MUSE KNOWLEDGE | HYBRID

SMART CONNECTOR TECHNOLOGY FOR FEDERATED SEARCH

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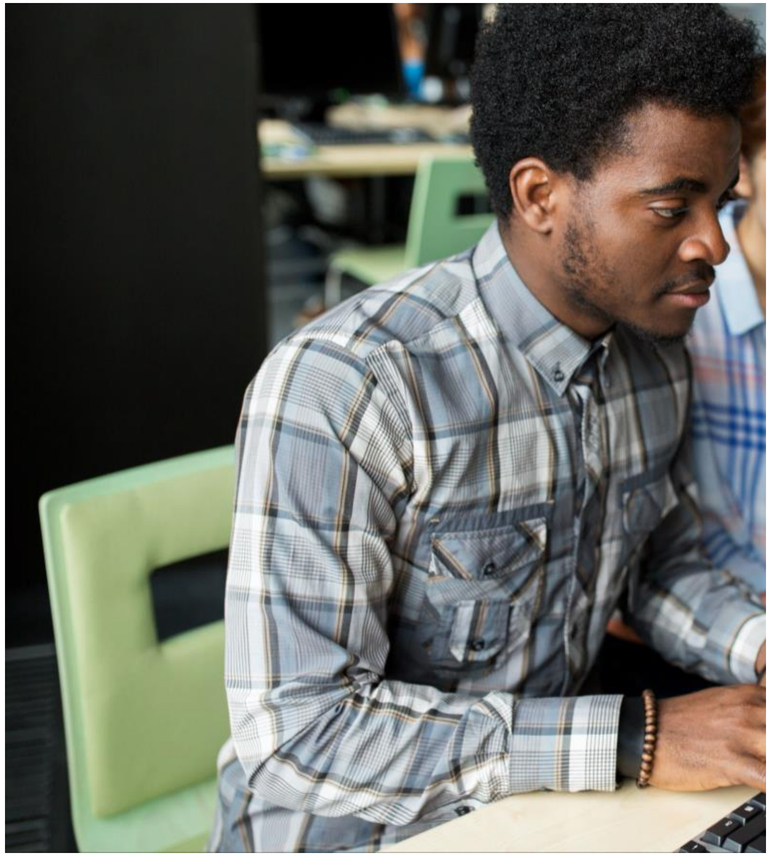
CURRENTLY…

There are two basic types of Search Engines:

- **Indexing Search**
    - A local Indexing Search creates an index from a repository of records, often on a "just in case" basis. The repository may be local (publisher, aggregator, etc.) or may be as wide as the whole Web (Bing, Baidu, Google, etc.)
    - Proprietary web index, such as Bing, Baidu, Google, etc.
    - Open Source Search (OSS) server, such as Apache Solr.
- **Federated Search**
    - A local Federated Search translates the user search and sends it to a number of remote Indexing Search Engines, and co-ordinates the results. Since there is no index this is an ad hoc, "just in time" search for each user
    - Only proprietary systems, largely due to the ongoing maintenance cost of the Connectors to the remote Sources
    - Muse, with its unique connector technology does this and is properly fit in the Federated Search category

PROBLEMS AND OPPORTUNITIES



Both types of Search Engines have their strengths and weaknesses:

- Indexing Search Weaknesses
  - Not all publishers provide meta-data
  - Lack of transparency, what is being indexed (which Journals/Databases), what period is covered
  - Out of date records due to delayed record indexing
  - Only metadata is indexed
  - Large, resource consuming software systems
  - Records are indexed and their index possibly never used
  - Maintenance of the index is an administrative chore due to various delivery formats and types
- Indexing Search Strengths
  - Having all records in the result set
  - Facets features and filtering
  - Browsing features
  - Query suggestions, spelling

PROBLEMS AND OPPORTUNITIES

Federated Search Weaknesses

- Inconsistent search results, depending on the Source
- Slow response times
- because of the extra communications involved
- because of the need to process every result record for normalization
- Incomplete coverage
- Unable to rank results well (meta-data differences, lack of info)
- Brings only a limited number of results from each searched source

Federated Search Strengths

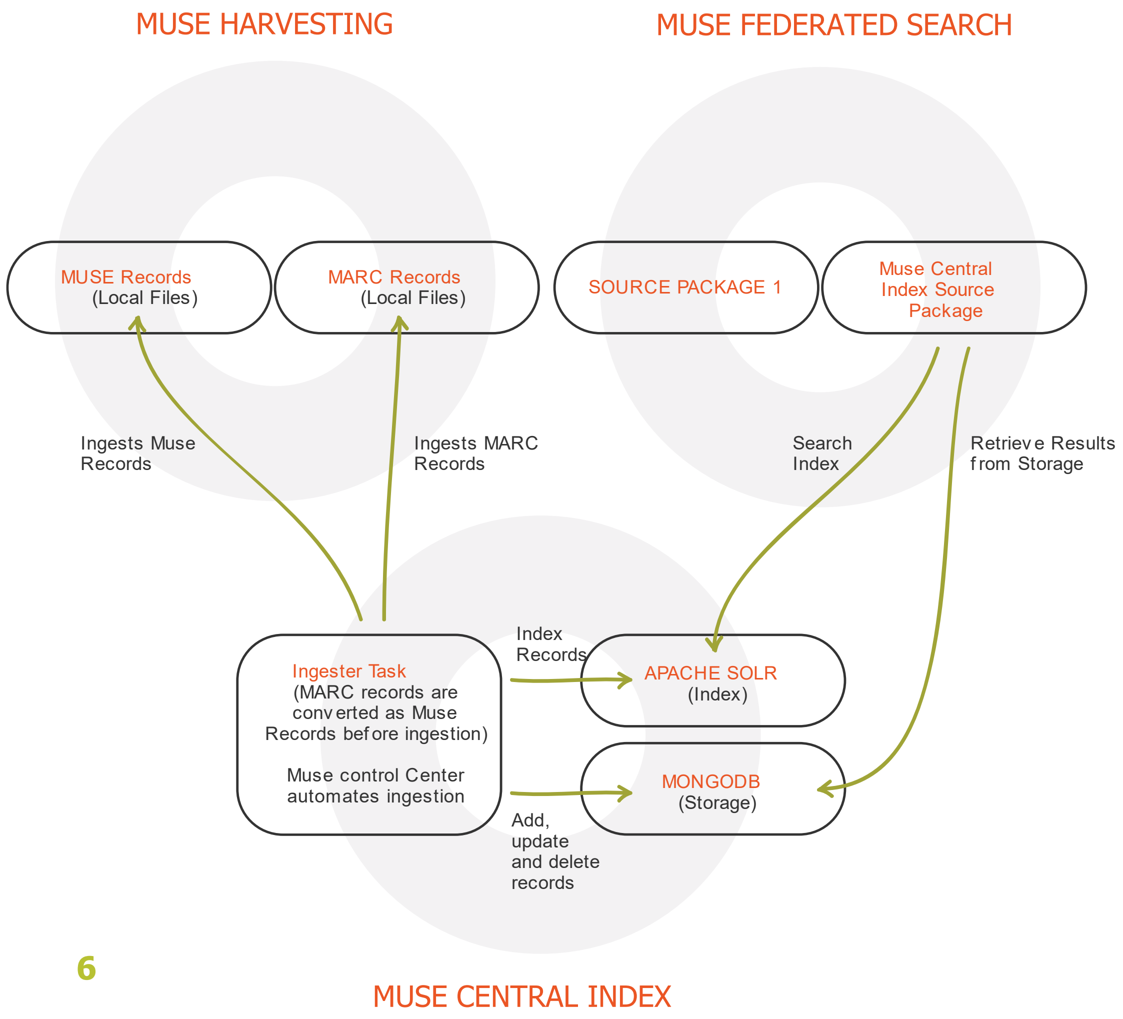
- The returned records are up to date, e.g. the latest information is immediately available with no efforts at all
- Integrate publisher platforms on various protocols: Atom, HTTP/HTML, HTTP/XML, JSON, NCIP, OAI-PMH, RSS1.0, RSS2.0, SIP2, SQL, SRU, SRW, Telnet, Z39.50
- The returned records match the native platforms
- Specialized research: medical, legal, etc.
- Wide range of subscribed content

MOVING FORWARD

Combine the strengths of Muse Federated Search platform with an available, high performance local Indexing Search to give the best of both worlds, without the drawbacks of either.

- **Combine standard** Indexing Search and Federated Search to optimize the powers of both
- **Run them together** to give rise to MuseKnowledge™ Hybrid Search (MuseKnowledge™ HY) which provides a next generation answer to the current problems
- **Index records** into Apache Solr and store the actual records content in database (MongoDB)
- **Search the index** and retrieve the records from the database
- **A harvesting component must** exist to collect the initial set of records and incremental updates
- **Muse Control Center** is the engine that drives the harvesting

MUSEKNOWLEDGE™ HYBRID SEARCH COMPONENTS



Muse Harvesting

- **Harvest records from publishers;** OAI-PMH, MARC records, Common Cartridge
- **Initial harvesting for getting records** up to current date
- **Incremental harvesting** for getting the periodical updates

Muse Central Index

- **Contains the index** (Apache Solr), storage (MongoDB) and the ingester tools
- **Records brought by** the Harvesting Component are processed by the ingester tool which indexes them and stores their content in the storage

Muse Federated Search Component

- **Runs Muse Applications** for end-users
- **Source Packages** that search the index and retrieve the records from the storage

MUSEKNOWLEDGE™ HARVESTING

Muse Knowledge™ Harvesting is a functional system that is used to harvest records for a Muse Knowledge™ Hybrid Search System.

Harvesting Connectors

- Screen scraping
- Database (JDBC, DBF local binary files)
- Custom XML (HTTP or local files)

Muse Harvesting Application

- Runs the Harvesting Source Packages
- Allows advanced editing of Muse Alerts

Muse Alerts

- Used to run the predefined searches for harvesting
- Allow granular time searches on minutes, hours, days, months, years

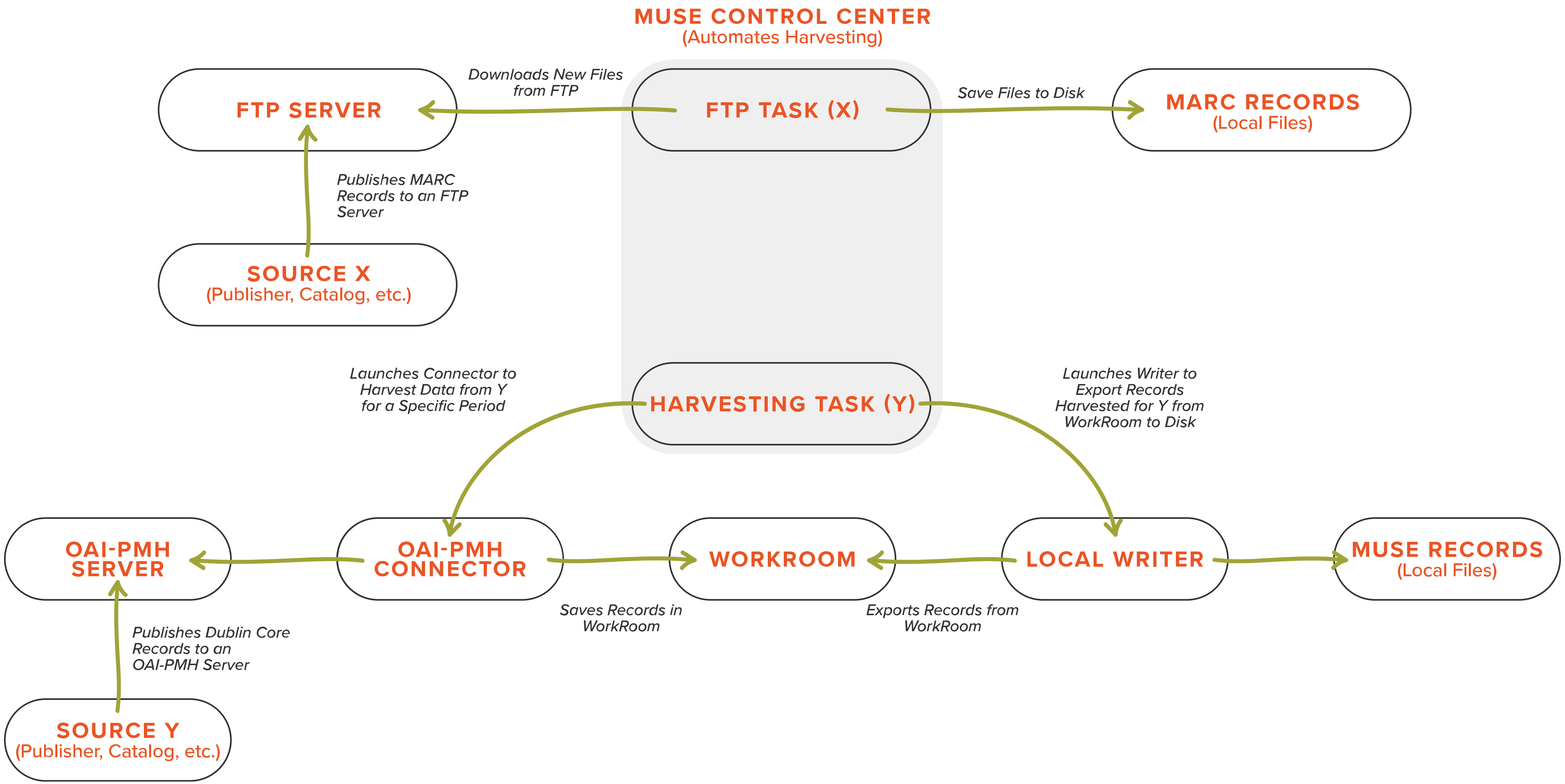
Writers

- Local files

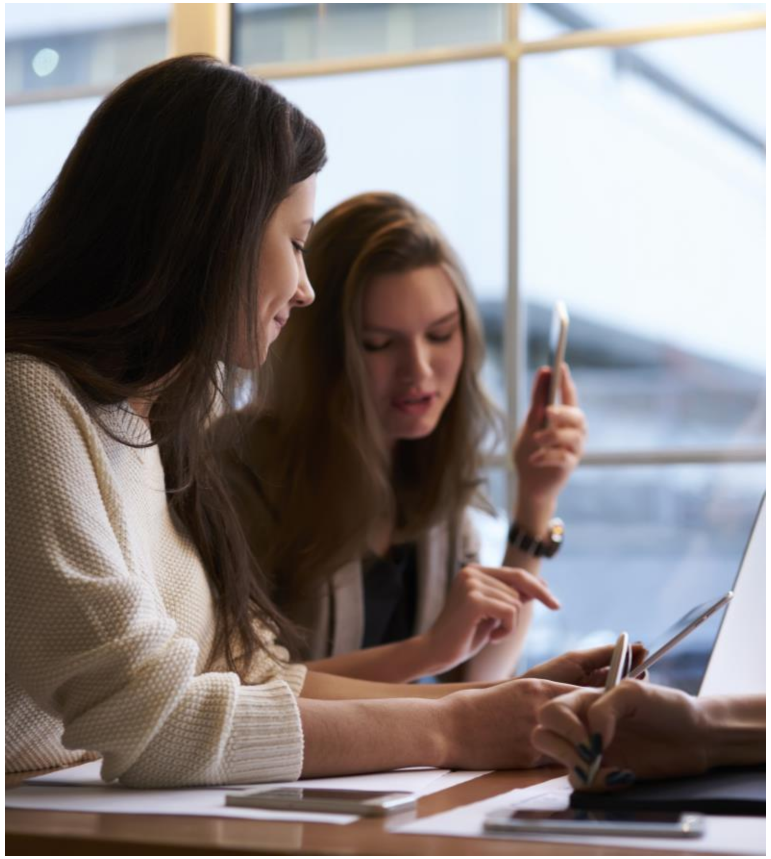
Muse Control Center

- Used for scheduling system tasks such as harvesting operations
- Supports other types of operations like FTP transfers, email and custom scripts; Complex workflows can be implemented via scripting

MUSEKNOWLEDGE™ HARVESTING



MUSEKNOWLEDGE™ HARVESTING OAI-PMH



About OAI-PMH

- OAI-PMH stands for "Open Archives Initiative Protocol for Metadata Harvesting”
- Protocol developed for harvesting (or collecting) metadata descriptions of records in an archive so that services can be built using metadata from many archives
- Publishers expose structured metadata via OAI-PMH
- It uses XML over HTTP

Support in MuseKnowledge™ Harvesting

- A Harvesting Connector for OAI-PMH protocol is available in Muse. It can harvest data selectively (date range), in oai_dc metadata format
- OAI-PMH Source Packages exist: EmeraldOAI, NatureOAI, ArXivOAI, etc.
- Generic Source Packages are also available

MUSEKNOWLEDGE™ HARVESTING MARC FILES

About MARC records

- **MA**chine-**R**eadable **C**ataloging
- Library catalogs keep records in MARC format
- Libraries provide MARC records using various methods: FTP repository, HTTP, email, etc.

Support in MuseKnowledge™ Harvesting

- MuseKnowledge™ Control Center is used to download MARC files from FTP; Custom scripts can be written to download MARC from HTTP
- Once MARC files are obtained they are indexed

When indexing MARC records, the following fields are used to determine the status of a record:

- The record id is obtained by concatenating the Control Number Identifier (003) and Control Number (001) fields
- The record datestamp is obtained from the Date and Time of Latest Transaction (005) field
- The record deleted status is obtained from the MARC record leader. If a record is marked as deleted, it will also be deleted from Muse Central Index

MUSEKNOWLEDGE™ HARVESTING COMMON CARTRIDGE®

About Common Cartridge®

- Standardized way to package and exchange digital learning materials and assessments
- Standardized way to exchange links and provide authorization to third party web-based learning tools via Learning Tools Interoperability
- Provides a standard way to represent digital course materials for use in online learning systems

Support in MuseKnowledge™ Harvesting

- MuseKnowledge™ Control Center is used to download Common Cartridge® archives from FTP; Custom scripts can be written to download Common Cartridge® archives from HTTP
- Once Common Cartridge® archives are obtained they are indexed

When indexing Common Cartridge® records, the following fields are used to determine the status of a record:

- The record id is obtained by concatenating the Organization Identifier, Root Item Identifier and the Record Identifier attributes
- The updates are ingested from scratch, like the initial ingest

MUSEKNOWLEDGE™ CENTRAL INDEX

MuseKnowledge™ Central Index is a collection of pre-harvested metadata and full text that is searched by the MuseKnowledge™ Hybrid Service.

- **The record format** used is a Dublin Core-based schema
- **Can index** e-book and article metadata, catalog records, and other information harvested from institutional repositories and other digital collections via the Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH)
- **Index**
  - Apache Solr is the most popular enterprise search engine
- **Storage**
  - The storage keeps all the records available in the Muse Central Index
  - MongoDB is a popular database engine
- **Ingester**
  - The process of adding or updating records in Muse Central Index is called ingesting
  - The MuseKnowledge™ Central Index Ingester can handle MARC records and Muse records
  - Ingested records are indexed in Apache Solr and stored in MongoDB

ABOUT APACHE SOLR AND MONGODB

Apache Solr

- **Open source** enterprise search platform built on Apache Lucene™ - java-based indexing and search technology
- **Powerful matching capabilities** including phrases, wildcards, joins, grouping and much more across any data type
- **Schema driven** indexing
- **Providing faceted search** and filtering, query suggestions and spelling
- **Support for** multi-tenant architectures
- **Performance** optimizations, scalability
- **Great developer** and user community

MongoDB

- **Fourth most widely mentioned** database engine on the web, and the most popular for document stores
- **Free and open source** cross-platform document-oriented database; NoSQL database, JSON like documents with dynamic schemas
- **Provides field, range queries,** regular expression searches. Queries can return specific fields of documents and also include user-defined JavaScript functions
- **Internal index** for quicker retrieval of records
- **Provides high availability** with replica sets
- **High scalability** using sharding

MUSEKNOWLEDGE™ HYBRID SEARCH SETUP

Evaluate the list of publishers from metadata availability point of view

Contact them for confirming and getting the metadata. Clarify the delivery of the periodical updates

Set up the harvesting:

- **For OAI-PMH delivery load** the corresponding OAI-PMH Source Packages into the Muse Harvesting Application and create the Muse Alert with the needed details, such as the extraction time frame. In MuseKnowledge™ Control Center setup and configure the Muse Alerts Task to run with the desired frequency for the saved alerts
- **For MARC records delivered** via FTP, set up in Muse Control Center an FTP download task

Set up the ingesting:

- **In MuseKnowledge™ Control Center** create and configure tasks for each harvested resource; Done via an Ant type task which calls the Muse Central Index Ingester tool with the following mandatory parameters:
    - Solr URL
    - MongoDB URI
    - ICE Records folder (for OAI-PMH harvested records) or MARC files location

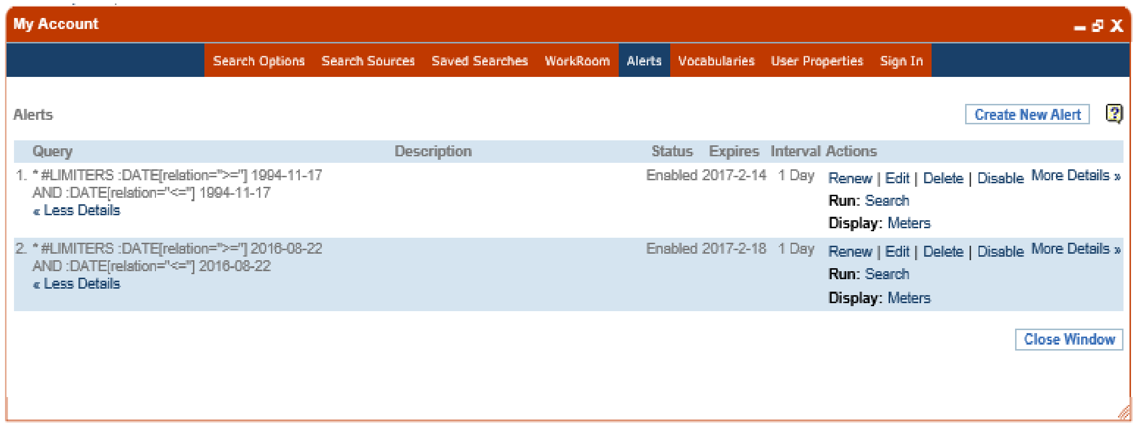
Searching:

- **In a Muse Search** (or MuseKnowledge™) Application add and configure Muse CentralIndex Source Packages
- **Generic Source Packages** are also available.

LINKING TO FULL TEXT

- **Mandatory to link** to publisher's platform for the full text
- **Usually the provided metadata contain** URLs to link to the record/journal/book on the native website
- **If an URL is not available** build one dynamically if possible. If a DOI identifier is available use it to form the URL to a DOI System Proxy Server, like dx.doi.org; Example:
  - http://dx.doi.org/10.1109/JSEE.2013.00023
- **Authentication to** the publisher's platform needs to be addressed as well; This is done with MuseKnowledge™ Proxy rewriting, e.g. all record URLs are being custom rewritten by appending it to the proxy prefix URL. Example:
  - http://PROXY_HOST:PROXY_PORT/ProxyApplication?qurl=RECORD_URL
- **The MuseKnowledge™ Proxy Application** (Proxy Application) must contain source profiles that cover the rewriting of all publishers URLs. A source profile for the dx.doi.org resource must exist as well
- **The authentication mechanism** to the MuseKnowledge™ Proxy Application must be considered as well: User/Password files, client IP addresses, client referer URL, standard or custom authentication methods (LDAP, IMAP, SQL, FTP), SAML, HMAC;

MUSEKNOWLEDGE™ HYBRID SEARCH DEMONSTRATION



Harvesting:

- **Harvesting Application:** MuseHarvesting, Source Packages installed: EmeraldOAI, NatureOAI
- Muse Alerts set

- **List of Publishers:** Springer/Nature, Thomson Reuters, Elsevier, Wolters Kluwer, Emerald Insight, IET, SAGE/AMDigital, Wiley, Gale, Digital Content Associates (Zinio, Atomic Training, Rosen Digital, InfoBase, ME Books, PressReader), RSC, Britannica, DarAlMandumah, Discovery, IEEE, Cambridge University Press, Ebsco, ProQuest
- **OAI-PMH providing publishers:** Nature, Emerald
- **MARC files providing publishers:** Springer, Wolters Kluwer, IET, SAGE, AMDigital, Gale, RSC, IEEE, Ebsco, InfoBase
- **Common Cartridge® providing publishers:** Discovery Education

MUSEKNOWLEDGE™ HYBRID SEARCH DEMONSTRATION

4	Emerald - Harvest OAI Start Delete Copy Edit Report	Alerts	Idle	☑	Record processing for Emerald.
23	Nature - Harvest OAI	Alerts	Done	☑	Historical record processing for Nature.

Muse Control Center tasks loaded:

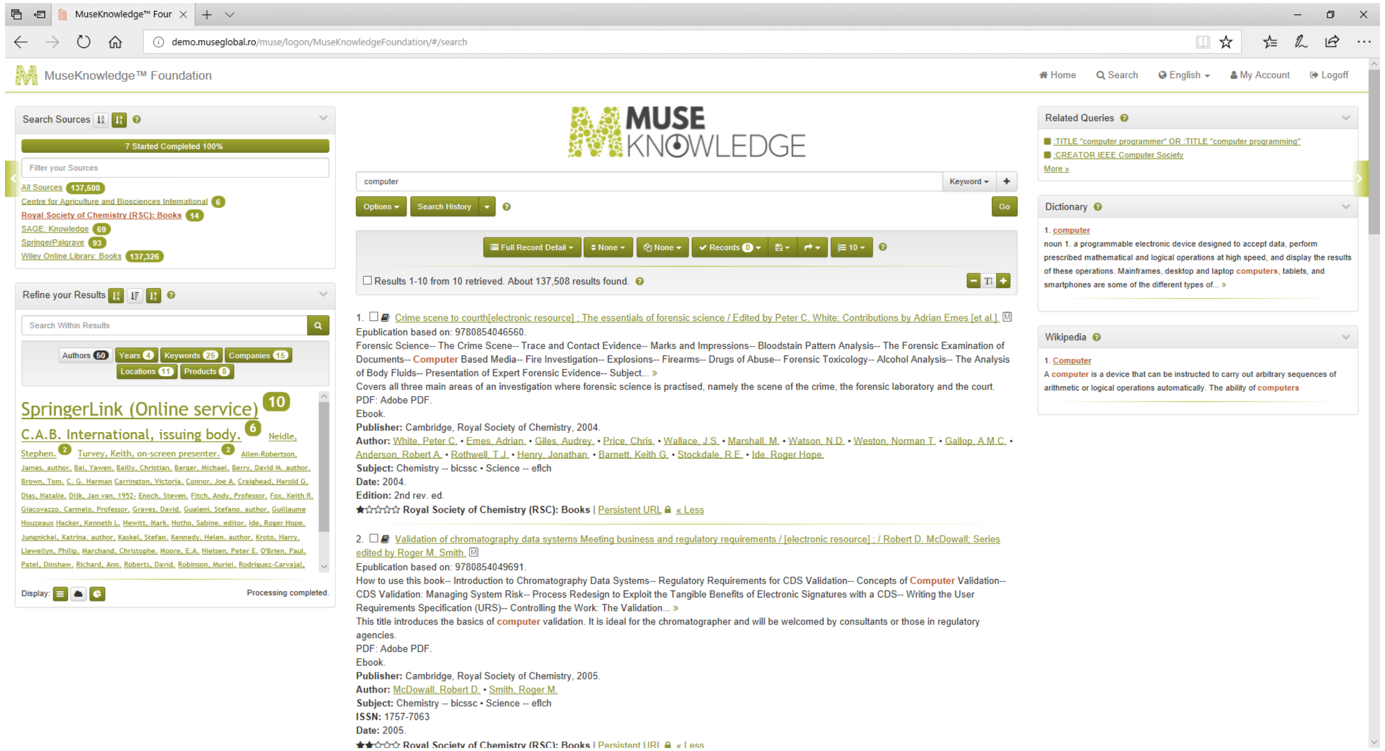
- For OAI-PMH harvesting

1	Muse Control Center Scheduler	Scheduler	Running	☑	This task generates time events for the other tasks to trigger at different moments of time (hourly, daily, weekly or monthly).
2	Reset	Ant	Idle	☑	No description available.
3	SpringerProtocols - Ingest MARC	Ant	Idle	☑	Record ingesting for Springer Protocols.
4	Emerald - Harvest OAI Start Delete Copy Edit Report	Alerts	Idle	☑	Record processing for Emerald.
5	Emerald - Ingest XML	Ant	Idle	☑	Record ingesting for Emerald.
6	AMDigitalCPA - Ingest MARC	Ant	Idle	☑	Record ingesting for Adam Matthew: Confidential Print: Africa, 1834-1966
7	AMDigitalCPME - Ingest MARC	Ant	Idle	☑	Record ingesting for Adam Matthew: Confidential Print: Middle East, 1839-1969
8	IEEE - Ingest MARC	Ant	Idle	☑	Record ingesting for IEEE Xplore Digital Library.
9	RSCBooks - Ingest MARC	Ant	Idle	☑	Record ingesting for RSCBooks.
10	GaleMiddleEastArabIsraeli - Ingest MARC	Ant	Idle	☑	Record ingesting for Gale: the Middle East Online: Arab-Israeli relations, 1917-1970
11	GaleMiddleEastIraq - Ingest MARC	Ant	Idle	☑	Record ingesting for Gale: the Middle East Online: Iraq, 1914-1974
12	GaleNGMA - Ingest MARC	Ant	Idle	☑	Record ingesting for Gale: National Geographic Magazine Archive
13	SAGEKnowledge - Ingest MARC	Ant	Idle	☑	Record ingesting for SAGEKnowledge.
14	Ovid - Ingest MARC	Ant	Idle	☑	Record ingesting for Ovid.
15	EbscoArabWorldResearch - Ingest MARC	Ant	Idle	☑	Record ingesting for Ebsco Arab World Research.
16	EbscoPrimarySearch - Ingest MARC	Ant	Idle	☑	Record ingesting for Ebsco Primary Search.
17	EbscoMiddleSearchPlus - Ingest MARC	Ant	Idle	☑	Record ingesting for Ebsco Middle Search Plus.
18	EbscoGreenFILE - Ingest MARC	Ant	Idle	☑	Record ingesting for Ebsco GreenFILE.
19	EbscoMASUltra - Ingest MARC	Ant	Idle	☑	Record ingesting for Ebsco MAS Ultra.
20	InfobaseScienceOnline - Ingest MARC	Ant	Idle	☑	Record ingesting for Infobase Science Online.
21	SpringerEbooks - Ingest MARC	Ant	Idle	☑	Record ingesting for Springer Ebooks.
22	SpringerPalgrave - Ingest MARC	Ant	Idle	☑	Record ingesting for Springer Palgrave.
23	Nature - Harvest OAI	Alerts	Done	☑	Historical record processing for Nature.
24	Nature - Ingest XML	Ant	Done	☑	Record ingesting for Nature.
25	TheIET - Ingest MARC	Ant	Idle	☑	Record ingesting for TheIET.

Ingesting:

- For OAI-PMH and MARC files

MUSEKNOWLEDGE™ HYBRID SEARCH DEMONSTRATION



Search:

- **MuseSearch Application** with Muse Central Index Source Packages
- **Individual Source Packages** for each publisher/product:
  - MuseCentralIndexEbscoAWR
  - MuseCentralIndexEmerald MuseCentralIndexIEEE
  - MuseCentralIndexNature
  - MuseCentralIndexNature, etc.

REFERENCES

- Muse Central Index.pdf
- Muse Harvesting Overview.pptx

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