

Introduction to Digital Libraries and their Technologies – II.



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Topics

1. Introduction to Digital Libraries (DLs)
 2. Architecture of DLs
 3. Identifiers
 4. Metadata
-
- 5. Interoperability**
 - 6. Searching**
 - 7. Economy and Legislation**
 - 8. Digital Preservation**
 - 9. DLs@MU**

5. Interoperability



Logo from www.ncstrl.org

5. Interoperability

5.1 Introduction

5.2 Z39.50 Protocol

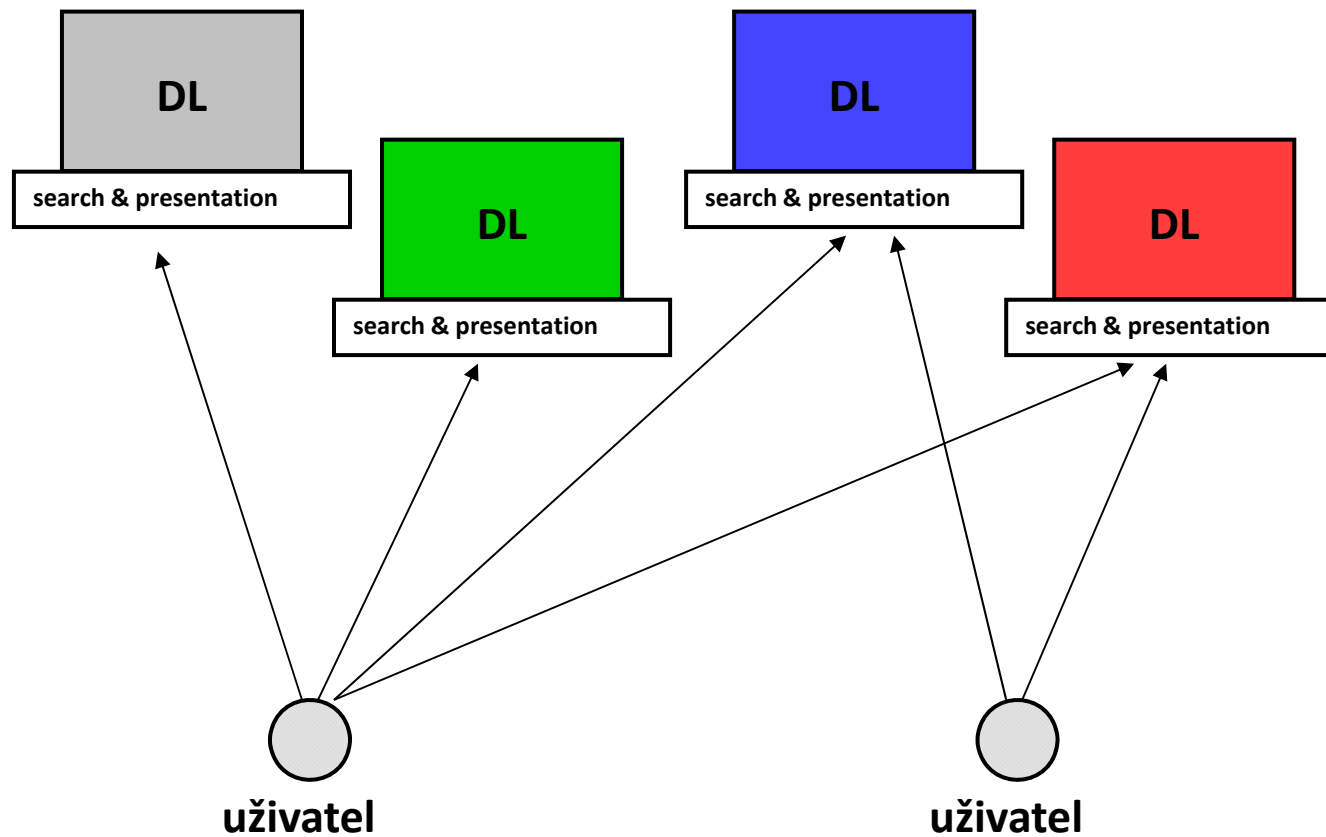
5.3 OAI-PMH

5.4 Linking Services

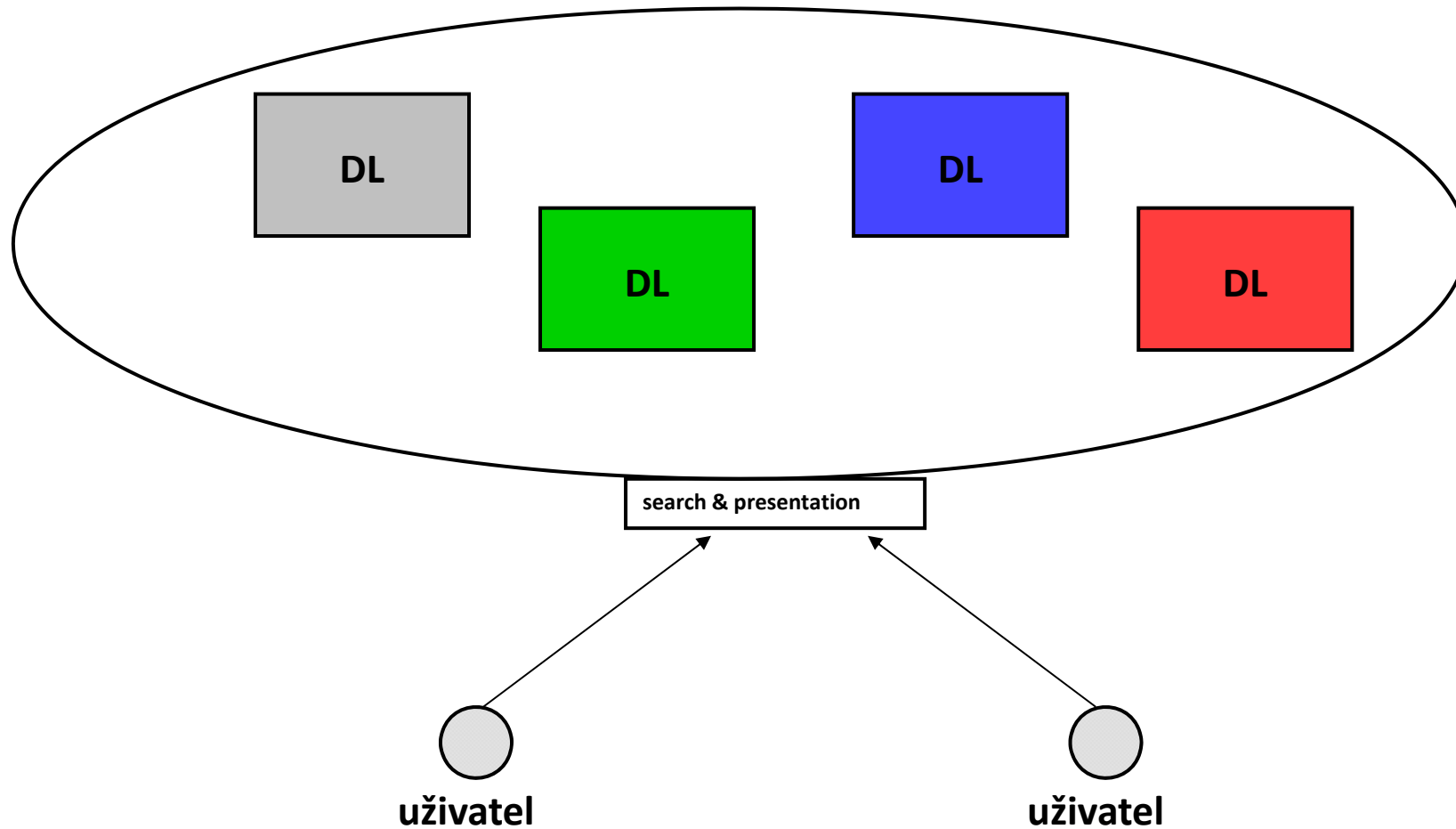
5.1 Interoperability

- “Interoperability is the name of game for libraries”
- The common vision is one of tens of thousands of repositories of digital information that are autonomously managed yet integrated into what users view as a coherent digital library system.
C.Lynch, H.García-Molina, IITA DL Workshop, 1995
- Interoperability is ability to cooperate between technically diverse and organizationally independent components (DLs)
- Interoperability is the ability of independent systems to exchange meaningful information and initiate actions from each other, in order to operate together to mutual benefit. In particular, it envisages the ability for loosely-coupled independent systems to be able to collaborate and communicate.
ISO TC46/SC9, 2006

DL-centred architecture



User centred architecture



5.1 Criteria for interoperability

General criteria for interoperability:

- high degree of component autonomy
 - low infrastructure cost
 - ease of adding a new component
 - ease of use of the component
 - total complexity
 - scalability in the number of components
- It is difficult to compare different solutions due to the variety of underlying assumptions and goals
 - Optimizing one criterion may lead to worsening another
 - Main approach: **strong standards**

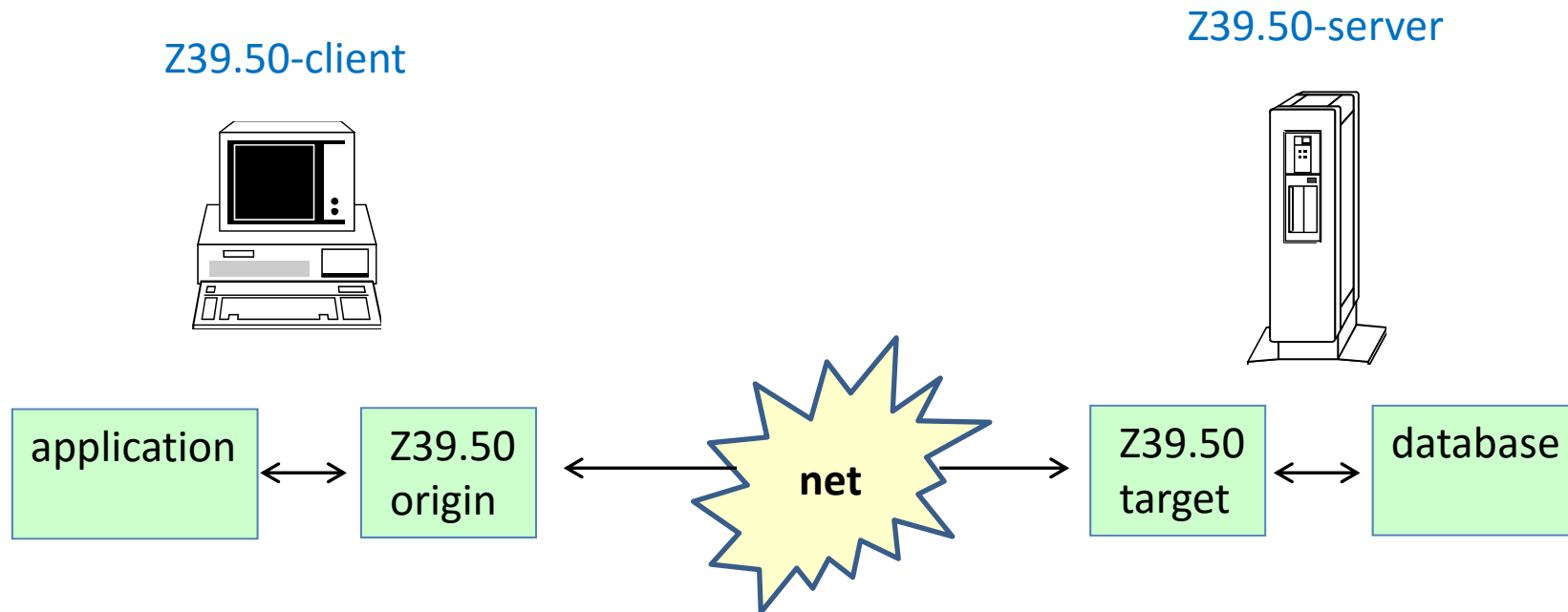
5.2 Z39.50 Protocol

- Interoperability for search and retrieval of information
- Example of classic approach to interoperability – strong standard
- One computer (client, origin) searches and retrieves data from another computer (DB-server, target) independently of:
 - operating systems
 - databases
 - query languages
 - application areas
- main areas of deployment: libraries, government, museums, ...
- 4 versions: 1988 (v1), 1992 (v2), 1995 (v3), 2002 (Z39.50-2003)
- <http://lcweb.loc.gov/z3950/agency/>

5.2 Z39.50 Protocol

Abstract databases

- Standardized access points (attribute sets)
- Standardized searching (queries)
- Standardized data formats (record syntax)



5.2 Z39.50 main features

- more general database abstraction than SQL
- very extensive / complex protocol (> 200 pages of specifications)
- state protocol, session
- only communication between computers specified, not user-interface
- 11 logical sections – "facilities" (each containing a range of services)
 - initialization
 - explain
 - search
 - browse
 - retrieval
 - sort
 - result-set-delete
 - access control
 - accounting / resource control
 - extended services
 - termination

5.2 Z39.50 main features

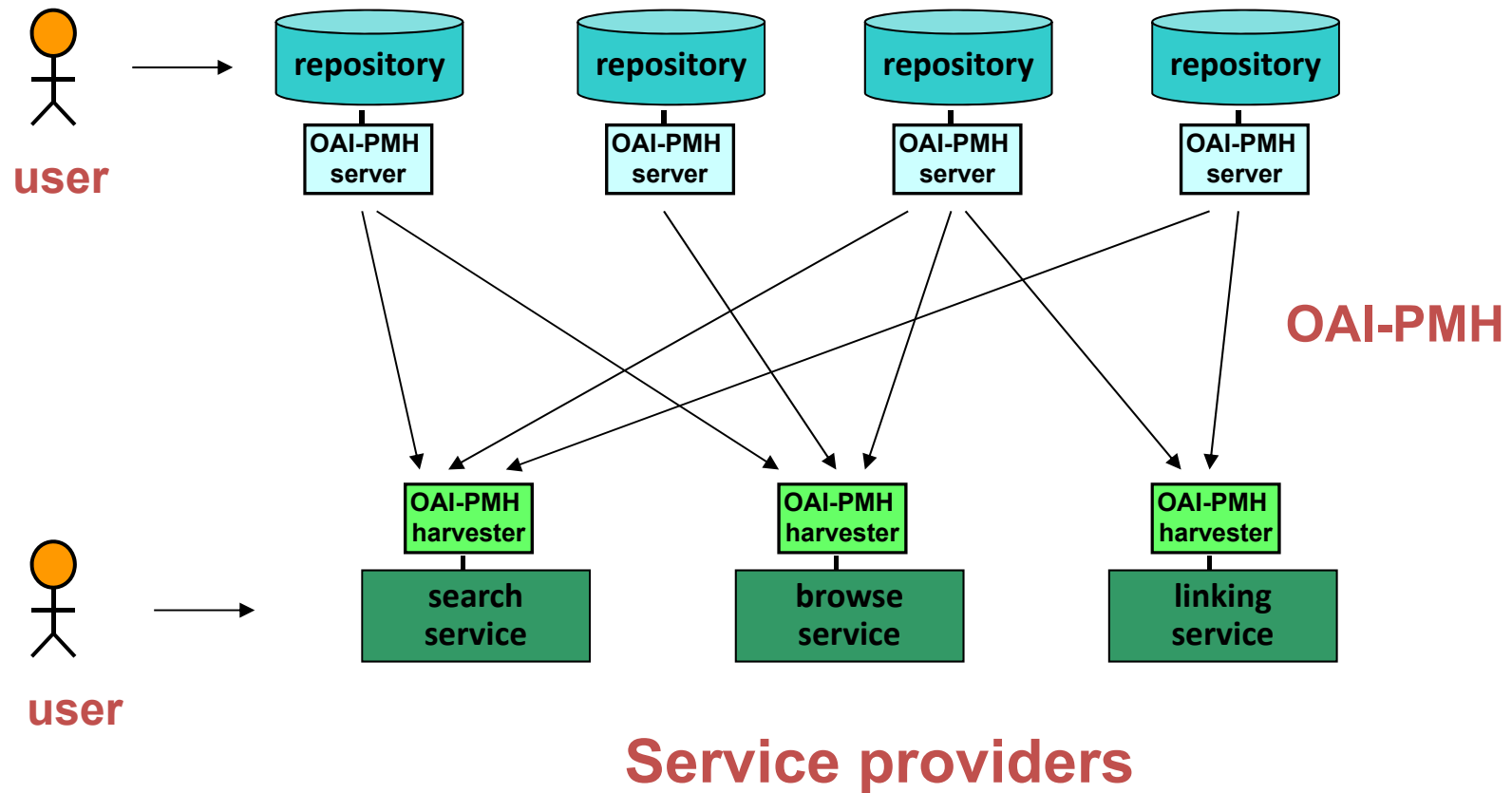
- Heavily used in library management systems
 - searching, record exchange & updates
- outside the library area did not spread too much (too complex)
- now obsolete, is not compatible with web technologies
- Attempt to revitalize Z39.50 – to simplify and convert to web technologies (ZING – Z39.50 Next Generation)
 - **SRW** – Search/Retrieve Web Service
 - **SRU** – Search/Retrieve URL Service
 - + CQL – Common Query Language
- <http://z3950.loc.gov:7090/voyager?version=1.1&operation=searchRetrieve&query=title=dinosaur&maximumRecords=5&recordSchema=dc>

5.3 Open Archive Initiative

- Interoperability in harvested-based searching
- Open Access movement -> thousands of repositories
- Problem: How to search all repositories with one query?
Cross Repository Search
- 1999 Sante Fe – initial OAI meeting – <http://www.openarchives.org>
- **Solution:**
 - to separate the roles of data providers and service providers
 - Data provider: looks after the repository and makes it accessible
 - Service provider:
 - harvests metadata from repositories into one database
 - provides services (e.g. searching) over a harvested database
 - What do we need?
 - **Protocol for Metadata Harvesting** (OAI-PMH)

5.3 OAI – diagram

Data providers (universities, libraries, archives, ...)



5.3 OAI Technical infrastructure

Three OAI components:

- **Metadata standard: Open Archives Metadata Set**
 - obligatory form (simple DC) + optional form (any, subject specific)
 - metadata records (XML) in a repository supporting the OAI protocol
 - optional link to document in repository (full text)
- **Unified identification: oai:arXiv:hep-th01**
 - unambiguous repository identifier within OAI (prefix)
 - local document identifier inside the repository (suffix)
- **Protocol for metadata harvesting: OAI-PMH protocol**
 - simple protocol based on HTTP (6 commands)
 - it is not a search protocol (does not compete with Z39.50)
 - all data is transmitted in XML format



5.3 OAI-PMH Protocol

- OAI-PMH commands (verbs):
 - **Identify** - description of repository (archive)
 - **ListMetadataFormats** - which metadata formats repository offers (except DC)
 - **ListSets** - subdivision of documents into a repository into groups (sets)
 - **ListIdentifiers** - list of document identifiers
 - **GetRecord** - send one entry (with given id)
 - **ListRecords** - send a set of records (in the given format)
- communication via HTTP GET / POST, result = XML document
- command parameters specifying range (archive / set / document / time)
- **`http://archive-url.xxx/oai-script?verb=Command¶metr=value`**

5.4 Linking Services

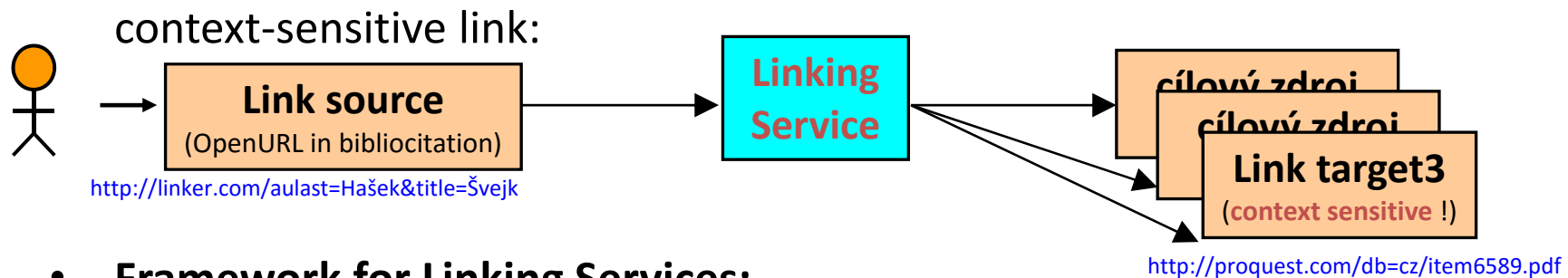
- Interoperability in [resource linking](#)
- Problem:
The article exists in many (paid, not freely available) databases. How to make a link in the article's bibliographic citation, so that a user is directed to the correct database (which his parent institution subscribes)?
Appropriate Copy Problem
- Solution:
 - OpenURL standard
 - and Linking Services Framework
- Based on research at the Gent University (Herbert von Sompel)

5.4 OpenURL Standard

- NISO-ANSI standard Z39.88-2004
- **OpenURL** - standardized format for encoding a description of a resource within a Uniform Resource Locator (URL)
- Example:
- Article bibliographic citation in EBSCO MEDLINE database:
Moll, JR. Attractive electrostatic interactions. J Biol Chem. 2000 Nov 3, 275(44):34826-32. doi:10.1074/jbc.M004545200
 - Corresponding OpenURL:
<http://sfx1.exlibris.com/demo?sid=ebSCO:medline&aUlSt=Moll&aUinit=JR&date=20001103&stitle=J%20Biol%20Chem&volume=275&issue=44&spage=34826>

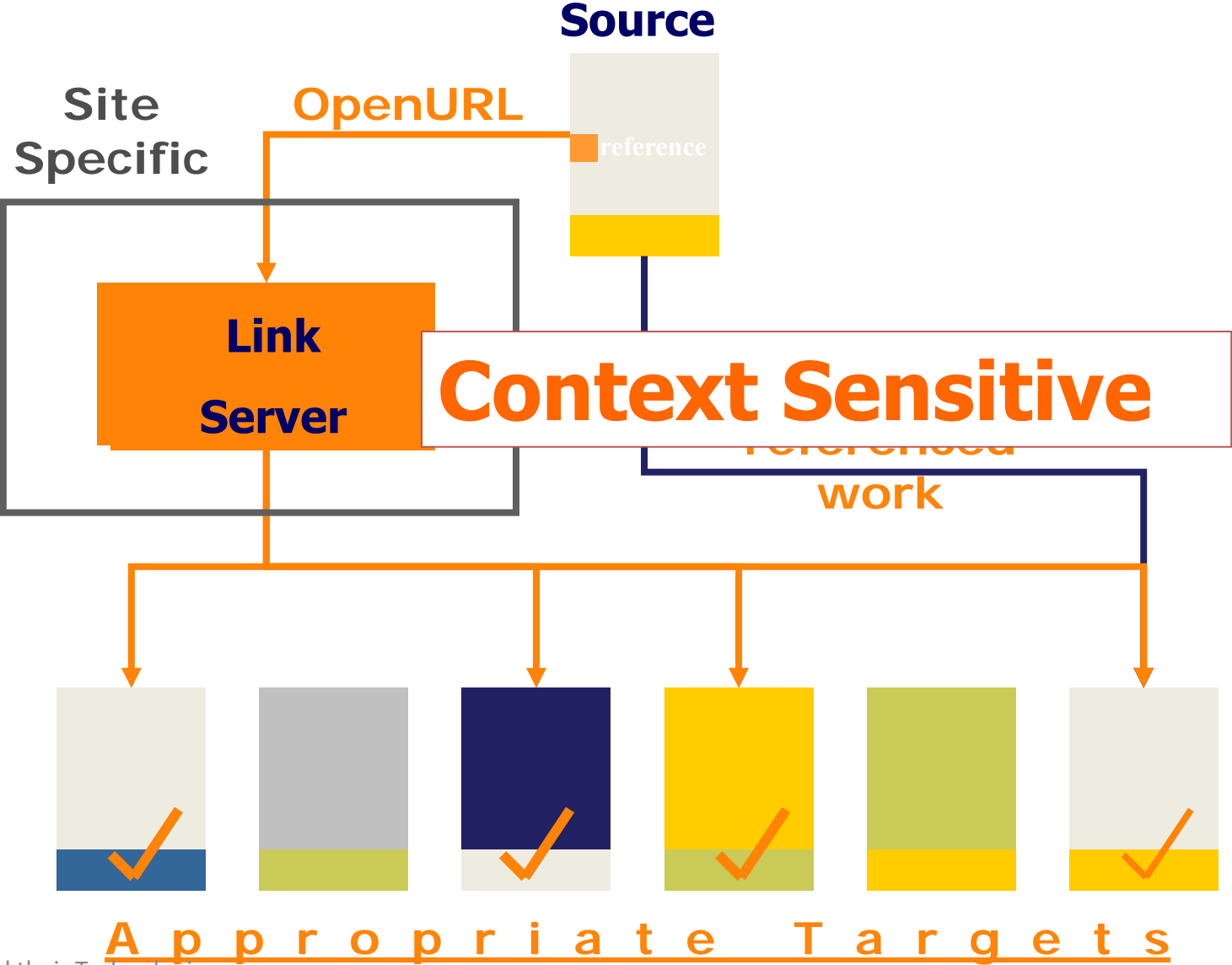
5.4 Linking Services Framework

- **Linking service** – software application using OpenURL
- principle: separating resource description from providing links
- classic link:



- **Framework for Linking Services:**
 1. According to the IP address of the user, LS determines the user institution
 2. from the Knowledge base, LS find out which information resources the institution subscribes
 3. from OpenURL LS pick up metadata about the target source requested by the user
 4. LS searches all institution's information sources and returns results to the user

Linking II



6. Searching



6. Searching

6.1 Introduction

6.2 Federated Search x MetaSearch

6.3 Semantic Web

6.1 Searching

- DLs: global system highly
 - distributed
 - decentralized
 - dynamic
- How can I effectively search in a distributed DL?
- DL Search versus Internet Web Search?

6.1 Searching – research areas

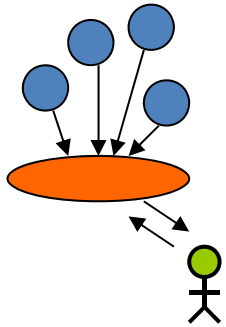
- **Organization**
in distributed search, every solution has its organizational aspect; there must always be some form of coordination – if search is to be effective
- **Systems**
Preparing and deploying system search infrastructure (query routing, inter-protocol protocols, security, privacy, authentication, payment options)
- **Digital content**
logical selection of inf. bases; queries of non-text sources; ratings, filtering; transition from explicit information searching to knowledge discovery (semantic web)
- **Interface**
HCI: queries construction, presentation/visualization of results, task understanding, process exposure
- **Metrics**
taxonomies and metrics for evaluating different solutions, large testbeds

6.1 DLs and Web Search Engines

- „Nearly everything that works best in digital libraries is miserable for web search engines – and vice versa“
- **Web-search engines**
 - *quick first information*
 - + Practically realized, widely available,
 - + useful, link to open source resources
 - High coverage and completeness, low precision
 - only surface web (500x larger deep-web unavailable)
- **DLs**
 - *quality targeted information*
 - + perspective, theoretically well-grounded
 - + better search (due to metadata), a wider range of services
 - not yet fully mastered, globally undeveloped

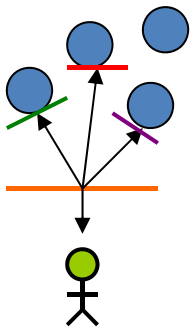
Rather complementary
than competing systems

6.2 Two search paradigms



a) Federated search (Google, OAI, discovery services)

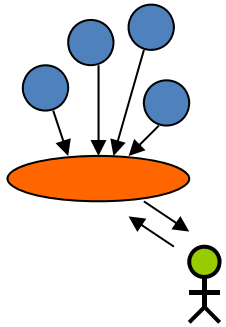
- Preliminary harvest of information sources into one repository
- Pre-processing of harvested data before searching
- Search goes into harvested repository only
- just-in-case processing



b) MetaSearch (Z39.50, SRW/U, Metalib)

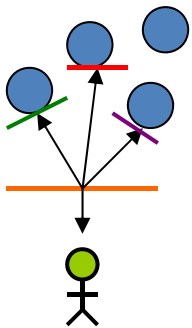
- integrated/parallel/simultaneous/cross-db searching
- Query send in parallel to multiple information sources
- Each source performs its own search and returns results
- Metasearch combines all results into one final result
- Just-in-time processing

6.2 Advantages / disadvantages



a) Federated search (Google, OAI, discovery services)

- + fast response, scalability, performance
- - unpredictable results topicality, static web pages only



b) MetaSearch (Z39.50, SRW/U, Metalib)


- + best results topicality, dynamic web pages search
- - long response time, poor scalability, fragility

6.2 Discovery services

- New trend in searching for professional and scientific information in universities/libraries
- Commercial services / open source systems
 - Primo (ExLibris), Summon (ProQuest), Ebsco Discovery Service (EBSCO), ...
 - VuFind
- Components
 - **Central index**
 - Huge (bilions of records), regularly updated data from all big world publishers, data from subscribed electronic resources, library catalogue, local DLs content
 - **Searching interface**
 - Simple/advanced search, refining results using filtering, relevance ranking
 - **Linking service**
 - Linking search results to available fulltexts

<http://discovery.muni.cz>

New Search List of available journals and books at MU Sign In Folder Preferences Čeština Contact Help Nápověda (CZ)

 Search the information resources for **Masaryk University** Masarykova univerzita

Keyword Search

Basic Search Advanced Search Search History

Refine Results

Current Search

Find all my search terms:
digital libraries

Expanders

Also search within the full text of the articles

Apply equivalent subjects

Limit To

Full Text
 Peer Reviewed
 Catalog Only

1680 Publication Date 2018

Show More

Source Types


All Results
 Academic Journals (540,181)
 Books (519,864)
 eBooks (430,835)
 Magazines (160,994)
 Conference Materials (118,955)

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Subject

Publisher

Search Results: 1 - 10 of 1,703,026 Relevance Page Options Share

 **Research Starter Digital Libraries.**
In the early 1990s, when traditional library systems were first galvanized by the sweeping possibilities of digitalizing centuries of paper artifacts... [More](#)
Salem Press Encyclopedia, 2017


1. **Handbook of Research on Managing Intellectual Property in Digital Libraries** Share

 eBook
By: Tella, Adeyinka; IGI Global; Kwanya, Tom. Hershey, Pennsylvania [701 E. Chocolate Avenue, Hershey, Pennsylvania, 17033, USA] : Information Science Reference. 2018. eBook., Database: eBook Index

Subjects: LANGUAGE ARTS & DISCIPLINES / **Library & Information Science / Digital & Online Resources**; LANGUAGE ARTS & DISCIPLINES / **Library & Information Science / General**; LANGUAGE ARTS & DISCIPLINES / **Library & Information Science / Administration & Management**; Open access publishing; **Digital rights management**; **Digital libraries**--Computer programs; Copyright--Electronic information resources; **Digital libraries**--Africa; **Digital libraries**; Copyright and electronic data processing; Electronic information resources--Management

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2. **Exploring Digital Libraries : Foundations, Practice, Prospects** Share


 eBook
By: Karen Calhoun. [N.p.] : Facet Publishing. 2017. eBook., Database: eBook Index


Subjects: LANGUAGE ARTS & DISCIPLINES / **Library & Information Science / Digital & Online Resources**


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AP Associated Press Video (4) [View All](#)


 2:43
Digital library opens in South Korea

 2:03
Queues as New York Public Library sells...

 5:16
Google aims to create largest digital...

 2:40
British library digitises oldest Bible

3. **Discover Digital Libraries : Theory and Practice** Share

 eBook
By: Xie, Iris. Saint Louis, UNITED STATES : Elsevier. 2016. eBook., Database: eBook Index

Subjects: COMPUTERS / Management Information Systems; LANGUAGE ARTS & DISCIPLINES / **Library & Information Science / Archives & Special Libraries**; **Digital libraries**

6.3 Semantic web

- **Web today**: repository of documents designed for humans
- **Sem-Web** : repository of computer-understandable information
- **Tim Berners-Lee**
 - The semantic web is an **extension of the current Web** in which information is given well-defined meaning, enabling computers and people to work in better cooperation.
 - The Semantic Web is a vision: the idea of having data on the web defined and linked in a way **that it can be used by machines not just for display purposes, but for automation, integration and reuse of data across various applications.**

- [1] Tim Berners-Lee, James Hendler, Ora Lassila:
The Semantic Web. Scientific American, May 2001
- **W3C – Semantic Web Working Group**
<http://www.w3.org/2001/sw/>



7. Economy and legislation



7. Economy and legislation

7.1 Economic models

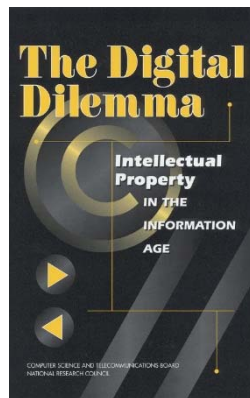
7.2 Intellectual Property Rights

7.3 Creative Commons

7.4 Open Access

7.1. Internet and digital dilemma

- Hailed for quick and convenient access to a world of material, the Internet also poses serious economic issues for those who create and market that material. If people can so easily send music on the Internet for free, for example, who will pay for music?



The Digital Dilemma:
Intellectual property in the Information Age.
National Academy of Sciences, 2000

7.1 Economic and social aspects of DLs

- The technical DL framework always operates in a certain legislative, economic and social context (Kahn-Willensky)
- economy and legislation (IPR) – closely related!
- Basic questions:
 - 1. The copyright in digital libraries**
how to balance the public right of access to information with the economic interests of authors, publishers and third parties
 - 2. How to cover the cost**
in the process of creating, organizing, accessing, maintaining, archiving digital information and other added services

7.1 Economic models

1. Open access (free for end-users)

- 1.1 income from advertisement
- 1.2 external financial sources

2. Closed access (access for fee)

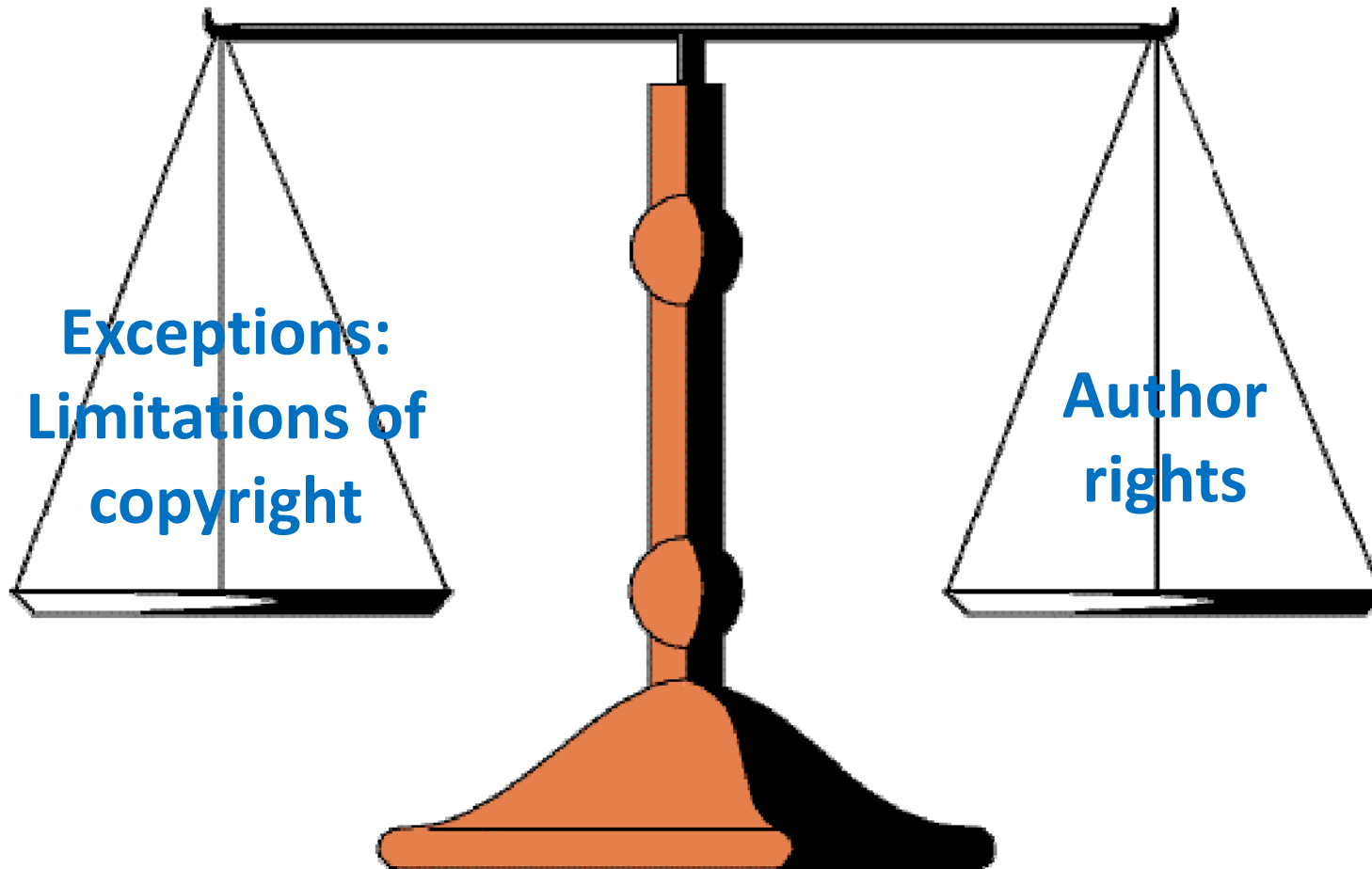
- 2.1 subscription
- 2.2 pay by use

- Restricting access is expensive !! -> The price advantage of open access (security, billing, user database, help-line)
- Despite the assumptions – an increase of (quality) information resources using open access models

7.2 Intellectual Property Rights

- It is normally expected that protection of intellectual property is necessary to encourage people to create it. **How much** protection is required, however, is not clear. [Michael Lesk, Practical DLs, 1997](#)
- Intellectual Property Rights
= the right to decide on the outcome of your intellectual effort
 - **Copyright**
 - **Patent protection**
 - **Trademarks**
- The principles of justice and the necessary motivation of creative people
- Controversy: What to protect x considering the impact of too strict legislation
- How to balance the interests of the Creators – Users – Intermediaries?

7.2 Copyright



7.2 History of copyright

- Middle Ages – No Protection (Shakespeare)
- 1709 – 1st copyright law (England, 14 years of copy protection)
- 1790 – USA (28 years until 1976, only for American authors until 1891)
- 1886 – **Bern Convention** on the Protection of Literary and Artistic Works (the drive for international unification, many times revised, last 1979)
- 1961 – **Rome Convention** (the protection of performers, publishers of sound carriers and radio broadcasters)
- 1994 – **TRIPS Agreement** (on trade aspects of IPR, part of WTO agreements)
- 1996 – **WIPO Agreement** – "Internet Treaties" (special agreement in the sense of BC, a wider scope of rights to authors)
- national Copyright legislation (EC directives to harmonize legislation in EU – 70 years protection)
„The rights of authors are protected within their lifetime and for seventy years after their death“

7.2 Copyright

Copyright:

- the right of the copyright holder to protect the personality rights associated with his work and the right to have under exclusive control **some exploitation** of the work **for a certain period of time** (such as making copies, creating derivative works, distributing copies to the public, ...).
- At the same time, however, the purpose of the whole system is to protect the public interest in the use of the work by the general public (the author **does not control all the exploitation** of his works).
- For example, the author no longer controls the use of already sold copies of his books (the owner may to book freely use, borrow, rent, sell, exhibit, etc.).

7.3 Creative Commons

- **Public licenses for the legal sharing and distribution of copyright works on the Inet**
- A set of public licenses (prepared by the CC community) that the author can assign to his work, and decide on what conditions the work will be publicly available
- Legal alternative to copyright
- Applied to various kind of works (text, video, images, audio, software, ...)
- The author himself determines the degree of protection and freedom of his work
- **All rights reserved -> Some rights reserved**
- <http://creativecommons.org/>



7.3 CC – basic elements for licences

- **Attribution** (cc-by)



- **Attribution Share Alike** (cc-by-sa)



- **Attribution No Derivatives** (cc-by-nd)



- **Attribution Non-commercial** (cc-by-nc)



- **Attribution Non-commercial Share Alike** (cc-by-nc-sa)



- **Attribution Non-commercial No Derivatives** (cc-by-nc-nd)





7.4 Open Access

Problems of Scholarly communication

- **Financial problems**
 - serials crises – prices of journals grow faster than inflation (10-12%)
 - monopolistic practices by big publishers (packages, license terms)
- **Rapid increase of publications**
 - 25,000 scientific peer-review journals, 2.5 million articles / year – sustained growth
- **Slow communication**
 - 1-1.5 years before the submitted article is published
- **Low availability**
 - copyright monopoly
 - access only for the rich

Scientific knowledge is available only to a limited community of privileged users!



7.4 What is Open Access

- Idea: **Scientific information available to everyone-free-online**
 - Movement: to realize the idea
-

- **Quality scientific literature**
 - Peer-reviewed
 - others (preprints, data, technical reports)
- **Access**
 - free access **gratis OA**
 - unlimited use **libre OA**
- **The only limitations**
 - authoring
 - author's control over the integrity of his work

7.4 Two ways to OA

- **Gold**
 - publishing in open journals
 - (OA provide publishers)
- **Green**
 - self-archiving in open repositories
 - (OA provide authors)

7.4 Gold – OA journals

Free access for readers – who covers the costs?

- **Non-commercial journals**
 - free both for readers and authors
 - the costs are covered by a third party (scientific institution)
- **Commercial OA journals**
 - free of charge for readers, costs are covered by the author
 - APC – Article Processing Charge**
 - 300 – 3,500 USD / article (max 14,000 USD for eLife journal)
 - Nonprofit Publishers (PLoS), Profit (BioMed Central)
- **Other models**
 - Hybrid – open access only for paid articles, others for subscribers only
 - Delayed OA – open access upon expiration of a time embargo

DOAJ – Directory of OA journals

DOAJ DIRECTORY OF
OPEN ACCESS
JOURNALS

7.4 Green – OA repositories

- *Authors themselves open their published works on the web (self-archiving)*
- **Institutional repositories**
 - author puts his version of (published) work into repository (preprint, postprint)
 - repository provides OA access & long-term archiving
 - Univ of California: eScholarship Repository - <http://escholarship.org>
- **Subject repositories**
 - cover a certain scientific area worldwide
 - <http://arxiv.org> – preprints for physics, mathematics, comp.sci (1.1 million)
- **Personal pages**
 - personal www pages (not recommended – low visibility/lifetime/interoperability)
 - Scientific Profile on the scientific social networks – Research GATE, etc.

ROAR – Registry of OA Repositories

8. Digital Preservation



8. Digital preservation

8.1 Introduction

8.2 Threats to preserve digital information

8.3 OAIS Reference Model

8.1 Introduction

„Digital information is forever. It doesn't deteriorate and requires little in the way of material media“.

Andy Grove, Intel Corp.

**„Digital information lasts forever
– or five years, whichever comes first.“**

Jeff Rothenberg, RAND, 1995

8.2 Threats to digital preservation

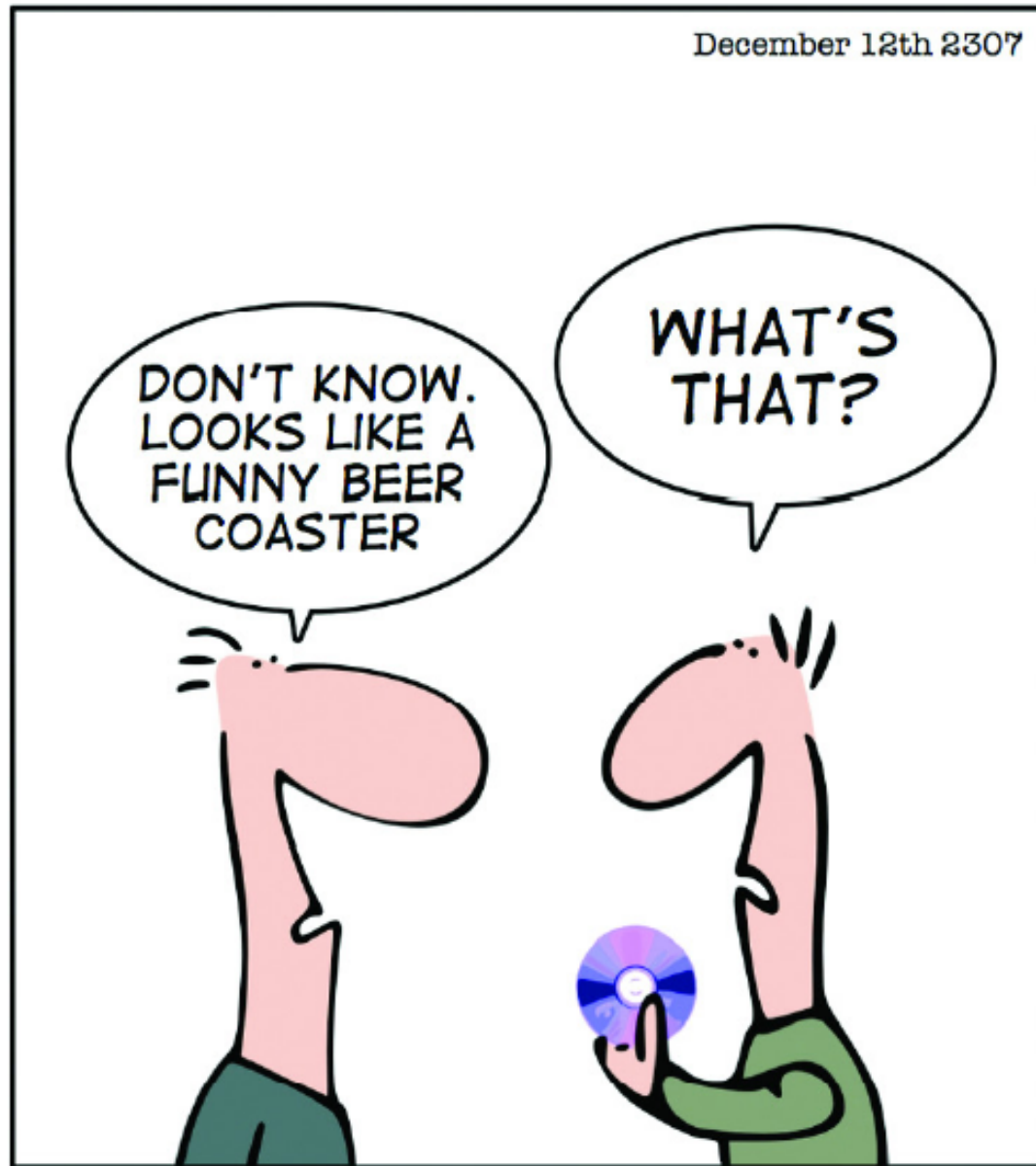
- 1. volatility / vulnerability of the recording media**
 - Problem: unreadable or destroyed media
- 2. hardware and software required to present digital info**
 - Problem: required HW / SW not available
- 3. Fast and permanent technological changes**
 - Problem: obsolete data format or recording medium



Color photo by Jeff Rothenberg

HOW TO SAVE YOUR DIGITAL WORK FOR THE POSTERITY?

December 12th 2307

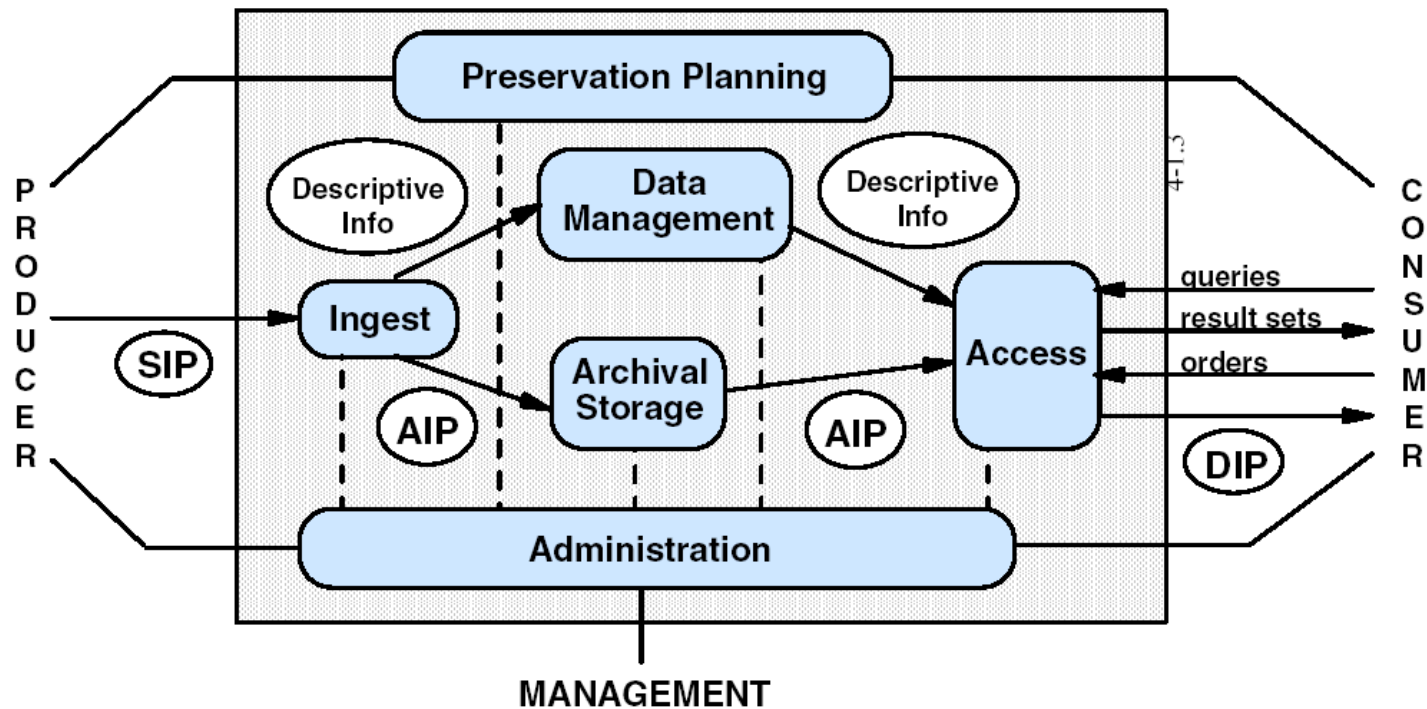


Source: <http://geekandpoke.typepad.com/>

8.3 OAIS – Open Archival Information System

- **Reference model for long-term digital archive**
 - conceptual model (general architecture)
 - basic entities (players, information objects, functions)
 - terminology – unified dictionary
- Basic standard for digital preservation
- 1995 recommendation of the Consultative Committee for Space Data System (NASA and others)
- 2002 ISO-14721, 2012 Update ISO-14721: 2012
- 3 models in OAIS
 - **Environment Model** (Producer - Archive / Management - User Community)
 - **Information Model** (SIP - AIP - DIP)
 - **Functional Model** (6 basic functions / services of long-term archive)

8.3 OAIS – Open Archival Information System



- **SIP** – Submission Information Package
- **AIP** – Archival Information Package
- **DIP** – Dissemination Information Package

8.3 OAIS – Information Model

- **SIP Submission Information Package**
 - Information provided by data provider to the archive
 - Data for archiving + descriptive, technical and other metadata (licenses, ...)
 - information on data formats
- **AIP Archival Information Package**
 - Information stored and preserved by the archive
 - It originates from one or more SIP packages most often by adding other necessary metadata (for preservation and accessibility) and / or by changing the structure
 - Content Information + Preservation Description Information (Reference, Provenance, Context, Fixity, Access)
- **DIP Dissemination Information Package**
 - Information provided by the archive to the user upon request
 - It originates from the AIP so that the user receives useful and understandable information

8.3 OAIS – Functional Model

1. Ingest

- accepting the SIP input package from producer and creating the AIP archive package

2. Archival Storage

- safe physical storage of AIP in the archive and guaranteeing its integrity and fixity

3. Data Management

- administrative support and access to archive data

4. Administration

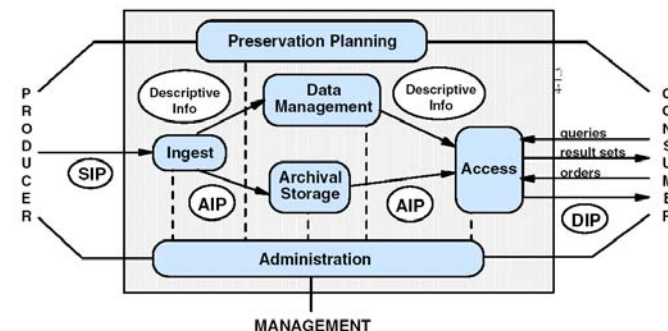
- managing processes, features, and settings of the archive itself

5. Preservation Planning

- creation of protection plans and implementation of protection actions (migration, etc.)

6. Access (accessibility)

- search by the user in the archive
- obtaining and rendering the desired content (DIP)



9. Digital Libraries at MU



9. Digital libraries at MU

9.1 Software for creation of DLs

9.2 Digital Library of Photos at MU

9.3 Czech Digital Mathematics Library

9.4 Faculty of Arts Digital Library

9.1 Software for DLs

- **Commercial Systems** (complex, expensive)
 - IBM Content Manager
 - ExLibris DigiTool
 - ...
- **Open Source Systems** (different levels of complexity)
 - **Greenstone** (University of Waikato, simple, UNESCO support)
 - **EPrints** (University of Southampton, repository system)
 - **DSpace** (MIT+HP Labs, repository system) --- used at MU
 - **Invenio** (CERN)
 - **FEDORA** (University Virginia, complex flrxible system)

9.2 DKF-MU

- **Digital library of MU photos**
- Proprietary software developed at MU
- Photo collection of digital and digitized photographs from the history and present of MU
- Photos and their metadata description
- Input, organization, description, search, archiving, presentations in photogalleries on the web
- Currently around 60,000 photos in 38 photo-collections

DKF-MU



Název 01 Pocta Leoši Janáčkovi

Title Homage to Leoš Janáček

Description A collection of works of art that was part of "Homage à Leoš Janáček", an exhibition composed of contributions by leading artists from all over Europe as their responses to the music written by this outstanding Czech composer. The works of art were either made expressly for the exhibition or created at an earlier date; they were later presented by the artists to the newly founded Masaryk University Art Museum.

Identifikátor 01500001.000

Počet objektů 63



Artymowski. Sinfonietta



Beck. Hommage à Leoš Janáček



Chatrný. Evoka



Dickerhof. Šumařovo dítě...



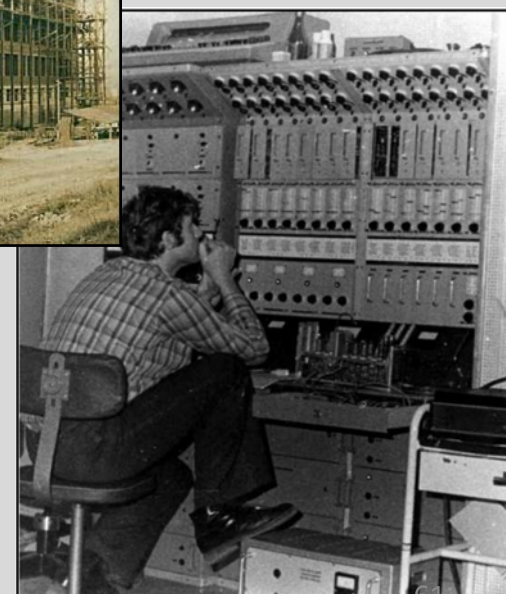
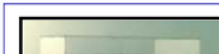
Dostál. Červánky nad polem



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Elben. Con moto II



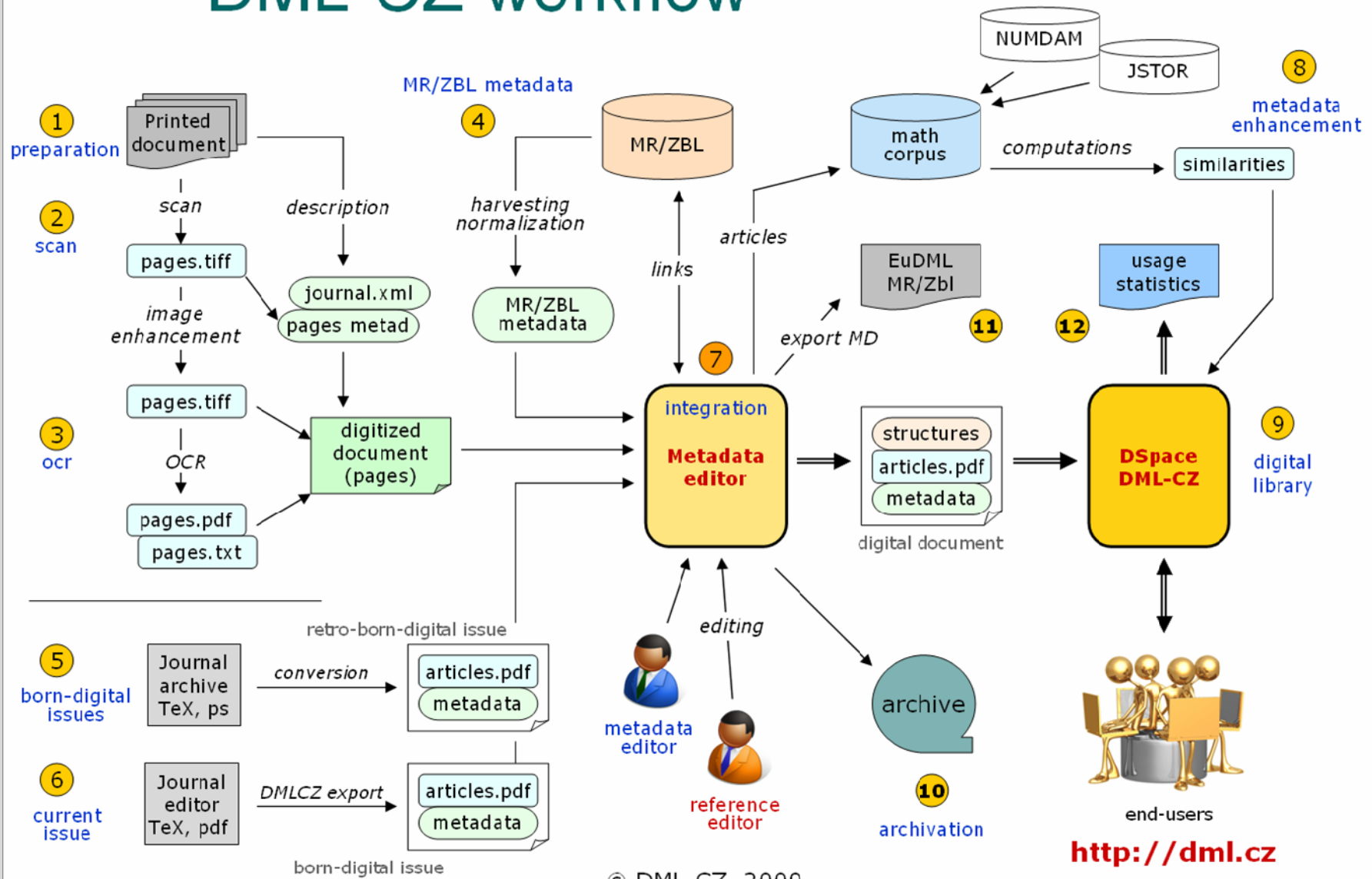
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Otakar Borůvka

* 10. 5. 1899 Uherský Ostroh
† 22. 7. 1995 Brno

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Description: Otakar Borůvka (1899-1995) is one of the most prominent Czech mathematicians of the 20th century. He spent most of his professional life in Brno (working at Masaryk University and at the Mathematical Institute of the Academy of Sciences of the Czech Republic - AV ČR). His extensive scientific work, i.e. 85 original scientific works and 5 monographs which have been translated into many languages, covers 5 mathematical areas: classical mathematical analysis, graph theory, differential geometry, algebra and theory of differential equations. Not only did he contribute significantly to each of these mathematical fields, but he also established scientific schools which were continued by his students and his students' students at Masaryk University and elsewhere.

Borůvka's works on classical analysis date mainly from the period 1923 -- 1925. In his paper "On a minimal problem" (1926) he was a pioneer in transport problems, the area that many years later became an important part of the theory of graphs. In his momentous works on projective differential geometry O. Borůvka was the first who studied analytic correspondences between two projective planes. Borůvka was also one of the main founders of the basic conception of general algebra. He established the theory of groupoids: his basic notions in this field made it possible to form deep and far reaching algebraic theories. After WW2 the essential part of Borůvka's work deals with differential equations, where he developed the original and fruitful theory of global transformations of linear differential equations of the second order.

Otakar Borůvka was not only excellent scientist but also an outstanding pedagogue, well-known by his well prepared lectures and winning his auditors by his tireless diligence.

The great importance of Borůvka's achievements has had wide response in a number of honours awarded to him in Czechoslovakia and abroad, and in numerous invitations to lecture at foreign universities and conferences. His contribution to the world science will never be forgotten.

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Czechoslovak Mathematical Journal, 43 (1993), Praha

THE ZERO-COMPLETION OF A MEDIAN ALGEBRA

HANS-JÜRGEN BANDELT, Hamburg, GERASIMOS C. MELETIOU, Arta
(Received May 15, 1989)

A distributive lattice (L, \wedge, \vee) gives rise to a self-dual symmetric ternary operation, viz.,

$$(*) \quad x, y, z \mapsto (xyz) := (x \wedge y) \vee (x \wedge z) \vee (y \wedge z),$$

named the median operation of L . This operation satisfies the identities

$$(xyz) = z$$

$$((vwx)(xyz)) = ((vwx)(vwy)z).$$

A median algebra M is a symmetric ternary algebra satisfying these two identities. Such an algebra is close to a distributive lattice: for any element a of M one obtains a median semilattice (M, \wedge) with partial join \vee (distributing over \wedge) and least element a via

$$x \wedge y := (xay)$$

such that the median of any x, y, z is recovered by the expression $(*)$. In general, (M, \wedge, \vee) is not a lattice, but still admits a representation as a lower set of some distributive lattice.

Typically, a property of a distributive lattice L that is invariant under interchanging meet and join often is expressible merely in terms of the median operation. Most concepts, though, are not self-dual. For instance, the *translational hull* ΩL of (L, \wedge, \vee) usually refers to the meet \wedge . It consists of all \wedge -translations of L , i.e., mappings $\tau: L \rightarrow L$ satisfying

$$\tau(x \wedge y) = x \wedge \tau y \quad \text{for all } x, y \in L.$$

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Article

[BANDELT, HANS-JÜRGEN ; MELETIOU, GERASIMOS C.](#)
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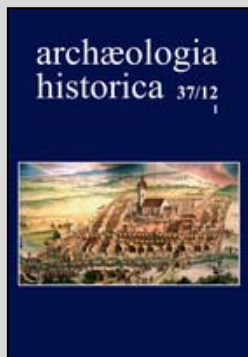
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Brno Studies in English
Volume 39, No. 1, 2013
ISSN 0524-6881
DOI: 10.5817/BSE2013-1-1

CHRISTOPHER HOPKINSON

TROLLING IN ONLINE DISCUSSIONS: FROM PROVOCATION TO COMMUNITY-BUILDING

Abstract

This paper focuses on the practice of trolling in online discussions. Working with a corpus taken from the websites of three British newspapers, it examines how users themselves define trolling; comparison with a previous study (Hardaker 2010) suggests that users' definitions of trolling may vary depending on the discussion topic. The paper then presents a qualitative pragmatic analysis of one discussion which was attacked by trolls. After examining how trolls announce their presence and attempt to provoke reactions from core community members, the article then moves on to discuss several salient aspects of the antagonistic facework used during the ensuing 'flame war'. Finally, the article turns to address the social dimension of trolling, outlining how a practice which is generally considered destructive can also paradoxically have constructive effects, helping to build new communities and strengthen existing ones.

Discussion forum: genre: face: impolite-community

Brno studies in English



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Publisher: Masarykova univerzita, Filozofická fakulta, Brno
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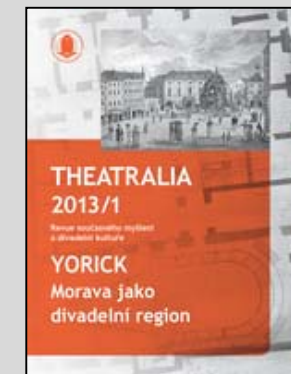
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