Flemish Public Libraries
-
Digital Library Systems Architecture Study

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1 Introduction

Over the last decades, the Flemish public libraries have seen an increase in their usage of ICT systems. This trend started with ILMSs (Integrated Library Management Systems) and continued with the arrival of the Internet. Libraries today are also working on digital collections, which can sometimes become mobile (e.g. e-books). This evolution has led libraries to manage more and more ICT systems: the traditional library has also become a "digital library".

1.1 Definition of a Digital Library

This study defines the **digital library** as the complete set of applications, digital content, related ICT infrastructure and ICT support provided by the three levels of public authorities (municipalities, provinces/Brussels-Capital region, Flemish region) in order to meet the challenges faced by public libraries. Today's most important challenges are either of a digital nature (e.g. online interaction with the public) or of a pure ICT nature (e.g. support of the physical collection management through the automation of metadata analysis). Coordinating the interoperability of the applications, files and infrastructure involved ensures that the library sector can function as a network of public libraries. The networked architecture must allow local public libraries to offer relevant services to our increasingly digital society.

If we refer to the conceptual framework set by Ian Rowlands and David Bawden ("Digital Libraries, A Conceptual Framework" - Department of Information Science, City University London, UK), this study covers the ICT systems that are needed to operate all kinds of libraries, from the "traditional library" to the "virtual library without wall".

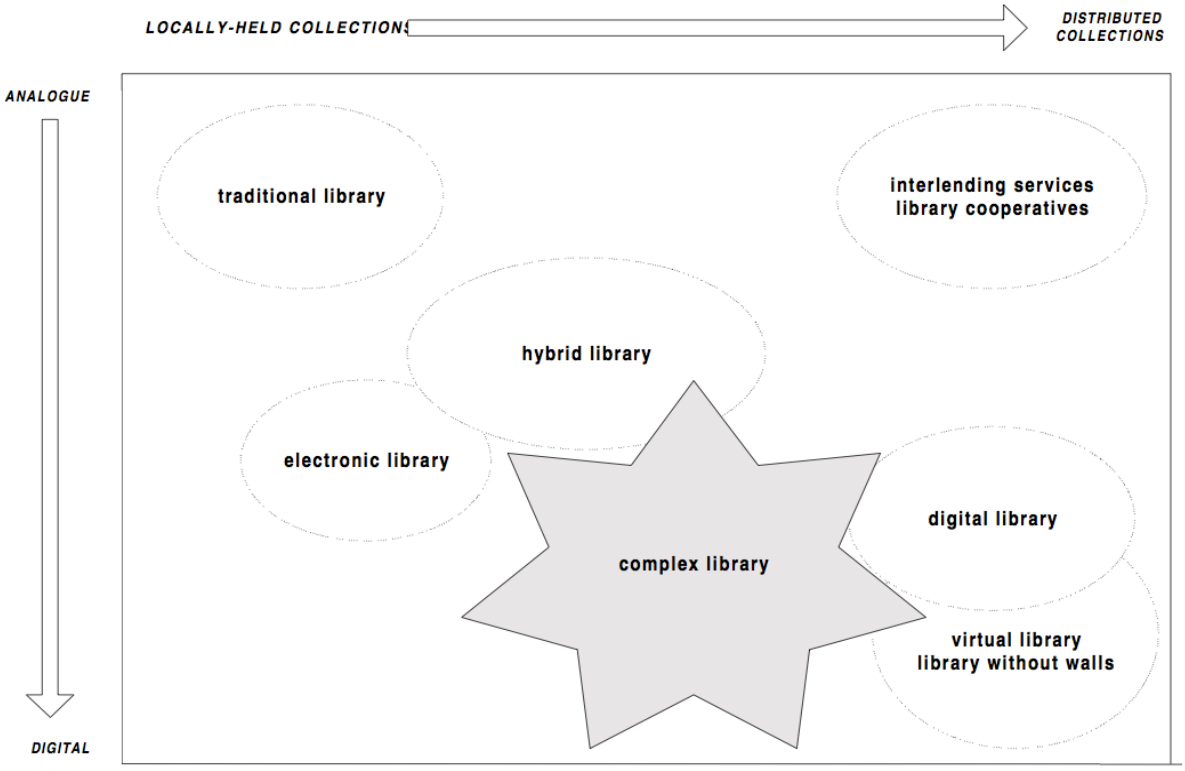


Figure 1: This study encompasses all the ICT systems of all library types as defined by IAN ROWLANDS AND DAVID BAWDEN

1.2 Study Objectives

As libraries operate more and more ICT systems, it is important for the public library sector to have a good overview of all the important systems involved, in order to optimise their operations and study how new systems can be smoothly introduced and integrated.

This study aims at providing an overview of the current situation and enabling better planning for 1) the optimisation of the current infrastructure and 2) the introduction of new public library ICT systems.

The results of the study aim at helping the public library sector:

- Define a common ICT vision and strategy
- Optimise the current system architecture
- Influence current suppliers' product planning
- Define a common blueprint for the further development of the digital library
- Influence the (international) market of library suppliers
- Supply a framework for later requests for proposals (RFPs)
- Determine a strategy and alternatives to avoid lock-in or monopoly situations with software suppliers
- Reduce licensing, maintenance, integration, migration and exit costs for library automation
- Share the Flemish experience with the wider European library sector

An additional description of the study's context may be found on Bibnet's website (NL): http://www.bibnet.be/portaal/Bibnet/Over_Bibnet/Onderzoek/Systeemarchitectuur%20voor%20de%20digitale%20bibliotheek

1.3 Study Approach

This study has been carried out in three phases:

1. The analysis of the current systems' architecture ("AS-IS").
2. The analysis of the future requirements (optimisation and innovation) through workshops and meetings.
3. The consolidation of a possible future architecture ("TO-BE") into a digital library architectural blueprint.

1.3.1 "AS-IS" Phase

In the first phase, **the current ICT architecture was analysed**; this will be referred to hereafter as the "**AS-IS**" (current) situation.
Several meetings were held with a selection of actors at all levels of the network:

- The 5 provinces and the Flemish Community Commission (VGC) in Brussels which all run a Provincial Library System (PBS – Provinciaal Bibliotheek Systeem)
- Local libraries (Antwerp, Gent, Muntpunt)
- Bibnet, which provides a series of centralised library solutions for the sector.

The AS-IS phase resulted in different deliverables, among which the "AS-IS capabilities map" that documents the current library capabilities that were discussed during the AS-IS meetings.

1.3.2 "TO-BE" Phase

In a second phase, a series of workshops and meetings were organised in order to **discuss the future of the libraries' ICT ("TO-BE" phase)**. Based on the results of the AS-IS phase, six workshops were held in June 2013 on:

- Systems Integration: applying the principles of Service Oriented Architecture (SOA) in the library sector
- Integration of municipalities
- The future of cataloguing
- User experience (UX)
- Consolidation workshops (one with experts from libraries and one with experts from partner organisations)

Many stakeholders were involved in the TO-BE phase:

- Local libraries: Antwerp, Gent, Bruges, Middelkerke
- The 6 PBS operators (5 provinces + VGC-Brussels)
- Bibnet
- Stichting Bibliotheek.nl
- University Libraries: University of Gent, University of Antwerp
- Partners
    - CultuurNet
    - V-ICT-OR
    - Leiedal
    - iMinds/VIAA
- External Consultants
- Suppliers: INFOR (Vubis), CIPAL (Brocade), LIBIS (Ex-Libris – Aleph/Alma), Digipolis

More than 70 people were involved in the TO-BE phase, allowing the study consultants to receive a lot of information and feedback, as well as validation of some assumptions.

1.3.3 Consolidation Phase

At the end of the TO-BE phase, two consolidation workshops were held: the first only with selected members of the library sector, the second with external stakeholders.

A structured analysis of the gap between the AS-IS and the TO-BE architecture then allows to suggest initiatives. Those initiatives can serve as the input for building a sector-wide ICT roadmap.

1.4 Study timeline

The study of the Flemish digital library system's architecture, coordinated by Bibnet, was conducted between January and July 2013.

- Kick-Off (30/01)
- AS-IS Analysis (March 2013)
  - Bibnet Workshop (4/03)
  - Antwerp (6/03)
  - Limburg & Brussels (11/03)
  - Muntpunt (11/03)
  - Antwerp province (22/03)
  - Gent (25/03)
  - West & East Flanders (26/3)
  - Flemish Brabant (28/3)
- TO-BE Analysis (March-July 2013)
  - TO-BE Bibnet Workshop (18/03 - Brussels)
  - Ugent meeting (8/05 - Gent)
  - Infor conference call – (22/05)
  - LIBIS/ALEPH meeting – (24/05 – Leuven)
  - SOA workshop (27/05 – Brussels)
  - Workshop in municipality integration (27/05 – Brussels)
  - Cataloguing - BIBNL – ELAG2013 (29/05 - Gent)
  - Cataloguing workshop (7/06 – Brussels)
  - User Experience workshop (7/06 – Brussels)
  - CultuurNet meeting (10/06)
  - V-ICT-OR meeting (10/06)
  - BIBNL workshop (12/06)
  - Consolidation workshop – Library sector (13/06)
  - Consolidation workshop – Library partners (13/06)
  - BROCADE UA meeting (2/07 - UA)
- Report
  - 1st Report review – Bibnet (30/7)
  - 2nd Report review – Bibnet (18/9)
  - Final report 27/11/2013

1.5 Study Steering Committee

The study has been directed by a "steering committee" composed of Bart Beuten (Bibnet), Jan Braeckman (Bibnet), Stefaan Froyman (West Flanders province), Patrick Vanhoucke (Flemish Community Commission, Brussels).

All members of steering committee were involved in at least one of the AS-IS meetings, and in all of the TO-BE workshops.

2 ICT Systems Architecture Concepts

In this study, several Enterprise and ICT architecture concepts are used:

- The **Enterprise Architecture Model** allows to model why and how ICT applications are necessary. Generally they enable business services and processes, and are implemented using technical services and their underlying technology.
- **Archimate** is a notation language used to create diagrams representing the business, application and technology elements.
- **Service Oriented Architecture** (SOA) is a business-centric IT architectural approach that supports integrating your business as linked, repeatable business tasks, or as services.
- **ITIL** (Information Technology Infrastructure Library) is a library of IT processes. It standardises the activities that an ICT department needs to carry out as a part of providing a quality ICT service.
- A **Capability Map** is a list of business, application and technology capabilities.

2.1 Enterprise Architecture Model

In order to get a comprehensive overview of the library ecosystem's current situation, we will use an enterprise architecture model based on multiple layers. We will also take the opportunity to define some terms that we will use throughout this report. The enterprise architecture model is described in the following picture.

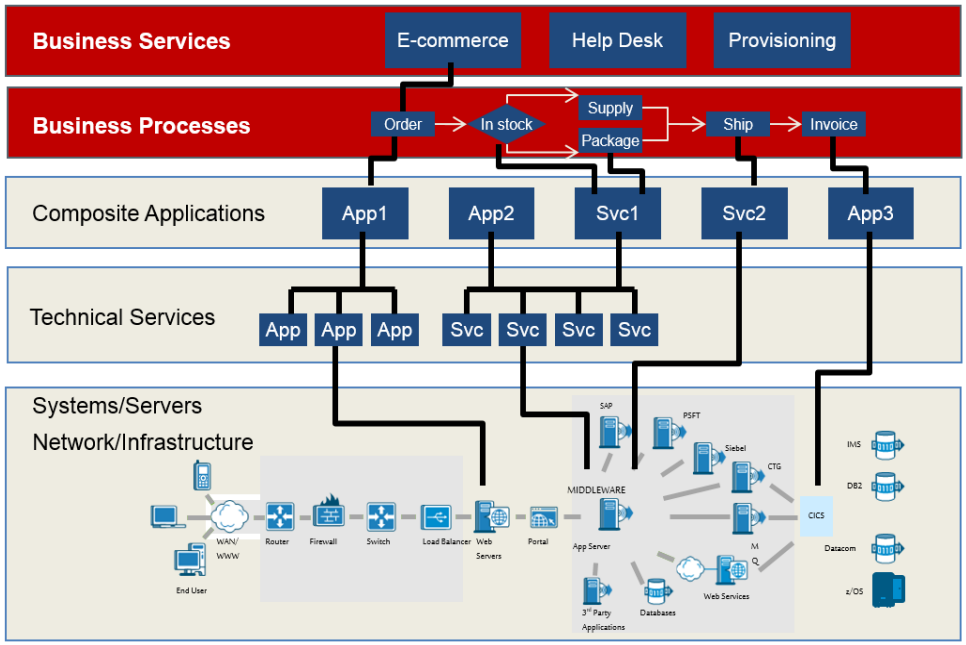


Figure 2: Enterprise Architecture Model

Let's go through it from the top.

At the highest level, we will start by identifying the **Business Services** that are delivered by the different organisations, entities or partners. A Business Service is any kind of service that is delivered by a person or an organisation (the Service Provider) to their customers (the Service Consumer). It might be a service that does absolutely not rely on any IT technology. Of course, we all know that most organisations are now using technology to support their business.

A first activity of the AS-IS analysis is to identify these business services and their respective providers and consumers. The chapter “AS-IS Business Services” covers the initial identification of the current library business services. The chapter “TO-BE Business services” attempts to list all future business services that libraries could operate in the future.

A characteristic of a Business Service is that it traditionally starts a **Business Process**. A Business Process is a sequence of tasks executed by a person or an organisation. The Business Process also describes the different criteria used to take decisions or to respond to specific events. The next step in the AS-IS analysis is to describe these business processes in terms of tasks and their executors. The “AS-IS Business Processes” and “TO-BE Business processes” chapters list the libraries' business processes.

Some of the tasks involved in a Business Process can be fully manual activities not involving any technology, or can be activities executed by people using an IT **Application**. Some other tasks can be fully automated and delivered by IT **Technical Services**. These applications and technical services can themselves be a combination of smaller applications or smaller technical services. Thus, another step of the AS-IS analysis is to list all applications and technical services that are already available, along with the functionality that they deliver. For each application/technical service, it will then be important to identify two things:

1) What are the features (also called services) that are available and that could be re-used when further building the future Digital Library (i.e. re-used in the TO-BE analysis)?
2) What integrations currently exist between the applications/technical services and how do they work together?

The library applications are described in the chapters entitled “AS-IS ICT Applications” and “TO-BE ICT Applications”.

Finally, all these services and applications are being executed on a certain **Infrastructure**, distributed across several locations. The “AS-IS ICT Technology Layer” and “TO-BE technology Layer” chapters cover the libraries' infrastructure situation and requirements.

Charting all these layers and describing them will provide a comprehensive view of today's ecosystem of libraries, and will serve as a basis for future developments.

2.2 Archimate

Archimate is a notation system that allows users to draw diagrams that represent components of an enterprise architecture. Just as in the Enterprise Architecture Model, those components are organised in 3 layers:

- Business
- Applications
- Technology

Typically, a traditional systems architecture would contain only the applications and technology components. However, it is important for IT specialists to also model the business layer in order to ensure that the ICT architecture is aligned with the business requirements. This is called “IT-to-Business alignment”.

The Archimate components are also categorised by their nature:

- Informational
- Behavioural
- Structural

The following table lists all the components that can be represented using Archimate:

Layer/Aspect	Informational	Behavioural	Structural
Business	Business Object Contract Product Representation	Business Service Business Process Event	Business Actor Business Role Business Interface Business Collaboration Location
Application	Data Object	Application Service Application Function	Application Component Application Interface Application Collaboration
Technology	Artifact	Infrastructure Service System Software	Device Node Communication Path Network Infrastructure Interface

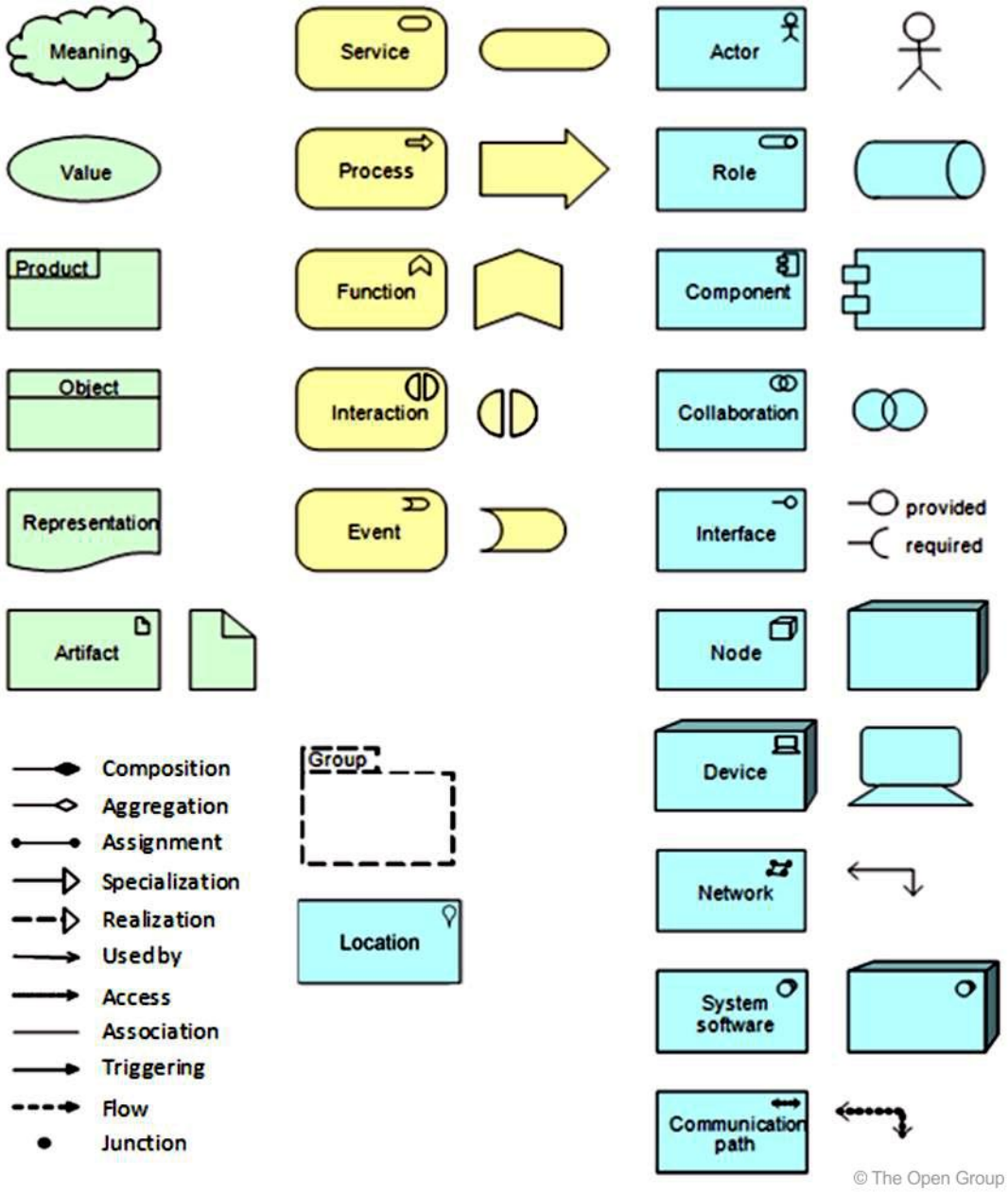


Figure 3: Archimate Notation

The AS-IS and the TO-BE Architectural overviews aim at identifying:

- Business Services
- Business Processes
- Business Objects
- Application Components
- Application Collaborations

The complete Archimate specification can be found here:
http://pubs.opengroup.org/architecture/archimate2-doc/

This study used the "Archi" open-source tool for modeling (version 2.4):
http://archi.cetis.ac.uk/

2.3 Service Oriented Architecture (SOA)

Service-oriented architecture (SOA) is a software design and software architecture design pattern based on structured collections of discrete software modules, known as services, that collectively provide the complete functionality of a large software application. The purpose of SOA is to allow a large number of computers that are connected over a network to work together seamlessly. Each computer can run an arbitrary number of programmes - called services in this context - that are built in such a way that they can exchange information with any other service within the reach of the network, without human interaction and without the need to make changes to the underlying program itself.
(Source: http://en.wikipedia.org/wiki/Service-oriented_architecture)

One of the ways to implement SOA is to plug SOA services into an Enterprise Service Bus (ESB). The ESB organises the mediation of services between the service consumers and the service providers.

For example, a service consumer can be a library website requesting a service to an ILS regarding a patron's borrowing history. Using an ESB for the mediation of this service allows to loosely couple the website and the ILS so that they can evolve independently. Furthermore, the ILS service can be re-used and exploited by other applications (e.g. CRM).

Adopting SOA aims at standardising the way services are built and used. It allows to reduce ICT costs (by replacing tailor-made integrations by reusable standard interfaces) and increase ICT flexibility (by reconfiguring composite applications and processes rather than migrating or replacing large monolithic applications).

The Oracle SOA Reference Architecture white paper (ORA-SOA-RA) is an excellent introduction to all the elements of a service-oriented architecture:

Oracle® Reference Architecture - SOA Foundation - Release 3.1 - E14484-03
http://www.oracle.com/technetwork/topics/entarch/oracle-ra-soa-foundation-r3-1-176715.pdf

The following figure is copied from the white paper and illustrates all the important concepts of SOA .

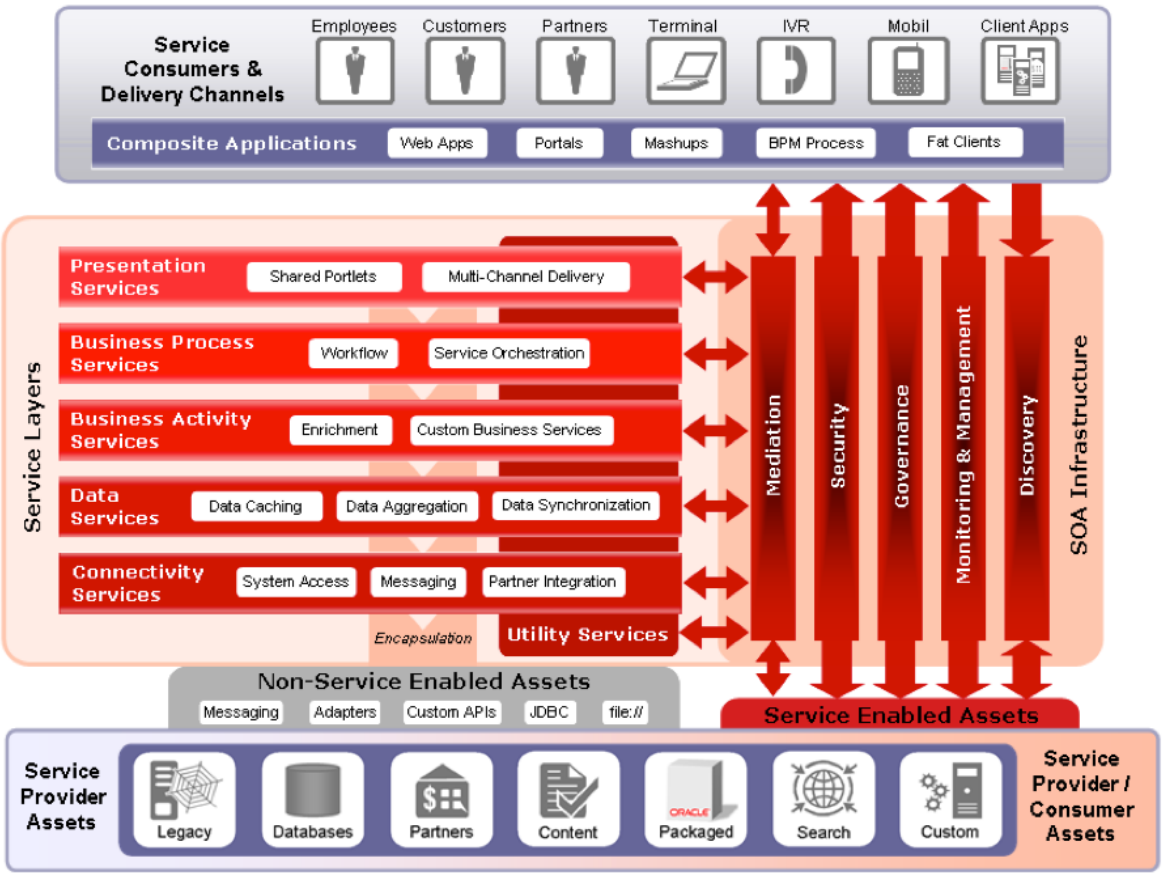


Figure 4 Oracle SOA Conceptual Architecture

This study considers the following SOA elements of the SOA reference architecture:

- **Business Process Services**: which library business processes need to be service enabled?
- **Service providers**: which library ICT systems need to provide services to other applications? Should libraries packages (ILS) become SOA-enabled?
- **Service consumers**: which library ICT systems need to exploit services from other applications?
- **SOA Infrastructure:**
  - **Mediation**: do the libraries need an Enterprise Service Bus to manage all the current and future SOA services?
  - **Security**: who can use what service? This is where Identity and Access Management plays an important role
  - **Governance**: should the libraries' ICT governance include an SOA governance?

2.4 Information Technology Infrastructure Library (ITIL)

The use of ICT applications in libraries is the outcome of ICT processes such as documenting requirements, developing applications, purchasing applications or deploying software. Each organisation that relies on ICT for its operations has a certain maturity for each of those ICT processes.

The systems architecture study allowed for the evaluation of the ICT maturity of public libraries. In order to analyse the current ICT processes and how they should evolve, the **ITIL** terminology has been used in this study.

The Information Technology Infrastructure Library (ITIL) is a set of practices for IT service management (ITSM) that focuses on aligning IT services with the needs of business. In its current form (known as ITIL 2011 edition), ITIL is published in a series of five core publications, each of which covers a lifecycle stage of ITSM. ITIL underpins ISO/IEC 20000 (previously BS15000), the International Service Management Standard for IT service management, although differences between the two frameworks do exist.
ITIL describes processes, procedures, tasks and checklists that are not organisation-specific, used by an organisation to establish integration with the organisation's strategy, delivering value and maintaining a minimum level of competency. It allows the organisation to establish a baseline from which it can conduct planning, implementation, and measurements. It is used to demonstrate compliance and to measure improvement.

There are five families of ICT processes in ITIL:

- ITIL **Service Strategy** provides guidance on clarification and prioritisation of investments in ICT services.
- ITIL **Service Design** provides guidance on good-practices related to the design of IT services, processes, and other aspects of the service management effort.
- ITIL **Service Transition** relates to the delivery of services required by a business into live/operational use, and often encompasses the "project" side of IT rather than business as usual (BAU).
- ITIL **Service Operation** aims at providing best practices to achieve the delivery of agreed levels of services both to end-users and the customers (where "customers" refers to those individuals who pay for the service and negotiate the SLAs).
- ITIL **Continual Service Improvement** aims to align and realign IT services to changing business needs by identifying and implementing improvements to the IT services that support the business processes.

Source: http://en.wikipedia.org/wiki/Information_Technology_Infrastructure_Library

The chapter “ICT - ICT Processes” uses the terminology of ITIL process families to present a number of considerations on the required evolution of the ICT maturity of the Flemish public library sector.

2.5 Capability Map

During the study, a “capability map” work-product was produced during the AS-IS phase. Its objective was to be able to structure all the information received during the workshops into a consistent sector-wide framework.

A capability is the practical ability to realise a benefit by a combination of Processes, Organisation, Technology and Information.

All library systems contain functional and technical capabilities that help libraries implement business capabilities. The AS-IS meetings enabled the identification of many technical, functional and business capabilities.

The methodology used to produce the capability map is the following:

- Conduct the analysis (interviews, meetings, workshops) and identify all "ICT systems related statements". For example, such a statement might be: "At library XYZ we do not use the purchasing module of our ILS".
- Identify the underlying capability: in this case the "Acquisitions" component within the "ILS Application".
- "Classify" the statement.

In order to classify the statement, we will categorise the related capabilities according to different dimensions in the capability map spreadsheet:

- Scope: AS-IS
- Domain: Collection Management
- Organisation: Library
- Actor: Library XYZ
- Architecture: "Accepted practice" or "Decision"
- Component (Generic application name): ILS
- Implementation (software used to implement the component): VUBIS
- Provider (services and support partner for the component): INFOR
- Capability: Acquisitions
- Capability Description: purchasing module not used
- Business Entities (related business object): Book, Order, Purchase

The most complex classification in our capability map is the Architecture dimension. It represents the type of information that is captured in the "capability description" column. The capability map is based on the following architecture elements:

- SOA Layer
- Motivations
- Business Layers
- Project – Implementation and migration
- Project – Risks, Assumptions, Issues, Decisions (RAID)

The following categorisation is used for SOA:

SOA Classification	
1.Presentation	Presentation Layer of an application (e.g. fat client)
1.Presentation-Web	Presentation Layer of an application - Web Based
2.Process	Process present in the architecture. Processes can reside in applications, in the middleware, or both.
3.Services	SOA Services Exposed by applications Services. They are governed by a service lifecycle (SOA Governance).
4.API	APIs exposed by the ICT system
5.Application	Core Functional Application Layer, represented by a set of logical components
6.Data	Application Data Layer of the architecture (databases, entities, business objects)

The following categorisation, based on the Archimate motivation extension, is used for Motivations:

Motivations Classification	
Stakeholder	The role of an individual, team, or organisation (or classes thereof) that represents their interests in, or concerns relative to, the outcome of the architecture.
Driver	Something that creates, motivates, and fuels change within an organisation.
Assessment	The outcome of the analysis of a certain driver.
Goal	An end state that a stakeholder intends to achieve.
Requirement	A statement of need that must be realised by a system.
Constraint	A restriction on the way in which a system is realised.
Principle	A normative property of all systems in a given context, or the way in which they are realised.
Motivation Extensions	
Architectural Goal	A requirement resulting from an architectural goal
Architectural Requirement	A requirement resulting from the architecture
Decision	A constraint resulting from a decision
Exception	A decision or constraint resulting from an exception
Standard	A constraint to use a certain standard
Accepted Practice	A constraint to adopt an accepted practice

Motivational concepts are used to model the motivations, or reasons, that underlie the design or change of some enterprise architecture. These motivations influence, guide, and constrain the design.

It is essential to understand the factors, often referred to as drivers, which influence the motivational elements. They can originate from either inside or outside the enterprise. Internal drivers, also called concerns, are associated with stakeholders, which can be some individual human being or some group of human beings, such as a project team, enterprise, or society. Examples of such internal drivers are customer satisfaction, compliance to legislation, or profitability. It is common for enterprises to undertake an assessment of these drivers; (ex: using a SWOT analysis, in order to respond in the best way).

The actual motivations are represented by goals, principles, requirements, and constraints. Goals represent some desired result – or end – that a stakeholder wants to achieve (ex: increasing customer satisfaction by 10%). Principles and requirements represent desired properties of solutions – or means – to realize the goals. Principles are normative guidelines that guide the design of all possible solutions in a given context. For example, the principle “Data should be stored only once” represents a means to achieve the goal of “Data consistency” and applies to all possible designs of the organisation’s architecture. Requirements represent formal statements of need, expressed by stakeholders, which must be met by the architecture or solutions. For example, the requirement “Use a single CRM system” conforms to the aforementioned principle by applying it to the current organisation’s architecture in the context of the management of customer data.

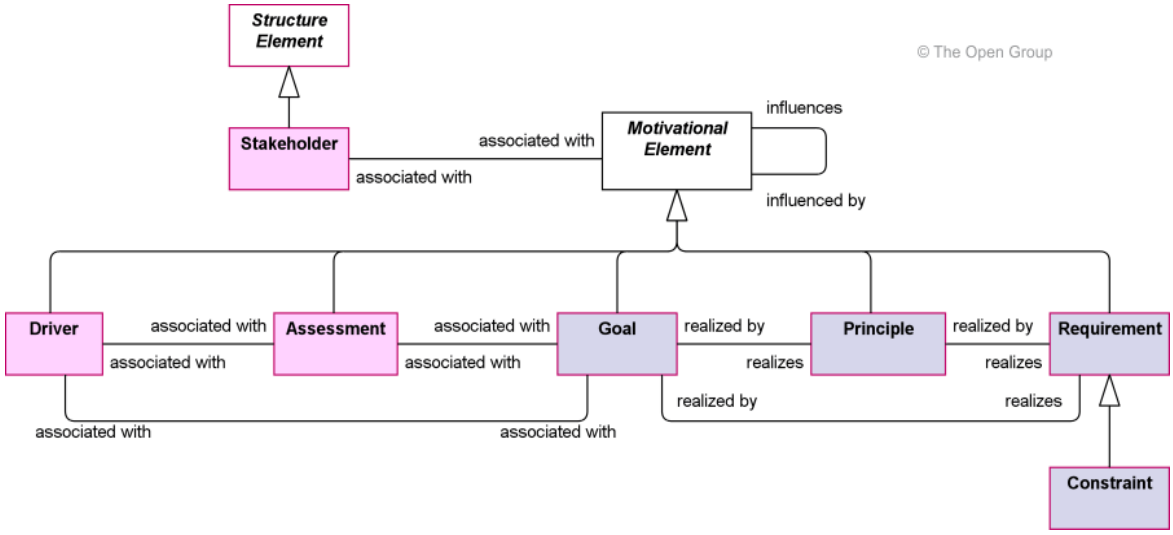


Figure 5: Motivations concepts in Archimate

http://pubs.opengroup.org/architecture/archimate2-doc/chap10.html#_Toc309639821

The following categorisation is used for business layers.

Business Classification	
Business Service	Externally visible ("logical") functionality, which is meaningful to the environment and is realised by business behaviour (business process, business function, or business interaction).
Business Process	Not used. SOA classification applied (2.Process).

3 Current system architecture of Flemish public libraries (AS-IS)

Before beginning to design the future library systems' architecture, it is important to understand its current state. Indeed, it would be nearly impossible for libraries to change all their ICT systems overnight. The future ICT architecture is only as good as its implementation roadmap, and this journey starts with the current ICT architecture.

3.1 AS-IS Analysis Approach

The first phase of the study consisted of an analysis of the current ICT architecture. In order to acquire information at the source, a number of meetings were organised in the field. Bibnet, "provincial" instances (PBS operators) and some local libraries were met to discuss the current ICT architecture and challenges. The discussions were not limited to the current situation; some TO-BE elements could also be identified and discussed.

The core of the discussions was captured in the "**AS-IS Capability map**": a spreadsheet that classifies the architectural elements identified (Business Processes, Applications, Technologies…), linking them to the related Business or ICT capability.

3.2 AS-IS Business Services

3.2.1 Libraries Business Services: a first model from Quebec

A first approach for identifying the library systems is to investigate what ICT tools libraries use in order to deliver their **business services**.

As no library business services model was currently available, one was built on the basis of a Canadian document:

Bibliothèque d'aujourd'hui
Lignes directrices pour les bibliothèques publiques du Québec [document électronique]
ISBN: 978-2-923563-33-6(PDF)

The AS-IS library business services model contains several components.

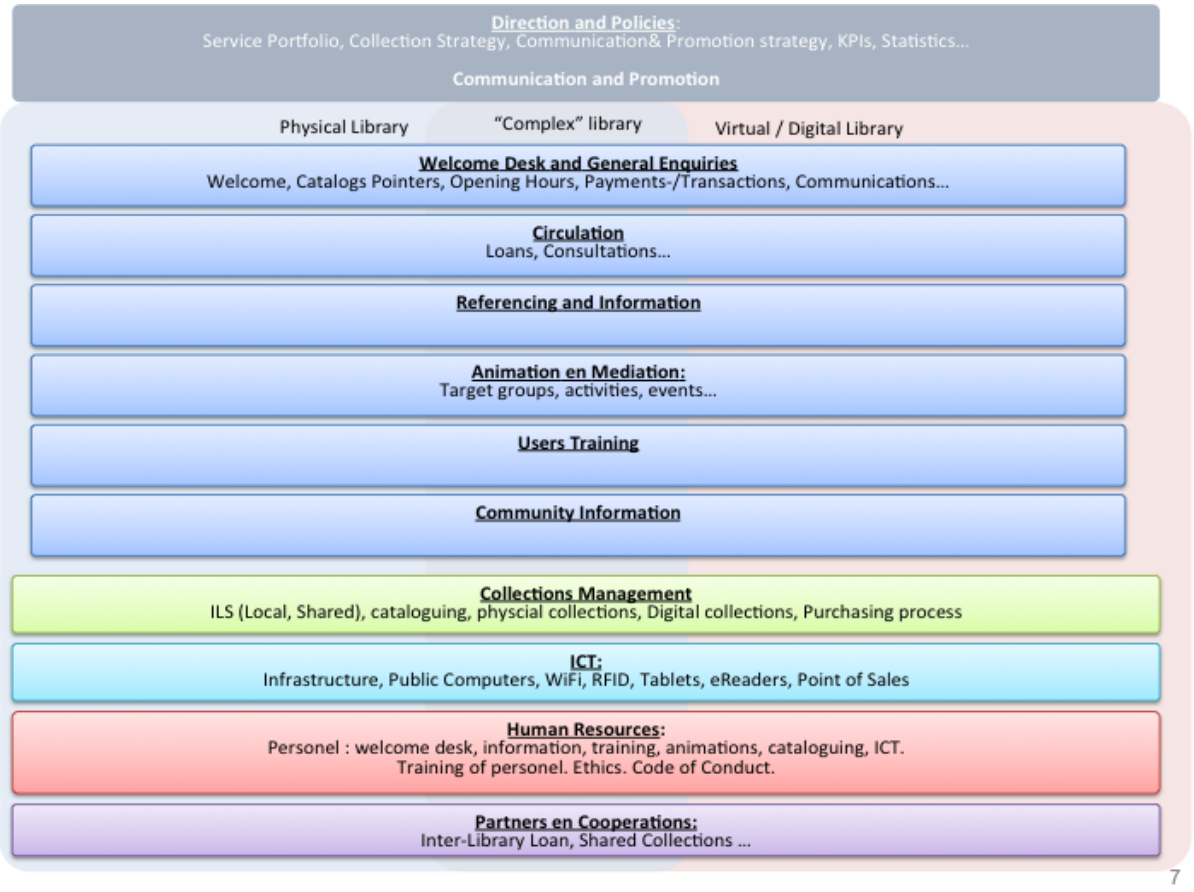


Figure 6 First library business services model used during the study

At the top we find the "**Library Direction and Policies**" layer. This is where the library's strategy and policies are defined and followed up on. It concerns the library services portfolio, the collections development strategy, the marketing strategy as well as the follow-up of the implementation of these strategies using Key Performance Indicators (KPIs) and statistics. Later in this study, this business service is sometimes simply called "Library Management".

We also find the "**communication and promotion**" layer, which ensures that the library

- Develops and implements a marketing plan
- Carries out public relations activities
- Promotes its activities
- Promotes its role, mission and services

The model specifies six additional public library services, the "**Patron Services**":

- **Front Desk & General Enquiries:** the library ensures that patrons feel welcome in the library and are helped with general and orientation information.
- **Circulation**: allows patrons to borrow items or consult the collections.
- **Referencing and Information**: the library guides and advises patrons in searching and using the available resources of all kinds.
- **Animation and Mediation**: the library services are promoted via animation and mediation activities.
- **User Training**: the library offers various training courses in line with their mission (for instance: initiation training for library services or technologies).

- **Community Information**: the library provides community information about municipal services, literacy and self-help organisations, etc.

The model further explores the library "back-office" that is necessary to provide the library's services:

- **Collection management**: cataloguing, collection planning, purchasing process
- **Information Technology (ICT):** ILS, internet systems, security systems, payment terminals
- **Human resources:** the library employs the personnel necessary to ensure its correct operation
- **Partners and cooperation**: for Inter-library loans or shared collections, for example

The business services can be delivered in three different environments:

- By the physical library (on-site of off-site)
- By the virtual library: online, on the web
- Physical and virtual, called "*the complex library*" in the conceptual framework of digital libraries defined by Rowlands and Bawden (see the "Digital Library Definition" section). Providing services that combine the physical and the virtual library can be a strong differentiator for public libraries against actors who only provide a virtual library.

Note that in order to be complete, additional components should be added to the model. For instance:

- Assets and facility management (building, furniture, accessibility…)
- Finance (Accounting, Payment facilities…)

3.2.2 Value Chain and High-Level Business Services

An alternative way to identify the library business services was to place them within the libraries' value chain. A value chain is a series of activities performed by an entity operating in a specific industry in order to deliver a valuable product or service for the market.

After multiple meetings with the various stakeholders of the library ecosystem, we were able to identify the different activities as parts of a high-level value chain. This value chain defines the broad categories of activities and their sequence. Note that this value chain is actually a cycle that repeats itself. There are also some activities that are executed continuously, throughout the value chain, such as cataloguing.
This value chain also takes its inspiration from the traditional retail value chain. This is not so surprising, as the primary activity of libraries is to bring books and other resources to users through a network of local libraries that must regularly be "replenished" with new collections. This is as far as the comparison goes, however, since the library ecosystem is much more fragmented and distributed than traditional retail structures.

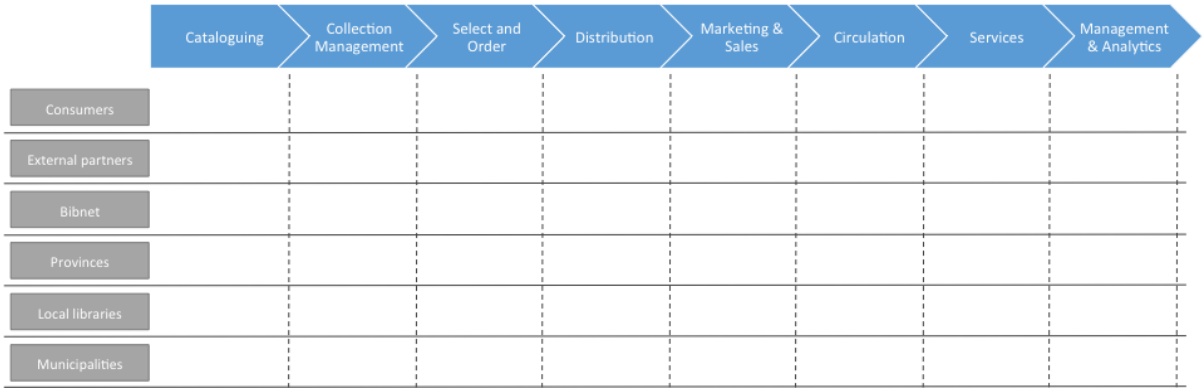


Figure 7: The AS-IS value chain of libraries

In this value chain, multiple stakeholders will interact and work together to deliver the business services to the service's consumers. Each stakeholder can be both a service provider and a service consumer. We identified six major stakeholders (or categories of stakeholders):

- Bibnet, the provinces/Brussels-Capital region, the local libraries and the municipalities form the core of the library ecosystem.
- Consumers: These are the patrons, the final “customers” of the libraries. It is the target audience, i.e. the people at the end of the chain who will be “consuming” the services offered by the libraries.
- External partners: These are commercial organisations or external public institutions that will provide some specific services or information that is not necessarily available within the core library ecosystem.

The first phase in the value chain is cataloguing. This term covers all activities, carried out by various parties, dealing with the management of a catalogue of any kind of cultural content (books, novels, magazines, articles, newspapers, audio content, movies, etc). This activity is a continuous process that happens throughout the chain, and this phase's output is used in all subsequent phases. It serves as the central reference for all following activities.
Collection management then covers the process of selecting the right content for each library, based on various criteria such as budget, new releases, specific campaigns and target audience. There is not enough budget, personnel or time to offer everything that is available in the world. Therefore, a selection needs to be done in order to achieve the main goals set by the libraries for their patrons. This step can be compared to the Merchandising & Assortment Planning that retail organisations follow in order to select the right products for their customer base.
Once the selection is made, it is obviously time to purchase and distribute it (if needed). This is a process in itself, involving multiple stakeholders, and as such it must be managed correctly.
While we are aware that libraries are not commercial organisations, we use the terms marketing & sales to identify the set of activities that will bring consumers and libraries closer, bringing the selected content to the right audience. Even if libraries do not sell content and are not held up to sales objectives, they do have concrete goals of getting more people introduced to culture and facilitating access to culture and knowledge. They do organise activities aimed at achieving these goals, and do measure the efficiency of these activities as well as their impact on the libraries' objectives.
Under “Circulation”, we combine the set of transactional activities typically encountered while loaning books, together with all associated interacting actions with readers.

Furthermore, libraries are increasingly offering additional services beyond just offering of culture and books, such as education services or an information counter. We gathered these activities under “Services”. Some of these activities are also continuous processes that do run throughout the value chain.
Finally, under “Management & Analytics”, we gathered all business processes related to the management of non-core but mandatory activities as well as the analytics of all collected data (e.g. typical reader profiles, successful books, etc.). The analytics' output is typically used to drive and fine tune other activities, such as collection management, “purchasing” or “marketing & sales”. It therefore closes the loop of the value chain.

Figure 8: AS-IS libraries value chain - feedback loop

3.3 AS-IS Business Processes

We will describe the business processes using a swim lane flowchart and the BPMN notation.

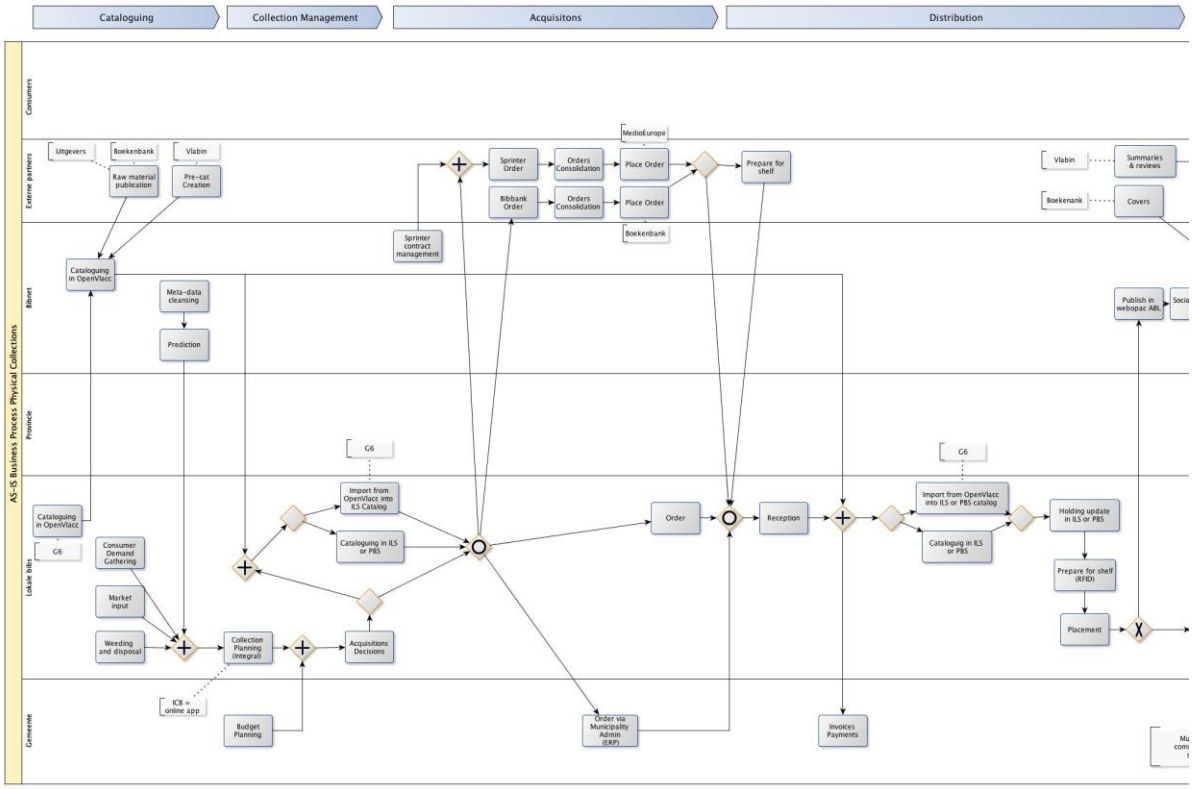


Figure 9: AS-IS business processes - cataloguing to distribution

The business process flowcharts are available in the appendices.

3.3.1 Cataloguing and Collection management

Several actors work together in the cataloguing phase. The central actor is Bibnet, offering cataloguing services using the Open Vlacc platform. The six largest libraries of Flanders also play an important role in the cataloguing on Open Vlacc. Finally, some external partners deliver additional content. One is Boekenbank, who is delivering raw content about books consolidated from publishers. Another is Vlabin, who prepares a pre-catalogue. Both these inputs are incorporated into Open Vlacc.

Bibnet is also working on a new project related to metadata clean-up (the process of converting metadata records into a more usable form) and collection demand prediction. Based on the circulation information ("who reads what?"), this project aims at identifying trends in demand and content usage. The output is a prediction, or a set of guidelines, that will help focus on the right offering during the selection process and collection management.

With regards to collection management, some libraries are already gathering and analysing consumer demand. Another input used by the libraries is, of course, the market information, which is publicly available, about hot topics and top selling books.

Finally, collection management is not only about adding new works in a collection, it also involves removing old works or elements that are no longer available. This activity is called weeding, or disposal

All these inputs and requirements are then gathered and combined in order to define the final collection planning. This collection planning is then adjusted based on the allocated budget, which is defined by the municipality.
A small note is needed here. Not all libraries follow such a strict process. Many smaller libraries manage their collections based on market information and removal requirements. One could also think that this collection management could be done in a centralised way, then made available to all libraries. The issue is that all libraries have different objectives, different needs (some focus on culture, others on heritage, etc.), different audiences and, of course, different current collections. Still, some of these activities (such as consumer demand gathering or prediction analysis) could be offered as a central service. This is not yet the case today.

3.3.2 Purchasing & Distribution

Once a decision has been taken on the collection planning and the related budget, two categories of activities take place: updating the catalogue of the Integrated Library System (ILS), and placing the orders.
Local libraries can use their own ILS or work with the ILS that is available through the provinces/Brussels-Capital Region (Provinciaal Bibliotheek Systeem, see Applications). To update the bibliographic data in the local catalogue of the ILS, the six largest libraries add and import the information from Open Vlacc. The other libraries describe their catalogue directly in their ILS, often based on a background copy of Open Vlacc.
For the actual purchasing of books, a municipality or a local library can obviously still purchase the references directly from the suppliers. Nevertheless, two initiatives have emerged in order to offer grouped purchasing, thus reducing expenses: an initiative called “Sprinter” offered by MedioEurope, and an initiative offered by Bibbank.
Municipalities can place Sprinter orders with MedioEurope. These are gathered and consolidated, then ordered together by MedioEurope. Bibbank also offers municipalities a similar possibility. Another service offered by both MedioEurope and Bibbank is the possibility to prepare the books and make them shelf ready. This means that the books are already protected and uniquely identified, and ready to be immediately presented on shelves. This reduces the amount of work required by the local libraries. Recently, StandaardBoekhandel also started a similar initiative called “SnelBoek”.
The goods are then directly delivered to the local libraries, who receive them and shelf them accordingly. The library updates the catalogue of its ILS, if this had not already been done before ordering. They then update their holdings, i.e. the number of copies of each reference that they hold and the exact item and location information. To update the holding data in the local catalogue of the ILS, the six largest libraries add and import the information from Open Vlacc. The other libraries add their holdings directly in their own ILS. They can also publish this information so that other libraries can find where a certain work is available (Inter Library Lending).

Some libraries track works using RFID. If this was not done by the shelf ready service from the external partner, local libraries add their own RFID tags and configuration.
At the end of the purchasing and distribution process, municipalities pay their bills and books are available for circulation.

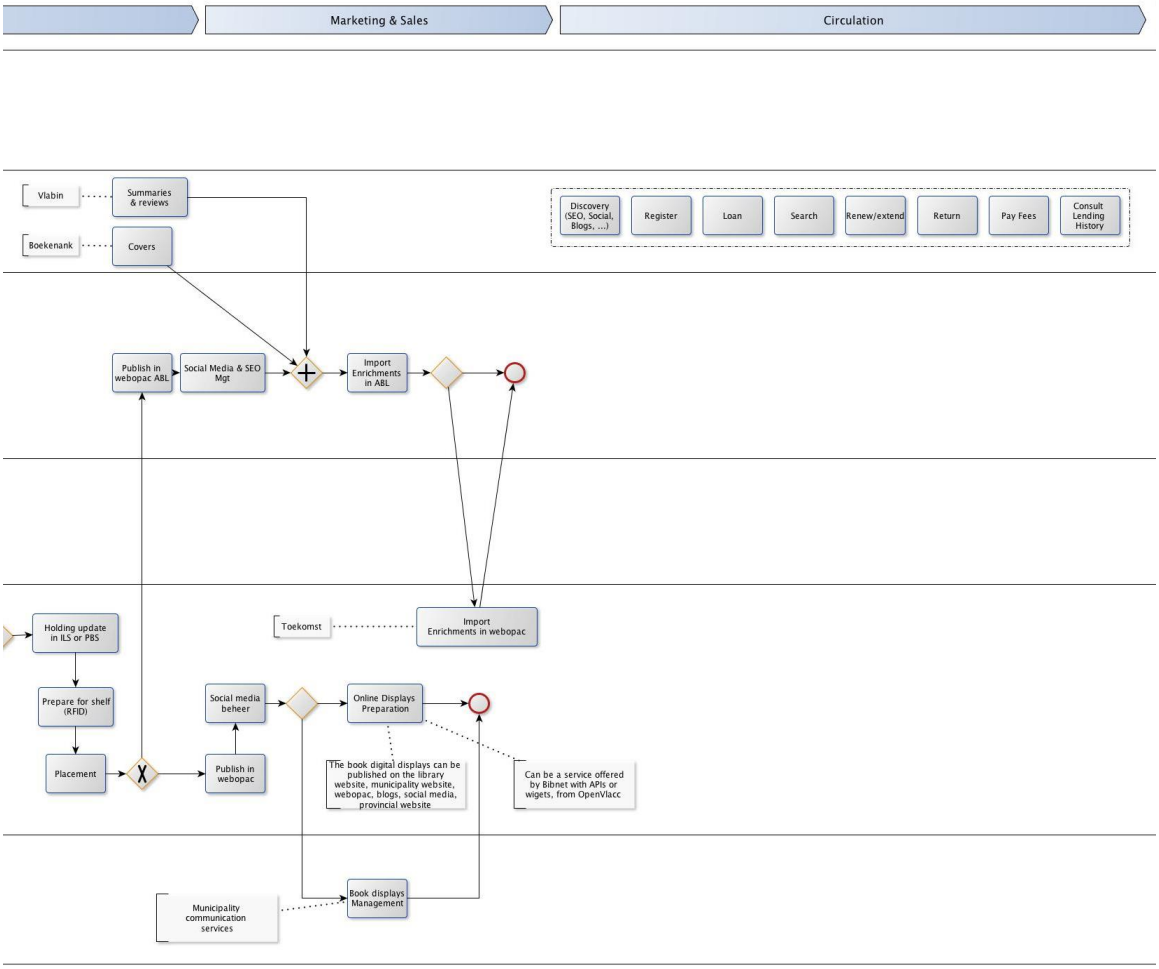


Figure 10: AS-IS Business process – Marketing to circulation

3.3.3 Marketing & Sales

Web catalogues

The web channel is of course a very important medium in the promotion of collections and in bringing readers and library materials together. Libraries can publish their catalogues to online public access catalogue ("webopac") applications. Libraries using their own ILS mostly have their own webopac. Libraries working on the provincial library systems will make use of the ABL webopac offered by Bibnet (see the "Applications" section). Bibnet also offers SEO services (Search Engine Optimisation).

Social media

Social media platforms (e.g.like Facebook and Twitter) are also playing an increasing part in the promotion of collections or activities offered by libraries. Today, each library is left to decide how it will approach social media. User generated content (comments, preferences, favourites, etc.) is also playing an increasing part in the promotion of collections. The "viral" aspect of social media and the opinion of users' friends are two elements that can help bring library services and consumers closer together.

Display

Libraries also define displays or virtual bookshelves), a subset of their collection that can be thematic or based on trending works, for example. These displays have also an online equivalent, and can be published on several websites or web catalogues. Libraries do not yet offer "recommended items" based on readers' preferences and borrowing history. It can also

happen that the municipalities' communication department adapts or creates its own displays, in collaboration with the library.

Content enrichment

Finally, external partners deliver additional content that is used to enrich the information available in the catalogue. Vlabin provides book summaries and reviews. Boekenbank provides all cover pictures in a standardised way.

This additional content is consolidated and linked to the items available in the ABL web catalogue provided by Bibnet, and also available for libraries using their own webopac application.

At this point, books and works are available to the readers, either through a search or through navigation and displays. They are ready to circulate.

3.3.4 Circulation

For this important part of the value chain, we want to establish a distinction between the physical world and the online platform. We will very briefly describe the most important processes so as to help identify the most important services that an ILS system must provide for re-use or integration purposes in the future.

3.3.4.1 Physical world

Readers must first register at the local library. The library employee creates the registration in the ILS (local or PBS). It is up to the library to define the payment model, for instance a free registration with payment per loan, or an annual registration with free book loans and payment for audio and video content only, etc. Some provincial networks have established a common payment model.

When a reader wants to borrow a book, the library employee must first check the registration. He then checks the book out and registers the loan in the ILS.

The reader can also ask about the availability of a certain item. If it is not immediately available, the reader can reserve it.

At the end of the loan period, the reader can either return the item or decide to extend the loan, with extra payment if required. In both cases, either the library employee or the user must update the ILS.

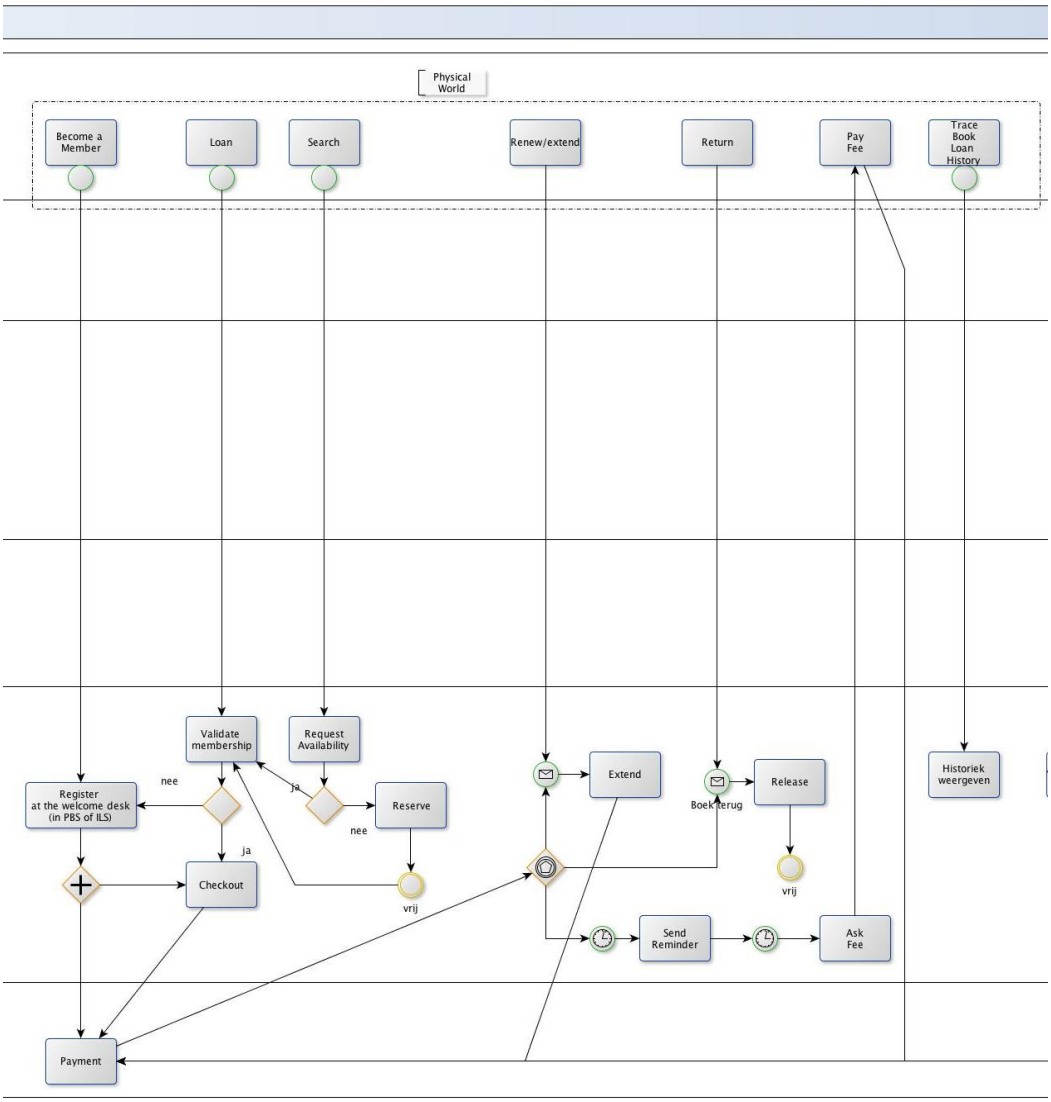


Figure 11: AS-IS business processes - physical world circulation

The library must manage the expiration of borrowed items, send notifications, and apply penalties as required.
It must also be possible at all times to view a patron's borrowing history.

3.3.4.2 Web channel

More and more libraries are offering some of their fundamental services through the web. Registration must still be done in the real world, at the library. But once the user is registered, his identification information is made available on the web platform (e.g. with their OpenBID account, managed on Mijnbibliotheek.be). The user is then able to log in through the web portal of the library. When the user logs in, the system verifies their membership.
From there, they can do any of three actions (as of today):

- Reserve a book: The user can check the availability of an item in a given library (or get the list of libraries where the item is available). They cannot loan or return the book through the web channel yet, since there is still a real book that must be fetched at or brought back to the library. However, this will change with electronic works.
- Renew a borrowed item: The user can extend the duration of their loan without having to go to the library in person.

- Consult their history: The user can view their borrowing history (if available by the library and allowed by the patron).

For each of these processes, we also make a distinction depending on where the actions are taken: from the central portal or from the portal of the local library. These two possibilities are made available through Bibnet, which offers libraries a webopac solution (ABL) and a self-service portal (Mijnbibliotheek.be). Currently, this self-service portal is available only to those libraries using the PBS offered by the provinces of Flemish Brabant and Antwerp. But some libraries still have their own ILS, webopac and self-service portal (see the "Applications" section).

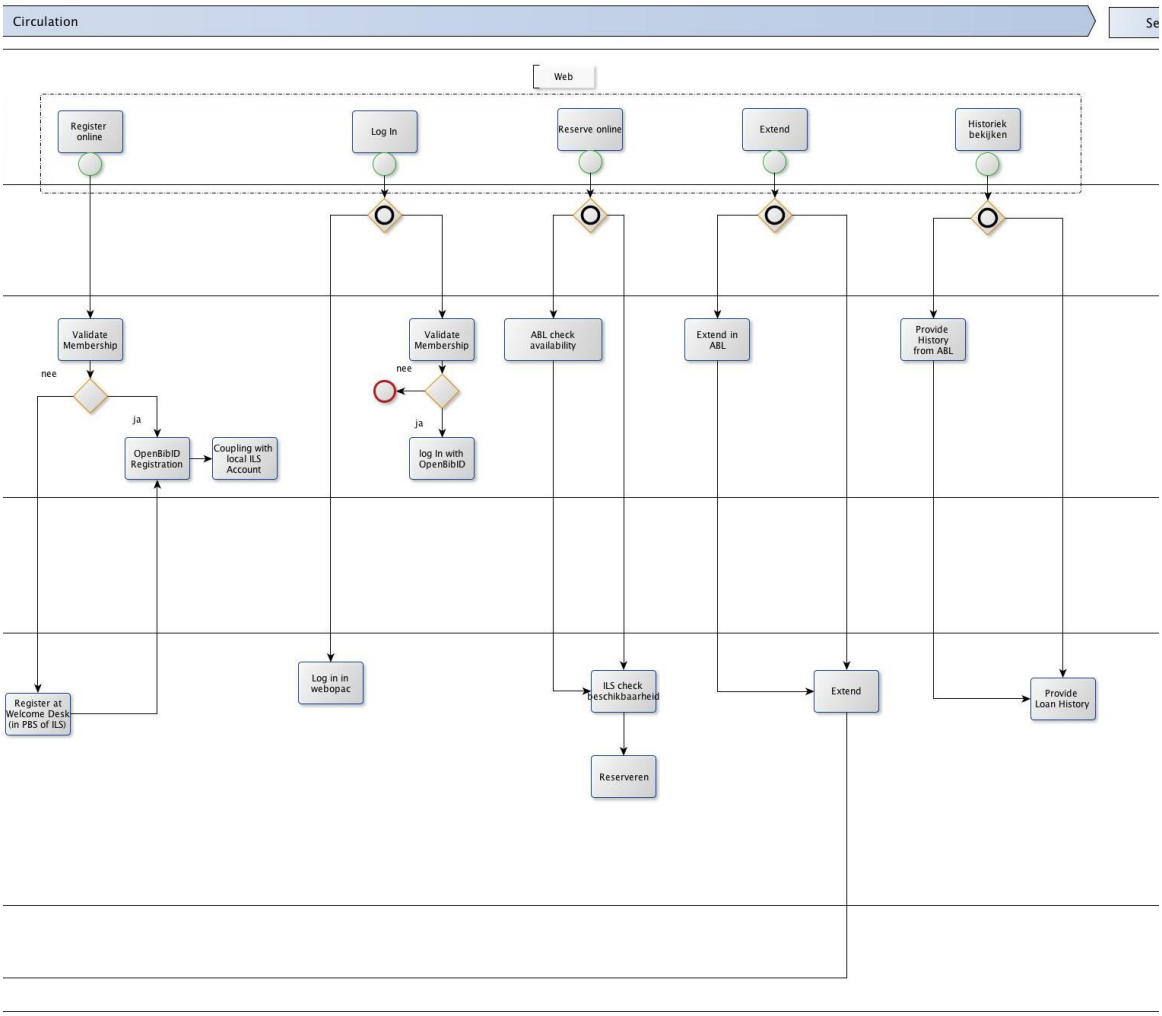


Figure 12: AS-IS business processes - circulation and the web

3.3.5 Services

Over the past years, more and more libraries have been diversifying their offering and have offered new services, all related in one way or another to their goal of facilitating access to culture and knowledge.
Examples of additional services are:

- Public computer rooms (Openbare ComputerRuimte): These are computers that patrons can use for a limited period of time (for example for internet searches or to browse electronic documents). In many cases, users must reserve a specific time slot to use these computers. The library then manages the occupancy and availability of the computer resources.

- Demand mediation: Some libraries also offer services to help answer questions. These can be questions about the services offered by the municipality, but they can also be more generic questions requiring document searches. Library employees can then help search for the right answers via the appropriate media.
- Education: Some libraries organise occasional joint courses with schools and organisations, providing rooms and content.
- Cultural events: Libraries also organise or host cultural events in order to increase their visibility and highlight some of their collections or new books.

3.3.6 Management & Analytics

Finally, libraries obviously need to be managed. Library management covers several aspects:

- Price management: The libraries' price policy can be determined either at the level of individual libraries, or at the provincial/regional level.
- Reporting: Libraries need to generate annual reports, presenting the most important achievements as well as the objectives for the next year. They also publish some basic key performance indicators (KPIs such as number of users, number of loans, etc.). These KPIs are then published in the BIOS2 system, which compiles statistics for all public libraries for comparison purposes.
- Some libraries are also more advanced, and actively work on customer profiling and collection analytics in order to support collection management and identify what the demand will be and, therefore, what the right offering will have to be.
- Local libraries are dependent upon their municipality. Therefore, employee and budget management, as well as technical services, are (partly) delivered by the municipality.

3.4 AS-IS ICT Applications

3.4.1 Public libraries ICT network structure

The ICT systems used by Flemish public libraries are organised in 5 different layers:

- **“Local” or “library”**: the ICT systems of the (local) libraries and their local partners (cities, municipalities)

- **Provincial**: the shared library ICT systems maintained by the provinces. The main system is the PBS (Provinciaal Bibliotheek Systeem). Note that in this study the Flemish Community Commission in Brussels (VGC-Brussels), which operates the Brussels' public library network (BruNO), is categorised as “Provincial” for the sake of convenience.

- **Flemish** (Vlaams): At the Flemish level, several systems are provided. Bibnet provides the majority of those systems (zoeken.bibliotheek.be, VEP…), but other systems also play a role, such as the UitDatabank managed by CultuurNet Vlaanderen.

- **National** (or Federal): some ICT systems that impact the ICT architecture of libraries can be provided by national partners, for instance the Belgian electronic identity card system.

- **International**: some international ICT systems play a role in the architecture, such as Facebook, Twitter, Centrale Discotheek Rotterdam (Netherlands), Centraal Boekhuis (Netherlands)…

3.4.2 AS-IS ICT applications used by the public library network

The Flemish libraries operate about 64 types of ICT systems. Each layer of the library network architecture operates a different kind of system, and the different systems are listed in the following table.

Layer	System type names
Library Systems	Aquabrowser (ABL), Biblioprint, Bibliotheek Kaart, BIDOC, Blogs, CiPAL BROCADE, C-OPT, CRM, Etalage, Facebook, ICB – (WebICB), Iguana (INFOR), INFOR VUBIS, PIMC Timetracs, Pinterest, Printers, Public computers, RFID, Standaard Boekhandel, Twitter, V-INSIGHT (INFOR)
Municipality Systems	A-Kaart, Betaalautomaten, Cash registers, CRM, DWH/BI, ERP, Gemeente Financiën, Gemeente ID , Gemeente Kaart, Gemeente Website, GIS
Provincial Systems	Aquabrowser (ABL), ALEPH (Ex Libris), BILI, BROCADE, C-OPT, Etalages based on Drupal/Expression Engine/SmartSites, INFOR VUBIS, Mijn Bibliotheek Integration, Mobile App (Brocade), mijnOvinob, , Pentagho, V-INSIGHT (INFOR), Winob digitaal (TO-BE)
Bibnet Systems	Aquabrowser (ABL), Adressengids, Bekroningen (Awarded books), Virtual bookshelf, BIBFM, Bibliotheek Portalen, bibliotheek.be, Blogs overzicht, Cover Server, DWH/BI, ICB DWH/BI, Kenniskantoor, Mijn Bibliotheek, OpenBIBID, Open Vlacc, Webservices.bibliotheek.be, VEP (TO-BE)
Flemish Systems	BibBank, BIOS, Boekenbank MedioEurope, Meta4Books, UitDatabank, UitID,
National Systems	eID, Gopress, Impala
International Systems	LibraryThing, MuziekWeb CDR, NBD Biblion

Notes:
1) This list may be incomplete.
2) At national level, we did not count the national register.
3) Due to the local workload that they generate, Social Media (Facebook, Twitter, Pinterest…) have been classified as “local systems” even though they should be considered as international systems.

The following figure shows how the main Flemish public libraries systems are distributed across the various governance layers. The list of systems is not exhaustive.

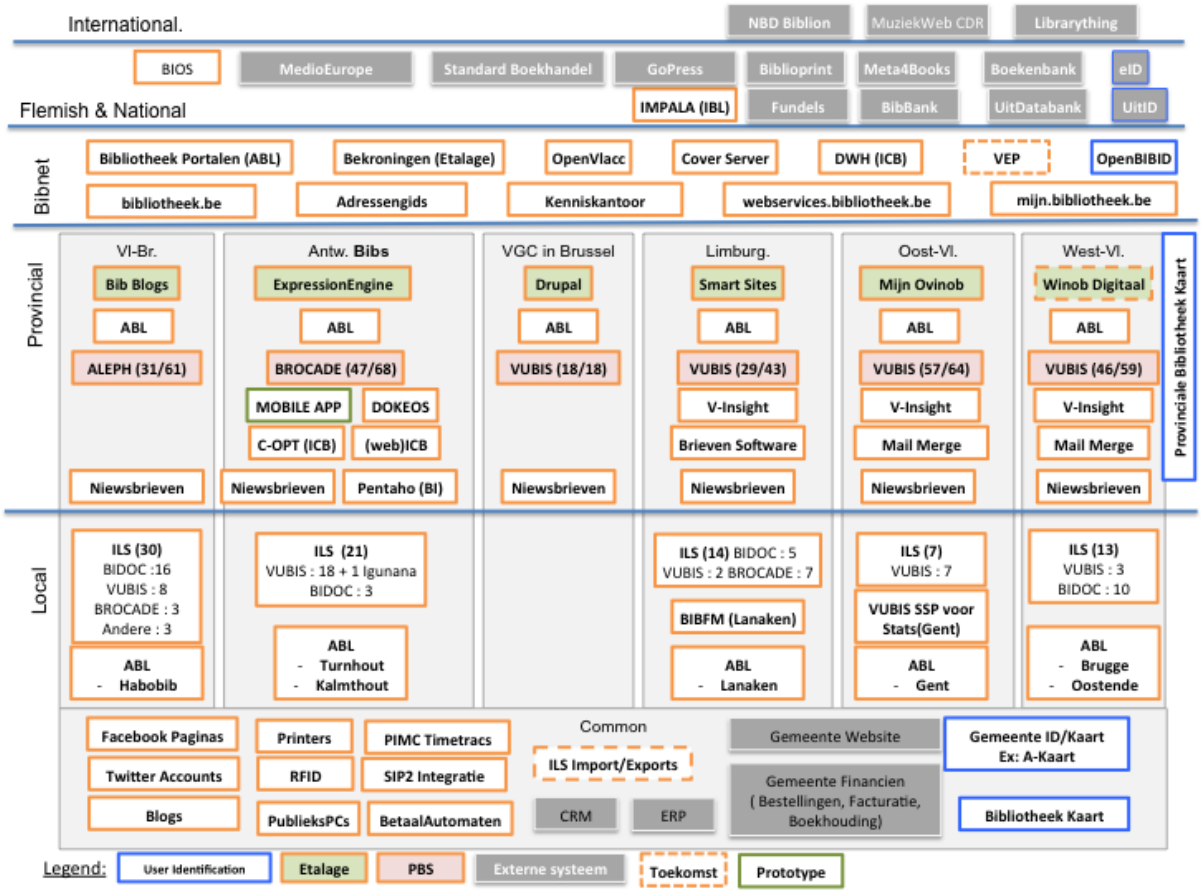


Figure 13 AS-IS view of the ICT systems used by the Flemish public libraries

Several systems have multiple implementations. For example, all libraries rely on an Integrated Library System (ILS). This system can either be provided by the province (PBS – Provinciaal Bibliotheek Systeem) or be operated locally (LBS- Lokaal Bibliotheek Systeem).

The following table provides an overview of the types of ILS systems.

ILS Systems used by the "erkende" Flemish public libraries

Systeem	Vlaams-Brabant	Antwerpen	Brussel	Limburg	Oost-Vlaanderen	West-Vlaanderen	Totaal	Percent.
PBS-VUBIS			18	29	57	46	150	48%
PBS-BROCADE		47					47	15%
PBS-Aleph	31						31	10%
LBS-VUBIS	8	18		2	7	3	38	12%
LBS-BROCADE	3			7			10	3%
LBS-BIDOC	16	3		5		10	34	11%
Filemaker	2						2	1%
LBS-Home made	1						1	0%
Totaal niet aangesloten	30	21	0	14	7	13	85	27%
Totaal	61	68	18	43	64	59	**313**	100%
	19%	22%	6%	14%	20%	19%	100%	

ILS breakdown by number of libraries (Flanders)	
VUBIS	60%
Brocade	18%
Aleph	10%
BIDOC	11%
Other	1%
Total	**100%**

The following table is an attempt to count the total number of systems that play a role in the public library system's architecture. These systems can run on dedicated or shared infrastructures.

Layer	Estimated Nb of System Types	Estimated Nb of Systems	Nb of Actors	Estimated Average Systems/Actor
Libraries	20	2703	313	9
Municipalities	10	1165	313	4
Provinces	15	25	6	4
Bibnet	16	16	1	16
Flemish	10	10	6	2 (*)
National	1	1	1	1
International	3	3	3	1
Total:	75	3883		

(*) Boek.be offers more than two systems.

The total estimated number of systems is the sum of the maximum possible instances for each system. For example, a payment terminal system can have 313 local/library instances (one per library). Mijnbibliotheek.be has only one Bibnet instance. The spreadsheet used to count the systems (EstimatedNbSystems.xlsx) is available as appendix.

Each system has a type. For instance, VUBIS is a type of system that has 38 instances.

According to this rough estimate, the Flemish public libraries' sector-wide systems architecture would contain more than 3,000 system instances of 75 types.

On average:

- A library works on nine local systems.
- A library can integrate and/or make use of four municipality systems.
- Each province provides four systems.
- Bibnet offers 16 systems.
- Four national and international systems are involved.

3.4.3 AS-IS Applications list

The following table provides a description of each application.

Name	Level	Nb	Description
A-Kaart	Municipality	1	The A-kaart is the city of Antwerp's loyalty card for culture and sports.
Aquabrowser (ABL)	Bibnet, Provinces, Libraries	<=12	"AquaBrowser provides an intuitive, feature-rich, and rewarding discovery experience that helps patrons be successful in their searches helping your library maximize its return on investment." http://www.serialssolutions.com/en/services/aquabrowser/
Adressengids	Bibnet	1	Guide of all the libraries' addresses.
ALEPH (Ex Libris)	Province	1+	ILS provided by Ex-Libris, used in the province of Flemish Brabant. http://www.exlibris.co.il/category/Aleph
Bekroningen	Bibnet	1	List of works that have received an award, information provided by zoeken.bibliotheek.be (Aquabrowser) http://www.bibliotheek.be/bekroningen
Betaalautomaten	Library	<=313	Point of Sale (POS)
Cash Registers	Library	<=313	Library cash register
BibBank	Flemish		Platform offered by Boek.be and bookstores for providing books to libraries.
BIBFM	Bibnet+Library	1	Pilot project offering music streaming through the library http://zoeken.lanaken.bib.fm/
Biblioprint	Bibnet	1	Book labelling solution provided by Schulz to Bibnet
Bibliotheekkaart	Library	?	Library card issued by a library.
Bibliotheekportalen	Bibnet, Provinces	1	Common user-friendly search interface giving access to the collections of the Flemish Public Libraries. Implemented using Medialab Aquabrowser Library (ABL)

Name	Level	Nb	Description
bibliotheek.be	Bibnet	1	Bibliotheek.be is a domain name that redirects to several library services: mijn.bibliotheek.be, bibliotheekportalen, discovery, http://zoeken.bibliotheek.be/, address guide, awarded books, library blogs, new arrivals, activities, author pages.. It is also a redirection system linking to the library websites (e.g. http://halle.bibliotheek.be, http://puurs.bibliotheek.be/) Library employees can also receive a bibliotheek.be email address. www.bibliotheek.be is the portal for the Flemish public libraries.
BIDOC	Library	34	ILS http://www.bidoc.be/
BILI	Province	1	The webopac of the province of Limburg. http://www.bili.be/webopac/vubis.csp
BIOS	Flemish		Reporting website of the Flemish public libraries, managed by the Flemish government. http://www.bibliotheekstatistieken.be/
Blogs	Library	>= 51	Library Blog http://www.bibliotheek.be/bibliotheekblogs
Boekenbank	Flemish	1	B2B ordering platform for bookstores and book distributors. http://www.meta4books.be/boekenbank
BROCADE	Provinces & Library	1+10 =11	ILS developed by the University of Antwerp and provided by CIPAL http://www.brocade.be/
C-OPT	Flemish	?	Library Collection Management software provided by OPTERA. http://www.optera.nl/?Page=86
Cover Server	Bibnet	1	The cover server stores all book covers in digital format, which is useful for discovery tools and book displays (virtual bookshelves).
CRM	Libraries, Municipalities	<=313	Customer Relationship Management. Some actors, mostly municipalities, invest in a CRM system. Library data can be sent to the CRM. Some libraries such as Muntpunt can also have a CRM (CIVI CRM)
Dokeos	Province	1	Knowledge Management system for the province of Antwerp.
DWH/BI	All	<=313	Data Warehousing / Business Intelligence. Bibnet implements a (prototype) Data Ware House for Collection Management. Municipalities, mostly cities, also have data warehouses that (can) ingest library data.

Name	Level	Nb	Description
eID	National	1	The Belgian electronic identity card http://eid.belgium.be/
ERP	Municipalities	<=313	Municipalities may have an Entreprise Resource Planning System (ERP) that the library should use or integrate, for instance for the purchasing process.
Etalage **= Display** **= "Online Book Display"**	Bibnet, Provinces, Libraries	>=7	Display systems allow presenting a selection of the library's collection and/or services in order to promote them. Each province has a different implementation of displays: • Flemish Brabant: implemented by libraries using blogs • Antwerp: Expression Engine • Brussels: Drupal • Limburg: Smart Sites • East Flanders: Mijn Ovinob • West Flanders: Winob (TO-BE) Libraries can also have their own display solutions. (e.g. Pinterest in Halle).
Expression Engine	Province	1	Display (Etalage) system provided by the province of Antwerp.
Facebook	Library	<= 313	A library may have a Facebook presence (page)
Fundels	Flemish	1	Fundels makes picture books come to life, offering a fun combination of animated picture books and engaging activities (on PC or tablet) for children aged three to seven. http://www.fundels.com/en_UK/
Gemeente Financiën	Municipalities	<=313	Municipality Accounting systems. The municipality has to incorporate library transactions into its accounting. The ERP could double as the accounting system for the library.
Gemeente ID	Municipality	Many	The identification system used by the municipality on its websites.
Gemeente Kaart	Municipality	>=1	"Culture, Sport and Leisure card" issued by the municipality, for instance the A-Kaart in Antwerp. http://www.antwerpen.be/eCache/ABE/80/97/236.html
Gemeente Website	Municipality	<=313	The municipality website. It provides a link to the library websites at the very least, and sometimes are more deeply integrated (e.g. in Gent).
Gopress	National		Mediargus provides access to press articles for library patrons. http://www.mediargus.be/bibnet/

Name	Level	Nb	Description
GIS	Bibnet, Provinces, Municipalities	>=2	Geographical Information Systems. Library data and/or statistics can be displayed on maps. It can be used to analyse the use of a library by its surrounding population (Ghent, West Flanders) or for library data (Adressengids), etc. http://www.bibliotheek.be/mijn-lokale-bib
ICB	Bibnet, Libraries	>=1	"Integraal Collectie Beheer". Different systems exist: Bibnet's data warehouse, C-OPT, WebICB.
ICB – (WebICB)	International	?	WebICB: Web-based Integraal CollectieBeleid http://www.bureauleemans.nl/webicb.html
Iguana (INFOR)	Library	>1	The Infor/VUBIS Library portal. Used in e.g. Turnhout and Houthalen-Helchteren http://go.infor.com/libraries/solutions/infor-iguana/
ILS	Library	89	Library own Integrated Library System (ILS)
ILS Import/Exports	Library	85	Libraries need to import and/or export data from/to different systems such as Open Vlacc, CRM, DWH, Accounting.
Impala	National	1	IMPALA is the Belgian Inter-Library-Loan system. It is managed by the University of Antwerp. http://anet.ua.ac.be/desktop/impala/static/impalaintro_n.html
INFOR VUBIS	Provinces, Library	4+39 =43	ILS provided by INFOR Two versions exist in libraries: Vubis Smart and V-Smart http://go.infor.com/libraries/solutions/infor-v-smart/
Kenniskantoor	Bibnet	1	Kenniskantoor ("Knowledge Office") is a user-friendly tool that allows public library profesionnals to share information with each other. http://www.bibnet.be/portaal/Bibnet/Lokale_Ondersteuning/Kenniskantoor/
LibraryThing	International	1	LibraryThing is a social cataloging web application for storing and sharing book catalogs and various types of book metadata. It is used by individuals, authors, libraries and publishers. http://www.librarything.nl/.
GoPress	National	1	Mediargus provides an access to press articles for library patrons. http://www.mediargus.be/bibnet/

Name	Level	Nb	Description
MedioEurope	Flemish	1	'Sprinters' are popular books that can be delivered faster thanks to an agreement with MedioEurope. http://www.bibnet.be/portaal/Bibnet/Collectie/Veelgevraagde_collectie
Meta4Books	Flemish	1	Meta4Books is the metadata centre for the Dutch language book industry.
Mijn Bibliotheek	Bibnet	1	Mijn Bibliotheek is a new application for loan renewal, resources reservation or digital collection browsing. It is connected to OpenBIBID. http://mijn.bibliotheek.be
Mijn Ovinob	Province	1	Library Portal provided by the province of East Flanders.
Mobile App (Brocade)	Province	1	In the province of Antwerp, a prototype of Mobile Application was developed on top of the Brocade ILS. http://www.cipal.be/nieuws/brocade-mobiel
MuziekWeb CDR	International (NL)	1	The "Centrale Discotheek Rotterdam (CDR)" provides music samples to the Flemish public libraries.
NBD Biblion	International	1	Biblion (Netherlands) provides book reviews for libraries patrons. http://www.knipselkranten.nl/bibnet/
Open BIB ID	Bibnet	1	Open BIB ID is a SSO solution that aims at providing a centralised identity and unique login to patrons across all library digital services. It is the basis of mijn.bibliotheek.be.
Open Vlacc	Bibnet	1	Central Flemish Library Catalogue http://www.bibnet.be/portaal/Bibnet/Open-Vlacc
PBS	Province	6	"Provinciaal Bibliotheek Systeem"
PIMC Timetracs	Library	<=313	Software to manage the access to public PCs http://www.tracs.be/
Printers	Library	<=313	Libraries have printers for patrons to use
Publiekspc's	Library	<=313	Public Computers available at the library. Also called in Dutch "Openbare Computerruimte"
RFID	Library	<=313	RFID system for self service (check-in/check-out of books equipped with RFID tags at a RFID desk)
SIP2 Integratie	Library	<=313	The ILS is integrated with the SIP2 protocol to systems like RFID and PIMC Timetracs.
Smart Sites	Province	1	Display (Etalage) system provided by the province of Limburg.
Standaard Boekhandel/Snel Boek	Flemish	1	'SnelBoek' are popular books that can be delivered faster thanks to an agreement with Standaard Boekhandel.
Twitter	Library	<=313	A library may have a Twitter account

Name	Level	Nb	Description
UitDatabank	Flemish (CutluurNet)	1	CultuurNet's central point, where all the information on culture and entertainment in Flanders is centralised. http://www.cultuurnet.be/over-ons/english
UitID	Flemish (CultuurNet)	1	UitID is the personal account used to log in to Uitdatabank.be.
V-INSIGHT (INFOR)	Libraries	>= 3	V-Insight is a statistics dashboard that provides libraries with key performance data and metrics.
VEP	Flemish	1	The Vlaams eBoek Platform is a Flemish e-book platform. It is a collaboration between the libraries and Boek.be (Association of Flemish publishers and bookstores). http://www.bibnet.be/eboeken
Webservices.bibliotheek.be	Bibnet	1	Bibnet's web service to retrieve book covers and descriptions.
Winob Digitaal	Province	1	Library Portal (under construction) for the province of West Flanders.

3.4.4 AS-IS Applications: library perspective

The figure "*AS-IS view of the ICT systems used by the Flemish public libraries*" describes the libraries' ICT architecture from a sectorial perspective. The library perspective presents the systems that a single library actually uses. A library is organised around a central library management system (the ILS or PBS) connected to the basic ICT infrastructure (Public PCs, RFID workstations and systems, Wi-Fi, Printers…). The ILS offers an OPAC that patrons can use to reserve or extend their loans. Online, the library can have a website, a blog, a Facebook page, a Twitter account, a Pinterest account… The libraries' websites generally integrate with the UitDatabank through the UitInVlaanderen widget.
Libraries can make use of external library systems such as those provided by Bibnet (Bibliotheekportalen, bibliotheek.be…) or by other partners such as the University of Antwerp for Inter-Library Loan (ILL-Impala).
Libraries also use a certain number of municipality systems: website, CRM, DataWarehouse, Accounting systems and ERPs (Purchases).

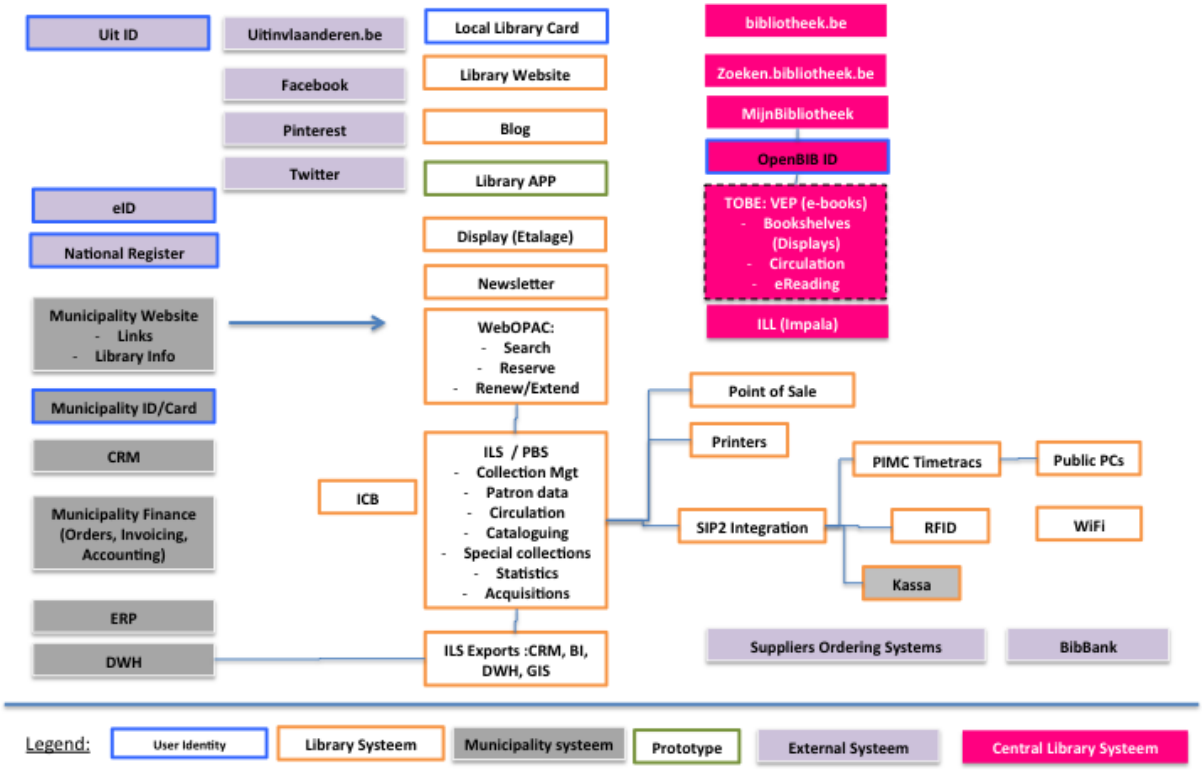


Figure 14: ICT systems - Library perspective – Systems potentially used by a library

3.4.5 The dis-integration of the ILS

The AS-IS analysis shows that the ILS is less and less of an integrated solution that covers all the needs of the library. Libraries operate several additional separate systems, either because the ILS does not fulfil to the requirements anymore or because they are required to use external systems for certain activities. Also, the new systems that libraries are developing or consider developing are not available as ILS modules.

For instance, the following ILS capabilities have been replaced or complemented by other systems:

- Search and Webopac: Bibliotheekportalen, Aquabrowser (ABL), specialised display systems…
- Statistics: Data warehouses, Business Intelligence (BI)…
- User Data: Open BIB ID, MijnOvinob, eID…
- Transactions, product sales: integration with cash systems
- Cataloguing: central catalogue (Open Vlacc)
- Purchasing, Invoicing, Accounting in municipality systems

Some other capabilities are not foreseen in ILSs today and will be required in the future, for example:

- Digital resource (e-books) metadata and storage
- Digital resource (e-books) circulation

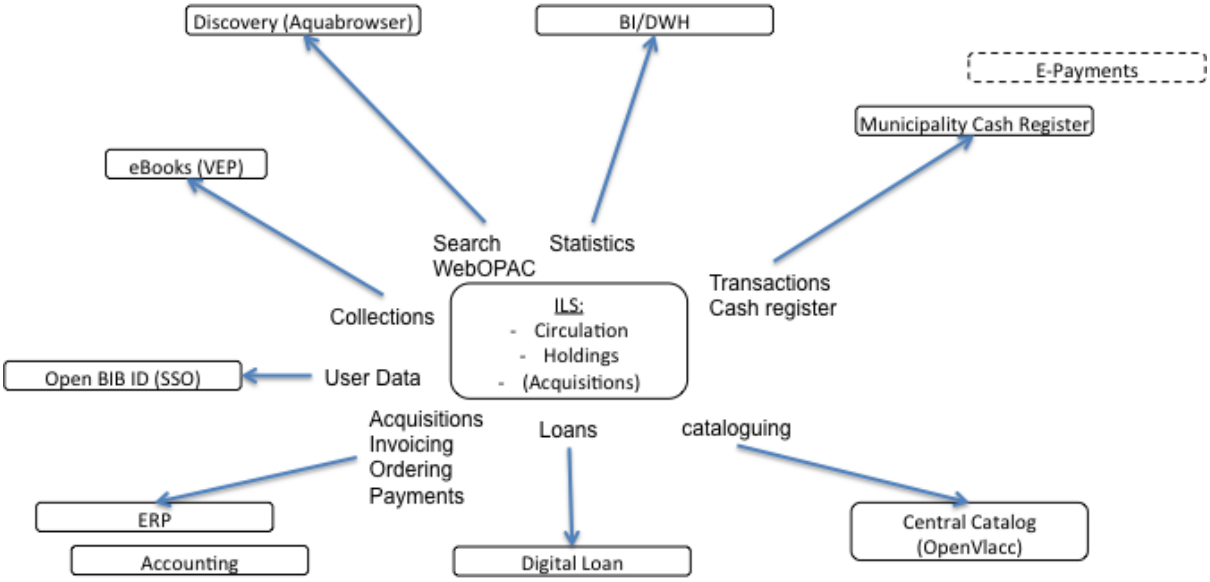


Figure 15: The dis-integration of the ILS

During the workshop with Bibliotheek.nl, our Dutch colleagues used another term for the same observation: “de functionele decompositie van de ILS” (the functional decomposition of the ILS).

The origin of the dis-integration of the ILS is the inability, or the lack of willingness, of the ILS suppliers to provide new features required by the libraries in a timely manner and/or at an affordable cost.

But libraries wanted to move on and they extended their ILS with other systems. As a result of the dis-integration of the ILS, libraries use more and more applications.

Using more systems has benefits and drawbacks. A benefit is that the libraries have more options when choosing new suppliers for their projects. A big drawback is that that maintaining different systems requires that they be integrates and synchronised. The proper integration of all the new applications becomes essential to the library’s operations. ILS suppliers have not always been helpful in integrating with other systems, maybe in an attempt to protect their commercial advantage. They should have instead invested in new innovative and open ILS modules, but this did not happen due to a lack of vision, innovation planning, or entrepreneurship.

Who can explain why ILS vendors have not offered basic e-book collection management functionalities, when Amazon had brought the Kindle and Apple the iPad as early as 2010?

Most probably, there will be no turning back in the foreseeable future: returning to an ILS system that covers 80% of the library's needs seems very unlikely in the next decade. As a consequence, ILS vendors will need to move to a modular and open architecture as described in the chapter entitled “From Integrated Library System to Modular Library Systems”.

3.4.6 AS-IS Applications: systems integration perspective

Because the integration of all the library systems has become mission critical ever since the dis-integration of the ILS, let's have a look at how the Flemish libraries integrate their applications.

The following integration techniques are used to connect systems:

- FTP and files: XML, ONIX, MARCXML, MARC21, Cover thumbnails and text, RDF/XML
- APIs: SIP2, UitAPI, SRU, Z39.50, BIOS2 API, Google Maps
- Widgets
- "Web services": RSS, OAUTH, GoPress, Fundels, GVA Archief, REST, JSON, bibliotheek.be, Aleph, Brocade VUBIS(1)
- Using a database: MySQL, Caché, Oracle

In order to evaluate the number of connections between library systems, an integration matrix is built (see SystemsIntegrations.xls). The integration matrix shows that there are about 143 types of integration between the 75 types of system.

The following table lists the systems that have more than five types of integration.

System name	Provider Connection types	Consumer connections types	Total Connection types
Public Computers	3	27	30
INFOR VUBIS	18	10	28
BROCADE	21	6	27
Library Website	6	18	24
ALEPH (Ex Libris)	15	7	22
Aquabrowser (ABL)	10	12	22
Bibliotheek Portalen	7	13	20
BIDOC	8	8	16
Open Vlacc	11	3	14
Bibliotheekkaart	7	6	13
Bibliotheek.be	5	7	12
Betaalautomaten	5	4	9
Cash Registers	4	5	9
Blogs	2	7	9
Municipality Website	1	8	9
PIMC Timetracs	4	4	8
UitDatabank	7	0	7
Cover Server	5	2	7
Open BIB ID	4	3	7
A-Kaart (Antwerp)	4	3	7
Printers	3	4	7
RFID	3	4	7
DWH/BI	2	5	7
Mediargus	4	2	6
Mijn Bibliotheek	3	3	6
Smart Sites	2	4	6

The Public PCs are obviously the systems that are the most integrated with the other library systems (30 types of integration): one can access all kinds of systems from the public PCs. Those connections are mostly very simple and simply require a modern web-browser. The PCs must also integrate with some specific software applications such as PIMC Timetracs, which controls the PC usage. Nevertheless, in order to enable the public PCs to consume information from many applications, they would need to be modern machines and/or the provider applications should be able to work with the public PCs' standard configuration.

VUBIS is the ILS system with the most integration types. Because of its strong presence (it is used by about 60% of public libraries), VUBIS has been integrated more often than other systems, and it allows for 28 integration scenarios. Therefore, from a technical point of view, the integration of VUBIS is possible. However, the issue is rather related to how this integration is performed

(variety of techniques and protocols) and to the cost associated to the available integration techniques.

The next largest information consumers after the public computers is the library's website (18 connection types). Then come Bibliotheekportalen and its Aquabrowser, VUBIS, BIDOC, Municipality Website, ALEPH, bibliotheek.be and BROCADE.

The main information providers are BROCADE, VUBIS, ALEPH, Open Vlacc, Aquabrowser, BIDOC and UitDatabank.

While we only refer to the library's perspective, it is possible to give an idea of all the connections that libraries need to establish between the ICT that they might eventually use and integrate.

	Acquabrowser (ABL)	BetaalAutomaten	Bibliotheek Kaart	bibliotheek.be	BIOS	Blogs	Cash Registers	CRM (Municipality)	DWH/BI (Municipality)	eID	ERP (Municipality)	Etalage	Facebook	Municipality Accounting	Gemeente ID / Kaart	Gemeente Website	GIS	Integral Collection Mgt	ILS + WebOpac	Inter-Library-Loan	Library Website	Suppliers Ordering Systems	Mijn Bibliotheek	OpenBIBID	OpenVlacc	Printers	PublieksPCs (OCR)	RFID	SIP2 Integratie	Twitter	UitDatabank
Acquabrowser (ABL)	x											1							1		1										
BetaalAutomaten		x																	1										1		
Bibliotheek Kaart			x					1	1										1		1						1	1			
bibliotheek.be				x		1													1		1										
BIOS					x														1												
Blogs						x							1						1		1			1						1	
Cash Registers							x												1										1		
CRM (Municipality)								x											1												
DWH/BI (Municipality)									x										1												
eID										x											1										
ERP (Municipality)											x								1												
Etalage												x	1						1		1				1						
Facebook												x									1										
Municipality Accounting														x					1												
Gemeente ID / Kaart															x						1										
Gemeente Website																x					1										
GIS																	x		1												
Integral Collection Mgt																		x	1												
ILS + WebOPAC																			x	1	1	1	1	1	1	1	1	1	1		
Inter-Library-Loan																				x	1										
Library Website																					x		1	1					1	1	
Suppliers Ordering Systems																						x									
Mijn Bibliotheek																							x								
OpenBIBID																								x							
OpenVlacc																									x						
Printers																										x	1				
PublieksPCs (OCR)																											x		1		
RFID																												x	1		
SIP2 Integratie																													x		
Twitter																														x	
UitDatabank																															x

Each of the 313 public libraries could have to establish and maintain up to 54 integrations (sum of all the 1's in the above table) between the ICT systems that it uses. The technical complexity and the cost of the libraries' systems integration is an important aspect of the library sector systems architecture. Therefore, the future of the library systems integration has an important place in this study (TO-BE workshops, analysis, blueprint).

3.5 AS-IS ICT Technology Layer

The technology layer lists the technology used to build the libraries' applications. The technology layer is composed of:

- The “nodes” (servers, appliances, RFID stations…)
- The library networks (Wi-Fi, LAN, internet, VPN…)
- The system software (RDBMS, Operating Systems, Virtualisation software, J2EE/.Net Application Servers, PHP, Middelware, Anti-Virus…)
- The Infrastructure services (e.g. to send SMS)
- The devices (Public PCs, Employee PCs, RFID Stations, Printers, Copiers…)

The AS-IS Application list shows that libraries use 64 types of ICT systems. Those are based on many **different technological stacks**; here are just a few examples:

- Operating Systems
  - Unix
  - Windows
  - Linux
- ILS Technical stacks
  - VUBIS: Intersystems Caché, Object script, Visual Basic…
  - Brocade: M (programming language), Caché…
  - Aleph: Oracle RDBMS…
  - BIDOC technical stack
- Web technical stacks
  - Caché server pages
  - Microsoft .Net
  - Java
  - PHP
  - CSP Coldfusion
  - MySQL

These technological stacks are hosted in **different data centres**:

- Municipalities ICT providers’ data centres
- Provincial ICT providers’ data centres
- Provincial data centres
- Bibnet’s providers' data centres

The library also manages a complete technology stack **within the library walls**:

- Public Computers allow patrons to get online and access most internet Services. The services are provided by the library's network or by partners (e.g. Mediargus)
- Cash registers (payment of municipality/library products and services)
- Points of sale
- RFID counters
- Printers
- Copiers
- Touchscreens
- Listening booths

Some libraries also allow the patrons to connect their devices (smartphones, tablets, laptops, e-readers…) to the Wi-Fi network.

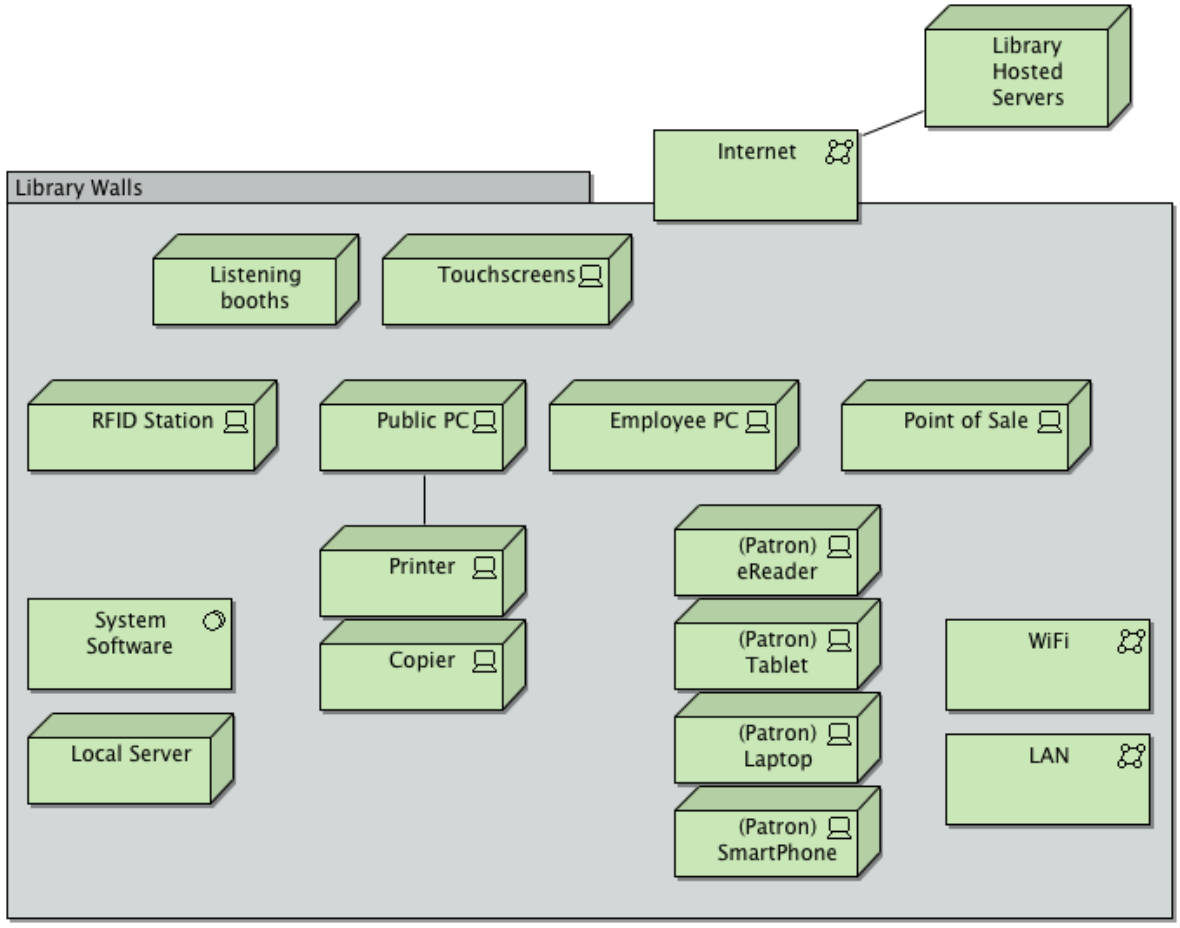


Figure 16 - Library Technology Layer

4 Evolution of the Flemish public libraries' System architecture

After the inventory of the current libraries' system architecture, it was time to analyse its state and how it could evolve.

The architecture's evolution is discussed here in function of the library various business services. Additional future requirements where collected during the “TO-BE” workshops.

Each TO-BE workshop brought future requirements to one or more business services.

TO-BE Workshop	**Library Business Service involved**
User experience (Online)	Direction and Policies - Service Portfolio - Communications and Promotion “Patron Services”: - Front Desk & General Enquiries - Circulation - Referencing and Information - Animation and Mediation - User Training - Community Information
Cataloguing	Collection Management Referencing and Information
Municipality Integration	Partners and Cooperation ICT / Application Integration
Library Integration with SOA	ICT / Application Integration

In order to facilitate discussions, various future scenarios where presented for evaluation. The attendees' preferences and feedback was collected in the form of pro/con arguments for each scenario.

The preparation and presentation materials used during the workshops are available in the appendixes.

For each business service, the following elements were analysed:

- Situation and observations: what can we observe in the current state?
- Optimisation: what can be improved in the current state?
- Future requirements and scenarios: what was discussed during the TO-BE Workshops?
- Innovation: what innovations will be applied to the business service in the future?
- Additional Information
    - What is the position of software vendors?
    - What is the position of external partners?
    - …

4.1 Library Management

The library directors define and manage a series of policies in the following fields:

- Public services portfolio
- Collection management
- Marketing
- Communication & Promotion
- KPIs (Key Performance Indicators)
- Statistics
- …

A certain number of ICT systems help decision-making and policy management in libraries.

4.1.1 Library Management: Situation

The analysis phase allows identifying the systems that are used by the library's director and management team for "PODC" actions: Plan, Organise, Direct, Control.

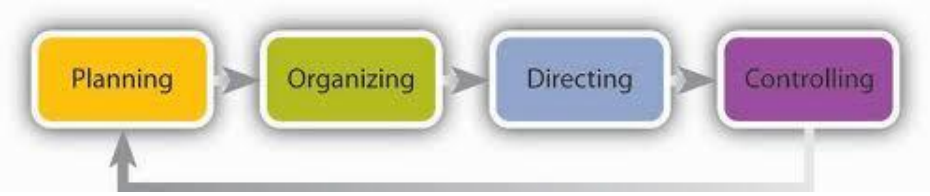


Figure 17 PODC - Plan, Organise, Direct, Control

4.1.1.1 Planning Systems

ICT planning is mostly done using MS Office tools. Some libraries such as Muntpunt have a strong need for Project Management software to plan their public initiatives.

At the municipality level, there is a demand for library data. The library data is injected into:

- Business Intelligence (BI),
- Data Warehouse (DWH),
- Customer Relationship Management (CRM) tools,
- GIS (Geographical Information Systems),
- Municipality management tools: (BBC – Beleids en beheer cyclus) as well as budgeting, financial reporting, and strategic planning, according to the "BBC" methodology (http://binnenland.vlaanderen.be/bbc).

The goal of these integrations is to better plan for the delivery and value of all municipality public services. GIS Integration is sometimes used: the projection of population and library statistics on a map can help decision-making. The integrations are always *ad hoc* and carried out for a specific time-limited objective. For instance, investing in a new library, or determining the best itinerary for the library bus (bibliobus)…

Some libraries can have a CRM. Muntpunt, for instance, works with CIVI CRM.

The output of a Digiscan analysis (analysis of the IT-business alignment of a local library, consulted by Bibnet) can lead to the planning of library adaptations.

4.1.1.2 Organisation Systems

To some extent, the knowledge systems can be considered as policy definition systems. Knowledge centres such as Kenniskantoor and DOKEOS (Province of Antwerp) will provide best practices to organise the work in such a way that it stays in line with the related direction policies.

The ILS/PBS configuration and usage reflect the library's collection management (acquisition modules), registration and circulation policies.

4.1.1.3 Management Systems

The Intranet can be seen as an important communication tool for the library managers.
Bibnet uses Basecamp as a communication tool to coordinate some of its own projects.

4.1.1.4 Control Systems

At the Flemish level, BIOS is one of the major controlling platforms.
http://www.bibliotheekstatistieken.be/

The ILS/PBS systems offers statistic modules (V-Insight, SSP…) that allow the library's management to control some of the library's KPIs.

4.1.2 Library Management - Observations

4.1.2.1 Not enough ICT tools for the "Plan, Organise Direct & Control" activities

Libraries could be better armed with **tools for "PODC"** activities on their projects, as they lack strategy and operations management tools for some of their activities. The traditional ILS modules cannot, on their own, serve as an end-to-end planning and reporting environment.

During the interviews, when asked about libraries' management and policies, a need for a general improvement of communication on the libraries' strategy and policies has been expressed. In the field, employees do not have a good view of where the library network wants to go as a whole. The different levels of governance (local, provincial, Flemish) make it difficult to understand the sector-wide strategy for libraries. The plans made by different levels of governance must be better coordinated and communicated.

The CAMEO handbook provides valuable information on "Planning for Library Excellence":
http://skyways.lib.ks.us/pathway/cameo/

From the point of view of the ICT architecture, a clear plan can only lead to substantial savings. A way to align all plans would be to use a sector-wide unique collaboration platform that supports the management of sector-wide and local planning, objectives, best practices, procedures, policies, KPIs…

The project management practices need to be improved, as libraries are more dependent on the success of ICT projects. In general, all projects (including non-ICT projects) would require better

ICT tools for planning and control. Some data warehouse initiatives attempt to address those needs.

Using a sector-wide collaboration and project management platform would help ensure better coordination of the libraries' management for two reasons:

1. It would allow regular updates on the sector-wide (ICT) roadmap including all Flemish, provincial and local initiatives
2. The project management platform would allow to follow up on the evolution of the roadmap initiatives. Putting project management tools at the disposal of Libraries could be a way to partially achieve this goal. By sharing projects as well as project objectives and milestones, libraries will have a better understanding of the evolution of their network.

Just as an example, one can think about how this architecture study has been introduced to the library network and the means they have to follow up on the study's status or reuse its deliverables.

It is important to work on the library management processes and the related ICT tools as the libraries will face several challenges related to managing changes in the future. Such changes can take on different forms:

- Population (age, origin, behaviour, languages spoken)
- Market (digital content, new partners)
    - Need for stronger marketing plan and tools for the library
    - Attract new users
    - Target groups
    - Personalisation of the service, CRM
- Technology (e-books, internet)
- Innovation requirements, such as:
    - VEP: extension of the library's portfolio of services through new digital collections and distribution using new channels
    - Muntpunt in the Brussels-Capital Region: extension of the library's portfolio of services through temporary partnerships
    - Waalse krook in Ghent: using the library's relocation to introduce new innovative library services together with iMinds
- The changing role of the library: from information provider to information broker. For instance, the Delphi libraries organise their services in function of their ability to answer user’s questions. See http://www.delphibibliotheken.be/ .
- Etc.

Facing these changes means that many projects with different goals will run in parallel. A lack of management and policies could lead to a duplicate development or deployment of similar library ICT systems.

Unfortunately, the library budgets have little chance of being increased to face the changes. A strong sector-wide plan will therefore be required, as well as an increase in agility allowing to adapt the plan to changing external circumstances. In order to increase agility, libraries need to:

1. Collaborate on the sector-wide project portfolio in order to understand project dependencies

2. Apply iterative and incremental project management approaches (for instance, agile methods such as SCRUM, but it can also work with traditional project management if smart planning is used). This can require finding new ways to define and execute public tenders.
3. Revisit the existing core business processes and design new ones
4. Adopt open standards and best practices , such as SOA

The PODC tools can be managed by municipalities or by the library sector. It is important that strategy and management practices are harmonised across all libraries. If different methods are used, it will become difficult to implement the recommended ICT consolidations.

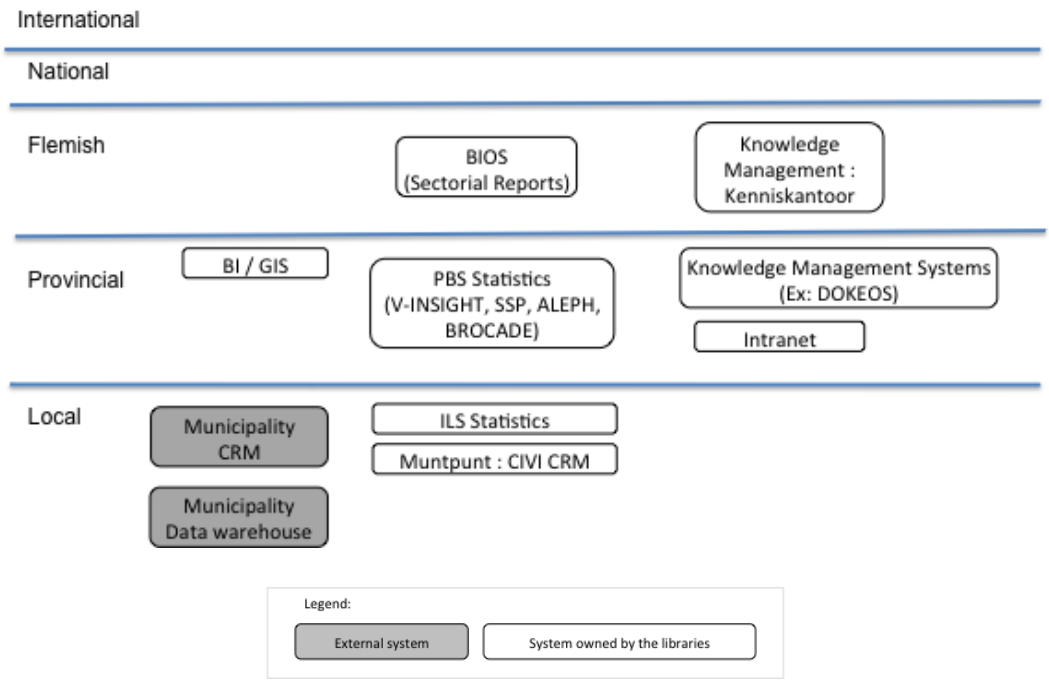


Figure 18: IT Systems used for Library Management

4.1.3 Optimisation of library management applications

Common library management practices should be documented before any ICT optimisation can take place.

The ICT tools used for library management are rather limited and diversified. Some initiatives show that libraries are working on Business Intelligence/Data-warehouse systems.

If we consider Knowledge Management (KM) within the field of library management, the few KM solutions could be merged into a sector-wide KM and collaboration platform.

4.1.4 Innovation in library management applications

Due to the arrival of new business processes in the library (such as e-book circulation), new KPIs and reports will have to be generated. This will require developing additional reporting solutions such as business intelligence, data warehousing or business process monitoring solutions. Traditional ICT systems will have to be integrated with new reporting systems.

When new business processes are integrated with a SOA, Business Process Management suites generally provide activity reports, SLA reports and KPIs out-of-the-box. Those can be very useful for library management.
With the extension of collections with digital collections, new policies will have to be defined. The pricing management process will have to be extended with new business models and business rules.

4.1.5 Library Management – Summary

Observations:

- Lack of library strategy and management support systems in the sector

Possible optimisation initiatives:

- Clarification and alignment of library management practices before any adequate ICT tool can be selected.
- Sector-wide knowledge management and collaboration solution
- Sector-wide project management platform (see also ICT services section)

Possible Innovation initiatives:

- Data warehouses and BI
- Business Process Monitoring
- Pricing Management: integration of new business models for digital collections

4.2 Marketing, communication and promotion

Libraries have plenty of tools for communication and promotion (websites, blogs, newsletters…). These tools exist at the service of the library's marketing plan. During the study, however, no reference was made to anything like a "library marketing plan".

4.2.1 Optimisation of marketing systems

There are several "**direct marketing**" systems, such as newsletter and mail merge systems. This could be a possible optimisation area, but the business case would not be attractive as such: a unified or standardised newsletter system would be much preferable, if used in combination with a consolidated CRM strategy.

A **unified marketing plan for libraries** would greatly help in determining the key marketing systems that libraries need. From there further ICT optimisation options could be suggested.

4.2.2 Innovation in communication and promotion

Competitiveness
From a marketing point of view, libraries might need to compete with other "virtual libraries" in the future. There are big players such as Apple and Amazon, but also local players (e.g. Skoobe https://www.skoobe.de/en/what-is-skoobe and http://eboektehuur.nl/). Competing with those players will require improved marketing communication tools, such as an appealing website,

mobile apps, coordinated social media communication and increased sectorial collaboration on marketing activities.

Personalisation of the service
Data related to patrons will increasingly used to develop online personalised services. This will require better knowledge of the patron and their preferences and tastes. This will be achieved through the combination of systems such as CRM and Identity Management.

Websites, Blogs and Social Media
The library websites are clearly very important tools for the library's marketing strategy. Search engines such as Google now integrate Social Media into their search ranking mechanisms, meaning that libraries must market their offerings on social media as well.
Those topics are discussed further in the “Online Patron Services” section.

4.2.3 Communication and Promotion – Summary

Observations

- The relationship between the library marketing plan and the required marketing ICT tools needs to be elaborated and documented more in depth.

Possible optimisation Initiatives

- Some (minor) gains are possible by harmonising current direct marketing tools (newsletters, mail merge).

Possible innovation initiatives

- Libraries will have to personalise the patron experience in order to stay competitive. This will require owning good CRM and Identity management systems.

4.3 Patron Services

In the AS-IS business services model, the following processes are “patron services”. They aim at providing a service to the patron:

- Front desk & Enquiries
- Patron Registration
- Patron Identification
- Public Activities
- Information mediation
- Education and Training

The following chapters delve into various aspects of the ICT systems used to deliver patron services:

- On-site systems
- Online systems (internet)
- Identity and access management
- Referencing and Information systems
- Circulation Systems

4.4 Patron Services – On-site

4.4.1 Patron Services – On-site – Situation

As illustrated in the AS-IS Technology chapter, patrons are in contact with several applications and systems at the library, including:

- RFID
- Public computers
- Printers
- Payment terminals
- OPAC

Libraries rely on the SIP2 protocol to integrate many of these local systems with their ILS/PBS (see "AS-IS applications – library perspective").

4.4.2 Patron Services – Local infrastructure optimisation

Libraries buy and operate the same kind of local ICT equipment: computers, printers, Wi-Fi, RFID, payment terminals, interactive displays… Due to the dependence on the municipality as well as on local partners, it is difficult to make grouped purchases. In addition, the equipment must be installed and configured locally.

The local ICT infrastructures require reliable ICT support. Benefitting from documented and reliable ICT support processes goes with ICT maturity. Since libraries have the same kinds of local ICT infrastructures, they could at least share a common ICT support process template. Ideally, they could consolidate their local ICT support processes.

If libraries regularly benchmark the cost of their local ICT infrastructure with their peers, they could find ways to optimise the local ICT infrastructure costs. A Sector-wide collaboration platform could help in that process.

4.4.3 Patron Services – On-site – Future requirements

The on-site ICT equipment used in the future can be very different depending on the library's "role". The CAMEO handbook identifies eight library roles (http://skyways.lib.ks.us/pathway/cameo/chap4.htm):

1. Community Activity Centre
2. Community Information Centre
3. Formal Education Support Centre
4. Independent Learning Centre
5. Popular Materials Library
6. Preschoolers' door to Learning
7. Reference Library
8. Research Centre

The Arts Council's report on innovation mentions the Delft Concept Library ('DOK' - http://www.dok.info/) as one of the best known international examples of an innovative library.

In Flemish public libraries, during the AS-IS phase, we had a look at the innovations made by new libraries such as Muntpunt (http://www.muntpunt.be/) in Brussels and the Waalse Krook in Ghent. (see http://www.dekrook.be/faq/bib). Muntpunt has a clear objective of leveraging public activities organised with and by external partners. Playing this "role" will have an impact on systems such as the library's website (hosting partner event descriptions and content) or CRM (inviting patrons to the appropriate events depending on their profile).

Libraries need to better specify the kind of business services that they want to offer (i.e. their "roles") in order to implement the appropriate local ICT infrastructure and make the right ICT investments. The local infrastructure requirements can therefore only be determined when the library's manager has communicated a clear strategy for business services to its ICT personnel and suppliers.

Up to date on-site infrastructure

Depending on the role that the library aims for, it will have to **keep the related ICT on-site infrastructure up to proper standards**. For instance, if the public PCs are not up to date, they cannot be used to access and use the newest ICT systems. If patrons do not have their own tablets or smartphones, they might not be able to read e-books and the library might be forced to lend them tablets or e-readers. The on-site infrastructure has to stay "in sync" with the rest of the systems architecture.

4.4.4 Patron Services – On-site - Summary

Observations

- Libraries operate several systems on-site, which require specific IT support
- In general, libraries have limited ICT support from their own municipality

Possible Optimisation Initiatives

- Identify possible synergies by starting to compare the on-site ICT infrastructure with peers
- Standardisation and levelling of the minimum required local ICT infrastructure (e.g. Wi-Fi)

Possible Improvement Initiatives

- The on-site improvements will depend on the role(s) that the library wants to play.

4.5 Patron Services - Online Services

The patron online services are the library services that patrons can access through the internet. On the web, patrons can search for library information, search in the library catalogues, reserve books, extend books loans, listen to music, find out about events…

4.5.1 Online Patron Services Situation

When patrons access the library online, they have many points of entry at the different levels of the library network:

At the local level:

- The city/municipality website
- The ILS webopac (if the library has its own ILS) or in some cases its own Aquabrowser or Iguana catalogue/portal
- Bibliotheekportalen – local profile (as PBS library)
- The library's blog
- The library's website, which can feature a virtual bookshelf
- The news briefs (paper or electronic)

At the provincial level:

- Bibliotheekportalen (search in the collections of all libraries across the province), e.g. http://limburg.bibliotheek.be/, http://provant.bibliotheek.be/?q=aspe
- The PBS webopacs (e.g. http://www.bili.be/)
- The provincial digital book displays (Book boards)

At the Flemish level

- Bibliotheekportalen (http://zoeken.bibliotheek.be/)
- Display of award-winning books
- Bibliotheek.be services (e.g. library addresses and opening hours)

At the “International” Level

- Library Facebook pages
- Library Twitter accounts
- Library Pinterest pinboards
- Library Blogs on Blogger.com and Wordpress.com
- Google and other search engines

With the new version of zoeken.bibliotheek.be, Bibnet has further implanted its SEO strategy aiming at making the libraries' collections visible on Google.be.

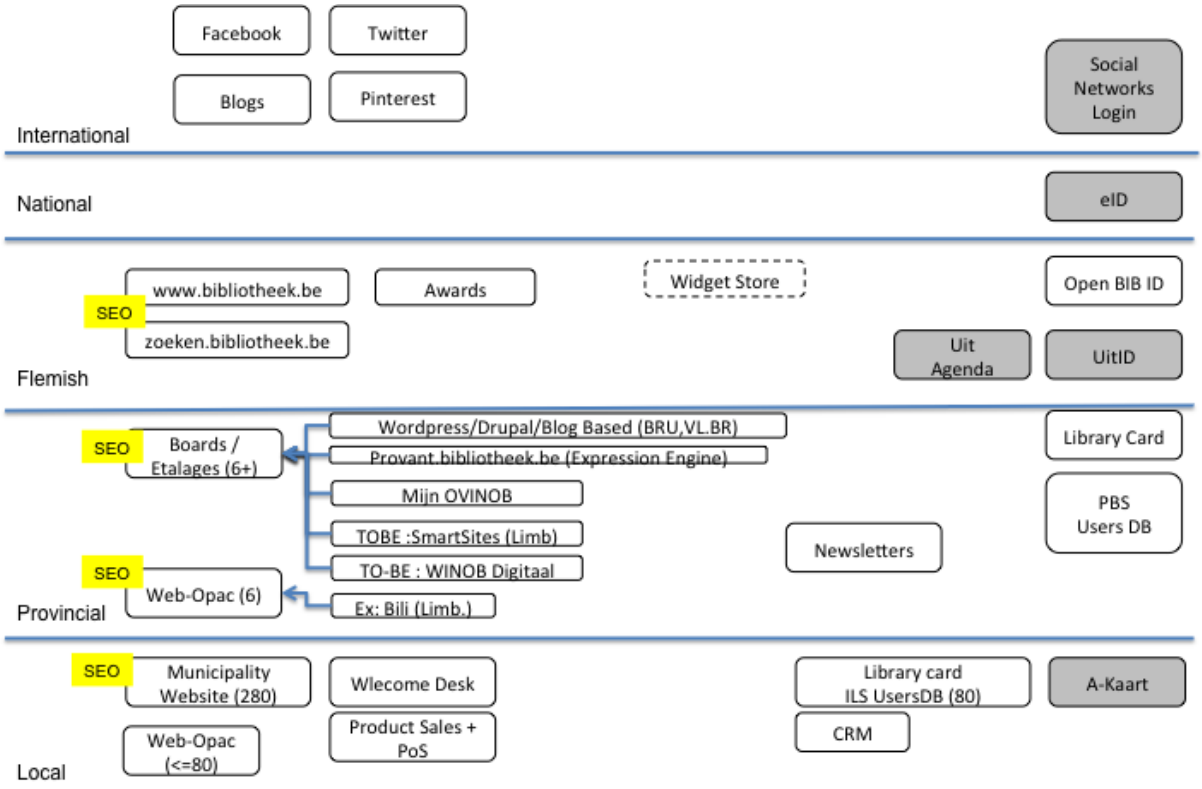


Figure 19: Patron Online Services - AS-IS Systems

The following list of websites gives an idea of the variety of library websites on the internet. The variety of URLs reflects the variety of underlying systems.

Website type	**URL**
Pinterest	http://pinterest.com/bibhalle/
Facebook	https://www.facebook.com/BibvanBalen
Twitter	https://twitter.com/bibliotheekgent
Blog	http://bibliotheekgent.wordpress.com/ http://www.bibliotheek.be/bibliotheekblogs http://bibbuggenhout.blogspot.be/
Municipality websites	http://overijse.be/html/diensten/index.asp?id=23&i=23 http://www.gent.be/eCache/THE/46/038.html
WebOpacs	- http://www.bidoc.be/poboverijse/bidoc0.htm - http://www.bili.be/webopac/Pa.csp?OpacLanguage=dut&Profile=Profile_14 - http://bruno.vgc.be/webopac/Pa.csp?OpacLanguage=dut&Profile=ander - http://81.82.225.131/webopac/vubis.csp (Mol) - http://geapbib003.cipal.be/desktop/mijnbibbale/euiam (BROCADE) - http://webbib.gent.be/webopac/Pa.csp?OpacLanguage=dut&Profile=UserAccJeu
Iguana (Turnhout)	http://194.78.87.122/iguana/www.main.cls
Mijn Bibliotheek:	http://mijn.bibliotheek.be/
Provincial links	- http://isis.provant.be/ - http://balen.bibliotheek.be, http://bibbalen.provant.be/pbs - http://www.bruno.be/ , http://www.anderlecht.bibliotheek.be/ (DRUPAL)
Bibliotheek.be	- http://hasseltpbl.bibliotheek.be/ - http://halle.bibliotheek.be/ → http://www.bibliotheekhalle.be/
Zoeken.bibliotheek.be	- http://zoeken.bibliotheek.be/ - http://zoeken.bibliotheek.gent.be/?q=fiets
Others	- http://startschermen.bibliotheek.gent.be/ - http://www.bibliotheeknetwerk.be/
Etalage	http://bib.boutersem.be/index.php (latest items)

4.5.2 Online patron services - Observations

4.5.2.1 Not a uniform Patron Experience

Patrons can have a totally different experience of the online library services depending on:

- The library they use
- The library websites they know about

There can be several online points of entry (websites) for each library:

- Municipality website
- Social media: Twitter, Blog, Facebook, Pinterest…
- Virtual bookshelves – library website
- Catalogue search – Bibliotheekportalen, webopac
- "Circulation" websites: mijn.bibliotheek.be or webopac.

The diversified patron experience is a logical consequence of the municipalities' and libraries' autonomy in defining their service portfolio. From an ICT perspective, this diversification has a cost. This is further discussed in the chapter on the cost of ownership for business services.

4.5.2.2 Not all municipality websites can function as library portals

The main funder of the library being the municipality, the municipality's website should be used as the main portal. However, most municipalities are not equipped with a portal that is able to integrate external services such as library services. By standardising and harmonising the ways in which library systems can be integrated, libraries can help municipalities enhance the patrons' overall experience.

4.5.2.3 Duplication of efforts

The overwhelming majority of libraries have similar needs in terms of website functionality, yet many different web developments are made in parallel. An example of this is the development of different virtual bookshelf systems ("Etalages") in different places.

4.5.3 Online Patron Services – TO-BE Scenarios

During the "Municipality Integration" and the "User Experience" TO-BE workshops, several library website scenarios were discussed:

TO-BE Workshop	Scenario Name	Description
User Experience	Municipality Websites	The municipality website is the single online gateway to the library services.
User Experience	Library Websites	The library has an independent website (not integrated within the municipality website)
User Experience	Mobile Apps	The library offers a mobile app (iOS, Android…)
User Experience	Mobile Websites	The library offers a mobile website
User Experience	Personalisation	The library website/app adapts to the user's profile (e.g. recommendations)

Website
The workshops have shown that libraries are in favour of a fusion of library websites with municipality websites. But as municipality websites are not ready to integrate the library services, independent **library websites** remains the preferred solution.

Libraries must develop their websites on the basis of clearly defined web standards, so that the library's online services can later easily be integrated within the municipality website.

During the User Experience workshop, it was noted that there currently are no guidelines for library websites. Libraries could benefit from business and technical guidelines for websites. The business guidelines would provide a typical library website map, while the technical guidelines would specify how the website should be integrated with external systems (e.g. what kind of widgets? what kind of RSS feeds? Open BIB ID integration, ABL integration…).

Mobile Website via Responsive Web Design (RWD)
Having a mobile website has been recognised as an important requirement. One of the solutions suggested was to develop the library's website in such a way that it can be displayed on mobile devices (tablets, smartphones, mini-PCs…). The library website must feature a "responsive design" (RWD). This is a web design approach with the aim to provide an optimal viewing experience – easy reading and navigation with minimal of resizing and scrolling—across a wide range of devices (from desktop computer monitors to mobile phones).

Mobile Apps – towards a unique library app?
The Flemish e-book platform will probably come with a library app, allowing patrons to borrow e-books and read them offline.

Due to the cost of developing such an app for the different systems available (iOS, Android, Windows…), libraries should collaborate in order to maintain a minimum number of library apps, rather than multiply them.

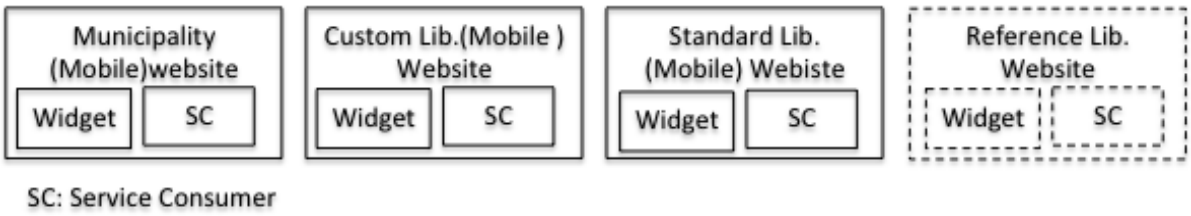
4.5.4 Online Patron Services – Optimisation

4.5.4.1 Common library website development
The optimisation opportunity for libraries is to collaborate on a single central web platform that could be hosted centrally or replicated at will. It could be used nearly "out-of-the-box" by libraries that are happy with the standard website, or it could be customised and extended by libraries who want to go the extra mile.

As soon as a common reference website is developed, a library would have three possibilities to create its own website:

- Use the standard website as an instance of the reference website
- Use the reference website and customise it
- Dismantle the reference website in order to integrate its components (widgets, web services, sample code) into the municipality website.

The reference website must be able to integrate widgets and consume SOA services, i.e. behave as a Service Consumer (SC).



This principle has been applied successfully in Wallonia: "Communes-Plone" is an open-source project to which all municipalities can contribute in order to build a complete municipality website with public service modules (http://www.imio.be/produits). More than 150 municipalities now use it and contribute to its development. With the open-source project's fast expansion, a new inter-communal organisation called IMIO was created to build and maintain the system for municipalities. The advantage of developing a reference system together is that development costs are shared. If the 150 municipalities all want a specific functionality, they would only pay 1/150th of the development cost. In addition, as the platform is built on open-source free software (Plone CMS), the system comes with no licensing cost. In addition, any ICT service provider – internal or external – who knows the programming language used by Plone (i.e. Python) can customise or extend the municipality system.

Collaboration with the municipality

Municipalities might also have initiatives aimed at harmonising websites. For example, the "Webs & Apps Standaarden voor de Converserende Overheid" (WASCO) project by the Flemish ICT organisation (V-ICT-OR, see http://www.v-ict-or.be/kenniscentrum/WASCO/) aims at helping municipalities with their websites by providing some best practices. Libraries should make sure that the municipalities' expectations are taken into account while designing the library website.

Integrated library website

Each library must aim at maintaining a central website that integrates all library services. It may have satellites (Facebook, Twitter, Webopac), but the website must attempt to integrate as many features as possible into a seamless user experience. This is only possible if library ICT systems can be integrated. This can be achieved using different techniques: widgets, plug-ins, web services.

An integrated library website should **integrate** the following elements:

- Personalisation of look& feel with the library's visual identity
- Standardised navigation structure across all library sites
- Clear list of library services, addresses, opening hours
- Blog
- Agenda/Events
- Open BIB ID login
- "Mijn Bibiliotheek"
- Discovery tools, widgets and services
- PBS/ILS
    - Webopac
    - Reservation
    - Current loans, loan extension
    - Loan History
    - Fees
- Virtual bookshelves

    - pBooks
    - e-books
    - special collections
- Self Service
- User Profile
- Social Media integration (Twitter, Facebook, Pinterest…)
- Accessibility

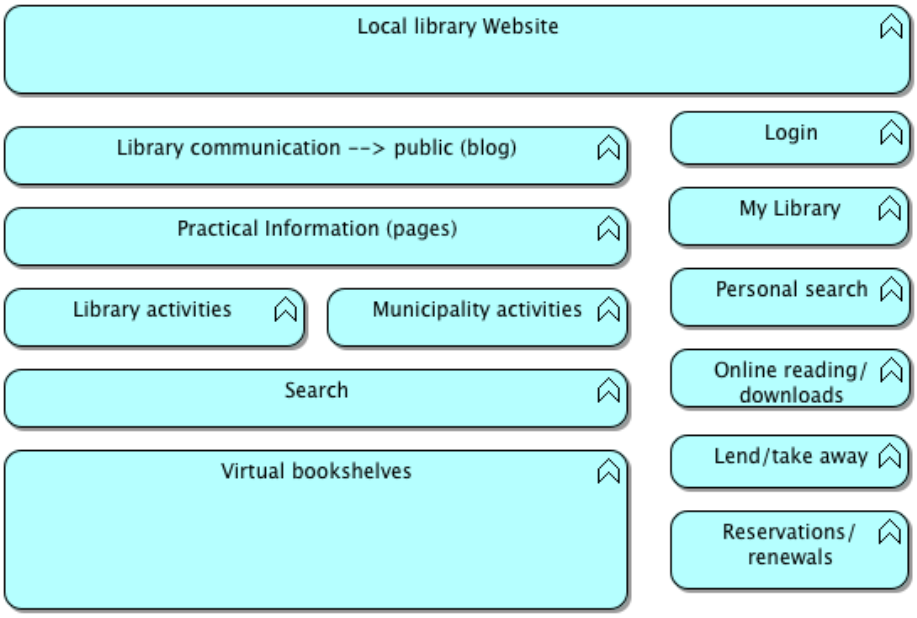


Figure 20: Integrated library website services

The library's strategy should be to systematically integrate all new public services into its website: the Flemish e-book Platform, Online Payment Services… This effort can be mutualised if the development is done on a single reference platform. Adopting an open-source platform as the basis could be a good option, as it allows libraries with internal or external development power to extend and customise their website to fit their needs.

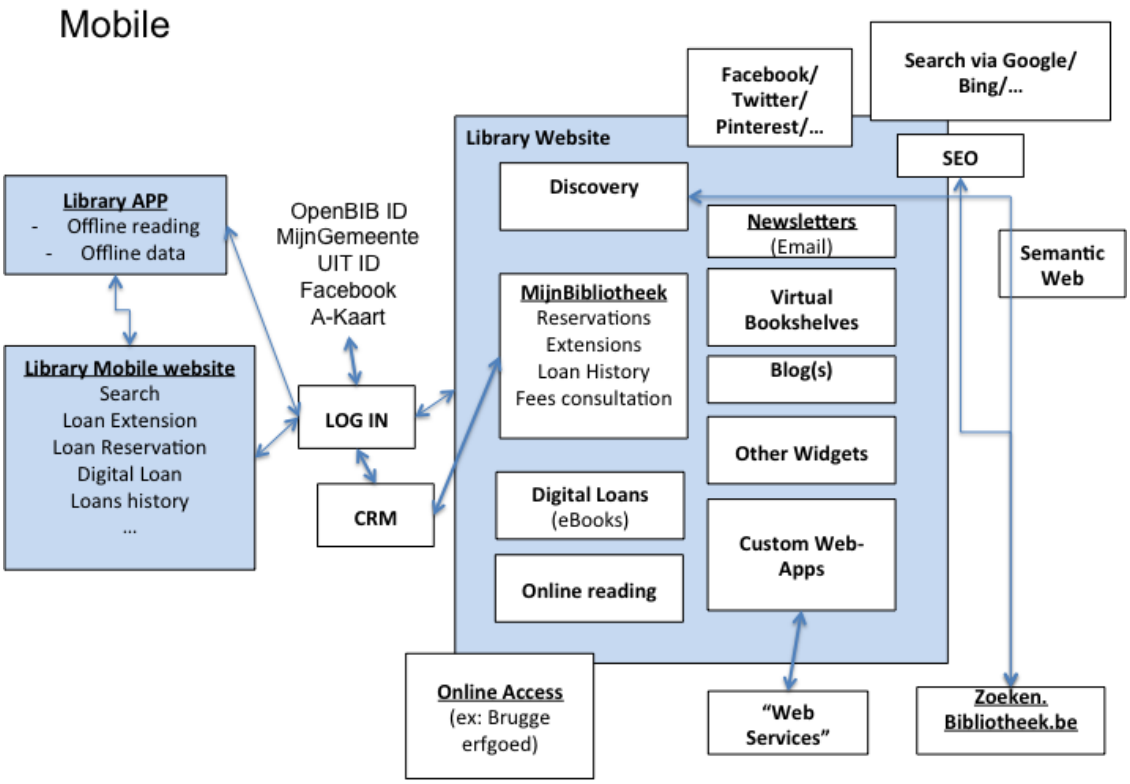


Figure 21: Web and Mobile Systems for the libraries

4.5.4.2 Mobile Website

Due to the high market penetration of smartphones and tablets, library websites should be readable and usable with mobile devices, for instance by using "responsive design" techniques.

4.5.5 Online patron services innovation

4.5.5.1 Mobile App

While libraries will have to continue their efforts to provide quality websites, the new ICT systems will most probably target mobile devices: smartphones, tablets, e-readers… Libraries will have to introduce mobile apps in their architecture.

4.5.5.2 Pervasive Information Architecture

What would the perfect library mobile app be like? There is currently no answer to that question. What we can say today is that web and mobile applications must contribute to a **Pervasive Information Architecture**. The online experience must be integrated into the total library experience, including the on-site experience. Patrons should be able to start an activity through a first channel (e.g. the library), and continue seamlessly on a second channel (e.g. a mobile app). Online and "real-life" experiences must remain consistent with each other.

The principles behind the pervasive information architecture are:

- Online experience as an integrated part of a comprehensive experience
- Cross-channel user experiences
- Complete user experience on all channels
    - In the library
    - On the library's website

    - On mobile (apps)
    - …
- Each channel provides links to other channels
- Seamless channel switching must be possible

4.5.5.3 Adaptive content

A pervasive architecture requires **Adaptive Content**: content that is structured so that a single item can be displayed across a variety of devices in a variety of formats (e.g. desktop webpage, mobile webpage, mobile app, tablet webpage, tablet app, etc.). Libraries manage and produce a great amount of content on their websites, on blogs, in the catalogues… they would therefore benefit from a sector-wide content management strategy. This would allow libraries to easily share and reuse content with their peers.

4.5.6 Online Patron Services – Summary

Observations

- Libraries' web presence is currently rather messy
- Municipality websites are not ready to integrate the library services.
- Libraries are developing similar web systems in parallel (websites, virtual bookshelves, blogs…)

Possible Optimisation initiatives

- Develop and communicate business and technical library **website guidelines**
- Develop a **reference library website** that libraries can use or clone
- Make sure the library website works on **mobile** devices

Possible Innovation initiatives

- Library mobile **app**
- **Pervasive Information Architecture**: align online services with other channels (e.g. on-site)
- **Adaptive content**: define a sector-wide content management strategy in order to improve content sharing and reuse between libraries

4.6 Patron Services - Identity and Access Management (IAM)

4.6.1 Patron Services - IAM – Situation

In order to access the library services (online or “in real life”), the patron must be identified.

Patrons can use a variety of identity and access management (IAM) systems:

- Social Network Identification (Facebook, Twitter…)
- Belgian Identity Card (eID)
- Open BIB ID
- UitID
- Library card
- Municipal card (e.g. A-Kaart)

- Application-specific user ID and password, e.g.
  - PBS/ILS
  - My Discoveries (ABL, zoeken.bibliotheek.be)
  - Library websites/blogs

eID is used for access to public PCs (for example in Kortrijk: http://www.kortrijk.be/producten/internet-printen-scannen-en-kopi-ren). Also, technically, the ILS can be integrated with the eID system to identify patrons (see http://www.library.extensity.com/page/VerslagVubisGebruikersdagdutch_LIB.html).

With the OpenBIBID system, libraries will be able to progressively provide a full SSO (Single Sign On) between the systems that they own.

4.6.2 Patron Services - IAM – Observations

The **Patron registration process** must be further developed in order to provide new patrons with access to all library systems. This process is known as "Identity and Access Provisioning". A new patron must receive access to the ILS, but also to other systems such as the Flemish e-book platform, My Discoveries (Library portal service), Gopress… And if a patron leaves the library, those access rights should be revoked ("deprovisionning" process).

4.6.3 Patron Services - IAM – TO-BE Scenario

During the workshops, the following scenario was discussed when addressing the IAM topic:

TO-BE Workshop	Scenario Name	Description
User Experience	External SSO	The library website allows to log-in with different kinds of identities (Municipality Card, UitID, Facebook, Twitter…)

After discussing this scenario, the requirement to **integrate with other IAM systems** has been validated by various stakeholders (e.g. Antwerp's A-Kaart, CultuurNet's UITiD).

4.6.4 Patron Services – IAM - Innovation

A possible solution to integrate with partners' IAM systems is to participate in a **federated identity system** such as WAYF ("Where are you From"). A "WAYF" system would allow libraries to establish a kind of "global SSO" with external partners from the cultural (CultuurNet, Museums) and e-government sectors.

Public libraries cannot establish and operate such an identity federation system on their own. They must **find a partner** who has the necessary authority to manage and control the identity federation system. During the study, this problem was discussed with V-ICT-OR. It was also mentioned during the workshops that the Flemish eGovernment Coordination Unit (www.corve.be) could be such a partner.

Technically, instead of connecting to many IAM systems, libraries need only to integrate with one federated IAM infrastructure. The system should allow two levels of security:

- Simple: "**web service style**" security to protect services for which a lower level of security is sufficient (Facebook login, book reservation…). The technical protocol used for this kind of security is called OAUTH (Open standard for authorisation).
- Strong: "**eID style**" security that makes use of security certificates and stronger authentication and encryption mechanisms. This will be necessary to access sensitive information or perform financial transactions.

A good example of such an infrastructure is the WAYF system used in Denmark. (see http://www.wayf.dk/en/institutions and http://www.wayf.dk/en/about-wayf/user-experience). WAYF stands for "Where are you from?".

If such Identity federation principles can be established with the libraries' partners, it can lead to **cost savings** because libraries would only need to integrate one external IAM system instead of integrating all partners' IAM infrastructures.

It can also provide a **better user experience**. For example, Open BIB ID provisioning processes could then also be extended so that partners can automate the creation and linking of library patrons' accounts. For example, the creation of a library account could be coupled with the creation of an UitID account. The creation of a Muncipality ID on the municipality website could lead to the automatic creation and linking of an Open BIB ID account. For the user, moving from the municipality website to the library website would then no longer require to manage two different accounts.

4.6.5 Patron Services – IAM – Summary

Observations

- Many identification and access management systems are used, and they must be integrated to help the patron to use library services seamlessly. Open BIB ID is a good strategy for SSO within library systems.

Possible Optimisation initiatives

- Continue the integration of IAM systems with Open BIB ID.
- Design and implement patron provisioning and de-provisioning processes.

Possible Innovation Initiatives

- Lobby the Flemish authorities to establish a sector-wide identity management infrastructure (WAYF like)

4.7 Patron Services – Referencing and Information

At the library, the reference desk or information desk is a public service counter where professional librarians provide library users with direction to library materials, advice on library collections and services, and expertise on various types of information from multiple sources.

4.7.1 Referencing and Information – Situation

Today, those services must also be provided online. This is why libraries have many online referencing and information ICT systems:

- Blogs
- Webopacs
- Bibliotheekportalen
- Virtual bookshelves
- …

These systems allow patrons to find and search information about the library's collections.

Nowadays, patrons search for information using internet search engines, therefore all library websites need to be optimised for SEO (Search Engine Optimisation).

4.7.2 Referencing and Information – Optimisation

4.7.2.1 SEO Everywhere?

In order to get on the radar of patrons who search for information using online search engines (Google, Bing), all providers of library websites should invest in Search Engine Optimisation (SEO) techniques. Making sure that the library's online systems (website, blog, catalogue…) are all optimised for search engines requires considerable work for each library.

The sector-wide SEO effort could be reduced if agreements could be reached in the field of online user experience.

For instance, the new version of zoeken.bibliotheek.be and Bibliotheekportalen will allow for better SEO. As soon as all libraries and author pages are integrated, Google will be allowed to index zoeken.bibliotheek.be, resulting in a higher visibility for local collections.

If libraries develop a reference website together, the website's SEO can be designed and implemented once and used for all websites.

4.7.2.2 Missed synergy: Virtual bookshelves X 4

Nearly all provinces have invested in the same kind of solution: online book displays. The solutions chosen all solve the same kind of problem, but are implemented in different ways (Expression Engine, Smart Sites, Drupal, Bibnet…). This is a missed opportunity to share costs and develop synergies.

All actors of the library sector could have reasons to develop their own version of any component. However, they must also be aware of the related total cost of ownership of such a component. The chapter entitled “Cost of ownership of business services” further elaborates on this topic.

4.7.2.3 Aquabrowser infrastructure

Flemish libraries currently use several ABL (Aquabrowser) instances. There could be some room for optimisation in that field.

4.7.3 Referencing and Information - Innovation

4.7.3.1 Discovery portals

In the future, old webopacs should disappear and give place to discovery portals that give the patron a more modern web experience.

4.7.3.2 Linked Data

Innovations in the discovery of the library services and collections will come from the semantic web. The semantic web aims at converting the current web, dominated by unstructured and semi-structured documents, into a "web of data" by encouraging the inclusion of semantic content (e.g. XML or RDF data) in web pages.

In the future, in addition to the catalogue information published with search engine optimisation (SEO) in mind, a parallel catalogue publication in XML/RDF will enable search engines to fully understand the semantics of a library service or product. This will allow search engines like Google to determine that a given book is available at a nearby library, e.g. using the item's "microformat" markup (http://en.wikipedia.org/wiki/Microformat).

These concepts are also further explained in the following document: "Transforming Library Metadata into Linked Library Data" - http://www.ala.org/alcts/resources/org/cat/research/linked-data

Linking the libraries' data with other open datasets is an interesting concept, but the **lack of Dutch language semantic data sources** can be a major showstopper. Libraries need to determine if they want to act as **early-adopters** or even as **leaders** in that area. For instance, libraries could publish information on Flemish authors or books in RDF in Dutch so that other parties can link to that information in their own applications. Libraries would first be a **Linked Data provider** before being a consumer, because today there are too few linked data sources in Dutch. A collaboration with the Netherlands could be interesting in this field.

4.7.3.3 Enquiry and Management System

Libraries could also wish to implement **Enquiry Management Systems**. In West Flanders there is a project to implement a "patron questions follow-up" system in the context of extending the library's services.

4.7.4 Referencing and Information - Summary

Observations

- Too many search services on libraries online systems (websites, catalogues, blogs…)
- Too much SEO work due to the large number of online systems

Possible optimisation initiatives

- Implement a sector-wide SEO strategy (via reference website, zoeken.bibliotheek.be)
- Merge the four virtual bookshelf systems into one comprehensive virtual bookshelf system (that can be configured locally)
- Consolidate the ABL systems

Possible innovation initiatives

- Linked Data: produce open linked data to be better referenced by "semantic web ready" search engines
- Implement an "Enquiry management system"

4.8 Patron Services – Circulation

This chapter covers ICT systems that allow the lending of resources from the library's collections. The term "access" hereafter refers to on-site consultation and access to online databases.

4.8.1 Circulation and access - situation

The circulation of physical resources is mostly managed using the local ILS or the provincial PBS.

For some libraries (PBS Antwerp and PBS Flemish Brabant), using the Open BIB ID project, part of the circulation process can happen online through self-service at MijnBibliotheek.be: reservation, borrowing history, extension, overview of fines.

There are also additional access processes related to circulation or information that are not managed by the ILMs:

- Access to Music (BibFM)
- Access to press articles (Mediargus, GVA archive)
- Inter-Library Loan (ILL) / Inter Bibliotheek Leenverkeer (IBL)
- Daisy books loans (audiobooks loaned through the device)
- Fundels loans (electronic versions of picture books)

The ILS circulation process is also sometimes used to reserve and "loan" special items, for instance:

- study desk at the library
- public computers
- Daisy audiobook reader devices

Determining whether the library's ICT systems should be extended to cover the circulation of special items outside of the boundaries of traditional collections depends on the future service portfolio that will be used by public libraries. Again, a definition of the library's roles is essential for the ICT alignment.

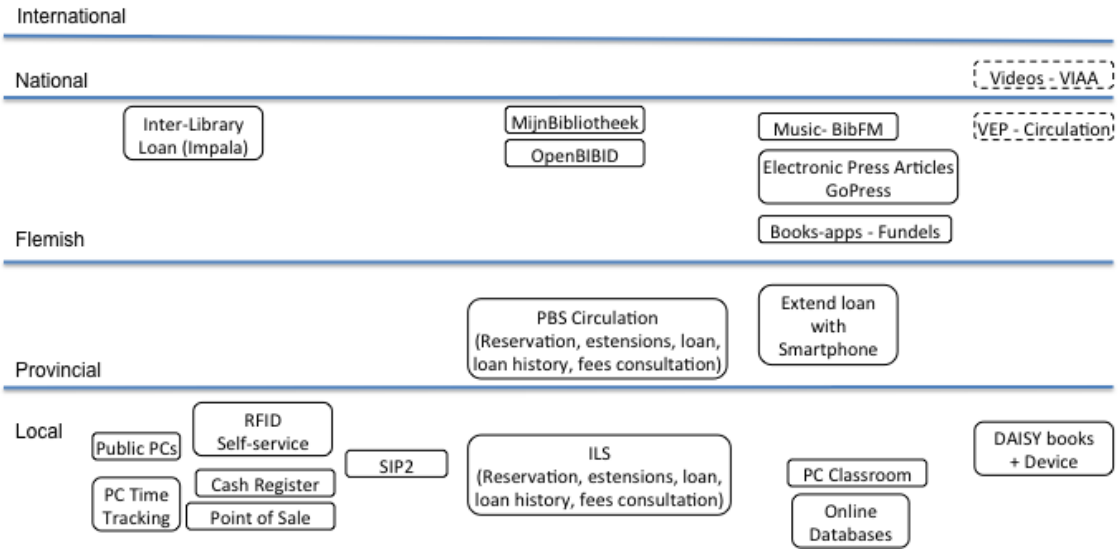


Figure 22: AS-IS Circulation Systems

4.8.2 Circulation – Optimisation

The circulation of "traditional" collections (printed books, DVDs, CDs…) is a mature and stable process. Recently the process was further improved with RFID self-service systems.

As the circulation process for physical resources is relatively standard across libraries, the underlying ICT systems could also be consolidated. However, such a consolidation can only be possible if one condition is fulfilled: libraries must have the possibility to tailor the process to their own policies, such as loan price, loan duration, fees, number of simultaneous loans…

4.8.3 Circulation - Innovation

4.8.3.1 Digital Collections Circulation

As collections are extended with digital resources, libraries will have to implement new circulation processes for digital resources.

e-books
The Flemish e-book Platform (VEP) will introduce an additional circulation process to those already in place for printed books, online databases, fundels, public computers, music, press articles…

Multi-Media
In the future, library collections will contain music, videos, games, software, software packaged within e-books, software in the cloud… Libraries will have to find ways to loan a great variety of digital content: videos, music, software embedded in e-books or in apps…

The "Vlaamse Instituut voor Archivering en ontsluiting van Audiovisueel erfgoed" (Flemish Institute for Archiving, VIAA) is working to provide digital video services to public libraries.

Agility Requirements
The current problem with the circulation of digital resources is that the underlying business models are not very stable. Libraries can pick among many models of e-book lending, because a legal framework for e-book lending has not yet been defined. E-book lending models can vary from individual e-book purchases to "all you can read" systems, changing the circulation process dramatically. A list of some of those business models can be found here:
http://www.appepaper.com/wiki/e-book-lending-business-models

Business Process Management (BPM) Suite
Due to this temporarily instable situation, libraries would be better off avoiding to "hard-code" a digital circulation process within a specific system, rather using agile ICT tools such as a Business Process Management (BPM) suite or a workflow system to manage the circulation of digital resources. The BPM concept is further elaborated in the chapter entitled "ICT - Application Integration".

4.8.3.2 Electronic Rights Management Systems (ERM)

With the proliferation of sources and types of digital content, libraries will have to deploy **Electronic Rights Management** solutions in order to determine whether the library has the right to give a patron access to a resource at a given time.

The business models for loans of digital resources by public libraries are still evolving, and they will continue to evolve for several years. Therefore, libraries need to use rather **flexible systems**

for the digital circulation processes. A possibility to implement such a flexible system is to use a Business Rules Management System (BRMS) within a BPM Suite. The advantage is that the decision logic of authorising the loan of a given resource can be modelled as a set of business rules. When there is a change in e-resource lending business models, contracts or providers, then business rules can be adapted to reflect this change and rapidly adapt the circulation process. For example, the KualiOLE "deliver module" uses Kuali Rules Management System (KRMS), a flexible and extendable business rules management tool, as a framework for its circulation policies (e.g. determining loan periods). http://www.kuali.org/ole/modules/deliver-entity

4.8.3.3 Master circulation process

Circulation and access are the core processes of the libraries' offering. Today there are different circulation and access processes that depend on the type of resource. The different types of circulation could be integrated into a "master circulation process".

As all circulation flows are not managed by the ILSs, it could be interesting to synchronise them all using a master circulation process that would be hosted centrally, within the SOA/BPM infrastructure.

Today's ILSs are not ready for the new kinds of circulation, e.g. the circulation of e-books. The new circulation processes require Electronic Resource Management (ERM) features. The circulation of digital resources in general could also be integrated into the master circulation process.

The master circulation process could allow sector-wide statistics on all kinds of circulation and accesses. This will allow to cross-fertilise different kind of collections, for instance by offering the electronic version of a book when the paper version is currently not available. It will also be possible to make better recommendations on what to lend next across all collections once an item is returned.

The master circulation process will also allow the library to see all the resources that a given patron is currently borrowing, regardless of the type of resource and underlying ICT systems involved.

4.8.3.4 Web, Mobile and Apps

Websites, mobile sites and mobile apps must continue to help patrons interact with the circulation process: reservations, extensions, lending and access to digital resources, payment of fees…
These possibilities will help offer patrons a modern library experience.

4.8.4 Circulation – ILS Vendors

Currently, ILS vendors do not provide a digital circulation module that could easily extend the current ILS systems. Such a module will therefore have to be developed for the Flemish e-book Platform.

Nevertheless, it is technically possible to integrate the ILS systems with external digital circulation systems such as Overdrive.

4.8.5 Circulation – Summary

Observations

- Several circulation processes already exist today: books, music, digital press articles, online databases, Daisy books with device, digital classroom…
- New circulation processes will be added: e-books, videos, software, apps…

Possible Optimisation Initiatives

- As the circulation process for physical resources is relatively standard across libraries, the underlying ICT systems could be consolidated (hardware, software…).

Possible Innovation Initiatives

- Gradual introduction of Electronic Rights Management Systems, possibly based on Business Rules Management Systems (BRMS)
- Extend the circulation process to digital resources using BPM
- Improve control of all circulations with a Master Circulation process in the BPM layer
- Use apps to help patrons

4.9 Collection Management

4.9.1 Collection Management - situation

The libraries' collections require the management of several types of content:

- Book metadata (ILS, PBS, Open Vlacc, Aquabrowser…)
- Book covers (Cover Server)
- e-book metadata (VEP)
- e-book contents (future VEP repository – VEP-R)
- Music metadata (BibFM, Open Vlacc, CDR)
- CD/DVD metadata (Open Vlacc, PBS, ILS)
- Special collection metadata (PBS, ILS)
- Apps (e.g. Fundels)
- Magazines, Serials
- Newspaper articles and bundles (GoPress)
- Author data
- Edition data
- Reviews (received from NBD Biblion and Vlabin)
- User Generated Content such as tags, comments, bookmarks…

Open Vlacc plays an important part in collection management, as it serves as a pre-catalogue for most public libraries. Open Vlacc is fed with new titles through an input stream from BoekenBank, CDR and the six Vlacc input partners.

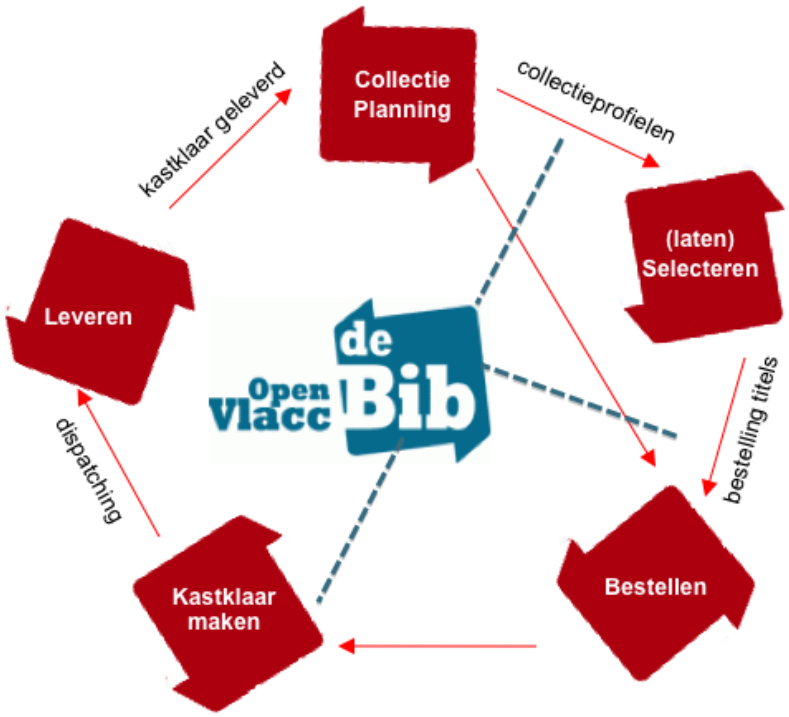


Figure 23: The Open Vlacc central catalogue at the centre of collection management

Collection Planning

Each library carries out its own collection management.

The Provinces of Antwerp and East Flanders are working on the establishment of best practices for integral collection management: ICB –(Integraal CollectieBeleid). Two systems are used: C-OPT and (Web)ICB.

Bibnet has created a first prototype (consolidated collection database in “FBRB” format) used to develop a sector-wide overview of the Flemish Brabant's collections (on the basis of the Open Vlacc and ABL data). Building such a “collections data warehouse” in order to provide better advice at the local level can lead to an improvement of the sector-wide collection management. It is not known whether this kind of system will be established definitively. In the meantime, Bibnet offers libraries advice and best practices for Integral Collection Management.

There is increasing pressure from municipalities to use their systems to manage orders and invoicing for library resources. In addition, they would like to use the usage statistics on the libraries' collections to consolidate citizen profiles in CRM systems, with a view to optimising municipality services.

Selection and orders

The book order process varies depending on the library's practices:

- Consignments

- ILS/PBS ordering system
- “Sprinters” system (MedioEurope) (40 bibliotheken)
- “Snelboeken” system (Standaard Boekhandels)
- Bibbank
- Shelf ready books
- …

In most cases, orders are encoded manually up to three times:

- In the ILS
- In the municipality's ordering system
- In the supplier's ordering system

Shelving books

After the resources have been received, the labelling is mostly specific to each library’s practices. Biblioprint helps libraries to make labels for books.

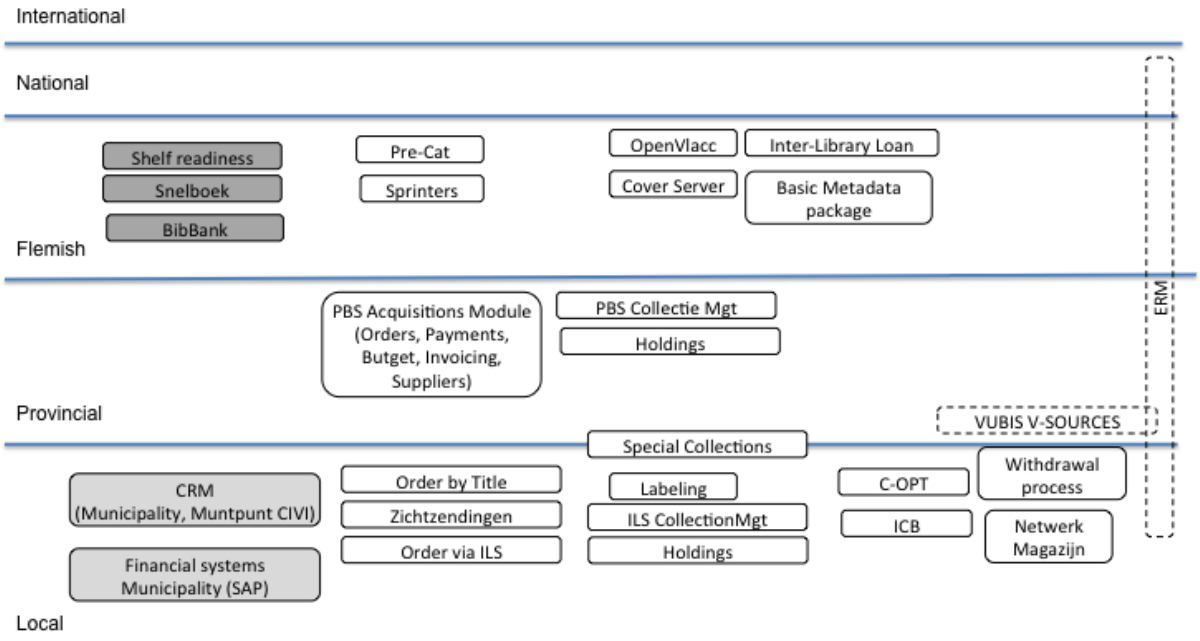


Figure 24: AS-IS Collections Management Systems

4.9.2 Collection Management – Observations

4.9.2.1 Integral collection management including digital collections

Libraries are still working on the traditional integral collection management of physical resources, while new digital collections will be arriving at libraries very soon. The integral collection management process should be extended to digital collections.

4.9.2.2 Purchasing process

The ILS's purchasing functionalities are not often used.

There is a need for a better integration of the library's purchasing process with the municipality's ordering/invoicing system.

In the Netherlands (Library of Apeldoorn), Infor has worked on such an integration using EDI (Electronic Data Interchange) techniques.
See http://www.vvbad.be/effici-nt-collectioneren-en-administreren-de-workflow-van-uw-bibliotheek-edi

In the future, ERP systems should be integrated with the library systems using SOA Services (e.g. web services) rather than EDI (application specific, mostly proprietary, structured text messages).

4.9.2.3 Special collections

According to Wikipedia, *"in many libraries,* special collections *is the name applied to materials housed in a separate unit with specialized security and user services. These materials can be in any format (including but not limited to rare books, manuscripts, photographs, archives, ephemera), and are generally characterized by their artifactual or monetary value, physical format, uniqueness or rarity, and/or an institutional commitment to long-term preservation and access. Individual libraries or archival institutions determine for themselves what constitutes its own special collections, resulting in a somewhat mutable definition."*
http://en.wikipedia.org/wiki/Special_collections

The Flemish public libraries own a certain number of special collections. A document listing all the provinces' special collections is provided in the appendix.

Libraries and Provinces manage special collections. There are no "special collections" systems at the Flemish level: they are managed directly by the libraries, sometimes with their province's support (special collection in the PBS).

Special collections have a special status at the moment in the Flemish public libraries. From a "centralised" perspective they are not standard enough to be considered as core-business, while in the libraries they are considered as a core asset.

Therefore, special collections need to move out of this "between the cracks" situation by either:

- Become standardised, by finding out which current best practices and ICT systems fit most of the requirements for special collections.
- Become considered an innovation field, by thinking about the requirements for a next generation special collections system. For example, one could want to investigate whether a combination of RDA, ontologies, Linked Data and new circulation modules could be used in the future as a common way to offer special collections to the public.

In order to plan for ICT, the library sector should provide a clear statement outlining a long-term strategy for special (or local) collections in public libraries.

4.9.3 Collection Management – Optimisation

The libraries' collections are currently managed in each library' ILS/PBS. The bibliographic records contained in the ILS have several origins:

- Copies from the central catalogue (Open Vlacc)

- Cataloguing by the library (book metadata not present in Open Vlacc)
- Cataloguing of special collections

In addition to book metadata, the library specifies the loan information used by the circulation process.

All libraries have implemented the same collection management processes:
- Import metadata from Open Vlacc
- Catalogue additional resources in the ILS
- Manage loans
- Integral Collection Management

As those processes are mostly identical, the underlying ICT infrastructures could be consolidated.

4.9.4 Collection Management - Innovation

4.9.4.1 Digital collections

The libraries' processes for collection management will have to be extended to digital collections. These do not work like physical collections: the selection, acquisition, cataloguing and delivery processes for digital collections must be designed and documented. Most of these processes are new and will have to be introduced in libraries in the future.

4.9.4.2 Integral collection management

Digital collections will require an extension of the integral management of the library's collections.

The library management business intelligence tools will most likely be extended with specific collections reports made using data warehouses and Business Intelligence (BI) tools.

4.9.4.3 Electronic Rights Management

Managing digital collections will also mean managing their associated rights. Together with each digital resource, its associated electronic rights have to be collected.

In the e-book platform (VEP), these rights will be stored as e-book metadata in VEP-R.

ILS vendors have different approaches to the management of electronic rights. The solutions are often based in the academic world, for the circulation of e-periodicals and sometimes e-books. They involve components such as link resolvers and reverse proxies, which sometimes cannot be directly used in the context of public libraries.

4.9.4.4 Purchasing process, SOA and BPM

Most libraries should improve their purchasing process in order to integrate the municipality's ordering and accounting systems.

There are two main ways to achieve this:

1. Enhance the ILS's ordering module using the ILS extension capabilities (hooks, plugins, workflow customisation) or custom code
2. Model the purchasing process and deploy a custom version on a BPM platform for each library. Integrate it with the ILS and the municipality using the SOA.

In the first case, there will be as many purchasing processes as there are implementations (at best, one per ILS brand). The purchasing process will be “hard-coded” in the ILS and will be difficult to adapt or improve.

In the second case, there will be one main standardised process for all libraries that interact with standardised ILS and ERP/Accounting SOA services. If a library wants to customise the standard process, it can add custom activities to it. The SOA Services will be specified upfront, and ILS suppliers will be paid to provide standard services instead of selling the same custom integration multiple times.

4.9.4.5 Special collections

The term ‘special collections’ is used for a variety of collections, from toys to books on cultural heritage.
Different libraries and organisations use different terms to refer to special collections.
The management of special collections is currently performed either using separate parts of the ILS, a second ILS, or another custom system.
The treatment of special collections depends on the strategy adopted by the different players in the field.

The short-term imperative for special collections in a public library environment should be to ensure they use the same authorities as the central catalogue when possible. This ensures proper presentation of the collection and improved descriptions. It is not clear which unique authorities are necessary for which type of collection, and it should be considered that if special collections need special authorities they rather belong in an alternative ILS.

In the medium term, a sector-wide plan must be developed to describe which special collections should rather be part of the public library database and which other collections belong in another system. This sector-wide plan must provide every organisation with guidelines to avoid different interpretations.

In the longer term, it should be possible to create a sector-wide discovery tool that searches through different databases to present customers with lists of books, objects, maps, sounds, and pictures related to the searched term. Therefore all systems should try to implement standards in their specific discipline, such as AAT, Unicode, Z39.50, Dublin Core, RDA… Not all datasets must be the same, but it must still be possible to match the fields of the different datasets. The issue of special collections is one of the more difficult challenges faced by authorities and libraries, and a central control body for standardisation is necessary. The initiative taken by PACKED, Expertisecentrum Digitaal Erfgoed, is a first good step.

It should also be possible to offer links to special collections using Linked Data standards such as RDF. At ELAG 2013, Joachim Neubert described how Drupal could be customised to manage special collections and present them as RDF for Linked Data:
http://www.slideshare.net/jneubert/linked-data-enhanced-publishing-for-special-collections-with-drupal

4.9.5 Collection Management – Summary

Observations

- The scope of collection management is extending with digital contents
- Purchasing processes are seldom automated
- Special collections are not well positioned in the sector-wide strategy

Possible optimisation Initiatives

- Since the management of collections of physical resources is relatively standard across libraries, the underlying ICT systems could be consolidated.

Possible Innovation Initiatives:

- Extend Integral collection management to digital resources
- Purchasing process automation (for example with BPM tools)
- Electronic Rights Management of digital collections
- New approach to special collections with linked data

4.10 Cataloguing

4.10.1 Cataloguing – Current situation

As already mentioned in the collection management section, Open Vlacc is an important system for the cataloguing of resources in Flemish public libraries.

The following picture shows metadata flowing first through Open Vlacc before being distributed to Bibliotheekportalen and the libraries' ILSs/PBSs.

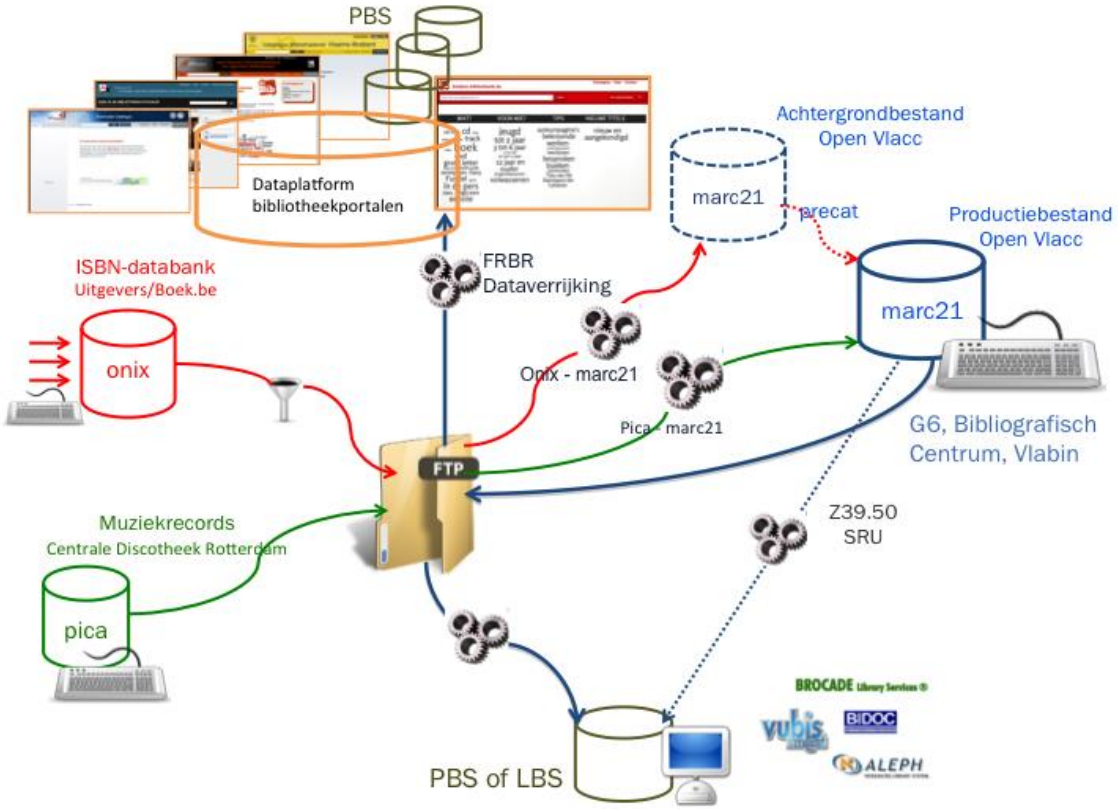


Figure 25: Metadata flows of the Flemish public libraries

Although most of the cataloguing information streams down from Open Vlacc, libraries still need to catalogue some parts of their collections:

- Books not present in Open Vlacc (filtered out in the pre-cat)
- Books not yet present in Open Vlacc
- Special Collections

4.10.2 Cataloguing - Systems optimisation

The traditional cataloguing process is quite optimised, mainly thanks to the use of the central catalogue (Open Vlacc).

But there are still some small elements in this process that could be further automated, such as:

- Alerts when local libraries purchase a book that is not already in Open Vlacc
- Better automation of the books' metadata imports from Boekenbank/Meta4Books. These imports require some manual work that could be simplified by additional automation.
- Reduce the manual work that is still needed for some updates due to the duplication of some metadata (e.g. author name) in the bibliographic records. Some conceptually simple updates result in many Open Vlacc updates. In the Netherlands, some of those changes are automated through scripting in the catalogue client software.

A cost/benefit analysis of the above-mentioned automation cases could reveal positive business cases as they can concern work-intensive human tasks.

4.10.3 Cataloguing - Innovation

4.10.3.1 Evolution of International metadata standards

The description of library collections using quality metadata becomes more and more important for the digital and online user experiences. Library patrons want to search within collections on the web, to be inspired by virtual bookshelves, and to make use of online services (renew, reserve, read, listen…) for both physical and digital publications. In order to provide all these services to patrons, having consistent, qualitative, reliable en rich metadata is a must. The management of the library collection's metadata is therefore a bottleneck in the further development of a digital library.

The observation of the international metadata trends can provide a list of important attention points for the future of cataloguing in Flemish libraries.

4.10.3.2 BIBFRAME

BIBFRAME is a bibliographic framework that has been initiated by the USA's Library of Congress. It started in 2011 with the description of a high level model for bibliographic data. The initiative stems from a need to rethink the international cataloguing and data standards. The standards in use today are older than the internet, and have not been rethought or redesigned since.

In the BIBFRAME model, the library's needs are combined with the characteristics of the web. A bibliographic record is seen as a set of linkable data chunks, using the internet's standards and protocols to link data elements. Libraries must make a fundamental shift in order to move from sector-specific standards to web standards. This change will have to take place with the help of collection management software.

The biggest step in the BIBFRAME conversion is the replacement of the MARC21 interchange format by web-based solutions and linked data standards.
In the transition from MARC21 to a linked data model, the bibliographic records are split into entities that can be stored in a database or referred to through the internet. Those entities, or information chunks, are inspired from the conceptual FRBR model.

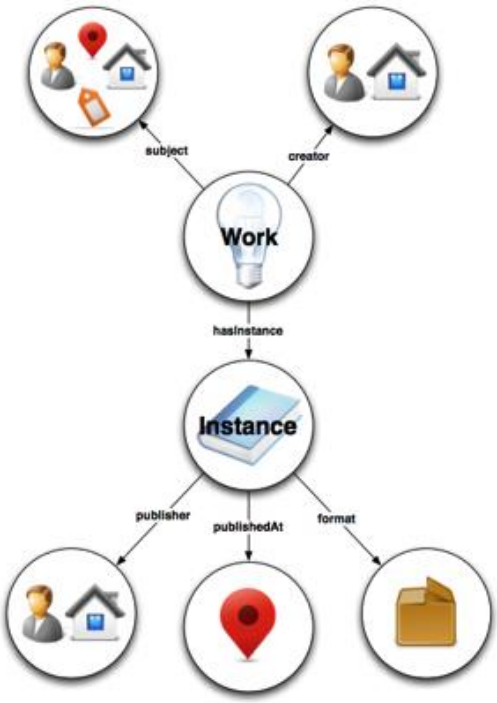


Figure 26: The BIBFRAME Model

The idea behind BIBFRAME is that every data element can be reused in an architecture that allows community cataloguing. BIBFRAME also foresees a complementary annotation model that will allow to enrich each data element with complementary information (e.g. availability in the library, reviews, covers…). A data element can also be enriched with information from outside the library (e.g. Wikipedia). By working this way, cataloguing can become more efficient: different organisations or people can focus on the enrichment of different specific data elements. In a linked data model, each piece of description can be reused in other contexts. The annotation model, provided it is correctly supported by software, can improve the efficiency of the cataloguing process.

The value of reusing publicly available information cannot be overstated in the context of Flemish public libraries. Today, there are too few open and public Dutch language linked data sources available. The library sector could decide to take on the role of "open data publisher" for open information related to the library collections, authors, subjects…

It is recommended to follow BIBFRAME's vocabulary (http://bibframe.org/vocab/) and to build new initiatives and make software choices based on BIBFRAME's evolutions, which can be followed on BIBFRAME's website: http://bibframe.org/.

4.10.3.3 FRBR

FRBR (Functional Requirements for Bibliographic Records) is a relational model that was published in 1997 by the International Federation of Library Association (IFLA - see http://www.ifla.org/files/assets/cataloguing/frbr/frbr_2008.pdf).

With "zoeken.bibliotheek.be", the Flemish Public Libraries were among the first players in the world to implement a library search service based on FRBR principles.

In the Bibliotheekportalen project, an algorithm that is launched when loading Aquabrowser performs the clustering and linking of data entities. As a result, the links built between data chunks upon loading are not known by the source catalogue.

In order to improve efficiency and consistence in this process, it is recommended to introduce BIBFRAME's annotation model in the cataloguing process. With annotations, the catalogue data entities can be enriched and linked, or referred to by other data entities. For instance, adding or removing a subject to a work involves a lot of manual work in the current cataloguing process, because the notion of work cannot be defined in Open Vlacc's current cataloguing system. With a "work" linkable data element, the subject data element would simply be linked to the work. Currently, each bibliographic record (manifestations or items) related to the work must be manually updated with the new subject, one at a time.

For more information, see
http://www.ifla.org/publications/functional-requirements-for-bibliographic-records

4.10.3.4 RDA

RDA (Resource Description and Access) is an international standard for the consistent description of library collections. One of the advantages of consistent metadata is that it can be linked with other data sets that have been built with the same set of rules. The RDA cataloguing rules recommend using international identifiers for different data entities: ISBN, VIAF/ISNI, ISTC…

For the Dutch speaking community, following the RDA cataloguing rules offers the best guarantee that users will be able to reuse metadata between libraries and collaborate with other organisations within the cultural sector.

The RDA standard was created by a joint steering committee composed of national and bibliographic organisations. It is relatively new (used since 2013 by the Library of Congress). The ambition of RDA is to establish new standards that will simplify and improve the efficiency of the cataloguing process. Those benefits cannot be attained as long as libraries work on systems that are incompatible with concepts such as those described in BIBFRAME.

More information about RDA can be found here: http://www.rda-jsc.org/

4.10.3.5 Cataloguing software

The current cataloguing software used by Flemish public libraries will not be able to evolve towards the management of rich data elements (work, authors, subjects…) that can be reused and linked with each other. From a technical and data point of view, Aleph and MARC21 are unable to:

- Enrich all publications related to a work in one shot (subjects, components…)
- Manage all the identifiers of the data elements (work, author subject)
- Register and manage the relations between data elements
- Manage the cataloguing access rights of data elements (which user group can change which data elements)

Aleph's cataloguing workflow and data management is based on MARC21. This flat data structure is not suitable for building a network of linkable data elements such as those of BIBFRAME. The management of identifiers and enriched data elements is not integrated into the core standard cataloguing flows of Aleph.

Aleph and Marc21 will not bring about the improvements in cataloguing efficiency that one can expect by adopting new cataloguing practices. Therefore, a new cataloguing system is required in order to provide an up-to-date and more efficient metadata back office for public libraries.

4.10.3.6 Sample projects

In France, a prototype was built to demonstrate how RDA can be applied to provide FRBR based catalogues using new semantic web technologies. It can be consulted on http://data.bnf.fr/. The system aggregates data from different sources and catalogues it using a FRBR model.

Within these new cataloguing systems, the metadata is no longer a single record. It rather becomes a set of data chunks linked to each other using relationships.

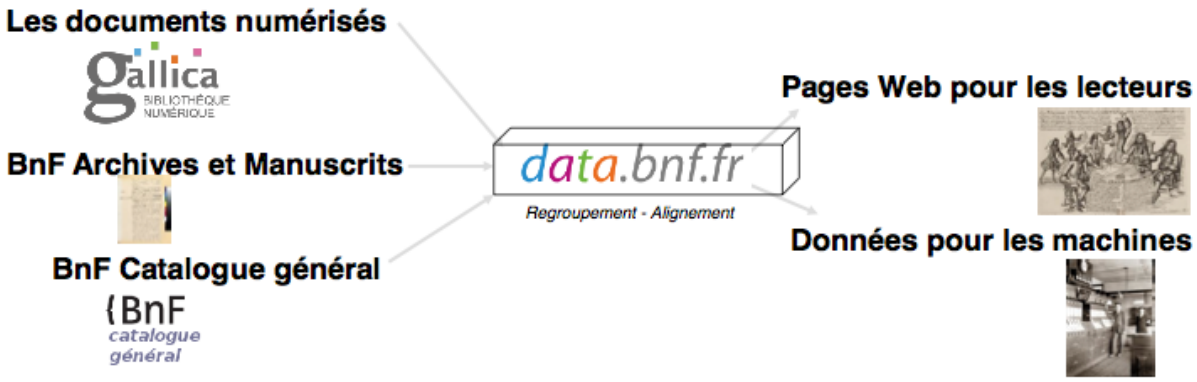


Figure 27: data.bnf.fr – metadata sources and publication targets

The FRBR model links data using different relationships:

- SKOS (Simple Knowledge Organisation System) for concepts
- FOAF (Friend of a Friend) for authors
- RDA for works

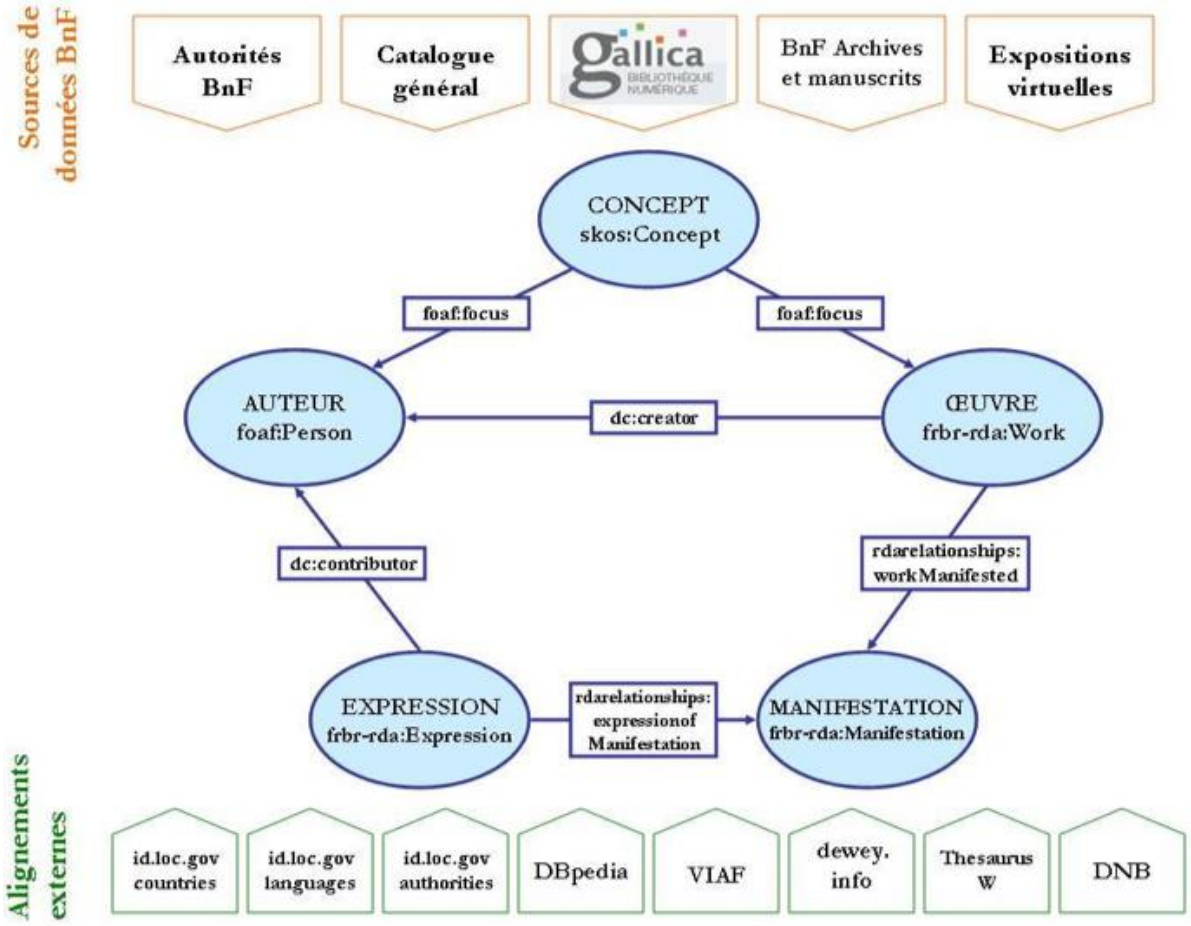


Figure 28: BNF.DATA.FR Linked Data Model

Semantic Web Technology.

Semantic search engines are able to manipulate and index data chunks and their relationships based on XML representation standards such as RDF. The resulting linked data catalogue can then be interrogated, for instance using "SPARQL" (SPARQL Protocol and RDF Query Language) queries. In Greece, the "Libver" project lets users perform SPARQL queries on a RDF catalogue implemented using Virtuoso. See: Public Library of Veroia Linked Data Project, http://gr.okfn.org/en/2012/10/libver/

The catalogue on data.bnf.fr is implemented using an open-source semantic web engine called Cubicweb. It supports a query language similar to SPARQL, called RQL (see http://data.bnf.fr/semanticweb).

4.10.4 Cataloguing – TO-BE Scenarios

The TO-BE workshop, called "The future of cataloguing", aimed at evaluating the following scenarios.

TO-BE Workshop	Scenario Name	Description
Cataloguing	Special Collections – Common solution	Common ICT system for cataloguing

		special collections
Cataloguing	Special Collections – Decentralised solutions	Each library cares for the cataloguing of its special collections.
Cataloguing	Cataloguing – RDA	The new RDA cataloguing rules are adopted
Cataloguing	Cataloguing – Publishing for Linked Data	Libraries publish RDF for Linked Data
Cataloguing	Cataloguing –Linking External Data	Libraries link their own data to external RDF data sources
Cataloguing	Cataloguing – The end of MARC21	Libraries stop cataloguing with MARC21
Cataloguing	Cataloguing – New authorities	Libraries use new kinds of authorities (e.g. VIAF)

The workshop (and the meeting with the Dutch colleagues of Biblioheek.nl) led to the following conclusions:

- It would be difficult today to design a unified cataloguing system for special collections. The cataloguing practices for special collections seem to be very different from one library to the next. In the short term, each library will have to continue to maintain a solution to catalogue its special collections.
- RDA is a long-term objective, but the current cataloguing system (Open Vlacc) is not ready for that kind of cataloguing, as it does not support the linking of data chunks as prescribed by BIBFRAME, FRBR, and RDA. In the future, cataloguing systems will need to be extended in order to support new standards and authority systems such as International Standard Text Code (ISTC) or the Virtual International Authority File (VIAF).
- The e-books cataloguing strategy is not finalised yet. In the Netherlands, e-book metadata enter the central catalogue (GGC – gemeenschappelijk Geautomatiseerd Catalogussysteem) before being further disseminated to the discovery tools. In Flanders, the e-book metadata will probably not enter Open Vlacc. The VEP-Repository will store the basic e-book metadata but will not contain cataloguing tools that would follow cataloguing standards such as AACR2, SIZO,RDA…
- It is important to follow the developments in international cataloguing practices.

4.10.5 Cataloguing – Evolution of the ILS

ILS vendors have two different approaches when looking at the evolution of cataloguing.

In the first case, the ILSs are said to be “cataloguing practices agnostic” and can be configured for any cataloguing practice. FRBR could be implemented by extending the catalogue model. Concerning linked data and RDF, the ILS could work with the import/export of metadata to/from RDF.

In the second case, the ILS is integrated into a network of catalogues at three levels: World, Network, and Local. As catalogues can be linked, these ILS are closer to the spirit of linked data.

However, in both cases, ILS vendors are waiting to better understand the evolution of cataloguing before starting any further extension of their product.

4.10.6 Cataloguing – Summary

Observations:

- The cataloguing of traditional resources is greatly facilitated by the central catalogue (Open Vlacc).
- De-centralised cataloguing happens for books that are not – or not yet – present in the central catalogue, as well as for special collections.

Possible optimisation Initiatives

- Further business process automation could be brought into the current cataloguing to facilitate metadata imports and updates. This could be implemented using Business Process Management (BPM) tools.

Possible innovation initiatives

- In the mid- to long-term, libraries will need new cataloguing systems that rely on new standards and practices such as BIBFRAME, RDA, FRBR.

4.11 Partners & Collaboration – Municipality Integration

4.11.1 Municipality Integration – Situation

In general, public libraries are municipality services. Therefore the library needs to comply with the municipality's rules on purchasing management, accounting, ICT…

From the point of view of ICT systems, libraries are not yet sufficiently aligned with municipalities. As the municipality is the main funder of the library, libraries should invest in satisfying the municipality's needs.

The requirements are the following:

- A better integration of the library's purchasing process with the municipality's financial systems (ERP/Accounting software….).
- A better integration of the library's website with the municipality's website
- A better integration between the library and municipality's identification and access systems: library card, municipality card, eID…
- A better integration of the library's patron data (contained in Open BIB ID or the ILS) with the municipality's citizen data (contained in the CRM, national register…)
- A better integration of the library's reporting system into the municipality reporting systems
- A better integration of the library's specific infrastructure with the municipality ICT infrastructure (payment terminals, cash registers…)
- A better integration with some patrimonial systems, e.g. a picture database (e.g. picture database of Bruges)
- A better access to local data (list of schools, culture centre program, sport databases…)

The municipality has to include the library's transactions into its accounting. Today, this is mostly done manually (import/export), but ERP could be the accounting system for the library as well.

4.11.2 Municipality Integration Optimisation

There are too few municipality integration cases in order to optimise.

Optimisation in this field will come in the form of business processes automation. For example, the current purchasing process requires too much manual work from the library. Information is encoded three times: in the ILS, in the supplier system, and in the municipality system.

In this case, optimisation involves the reduction of unnecessary manual tasks by automated integrations. This will allow libraries to focus on higher value tasks.

In the field of CRM, Business Intelligence and ERP, some libraries might have to exchange more and more data with the municipality. Libraries will have to take the path of standardising communication patterns with the municipalities. Otherwise, the cost of maintaining a different format and method with every municipality will result in huge overhead costs. A shared integration infrastructure (library hub) can help achieve that goal.

4.11.3 Municipality Integration – TO-BE Scenarios

During the Municipality Integration workshop, several scenarios where discussed (see table).

TO-BE Workshop	Scenario Name	Description
Municipality Integration	Municipality Website	The municipality website is the unique online gateway to the library services.
Municipality Integration	Use of Libraries Central ESB	The library systems are integrated with the municipality systems through a central ESB.
Municipality Integration	Use of Municipality ESB	The library systems are integrated with the municipality systems through the municipality's ESB.
Municipality Integration	Use of Provincial ESB	The library systems are integrated with the municipality systems through a provincial ESB.
Municipality Integration	CRM/DWH Integration	Libraries exchange data with the municipalities' CRM/DWH systems.
Municipality Integration	Municipality Card/ID Integration	Libraries allow patrons to authenticate using their municipality cards/IDs.

Website

The library website offers an interesting traffic perspective for the municipality. The reservation and renewal webpages are very often the most visited in the library's online presence. Municipalities are generally interested in hosting their libraries' full websites. Due to the great variety of technologies used by libraries and municipalities, it is currently impossible to proceed with the fusion of library services within the municipality website. Libraries and municipalities will have to work on the standardisation of their technology in order to produce a smooth citizen experience. Libraries can help municipalities by adopting a Library Hub (SOA) that will make it easier to technically integrate the library services. Municipalities can also strive to standardise their web infrastructure as suggested in the V-ICT-OR's Wasco project (see chapter entitled “Online Patron Services – Optimisation”)

Systems Integration requirements

The municipalities’ ICT capabilities and business standards are maturing, and libraries' ICT systems increasingly need to be integrated with the municipalities' systems. Currently, this trend

is mostly visible in the larger cities, but it will probably be propagated to mid-sized municipalities in the future. Libraries are asked to comply with some standards for orders and accounting. Data is also required for CRM or BI.

SOA/ESB
Some of the largest municipalities have invested, or are considering investing, in a SOA infrastructure to integrating all municipality services. SOA integration tools such as Microsoft Biztalk (through the implementation of the Microsoft Dynamics CRM in Bruges) or open-source ESBs (implemented by Digipolis) have been mentioned during the workshop.

This means that libraries could have to integrate their ICT systems using SOA principles through the municipality's ESB.

The option of using a provincial ESB for all kinds of municipality integrations (including those not related to the library services) has been rejected, as it would not be suited for all types of traffic.

The preferred SOA solution is that the libraries implement a central vertical library hub that all libraries can use to deploying and consume library-related services. This vertical library hub would be connected to local municipality ESBs and other partner services. This requirement was taken into account in the design of the TO-BE architecture.

CRM / Datawarehousing
Some municipalities (e.g. Antwerp) ask for a better integration of the patron and citizen data through the municipality card systems' CRM . Experience has shown that the data's quality must be assessed before it is integrated. Data integration must not result in a pollution of the best data sources. Library systems may have better (i.e. more up to date) patron data than other external systems. A global “master data” process must therefore first be established with the municipality.

Municipality Card / IAM
The need to integrate the libraries and municipalities' identity management systems has been confirmed during the workshop.

Different systems will remain (eID, A-Kaart, BrunNO card, Library card…) and rather than trying to unify all systems into one, a federated identity management system (e.g. WAYF) would be easier to setup and be accepted.

4.11.4 Municipality Integration – Innovation

If libraries want to act more and more as an ordinary municipality service, they will have to better integrate some of their ICT systems with the municipality's.

In the mid to long term, a single system could even be shared: the website.

4.11.4.1 Website standards
However, in order to benefit from a shared website infrastructure (e.g. CMS), libraries need to agree on web standards for the future so that both infrastructures can converge.

The Wasco project ("Webs & Apps Standaarden voor de Converserende Overheid" - http://www.v-ict-or.be/kenniscentrum/WASCO) aims at specifying web standards for municipality websites. Libraries should maintain their own web standards and make sure that there are aligned with the municipality's best practices.

A pragmatic way to test compatibility could be to benchmark the "Wasco compliance" of the "library reference website" (see "common website development" in Patron Online Services).

4.11.4.2 SOA Integration

Libraries should try to avoid integrating ad-hoc systems with the municipalities, and rather strive to define standardised integration service interfaces that can later be reused by other libraries.

It means that the integration of a municipality system should follow several steps (System Integration Governance):

- Analysis of the integration need
- Verification of whether such an integration has already been designed by another library
  - If so, consider reusing the service definition
  - If not, or if reuse is not possible, design a new system-independent SOA Service definition (SOA loose coupling principle)
- Review of the SOA Service design with peers (other libraries, Bibnet)
- Specific implementation and deployment of the SOA service for the library
- Publication of the SOA Service specification in a the library's SOA Repository/registry

Using international standards (such as NCIP, OAI-PMH) as the basis of library SOA services can accelerate this process, as the library does not need to design the service itself.

Also, at the Flemish level, V-ICT-OR is working on the specification of data standards for local administrations: the Open Standards for Local Administrations in Flanders (OSLO) project (see http://www.v-ict-or.be/kenniscentrum/projectfiches/oslo).

Libraries are advised to have a look at these standards before making any new data and service specifications.

4.11.4.3 Library Hub

Once developed, integration services could be deployed on the shared library hub (ESB) or on the municipalities ESB (if the municipality's governance rules allow it).

The library hub will also act as a catalogue of all library integrations and as a technical monitoring platform (it can check that all services are up ad running).

4.11.5 Municipality Integration – Summary

Observations

- Libraries and municipalities are not very well integrated today, yet such integration is increasingly becoming a requirement

Possible Innovation Initiatives

- Determine a library/municipality website fusion roadmap including a first "website standardisation" step
- Adopt an Integration/SOA approach and governance to integrate municipality and library ICT systems in order to facilitate the development and reuse of integration processes.

4.12 ICT - Systems Integration

As we have seen in the chapter entitled "Disintegration of the ILS", libraries have seen an increase in the number of ICT systems in use. The ILS has been integrated with several systems. Today's evolution means that if the ILS remains an important system for the library, it is not the sole pillar of its ICT architecture anymore. Other important pillars have emerged in fields such as the web, discovery, cataloguing, patron identification, customer relationship management (CRM), Business Intelligence (BI) communication and promotion… In addition, some new pillars will soon appear: digital collections, e-books…

If the libraries wish to streamline their business processes in order to optimise them and/or to innovate, they will have to integrate all these pillars with each other. This will lead to an increase in integration requirements.

Today, this integration process is starting and libraries need to take measures to avoid building a big "integration spaghetti" (see chapter "AS-IS Integration perspective").

In the ICT industry, a common pattern used to avoid this "integration spaghetti" is to integrate ICT systems using a Service Oriented Architecture (SOA) (see chapter "ICT Architecture Concepts").

Therefore an SOA workshop was organised to determine if libraries would benefit from SOA.

4.12.1 ICT Systems Integration – Situation

There are currently no standard systems Integration guidelines for libraries. This means that each library is responsible for choosing an adequate integration method.

Where no integration guidelines are specified, the cheapest and easiest integration technique is often used. In some cases, such short-term choices can be very expensive in the long run, as they need to be replaced or reconfigured multiple times. Some of the system integrations are mission critical, and as such they should be designed with care.

4.12.2 ICT Systems Integration - Optimisation

Libraries need to integrate many systems with each other. Indeed, each of the 313 libraries could potentially establish many connections between the different systems that they use. A quick look at the AS-IS Applications library perspective shows that each library can use about 30 ICT systems.

4.12.2.1 The need for integration guidelines

Today, the technical integration of library systems is mostly done in the context of specific projects. There are no integration guidelines, which results in frequent ad-hoc integration

processes. For example, there is nothing to keep each project from managing its own FTP server to exchanging data with other project stakeholders. As the number of partners and integration contact points grows, the system integration should be better governed. Ad-hoc integrations are cheaper in the short term, but they can lead to higher maintenance costs in the mid to long term.

4.12.2.2 A possible solution: a "library hub"

A way to keep the number of ad-hoc integrations in check is to adopt a shared integration platform, such as an Enterprise Service Bus. The common shared integration platform is an additional cost on the short term, but its benefits are manifold:

- Greatly reducing development costs by reusing work
- Reducing operational costs via centralised management and monitoring (only one "integration team" for the whole sector, not one "integration team" per project)
- Increasing the quality of the integrations by keeping applications very loosely coupled
- Allowing the decoupling of ICT systems in order to replace one of them if necessary: the new system simply has to provide the same services as the previous one.
- Reduce the amount of point-to-point connections between applications.

Quantifying the benefits of SOA in a given context requires custom return on investment (ROI) calculations. LogicLibrary has quantified the returns that one can achieve with SOA:

"In short, after a small investment in SOA organization, process, and tools, SOAs cost 20% less to implement and save 50% more with each reuse than traditional component-based development."

Source: "The ROI of SOA - Based on Traditional Component Reuse"
(http://semanticommunity.info/@api/deki/files/2729/=ROI_of_SOA.pdf)

There are many white papers that explain how to calculate the ROI of SOA, for instance "A practical guide to measuring return on investment" http://www-935.ibm.com/services/multimedia/innovation_soa_en.pdf

Libraries should collaborate on building **a common library hub for a number of reasons**:

- Implementing a service bus requires developing specific **technical skills** that would cost too much to build for a single library. Organisations that solve many integration issues tend to have only one ICT Integration team.
- The **reuse business case** consists of reusing integration code across libraries. A single library does not develop enough to achieve sufficient levels of reuse internally, so it is easier to ensure reuse on a shared integration platform.
- A library alone has less integration points than the sector as a whole. This means that the integration infrastructure has a higher relative cost per integration point. The **SOA business case** would not be positive for a single library.

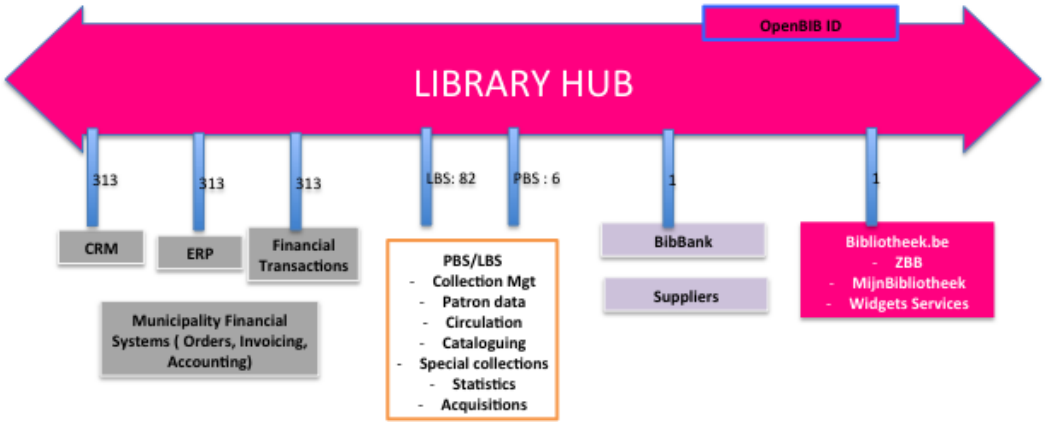


Figure 29: Library hub for ICT Systems Integration

The library hub must allow online (web services) and batch (FTP) information exchanges. It must be possible to restrict access to the hub services using Open BIB ID. Connectors must allow the integration of different types of systems and technologies, both internal and external.
The central library hub must be able to communicate with partners' hubs (municipalities, partners).

A way to implement such a library hub is to use an Enterprise Service Bus (ESB).

4.12.2.3 Extending the Library hub with Business Process Management

Plugging the library's SOA services into an Enterprise Service Bus (ESB) might not be sufficient in some cases, as services often need to be well organised in order to provide higher-level services to a business process.

Several library business processes must be renewed or developed. One can imagine that the following processes will be impacted by innovations:

- Digital resource circulation
- Library marketing
- Digital purchasing process
- Personal connections
- Customer Relationship Management (CRM)
- Library Management (Service Portfolio, Pricing, KPIs)
- Cataloguing: RDA and Enrichments
- Special collection circulation and management

Those business processes will need to be well organised. Libraries need an agile ICT architecture that will enable to develop, integrate and operate new business processes.
Business processes can be organised in several ways:

- By one of the participating applications
- By a collaboration between several applications
- By an organising component such as a Business Process Management Suite

If business applications organise the business processes and if they need to be adapted or extended, it must be possible to easily customise and/or augment the internal application logic through programming or configuration. In most cases, it is a difficult task because most applications have limited extension capabilities. Extensibility can be foreseen at design time, but

not all possible scenarios are yet known at that moment. If libraries want to adapt some application logic by themselves in order to comply with a new business process, they would require the necessary skills as well as access to the application's source code.

For new or evolving business processes, it is better to use an external organisation, e.g. by using a Business Process Management Suite.

Business Process Management Suite

In addition to the Library hub, a central BPM platform could be used. This platform will enable the coordination of the modelling and execution of the new business processes. Through the library hub, the new business processes can be integrated with the ICT systems, enabling the automation of (parts of) the business process. In such a business process management suite, human interaction is carried out via a web portal.

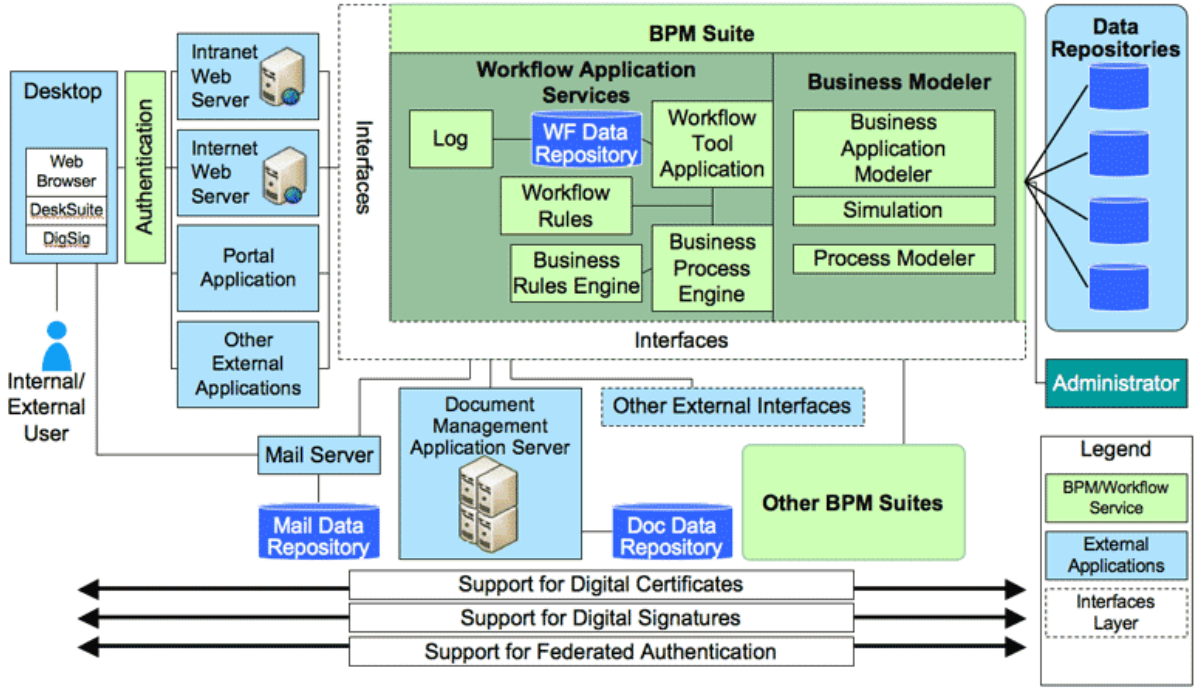


Figure 30: Anatomy of a business process management suite (source: Wikipedia)

For example, a new purchasing process could be based on such a BPM platform. In the case of the development of a new “acquisitions business process”, for example for digital collections, there could be several options:

1. Adapt one of the systems (e.g. the ILS) to host the services' organisation
2. Adapt all systems so that they collaborate properly according to a predefined collaboration protocol, each system knowing how to “pass the ball” to the next in order to execute the next business process activity
3. Use a BPM platform to ensure the organisation of the various application services

When a business process' “agility” is an important requirement, the two first options are not recommended:

- If there is a change in a process hosted by an application, the application must be changed, which is not always easy when the library depends on third parties to implement the change, especially when programming skills are required

- If several applications collaborate to carry out the business process, then several applications can be impacted by a change, which is even more complex to implement.

The third option consists of running the new business process into a specific middleware: the BPM platform. In our sample acquisition process, the BPM suite organises the different application services: Collection Planning and budgeting, Pre-Cat, partner ordering, municipality finances, and finally checking whether the e-books (or electronic rights) have been delivered in the digital content zone.

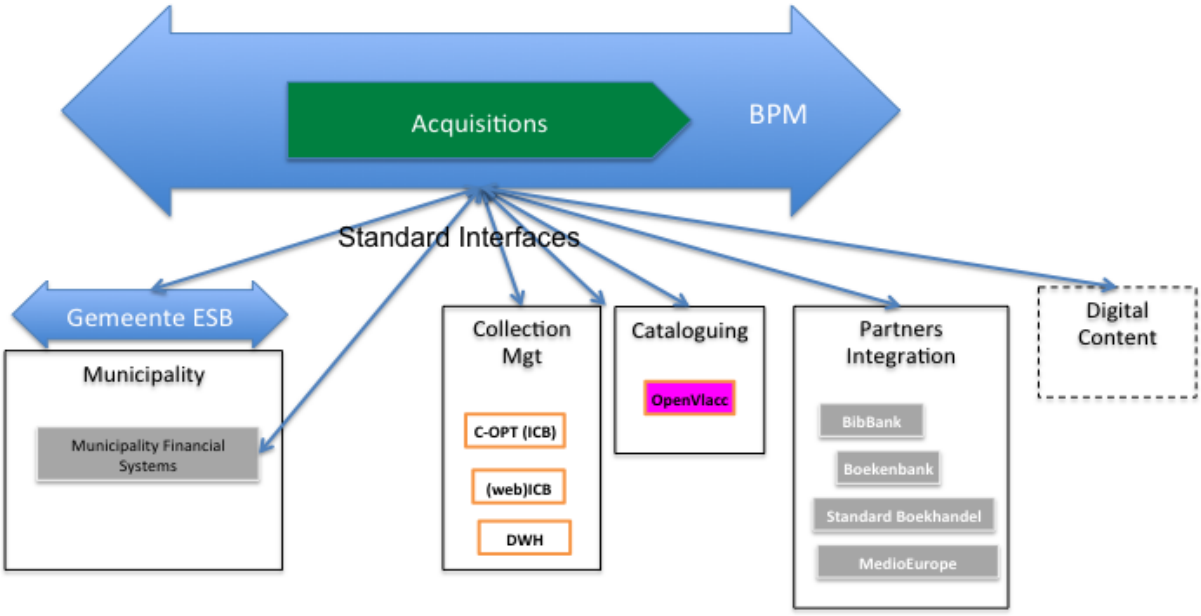


Figure 31: Purchasing Process Integration via a PBM Suite

Using a BPM suite will minimise the impact of a process change on the underlying applications. In some cases, the applications are not impacted at all, for instance in the simple case where two process steps simply swap their order of execution.

When working with a BPM Suite, the business process first needs to be modelled with a business process-modelling tool. The resulting diagrams can be communicated in order to make sure that the correct organisation will be implemented in the BPM Suite. The process diagrams of the AS-IS libraries value chain provide an example of Business Process Modelling using BPMN (Business Process Modelling Notation). After being modelled and implemented using the ESB service catalogue, the process can be run and controlled. Business Process execution KPIs and statistics can be provided as well.

The platform must be used only for new and agile Business processes. Processes that are correctly carried out within the scope of existing applications do not need to be “redeployed” in the BPM infrastructure.

Note that Flemish municipalities recently received the same advice: use a BPM layer. In the study entitled “Onderzoeksrapport: De stad als individuele dienstenaanbieder. Een verkennend onderzoek naar de rol van technologische toepassingen voor de organisatie van de stedelijke individuele dienstverlening (2013)” -

http://steunpuntbov.be/ned/publicaties/detail/s3P030503.htm, the BPM tool is placed in a midoffice layer.

Figuur 3: functionele componenten van de midoffice
(overgenomen uit: Keller & Roovers, ibid.)

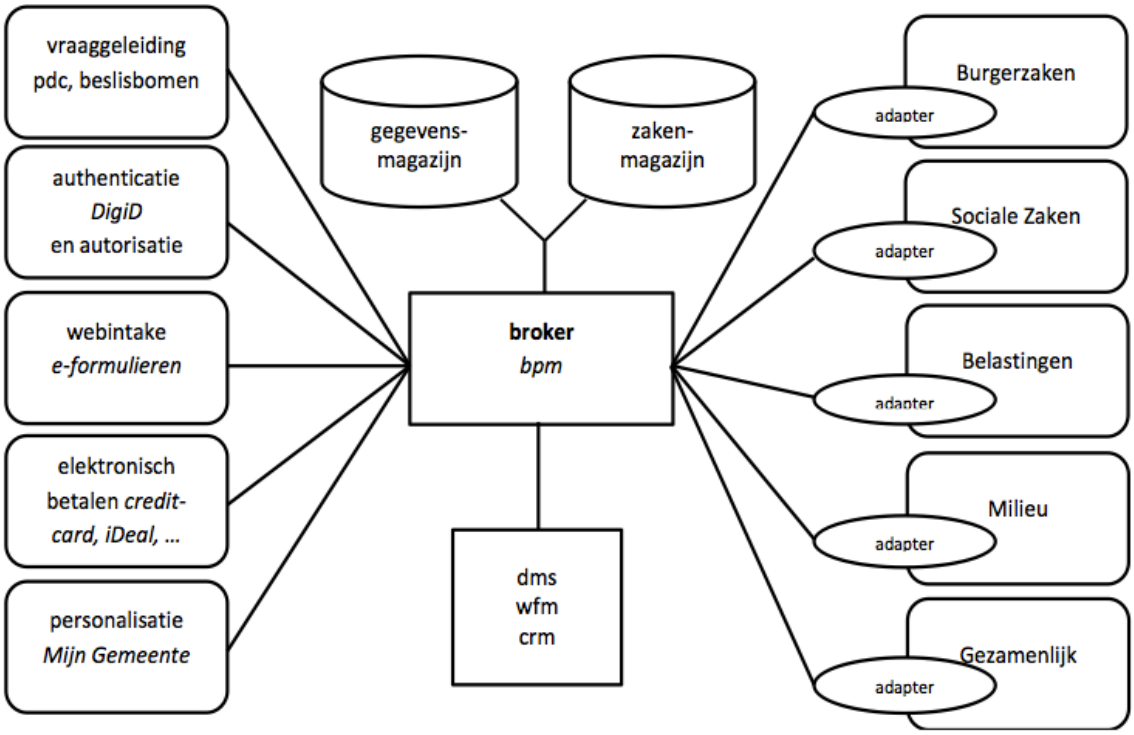


Figure 32: BPM component in a "midoffice" recommendation for Flemish municipalities

4.12.3 ICT Systems Integration - SOA Scenarios

The following scenarios were used during the SOA workshop aimed at investigating whether there would be an advantage in adopting best practices on integration (in the form of a SOA) in the library sector.

Workshop	Scenario Name	Description
Libraries Integration/ SOA	SOA - Do nothing	Do not invest in any integration tools. Let libraries integrate ICT systems as they see fit (no rules or standards).
Libraries Integration/ SOA	SOA-Central-Libraries-ESB	A maximum of system integrations go through a central (Libraries) ESB
Libraries Integration/ SOA	SOA-Multiple-ESBs	All actors (Bibnet, Provinces, Municipalities, Libraries) invest in their own ESB.
Libraries Integration/ SOA	SOA Governance Only	Nobody invests in SOA Infrastructure. There is only one general Integration Governance which allows to list the integration points (e.g. with the help of a wiki / registry/ repository)
Libraries Integration/ SOA	SOA - SSO Federation	Open BIB ID integrates with other IAM providers like UitID, eID, Municipality Cards.
Libraries Integration/ SOA	SOA - Centralised BPM Platform for Libraries	Some library processes require a centralised Business Process Management (BPM) platform, which allows for faster automation of business processes across many ICT systems.
Libraries Integration/ SOA	SOA – BRMS	Some business processes require advanced automated decision-making in the form of decision services that would be easily implemented with a Business Rules Management System (BRMS)

SOA Guidelines
Libraries should improve their integration governance. Specifying a SOA governance would be a step in the right direction.

Converging towards a sector-wide SOA will have several benefits:

- it will help manage the large number of system connections, especially when those systems are not operated by the same actors
- it will help reuse interface design and development assets, reducing the cost of integration
- it will improve the overall communication between stakeholders, since they would all follow the same Integration governance and standards
- it will help monitor the technical infrastructure and SLA performance

SOA guidelines can help libraries realise their reuse potential. All libraries have the same kind of integrations. SOA guidelines will help share what was developed for one library with all other libraries.

Enterprise Service Bus
Libraries would invest in a central library ESB that could be connected with partner services (Municipalities' ESB, suppliers' services, partner web services…).

The ESB investment case would only be positive if libraries collaborated on the same SOA (infrastructure, governance, best practices, programming and data standards).
A single library would not get the benefits of an ESB:

- it does not have enough integration points
- it could not gather all the necessary technical skills

Identity Management Federation
Identity and Access management are very important when building an SOA, because one needs to determine who can access what service. Cross-boundary access to SOA services is easier if the same identification mechanisms are supported.

Libraries have to deal with other legitimate identity providers: Federal, Culture, Municipalities… Trying to impose Open BIB ID to other stakeholder will not work. It is therefore better to augment Open BIB ID with an identity federation extension.

The identity federation subsystem should not be provided by the libraries, but by an external and neutral party above or beside the main stakeholders. (e.g. CORVE.be).

SOA stack: BPM and BRMS
Business Process Management (BPM) and Business Rules Management (BRMS) rule systems are complementary tools for an ESB in an SOA.

This study could identify several use cases:

- BPM
  - Further automation of the acquisition process
  - Workflow improvements in the cataloguing process
  - Circulation of Digital Resources
- BRMS
  - Electronic Rights Management with business rules

If libraries invest in a centralised SOA, they should consider extending the stack with BPM and BRMS. Note that one typical extension is a portal that is optimised for the use of SOA services and lets users interact with business processes.

The following website shows examples of SOA stacks: "Why an open source SOA Stack makes sense" - http://www.kavistechnology.com/blog/why-an-open-source-soa-stack-makes-sense/

4.12.4 ICT Systems Integration – Observations

ILS Vendors Approach to SOA
All ILS Vendors claim that their systems are open and can be integrated. Indeed, vendors can list some integration cases:

- ERP/SAP integration (LIBIS)
- Ping Ping (payment by SMS) integration (INFOR, Library of Haacht-Boortmeerbeek)

- EDI integrations with MedioEurope (http://www.vvbad.be/effici-nt-collectioneren-en-administreren-de-workflow-van-uw-bibliotheek-edi)
- CRM Integration (Library of Antwerp)
- …

ILS vendors offer APIs for their systems and may support a variety of standards: NCIP, OAI-PMH, SIP, EDI.. Some of those APIs are accessible through web standards such as REST and Web services.

Nevertheless, ILS vendors still have a long way to go before achieving a seamless integration of the ILS in an SOA:

- The APIs are not always complete
- The API documentation is difficult to obtain
- The APIs are accessible using different techniques (programming, REST, SOAP, Database, Import/Export scripts…)
- The APIs can be proprietary

In practice, libraries nearly always have to create a custom project to integrate a new system with the ILS.

TO start using SOA, the library would need from the ILS vendor:

- A set of well-documented API formats (e.g. XML Schema)
- A set of well-documented API functions
- The support of standardised communication transports and protocols (SOAP/HTTP, SOAP/JMS, REST/HTTP, XML/FTP, ONIX/FTP…)

In brief, a good SOA Service is much more than an API. It complies with many rules as specified in the SOA Governance.

NCIP - NISO Circulation Interchange Protocol (Z39.83-2002)

An example of good SOA Service candidates is provided by the NCIP standard. Some ILSs support NCIP. It is also an important element of Bibliotheek.nl's architecture.
NCIP specifies and standardises how the service needs to be provided:

"… the NCIP Implementation Profiles and Application Profiles include conformance requirements, which outline specific services, messages, and data structures that must be supported for a vendor to claim compliance. Implementation Profile 1, for example, requires XML encoding, a DTD to describe the structure, Unicode UTF-8 to describe character encoding, and transport using HTTP, HTTPS, or TCP/IP."
Source: http://www.ncip.info/uploads/7/1/4/6/7146749/niso_ncip_rfp_guide-revision_july2004.pdf

Libraries must specify the kind of SOA Services that they require in order to successfully integrate their business processes.

Buying versus Building SOA Services

When libraries purchase a new ICT system, they should always ask the supplier what SOA services the new system will provide. Those provided services should be reviewed in order to check whether they comply with the libraries' SOA standards. The baseline verification deals with the service protocols (e.g. HTTP, FTP, HTTP SOAP, HTTP REST…) and format (e.g. XML). If the

services offered do not comply with the SOA guidelines, the ICT system just provides a proprietary API that will need to be later integrated with the library hub using library standards. This will incur an additional cost for the library, as it will have to **build** the standard SOA service on the basis of the API.
It the new system is built on compliant protocols and formats, the library can **buy** the SOA services together with the system, which will greatly speed up the integration and deployment process. Suppliers should therefore strive to provide well-designed modular and business-oriented web services with their systems.
For innovative projects, libraries can design and **build** their own SOA services (e.g. digital resource circulation)

4.12.5 ICT Systems Integration – Summary

Observations

- Libraries have no sector-wide integration guidelines and/or tools. As the integration work tends to increase, it is important to act now in order to avoid building an "integration spaghetti"

Possible Optimisation Initiatives

- Develop a common integration/SOA guide and governance
- Communicate the SOA guidelines to suppliers so that they can take them into account in their product design
- Implement common SOA tools in the form of a "library hub"
- Extend the library hub with BPM and BRMS tools (full SOA Stack)
- Setup a common sector-wide "library integration team"

4.13 ICT - IT Management tools

4.13.1 ICT – IT Management tools - Situation

The study shows that common ICT best practices and shared ICT tools do not exist in the library sector. Libraries rely on their ICT suppliers for these IT tools.

4.13.2 ICT – IT Management tools - Optimisation

The library's "ICT organisation" should have its own tools to manage the library systems and projects:

- Project management software
- System monitoring
- Configuration database
- Development software
- Testing software
- SLA monitoring
- …

The analysis of these supporting systems is outside the core scope of this study.

For the library, there are only 2 options for those with the proper ICT Management tools:

1. The library sector collaborates on establishing best practices and recommends related tools, which may be part of a shared service.

2. The municipalities' ICT departments prescribe and provide best practices and related tools.

4.13.3 ICT – IT Management tools – Summary

Observations

- Common ICT best practices and shared ICT tools do not exist in the library sector. Libraries rather rely on their ICT suppliers for those tools.

Possible Optimisation Initiatives

- Analyse what IT management tools are required in all libraries
- Develop a plan to ensure that every library has access to the proper IT Management tools.

4.14 ICT – ICT Processes

During the preparation of the meetings, the available **ICT plan** has been requested. One plan for "ICT" projects could be collected (city of Antwerp). In Ghent, there is a strong foundation that can lead to a strong ICT plan.

Furthermore, the ICT plan should be aligned with or derived from the broader "business plan" for all libraries. They have not been provided to the consultants, however these plans can be found on the web… (e.g. http://www.provant.be/binaries/ACTIEPLAN_%202012_DEF_tg_tcm7-149606.pdf)

The ICT plan is the outcome of an ICT Service strategy process. The absence of formal ICT plans led this study to have a look at some of the ICT processes used.

4.14.1 ICT Processes – Situation

4.14.1.1 Maturity Status

For the description of the ICT processes, we will use the ITIL V3 terminology.

We will focus on the following processes:

- Service Strategy – Demand management, Project Portfolio Management
- Service Design – Service Level Management
- Service Design – Supplier Management
- Service Design – Change Management
- Service Operation – Service Desk

Demand Management

There is no sector-wide demand management process.

The sector could benefit from a sector-wide demand management process in order to centralise the demands and better negotiate sector-wide solutions. Best practices must be established for the tendering process. From the perspective of the ICT architecture, and probably also from a financial point of view, it would be very interesting to gather all tenders from the sector in order to build a sector-wide "Demand Management Knowledge Base" allowing libraries to reuse and consolidate each other's tenders. This would allow the sector to better identify those places where "inventing the wheel" is actually necessary.

Today, IT suppliers stand to gain from this lack of coordination and reuse.

Service Level Management
There are no Service Level Management standards in the sector. Each library/province will negotiate different SLAs with their suppliers, if any.

IT Supplier Management
There is no sector-wide supplier management process. Some 58% of libraries run an Infor/VUBIS ILS but most of these libraries deal with Infor independently.

Recently, a new VUBIS user group was started. Such a user group can help ensure that suppliers have a correct understanding of the libraries' expectations.

Service desk
The following suppliers have been identified as helpdesk contacts (data collected for eight systems using a form, see http://www.appepaper.com/projects/digbsa):

- Cevi
- Libis
- Infor
- Dolmen
- Cipal
- Gents BVBA
- Medialab/Serial Solutions
- (internal) Bibnet
- (internal) ICT Provincie

As libraries operate the same kind of systems and business processes, it should be possible to standardise some of the incident and problem management processes when they are related to library-specific ICT assets. Some of the names in the list above should be listed in the 2nd or 3rd level of support.

The support processes must take into account a support process with two layers:

- "General ICT" services: ICT commodities like servers, network, Wi-Fi, email…
- "Library-specific" services: ILS, RFID, Open BIB ID….

For some systems (website, data-warehouse, ESB), ownership can be unclear. Therefore, all ICT assets should have a single owner who is responsible for providing support to users. Libraries could have a sector-wide support plan for all systems of which they are owners.

4.14.1.2 Estimation of the Flemish library sector's ICT budget

What if the Flemish library sector were a single company? What would be its total ICT budget? How many people would work in the "Flemish Libraries Company" ICT department?

IT head count makes up 5% to 7% of a typical company's personnel (source: Gartner- "IT Spending: How Do You Stack Up?" - http://www.gartner.com/research/attributes/attr_47450_115.pdf). With 3,542 full-time

equivalents working for Flemish libraries, the "ICT department" of a Flemish libraries' "company" would have about 200 workers…

BIOS (http://www.bibliotheekstatistieken.be/), allows to determine how much each library spent on ICT in 2011. The following table makes an extrapolation of the ICT costs per library patron. The ICT personnel cost is estimated as 7% of the total workforce.

Year 2011 - BIOS Numbers

Library	Users	ICT Budget	%ICT Budget	ICT Budget/User
Aalst	19,015	66,153 €	2.51	3.48 €
Antwerp	83,445	258,262 €	2	3.09 €
Brussels	12,454	26,171 €	0.74	2.10 €
Gent	72,805	231,720 €	3.52	3.18 €
Hasselt	35,093	80,645 €	1.48	2.30 €
Herenthout	1,580	8,724 €	3.74	5.52 €
Knokke-Heist	9,502	42,904 €	3.03	4.52 €
Kortrijk	18,256	31,280 €	1.28	1.71 €
Leuven	29,897	47,986 €	1.39	1.61 €
Overijse	2,637	2,099 €	0.52	0.80 €
Tienen	7,199	21,509 €	2.2	2.99 €
Turnhout	10,169	77,475 €	4.43	7.62 €

Average ICT Budget / User	3.24 €
Total library users	1,560,466
Libraries' Estimated Total ICT Budget	**5,060,320 €**

Total subsidies in 2011 (sociaalcultureel.be)	52,096,004 €
Estimated ICT Budget / Subsidies	9.71%
Workforce: percentage of subsidies (sociaalcultureel.be)	60%
Workforce doing ICT (assumption)	7%
Libraries' Estimated ICT Workforce Budget	**2,188,032.15 €**

Estimated Provinces PBS Yearly Budget	**3.130.350,42 €**

(Source : Stefaan Froyman)

Total Estimated Libraries ICT Budget **10.378.702,94 €**

(ICT + ICT Workforce Budget + PBS Budget)

Most of the numbers used in the assumptions can be found here: http://www.sociaalcultureel.be/volwassenen/bib_gesubsidieerd.aspx

If on top of this amount, we add Bibnet's yearly budget (3.5 million euros in 2012 – Source: Bibnet Beleidsplan 2011 - 2014), we can reasonably estimate that the total ICT budget of the sector is above 10 million euros.

Libraries should benchmark their ICT best practices with companies that have similar ICT budgets (in the 10 million euro range) and department size (200 employees). It could be interesting for libraries to pay a visit to such an organisation and have a look at their ICT processes and organisation. For instance, Fedict has about 200 employees. Benchmarking with a retail company with 300 franchises could also be interesting (e.g. Telenet dealers).

With this level of ICT budget, a CIO would be appointed and responsible for the good governance of ICT.

Flemish libraries use ICT personnel (internally or externally), but this virtual ICT department is neither visible nor organised. If one wants to improve the maturity of the ICT processes, the roles and responsibilities of each collaborator in this virtual organisation would need to be clarified.

4.14.1.3 IT Processes – Optimisation IT Governance in Public Libraries

Libraries have gone, and will continue to go, through several technological waves (ILS, internet, apps, e-books, semantic web…). The importance of ICT in the performance of the libraries' business processes grows continuously. From a single library's perspective, it is difficult to follow all the technical evolutions. As a network of connected libraries, it would be easier, but it remains complicated. It requires collaboration. However, the collaboration can only be successful if some rules are established. Libraries can be confronted with several sets of ICT rules: the municipality rules, the provincial rules (if they are connected to the PBS) and the library sector rules. Today, those ICT rules are not documented. A set of rules for ICT is called an **ICT Governance**.

Following the ITIL (Information Technology Infrastructure Library) terminology, Flemish libraries should work on the improvement of some of their ICT processes by developing a sector-wide ICT governance for libraries concerning the following ITIL processes:

- **Service Strategy**
  - Service Portfolio Management
  - Demand Management
- **Service Design**
  - Design Coordination
  - Supplier Management
- **Service Transition**
  - Application Development (web)

4.14.1.4 Service Operations Service Strategy Improvements

"*The objective of ITIL Service Strategy is to decide on a strategy to serve customers. Starting from an assessment of customer needs and the market place, the Service Strategy process determines which services the IT organization is to offer and what capabilities need to be developed. Its ultimate goal is to make the IT organization think and act in a strategic manner*."
(Source: http://wiki.en.it-processmaps.com/index.php/ITIL_V3_Service_Strategy).

Service Portfolio Management Improvements
"*The Service Portfolio represents a complete list of the services managed by a service provider"* (in this case the library is the service provider).

One of this study's tasks was to establish a list of the ICT systems used by libraries. Compiling this list would have been possible if libraries had a **documented service portfolio**, which they do not have.

During the study, a **web form** was used to establish a first application list with additional details on the system's characteristics: supplier, database, servers, operational cost… (see http://www.appepaper.com/projects/digbsa/). The information was gathered for eight out of hundreds of library ICT systems (if we consider that each of the 313 libraries own one system or more). This effort should be continued.

The library sector needs to review its service portfolio at least once a year, ideally twice a year. This is essential for ICT decision-making.

Demand Management Improvements
"*ITIL Demand Management aims to understand, anticipate and influence customer demand for services. Demand Management works with Capacity Management to ensure that the service provider has sufficient capacity to meet the required demand*."

A demand management process must be established, ensuring that the libraries' true ICT needs are better understood. It is currently not possible to know if the average library simply needs a new computer room or an entirely new purchasing process. It is not clear what functional domains have to be improved first from a demand perspective.

Furthermore, libraries and provinces all have the same kind of needs and yet they develop different solutions to solve the same problem. Therefore it could be a good idea to centralise the demand management process so that common demands can be answered in an optimal way, resulting in shared costs.

Within the demand management process, it is important that libraries better prepare the ICT projects with two additional types of work-products:

- **Business cases**: what is the expected return on investment of the new project/system?
- **Business process specifications**: what business processes are impacted by this new ICT investment? Are these processes documented? Which steps of the process can be automated with the new system?

4.14.1.5 Service Design Process Improvements

"The objective of ITIL Service Design is to design new IT services. The scope of Service Design includes the design of new services, as well as changes and improvements to existing ones."

Design Coordination Improvements
"ITIL Design Coordination aims to coordinate all service design activities, processes and resources. Design Coordination ensures the consistent and effective design of new or changed IT services, service management information systems, architectures, technology, processes, information and metrics."

Libraries should work together on designing new systems. This could be organised by:

- The common specification of the libraries' business processes
- The common management of libraries' functional domains (optimisation and innovation)

Libraries should create virtual ICT teams to work on each of the business services. These teams must be provided with very concrete tools and techniques in order to avoid “analysis paralysis”. A pragmatic approach is to use a common BPM Suite.

Suppliers Management Improvements

“The objective of ITIL Supplier Management is to ensure that all contracts with suppliers support the needs of the business, and that all suppliers meet their contractual commitments”.

Libraries sometimes see a mismatch between what they expect from suppliers and what suppliers actually deliver. In order to improve this situation, libraries need to repeat their expectations to the suppliers, over and over. Libraries also need to follow-up on whether expectations were met and value was delivered.

On a regular basis, libraries must inform their suppliers on:

- Business and functional requirements, for example:
  - Understanding the library's goals and constraints
  - Functional capabilities match / mismatch
- Architectural requirements
  - Security and Open BIB ID Integration
  - Modularity
  - Integration guidelines (e.g. website guidelines)
  - SOA, APIs, web services, widgets…
  - Infrastructure alignment
- Non-functional requirements, for instance:
  - Performance
  - Availability
  - Scalability
  - Security
  - Maintainability (programming language, availability of R&D…)
  - Extensibility (openness, standards…)
- SLAs
  - Support
  - System performance and availability
- Costs

Each year, each ICT system should be evaluated according to those criteria and the report on applications must be sent to the supplier. Applications that perform poorly must be improved or replaced.

New RFPs must also take these elements into account. Systems must be selected based on more than just functional requirements. For instance, the following evaluation grid could be used:

Criteria	Weight
Business en functional requirements	40%
Architectural Requirements	10%
Non-functional Requirements & SLA	20%
Cost	30%
	100%

The application of this evaluation grid would slowly exclude suppliers who only provide functional coverage without helping the libraries adapt the system to all of the library's needs.

4.14.1.6 Service Transition – Application Development

"The objective of ITIL Service Transition is to build and deploy IT services."

Libraries involved in the development of applications must improve their ICT application development processes.

The TO-BE workshops have shown that libraries might be involved in common application development for several business services such as website development, Digital Resource Collection Management (VEP-R) or Systems Integration (SOA).

Here we provide examples of best practices in application development for websites and SOA.

Website Development

Libraries should improve the way library websites are built. The following figure illustrates the typical steps involved in developing a website.

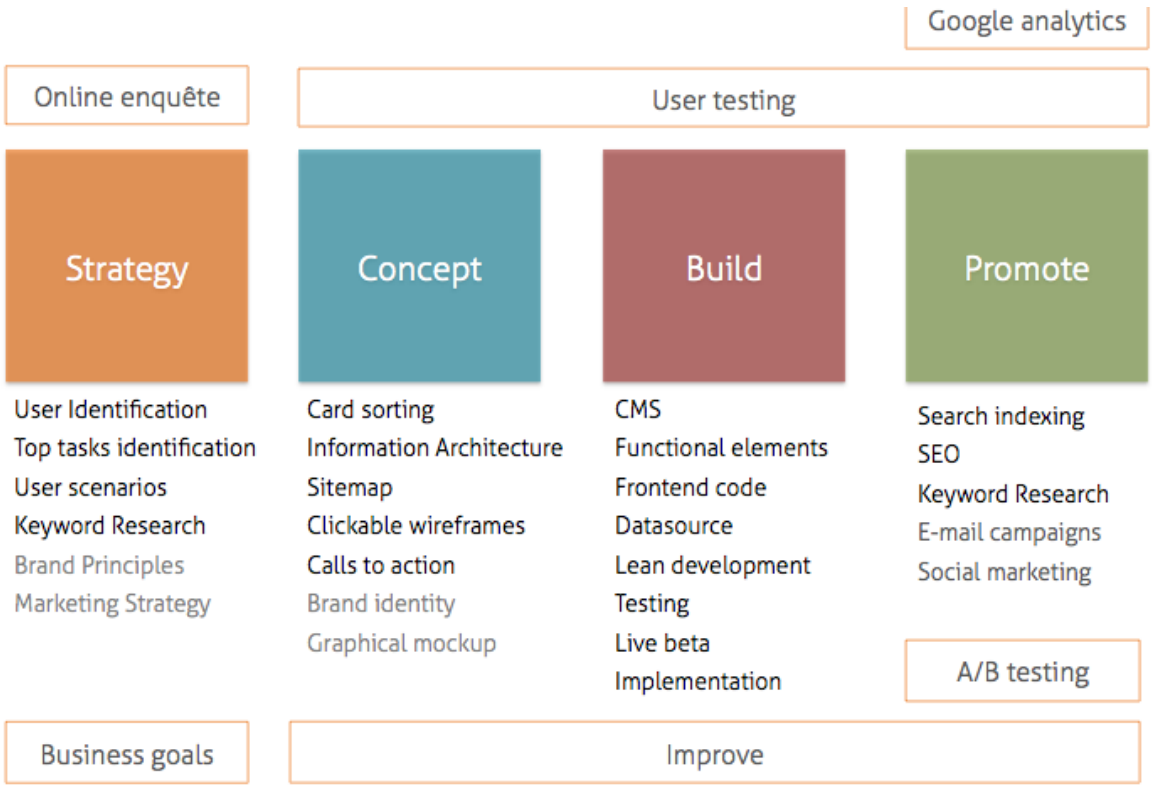


Figure 33: Website development steps

Many of the website's development activities could be done once for all libraries. For instance, the library's website strategy or the information architecture should not be so different across different libraries.

Systems Integration Development
By adopting SOA, libraries can standardise the way in which systems integrations are implemented by adopting a standard SOA Service Development Lifecycle (http://alwayshorizon.blogspot.be/2010/04/soa-testing-it-more-than-testing-web.html)

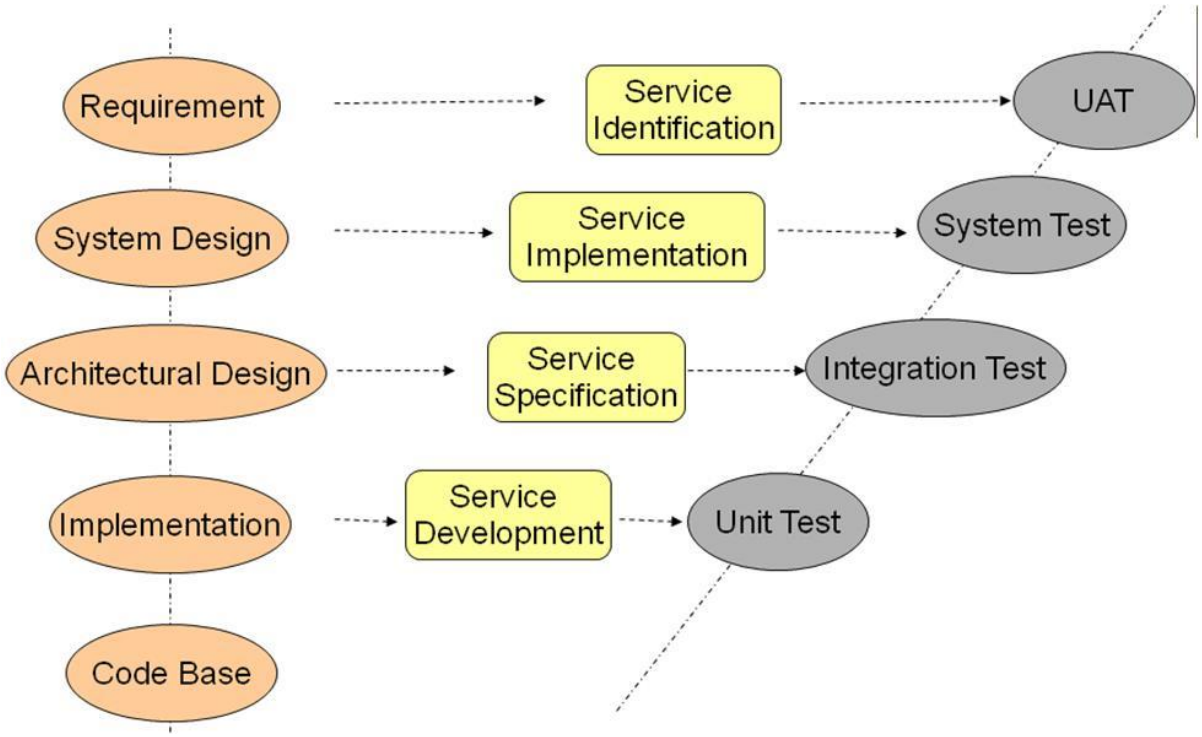


Figure 31: SOA Services Development Lifecycle

Adopting SOA Governance will force the ICT service supplier (either the library or its suppliers) to go through a formal development process (from design to testing) when the project produces value-added SOA Services. Since projects nearly always have integration requirements, the development process would be respected most of the time.

Application Development can be strategic for libraries in several areas, and projects benefit from standard application development methods. The library's ICT staff must be able to plan and follow up on different types of ICT projects (Web, SOA, Application development) using different methodologies (PMI, Prince2, Agile…) or frameworks.

4.14.1.7 Service Operations Improvements

"The objective of ITIL Service Operation is to make sure that IT services are delivered effectively and efficiently. This includes fulfilling user requests, resolving service failures, fixing problems, as well as carrying out routine operational tasks."

Libraries have the opportunity to further regroup service operations tasks such as IT operational control (monitoring), incident management, and problem management.

The new library systems will most probably need to be up 24/7, meaning the requirements for systems monitoring will grow. SLAs will be stronger. Libraries could invest in a sector-wide monitoring infrastructure.

The optimisation of the ICT systems portfolio could lead to a consolidation of the service desks.

4.14.1.8 ICT Governance: SOA as a pragmatic approach

Rome was not built in a day. Improving the maturity of an organisation's ICT processes is a long-term goal. SOA adoption can be a very good first step:

- SOA governance involves a smaller scale than ICT governance
- Most projects have integration requirements and so will have to go through the SOA governance board. This will help build the libraries project portfolio.
- When applications are integrated into the SOA, they can be identified and documented during the service discovery phase. This allows to build the list of applications underlying the library's service portfolio. The library's service catalogue can be gradually built.
- SOA requires a certain level of formal specification in the form of service profiles. These service profiles help build a standardised project specification.

4.14.2 IT - ICT Processes – Summary

Observations

- The maturity level of the Flemish libraries' ICT processes can be improved

Possible Initiatives

- Compare the library sector's "ICT department" with similar organisations (similar ICT budget and staff, networked structure)
- Establish a sector-wide demand management process
- Establish a sector-wide service portfolio management process
- Establish a sector-wide systems Integration / SOA Governance
- Establish service operations standards and processes (SLAs, incident management, problem management)
- Create an ICT coordination cell for each library business service

4.15 Sector-wide Systems Architecture

In this section we discuss optimisation options for the sector-wide architecture.

4.15.1 Sector-wide systems architecture – Optimisation

4.15.1.1 Managing the cost of ownership of business services

In the previous sections we have analysed how libraries provide ICT support for each of their business services. We observed that, mostly for historical reasons, libraries all have different application portfolios to support their business services. While the freedom of choice for applications does bring a number of advantages, it also comes with drawbacks. One of them is that a customised application portfolio results in a higher total cost of ownership.

Municipalities and libraries have the power to determine which library services they want to offer, the associated cost to the patron, and the services' access modes. In order to control their business processes, libraries want maximum control of the underlying ICT systems. Ownership of the library systems provides maximum flexibility in changing its parameters, extensions and operations.

There are advantages of running the library with “own” systems, e.g.:

- The library is independent from any other partner with regards to decision-making, roadmap, upgrade, innovation, supplier selection…
- The library is isolated from other libraries’ system failures or problems

But there are also disadvantages in “owning” the systems. Mainly: the library needs to care for the system evolution and this becomes more and more complex:

- The library has to plan for ICT changes, which requires business and technical vision and expertise
- The ICT resources that are knowledgeable about library systems are often rare and/or expensive
- The library systems architecture evolves very fast, there are many technological challenges (e.g. integration of eID, e-books…)
- The number of systems to manage increases very fast (ILS, RFID, website, Facebook, POS…)
- The system’s costs are not shared with other libraries

At the end of the road, the desire to own ICT systems results in higher ICT costs for the library. For many standard library business processes, there is an unnecessary duplication of ICT efforts (applications, servers, network, licenses, maintenance, development, operations….). We have seen that several similar yet different systems have been developed and operated: ILS, virtual bookshelves, websites, newsletters…

As an example, the processes involved in managing collections of physical resources (books) are very mature. The management of a book holding is not so different from one library to the next. The same goes for the circulation of a book. The operation of such common processes should be optimised as much as possible. Flemish libraries use about 91 ILSs to support a single set of highly mature and standardised processes. As long as the ILS (provincial or local) has a slow change rate, there is no need to maintain 91 small variations of the same standard processes.

The following table presents a list of mature process families that could be harmonised in the sector:

Library Management
Pricing Management
Statistics /KPIs
Collections Management
Choose and Order (Purchasing process)
Marketing the library
CRM
Patron Registration
Patron Identification
Lending Physical Resources
Access physical Resources
Fees Collection

Figure 32: Common mature library processes

If Flemish libraries can agree on a list of business processes that should be harmonised in the sector, they can achieve substantial ICT cost reductions.

During the workshop with the Dutch libraries (Stichting Bibliotheek.nl), one of the founding principles of bibliotheek.nl expressed this concern: “No harmonisation without standardisation”. With library standards, the architecture can be harmonised, resulting in an optimisation of the systems' architectures.

The harmonisation and standardisation of business services does not necessary mean that the business service governance is centralised outside of the library: it means that libraries acknowledge that there is little added value in having an own version of a business process or application.

Harmonising does not mean that all libraries offer the same services at the same price: the library will always have custom business processes (pricing, loan duration, membership fees…).

Harmonising does not mean that the business service quality decreases: libraries need to follow-up on all SLAs, whether the business service provider is an internal or an external partner.

Libraries do not have to harmonise all their business processes, but the harmonisation and standardisation of the library business services can result in substantial economies of scale through the establishment of one or more shared ICT service centres.

4.15.1.2 Business processes harmonisation

Libraries can reduce their ICT TCO if they harmonise the existing business processes. They can also decide to develop new business processes together in order to reduce development costs.

In order to determine which processes should be harmonised (i.e. optimisation) and which ones should be developed in partnership (i.e. innovation), we will sort some of them along two dimensions.

The horizontal axis is the differentiation axis:

- **Differentiating**: Those business processes are truly differentiating. The library does things differently in order to provide a different product or service. The objective is to outperform on specific processes.
- **Non-Differentiating**: Those business processes are just standard business processes. Each library does the same as others in this field.

The vertical axis is the "core business" axis:

- **Core business**: these business processes are core to the library's activity. Example: circulation of resources (e.g. lend a book).
- **Non-Core**: those business processes are not really core to the library, but they are still necessary. (e.g. payroll, building maintenance and security, financial reporting to the authorities…)

Business Processes can be classified into four business process types. This (simple) model suggests that:

- Core/Non-differentiating business processes should be **optimised**
- Core/Differentiating business processes are subject to **innovation**
- Non-core/non-differentiating business processes should be **outsourced**
- Non-core/differentiating projects should be stopped, standardised and outsourced or promoted as a core-business activity. They are **question marks**.

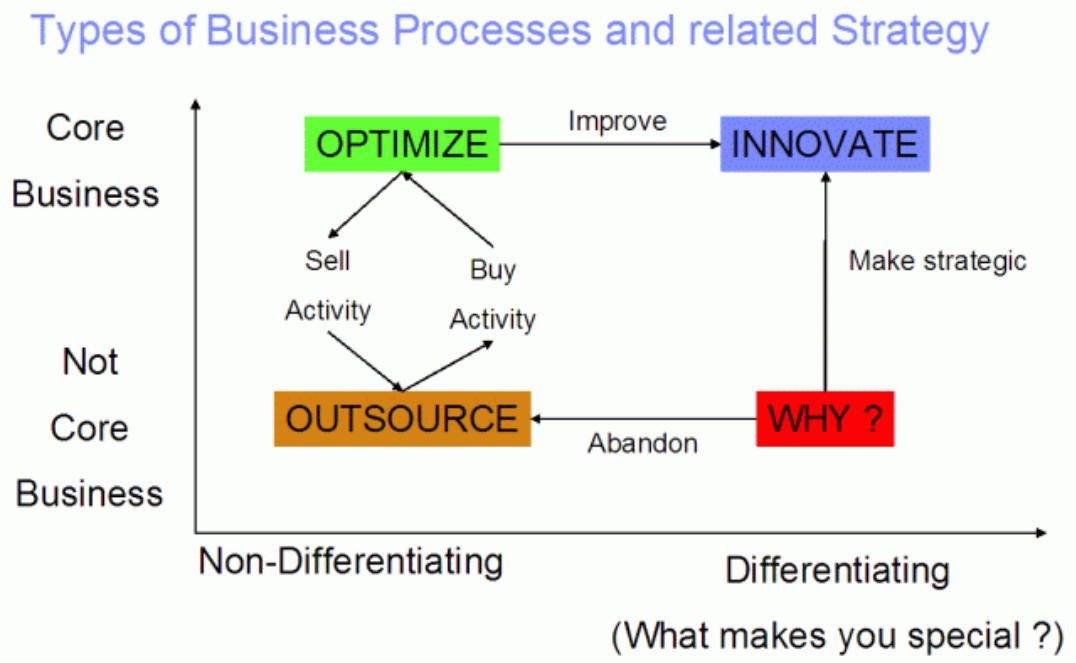


Figure 33: Business process classification

After the workshops, as the list of library business processes was refined, the following classification of library processes was presented.

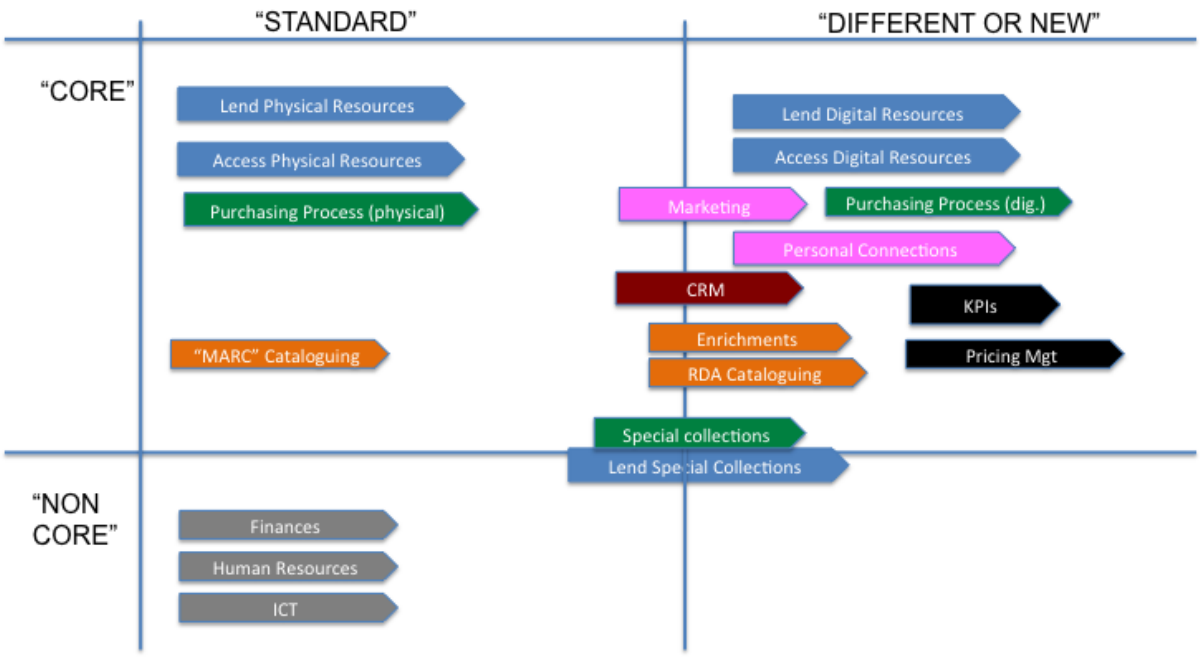


Figure 34: Classification of some of the libraries' business processes

Among the core business processes to be optimised, we find:

- Physical/print resource circulation (loans and access)
- Purchasing of physical/print resources
- Traditional cataloguing (as opposed to new cataloguing practices such as RDA)

The core business processes with a potential for innovation are related to:

- The circulation of digital resources
- A new purchasing process for digital resources
- The process of marketing the library
- The "personal connections" processes where the library will further try to personalise the patrons' experience, mostly online
- The CRM processes
- The development of new KPIs for the new digital services
- The extension of the library's management processes for the pricing of digital services

This study was unable to clarify whether the processes related to "special collections" are "core" or "non-core". If they are core processes, special collection management should be either optimised or reinvented.

Note that the ICT processes can only be classified as non-core if libraries are able to professionally express their needs to the ICT supplier (Demand Management). The correct documentation of a library's business process is an important step in that direction.

Business Service	Business processes to be optimised	Innovative Business processes
Library Management		KPIs Pricing management
Marketing		Marketing the library
Patron Services	Physical collection loans	Personal connections Digital collections loans
Collection Management	Purchasing process (Physical)	Purchasing process (Digital)
Cataloguing	Traditional cataloguing	RDA Cataloguing Enrichments
Partners & Collaboration	Purchasing process (Physical)	Purchasing process (Digital)
IT / ICT Processes	Demand Management	

For most business services, several business processes need to be optimised, designed or re-designed.

This classification method for business processes can help libraries plan for the evolution of the systems architecture: each process improvement leads to changes in the sector-wide systems architecture.

4.15.2 Sector-wide Architecture – Observations

4.15.2.1 Library Collaborators' Open Bib ID

Note that today, the architecture does not explicitly take the library employees, IAM and user experience into account. The employee-specific interfaces (e.g. ILS Administration) are scattered across the architecture. If the improvement of the employee's user experience is a firm objective, then a "Library Operations" business service should be added to host the new related applications, which can be a "Library Operations Portal" or an "Employee Dashboard" for instance. An IAM strategy for library employees ("Open BIB ID for library collaborators"), as well as standards for employee user interfaces, would then be required.

4.15.3 Sector-wide Architecture – Summary

Observations

- Libraries have not yet harmonised and standardised a series of business processes, which has resulted in multiple implementations of the same business services
- No SSO is included for library employees and collaborators

Possible Optimisation Initiatives

- Identify the library business services that could be harmonised in order to reduce the underlying ICT systems costs
- Identify the business processes that could be optimised (via the previously defined classification method here above) in order to reduce the underlying ICT systems costs
- Analyse the harmonisation options

- Implement the selected harmonisation and optimisation options
- Develop a “Library Operations” business service with new productivity tools for the library's collaborators/employees

Possible Innovation Initiatives

- Identify all new library business services in order to collaborate on them and reduce the related development costs (e.g. VEP).
- Identify the business processes that are innovative (via the previously defined classification method here above) in order to collaborate on them reduce the related development cost.

4.16 Observations and Possible Initiatives - Summary

The previous chapters have discussed various dimensions of the library services:

- Library Management
- Marketing, communications and promotion
- Patron Services
    - On-site
    - Online
    - Identity and access management
    - Referencing and Information
    - Circulation
- Collection Management and Cataloguing
- ICT
    - Systems integration
    - IT Management
    - IT Processes

For every business service, a summary was offered with the main observations, potential optimisations, and possible innovation initiatives.

Finally, the sector-wide system architecture's evolution was also analysed according using the same canvas.

The following table summarises the observations and possible initiatives.

Business Service	Observations	Optimisation Initiatives	Innovation Initiatives
Library Management	⇒ Global lack of library strategy and management support systems	⇒ Clarification and alignment of **library management practices** before any adequate ICT tool can be selected. ⇒ Sector-wide **knowledge management** and collaboration solution ⇒ Sector-wide **project management** platform (see also ICT services section)	⇒ **Data warehouses and BI** ⇒ **Business Process Monitoring** ⇒ **Pricing Management**: integration of new business models for digital collections
Communications and Promotion (including Marketing)	⇒ The relationship between the library's marketing plan and the required marketing ICT tools needs to be further elaborated and documented	⇒ Some (minor) gains possible by **harmonisation** of current direct marketing tools (newsletters, mail merge)	⇒ Libraries will have to **personalise the patron experience** in order to stay competitive. It will require owning good CRM and Identity management systems.
Patron Services – on-site	⇒ Libraries operate several systems on-site, which requires dedicated IT support ⇒ In general, libraries have limited ICT support from their own municipality	⇒ Identify possible synergies by starting to **benchmark** the on-site ICT infrastructure with peers ⇒ Standardisation and levelling of the minimum required local ICT infrastructure (e.g. Wi-Fi)	⇒ The on-site innovations will depend on the **role**(s) that the library wants to play.
Online Patron Services	⇒ Libraries' web presence is rather messy ⇒ Municipality websites are not ready to integrate library services. ⇒ Libraries develop similar web systems in parallel (websites, virtual bookshelves, blogs…)	⇒ Develop and promote business and technical **guidelines** for library websites ⇒ Develop a **reference library website** that libraries can use or clone ⇒ Make sure the library's website works on **mobile** devices	⇒ Library mobile **app** ⇒ **Pervasive Information Architecture**: align online services with other channels (e.g. on-site) ⇒ **Adaptive content**: define a sector-wide content management strategy to enable better content sharing and reuse between libraries
Identity and Access Management	⇒ Many identification and access management systems are used, and they must be integrated in order to help patrons use library services seamlessly. ⇒ Open BIB ID is a good strategy for SSO within libraries systems	⇒ Continue IAM systems integration with **OpenBIBID**. ⇒ Design and implement patron provisioning and de-provisioning processes.	⇒ Lobby the Flemish authorities to establish a sector-wide identity management infrastructure (**WAYF** like)

Business Service	Observations	Optimisation Initiatives	Innovation Initiatives
Referencing and Information	⇒ Too many search services on libraries online systems (websites, catalogues, blogs…)Too much SEO work due to large number of online systems	⇒ Maintain a sector-wide **SEO** strategy (using reference websites, zoeken.bibliotheek.be) ⇒ Merge the four virtual bookshelf systems into one sector-wide virtual bookshelf system (that can be configured locally) ⇒ Consolidate the **ABL** systems	⇒ **Linked Data**: produce open linked data to be better referenced by "semantic web ready" search enginesImplement an "**Enquiry management system**"
Circulation	⇒ Several circulation processes are already in use today: books, music, digital press articles, online databases, Daisy books with device, digital classroom… ⇒ New circulation processes will be added: e-book, video, software, apps…	⇒ As the physical resources **circulation process** is relatively standard across libraries, the underlying ICT systems could be **consolidated** (hardware, software…).	⇒ Gradual introduction of **Electronic Rights Management** Systems, possibly based on Business Rules Management Systems (**BRMS**) ⇒ Extend the circulation process to digital resources with **BPM** ⇒ Better control all circulations with a **Master Circulation process** in the BPM layer ⇒ Use an **app** to help patrons
Collection Management	⇒ The field of collection management is extending with digital contents ⇒ Purchasing processes are seldom automated ⇒ Special collections are not well positioned in the sector-wide plan	⇒ As the physical resource **collection management processes** are relatively standard across libraries, the underlying ICT systems could be **consolidated**.	⇒ Extend Integral collections management to **digital resources**. ⇒ **Purchasing process** automation (for example using BPM tools) ⇒ **Electronic Rights Management** of digital collections ⇒ New approach for **special collections** with **linked data**.
Cataloguing	⇒ The cataloguing of traditional resources is greatly facilitated by the central catalogue (Open Vlacc). ⇒ De-centralised cataloguing happens for books that are not or not yet present in the central catalogue and for special collections… ⇒	⇒ Increased business process automation could be brought in the current cataloguing to facilitate metadata imports and updates. Could be implemented with BPM tools.	⇒ In the mid- to long-term, libraries will need new cataloguing systems that follow new standards and practices such as BIBFRAME, RDA, FRBR.

Business Service	Observations	Optimisation Initiatives	Innovation Initiatives
Municipality Integration	⇒ Libraries and municipalities are not very well integrated today and this becomes more and more a requirement	⇒ Adopt an Integration/SOA approach and **governance** to integrate municipality and library ICT systems, in order to facilitate integration development and reuse	⇒ Determine a library/municipality website fusion roadmap including a first "**websites standardisation**" step ⇒
ICT Systems Integration	⇒ There are no sector-wide integration guidelines and/or tools in libraries. As the integration work tends to increase, it is an important to act now in order to avoid building an "integration spaghetti" ⇒	⇒ Develop a common **integration/SOA guide and governance** ⇒ **Communicate** the SOA guidelines to suppliers so they can take them into account in their product designs ⇒ Implement common SOA tools in the form of a "**library hub**" ⇒ Extend the library hub with **BPM** and **BRMS** tools (full SOA Stack) ⇒ Set up a common sector-wide "**libraries integration team**"	
ICT / IT Management tools	⇒ Common ICT best practices and shared ICT tools do not exist in the library sector. Libraries rely on their ICT suppliers for those tools. ⇒	⇒ **Analyse** which IT Management tools are required in all libraries ⇒ Develop a plan aimed at ensuring that every library has **access to the proper IT Management tools**.	
IT / ICT Processes	⇒ The ICT processes maturity level of the Flemish libraries can be improved	⇒ **Compare** the library sector's "ICT department" with similar organisations (similar ICT budget and staff, networked structure)Establish a sector-wide **demand management** process ⇒ Establish a sector-wide **service portfolio management** process ⇒ Establish a sector-wide systems Integration / SOA Governance ⇒ Establish **service operations standards and processes** (SLAs, incident management, problem management) ⇒ Create an ICT coordination cell for each library business service	

Business Service	Observations	Optimisation Initiatives	Innovation Initiatives
Sector-wide System Architecture	⇒ Libraries have not yet harmonised and standardised a series of business processes resulting in several implementation of the same business services	⇒ **Identify** the library business services that could be **harmonised** in order to reduce the underlying ICT systems costs ⇒ **Identify** the business processes that could be **optimised** (via the previously defined classification method here above) in order to reduce the underlying ICT systems costs ⇒ **Analyse** the harmonisation/optimisation options ⇒ **Implement** the selected harmonisation and optimisation options ⇒ Develop a "**Library Operations" business service** with new productivity tools for the library collaborators/employees	⇒ **Identify** all **new** library business services in order to collaborate on them and reduce the related development costs (e.g. VEP). ⇒ **Identify** the business processes that are **innovative** (via the previously defined classification method here above) in order to **collaborate** on them reduce the related development costs.

4.17 SWOT Analysis

The observation and initiatives table already provides a first list of strengths, weaknesses (observations) and opportunities (optimisation and innovation initiatives) for the library sector. We can complete and further refine the SWOT analysis with some additional considerations.

4.17.1 Strengths

Business Service	Strengths
Library Management	- Collaborative, open, and disciplined personnel - Libraries have less short-term pressure than their commercial partners, so they can make strategic investments at their own pace
Communications and Promotion (including Marketing)	- Positive image of the libraries - Information mediation skills
Patron Services –on-site	- Physical space available for public PCs - Physical & human presence complementary to ICT and internet systems
Online Patron Services	- The library website enjoys high traffic thanks to the webopacs renewal and reservation capabilities.
Identity and Access Management	- Id & access management initiative (Open BIB ID), as basis for personalised services
Referencing and Information	- Aquabrowser is a modern discovery tool used by a majority of the network
Circulation	- Stable processes, with user interaction points (e.g. email as reminder of expiration of lending period)
Collection Management	- BI/Datawarehouse prototype to improve integral collection management
Cataloguing	- High-performance Open Vlacc used as a metadata hub
Municipality Integration	- The largest libraries have already some experience
ICT / Application Integration	- Technical expertise in many ad-hoc integrations that could be leveraged with a SOA
ICT / IT Management tools	
IT / ICT Processes	- From an ICT governance point of view, having three levels of governance (Flemish, Provincial, Local) should in theory allow to centralise systems that should be centralised while keeping some local autonomy. Each governance level can focus on its strong points. For instance, libraries could follow the local municipalities' ICT governance with regards to PC purchases, but adhere to other provincial or sectorial governance to run their library systems. - Libraries can rely on local, provincial or sector-wide support, provided that clear responsibilities have been assigned.
Sector-wide Systems Architecture	

4.17.2 Weaknesses

Business Service	Weaknesses
Library Management	- The whole Library sector needs to better serve their internal customer: the municipalities - Too little attention and budgets for small innovations within the existing systems - No common strategy for the library sector as a whole, shared by all stakeholders
Communications and Promotion (including Marketing)	- Weak marketing of the library services - No sector-wide marketing plan that would allow the alignment and optimisation of ICT tools
Patron Services – on-site	- No (explicit) sector-wide CRM policies and strategy - Many libraries lack basic on-site infrastructure (e.g. Wi-Fi)
Online Patron Services	- No clear point of entry on the web for patrons - Large differences in online services depending on the local membership of the patron
Identity and Access Management	- No fully online IAM in many libraries (OpenBibID ticket system) for digital services.
Referencing and Information (including Discovery)	- Some ILS webopacs give an old-fashioned image to the library
Circulation	- Duplication of standard circulation processes in 90+ different systems, which results in extra costs
Collection Management	- No sector-wide support for special collections, despite their potential status as differentiators
Cataloguing	- Huge operational overhead (and cost) for the Open Vlacc system, which minimises the financial possibilities for further innovations
Municipality Integration	- No substantial IT support by municipality IT offices for many libraries
ICT / Application Integration	- Growing Integration spaghetti due to 1) lack of integration governance and 2) duplication of similar systems
ICT / IT Management tools	- Low IT maturity of library organisations and limited IT skills of library staff

Business Service	Weaknesses
IT / ICT Processes	- The support and operations of library ICT systems is very specific and libraries do not have enough experts at their disposal - ICT contract management is ad-hoc or absent - Common decision-making in the ICT field is slow, due to the network size and the lack of a sector-wide process for demand management and project portfolio management - Too few SLAs for ICT systems - Many helpdesks result in complex sector-wide ICT Support processes - Centralised ICT solutions tend to have a “one size fits all” approach
Sector-wide Systems Architecture	- Too little sector-wide coordination, common vision/strategy/portfolio - Too many similar applications (ILS, virtual bookshelves, newsletters…) - Overhead, many dependencies and IT risks due to distributed model (with six PBS systems)

4.17.3 Opportunities

Business Service	Opportunities
Library Management	- Optimise the library ICT infrastructure to enable new library business services - Contribute to building shared ICT services to improve quality of service of ICT systems while reducing costs
Communications and Promotion (including Marketing)	- Dynamic local market with its own identity
Patron Services – on-site	- Align library ICT infrastructure with library role
Online Patron Services	- Attract new library users and create added value by building modern and attractive online patron services (e.g. personal recommendations)
Identity and Access Management	- Integrate OpenBIB ID with other circles of trust (UitID, eID, A-Kaart) to enable a WAYF (Where are you from?) experience
Referencing and Information (including Discovery)	- Exploit libraries' skills in information mediation online
Circulation	- Extend circulation to digital collections
Collection Management	- Use special collections as a differentiator - Extend collections with new digital collections - Extend Integral Collection Management to digital resources in order to optimise collection budget planning

Business Service	Opportunities
Cataloguing	- Link Data with NL and other partners in order to boost cataloguing productivity and enrichments - Leadership role of libraries with Linked Data, to compensate for the current lack of Dutch language open data sources.
Municipality Integration	- Facilitate shared CRM and Financial business processes
Partner Integration	- Collaboration with Boek.be (Bibbank, VEP) - Reduce amount of low added-value task with integrated business processes with partners (e.g. RDA cataloguing, manual entries needed for acquisitions)
ICT / Application Integration	- Avoid an integration spaghetti and build a modular library architecture using SOA
ICT / IT Management tools	- Improve ICT Management, follow up on SLAs, reduce operational risks - Improve ICT project execution and follow-up
IT / ICT Processes	- Common development of a library sector ICT Governance in order to improve the ICT maturity to the required level
Sector-wide Systems Architecture	- Share ICT best practices, resources and systems.

4.17.4 Threats

Business Service	Threats
Library Management	- Budget cuts - Not finding the necessary ICT experts for some ICT systems
Communications and Promotion (including Marketing)	- No CRM = No personalisation of patron experience and service
Patron Services – on-site	- Under-equipped or over-equipped library if the library's role is not clearly defined or if no choices are made
Online Patron Services	- Internet as the new library - Digital libraries (Nederland, Amazon, Google, Apple) - Not offering mobile services (smart phones, apps…) can cost active users
Identity and Access Management	- Patrons expecting Social Media Login to access key library resources - Patrons not willing to use yet another account
Referencing and Information (including Discovery)	- Slowly decreasing SEO efficiency if no move is made towards Semantic web publishing (RDF) and if no clear social media strategy is adopted
Circulation	- Poor Electronic Rights Management can lead to a misconfiguration of digital collection access rights (too much/not enough access restrictions) and expose the library to piracy.
Collection Management	- Digital Collection offers may limit the library's freedom in collection planning. - Takeover of the best special collections by other parties.
Cataloguing	- Bad cataloguing when the library sector is not able to control the flow of metadata coming from external parties.
Municipality Integration	- Not integrating with the municipalities' ICT systems could isolate the library as municipality service.
ICT / Application Integration	- Current suppliers are unwilling to open their systems, forcing the library to engage in risky migrations - Suppliers selling the same integration multiple times because of the lack of communication and reuse in the sector
ICT / IT Management tools	- No intervention by suppliers who do not respect their SLAs - Library unable to observe its ICT system's performance degradation
IT / ICT Processes	- Suppliers exploiting the low maturity of libraries' ICT (e.g. initial scope invoiced as change request)
Sector-wide Systems Architecture	-

4.18 Evolution of the libraries' ICT Architecture - Conclusion

The study of the libraries' ICT architecture, examining each business service individually, shows that there are many innovation and optimisation initiatives that could be undertaken. Obviously, Flemish libraries will not be able to launch all the suggested initiatives at once. These will have to be prioritised and launched at the right moment. The roadmap presented later in this report suggest a planning schedule for the launch of an arbitrary selection of common sectorial initiatives.

The nature of the initiatives could be summarised as follows:

1. Harmonisation of selected library business services (e.g. library website)
2. Harmonisation of selected library business processes (e.g. purchasing process)
3. Common innovation for selected library business services (e.g. digital collections)
4. Common innovation for selected library business processes (e.g. RDA cataloguing)
5. Sector-wide ICT Governance
    a. Sector-wide SOA to avoid an integration spaghetti
    b. Sector-wide service portfolio management and supplier management, enabling a better understanding of the TCO structure
    c. Sector-wide demand management, collaboration and project management for an integrated ICT roadmap

Most initiatives require the collaboration of the whole library sector. As a result of the evolution and growth of the application portfolio, most libraries would not be able to build, integrate and run all the IT services on their own. Therefore, libraries must strive to share ICT services as much as possible in order to make room for custom local ICT projects and innovations.

5 The Future system architecture of Flemish public libraries (TO-BE)

The current situation analysis (AS-IS) and the TO-BE workshops provided valuable information about the libraries' ICT systems. Intermediary models were necessary in order to discuss the situation and its evolution (see previous figures in the document).

This chapter integrates all the architecture elements that were identified during this study and establishes a first blueprint for the enterprise and ICT architecture of Flemish public libraries. The blueprint must allow any library to think about its system architecture.

The model consists of different views, corresponding to the Archimate meta-model:

- The **business view**: what are the businesses services, business processes, and business objects?
- The **application view**: what functions do the ICT systems provide?
- The **technical view**: what are the technical elements of the ICT architecture?

The blueprint is available as an Archi2.4 file in the appendixes.

5.1 TO-BE Library Business Services

The TO-BE workshops allowed to test the initial models that were established during the AS-IS phase. The model was afterwards refined and completed:

- Some business service components have been put forward because they correspond to important current or future initiatives:
  - In the Patron services: Discovery, Web & Mobile and IAM.
  - In the Partner & Collaboration services: Municipality Integration.
  - In ICT, “Library Systems Integration” aims at integrating all services whenever possible.
- Marketing has been promoted as a separate business service, a generalisation of “Communication and Promotion”.
- Collection Management covers the three types of collections: physical, digital and special.
- Collection Management includes cataloguing (in the AS-IS value chain, cataloguing was seen as a separate step).

The business services blueprint then features the following business services:

- Library management
- Collection Management Processes for physical, digital and special collections, including
  - Planning
  - Acquisitions
  - Cataloguing
  - Distribution
  - Withdrawal
- Marketing (& Sales)
- Patron Services

- Circulation services (part of Patron Services)
- Supporting services (ICT, Human Resources, Finance, Facilities…)

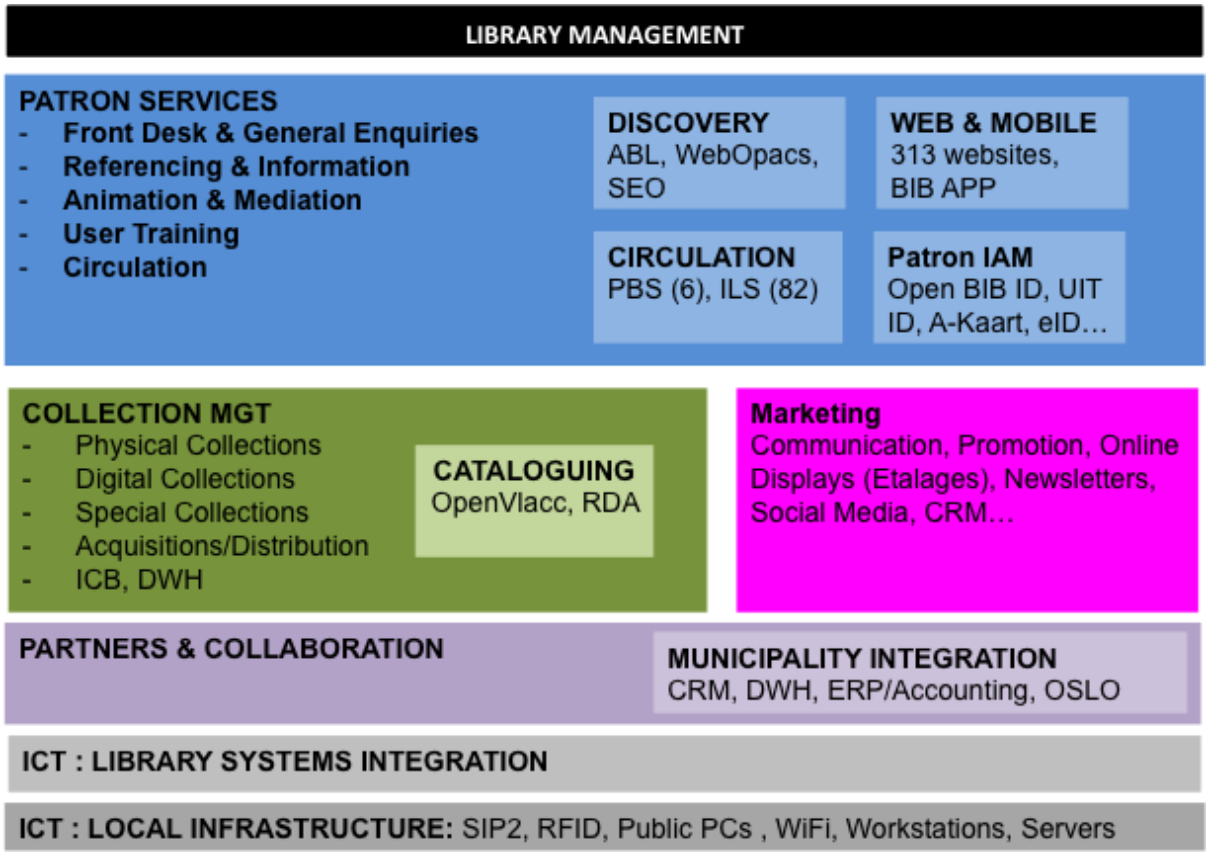


Figure 35: Library TO-BE business services model with sample related architecture elements

By comparison, the following figure represents the Integrated Business Process Framework of the National Library Board of Singapore.

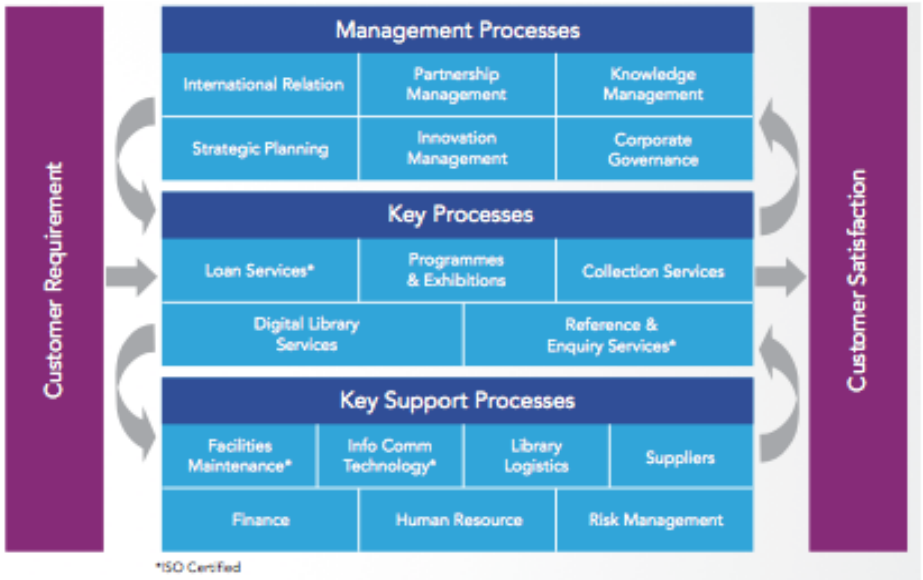


Figure 36: National Library Board (Singapore) Integrated Business Process Framework

5.2 TO-BE Libraries Business Processes

Drawing the AS-IS value chain was a good start for identifying some of the libraries' business processes. After the TO-BE workshops, the list of business processes can be completed and adapted.

Each business service relies on several business processes. The following sections describe the library business processes for each business service. Note that some business processes are "abstract"; in order to be operationalised they would need to be further refined.

5.2.1 Library Management Processes

Process Name	Description
Library Management	Process that represents all the actions required managing the library (PODC: Plan, Organise, Direct, Control)
Pricing Management	The definition of the library's service pricing, an important element of the library's service portfolio
Statistics /KPIs	The process of establishing and monitoring Key Performance Indicators for the library as well as providing statistics about the library (e.g. BIOS reporting)
Partnership Management	Processes required to establish and maintain business partnerships in order to use partner services that are needed for the library

5.2.2 Collection Management Processes

We can identify three types of collection management processes:

- Physical Collection Management processes
- Digital Collection Management processes
- Special Collection Management processes

So all following processes below may have three different versions, one for each type of collection.

Process Name	Description
Collection Management	Processes required for the management of the library's collections: Physical, Serials, Shared, Digital and Special.
Comprehensive Management of library Collections	Processes required for the comprehensive management of the library's collections. Processes used for the integration of all the collection management processes.
Shared Collection Management	Processes required for the management of shared collections. For example, e-book collections can be shared and therefore will have specific processes to build and maintain the collections.
Collection (Budget) Planning	This process is related to planning for collection management, e.g. planning the budgets dedicated to enlarging and maintaining the collections.

Process Name	Description
Contract Management	The processes related to establishing and maintaining contracts with resource suppliers. Those contracts are important for the purchasing process and the circulation of digital resources.
Choose and Order (a.k.a. Select and Acquire) (a.k.a. Purchasing process)	Those processes deal with the purchase of items that will enter the library's collections. There could be several sub-processes depending on content type. This process can involve a pre-cataloguing process.
Resources Orders Reception	The reception of purchased resources.
Resource Cataloguing	The processes of cataloguing the library collections so that they can circulate.
Collection Catalogue Enriching	The processes of enriching the catalogue so that resources are better described, improving the resource discovery process.
Resource Processing (e.g. Book Processing)	The process of preparing resources before they can circulate.
Resource Distribution	The processes related to the distribution of resources up to the final library placement.
Resource Placement – "Shelving books"	The process of placing the library resource at the right place so that patrons can use it. Once items have been purchased and received, they need to be "distributed" by the library: "books need to find a shelf" so that patrons can find them. Digital resources such as e-books can bring many changes to the way library resources are distributed.
Collection Relocation	The processes related to the relocation of a collection (e.g. "Netwerk Magazijn")
Collection Withdrawal	The processes related to the withdrawal of collections
Digital Collection Content Management	The processes related to content management for digital collections (e.g. storage)

5.2.3 Collection Management - Cataloguing Processes

The cataloguing processes are part of the Collection Management processes.

Process Name	Description
Pre-Cat	The process related to making a pre-catalogue where libraries can search for new items to purchase.
Cataloguing	The process of adding collection items into the library's catalogue through the production or importation of bibliographic descriptions of books and other library resources (e-books, DVDs…). The process can follow cataloguing such as like AACR2 or RDA.
RDA Cataloguing	The processes of cataloguing collections following the RDA guidelines. http://en.wikipedia.org/wiki/Resource_Description_and_Access.
Enriching	The process of enriching the catalogue's bibliographic records with additional metadata or metacontent. The objective is to encourage library customers to browse, search, and interact with the library's collections in completely new ways.

5.2.4 Marketing Processes

Process Name	Description
Marketing the library	The process of elaborating and executing a marketing plan for the library. This plan should be aligned with the library's objectives as defined in one of the library management processes.
External communications	The library's external communication processes: newsletters, website, blog, Facebook, Twitter, municipality communications…
Knowledge Sharing	Knowledge sharing processes. By sharing knowledge, the library demonstrates leadership in certain fields. This is an important marketing process for libraries wishing to inspire new or existing users to come to the library.
Personal Connections	The processes associated with the objective of establishing a personalised connection between the user and the library.
Inspire existing patrons	The processes used to make patrons return to the library.
Attract new patrons	The processes used to attract new patrons to the library.
CRM	The processes related to managing the relationship with patrons.

5.2.5 Patron Services Processes

Process Name	Description
Front desk & Enquiries	The processes related to welcoming and informing people who enter the library, whether physically or virtually.
Patron Registration	The processes related to registering new patrons, whether physically or virtually.
Patron Identification	The processes related to identifying and authenticating patrons before giving them access to library services.
Public Activities	The process of organising public activities.
Information mediation	The processes related to helping patrons find the right information.
Education and Training	The processes of organising training sessions for library patrons.

5.2.6 Patron Services - Discovery Processes

Process Name	Description
Present Resource	The process of putting resources in the spotlight for patrons. For instance, a (virtual) bookshelf is an important presentation tool. This process is at the edge of marketing.
Search and Find	The processes that allow patrons to search and find a resource.
Referencing and Information	The referencing and information processes that allow patrons to be guided towards a resource via a reference or information about it.

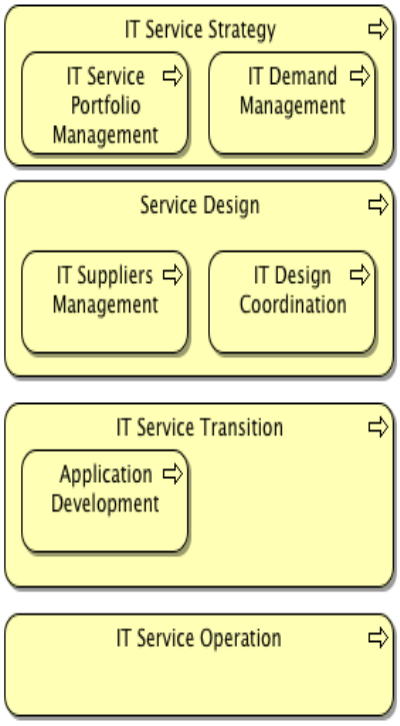
5.2.7 Circulation Processes

Circulation processes are in fact Patron Services processes. They are grouped separately because they are the core of the library services: libraries acquire resources in order to circulate them.

Process Name	Description
Lending Physical Resources	The processes related to lending physical resources such as books, DVDs…
Access physical Resources	The processes related to accessing physical resources such as books that may only be consulted on-site.
Lending Digital Resources	The processes related to lending digital resources such as e-books.
Access Digital Resources	The processes related to accessing digital resources such as electronic press articles or online databases.
Special Collections Circulation	The processes related to the circulation of special collections (e.g. board games)
ILL (Inter-Library Loan)	The processes related to ILL
Self Service	The processes related to self-service circulation: RFID, online loan renewal, online loan reservation…
Fees Collection	The processes related to collecting patron fees
Premium Services Fees Collection	The processes related to the payment of premium services as defined in “Library Management - Pricing management”

5.2.8 ICT Processes

All ITIL services are important. Throughout our study, we focused on the following ICT processes:



Process Name	Description
IT Service Strategy	*"The objective of ITIL Service Strategy is to decide on a strategy to serve customers. Starting from an assessment of customer needs and the market place, the Service Strategy process determines which services the IT organization is to offer and what capabilities need to be developed. Its ultimate goal is to make the IT organization think and act in a strategic manner."*
IT Service Portfolio	*"The Service Portfolio represents a complete list of the services managed by a IT service provider"*
IT Demand Management	*"ITIL Demand Management aims to understand, anticipate and influence customer demand for services. Demand Management works with Capacity Management to ensure that the service provider has sufficient capacity to meet the required demand."*
IT Service Design	*"The objective of ITIL Service Design is to design new IT services. The scope of Service Design includes the design of new services, as well as changes and improvements to existing ones."*
IT Design Coordination	*"ITIL Design Coordination aims to coordinate all service design activities, processes and resources. Design Coordination ensures the consistent and effective design of new or changed IT services, service management information systems, architectures, technology, processes, information and metrics."*
IT Service Transition	*"The objective of ITIL Service Transition is to build and deploy IT services."*
IT Service Operation	*"The objective of ITIL Service Operation is to make sure that IT services are delivered effectively and efficiently. This includes fulfilling user requests, resolving*

Process Name	Description
	service failures, fixing problems, as well as carrying out routine operational tasks."
IT Governance	The accepted "rules" for IT. A "governance" has several elements: Vision (goal), Rules, Communication, Exceptions and Appeals, Compliance, Vitality. See http://jfdeclercq.biz/2013/05/23/what-is-a-governance/
SOA Governance	The accepted "rules" for SOA.

5.2.9 Library Business Processes – Overview

The following diagram shows all the library business processes for each business service. The collection management processes have been developed for the three types of collections: Physical, Digital and Special.

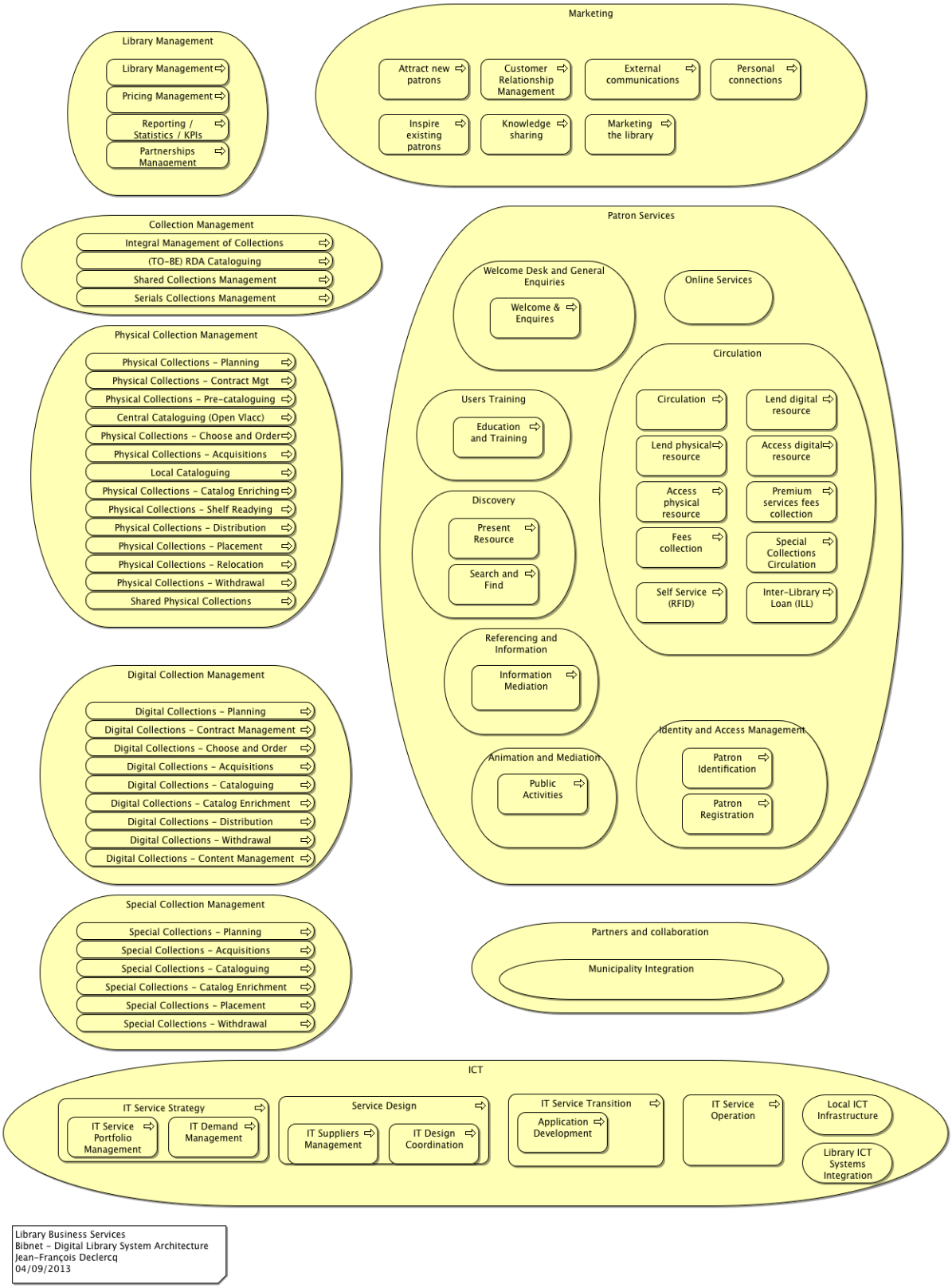


Figure 37: Library business processes

5.2.10 Additional Business Processes

Library business processes can be added to the blueprint. For instance, the "Patron Content Creation" and "Patron Content Sharing" processes could be added to patron services as suggested by the Arts Council's study: **"Envisioning the library of the future suggests the public library will be a place where people create, learn, discover and share".** (Source: The library of the future - A response to Envisioning the library of the future by Arts Council England Chief Executive Alan Davey - http://www.artscouncil.org.uk/what-we-do/supporting-libraries/library-of-the-future/)

5.3 TO-BE Libraries Information Model

Discussing the library business services and business processes allows for the identification of many library business objects. The following diagrams list the business objects identified during this study, for each business service. The diagrams include "TO-BE" business objects: this is new data that the libraries will have to manage in the future.

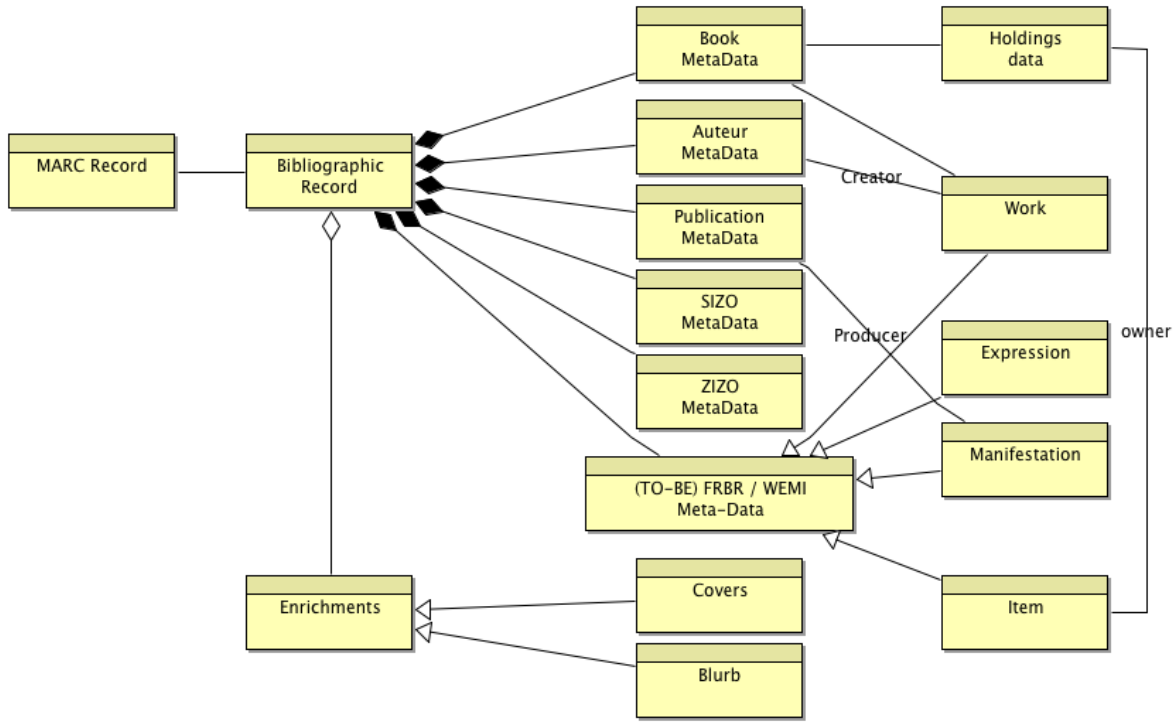


Figure 38: Business Objects - Cataloguing

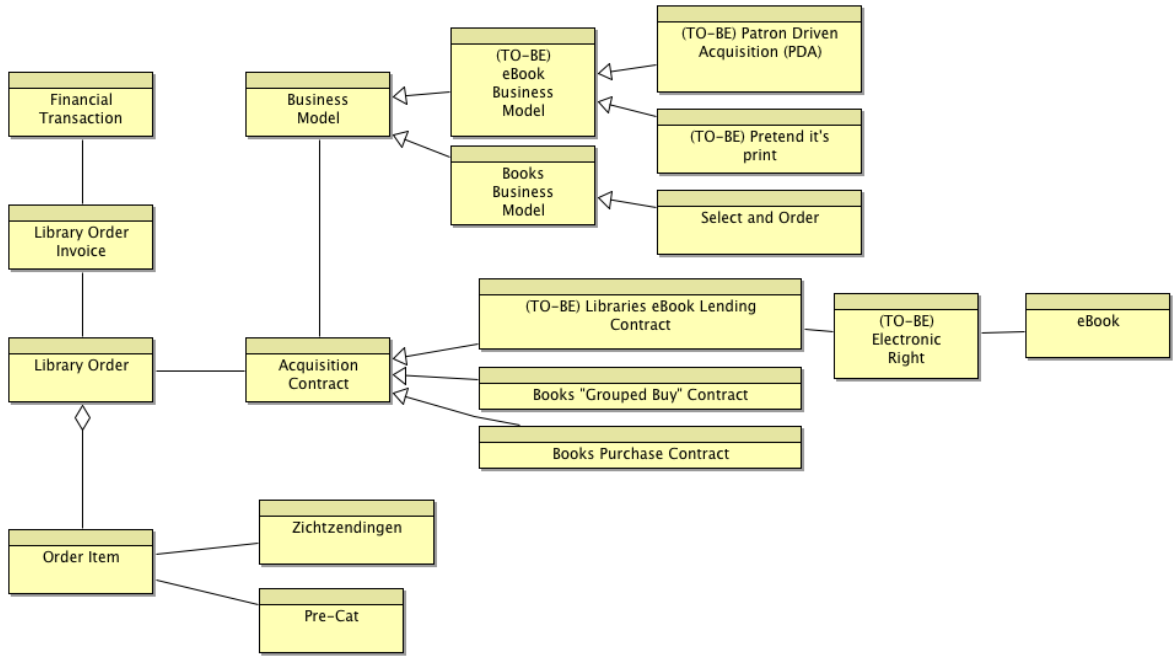


Figure 42: Business Objects - Acquisitions

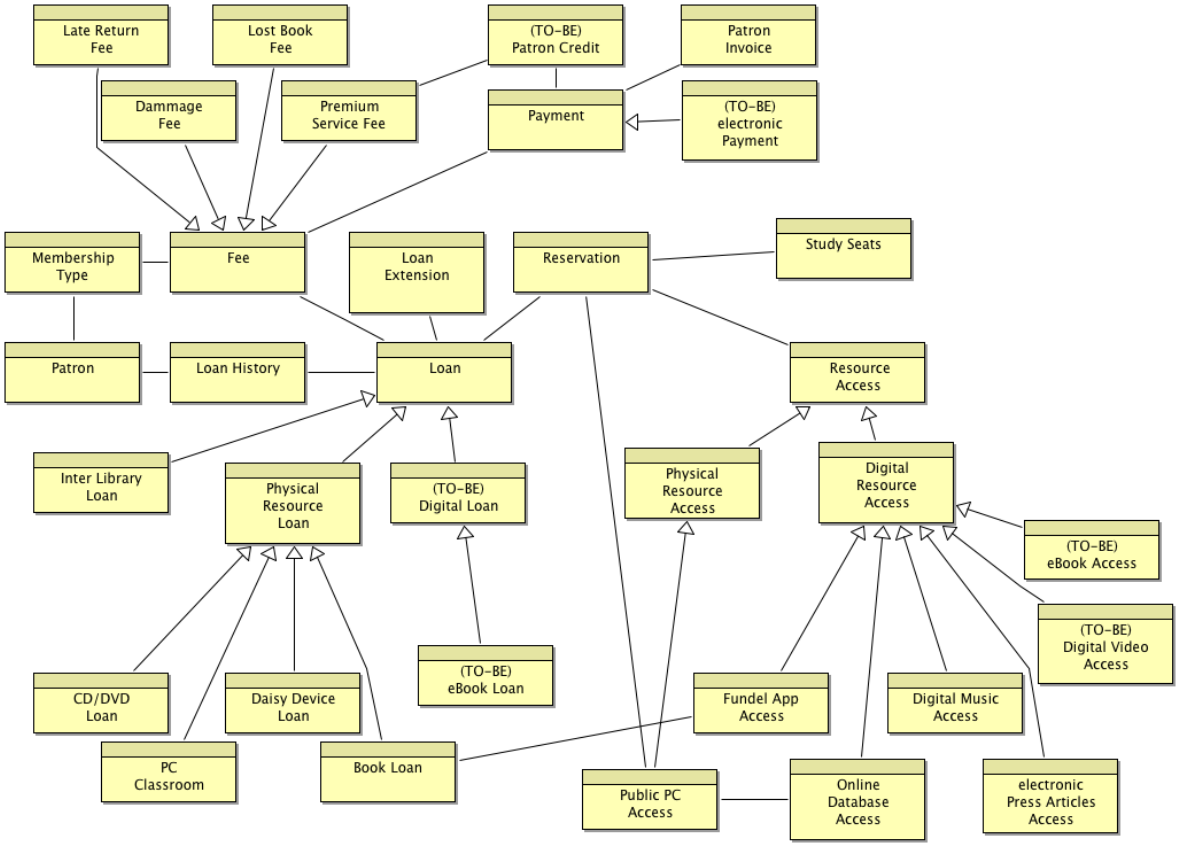


Figure 39: Business Objects – Circulation

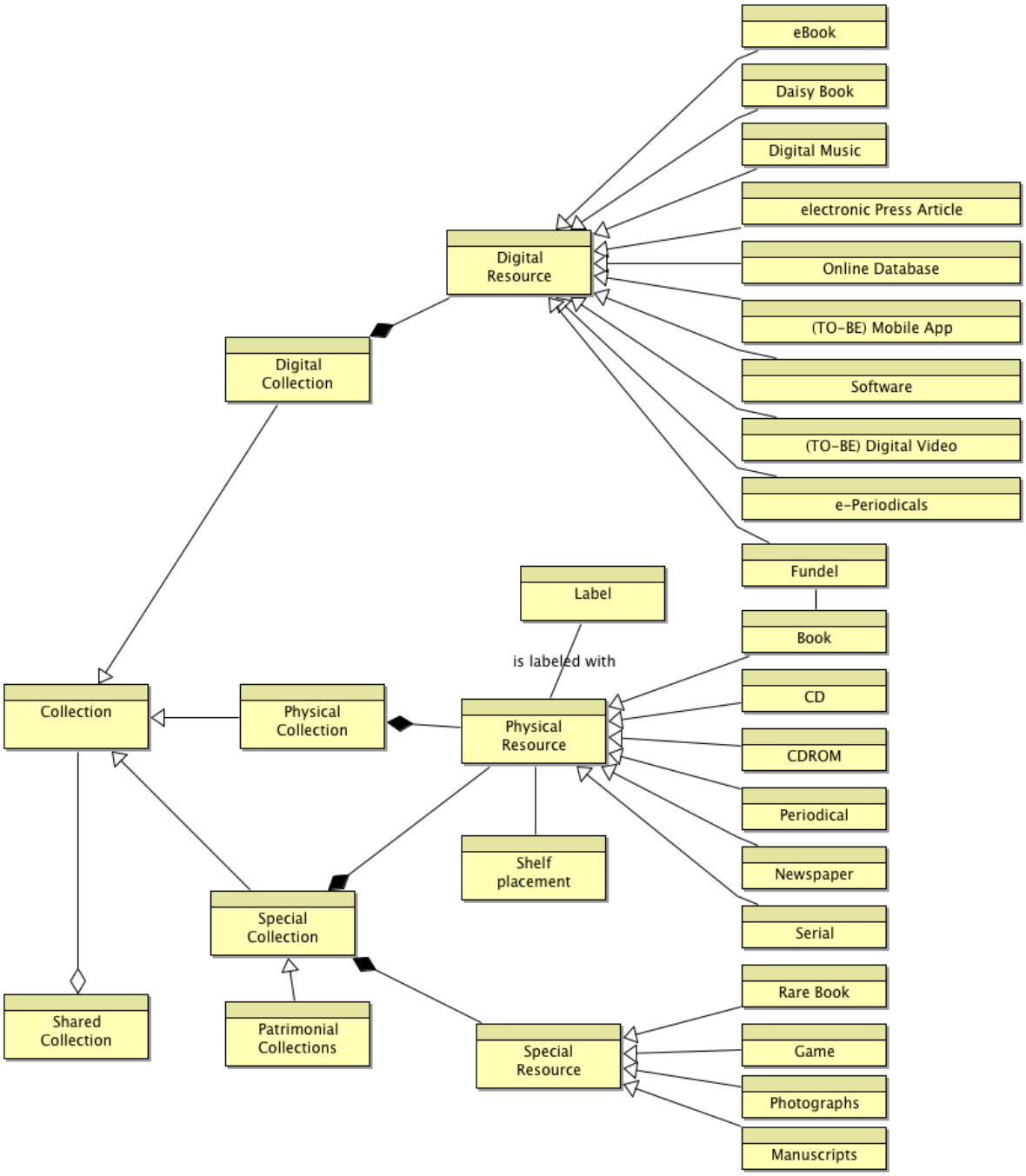


Figure 40: Business Objects - Collections

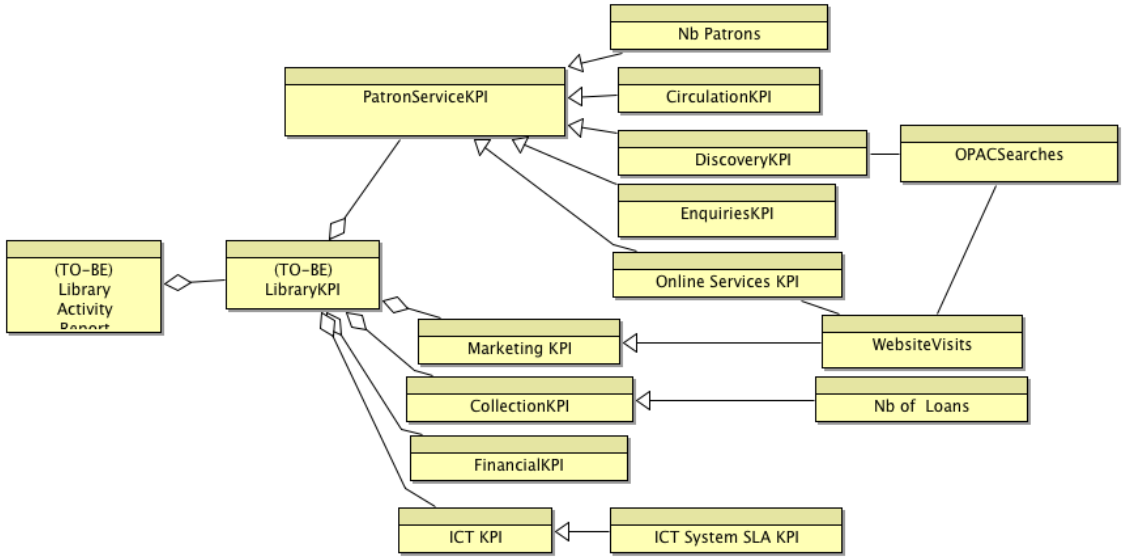


Figure 41: Business Objects - Library Management

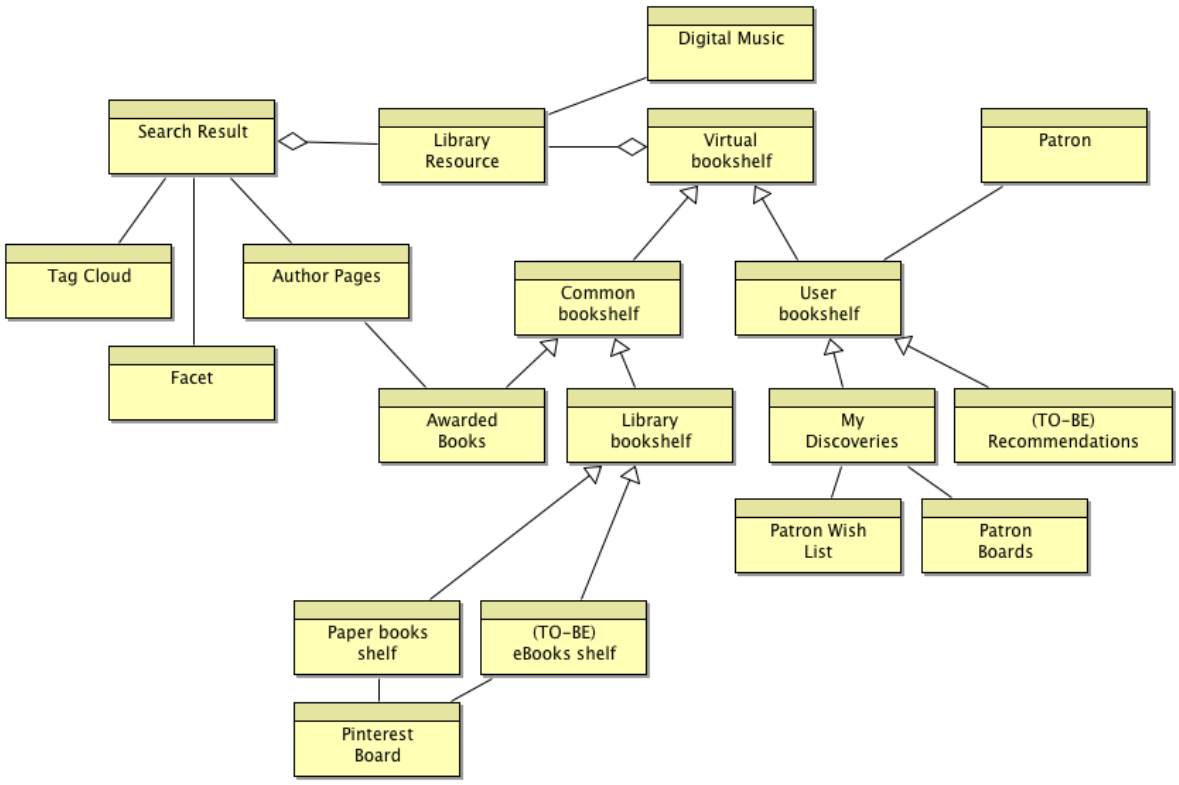


Figure 42: Business Objects – Discovery

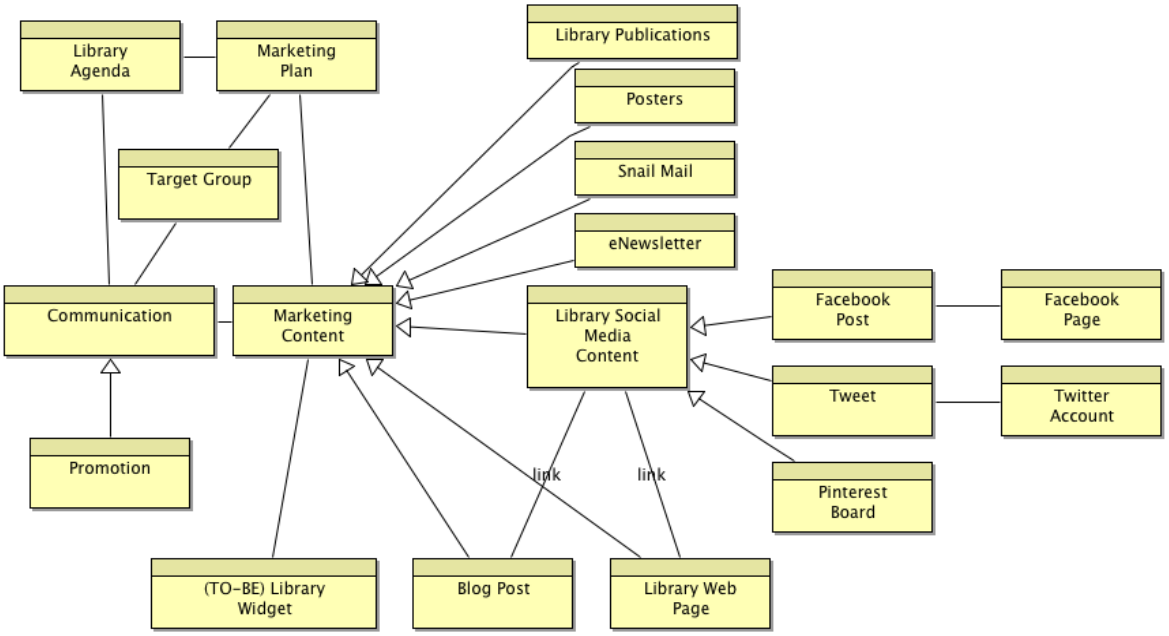


Figure 43: Business Objects – Marketing

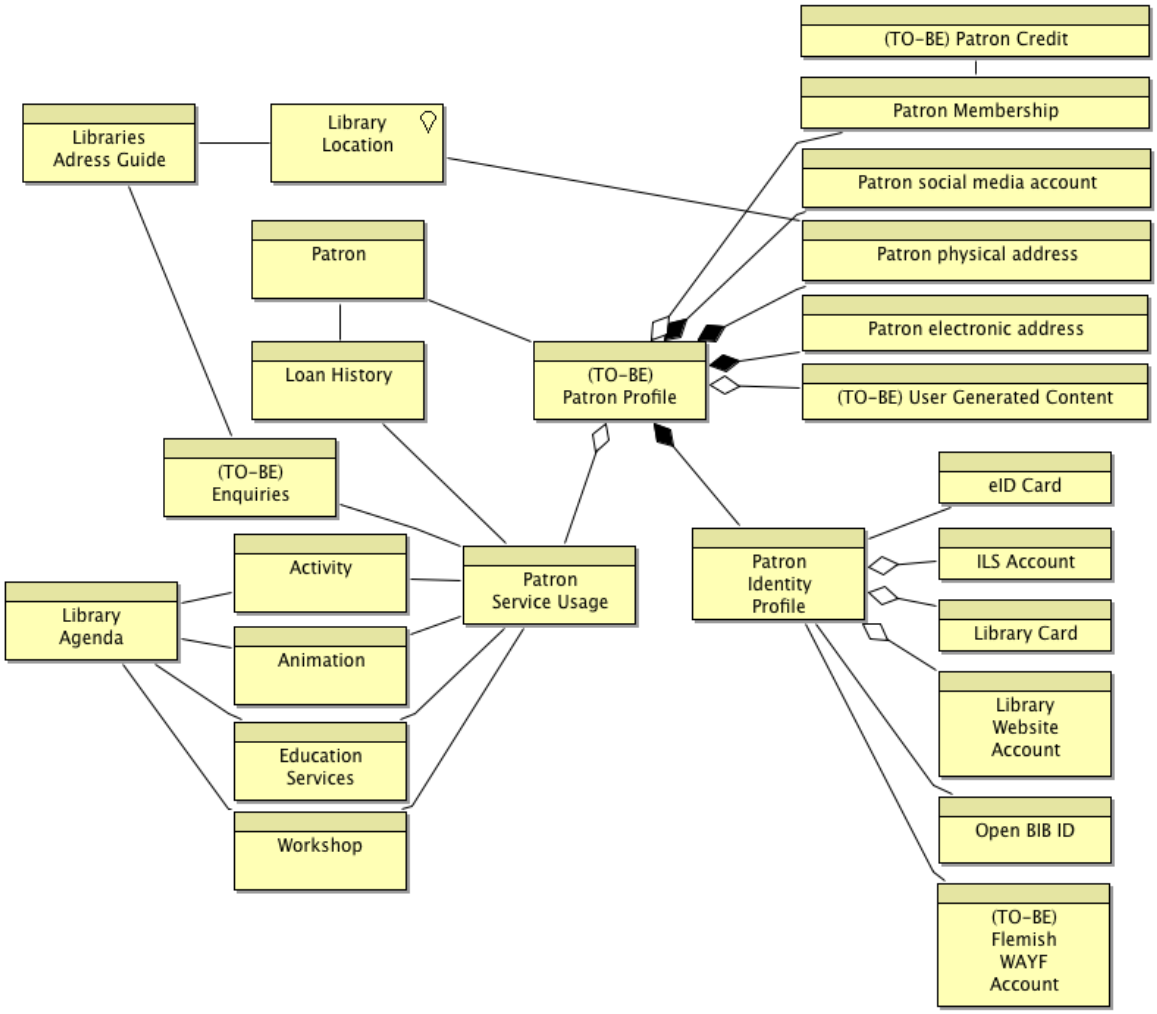


Figure 44: Business Objects - Patron Profile

Library Information Model

If the libraries adopt SOA Governance, the detailed information model will gradually be built using the definition of SOA Services' inputs and outputs. Those require specifying the library's information structure (e.g. by using well-defined XML Schemas).

TO-BE Business Objects

The following business objects are new in the TO-BE library information architecture:

- e-book Business Models (e.g. Business Rules for Patron-Driven e-book Acquisitions)
- Electronic Rights
- Library's e-book Lending Contract
- Work-Expression-Manifestation-Item (WEMI) FRBR metadata
- Digital Video
- Mobile App
- Library Widget
- Electronic payment
- Library Activity Report
- Library KPI
- Enquiry
- Patron Credit
- Patron Profile
- User Generated Content
- Digital Loan
- Digital Video Access
- e-book Access
- e-book Loan
- e-book Display (virtual bookshelf)
- Recommendation
- “WAYF” Account

Master Data Management

When library business objects are identified and documented, it is possible to map them to the Application architecture in order to clearly specify which systems are responsible for a given business object's master data. The goal is to have a clear view on what systems manage the business object’s data.

For example, Open BIB ID can be the master of the “Patron Identity Profile”. The patron Identity profile establishes the link to all other identity data in other systems. In the following scenario, the website is the master of the library website account, but not the master of the social media account. Therefore, if the library website wants to retrieve the social media account it should do it through the Open BIB ID SOA Data services. The website can then decide to make a copy and cache the social media account, but it is aware that it is not the master of this data and that there is a risk that the data is outdated.

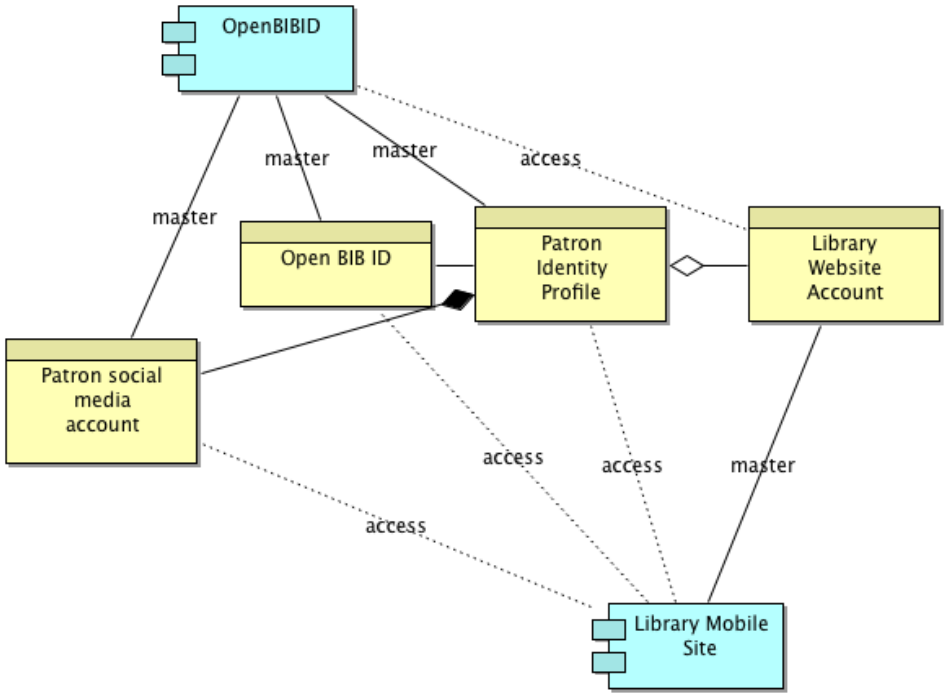


Figure 45: Applications and Master Data Management

Identifying master data sources helps optimise the cost of duplicating data in different systems. If all systems claim to hold the master data, libraries will face many synchronisation headaches.

5.4 TO-BE ICT Applications

In the future, libraries will continue to use a certain number of applications to support their business processes.

Furthermore, the evolution analysis indicates that several new applications will most probably appear in the architecture.

Among the new applications, the introduction of a SOA stack is suggested.

Some applications will be fully dedicated to supporting a particular business service. Others applications, such as the traditional ILS, can support multiple business services. The architectural blueprint must provide guidelines for applications that span across multiple business services. This will be illustrated with the requirements for the “ILS of the future”.

5.4.1 New Library Applications

During the workshops and our analysis, the following systems were identified and should be introduced in libraries' ICT landscape in the future:

- RDA Cataloguing system (Collection Management)
- Electronic Rights Management (Digital Collection Management)
- Collaboration and project management tools (Library Management and ICT)
- Library hub: ESB, BPM, BRMS (SOA Tools) (ICT)
- Enquiry Management System
- Digital Resource Circulation (e-books loans) (Patron Services)

- Semantic Web Publishing (Patron Discovery Services)
- Identity Federation/SSO with business partners ("WAYF" system) (Patron Services)

The SOA perspective describes how these new applications should be integrated with the existing ones.

5.4.2 Integrating library applications with SOA

The OSLO application portfolio should be rationalised in order to reduce the integration spaghetti and its associated cost. However, libraries will not be able to return to a sector-wide integrated system. The richness of the business service portfolio means that libraries will continue to operate a certain number of different systems.
The blueprint suggests to adopt SOA as a pragmatic way to implement a "Systems integration governance" in the library sector and ensure that systems are properly integrated (loose coupling of IT systems).

5.4.2.1 Library hub

The proposed ICT blueprint follows a concrete recommendation: organise and connect libraries' ICT systems around a "**library hub**".

All libraries' business interfaces are then connected to the library hub. The library hub could be connected to partner's hubs (e.g. municipality ESB).

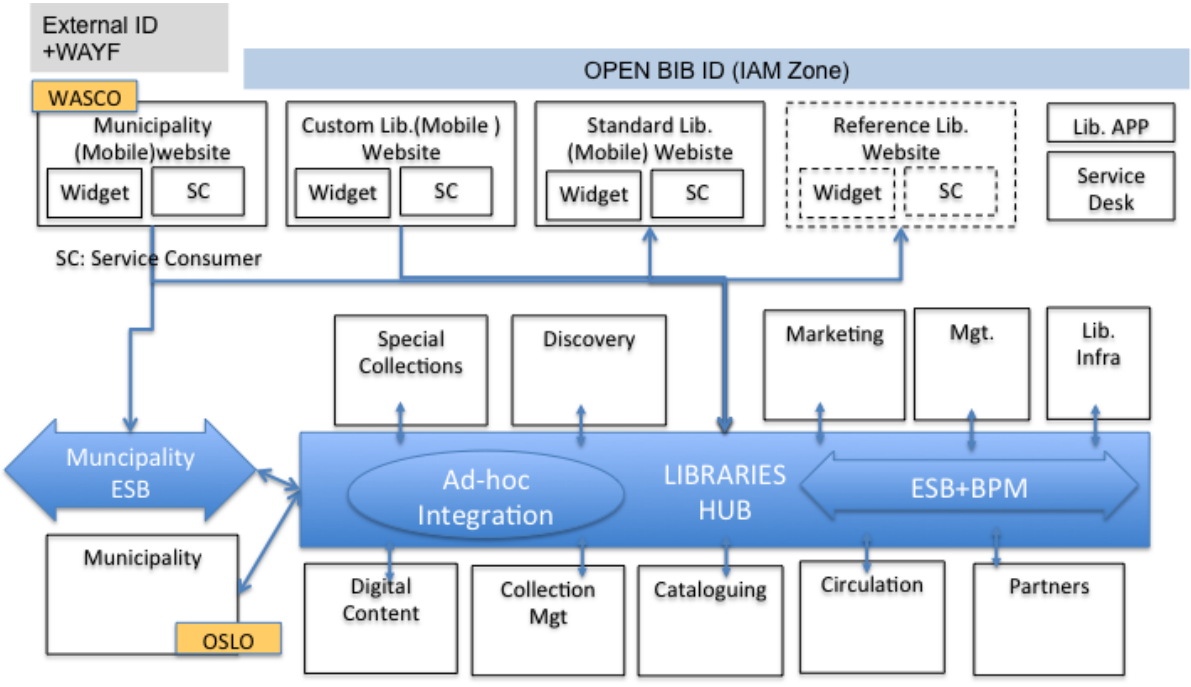


Figure 46: Library hub Blueprint

WASCO and OSLO are indicated simply as a reminder that those V-ICT-OR projects could influence the related business services.

The library hub is based on the following principles:

- The libraries cares for both SOA and ad-hoc integration

- The "integration governance", which cares for both ad-hoc and SOA integrations, governs the library hub.
- The library hub's SOA stack contains an ESB and a BPM suite
- Business Services' Services are exposed to other business services via the Library hub
- The library hub can be integrated with Open BIB ID to provide security aware services.
- The library hub can ensure a good usage of the library's SOA services (performance, security, service monitoring, SLAs…).
- Within the boundaries of a business service, other integration methods could be acceptable depending on the ICT Integration Governance rules (e.g. SIP2 between ILS and Public PCs)

Each business service relies on one or more ICT systems. Those library ICT systems should be able to expose services to the library hub through their APIs in order to allow other functional domains (mostly Web & Mobile) to consume data and functionalities.

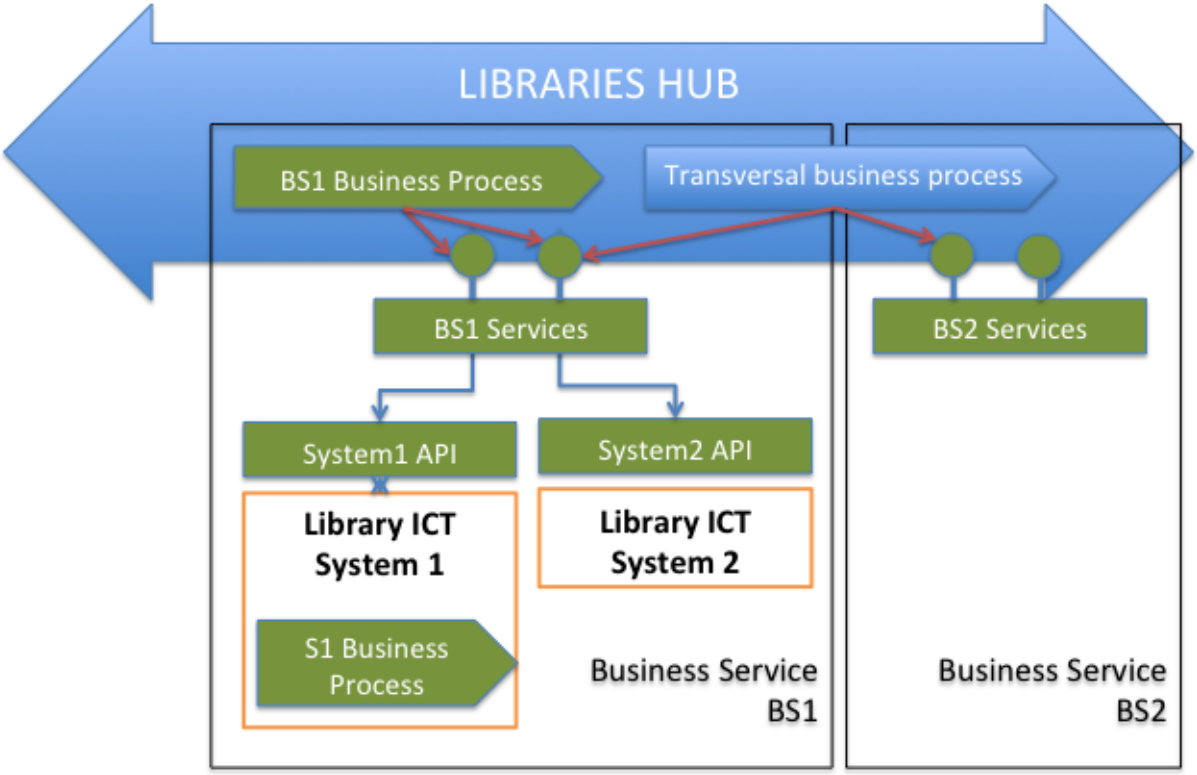


Figure 47: Library Business Services exposing SOA Services via the Library hub

"Business Services" interfaces should be independent of the underlying applications. Using a "Business Service" layer allows to improve a business service without impacting other business services.

Some library business processes will reside in a functional domain on the hub or in a specific ICT system (e.g. RDA in the cataloguing domain), while other business processes cross the boundaries of business services; they are "transversal business processes" (e.g. marketing of newly arrived books on the web). According to the blueprint, transversal business processes could reside within the library hub in the BPM layer. In other words, the library hub can host

business processes. In extreme cases, some business services could be implemented with a single application: the library hub.

The library hub can be implemented by a shared centralised SOA stack or by a federation of ESBs (Federated ESB architecture). Smaller libraries should not attempt to run their own ESBs as this requires specific SOA skills.

5.4.2.2 SOA overview

Libraries will gradually develop and deploy “Library SOA Services”, classified by business service. The library's SOA can be represented using the SOA Reference Architecture.

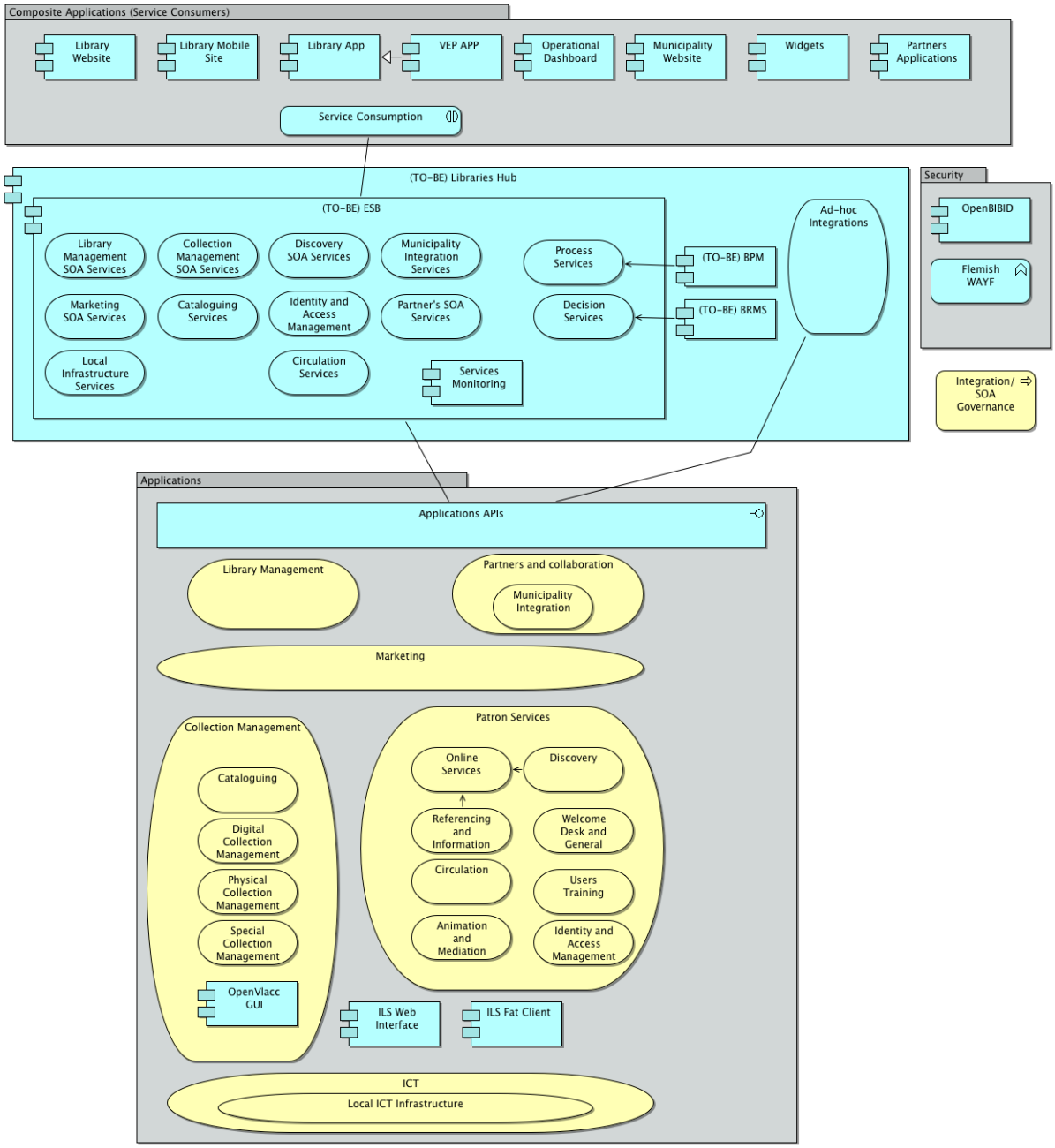


Figure 52: SOA Architecture for Libraries

5.4.2.3 Library SOA Services

The library SOA services are standardised and system-independent versions of the underlying ICT systems' APIs. They allow to integrate the library systems using a "LEGO" approach. The following figure shows a potential SOA Service portfolio for the libraries.

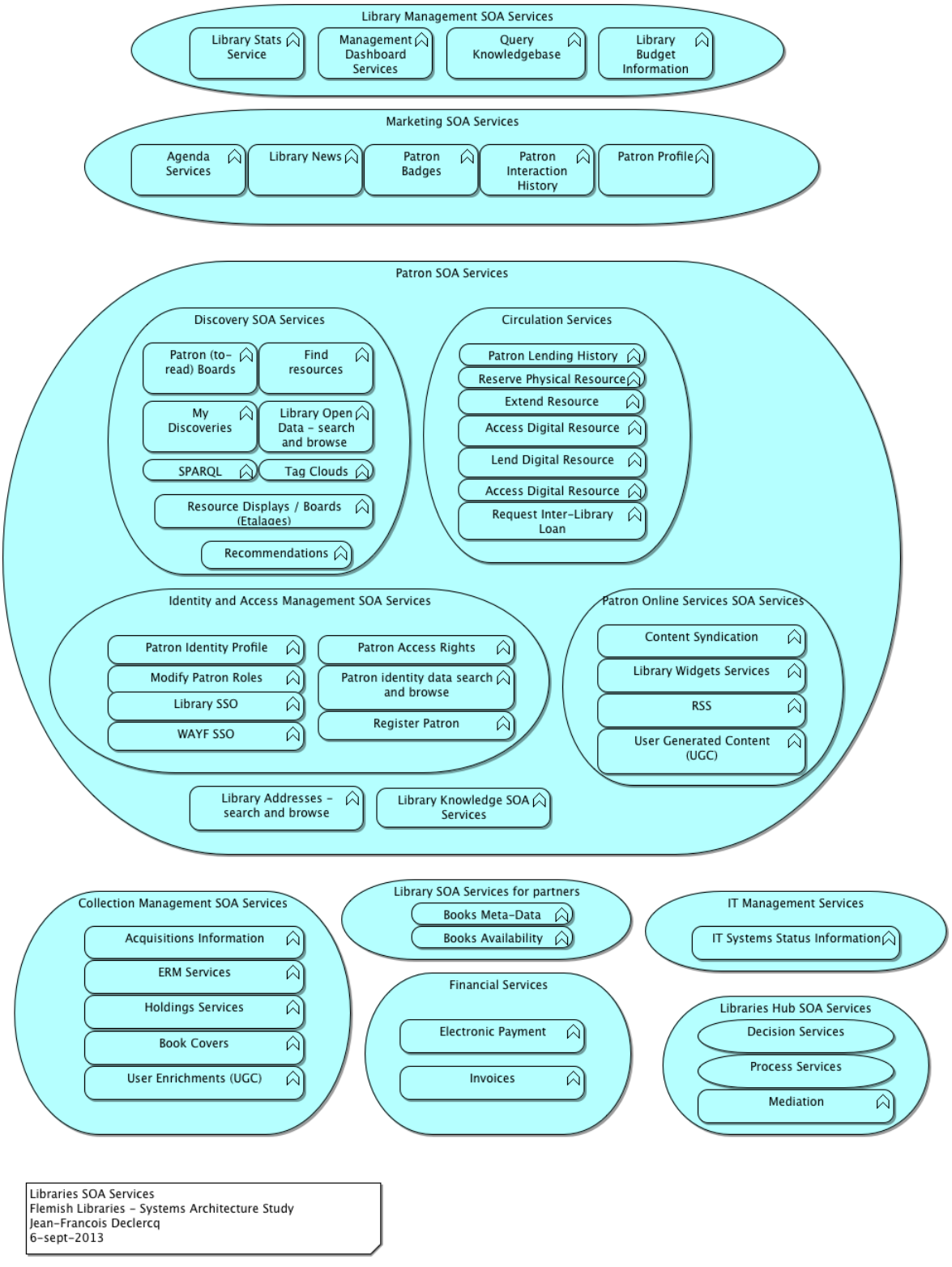


Figure 53: Potential Libraries SOA Services Portfolio

The figure lists about 50 candidate SOA services that could be set up by the libraries. If we consider the service variations and the underlying systems' APIs integration, we advise libraries to manage the setup and operation of those services with a SOA infrastructure.
Not only will libraries need to provide SOA services, they will also consume services from partners.
The following figure lists some SOA services that are or will be consumed by libraries.

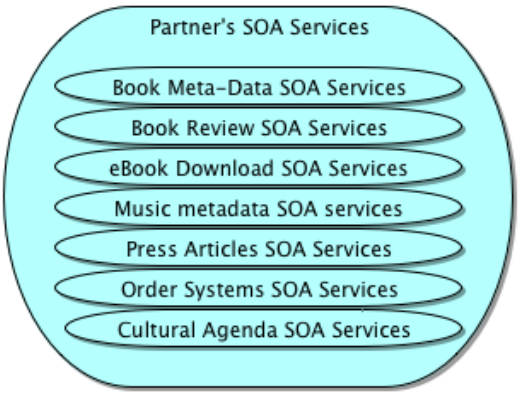


Figure 54: SOA Services provided by libraries' partners

5.4.3 From "Integrated Library System" to "Modular Library Systems"

Is there a place for the "traditional" ILS in the blueprint?

The rather monolithic traditional ILS suffers from several problems in a modern architecture. The ILS functions and data are not always accessible to external systems. The data and functions can also be completely fixed into the package, making it hard to exploit them from an external system.

In order to better support the library business services, ILS vendors will have to improve their systems by:

- Making them modular
- Making them open with well designed APIs, standards and SOA Services.

Within a "**modular"** offering, libraries must be able to purchase a selection of ILS modules only. For instance, if the Acquisitions module is not necessary, the library should not have it deployed and have to pay for it.

A library software vendor can still, on top of its modules, offer added-value productivity components such as dedicated professional tools for the library's collaborators (dashboard, workflow, specialised GUIs…). These make sure that the end-user only has to use one application to control all the modules.

The following figure illustrates a possible design for modular library systems. Module data and functions are exposed via application services plugged into the library hub.

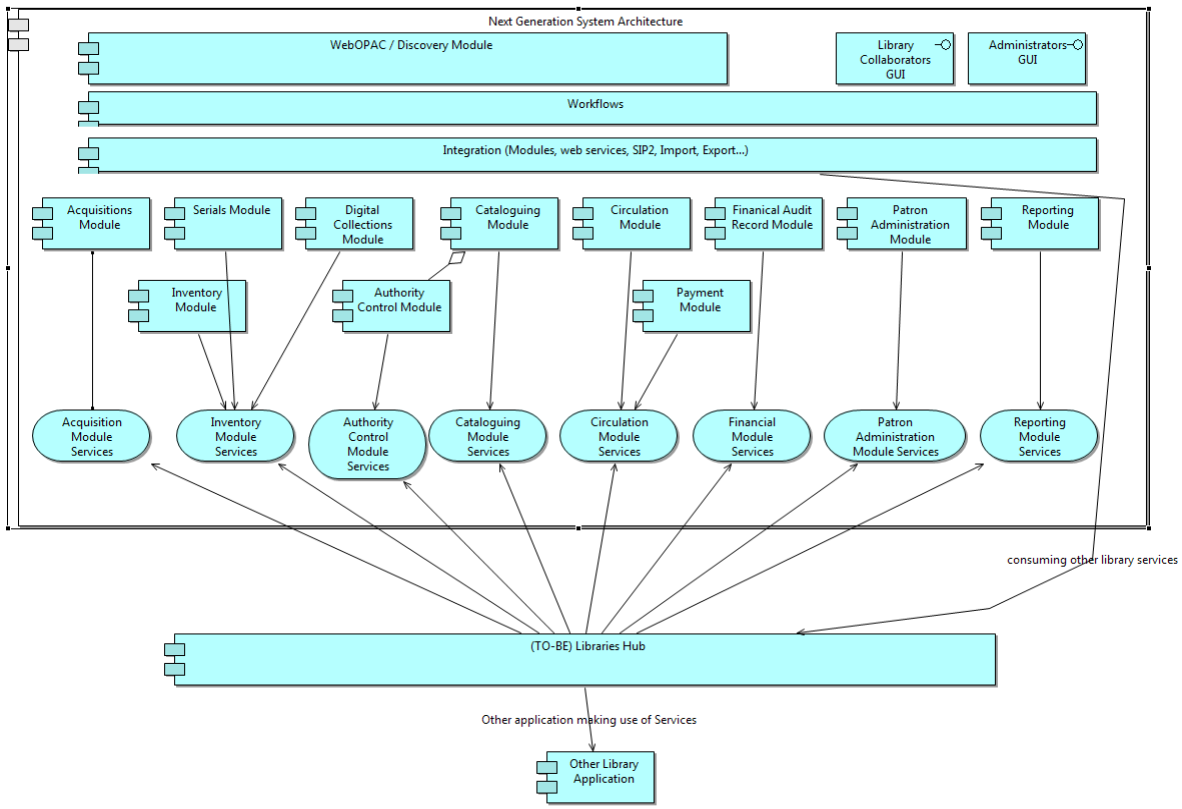


Figure 55: The next generation library software: Modular and Open

The following figure shows some examples of functionalities for each module.

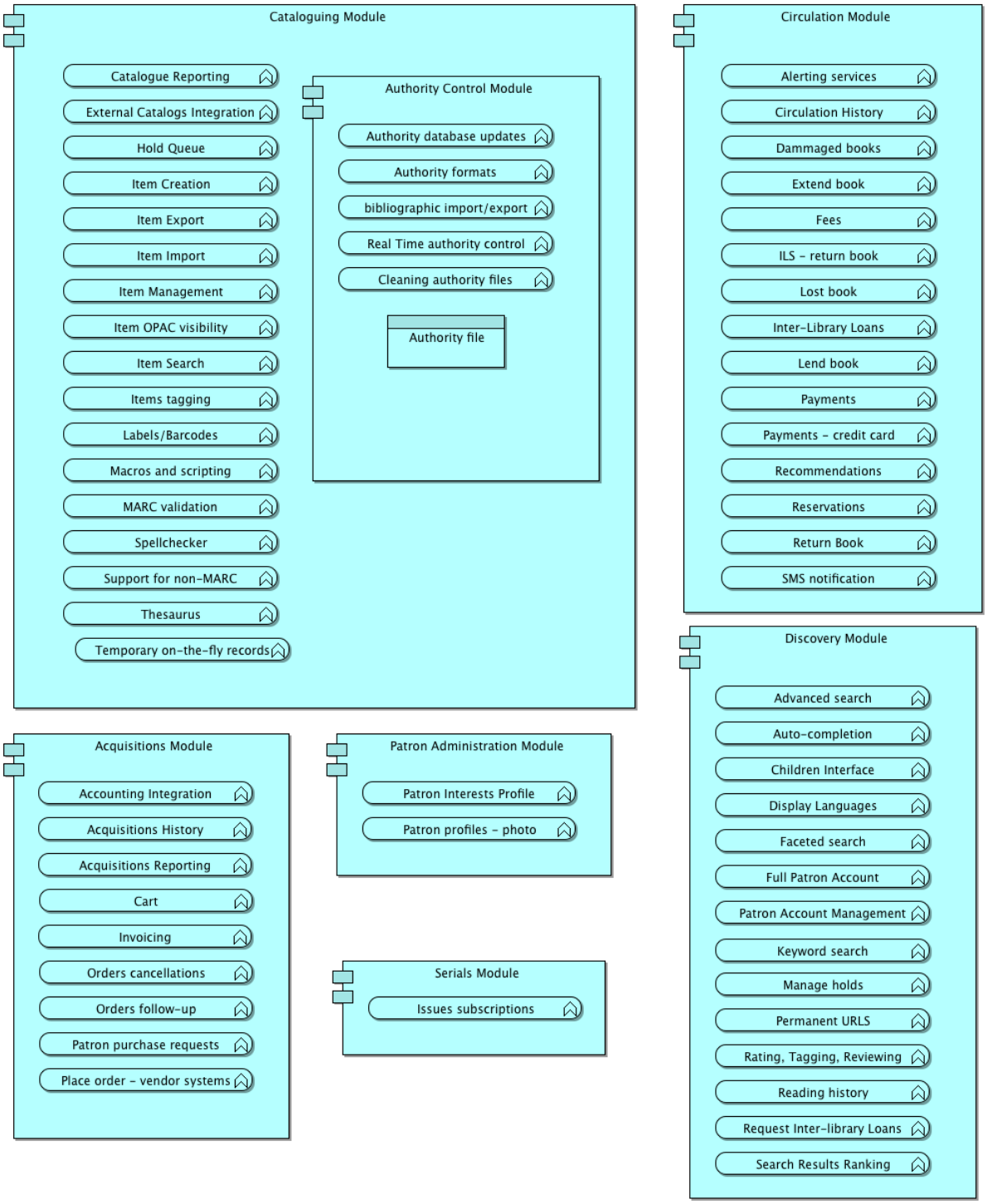


Figure 56: Next Generation ILS Sample Functionalities per module

ILS vendors should invest in requirement analysis and the development of innovative modules that libraries will need or want in the future.

An example of modular ILS (in the academic field) is Kuali-Ole. Kuali-Ole is built on four main modules (see https://www.kuali.org/ole/modules)

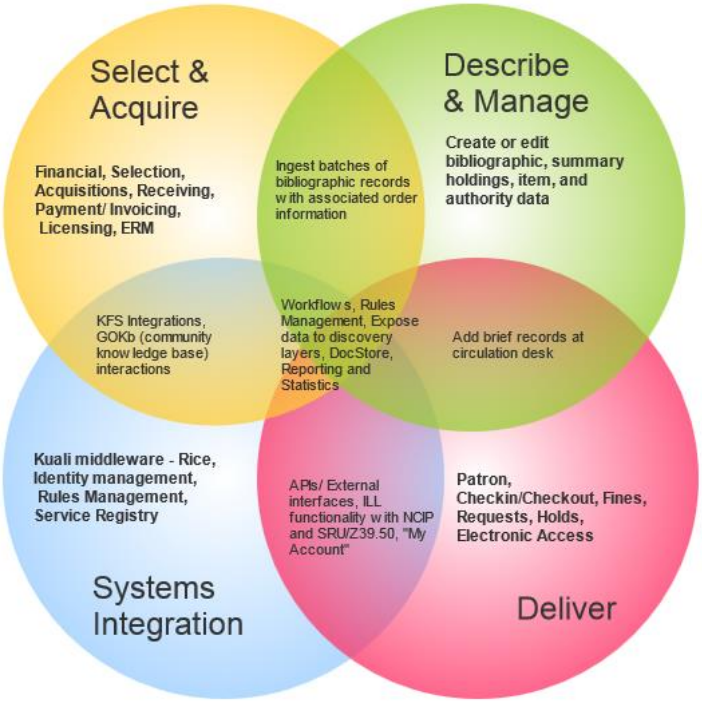


Figure 57: Kuali-OLE Modules

An "**open**" ILS provides complete and well designed, well documented APIs out of the box. Furthermore, by adopting business standards (e.g. SRU/SRW, OAI-PMH, NCIP…) or technical standards (e.g. REST, SOAP, XML, MARC,ONIX…), it will be easier for libraries to integrate the ILS in the SOA.

Vendors cannot deliver ready-to-use SOA Services unless they are aware of the library's SOA Governance. It is the libraries' role to specify their SOA Governance standards so that ILS vendors can produce "plug and play" SOA services. However a well-designed "business oriented" ILS Module API would greatly help libraries produce SOA services based on the ILS. By "business oriented" API, we mean that the API's documentation should be understandable for the library collaborators, even if they do not work in IT.

The libraries' SOA governance should also specify a "Library Canonical Data Model", which is a common data model for all libraries. The documentation of the ILS data model by the vendor can also help libraries produce ILS Data Services and plug them into the SOA.

ILS Modularity and cost optimisation

As soon as the ILS becomes modular and open, libraries will be able to optimise their investments by:

- Investing more in those ILS modules that deliver the highest value
- Incurring costs only for the modules that are used
- Sharing ILS modules when applicable and desirable

The cost optimisation of the ILS systems is a must for the library sector. It is a pre-requisite if libraries want to fund the innovations required to **offer patrons modern library services**.

With modular library systems, the library has full freedom to choose different providers for different modules. For example, the cataloguing module can be implemented using the central catalogue (Open Vlacc), the Digital Collections module can be implemented using the e-book platform (VEP), and the inventory module can be implemented using a local solution.

All ILS modules do not need to be merged and/or to be included in one large shared infrastructure (data centre), as long as their operating cost is in line with the business value of the business services and processes that they serve. This study identified roughly 40 processes. Twelve of these 40 processes (i.e. 30%) depend on the ILS/PBS. Each library should estimate how much the ILS cost can weigh in the total operating cost for the library' ICT systems. Sharing ILS modules, systems, or infrastructure would obviously help reduce the operational costs by reducing the cost of the underlying infrastructure and the cost of integrations (fewer systems to integrate).

5.4.4 Library applications overview

As soon as Business services have been identified, it is possible to place applications in the corresponding business service. The AS-IS diagram can rapidly be reorganised as follows:

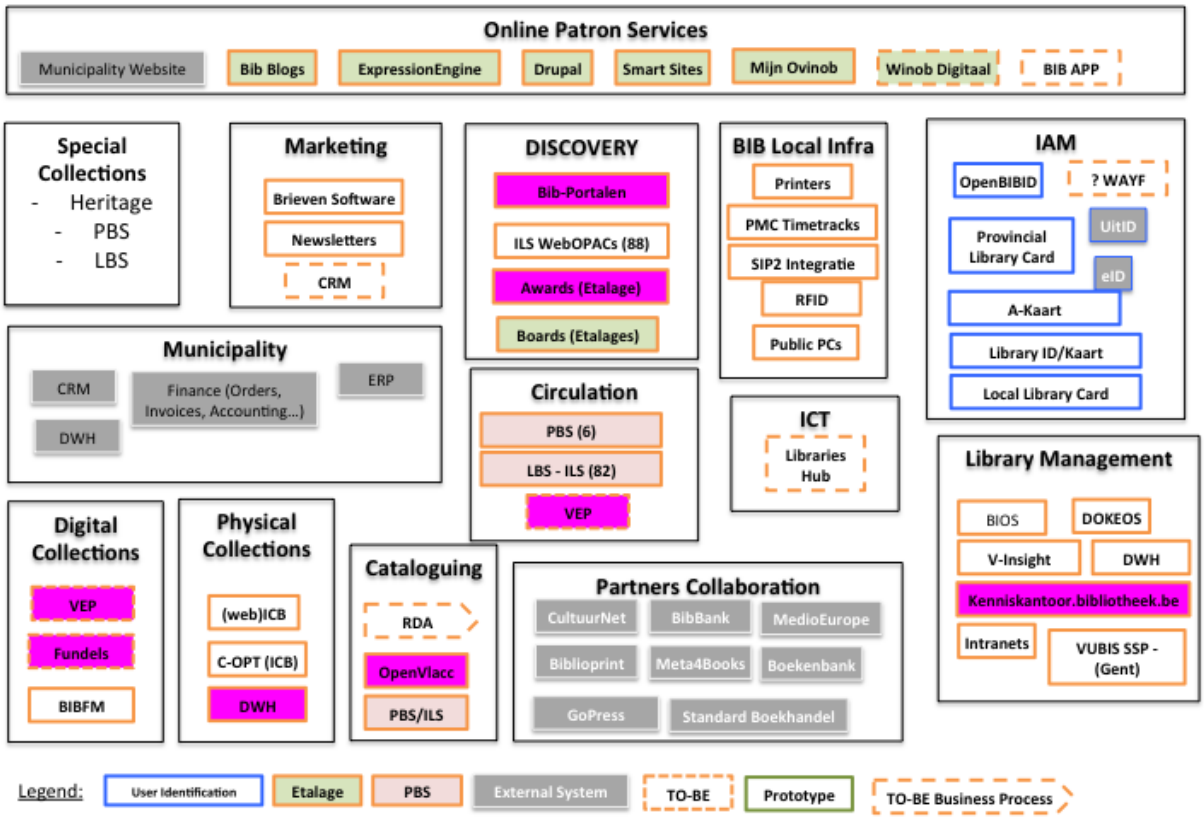


Figure 58: Rapid allocation of AS-IS Applications to Library Business Services

From there, the application portfolio had to be re-worked to get to the blueprint:

- As suggested in the above paragraph, the ILS has been “modularised” so that each ILS module can be allocated to the right business service.
- Some specific applications were made more general:

    - Suppliers Ordering Systems instead of MedioEurope, BibBank, Standaard Boekhandel…
    - Municipality card system instead of “A-Kaart”
    - Press Articles instead of GoPress
    - Online Database instead of NBD Biblion
    - e-book suppliers instead of Centraal Boekhuis
    - e-book Metadata suppliers instead of Meta4Books
    - Book metadata suppliers instead of Boekenbank
    - Music metadata supplier instead of Muziekweb CDR
    - Integral Collections Management instead of ICB and C-OPT
    - Virtual (book)shelves instead of the various specific virtual (book)shelf systems
- The new systems were introduced as a result of the initiative recommendations. Those systems have a name starting with (TO-BE)

The optimisation of the ICT architecture consists in optimising each application’s implementation, for each business service.

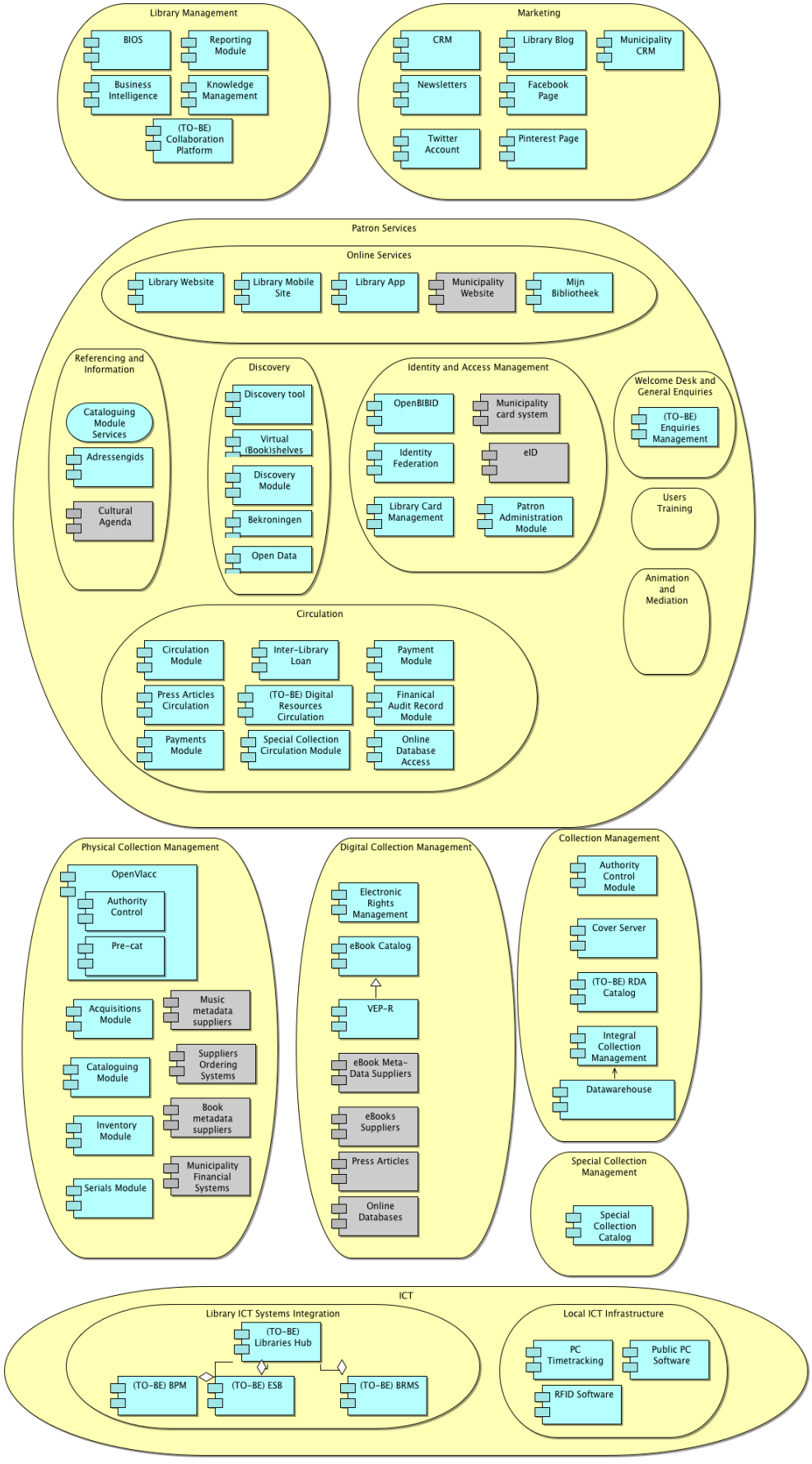


Figure 59: Library ICT Systems per Business Service

5.5 TO-BE Technology Layer

Due to the number of applications that libraries use, the future technology layer can remain very rich. Each application could have its own configurations for network, servers and system software resulting in a large technology stack.

Controlling the technology stack

Leaving the size of the technology stack unchecked can result in higher costs for the library. Indeed, each technology requires certain skills in order to ensure its maintenance and evolution (e.g. operating system upgrades). Even if the technical work is outsourced to a supplier, a partner or the municipality, the library will indirectly incur the related technological costs. It is therefore important to control the size and the expansion of the technology layer.

There are several ways to control the complexity of the technology layer:

- Reduce the number of application types, which will result in a consolidation of the underlying technology
- Manage the technology portfolio on a sector-wide scale by agreeing on technology standards in the sector before purchasing a new technology or application. For instance, the Belgian Ministry of Finance publishes its list of technology standards online: http://financien.belgium.be/nl/over_de_fod/geschiedenis_modernisering/ict/ict_fundamenten/
- Compare the library technology with peers (other libraries) and align on common best practices.

Local Infrastructure

Depending on the library's strategy for patron services (library role), the local technical infrastructure can become mission critical:

- The further evolution of the digital collections (e.g. digital videos in apps or e-books) will require an adequate, **rather powerful public PC infrastructure** as well as a **strong internet connection** for the use of externally hosted or shared applications.
- The **Wi-Fi and internet connection** must possibly allow new devices to connect (patrons' tablets, smart phones, PCs or e-Readers)
- The **self-service RFID equipment** must have high SLAs as soon as a majority of patrons are used to it.
- Premium Services (e.g. e-book credit for the VEP) will require a strong availability of the **point of sale**.

Cloud

In the future, libraries should be able to better leverage the advantages of shared data centres, virtualisation and cloud solutions. However, too large a number of different clouds can become counter-productive in terms of network communications and supplier management. Ideally, there should be only two large private clouds: a municipality cloud and a library cloud.

5.6 TO-BE Architecture – Conclusion

This study allowed to draw up a blueprint that can be used by public libraries in order to think about their ICT systems architecture.

The blueprint shows the complexity of running a public library:

- Over 8 business services
- Over 50 business processes
- Over 100 business objects
- Over 50 families of SOA Services
- Over 60 application types
- Over 30 technological components (See AS-IS Libraries Technology Layer)

The blueprint includes some recommendations for the future:

- The adoption of SOA with a library hub
- The transition from Integrated systems to modular systems, allowing the library to choose alternatives sources for each module

6 Roadmap

The analysis of the architecture's evolution identified several potential initiatives for the innovation or optimisation for each business service. If these initiatives and recommendations are followed, the current systems architecture will gradually evolve towards the recommended blueprint. As initiatives cannot all be undertaken immediately and independently of each other, it is preferable to identify groups of initiatives by “work zones”.

Seven such work zones have been identified:

1. Business Intelligence: Libraries need to use better tools for the analysis and reporting of their operations. It is important for the library's management to get the best data around collection management (acquisitions), finances, patron services (circulation), etc.

2. ICT Maturity: The library sector needs to improve many of its ICT processes. This is very important for the correct execution of ICT related projects.

3. Web Presence: The web (including mobile and apps) will continue to be an important channel for libraries, and the integration between the web and the libraries' business processes must be further developed.

4. Identity and Access Management: The future of Patron services is a personalised experience; libraries therefore need to continue to invest in IAM and CRM solutions.

5. Digital Collections: Libraries will further integrate digital products into their collections, such as e-books, digital music, digital videos, software, apps…

6. Collection Management and Cataloguing: Some collection management processes still can be improved (e.g. acquisitions), and cataloguing processes will change towards semantic web concepts in the coming years (e.g. BIBFRAME, RDA…).

7. ICT Architecture consolidation: the optimisation initiatives offer different ways to consolidate the global ICT architecture. This will require working on the harmonisation and the standardisation of the digital library system's architecture. Systems that handle stable business processes (circulation, user registration…) should be consolidated in order to reduce the architecture's complexity and maximise cost-efficiency.

There are two important pre-requisites for the success of the seven work zones:

- **Marketing**: without an integrated marketing plan, it will not be possible to design IAM, Web or Collection Management solutions that will deliver the desired patron experience
- **IT Governance**: the work zones will require clear governance in order to determine who makes which decisions and how decisions on shared ICT work are taken.

The following table illustrates how the initiatives can phased through the work zones.

Work Zones	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5
IT Governance	IT Governance Principles for Public Libraries				
Marketing	Integrated Marketing Plan				
Business Intelligence	Analysis and Decision tools : Global Datawarehouse, KPIs, Dashboards…				
ICT Maturity	Libraries (virtual) ICT organization clarification Shared project management platform	Global Collaboration/KM system			
Web Presence	Develop and promote business and technical **guidelines** for library websites	Reference Website V1 Development	Reference Website Adoption	Reference Website - WASCO prototype	
Identity and Access Management	Continue IAM systems integration with OpenBIBID.	Libraries will have to **personalise the patron experience** in order to stay competitive. It will require owning good **CRM** and Identity management systems.			
	Lobby the Flemish authorities to establish a sector-wide identity management infrastructure (**WAYF** like)				
Digital Collections	eBooks Circulation including light ERM (version 1) on the basis of VEP-R			Integrated Digital Circulation Process (BPM/BRMS based)	
Collection Management and Catalography		Decision: Libraries Leadership for Semantic Web/Linked Data New RDA System Business Case Special collections strategy statement Aankoopbeleid en bestelprocessen meer integreren en meer automatiseren	New RDA system	Semantic Web Publishing	Unified special collections management
ICT Architecture consolidation	Physical Resources systems optimization	Common CRM Strategy Definition Libraries Hub ROI Calculation and Decision Libraries Hub Setup Integration/SOA Governance Development Standardization of the physical resource circulation process Virtual Bookshelves Systems Consolidation	Marketing tools harmonization Purchasing process with BPM Platform		

7 Conclusion

From a sectorial point of view, the Flemish public libraries' systems architecture is and will remain rather complex:

- more than 8 business service families
- more than 50 business processes
- more than 60 types of ICT systems
- up to 313 locations with a local ICT infrastructure

A single library can use up to 30 different ICT systems.

The requirements related to ICT systems will continue to grow: in order to offer a modern experience to patrons, libraries will have to evolve towards integrated multi-channel and multi-media services. This will require the introduction of new ICT systems.

For each business service, this study has identified possible optimisation and innovation initiatives that could be undertaken. These initiatives have been divided into seven "work zones":

1. **Business Intelligence (BI)**: Provide better analysis and decision-making tools for the library's management and operations
2. **IT maturity:** Improve the public libraries' "ICT organisation" (IT Processes, IT Tools, SLAs…)
3. **Web presence**: Collaborate on common solutions for websites, mobile sites and mobile apps.
4. **Identity and access Management (IAM)**: enhance the relationship with patrons, with a view to progressing towards personalised services
5. **Digital collections**: give libraries a strong position in the digital space
6. **Collection management and cataloguing**: Optimise and modernise collection management processes, bringing them up to date in order to benefit from productivity gains
7. **IT Architecture consolidation**: Move towards a modern streamlined digital library systems architecture by - among other transformations - transitioning from Integrated Library Systems (ILS) to a Modular architecture.

The consolidation of the systems that handle stable business processes is a necessary condition for being able (technically and financially) to undertake innovative initiatives. An initial optimisation investment (selection of optimisation initiatives) can allow the sector reduce a portion of its ICT costs and help fund innovative projects.

There are two important assets required for a good progress of the work zones:

- **Marketing**: the BI, Web, IAM, Collection Management and Digital collections work zones require the best possible comprehension of the Flemish public libraries' "integrated marketing plan".

- **IT Governance**: the IT architecture consolidation and IT Maturity improvements will be greatly facilitated by the development of a global ICT Governance for the library sector, in agreement with the Provincial and Municipal ICT parties.

Working simultaneously on the seven work zones and the two requirements, all the while managing the complete digital library system architecture, would result in too large an overhead for any Flemish public library. Only a strong sectorial collaboration across Flemish public libraries will enable the transformation of the current system's architecture into an optimised and innovative digital library system architecture.

8 Glossary / Terminology

English	Nederlands	Français
"BBC" Municipality Direction and Management Cycle	**BBC** Beleids- en Beheerscyclus in Gemeenten	**"BBC"** Outils de gestion communaux.
AS-IS Current state (of the architecture)	**AS-IS** Huidige situatie (van de architectuur)	**AS-IS** Situation actuelle (de l'architecture)
BI Business Intelligence	**BI** Business Intelligence	**BI** Business Intelligence
Blurb	**Flaptekst**	**@todo flaptesk**
Boek.be is the union of the Flemish book industry. The organization brings together the Flemish booksellers (VVB), publishers (VUV) and importers (VBI).	**Boek.be** is de vakvereniging van het Vlaamse boekenvak. De organisatie groepeert de Vereniging Vlaamse Boekverkopers (VVB), de Vlaamse Uitgevers Vereniging (VUV) en Verenigde Boeken Importeurs(VBI).	**Boek.be** est l'union de l'industrie du livre flamand. L'organisation rassemble les libraires (VVB), les éditeurs (VUV) et les importateurs (VBI).
BPM Business Process Management	**BPM** Business Process Management	**BPM** Business Process Management
BRMS Business Rules Management System	**BRMS** Business Rules Management System	**BRMS** Business Rules Management System
BruNO Brussels network of flemish public libraries. http://www.bruno.be/	**BruNO** Brussels Netwerk Openbare bibliotheken http://www.bruno.be/	**BruNO** Réseau bruxelloise des bibliothèques publiques néerlandophones. http://www.bruno.be/
Consignments	**Zichtzendingen**	?
CRM Customer Relationship Management	**CRM** Customer Relationship Management	**CRM** Customer Relationship Management
DIGB-SA Digitaal Bibliotheek Systeem Architectuur (studie)	**DIGB-SA** Digital Library System Architecture (study)	**DIGB-SA** (Etude sur) l'architecture des systèmes de la librairie digitale.
DWH Data warehouse	**DWH** Data warehouse	**DWH** Entrepôt de données
Etalage (van boeken)	Online book display ?Online book boards	**Expositions virtuelles**

English	Nederlands	Français
IAM Identity and Access Management	**IAM** Identiteit en toegang management	**IAM** Gestion des identités Gestion des droits d'accès
ILMS Integrated Library Management System	**Bibliotheeksysteem**	**SIGB** Système Intégré de Gestion de Bibliothèque
ILS Integrated Library System	**Bibliotheeksysteem**	**SIGB** Système Intégré de Gestion de Bibliothèque
LLS Local Library System	**LBS** Lokaal Bibliotheeksysteem	SIGB local
NCIP NISO Circulation Interchange Protocol http://www.niso.org/workrooms/ncip	**NCIP**	**NCIP**
Patron or User	**Gebruiker**	**Usager, e-Usager**
pBook Printed book	**pBook** Printed book	**pBook** Printed book
PBS Provincial Library System (Flanders). It is a shared ILS for libraries of the province.	**PBS** Provinciaal Bibliotheeksysteem	**PBS** Système Provincial de Gestion de Bibliothèque (Flandres et Bruxelles). Système SIGB mutualisé au niveau d'une province / région Bruxelles-Capitale.
PODC Plan, Organize, Direct, Control	**PODC** Plan, Organize, Direct, Control	**PODC** Plan, Organize, Direct, Control
Renewal	**Verlenging**	**Prolongation de prêt**
Resource (Book) processing	**Kastklaar maken**	**@todo kastklaar maken**
Shelving books	**Boek plaatsing**	**@todo boek plaatsing**
TO-BE Desired state (of the architecture)	**TO-BE** Gewenste situatie (of the architecture)	**TO-BE** Situation désirée (de l'architecture)
VGC-Brussel Flemish Community Commission of the Brussels-Capital Region.	**VGC-Brussel** De Vlaamse Gemeenschapscommissie in Brussel.	**VGC-Brussel** Commission communautaire flamande de la Région Bruxelles-Capitale.
WAYF (Security, SSO) "Where are you from ?" http://www.wayf.dk/en	**WAYF** (Security, SSO) "Where are you from ?" http://www.wayf.dk/en	**WAYF** (Security, SSO) "Where are you from ?" http://www.wayf.dk/en
Special Collection	**Speciale collecties**	**Collections spéciales**

English	Nederlands	Français
http://en.wikipedia.org/wiki/Special_collections	(Cfr Special collection provinces in appendixes)	
WEMI Work-Expression-Manifestation-Item	Werk-Manifestatie-Expressie-Exemplaar	Oeuvre-Manifestation-Expression-Exemplaire
BIBFRAME Bibliographic Framework Initiative http://www.loc.gov/bibframe/	**BIBFRAME** Bibliographic Framework Initiative http://www.loc.gov/bibframe/	**BIBFRAME** Bibliographic Framework Initiative http://www.loc.gov/bibframe/
OSLO Open Standards for local administrations in Flanders http://purl.org/oslo	**OSLO** Open Standaarden Lokale Overheden http://purl.org/oslo	**OSLO** Standards ouverts pour les administrations locales Flamandes http://purl.org/oslo
WASCO Webs & Apps Standards for the local administration (V-ICT-OR project)	**WASCO** Webs & Apps Standaarden voor de Converserende Overheid http://www.v-ict-or.be/nieuws/labels/wasco	**WASCO** Standards Web et Apps pur les administrations locales (project V-ICT-OR)

9 Appendixes

9.1 Een systeemarchitectuur voor de Digitale Bibliotheek

Study description on Bibnet's website (In Dutch)

- SysteemArchitectuurDigitaleBibliotheekContext.pdf
- http://www.bibnet.be/portaal/Bibnet/Over_Bibnet/Onderzoek/Systeemarchitectuur%20voor%20de%20digitale%20bibliotheek

9.2 AS-IS Capability Map

- 20130514-DIGB-SA-AS-IS-Capability-Map.xlsx
- EstimatedNbOfSystems.xlsx

9.3 AS-IS Analysis Slides

- 2013-05-08-DIGB-SA-AS-IS.pptx

9.4 AS-IS Library Value Chain

Yed and JPEG Versions of the AS-IS business processes

- 20130514-BibnetValueChain_V2-EN.graphml
- 20130514-BibnetValueChain_V2-EN.jpg
- 20130514-BibnetValueChain_V2_Circulatie.graphml
- 20130514-BibnetValueChain_V2_Circulation-EN.graphml
- BibnetValueChain_V2.pdf

9.5 Systems Integrations spreadsheet

This excel sheet counts the number of systems and the number of connections between them.

- 20130627-SystemsIntegrations.xlsx

9.6 TO-BE Workshops slides

- 2013-05-08-DIGB-SA-Catalografie.pptx
- 2013-05-23-DIGBSA-Common.pptx
- 2013-05-23-DIGBSA-GemeentelijkeIntegratie.pptx
- 2013-05-23-DIGBSA-SOA-Workshop.pptx
- 2013-06-06-DIGBSA-Gebruikerservaring.pptx
- 2013-06-12-BIBNL.pptx
- 2013-06-12-DIGBSA-Findings.pptx
- 2013-10-11-DIGBSA-FiguresEN.pptx
- WorkshopCatalografie-architectuurstudie.pdf
- WorkshopUX-architectuurstudie.pdf

9.7 List of special collections in the provinces (NL)

- SpecialeCollectiesProvincies.pdf

9.8 Situation Analysis by Jan Vangrinsven (NL)

- Uitdagingen voor het Vlaams Bibliotheekwezen.docx

9.9 Blueprint model in Archi 2.4 format

- DIGBSA-ARCHI.archimate

9.10 Other

- ICTBudgetEstimation.xlsx
- DIGBSA-Catalografie-tekst.pdf (NL)