

# CHANGE AS A SERVICE – CHALLENGES AND EFFECTS OF A NEW PARADIGM FOR LIBRARY SYSTEMS AND CONTENT INFRASTRUCTURE

Daniel Forsman  
Chalmers University of Technology, Sweden  
daniel.forsman@chalmers.se

## Abstract

The infrastructure for supplying information resources to higher education and research has gone through dramatic changes the last 15 years. The amount of electronic resources available and library systems that handle them have multiplied leaving libraries in a challenging situation. We are coping with a changing definition of library collections, changing business models for owning and accessing materials as well as a shift in the architecture of library systems.

The Library at Chalmers University of Technology spent close to 98% of the media budget in 2010 on electronic resources and has been spending more than 50% of the budget on electronic resources for over 10 years. So far the library has not been able to lower total cost of ownership for library systems or information resources since there has been few changes to existing systems or subscriptions. Instead we have been trying to cope with the development by introducing new systems and more electronic resources leaving us with complex workflows and dependencies.

As we look to new unified services for libraries where information resources and systems are merged in a — as a service environment there is a need for libraries to re-evaluate the current situation and what led up to it.

Chalmers university library has initiated a system survey with the ambition of reviewing current workflows, quantifying and defining the crucial elements of today's systems with the goal of finding what we actually need in the near future. The evaluation is still in progress but this paper summarizes Chalmers evaluation so far, highlighting key findings, trends and possible strategies for the future.

Keywords: Library Information Systems, Emerging technologies, Strategies, Change

## Introduction - Time for a change?

A woman, standing on a slope, facing the sun and a spectacular mountain scenery. She is extending her arms; the backpack seems to be a light burden on her shoulders. Caption: FREEDOM. Imagine what you always wanted your library to be. ("Innovative Interfaces: Sierra Services Platform", 2012)

Another vendor promotes its upcoming Next-Generation Library Services Framework with three keywords: Consolidate, Optimize, Extend and names these as features that will recognize libraries "... present and future needs ...". ("Ex Libris the bridge to knowledge, Overview", 2012)

A third vendor aims to provide libraries with a new approach to managing library services that will "eliminate traditional operational silos and deliver new efficiencies in library management, freeing libraries from the restrictions of local hardware and software to provide more time to focus on serving users and communities." ("OCLC Worldshare: Introducing sharing at Webscale", 2012)

Yet another vendor will address "the Challenges of Doing Today's Job with Yesterday's Tools" delivering "A single, centrally provisioned solutions that manages the entire resource lifecycle regardless of format". ("Intota | Services | Serials Solutions", 2012)

The media landscape and infrastructure for information resources has rapidly become complex. Ten to fifteen years ago the local integrated library system (ILS) and union catalog were at the center of library information discovery. Today a modern academic library operates in an environment with systems for handling physical items (Modular ILS: Catalog, Acquisitions, Serials, Inter Library Loan (ILL), Reports, Online Public Access Catalog (OPAC)), for resource sharing of physical items (ILL, Union Catalog and Union Discovery), an Institutional repository (IR) for publishing and maintaining the scientific output from the university, an Electronic Resource Management (ERM) system for handling administrative and license information, licensed databases, eBooks and electronic journals, link resolver, recommendation services, subject guides, databases of databases, proxy/virtual private network (VPN) services, federated search engines, Discovery services and content management systems for publishing information on the web. In many ways the current system and content delivery infrastructure has got out of hand and the vendors know it as they market their new products.

Today libraries are expected to deliver information and services where the users are. Users expect easy to use and platform independent solutions. The modern system architecture based on Service Oriented Architecture (SoA) with open standards and Application Program Interfaces (API) allows an infrastructure where systems and media are consumed as services by libraries. The "as a service" paradigm moves libraries towards identifying components in the global information infrastructure and in that environment there is a real strategic challenge choosing what services and content to license, what to store locally, at the vendor or in the cloud and where to focus the development efforts alone, in consortia or in partnership with one or multiple vendors. The library media and systems space is integrating and converging. Choosing the next step for handling library systems and media providers might be one of the most important strategic decisions libraries are facing for the coming ten years.

### **Where are we?**

The infrastructure for supplying information resources to higher education and research has gone through dramatic changes. The amount of electronic resources available and library systems that handle them have multiplied leaving libraries in a challenging situation. We are coping with a changing definition of library collections, different business models for owning and accessing materials as well as a shift in the architecture of library systems.

So far the library has not been able to lower Total Cost of Ownership (TCO) for library systems or information resources since there has been few changes to existing systems or subscriptions. Instead we have been trying to cope with the development by introducing new systems leaving us with complex workflows and dependencies.

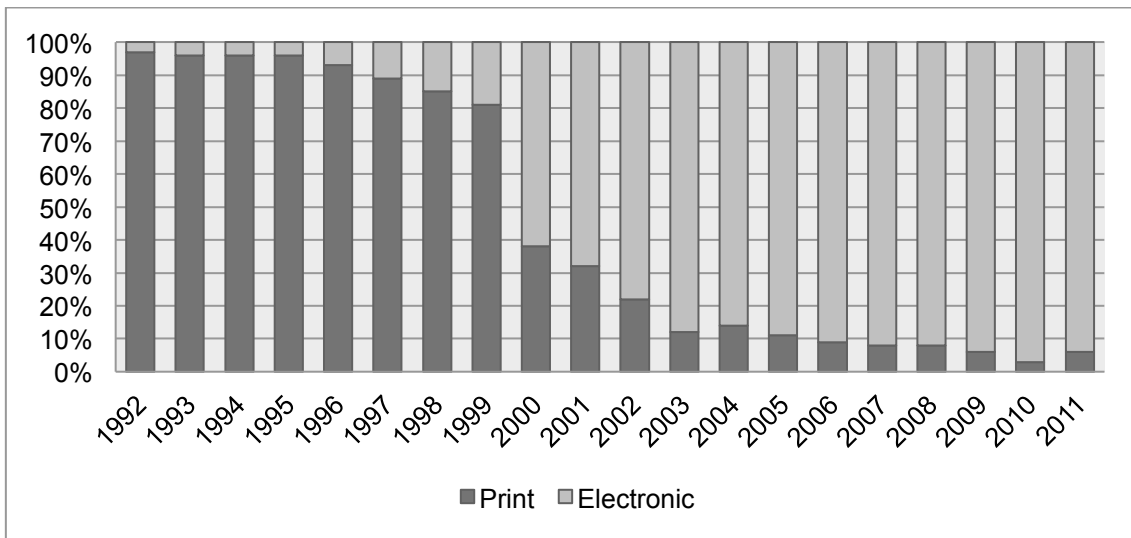
As we look forward to new unified services for libraries where information resources and systems are merged in a "as a service environment" there is a need for libraries to re-evaluate the current situation and what led up to it.

Chalmers university library initiated a complete system survey through a series of workshops with the ambition of reviewing current activities, quantifying and defining the crucial elements of today's systems, acknowledging change and starting to think about what we really need in the near future from our library systems based on actual usage and perceptions of where we are heading.

### **From print to electronic**

Chalmers Library was surprised to learn that the local shift from print to electronic occurred as early as the year 2000.

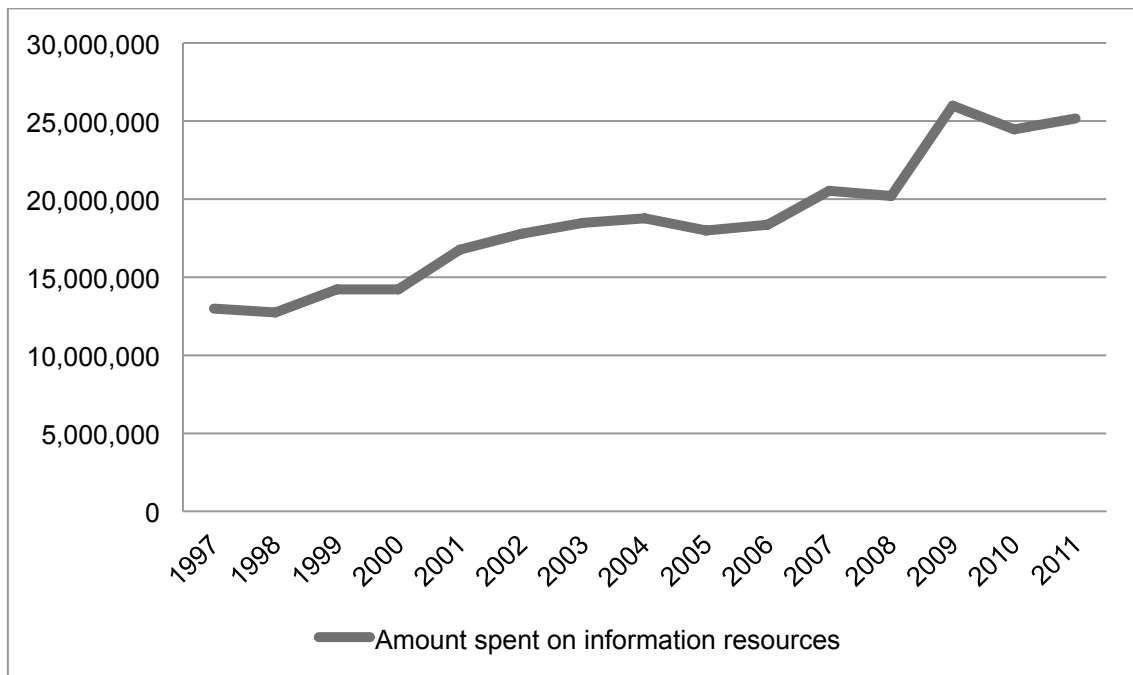
Figure 1



Expenditure on print and electronic resources at Chalmers Library 1992 – 2011

As we can see in Figure 1 Chalmers Library licensed or purchased more and more electronic resources during the first ten years of 2000 completely marginalizing print items towards the end of the period. This has also made an impact on the media budget as shown in Figure 2 as the increasing electronic content has brought a vulnerability to rising subscription fees.

Figure 2



Amount spent on information resources at Chalmers Library 1997 - 2011

The problem with increasing subscription fees was pointed out by Library Journal in 2011:

“During the recession there was a reduction in cost for most commodities and goods—with the Consumer Price Index (CPI) dropping in 2009 and only increasing 1.6 percent in 2010. During that same period, serials prices continued to rise at well above the CPI (four to five percent), and, against the backdrop of decreased funding for libraries, price increases are very hard to

sustain. Libraries do not have the resources to continue to exist in a world of ever-increasing prices, nor can publishers exist in world of no revenue increases.” (Bosch, 2011)

Chalmers library has felt the pressure of increasing costs for accessing electronic serials and have so far been successful in acquiring the funds to keep up. In an effort to break some of the dependencies Chalmers Library sought extra funding acquiring backfiles with ownership and thus expanding and controlling the collection. The Big Deals model has received a lot of critique the last years. But as the Research Information Network report e-Journals: their use, value and impact show e-journals are the life-blood of our research institutions. E-Journals enable fast and direct information seeking through gateway sites and there is a connection between high levels of expenditure and high levels of use to the point where usage is rising and cost-per-use is falling. Thus it would seem that investing into electronic content is a correct strategic path forward. (Research Information Network, 2011)

### **A growing collection**

Before acquiring a Discovery product it was very hard for Chalmers Library to estimate the size of its collection. The printed collection consisting of individual items monitored by a catalog and circulation system was very easy to measure. But how do you measure a collection of “things” on the Internet where you have access and how do you deal with “floating collections” where titles are added and retracted daily.

With the Discovery-layer unifying more the 90% of the libraries resources into one single index it became possible to estimate the size of the library collection once again and the results were staggering when comparing to the printed collection.

In 2011 the collection of resources defined by Chalmers library for its users exceeded 260 million records. 350 000 of these are printed bibliographic holdings.

The growing library collection is a sign of several changes. First and foremost, the amount of available content to our users has changed the way we construct and define our collections. Today a library can define an Open Access repository as a part of the collection and in one stroke harvest and make all of that data available. There is a real challenge for libraries to update their governing documents for collection building and maintenance to match the current situation.

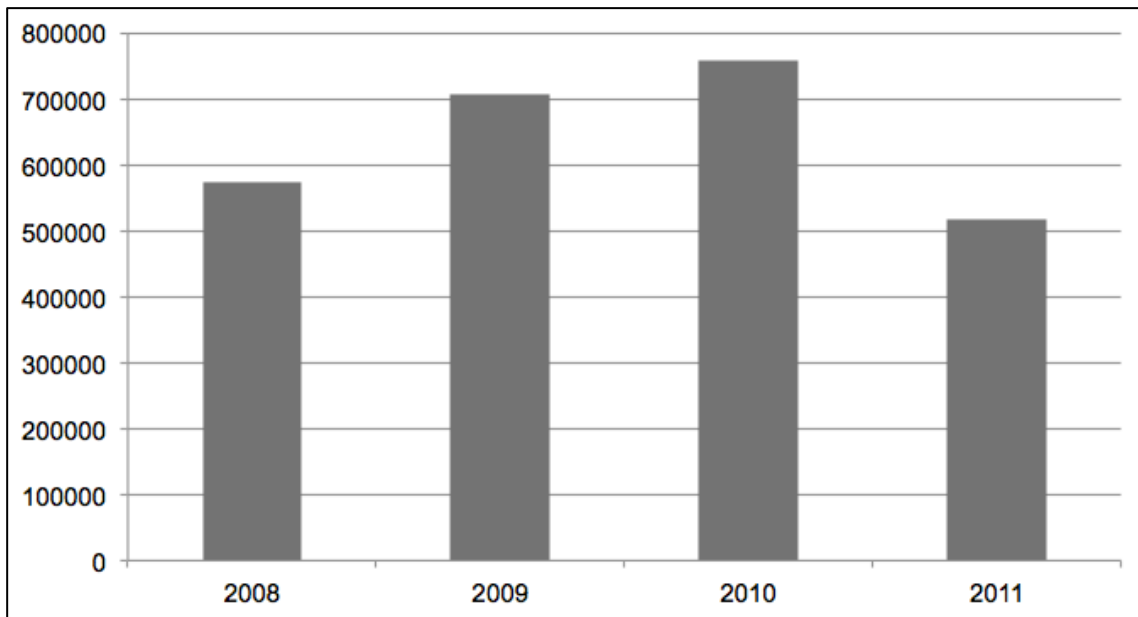
Second, articles available in databases are increasing at an alarming, almost exponential rate (Larsen, 2010). Danish research professor in disease systems biology, Lars Julh Jensen, calculated that if he did nothing else then to read all of the relevant research articles to him during a year he could dedicate about 45 seconds per paper. (Jensen, 2011)

The number of authors and papers are exploding and researchers are struggling to keep up. Imagine if researchers are struggling to keep up within their field of excellence how acquisitions librarians are struggling to keep up with all disciplines. Big deals and patron/demand driven acquisition are changing the way librarians are building collections. From reviewing and deciding on individual items to monitoring user behavior and making big deals. It is no longer possible for library staff to keep track of all the relevant scientific publishing. Especially not when many libraries are experiencing cuts. We need to do more with less.

### **Usage**

Usage statistics for Chalmers bibliographic databases shows an increase of searches up to 2010 and then a dramatic drop as shown in Figure 3.

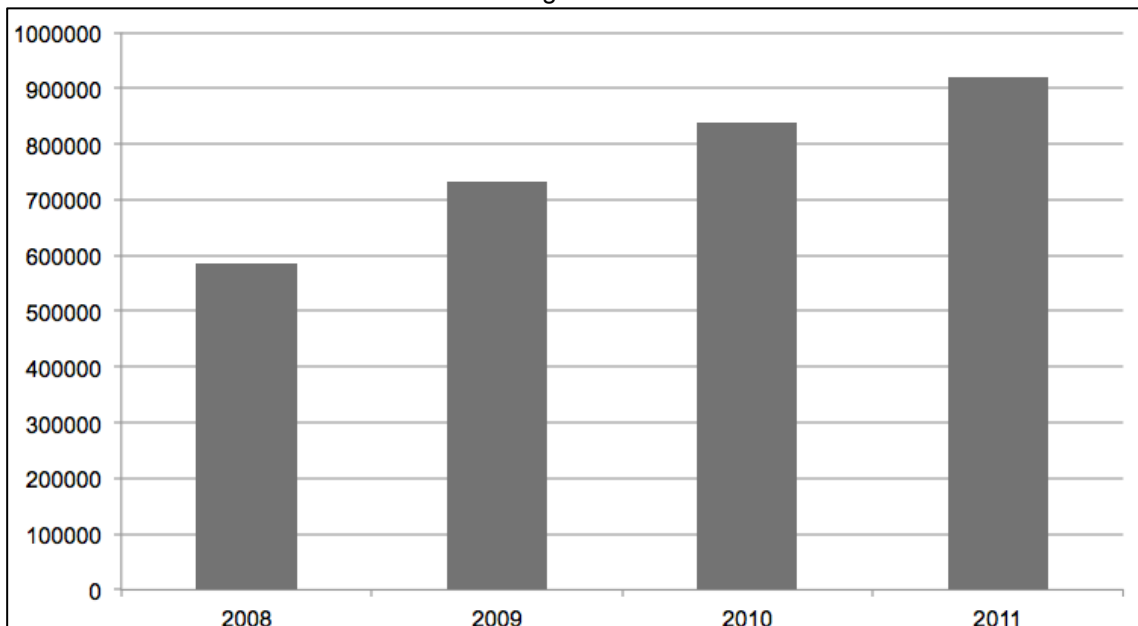
Figure 3



Searches in bibliographic databases at Chalmers Library 2008 - 2011

However looking at the usage of full text documents and downloads from the different databases there is a continuing increase (Figure 4).

Figure 4

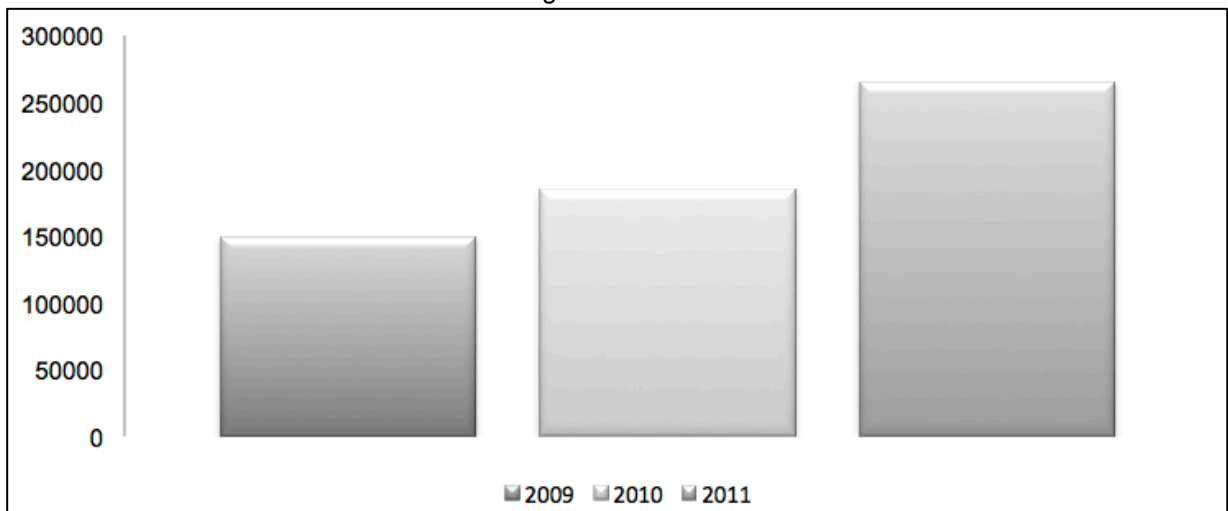


Downloaded full-text files from databases at Chalmers Library 2008 - 2011

This seems to support the conclusion from the RIN research that users/researchers are using gateway sites and avoid native search interfaces. (Research Information Network, 2011) For Chalmers the implementation of a Discovery tool with the usage from Google Scholar seems to be driving traffic to the full text documents and a success. There seems to be a change in user behavior when these tools are introduced and promoted. Over time it will be interesting to see if databases that do not expose their data in Discovery services will see a decrease in usage. Preliminary results from the University of Huddersfield shows a decrease in usage of resources not being searchable through the Discovery service (Pattern, 2012).

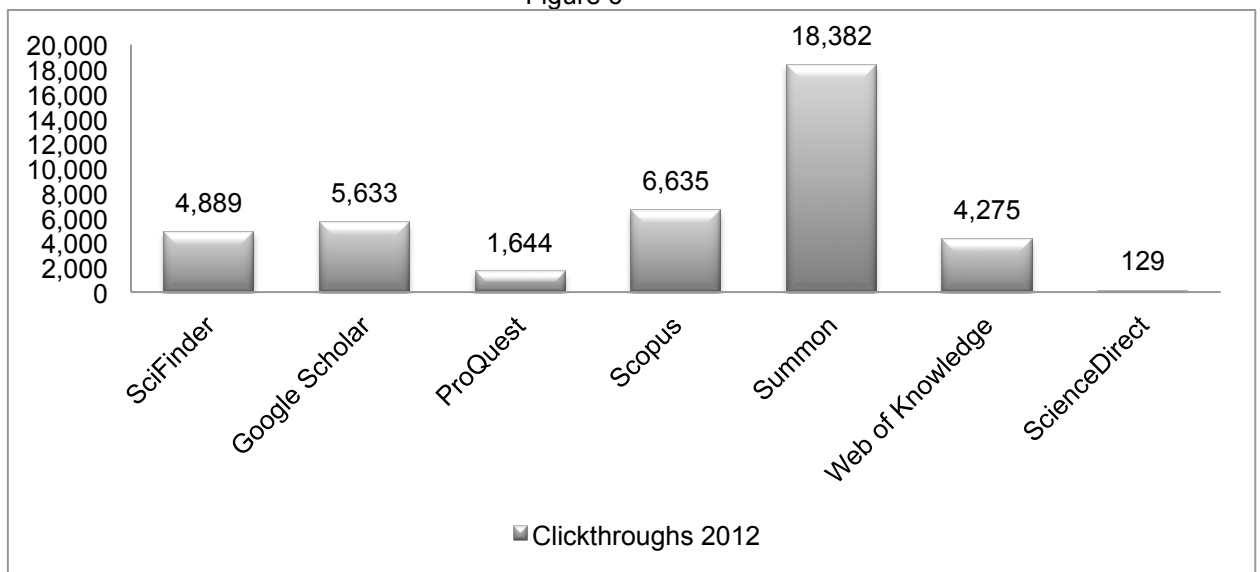
As shown in Figure 5 usage of the link resolver is increasing and a lot of the traffic is coming from the Discovery service as seen in Figure 6. This is despite that the Discovery service supports direct linking that bypasses the link resolver when applicable.

Figure 5



Link resolver click through at Chalmers Library 2009-2011

Figure 6

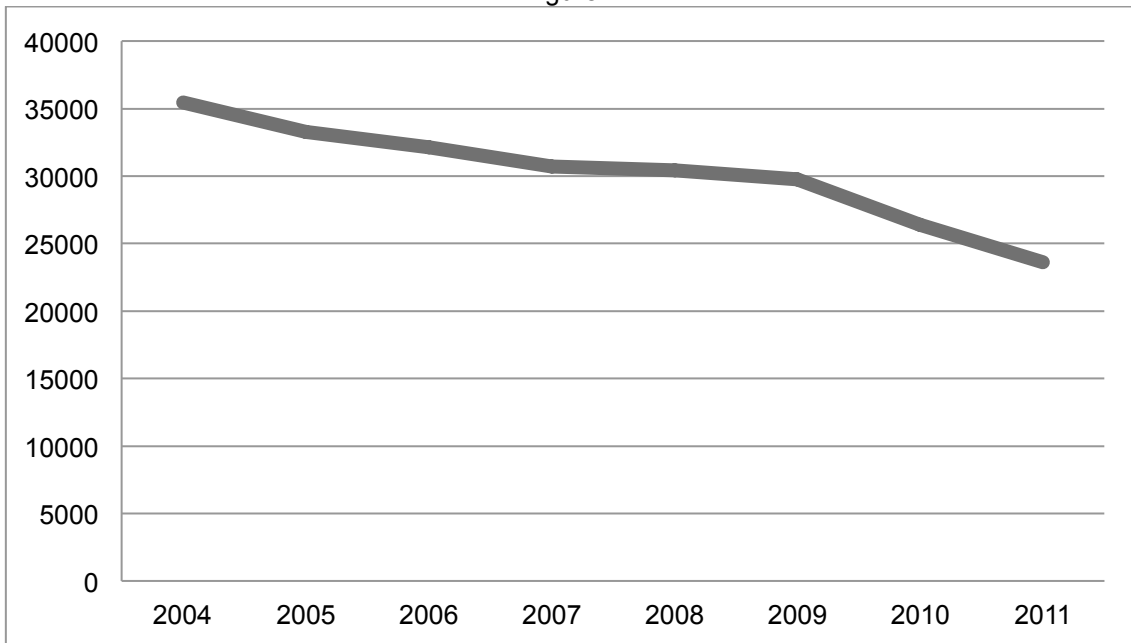


Link resolver click through for sample services at Chalmers Library January – March 2012

It would seem that the users are indeed embracing gateway sites to find and access the full text of resources and avoid using native database search interfaces when they can.

As usage of electronic resources are increasing usage of the printed collection is decreasing as shown in Figure 7.

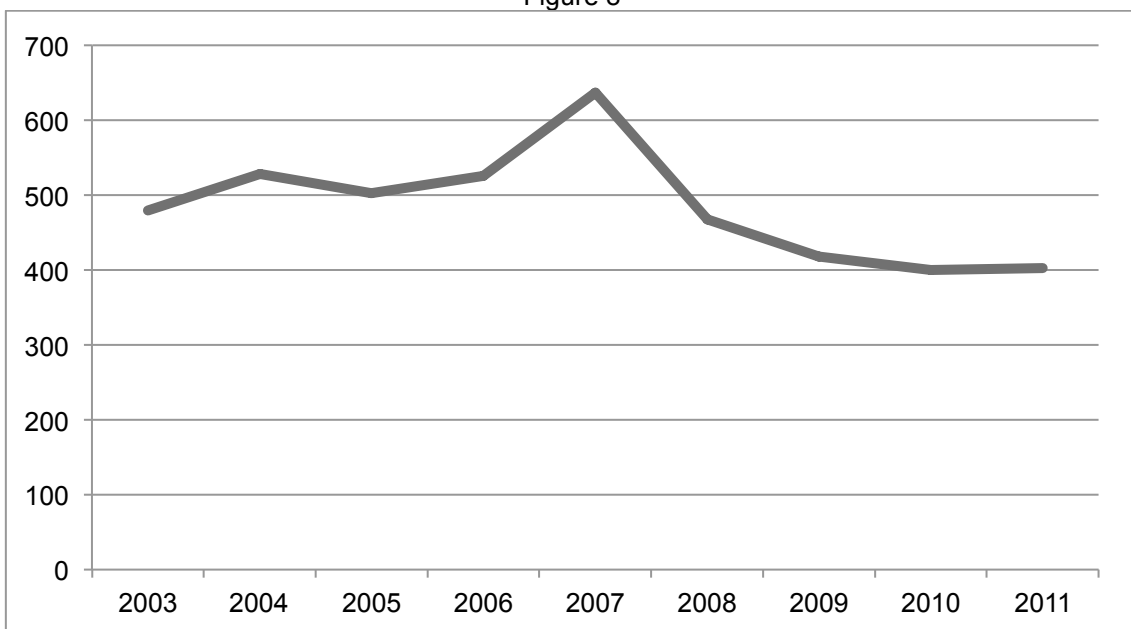
Figure 7



Circulation at Chalmers main Library 2004 – 2011

Circulation at the main library at Chalmers library is down 33% since 2004. This is not surprising as you might remember from Figure 1 that expenditure on printed resources are diminishing. We are simply not buying new books to circulate. The interesting part though is that we do not enforce electronic content before printed in our acquisitions policy. We acquire access to what our users ask for and the purchase requests are pretty stable over years the years as shown in Figure 8.

Figure 8

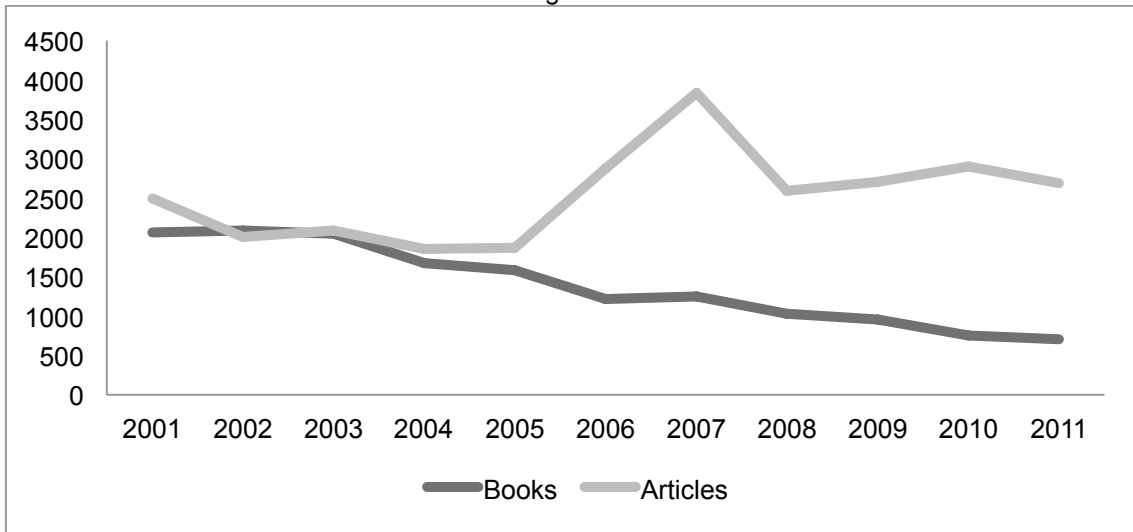


Purchase requests at Chalmers Library 2003 - 2011

ILL is still a popular service provided by the library. Ten years ago researchers at Chalmers requested as many books as they did articles. With the explosion of references to articles available online we can see that researchers today are still finding resources that the library

doesn't provide access too but that the resources that they are finding are articles and not books. Requests for books are of down 65% in ten years as shown in Figure 9.

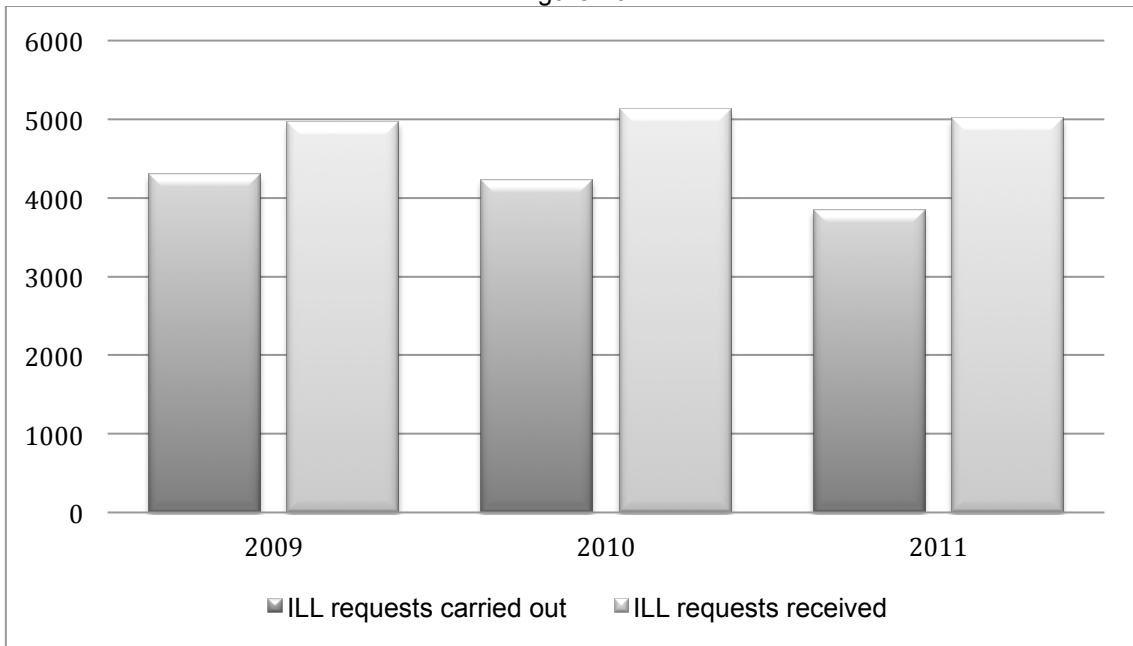
Figure 9



ILL requests for articles and books at Chalmers Library 2001 – 2011

A problem for the library is that researchers are requesting articles the library already has access to indicating that they are not using our gateway sites or link resolver service (Figure 10). The ILL department of the library still has to process the requests and notify the researcher.

Figure 10

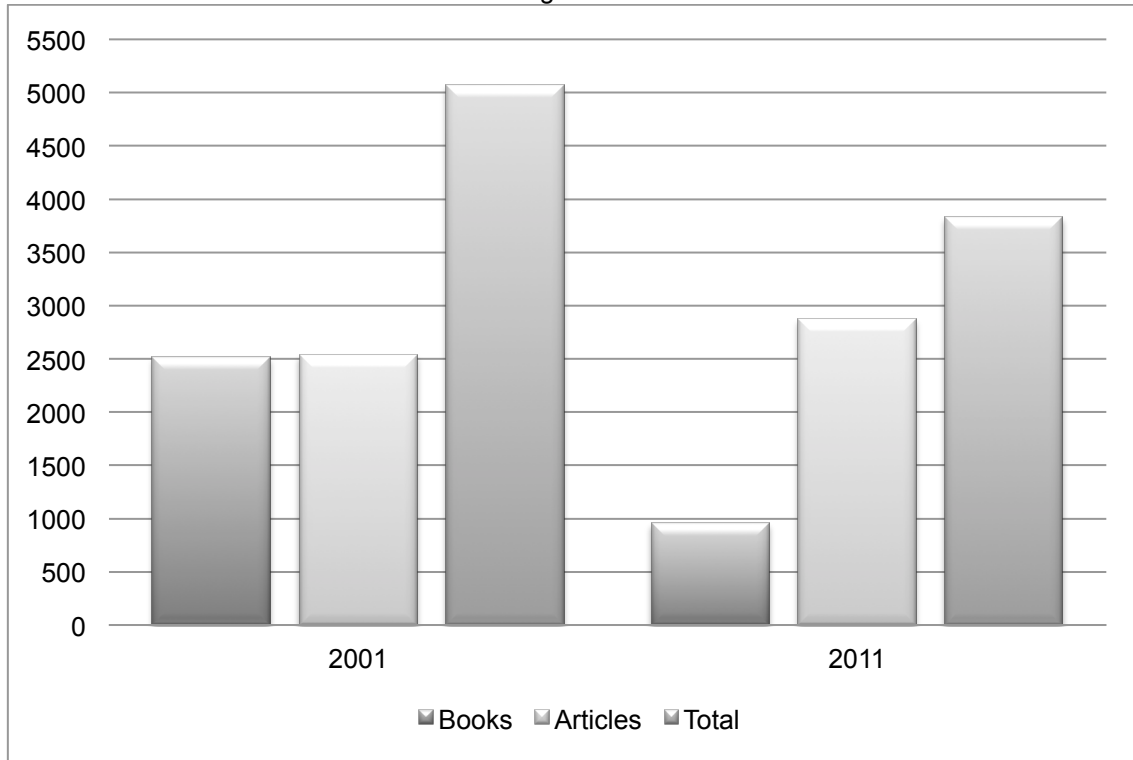


ILL requests received / carried out at Chalmers Library 2009 - 2011

As shown in Figure 11 the total amount of requests are down 24% in ten years, hopefully a result of the expanding electronic collection.



Figure 11



ILL requests carried out at Chalmers Library 2001 and 2011

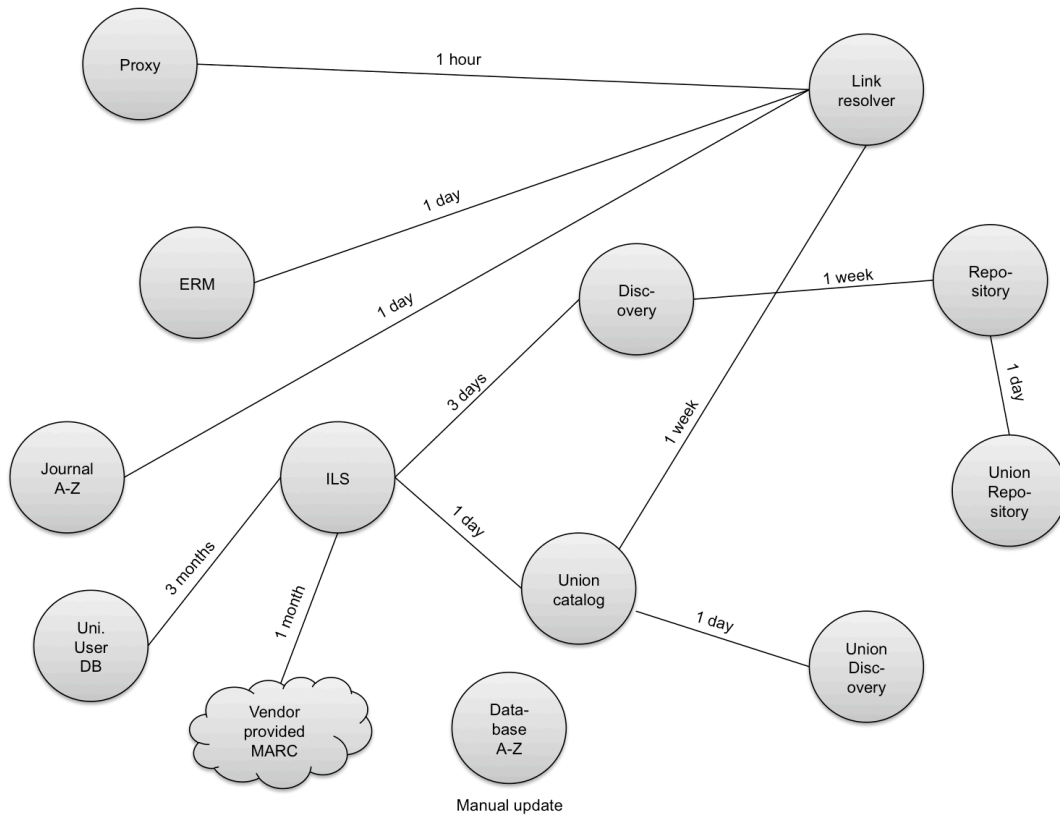
### Keeping silos in sync

As electronic content has exploded the old ILS has been pushed to the limit coping with new workflows and extensive data-loads, exports and record manipulation. Over the last ten years library automation vendors has introduced several new systems to help libraries with the development of electronic resources.

However the gradual development of different systems have left libraries in a complex world of local and hosted systems. TCO for license fees, maintenance of hardware and staff are increasing together with subscription fees.

Chalmers library mapped the current systems in production for supporting library operations and found a situation where the many systems at best are working together but it takes a lot of effort to keep them in sync leaving many librarians lost when there is a failure. Perhaps one of the most alarming conclusions from the survey was the problem of keeping the different systems in sync and the delays in data transfer and ingestion as seen in Figure 12.

Figure 12



System latency mapped out

Table 1

System	Primary function and dependencies
ILS	Handle circulation, inventory, support acquisitions, patron data and information about printed resources and e-books. E-book records are supplied by vendors and imported manually once a month. Records for printed resources are imported from the national union catalog daily. Handles user credentials for electronic resources.
Union catalog	Main source for copy cataloging. Printed resources are exported daily to the local ILS. There is a one day delay before resources cataloged in the union catalog are visible in the union catalog discovery service. Local electronic holdings are imported from the link resolver once a week (automated).
Link resolver	Manually maintained information on electronic resources holdings in a Central Knowledgebase (CKB). Feeds the journal A – Z and the union catalog with records for electronic holdings.
ERM	Handles administrative information about electronic resources and interoperates with the link resolver.

Discovery	Unifies resources into a single index search interface. Receives data from multiple points and requires activation of electronic resources in a CKB.
University user database	Contains patron information exported to the ILS twice each semester manually.
Proxy	Configuration file updates once / hour via automated export from link resolver. Requires information from the ILS for user credentials.
Database of databases	A manual system for maintaining and presenting information about databases the university has access to.
Repository	University publication system. Harvested by Discovery service and union Discovery service daily.

The situation is troublesome as there are a lot of system dependencies and personal dependencies in the current system landscape. The next generation systems currently being developed by automation vendors seem to target the right issues.

By merging the different systems that has evolved over the last ten years into one leveraging multi-tenant SaaS they promise lower TCO and more effective workflows for library operations, especially dealing with electronic resources and working with global CKB:s where customers share data.

### **Current trends affecting our systems**

The investigation into our current system situation shows that there is a real need for introducing new workflows and lowering TCO. But what are the emerging trends that could effect us? In a series of workshops at Chalmers Library the following trends where identified as important for our strategic work:

- Google-initiatives that effect user behavior and expectations including the development of personal relevancy ranking.
- A continued emphasis on electronic content over print resources.
- Just in time access and demand driven acquisition.
- Utilizing the systems oriented architecture, linking services libraries subscribe to and exposing library services outside the library domain.
- A continued emphasis on working with the scientific output from Chalmers University of Technology. Including looking into data curation and maintaining information about research projects.
- The need for stable partnerships with other libraries in networks and consortia, going outside of national borders if needed.
- Will webscale and cloud services peak? As we move into centralized services there is a need for localization and customization. Will this drive us back to local systems and implementations and if so when will that occur? In 3 to 5 years?
- Supporting the development of open linked data.
- A continued legal support for library operations focusing on business law, contract negotiation and copyright/intellectual property.

The systems workshop resulted in 5 primary areas of focus for the library the coming years:

- Central Knowledgebase Administration – identifying a master central knowledgebase and keeping data transportation to a minimal between information silos to lower cost of ownership and keeping data flows in sync. Keeping the back end administration to a reasonable level without having to work in to many different systems.
- Continued emphasis on the university publications and knowledge creation. Exposing publications, author and research environment.

- Central User Administration – identifying a master user information database. Minimizing different user identifications and passwords. Working with a master directory, using university IT infrastructure for authentication and authorization.
- Discovery – a continued emphasis and focus on exposing the unified discovery service to our users in different contexts.
- Delivery – working as seamless as possible between our different services and systems to deliver the resources to our users as direct as possible.

## **Conclusions and moving forward**

The process of mapping out our current systems situation, identifying what they are doing, looking at usage statistics and emerging technologies/trends have helped the library in identifying different strategies for facing the next generation library systems offered by vendors. All identified strategies poses questions for our continued work as we go ahead with the ambition of starting a process to change our current library systems environment during 2013-2014.

### **All in**

The idea of a library system that integrates print and electronic content workflows, with a global central knowledgebase, delivered as a service and built upon service-oriented architecture is appealing. It is a strong concept that should free local resources, dependencies and lower TCO. At the same time there are some concerns on keeping financial and patron data in the cloud and the fact that these systems are just emerging. We can expect a time of rapid development and initial problems. But as a concept it would seem to be a step in the right direction, the question is the when to take the plunge. Are we ready to be early adopters of these products and which vendor suits our needs best? Do we care about vendor lock in? Can we do this in a consortia environment?

### **Keeping print and electronic separated**

It is obvious that print is declining and will continue to do so at Chalmers library. Our current ILS does handle circulation very well, why would we change that and risk going through a migration to a new generation of library systems that might impose changes to our very functional print workflows. A valid option would be to keep our current ILS and to be very conservative with upgrades and changes unless they mean better ways of accessing circulation and patron information functions.

Another option, in lines with keeping electronic and print back end management to a minimal would be to migrate to a open source ILS providing us with control and access to the data we need within the ILS but lowering our license fees. We would still be depending on local expertise and have to solve support and maintenance of the system.

Exporting ILS meta-data into a central knowledgebase with a Discovery front-end seems to be something that all vendors are doing well.

As for the electronic content it seems we are in desperate need of merging the different management silos for Discovery, link resolving, electronic resource management, acquisition, proxy configuration and knowledgebase/data operations. Finding a modern solution that can help us keep data transportation (and data latency) to a minimum, utilizing SOA and solutions offered as a service is of the highest importance to us and should be our primary goal as we review our options for the different vendor and local library information systems.

## **Acknowledgements**

This work was completed with the support from key staff members at Chalmers University of Technology: Urban Andersson, Rose-Marie Boström, Marie Ekman, Emma Gustafsson, Lars-Håkan Herbertsson, Rolf Johansson, Ylva Lindgren, Kristin Olofsson, Marie Wenander and Marie Widigson.

## References

Bosch Stephen, Henderson Kittie, & Klusendorf Heather. Periodicals Price Survey 2011 - Under Pressure, Times Are Changing (2011). Retrieved April 29, 2012 from [http://www.libraryjournal.com/lj/newslettersnewsletterbucketacademicnewswire/890009-440/periodicals\\_price\\_survey\\_2011\\_under.html.csp](http://www.libraryjournal.com/lj/newslettersnewsletterbucketacademicnewswire/890009-440/periodicals_price_survey_2011_under.html.csp)

Ex Libris the bridge to knowledge, Overview (2012). Retrieved April 29, 2012 from <http://www.exlibrisgroup.com/category/AlmaOverview>

Innovative Interfaces: Sierra Services Platform (2012). Retrieved April 29, 2012, from <http://sierra.iii.com>

Intota | Services | Serials Solutions (2012). Retrieved April 30, 2012, from <http://www.serialssolutions.com/en/services/intota/>

Jensen Juhl Lars. Mining biomedical texts (2011). Retrieved April 29, 2012 from <http://www.slideshare.net/larsjuhljensen/mining-biomedical-texts>

Larsen Olesen Peder and Ins von Markus. The rate of growth in scientific publication and the decline in coverage provided by Science Citation Index. *Scientometrics*. 2010 September; 84(3): 575–603, DOI:10.1007/s11192-010-0202-z

OCLC Worldshare: Introducing sharing at Webscale (2012). Retrieved April 30, 2012, from <http://www.oclc.org/go/us/en/worldshare>

Pattern, Dave. I wouldn't start from here (2012). Retrieved April 29 from <http://www.daveyp.com/blog/stuff/uksg2012/UKSG2012.pdf>

Research Information Network. E-journals: their use, value and impact (2011). Retrieved April 29, 2012 from <http://www.rin.ac.uk/our-work/communicating-and-disseminating-research/e-journals-their-use-value-and-impact>