Implementing Service Oriented Architecture at the Canada Institute for Scientific and Technical Information

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Summary. This article discusses the experience and challenges involved in implementing enterprise and service oriented architecture practice at CISTI, conveys CISTI's progress and plans, and illustrates how architecture could affect how libraries meet their mandate in future.

Keywords. Service oriented architecture, enterprise architecture, web services, Internet, CISTI, Web 2.0, library future

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Glossary

Architecture: "Set of plans that describe how all parts of the IT infrastructure need to behave to support the enterprise needs and goals."[1]

Component or Architecture Component: An abstract term for a self-contained piece of an architecture. This could be a web site, a search function, a payment mechanism, a database, or anything that fulfills some identified need of the enterprise.

Enterprise: "All parts of the company, business unit, agency, or organization."[2]

Offering: A product provided to a client by an organization.

Service: In the context of service oriented architecture an architectural component that is well defined, self-contained, and does not depend on the context or state of other services. A service accepts requests and performs activities on the behalf of the requester.

Project Process: CISTI follows a process for initiating, planning, executing, and controlling projects based largely on the Project Management Institute's (http://www.pmi.org/) Project Management Body of Knowledge (PMBOK) guidelines for project management.

Introduction

As they seek new roles in the digital realm, libraries are finding it increasingly difficult to manage the complexity of technology implementation while continuing to cost-effectively meet their mandates as information providers. Many organizations find themselves dealing with legacy, isolated, duplicated and ineffective information systems. The practices of enterprise architecture and service oriented architecture hold much promise as methodologies to reduce complexity, to encourage and enable collaborations, and finally to rein in the beast of technology. Even libraries under budgetary constraints can benefit from knowledge of enterprise architecture and service oriented architecture best practices.

Background

As well as being Canada's national science library, the Canada Institute for Scientific and Technical Information (CISTI) provides library services to the National Research Council Canada, has a substantial document delivery service, and is Canada's largest publisher of scientific journals.

Like many libraries, CISTI had been attempting to revitalize itself to meet the needs of the digital world. With the advent of web mashups and Web 2.0, CISTI found itself ill equipped to provide the types of offerings patrons desire. It had built a complex and "siloed" legacy infrastructure with significant vendor lock-in. While CISTI wanted to move from supporting paper-based document delivery services for libraries towards supporting end-user, on-the-fly search and retrieval functionality, it had several roadblocks before it.

First, CISTI's WebOPAC has been the primary interface for clients to discover and request delivery of documents. However, the WebOPAC no longer meets the needs of researchers

seeking article-level digital materials and services. Library patrons are increasingly turning to online services such as Google and Google Scholar as initial research starting points.[3]

Secondly, CISTI created a large document delivery and related client information infrastructure to meet its mandate to disseminate scientific, technical and medical information to Canadian clients. While well suited for its original purpose, this infrastructure does not accommodate the discovery of information via electronic means. Nor does it provide appropriate client interfaces for the retrieval and manipulation of digital information.

To compound the problem, CISTI's document delivery system requires article-level metadata to properly select, scan and deliver documents. On document orders the WebOPAC can automatically pre-fill journal-level metadata such as the ISSN and title. However, it cannot supply parameters such as article titles or page numbers. Clients must perform further searches to obtain all of the specific information required.

Finally, until recently the payment model was restricted to payment by invoice after delivery of material had taken place, requiring that clients undergo a complicated registration process in advance of ordering. Due to a large amount of uncertainty regarding the size of paper documents and copyright fees, prices could often not be determined until after a document had been processed for delivery. A large, inflexible system had to be built to accommodate all these variables.

Many of CISTI's technology problems stemmed from the data-oriented architecture of CISTI's systems. Databases were used not only to store information, but also to manage messaging and program control in CISTI's systems. Furthermore, the complex infrastructure related to CISTI's document delivery service—including billing, pricing and client information systems—was designed to provide documents from paper as opposed to electronic resources. The result was a tangle of systems that were expensive to maintain, slow to change, and unable to meet the needs of current and future patrons.

A New Process

CISTI, like many organizations, persevered for many years without an identifiable architecture process. Technology projects were reactionary, spawned from client requests or general consensus and implemented to meet CISTI's immediate perceived requirements. Such efforts rarely resulted in deliverables that met long-term or even initial needs of the organization. Often large, expensive endeavors, these projects only served to increase the size, complexity and costs of CISTI's technical infrastructure. More often than not, the existing infrastructure was extended or redesigned to meet purported needs, without consideration for the complexity that was being added to overcomplicated systems.

Before the enterprise architecture practice was established, one of the primary concerns at CISTI was its inability to visualize the path from the present state to the desired state. Because the enterprise was so large and the time line so long, it was difficult for project teams who were used to thinking in the short term to conceive of the long-term path towards the enterprise goal. CISTI needed a process to determine a path towards its true *enterprise* goals.

In 2003, CISTI determined that process changes were required to move CISTI from its existing technology foundation to one that would allow for modernization and advancement of its information services. In order to effect these changes, a five-person architecture team was formed to establish an architecture program at CISTI.

The group began its project by attending workshops on enterprise architecture using a methodology developed Jane Carbone of InfoMagic.[4] Designed to train architects, business analysts, technology managers and developers, the workshops made clear that enterprise architecture was a much broader practice than simply technology implementation. In fact, its scope covered determination of business needs, analysis, project selection and—finally—technology implementation. Moreover, enterprise architecture required the participation of all levels of the organization, not just technology developers. The workshops confirmed that enterprise architecture had the scale required to resolve many of CISTI's outstanding problems if implemented with a revitalized project process.

Enterprise Architecture

Enterprise architecture is the process for planning technology from a business perspective. It helps an organization define its future direction, analyze its needs, and create a plan to implement components of technology to achieve its goals.[5]

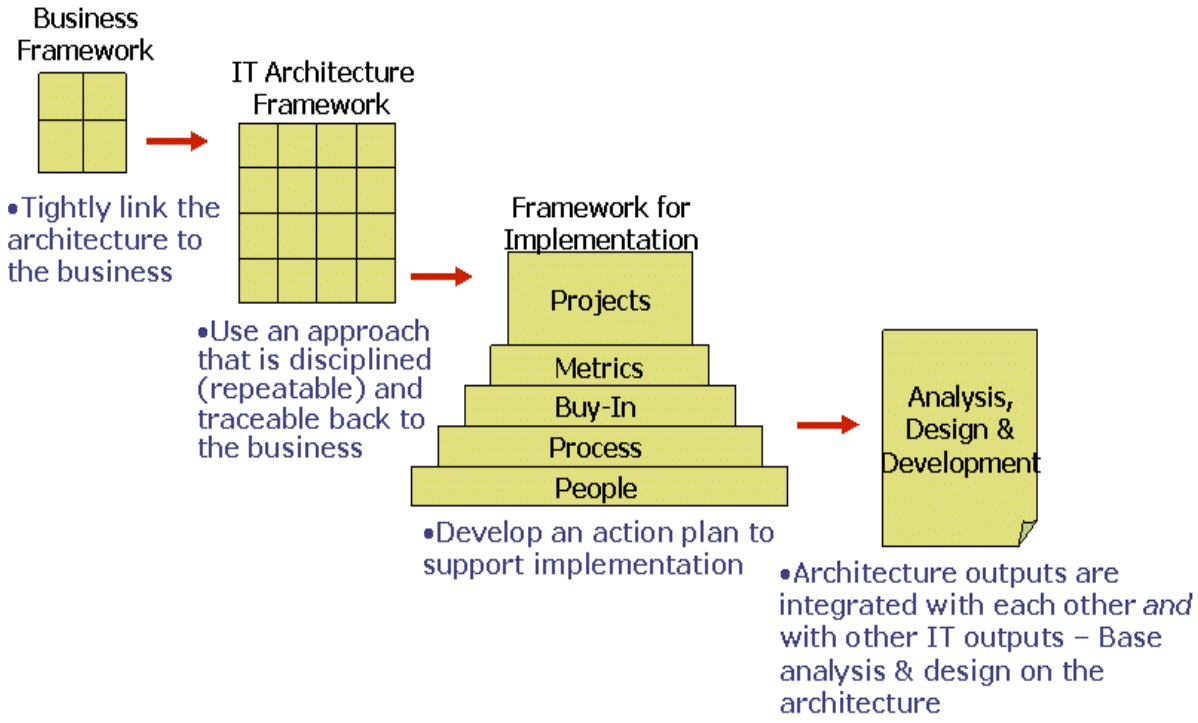
It is difficult, if not impossible, for organizations to move incrementally toward a target unless they have planned both the desired goal and the path to achieve that goal. For this reason, enterprise architecture always refers to the ultimate target state an organization is attempting to achieve and works toward planning the steps (through models, principles, standards and strategies) required to achieve this state. Enterprise architecture also asserts that any diversion from the path towards the target state is a waste of resources.

The complex process of enterprise architecture can be summarized to three basic frameworks (see Figure 1):[6]

1. Business Framework or Ingest: Collection and organization of business desires.
2. Architecture Framework or Analysis: Determination of which data, people, and processes exist and of what is required to achieve business desires.
3. Implementation Framework: Initiation, execution and governance of projects and initiatives to realize the architecture.

These frameworks are executed in parallel and iteratively. They take into account the fact that the desires of the business will change and that architecture analysis can always be improved over time.

FIGURE 1. Enterprise Architecture Frameworks - The InfoMagic Architecture Process



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CISTI has completed three major iterations of the frameworks in the past four years and continues to improve both the deliverables of the frameworks and their integration into CISTI's existing processes. Unsurprisingly, the Architecture team discovered that such integration was key to the organization's acceptance of architecture guidance and to helping ensure that the architecture plan was carried out as part of the project process. Without this integration, architecture is perceived as an extra burden on top of the existing bureaucracy, as opposed to a helpful guiding service to the organization.

Enterprise Architecture: Business Framework

Enterprise architecture is less a practice about technology than it is a practice of planning and problem solving. Organizations often become stuck at the strategic planning level, unable to move toward practical implementation because of uncertainty or inability to devise a cohesive plan for moving from a high-level vision to actionable tasks. Enterprise architecture helps organizations plan a path towards technology implementation which follows enterprise-wide directions set by strategic plans.[7] CISTI felt it was extremely important that any architecture efforts be practical and result in the actual implementation of the planned architecture, and hence the goals of the strategic plan.

To define CISTI's business framework, the Architecture team conducted a survey of the organization to determine its needs, desires and ideas. The survey also took into account CISTI's strategic plans and related documents. The result was a master document of gaps and opportunities (see Figure 2). This initial effort was a stepping stone towards establishing a process to collect these data in an ongoing fashion.

In the past anyone in the organization could submit an opportunity document—a short document describing an idea—which served as a request for permission to begin a more lengthy project proposal. These proposals would be reviewed by management and, if justified, approved.

With the introduction of enterprise architecture, the Architecture team now intercepts these opportunity documents and performs a short analysis to determine what gaps are preventing progress toward the target. An architect then determines which portions of architecture exist and which are needed. Such analysis provides the raw material the Architecture team requires to construct and revise a target architecture that satisfies the goals of the business.

FIGURE 2. Segment of Gap & Opportunity Summary: C = Current State, T = Target (desired) State, G = Gap – What is preventing the achievement of the target state, O = Opportunity – A means to eliminate the identified gap.

	Business Framework		Architecture Framework	
	Vetted Current/Target/Gap/Opportunity Statements	Strategic / Business Justification	Existing Architecture	Created Architecture
C	Clients can search various metadata stores separately, but must then be registered, and place an order to access the content. Clients are then invoiced at the end of the month.	Strategic Objective 1.4:Tools for discovery-exploitation. Designed to extend the availability of information to more researchers by offering a new purchase method. Various search features are also needed to support this group of researchers.		
T	Clients will be able to perform fast and simple article citation searches to find and obtain content from the result set (LS PPV).			
G1	NRC staff have access to the digital (full text) repository, but casual users or registered clients cannot access these documents.			Illustration - CISTI PPV.v0.6.vsd
O1	Create a product offering and interface to enable searching, payment, rights management, and retrieval of electronic documents from our full-text electronic holdings.			
G2	We do not have the ability to protect content from inappropriate usage as required by publishers.		F9.3.5, F9.3.8, D8.5	F9.3.7. F9.3.12, F9.3.11, F9.3.8
O2	Create a service to apply digital rights management (DRM) to content from all sources including the digital repository and items scanned from the paper collection.			
G3	Clients cannot gather a set of citations from various sources and then store them for later action.			F9.11, F9.12
O3	Create a system that allows clients to save a collection of citations (article level metadata) for later action , and add, view and delete citations from this saved list .			
G4	There is no mechanism to retrieve content from a remote respository a selected full-text electronic article.		F9.3.1, F9.3.6, F9.3.7, D3.1, F9.3.3	F9.3, especially: F9.3.2, F9.3.4
O4	Create a service to locate, and retrieve full-text electronic articles from a remote full-text repository.			
G6	(34) Only one payment option is offered to clients who order and receive documents, I.e. monthly invoicing. This also requires clients to be fully registered.			F4.3.6, F9.12, F9.11
O6	Develop a PPV system where clients can request documents (from paper or electronc sources) and pay on receipt of document by credit card. No or very light registration will be required.			

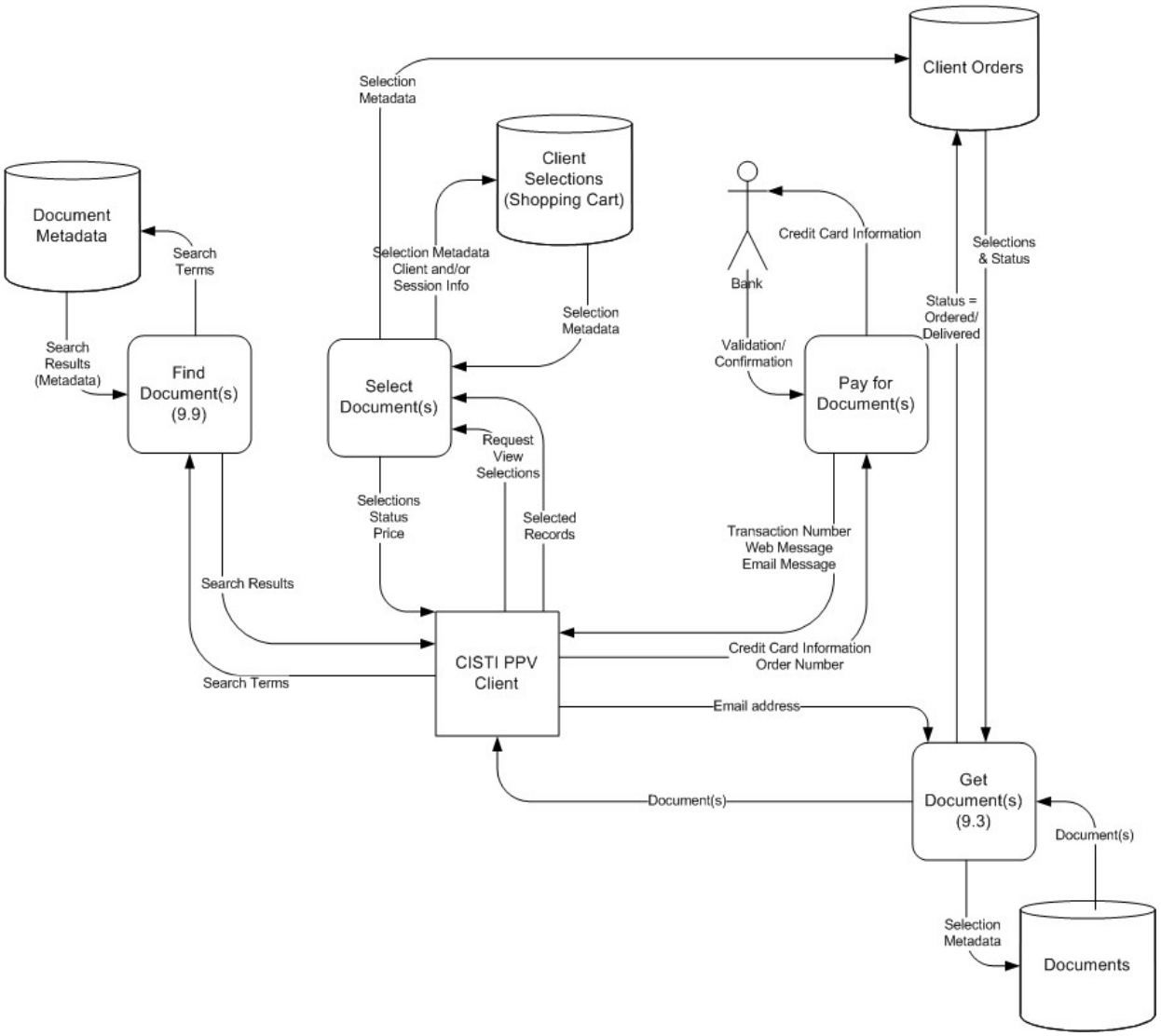
Collecting, analyzing and confirming business desires is the first step towards creating a comprehensive and enterprise-wide architecture. It is important to note that the business framework simply collects and organizes business desires. It does not define the architecture or projects. These activities take place in the architecture and implementation frameworks, respectively.

Before the existence of enterprise architecture, the organization would have moved directly to initiating projects. However, without an architecture, the path forward is often unclear, and the amount of effort and its return on investment cannot be reasonably determined. This is where an architecture process makes a difference. With the collected business desires at hand, architecture analysis and modeling can take place.

Enterprise Architecture: Architecture Framework

In the architecture framework, the collected desires along with the established rules of architecture are combined to produce a model of what exists and what is required to achieve the desired goals. At CISTI architects use data process models to express how data, data flows, components, people and external interfaces will interact in the desired target (see Figure 3).

FIGURE 3. A typical high-level architecture model showing several architecture components.



The primary focus of architecture modeling is to describe a target state that will meet the desires expressed in the business framework. CISTI has produced many architecture models

for this purpose at many levels of abstraction: higher level models for a broad description and to place more detailed models in the proper context; more detailed models to describe the interactions amongst architecture components for use by developers and designers who will eventually implement the architecture through technology.

Architecture is an ongoing, iterative process. The experience of CISTI's Architecture team has been that it is impossible, and indeed a hindrance, to model every aspect of an architecture far in advance. Often issues are not described or understood fully until they are near the implementation stage. Furthermore, if one goes too far in producing architecture, one may spend a lot of time resolving issues that resolve themselves by implementation time, or that are better resolved during design and implementation of the technology solution. The best practices discovered have been to focus on one particular problem at a time and to solve no problem before its time. Indeed, CISTI's architecture is rarely completed, but is constantly updated during project implementation.

Enterprise Architecture: Implementation Framework

An enterprise architecture that is not implemented is useless. An architecture is essentially an organization's long-term technology implementation plan. An organization must integrate the architecture process into project selection and management processes to ensure that projects implement the architecture and, more importantly, to guarantee that projects not aligned with the architecture do not proceed. At CISTI, projects are the way things get done, and what gets done should always move towards the target state defined by business though the architecture process.

The Architecture team expended a great deal of effort encouraging CISTI to modify its project process to ensure the implementation of architecture. It was nearly impossible to stop projects already in progress, even those that were obviously counter to the architectural direction. It took a lot of convincing that the architecture process could improve the organization's efficiency by doing only the right things headed toward the agreed-upon target direction. The Architecture team and process both had to prove themselves to ensure that new processes were accepted and adopted.

The Architecture team began to achieve acceptance first through communication to project teams and to management. Next, the team set goals and reported on its plans and progress on a regular basis. The final step, measuring the success of the architecture process, is being implemented after 3 years of effort. Early findings of architecture metrics indicate that the value of the architecture effort significantly outweighs the cost.

To facilitate integration of architecture into the project process, the first step the Architecture team took was to assist with the writing of new project proposals. The second step was to prove that architecture assistance led to better proposals and ultimately more efficient projects. Architects help projects achieve the architectural vision, which is directly linked to business desires. Architects essentially become project initiators, helpers and consultants and help to ensure that the project meets both its own objectives as well as enterprise objectives.

The Architecture team also created roadmaps of business desires, architecture components and projects that would implement those components. One of the great advantages of having an architecture is being able to rationally project what activities need to take place, and when, to achieve agreed-upon targets. For the first time, CISTI was able to chart when components could be implemented through projects to achieve short term (3-12 month) goals, as well as how those components were simultaneously moving the enterprise towards

achieving its longer-term targets (3-5 years).

The effect of architecture on people in the organization should not be underestimated. Implementing an architecture process means culture change for the organization, and culture change can take a long time. Management may no longer feel it is "in charge"; developers may think their roles have been commandeered; business analysts may believe their traditional role has been usurped. In reality, however, the Architecture team is taking guidance from these people and strengthening their positions and roles. Still, buy-in is essential and can only be achieved by proving architecture and its methodology to stakeholders. Repeated and persistent communication is essential for success and acceptance.

Service Oriented Architecture

Traditionally, applications were developed as vertical applications or "silos" designed and constructed to serve a particular set of functions for a particular client through a particular interface. In the library the ILS is a prime example. As time goes on and clients desire more functionality from such systems, there is only one option: to extend the functionality of the vertical application to meet needs. The problem with this tactic is that it is almost always very expensive to extend a software system to perform functions it was not originally designed to perform. Considering that it is impossible to anticipate all possible future needs and that the chance of a change being required eventually is 100%, the potential for efficient software development on the large scale appears grim.

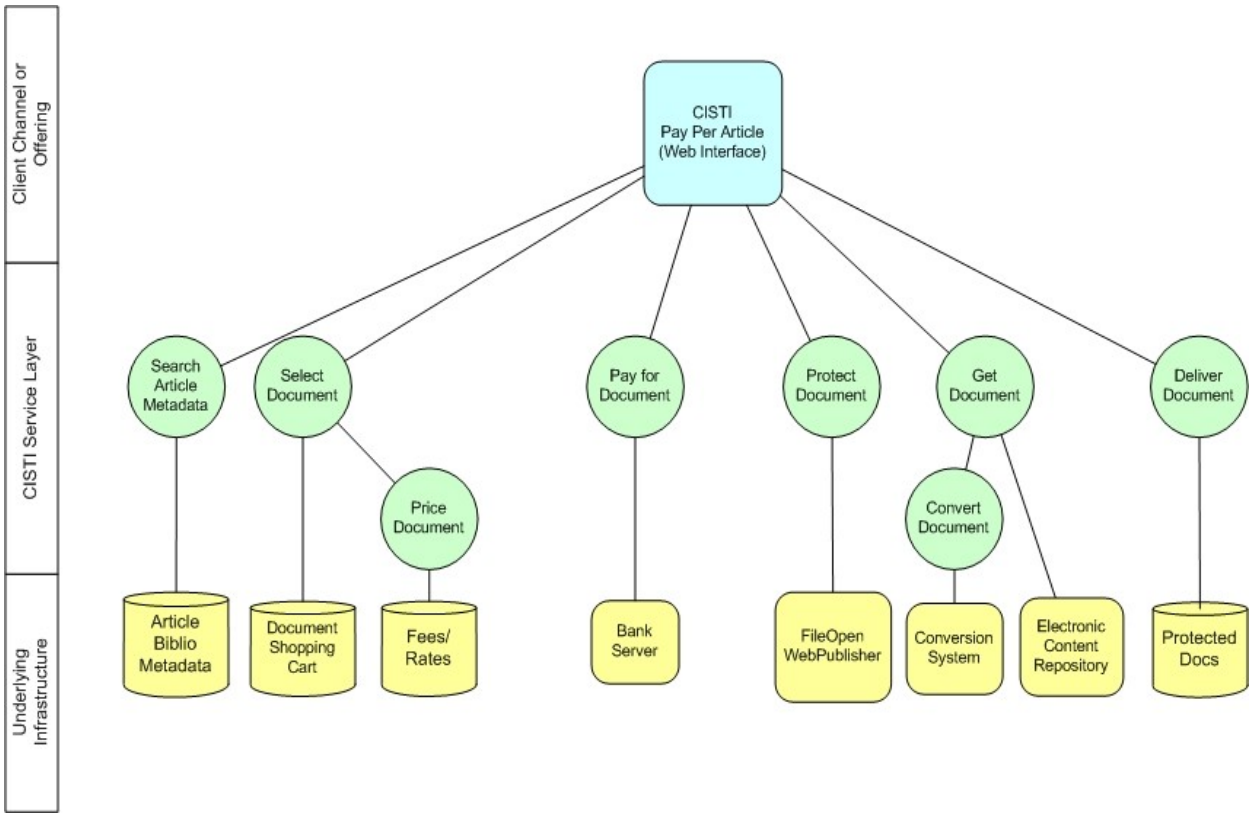
In the process of creating the enterprise architecture program at CISTI, the Architecture team realized that enterprise architecture—although necessary—was insufficient to resolve many ongoing technology problems. In particular, CISTI had a strong desire to reduce maintenance on existing and future technology. But it also wished to provide a variety of ways for patrons to interact with CISTI, for example, from the CISTI web site and via new protocols and alternate channels, such as RSS. In particular, CISTI wished to integrate functionality beyond CISTI's own web site on the web sites of others and by making it possible to use such services through desktop widgets and applications and in browser extensions.

Most important for CISTI was the desire to move away from a "one stop shop" model, and recognize the strong value in positioning CISTI services as part of a larger network of information services in the global sphere. Researchers are using other tools to search and are able to procure documents from an increasingly web-enabled publishing community. It is no longer reasonable to expect patrons to come to the CISTI web site for discovery and access to information.

Service oriented architecture assumes change will happen and designs for change at the outset. Instead of designing a system around data, or building a vertical application, the service oriented architecture approach puts the focus on services. In service oriented architecture, the term "service" has a different meaning to that found in the usual library context. In service oriented architecture, a service is an architectural component that is "well defined, self-contained, and does not depend on the context or state of other services".[8] A service accepts requests and performs functions on the behalf of the requester. The service may be storing a piece of client information, looking up some information, transforming data from one format to another, or performing a computation. The advantage of constructing an architecture in this manner is that in the end you have a number of useful, reusable and combinable services that can be employed in any number of applications or served raw over networks for others to use.

An oft-used analogy is that of building blocks, where the blocks represent services that can be used to assemble any number of constructions (applications).[9] Of course, unlike physical blocks, services can be used simultaneously in more than one application at a time.

FIGURE 4. An example of CISTI's service oriented architecture, with a web interface, the services and underlying technical infrastructure. Note that the web application is completely isolated from the actual databases, applications and servers.



For CISTI, the Architecture team defined a number of architectural components that were required to satisfy expressed business needs. These components included functions to search for documents, locate documents, get documents, price documents, pay for documents, create alerts, and deliver alerts (see Figure 4). CISTI would like to perform these same functions in several places, for several business lines, using several different client interfaces. If CISTI were to build these components in the traditional manner, it would have to create a system to perform all of these functions within vertical silos, one silo per need. While perhaps some of the code and data structures would be reusable, CISTI would have to create several separate, unrelated applications that would require maintenance. Following an service oriented architecture approach, however, each of the core components exists as its own self-contained application, with a well-defined interface for other applications to call and use it over a network. Each of the services does only one job and does that job well.

While an organization could establish an service oriented architecture without enterprise architecture, the experience of the CISTI Architecture team has been that enterprise architecture and service oriented architecture complement each other very well.[10] In the

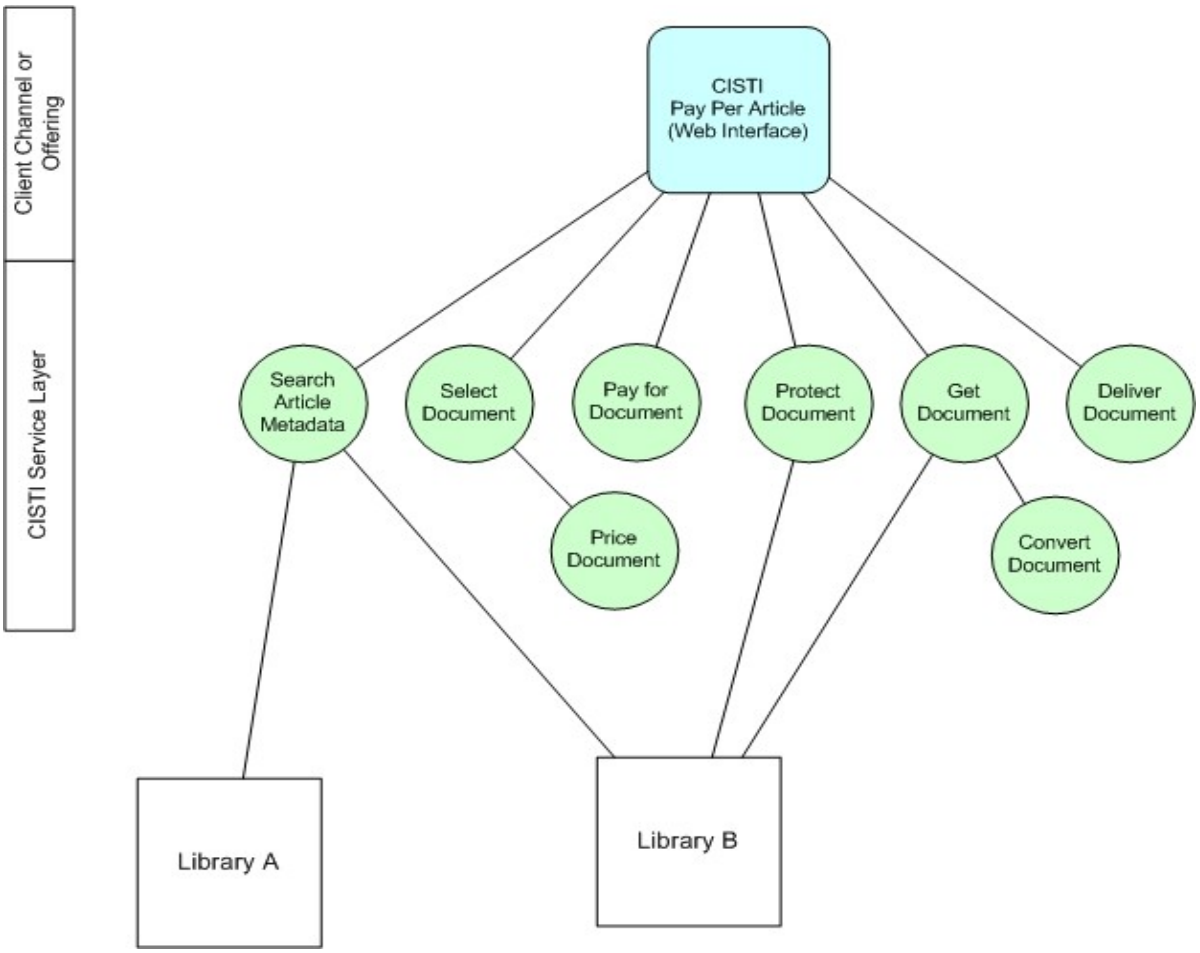
absence of enterprise architecture, the service oriented architecture process would have to manage a large amount of planning and thinking in order to ensure that the services being designed were correct and reasonable. CISTI discovered that its enterprise architecture could be implemented in conjunction with an service oriented architecture approach with a few minor additions to its process. In this way, a single unified process for architecture can achieve the benefits of both enterprise architecture and service oriented architecture, while only slightly increasing the work to develop the architecture. Combined, enterprise architecture provides a long term vision and enterprise scope while service oriented architecture provides the underlying technical infrastructure that supports reuse, sustainability and extensibility of the system.

On the surface, the addition of service oriented architecture appears to complicate matters. Indeed, a great deal of effort is expended in building, maintaining and governing services. In practice, however, what is achieved is a form of small reusable applications that can be employed in many different applications and contexts. Much like building blocks, services can be used and reused to create different workflows in different applications. As a result of this building-block process, most applications become a collection of services operating together, rather than a large monolithic black box application that is difficult to integrate or impossible to communicate with programmatically. There is a large advantage to maintaining a set of well-scoped services that can be reused, changed as required, and assembled in different ways.

Often service oriented architecture is implemented with web services as the enabling technology; however, the two should not be confused. It is important to note that web services are a set of protocols for communication, while service oriented architecture is a framework and methodology—a plan—for what services are needed and how they will interoperate. Constructing web services without an service oriented architecture or some guiding framework introduces the risk of creating an overly complex and unsustainable network of services.[11] An infrastructure comprised of a complex, changing set of underlying services would certainly cause problems for any applications or web sites built on top of it. CISTI's Architecture team believes service oriented architecture provides the kind of maintainable loose-coupling that will allow for a reusable and sustainable infrastructure for our library and will enable libraries to collaborate and share their web services.

Service oriented architecture allows for the creation of services that can be used both to implement its offerings to patrons and also to allow those service interfaces to be exposed to the world for use by others. These services could be exposed as web interfaces or integrated into other organizations' web sites or applications (see Figure 5). In this way services themselves have the potential to become valuable products of their own accord.

FIGURE 5. Services used internally, with some services exposed for direct use by other libraries.



Libraries and Architecture

Enterprise architecture and service oriented architecture help organizations to answer the question: "How do we get there from here?" For many years before it adopted its architecture practices, CISTI was able to formulate its technology desires, but could not realize its technological goals. The primary purpose of architecture—and architecture analysis—is to assist organizations in moving from ideas to practical (often technological) implementation. A primary desire of CISTI was to have a practical approach to architecture that yielded real results in the form of running, sustainable systems. Through our practice we have come to the conclusion that a combined enterprise architecture and service oriented architecture practice produces tangible results in an organization of CISTI's size.

One of the key lessons learned from our implementation of an architecture practice was that no architecture is ever perfect or complete. However, that does not mean that portions of the architecture cannot be implemented or that practical results cannot be achieved early. CISTI's practice has been to select and focus primary attention on high priority and achievable desires, as opposed to waiting for a complete architecture to be finished. There are no perfect solutions, but there are varying levels of uncertainty and risk. Leveraging the best areas for improvement with the highest value and lowest cost allows architecture implementation to proceed while analysis of new business desires and architecture proceeds in parallel.

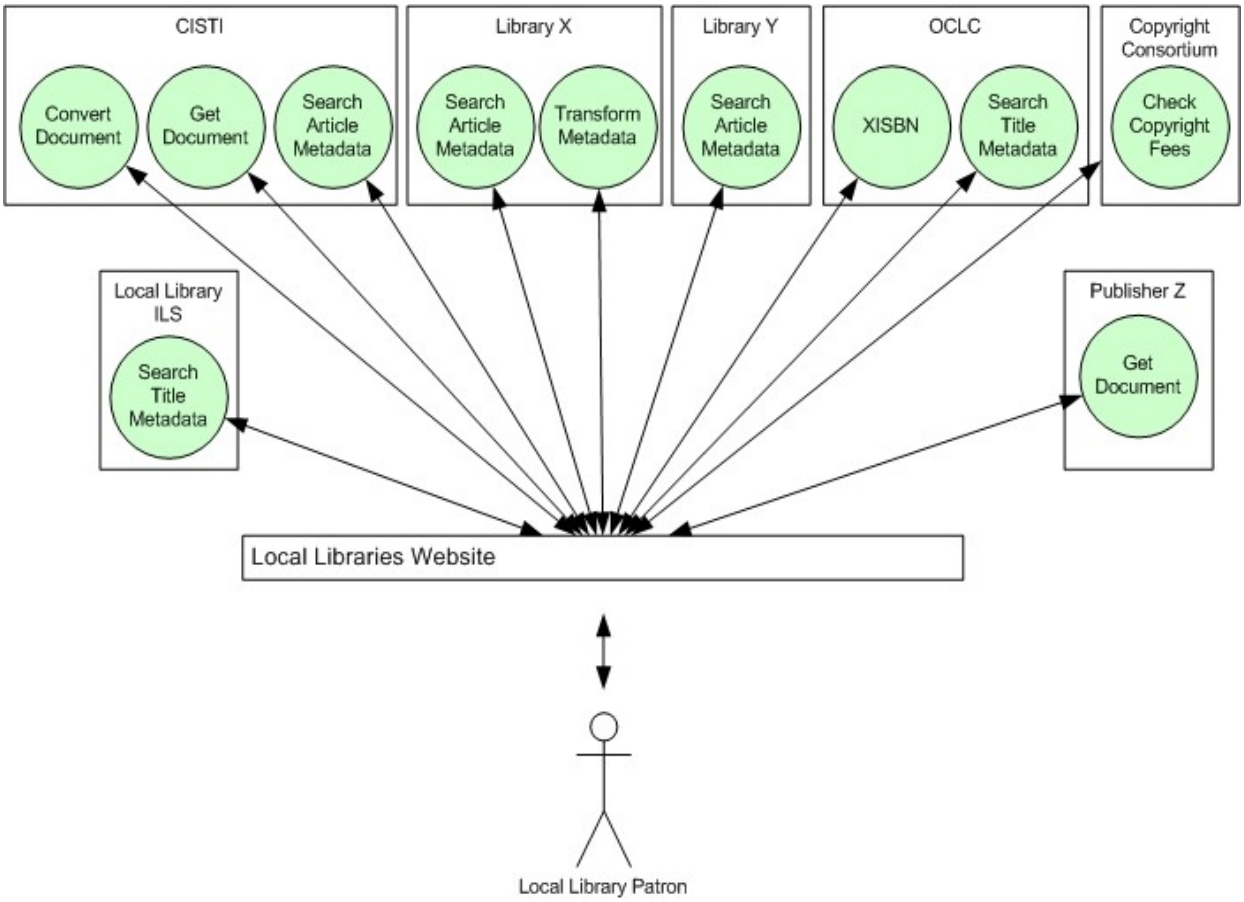
Several organizations, including the Digital Library Federation[12] and the Joint Information Systems Committee[13], have started work on defining or clarifying service oriented architecture frameworks for libraries. Similarly, the CISTI Architecture team believes libraries would benefit from implementing architecture practices. While it is probably not practical for smaller libraries to engage in a full enterprise architecture practice, they may be able to participate as consumers of service oriented architecture services created by larger organizations such as CISTI, OCLC, Amazon, Google and others.[14] Being aware of the services trend and how it might help to improve and augment local library services is particularly important to all libraries.

Service oriented architecture gives libraries the opportunity to provide services through different channels and at new levels.[15] The traditional library web interface (often the WebOPAC) requires that clients actually visit the libraries' web site. However, studies show that clients usually begin their research elsewhere.[16] Service oriented architecture allows libraries to reuse and extend their services beyond traditional library web sites and to integrate them within patrons' applications, intranets, and desktops. To date, CISTI has experimented with providing library services using Yahoo Widgets, browser extensions and toolbars.[17] As a next step, CISTI would like to experiment with exposing its service oriented architecture-based web services for use beyond CISTI and integrating these services into client-side applications. Perhaps the most interesting aspect of exposing services is the potential of others to make use of the services in unexpected and novel ways.

Service oriented architecture may permit libraries to control processes normally under the purview of vendors and other external entities. Library services implemented in an service oriented architecture framework could allow libraries to control how these functions are interconnected and presented to patrons. Proponents of service oriented architecture argue that the place for integration of library services is not in the backend, as is the case with most ILSs, but rather in the presentation to the client of a set of disintegrated behind-the-scenes services.[18] In other words, integrate the experience, but disintegrate the systems and applications.

Service oriented architecture also allows libraries both large and small to work collaboratively to utilize each others' services for mutual benefit. For example, if an institution were to create and expose a terrific metadata conversion service, other libraries could simply use that service and integrate it into their own processes (see Figure 6).

FIGURE 6. Local library patron using local library web site and receiving service from multiple distributed service providers. The patron need not be aware that services are being provided from multiple remote sources.



One can imagine a scenario where a student begins a search at his local library's internal web site. This search covers the resources of several libraries that have used standard protocols to open their search services for a rich federated search experience. Results received, the student now has a number of options before him, including selecting sets of citation results for export, retrieving articles from available repositories, or creating an alert to be notified when similar documents are available. The student's library does not construct these services. Instead, it consumes these services to present results and coordinate the student’s activities in a manner that the library feels is appropriate for its patrons.

CISTI's Architecture Future

Since it introduced architecture processes, CISTI has created its Pay Per Article offering, a suite of services that supports a modern, flexible document search and purchasing system. This suite of services will be improved and new services added. For example, several services for creating and delivering alerts will most likely be built to support a renewed current awareness service, as will new services to manage client information and personalization.

CISTI plans to expose some web services to other developers for use in their own applications. As well, to demonstrate the value of web services and service oriented architecture to libraries, CISTI is pursuing developing example tools in the form of small client applications and browser extensions that employ services exposed by CISTI and

others. Further, we would like to show how these services allow libraries to integrate services within the patrons' environment—while they are reading articles or searching the web, for example—as opposed to forcing patrons to visit the library's web site. We have begun to experiment with some of these alternative client interfaces, including a CISTI Yahoo widget and some Firefox browser extensions, but we have not yet integrated them with CISTI services.[19] In future we can imagine integration (service enabled mashups, if you will) with Facebook, Delicious, Google Scholar, LibraryThing and any number of online services.

CISTI also plans to produce toolkits with API documentation for the services, as well as sample code and small tools that organizations and individuals can use as examples for integrating CISTI services within their own web sites and applications.

CISTI encourages the library community to invest in the creation of service oriented architecture-based services to support library functions or to integrate services into local library infrastructures. Libraries have traditionally been about communities pooling resources for their common benefit. The world of services is no different. Libraries have many opportunities to develop a collection of services to commonly provide for their patrons. One can imagine that if many libraries were to share well formed and standardized article and title level search services, along with services such as alerting, visualization, linking, and metadata transformation, the capabilities of individual libraries could be significantly enhanced.

Conclusion

While the initiation and practice of enterprise architecture is a fairly complicated and expensive endeavor, it has improved CISTI's technology practice immensely. With the adoption of enterprise and service-oriented architecture, CISTI has realized a vast improvement in its technology capability and its ability to meet the needs of clients, currently and in future. The adoption of a service-oriented architecture in particular has opened the possibility for CISTI to build upon its technology foundation to provide new channels to clients and to interact with other information organizations in new ways.

Although CISTI's Architecture team is small, it has accomplished significant positive change with regard to CISTI's technology development and project processes. Architecture practice has given CISTI the ability to plan its future in the long-term while simultaneously pursuing short-term goals.

Notes

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