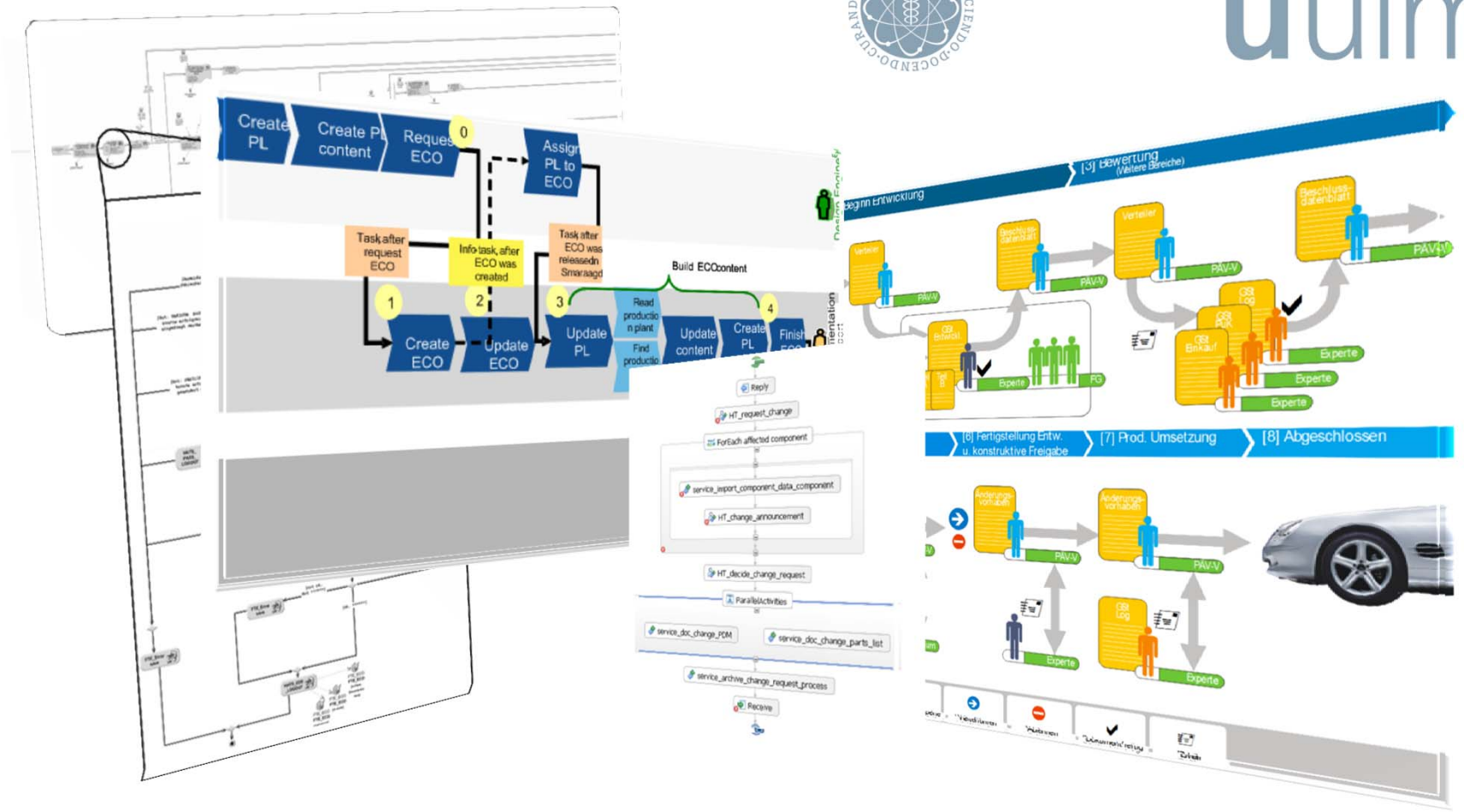
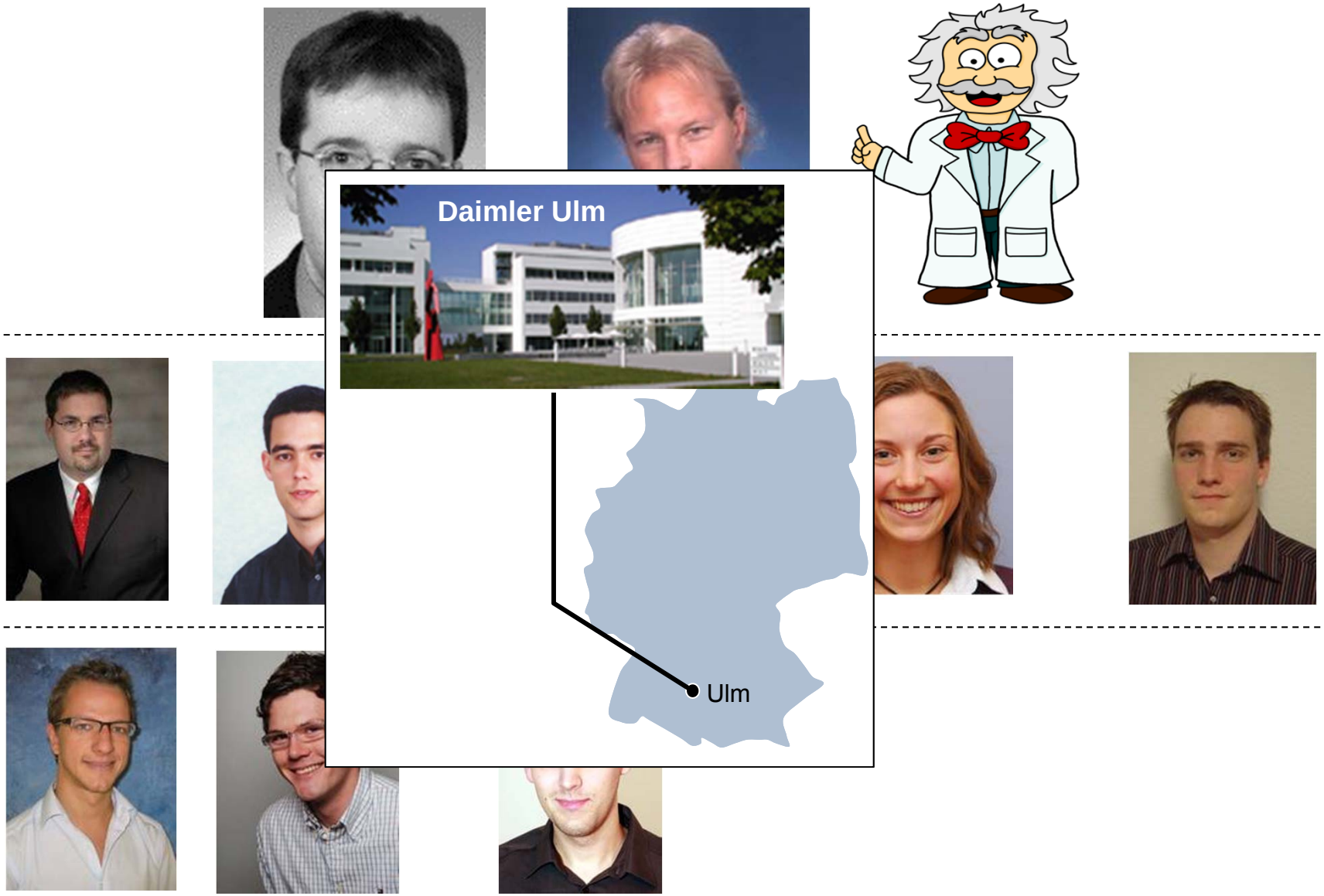



# From Theory to Practice - A Decade of BPM Research & Development in the Automotive Domain: Challenges, Solutions, Project Examples


## Manfred Reichert

# The Daimler BPM Round Table



# Agenda

- Large Process Models
- Large Process Model Collections
- Large Process Structures

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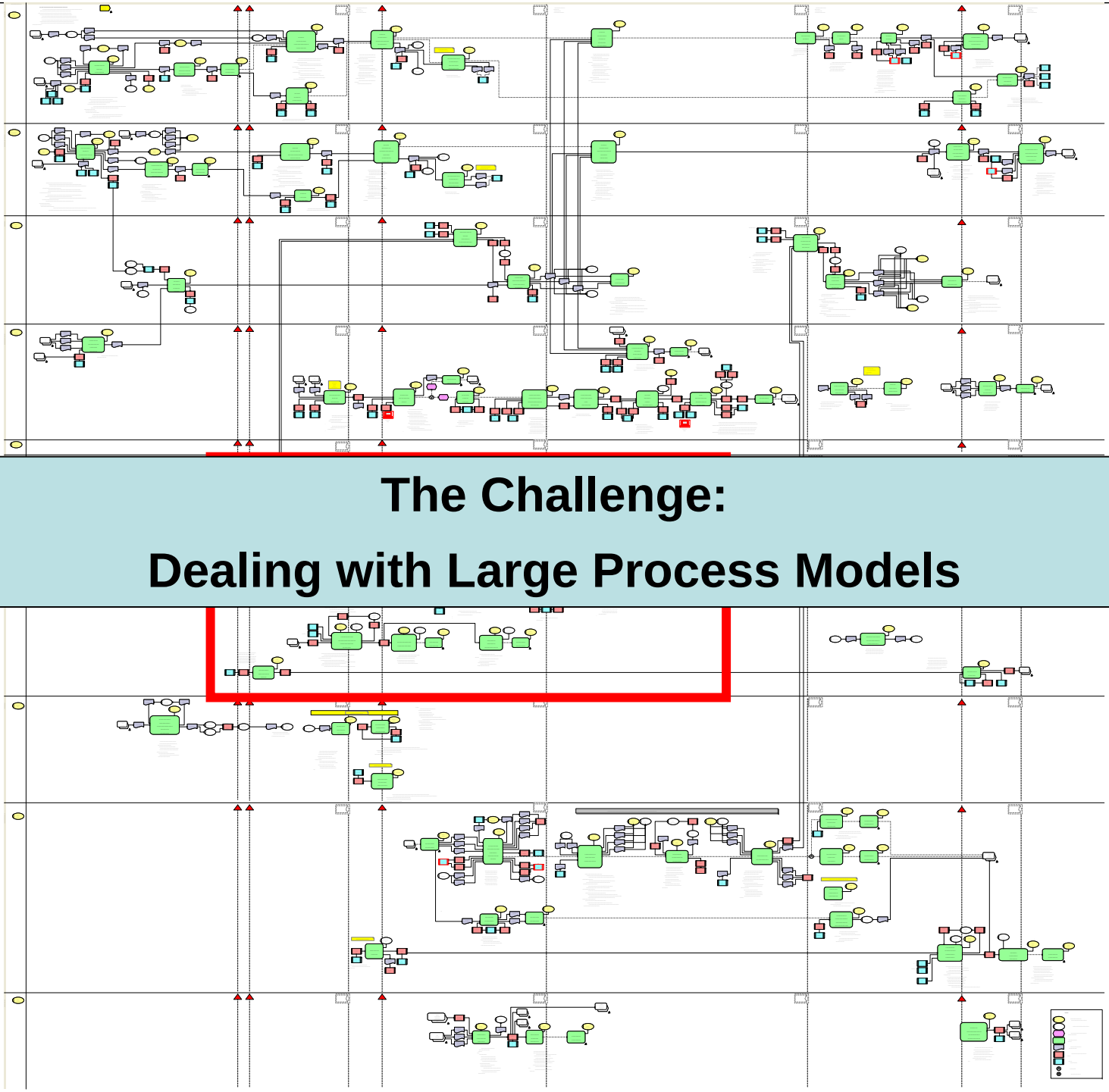
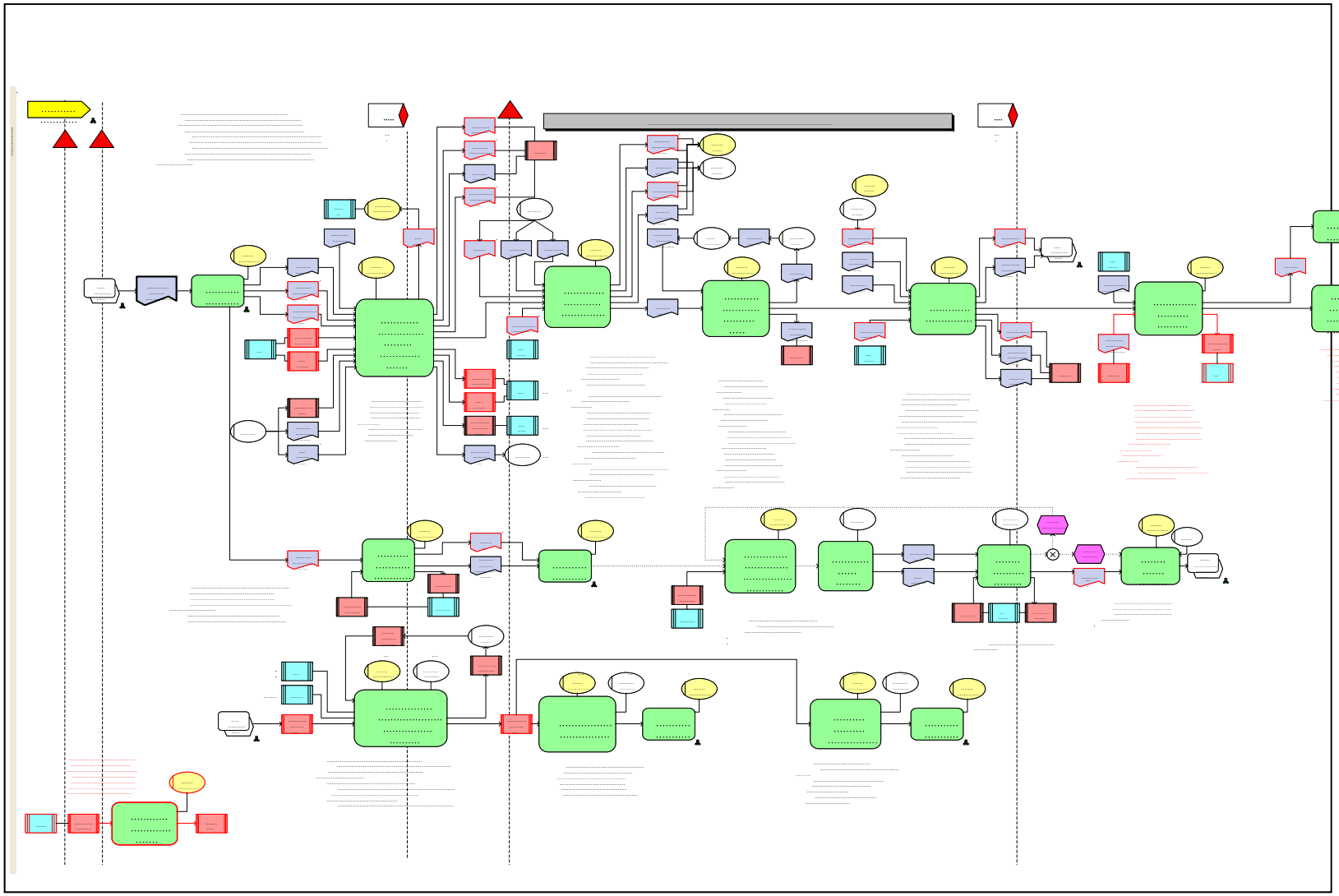
- Large Process Models
- Large Process Model Collections
- Large Process Structures



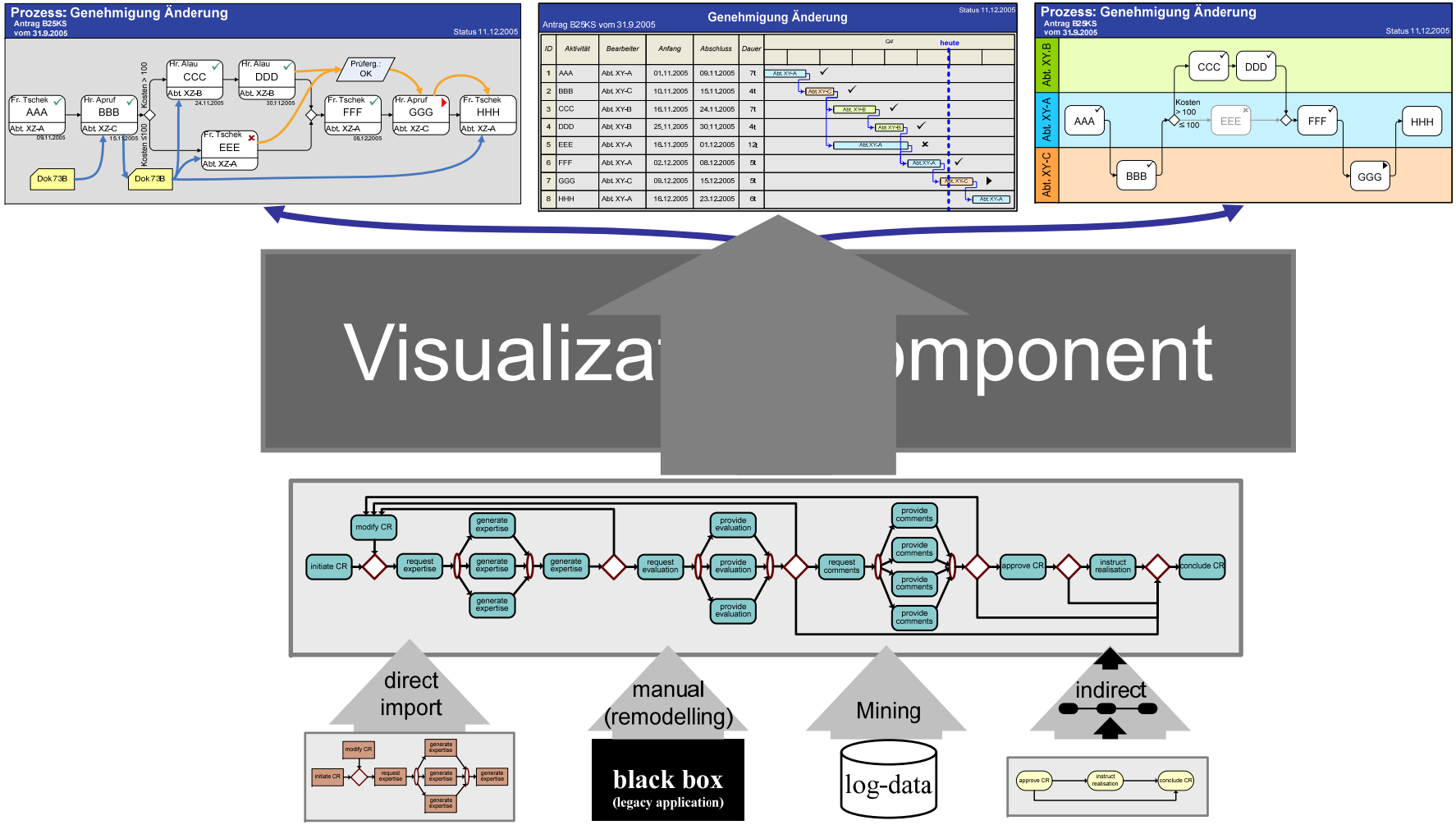
# The Challenge:

# Dealing with Large Process Models

# The Challenge: Dealing with Large Process Models

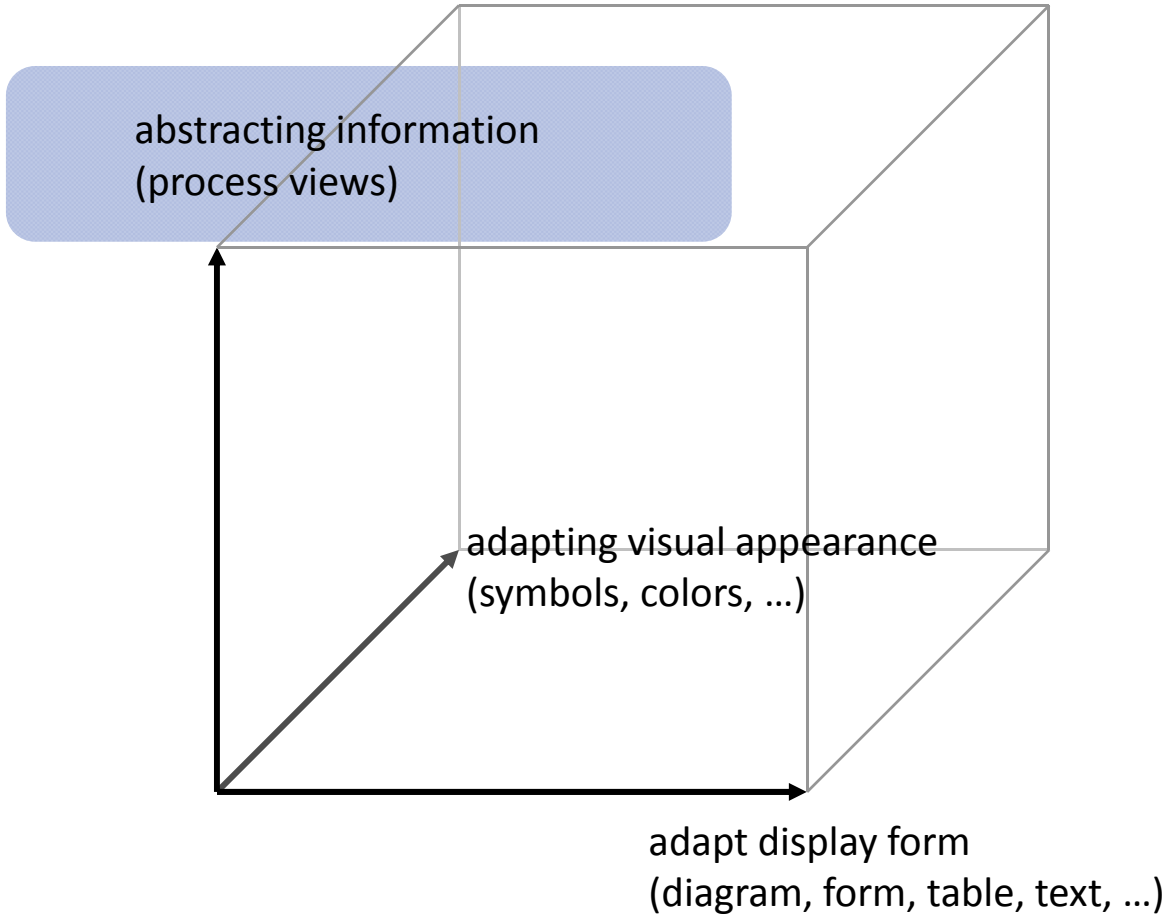


# Dealing with Large Process Models: Need for an Advanced Visualization Framework

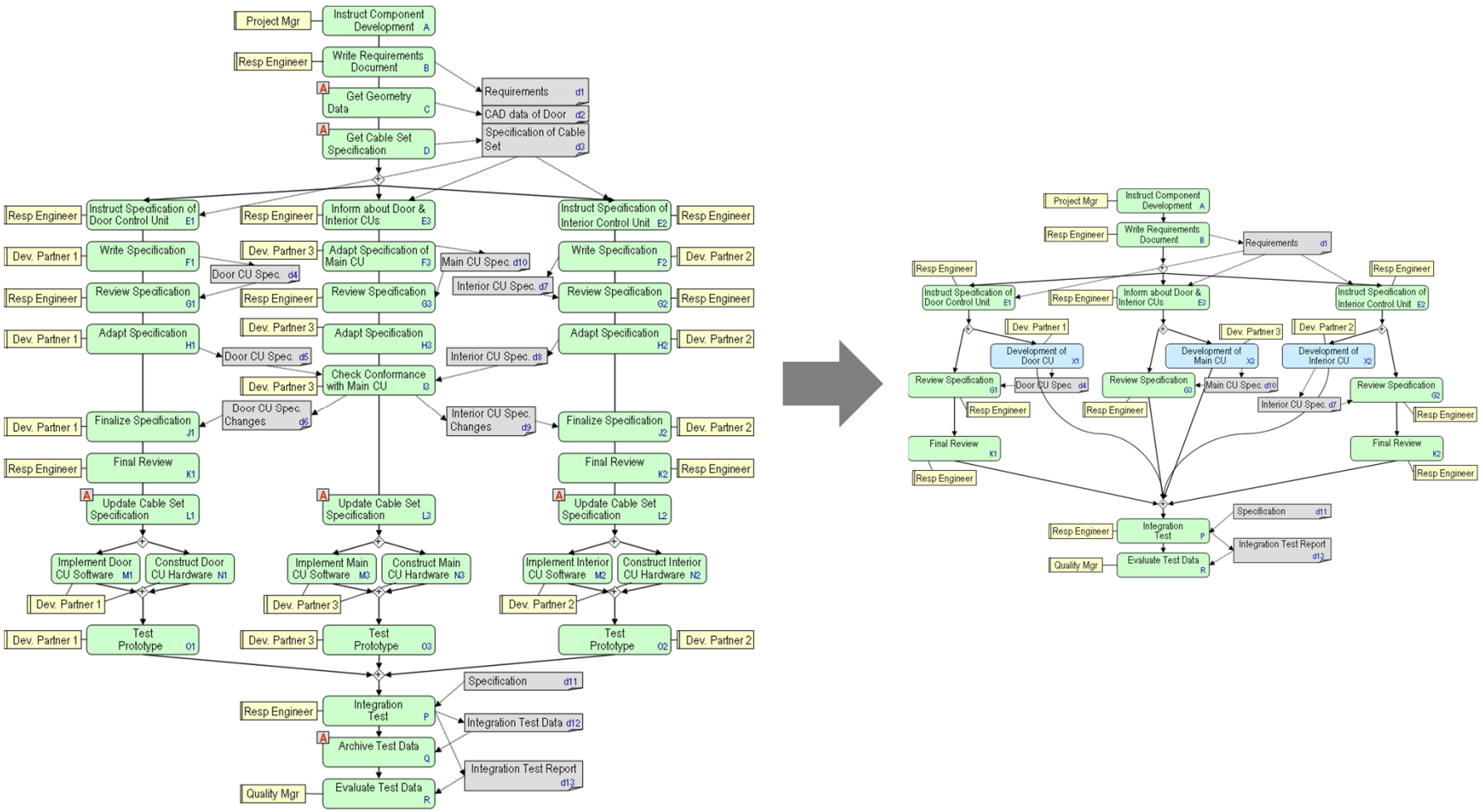


# The Proviado Project

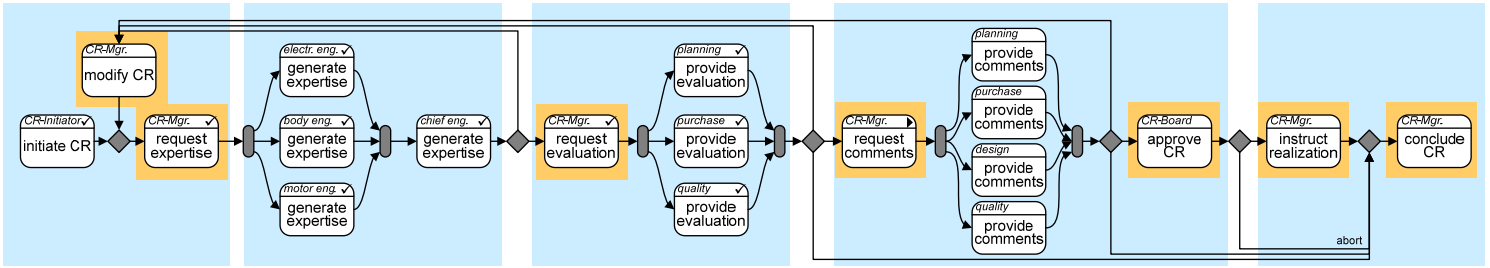
# The Proviado Visualization Framework



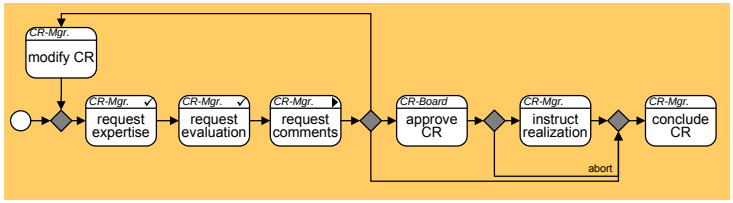
# Proviado: Process Model Abstraction - Example



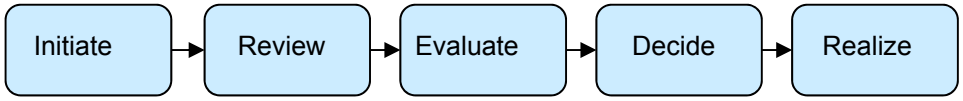
# Proviado: Process Model Abstraction – Basic Operations (1)




CREATE REDUCED VIEW cr-manager AS
SELECT FROM cr-process p
WHERE p.activity.actor = „CR-Mgr.“




**CREATE VIEW cr-overview AS**
**AGGREGATE(‚Initiate CR‘,…) AS ‚Initiierung‘**
**…**
**FROM cr-process**

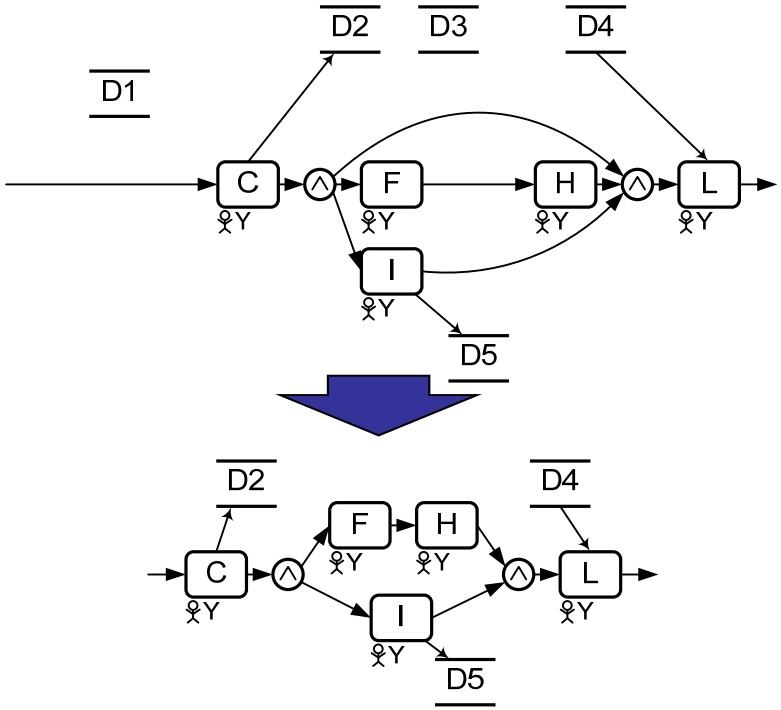



## Some Requirements:

- Reduce complexity of (large) process models
- Aggregate or eliminate certain process information in a given application context
- Cover all process perspectives: behavior, data, …

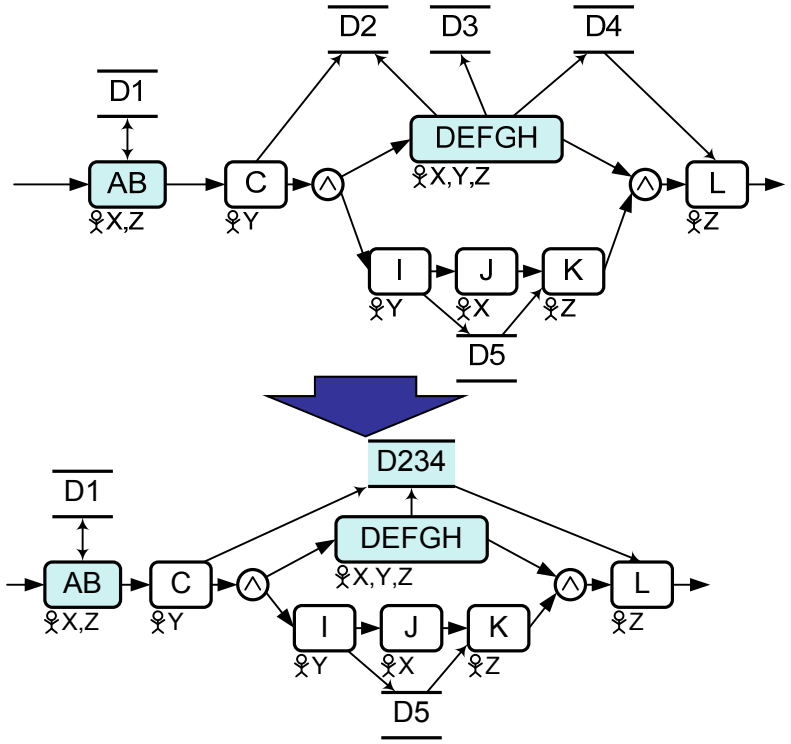
# Proviado: Process Model Abstraction – Basic Operations (2)

## Reduction




- Eliminate activities
- Simplify the resulting schema
- Remove adjacent satellite objects

## Aggregation

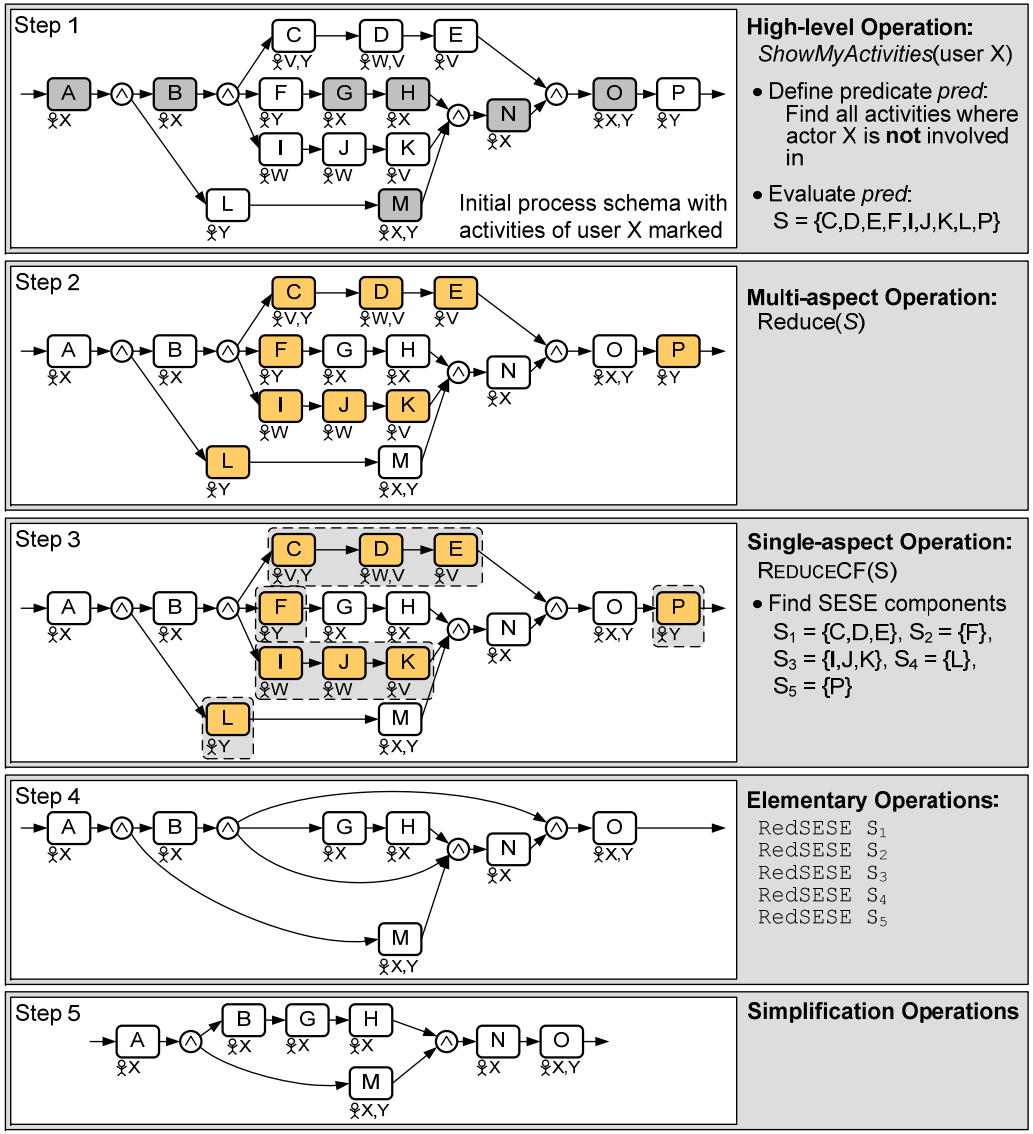



- Aggregate activities
- Aggregate adjacent objects if required

# Proviado: Process Model Abstraction – High-Level Operations

Example:

ShowMyActivities

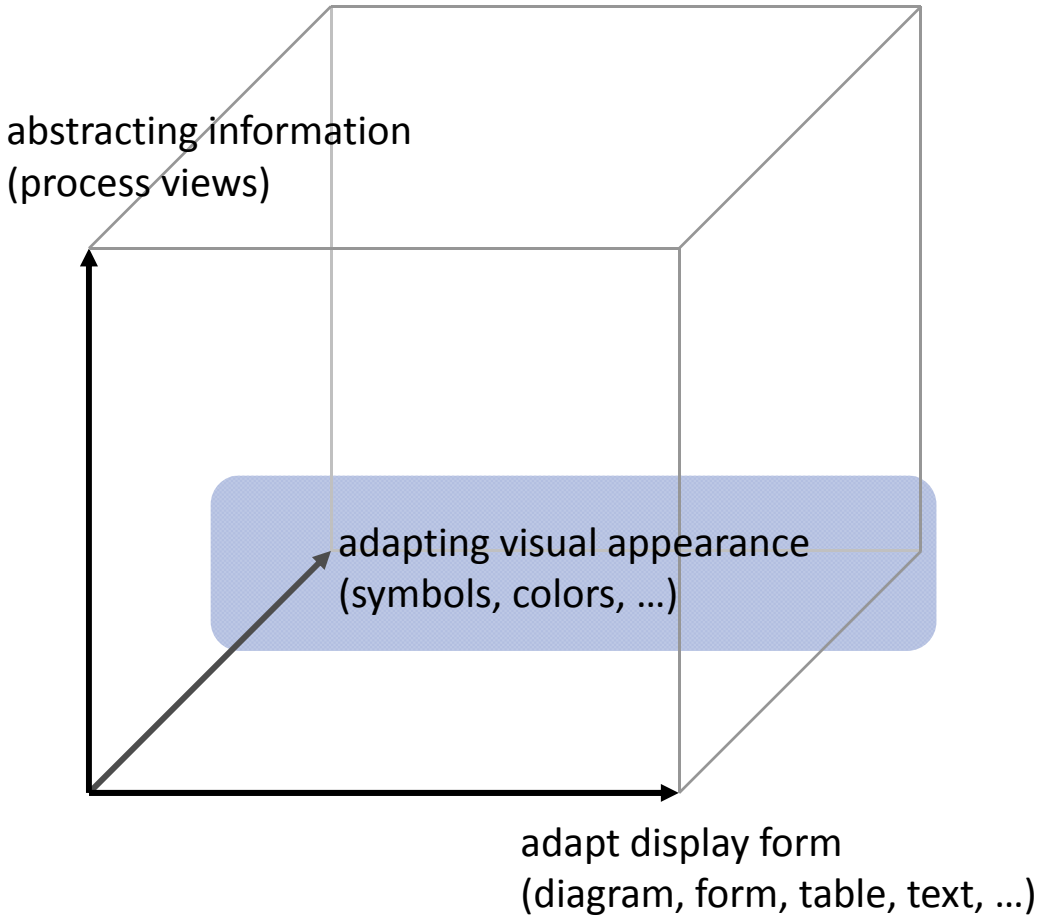


# Proviado: Process Model Abstraction – Summary

**Proviado …**

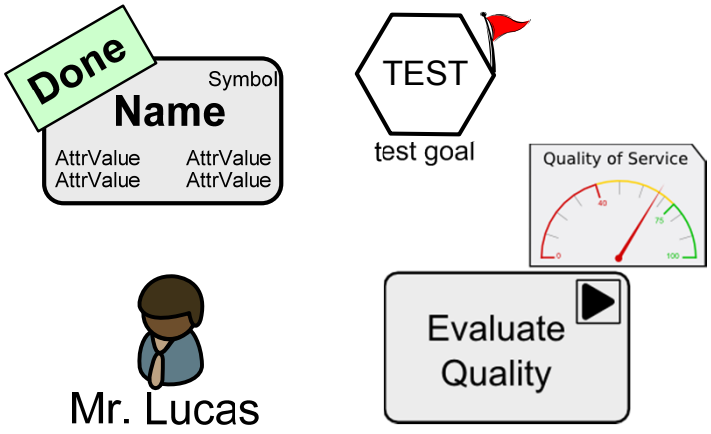
- offers a powerful mechanism for creating and visualizing process model abstractions (i.e., process views)
- enables a high degree of flexibility in respect to the artefacts created (based on parameterizable view-building operations)
- considers all process perspectives, e.g., control and data flow, process attributes, process logs
- has a well-defined formal foundation

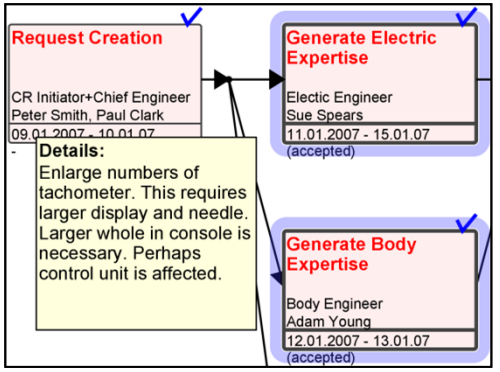
# The Proviado Visualization Framework

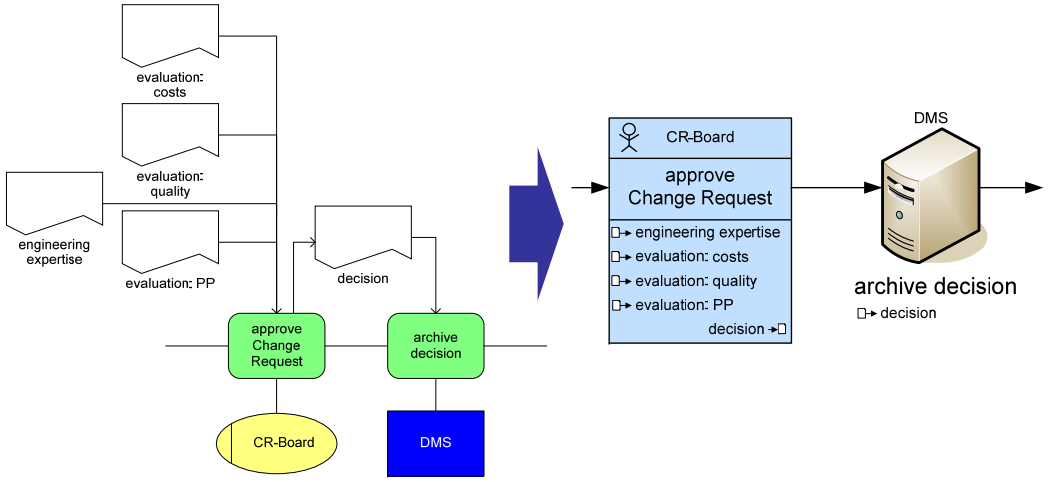


# Proviado: Adjusting the Visual Appearance of Process Models

## Visualization templates



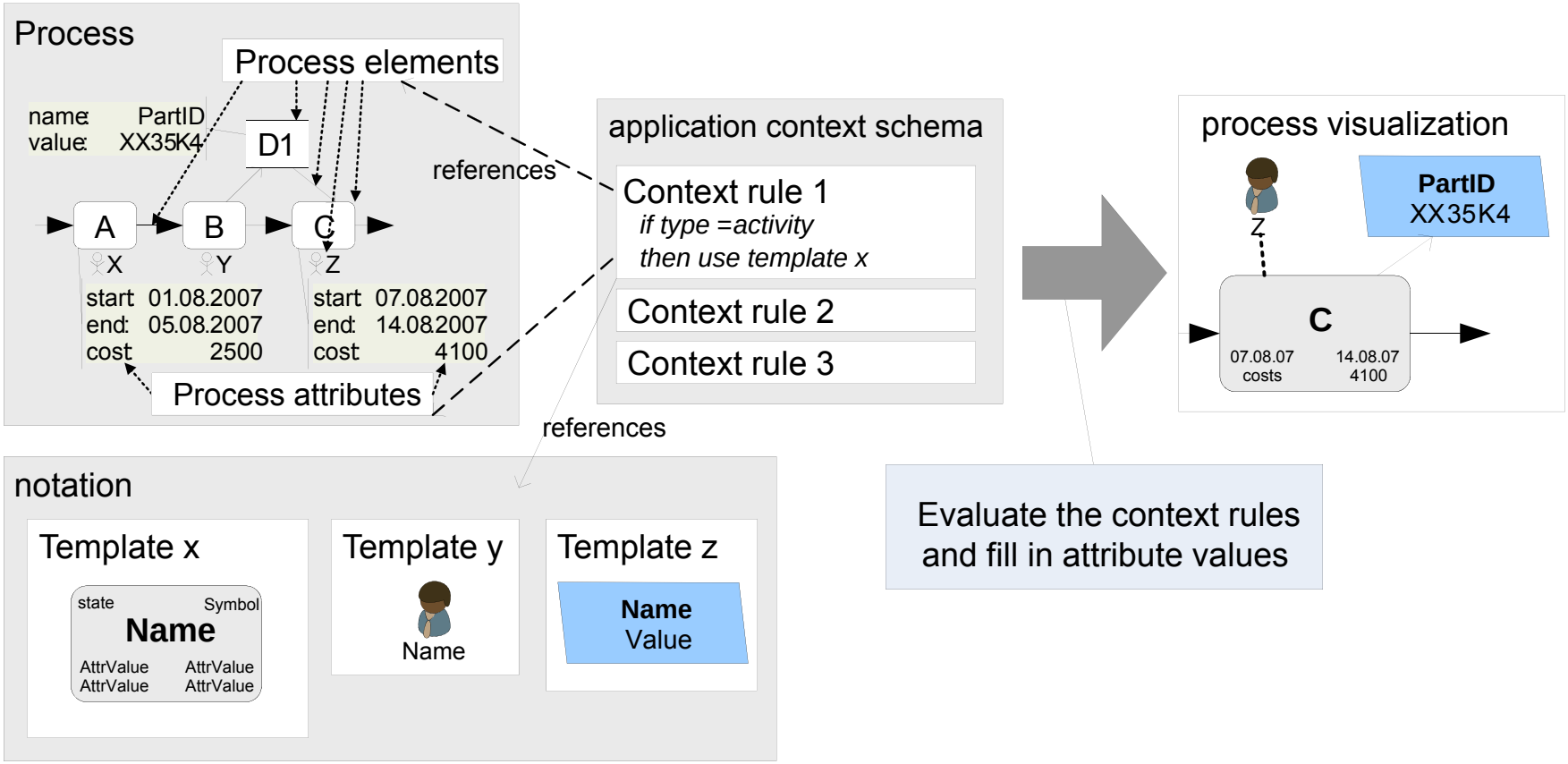




**Visualization template defines**

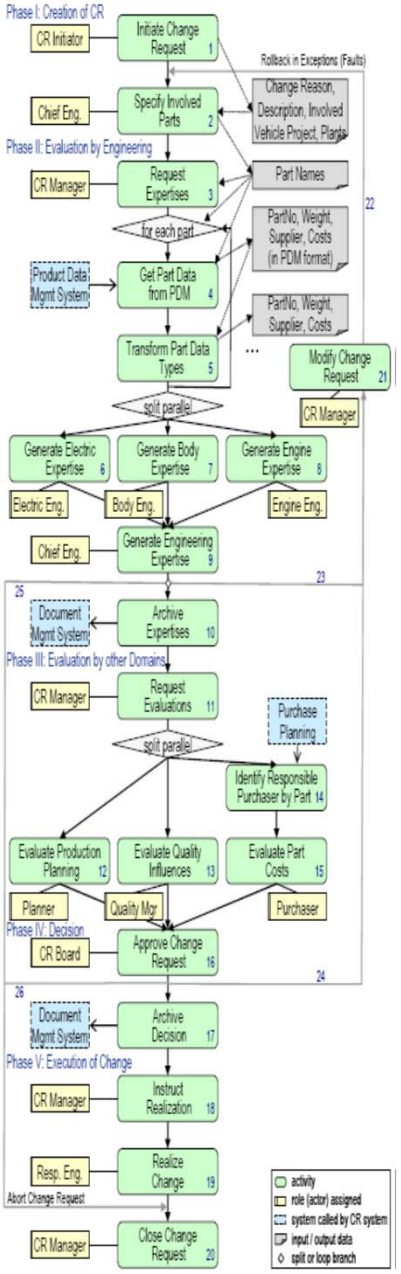
1. symbol to be used
2. data to be displayed
3. application context

# Proviado: Adjusting the Visual Appearance of Process Models

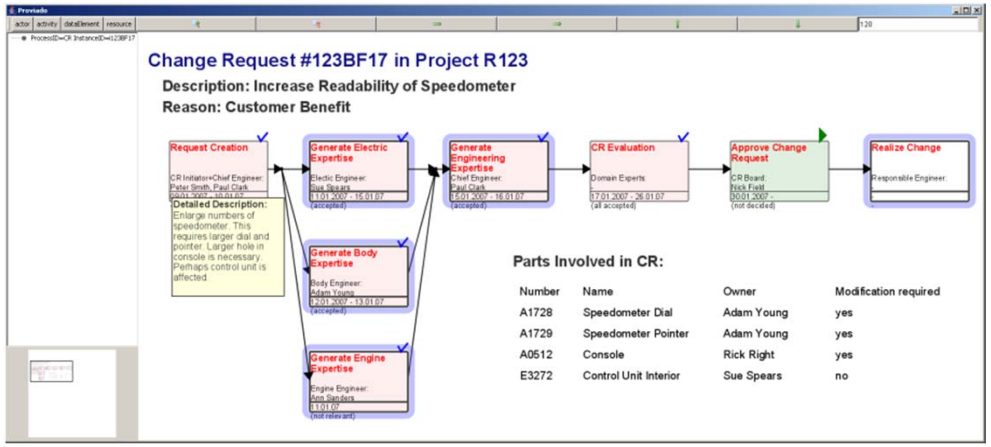
## Creating a process visualization



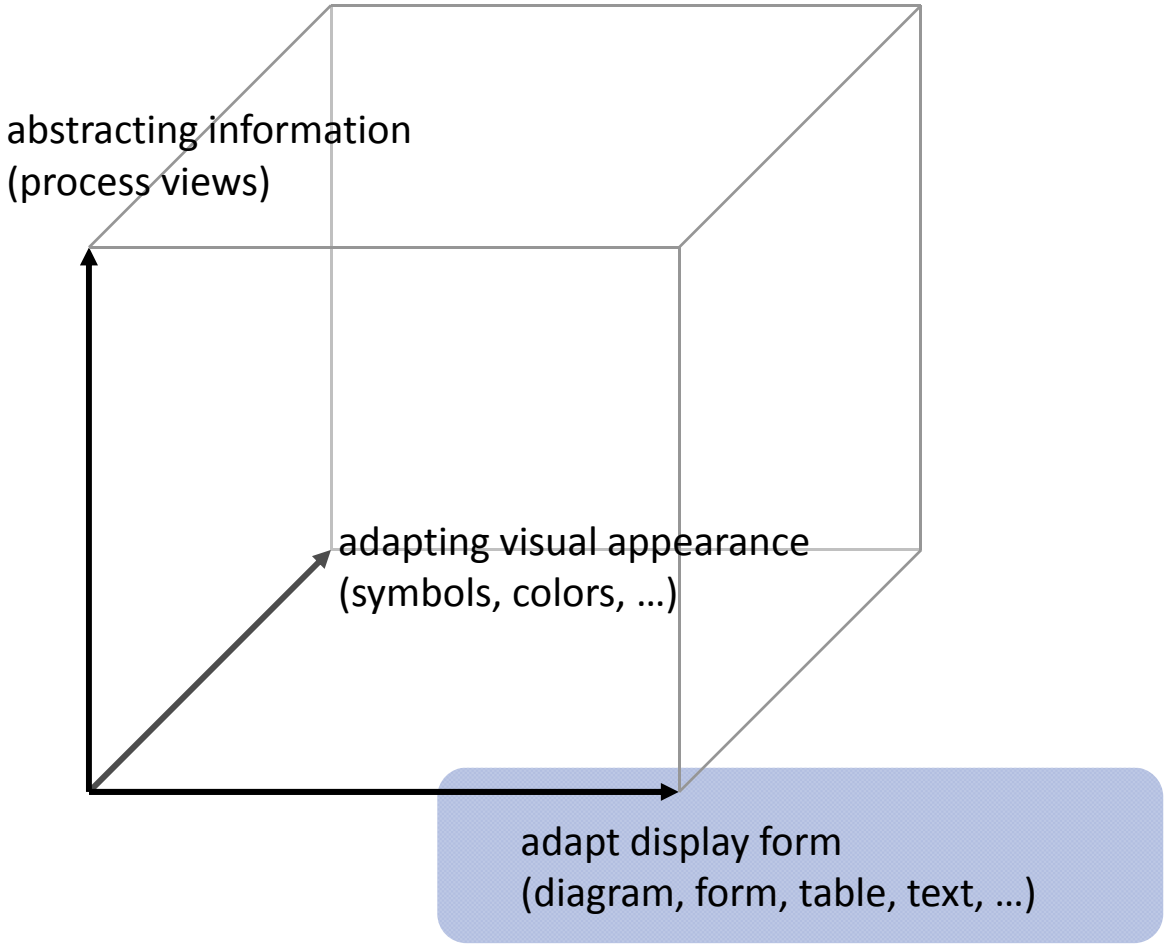
# Proviado: Abstraction + Visual Configuration



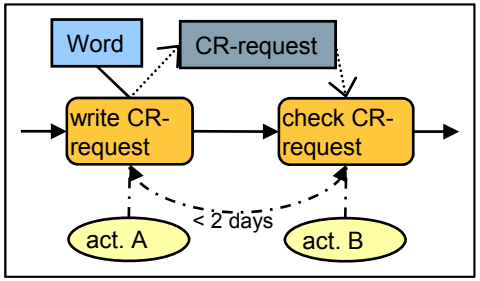

Personalized Visualization

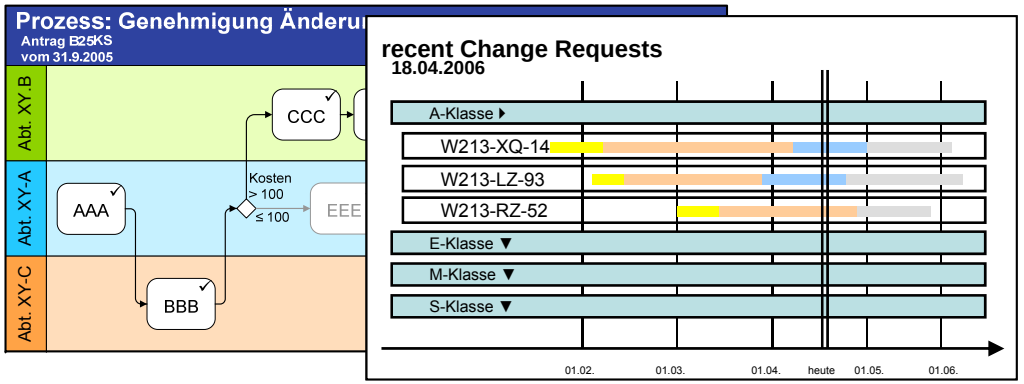


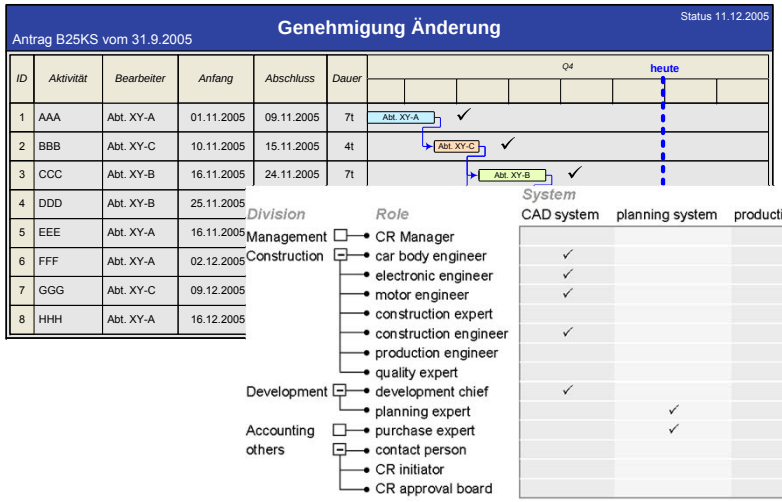
# The Proviado Visualization Framework

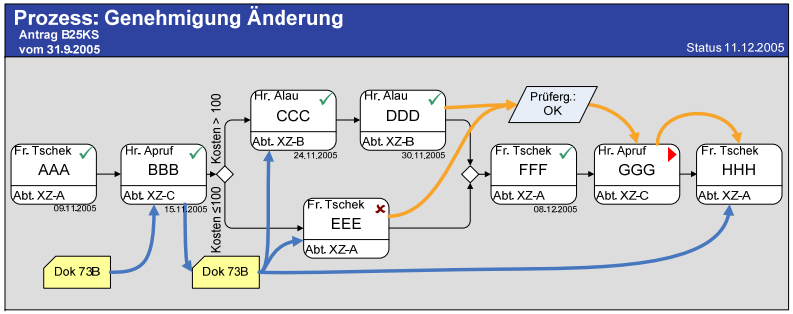


# Proviado: Supporting Different Display Forms for Process Models

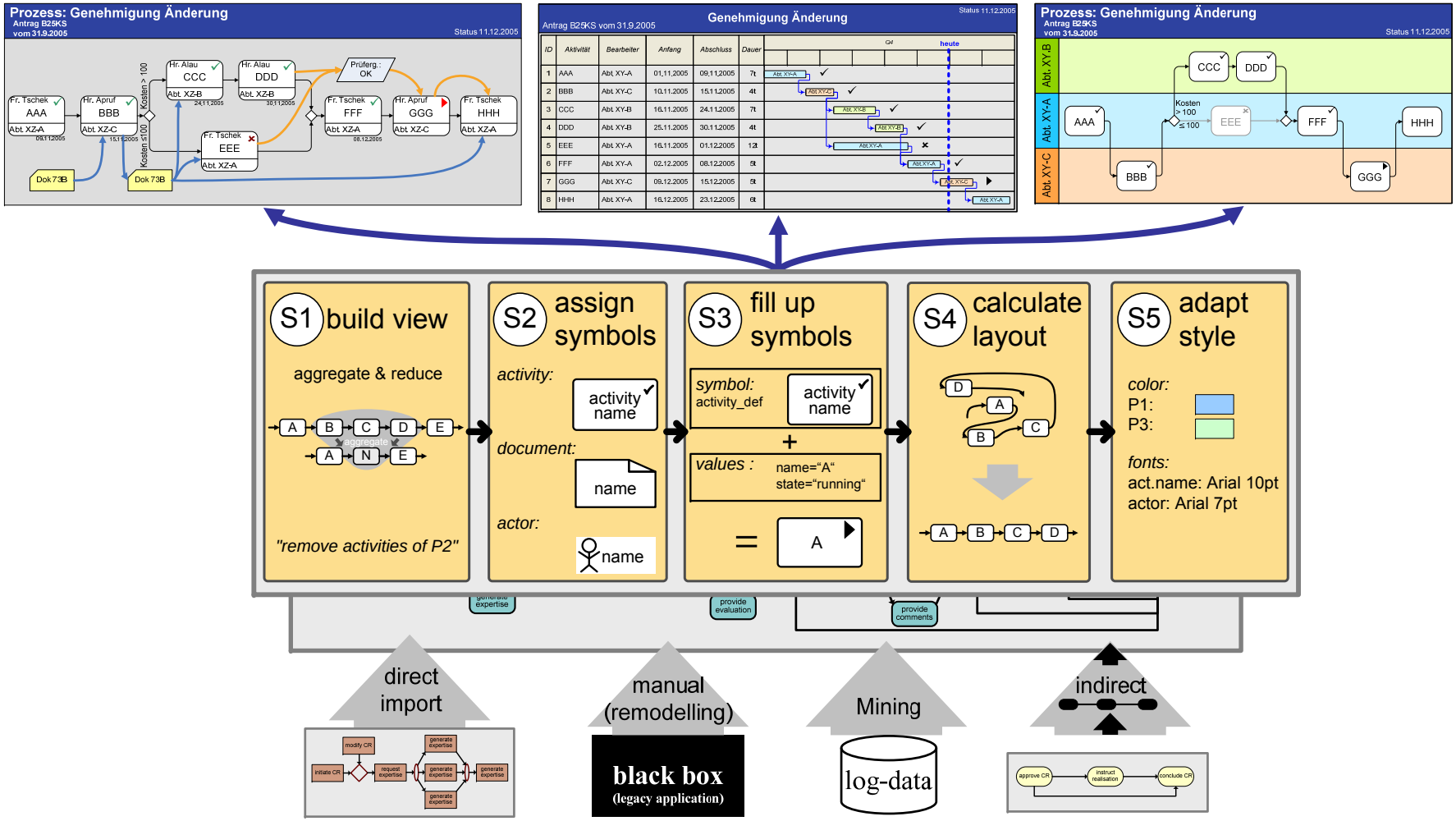


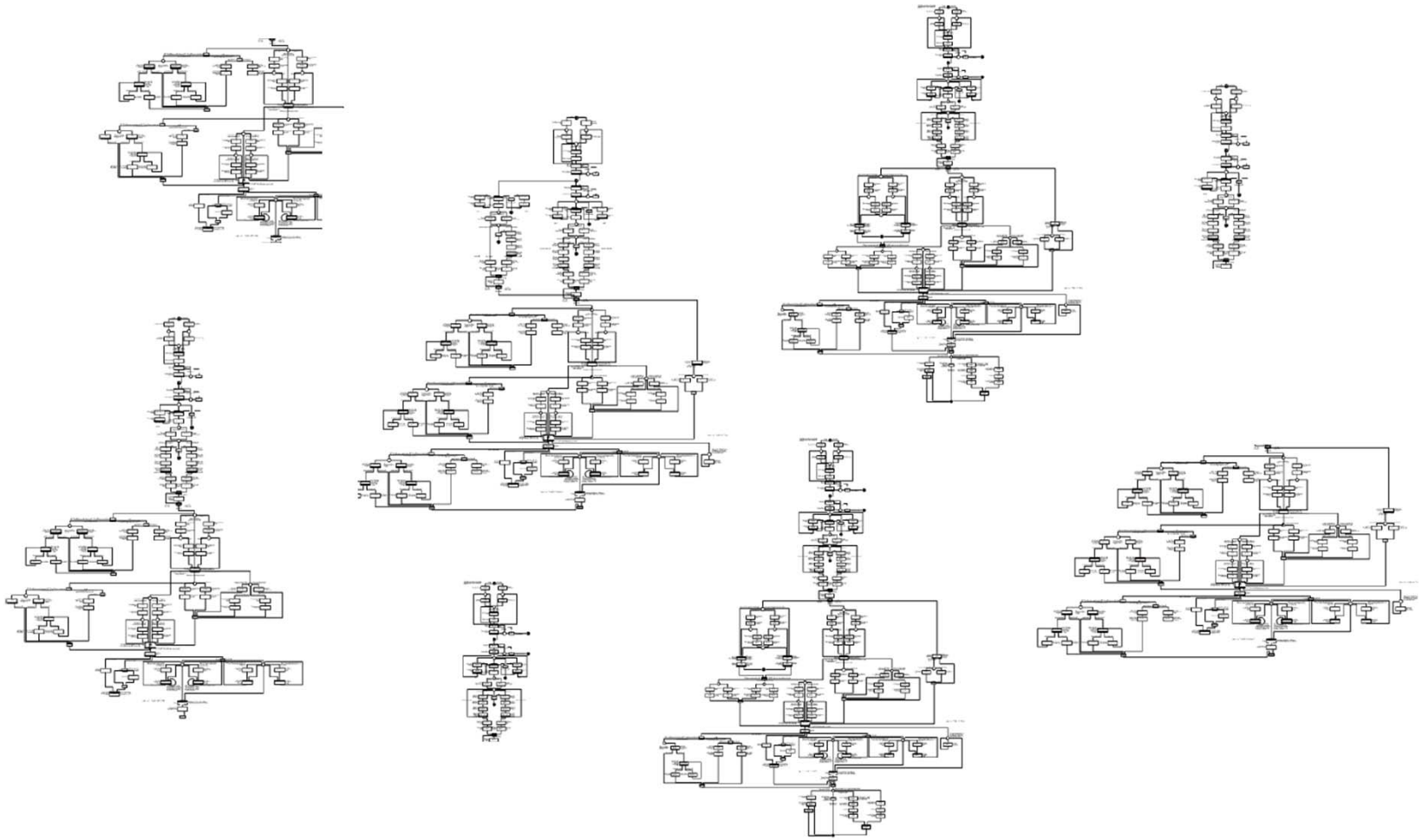
# The Proviado Visualization Framework: Achievements



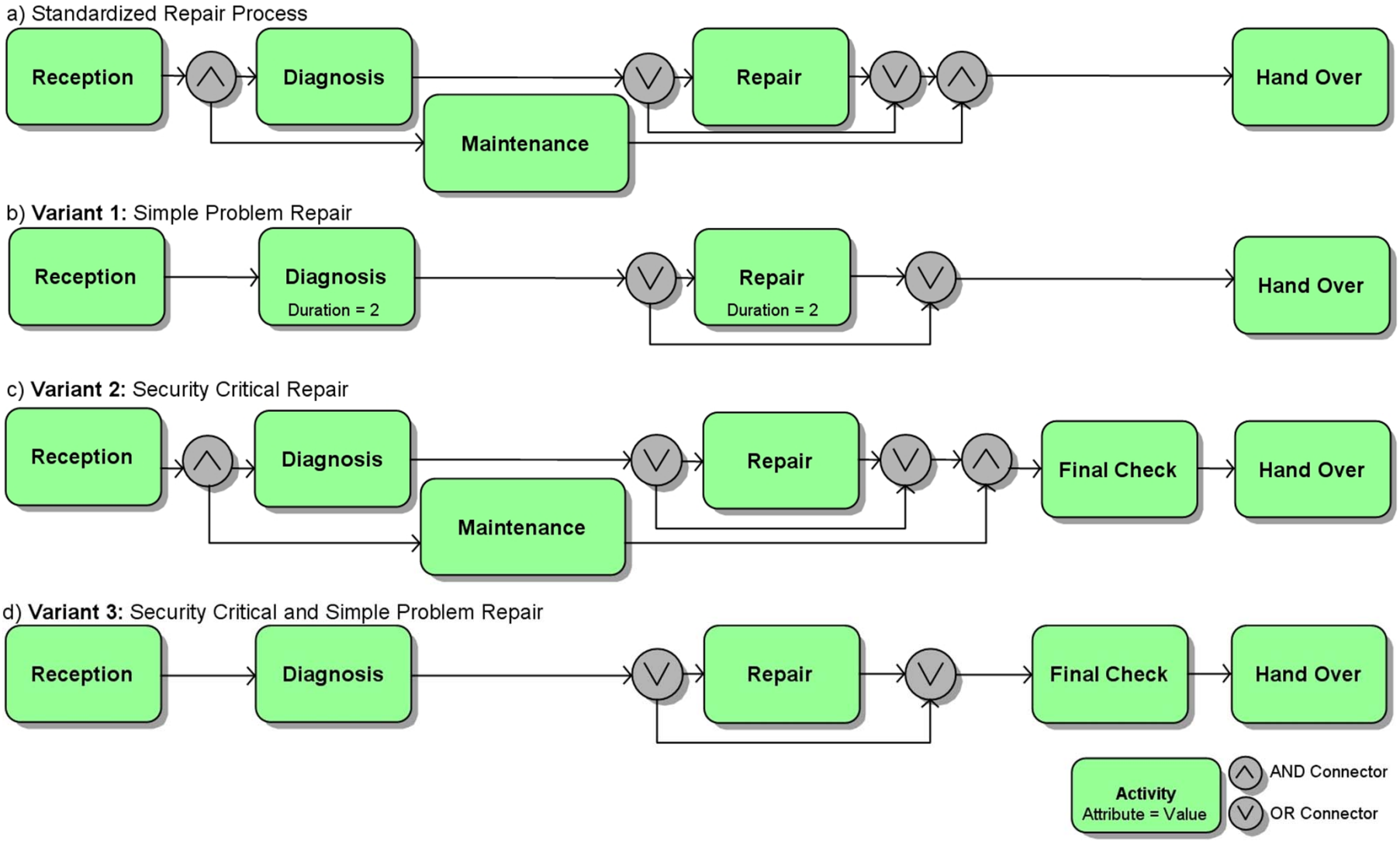
# Agenda

- Large Process Models
- **Large Process Model Collections**
- Large Process Structures

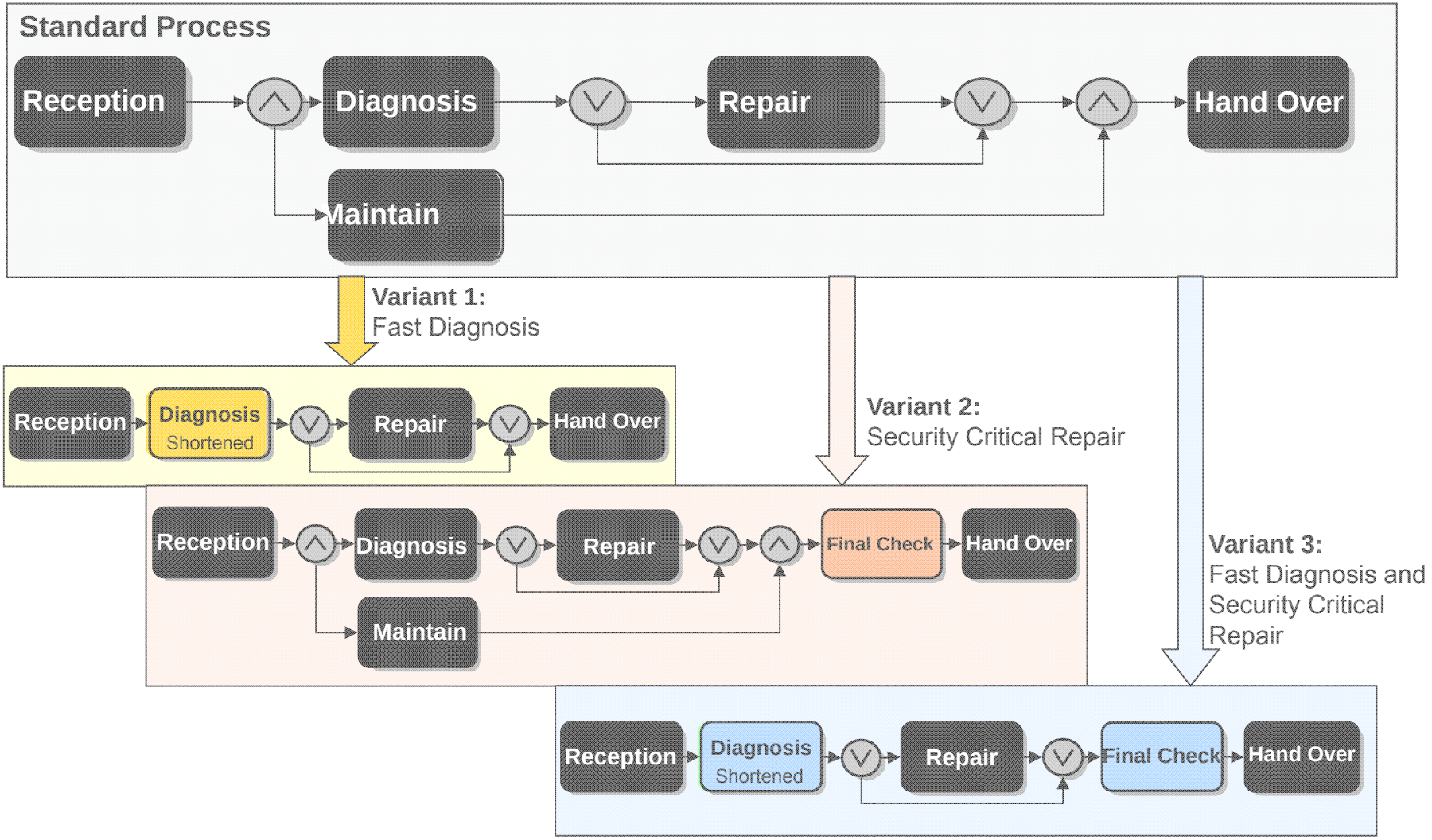
# The Challenge: Dealing with Large Process Model Collections



# … And a Particular Challenge: Managing Process Variants

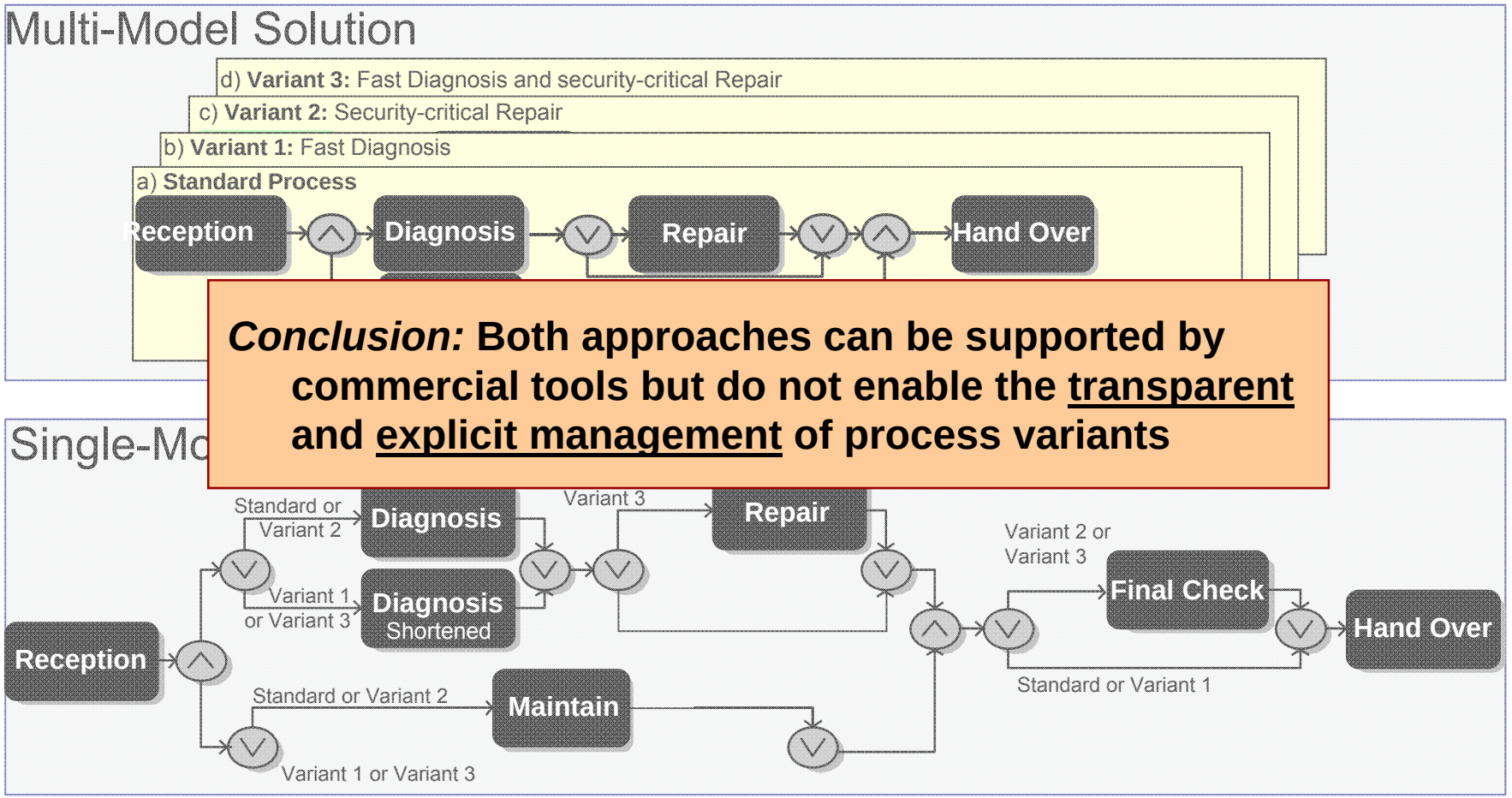


# … And a Particular Challenge: Managing Process Variants

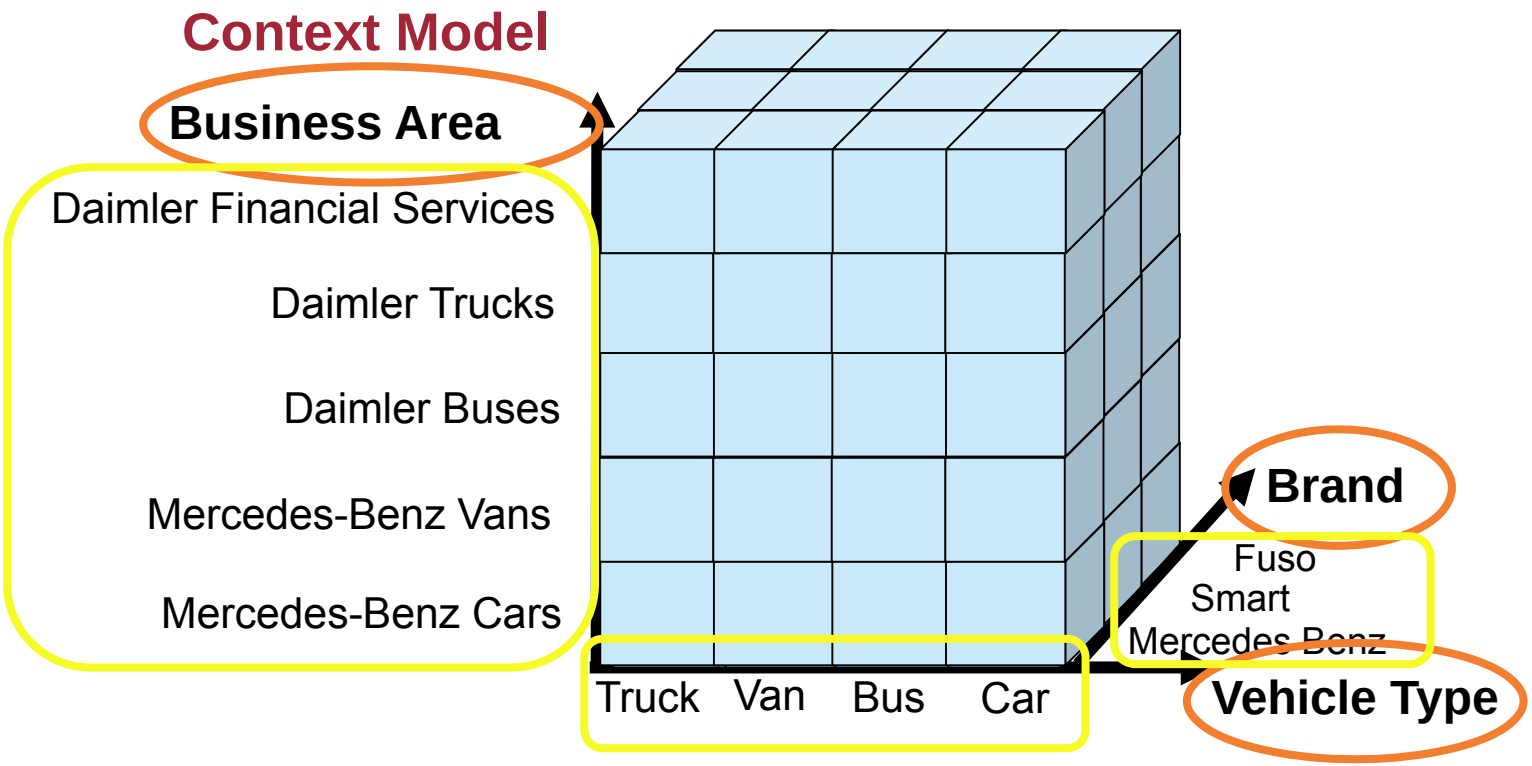


# … And a Particular Challenge: Managing Process Variants

## How Daimler captured the variants of a process family ….



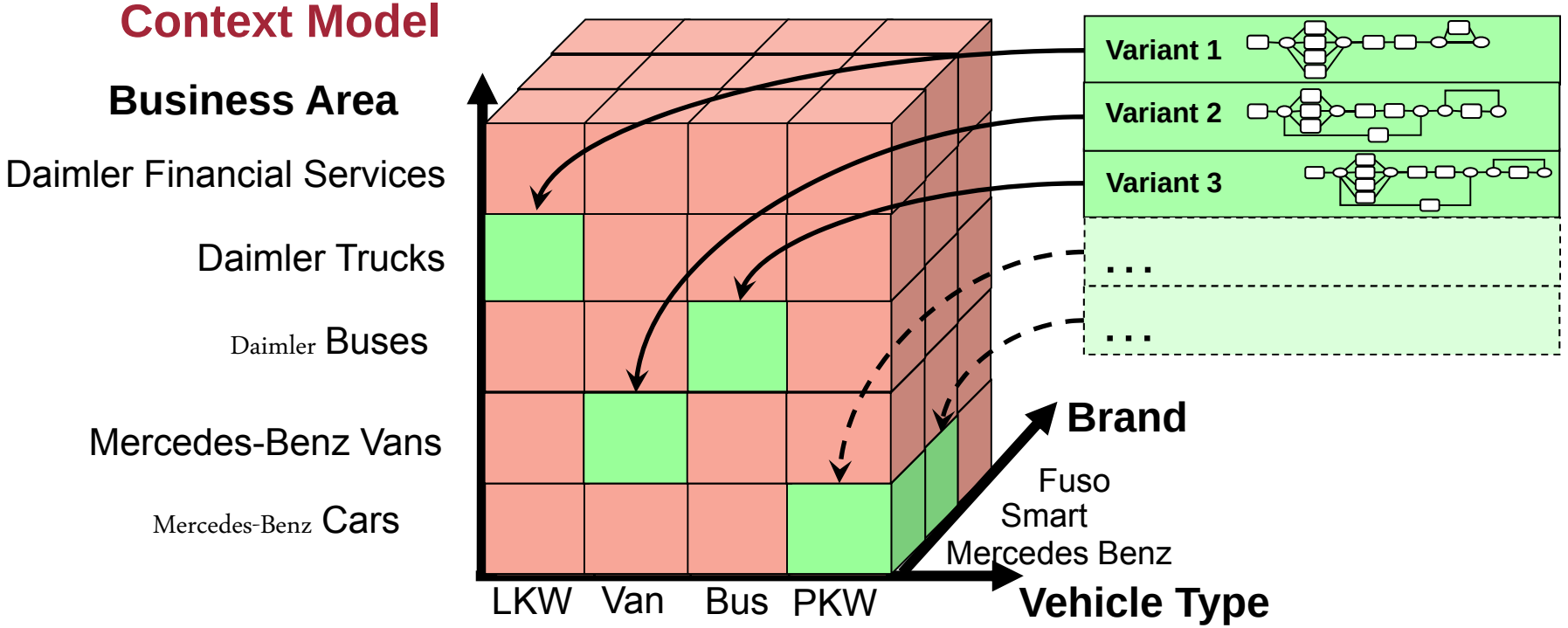
# … And a Particular Challenge: Managing Process Variants




***Problem: Not all value combinations make sense!***

# … And a Particular Challenge: Managing Process Variants

## Context Model



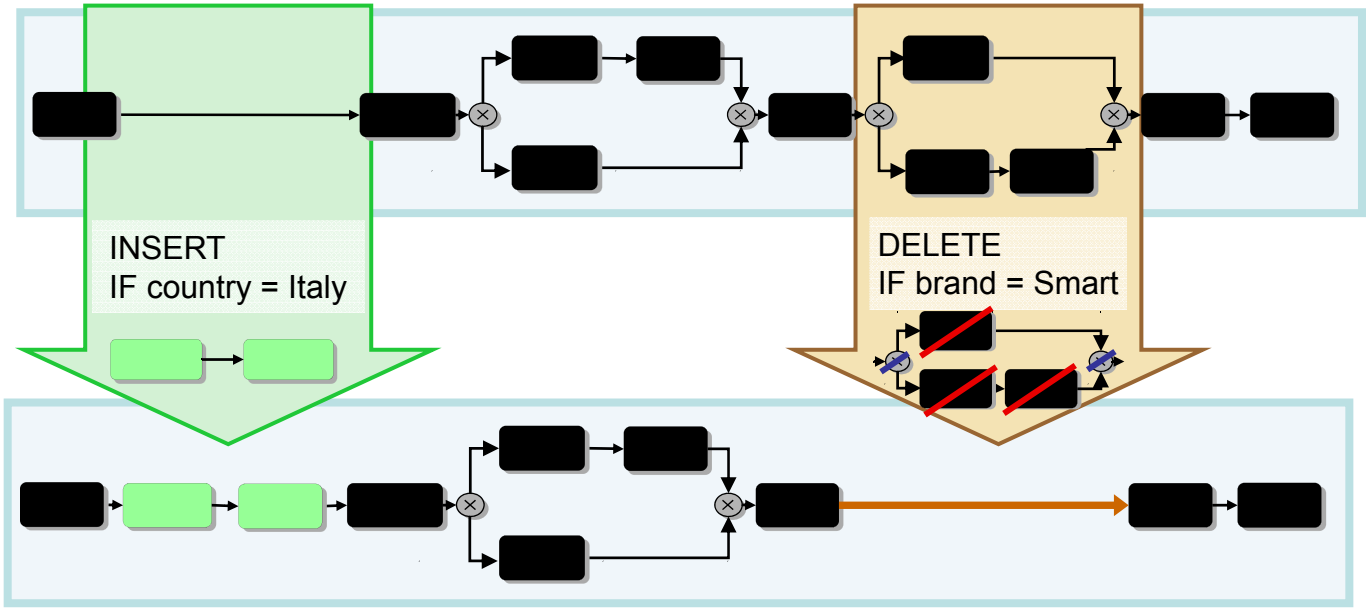
# The Provop Project

# The Provop Approach for Managing Process Variants

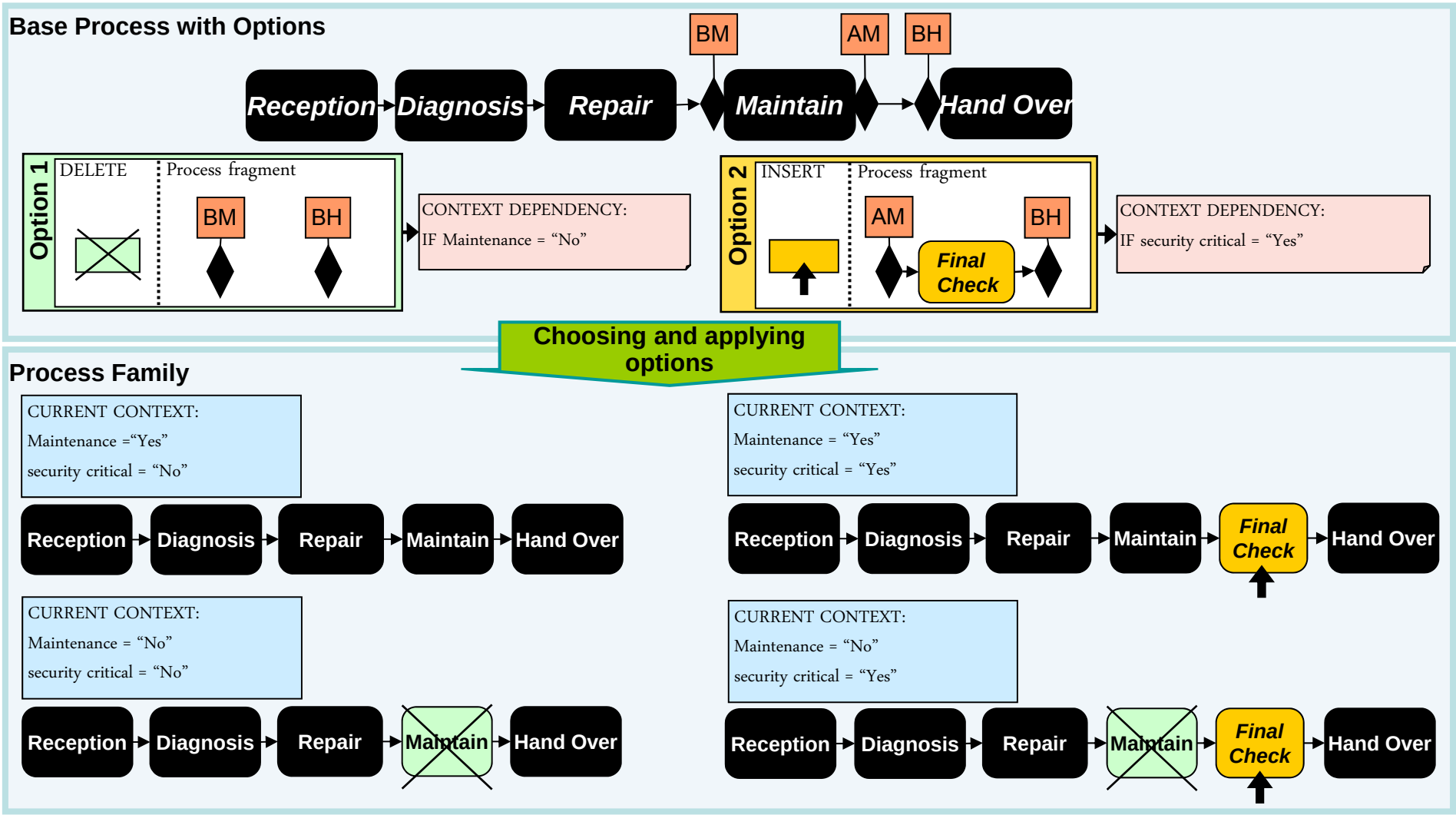
**Base process**

**Variant specific adjustments**

**Configured process variant**



# The Provop Approach for Managing Process Variants



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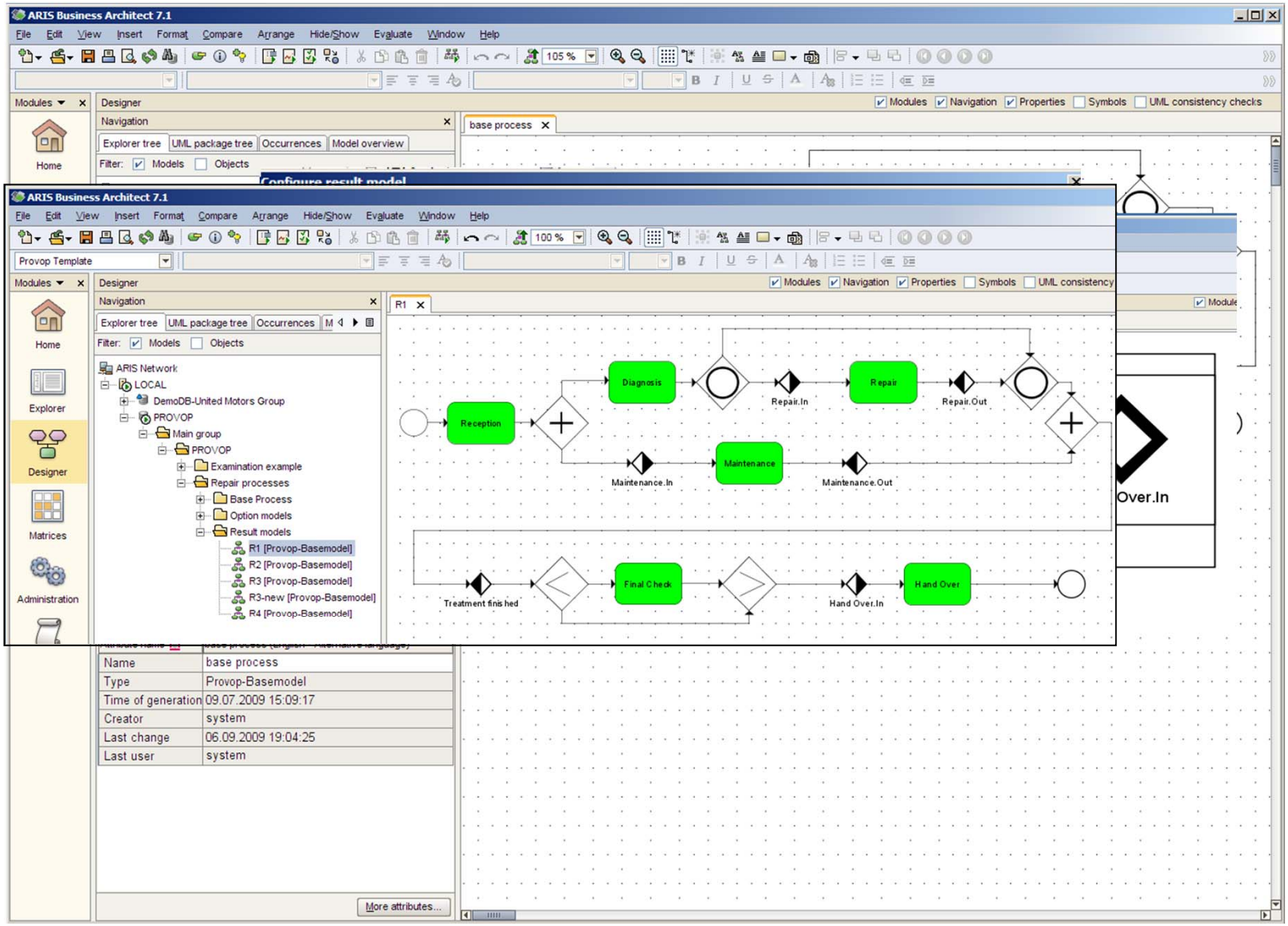
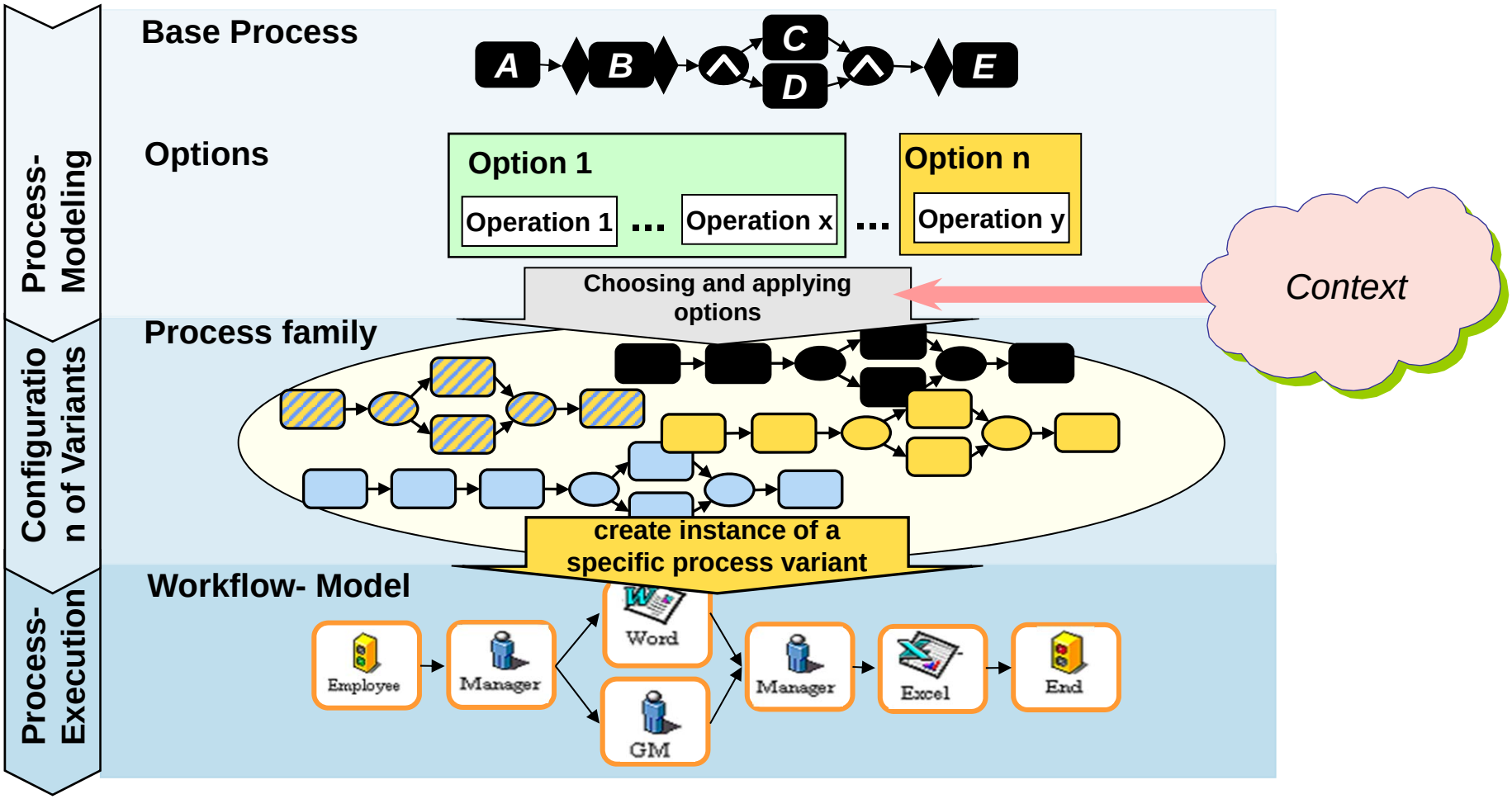


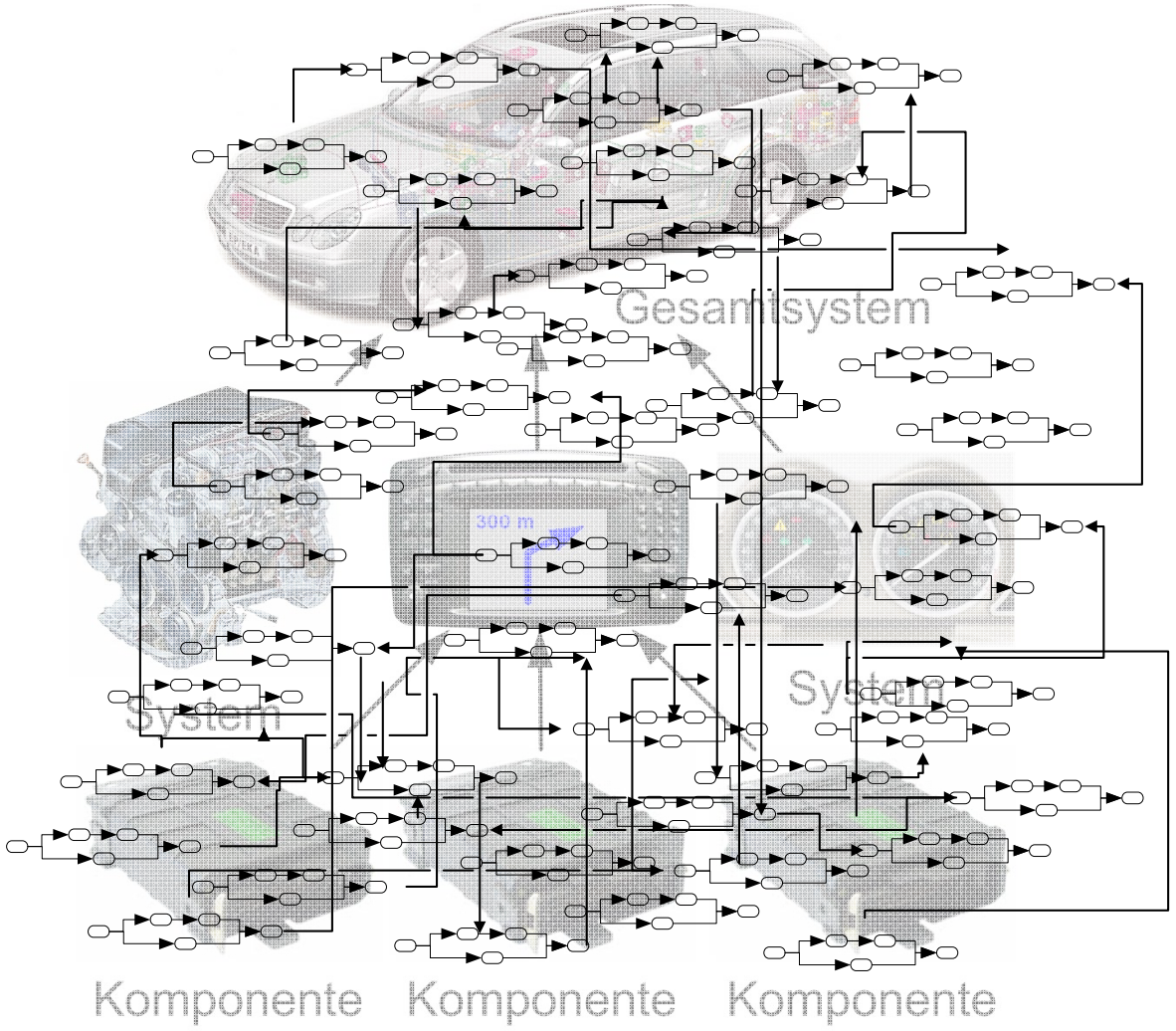
# The Provop Approach for Managing Process Variants



# Agenda

- Large Process Models
- Large Process Model Collections
- **Large Process Structures**

# The Challenge: Dealing with Large and Complex Process Structures



# The Challenge: Dealing with Large and Complex Process Structures

## Automotive Engineering:

- Electrical control units (ECUs) become more and more important:
  - provide many safety-critical functions
  - fast implementation of changes: adjustments and bug fixes by flashing new software onto the ECU
- Modern cars comprise up to 70 ECUs; >10.000.000 LoC
- ECUs interconnected by up to 10 buses with 2 kilometers of wires
- 90% of car innovations enabled by E/E systems

**Example:**
**Electronics in side door**

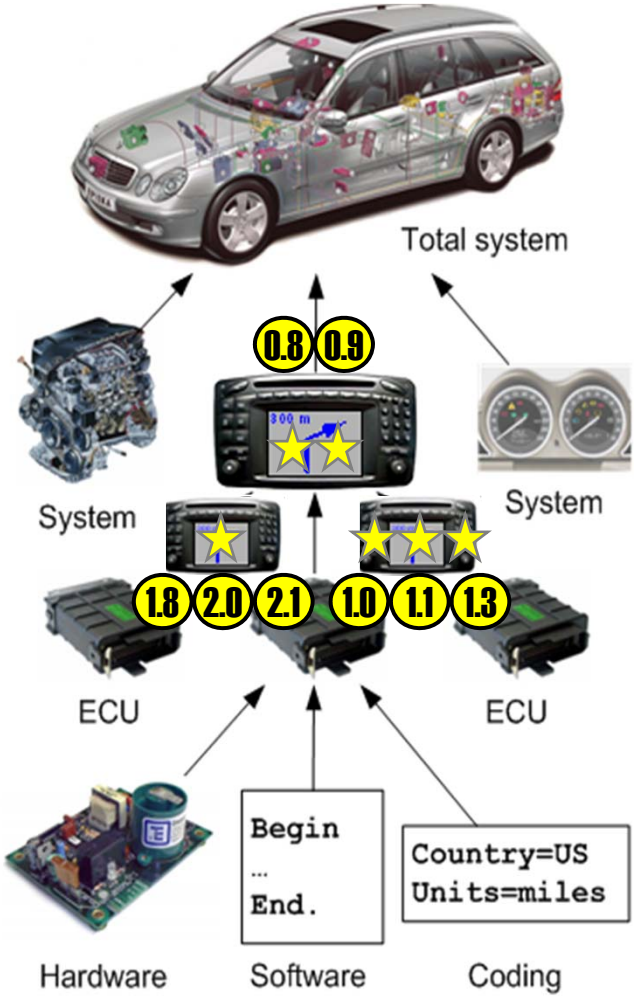
- **Power window**
  - Safety stop
  - Close with central locking system
  - Safety functions (Presafe)
  - Communication with air condition
- **Electrical side mirrors**
  - Electrical adjustment
  - Electrical heating
  - Memory function
  - Retractable side mirror
  - Automatic fading out
  - Ambient illumination
  - Turn indicator
- **Door lock**
  - Open / Close with central locking system
  - Sensors for alarm system
  - Power closing
- **Sidebags**
  - Side impact sensors
- **Active surround speakers**
- **Control unit for**
  - Power windows
  - Mirror adjustment
  - Seat adjustment
  - Memory function
  - Child safety lock
  - Central locking system

# The Challenge: Dealing with Large and Complex Process Structures

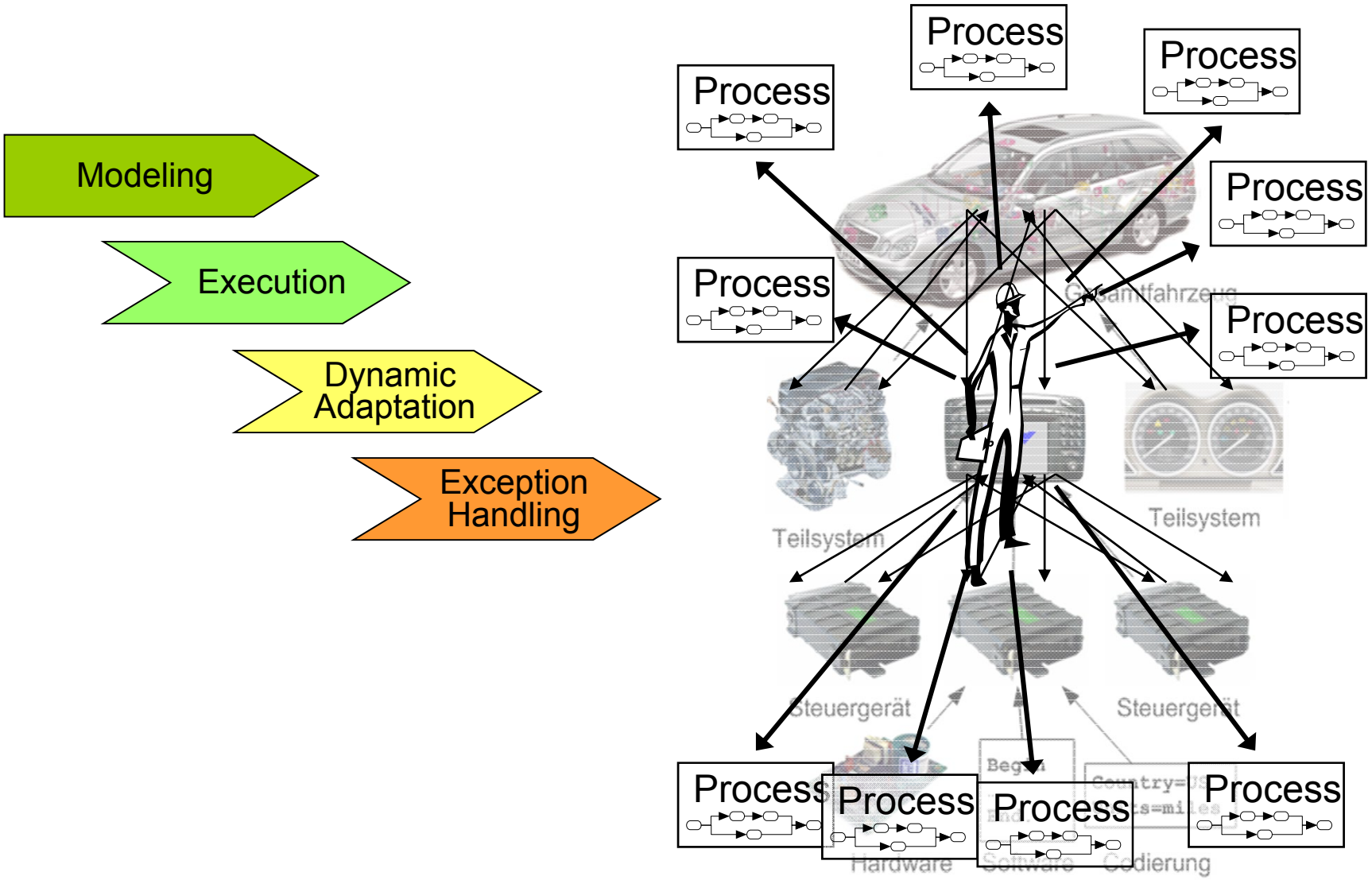
## Current Problems in Automotive Engineering

- Up to 50% of all car breakdowns due to electrical / electronic problems
- Some facts
  - Many non-obvious dependencies between ECUs
  - Different life and development cycles of mechanics, hardware and software
  - Numerous ECU variants and versions

☞ **Systematic verification and release management required**

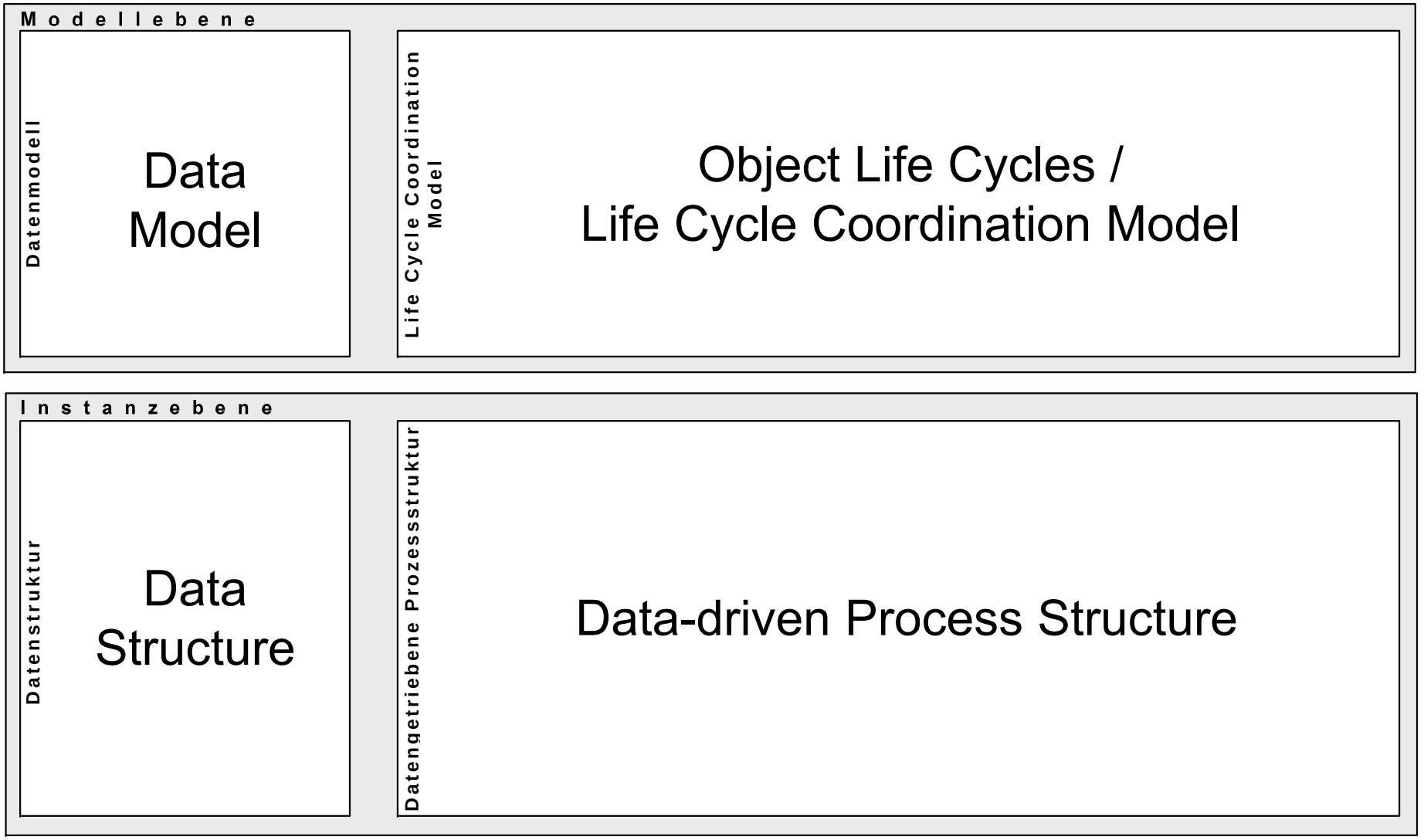


# The Challenge: Dealing with Large and Complex Process Structures



# The Corepro Project

# The Corepro Project – Basic Approach



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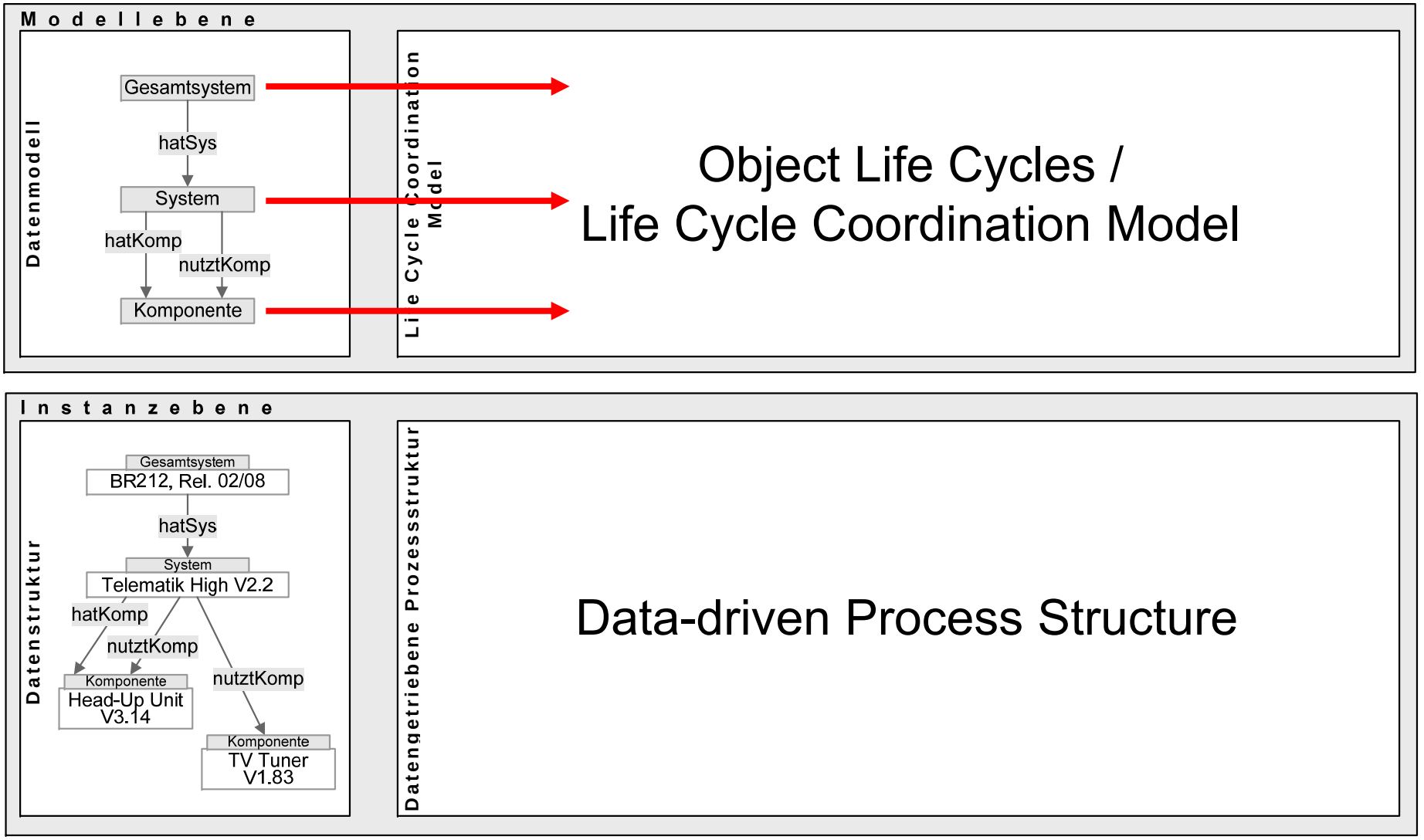

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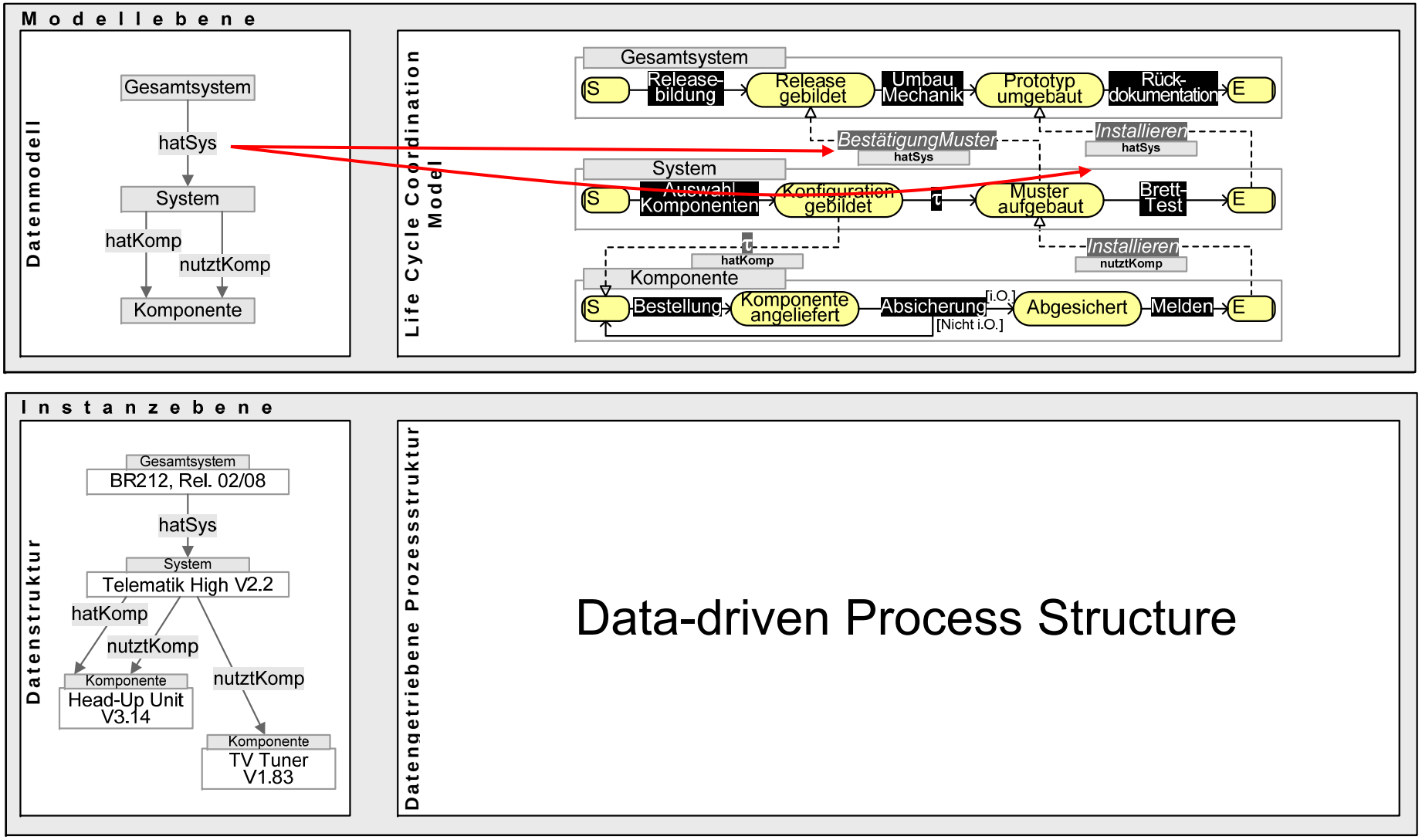

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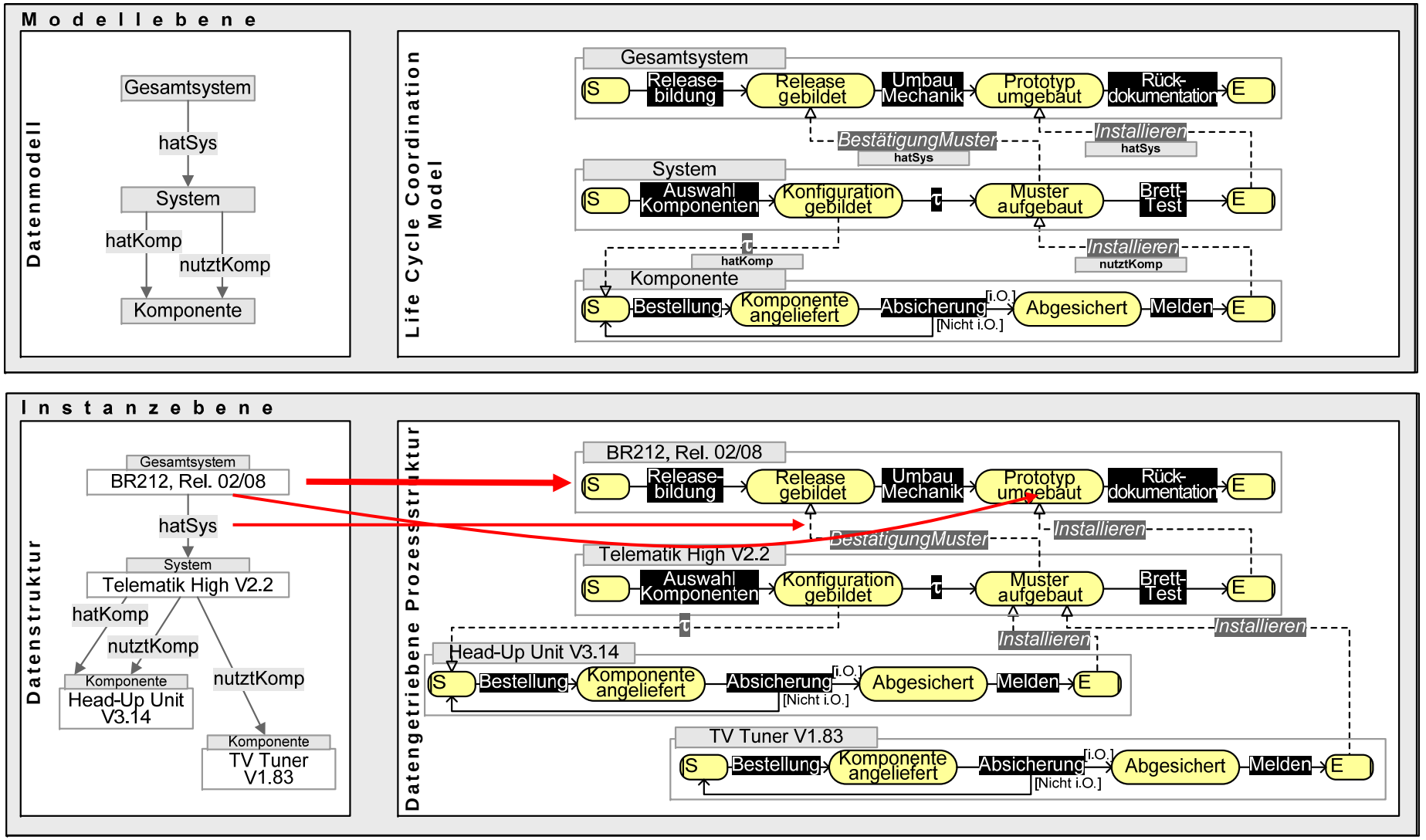

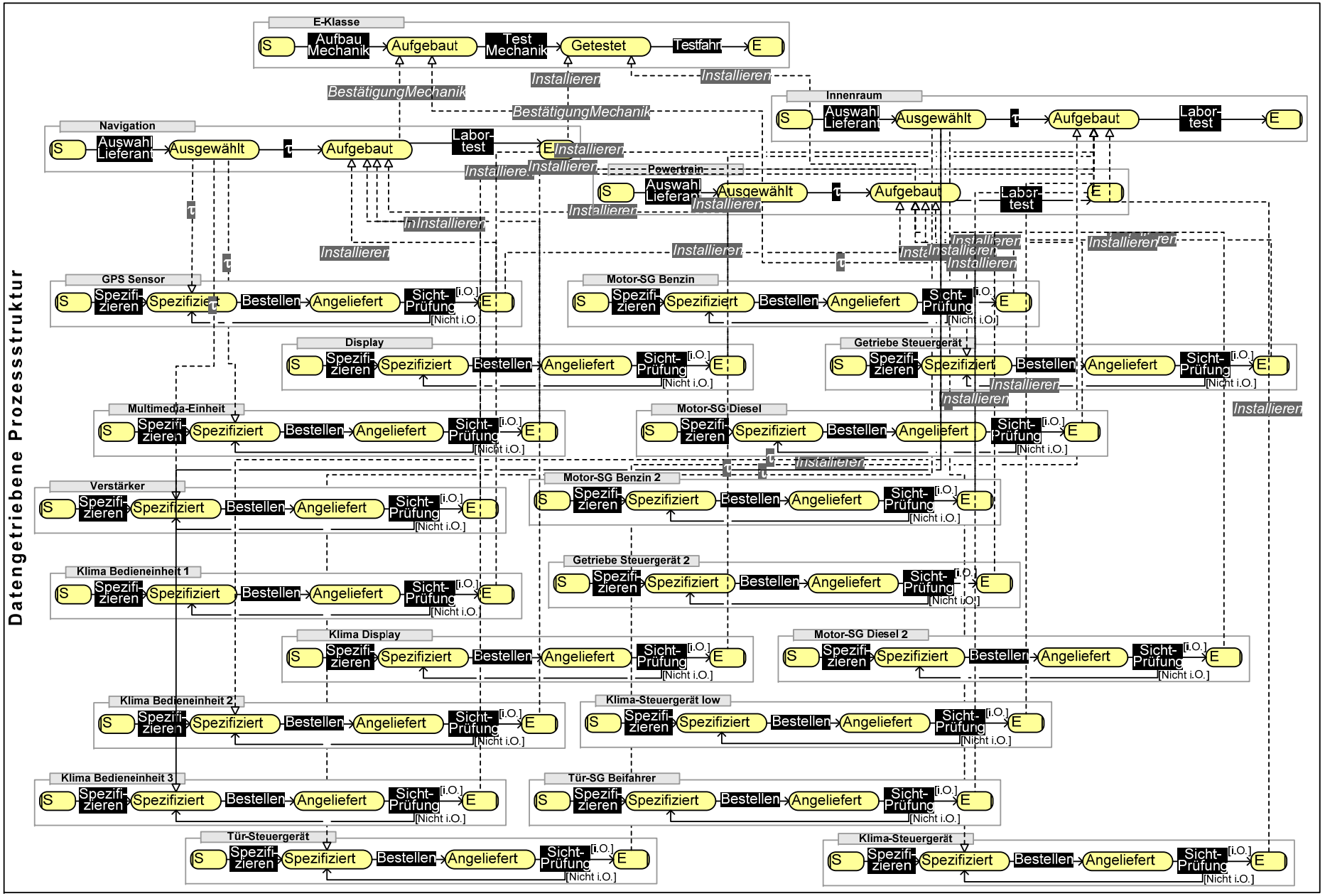
Datengetriebene Prozessstruktur
E-Klasse
S
Aufbau Mechanik
Aufgebaut
Test Mechanik
Getestet
Testfahrt
E
BestätigungMechanik
Installieren
Navigation
Auswahl Lieferant
Ausgewählt
Aufgebaut
Labor-test
Powertrain
Innenraum
GPS Sensor
Spezifi-zieren
Spezifiziert
Bestellen
Angeliefert
Sicht-Prüfung
[i.O.]
[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
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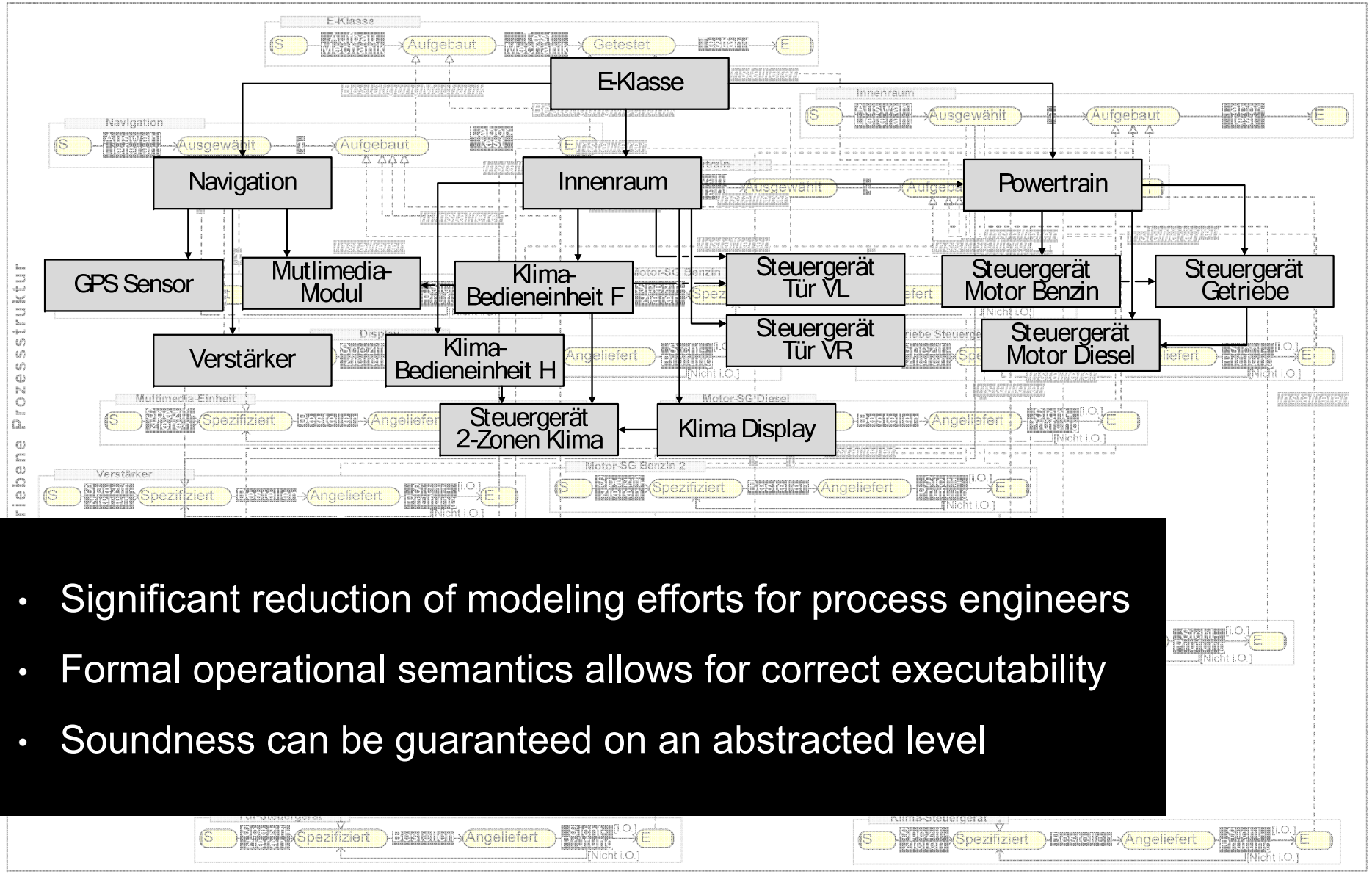
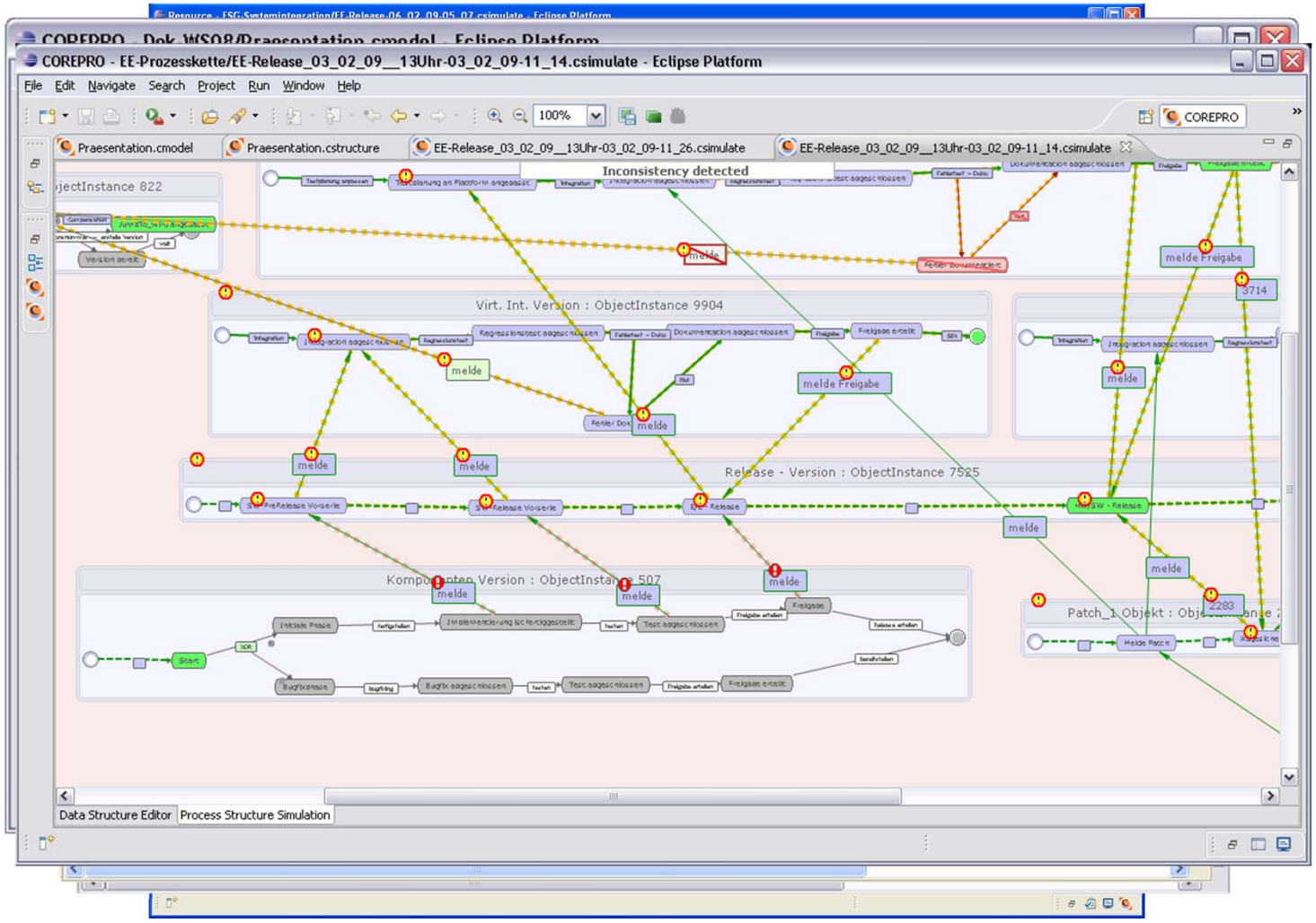
Klima Bedieneinheit 3
Tür-SG Beifahrer
Tür-Steuergerät
Klima-Steuergerät




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

# The Corepro Project – Exception Handling

Au[illegible]sture



# Concluding Remarks