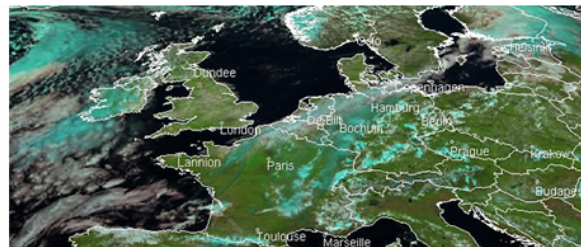
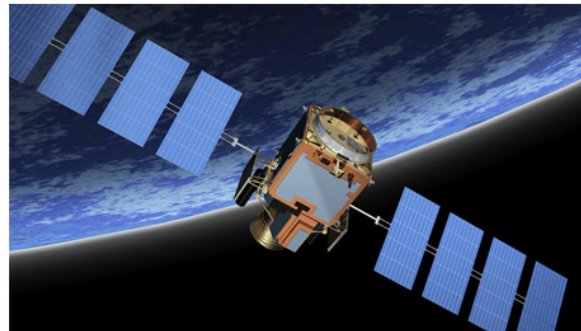


System Design Toolkit for IMA-SP

Mark Hann, José Enrique Simo Ten

SCISYS, TASF, fentISS

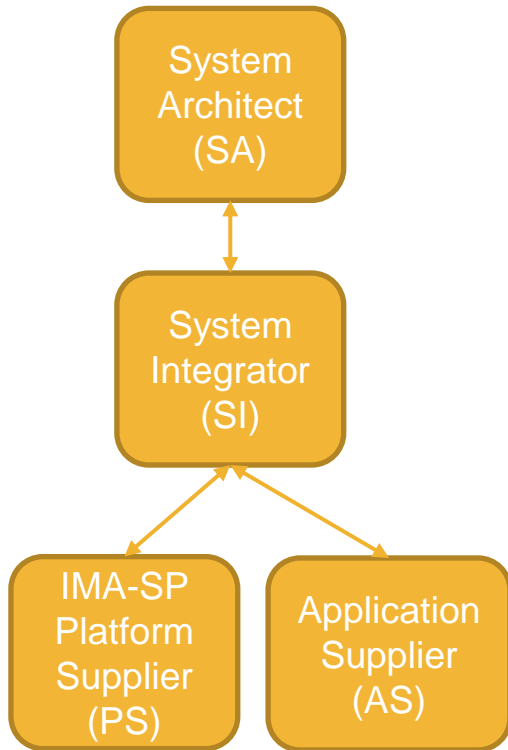
9th December 2015



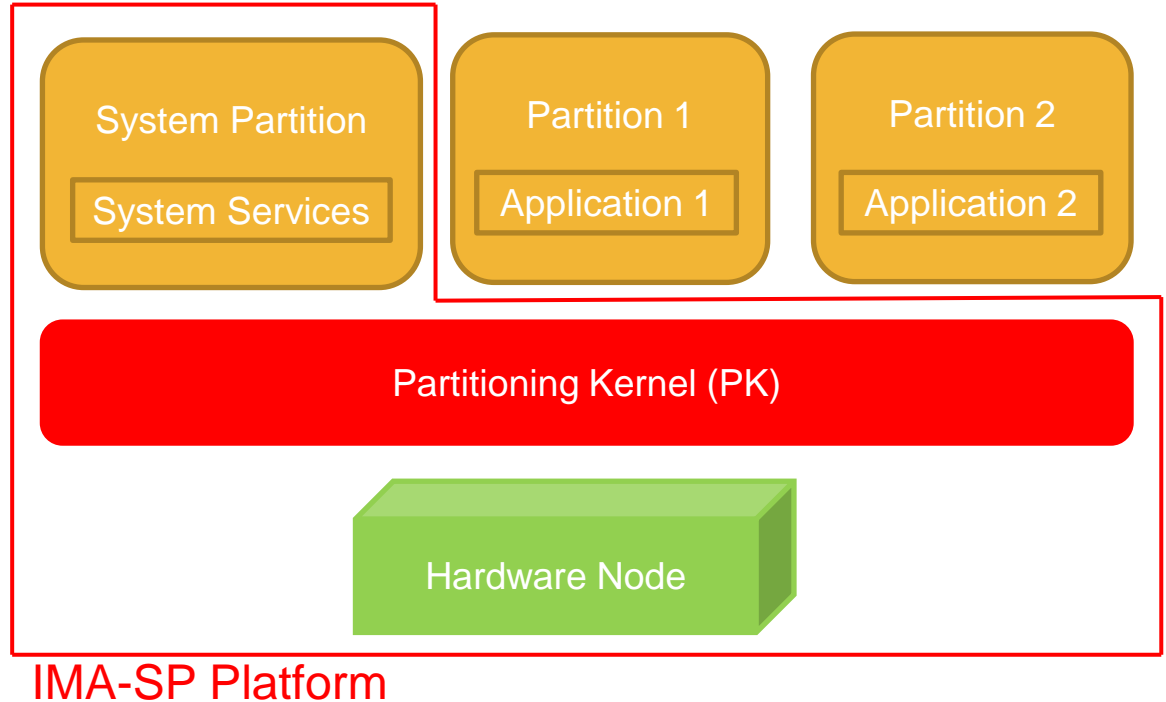
- Prime :  SCISYS
- Data Model Definition:  ThalesAlenia
A THALES / FINMECCANICA CONSORZIO Space
- Tool Development:  **fentISS**
FOR SYSTEMS ENGINEERING
- Demonstrator:  SCISYS

Introduction - IMA-SP Terminology

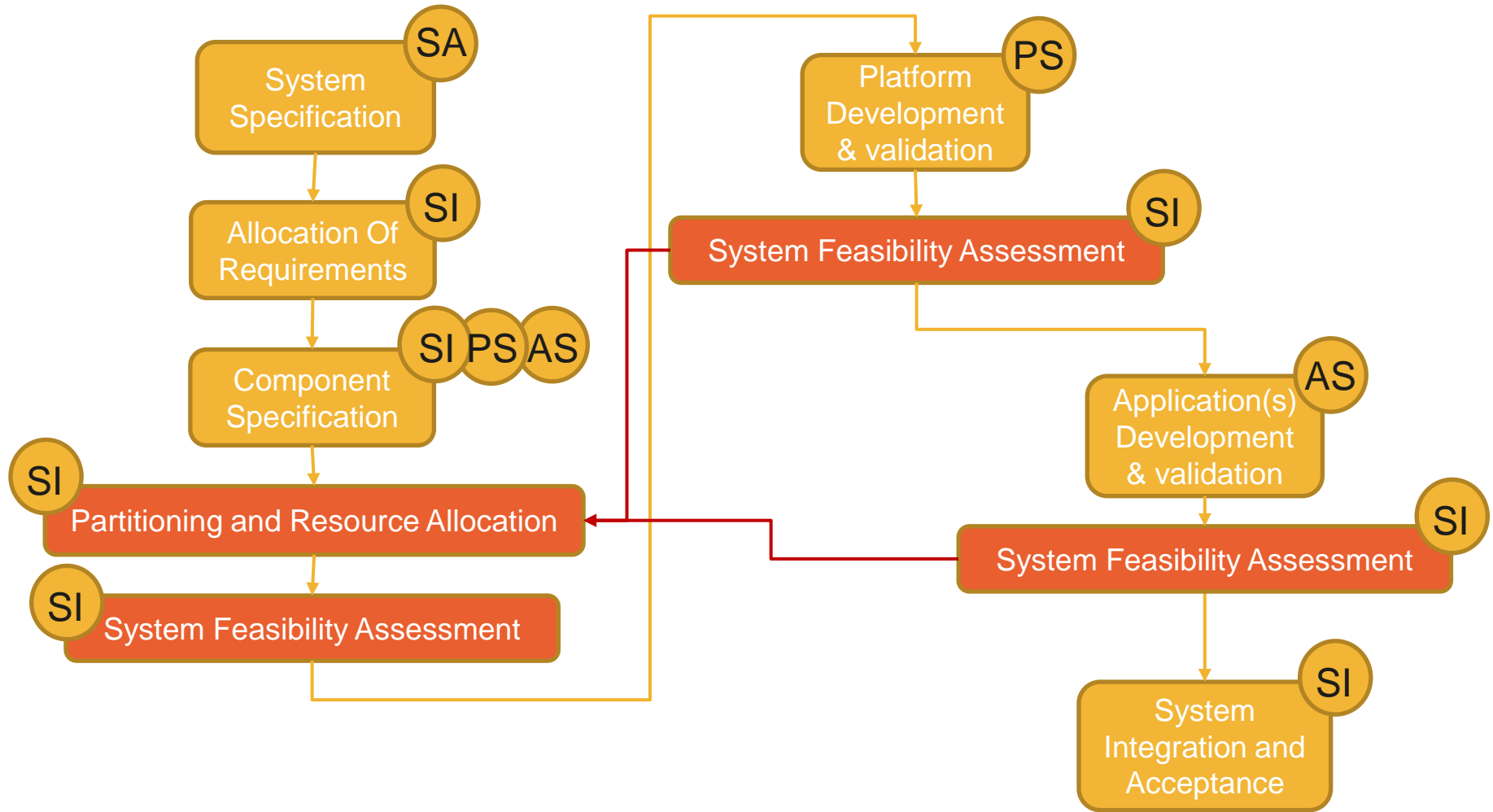
Roles



Architecture



IMA-SP Development Process



IMA-SP System Development Tools

- Partitioning, Resource Allocation and Configuration
 - » define the partitions,
 - » allocate requirements to partitions
 - » allocate resources to each partition
- System Feasibility Assessment
 - » using requirements of the individual partitions,
 - » define configuration of the platform
- Software Image Configuration
- Cross development tools

Objectives of System Design Toolkit

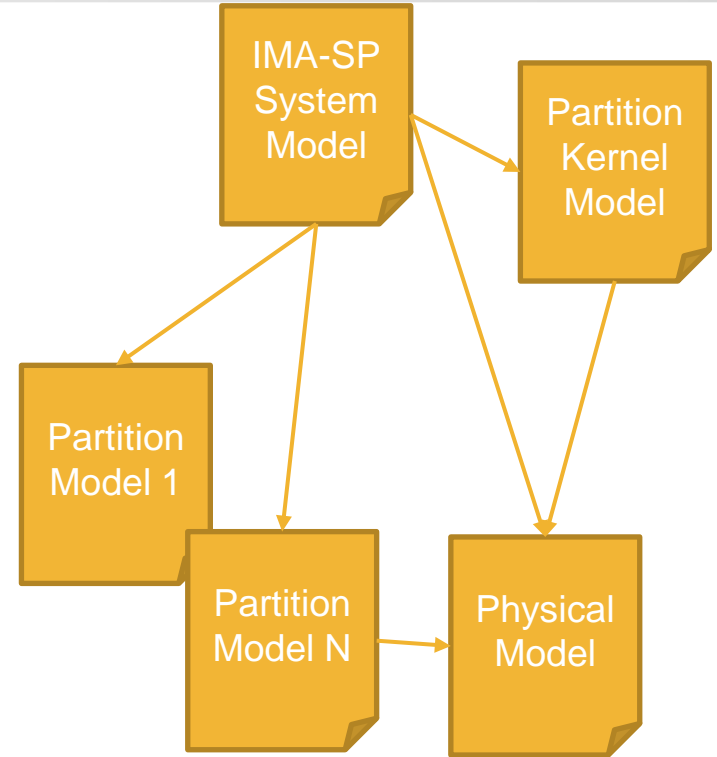
- Define a **data model** for the definition of partitioning, resource allocation, platform configuration
- Define a set of **configuration files** to capture the content of the data model
- Develop **prototypes** of the tool set
- **Demonstrate** the developed tools suite

Data Model Requirements

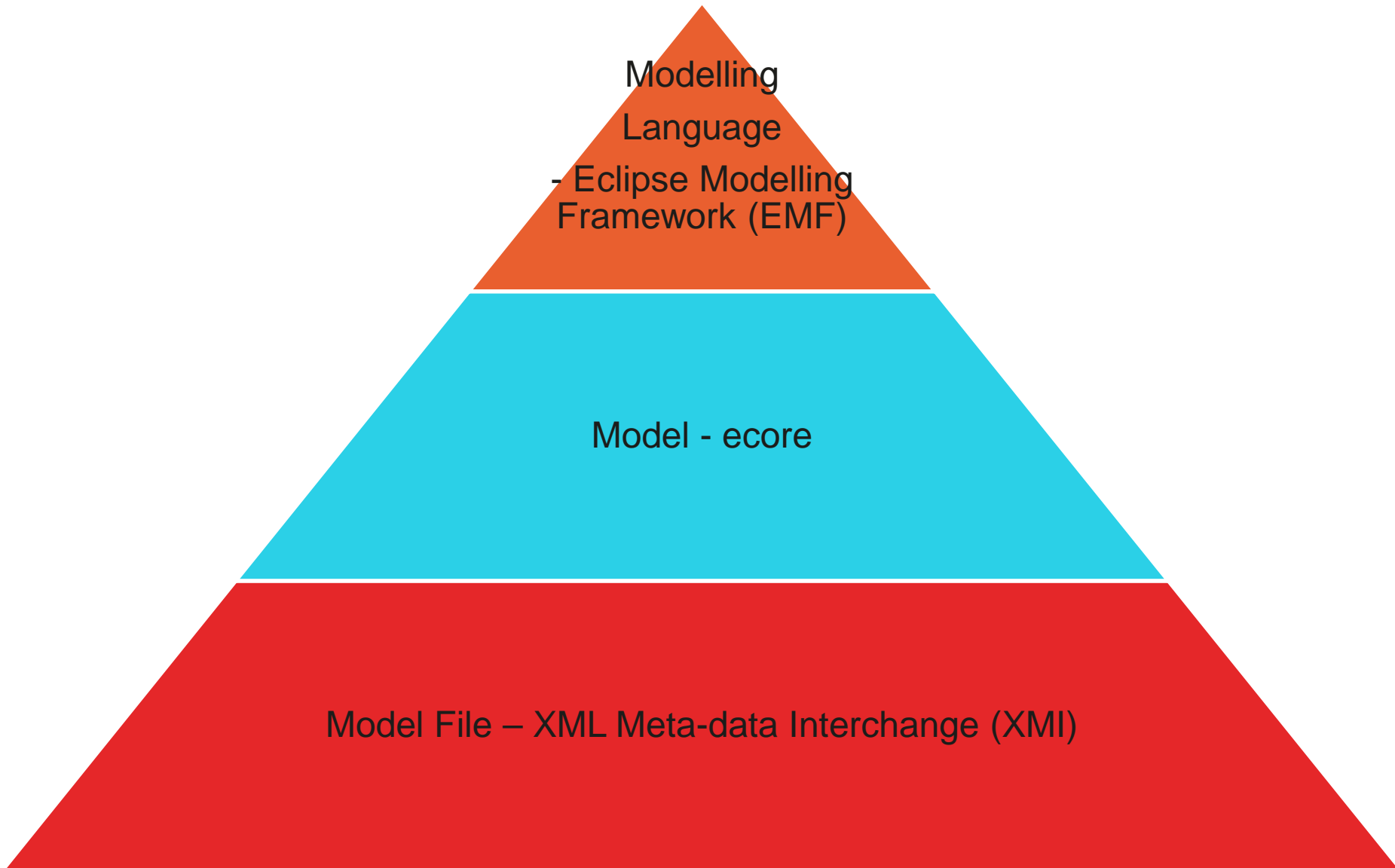
- Supports feasibility analysis of the resource allocation
- Allows segregation of the data in separate files
 - » So can be used by different roles
- Allows re-use of existing data in a new project
- Is coherent and consistent, with a precise syntax and semantics
- Is agnostic to the partitioning kernel selected
- Is consistent with existing partitioning kernels

Data Model Content

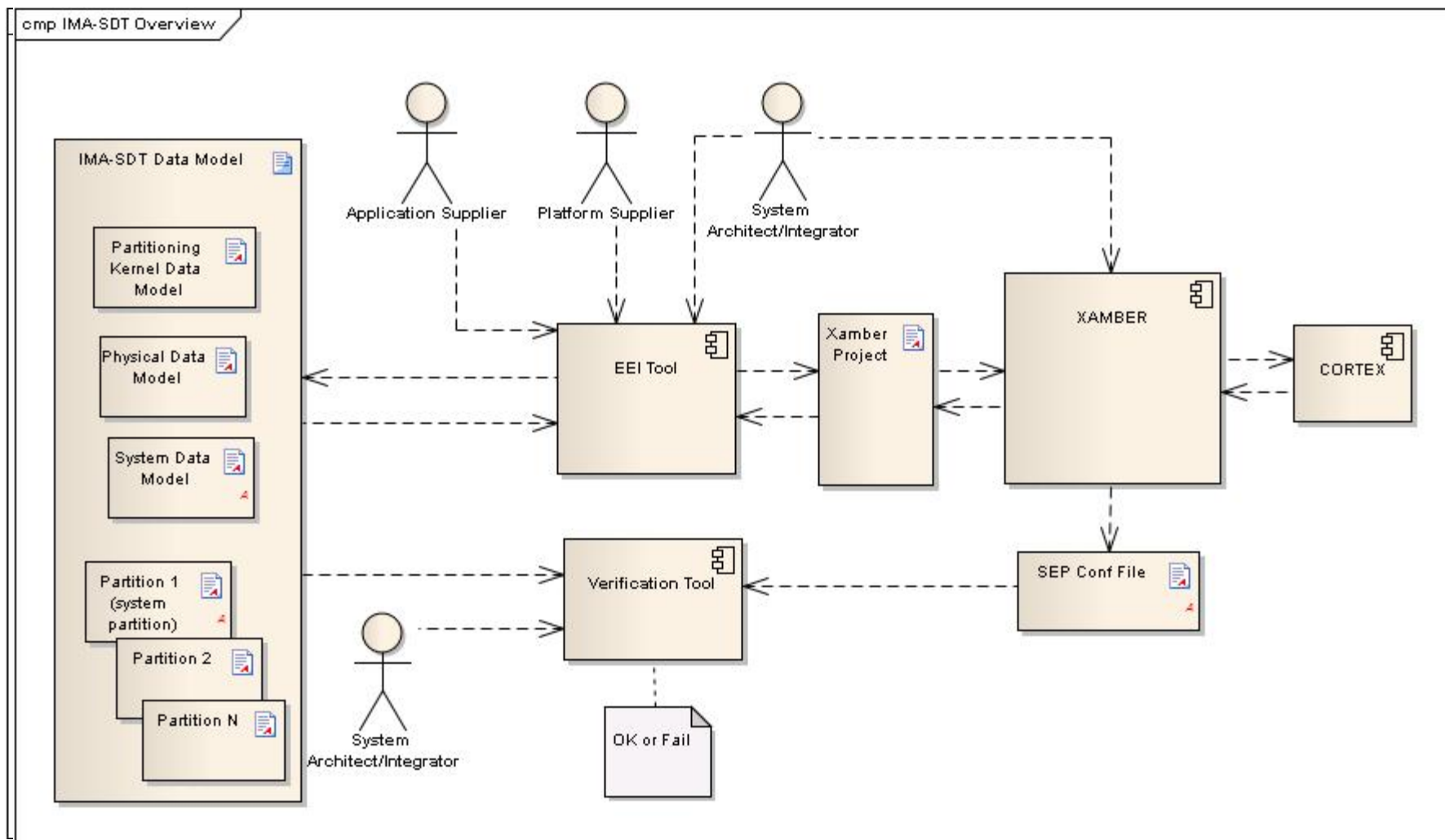
- Model of hardware
 - » Captures properties of HW:
 - › CPU, memory, I/O, peripherals
- Model of Partition(s)
 - » Captures application requirements
 - › Timing, budgets, memory, ports, I/O
- IMA-SP System Model
 - » Captures resource allocation
 - › Memory, CPU, Interrupts
- Partitioning Kernel Model
 - » Captures Partitioning Kernel (PK) features
 - › Memory, health monitoring events and actions, context switch time
- Partitioning Kernel Model - Configuration
 - » Captures configuration information of PK
 - › Scheduling plan, ports and channels, memory table, health monitoring
- Common Data Model



Data Model Technologies



IMA – SDT Tool

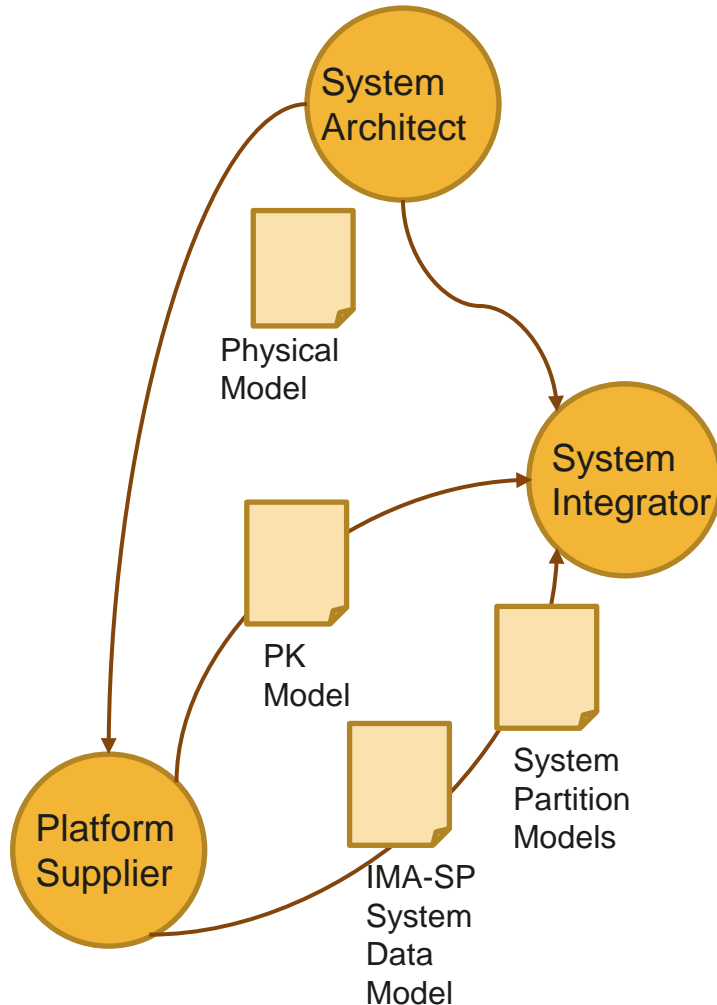


Xamber

The screenshot displays the Xamber Hypervisor Configuration Tool interface. At the top, the title bar reads "Xamber, the Hypervisor Configuration Tool (/home/ima/projects/IMA_SDT_IPDHS_AT_005/Xamber_FilesExportedFromEEI)". The main window is divided into several sections:

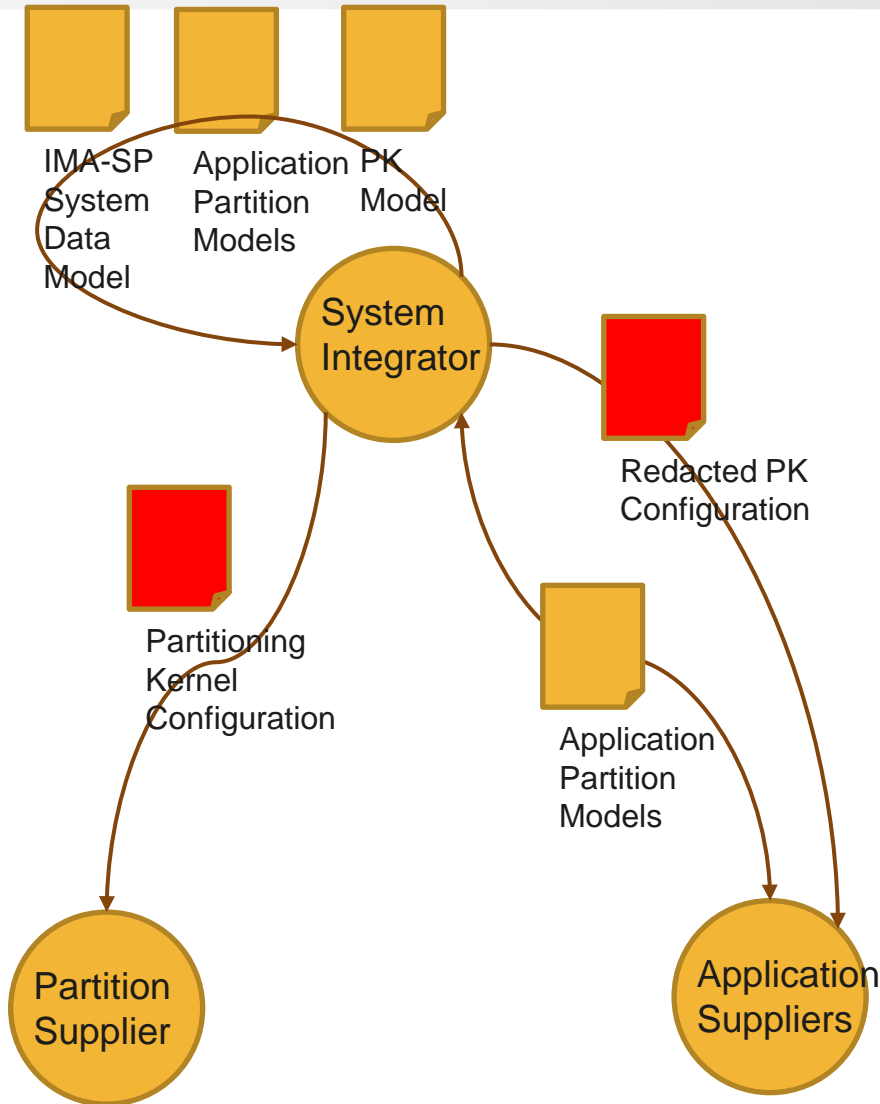
- Menu Bar:** File, Edit, Project, Help.
- Toolbar:** Includes icons for AS, Res, Plan, Etef, MAI, Plan, Move, and Step.
- Task Plan:** A Gantt-style chart showing the execution of tasks. The tasks are: SystemMainTask (pink), RALMainTask (green), and ICMainTask (blue). The plan shows the following steps:
 - Step SystemMa (pink) from 0ms to 80.000ms.
 - Step RALMainT (green) from 80.000ms to 120.000ms.
 - Step SystemMa (pink) from 120.000ms to 160.000ms.
 - Step ICMainTas (blue) from 160.000ms to 200.000ms.The x-axis is labeled "Run" and "Plan" on the left, and "0ms" to "400.000ms" on the bottom. A green vertical line indicates the current time (TMin) at approximately 360.000ms, and a blue vertical line indicates the maximum time (TMax) at 405.000ms.
- Console:** Shows the message "Project loaded!: /home/ima/projects/IMA_SDT_IPDHS_AT_005/Xamber_FilesExportedFromEEI".

Data Model WorkFlow - 1



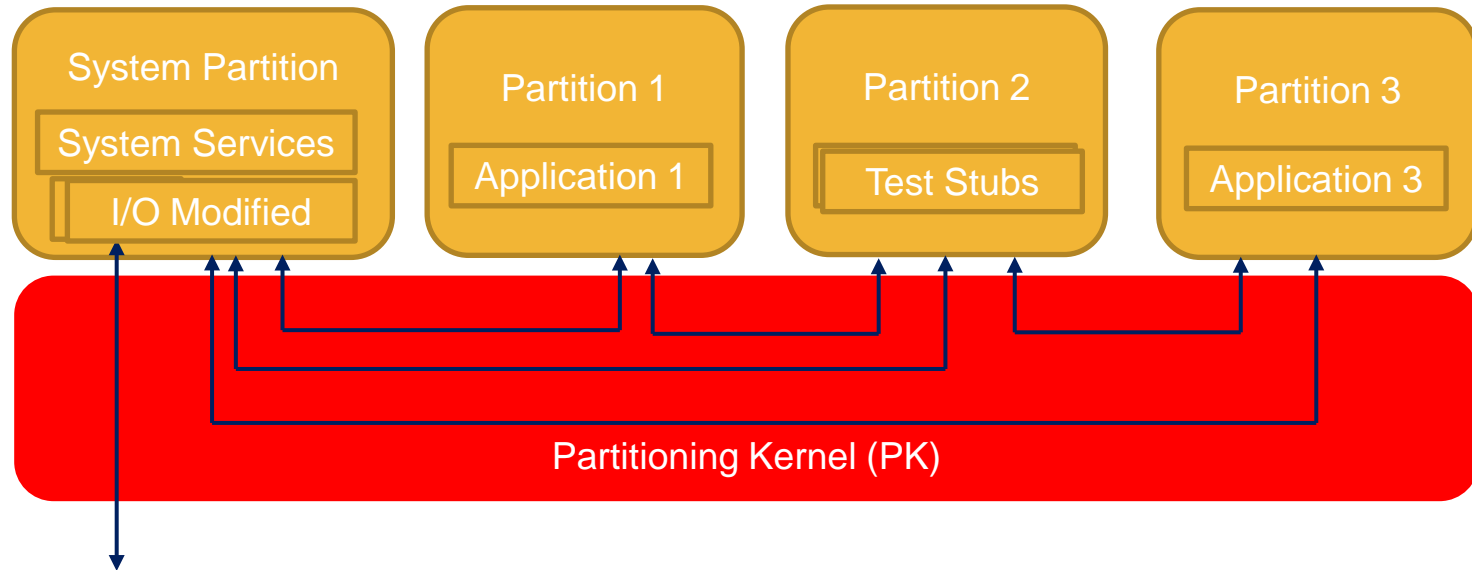
- Define Physical Model
- In PK Model define:
 - » Events, Actions, Memory
 - » Default System and Partition Health Monitoring
- Define System Partition's Model(s)
- IMA-SP System data Model
 - » Define HW resource allocation

Data Model WorkFlow - 2



- Defines Partitions and its Properties
- Partition Model(s):
 - » Define Ports/Resources/Activities
- Defines:
 - » Health Monitoring table
 - » Connection Table
 - » Resource Allocation table
 - » Dynamic Properties
- Performs:
 - » Feasibility Analysis
 - » PK Model Configuration
- Creates:
 - » Partitioning Kernel Configuration
 - » Redacted PK Configuration

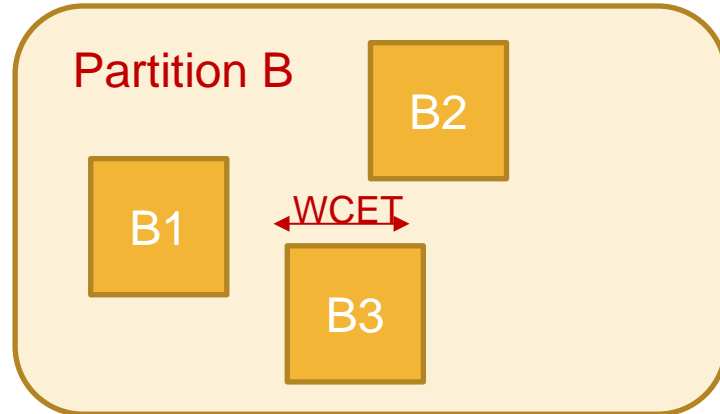
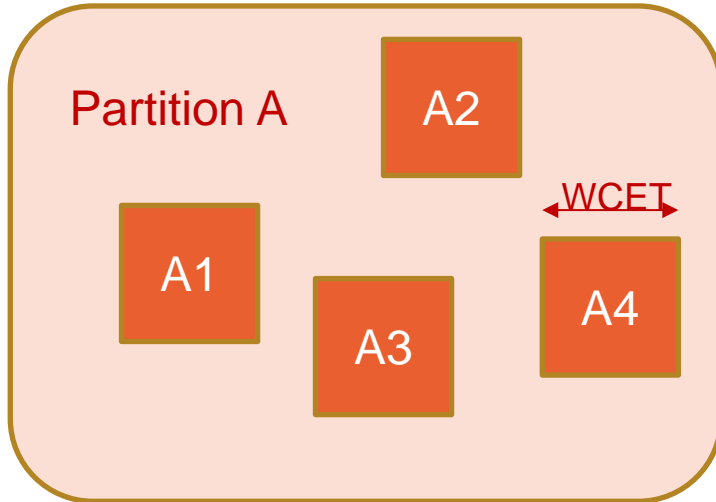
Redaction – IMA Platform Simulator



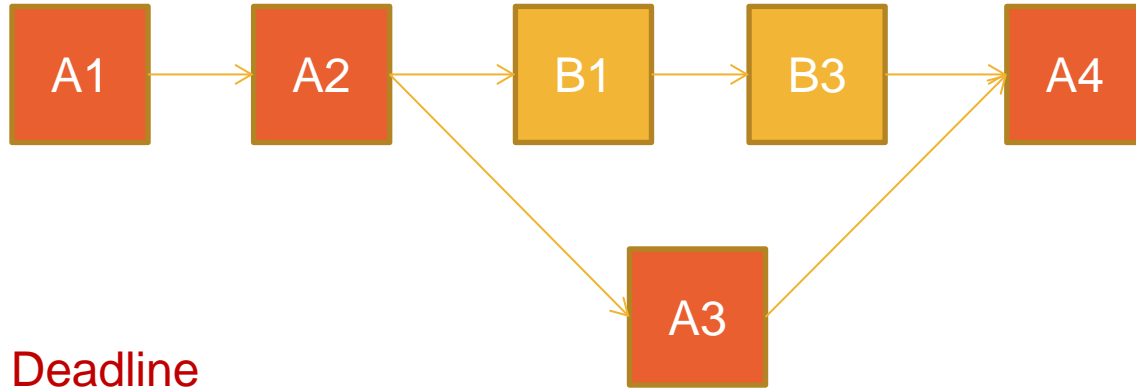
- Redaction
 - » Hides partition configuration from other partitions
- Platform simulator
 - » Platform supplier provides test platform to application suppliers

Computational Model

- A Partition Contains activities
 - » Characterised by Worst Case Execution Times

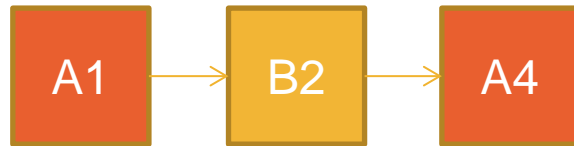


End To End Flow (ETEF)



Deadline

Period Range



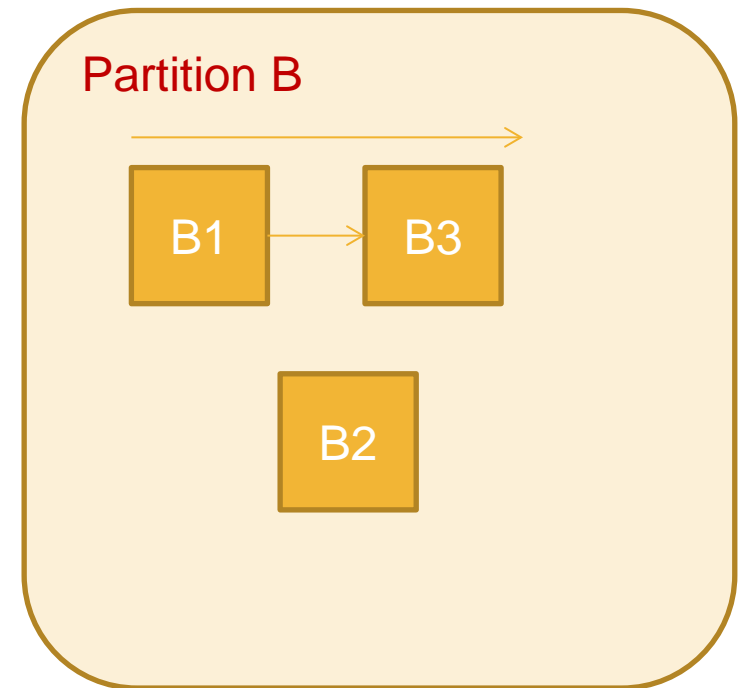
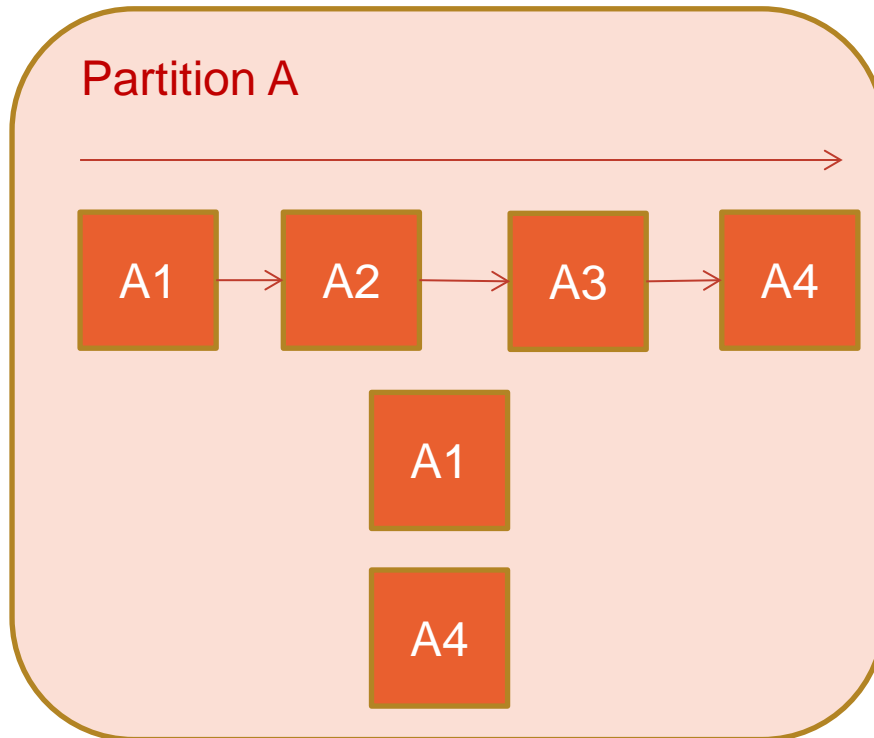
Offset

Deadline

Period Range

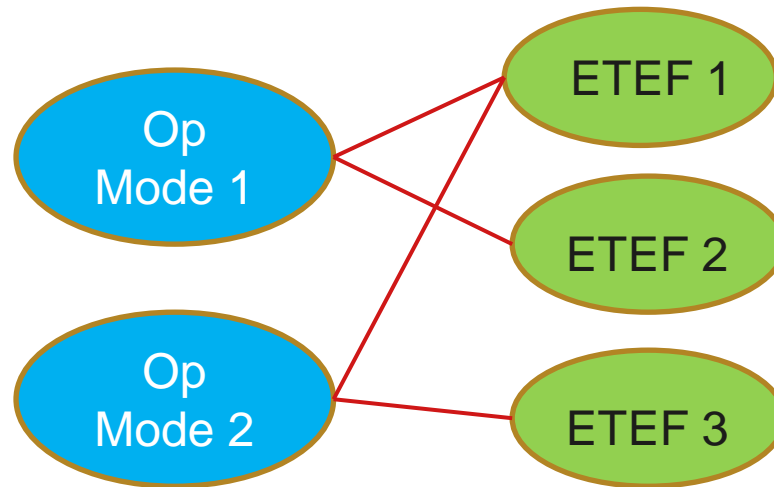
Partition Flows

- Partition Flows are Segments of ETEFs
 - » Contain steps, deadlines and periods
- Referenced from System Level Flows



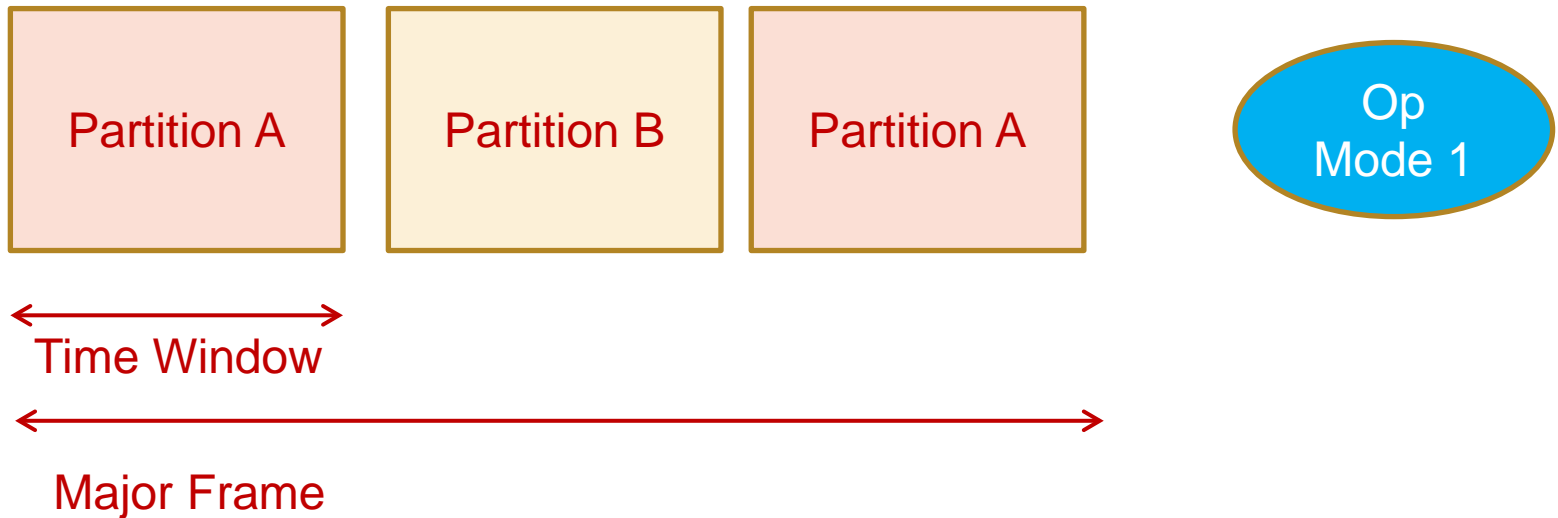
ETEF Usages

- In an Operational Mode an ETEF has a fixed period.
- This relationship is ETEF Usage
- The Schedule repeats over a Major Frame (MAF)
- A MAF reduction algorithm is applied to find the **shortest** MAF

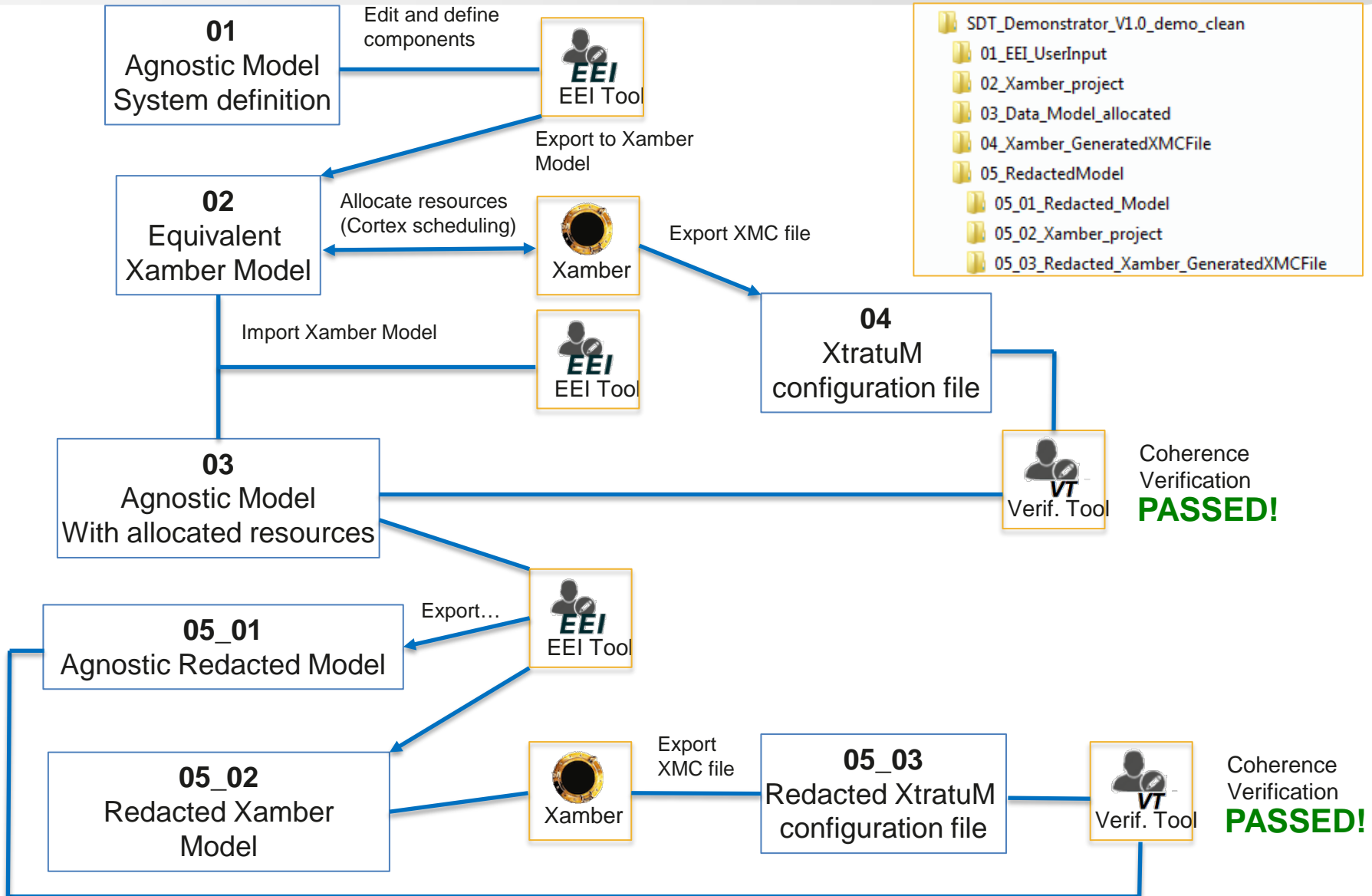


Schedule Calculation

- Schedule calculated for each Operational Mode
- Calculation assesses if schedule is feasible

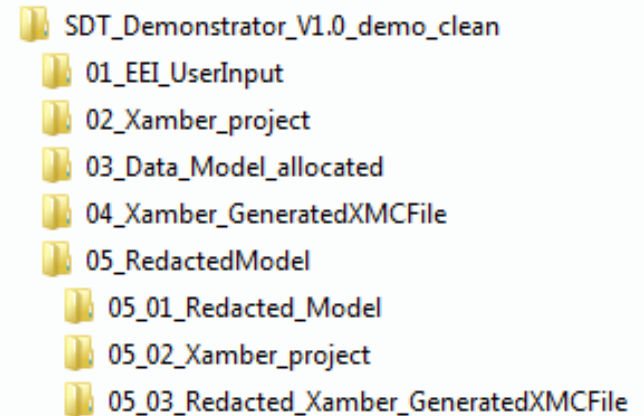


Demonstration



Demo structure

- Edit Agnostic Model with EEI
- Validate Model with EEI
- Export to Xamber with EEI
- Allocate Resources with Xamber
- Generate XtratuM config file (XMC) with Xamber
- Import Xamber project with EEI
- Black box verification with VT
- Generate Redacted Model with EEI
- Generate Redacted XMC and VT verification



Conclusion

- Data Model has been defined to:
 - » define the system and
 - » perform feasibility assessment
- Configuration Files for information exchange defined
- Tool has been created to:
 - » Edit and Combine Agnostic Model Parts
 - » Allocating Resources between applications
 - » Export/Import model parts and redacted models
 - » Assessing the System Feasibility
- Tool TRL = 4
- Work Flow for tool and data model has been defined
- Future Extensions for Multicore
- Future Harmonisation with SCM

Thank You for your Attention - Any Questions?



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