

Systematic Reuse Of Capella Assets with pure::variants – How to Capitalize on Your Assets

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Why MBSE?



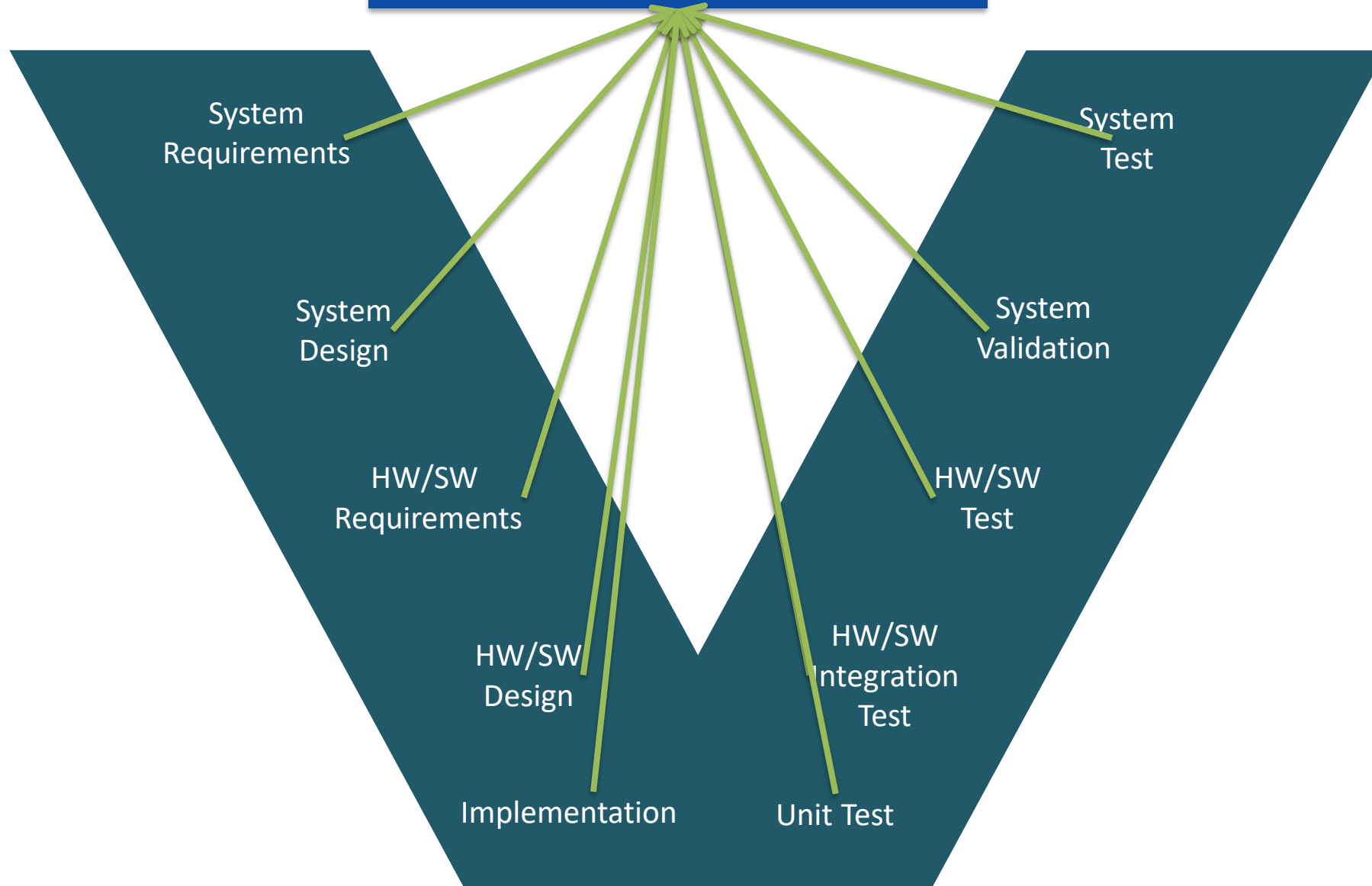
Why Reuse?



Variations Everywhere



Everything is potentially reusable





Reuse Complexity

Quick Time To Market

Engineering Efficiency

Best Solution: Use Product Line Engineering

High Quality

Match for Market Needs

How to do PLE with Capella?

It Is A Simple Equation

N x Similar Product Engineering

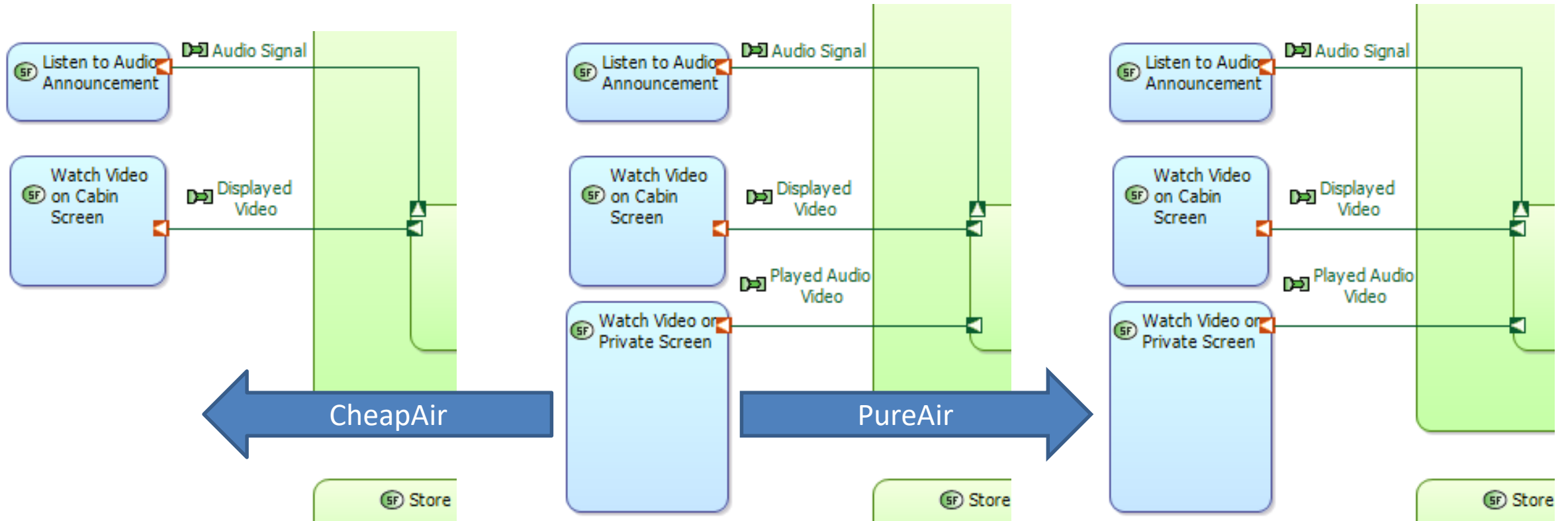


Systematic Variant Management

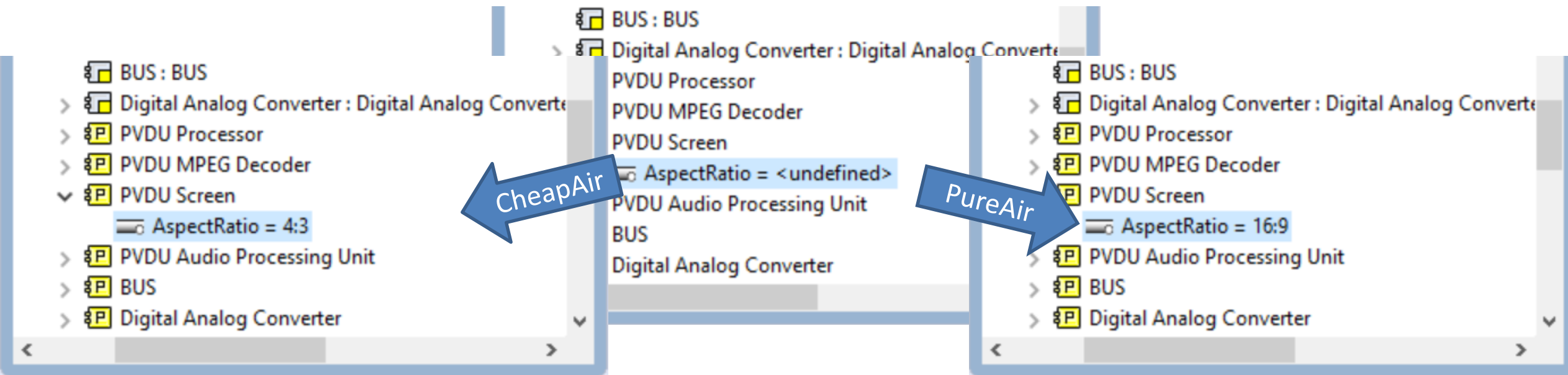


Product Line Engineering (PLE)

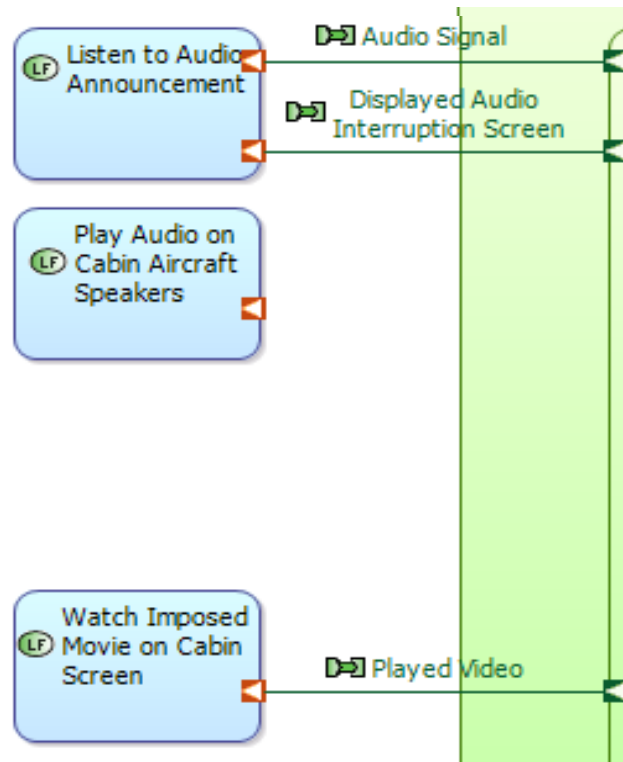
Basic Variation Concepts – Existence



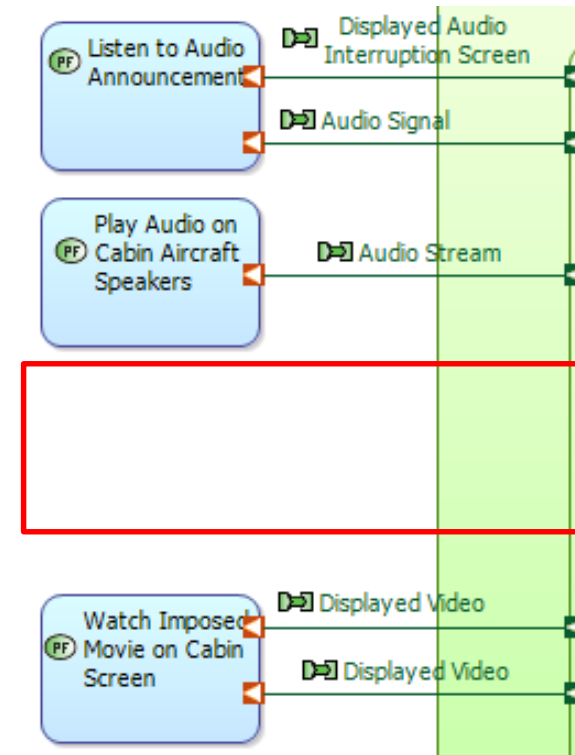
Basic Variation Concepts – Parametric Variation



Helpful Variation Concepts – Propagation



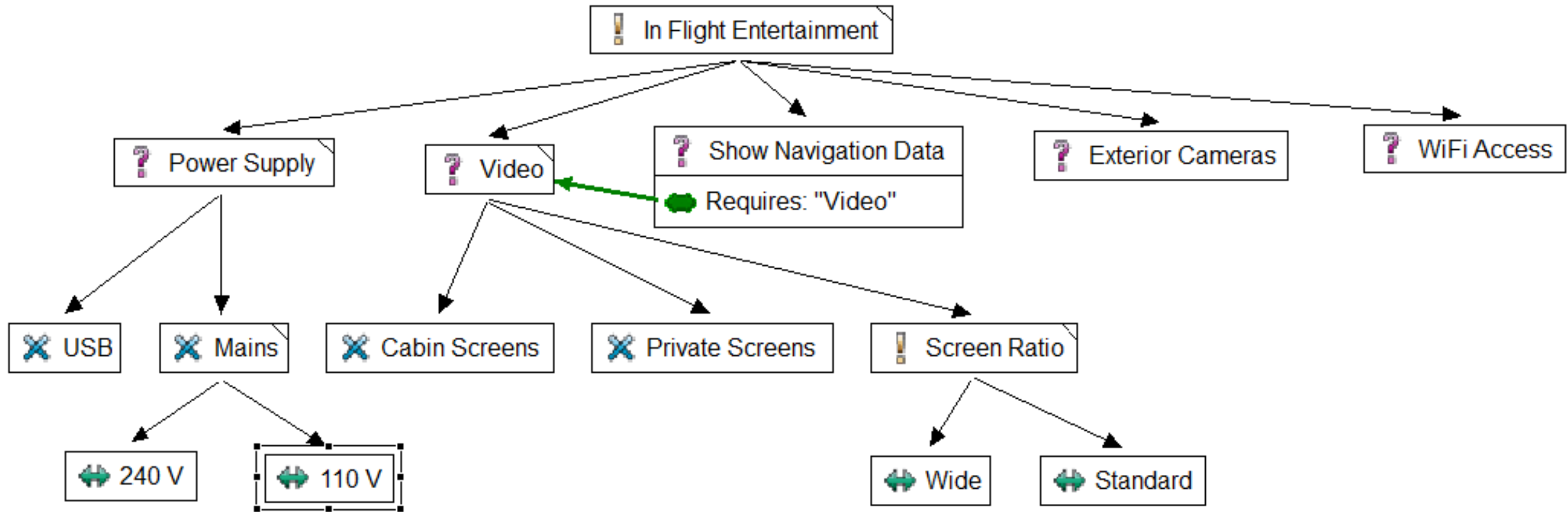
Logical Architecture



Physical Architecture

Controlling Variation with Feature Models

Feature Model – Inflight Entertainment Domain



Legend: ! = Mandatory ? = Optional ↔ = Alternative X = Or

From Feature Model to Variants

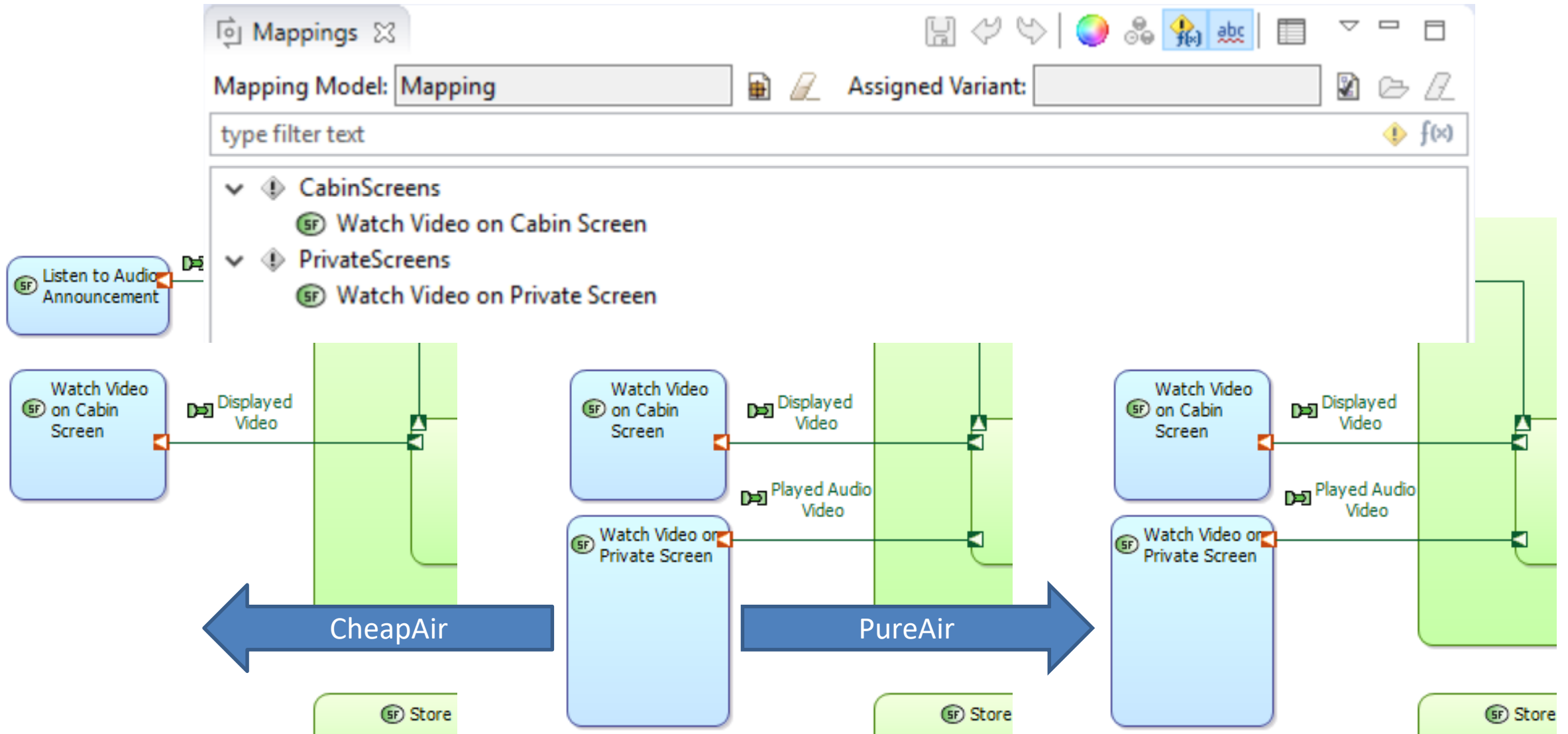
In-Flight Entertainment.xfm *InFlightVariability

Model Elements	Level	CheapAir	PureAir
[-] InFlightVariabilityFeatures			
[-] ! (F) In Flight Entertainment		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
[-] ? (F) Power Supply	1	<input type="checkbox"/>	<input checked="" type="checkbox"/>
X (F) USB	1.1	<input type="checkbox"/>	<input checked="" type="checkbox"/>
[-] X (F) Mains	1.2	<input type="checkbox"/>	<input checked="" type="checkbox"/>
↔ (F) 240 V	1.2.1	<input type="checkbox"/>	<input checked="" type="checkbox"/>
↔ (F) 110 V	1.2.2	<input type="checkbox"/>	<input checked="" type="checkbox"/>
[-] ? (F) Video	2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
X (F) Cabin Screens	2.1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
X (F) Private Screens	2.2	<input type="checkbox"/>	<input checked="" type="checkbox"/>
[-] ! (F) Screen Ratio	2.3	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
↔ (F) Wide	2.3.1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
↔ (F) Standard	2.3.2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
? (F) WiFi Access	3	<input type="checkbox"/>	<input checked="" type="checkbox"/>
? (F) Show Navigation Data	4	<input type="checkbox"/>	<input checked="" type="checkbox"/>
? (F) Exterior Cameras	5	<input type="checkbox"/>	<input checked="" type="checkbox"/>

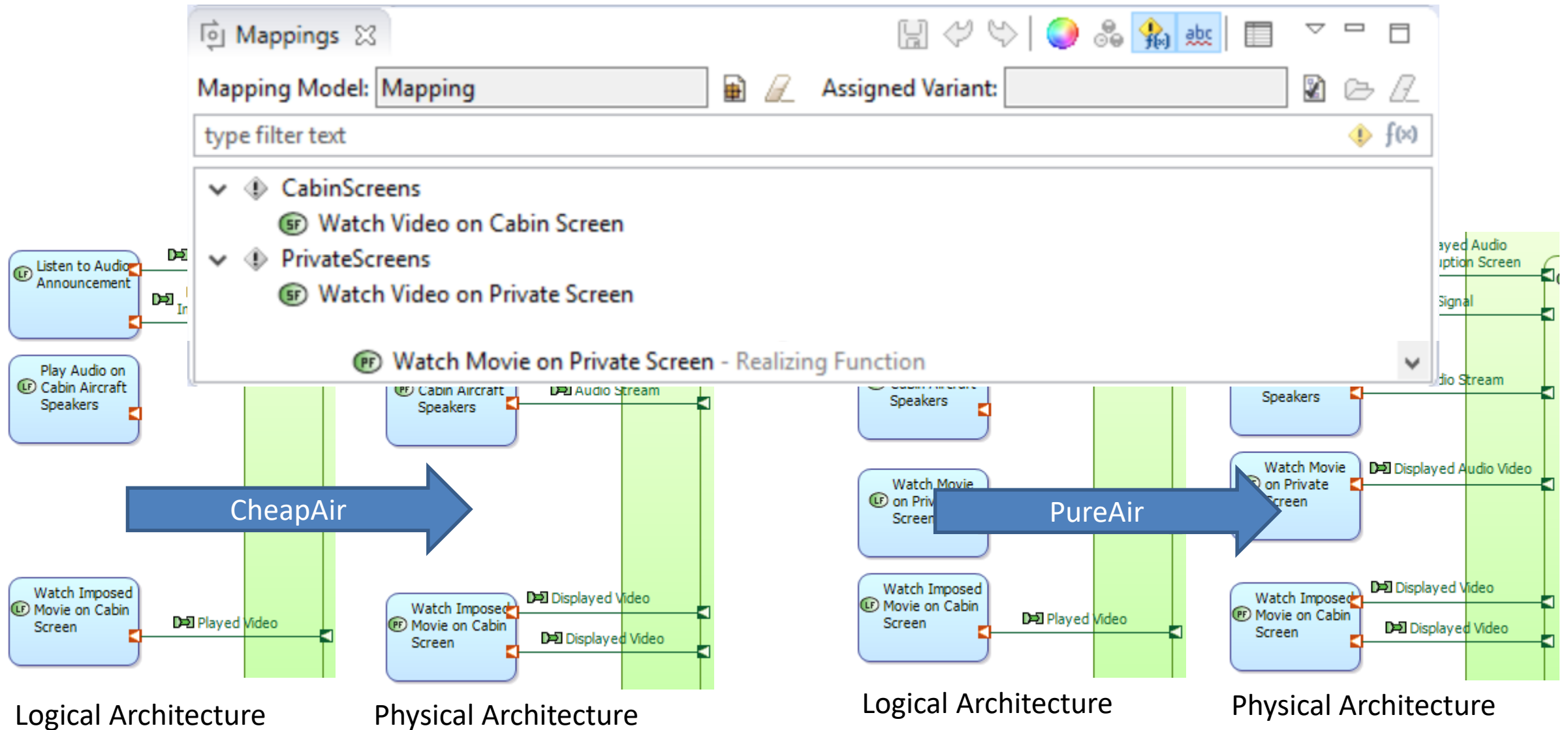
Matrix

Legend: ! = Mandatory ? = Optional ↔ = Alternative X = Or

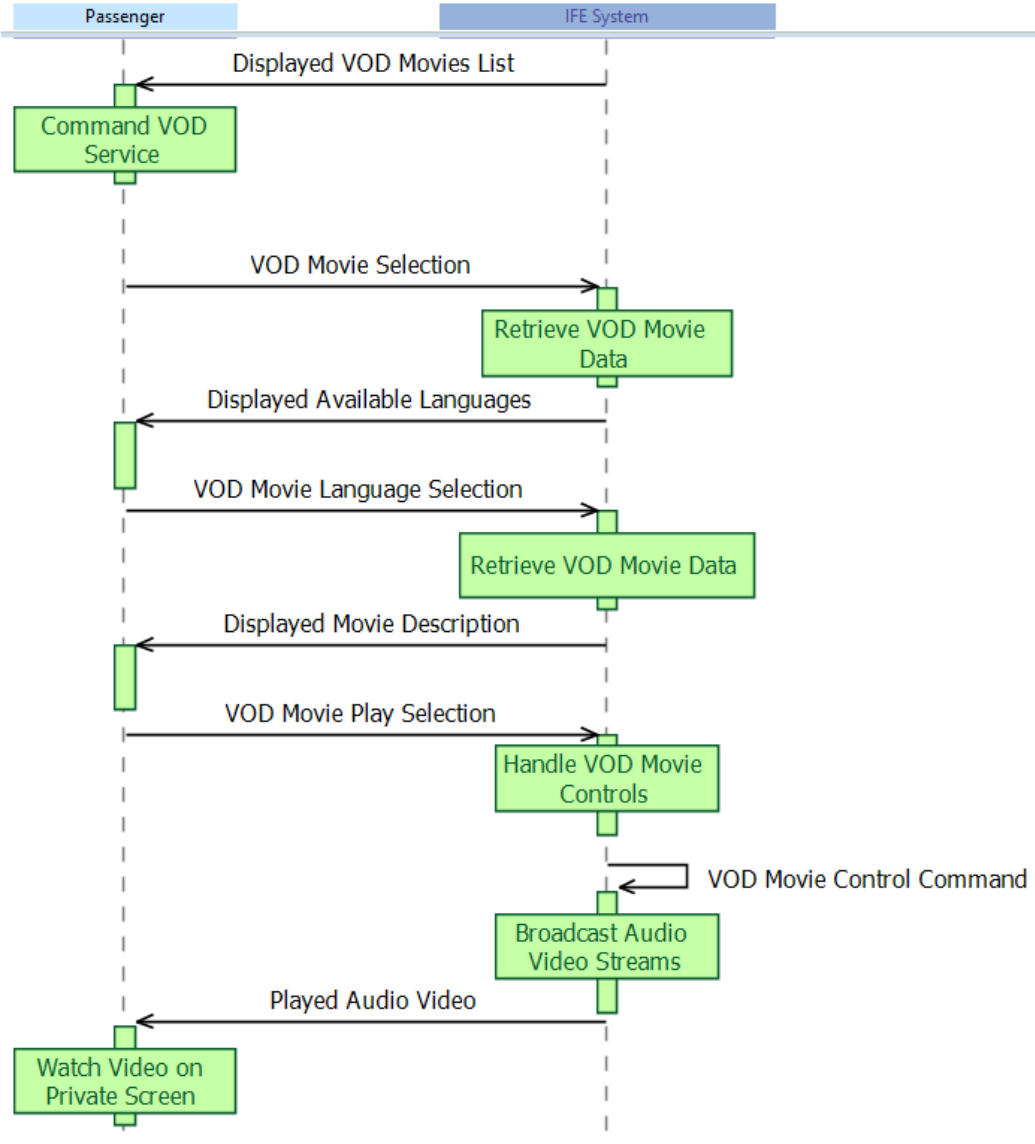
Basic Variation Concepts Revisited – Existence



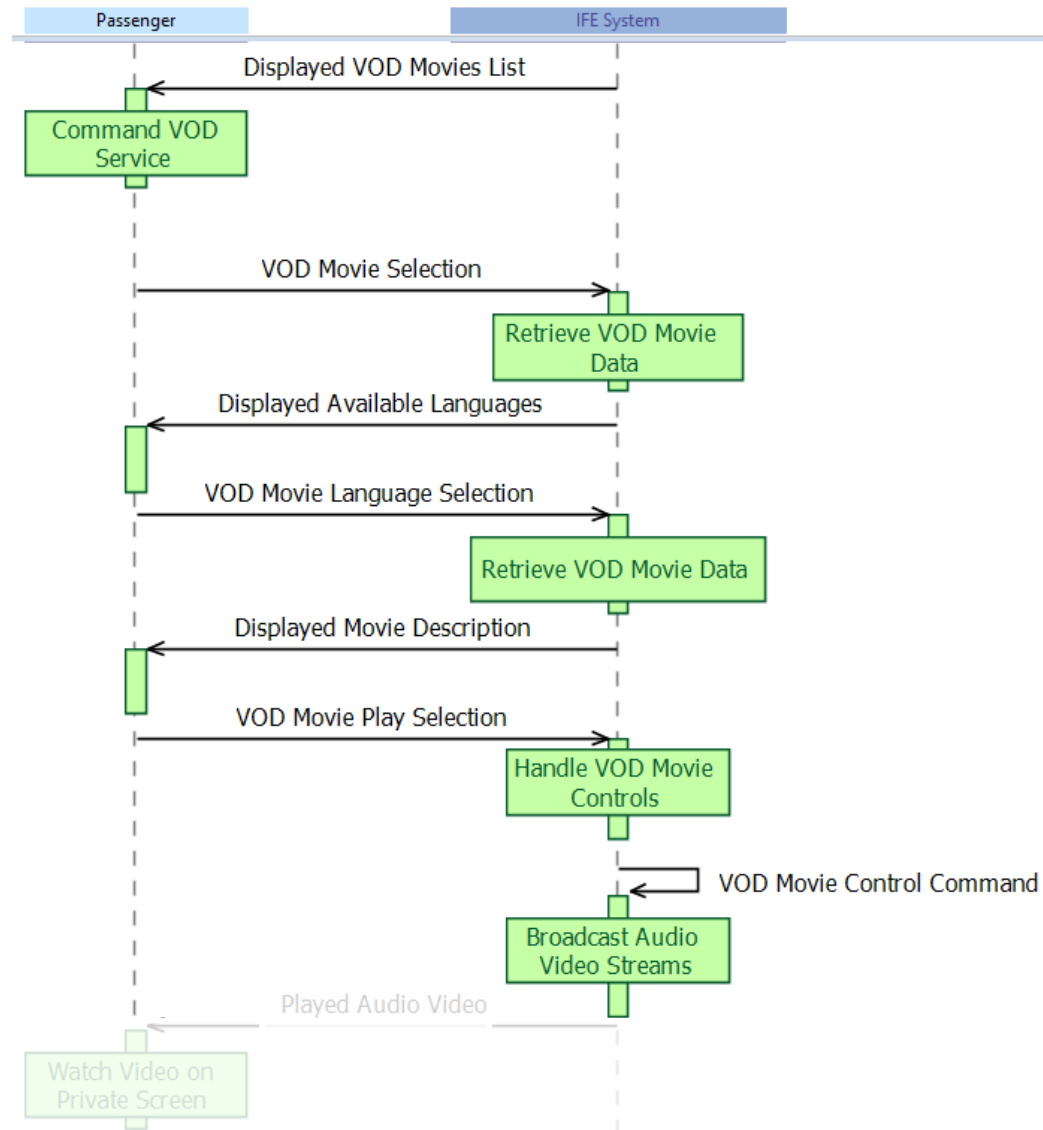
Helpful Variation Concepts Revisited – Propagation



Propagation Challenges



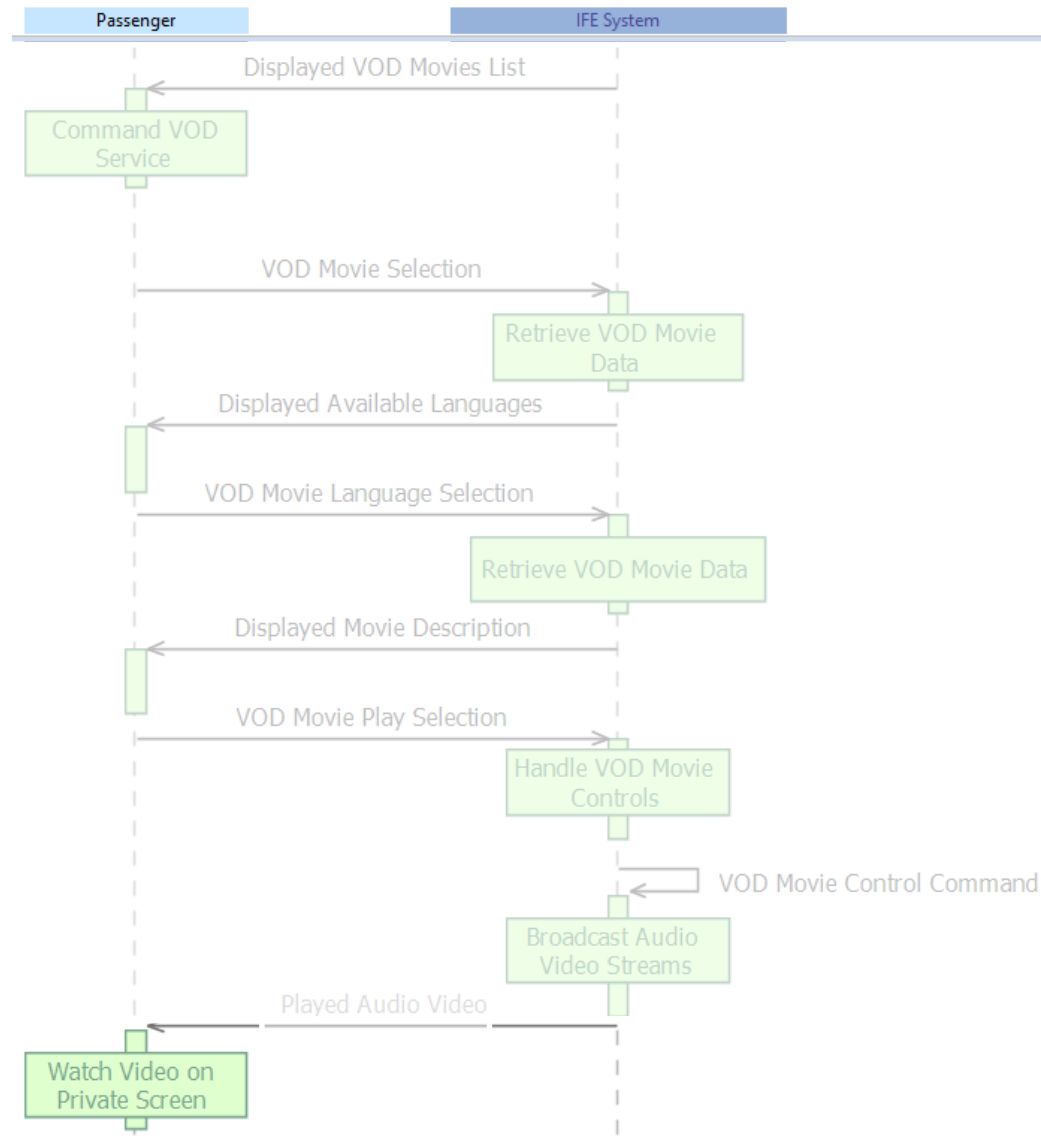
Propagation Challenges



Removal of this element
alone MAY or MAY NOT
be the „right“ propagation



Propagation Challenges



Removal of the whole is what should be done.



Propagation has not enough knowledge (yet) to be smart here

Basic Variation Concepts Revisited – Parametric Variation

*Mappings

Mapping Model: Mapping Assigned Variant: CheapAir

type filter text

- ! CabinScreens
 - SF Watch Video on Cabin Screen
- ! PrivateScreens
 - SF Watch Video on Private Screen
- f(x) IF Wide THEN '16:9' ELSE '4:3' ENDIF = '4:3'

- BUS : BUS
- > Digital Analog Converter : Digital Analog Converter
- > P PVDU Processor
- > P PVDU MPEG Decoder
- ! PVDU Screen
 - AspectRatio = 4:3
- > P PVDU Audio Processing Unit
- > P BUS
- > P Digital Analog Converter

CheapAir

value : EString

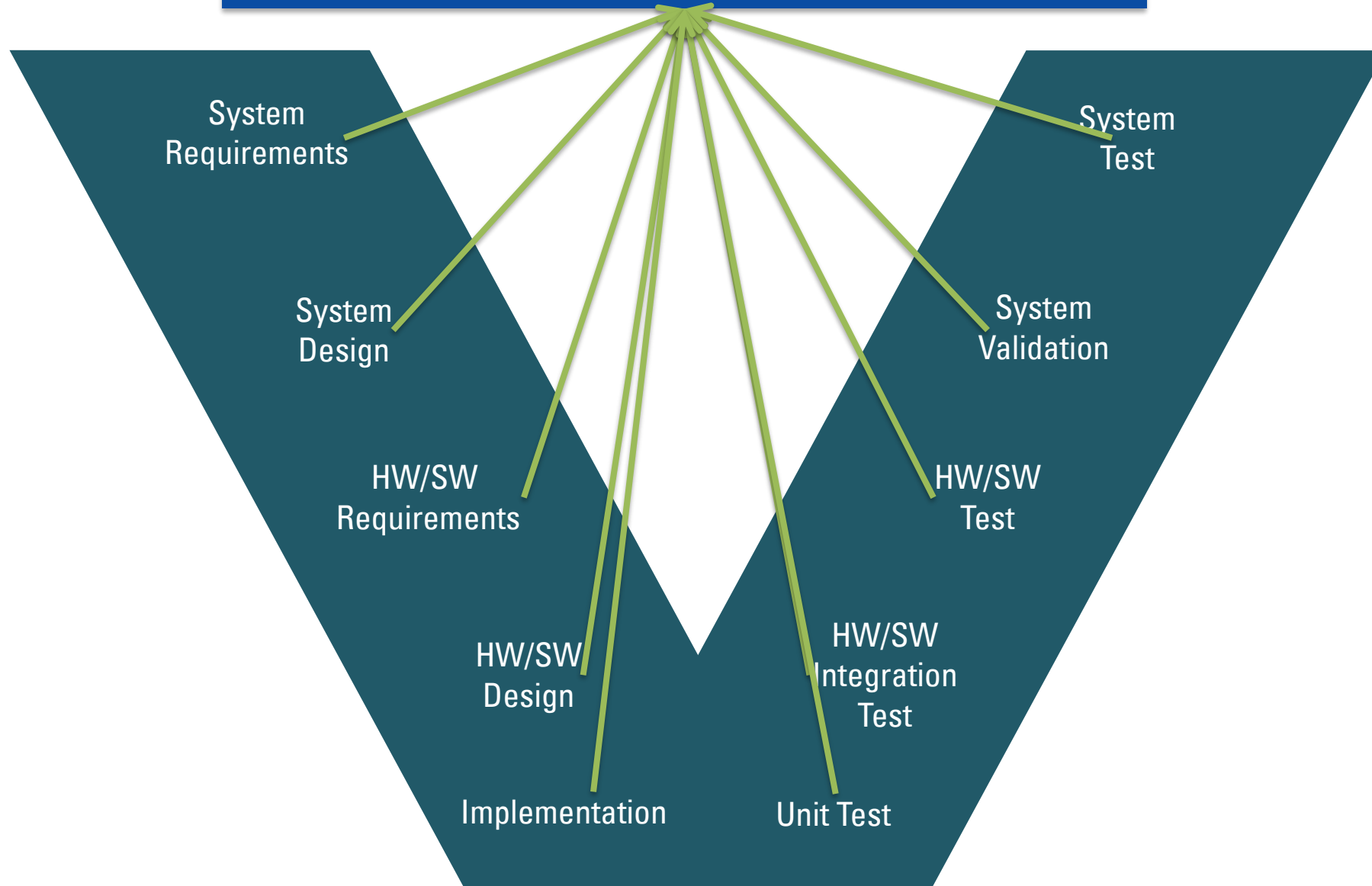
- PVDU MPEG Decoder
- PVDU Screen
 - AspectRatio = <undefined>
- PVDU Audio Processing Unit
- BUS
- Digital Analog Converter

PureAir

- BUS : BUS
- > Digital Analog Converter : Digital Analog Converter
- > P PVDU Processor
- > P PVDU MPEG Decoder
- ! PVDU Screen
 - AspectRatio = 16:9
- > P PVDU Audio Processing Unit
- > P BUS
- > P Digital Analog Converter

pure::variants

Holistic Variant Management orchestrated by pure::variants



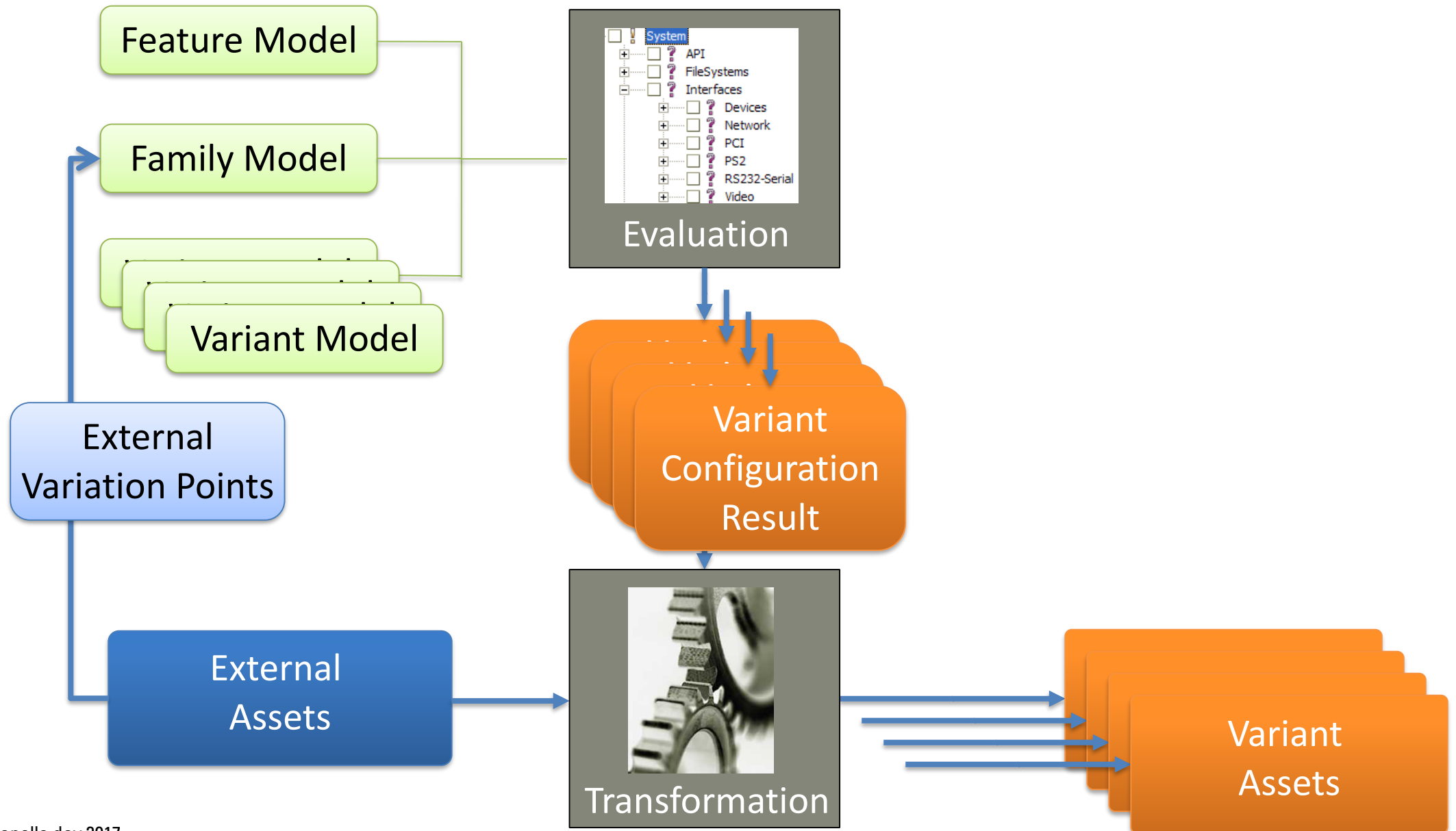
pure::variants Integrates With Market Leading Engineering Tools



Integrate engineering tools and management systems throughout lifecycle of product line



pure::variants Dataflow



pure::variants Connector for Capella

AiO – Capella and pure::variants

Capella - platform:/resource/In-Flight%

File Edit Diagram Navigate Search

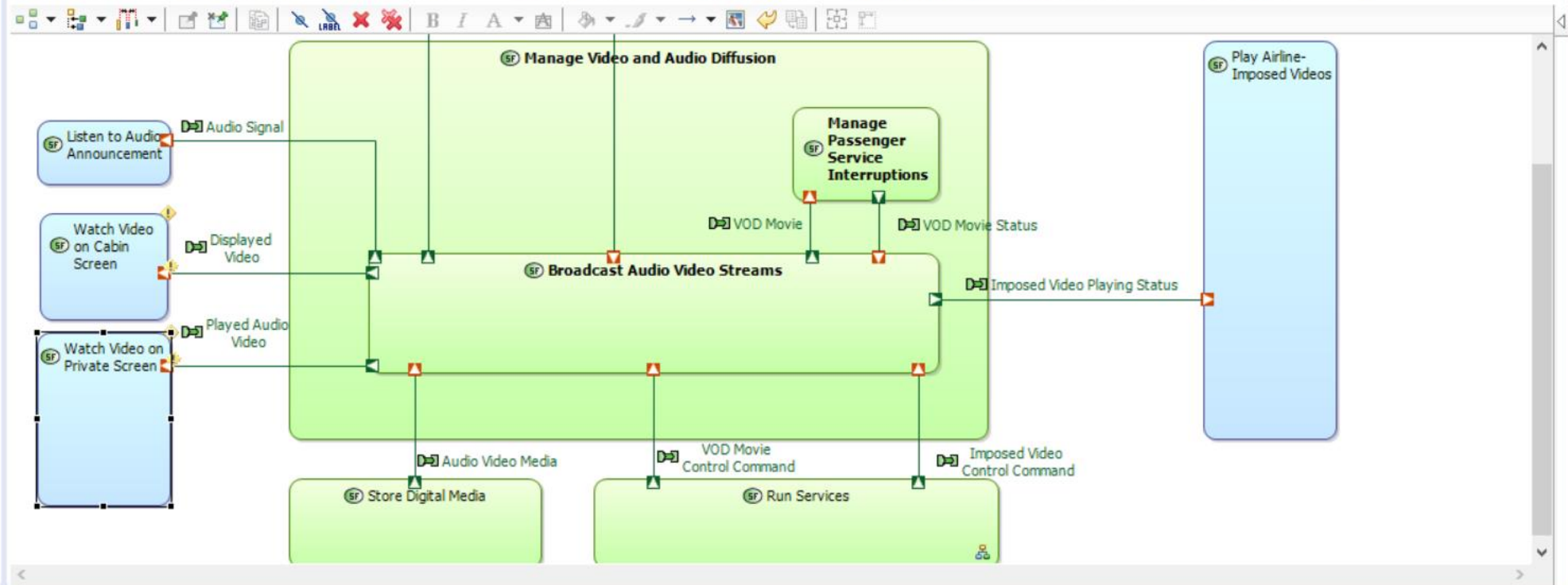
Capella Project Explorer

Select a name to find
? = any character, * = any string

type filter text

- In-Flight Entertainment System
 - In-Flight Entertainment System.afm
 - In-Flight Entertainment System.aird
 - In-Flight Entertainment System
 - Representations per category
 - In-Flight Entertainment System.melodymodeller
- In-Flight Variability
 - InFlightVariability
 - input
 - output
 - In-Flight Entertainment.xfm
 - Mapping.cfm

[SAB] High L... [SDFB] Top L... [LAB] [BUIL... [LAB][CTX] ... [OAB] All O... [SDFB] [CTX]... [SDFB] [CTX]... [SFBD] All A... >> 11



Properties Fast Linker Semantic Browser Error Log

[System Function] Watch Video on Private Screen

Referencing Elements	Current Element	Referenced Elements
<ul style="list-style-type: none">Allocating Actor<ul style="list-style-type: none">PassengerFunctional Chains<ul style="list-style-type: none">Resume VOD MovieStart Playing VOD MovieWatch Imposed Video on PrivatIncoming Functional Exchanges<ul style="list-style-type: none">Played Audio Video	<ul style="list-style-type: none">Watch Video on Private Screen<ul style="list-style-type: none">Parent<ul style="list-style-type: none">Entertain with IFE SystemAll Related TablesSystem Functions - OperaticAll Related Diagrams<ul style="list-style-type: none">[ES] Start Playing VOD Movi[SAB] High Level System Ov	<ul style="list-style-type: none">Realized Operational Activities<ul style="list-style-type: none">Watch Movie

Mappings

Mapping Model: Mapping Assigned Variant: PureAir

type filter text

- CabinScreens
 - Watch Video on Cabin Screen
- PrivateScreens
 - Watch Video on Private Screen
- f(x) IF Wide THEN '16:9' ELSE '4:3' ENDIF = '16:9'
 - AspectRatio = <undefined> - value: EString

Proudly made in Magdeburg, Germany, since 2001



Final Words

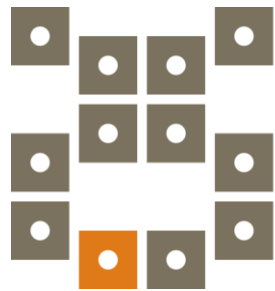
Summary

Strong Capella semantics ease variation

Feature models good match for Capella

pure::variants brings together MBSE and PLE in Capella

Modularization ongoing topic for Reuse in Capella



pure-systems