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 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
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

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

Image description:
- User Panel with options to manage account and log out.
- Web page with options for migration and partial migration.
- Target Devices Available list:
  - HTC: No page visited.
  - giuseppe: Visiting pages with bebpe laptop:
    - Austin, Texas - Wikipedia, the free encyclopedia
    - BBC - Homepage
  - carmen: Does not allow you to see pages visited.
  - marco: Does not allow you to see pages visited.

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 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
- Multi-Device team: Giuseppe Ghiani, Marco Manca, Luca Frosini, Fabio Paternò