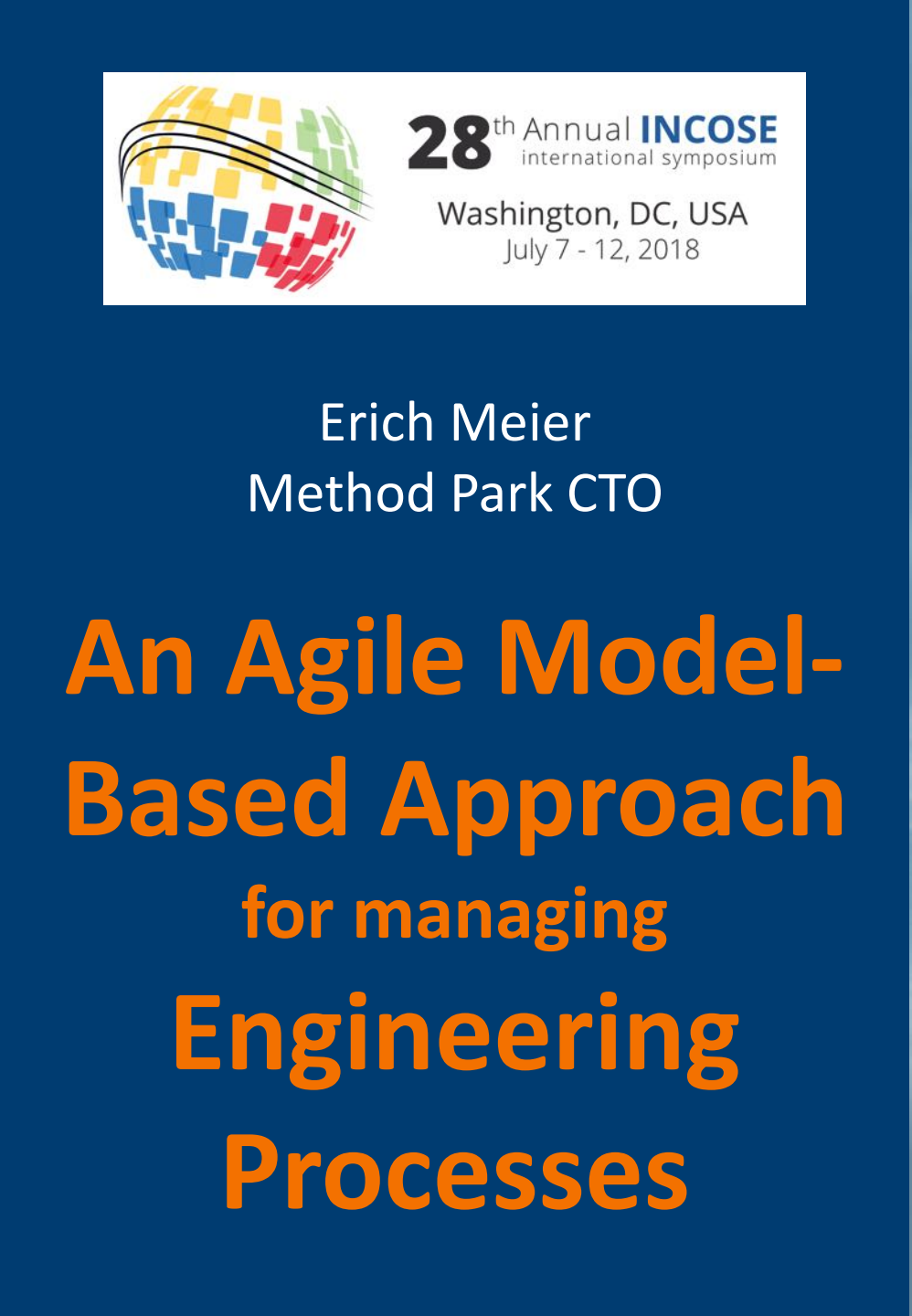
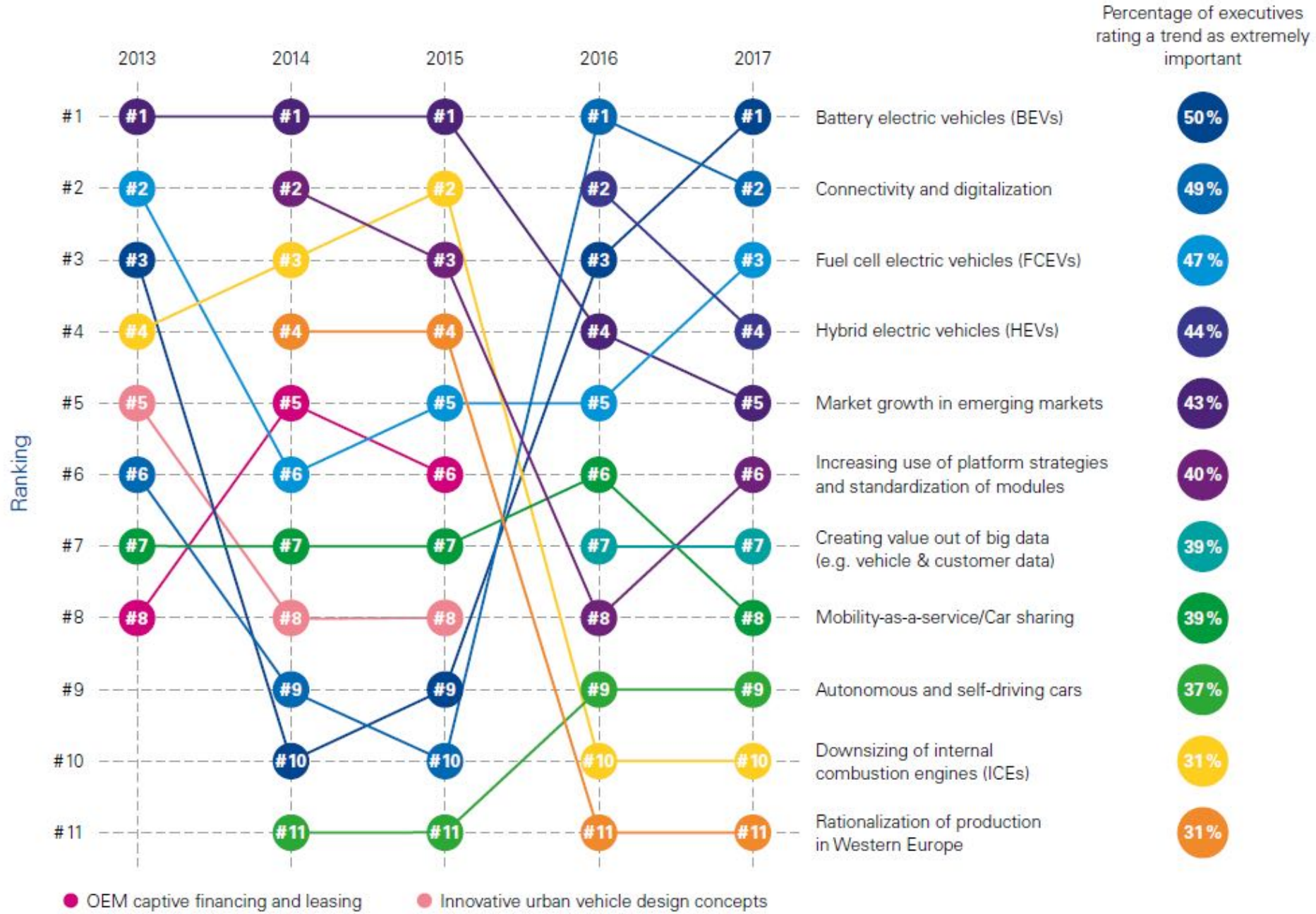



Erich Meier
Method Park CTO

# An Agile Model-Based Approach for managing Engineering Processes

methodpark




**Source:** KPMG's Global Automotive Executive Survey 2017

# Electrification

# Digitization

# Platforms

# Autonomy

# Sharing

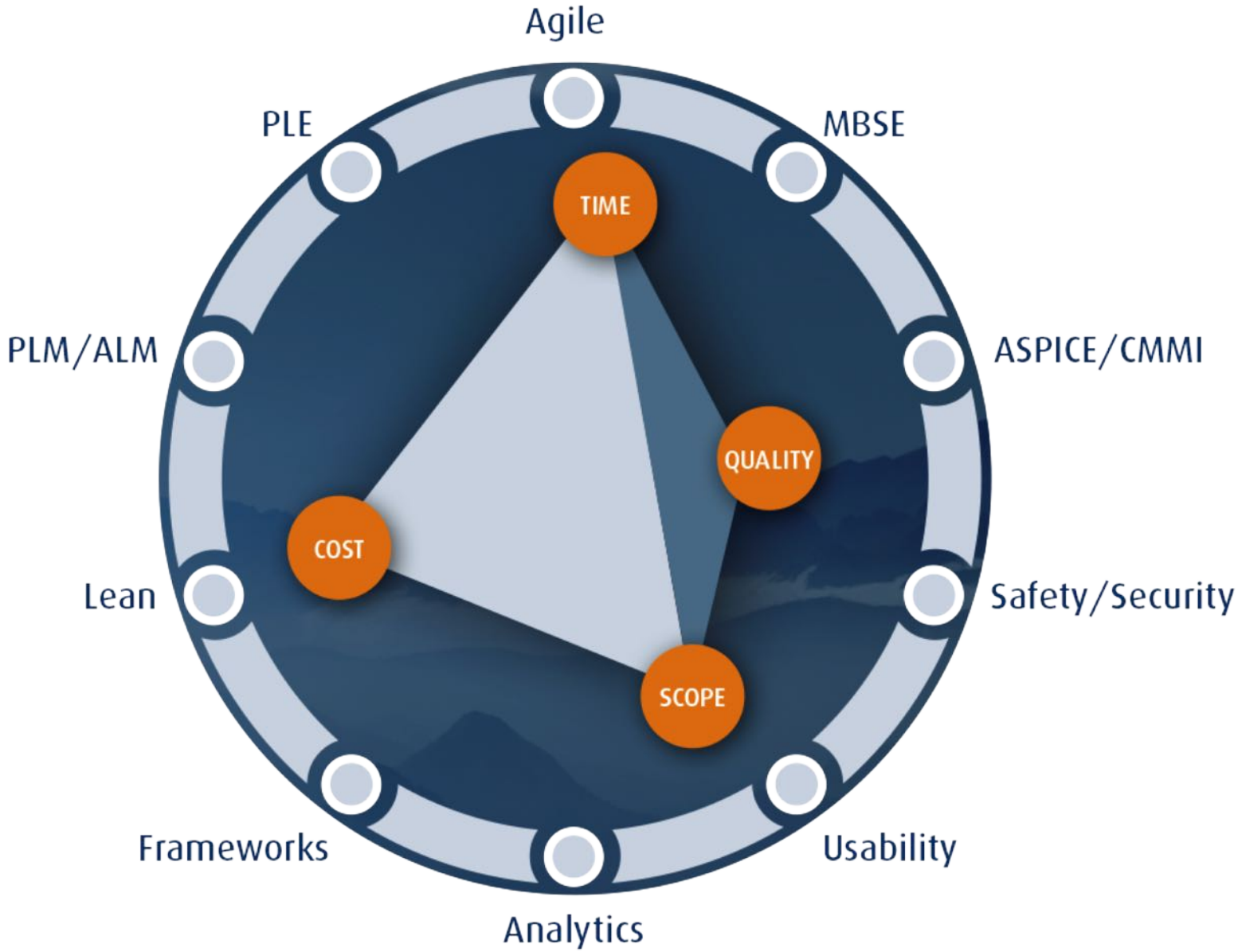
Electrification

Digitization

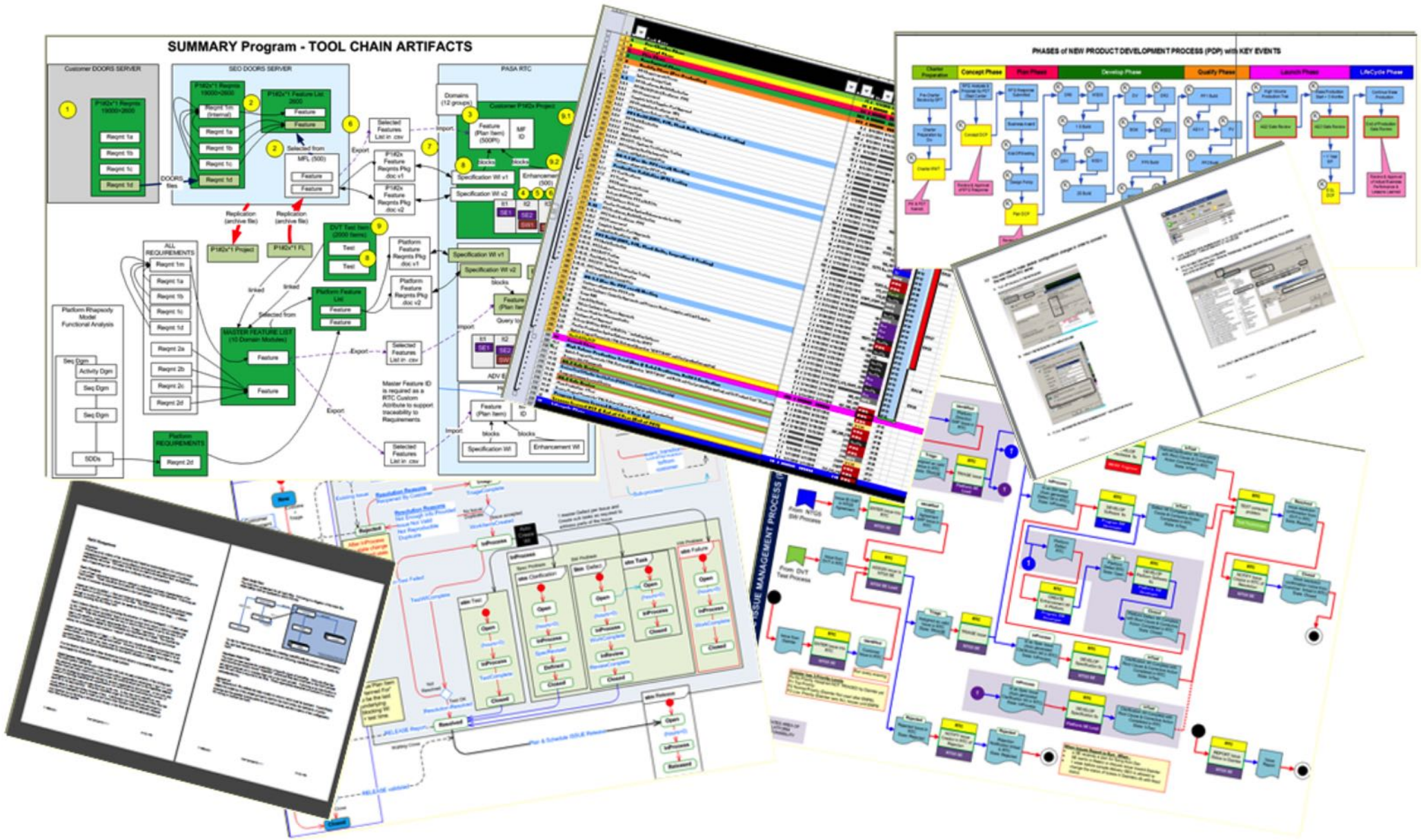
Platforms

Autonomy

Sharing


Agile
PLE
MBSE
TIME
PLM/ALM
ASPICE/CMMI
QUALITY
COST
Lean
Safety/Security
SCOPE
Frameworks
Usability
Analytics

# The Sad Reality



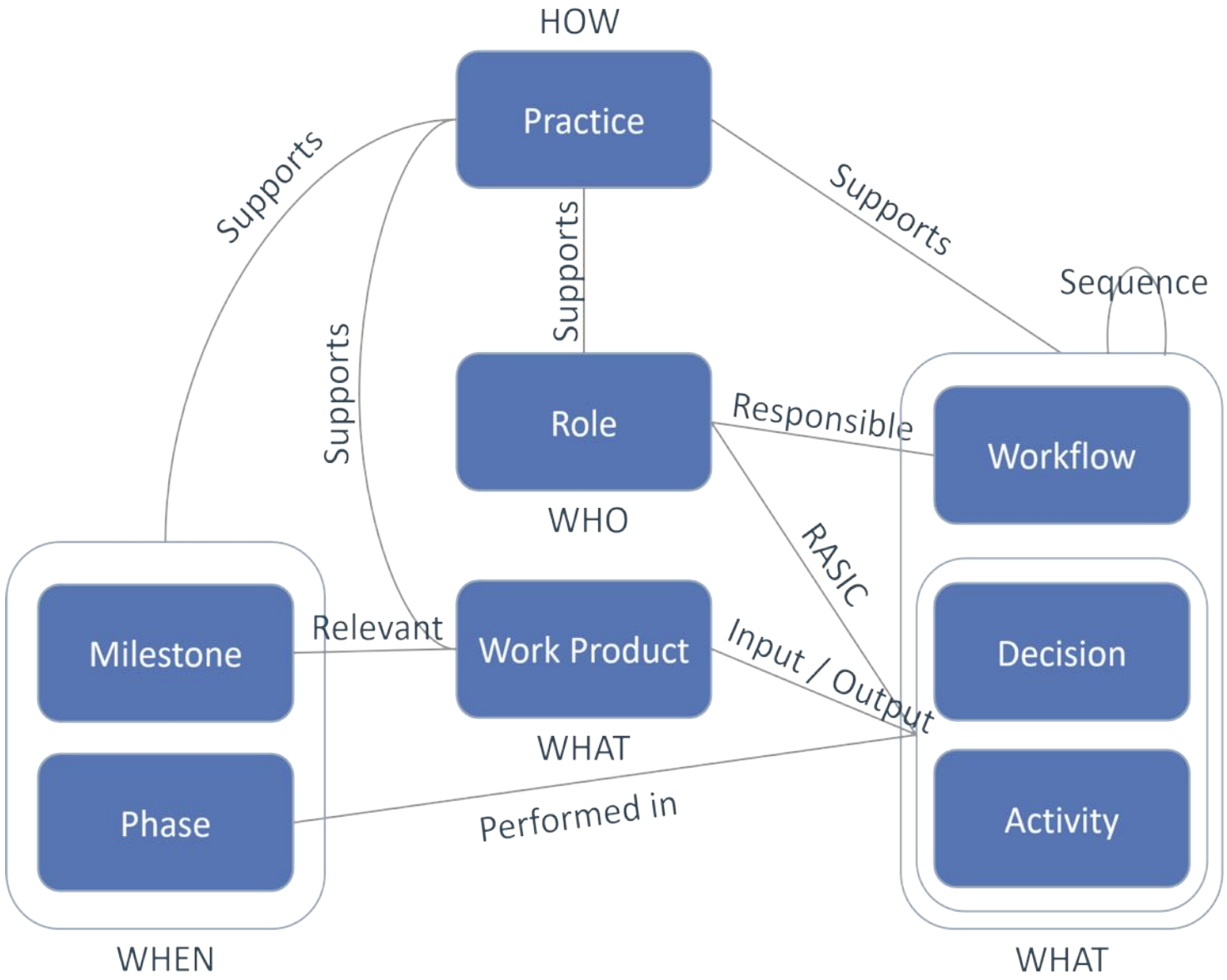
# Model-Based Process Management

1. Create a Process Architecture

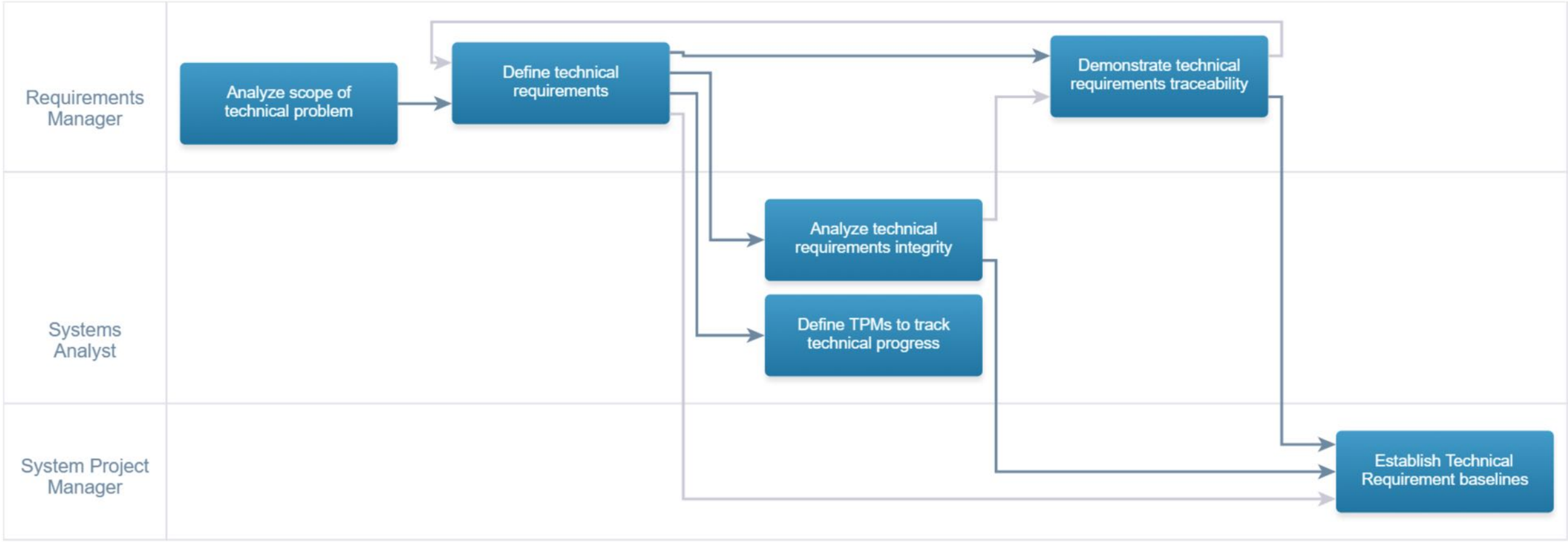
2. Model Process Components

3. Use, Inspect, Adapt

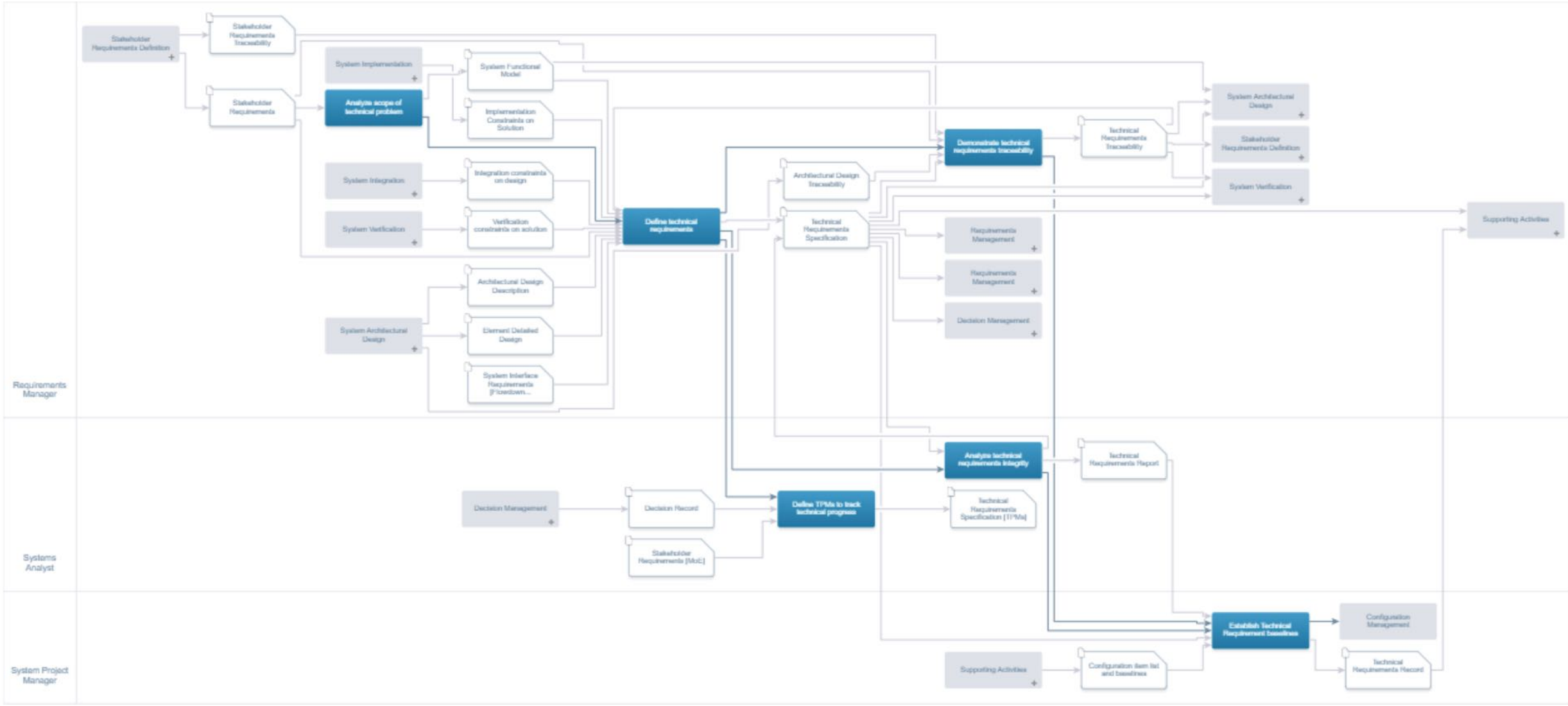
# Process Architecture Metamodel



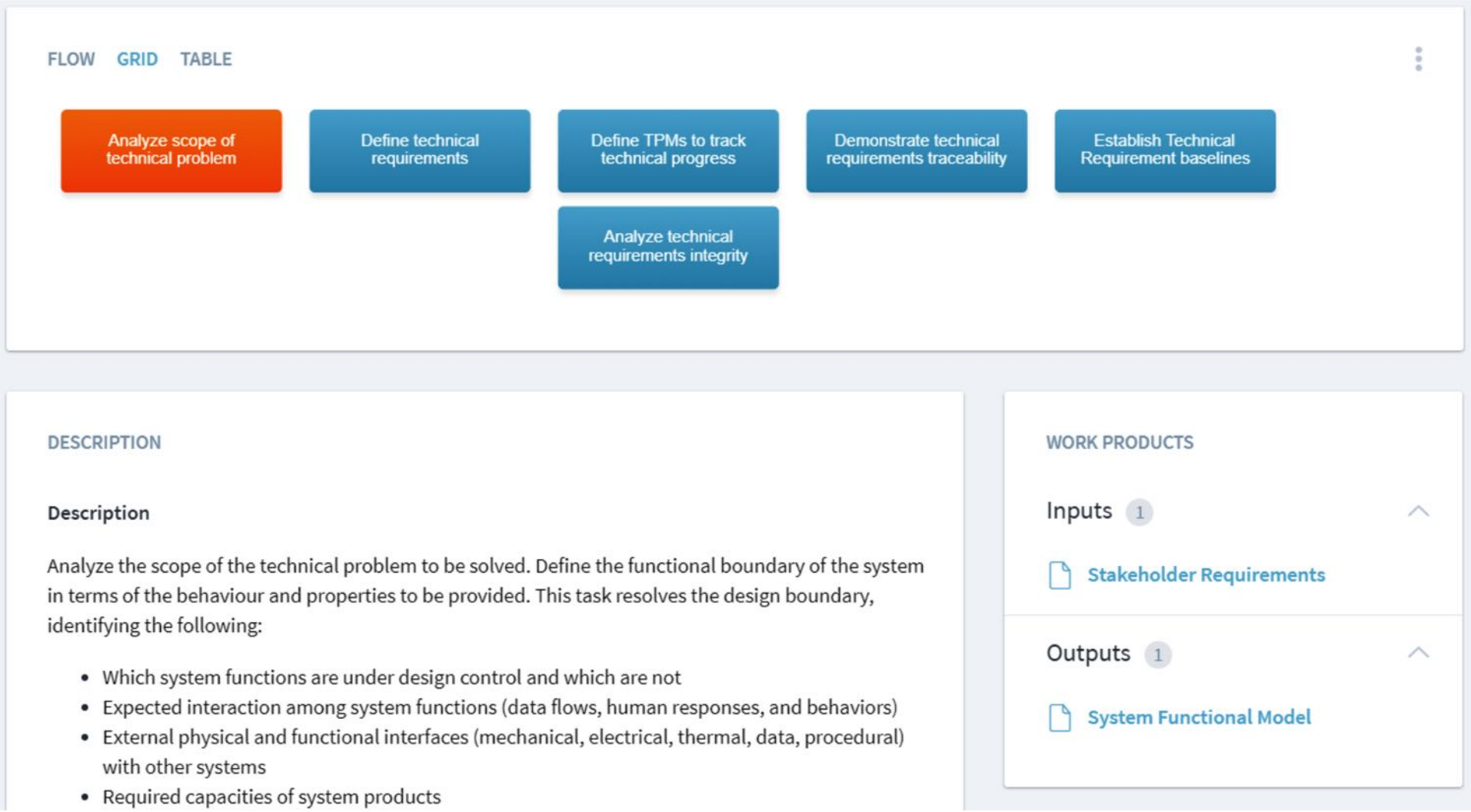
# Process as a Swimlane



# Same Process including Deliverable Flow



# Same Process for Experts



# Same Process as SIPOC Table

| Supplier | Inputs | Process | Outputs | Customer |
|---|---|---|---|---|
| Stakeholder Requirements Definition | Stakeholder Requirements | Analyze scope of technical problem | System Functional Model | System Architectural Design |
| System Architectural Design<br>System Integration<br>System Verification<br>System Implementation<br>Stakeholder Requirements Definition | Architectural Design Description<br>Integration constraints on design<br>Verification constraints on solution<br>Implementation Constraints on Solution<br>System Interface Requirements<br>Technical Requirements Traceability<br>Element Detailed Design<br>System Functional Model<br>Stakeholder Requirements | Define technical requirements | Technical Requirements Specification | Requirements Management<br>Requirements Management<br>System Architectural Design<br>System Verification<br>Supporting Activities<br>Decision Management |
| Decision Management | Decision Record<br>Stakeholder Requirements | Define TPMs to track technical progress | Technical Requirements Specification | |
| | Technical Requirements Specification | Analyze technical requirements integrity | Technical Requirements Specification<br>Technical Requirements Report | Requirements Management<br>Requirements Management<br>System Architectural Design<br>System Verification<br>Supporting Activities<br>Decision Management |
| Stakeholder Requirements | Stakeholder Requirements<br>Architectural Design Traceability | | Technical Requirements | Stakeholder Requirements Definition |

# Same Process seen from Role Perspective

## Requirements Manager

DESCRIPTION

### Description

The Requirements Manager elicits, develops and analyses the requirements.

### Tasks

- Collecting the stakeholder requirements and documenting them
- Analysing the stakeholder requirements and resolving ambiguities in consultation with other team members
- Definition of the system's technical requirements
- Defining the logical architecture of the system along with the systems analyst
- Maintaining the requirements database
- Ensuring the traceability of the requirements is maintained
- Extending support to the Systems Architect, Systems Analyst and Systems Engineer

### Required knowledge and skills

- Thorough knowledge about the users and environment of the intended system

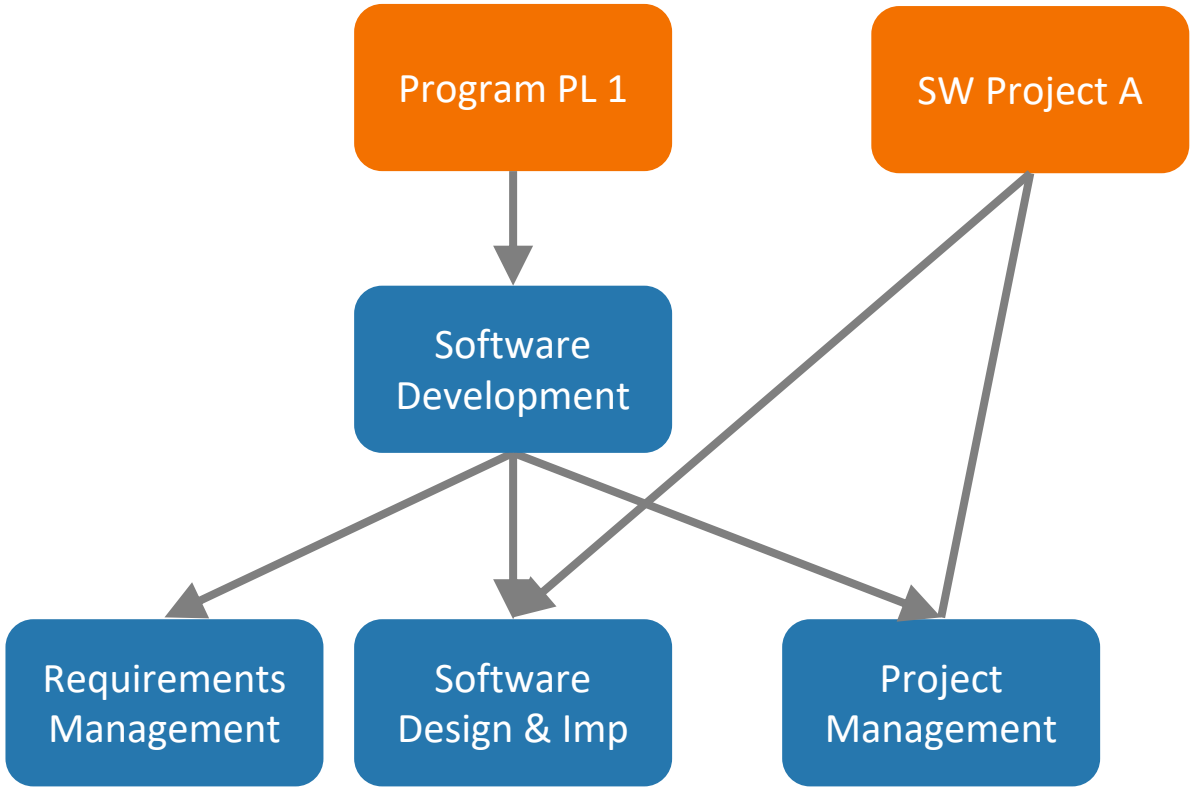
ACTIVITIES

Responsible 11

- Elicit stakeholder requirements
- Establish Stakeholder Requirement baselines
- Identify stakeholders
- System Requirements Analysis
- Stakeholder Requirements Definition
- Maintain stakeholder requirements traceability
- Define Stakeholder Requirements
- Review stakeholder requirements with stakeholders
- Define technical requirements

# Process Composition

# Create Processes from Components

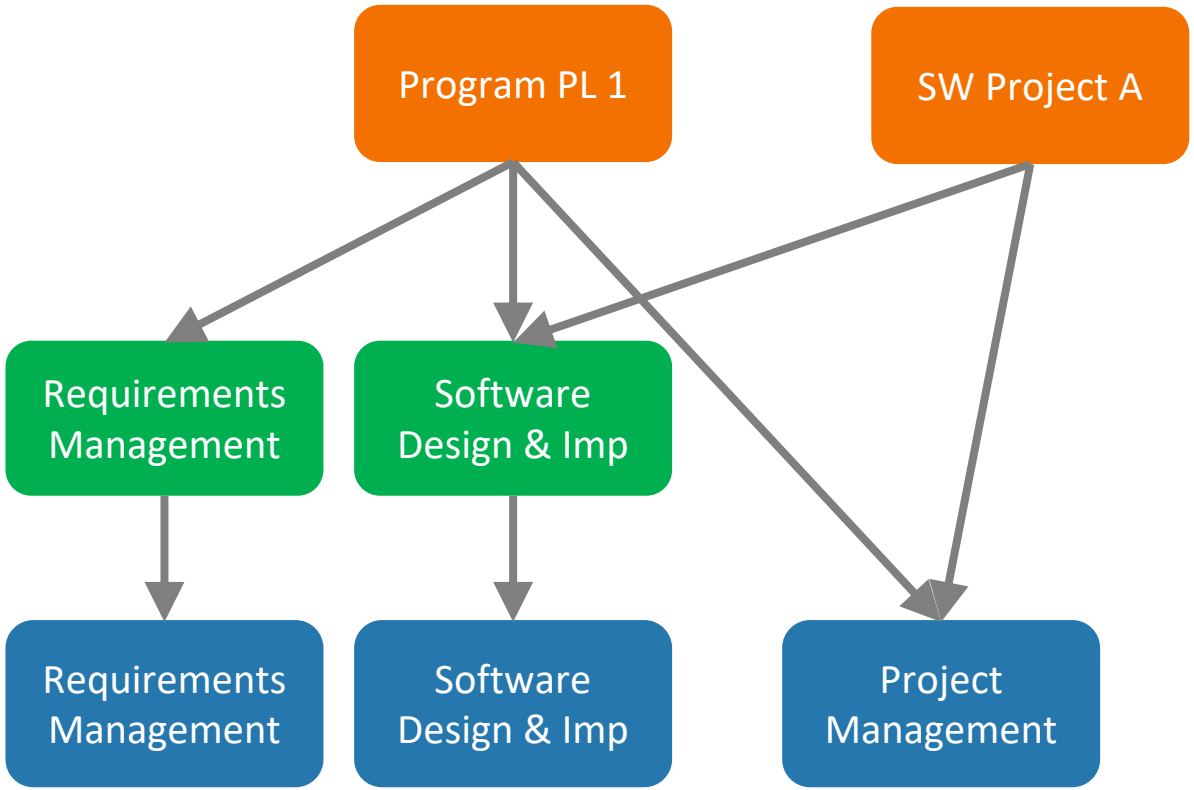



Projects & Programs

Integrated Processes

Standard Process Components

# Create Product Line Processes from Tailored Process Components




Projects & Programs

Product Line Process Components

Standard Process Components

# Standard Compliance

# Manage Compliance

**Automotive SPICE 2.5/3.1 & ISO 26262:2018**

**AS9100D & DO-178B/C & DO-254**

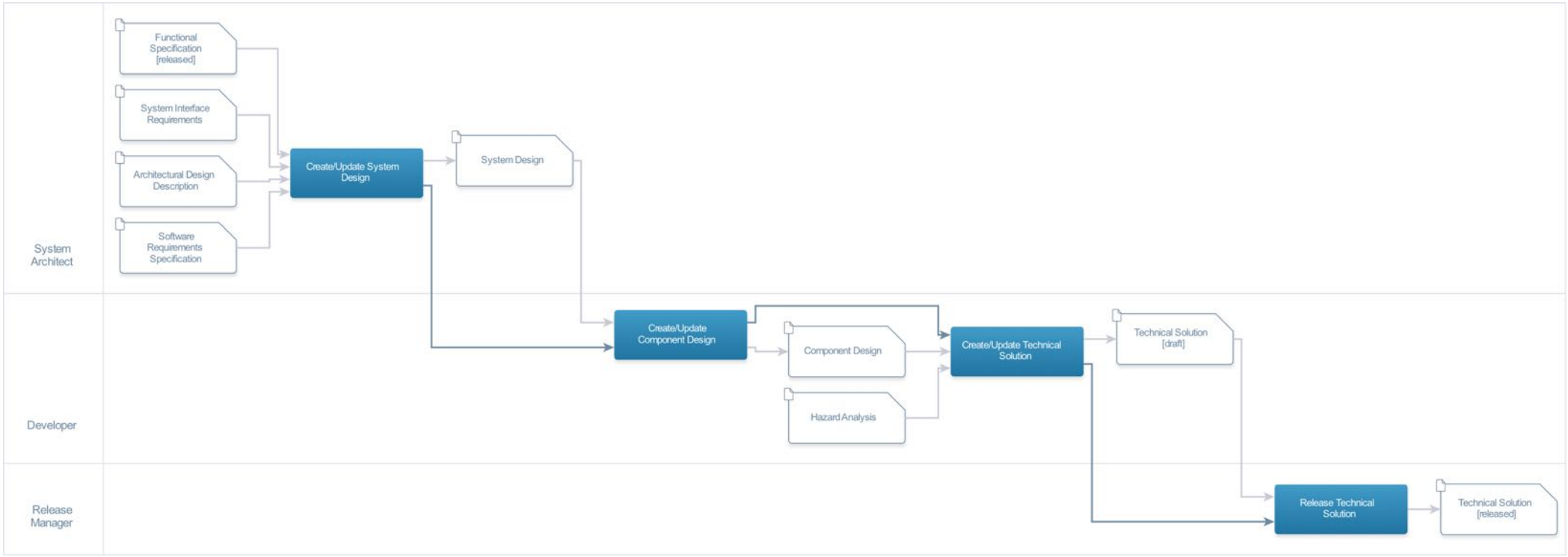
**ISO 13495 & ISO 14971**

**CMMI V1.3 & V2.0**

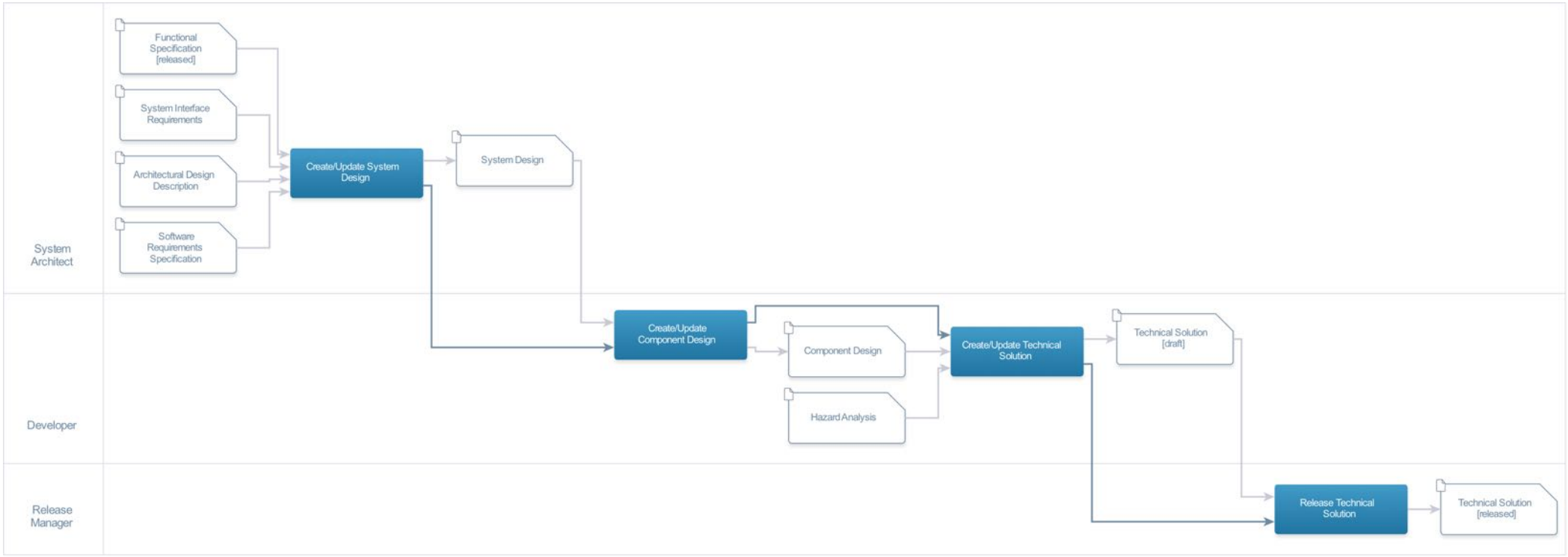
**ISO/IEC 15288 (INCOSE Handbook)**

**APQC Process Classification Frameworks**

# Mapping to Standards

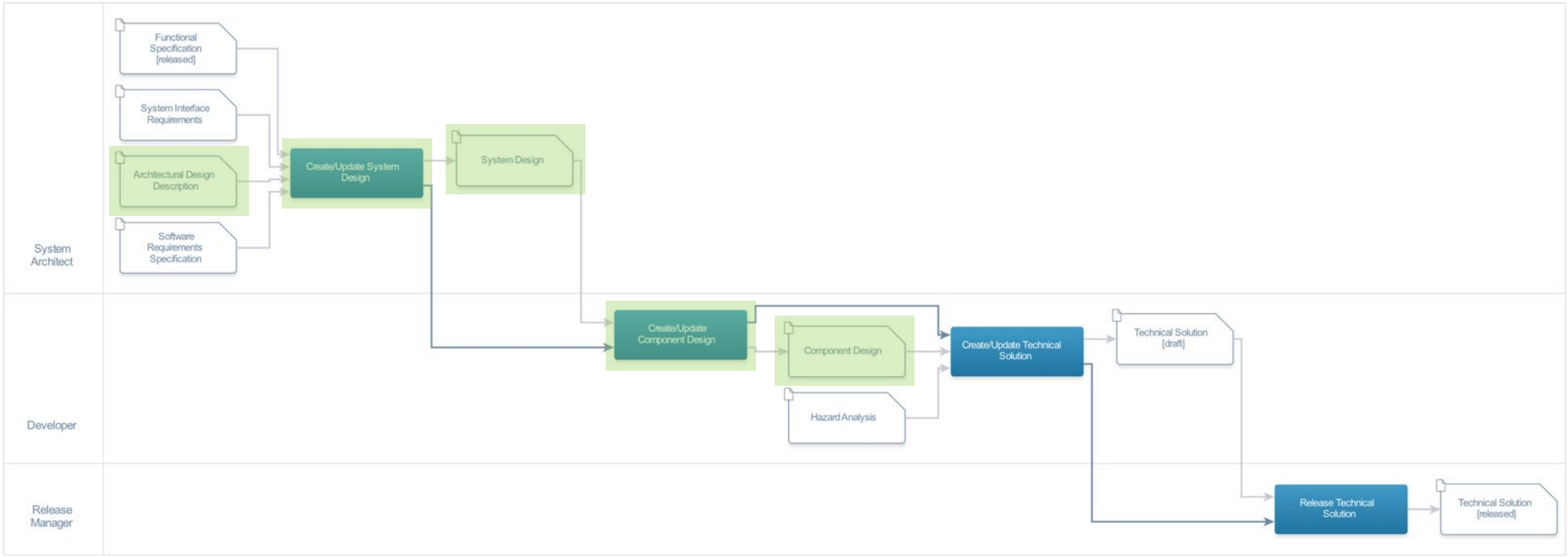


# Mapping to Standards



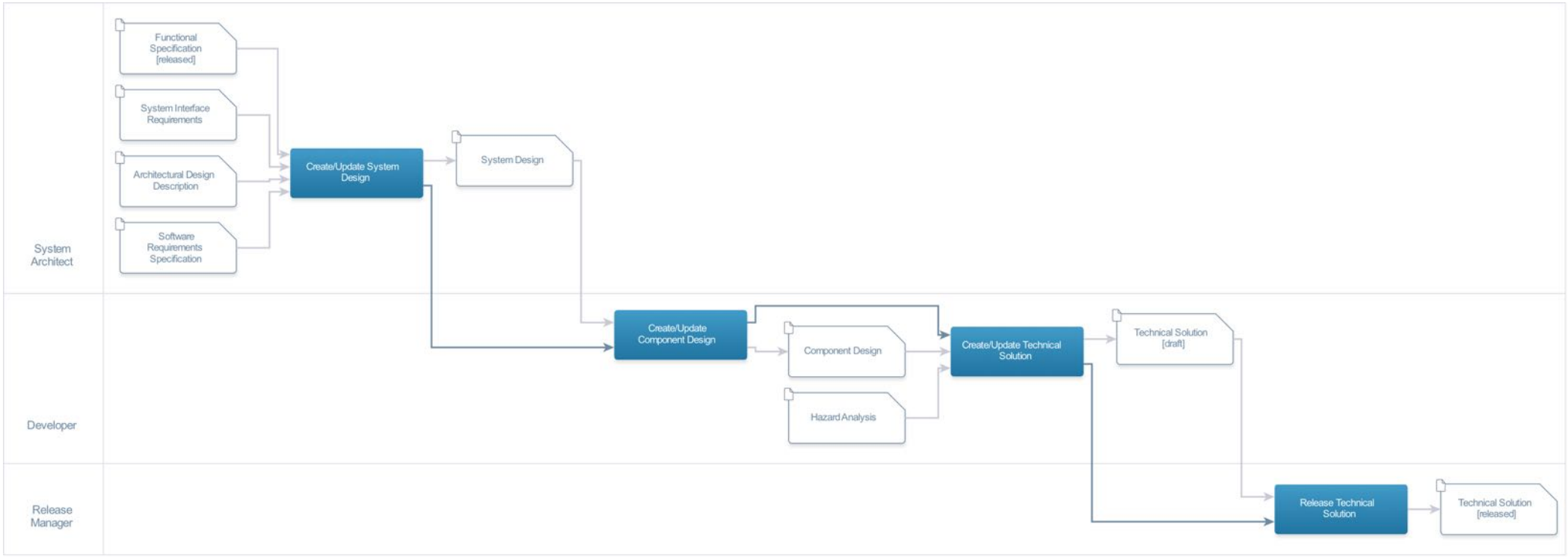

CMMI-DEV V1.3: TS SP 2.1: Design the Product or Product Component

# Mapping to Standards




CMMI-DEV V1.3: TS SP 2.1: Design the Product or Product Component

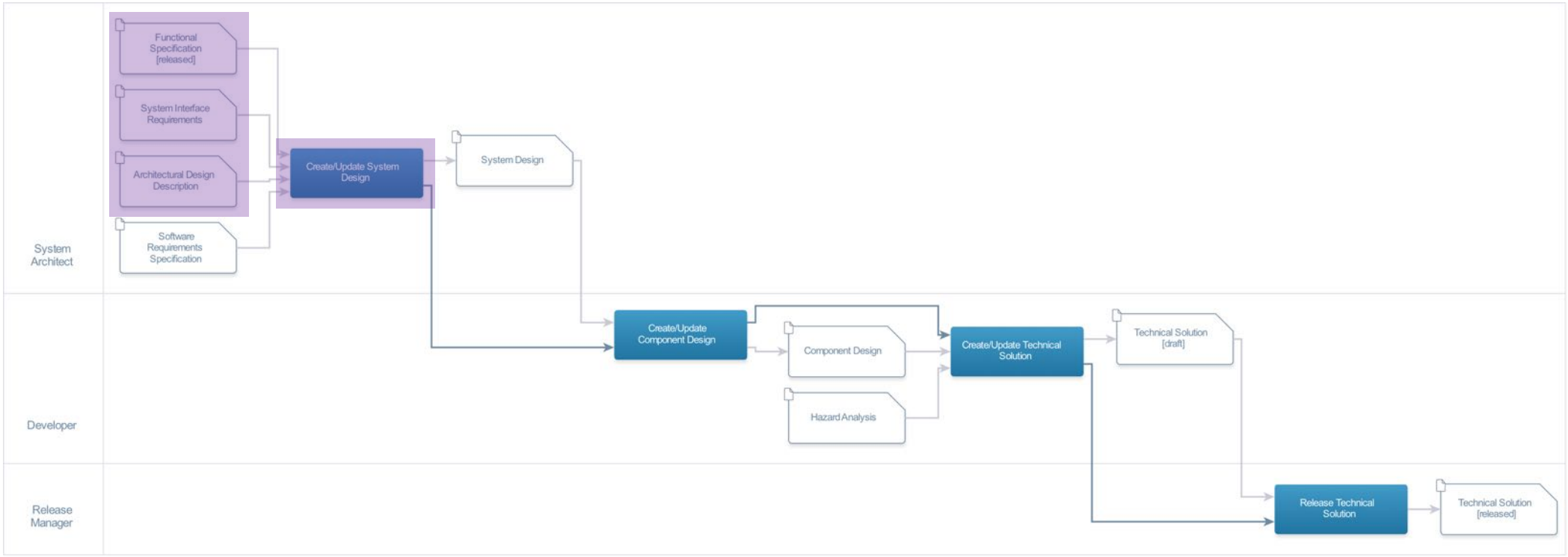
# Mapping to Standards




CMMI-DEV V1.3: TS SP 2.1: Design the Product or Product Component

DO-178C: 2.2.1: Information Flow from System Processes to Software Processes

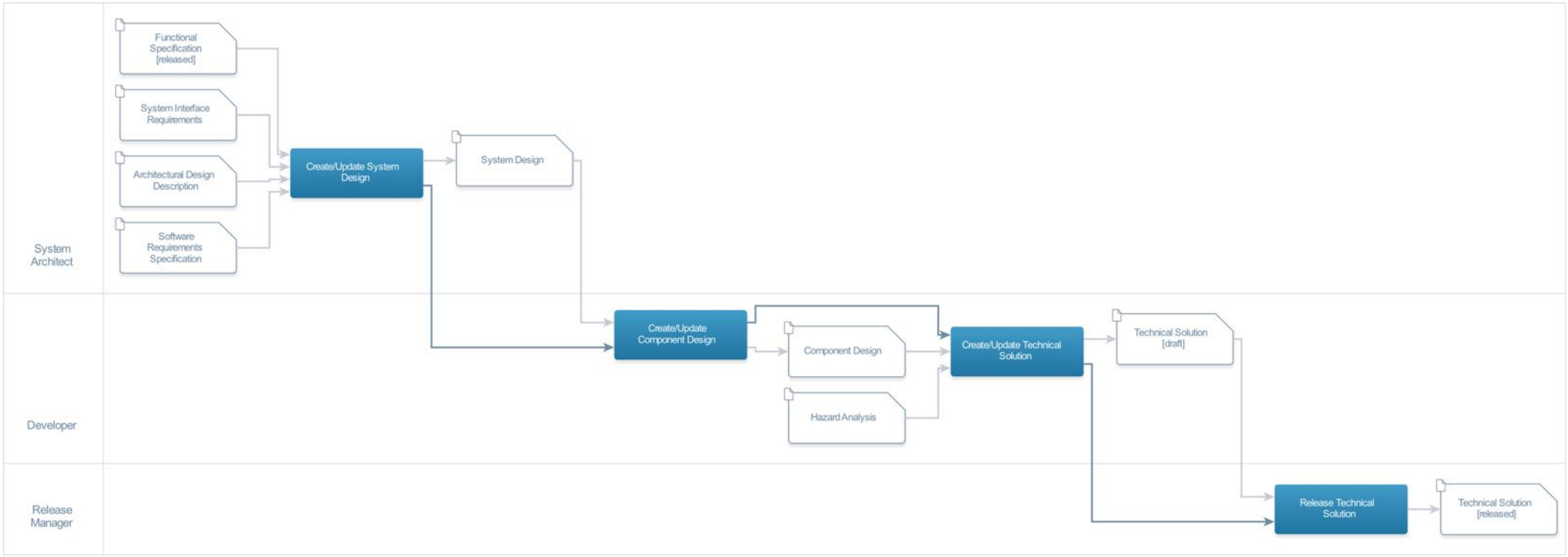
# Mapping to Standards




CMMI-DEV V1.3: TS SP 2.1: Design the Product or Product Component

DO-178C: 2.2.1: Information Flow from System Processes to Software Processes

# Mapping to Standards

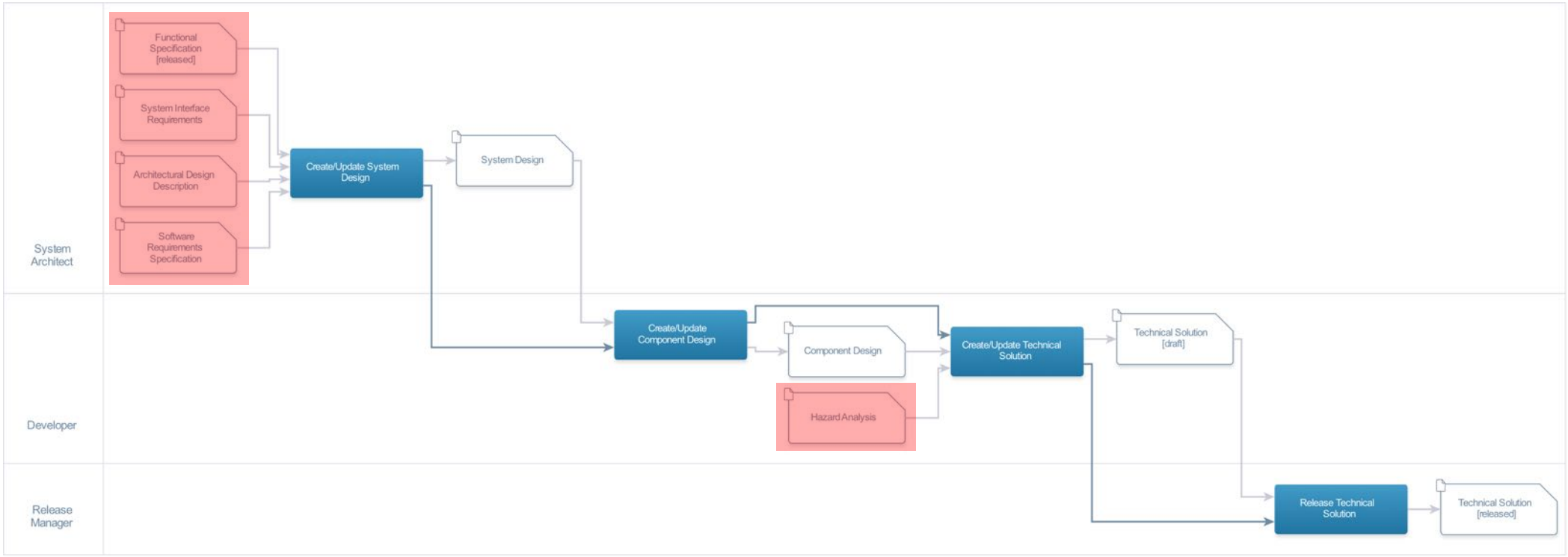



CMMI-DEV V1.3: TS SP 2.1: Design the Product or Product Component

DO-178C: 2.2.1: Information Flow from System Processes to Software Processes

AS9100D: 8.3.3: Design and Development Inputs

# Mapping to Standards

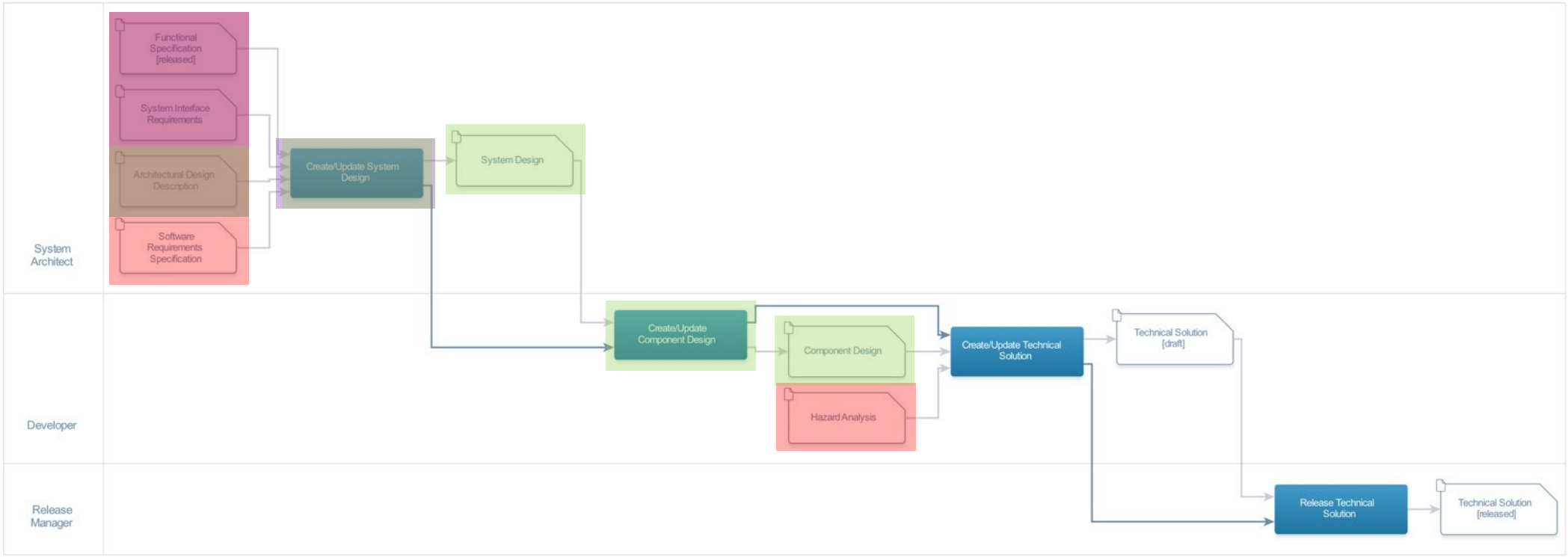



CMMI-DEV V1.3: TS SP 2.1: Design the Product or Product Component

DO-178C: 2.2.1: Information Flow from System Processes to Software Processes

AS9100D: 8.3.3: Design and Development Inputs

# Mapping to Standards




CMMI-DEV V1.3: TS SP 2.1: Design the Product or Product Component

DO-178C: 2.2.1: Information Flow from System Processes to Software Processes

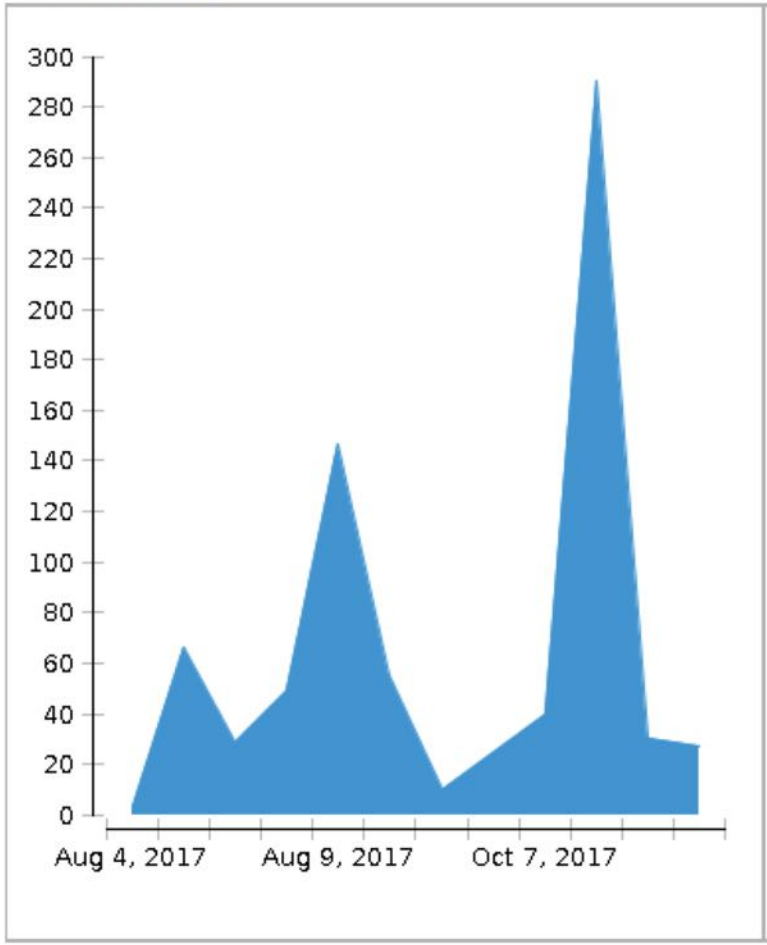
AS9100D: 8.3.3: Design and Development Inputs

# Generate Compliance Evidence

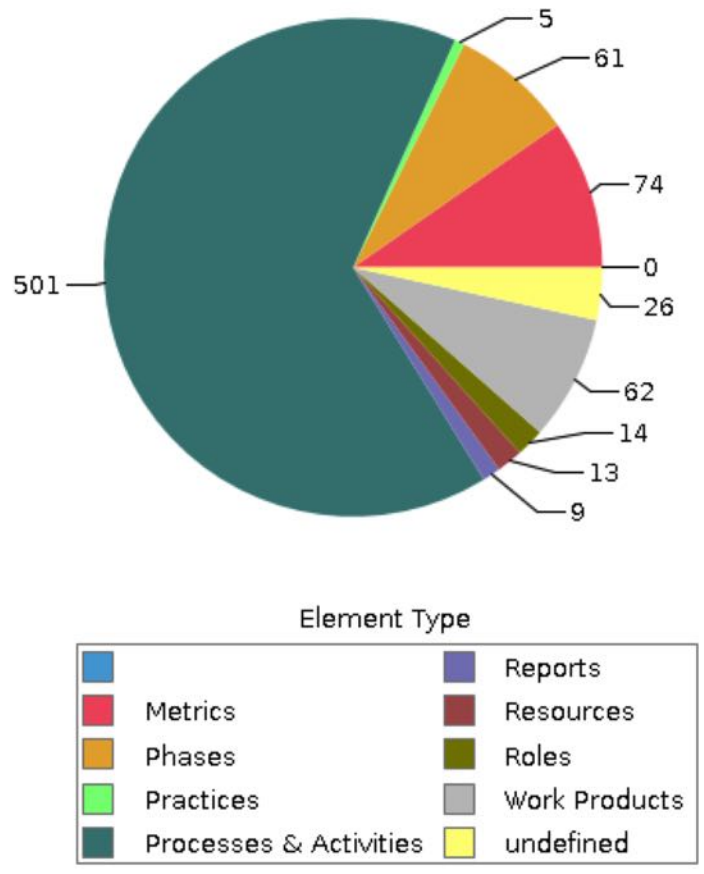
| Reference Model | Scope | PA | Goal | ID | Requirement Name | Workspace Name | Process Version | Process Element Typ | Process Element |
|---|---|---|---|---|---|---|---|---|---|
| Automotive SPICE 3.0 | SWE.2: Architectural Design (L3) | SWE | SWE.2 | SWE.2.BP9 | Communicate agreed software archit | Automotive Generic Engineering Pro | Working revision | Activity | Approve Software Architectural Design |
| Automotive SPICE 3.0 | SWE.2: Architectural Design (L3) | SWE | SWE.2 | SWE.2.BP9 | Communicate agreed software archit | Automotive Generic Engineering Pro | Working revision | Work Product | Software Architectural Design Specification |
| Automotive SPICE 3.0 | SWE.2: Architectural Design (L3) | SWE | SWE.2 | SWE.2.BP8 | Ensure consistency [Outcome 1, 2, 5 | Automotive Generic Engineering Pro | Working revision | Activity | Verify Software Architectural Design |
| Automotive SPICE 3.0 | SWE.2: Architectural Design (L3) | SWE | SWE.2 | SWE.2.BP8 | Ensure consistency [Outcome 1, 2, 5 | Automotive Generic Engineering Pro | Working revision | Work Product | Software Architectural Design Specification |
| Automotive SPICE 3.0 | SWE.2: Architectural Design (L3) | SWE | SWE.2 | SWE.2.BP8 | Ensure consistency [Outcome 1, 2, 5 | Automotive Generic Engineering Pro | Working revision | Work Product | Software Architectural Design Review Protocol |
| Automotive SPICE 3.0 | SWE.2: Architectural Design (L3) | SWE | SWE.2 | SWE.2.BP7 | Establish bidirectional traceability [Ou | Automotive Generic Engineering Pro | Working revision | Activity | Create Software Architectural Design |
| Automotive SPICE 3.0 | SWE.2: Architectural Design (L3) | SWE | SWE.2 | SWE.2.BP7 | Establish bidirectional traceability [Ou | Automotive Generic Engineering Pro | Working revision | Work Product | Software Architectural Design Specification |
| Automotive SPICE 3.0 | SWE.2: Architectural Design (L3) | SWE | SWE.2 | SWE.2.BP7 | Establish bidirectional traceability [Ou | Automotive Generic Engineering Pro | Working revision | Work Product | Software Design Traceability Record |
| Automotive SPICE 3.0 | SWE.2: Architectural Design (L3) | SWE | SWE.2 | SWE.2.BP6 | Evaluate alternative software architec | Automotive Generic Engineering Pro | Working revision | Activity | Create Software Architectural Design |
| Automotive SPICE 3.0 | SWE.2: Architectural Design (L3) | SWE | SWE.2 | SWE.2.BP6 | Evaluate alternative software architec | Automotive Generic Engineering Pro | Working revision | Work Product | Software Architectural Design Specification |
| Automotive SPICE 3.0 | SWE.2: Architectural Design (L3) | SWE | SWE.2 | SWE.2.BP5 | Define resource consumption objecti | Automotive Generic Engineering Pro | Working revision | Activity | Create Software Architectural Design |
| Automotive SPICE 3.0 | SWE.2: Architectural Design (L3) | SWE | SWE.2 | SWE.2.BP5 | Define resource consumption objecti | Automotive Generic Engineering Pro | Working revision | Work Product | Software Architectural Design Specification |
| Automotive SPICE 3.0 | SWE.2: Architectural Design (L3) | SWE | SWE.2 | SWE.2.BP4 | Describe dynamic behavior [Outcome | Automotive Generic Engineering Pro | Working revision | Activity | Create Software Architectural Design |
| Automotive SPICE 3.0 | SWE.2: Architectural Design (L3) | SWE | SWE.2 | SWE.2.BP4 | Describe dynamic behavior [Outcome | Automotive Generic Engineering Pro | Working revision | Work Product | Software Architectural Design Specification |
| Automotive SPICE 3.0 | SWE.2: Architectural Design (L3) | SWE | SWE.2 | SWE.2.BP3 | Define interfaces of software element | Automotive Generic Engineering Pro | Working revision | Activity | Create Software Architectural Design |
| Automotive SPICE 3.0 | SWE.2: Architectural Design (L3) | SWE | SWE.2 | SWE.2.BP3 | Define interfaces of software element | Automotive Generic Engineering Pro | Working revision | Work Product | Software Architectural Design Specification |
| Automotive SPICE 3.0 | SWE.2: Architectural Design (L3) | SWE | SWE.2 | SWE.2.BP2 | Allocate software requirements [Outc | Automotive Generic Engineering Pro | Working revision | Activity | Create Software Architectural Design |
| Automotive SPICE 3.0 | SWE.2: Architectural Design (L3) | SWE | SWE.2 | SWE.2.BP2 | Allocate software requirements [Outc | Automotive Generic Engineering Pro | Working revision | Work Product | Software Architectural Design Specification |
| Automotive SPICE 3.0 | SWE.2: Architectural Design (L3) | SWE | SWE.2 | SWE.2.BP1 | Develop software architectural desigr | Automotive Generic Engineering Pro | Working revision | Activity | Create Software Architectural Design |
| Automotive SPICE 3.0 | SWE.2: Architectural Design (L3) | SWE | SWE.2 | SWE.2.BP1 | Develop software architectural desigr | Automotive Generic Engineering Pro | Working revision | Work Product | Software Architectural Design Specification |

# Analytics

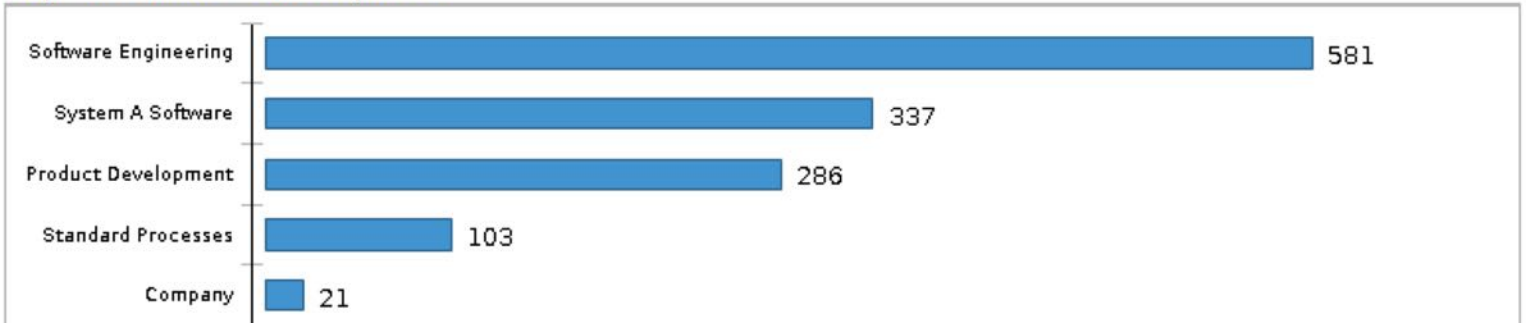
## Process Usage




## Usage per Type




## Top 10 Active Workspaces



# Process Tailoring Hotspots

| Process Area | Process | Phases | | | Processes & Activities | | | Work Products | | | Roles | | | Metrics | | | Practices | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | #Tail | #All | % | #Tail | #All | % | #Tail | #All | % | #Tail | #All | % | #Tail | #All | % | #Tail | #All | % |
| Change Management | OTHER | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Configuration Management | OTHER | 0 | 4 | 0 | 0 | 5 | 0 | 0 | 3 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Electronics Design | OTHER | 0 | 6 | 0 | 3 | 7 | 42.9 | 0 | 4 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 11 | 0 |
| OTHER | OTHER | 0 | 28 | 0 | 0 | 0 | 0 | 5 | 66 | 7.6 | 1 | 25 | 4 | 0 | 6 | 0 | 3 | 58 | 5.2 |
| Project Management | Decision Management | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | OTHER | 0 | 8 | 0 | 2 | 7 | 28.6 | 2 | 5 | 40 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| | Project Assessment and Control | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Project Planning | 0 | 1 | 0 | 0 | 5 | 0 | 0 | 5 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Risk Management | 0 | 1 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Quality Management | OTHER | 0 | 1 | 0 | 0 | 3 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Release Management | OTHER | 0 | 1 | 0 | 0 | 4 | 0 | 0 | 1 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Requirements Management | OTHER | 0 | 3 | 0 | 4 | 4 | 100 | 1 | 4 | 25 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 5 | 20 |
| Safety Management | OTHER | 0 | 0 | 0 | 3 | 3 | 100 | 2 | 2 | 100 | 1 | 1 | 100 | 0 | 0 | 0 | 0 | 0 | 0 |
| Stakeholder Requirements Definition | OTHER | 0 | 1 | 0 | 0 | 12 | 0 | 0 | 5 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 5 | 0 |
| Supporting Activities | OTHER | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| System Architectural Design | OTHER | 0 | 2 | 0 | 0 | 12 | 0 | 0 | 5 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 10 | 0 |
| System Implementation | OTHER | 0 | 1 | 0 | 0 | 5 | 0 | 0 | 3 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| System Integration | OTHER | 0 | 1 | 0 | 0 | 8 | 0 | 0 | 3 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| System Requirements Analysis | OTHER | 0 | 1 | 0 | 0 | 10 | 0 | 0 | 5 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 9 | 0 |
| System Validation | OTHER | 0 | 3 | 0 | 0 | 6 | 0 | 0 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| System Verification | OTHER | 0 | 3 | 0 | 0 | 6 | 0 | 0 | 3 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| Verification & Validation | Component Test | 0 | 3 | 0 | 1 | 4 | 25 | 0 | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Functional Test | 0 | 4 | 0 | 0 | 4 | 0 | 0 | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Integration Test | 0 | 3 | 0 | 0 | 4 | 0 | 0 | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | OTHER | 0 | 3 | 0 | 0 | 3 | 0 | 0 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Software Validation | 0 | 4 | 0 | 0 | 4 | 0 | 0 | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | System Test | 0 | 2 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

# Some Results

## General Motors
Increased process acceptance
Assured compliance to ISO 26262

## Honeywell Aerospace
Reduced command media procedures by 65%
Increased response to change 4x

## Bosch
Reduced process change turnaround time by configuring
IBM Team Concert workflows through the defined processes

## Siemens Healthineers
Simplified cross-functional process flows by about %35


What you can do?
Contact me on LinkedIn
Hear more Industry Insights
Look at Our Solution
stages.methodpark.com