AVATAR: An Advanced Multi-Agent Recommender System of Personalized TV Contents by Semantic Reasoning

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Motivation of TV Recommender Systems

- Migration from analogue to digital TV.
- Implications:
  - More channels in the same bandwidth.
  - Software applications mixed with audiovisual contents.

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- Implications:
  - More channels in the same bandwidth.
  - Software applications mixed with audiovisual contents.
- Disoriented users among large amount of irrelevant information.
  - User cannot use this new type of TV efficiently.
  - Necessary tools to find interesting TV programs

Related Work

- Different approaches in the field of TV personalization tools:
  - Bayesian techniques
  - Decision trees
  - Content-based methods
  - Collaborative filtering
  - ...

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- Different approaches in the field of TV personalization tools:
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  - Collaborative filtering
  - ...
- A common base: **limitation in reasoning capabilities**.
  - Mechanisms to represent the knowledge of TV domain are not used in previous proposals.
  - Reasoning process allows to obtain enhaced recommendations.

AVATAR: Main Design Decisions (I)

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- Semantic reasoning about user preferences and TV contents. Key elements are:
  - **TV-Anytime** specification for:
    - Generic descriptions of TV programs: title, genre, set of keywords, etc.
    - User preferences
    - User viewing history
  - Knowledge about TV domain provided by an **OWL ontology**.

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  - MHP applications tuned in user's receiver (Set-Top Box or STB).
- MHP applications run in the context of a service or event.
  - Problem: All user actions must be recorded all the time: **local agent** to watch the viewer behaviour.
  - Local agent stores feedback information.
  - Normalized access by TV-Anytime MHP API.

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- A modular architecture based on multiple agents.
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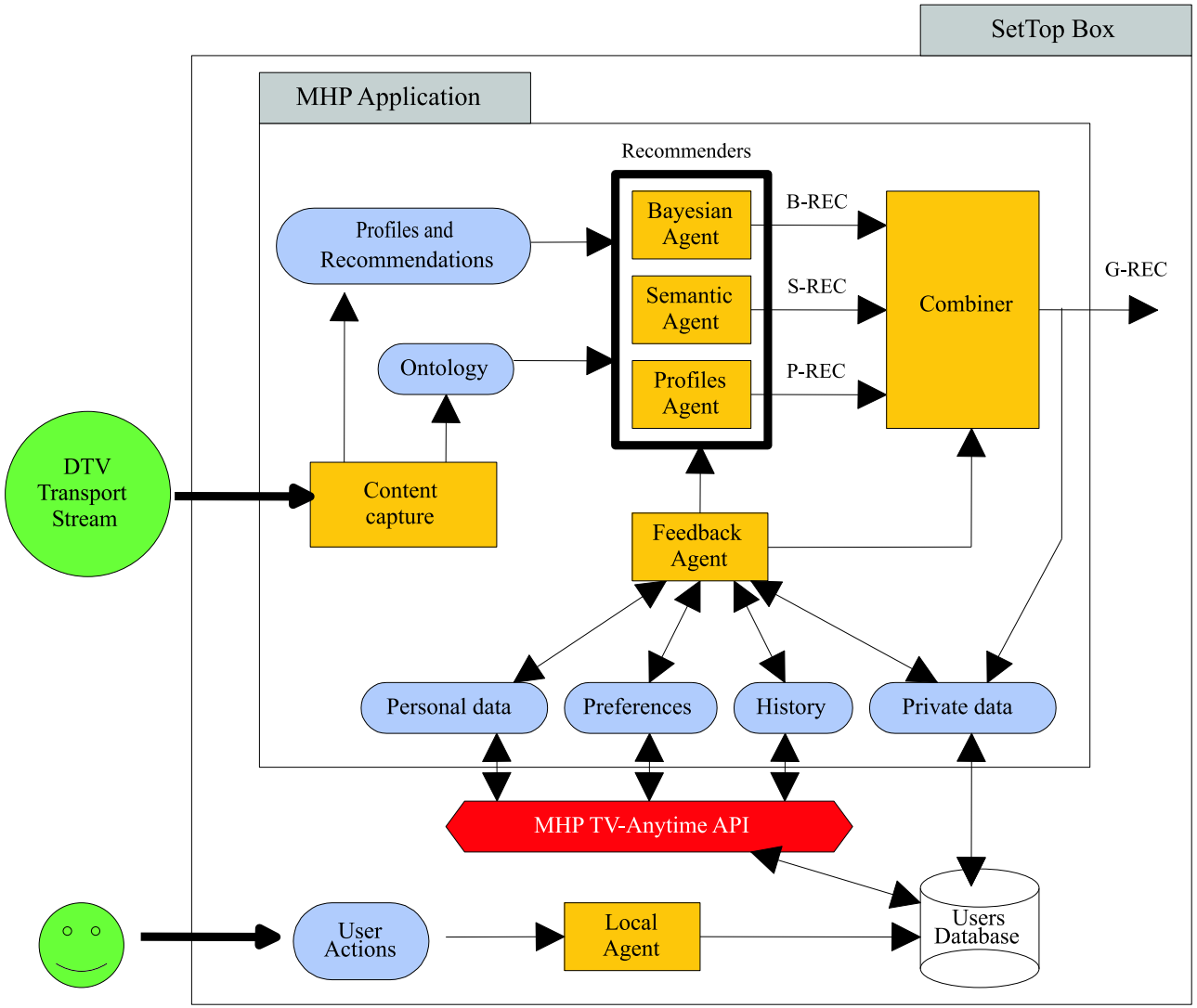
- Local software of user's STB
- MHP applications $\Rightarrow$ recommendation service
  - Capture and classifications of received information
  - Recommenders:
    - Bayesian agents
    - Agents based on profiles matching
    - Semantic agents
  - Feedback system

AVATAR: The Architecture (II)



The AVATAR contributions (I)

- **Semantic Web**:
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- **AVATAR** uses Semantic Web technologies:
  - Goal is to discover semantic relations among TV programs leading to enhanced recommendations.
  - Main needs are:
    - Metainformation
    - Tools to explore the hierarchy of classes and properties defined in the OWL ontology

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- There exist classical tools in the domain of Description Logics $\Rightarrow$ **RACER**
- **RACER** is a Semantic Web inference engine to explore the knowledge base.

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- There exist classical tools in the domain of Description Logics $\Rightarrow$ **RACER**
- **RACER** is a Semantic Web inference engine to explore the knowledge base.
- We propose the query language **LIKO** based on RACER
  - Goal: Infer knowledge from OWL ontology to define semantic relations between programs of interest for the user and other TV contents.

The LIKO language (I)

- Extraction operations:
  - Related to an input class
    - Subclasses (Operator $\triangleright$)
    - Superclasses (Operator $\triangleleft$)
  - Related to an input property
    - Subproperties (Operator $>>$)
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  - Related to an input property
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    - Superproperties (Operator $<<$)
  - Related to input instances or *Datatype* properties
    - Properties where the input argument appears as domain (Operator $>\Rightarrow$)
    - Properties where the input argument appears as range (Operator $>\Leftarrow$)

The LIKO language (II)

- Inference operations:
  - They are implemented by previous query operators.
  - *Infer knowledge* from the properties defined in the OWL ontology
    - Transitive properties (Operator $>\odot$)
    - Functional properties (Operator $>\oplus$)
    - Inverse properties (Operator $>\ominus$)
    - Symmetric properties (Operator $>\hookleftarrow$)

Conclusions

- The semantic reasoning allows to obtain an intelligent recommender
- **AVATAR**:
  - is able to understand the TV domain knowledge organized in an OWL ontology.
  - suggests in an autonomous way enhanced and higher quality recommendations.
  - goes beyond the conventional syntactic content search of previous approaches.

Further Work

- We are working on a semantic reasoning framework:
  - Application of the $\mathcal{ALC}(\mathcal{D})$ Description Logic in user profiles.
  - Classification of semantic relations among TV programs.
  - Inference algorithms to reason on the OWL ontology by the LIKO language.
  - Ranking mechanisms to order the inferred relations according to their semantic relevance.

Thank you for your attention