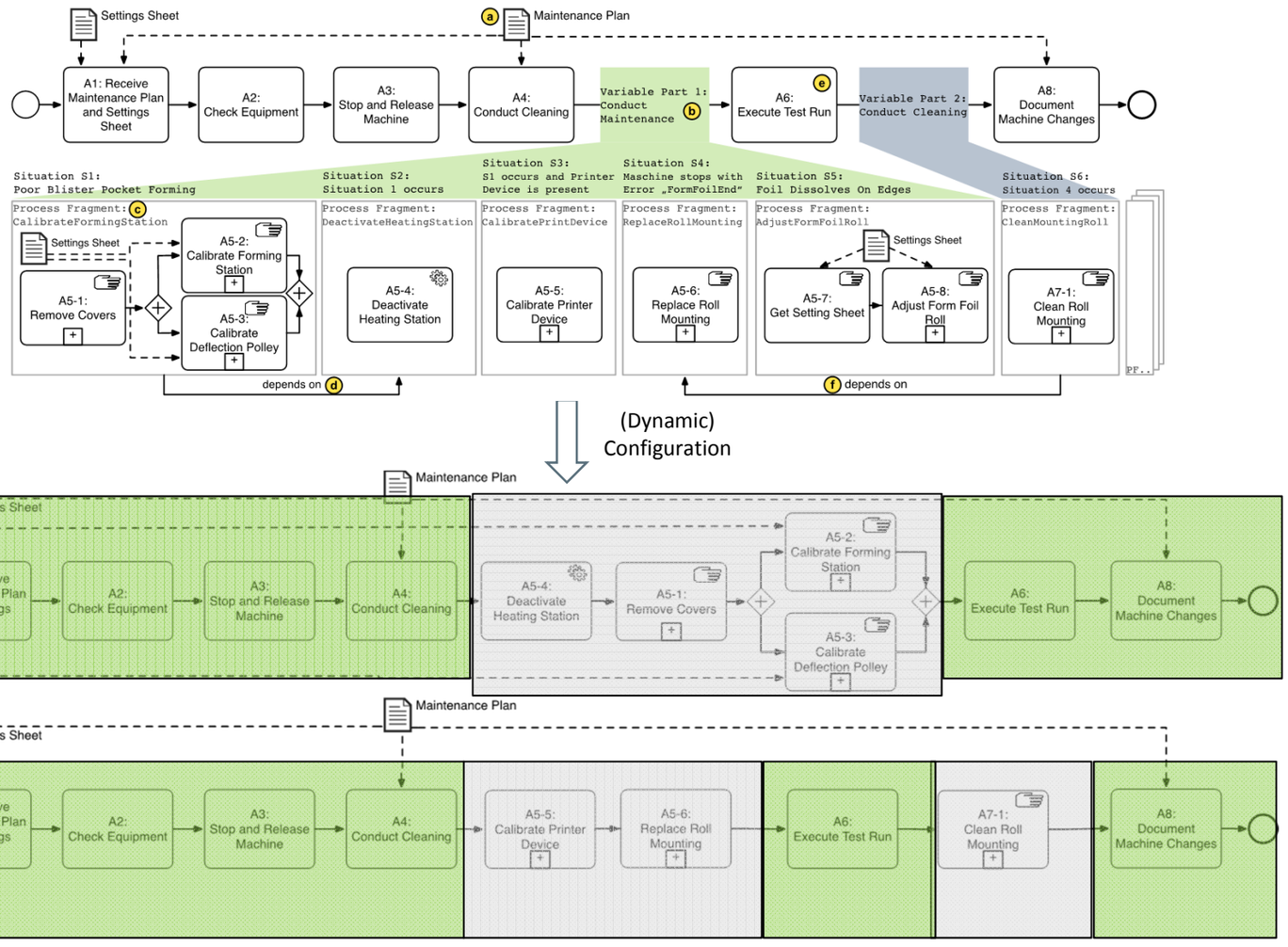
Advanced Applications of the AristaFlow BPM Suite

Smart Process Guidance with AristaFlow BPM Suite: KALUNA Reports



Advanced Applications of the AristaFlow BPM Suite

Smart Process Guidance with AristaFlow BPM Suite: Process Variability



Case Study
Maintenance Processes of a Press Line

Requirements & Challenges:

High process variability requires context-dependent process configurations!

Context is determined by both static factors (e.g. press line variant) and dynamic elements (e.g., machine status, sensor data).

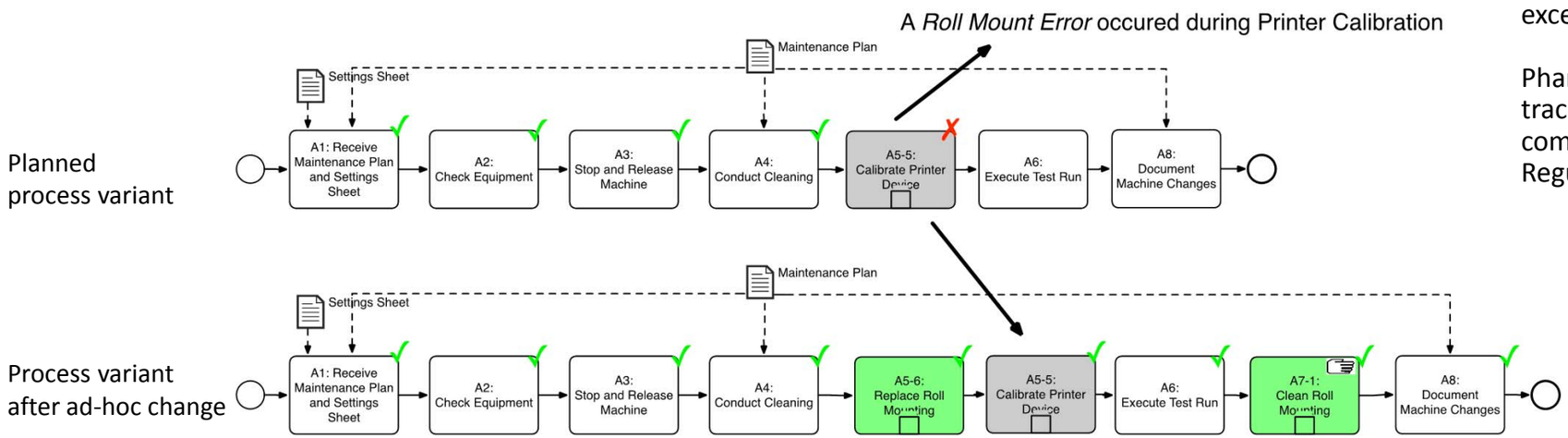
Process guidance with AR needs to be context-driven!

Common parts

Variable parts

Advanced Applications of the AristaFlow BPM Suite

Smart Process Guidance with AristaFlow BPM Suite: Runtime Process Adaptation



Case Study
Maintenance Process of a Press Line

Requirments & Challenges:

Robust and flexible execution of maintenance processes!

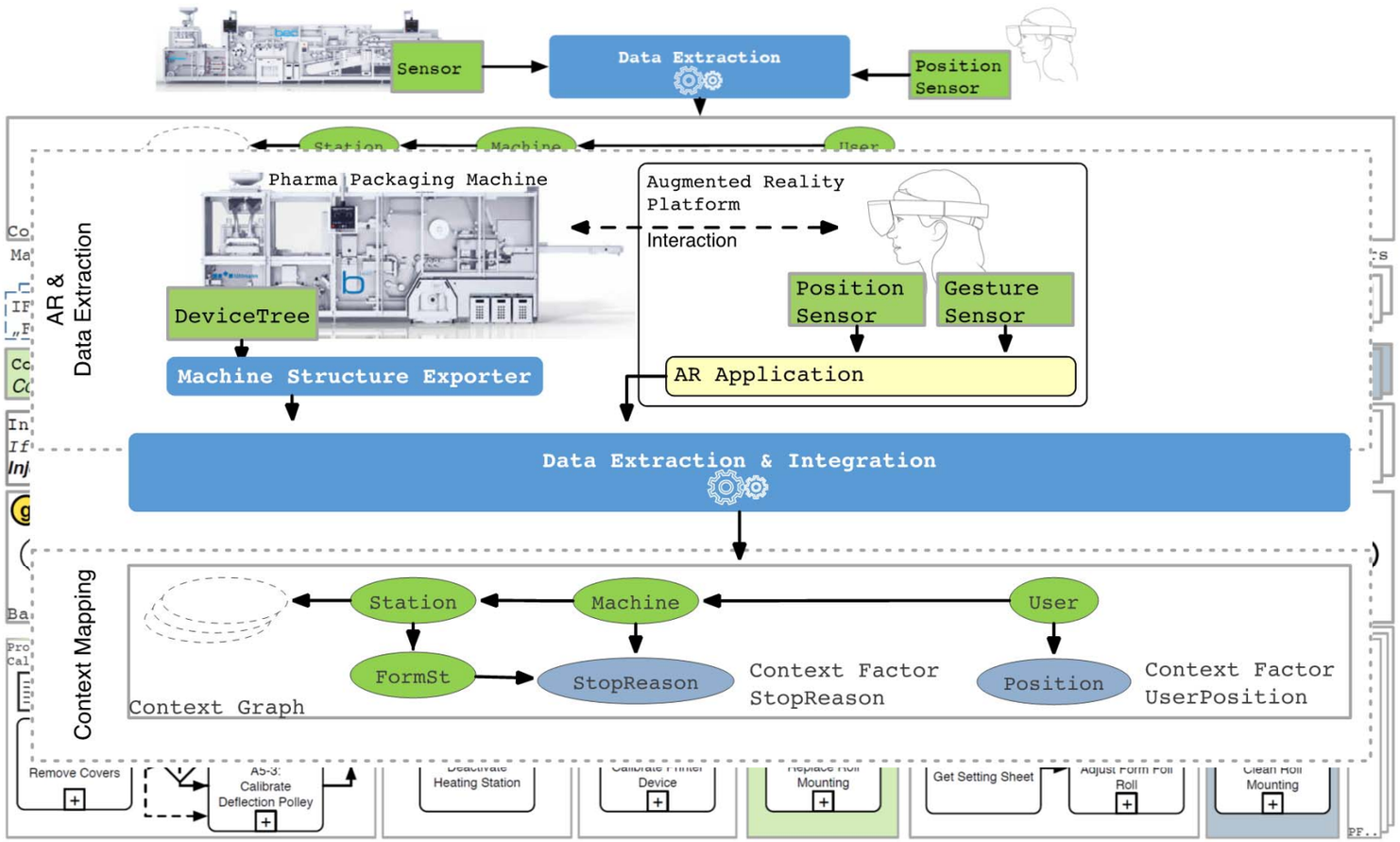
Enabling ad-hoc changes to handle exceptions and errors.

Pharmaceutical packaging requires full traceability of any process change to comply with Title 21 Code of Federal Regulations (CFR) Part 11

US Food and Drug Administration,"Title 21 Code of Federal Regulations (21 CFR Part 11): Electronic Records, Electronic Signatures"

Advanced Applications of the AristaFlow BPM Suite

Smart Process Guidance with AristaFlow BPM Suite: Context Modeling, Assessment and Adaptation



Case Study
Maintenance Process of a Press Line

Requirements & Challenges:

Determine contextual situation (CS) from the current context model

Example of a CS: Occurence of production error `FormFoilEnd` (e)

Relevant CS should be describable and assessable (b - e)

Requires sensor data integration

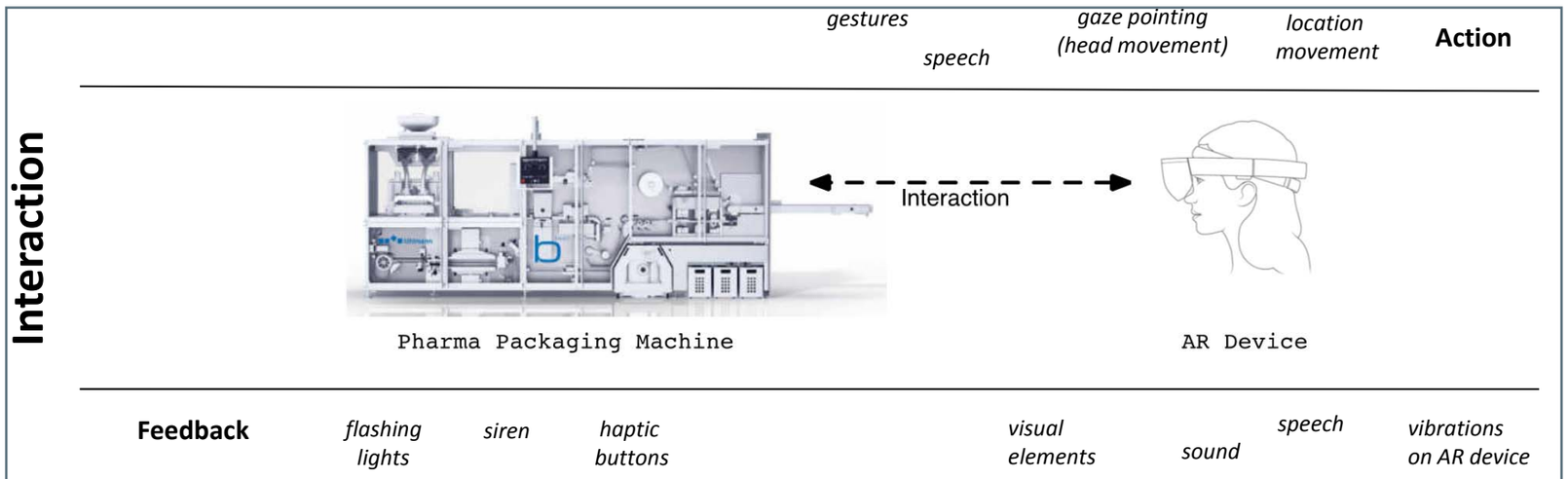
Core concept: **Context-aware Process Injection** ⇨ Injection specifications (f) control changes of running process instances (h) based on evaluated CS

N. Mundbrod, G. Grambow, J. Kolb, M. Reichert (2015) *Context-Aware Process Injection: Enhancing Process Flexibility by Late Extension of Process Instances.* In: CoopIS 2015, LNCS 9415, pp. 127-145.

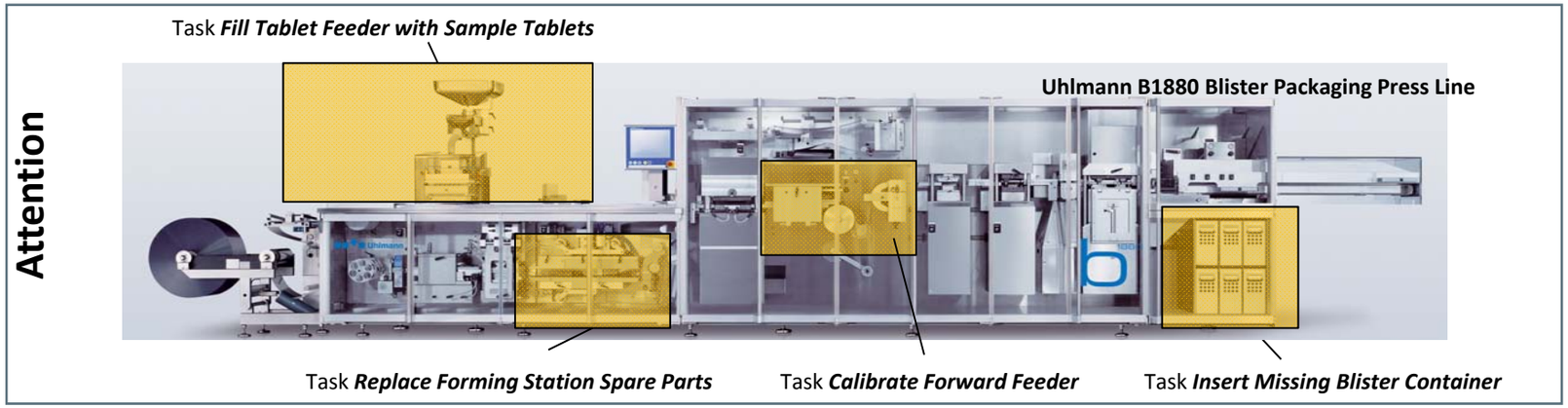
Advanced Applications of the AristaFlow BPM Suite

Smart Process Guidance with AristaFlow BPM Suite: Interaction, Attention, Mapping

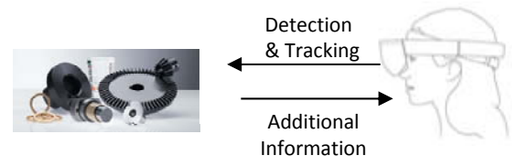
Interaction



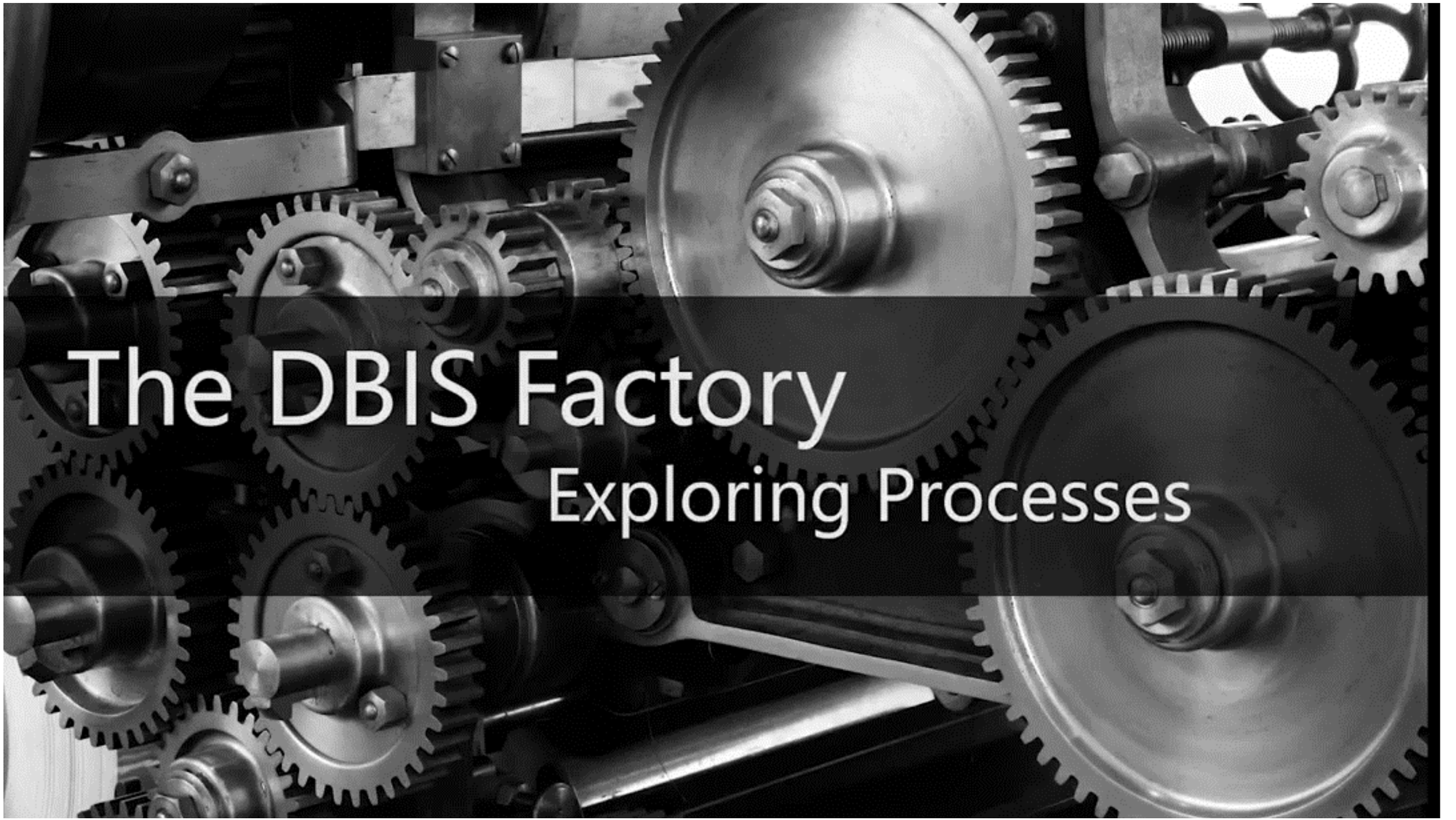
Attention



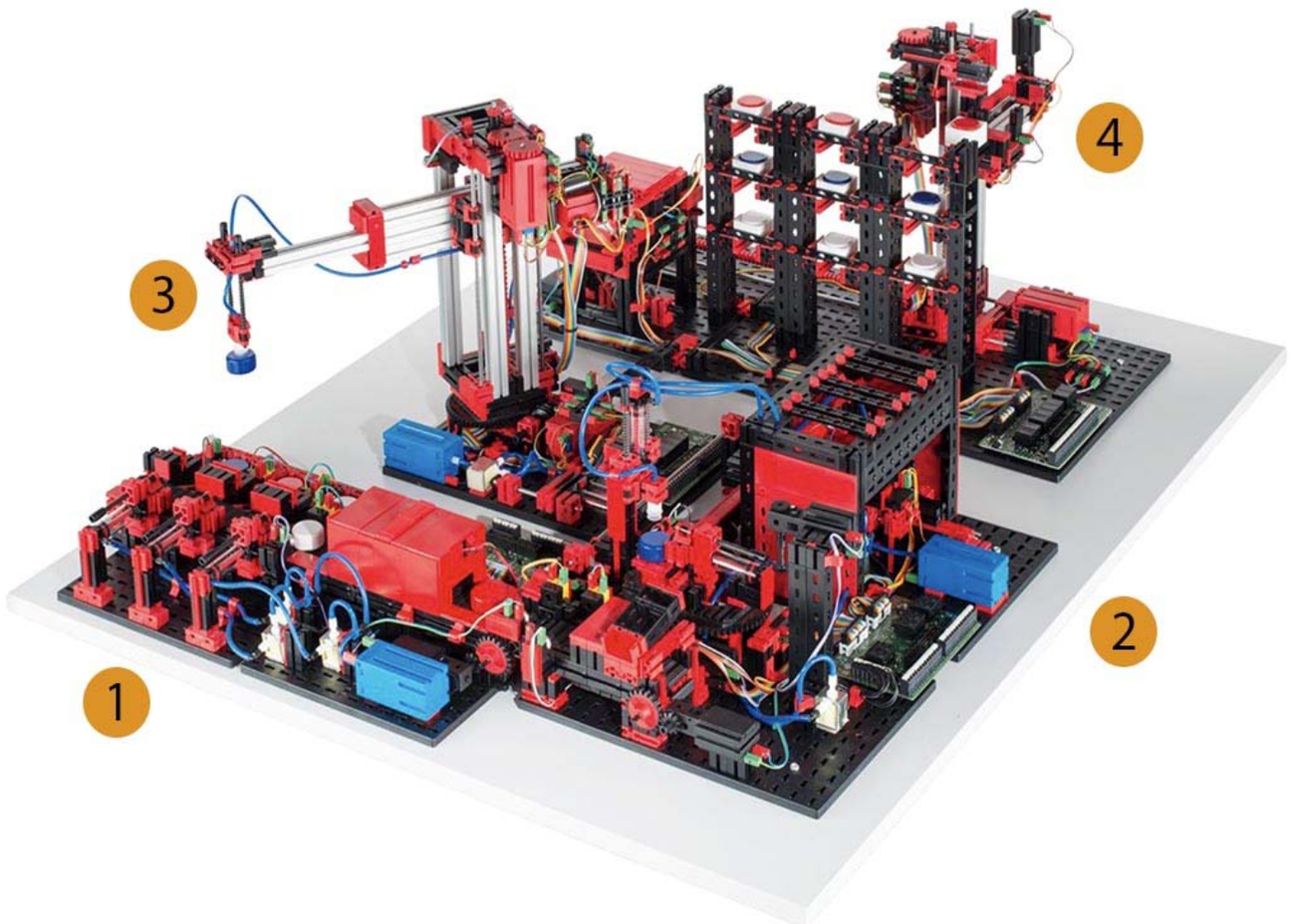
Mapping

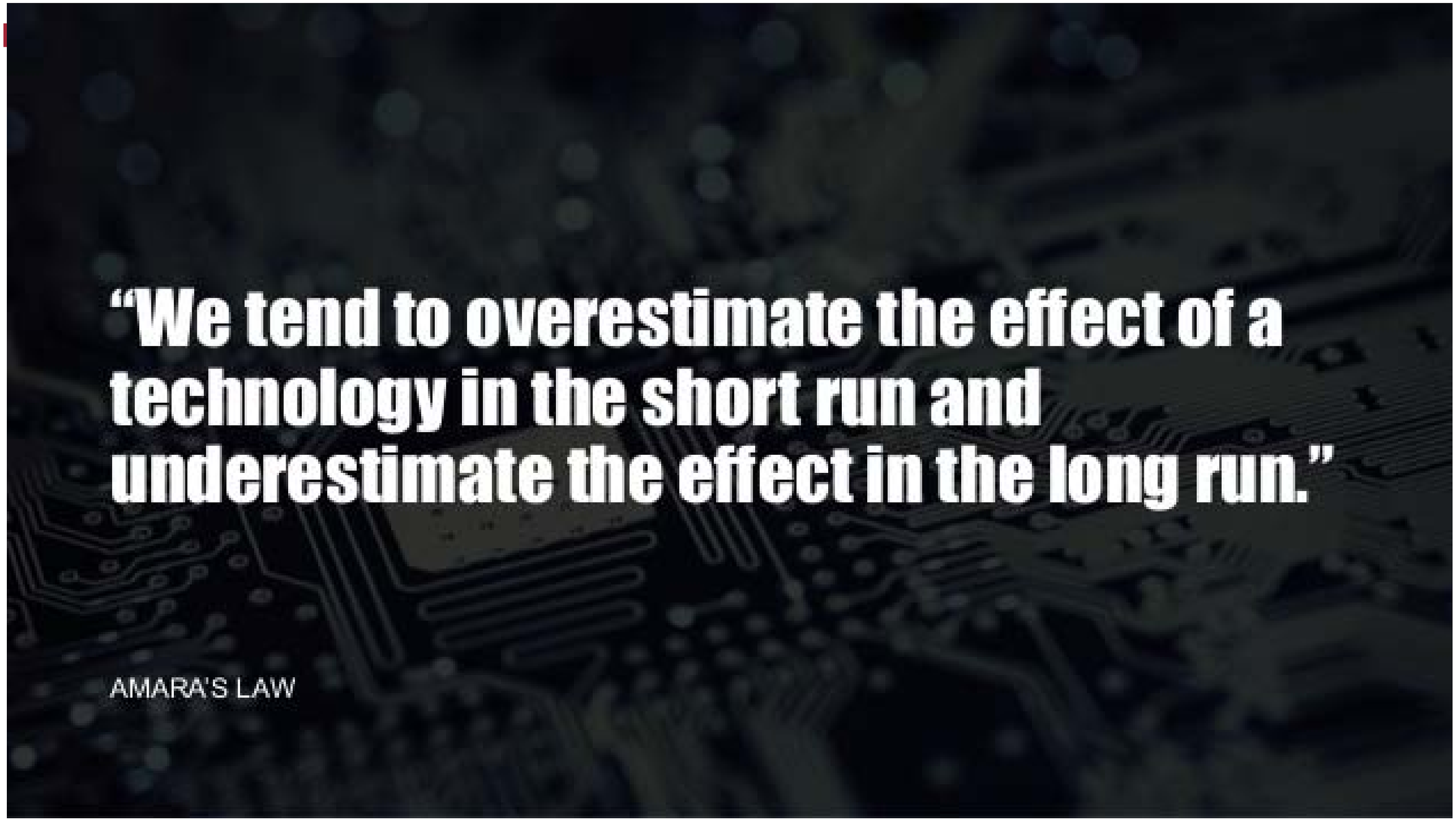


- Mapping physical objects (i.e. machine parts) to virtual counterparts from the context graph
- Enables AR device to present the additional digial information in an AR view or to automatically change configuration settings of a machine to fit the currently built-in format part
- Shall enable precise interactions and proper attention guidance
- Marker-based (e.g., QR code) vs. markerless object detection & tracking


The DBIS Factory
Exploring Processes

The DBIS Factory – Exploring Cyber-Physical Processes in the Lab




“We tend to overestimate the effect of a technology in the short run and underestimate the effect in the long run.”
AMARA’S LAW

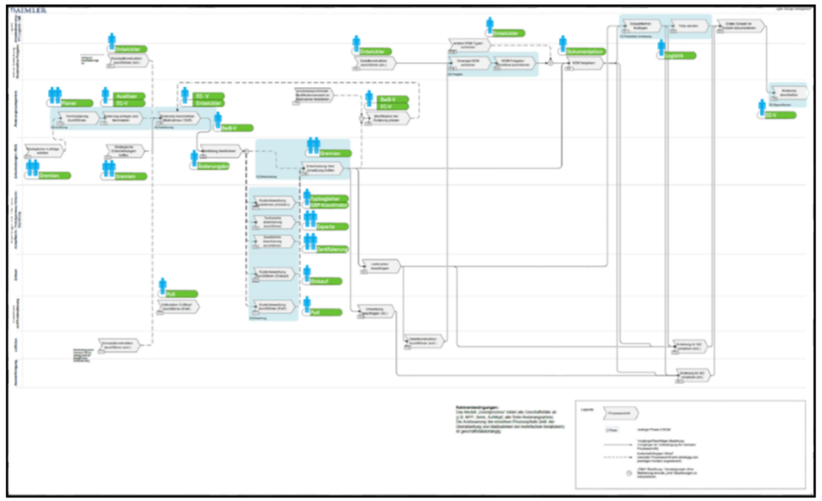
Large Process Structures & Process Coordination

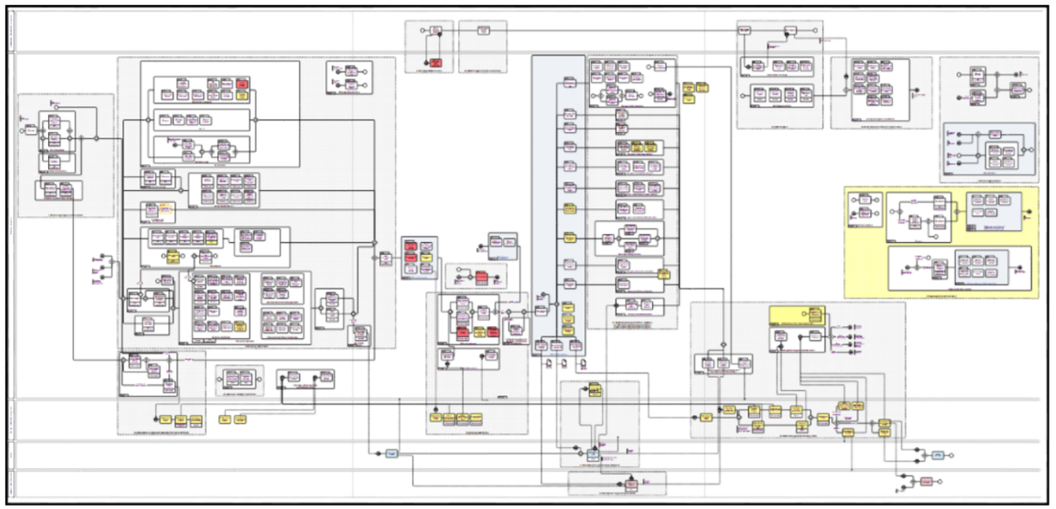
Large Process Structures & Process Coordination

The Current Situation in many Companies

Business Level

Model created by domain expert



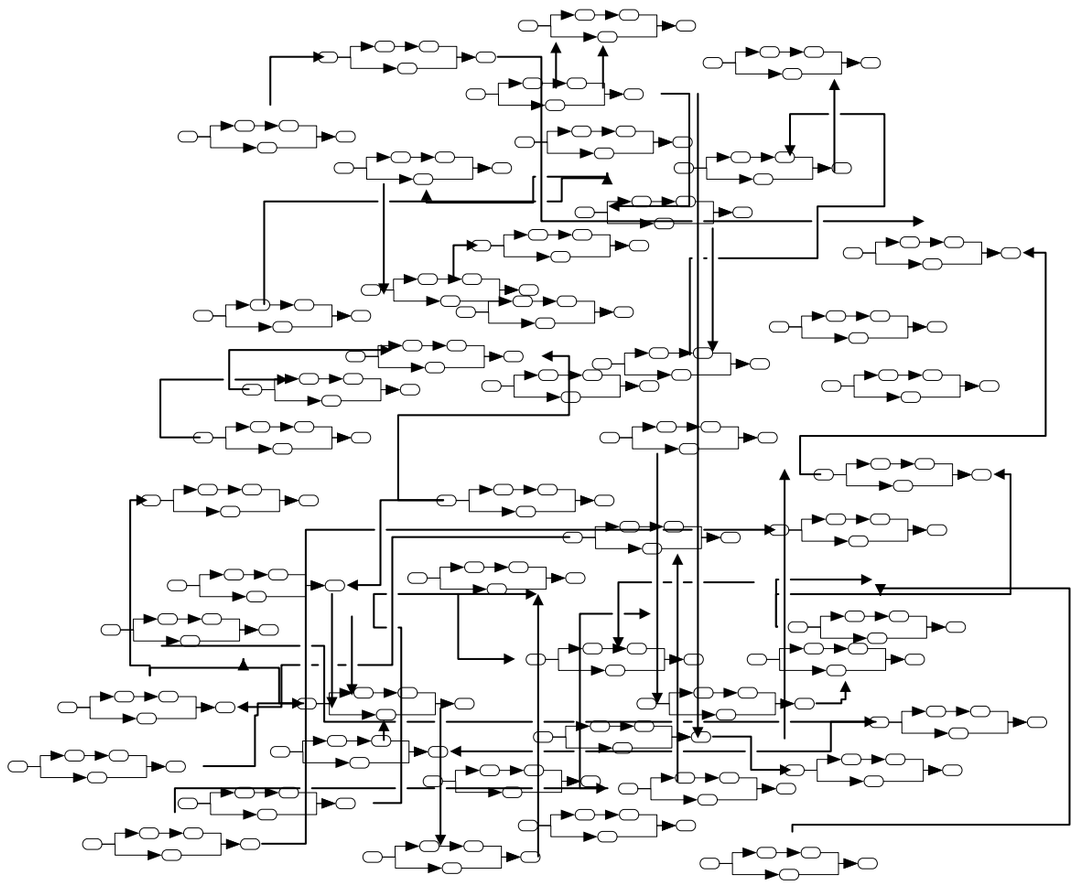


Model created by IT expert

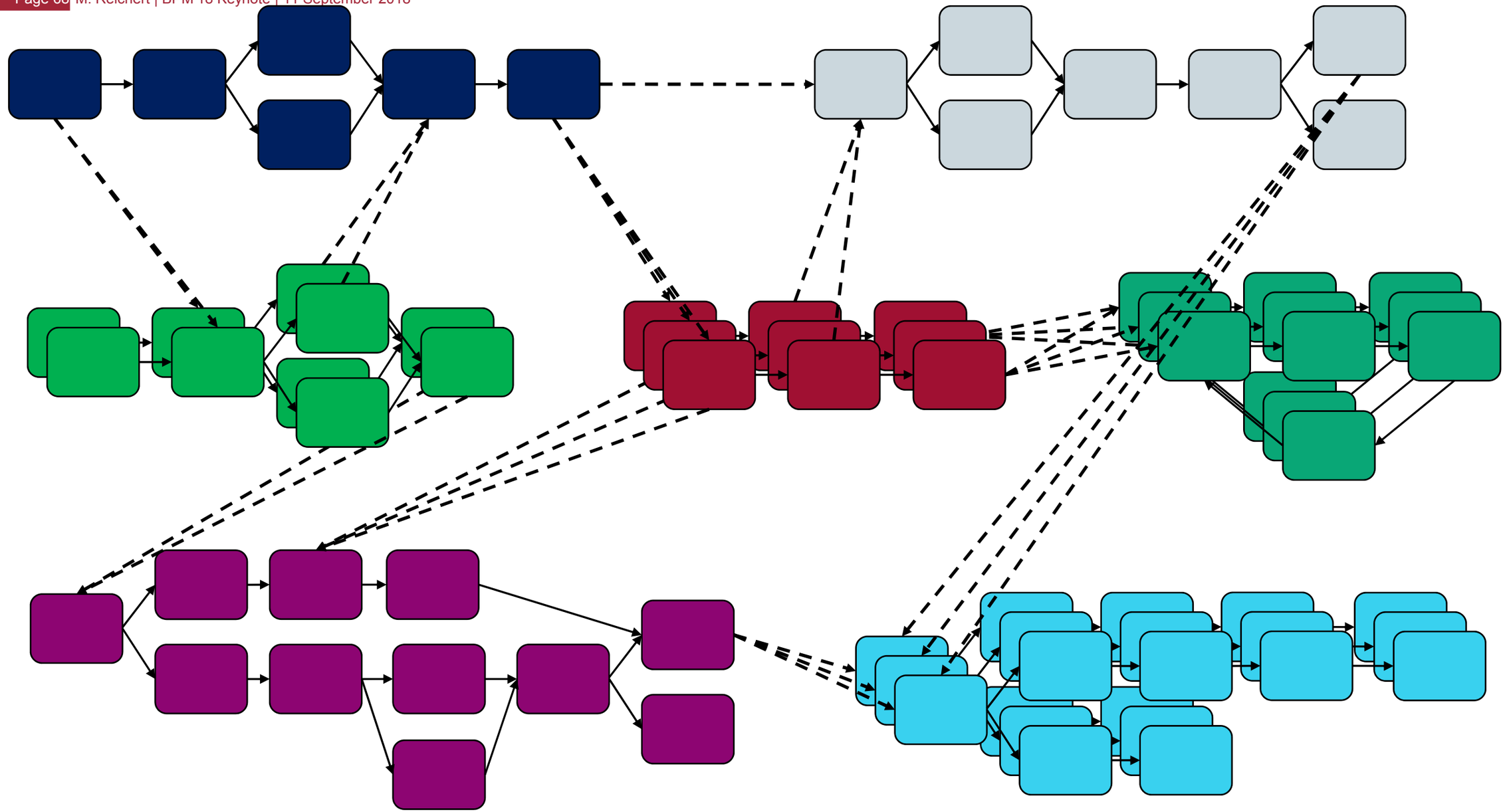
IT Level

Large Process Structures & Process Coordination

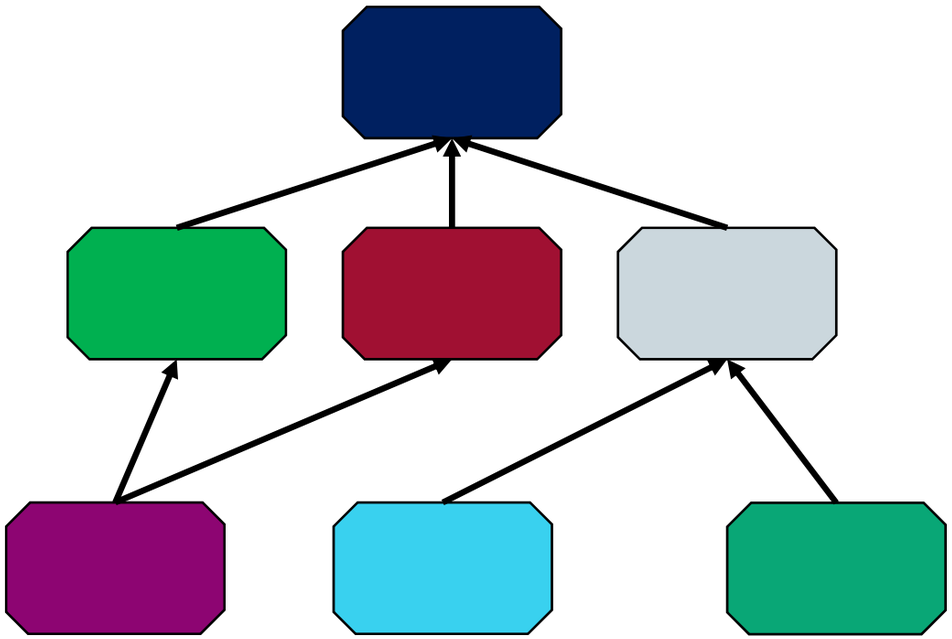
Challenge: Coordinate Execution of Multiple Interrelated Small Processes



D. Müller, M. Reichert, J. Herbst: A New Paradigm for the Enactment and Dynamic Adaptation of Data-Driven Process Structures. CAiSE 2008: 48-63

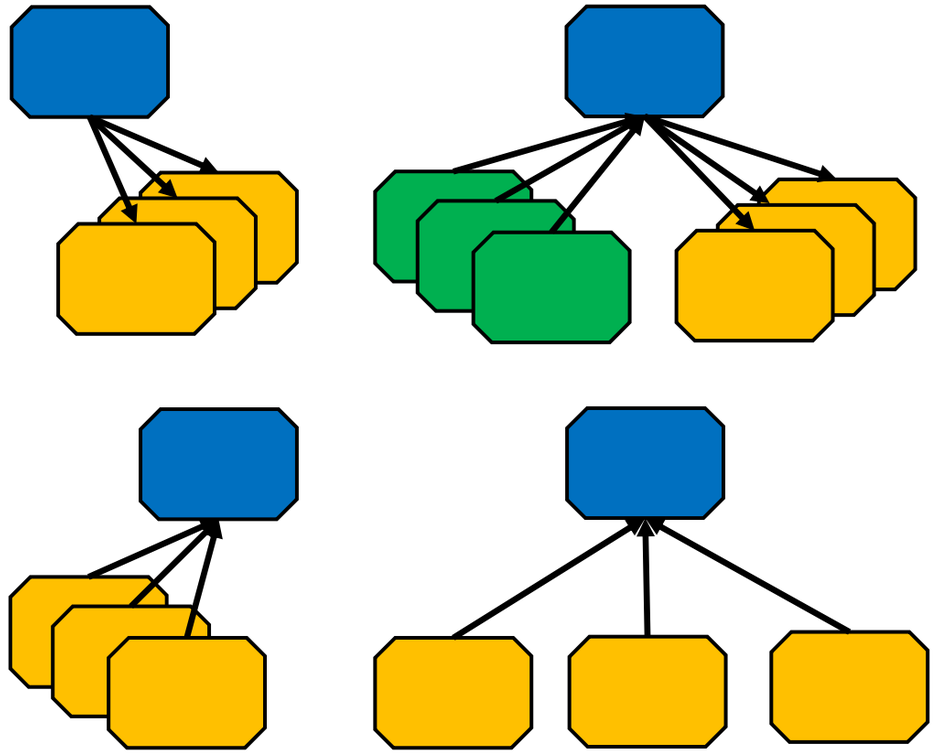


Relational Process Structure



- Captures process types and their structural relations

Semantic Relationships

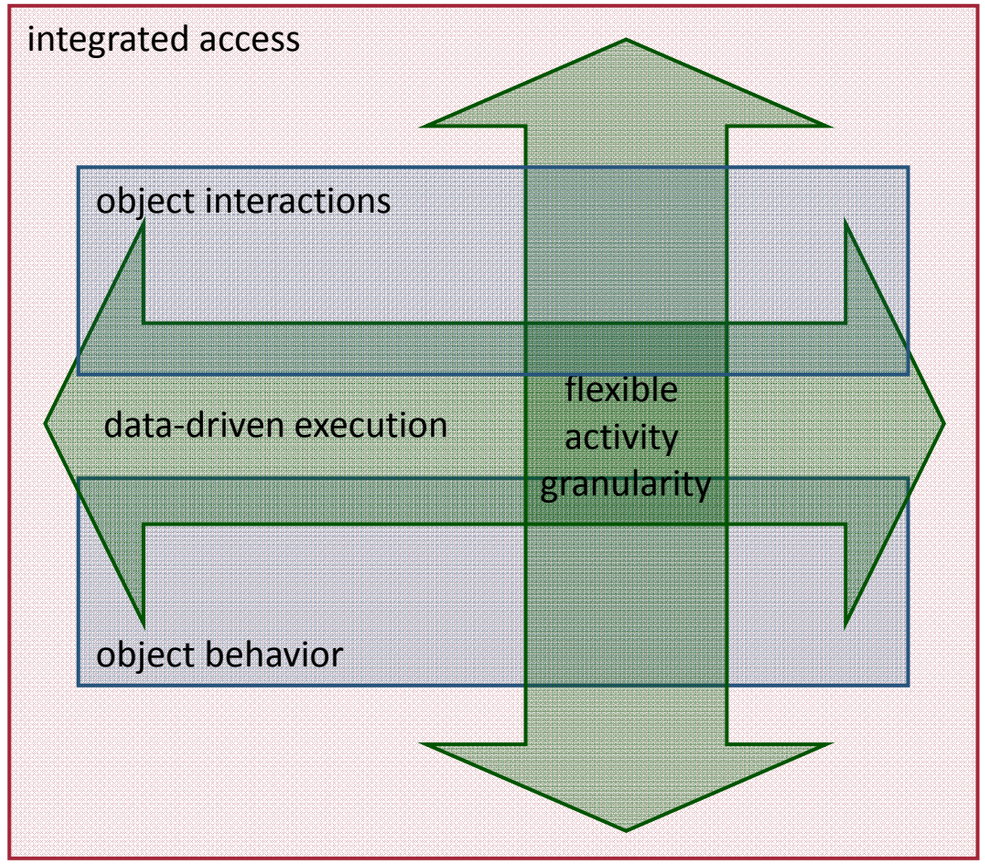


- Describes inherent patterns in the coordination of processes

Steinau S., Andrews K., Reichert M., The Relational Process Structure. In: Krogstie J., Reijers H. (eds) Advanced Information Systems Engineering. CAiSE 2018. LNCS vol 10816. Springer, Cham
Steinau S., Künzle V., Andrews K, Reichert M., "Coordinating Business Processes Using Semantic Relationships," *2017 IEEE 19th Conference on Business Informatics (CBI)*, Thessaloniki, 2017, pp. 33-42.

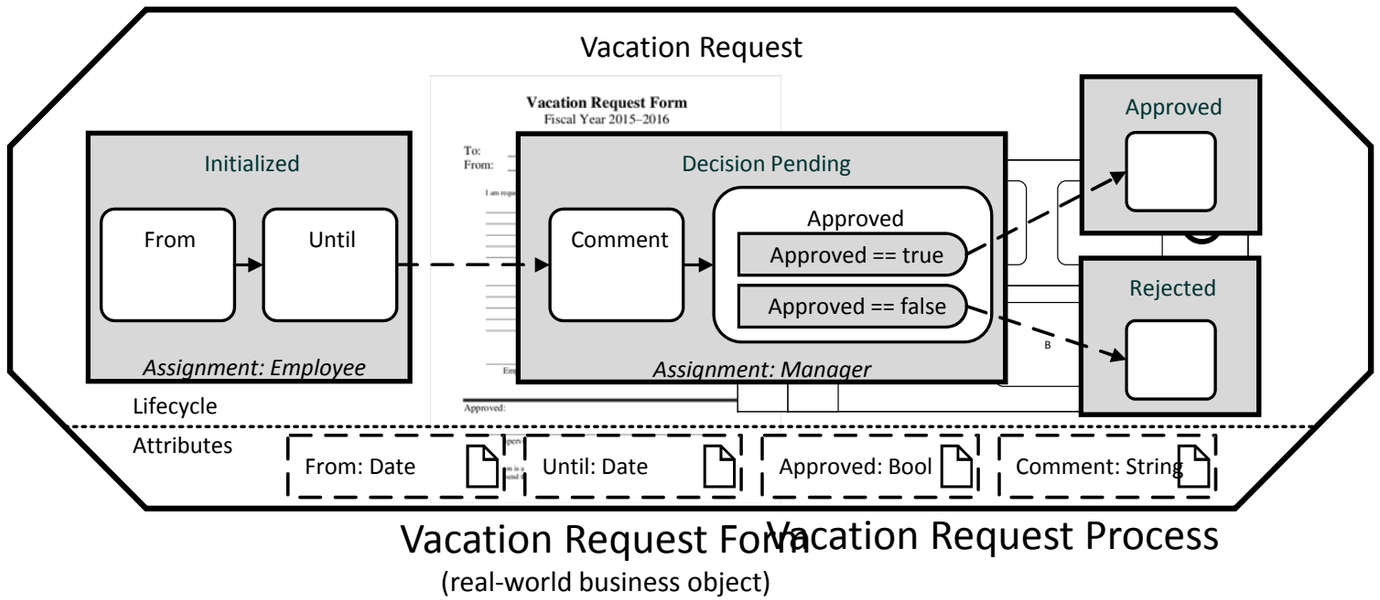
The PHILharmonicFlows Approach

An Object-Centric Approach to BPM



The PHILharmonicFlows Approach

Object Lifecycle Process: Modeling

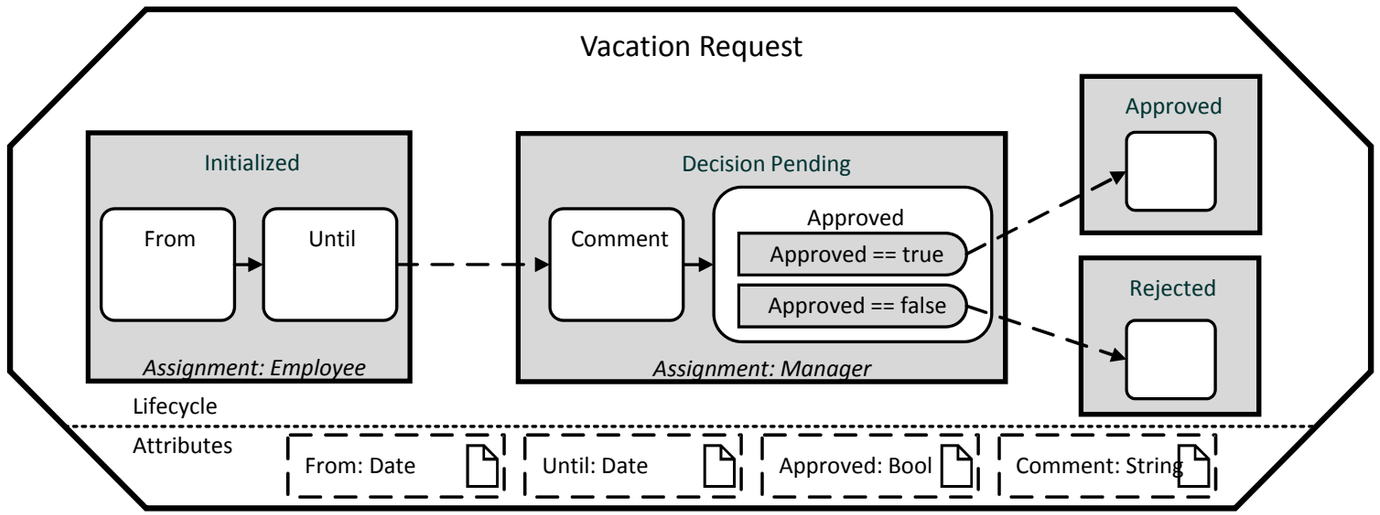


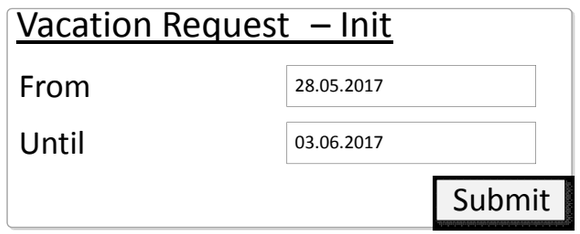
[1] Künzle, Vera and Reichert, Manfred
PHILharmonicFlows: towards a framework for object-aware process management
Journal of Software Maintenance and Evolution: Research and Practice

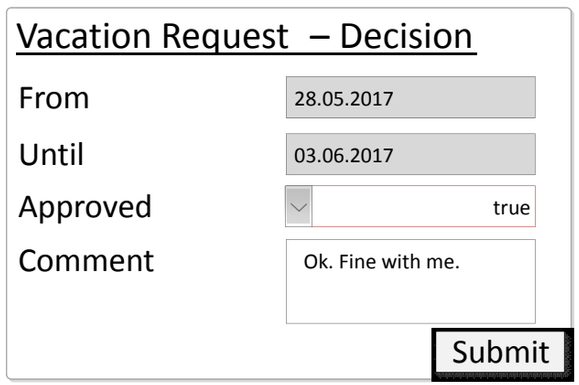
[2] Künzle, Vera
Object-Aware Process Management
PhD thesis, University of Ulm.

The PHILharmonicFlows Approach

Object Lifecycle Process: Execution

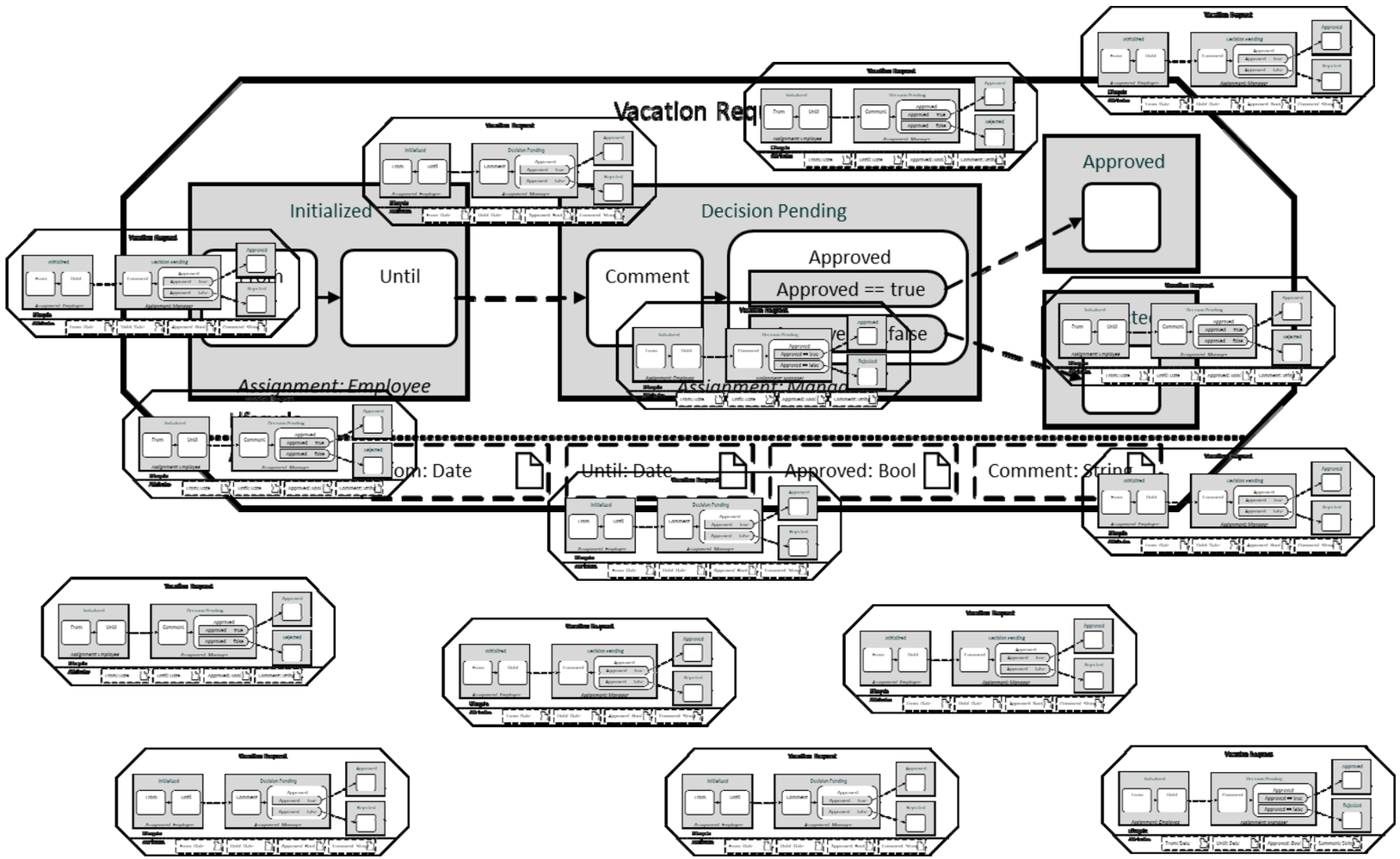






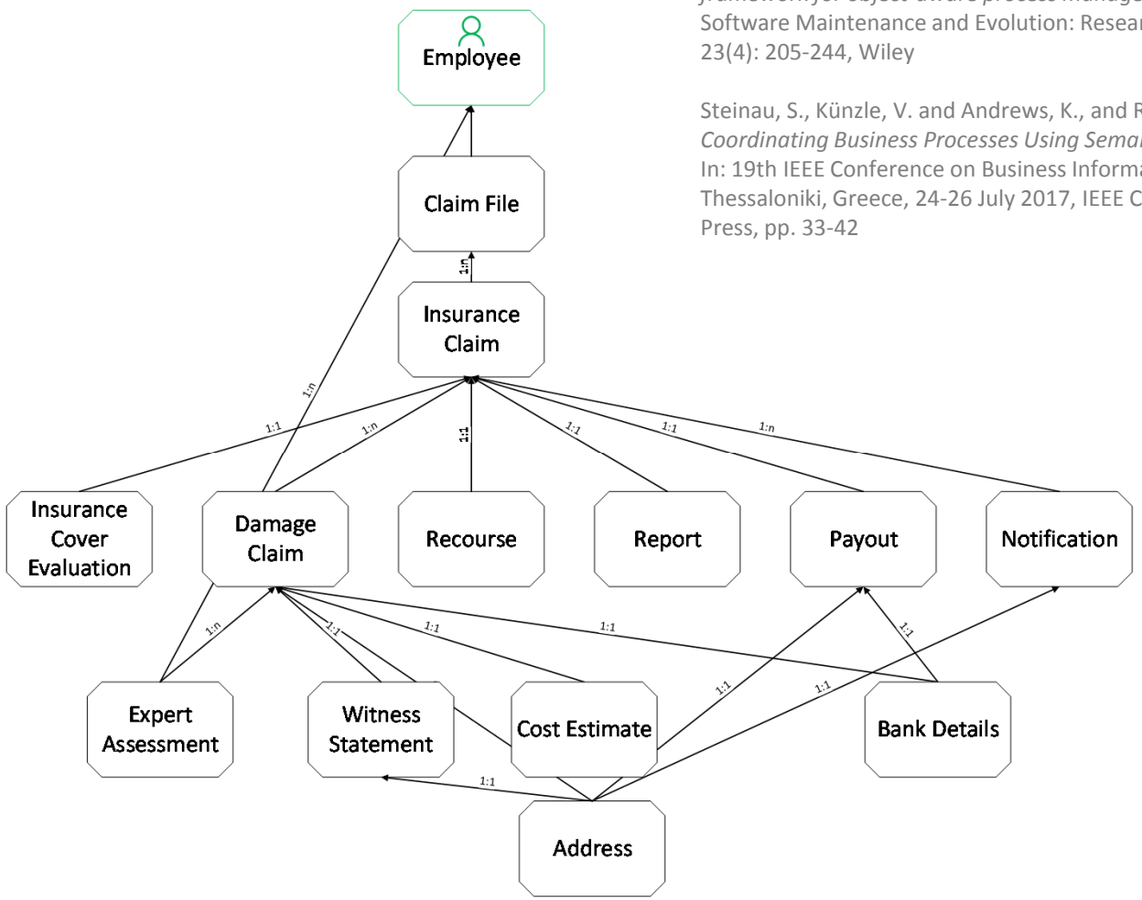
The PHILharmonicFlows Approach

Object Lifecycle Process: Execution



The PHILharmonicFlows Approach

Semantic Relationships

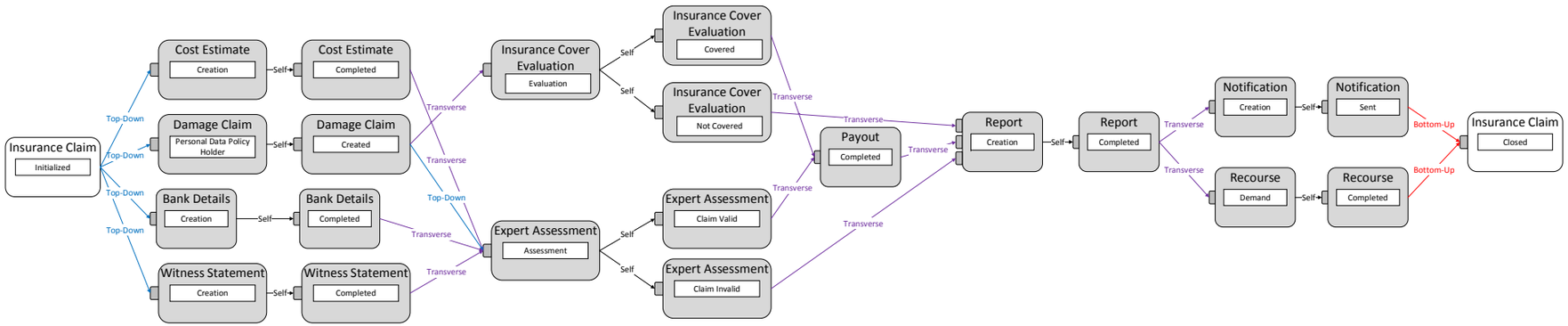


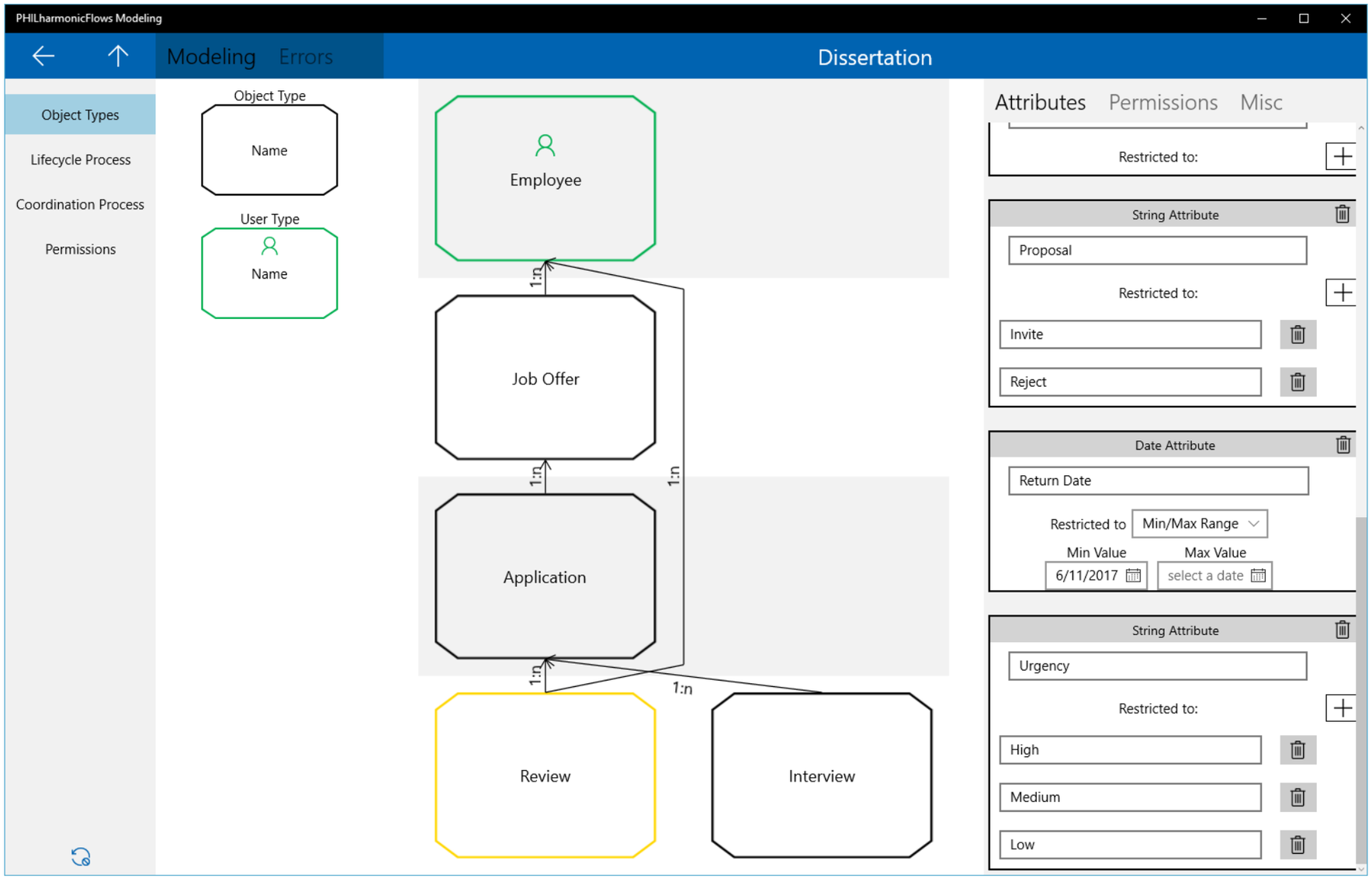
Künzle, V.and Reichert, M. (2011) *PHILharmonicFlows: towards a framework for object-aware process management.* Journal of Software Maintenance and Evolution: Research and Practice, 23(4): 205-244, Wiley

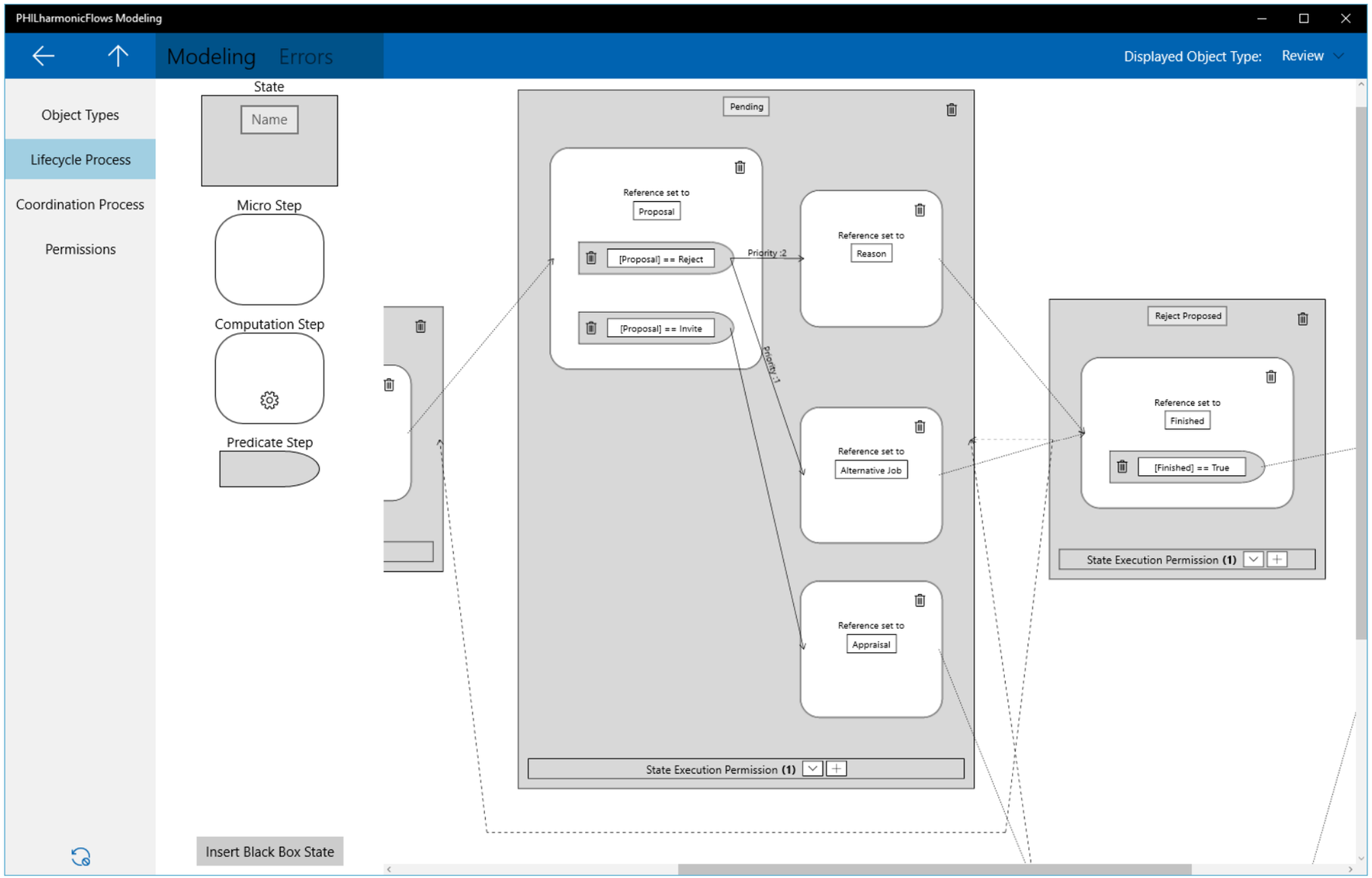
Steinau, S., Künzle, V. and Andrews, K., and Reichert, M. (2017) *Coordinating Business Processes Using Semantic Relationships*. In: 19th IEEE Conference on Business Informatics (CBI 2017), Thessaloniki, Greece, 24-26 July 2017, IEEE Computer Society Press, pp. 33-42

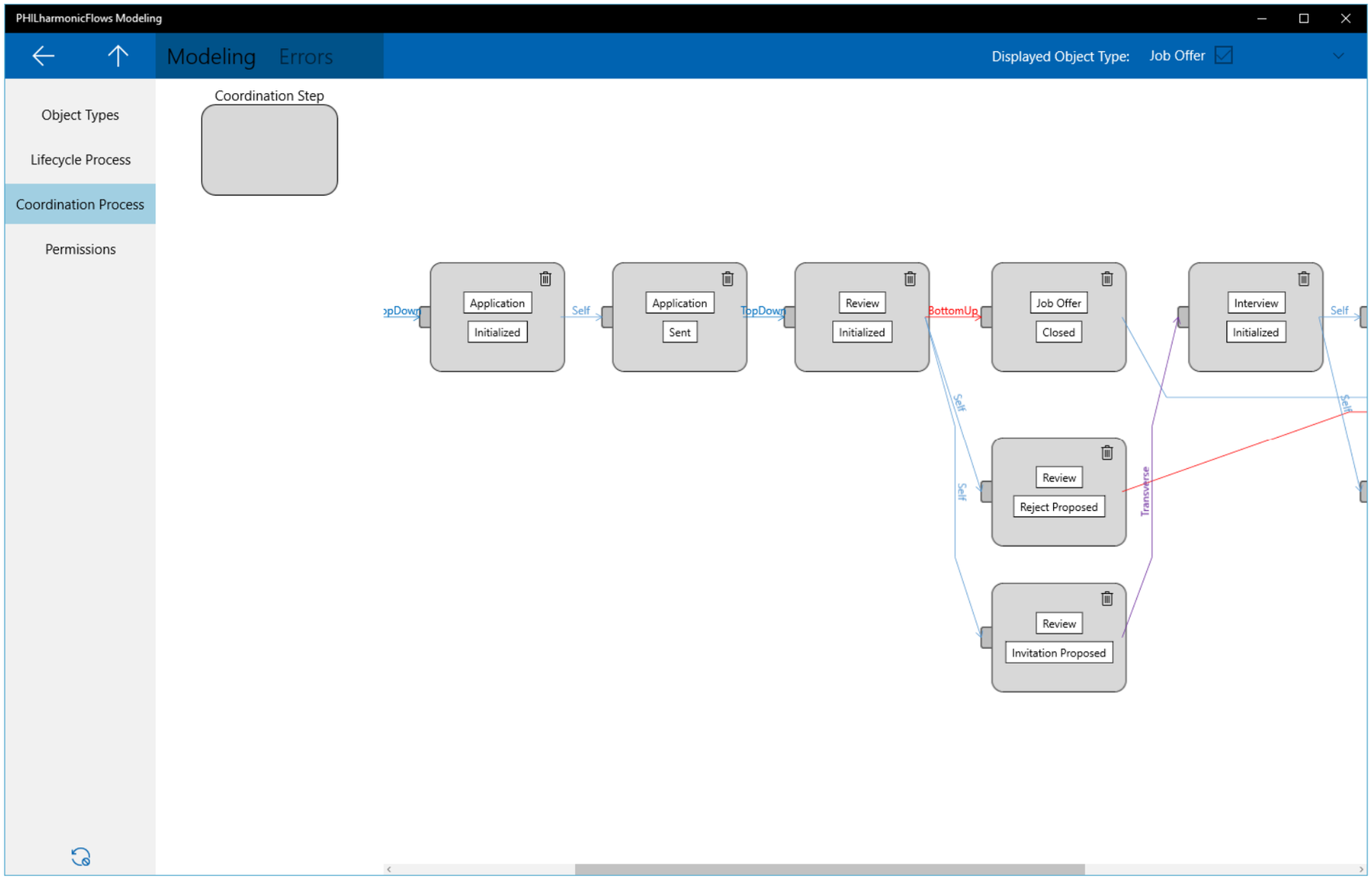
The PHILharmonicFlows Approach

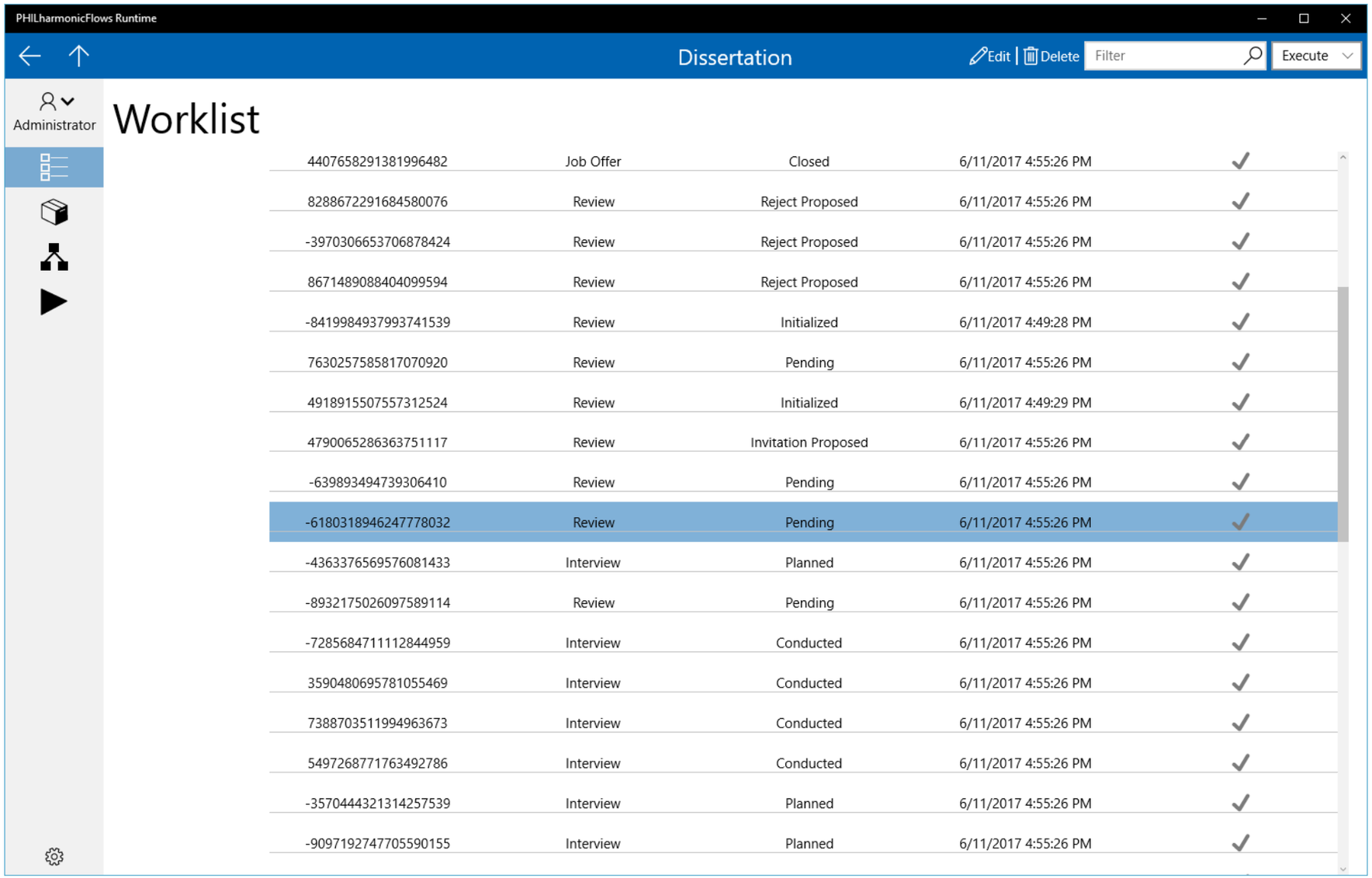
Coordination Process

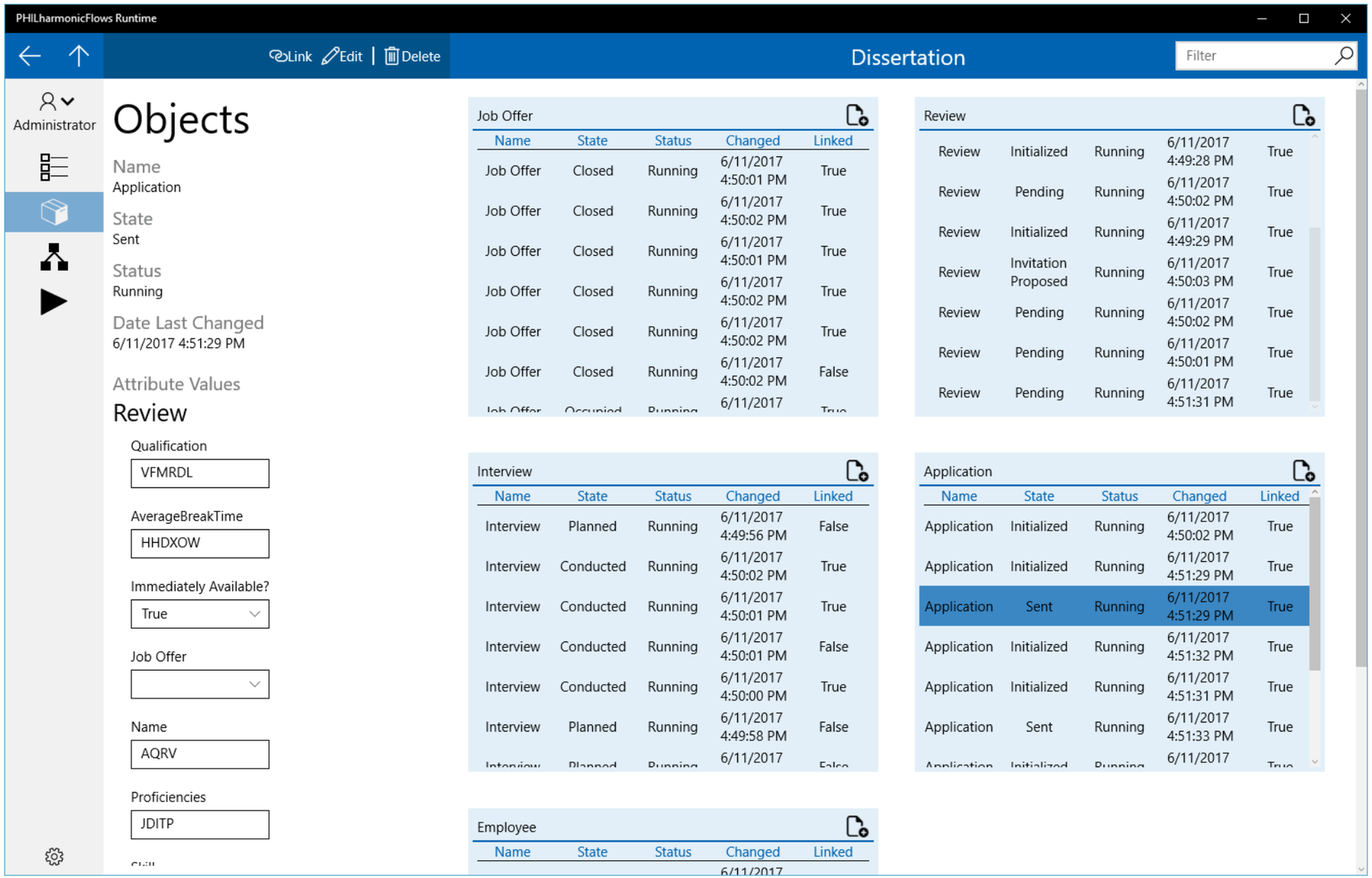


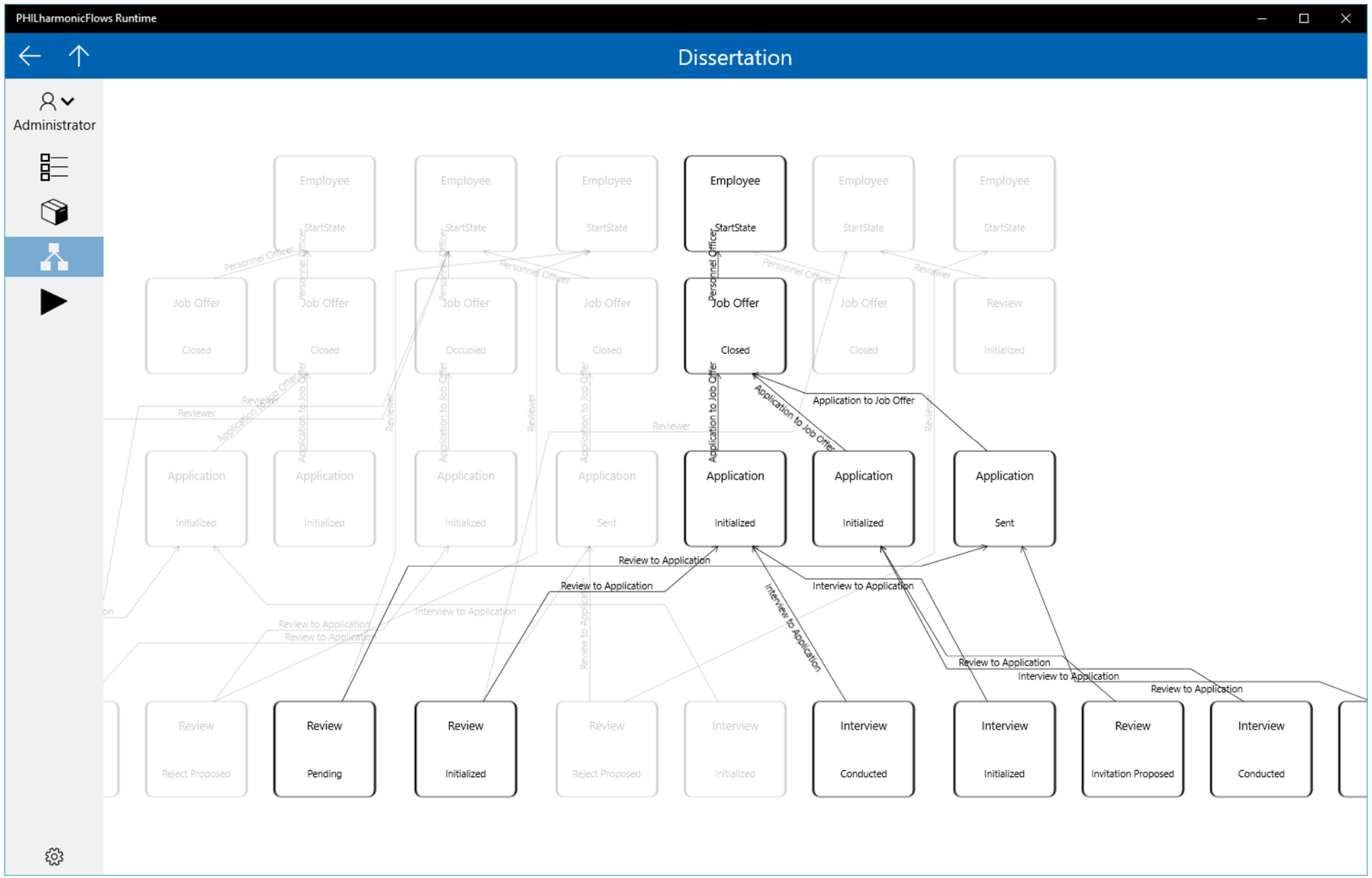

PHILharmonicFlows Modeling
Modeling
Errors
Dissertation
Object Types
Lifecycle Process
Coordination Process
Permissions
Object Type
Name
User Type
Name
Employee
Job Offer
Application
Review
Interview
1:n
1:n
1:n
1:n
1:n
Attributes
Permissions
Misc
Restricted to:
String Attribute
Proposal
Restricted to:
Invite
Reject
Date Attribute
Return Date
Restricted to
Min/Max Range
Min Value
Max Value
6/11/2017
select a date
String Attribute
Urgency
Restricted to:
High
Medium
Low

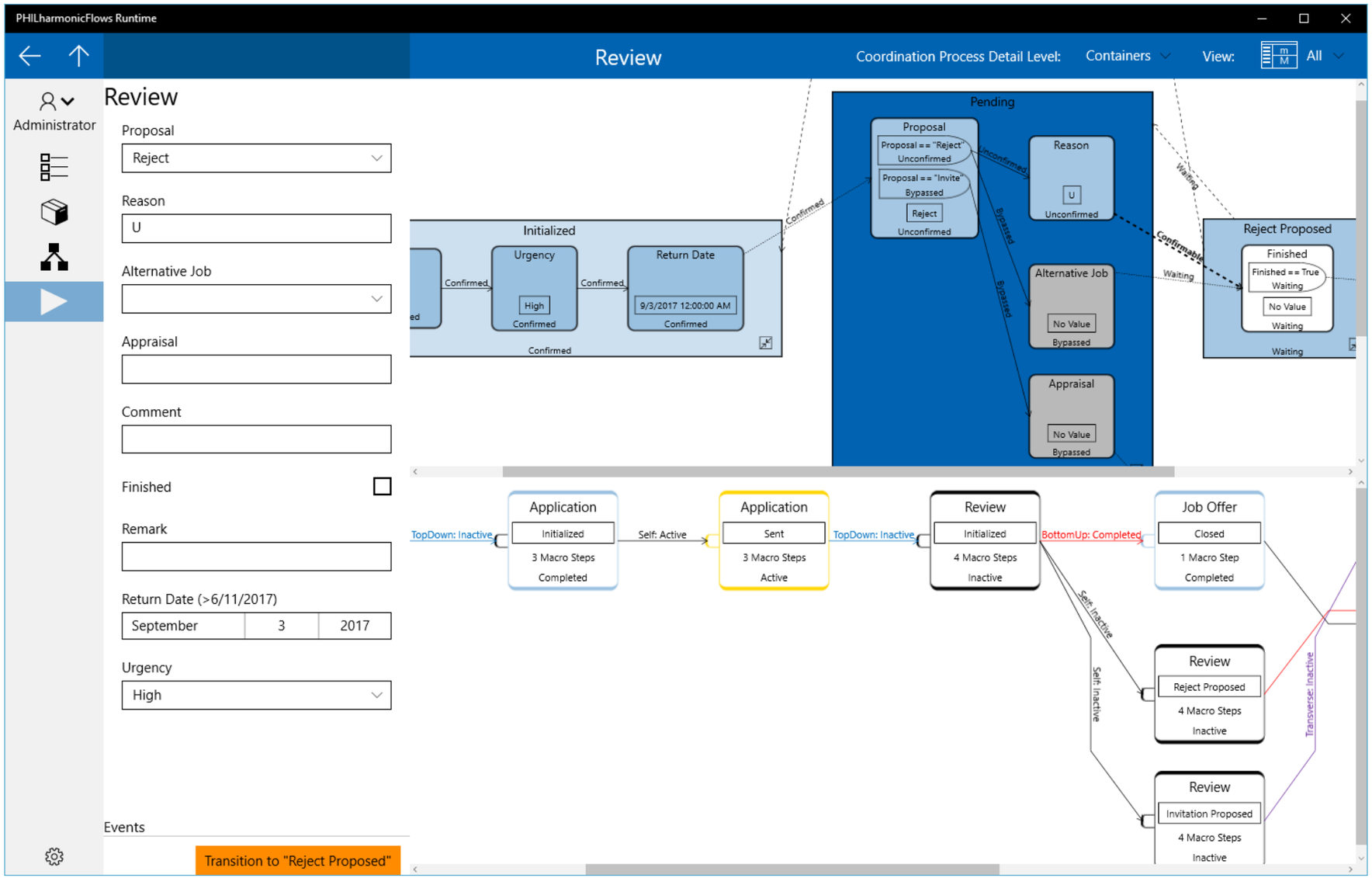

PHILharmonicFlows Modeling
Modeling
Errors
Displayed Object Type:
Review
Object Types
Lifecycle Process
Coordination Process
Permissions
State
Name
Micro Step
Computation Step
Predicate Step
Insert Black Box State
Pending
Reference set to
Proposal
[Proposal] == Reject
Priority :2
[Proposal] == Invite
Priority :1
Reference set to
Reason
Reference set to
Alternative Job
Reference set to
Appraisal
State Execution Permission (1)
Reject Proposed
Reference set to
Finished
[Finished] == True
State Execution Permission (1)


PHILharmonicFlows Modeling
Modeling
Errors
Displayed Object Type:
Job Offer
Object Types
Lifecycle Process
Coordination Process
Permissions
Coordination Step
Application
Initialized
Self
Application
Sent
TopDown
Review
Initialized
BottomUp
Job Offer
Closed
Interview
Initialized
Self
Review
Reject Proposed
Review
Invitation Proposed
Transverse


PHILharmonicFlows Runtime
Dissertation
Edit | Delete
Filter
Execute
Administrator
Worklist
4407658291381996482 Job Offer Closed 6/11/2017 4:55:26 PM
8288672291684580076 Review Reject Proposed 6/11/2017 4:55:26 PM
-3970306653706878424 Review Reject Proposed 6/11/2017 4:55:26 PM
8671489088404099594 Review Reject Proposed 6/11/2017 4:55:26 PM
-8419984937993741539 Review Initialized 6/11/2017 4:49:28 PM
7630257585817070920 Review Pending 6/11/2017 4:55:26 PM
4918915507557312524 Review Initialized 6/11/2017 4:49:29 PM
4790065286363751117 Review Invitation Proposed 6/11/2017 4:55:26 PM
-639893494739306410 Review Pending 6/11/2017 4:55:26 PM
-6180318946247778032 Review Pending 6/11/2017 4:55:26 PM
-4363376569576081433 Interview Planned 6/11/2017 4:55:26 PM
-8932175026097589114 Review Pending 6/11/2017 4:55:26 PM
-7285684711112844959 Interview Conducted 6/11/2017 4:55:26 PM
3590480695781055469 Interview Conducted 6/11/2017 4:55:26 PM
7388703511994963673 Interview Conducted 6/11/2017 4:55:26 PM
5497268771763492786 Interview Conducted 6/11/2017 4:55:26 PM
-3570444321314257539 Interview Planned 6/11/2017 4:55:26 PM
-9097192747705590155 Interview Planned 6/11/2017 4:55:26 PM


PHILharmonicFlows Runtime
Link
Edit
Delete
Dissertation
Filter
Administrator
Objects
Name
Application
State
Sent
Status
Running
Date Last Changed
6/11/2017 4:51:29 PM
Attribute Values
Review
Qualification
VFMRDL
AverageBreakTime
HHDXOW
Immediately Available?
True
Job Offer
Name
AQRV
Proficiencies
JDITP
Job Offer
Name State Status Changed Linked
Job Offer Closed Running 6/11/2017 4:50:01 PM True
Job Offer Closed Running 6/11/2017 4:50:02 PM True
Job Offer Closed Running 6/11/2017 4:50:01 PM True
Job Offer Closed Running 6/11/2017 4:50:02 PM True
Job Offer Closed Running 6/11/2017 4:50:02 PM True
Job Offer Closed Running 6/11/2017 4:50:02 PM False
Review
Review Initialized Running 6/11/2017 4:49:28 PM True
Review Pending Running 6/11/2017 4:50:02 PM True
Review Initialized Running 6/11/2017 4:49:29 PM True
Review Invitation Proposed Running 6/11/2017 4:50:03 PM True
Review Pending Running 6/11/2017 4:50:02 PM True
Review Pending Running 6/11/2017 4:50:01 PM True
Review Pending Running 6/11/2017 4:51:31 PM True
Interview
Name State Status Changed Linked
Interview Planned Running 6/11/2017 4:49:56 PM False
Interview Conducted Running 6/11/2017 4:50:02 PM True
Interview Conducted Running 6/11/2017 4:50:01 PM True
Interview Conducted Running 6/11/2017 4:50:01 PM False
Interview Conducted Running 6/11/2017 4:50:00 PM True
Interview Planned Running 6/11/2017 4:49:58 PM False
Application
Name State Status Changed Linked
Application Initialized Running 6/11/2017 4:50:02 PM True
Application Initialized Running 6/11/2017 4:51:29 PM True
Application Sent Running 6/11/2017 4:51:29 PM True
Application Initialized Running 6/11/2017 4:51:32 PM True
Application Initialized Running 6/11/2017 4:51:31 PM True
Application Sent Running 6/11/2017 4:51:33 PM True
Employee
Name State Status Changed Linked

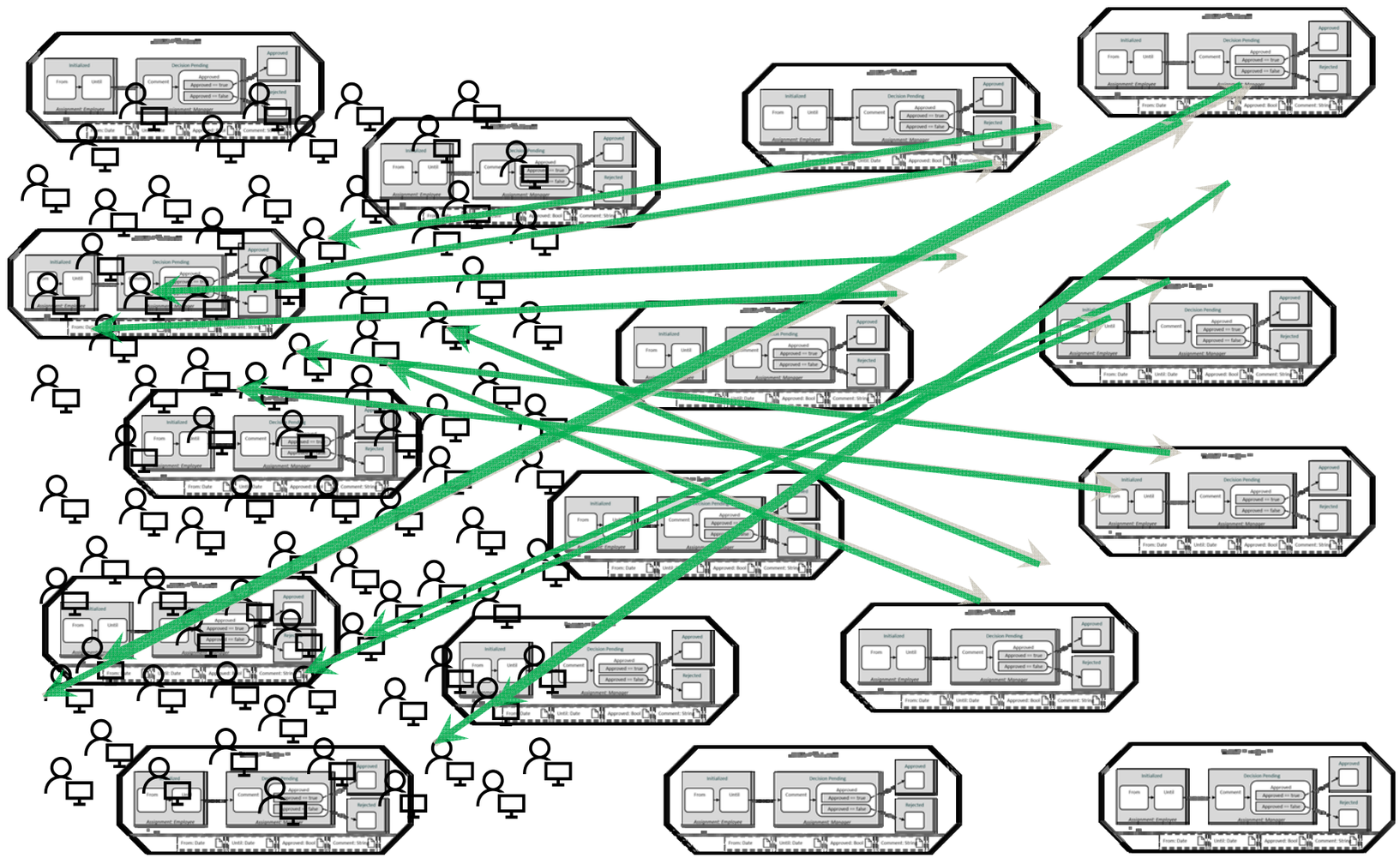

PHILharmonicFlows Runtime
Dissertation
Administrator
Employee
StartState
Job Offer
Closed
Occupied
Application
Initialized
Sent
Review
Pending
Initialized
Reject Proposed
Invitation Proposed
Interview
Conducted
Personnel Officer
Reviewer
Application to Job Offer
Review to Application
Interview to Application


PHILharmonicFlows Runtime
Review
Coordination Process Detail Level:
Containers
View:
All
Administrator
Review
Proposal
Reject
Reason
U
Alternative Job
Appraisal
Comment
Finished
Remark
Return Date (>6/11/2017)
September
3
2017
Urgency
High
Events
Transition to "Reject Proposed"
Initialized
Urgency
High
Confirmed
Return Date
9/3/2017 12:00:00 AM
Confirmed
Pending
Proposal
Proposal == "Reject"
Unconfirmed
Proposal == "Invite"
Bypassed
Reject
Unconfirmed
Reason
U
Unconfirmed
Alternative Job
No Value
Bypassed
Appraisal
No Value
Bypassed
Reject Proposed
Finished
Finished == True
Waiting
No Value
Waiting
Application
Initialized
3 Macro Steps
Completed
Application
Sent
3 Macro Steps
Active
Review
Initialized
4 Macro Steps
Inactive
Job Offer
Closed
1 Macro Step
Completed
Review
Reject Proposed
4 Macro Steps
Inactive
Review
Invitation Proposed
4 Macro Steps
Inactive
TopDown: Inactive
Self: Active
TopDown: Inactive
BottomUp: Completed
Self: Inactive
Self: Inactive
Transverse: Inactive

Hybrid Process-Aware Information Systems
Human Robot Collaboration

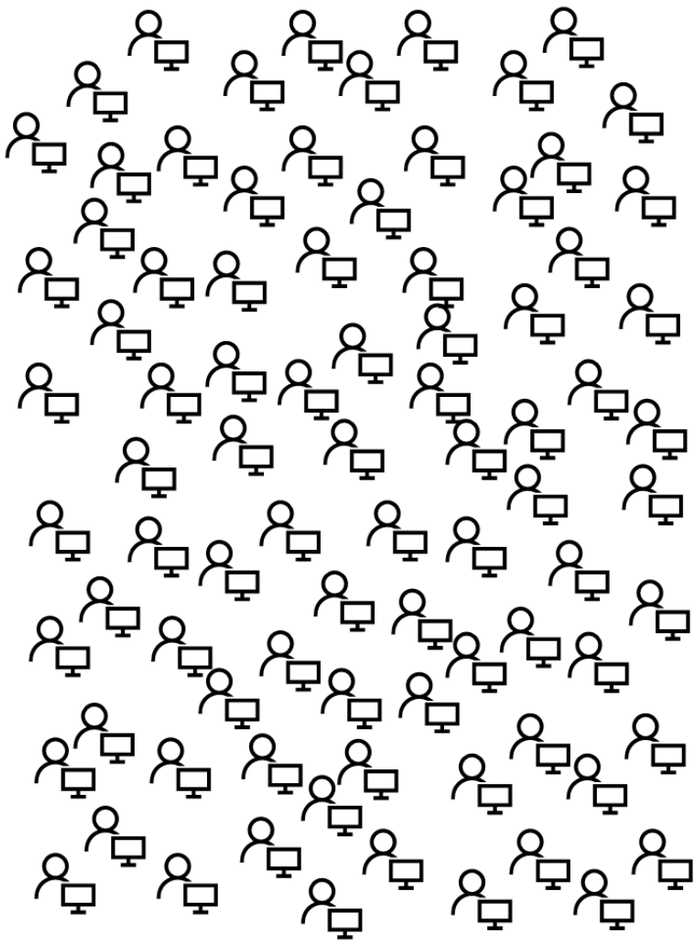
The PHILharmonicFlows Approach

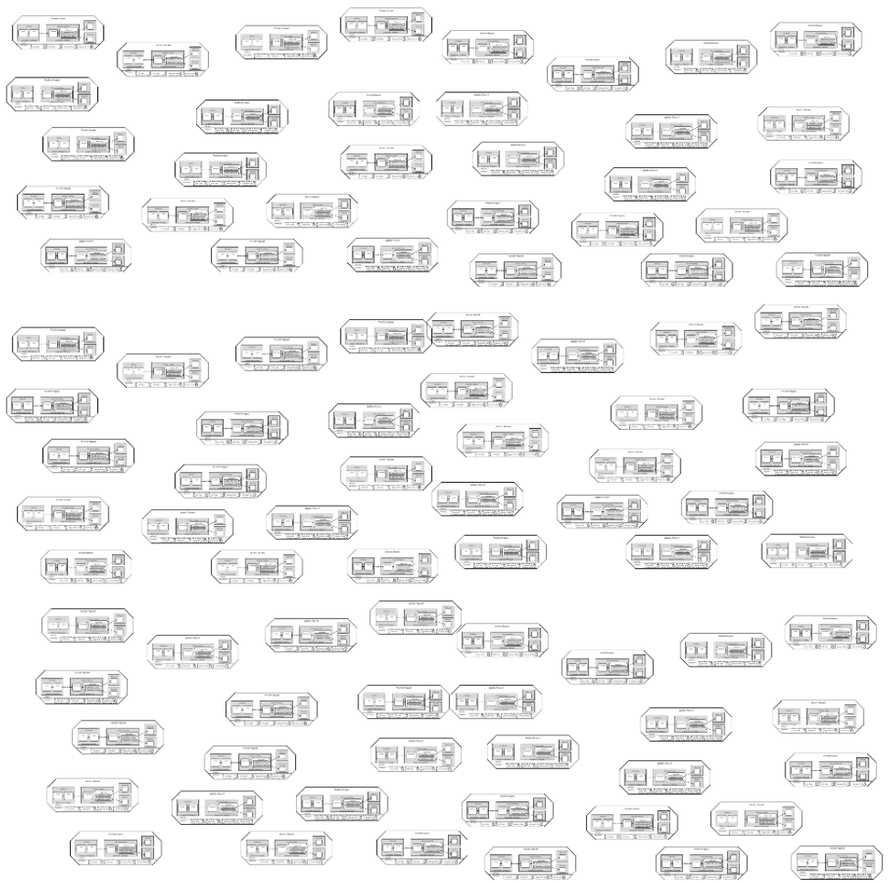
Are Scalable Object-Aware Processes Technically Feasible?



The PHILharmonicFlows Approach

Are Scalable Object-Aware Processes Technically Feasible?



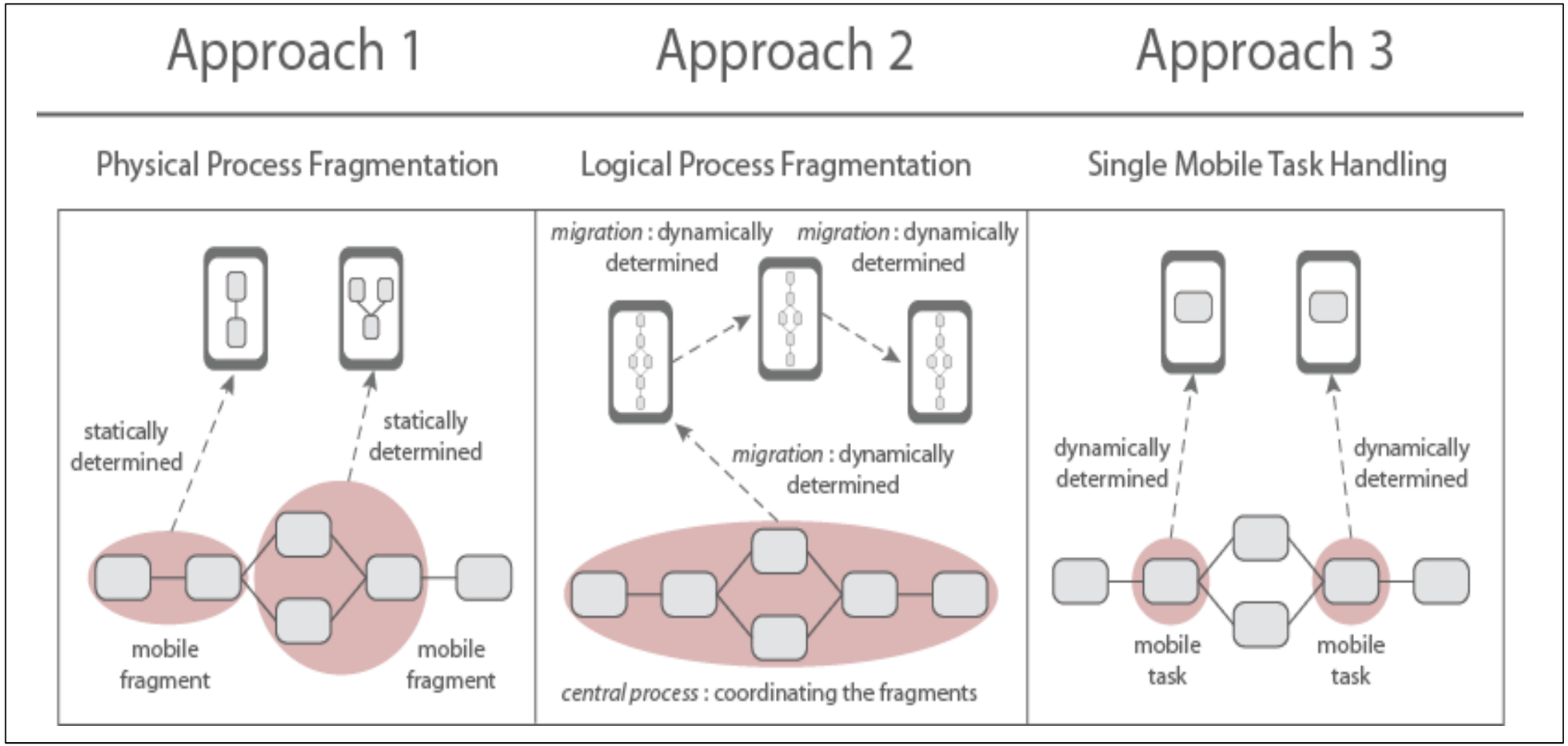


Microservices?

Mobile Processes

Mobile Processes

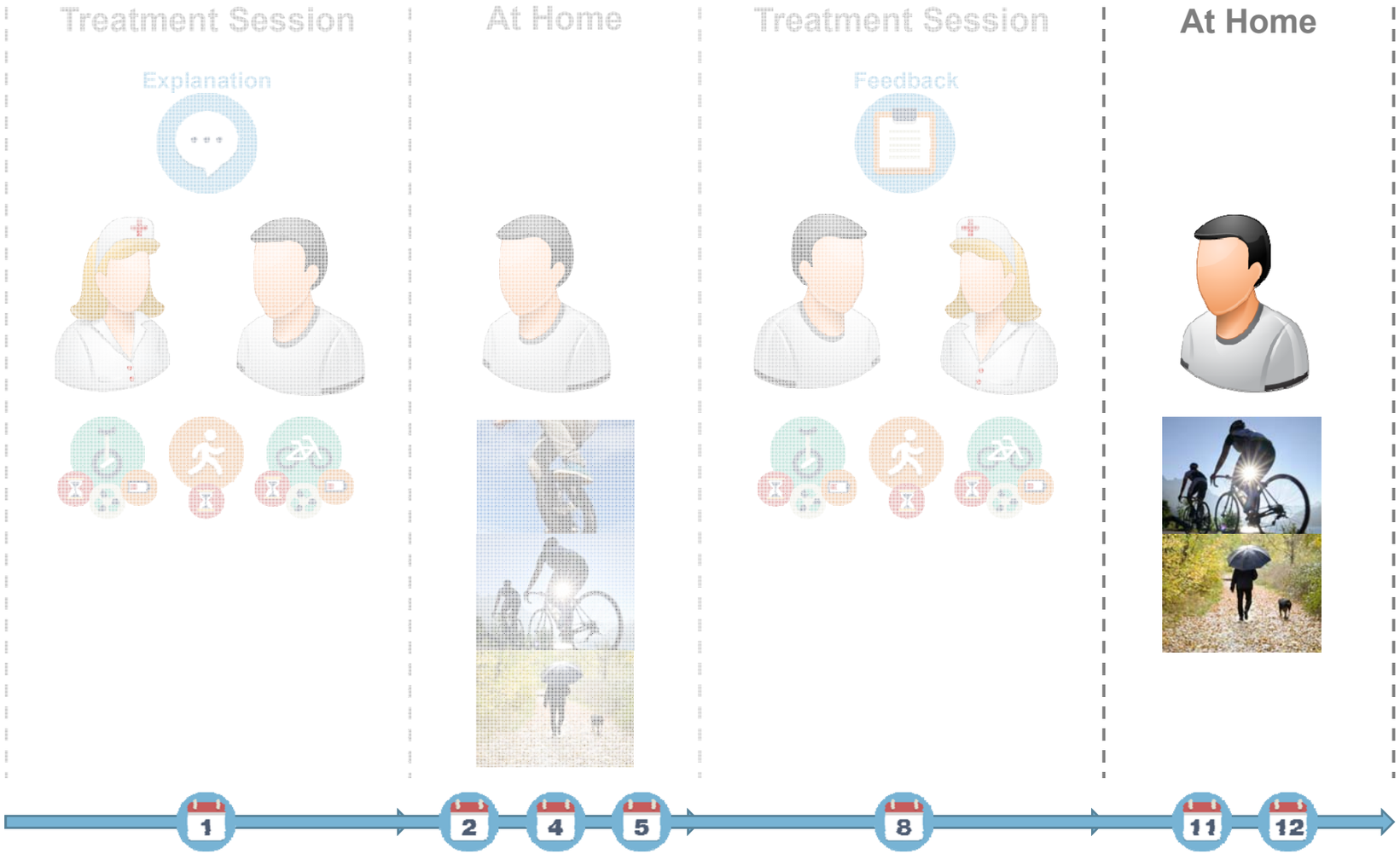
Scenarios



Mobile Process Support for Therapeutic Interventions

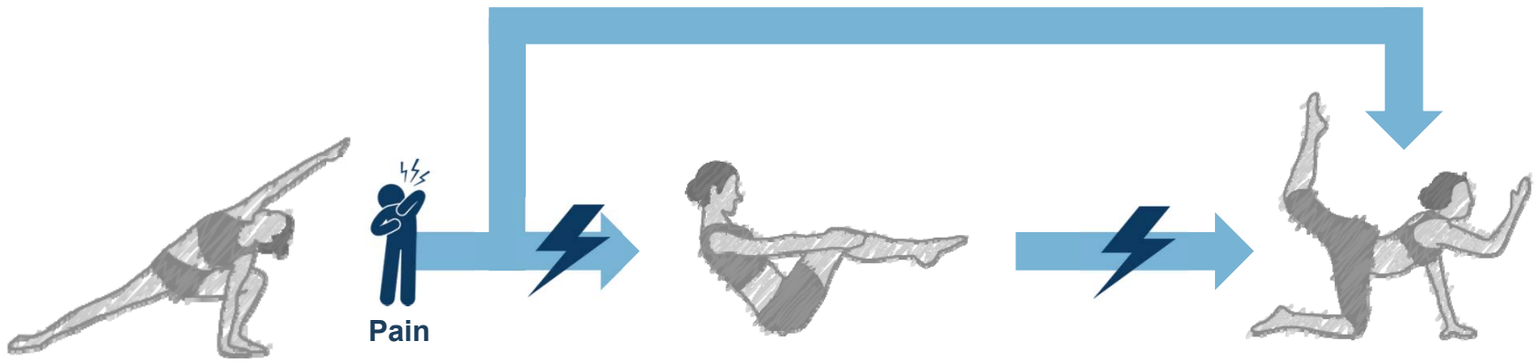
Mobile Processes

Mobile Process Support for Therapeutic Interventions: Motivation



Mobile Processes

Mobile Process Support for Therapeutic Interventions: Homework Characteristics



Stretching

- 70% Stretch
- Hold for 25 sec.
- 3 times each side

Strengthening

- Extra aids
- 80% of HF_{max}
- 3 sets / 25 repet.

Stabilization

- Max. Stretch
- Hold for 25 sec.
- 1 time each side

Con

Pre-

xercises

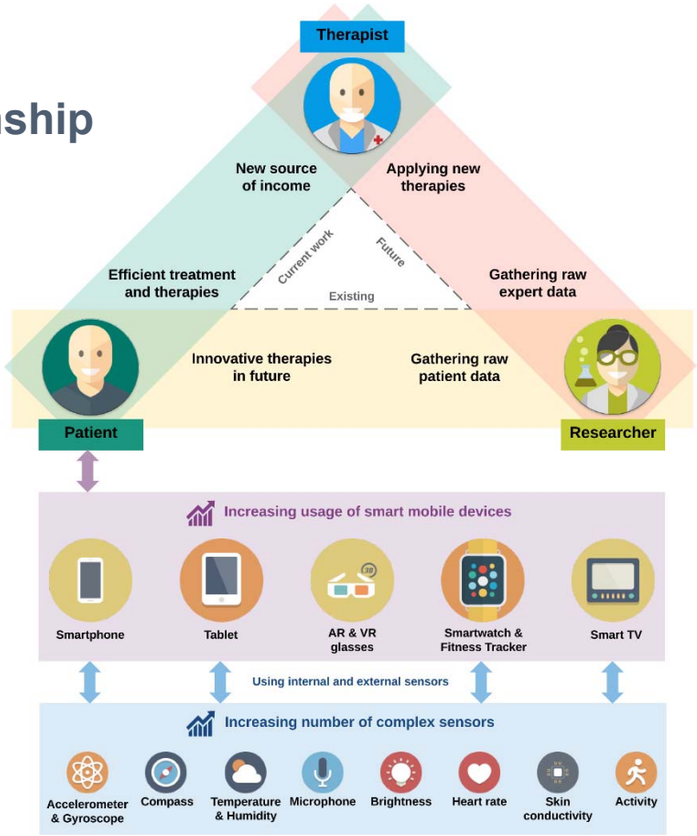
Dependencies between exercises

Mobile Processes

Mobile Process Support for Therapeutic Interventions: Key Points

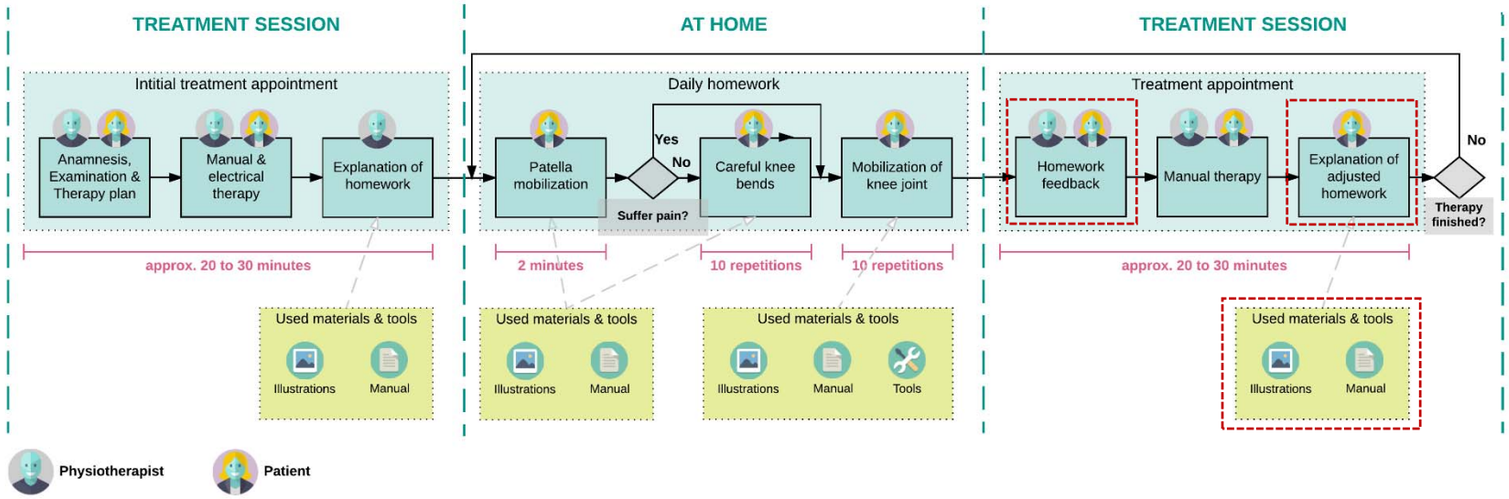
- Hierarchical Information Exchange
- Therapist-Patient-Researcher Relationship
- Expectations & Opportunities
- Integration of Smart Mobile Devices
- Use of internal and external Sensors

- New Concepts & Methods



Mobile Processes

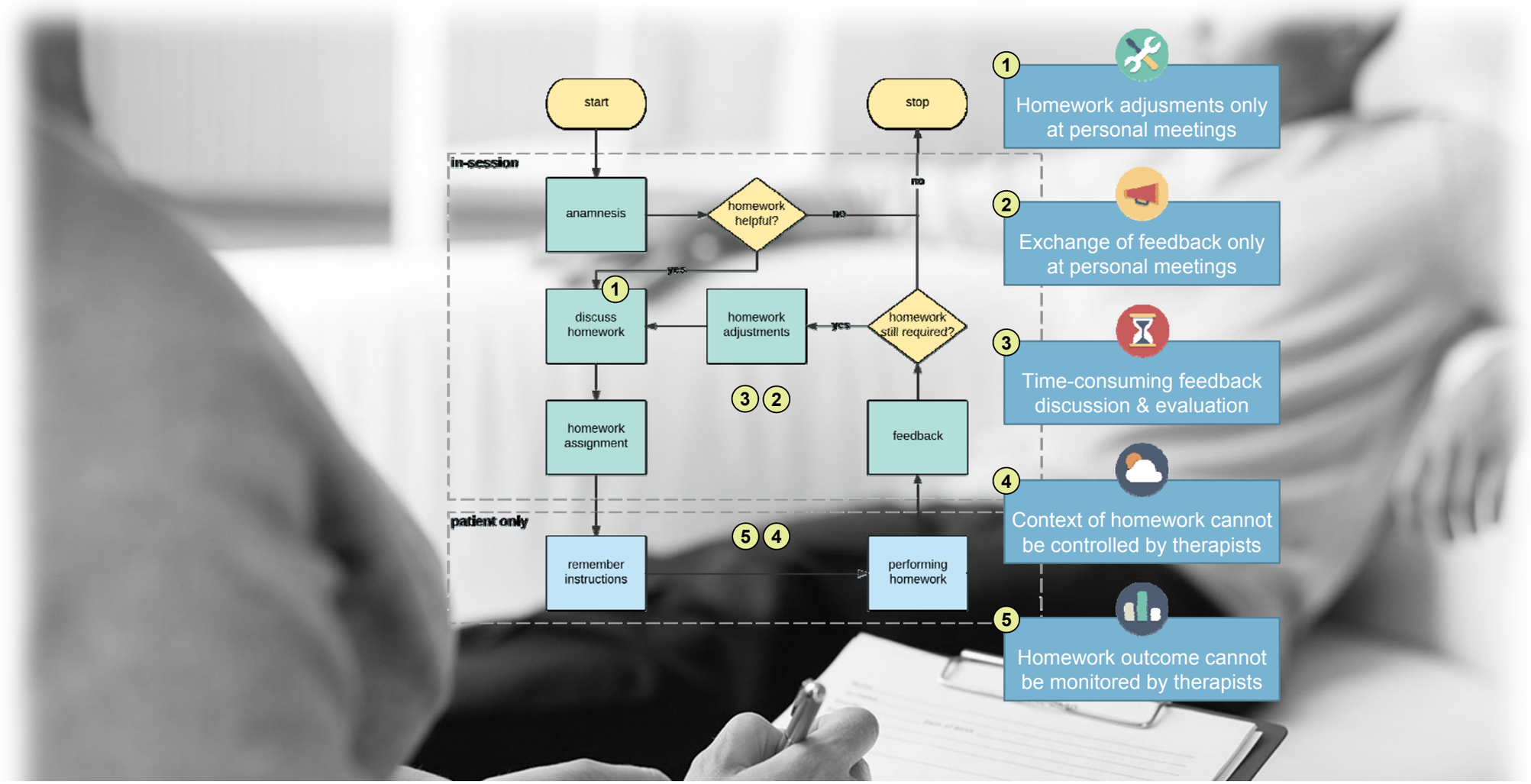
Mobile Process Support for Therapeutic Interventions: Rehab Traninig



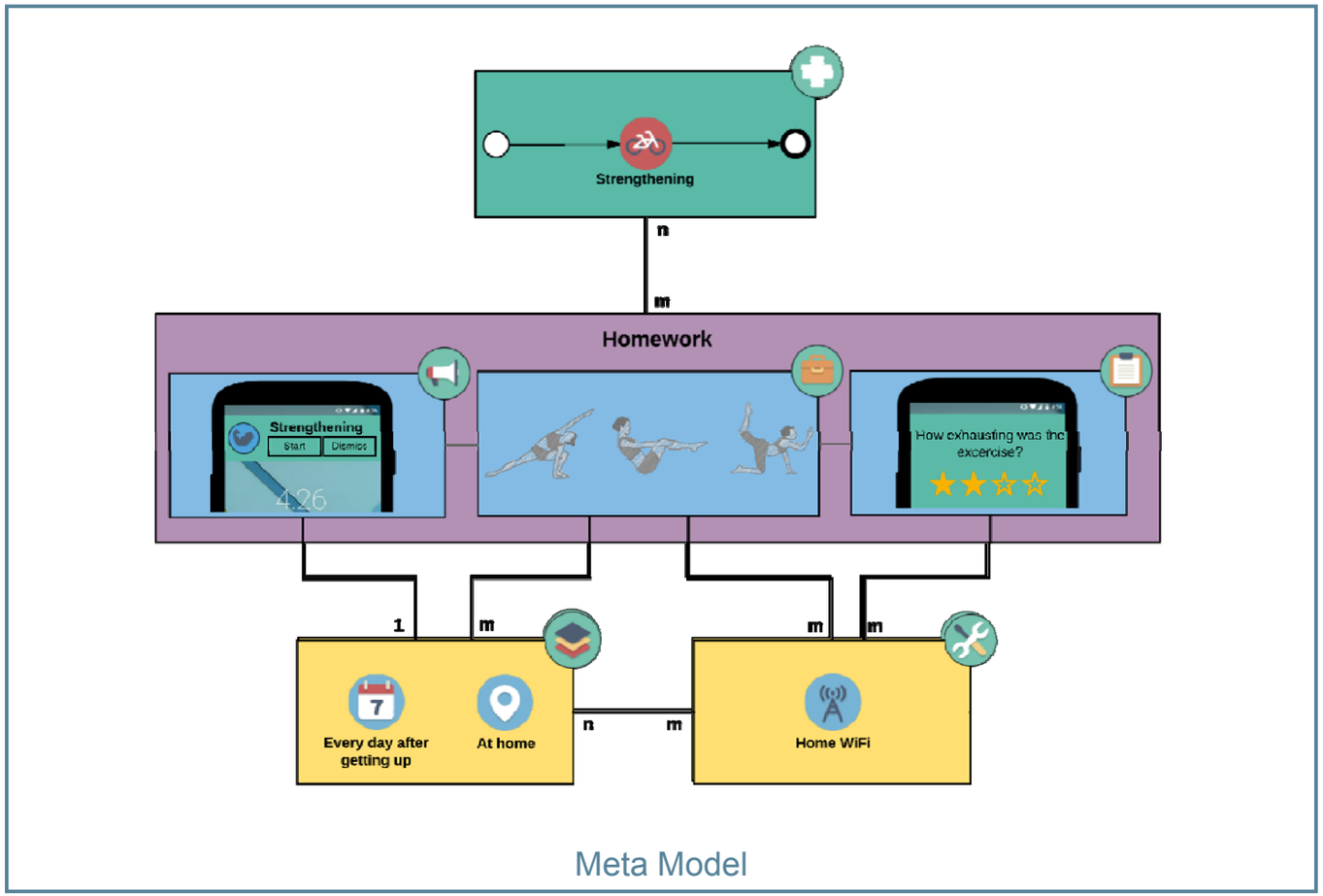
Example: Follow-up Treatment after Cruciate Ligament Reconstruction

Mobile Processes

Mobile Process Support for Therapeutic Interventions: Common Homework Application Procedure

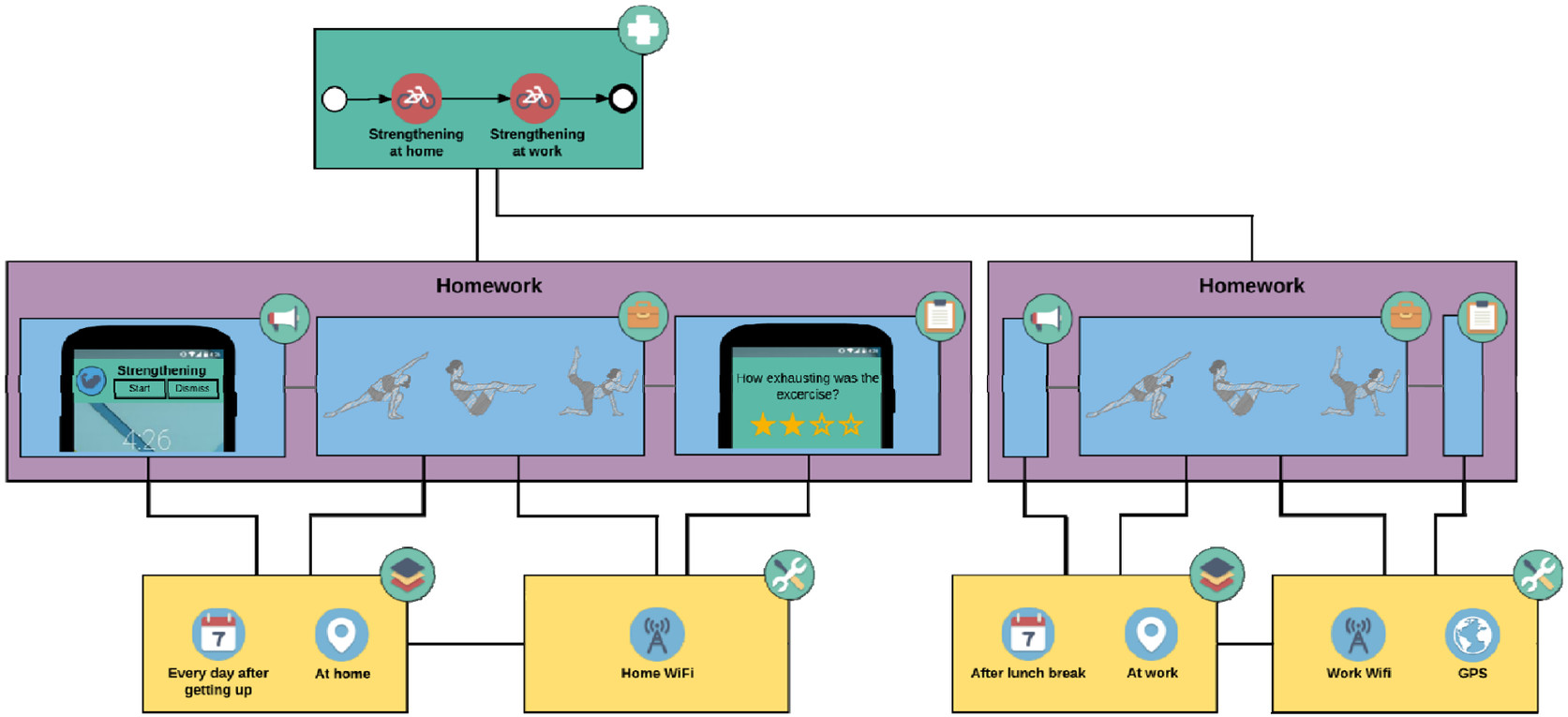


Meta Model



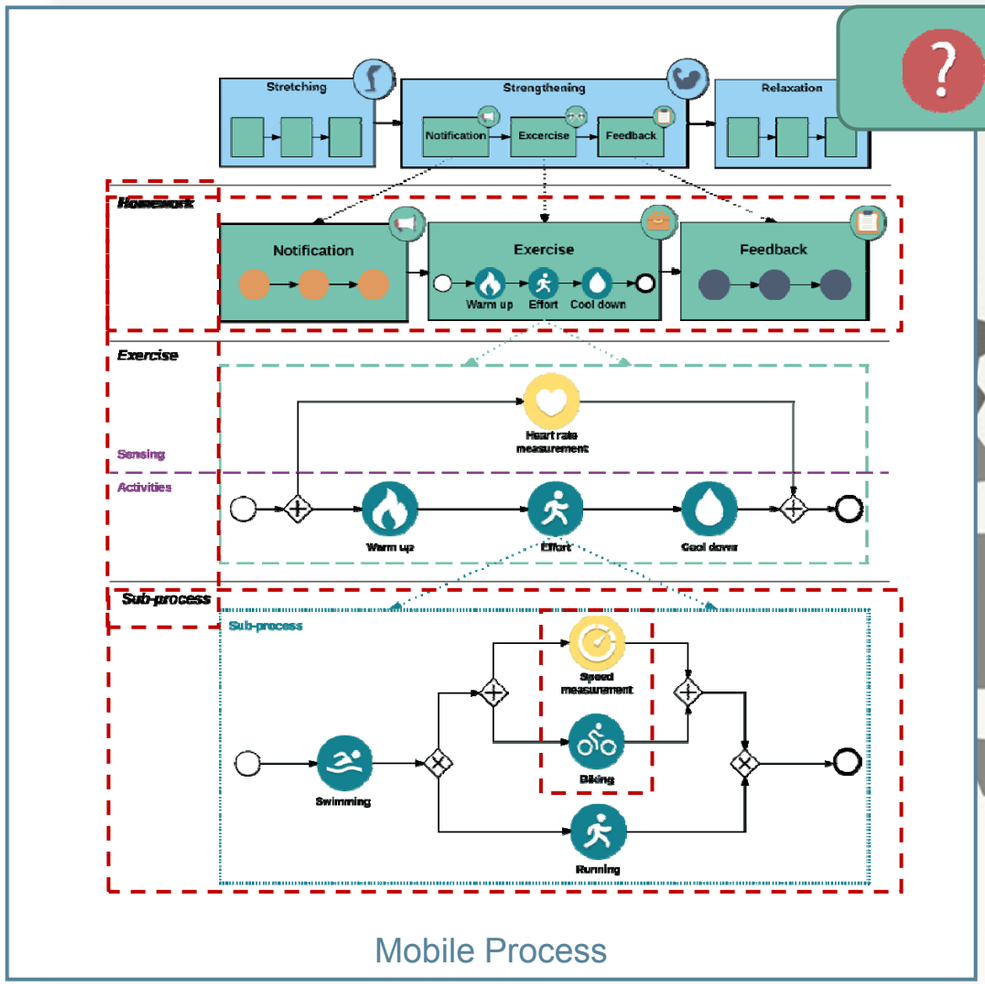
Meta Model

Model


Strengthening at home
Strengthening at work
Homework
Strengthening
Start
Dismiss
How exhausting was the excercise?
Homework
Every day after getting up
At home
Home WiFi
After lunch break
At work
Work Wifi
GPS

Mobile Processes

Mobile Process Support for Therapeutic Interventions: Basic Approach



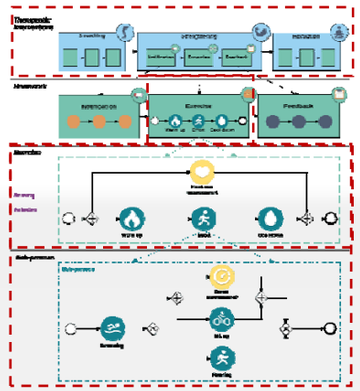
Mobile Process

How to enable domain experts to flexibly create and remotely change homework?

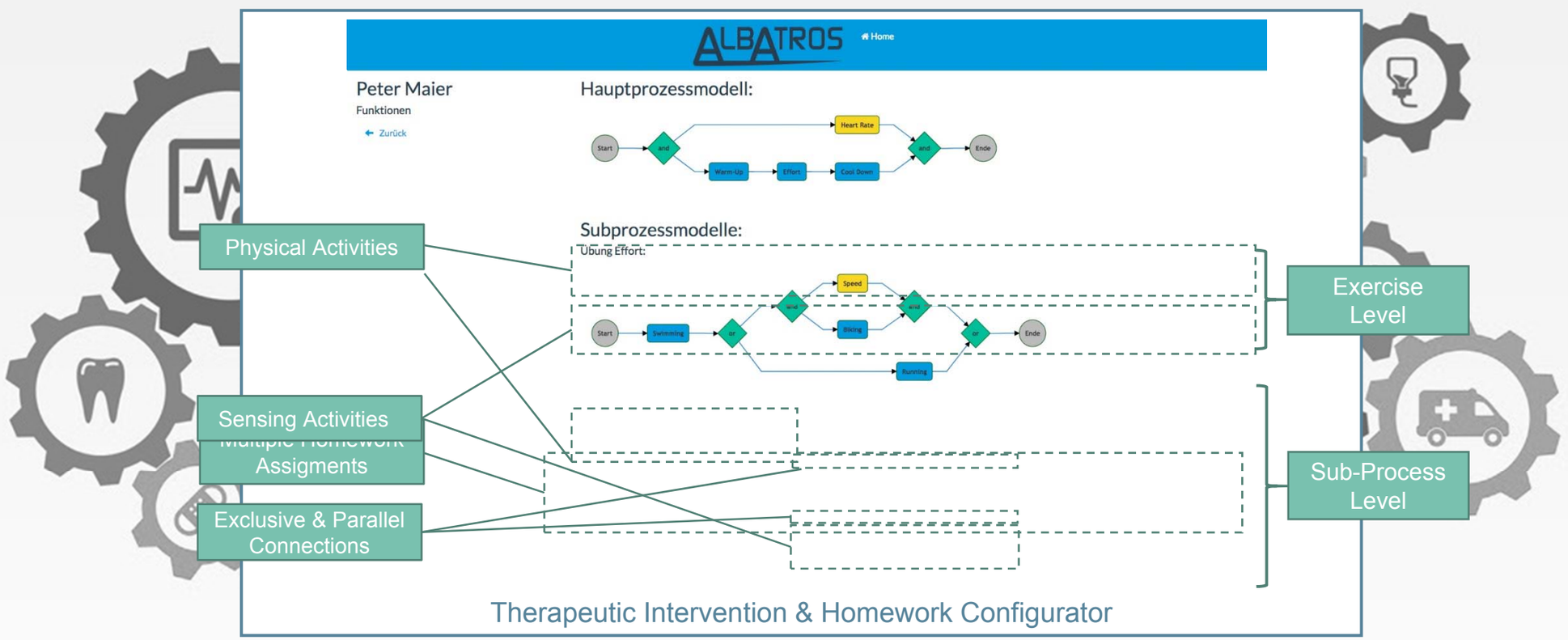
Schickler, Pryss, Schobel, and Reichert (2017) Supporting Remote Therapeutic Interventions with Mobile Processes. In: IEEE Int Conf on AI & Mobile Services (IEEE AIMS 2017).

Mobile Processes

Mobile Process Support for Therapeutic Interventions: Modeling & Configuration



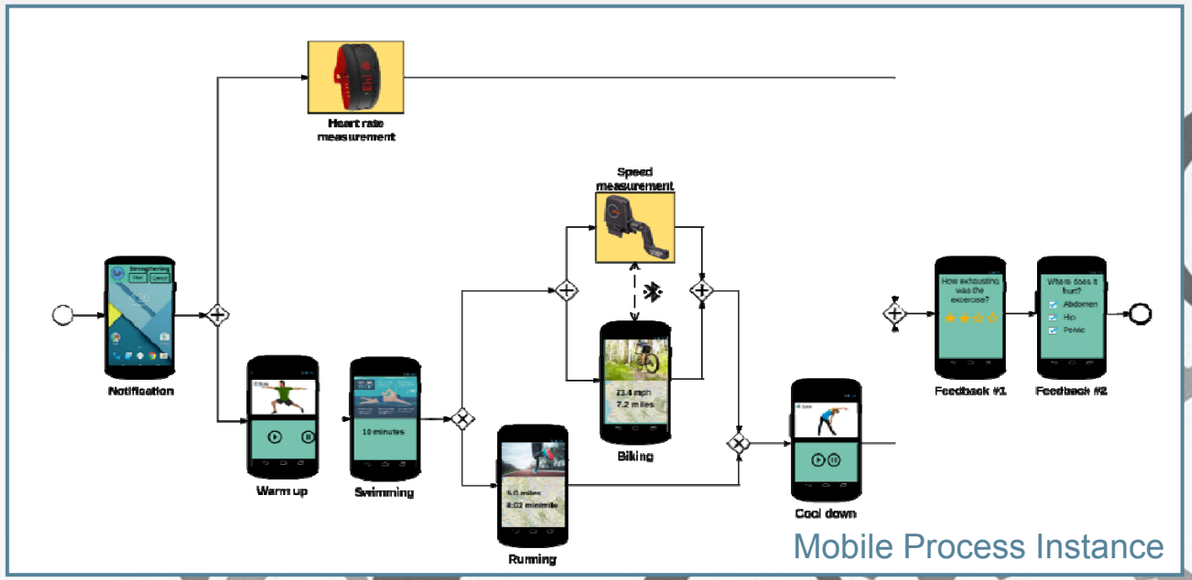
How to assist domain experts during therapeutic homework configuration?



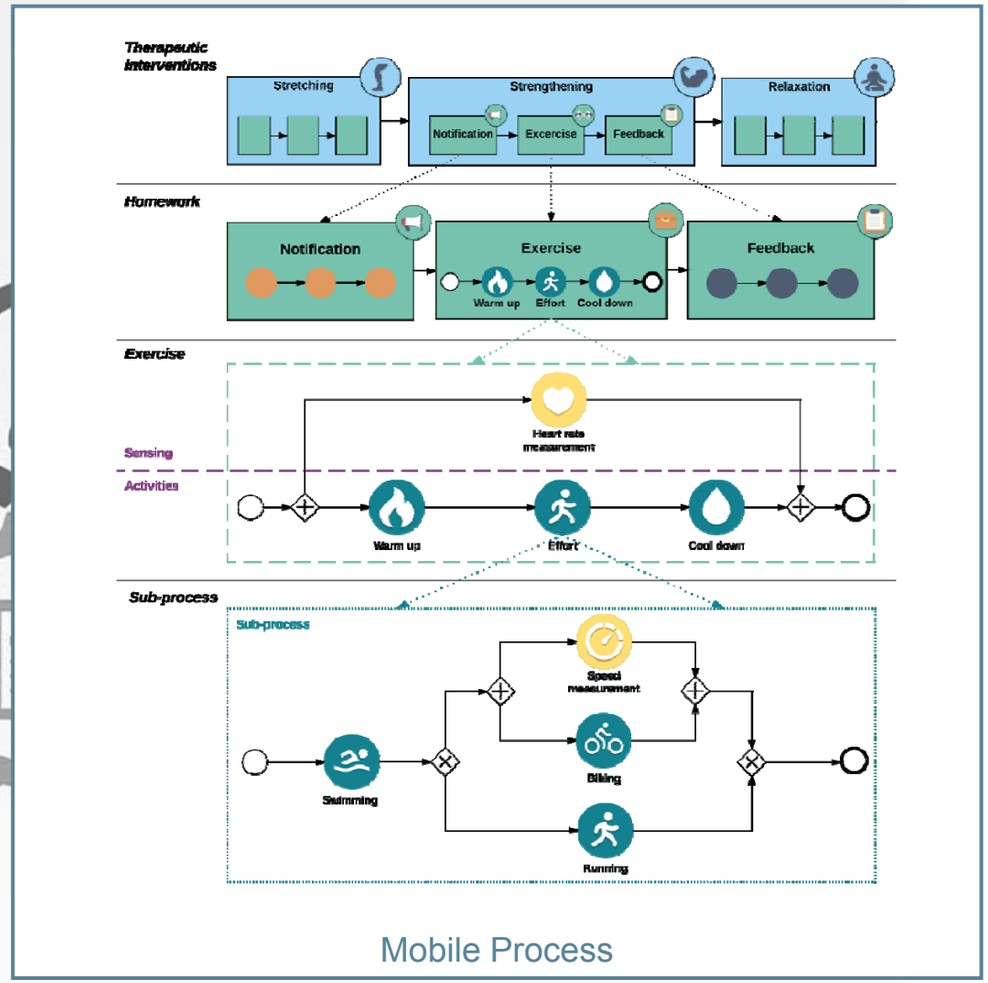
Mobile Processes

Mobile Process Support for Therapeutic Interventions: Execution

How to realize appropriate monitoring and feedback concepts for therapeutic homework?



Mobile Process Instance

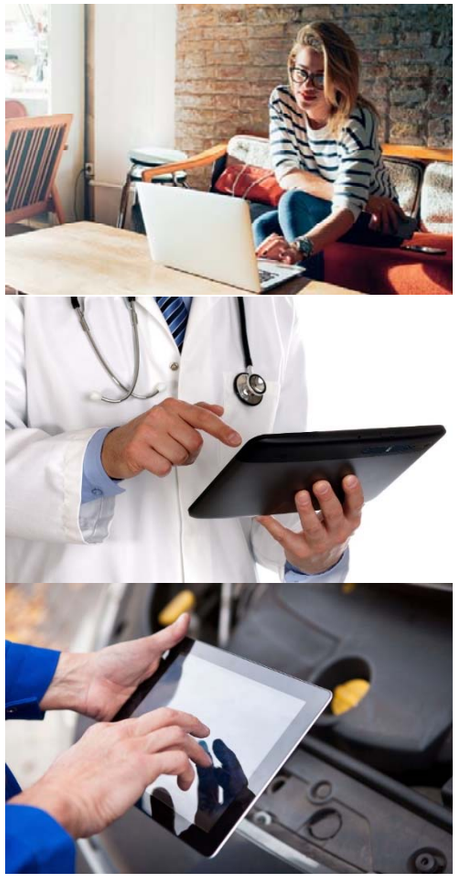


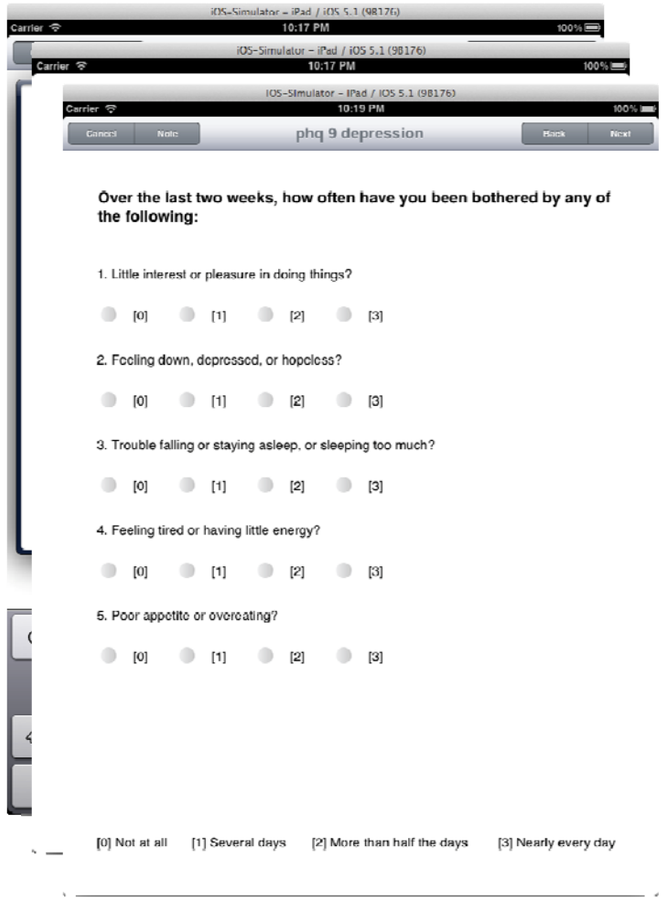
Mobile Process

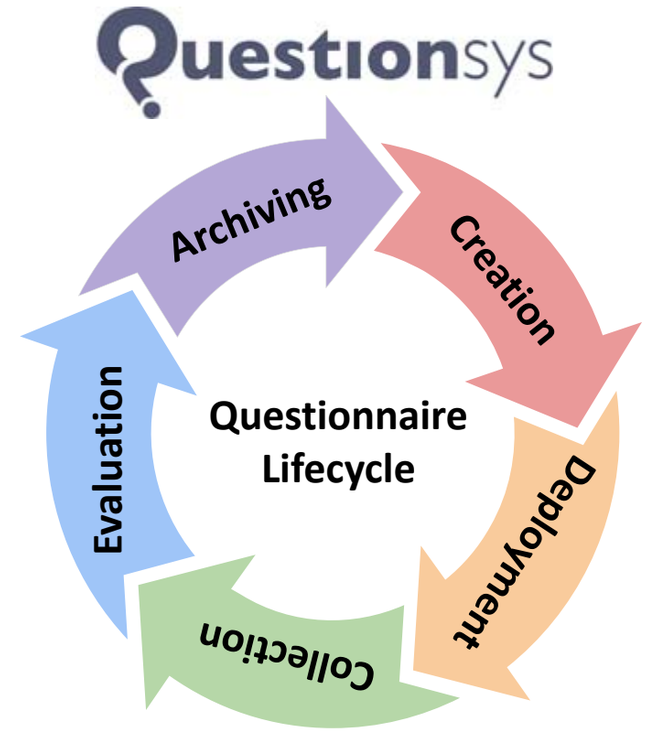
Schobel, Pryss, Schickler, Reichert (2016) A Lightweight Process Engine for Enabling Advanced Mobile Applications. In: CoopIS 16, LNCS 10033, Springer, pp. 552-69.

Mobile Processes

Mobile Data Collection – The QuestionSys Framework



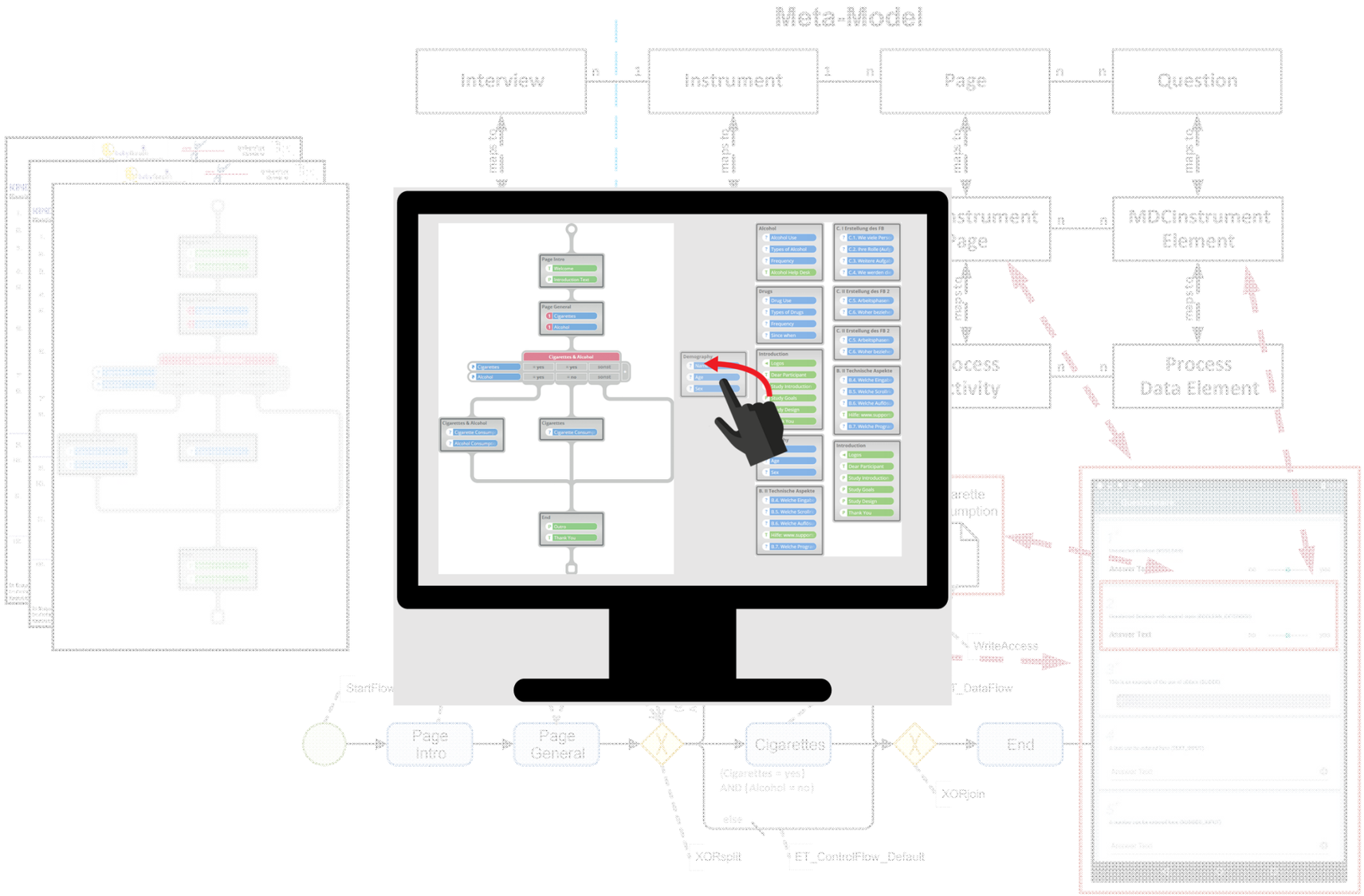




A Model-Driven Framework for Enabling Flexible and Robust Mobile Data Collection Applications

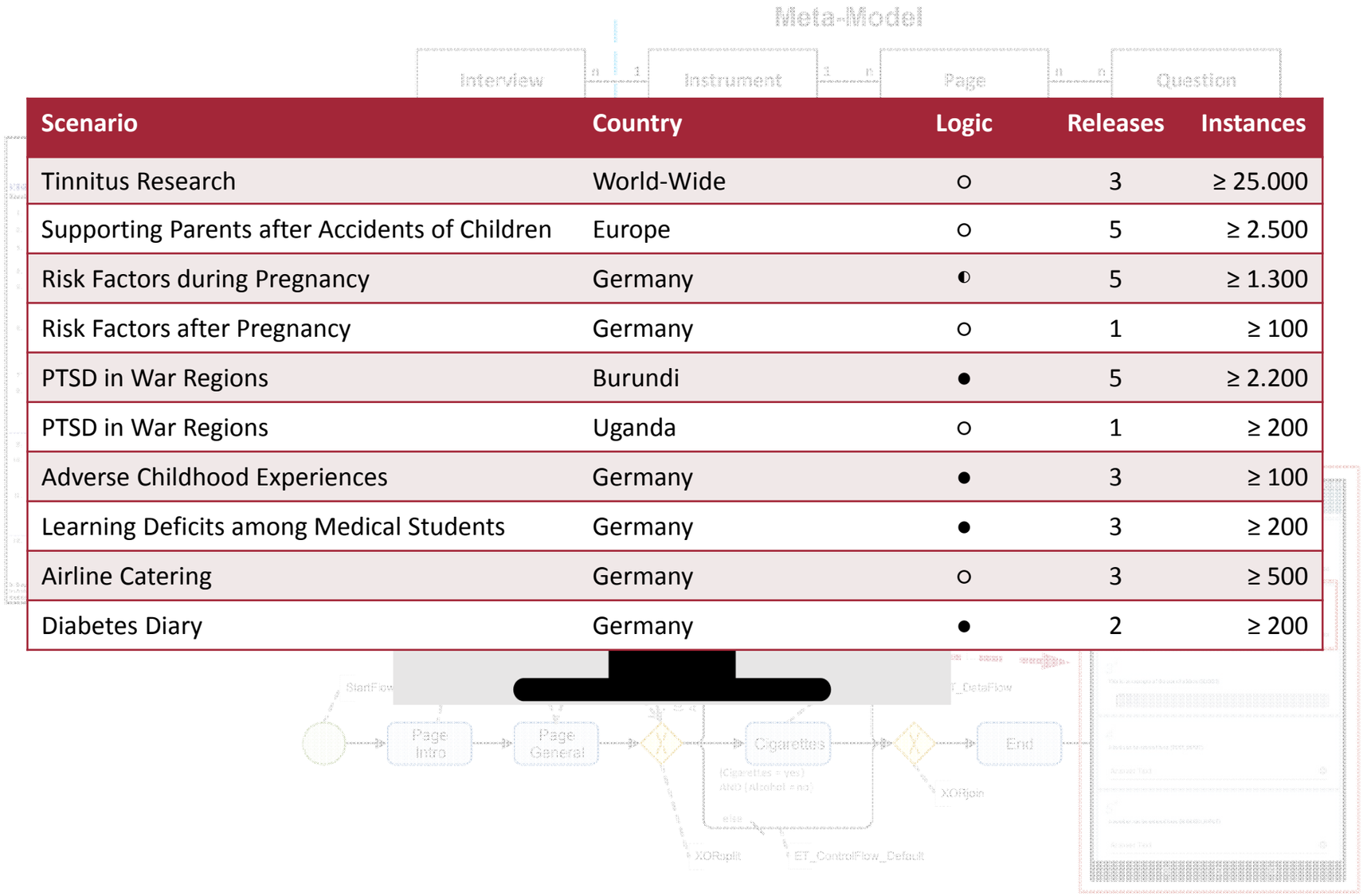
Mobile Processes

The QuestionSys Framework: Mobile Data Collection Instruments



Mobile Processes

The QuestionSys Framework: Mobile Data Collection Instruments



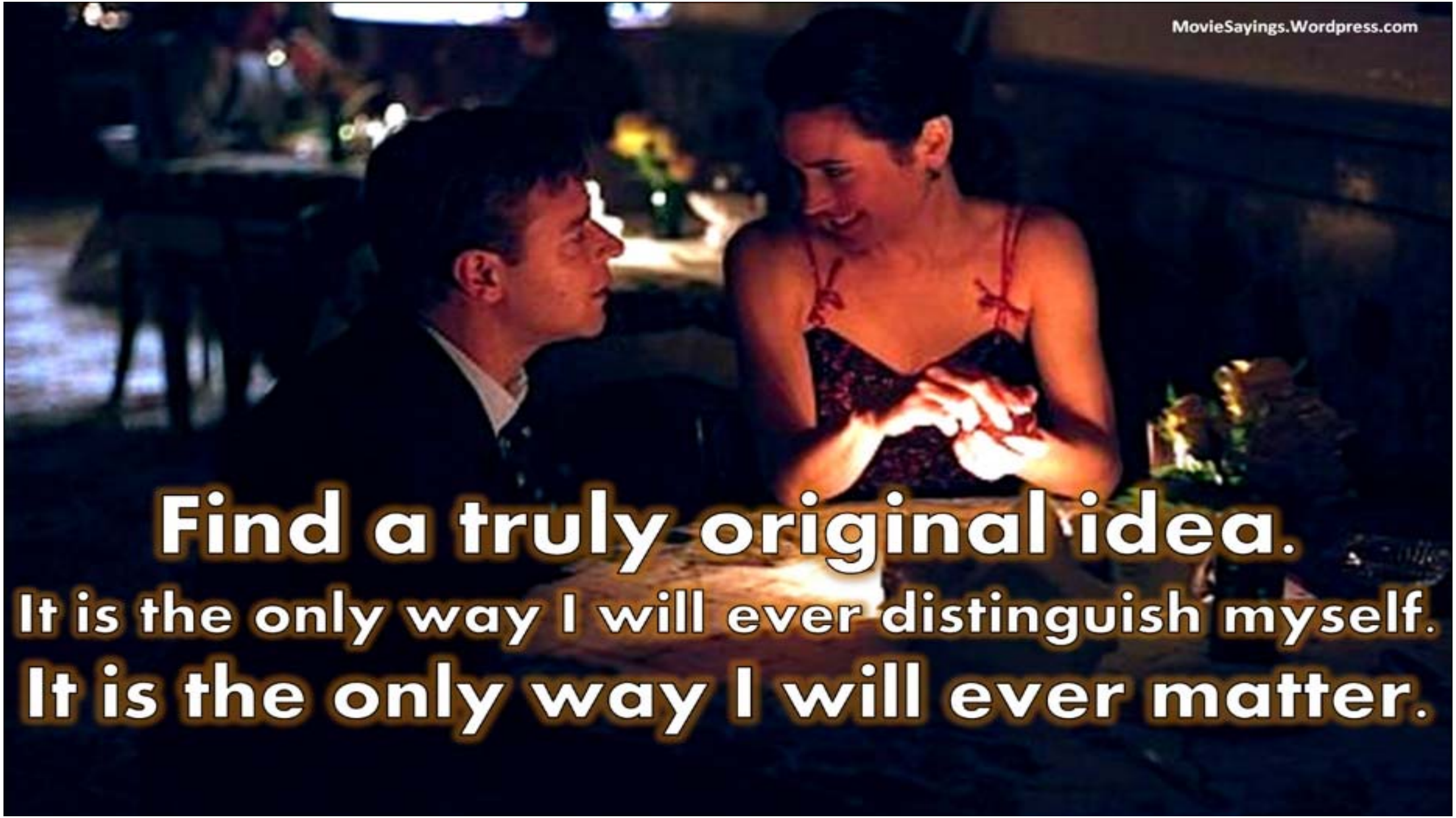
Scenario	Country	Logic	Releases	Instances
Tinnitus Research	World-Wide	○	3	≥ 25.000
Supporting Parents after Accidents of Children	Europe	○	5	≥ 2.500
Risk Factors during Pregnancy	Germany	◐	5	≥ 1.300
Risk Factors after Pregnancy	Germany	○	1	≥ 100
PTSD in War Regions	Burundi	●	5	≥ 2.200
PTSD in War Regions	Uganda	○	1	≥ 200
Adverse Childhood Experiences	Germany	●	3	≥ 100
Learning Deficits among Medical Students	Germany	●	3	≥ 200
Airline Catering	Germany	○	3	≥ 500
Diabetes Diary	Germany	●	2	≥ 200

Conclusions

- BPM needs good theories, methods, and technolgies for contributing to the digital transformation!
- To create an impact in the digital era, a stronger focus on process automation (i.e. engineering and runtime) is needed!
- We need to rethink BPM applying it in a broader scope!
- Emerging technologies (e.g. RBA, Block-chain, Smart Devices) will open up opportunities to totally rethink processes

Conclusions

- Flexible BPM platforms deliver the ability to manage work while dynamically adapting processes according to a contextual awareness and understanding of content, data, business and events.
- This is the basis of intelligent automation, making BPM technologies the appropriate platform for digital transformation.
- But: True digital transformation requires more than just digitizing back end processes!


MovieSayings.Wordpress.com
Find a truly original idea.
It is the only way I will ever distinguish myself.
It is the only way I will ever matter.