

An Example: In-Flight Entertainment System

Playing videos on demand

Listening to music and audio Announcements

Surfing the web through personal device

Watching the Map



Operational Analysis

Operational Analysis - Overview

- **Focuses on analysing the needs and goals, expected missions & activities**
- **Is expected to ensure good adequacy of System definition with regards to its real operational use – and define IVVQ conditions**
- **Outputs:**
 - Needs, in terms of Actors/Users
 - Operational capabilities and activities
 - Operational use scenarios (dimensioning parameters, operational constraints, including safety, security, system life cycle)

Operational Analysis - Overview



◆ Operational Activity

- Process step or function performed toward achieving some objective, by entities that could necessitate to use the future system for this
- e.g. Control traffic, go along a place, detect a threat



◆ Operational Entity

- An operational Entity is a real world entity (other system, device, group or organisation...), interacting with the system (or software, equipment, hardware...) under study, or with its users

OA 1



◆ Operational Actor

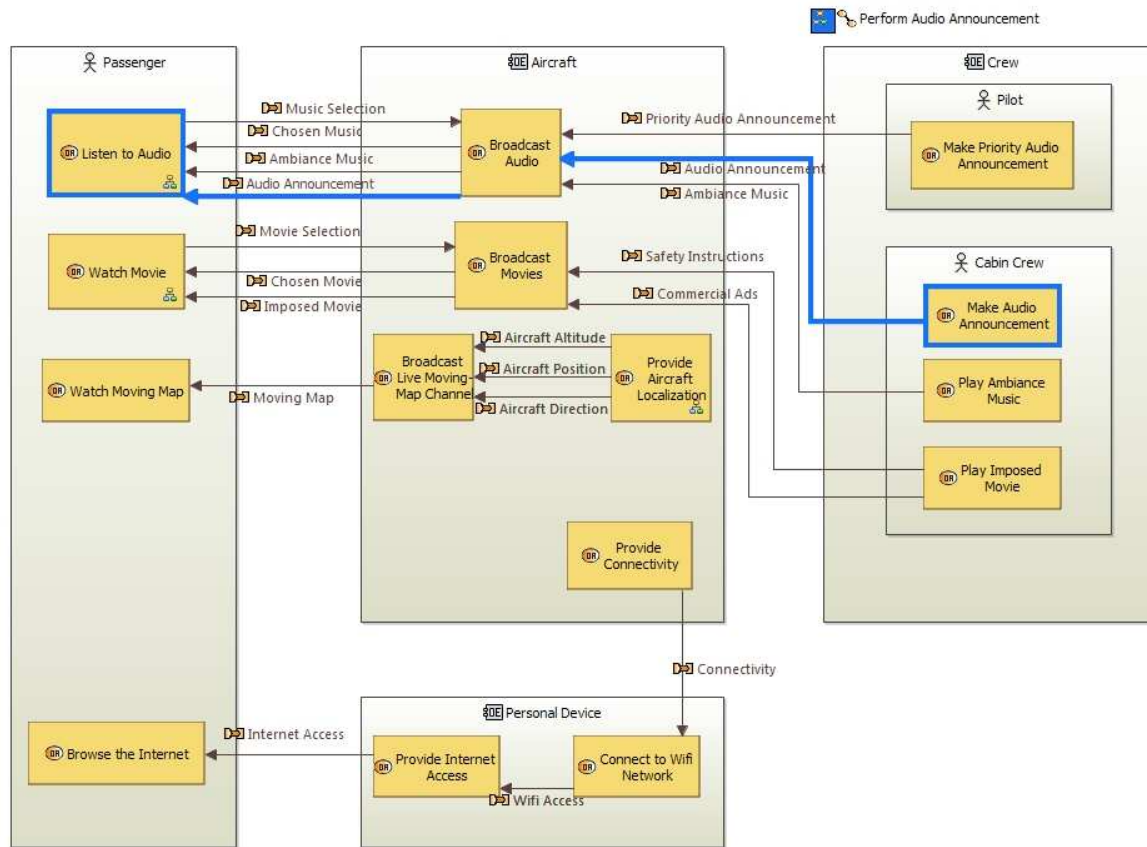
- An actor is a [usually human] non decomposable operational Entity



◆ Operational Interaction

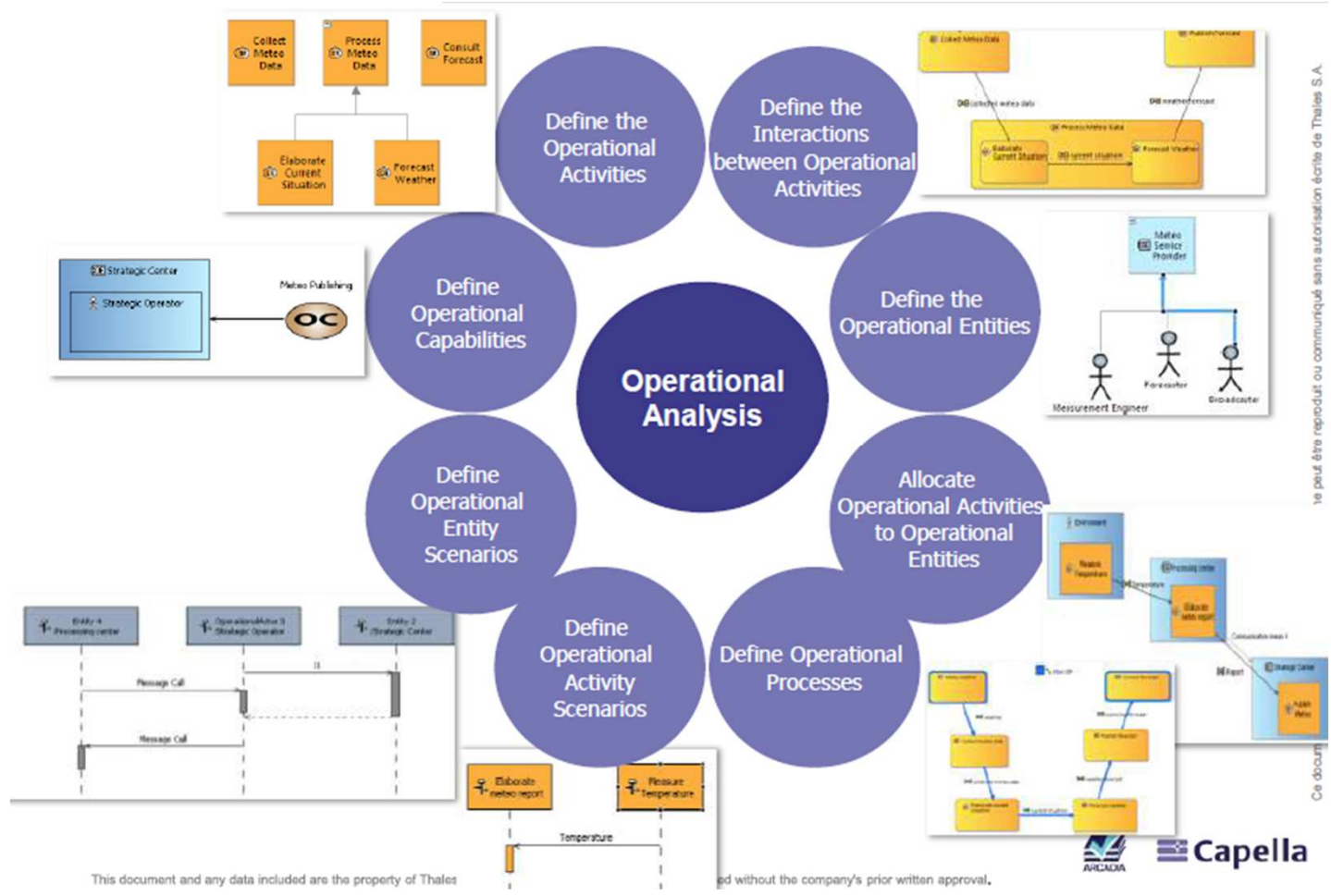
- Set of Operational services invocations or flows exchanged between Operational Activities, (e.g. Operational Interactions can be composed of Operational data, events...).

IFE / Operational Analysis



- Define**
- The Actors, and Entities
- Operational Activities
- Operational Interactions

Operational Analysis Workflow and Main Diagrams



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System Analysis

System Need Analysis - Overview

■ Define how the system can satisfy the former operational needs:

- System functions to be supported & related exchanges
- Non functional constraints (safety, security,...)
- Performances allocates to system functional chains
- Role sharing and interactions between the Operators and the System

■ Checks for feasibility (including cost, schedule and technology readiness) of customer requirements

■ Outputs: System Functional Analysis description

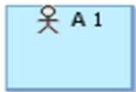
- Interoperability and interaction with the users and external systems (functions, exchanges, plus non functional constraints), and system requirements

System Analysis: Main Concepts (1/2)



◆ System

- An organized set of elements functioning as a unit.
- An aggregation of end products and enabling products to achieve a given purpose.



◆ System Actor

- External actor interacting with the system via its interfaces



◆ System Mission

- A mission describes a major functionality of the system from a very high level point of view. It is a reason why the system is developed.
- high-level operational goal



◆ System Capability

- A capability is the ability of a system to provide a service that supports the achievement of high-level operational goals



◆ System Function

- Function at System level
- A function is an action, an operation or a service fulfilled by the system or by an actor when interacting with the system
- e.g. 'measure the altitude', 'provide the position'

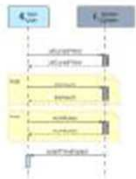
System Analysis: Main Concepts (2/2)

◆ Exchange and Port



- An Exchange is an interaction between some entities such as actors, the system, functions or components, which is likely to influence their behaviour.
- e.g. tuning frequency, radio selection command...
- The connection point of an exchange on an entity is called a port.

◆ Functional Exchange



- Piece of interaction between functions that is composed of data, events, signals, etc. A Flow Port is an interaction point between a Function and its environment that supports Exchanges with other ports

◆ Scenario

- A scenario describes the behaviour of the system in a given Capability.
- Scenarios permit to specify the dynamical behaviour of the system by showing interaction sequences performed by the actors and by the system



◆ State

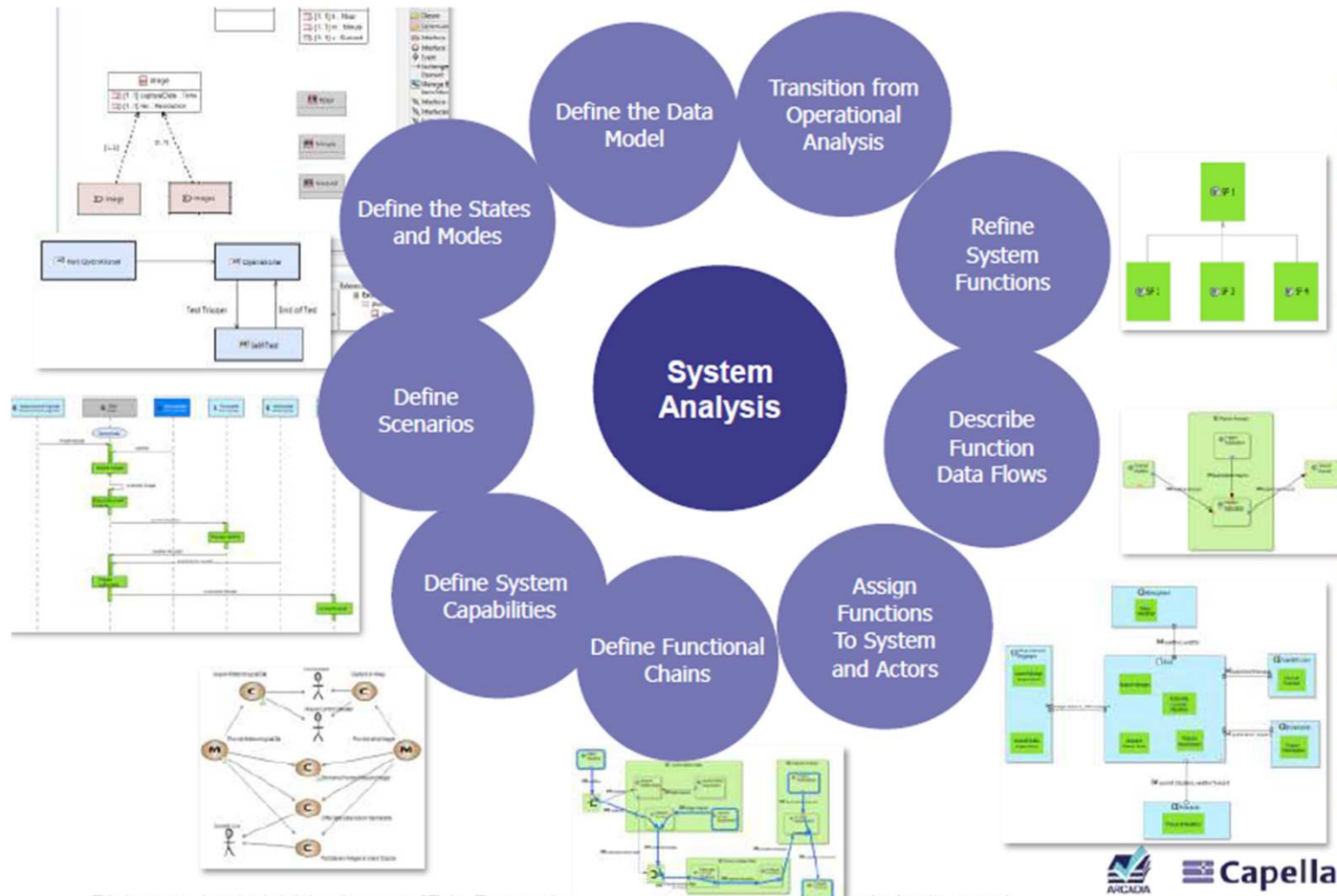
- a physical and operational environment condition



◆ Mode

- a type of operation in a given state of the system, or the performance level within a state

System Analysis: Workflow and Main Diagrams



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Logical Architecture

Logical Architecture - Overview

Intends to identify the system components, their contents, relationship and properties, excluding implementation or technical/technological issues.

➤ This constitutes the system logical architecture

All major non functional constraints are taken into account so as to find the best compromise between them

Output: Selected Logical Architecture

➤ Components and Interfaces definition, including formalisation of all viewpoints and the way they are taken into account in the components design.

➤ Links with requirements and Operational scenarios are also produced

Logical Architecture Design: Managed Entities



◆ Logical Function

- Function applied at Logical level



◆ Logical Component

- Logical Components are the artefacts enabling a notional decomposition of the system as a "white box", independently from any technological solutions, but dealing with major system decomposition constraints
- Logical components are identified according to logical abstractions (i.e. functional grouping, logical interfaces)



◆ Functional Exchange

- Piece of interaction between functions that is composed of data, events, signals, etc. A Flow Port is an interaction point between a Function and its environment that supports Exchanges with other ports



◆ Component Exchange

- Represent the interactions between Logical Components

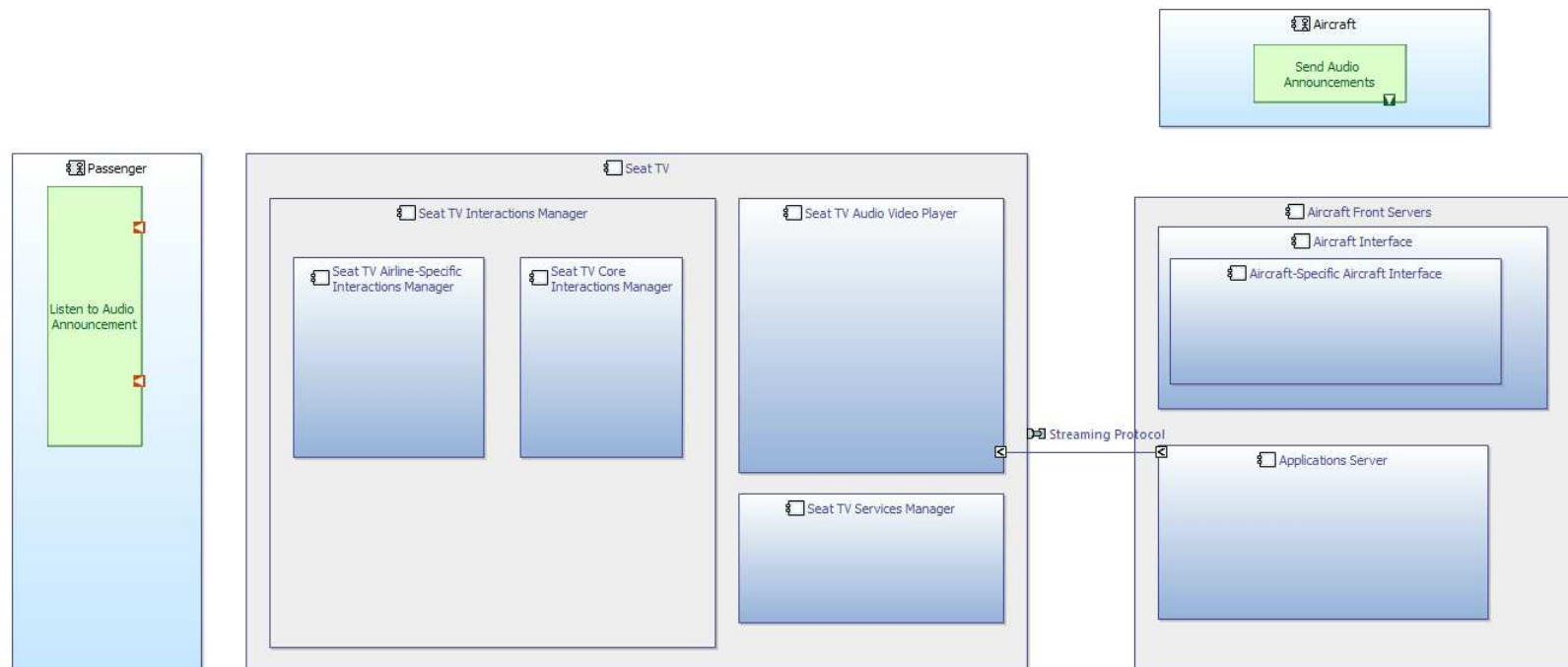
Logical Architecture

■ Focus on Broadcast Audi Announcement

Logical Architecture

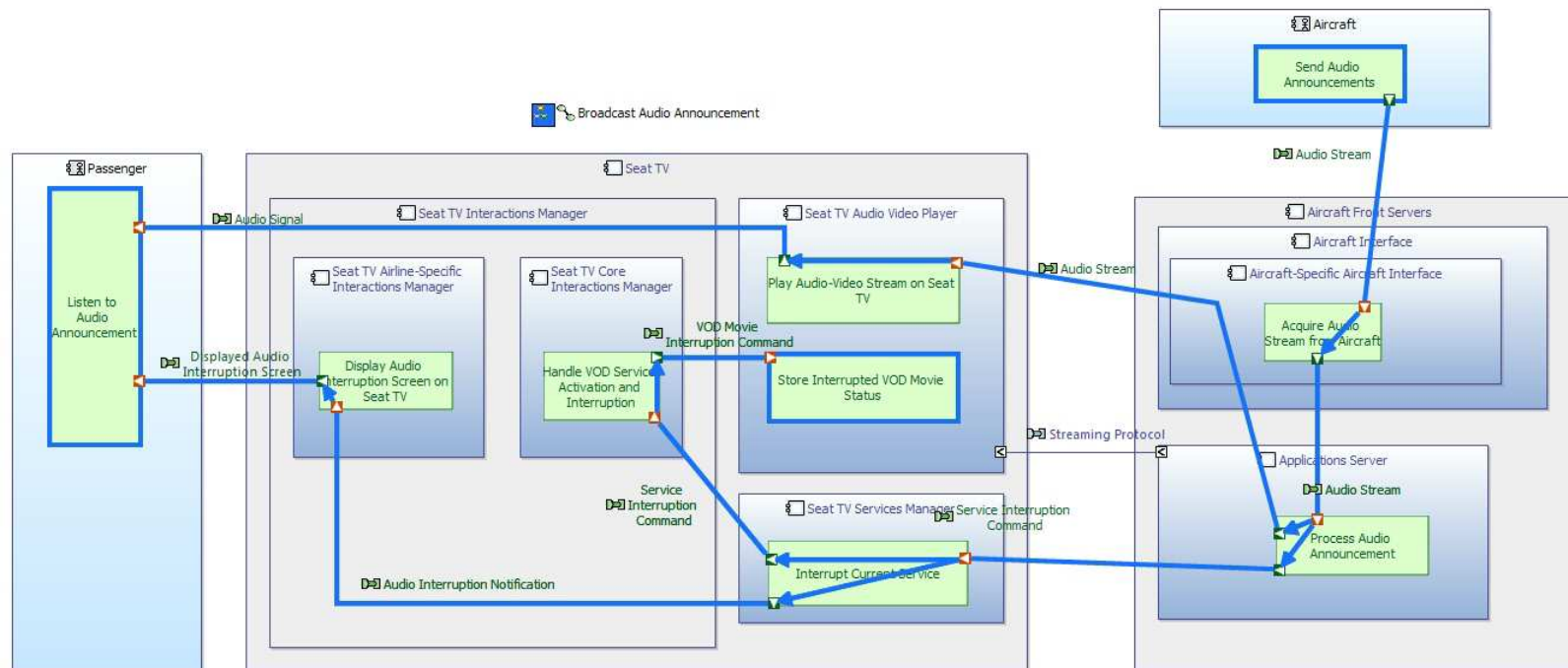
Transition from SA elements to LA

Define the Components



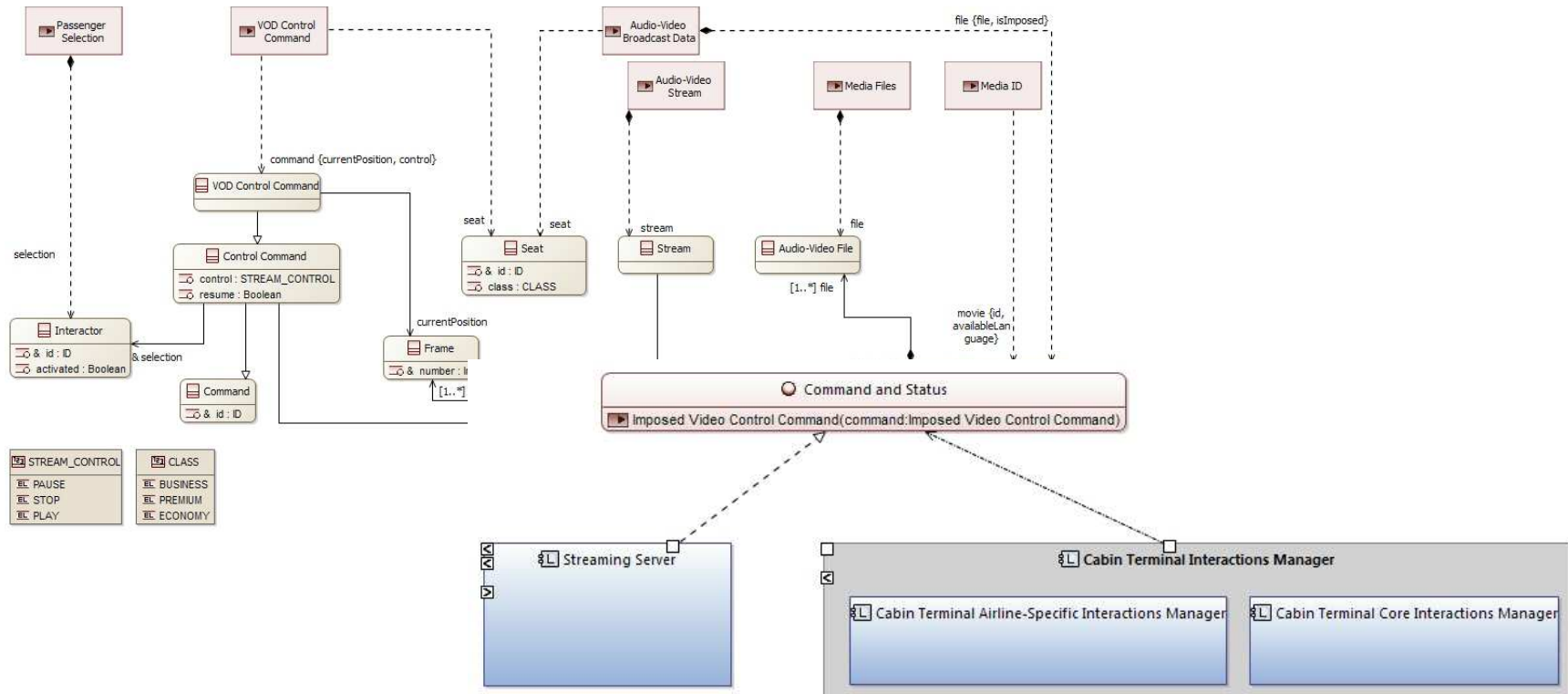
Logical Architecture

- Refine the functions
- Complete the Functional Flow

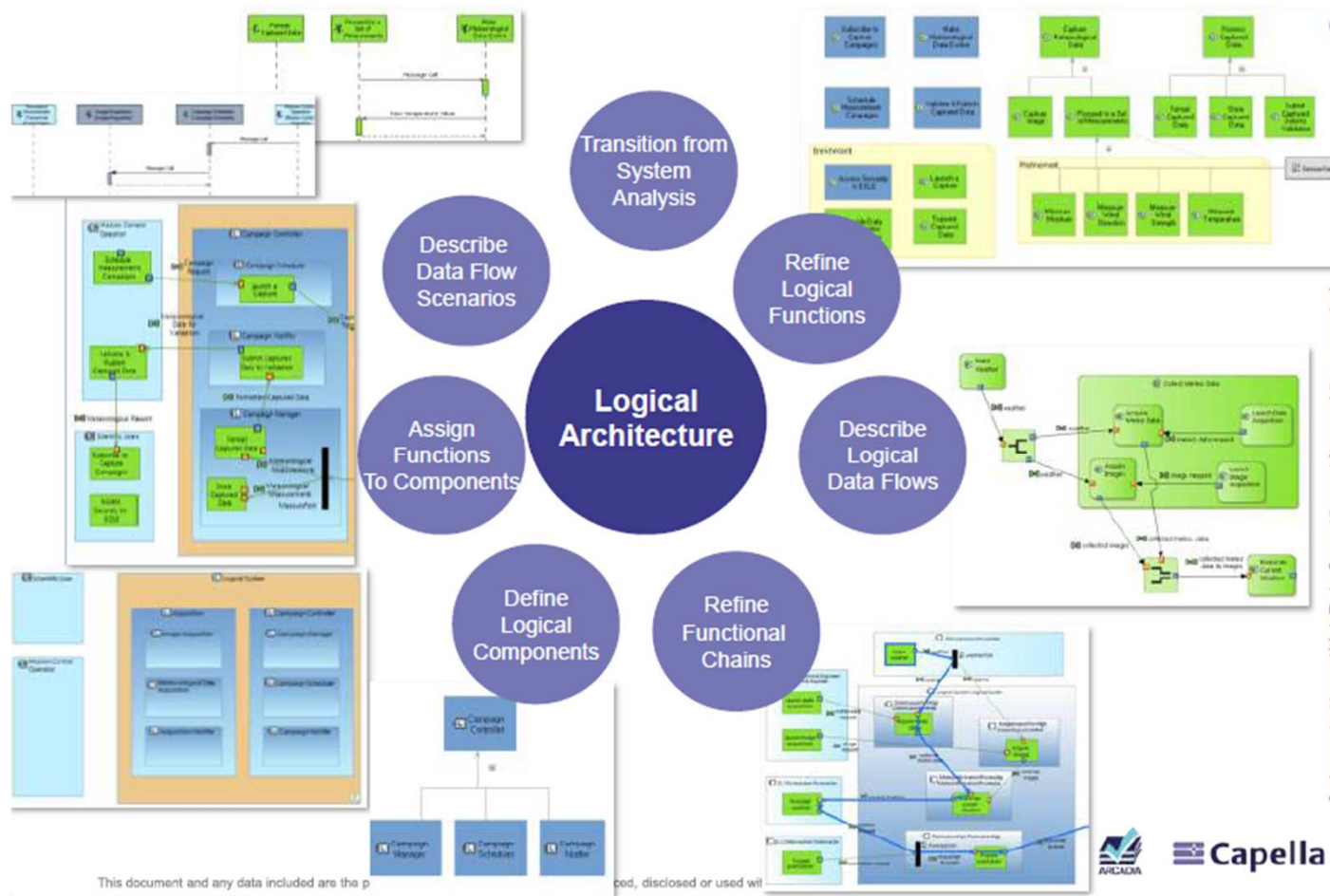


Logical Architecture

Interfaces



Logical Architecture Workflow and Main Diagrams



Physical Architecture

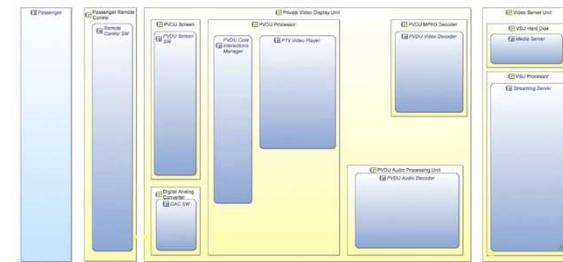
Physical Architecture - Overview

- **Intends to identify the system components, their contents, relationship and properties, including implementation or technical/technological issues.**
- **Introduces rationalisation, architectural patterns, new technical services, and components**
- **Makes the Logical Architecture evolve according to implementation, technical and technological constraints and choices (at this level of engineering)**
- **The same 'Viewpoints-driven' method as for logical architecture used**
- **Output: Physical Architecture**
 - Physical Components, Viewpoints formalisation, links to requirements...

IFE / Physical Architecture

HOW THE SYSTEM WILL BE DEVELOPED AND BUILT

SW vs HW allocation, functional allocation check, interface definition and justification, trade-off analyses



Physical Architecture Design – Main Concepts (1/2)



◆ Physical Function

- Function applied at physical level

◆ Physical Component

- Physical Components are the artefacts enabling to describe physical decomposition of the system to satisfy the logical architecture identified at the upper abstraction level. Physical components are identified according to physical rationale (i.e. components reuse, available COTS, non functional constraints...).

- Two natures of components :

- Behaviour

- physical component in charge of implementing / realising part of the functions allocated to the system
- e.g. operational software, radar antenna, ...

- Node or implementation

- material physical component, resource embedding some behavioural components, and necessary to their expected behaviour
- e.g. motherboard, units of memory, middleware's and operating systems ...



Physical Architecture Design – Main Concepts (2/2)

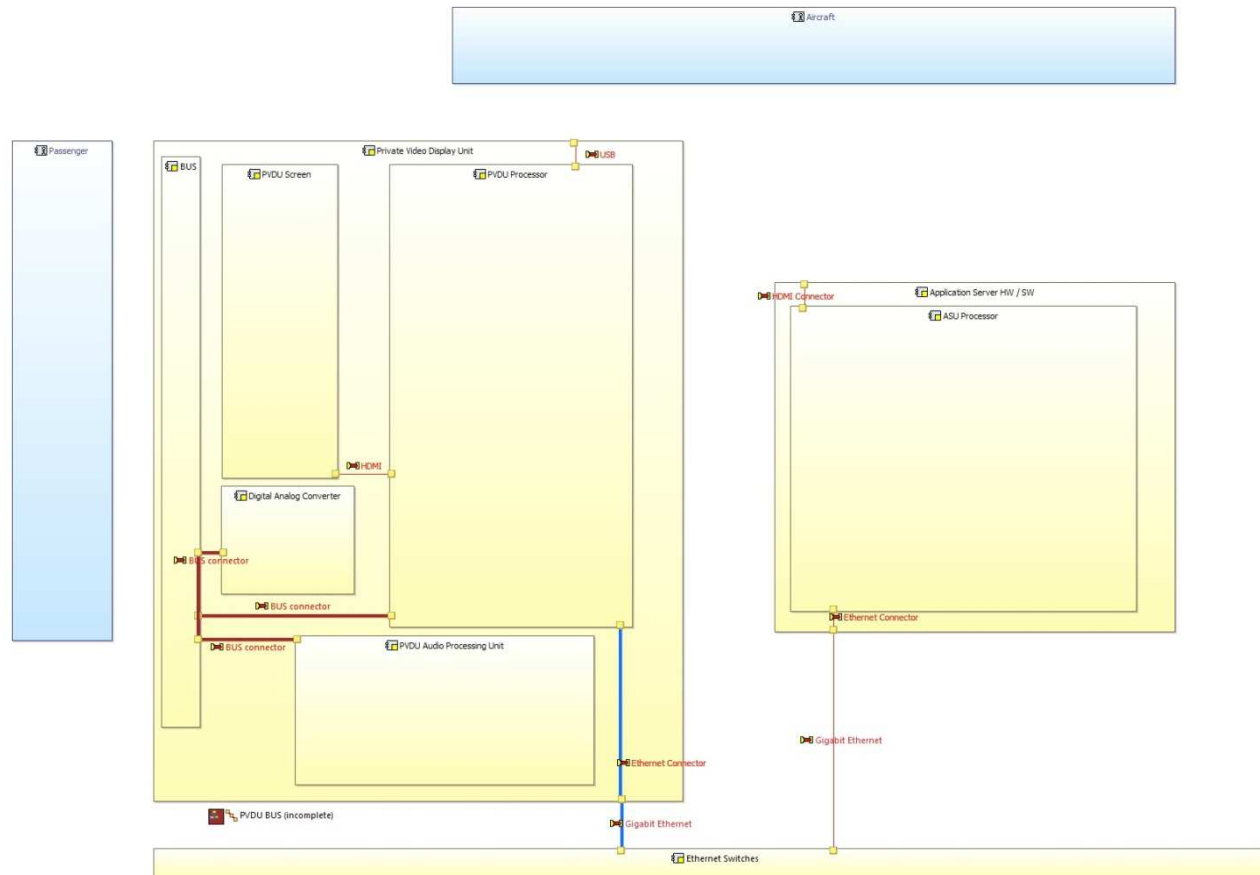


- ◆ Component Exchanges are meant to be used between Behaviour Components.
 - They are identical to the Component Exchanges of the System Analysis and the Logical Architecture



- ◆ Physical Links are non-oriented material connections between Node Components, through Physical Ports.
 - They realize Component Exchanges, and appear in red on the diagram

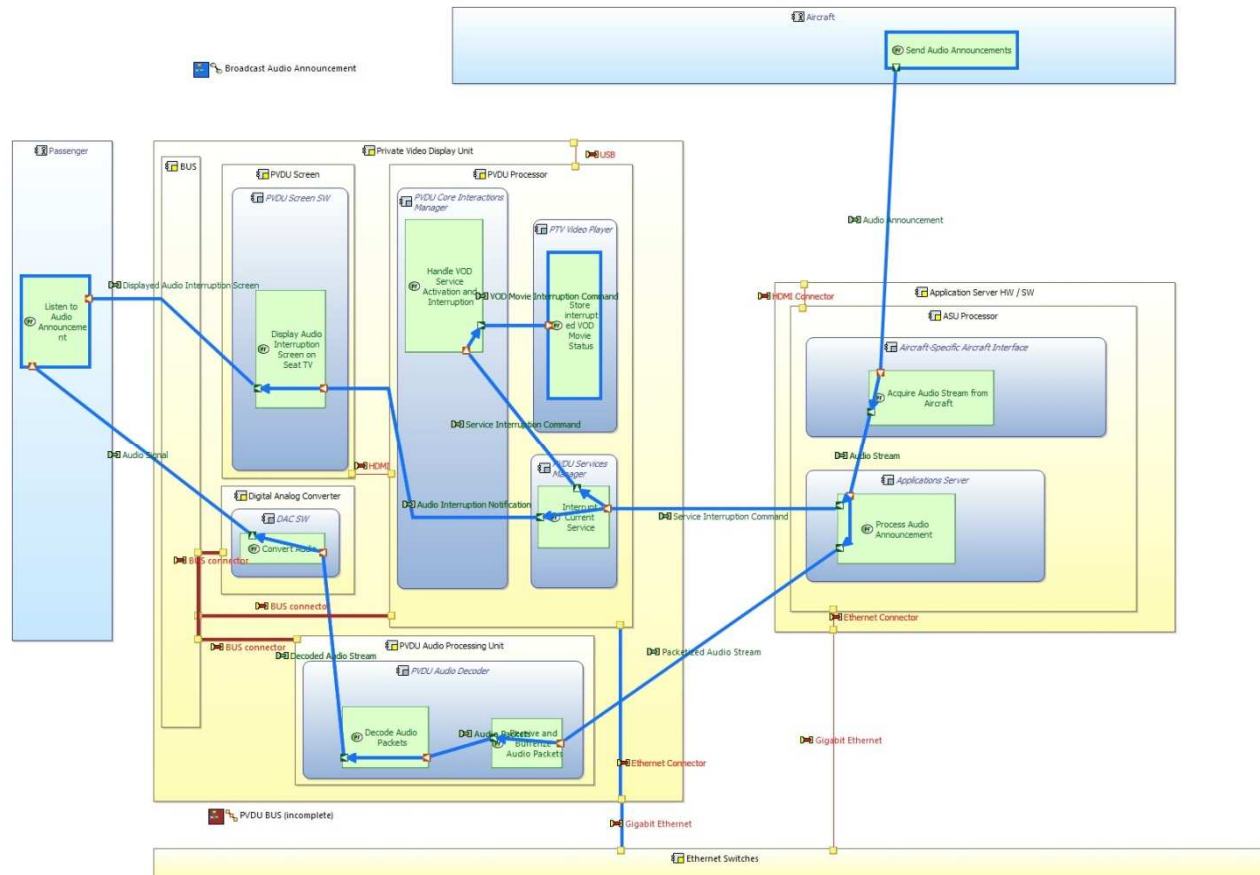
IFE / Physical Architecture



Define

- Physical Nodes
- Physical links

IFE / Physical Architecture



Define

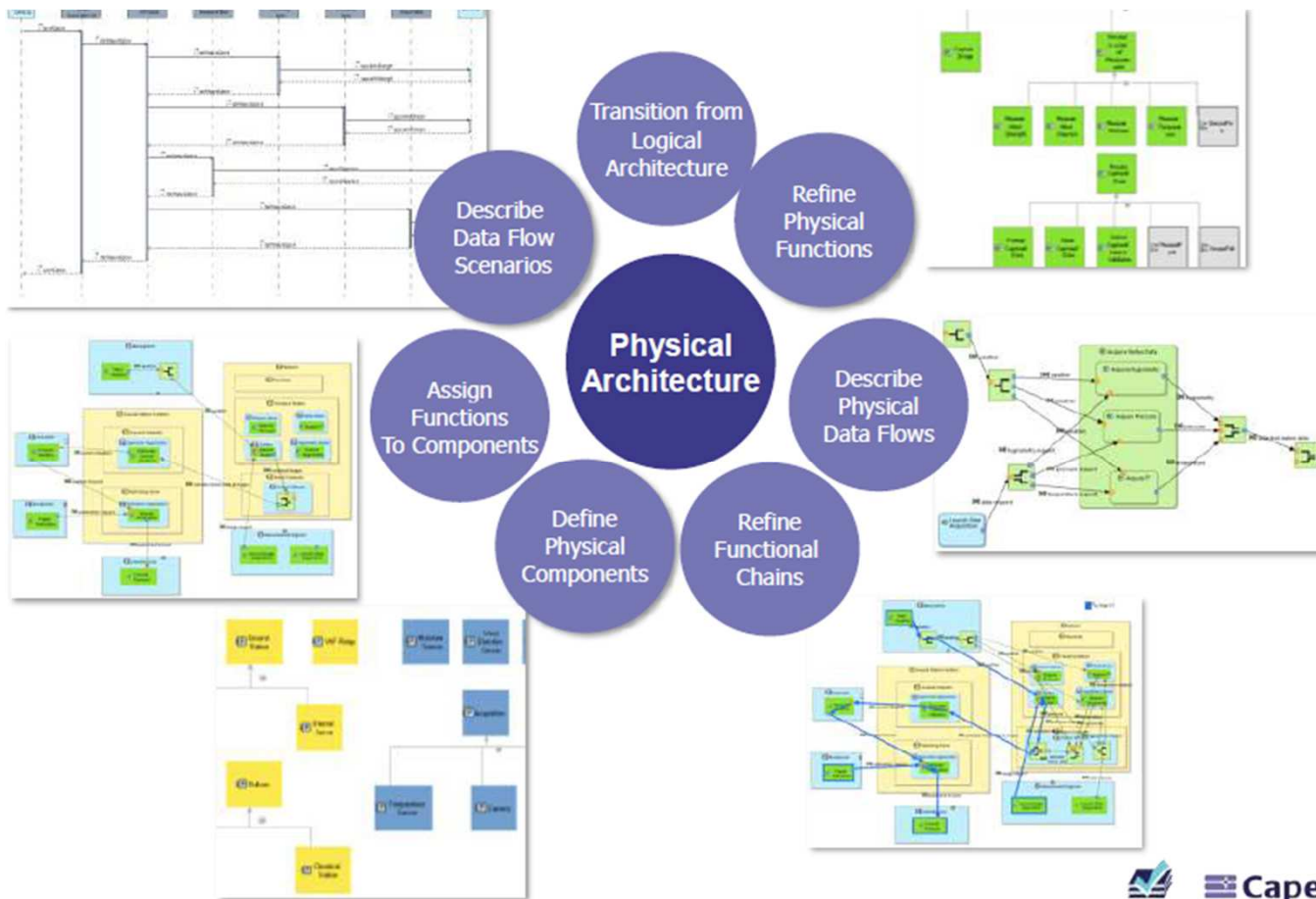
- Physical Nodes
- Physical links

Allocate

- transited and refined Behavioural Nodes
- Allocate transited functions to nodes

Define physical paths

Logical Architecture Workflow and Main Diagrams



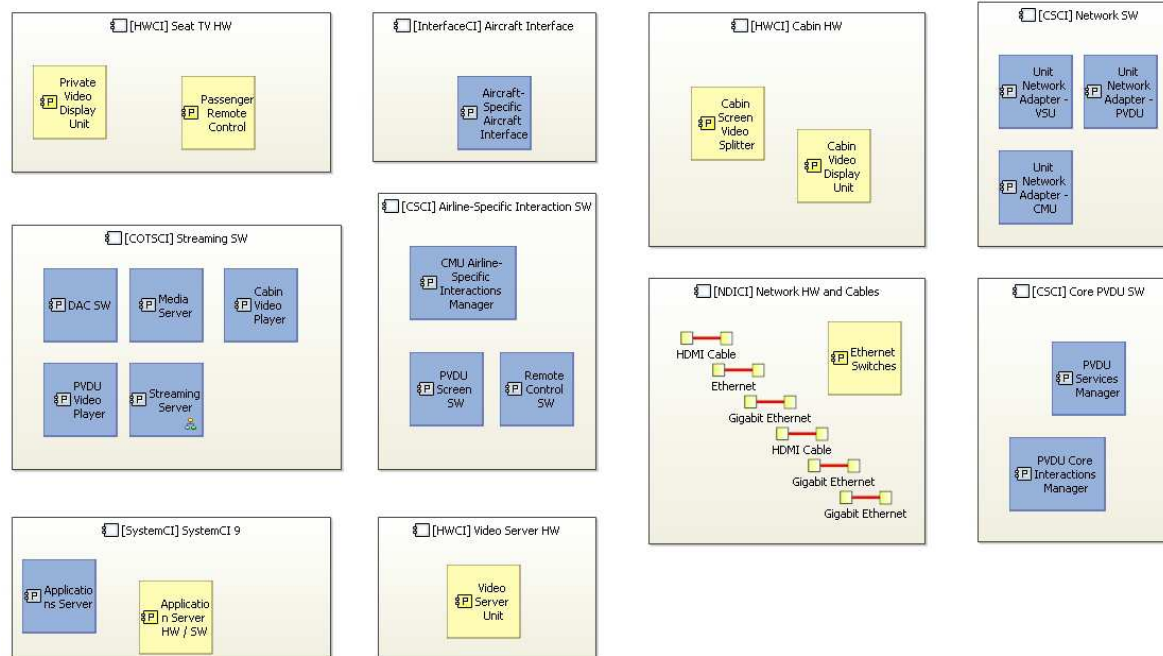
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End Product Breakdown Structure

IFE / EPBS and Components Integration Contracts

WHAT IS EXPECTED FROM EACH DESIGNER / SUB-CONTRACTOR

Requirements, interfaces, operational use cases, etc.



CLARITY in a nutshell

CLARITY facts & figures

- French (LEOC) proposal
- T0 : September 1st, 2014, Duration : 36 months

CLARITY objectives

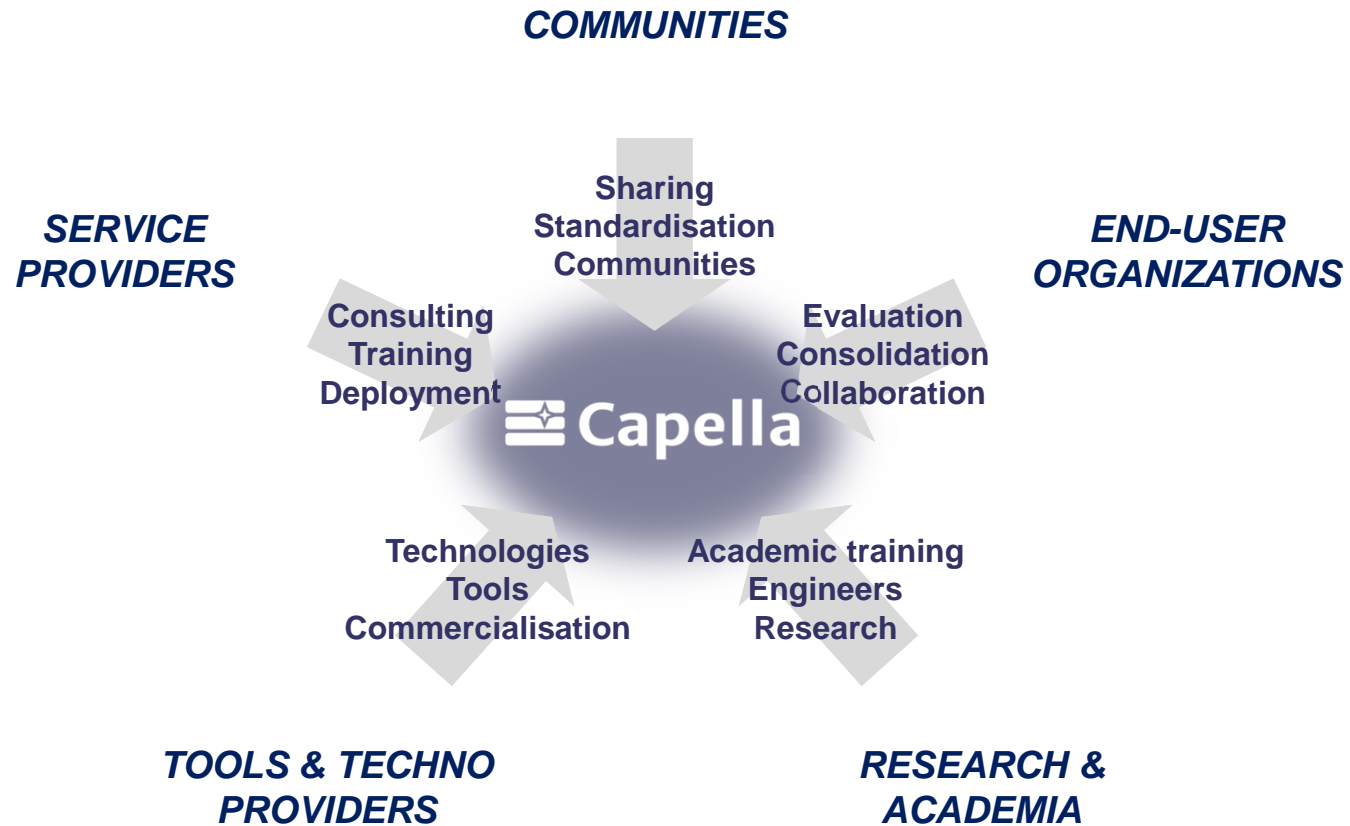
- Arcadia standardisation & Capella Open Sourcing
- Further innovation (functional, non-functional) around Capella
- Ecosystem building around Arcadia & Capella
- Driven by industries, supported by Services & Technologies providers, enriched by research teams

CLARITY highlights

- 19 major reference partners all along the value chain
- Major promotion efforts : Communities, Conferences, Book, Training
- Standardisation objectives
 - Melody de facto standardisation 
 - Arcadia standard technical document 




Capella : Open innovation at work



Capella : Open innovation at work



Thank You! Questions?

Capella website:

<http://www.polarsys.org/capella/>

LinkedIn 

<http://www.linkedin.com/company/capella-modelling-workbench>

Twitter 

https://twitter.com/capella_arcadia

Arcadia forum:

<https://polarsys.org/forums/index.php/f/12/>

Capella forum:

<https://polarsys.org/forums/index.php/f/13/>

IFE model & doc.:

<http://www.polarsys.org/capella/start.html>

