MAENAD

EAST-ADL

Concept Presentation

EAST-ADL Variability

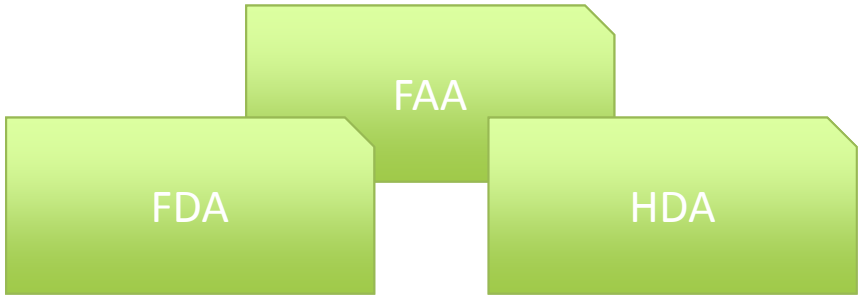
Two Levels of Variability

Variability on the **vehicle level**:

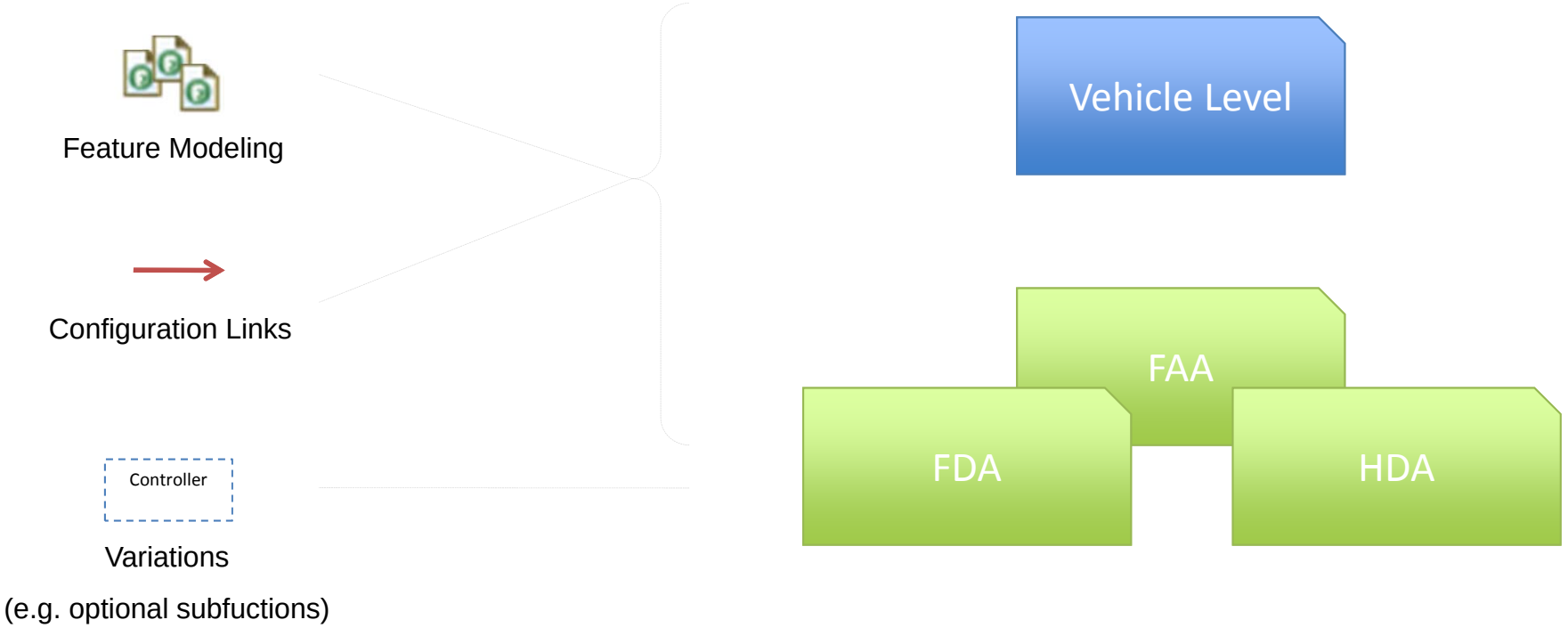
- Very abstract ; no design/implementation details.
- Distinction of customer vs. technical perspective.
- Modeling means: only Feature Modeling.

Variability on the **„artifact level“**:

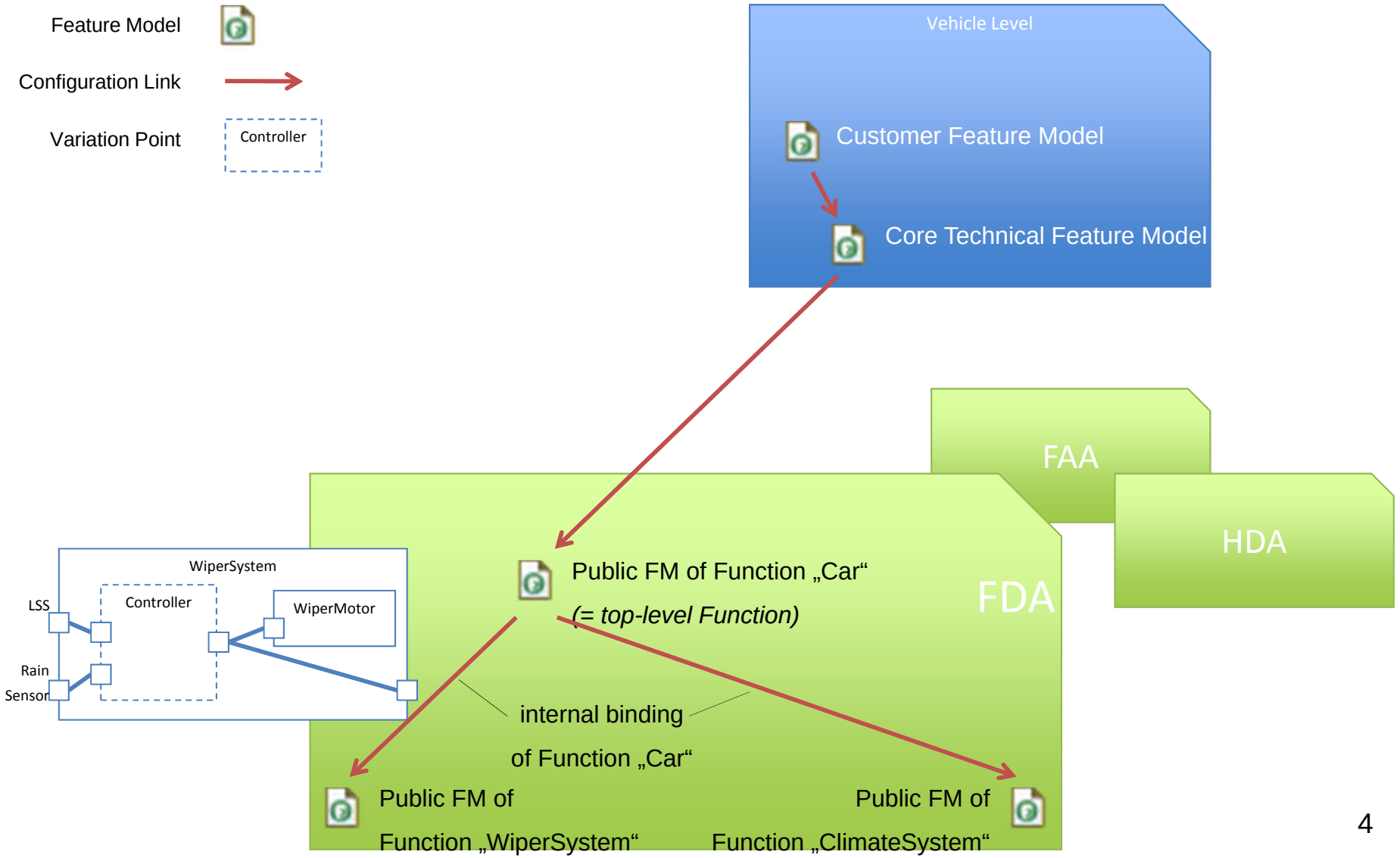
- Variability of the actual requirements, design, etc.
- Only technical perspective.
- Modeling means: Feature Modeling + Variation Points inside FAA/FDA/...-Diagrams



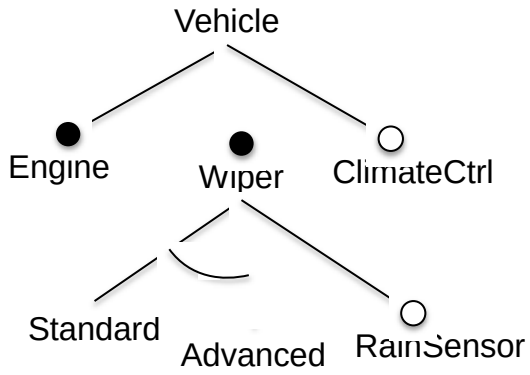
Concepts Used on These Levels



Plus: Multi-Level Approach for cross-model-range variability (currently only on Vehicle Level, might be extended)


Feature Model
Configuration Link
Variation Point
Controller
Vehicle Level
Customer Feature Model
Core Technical Feature Model
FAA
HDA
FDA
WiperSystem
LSS
Controller
WiperMotor
Rain Sensor
Public FM of Function „Car“
(= top-level Function)
internal binding of Function „Car“
Public FM of Function „WiperSystem“
Public FM of Function „ClimateSystem“

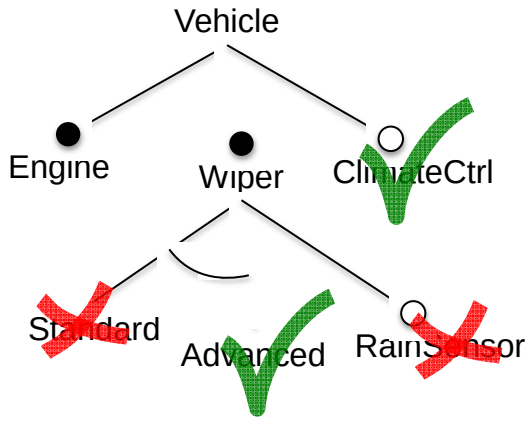
Feature Models



Feature Model

Cardinality-based feature models ...
(cf. Czarnecki et al.)

with some modifications
(e.g. 1+ root features per model)



Configuration (of a Feature Model)

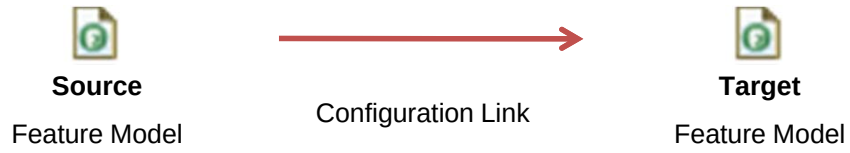
incl. support for ...

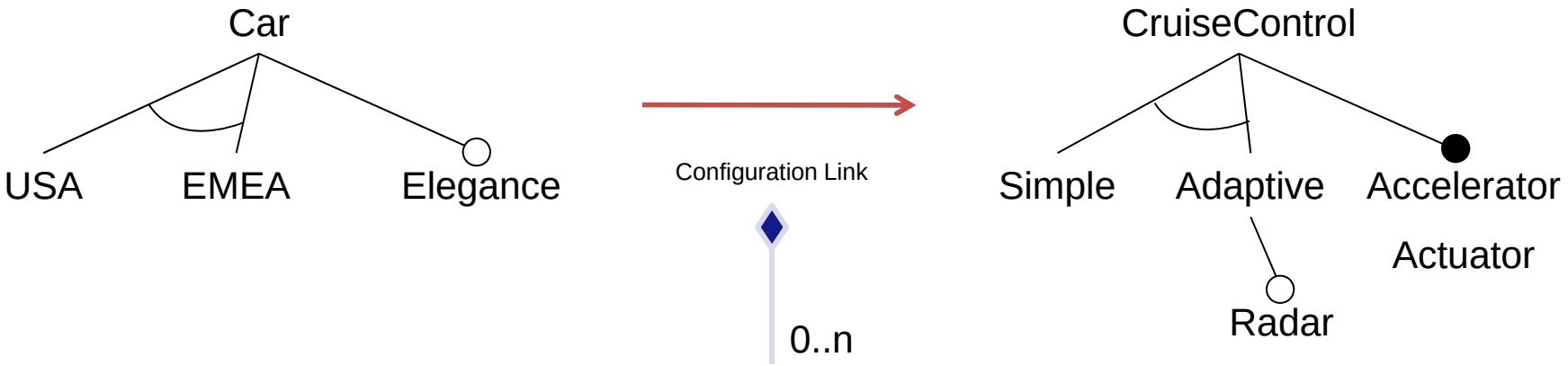
– parameterized features
(a.k.a. feature attributes)

– instances for cloned features

(subtrees of instances can be configured separately)

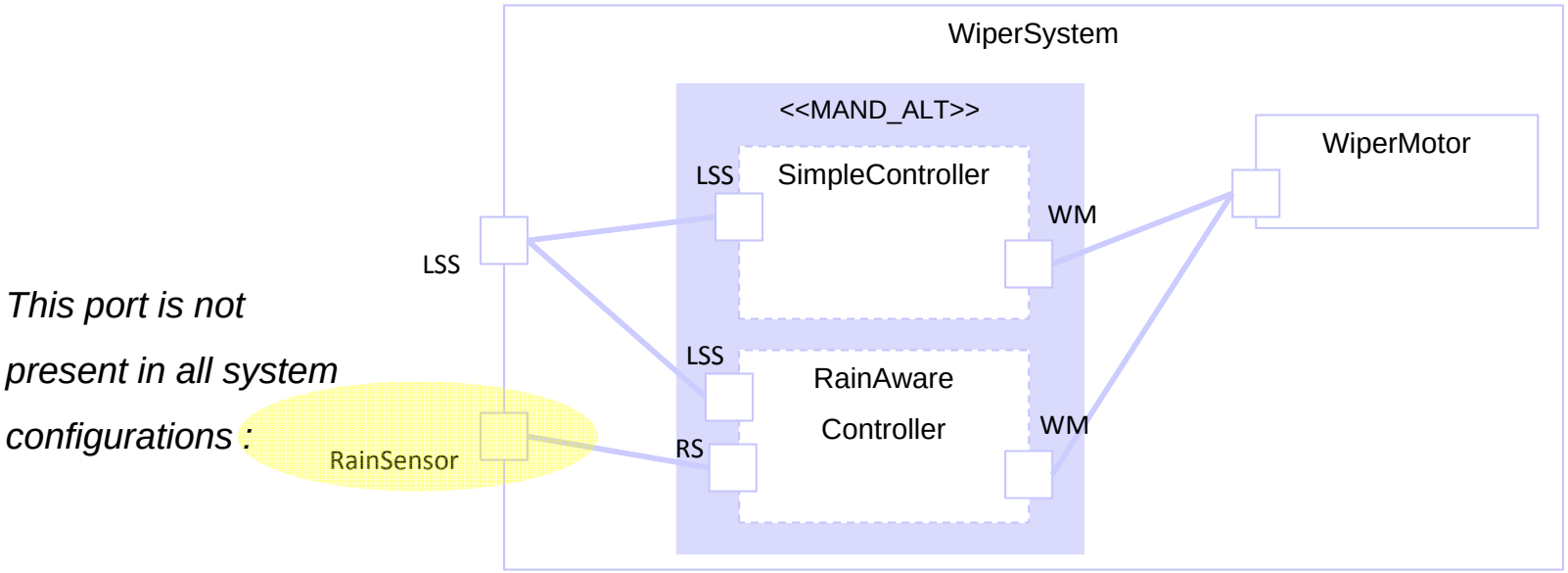
Configuration Links





„Use Radar in USA.“

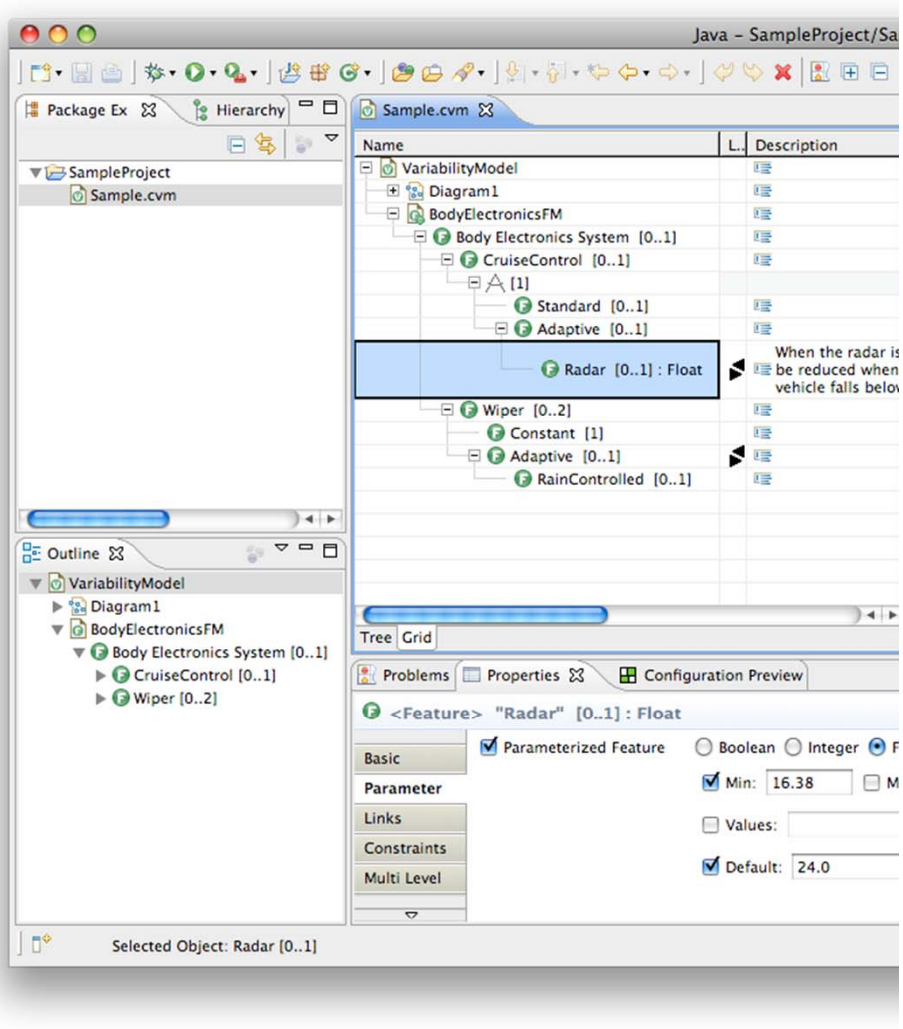
Variation Definition

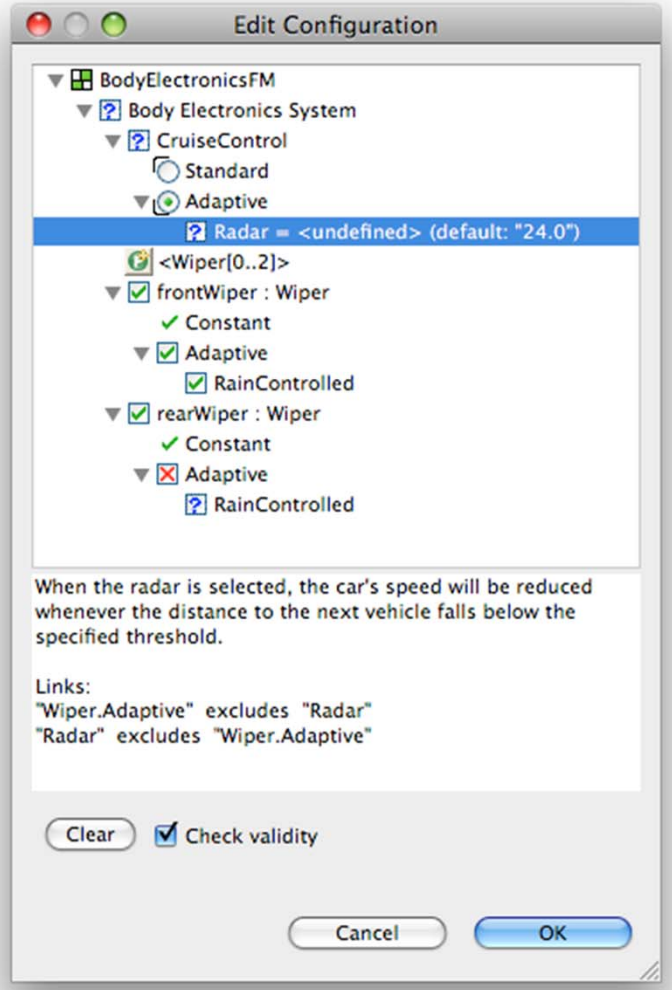


This port is not present in all system configurations :

Technical realization does not require explicit variation points.

In simple cases, optional FunctionPrototypes and VariationGroups can be used directly to achieve same result.


Java – SampleProject/Sa
Package Ex
Hierarchy
SampleProject
Sample.cvm
Sample.cvm
Name
L..
Description
VariabilityModel
Diagram1
BodyElectronicsFM
Body Electronics System [0..1]
CruiseControl [0..1]
[1]
Standard [0..1]
Adaptive [0..1]
Radar [0..1] : Float
When the radar is
be reduced when
vehicle falls belo
Wiper [0..2]
Constant [1]
Adaptive [0..1]
RainControlled [0..1]
Outline
VariabilityModel
Diagram1
BodyElectronicsFM
Body Electronics System [0..1]
CruiseControl [0..1]
Wiper [0..2]
Tree
Grid
Problems
Properties
Configuration Preview
<Feature> "Radar" [0..1] : Float
Basic
Parameter
Links
Constraints
Multi Level
Parameterized Feature
Boolean
Integer
Min:
16.38
Values:
Default:
24.0
Selected Object: Radar [0..1]

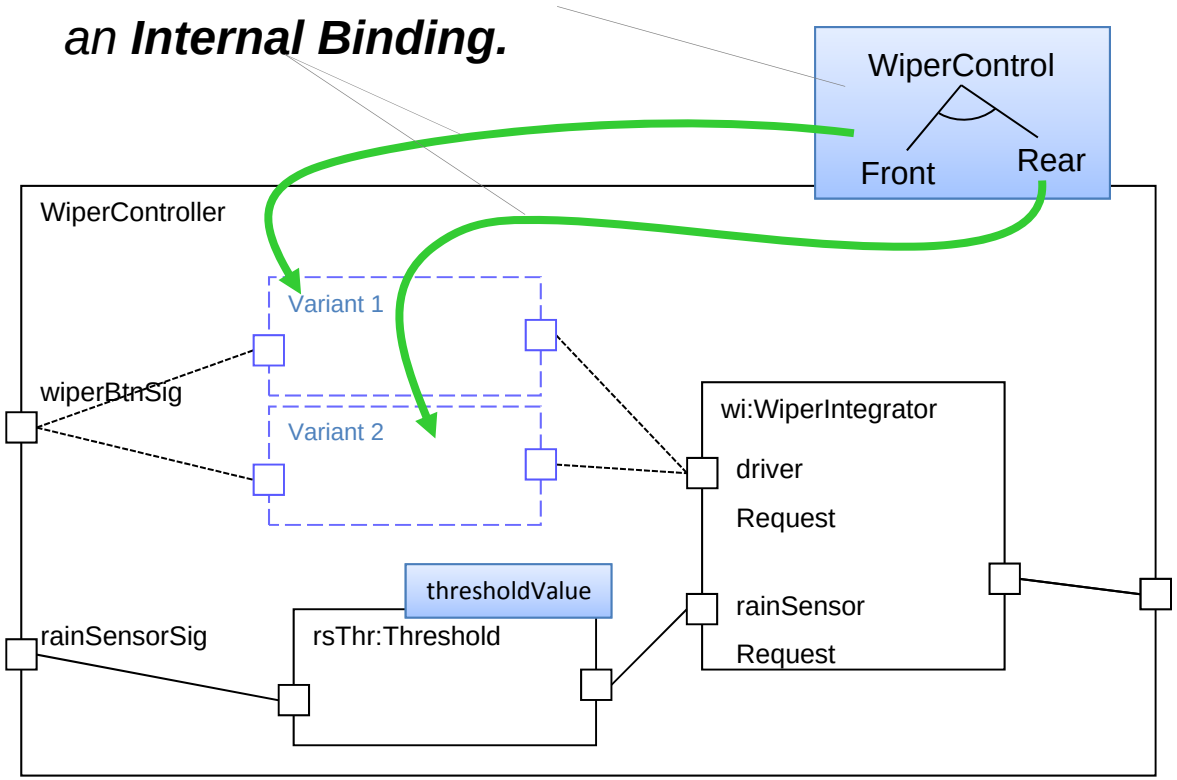

Edit Configuration
BodyElectronicsFM
Body Electronics System
CruiseControl
Standard
Adaptive
Radar = <undefined> (default: "24.0")
<Wiper[0..2]>
frontWiper : Wiper
Constant
Adaptive
RainControlled
rearWiper : Wiper
Constant
Adaptive
RainControlled
When the radar is selected, the car's speed will be reduced whenever the distance to the next vehicle falls below the specified threshold.
Links:
"Wiper.Adaptive" excludes "Radar"
"Radar" excludes "Wiper.Adaptive"
Clear
Check validity
Cancel
OK

Compositional Variability

FunctionTypes have ...

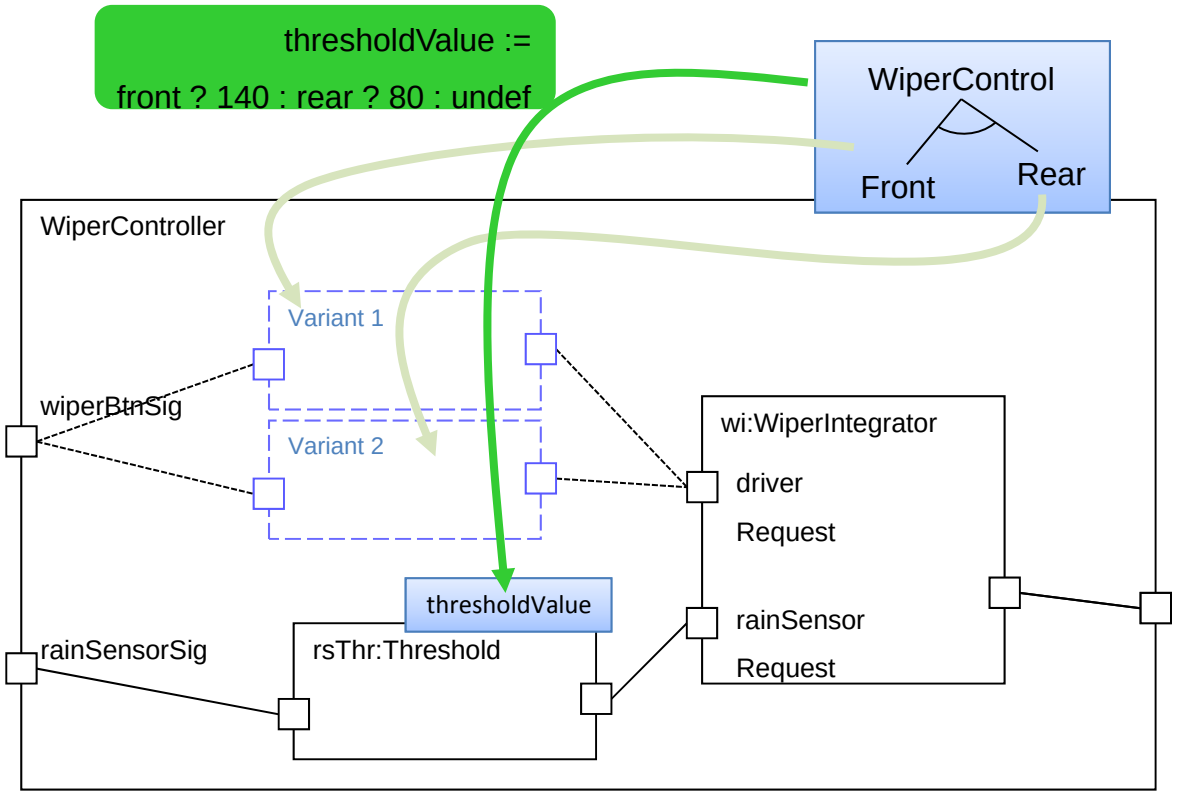
*a **Public Feature Model**,*

*an **Internal Binding.***



Compositional Variability

The Internal Binding can be more complex ...



Compositional Variability

- Note:
  - deriving lower level configurations

1 configuration of FM of containing component → N configurations of FMs of contained components

  - mapping is part of definition of containing component
  - mapping is internal / private

⇒ information hiding for binding variability of lower-level components

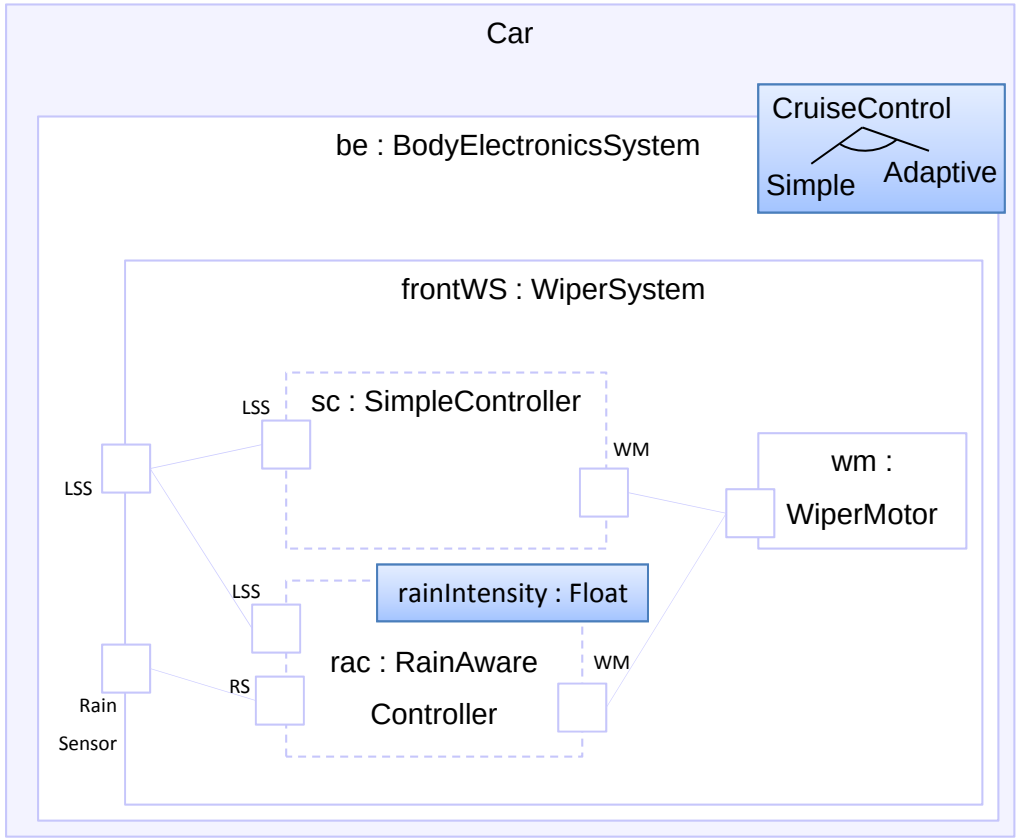
„Configuration Hiding“

(cf. Reiser, Tavakoli, Weber HICSS-42 2009)

Compositional Variability

Syntax & semantics of configuration decisions ...

Defined by Variability Specification Language (VSL).



Example 1:

```
be#CruiseControl.Adaptive[+]
```

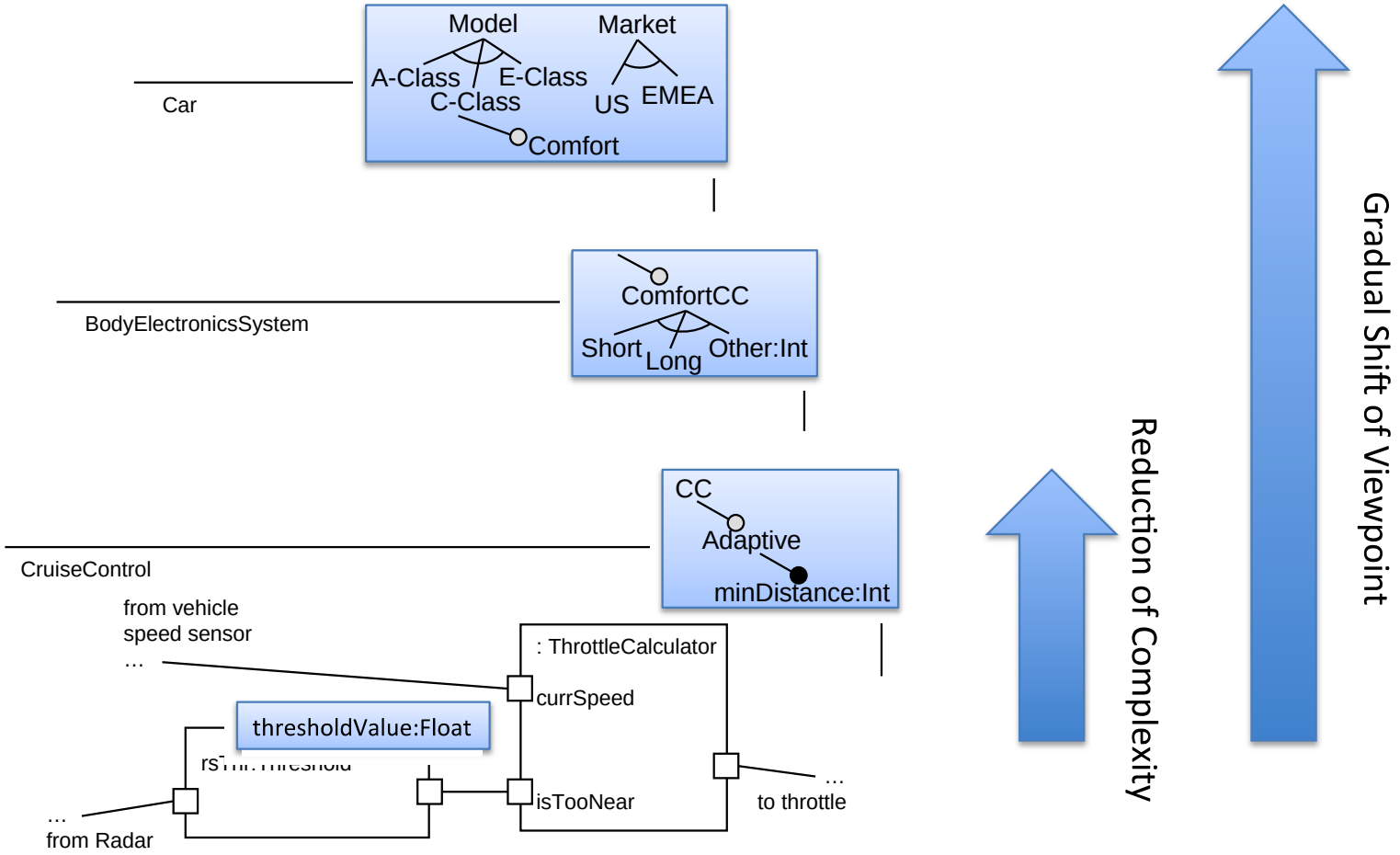
Example 2:

```
be.frontWS.sc[+]
```

Example 3:

```
be.frontWS.rac[+]
be.frontWS.rac#rainIntesity=0.8
```

Benefits of Compositional Variability



Summary: EAST-ADL Variability

- Supports:
- multiple viewpoints (e.g. technical vs. end-customer)
- different abstraction levels

- containment hierarchies – *„compositional variability management“*
- complete-system configuration

- reuse ← *„configuration hiding“*
- integration within a larger context
  - cooperative active safety systems
  - manufacturer/supplier scenario

- pragmatic cross-model-range VM (not covered in this presentation)