Digital TV

Ifi, UiO
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This part of the course ...

• ... is prepared by
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• ... uses material from MHP (Georg Luettke)
• ... and DVB, ... and ...
Preview

- Television Technology
- Roles in today's and future TV
- Interactive TV technology
- Standards for digital TV
- DVB, MHP, ...
- Bandwidth and program manyfold
- Digital TV and interaction
- New opportunities with Digital TV

Television

Paul Nipkow (1884)
- A.A. Campbell Swinton (1911): CRT
- von Ardenne, Zworykin, Schoenberg, Bartholemy
- Broadcast: 1936 Berlin Olympics
- Different standards: lines: 240, 405 (Gr.Br.), 441 (Germany), 455 (France), 340 (New York), ...
- 1941: 525-line 60 frames/sec (America)
- 1952: 625-line 50 frames/sec (Europe)
Colour Television

- 1953 RCA and Hazeltine labs ↑ NTSC
- 1961 Henri de France ↑ SECAM
  Sequential Couleur à Memoire
- 1961 Dr Walter Bruch ↑ PAL
  Phase Alternation by Line

\[
\begin{align*}
Y &= 0.299 \cdot R + 0.587 \cdot G + 0.114 \cdot B \\
U &= 0.493 \cdot (B - Y) = -0.15 \cdot R - 0.29 \cdot G + 0.44 \cdot B \\
V &= 0.877 \cdot (R - Y) = 0.61 \cdot R - 0.52 \cdot G - 0.097 \cdot B
\end{align*}
\]
Colour Television

- PAL
- SECAM
- NTSC
- U,V components, (Q,I components NTSC)
- ampl. modulation 90°, 4.43 MHz
- FBAS signal
**Set-top boxes (STB)**

- **Analogue broadcast**: 1st generation, one-to-many, without return channel; e.g., decoder for cable TV or satellite
- **Analogue interactive**: hybrid, data services and return channel, e.g., WebTV
- **Digital broadcast**: 2nd generation, digital compression and transfer, e.g., satellite decoder
- **Digital interactive**: 3rd generation, future solution, “everything” is digital, return channel; e.g., DVB MHP

**DVB**

- **Digital Video Broadcasting Project**
- **industry-led consortium** of over 300 broadcasters, manufacturers, network operators, software developers, regulatory bodies and others in over 35 countries
- **committed to** design global standards for the delivery of digital television and data services.
- **http://www.dvb.org**
DVB Standards

- Audio
- Conditional Access
- Interactivity
- Interfacing
- Measurement
- MHP
- Multiplexing
- Sub-titling
- Transmission
- Cookbook

NorDig

NorDig is specifying a common platform for Digital Television to be used within the Nordic region (Denmark, Finland, Island, Norway and Sweden).

- NorDig follows DVB
- + nordic specifications
- http://www.svt.se/nordig/
NorDig Migration Plan

NorDig Migration Plan -- Milestones

Set Top Box

- Set top box
- API
- CA system
- Operating system
- Networking connection
Digital TV Hardware

- Specified by DVB (Digital Video Board)
- Set top box

Multiplexing

- DVB DATA
- DVB MPEG
- DVB SI
- DVB TXT
- DVB VBI
Transmission

- DVB-C: Cable
- DVB-DSNG: Digital Satellite News GAthering
- DVB-MC: MMDS
- DVB-MS: MVDS
- DVB-MT: OFDM (digital terrestrial television)
- DVB-S: Satellite
- DVB-SFN: Single Frequency Network
- DVB-SMATV: Satellite Master Antenna TV
- DVB-T: Terrestrial
- DVB-H: Handheld

Conditional Access (CA)

- DVB CA package (available from ETSI)
- DVB Common Scrambling Algorithm (CSA)
- only partially defined by DVB
- CA Interoperability Scenarios:
  - SimulCrypt (one stream - several CA systems)
  - MultiCrypt (Common Interface - switch cards)
Standards, API, and CA

Digital Television

ECCA

CANAL+

d-box (K tough)

ATVEF

Microsoft

WebTV

TVML

DVB / NetDig

MHP

DVB / NetDig

 MPEG

 HTML


Actors

DVB

ECCA

Nokia

Motorola

Telenor

Conax

OpenTV

Sun

Betamora

Seca

Vivanco

Conax


Digital Video Broadcasting

EuroBox

EBCA

Telenor

Conax

OpenTV

Sun

Betamora

Seca

Vivanco

Conax


Digital broadcasting solutions
EuroBox (ECCA)

- Example for a set top box
- Remote Control Unit

DTV Platforms

- proprietary APIs
- associated to proprietary CA systems
- operating systems

API Systems

- MediaHighway
- OpenTV
- MHEG-5
- BetaNova
- .......

MediaHighway

A / V Coding

Programmes

MPEG-2
**DTV Platforms**

Access to system functionality:
- GUI, graphics, EPG, interaction
- network access
- stream objects, MPEG
- conditional access, security
- system functions (file, clock, hardware access)

Examples: Java, JavaTV, OpenTV, MediaHighway, TVML, SMIL, MHEG, ...

**DVB Standardisation**

- **Infrastructure / Transport**
  - Broadcast Transmission (satellite, cable, terrestrial, ...)
  - Service Information SI
  - Return channels for interactive services

- **Middleware**
  - Multimedia Home Platform, including API
MHP

- MHP = API for digital TV, defined by DVB
- MHP1.0 formally accepted by ETSI
  - Enhanced Broadcasting
  - Interactive Broadcasting
- MHP1.1 (spring 2001)
  - Internet Access
Based on DVB-Java
- HTML / XML
  - Enhanced & Interactive Broadcasting (optional)
  - part of Internet Access profile
- Existing (legacy) APIs to be handled as plug-ins

The Scope of MHP

- Independent developers
- Different service providers
- Various application areas

Applications

Generic SW Interface (API)

- Independent implementations
- Different hardware
- Different software
- All kind of terminals
  (low-end STB / high-end PC)

MHP Terminals
MHP System Definition

- **Equipment (hardware, software)**
  - home terminal / receiver
    - set top box, integrated TV set, multimedia PC, PDA
  - local cluster
    - peripherals, in-home digital network (smart house)

- **Services / applications (content)**
  - enhanced broadcasting with local interactivity
  - interactive services using a return channel
  - internet access

- **Security**
  - operation (… the TV should not crash …)
  - content
  - user data, transactions etc.

- **Local Cluster**

- **Copyright Management & Protection**
  - levels, signalling
  - operational model

- **Conformance & Interoperability Testing**

- **Migration**
Multimedia Infrastructure & Value Chain

- Content / Applications
- Services / Programmes
- Conditional Access
- Networks / Transport

Multimedia Home Platform MHP

Vertical markets

Digital Television

e.g. d-box e.g. Canal+

Horizontal market

API

CA

MHP Market Model

Vertical businesses in a horizontal market

Supplier 1 Supplier 2 Supplier 3 Supplier 4

Provider 1 Provider 2 Provider 3

Operator 1 Operator 2 Operator 3

Manuf. 1 Manuf. 2 Manuf. 3 Manuf. 4

Applications & Content
Programmes & Services
Conditional Access
Networks / Transport

Receivers / Terminals

A horizontal Market for Free und Pay TV

Competition in all layers of value chain
Typical MHP Applications

- Electronic program guides
- “Super Teletext”
- Applications synchronised to TV content
- Games
- E-commerce
- Interactive advertising
- Internet access
MIT: Vær

Digital Television

ZDF.vision EPG
Application Synchronised to TV Content
Golf Game

E-Commerce
Top of the Pops

Digital Television

Airport Information System

Digital Television
Airport Information System

T-banehjelper på TV
Specification Elements (1)

- **MHP architecture**
- Detailed **profile** definition enhanced and interactive broadcasting
- **Content formats**
  - including PNG, JPEG, MPEG-2 Video/Audio, subtitles and resident and downloadable fonts
- **Mandatory transport protocols**
  - including DSM-CC object carousel (broadcast) and IP (return channel),

Specification Elements (2)

- Application model and **signalling**
- Hooks for HTML content formats
- **DVB-J platform**
  - DVB defined APIs and selected parts from existing Java APIs, JavaTV, HAVi and DAVIC
- **Security framework**
  - broadcast application or data authentication return channel encryption (TLS)
- **Graphics reference model**
- Annexes
  - DSM-CC OC profile, text presentation, minimum platform capabilities, various APIs
MHP Architecture

- Applications
  - Appl. 1: e.g. EPG
  - Appl. 2: e.g. Game
  - Appl. 3: e.g. Home-shopping
  - Appl. n

- Middleware
- Operating System
- Drivers
- Hardware

Cond. Access separated from API

MHP Profiles

- Enhanced Broadcast
  - "HTML" subset
  - Plug-in
  - Broadcast Transport Protocols: DVB OC
  - APIs
  - Java VM

- Interactive Broadcast
  - "HTML" subset
  - Option
  - Interactive Transport Protocols: IP
  - API extensions for interactivity

- Internet Access
  - HTML, ECMA script, DOM, CSS, ...
  - Broadcast Transport Protocols: IP
  - Java APIs for Internet access

MHP 1.1
DVB-J Platform

Interoperable Application (and libraries)

Legacy Appl. A

Plug-in A

Legacy Appl. B

Plug-in B

Application Manager (Navigator)

Transport Protocol(s)

Sun Java APIs

DAVIC APIs

DVB specific APIs

Java Virtual Machine

OS, drivers, firmware, ...

System Software

Sun Java APIs

HAVi APIs

DAVIC APIs

MHP API

DVB-J Platform with Plug-ins

"Interoperable" plug-in

Platform specific plug-in

Plug-in interface

"Interoperable" Java Applications (and libraries)
1011010010110100
Digital Television
Digital Television
Lifecycle DVB-J
Application Signalling

• Application Signalling
  – Extension to DVB-SI
  – Dedicated tables (AIT, VST)

MHP Technical Implementation Group Members

• ARD
• Bertelsmann
• Beta Research
• Canal+ Technologies
• Deutsche Telekom
• DVB
• EBU
• Fantastic
• F.U.N.
• GMD
• Grundig
• I-D Media
• IN TNT Braunschweig
• IRT
• LtR

• Loewe
• Medialog
• Nine Network Australia
• Nokia
• NTL
• OpenTV
• ORF
• Panasonic
• Philips
• Pioneer
• PowerTV
• QuBix
• RAI
• RTL New Media

• Samsung
• S & T
• Scientific Atlanta
• Scip
• Singapore Broadc. Authority
• SES/ASTRA
• Sony
• Sun
• Telenor
• Televísó de Catalunya
• Television Corp. Singapore
• Teracom
• WDR
• YLE
• ZDF
Nokia Media Terminal

- Intel 566 MHz CPU
- 40 GB Disk
- 64 MB RAM
- MPEG2/DVB compliant
- Modem/DSL
- Accelerated 3D graphics
- Content protection
- Linux Operating System
- Mozilla, NaviBars, Plug-Ins, ...
- IP over MPEG
- ...

DirectFB
OstDev
LinuxTV
**OstDev**

- Framework: integrates MHP, Linux, Web
  - Native Linux applications, e.g. games
  - Full IP access
  - Support all web standards
  - Support legacy iTV standards
  - Extend to new application and content standards

[http://www.ostdev.net/](http://www.ostdev.net/)

**LinuxTV**

- Development platform
- DVB API
- DVD API
- clib (for embedded devices)
- directFB


Platform for the development of open source software for digital television (DVB, DTV) receivers, Linux DVD players and tools to stream audio and video to the net.
LinDVR

- Debian-based Linux distribution
- For PC with DVB card
  - watch digital television
  - record digital television
- lindvr.org

Bandwidth needs and program manifold

Why DTV?
- bigger distribution capacity
- access to several channels
- cheaper distribution
- available channels: 20-200

Electronic Program Guide (EPG)
- tool to navigate in the programme jungle
- program that runs locally in the set top box
- possible to integrate functionality as:
  - personal profiles
  - order programmes
  - interaction
  - integration towards other services (Web, irc, news)
Digital TV and interactivity

What is a return channel?
- telephone line
  - POTS (trad. telephony)
  - ISDN
  - ADSL (xDSL)
- cable TV with modem
- (satellite...)

“Down stream” (broadcasting):
- satellite
- ground based net (air born)
- cable
- (broadband via telephone network xDSL)

Categories for interactivity

- interaction with TV / set top box locally
  - video text (text-TV)
  - electronic programme guide (EPG)
  - use of downloadable applets
  - broad band material: sent together with the program, and downloaded to the set top box.
Categories for interactivity

- interaction with information available on web
  - additional information provided by the channel
  - electronic commerce, attached to programs or commercials
  - use of web
  - email

- real time add-ons to programmes
  - vote
  - answer in quiz-show
  - smart house applications
  - auctions
Categories for interactivity

- adaptation of programmes to individuals
  - personal profile and choice of material
  - be your own producer / director
    (chose between cameras, see parts once again, …)
  - advanced applications by Image Based Rendering

New opportunities with DigitalTV

- What will be futures channel: EPG?
- order programmes
- store programmes locally
- new types of services
- create communities
  - based on subject
  - based on place/area
Literature and Links

- DVB:
  http://www.dvb.org

The End of Part