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Marjorie M. K Hlava, 505-998-0800
Chief Scientist, Chairman, President, Founder
Mhlava2accessinn.com

# Eureka I Found It!!
# A Presentation On How Search Works With Taxonomies
# SLA Taxonomies 2021

# Description:

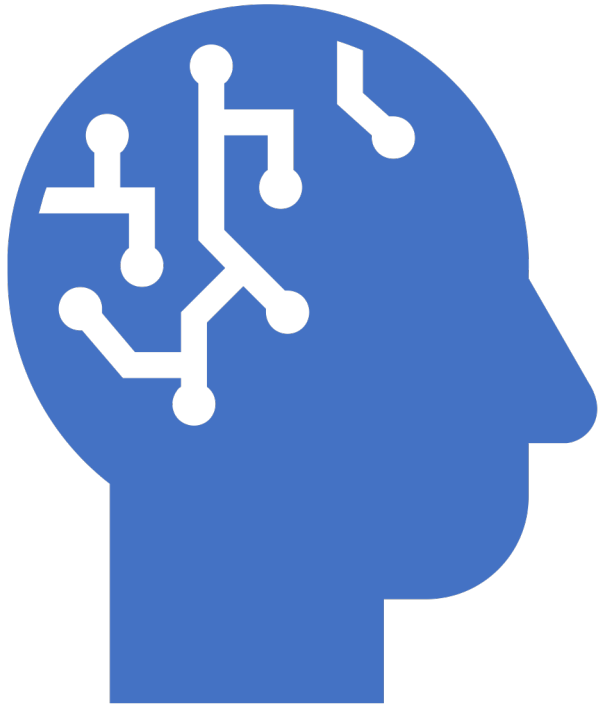
Have you ever wondered how search works while visiting an e-commerce site, internal website, or searching through other types of online resources? Look no further than this informative session on the ways that taxonomies help end-users navigate the internet! Hear from taxonomists and other information professionals who have first-hand experience creating and working with taxonomies that aid in navigation, search, and discovery across a range of disciplines.

# Who is speaking? Marjorie M.K. Hlava

- I am a lifetime member 45 years of SLA, joining in 1974.
- I have spent my career searching, building databases, building taxonomies, First for NASA then for my own company.
- Over 2000 engagements and 600 custom taxonomies built by my team and me.
- Also active in the standards we use you will find my name in the Dublin core (Z39.84), Controlled vocabulary (Z39.19), Credit, DOI Syntax and other infrastructure standards for the information industry.
- I am the founding chair of the SLA taxonomy division
- I have written four books and the Taxobook series is a best seller on Amazon.  I also have authored over 200 articles and any presentations

# Content Without Access Is Nearly Worthless.

- Enterprise search is how an organization
  - … helps people seek the information they need,
  - … in any format,
    - databases,
    - document management systems
    - paper.
  - … from anywhere inside their company.
  - We need to get the right information at the right time.



# What's the problem with search?

- Returns do not match the query – search question
- Need to know all the ways something can be labeled to find it, synonyms
- Colloquial use of terms to mean something else, homonyms
- Too many returns to look at easily
- Users only want to click 3 times to find an answer
- Too much time needed to set up good search system by IT
- Most orgs have 5 previous search systems on the shelf – trying a new one
- The problem was probably the data not the system.

# Is All Search The Same?

- Key outcomes in a comprehensive knowledge management strategy.

- Discover “discoverability”
- Search
- Find “findability”

# Search Behavior Types

- Findability
  - The ease with which information can be found. Means users can easily find content or information present on a website or in a database.
- Discoverability
  - Making sure that new content or information can be found
  - … even if the user doesn't know that it exists yet.
- Browse
  - Like in a library or bookstore – allows serendipity in search

- Each type needs different support from the search system

- Taxonomies provide consistency in terms and categories to enable findability in content. This is true regardless of the subject.

# How do we measure good search results?

## Relevance

The systems guess at what you are looking for

## Precision

Returning only those items which exactly match the query – search question

## Recall

Returning ALL the items in the data base which match the search query

## Match against human vetted sets

Training sets or humanly indexed data

Indexing indicates a controlled list of terms

# What Search Using a Taxonomy OUGHT To Do!!

| | | | |
|---|---|---|---|
| Gives precedence to Taxonomy terms in search | Search by Navigation tree | Expand search by Related terms | Refine search via Narrower terms |
| Type ahead shows both terms and synonyms<br>• Permuted list format | Suggests preferred term if synonym is entered in search box | Provide for recursive search (Search within a search set) | Give recommendations |

# What are the Parts of Search?

## Search software

- Inverted Index
- Search algorithms

## Content layer

- Rich metadata
- Consistent format

## Presentation layer (User Interface)

- Search box
- Auto-completion
- Related content
- Advanced search options

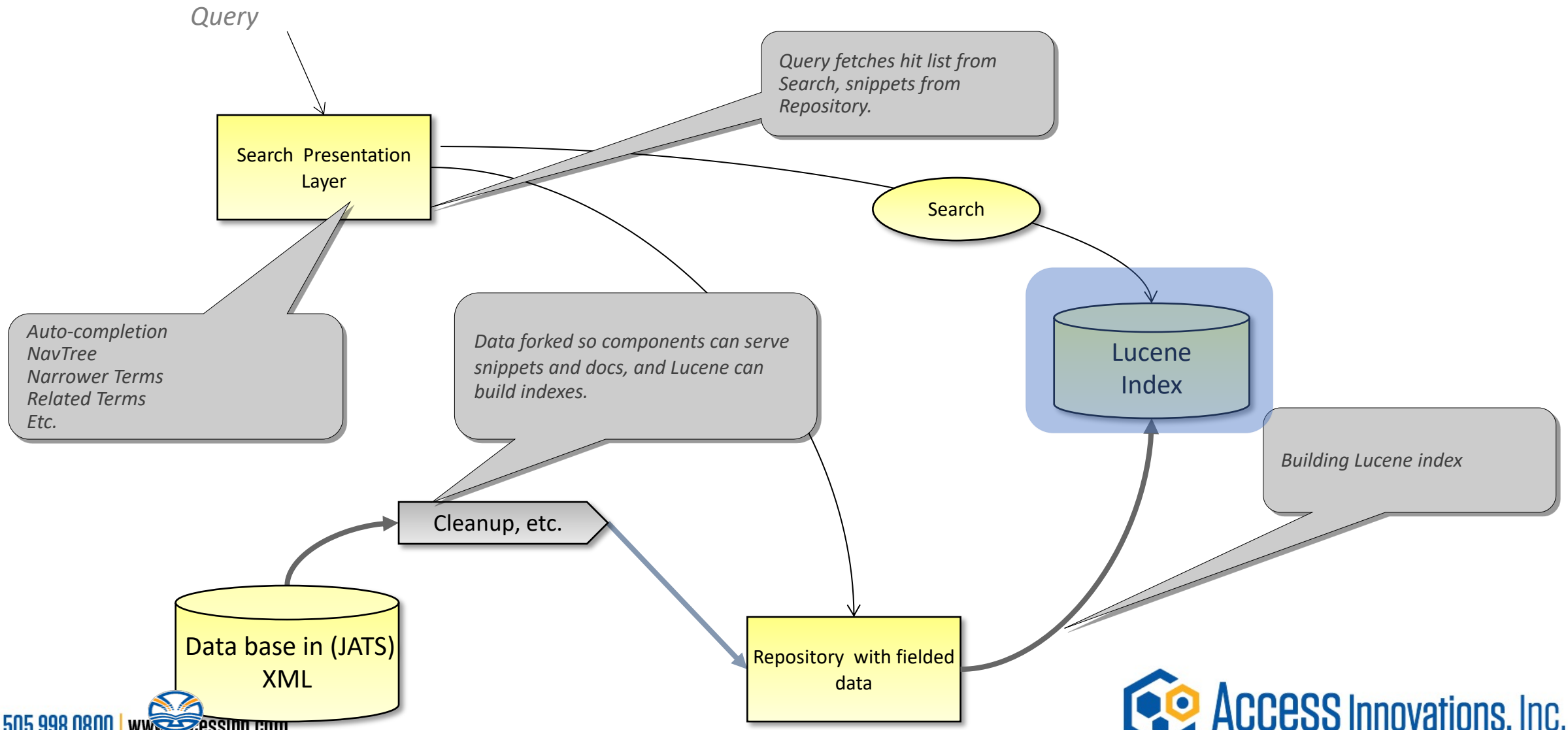
# Search Software

Content Layer

Adding the Taxonomy

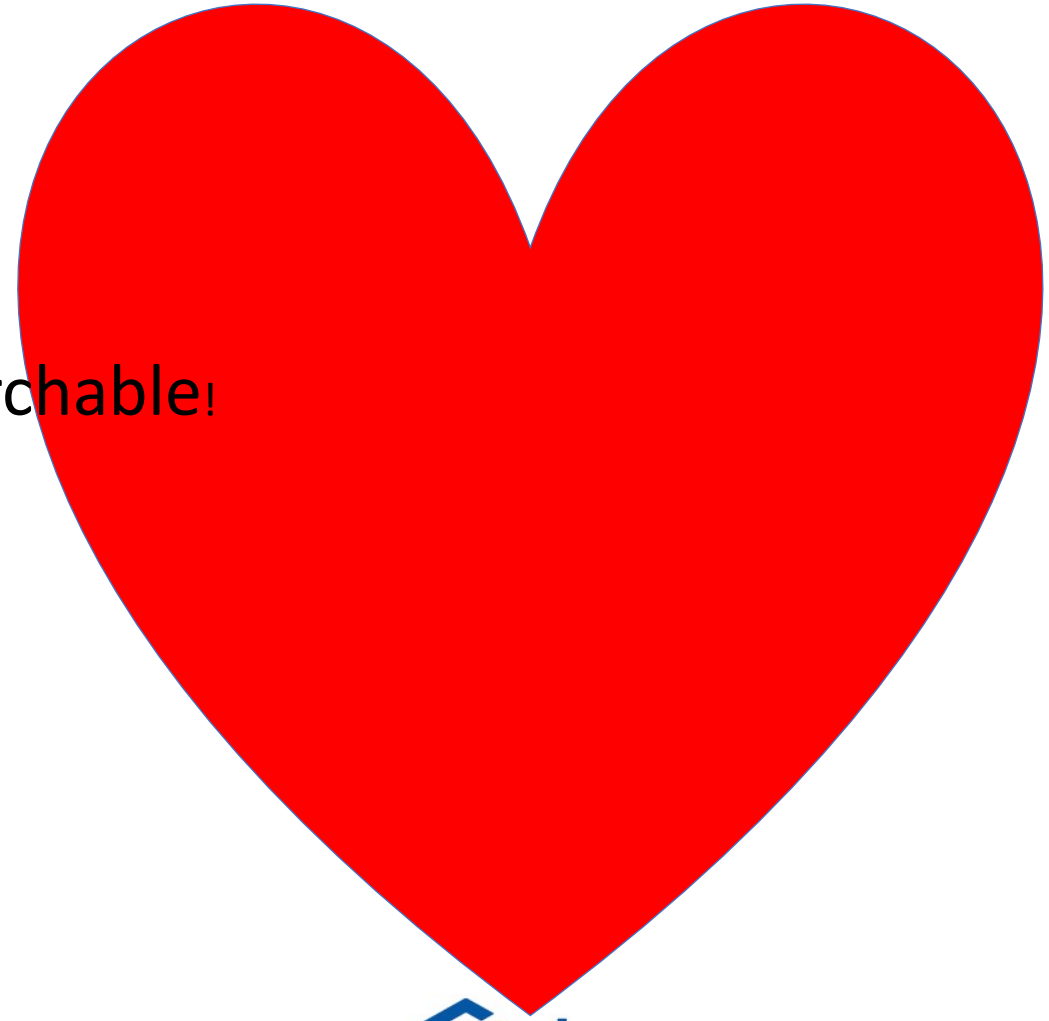
Presentation layer (User Interface)

# Sample – Lucene Deployment



# The inverted index

If its not in the inverted index.... It is not searchable!



# Sample DOCUMENT

Creating an Inverted File Index

## "Outline of Presentation"

1 Define key terminology

2 Thesaurus tools
- Features
- Functions

3 Costs
- Thesaurus construction
- Thesaurus tools

4 Why & when?

# Simple Inverted File Index of the Terms from the “Outline”

&
1
2
3
4
construction
costs
define
features
functions
key
of
outline
presentation
terminology
thesaurus
tools
when
why

# Complex Inverted File Index: Placement, Location added

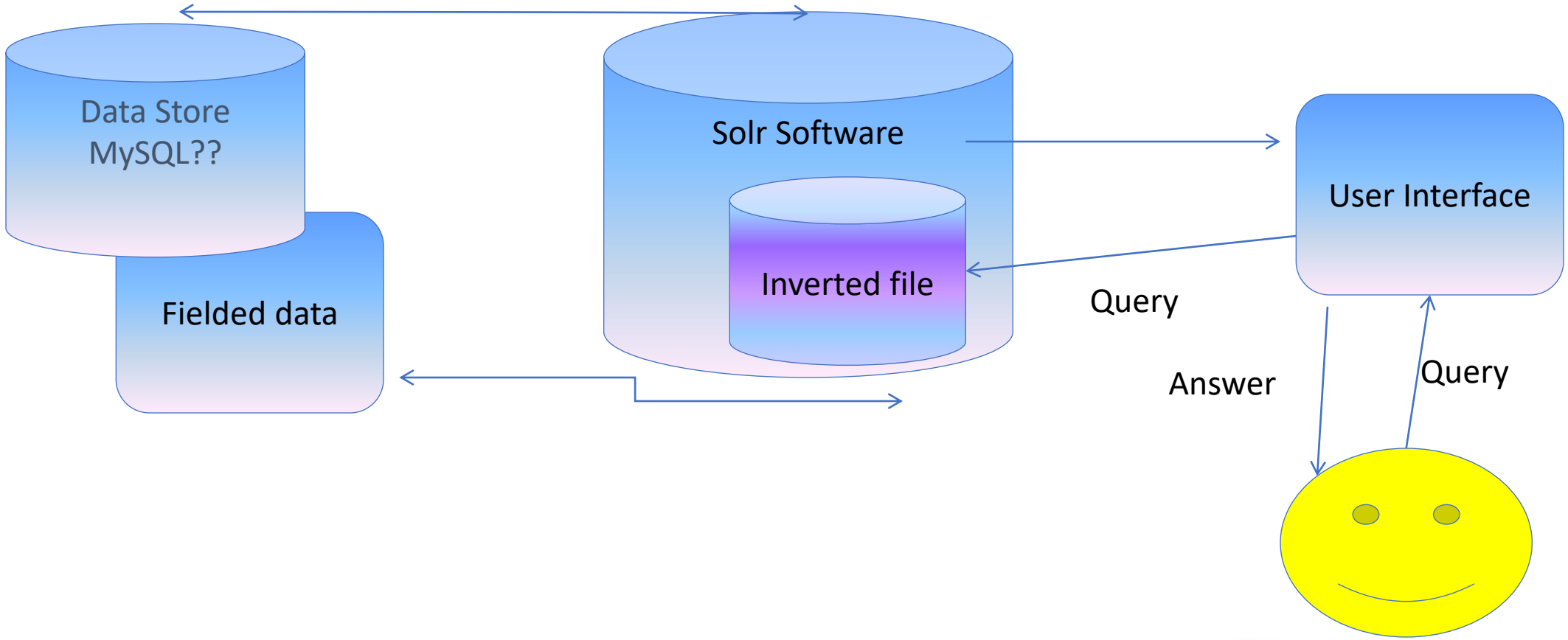
& - Stop
1 - Stop
2 - Stop
3 - Stop
4 - Stop
construction - L7, P2, SH
costs - L6, P1, H
define - L2, P1, H
features - L4, P1, SH
functions - L5, P1, SH

key - L2, P2, H
of - Stop
outline - L1, P1, T
presentation - L1, P3, T
terminology - L2, P3, H
thesaurus - (1) - L3, P1, H
(2) - L7, P1, SH
(3) - L8, P1, SH
tools - (1) - L3, P2, H
(2) - L8, P2, SH
when - L9, P3, H
why - L9, P1, H

# Search for thesaurus tools

- Search = Thesaurus tools
- thesaurus - (1) - L3, P1, H
- (2) - L7, P1, SH
- (3) - L8, P1, SH
- tools - (1) - L3, P2, H
- (2) - L8, P2, SH

# Lucene - SOLR Search Flow



Search Software

Content Layer

Adding the Taxonomy

Presentation layer (User Interface)

# So how do we get there?

Have to tag the records

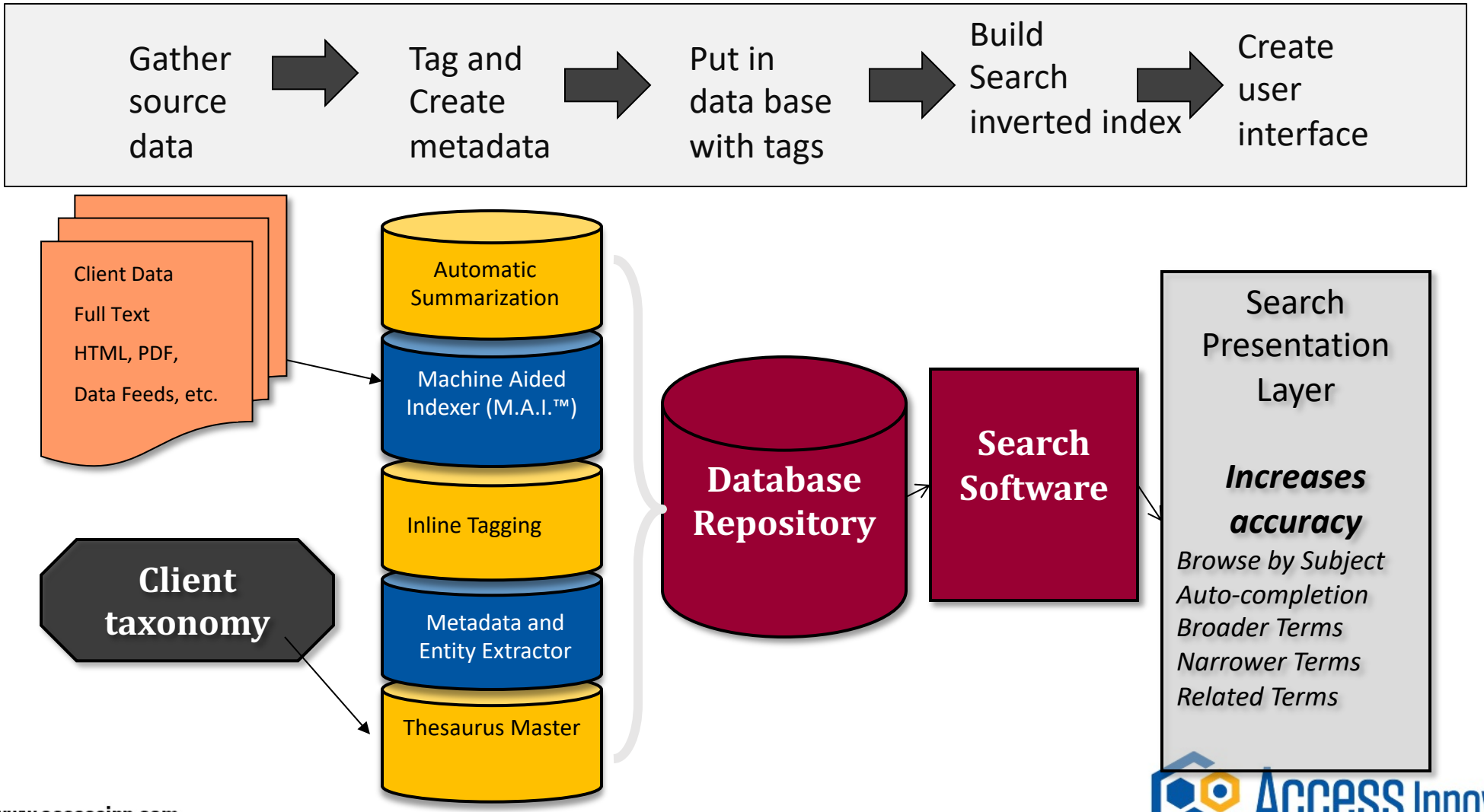
Semantically enrich

Add subject metadata

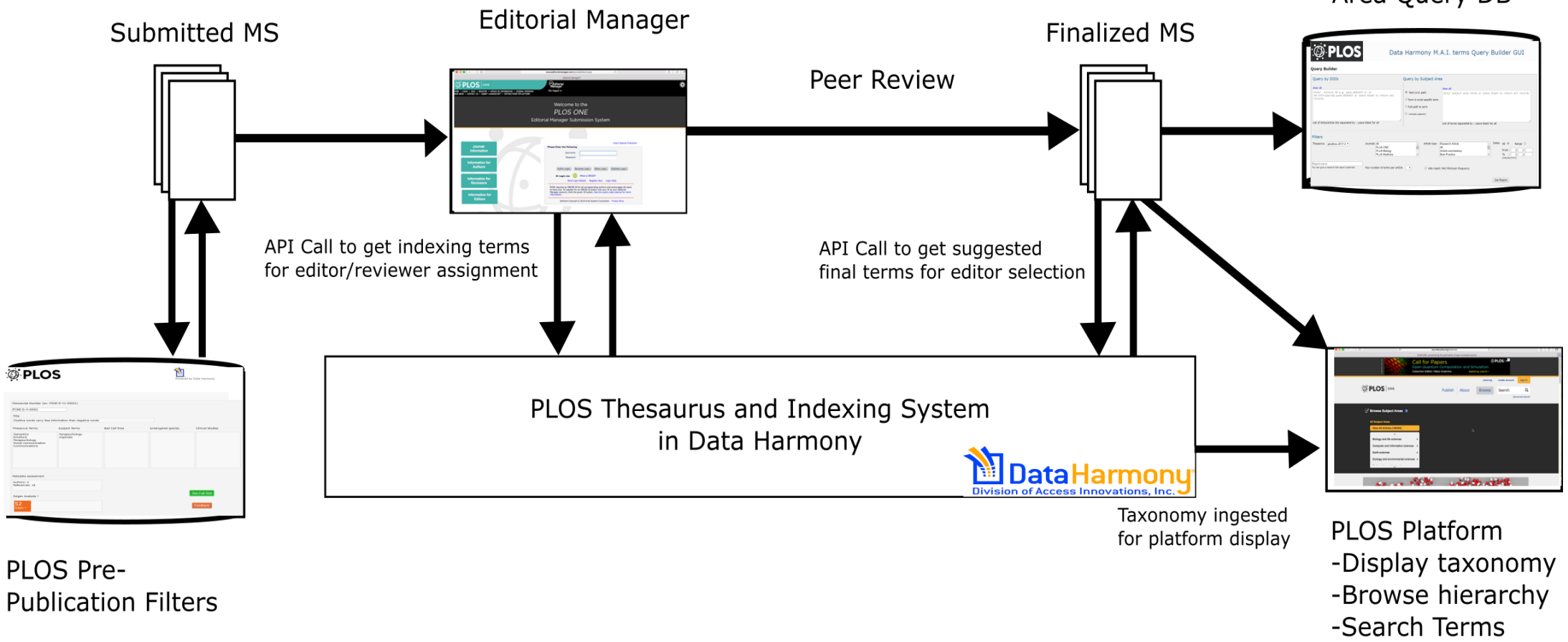
Create a controlled vocabulary

Use good metadata at the input and the search ends of the pipeline

# The Workflow



# Where does the taxonomy get added to the production workflow?

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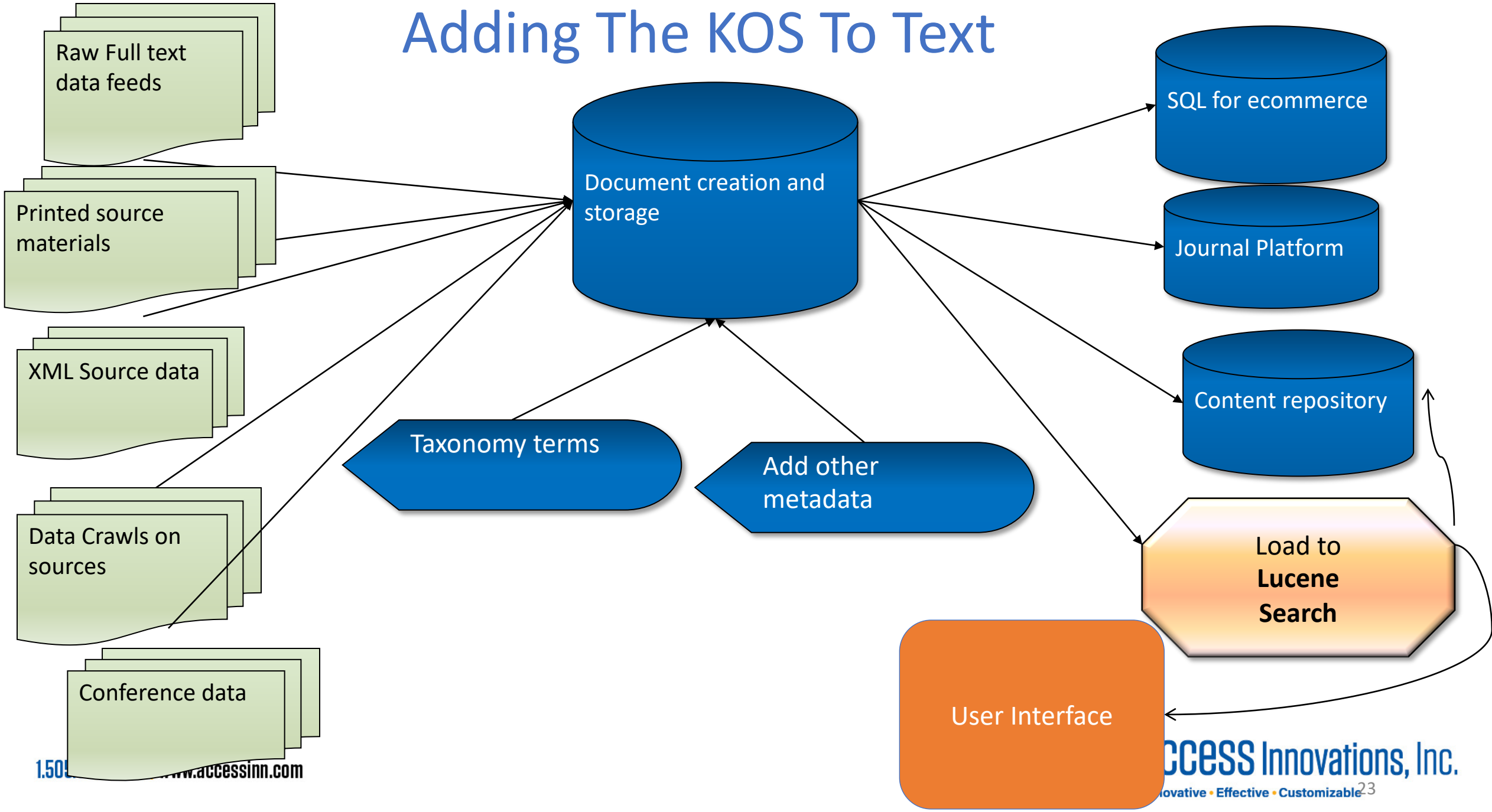
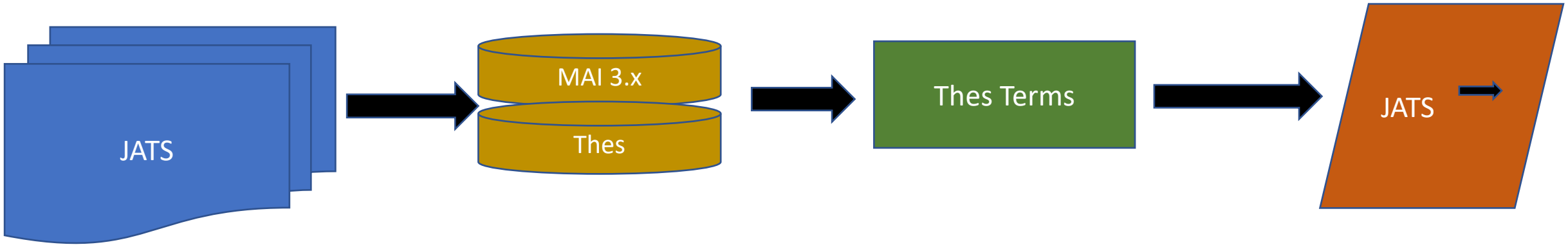
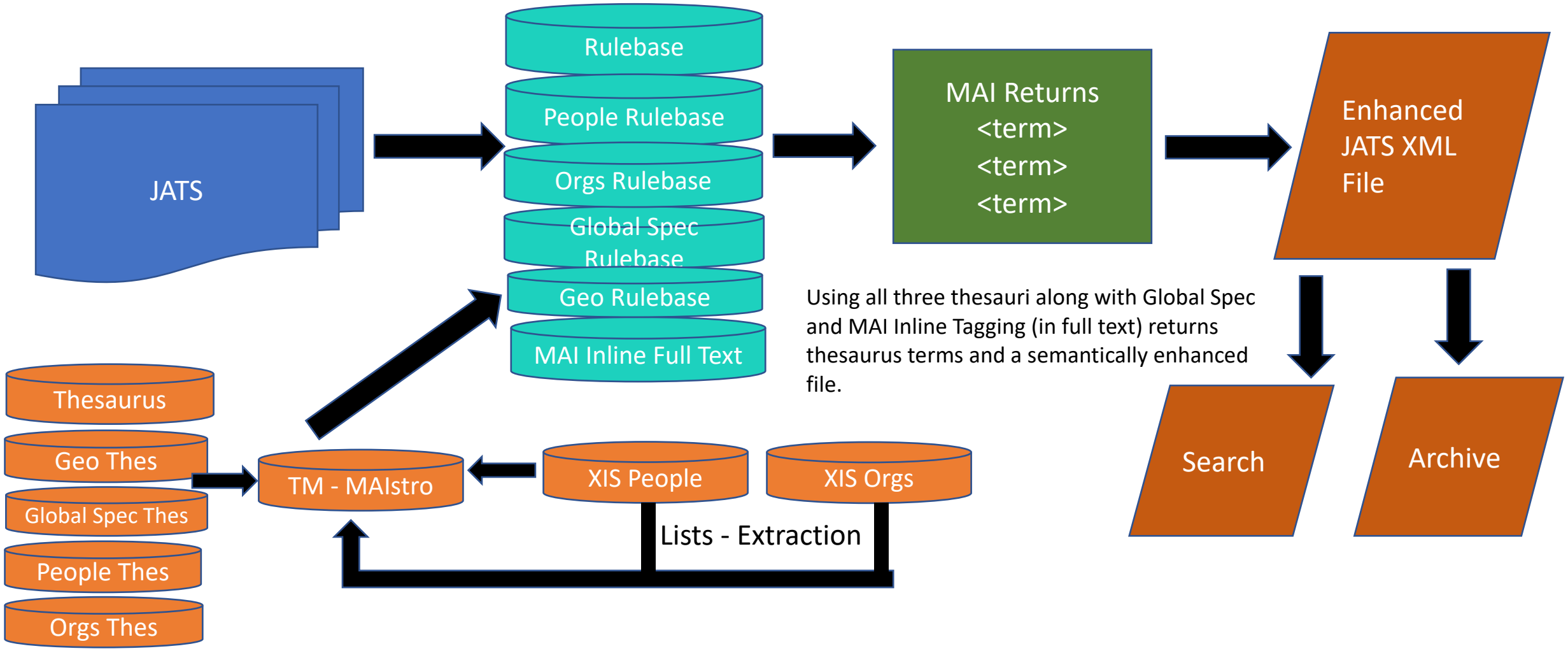
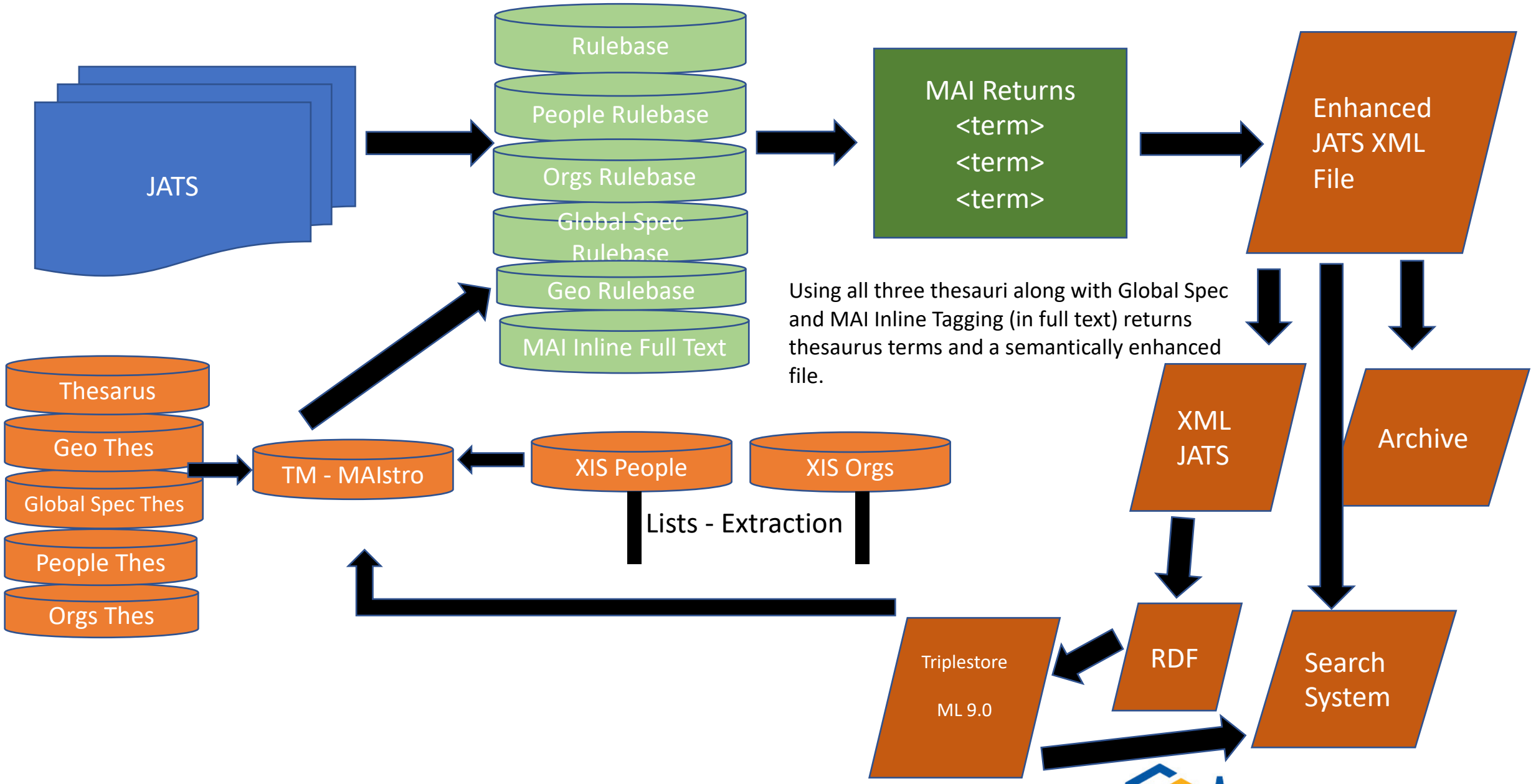
# Adding The KOS To Text






Indexing using the controlled vocabulary or thesaurus / taxonomy will return basic thesaurus terms to be converted into enriched data (like JATS XML for ingestion as the “Article of Record” storage).


JATS
Rulebase
People Rulebase
Orgs Rulebase
Global Spec Rulebase
Geo Rulebase
MAI Inline Full Text
MAI Returns
<term>
<term>
<term>
Enhanced JATS XML File
Using all three thesauri along with Global Spec and MAI Inline Tagging (in full text) returns thesaurus terms and a semantically enhanced file.
Search
Archive
Thesaurus
Geo Thes
Global Spec Thes
People Thes
Orgs Thes
TM - MAIstro
XIS People
XIS Orgs
Lists - Extraction

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# Florida Thesis Project

**Sample records from the pilot project clearly demonstrate the enhanced metadata:**

**Subjects**

**Subjects / Keywords:**
alligator, detectability, estimates, habitat, population, sightability, survey
Interdisciplinary Ecology -- Dissertations, Academic -- UF

**Genre:**
Electronic Thesis or Dissertation
bibliography ( marcgt )
theses ( marcgt )
Interdisciplinary Ecology thesis, M.S.

**Original Record**

**Semantically Enhanced Record**

**Subjects**

**Subjects / Keywords:**
alligator, detectability, estimates, habitat, population, sightability, survey
Interdisciplinary Ecology -- Dissertations, Academic -- UF
Alligators ( JSTOR )
Population estimates ( JSTOR )
Aquatic habitats ( JSTOR )
Wet prairies ( JSTOR )
Vegetation ( JSTOR )
Night lights ( JSTOR )
Water depth ( JSTOR )
Area Surveys ( JSTOR )
Florida -- Everglades
Florida -- Kissimmee
Florida -- Franklin County
Florida -- Taylor County

**Genre:**
Electronic Thesis or Dissertation
bibliography ( marcgt )
theses ( marcgt )
Interdisciplinary Ecology thesis, M.S.

# Florida Thesis Project

University of Florida Digital Collections

UF Theses & Dissertations

Digital Library of the Caribbean

Portal of Florida History

Cuban Heritage Collection

IR@UF

XML Records & Full Text Exported from UFDC for Analysis

XIS XML CMS System

MARC Records Exported from XML

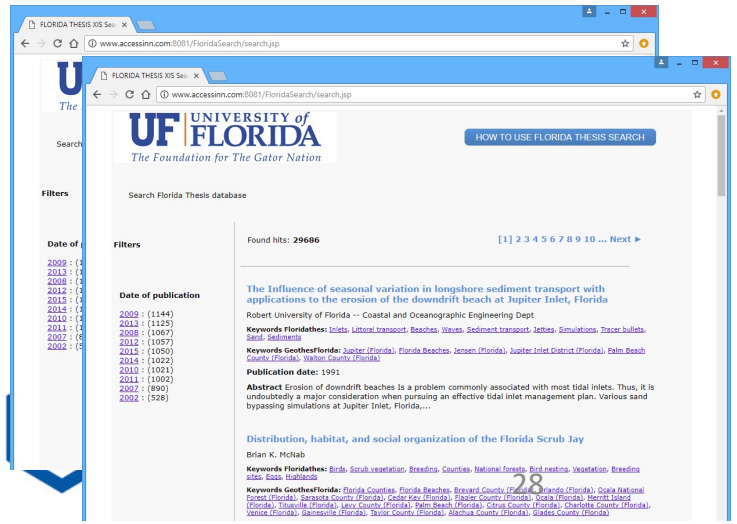
OCLC

Enhanced Metadata Added to UFDC Records

XIS Repository of Updated Records

Updated Records Returned to UFDC

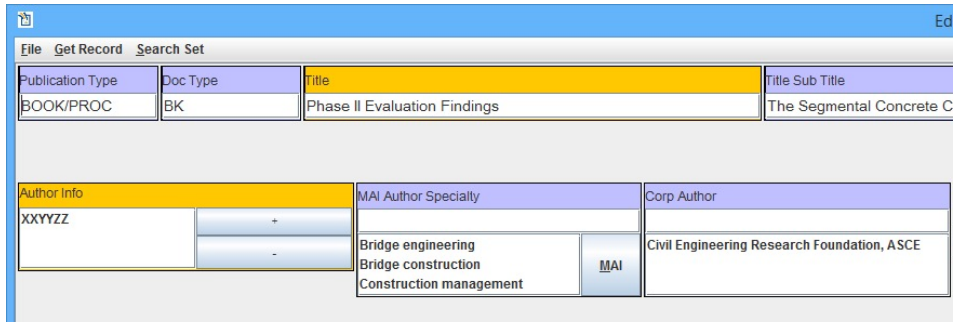
XIS Staff Review Panel



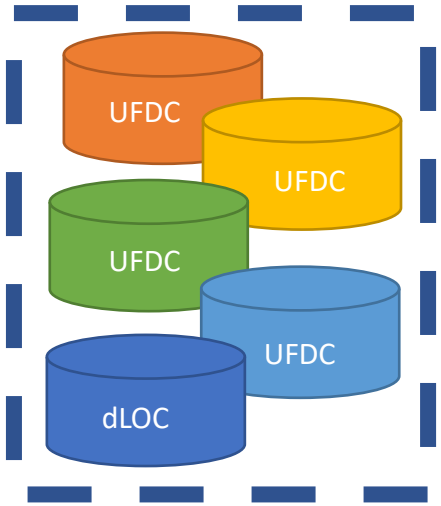
# Planned Florida Record Creation

## All Records Created in XIS

XIS Data Input Panel




XIS
XML CMS System




XML Records Exported from XIS to UFDC/dLOC

XIS Repository of UF Records

UF Libraries OPAC/ Discovery Service

MARC Records Exported from XIS to the UF Libraries OPAC/Discovery Service

MARC Records Exported from XIS to OCLC

OCLC



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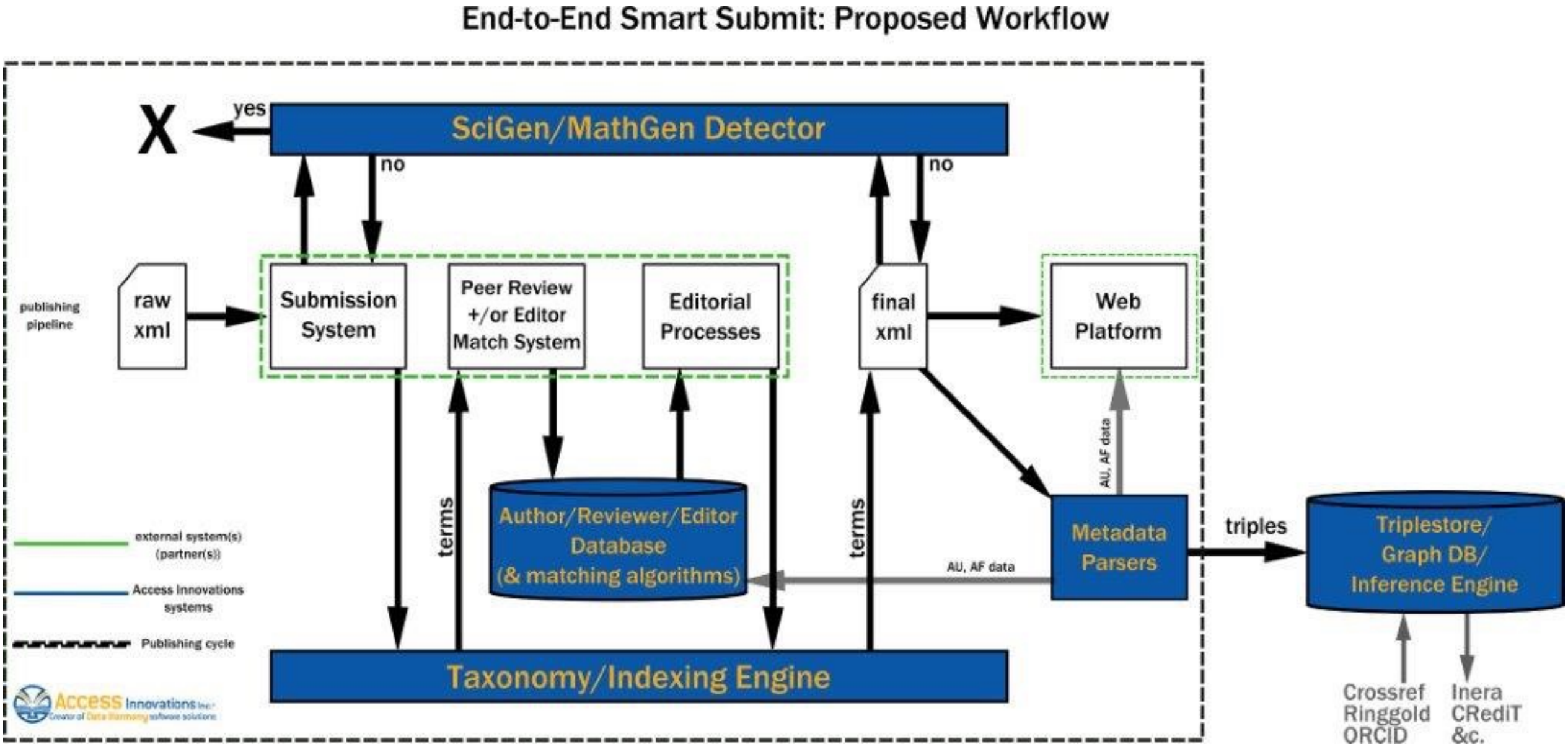
# Document submission uploads - Smart Submit



Search Software

Content Layer

Adding the Taxonomy

Presentation layer (User Interface)

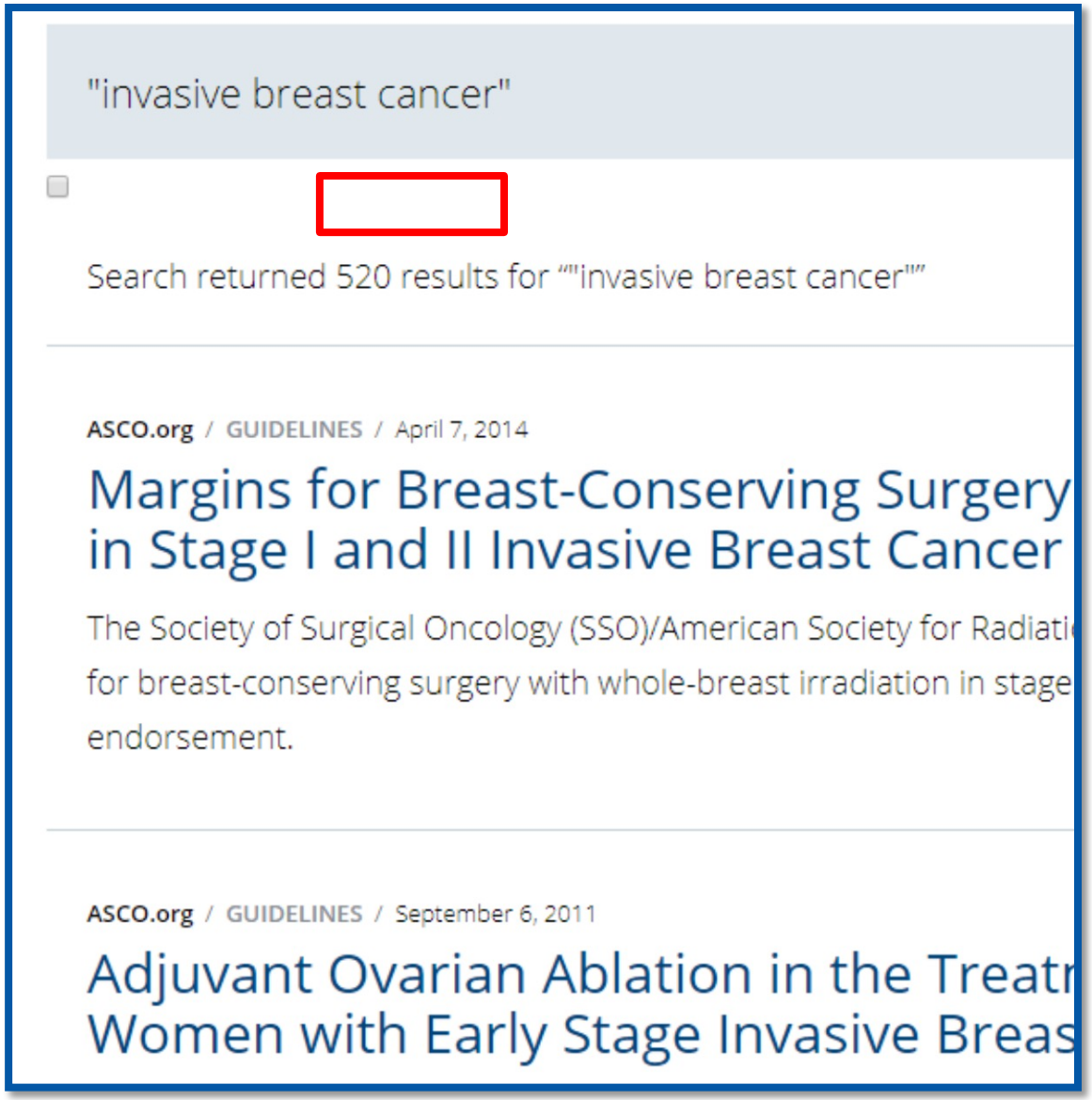
# All the taxonomy

- Hierarchical relationships
  - The broader narrower
  - Browse and Discovery
- Equivalence relationships
  - Synonyms
  - Findability
- Associative terms
  - Related but not synonyms or hierarchical
  - Knowledge maps
  - Cross area searching
  - Ontologies
- Linking
- Alphabetic views for type ahead

# Non-intuitive Synonyms

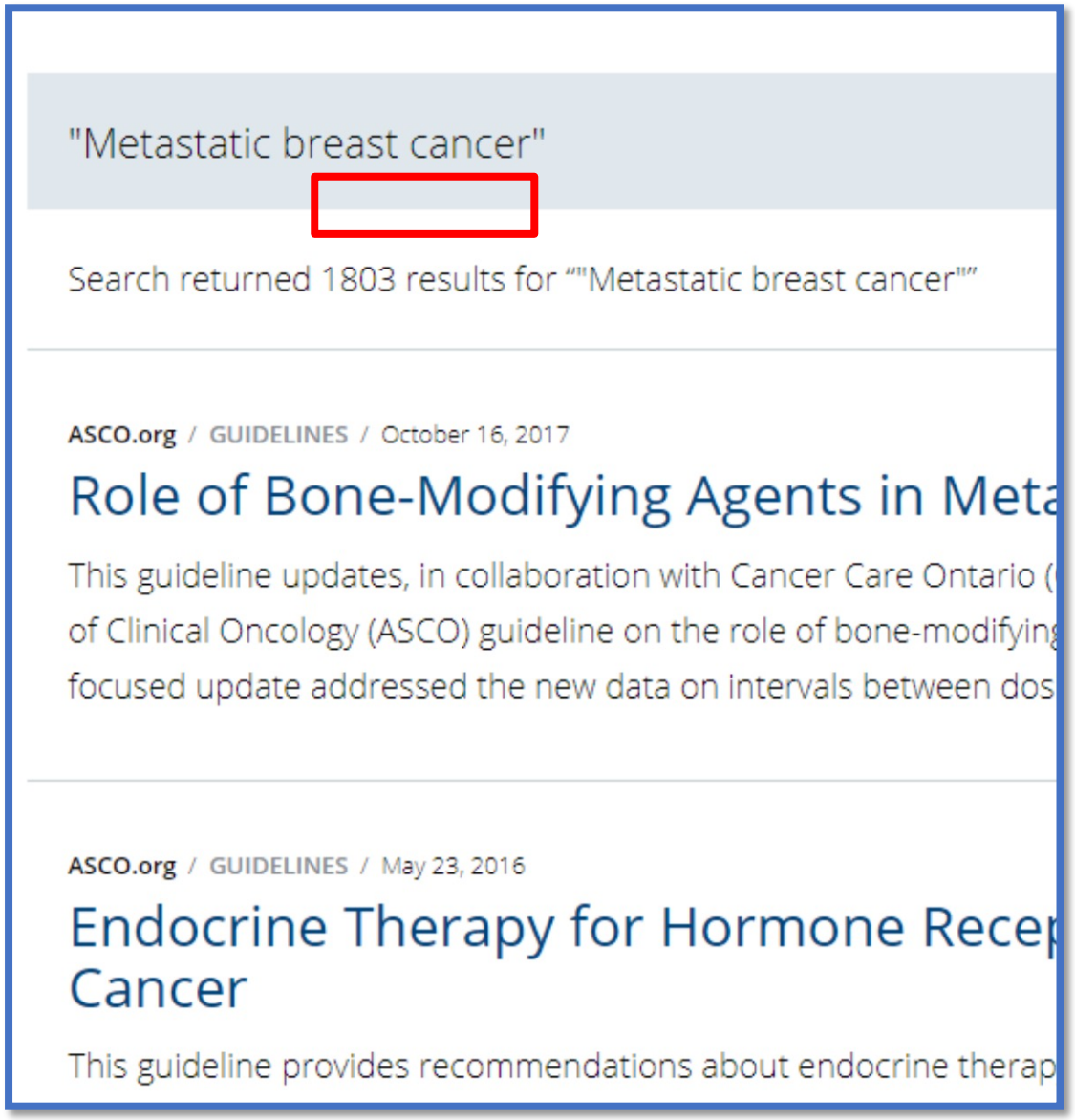
- Invasive breast cancer
- Metastatic breast cancer
- Stage IV breast cancer

*These all mean the same thing in MeSH, etc. (as well as in the ASCO thesaurus)*



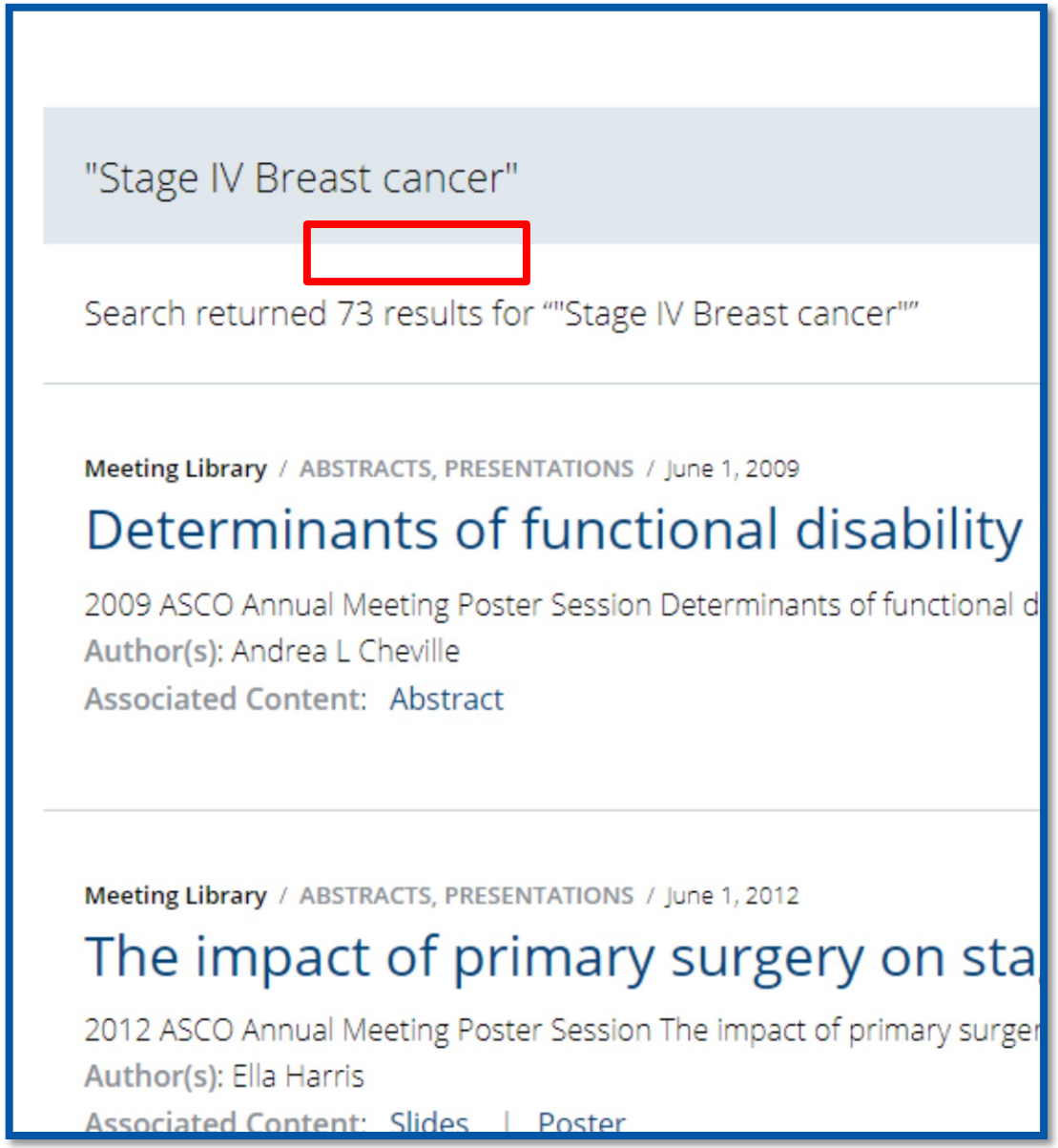

# 520 hits

## Lack of Synonymy Breaks Search




# 1803 hits

## Lack of Synonymy Breaks Search




# *73 hits*

*I would want my medical team to see all 2,396 articles*

## Lack of Synonymy Breaks Search

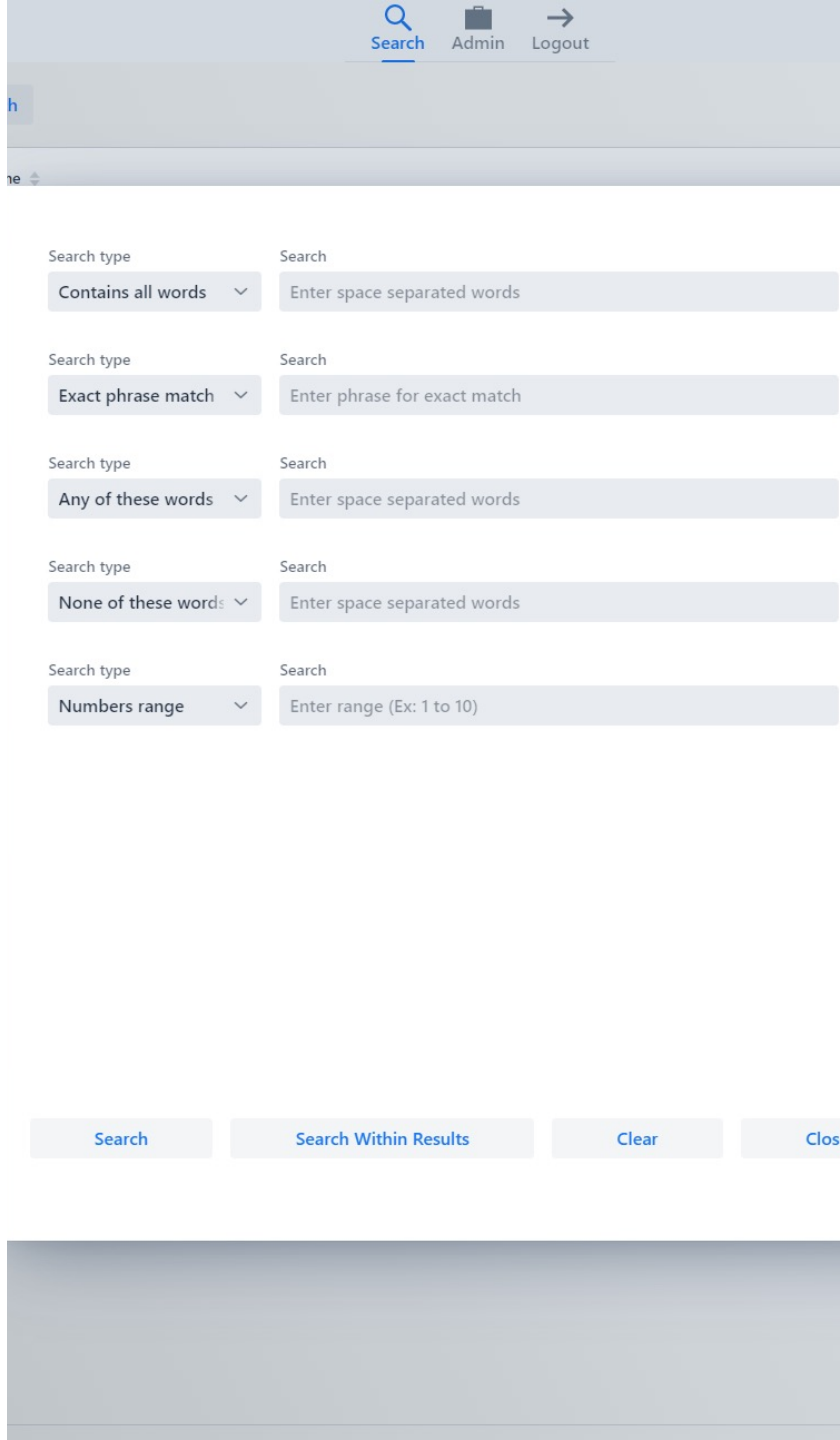
# Disambiguation

# Achieving Synonymy

| Find | Merge | Choose | Build |
| --- | --- | --- | --- |
| Find like concepts | Merge the terms | Choose a preferred form | Build term record<br>• Hierarchy<br>• Equivalence<br>• Associative |

# Integration into Search

- Mandatory input fields, Fixed-length, Display fields in the result, Searchable fields, Subfields
- Database indexing behavior
  - Allows for custom indexing behavior
- Search types
  - Word parse, phrase parse, and indexing terms
  - Boolean search types: Equals, Not, Or, Number, Exact matches, etc.…
    - Can be mixed and matched based on the desired query
- Sortable fields
  - Sort fields in export or other views (already in-spec)
- Search implementation
  - Search against title, abstract, descriptors, organizations, people names, and geographic information
- Allows for map-integration
  - Utilize a GIS field for presenting the location meta-data of records



# Content Management – More Than Just Documents

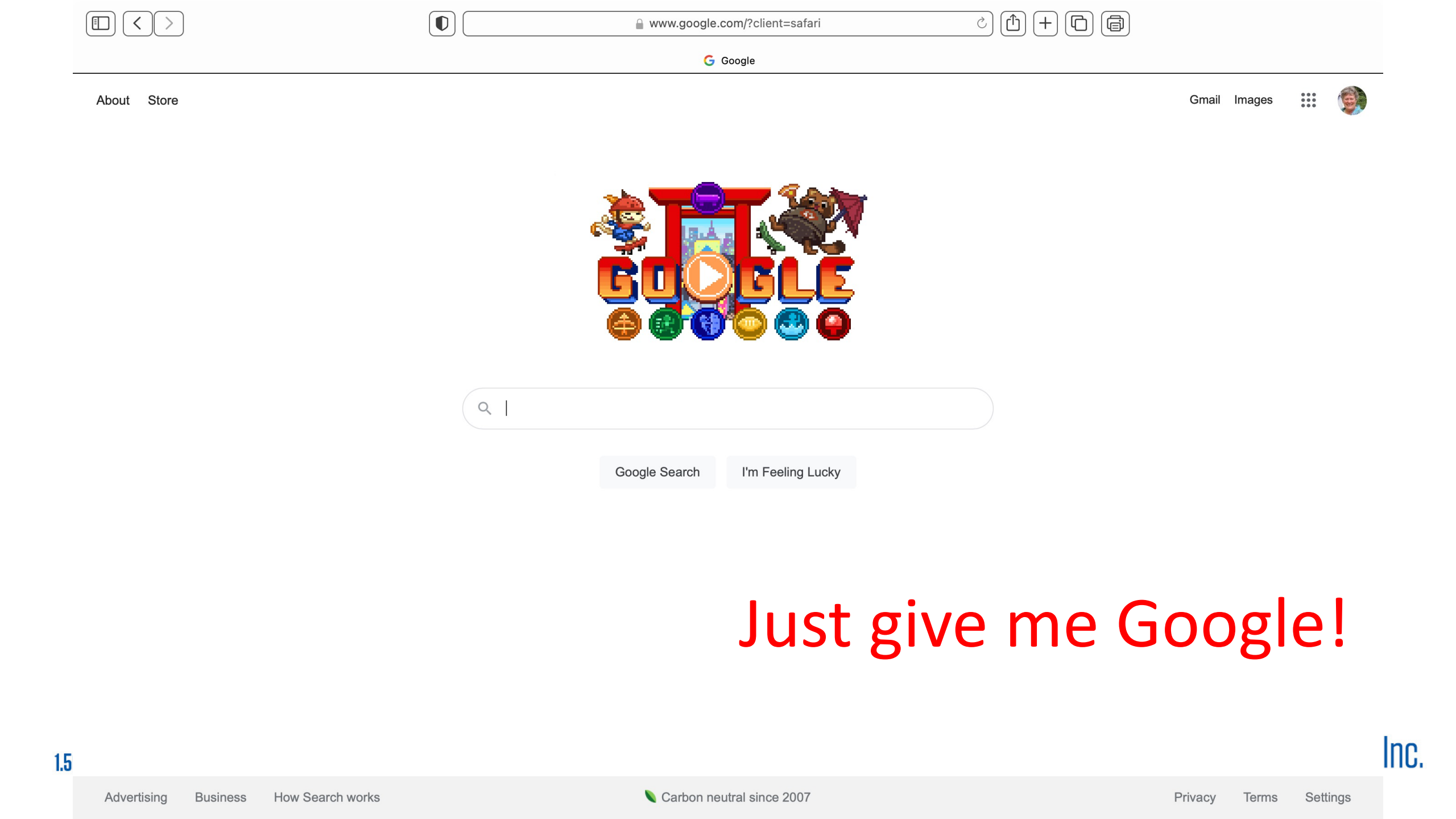
- Content management is much more than acting as a document store
  - Ability to upload and store additional data-types
    - Videos
    - Images
    - Files
      - Excel
      - Word
      - Etc.…
  - Ability to serve the content along-side the document
    - API's to access and deliver the objects
      - While AWS provides this, it is generally very complex
      - XIS simplifies this process via understanding the target audience
  - Challenges for libraries
    - Systems are often designed for naïve implementations
      - Storage of books and journals and the like
    - XIS solves this by giving a use-case specific implementation of CMS

Search Software

Content Layer

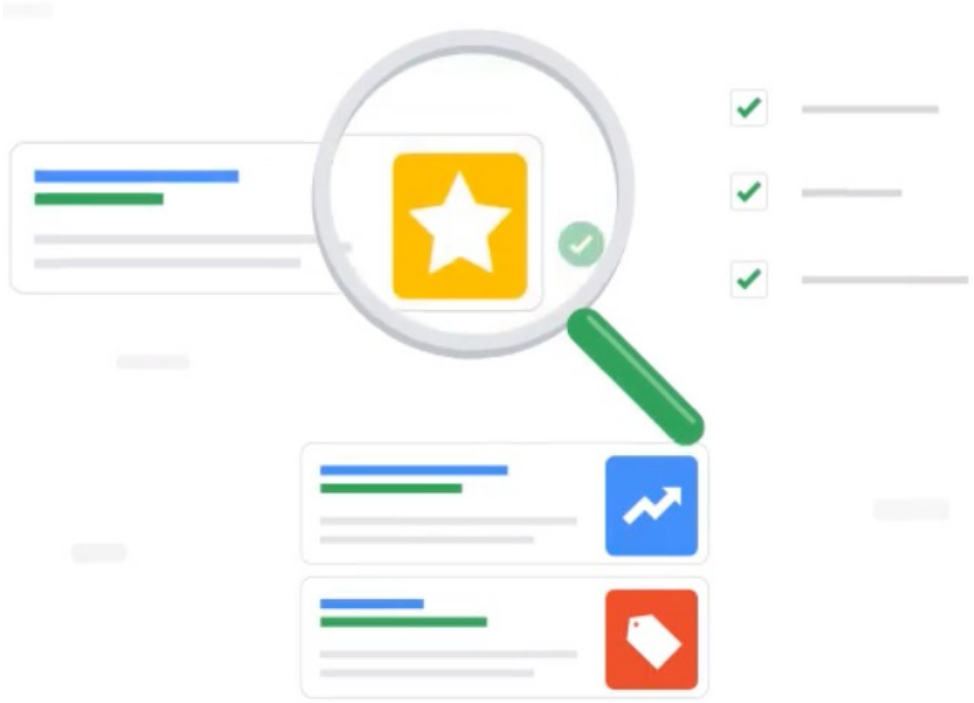
Adding the Taxonomy

Presentation layer (User Interface)

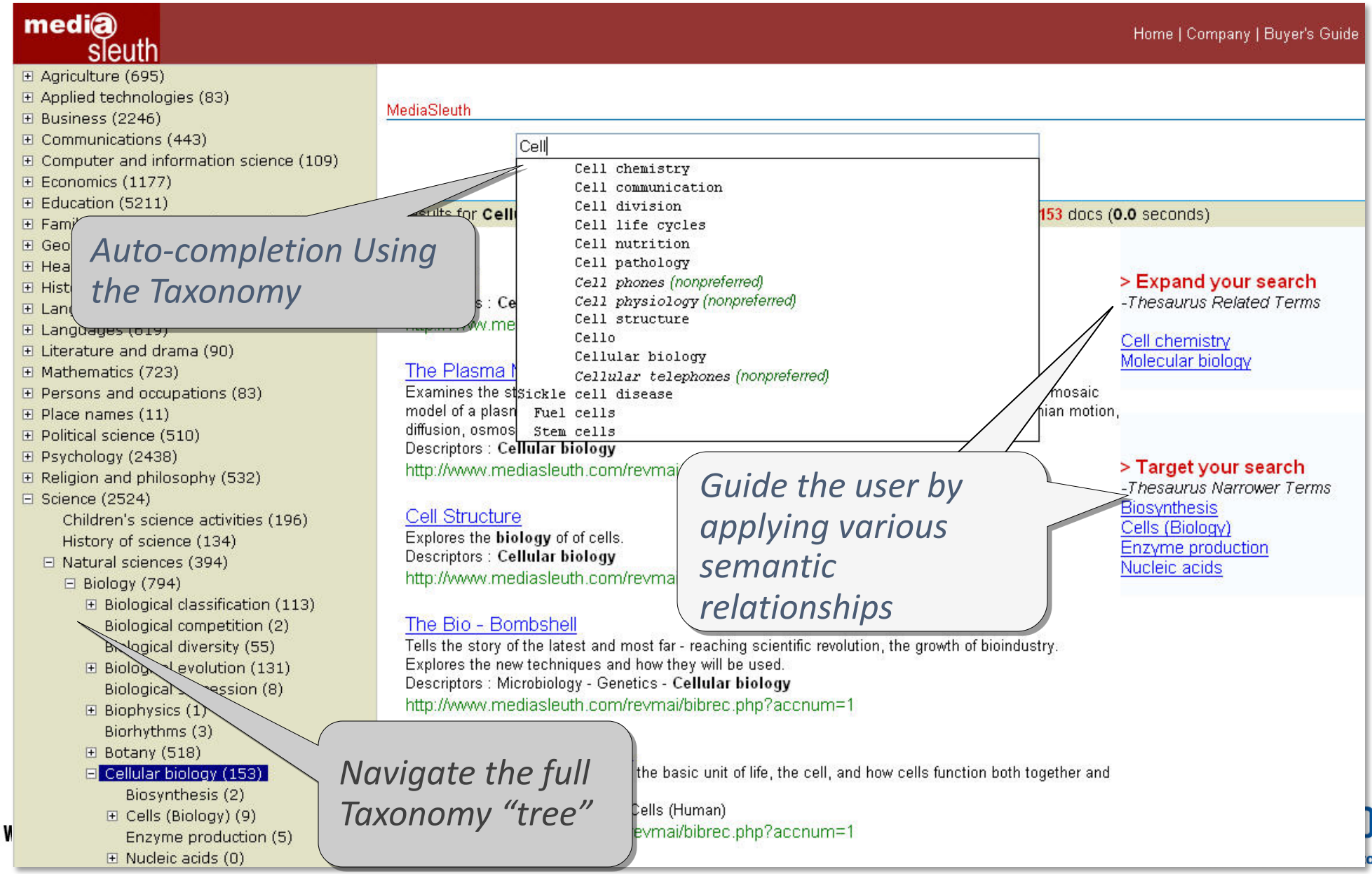

www.google.com/?client=safari
Google
About
Store
Gmail
Images
Google Search
I'm Feeling Lucky
Just give me Google!
Advertising
Business
How Search works
Carbon neutral since 2007
Privacy
Terms
Settings

# Google

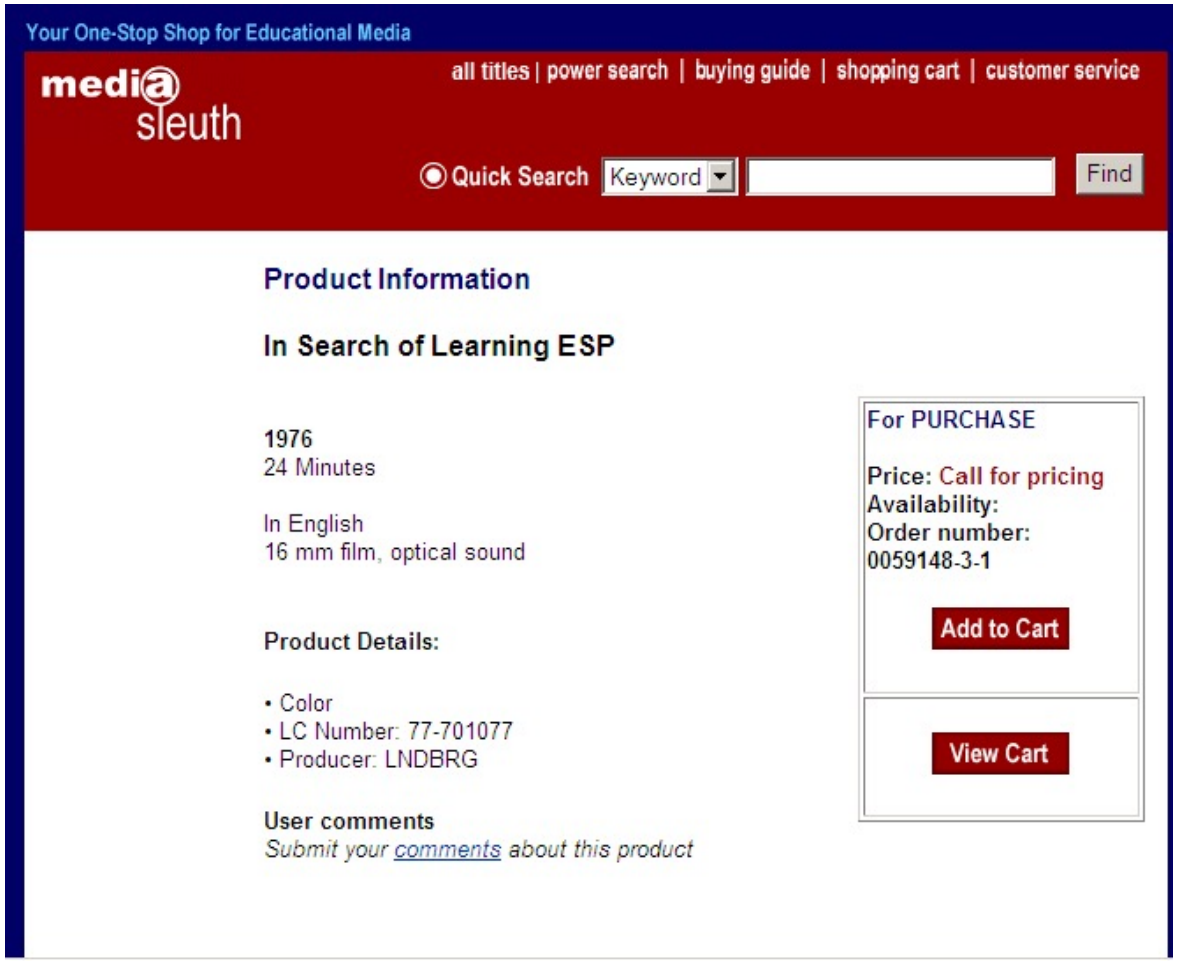
- Billions of pages
- Trillions of queries
  - 15% new topics each day
- User Contributed Content
- Ranking of pages
- Synonyms
- Interpretive meaning of query
  - understanding exactly what you mean and giving you back exactly what you want
- Doesn't work on small collections



# Taxonomy Search

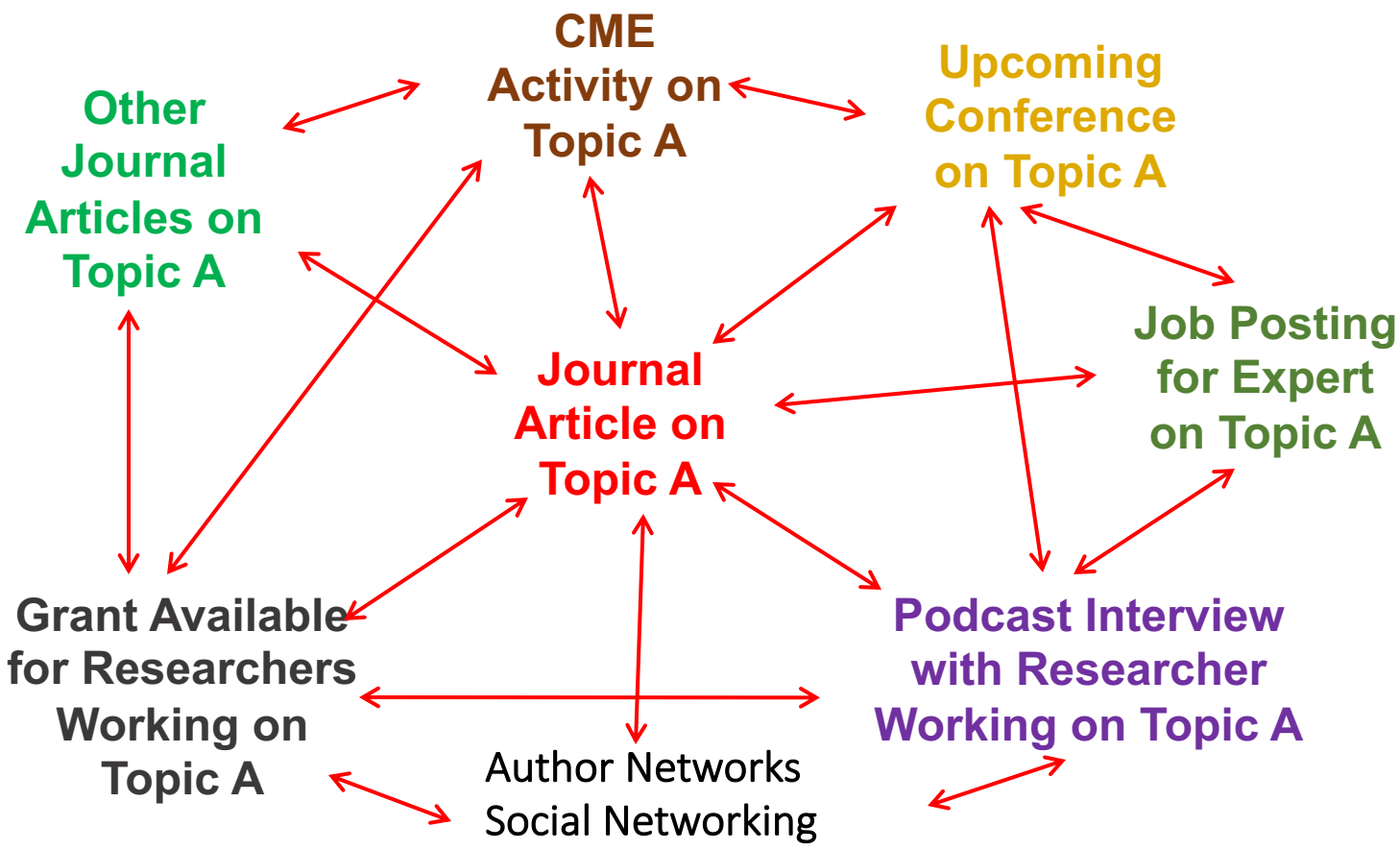


Direct link to e-commerce to improve sales




Link search and taxonomy directly to the supply or documents or by redirecting to a shopping cart

# Link to Additional Resources



# Sample Linked Page

**Cancer Epidemiology Biomarkers & Prevention**
Vol. 12, 161-164,
February 2003
© 2003 American Association for Cancer Research
**Short Communications**

## Alcohol, Folate, Methionine, and Risk of Incident Breast Cancer in the American Cancer Society Cancer Prevention Study II Nutrition Cohort

**Heather Spencer Feigelson[1], Carolyn R. Jonas, Andreas S. Robertson, Marjorie L. McCullough, Michael J. Thun and Eugenia E. Calle** Department of Epidemiology and Surveillance Research, American Cancer Society, National Home Office, Atlanta, Georgia 30329-4251

Recent studies suggest that the increased risk of breast cancer associated with alcohol consumption may be reduced by adequate folate intake. We examined this question among 66,561 postmenopausal women in the American Cancer Society Cancer Prevention Study II Nutrition Cohort.

**Related Press Releases**
- How What and How Much We Eat (And Drink) Affects Our Risk of Cancer
- Novel COX-2 Combination Treatment May Reduce Colon Cancer Risk Combination Regimen of COX-2 Inhibitor and Fish Oil Causes Cell Death
- COX-2 Levels Are Elevated in Smokers

**Related AACR Workshops and Conferences**
- Frontiers in Cancer Prevention Research
- Continuing Medical Education (CME)
- Molecular Targets and Cancer Therapeutics

**Related Meeting Abstracts**
- Association between dietary folate intake, alcohol intake, and methylenetetrahydrofolate reductase C677T and A1298C polymorphisms and subsequent breast
- Folate, folate cofactor, and alcohol intakes and risk for colorectal adenoma
- Dietary folate intake and risk of prostate cancer in a large prospective cohort study

**Related Working Groups**
- Finance
- Charter
- Molecular Epidemiology

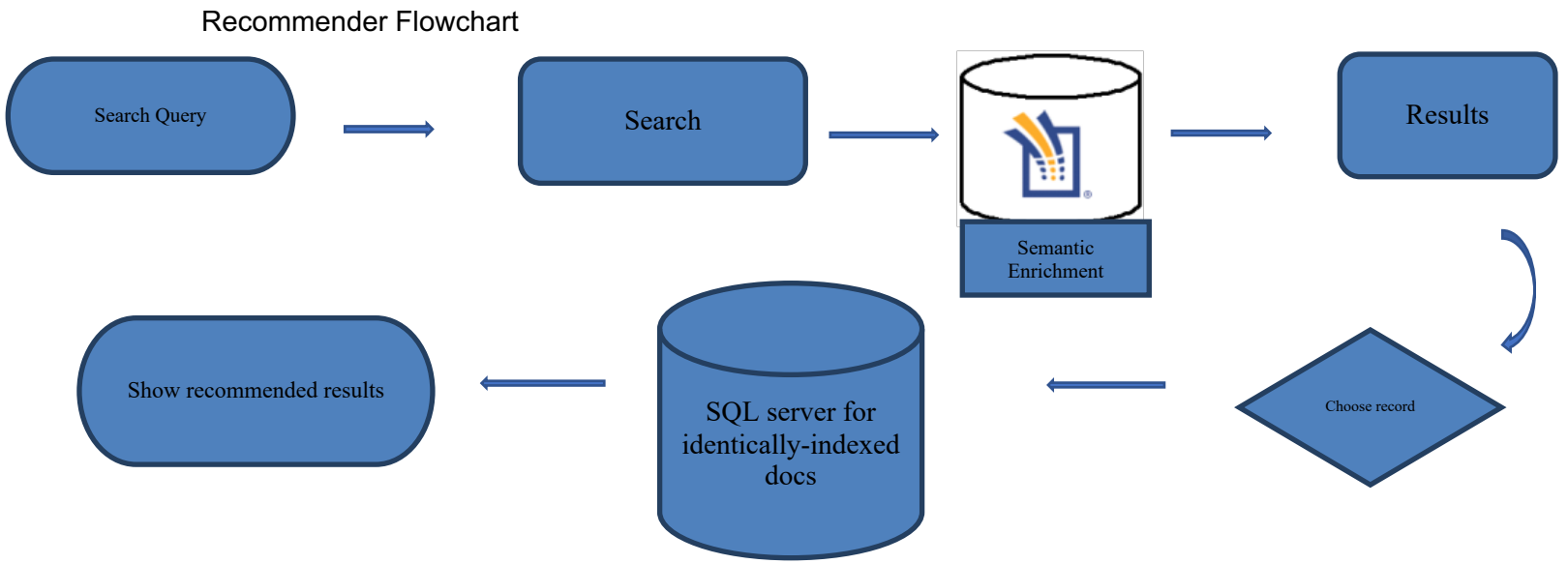
**Webcasts**
Related Webcasts

**Think Tank Report**
Related Think Tank Report Content

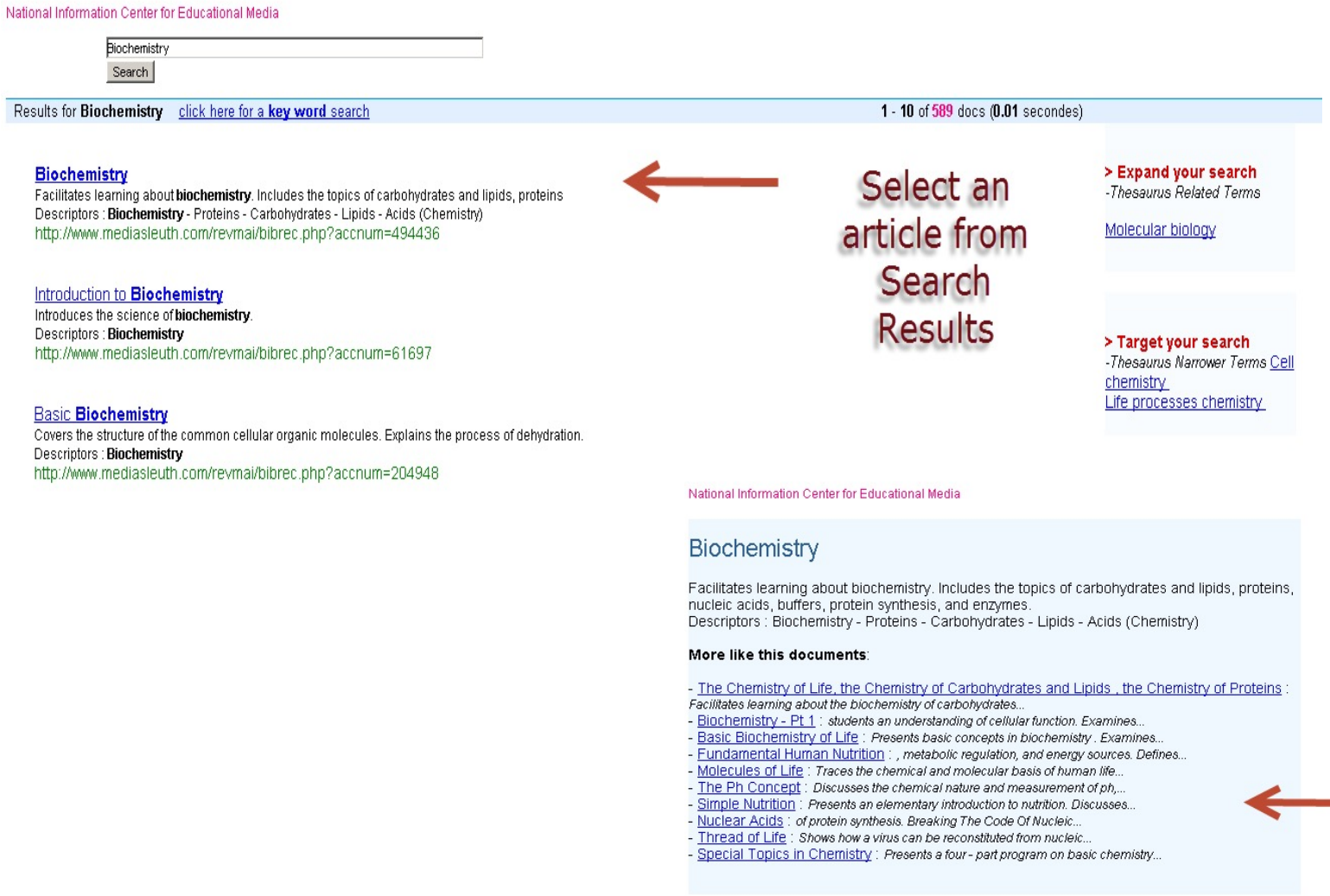
**Related Awards**
- AACR-GlaxoSmithKline Clinical Cancer Research Scholar Awards
- ACS Award
- Weinstein Distinguished Lecture

**Related Education Book Content**
Oral Contraceptives, Postmenopausal Hormones, and Breast Cancer
Physical Activity and Cancer
Hormonal Interventions: From Adjuvant Therapy to Breast Cancer Prevention

# Recommender

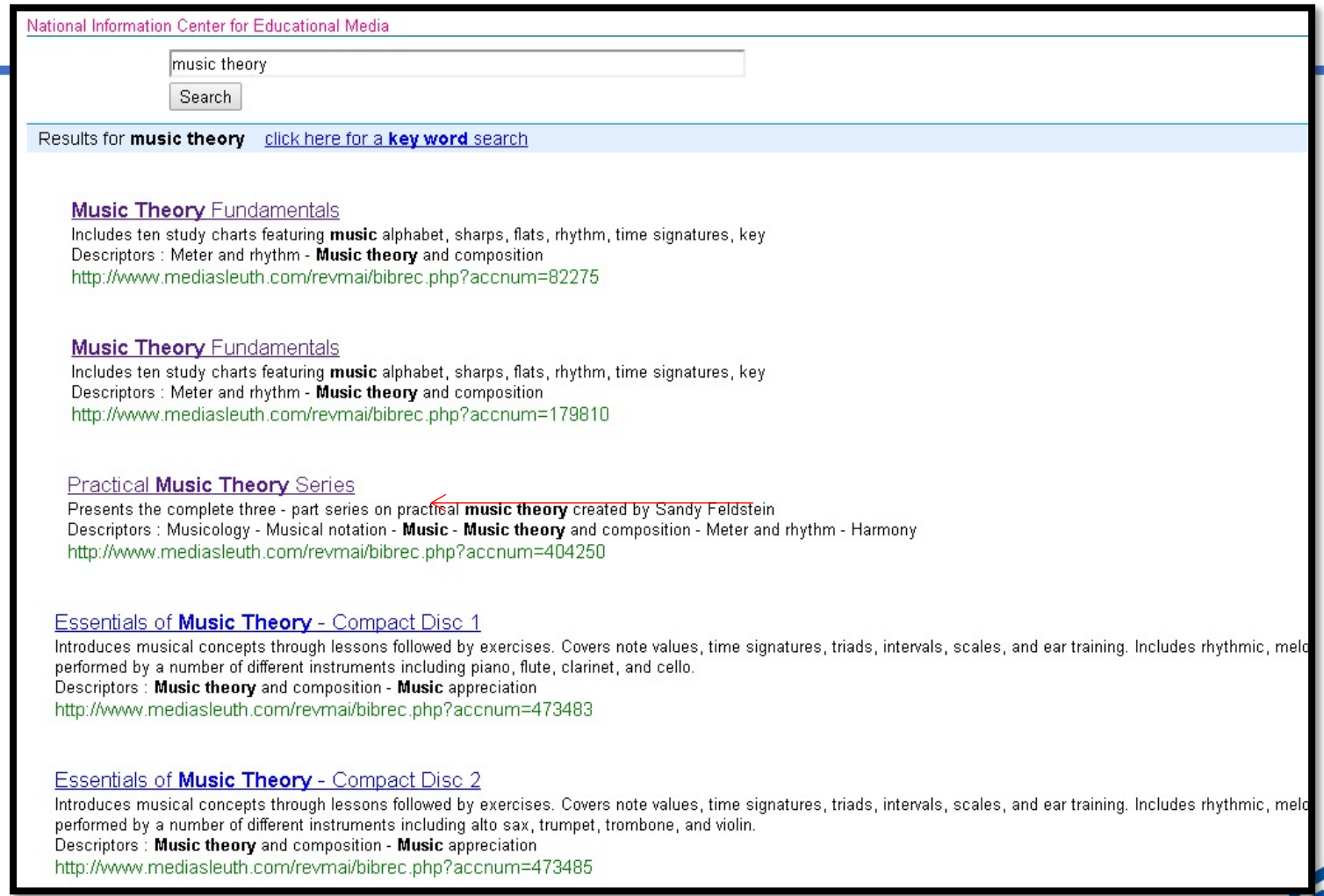


# Recommender




After an article is selected, a machine-to-machine call is made to your indexed corpus to retrieve articles with identical indexing parameters

# Content Recommender


National Information Center for Educational Media

music theory

Search

Results for **music theory** click here for a **key word** search

**Music Theory** Fundamentals
Includes ten study charts featuring **music** alphabet, sharps, flats, rhythm, time signatures, key
Descriptors : Meter and rhythm - **Music theory** and composition
http://www.mediasleuth.com/revmai/bibrec.php?accnum=82275

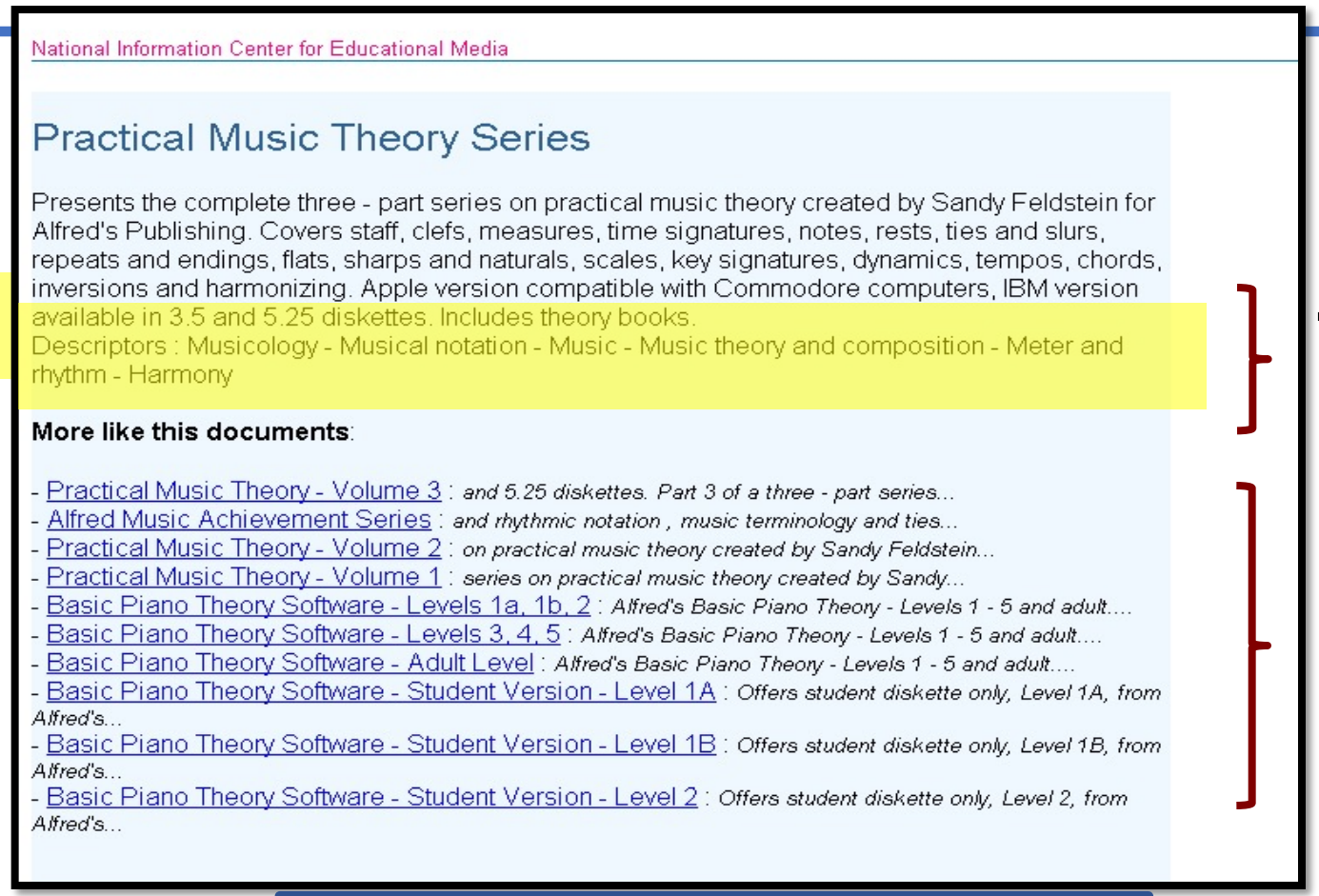
**Music Theory** Fundamentals
Includes ten study charts featuring **music** alphabet, sharps, flats, rhythm, time signatures, key
Descriptors : Meter and rhythm - **Music theory** and composition
http://www.mediasleuth.com/revmai/bibrec.php?accnum=179810

Practical **Music Theory** Series
Presents the complete three - part series on practical **music theory** created by Sandy Feldstein
Descriptors : Musicology - Musical notation - **Music** - **Music theory** and composition - Meter and rhythm - Harmony
http://www.mediasleuth.com/revmai/bibrec.php?accnum=404250

Essentials of **Music Theory** - Compact Disc 1
Introduces musical concepts through lessons followed by exercises. Covers note values, time signatures, triads, intervals, scales, and ear training. Includes rhythmic, melo
performed by a number of different instruments including piano, flute, clarinet, and cello.
Descriptors : **Music theory** and composition - **Music** appreciation
http://www.mediasleuth.com/revmai/bibrec.php?accnum=473483

Essentials of **Music Theory** - Compact Disc 2
Introduces musical concepts through lessons followed by exercises. Covers note values, time signatures, triads, intervals, scales, and ear training. Includes rhythmic, melo
performed by a number of different instruments including alto sax, trumpet, trombone, and violin.
Descriptors : **Music theory** and composition - **Music** appreciation
http://www.mediasleuth.com/revmai/bibrec.php?accnum=473485

# Content Recommender



National Information Center for Educational Media

## Practical Music Theory Series

Presents the complete three - part series on practical music theory created by Sandy Feldstein for Alfred's Publishing. Covers staff, clefs, measures, time signatures, notes, rests, ties and slurs, repeats and endings, flats, sharps and naturals, scales, key signatures, dynamics, tempos, chords, inversions and harmonizing. Apple version compatible with Commodore computers, IBM version available in 3.5 and 5.25 diskettes. Includes theory books.
Descriptors : Musicology - Musical notation - Music - Music theory and composition - Meter and rhythm - Harmony

**More like this documents**:

- Practical Music Theory - Volume 3 : *and 5.25 diskettes. Part 3 of a three - part series...*
- Alfred Music Achievement Series : *and rhythmic notation , music terminology and ties...*
- Practical Music Theory - Volume 2 : *on practical music theory created by Sandy Feldstein...*
- Practical Music Theory - Volume 1 : *series on practical music theory created by Sandy...*
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Thesaurus terms

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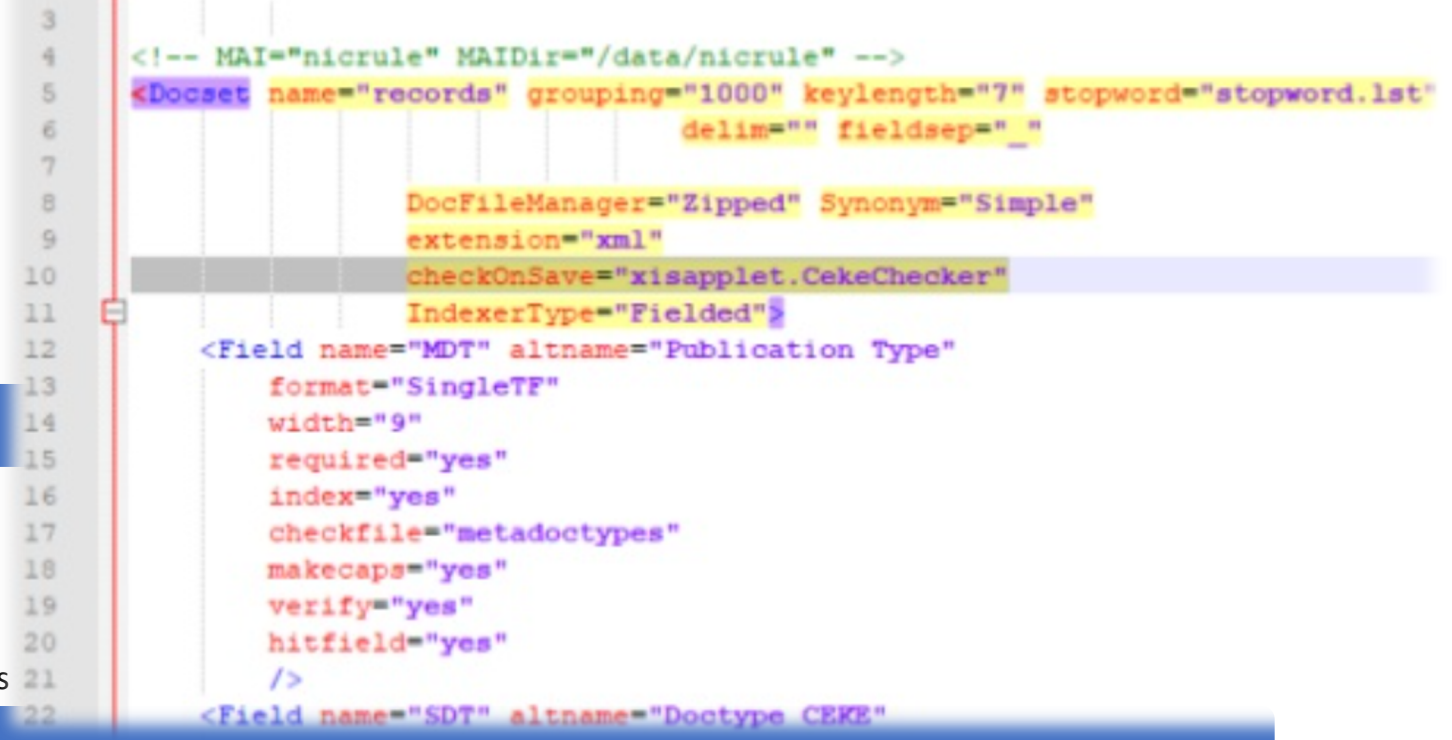
# Search Leverage




## Search Priority Using the Thesaurus terms

- Better precision and recall in search
- No false presentations
- Insures full coverage of publications
- Synonymy fully expanded to match the thesaurus
- Searches the thesaurus terms first on the tagged documents

## Triple store leverage

- Provide new connection options in search
- Expand the connections users can make

## Knowledge graph presentations for an expanded user experience

## Integration first with the current user interface

## Expand the options for the users with the new technology behind the scenes

# Word and Term Parsing In Search

## Stemming

- -ing, -ed, -es, -'s, -s', etc.
- Depluralization

## Truncation

- Left and right

## Wild cards

- Organi*ation

## Variant Spellings

- Centre, center

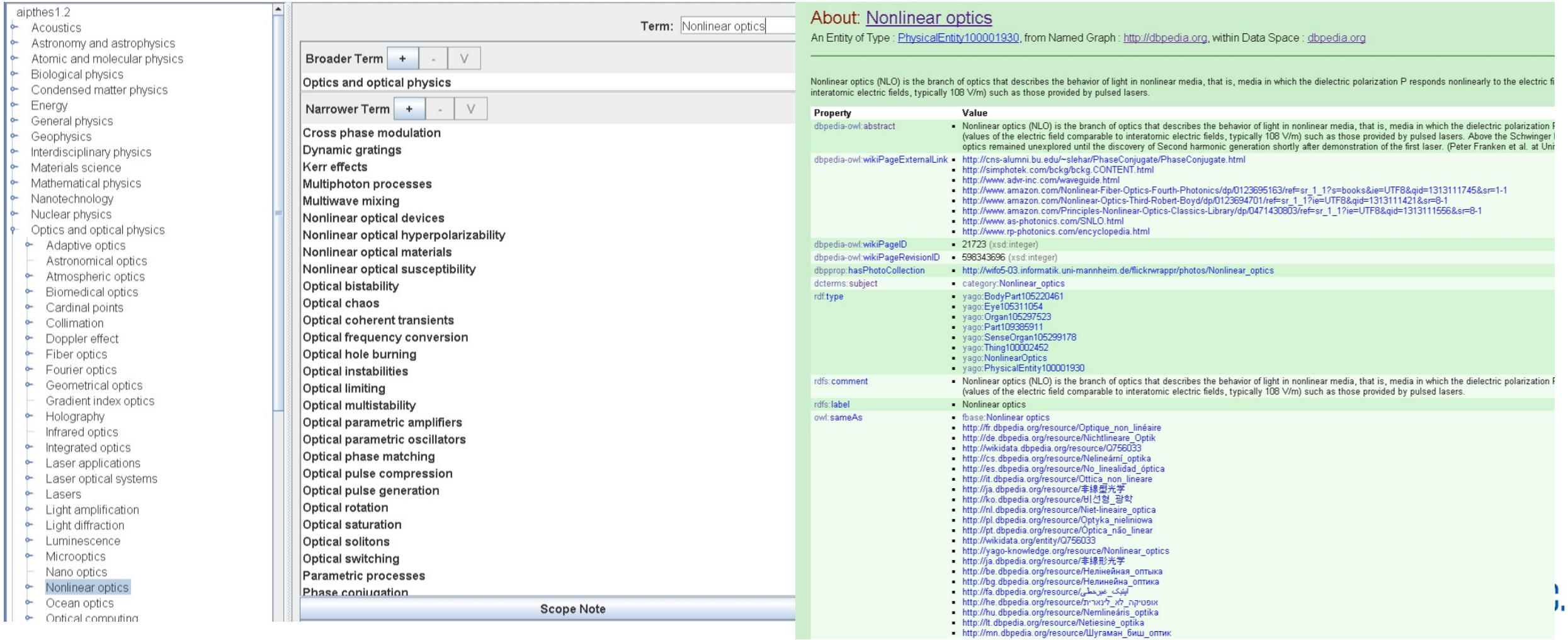
## Hyphens

# Search Taxonomy Terms First

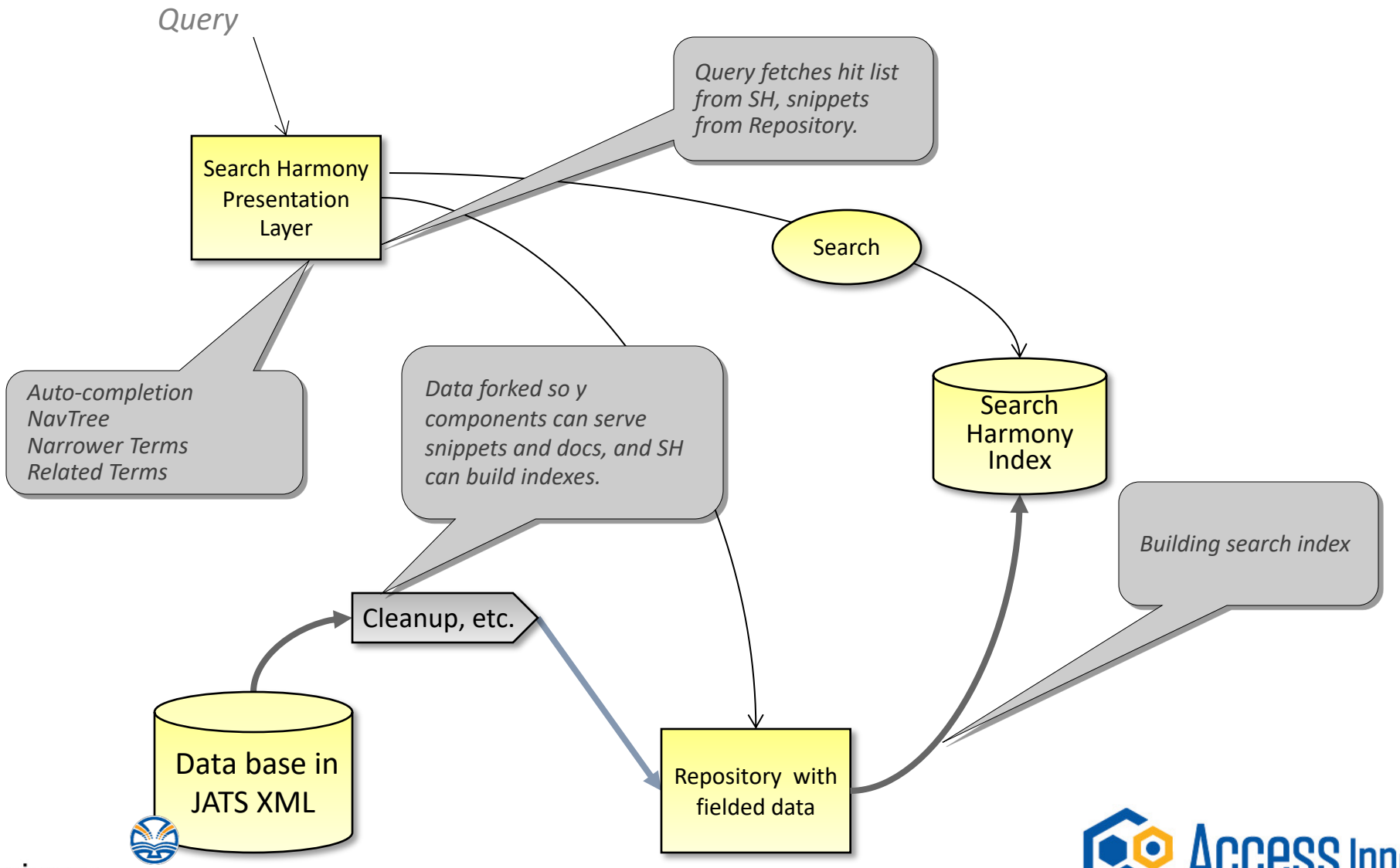
| Tag | Search | Add | Search |
| --- | --- | --- | --- |
| Tag the content with the taxonomy | Search the preferred form – taxonomy term first | BUT add all synonyms as equal to the term so they are all searched together | Then search body and abstract title<br>• If desired<br>• If no results on controlled terms |

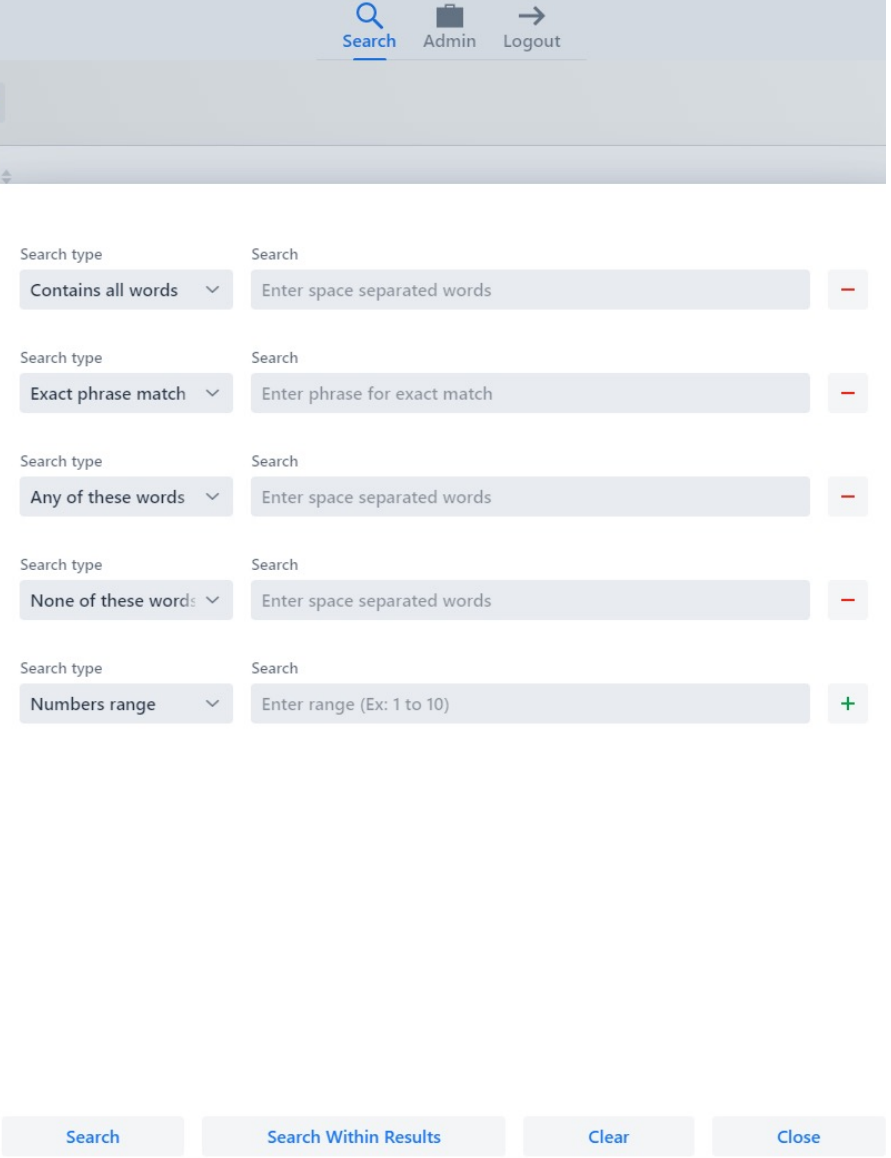
# Linked Data

Assert that the AIP Thesaurus term “Nonlinear optics” refers to the **same concept** as the dbpedia page “Nonlinear optics” by putting links in both places.



# Sample – Search Harmony Deployment






# The User Interface and Experience

- The most critical component
- User-driven features for speeding the delivery of content
  - A UI/X driven experience
    - For configuring document structures
    - Creates and displays API calls to retrieve/store data
      - user may copy and paste into their application layer
    - Allow for on the fly changes to the document schema
      - Can be configured to automatically serve and update the API settings with no need for input from the programmers

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ASCO Meeting Library

Session: Breast Cancer—Local/Regional/Adjuvant

# Cost-effectiveness of the Oncotype DX Breast Recurrence Score with node-positive early breast cancer based on the RxPONDER

Add to Collection

Abstract


**Authors:**
Vladislav Berdunov, Steve Millen, Andrew Paramore, Sarah Reynia, Nina Fryer, Georges; PHMR Ltd, London, United Kingdom; Exact Sciences, London, United Associates, East Molesey, United Kingdom


Abstract Disclosures


**Research Funding:**
Exact Sciences.



**Background:**
The Oncotype DX test is a predictive and prognostic multigene assay used to guide adjuvant chemotherapy in HR+/HER2- early breast cancer. The ability of the Oncotype DX test to predict the benefit of chemotherapy in node-positive early breast cancer was demonstrated in SWOG-8814. This evidence, in combination with findings from a bespoke analysis of the TransATAC study, informed an economic evaluation of the Oncotype DX test by the National Institute for Health and Care Excellence in the UK. This study examined the impact of new evidence from the RxPONDER trial on the cost-effectiveness of the Oncotype DX test in postmenopausal women with node-positive early breast cancer.

**Methods:**
The cost-effectiveness of the Oncotype DX test compared to clinical risk tools only in postmenopausal HR+/HER2- early breast cancer was estimated using a model in Microsoft Excel. The pre-RxPONDER analysis using the old cut points (RS 0-17, RS 18-30, RS 31-100) was informed by TransATAC and SWOG-8814. The model was updated with 5-year probability of distant recurrence as first site estimates based on new RS cut points (RS 0-25, RS 26-100) from RxPONDER. The impact on incremental lifetime costs and quality-adjusted life-years (QALYs) gained was examined based on the list price for the Oncotype DX test in the UK.


ASCO Meeting Library

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Laura Miotke, Christopher D

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| Subtrack: | Adjuvant Therapy |
| Abstract #: | 534 |
| Citation: | J Clin Oncol 39, 2021 (suppl 15; abstr 534) |
| DOI: | 10.1200/JCO.2021.39.15_suppl.534 |


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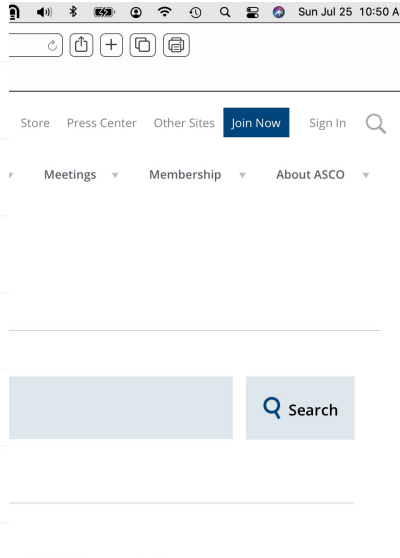


e DX Breast Recurrence
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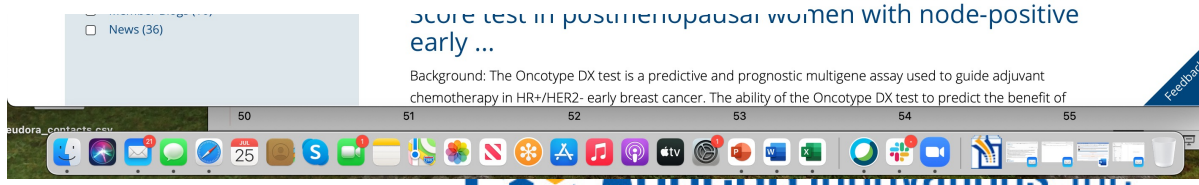
Background: The Oncotype DX test is a predictive and prognostic multigene assay used to guide adjuvant chemotherapy in HR+/HER2- early breast cancer. The ability of the Oncotype DX test to predict the benefit of

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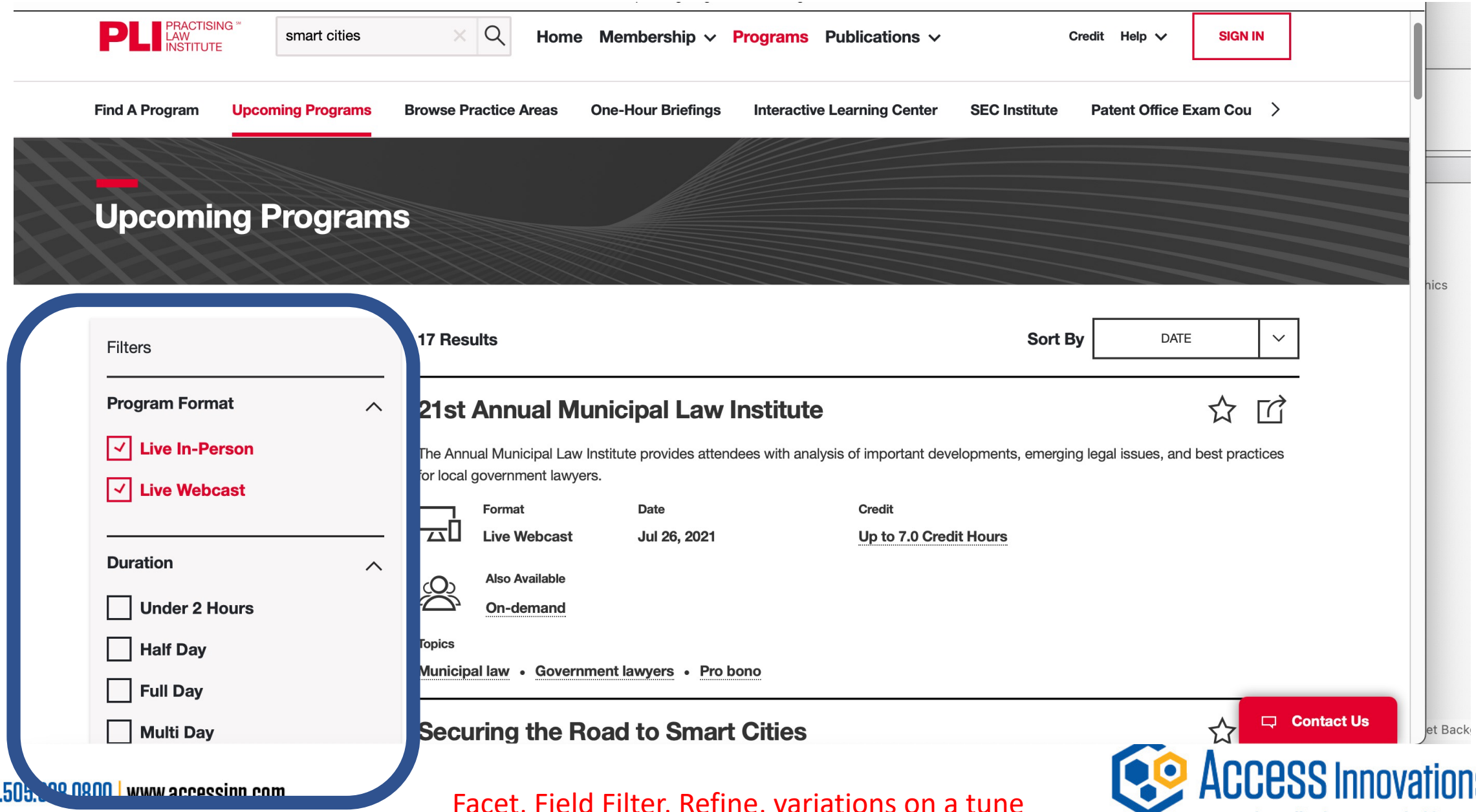


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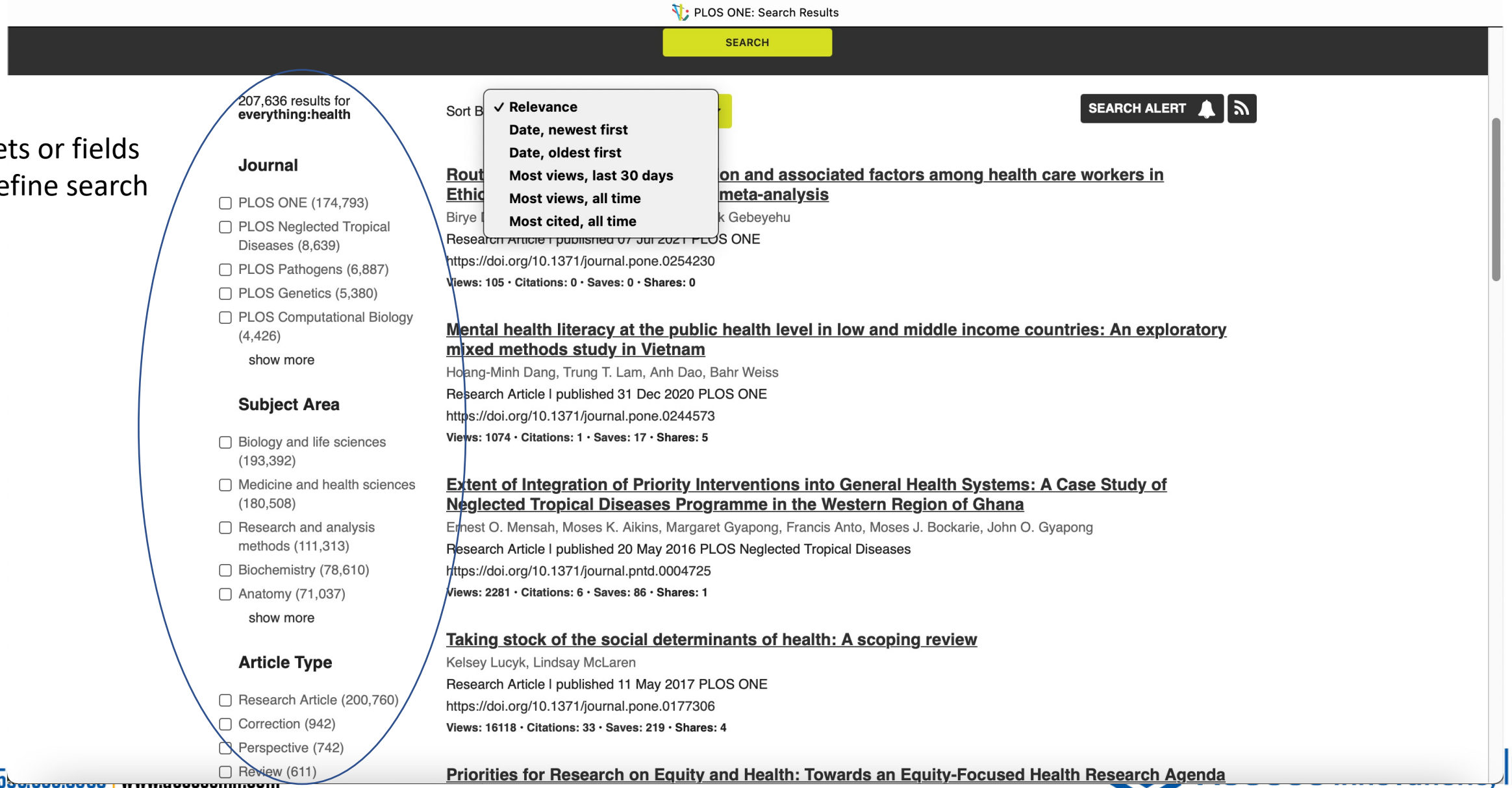
Facets or fields to refine search



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**https://www.asce.org/cemagazine/delivering-a-masterpiece/**

## P3 PROGRAM HELPS PENNSYLVANIA CUT BRIDGE DELIVERY TIME IN HALF

Kevin Wilcox

Magazine Article | February 14, 2017

An innovative program taps into private activity bonds and employs standardized designs to speed the replacement of structurally deficient spans.

**https://www.asce.org/ce-magazine/web-exclusives/articles/p3-program-helps-pennsylvania-cut-bridge-delivery-time-in-half/**

## TURN FOR THE BETTER

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Turn for the Better 2019-05-01 Keith R. Griesing, P.E., M.ASCE, and Brian J. Mileo, P.E. The Johnson Street Bridge has served as a critical link to the city of Victoria, British Columbia, Canada, for many...

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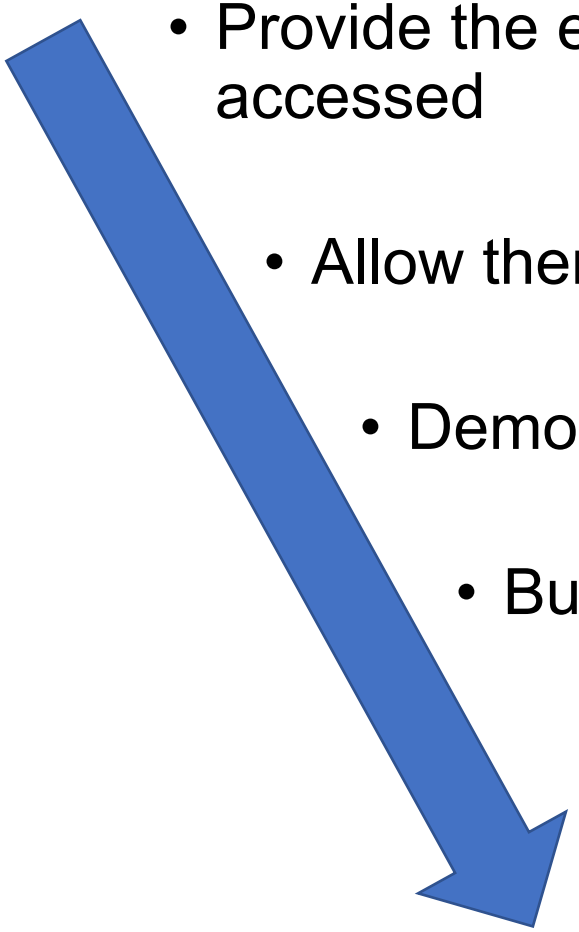
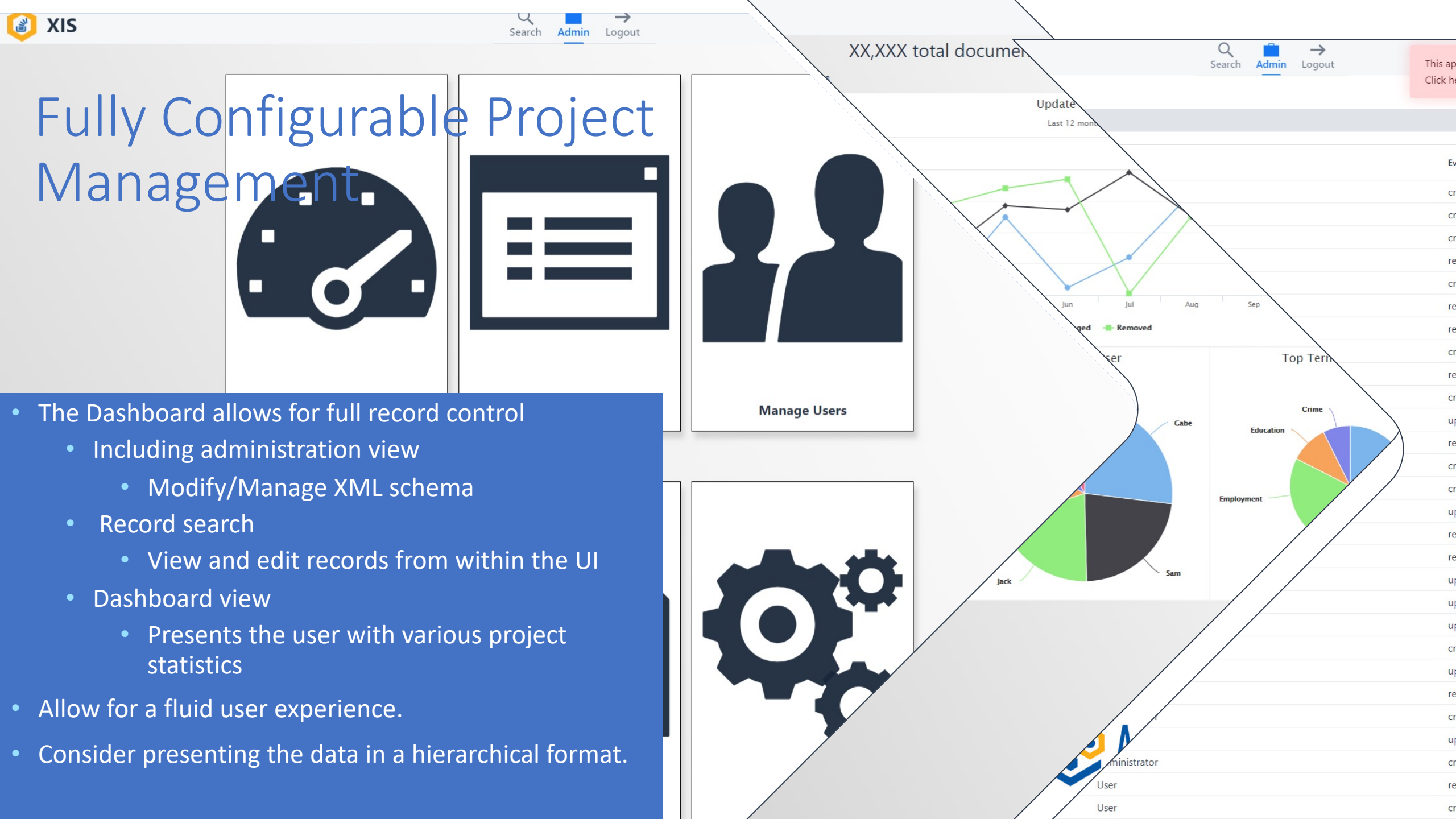
# User statistics and analytics

- Provide the end-user with a variety of analytics for how their data is accessed
- Allow them to make enhancements/improvements to their schemas
- Demonstrate the robustness and capability of the platform
- Builds consumer trust



# Fully Configurable Project Management




- The Dashboard allows for full record control
  - Including administration view
    - Modify/Manage XML schema
  - Record search
    - View and edit records from within the UI
  - Dashboard view
    - Presents the user with various project statistics
- Allow for a fluid user experience.
- Consider presenting the data in a hierarchical format.

# About Access Innovations

Access Innovations are experts in content creation, enrichment, and conversion services. We provide services to semantically enrich and tag raw text into highly structured data. We deliver clean, well-formed, metadata-enriched content so our clients can reuse, repurpose, store, and find their knowledge assets. We go beyond the standards to build taxonomies and other data control structures as a solid foundation for your information. Our services and software allow organizations to use and present their information to both internal and external constituents by leveraging search, presentation, and e-commerce. We change *search to found!*

*Quick Facts*

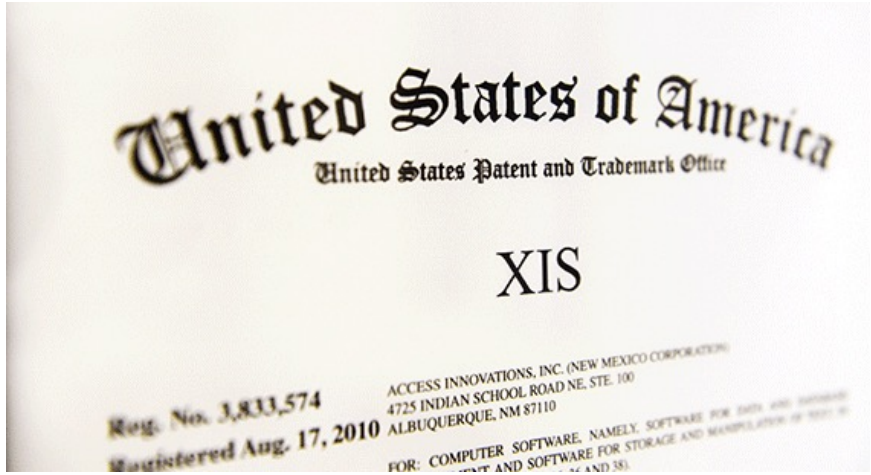
- Founded in 1978
- Headquartered in Albuquerque, NM
- Privately held
- Delivered more than 2000 engagements

# Our Software

- Data Harmony
  - XIS (XML Intranet System)®
  - M.A.I.® (Machine Aided Indexer)
  - Thesaurus Master ®

MAIstro™

Data Harmony Suite



## Core Modules

- MAIstro
  - MAI
  - Thesaurus Master
- XIS

## Extension Modules

- Search Harmony
- Smart Submit
- Semantic Fingerprinting

## Data Management

- Inline Tagging
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