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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

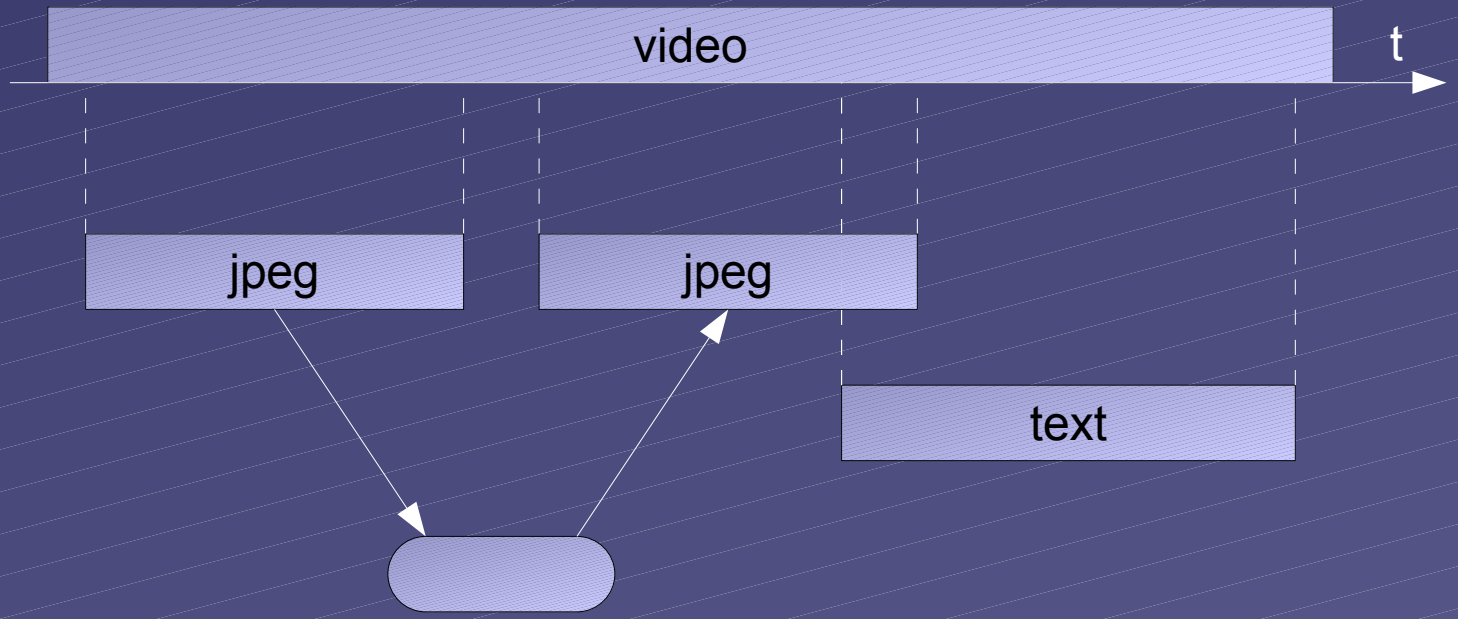
What is Advene

- 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

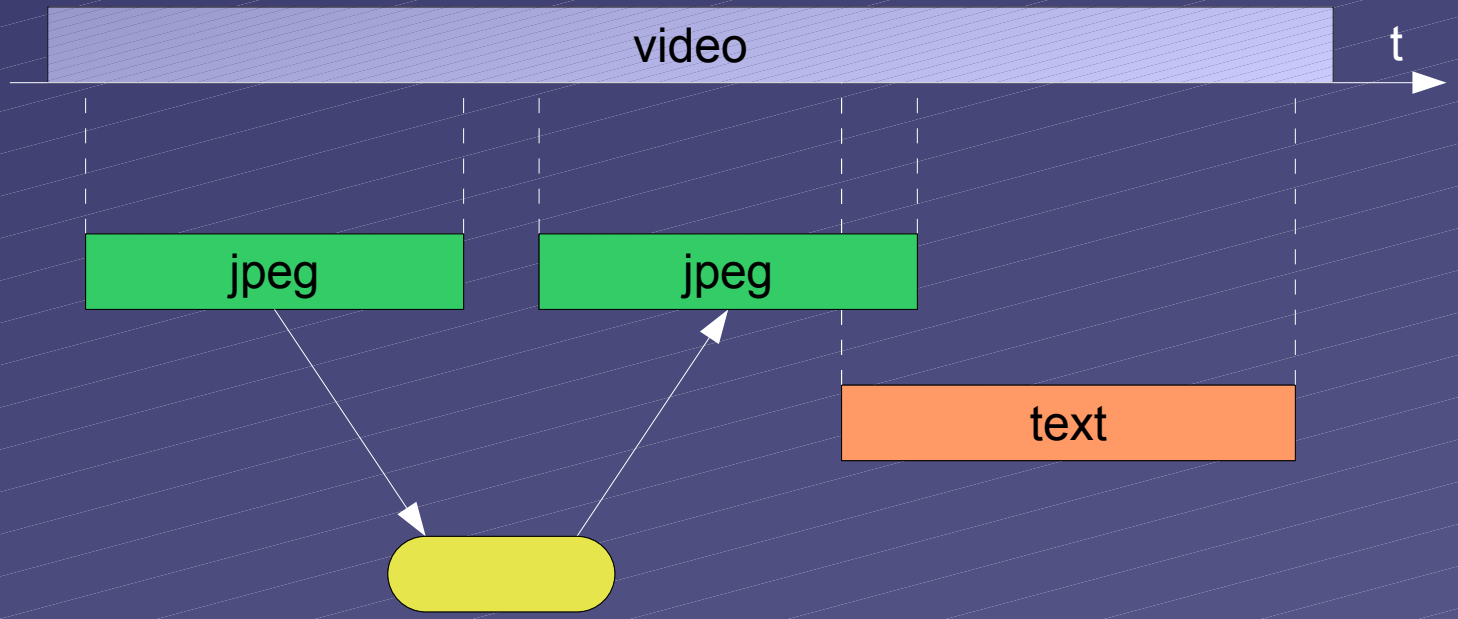
The Advene annotation model (1)

Annotations

Relations



The Advene annotation model (1)



Annotations

Relations

Annotation types

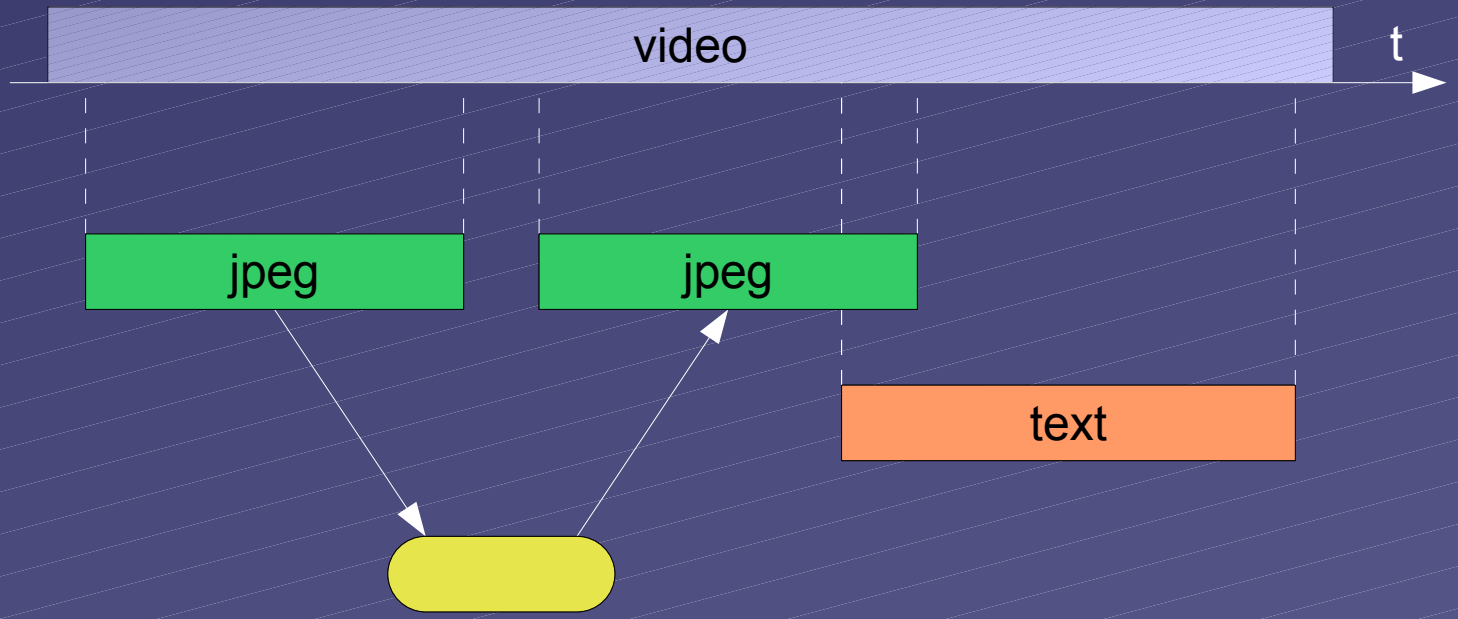
Person: jpeg

Part of speech : text

Relation types

Knows: (Person,Person)

The Advene annotation model (1)



Annotations

Relations

Annotation types

Person: jpeg

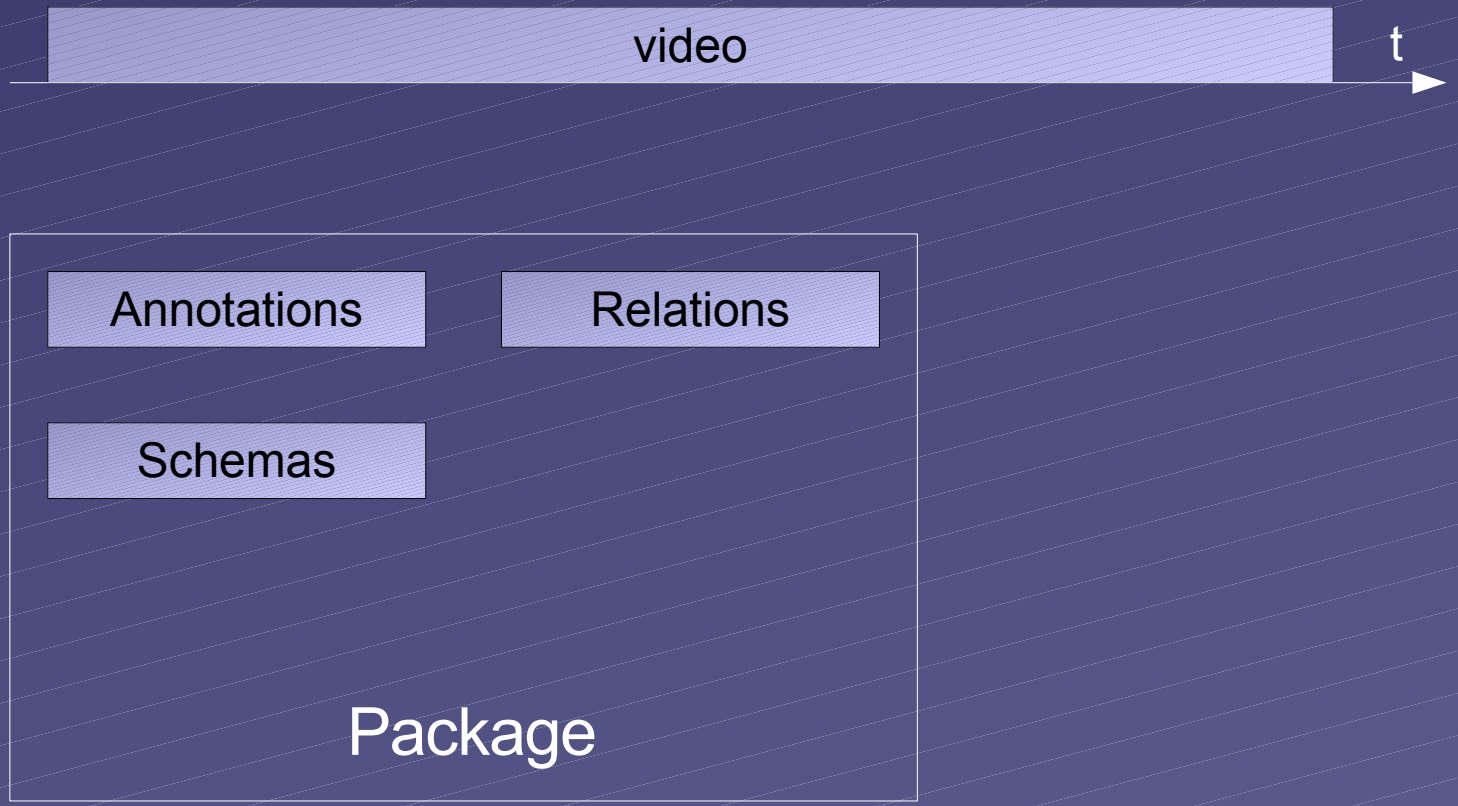
Part of speech : text

Schema

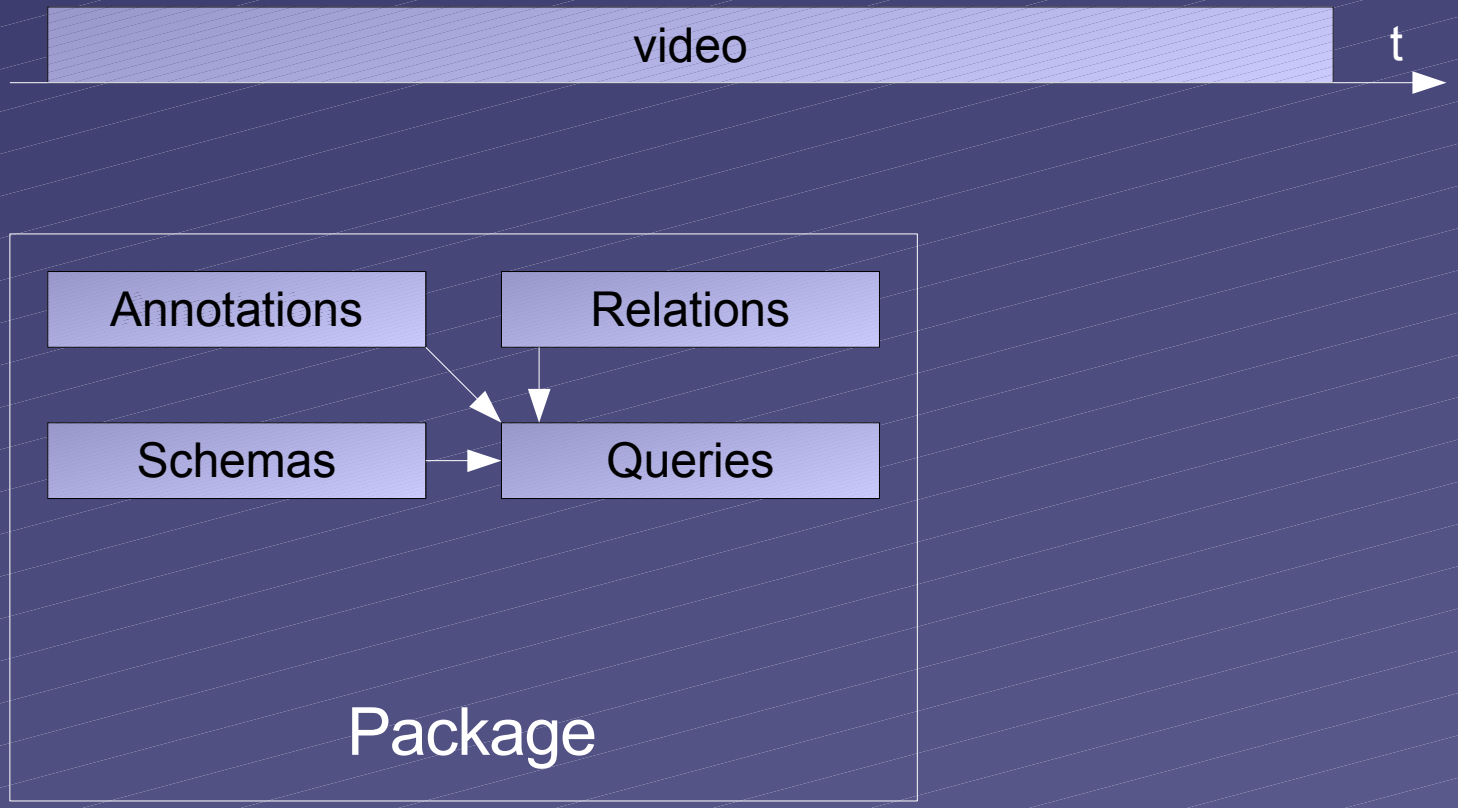
Relation types

Knows: (Person,Person)

The Advene annotation model (2)

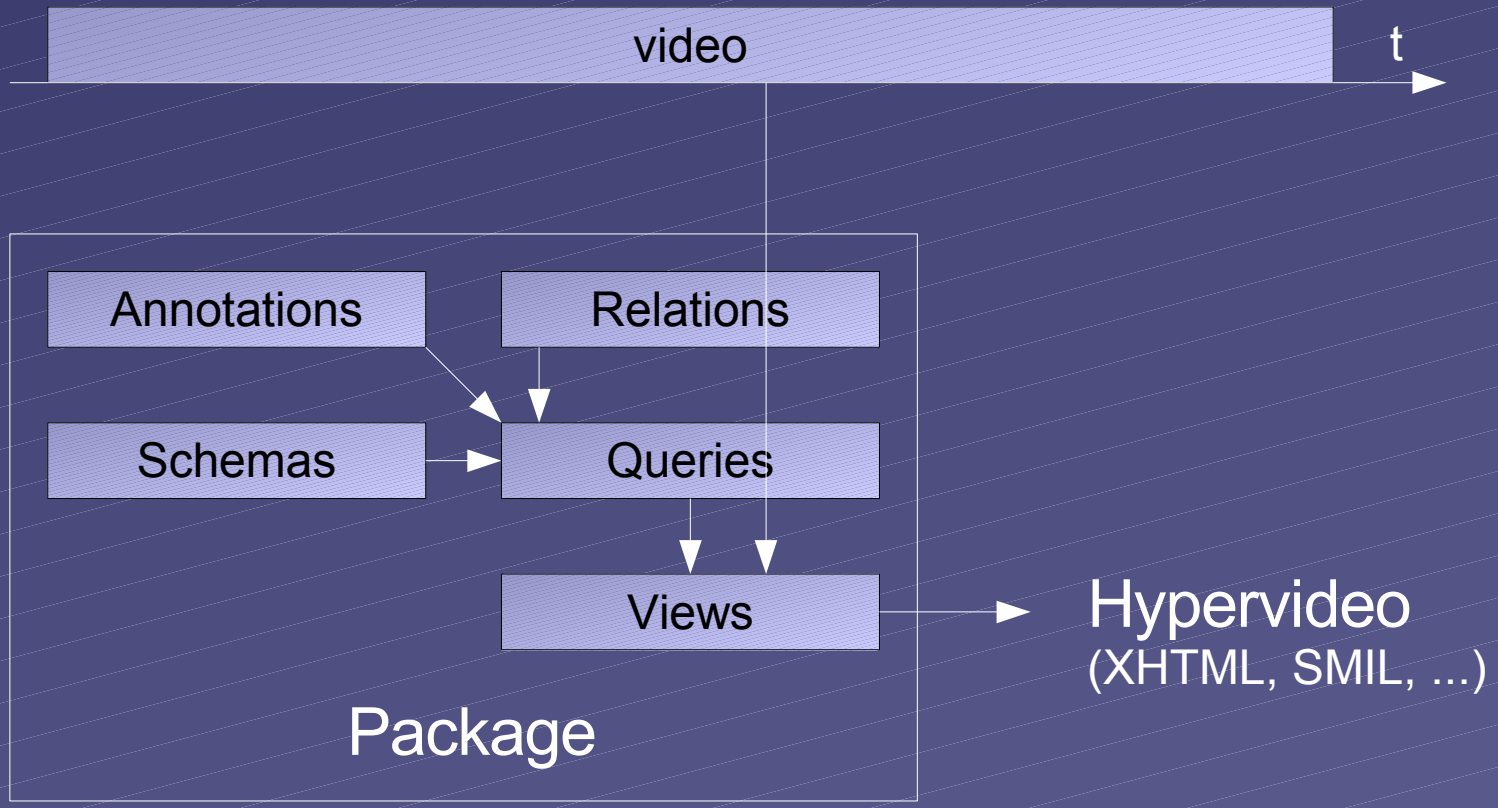


The Advene annotation model (2)



- Queries select a subset of the elements of the package

The Advene annotation model (2)

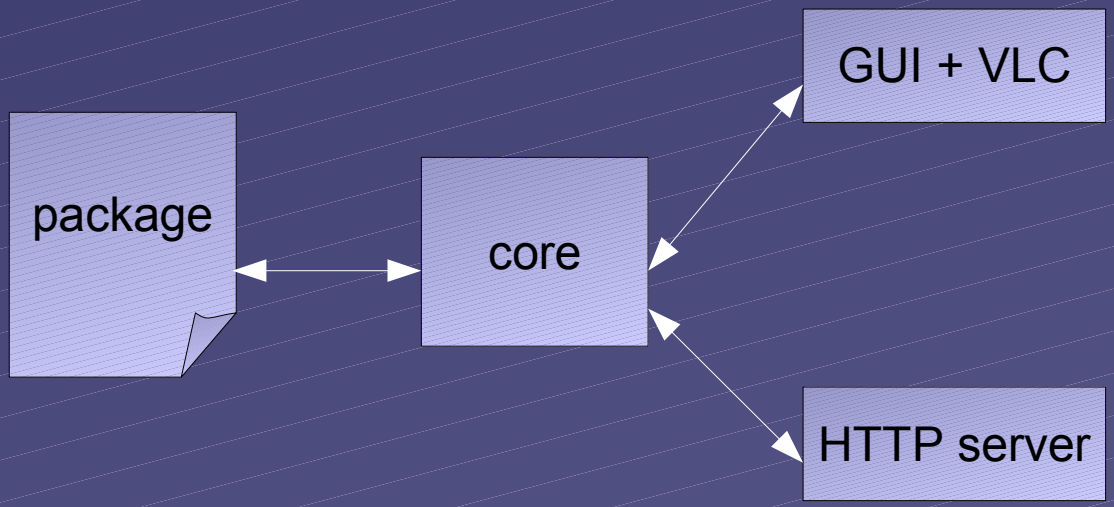


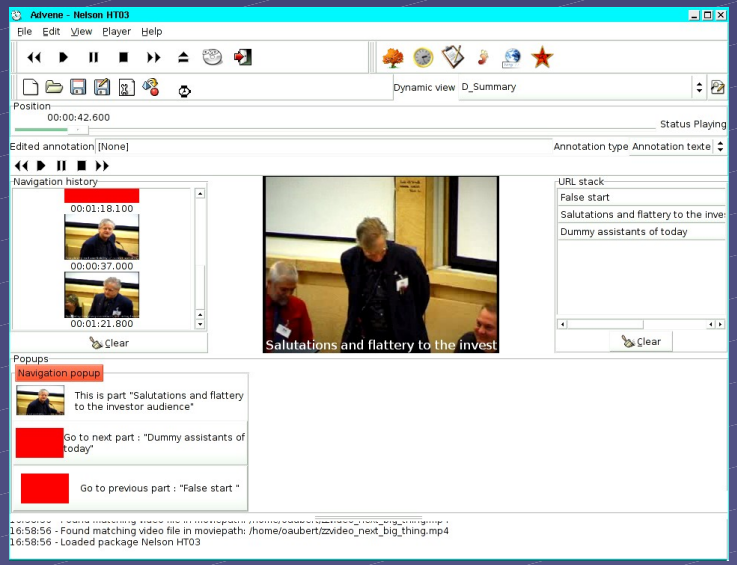
- Views render the result of queries with information from the video into hypervideos

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





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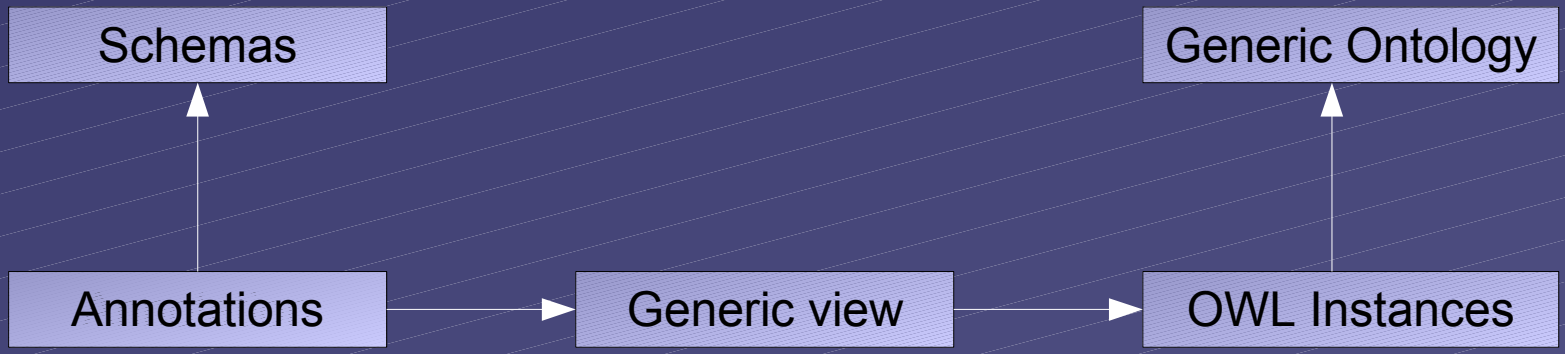
OWL in Advene – Goal

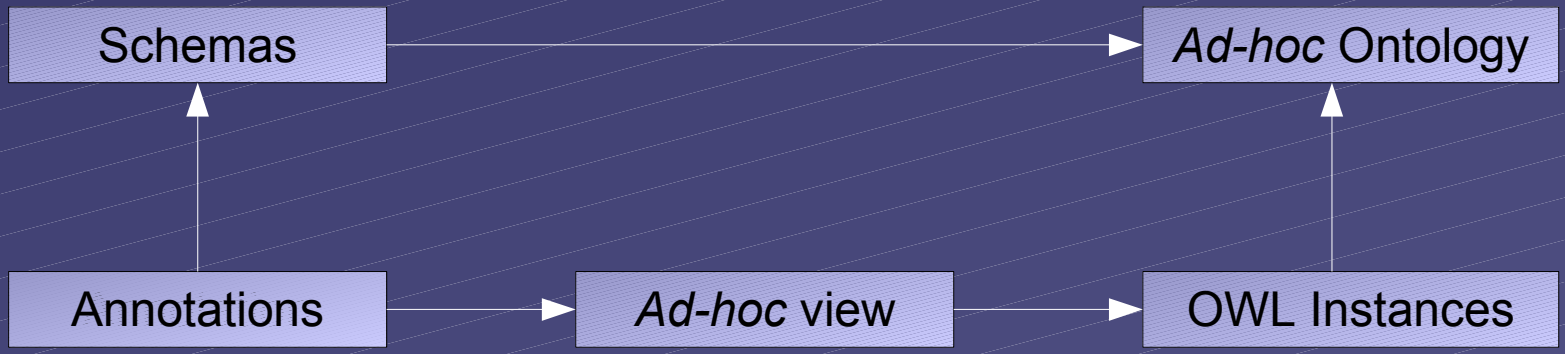
- Benefit from OWL inferences in Advene
  - expose Advene structure in OWL
    → OWL views
  - reason with the resulting OWL description
    → OWL queries
  - use the result of the reasoning in Advene

OWL in Advene views (1)



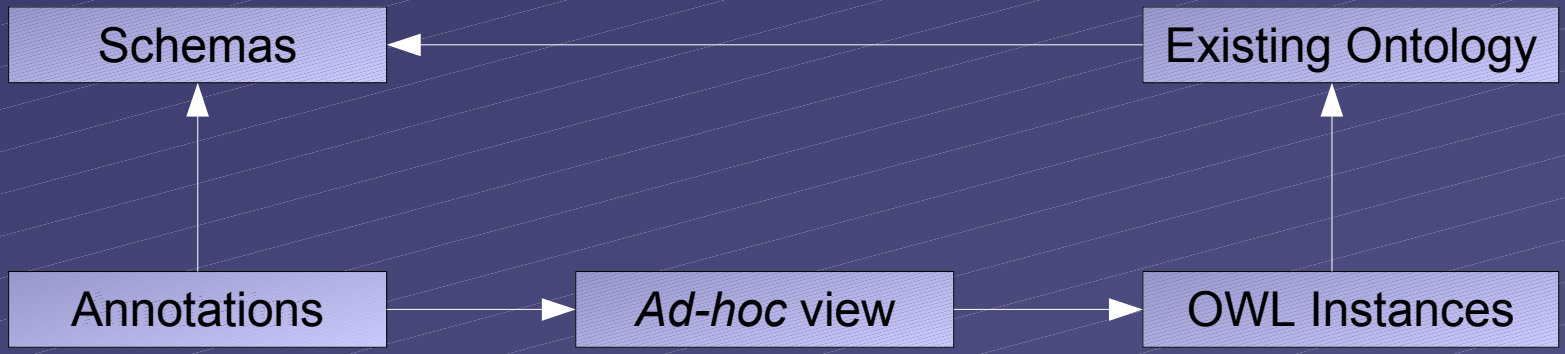
- Advene structures can be straightforwardly translated into OWL by a generic view, according to an OWL ontology of the Advene annotation model

OWL in Advene views (2)



- *Ad-hoc* translations may be preferred for some schemas
  - more adapted representation of instances
  - more structure and integrity constraints

OWL in Advene views (3)

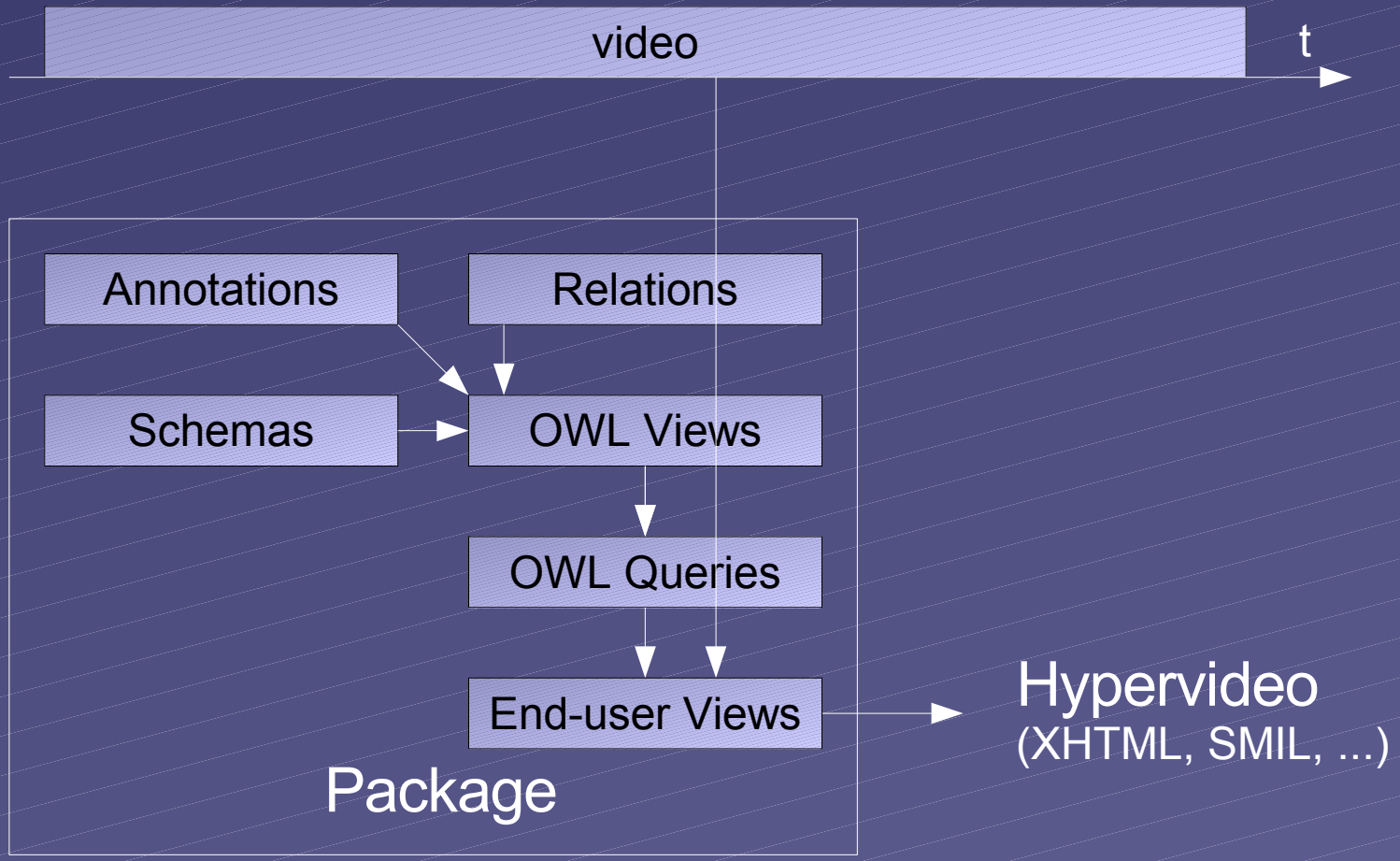


- Some schemas can be designed from an existing ontology, and be accompanied with views to convert annotations back to OWL
  - Advene as a front-end tool for semantic annotations

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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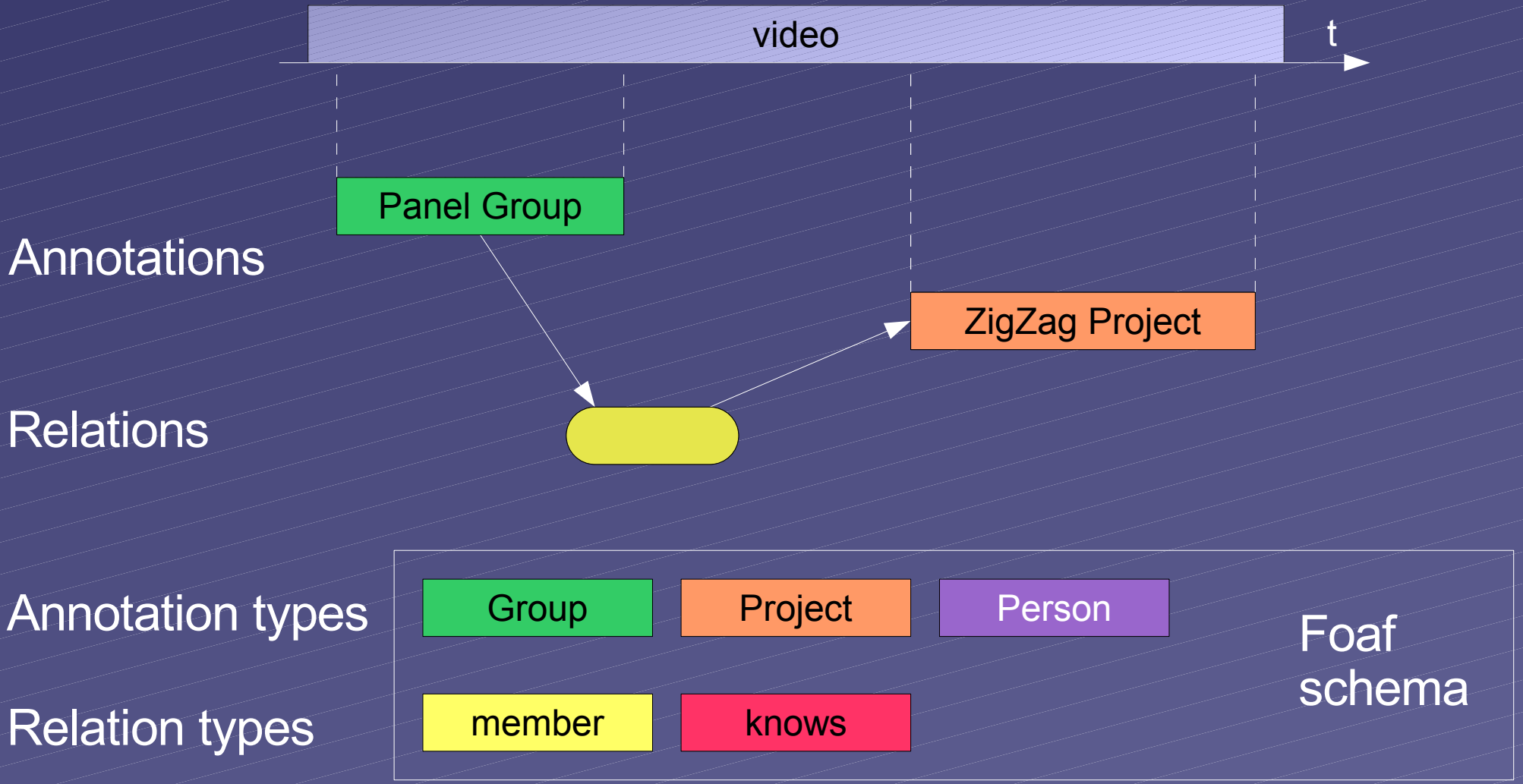
OWL in Advene – running example

- 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)



Using consistency checking for integrity constraints – example (2)

- Only Agents (Person, Group) can be member 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

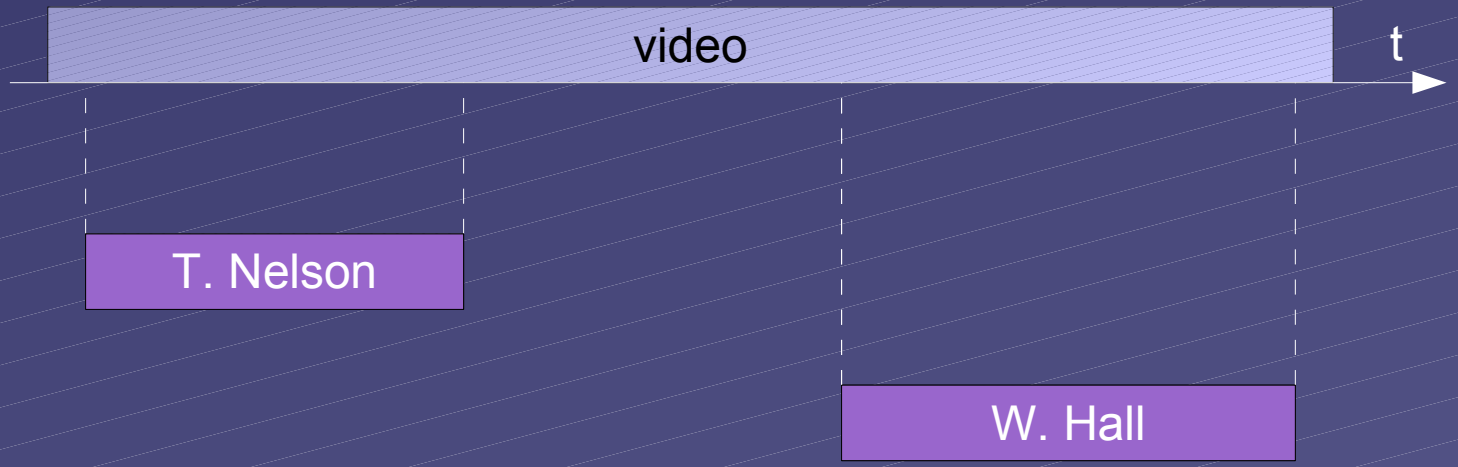
- Only Agents (Person, Group) can be member of a group
- Class Invalid is a subclass of the intersection of classes Project and Agent
  (replaces all disjunction axioms)
- hence annotation “ZigZag Project” is an instance of Invalid

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 infered relations
  - changing the type of an annotation
  - adding information in an annotation content
  - ...

Using inference for advising additions – example (1)

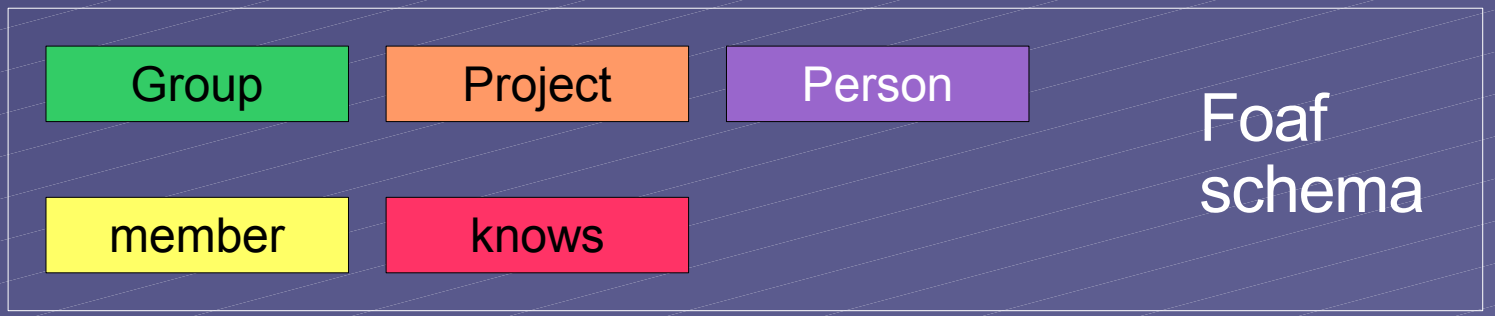


Annotations

Relations

Annotation types

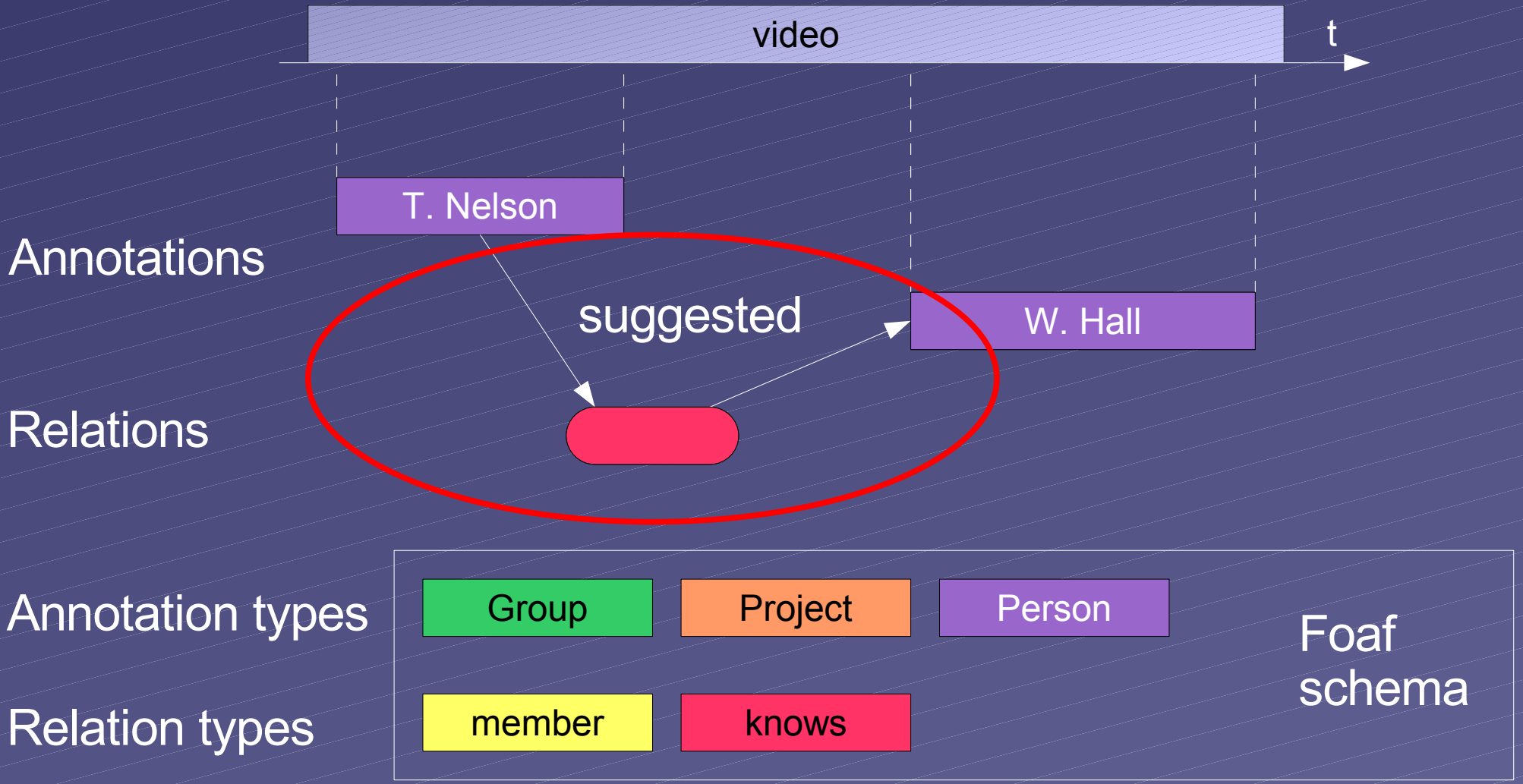
Relation types



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://liris.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 an 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