

# Open Graphical Framework for Interactive Television

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Open Graphical Framework for  
Interactive Television



## Outline

- Introduction
- Background
- Proposed Graphical Software Architecture
- Digital Television
- Prototype (Ubik)
- Screenshots
- Conclusion
- Questions

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## Introduction

- "Interacting in Chaos" (1999, by Olsen):
  - "The fundamental assumptions of interactive computing must be reconsidered"
  - Device chaos: "variability of future interactive devices"
- "Past, present, and future of user interface tools" (1999, Myers et. al):
  - "We are at the dawn of an era where user interfaces are about to break out the "desktop" box"
- In conclusion
  - Not so long ago, desktop computer the only multimedia platform
  - Today, the number of interactive devices is growing (e.g., mobile phones, digital television receiver)
  - So, a new user interface model is needed

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## Classic Architecture

- "User Interface Software Tools" (1995, Myers) defines a layered model
- Each layer includes one more level of abstraction
- Applications implemented using higher-level tools
- Toolkit: a library of widgets used by applications
- Windowing System: helps user to monitor and control different contexts (input and output functionality)

**Applications**

**Higher-level Tools**

**Toolkit**

**Windowing System**

**Operating System**

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## System Architecture Requirements

- User Experience
  - Support for multimedia objects (video, image...)
  - User interaction effectively handled
- Developer Experience
  - Need a set of APIs as easy as possible to use to develop the software
- Core Architecture
  - Control different contexts
  - Synchronise audio, video, and applications
- Adaptability
  - Cross platform development

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## User Interface Software Tools Metrics

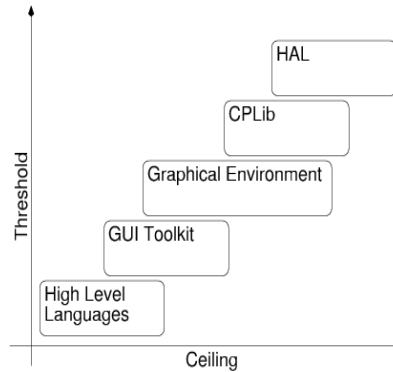
- “Past, present, and future of user interface tools” (1999, Myers et. al) proposed several metrics to evaluate user interface software tools
- In this presentation, two of them are widely used:
  - Ceiling: expressional power of a tool
  - Threshold: difficulty of learning the tool
- They are really useful because for example it makes clear that 3D games should not be implemented the same way as Information Systems
- In conclusion:
  - Device chaos + basic requirements
  - Classic architecture + user interface software tools metrics

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## Proposed Model (1/2)

- Different Layers, which can be use for development (image upside down):
  - HAL: Hardware Abstraction Layer
  - CPLib: Cross-platform graphics library
  - Graphical Environment
  - GUI Toolkit
  - High Level Languages



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## Proposed Model (2/2)

- Hardware Abstraction Layer
  - Provides a unified way to access the hardware (e.g., access video memory)
- Cross-platform graphics library
  - Provides multimedia primitives for presentation, user interaction, and video and audio
- Graphical Environment
  - Manages the different contexts
- GUI Toolkit
  - A set of “ready-made” user interface widgets
- High Level Languages
  - Fast and easy development of applications

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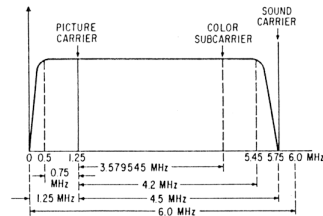
## Digital Television (1/5)

### Analog tv:

1 television program in a 6 or 8 MHz channel

Little choices

Receiver: only Television set



### Digital tv:

Audiovisual signal is compressed and transported by digital means (MPEG-2 stream).

Spectrum efficiency. Multiple programs in 6 or 8 MHz.

Interactive Services: VoD, banking, games...

Receiver: TV set + decoder.

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## Digital Television (2/5)

- Each Broadcaster decides how to use its own bit-rate:
  - Only television programs
  - Only interactive applications
  - Television program(s) plus interactive application(s)
- Flexible quality of video and audio signals
  - 3 Mbps is enough for satisfactory video quality.
- Interactive Applications as value added services
  - Java Xlets and XHTML documents
  - Internet access (e-mail, web, ...)

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## Digital Television (3/5)

- Standards = Horizontal Market
  - Applications and decoders can be developed by different developers and manufacturers.
- DVB Standards (Digital Video Broadcasting)
  - DVB is the European initiative in Digital Television field
  - Specifies the transmission in different mediums: DVB-S (Satellite), DVB-C (Cable), DVB-T (Terrestrial)
- MHP (Multimedia Home Platform)
  - Set of Java Application Program Interfaces (APIs)
  - Home/Audio Video Interoperability (HAVi) is the GUI library. It is based on a subset of Abstract Windowing Toolkit (AWT)
  - Every DTV receiver include them

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## Digital Television (4/5)

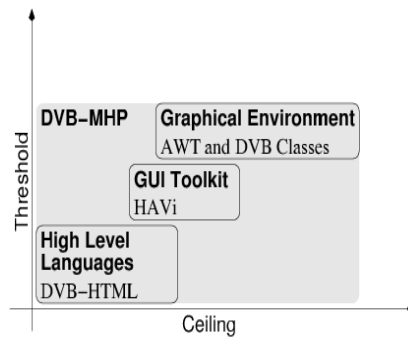
- Resident applications
  - Navigator
    - Display current program information.
    - Allow control over the decoder settings.
    - Display forthcoming information, Electronic Program Guide.
  - Digital Teletext
    - Mass media information delivery (news, sport results...).
    - Information structured in pages.
    - Contains multimedia objects (audio, images, animations...)
- Broadcast applications
  - All kind of services: VoD, banking, games...

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## Digital Television (5/5)

- The proposed model can be used for digital television
  - AWT + MHP classes
  - HAVi
  - DVB-HTML
- Hardware Abstraction Layer breaks Java interoperability
- Other High Level Languages not taken into account yet



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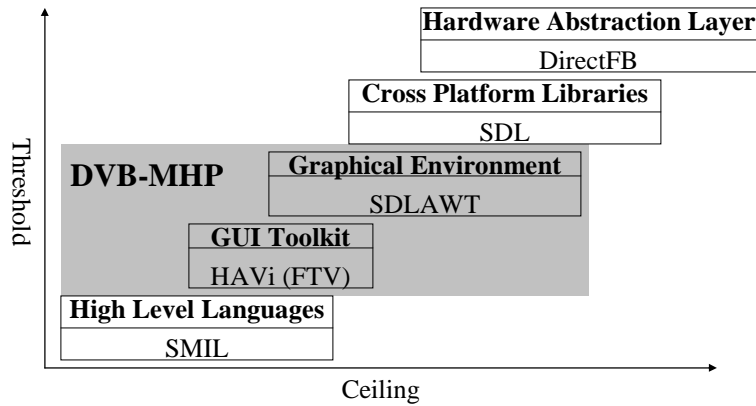
## Ubik

- A prototype system for digital television receivers based on the proposed model
- Open and extensible system
- MHP compliant, overcoming today's restrictions (interaction channel capabilities, video player implementation...)
- Allows the study of new ideas for MHP
- It is based on Linux Operating System
- Combine different relevant open source projects

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## Ubik Layered Model



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## Hardware Abstraction Layer

- Uses DirectFB: <http://www.directfb.org>
- Renders directly in the framebuffer console, so no extra windowing system is needed (e.g., X Windows)
- Includes hardware acceleration
- Supports controlling different applications in the same screen (e.g., audio-visual content + MHP service)
- Easy to develop a video player for the audio-visual content

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## Cross Platform Multimedia Libraries

- Uses Simple DirectMedia Layer (SDL):  
<http://www.libsdl.org>
- SDL can be compiled in a variety of Operating Systems:
  - Linux, Palm OS
- SDL provides native multimedia primitives:
  - Presentation (visualisation)
  - User Interaction
- Other libraries used in Ubik:
  - SDL\_image: support for images
  - SDL\_ttf: support for true type fonts

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## Graphical Environment (1/2)

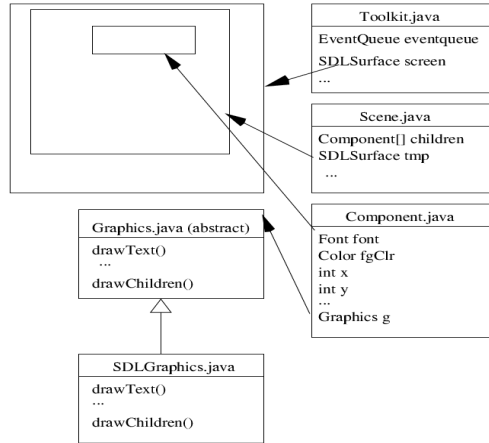
- Ubik includes Kaffe 1.1 Virtual Machine:
  - <http://www.kaffe.org>
  - Open source Virtual Machine
- AWT was modified (Java Native Interface bindings), so it renders using SDL library
- Final result is an AWT subset (only essential classes to manage graphics) specified by HAVi:
  - Toolkit, Graphics, Font, FontMetrics, Image, Color...
  - Shape, Polygon, Rectangle, Point..
  - Control of Windows (Component, Container)
  - Event handlers and Listeners (*java.awt.event*)

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## Graphical Environment (2/2)

- The actual screen is defined in *Toolkit* as a *SDLSurface*
- *Scene* is a context (like *awt.Window*)
- *Scene* includes *Components*
- Each *Component* is drawn by its *Graphics* class

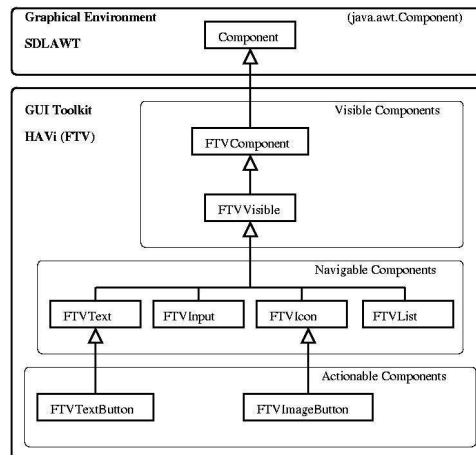


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## Toolkit

- All widgets are visible, in addition they could be:
  - Navigable: navigated using the remote control
  - Actionable: launch functionality (buttons)
  - Selectionable: selection of an item or set of items (Lists)
- Each widget has associated a Look class (i.e., view)



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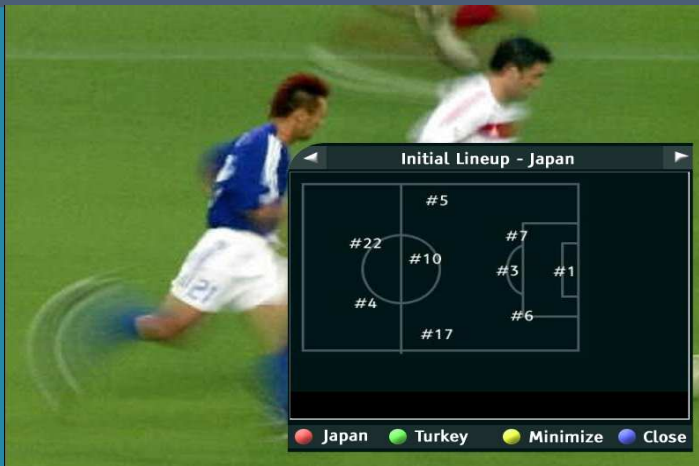
## High Level Languages

- eXtensible Markup Language (XML) is a meta-language to define other languages
- World Wide Web Consortium (W3C) has defined different languages, two of them:
  - Synchronized Integration Markup Language (SMIL), multimedia presentations on the Web (presentation, time based)
  - XForms, structured web forms (interaction)
- A Language profile SMIL+XForms hybrid documents are integrated in Ubik
- Advantages:
  - Easy and fast to implement (no compilation needed)
  - Small applications (only a document + multimedia objects)
  - Structured and interchangeable content

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## Screenshots SMIL



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## Screenshots Navigator

### Channel Guide



Wellnet	6.4.2003	Wed
07:00	Vaara Vuoteessa	
08:30	Kulissien takana	
09:30	Nu talar pappa igen	
11:00	Esko Oinas lavoilla	
12:30	Entertainers '03	
13:15	Pelastusvene	

Tangolaulajien kuningas Esko Oinas viihdyttää jälleen. Mukana myös Reiska Laineen rytmiorkesteri. Jukka Kajava: 5 tähteä.

● DATE ● CHANNELS ● TYPES ● HELP

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## Screenshots Teletext

### Super Teletext

MAIN INDEX

News  
Weather  
TV Guide  
Finance  
Shopping  
Documentaries  
Travel  
Film



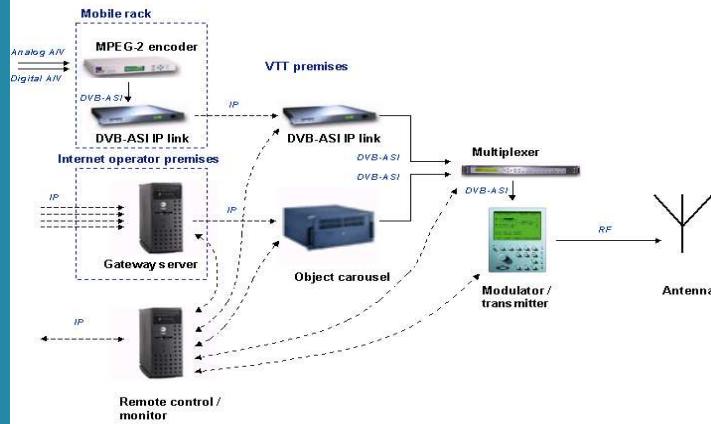
YLE: 18:00 - 21:30  
European Cities, Helsinki

● GOTO ● BACK ● HOME ● HELP

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## Otadigi



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## Otadigi

- New multiplex (2002) for academic and research purposes in the Helsinki University of Technology campus area (<http://www.otadigi.tv>)
- DVB-T network
- Stable environment
- Reception by commercial set-top boxes
- In Otadigi, different MHP applications are running using our HAVi widgets:
  - Navigator
  - SMIL player
- Real network can study today's digital television

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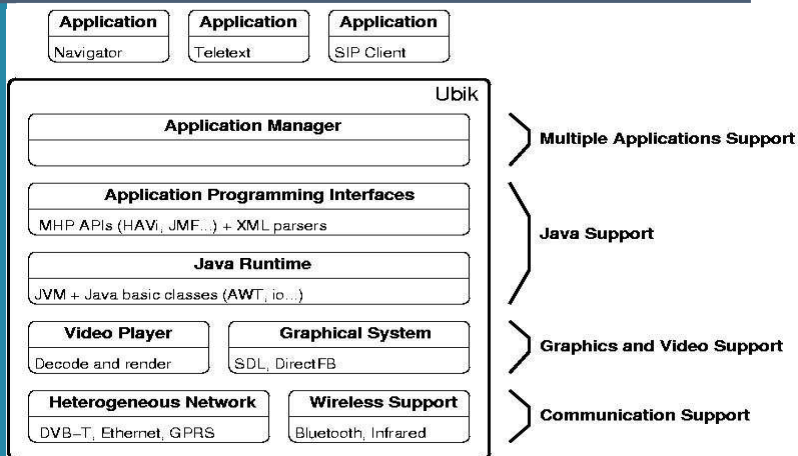
## Conclusions

- Today situation: Device Chaos = growing number of multimedia terminals
- A Graphical Software Architecture for multimedia platforms has been presented
- Multiple configurations can be obtained (e.g., MHP, game console)
- A prototype for digital television receivers based on the model has been implemented (Ubik)
- Ubik proposes two extension profiles for MHP (low level and high level)
- Otadigi is a real DVB-T network, where Ubik can be tested

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## Ubik Future



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## Ubik Future

- DVB-T reception (DirectFB video player)
- Java Video Player (use of JMF)
- Communication mechanism such as Bluetooth
- Deeper study of the interaction channel:  
heterogeneous network support
- SIP client (e.g., Video conference)
- Inclusion of minimal XML parsers

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## Questions

Thank you very much!

Questions ?  
Comments ?

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