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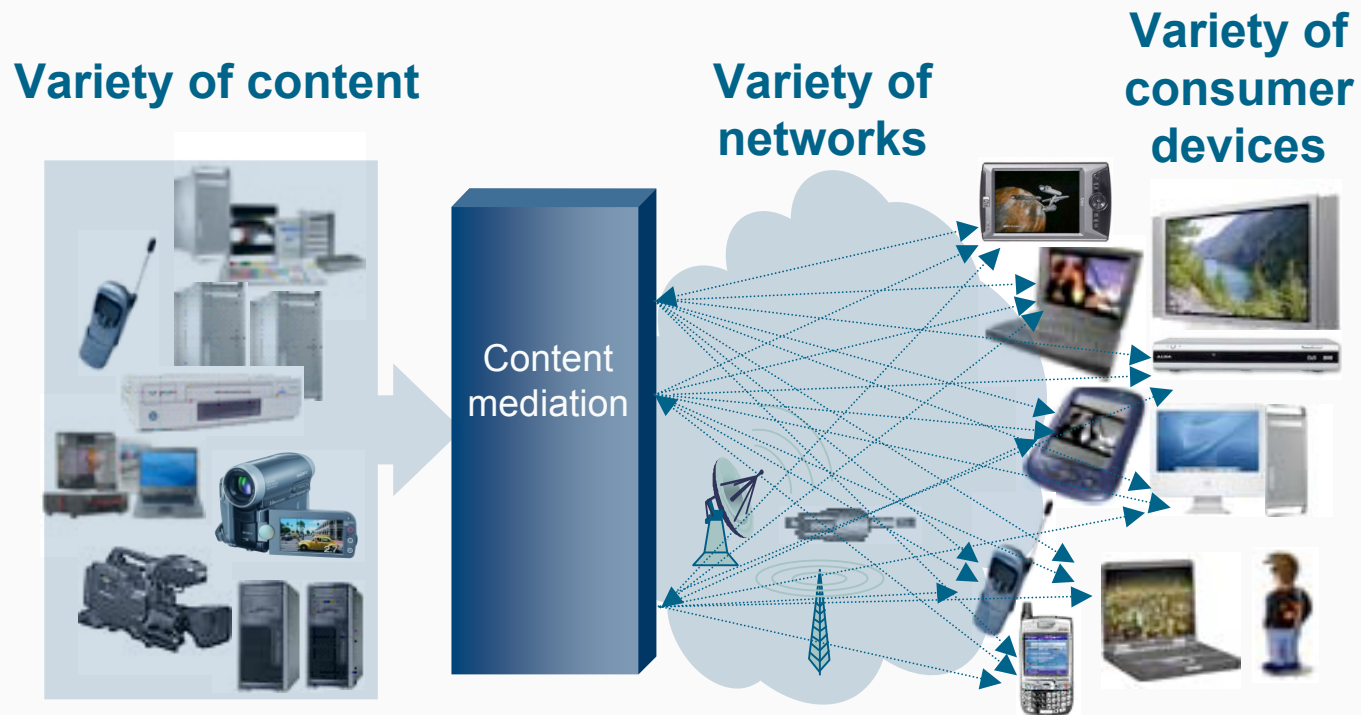
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Context-aware platforms and metadata-assisted content search

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The motivation



Variety of consumer devices, users and networks

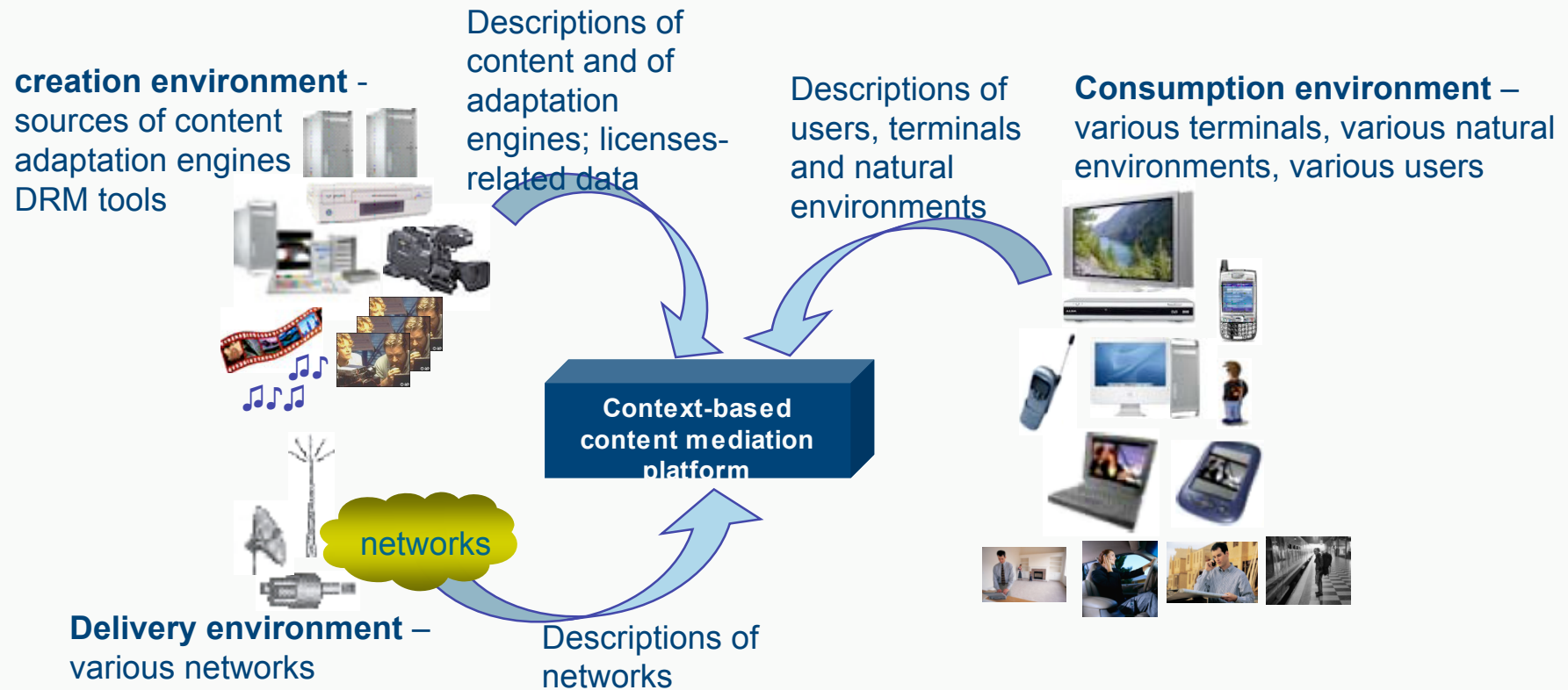
- Need for *Context awareness!*

↑ *Context-aware applications are those having the ability to detect, interpret and react to aspects of user's preferences and environment characteristics, device capabilities or network conditions by dynamically changing or adapting their behaviour based on those aspects that describe the context of the application and the user.*

Variety of content

- Need for efficient metadata-assisted search engines and interoperable data models!
- Large amounts of multimedia content available on-line
 - different encoding and representation formats
 - different description schemes
- Turned search and retrieval into an extremely difficult task
 - To find more or less accurately matching results is easy; to find really useful results is hard!
- Large archives are of no use since they cannot be efficiently queried

Context aware systems



Technological challenges

... to provide meaningful semantic based content search

- Interoperability across different content description schemes
 - How to bridge the *semantic gap*?
- Interoperability across different content representation formats
 - how to represent universally, rich complex multimedia objects?
- how to learn from the user experience?

Technological challenges (2)

... to gather and process context

- how to identify the required contextual information?
- how and when to sense and gather that contextual information?
- how to use the context to take decisions?
- how well do automatically generated context describe real world situations?
- how can automatically generated context be used to form rich concepts that translate well real world situations?

The strategy

- use of open tools and standards
- service oriented approach
- use low-level (sensed) and high-level (inferred) contexts
- perform quality-based content adaptation strategy under constrained environments
- allow dynamic operation - content adaptation decision capability both during service negotiation (static) as well as during service delivery (dynamic)

Approach

- digital object architecture to facilitate the management of and access to distributed heterogeneous content
 - based on the MPEG-21 standards
 - ability to aggregate multiple data sources and descriptions
 - ability to provide the means for multimodal access to complex digital objects
- Provision of relevant distributed processing services
 - ability to mediate between heterogeneous information formats
 - services for publishing and searching complex digital objects under a single object architecture
 - services to adapt content and services to the context of usage
 - services to interoperate with multiple context providers

MPEG-21 basic concepts

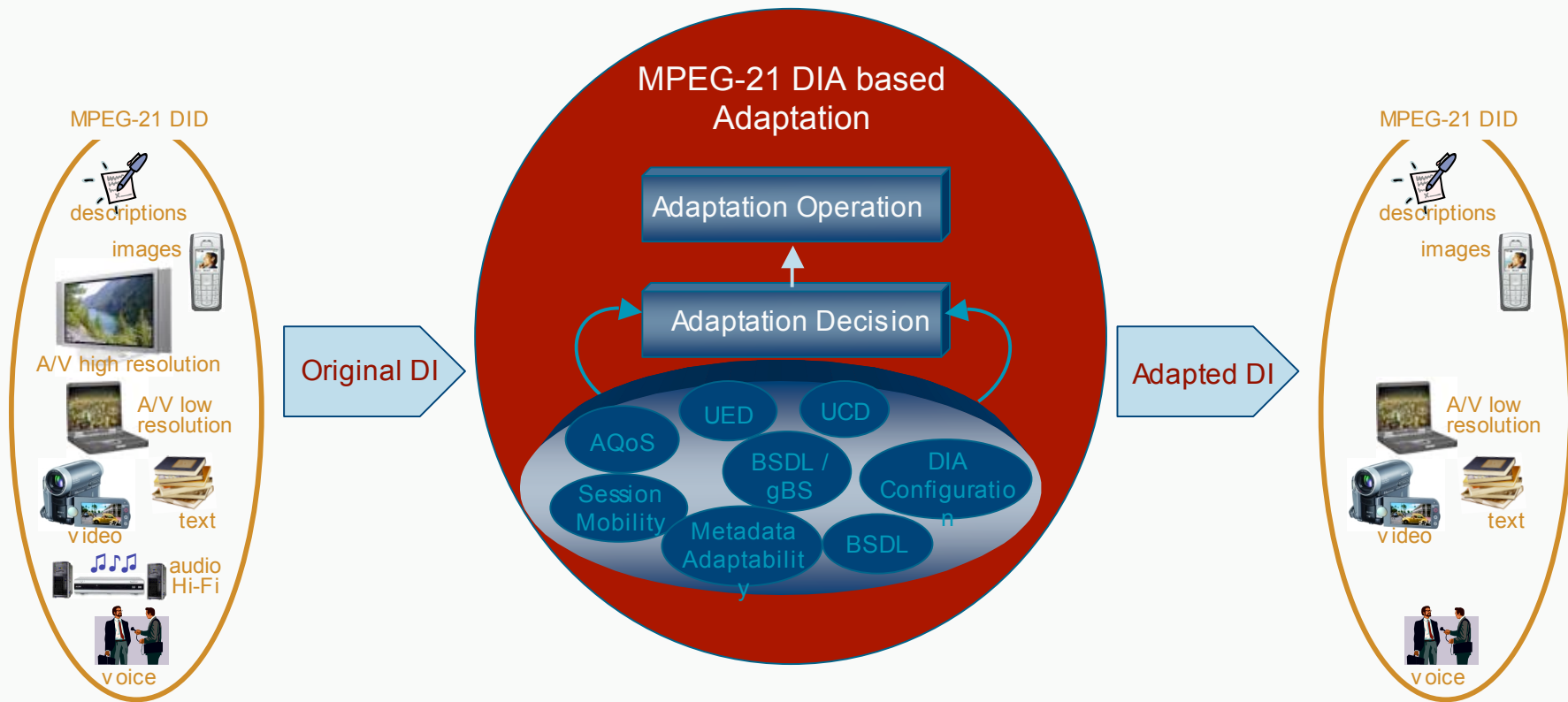
- User
 - any type of actor that manipulates content, be it a person or a system (e.g. subscriber, producer, provider, network)
- digital item
 - smallest unit of content for transaction and consumption
 - at the conceptual level it can be seen as a package of multimedia resources related to a certain subject

```
<?xml version="1.0" encoding="UTF-8"?>
<DIDL xmlns="urn:mpeg:mpeg21:2002:01-DIDL-NS">
  <item>
    <Descriptor id="final_European_Championship_2004">
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        <Resource mimeType="video/mpeg2" ref="videos/final.mpg"/>
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    <Descriptor id="foto_team_Portugal">
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    </Descriptor>
    <Descriptor id="interview_team_coach">
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    </Descriptor>
    :
  </item>
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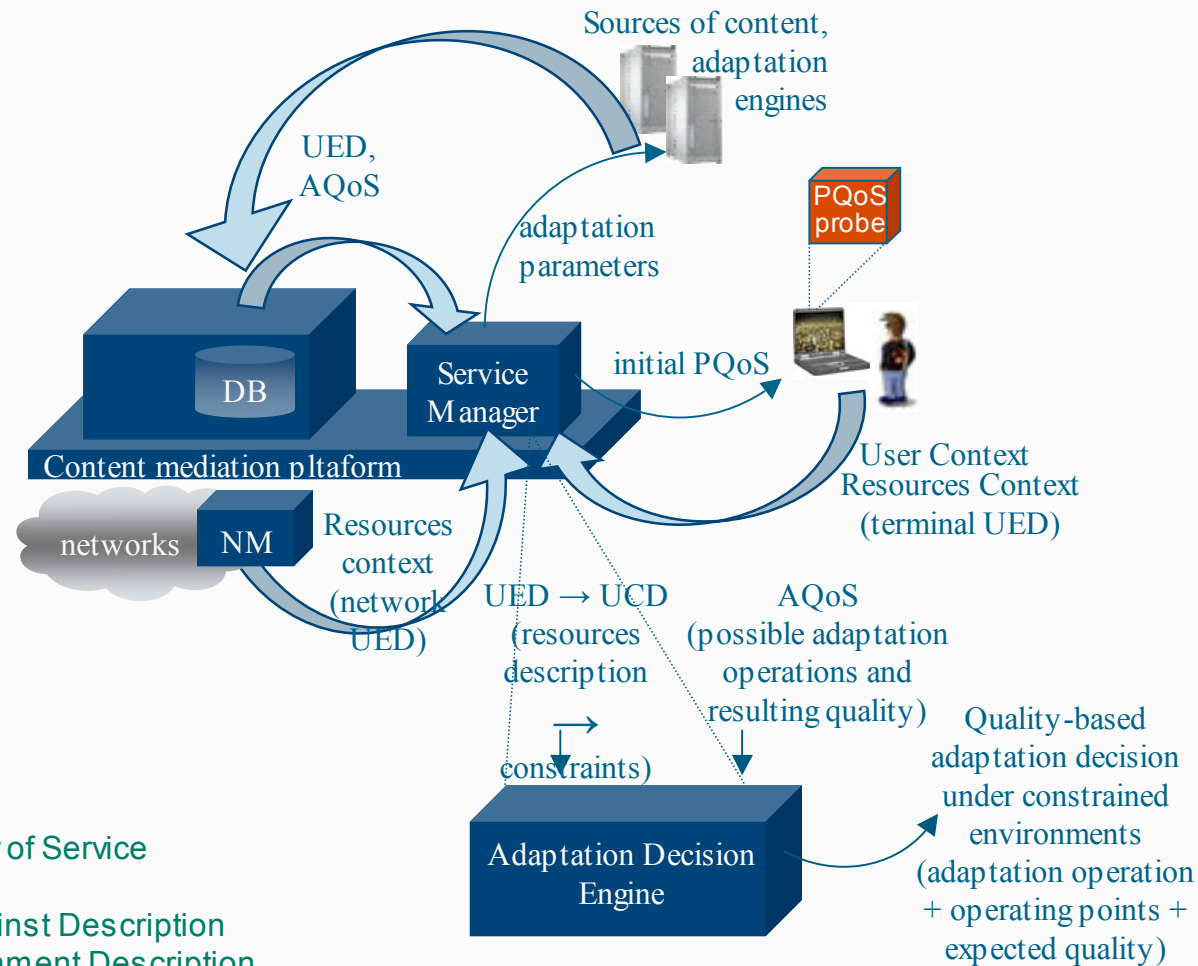


MPEG-21 Adaptation concepts

- DIA – Digital Item Adaptation

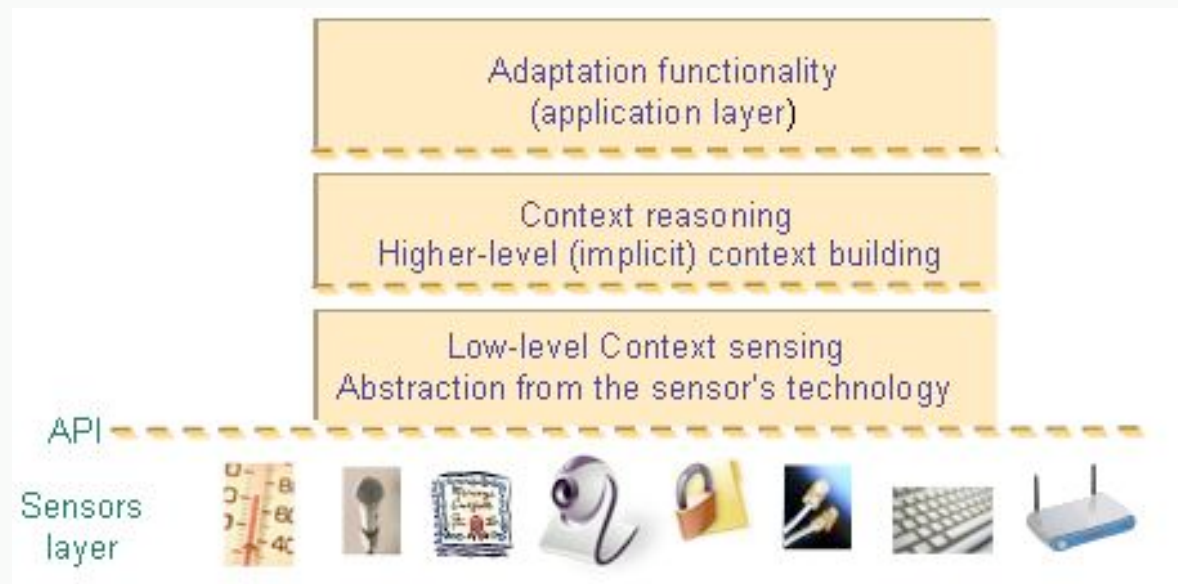


The approach for quality-based adaptation using MPEG-21



AQoS- Adaptaion Quality of Service
 PQoS – Perceive Quality
 UCD – Universal Contrainst Description
 UED – Universal Environment Description

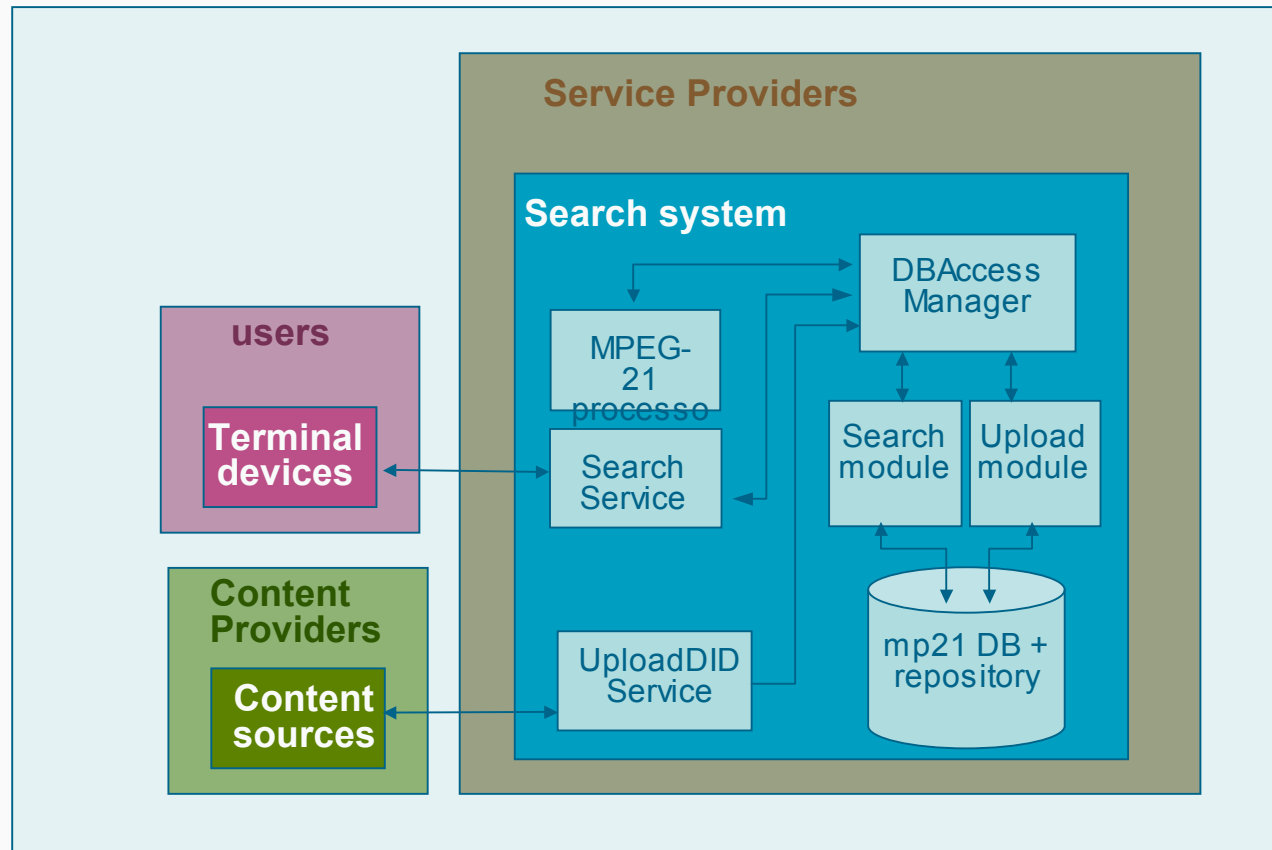
System Functional Layers for context-awareness



Open issues

- Interaction with multiple context providers
 - Definition of profiles of context?
 - Application-centric versus context provider-centric
- Reasoning about low level context to infer higher level concepts
 - Define ontologies
 - General purpose with common concepts
 - Domain-application specific
- Interaction with adaptation engines

System architecture for metadata-assisted content search



System Features

- Integration of metadata and generation of DIDs
 - upload to an MPEG-21 data base and DID repository
 - relational database with descriptors extracted from the DIDs
 - Support for storing and browsing content-related and context-related metadata in a combined way
 - Support for descriptive metadata content search (keyword based)

Open issues

- Enhanced semantic-based content search
 - Relate low-level content's features descriptions with high-level semantics
 - techniques for combining ranks obtained from distinct similarity measures applied to diverse low-level features and to high-level descriptions
 - Implement mechanisms of relevance feedback (RF)
 - at the session level (short-term) having effects restricted only to each query session.
The RF mechanism will be based, essentially, on low-level descriptors
 - Evaluate the use of ontologies to achieve semantic interoperability
 - LSCOM ontology will be taken into account
 - possibility to store textual annotations created interactively by the end users: the textual tags. This represents the concept of folksonomy, a user generated taxonomy

Thank you very much for your attention!