First International Workshop on Evaluating Information Access (EVIA 2007)
Tokyo, May 15, 2007

A Proposal to Extend and Enrich the Scientific Data Curation of Evaluation Campaigns

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Outline

- Background on experimental evaluation
- Motivations and objectives
- Discussion on the current methodology
- Possible extensions to the current methodology
- A concrete example: the DIRECT system

Experimental Evaluation Background

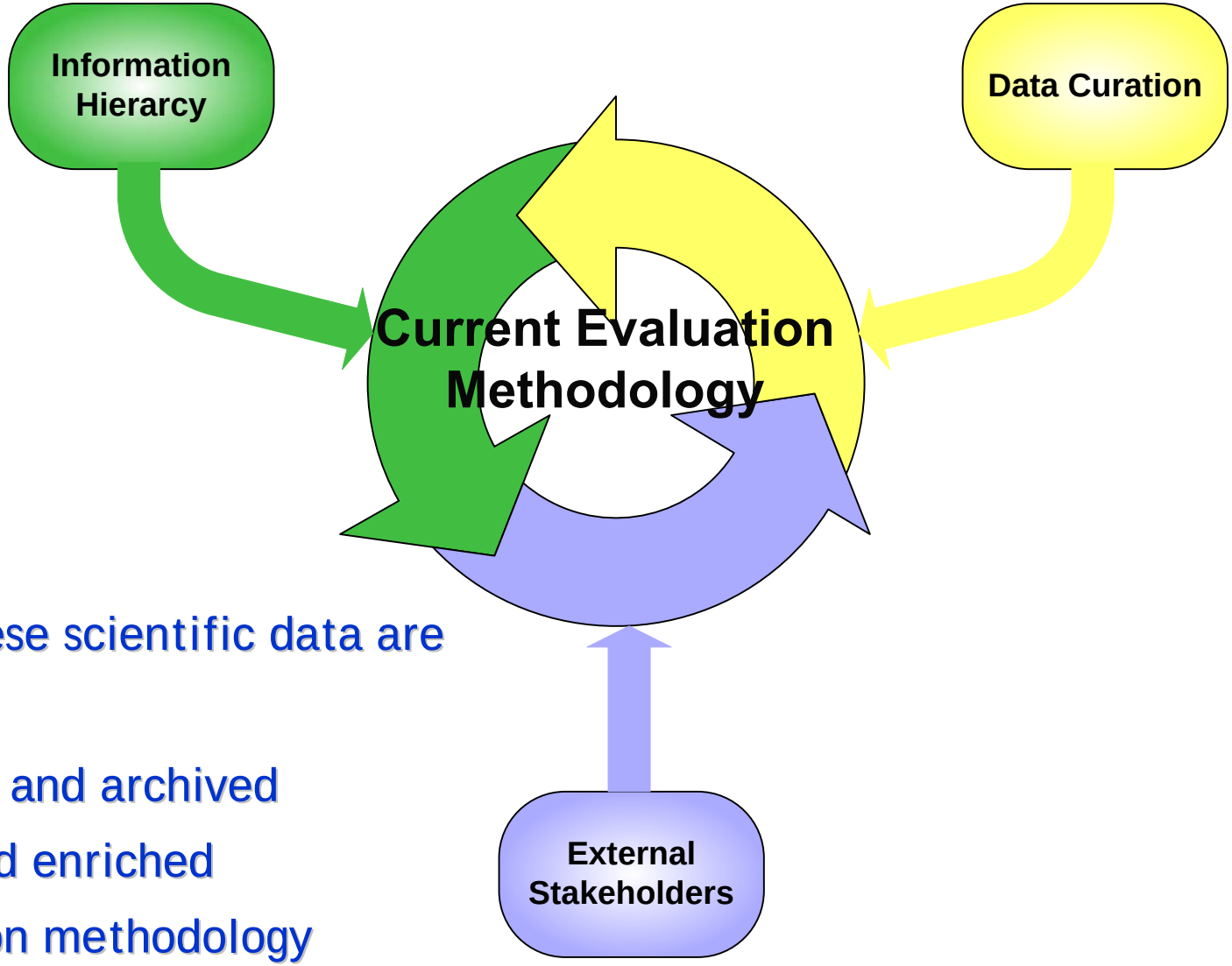
- The Cranfield evaluation methodology is a very well understood paradigm
  - its main focus is on **experiment comparability** and **performance evaluation**
- Several successful evaluation initiatives (TREC, CLEF, NTCIR, ...) have adopted this paradigm
  - they have produced a **huge amount of data**, **promoted the research** in the IR field, and favoured the creation of **cross-disciplinary communities**
- Steve Robertson, in his keynote at ECIR 2007, pointed out
  - the IR field has a **long tradition in evaluation** and "the tradition that began with Cranfield is **alive and kicking**, half a century later"
  - we need to understand "how and when to **push its boundaries**, how and when to **transcend it without throwing it away**"
  - such **evaluation initiatives** are an "**extremely valuable infrastructure** for the [IR] field".

Motivation

The experimental evaluation is a **scientific activity** and, as such, we have to realise that its outcomes are very valuable **scientific data**.

- Comparable experiments
- Performance measurements concerning the experiments
- Descriptive statistics about a collection of experiment
- Hypothesis tests for in-depth analysis of the experiments

Objectives

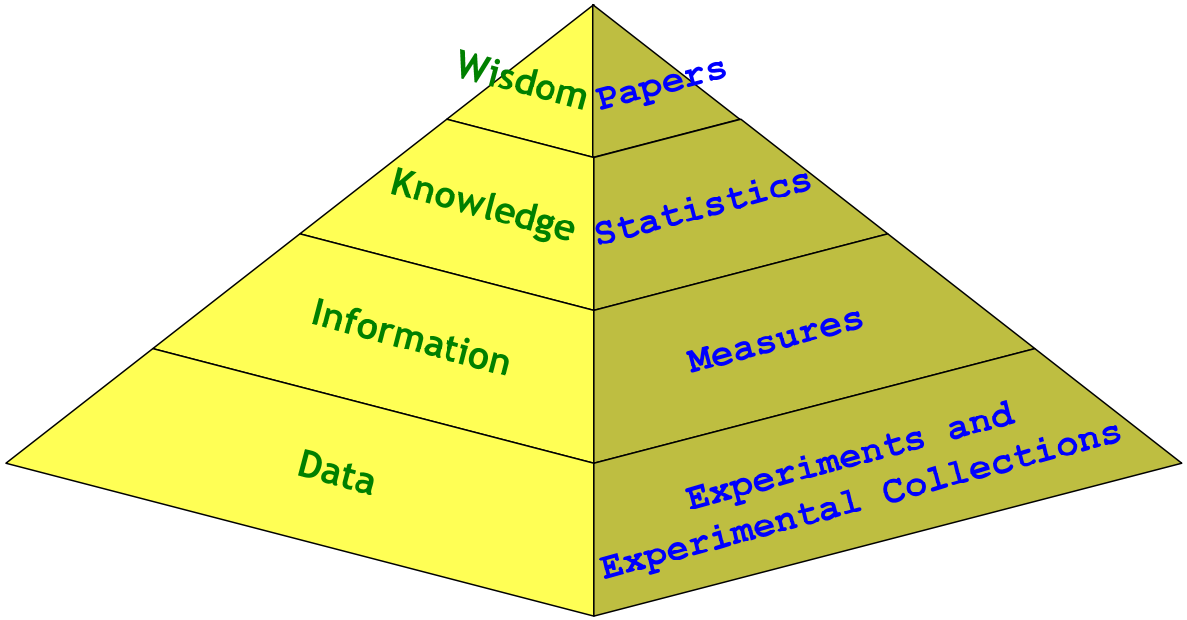


Investigate whether these scientific data are

- properly modelled
- effectively managed and archived
- carefully curated and enriched

in the current evaluation methodology

Information Hierarchy



- **experimental collections** and the **experiments** are **data**, since they are the raw, basic elements needed for any further investigation
- **performance measurements** are **information**, since they are the result of computations and processing on the data,
- **descriptive statistics** and the **hypothesis tests** are **knowledge**, since they are a further elaboration of the information carried by the performance measurements
- **theories, models, algorithms, and techniques** are **wisdom**, since they provide interpretation, explanation, and formalization of the content of the previous levels.

Data Curation

- Scientific data should be **archived, preserved**, **maintained over the time**, and **made easily accessible** to interested users;
  - Re-use of data for new research
  - Retention of expensive or difficult to generate data
- Their **lineage** should be tracked since it allows us to judge the quality and applicability of information for a given use;
  - Validation of published research results
- Scientific data should be **enriched** progressively adding further analyses and interpretations on them;
  - Enhancement of existing data available for research projects
- It should be possible to **cite** scientific data and their further elaboration
  - cross-dissemination of scientific results to research communities and industrial partners

External Stakeholders

- The EC in the 7FP i2010 Digital Library Initiative states that
  - digital repositories of scientific information are essential elements to build European eInfrastructure for knowledge sharing and transfer, feeding the cycles of scientific research and innovation up-take
- The US National Scientific Board points out that
  - organizations make choices on behalf of the current and future user community on issues such as collection access; collection structure; technical standards and processes for data curation; ontology development; annotation; and peer review
- The Australian Working Group on Data for Science suggests to
  - establish a nationally supported long-term strategic framework for scientific data management, including guiding principles, policies, best practices and infrastructure

Extending the Approach to the Evaluation (1/2)

- Introduce a **conceptual model**
  - it makes clear what are the **entities** entailed by the information space of an evaluation campaign, their **features**, and their **relationships**
  - **logical models** can be derived from it to **manage** and **preserve** the experimental data
  - commonly agreed **data formats** for **exchanging information** can be derived from it
- Develop common **metadata formats**
  - they provide meaning to the data, and thereby enable their **sharing** and **re-use**
  - they allow to keep track of the **lineage** of the managed information
- Adopt a **unique identification** mechanism
  - it allows for explicit **citation** and **easy access** to the scientific data and it supports the **enrichement** of the scientific data

Extending the Approach to the Evaluation (2/2)

- Provide **common tools for statistical analyses**
  - they allow for judging whether measured differences between retrieval methods can be considered statistically significant
  - a uniform way of performing statistical analyses on experiments make the analysis and assessment of the experiments comparable too

- Design and develop a **Digital Library System (DLS) for IR scientific data**
  - it is well suited for managing and making accessible the scientific data and the experiments produced during the course of an evaluation campaign
  - it also provides tools for analyzing, comparing, and citing the scientific data of an evaluation campaign, as well as curating, preserving, annotating, enriching, and promoting the re-use of them

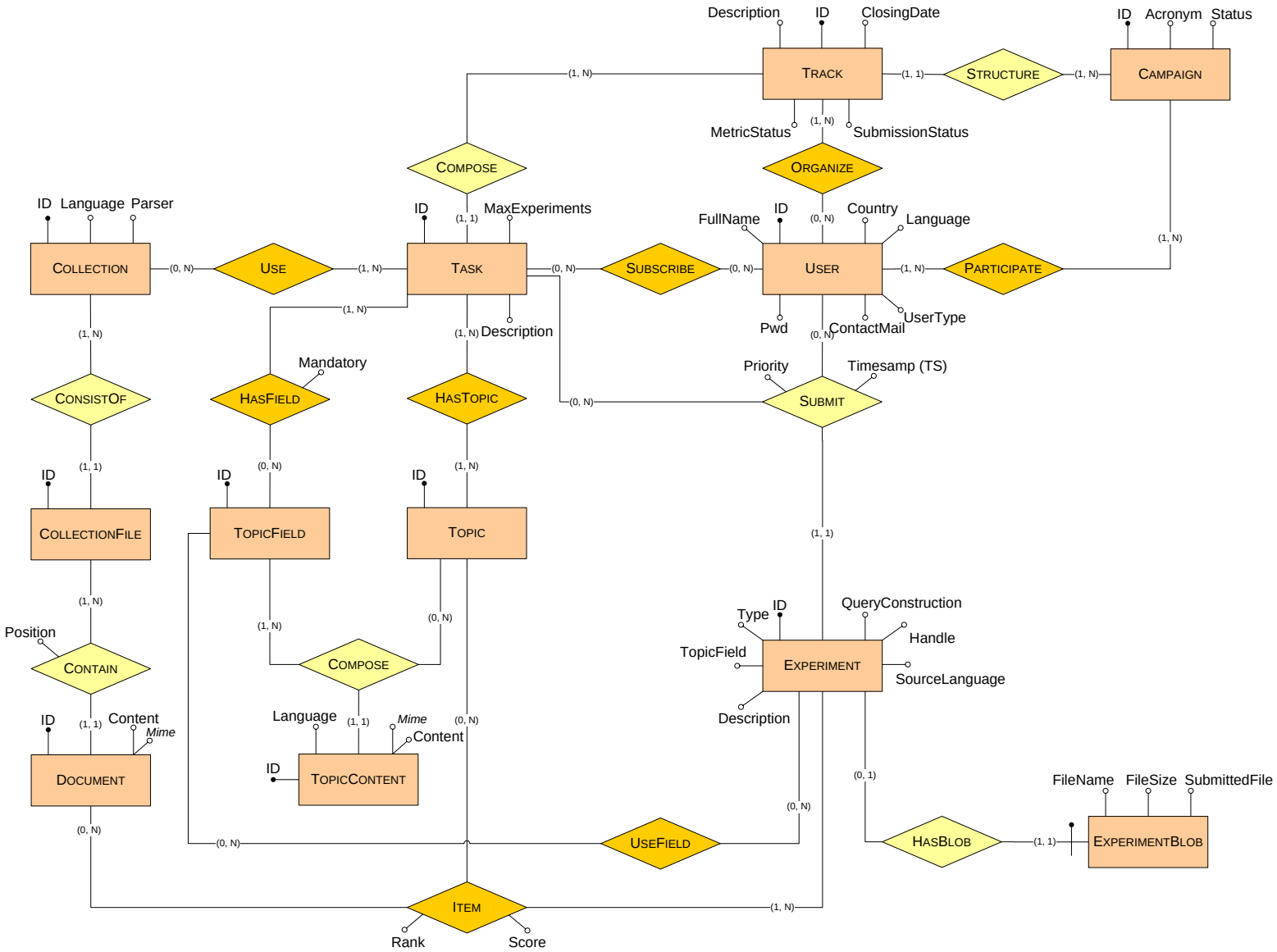
- Give to **organizations** responsible for evaluation initiatives an **active role** in this process
  - they should take a leadership role in developing a comprehensive strategy for long-lived digital data collections and drive the research community through this process in order to improve the way of doing research
  - they should take care also of defining guiding principles, policies, best practices for making use of the scientific data produced during the evaluation campaign itself

DIRECT: a DLS for IR Scientific Data

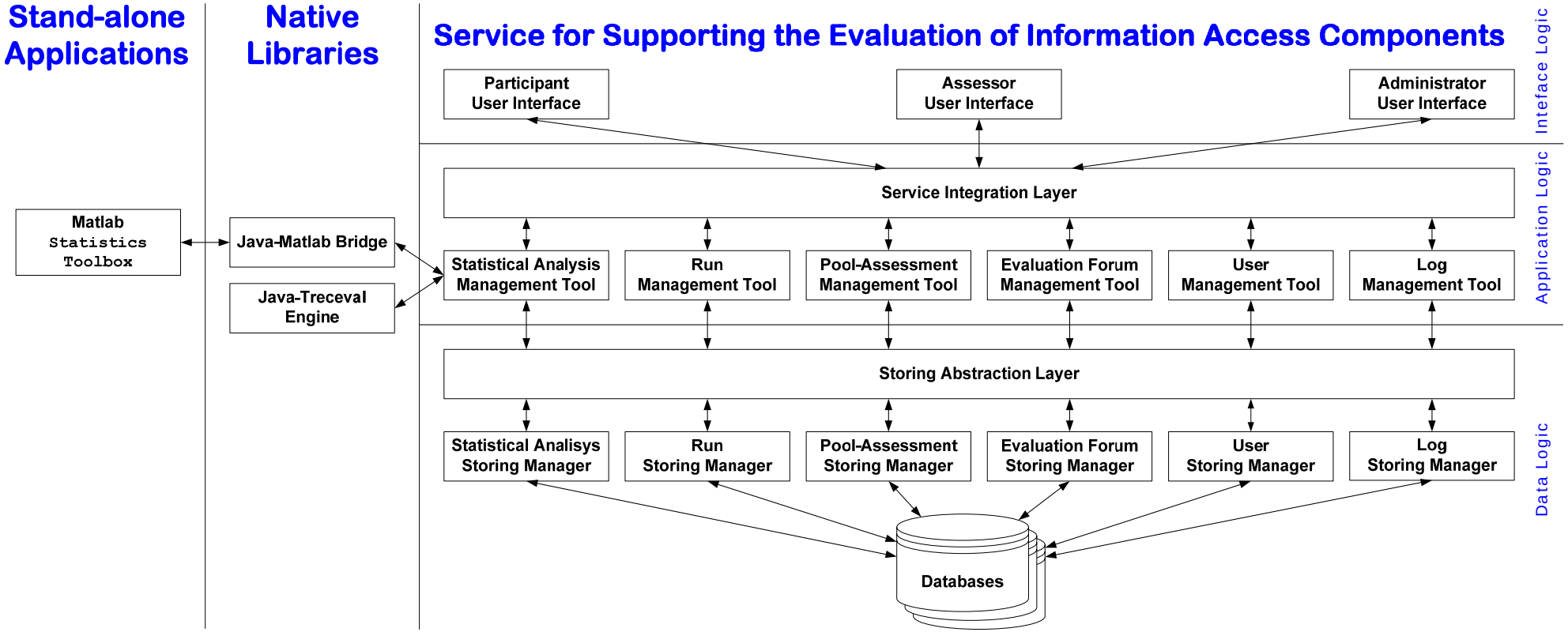
- DIRECT (Distributed Information Retrieval Evaluation Campaign Tool) is a digital library system for managing the scientific data produced during an evaluation campaign

- DIRECT has been adopted in
  - **CLEF 2005**: 30 participants spread over 15 different nations submitted more than 530 experiments; 15 assessors assessed more than 160,000 documents in 7 different languages (Latin and Cyrillic alphabets)
  - **CLEF 2006**: nearly 75 participants spread over 25 different nations submitted around 570 experiments; 40 assessors assessed more than 198,500 documents in 9 languages (Latin and Cyrillic alphabets)
  - **CLEF 2007**: ongoing

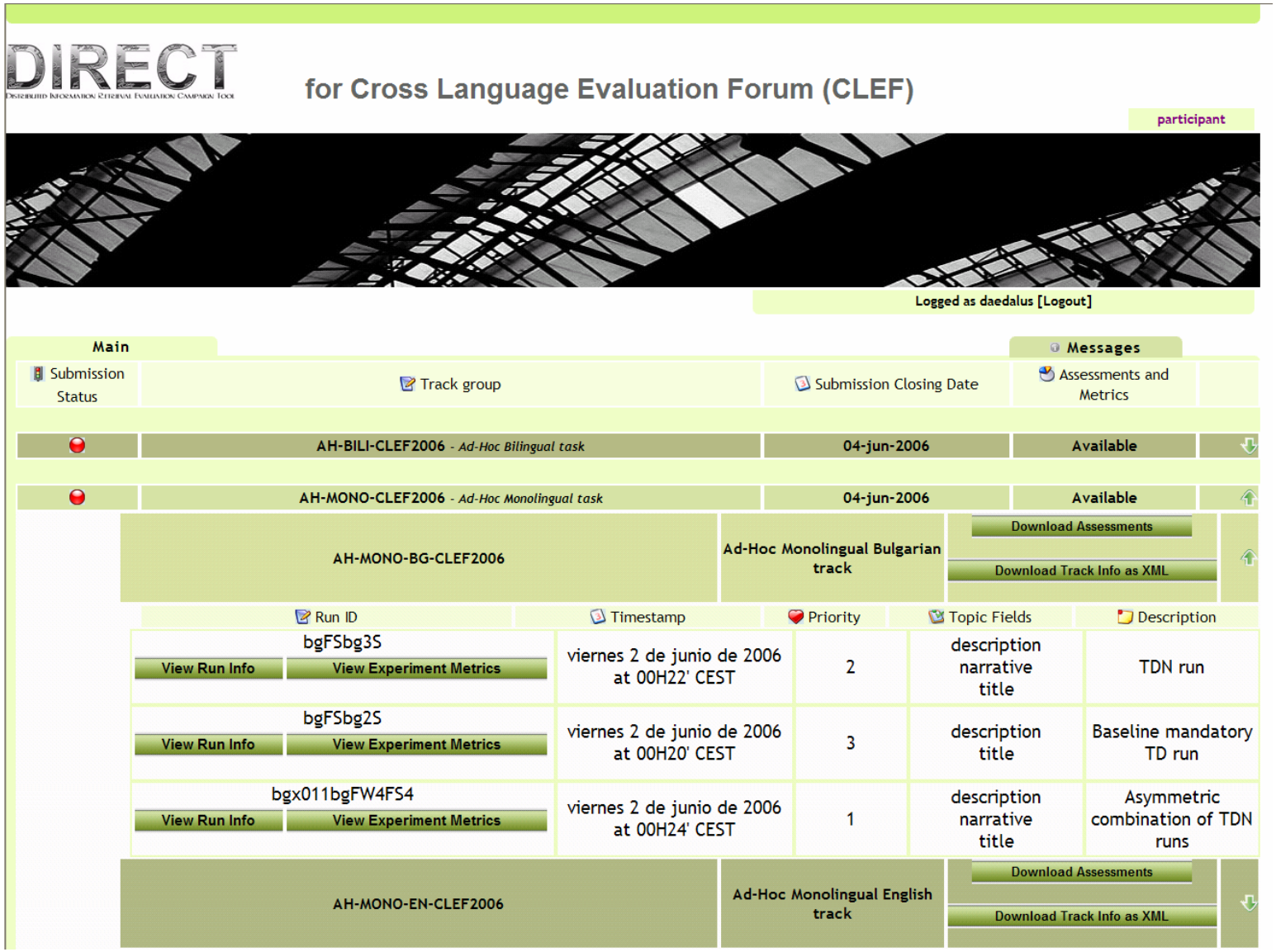
DIRECT Conceptual Model



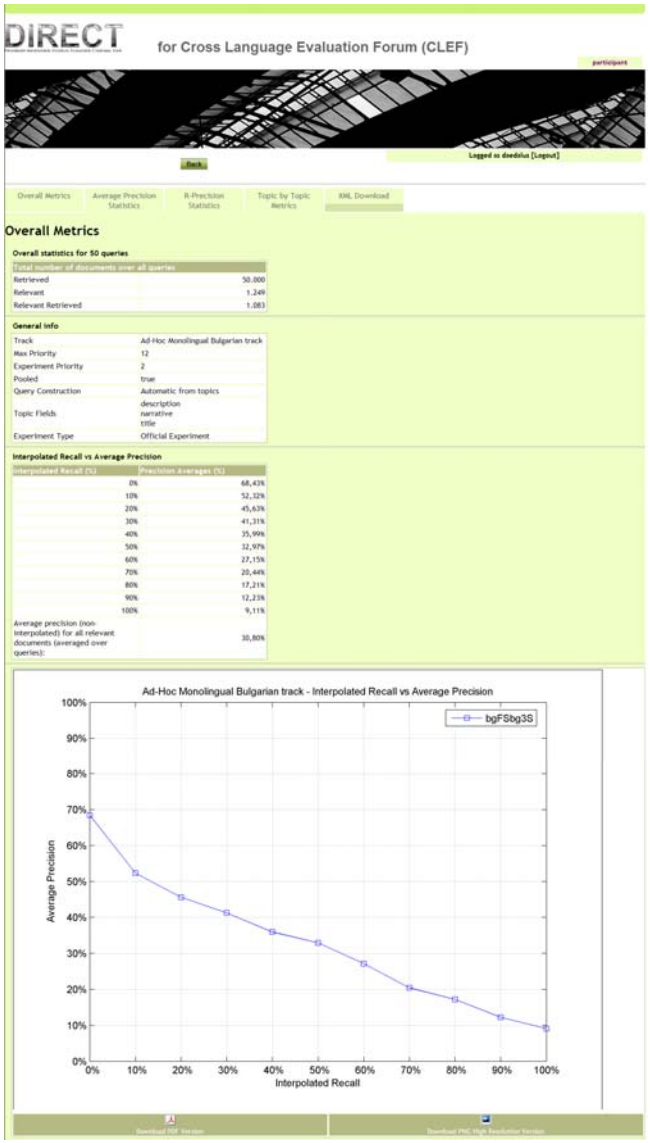
DIRECT Architecture

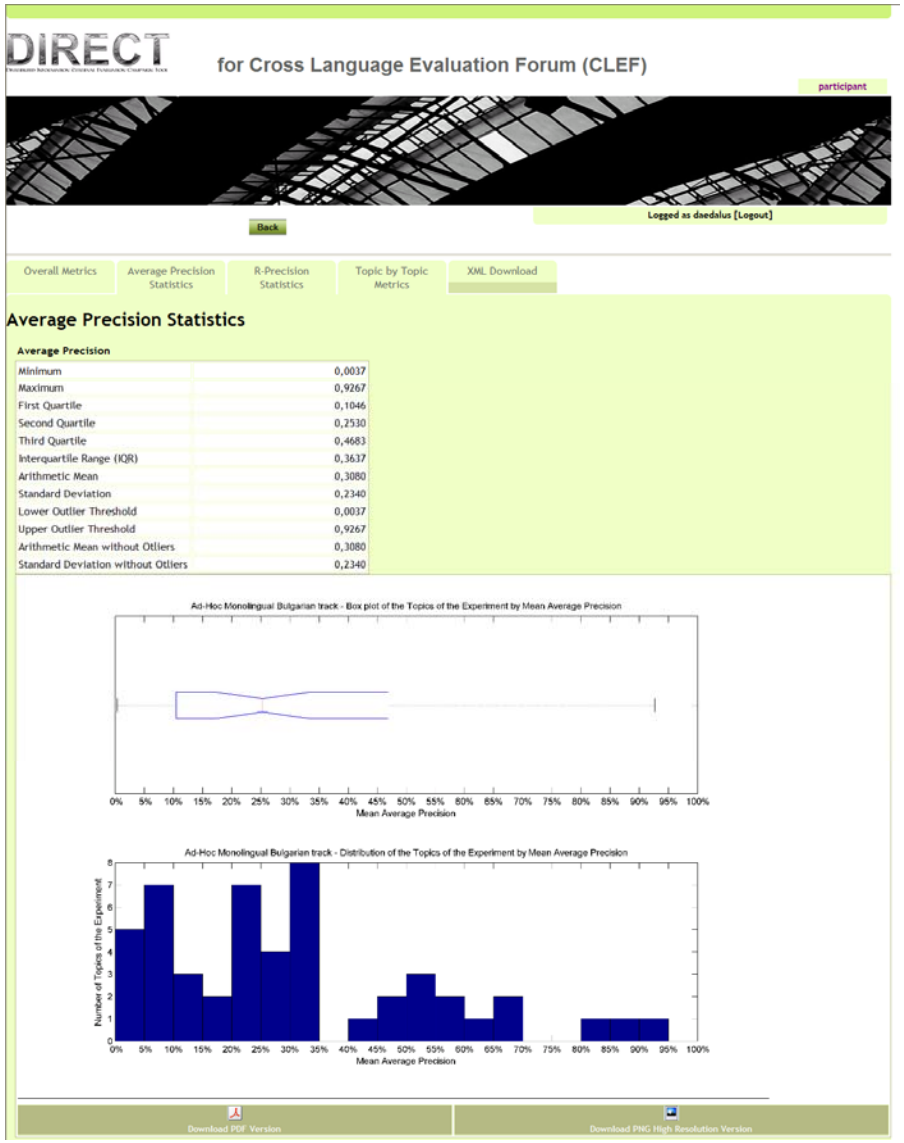


DIRECT Participant Interface (1/2)



DIRECT Participant Interface (2/2)





DIRECT Assessor Interface (1/2)

DIRECT

for Cross Language Evaluation Forum (CLEF)

assessor

Logged as petya [Logout]

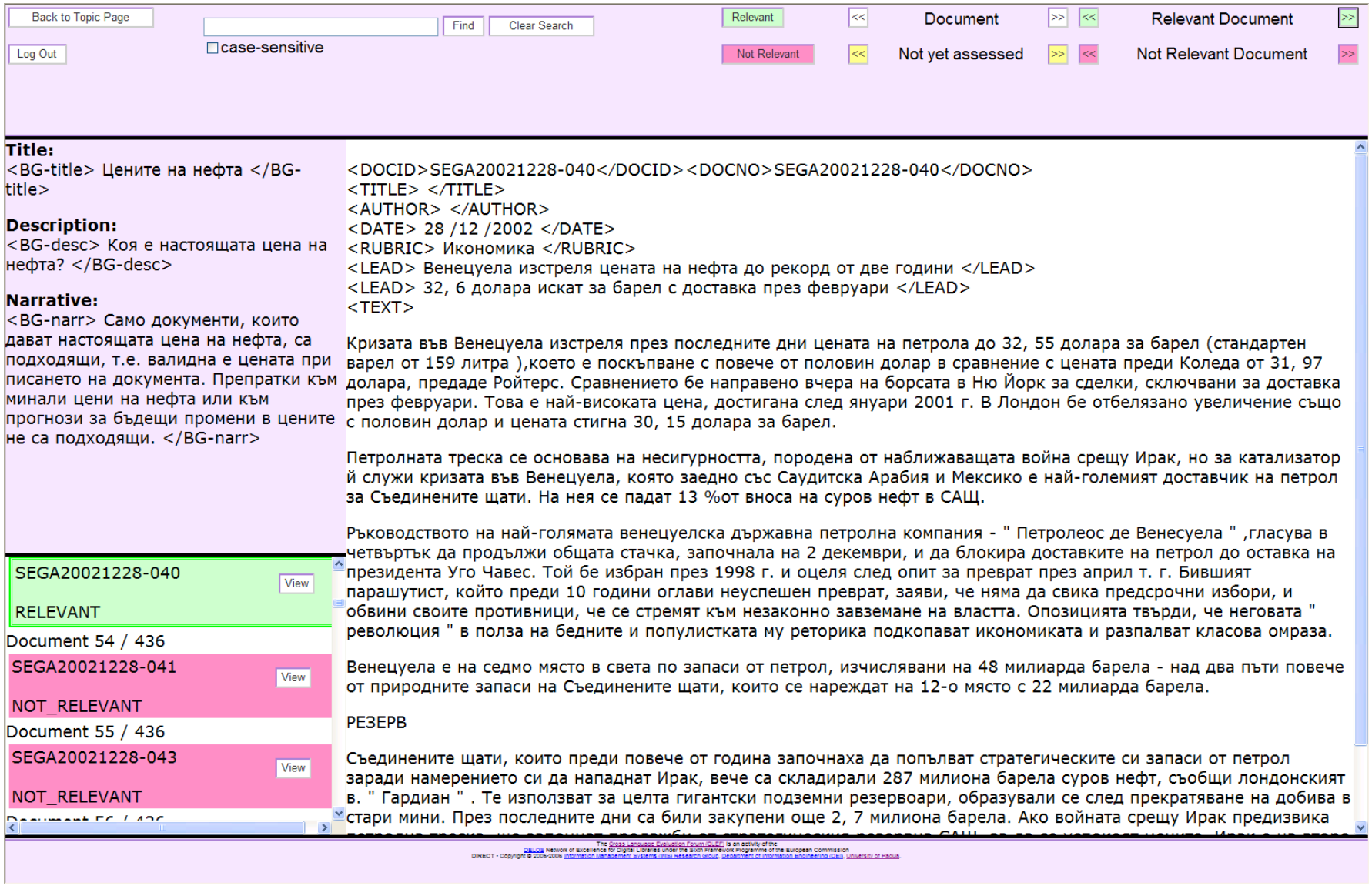
Assessments | **Messages**

Reload Pools

Assessments Status	Pool Name	Pool Description	Assessed Documents / Total Documents
	AH-BULGARIAN-CLEF2006	**Bulgarian Pool for AH-MONO-BG, and AH-BILI-X2BG**	**17 308 / 17 308**

Topic ID	Topic Summary	Total	Relevant	Not Relevant	Not Assessed	Assess Topic
301	Какви продукти на Нестле се продават по света?	487	2	485	0	
302	Намерете документи, които описват или дискутират въздействието на бойкоти от страна на потребителите.	413	6	407	0	
303	Намерете информация за места, където са изложени италиански картини.	367	9	358	0	
304	Дайте имената и/или нахождението на местата, които са били посочени от ЮНЕСКО за места на световното наследство с изключителна красота или важност.	402	14	388	0	
305	Коя е настоящата цена на нефта?	436	16	420	0	
306	Намерете документи, описващи дейността на баската терористична група ЕТА във Франция.	330	3	327	0	
307	Намерете каквато и да е информация за филми, чието действие се развива в Шотландия.	274	3	271	0	
308	Намерете документи, които споменават за пълно или частично слънчево затъмнение.	483	11	472	0	
309	Какви са опасностите за здравето от нелегалните "твърди" наркотици, като например хероин и кокаин, в сравнение с "леките" наркотици?	250	25	225	0	
310	Намерете документи, които описват методи, използвани за обработката или съхранението на индустриалните отпадъци.	321	8	313	0	
311	Намерете информация и цифри за нивото на безработица в европейските страни.	259	5	254	0	
312	Какви са последствията от нападенията на кучета над хора?	299	26	273	0	
313	Намерете документи, описващи чествания по случай 100-годишнината на някое събитие.	318	42	276	0	
314	Какви мерки се вземат в Европа, за да се защитят животните или растенията, които са изложени на риска да изчезнат?	490	30	460	0	
315	В кои спортове се използват непозволени лекарствени средства?	536	66	470	0	

DIRECT Assessor Interface (2/2)



Conclusions

- We have discussed the issues concerning the management, enrichment and curation of the scientific data produce during the evaluation
- We have proposed some possible extension to the current evaluation methodology
- We have designed and developed the DIRECT system, a DLS for IR scientific data, which has been tested in the context of CLEF 2005 and 2006