Federated Search: New Option for Libraries in the Digital Era

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Abstract

The article describes the concept of federated searching and demarcates the difference between metasearching and federated searching which are synonymously used. Due to rapid growth of scholarly information, need of federated searching arises. Advantages of federated search have been described along with the search model indicating old search model and federated search model. Various technologies used for federated searching have been discussed. While working with search, the selection of federated search engine and how it works in libraries and other institutions are explained. Article also covers various federated search providers and at the end system advantages and drawbacks in federated search have been listed.

Keywords: Federated Search, Meta Search, Google Scholar, SCOPUS, XML, SRW

1.   Introduction

In the electronic information environment one of the responses to the problem of bringing large amounts of information together has been for libraries to introduce portals. A portal is a gateway, or a point where users can start their search for information on the web. There are a number of different types of portals, for example universities have been introducing "institutional portals", which can be described as "a layer which aggregates, integrates, personalizes and presents information, transactions and applications to the user according to their role and preferences" (Dolphin, Miller & Sherratt, 2002). A second type of portal is a "subject portals". A third type of portal is a "federated search tool" which brings together the resources to a library subscribes and allows cross-searching of these resources. They work using the Z39.50 protocol used by database suppliers to enable communication between computers. This protocol is not always effective because database suppliers have not always adopted it consistently so other protocols are also used such as HTML, XML and SQL (Lewis, 2002). Since these tools access resources that the library pays for, some type of authentication is required to ensure.

Well before the launch of the World Wide Web, librarians recognized the need for establishing a common interface to search multiple sources. The ANSI/NISO gives the international search-and-retrieval protocol, Z39.50, which was originally proposed in 1984 as a standard means of interrogating bibliographic databases. Since then it has gone through three versions, the latest of which was issued in 1995. Federated search compliments the Z39.50 facility, it offers the ability to extend search beyond the online catalog virtually to any electronic resources that can be authenticated at the point of access. This means that users no longer need to jump from one search interface to another.

Information integration over distributed sources is an urgent problem to be solved for providing access to a variety of Digital Libraries through a common search interface and portal. Federated or cross-database search tools now available on the market are the correct solution for unifying access to a variety of information resources. These tools can search not only library catalogs but also commercial abstracting and indexing databases, web search engines, and a variety of other databases, while often merging and de-duplicating results.

Federated searching started in 1998 when Webfeat Team took the initiative to connect any or all of their databases at the same time through a simple, common user interface and turned this idea into a product called Webfeat. WebFeat, the original federated search engine, used by over 15,000 leading public, academic, government and Global 1000 libraries and information centers — including over a third of the largest 100 U.S. public libraries, 18 statewide library systems, and 2 out of every 10 Association of Research Libraries (ARL) institutions, brings you the next frontier in federated search technology. Originally founded in 1992 as an information technology consultancy. The WebFeat concept is simple: search any or all of your library's databases simultaneously with a single intuitive interface. WebFeat can search any database, including licensed databases, free databases, catalogs, Z39.50, Telnet, proprietary databases, anything! And with SMART, WebFeat's next generation usage tracker, you can report detailed database usage within your library with just a few mouse clicks.

2.   What is Federated Search?

Federated search is the simultaneous search of multiple online databases and is an emerging feature of automated, Web-based library and information retrieval systems. It is also often referred to as a portal, as opposed to simply a Web-based search engine. It is sometime termed as broadcast search, parallel search, cross reference search etc.

Various terms are used to refer to these tools in the literature including: metasearchers, cross-searchers, cross-database searchers, portals, broadcast searchers or parallel searchers. The term metasearcher is particularly prominent and is the term adopted by the United States National Information Standards Organization (NISO), which has developed a Metasearch Initiative (NISO, 2003). However as Fryer (2004) explains, the term metasearcher can cause confusion due to its association with web Metasearch engines such as Metacrawler which function in a different way to federated search tools. The term federated searching is the function of search tools, which search a number of databases, particularly subscription databases, simultaneously with one interface. The content searched by federated search tools is content that could not normally be searched via a web search engine.

2.1   Definitions

Peter Jasco defines federated search as, "Transforming a query and broadcasting it to a group of disparate databases with the appropriate syntax, merging the results collected from the databases,

presenting them in a succinct and unified format with minimal duplication, and allowing the library patron to sort the merged result set by various criteria".[1] In simple words, Federated searching will be defined as a search system using a common interface that enables the simultaneous searching of databases from a variety of vendors. Federated search technology enables users to search multiple information resources simultaneously through one search query. Users can then view search results in a single integrated list. In other words, users do no longer need to consult each information resource individually. Instead, they can search multiple library catalogs (OPACs), Web sites (e.g. Amazon.com, Google etc.), subscription and citation databases all at once.

Federated search technology is an integral component of an Information Portal, which provides the interface to diverse information resources. Once the user enters his or her search query in the search box of the Information Portal, the system uses federated search technology to send the search string to each resource that is incorporated into the Portal. The individual information resources then send the Information Portal a list of results from the search query. Users can view the number of documents retrieved in each resource and link directly to each search result.

Metasearch, this word is synonymous to federated searching, people find no difference between federated searching but there is slight difference between federated and meta searching.

3. Difference between Federated Search Engine and Meta Search Engine:

Federated search engine and Meta search engine seems to be synonymous but we found slight difference between them. Some of them are as follows:

Federated Search	Meta search
1. Federated search engine have cost. More, depending upon the seats, design, functionality and targets or databases and subject categories and thesauri	1. Meta search engines are available "free" of cost on internet.
2. Federated searches concentrate mostly on textual information and offer subscription-based premium content database searching ignored by Web-oriented meta search engines that miss these invisible Web sources.	2. Meta search engine commonly found on internet. The public at large uses meta search engines because they run searches via multiple web search engines that spider the open Web, including multimedia sources.
3. Federated searching refers to the ability to issue a single query that concurrently searches multiple disparate and heterogeneous collections of information. This is especially important to library patrons and staff that are interested in locating resources that exist within, or are licensed by libraries or library consortia.	3. This technical part is lacking in meta searching.

4. Typically, these collections include the library catalog(s), commercial databases *(Ebsco, Gale, ProQuest, etc.)*, digital collections, specialized collections, and even third party systems and content (Library of Congress, Web search engines, etc.).Single-search access to multiple resources enables libraries to offer value added services that Web savvy patrons have come to expect. These include a single log-in, personalization features, and the ability to remotely interact with your library Value added services not only enhance end user experience, but help ensure that the library continues to be the epicenter for information discovery in the ever-increasing digital world.	4. Web meta-search tools such as DogPile and MetCrawler run across multiple web search engines at once, returning sets of results grouped individually in each search source. Names such as VIVISMO and IXQUICK also spring to mind in this context. In this context meta-search vendors are Muse Global's Muse Search, Web Feat's Prism that is used by Dynix, and Sirsi uses Muse Search, just to name a few common vendors

4.   Need and Purpose of Federated Search Tools

The need and purpose of the federated searching are as follows:-

♦ The growth of different types of databases, produced by different suppliers, with numerous interfaces and logins means that library users can find it confusing when attempting to access information;

♦ Library OPACs and web-pages have been alienating users with their use of library terminology and by including long lists of databases that users find it difficult to select from and search;

♦ The needs and expectations of library users, particularly students using academic libraries. The growth of different types of databases, produced by different suppliers, with numerous interfaces and logins means that library users can find it confusing when attempting to access information.

There are certain purposes which can be served by the federated search are as follows:-

♦ Transforming a query and broadcasting it to a group of disparate databases with the appropriate syntax.

♦ Merging the results collected from the databases,

♦ Presenting them in a succinct and unified format with minimal duplication,

♦ Providing a means, performed either automatically or by the portal user, to sort the merged result set.

In traditional search engines such as Google, only sources that have been indexed by the search engine's crawler technology can be searched, retrieved and accessed. The large volume of documents housed in databases is not open to traditional Internet search engines because of limitations in

crawler technology. Federated searching resolves this issue by the technique described above and makes these deep Web documents searchable without having to visit each database individually.

## 5.   Advantages of Federated Search

There are certain advantages of using Federated Searches. Some of them are as follows:

- ♦ The reduced time it takes to do a basic search is benefit enough.
- ♦ Unified access to diverse content sources.
- ♦ Simultaneous searching across all sources.
- ♦ Ability to Simple search as well as advanced search.
- ♦ Integrated results which are easy to view and use.
- ♦ Direct links to the native source for further searching.
- ♦ Ability to filter, sort, save, print, export and e-mail search results

6.   Search Models

Search on data bases starts with simple search formulation using single keyterm and combinations of terms. The search results thus obtained can be listed in simple predefined format or using user customized format to get desired information. Various search models indicate the interactions of users search formulations and its interface with databases in a Library or online web access to aggregated databases.

6.1   Old Search Model
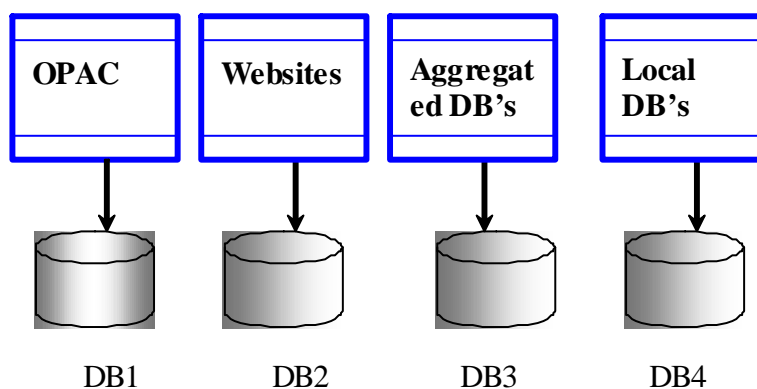
Without a federated search tool, each database requires its own unique search tool - significantly complicating and slowing the search process for patrons. In this kind of search model user submit their search query to individual database or search engines etc and individually they get their required information. This kind of search tools are very time consuming and most of the time user didn't get their desired information.

6.2   Federated Search Model
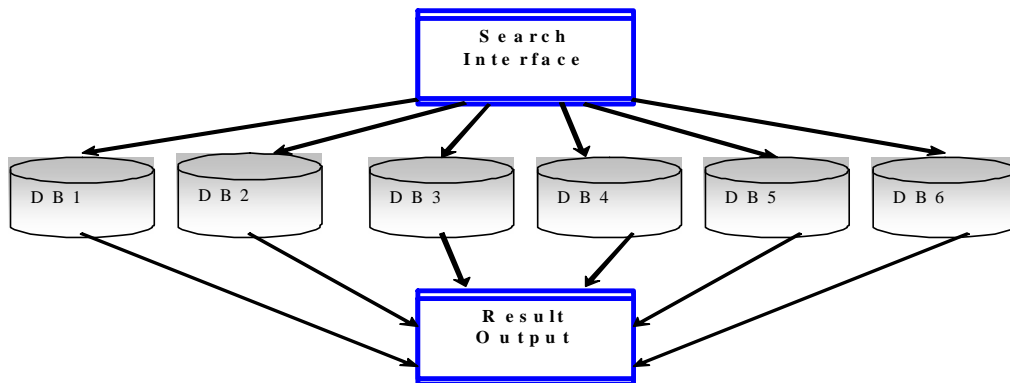
Using federated search, a single tool searches and accesses all databases with one, easy to use interface. It provides opportunity to the users that they get their desired information from various databases, search engines etc.

7.   Federated Search Technologies

There are mainly four technologies used for federated searching.

♦ Screen scraping or HTTP
♦ Z39.50 protocol
♦ ZING - SRW protocol
♦ XML gateway

7.1   Screen Scrapping or HTTP

"Hyper Text Transport Protocol" - HTTP is the single most important technology that drives the web and yet remains virtually transparent. Without this protocol HTML and XML via the web would not be able to perform the myriad of tasks that we put them to daily. The Hypertext Transfer Protocol (HTTP) is an application-level protocol for distributed, collaborative, hypermedia information systems. HTTP has been in use by the World-Wide Web global information initiative since 1990.

The HTTP protocol is a request/response protocol. A client sends a request to the server in the form of a request method, URI, and protocol version, followed by a MIME-like message containing request modifiers, client information, and possible body content over a connection with a server. HTTP communication usually takes place over TCP/IP connections. TCP guarantees that packets arriving to and from the web server are error free and in the right order. It doesn't however guarantee that packets arrive no matter what the network conditions are. When communications are congested or unavailable web page delivery is slow and can time-out.

7.2   Z39.50   Protocol

Z39.50 is an American national standard for information retrieval. It is formally known as ANSI/ NISO Z39.50-1995 - Information Retrieval (Z39.50): Application Service Definition and Protocol Specification. This document specifies a set of rules and procedures for the behavior of two systems communicating for the purposes of database searching and information retrieval. As a network application standard, Z39.50 is an open standard that enables communication between systems that run on different hardware and use different software

The Z39.50 standard was developed to overcome the problems associated with multiple databases searching such as having to know the unique menus, command language, and search procedures of each system accessed. Z39.50 simplifies the search process by making it possible for a searcher to use the familiar user interface of the local system to search both the local library catalogue as well as any remote database system that support the standard.

In libraries, the Z39.50 protocol is most often used for searching OPAC sources. The important facilities offered by Z39.50 are as follows:

- ♦ **Browse:** Allows the client to scan the contents of wordlists or indexes on the server. This can be particularly useful in the case of controlled keyword lists or facets.
- ♦ **Access and resource control:** Allows authentication of users, and cost control and online charging for commercial services.
- ♦ **Sort:** Allows the client to request different orderings of query results, eg. relevance ranking, sorting by date or version number, etc.
- ♦ **Explain:** Allows the client to interrogate the server about a number of details about its contents and its level of support for the application profile.
- ♦ **Item Order:** Allows offline ordering of materials in cases where they cannot be delivered electronically, or where per-unit charging (eg. online charging) is required. Such services are being supplied in an ad-hoc fashion by online Web-based component repositories such as ASSET. The item order service provides a ready-made and semantically standardized version of this service.
- ♦ **Item Update:** Permits an authorized client to update the contents of the remote database.

7.3   SRW (Search/Retrieve Web Service)

Search/Retrieve Web Service is a new HTTP-based information retrieval protocol providing broadly the same facilities as Z39.50, but by means of very different technology. SRW is designed to be a low barrier to entry solution to performing searches and other information retrieval operations across the internet. It uses existing, well tested and easily available technologies such as SOAP and XPath in order to perform what has been done in the past using proprietary solutions.

The protocol has two ways that it can be carried, either via SOAP or as parameters in aURL. This second form is called SRU – Search Retrieve by URL. Other transports would also be possible, for

example simple XML over HTTP, but these are not defined by the current standard.

The primary function of SRW is to allow a user to search a remote database of records. This is done via the search Retrieve operation, in which the client sends a search Retreive Request and the server responds with a search Retrieve Response. The request has several parameters, most of which are optional. The response is primarily a list of XML records which matched the search, along with the full count of how many records were matched.

7.4   XML (EXtensible Markup Language)

XML stands for E**X**tensible **M**arkup **L**anguage. XML is a markup language much like HTML and was designed to carry data, not to display data. XML tags are not predefined. You must define your own tags. XML is designed to be self-descriptive and it is is recommended by the World Wide Web Consortium. It is a fee-free open standard. XML is not a replacement for HTML. HTML is about displaying information, while XML is about carrying information. In simple words, XML is a software and hardware independent tool for carrying information. It is used both to encode documents and serialize data. It supports Unicode, allowing almost any information in any written human language to be communicated.

XML is now as important for the Web as HTML was to the foundation of the Web. XML is everywhere. It is the most common tool for data transmissions between all sorts of applications, and becomes more and more popular in the area of storing and describing information. XML simplifies data sharing as in the real world; computer systems and databases contain data in incompatible formats. XML data is stored in plain text format. This provides a software- and hardware-independent way of storing data. This makes it much easier to create data that different applications can share.

8.   Selection of Federated Search Engine

In selecting a Federated search engine, one needs to bear in mind the following:
- The maximum number of resources the software can include
- The ease of setting up resource targets
- Availability of simple search options
- Speed of search results
- Limiting and refining searches
- Ranking results by relevance
- Export options i.e. print, e-mail, download
- Adequate statistics and reporting features

8.1   Standards and Development

NISO – (US) National Information Standards Organization launched and continue to develop initiatives in order to develop and adopt standard search and retrieval protocols for federated searching. XML – Web protocol and SOAP (Single Object Access Protocol)

8.2 Access Issues with Federated Search

Verification, authentication and certification can be difficult for the federated search vendor. Since federated search engines don't hold the data locally i.e. the engines perform the search, and send the results back to the portal. The federated search engine must be able to access multiple password-protected databases behind the scenes, or IP validate all at the one time, and show users their results in one easy navigable interface. The challenge for federated search vendors is to provide only licensed users access to databases, as specified for each license agreement that is in place for the organization.

8.3 Authentication

Authentication sets federated search engines apart form other expensive and highly sophisticated search software such as Verity and Autonomy. The latter usually restricts searches to internally generated information, ignoring subscription databases that enterprises have bought in-house.

All the user needs with federated searching is ID, password or IP validation along with files to be searched, and the federated search engine do the rest. (Wilson, 2004, Para 6).

8.4 The Set—up Process

The set up process is lengthy and time consuming for both the Library and the vendor. This is not the end of the process either! It continually evolves as databases change, or new resources are acquired and links are added to the federated search portal.

8.5 Interface Issues

We need to decide how much time is to be devoted to design, who is the audience and should this audience be able to perform multiple searches, without having to do more than input their ID and password or IP authenticate, and type in the search query.
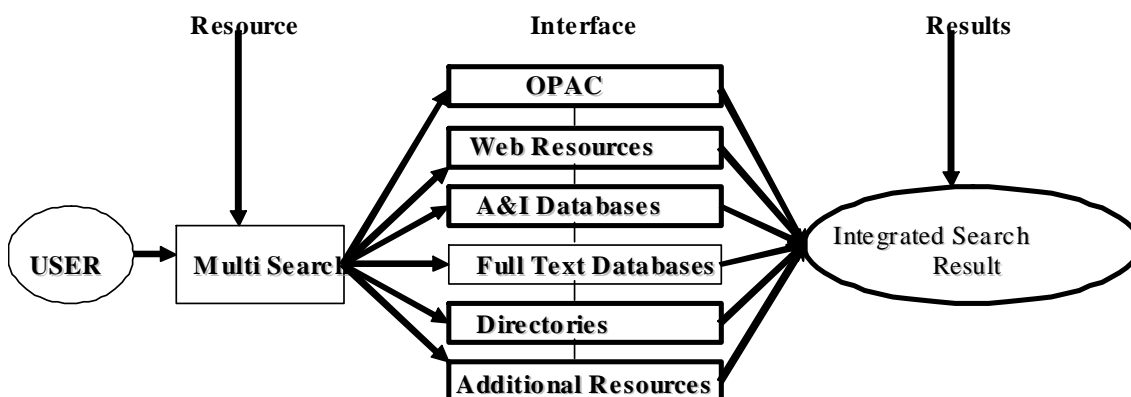
8.6 Removing Duplicates (de-duping)

Most federated search engines will de-dupe some only when requested. However this opens up a Pandora's Box about how the results are returned. User habits indicate that the end user views only the first ten hits or results. How do the vendor and the interface designer ensure that the highest hits are returned? This area is continually evolving, and it is up to the federated search engine provider, to provide what they can, to the best of their technological ability in this regard.

9. How Federated Search Works?

Federated search computer programs allow users to search multiple data sources with a single query from a single user interface. The user enters a search query in the portal interface's search box and the query is sent to every individual database in the portal or federated search list. Access

details for the individual databases must be preset in the portal by its owner. Federated search systems either rely upon vendors to create commercial portal systems, or they rely upon government or other organizations to provide open access portals. How federated search is implemented depends upon which of the two types of organizations is providing the portal.

Federated search portals, either commercial or open access, generally search public access bibliographic databases; public access Web-based library catalogues (OPACs), Web-based search engines like Google and/or open-access, government-operated or corporate data collections. These individual data sources send back to the portal's interface a list of results from the search query. The user can review this hit list. Some portals will merely screen scrape the actual database results and not directly allow a user to enter the data source's application. More sophisticated ones will de-dupe the results list by merging and removing duplicates. There are additional features available in many portals, but the basic idea is the same: to improve the accuracy and relevance of individual searches as well as reduce the amount of time required to search for resources.

Resource   **Interface**   **Results**

```
                        ┌──────────────────┐
                        │      OPAC        │
                        ├──────────────────┤
                        │  Web Resources   │
                        ├──────────────────┤
  ┌───────┐  ┌────────────┐  A&I Databases
  │ USER  │→ │Multi Search│ ─────────────── Integrated Search
  └───────┘  └────────────┘  Full Text Databases     Result
                        ├──────────────────┤
                        │   Directories    │
                        ├──────────────────┤
                        │Additional Resources│
                        └──────────────────┘
```

Diagrammatic Representation of Federated Searching

In federated searching, a wealth of information is incorporated into a single repository that can be searched. In this model, the information is processed prior to the user's search. From the end-user's point of view, federated searching and metasearching may seem similar, because both provide a single interface to multiple resources, but they actually differ in many respects. The pre-processing taking place in a federated searching environment, which we can describe as just-in-case processing, offers new opportunities regarding search methodologies and the presentation of results. For example, a ranking algorithm can be applied to each data element stored in the repository, unrelated to any future user query. Such an algorithm can take into account the number of times that an article has been cited, the number of articles that the author has published, the number of times that a book

has been borrowed, a journal's impact factor, and other parameters. A federated searching system can use the calculated rank to better evaluate the relevance of the specific item once it has been retrieved as the result of a query.

QUERY FORM

DIVERSE INFORMATION RESOURCES
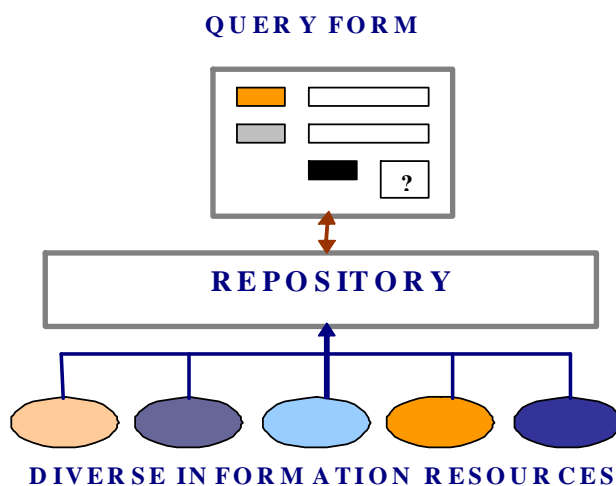
Federated searching: The system searches a local repository that was created earlier through the accumulation of data from numerous resources.

Looking back a few years, we can see that the need for a single search interface to multiple resources arose some time ago, and, in fact, metasearching and federated searching have been available for quite some time. Such systems originated in a variety of environments; for example, Elsevier, a publisher offering numerous journals, created a federated search mechanism enabling its users to search all its e-journals through its ScienceDirect service. As Elsevier acquired other publishers, it was able to add their journals to the same platform.

Database vendors developed similar mechanisms. For example, Ovid provides a single interface to a few hundred databases that it publishes, and still retains them as separate databases. Commercial organizations were not the only ones that addressed the need for a single search interface; several large research institutions created a local environment based on federation. For example, the Los Alamos National Laboratory and the Ohio Link consortium in the United States, the University of Toronto in Canada, the Technical Knowledge Center of Denmark (DTV), and the Max Planck Society in Germany all offer large, diverse collections of e-journals that they store locally. These institutions have implemented federated searching to provide a single search interface across their electronic collections. However, not all organizations have the resources to adopt this just-in-case approach. Furthermore, with the rapid increase in the number of heterogeneous resources that institutions offer their users, a single federated searching system can serve only as a partial solution.[2]

10.   Implementation

When a federated search engine is implemented at a particular library, it then becomes a unique service. Federated-searching software allows customization, so no two implementations are exactly the same. For example, a library may choose to include all of its online resources as targets for a federated search engine or it may choose to create subject groupings first, each of which leads to a federated search service for a narrow topic. Gerrity, Lyman, and Tallent discuss implementing a federated search system at Boston College, where they promoted the new service as "MetaQuest".

One application of federated searching is the metasearch engine; however, this is not a complete solution as many documents are not currently indexed. This is known as the deep Web or invisible Web. Many more information sources are not yet stored in electronic form. 'Google Scholar' is an example of a project trying to address this.When the search vocabulary or data model of the search system is different from the data model of one or more of the foreign target systems the query must be translated into the each of the foreign target systems. This can be done using simple data-element translation or may require semantic translation.

11.   Federated Search Providers

Individual institutions have their in-house Federated option and other institutions uses global federated search options, following are the popular federated search providers:

- ♦ **Google Scholar**
- ♦ **Scopus**
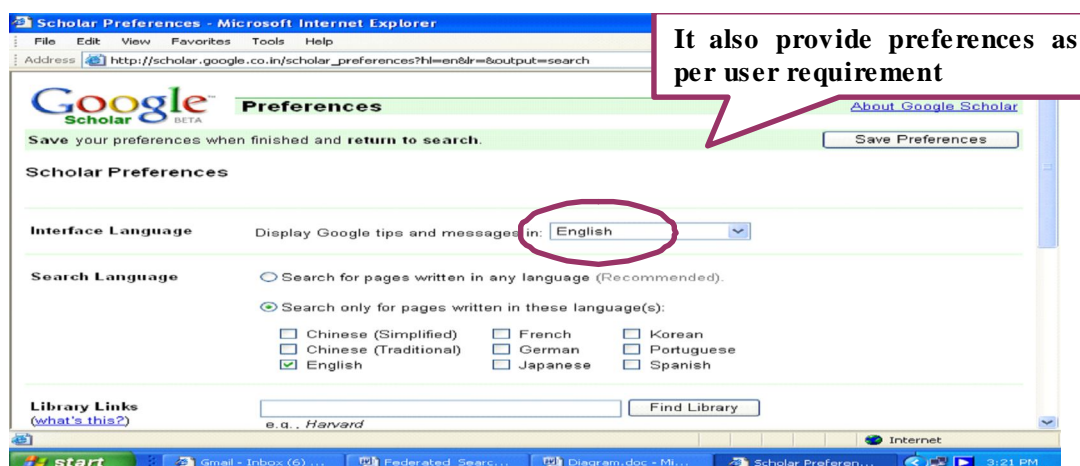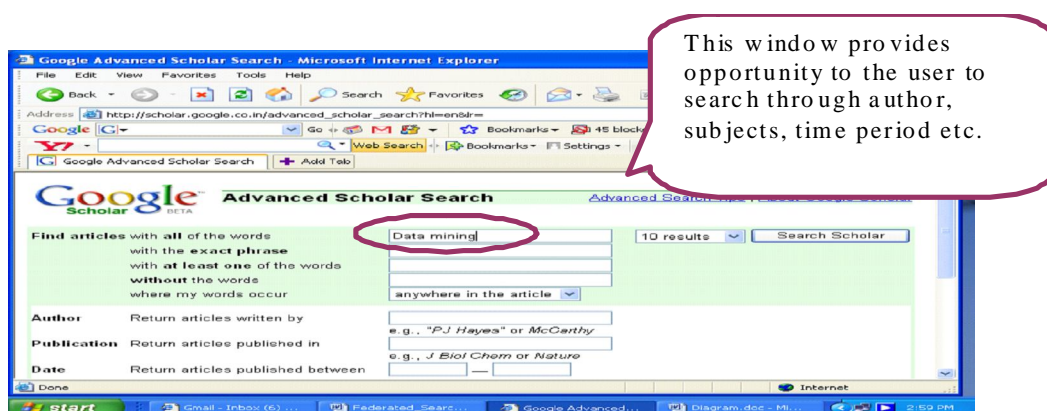- ♦ **Liberty**

11.1 Google Scholar

- ♦ Google Scholar is seen as the competition for both campus institutional repository systems (at least in terms of search and discovery) and academic library federated searching. Google Scholar provides a simple way to broadly search for scholarly literature. From one place, you can search across many disciplines and sources: peer-reviewed papers, theses, books, abstracts and articles, from academic publishers, professional societies, preprint repositories, universities and other scholarly organizations. Google Scholar helps you identify the most relevant research across the world of scholarly research.

11.2 Features of Google Scholar

- ♦ **Search** diverse sources from one convenient place
- ♦ **Find** papers, abstracts and citations
- ♦ **Locate** the complete paper through your library or on the web
- ♦ **Learn** about key papers in any area of research

Google Scholar gives various option to the user so that they can search according to their equirements, such as time period, author wise search, subject wise, publication, institution wise etc and after

giving the key term by the user, it searches that key term to various databases, search engines, journals etc and display the result on interface with name of author along with its full bibliographical description and it also provide citation information.

Here user submit single search

This window provides opportunity to the user to search through author, subjects, time period etc.

It also provide preferences as per user requirement

Federated Searching: A search output with the help of Google Scholar.

11.3 Scopus

Scopus is the largest abstract and citation database of research literature and quality web sources. It's designed to find the information scientists need. Quick, easy and comprehensive, Scopus provides superior support of the literature research process. Scopus is updated daily and it offers 15,000 peer-reviewed journals from more than 4,000 international publishers, over 1000 Open access journals, 500 Conference proceedings, over 600 trade publications and over 125 Book series. It also covers 33 million records, out of which, 16 million records include references going back to 1996 and 17 million pre-1996 records go back as far as 1869. +

Federated Searching: SCOPUS advanced search interface

In SCOPUS: it displays the result from different sources and also provides opportunity to the users that they sort their result through the relevancy

11.4   Liberty: Quest

Liberty is a total web based library automation software which allows federated searching. In Liberty federated searching refers as "Quest" it capitalizes our investment in online databases by providing library users with a single search point from with in Liberty[16].

Benefits of Quest:

♦   **Single Search Point for Multiple Databases:** Include databases that your organization subscribes to in your Liberty3 search. Quest simplifies searching and access for your users.

♦   **Easy to Use:** Quest offers basic or advanced searching options, interleaves search results, and represents search results graphically. Quest allows a number of refine and sort options including sort by relevancy.

♦   **De-duplicate Searches:** Easily remove duplicates from search results by title or URL.

♦   **Customizable:** Quest offers you the option to include the library catalogue in the federated search. You can also select the databases you wish to search in your federated search.

♦   **Local Soft link Support and Service:** Quest is supported locally and hosted on Soft link servers. There is no need for you to worry about installation or maintenance.

Federated Searching: Search results through Quest via Liberty

♦ The biggest players in the federated searching industry are MuseGlobal (Muse Search), Fretwell-Downing (Zportal), and Webfeat (Knowledge Prism). These product offerings allow a user, regardless of vendor, to access multiple databases through one search interface. Endeavor (ENCompass) and ExLibris (MetaLib) are also in the federated search engine.

♦ Scirus, Wikipiedia, Pub med central, these are public domain site which provide federated searching.

- Publishers offering numerous journals created a federated search mechanism so that users are able to search their all journals. A good example is Elsivers Science Direct. As Elsivers acquired other publishers, it was able to add their journals at the same platform.
- Database vendor develop the same mechanism such as Sliver Platter provide a single interface for more than 300 databases that they published SCOPUS etc.
- Proquest, Ebsco, Gale Cengage and Elsevier etc are such databases who offer federated search. In Gale Cengage "federated search" refers as "Power Search".
- The NISO Metasearch Initiative (http://www.niso.org/committees/MetaSearch-info.html) seeks to develop industry standards for one-search access to multiple resources that will allow libraries to offer portal environments for library users offering the same easy searching found in Web-based services like Google.
- Many public and academic libraries also utilize Auto-Graphics' federated search solution AGent Search.

12.   Drawbacks of Federated Search

Limitations of the current generation of federated search engines. These include:

- The lack of a uniform authentication standard means that some databases are inaccessible to federated search engines.
- True, full, deduplication is impossible because databases download results in small sets and metadata standards vary by resource.
- Relevancy ranking is limited by the quality of the metadata, which usually does not include abstracts or full-text information.
- Although federated search systems are fundamentally software, they must be implemented and managed as a service, which takes a great deal of resources.
- Federated search engines cannot improve on the native interface in terms of search accuracy and precision.
- Federated searching is not for power searching needs. Just as with searching metasearch engines, only basic Boolean commands can be used.[4]

The federated search has some other issues as well. First, it cannot cover all online library resources. The goal of one-stop shopping cannot be achieved completely by any federated search. There are various reasons for this:

- Some databases do not work with any federated search at all, such as SciFinder Scholar. SciFinder Scholar does not use a web browser but rather requires its own internet client. Neither MetaLib nor WebFeat can cover SciFinder Scholar.
- If databases require a login, they will not work with the federated search.
- Some databases work with one federated search product but do not work with the other. MetaLib cannot search LexisNexis databases because LexisNexis does not allow Z39.50 or

XML gateway access. WebFeat cannot search databases that do not have a search box on their front page because WebFeat counts on the search box on the native interface to search.

♦ Many libraries have databases on a pay-per-search basis, and libraries normally do not want them to be searched by a federated search for budgetary reasons.

♦ Some databases have a limited number of concurrent users, and if these databases are included in a federated search, the limited seat(s) is/are taken immediately whenever someone logs into the federated search, and no other users can use these databases. Libraries normally do not want to include databases with a very limited number of concurrent users in the federated search.

It may not make sense to add to a federated search menu the very specialized databases that most general users would not be interested in, or the databases that require special software. One example is Inter-university Consortium for Political and Social Research (ICPSR) that requires statistics software such as SPSS to view data.

13. Conclusion

By allowing users to search multiple databases simultaneously, federated search engines may save some steps in getting results from various library resources, and may also attain search results from databases users otherwise would not try without the federated search. Even librarians at reference desks sometimes notice a good number of search results from databases they might not expect would have many good hits. But in no way can the federated search compete with Google in Google's strengths: speed, simplicity, ease of use, and convenience. Nor can the federated search truly serve as one-stop shopping for all library databases as people hoped, because some databases cannot be searched by the federated search for various reasons.

The federated search probably cannot replace information literacy education or the learning process either, partly because it cannot make searching as easy as a Google search, as serious research may require selecting various information sources beyond Google results. In a certain sense, the federated search shifts the process of selecting a database from "before" performing searches to "after" performing searches. Users still need to learn the functions of the library OPAC and periodicals indexes with names like ABI, CINAHL, ERIC, MLA, and CHICAGO etc. It is also very helpful for users to learn other information literacy basics, such as the ability to interpret bibliography or to tell the difference between books, book chapters, and periodical articles, in order to make better use of the federated search engine offered by their libraries.

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