

From requirements
to implementation



Federated Search at the Intel Library

BY BARCLAY HILL

Intel employees' expectations for information search, discovery, and retrieval continue to be influenced by popular Internet technologies. Employees expect Intel Library information access to be as easy and convenient as their favorite Internet search engine. Due to user expectations and a continuously growing electronic collection, we knew we had to upgrade our existing search solution to retain and expand our user base. To maintain user satisfaction, a single search interface must include all of our resources within its search scope.

We pursued a federated search solution for two years, but available solutions fell short of our requirements. In late 2005, we made our search for the right vendor top priority. Without compromising our original requirements, we focused on how our current requirements could be immediately met while targeting enhancements that could be incrementally added over time and within long-term project plan constraints. By

the end of 2005, we selected Deep Web Technologies as our federated search vendor. In late 2006, while closely working with the vendor, we released our federated search solution.

This case study discusses project goals, requirements, vendor selection, technology selection, lessons learned, and benefits of our federated search implementation. We examine these aspects in terms of enhancements to current library services and the projected value of a flexible and adaptive search solution.

Overview

The Intel Library, founded almost 30 years ago, is Intel Corporation's corporate library. The Intel Library started out primarily serving Intel's U.S. Technology and Manufacturing Group. Its collection and services have now expanded to serve all Intel business groups worldwide.

Our mission: Sustain Intel leadership in technology, manufacturing, and business by designing and disseminating enterprise-wide information solutions.

Our vision: The Intel Library's goal is to be the corporate leader in delivering cost effective, integrated, enterprise-wide information solutions and to be respected as a trusted and effective strategic partner.

The Intel Library provides the following globally accessible services to employees:

- Research and reference services.
- Electronic and print document delivery.
- Book, journal, and materials circulation.
- Employee-authored technical document archival and retrieval.
- Access to licensed online databases, electronic books, and journals.

The library is committed to improving the accessibility and retrieval of high-quality, authoritative, published literature for employees. We implement solutions that aid employees in efficiently locating and retrieving information that will support them in their jobs. These include:

- Intranet portal with intranet search.
- Catalog system.
- Content management system.
- Document management system.

- Customer request and ticket workflow system.

Online Services

The Intel Library evolved with the advances in information science and technology. It progressed from individual regional facilities at many sites to a centralized and completely virtual organization offering Web-based solutions. This model has evolved to effectively meet the changes in employee information needs. Employee self service has become our customer service goal. This provides our staff with greater opportunity to provide high-touch research and reference services to targeted business groups and stakeholders to maximize our contributions to the company's bottom line.

Here's how virtual development evolved:

- **1987.** Host-based automated library database management system installed. Provided regional access to online catalog as well as other library-managed databases and bulletin boards.

- **2000.** Intranet site released. Employees worldwide have access to online products.
- **2001.** New online catalog released. Employees worldwide have access to Intel Library holdings. Collection consolidation of regional and worldwide facilities begins.
- **2002 and 2003.** Numerous products added to suite of information solutions. Supporting services added to these products to manage the interactions with employees; 97 percent of content budget allocated to electronic content solutions.
- **2003.** Web and Systems Group (WSG) created to develop and support the Intel Library's intranet solutions. WSG begins integrating the numerous online solutions into a consistent user experience. These improvements support the library's self-service model.
- **2004 and 2005.** Iterative improvements are made to online services and products. These enhancements improve staff efficiency in managing

and delivering library content.

- **2006.** Last physical library closes. Physical collection centralized and circulated from a closed facility. New online catalog released with automated workflows. All employee interactions with the Intel Library now occur through intranet portal.

Business Case

Intel employees work in an environment that is information and tool rich. They are required to learn many processes for retrieving information from different systems inside and outside of the company's intranet. Employees do not have time to learn new processes or systems to get the information they need to do their jobs. They struggle to understand where they should start when they need information. They have little patience for excessive browsing and navigation to find promising resources.

Employees often asked, "Why can't the Intel Library site work like Google or Yahoo?" They were not concerned

AN INFO ISLAND OR THE KITCHEN SINK

WHEN YOU THINK ABOUT FEDERATED SEARCH ENGINES, THINK ABOUT WHAT YOU'LL INCLUDE IN THE SEARCHES.

BY RICHARD L. TODD

Now that federated search engine software is more affordable and technically easier to implement, more medium and small libraries may be able to offer their patrons this popular "Google-like" interface. If your library decides to build a federated search engine, remember that in the midst of implementing all the technical and security requirements, it is easy to overlook the importance of establishing a collection policy specifically for this service.

Many of us are accustomed to working with the "comprehensive" collection policies of our libraries that govern what we purchase, subscribe to, and maintain. A federated search engine constitutes a new collection that can integrate freely available resources found on the Web with internal or subscribed resources that have met the criteria of an organization's comprehensive collection policy.

In the course of implementing a federated search engine at my organization, I eventually recognized three fundamental approaches for determining which of the available sources to include in our system. I call these three guiding concepts the kitchen sink approach, the Easter Island approach, and the gatekeeper approach.

THE KITCHEN SINK APPROACH

While this "no-stone-left-untuned" approach may attempt to demonstrate the full power of the federated search engine, it risks frustrating patrons by becoming not so much "Google-like" as rather "just another Google."

As information professionals, we encounter all kinds of resources that have at one time or another assisted us in providing solutions for our patrons. It is in our nature to educate, inform, and share knowledge of these resources with our patrons. In the kitchen sink approach, the federated search engine is used as a platform, or reservoir if you will, for this transfer of knowledge. At its extreme, in addition to the organization's subscription resources and internal databases, every available external resource that might possibly be of use is included, right down to the Amazon.coms and Google Scholars.

This approach may be desirable for certain applications such as in prior-art searches where the concern is to avoid overlooking any potential resource. However, should you include too many Web sources, the possibility exists that your organization's subscription resources and internal databases could become buried in the mix.

with understanding the limitations of purchased content, lack of information provider integration, or the differences between information retrieval for commercial online databases and freely available Web content. They wanted to know how to retrieve information quickly from our resources. They went elsewhere if getting the information took too long or was too demanding.

Due to employee expectations, a continuously expanding collection, and the need for increased return on investment for our licensed content, we knew we must upgrade our search solution to include a larger scope of materials. We knew that to maintain employee loyalty a single search interface must include all our information resources within its search scope and demonstrate the same features and performance provided by popular Internet search engines.

Project Inception

In 2003, we began reviewing federated search engines (FSEs) on the market.

We believed that FSE technology would resolve many of the information retrieval issues our customers were experiencing. FSE would also provide the glue to bind our many independent information databases together and produce a consistent user experience for the employee.

Employee self service has become our customer service goal. This provides our staff with greater opportunity to provide high-touch research and reference services.

We defined FSE as:

“An information retrieval system that executes a user’s query across many databases, Web sites, and information systems called sources and then aggregates and ranks search results from these many sources into a single user interface. It integrates with sources through the source system’s native

query languages, application-programming interfaces (API), and search user interfaces. It provides users with a simplified, consistent, and efficient method for retrieving relevant information from many systems in a familiar user experience. It also enables the retrieval of information from systems that do not

have a web user interface. Federated Search goes by other names in the information industry, including distributed search, real-time search, cross search or cross-database search and metasearch.”

The project problem statement was:

“The Intel Library licenses a large number of commercial information

THE EASTER ISLAND APPROACH

This method represents the extreme opposite of the kitchen sink approach. Like the remote island in the Pacific, whose inhabitants were detached from the outside world, the Easter Island approach strives to isolate the patron from outside resources and focus entirely on the organization’s internal databases or licensed resources.

This system’s collection of highly specialized data may very well be the approach that your organization desires. With it, there is little need for a separate collection policy because the applicable resources met the criteria of your organization’s comprehensive collection policy when purchased or created.

THE GATEKEEPER APPROACH

This approach represents the middle ground of the three. The gatekeeper methodology requires the highest level of critical thinking on the part of the information professional as well as the most detailed collection policy.

As alluded to earlier, the goal here is to use the federated search engine to assemble a collection of highly pertinent sources, both internal and external, that will provide the patron with the simple, single search, Google-like interface he or she desires, but with much more relevant and easily accessed results than usually found in Google.

When applying this approach, try to answer the following question before you begin: Do you want to include sources that are very relevant but to which you don’t necessarily have full text access, or do you want your patrons to see this as a product in which they can count on results retrieved being instantly accessible in full text from their desktop?

Either way, your diligence as gatekeeper in resource selection will hopefully produce a federated search engine poised to become the preferred search engine of your patrons.

CONCLUSION

No matter which approach you feel best fits your organization—and there may well be others that I’ve missed—I would encourage anyone considering the addition of a federated search engine to consider this aspect of its application in the earliest stages of planning. Approaching the task with a preconceived “ideal” could save a lot of time and frustration for you and get your federated search engine up and running quicker and with greater applicability for your patrons.

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products that provide indexing and retrieval of published information. Most of these products allow the user to read full-text articles, books, or papers at their desktop. Because there is no single product that covers all of the information needs of our employees, multiple products are required and there is a considerable learning curve for employees to become familiar with each of the products and select which products to use for a specific information need. If more than one product is appropriate, the customer must perform searches correctly for each product and then compare the results from each and remove any duplication. Employees

Employees often asked, "Why can't the Intel Library site work like Google or Yahoo?"

do not wish to learn a licensed product's tool to retrieve information from its contents. They want a single search interface with familiar options to search and retrieve information with the least amount of effort possible."

Expected project outcome was:

"This project will implement a Web-based search solution that allows an employee to submit a single search

query to all Intel Library products at once and receive a combined set of ranked search results. The search solution will include internal and external information sources within its search scope. The search solution will be fully integrated with the Intel Library's intranet portal and be recognized by employees as the primary search tool to retrieve information from their corporate library. All search results will allow for direct linking to the full-text of items being returned through search, thereby eliminating a significant amount of employee browsing and navigation."

Vendor Evaluation

We began our thorough vendor evaluation and selection process in 2003. We developed and prioritized a set of requirements. We then developed a vendor short list that included five of the strongest vendor products on the market at that time. Vendors were selected based on their product's feature set, recommendations, and reputation.

Our criteria were based on:

- Vendor product software and system specifications.
- Vendor product feature functionality.
- Intel Library requirement satisfaction.
- Vendor product end user training resources.
- Vendor maintenance and support.
- Total cost of ownership.

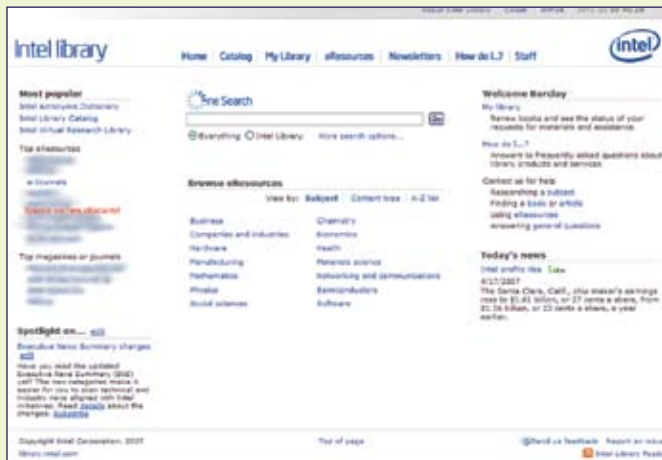
Our initial evaluation process was frustrating. After evaluating vendor products and scoring each vendor based on the

defined criteria, we selected a vendor that best met our criteria. We had the vendor demo a software prototype using our licensed information products. We piloted the prototype for a number of weeks and gathered stakeholder input and feedback on the product. Once the product passed stakeholder review, we negotiated an agreement with the selected vendor.

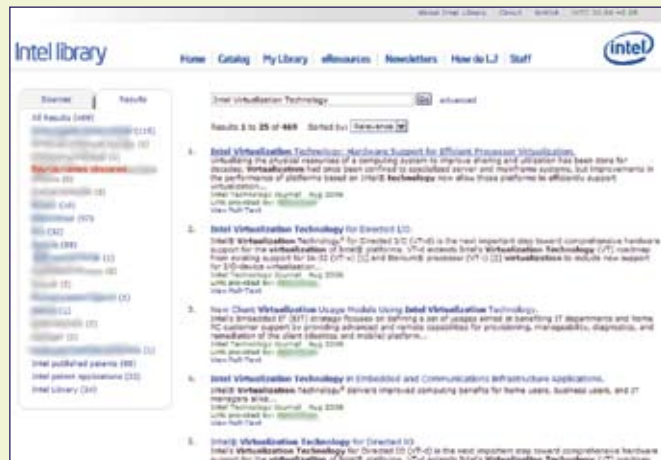
During the negotiations, we revalidated many of the specifications we established during the evaluation phase. We discussed specifications in much more detail as we began developing the implementation plan and anticipating a signed contract with the vendor. Unfortunately, through these discussions, it became apparent the vendor could not completely meet the specifications. The issues were largely based on some of the implementation requirements. After more discussion and additional review, we terminated negotiations.

The project team's post mortem on the vendor evaluation process determined what went wrong and recorded the knowledge for the next evaluation process. The team concluded that a thorough evaluation process had been performed, but we missed working through the finer implementation details with the vendor. We spent most of our efforts in the evaluation process reviewing feature functionality and negotiating pricing for the solution. Insufficient effort was spent planning for the imple-

Intel Library portal with One Search



Intel Library One Search (Search Completed)



We established a design goal to minimize the dependency of the implementation on any specific vendor product.

mentation as we moved forward with negotiations.

The specific implementation issues were:

- FSE product support for the operating system software, database software, and hardware.
- Ability to deploy FSE solution behind Intel firewall with no remote connections from vendors.
- Compatibility with existing service and software components.

The project team revisited the vendor short list and concluded that no vendor existed that could meet our requirements. In early 2004, the project was shelved because FSE technology had not reached the maturity level the project sponsor had expected. The project team was reallocated to other projects that supported the Intel Library's self-service model.

Requirements

We continued to refine requirements for the FSE implementation project over the next two years as the project team completed related projects. We replaced the Intel Library's Web site with a portal integrating all the solutions into a common user interface. The Intel Library's intranet portal search now included all internal products in one search interface.

We conducted a user study in mid-2005 to determine employee satisfaction with recent Intel Library upgrades. This study covered a significant segment of Intel Library users and solicited participation from multiple geographies and business groups. Twenty-five employees were interviewed and observed using the new portal. We also surveyed a sampling of 13,000 employees from our user base.

Employees reported satisfaction with the recent changes, but also said that the search engine was ineffective. The fact they could now search all internal collections (like our online catalog and

the Intel author research database) through the portal's search engine mattered little to them. There was a common perception our search engine searched all online products on our portal. When customers did not receive results from our licensed products, they assumed the search function was broken. This was also a common finding during the observations and interviews with employees. Employees ranked "ease of use" as the most important characteristic of an information retrieval tool. This user study confirmed much of what we already knew. Our search solution required an upgrade, and our search scope needed to be expanded to include all of our resources. We made licensing an FSE our top priority.

In July 2005, we renewed our vendor selection process for a FSE product. We planned a 2006 implementation and set a goal to deploy a significant search upgrade by the end of 2006. Since we had spent a significant effort upgrading our existing systems and employee service points over the past three years, we adopted an integration approach as opposed to a side-by-side implementation approach. Our goal was to license an FSE solution, but only the engine component. We would integrate the engine into our existing intranet portal architecture. Instead of adding another search solution, we would replace our existing search solution with the FSE and integrate it into the user interface of our portal. This solution would serve as our primary search interface.

This approach created new requirements and specifications for the vendor evaluation criteria. These new requirements were much more detailed than our previous set of requirements as they identified the application programming interfaces (API), software and hardware specifications, performance and scalability targets, and related features necessary for the selected product. In addition to the previous criteria, we

identified the following requirements categories:

- Vendor product API support.
- Vendor software and hardware platform support.
- Vendor product performance and scalability.
- Vendor product customization and configurability.
- Vendor product installation and implementation requirements.

With this detailed set of requirements, we accelerated our vendor evaluation process. We had a firmer grasp on the requirements and knew which were critical to implementation success. We largely followed a disqualification process in our vendor evaluation process as we found most vendors could not support our new set of requirements.

Vendor Selection

In October 2005, we disqualified most of the vendors on our shortlist because two critical requirement categories were not supported. The API and the software/hardware requirement categories were particularly lacking in support by most vendors. We changed our approach and decided that the ideal product did not exist. We then focused our efforts on selecting a vendor with whom we could work to meet these requirements.

One vendor remained. It was not on our shortlist but had indicated it supported APIs and the platform on which we wanted to deploy the FSE. The vendor was Deep Web Technologies (DWT) in Santa Fe, New Mexico. DWT had completed a large-scale implementation for the federal government that we reviewed over the Internet. We decided to revisit the vendor to review our requirements and specifications.

On an onsite visit, we were impressed with the DWT team. They demonstrated a significant knowledge of search technologies and systems integration. This was refreshing given our experience with

other vendors. DWT fully addressed our specifications and requirements. We were equally impressed with its FSE product, Explorit. We were able to observe some of our external databases working in a prototype. Through this collaboration, we determined that some customization work was needed to meet all requirements, but we trusted that the vendor could work with us to complete modifications for a successful implementation.

In late 2005, we committed to work with DWT. Our decision points were:

- **API support.** DWT already had APIs implemented for its Explorit product. Explorit's Service Oriented Architecture easily allowed aggregating the FSE into a larger solution using its Web services. Integration was critical to the success of our implementation plans, and DWT demonstrated significant competencies in this area.
- **FSE platform.** DWT's FSE could run on a number of platforms. The FSE is written in Java and based on open

results and dedupping. DWT supported numerous APIs, protocols, and options for creating source connectors that take best advantage of each source's search capabilities. Their FSE also supported a significant amount of configurability.

- **Relevant results.** DWT's FSE employs sophisticated relevance ranking algorithms that effectively merge and rank search results in order of relevance to the user's query based on the occurrence and location of search terms within titles and snippets.
- **Existing implementations.** DWT's Explorit was deployed on public-facing Web sites for some very large organizations. This demonstrated the maturity of DWT's FSE and showed it would likely scale to meet our current and future need.

We scheduled the project to start March 1, 2006, and targeted November 2006 for completion. DWT provided a comprehensive product schedule that

terms or requiring our employees to learn a new product.

We established a design goal to minimize the dependency of the implementation on any specific vendor product. To minimize this dependency, we designed an abstraction layer that would serve as the interface between the FSE and our internal systems. All our development would target the abstraction layer and not directly communicate with the FSE. If we selected a new vendor or the product changed substantially in the future, impacts on our other systems would be minimized. This abstraction layer would be constructed with Web Services and would be based on the W3C SOAP 1.2 Messaging Framework (<http://www.w3.org/TR/soap12-part1>).

The team spent a fair amount of time designing the user interface to make it simple and easy to use. A design goal was set that no training or support would be necessary for employees to use the upgraded search solution. We assumed that employees had previous exposure to an Internet search engine, and this experience was all they needed to use the new search solution. We also assumed that employees would search all sources the majority of the time. This allowed the team to simplify the search interface and easily fit the new search solution into the home page of our portal. We located advanced search options on a secondary level employees could easily access if they wanted to change the default options and search scope.

We set a performance goal that users should receive search results within a maximum of three seconds and that searches for all sources together should complete in an average of eight seconds. To accomplish this, we needed the FSE's API to return results asynchronously as soon as they became available, and we needed an interactive user interface to stream search results back to the user as the search executed. As a result, we designed the search interface as a Rich Internet Application and used AJAX (Asynchronous JavaScript and XML) for portions of the user interface that required interactivity. A usability issue we had to overcome was that

Each phase of the project was managed as a mini-project that had tangible and measurable deliverables as its output. Each phase also built on the previous phases in a progressive elaboration of the larger project.

standards and thus largely hardware and OS independent. This allowed us flexibility in deployment and in sustaining the solution into the future.

- **Vendor flexibility.** DWT was flexible and had strong customer orientation. They were dedicated to understanding our requirements and proposed innovative solutions to meet our specific needs. They also sufficiently demonstrated their ability to deliver the customization required to meet our specifications.
- **Competitive product.** DWT's FSE satisfied all of our FSE feature requirements and some of our nice-to-have features such as search within search

identified the milestones and deliverables throughout the timeline for the project. We used this information to plan our internal development and implementation of our search upgrade.

Solution Design

Intel's Web and Systems Group designed the integration of the FSE into the library's intranet portal, the user interface for search and results, and the integration of our internal sources. We established numerous design goals that would guide our implementation of the FSE. We added federated searching capability to the library portal without substantially affecting our existing sys-

most employees had never before used a search engine that ran asynchronously in their browsers. The interactive portions of the interface were limited to just areas where it supported the user. We made a number of iterative modifications to this design to make the interface easy to understand and to ensure that performance was within employee expectations.

Intel Library internal sources needed to be integrated into the FSE search scope. It is desirable to limit the integration with our internal systems and a vendor supplied product. DWT supports a number of source APIs. We

become inoperable. Also, minor changes at the source can have significant effects on the integration. Recognizing there will be times when it is necessary to expand and contract the search scope, we designed controls that would allow for bypassing the FSE entirely so our portal could use our internal search API independently. These controls also allow the temporary removal of sources from the search interface with a few clicks of the mouse.

Implementation

The implementation ran through the remainder of 2006, with the release

release testing.

We executed the project concurrently with other high-priority projects. The team members responsible for the development and implementation portion of the project consisted of a systems analyst, software engineer, and project manager. One third of the team's time was dedicated to the project. This team collaborated with DWT's technical team throughout the project through e-mail and phone discussions.

The team managed the project with an agile software development approach and integrated the project into the team's larger project roadmap. Each

Talking with one employee, we were surprised to find he had not noticed that the search capability had been upgraded—he only mentioned it now worked as he had expected our previous search solution to perform.

already had experience with developing SOAP Web Services and the DWT FSE effectively worked with Web services. We designed a Web service to search all of our internal databases. The DWT FSE would treat our internal web service API as just another source. Our API was designed to support basic and advanced search features and would allow filtering to subsets of the collection. For example, through our API, employees could search the catalog system, document management system, content management system, or all of our internal repositories at once. This simplified the integration of internal and external sources into one search scope as they are handled within the FSE in a consistent manner.

By its nature, federated search can be a fragile distributed system because network connectivity between the FSE and its many sources can be affected by factors uncontrollable by the FSE vendor or the administrator. Network latency has a significant impact to the user's perceived performance of the solution. If network connectivity between the FSE and the source degrades, integration with the FSE can

now scheduled for the first week of December. Our development and implementation milestones ran approximately two weeks behind DWT's product schedule. We broke the project into phases and prioritized the implementation so we could guarantee some level of federated search capability by the end of the year. Our implementation plan included the following phases:

- **Phase 1**—Detailed design of Intel Library search application.
- **Phase 2**—Development of the FSE API abstraction layer.
- **Phase 3**—Development of prototype application that included the top six external sources.
- **Phase 4**—Procurement and installation of hardware that would host the FSE.
- **Phase 5**—Development of internal Web service API.
- **Phase 6**—Development of a functional application that included the remaining 15 sources.
- **Phase 7**—Development of Intel Library search interface.
- **Phase 8**—Integration into Intel Library portal.
- **Phase 9**—Customer acceptance and

phase of the project was managed as a mini-project that had tangible and measurable deliverables as its output. Each phase also built on the previous phases in a progressive elaboration of the larger project. Within each phase, the team performed the analysis, design, development, integration, and testing tasks for each deliverable. Some phases ran concurrently and some synchronously. The scope and schedule of the project was aggressively managed to ensure that a partial release of the solution would be possible by the end of the year, regardless of what occurred in the final phases of the project.

The project was implemented as planned with the exception of two areas. The first was issues with our information providers' ability to support connectors to be developed for their products or APIs that did not work as expected. The second was technical challenges with the AJAX technology we had selected for the user interface.

In 2003, shortly before the project's inception, the team had surveyed all of our information providers to determine what integration technologies they supported. We performed another survey

Our federated search implementation was not perceived as an enhancement or new capability by our employees, but rather a fix to what was previously broken.

in 2005 when the project's priority was elevated. Based on responses from our suppliers, we saw that not all sources might be integrated by release time. We managed this risk by prioritizing the sources based on customer usage; making sure to include the most heavily used sources in the early phases of the project. We also began communicating with

our sources' technical support services to determine any issues that might occur with the integration of their products.

We were surprised by our supplier's lack of knowledge of federated search technologies. Some suppliers were unresponsive regarding integration. Some that had APIs for search integration were found to be in beta and had not previously supported a client in production status. The vendor management aspect of the project swelled and consumed time we had not previously scheduled.

The AJAX component we selected for our user interface was in beta. We selected the component based on compatibility with our existing development tools. We discovered in development that the component was undependable and could not support the complexity of our design. We also identified that the component might not be compatible with all employee browser configurations. Given these issues, we built our own AJAX solution to meet the implementation schedule. We were confident that stable

and dependable off-the-shelf AJAX component solutions would be available to support additional enhancements to the user interface after our release.

Release

Our upgraded search solution was released the first week of December 2006, one week behind what the original project plan identified. We spent that additional week making last minute user interface modifications and source configuration changes. The search solution's scope covered both internal and external sources and was fully integrated with the portal. Twenty of the 21 sources identified for the initial release were available. During implementation, one vendor refused to include its product in the FSE search scope out of fear that their systems would not be able to support the load.

At the time of the release, we branded the new search solution "Intel Library One Search" instead of merely calling it a federated search engine. We felt that

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the name more accurately conveyed the value proposition of the solution to Intel employees. We also wanted to focus on the capabilities of the solution, not the technology or the activities behind the scenes that occurred during a user's search. The search solution replaced our previous search solution and became the employees' primary search interface for the Intel Library.

Intel Library One Search was released without heavy promotion. We planned on a soft release so we could manage any post-release issues easily. A soft release also allowed for any last-minute adjustments to the user interface if a usability issue was missed during testing. We were also curious to observe users' behavior regarding the new capability without calling it to their attention. The design of the user interface was intended to be so simple that any employee could use it without prior knowledge or training. A soft rollout was a good test to see if that design goal was met.

Throughout December, we moni-

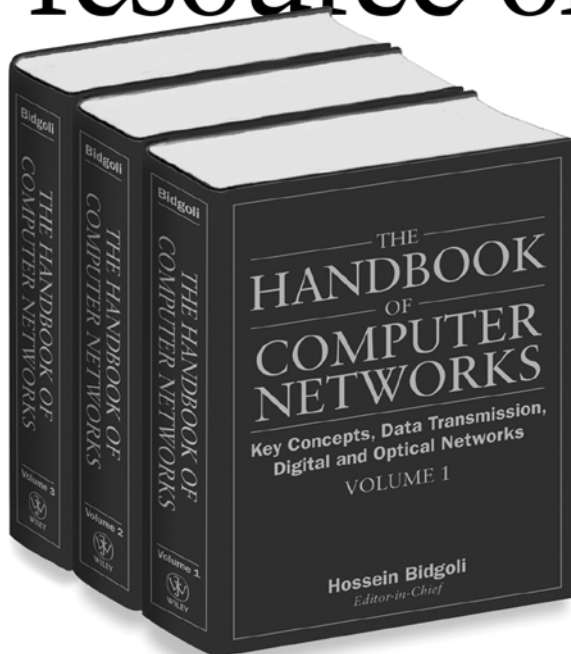
tored the solution and reviewed the usage data that our portal collected. Employees used the search solution without issue. We had no requests for support or training using the product. Talking with one employee, we were surprised to find he had not noticed that the search capability had been upgraded—he only mentioned it now worked as he had expected our previous search solution to perform. The feedback that we did receive pertained to the look and feel of our portal and specific functions related to products upgraded at the same time of the release. We attributed the absence of employee issues and the continued search activity as a measure of success that we had achieved our design goals for the user interface.

The new solution performed very well throughout December and into January. There were issues with a few of the external source connectors that required adjustments by DWT, but we were able to effectively use the controls we had developed to easily remove the

sources with issues and later add them back to the search scope once the issues were resolved. This helped minimize impact to the users of our site as these changes could all be performed without taking the site down.

In the second week of January, we began actively promoting the new search capability. We added promotional text to the Intel Library One Search user interface and previous users of our products and services were notified through email and RSS of the new capability. We observed the number of employees who used search increased by more than 10 percent and the searches ran by those users increased more than 70 percent compared to the previous year. The number of search terms used by our employees has also increased significantly. This increase in search activity has persisted throughout the first quarter of 2007. We no longer receive employee feedback that our search is broken or that it is too limited. Instead, we receive feedback

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requesting that we expand our search scope even further and that our recent upgrade saves employees time. We consider all of this feedback a good indication of success.

The Future

Since the release of Intel Library One Search, our search scope has been expanded. We added the remaining source that was not part of the initial release. All of our licensed online data-

end of the second quarter of 2007.

We have begun scoping the clustering of search results as an enhancement upgrade to One Search in the second half of 2007. Employees have shown interest in textual based topic clusters that are dynamically generated from search result metadata. At this time, we are uncertain to what degree employees will use the feature but believe that it will be a valuable feature as our search scope continues to expand. Features

by our employees, but rather a fix to what was previously broken.

- Not all users will immediately make the switch to federated search. Old habits are hard to break. It is important to maintain browsing features as users take time to begin using search as a means to navigation.
- Sites that have been browse-centric may have a drop in usage as their users become more search-centric. Users may spend less time at a site

Federated search does not always fix a portal that is perceived to be broken. Federated search is much more valuable to the user when it supports an existing site by consolidating the search functions of already well-performing products.

bases that have been identified to have value in the FSE search scope are now included. We also added a few more sources that had been identified as valuable to employees and that have expanded our search scope to include public domain Internet sources. The flexibility of DWT and our internal search application have made adding new sources simple, quick, and cost effective.

We have also begun implementing saved search and alerting capabilities. Both are using APIs provided by the DWT FSE. Our implementation will follow the process that was used for the original project and the new features will be fully integrated with our One Search interface and portal. Alerts will be available for the majority of our external sources and all of our internal sources. Alerts will be delivered to employees through email and RSS. This new alerting capability will satisfy many outstanding requirements we have for a number of our internal systems and provide employees the ability to track content changes in these systems. Employees are excited about the new feature, as it will save them time tracking topics important to their work. As this was written, the project was progressing well and we expected to release the enhancement before the

that allow the employee to navigate through large sets of results based on topic, source, type, and other facets will improve employees' search success.

The Intel Library One Search user interface is producing usage information not previously available to us. It is now possible for Intel Library staff to understand not only what the employee is searching for, but also what they are finding and where the information is coming from. We were previously limited to seeing this level of detail only with our internally managed collection. It is now possible to see a more complete picture of employee usage across almost all of our sources. We are establishing measures from this data that will be integrated with our collection development processes. These measures will enhance the accuracy of our collection development decisions and thereby help us maximize our collection budget.

Lessons Learned

User expectations and adoption

- Intel employees expect the Intel Library to provide a robust search solution that covers all available materials. Our federated search implementation was not perceived as an enhancement or new capability

when they are successful in easily finding what they need through a search.

Vendor evaluation and selection

- Establish project success criteria early and prioritize requirements based on user value. What users deem as important will often be a subset of the original feature requirements.
- Effective vendor evaluation and selection is critical to the successful implementation of any large system or solution. The vendor evaluation process should be comprehensive and include not only functional and cost requirements, but also implementation and sustaining requirements. A relationship with a federated search vendor may span years. Plan.
- Federated Search is more of a service than a product. It depends on many factors that can change over the life of the solution. It requires ongoing monitoring and source adjustments as changes are inevitable. Ensure the vendor is flexible and agile enough to meet your organization's needs.

Information supplier management

- Federated search can add supplier management complexities that your organization previously did not have to manage. This is especially true for

large collections. Plan by sufficiently resourcing supplier management processes for the implementation and sustaining phases of the project.

- Federated search can affect content development policies as content integration and the ability to surface information through search becomes more critical. Products that are not in the search scope can suffer from lower utilization as users become more search dependent. This is especially true of expensive, single-source information products that require sufficient usage levels to achieve ROI. Intel Library product renewal and selection procedures now require that the licensed content solutions support the necessary technologies to enable FSE capabilities.
- Information suppliers that are typically used for certain subject or topic searches may see a change or decrease in usage as other sources, previously less known, rise to the top of the search results. In a quarters time we are seeing shifts in usage of our licensed products that had historically remained consistent. Federated search levels the field for lesser-known products as relevancy ranking becomes the driving force of usage.

Implementation

- A phased or incremental federated search implementation approach is easier to manage and helps reduce risk in the project. Users are pleased to see incremental progress and can provide valuable feedback so that additional features can be accurately prioritized and weighted. It may be that users are more interested in expanding the search scope than adding new features.
- Federated search does not always fix a portal that is perceived to be broken. Federated search is much more valuable to the user when it supports an existing site by consolidating the search functions of already well-performing products. We waited and addressed many of the areas that needed improvement before committing to federated search. This paid off,

as all of our internal content is easily searchable through Intel Library One Search. The employee now has a consistent user experience throughout all of our internal products.

Simplicity of design

- Design the user interface to match the user's expectation. Our employees wanted simple and efficient information search and retrieval. The Intel Library wanted employees to be self sufficient. The design of the user interface was guided by these expectations.
- Replacing a limited search solution with FSE can be more effective than running both search solutions side-by-side. The Intel Library wanted to have fewer places for the employee to search for information. This has facilitated employee adoption and reduced need to educate employees regarding the change.
- Advanced search features are not for everyone. We designed the user interface to use the most common use case as the default configuration for each search. The decisions the users are required to make before using the search interface were either eliminated or reduced as much as possible. Advanced search options are used by less than 5% of our users and less than 4% of total searches. Prioritize search options accordingly.
- Introduce new features incrementally to allow users to consume features at a comfortable pace and without excessive change to the user interface. Users like familiarity and consistency in the tools they use. New features are best driven by the users of the tool not the tool implementer. We have phased the implementation of our search enhancements to allow employees to become comfortable with changes. Employees are providing us the feedback and usage data necessary to select features that best meets their needs.

Conclusion

Federated search takes the concerted effort of a team to effectively deploy and sustain. It is more of an ongoing

program than a discrete project. It requires periodic adjustments throughout the life of the solution. Selecting a flexible and responsive FSE vendor is important to support an organization through these changes and ensuring success. DWT's products and services substantially contributed to our success. Through integrating DWT's FSE, we have achieved seamless federated search capability integration with our library portal. We also have a manageable and sustainable federated search solution that we can build upon for the future.

Our federated search implementation has advanced us in our mission and vision. We have a comprehensive and user friendly search solution that spans our external licensed information, internal managed information, and internet information sources. We have achieved a higher level of employee satisfaction with our online services and increased ROI for our licensed information. The Intel Library collection will continue to expand to meet the employee's information needs. We are confident the search solution will support this growth and increased scope. As employees continue to adopt the search solution, we expect employee time savings to increase. Current usage data and customer feedback supports this assertion. We will continue working with employees to identify the features and sources that will increase the value of Intel Library online services to their work and the company's bottom line. **SLA**

BARCLAY HILL is manager, Web and Systems Group, Intel Library at Intel Corporation. Specific figures, vendor names, and statistics considered confidential by Intel Corporation have been omitted. Hill thanks the talented team of folks at the Intel Library for their contributions. The article was written for the 2007 SLA Contributed Papers program. Details—and full texts of the papers—are online at www.sla.org/content/Events/conference/ac2007/conference/papers.cfm.