Virtual Observatory Concept

The eGY Education and Outreach Program is developing an education portal that connects teachers around the world, in a well-defined way, to the virtual observatories and their data. The serious question is: are these virtual observatories ready or capable of providing quality scientific data for teachers (and students) to use in lessons? What role do efforts such as virtual research environments (e.g. Sakai) play as an intermediary between the teacher and any particular virtual observatory which can be complex, jargon-ridden, acronym-laden, hard to navigate, and just ‘different’ from another virtual observatory?

An answer to both these questions, interestingly, also provides a valuable resource for virtual observatories themselves. The so-called ‘Use-Case’ methodology where a user writes down, in a specified level of detail, their use of a virtual observatory including their pre-conditions, knowledge assumptions, etc. is essential in developing interfaces, architectures and choosing technologies for virtual observatories.

In short, if a virtual observatory was never asked to serve an educational user (e.g. a teacher), and that need was never articulated, then it is little surprise when an educational user finds it hard or impossible to use a virtual observatory.

This presentation will give examples of use-cases, show how to develop them, and how they lead to user requirements and system design. We also show why semantics and the use of formal methods such as ontologies can break down formidable vocabulary barriers and provide educators with useful tools.

What’s a Use-Case?

A 12th grade teacher is preparing a lesson plan aimed at getting students to learn more about the northern lights. The teacher wants the students to learn the scientific terminology, where the phenomena occurs and retrieve some data or graphics for a recent occurrence.

1. Goal

To generate enough information to prepare a lesson plan in this topic area.

2. Main Actor

Teacher. The teacher is an individual with college education and knows in general terms what to search for and what hints a student may need to complete the assignment.

3. Preconditions

Teacher does not need any special permission, access requirements or additional resources to meet the goal; students and teacher must be able to access all data, images, etc. over the internet over low-speed connections.

4. Characteristics

* Each selection made by the teacher acts as a constraint for the presentation of selections on the next screen. For example, by selecting a particular phenomenon the teacher is presented with both more specific and related information.

* The teacher is guaranteed, through the selections made, to obtain data, images and supporting information that are directly related to the topic area of interest (i.e. are not spurious).

5. Use Case is displayed in diagram form below and across.

**What are virtual observatories?**

A Virtual Observatory (VO) is a suite of software applications on a set of computers that allows users to uniformly find, access, and use resources (data, software, document, and image products and services using these) from a collection of distributed product repositories and service providers. A VO is a service that unites services and/or multiple repositories.

An interdisciplinary VO, the Virtual Solar-Terrestrial Observatory (VSTO) is a distributed, scalable education and research environment for searching, integrating, and analyzing observational, experimental and model databases in the fields of solar, solar-terrestrial and space physics.

VSTO comprises a system-like framework which provides virtual access to specific data, model, tool and material archives containing items from a variety of space- and ground-based instruments and experiments, as well as individual and community modeling and software efforts bridging research and educational use.

**What do virtual observatories need?**

Virtual Observatory efforts need use-cases that push the boundary between the specialist and non-specialist. The non-specialist can be anywhere from familiar with a field to very unfamiliar. The key is the terminology and vocabulary generated out of the use-case. Developers, educators and educators need to consider the knowledge representation experts, VO designers and engineers can transform the use-case into a set of semantic specifications for how to implement a use-case such as the one in the left panels of this poster.

What would arise in this use-case is the need for a set of linked and consistent terminology across the physical domains that are covered, the physical phenomenon, the parameters to represent the phenomenon, etc.

To bridge this terminology gap a controlled vocabulary which, when implemented within a network of computers and services, is known as an ontology needs to be developed.

**How to make the connection?**

VIRTUAL OBSERVATORIES - What do they need?

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**Use-Case**

Teacher accesses internet goes to Virtual Observatory entry site and enters a search for "Aurora".

Teacher receives four groupings of search results:

- Educational materials: http://www.meted.ucar.edu/topics_spacewx.php and http://www.meted.ucar.edu/topics_aurora/
- Research, data and tools: via VSTO, VSPO and VITMO, knows to search for brightness, or greenline emission
- Did you know?: Aurora is a phenomena of the upper terrestrial atmosphere (ionosphere) also known as Northern Lights

Teacher selects: models of the aurora during high solar activity

VO returns a link to an animation of a solar Coronal Mass Ejection impacting the Earth's Magnetosphere and transmitting the disturbance into the inner magnetosphere and then into the lower thermosphere and ionosphere, and demonstrates the electron precipitation that results in the northern auroral oval.

A link is provided for the teacher to download the movie and search for data of brightness on a latitude/longitude grid.

Teacher loads the data into a spreadsheet program and plots a color contour of the aurora. The teacher then starts developing the lesson plan for the students.

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