

Workshop on Models and Languages for Robotics:

„Separation of Roles“



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Former Members:



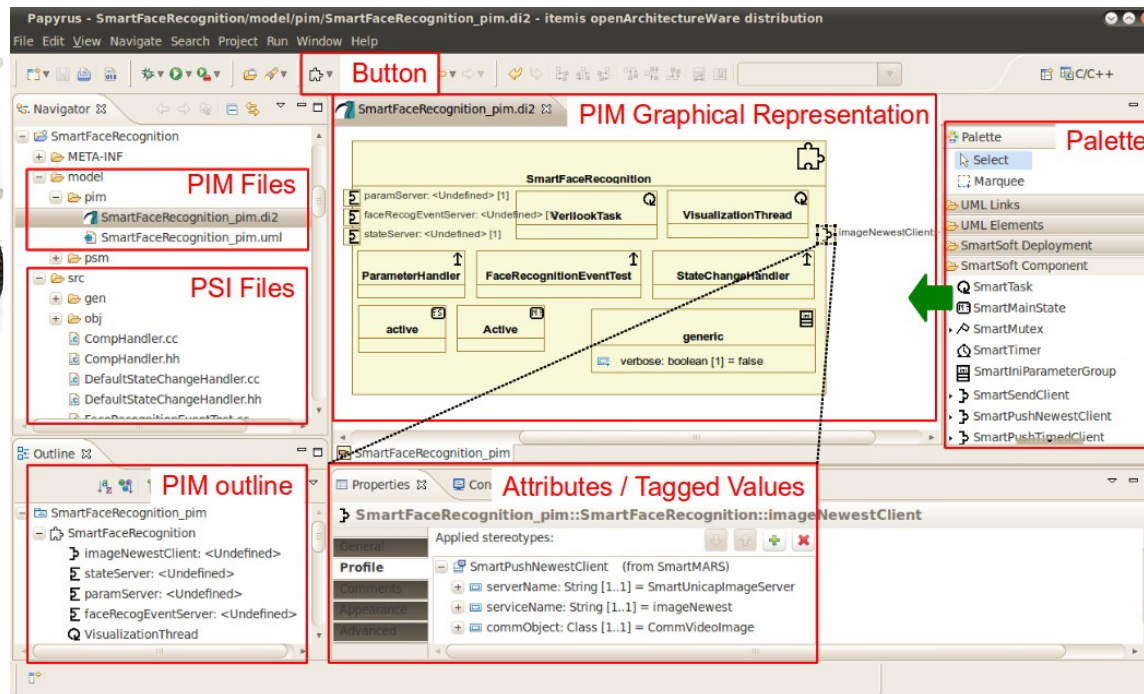
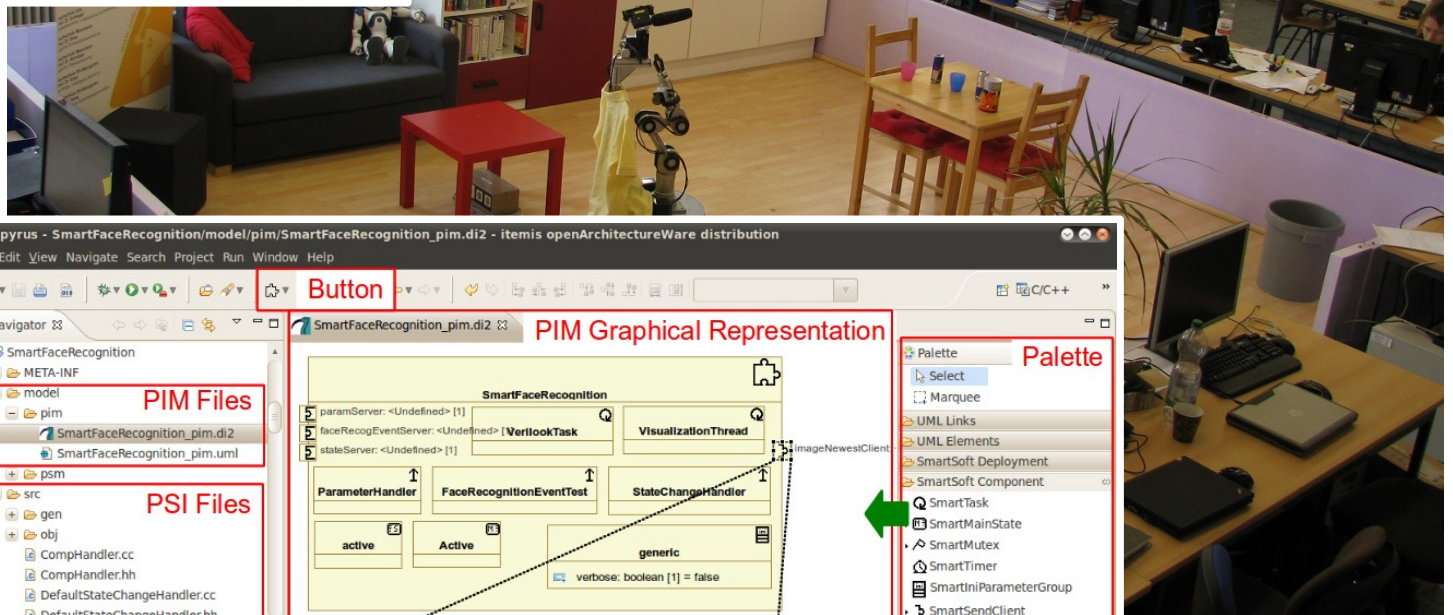
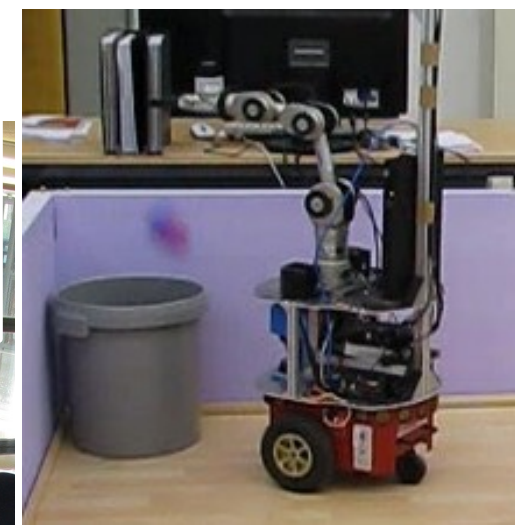
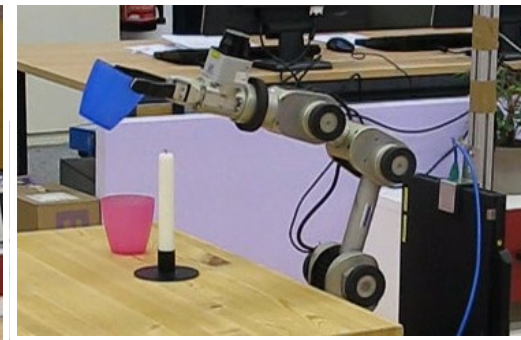
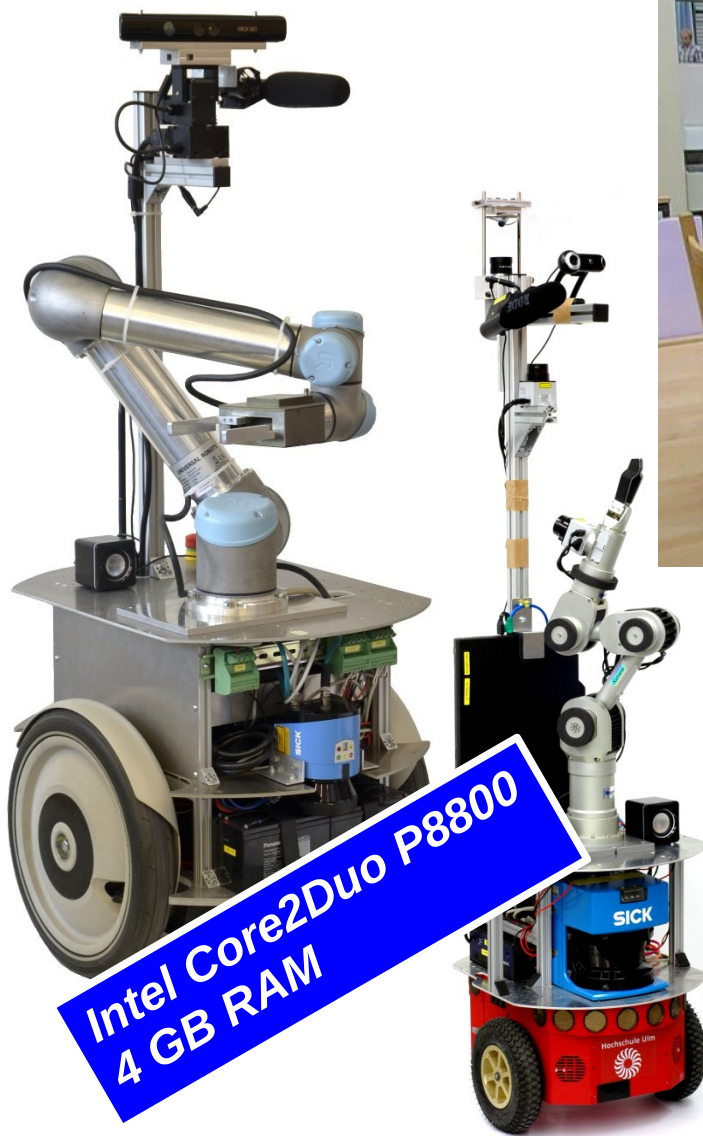
M.Sc. Andreas Steck



Dr. Siegfried Hochdorfer



Prof. Dr. Christian Schlegel



Current Situation and Motivation

No separation of roles

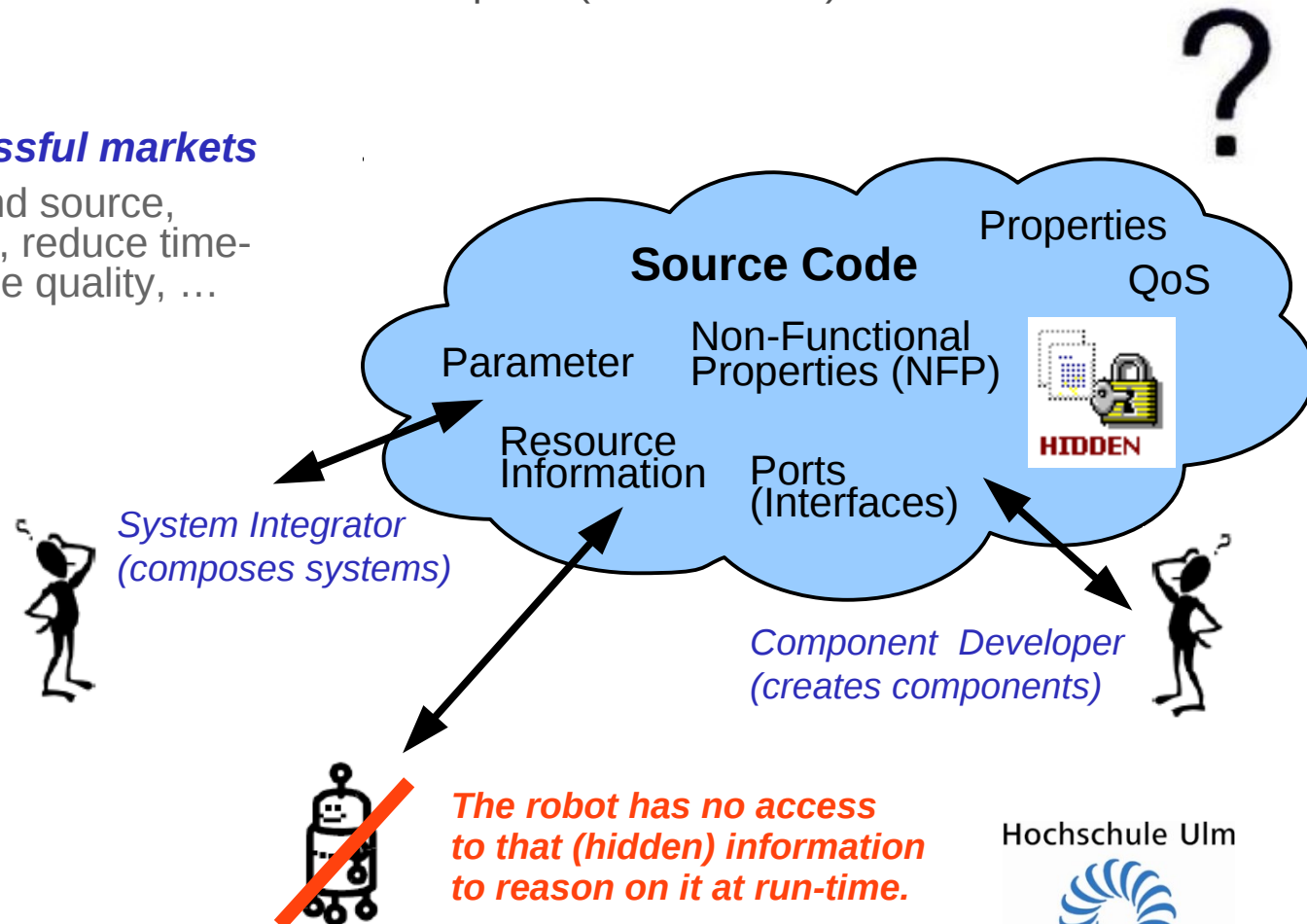
- relevant information is hidden in source files (parameters, properties, ports, resource information)
=> source code has to be analyzed
- no explicit descriptions of properties of software building blocks
=> no black box reuse possible
- domain experts (e.g. cleaning business) need to become robotics experts (or vice versa)
=> no specialization supported

Separation of roles is essential for successful markets

- lower risks, share efforts, provide second source, reduce costs, reduce development time, reduce time-to-market, increase robustness, increase quality, ...

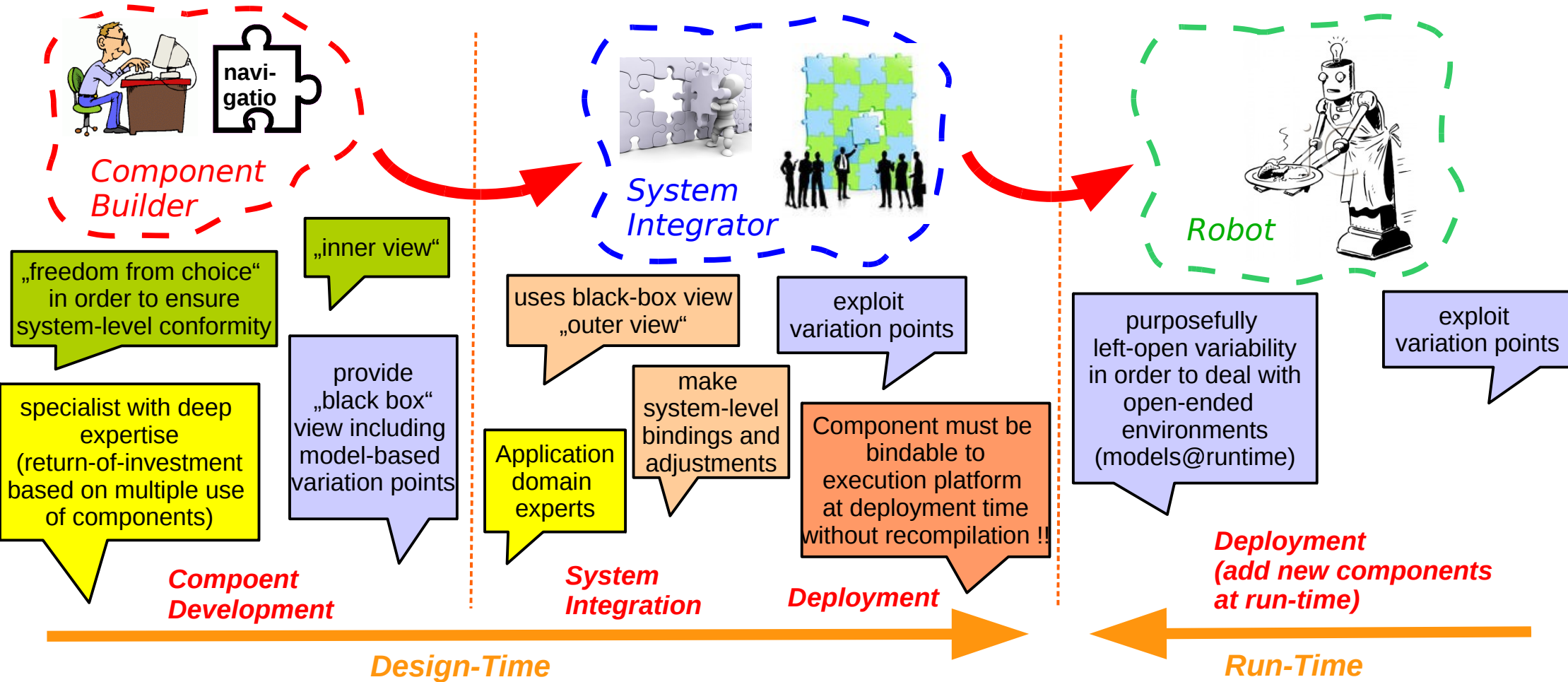


Academia so far circumvented this challenge by **not** separating between component builders and system integrators



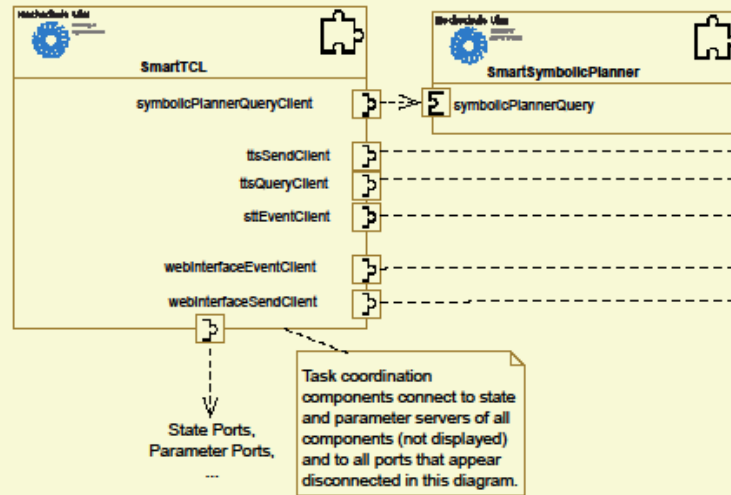
Separation of Roles: Impact on the 5/6 Phases Model

- Use models for the entire life-cycle of the robot
- Models are refined step-by-step until finally they become executable
- Separate inside view (component builder) from outside view (system integrator)
- Separate stable execution container from implementational technologies (middleware, OS)
- Variation points: design-time (component builder, system integrator), runtime (robot)
 - Explicitly model variability for late binding (by system integrator and even by the robot at runtime)

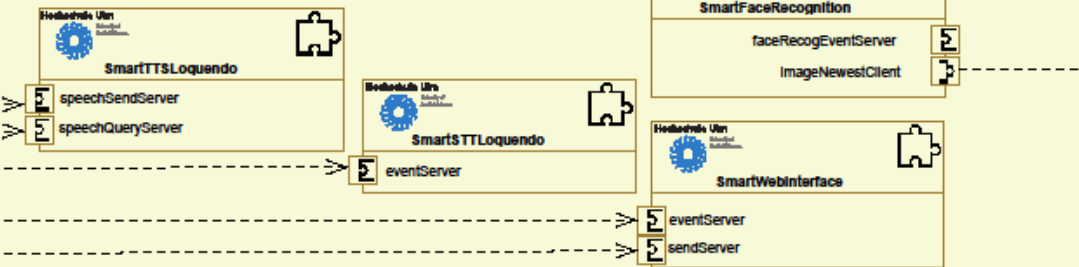


Additional Slides

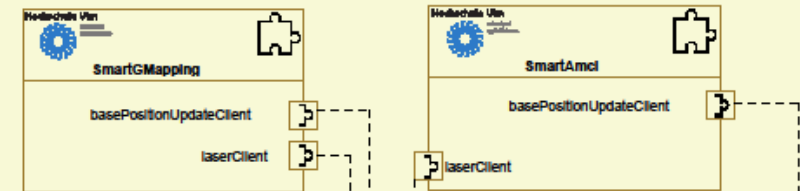
Task Coordination



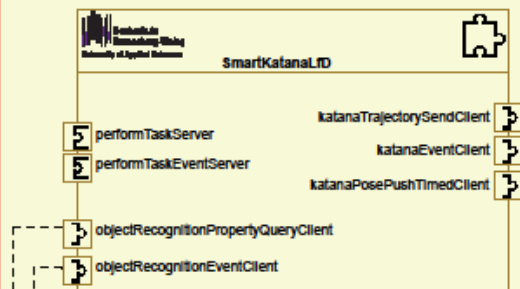
Human Robot Interaction



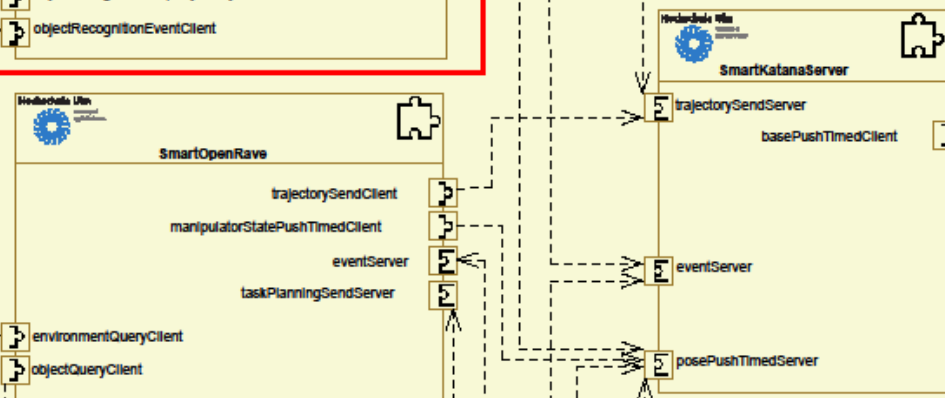
Localization



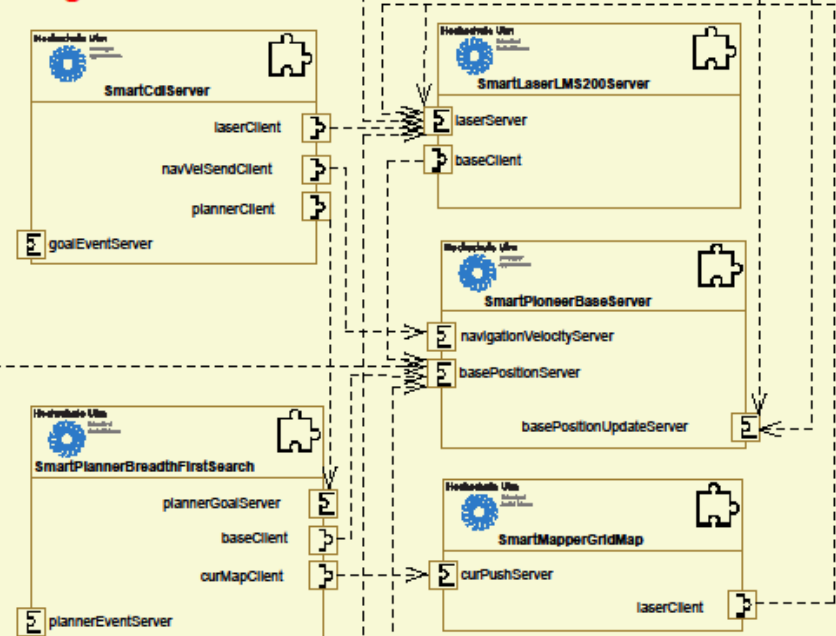
Learning from Demonstration



Mobile Manipulation



Navigation

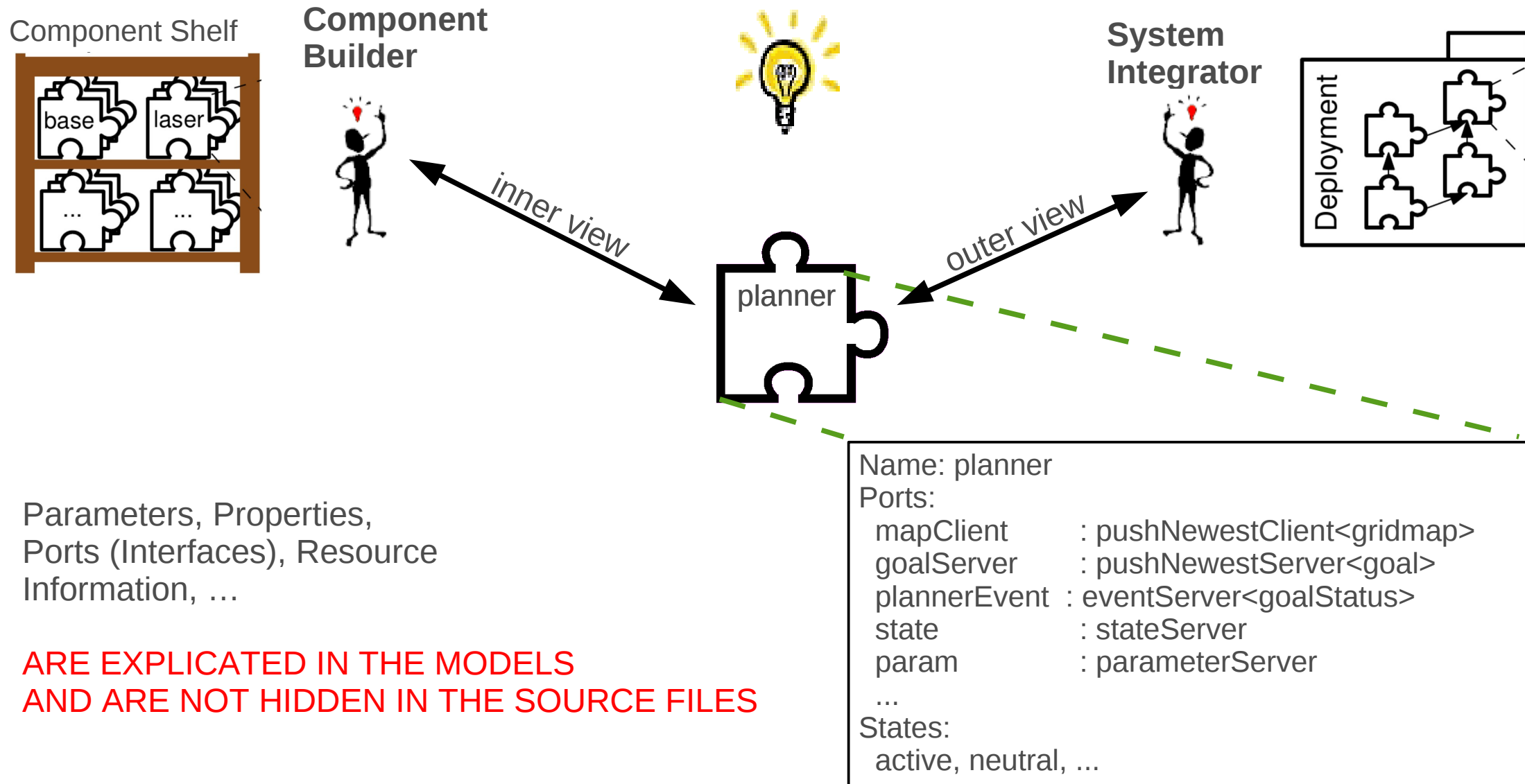


Object Recognition



Software Concepts for Service Robots:

What we want to have: separation of roles, concerns



Model-Driven Software Development: Component Builder View

Papyrus - SmartFaceRecognition/model/pim/SmartFaceRecognition_pim.di2 - itemis openArchitectureWare distribution

File Edit View Navigate Search Project Run Window Help

Button

PIM Graphical Representation

Palette

PIM Files

PSI Files

PIM outline

Attributes / Tagged Values

SmartFaceRecognition

paramServer: <Undefined> [1]
faceRecogEventServer: <Undefined> [1]
stateServer: <Undefined> [1]

VisualizationThread

ParameterHandler

FaceRecognitionEventTest

StateChangeHandler

active

Active

generic

verbose: boolean [1] = false

imageNewestClient

Palette

Select
Marquee

UML Links
UML Elements
SmartSoft Deployment
SmartSoft Component

SmartTask
SmartMainState
SmartMutex
SmartTimer
SmartIniParameterGroup
SmartSendClient
SmartPushNewestClient
SmartPushTimedClient

Outline

SmartFaceRecognition_pim

SmartFaceRecognition

imageNewestClient: <Undefined>
stateServer: <Undefined>
paramServer: <Undefined>
faceRecogEventServer: <Undefined>
VisualizationThread

Properties

SmartFaceRecognition_pim::SmartFaceRecognition::imageNewestClient

Applied stereotypes:

SmartPushNewestClient (from SmartMARS)

serverName: String [1..1] = SmartUnicapImageServer
serviceName: String [1..1] = imageNewest
commObject: Class [1..1] = CommVideoImage

General
Profile
Comments
Appearance
Advanced

Movie Time

Screencast
„Build a Component Hull“

Model-Driven Software Development: System Integrator View

Papyrus - DeployNavTask/model/DeployNavTask.di2 - itemis openArchitectureWare distribution

File Edit View Navigate Search Project Run Window Help

Button

Deployment Model

- model
- DeployNavTask.di2
- DeployNavTask.uml

Imported Components

- import SmartCdiServer
- SmartCdiServer
- import SmartMapperGridMap
- SmartMapperGridMap
- import SmartPioneerBaseServer
- SmartPioneerBaseServer
- import SmartPlannerBreadthFirstSearch
- SmartPlannerBreadthFirstSearch
- import SmartLaserLMS200Server
- SmartLaserLMS200Server
- import SmartRobotConsole
- SmartRobotConsole
- import SmartAmcl
- SmartAmcl

Graphical Representation of Deployment Model

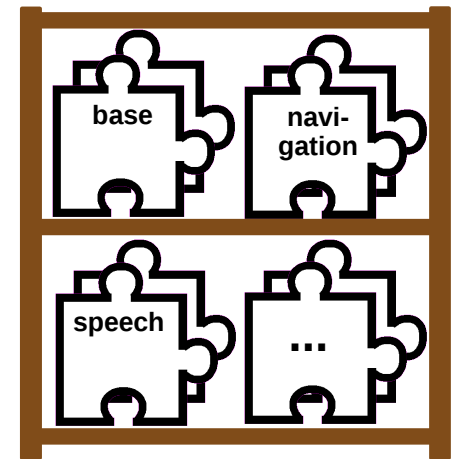
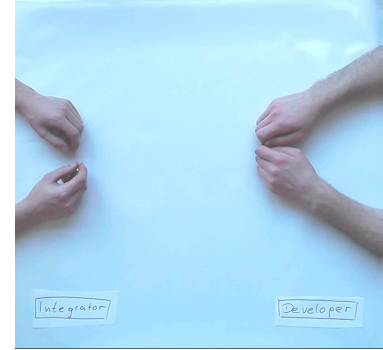
Palette

- Select
- Marquee
- UML Links
- UML Elements
- SmartSoft Deployment
- CorbaNamingService
- RTAISetup
- Connection

Deployment Properties

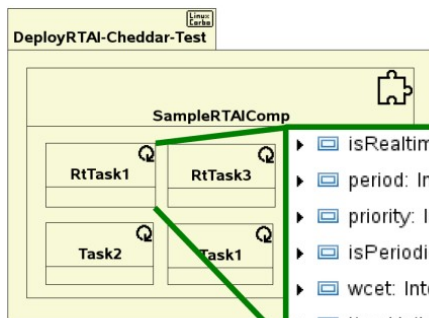
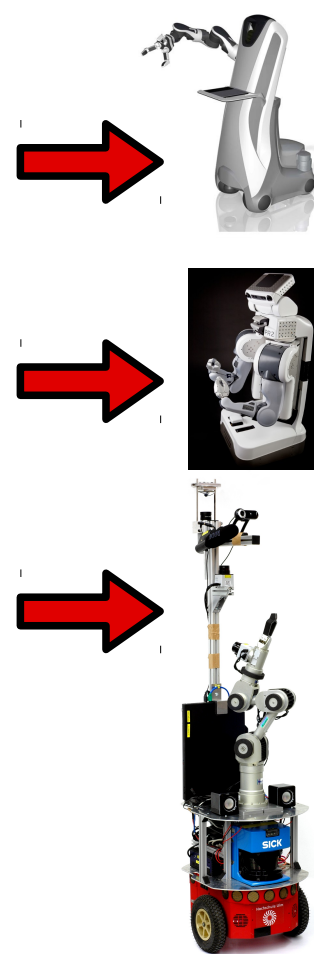
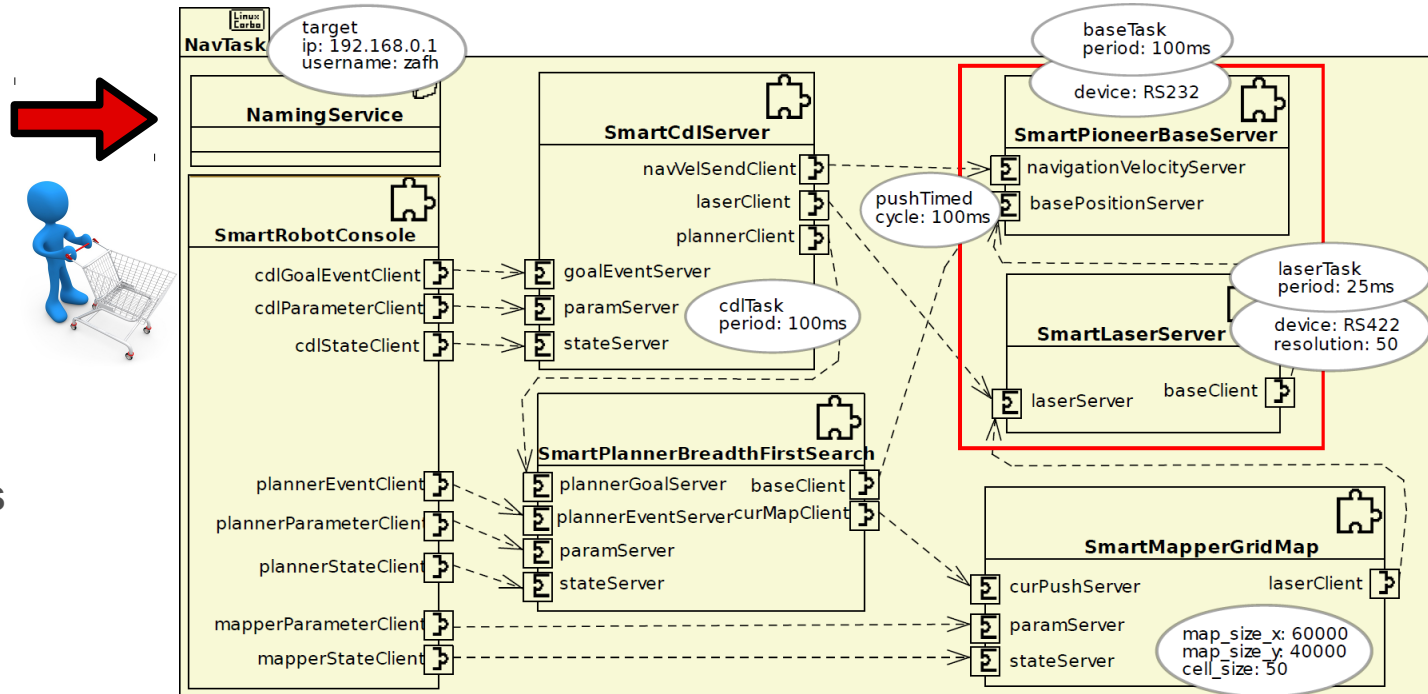
- ip: String [1..1] = 192.168.31.115
- deployed: DeployType [1..1] = remote
- username: String [1..1] = student
- directory: String [1..1] = tmp/autms

Model-Driven Software Development: System Integrator View



Component Shelf
Reusable Components

System Level Properties / Bindings / Conformance Checks



- isRealtime: Boolean [1..1] = true
- period: Integer [1..1] = 1000
- priority: Integer [1..1] = 1
- isPeriodic: Boolean [1..1] = true
- wcet: Integer [1..1] = 25
- timeUnit: TimeUnitKind [1..1] = ms

