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.
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 at 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.
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.
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.