

Digital Libraries in Higher Education:
Scientific Experiences
(Riyadh, Saudi Arabia– 30-31 October)

**“Digital Library Support for
1) Graduate Education and
2) Computing-related Education”**

by Edward A. Fox

- fox@vt.edu <http://fox.cs.vt.edu> (/talks)
- Dept. of Computer Science, Virginia Tech
- Blacksburg, VA 24061 USA

Ed Fox, Director, Virginia Tech Digital Library Research Laboratory
Executive Director, Networked Digital Library of Theses & Dissertations
Chair, Steering Committee, ACM/IEEE Jt. Conf. on Digital Libraries
Member, Board of Directors, Computing Research Association

Digital	Information	Libraries	Retrieval
Chair	Committee	Conference	Workshop
Education	Electronic	Dissertations	Theses
Research	Science	Systems	Technology
Open	Initiative	International	Multimedia
Access	Archive	Intelligent	Interactive
Knowledge	Learning	SIGIR	Tutorial

Philosophy, Message

Collaboration

Local

National

Regional, Global

Empowerment

Uploading

Sharing

Open Access

Research

Board, CRA

Over 110 grants:

Epub, IR, DL, MM

Education

DL curriculum

Graduate: ETDs

Ugrad: Ensemble

Outline

- **Acknowledgements**
- NDLTD
- Digital Library Curriculum Project
- Ensemble (Pathway in NSDL)
- Extra Slides
 - Digital Libraries
 - Crisis, Tragedy & Recovery Network (CTRnet)
 - Digital Preserve in Second Life

Acknowledgements

- Mentors (Licklider & Kessler 1967-71 MIT, Salton 1978-1983 Cornell)
- NSF and other sponsors
- Students, colleagues, co-investigators
- Virginia Tech, CS, Digital Library Research Lab
- Collaborators: Dlcurric, Ensemble, CTRnet, ...
- NDLTD Board, Members
- ETD supporters: conference/regional/local

Acknowledgments (2)

NSF-funded DL Projects

- Digital Library Curricular Resources
 - NSF IIS-0535057 & 0535060
- Ensemble (Computer Science Education)
 - NSF DUE-0840719
- CTRnet (Crisis, Tragedy & Recovery Net)
 - NSF IIS-0916733
- Digital Preserve
 - NSF IIS-0910183 & 0910465
 - <http://slurl.com/secondlife/Digital%20Preserve/140/126/29>

Outline

- Acknowledgements
- **NDLTD**
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A Digital Library Case Study

- **Domain:** graduate education, research
- **Genre:** ETDs=electronic theses & dissertations
- **Submission:** e.g., <http://etd.vt.edu>
- **Collection:** Union Catalog run by OCLC, with access through OAI-PMH, SRU

Project:

Networked Digital
Library of Theses
& Dissertations
(NDLTD)

<http://www.ndltd.org>

ETD Conferences

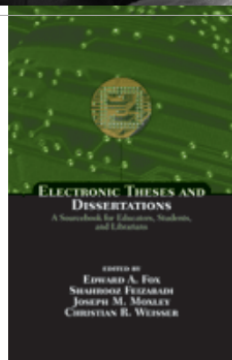
1987 mtg in Ann Arbor: UMI, VT, ...	2002 – 5 th symposium – BYU, Provo, Utah
1992 mtg in Washington: CNI, CGS, UMI, VT and 10 universities	2003 – 6 th symposium – Berlin (215)
1993 mtg in Atlanta to start Monticello Electronic Library	2004 – 7 th symposium – U. Kentucky
1994 mtg at VT: std: PDF + SGML + multimedia objects	2005 – 8 th symposium – Sydney, Australia
1996 mtg w. funding by SURA, US Dept. of Education(FIPSE)	2006 – 9 th symposium – Quebec City, Canada
1997 meetings in UK, Germany, ... =====	2007 – 10 th symposium – Uppsala, Sweden
1998 – 1 st symposium – Memphis (20)	2008 – 11 th symposium – Aberdeen, Scotland
1999 – 2 nd symposium – Blacksburg (70)	2009 – 12 th symposium – Pittsburgh, PA
2000 – 3 rd symp – St. Petersburg, FL (225)	2010 – 13 th symposium – Austin, TX
2001 – 4 th symposium – Caltech (200)	2011 – 14 th symposium – Cape Town,S. Africa September 13-17

NDLTD: www.ndltd.org

- N D Ltd or Noodle TD
- Vision: Every thesis and dissertation in the world is:
 - Devised to take advantage of the most helpful electronic publishing methods
 - Shared globally and easily found
 - Supported by a suite of digital library services to aid authors, researchers, learners, universities
 - Preserved and migrated permanently

What are we doing?

- Aiding universities and nations to enhance graduate education, publishing, preservation (data sets next!), and Intellectual Property Rights efforts
- Helping improve the availability and content of theses and dissertations
- Educating ALL future scholars so they can publish electronically and effectively use digital libraries (i.e., are Information Literate and can be more expressive)



ELECTRONIC THESES AND DISSERTATIONS

A Sourcebook for Educators, Students, and Librarians

by

Edward Fox *Virginia Polytechnic Institute and State University, Blacksburg, Virginia, USA*

Shahrooz Feizabadi *Virginia Polytechnic Institute and State University, Blacksburg, Virginia, USA*

Joseph M. Moxley *University of South Florida, Tampa, Florida, USA*

Christian R. Weissner *Harriet L. Wilkes Honors College, Florida Atlantic University, Jupiter, Florida, USA*

April 2004 / ISBN: 0-8247-0973-X / E-ISBN: 0-8247-4946-4 / 440 pp. / List Price: \$79.95

Examining how electronic publication of theses and dissertations may enhance graduate education, this text clarifies the composition, evaluation, dissemination, and preservation of electronic theses and dissertations (ETDs)—providing a conceptual framework for the development of effective ETD programs and identifying the main technical concerns related to the adoption of ETD initiatives. This volume contains answers, techniques, and methods that have proven effective in the longest-running library-group support effort for campus ETDs. Helping graduate students, research mentors, and librarians ease students through the transition from paper to electronic theses and dissertations, this text

- Addresses seven key questions that students often face when considering an ETD
- Studies how institutions are providing technical support and offering digitized versions of theses and dissertations
- Provides case study examples of how ETDs have evolved through the influence of new technologies and institutional efforts
- Analyzes currently utilized technologies for the publishing and maintenance of ETDs
- Examines strategies currently in use by universities for handling of copyright issues
- Discusses the best methods for cataloging ETDs to ensure that they can be easily found

Presenting studies by leading figures in the ETD community, *Electronic Theses and Dissertations* is a must-have guide for all

The Guide for Electronic Theses and Dissertations - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Reload Home Search Favorites Media Print Mail News Groups

Address http://etdguide.org/ Go Links

Google eprints Search Web 285 blocked AutoFill Options eprints

The Guide to Electronic Theses & Dissertations

UNESCO


The ETD Guide	ETD Models	ETD Resources	Collaborate
About this site	The ETDGUIDE [Word]	NDLTD	About the Authors

[Français](#) [Español](#) [ETD Web Blog](#) [ETD WIKI](#) [Download a printable version of this site.](#)

Welcome to *The Guide for Electronic Theses and Dissertations*. We offer this site as a resource for graduate students who are writing theses or dissertations, for graduate faculty who want to mentor ETD authors, for graduate deans who want to initiate ETD programs, and for IT administrators at universities. *The Guide* is designed specifically for academic researchers and their mentors, yet anyone interested in research and e-publishing will enjoy this resource.

Published by UNESCO, *The Guide* is an international, "living" document, written by ETD (electronic thesis and dissertation) scholars throughout the world (see [About the Authors](#)). *The Guide* will be updated regularly based on submissions by ETD authors and [NDLTD](#) members.

We invite you to contribute essays describing your university's best ETD practices, to suggest [ETD Resources](#), or to nominate ETDs for our [Exemplary ETD Database](#).

This site requires Adobe Acrobat Reader - 

[\[ETD Guide\]](#) [\[ETD Models\]](#) [\[ETD Resources\]](#) [\[Collaborate\]](#) [\[About this Site\]](#) [\[Chat\]](#) [\[NDLTD\]](#) [\[About the Authors\]](#)

http://etdguide.org/french/default.htm Internet

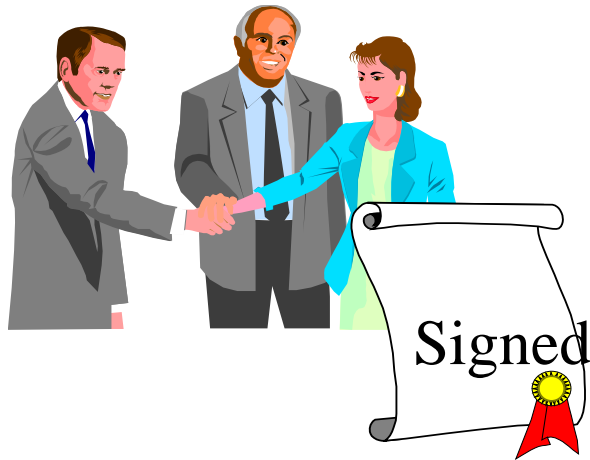
ETDs: Library Goals

- Improve library services
 - Better turn-around time
 - Always available
- Reduce work
 - catalog from e-text
 - eliminate handling: mailing to ProQuest, bindery prep, check-out, check-in, reshelving, etc.
- Save space

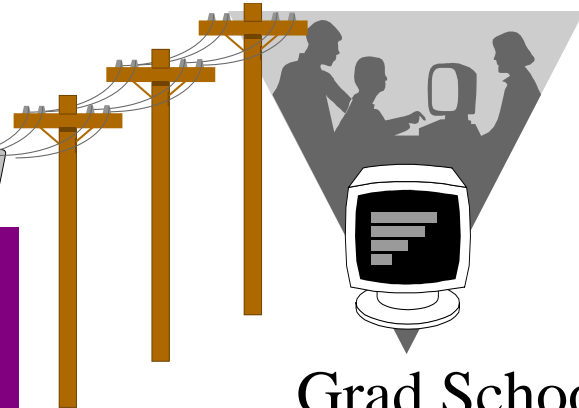
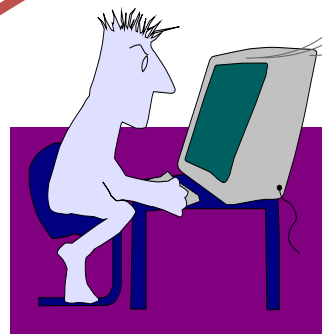
NDLTD: How can a university proceed?

- Select planning/implementation team
 - Library
 - Graduate School
 - Computing / Information Technology
 - Institutional Research / Educ. Tech.
- Join online, give us contact names
 - www.ndltd.org/join
- Adapt Virginia Tech or other proven approach
 - Build interest and consensus
 - Start trial / allow optional submission / start requirement
 - ETDdb, DSpace, EPrints, other institutional repositories

Student Gets Committee Signatures and Submits ETD

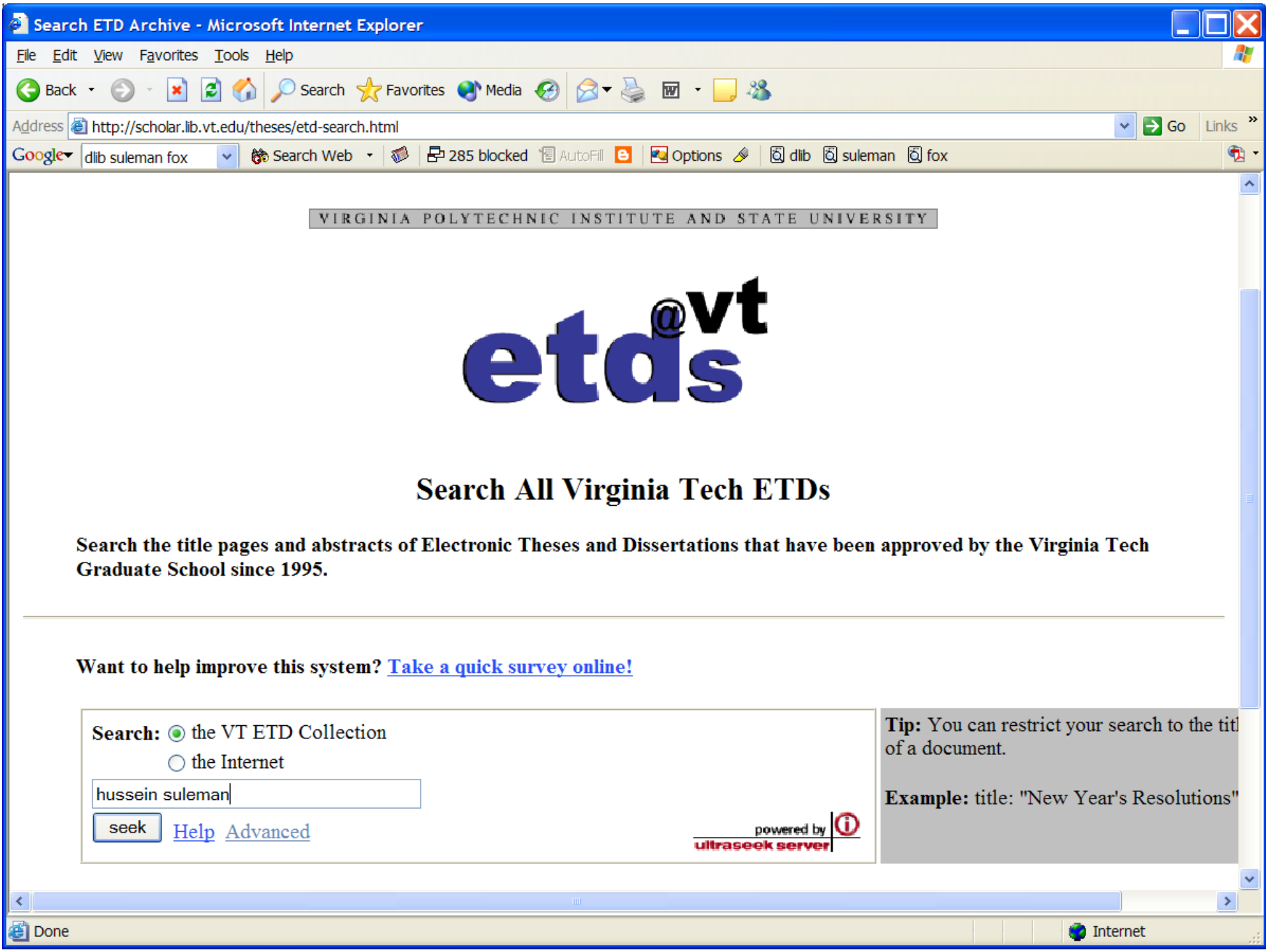


**Approval
form**



Library Catalogs ETD, Access is Opened to the New Research





VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY



Search All Virginia Tech ETDs

Search the title pages and abstracts of Electronic Theses and Dissertations that have been approved by the Virginia Tech Graduate School since 1995.

Want to help improve this system? [Take a quick survey online!](#)

Search: ☒ the VT ETD Collection
☐ the Internet

hussein suleman

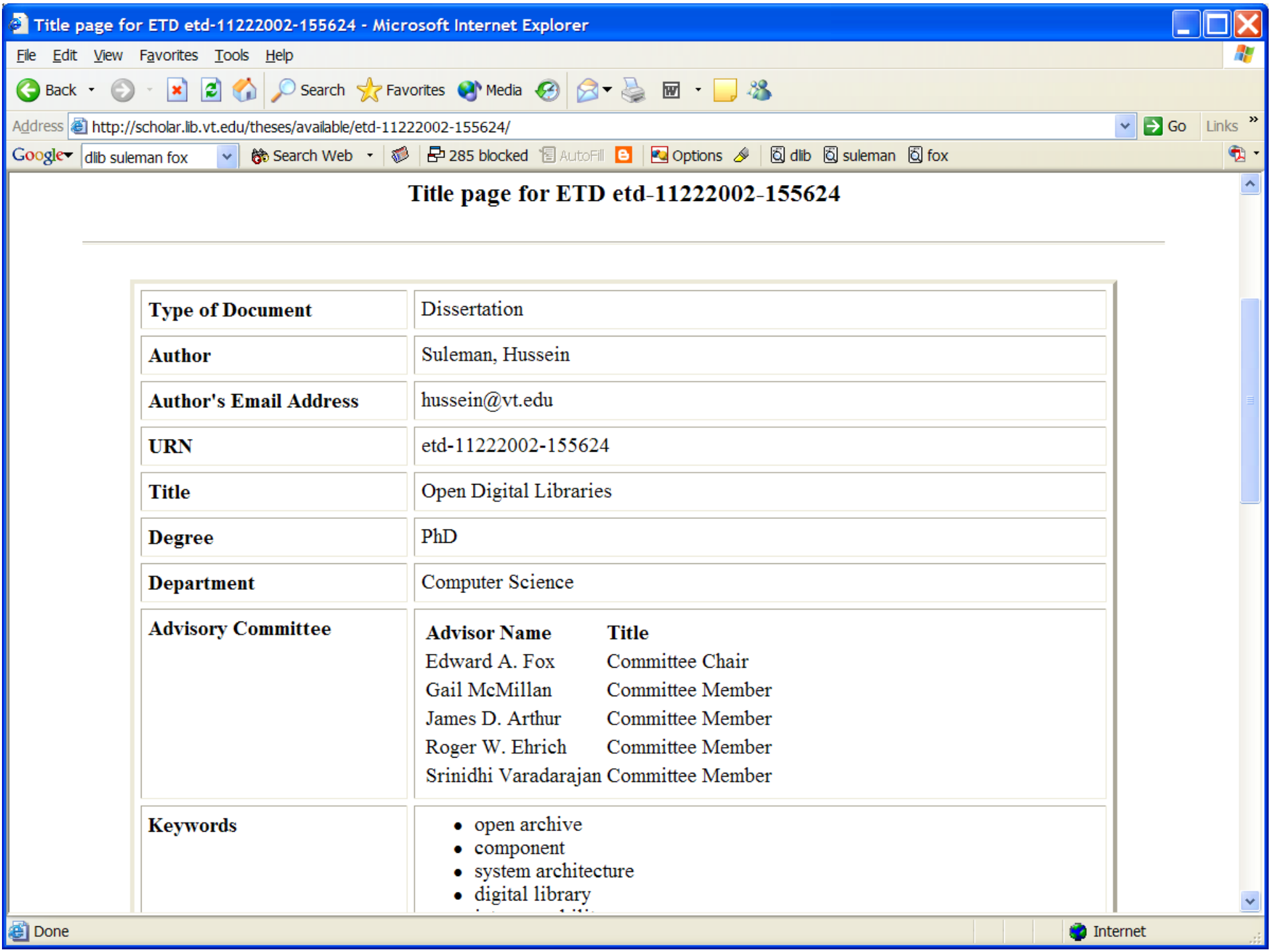
seek

[Help](#) [Advanced](#)

powered by
ultraseek server

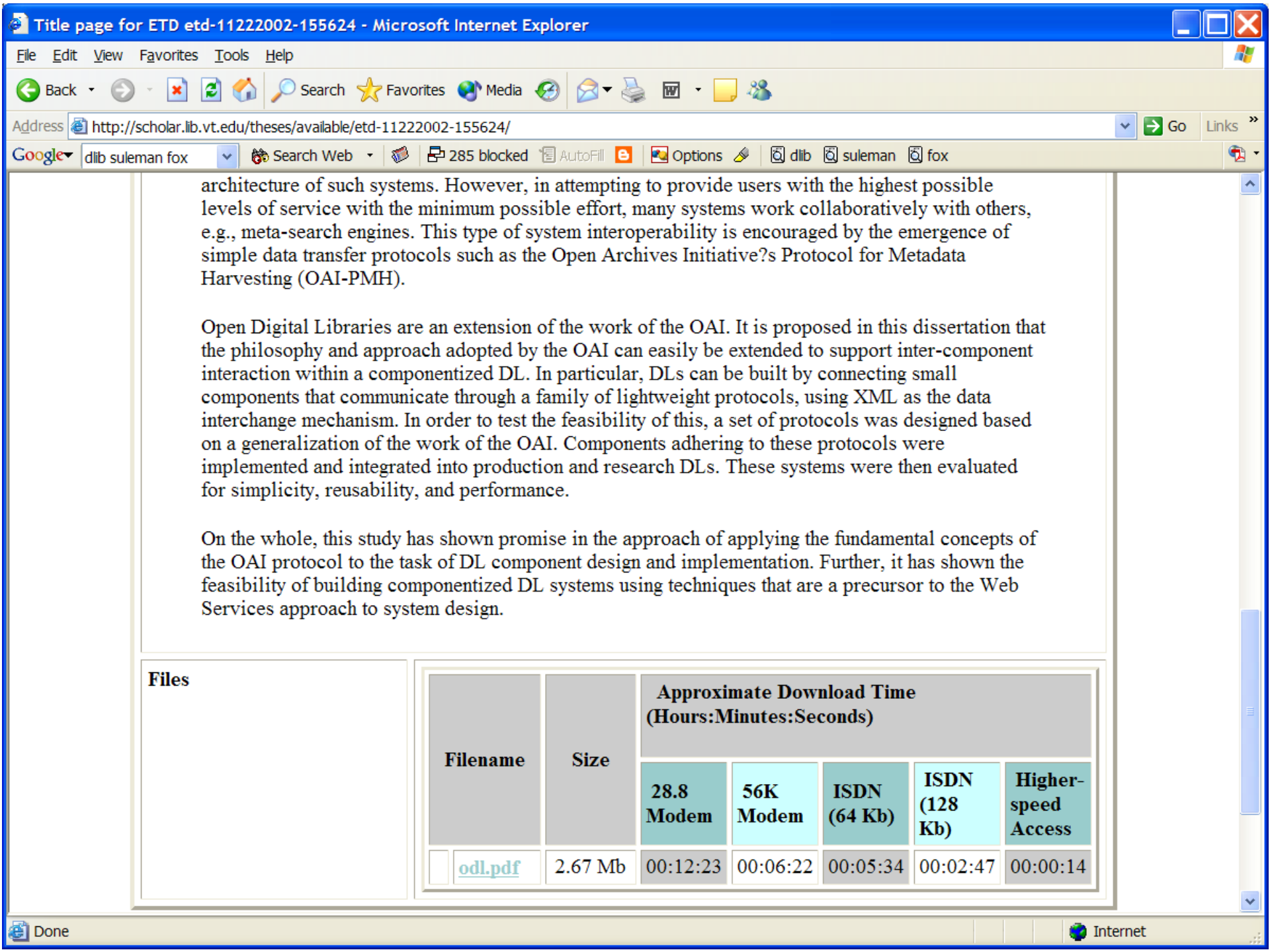
Tip: You can restrict your search to the title of a document.

Example: title: "New Year's Resolutions"



Title page for ETD etd-11222002-155624

Type of Document	Dissertation													
Author	Suleman, Hussein													
Author's Email Address	hussein@vt.edu													
URN	etd-11222002-155624													
Title	Open Digital Libraries													
Degree	PhD													
Department	Computer Science													
Advisory Committee	<table><tr><th>Advisor Name</th><th>Title</th></tr><tr><td>Edward A. Fox</td><td>Committee Chair</td></tr><tr><td>Gail McMillan</td><td>Committee Member</td></tr><tr><td>James D. Arthur</td><td>Committee Member</td></tr><tr><td>Roger W. Ehrich</td><td>Committee Member</td></tr><tr><td>Srinidhi Varadarajan</td><td>Committee Member</td></tr></table>		Advisor Name	Title	Edward A. Fox	Committee Chair	Gail McMillan	Committee Member	James D. Arthur	Committee Member	Roger W. Ehrich	Committee Member	Srinidhi Varadarajan	Committee Member
Advisor Name	Title													
Edward A. Fox	Committee Chair													
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Srinidhi Varadarajan	Committee Member													
Keywords	<ul style="list-style-type: none">• open archive• component• system architecture• digital library													



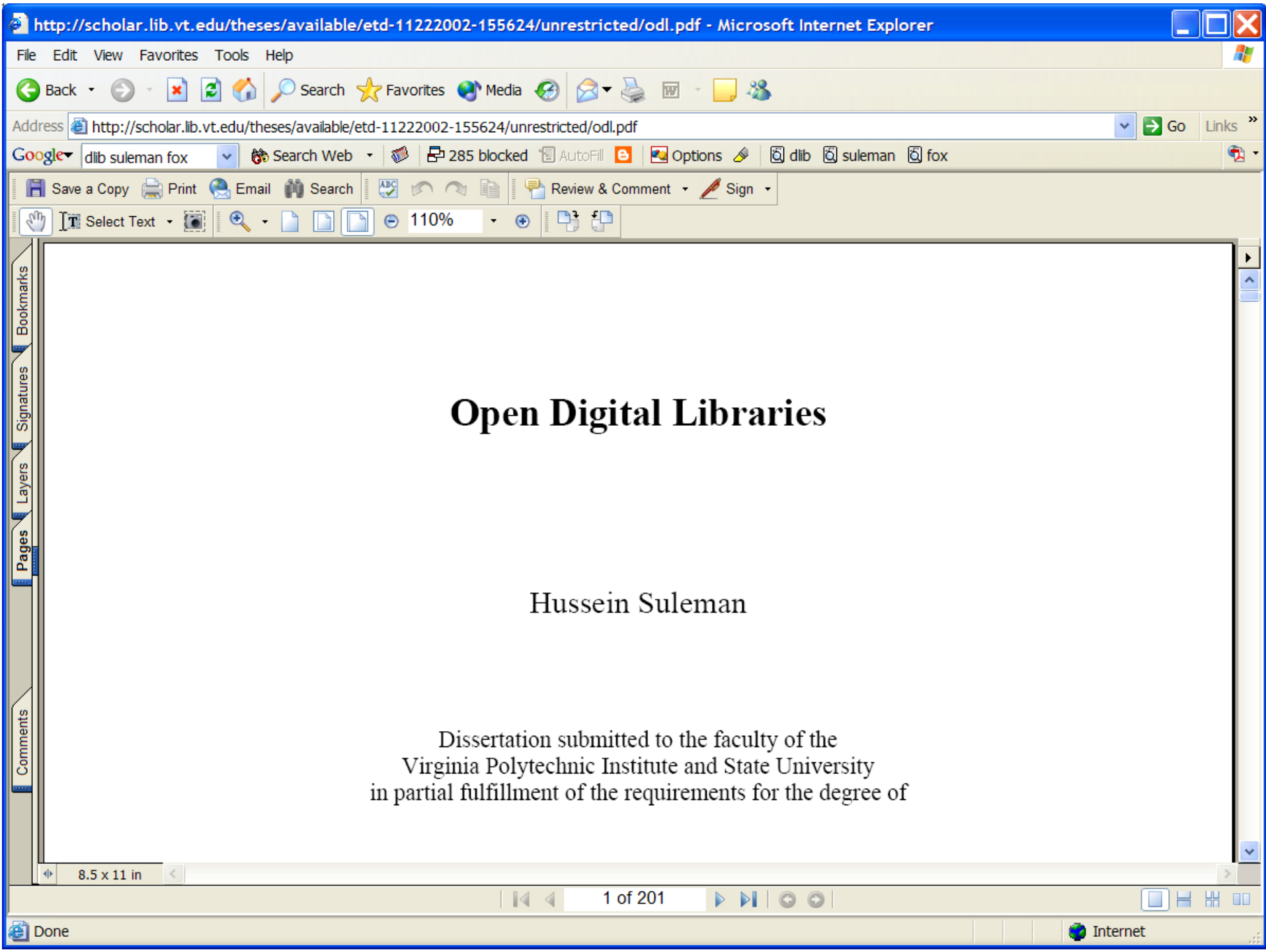
architecture of such systems. However, in attempting to provide users with the highest possible levels of service with the minimum possible effort, many systems work collaboratively with others, e.g., meta-search engines. This type of system interoperability is encouraged by the emergence of simple data transfer protocols such as the Open Archives Initiative's Protocol for Metadata Harvesting (OAI-PMH).

Open Digital Libraries are an extension of the work of the OAI. It is proposed in this dissertation that the philosophy and approach adopted by the OAI can easily be extended to support inter-component interaction within a componentized DL. In particular, DLs can be built by connecting small components that communicate through a family of lightweight protocols, using XML as the data interchange mechanism. In order to test the feasibility of this, a set of protocols was designed based on a generalization of the work of the OAI. Components adhering to these protocols were implemented and integrated into production and research DLs. These systems were then evaluated for simplicity, reusability, and performance.

On the whole, this study has shown promise in the approach of applying the fundamental concepts of the OAI protocol to the task of DL component design and implementation. Further, it has shown the feasibility of building componentized DL systems using techniques that are a precursor to the Web Services approach to system design.

Files

Filename	Size	Approximate Download Time (Hours:Minutes:Seconds)				
		28.8 Modem	56K Modem	ISDN (64 Kb)	ISDN (128 Kb)	Higher- speed Access
odl.pdf	2.67 Mb	00:12:23	00:06:22	00:05:34	00:02:47	00:00:14



Open Digital Libraries

Hussein Suleman

Dissertation submitted to the faculty of the
Virginia Polytechnic Institute and State University
in partial fulfillment of the requirements for the degree of

A CONTEMPORARY TURKISH COFFEEHOUSE DESIGN
BASED ON HISTORIC TRADITIONS

by

Timur Oral

Thesis submitted to the Faculty of the
Virginia Polytechnic Institute and State University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

in

Housing, Interior Design, and Resource Management

APPROVED:

Jeanette Bowker, Chair

Muzaffer Uysal

Eric Wiedegreen

April 16, 1997
Blacksburg, Virginia

Keywords: Turkish, coffee, coffeehouse, tradition, culture, franchising, shop design



Union catalog: OCLC

- Is getting data from WorldCat (so, from many sites).
- Need DC and either ETD-MS or MARC.
- Will harvest from all others who contact them.
- Has a set for ETDs, using Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH)

OCLC ONLINE COMPUTER LIBRARY CENTER

A Project of OCLC Research

XTCat NDLTD

NDLTD Union Catalog



The **NDLTD Union Catalog** is an [OAI Cat](#) server containing thesis and dissertation records harvested from registered NDLTD OAI repositories.

NDLTD OAI baseURL

<http://alcme.oclc.org/ndltd/servlet/OAIHandler>

Protocol Request Forms

1. [Identify](#)
2. [GetRecord](#)
3. [ListIdentifiers](#) ([Resumption](#))
4. [ListMetadataFormats](#)
5. [ListRecords](#) ([Resumption](#))
6. [ListSets](#)

Notes

- OAI XML responses from this repository include references to an XSL stylesheet. This allows modern web browsers (e.g. IE 6.0 or Netscape 7.0) to automatically render the XML into HTML instead of displaying the raw XML. Typical OAI harvester clients will naturally ignore the stylesheet reference and deal with the XML directly.

OCLC ONLINE COMPUTER LIBRARY CENTER

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NDLTD Union Catalog

[Identify](#) | [GetRecord](#) | [ListIdentifiers](#) ([Resumption](#)) | [ListMetadataFormats](#) | [ListRecords](#) ([Resumption](#)) | [ListSets](#)

responseDate	2003-05-09T17:54:25Z
request	http://alcme.oclc.org/ndltld/servlet/OAIHandler?verb=ListSets

ListSets

setSpec	setName
VTETD	Virgina Tech. Theses and Dissertation
LMU	Digitale Hochschulschriften der LMU
LSU	Louisiana State University
CALTECH	California Institute of Technology
HKU	Hong Kong University Theses
VIENNA	Wirtschaftsuniversität Wien
USF	University of South Flordia
DUETT	Dissertations and other Documents of the Gerhard-Mercator-University Duisburg
MIT	M.I.T. Theses and Dissertation
WATERLOO	Waterloo University Canada
PHYSNET	PhysNet, Oldenburg, Germany, Document Server
NCSU	North Carolina State University
UUdiva	Upsalla University

OCLC ONLINE COMPUTER LIBRARY CENTER

A Project of OCLC Research

XTCat NDLTD

NDLTD Union Catalog

[Identify](#) | [GetRecord](#) | [ListIdentifiers](#) ([Resumption](#)) | [ListMetadataFormats](#) | [ListRecords](#) ([Resumption](#)) | [ListSets](#)

responseDate	2003-05-09T17:55:20Z
request	http://alcme.oclc.org/ndltd/servlet/OAIHandler?verb=ListRecords

ListRecords (oai_dc)

identifier	oai:VTETD:etd-01242001-123819
datestamp	2002-12-18T00:00:00Z
<u>VTETD</u>	All

dc:title A Study of the Relationship Between Current Event Knowledge and the Ability to Construct a Mental Map of the World

dc:creator Bunin, J. Christopher

dc:subject Geography

dc:description This thesis studied the relationship between current event knowledge and the ability to construct a mental map of the world. It was hypothesized that participates with more current event knowledge would demonstrate better mental mapping abilities. The study was designed using two activities recommended for 12th graders by Geography for Life, National Geography Standards 1994, and the theory of spatial familiarity (Kitchen, 1994b; Gale et al., 1990, Golledge & Spector, 1978). One hundred-twenty eight students drawn from two courses offered at Virginia Tech completed a participant profile questionnaire, a current event quiz, drew a map of the world outlining the seven continents, and located and labeled 27 cities on a world map. Using ATLAS GIS the sketch maps and place locations were digitally transformed and scored for accuracy. Descriptive statistics were used to analyze current event knowledge, place location ability, and sketch mapping ability. Using Spearman rank correlation, the relationship between current event knowledge and mental mapping abilities was assessed at a number of levels. Results indicate that participants with a stronger understanding of current events tended to create a more accurate mental map of the world. That is, place location accuracy and drawing accuracy correlated with current event knowledge. However, similar to previous research (Cross, 1987; Helgren, 1983; Muller, 1985) place location knowledge outside of North America and Western Europe was poor. The results of this thesis offer baseline data that can be used for future research to study the effectiveness of

OCCLC SRU Interface

OCCLC ONLINE COMPUTER LIBRARY CENTER

A Project of OCLC Research

XTCat NDLTD
NDLTD Union Catalog



[Identify](#) | [GetRecord](#) | [ListIdentifiers](#) ([Resumption](#)) | [ListMetadataFormats](#) | [ListRecords](#) ([Resumption](#)) | [ListSets](#)
[SearchSRU](#)

GetRecordbySru Request Form

Title Word Creator Contributor Abstract

Topic: Institution: Year: Language:

Records Start:

Records to
Return:

- JOIN NDLTD
- SUBSCRIBE
- RELATED LINKS
- ETDS IN THE NEWS
- CONTACT NDLTD
- ADMIN LOGIN
- GO TO OTHER LANGUAGE: Select Language

Scirus ETD Search

This search service is provided courtesy of **Scirus**, based on data harvested from the Union Archive hosted by OCLC.

Basic Search

Query : powered by **scirus**

Advanced Search

All of the words in

AND

All of the words in

AND

All of the words in

Only show results published between

and

Only show results in

- | | |
|---|--|
| <input checked="" type="checkbox"/> All subject areas | <input type="checkbox"/> Agriculture and Biological Sciences |
| <input type="checkbox"/> Astronomy | <input type="checkbox"/> Chemistry and Chemical Engineering |
| <input type="checkbox"/> Earth and Planetary Sciences | <input type="checkbox"/> Economics, Business and Management |
| <input type="checkbox"/> Engineering, Energy and Technology | <input type="checkbox"/> Environmental Sciences |
| <input type="checkbox"/> Languages and Linguistics | <input type="checkbox"/> Law |
| <input type="checkbox"/> Life Sciences | <input type="checkbox"/> Materials Sciences |
| <input type="checkbox"/> Mathematics | <input type="checkbox"/> Medicine |
| <input type="checkbox"/> Neuroscience | <input type="checkbox"/> Pharmacology |
| <input type="checkbox"/> Physics | <input type="checkbox"/> Psychology |
| <input type="checkbox"/> Social and Behavioral Sciences | <input type="checkbox"/> Sociology |

Only search in the following collection

- ☒ ETDs ☐ The Scholarly Web

VTLS Visualizer Service -> Chivas

The screenshot displays the VTLS Visualizer Service Chivas web application. The browser address bar shows 'gaia.vtls.com:8080'. The page features a navigation bar with links: Login, Cart, Heading Search, Reserves Search, Search History, Clear Session, and Mobile Chivas. A search bar is present with a 'Search' button and a link to 'Advanced Search'. On the left, there is an 'Account Login' section with fields for Username and Password, a 'Remember Me' checkbox, and a 'Login' button. Below this is a 'Refine your search' section with 'Additional Terms' and 'Add' button, and lists for 'Source' (NDLTD, Local Catalog, DOAJ), 'Set' (OCLC ETD SET, IBICT Brazilian ETDs, Local Catalog, Brigham Young University Theses, Australasian Digital Theses Program), and 'Publication Year' (2010-2019, 2000-2009, 1990-1999, 1980-1989). The main content area shows 'Current Search: Viewing all records' with 'Results 1 to 10 of 1970668' and a 'Sort by' dropdown set to 'Recently added items first'. A 'SHARE' button with social media icons is also visible. The search results list includes:

- 1. **Methods in pharmacoepidemiology : four studies, four settings**
Sundström, Anders
Year 2010
[View Source Record](#)
- 2. **Influence of renal dysfunction on therapy and prognosis in patients with myocardial infarction**
Szumner, Karolina
Year 2010
[View Source Record](#)
- 3. **Patient education a portfolio of research related to the methods of providing education for patients pending a cardiac intervention**
Year 2003
[View Source Record](#)
- 4. **The influence of occasion on consumer choice: an occasion based, value oriented investigation of wine purchase, using means-end chain analysis**
Year 2003
[View Source Record](#)
- 5. **Postharvest improvement of Cavendish banana quality and shelf life**
Year 2002
[View Source Record](#)
- 6. **Product innovation and differentiation, intra-industry trade and growth a thesis**

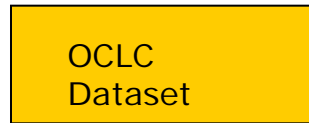
The Windows taskbar at the bottom shows the time as 6:46 AM on 10/29/2010.

Other facets: Format, Language, Subject, Genre, Author

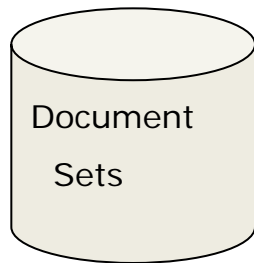
ETD Classification Research:



Category label for
each node used as
query



Top entries (for each
node in the tree)



Cleanup
(stemming,
stopword removal,
etc.)



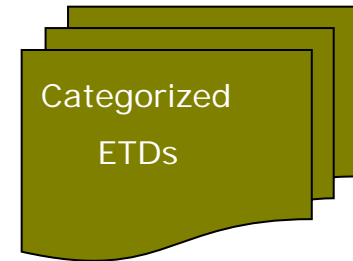
ETD metadata used
for categorization



Training

Algorithm Pipeline (Venkat Srinivasan dissertation)

ETDs categorized into
a node of the
category tree (after
classification)



Level-wise
categorization

Browsing



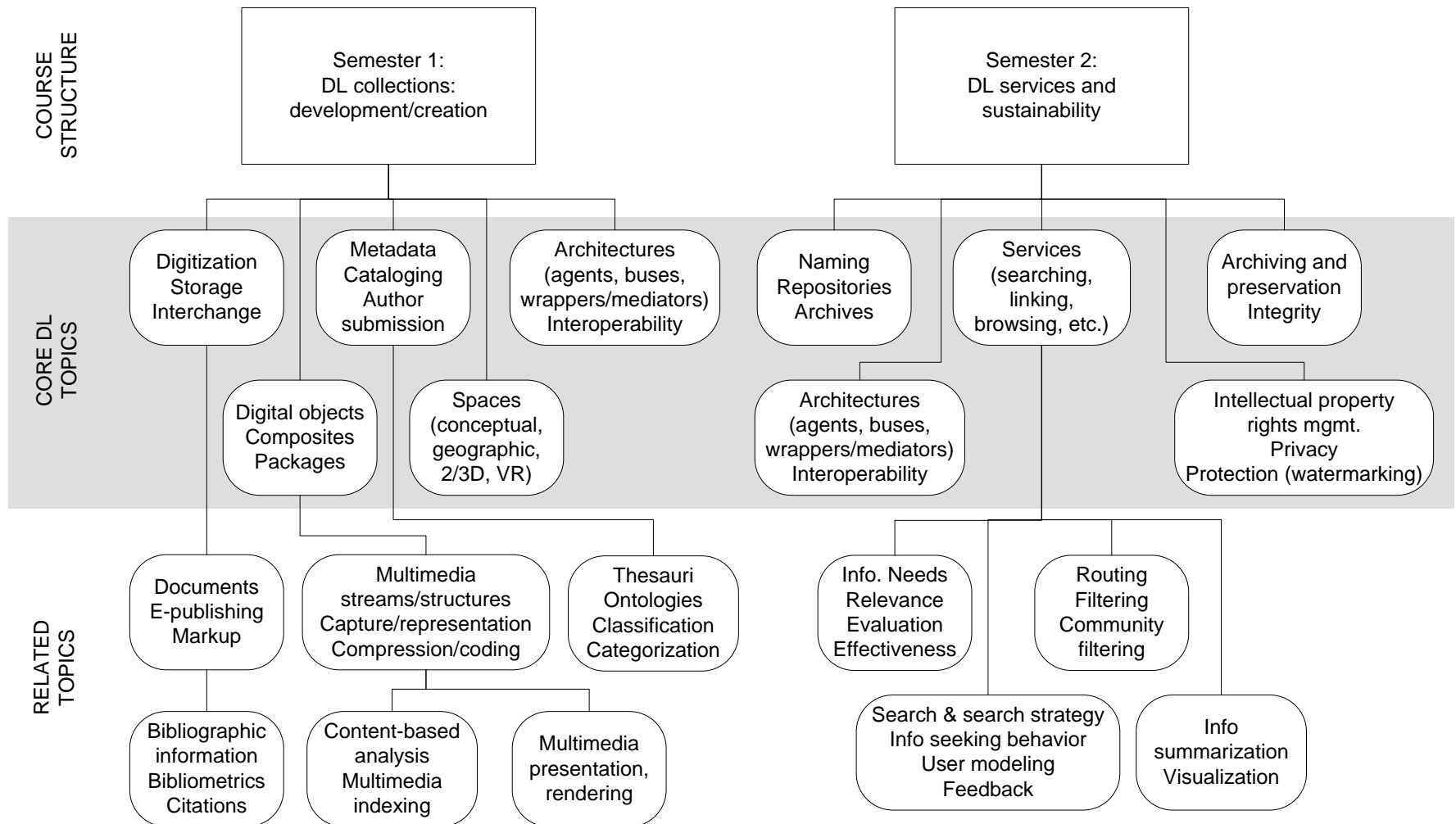
Why ETD? Short Answer

- For Students:
 - Gain knowledge and skills for the Information Age
 - Richer communication (digital information, multimedia, ...)
- For Universities:
 - Easy way to enter the digital library field and benefit thereby
- For the World:
 - Global digital library – large, useful, many services
- General:
 - Save time and money
 - Increased visibility for all associated with research results

Outline

- Acknowledgements
- NDLTD
- **Digital Library Curriculum Project**
- Ensemble (Pathway in NSDL)
- Extra Slides
 - Digital Libraries
 - Crisis, Tragedy & Recovery Network (CTRnet)
 - Digital Preserve in Second Life

DL Curriculum Framework



- 1. Module name**
- 2. Scope**
- 3. Learning objectives**
- 4. 5S characteristics of the module (streams, structures, spaces, scenarios, society)**
- 5. Level of effort required (in-class and out-of-class time required for students)**
- 6. Relationships with other modules (flow between modules)**
- 7. Prerequisite knowledge/skills required (what the students need to know prior to beginning the module; completion optional; complete only if prerequisite knowledge/skills are *not* included in other modules)**
- 8. Introductory remedial instruction (the body of knowledge to be taught for the prerequisite knowledge/skills required; completion optional)**
- 9. Body of knowledge (theory + practice; an outline that could be used as the basis for class lectures)**
- 10. Resources (required readings for students; additional suggested readings for instructor and students)**
- 11. Exercises / Learning activities**
- 12. Evaluation of learning objective achievement (graded exercises or assignments)**
- 13. Glossary**
- 14. Additional useful links**
- 15. Contributors (authors of module, reviewers of module)**

DL Curric. Project - 1

- NSF awards to VT and UNC-CH
- CS and LIS
- Project server: <http://curric.dlib.vt.edu/>
- Wikiversity:
http://en.wikiversity.org/wiki/Curriculum_on_Digital_Libraries

DL Curric. Project - 2

- **Module 1-b: History of digital libraries and library automation**
- **Module 2-c: File Formats, Transformation, and Migration**
- **Module 3-b: Digitization**
- **Module 3-e (7-e): Web Publishing**
- **Module 3-f (7-f): Crawling**
- **Module 4-b: Metadata**
- **Module 5-a: Architecture overview**

DL Curric. Project - 2

- **Module 5-b: Application software**
- **Module 5-d: Protocols**
- **Module 6-a: Information needs/relevance**
- **Module 6-b: Online information seeking behaviors and search strategies**
- **Module 6-d: Interaction design and usability assessment**
- **Module 7-a: Indexing and searching**
- **Module 7-a(1): Image retrieval**

DL Curric. Project - 3

- **Module 7-b: Reference services**
- **Module 7-c: Recommender systems**
- **Module 7-d: Routing**
- **Module 7-g: Personalization**
- **Module 8-a: Preservation**
- **Module 8-b: Web archiving**
- **Module 9-c: Digital library evaluation, user studies**

- **Plus others in process, and 10 under development by VT's CS5604Fall 2010 students**



DIGITAL LIBRARIES

Curriculum Development

Google™ Custom Search

Search

Welcome to the Digital Library Curriculum Project!

This project is funded by the National Science Foundation through grants NSF IIS-0535057 (to Virginia Tech) and IIS-0535060 (to the University of North Carolina at Chapel Hill), and builds upon a collaboration between Virginia Tech and the University of North Carolina, Chapel Hill. Project details include:

- **Title:** Collaborative Research: Curriculum Development: Digital Libraries
- **Period:** 1/1/2006 - 12/31/2009 (including one-year extension)
- **Project Team at VT:**
 - PI: Edward A. Fox (fox@vt.edu)
 - GRA: Seungwon Yang (seungwon@vt.edu)
 - REU: John Ewers (jewers@vt.edu)
- **Project Team at UNC-CH:**
 - PI: Barbara M. Wildemuth (wildem@ils.unc.edu)
 - Co-PI: Jeffrey P. Pomerantz (pomerantz@unc.edu)
 - GRA: Sanghee Oh (shoh@email.unc.edu)
- **Wikiversity Collaboration Effort :** [Wikiversity page](#)





DIGITAL LIBRARIES

Curriculum Development

FRAMEWORK FOR A DIGITAL LIBRARY CURRICULUM¹

(2008/08/23)

CORE TOPICS

1	Overview	1-a (10-c): Conceptual frameworks, models, theories, definitions	1-b: History of digital libraries and library automation
2	Digital Objects	2-a: Text resources 2-b: Multimedia 2-b (1): Images	2-c (8-d): File formats, transformation, migration 3-c: Harvesting
3	Collection Development	3-a: Collection development/selection policies 3-b: Digitization	3-d: Document and e-publishing/presentation markup 3-e (7-e): Web (push) Publishing 3-f (7-f): Crawling
4	Info/ Knowledge Organization	4-a: Information architecture (e.g., hypertext, hypermedia) 4-b: Metadata 4-c: Ontologies, classification, categorization	4-d: Subject description, vocabulary control, thesauri, terminologies 4-e: Object description and organization for a specific domain
5	Architecture (agents, mediators)	5-a: Architecture overviews 5-b: Application software 5-c: Identifiers, handles, DOI, PURL	5-d: Protocols 5-e: Interoperability 5-f: Security

6	User Behavior/ Interactions
---	--------------------------------

6-a: Info needs, relevance
6-b: Online info seeking behavior and search strategy

6-c: Sharing, networking, interchange (e.g., social)
6-d: Interaction design, usability assessment
6-e: Info summarization and visualization

7	Services
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7-a: Indexing and searching
7-a (1): Image retrieval
7-b: Reference services
7-c: Recommender systems

7-d: Routing, community filtering
7-e (3-e): Web (push) Publishing
7-f (3-f): Crawling
7-g: Personalization

8	Preservation
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8-a: Preservation
8-b: Web archiving

8-c :Sustainability
8-d (2-c): File formats, transformation, migration

9	Management and Evaluation
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9-a: Project management
9-b: DL case studies
9-c: DL evaluation, user studies
9-d: Bibliometrics, Webometrics

9-e: Intellectual property
9-f: Cost/economic issues
9-g: Social issues

10	DL education and research
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10-a: Future of DLs
10-b: Education for digital librarians

10-c (1-a): Conceptual framework, theories, definitions
10-d: DL research initiatives

¹ This project is funded by the National Science Foundation through grants NSF IIS-0535057 (to Virginia Tech) and IIS-0535060 (to University of North Carolina at Chapel Hill).



Modules for 5 more packages just completed: **CLUTO, NLTK, SOLR, TRECeval, and WordNet**. 5 more will be completed in December: **Hadoop, Lemur, R, Weka, and an XMLdatabase (on IBM Cloud)**.

How to organize a DL course?

- Various frameworks
 - What, Why, How
 - History, Current status, Future (research)
 - Economics: open source, sustainability
 - Social: users/patrons, management
 - Technical: HCI, HT, IR, LIS, Web
- Suggest that concept maps be drawn by readers to help in working with this book
- Instructors can access “expert” maps with IHMC tools

Outline






- Acknowledgements
- NDLTD
- Digital Library Curriculum Project
- **Ensemble (Pathway in NSDL)**
- Extra Slides
 - Digital Libraries
 - Crisis, Tragedy & Recovery Network (CTRnet)
 - Digital Preserve in Second Life

Ensemble, Pathway in NSDL

- National STEM (science, technology, engineering, and mathematics) education Digital Library – **NSDL**
- **National Science Digital Library**
- **www.nsd.org**
- **Many projects, largest now called Pathways**

www.nsd.org

NSDL.org - The National ...
www.nsd.org/?set_css=large



NSDL Home Smaller Text

Home

Advanced Search

- General
- K-12
- Higher Education

Browse

- Science Literacy Maps
- Science Refreshers
- Math Common Core
- Bilingual Resources
- NSDL on iTunes U
- NSDL Pathways
- Collections
- Resources

Resources for

- K-12 Teachers
- Higher Education
- Librarians


News and Information

Search The National Science Digital Library


NSDL is the Nation's online library for education and research in Science, Technology, Engineering, Mathematics.

Highlights

[**Teaching History of Chemistry in National Chemistry Week, October 17-23, 2010**](#)



Chemistry, what a fascinating science discipline! Isaac Newton, one the greatest scientists in history said in 1676: *"If I have seen far, it's because I stood on the shoulders of giants"*. And you bet that's true for Chemistry and for any other



NSDL Pathways

Learn More

ComPADRE: Physics and Astronomy Pathway

ComPADRE is a network

NSDL Pathways

DL.org - NSDL Pathwa...
www.nsdl.org/about/?pager=pathways



THE NATIONAL SCIENCE DIGITAL LIBRARY



NSDL Home > About > NSDL Pathways

Smaller Text

Home

Advanced Search

Browse

Resources for

News and Information

Participate in NSDL

Professional
Development

About NSDL

Policies and
Guidelines

Technical Network
Services

Resource Center

For Developers

Brands and
Templates

FAQ

Organization

Funded Projects

Pathways

Search

Search

- Search NSDL Library
- Search NSDL Website

What are NSDL Pathways

Pathways are large projects that are aggregators and stewards of resources and services to broad categories of users---either discipline-focused (e.g. chemistry), or audience-focused (e.g. middle school educators), or resources of a specific type or format (e.g. multimedia content). They are digital library portals developed and managed in partnership with organizations and institutions that have a history and expertise in serving their portal's target audiences. They contribute metadata (descriptive information) about their resources to NSDL to make their resources searchable and discoverable via the NSDL.org portal, in addition to their own portals.

- Browse NSDL Pathways collections in NSDL.org: follow the blue link on the title of a Pathway's project. This takes you to a secondary page (on NSDL.org) for the Pathway, that in turn, links to that Pathway's entire collection (or multiple collections) of resources in the NSDL Data Repository.

NSDL Pathways News

- [TRON Legacy Exhibit at the National Science & Engineering Festival](#)
- [Engineering Education "Today in History" Blog: Portland Cement Patented](#)
- [Engineering Education "Today in History" Blog: Discovery of the Structure of DNA](#)
- [Engineering Education "Today in History" Blog:](#)



[AMSER: Applied Math and Science Pathway](http://amser.org/)

<http://amser.org/>

Applied Math and Science for Technical and Community Colleges



[BEN: Biological Sciences Pathway](http://www.bioscienet.org/portal/)

<http://www.bioscienet.org/portal/>

Biological Sciences for High School to Graduate



[CLEAN: Climate Literacy and Energy Awareness Network Pathway](http://www.cleant.net)

<http://www.cleant.net>

Climate Literacy and Energy Awareness for Middle School to Under



[ChemEd DL: Chemistry Education Pathway](http://www.chemeddl.org/)

<http://www.chemeddl.org/>

Chemistry for High School to Graduate



[ComPADRE: Physics and Astronomy Pathway](http://www.compadre.org/portal/)

<http://www.compadre.org/portal/>

Physics and Astronomy for High School to Graduate



[CSERD: Computational Science Education Resources Pathway](http://www.shodor.org/refdesk/)

<http://www.shodor.org/refdesk/>

Computational Science for K-12 to Graduate



[DLESE: Digital Library for Earth System Education](http://dlese.org/)

<http://dlese.org/>

Earth Science for K-12 to Undergraduate



[Engineering Pathway: Engineering Education Resources](http://www.engineeringpathway.com/)

<http://www.engineeringpathway.com/>

Engineering for K-12 to Graduate



[Ensemble: Computing Pathway](http://www.computingportal.org)

<http://www.computingportal.org>

Computing for K-12 to Graduate



[MatDL: Materials Digital Library Pathway](http://matdl.org/)

<http://matdl.org/>

Materials Science for Undergraduate to Graduate



[MathDL: Mathematics Pathway](http://mathdl.maa.org/)

<http://mathdl.maa.org/>

Mathematics for Undergraduates



[MathPath: Elementary Mathematics Pathway](http://www.mpt.org)

<http://www.mpt.org>

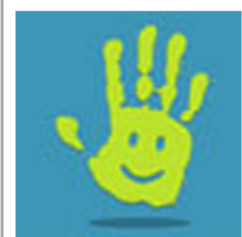
Mathematics for Elementary School



[Middle School Portal: Math and Science Pathways](http://msteacher2.org/)

<http://msteacher2.org/>

Math and Science for Middle School



[SMILE: Science and Math Informal Learning Educators Pathway](http://www.howtosmile.org)

<http://www.howtosmile.org>

Science and Math for Informal Learners



[Teachers' Domain: Digital Media Resources Pathway](http://www.teachersdomain.org)

[http://www.teachersdomain.org/](http://www.teachersdomain.org)

Life, Earth, Space, and Physical Science for K-12



[Teach the Earth: the SERC Portal for Geoscience Educators](http://serc.carleton.edu/teachearth/index.html)

<http://serc.carleton.edu/teachearth/index.html>

Geoscience Education for K-12 to Undergraduate



[TeachingwithData.org: Pathway to Quantitative Literacy in the Social Sciences](http://www.teachingwithdata.org)

<http://www.teachingwithdata.org>

Quantitative Literacy in the Social Sciences for High School to Graduate

NSDL Connects:

These 3 slides
from Lee Zia

Users: students, educators, life-long learners

Content: structured learning materials;
large real-time or archived datasets;
audio, images, animations;
primary sources;
digital learning objects (e.g. applets);
interactive (virtual, remote) laboratories; ...

Tools: search; refer; validate; integrate; create;
customize; publish; share; notify; collaborate; ...

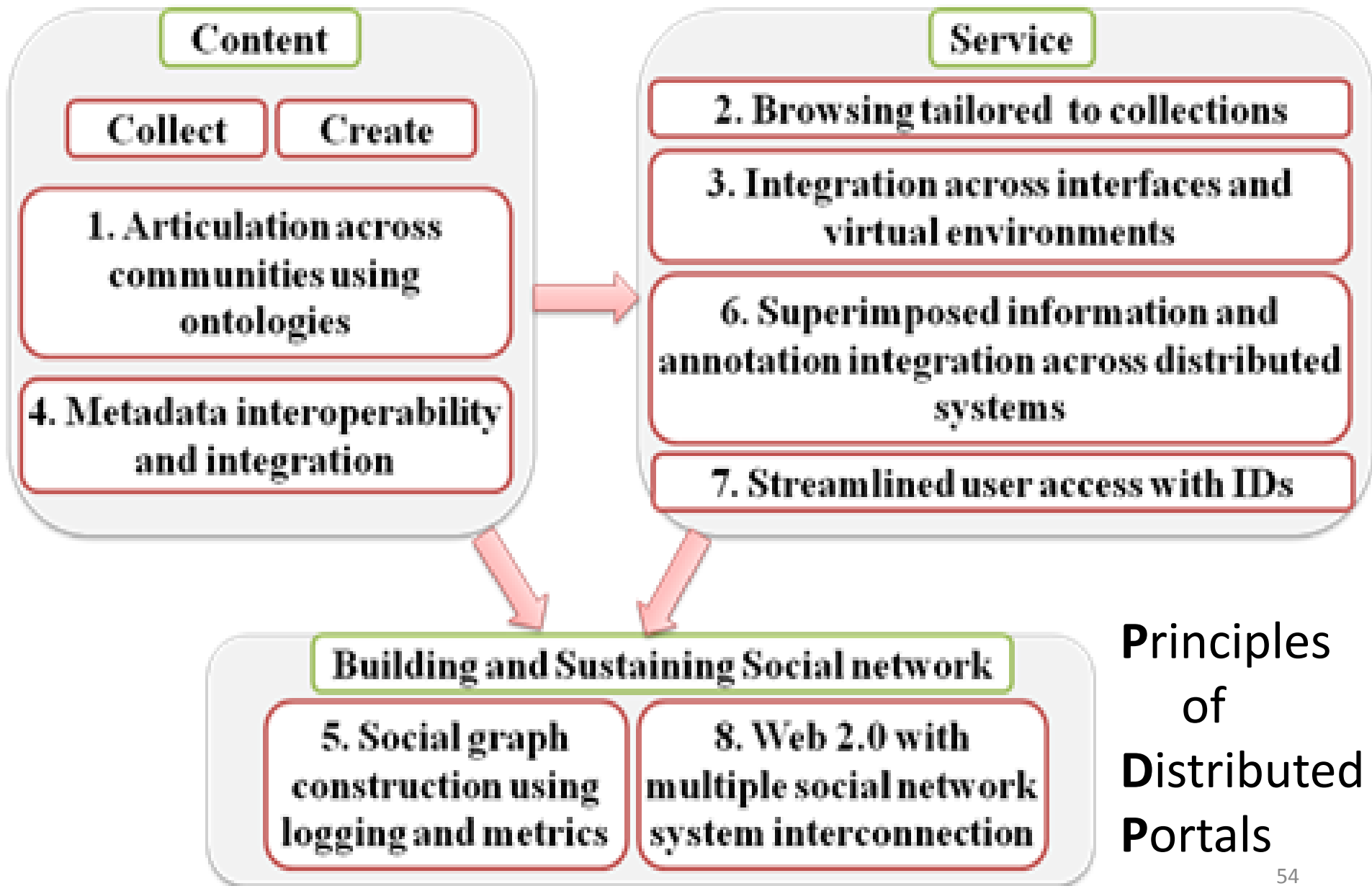
Collections

- Discovery of content
- Classification and cataloguing
- Acquisition and/or linking; referencing
- Disciplinary-based themes define a natural body of content, but other possibilities are also encouraged
- Access to massive real-time or archived datasets
- Software tool suites for analysis, modeling, simulation, or visualization
- Reviewed commentary on learning materials and pedagogy

Services

- Help services, frequently asked questions, etc.
- Synchronous/asynchronous collaborative learning environments using shared resources
- Mechanisms for building personal annotated digital information spaces
- Reliability testing for applets or other digital learning objects
- Audio, image, and video search capability
- Metadata system translation
- Community feedback mechanisms

Ensemble: PDP-8 Overview



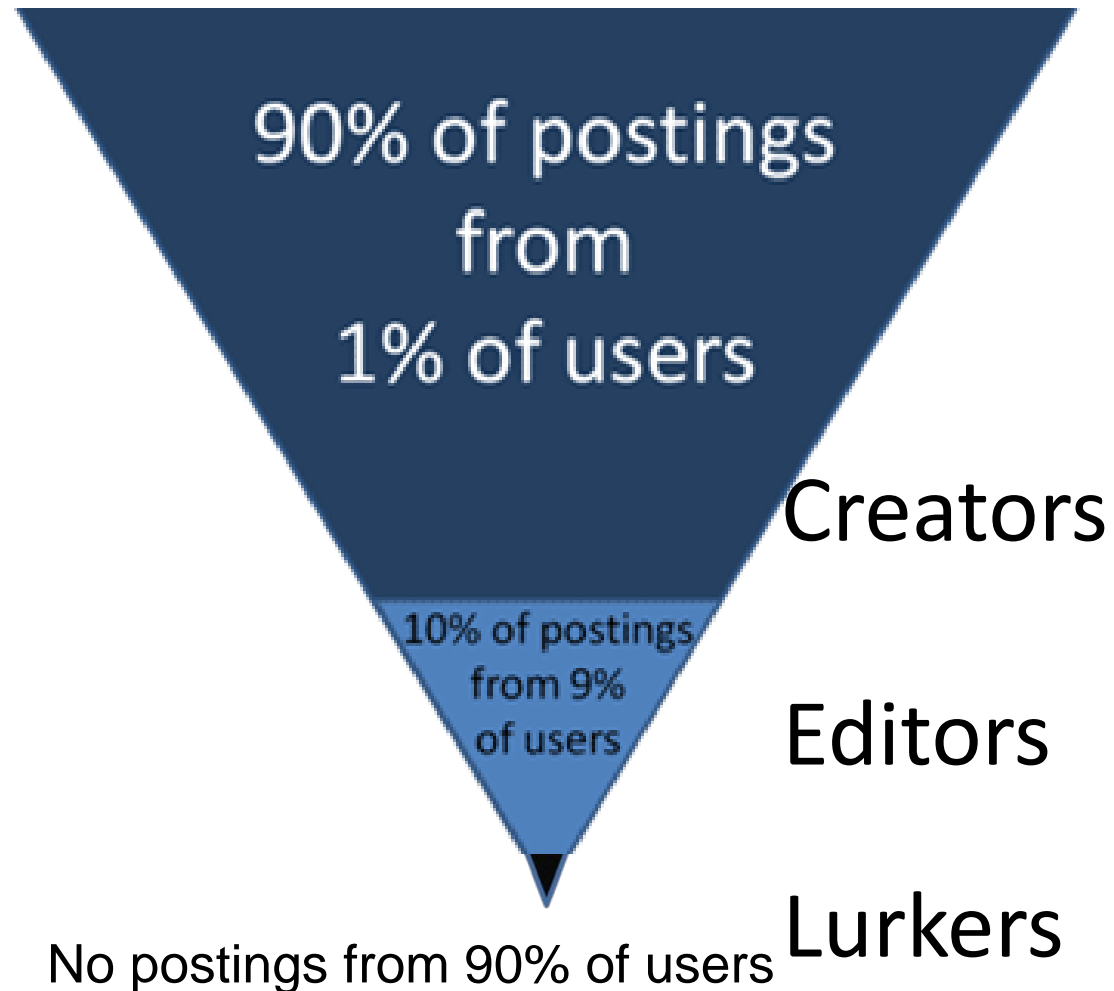
Principles
of
Distributed
Portals

Overcoming 90-9-1 Behavior

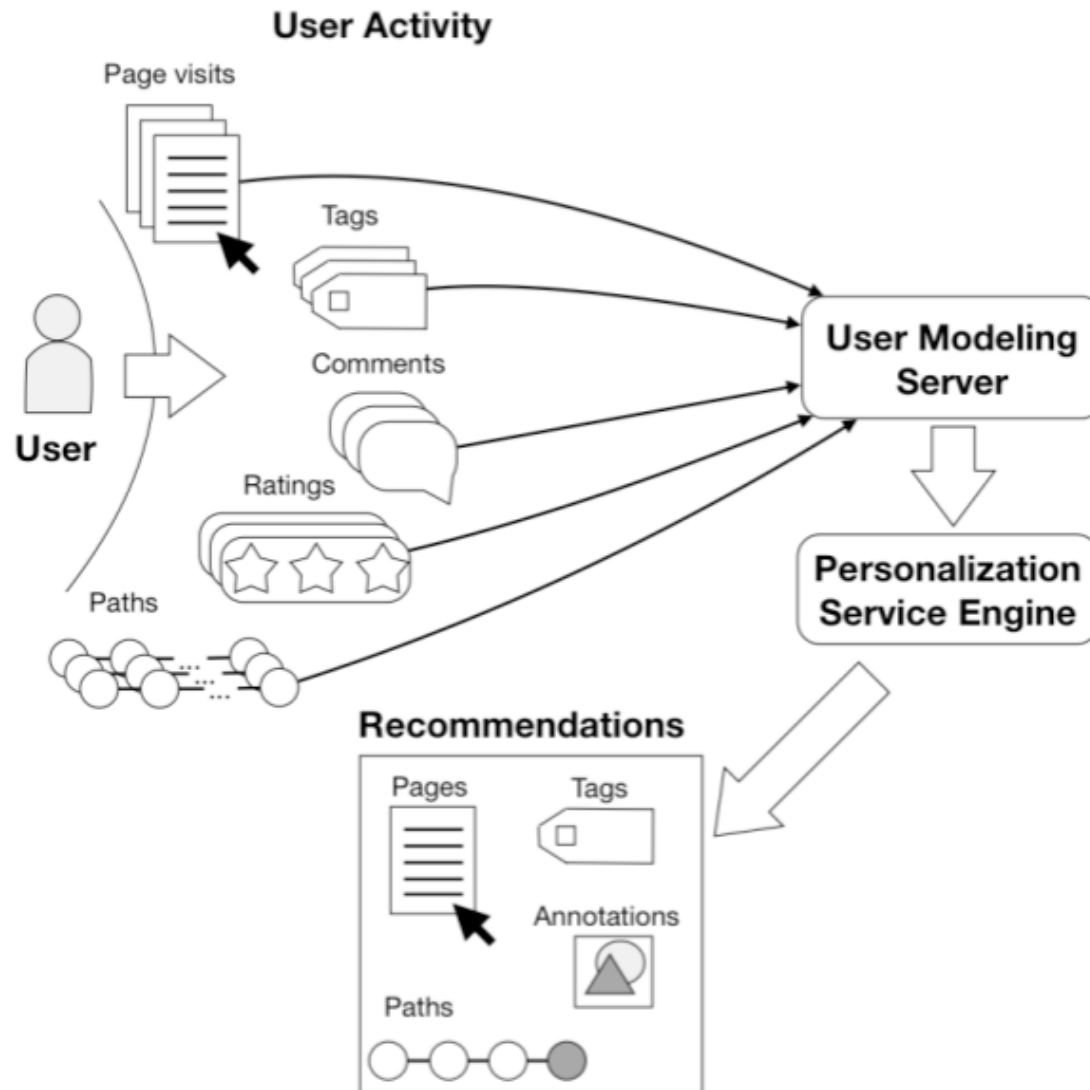
Source:

www.useit.com/alertbox/participation_inequality.html

- Make it easier to contribute
 - Clicking stars for a rating vs. writing a natural language review
- Promote quality contributions
 - Reputation rankings
- **Reward participants**
 - Badges for roles



Ensemble, U. Pittsburgh, PERSEUS: Collecting Social Wisdom



Ensemble in 5 S - Societies

- What *Societies* must Ensemble serve?
 - Teachers
 - Students, perhaps
 - Groups with computing education tasks
 - The NSDL
 - The NSF
 - Partner sites (providers and harvesters)
 - The developers
 - Related hardware / software components

Ensemble in 5S - Scenarios

- What *Scenarios* must be addressed? (a sample)
 - Search, Browse
 - User registration, login
 - Commenting, rating, tagging
 - Acquisition/de-acquisition/user contributing
 - Share resources in, and collect data from, other places (CiteULike, Facebook)
 - Acknowledge contributions
 - Harvest and be harvested
 - Join groups, participate in discussions
 - Recover from failures
 - Computer systems, storage

Ensemble in 5S - Spaces

- What *Spaces* will matter in Ensemble?
 - User interface (2D generally, 3D in Second Life)
 - Education level
 - Curriculum standards or recommendations
 - Topic spaces
 - Vector and feature spaces to support indexing, searching, and classifying

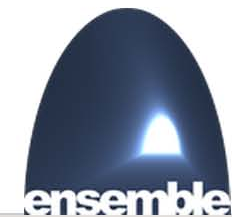
Ensemble in 5S - Structures

- What *Structures* will we hold?
 - Metadata
 - Computing Ontology
 - Database schema and tables
 - Taxonomies
 - Educational schema
 - Computing topics (Knowledge units)
 - Rating schemes

Ensemble in 5 S - Streams

- What *Streams* of data will we see?
 - All the document types we can imagine: text, word processor, PDF, spreadsheets, presentations, HTML, XML, ...
 - All the image types, all the video types
 - Images (jpg, tiff, ...)
 - Video (avi, mov, ...)
 - Program code, both source code and object code
 - Comments, ratings, tags
 - Group membership profiles
 - E-mail addresses
 - User information (preferences, ...)

Ensemble: www.computingportal.org



Connecting Computing Educators

[ENSEMBLE HOME](#)[LOGIN](#)[SEARCH](#)[ABOUT](#)[CONTACT](#)

**Browse
our Collections**



**Explore
our Communities**



**Try
our Tools**

Powered by **Drupal**, an open source content management system. Arch images by criminalintent, auntlaura, and geishaboy500. CC BY-SA 2.0



COLLECTIONS

PAWS



C,Java and database course material











Previous 1 2 3 4 5 6 7 8 Next

COMING SOON...

CAP Space:

It is an interactive repository of Curricula, Assessment and Pedagogy for associate-degree programs in computing. CAP Space, a service of the ACM Two-Year College Education Committee, provides resources for faculty, students, administrators, academic advisors and parents.

Ensemble Collections

 <p>Algorithm Visualization</p>	 <p>Computing Education Resource</p>	 <p>C, Java and database course material</p>
 <p>K-12 CS teaching and learning materials</p>	 <p>Virtual History Museum</p>	 <p>Walden's Paths Walden's Paths - Ensemble Edition</p>
 <p>Digital Library Curriculum</p>	 <p>Computer Science Syllabi</p>	 <p>PlanetMath</p>
 <p>SWENET</p>		

AlgoViz [434]: A gathering place for users and developers of algorithm visualizations and a gateway to AV-related ser resources.

CITIDEL [432]: Computing and Information Technology Interactive Digital Educational Library.

CS Syllabi [7617]: Syllabus collected computer science syllabi available from the Web.

CSTA [209]: A Web Repository of K-12 Computer Science Teaching and Learning Materials.

Digital Library Curriculum [14]: A unified digital library curriculum has been developed by collaboration between D School of Information and Library Science at UNC, Chapel Hill.

Summary

- Acknowledgements
- NDLTD
- Digital Library Curriculum Project
- Ensemble (Pathway in NSDL)
- Extra Slides
 - Digital Libraries
 - Crisis, Tragedy & Recovery Network (CTRnet)
 - Digital Preserve in Second Life



Questions?

Ask: fox@vt.edu. Feel free to visit Blacksburg, Virginia, USA

Extra Slides

- Digital Libraries
- Crisis, Tragedy & Recovery Network (CTRnet)
- Digital Preserve in Second Life

Digital Libraries --- Objectives

- World Lit.: 24hr / 7day / from desktop
- Integrated “super” information systems: 5S:
Table of related areas and their coverage
- Ubiquitous, Higher Quality, Lower Cost
- Education, Knowledge Sharing, Discovery
- Disintermediation -> Collaboration
- Universities Reclaim Property
- Interactive Courseware, Student Works
- Scalable, Sustainable, Usable, Useful

DL Overview

Why of Global Interest?

- **National projects** can preserve antiquities and heritage: cultural, historical, linguistic, scholarly
- Knowledge and information are essential to economic and technological **growth, education**
- DL - a **domain for international collaboration**
 - wherein all can **contribute** and **benefit**
 - which leverages investment in **networking**
 - which provides useful **content** on Internet & WWW
 - which will **tie nations and peoples together** more strongly and through **deeper understanding**

DL Challenges

- Preservation - so people will trust DLs
- Supporting infrastructure - networks, ...
- Scalability, sustainability, interoperability
- DL industry - critical mass by covering libraries, archives, museums, corporate info, govt info, personal info - “quality WWW” integrating IR, HT, MM, ...
 - Need tools & methods to make them easier to build

DL Challenges – 2: Terminology

- Digital / electronic / virtual library
- Born digital, hybrid (digital/physical)
- Universal access (all people/places/times)
 - Accommodate disabilities (color, visual, auditory)
 - Mobile (office, home, laptop, PDA, mobile)
- Archiving, self-archiving
- Open (source, standards, archives)

KNOWLEDGE LOST IN INFORMATION

Report of the NSF Workshop on Research Directions for Digital Libraries



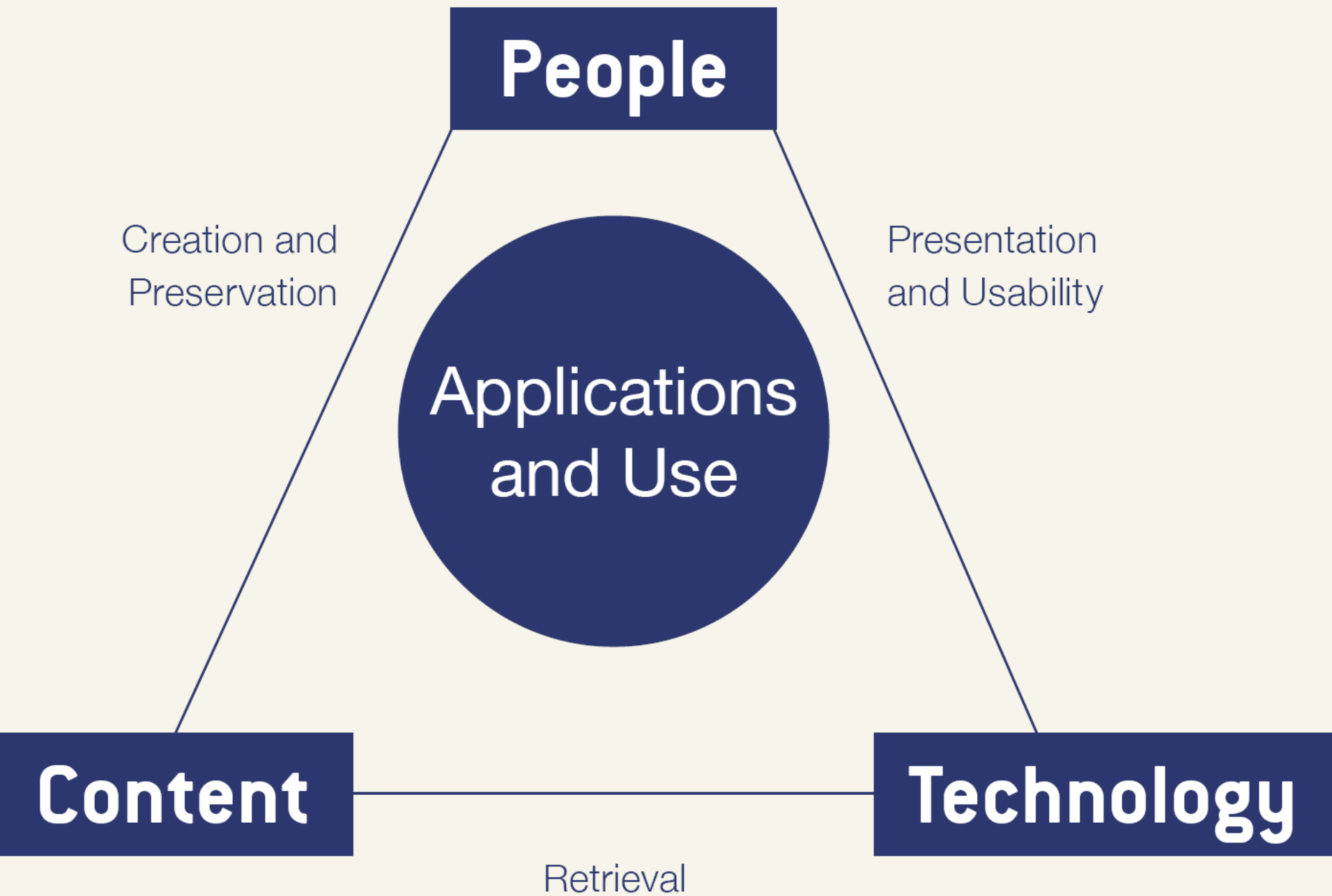
June 15–17, 2003
Chatham, MA

National Science Foundation Award No. IIS-0331314

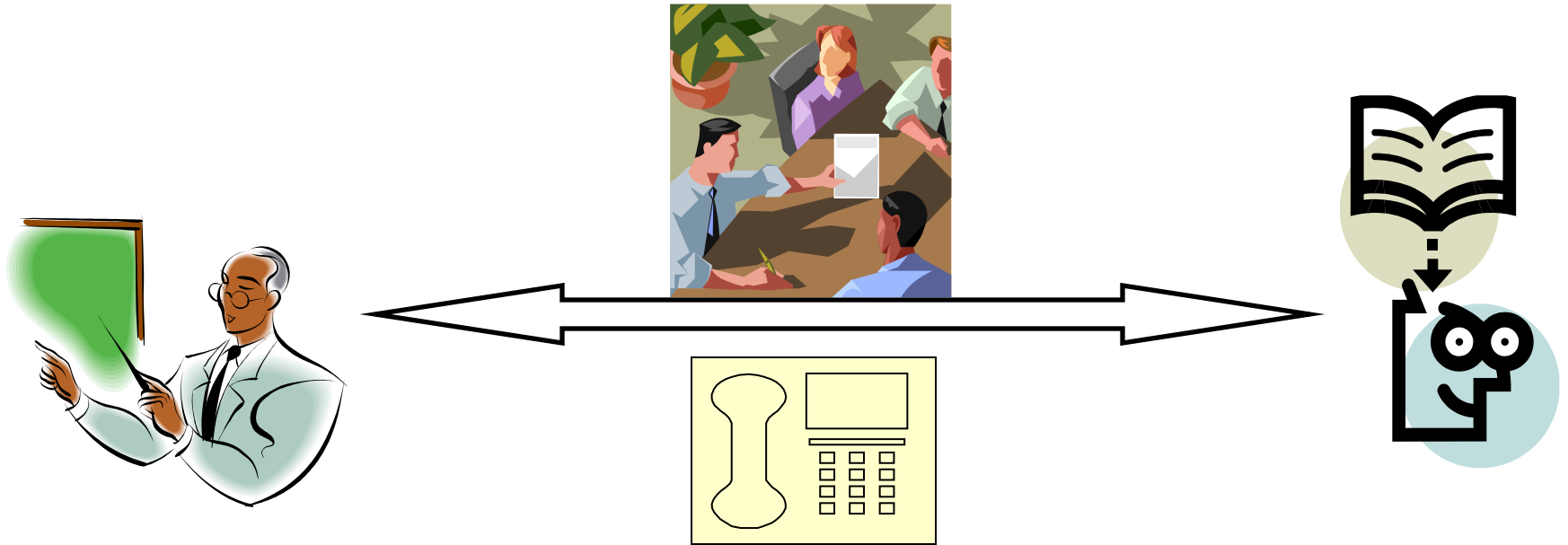
Digital Libraries Program Planning and Management History Major Community Planning Input

- 1990 Preliminary Planning Workshops ⁱ
- 1995 Information Infrastructure Technology and Applications (IITA) Working Group Workshop on Digital Libraries ⁱⁱ
- 1996 Workshop on Social Aspects of Digital Libraries ⁱⁱⁱ
- 1997 Planning Workshop on Research Agenda for Distributed Knowledge Work Environments ^{iv}
- 1998 NSF/EU Working Groups on Digital Libraries Research [Round 1] ^v
- 2001 President's Information Technology Advisory Committee (PITAC) Report ^{vi}
- 2002 NSF/EU Working Groups on Digital Libraries Research [Round 2] ^{vii}
- 2003 Blue-Ribbon Advisory Panel on Cyberinfrastructure ^{viii}

Details of other digital library workshops and meetings can be found at www.dli2.nsf.gov/workshops.html.

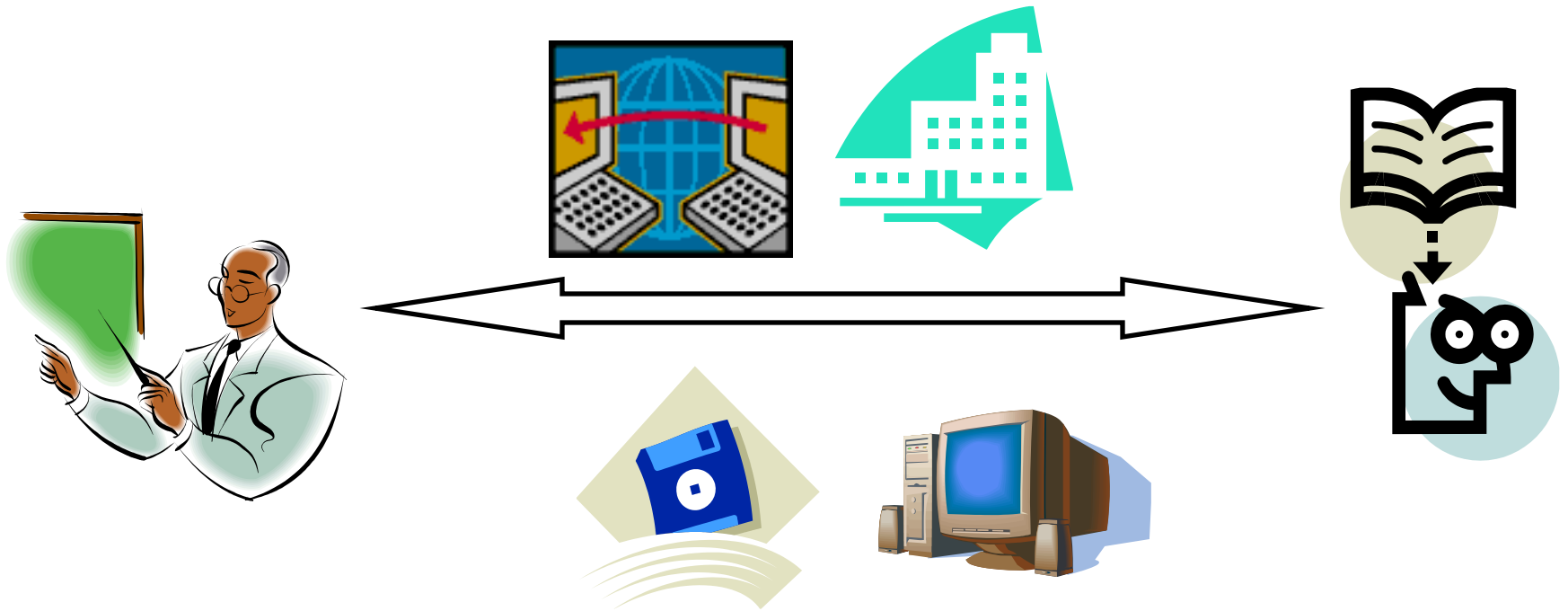


Synchronous Scholarly Communication



Same time, Same or different place

Asynchronous, Digital Library Mediated Scholarly Communication



Different time and/or place

Libraries of the Future

JCR Licklider, 1965, MIT Press

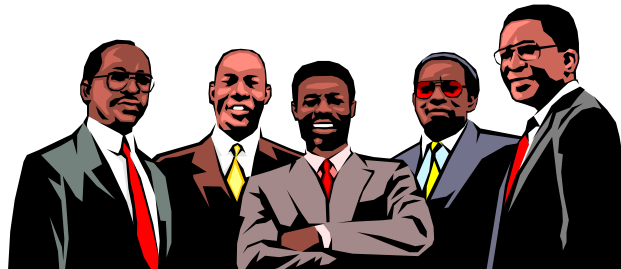
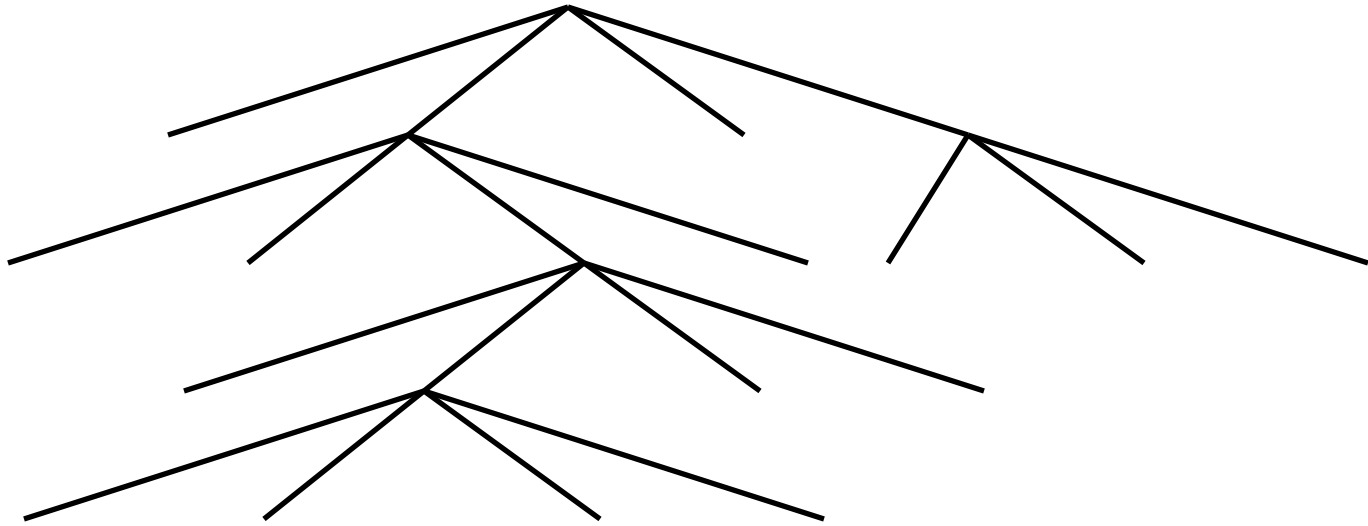
World

Nation

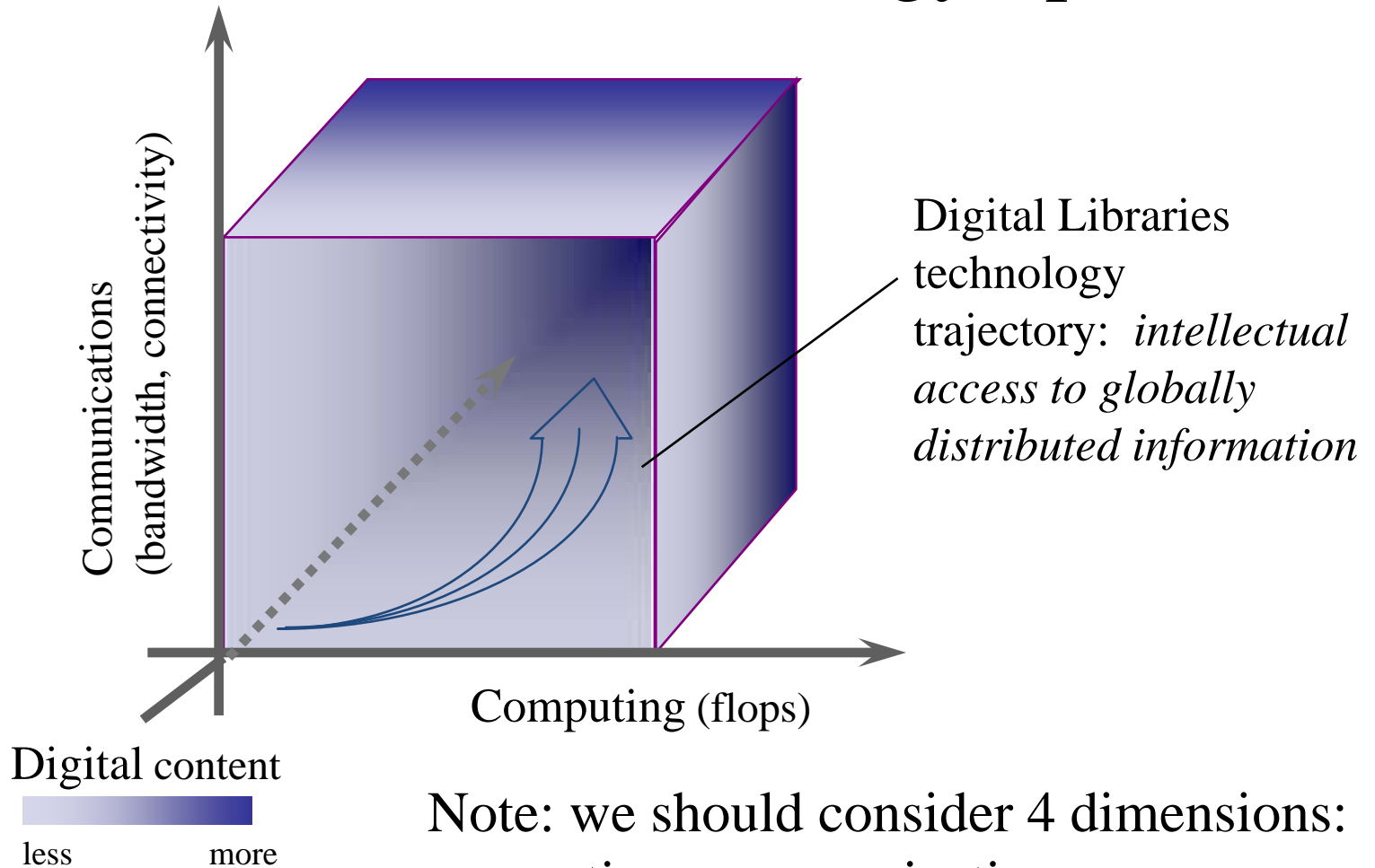
State

City

Community

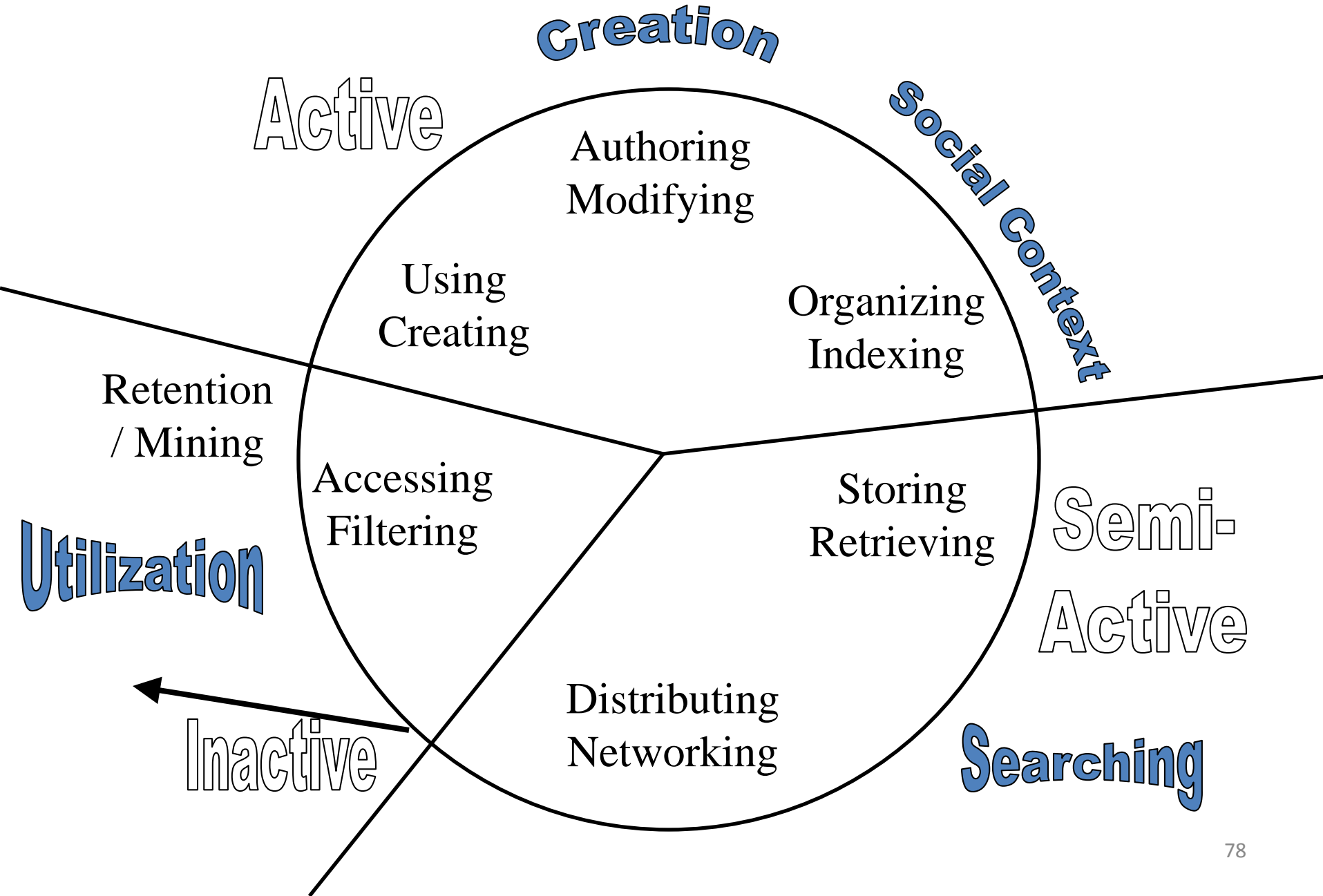


Locating Digital Libraries in Computing and Communications Technology Space



Note: we should consider 4 dimensions: computing, communications, content, and community (people)

Information Life Cycle



Digital Libraries

Shorten the Chain from

Author

Editor

Reviewer

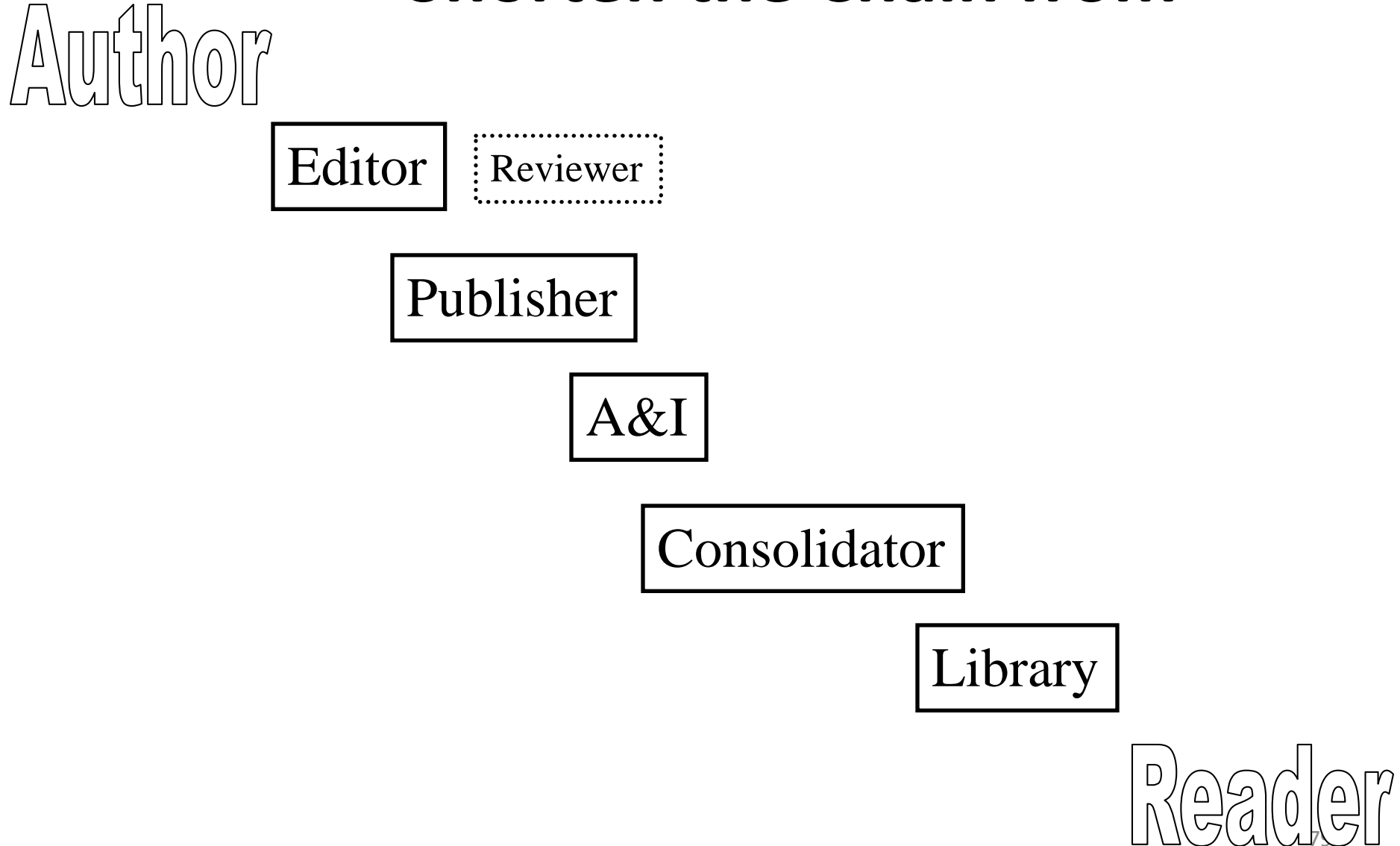
Publisher

A&I

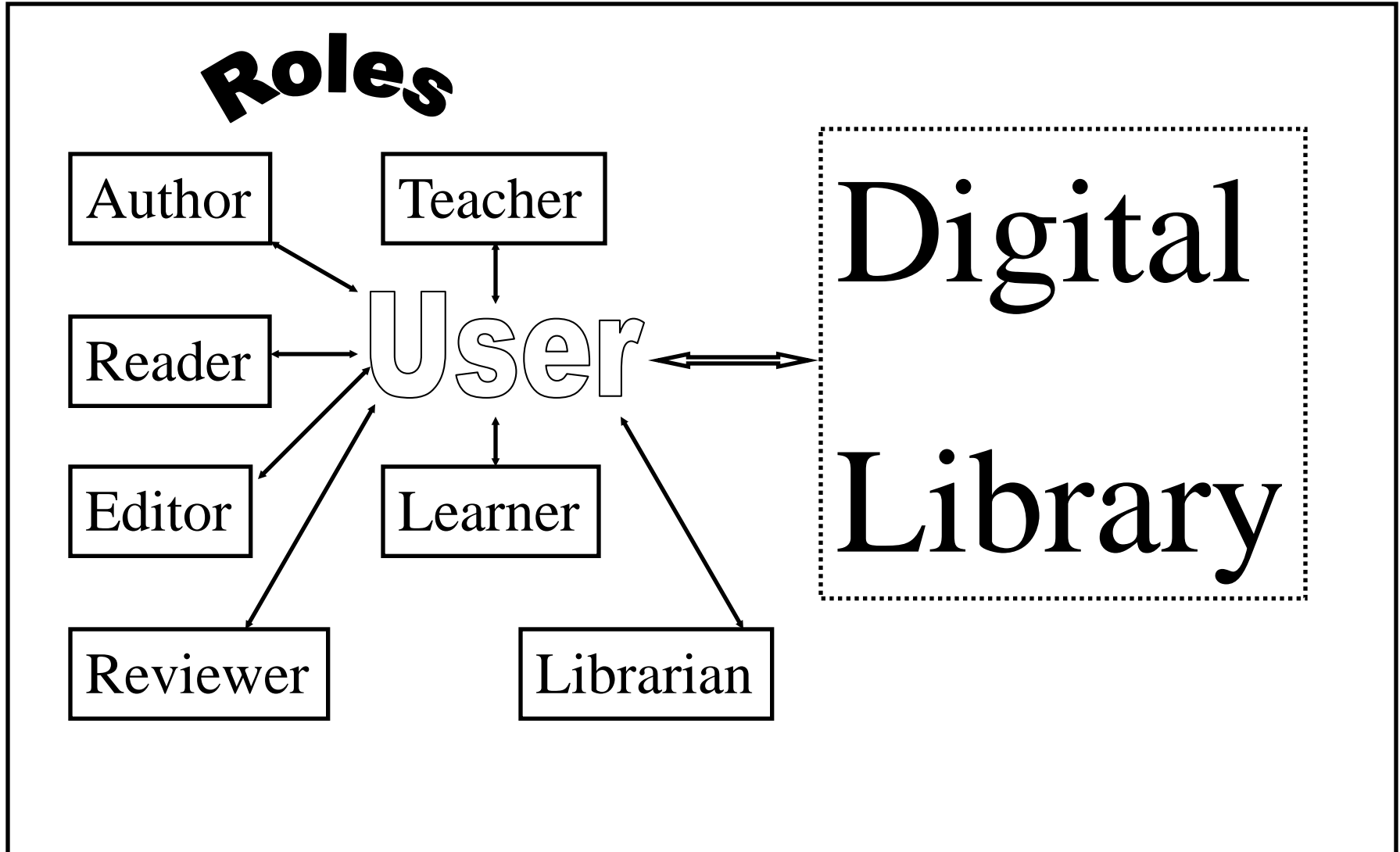
Consolidator

Library

Reader



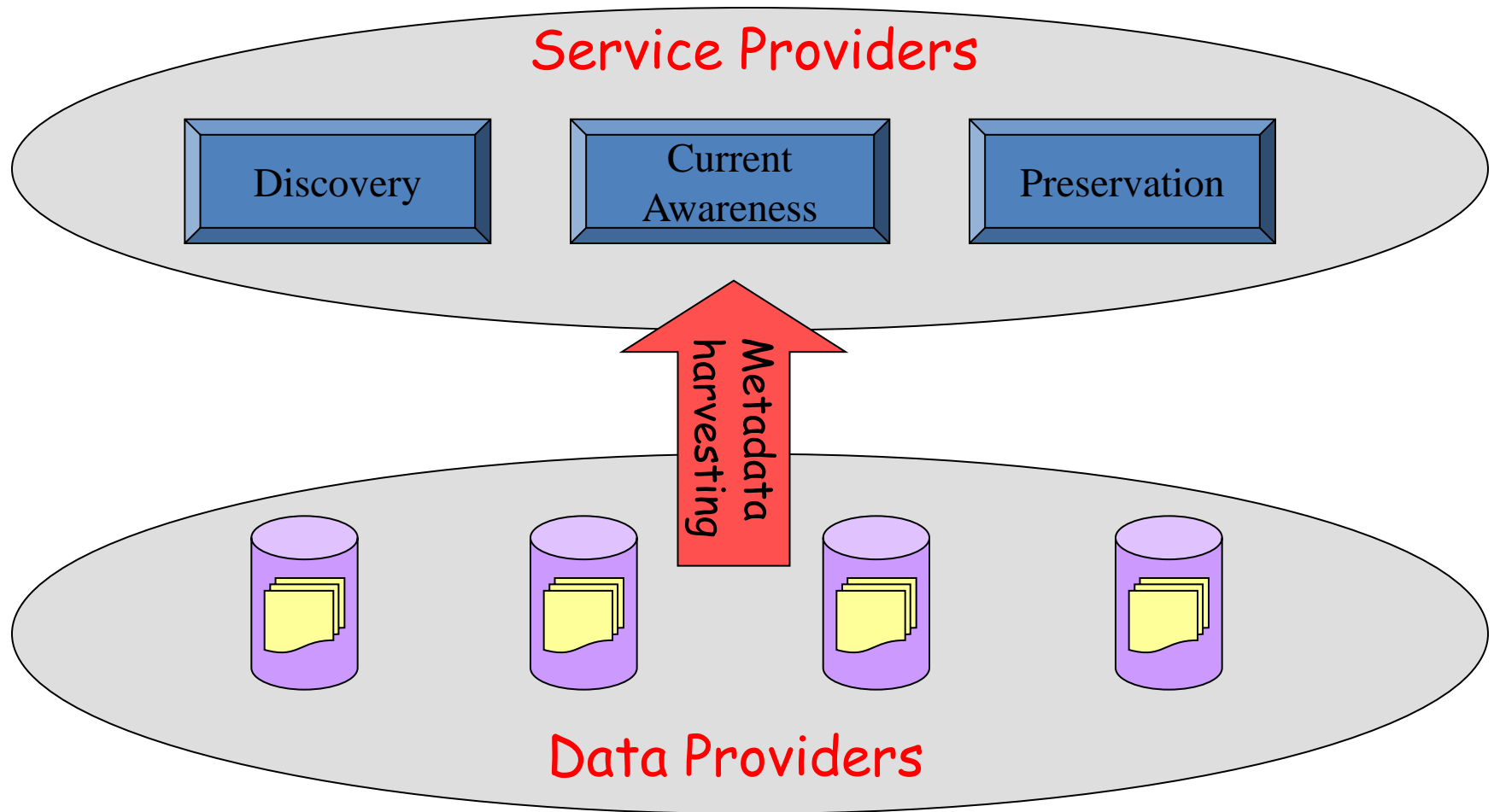
DLs Shorten the Chain to



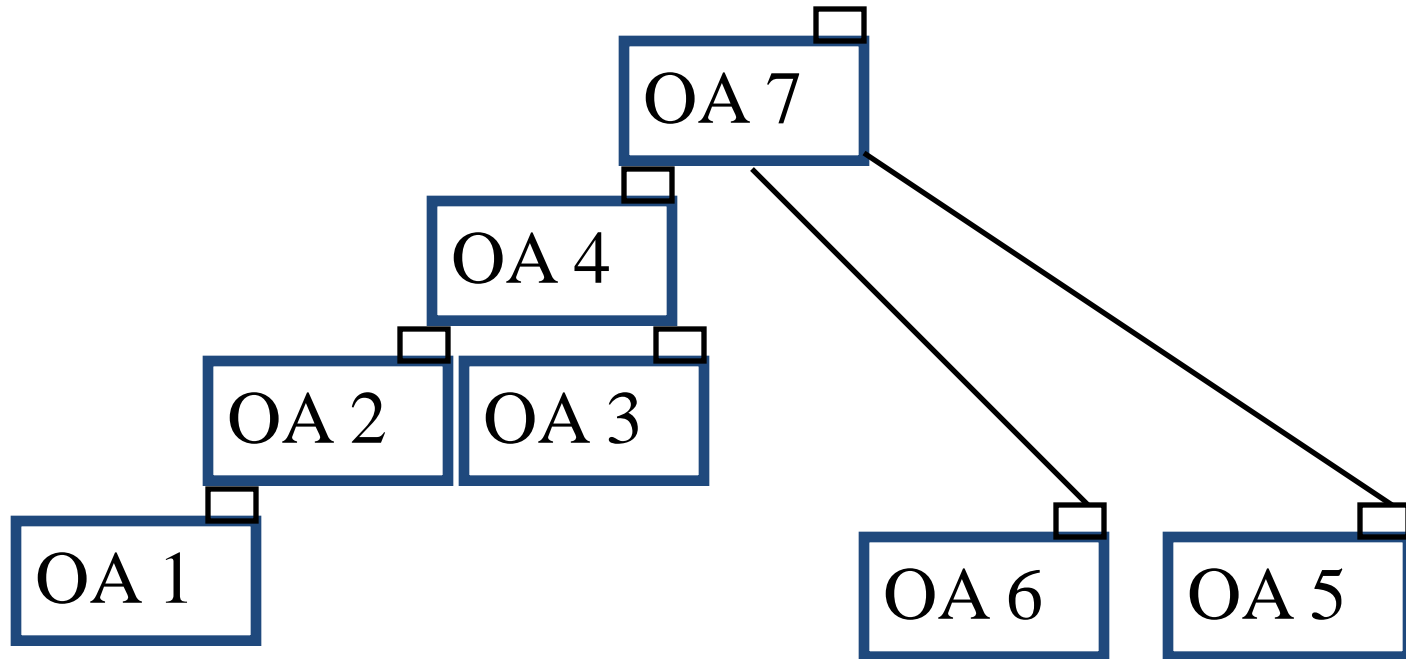
Institutional Repositories

- “Institutional repositories are digital collections that capture and preserve the intellectual output of a single university or a multiple institution community of colleges and universities.”
- Crow, R. “Institutional repository checklist and resource guide”, SPARC, Washington, D.C., USA
- www.arl.org/sparc/

The World According to OAI



OAI – Black Box Perspective



OAI – Repository Perspective

Required: Protocol

Set Structure
URI Scheme

MDO

MDO

MDO

MDO

MDO

MDO

MDO

MDO

DO

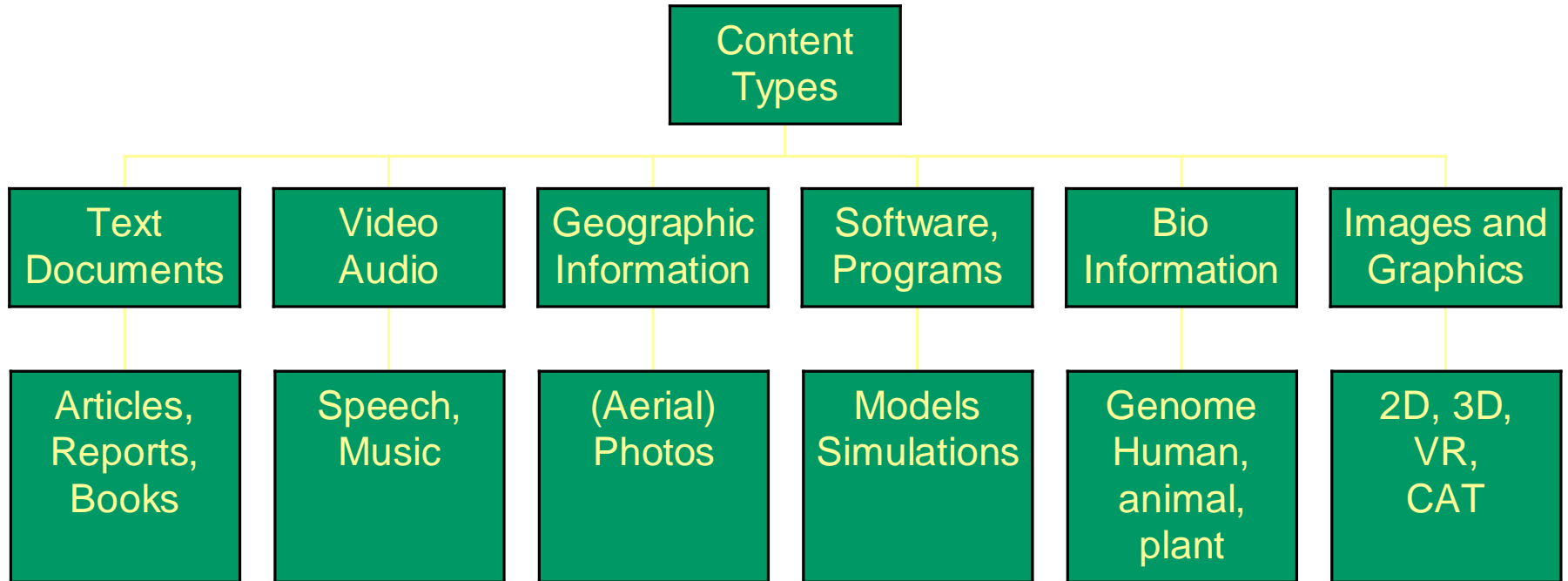
DO

DO

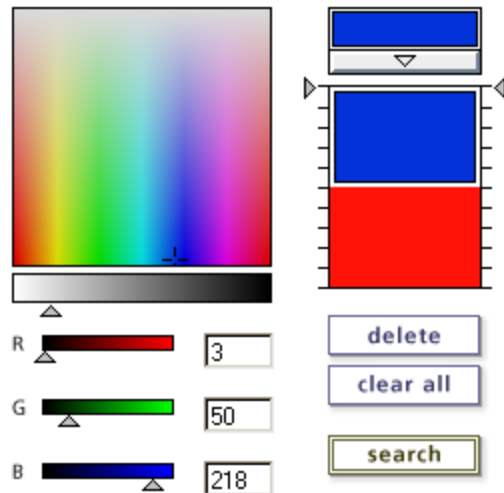
DO

Required: DC

Digital Library Content



Content Based Information Retrieval



1) Pink Statuette and Jug on a Red Chest of Drawers

Matisse, Henri
1910



2) Girl with Tulips

Matisse, Henri
1910



3) Portrait of Suzanne Dufy, the Artist's Sister

Dufy, Raoul
1904



4) Zorah Standing

Matisse, Henri
1912



5) Bouquet (Vase with Two Handles)

Matisse, Henri
1907



6) The Red Room (Harmony in Red)

Matisse, Henri
1908



7) Flower Study

Shaykh 1777



8) The Dance

Matisse, Henri
1909 - 1910

Digital Objects (DOs)

- Born digital
- Digitized version of “real” object
 - Is the DO version the same, better, or worse?
 - Decision for ETDs: structured + rendered
- Surrogate for “real” object
 - Not covered explicitly in metamodel for a minimal DL
 - Crucial in metamodel for archaeology DL

Informal 5S & DL Definitions

DLs are complex systems that

- help satisfy info needs of users (**societies**)
- provide info services (**scenarios**)
- organize info in usable ways (**structures**)
- present info in usable ways (**spaces**)
- communicate info with users (**streams**)

5S Layers

Societies

Scenarios

Spaces

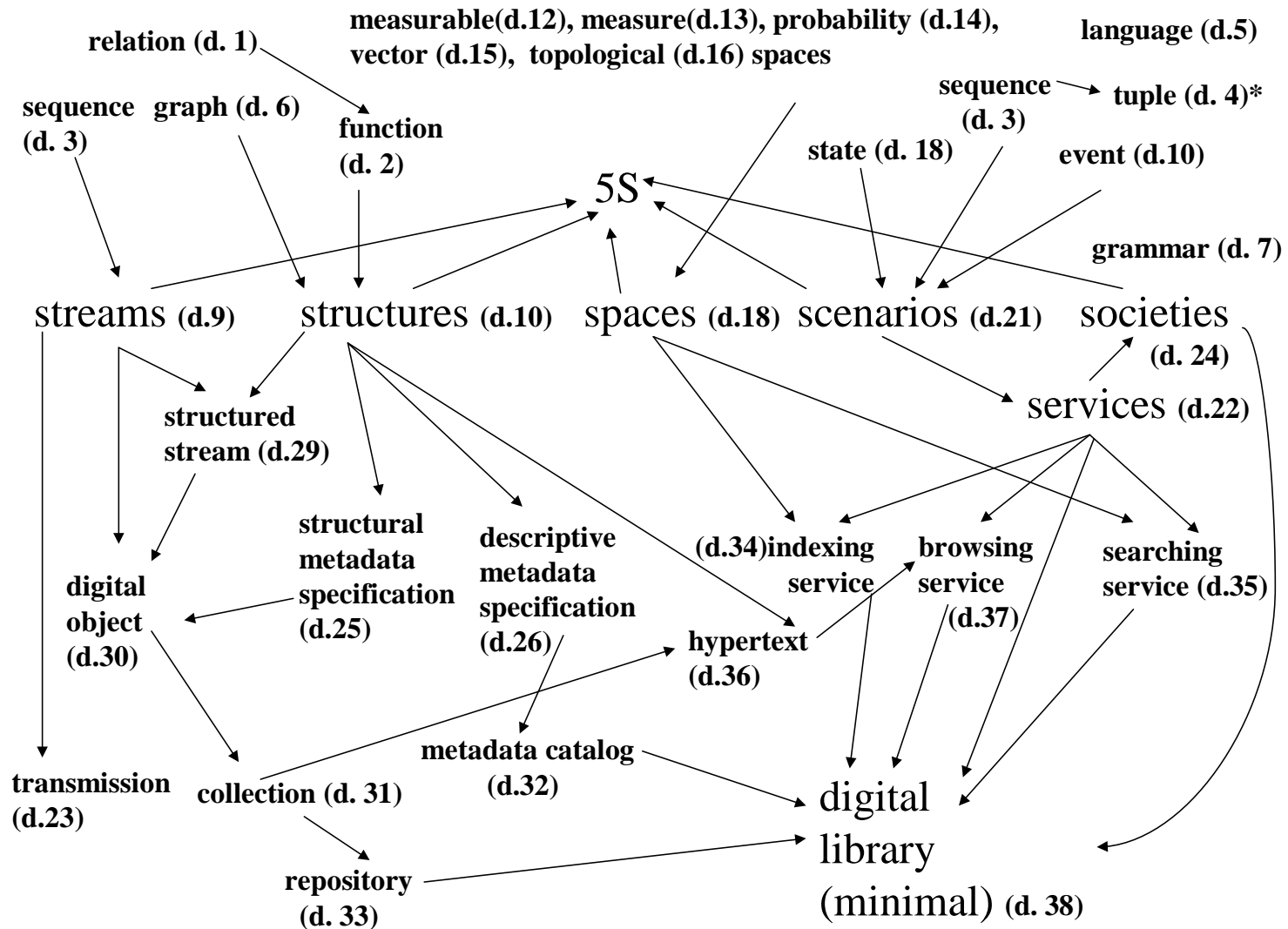
Structures

Streams

5Ss

Ss	Examples	Objectives
Streams	Text; video; audio; image	Describes properties of the DL content such as encoding and language for textual material or particular forms of multimedia data
Structures	Collection; catalog; hypertext; document; metadata	Specifies organizational aspects of the DL content
Spaces	Measure; measurable, topological, vector, probabilistic	Defines logical and presentational views of several DL components
Scenarios	Searching, browsing, recommending	Details the behavior of DL services
Societies	Service managers, learners, teachers, etc.	Defines managers, responsible for running DL services; actors, that use those services; and relationships among them

5S and DL formal definitions and compositions (April 2004 TOIS)



Infrastructure Services			Information Satisfaction Services
<i>Repository-Building</i>		<i>Add Value</i>	
<u>Creational</u>	<u>Preservational</u>		
Acquiring Cataloging Crawling (focused) Describing Digitizing Federating Harvesting Purchasing Submitting	Conserving Converting Copying/Replicating Emulating Renewing Translating (format)	Annotating Classifying Clustering Evaluating Extracting Indexing Measuring Publicizing Rating Reviewing (peer) Surveying Translating (language)	

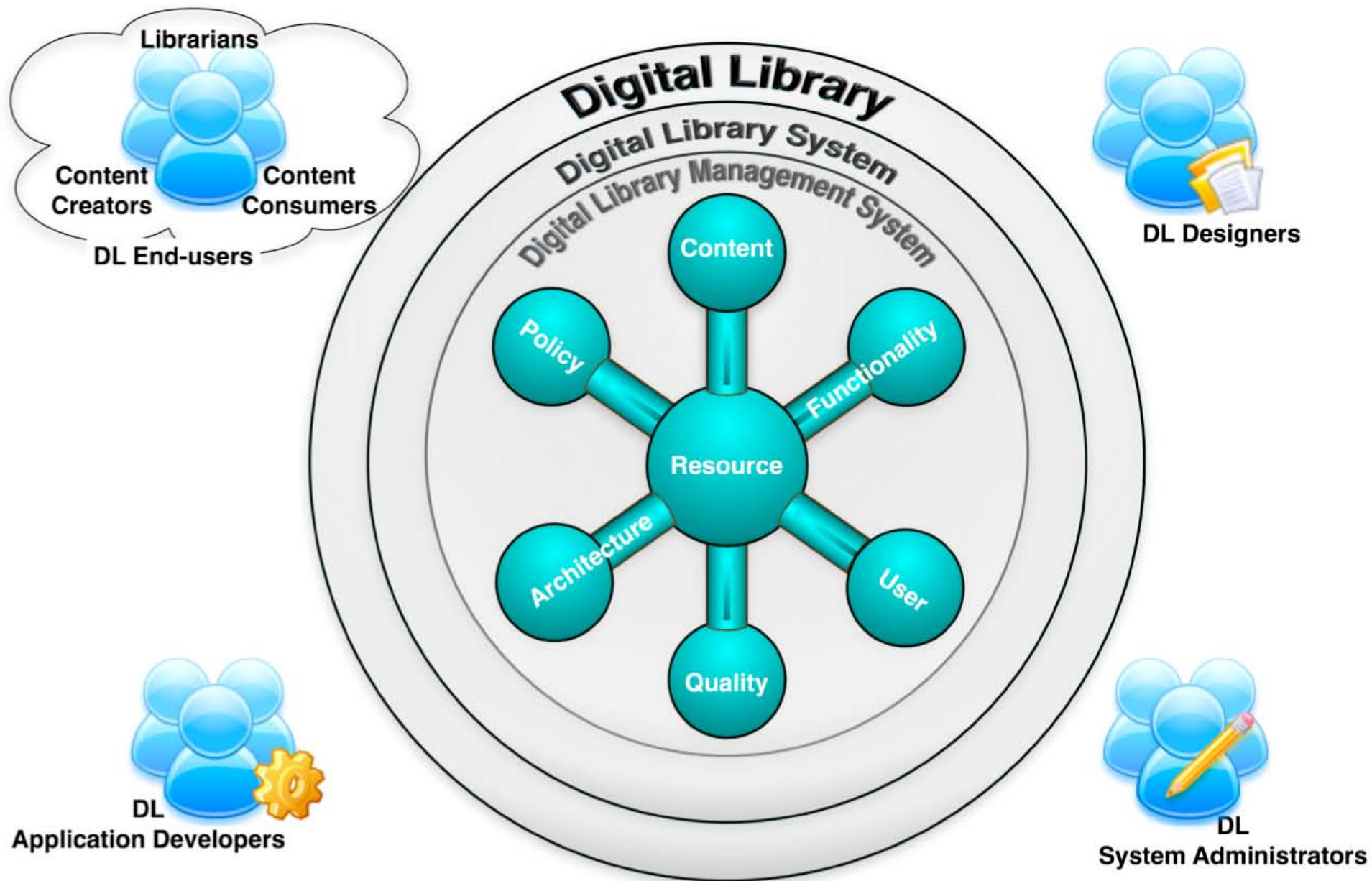


Figure II.1-1. The Digital Library Universe
Digital Library Reference Model 1.0 p. 30 of 234

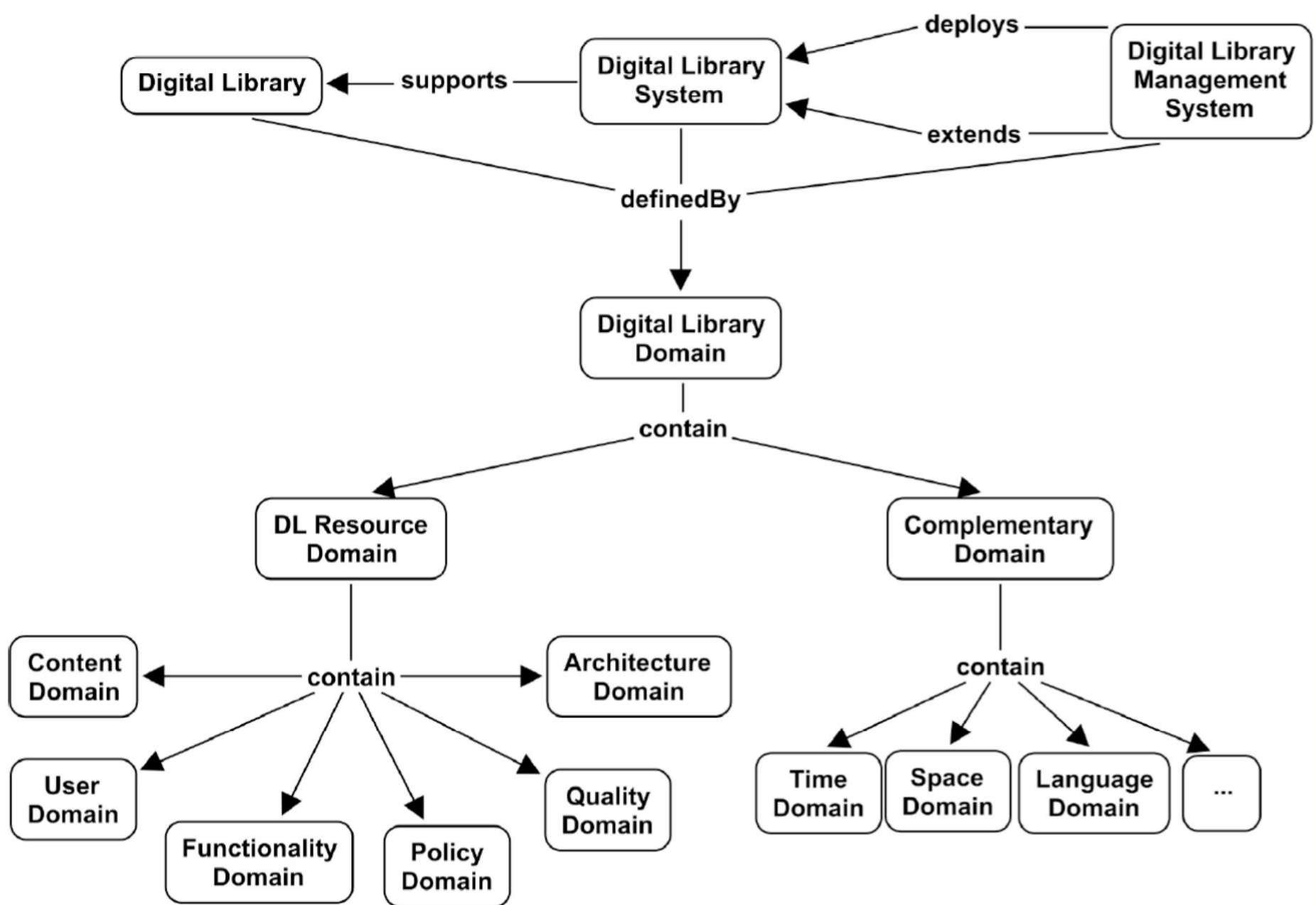


Figure II.2-1. DL Domains Hierarchy Concept Map

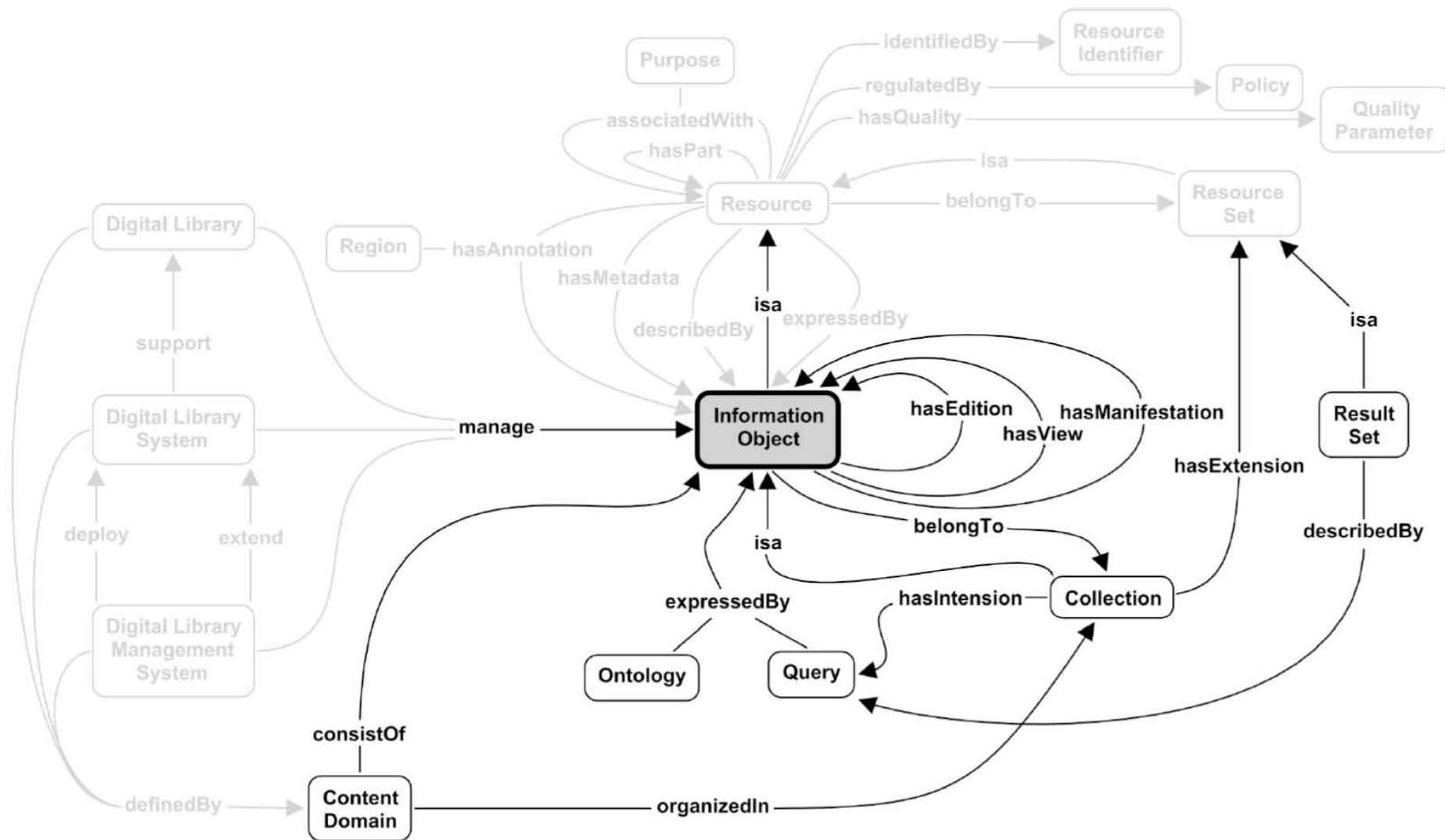
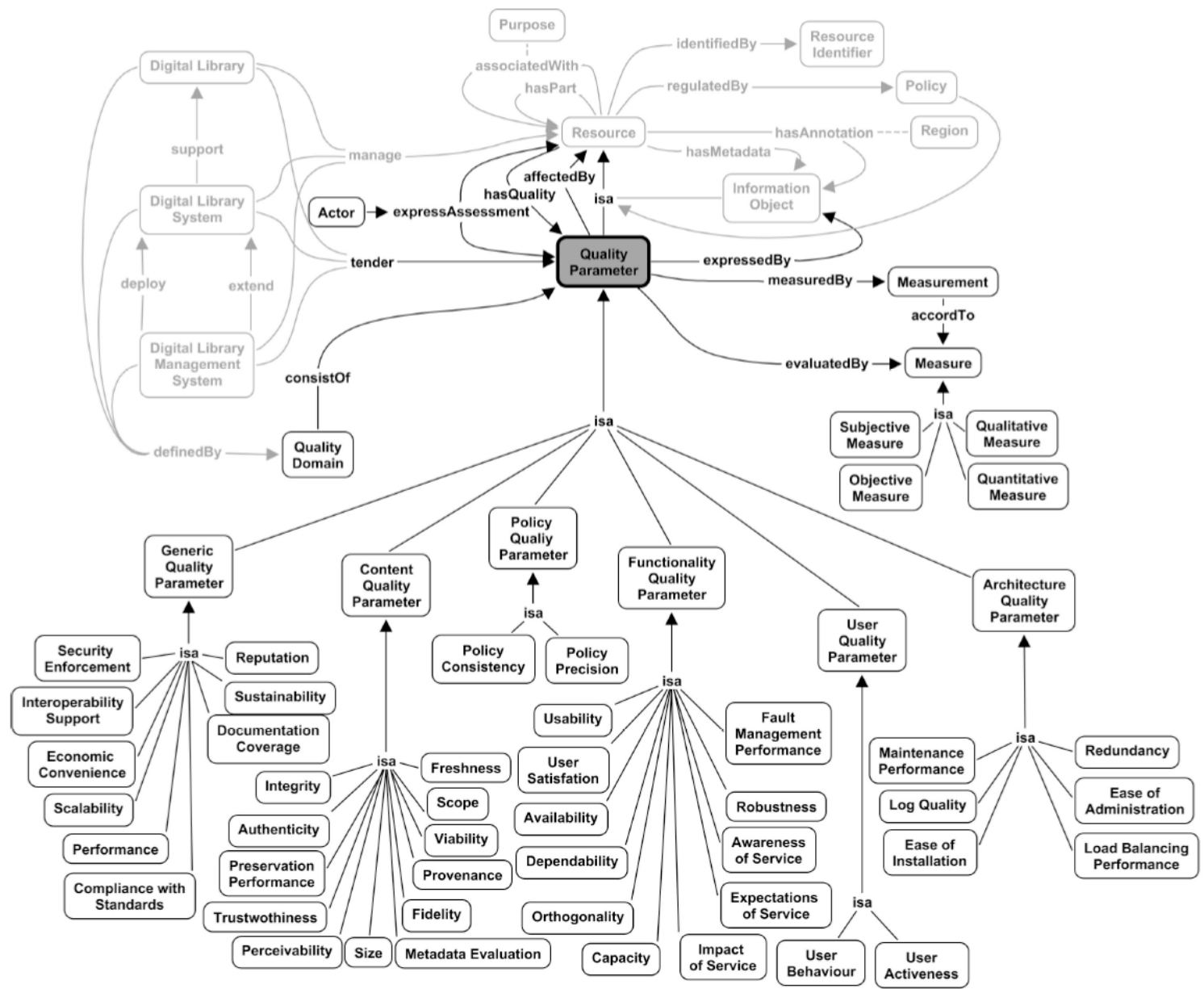


Figure II.2-3. Content Domain Concept Map

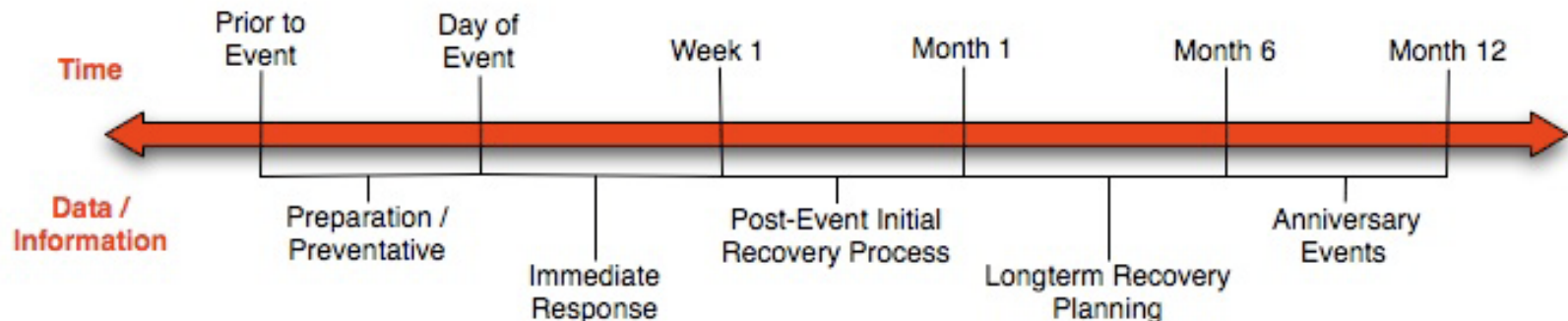


For More Information

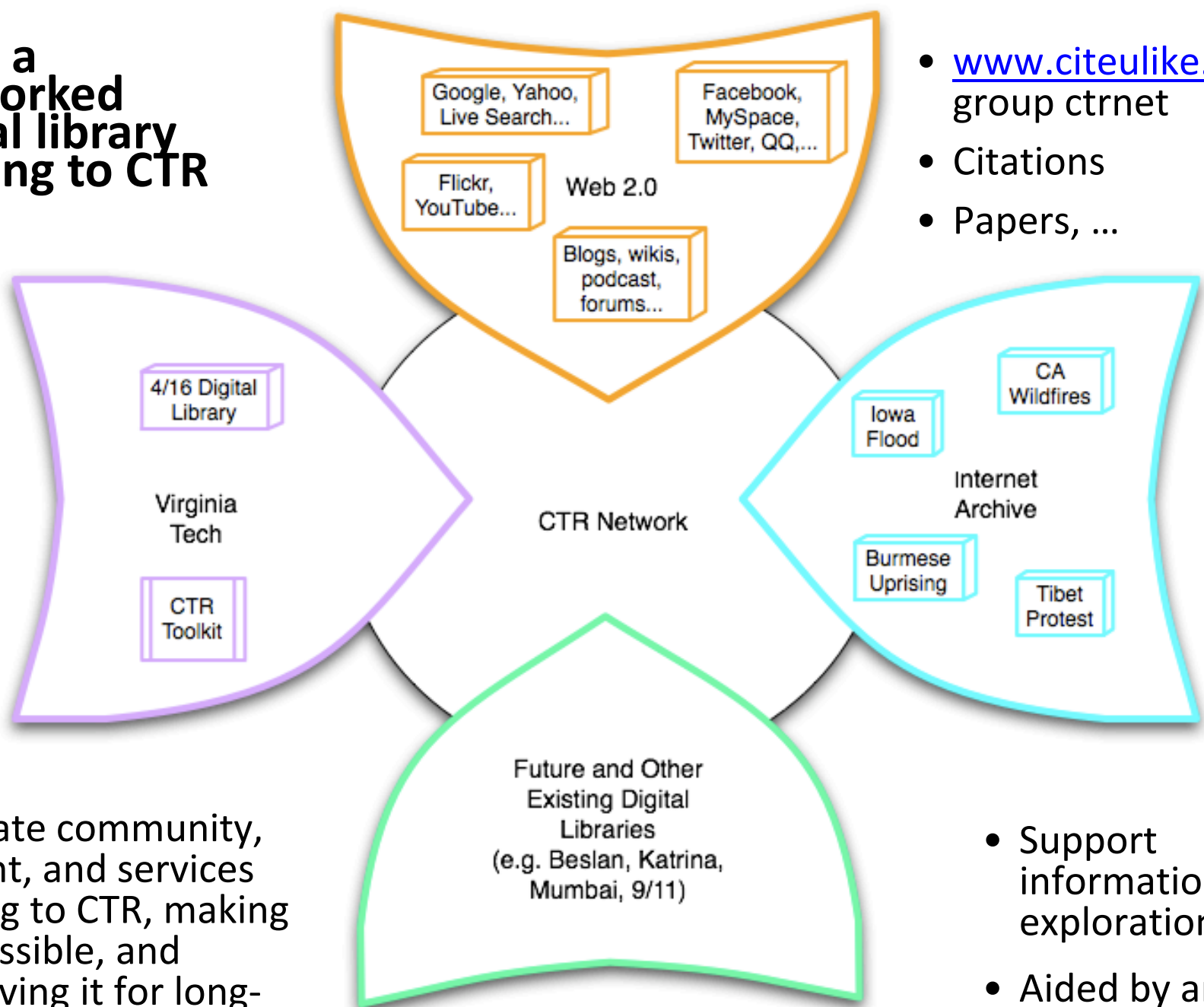
- **Magazine:** www.dlib.org
- **Books:** <http://fox.cs.vt.edu/DLSB.html> (1994)
 - MIT Press: Arms, plus by Borgman, Licklider (1965)
 - Morgan Kaufmann: Witten... (several), Lesk (2nd edition)
- **Conferences**
 - ECDL/TPDL: www.tpdl2011.org/
 - ICADL: www.icadl.org
 - JCDL: www.jcdl.org
- **Associations**
 - ASIS&T DL SIG
 - IEEE TCDL: www.ieee-tcdl.org (student awards, ...)
- **NSF:** <http://www.nsf.gov/pubs/1998/nsf9863/nsf9863.htm>
- **Labs:** VT: www.dlib.vt.edu

Crisis, Tragedy, and Recovery

- Human tragedies that result from man-made and natural events affect humans and communities significantly.
- During and after a tragic event, there are a series of needs that have to be addressed.
 - Compounded by communication failures and a confusing plethora of data and information



- Build a networked digital library relating to CTR



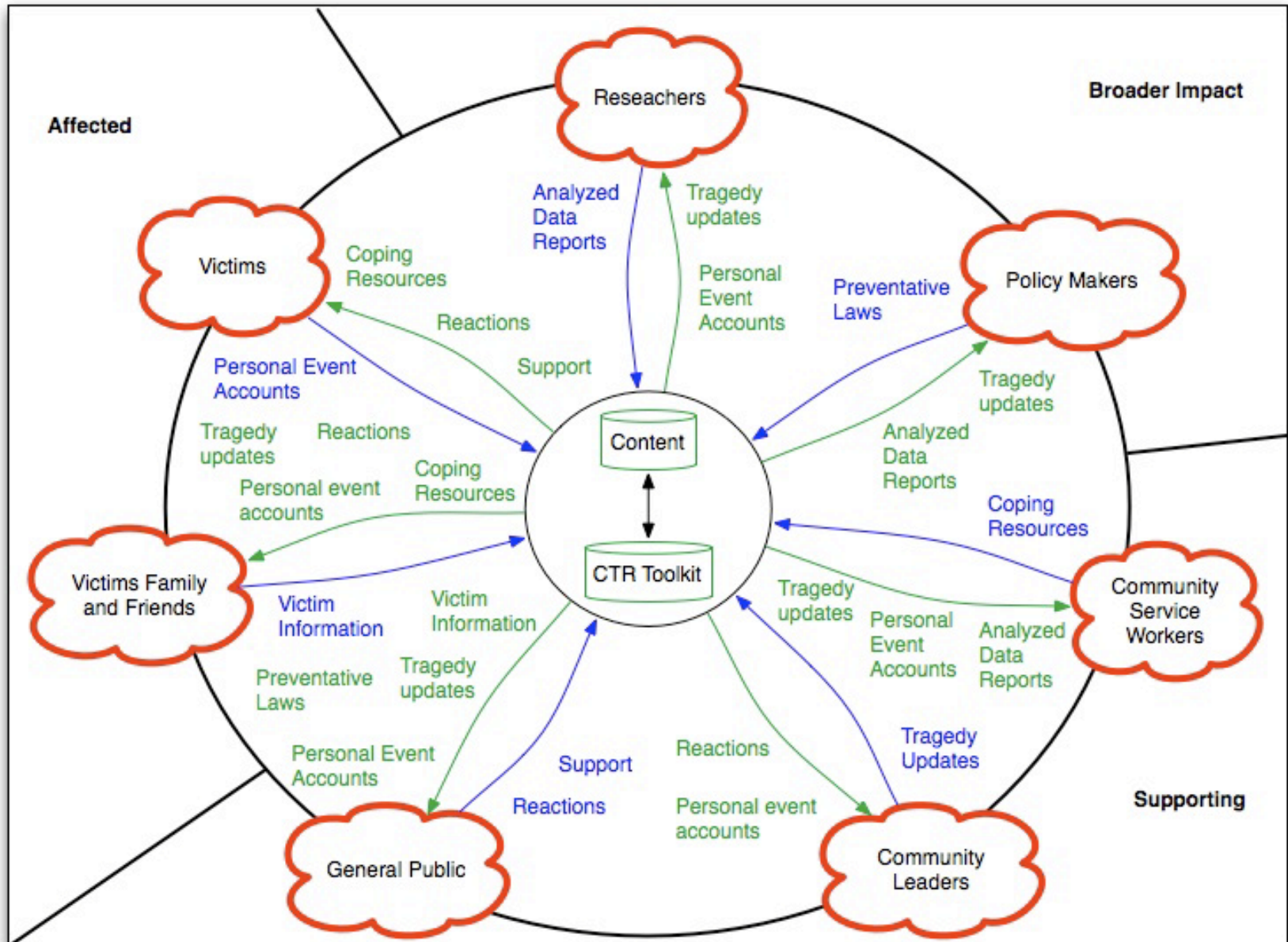
- www.citeulike.org group ctrnet
- Citations
- Papers, ...

- Integrate community, content, and services relating to CTR, making it accessible, and preserving it for long-term reuse

- Support information exploration
- Aided by an ontology

www.ctrnet.net

CTR stakeholders



Haiti Photographs, Content Based Image Retrieval Evaluation


Facebook WebMail: Welcome Eva tool - User-orient...

http://localhost/eva/codes/view_images_feedback.php

User-oriented evaluation










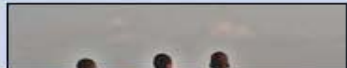
Evaluating query 1 of 1

Query image:



Name:
HumanGrandGoave1.jpg

RESULTS

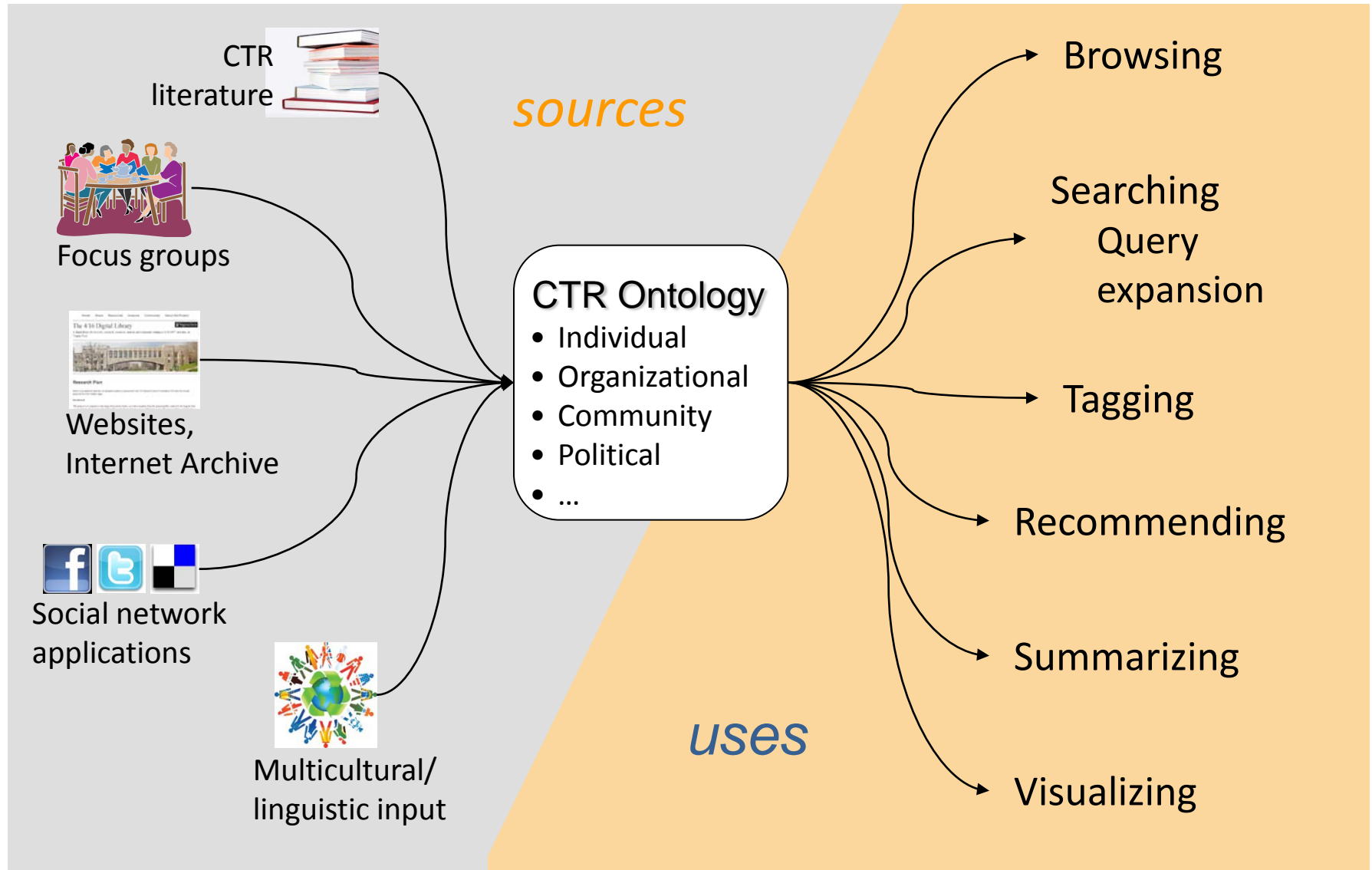
 HumanLeogane1.jpg	 grand-goave2.jpg	 HumanGrandGoave2.jpg	 sacrecoeur-church.jpg	 petit-goave3.jpg
				

Menu Eva tool - User-orient... jennifer - File Browser HaitiDisasterPhotoFin... Tue Apr 27, 11:14 AM

CTR Ontology

- An ontology is
 - Collection of words and phrases
 - Graph of relationships, sometimes mostly hierarchical as in a taxonomy
 - Covering the key concepts and terms in the discipline
 - Supporting differing views on the field
- Purposes
 - Describes documents
 - As tags, descriptors, keywords
 - Supports navigation, learning, and research

Goals for Ontology for CTR



Second Life: Ensemble, Digital Preserve



The Ensemble Pavilion offers:

- teleports to other computing sites in Second Life like the *Digital Preserve*
- hyperlinks to related computing websites
- RSS readers with feeds from computing and computing education blogs
- membership in the Ensemble Computing group in Second Life, Facebook, and Twitter

Selected Digital Preserve Personnel



Gary Octagon
Gary Marchionini



EdFox Rieko
Edward Fox



zamfir Paule
Spencer Lee



mantruc Martian
Javier Velasco-Martin



Uma Aldrin
Uma Murthy



Krad Proto
Seungwon Yang

DP areas

Poster Buildings

- Posters on display
- Poster view tips
- Video screens



Cafe

- Beverages
- Screens
- Discussion areas

Digital Preserve Layout

