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Space Science Education Resource Directory

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Abstract. The Office of Space Science (OSS) of NASA supports educational programs as a by-product of the research it funds through missions and investigative programs. A rich suite of resources for public use is available including multimedia materials, online resources, hardcopies and other items. The OSS supported creation of a resource catalog through a group lead by individuals at STScI that ultimately will provide an easy-to-use and user-friendly search capability to access products. This paper describes the underlying architecture of that catalog, including the challenge to develop a system for characterizing education products through appropriate metadata. The system must also be meaningful to a large clientele including educators, scientists, students, and informal science educators. An additional goal was to seamlessly exchange data with existing federally supported educational systems as well as local systems. The goals, requirements, and standards for the catalog will be presented to illuminate the rationale for the implementation ultimately adopted.

1. The Challenge

For the last decade, NASA has invested the creation of a wealth of Space Science educational and informational resources derived from its flight missions and related research. These materials are available from a variety of sources including universities, other educational institutions and NASA Centers. A wide range of users (teachers, students, museum staff, the general public, etc.) are keen to find and access these resources.

Content providers (i.e., the Space Science flight mission personnel, individual researchers and NASA staff), desire to know what kind of resources exist and how materials currently in production complement each other and need a consolidated mechanism for making their own products visible and easily deliverable to the public. NASA as a stake-holder is interested in determining the level of return on its support to education and outreach efforts. These objectives have been addressed through the creation of an education resource directory meeting the varied needs of the different customers of Space Science education.

2. Directory Development Strategy

The directory provides a robust infrastructure spanning all of NASA's Space Science education endeavor. It is to be a single source (i.e., a "one stop shop")

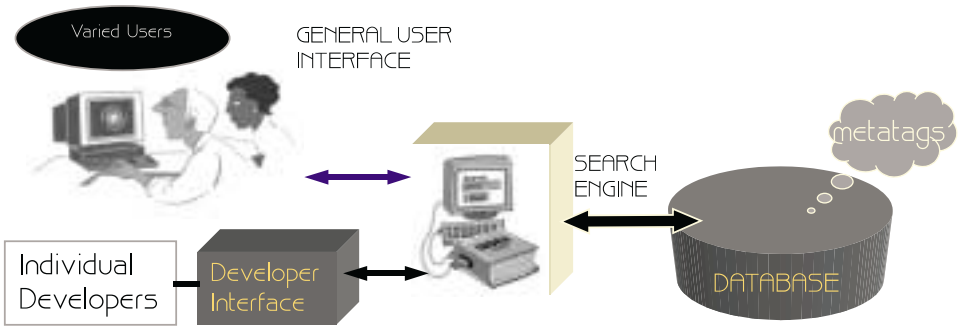

Figure 1. Basic architectural scheme for Space Science directory.

for access to online, hardcopy, and physical media. The model is based upon the successful *amazon.com* interface because we need to address a wide range of user needs in a similar way. More sophisticated attributes of the directory interface will include resource recommendations, user feedback mechanisms, thumbnail sketches of resources and personal preference lists and notifications. Also, providers and stake-holders wish to generate various reports, probe inventory information and track resource usage with other custom interfaces to the directory. There was also a strong motivation not to re-invent needed infrastructure, but to use existing methods where possible.

Additional directory requirements were culled from the end users as well as providers and NASA agency personnel. These requirements include:

- handling multimedia and varied physical media
- insuring quality control and assurance of the content, upholding the level of excellence expected of NASA
- testing materials for utility, functionality, and pedagogy and certifying scientific and technical accuracy
- protecting intellectual property rights
- enabling programmable interfaces for various directory uses, including inventory resolution and various methods of payment

3. Implementation

3.1. Creation of infrastructure and core functionality

The basic architecture on the user side developed in Phase I (Fig. 1) involves the creation of the core database that contains all descriptions of available resources, the overlying search engine, other software applications and an interface layer. The end user interface layer is initially a generic web interface intended to eventually accommodate more individualized features. Developers use customized interfaces to extract more detailed information from the system as well as generate reports.

Registration of materials occurs as content providers enter relevant information through a form based web interface (not shown). Upon entry, information on resources is cached. Subsequently, cursory initial reviews and more sub-

stantial evaluation processes serve as a gate to the registry process. Resources needing revision are identified to content developers for rework, and suitable resources are registered in database in order to insure resource integrity. Resources are reviewed for accuracy, relevance, usability, and pedagogical approach and other criteria. Automatic processes generate appropriate information to export information and translate Space Science information for submission to external systems (Eisenhower, Gateway to Education Materials, NASA EDCATS, NASA CORE, SpaceLink, etc.)

In Phase II, tools for user customized interfaces similar to web interfaces such as "My Netscape" and others will be developed. Also the issues of inventory currency and location are being addressed, and methods derived from e-commerce applications must clearly be considered. Phase III involves implementation of user profiles to provide custom recommendations, email notification, cell phone notices and the like.

4. Metatags

The heart of the Directory is a meta-tag scheme used to thoroughly describe the educational resources. After examination of a number of candidate systems, the Dublin Core Standards were adopted. In particular, the national consortium, Gateway to Education Materials (GEM)[1] has defined particular schema relevant to education materials. These established efforts represent years of considerable investment that could be easily adapted to insure that the NASA Space Science directory contains schema (controlled vocabulary and accepted, standard values for meta-tags) relevant to its discipline including astronomy, space physics and solar system physics nomenclature. By adopting these standards, the directory is as widely distributable as possible. The GEM consortium was formed and produced an infrastructure that has an expansive view of its target audience, beyond what NASA requires. In addition, GEM continues to do active research in the area of meta-tags while keeping in lockstep with Dublin Core developments. In this way the NASA directory is continually kept in line with the state-of-the art in information technology education cataloging.

5. Aknowledgements

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[1] `http://www.thegateway.org/`

Figure 2. Upper graphic: General User Interface for the Space Science Directory. Lower graphic: User interface demonstrating browsing for specific Space Science resources. See http://teachspacescience.stsci.edu