OEM – Supplier Model Based Collaboration
AUTOSAR Methodology

Rosa Gragossian
DASSAULT SYSTEMES, North America
10/22/2015
Model Based Collaboration – partial models

- **OEM asks Supplier to implement a subsystem**
  - **SYSTEM-EXTRACT:** From the complete System, OEM extracts and shares only the information defining that subsystem

- **OEM is interested in the function and its interfaces**
  - **SYSTEM-EXTRACT** may contain empty components (black box), partial model

- **Supplier delivers component implementation and ECU HW**
  - Tier1 implementation usually contains IP, not to be disclosed
Virtual Functional Bus (VFB) System

OEM’s Abstract System Description – Functional View
Virtual Functional Bus (VFB) System

OEM’s Abstract System Description – Functional View

OEM’s VFB System Description – SW View (based on AUTOSAR templates)

OEM’s model

SWCs (Black Box)
Inter-Connections
Interfaces
Data Exchange

SWCs as Black Boxes or with some level of refinement
System Constraint Description owned by OEM

**OEM’s model**
- Network Topology
- ECU & Buses
- Communication Matrix
- Signals, PDUs, Frames

![Diagram of network topology with ECUs and buses connected through Can Bus 1. ECU-1, ECU-2, ECU-3, ECU-4, ECU-5, ECU-6, ECU-7 are connected on the diagram.]
System Mapping by OEM

Can Bus 1

ECU-1

ECU-2

ECU-3

ECU-4

ECU-5

ECU-6

ECU-7

SWComp-1

SWComp-2

SWComp-3
System Mapping by OEM
OEM’s model
Root Composition and Topology
SW-C to ECU Mappings
Communication Matrix
Data – Signal Mappings

System Configuration by OEM

ECU-1
ECU-2
ECU-3
ECU-4
Can Bus 1

ECU-5
ECU-6
ECU-7
OEM’s Partial Model
SYSTEM-EXTRACT

OEM Transfers to Tier1 a System-Extract including one or more Functions

Tier1
Implements the ECU HW & SW

OEM’s model
SYSTEM-EXTRACT

Root Composition
FLM Composition
ECU & Connected Bus Communication Matrix
SWC to ECU Mapping
Data to Signal Mappings

Can Bus 1

FLM Composition

ECU & Connected Bus Communication Matrix
SWC to ECU Mapping
Data to Signal Mappings

ECU-1

ECU-2

ECU-3

ECU-4

ECU-5

ECU-6

ECU-7
New Frontiers for Model Based Processes

- System-Extract is OEM’s specification
- System-Extract is an executable model instead of a document
- Tier1 merges with OEM’s model seamlessly and refines it
- OEM’s artifact remains intact
- Tier1’s detailed design remains protected
- Any AUTOSAR tool can be used by different parties
Tier1 - Implements the ECU SW and HW

Refines the model:
Decomposes the function into atomic level SW components

Tier1’s model
- Refined SWC
- SWC Internal Communications
- ECU Extract
- Refined SWC
- SWC Communications
- Communication Matrix
- Data – Signal Mappings
- Signal – Frame Mappings
Tier1 populates/refines OEM’s partial model

OEM’s Partial Model, Root Composition

Includes a black box Composition, only delegation ports
Tier1 populates/refines OEM’s partial model

OEM’s Partial Model, Root Composition

Includes a black box Composition, only delegation ports

Tier1 adds a refined Composition prototype
New Frontiers for Model Based Processes

- OEM only transfers required content: Ports and Mapping
New Frontiers for Model Based Processes

- OEM only transfers required content: Ports and Mapping
- Tier1 splits the Composition to refine the content in separate files
New Frontiers for Model Based Processes

- OEM only transfers required content: Ports and Mapping
- Tier1 splits the Composition to refine the content in separate files
New Frontiers for Model Based Processes

- Merge is in the tool not in the files
- OEM's artifact remains intact
- Tier1 sends back only needed info

- Separate Version Control
- Exchange only what is needed
- Compare files for relevant content

Split in a different file for IP protection
New Frontiers for Model Based Processes

- Merge is in the tool not in the files
- OEM’s artifact remains intact
- Tier1 sends back only needed info

- Separate Version Control
- Exchange only what is needed
- Compare files for relevant content

Replace with an empty composition
ECU Extract by Tier1

Tier1 extracts only ECU specific information from merged model to generate ECU-Extract
ECU Extract by Tier1

Tier1 extracts only ECU specific information from merged model to generate ECU-Extract

Next Step Connect Service SWCs
Configure services for functional needs
Tier1 – Tier2 Collaboration – one possible scenario

Merge ECU–Extract with Tier2 Services model

Tier1 or Tier2

- In merged model creates connections
- Configures Services in merged model
- Merged model used for generation of BSW configuration
A Use Case with AUTOSAR Builder™
System Extract contains a Function sent to the Tier1 for the first time
System Extract from OEM

- Root Composition, from OEM Contains a prototype of FLM_CompositionType
- OEM’s FLM_CompositionType Contains only Delegation Ports
System Extract Mapping

- OEM’s FLM_Composition_PT is mapped to an ECU
- The data from its delegation ports are mapped to system signals
Split out Tier1 model from System Extract

Tier1’s starts by creating an empty Composition Type (to be refined) with no ports, in a file belonging to the Tier1.
Split out Tier1 model from System Extract

Tier1’s Refined Composition Type

OEM - file

FLM_Composition_Type

FLM_RevisedComp_PT
Split out Tier1 model from System Extract

Tier1's Refined Composition Type

OEM - file

Tier1 - file

FLM_Composition_Type

FLM_RefinedComp_PT
System Extract split in OEM and Tier1 model

OEM - file

Tier1 - file

FLM_Composition_Type

EngineFuelType
FuelConsumption
FuelLevelRefInfo
FuelMaxDep
FuelTankCap
InvAdjFuelConsumption
InvVarVehicleFuelStatus
PowerTrainStatus
TestData
VehicleConfig
VehicleRecFuelStatus
VehicleModelInfo
VehicleLongitudSpeed
VehicleLongitudSpeedKmH

Out_FuelCompOnRequest
Out_FuelLevel
Out_FuelLevelSvw
Out_VehLongSpeedDepMode
Out_VehFuelLevelSvw
Out_VehFuelLevelSound
Out_VehFuelLevelFlashReq

FLM_RefinedComp_PT
System Extract from OEM **merged** with Tier1 model

Root Composition contains a prototype of FLM_CompositionType populated by Tier1’s refinement

System Extract Mapping is propagated through the refined model

- Perform Ecu_Extract
- OEM’s file is intact
- No mapping by Tier1
- Same process to integrate service SWCs and their connectors