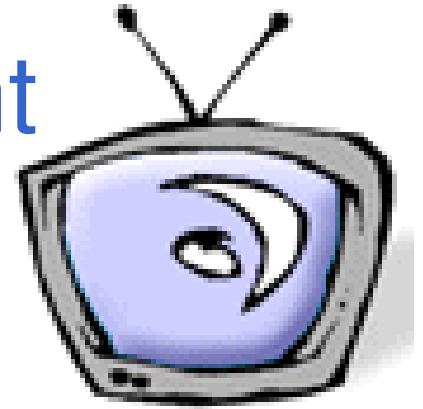


# Application development on iTV



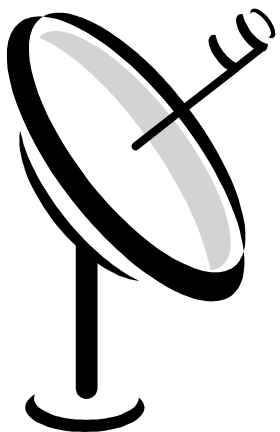
**Didier DONSEZ**

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PolyTech'Grenoble LIG/ADELE

`Didier.Donsez@imag.fr`

`Didier.Donsez@ieee.org`



# Definition

## ☐ Télévision interactive (iTV)

- Télévision Numérique
  - Pay-per-view
  - Vidéo à la Demande, Near VOD, Prefetch VOD, ...
- + Accès à des services proposés par l'opérateur TV
  - mail, banque, boutique de shopping (T-Commerce), ...
  - qui sont des partenaires/fournisseurs de l'opérateur

## ☐ Prochaine étape

- Accès à un service quelconque du WWW
- Indépendance Opérateur / Commerçant

# iTV application examples

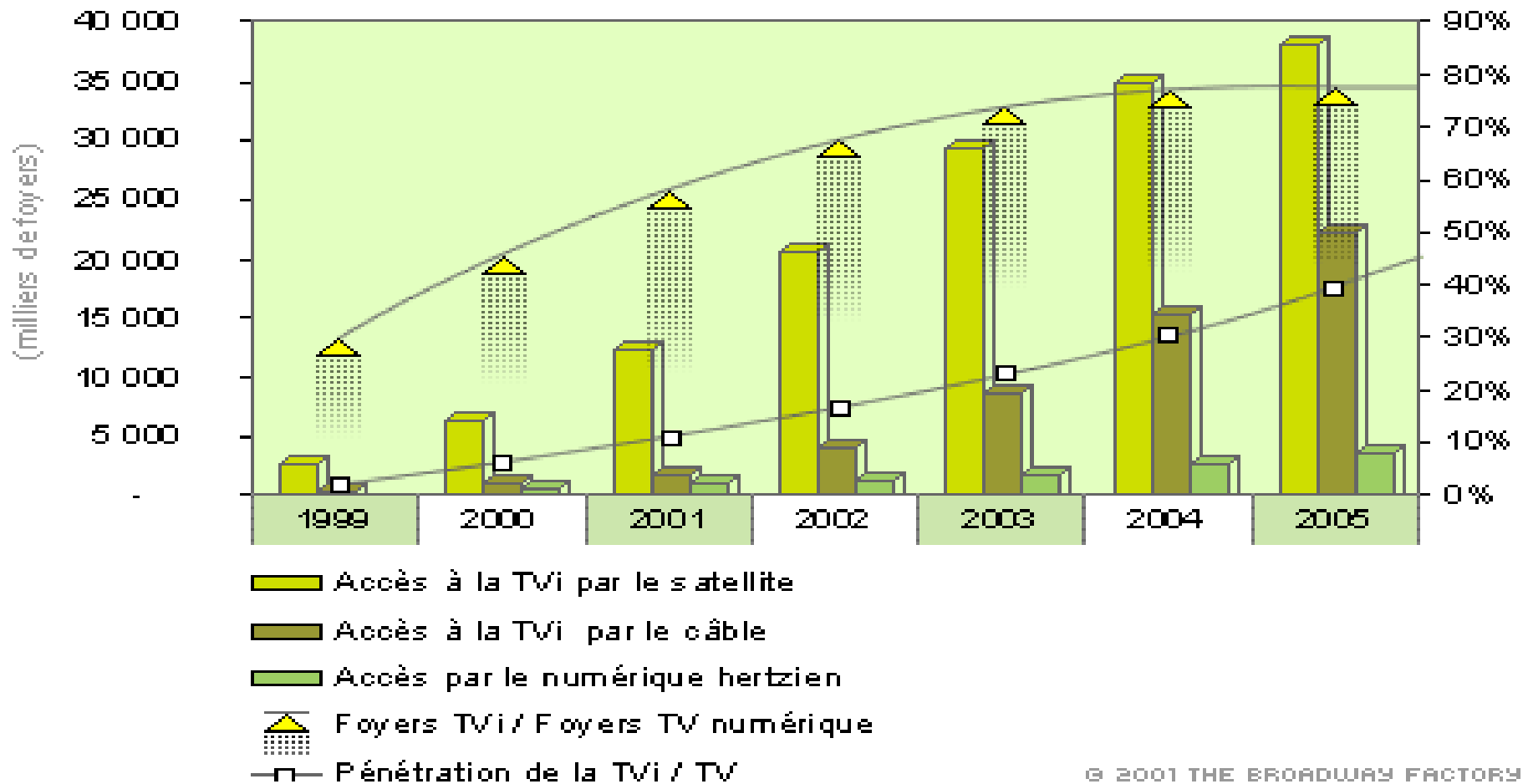


# iTV previsions

- ❑ Numeric TV transmissions replace progressively Analogic ones.
  - Planned by several EU countries
    - France, Irland, Spain, Germany, UK, ...
  - USA, Federal Communications Comision (FCC) fixes the last deadline in 2006.
- ❑ Previsions
  - 625 millions people acces to iTV by 2005 (Src : Strategy Analytics et Ovum)
  - Revenue by 2004 (Forrester Research ): 20 G\$
    - \$11 billion from advertising,
    - \$7 billion from T-commerce
    - \$2 billion from subscription fees

# iTV Previsions

 in Europe: [www.broadwayfactory.com](http://www.broadwayfactory.com)



# Consequences

- ❑ Augmentation du nombre d'usagers
  - >> CanalSat et TPS (France)
- ❑ Hétérogénéité du parc de STB
  - STB fournis (vendues, louées) par les opérateurs (à payage)
  - STB achetée pour la réception des bouquets sans payage
  - Consoles de Jeux (Sony PS2, MS XBox, ...)
  - Future génération de TV intégrant la STB



# Networks and Terminals

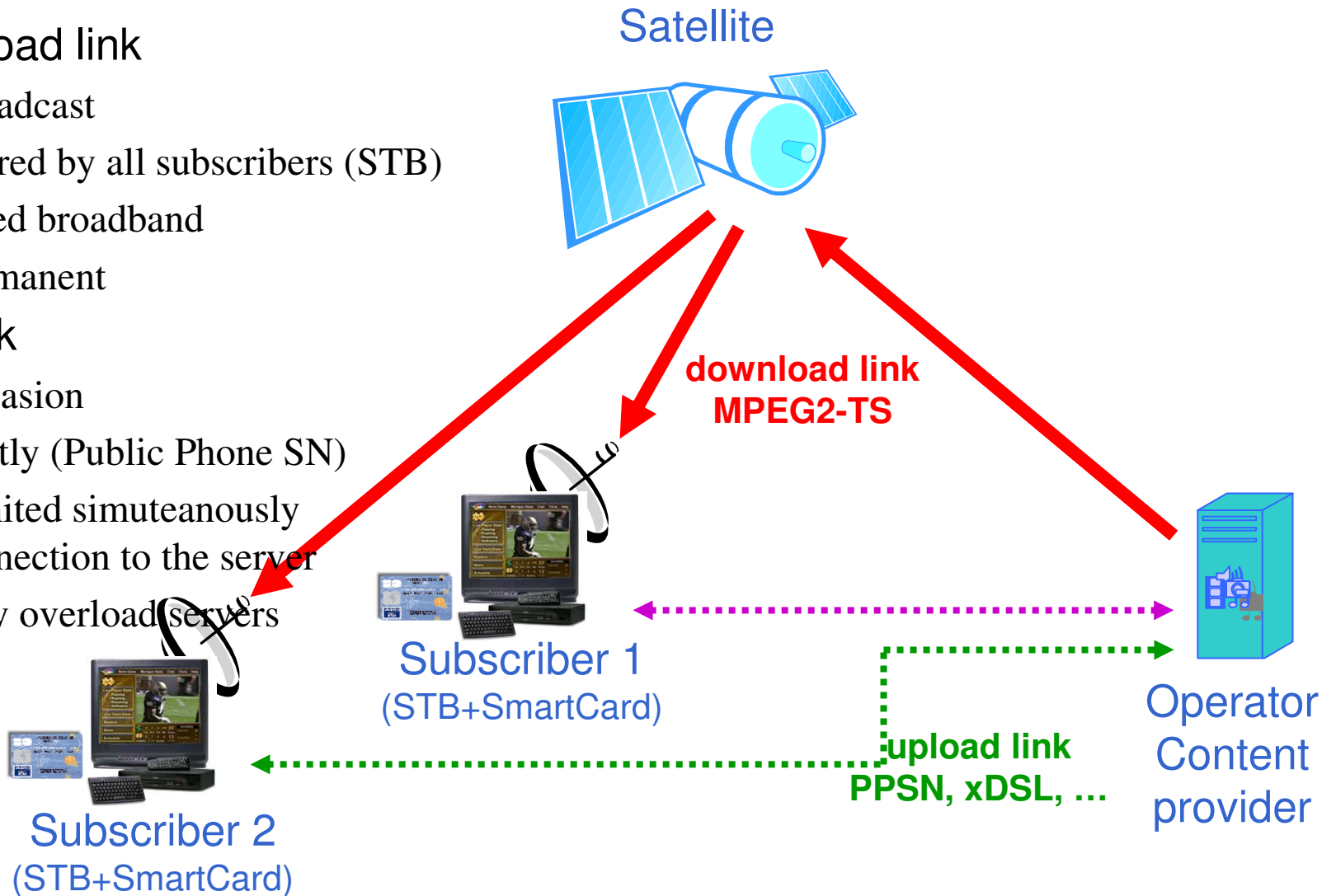
# iTV Satellite Network

□ Download link

- Broadcast
- Shared by all subscribers (STB)
- Fixed broadband
- Permanent

□ Up Link

- Occasion
- Costly (Public Phone SN)
- Limited simuteaneously connection to the server
- May overload servers





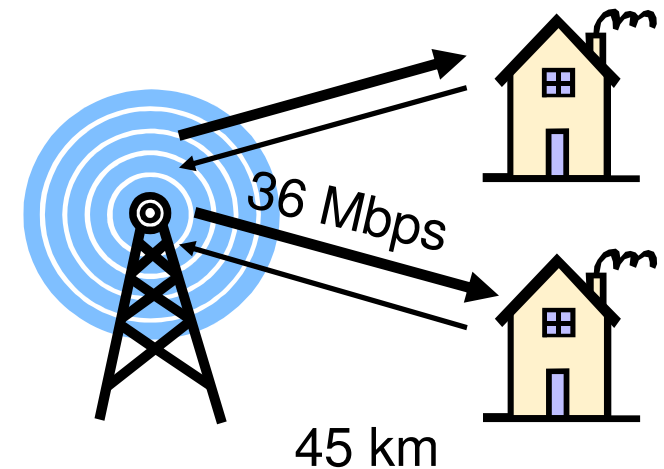
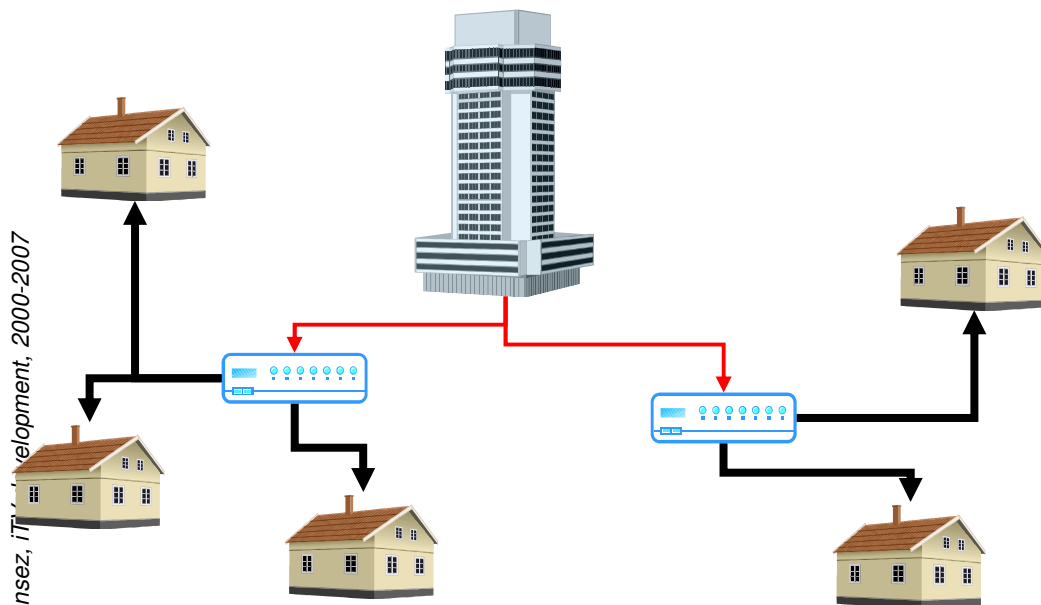
# Other iTV network

## ❑ Cable Numeric TV

- Cable segment : 4000 subscribers
- Cable Modem for uplink

## ❑ Terrestrial Numeric TV

- Broadcast in a « Segment »
  - a “circle” with a 45 kms radius
- USA, Mexico, Australie, ...
- France : 36 public channels planned for end 2002.



# iTV Networking

- MPEG2 TS (Transport Stream)

# iTV terminal hardware : STB (i)

## □ Low end and High end terminal

- Tuner(s) : Cable or Satellite
  - 1 at min
  - 2 for prefetching during usage
- MPEG2 DeMux / UnScramble
- Embedded Low Cost CPU (MPEG decoded CoProcessor, DSP, ...)
  - 4/3 or 16/9
- Memory
  - RAM (few MB)
  - ROM (bootstap, Operating System Kernel)
  - FlashRAM (User profile)
- Storage
  - SmartCard (User profile, Cryptographic Keys, Secure Payment, ...)
  - FlashRAM (PCMCIA module, CompactFlash, SONY MemoryStick, ...)
  - Hard Drive (40-80GB) for High end STD (enables PreFetch VOD, ...)

# iTV terminal hardware : STB (ii)



- User Control
  - IR Remote control
  - IR Keyboard (optional)  
RMAP: <http://www.ruwido.com/en/rmap.htm>, ...
- Communication
  - PSTN modem (for the return link)
- Other devices
  - Serial links (PC connection), Firewire, Audio link (SPDIF), ...
  - SmartCard Reader (2 slots on CanalSat STB)
  - Web Cam, ...

## Business model

- Buy or Rent

## Progressively integrated in Numeric TV Sets

- Thomson TAK TV
- Canal Sattelite Pilotime (<http://pilotime.online.fr>), TiVO, ...

# iTV terminal hardware : SmartCard (iii)

## □ SmartCard

- Subscriber information
  - Decryption keys
- User profile
  - One per home member
- ePurse
  - Tokens to pay *pay-per-view* programs

# API for iTV developement

# Domain constraints

- ❑ Code downloading over the air (downlink)
  - Carrousel file system
- ❑ Limited GUI and control
- ❑ Transponder cost
  - 1 transporter for 6 digital channels
  - 4M€ / year / transponder
- ❑ Interactivity
  - Connection to the server through a modem (uplink)
    - Slow connection establishment
    - Costly for the end user if too frequent
    - Required in case of secure payment, online transaction (order my shopping cart)
    - ...
- ❑ Numbers of end users
  - several millions for a European country (France, GB, Germany, ...)
  - >> service Web via des PC
  - Risks of burst on the server side

# Main iTV software technologies

- ❑ Documents BHTML (B comme Broadcast)
- ❑ MHEG
- ❑ Sun' JavaTV : modèle des Xlet
  - Une Xlet (écrite en Java) est téléchargée puis exécutée en fonction du contexte abonné
- ❑ « Carrousel » : Système de fichiers en diffusion
  - les fichiers (.class, .bhtml) sont organisés dans un système de fichier
  - Ils sont diffusés régulièrement à tour de rôle dans un flux MPEG2-TS
  - Les STB peuvent cacher les fichiers



# Les acteurs et la normalisation en iTV

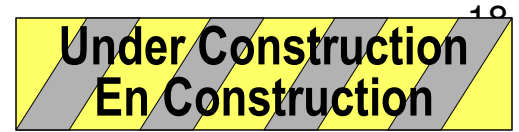
## ☐ Normalisation

- DAVICS, DVB, ATSC

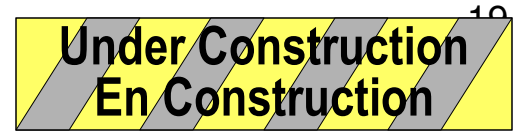
## ☐ Acteurs

- Software : Canal Plus, OpenTV, Sun, MicroSoft ...
- Hardware : Philips, Thomson, Sagem, Matsushita, Sony, Hitachi ...

# DVB-MHP



# HAVi



# JavaTV

## □ API TV for STB

- Largely inspired from DVB-MHP

## □ Xlet model

- Represents the iTV download application
- Now in Personal Basic Profile (PBP JSR129)

## □ Main Apis for

- GUI, Events, Carrousel File System,

# JavaTV

## Broadcast File Systems

### □ Principles

- L'opérateur diffuse régulièrement le contenu de tous les fichiers et tous les répertoires
- La STB se bloque en attente du fichier

### □ DSM-CC Object Carousels

- The DSM-CC object carousel protocol is a commonly used form of broadcast file system. It specifies three object types for structuring carousel data:
- **DSM::ServiceGateway** - provides access to the top-level directory of an object carousel.
- **DSM::Directory** - represents a conventional directory structure; may refer to files or other directories.
- **DSM::File** - represents generic file data.

# JavaTV

## Broadcast File Systems

### □ API

```
// Create javax.tv.carousel.CarouselFile of top-level directory.
// Use javax.tv.locator.Locator
CarouselFile serviceGateway = new CarouselFile(locator);
// List top-level objects.
String files[] = serviceGateway.list();
// Create a file object.
CarouselFile myFile = new CarouselFile(serviceGateway, files[0]);
// Create a file input object.
FileInputStream fis = new FileInputStream(myFile);
// Read from file.
byte data = fis.read();
// Close file.
fis.close();
```

# ITV related JSRs

- ❑ JSR 927:Java TV API 1.1
- ❑ JSR 272: Mobile Broadcast Service API for Handheld Terminals
- ❑ JSR 242: Digital Set Top Box Profile - "On Ramp to OCAP"

# Internet on TV

- ☐ Mail
- ☐ Web Browsing



# Email on iTV

## □ Principles

- Individual mail notifications broadcasted on the download link
- New mails are notified in the STB GUI
- Mail reading requires a connection (modem) with the mail server (IMAP4 for OpenTV)

## □ Offline

- New email notification
- Mail writing
- Mail Reading

## □ Online (modem connection)

- InBox Mail loading
- ToSend Mail sending

# Email on iTV (OpenTV GUI)



# Solutions for Email on iTV

## ❑ OpenTV

- TPS (France), BSkyB (UK), MultiChoice (South Africa), USA Media (US)
- MUA Requirement : 600 KB RAM, 12KB FlashRAM
- Mail Content-type : text/plain
- Protocol : IMAP4v1
- Manages a personal address book
- Number of users:
  - BskyB (UK) : 1.3 millions of subscribers use OpenTV mailer
  - TPS (France) : ???

## ❑ Canal+Technologies

- MediaOne, WinFirst
- Package MediaHighway : mhw.mediastart.mail
  - No more information

# Solutions for Email on iTV

## ☐ Liberate

- Liberate TV Navigator :
  - navigateur léger peu exigeant avec performances des terminaux

## ☐ MicroSoft TV

- <http://www.microsoft.com/tv/>
- Microsoft TV Basic Digital:

DVB compliant

games, e-mail, chat, EPG

France : TAK <http://www.tak.net>

# TAK Email

# TAK



**LISTE DES MESSAGES**  
4 MESSAGES, 2 NON LUS  
L'ESPACE DISPONIBLE 99,7%

De **celinedurand@tak.fr**  
Sujet Le chapeau de Léa 10/05

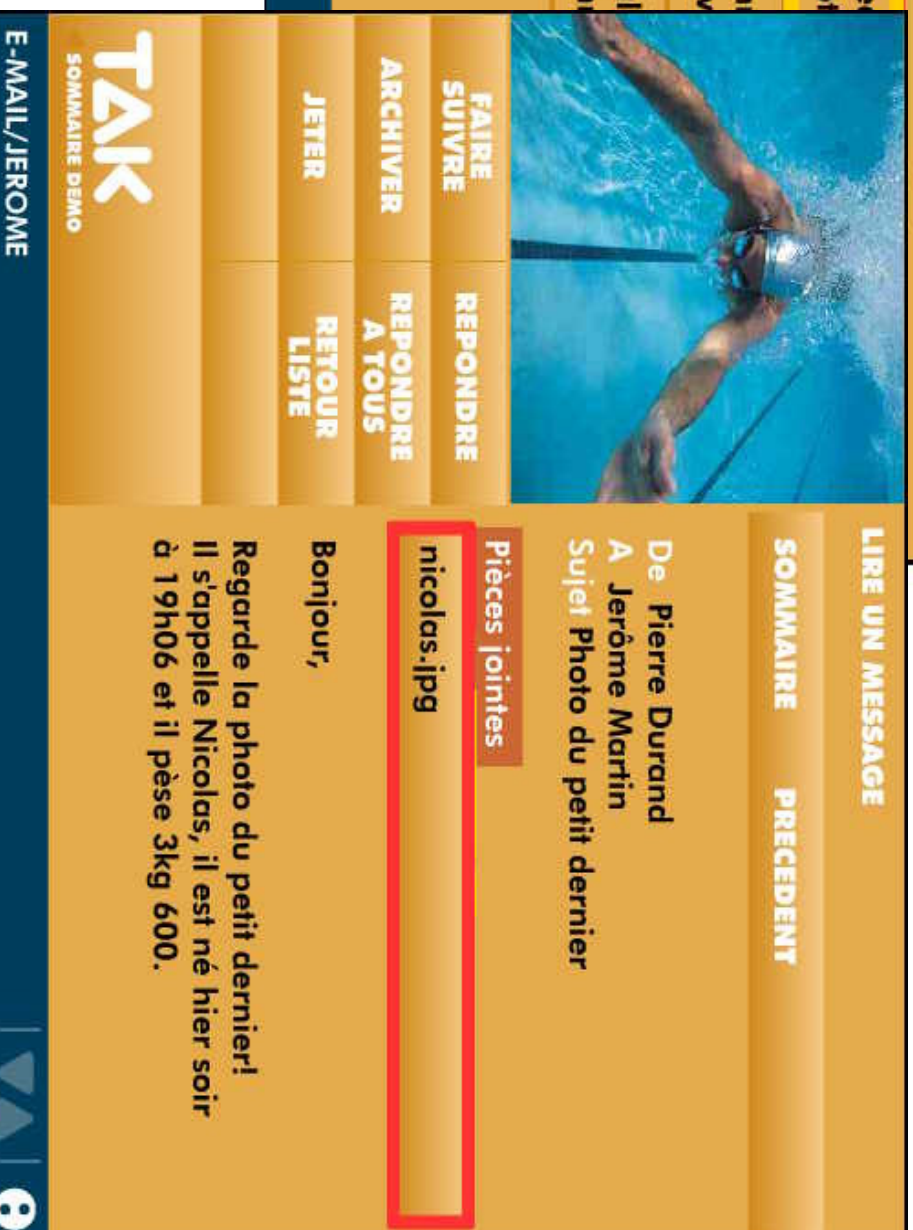
De pierre durand  
Sujet Photo du petit dernier

De simon martin  
Sujet Va voir le petit dernier

De magali  
Sujet Bon anniversaire

**TAK**  
SOMMAIRE DEMO

E-MAIL/JEROME



**LIRE UN MESSAGE**

**SOMMAIRE** **PRECEDENT**

De Pierre Durand  
A Jérôme Martin  
Sujet Photo du petit dernier

Pièces jointes  
**nicolas.jpg**


Bonjour,  
Regarde la photo du petit dernier!  
Il s'appelle Nicolas, il est né hier soir  
à 19h06 et il pèse 3kg 600.

**TAK**  
SOMMAIRE DEMO

E-MAIL/JEROME

# Instant Messaging on iTV

 OpenTV

 Canal+Techno

# Web Browsing with iTV

## □ HTML/CSS

## □ BHTML

- <http://www.w3c.org>

## □ XTVML

- [http://www.canalplus-technologies.com/media/v9/html/press/prel\\_wok\\_01.htm](http://www.canalplus-technologies.com/media/v9/html/press/prel_wok_01.htm)

## □ DVB-HTML

## □ Flash

- sur OpenTV EN2
- sur TAK

# Newsletter (i)

## ☐ Multicast personalized emails/ News

- High volume, ...

## ☐ User tracking, Capture clicks and surfing

- Customer Profiling, ...

## ☐ Problem with iTV networks

- Broadcast Personalized Data (mail, ...) is costly
- Mail reading is offline
  - So clicks can't be captured with the online connection
- Surfing may be done on broadcasts documents
  - BHTML (old W3C spec.), XTVML (proposed by C+Techno)



# Newsletter – Principles (ii)

- ❑ Notifications and message templates are broadcasted
  - Each message is design as a TOC and several panels
- ❑ NUA (News User Agent)
  - filters notifications according the subscriber profile
    - The subscriber can configure his profile (ie preferences : movie, sports ...)
  - and personalizes and display the message by merging the broadcasted template and profile data
    - first name, gender, ...
  - And track user clicks between panels
    - Clicks are captured and are buffered locally (for later distribution) and surfs are done on broadcast documents (or attached documents)
- ❑ When the uplink connection is opened, the NUA returns the set of recent click events (date, ...) to the CC server

# iTV Platforms

# OpenTV Tools



## ❑ 10 Millions STB installed

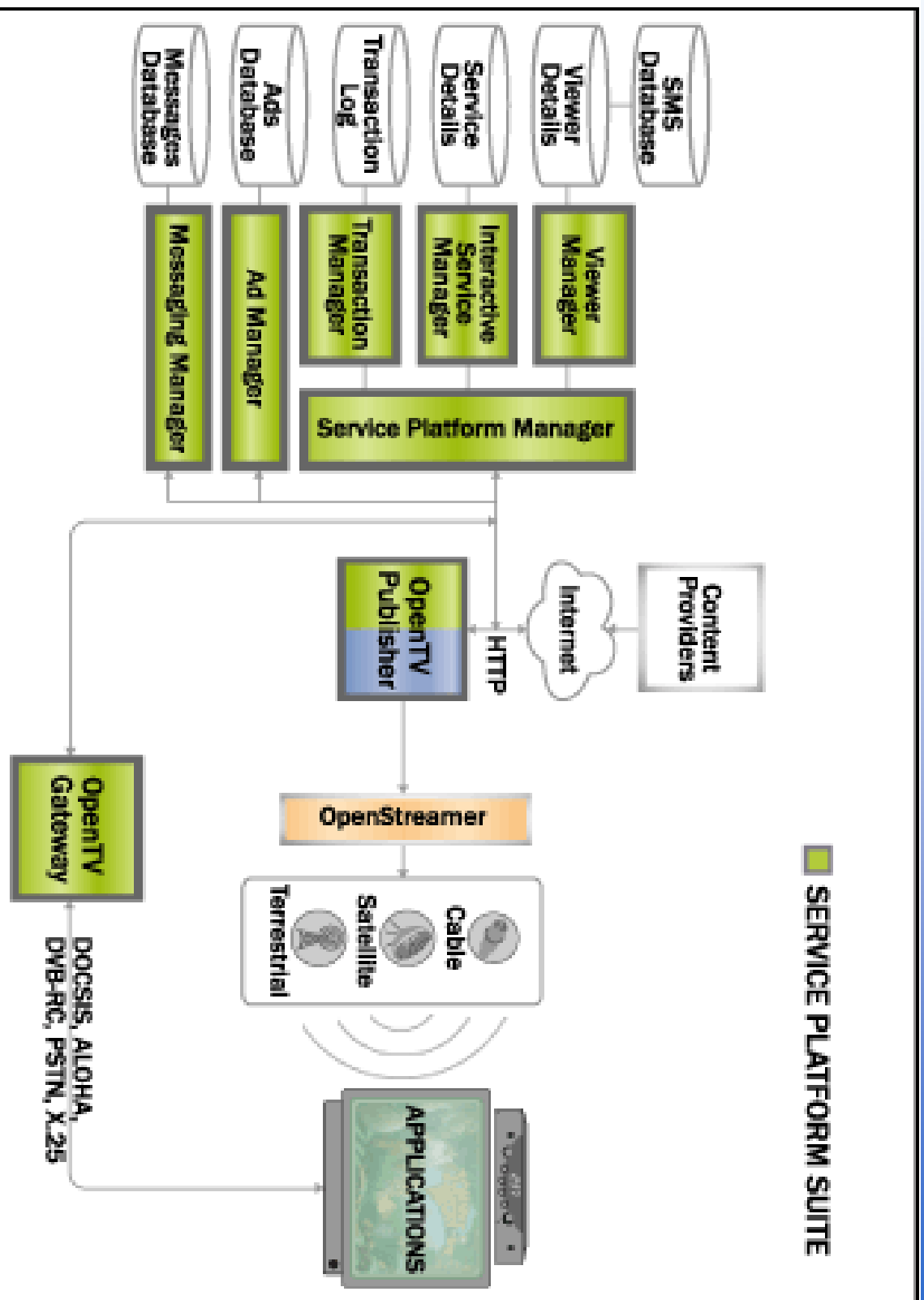
## ❑ Terminal : STB

- OpenTV Middleware (EN2)™
- OpenTV Hardware Porting Kit (HPK)™
  - Terminal hardware-independent layer for EN2

## ❑ Broadcaster (server)

- OpenStreamer™
  - server-side solution for network operators and content producers
  - broadcast multiple streams of data reliably and efficiently.

# OpenTV Tools



# Canal+Technologies Tools



## ☐ Remark:

- Canal+Technologies was sold to Thomson (then NDS) and while Vivendi crashed !

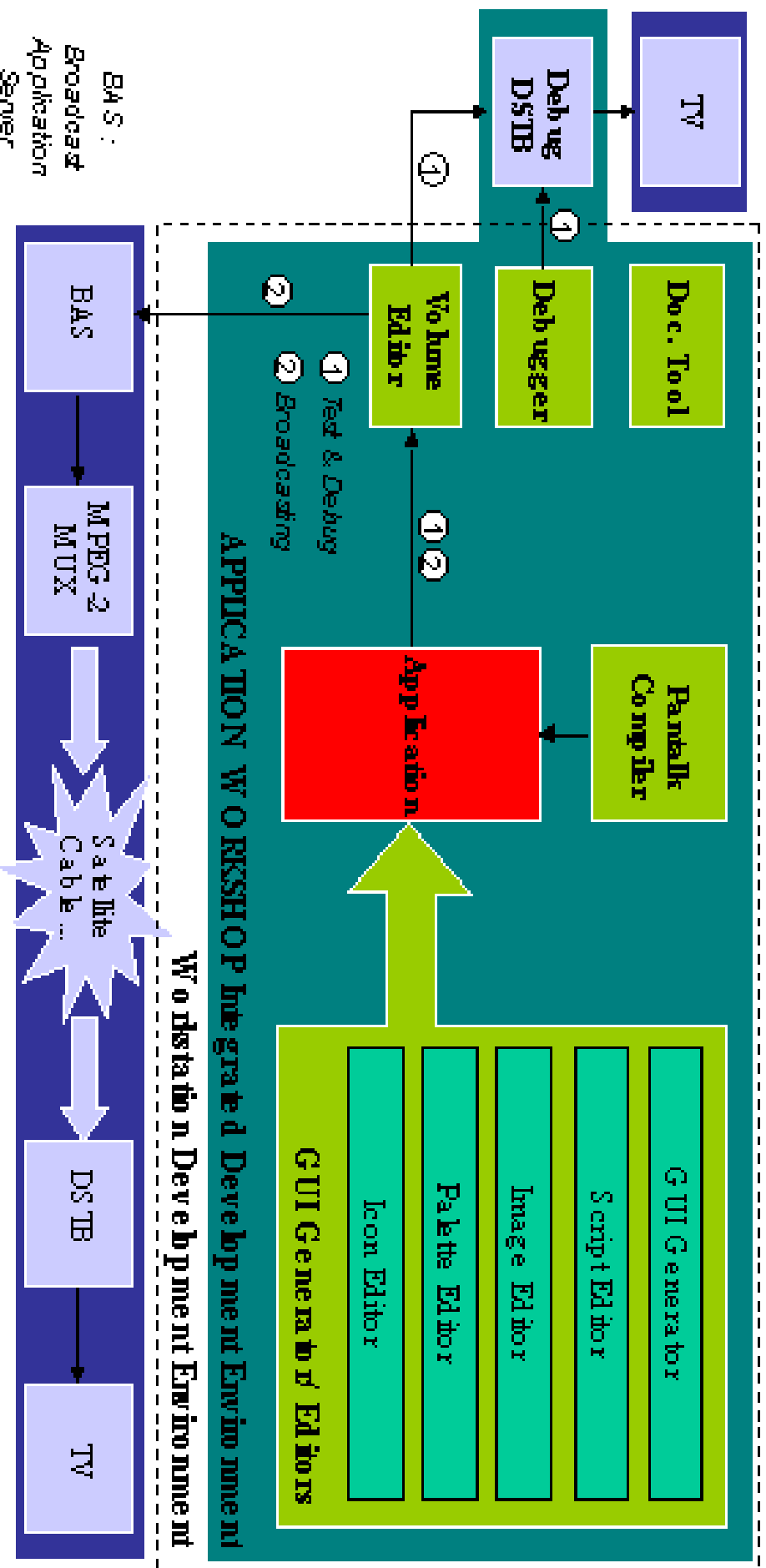
## ☐ 6 Millions STB installed

## ☐ Terminal : STB

- Studio+ IDE
  - Java
- MediaHighway
- MediaStart

## ☐ Broadcaster (server)

# Canal+ Technologies Tools

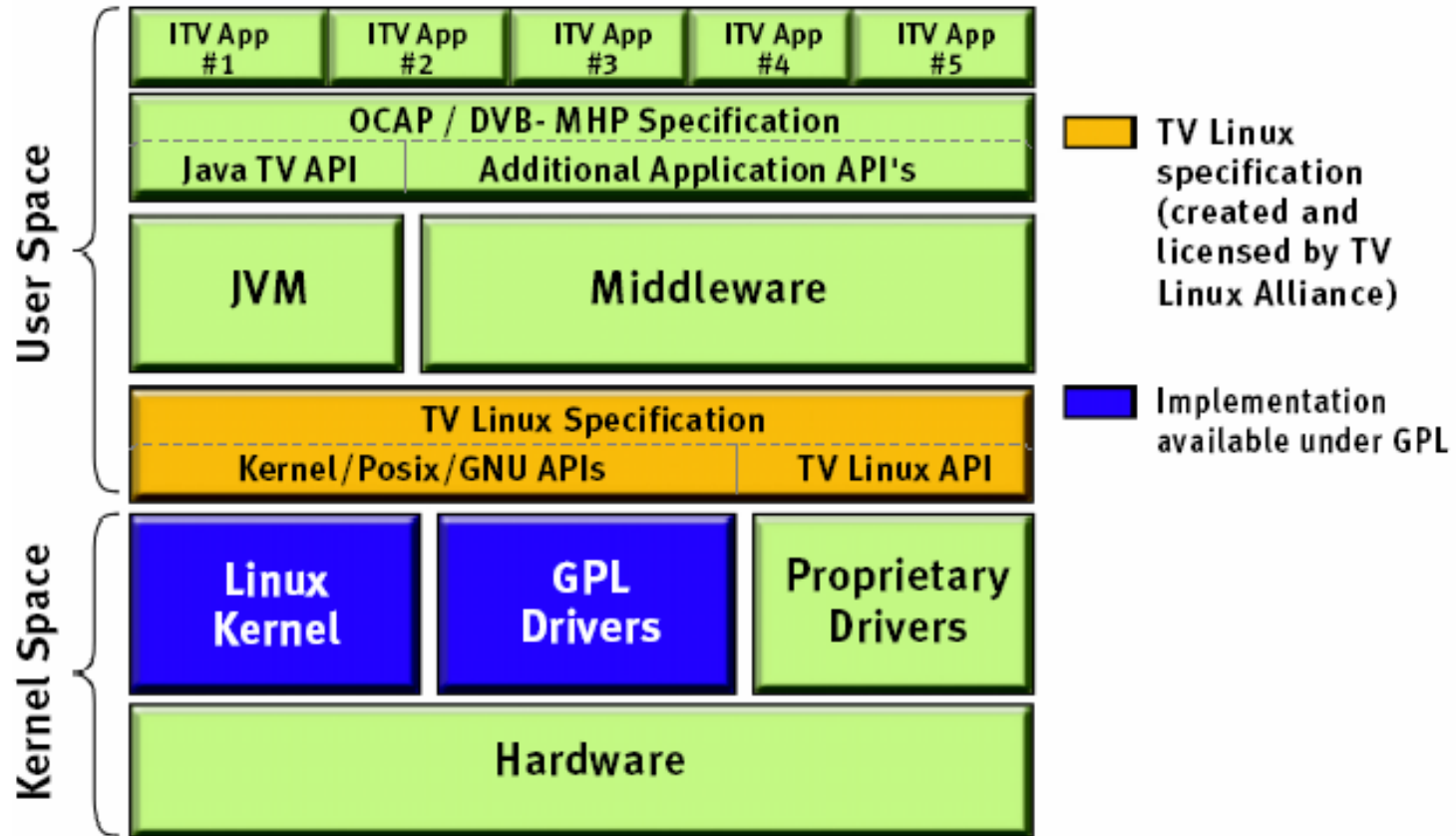


# TV Linux Alliance

(<http://tvlinuxalliance.org>)



- OS STB basé sur Embedded Linux
- Architecture



# Training on iTV middleware

## ☐ Rates

- OpenTV 4000 USD/5 days/student
- Canal+Techno 4500 USD/5 days/student

## ☐ Dev Environment

- Unix/PC workstation + STB
- C, C++, Java, ADA95

## ☐ Contents

- Application development environment
- User interface messaging system, Gadgets
- Resources, Animation
- File systems, Building flows, Communications
- Audio and video services
- Tools, ...



# Bibliographie

- ❑ M. Orzessek, P. Sommer, « ATM and MPEG-2, Integrating Digital Video into Broadband Networks », 1995, Ed Prentice Hall PTR, ISBN 0-13-243700-7 (BUVHC TK6678ORZ)
  - Décrit les différentes parties de l'encodage vidéo et audio MPEG2 mais également de son transport avec MPEG2/TS
  - parle également de l'ATM et des autres réseaux de distribution de la vidéo
- ❑ Gerard O'Driscoll, “ Essential Guide to Digital Set-Top Boxes and Interactive TV, The, 1/e,” Ed Prentice Hall PTR (ECS Professional), November 1999, 295 pp, ISBN 0-13-017360-6
- ❑ Jan Smits, Roanld De Bruin, Ronald de Bruin , “ Digital Video Broadcasting : Technology, Standards, and Regulations (Artech House Digital Audio and Video Library), (January 1999) , Artech House; ISBN: 0890067430
- ❑ Jerry Whitaker , “ DTV: The Revolution in Digital Video ”, 2nd edition (March 1999), McGraw Hill Text; ISBN: 0071350217
- ❑ Jim Boston , DTV Survival Guide, Ed McGraw-Hill, ISBN: 0-07-135061-6, March, 2000
- ❑ IEEE Multimedia, Computer Society ([www.computer.org](http://www.computer.org))

# Links

## ❑ RDF, BHTML, P3P

- <http://www.w3c.org>

## ❑ RSS (RDF Site Summary)

- RSS is a lightweight multipurpose extensible metadata description and syndication format.
- <http://groups.yahoo.com/group/rss-dev/files/specification.html>

## ❑ XTVML

- [http://www.canalplus-technologies.com/media/v9/html/press/prel\\_wok\\_01.htm](http://www.canalplus-technologies.com/media/v9/html/press/prel_wok_01.htm)

## ❑ DVB-HTML

## ❑ TVAnyTime

## ❑ JavaTV

- <http://java.sun.com/products/javatv>

## ❑ DVB

- <http://www.dvb.org/standards/index.html>