



# Migrating Web Applications through Declarative Models

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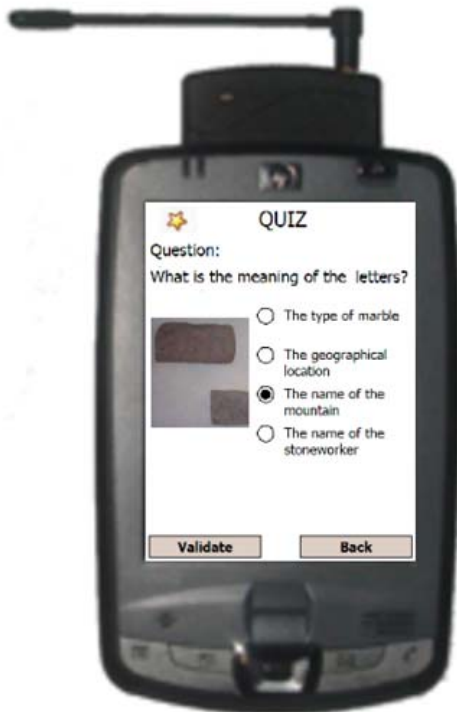
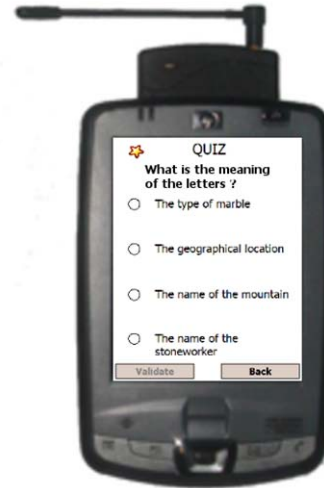
Pisa, Italy

# Why Migratory Interfaces?

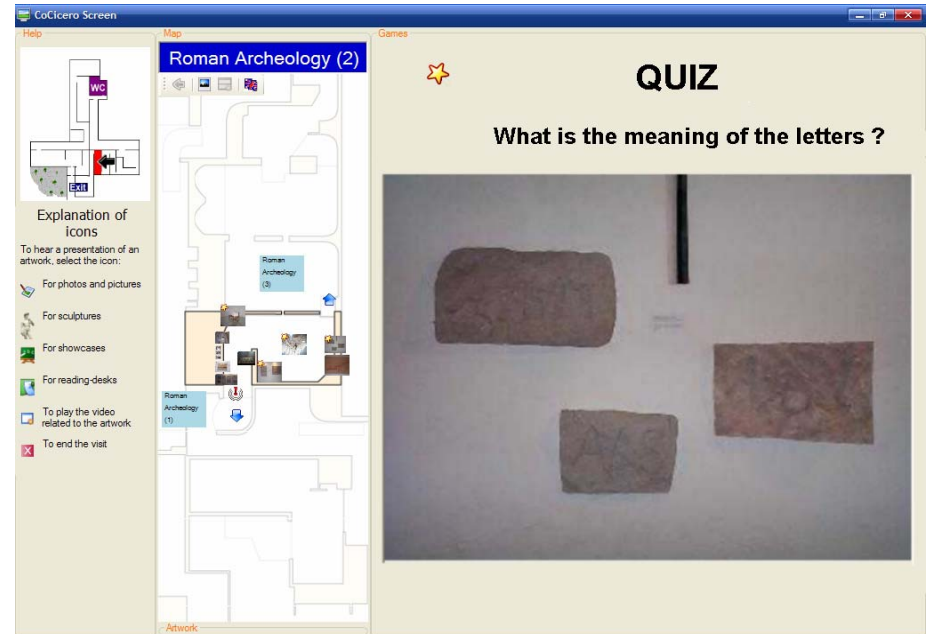
- Our life is becoming a multi-device experience
- One of the main source of frustration is that we need to restart for each device change
- Need for continuous access to interactive services
- Application domains such as shopping, bids for online auctions, games, making reservations

# Migration Types

- Total, Partial, Distributing, Aggregating, Multiple

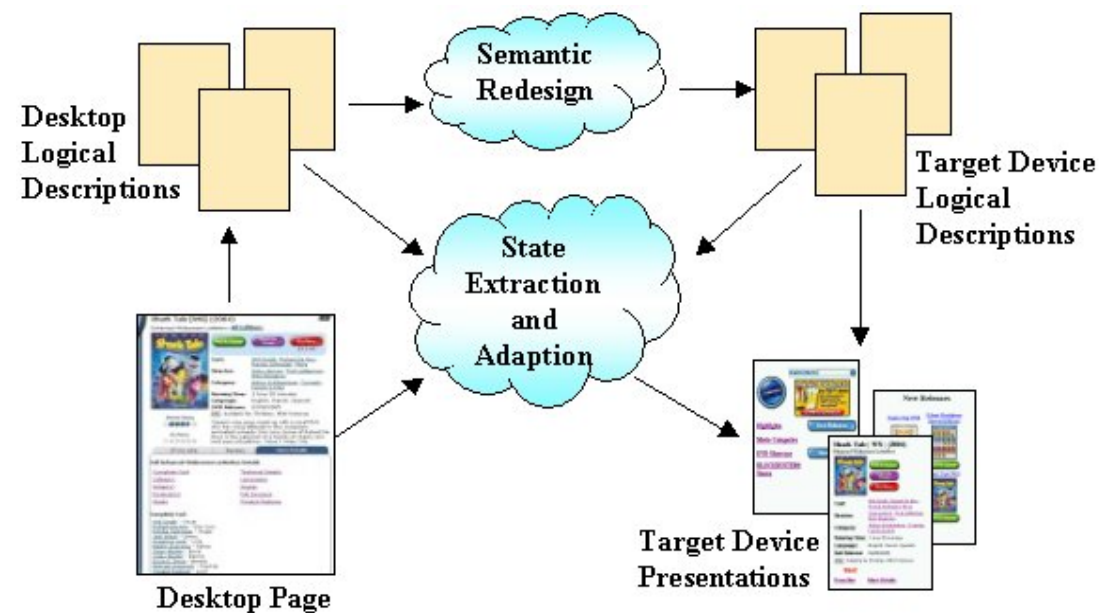


Migration



# Our Approach to Migration

- Device Discovery (client application)
- Migration Trigger and Target Identification
- Reverse Engineering/Semantic Redesign
- State extraction, adaptation and association
- Run-time Interface Generation and Activation

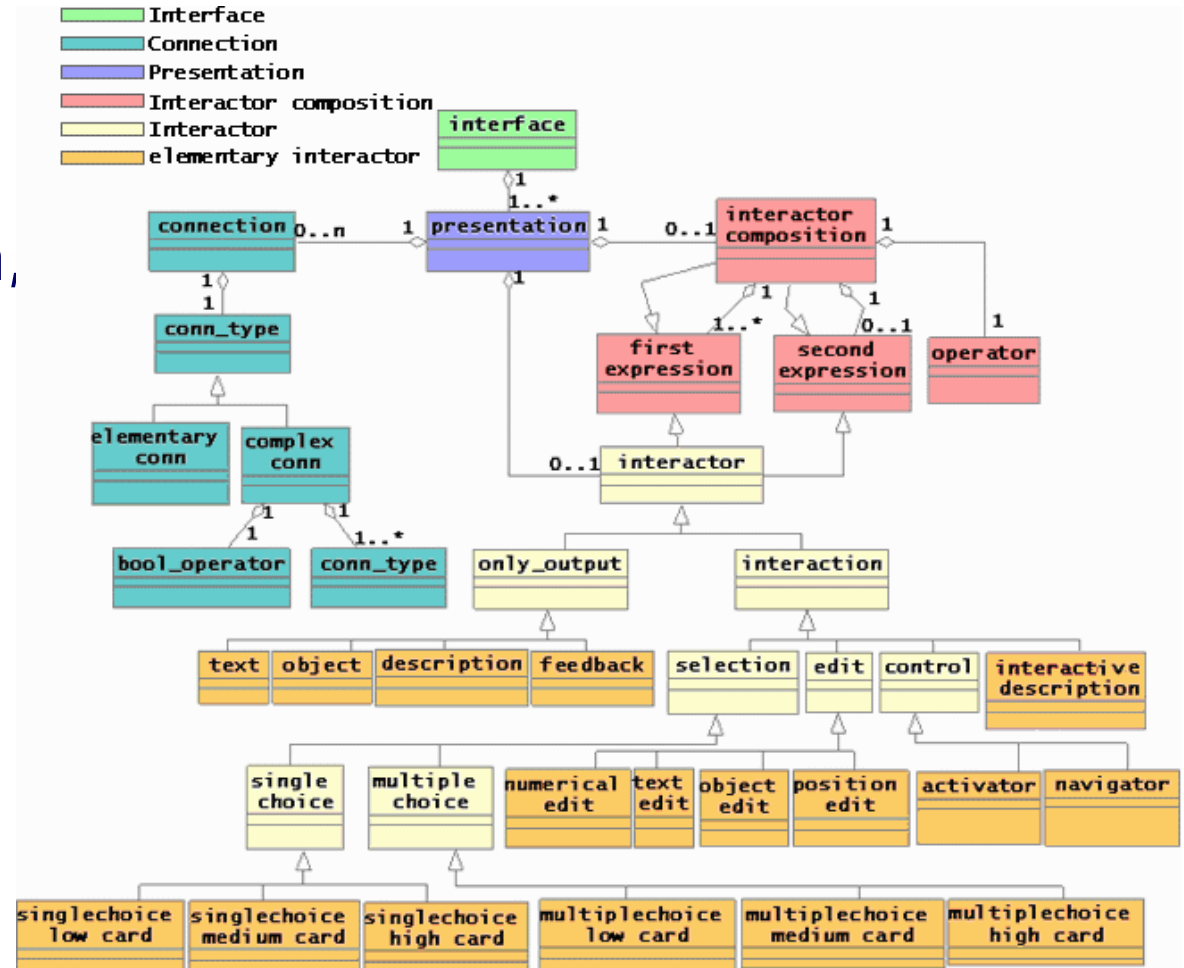


# Semantic Descriptions for Interactive Systems

- Task and object
  - – *I want to select a work of art*
- Abstract Interface – platform independent
  - – *Single selection object with high cardinality*
- Concrete Interface – platform dependent
  - – *List Interaction object with X elements*
- Interface Implementation
  - – *List object in Java or XHTML or ....*
- *TERESA XML*

# The Structure of the Abstract User Interface

- Language platform-independent
- Interactors (selection, navigator, activator, ...)
- Communication-oriented composition operators
- Connections among presentations



# Composition operators

The screenshot shows the BBC Sport website interface with several annotations:

- HIERARCHY:** Points to the navigation menu (Home, News, Sport, Radio, TV, Weather, Languages).
- ORDERING:** Points to the 'Sport' link in the navigation menu.
- RELATION:** Points to the search bar.
- GROUPING:** Two boxes point to the left-hand navigation menu and the main content area.

**Navigation Menu:** Home, News, Sport, Radio, TV, Weather, Languages

**Search Bar:** Search

**Left-hand Navigation Menu (GROUPING):**

- Football
- Cricket
- Rugby Union
- Rugby League
- Tennis
- Golf
- Motorsport
- Boxing
- Athletics
- Snooker
- Horse Racing
- Cycling
- Disability Sport
- Olympics 2012
- Other Sport...
- Video and Audio
- TV/Radio Schedule
- Scores & Fixtures 606
- Sport Academy
- Health & Fitness
- Fun and Games
- Question of Sport
- Northern Ireland
- Scotland
- Wales
- RELATED BBC SITES

**Main Content Area (GROUPING):**

- FOOTBALL:** Beckham poised for England start. David Beckham is set to start for England against Brazil and Estonia after Aaron Lennon is ruled out with a knee injury.
- FOOTBALL:** Davies future at Derby uncertain, Platini asks clubs to disband G14.
- TENNIS:** Paris rain stalls Federer charge.
- CRICKET:** England attitude delights Vaughan, Sarwan could miss rest of series.
- MOTORSPORT:** McLaren race victory to be probed.

**Other Content:**

- BBC WORLD SERVICE:** Radio schedules | Latest sports round-up
- HIGHLIGHTS AND FEATURES ON THE BIG STORIES:**
- FIVE LIVE SPORTS EXTRA:** Live tennis: French Open (LISTEN)
- TMS podcast:** Ryan Sidebottom on England's convincing win (WATCH)
- WATCH:** PGA Championship final day play-off (LISTEN)
- LISTEN:** Missed chances cost us - Mowbray (LISTEN)
- LISTEN:** Vaughan happy with 'impressive' display (LISTEN)
- Henman's plunge into the unknown:** Tim Henman prepares to face a tyro Latvian opponent in Paris (WATCH)
- David Pleat on Derby's promotion:** "I'm delighted - Derby's a town of fine football tradition" (WATCH)
- Jonathan Agnew column:** "Beating West Indies is like taking candy from children" (WATCH)
- Roger v Rafa:** The BBC team sees Federer start his campaign at rainy (WATCH)
- 10 Play-off Player Rater:** Your marks out of 10 for Derby & West (WATCH)
- Justin Langer column:** "Australia would love to have Kevin" (WATCH)



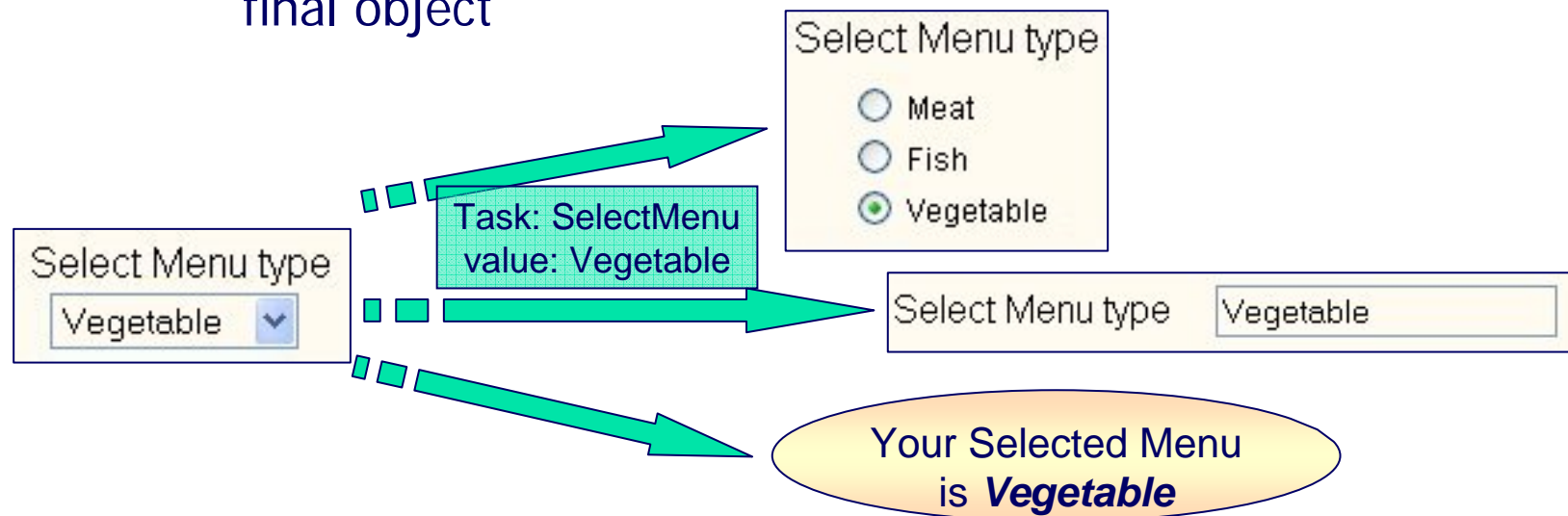
# Reverse Engineering

- Filtering out elements that cannot be reversed
- From XHTML/CSS to Concrete User Interface through recursive analysis of the DOM
- From Concrete to Abstract User Interface
- From Abstract User Interface to Task identifier

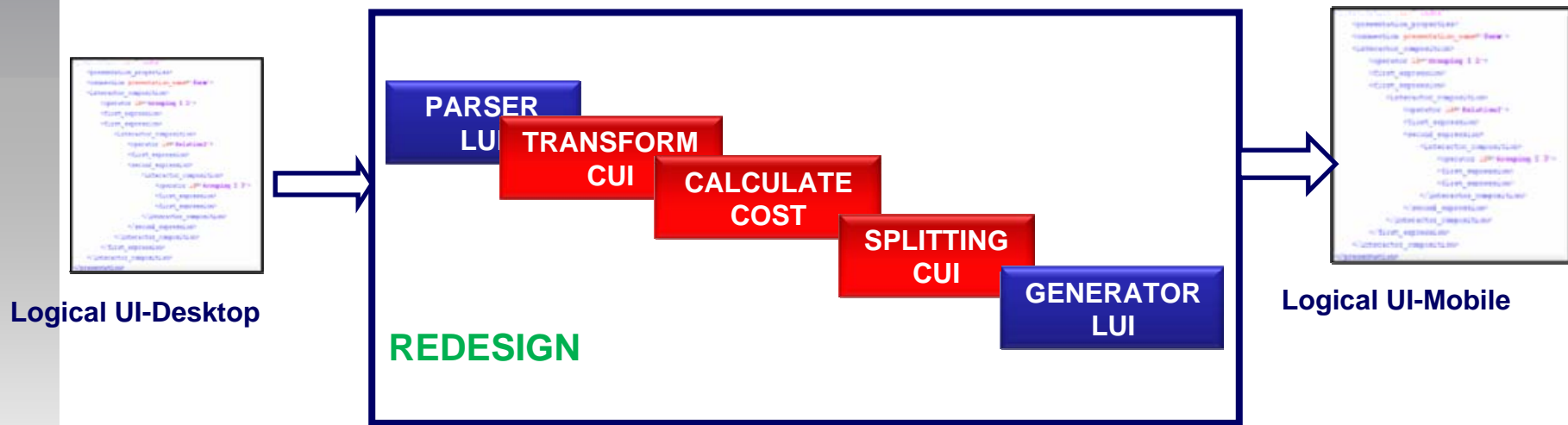


# Support for task continuity

- Collection of the user interface state in the client side of source device through JavaScript inserted by the proxy server
- For each basic task also supported in the target device
  - Adapt and apply the state to the corresponding target final object



# Semantic Redesign





# Support for Desktop-to-Mobile Redesign

- Page splitting based on the cost of composition operators and interactors
- Connections: original ones + those derived from page splitting
- Images: resize depending on target device keeping the same aspect ratio
- Tables for converting terms and labels

# From Desktop to Cell-phone

## Download Software

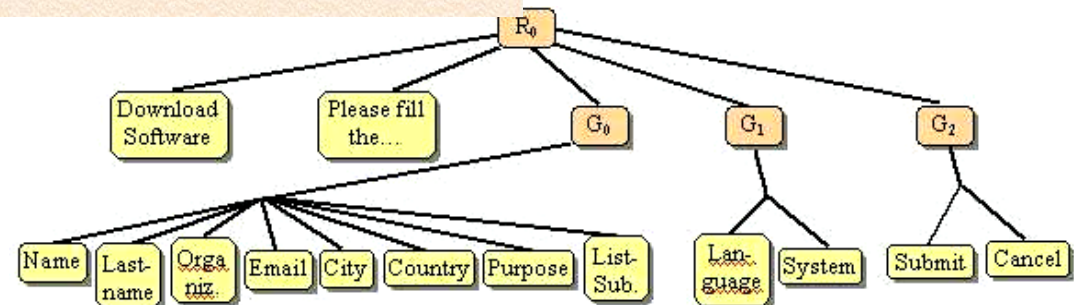
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Country:	<input type="text" value="Italy"/>
Purpose:	<input type="checkbox"/> Research Project <input type="checkbox"/> Application Designer <input type="checkbox"/> Teaching <input type="checkbox"/> Development
List Subscription:	<input type="radio"/> Yes <input type="radio"/> No
Language:	<input type="radio"/> French <input type="radio"/> English
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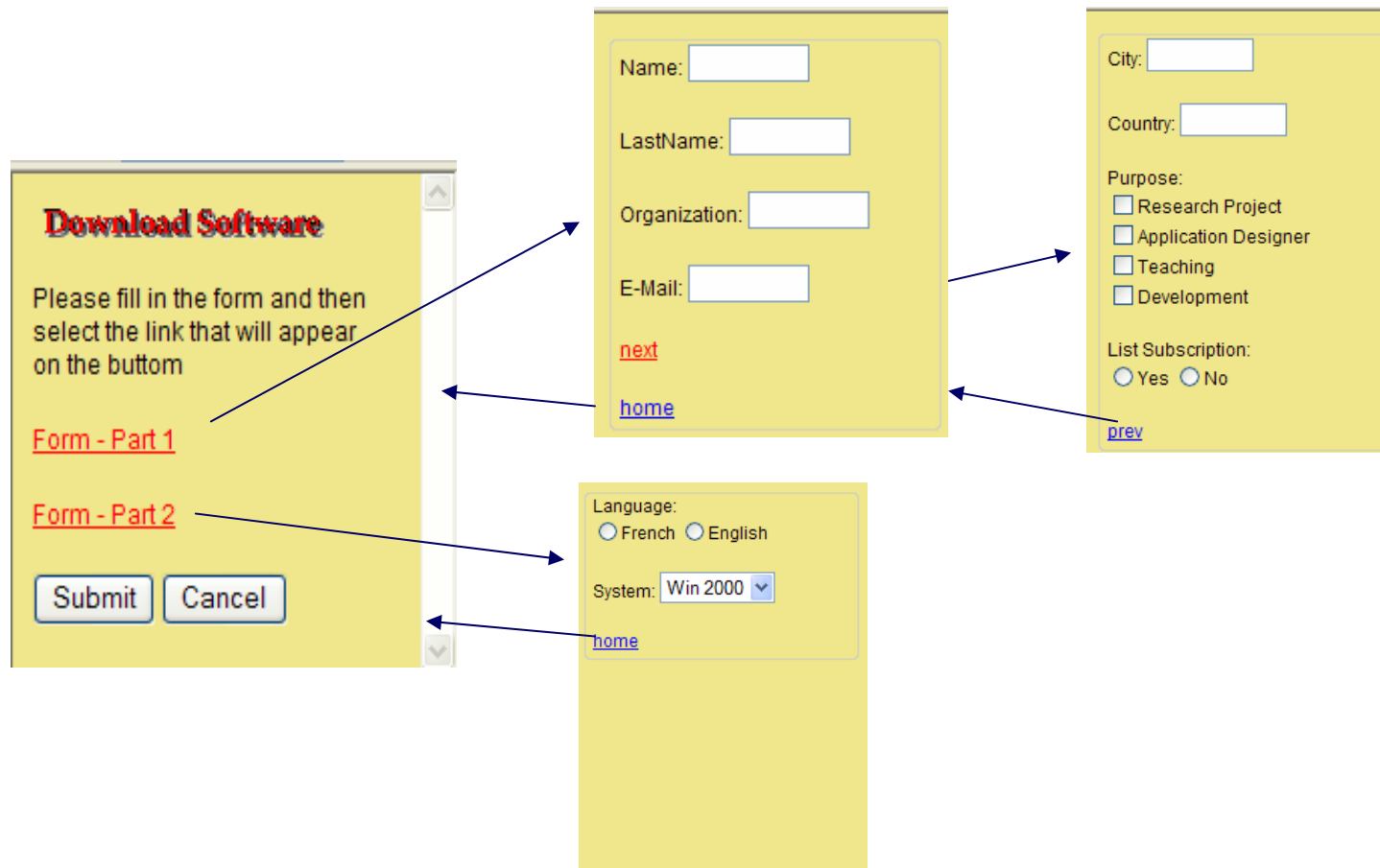
Grouping 0

Grouping 1

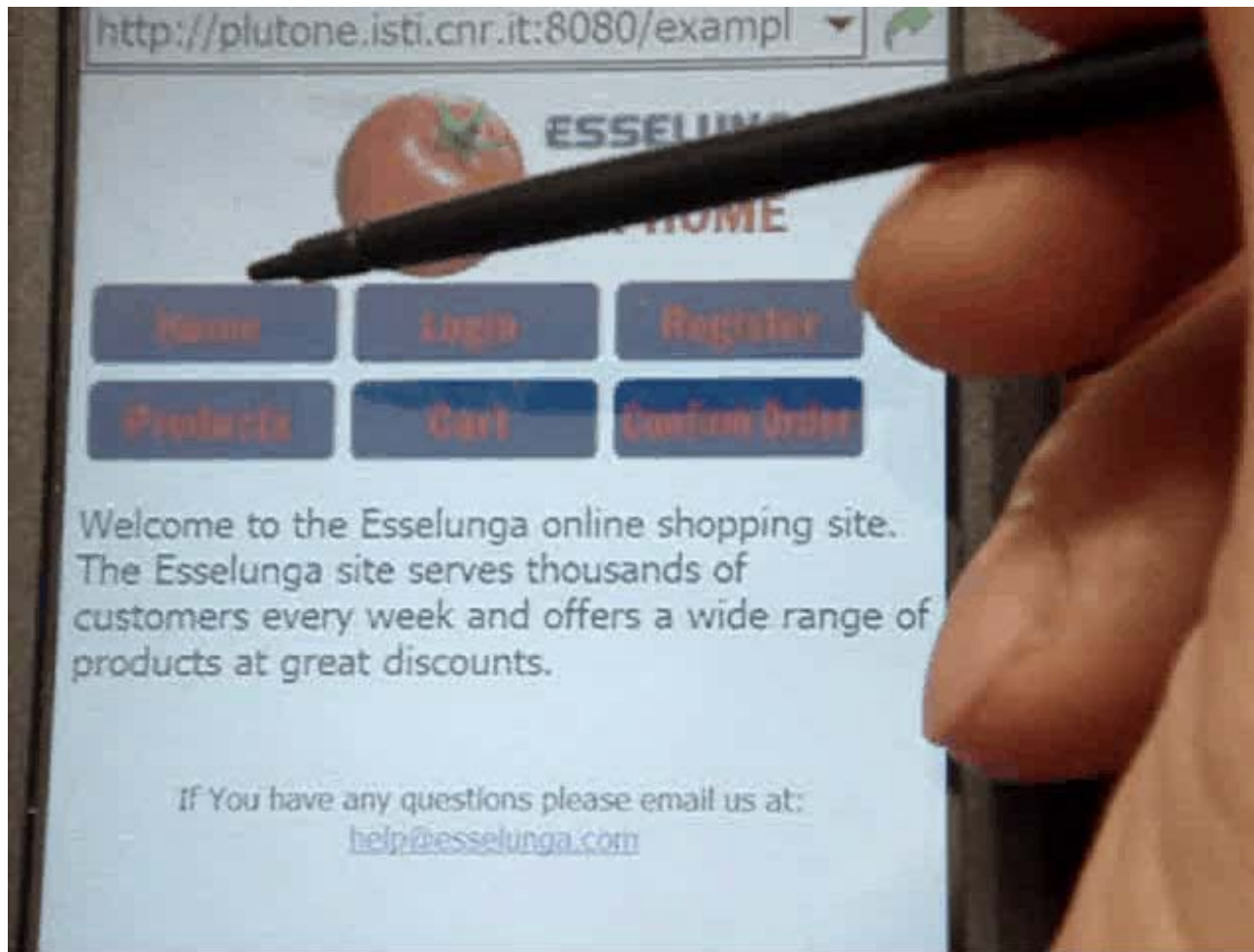
Grouping 2



# From Desktop to Cell-phone

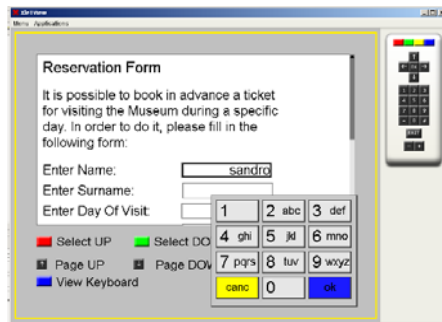


# Example Migration (Video)

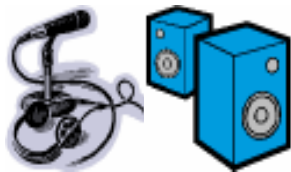


# Transformations

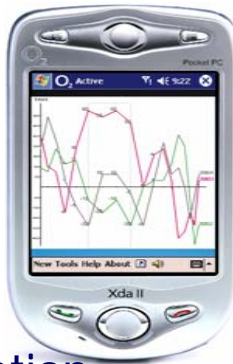
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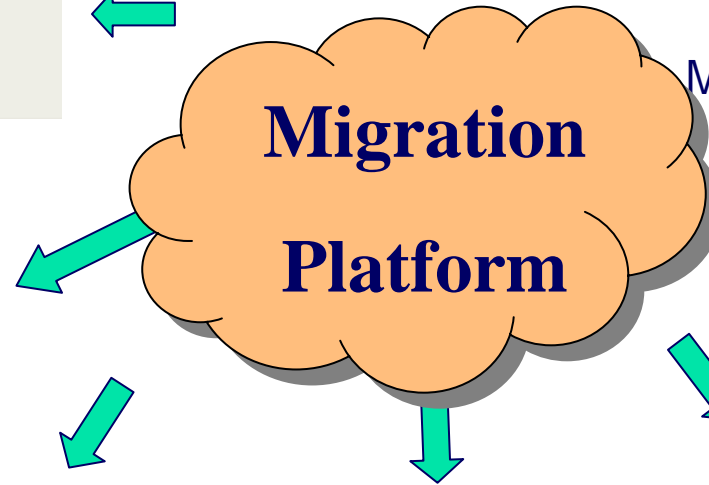
Digital TV  
(Java)



Vocal  
interfaces  
(VoiceXML)



Direct  
Manipulation  
XHTML/SVG



Mobile XHTML MP



Graphical+Gesture  
C#



Graphical+Vocal  
X+V



Form-based  
XHTML



# Conclusions and Future Work

- Migration between multiple devices can improve user experience at home and on the move
- Support for generation of new implementation languages from TERESA XML such as XForms, SMIL
- Extension of the approach to distributing migration