



# Designing Usable Applications based on Web Services

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# Goals and Motivations

- Model-based user interface generation for multi-device environments
  - exploiting XML logical descriptions and associated transformations for the target devices and implementation languages.
- Web services are increasingly used to support remote access to application functionalities
  - “a software system designed to support interoperable machine-to-machine interaction over a network”
  - Often described using WSDL (Web Services Description Language) files, which are XML-based descriptions as well.
- The home is becoming more and more populated by interactive devices
  - remote access to their state in order to query or modify it.
- Industrial Collaboration with Al maviva Company / ServFace EU Project

# Problems with Mobile Access

The image shows a screenshot of the Amazon.com homepage. A red rectangular box highlights the left sidebar area, which contains several promotional links. The main content area features a navigation bar at the top with the Amazon logo, account links, and a search bar. Below the navigation bar, there are several promotional banners: one for the Amazon Kindle, one for toys and games with savings up to 70%, and one for filling an iPod with MP3s. At the bottom, there is a section for 'Most Wished For in Electronics' featuring an iPod, an iPod touch, and a Wii Zapper. A large advertisement for Disney Vacation Club is also visible on the right side.

**Check This Out**

- Kindle**  
Amazon's wireless reading device.
- High-Def 101**  
Everything you need to know about high def.
- J.K. Rowling's Fairy Tales**  
Discover more about this rare book.
- All Business Center**  
Find everything you need to outfit your office.

**amazon.com** Your Amazon.com See All 45 Product Categories Your Account | Cart | Your Lists | Help |

Gift Certificates/Cards | International | Hot New Releases | Bestsellers | Today's Deals | Sell Your Stuff

Search Amazon.com GO Gift Cards A9 GO

**Introducing Amazon Kindle**

Amazon is excited to introduce Kindle—a wireless, portable reading device with instant access to more than 90,000 books, blogs, magazines, and newspapers. [Learn more](#)

**Amazon Daily BLOG** 2 posts since yesterday [Read posts](#)

**89 Cents: Fill Your iPod® with MP3s**

**amazonmp3** Fill your new player with our [Best Songs of 2007](#), and [top sellers](#), all at special prices and always compatible in Amazon MP3.

[Shop Amazon MP3 now](#)

**See All Our Huge Savings on Toys and Games**

Save up to **25%** Save up to **50%** Save up to **70%**

**Today's Deals** [Save now](#)

**Most Wished For in Electronics**

- Apple 80 GB iPod classic (Black)** **8% off**
- Apple 8 GB iPod touch** **6% off**
- Wii Zapper with Link's Crossbow Training**

[See all most-wished-for items in Electronics](#)

**Features & Services**

**Selling on Amazon**

- Digital Text Platform
- Sell Your Stuff
- Fulfillment by Amazon
- WebStore by Amazon
- Advantage Program
- Associates Program

**Amazon Exclusives**

- Amazon Prime
- Amazon Bestsellers
- Amazon Breakthrough Novel Award

**ADVERTISMENT**

Make the world your playground.

> Get your FREE DVD

© Disney

**Free Towels and More**

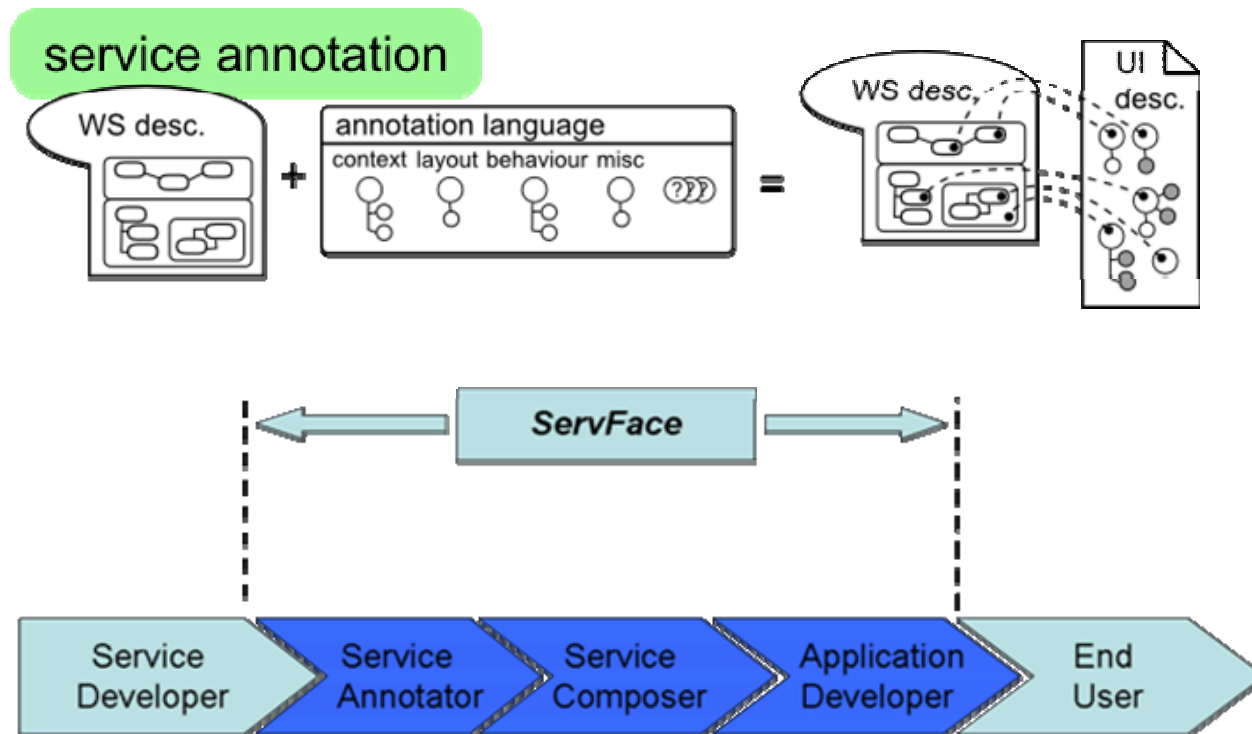


# Design of Multi-Device Interfaces: Approaches

- **Manual solutions,**
  - Expensive
- **Transcoders,**
  - Low cost/low usability
- **Style sheets,**
  - Partial solution
- **Information Visualization**
  - Require heavy computations
- **Model-based Approaches**
  - Need for a trade-off between abstraction and control

# ServFace EU Project

- ServFace aims to create a **model-driven service engineering methodology** for
  - the design of user interfaces for applications based on web services (primary goal); and
  - the composition and integration of user interfaces for applications based on web-services (secondary goal)
- Consortium: SAP Research, CNR-ISTI, Lyria, Univ. Dresden, Univ. Manchester



# Abstraction Levels and Transformations

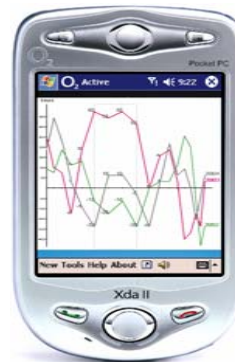
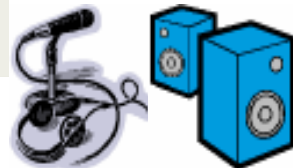
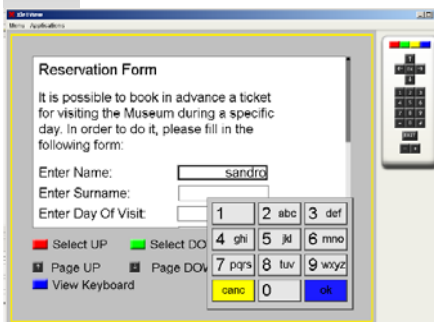
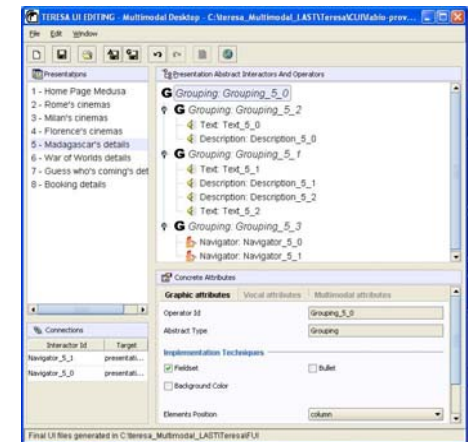
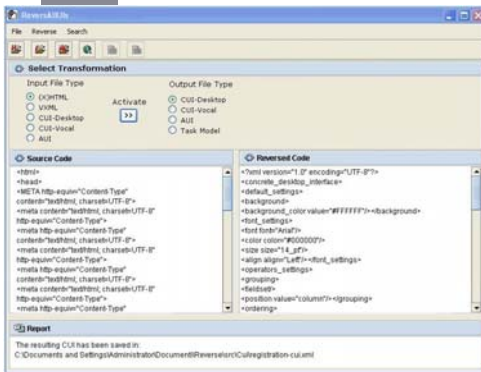
Reverse

Forward

Task and Object

Abstract Interface

Concrete Interface



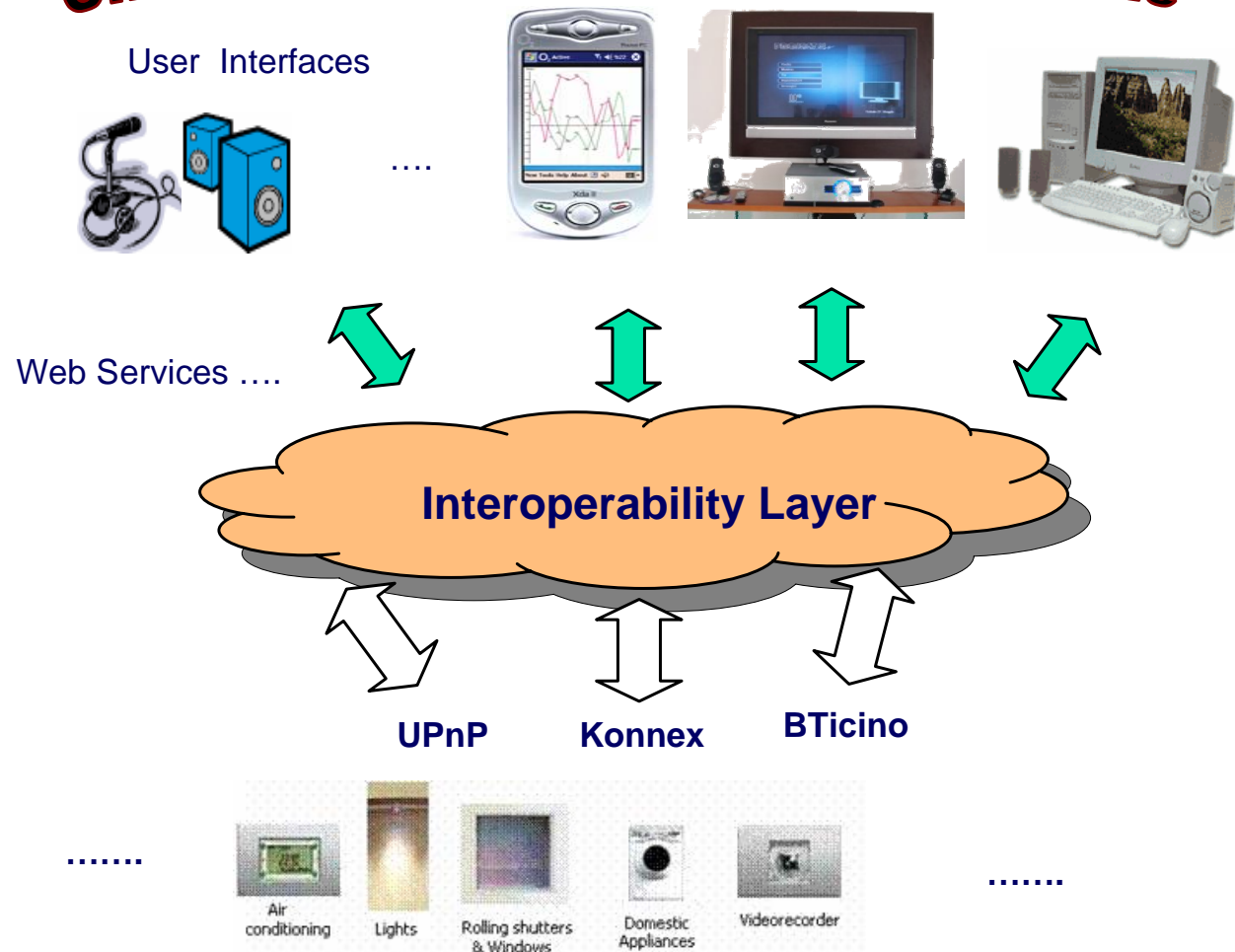


# Related Work

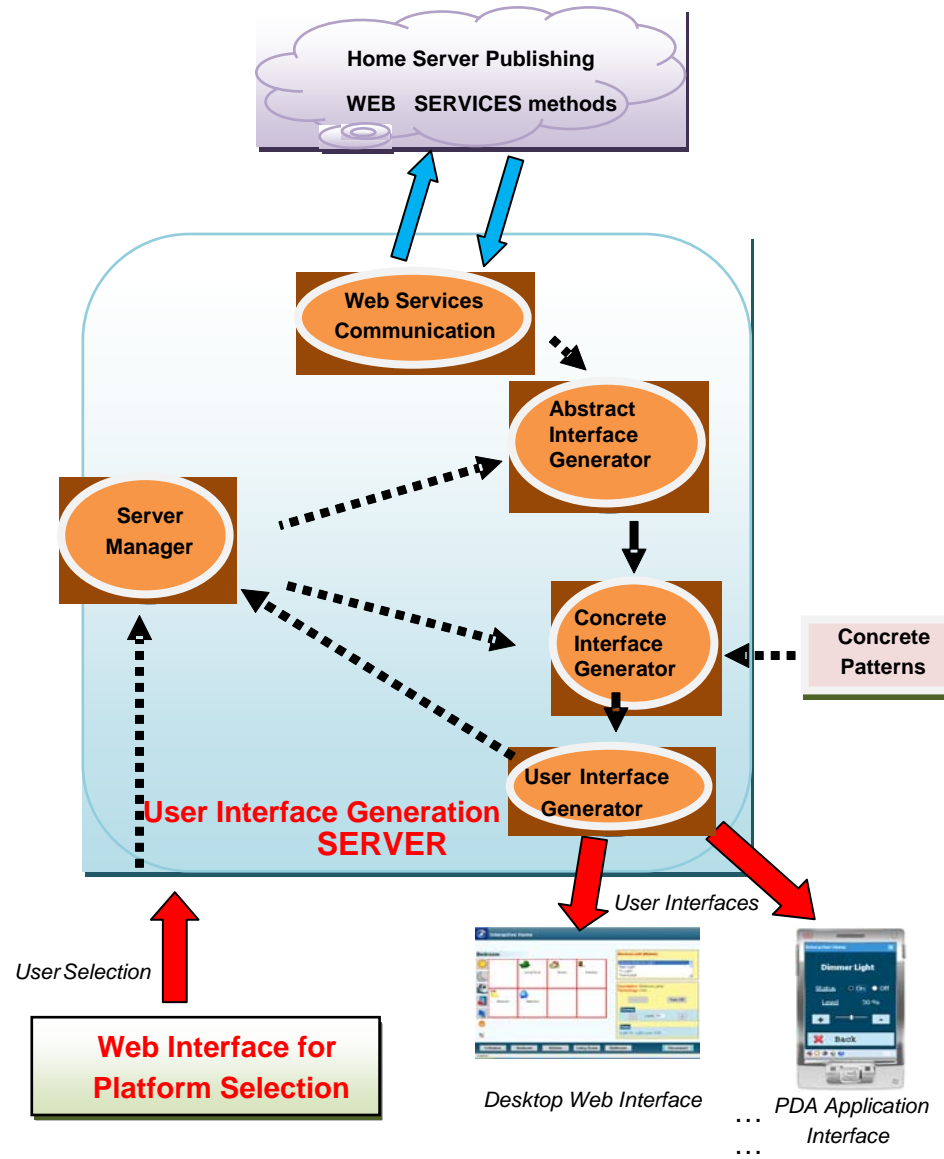
- Most model-based approaches have not addressed Web-service based applications
- PUC supports only access to one appliance at any time
- Work on user interfaces for web services but without using model-based approaches at Dresden and Yonsei Universities
- Work by Vermeulen et al. (EIS07) on extending Web services with OWL-S combined with task and layout model

# The First Case Study

## Universal Access to Interactive Home



# The Home Control Environment Architecture



# The Desktop Interface

The screenshot displays the 'Interactive Home' desktop interface. At the top left, there is a home icon and the text 'Interactive Home'. Below this, a grid of room icons is shown, with 'Bedroom' selected and highlighted in red. To the right of the grid is a control panel for the selected device, 'Dimmer Bedroom Light'. The panel includes a 'Devices List (Home)' with a scrollable list containing 'Dimmer Bedroom Light', 'Main Light', 'TV Light', and 'Thermostat'. Below the list, the 'Description' is 'Bedroom Lamp' and the 'Technology' is 'KNX'. There are 'Turn On' and 'Turn Off' buttons. A 'Dimmer' section shows a slider set to 'Level: 30%' with minus and plus buttons. A 'State' section indicates 'Light On - Light Level: 30%'. At the bottom, a navigation bar contains buttons for 'Entrance', 'Bedroom', 'Kitchen', 'Living Room', 'Bathroom', and 'Disconnect'. The word 'Completato' is visible in the bottom left corner.

**Interactive Home**

**Bedroom**

Living Room   Kitchen   Entrance

Bedroom   Bathroom

**Devices List (Home):**

- Dimmer Bedroom Light
- Main Light
- TV Light
- Thermostat

**Description:** Bedroom Lamp  
**Technology:** KNX

Turn On   Turn Off

**Dimmer**

Level: 30%

**State**

Light On - Light Level: 30%

Entrance   Bedroom   Kitchen   Living Room   Bathroom   Disconnect

Completato

# The Mobile Interface



# MARIA XML Requirements

(MARIA – Model-based Authoring enviRonment  
for Interactive Applications)

- XML-based Languages with Schemas
- Support for Abstract Data Types
- Able to generate user interfaces including complex Javascripts and Ajax scripts
- More engineered and powerful language (e.g. Pacman)

# Mappings WSDL/AUI/CUI

| Data type                             | Abstract UI             | Concrete UI                |
|---------------------------------------|-------------------------|----------------------------|
| Numerical                             | Numerical edit          | Numerical edit             |
| Numerical restricted into a range     | Numerical edit in range | Numerical edit in range    |
| Boolean                               | Single choice           | Radio button               |
| Enumeration with low cardinality      | Single choice           | Drop down list             |
| Enumeration with high cardinality     | Single choice           | List box (single choice)   |
| Array data type with low cardinality  | Multiple choice         | Check box                  |
| Array data type with high cardinality | Multiple choice         | List box (multiple choice) |
| Text                                  | Text edit               | Text edit                  |
| Unknown type                          | Object edit             | Object edit                |

# MARIA Tool Requirements

(**MARIA – Model-based Authoring enviRonment  
for Interactive Applications**)

- **New Authoring Environment**
  - **Integrated Support for Web Services**
    - Mappings WSDL/LUI
    - Generation/Refinement
  - **Not only traditional top-down approaches**
  - **Transformations not hard-coded but defined externally and performed with XSLT**
  - **Integration of BPMN/BPEL with Model-based UIs.**

# Automatic vs Semiautomatic Development



Automatic



Semi-Automatic



# Automatic generation

- + More Efficient
- + More Consistent
- - Less Control
- - Less Usability
- More effective when the application domain is well-known

# The Proposed Approach

- A traditional top-down approach going through the various abstraction layers does not seem particularly effective.
  - Create interactive applications accessing application functionalities developed by others.
- First a bottom-up step in order to analyse the Web services providing functionalities useful for the new application to develop.
  - Analysis of the operations and the data types associated with input and output parameters is carried out in order to associate them with suitable abstract interaction objects
- Task model expressed in ConcurTaskTrees (CTT) for describing the interactive application and how it assumes that tasks are performed.
  - Design based on user requirements
  - Indicate how to compose functionalities implemented in different Web services.
  - Web services are application functionalities, thus they are associated with system tasks.
- Level of granularity to reach in the task decomposition.
  - Associating the system basic tasks to the web services
  - Associate each system basic task with the operations of the web services. Thus, if a Web Service supports three operations, then there would be three basic system tasks.
- Inclusion of Usability Guidelines in Authoring and UI Generation

# Conclusions and Future Work

- Automatic vs Semi-Automatic vs Manual Design
- Future work will be dedicated to
  - Improving tool support for the identified methodology
  - Relations between BPMN/BPEL and CTT/MARIA
  - Application to other case studies
- W3C Meeting in Cannes on October 21 on Model-Based User Interfaces and the Potential Role of Standards