

SMART User Interfaces in Multi-Device Ubiquitous Environments

Fabio Paternò
CNR-ISTI, HIIS Laboratory
Pisa, Italy

fabio.paterno@isti.cnr.it
<http://hiis.isti.cnr.it/>



Why Multi-Device User Interfaces for our Smart Cities?

- ❖ Growing demand for “always-on, accessible-everywhere services”
- ❖ Our life is becoming a continuous multi-device experience (smartphones, tablets, PC, laptops, large screens, TVs, ...)
- ❖ There are two modes of using them:
 - Sequential usage, moving from one device to another at different times to accomplish a task
 - Simultaneous usage, using more than one device at the same time for either a related or an unrelated activity
- ❖ Managing information across such devices is one challenging aspect of using multiple devices.
- ❖ In general main issues in multi-device UIs are:
 - poor adaptation to the context of use,
 - lack of coordination among tasks performed through different devices,
 - inadequate support for seamless cross-device task performance

- ❖ Accessing applications through different devices at different times (one device at each time)
- ❖ Distributed user interfaces: application logic receiving input from multiple devices
- ❖ Moving objects across interactive devices (e.g. through pick-and-drop)
- ❖ Migratory user interfaces: device change, interface migration with state preservation



Our Solution for Dynamic User Interface Distribution



Users with Personal Device



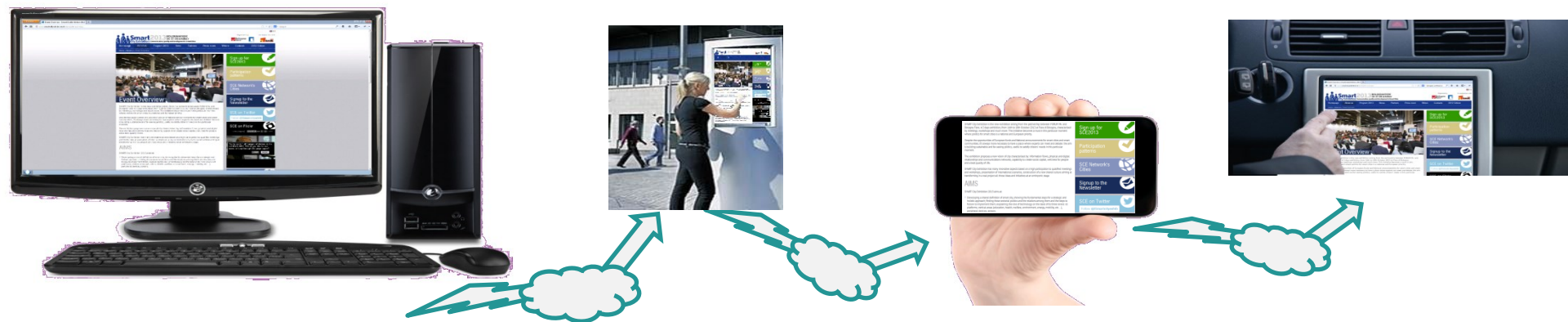
Users with Distributed User Interface between
Personal Device and Large Public Display

Example Application

<http://hiis.isti.cnr.it/videos/24>

Our Solution for Migratory Interfaces

- ❖ One of the main sources of frustration is that users need to restart their sessions for each device change
- ❖ Migratory user interfaces can transfer among different devices (from 'source' devices to 'target' devices), so as to allow the users to continue their tasks
- ❖ Various ways to decide when migrating (*manual*, *assisted* and *automatic*)
- ❖ Support for identifying:
 - Where to migrate
 - What to migrate: Total vs Partial
 - How to Migrate: Push vs Pull

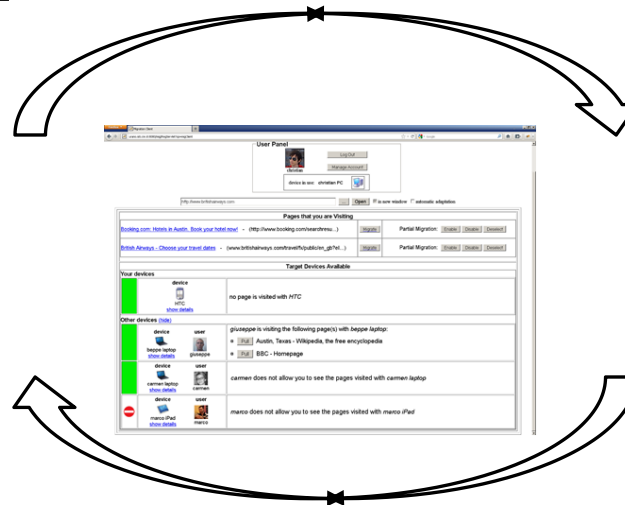


Multi-User Migration through Push and Pull

1- Laura accesses Booking.com and British Airways site



2 – Laura pushes selection of hotels to Tom



3 – Tom pulls also British airways selection and then accesses weather forecast



4 - Partial migration of wheather forecast




Push & Pull Control of Web Applications

Firefox Migration Client


urano.istc.cnr.it:8080/mig/RegServlet?op=mgClient

User Panel


christian

Log Out

Manage Account

device in use: christian PC 

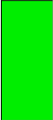

☒ in new window ☐ automatic adaptation

Pages that you are Visiting

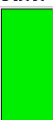


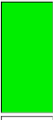





Booking.com: Hotels in Austin. Book your hotel now! - (http://www.booking.com/searchresu...)	<input type="button" value="Migrate"/>	Partial Migration: <input type="button" value="Enable"/> <input type="button" value="Disable"/> <input type="button" value="Deselect"/>
British Airways - Choose your travel dates - (www.britishairways.com/travel/fx/public/en_gb?el...)	<input type="button" value="Migrate"/>	Partial Migration: <input type="button" value="Enable"/> <input type="button" value="Disable"/> <input type="button" value="Deselect"/>

Target Devices Available

Your devices

	device  HTC show details	no page is visited with <i>HTC</i>
--	---	------------------------------------

Other devices (hide)


	device  beppe laptop show details	user  giuseppe	<i>giuseppe</i> is visiting the following page(s) with <i>beppe laptop</i> : <ul style="list-style-type: none"><input type="button" value="Pull"/> Austin, Texas - Wikipedia, the free encyclopedia<input type="button" value="Pull"/> BBC - Homepage
	device  carmen laptop show details	user  carmen	<i>carmen</i> does not allow you to see the pages visited with <i>carmen laptop</i>
	device  marco iPad show details	user  marco	<i>marco</i> does not allow you to see the pages visited with <i>marco iPad</i>

Select a target device for migration...



Close source page automatically ☐

Adapt source page to target device automatically ☐

Your devices

select	type	name	
<input type="checkbox"/>		HTC	show details

Other devices

select	type	name	user	
<input checked="" type="checkbox"/>		beppe laptop	giuseppe	show details
<input type="checkbox"/>		carmen laptop	carmen	show details

HTC
[show details](#)

Components of the Proposed Solutions

- ❖ Context manager to detect the events generated by users, devices, environments,
- ❖ Rules to personalize adaptation, migration, ...
- ❖ Server able to augment Web applications with migratory capabilities
- ❖ Framework and run-time support for developing distributed and migratory user interfaces
- ❖ User interfaces can exploit various interaction modalities (graphics, voice, gesture, ...).

Example Migratory Applications

(OPEN EU Project)

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Emergency Prototype



- Cooperation among different experts
- Flood and traffic simulation components
- Map mashup component
- Total and partial migration
- Multi-user interaction and synchronization



Social Game



- Rich web application
- Different technologies involved
- Multiplayer online game
- Multitarget partial migration
- Partial migration with UI adaptation

Twitter Wall



- Mobile Twitter Client
- Social environments: ice breaker application
- Can be split in components for partial migration
- Supports multiple users

Pacman



- Web application
- User interface and application layer
- Desktop and mobile gaming
- Adaptive and context-aware application logic
- UI migration and adaptation

More Info at

- ❖ HIIS Laboratory @ CNR-ISTI <http://hiis.isti.cnr.it>
- ❖ EU SERENOA Project <http://www.serenoa-fp7.eu/>
- ❖ EU Artemis SMARCOS Project
<http://smarcos-project.eu/>
- ❖ W3C group on model-based interfaces
<http://www.w3.org/2011/01/mbui-wg-charter>
- ❖ Book on Migratory Interactive Applications in Ubiquitous Environments
<http://www.springer.com/computer/information+systems+and+applications/book/978-0-85729-249-0>
- ❖ Multi-Device team: Giuseppe Ghiani, Marco Manca, Luca Frosini, Fabio Paternò