



Ontology-Driven Sub-Query Extraction in **UnIT-Net IEDI**



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**UnIT-Net: IT in University
Management Network**
TEMPUS/TACIS MP-JEP-2010-2003

<http://www.unit-net.org.ua/>

ISTA'04, Salt Lake City, 15-17.07.2004

UnIT-Net - TEMPUS/TACIS MP-JEP-2010-2003

□ **Title: IT in University Management Network**

□ **Objective(s):**

- Creation of the Ukrainian National “**Network of Excellence**”
- Dissemination of the **best practices** – IT in University Management
- Elaboration of the **Specifications** recommending reasonable ways of using IT in University Management
- Design and implementation of the **Research Prototype** of the National **Infrastructure for Electronic Data Interchange** (mediator-wrapper, hybrid knowledge representation)



□ **Participants:**

- Kherson State University (project coordinator)
- Ministry of Education and Science of Ukraine
- Kharkiv national University
- Zaporozhye State University
- University of Nice – Sofia Antipolis, France
- Glasgow Caledonian University, UK

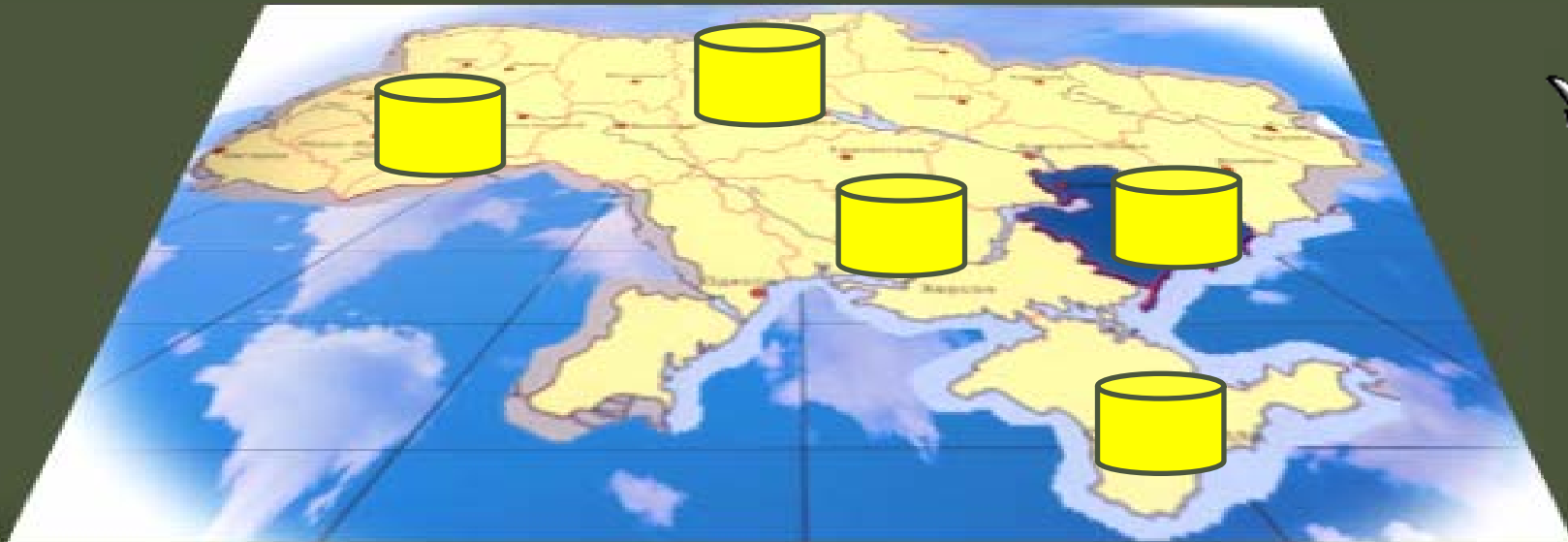
□ **URL:** <http://www.unit-net.org.ua/>



UnIT-Net IEDI Context: Distributed IR





I have a query to all of you
in terms (and in language)
that I understand



We provide IR-s annotated in terms suitable for us
And, normally, we do not care about the others

Problems to Solve:

- **Q1: How to add a new IR to a Retrieval System?**
 - **A1.1:** Wait until its owner volunteers to provide the annotation (**IR registration**) – **UnIT-Net** 
 - **A1.2:** **Crawl** the Web for publicly available IR-s


- **Q2: How to align our beliefs on IR to its actual state?**
 - **A2.1:** **Wait until the owner informs** about the changes, then align – **UnIT-Net** 
 - **A2.2:** **Mine** the changes from IR-s regularly.
Align accordingly

Problems to Solve:

□ **Q3**: How to formulate & perform queries to such an IR Grid?

□ **A3**: **UnIT-Net**

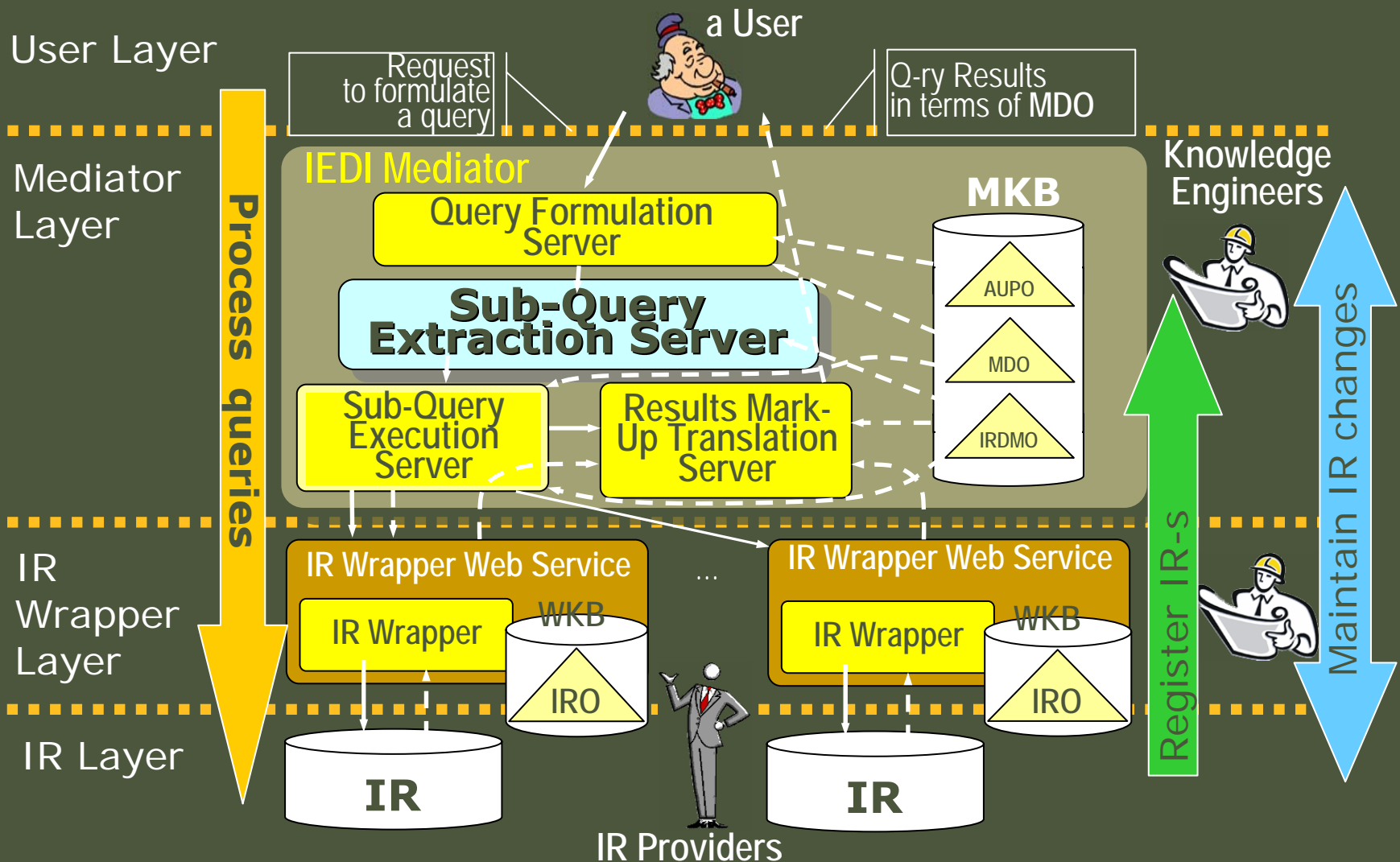
- Assist a User to **formulate** his query in terms familiar to him
- **Transform** the query to the terms commonly accepted for the Domain

 **Decompose** the query to the set of sub-queries

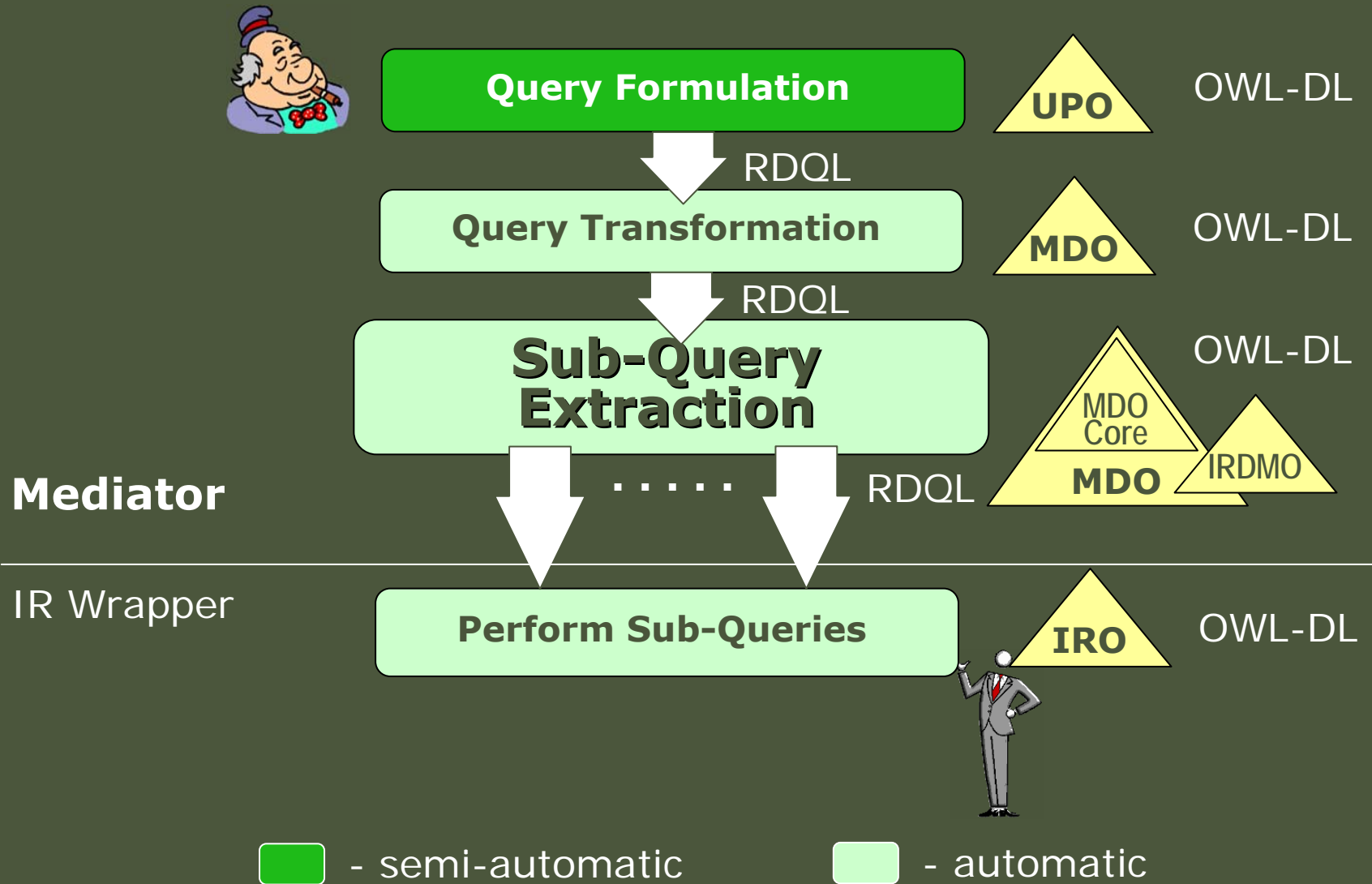
- **Forward** sub-queries to appropriate IR wrappers
- ...
- (**Fuse** and) **Return** the **results** to the User



IEDI Architecture in a Nutshell



Ontology and Language Aspect:



A Walkthrough Example

Why?

- Return the list of the 1-st year CS students who:



- had received **maximal grade** in **Mathematics** at the entrance examinations

- and have **failed** to pass the 1-st Term examination in **any basic course in Mathematics**



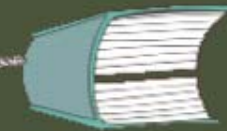
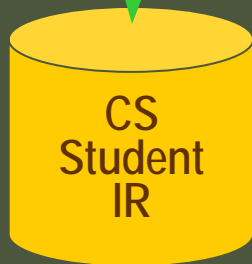
A Walkthrough Example

Return the list of the 1-st year CS students who:

had received **maximal grade** in **Mathematics** at the entrance examinations



and have **failed** to pass the 1-st Term examination in **any basic course in Mathematics**



Ontology

Mathematics:

- Math Analysis
- Linear Algebra
- Analytical Geometry

...

A Walkthrough Example

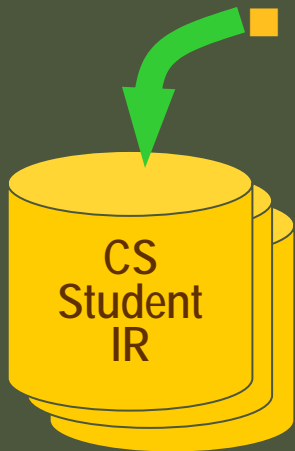
of different
Universities

Return the list of the 1-st year CS students who:

had received **maximal grade** in **Mathematics** at the entrance examinations



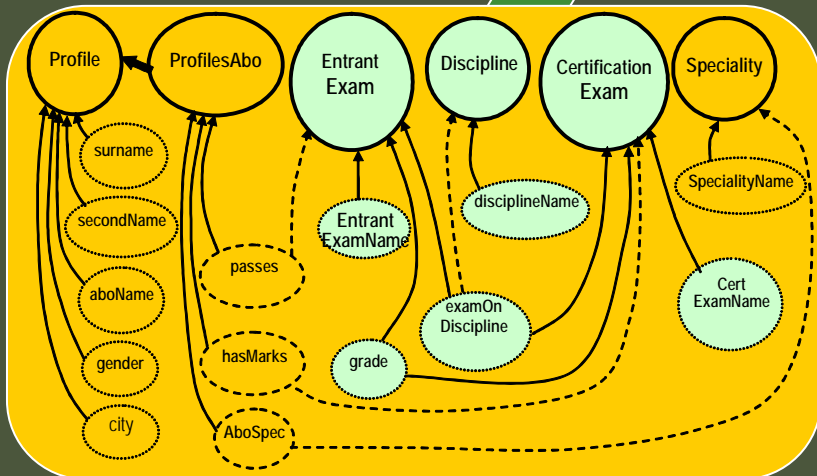
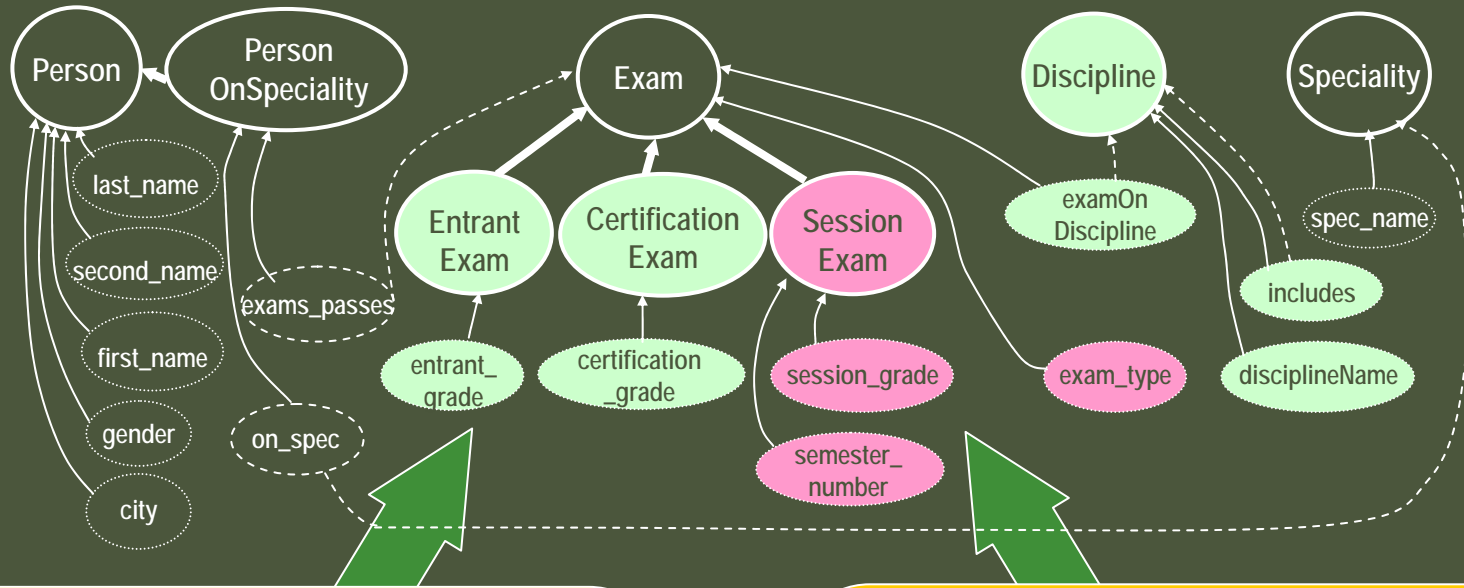
and have **failed** to pass the 1-st Term examination in **any basic course in Mathematics**



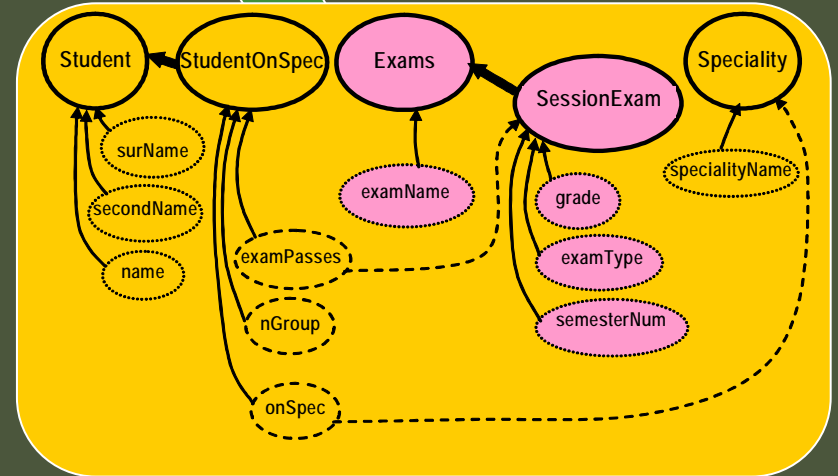
..and different
basic courses
in the 1-st
term

Mathematics:
- Math Analysis
- Linear Algebra
- Analytical Geometry
...

MDO and IRO-s for the Example



IRO: University Entrants



IRO: CS Students

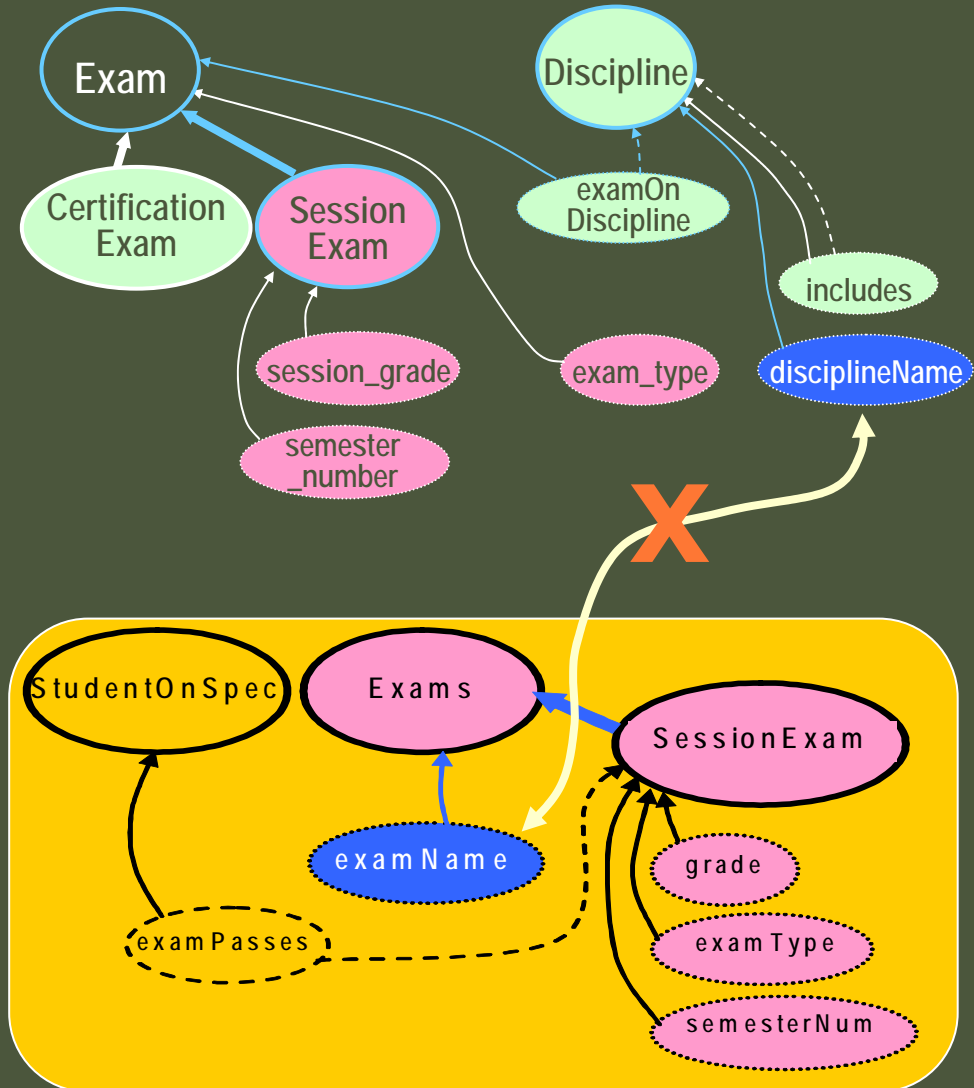
IRO Registration is NOT a Simple Join

Note:

- IR-Domain Mapping Ontology (**IRDMO**) provides only **minimally necessary mappings**:

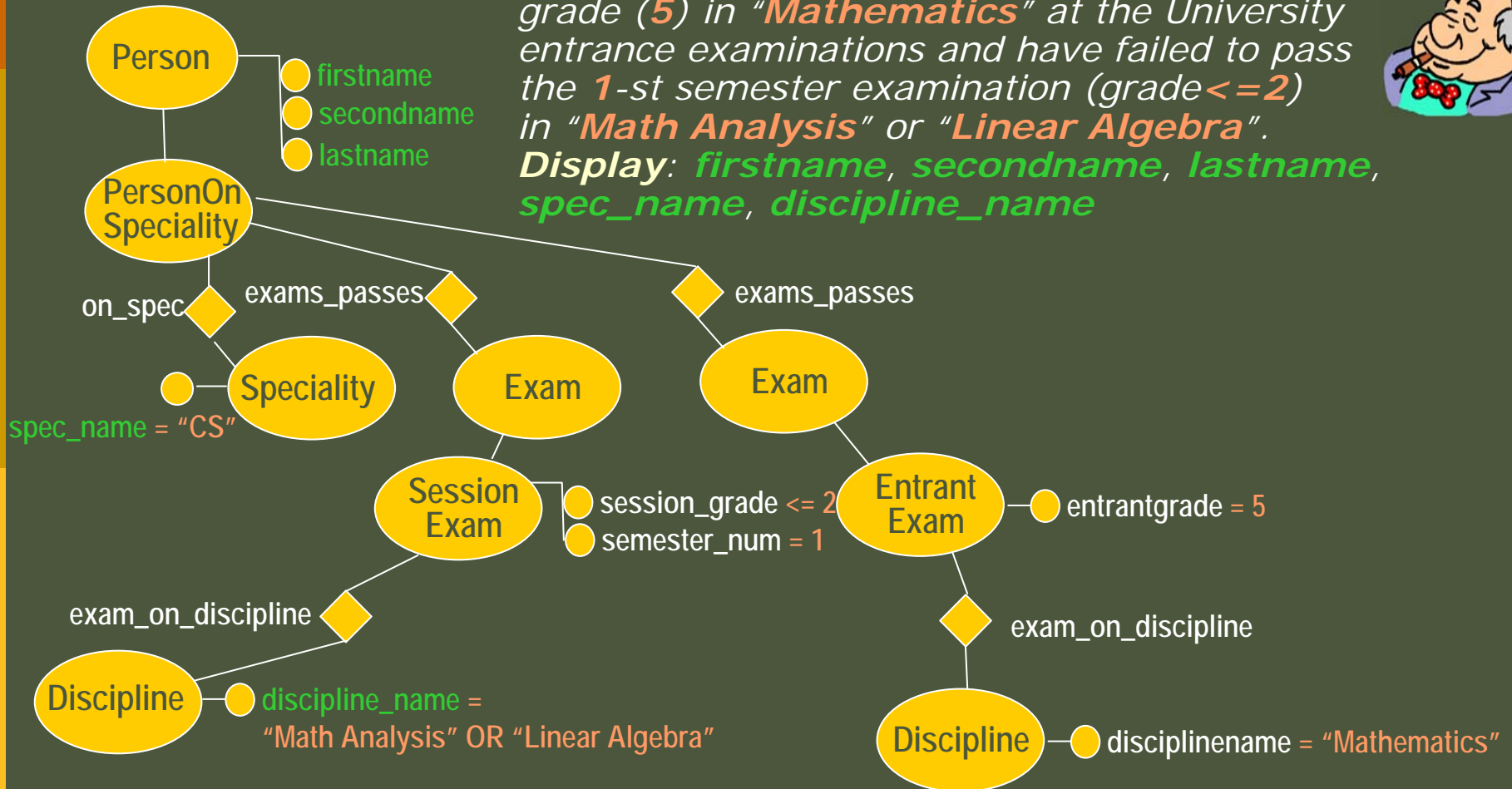
- Slots defined for the concept
- But NOT the slots inherited from its superclass

Requires **Late Binding**



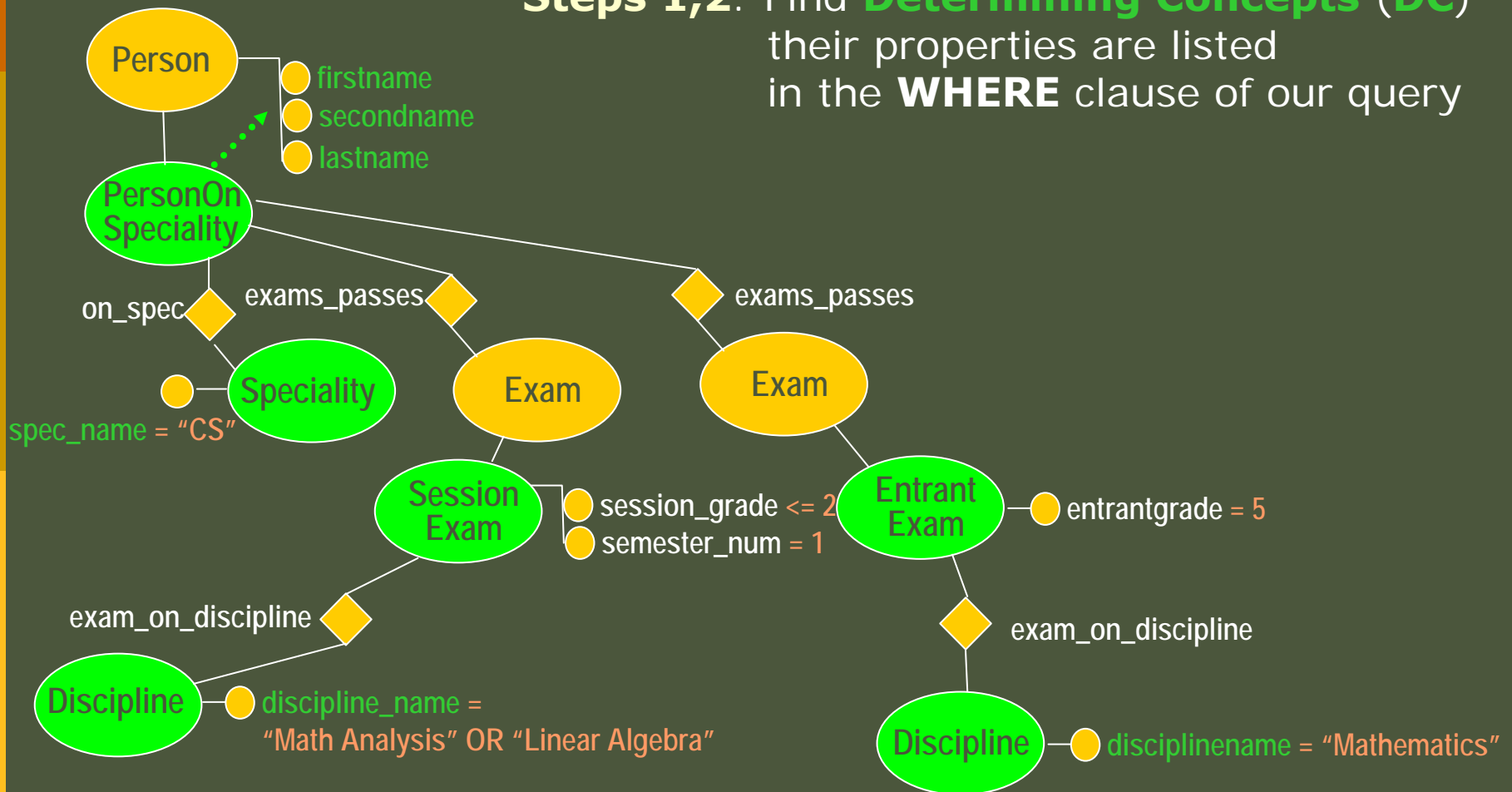
Conceptual Graph for Example Query

Retrieve "CS" students who had got maximum grade (5) in "Mathematics" at the University entrance examinations and have failed to pass the 1-st semester examination (grade ≤ 2) in "Math Analysis" or "Linear Algebra".
Display: *firstname, secondname, lastname, spec_name, discipline_name*

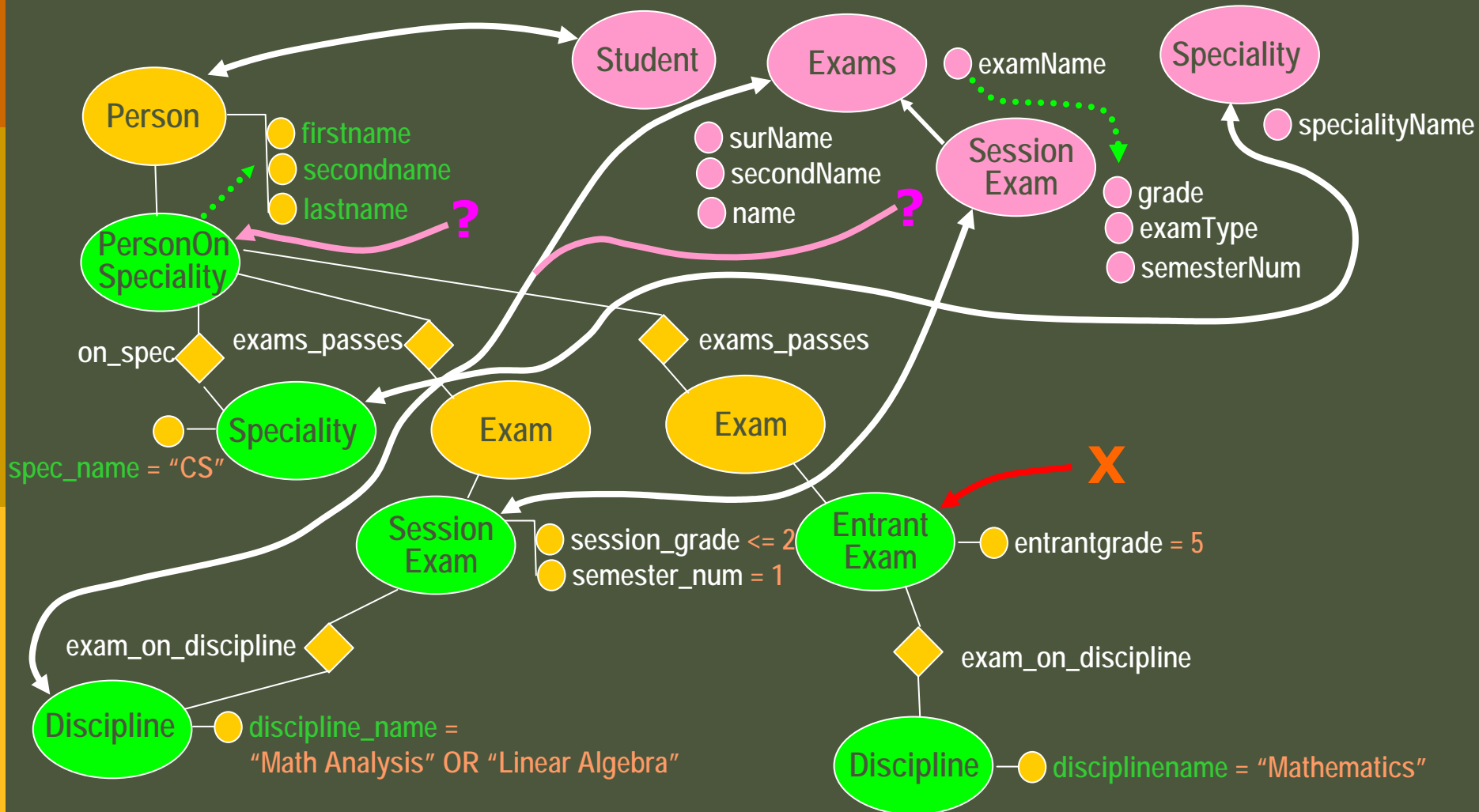


Sub-Query Extraction

Steps 1,2: Find **Determining Concepts (DC)** their properties are listed in the **WHERE** clause of our query



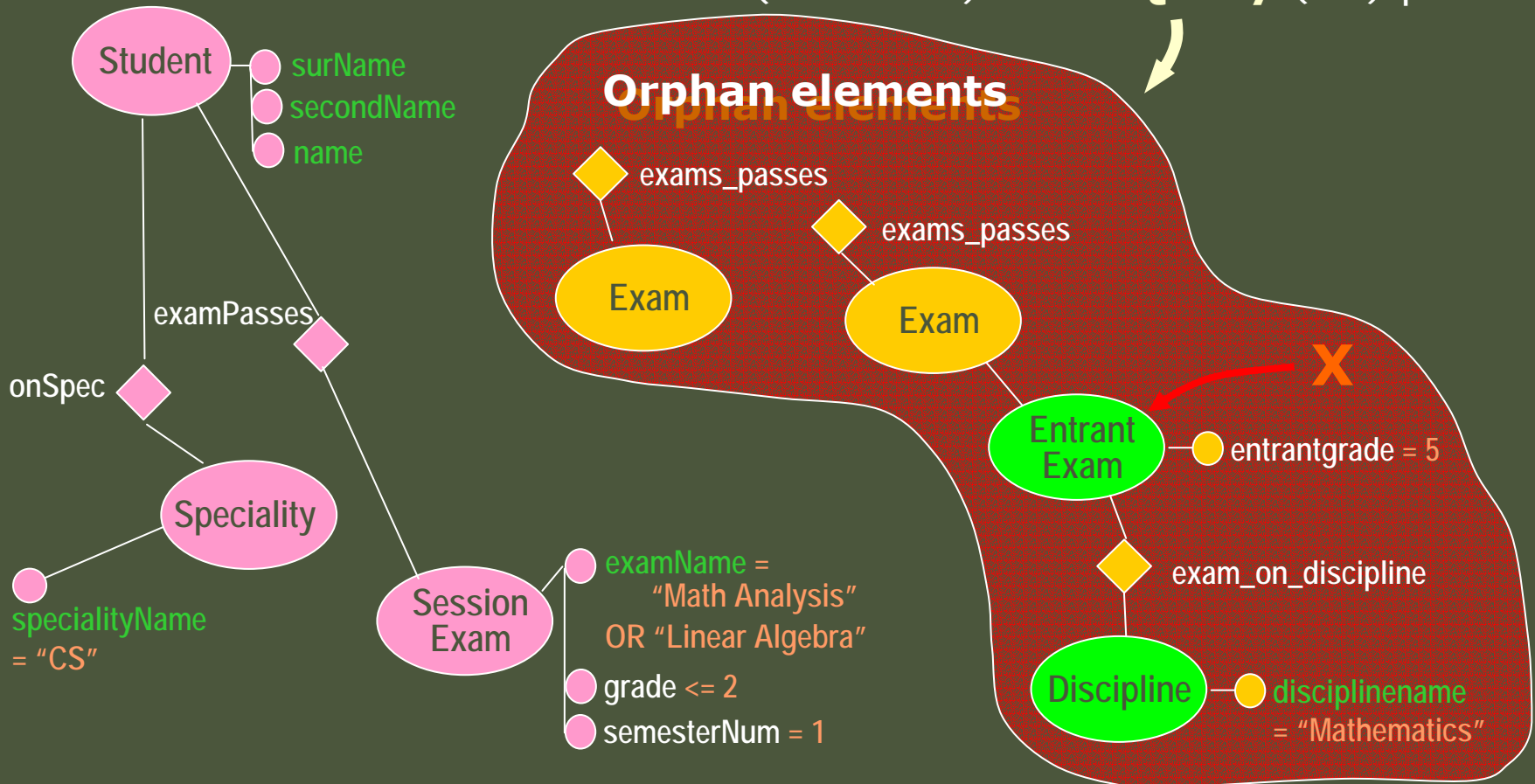
Mappings Recorded in IRDMO (MDO ↔ Stud IRO)



? – **Late Binding** required to resolve the mapping

Resolved Mappings: MDO ↔ Stud IRO

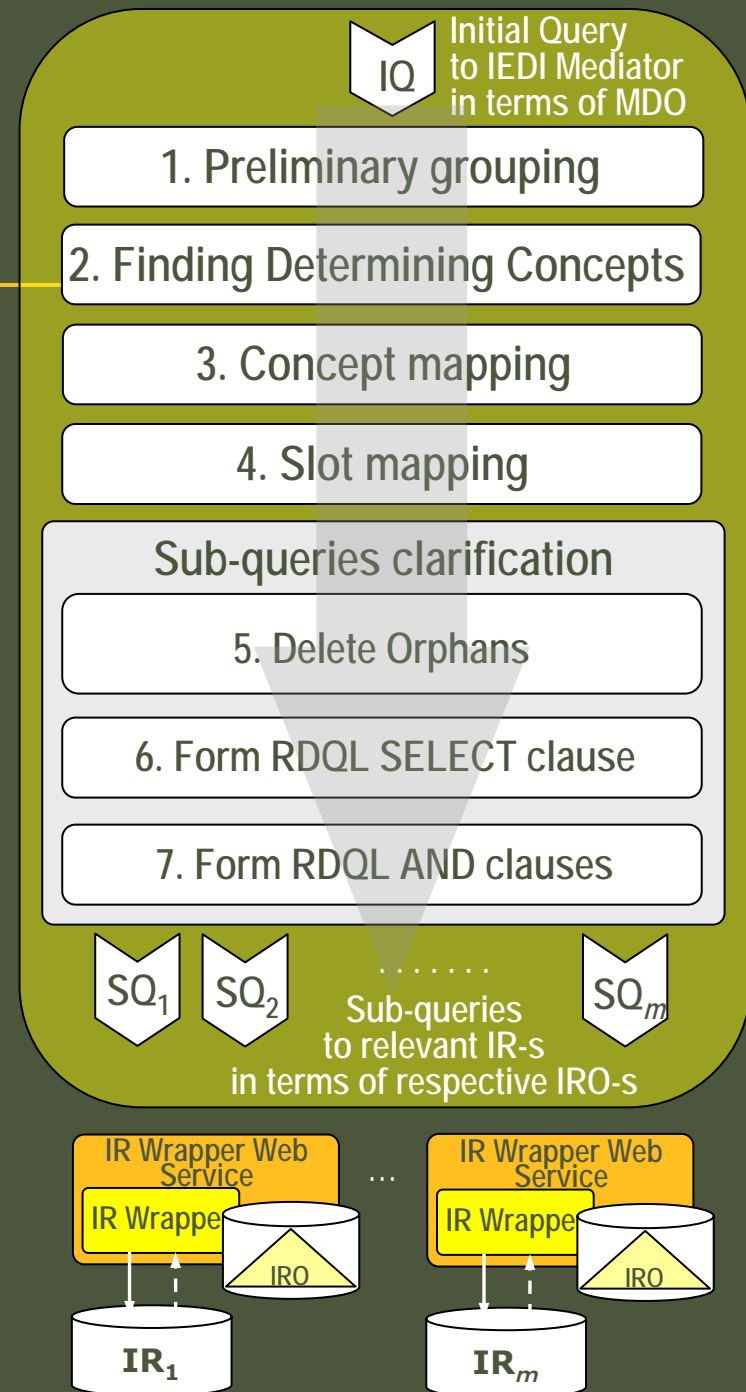
Steps 3,4: Resolve **Concept and Slot Mappings**
Result: a (subset of) **Billet Query** (ies) per **IR**



Orphan elements – to be deleted at Query Clarification - Step 5

ODSQE at a Glance

- Features:
 - IRDMO provides only minimally necessary mappings
 - Late Binding is used to resolve mappings in subclass/superclass chains (further development - meronymy)
 - Multiple mappings result in series of Billet Queries per IR
 - MDO Core is used to fix the minimal set of concepts common to all IR-s



ODSQE Properties

- ❑ Builds the set of IRO queries for a specific MDO query (**existence**)
- ❑ Builds the unique set of IRO queries for a specific MDO query (**uniqueness**)
- ❑ The recall of a hypothetical MDO query is less or equal to the combined recall of the set of the produced IRO queries (**complete coverage**)

To Conclude ...

- Initial **proof-of-concept implementation** of ODSQE is done
- **UnIT-Net IEDI** Sub-Query Extraction Server is **under development**

- **Further development:**
 - Richer semantic relationships
 - More intelligence in Late Binding for non-equivalent concepts

That's it ...

**Shall be happy
to know the answers**

These slides are available from: http://eva.zsu.zp.ua/eva_personal/evapubs.htm