SMART User Interfaces in Multi-Device Ubiquitous Environments

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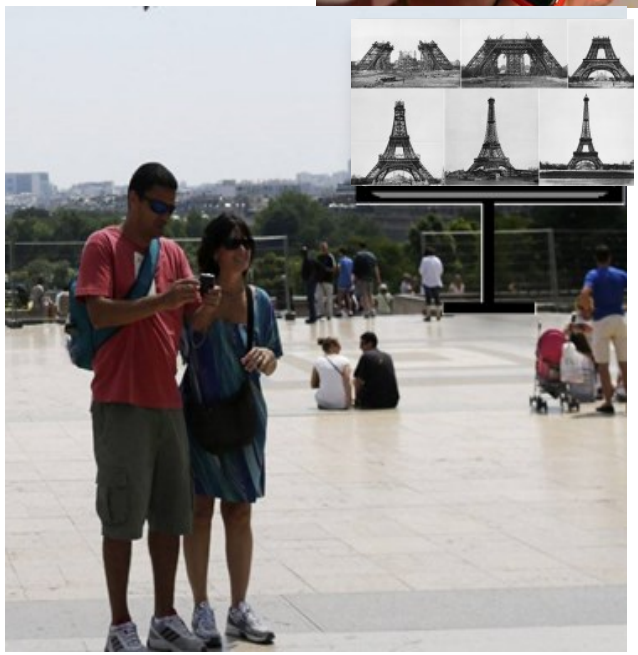
Why Multi-Device User Interfaces for our Smart Cities?

- Growing demand for “always-on, accessible-everywhere services”
- Our life is becoming a continuos 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

User Access in Multi-Device Environments

- 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

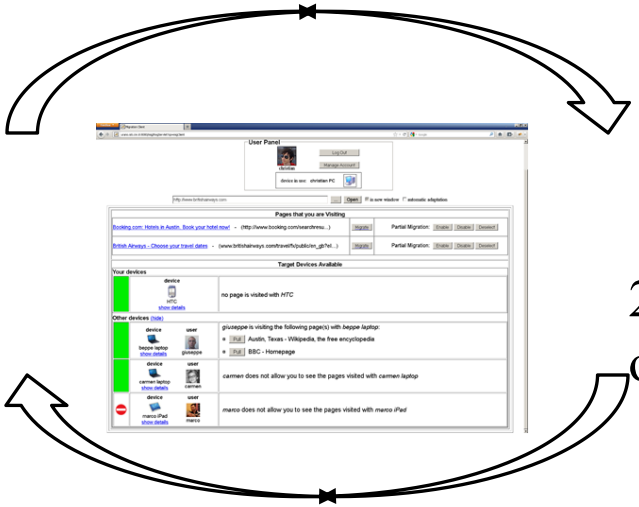
Our Solution for Migratory Interfaces

- 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

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

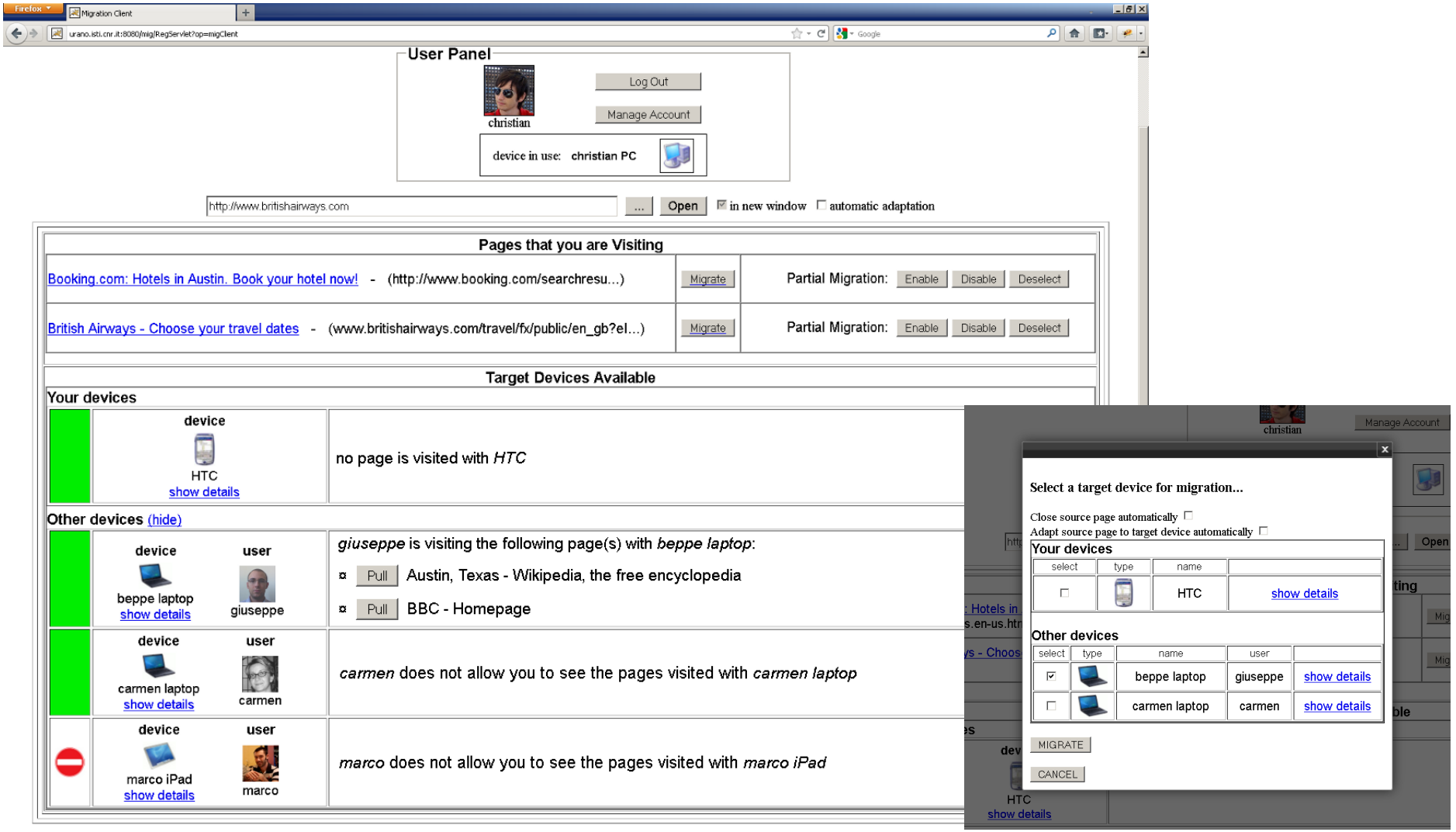


2 – Laura pushes selection of hotels to Tom

4 - Partial migration of wheather forecast

Push and Pull of Web User Interfaces in Multi-Device Environments, Ghiani et al., AVI 2012

Push & Pull Control of Web Applications



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)

Emergency Prototype

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

Twitter Wall

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

Social Game

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

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

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