LMU LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN

NTT DoCoMo

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Comparing Techniques for Mobile Interaction with Objects from the Real World

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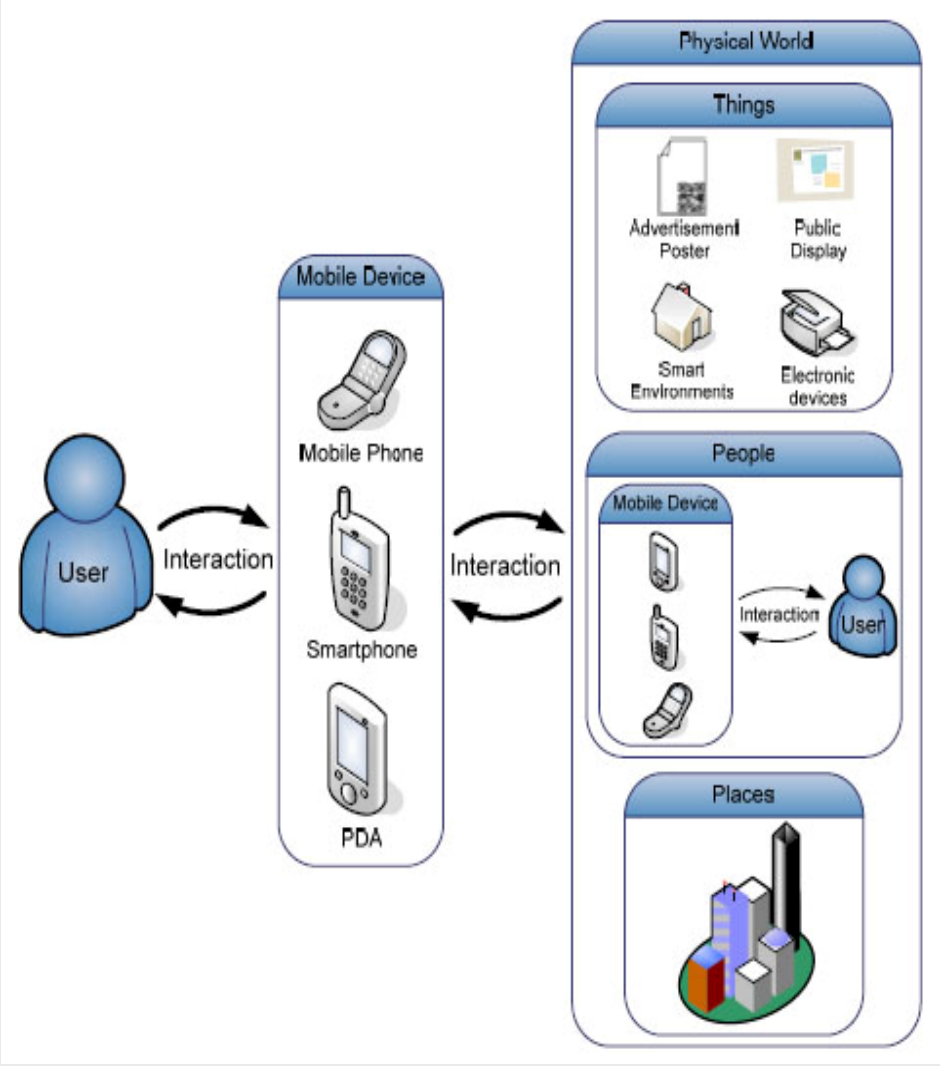
Motivation: Mobile Interaction with the Real World

- Everyday objects can be augmented and associated with additional information and services
- Technologies: visual marker recognition, RFID,NFC, laser pointer, IrDA, Bluetooth, GPS, …
- Objects become electronically recognizable and get digital identities
- Powerful mobile devices for capturing, processing and using this information from the real world
- Both trends build the foundation for Physical Mobile Interaction

Physical Mobile Interaction

- Extends mobile interaction to the interaction with real world objects
- More intuitive and more familiar access to information through interaction with associated objects
- Techniques:
  - Touching (e.g. NFC)
  - Pointing (e.g. visual marker)
  - Scanning (e.g. Bluetooth)
  - Location Based Selection (e.g. GPS)
  - …
- Often only simple usage => gateway for traditional interaction

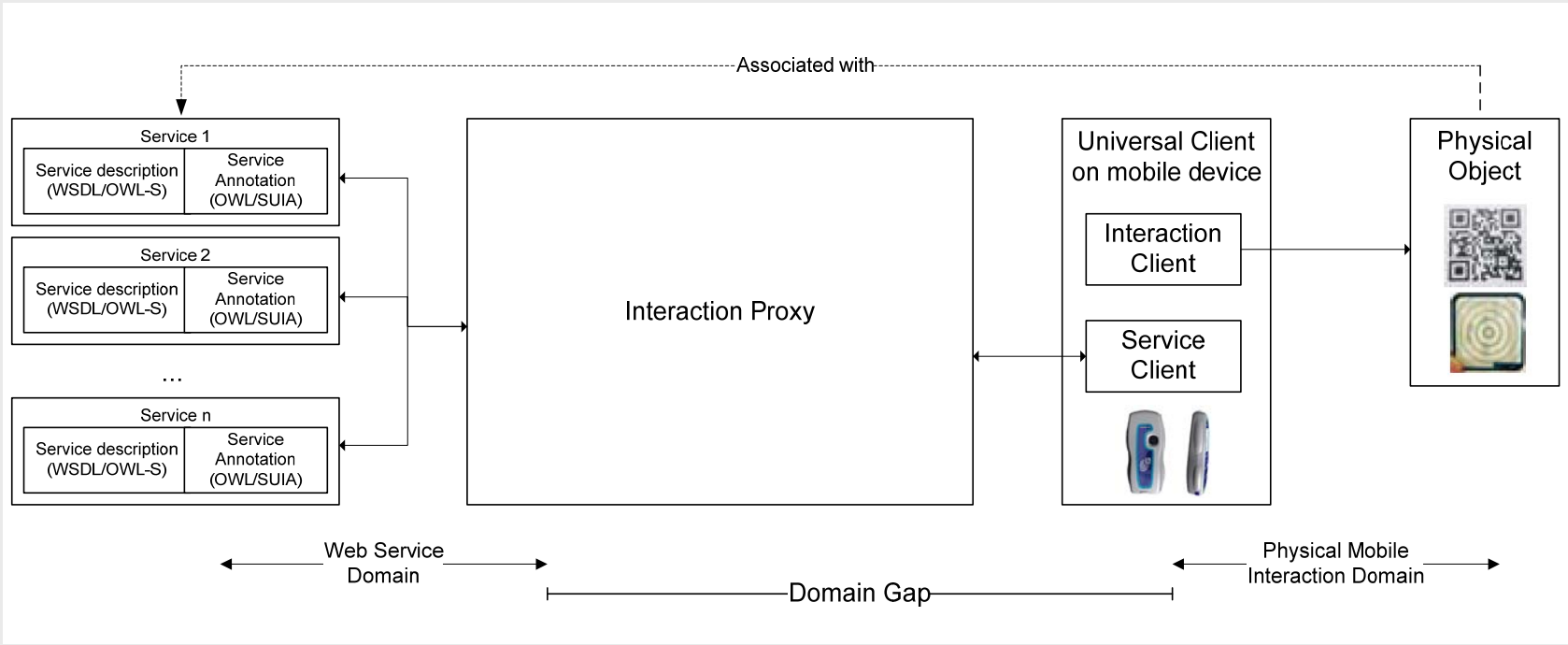


Motivation and Approach

- Approach of PERCI (PERvasive ServiCe Interaction): Collaboration between NTT Docomo Eurolabs and LMU
- Taking advantage of Physical Mobile Interaction for better mobile interaction with (Semantic) Web Services
- Physical Mobile Interaction to make mobile interaction with people, places, things easier and more intuitive
- Touching or Pointing instead of complex menus
- Outbalancing constraints of traditional mobile interaction
- Shift focus of interaction from mobile devices onto physical objects => ubiquitous interfaces
- Explore the potential of more complex techniques for Physical Mobile Interaction

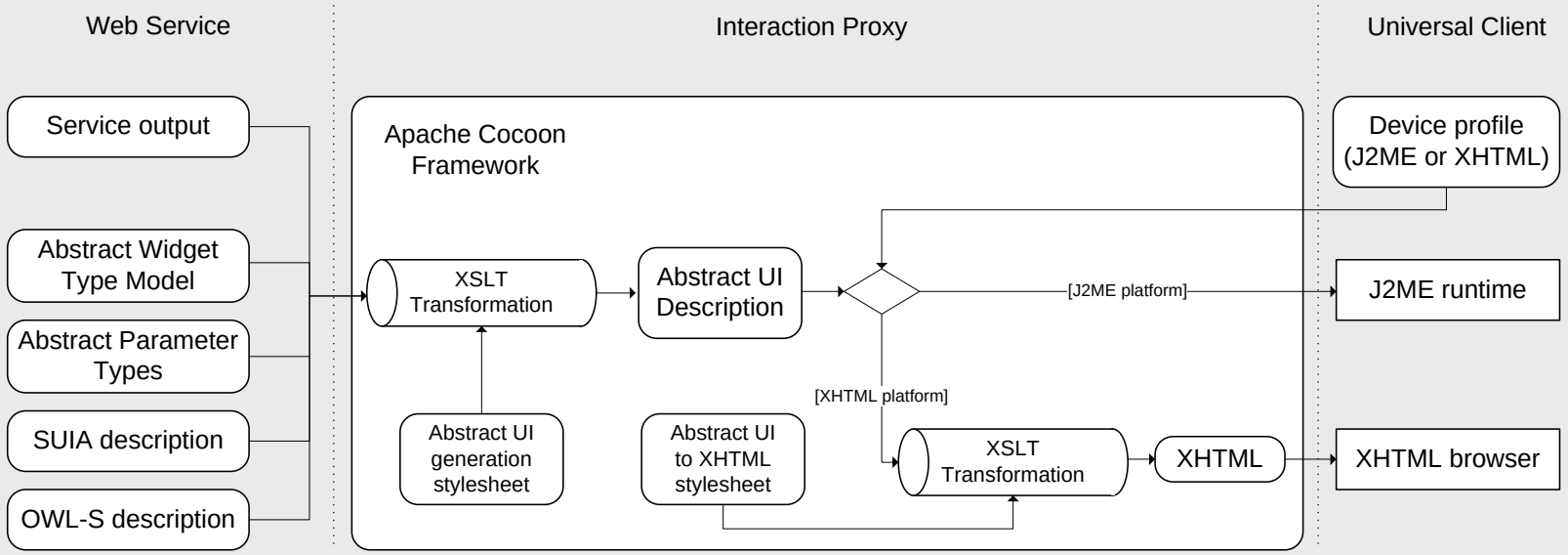
The Perci Framework - Overview

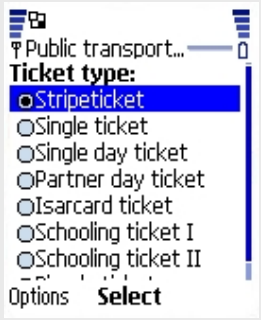
- Framework bridging the gap between the *Web Service Domain* and the *Physical Mobile Interaction Domain*
- A *Universal Client* running on a mobile device is interacting with *Physical Objects,* providing a technical connection to services
- *Interaction Proxy* (IAProxy) mediates between the two domains

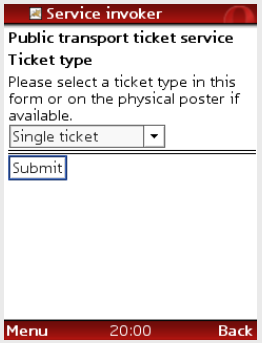


User Interface Generation Process

- Automated generation of adaptable interfaces from extended Semantic Web Service descriptions to support Physical Mobile Interaction
- Different service descriptions and interface extensions as basis for interface generation, customization and rendering
- XSLT transformation of different description sources to composed *Abstract UI Description* => basis for further transformations and ui rendering







Use Cases for Mobile Ticketing

Prototype-Implementation of Physical Mobile Interaction

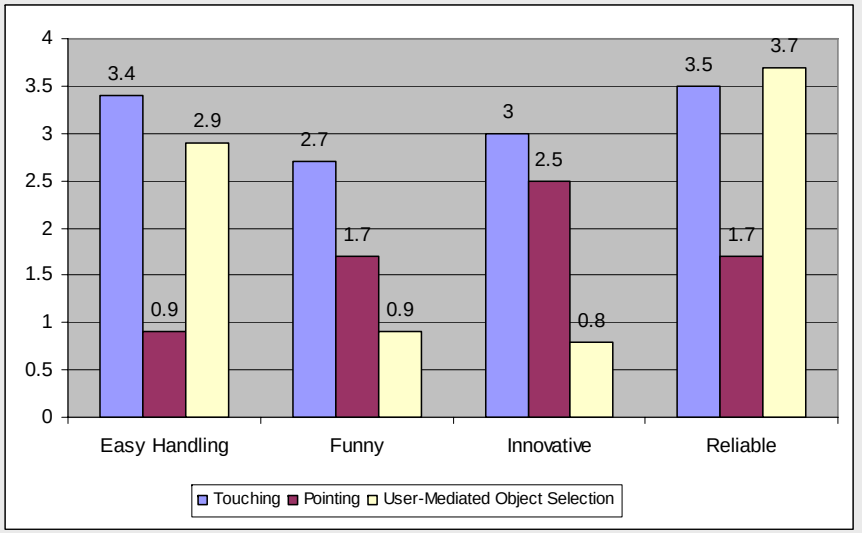
- Prototype implemented with J2ME, the Nokia RFID & NFC SDK 1.0 and kXML
- Posters were augmented with NFC-tags and visual markers
- Development and testing with Nokia 3220 (plus NFC shell) and 6630 mobile phones
- Typing of tags: actions and parameters
- **Touching:** reading object descriptions from NFC-tags
- **Pointing:** recognition of visual codes through phone cameras
- **Direct Input:** typing of number identifiers (e.g. in a HTML-browser)

User Study and Evaluation

- 17 participants, aged from 23 to 46, 4 female, 13 male
- Process
  - Preliminary interview
  - Carrying out a task (buying a movie ticket) with all 3 interaction techniques
  - Touching and Pointing tested with Java ME clients
  - Direct Input was tested with a mobile HTML-browser (Opera)
  - Order of the techniques was changed with every user
- General Results and Issues:
  - Subjects often did not know how to start the interaction; expected workflow
  - Lack of predefined interaction sequence confused them
  - Most subjects ignored instructions on the poster or did not appreciate them
  - Concept of action/parameter tags was often not understood at first
  - Subjects learned how to use them after the initial problems

Comparison between Touching, Pointing and Direct Input

- Direct input suffered from problems with the HTML-browser
- Pointing suffered from the delay when taking a picture of a visual marker
- Touching was by far considered to be the fastest (13/12 subjects before/after the study) and most favourite (13/13 subjects before/after the study) interaction technique
- Touching:
  - best overall results
  - most reliable, enjoyable, innovative and easiest to handle
- Pointing:
  - overall bad results
  - more innovative and reliable than Direct Input
- Direct Input:
  - reliable and easy to handle
  - neither innovative nor enjoyable



Conclusion and Future Work

- Generic framework for the combination of Physical Mobile Interactions and Semantic Web Services
- J2ME client prototype supporting the interaction techniques Touching, Pointing and Direct Input
- Evaluation showed overall acceptance and potential of more complex techniques for Physical Mobile Interaction
- Still constraints and limitations => need for usability design guidelines

Questions?

Thank You!

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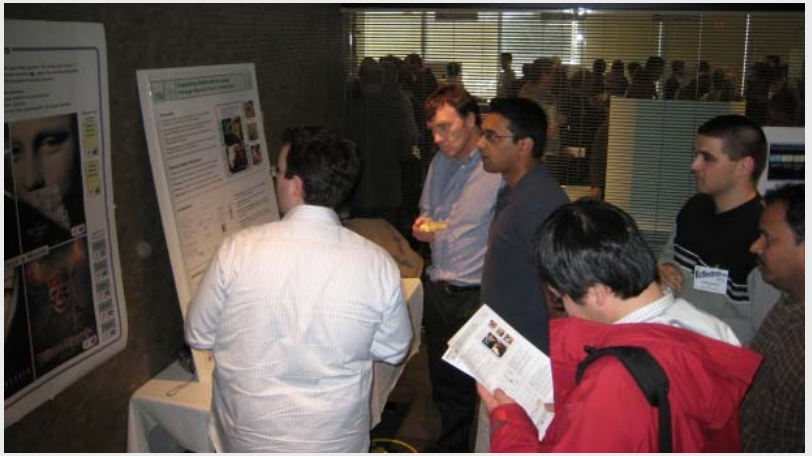
www.hcilab.org/projects/perci



Related Work