

A User Interface Adaptation Architecture for Rich Internet Applications ESWC 2008



SYSTEMATIC THOUGHT LEADERSHIP FOR INNOVATIVE BUSINESS

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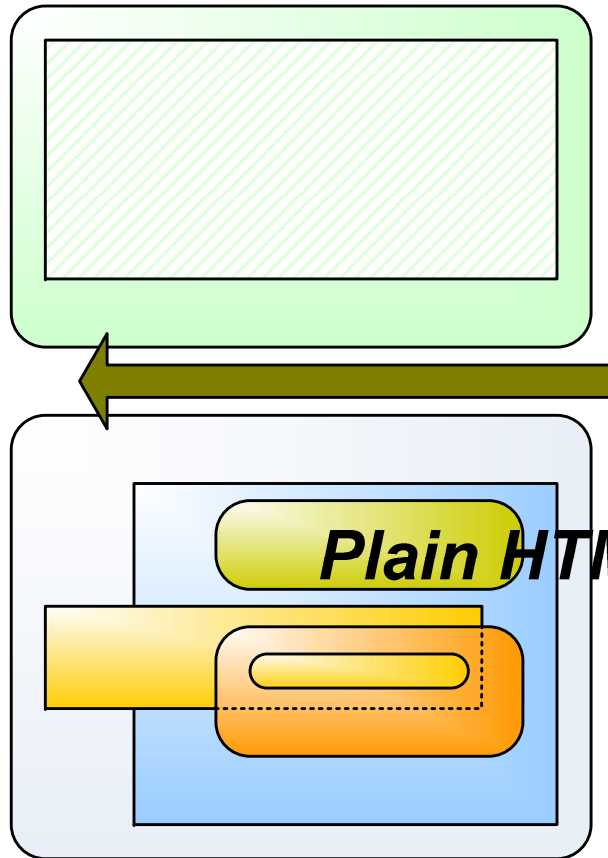
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Agenda



- 1. The Evolution of Rule-based Web Applications**
2. The Adaptation Framework
3. Evaluation and Conclusions

From Server- to Client-side Adaptive Hypermedia Systems (AHSs)

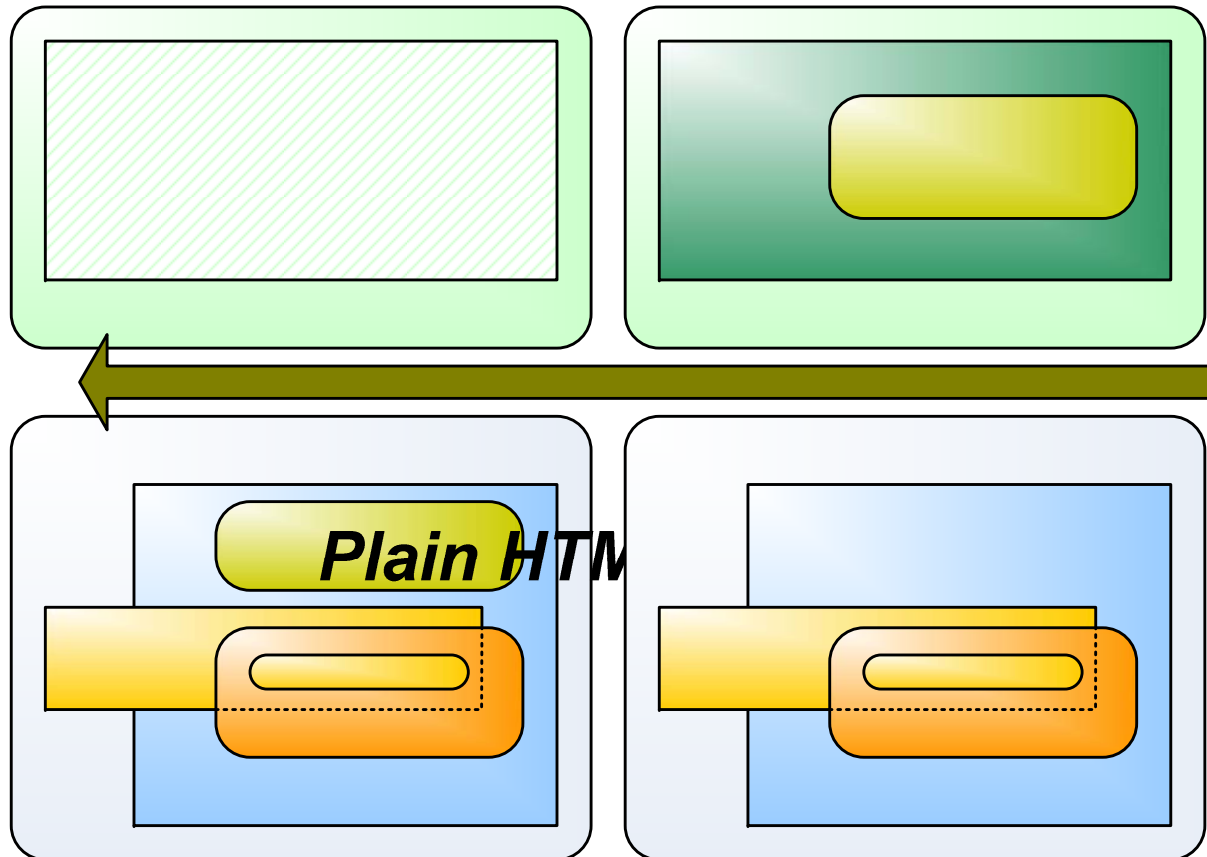


- Traditional adaptation strategies have been intensively studied
- Web Page Paradigm: Every Web page in a series of pages is downloaded separately.
- Conventional architecture: tracking of user clicks, the user modeling, as well as the adaptation take place on the server.
- Limited user tracking possibilities
 - User requests seen by the server
 - Subset of user clicks
- Adaptation only on behalf of an explicit user request
- **On-the-fly adaptation not obtainable**

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From Server- to Client-side Adaptive Hypermedia Systems (AHSs)



■ RIAs / AJAX

- New user tracking possibilities
- New user interface adaptation possibilities
- Look and feel of desktop applications
- Highly responsive user interfaces

■ Adaptation rules still on the server

■ **On-the-fly adaptation not obtainable**

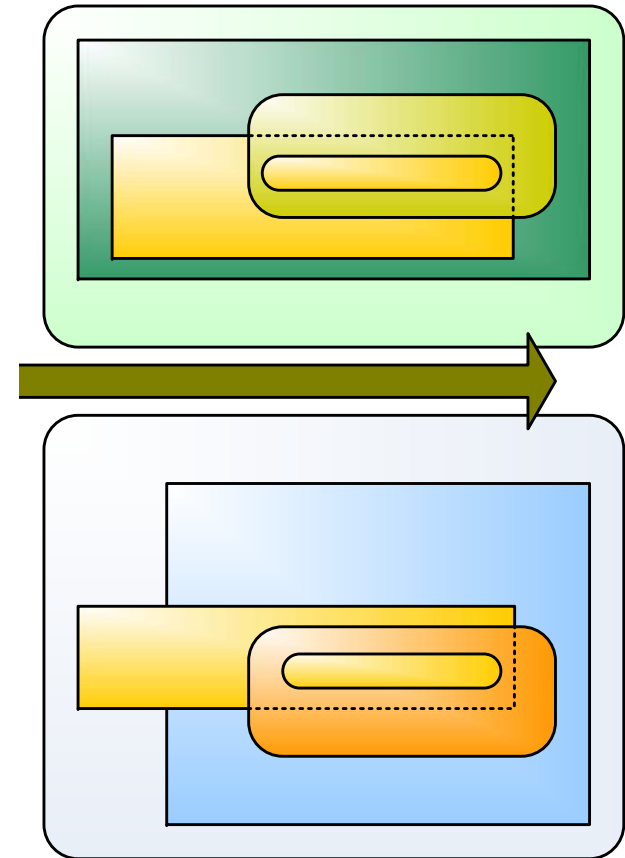
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From Server- to Client-side Adaptive Hypermedia Systems (AHSs)



- Client-side rule processing
 - Reduction of client-server-communication to a minimum
 - Enhanced user tracking capabilities
 - In-time response to user actions
- **On-the-fly adaptation is obtainable**

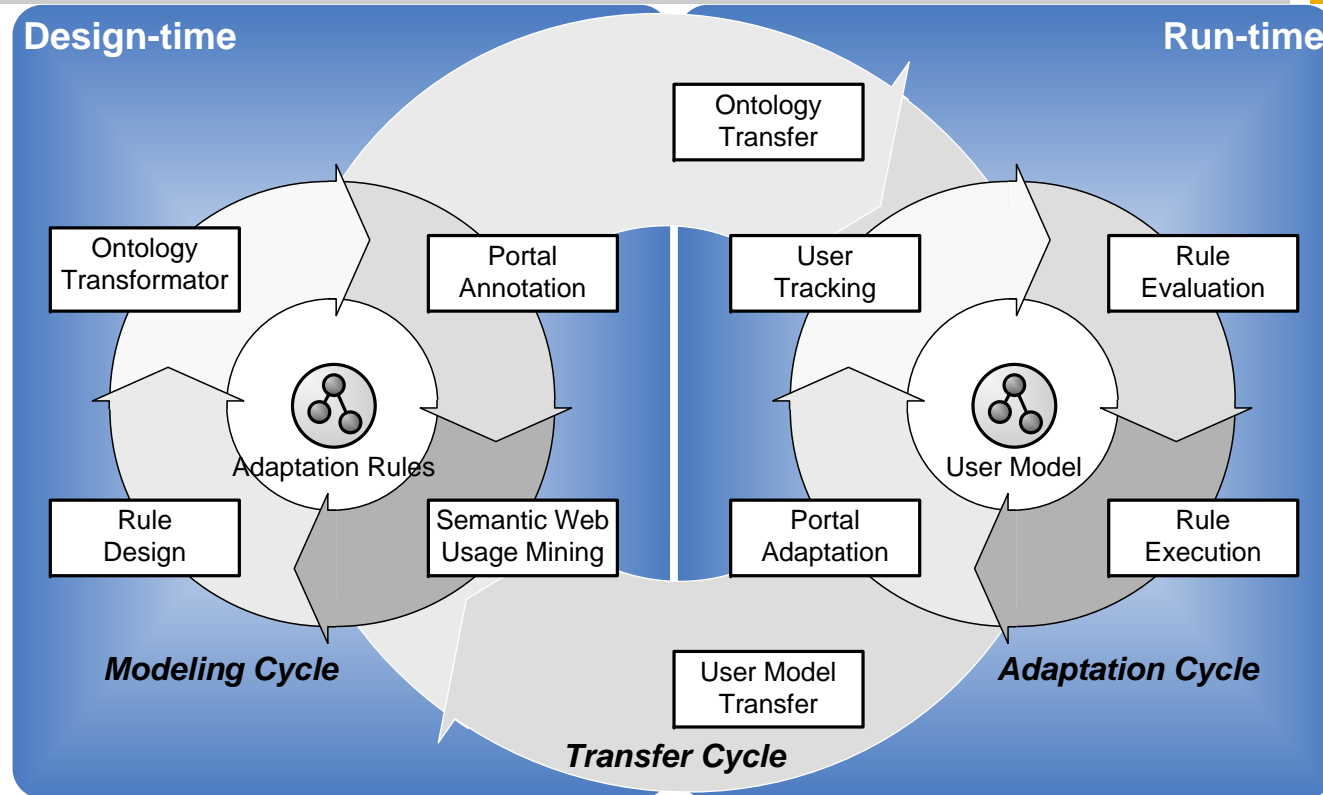


Browser

Agenda



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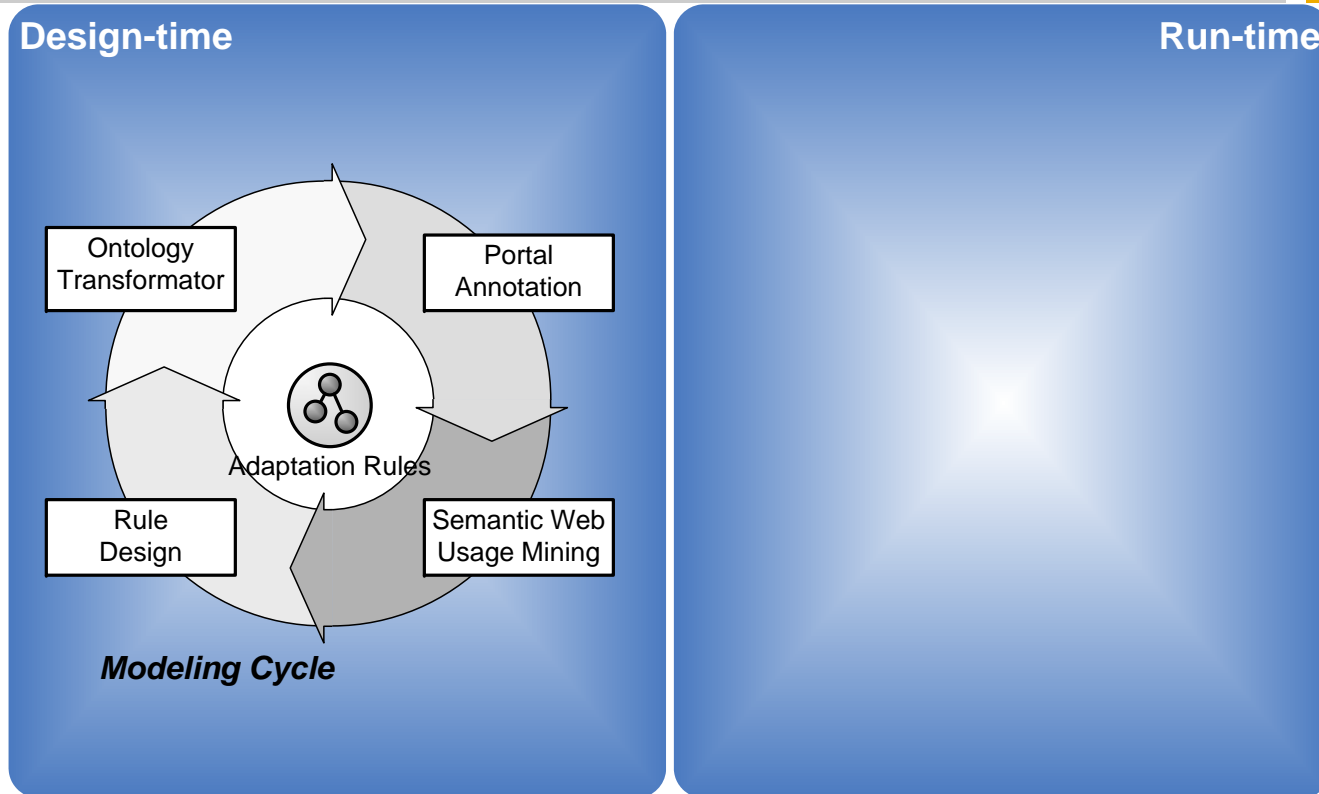


Holistic framework covering the whole adaptation cycle

- Obtaining adaptation rules and user modeling
- Transformation of rules and ontologies into a client-side readable format
- Client-side user model evaluation and rule execution

On-the-fly user interface adaptation

Ontology Creation and Portal Annotation

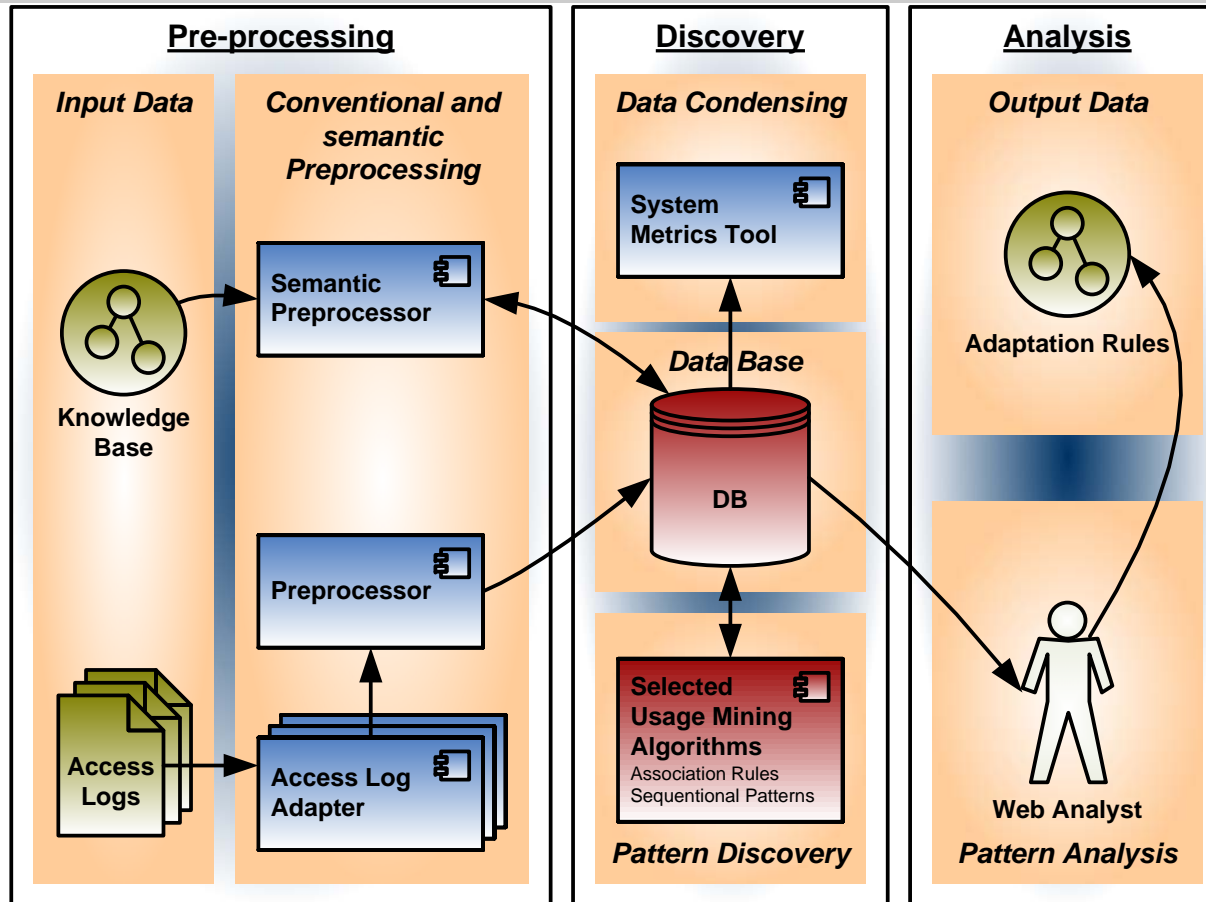


Adaptation rules: declarative adaptation logic based on the user model (ontologies)

Ontologies: domain ontologies, RIA ontology, annotation knowledge base

Coherent tool combining learning, refinement and annotation

Obtaining the Adaptation Rules



■ Association Rules:

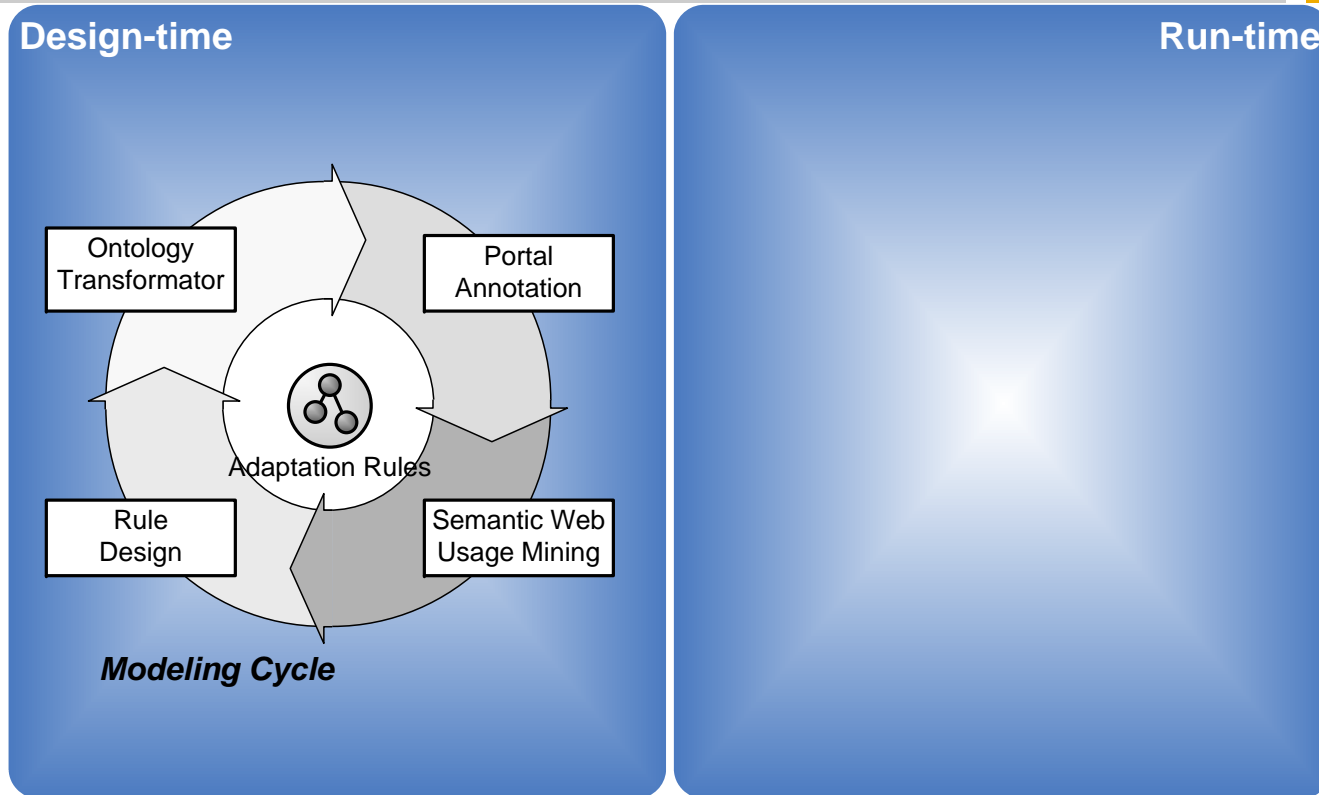
- Algorithm: FP-Growth
- Tool: Artool

■ Sequential Rules:

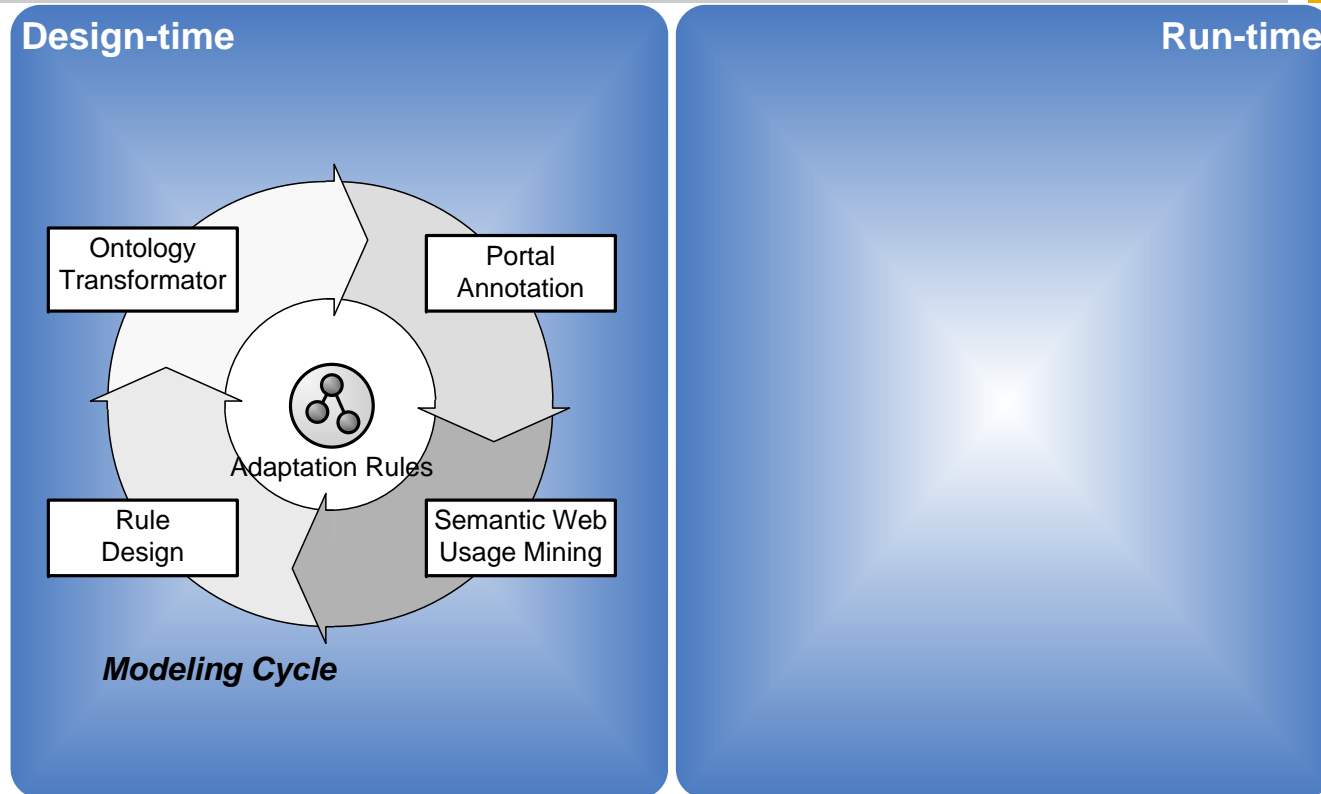
- Algorithm: SPAM
- Tool: Himalaya Data Mining Tools

■ New item problem

- Recommendation of new items
- C1 & C2 → C3

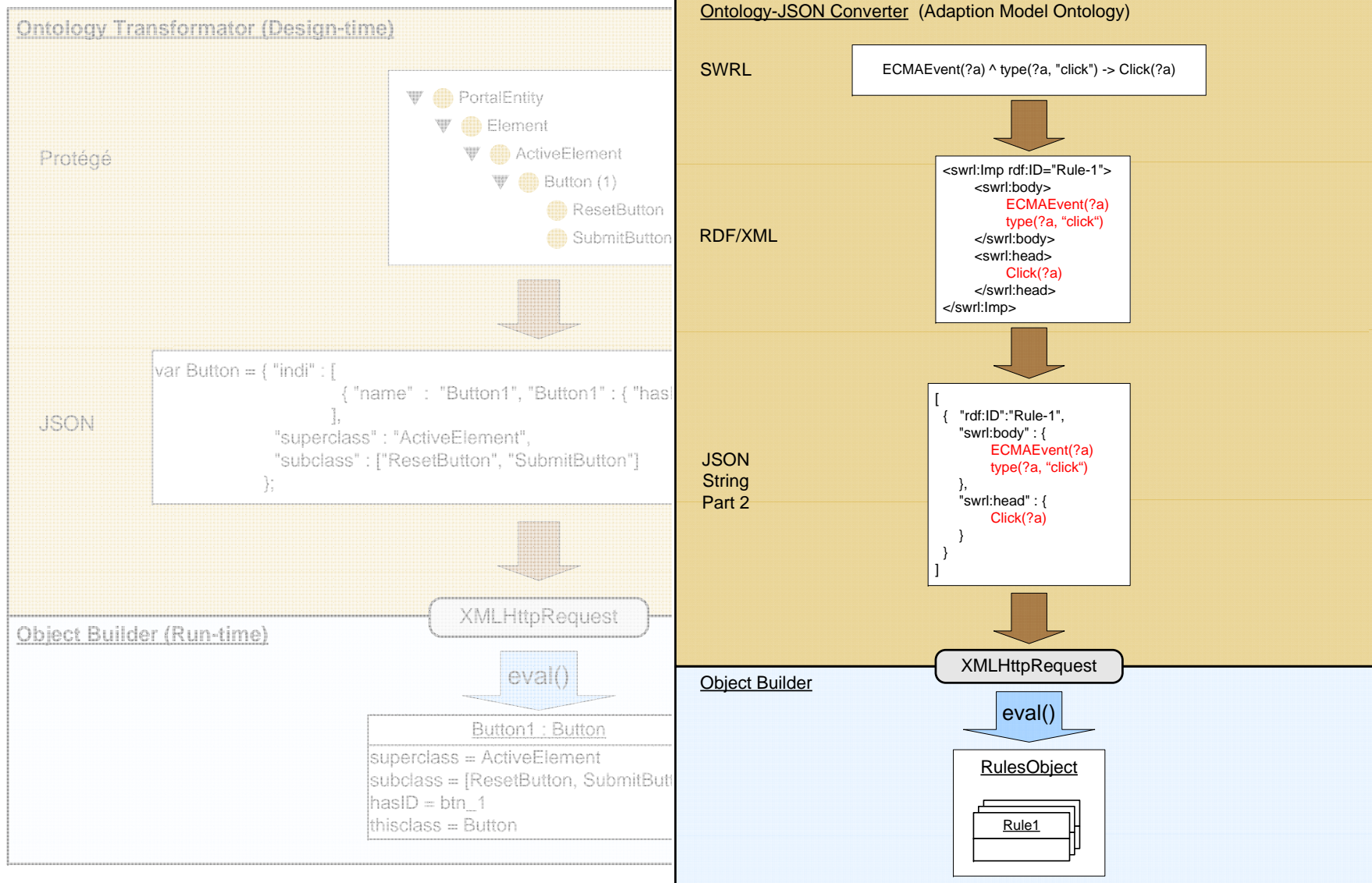


portal:Form(?a) \wedge portal:isVisited(?a, true) \wedge
domain:WeddingDay(?b) \wedge portal:isAnnotated(?a, ?b) \wedge
portal:Form((?c)) \wedge portal:isVisited(?c, true) \wedge
domain:MarriageCertificate(?d) \wedge portal:isAnnotated(?c, ?d) \wedge
domain:BirthCertificate(?e) \rightarrow portal:showLink(?e)

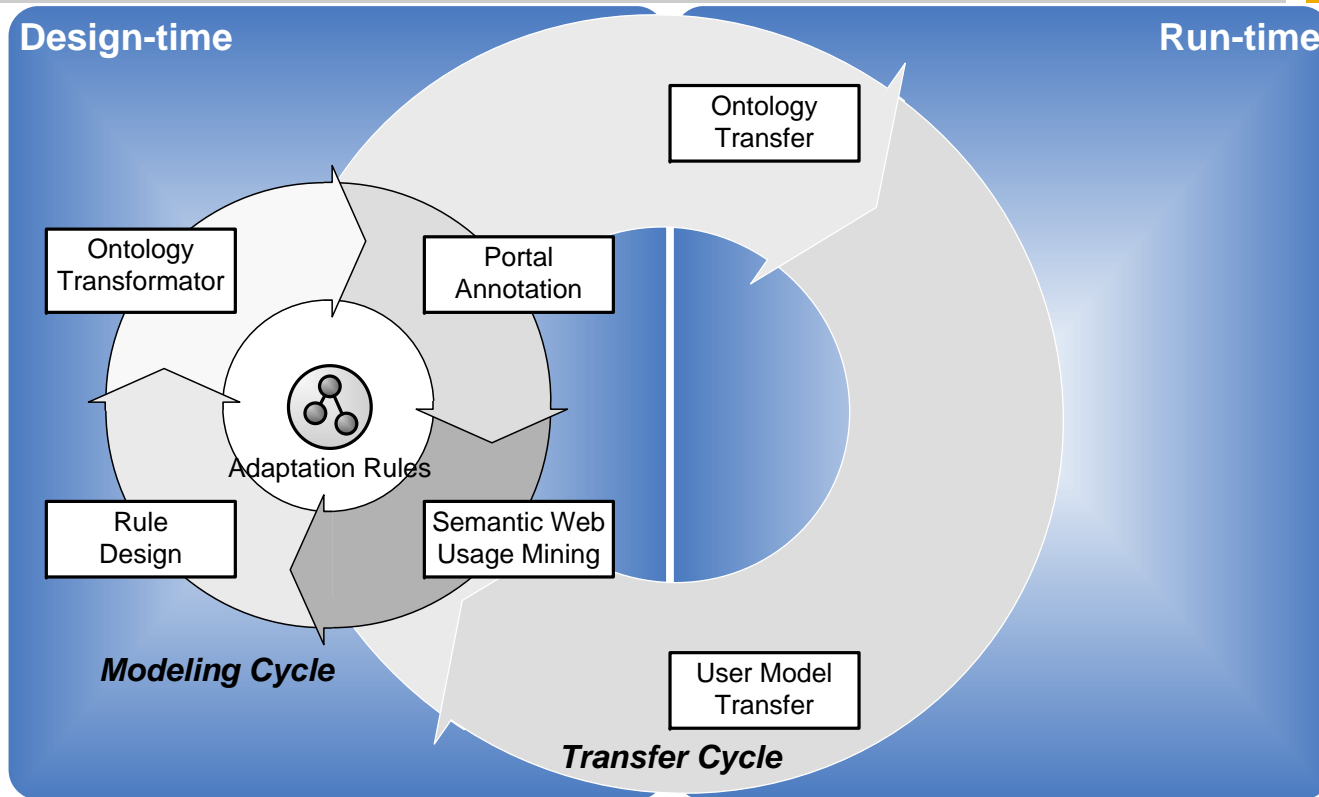


- Transformation of all of parts into a client-readable format that can be executed by a browser's JavaScript engine
- Ontologies and rules must be translated beforehand in easy-to-parse and effortlessly executable format
- Materialization of all ontologies at the server by using an off-the-shelf OWL reasoner
 - Consistency checks and derivation of the class hierarchy

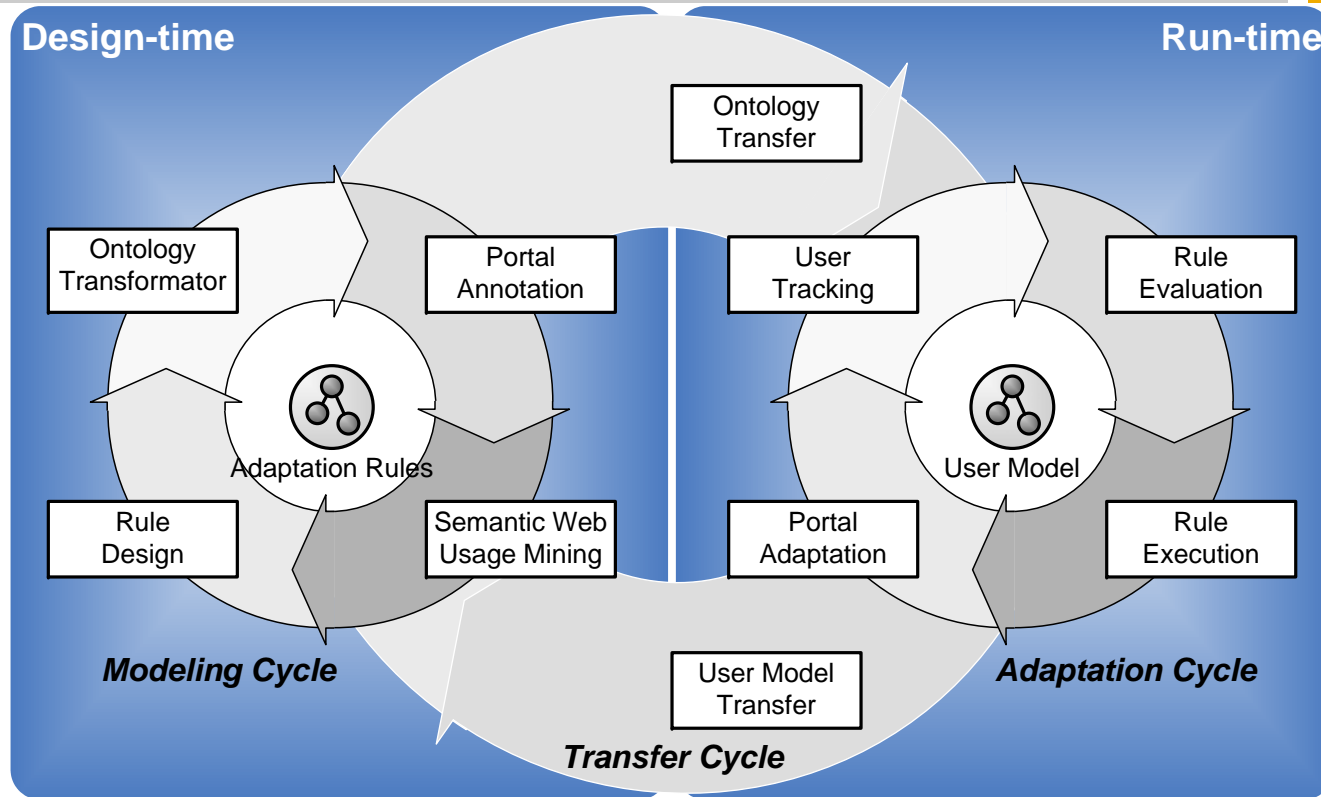
OWL / SWRL To JSON Transformer

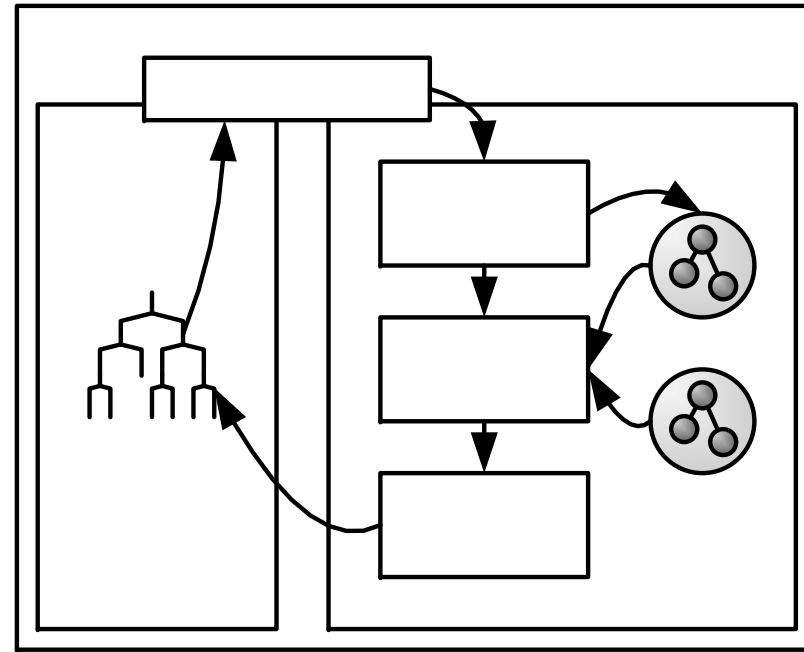


The Transfer Cycle



The Adaptation Cycle





Event Handler

User Interactions

U
T
C
R
E

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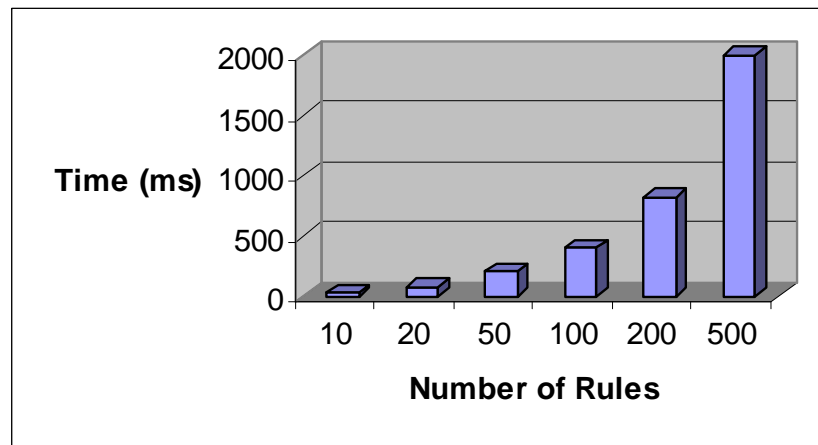
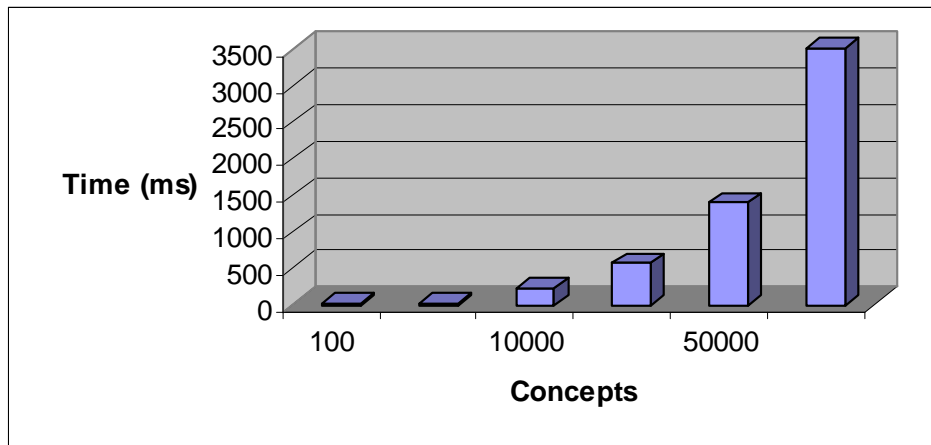


Proof of concept for the FIT ontologies

- Less than 500 concepts
- About 20 rules

Results

- Initial Client-side concept creation
- 500 concepts: 20 ms
- Rule execution time
- 20 rules: 78 ms



Intel Pentium 1,6 GHz, 2 GB RAM, Windows XP, Internet Explorer 6, Firefox 2

T-Box expressions shrank to a simple taxonomy

- Subsumption hierarchy without:
 - OWL class axioms (equivalent class)
 - Class descriptions (union of)
 - Information about relations are completely lost
- Individuals are transformed without information loss

Complexity problems with the sequential algorithm

Prototypical implementation of an responsive RIA based on declarative rules and ontologies.

Discussion

- Annotation of RIAs extremely difficult, time-consuming and error-prone
- Even more the maintenance of the annotations
- Semantic datamining results did not meet the expectations
- Due to exponential run-time behavior more sophisticated algorithms needed
- SWRL not sufficient for expressing temporal logic constructs: ECA rules needed

Thank you!

Questions?

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