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# Supporting Mobile Service Usage through Physical Mobile Interaction

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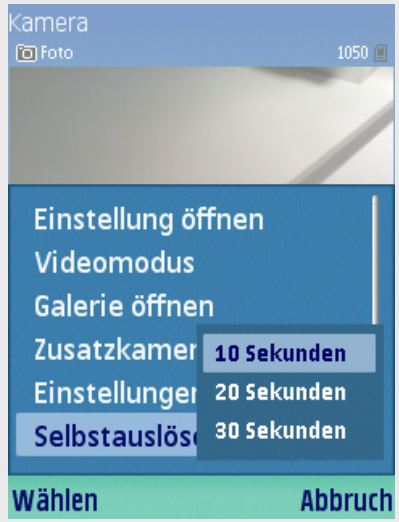
# Motivation: Using Mobile Services

- Using Web Services in the mobile domain not as widespread and established as in desktop computing
- Mobile applications and services restricted by constraints of mobile devices:
  - Interaction (e.g. tiny keys, fiddly joysticks)
  - Presentation (e.g. small screens)
  - Usability (e.g. nested and glutted menus)
- Adds to general problem of adapting mobile applications and interfaces to different platforms
- Development of and interaction with mobile applications/services thus often tedious, intricate and inflexible

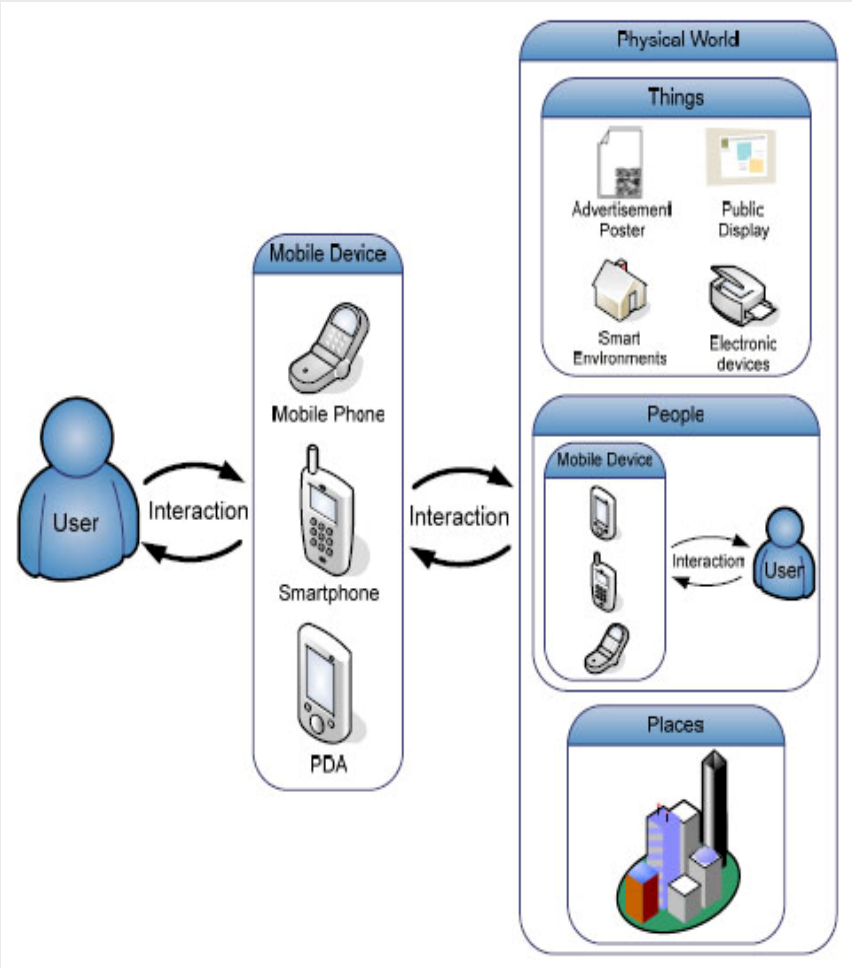
# Motivation: Mobile Interaction with the Real World

- 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



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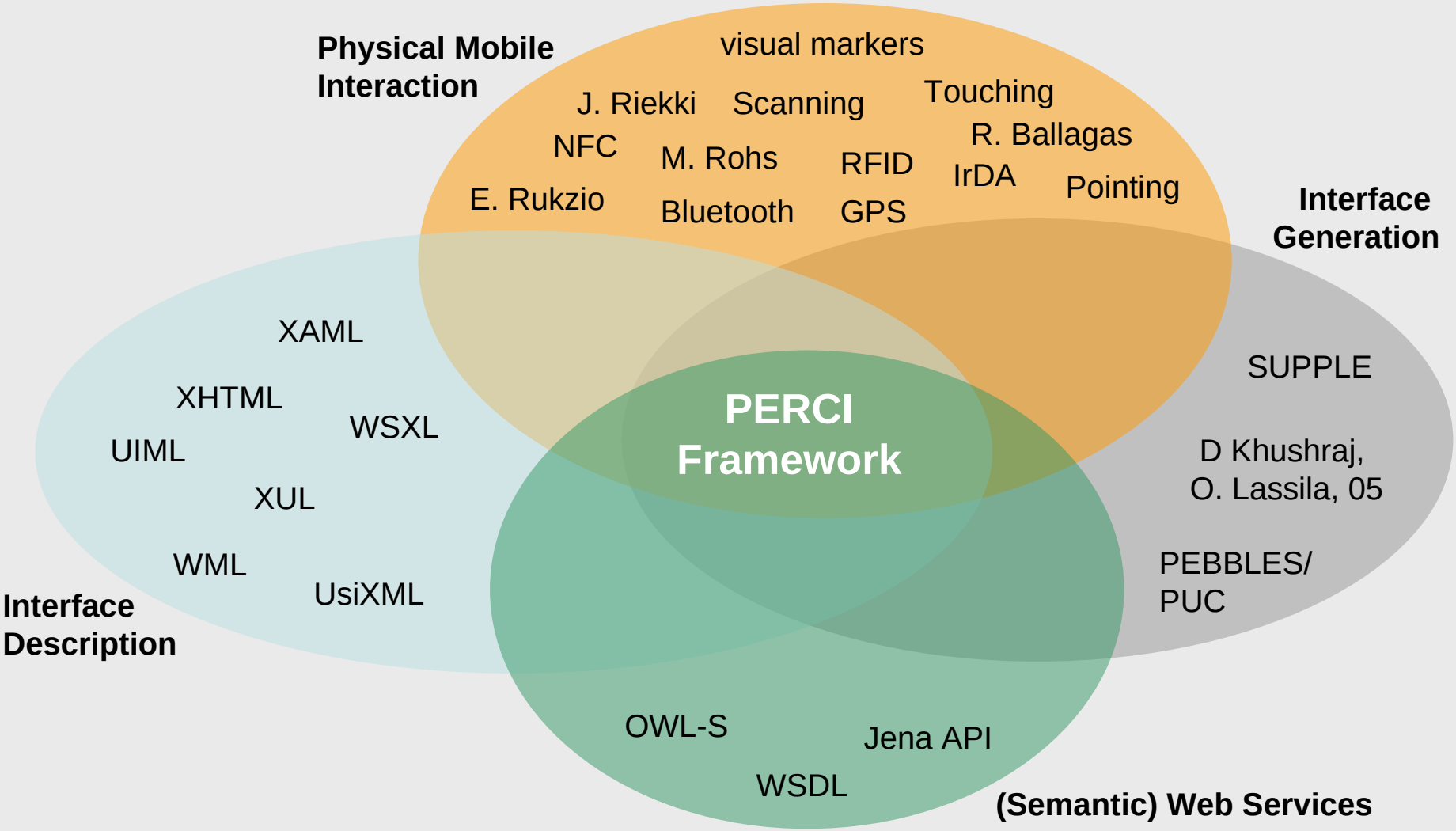
# Physical Mobile Interaction - Examples

# Approach and Agenda

- How to facilitate mobile interaction with Web Services through the interaction with physical objects?
- How to make complementary usage of Web Services and Physical Mobile Interaction?

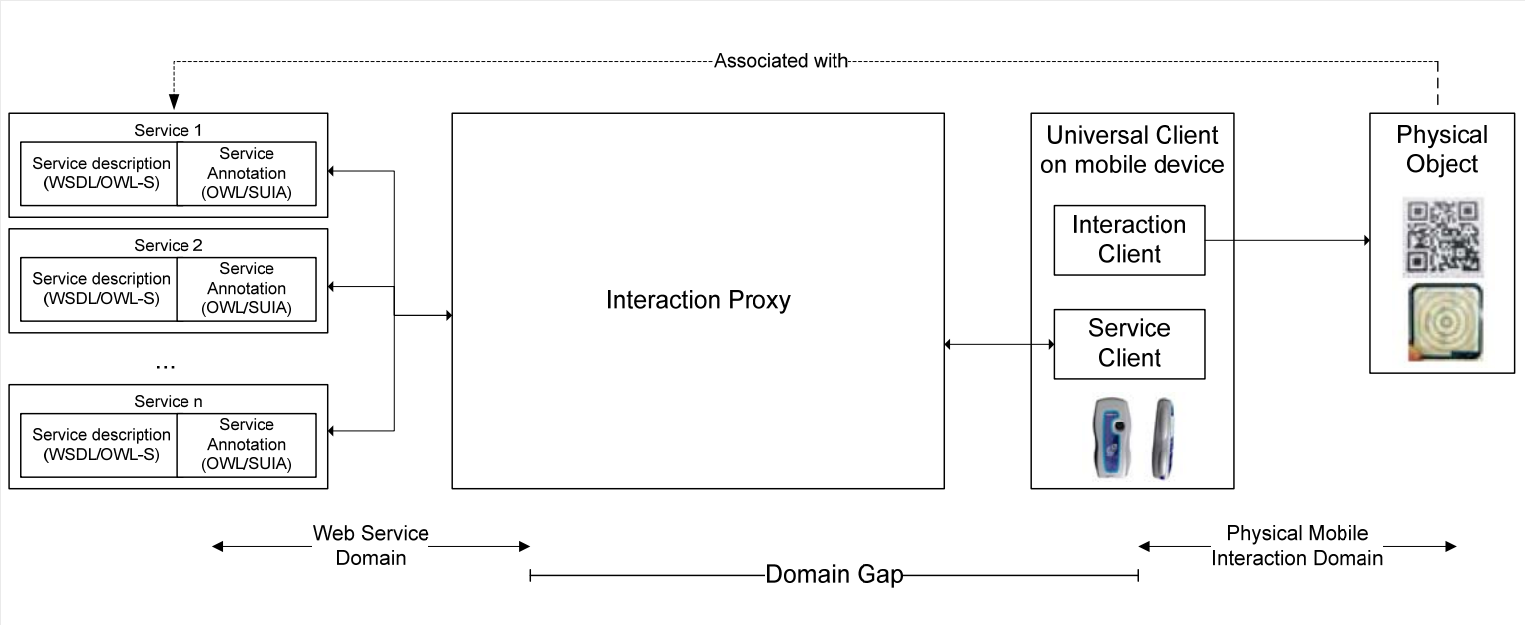

- Focus of the PERCI project (PERvasive ServiCe Interaction): collaboration between LMU and DoCoMo Eurolabs
- Taking advantage of Physical Mobile Interaction for easier access to and usage of mobile services
- Taking advantage of Semantic Web Services to support more complex Physical Mobile Interactions
- Shift focus of interaction from mobile devices onto physical objects => ubiquitous interfaces

# Related Work



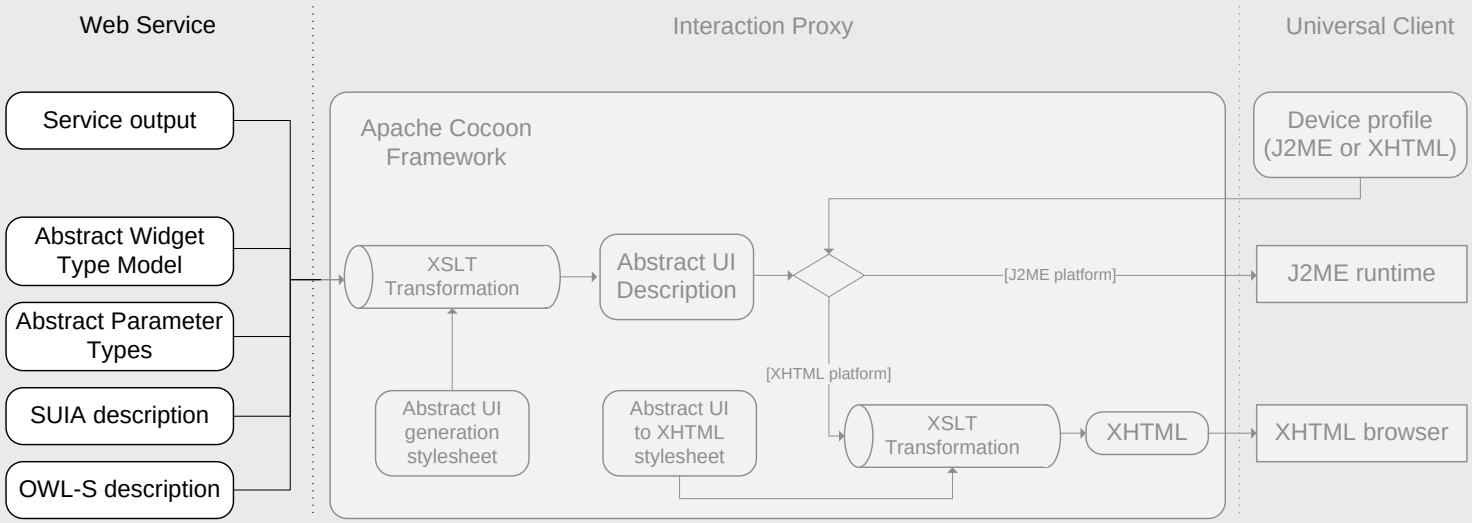
# The Perci Framework - Overview

- 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



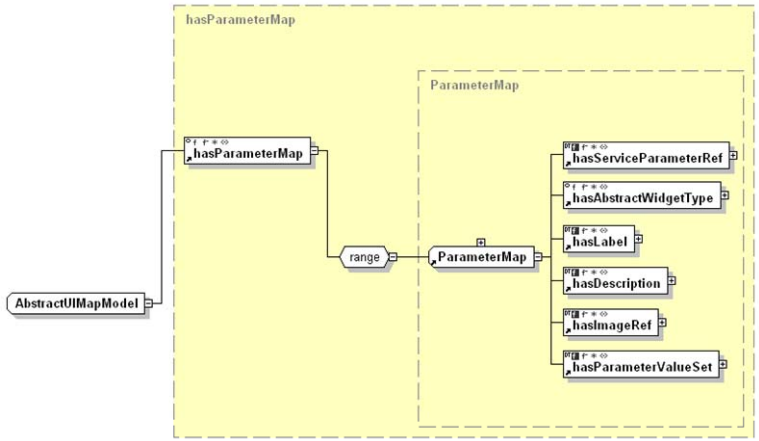
# User Interface Generation Process

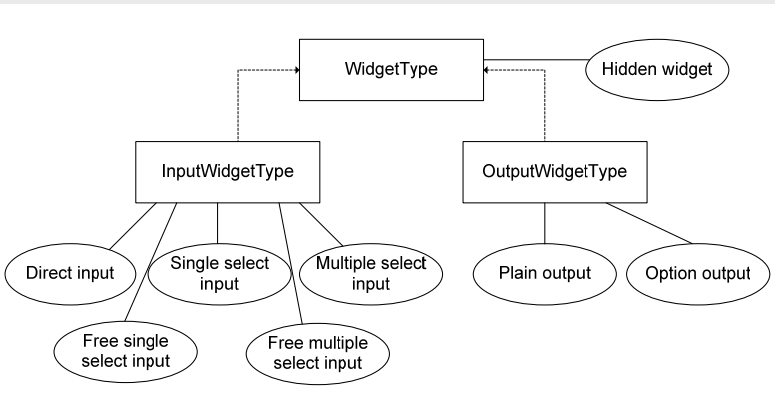
- Automated generation of adaptable interfaces from extended Semantic Web Service descriptions to support Physical Mobile Interaction
- Different service descriptions and interface extensions as basis for interface generation, customization and rendering



# Service Description Extensions

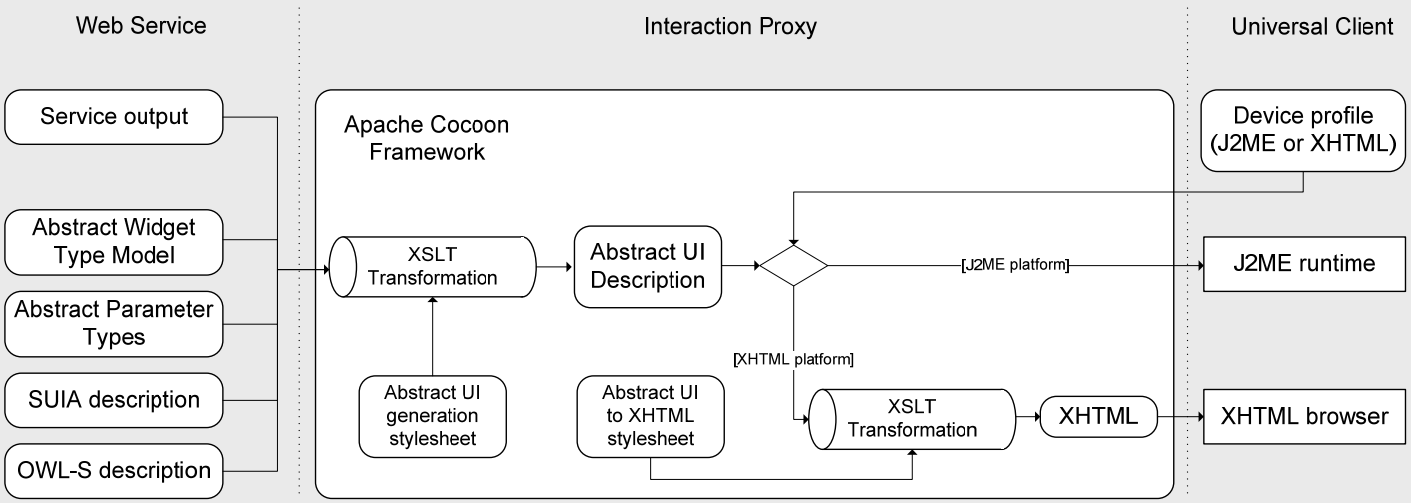
- **Service User Interface Annotation:**
  - Extensions of OWL-S service descriptions
  - Describe additional interface elements
  - E.g. labels, predefined value sets, image, …
- **Abstract Widget Type Model:**
  - Represents most common widget concepts in user interfaces
  - Suggests application-specific rendering of abstract widgets
  - E.g. Single select input => radio buttons
- **Abstract Parameter Types:**
  - Abstract information typing system
  - Associates service parameters and information captured through Physical Mobile Interaction

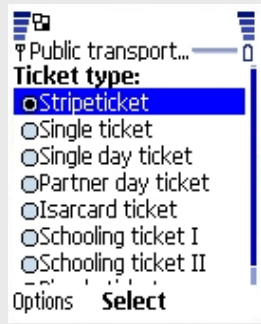


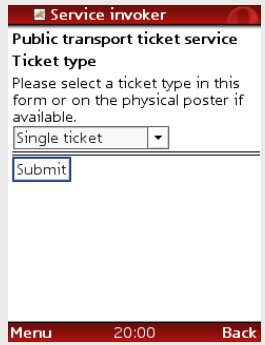



# User Interface Rendering

- XSLT transformation of different description sources to composed *Abstract UI Description* => basis for further transformations and ui rendering
- Two target platforms depending on the *device profile:*
  - Direct interpretation by J2ME runtime
  - Additional transformation to create HTML-interfaces for mobile web browsers

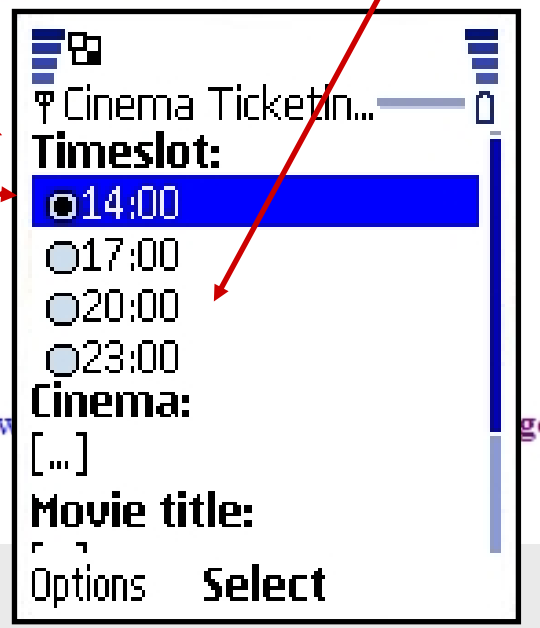


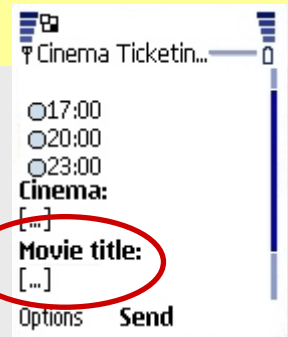
# Abstract User Interface Description

```
- <abstractUI>
  - <group title="Cinema Ticketing Service">
    - <widget type="http://perci.medien.ifi.lmu.de:8080/axis/ui/ParameterTypeModel.owl#singleSelectInputParameterType">
        <abstractType> http://perci.medien.ifi.lmu.de:8080/axis/domain/cinema/cinema.owl#Time </abstractType>
        <label>Timeslot</label>
        <desc> Please select the timeslot in this form or on the physical poster if available. </desc>
        <image> http://perci.medien.ifi.lmu.de:8080/axis/serviceDescription/extendedCinema/image4.jpg </image>
        <parameterValueType>http://www.w3.org/2001/XMLSchema#string</parameterValueType>
      - <parameterValueSet>
        - <option>
            <value>14:00</value>
            <label>14:00</label>
            <desc>N/A</desc>
          </option>
        + <option></option>
        </parameterValueSet>
      </widget>
    + <widget type="http://perci.medien.ifi.lmu.de:8080/axis/ui/ParameterTypeModel.ow                    get>
    </group>
  </abstractUI>
```

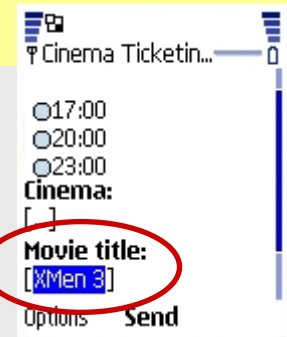


# Linking Objects and Services through Abstract Parameter Types

```
<tag type="parameter">
  <abstractType>http://perci.medien.ifi.lmu.de:8080/axis/domain/cinema/cinema.owl#MovieTitle</abstractType>
  <value>XMen 3</value>
  <label>XMen 3</label>
  <desc>The X-Men make a last stand in the war between humans and mutants.</desc>
</tag>
```




Matching Abstract Parameter Types



# 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

- **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

- 10 participants, aged from 23 to 46 (average 30.7), 8 participants with technical background
- Process
  - User-Experiment: Accomplish to buy cinema tickets for given properties. Use all interaction techniques (Touching, Pointing, Direct Input).
  - Post-Survey: Quantitative rating of interaction techniques
- Results:
  - Good acceptance of the prototype in general, but strongly depending on the used interaction technique
  - Initial problems with the workflow of the interaction
  - Uncertainty about interaction order on the poster
  - Many participants wanted to use the interface directly for inputs although having been advised to use Touching or Pointing

# Conclusion and Future Work

- Generic framework for the combination of Physical Mobile Interactions and Semantic Web Services
  - Automatic user interface generation from service descriptions and annotations
  - Support for the complete Physical Mobile Interaction workflow
  - UI adaptation to J2ME runtime and XHTML browser
- J2ME client prototype supporting the interaction techniques Touching, Pointing and Direct Input

- Making Physical Mobile Interaction more usable and intuitive
- Extending the different service models
- Evolving Ubiquitous Interfaces
- Authoring support for creating physical mobile service applications

# Questions?

# Thank You!

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**www.hcilab.org/projects/perci**