The MVCE Knowledge-Based Content and Service Adaptation Management Framework

Dr Ning Li

CCSR, University of Surrey
Outline

- Mobile VCE
- Ubiquitous Services Programme
- Content and Service Adaptation
- Challenges
- Proposed Solution
  - Adaptation Manager
  - Content Adaptor
  - Interactions: The Dispatcher
- Summary
Mobile VCE

- Virtual Centre of Excellence in Mobile and Personal Communications
- 7 UK Universities
  - Surrey, Kings, Edinburgh, Strathclyde, Bristol, Southampton, Royal Holloway
- Around 20 Industrial Sponsors
  - Operators, Broadcasters, Manufacturers
- Funded by UK Department of Trade & Industry
- Website: www.mobilevce.com
Core 4: Ubiquitous Services

Barriers in three domains

User

Network

Service/Content

Devices
Service is “action taken on the object when content is the object of interest”. Examples: transformation, presentation of content.

Service adaptation changes the actions taken upon the "object", e.g. the content delivery path or interface, while content adaptation changes "object of interest".

To change the trigger of service, such as wake-up, or call diversion service is NOT considered as service, instead, the service is regarded as an intelligent service.
Challenges

- **User Domain:** Users will own multiple wireless devices
  - Personal Assistant Agent
    - To act on users’ behalf
  - Personal Content Manager
    - To organise pan-device content storage & delivery
- **Network Domain:** Networks are expected to use different QoS, mobility and security mechanisms
  - Network support sub layer
    - to integrate mobility, QoS and security functions
Challenges

- **Content and Service Domain:**
  - Traditionally, content/service delivery mechanisms considered only the heterogeneity of the different network access technologies without taking into account user context, user preferences and device capabilities.
  - Existing adaptation mechanisms e.g. media transcoding, image conversion, language translator use different heterogeneous interfaces. This makes their integration a complex issue.
  - No effective interaction mechanisms exist between the content service adaptation framework and the user’s Personal Distributed Environment (PDE).
Proposed Solution

To design a Content/Service (C/S) Adaptation Management Framework (AMF)

- **Adaptation Manager (AM):** manage and analyse the heterogeneous context information and make appropriate adaptation decisions.

- **Content Adaptor (CA):** provide management framework for existing adaptation mechanisms

- **Dispatcher:** provide management mechanisms for the interaction and communication the AMF and the PDE
Proposed Architecture

Personal Distributed Environment (PDE)
Ubiquitous Architecture

Personal Distributed Environment (PDE)

Content and Service Adaptation

Content Adaptor

Content/Service Adaptation Manager

CONTEXT ASSIMILATION

ADAPTATION ENGINE

Dispatcher

Network Gateway

Mobility Management

QoS

Security

DME Proxy

Network

Control Flow

Content Flow

Device Resources

Services & Applications

Input / Output Modality

Content Storage
Adaptation Manager
Context Modelling

- Context representation scheme:
  - Ontology (out of key-value, markup scheme etc.)

- Context representation language:
  - OWL (out of XML, RDF, RDFS etc.)

- Context ontology vocabulary:
  - Defined, MPEG-21 DIA, MPEG-7 etc.

- Generate an overall C/S Adaptation Context Ontology to provide common vocabulary for describing user environment, C/S and adaptation mechanisms
Context Modelling

- `<rdf:RDF`
- `xmlns:mvce="http://www.mobilevce.com/ubiquitous/AMFOntology.owl#"`
- `xmlns:xsd="http://www.w3.org/2001/XMLSchema#"`
- `xmlns:prf="http://www.wapforum.org/UAPROF/ccpps schema19991014#"`
- `xmlns:mpeg7="http://rhizomik.net/ontologies/2005/03/Mpeg7-2001.owl#"`

```
......
<mvce:Content rdf:ID="image">
  <owl:onProperty rdf:resource="#mpeg7:height"/>
  <owl:allValueFrom rdf:datatype="#xsd:integer"/>
  <owl:onProperty rdf:resource="#mpeg7:width"/>
  <owl:allValueFrom rdf:datatype="#xsd:integer"/>
</mvce:Content>
......
<mvce:Device rdf:ID="PDA"/>
  <owl:onProperty rdf:resource="#prf:CPU"/>
  <owl:allValueFrom rdf:datatype="#xsd:string"/>
  <owl:onProperty rdf:resource="#prf:ImageCapable"/>
  <owl:allValueFrom rdf:datatype="#xsd:boolean"/>
  <owl:onProperty rdf:resource="#mpeg7:ScreenSize"/>
  <owl:allValueFrom rdf:datatype="#prf:Dimension"/>
</mvce:device>
......
```

- `<rdf:RDF>`
Adaptation Manager: CP

- Receive PDE request
- Get PDE context
- Identify and get content/service context
- Get adaptation operation context
- Create/Add to adaptation context ontology
- Send feedback to PDE e.g. not authorised
Adaptation Manager: CR

- Analyse and validate the context
- Check consistency of context
- Deduce more knowledge about the adaptation environment
- Maintain adaptation context ontology
Adaptation Manager: ADE

- Choose the content version
- Decide the content output format
- Generate initial adaptation plan
- Hand the plan to CA
- Notify PDE e.g. not adaptable
Content Adaptor

- Adaptation Process
  - Realization of Adaptation Manager’s decisions

- Adaptation Operation
  - Intermediate steps that constitute an Adaptation Process

- Adaptation Mechanism (ADME)
  - Practical Implementations that perform single Adaptation Operations

- An ADME can be available at:
  - PDE Devices
  - Content Server
  - Third-Party Adaptation Service Providers
Content Adaptor

- Translate Adaptation Decisions into specific Adaptation Operations
- Optimally select the appropriate ADMEs
- Carry out the Adaptation Process
- Manage ADME profiles, e.g. OWL-S, SA-WSDL
Dispatcher

- AMF Service advertisement to PDE
- Negotiate communication streams between PDE, AMF and C/S Provider
- Routing of service requests to AMF and responses to PDE
- Load-balancing of AMFs and PDE devices
- Efficient interaction mechanism between heterogeneous entities
- Interface with legacy protocols/systems
Data Flow

Adaptation Manager

PDE

CP

CR

ADE

CA

ADME

C/S Provider

Content Request

PDE’s Context

Content’s Context

Formatted Context

Refined Context

Adaptation Plan

Adaptation Request

Content

Adaptation Response

Content Response
Summary

- The Adaptation Management Framework
- Knowledge-based approach
- Distributed across network
- Management for Adaptation Mechanism
Thank you!