

Lived happily ever after: Combining a dynamic CMS front- end with Semantic Mashup Personalization Features

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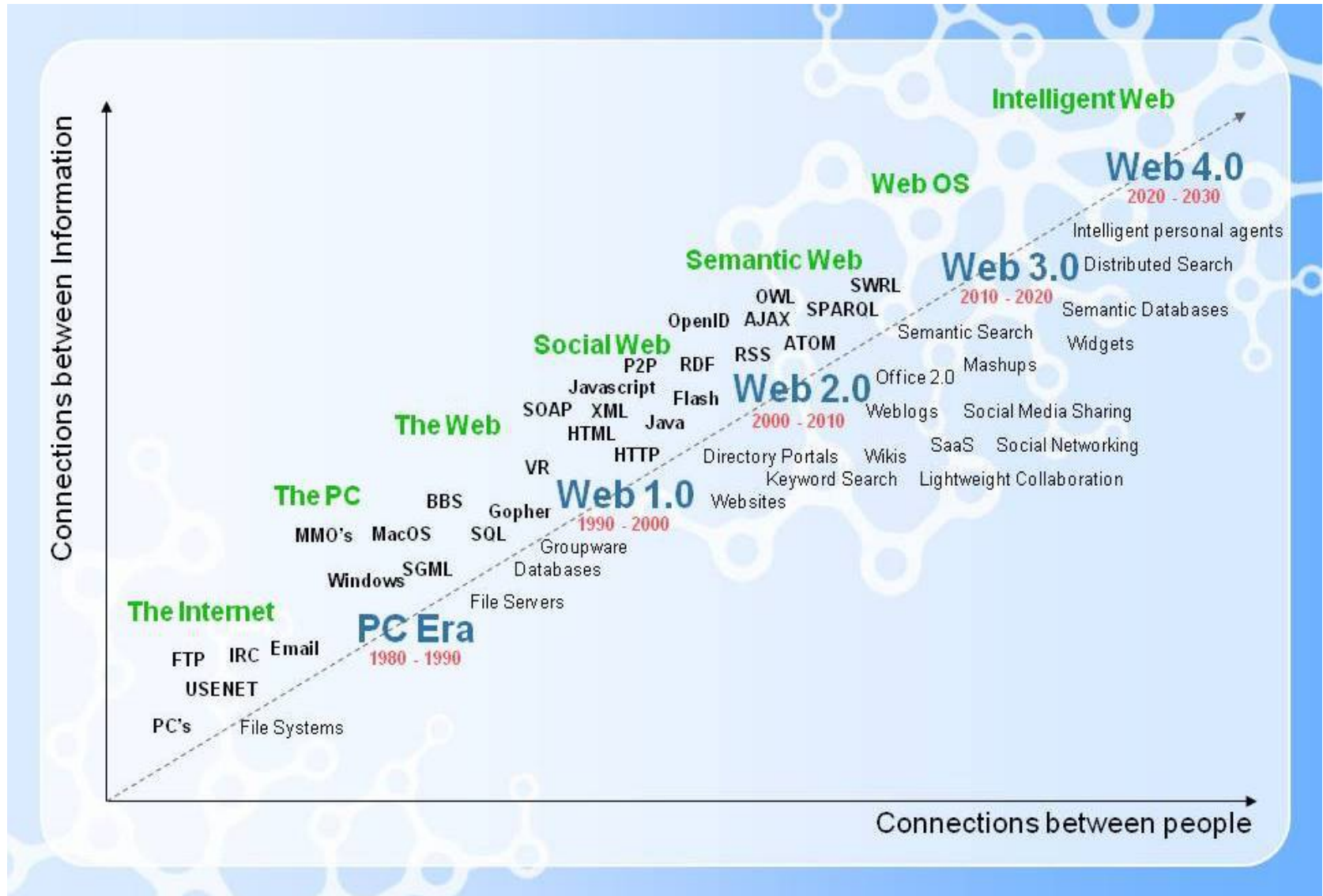
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The evolution of Web Development



Semantic Web development

❖ Puts focus on data analytics and semantics

- Strives towards 'intelligent' applications with semantic front-ends
- Data linking, merging, organizing → Machine-readable formats (XML, RDF, OWL)
- Knowledge-intensive scenarios

❖ However...it is still about **Web** development!

❖ A lot to consider out of the Web scope

- Expressivity?
- Scalability?
- Reasoning?
- Rules?

→ Insufficient **Web** design

- ...or compromising semantic aspects
 - 'lightweight' reasoning
 - lower expressivity

Design in the time of Web 2.0 (*...or 3...or...*)

❖ The role of a modern CMS

- Out-of-the-box solution for web page design **and** management
- Tried and true frameworks (joomla, drupal, wordpress,...)
- Many years of evolution (in contrast to SW childhood)
- Forging Web 2.0

❖ Saves time and effort!

- Open source / large developer base
- Withhold technical detail
- Issues already resolved
 - Front-end, user & content management, caching, modules...



❖ Web development framework



- Develop and integrate additional services on top

Mashups

❖Of many kinds

- *data mashups, social mashups, service mashups, search mashups, semantic mashups...*

“...a Web page or application that uses and combines data, presentation or functionality from two or more sources to create new services”

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Require:

- The use of **Web APIs and Linked Data** to collect and combine the data

Semantic Mashup Personalization Service

❖ **Books@HPCLab**

- Mashups + Linked Data + Reasoning
- Personalized search for books and offers

❖ **Data Sources**

- Amazon and Half eBay bookstores

❖ **Book metadata**

- mapped to an OWL ontology (BookShop)
- Axioms to match between user profiles and books features
- offered as Linked Data

❖ **Integrate with a CMS – Drupal**

- User profile construction and maintenance
- Synchronizing relational and ontology back-ends?
- Data linking?
- Reasoner Integration?

BookMashup Architecture



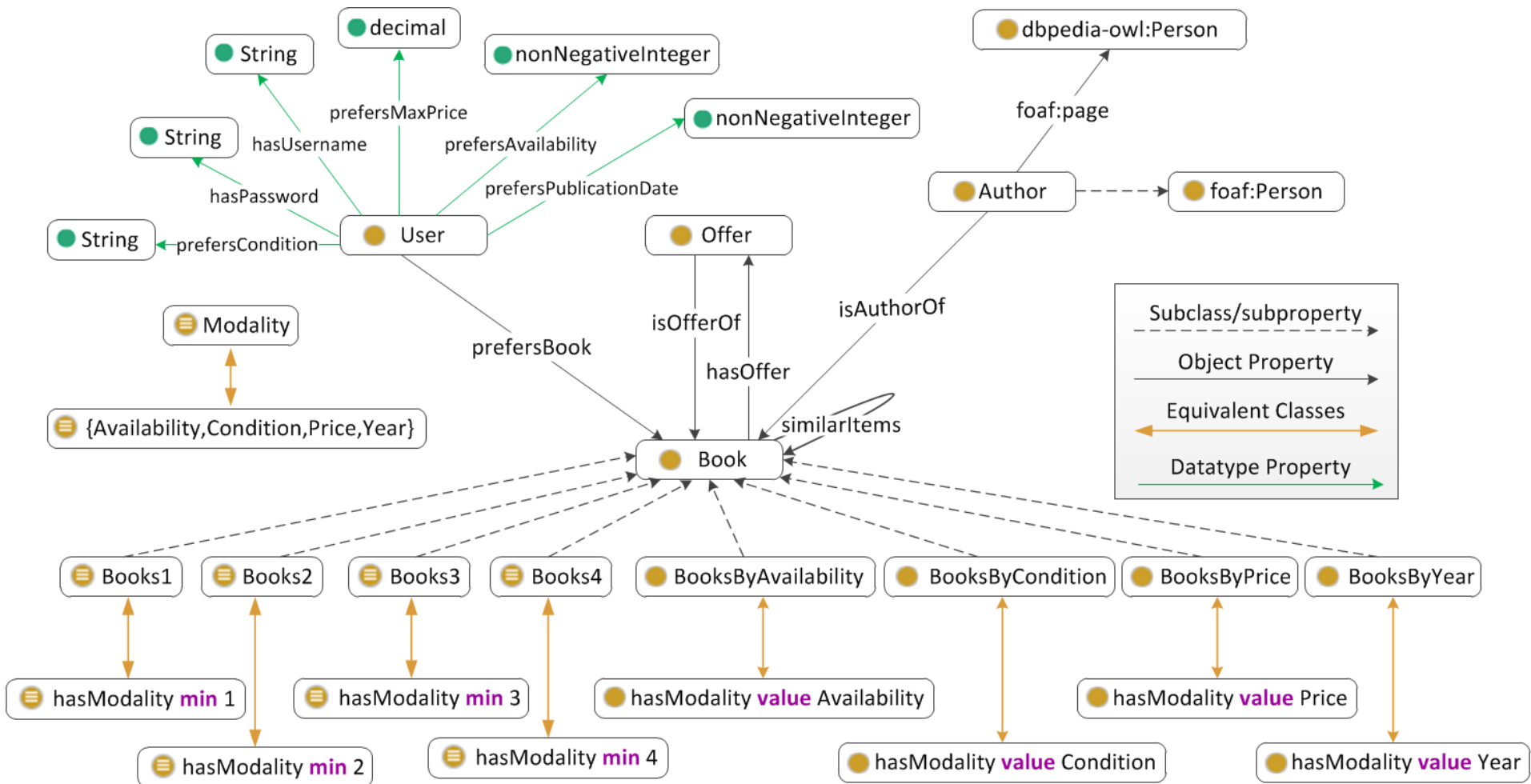
❖ *AmazonStore* Module

- Wrapper and front-end for the Amazon API

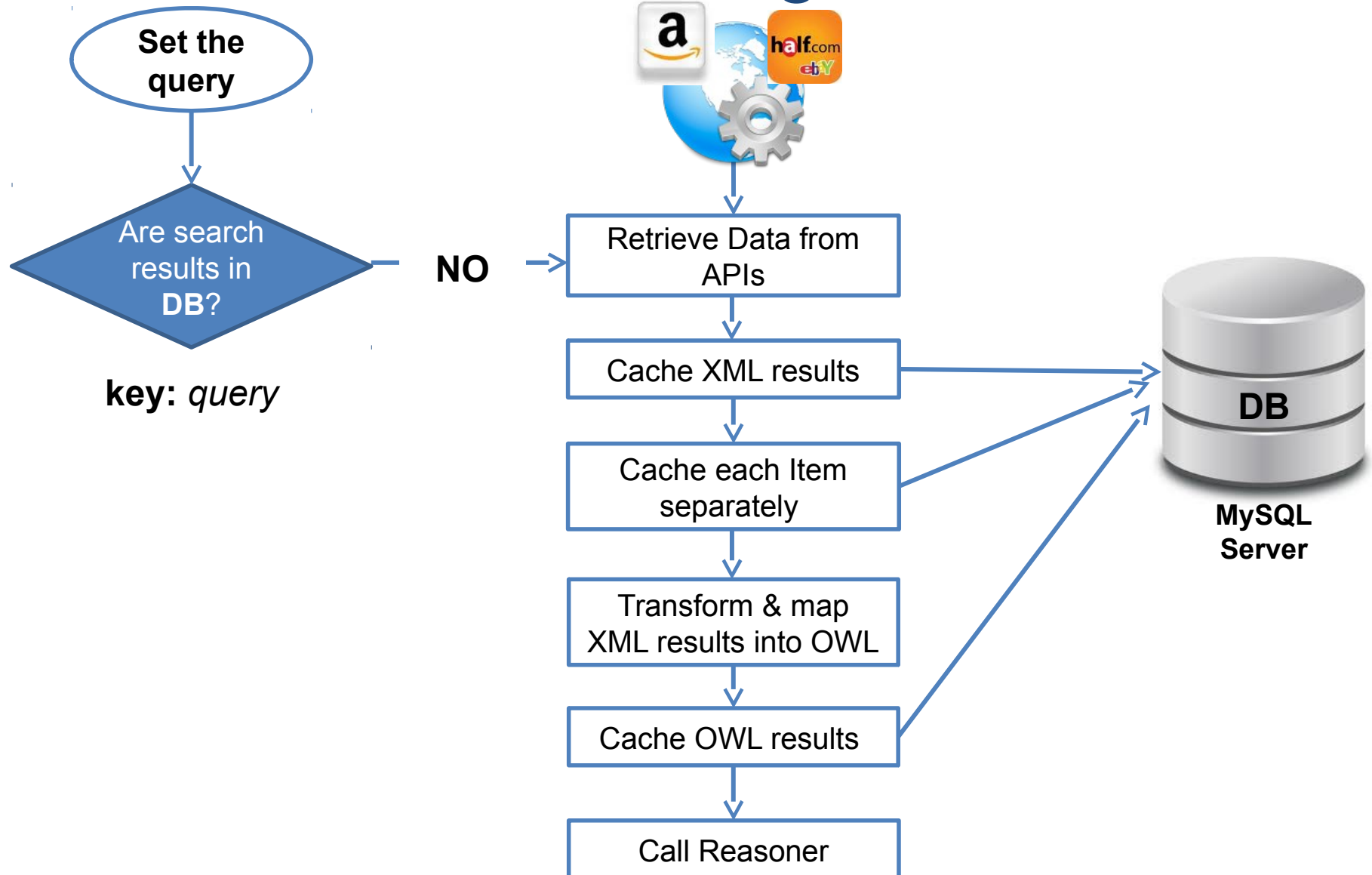
❖ *WebForm* Module

- Form-based data collection for user profiles

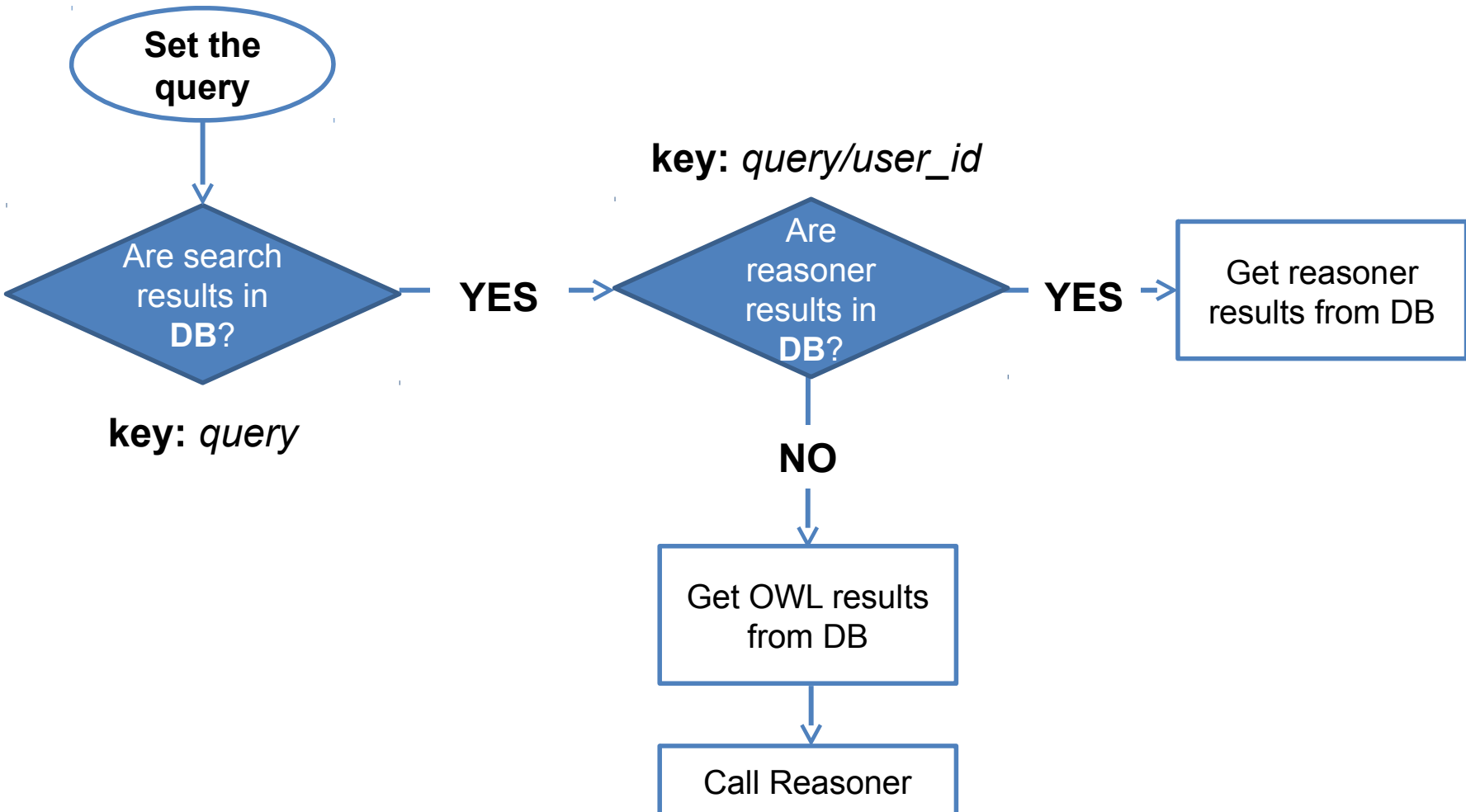
The BookShop ontology



Workflow: Data Storage



Workflow: Data Storage



Communicating with a reasoner

❖ OWLlink: Successor to DIG

- Interface to mainstream DL reasoners

❖ HTTP REST-like communication with the OWLlink Server

- The OWLlink server “wraps” any OWL-API compliant reasoner (Pellet)
- Exchange of XML request & response messages
- OWL/XML syntax

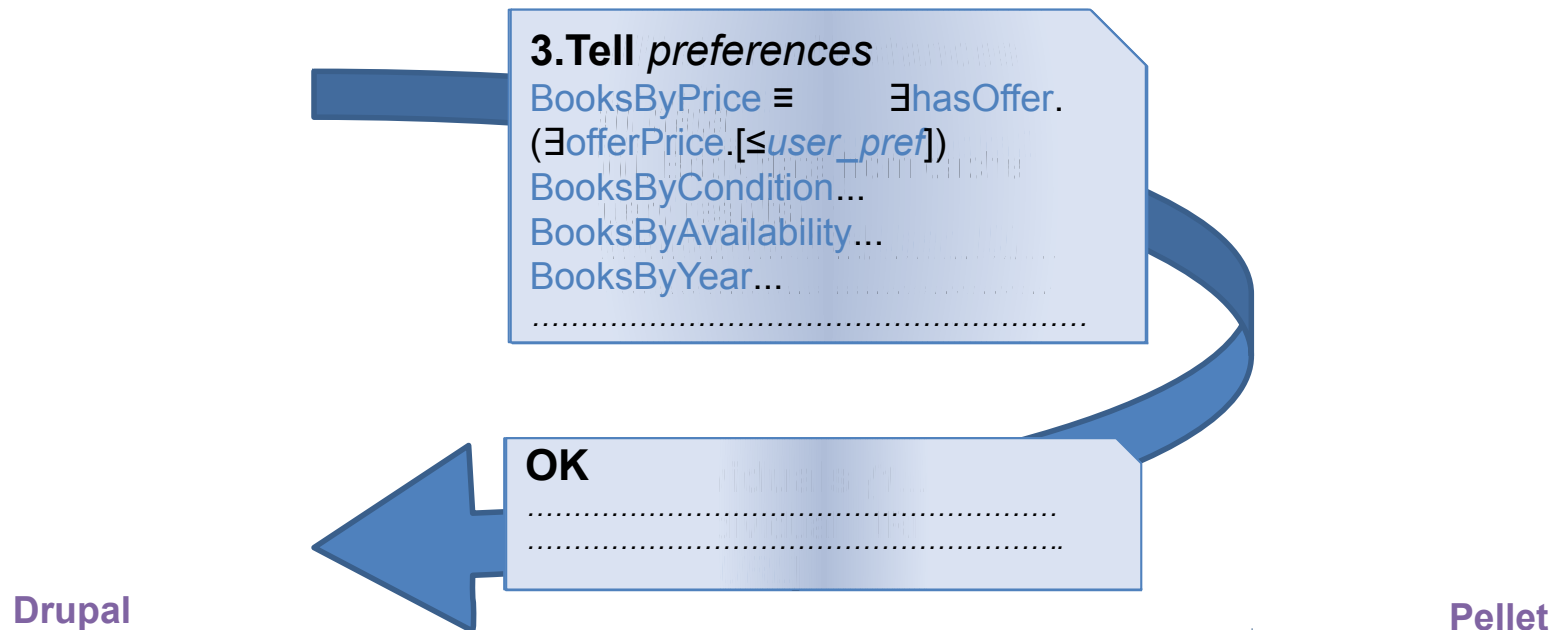
❖ Pros

- Interoperability
- Programming language independency
- 3-tier architecture: logical **and physical** delegation of (hard) reasoning tasks

❖ Trade-offs

- Potential communication overhead / verbosity

OWLlink Protocol



HTTP POST *Requests/Responses* (XML)

Data Mapping & Linking



ItemSearch operation:



FindHalfProducts operation:

**Resolvable
identifiers**

X S L T

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</bs:Offer>
...
```

Dereferencing URIs

❖ 303 URIs strategy

❖ <http://levantes.hpclab.ceid.upatras.gr:8000/bookmashup/resource/asin>

- GET

Accept: text/html

303 See Other

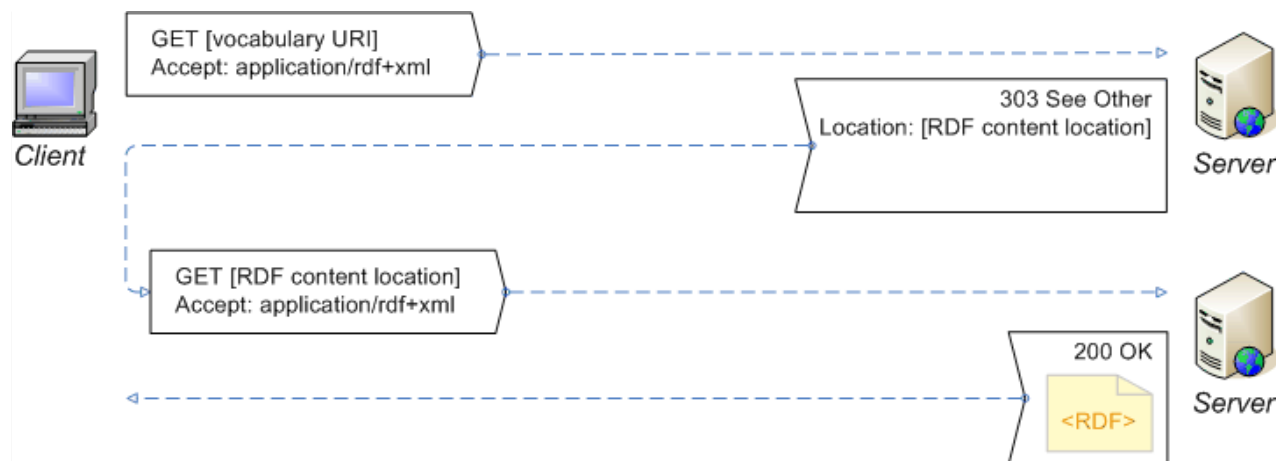
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- GET

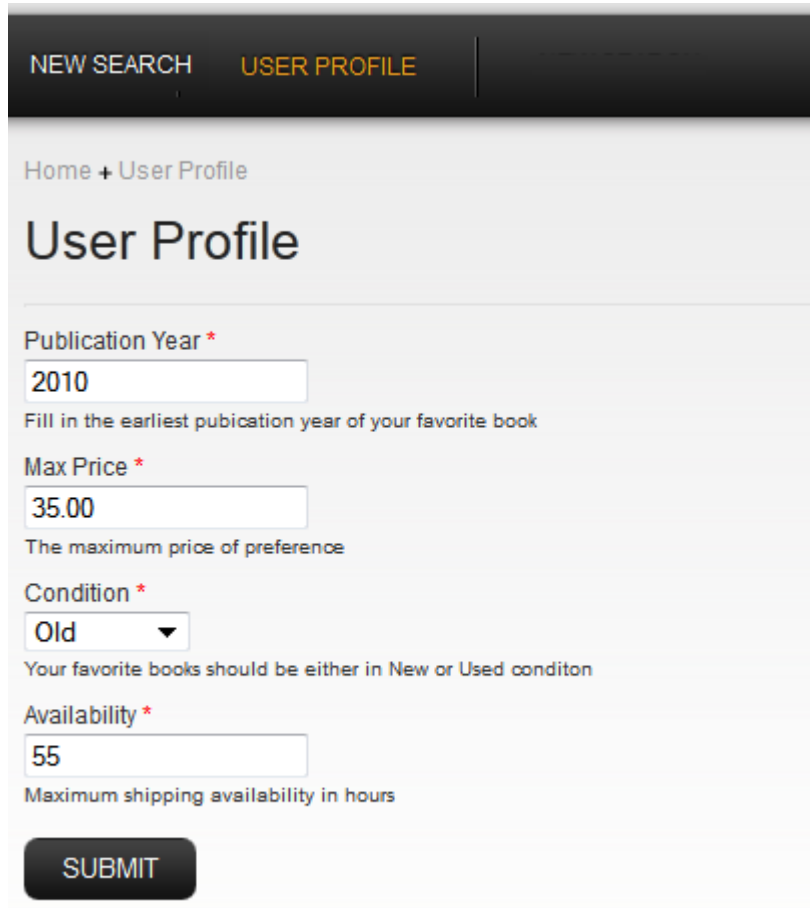
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303 See Other

Location: <http://levantes.hpclab.ceid.upatras.gr:8000/bookmashup/data/asin>



User profile construction



The screenshot shows a web application interface for 'User Profile' construction. At the top, there is a dark navigation bar with 'NEW SEARCH' and 'USER PROFILE' (highlighted in orange). Below the navigation bar, the breadcrumb 'Home + User Profile' is visible. The main heading is 'User Profile'. The form contains several fields: 'Publication Year *' with a text input containing '2010' and a hint 'Fill in the earliest publication year of your favorite book'; 'Max Price *' with a text input containing '35.00' and a hint 'The maximum price of preference'; 'Condition *' with a dropdown menu showing 'Old' and a hint 'Your favorite books should be either in New or Used condition'; and 'Availability *' with a text input containing '55' and a hint 'Maximum shipping availability in hours'. A dark 'SUBMIT' button is at the bottom.

❖ **WebForm module**

❖ **Storage** in DB

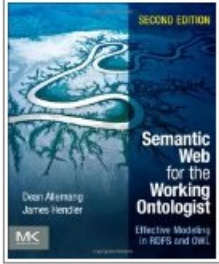
❖ **Semantic expression** → on-the-fly process

❖ **User Profile update** → Clear reasoner cache table

Query and Results

Search For

SEARCH



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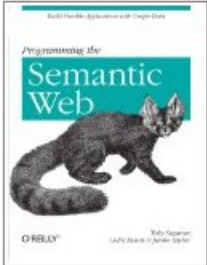
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Linked Data: Search Results

```
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g in RDFS



Item Details

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Item Description

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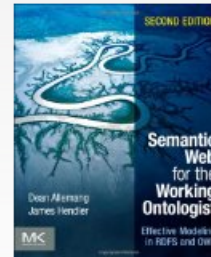
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New in this edition:

- Coverage of the latest Semantic Web tools for organizing, querying, and processing information - see details in TOC below
- Detailed information on the latest ontologies used in key web applications including ecommerce, social networking, data mining, using government data, and more
- Updated with the latest developments and advances in Semantic Web technologies for organizing, querying, and processing information, including SPARQL, RDF and RDFS, OWL 2.0, and SKOS
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- Author:
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```

real-world problems

Product Details

- Author:
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 - James Hendler
- Publication Date: 2011-06-03

Technology)

Evaluation of personalised search accuracy

❖ Average Rank Metric

$$AvgRank_s = \frac{\sum_{p \in P_{s_1}} R(p) + \sum_{p \in P_{s_2}} R(p) + \dots + \sum_{p \in P_{s_{10}}} R(p)}{P_{s_1} + P_{s_2} + \dots + P_{s_{10}}}$$

P_s : the number of books that the user U has clicked for the test keyword s

- $R(p)$: the rank of the book p , can take any of the distinct value $\{1,2,3,4\}$

❖ Final Average Rank

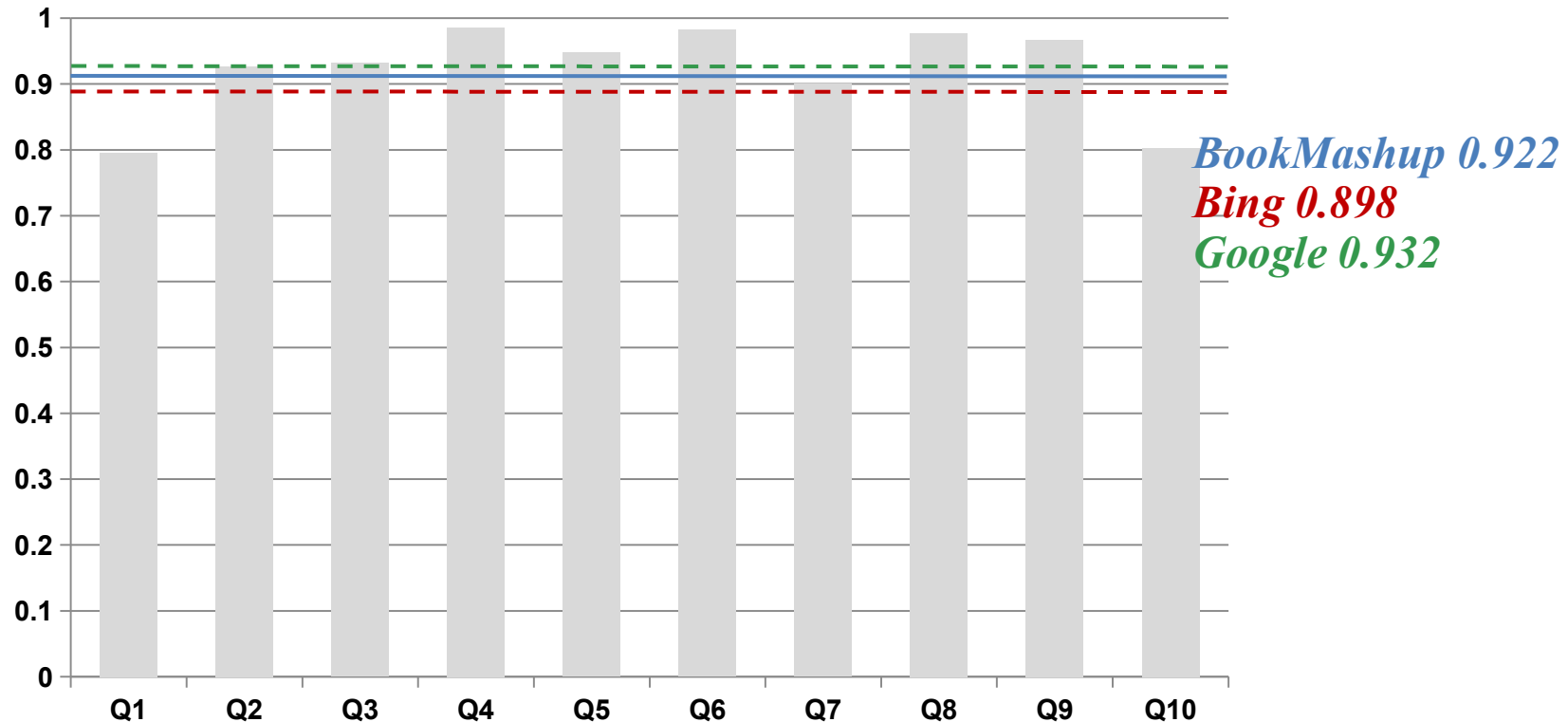
$$AvgRank = \frac{1}{|S|} \sum_{s \in S} AvgRank_s$$

$$AvgRank_{norm} = \frac{AvgRank}{|C|}$$

- S : test keyword set
- $|S| = 10$

$$- |C| = 4$$

Evaluation results



Most frequently search keywords in Amazon

Q1: diary of a wimpy kid

Q2: gone girl

Q3: harry potter

Q4: ipad

Q5: james patterson

Q6: obama

Q7: vince flynn

Q8: x-men

Q9: yoga

Q10: zombie

Next steps and roundup

Potential improvements

- ❖ Revise data replication strategy
 - E.g. Accessing relational data as virtualized RDF graphs
- ❖ Scalability
 - Reasoning with rule-based triple stores
- ❖ Develop independent Drupal modules

Conclusions

- ❖ Integrating Semantic Web apps with CMSs
 - Not trivial
 - No semantic underpinnings in CMS!
 - Cache and relational back-end
 - Beneficial even for the ‘semantic’ aspects
- ❖ Explicit manipulation of semantic data
- ❖ Incorporation of a reasoning infrastructure

... and they lived Happily Ever After!

Questions? Comments?

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