End User Development for Interactive Multi-Platform Applications

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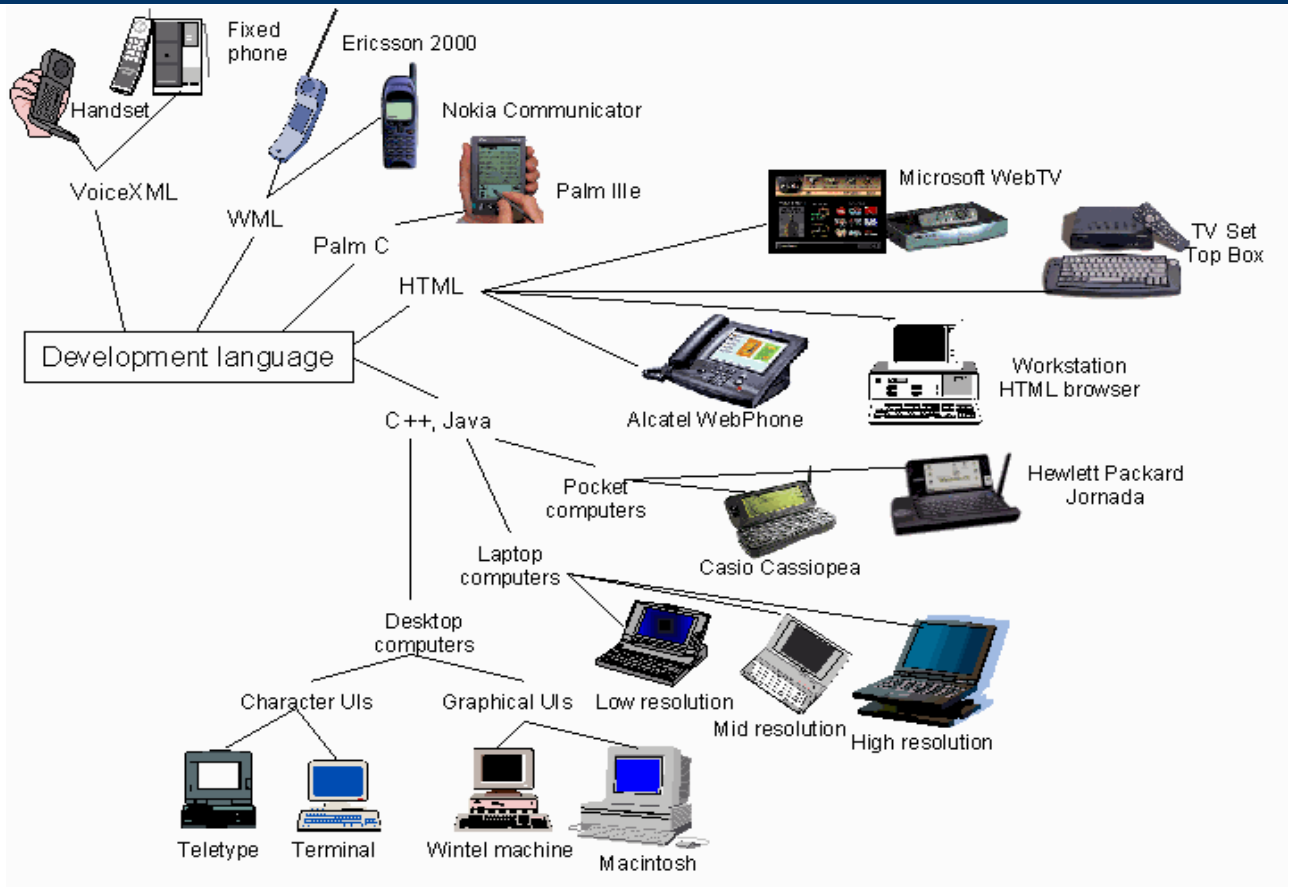
Interacting with chaos



Universal Usability

- Ever-increasing introduction of new types of interactive devices
- Applications often need to be accessed through different interactive devices
- How to support designers and developers?
- How to obtain interfaces able to adapt to multiple devices (any device) while preserving usability?

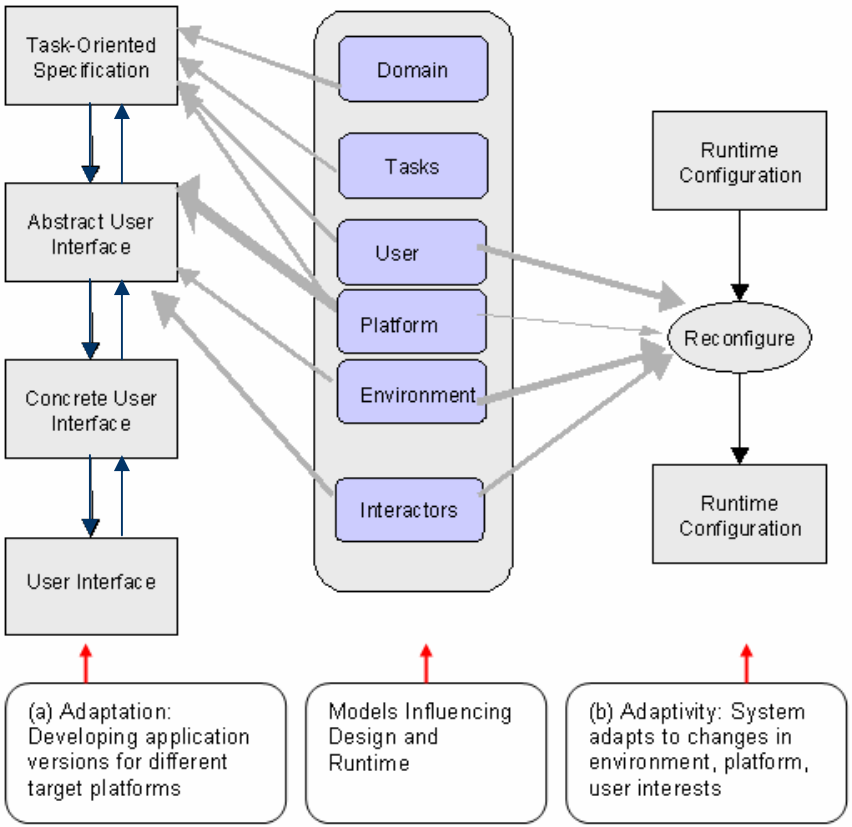
Why Model-based approaches?

- Highlight important information
- Help to manage complexity
- Useful to support methods

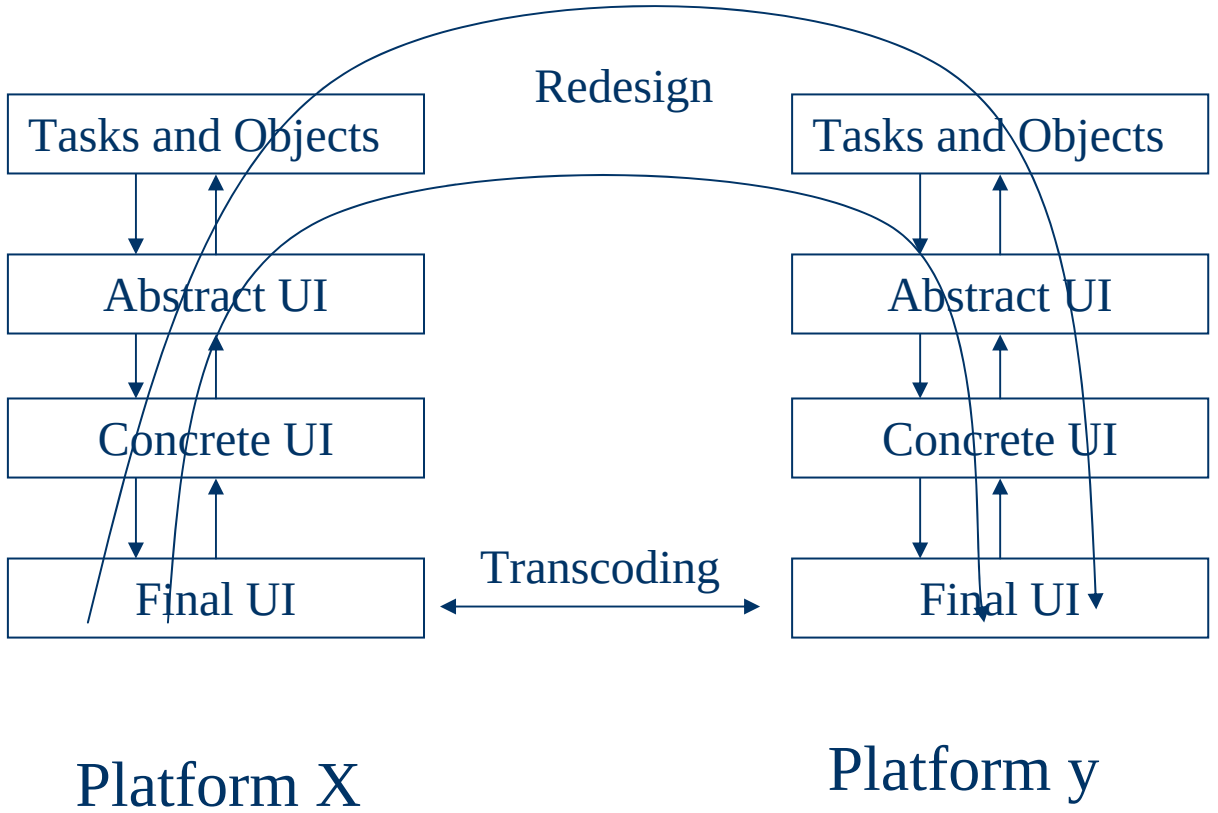
Possible Views of an Interactive Systems

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

The Framework



Use of Reverse Engineering



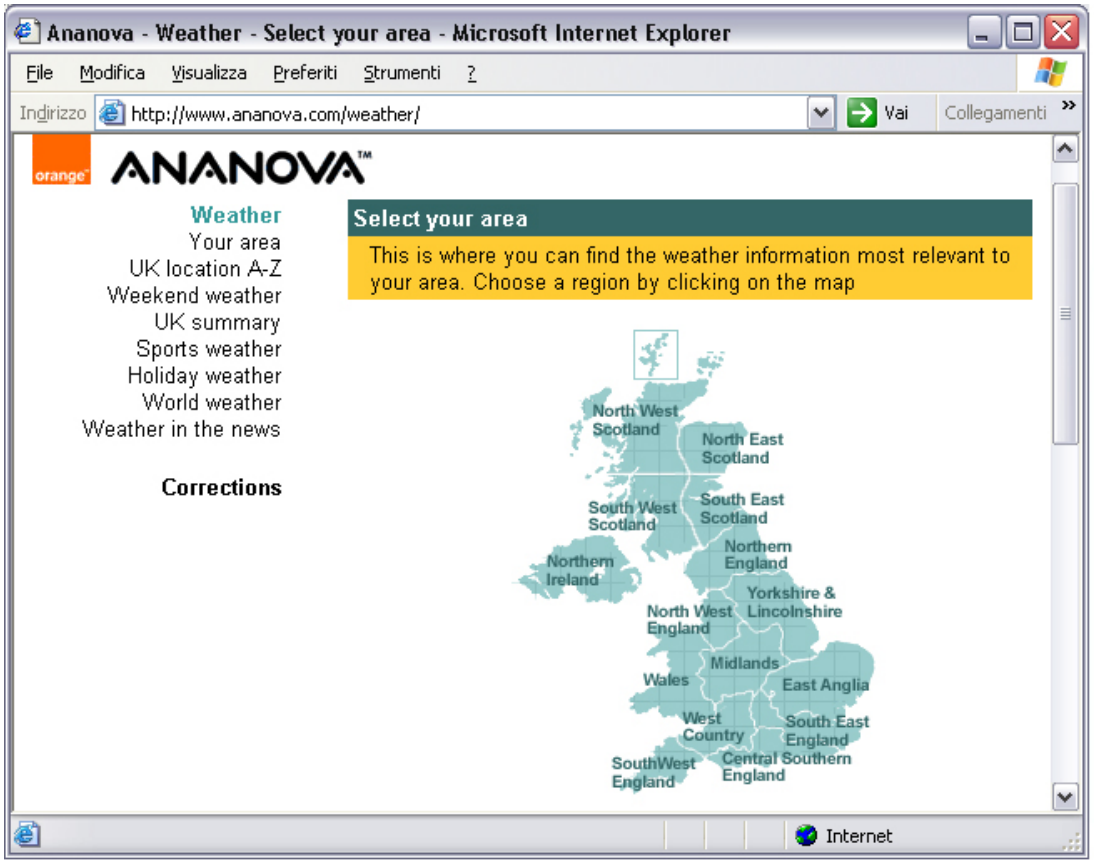
Examples of Platform-dependent tasks

Desktop system	Mobile System
Comparing prices of flights and making reservations.	Checking status of a particular flight.
Gathering background on a company, including maps.	Getting driving directions to a company—while on the road.
Browsing medical information.	Monitoring a medical condition.
Reading a movie review and/or watching a trailer.	Purchasing a cinema ticket to avoid the line.

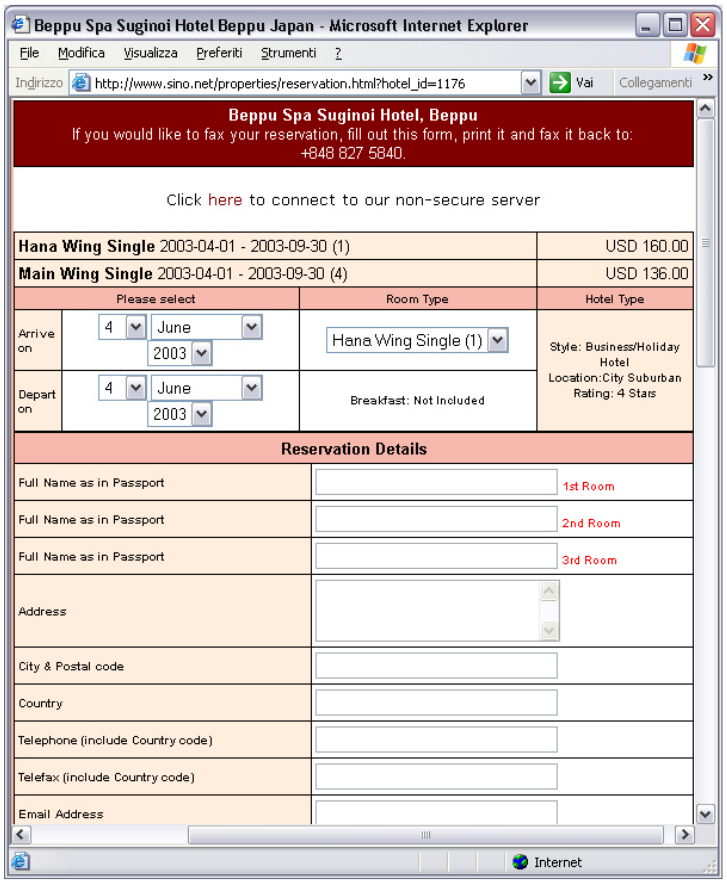
Task –related issues in multi-platform environments

- Same task on multiple platforms in the same manner
- Tasks meaningful only on a single platform type
- Dependencies among tasks performed on different platforms
- Same task on multiple platforms but performed in different manner …

Same task on multiple platforms with different user interface objects

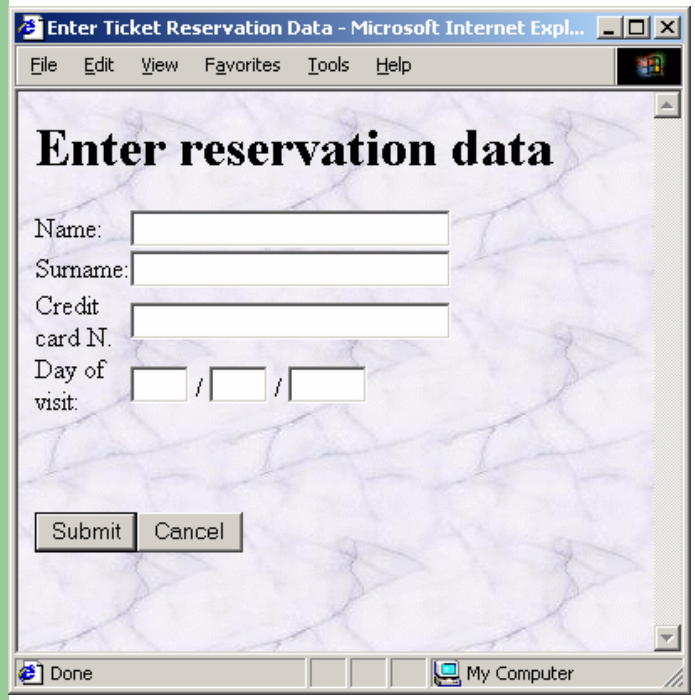


Same task on multiple platforms with different task decomposition

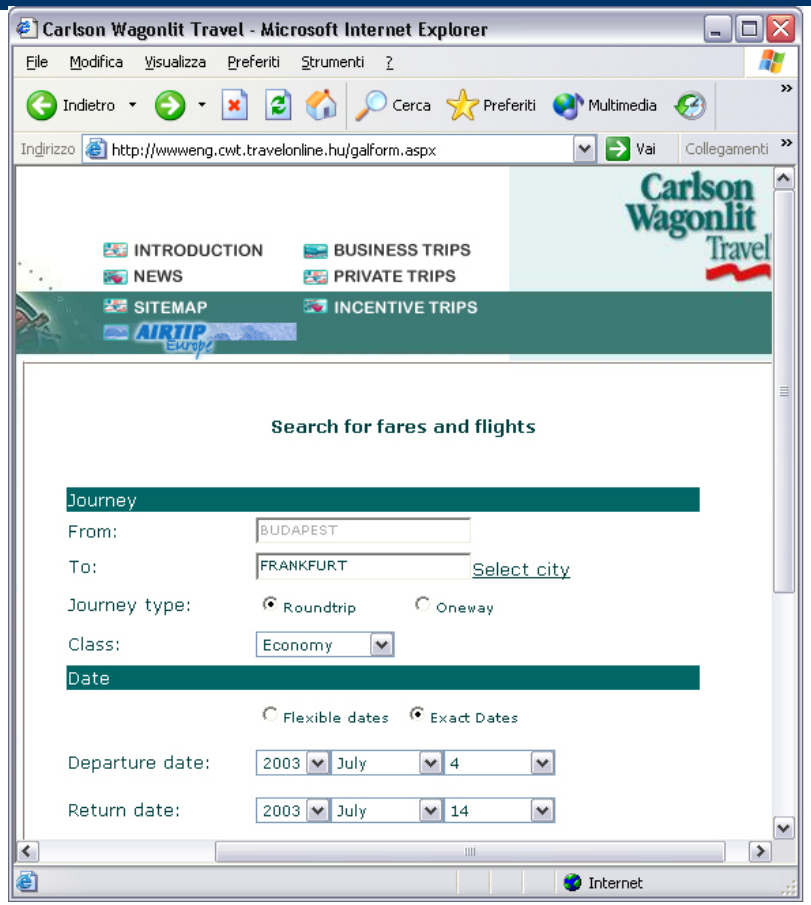


Same task on multiple platforms with different temporal relationships among tasks

- Example: Enter reservation data



Dependencies among tasks performed on different platforms



Design of Nomadic Applications Current Practice

- **Transcoders**, low cost/low usability (example at http://www.ibm.com/software/webservers/transcoding/)
- **Manual solutions**, expensive
- **Style sheets**, partial solution

Approaches to multi-platform interface development

- *The User Interface Markup Language (UIML)* (http://www.uiml.org/) developed by Harmonia and Virginia Tech.
- *The eXtensible Interface Markup Language (XIML)* (http://www.ximl.org/) developed by a forum driven by RedWhale software.
- PUC: Personal Universal Controller by Myers et al. (UIST'02)
- Xweb by Olsen et al. (UIST'01)

XForms

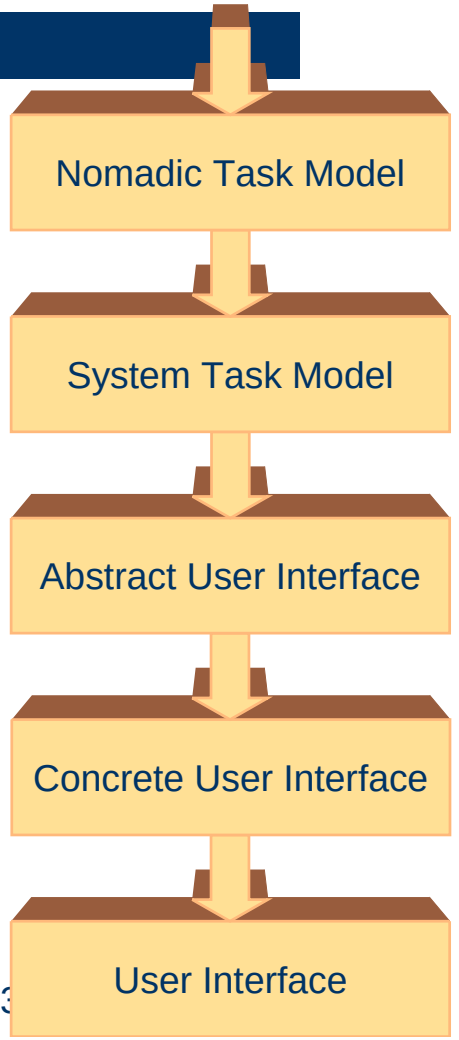
- Apply concepts from model-based design
- Separate presentation from content (form controls markup is separated from data-types and returned values)
- XForms 'native' form controls are device-independent
- Reduce need for scripting through client-side checking
- XML instance is returned allowing strong typing

Teresa Requirements

- Mixed initiative
- Model-based
- XML-based
- Top-down (complementing WebRevEnge)
- Different entry-points
- Web-oriented
- http://giove.cnuce.cnr.it/teresa.html

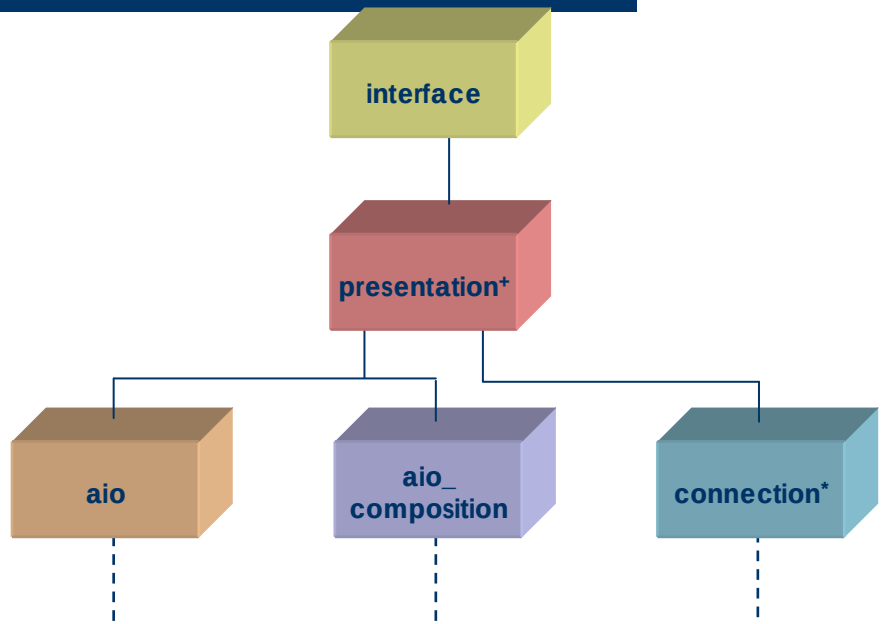
The Method

1. Specification of Nomadic Task Model
2. Filtering for deriving System Task Model for each platform
3. Identification of the corresponding abstract user interfaces
4. Refinement in the concrete user interface
5. Generation of the user interface code



The Structure of the Abstract User Interface

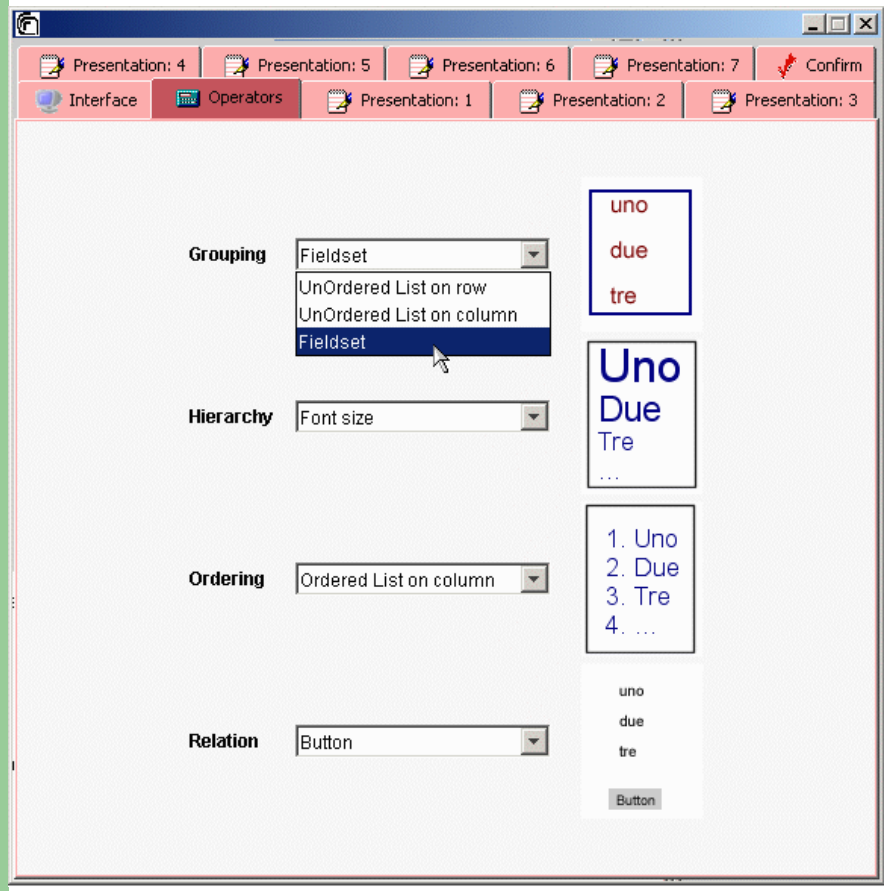
- Connections among presentations
- AIOs for interaction modalities supported by each presentation
- Different types of AIOs
  - interaction_aio (selection, editing, control)
  - application_aio(overview, grouping, etc.)

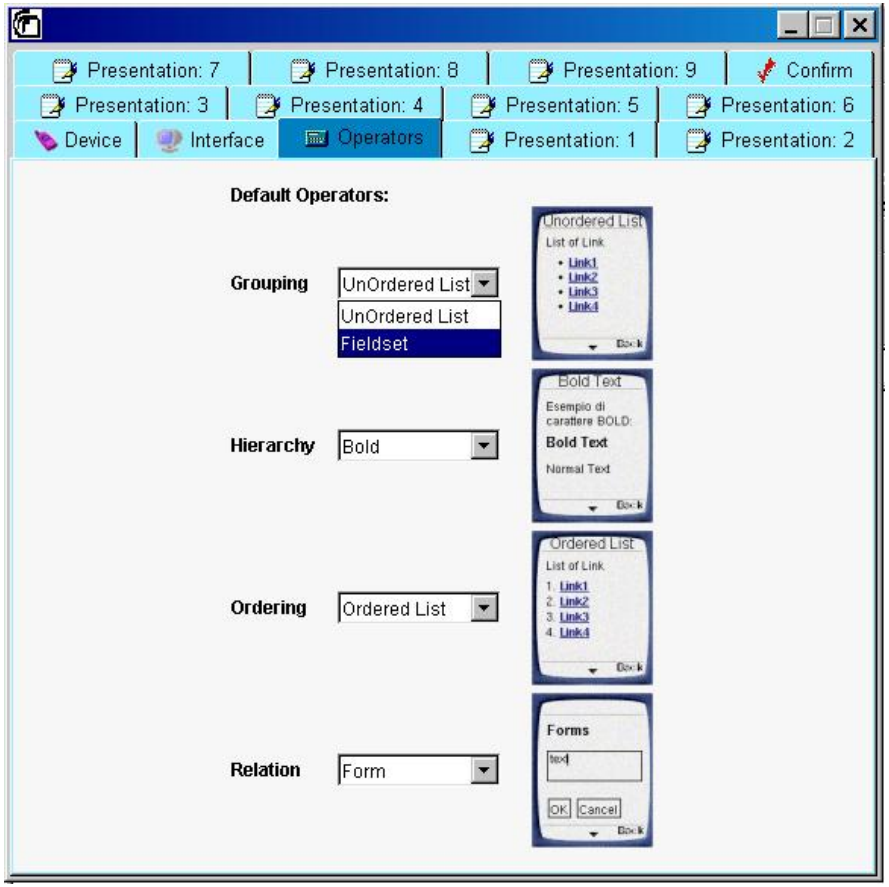


Communication-oriented Composition operators

- Grouping: a set of elements logically related to each other
- Ordering: existing of an order among AIOs (i.e. temporal)
- Relation: 0ne AIO related to a group of AIOs (i.e. Disabling them)
- Hierarchy: a logical hierarchy among a set of AIOs

Operators platform-dependent implementation





Example of platform-dependent composition operator implementation

EXAMPLE: Grouping Operator

- Desktop Computers
  - Fieldset
  - Bullet
  - Background Color
  - Column-oriented organization
  - Row-oriented organization
- Mobile Phones
  - Unordered List On Column
  - Fieldset (only for medium-large phones)

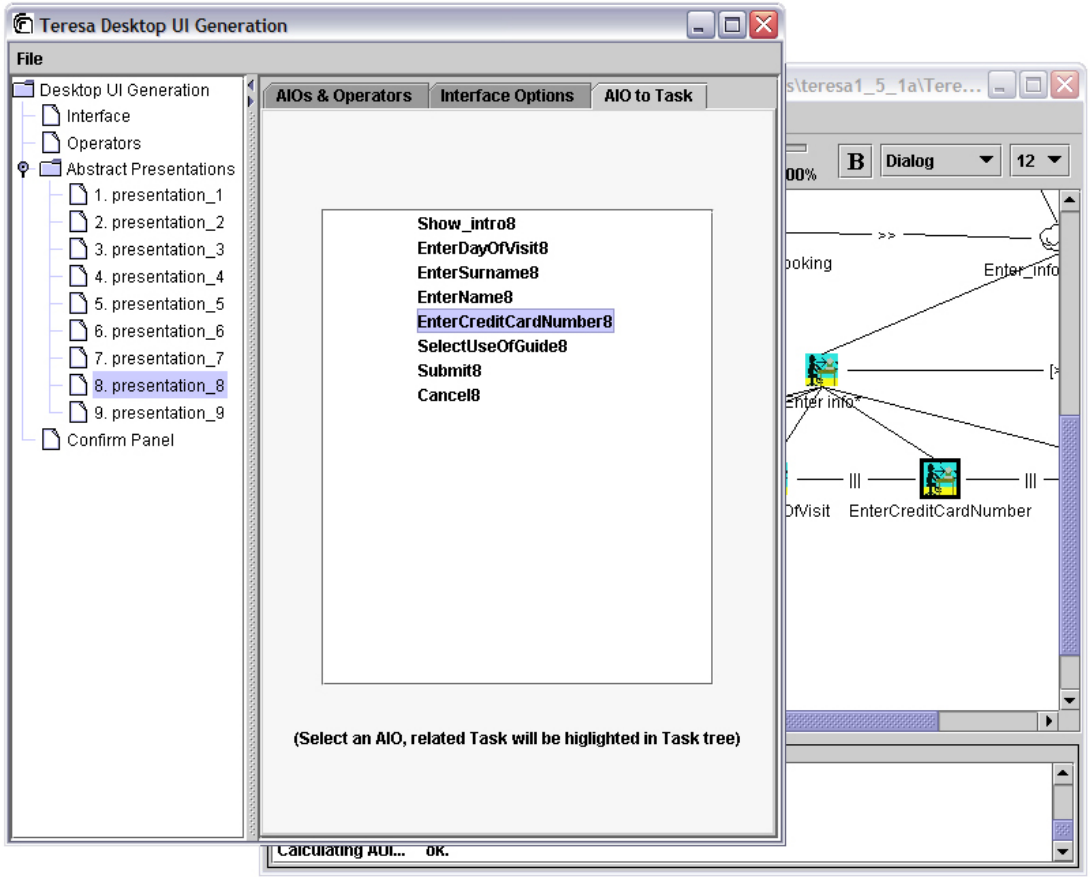
Example of platform-dependent CIO choice

EXAMPLE:

Single choice AIO (*single_select_aio*)

Cardinality	**Desktop Computers**	**Mobile Phones**
Low cardinality	Radio Button	Radio Button
Medium cardinality	List Box	Drop Down List
High cardinality	List with scrollbars	Drop Down List

Mapping AIOs -> Tasks



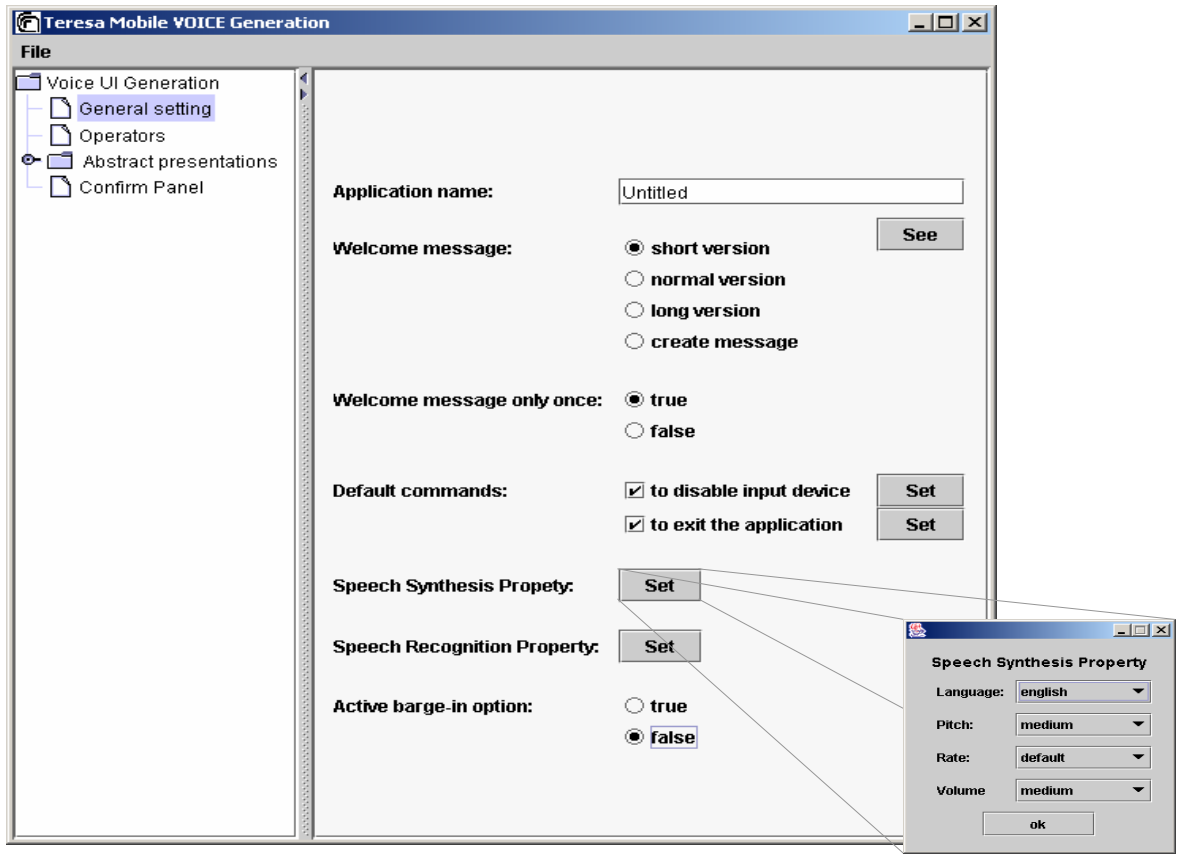
TERESA support in Development

- Choice of device type
- General settings
- Default settings for composition operators
- How to implement presentation components
- Summary of design choices and XHTML preview
- Recording of concrete aspects defined

Voice Interaction

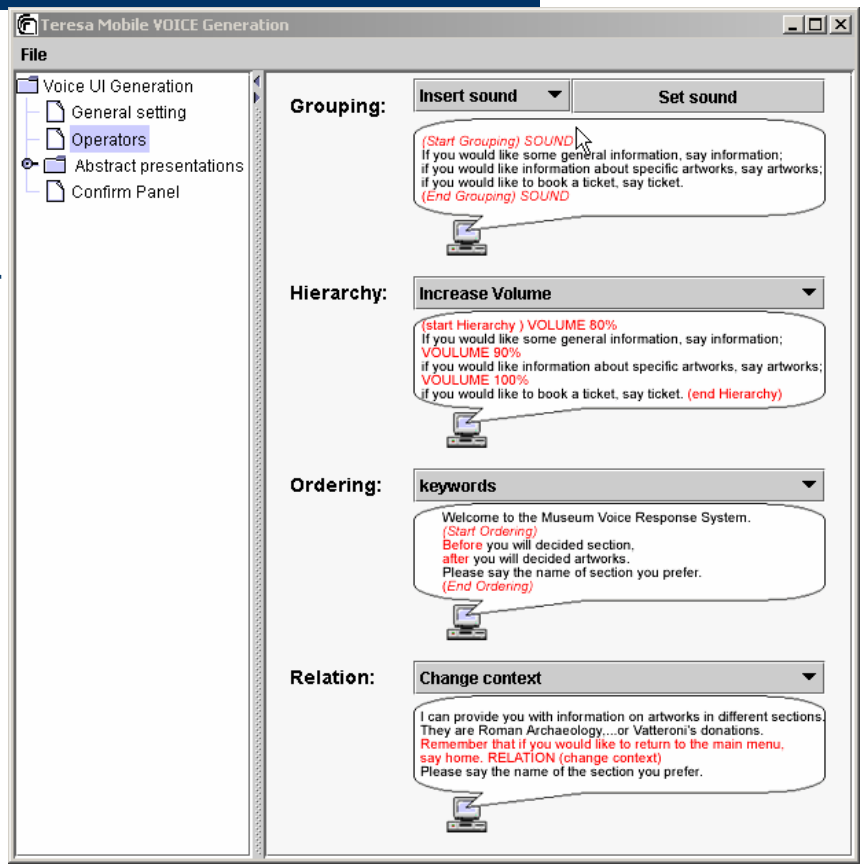
- Characteristcs:
  - Linear
  - Not persistent
  - More faster and natural some operations
- Voice Guidelines:
  - Provide feedback to check the status of application
  - Use specific error messages
  - Brief prompts and short lists of options to reduce memory capability
  - Management of no-input events

Specifying general parameters for all presentations



Speech user interface composition operators

- Grouping:
  - Insert a sound
  - Insert a pause
  - Use some keywords
  - Use a specific volume of synthesizer voice
- Ordering
  - Alphabetical order
  - Use some keywords
- Relation
  - Change context (change type of menu)
- Hierarchy
  - Increase or decrease the volume of synthesizer voice



GUI vs VUI

Fifth presentation	System:	The Boat has been achieved through the subtle divisions of the planes enveloping its central part, which is only rough-hewn; the material is white marble. (*Five second pause*) Remember that if you would like to return to the main menu, say home or if you would like to go back to the previous menu, say back.
	Caller:	Home

- Welcome message
- Management of no input event
- Provide feedback
- Description Object
- Composition operators

Research Agenda

- Knowledge intensive tools
- Interactivity vs. automation
- Runtime uses of interface models
  - Adaptation, context-aware interaction
- Integration of forward and reverse engineering
- Natural Development for Multi-Device Applications
- Improving techniques for editing the relevant models
  - Vocal Interaction with natural language-to-model specification translation
  - Sketch-based input
  - Tangible Interfaces