



SIEMENS



UNIVERSITÄT PADERBORN

**Cooperative Computing &
Communication Laboratory**

NATO TG 12 Workshop on ,Middleware in Mobile Networks‘

Context-Awareness in Middleware for Mobile Networks

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Introduction:

Middleware

What is middleware?

*An **enabling layer of software** that resides between the **business application** and the **networked layer of heterogeneous (diverse) platforms and protocols.***

It decouples the business applications from any dependencies on the plumbing layer, which consists of heterogeneous operating systems, hardware platforms and communication protocols. (Source: International Systems Group)

Introduction:

Mobile Middleware

Data-Access Middleware (JDBC,...)

Message-Oriented Middleware (MQ Series, JMS,...)

Transaction Processing Middleware (X/Open, OTS, JTS...)

Desktop-Access Middleware (Citrix,...)

Object Middleware (DCOM, CORBA,...)

Mobile Middleware

Enabling Middleware

Service and device management (Jini, UPnP) etc.

Connectivity Middleware

Network gateways etc.

Front-End Middleware

Content processing for the front-end.

Back-End Middleware

Processing of back-end data (server data access).

Introduction:

Context and Context-Awareness

What is context?

*Context is **any information** that can be used to **characterize the situation** of an **entity**. An entity is a person, place, or object that is considered relevant to the **interaction** between a **user** and an **application**, including the user and applications themselves.*
(Source: A. K. Dey, Georgia Tech)

Introduction:

Context-Aware Computing

Features:

- ◆ **Presentation**

of personalised and adapted data / information and services to the user

- ◆ **Automatic execution**

of a service for the user

- ◆ **Logging**

of context information to support later retrieval and evaluation

Introduction:

Related Work

- ◆ **MosquitoNet:** Mobile Computing Group at Stanford
- ◆ **Endeavour:** University of California in Berkeley
- ◆ **Oxygen:** MIT
- ◆ Future Computing Environments (**FCE**): Georgia Tech -> *Context Toolkit*
- ◆ **Portolano:** University of Washington at Seattle -> *Context aware computing esp. w.r.t. user interfaces*
- ◆ **2K:** University of Illinois at Urbana-Champaign (a component-based, network-centric operating system)
- ◆ **PIMA:** IBM T.J. Watson Research Center
- ◆ **Monads:** Department of Computer Science at the University of Helsinki

Application domain:

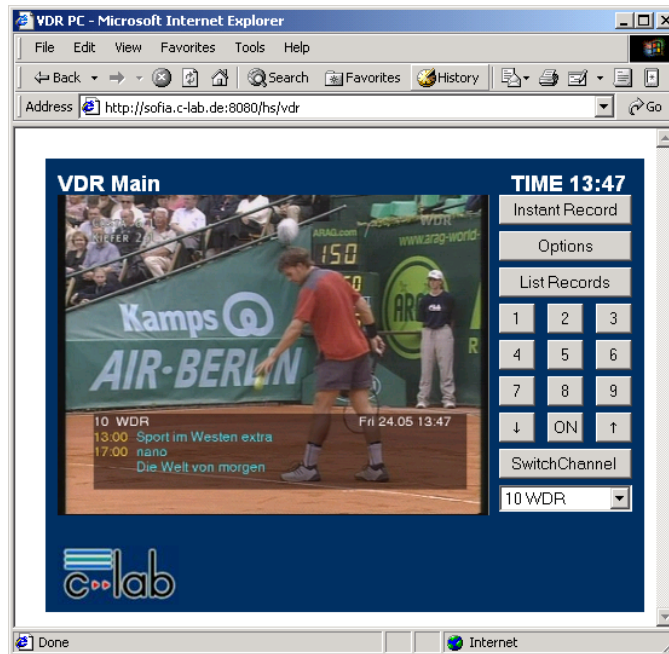
Home Networking

	Technology	Standard	Speed	Max. Distance
Wired	HomePNA	HomePNA v2.0	1~2 / 10 Mbps	150~1.5 km
	USB	USB v1.1	12 Mbps	30 m
	Ethernet	IEEE 802.3	10 M / 1 Gbps	100 m
	IEEE 1394	IEEE 1394	~400 Mbps	72 m
	Power Line	None	1~2 Mbps	100 m
Wireless	Bluetooth	Bluetooth v1.0	720 Kbps	10 m
	HomeRF	SWAP v1.2	1~2 Mbps	50 m
	IrDA	IrDA v1.3	max. 4 Mbps	1 m
	Wireless LAN	IEEE 802.11	5.5~11 Mbps	50 m

Application example:

Mobile Inhome Entertainment

Extended Home Environment (xHE)



PDA

WLAN / GSM

**Server
(VDR / DTV)**

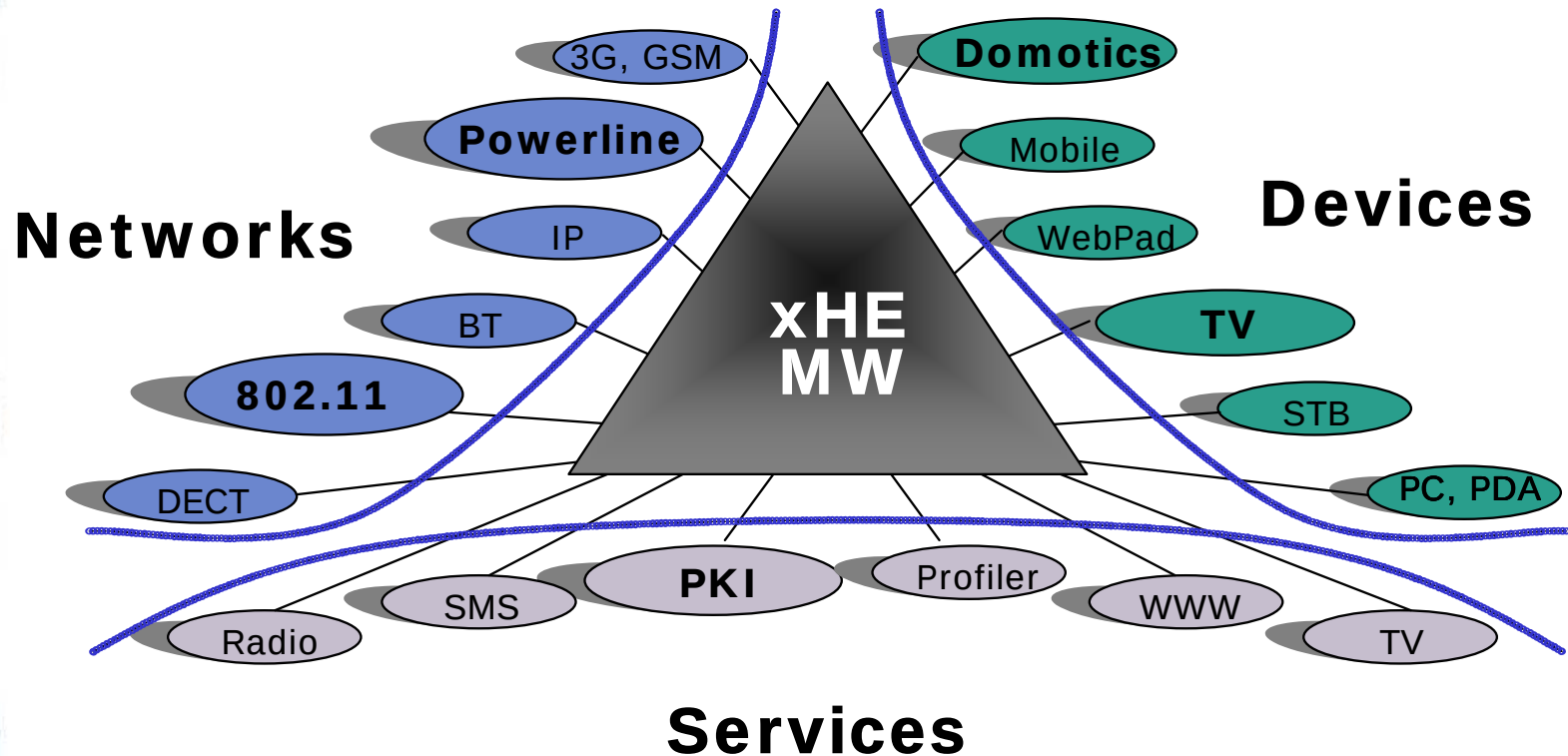


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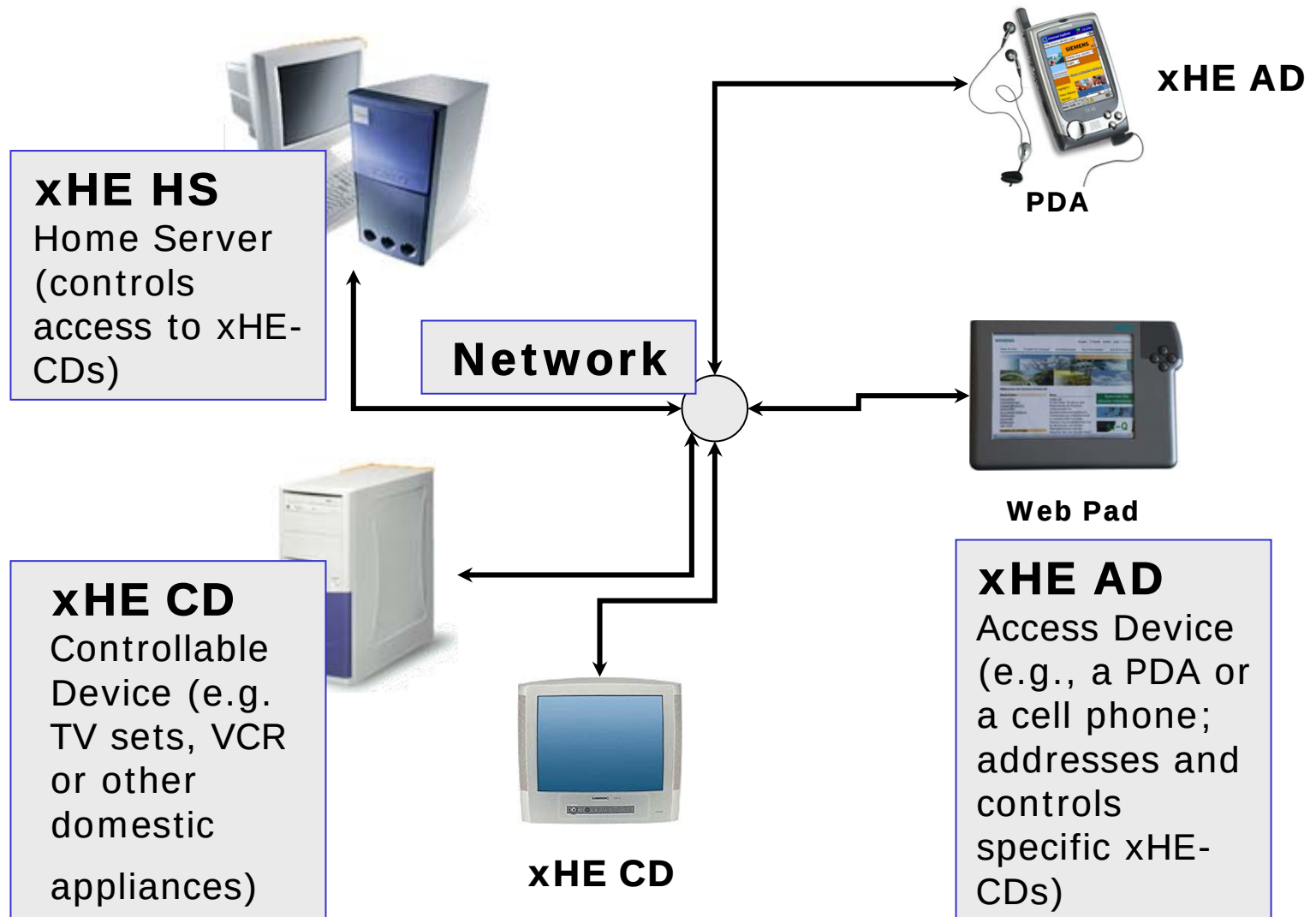
Web Pad

Requirements and Approach: Middleware for Integration



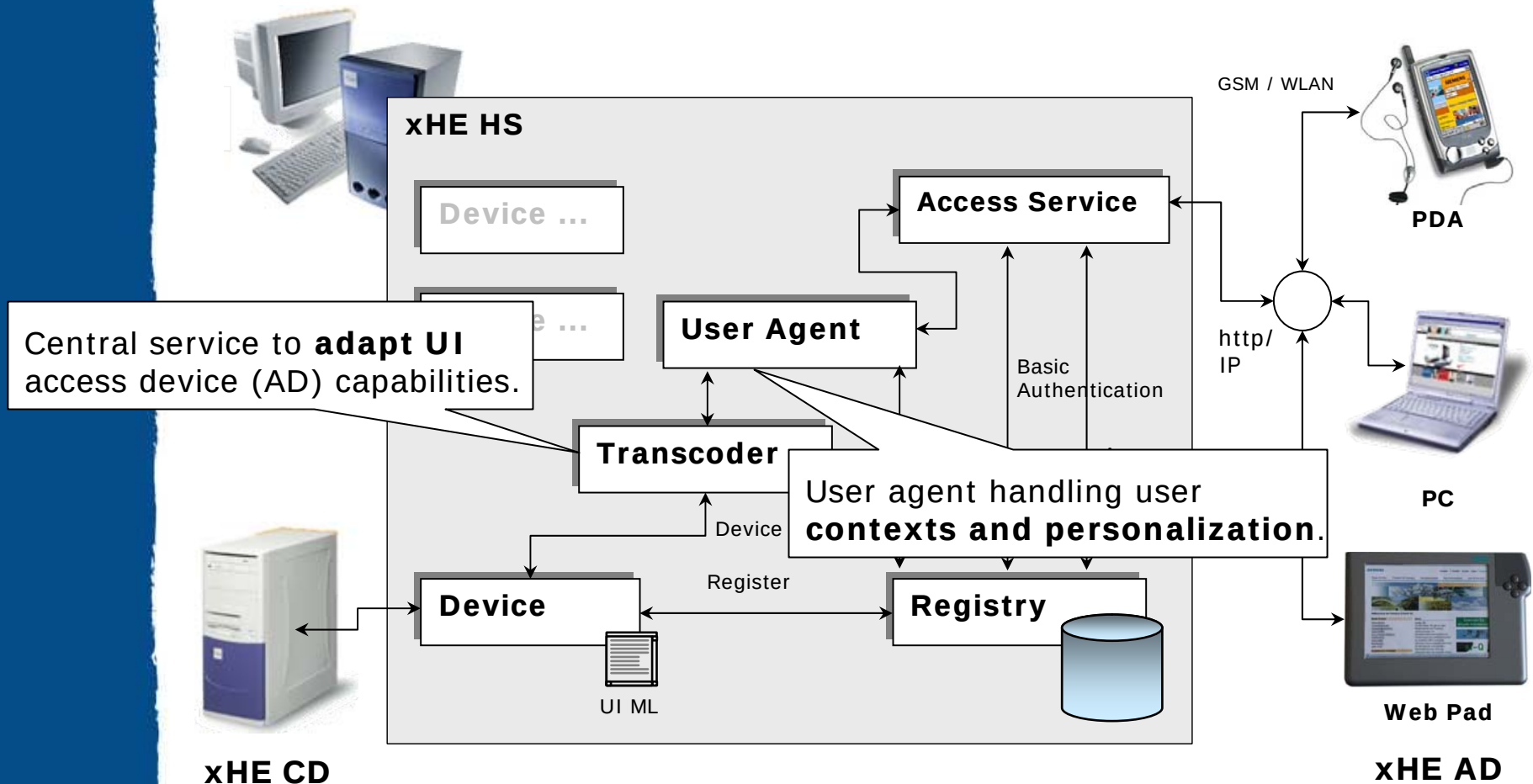
Architecture:

Components xHE



Architecture:

Adaptation & Personalisation



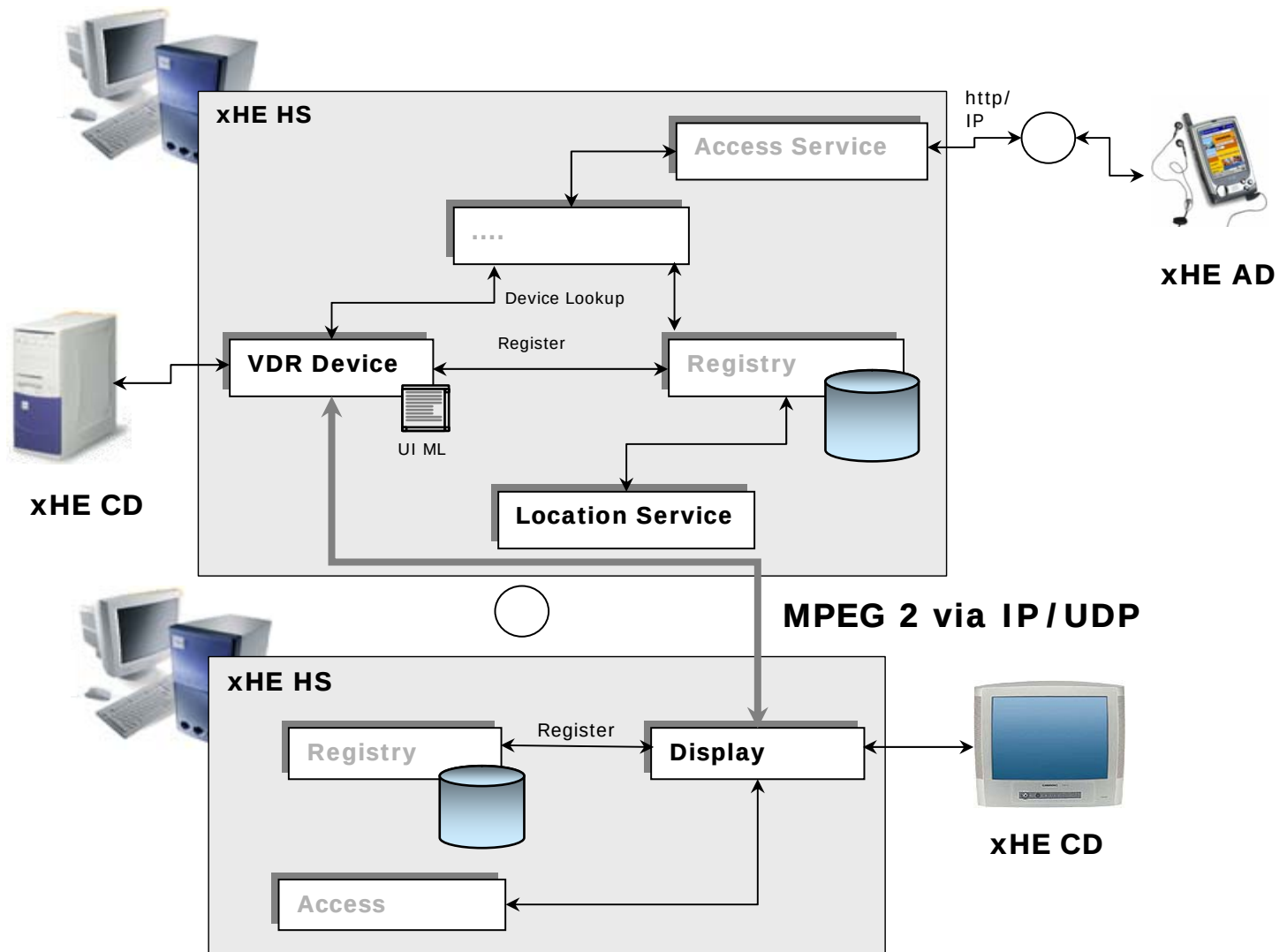
Prototype System:

OSGi-compatible HS

Open Services Gateway initiative:

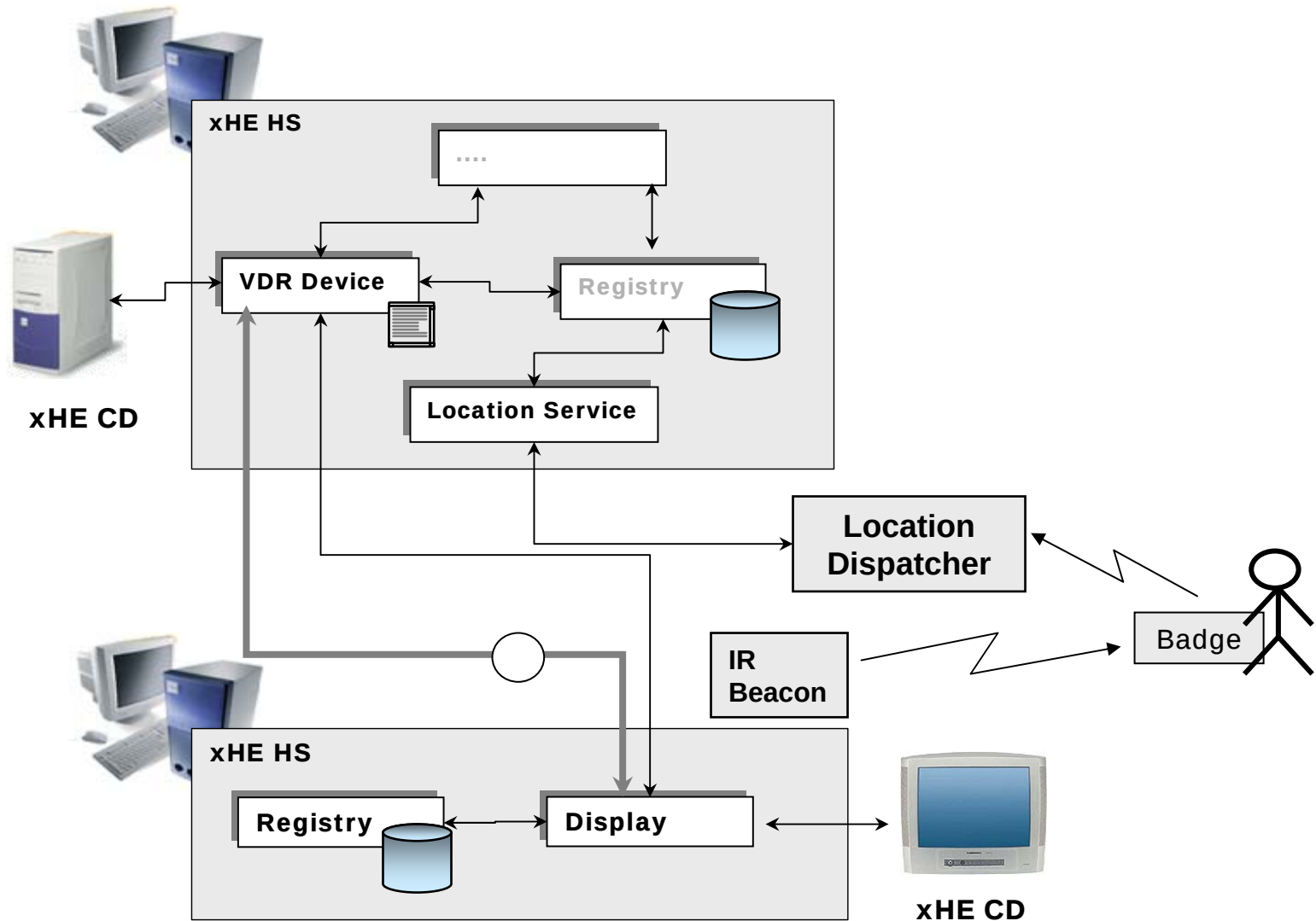
- ◆ **Java** Technology for the web-based access to CDs
- ◆ xHE Components/Services -> Bundles
 - ◆ **Servlet** Packages in Java
 - ◆ Deployment to **central Server** (HS)
- ◆ Consideration of other Middleware Models:
 - ◆ HAVi, Jini, UPnP,...
- ◆ Different Products:
 - ◆ JES (Sun), ProSyst, IBM,...
 - ◆ OSCAR, JEFFREE, DC Server, Oxygen,...

Prototype System: Deployment for *Mobile Display*



Prototype System:

Deployment *Follow-Me Display*



Prototype System: **Java Board Tini**

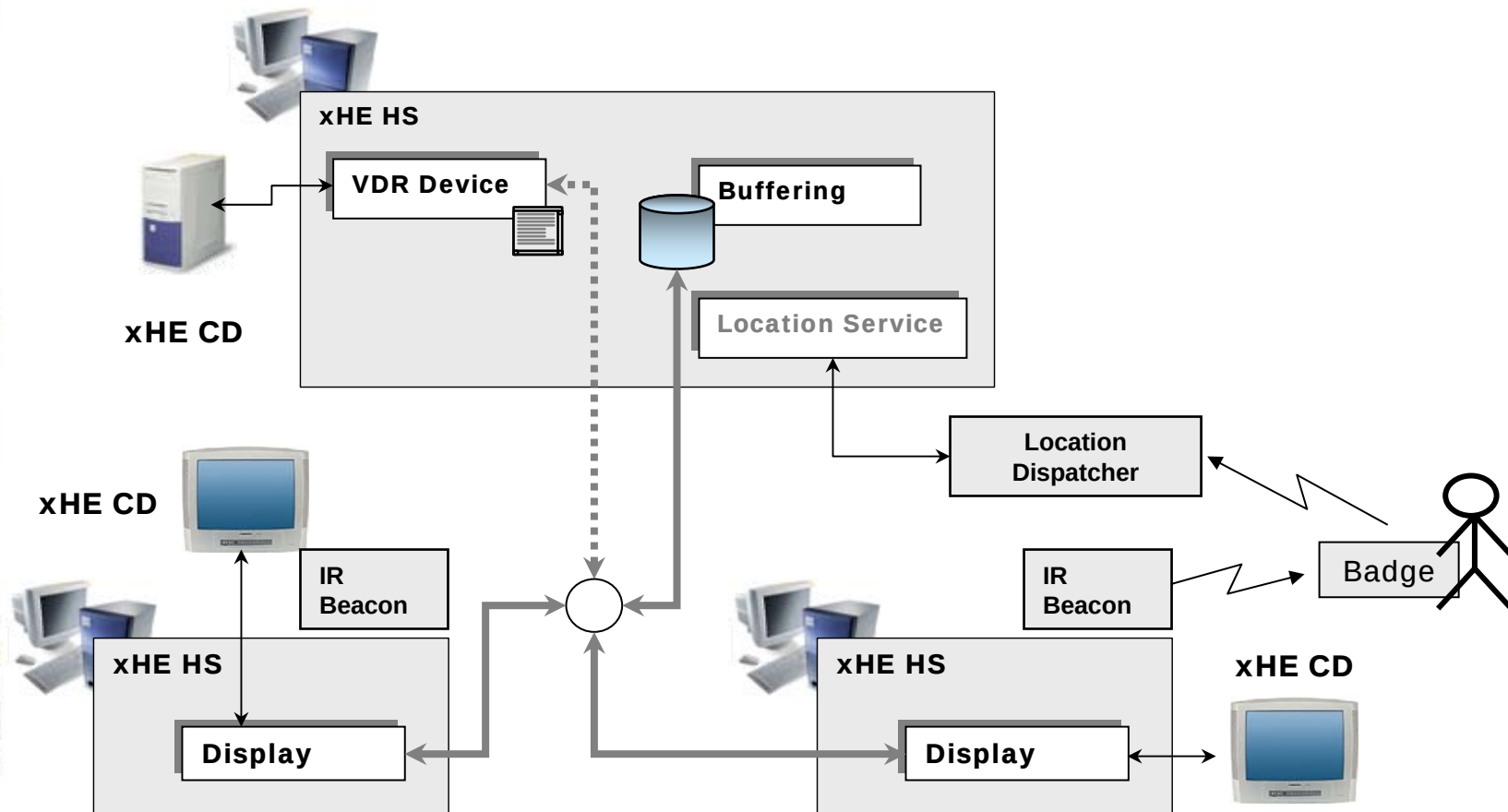
- ◆ Dallas Semiconductors
- ◆ Platform for small/tiny network-enabled applications
 - ◆ serial communications, 10Mb Ethernet, Controller Area Network and 1-Wire
 - ◆ JAVA programmable
 - ◆ TBM390 ca. 50\$ + socket board
- ◆ -> Platform for HW Gateway



Prototype System: Streaming & Timeshift Playback

Handling of streamed & recorded content:

- ◆ Handling of different client applications:
Windows Media, JMF, MPlayer, Elecard,...
- ◆ Platforms: Linux, Windows 2k



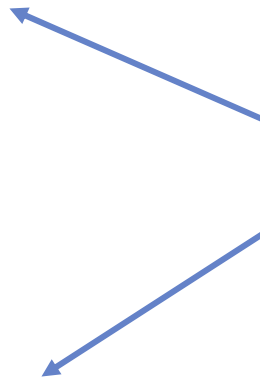
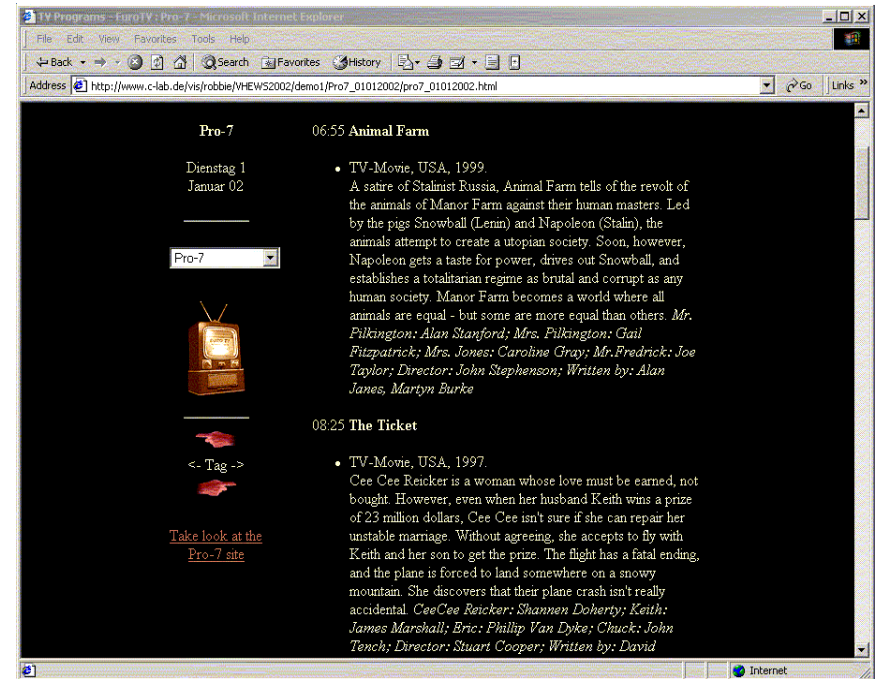
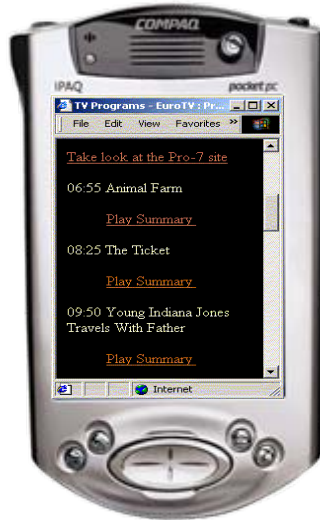
Prototype System:

Additional Options

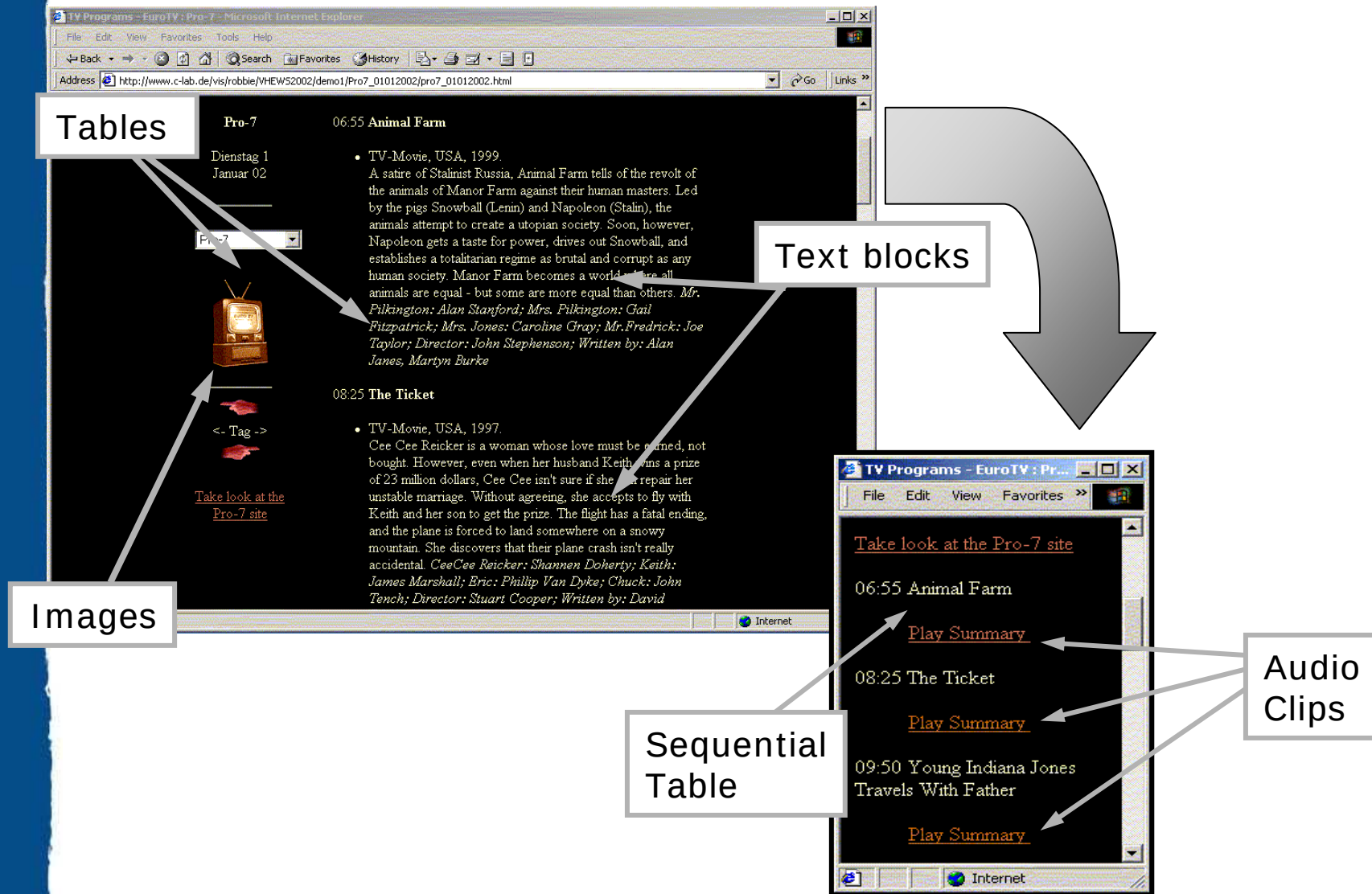
Additional Services:

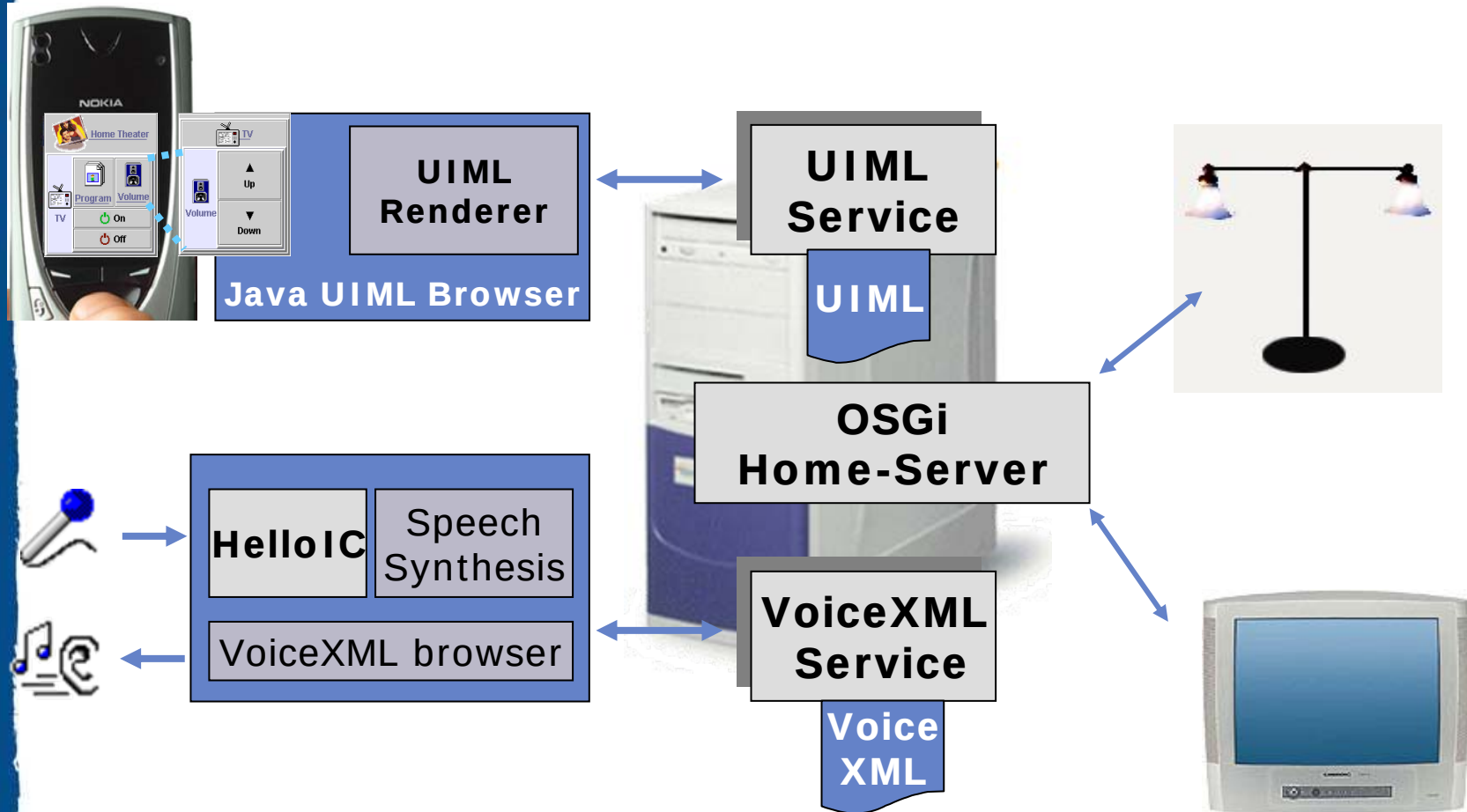
- ◆ Personalisation of VDR Settings (Channel selections) via **SmartCard**
- ◆ **Portability**: HS-based profile (e.g. Playlist) to be used in car / office
- ◆ Distributed Media Archive utilising **Peer-2-Peer** technology (JXTA)
- ◆ ...
- ◆ **Transcoding** for different xHE-ADs using XML

UI Technologies: Adaptation through Transcoding



UI Technologies: Adaptation through Transcoding



*UI Technologies:***Targeted UI-Middleware Technologies**

Data Management: Peer-to-Peer Communications

