Graphics Architecture for Multimedia Non-Desktop Devices: a study of digital television receivers

Pablo Cesar: pcesar@tml.hut.fi

Non-desktop devices are evolving into advanced interactive multimedia terminals, generating a new set of requirements for their user interface software architecture. Thus, traditional approaches used in desktop computers have to be reconsidered. The thesis proposes a new graphics architecture model. Moreover, it presents the experiences of applying it for the design and development of a configurable digital television receiver.

Starting Assumptions
1) In the future, a number of multimedia terminals will have access through a number of networks to a variety of content and services
2) "User Interfaces are breaking out of the desktop", thus traditional graphics architecture model has to be reconsidered

Software Requirements for multimedia non-desktop devices:
* Lack of input pointing device
* Seamlessly integrated video, 2D, and 3D graphics
* Scene metaphor
* Low memory footprint
* Support for several programming levels: Java, XML

Digital Television
Digital Television receivers are studied as an example of non-desktop devices. They are starting to show a technological maturity level, but in the future they will evolve, so different configurations will be available.

Proposed Graphics Model
Taking into account all the mentioned requirements of non-desktop devices, we propose a new graphics architecture model composed of five thin layers:
* Hardware Abstraction Layer (HAL): provides a unified way to access hardware (e.g., hardware acceleration)
* Graphical context: a cross platform abstraction of the rendering region, which provides native graphics primitives
* Graphical Environment: provides the means to control different graphical contexts
* GUI toolkit: a set of "ready-made" user interface widgets
* High Level Languages (HLL): to develop simple services

Reference Implementations
Two implementation threads were followed:
* Otadigi: a real digital television broadcast system, operating in Otaniemhi area, Helsinki, Finland. The author of the thesis is part of the technical committee. He implemented services and broadcasted them
* Ubik: a prototype implementation of a configurable digital television receiver

Contribution
* Theoretical: looking from a new perspective, multimedia capabilities in non-desktop devices, previous research about user interface software architecture
* Standardisation: extensions to MHP standard such as 3D graphics support in digital television receivers
* Commercial: new ideas, tested in reference implementation, to receivers manufacturers such as game console convergence and XML user agent supporting several W3C languages