

Remote Sensing Utility Expansion through Earth Portal Internet Browser

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Abstract - A modular, graphic-oriented Internet browser has been developed to enable non-technical client access to a literal spinning world of information and remotely sensed. The Earth Portal (www.earthportal.net) uses the ManyOne browser (www.manyone.net) to provide engaging point and click views of the Earth fully tessellated with remotely sensed imagery and geospatial data. The ManyOne browser technology use Mozilla with embedded plug-ins to apply multiple 3-D graphics engines, e.g. ArcGlobe or GeoFusion, that directly link with the open-systems architecture of the geo-spatial infrastructure. This innovation allows for rendering of satellite imagery directly over the Earth's surface and requires no technical training by the web user. Effective use of this global distribution system for the remote sensing community requires a minimal compliance with protocols and standards that have been promoted by NSDI and other open-systems standards organizations.

Keywords: 3-D Geobrowser, Digital Earth, Global Tessellation, Internet Web Services.

1. Introduction

The Earth Portal, managed by the Environmental Information Coalition (EIC), represents a bold new enterprise in creating the world's first comprehensive, science-validated and authoritative online environmental information resource. From the expertise of thousands of EIC affiliated scientists and expert partners nationally and globally, the Earth Portal is creating an unprecedented and engaging experience for citizens and decision makers (www.earthportal.net). Beginning in summer 2005, citizens and scientists will be presented with a unique 3-dimensional Digital Earth projection as the initial navigation and query interface to access and communicate with the content and resource domain, know as the Digital Universe. The Digital Universe framework will include portals for Astronomy, Cosmos, Health, Energy, Climate Change, Biodiversity, Sustainable Development, Youth, and Education Resources, et cetera, to help shape a better future for our planet.

Why do we need the Earth Portal? Since the Digital Earth vision was popularized by former Vice President Al Gore in 1998, internet experiences have not changed for the better. Current experience with the World Wide Web network provides the user with huge quantities of valuable but fragmented information without any ability to discriminate or determine the authenticity or value of the information. In addition, a plethora of spam, spy-bots, and viruses have added significantly to this user

experience. Uncertified and indeed, socially destructive materials are rapidly spoiling the Internet experience for many. Valuable information can be difficult to distinguish from unreliable materials making teaching, research, and daily educational experiences a formal challenge. The Earth Portal has created the first universal, non-commercial, collaborative forum for bringing the best qualified materials and resources together under the highest standards for quality, verification, and appropriateness for specialized subjects or geography. And it is fun.

Who created the Earth Portal? A coalition of distinguished socially-responsible organizations have harnessed the technology and governance components along with the expert input from thousands of "stewards" for this enterprise in order to educate millions of people about the state of the environment via timely, objective, trustworthy information. This coalition is managed through the Environmental Information Coalition secretariat, hosted by the National Council for Science and the Environment, and includes many nodes and principals from NASA's original Digital Earth program (1999-2000). The technology platform, both 3D browser and internet service provider (ISP) are supported by the ManyOne Networks corporation, which is overseen by an international non-profit foundation. Major science, NGO, academic, government, and industry groups are providing the content resources. This tremendous array of entertaining information resources and tools combined with facilitated community forums will empower users at home, in the community, and regionally to make informed decisions about the Earth and the wise use of its ecological services and resources. All of this is set within a unique Internet Service Provider business model that divides the profit margins for sustained maintenance, upgrades, and quality assurance of content. While the science community rarely attends to the issue of sustainable business models for science and remote sensing data access, they have been fully dependent upon unsustainable systems using tax dollars or grants. A unique, sustainable public-private business model akin to a Type II Partnership, is therefore being constructed for implementation of the Digital Earth design concepts.

How does the Earth Portal work? The Earth Portal consolidates and organizes a world of information into an array of logically presented topics, accessibly with an innovative "universal navigator" for a taxonomy ranging from coral reefs to neighborhood recycling centers. Content managers (stewards) working within a collaborative framework of experts provide quality control and certify an encyclopedia of linkages within their area of expertise. The browser menu options and

technical tools supported by ManyOne Networks. (www.manyone.net), provide rich and entertaining visual content as well as state-of-the-art Internet experience for email, news, sports, investment and shopping in addition to the specialized Earth Portal search and link features, all within the context of a unique certified information architecture. The ManyOne technology is overseen by an international non-profit foundation to ensure adherence to the Earth Charter and the Digital Earth Declaration. Internet implementation of Digital Earth provides an attractive alternative for real people, old and young alike.

Early partners of the Environmental Information Coalition include: National Council for Science and the Environment, World Resources Institute, Environmental Systems Research Institute, Earth 911, George Mason University, National Library of Medicine, Boston University, University of California at Berkeley, American Museum of Natural History, United Nations Environment Programme, Environmental Literacy Council, ManyOne Networks, NatureServe, Humane Society of the United States, and Society for Conservation Biology. It is envisioned that ultimately thousands of such organizations will become content developers for the Earth Portal and distributors of the ManyOne browser and Internet service.

2. Sustainable Technology Business Model

Underlying the Earth Portal is the unique technology business model. This advanced browser and Internet service offers ordinary Internet users a compelling, trustworthy option to the over-commercialized Internet services available today. ManyOne browser system is:

1. An easy-to-use, breakthrough Web browser
2. Bundled with trustworthy Internet services
3. Distributed by affinity partners that share in subscriber revenue
4. Operated by a pioneering, socially-responsible enterprise

3. Enabling a Next-Generation, Rich-Content Web Medium

The development of this innovative Internet platform will catalyze the next-generation, multimedia Web medium, made possible by the synthesis of three technology model elements: 1. The Client: 3-D Universal Browser 2. The Server: Digital Universal Portal Service 3. Content and Distribution: Earth Portal/ManyOne Partner Network (a. Content: Stewardship Partners b. Distribution: Network Partners).

3.1 The Client: ManyOne Universal Browser

One of the central challenges facing organizations wishing to deliver content and services through the Web is the inability to deliver compelling rich-media experiences. The two most popular strategies for conveying multimedia 2D and 3D content to a consumer computing device – media download or polygon download and client-side rendering – cannot by themselves provide a compelling, photorealistic, immersive “space” that instantly responds to user activity, if downloading occurs in real time on less than 5

mbps or so. The duration of download is simply too lengthy for highly interactive content, when compared to the speed afforded by simply fetching content from local RAM or disk storage. Hardware systems and software applications that combine client-device-resident local processing, storage, display, and audio resources with the remote information, applications and services available on the Internet can address this challenge. And the trend is emerging fast. Early examples of this architecture span a spectrum from dedicated applications for e-mail such as Microsoft Outlook to very generalized media interfaces such as America Online to niche tools like the popular SETI@home screen saver. Others include various downloadable stock trading applications, and Microsoft’s MSN Explorer. Yet these represent merely the earliest beginning of this trend. “Internet consoles” employing this architecture are now beginning to emerge in non-PC devices. Innumerable MP3 music players and recorders, TiVo, and online-ready versions of Sony’s PlayStation 2 and Xbox represent examples of the growing diversity of Internet consoles. By 2006, most cell phones will be Internet consoles. The key benefit of this architecture is that it can offer 100mbps-equivalent media experiences decades before such connectivity can conceivably be deployed to the world’s population. Indeed, properly designed Internet consoles can provide Sony Playstation 2 levels of interactivity and immersion at Yahoo levels of snappy performance, on 28.8kbps. The Earth Portal will function on the first Web browser built upon this architecture; perhaps the only Web browser that has truly been “designed for the future.”

A key characteristic of this Universal Browser enables independently-developed portals to automatically and intelligently download and “edge-cache” rich-media content to users’ PCs. This enables portals to provide their subscribers with Sony Playstation-like multimedia experiences on any level of bandwidth – 28.8kbps to DSL or higher. Ordinary 2D Web pages can therefore be replaced with immersive “3D Web spaces,” providing the equivalent of up to a 100mbps user experience even on narrowband. Developed entirely within open Internet and Web standards these capabilities brings to the world of portal developers for the first time, with almost no startup or operating costs using open-source protocol, an plethora of popular site development tools to build their portals, and they can host their portals on their own as they do today. Content partners are collaborating on developing together a multimedia Internet directory and navigation system ultimately tying over 400,000 portals and millions of the Web’s best links together into the world’s first “Digital Universe” – a rich-media electronic representation of the actual Universe, Earth, Nature, and society we all live within. Once installed, subscribers can navigate the Internet as a whole using a dazzling 3D “cockpit” – right inside their browser, without the need for a 100mbps connection.

This incredibly user-friendly interface is designed to match the reality we all experience in everyday life. Since the ManyOne Universal Browser is designed as a 3D mirror of the world people experience in everyday

life, users can navigate the Web using their usual mental picture of reality. A taxonomy navigation system is based upon the scientific structure of reality, providing continuity across languages and cultures.

3.2 The Server: Universal Portal Service The Universal Portal Service is essentially a next-generation Internet access and portal infrastructure built upon open source standards, including open source UNIX, Apache, and XML. Constructed to run as a Web Service Provider enabling an unlimited number of private-labeled versions and extensions, it provides basic dial-up Internet access (supplied to ManyOne by major partners such as UUNet, Level3 and Qwest, with broadband to come in late 2005) and portal application functions including AOL- and Google-class e-mail. The ISP infrastructure is actually supplied by the same telecommunications providers powering other major ISPs, including AOL, MSN and Earthlink. Bundling agreements with major broadband carriers will be established in late 2005.

The Universal Portal Service establishes an XML protocol standard by which a growing array of more advanced functions, such as curriculum tools can be offered by independent third party developers. Developers trained in XML, Flash and other rich media visualization tools can move from developing website adornments to actually catalyzing the evolution of Web-based rich-media applications for the benefit of potentially all subscribers of the Earth Portal and Universal Portal Service.

To support the needs of these developers, and the third party tool producers who also support the developers, specialized development tools and frameworks are being created and delivered through the browser and services.

3.3 Content and Distribution: Earth Portal Partners The business model includes content creation and a distribution system for the Earth Portal and Digital Universe network, leveraging the innovative technology platform.

The Earth Portal is the premier example of the ManyOne Stewardship Partner Program and is designed to address two problems inherent in today's World Wide Web: an overwhelming amount of unfiltered information, often of unknown authenticity, validity, and reliability. It is the primary job of Earth Portal Stewards to find, filter and qualify the best and most representative informational resources on the Web within their assigned domain of expertise. Through the collective efforts of a large network of Stewardship partners, a vast living directory – the Digital Universe – is being built which will serve as an authoritative and engaging online informational and educational resource for a wide audience, ranging from pre-schoolers to Ph.D. level researchers. This resource will remain completely in the public domain, and since it is intended to be an “online digital mirror of reality” it will eventually encompass a large fraction of all human knowledge. Stewards may elect to develop

summary and educational material specific to the Digital Universe, including multimedia and 3D content that take full advantage of next-generation web presentation capabilities of the Universal Browser. Stewardship Partners, that is the Environmental Information Coalition for the Earth Portal, represent organizations (sometimes coalitions of organizations) or individuals that have recognized expertise within a domain of knowledge and possess a desire and ability to communicate and engage with a larger audience. Stewards need to demonstrate suitable qualifications to assume responsibility for a specific domain within the Digital Universe and are selected based on the following general qualifications:

- A proven level of expertise within a particular domain of knowledge and a high level of credibility and respect among peers.
- An established ability and passion for communicating information in an understandable and compelling fashion.
- Experience making judgments on quality of material (information) in the field of expertise.
- A philosophy of inclusiveness for different points of view (within reasonable limits).

4. The Earth Portal & the Environmental Information Coalition.

On July 1, 2003, the Earth Information Coalition was formally launched in Washington DC at the United Nations Environment Programme office by the National Council for Science and the Environment, Earth Voice/HSUS, and Manyone. In tremendous validation of this effort to build the Earth Portal, a global intellectual foundation for addressing the environmental challenges of the 21st century, we have already been joined by some of the leading NGOs and global scientific and professional organizations, including World Resources Institute, Environmental Systems Research Institute, Earth 911, National Library of Medicine (environmental impact on health), Houston Advanced Research Center, Boston University, George Mason University, Polistes Foundation, National Geographic Society, Counterpart International, Society of Environmental Journalists, Society for Conservation Biology, and NatureServe. These individuals and organizations have agreed to be founding members in the ongoing coalition recruitment and full build out and promotion of the Earth Portal (scheduled for formal launch season beginning with World Environment Day 2005).

5. Remote Sensing Utility

With this framework setting of 3D Universal Browser, Earth Portal content stewards and partners, and underlying technology platform sustainable business model, a fresh perspective on access and delivery of remotely sensed data for the planet can be offered. First, the most obvious element is for the central focus of a 3D virtual Earth that is constructed from satellite observation data of the planet's surface. From the Earth-centric and visually rich medium, we have an unprecedented opportunity to expose a tremendous segment of the Web-connected community to views from space that are accurate and regularly updated. The

key is setting the open architecture to capture the richly populated archives of remotely sensed data and derived information for all points of the compass.

Second, the Earth Portal provides the unique ability to access over the internet a 3D Earth that can be populated with satellite and aerial photography for every square meter of the globe. Archives at the US Geological Survey's EROS Data Center, the University of Maryland's Global Land Cover Facility, NASA's Jet Propulsion Laboratory, and other large repository facilities located internationally can be directly access for display. Currently, these Earth skin renditions are prepositioned in databases that can be directly display on tessellation engines. With compliance of open standards, we should expect that any remotely sensed data with proper metadata documentation and interoperability server wrappers to serve up images for any place on the planet. Ongoing negotiations are being made by the Earth Portal community and the Earth Observation community to push the calendar for this enablement since the proof of concept has been launched.

Researchers and operational agencies will need to begin viewing the efficacy of the Earth Portal and its range of rendering virtual, digital Earths as the principal method for displaying the output of their remote sensing activities. Just as the GIS community is being enabled by the Earth Portal for exchange, interoperability, and

advancing the geospatial applications, the remote sensing community will soon discover the easy of accessibility and distribution of their products and outputs. For a range of applications related to ecosystem health and management, resource management, and human health and disaster prevention, this new model for the Internet distribution will prove attractive.

6. Summary

The Earth Portal and its underlying technology framework represent the near-term implementation of the Digital Earth vision as expressed some six years past. The technological innovations and advances have made the opportunities available for attempting to create a universal system for improving the understanding of the planet and offering communities around the planet new approaches to conducting community-based decision support. With the necessary ingredients of a sustainable business model, an innovative 3D technology browser and ISP, and the coalitions for content development and governance necessary to ensure quality science-based information, our community is one step closer to a Digital Earth future. Remote sensing offers the best perspectives on the conditions and trends of our planet. A future where every one with Internet access can view the Earth and better understand our individual responsibilities for preserving the planet and sustaining the ecological goods and services that sustain our lives will need to rely on remote sensing technologies.