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Rules for an ontology-based approach to adaptation

Tran Thanh, AIFB, University Karlsruhe

Structure

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- Overview on ontology-based approach
- ODAS ontology
- **Adaptation Rules**
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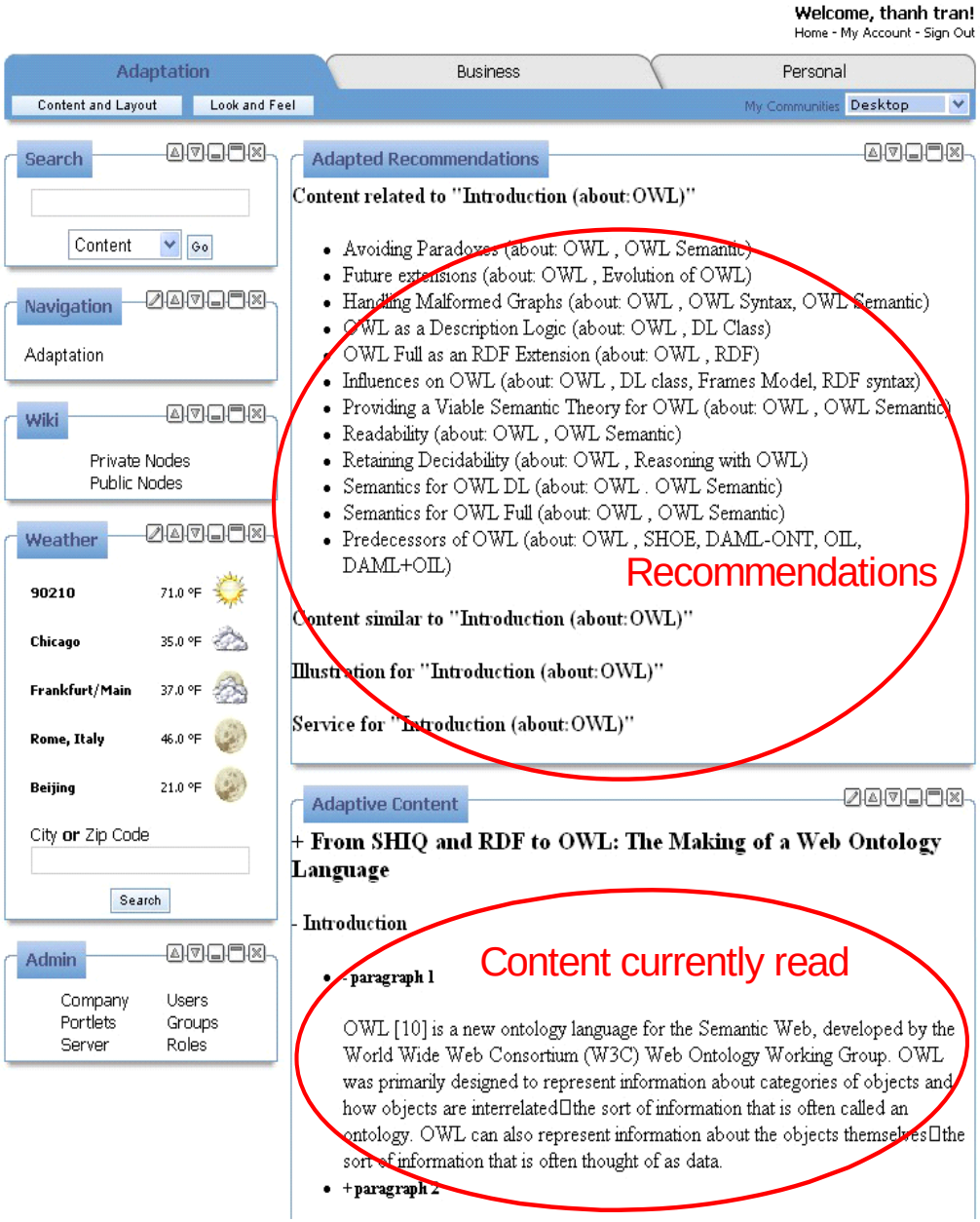
  - **Examples**
- Summary

Motivation



- Increasing amount of avialable resources on the Web as well as enterprise portal
- [Nielson]
  - "Cognitive Overload"
  - "Lost in information space"
- Personalized information delivery !!
  - Push + Pull
  - Adaptation + Search

"*…adapting the delivery of content resources of any imaginable types to the needs of the user in terms of the **presentation** of the content, the **structure** of the **content** and the content itself*"

Adaptation Approaches

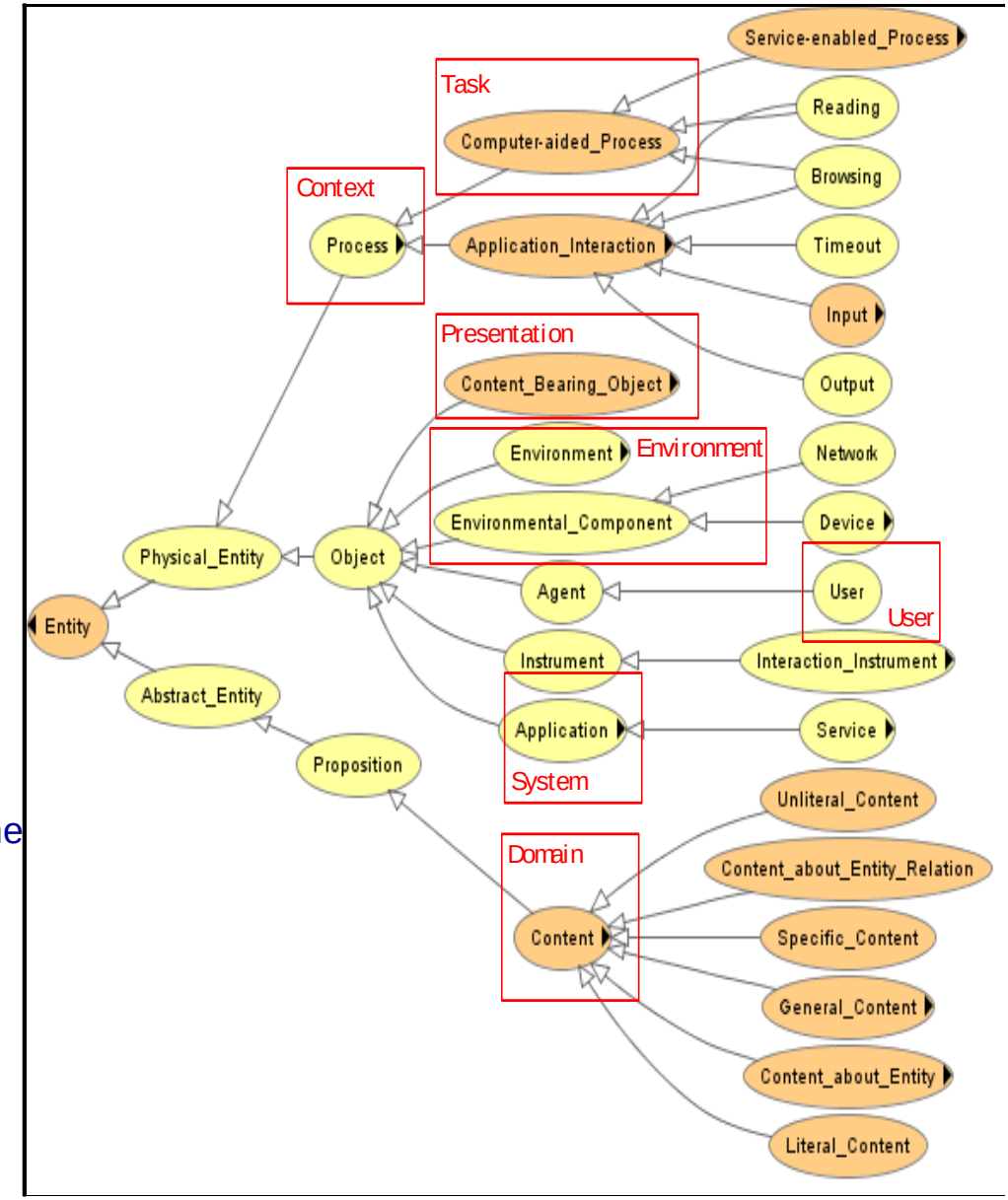
- Filtering-based approaches
  - Content-based filtering → model bases on **content** ratings of the user
  - Collaborative Filtering → model bases on similar **user**s and their ratings
  - Drawbacks:
    - Objective characteristics (group-based preferences) vs. subjectivity (individuality)
    - “Overspecialization”, “Sparsity” and “New Item” problem
- Advanced approaches
  - Content + User: combined the two complementary dimensions
  - Add more information sources such as **task**, **system**, **environment**
  - **Presentation** model for adapted presentation
- Drawbacks
  - “**Lack of data**”
    - model data can only be acquired in specialized systems
  - “**black boxes**”
    - Underlying algorithm too complex
    - Computerized oracles which give advice but cannot be questioned

An Ontology-based approach to adaptation

- "Black box" → **transparent** adaptive behaviour
  - **Framework for rules** that can capture the underlying rationales
  - Simpler to understand, can be inspected and modified by the user
  - Enable feedback loops and increase trust
- "Lack of data" → **interoperability** of model information
  - exchange of model information across systems on the basis of an standardized **domain ontology for adaptive systems**
- Multidimensional
  - Ontology **concepts** employed for the representation of the different dimensions required for **sophisticated personalization**
    - Task + Content + Presentation + User + System + Environment

ODAS – ontology for the domain of adaptive systems

- ODAS – "*a documented and formalized conceptualization of objects and relations that are relevant for the adaptation of hypermedia resources to the user context*"
- **interoperability**
  - Alignment with foundational ontology for cross domain interoperability
  - Alignment with related ontology and metadata standard for the interoperability of particular subparts
    - User → PAPI, LIP
    - Content → Dublin Core, LOM
- **extensibility**
  - Clarity:
    - documentations and formalization of the intended meaning to avoid conceptual ambiguity
  - Minimal ontological commitment
  - Minimal encoding biases



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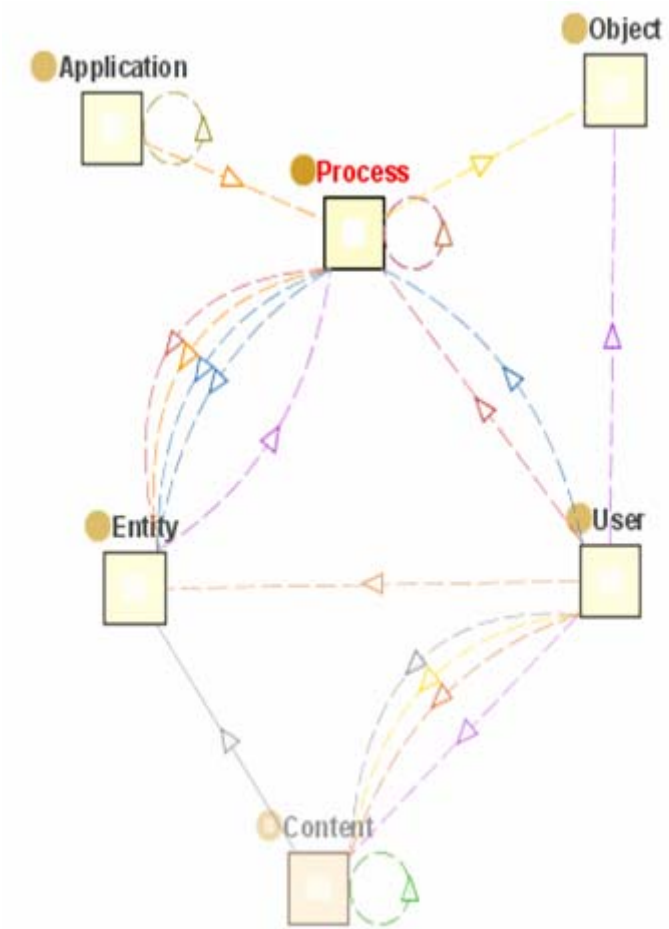
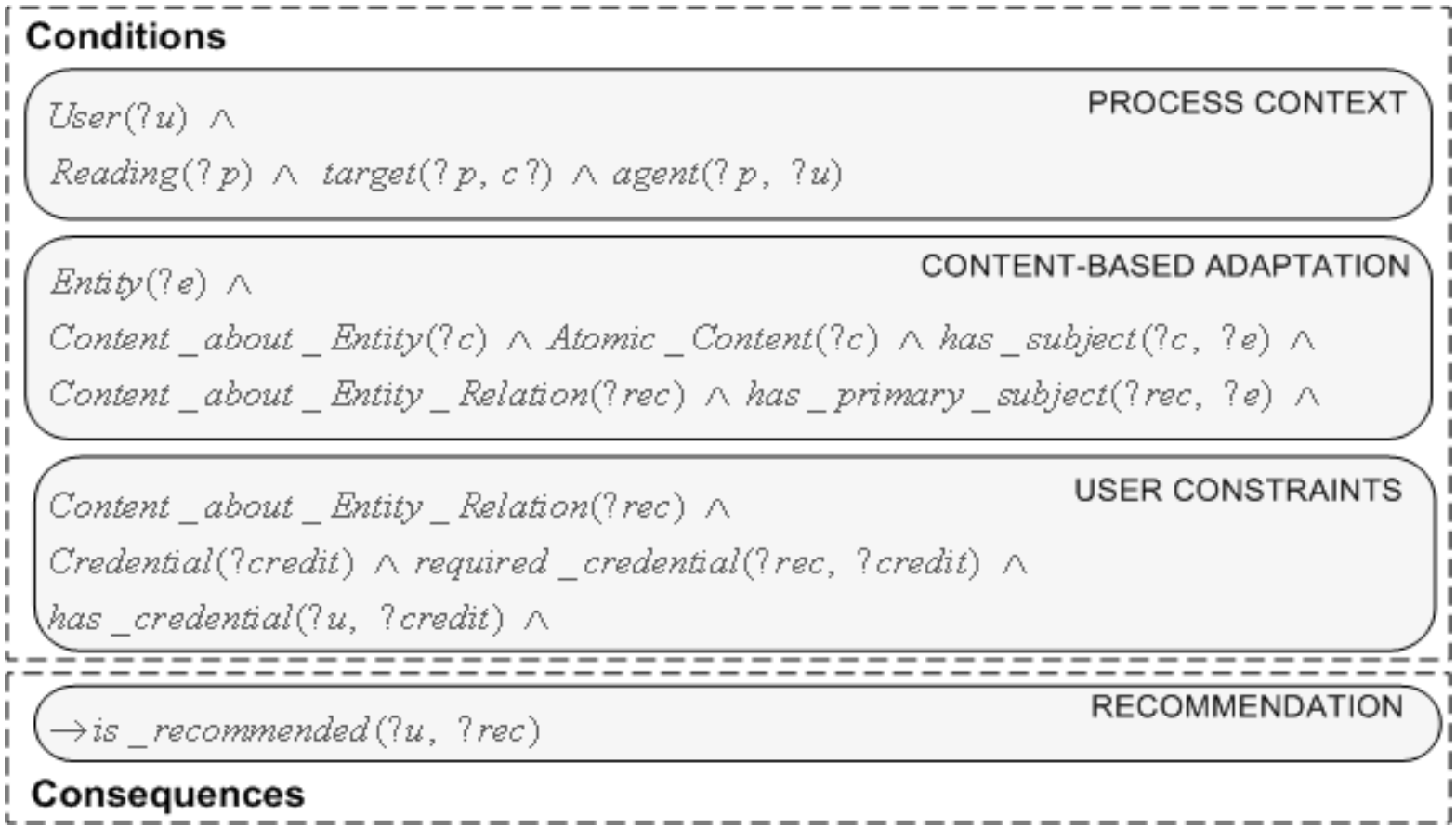
ODAS - A process representation of context

- **Context:** `Application Interaction`
  - Representation of the adaptation context
  - Intuitive notion: "*by means of some input devices part of the **environment**, the **user** interacts with the **application** that in turn, processes and presents the **resources** to the user via a display device to accomplish a **task***"
- **Task:** `Computer-Aided Process`
  - Notion: "*a task can be modeled as a complex process and interpreted as a **sequences (hierarchy) of processes** – either atomic application interactions or more complex ones called computer-aided process*"
- **Computation / Inferences**
  - New information from recorded user interactions
  - `Reading: Activation + Timeout`
  - `Has read: user involve in reading`



Adaptation rules – exploitation of ODAS conceptualization

- **Context-related** part: “entry point” to access various model dimensions
- **Adaptation-related** part: content- or task-based adaptation
- **Constraints-related** part: adapt the set of recommended resources to user and environmental constraints



Adaptation rules – examples

- Narrative-based adaptation

$$\forall u, x, y, \ldots : [\text{"context"} \wedge \text{AtomicContent}(x) \wedge \text{AtomicContent}(y) \wedge \text{isPostOf}(x, y) \wedge \text{"constraints"} \rightarrow \text{isRecommended}(u, y)]$$

- Task-based adaptation

$$\forall p, p1, p2, s, c \ldots : [\text{ApplicationInteraction}(p1) \wedge \text{User}(u) \wedge \text{isInvolvedIn}(u, p1) \wedge \text{ComputerAidedProcess}(p) \wedge \text{isPartOf}(p1, p) \wedge \text{ApplicationInteraction}(p2) \wedge \text{isPostProcess}(p2, p1) \wedge \text{Service}(s) \wedge \text{instrument}(p2, s) \wedge \text{ExecutableContent}(?c) \wedge \text{isRepresentationOf}(?e?s) \wedge \text{"constraints"} \rightarrow \text{isRecommended}(u, c)]$$

- User constraints

$$\forall u, y, \ldots : [\text{"context"} \wedge \text{"adaptation"} \wedge \text{Content}(y) \wedge \text{User}(u) \wedge \text{interestIn}(u, y) \wedge \neg \text{knows}(u, y) \rightarrow \text{isRecommended}(u, y)]$$

Summary

- Address drawbacks by
  - ODAS ontology to capture relevant model dimensions
  - Structure and content and examples of adaptation rules
- Benefits
  - **Sophisticated personalization**
  - Increase **transparency, user-control and trust** towards the system
  - Facilitate **exchange of information**
    - User data
    - Content metadata
    - Adaptation rationales
  - Pave way for **open-corpus adaptation**
    - interoperability of content semantics
    - Automated syndication and inclusion of resources in a dynamic and ad-hoc way
    - Require integration of domain ontologies
- Problems
  - tradeoff of semantic interoperability and efficiency of DL reasoning
    - Axiomatized ontology for interoperability
    - Lightweight ontology for adaptation

THANK YOU