**Digital TV**

Wolfgang Leister

IMEDIA

- 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
- Séquentiel Couleur à Memoire
- 1961 Dr Walter Bruch ➩ PAL
- Phase Alternation by Line

**Characteristics of Digital TV**

- mostly broadcast
- individualize for customers
- but: individuality within limits
  (much of the content is the same, the view is different, the time is different)
- user wants interactivity
  (local on TV, return channel, ...)

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**Roles**

- Content providers
- Channels
- Distributor
- Consumer
- U, V components, Y component (NTSC)
- ampl. modulation 90°, 4.43 MHz

**Colour Television**

- PAL
- SECAM
- NTSC
What is digital in digital TV?
- Production
- Content
- Transmission
- API
- Cond. Access
- Applications
- Return channel

Digital TV Production
- Use of digital equipment
- Computer graphics / animation / ...
- Digital TV production tools
- Interactivity (xlets, ...)

Digital Content
- Storage format: MPEG 2, MHP
- Streaming format: MPEG2 TS
- Interactive Content: HTML, XML, (Flash), other Web standards ...
- Java xlets

Streaming
- Streaming format: MPEG2 TS

Content Transmission

Programme Service Information
- PMT: PID=1127
- PAT: PID=0 (always)
Why not Internet?

- DTV is broadcast technology!
- infrastructure costs ⇒ ADSL ...
- multicast in communities
- peer-to-peer techniques show that providers are not prepared to traffic

Set-top boxes (STB)

- Analogue broadcast: 1st generation, one-to-many, without return channel; e.g., decoder for cable TV or satellite.
- Analogue interactive hybride, data services and return channel, e.g., WebTV.
- Digital broadcast: 2nd generation, digital compression and transfer, e.g., satellite decoder.
- Digital interactive: 3rd generation, digital broadcast + interactive, includes data services, web, games, ... e.g., DVB MHP, return channel.

Digital TV Hardware

- set-top box
- API
- CA system
- Operating system
- Networking connection

Standards, API, and CA

- DVB
- NorDig
- IXCA
- CANAL+
- SET-Top

NorDig II (sw arch.)

- NorDig Migration Plan
vertical - horizontal markets

MHP
- MHP = API for digital TV, defined by DVB
- MHP 1.0 formally accepted by ETSI
  - Enhanced Broadcasting Profile
  - Interactive Broadcasting Profile
- MHP 1.1 (spring 2001)
  - Internet Access
  - Based on DVB-java
  - HTML / XML
  - Enhanced & Interactive Broadcasting (optional)
  - Existing (legacy) APIs as plug-ins

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
- Graphics reference model
- Annexes DSM-CC OC profile, text presentation, min.platform capabilities, various APIs

MHP Profiles

MHP Architecture
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
- ...

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
- LinuxTV
- ... http://www.linuxtv.org/
- http://www.ostdev.net/

Typical DTV Applications
- Electronic program guides (EPG)
- Applications synchronised to TV content
- Games
- E-commerce
- Interactive advertising
- Internet access

Research Areas
- New types of applications
- User Interface studies
- Networking Infrastructure
- Production tools