Model-Based Avionics Roadmap

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Objectives of MB(A)SE Activities

- Support the shift from a document-centric towards a model-centric approach.
- Achieve continuity of models throughout the lifecycle:
  - Automation
  - Consistency
  - Inter-discipline communication
- Encourage model and product reuse.
- Support the development of product lines.

Context

The SAVOIR technical note on Model-Based Avionics is available (TN-003).

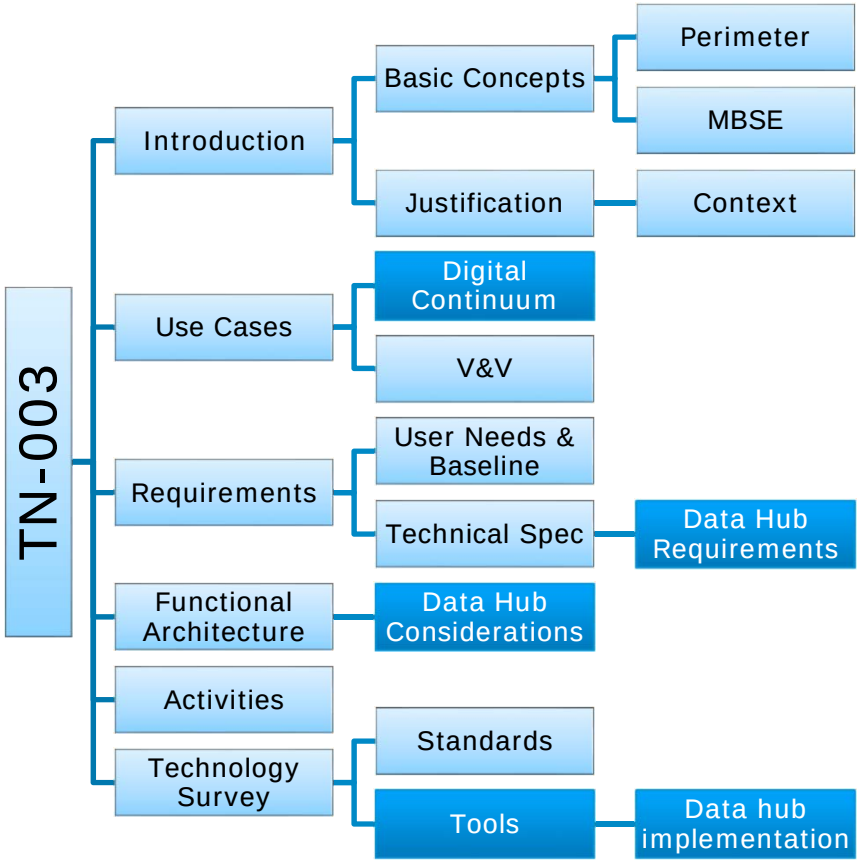
It contains:

- User Needs, high level requirements, functional architecture, and tool landscape
- Mapping to SAVOIR scope and definitions
- Mapping of MBA Activities from the avionics harmonisation roadmap
- Moving the focus from a monolithic factory to a distributed one (data hub)

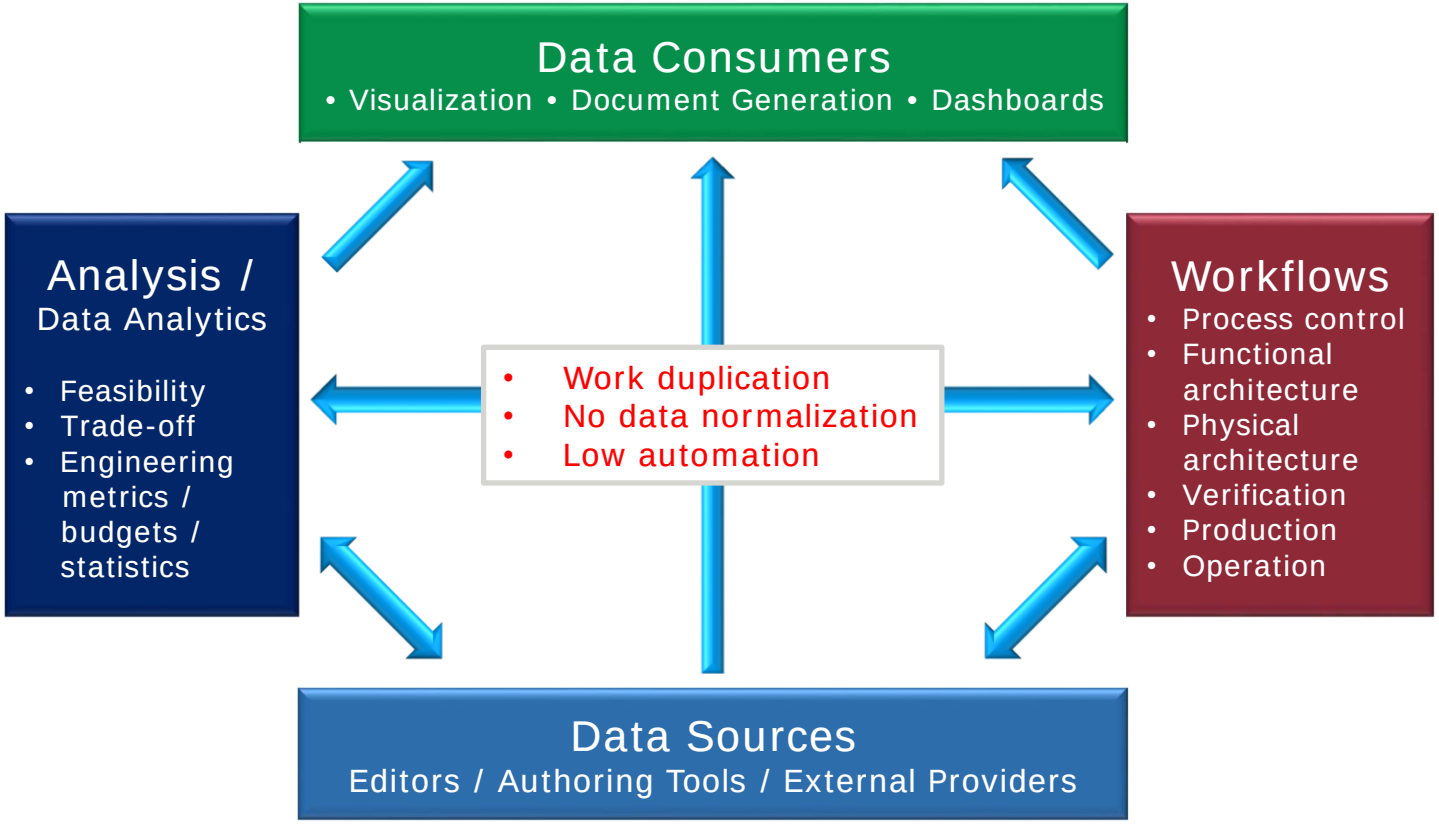
Also:

- Tool prototypes in development

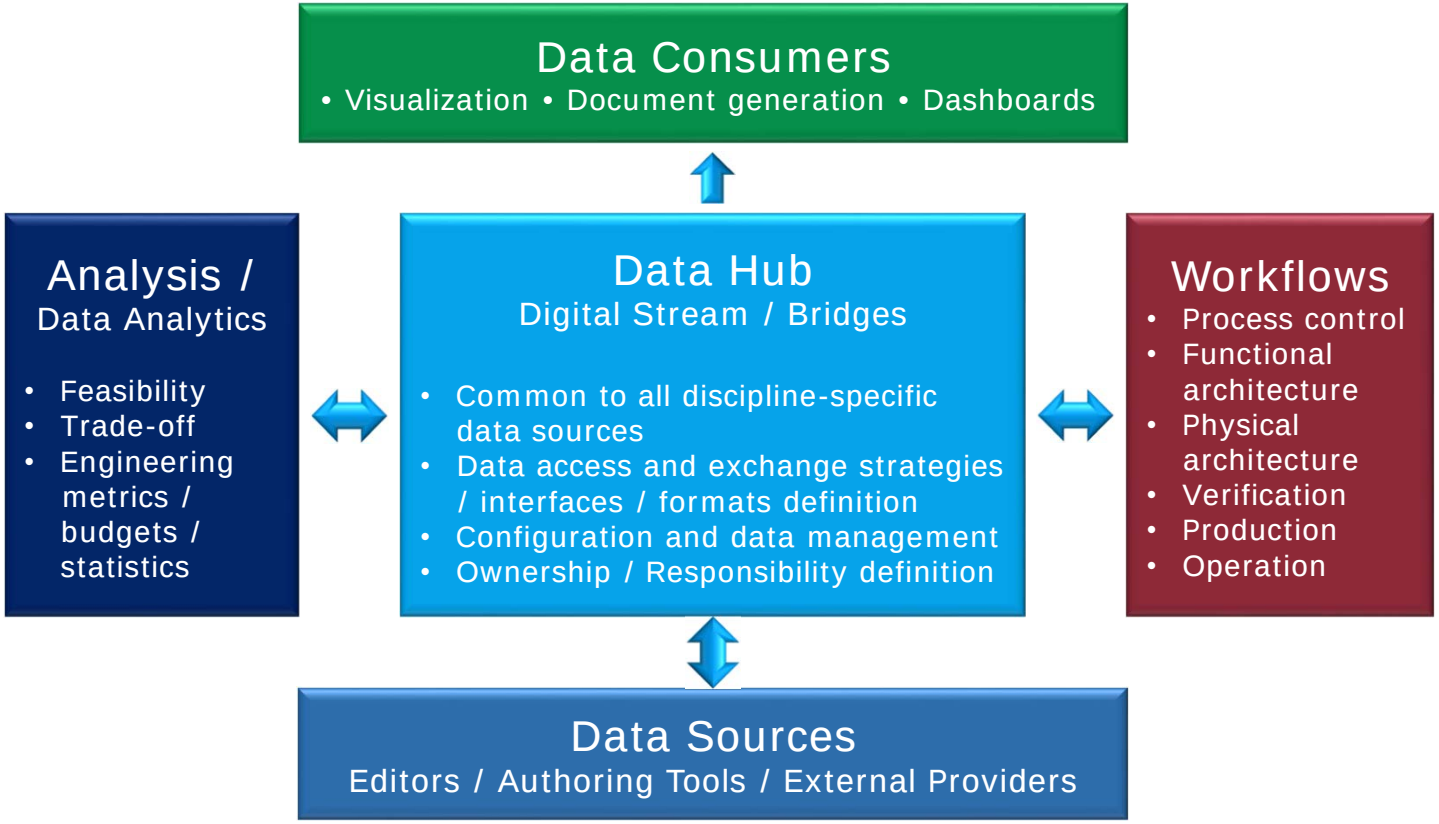
Document Structure



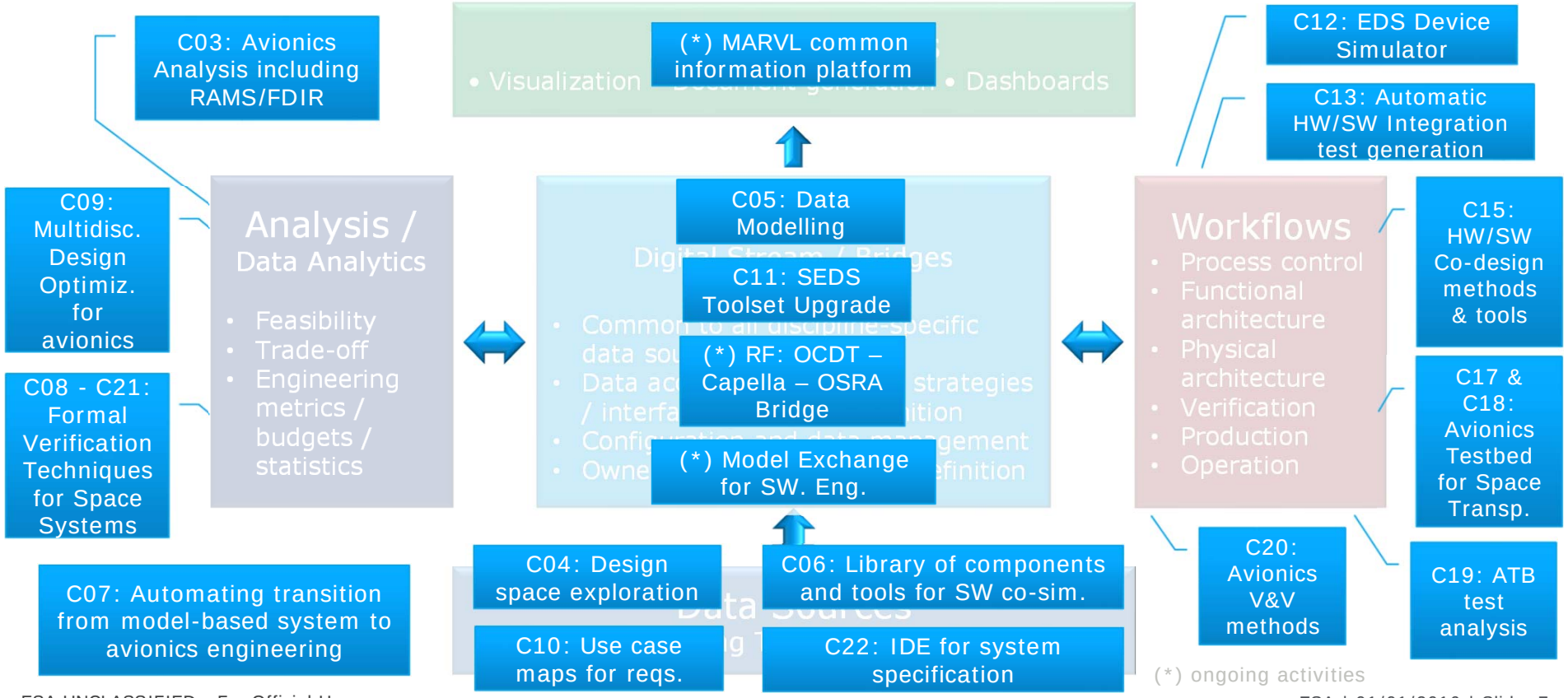
Avionics Factory



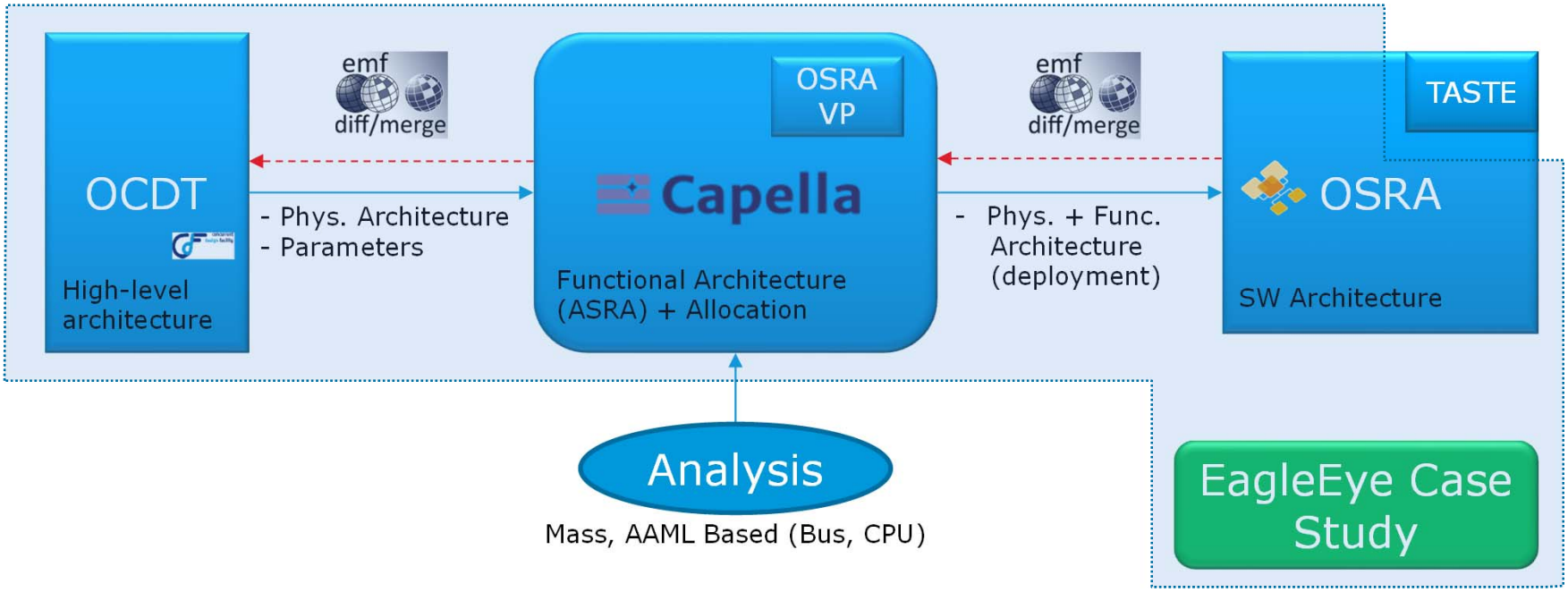
Avionics Factory



Avionics Factory – Roadmap Activities



Prototyping Activities



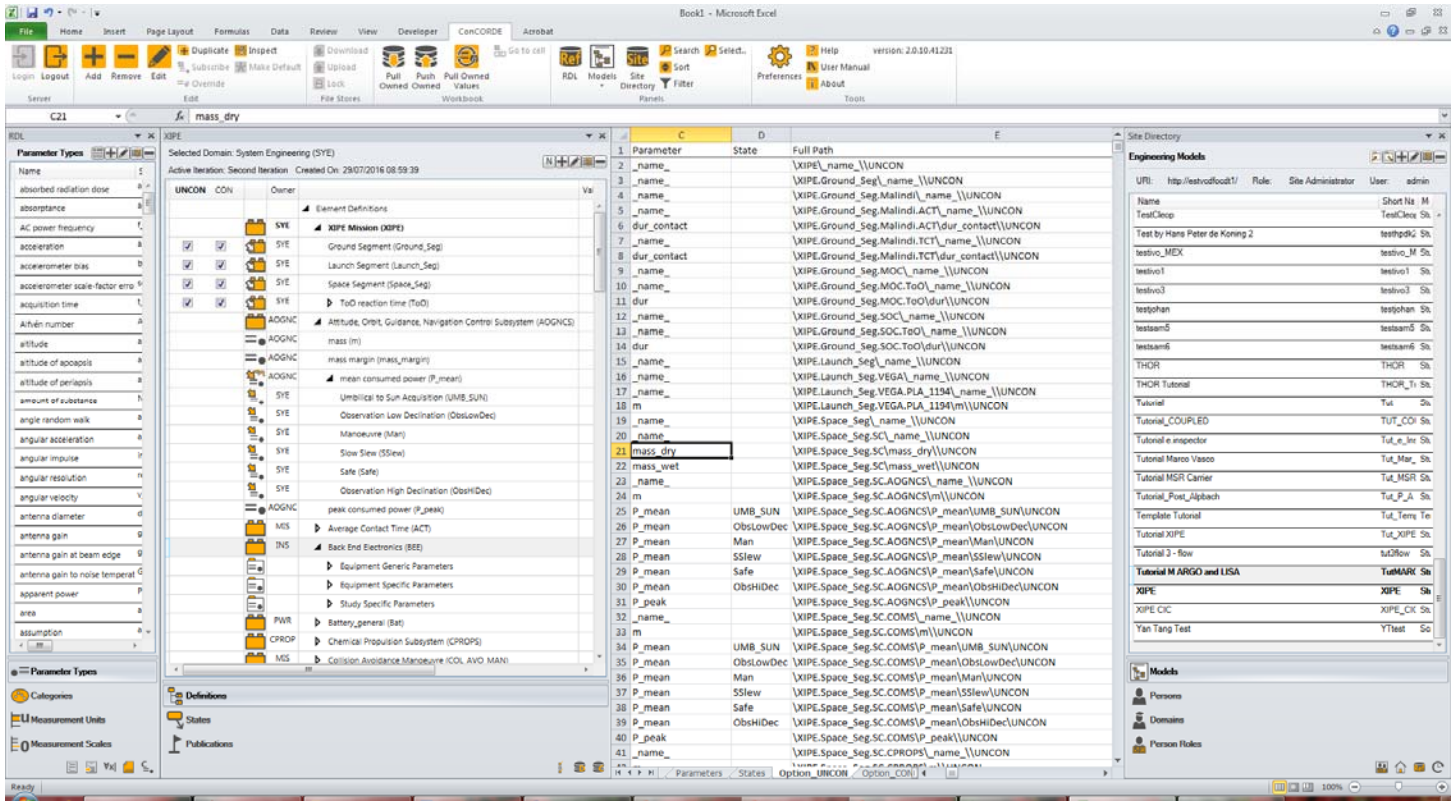
OCDT

Initial Study

- Requirements
- S/C Design
- Launcher
- Risk
- Cost
- Simulation
- Programmatics
- Options

Initial Model

OCDT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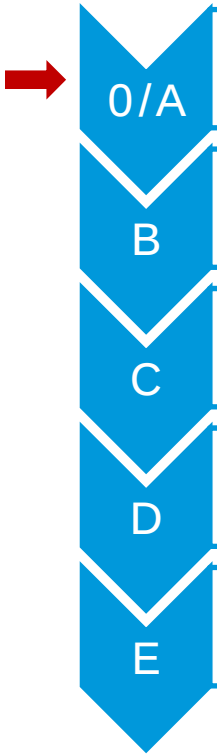
Parameter
State
Full Path
mass_dry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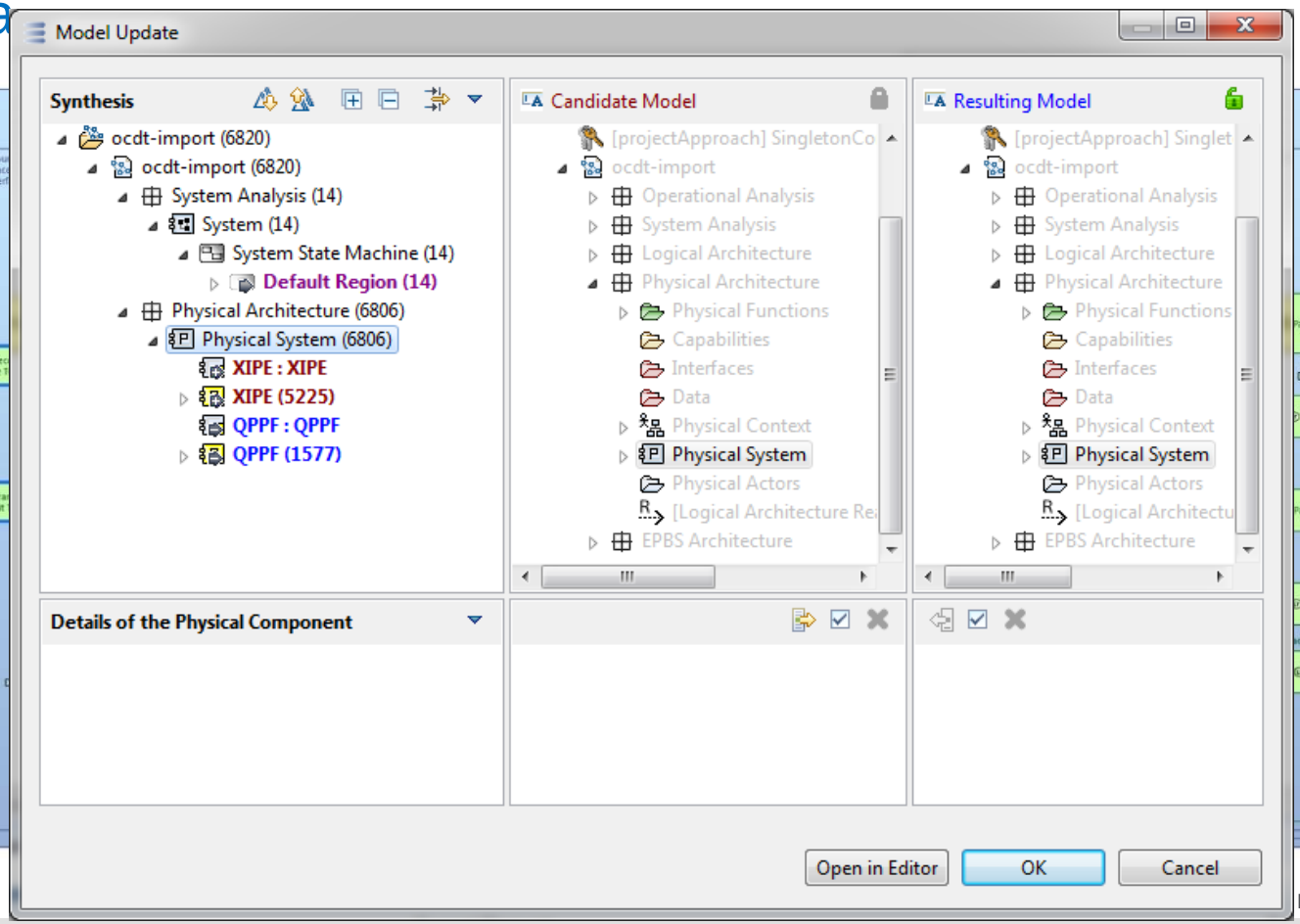
Capella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Synthesis
ocdt-import (6820)
ocdt-import (6820)
System Analysis (14)
System (14)
System State Machine (14)
Default Region (14)
Physical Architecture (6806)
Physical System (6806)
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QPPF : QPPF
QPPF (1577)
Candidate Model
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ocdt-import
Operational Analysis
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Physical Architecture
Physical Functions
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Interfaces
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Details of the Physical Component
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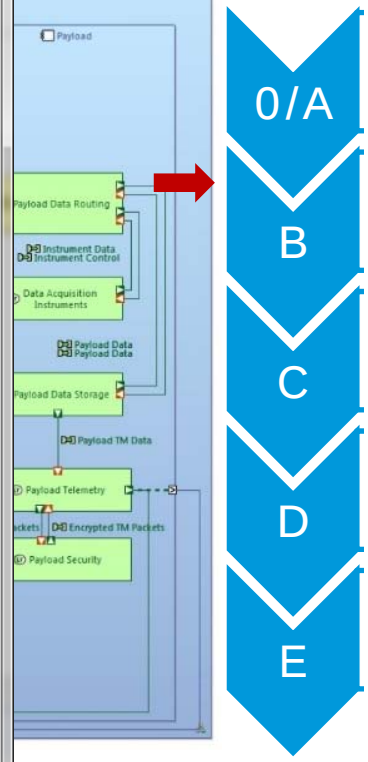
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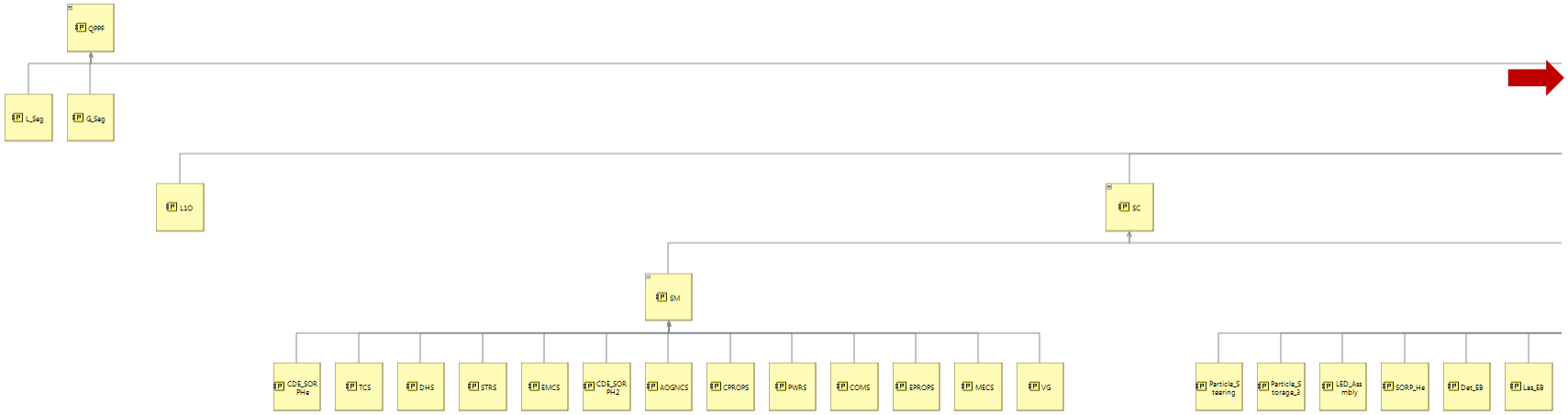
Capella – Physical Architecture



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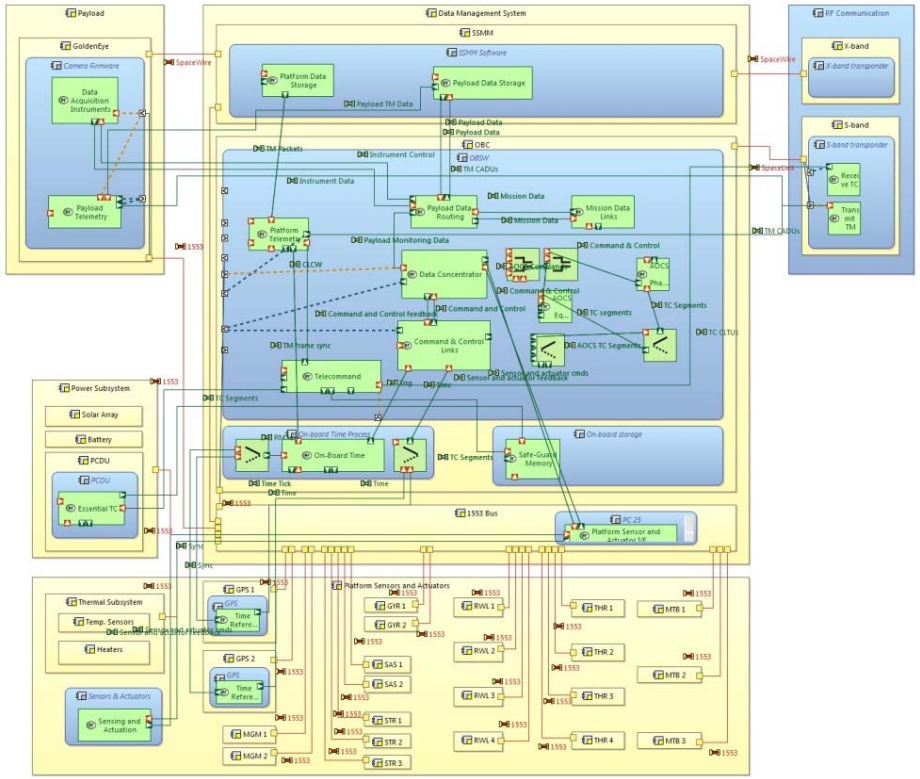
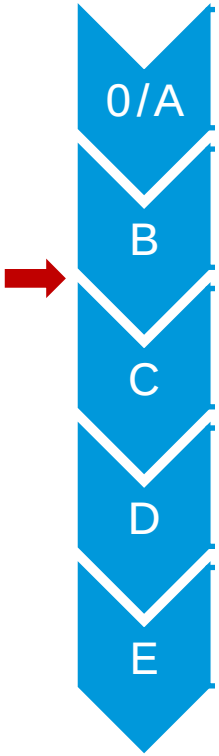
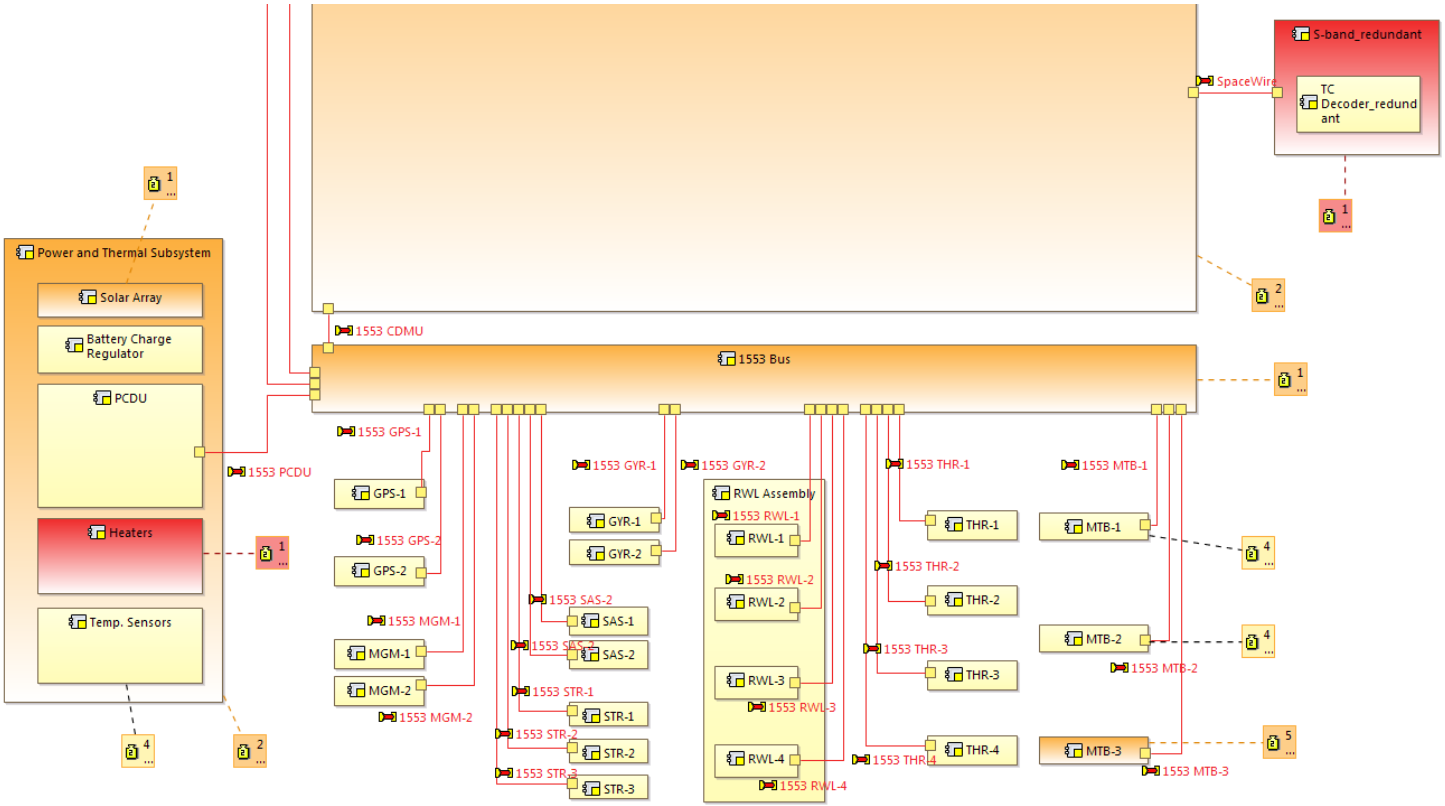
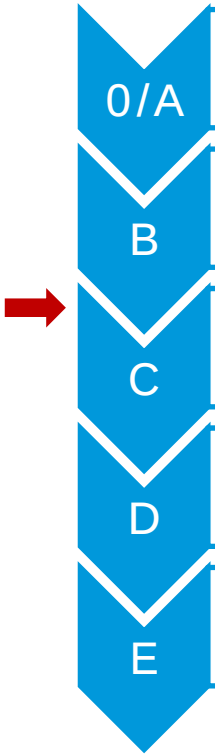
Capella – Architecture Mapping



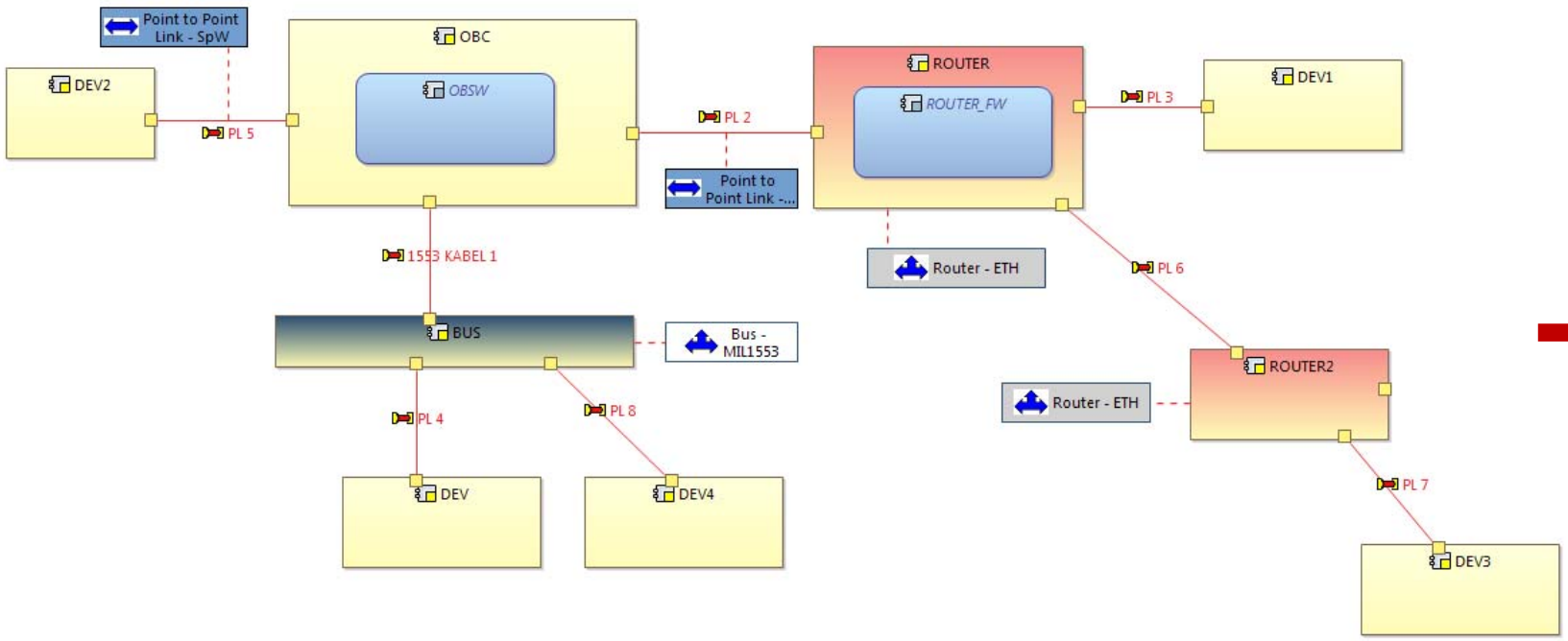


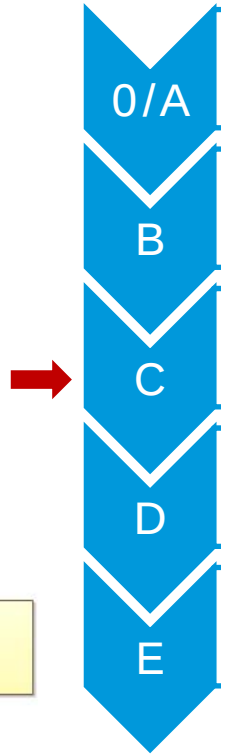
Capella – Analysis Viewpoints

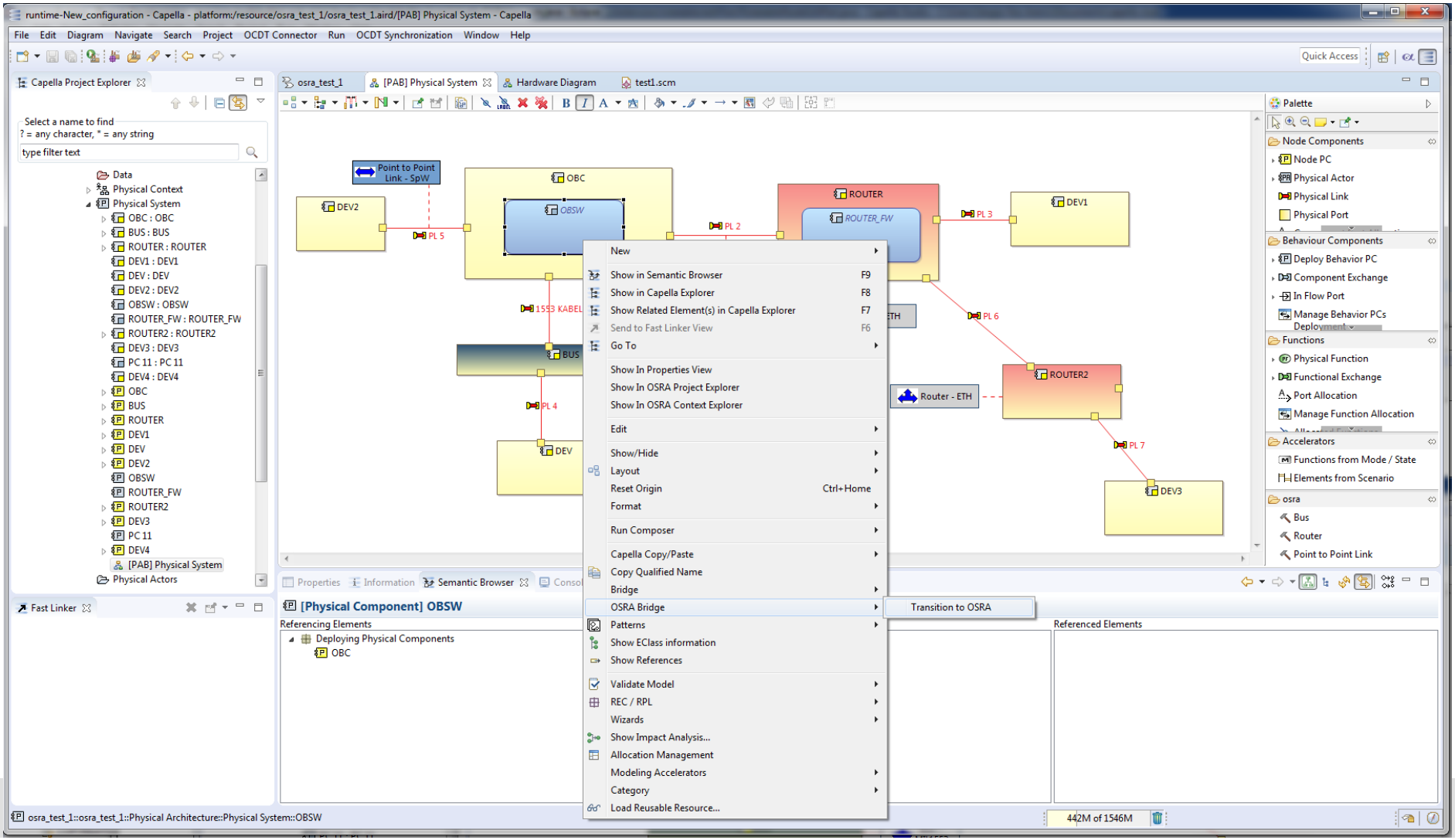




Capella – OSRA Viewpoint



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File Edit Diagram Navigate Search Project OCDT Connector Run OCDT Synchronization Window Help
Capella Project Explorer
Select a name to find
? = any character, * = any string
type filter text
Data
Physical Context
Physical System
OBC : OBC
BUS : BUS
ROUTER : ROUTER
DEV1 : DEV1
DEV : DEV
DEV2 : DEV2
OBSW : OBSW
ROUTER_FW : ROUTER_FW
ROUTER2 : ROUTER2
DEV3 : DEV3
PC 11 : PC 11
DEV4 : DEV4
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BUS
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DEV1
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DEV2
OBSW
ROUTER_FW
ROUTER2
DEV3
PC 11
DEV4
[PAB] Physical System
Physical Actors
Fast Linker
osra_test_1
[PAB] Physical System
Hardware Diagram
test1.scm
Point to Point Link - SpW
DEV2
OBC
OBSW
ROUTER
ROUTER_FW
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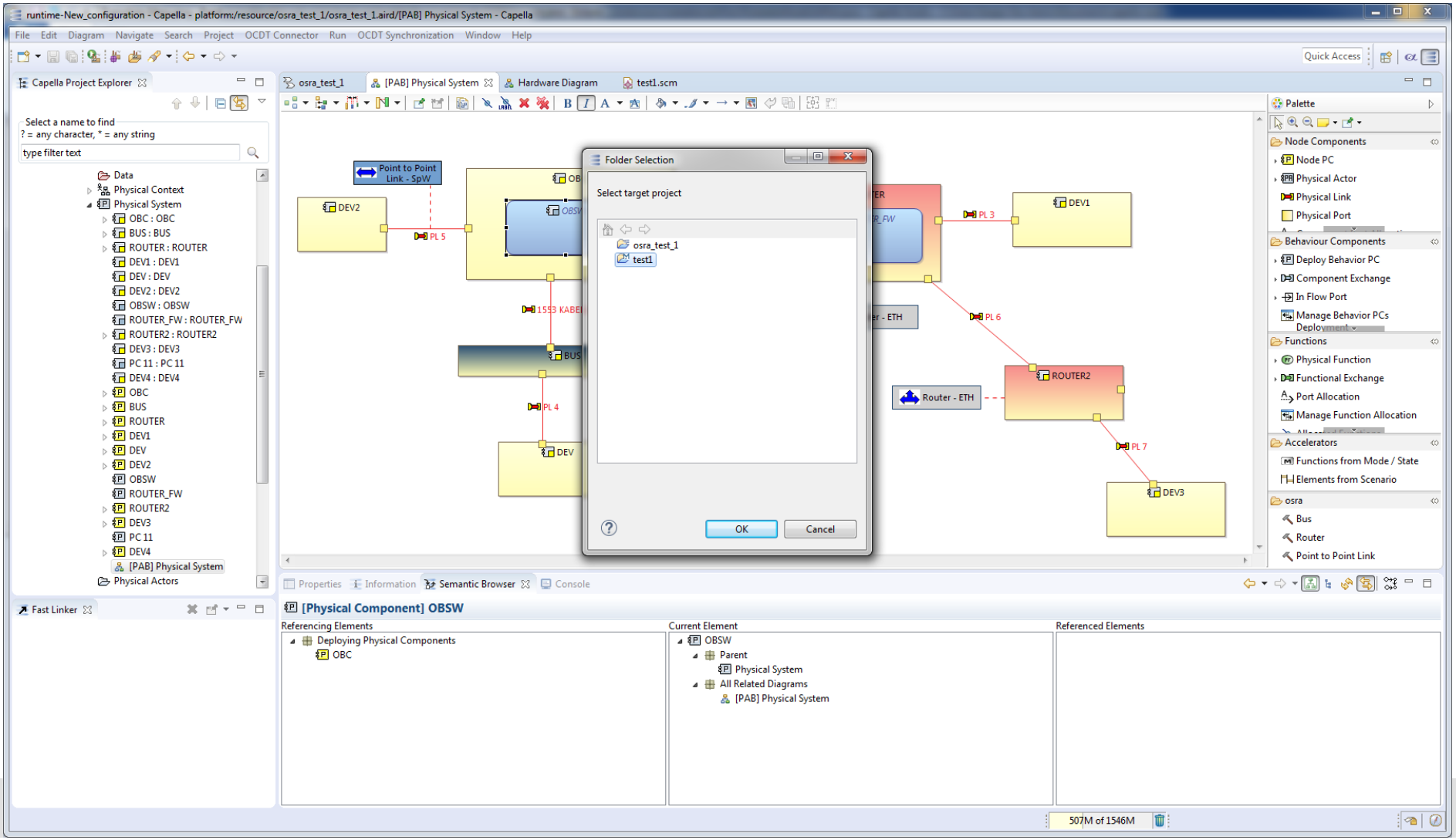
PL 5
PL 2
PL 3
1553 KABEL
BUS
PL 4
DEV
PL 6
ROUTER2
Router - ETH
PL 7
DEV3
New
Show in Semantic Browser F9
Show in Capella Explorer F8
Show Related Element(s) in Capella Explorer F7
Send to Fast Linker View F6
Go To
Show In Properties View
Show In OSRA Project Explorer
Show In OSRA Context Explorer
Edit
Show/Hide
Layout
Reset Origin Ctrl+Home
Format
Run Composer
Capella Copy/Paste
Copy Qualified Name
Bridge
OSRA Bridge
Transition to OSRA
Patterns
Show EClass information
Show References
Validate Model
REC / RPL
Wizards
Show Impact Analysis...
Allocation Management
Modeling Accelerators
Category
Load Reusable Resource...
Properties
Information
Semantic Browser
[Physical Component] OBSW
Referencing Elements
Deploying Physical Components
OBC
Referenced Elements
Palette
Node Components
Node PC
Physical Actor
Physical Link
Physical Port
Behaviour Components
Deploy Behavior PC
Component Exchange
In Flow Port
Manage Behavior PCs Deployment
Functions
Physical Function
Functional Exchange
Port Allocation
Manage Function Allocation
Accelerators
Functions from Mode / State
Elements from Scenario
osra
Bus
Router
Point to Point Link
osra_test_1::osra_test_1::Physical Architecture::Physical System::OBSW
442M of 1546M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Quick Access
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OBSW
ROUTER_FW
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DEV3
PC 11
DEV4
[PAB] Physical System
Physical Actors
Fast Linker
osra_test_1
[PAB] Physical System
Hardware Diagram
test1.scm
Point to Point Link - SpW
DEV2
PL 5
1553 KABEL
BUS
PL 4
DEV
PL 3
DEV1
PL 6
ROUTER2
Router - ETH
PL 7
DEV3
Folder Selection
Select target project
osra_test_1
test1
OK
Cancel
Palette
Node Components
Node PC
Physical Actor
Physical Link
Physical Port
Behaviour Components
Deploy Behavior PC
Component Exchange
In Flow Port
Manage Behavior PCs Deployment
Functions
Physical Function
Functional Exchange
Port Allocation
Manage Function Allocation
Accelerators
Functions from Mode / State
Elements from Scenario
osra
Bus
Router
Point to Point Link
Properties
Information
Semantic Browser
Console
[Physical Component] OBSW
Referencing Elements
Deploying Physical Components
OBC
Current Element
OBSW
Parent
Physical System
All Related Diagrams
[PAB] Physical System
Referenced Elements
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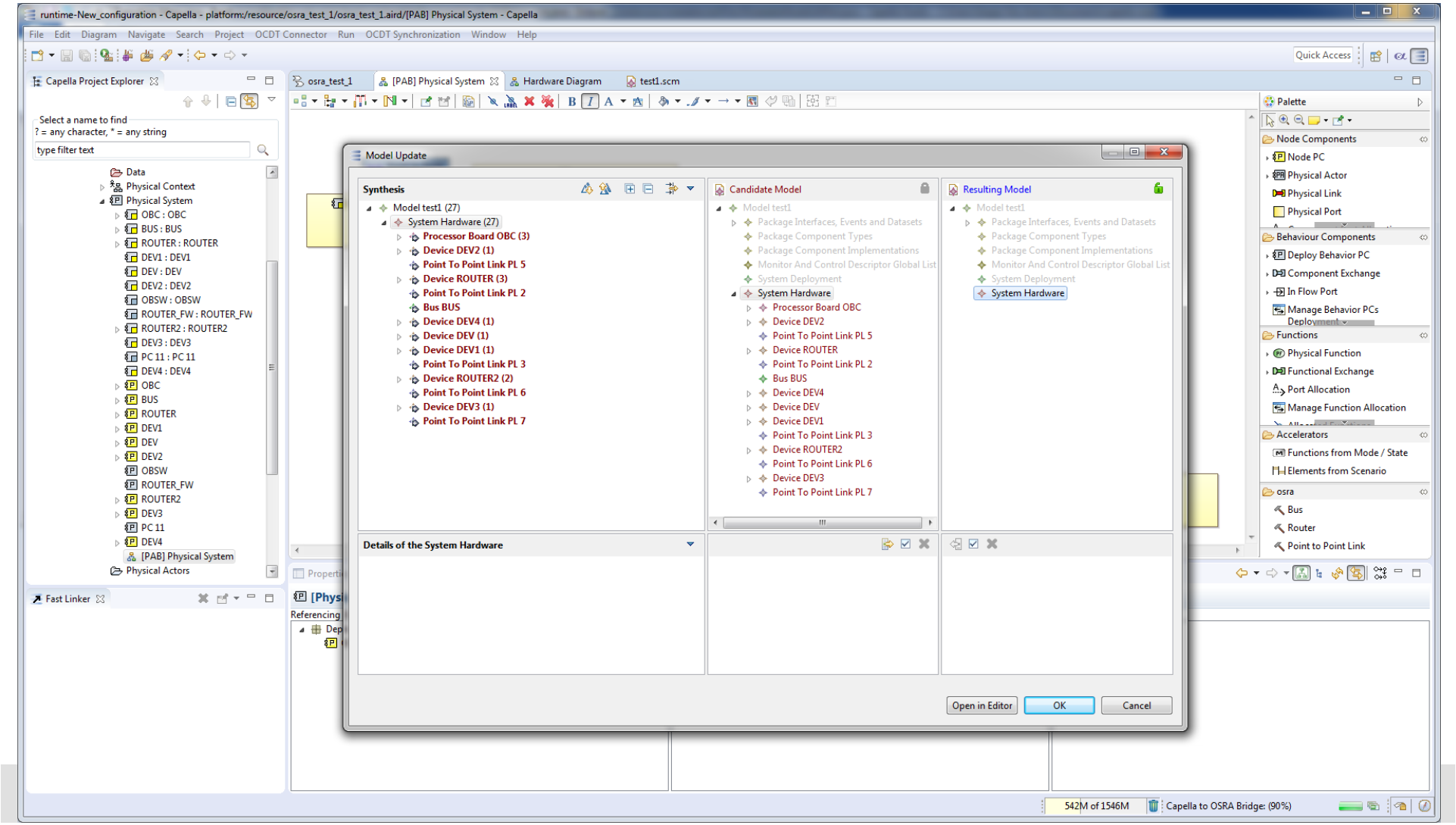
runtime-New_configuration - Capella - platform:/resource/osra_test_1/osra_test_1.aird/[PAB] Physical System - Capella
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Quick Access
Capella Project Explorer
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DEV3 : DEV3
PC 11 : PC 11
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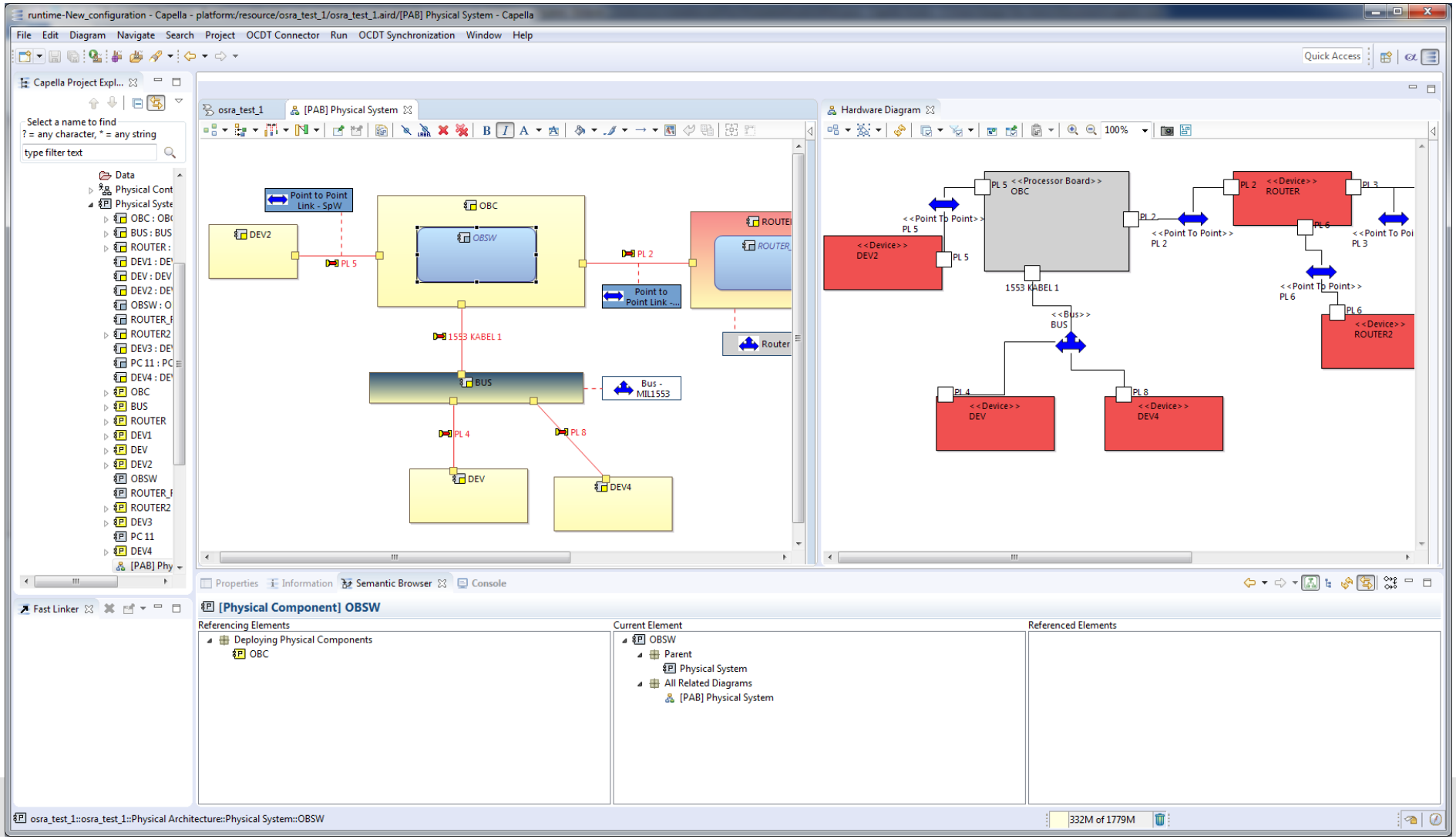
DEV2
OBSW
ROUTER_FW
ROUTER2
DEV3
PC 11
DEV4
[PAB] Physical System
Physical Actors
Fast Linker
osra_test_1
[PAB] Physical System
Hardware Diagram
test1.scm
Model Update
Synthesis
Model test1 (27)
System Hardware (27)
Processor Board OBC (3)
Device DEV2 (1)
Point To Point Link PL 5
Device ROUTER (3)
Point To Point Link PL 2
Bus BUS
Device DEV4 (1)
Device DEV (1)
Device DEV1 (1)
Point To Point Link PL 3
Device ROUTER2 (2)
Point To Point Link PL 6
Device DEV3 (1)
Point To Point Link PL 7
Candidate Model
Model test1
Package Interfaces, Events and Datasets
Package Component Types
Package Component Implementations
Monitor And Control Descriptor Global List
System Deployment
System Hardware
Processor Board OBC
Device DEV2
Point To Point Link PL 5
Device ROUTER
Point To Point Link PL 2
Bus BUS
Device DEV4
Device DEV
Device DEV1
Point To Point Link PL 3
Device ROUTER2
Point To Point Link PL 6
Device DEV3
Point To Point Link PL 7
Resulting Model
Model test1
Package Interfaces, Events and Datasets
Package Component Types
Package Component Implementations
Monitor And Control Descriptor Global List
System Deployment
System Hardware
Details of the System Hardware
Open in Editor
OK
Cancel
Palette
Node Components
Node PC
Physical Actor
Physical Link
Physical Port
Behaviour Components
Deploy Behavior PC
Component Exchange
In Flow Port
Manage Behavior PCs
Functions
Physical Function
Functional Exchange
Port Allocation
Manage Function Allocation
Accelerators
Functions from Mode / State
Elements from Scenario
osra
Bus
Router
Point to Point Link
542M of 1546M
Capella to OSRA Bridge: (90%)


runtime-New_configuration - Capella - platform:/resource/osra_test_1/osra_test_1.aird/[PAB] Physical System - Capella
File Edit Diagram Navigate Search Project OCDT Connector Run OCDT Synchronization Window Help
Capella Project Expl...
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1553 KABEL 1
BUS
Bus - MIL1553
PL 4
PL 8
DEV
DEV4
Hardware Diagram
100%
PL 5 <<Processor Board>> OBC
<<Point To Point>> PL 5
<<Device>> DEV2
PL 5
PL 2
<<Point To Point>> PL 2
PL 2 <<Device>> ROUTER
PL 3
PL 6
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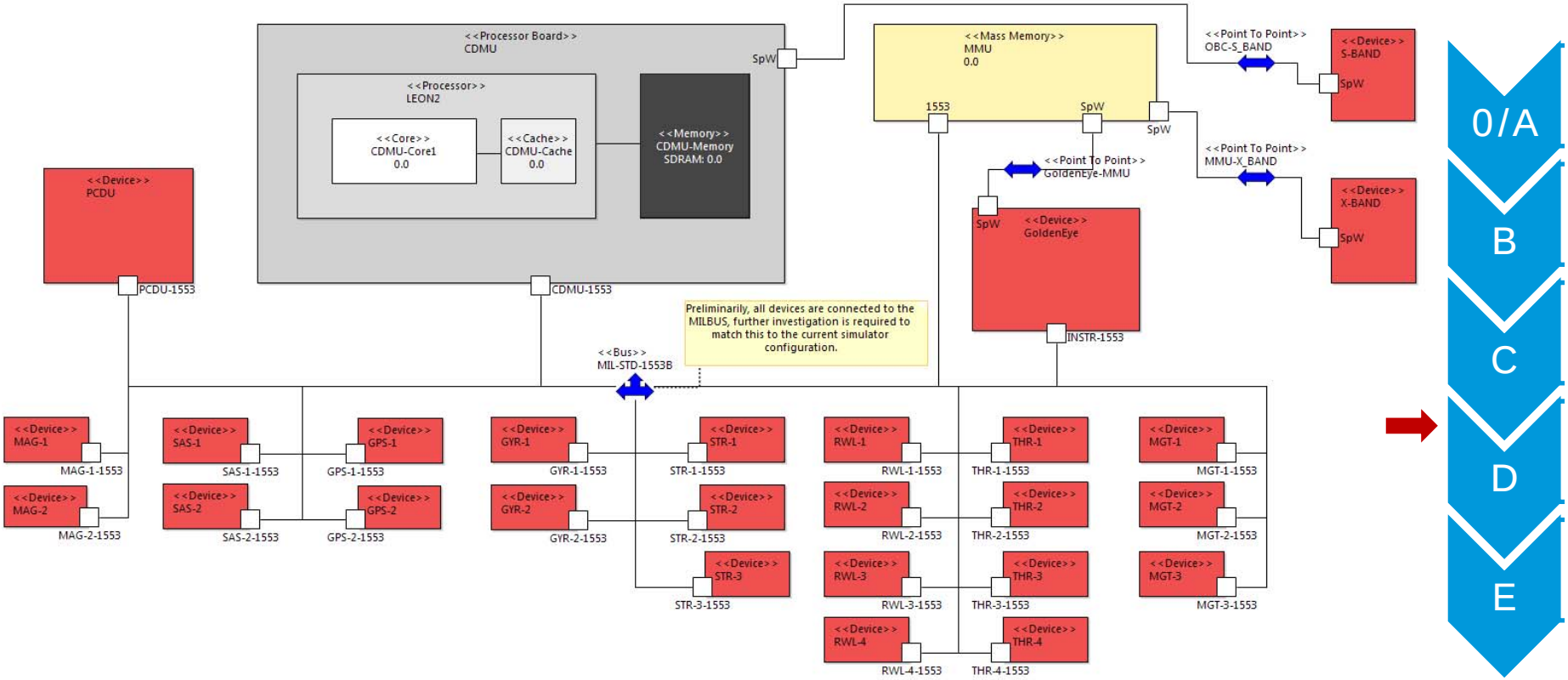
<<Point To Point>> PL 6
PL 6
<<Device>> ROUTER2
1553 KABEL 1
<<Bus>> BUS
PL 4
<<Device>> DEV
PL 8
<<Device>> DEV4
Properties
Information
Semantic Browser
Console
Fast Linker
[Physical Component] OBSW
Referencing Elements
Deploying Physical Components
OBC
Current Element
OBSW
Parent
Physical System
All Related Diagrams
[PAB] Physical System
Referenced Elements
osra_test_1::osra_test_1::Physical Architecture::Physical System::OBSW
332M of 1779M

OSRA


<<Processor Board>>
CDMU
<<Processor>>
LEON2
<<Core>>
CDMU-Core1
0.0
<<Cache>>
CDMU-Cache
0.0
<<Memory>>
CDMU-Memory
SDRAM: 0.0
SpW
CDMU-1553
<<Mass Memory>>
MMU
0.0
1553
SpW
SpW
<<Point To Point>>
OBC-S_BAND
<<Device>>
S-BAND
SpW
<<Point To Point>>
MMU-X_BAND
<<Device>>
X-BAND
SpW
<<Point To Point>>
GoldenEye-MMU
SpW
<<Device>>
GoldenEye
INSTR-1553
<<Device>>
PCDU
PCDU-1553
Preliminarily, all devices are connected to the MILBUS, further investigation is required to match this to the current simulator configuration.
<<Bus>>
MIL-STD-1553B
<<Device>>
MAG-1
MAG-1-1553
<<Device>>
MAG-2
MAG-2-1553
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SAS-1
SAS-1-1553
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GPS-1
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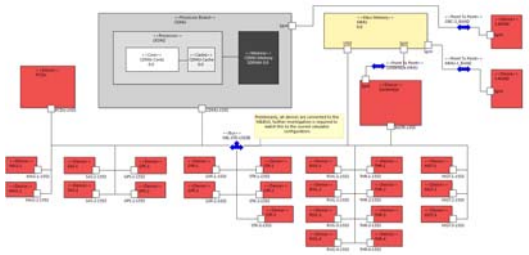
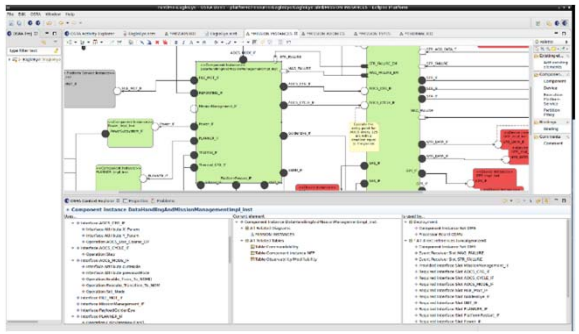
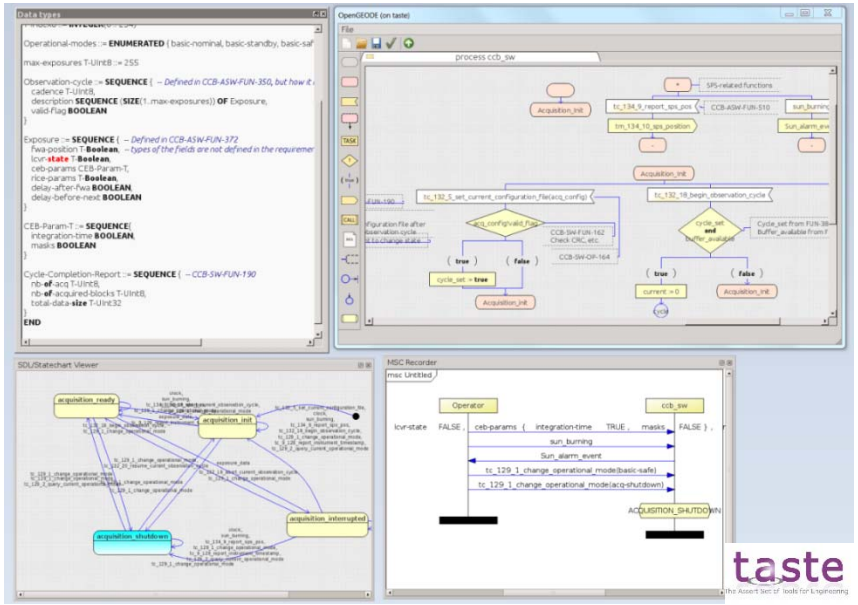
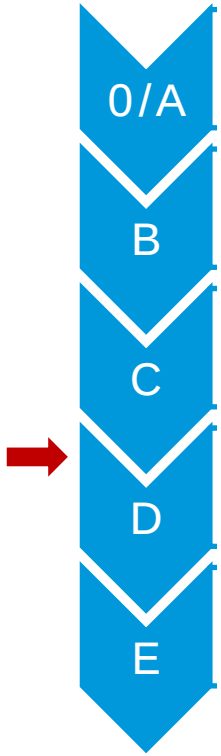
Towards Implementation





SW Implementation / Deployment





Summary

- The technical note on Model-Based Avionics is available as SAVOIR-TN-003
- We have investigated the technologies and effort to develop model exchange tooling by building a prototype (OCDT – Capella – OSRA)
- The prototype tools will be available for evaluation as an update site, installable in Capella 1.2.x and 1.3.x
- Demo available for discussion at the exposition area

Further Work

- Tool evaluation on representative case studies, sketch model-based process
- Further development of tool bridges
  - FDIR – COMPASS
  - On-board Network Configuration / Analysis
- Investigate technologies for the implementation of the data hub
  - Requires uniform access to data
  - Requires suitable exchange formats
- Possible candidates:
  - OSLC (Open Services for Lifecycle Collaboration)
  - RDF / OWL (Resource Description Format / Web Ontology Language)
  - ORM (Object-Role Modelling)