Обзор LASER-2017

Ю.В. Литвинов
А.Н. Терехов
y.litvinov@spbu.ru
a.terekhov@spbu.ru

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LASER-2017

- Летняя школа, с 9 по 17 сентября, о. Эльба, Италия
- Тема школы этого года: **Software for Robotics**
- Формат: 7 лекций по 45 минут в день + студенческие презентации
- 7 докладчиков, примерно по 6 лекций на каждого:
  - Davide Brugali, University of Bergamo
  - Rodolphe Gelin, Softbank Robotics
  - Ashish Kapoor, Microsoft Research
  - Nenad Medvidovic, University of Southern California
  - Bertrand Meyer, Politecnico di Milano
  - Issa Nesnas, NASA Jet Propulsion Laboratory
  - Hiroshi “Gitchang” Okuno, Waseda University and Kyoto University

Robot variability

Tourist guide

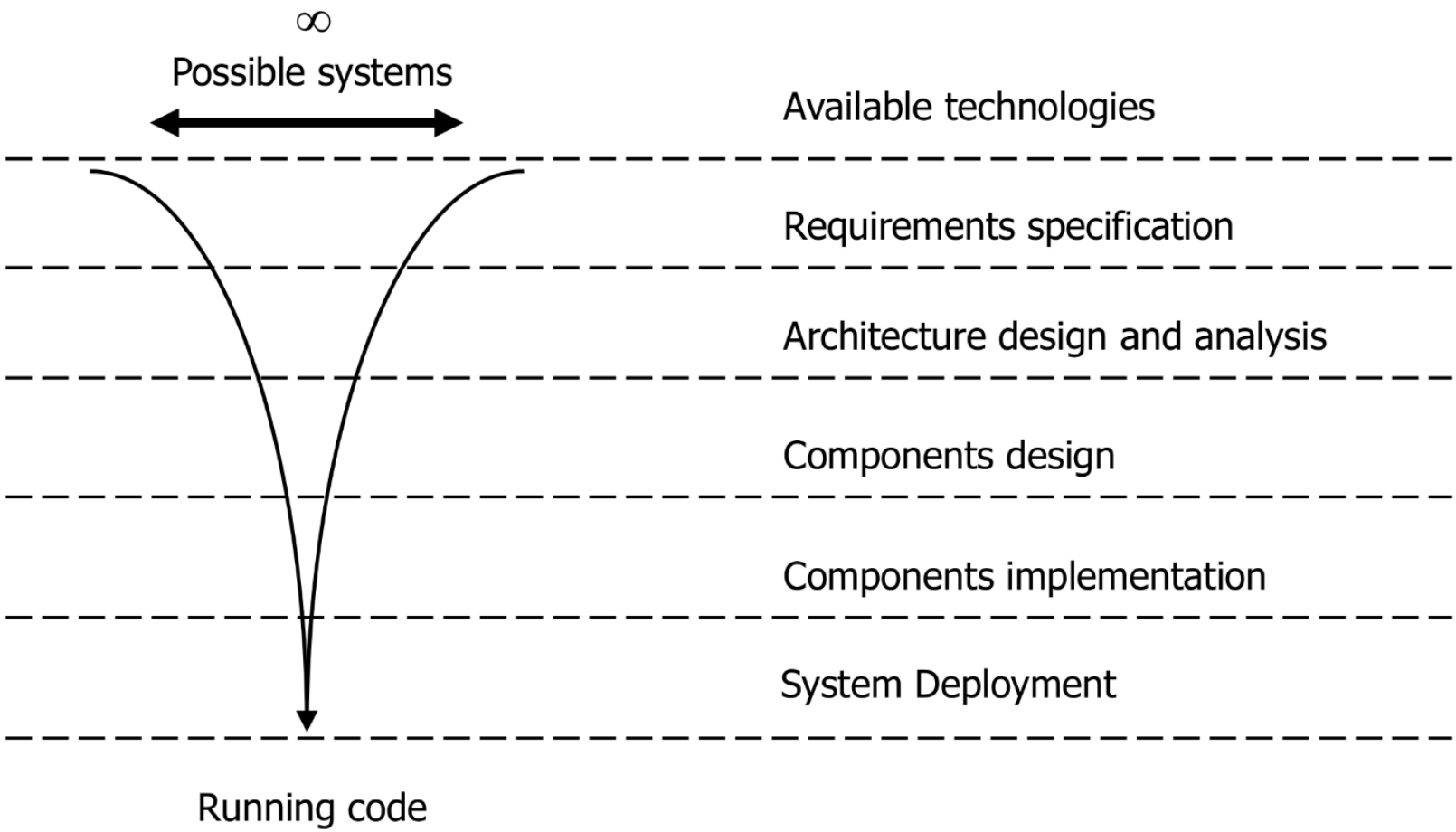
Store inventory

Autonomous cars

RoboCup

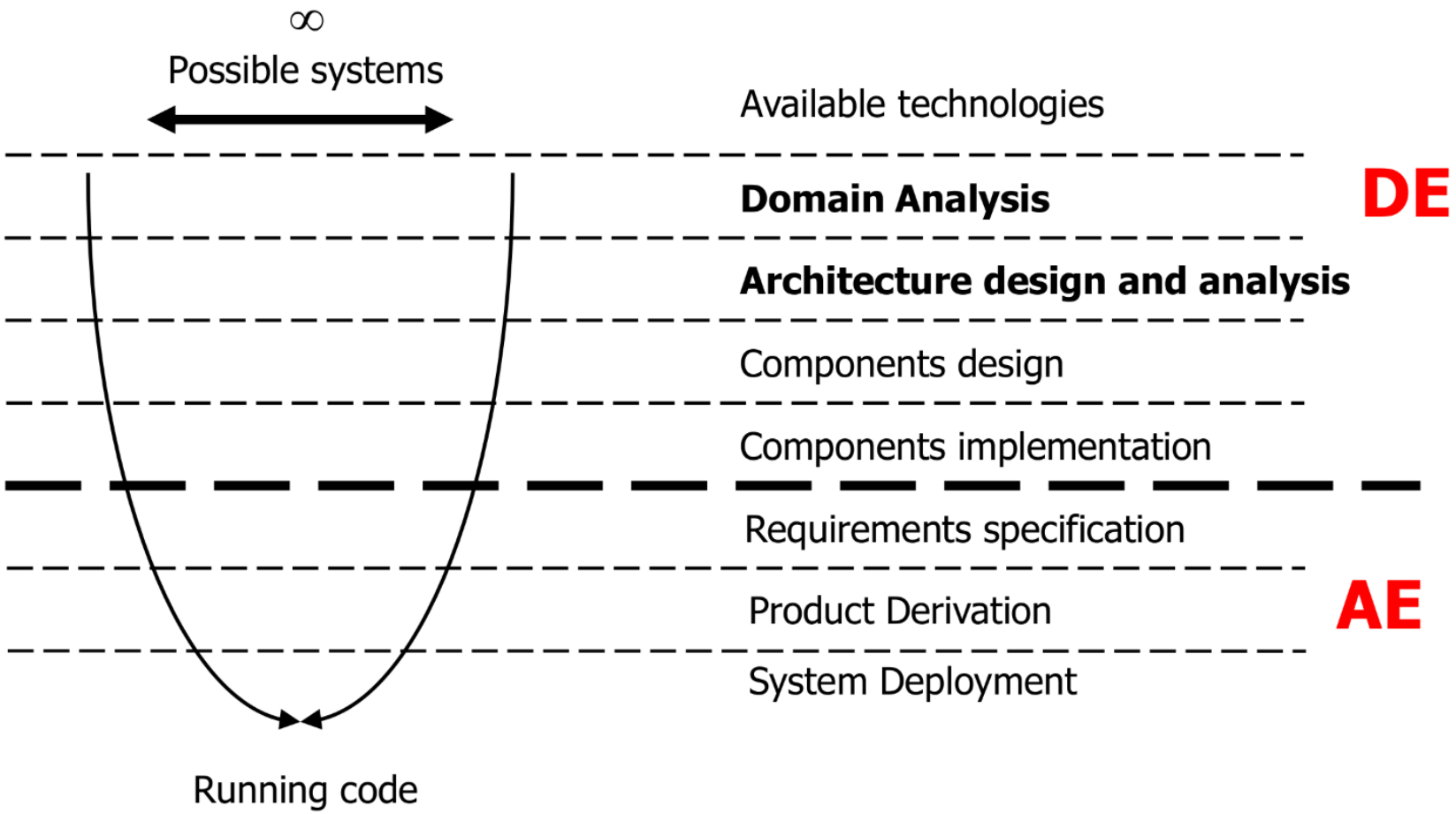
Shop Floor logistics

Traditional software development approach



Courtesy of Svahnberg, van Gurp, Bosch

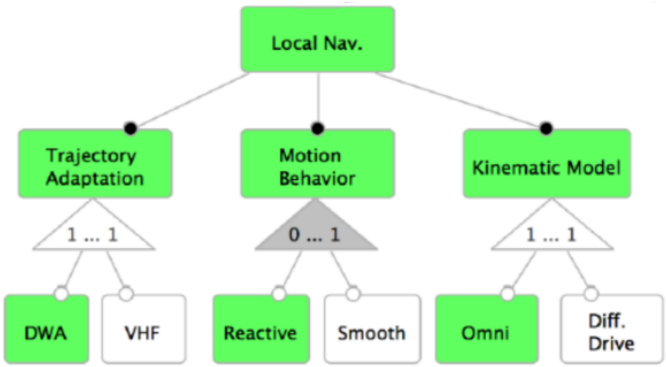
Software Product Lines



Courtesy of Svahnberg, van Gurp, Bosch

Product Line Engineering

The specification of
functional requirements

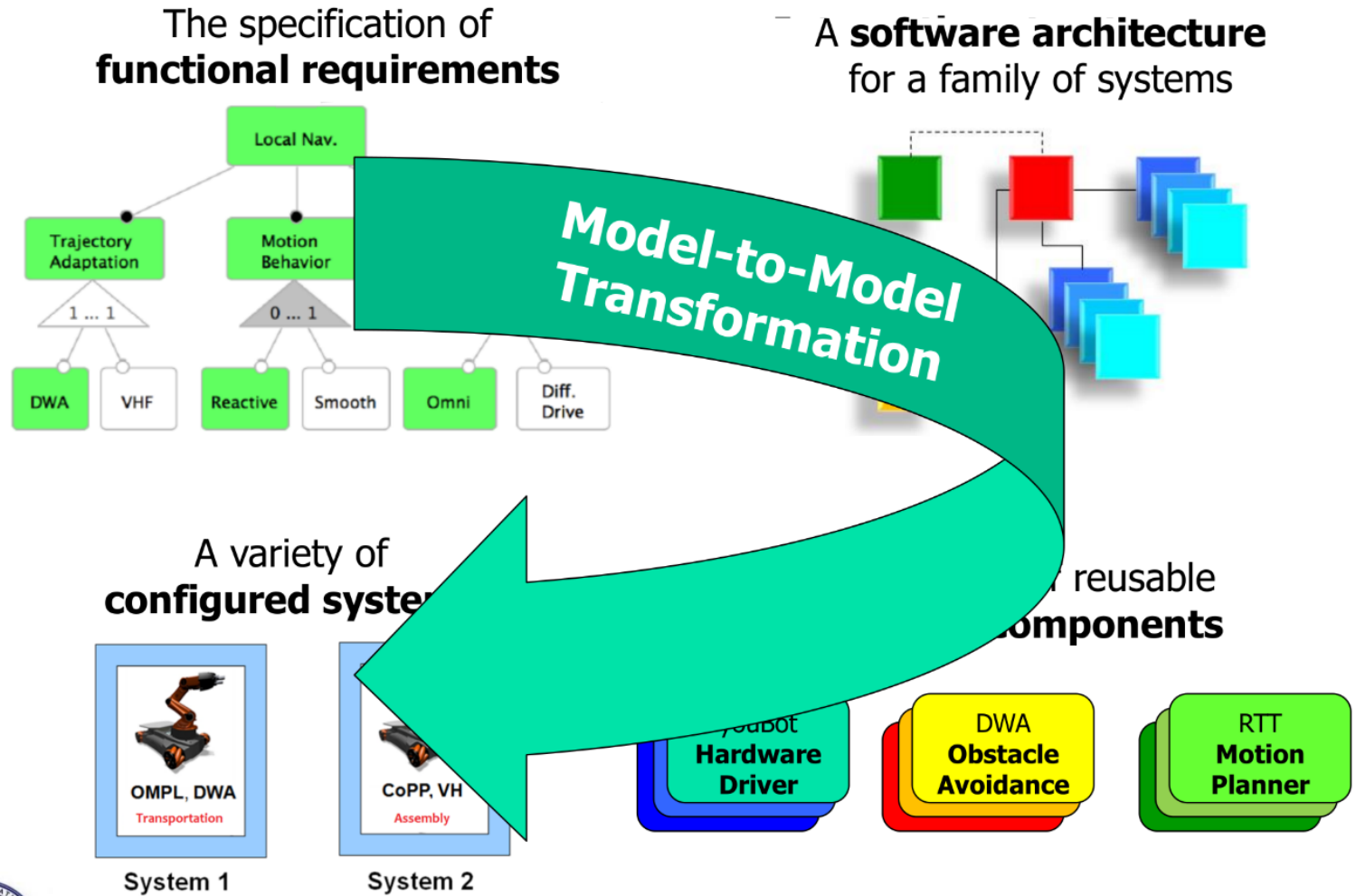


Integration structure

Products

Components

Product Line Engineering

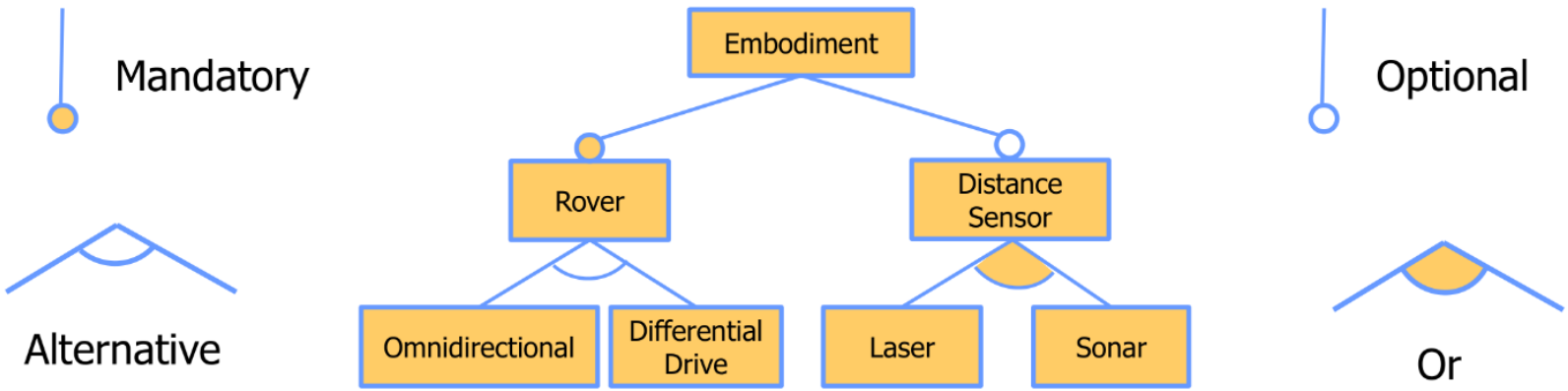


Domain Analysis

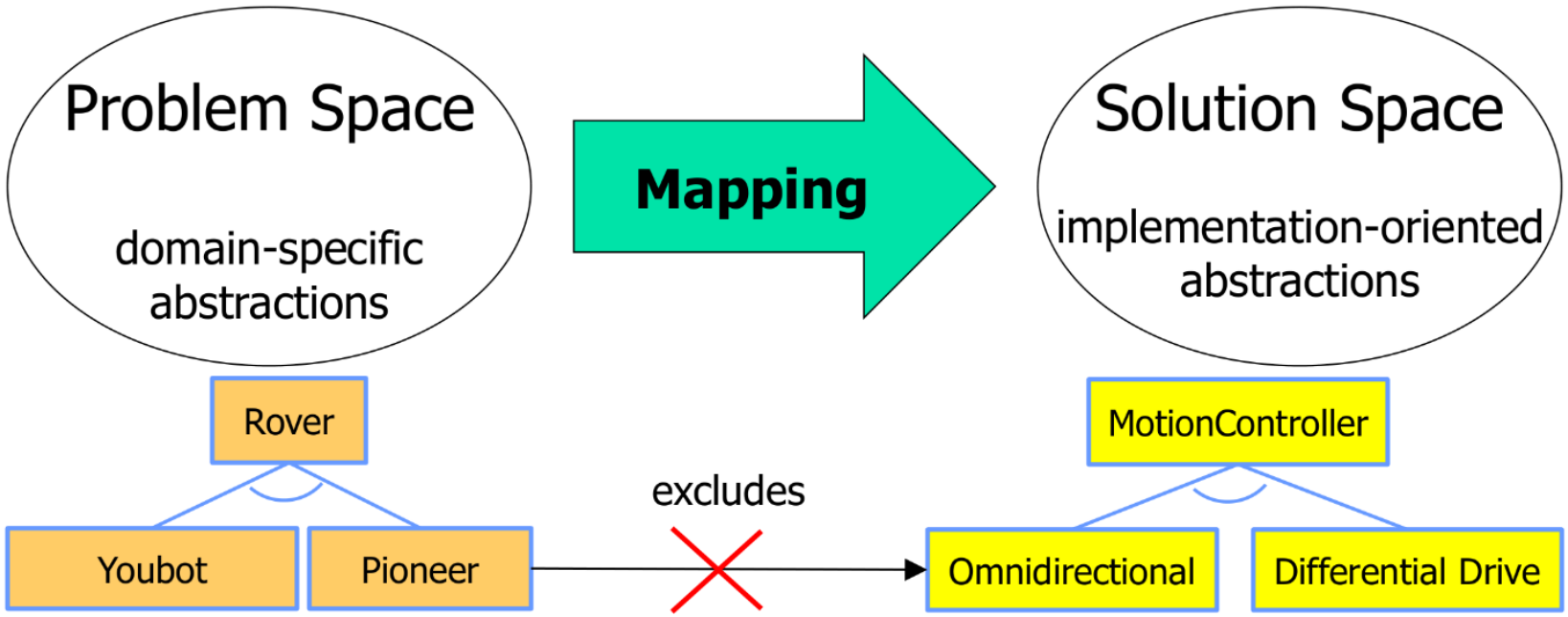
- Feature-oriented Domain Analysis (FODA)
  - Kang, K. et al. Feature-Oriented Domain Analysis (FODA) CMU/SEI 1990
  - Commonalities and variabilities in software systems
  - Feature: symbolic representation of a system characteristics
  - Feature Model: relationships among the features

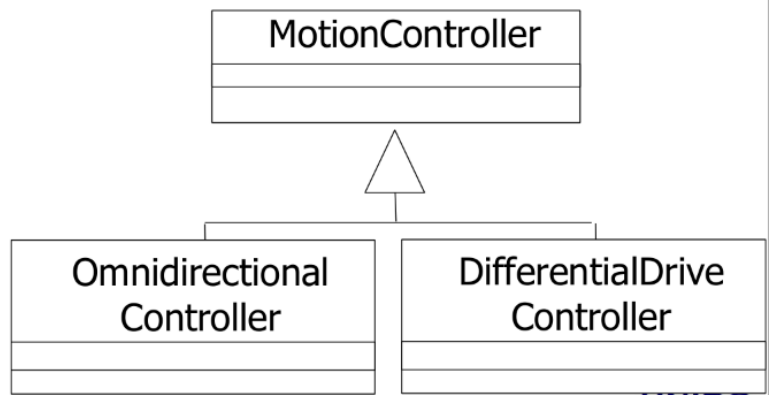
- Stability Analysis
  - Software stability: a software system's resilience to changes in the original requirements specification.
  - Clien M. & Girou M. Enduring Business Themes. CACM, Vol 43(5), 2000
  - Fayad M.E. Accomplishing Software Stability. CACM 45(1), 2002

Feature Models

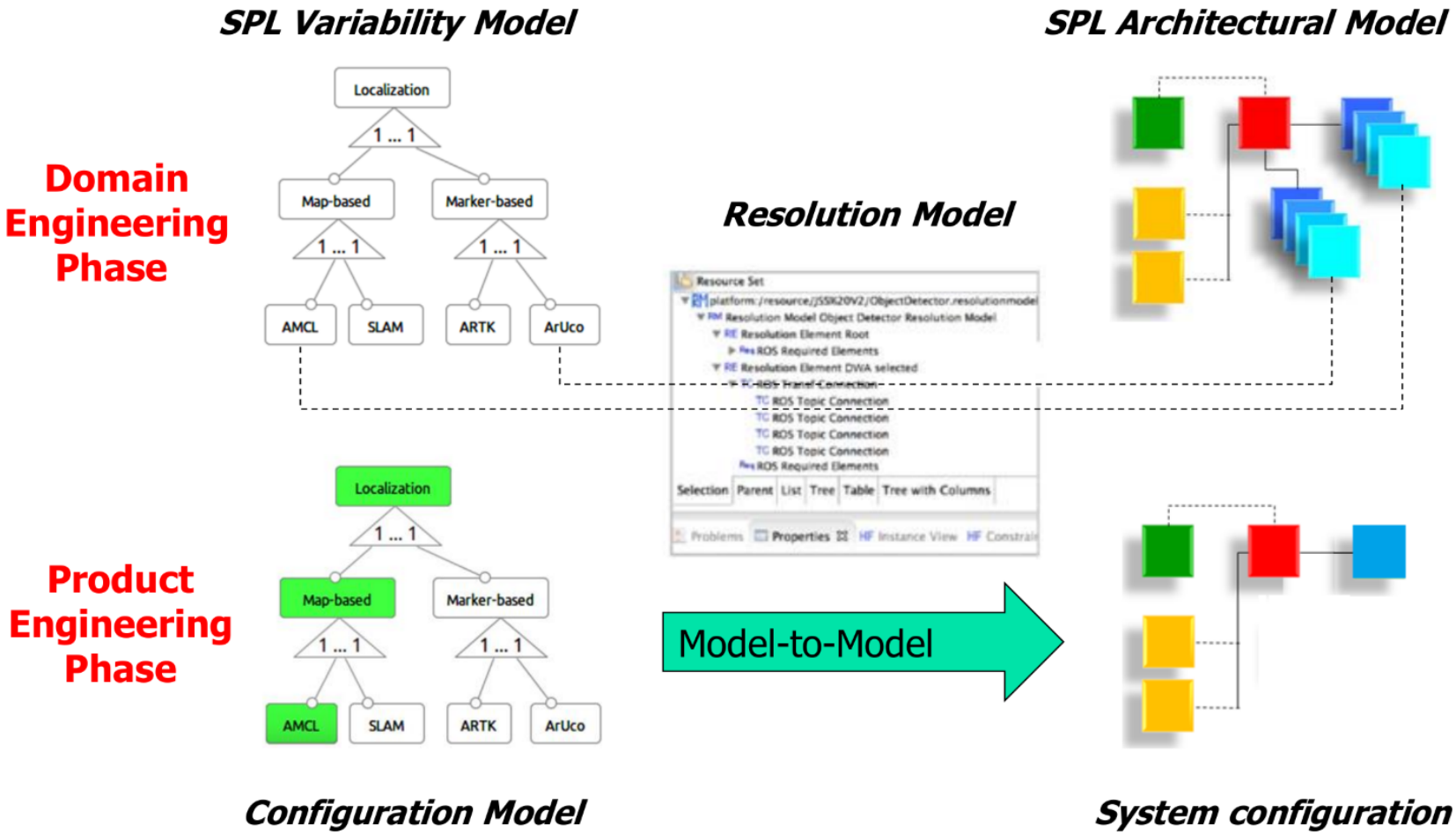


Modelling variability

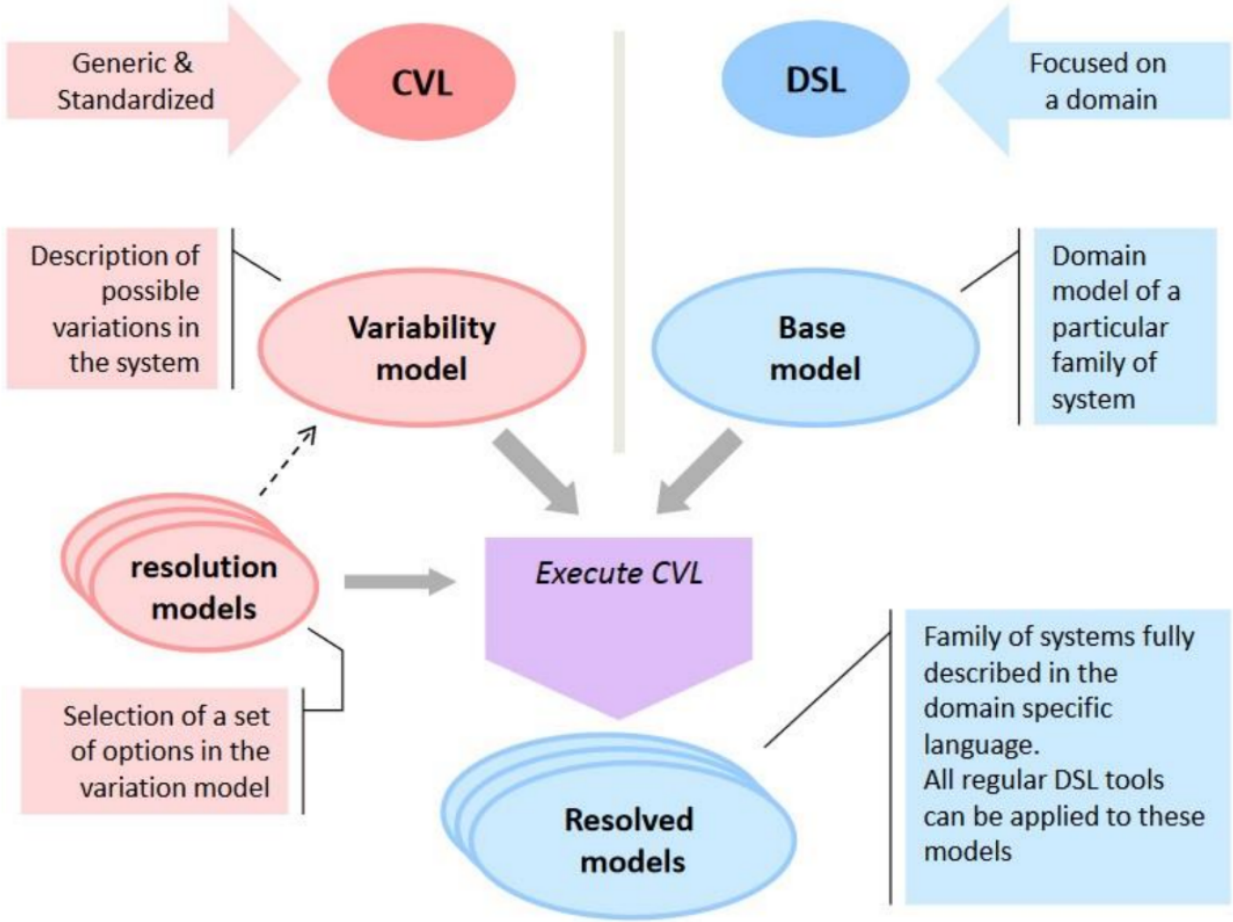




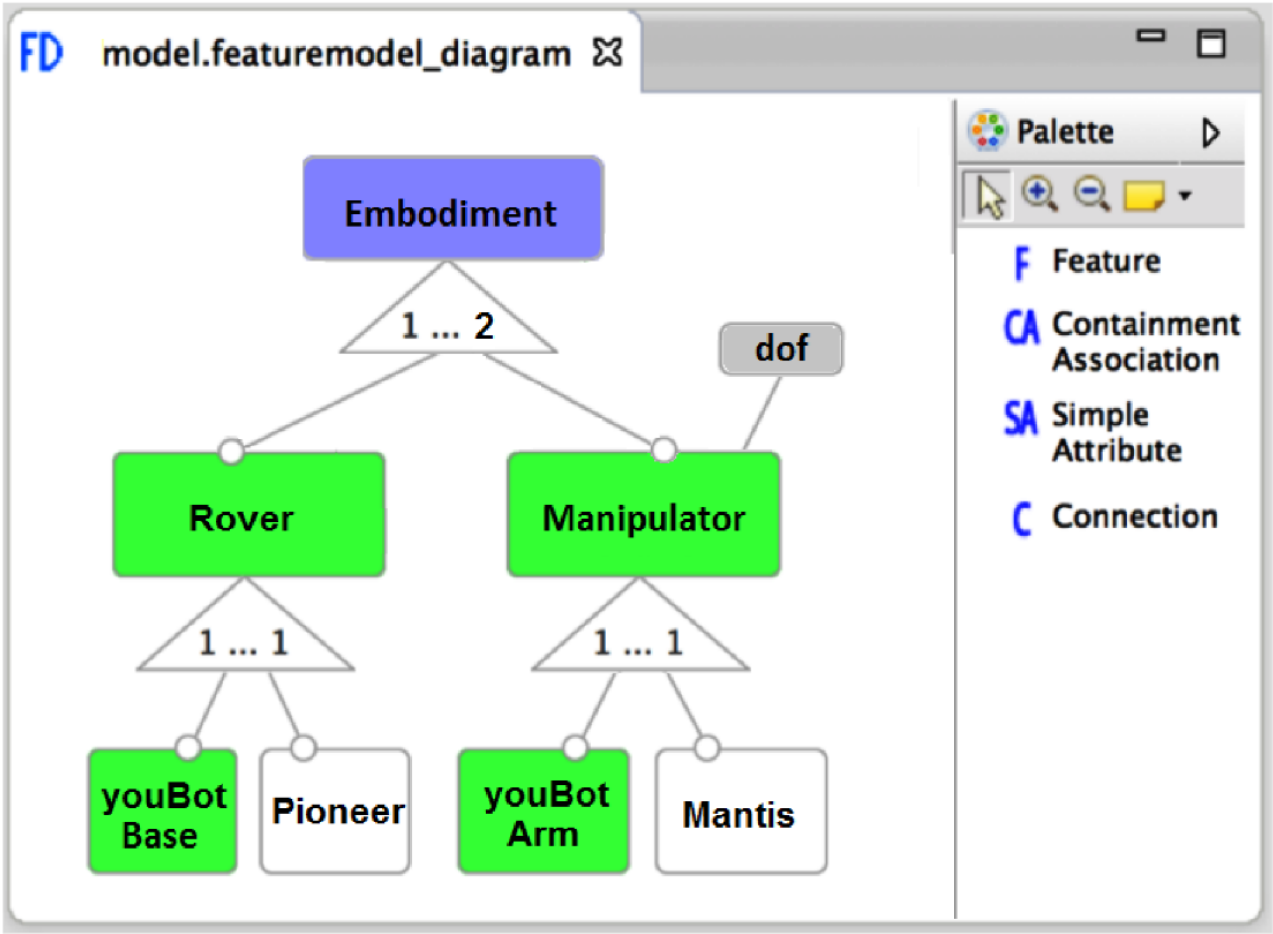
Orthogonal models



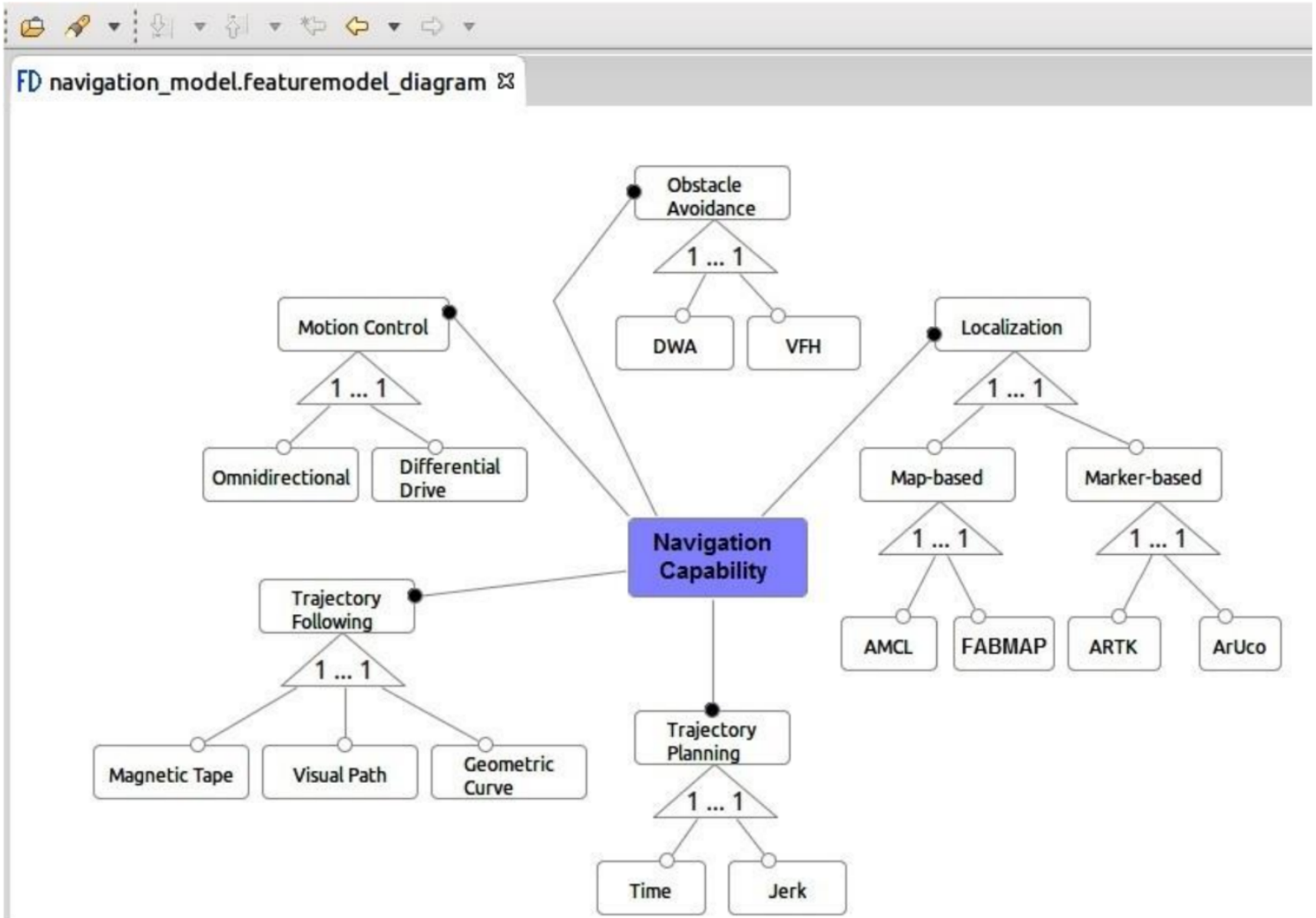
OMG Common Variability Language (CVL) (Late 2010 initial submission)



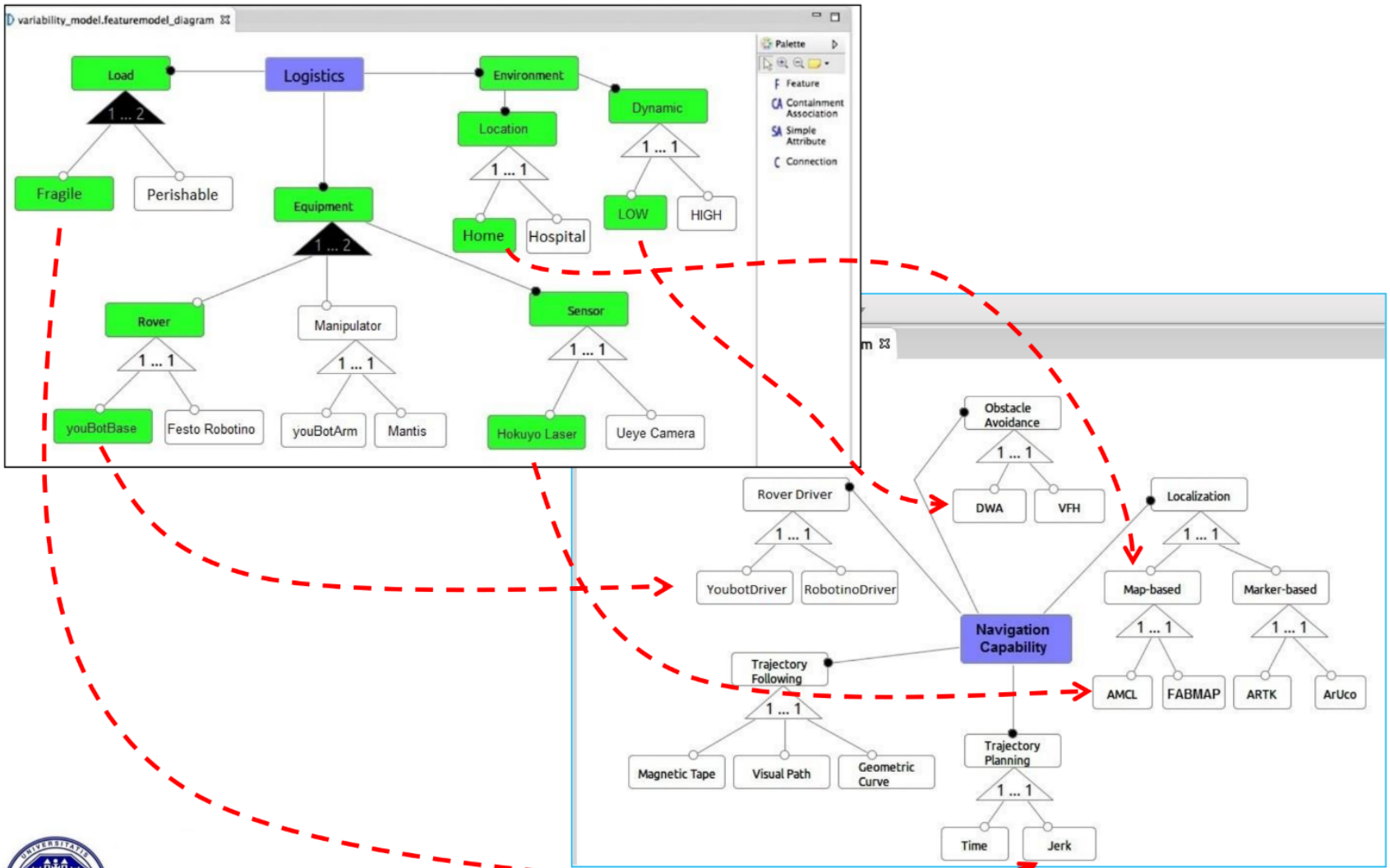
HyperFlex (BRICS project 2009-2012)



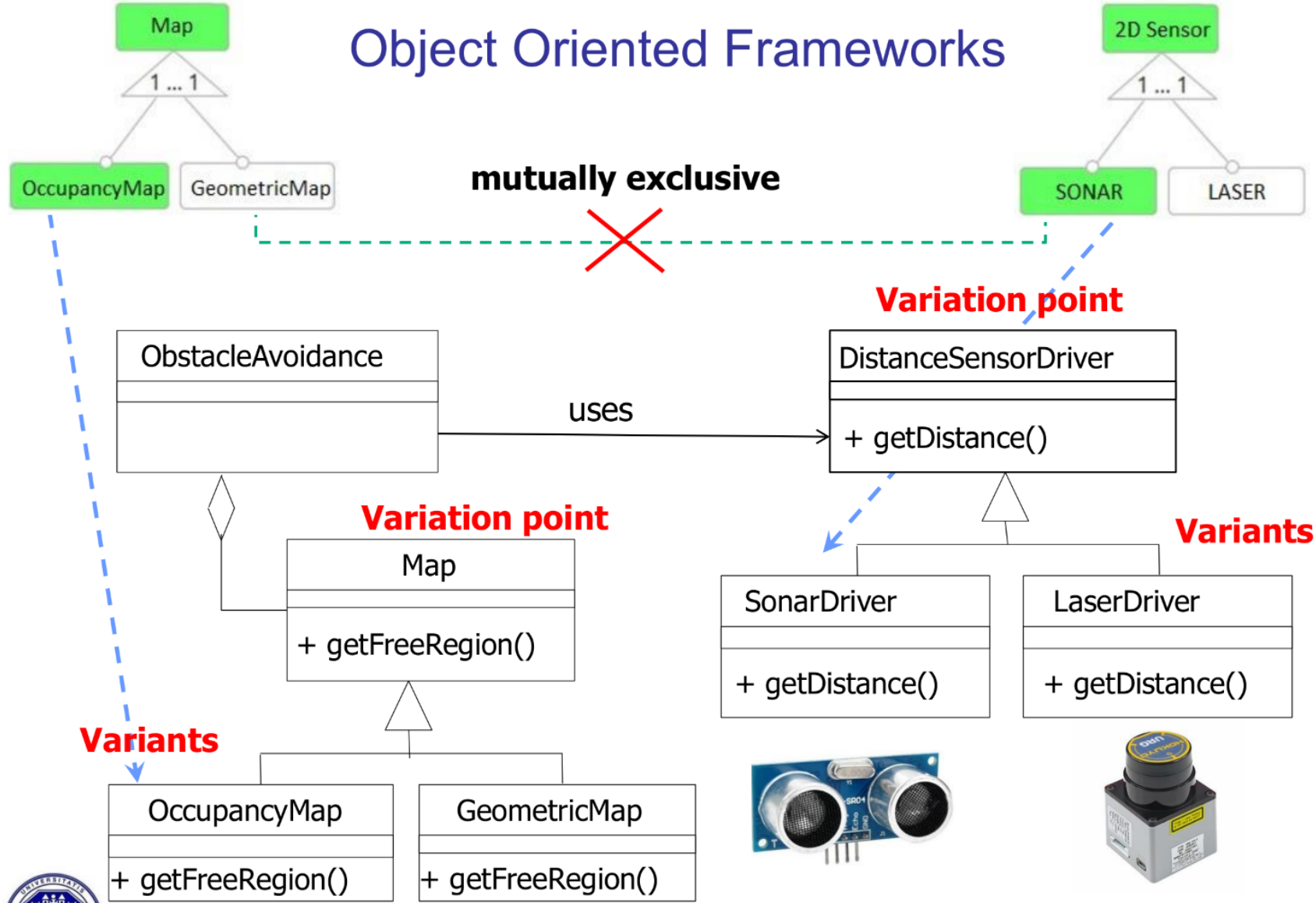
Feature Diagram of Navigation Capability



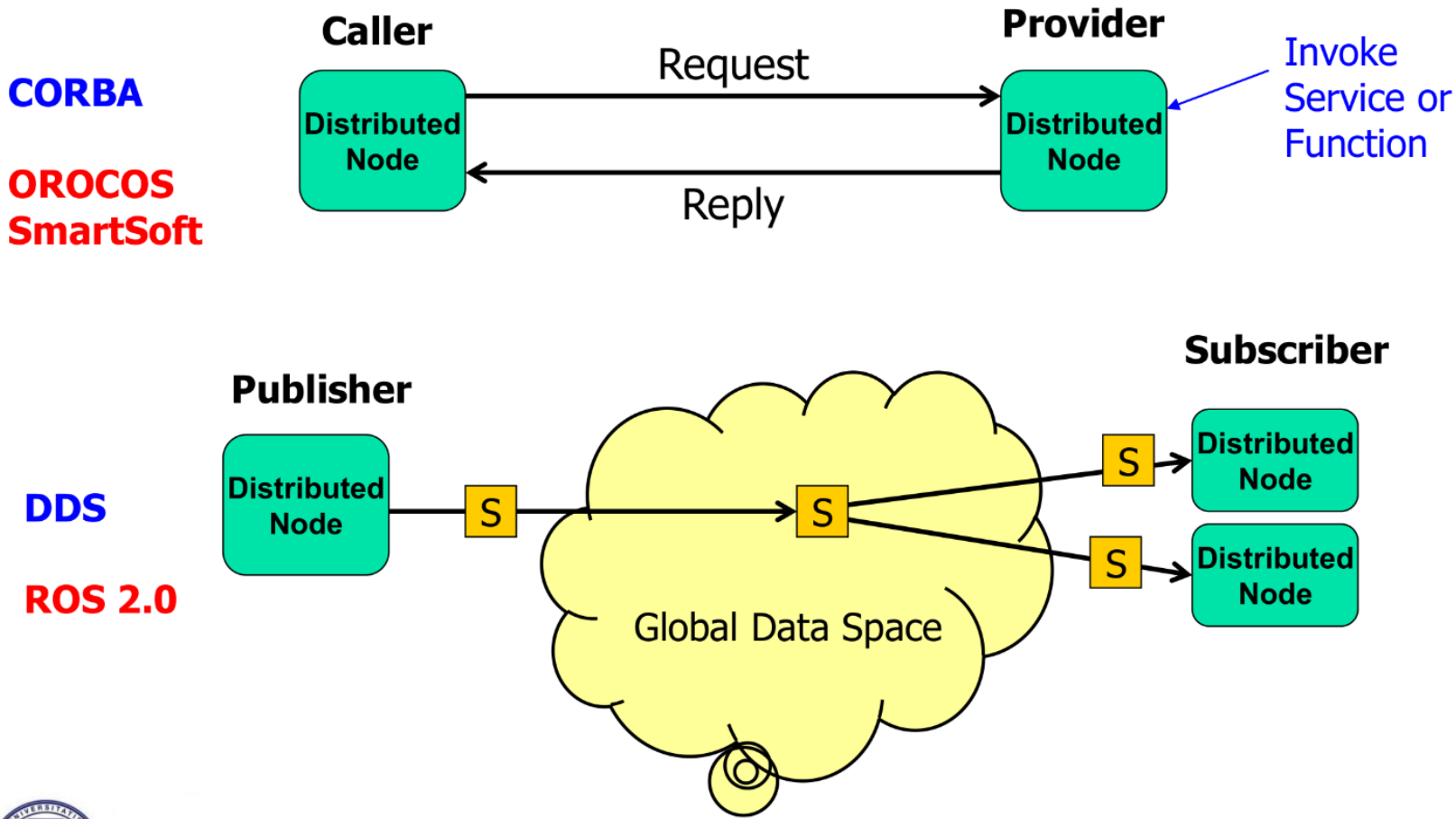
Connecting Feature Models

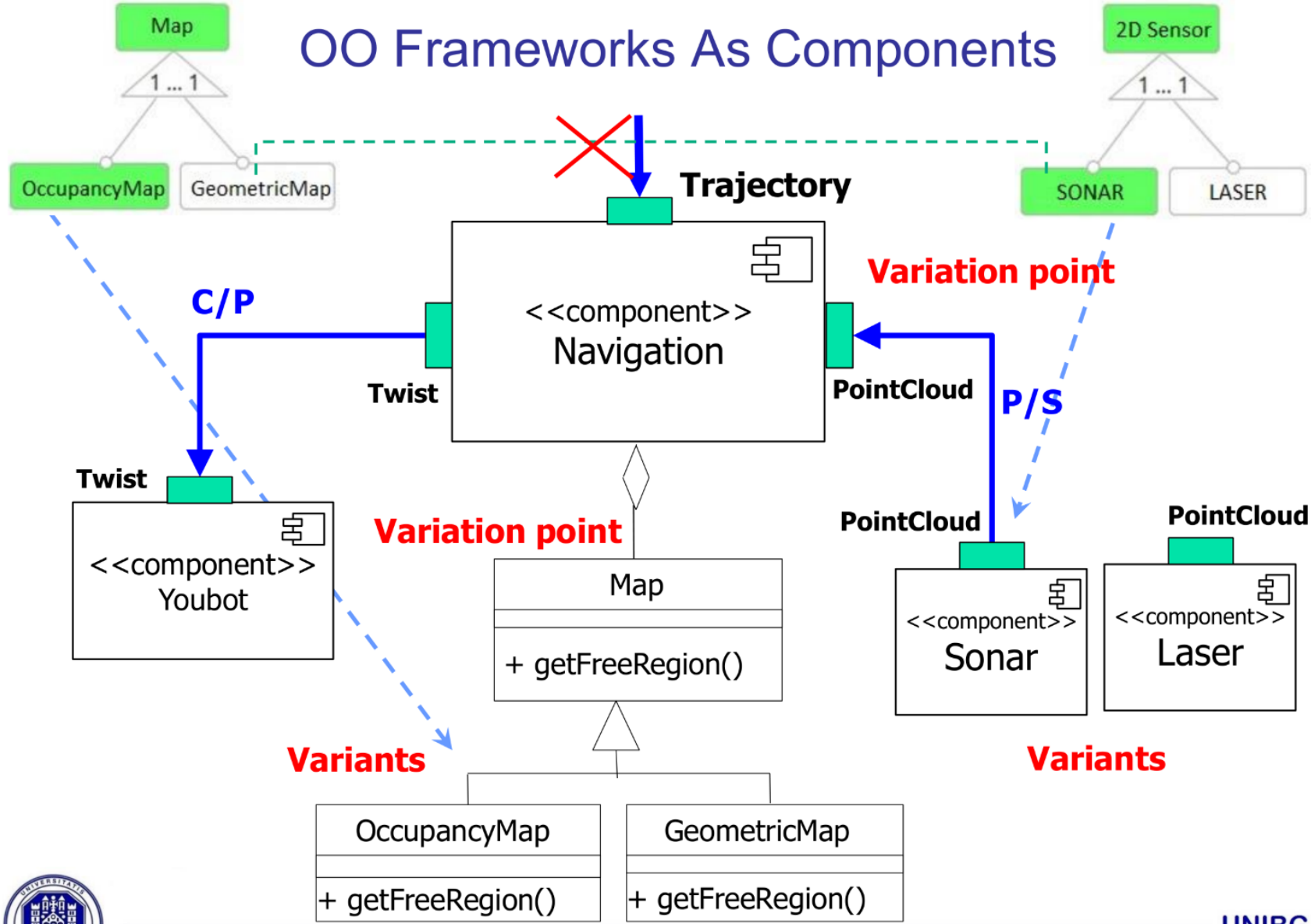


Object Oriented Frameworks



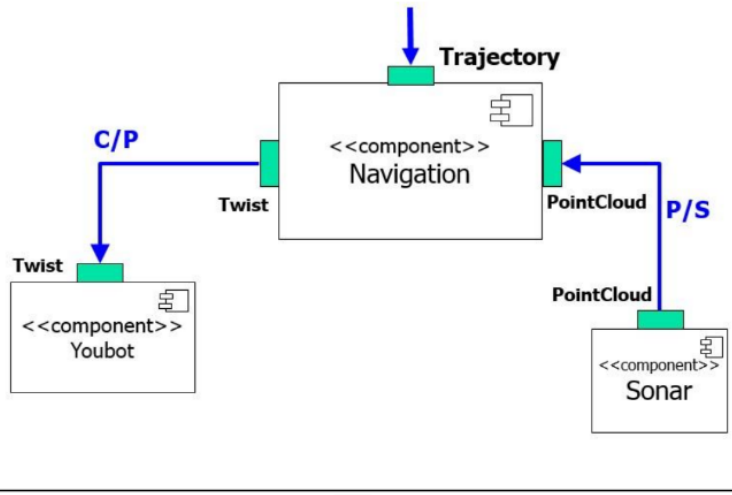
Component-based Distributed Middleware




OO Frameworks As Components
Map
1 ... 1
OccupancyMap
GeometricMap
2D Sensor
1 ... 1
SONAR
LASER
Trajectory
<<component>>
Navigation
C/P
Twist
PointCloud
Variation point
P/S
Twist
<<component>>
Youbot
Variation point
Map
+ getFreeRegion()
PointCloud
PointCloud
<<component>>
Sonar
<<component>>
Laser
Variants
Variants
OccupancyMap
+ getFreeRegion()
GeometricMap
+ getFreeRegion()
UNIBG
LASER Summer School 2017 - Davide Brugali

Architecture Design and Analysis

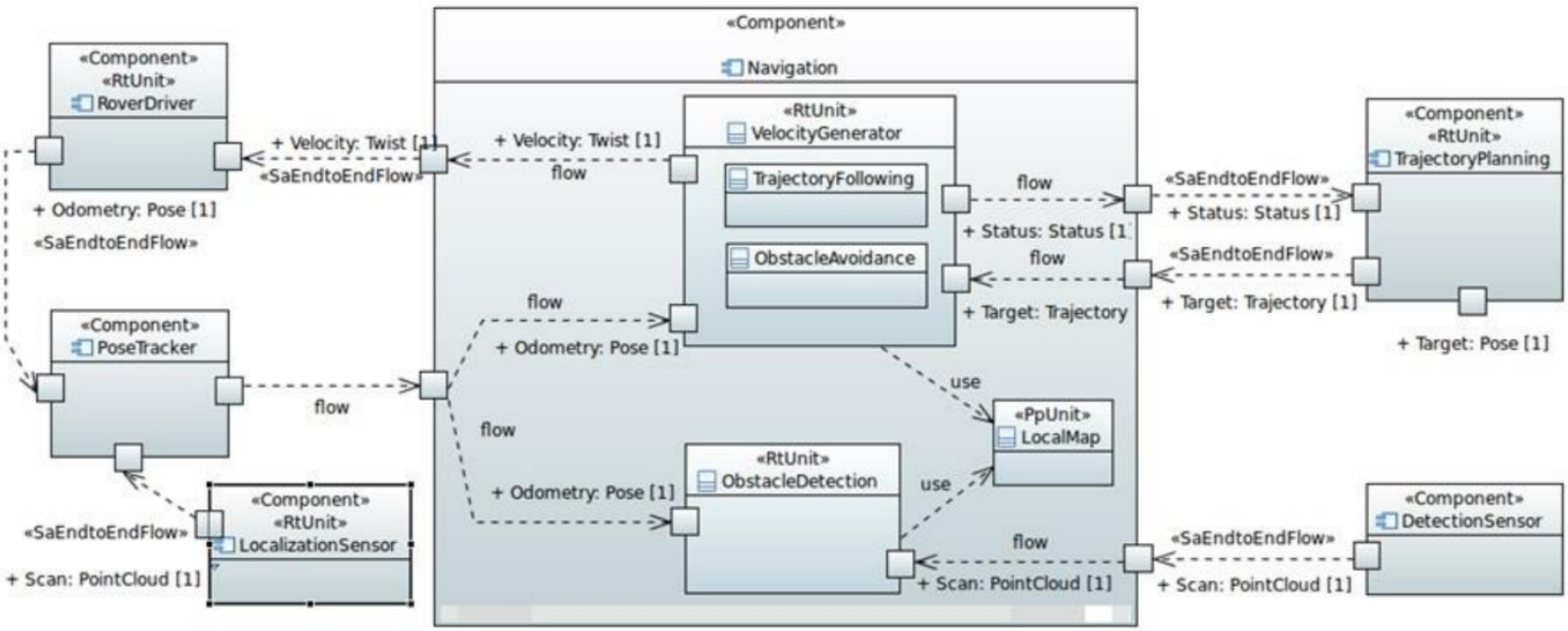
- Architectural Model



- Non Functional Properties
  - Timing constraints
  - Resources capabilities
  - Allocation of functionalities to resources

- Analysis Models
  - Timed Automata
  - Queueing Networks
- System properties
  - Schedulability
  - Response Time
  - Safety
- Analysis Methods
  - Model checking
  - Theorem Proving
  - Rate Monotonic Analysis

UML Modeling and Analysis of RTE Systems (MARTE)



Architecture Analysis and Design Language (AADL)

```
device laser_scanner
  features
    point_cloud: out data port;
  flows
    on_flow_src:flow source point_cloud
                {latency => 5 ms .. 5 ms;};
end laser_scanner;
```

```
process adapt_trajectory
  features
    point_cloud: in data port;
    trajectory: out data port;
  flows
    on_flow_path:flow path point_cloud->traje
                 {latency => 40 ms .. 60 ms;};
  properties
    Period => 100 ms;
end adapt_trajectory;
```

```
process compute_twist
  features
    odometry: in data port;
    trajectory: in data port;
    twist: out data port;
  flows
    on_flow_path:flow path trajectory->twist
                 {latency => 20 ms .. 30 ms;};
  properties
    Period => 50 ms;
end compute_twist;
```

```
device rover
  features
    twist: in data port;
  flows
    on_flow_snk:flow sink twist
                {latency => 10 ms .. 10 ms;};
end rover;
```