

# T.U.C./M.U.S.I.C.

## Lab. Of Distributed Multimedia Information Systems and Applications

### Technical University of Crete

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#### The TV-Anytime Metadata Management Services implemented by TUC/MUSIC in the context of the IST 20751 UP-TV project

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**Abstract:** TUC/MUSIC has implemented integrated tools for the management of TV-Anytime metadata for programs and users. The tools include functionality for transforming external program metadata to TV-Anytime metadata, functionality for storing the program metadata into databases, functionality for storing TV-Anytime consumer metadata into databases, functionality for matching program and profile metadata and functionality for user profile adaptation.

The development of the tools for the integrated management of TV-Anytime program and profile metadata has been carried out in the scope of a larger EU-funded project (IST-1999-20751 UP-TV: “Ubiquitous personalized interactive Multimedia TV Systems and Services” project).

#### TV-Anytime Metadata Management Services implemented by TUC/MUSIC:

##### 1) Program Metadata workflow management:

- Metadata model which is compatible with the TVA metadata specification
- XSL transformations to support information providers with proprietary formats (e.g. “Presse Program Service GmbH, PPS” Program Metadata Provider)
- Interoperable with other TVA data creation editing and management tools (i.e. OPUS v1.0 from Videsti)
- Java-based XML-DB middleware s/w

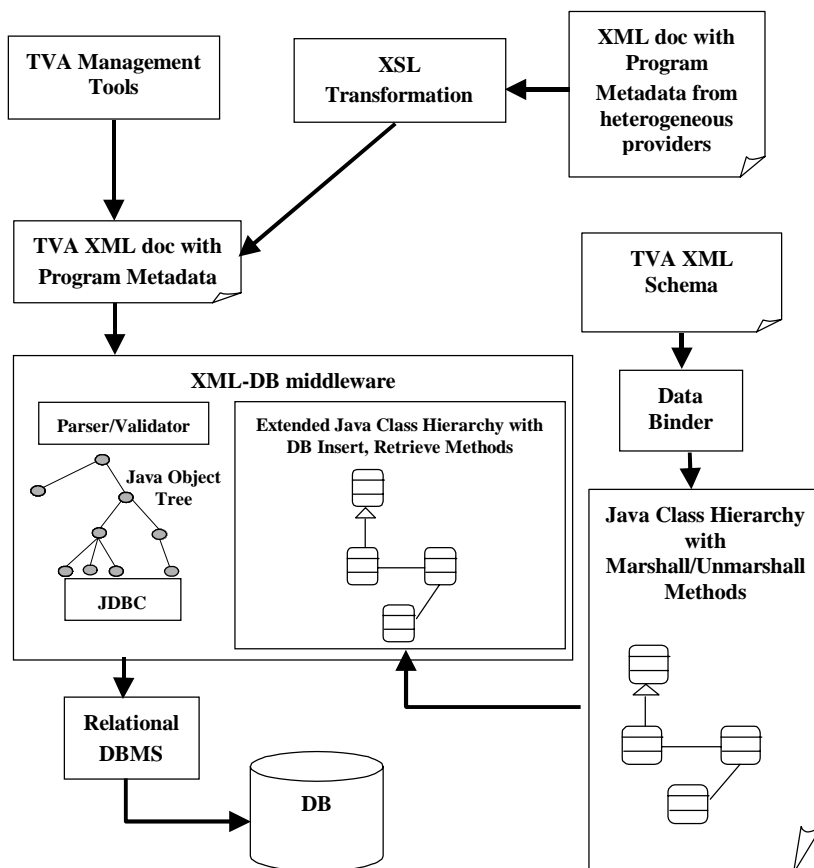
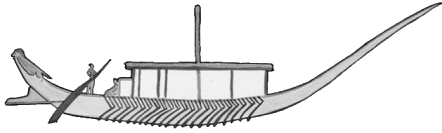


Figure 1: Tools for Program Metadata Management



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2) Relational Metadata Content management:

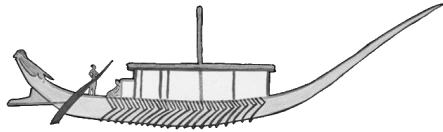
- Based on open source, light weight, RDBMS for easy porting and exploitation
- Several database tables are used to hold the metadata and the pointers to data
- Efficient optimizations (second version of the system) have been implemented to achieve a high performance metadata management system
- Efficiently integrated with the metadata workflow management functionality to capture metadata from heterogeneous external providers

3) Relational Profile and User Action Management:

- Profile model based on TVA specification
- Implementations on top of RDBMS
- Matching of profile metadata with the program metadata based on the Extended Boolean Model which has as special cases the Boolean, the fuzzy and the statistical models
- Automatic Profile determination and/or adaptation based on user action metadata

4) Methods for Program Access:

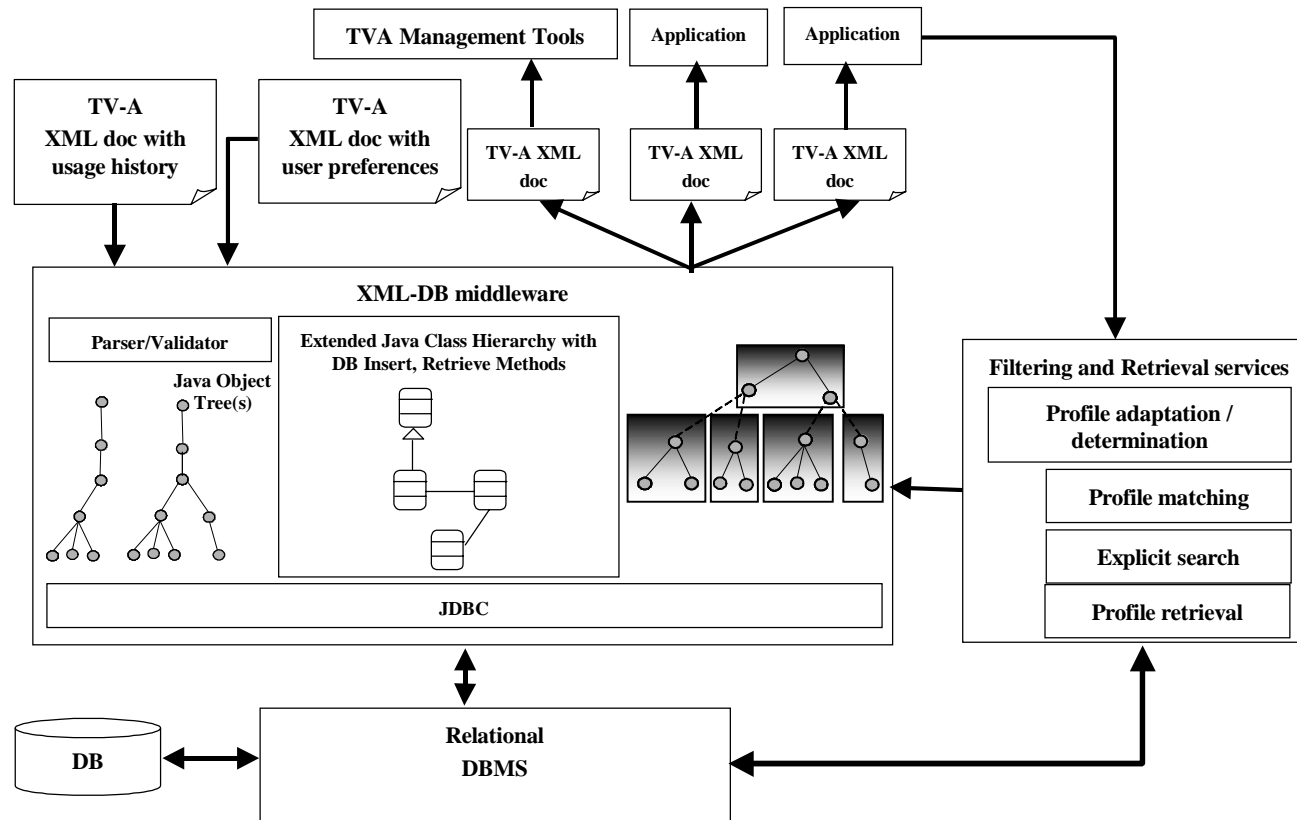
- Alternative ways and primitives to access relevant programs
  - Profile to program metadata matching
  - Explicit search (Extended Boolean Queries)
  - Stereotype based information dissemination has been implemented
- Mechanisms for automatic profile determination and/or adaptation from user actions
- Mechanisms to retrieve any valid fragment of a TVA document
- Mechanisms to assemble valid TVA documents from fragments



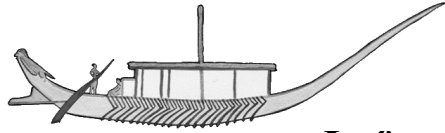
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**Figure 2: Tools for Profile and User Action Management /Program Access**



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#### **Implementation environment:**

XSL Transformation: Apache/Xalan 2.4

Data Binder: Breeze XML Binder 3.0 for Java

Parser/Validator: Apache/Xerces 2.0.1

Java: J2SDK-SE 1.4.0

RDBMS: MySQL 3.23.51

JDBC: mm.mysql-2.0.14

OS: Linux/Windows9x/NT/XP

**The UP-TV project**<sup>1</sup>: The purpose of UP-TV ("Ubiquitous personalized interactive Multimedia TV Systems and Services") is to create advanced and expandable architectures and systems for TV Anytime applications. The research questions targeted in this project focus on the identification of media content that has to be recorded, the placement of those media assets onto single and networked media servers as well as the organization of an efficient and comfortable access to these assets. The results of this research work influence the development of a TV Anytime server system that supports a scalable number of users, ranging from a cost-effective consumer system to a large-scale server system. Based on a general service platform, two trial applications that integrate TV Anytime scenarios are implemented and tested. The trials study personal TV in hotel environments and hierarchical wide area networks. The technical work in UP-TV is accompanied by preparation of business plans for the role out of personal TV services.

**Envisioned architecture and innovations:** The basic UP-TV architecture contains the following:

- A home system (PVR) receiving broadcasted data according to TVA concept, with internet server and client capabilities to support point to point access
- A scalable local area server connected with high bandwidth connections to the home PVRs to expand the functionality and capabilities of the PVRs
- TVA support for mobile consumers and UP-TV server applications in hotels via distributed UP-TV functionality.

#### **Advantages of the Architecture:**

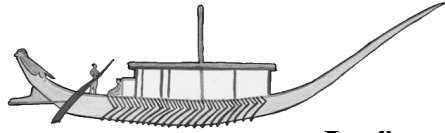
- Integration of broadcasting and point to point delivery of programs to consumers
- Expanded program capturing from multitude of resources (powerful server)
- Added value information integration in the servers (e.g. targeted advertising, T-Commerce)
- Expanded virtual memory for program capturing beyond the storage size of the PVR
- Economies of scale for particular application environments (hotels etc.)
- Integration of metadata from diverse heterogeneous providers
- Incorporation of community filter capabilities
- Support for the needs of mobile consumers

#### **Focus of the UP-TV R&D:**

- Delivery of completely new and advanced middleware functionality based on PVRs, scalable servers, and distributed support for mobile consumers to achieve high user satisfaction and usability in TVA environments.

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<sup>1</sup> IST-1999-20751 project "Ubiquitous personalized interactive Multimedia TV Systems and Services". The consortium is comprised by Intracom SA (EL), TUC/MUSIC (EL), Universität Paderborn (D), Infonova (A), Pixelpark (D), PPS (D), Grundig (D), ERT (EL), TVL (B).



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- Design and Implementation to be built on existing and emerging industry standards (TVA, XML Schema, XSL transformation, UML, etc.) exploring their use and further development needs to achieve advanced TVA environment and applications.
- Investigation of algorithms for high performance implementations of demanding multimedia applications.
- Integration of the hardware and systems software needed to create a basic PVR platform.
- Investigation of multitude of marketing possibilities in the integration of TV & Internet.

#### Objectives of the UP-TV:

- 1) **Full TV-A metadata compliance**; at this phase it is used as reference the TVA document Metadata Specification S-3 (Document: SP003v1.1, Date: August 17, 2001, corrigendum COR1\_SP003V11, Date: December 21st, 2001)
- 2) Use of a **client-server architecture** to support retrieval from an extensive set of channels, retrieval of related information, extensible client storage:
  - Stackable system approach (clustering) for setting up hierarchies of TV Anytime systems
  - Reusable software modules in the client and in the server
  - Co-ordination of clients and servers to support retrieval from an extensive set of channels and advanced applications
  - Efficient data distribution from servers to clients
  - Efficient data distribution across servers
- 3) Efficient organization and management of **metadata** about programs, both in a set-top-box and a server:
  - Use of DBMS's for systematic organization, extensibility with other data types (ads), connection to other information, advanced querying, transactional support
  - Optimized storage and retrieval
  - Use of industrial standards (TVA, MPEG-7) for indexing and provide capabilities for the extension to important application areas (news, sports, etc.)
  - Implementation using open source s/w, light DBMS
- 4) Advanced **personalization** and filtering capabilities:
  - Provide advanced matching algorithms between profiles and metadata
  - Support of collaborative filtering
  - Support of usage histories
  - Provide advanced profile adaptation techniques
- 5) Support for the **mobility of users** between different locations:
  - Design of components to support user mobility between different locations
  - Co-ordination of the servers involved to transfer Travel schedules, User profiles
  - Remote management of the PVR
  - QoS mechanisms for browsing content
- 6) Development of business models