Multimedia applications
Services, platforms and technologies
ToC

- Introduction
- Services
  - Most wanted
  - What are the big ones up to?
- Overview of platforms
  - Mobile
  - smartTV
- Development aspects
  - Web technologies
  - Development ecosystem
Big picture: from creation to consumption
A short introduction
2020 – 50 bilion devices in Internet

- Internet of Things
- Machine2machine
- Future Internet
- NGN

- Mobile devices will prevail → OTT

source: Ericsson Vision, 2010
OTT growth and forecasts

- **Smart TV** (source: GII – Global Information company)
  - 17% of the entire OTT business = approx. 3,3 billion $ until 2016
  - Major growth foreseen in 2015

- **Triple play is on the rise** (source: Digital TV research)
  - 400 million new subscribers worldwide (China almost 50%)
  - Mostly cable (66%), IPTV also on the rise
  - income: USA 59 billion $, France and Germany 4 billion $,…)

- **pay TV services (2011-2015)** (source: Digital TV research)
  - STB growth 17%
  - second screen device growth 400%
(smart) TV
Trends and services
Current situation- (smart) TV

- Many devices, standards, manufacturers

- Players from different fields are coming to MM “playground”
  - Content owners: (BBC, Sky,)
  - Device and OS manufacturers: Google, Apple, Samsung, Sony, Microsoft, Nintendo...
  - Others: Nagra Vision, Cisco, Intel...
Positioning of Google and Sony in the Connected TV value chain

Source: IDATE – "Connected TV Watch Service"
Services

- "Classic" still most wanted
  - Entertainment and info (movies, sports, shows, music, news, ...)
  - Personalisation!

- "Smart" sensor based solutions are on the rise
  - Energy efficiency
  - Smart home control
  - Medical solutions
  - ...
Services (2)

- **Solutions are pretty similar**
  - 2nd screen!!
  - Content consumption on all devices
  - Additional content to linear TV (behind the scenes, advertising,...)
  - Personalisation

- **Added value is user-friendliness and simplification of use**
  - Control and content access
  - Personalisation
Most wanted services

- Second screen has become “the Holy grail”
- Access to all content on all devices (mobile, TV, tablets,...)
  - Regardless of the distribution mechanism: OTT, IPTV, broadcast
  - Catch-up TV!
- Remote control using mobiles and tablets
  - A remote
  - Content browsing on the tablet, content consumption on the TV
- Interactive user participation
  - Voting (quiz)
  - Event prediction (ex.: goals, winners,...)
  - Live comments for shows,...
  - …
Most wanted services (2)

- **Content on demand (VoD)**
  - Old story, new technical approaches on all platforms
  - Many providers (Netflix, Hulu, Amazon, sports,…)
    - Amazon is on the rise (17% → 22%, feb - sep)
    - Netflix in the lead, but dropping 84% → 82%
    - iTunes (16%), Hulu (8%), …
  - Microsoft acquisition of Netflix?
  - Coming: Google Play movies and music (nov. 2012)
  - Channel 4 sets up a VoD system (4oD)
    - Free but with ads
    - All devices (STB, iOS, Android,…)
    - 6 million registered users
      - 50% of subscribed kids between 16 and 24!

- **Content recommendations**
  - By other users through FB, twitter
  - System recommendations (personalisation)
Most wanted services (3)

- **Additional content**
  - Catch-up TV
  - “Behind the scenes”
  - Recipes, tourist destinations
  - Interactive adds related to the events on the screen
  - Linking of related sites (wiki)
  - …
  - Example: Forecasting of the dead in the Walking Dead series 😊
    - 20% of viewers have installed the 2nd screen app Walking Dead
Most wanted services (4)

- Extinction of linear TV?
  - Linearna TV is being watched more than ever
  - VoD is also on the rise

- Social networks
  - Usage depends on age and culture
  - USA 60%, GB 86% of viewers use tablets while watching TV
  - Not in a second screen fashion
  - Most are using Facebook, Twitter, wikipedia, games

Viri:
• GFK media efficiency panel 2011 (20000 uporabnikov)
• RedBee media (2000 uporabnikov),
• Nielsen mobile study 2012
2nd screen: a good example 😊

- **Cinergy**

- **Similar solution by Gracenote**
  - Philips’ audio fingerprinting technology

- **Useful for any service**
  - Additional info, interactive participation, target advertising, ...
Advertising – new approaches

■ Old story
  ■ First TV add: 1.7.1941, Bulova watches, 9$ for 9 sek, before a baseball match
  ■ http://www.youtube.com/watch?v=lsjc2uDj1OI

■ Trend
  ■ 2nd screen advertising
  ■ Personalised advertising, game based advertising
  ■ Much easier interaction as on a TV screen
  ■ Moving from “push” to “pull” model
  ■ Requires a good connection between TV content and 2nd screen content
    ■ From technological perspective
    ■ From consumption perspective
Advertising – new approaches (2)

- **Example:**
  - Magic Ruby for “Sons of Anarchy”:
    - Advertising and sales of items from the show (clothes, eye glasses, motorbikes, …)
    - Information about actors in the series
    - Cooking recipes for food
    - Synchronises with the current show on the airm(audio finger-printing)
Mobile services
Mobile internet

- Full web browsers
- Rich HTML5 web apps
- Flash
  - Demanding for low performance mobile devices
  - Existing flash apps not adapted for touch interaction
  - Not supported on iOS
  - Only partially supported on Android
    - No support on 4.1 and higher

- The future: HTML5
  - Support for HW access (accelerometer, camera, NFC, etc)
  - WebGL (3D games and apps)
Mobilne sociale networks

- Unified communication
  - Location aware (GPS/WiFi/Cell ID)
  - Facebook, twitter apps for iPhone, iPad, Android
  - +adapted web sites

- iPhone, iPod Touch (>100M)
- Facebook 845 mio users
- iPad (3G)
- iPad (3G)
- Readers e-books (3G) (Kindle)
- Netbooks (39 mio)
YouTube (2011)

- More than 3 billion hours watched per month
  - 1000 billion watched in 2011
  - 25% from mobile devices

- 72 hours of new videos uploaded every minute!

- Content formats
  - HD 480p, 720p, 1080p (1920x1080), 4k
  - Do 24MB (200 Mbit) for each minute of video
NFC services

- 2011 first Android phones with NFC
- Google makes deals with Mastercard
  - Mobile payments
- Touch as new interaction mode
  - Social network Foursquare: NFC check-in
  - Google Placemarks
Augmented reality

- Enhancement to real world with data on screen (overlay)
  - GPS + compass + gyroscope + camera
- iPhone and Android apps
  - Augmented SDK for development (only Android)
Examples

- Odpiralni časi (opening hours)
- Layar
LTTE + BicikeLj

- Layar layer with realtime data about BicikeLj stations in Ljubljana (rent-a-bicycle)
  - Android, iPhone and Nokia
Augmented reality (2)

- Different approach: image processing
- Typically: Open CV framework
  - Open Source Computer Vision framework
- Ex: Sven Bomwollen
  - Visual marker
  - App
Educational applications

- Portable device is ideal for a classroom
- Battery capacity sufficient for an entire day of usage
LTFE: Coome

Lost in Translation from Genes to Organisms
Juika Jermak
June 2006

Game theoretic models in molecular biology
Tommi Jaakkola
June 2006

Kernel Methods in Computational Biology
Jean-Philippe Vert
July 2006

Protein Subcellular Localization Prediction Based on Complex...
Chia-Yu Su
July 2006

Joint Mining of Biological Text and Images: Case Studies
Robert Murphy
September 2006

Mutual Cuts in Graphs: Learning in Bioinformatics
Kristian Pekkmans
October 2006

Industry 2: From the Bench to the Bedside: The role of Semantics...
Vipul Khashyap
November 2006

Benchmarking parameter estimation and reverse engineer...
Pedro Mendes
March 2007

Estimating Parameters and Hidden Variables in a Non-linear...
Minh Quach
March 2007

Razvoj PHP aplikacij v okolju Eclipse in sistem za nadzor različic kode Subversion
Marko Štamicar
July 2008

ECLIPSE IN SUBVERSION

www.ltfte.org, Laboratorij za telekomunikacije
Games

- High processing and graphical power of devices
- 3D games are possible
  - New interaction modes (turning of the device)
Angry Birds

- Extremely successful
- Success → merchandise (plush toys)
- Coming soon: A Disney movie
- OpenGL → WebGL
  - Simple porting between platforms
  - http://chrome.angrybirds.com/
Book readers

- eBooks (ex. Kindle for iPhone, Android, iPad…)
- PDF or ePub formats
- Synchronisation between user’s devices
- Built-in dictionary, notes and bookmarks
Amazon

- Sale of Kindle books has surpassed sales of all printed books
  - Since April 1 2011, for every 100 print books Amazon.com has sold, it has sold 105 Kindle books.
  - This includes sales of hardcover and paperback books by Amazon where there is no Kindle edition. Free Kindle books are excluded and if included would make the number even higher.

- New ad-supported Kindles even cheaper
  - For $25 discount the device shows a commercial logo when turned off
Electronic magazines

- Mobile devices are a new opportunity for publishing
- Purpose built apps ex..
  - The Daily (rich app with video, animations,...)
  - Delo (standard PDF)
  - Mercedes magazine
Audio fingerprinting

- Music recognition apps
  - Shazam
  - SoundHound
Outfit7 – portfolio

- >20 apps, all with the same functionality 😊
<table>
<thead>
<tr>
<th>App</th>
<th>Downloads/Ins/Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outfit7</td>
<td>100 million downloads: in under 10 months</td>
</tr>
<tr>
<td>Firefox</td>
<td>100 million downloads: slightly less than a year</td>
</tr>
<tr>
<td>Foursquare</td>
<td>100 million check-ins: slightly over a year</td>
</tr>
<tr>
<td>iTunes</td>
<td>100 million downloaded songs: 15 months</td>
</tr>
<tr>
<td>Angry Birds</td>
<td>100 million downloads: 1.5 years</td>
</tr>
<tr>
<td>Zynga</td>
<td>100 million users: slightly over 2.5 years</td>
</tr>
<tr>
<td>Facebook</td>
<td>100 million users: 4.5 years</td>
</tr>
</tbody>
</table>
Toshl

- ThirdFrameStudios
- Personal costs tracking
  - Combines mobile app and “cloud” storage
Other apps

- Music instruments
- Camera + video -> video editing
- Remote desktop and terminal
- Word, Powerpoint, Excel

- A long list...
- Most of the apps are developed by 3rd party developers
  - Also increases value of the platform
Other apps - LTFE (2)

- RTV SLO Live

- Mobitel Voip Komunikator
What are the big-ones up to?

(smart TV&mobile)
Microsoft

- **XBOX** as central home platform
  - Games
  - OTT content!!!

- **Users can access over 200,000 movies, shows...**
  - Netflix, BBC iPlayer, HBO, Hulu, sport1, sky, Canal+, ...

- **Users spend more time watching movies than playing games!**
Microsoft (2)

- **Hot topics:**
  - Connecting other devices with XBOX and content streaming - XBoxSmartGlass
    - As a remote, content consumption, additional content, VoD,…

- Gesture and voice control - huge success in child game Sesame street

- **Windows 8**
  - Over the top content included
    - Netflix, YouTube,…
Samsung

- **Smart TV**
  - 1/3 share in smart TV market!!!
  - % of internet connected devices is growing (2010 – 15%, 2011 – 50%)

- **OTT content repository**
  - Netflix, Hulu, YouTube, ESPN, MLB, Blockbuster,…

- **Hot topics:**
  - Gesture and voice control
  - User recognition
Google TV
- First version a failure
- New version on the market (July 2012 GB, August Germany, September France…)

OTT content
- Netflix, HBO, CartoonNetwork, YouTube, Nascar, Vimeo, DailyMOTion, TuneIn, FoxNews…

Apps, games,…

Linear content through Google TV platform
- Indexing and recording

Hot topics:
- Search?
Google glass

- Eyeglasses with a camera and a display
  - Voice controlled
  - Internet access, video-chat, virtual reality…
  - Android OS
  - 1500$ price for developers

- Market version in 2014?

Apple

- Apple TV
  - Apple style: well designed and simple to use
  - 3rd generation

- OTT content:
  - Netflix, Hulu, YouTubre, NBA, MLB, NHL, Wall street journall, iTunes

- Hot topics:
  - Simple to use remote
    - Also with iPhone, iPad, …
Apple (2)

- Connectivity with other apple devices:
  - AirPlay: content or screen transfer from other devices, dual screen (at home)
  - iCloud: consumption of bought content on all Apple devices (anywhere)
“The” broadcaster 😊
- Top content

High investment in content distribution technologies
- iPlayer: accessible on most platforms (PC (50%), mobiles, tablets, smart TV, STB, games consoles)
  - Pogodbe s proizvajalci STB oz. distributerji vsebin (Virgin, Freesat, Sky Go, BT Vision, …)
- Linear content as well as on demand

Usage growth (in 2012):
- PC 14%
- Mobile: 140%
- Tablets: 580% (iPad)
- Smart TV: > 1000%
Trend: additional content for most interesting shows ("red button")

- Additional AV content
  - Major events (additional content for Olympic games, …)
  - Live shows with people in studios ("behind the stage", …)
- Use interactivity
  - Voting, participation in a quiz, …
Nintendo

- **Nintendo Tvii**
  - Nintendo U as a remote and second screen device
    - Knows TV models and can connect with them
    - Knows cable operators and shows EPG
    - Interactive sports apps - stats
  - Netflix, Hulu, Amazon, sports channels,...
    - On device or over DLNA onTV
  - Control and content access from TiVo box
  - And games of course 😊

- **User experience? 😞**
Sony

- **PlayStation**
  - Basically games
  - Movies and TV series
    - Most Netflix content is sold on PS3, more than on PCs
- **Cross-platform**
  - Start a game on PS3 continue on PS Vita
  - PS Move: motion based control
    - Same story in a slightly different way
Senzorske storitve
(vse platforme)
Internet of Things (IoT)

- An increasing number of data sources are available over internet
- All we need are devices and sensors and automatisation of data processing
- Numerous fields of usage
  - Traffic, environment, medicine, energy… anything 😊
- Data accessible on any device, even on TV 😊
Sensors

- Sensor is a device transforming physical quantity into an electrical signal
- Advancement in technology
  - Technological solutions are getting smaller and cheaper
  - They are also getting more accurate
- Nowadays almost any sensors are available:
  - Light, temperature, humidity, air pressure
  - Wind speed and direction, precipitation, sun and UV lights
  - Gas concentration (CO, CH4, C4H10, CO2, NO)
  - Radioactivity, vibrations, IR movement
  - GPS, magnetometer, camera, microphone, proximity sensors
  - Heart rate, sugar blood levels, pH, accelerometer
Sensor platforms

- More than a sensor
  - “glue” connecting sensor in a bigger system
- Embedded platforms on the rise
  - CPU, RAM and communication interfaces
  - RaspberryPi (PC for 30 EUR)
  - Popular platform Arduino (cheap and simply programable)
- Possible integration into a modem, STB,…

![Arduino + Ethernet shield = Sensor platform](image)
Ecology and pollution

- **Past:** small number of specialized stations for measurement
  - ARSO: 20 locations with publicly available data
  - The entire city just one value

- **Today:** commercially acceptable solutions
  - Less accuracy but geographically widespread

- Ex. : Air Quality Egg
  - CO2, NO, humidity and temperature
  - Approx: $70
Smart energy

- **Smart metering**
  - Connected meters
  - Energy consumption monitoring
  - Prediction of needs

- **Allows for**
  - Better network planning with prediction of consumption
  - Cheaper energy
  - Feedback motivates user for lower consumption

- **Monitoring of energy consumptions on all devices**
  - Mobiles, TV,...
Smart home

- Automated processes in residential and business buildings
  - Increased safety and comfort
  - Higher energy efficiency

- Usage scenarios
  - Cooling and heating systems
    - Inner/outer temperature detection
    - Open windows detection
    - User presence detection
  - Lights
    - IR presence sensors
    - Light sensors
Until recently not supported
- Doctors prescribe medicine of which they know little, to cure diseases of which they know less, in human beings of which they know nothing. —François-Marie Arouet Voltaire, about 250 years ago
- Traditional though personaliziran

A lot of interest by people
- 50% of Slovene population was looking for health related data (Q1 2012)
- “only” 27% for watching Web TV (Vir: RIS)

Portable sensors are generating huge amounts of data
- before: 1 sample every $n$ years
- today: 10 samples a day

Many fields are covered
- Weight, activity, sleep, blood pressure, temperature, heart rate, blood sugar levels
Medicina: sensors within a reach

BodyTrack chest strap:
EKG, respiration, accelerometry;
stress, cough/sneeze, snoring

Actigraphy:
Activity and energy levels

Phone:
Pictures, GPS location, activity;
food, events, self-reporting

Indoor air quality

BodyTrack Indoor Environmental station:
Temp, humidity, barometric, sound levels, light levels;
Sleep hygiene, air quality (with external sensor), charger and data gateway for chest strap

BodyTrack Website

Weight

Sleep logging

Regional air quality:
Particulates, other pollutants, pollen, mold
Wearable computing today

- **"I'm Watch"** – wireless terminal
  - Runs Android
  - Touch screen and Bluetooth 4.0
  - Apple is preparing a similar solution – iWatch
  - Bluetooth 4.0

- **Basis**
  - Fitness watch + data mining (5 sensors)
  - Air temperature, skin temperature and conduction, accelerometer, heart rate
  - Many other solutions

- **iPod Nano**
  - Touch screen
  - iOS-like operating system
Some time left?
Mobile platforms
Windows Mobile

- System based on platform Windows CE
- Closed environment
  - Costly development tools (Microsoft Visual Studio)
  - From 2009 includes services for app distribution
- Mobile GUI similar to PC based GUI
  - Microsoft Office Mobile, Outlook Mobile, Internet Explorer
  - VPN for business users
  - Advantage: close integration with MS environment (AD, Exchange)
- Last version: 6.5 (2010)
  - Replaced by Windows Phone 7
Windows Phone 7

- Upgrade of Windows Mobile
- Completely new GUI
  - Adapted for a mobile device
  - koncept ploščic
  - interakcija s prstom (nič več stylusa)
- Rich media funkcionality
  - Zune player
  - Speech recognition
- Minimal HW requirements
  - Capacitive touch screen 480x800
  - 1GHz CPU, 256MB RAM
  - accelerometer, compass, light sensor, GPS
  - Separate buttons for search, start, back, sleep, camera
Windows Phone 7

- Development platform
  - Silverlight (WP7 version) and
  - XNA platform (based on Xbox new architecture)
- Development environment
  - Visual Studio 2010 Express and Expression Blend (free)
- Windows Phone Marketplace
  - 60,000 apps (2012) (12,000 in 2011)
  - Also “trial”
  - Need approval
  - Microsoft takes 30%
Windows Phone 8 (RT)

- Based on Windows 8 platform
  - Unfortunately quite different from previous platform (development)
- Support for screens 1280x768
  - Similar GUI as WP7
- XBOX connectivity
  - Music, video, podcasts
  - Games: standalone or 2nd screen
Cooperation: Nokia-Microsoft

- Mutual benefit
- Why not Nokia-Android?
  - Nokia would be “just another Android terminal”
  - Microsoft would have to target niche high-end devices and couldn’t compete with Google and Apple
  - Together they are 3rd major player
- Furious reaction of Nokia hardcore fans
Apple Inc.

- Ecosystem

- Mac computers
- iPad
- Apple TV
- iPod MP3 players
- iPhone

iTunes store:
- Music
- Movies
- TV series
- Apps
- Newspapers
- Books
iPhone

- **Presented in 2007**
  - Sceptical acceptance
  - “Apple has no experience”
  - Partially justified critics (poor radio, partially useful as phone)

- **Innovative GUI**
  - At first limited functionality (2G)
  - No MMS, vCard, no 3G and second camera

- **Current model (iPhone 5)**
  - GPS, accelerometer, compass, gyroscop, autofocus camera, bluetooth, voice recognition, text-to-speech, ActiveSync, VPN client
  - 960x640 screen, 512MB RAM, 800MHz CPU, 64GB Flash

- **Very clear product line**
  - Only 1 current model (little fragmentation)
Apple iPad

- **Technical specs (iPad4)**
  - 1.4GHz CPU, 1GB RAM
  - WiFi, 3G, up to 128 GB flash memory
  - 2048x1536, 10” diagonal
  - GPS, accelerometer, bluetooth, compass

- **Same ecosystem as iPhone**
  - Can run same apps -2x magnified
  - Today >100.000 apps specially developed for iPad

- **Final result**
  - 15 MIO sold in first 9 month (end of 2010)
  - Best sold consumer device of all times
Apple SDK

- Development tool for iPhone apps
  - One year after iPhone (2008)
  - Runs only on Macs
  - Phone simulator

- SDK presents
  - Programming environment for applications - Xcode (IDE)
  - A set of interfaces for access to device data and events
  - E.g. multitouch, camera, location, accelerometer, recording and playback of audio and video, Core Animation, Core Graphics (Quartz)

- App development
  - Membership in development programme required (Apple developer): $100 per year
  - Apple terms of service (TOS)
  - Every app is checked before release (problem!)
App Store

- Free and paid apps
- Paid:
  - Apple takes 30% (most po $0.99)
- Install over PC or web
- AppStore today
  - 800.000+ apps
  - sum >40.000.000.000 downloads
  - Apple gets an estimated $1.8B a year (profit wasn’t expected at first)
  - 60% of developers don’t even cover development costs 😞
- A model to look up to!
  - Increases the usability of the device!
  - Android Marketplace, OVI store
Android

- Mobile OS based on Linux kernel
  - Google and Open Handset Alliance
  - Fastest growing mobile platform
- Mobile terminals
  - HW requirements are specified
  - Connectivity: GSM/EDGE, CDMA, EV-DO, UMTS, Bluetooth, Wi-Fi
  - Touch screen, GPS, accelerometer, compass, gyroscope, NFC, camera
Android Mobile terminals

- **First terminal available in 2008**
  - HTC Dream,

- **A year later**
  - 20 models available

- **Today over 200 models of different manufacturers**
  - HTC, Samsung, Huawei, Motorola, Acer, Dell, Lenovo, LG, Sony Ericsson, Philips
  - Google-branded Nexus One (HTC), Nexus S (Samsung)
Technical specs (v2)
- 1GHz CPU, 512 MB RAM
- WiFi, 3G, 32GB flash
- 1200x800, 10” diagonal
- GPS, accelerometer, 2 cameras, BT

Platform
- Android
- Lack of real tablet designed apps

Business results
- 6 months after iPad
- 2M pieces sold in 2010, >10M in 2011
App development and distribution

- **Development in Java**
  - Well known tools (Eclipse IDE, ipd.)

- **Distribution through Android Marketplace**
  - App verification similar to Apple
  - Device settings relevant for app versions

- **Problems**
  - Fragmentation: Android is open → thousands of existing device versions
  - Every device provider adds its own specifics to OS to make some differentiation
    - Apps no longer work on all devices
    - Similar problem to J2ME

VIR: http://opensignal.com/reports/fragmentation.php

www.ltte.org, Laboratorij za telekomunikacije
Android – development and apps

- App distribution supported by Android Market
  - Anyone can participate, individuals or companies
  - Licencing is not necessary
- Development tools and libraries
  - Free (Eclipse, Android SDK)
  - Available on all platforms (Windows, Linux, Mac)
BlackBerry (RIM)

- Proprietary HW in SW
  - BlackBerry OS
  - SDK - Java, coming HTML5, ActionScript
- Strong market share by business users
  - Push e-mail from 2002
  - BlackBerry Messenger
  - Using own server-side
- BlackBerry Enterprise Server (BES)
  - Intermediary between mail servers and mobiles
  - Checks many mailboxes
  - Changes immediately communicated to the mobile
- Coming: BlackBerry 10
  - Touch screen (Z10), also with a keyboard (Q10)
  - Uncertain future
Market share comparison

- All phones!
  - Including "dumbphones"
War of platforms: Android vs. iOs

- Market share: 2011:

Q1 2011: sold altogether 428 M mobiles
100 M smartphones
36 mio Android, 28 mio Symbian, 17 mio iOS

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Source: The Nielsen Company.
Comparison of profits

- Apple accounts for 50% of total profit [2011]
Vpliv na računalniško industrijo
smartTV platforms
Middleware

- Middleware – proprietary
  - OpenTV, MediaHighway, Microsoft TV, Liberate, PowerTV, NDS Core
- Middleware – open standard
  - MHEG, MHP, OCAP, ACAP, ARIB B23, Java TV, HbbTV
Specification HbbTV

- HBBTV v1.5 (March 2012)
  - http://www.hbbtv.org/
- HbbTV is an open industry standard
  - Združitev dveh ločenih tehnologij (Nemčija, Francija)
- Standard prepared by the HbbTV consortium
  - www.hbbtv.org
  - ANT, APS, Canal+, EBU, France Télévisions, IRT, OpenTV, Philips, Sony, Samsung
- Many existing standards reused
- Country specific rules can be applied
- First HbbTV devices were available end of 2009 (in Germany)
- Official certification is underway
HbbTV supported devices
Architecture

- **Broadcast:**
  - Transmission of live TV, radio and data
  - Signaling of “broadcast-related” applications
  - Transmission of “broadcast-related” applications and data
  - Synchronization of application and broadcast TV/radio/data services

- **Broadband:**
  - Content on demand
  - Transmission of “broadcast-related” and “broadcast-independent” applications and corresponding data
  - Information exchange between servers and applications
  - Access to “broadcast-independent” applications
Architecture

Broadcast
(e.g. DVB-S)

Broadband

Hybrid Terminal

Back Channel

Internet

Application Data
Non-linear A/V Content

Application Hosting / Web-Playout

Application Data and Signaling

Linear A/V Content

Uplink

Broadcaster and Application Provider
Hybrid device (STB, IDTV)

Application Data:
HTML 4, JavaScript, CSS, XML, multimedia files
Some time left?
Web technologies
Web evolution

- At first intended for scientific exchange of information
  - CERN
- Later on, growing with availability of bandwidth
  - Multimedia content
  - A growing number of web pages…
  - …and users
  - Ever more performant HW
    (decoding of video, audio, 3D rendering)

- Today
  - Web page in a browser can replace
    a native app
  - On both mobiles and desktop
- Tommorow
  - Google Chrome OS instead of Windows?
  - Web based operating systems?
Tehnologije

- Some web technologies are almost 20 years old
  - Most obvious one: HTTP
  - Some changes ahead: SPDY draft (Google)

- Nekatere so se razvijale počasi, v koraku s številom spletnih strani in uporabnikov
  - HTML 1.0 [1991] … first web page
  - HTML 2.0 [1995] … web has 10,000 web pages
  - HTML 3.2 [1997] … web has 500,000 web pages
  - HTML 4.0 [1997] … web has 1M web pages

… 10 year break, where development of plugins made up for lack of standardisation (Flash)

- HTML 5 [2008]
- Today [2013] … web has bilions of web pages
Web is open

- World wide web was always open
  - An example to other systems
- Anyone can add their own HW
  - And by that physically extend the web
- Anyone can add content
  - And extend the web with new web pages
- Openess
  - All standards and protocols are known (published in ASCII/txt on the Web)
  - One can implement its own server without patent infringement
  - Or setup their web site

- Certain components somewhat spoil the overall impression
  - Proprietary technologies such as Adobe Flash
  - Standardisation of such technologies is under way, supported by the “Big-ones”
Some time left?
Web2.0 application technologies
WEB 2.0 API

“Write Applications not Code”

- Basic building blocks are available
  - Open interfaces over HTTP/REST/SOAP
  - A set of supported libraries

- Support for a number of programming languages
  - PHP
  - Javascript
  - Python
  - Java
  - .NET...

- APIs allow for creation of Mashups
WEB 2.0 API (2)

- **Google API** ([http://code.google.com/more/](http://code.google.com/more/))
  - A number of APIs
    - Search
    - You TUBE
    - Open Social
    - Maps
    - Earth
    - Calendar
    - Chart
    - ...

  - Support for a number of functionalities
    - Login/logout
    - Adding textual and other notes:
      - Comments, notes, like, tags
    - Upload and access to images and videos
  - Implemented on a server or as a standalone application
WEB 2.0 API (3)

- YouTube API (http://code.google.com/apis/youtube/overview.html)
  - Problem
    - Storing and processing of video is demanding
      - High bandwidth, high storage requirements

  - YouTube API allows for simple use of YouTube infrastructure
    - Only parts can be used
    - Using application with APIs one can do the same and even more as YouTube portal users
    - Implementation of YouTube-like portals without storage and access problems

- Basics
  - User registration
  - Basic and advanced search
  - Uploading and transcoding of videos
  - Serving of videos
WEB 2.0 API (4)

- YouTube API (2)
  - YouTube player
    - Basic player with all options
      - Simple use (HTML Embed)
    - Advanced player with reduced functionality (just video)
      - Player control implemented using Javascript
      - Customisable controls (graphics)
  - At what price?
    - Standard YouTube player (embedded video)
    - Advanced player with embedded YouTube logo
      - Not really annoying
    - Dependent on Google
Examples - Google Charts

- Primer

**Charts API**

| Juraj  | 30 |  
| Urban  | 30 |  
| Jernej | 40 |  
| Ostali |   |  

```javascript
javascript:writeChart();
```
Examples - Google Maps

- Primer
Application development - Ecosystem
SW development: past

- **Traditional environment**
  - Closed OS
  - Tedious app development
  - Limited HW capabilities
  - Expensive data links
  - No sensors on devices

- **Consequently:**
  - Low motivation for app development
  - Developers are mostly operators and device manufacturers
  - Poor documentation
  - Specialized knowledge needed
    (details, details,...)
Ecosystem in the past

Operator
- price ↑
- Quality of service ↓

Developers
- Specialized companies
- Rarely individuals

Users
- Manufacturers adapts applications to the infrastructure
- Operator offers terminals most suitable for services

Manufacturers
- Openess
- performance
- price ↑

Apps and services
SW development: today

- Trend and reality: open platforms
- Platform owner (Nokia, Microsoft, Google, Apple) opens the platform and offers development tools
  - Usually free of charge
- Developers over the world are developing the applications
  - And by that enrich the platform
  - Contribute some % from revenue to the platform owner
- Platform owner
  - makes % from app sales
  - Gets a more appealing and better platform
  - The latter attracts more users
More users result in more interest for app and service development.

Operators:
- Price \( \downarrow \)
- Quality of service \( \uparrow \)

Developers:
- Specialized companies
- Individuals

Users

Manufacturers:
- Openess \( \uparrow \)
- Performance \( \uparrow \)
- Price \( \downarrow \)

Apps and services

Big offer of apps increases usage of advanced devices.

Manufacturers invest in development and increase interest in devices.
Users

**In the past**
- High prices of devices and services → low interest

**Today**
- Low prices mean affordable devices and services for everyone
- **Usability**
  - Many useful apps and services
  - Dynamic way of life requires a lot of functionality
BEING A GOOD PROGRAMMER IS 3% TALENT
97% NOT BEING DISTRACTED
BY THE INTERNET