KPIT Industry Focused Solutions

Automotive & Transportation

Manufacturing

Energy & Utilities

KPIT = Product Engineering & Enterprise IT

Embedded Software | Product & Engineering Design | IT Platforms & Solutions

Process modernization using IT | Cloud & Big Data Analytics | PLM | Digital Transformation | Infrastructure Management Solutions

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Automotive and Allied Engineering - Snapshot

Product Engineering to make mobility **Smarter, greener, safer & affordable**

Product Engineering Solutions Across

| AUTOSAR & In Vehicle Networks | Body Electronics | Chassis, Autonomus and Driver Assistance | Engineering Design | Functional Safety ISO 26262 | Infotainment | Instrument Clusters | Powertrain | Vehicle Diagnostics |

Products Business Portfolio

Tools

K-SAR
AUTOSAR Suite

Worlds' FIRST AUTOSAR R 4.0.3 Solution

RTE | Basic Software Stack | MCAL

In2Soft Diagnostic Tools

ODX Designer | OTX Suite | Diagnostic IDE/RTE

Products

BMS
Battery Management Systems
Automotive | Stationary Applications

KIVI
KPIT In Vehicle Infotainment Platform

ReVOLO®
hybrid solution for everyone

Plug In Parallel Hybrid Solution

People with passion for Technology
4500+

OEMs & Tier 1s who benefit from our technology
85+

Vehicle Production Programs impacted by us
350+

Total number of projects executed
2000+

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The Global Automotive Industry is in a Transformational phase....

Electrification & Fuel Efficiency

Electric vehicles to be **35%** of global new car sales by 2040
Various Geos offers imperatives and constraints for Electric vehicle adoptions

Connectivity

89% of new cars sold worldwide will have embedded connectivity by 2024

Autonomous Driving

10 Million Self-Driving Cars Will Be On The Road By 2020

Consumer Experience

Vehicle **customization, ride sharing, personalization, multi modal** transport considered game changers by Automotive industry

We are moving towards the world of Autonomous, Connected, Fuel Efficient, Lightweight vehicles with personalized Consumer Experience

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Future trends imposing technical need of standard compliance and change in development workflow

Technical Needs

Functional Safety

Platform strategies

AUTOMOTIVE SPICE®

Increase in Automotive Controls System Complexity
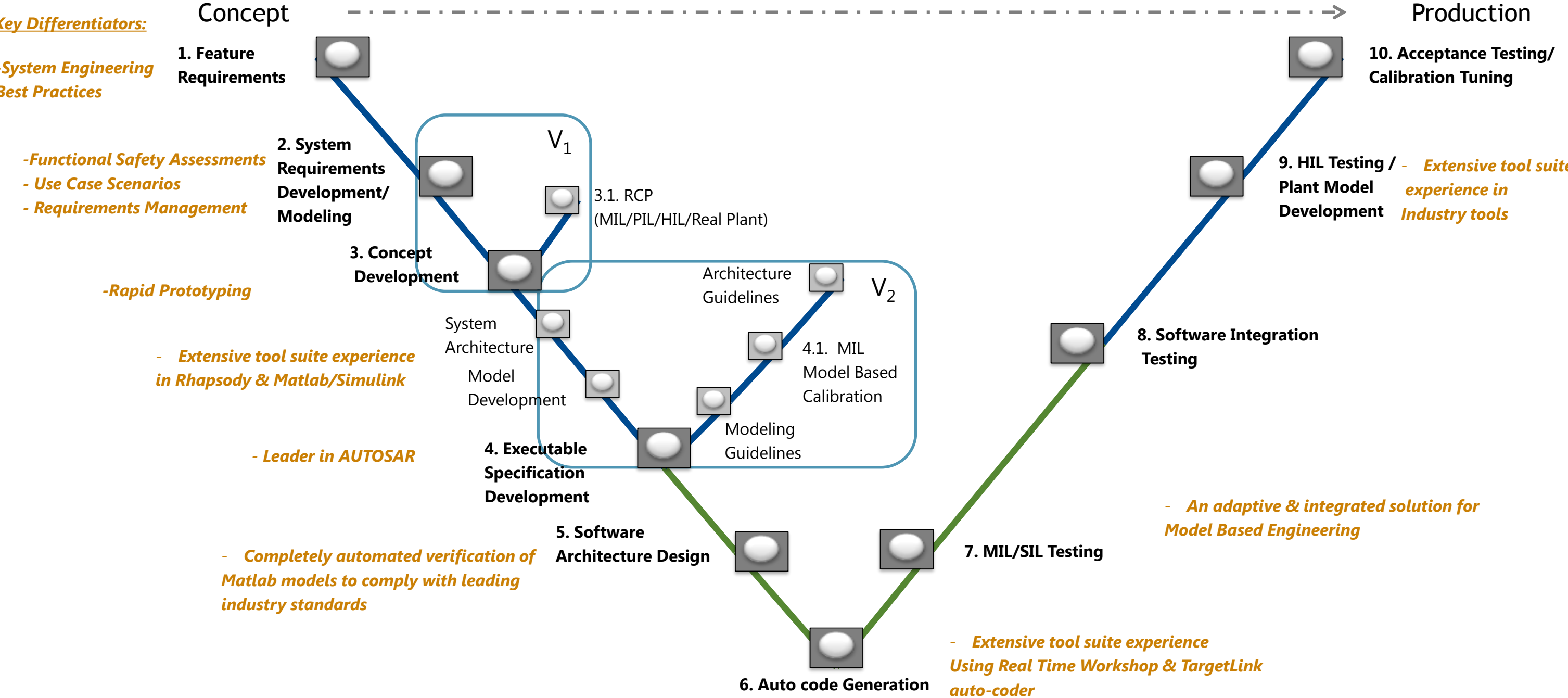
Development Needs

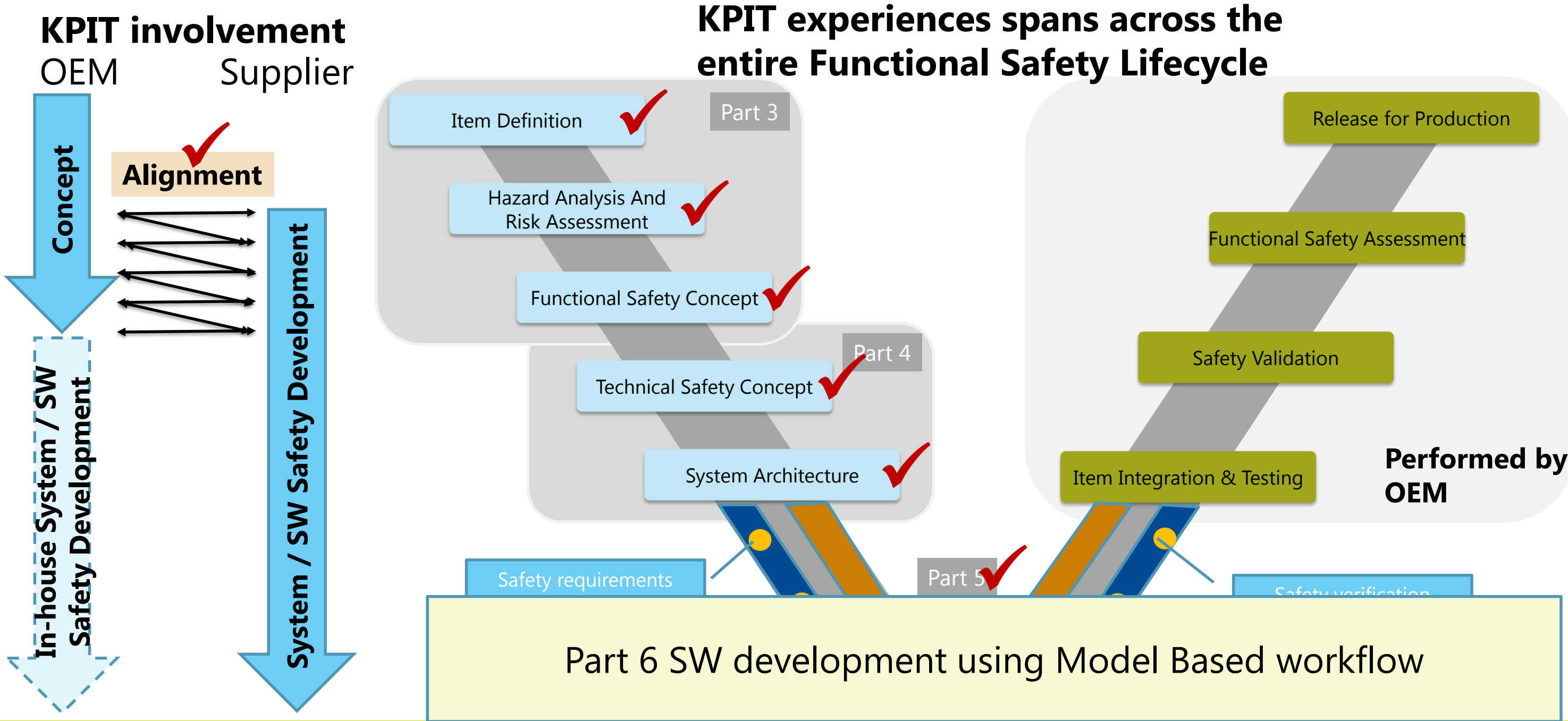Model based system and software engineering

Autosar Platform approach

Integrated model based development environment

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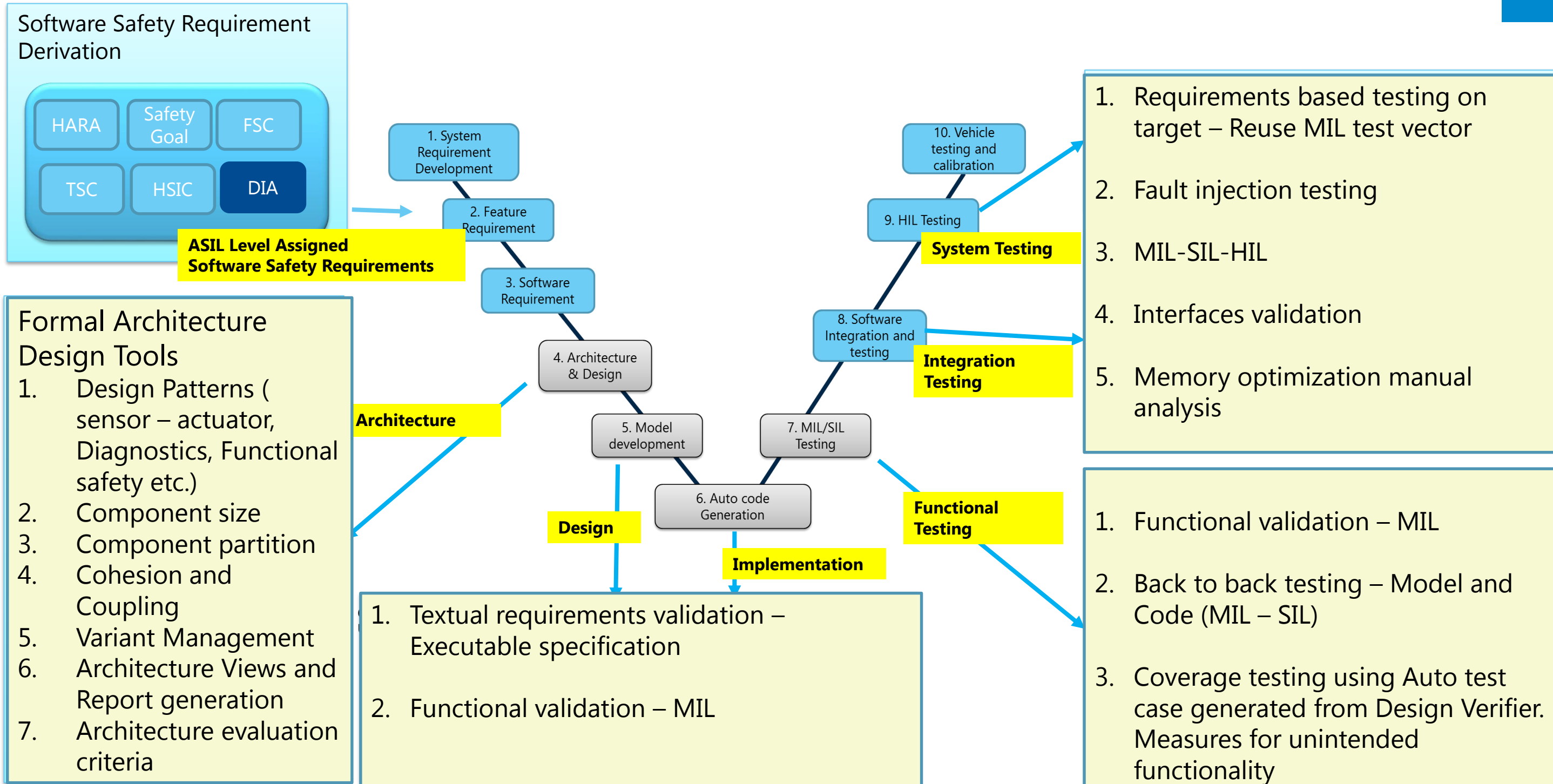# KPIT' Feature Development MBD workflow: Focus on 'Continuous Verification' Compliant to ISO26262, ASPICE and Autosar standards

Concept

Production

Key Differentiators:

-System Engineering Best Practices

-Functional Safety Assessments
- Use Case Scenarios
- Requirements Management

-Rapid Prototyping

- Extensive tool suite experience in Rhapsody & Matlab/Simulink

- Leader in AUTOSAR

- Completely automated verification of Matlab models to comply with leading industry standards

1. Feature Requirements

2. System Requirements Development/ Modeling

3. Concept Development

V_1

3.1. RCP (MIL/PIL/HIL/Real Plant)

System Architecture

Model Development

4. Executable Specification Development

Architecture Guidelines

V_2

4.1. MIL Model Based Calibration

Modeling Guidelines

5. Software Architecture Design

6. Auto code Generation

7. MIL/SIL Testing

- Extensive tool suite experience Using Real Time Workshop & TargetLink auto-coder

8. Software Integration Testing

- An adaptive & integrated solution for Model Based Engineering

9. HIL Testing / Plant Model Development

- Extensive tool suite experience in Industry tools

10. Acceptance Testing/ Calibration Tuning

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Functional Safety Lifecycle – KPIT Involvement

KPIT involvement

OEM   Supplier

Concept

Alignment

In-house System / SW Safety Development

System / SW Safety Development

KPIT experiences spans across the entire Functional Safety Lifecycle

Item Definition — Part 3

Hazard Analysis And Risk Assessment

Functional Safety Concept

Technical Safety Concept — Part 4

System Architecture

Safety requirements

Part 5

Safety verification

Release for Production

Functional Safety Assessment

Safety Validation

Item Integration & Testing

Performed by OEM

Part 6 SW development using Model Based workflow

Part 6

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ISO26262: Part 6 : REQUIREMENTS & METHODS

Software Safety Requirement Derivation

HARA	Safety Goal	FSC
TSC	HSIC	DIA

ASIL Level Assigned Software Safety Requirements

Formal Architecture Design Tools
1. Design Patterns (sensor – actuator, Diagnostics, Functional safety etc.)
2. Component size
3. Component partition
4. Cohesion and Coupling
5. Variant Management
6. Architecture Views and Report generation
7. Architecture evaluation criteria

1. System Requirement Development

2. Feature Requirement

3. Software Requirement

4. Architecture & Design

Architecture

5. Model development

6. Auto code Generation

Design

Implementation

7. MIL/SIL Testing

8. Software Integration and testing

Integration Testing

9. HIL Testing

System Testing

10. Vehicle testing and calibration

1. Requirements based testing on target – Reuse MIL test vector
2. Fault injection testing
3. MIL-SIL-HIL
4. Interfaces validation
5. Memory optimization manual analysis

Functional Testing

1. Functional validation – MIL
2. Back to back testing – Model and Code (MIL – SIL)
3. Coverage testing using Auto test case generated from Design Verifier. Measures for unintended functionality

1. Textual requirements validation – Executable specification
2. Functional validation – MIL

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Motivation & Implications of migrating to AUTOSAR

Main motivation to migrate from the legacy software is to manage the increasing complexity of the increasing electronics and software complexity and at the same time:

- Improve quality
- Reduce cost
- Reduce time to market

Typical challenges when migrating from the legacy software to AUTOSAR

- Software migration & complexity
- Variants management
- Configurator vs. implementer
- New technologies

Software migration & complexity
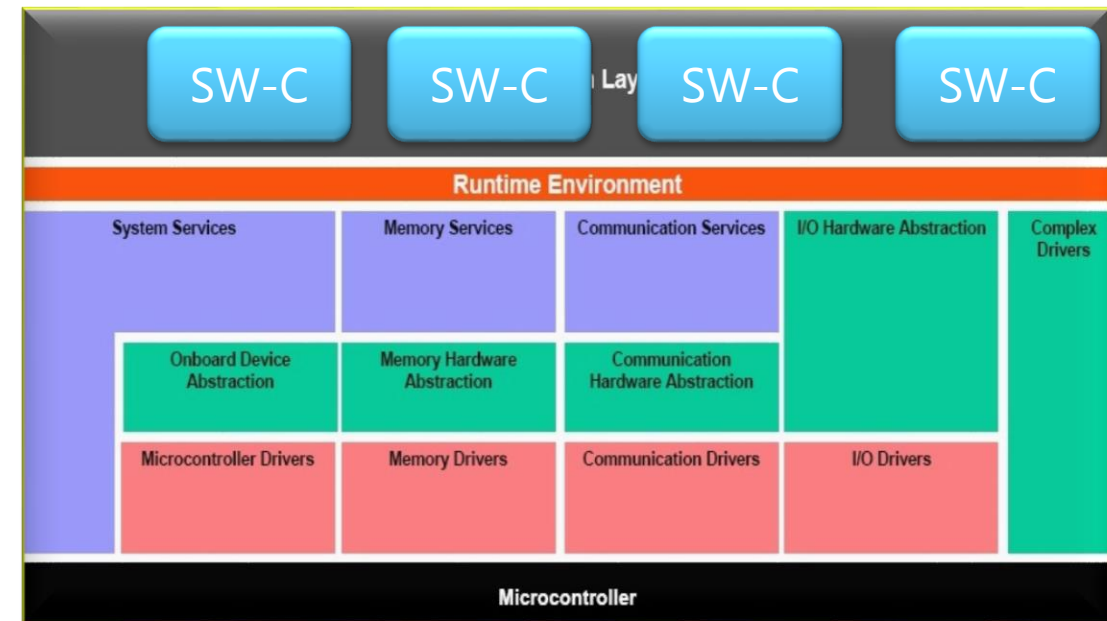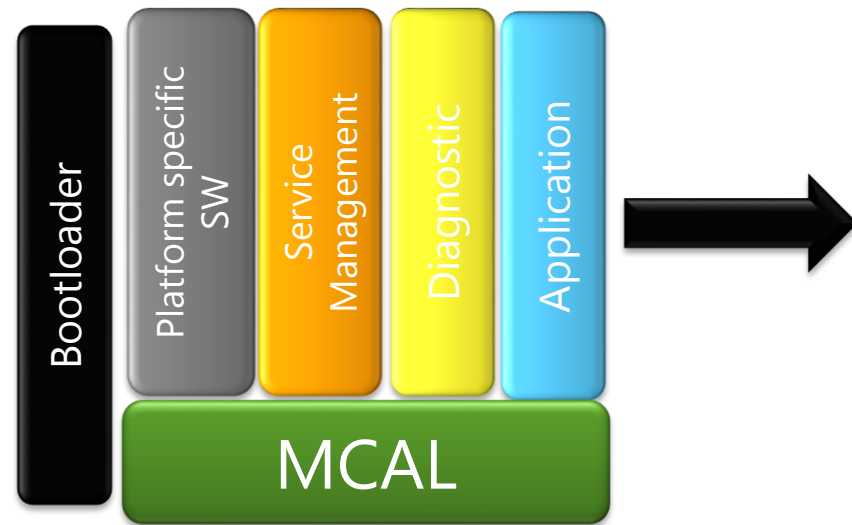
- Application Migration
- Application integration with BSW
- BSW License – delivered pre-integrated with MCAL
- Diagnostics integration and configuration

- BSW configuration → Most services are available in AUTOSAR
- Project specific complex drivers and I/O abstraction
- Bootloader integration
- SWC unit testing and Rapid Prototyping

Workflow of AUTOSAR Application Migration using MBD

1. System Requirement Development

2. Feature Requirement

3. Software Requirement

Analysis Document

4. Architecture & Design

- Model SWC/Runnable
- Interface/DataType

AUTOSAR Configuration Tools

5. Model development

Embedded Coder AUTOSAR Block set

6. Auto code Generation

AUTOSAR ACG c/.h

Atomic SW-C.arxml

Test Cases For Testing
- Functional Test Cases
- Integration Test Cases

10. Vehicle testing and calibration

9. HIL Testing

8. Software Integration and testing

7. MIL/SIL Testing

Test Report

AUTOSAR I/F → Configuration → **Rte.exe** → .c/.h → Compliance

Communication Matrix Analysis

Application (SWC.arxml)   ECU-Extract/dbc   Service Component IoHwAb Component

BSW Platform & RTE Config

Integration & Test

Interface Test

K-SAR AUTOSAR Suite

AUTOSAR Configuration Tools

KPIT Tools

Round trip approach –AUTOSAR Compliant Development

1 **Create AUTOSAR Architecture**
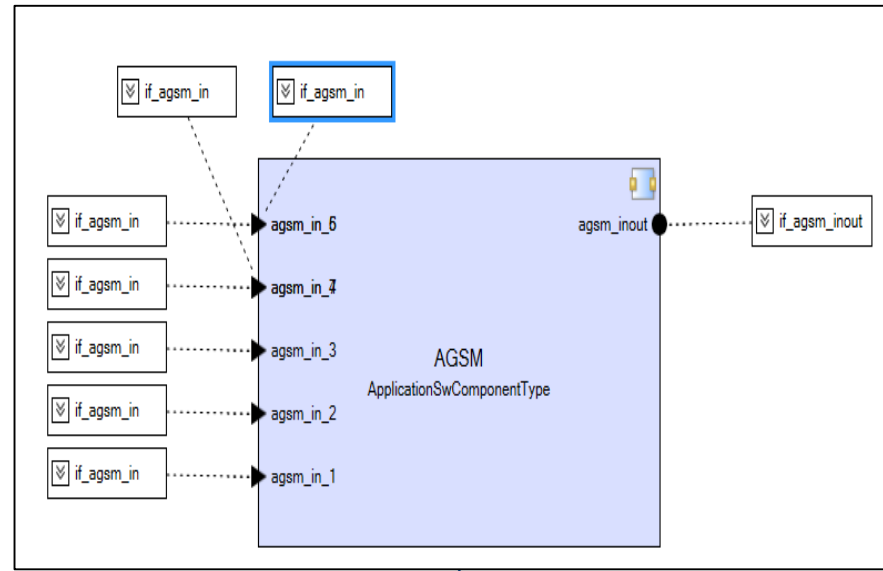
2 **Import ARXML & Create Frame Model**
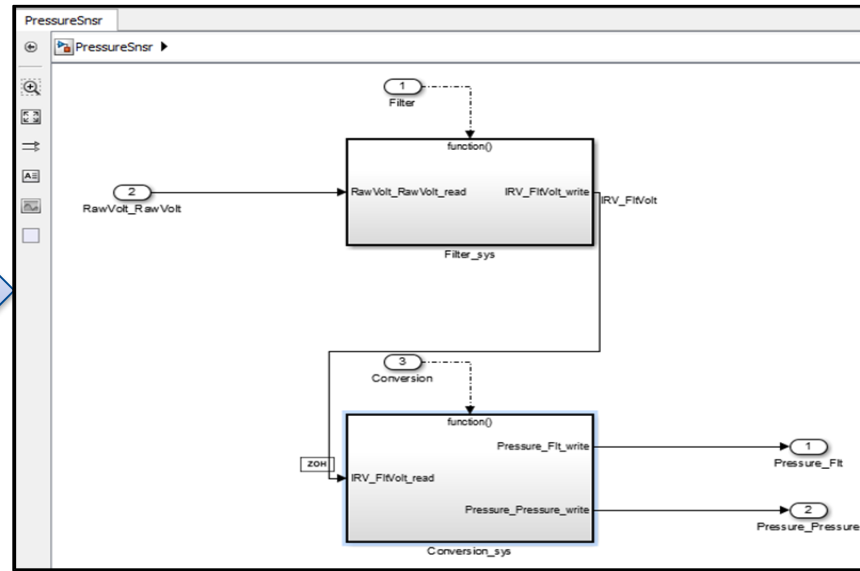
3 **Update Detail logic**

7 **Merge ARXML**

6 **Generate ARXML**

5 **Generate Code & Preform SIL**

4 **Perform MIL Validation**
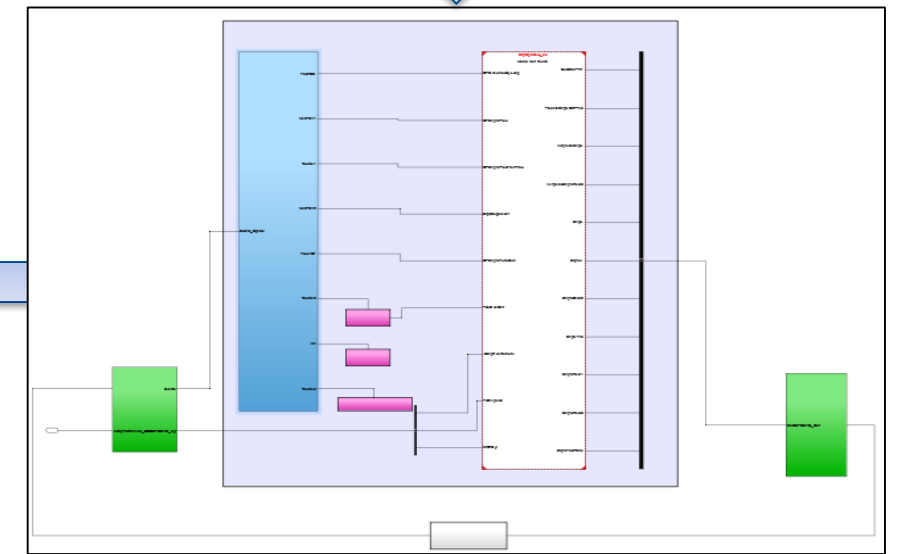
Automotive Spice – Software Quality Assurance Standard

MAN.3 – Project Management

ENG 1 – Requirement Elicitation	MAN 5 – Risk Management	ENG 10 – System testing
ENG 2 – System Requirement Analysis		ENG 9 – System integration test
ENG 3 – System Architectural Design		ENG 8 – Software testing
ENG 4 – Software Requirement Analysis		ENG 7 – Software integration test
ENG 5 – Software Design		ENG 6 – Software Construction

Need integrated environment to manage requirements

SUP 1 – Quality Assurance	SUP 8 – Configuration Management	SUP 9 – Problem resolution mgmt	SUP 10 – Change Request management

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KPIT approach : Integrated tools environment for ASPICE compliant workflow
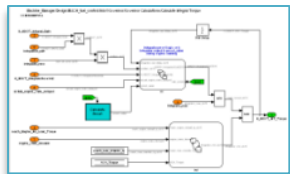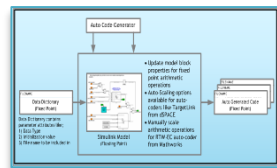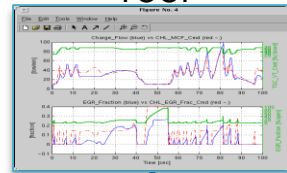
Requirements Management Tool
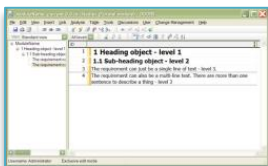
Architecture Modeling Tool

Systems and Controls Modeling Tool

Auto-code Tool

MIL/SIL/HIL Testing Tool

Objective:
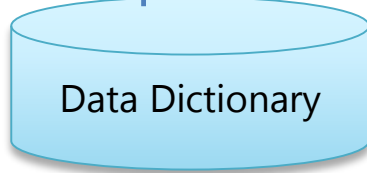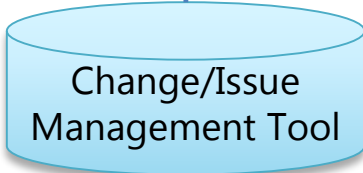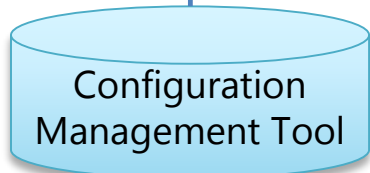- Allows management of product lifecycle development based on PLA principles
- Allows traceability throughout product development lifecycle
- Allows impact analysis across product lines and engineering artifacts
- Allows management visibility of the whole process
- Enable global collaboration
- Process and standards compliance (CMMI, AutoSpice, SAE, ISO 26262)

Engineering Workflow

Systems → Controls → Software → V&V

Integrated Infrastructure

Configuration Management Tool

Change/Issue Management Tool

Data Dictionary

Workflow Management Tool

Test Management

Build and Release Management

ALM Environment

Summary
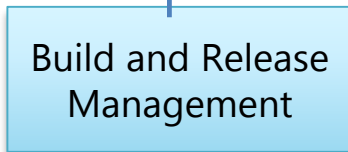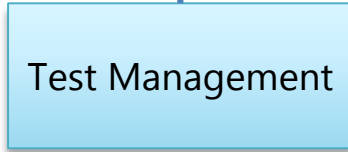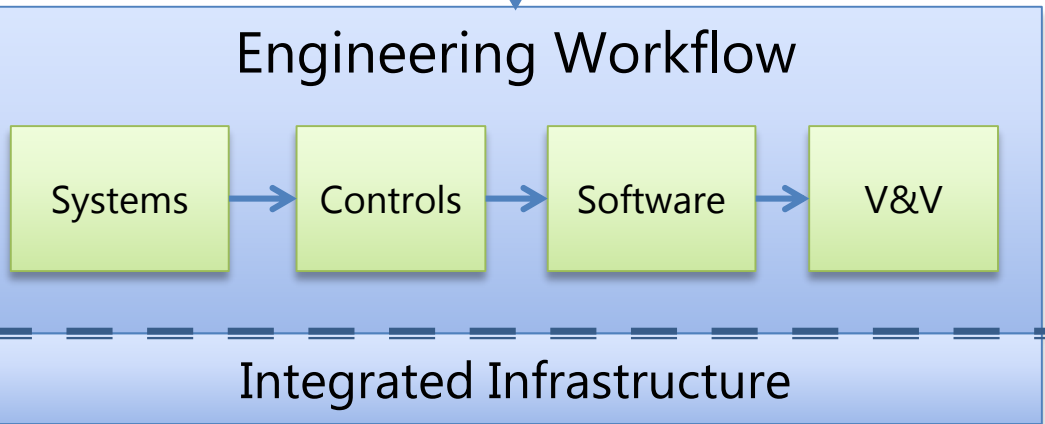
- Model based development is way forward to develop Automotive controls software
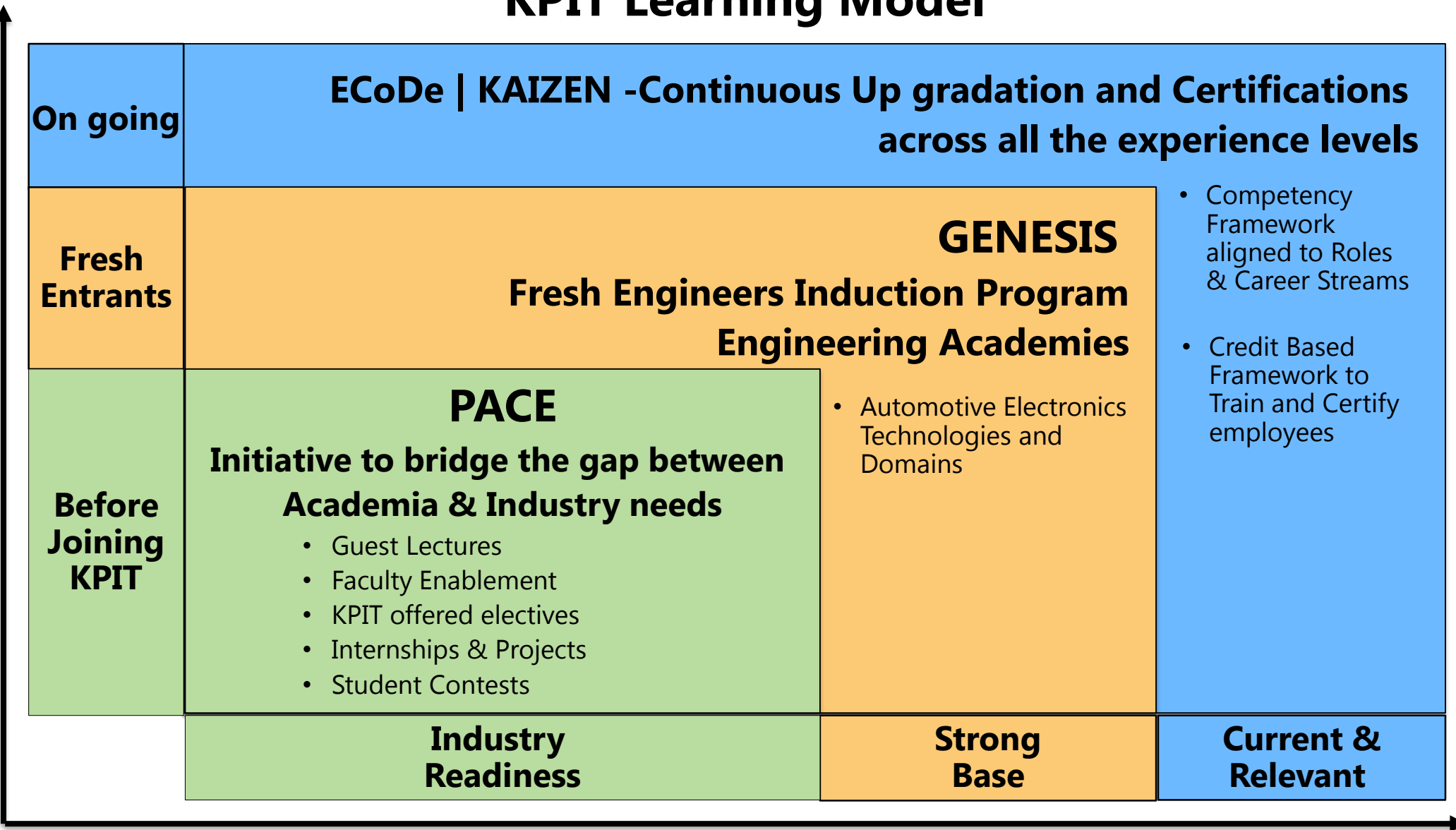- Model based development is well suited to develop controls software compliant to Automotive standards
  - ISO26262
  - ASPICE
  - Autosar
- Increasing electronics content in Automotive is increasing system complexity, needs many engineers with expertise in Model based development.

Our approach to meet demand - ECoDe – developing right talent to cater to customer demands

KPIT Learning Model

On going	**ECoDe | KAIZEN -Continuous Up gradation and Certifications across all the experience levels**		
Fresh Entrants	**GENESIS** **Fresh Engineers Induction Program** **Engineering Academies**		• Competency Framework aligned to Roles & Career Streams • Credit Based Framework to Train and Certify employees
Before Joining KPIT	**PACE** **Initiative to bridge the gap between Academia & Industry needs** • Guest Lectures • Faculty Enablement • KPIT offered electives • Internships & Projects • Student Contests	• Automotive Electronics Technologies and Domains	
	Industry Readiness	**Strong Base**	**Current & Relevant**

PACE: Program for **A**cademic **C**ollaboration and **E**ngagement

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Collaborations with Internal Stake holders and External Partners

ELEVATE | LIFT | ASPIRE | SOFT SKILLS
Leadership Development Programs to mentor Emerging & Existing Leaders

40-40-20
Academy SME + KPIT SME + Vendor Partners Model
Collaborative Education Model

GENESIS (6-8 weeks)
Every Campus recruited engineer trained & ready for customer projects

KPIT

Program for Academic Collaboration & Engagement (PACE) & GENESIS

Unique Initiative of KPIT

Programme objectives
Build **KPIT Brand** in Universities / Institutions to attract the right talent
Hire the **Right motivated talent for each practice**
Quicker deployment on projects / reduce internal training time / costs /efforts
Representation on Academic boards of Institutions **To influence education System**
Work to create **Industry ready niche resources**
SBU Aligned fresher induction and deployment
Faculty Development through collaborations

1. "PACE" Programme partnership kit for academic institutions

2. **MOUs with 20 Partner Institutions aligned to SBU needs**

3. Standard education artifacts in partnership with SBUs & Academies and repositories

4. **KPIT created courses approved by Academic boards and taught as part of Curriculum**

5. Through "Train the Trainer" Faculty enablement programmes & exchange programmes **60+ faculty trained**

6. Joint partnership for deployment & support institutions

7. **PACE linked to Campus hire, Internships and prospective employee engagement**

8. Induction to SBUs and Accounts –additions skill gap trainings as per needs

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Thank You

www.kpit.com

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