Pervasive Computing
at the Maersk Institute

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Background

Kasper Hallenborg
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Previously:

- Finished my masters project last year.

  Applied Mathematics and Software Engineering.

  Creating a framework for supporting simulations in general.

Currently:

- Ph.D. project:

  Creating a framework for pervasive and ubiquitous computing.

  Based on a conceptual model called TangO.

- Diploma in Economics and Management

Ph.D. Project

Currently working on:

- Validating the TangO conceptual model for modelling pervasive and ubiquitous computing.

- Supporting TangO implementations by the Jini Technology.

- Exploring the limitations of Jini.

  Jini on PDAs without a surrogate architecture.

  Service descriptions for unknown services.

- An motivating example

  A shopping mall transferring commercials, maps, and guidance applications to customers PDAs.

- Other topics of interest

  Positioning techniques
  - GPS or DGPS
  - Pseudolites (GPS for indoor positioning), very accurate.

  Contextual interfacing
  - Framework for sensors and actuators with different abstraction levels

TangO conceptual model - concepts
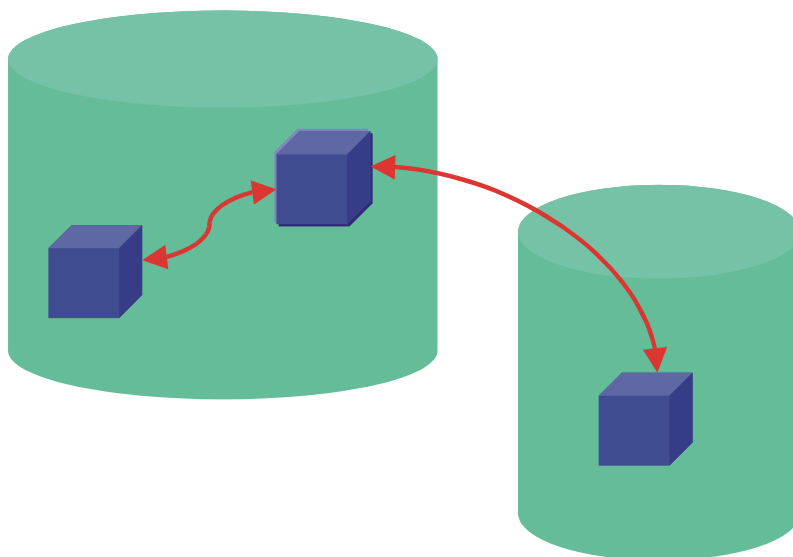
Tangible Object

- An artifact that has been designed for the pervasive world, incorporating design factors from each of the spaces.

Habitat

- A logical context in which the tangible objects exists and interact.

Association

- A relation by which tangible objects and habitats collaborate in a given way at a given time – the actual collaboration is not predetermined by properties of objects and habitats.

Tangible objects
Habitats (computational)
Associations (associative behavior)

TangO conceptual model - spaces

Physical space

- We can interact with artifacts in the physical form (atoms), they can be touched, thrown or moved around.
- Example: Conventional books that sit on a shelf, physically located in a library or a bookstore.

Informational space

- Artifacts can be stored, copied, modified. We think of artifacts by their informational form (bits).
- Example: The corresponding software object of the conventional book, residing a a database system.

Conceptual space

- We interact with artifacts by their conceptual form (ideas). The concepts can shape the way we understand the world and purpose of the artifact.
- Example: The idea of a book being stored in a library and being capable of being borrowed.

habitats

associations

spaces
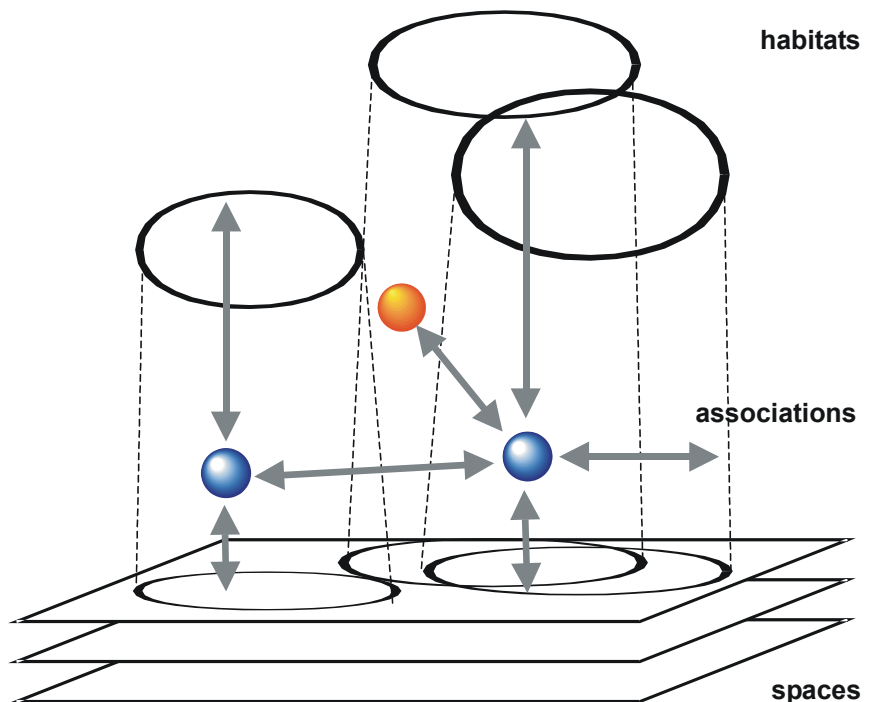
FLIP – Flexible Packing Process

The aims of the project

- Turn the production area of Lego in a pervasive system

  Current setup:
  - Very automatic, but inflexible, production area.
  - Robots driving around picking up boxes with bricks.
  - Centralized controlled and very strict rules for movements.

  Future setup (hopefully):
  - Still automatic production area.
  - Autonomous robots transporting boxes with bricks, but can change tools and do other things.
  - Pervasive system, where robots adapt the behavior to the current context.

12 Welding rooms

High-store area

Pickup stations

Pallet lifters

Trucks
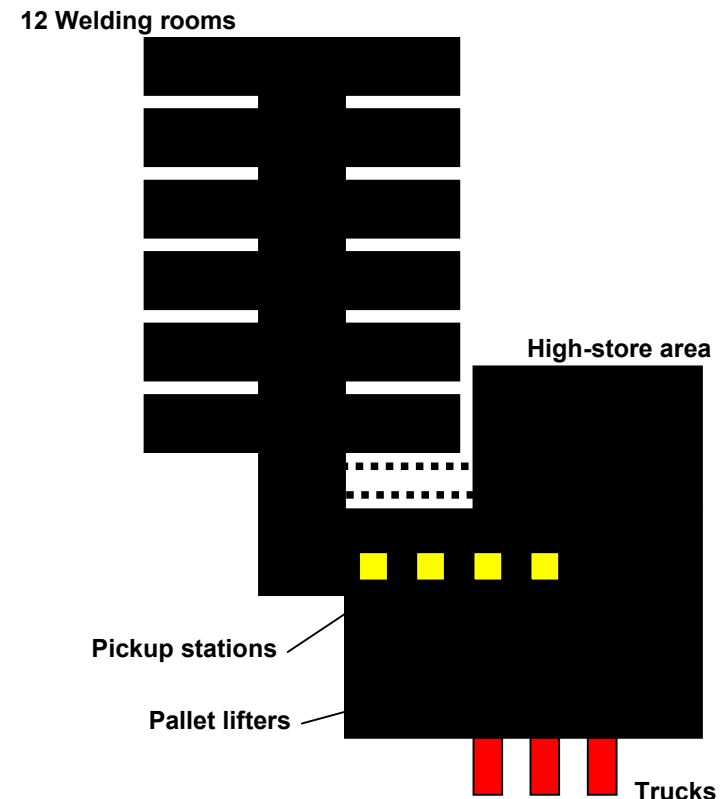
FLIP – Cont'd

How to do it?

- ### Simulation

  Simulate the production area in our lab.

  Lego Mindstorm Robots equipped with a PDA, WLAN, and some kind of accurate positioning sensor (GPS receivers and pseudolites).

  IR communication between the PDA and the RCX computer.

- ### Real implementation

  Adapting and reprogramming existing robots.