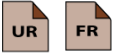
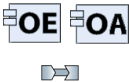
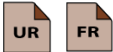
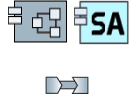
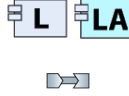
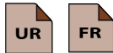
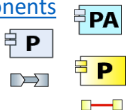
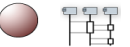
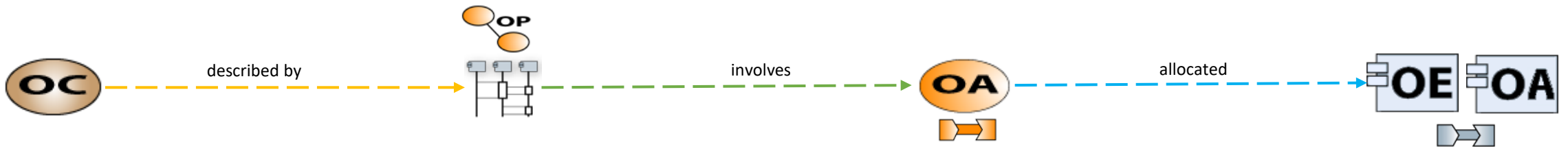


Arcadia layer	Requirements	Capability	Capability description	Functional	Structure	Modes and States	Data	Interfaces
Operational Analysis	R-OA	OA1	OA2	OA3	OA4	M&S-OA5	D-OA6	I-OA7
	Capture stakeholder needs 	Define Operational Capabilities 	Define processes and scenarios 	Define Operational Activities and interactions 	Capture Operational Entities and Actors Allocate Operational Activities to Operational Actors, Entities 	Define operational modes and states 	Define operational data model 	Define interfaces and describe interfaces scenarios 
System Analysis	R-SA	SA1	SA2	SA3	SA4	M&S-SA5	D-SA6	I-SA7
	Derive Stakeholder requirements and capture System requirements 	Define System Missions and System Capabilities 	Define Functional Chains and Scenarios 	Define System Functions Define Functional Exchanges and components 	Allocate System Functions to System and Actors 	Define system modes and states 	Define system data model 	Define interfaces and describe interfaces scenarios Enrich Logical Scenarios. 
Logical Architecture	R-LA	LA1	LA2	LA3	LA4	M&S-LA5	D-LA6	I-LA7
	Derive system requirements and Capture components requirements 	Transition Capabilities Realization from system layer 	Define Functional Chains and scenarios 	Derive System Functions and define Logical Functions. Define Functional Exchanges and components 	Allocate Logical Functions to Logical Components 	Define logical components modes and states 	Define logical data model 	Delegate System Interfaces and create Logical Interfaces. Enrich Logical Scenarios. 
Physical Architecture	R-PA	PA1	PA2	PA3	PA4	M&S-PA5	D-PA6	I-PA7
	Derive logical requirements and capture physical requirements 	Transition Capabilities Realization from logical layer 	Define Functional Chains, Scenarios, and Physical Path 	Derive Logical Functions and define Physical Functions Define Functional Exchanges and components 	Define Physical Nodes and refine Behavioural Physical Components Allocate Behavioural Components 	Define physical nodes modes and states 	Define physical data model 	Delegate Logical Interfaces and create Physical Interface. Enrich Physical Scenarios. 

Arcadia layer	Requirements	Capability	Capability description	Functional	Structural	Modes and States	Data	Interfaces
Operational Analysis	R-OA	OA1	OA2	OA3	OA4	M&S-OA5	D-OA6	I-OA7
	No dedicated diagram	[OCB] Operational Capabilities	[OAS] Operational Activity Scenario [OPD] Operational Process Scenario [OES] Operational Entity Scenario	[OABD] Operational Activity Breakdown Diagram [OAIB] Operational Activity Interaction Blank	[OEBD] Operational Entities Blank Diagram [ORB] Operational Roles Blank [OAB] Operational Architecture Blank	[MSM] Modes and States	[CDB] Class Diagram	[IDB] Interface Definition Blank [CEI] Component External Interfaces [IS] Interface Scenario [CDI] Component Detailed Interface
System Analysis	R-SA	SA1	SA2	SA3	SA4	M&S-SA5	D-SA6	I-SA7
	No dedicated diagram	[MCB] Mission and Capabilities Blank [CC] Contextual Capability	[FS] System Functional Scenario [ES] System Entity Scenario [SFCD] System Functional Chain Description	[SFBD] System Functional Breakdown Diagram [SDFB] System Data Flow Blank	[CSA] Contextual System Actor [SAB] System Architecture Blank	[MSM] Modes and States	[CDB] Class Diagram	[IDB] Interface Definition Blank [CEI] Component External Interfaces [IS] Interface Scenario [CDI] Component Detailed Interface
Logical Architecture	R-LA	LA1	LA2	LA3	LA4	M&S-LA5	D-LA6	I-LA7
	No dedicated diagram	[CRB] Capabilities Realization Blank [CRI] Contextual Capability Realization Involvement	[FS] Logical Functional Scenario [ES] Logical Entity Scenario [LFCD] Logical Functional Chain Description	[LFBD] Logical Functional Breakdown Diagram [LDFB] Logical Data Flow Blank	[LCBD] Logical Component Breakdown Diagram [LAB] Logical Architecture Blank	[MSM] Modes and States	[CDB] Class Diagram	[IDB] Interface Definition Blank [CEI] Component External Interfaces [IS] Interface Scenario [CDI] Component Detailed Interface
Physical Architecture	R-PA	PA1	PA2	PA3	PA4	M&S-PA5	D-PA6	I-PA7
	No dedicated diagram	[CRB] Capabilities Realization Blank [CRI] Contextual Capability Realization Involvement	[FS] Physical Functional Scenario [ES] Physical Entity Scenario [PFCD] Physical Functional Chain Description	[PFBD] Physical Functional Breakdown Diagram [PDFB] Physical Data Flow Blank	[PCBD] Physical Component Breakdown Diagram [PAB] Physical Architecture Blank	[MSM] Modes and States	[CDB] Class Diagram	[IDB] Interface Definition Blank [CEI] Component External Interfaces [IS] Interface Scenario [CDI] Component Detailed Interface

Operational Analysis

“What the users of the system need to achieve”



Objectives and activities

- Capture who or what uses the system.
- Identify and capture what the stakeholders need to accomplish in the operational context.
- Identify and capture stakeholder activities.
- Identify and describe user goals with Operational Processes and different scenarios.

Outcomes and value

- Stakeholders of the system identified and captured.
- User goals identified and described with operational processes and scenarios.
- Stakeholder requirements captured and identified new requirements.

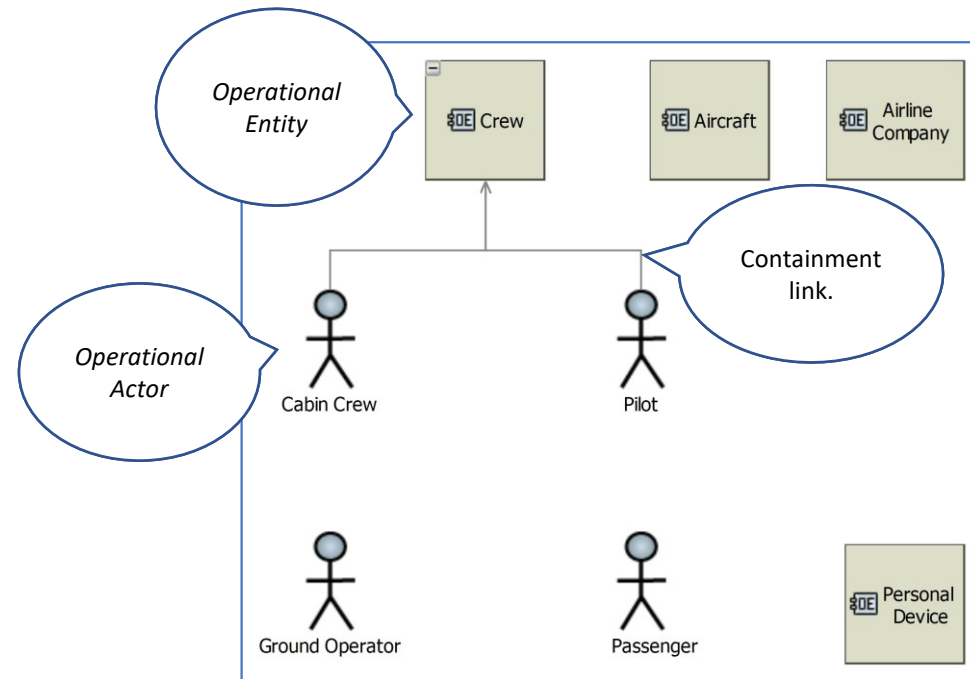
Operational Analysis steps

Step	Diagram output	Step description
Step 1	OEBD	Identify and capture Operational Entities and Actors
Step 2	OCB	Identify and capture operational capabilities
Step 3	OABD	Identify Operational Activities
Step 4	OAIB	Describe Operational Interactions
Step 5	OPD	Identify Operational Process
Step 6	OAB	Allocate Operational Activities to Operational Entities and Actors
Step 7	OPD	Describe Operational Capabilities with Operational Processes
Step 8	OAS OES	Describe Operational Capability with Operational Scenarios
Step 9	M&S	Define Operational Modes and State

Identify and capture Operational Entities and Actors

Activities

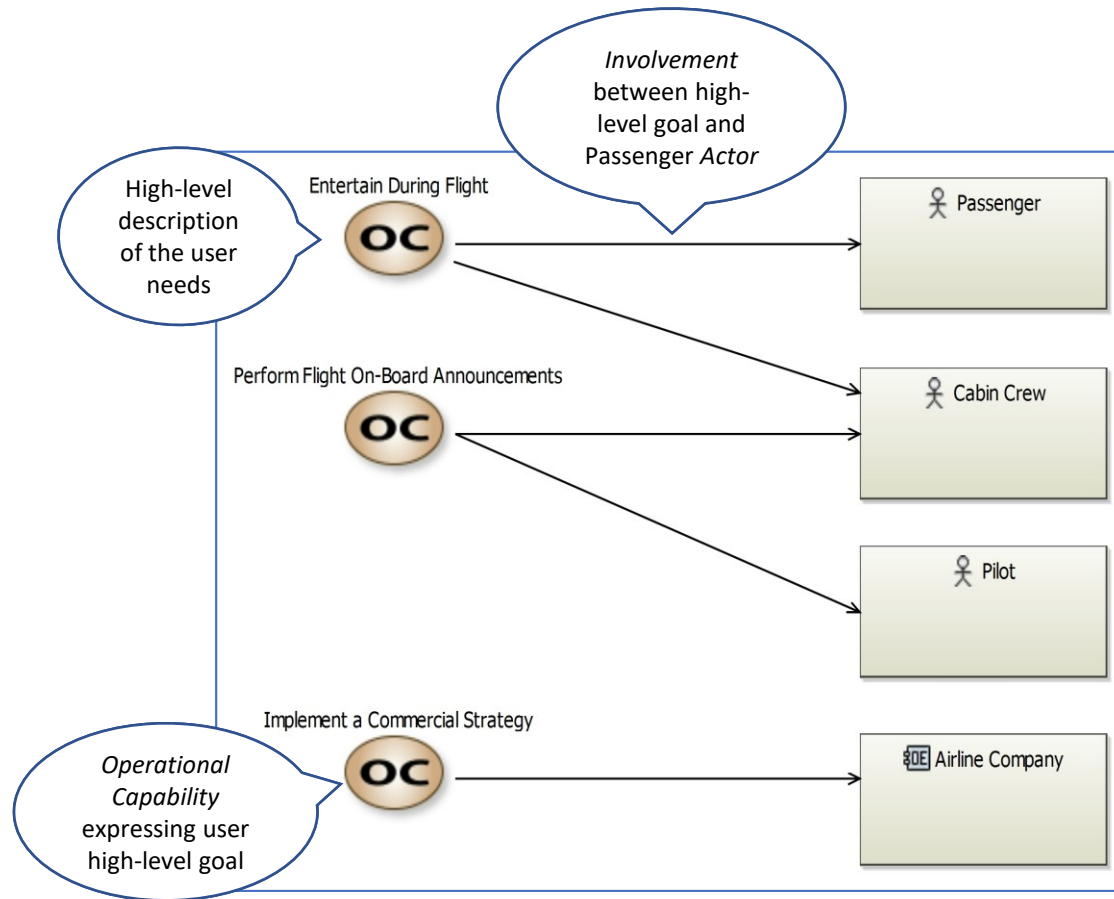
- Identify entities and actors that will interact with the future system.
- Identify entities and actors containment (hierarchy).



[OEBD] Operational Entity Breakdown Diagram

Activities

- Identify Operational Capabilities (needs) expected from the Operational Entities and Actors.
- Identify entities and actors associated against each Operational Capability



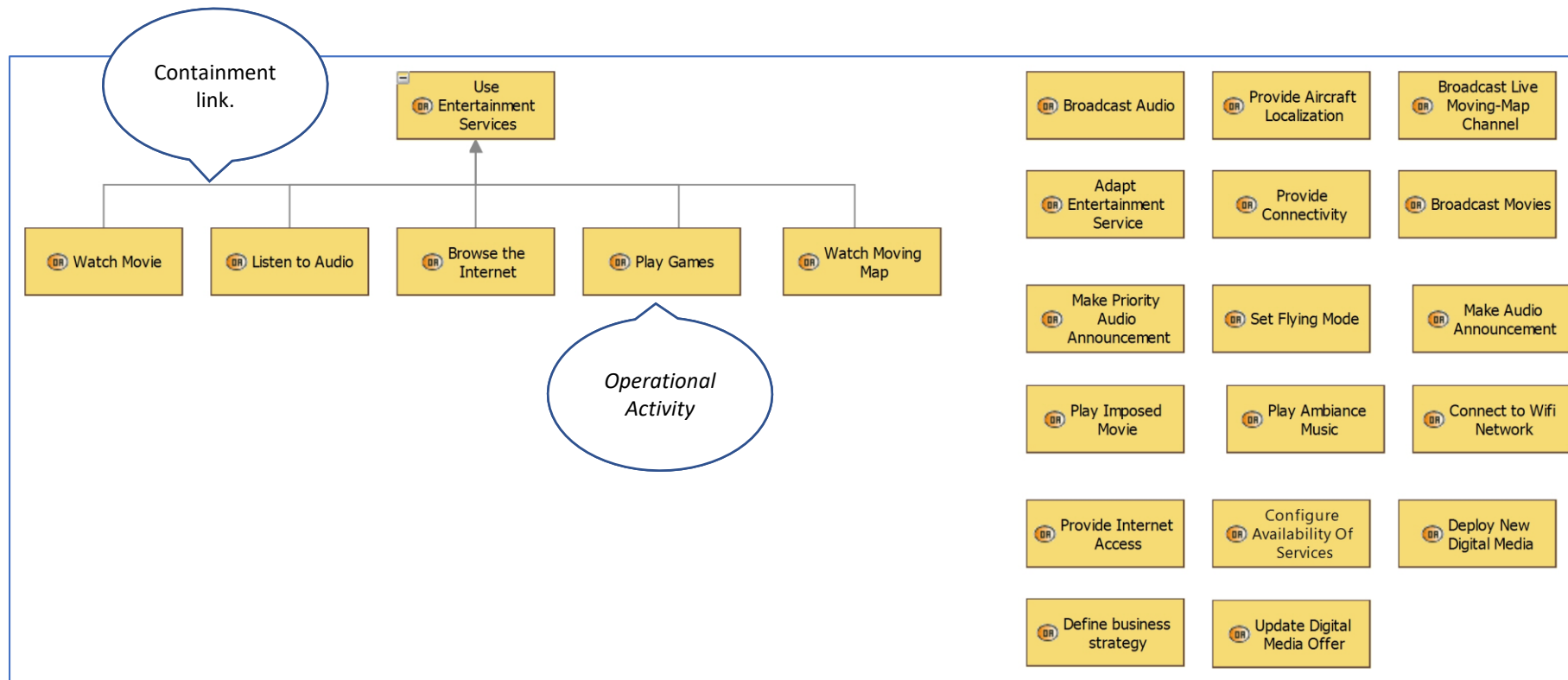
[OCB] Operational Capability Blank diagram

Operational Capability	Description
Entertain During Flight	The user needs to entertain during flight
Perform Flight On-board Announcements	The crew needs to perform flight on-board announcements. The Pilot needs to perform flight on-board announcements.
Implement a Commercial Strategy	The company needs to implement a commercial strategy

Identify Operational Activities

Activities

- Identify Operational Activities performed by the Operational Entities and Actors.
- Identify high-level Operational Activities containment relationship.

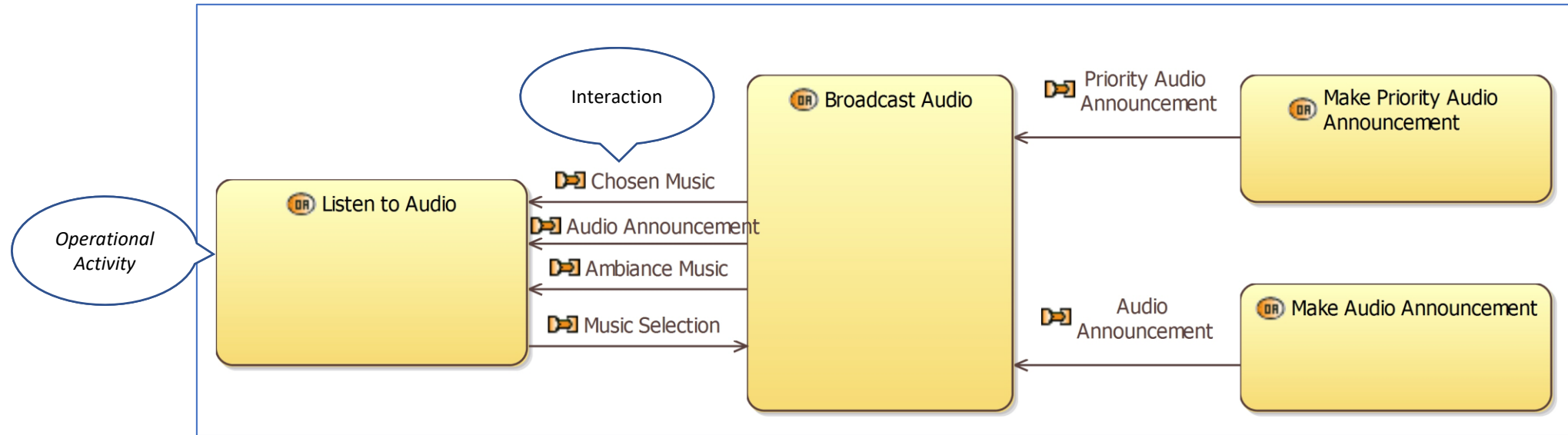


[OABD] Operational Architecture Blank diagram

Describe Operational Interactions

Activities

- Describe related Operational Activities interactions.

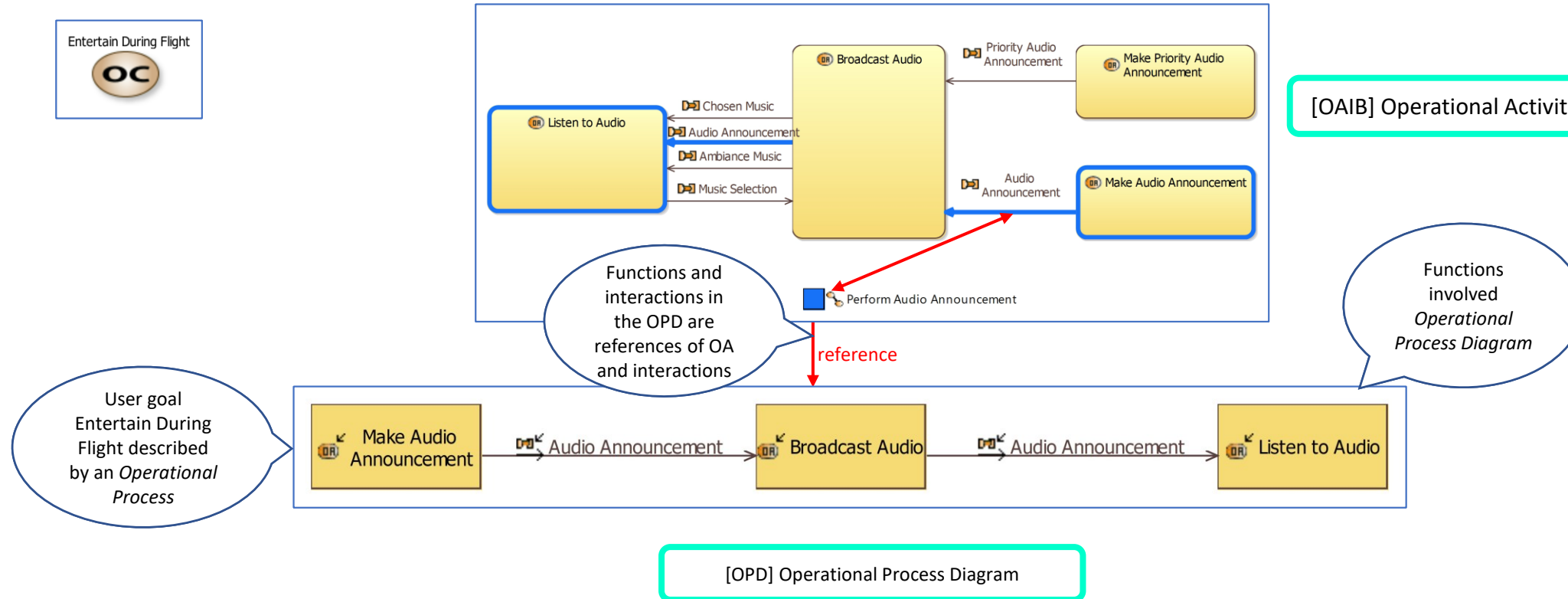


[OAIB] Operational Activities Interaction Blank diagram

Identify Operational Process

Activities

- Identify Operational Process(es) that describe an Operational Capability.
- Identify for each Operational Process the start and end, and activities involved.

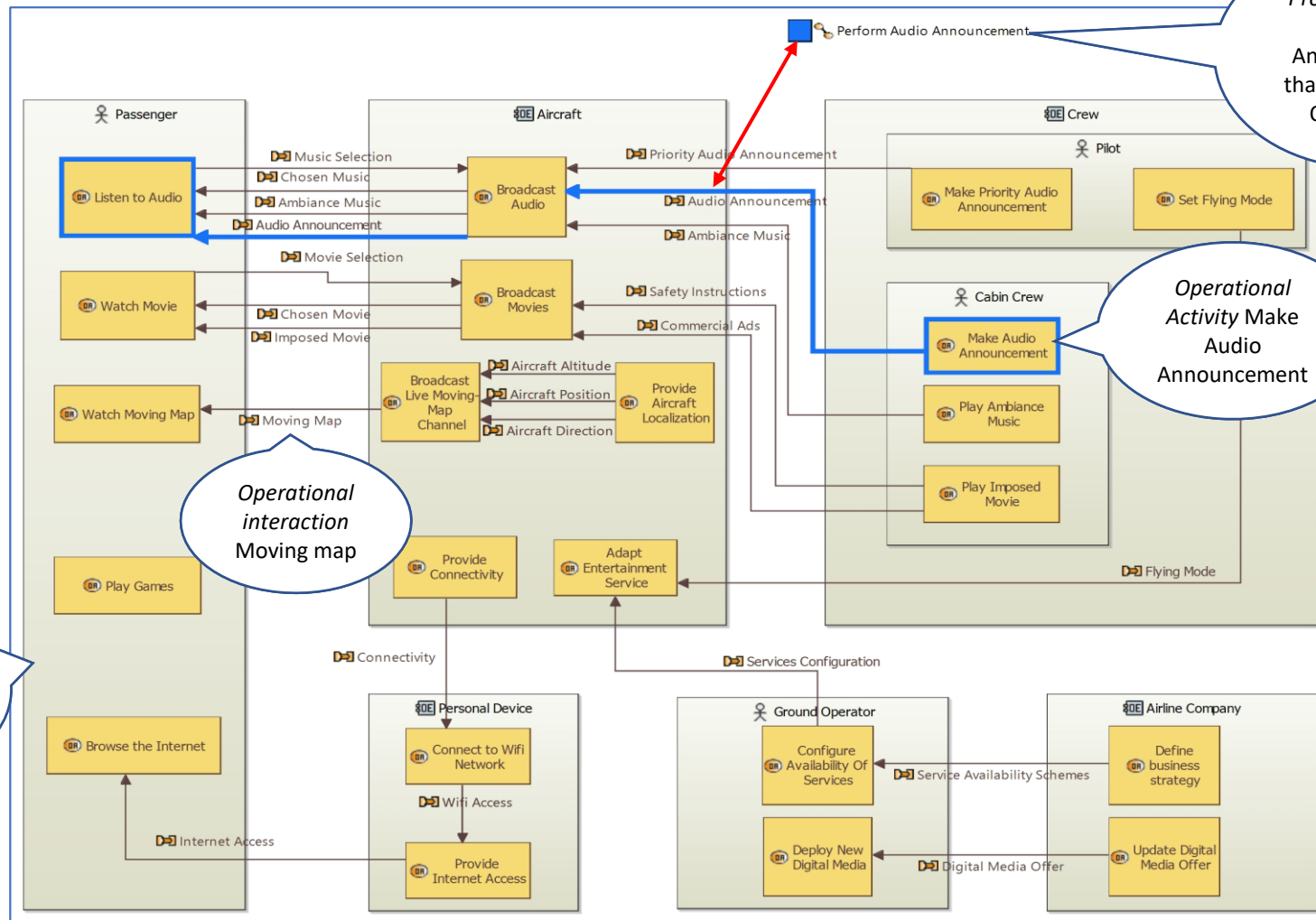


Allocate Operational Activities

Activities

- Identify and allocate Operational Activities performed by each Operational Entity and Actors.
- Identify Operational Interaction between Operational Entities and Actors.
- Identify Operational Processes for each Operational Capability.

Entertain During Flight



Describe Operational Capability with Operational Process and Scenarios

Automated transitions

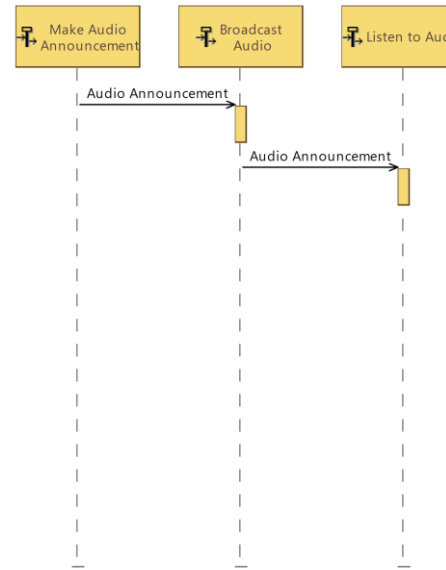
An Operational Capability can be described by:

- An Operational Process Description (OPD) diagram.
- An [OPD] can be transitioned (Capella tool capability) to an Operational Activity Scenario [OAS].
- An [OAS] can be transitioned (Capella tool capability) to an Operational Entity Scenario [OES].

Entertain During Flight

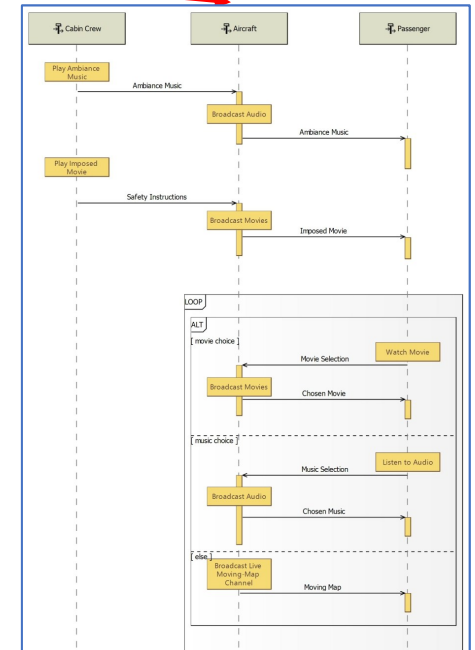


described by



transition

transition



[OPD] Operational Process Description

[OAS] Operational Activity Scenario

[OES] Operational Entity Scenario

Describe Operational Capabilities with scenarios

Activities

- Identify Entities and Actors involved to describe an Operational Capability.
- Identify the sequence in time of the interactions.
- Add Operational Activities and Fragments to enrich scenario.
- Add interactions between each Operational Entity.

Entertain During Flight



Operational
Capability
described by a
Operational Entity
Scenario

Operational
Entity

Interaction

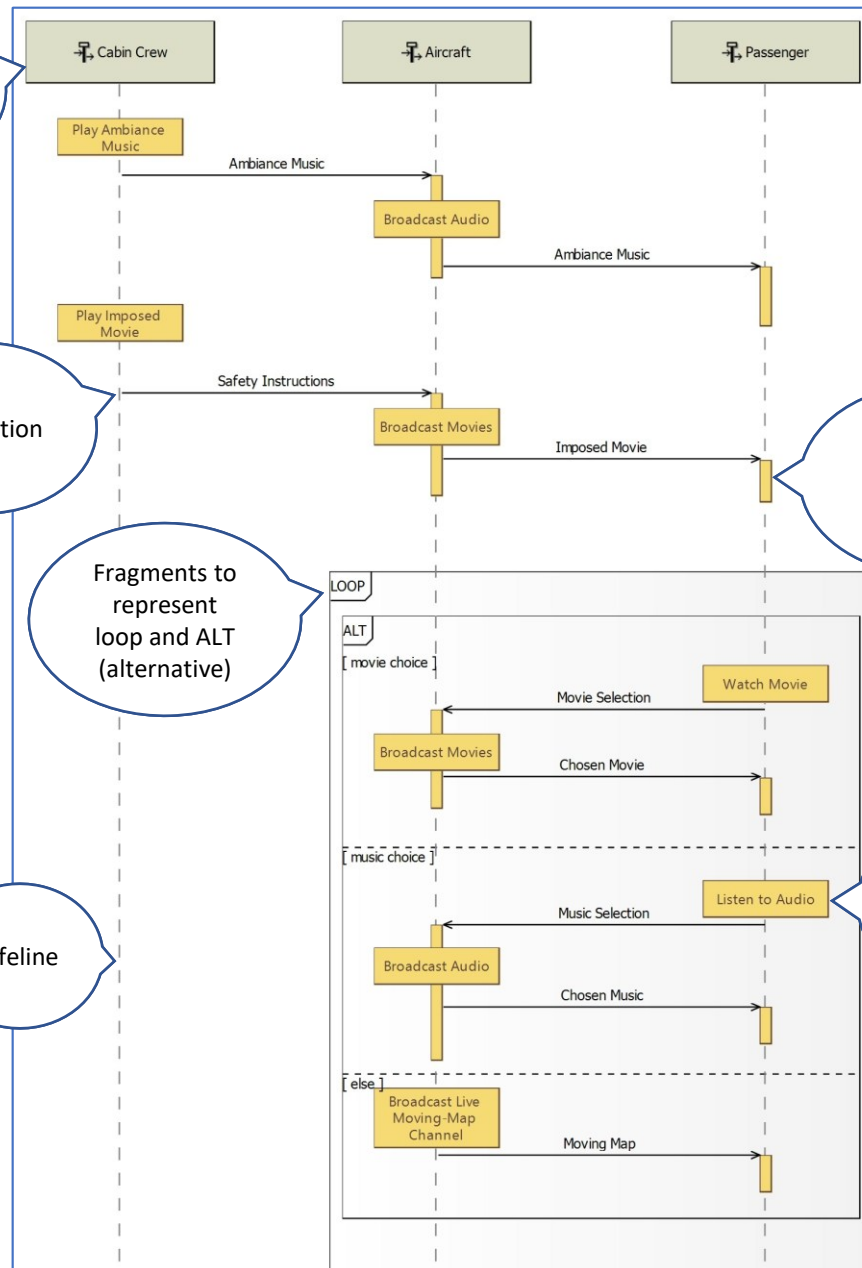
Fragments to
represent
loop and ALT
(alternative)

Lifeline

Operational
Scenario that
describes in time
an Operational
Capability

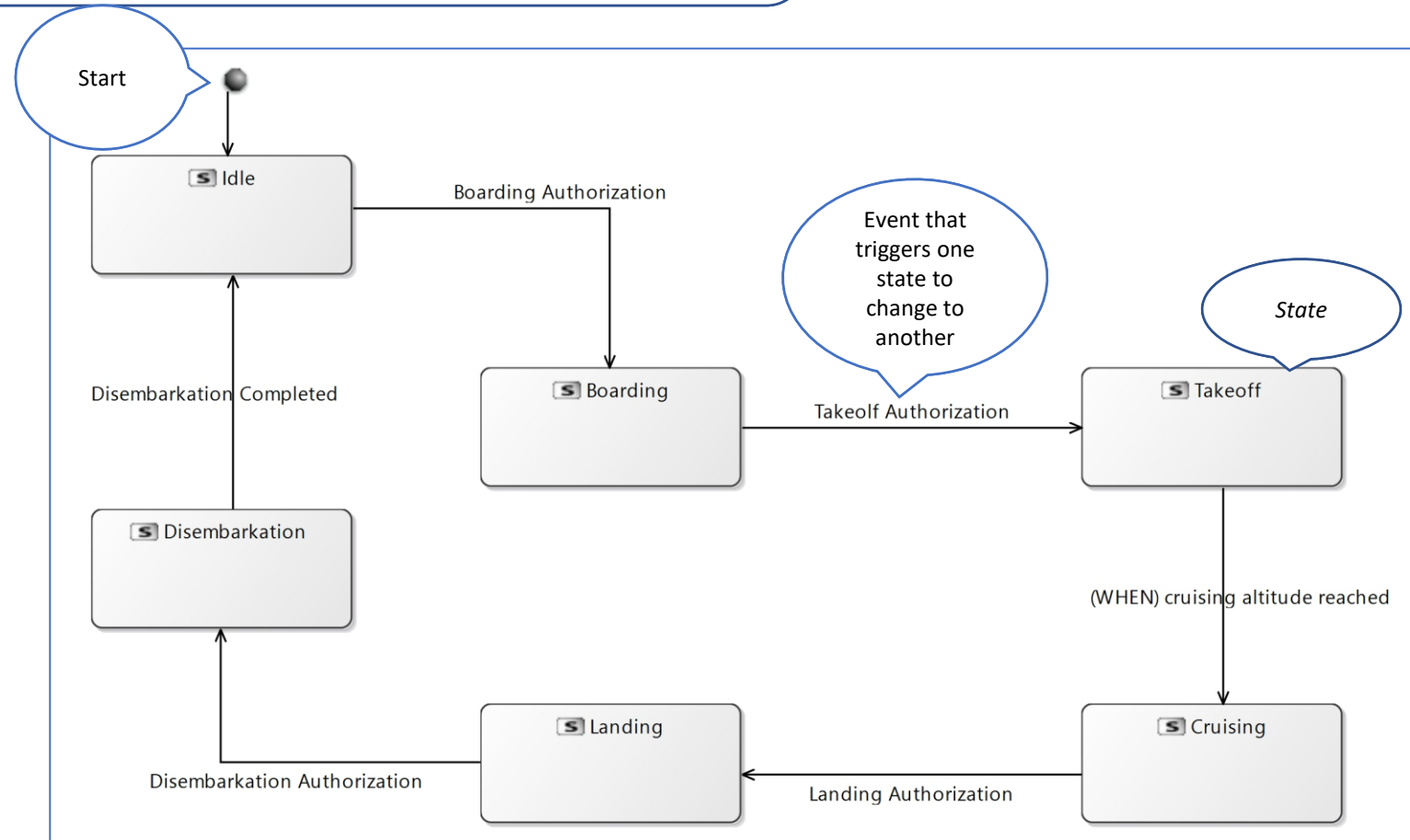
Operational
Activity
execution

Operational
Activity
reference

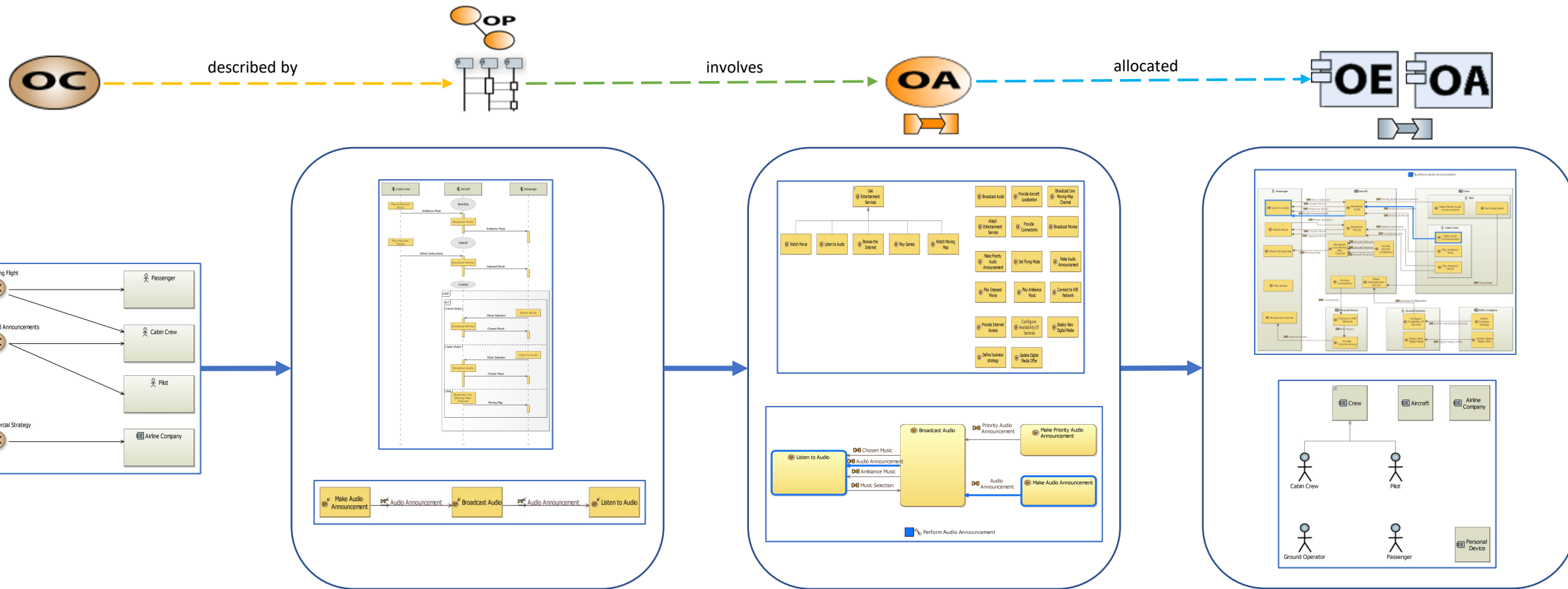


Activities

- Identify and capture modes and states relevant to the system Life Cycle, phases.



Operational Analysis traceability flow



Capability diagram

Capability description diagrams

Functional diagrams

Structural diagrams

[OCB] Operational Capabilities

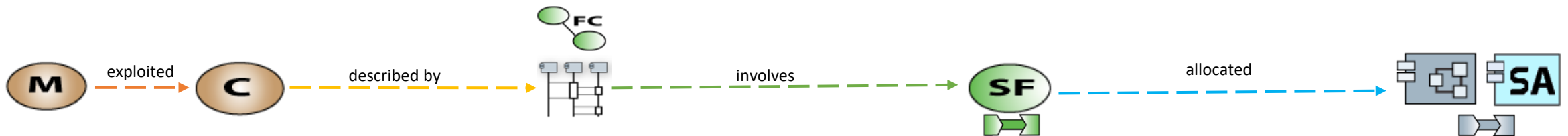
[OAS] Operational Activity Scenario
 [OPD] Operational Process Scenario
 [OES] Operational Entity Scenario

[OABD] Operational Activity Breakdown Diagram
 [OAIB] Operational Activity Interaction Blank

[OEBD] Operational Entities Blank Diagram
 [ORB] Operational Roles Blank
 [OAB] Operational Architecture Blank

System Analysis

“What the system must do for the users”



Objectives and activities

- Identify and define system missions and capabilities.
- Identify and define System and Actors functions.
- Identify boundaries of the System-of-Interest (Sol).
- Identify and define Functional Chains and scenarios that contribute and validate a capability.

Outcomes and value

- Traceability ensured from Operational Analysis to System Analysis.
- Identified System Capabilities as services.
- Identified external System interfaces with Actors.
- Described capabilities with scenarios and functional chains.

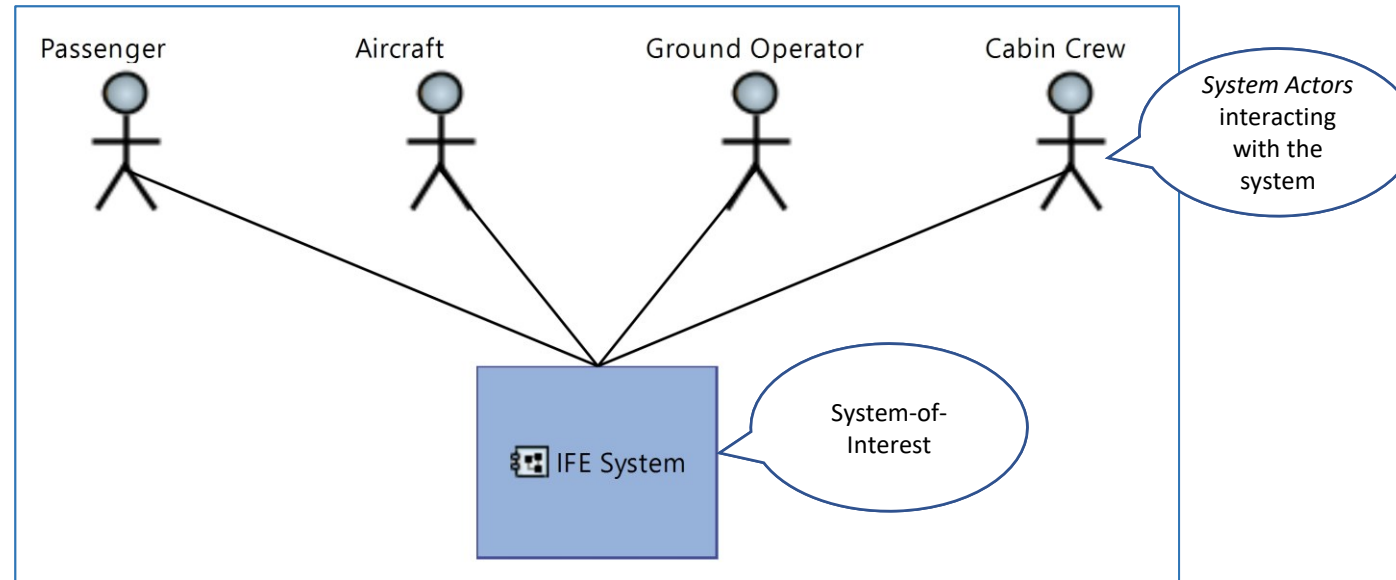
System Analysis steps

Step flow	Diagram	Step description
Step 1	CSA	Transition Operational Entities and Actors and identify new Actors
Step 2	MCB	Refine Operational Capabilities in System Capabilities
Step 3	SFBD	Derive System Functions
Step 4	SDFB	Identify and define Functional Exchanges
Step 5	SAB	Allocate System Functions to System Component and Actors
Step 6	SFCD	Describe System Capabilities with Functional Chains
Step 7	FS	Describe System Capability with Functional Scenarios
Step 8	ES	Describe System Capability with Entity Scenarios
Step 9	SFCD FS ES	Describe Capability Realizations with Functional Chains and Scenarios automated transitions

Transition Operational Entities and Actors and identify new Actors

Activities

- System Component Actors will be Contextually (transition) created as System Actors from Operational Entities and Actors defined at Operational Analysis.
- Identify new System Actors.

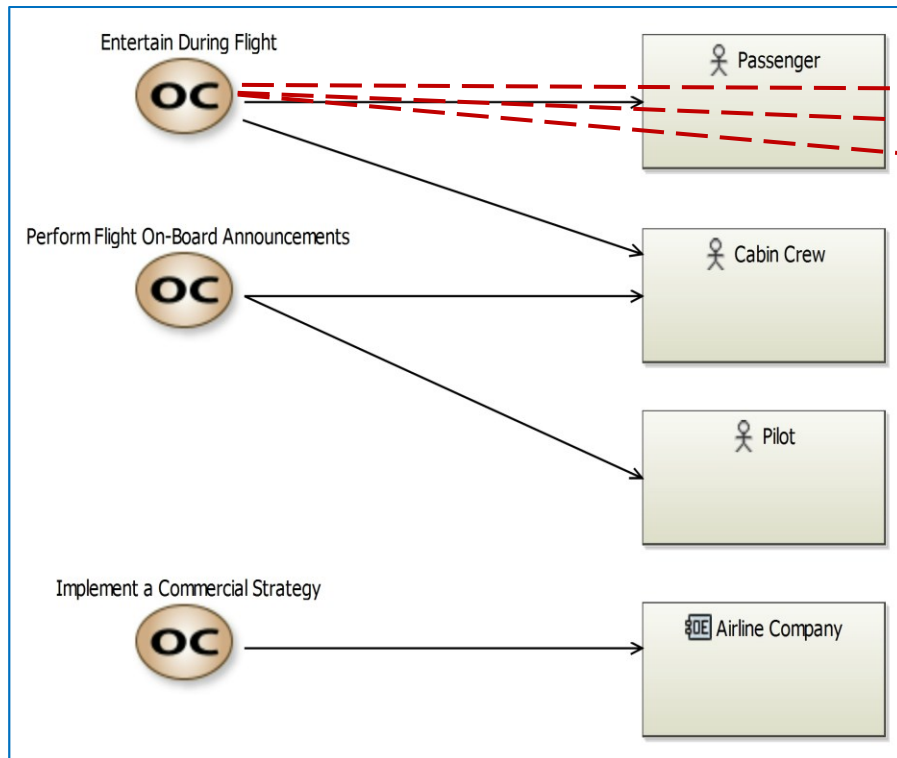


[CSA] Context System Actors

Refine Operational Capabilities in System Capabilities

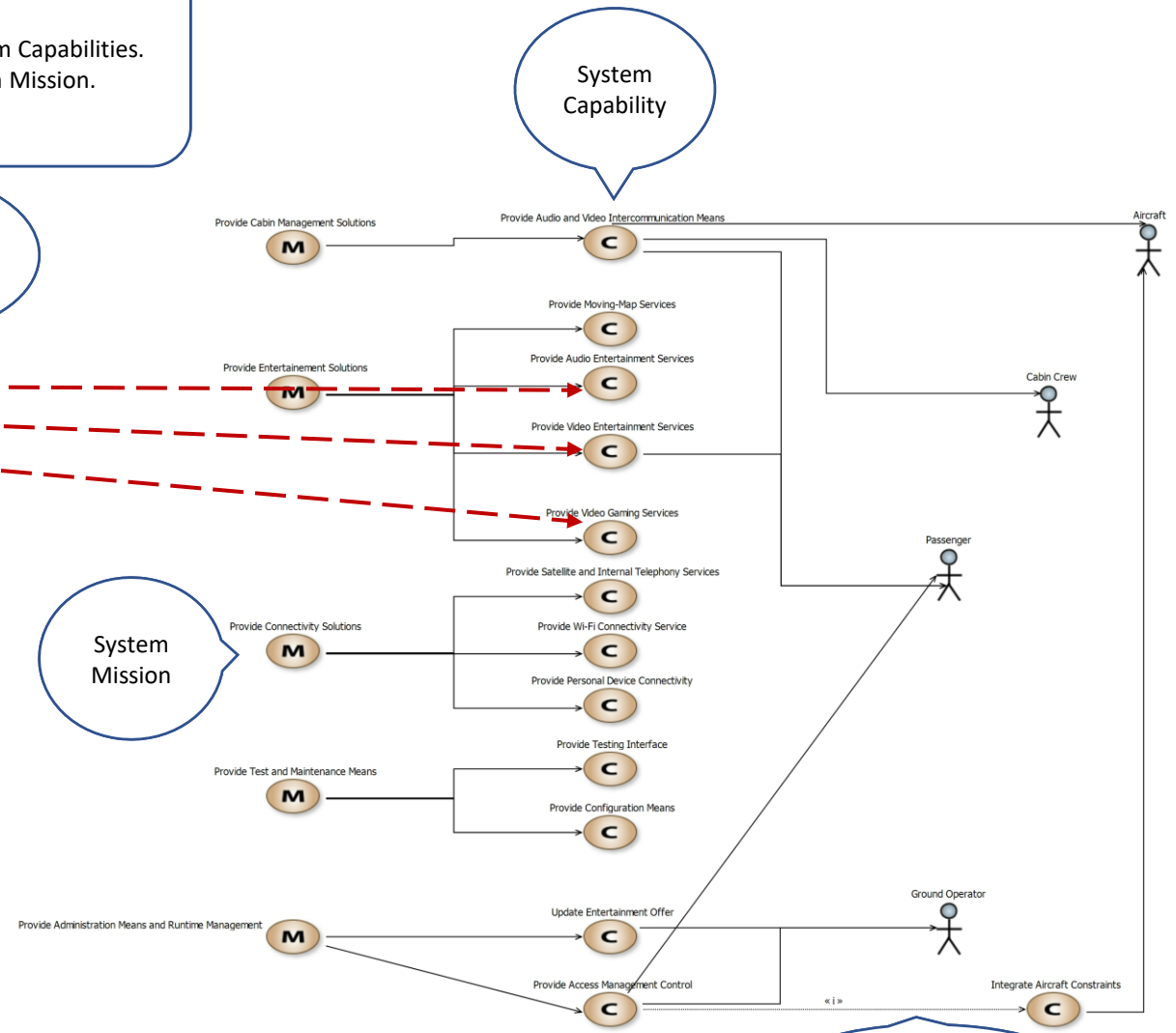
Activities

- Perform a transition from Operational Capabilities and translate Operational Capabilities into System Capabilities.
- Identify and define System Missions (i.e. system goals) and new System Capabilities for each System Mission.
- Identify involved main Actors against each Capability.



[OCB] Operational Capability Blank

Operational Capabilities decomposed



[MCB] Mission Capability Blank

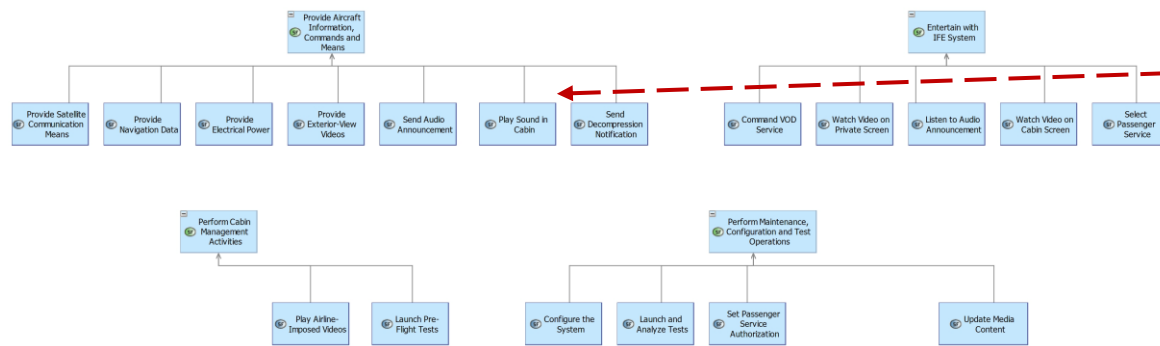
System Capability include relationship

Activities

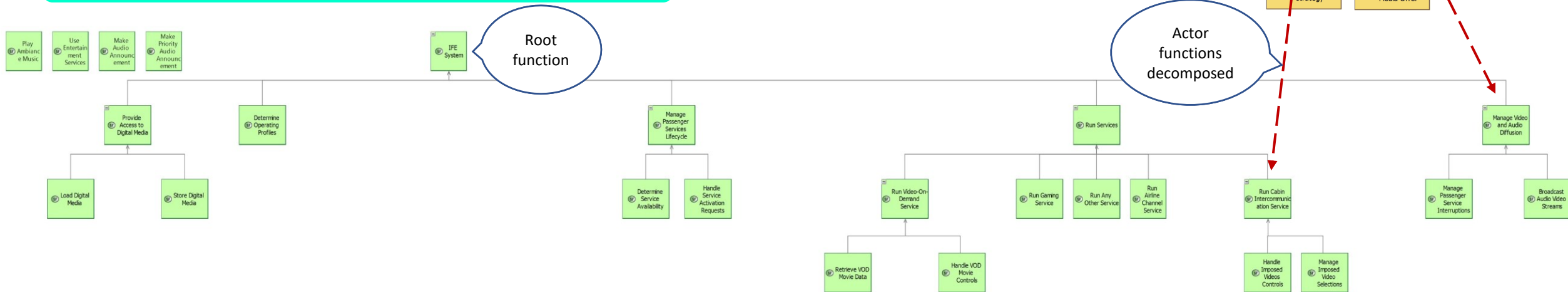
- Transition Operational Activities and refine Operational Activities in new System Functions
- Identify high-level System Functions containment relationship.
- Decompose Operational Activities to new System Functions and/or System Actors.

Modelling tips

- Define a root function where all the functions will be decomposed from.



[SFBD] System Functional Breakdown Diagram (Actor Functions only)

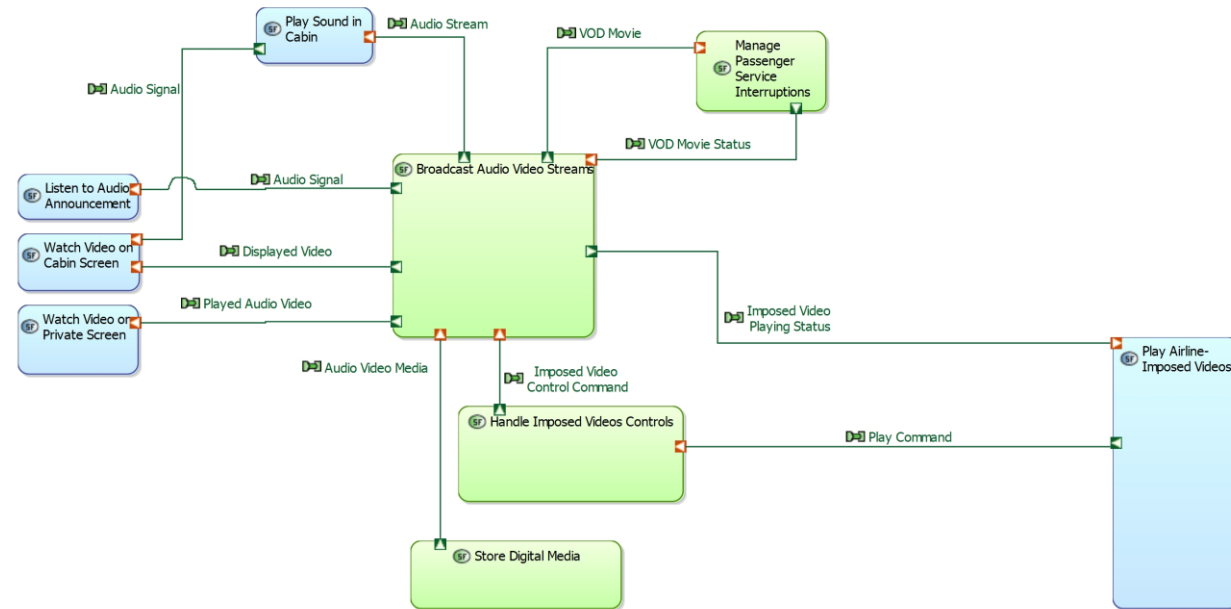


[SFBD] System Function Breakdown Diagram (System Functions only)

Identify and define Functional Exchanges

Activities

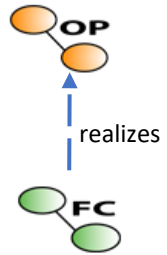
- Identify and define System Functional Exchanges.



[SDFD] System Dataflow Blank Diagram

Traceability

- Operational Processes can and should be transitioned and refined at System layer.



[OPS] Operational Process Description

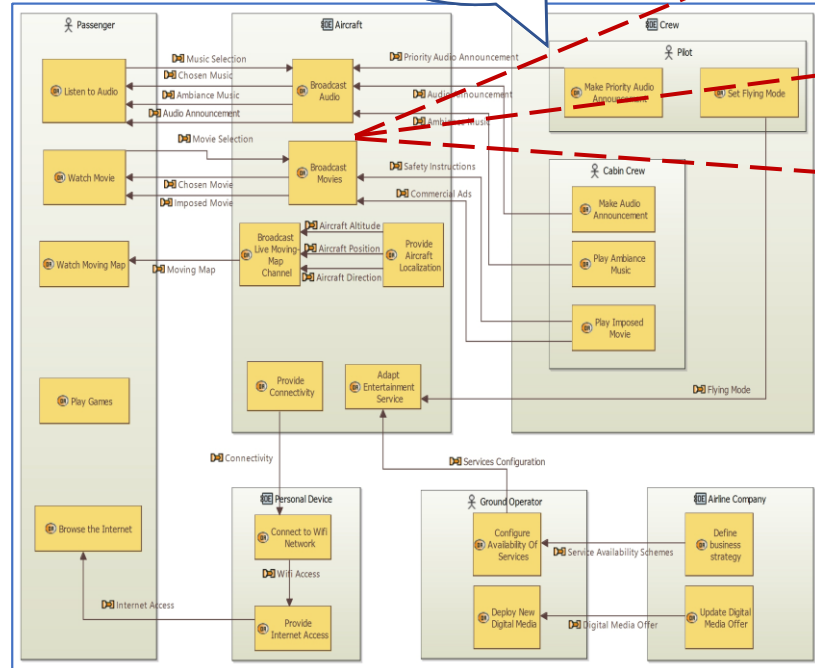
[SDFD] System Dataflow Blank Diagram – with Functional Chains

Allocate functions to System Component and Actors

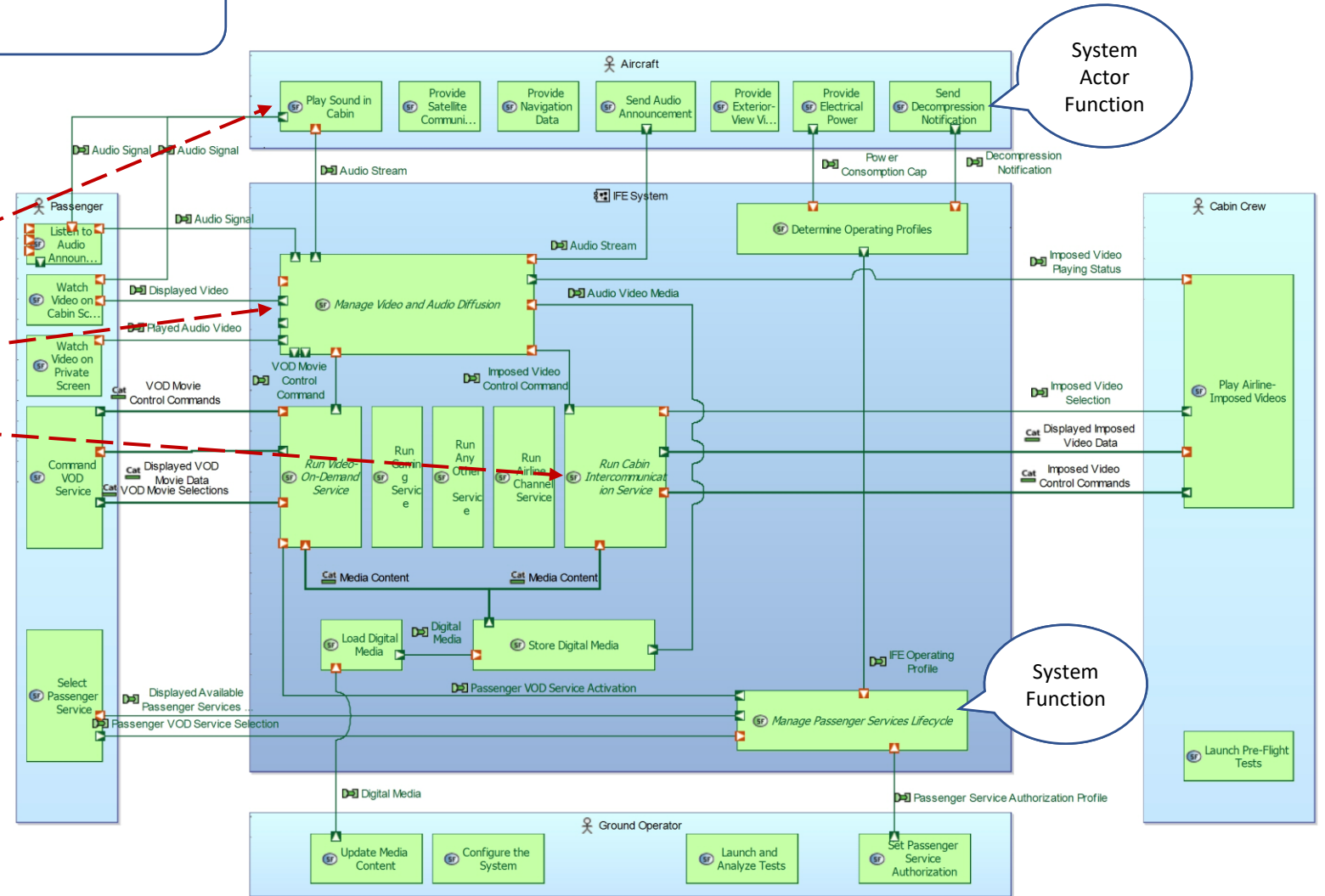
Traceability

- Traceability flow between different model elements is done via Arcadia ontology elements.
- Allocate functions to System Component and Actors

Operational Activity refined



[OAB] Operational Architecture Blank



[SAB] System Architecture Blank

Describe System Capabilities with Functional Chains

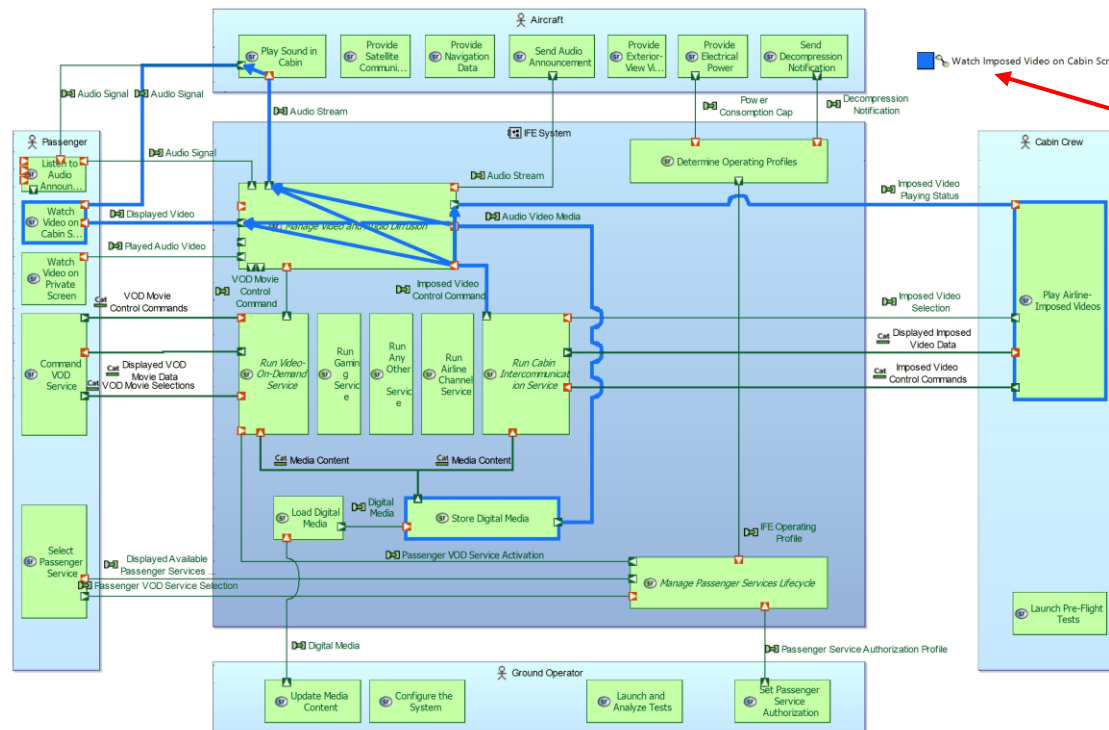
Activities

- A new System Functional Chain Description [SFCD] diagram can be created from the Functional Chains.

Remember

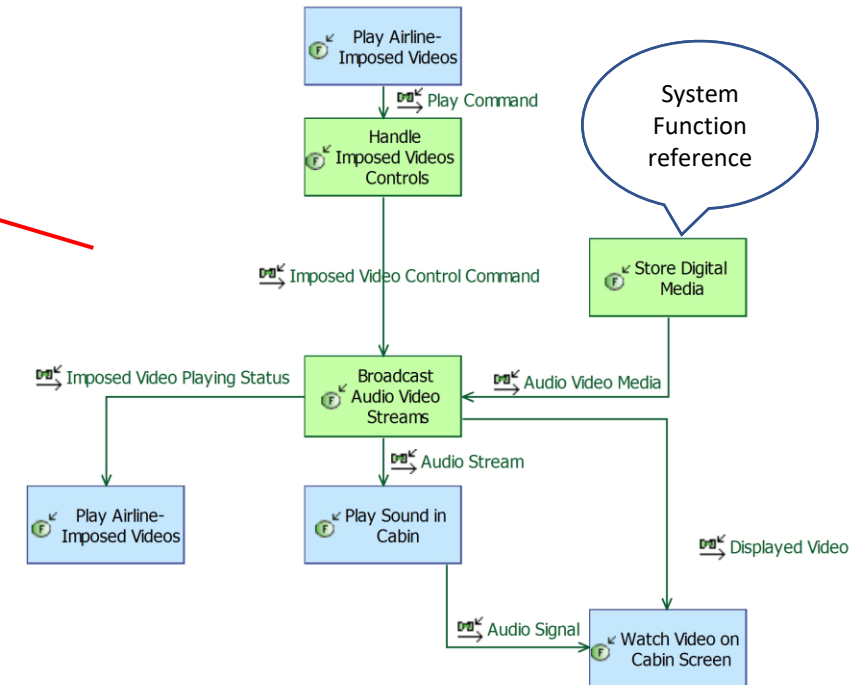
- System Functional Chains Description diagram are needed when a Functional Chain is created and needs to be updated, e.g., new System Functions need to be added.

Provide Audio and Video Intercommunication Means



[SAB] System Architecture Blank – with Functional Chains

reference



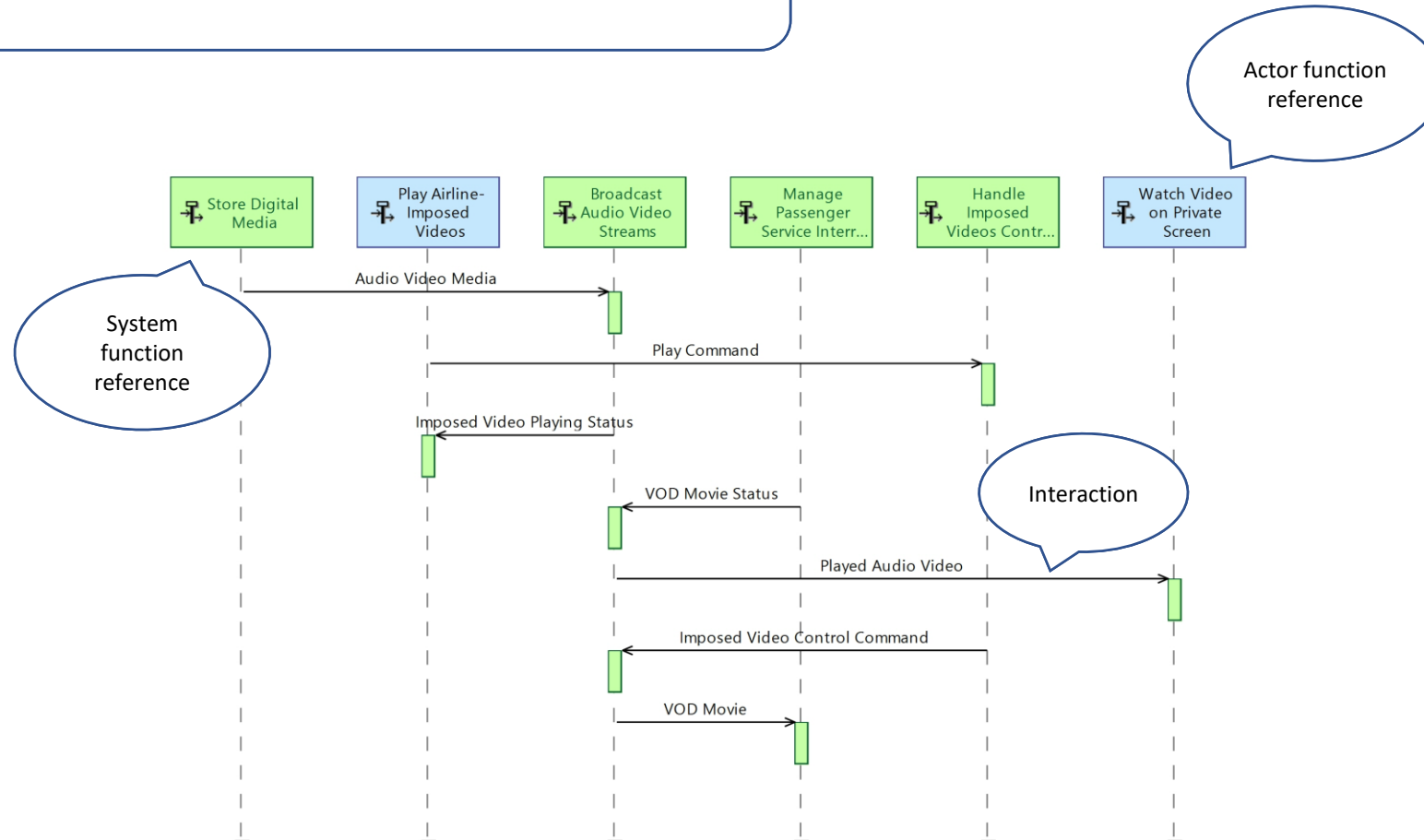
[SFCD] System Functional Chain Description

Describe System Capability with Functional Scenarios

Activities

- Functional Scenarios (FS) describe a sequence in time of the interactions. It can be created from a transition of the Functional Chain.

Provide Audio and Video Intercommunication Means

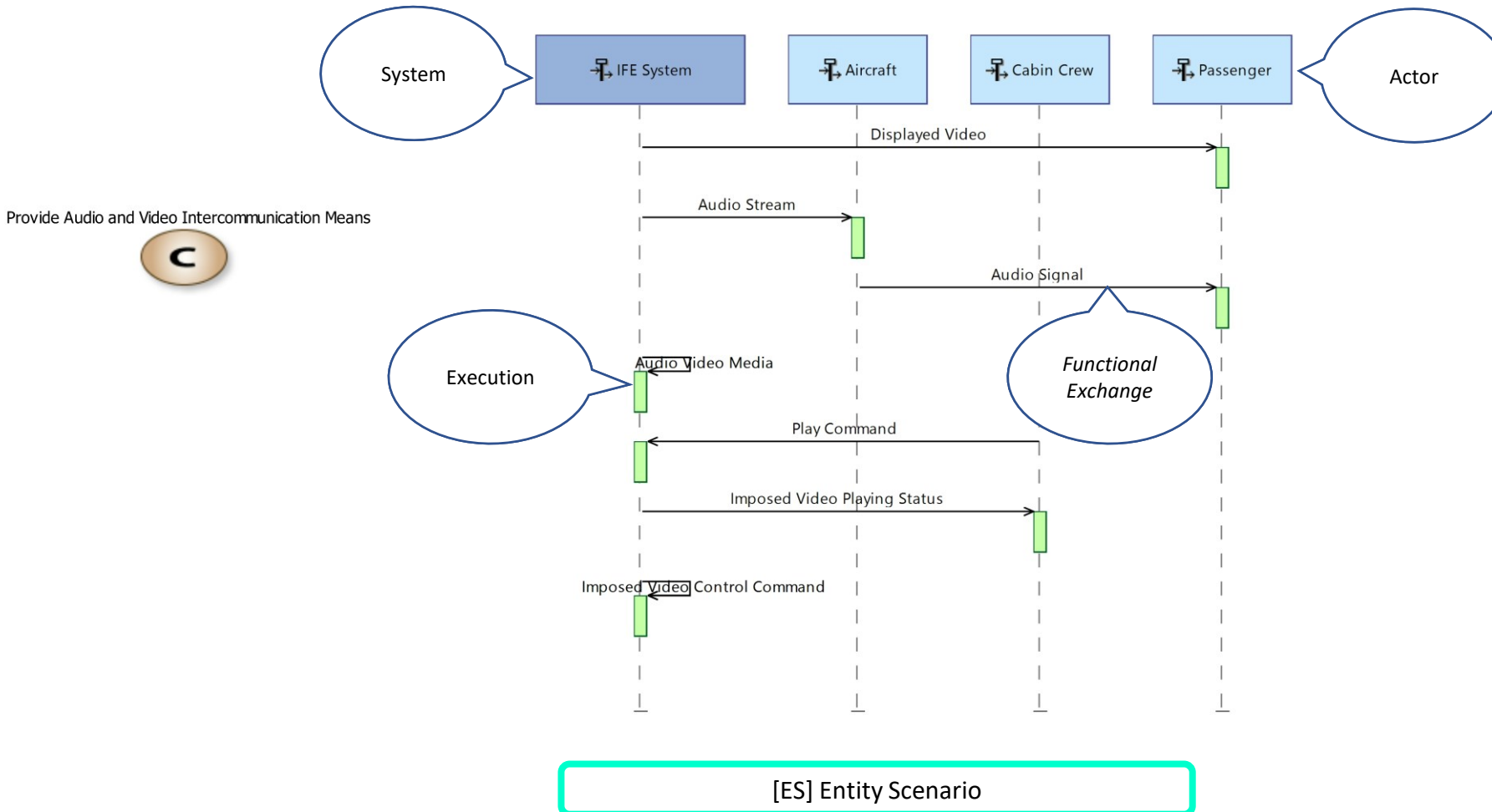


[FS] System Functional Scenario

Describe System Capability with Entity Scenarios

Activities

- Describe System Capability with Entity Scenarios.
- Entity Scenarios describe sequence in time of a System Capability

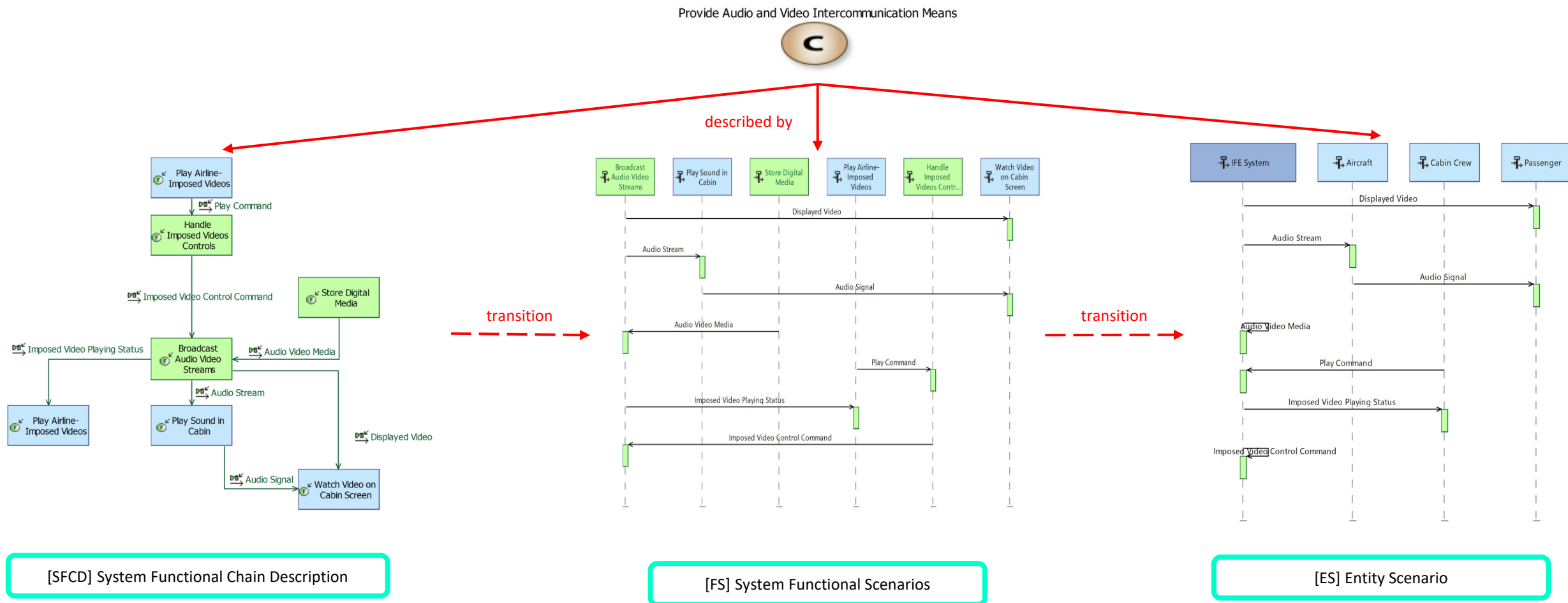


Describe Capability Realizations with Functional Chains and Scenarios

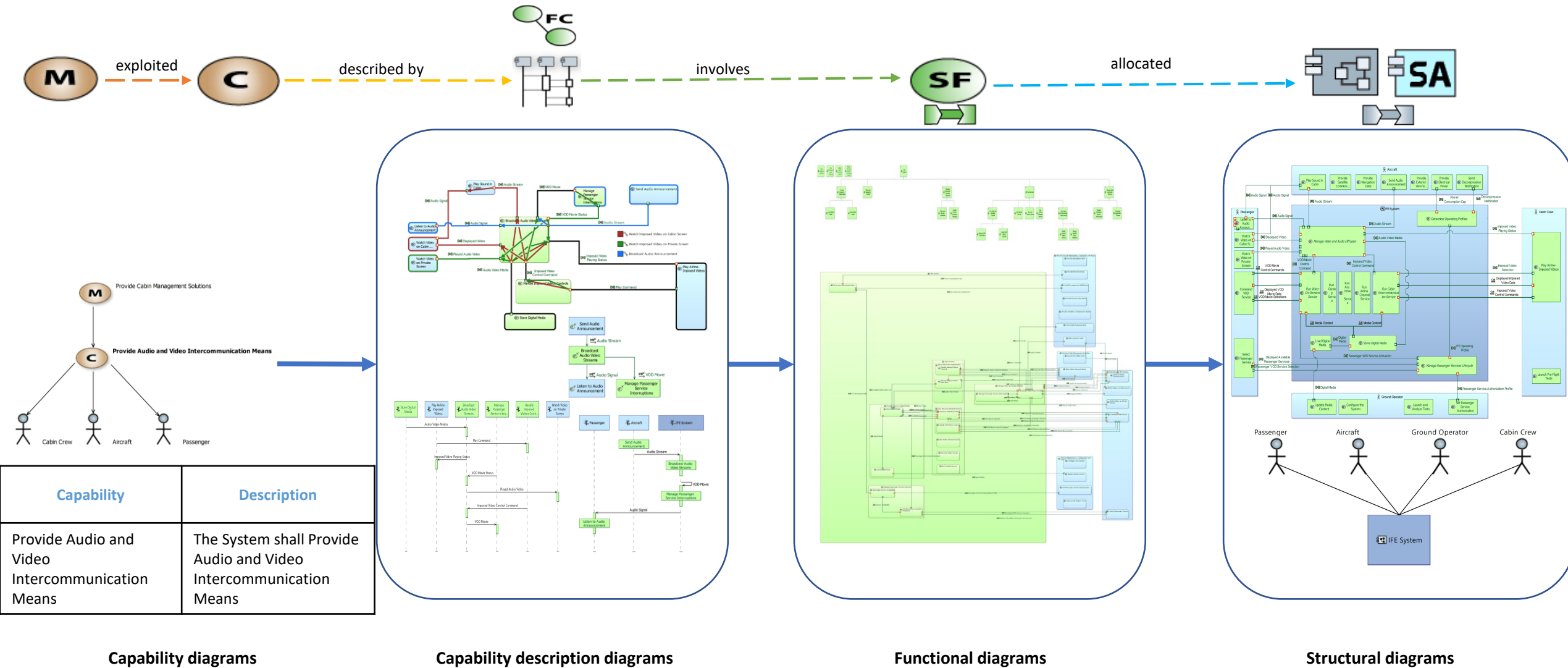
Automated transitions

A Capability can be described by:

- A Functional Chain.
- A Functional Chain can be transitioned (Capella tool capability) to a Functional Scenario.
- A Functional Scenario can be transitioned (Capella tool capability) to an Entity Scenario.



System Analysis traceability



[MCB] Mission and Capabilities Blank
[CC] Contextual Capability

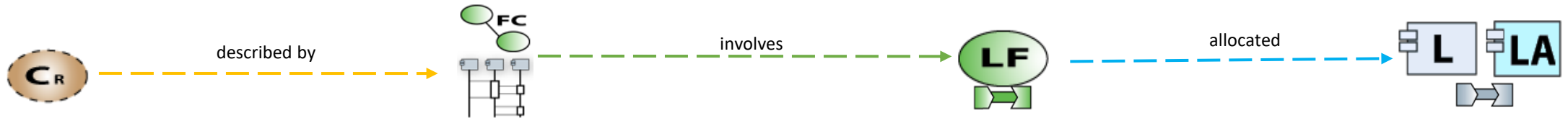
[FS] System Functional Scenario
[ES] System Entity Scenario
[SFC] System Functional Chain Description

[SFBD] System Functional Breakdown Diagram
[SDFB] System Data Flow Blank

[CSA] Contextual System Actor
[SAB] System Architecture Blank

Logical Analysis

“How the system should work”



Objectives and activities

- Define the principles underlying the system behaviour.
- Build component-based system structuring alternatives.
- Select the architecture alternative offering the best compromise.

Outcomes and value

- Traceability ensured from System Analysis to Logical Analysis.
- System behaviour how system should work defined.
- Logical components defined and ready for reuse in future projects.
- Logical architecture independent of a physical solution or technological decisions.

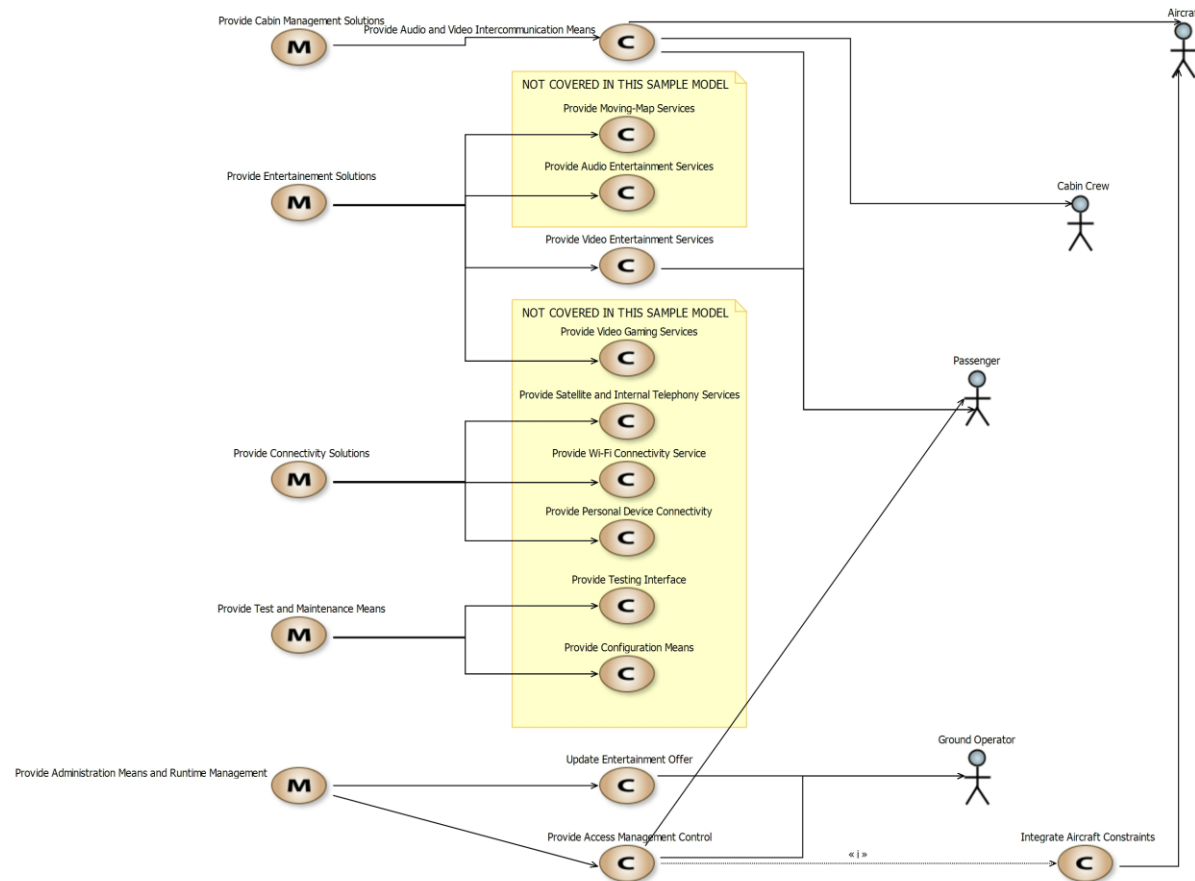
Logical Architecture steps

Step	Diagram	Modelling activities
Step 1	CRB	Transition Capabilities Realization from System Analysis layer
Step 2	LFBD	Derive System Functions in Logical Architecture Functions
Step 3	LDFB	Identify Functional Exchanges and delegate transitioned parent functions
Step 4	LCBD	Identify and define logical components
Step 4	LAB	Allocate Logical Functions to Logical Components
Step 5	LFCD FS ES	Describe Capability Realizations with Functional Chains and Scenarios

Transition Capabilities Realization from system layer

Activities

- Transition System Capabilities and create Capabilities Realization Blank diagram.
- Represent and involve actors with Capability Realization



[MCB] Mission Capabilities Blank

[CRB] Capabilities Realization Blank

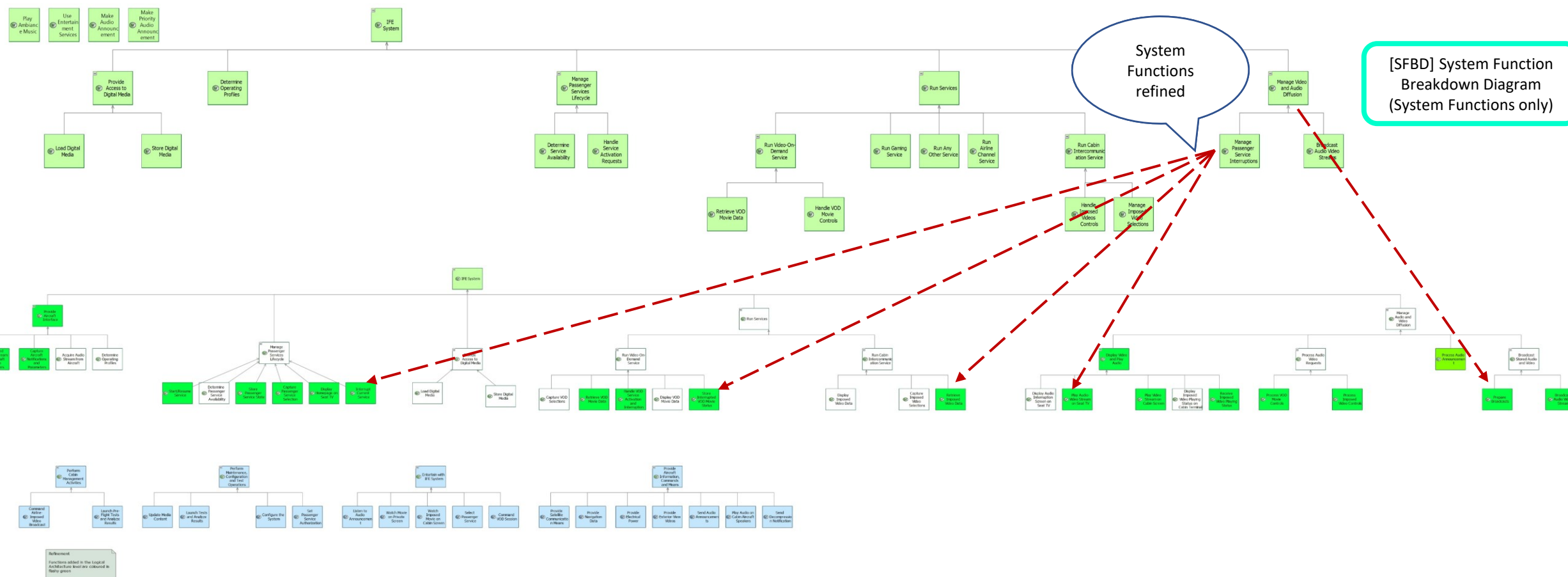
Refine system functions into Logical Functions

Modelling activities

- Refine System Functions in Logical Functions.
- Identify containments (hierarchy).
- Update this diagram when new functions added during the logical architecture design.

Capella modelling actions

- Transition System Functions
- In the LFBD, change the transitioned system functions background to white, it will help to identify which functions were captured at system layer and transitioned to the logical layer.



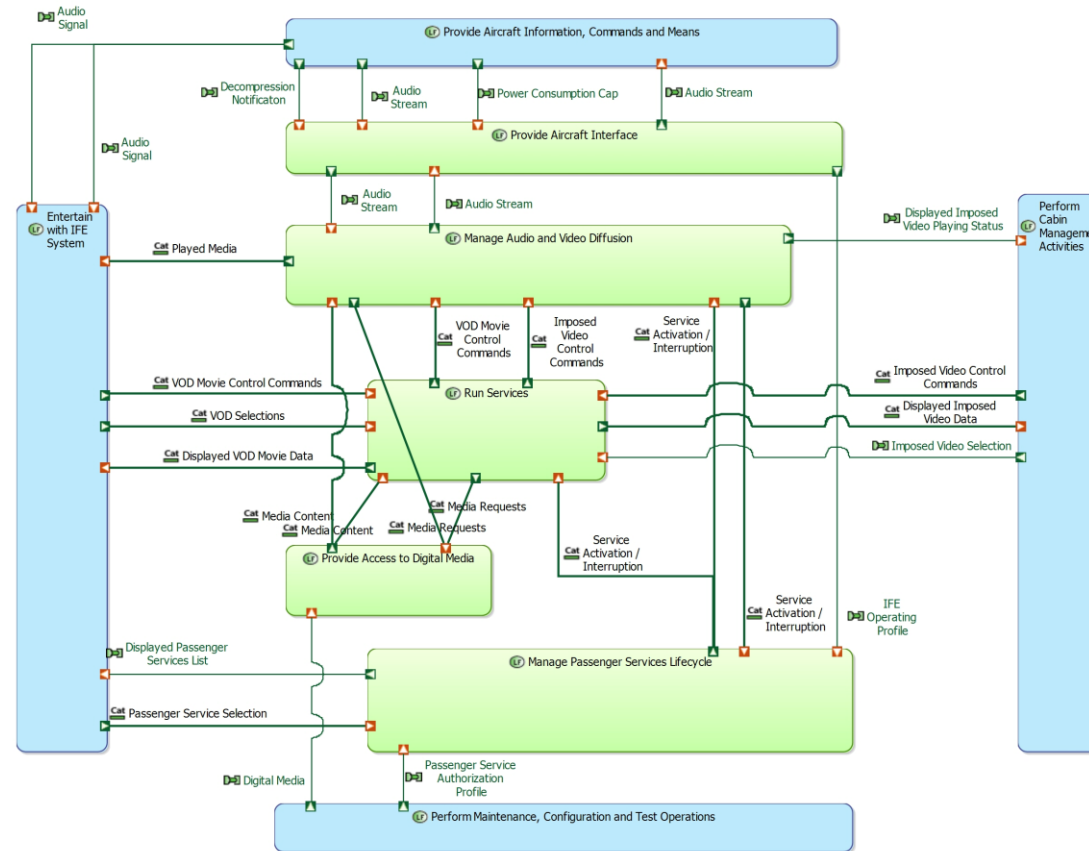
Identify Functional Exchanges and delegate transitioned parent functions

Activities

- Identify Functional Exchanges between Logical Functions.
- Diagrams can be created and focused in one aspect of the behaviour, for example to describe a capability realization.

Capella modelling actions

- System functions will be decomposed in more detail at logical layer. Do not forget to delegate (i.e., move) function ports from a transitioned system function to the correspondent logical decomposed child function.



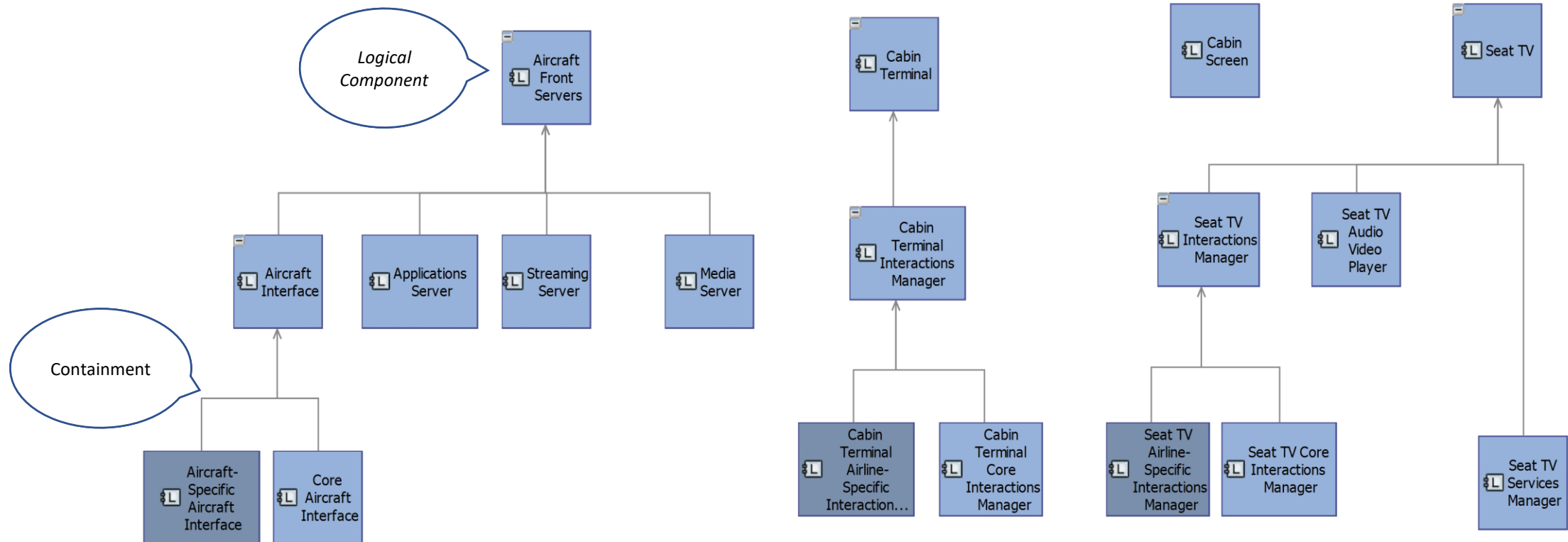
Identify and define logical components

Activities

- Identify and define logical components.
- Identify logical components containments.

Modelling tips

- Logical components implement functions that work together to achieve a common goal within a component.
- The important rule to comply with is to force ourselves to exclude all technological considerations or implementation choices.
- The functional analysis performed at this stage should not be regarded as a simple refinement of the SA, but as the result of the system design in terms of its behaviour in response to this need.



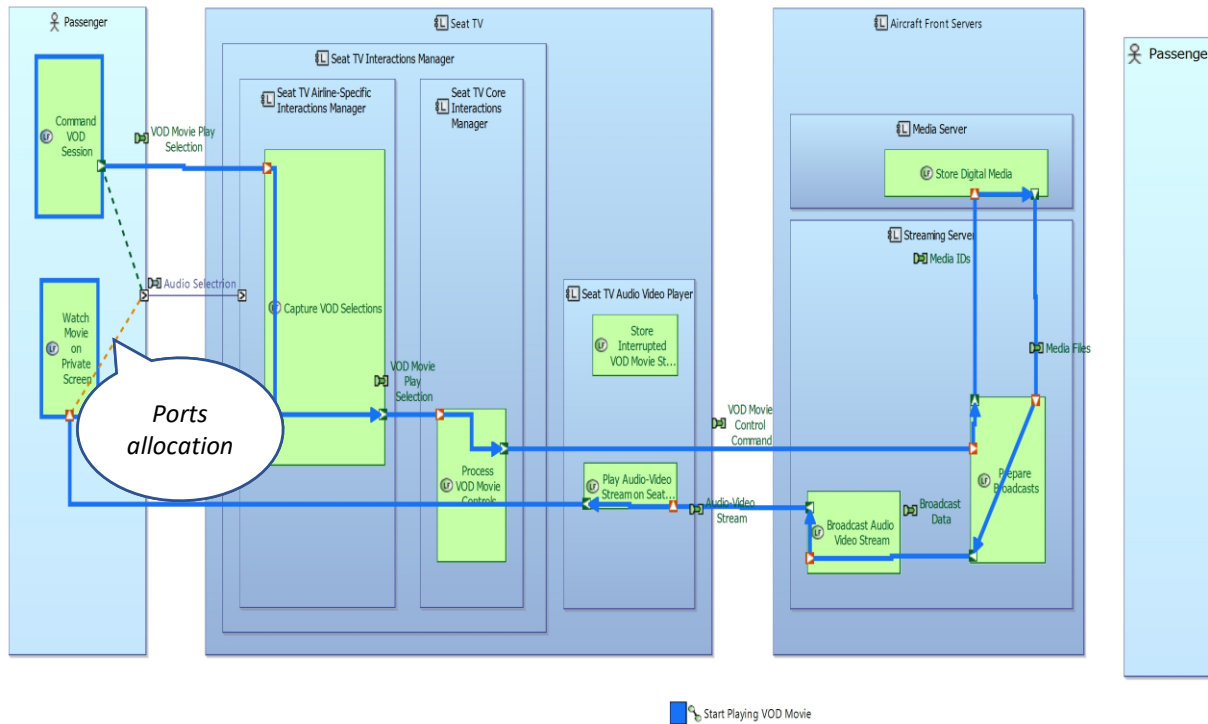
Allocate Logical Functions to Logical Components

Activities

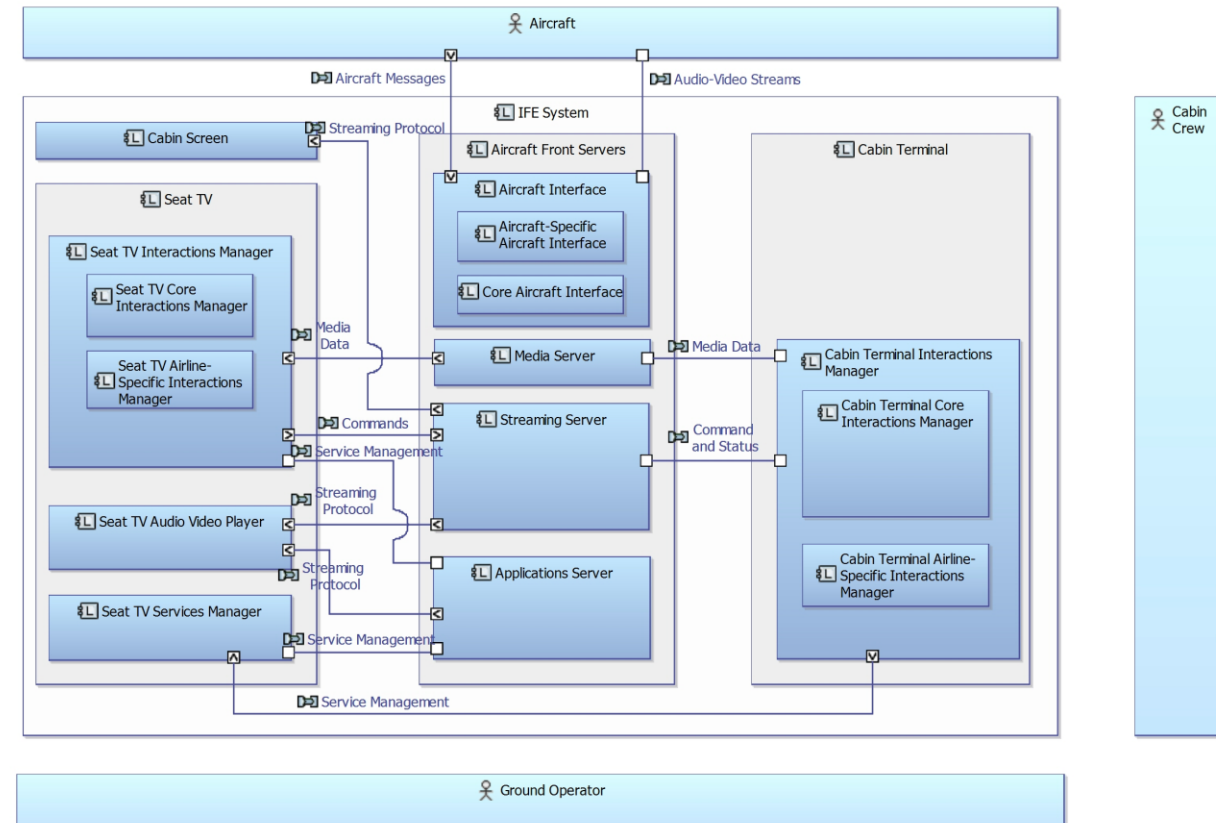
- Allocate Logical Functions to Logical Components.
- Define Components Exchange
- Allocate Function Ports to Component Exchange.

Modelling tips

- When components exchanges are defined, it can applied the filter: “Hide functions” to show in the diagram components exchanges only.



[LAB] Logical Architecture Blank



[LAB] Logical Architecture Blank – showing components exchanges only

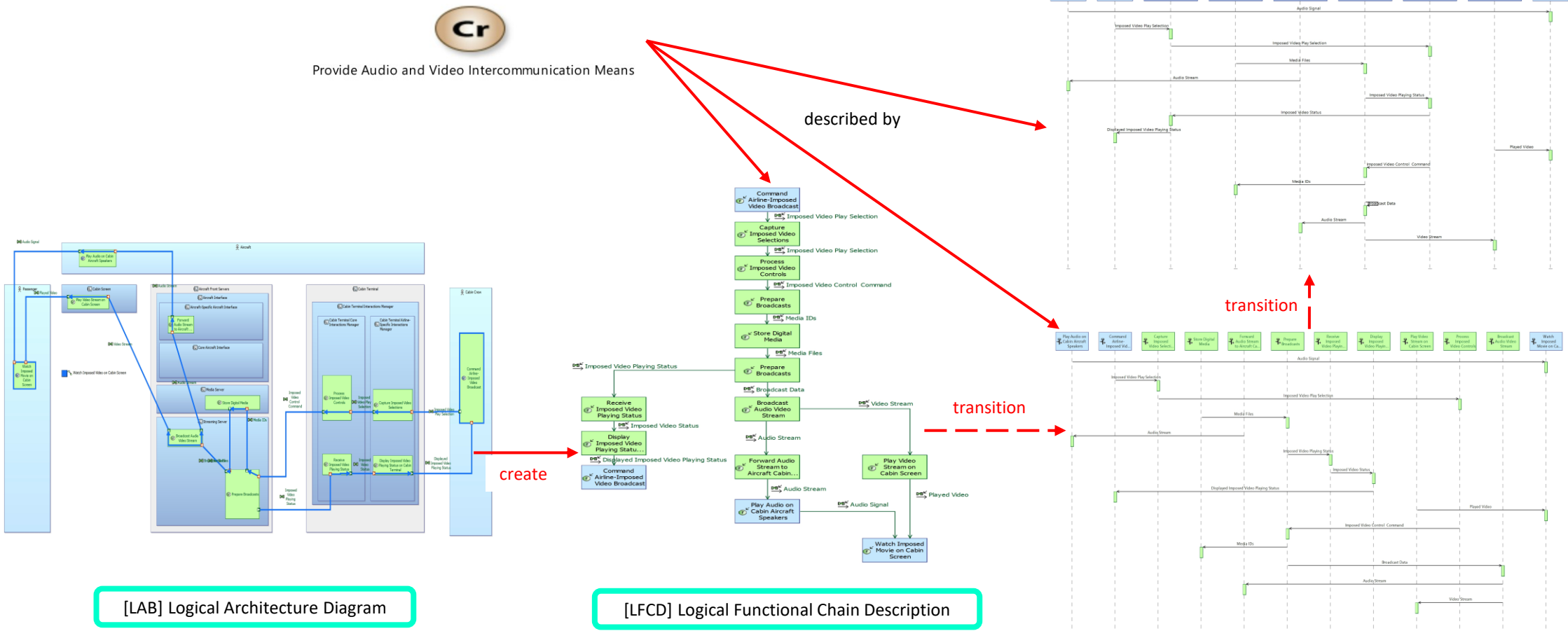
Describe Capability Realizations with Functional Chains and Scenarios

Activities

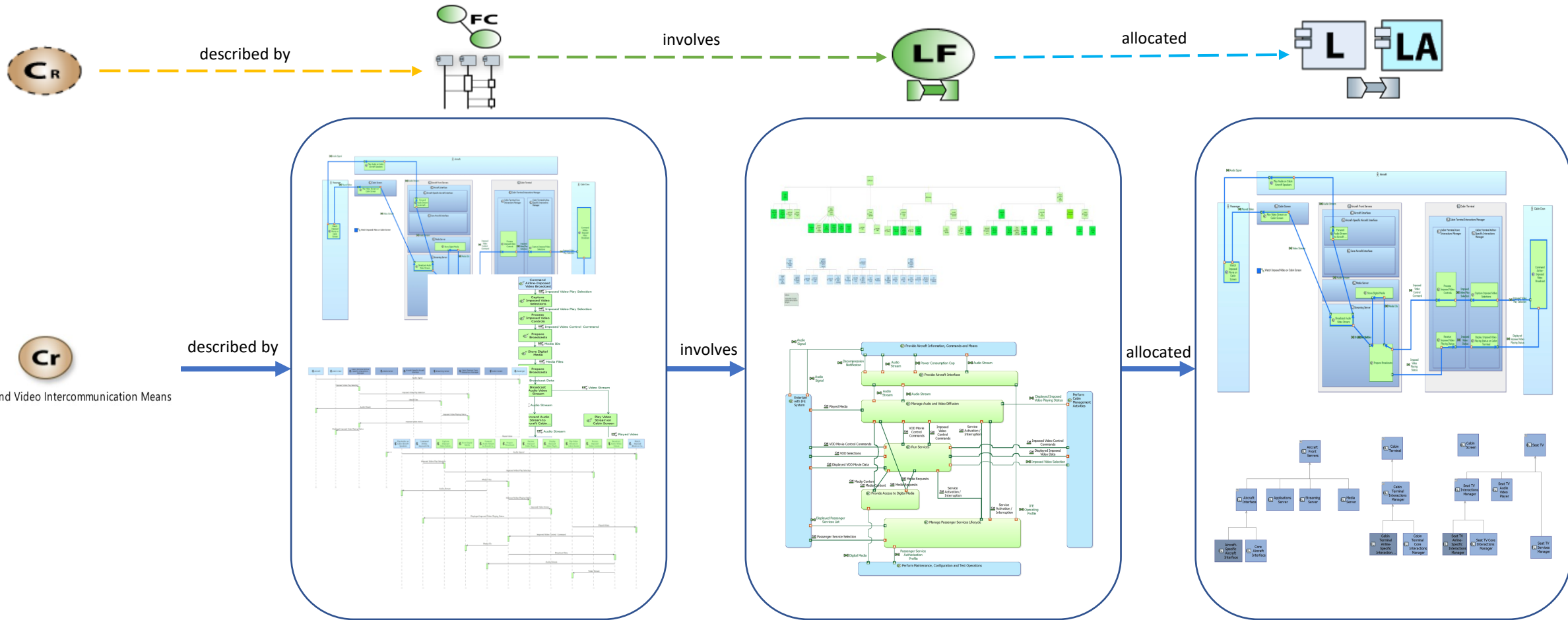
- Similarly to System analysis layer, identify functions involved in a functional chain that describes a Capability Realization.
- Create a new Logical Functional Chain Description Diagram.
 - Transform Logical Functional Chain Diagram to a Functional Scenario.
 - Transform a Functional Scenario to an Entity Scenario.

Modelling tips

- Transitioned functional chains might need to be “reconstructed” as the system functions were decomposed at logical architecture and functional chains might have turned as invalid. Leaf functions captured at System level not the same as logical architecture.



Logical Architecture traceability



Capability diagrams

Capability description diagrams

Functional diagram

Structural diagrams

[CRB] Capabilities Realization Blank
[CRI] Contextual Capability Realization Involvement

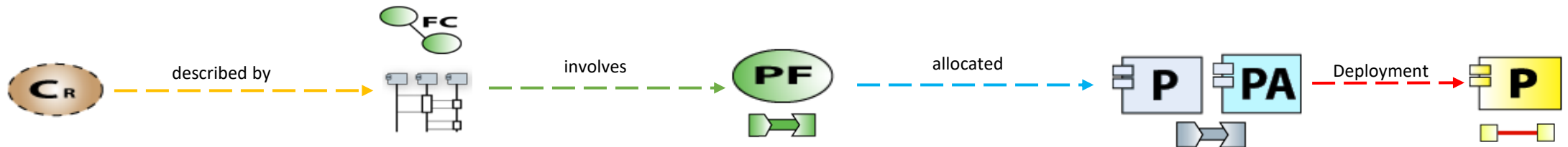
[FS] Logical Functional Scenario
[ES] Entity Scenario
[LFCD] Logical Functional Chain Description

[LFBD] Logical Functional Breakdown Diagram
[LDFB] Logical Data Flow Blank

[LCBD] Logical Component Breakdown Diagram
[LAB] Logical Architecture Blank

Physical Architecture

“How the system should be built”



Objectives and activities

- Detail and finalize the expected system behaviour.
- Build and rationalise one or more possible system architectures.
- Refine Logical Functions to support Physical Architecture.
- Define new Behavioural Node Components.
- Identify and define Physical Node Components.
- Allocate physical leaf functions to Behavioural Node Components.
- Deploy Behavioural Node Components in Physical Node Components

Outcomes and value

- Traceability ensured from Logical Architecture layer to Physical Architecture layer.
- Behavioural Node Components defined and deployed.
- Final physical architecture solution defined.
- Identified physical exchanges and interfaces

Physical Architecture steps

Step	Diagram output	Step description
Step 1	CRB	Transition Capabilities Realization from logical layer
Step 2	PFBD	Refine logical functions into physical functions
Step 3	PDFB	Identify Physical Functional Exchanges
Step 4	PCBD	Identify and define behavioural and physical nodes
Step 5	PAB	Allocate Functions to Behavioural Nodes and deploy Physical Nodes Components
Step 6	PFCD FS ES	Describe Capability Realizations with Functional Chains and Scenarios
Step 7	CDB	Describe the content of exchanges between functions
Step 8	CDI	Delegate Logical Interfaces and create Physical Interface
Step 9	CID	Create and show exchange items
Step 10	IDB	Show produced and consumed exchange items
Step 11	IS	Define Interface Scenarios

Transition Capabilities Realization from logical layer

Activities

- Transition Logical Capabilities Realization and create Capabilities Realization Blank diagram.
- Represent and involve actors with Capability Realization



[CRB] Capabilities Realization Blank – logical layer

[CRB] Capabilities Realization Blank – physical layer

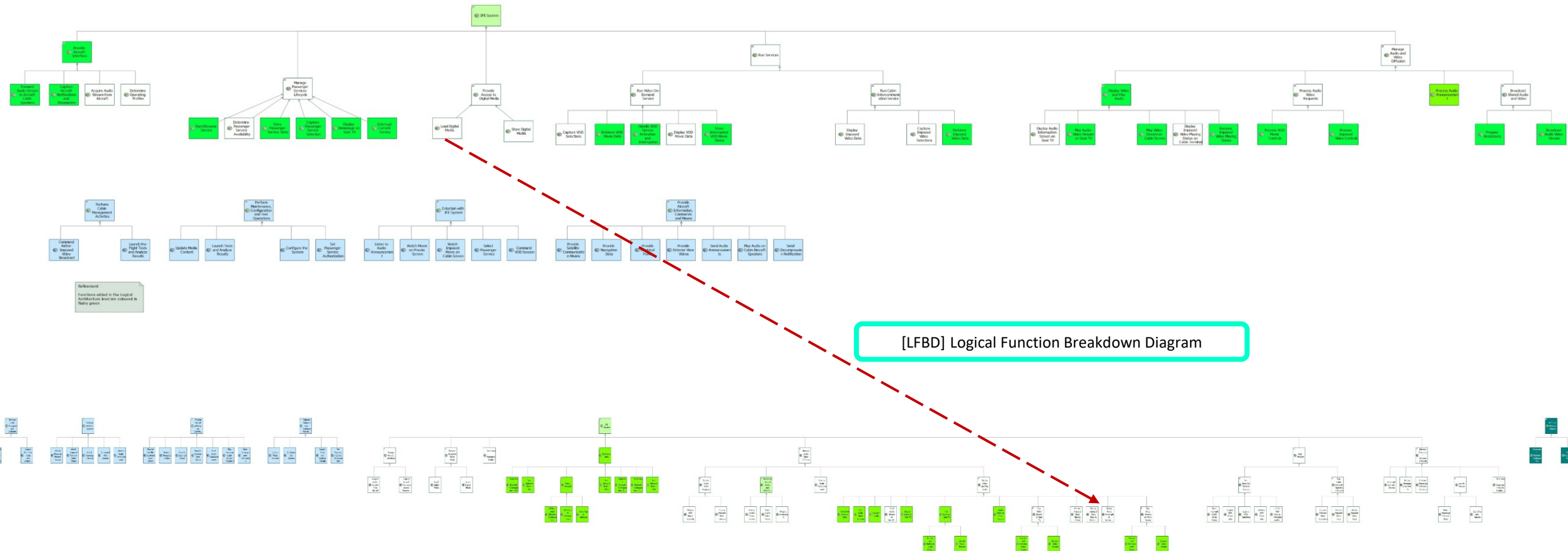
Refine logical functions into physical functions

Activities

- Transition and refine, where needed, Logical Functions in Physical Functions.
- Identify containments (hierarchy).
- Update this diagram when new functions added during the logical architecture design.

Modelling tips

- Similar approach applied in the LFBD to the PFBD, change the transitioned logical functions background to white, it will help to identify which functions were captured at logical layer and transitioned to the physical layer.



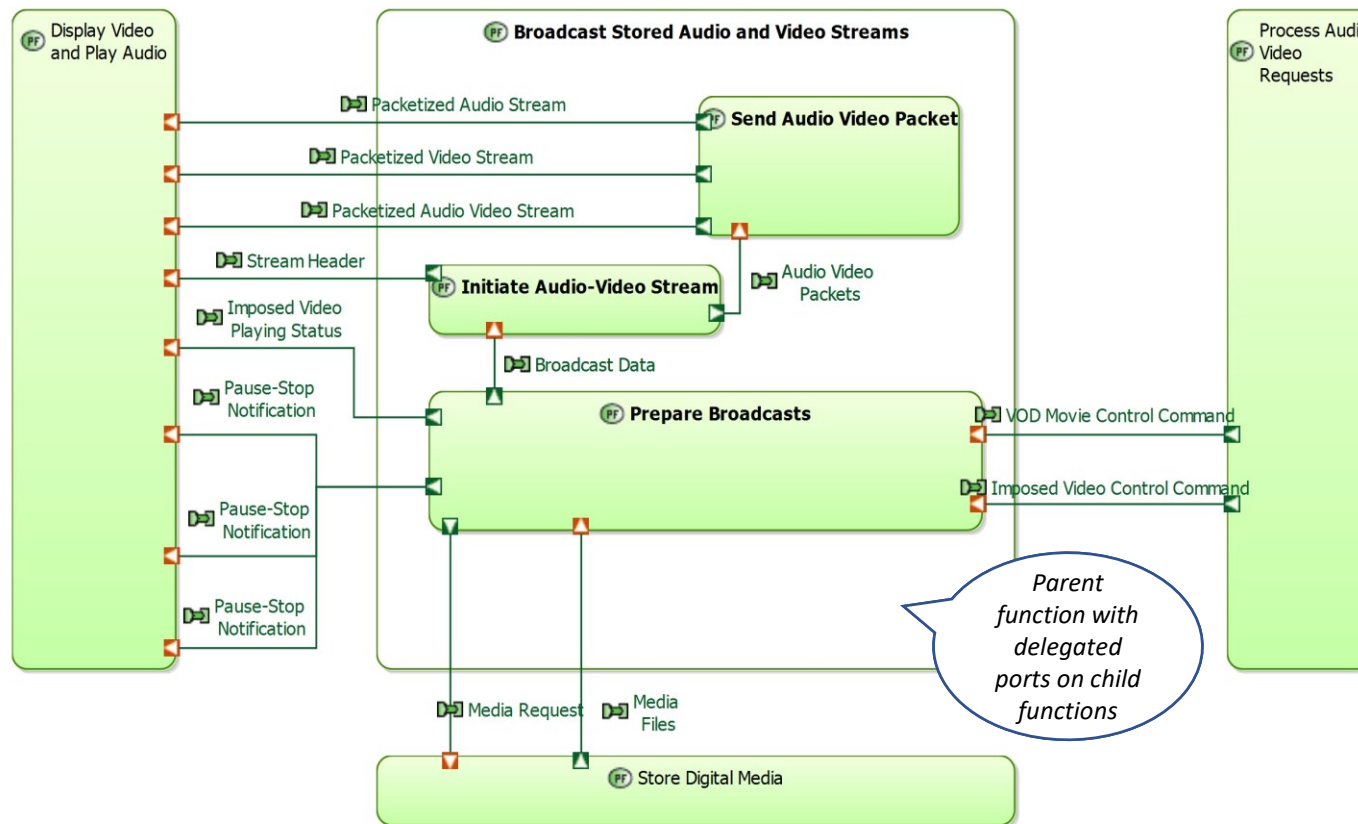
Identify Physical Functional Exchanges

Activities

- Identify Functional Exchanges between Physical Functions.
- Diagrams can be created and focused in one aspect of the behaviour, for example to describe a capability realization.

Modelling tips

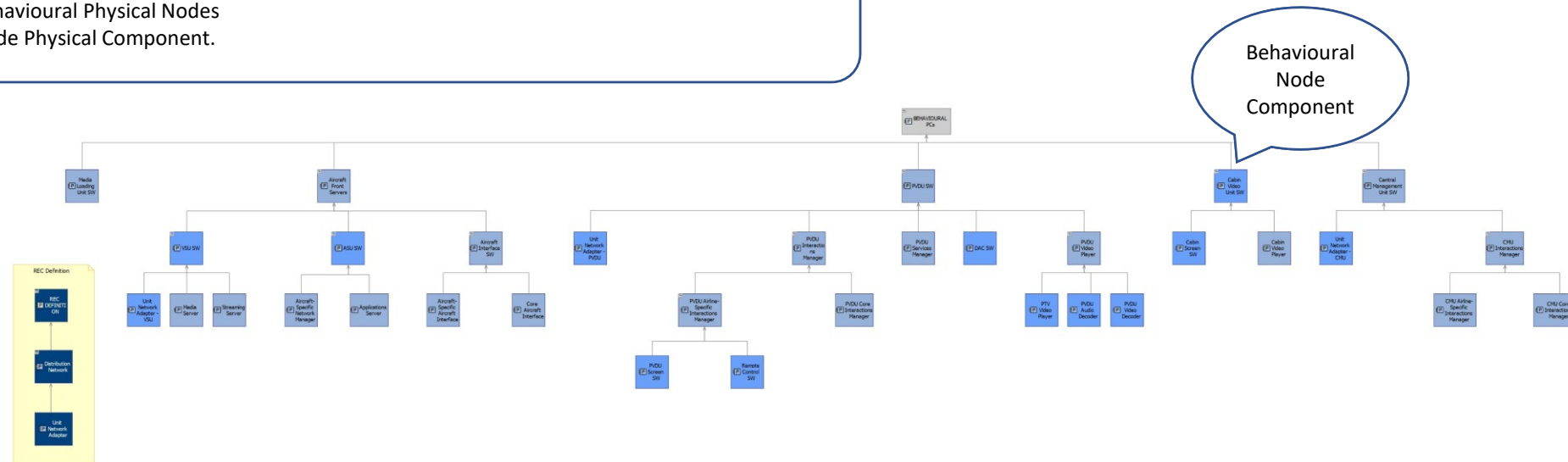
- Logical functions can be decomposed in more detail at physical layer. Do not forget to delegate (i.e., move) function ports from a transitioned system function to the correspondent physical decomposed child function.



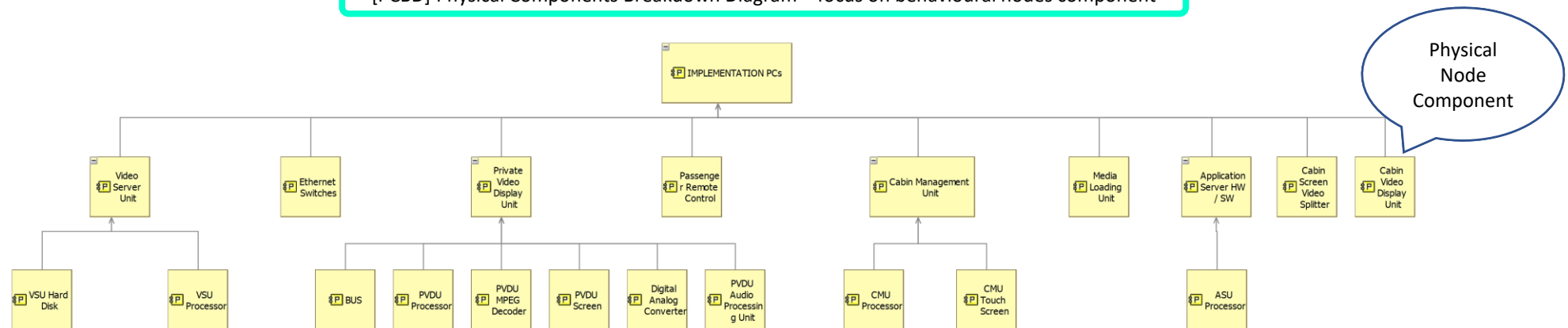
Identify and define behavioural and physical nodes

Activities

- Identify and define Behavioural Physical Nodes
- Identify and define Node Physical Component.



[PCBD] Physical Components Breakdown Diagram – focus on behavioural nodes component

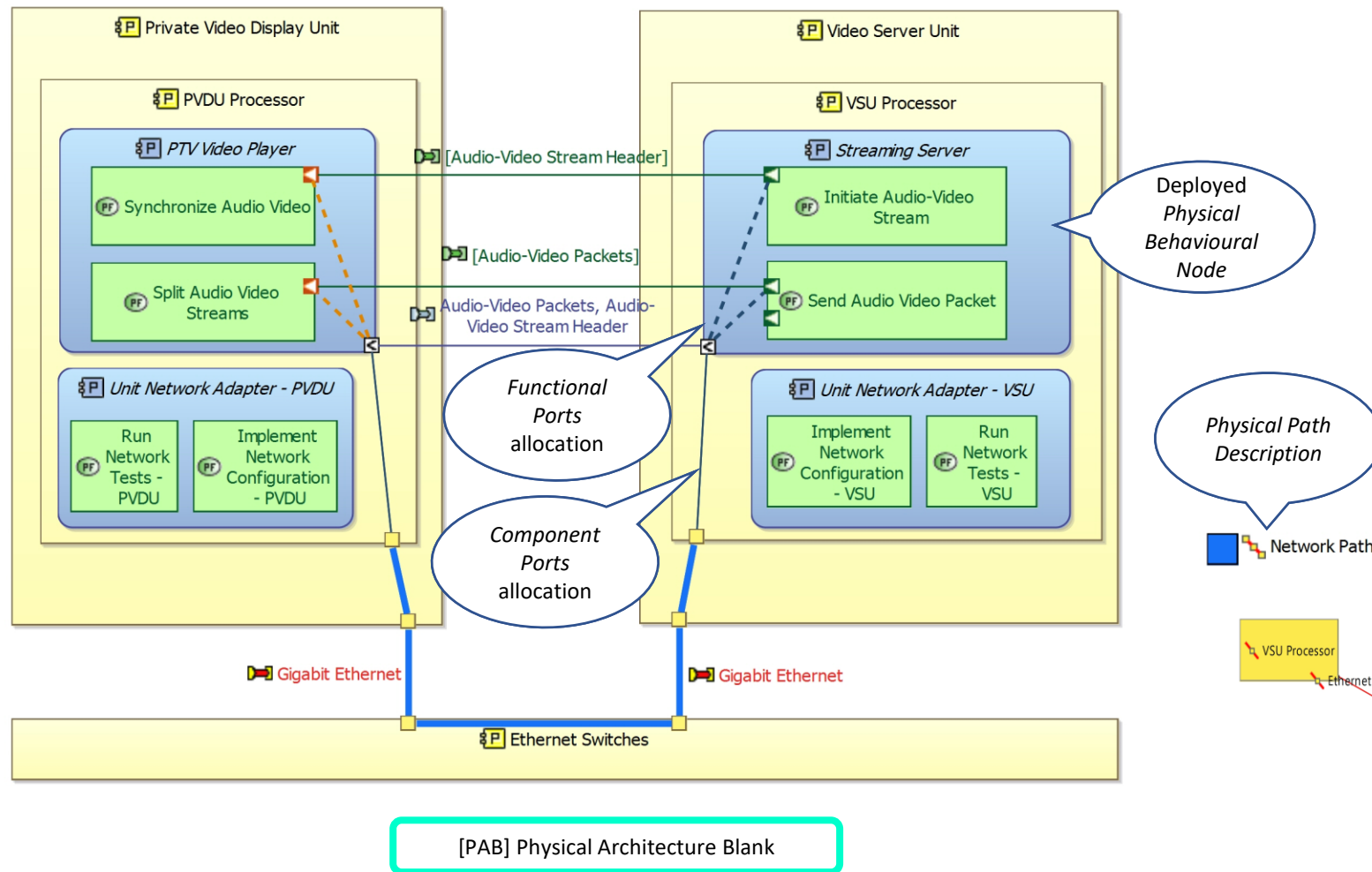


[PCBD] Physical Components Breakdown Diagram – focus on physical nodes component

Allocate Functions to Behavioural Nodes and deploy Physical Nodes Components

Activities

- Allocate Physical Functions to Behavioural Nodes Components.
- Define Behavioural Physical Components Exchange.
- Deploy Behavioural Physical Components in Physical Nodes Components.
- Allocate Functional Ports to Component Exchange AND Component Exchanges to Physical Ports.



[PPD] Physical Path Description

Describe Capability Realizations with Functional Chains and Scenarios

Similarly activity to previous system and logical layers:

1. Create a new Logical Functional Chain Description Diagram.
2. Transform Logical Functional Chain Diagram to a Functional Scenario.
3. Transform a Functional Scenario to an Entity Scenario.

Activities



Provide Audio and Video Intercommunication Means

described by

transition

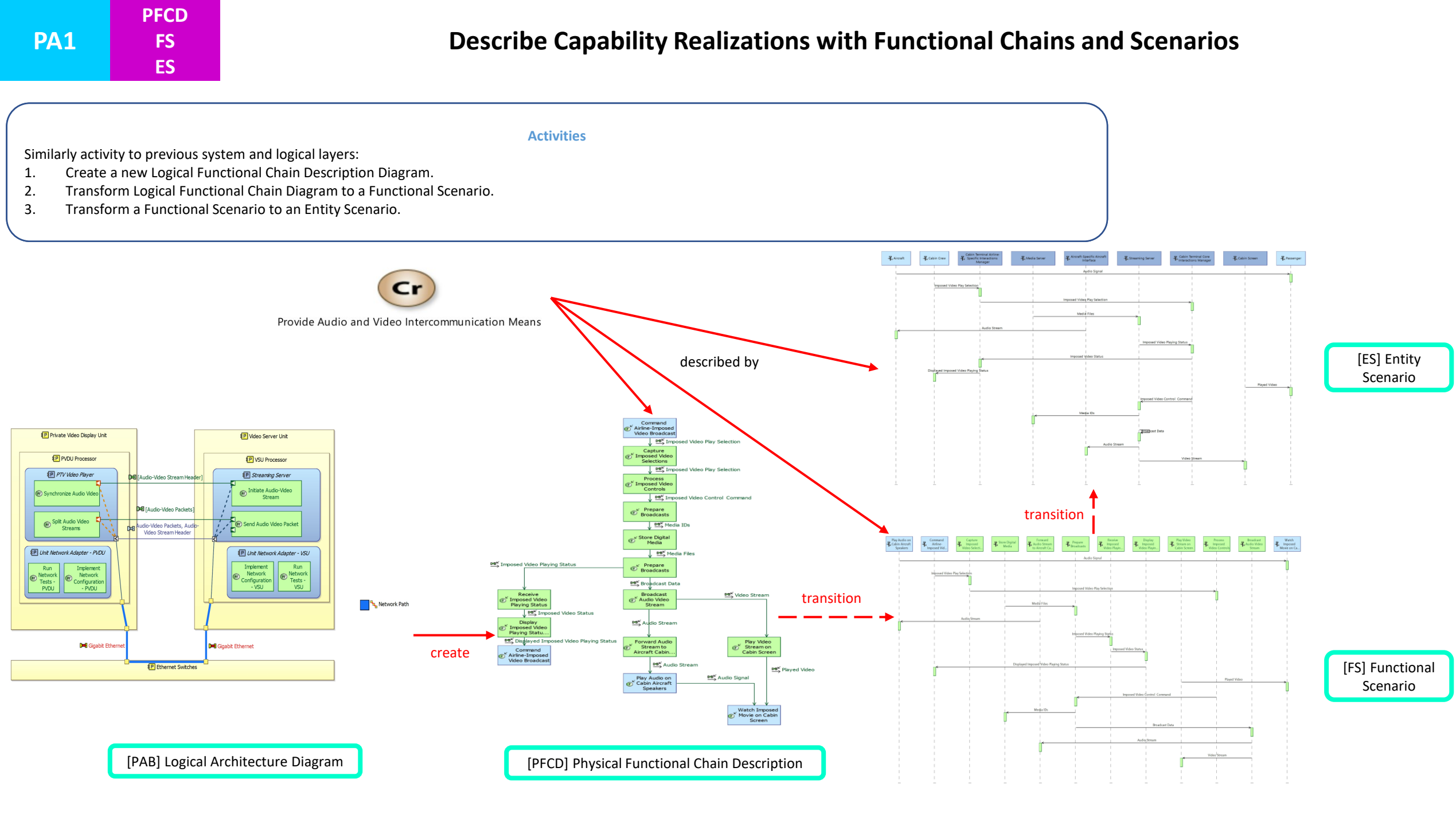
transition

[ES] Entity
Scenario

[FS] Functional
Scenario

[PAB] Logical Architecture Diagram

[PFCD] Physical Functional Chain Description

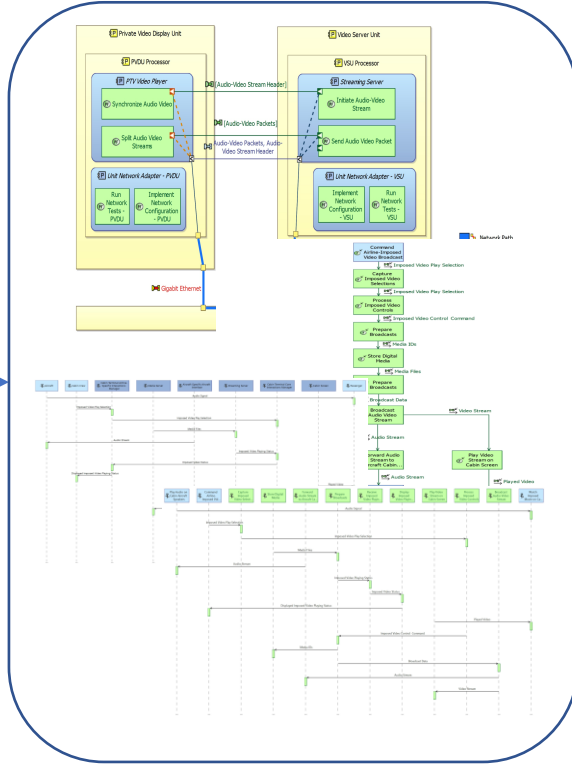


Physical Architecture traceability

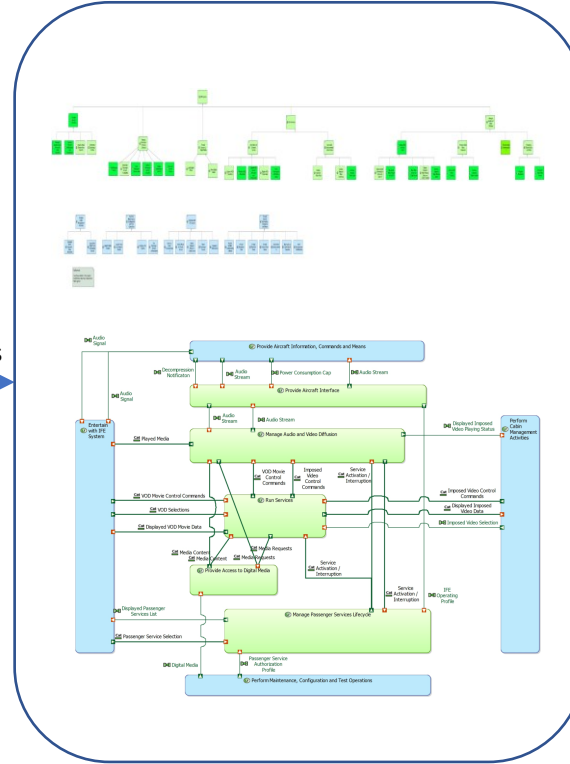


Provide Audio and Video Intercommunication Means

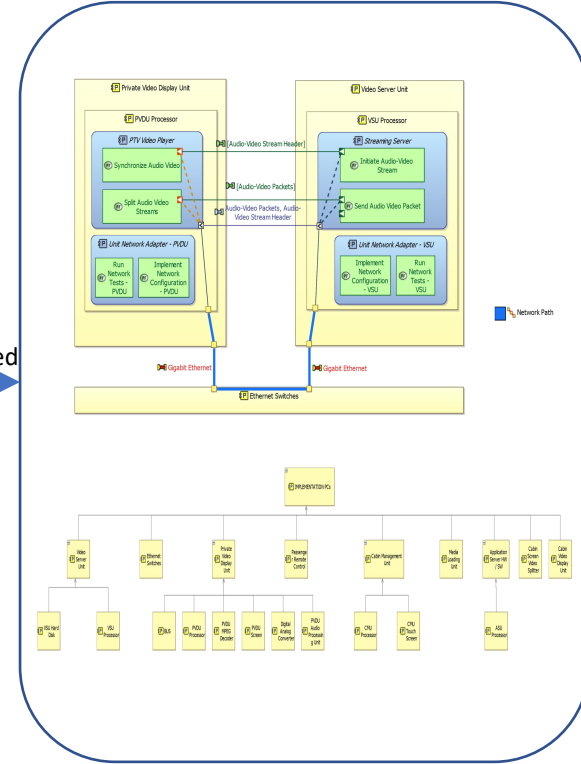
described by



involves



allocated



Capability diagrams

Capability description diagrams

Functional diagrams

Structural diagrams

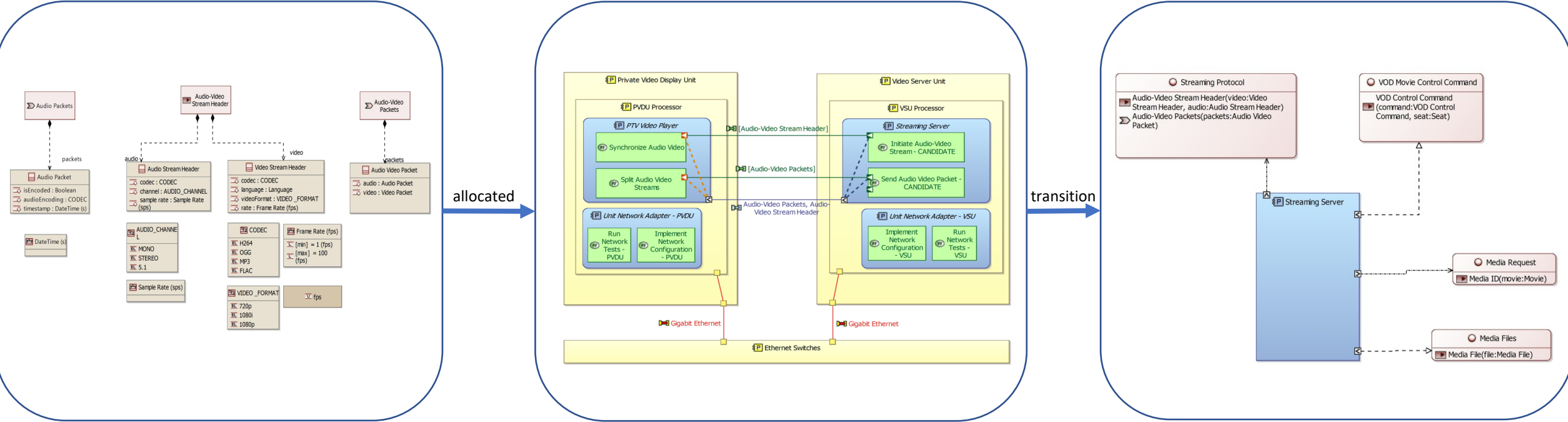
[CRB] Capabilities Realization Blank
[CRI] Contextual Capabilities Realization Involvement

[FS] Physical Functional Scenario
[ES] Physical Entity Scenario
[PFCD] Physical Functional Chain Description

[PFBD] Physical Functional Breakdown Diagram
[PDFB] Physical Data Flow Blank

[PCBD] Physical Component Breakdown Diagram
[PAB] Physical Architecture Blank

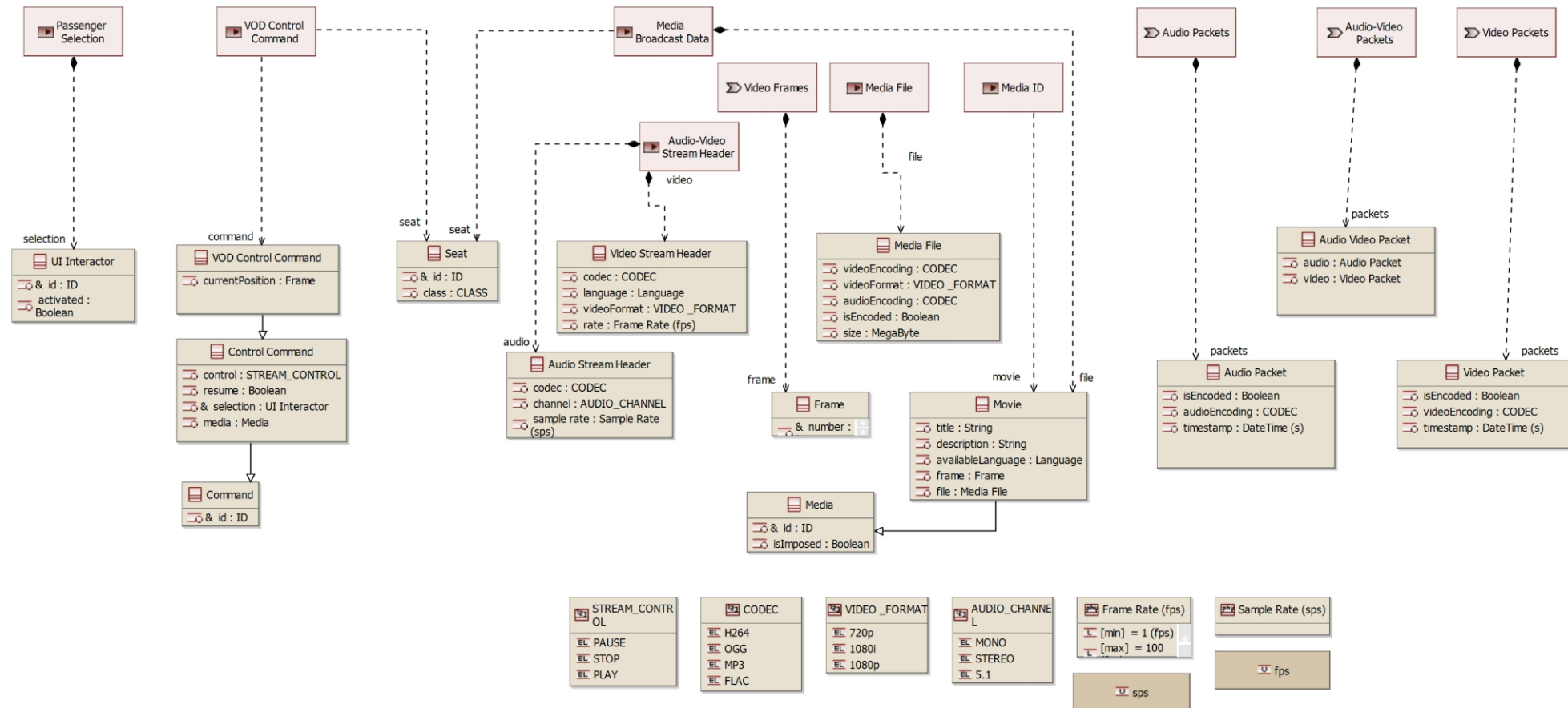
Data models diagrams



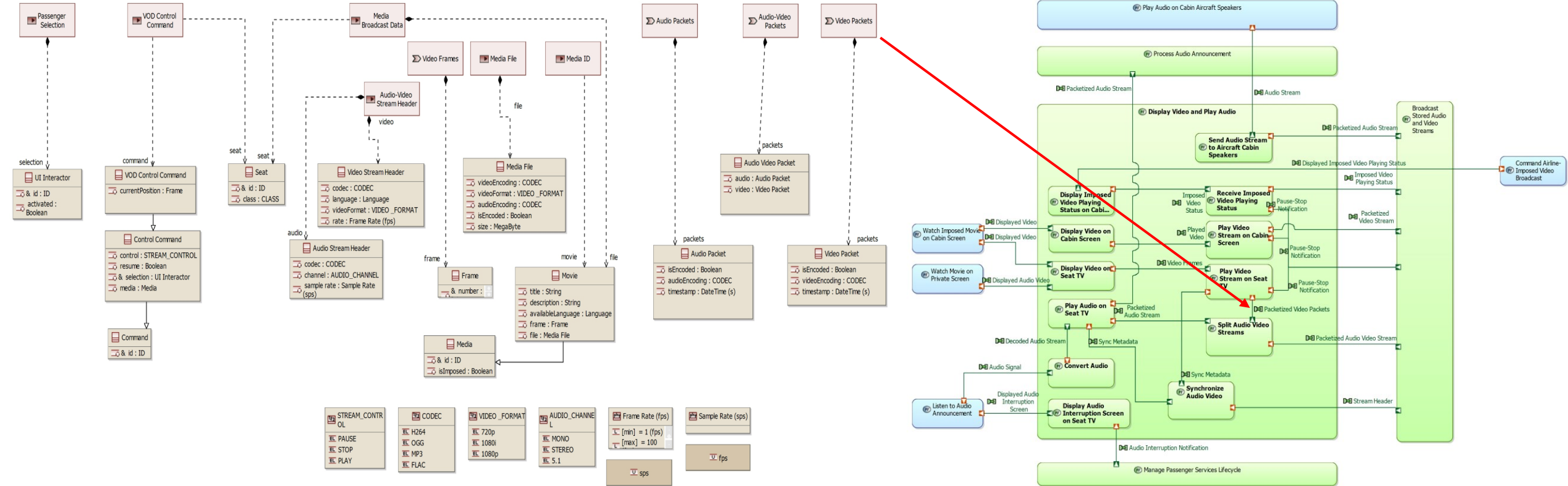
Describing functional exchanges content

Activities

- Define data exchanged in the functional exchanges.
- Define Exchange Items associated to each Class.



Allocate Exchange Item to Functional Exchange



[CDB] Class Data Blank

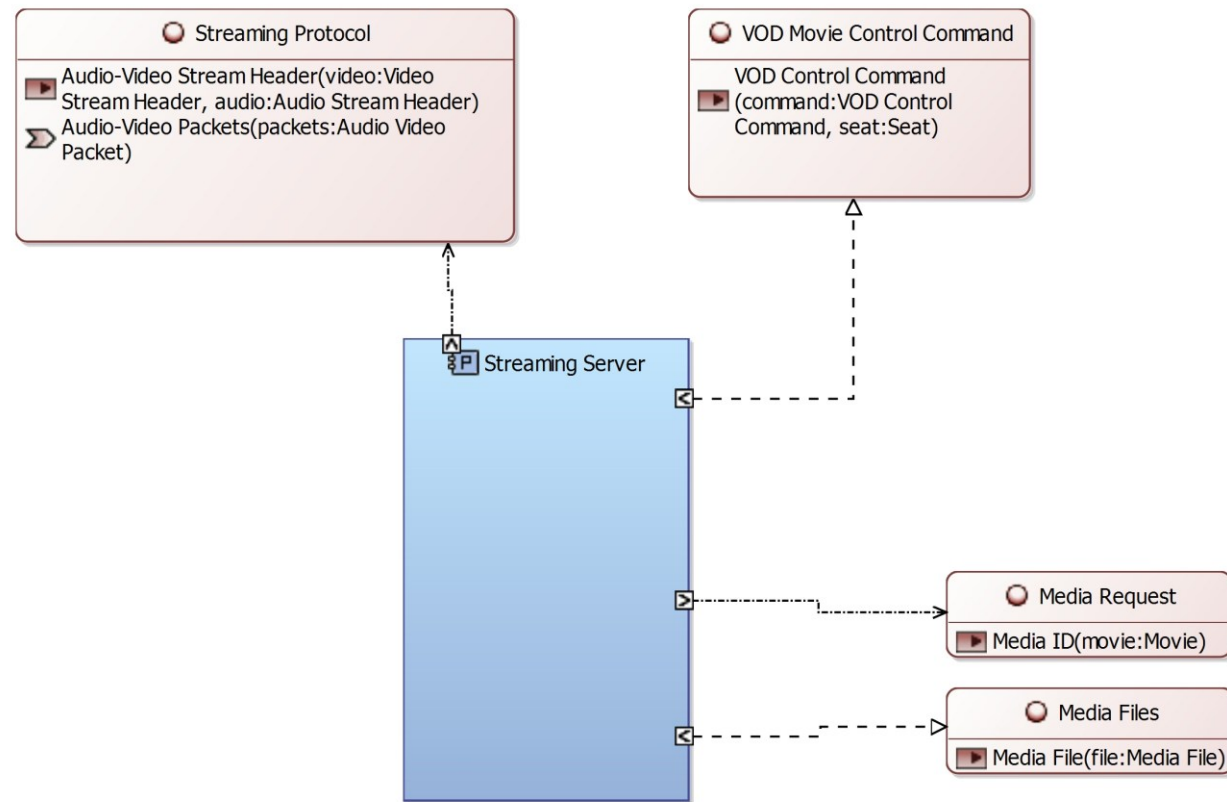
[PDFB] Physical Data Flow Blank

Interfaces diagrams

Delegate Logical Interfaces and create Physical Interface

Activities

- Captures all the interfaces of a component as well as their Contained Exchange Items

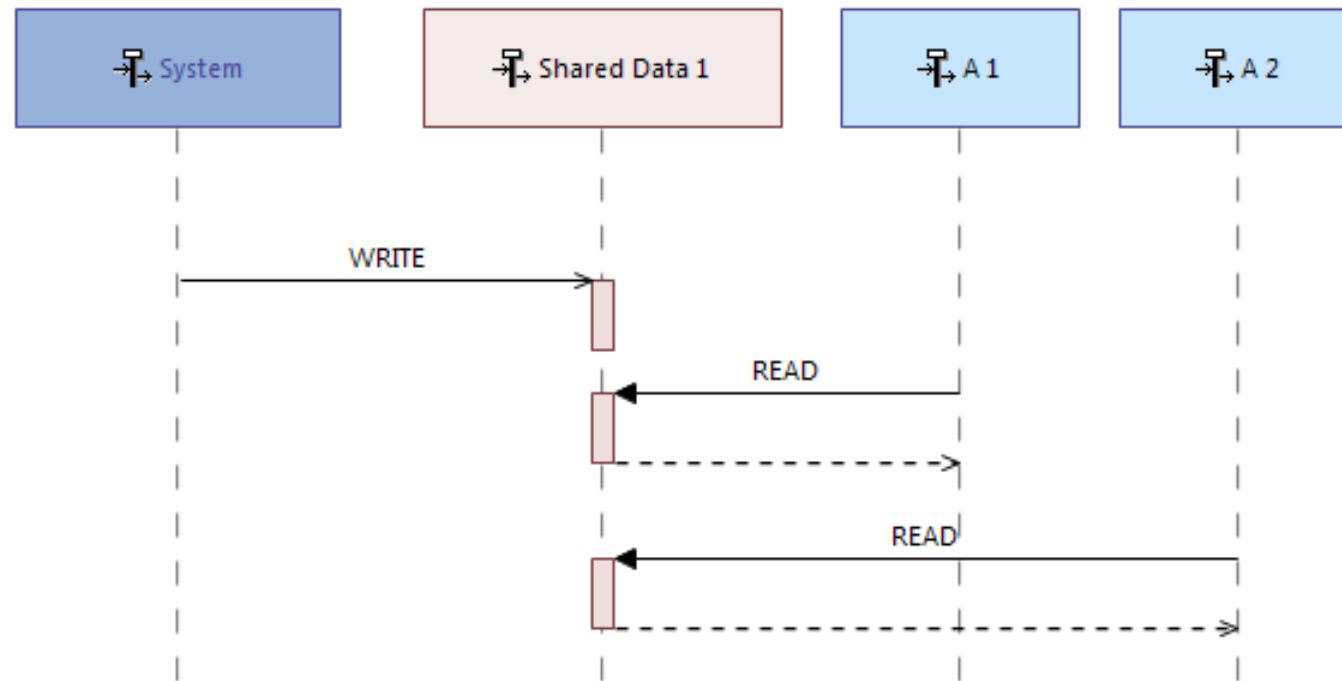


[CDI] Contextual Detailed Interface

Define Interface Scenario

Activities

- Create Interface Scenario

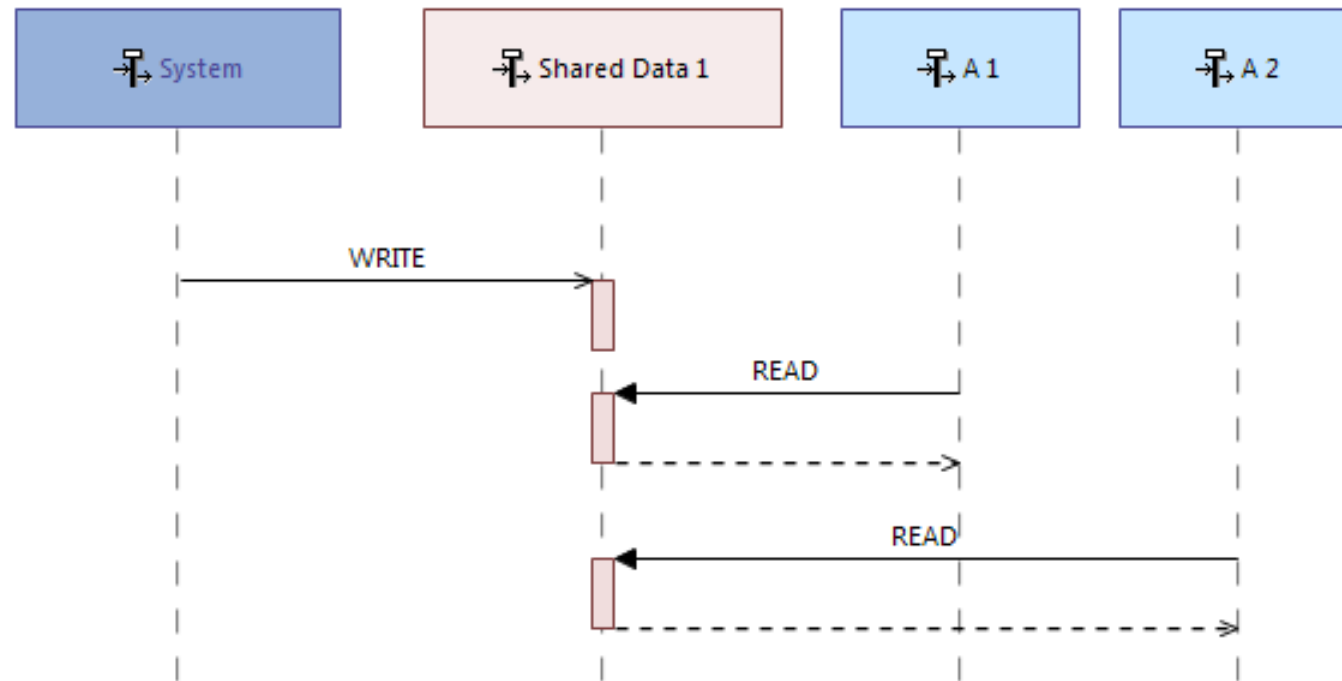


[IS] Interface Scenario

Define Interface Scenario

Activities

- Create Interface Scenario



[IS] Interface Scenario

Online references

Online references:

- Following the links on this slides (underlined), it can be found extended explanation of this slides.
- All MBSE with Arcadia step-by-step can be found on this page: [MBSE Arcadia guide](#)
- See also the MBSE Arcadia matrix in use in Capella: [Navigate the MBSE Arcadia Matrix in Capella: Complete Diagram Index](#)

Visit the online content and show your support with a click ❤️

Thanks!!

Documents / resources (PDF format):

- MBSE with Arcadia step-by-step guide
- Capturing textual requirements in Capella handbook
- Visit: [resources](#)

Thanks!!