Integrating Semantic Web technology in an Annotation-based Hypervideo System

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Structure of the talk

• What is Advene
  – the Advene model
  – the Advene tool

• Putting OWL in Advene
  – OWL views
  – OWL queries

• Using inference in Hypervideos
What is Advene

• Annotation-based model and authoring tool for Hypervideos

• Given a video augmented with an annotation structure,
  a Hypervideo is a view that
  – uses information from both the video and the annotation structure, and
  – gives access to the temporality of the video
The Advene annotation model (1)
The Advene annotation model (1)

Annotations

Relations

Annotation types

Relation types

Person: jpeg

Part of speech : text

Knows: (Person,Person)
The Advene annotation model (1)

Annotations

Relations

Annotation types

Relation types

Schema

Person: jpeg  Part of speech: text

Knows: (Person, Person)
The Advene annotation model (2)

[Diagram showing a video timeline with 't' on the right side, and boxes for 'Annotations', 'Relations', and 'Schemas' within a 'Package' block]
• Queries select a subset of the elements of the package
The Advene annotation model (2)

- Views render the result of queries with information from the video into hypervideos

Diagram:
- Video
- Annotations
- Relations
- Schemas
- Queries
- Views
- Hypervideo (XHTML, SMIL, ...)

Package
The Advene tool

- Open-source prototype: http://liris.cnrs.fr/advene
- Reuse of existing components (VLC, Template Attribute Language, HTTP...)
- Test-bed for experimentation on video and hypervideo uses
The Advene tool – structure

package

core

GUI + VLC

HTTP server

The different parts of the speech:
- False start (Details)
- Salutations and flattery to the investor
- Dummy assistants of today (Details)
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OWL in Advene – Goal

- Benefit from OWL inferences in Advene
  - expose Advene structure in OWL
    → OWL views
  - reason with the resulting OWL description
    → OWL queries
  - use the result of the reasoning in Advene
• Advene structures can be straightforwardly translated into OWL by a generic view, according to an OWL ontology of the Advene annotation model.
• *Ad-hoc* translations may be preferred for some schemas
  - more adapted representation of instances
  - more structure and integrity constraints
Some schemas can be designed from an existing ontology, and be accompanied with views to convert annotations back to OWL.

- Advene as a front-end tool for semantic annotations.
OWL in Advene queries (1)

• Several kinds of queries for OWL
  - T-Box services (satisfiability, subsumption...)
  - A-Box services
    (consistency, all instances of a class, properties of an instance...)

• We focus on A-Box services:
  reasoning about the annotations and relations
OWL in Advene queries (2)
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OWL in Advene – running example

• FOAF Schema based on the FOAF ontology

• Annotation types
  (contain foaf attributes)
  - Person
  - Group
  - Project

• Relation types
  - knows
  - member
  - currentProject
Using consistency checking for integrity constraints

- OWL enables the expression of complex integrity constraints
  - restrictions, set operators...

- Annotations structures are valid if their OWL translation is consistent

- In the case of inconsistency, inference engines even provide an explanation of its cause
  - not really usable by end users
Using consistency checking for integrity constraints – example (1)

Annotations

Relations

Annotation types

Relation types

Foaf schema

Group  Project  Person

member  knows
Using consistency checking for integrity constraints – example (2)

- Only Agents (Person, Group) can be members of a group

- Classes Project and Agent are disjoint (not really in foaf)

- Hence annotation “ZigZag Project” is inconsistent
Using classification for integrity constraints (reporting)

- As an alternative, the ontology can accept invalid annotations/relations, but classify them in specific “invalid” class(es)

- This allows for higher level explanation for “inconsistency”, suitable for end-users
Using classification for integrity constraints – example

- Only Agents (Person, Group) can be member of a group

- Class Invalid is a subclass of the intersection of classes Project and Agent (replaces all disjunction axioms)

- hence annotation “ZigZag Project” is an instance of Invalid
Using inference for advising additions

• Inference can be used to provide some advices to the annotator to improve the annotation structure

• For example
  – making explicit some inferred relations
  – changing the type of an annotation
  – adding information in an annotation content
  – ...

Using inference for advising additions – example (1)

Annotations

Relations

Annotation types

Relation types

Foaf schema
Using inference for advising additions – example (2)

• In the content of annotations
  - it is known that Ted Nelson knows someone whose homepage is http://www.ecs.soton.ac.uk/~wh/
  - it is known that Wendy Hall has homepage http://www.ecs.soton.ac.uk/~wh/

• From the ontology, homepage is an inverse functional annotation

• Hence Ted Nelson knows Wendy Hall
Using inference for advising additions – example (3)
Using inference in end-user views

Consistency

Consistent: No

Reason: Individual http://mirg.cnrs.fr/advene/packages/nelson-sw/unstable/index.xml#a505 is forced to belong to class http://xmlns.com/foaf/0.1/Agent and its complement

Report

The following are inconsistent with the ontology. Check the relations.

- a505 (type Project)
  - currentProject of a502 (type Person)
  - member of a504 (type Group)

Advice

Ted Nelson knows

- Cathy Marshall
- Wendy Hall

Add this relation

Paul de Bra knows

- Ted Nelson
Conclusion (1)

• Advene: model and tool for video annotation
  − simple working model
  − available opensource prototype
    http://liris.cnrs.fr/advene
  − test-bed for novel uses of videos and hypervideos

• Semantic Web technologies smoothly integrate into Advene
  − despite (thanks to?) the simplicity of the underlying model w.r.t. the OWL model
  − demonstrated on a real ontology
Conclusion (2)

- Benefits for the multi-media community: brings the computational power of OWL inference to hypervideo generation

- Benefits for the Semantic Web community: bridges the gap between semantic models and audiovisual document models, without requiring the existence of a complete and commonly agreed ontology of audiovisual descriptors
Thank you for your attention any questions?
• Advene: to be added to something or become a part of it, though not essential (Webster 1913)
The Advene tool – relevant features

• Implementation of queries: simple list of conditions chosen from a pre-defined list (similar to filters in an e-mail application)

• Implementation of views: TAL (Template Attribute Language) special attributes in a valid XML document are processed to alter its content
OWL in Advene queries – structure

- Package
- Core
  - Result as a set of Advene items
- HTTP server
- Pellet adapter
  - Result as a set of URIs
- Pellet
  - OWL views
  - SPARQL queries