



Module 3: Libraries Supporting Research and Open
Access

The Place of the Digital Library within Virtual Research Environments

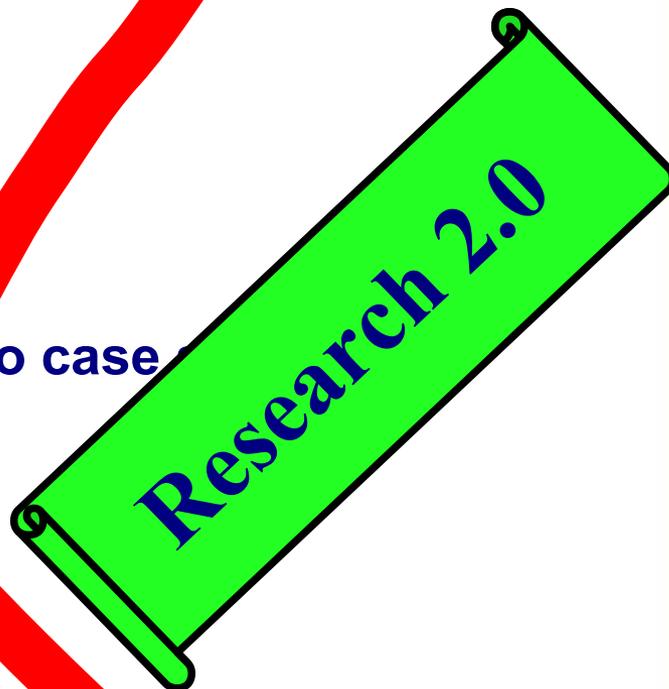
Dr Michael Fraser
Oxford University

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Outline

- **Defining Virtual Research Environments (VRE)**
 - research machinery
 - integrated environments
 - **VRE as part of e-Infrastructure**
 - key components
 - overlapping architectures
 - **VREs to support subject domains: two case studies**
 - Integrative Biology
 - Building a VRE for the Humanities
 - **(inter) Institutional VRE framework**
 - Focus: institutional repository
 - Focus: resource discovery
- Concluding remarks
- THANKS



Participation Literacy

A Research 2.0 Project about Participation in Web 2.0 Environments

- Blog
- About PL
- Archives
- References

Tag Archive for 'research-2.0'

About PL

0 Comments Published May 20th, 2006 in Blog Article

Peter Giger

Division of Technoscience Studies
School of Technoculture,
Humanities and Planning
Librarian at the University Library
Blekinge Institute of Technology

email: forename.surname@bth.se

This web project is a hybrid between a research blog and a personal academic publishing environment. It is a research 2.0 project as discussed in the Research 2.0 section of my Licentiate Thesis. The web site is administrated and [...]

The Web as Platform

0 Comments Published May 19th, 2006 in Academic Theme - Licentiate Thesis 2006

Thinking about the Web as a native environment for research will lead to more information within reach for the CI machines. Let us say, for example, that you prepare a PowerPoint presentation for a lecture series. You probably want your students to be able to download the presentation instead of splitting their attention by writing [...]

Type and Wait to Search

- RSS Feed-Posts
- RSS Feed-Comments

About

You are currently browsing the Participation Literacy weblog archives for research-2.0.

Longer entries are truncated. Click the headline of an entry to read it in its entirety.

Tags

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LIC 2006 / Participation Literacy
Part 1: Constructing the Web 2.0
Concept

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Acknowledgements
Prologue

Part I - A Reading Guide

- The Structure
- Transdisciplinarity
- Feminist Technoscience and The Cyborg Figure
- Approach
- Some Issues
- Disclaimer

Part II - Building the Concept Web 2.0

- Starting a Position
- Main Concepts
 - The Web as a Platform
 - Collective Intelligence
 - Folksonomy
 - Ajaxian Interfaces
- Main Actors: Google and Yahoo
- The Web 2.0 Document Model
- Web 2.0 in Figures
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 - Identity 2.0
 - Dick Hardt's notion of Identity 2.0



Terminology



- **e-Science**
- **e-Research**
- **e-Infrastructure**
- **Virtual Research Environments (VRE)**
- **Virtual Research Communities (VRC)**





e-Infrastructure



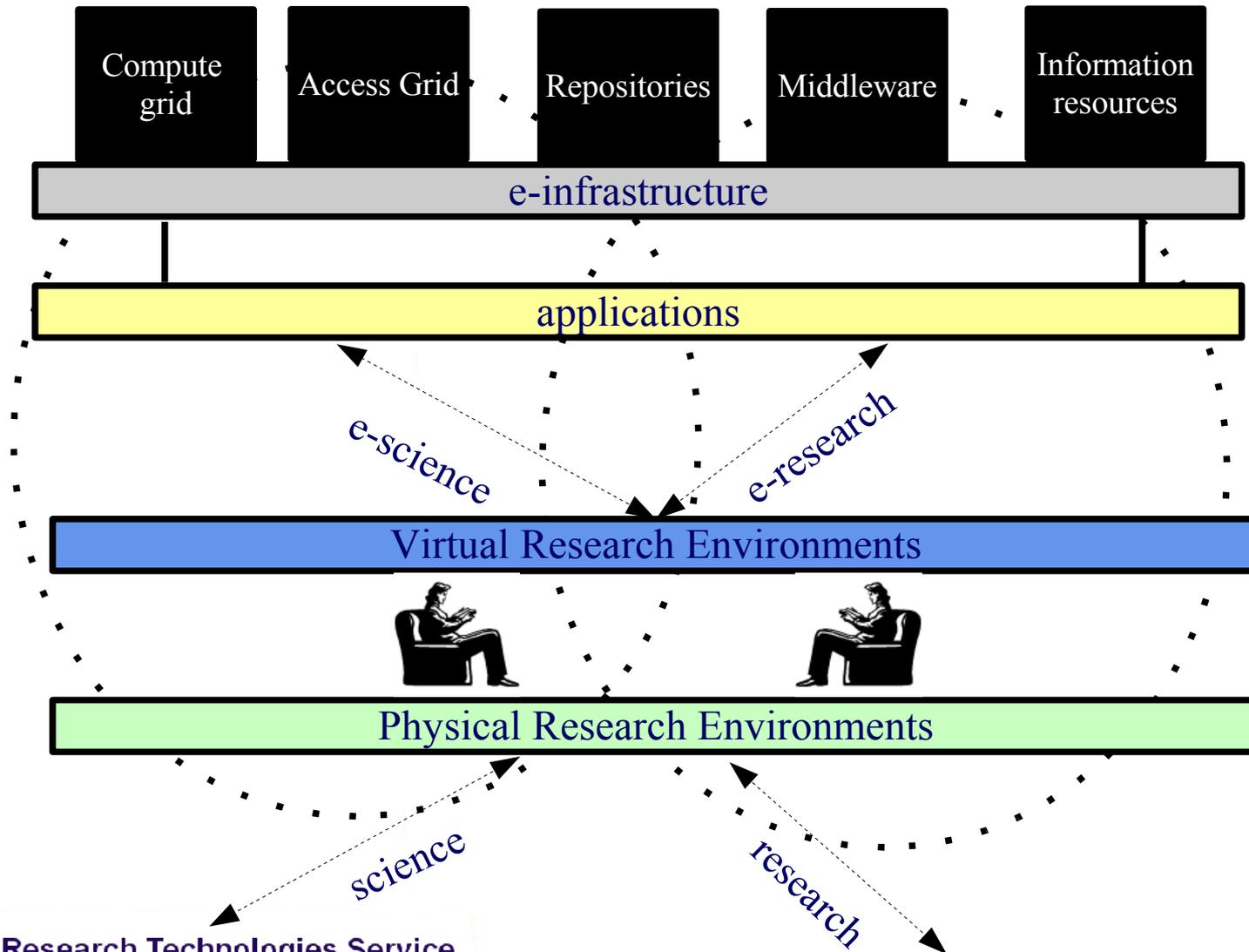
e-Infrastructure



- **Shared services and middleware to enable inter-institutional collaborative research**
 - ▶ access management (e.g. shibboleth, digital certificates)
 - ▶ data repositories and discovery services
 - ▶ supercomputing/grid computing
 - ▶ Access Grid (enhanced video-conferencing)
 - ▶ shared research facilities (e.g. laboratory, text mining)
- **Also human/organisational issues (e.g. training, virtual organisations)**
- **e-Infrastructure components overlap at various levels (dept, institutional, national, international)**
- **VREs combine applications and presentation interface**



High-level view



e-Infrastructure strategy 1



- **Australia**

- ▶ *An e-Research Strategic Framework (2005)*

- Researchers need to know what data and metadata standards are appropriate
 - needs to be widespread adoption of best practice for curation of data
 - An Accessibility Framework is needed to manage publicly funded research data
 - IT service centres or departments could align their activities more closely with the needs of researchers and research departments
 - Outreach activities need to encompass information services; education and training services; and research support services

“Monash e-Research Centre is an initiative of the DVC Research to support researchers, by harnessing the resources and capacities of the IT Services Division, the Library and computer scientists in the Faculty of Information Technology to create ICT services that enhance research capability.” (<http://www.monash.edu.au/eresearch/>)

- ARROW, DART, e-Research Portal projects





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Current e-Research development activities at Monash

• **ARROW Project**

Australian Research Repositories Online to the World. A collaboration between Monash University, National Library of Australia, the University of New South Wales and Swinburne University of Technology.

• **DART Project**

Dataset Acquisition, Accessibility and Annotation e-Research Technologies. A collaboration between Monash University, The University of Queensland and James Cook University.

• **Monash Campus Grid (MCG) Programme**

A programme of activities to build a comprehensive and integrated set of central and devolved facilities. Major components of the Monash Campus Grid will include:

- Monash Sun Grid (MSG) – central compute facility
- Large Research Data Store (LaRDS) – central storage facility
- various faculty-based compute grid clusters
- harnessed capacity on desktop and central computers
- a comprehensive Grid Middleware suite
- Monash e-Research Portal (MeRP)

• **Monash Sun Grid (MSG) Project**

The Monash Sun Grid (MSG) is currently being expanded by the commissioning of additional compute power which has recently been delivered to Monash.

• **Monash Large Research Data Store (LaRDS) Project**

Project to provision large data storage capacity for Monash researchers; to provide a "pilot" service; and hence to explore needs and issues surrounding the subsequent provision of a broader "production" service.

Related links

- > [Recent activities](#)
- > [Research Office](#)

e-Infrastructure strategy 2



- UK
 - ▶ JISC
 - funds an e-infrastructure programme which prioritises
 - community engagement
 - access management and security
 - Grid services and tools
 - Knowledge organisation and semantic-aware services
 - ▶ e-Infrastructure strategy (2006) – ten years ahead
 - <http://www.rin.ac.uk/e-infrastructure-strategy>
 - Access management/middleware
 - network, compute power and storage
 - preservation and curation
 - search and navigation
 - data and information creation
 - virtual research communities

http://www.jisc.ac.uk/programme_einfrastructure.html

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e-Infrastructure Programme

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What is e-Infrastructure?

Currently, research is increasingly carried out through distributed regional, national and global collaborations enabled by the Internet. A feature of such collaborations is that they are built upon an infrastructure, comprising of grid computing software, which

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Welcome to OeRC

<http://www.oerc.ox.ac.uk/>

Welcome to the Oxford e-Research Centre

The Oxford e-Research Centre (OeRC) is a new focus for e-Research in the University and in the region. It builds on the activities and community generated by the Oxford e-Science Centre over the last 5 years. It will be housed in the [e-Science Laboratory building](#), when this is complete later this year.

The OeRC will:

- act as a facilitator for new e-Research projects across the University;
- undertake research to determine future requirements for supporting ICT technologies;
- evaluate, implement and support use of existing technologies as they emerge and are required by the user community;
- develop essential technologies with other departments, institutions and industry;
- operate a comprehensive dissemination programme within the University, and across the wider academic and industrial community, including a leading role in teaching and training.

The OeRC intends to be a focus for inter-divisional work, a catalyst for interdisciplinary activities underpinned by new ICT technologies. We are already working closely with the [Oxford Internet Institute](#) through collaboration in the [e-Horizons Institute](#).



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HUMANITIES, ARTS, SCIENCE, AND TECHNOLOGY ADVANCED COLLABORATORY

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CYBERINFRASTRUCTURE TOOLKIT

You are here: [Home](#)

Submitted by [molson](#) on March 31, 2006 - 9:28pm.



[view](#) [track](#)

The Human Sciences Cyberinfrastructure Toolkit is a collection put together by HASTAC members of existing open-source software, search engines, and applications for broad public use by researchers and students in the humanities and interpretive social sciences. If you have a CI tool you would like to contribute to this collection, please contact the HASTAC project manager.

NAME: CITRIS Collaborative Gallery Builder

DESCRIPTION: The CITRIS Collaborative Gallery Builder is a system designed to allow researchers in the humanities to interact with 3-dimensional artifacts and related digital content inside of a collaborative virtual environment. The CITRIS Collaborative Gallery Builder creates digital galleries, which are simple virtual structures emulating real-life exhibitions and collections. Visitors find themselves in a virtual space composed of various rooms, with 2-dimensional and 3-dimensional artifacts and multimedia presented in the space. Each visitor is represented by an avatar which they can navigate through the 3D space.

SAVE THE DATE!

HASTAC International
In|Formation Conference
April 19-21, 2007
Durham, NC

[more information](#)

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- Michael Naimark presentation
 - Geert Lovink Keynote
- Showing 1 - 2 of 24.
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UPCOMING EVENTS:

- In|Formation Year -
In|Common
(09/01/2006)
- In|Formation Year -
Interplay



Virtual Research Environment



Research Technologies Service
Oxford University Computing Services



Towards a definition of a VRE

- **Some (almost) equivalent terms:**

- ▶ Collaboratory

- “... a center without walls in which the nation's researchers can perform research without regard to geographical location - interacting with colleagues, accessing instrumentation, sharing data and computational resources, and accessing information from digital libraries.” (based on Wulf, 1989)

- ▶ Cyberenvironment

- “to provide researchers with the ability to access, integrate, automate, and manage complex, collaborative projects across disciplinary as well as geographical boundaries.” (Dunning & Nandkumar, 2006)

- **Key criteria**

- ▶ Do research – access disparate resources – collaborate – location independent – Multi/inter-disciplinary



Towards a definition of a VRE



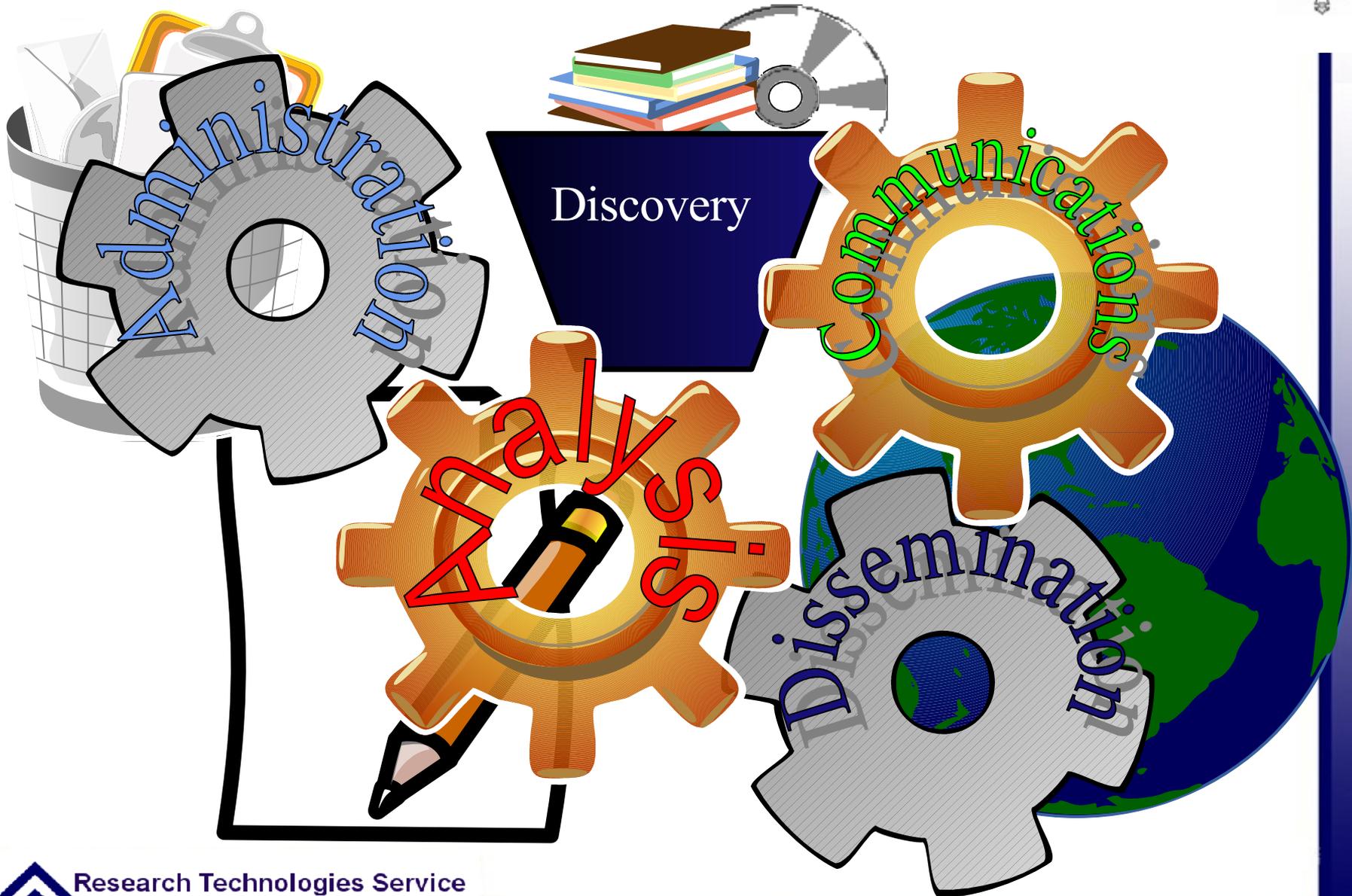
▶ Virtual Research Environment

- “The purpose of a VRE is to help researchers in all disciplines manage the increasingly complex range of tasks involved in carrying out research... a framework of applications, services and resources to support the underlying processes of research.” (JISC)
- “A VRE comprises a set of online tools and other network resources and technologies interoperating with each other to facilitate or enhance the processes of research practitioners within and across institutional boundaries.” (based on Fraser, 2004)

● Key criteria

- ▶ research process – framework – interoperating components – institutional
- ▶ Do research – access disparate resources – collaborate – location independent – Multi/inter-disciplinary

Research Machinery





Facilitating the research process

- **Research administration and management**
 - ▶ Contracts office ----- online grant admin ----- online project management
- **Resource discovery and access management**
 - ▶ Library ----- networked collections ----- single sign-on portal
- **Data creation, use and analysis**
 - ▶ Desk ----- Data/tools repositories ----- shared remote facilities
- **Collaboration and communication**
 - ▶ Seminar ----- Audio-visual conferencing ----- shared workspace
- **Research publication, curation and preservation**
 - ▶ Monograph ----- institutional repository ----- Workflow integration

*The research **environment** is a complex integration or continuum of physical and digital structures, processes, resources and tools.*





How many VREs?

- **What is the appropriate level of granularity?**
 - ▶ one VRE per researcher?
 - ▶ one per research group?
 - ▶ one per subject?
 - ▶ one per institution?
 - ▶ national? international?
- **Approaches**
 - ▶ discrete VRE for defined research community/collaboration
 - ▶ generic VRE to serve bulk of institution
 - ▶ VRE framework with institutional, domain and shared components
 - research requirements as starting point
 - but takes advantage of existing/emerging e-infrastructure wherever found
 - encourages shared services, tools, data, expertise...



JISC VRE Programme



- **UK programme of VRE projects**

- ▶ aims to build, assess, extend, develop VREs within and across subjects
- ▶ Fifteen projects, from April 2004 to April 2007
- ▶ Sample subject projects include:
 - Sakai VRE for Educational Research
 - CSAGE: Collaborative Stereoscopic Access Grid Environment
 - CORE: Collaborative Orthopaedic Research Environment
 - Silchester Roman Town: A Virtual Research Environment for Archaeology
- ▶ Set of institutional or 'generic' projects
 - Sakai VRE Portal Demonstrator
 - ELVI: Evaluation of a Large-scale VRE Implementation
 - Implementing the Kepler Workflow Interface into the Cheshire Digital Library Framework
 - IUGO: Conference Information Integration Project



VREs by Subject (User Requirements)



By subject: Integrative Biology VRE



- **Aim**

- ▶ "To develop a large-scale Virtual Research Environment (VRE) demonstrator investigating the utility of existing collaboration frameworks to provide end to end support for the research process of a large-scale, international, multi- and inter-disciplinary research consortium: the Integrative Biology (IB) e-Science Pilot Project."
- ▶ Computing science, pathology, mathematics, bioengineering

- **Step 1: Gather requirements**

- Interviews

- 'day in the life of'
- highlight areas in which collaboration takes place

- Focus group

- high level requirements
- prioritise requirements set

With thanks to Matthew Mascord, IBVRE Project Manager for assistance with IBVRE slides.

By subject: IB VRE



- **Step 2: Requirements analysis**

- ▶ support for daily activities
- ▶ secure repository of *in silico* experiments critical
- ▶ those who model cancer to learn from those who model hearts
- ▶ real-time communication in order to share visualisations etc
 - and recording of collaborative discussions

- **Step 3: Work task outcomes**

- ▶ Agile development which ensures
 - VRE solution interoperates with local research infrastructure
 - science steers user interface development
- ▶ Priorities
 - **repository**: *in silico* experimental process management tool
 - **collaboration**: collaborative visualisation tool, paper-born material management tool
 - **communication**: research notification tool, events management tool





IB VRE Portal

<https://vre.integrativebiology.ac.uk/>

The image shows two overlapping windows. The background window is the IBVRE Portal in Mozilla Firefox. The foreground window is a Digital Note Viewer displaying handwritten notes on fluid dynamics.

IBVRE Portal - Mozilla Firefox

File Edit View Go Bookmarks Tools Help

https://vre.integrativebiology.ac.uk/uPortal/tag.bb0db39cc3ab808a.render.userLayoutRootNode.t...

IBVRE
Integrative Biology Virtual Research Environment

Developers IB - Credentials IB - Job Submission

Credentials (WS2)

Username: Password:

Launch Integrative Biology Proxy via Java Web Start
Java Webstart is not detected on your machine!
Download and install the latest version of Java Web Start

Experiment (WS2)

Experiment Name:

To create a new Experiment, or lookup existing Experiment

Done

Digital Note Viewer - [Maxell digital note A5.pgd]

File Edit View Window Help

100%

SW equations from Full Euler Model

Euler

$$\textcircled{1} \frac{\partial u}{\partial t} + u \frac{\partial u}{\partial x} + v \frac{\partial u}{\partial y} = - \frac{\partial p}{\partial x}$$

$$\textcircled{2} \frac{\partial^2}{\partial t^2} \left(\frac{\partial u}{\partial t} + u \frac{\partial u}{\partial x} + v \frac{\partial u}{\partial y} \right) = - \frac{\partial^2 p}{\partial y^2} \quad \delta = h_0 / L \quad U = \sqrt{g h_0}$$

$$\textcircled{3} \frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} = 0$$

bc's

$$\left. \begin{aligned} v=0 & \quad y=0 & \textcircled{4} \\ v = \frac{\partial \eta}{\partial t} + u \frac{\partial \eta}{\partial x} & \quad y=\eta & \textcircled{5} \\ \eta = 0 & & \textcircled{6} \end{aligned} \right\}$$

Let $\delta \ll L$ (shallow).

Integrate $\textcircled{2}$ wrt $y \Rightarrow p = \rho g (\delta y - y + \alpha \delta^2)$.



Building a Virtual Research Environment for the Humanities

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The JISC funded '**Building a Virtual Research Environment for the Humanities**' (BVREH) project focuses on the humanities division at Oxford University. The aim of the fifteen month project is to identify areas in which electronic research tools would be beneficial, both for researchers at Oxford and in a wider context.

The BVREH is carrying out a detailed survey of research activities across the humanities division, forming the basis for the selection of a number of demonstrator applications. These 'demonstrators' or tools will allow the project to provide researchers with tangible ideas of how their needs might be addressed and will facilitate a phase of interactive user testing.

User Requirements Gathering for the Humanities

In conjunction with the AHRC, the BVREH project is holding a series of workshops to highlight the necessity of **user requirements gathering for the humanities** community.

The BVREH project has recently been carrying out an extensive user requirements survey of humanities researchers at Oxford University. This is one of a number of ICT projects based in the humanities which have begun to focus on user requirements gathering prior to developing technology, and it is an important time to bring together these initiatives and work towards building a requirements capturing community for the humanities sector.

The proposed workshops will be of particular importance in identifying the needs of humanities researchers in a broad range of subject areas and disciplines. Building on the existing expertise in e-Science they will attempt to identify ways in which humanities research can develop equivalent and inter-disciplinary structures and methodologies which will serve the needs of the research community and link it more firmly to ICT research structures on a national scale.

The three workshops will be designed to build a community in which the methodologies for humanities requirements gathering will continue to grow and evolve. The programme is designed to provide an understanding of where the current issues and gaps in humanities user requirements are, what practices currently exist, including which would be useful to adopt and which might be created. Finally the programme will define how the community will use the knowledge gained to develop coherent methodologies for future projects.

Recent blog posts

[New website! - March 2006 \(Ruth\)](#)

[BVREH at the Oxford Internet Institute - January/February 2006 update \(Ruth\)](#)

[more](#)

External News Feeds:

Oxford e-Research Centre news

[OeRC Director speaking at e-Research seminar in Auckland](#)

[Professor Miron Livny's OeRC visit and seminar](#)

[Introducing the OeRC](#)

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The AHRC Methods Network

By subject: BVREH

*With thanks to Ruth
Kirkham and John Pybus for
assistance with BVREH
slides*



- **Building a VRE for the Humanities**
 - ▶ Focus on capturing user requirements across humanities subjects
 - ▶ Definition of VRE for humanities evolving
 - ground-up approach and investigating differing requirements from science
 - ▶ Interviews – articulate research working practices and location
 - resulted in four user archetypes or personas
 - Simon Brown: Researcher - 18th Century German
 - Dr Mary White: Researcher at a university library
 - Bob Black: Researcher – Classics
 - Gwendolyn Green: Lecturer and artist in the Fine Art department
 - Priorities:
 - Resource and people discovery
 - Communication tools
 - Collaborative document editing

By subject: BVREH



- **Demonstrators to test requirements understanding**
 - ▶ Eighteenth century workspace
 - bringing together disparate resources for study of Jane Austen
 - ▶ Evaluation of digital pens and personal access grid (as with IB VRE)
 - integrating VRE with physical environment
 - ▶ Virtual workspace for the study of ancient documents
 - find, view, compare, annotate image collections and associated research resources using common workspace
 - ▶ Research discovery service
 - locating expertise across discipline
- **Part of wider strategic plan to support e-research within the humanities**



VREs by Function



By function: repository



- **Institutional repository**
 - ▶ At 30,000 feet an institution looks like it has a single repository.
 - ▶ At 10,000 feet it is evident that the institution has a range of repositories holding different types of digital object
 - ▶ At 1,000 feet, the specific services offered by multiple repositories become clearer.
 - ▶ On the ground, the bigger picture is obscured by the range of workflows, metadata standards and supporting interfaces.

By function: repository



- **Within a VRE interoperability with repository *services* might enable**
 - ▶ secure ingest, storage, and retrieval of domain-specific working meta+data (Mbs to Pbs)
 - *Services for data mining, visualisation, analysis tools*
 - ▶ discovery of and open access to research outputs, digitised collections
 - ▶ document version and revision control integrated with desktop
 - ▶ audit and provenance trails for data, workflows
 - ▶ Curation, preservation and re-presentation of diverse digital assets

By function: resource discovery



- **Intute (<http://www.intute.ac.uk/>)**
 - ▶ UK national resource discovery service
 - ▶ evaluates and describes websites for research and teaching
 - ▶ database of over 110,000 reviews
 - ▶ provides MyIntute, **open access repository** and Z39.50 service for integration with remote services
- **Resource discovery requirements for research**
 - ▶ 6 month study across disciplines
 - ostensibly for Intute to set priorities for better research support
 - ▶ Interviews, survey and literature review



By function: resource discovery



- **Intute resource discovery requirements – findings**
 - ▶ Beware of generalising about ‘researchers’ and ‘research’
 - ▶ High proportion use a small number of online resources regularly (91% use Google, for other only journal articles matter...)
 - ▶ For any resource essential to know, “ the information it contains reliable and accurate”
 - ▶ Priority services
 - directory of bibliographic databases
 - evaluations of journals and conferences
 - discovery services for funding, people, events
 - graduate training resources
 - annotation of existing reviews





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Arts and Humanities



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Health and Life Sciences

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Summary of functionality



- **Key functionality within VRE**
 - ▶ discovery services (compute, people, sources, events, funding)
 - ▶ collaboration tools (shared view of data objects, desktop conferencing, community annotation)
 - ▶ repository services (ingest, storage, export, control)
 - ▶ location and time-independent access
 - ▶ integration with physical environment
 - ▶ integration/interoperability with institutional and domain e-infrastructure
- **e-infrastructure *applied* to the agreed requirements of research communities to enable research to take place**
- **Through organisation, access and preservation to the food of scholarly endeavour libraries been fulfilling this forever...**
 - ▶ Just maybe getting bigger and more complex
 - ▶ Role of individual libraries or collaborative virtual library environments?



Is this Web 2.0 obfuscated?



- **Yes and but**

- ▶ The overall outcomes are similar

- Data exposure, sharing and reuse (standards)
- Facilitating social or collaborative work
- Responding to user requirements

- ▶ Possible differences

- VRE driven by requirements of research workflows
- VRE tends towards a large-scale enterprise activity
- VRE tends towards implementation via a portal framework

- ▶ Possible convergence

- Service-oriented architecture approach
- Web 2.0 provides some of the tools/standards, VRE provides the glue
- ...



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Technical solutions: Certification in a digital era

What functions do we take for granted in print?

The Digital Library Research and Prototyping Team at the research library of the Los Alamos National Laboratory conducts research on various aspects of scholarly communication in the digital age, including peer review. Our research attempts simultaneously to analyse properties of the existing review system, and to formulate feasible alternatives.

A core inspiration is that the digital environment allows for (indeed, requires) systemic changes in scholarly communication procedures. This potential for fundamental change is related to two properties of the digital environment that were unavailable in the paper world. First, the core functions of our scholarly communication system can be separated (at least theoretically) in the digital environment¹. Second, we will be able to record in a machine-readable form, then aggregate, and later data-mine the collection of events of this system.

One line of investigation led us to define a framework in which peer review is an autonomous service overlaid on scholarly repositories hosting unreviewed manuscripts, with the repositories and reviewing services linked together for an integrated view of the distributed information². Another effort automatically identifies possible reviewers based on extractable information from the digital environment, such as a manuscript's subject area and citation pattern, and the existing body of literature in the subject area³.

A recent effort relevant to *Nature's* current debate attempts to analyse reviewer behaviour systematically. We have found that, when asked to express preferences for conference papers to review, potential reviewers are only marginally driven by their level of expertise in a paper's subject domain as

FULL TEXT

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Technical solutions: Certification in a digital era

Herbert Van de Sompel

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Read more [here](#).

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<http://blogs.nature.com/cgi-bin/mt/mt-tb.cgi/684>

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COMMENTS

Has anyone examined a more distributed manner of certification, modeled on such web projects as SETI@Home, where chunks of data are sent to users in a network? This model might work in the fields of mathematics or computer science (perhaps others). A paper is broken into small parts, and sent to "subscribers" in the mathematical community. These small parts are verified, and returned. This model would require that authors write their papers in a more structured and organized fashion - perhaps more difficult for them, but much more useful for the community.

Posted by: [Sean O'Hagan](#) | [June 8, 2006 04:16 AM](#)

<http://www.qub.ac.uk/imagining-history/wordpress/>



August 9th, 2006

Print Stylesheet

We've finally applied the new print stylesheet to the site. This cleans up all unnecessary formatting, images, etc., and provides users with a crisp grayscale print-out. Some users using old browsers - such as Internet Explorer 5 and earlier - may have difficulties; if so, please email us.

Posted by Stephen Kelly at 10:32 AM. Filed under: [News](#)
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August 7th, 2006

Gavin Cole/ Rylands MSS. descriptions

Many thanks to Gavin Cole who described several of the manuscripts in the John Rylands Library for the project team (Eng. 103 and Eng. 206). Gavin is currently finishing his PhD thesis entitled, 'A textual study of CV-1333 of the Middle English Prose Brut Chronicle', a work

About



The 'Imagining History' project is the first large-scale collaborative investigation of the manuscripts of the Middle English Prose *Brut* chronicle, arguably the most prolificly disseminated secular text of the English Middle Ages. The project explores the cultural capital of the Prose Brut within...

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Towards... an e-Research Strategy



“While it is possible for individual disciplines within an organisation to adopt an ad-hoc approach to interdisciplinary collaboration, it is likely to prove more fruitful for universities and research bodies to give serious consideration, through an institutional e-research strategic plan, for example, to the identification and deconstruction of disciplinary ‘silos’ that impede research and communication, and to the creation of organisational structures more aligned with the new ways in which research is conducted. *In particular, IT departments that service the needs of universities could be steered to provide and integrate new research-enabling activities by working closely with the various research disciplines they serve.*”

- An e-research strategic framework (Australia, Sept 2005)



Items for Discussion



- **Role of digital librarians?**

- ▶ Institutional repository is key component of e-infrastructure
 - nearly always in library domain
 - how 'sharable' or flexible? Access and preservation?
 - Interoperability with departmental, national, subject repositories?
- ▶ Data curation
 - creation, metadata, preservation of institutional intellectual assets
 - but disparate data types and ontologies
- ▶ Training provision
 - research methods training for graduates and staff
 - data creation, documentation, management
- ▶ Awareness raising, policy setting
 - cross-disciplinary approach to key issues
 - expand open access agenda
 - weave together e-research, open access, VREs



References



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- **W. A. Wulf. Towards a National Collaboratory. Report of Invitational Workshop at Ruckerfeller Univ. Oct. 1989. (see <http://www.scienceofcollaboratories.org/>)**