

# Opening the Walls of the Library

SOA and web services at Talis



# Contents

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Introduction .....	3
Business model.....	4
Overview .....	4
Talis Keystone modules .....	4
Portal Integration Module .....	4
ePayments Integration Module.....	5
Identity Management Integration Module.....	5
Finance Integration Module.....	6
CRM Integration Module.....	6
Consulting .....	7
Partners .....	7
An internal SOA platform.....	8
Community initiatives.....	8
Technology brief.....	9
Adopting an SOA approach .....	9
The benefits of SOA.....	9
Reuse.....	9
Convergence of services and composite applications .....	10
Incremental adoption.....	10
The importance of web services .....	10
Talis SOA architecture and web services.....	11
Talis SOA architectural components .....	12
An SOA maturity model .....	13
Conclusion .....	14
Appendix A: Case studies.....	15
The University of Plymouth – 21st January 2009 .....	15
Integration solution, Talis Keystone continues to grow – 9th October 2008.....	16
The University of Salford - 26th January 2009.....	17
Manchester Metropolitan University – 15th October 2009.....	18
The University of Wolverhampton – 4th December 2008.....	19
Queen’s University Belfast – 10th January 2008.....	20
Appendix B – Index of web services .....	21

## Introduction

“Service-Oriented Architecture is an IT strategy that organizes the discrete functions contained in enterprise applications into interoperable, standards-based services that can be combined and reused quickly to meet business needs.”

BOA<sup>1</sup>

Talis began researching and experimenting with Service Oriented Architecture (SOA) and web services over seven years ago when a small need for system integration began to emerge in the UK market. During this time a number of academic institutions were beginning to implement institutional portals and the need for integration with the library system demanded a practical, simple and robust solution for the portal developers. The early work done at this time saw the development of some simple read-only RESTful based web services in the Talis Prism OPAC which could be used by portal developers to display borrower (patron) account details from the library system inside the campus portal.

The success of these early implementations gave birth to a new internal project called Talis SOA that produced the product called Talis Keystone. The Talis SOA project is where the research and focus on an SOA strategy has continued at Talis since, with many successful implementations in both academic institutions and local authorities, both with Talis Library Management System (ILS) and other vendors' Library Management Systems covering a wide range of functional areas to both read and update data on the library system. The Talis SOA architecture also delivers integration capabilities for members of the Talis Additions Partnership Programme and furthermore is the engine behind a number of components within the Talis product suite.

Talis SOA is a continuously evolving architecture which is the technical engine behind three commercial areas:

- ◆ Talis Keystone is the product which enables institutional integration for both academic institutions and local authorities across multiple Library Management Systems in the areas of portal integration, online payments of library fines and charges, integration with corporate finance systems, integration with identity systems - such as student registries and Identity Management (IDM) services and Customer Relationship Management (CRM) systems. Talis Keystone is a fully managed product, backed by the Talis Consulting department who are experienced in providing integration project services to customers enabling them to tailor their integrated solution to meet their exact commercial requirements.
- ◆ Talis Connect Services is the licence issued to Talis customers to enable them to provide interoperability with third party suppliers who are members of the Talis Additions Partnership Programme. Working closely with our partners to implement an integrated solution on top of the web service stack in the Talis SOA architecture, we at Talis are able to give our customers the assurances that their products fully interoperate with their library management solution.
- ◆ Talis Local Data Services is the component inside of the Talis Library Management System (Alto) which provides internal interoperability for features inside of the Talis product portfolio. Talis products are using the SOA architecture as the interface to the business logic and services of the core library system; over time more products and services will evolve over to this architecture.

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<sup>1</sup> BEA white paper. 2005. "Domain Model for SOA: Realizing the Business Benefit of Service-Oriented Architecture." Available at <http://eudownload.bea.com/uk/events/soa/soa.pdf>

The Talis SOA architecture is a standalone appliance which is designed with the principles of componentisation, reusability, interoperability, orchestration and loose coupling at its core. Over time the use of SOAP based web services has been fully replaced with a growing portfolio of approximately seventy RESTful web services in various functional areas. Based upon the Java platform and on open standards such as XML and HTTP the web services have enabled developers in libraries, in other institutional departments and in third party suppliers to easily integrate their solutions with their library management system.

Community initiatives such as Jangle ([www.jangle.org](http://www.jangle.org)) and the OLE Project ([www.oleproject.org](http://www.oleproject.org)) are fully backed by Talis as we continue to evolve our SOA architecture:

- ◆ The support for Jangle is on our internal roadmaps as we look to add support for version 1.0 of the Jangle specification. In addition we aim to Open Source relevant software components which emerge from these developments.
- ◆ We continue to publically support the OLE Project and see this as an exciting and very relevant initiative. The Talis SOA architecture, being based on open standards, would fit in with the 'library service components' definition as documented in the draft OLE Project report (26th July 2009).

The Talis SOA architecture is a vertical SOA for the library domain and has grown over time in terms of number of successful customers and number of functional areas. Over the last few years the practical challenges of implementing SOA have been overcome through dedicated and managed projects which help to bring together the disparate institutional departments which manage the application silos that are being integrated. Experience of implementing pragmatic SOA solutions has taught us that the challenges in implementing an SOA strategy are beyond technical, and require the integration of disparate teams in disconnected departments with different plans and different commercial agendas. However, by lowering the technical barriers of entry, by providing simple RESTful web services behind a sophisticated SOA stack the walls of the library in many places are now being opened to embrace the rest of the institution.

## Business model

### Overview

Talis Keystone is a licensed product with a central middleware and a series of bolt on modules that can be activated as required, depending on the business requirements of the library service. This gives customers choice and flexibility to create the integration solutions that they require, rather than imposing a suite of solutions which may not be entirely relevant. As well as the middleware licence, each module also has a licence fee. Talis Connect Services has a similar business model to Talis Keystone; however, Talis Local Data Services is part of the Talis Alto (Library Management System) subscription.

### Talis Keystone modules

Talis Keystone modules relate to specific areas of integration which require varying levels of implementation support, depending on the customer's needs; however each module delivers specific benefits to the customer to meet their business requirements. The benefit in this modular approach not only supports the technical SOA goals of having flexible and reusable components, but also allows customers to take modules when it is deemed commercially viable to do so and moreover allows customers to combine modules for enhanced service delivery: for example the Portal Integration module can be taken and implemented, delivering immediate end user benefits but at a later date the ePayments module can then be taken to further enhance the student experience in the portal.

### Portal Integration Module

Student portals are becoming the place for student materials and council portals are becoming the hub of all public services. Portal Integration mean users no longer need to remember multiple passwords to login to multiple systems to access institutions services.

Yet often valuable library services are missing from this new first point of interaction with students and citizens. Providing library information such as reservations waiting collection, library fines and which books are on loan to the user; Portal integration offers several key outcomes:

- ◆ Improved user experience
- ◆ Promotes the online visibility of the library service

Talis have developed a complete solution that enables library information to be integrated with major portal solutions such as:

- ◆ Microsoft SharePoint
- ◆ Students/campus portals (uPortal, Moodle etc)
- ◆ Virtual Learning Environments (Blackboard)

In addition, some customers have also implemented the Portal Integration Module of Talis Keystone inside portal systems that have been developed in-house.

"The integration with Talis Keystone has enabled us to deliver a seamless service to staff and students visiting us via the University's portal. We are delighted that our efforts are available on the Talis Developer Network to help other libraries, and look forward to benefiting from their contributions to this open community in the future."

Lorraine Beard, Head of Information Services at The University of Manchester

### ePayments Integration Module

People are increasingly accessing library resources and services out of hours and online. Whilst improving service provision and efficiencies users have to adopt traditional, time consuming methods to pay for library services.

- ◆ Integrating library systems with the institutional payment engine will provide:
- ◆ Quick and efficient payment for library services online from the borrower account, 24/7
- ◆ Increased service provision without investing in costly extended operating hours
- ◆ Savings in staff time

To enable this valuable integration we have combined market leading library integration technology with bespoke consultancy in one simple solution, ePayments.

"Talis Keystone was easy to implement giving both the library and IT staff the confidence to explore further integration projects such as e-payments. Students now have real choice going beyond cheques, cash and Smartcards at the service desk. We had no hesitation in working with Talis to support this venture."

Jane O'Neill, Library Systems Manager at Queen's University Belfast

### Identity Management Integration Module

Although back-office identity management solutions have simplified the complex task of maintaining electronic identities, securing multiple identities across an organisation remains a major institutional challenge. For example, the management of borrower identities within the Library Management System often requires inputting information which has already been entered elsewhere, either by batch data transfer or even manual methods.

The Talis Keystone Identity Management module synchronises the Library Management System with existing identity systems in real-time - providing the following benefits:

- ◆ Removes the reliance on manual input, ensuring data integrity and delivering efficiency savings
- ◆ Speeds up registration as new members have instant access to the library

- ◆ Links to numerous data sources, including student record systems. HR systems and even alumni

"The benefits of our new Talis IdM module are mostly seen in the improvements in quality and accuracy of data held on our borrowers. In addition, it gives us significant security improvements through the immediate (real-time) disablement of library borrowing and library access. As an organisation, this will mean that we can adapt more quickly to new requirements involving changes to the level of borrowing that we provide for various staff, student and 'associate' institutional roles. From a technical point of view, the implementation of a real-time interface via a web service meant that our developers in the IdM team were working to an abstract specification that removed the need to understand the technical details of how transactions are actually implemented in the Talis database. We were extremely pleased with how well Talis consultants worked with us during this critical time in our programme."

David Kerr, Programme Manager for the Identity Management programme at the University of Salford

### Finance Integration Module

Automatically sharing financial information, such as invoice data, between library and finance systems removes manual intervention offering many benefits including:

- ◆ Time and cost savings
- ◆ Reliable accurate data
- ◆ Simplified audit tracking

Yet, projects to achieve integration such as this are traditionally expensive, complex and prone to delays.

Talis offer a bespoke finance integration that includes world class project management, consultancy and implementation of the integration solution - Talis Keystone - which removes all the hard work.

We have enabled Universities and Local Authorities to seamlessly integrate their Library Management System with several institutional finance systems including:

- ◆ Aggresso
- ◆ Civica
- ◆ Oracle
- ◆ SAP

"Before implementing this integration, our staff had to manually input library invoice data into our SAP finance system. Through working with Talis, the automatic transfer of invoice data has resulted in considerable costs savings and improved accuracy."

Lynne Stanley, Assistant ICT Manager Children & Lifelong Learning, at Staffordshire County Council

### CRM Integration Module

An increasing number of councils are adopting CRM to manage their citizens' identities. So the ability to link the Library Management System with external databases (such as the information within a call-centre CRM system) is more attractive than ever.

Until recently, it's proved difficult to extract library account information into these systems. But with the Talis Keystone CRM module, library information is seamlessly transferred into the CRM database - without the need of Library Management System expertise - providing the following benefits:

- ◆ Raised profile of the library service, putting citizen's needs at the heart of the CRM
- ◆ Improved work flows for call centre staff, with library data displayed within their CRM system
- ◆ Information updated in real time, providing an enhanced, accurate service for citizens

## Consulting

Talis consultants have years of experience in the library and information sector, and pride themselves on delivering consultancy projects on time, to budget, through a controlled and managed process.

Experience has shown us that implementing an SOA strategy and an integrated solution can be challenging for a library and its neighbouring departments in the institution and its other suppliers. Often there are operational procedures which need to change, conflicting priorities and quite often, members of staff who have never worked with each other before.

To support our policy of having successful customers we have moved Talis Keystone and Talis Connect Services delivery under the Talis Consulting arm of the business to provide a team of dedicated professional consultants who can help customers manage projects from inception, to successful customer implementation.

Although we pride ourselves on delivering meticulous API documentation for our web services – and in some cases, this is all our customers need – Talis understand that getting the technology in place is often only half the battle and we are able to provide a full service to our customers to meet their entire business needs. Appendix A of this paper outlines some success stories from a few of our customers.

## Partners

The Talis Additions Partner Programme has been established to support partner organisations develop products for Talis customers. This includes promoting partner products and integrating partner products with the Talis Library Management System; striving for a more connected, seamless experience for library users.

There is a variety of protocols that we offer partners to integrate with Talis applications including SIP2, to integrate self-service machine, and ODBC/JDBC where the Library Management System database needs to be directly queried. Another approach is to use web service APIs.

Using web service APIs, partners benefit from a level of separation from the database, meaning database changes or changes to Talis applications will not affect the effectiveness of the connection between our products. Not only does this minimise disruption to mutual customers but also allows the technical teams to focus on developing new features rather than updating and maintaining existing functionality.

More partners have started to choose to use web service APIs for a variety of reasons. This includes companies without specific library domain experience who don't know the establish library interfaces such as NCIP, SIP2 and Z39.50 but are accustomed to using web service APIs.

Through the use of SOA, all partners are able to benefit by easily been able to utilise new functionality developed for other purposes, reducing the cost of developing new features for each specific user case. For example, a web service developed to notify library users of outstanding library fines for a partner providing a SMS update service could be used by another partner who provides portal integration. In addition, the power of the loose coupling to the underlying Library Management System means the partner's solution is potentially portable across vendor's systems.

So, web service APIs and SOA drive innovation into the library sector; by introducing more vendors to the market. It also provides greater choice for libraries as well as other economic effects such as price competition and product innovation.

## An internal SOA platform

Talis Local Data Services is an internal component of the Talis Library Management System and forms part of the core solution. Talis Local Data Services is a view of the Talis SOA architecture with the intention of inter-product integration and represents the next evolutionary step as we move through our SOA maturity model.

Talis Local Data Services is already supporting local library integration for the Talis next generation OPAC, Prism 3<sup>2</sup> and also the Talis next generation Resource List Management tool, Talis Aspire<sup>3</sup>.

R&D continues in this area at Talis as an ongoing theme of development and supports the other intentions of the SOA architecture, namely customer integration (Talis Keystone) and partner integration (Talis Connect Services).

These three distinct faces of the Talis SOA architecture are a clear indicator of the success of this platform as providing reusable loosely coupled services.

## Community initiatives

Talis' commitment to specifications such as Jangle and the Digital Library Federation's Integrated Library System and Discovery Interface (DLF ILS-DI) API are predicated on the belief that simple, unobstructed access to the library's own data can only help spur innovation. By opening the Library Management System with protocols that are powerful yet simple to use and understand, the library's data is available for experimentation and enrichment, whether through sophisticated applications built by the institution, mashups created by members of the community using tools such as Yahoo! Pipes, or by third parties with the aim of enhancing the library user's experience in a seamless fashion.

Alto's Jangle connector was developed from the start as an open source project, with the intention that the community could help guide the process, contribute functionality that benefits the specific needs of real-world Alto libraries, and begin to use and build Jangle-enabled applications. It is also intended to be used as an example of how Jangle connectors can be built atop legacy Library Management Systems. Via the Jangle connector, Talis will be among the first library automation vendors to uphold its commitment to the DLF ILS-DI Berkely Accord. Moving forward Talis are currently adding support for the Jangle specification<sup>4</sup> to its own SOA architecture and any relevant components which are engineered will be fully Open Sourced.

Talis continue to publically support the OLE Project and see this as an exciting and very relevant initiative. The reference model defined in the final OLE Project Report<sup>5</sup> defines a componentised heterogeneous environmental framework with components and entities which fully support the architectural patterns of a library domain SOA. The Talis SOA architecture, being based on open standards too is already technically positioned to interoperate with components of the OLE framework which Talis look forward to seeing emerge over the next few years.

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<sup>2</sup> <http://www.talis.com/prism/>

<sup>3</sup> <http://www.talis.com/aspire/>

<sup>4</sup> <http://jangle.org/drupal/spec/1.0>

<sup>5</sup> <http://oleproject.org/final-ole-project-report/>

## Technology brief

The Talis SOA architecture is deployed into the institution and delivers services to and from the Library Management System via industry standard web services, delivering loosely coupled, reusable software components to maximise the orchestration of business processes and workflows.

## Adopting an SOA approach

The adoption of SOA is one of the most significant initiatives taking place in IT Technology today. Business services are now being aligned to IT assets in loosely coupled, componentised, reusable and standards-based architectures. These principles, which form the foundation of SOA, are not new ideas but are a rational extension of early IT theory and experiences.

As a result of advancements in machine to machine interoperability, the computing industry is now delivering on these promises to deliver improved business effectiveness and agility. The adoption of SOA presents organisational (opposed to technological) challenges.

It's widely accepted that IT assets have developed into technical silos containing duplicated data and features, with interoperability which does not effectively scale to the demands of modern business processes. These silos are mostly the result of social and cultural barriers which have evolved over time as departments grow and shrink and businesses re-organise themselves. Staff have developed their own business work-flows and have invested significantly in IT solutions which meet the demands of their specific business needs.

"Successful SOA isn't a technology initiative - it's a business initiative backed up by IT."

Foody<sup>6</sup>

## The benefits of SOA

The monolithic technology stacks which have evolved to meet the needs of departmental silos are now being challenged with increasing demands for improved business efficiencies. Tightly coupled systems result in vendor lockin, commitment to specific technology stacks and inconsistent islands of core data across the organisation.

Furthermore, interfacing between these systems is cumbersome which leads to bespoke non-standardised integrations. The demand for joined-up business services is challenging today's academic institutions and local authorities.

The Talis SOA architecture adopts the following core principles to deliver library business services and core library data to and from the Library Management System, across departmental silos around the organisation, amongst 3rd party applications provided by Talis Additions partners and as an evolving internal engine to the core Library Management System:

### Reuse

Silos, built on different technology platforms in different programming languages, will contain duplicate features and data which are aligned to different business units.

For example, most systems in an organisation recognise the concept of 'identity'. The finance system will have records of the customer's identity to deal with their financial transactions, and the Library Management System will have records of a borrower's identity to manage their circulation. This redundancy means multiple versions of identity management logic is replicated across multiple systems on different platforms, maintained by either different vendors or by people with different skill sets.

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<sup>6</sup> Foody, Dan <http://soa-zone.com/>

In an SOA environment, a single component manages the business concern of 'identity', and other systems reuse this component. When business requirements inevitably change, only the single instance of the identity service needs to be changed, allowing the organisation to update its operations more quickly.

### Convergence of services and composite applications

With SOA it is now possible to build new business applications that combine functionality from a multitude of disparate applications around the organisation – effectively combining the silos to deliver cross-functional capabilities.

Integrating the Library Management System with an application such as a university portal or a council Web site will improve users' experience by delivering the functionality and data to them as they need it; empowering them to access a full range of services from a single location.

Tightly coupled systems lead to complex dependencies which are expensive to maintain and are not agile enough to support the introduction of new business initiatives.

"Systems are complex, but the dependencies between them should be kept as simple as possible."

Andy Latham, Technical Lead, Talis

Using SOA, the consumer of a business service does not need to be aware of its technology stack or the details of its implementation. This principle of 'separation of concerns' removes the complex dependencies between systems by providing layers of encapsulation, hidden behind standard interfaces which vendors (who are experts in a particular business area) can provide services to be used by other systems. Consuming a service is far cheaper and more effective than implementing it 'in-house'.

The Talis SOA architecture business tier models the concept of adaptors which allows the SOA framework to sit on various Library Management Systems. Each adaptor encapsulates the knowledge of the underlying system without inferring any local system business logic to the integration tiers.

Moving the SOA technology stack from one system to another is analogous changing the tyres on a racing car: if you want the car to drive on a wet track you swap to wet tyres, if you want it to drive on a dry track you change to slicks; in the same way, to implement the Talis SOA stack on the Talis Library Management System you install the Talis adaptors, if you want it to work on the Ex Libris Voyager ILS you install the Voyager adaptors – this architectural pattern of loose coupling is the answer to how Talis Keystone can facilitate Portal Integration and ePayments Integration against both of these systems.

### Incremental adoption

The step-by-step introduction of services is a common strategy as it mitigates business risk and also allows the adoption of new services to filter through the user base.

Not only do users experience a gradual delivery of new services with a staggered learning curve, but the barriers between the departmental silos begin to break down through a gradual change in culture. SOA, with loosely coupled and reusable business services is ideally suited to iterative deployment.

### The importance of web services

The potential of SOA is only now being realised because significant advancements have been made in machine to machine interoperability. As technology has advanced, distributed computing delivered exceptional productivity and raised expectations. Business critical operations no longer existed without an IT infrastructure. The arrival of the Internet, with the promise of ubiquitous connectivity, altered perceptions and raised the bar for business services.

However, with these advancements came significant challenges in joining different technology stacks together - technology platforms which were never architected with interoperability as a fundamental requirement. Numerous low level binary protocols were created to address these issues - such as Z39.50, COM, CORBA & RMI. However, the standards which underpin the Web's infrastructure gave engineers a different way to address these problems.

The traditional view of the Web is one of Web pages with text, graphics and business services all designed for consumption by the human user. But the workflow of the Web is not that different from the workflow of two or more computer systems interoperating with each other. Web servers all over the planet are built on different technology stacks and still manage to deliver the same content to users PCs whether they are using MAC OS, Windows, or any other operating system.

What if Web servers could deliver content and services in a format which was not designed to be consumed by a human user, but in a format which could be understood and consumed by another machine? Moreover, what if this was a format that could also be easily read and understood by developers and other IT professionals? Even more importantly, what if this could be delivered using the existing infrastructure and protocols?

The answer to all of these questions is web services. Web services are simply the data and business services which are already present in existing systems delivered over existing Internet infrastructure in a format which can be consumed by machines. Web services solve the problem of machine to machine communication and moreover they do not have a dependency on any one particular technology stack. They are based on software industry standards and are widely understood by developers and other IT professionals.

From a technical perspective, web services are the solution which removes the barriers between departmental silos and provides the integration between disparate technology platforms. In fact, with the adoption of web services vendors do not even need to know the underlying technical platform they are integrating with – the web services interface provides a layer of encapsulation and abstracts the details of the underlying service.

## Talis SOA architecture and web services

SOA allows loosely coupled business services to deliver the benefits of reuse, componentisation and encapsulation. Web services provide the technical glue which joins the loosely coupled business services together using standards based interfaces. Although an SOA can be achieved without web services and vice versa, when combined they provide a powerful platform for the interoperability and convergence of different business services.

Talis SOA architecture delivers library business services in a loosely coupled, reusable and componentised framework. Based on web services, they are designed to be reused in different applications - either in isolation, or combined to provide powerful composite applications. The web services do not have any dependency on a particular consuming application or technology stack, they provide discreet business services which can be used, reused and combined to meet business objectives.

The Talis SOA web services are all based on the principles of REST (REpresentational State Transfer<sup>7</sup>) and also support WADL<sup>8</sup>. There are a number of protocols and standards, mostly build on top of HTTP, designed for building Web Services (note the capitalization). These standards, commonly referred to as the WS-\* stack<sup>9</sup> include SOAP, WSDL, WS-Notification, WS-Security etc and are known colloquially as "Big Web Services".

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<sup>7</sup> Fielding, Roy (2000) <http://www.ics.uci.edu/~fielding/pubs/dissertation/top.htm>

<sup>8</sup> <https://wadl.dev.java.net/>

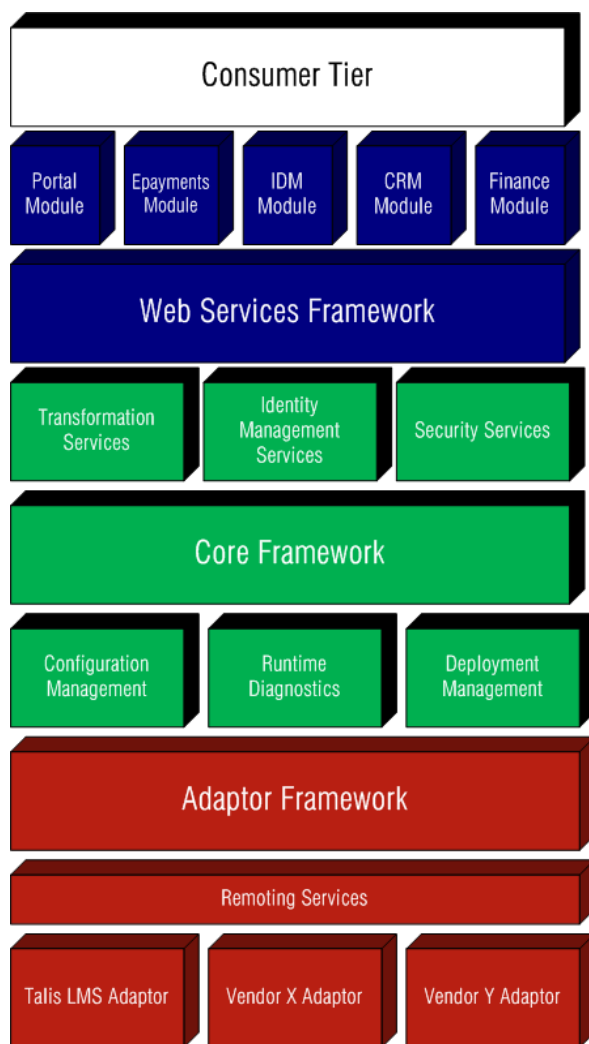
<sup>9</sup> <http://www.w3.org/2002/ws/>

“Big Web Services” do have significant benefits and are extremely powerful; however they can be needlessly complex and are often used for cases where plain HTTP could handle the task just fine. The over complexity of this style of Web Service is a barrier of entry to software engineers who require simple API’s to the system which are both powerful in their processing but moreover, pragmatic in their ease of implementation and enable them to get their job done effectively. Modelling components as simple abstractions within a Library Management System as straightforward URI’s and affecting the state of those representations in tools as simple as a Web browser is a powerful and sensible technical design model which backs the demands of the business.

The Talis SOA architecture has embraced the trend towards composite RESTful web services to give developers the style of web API’s that they are used to and to put them in the driving seat to creating innovative and beneficial applications on top of their library system data and feature sets and allow them to be truly decoupled from the fine grained business logic of the system. The developers who consume the web services are a primary focus for the design decisions made as each service is produced.

### Talis SOA architectural components

Talis SOA architecture builds upon a loosely coupled and componentized Service Oriented Architecture to deliver business services as platform independent RESTful web services. The architecture is divided into three main tiers to enable the incremental introduction of new business integration services and support for multiple vendor Library Management Systems:

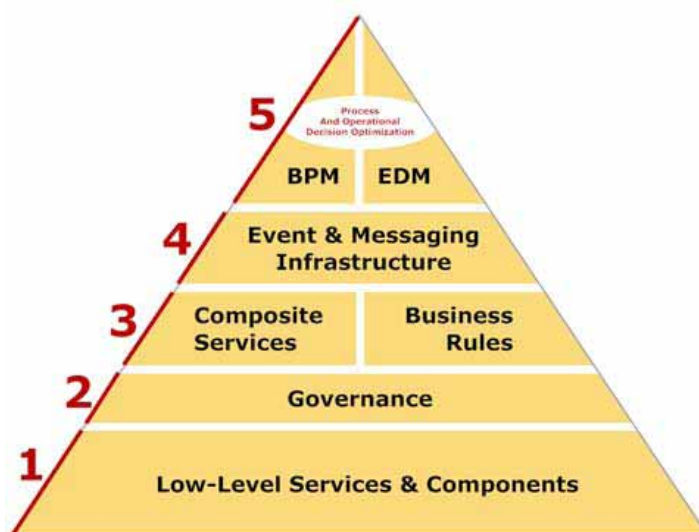


This architecture is built on the Java 6.0 platform and the J2EE specification making the architecture portable across Operating Systems and uses the Apache Tomcat 6.0 web container to serve the HTTP content. In certain deployments the Apache HTTP server is also used to façade the Tomcat container and also to provide HTTPS and other security services.

At the heart of the SOA architecture is a central tier which manages the decoupling of the web service interfaces from the lower level business services and adds supporting components for maximum functionality and flexibility. Business services are grouped into abstract adaptors which support a heterogeneous environment for multiple interfaces into the orchestrated business processes of the underlying Library Management System.

### An SOA maturity model

The Talis SOA architecture is a dynamically evolving technology stack which is growing to support market demands and commercial goals. The architecture is following a maturity model and is heading towards a full SOA Platform for the library domain:



This maturity model is designed to illustrate the journey towards a full SOA platform and as the pyramid suggests, each stage, at least in-part, depends on the former and not all levels are required for every environment making this a very flexible model. The Talis SOA architecture is half way through level three of this maturity model:

1. Low-Level Services & Components are the foundation of services and related components
2. Level two requires a governance program to ensure that these services are consistently developed using a common framework, along with associated security policies and a means for publication
3. The next tier is where significant benefits begin to be realized. With a governance program in place, it now becomes possible to build more coarse-grained, composite services, whose audience may span beyond just the technical team and business users may begin consuming services, such as adding new library workflows and dynamically adding business rules.
4. Similar to business rules, a message and event-driven architectural orientation can be introduced earlier in the pyramid; it's a requirement for those aspiring to level 5. The ability to monitor, in real time, events that occur within the Library Management System is essential for optimizing business processes and operational decisions.

5. Level five is where BPM (Business Process Management) and EDM (Enterprise Decision Management) can really flourish: BPM almost always requires the ability to tightly integrate with applications, data, and business rules, and when these assets are exposed as services using SOA principles, implementing BPM is greatly simplified. Centrally managing business rules through EDM exposes business rule assets to a wider audience of business users, who are best positioned to align them to the dynamic changes of the marketplace, which can detect more accurately when events can be assessed in real time through complex event processing filters.

## Conclusion

Marketed as a “silver bullet” over recent years SOA has promised cost savings and much improved business agility across a horizontal market. SOA has already gone through a number of iterations as commercial vendors have hit the market first with their powerful, but costly solutions in this area. As trends often dictate, the Open Source community have also caught up with their production strength innovations. The reality of today’s market is that a full SOA Platform can now be build with Open Source components. Currently the Talis SOA architecture is closed source, but does use many Open Source components. Over time as implementations for specifications, such as Jangle, are introduced, relevant components are planned to be Open Sourced. And rather than aiming to be a horizontal SOA architecture it is focusing on being a library domain SOA architecture.

However SOA is not all about technology; SOA is a business journey that needs to follow a path with small commercial and technical steps towards a known vision of business maturity. Commercial and Open Source technology has paved a way for businesses to begin introducing an SOA strategy. Introducing an SOA strategy is as much of a technical challenge as it is an operational challenge as the technology will break down silos between teams, departments and organisations and conflicting business processes which worked well in the silo will need to be redeveloped to meet the new needs of the more agile business.

Experiencing this conflict at first hand over the last seven years by introducing SOA into libraries and their neighbouring departments Talis have developed Project Management and Consultancy services to fully support customers though the implementation transitions. Appendix A shows that SOA in libraries is not hype and is a reality, as customers case studies demonstrate.

Furthermore the implementation of the Talis SOA architecture over other vendor systems, such as the Ex Libris Voyager system, as demonstrated by the University of Plymouth shows, the intention of loose coupling is being realised.

Finally, the use of the same underlying architecture for supporting Talis Additions partners and also to supporting Talis’ Software As a Service (Saas) cloud based applications highlights; the power of composite and well governed reusable web service interfaces is also a reality.

This paper has demonstrated that through the adoption of SOA and by making strategic business decisions about agility and commercial maturity, libraries are breaking down the silos and are opening the walls to embrace the rest of the institution.

## Appendix A: Case studies

### The University of Plymouth – 21st January 2009

#### **The University of Plymouth adopts integration solution Talis Keystone with the Ex-Libris LMS**

Talis is delighted to announce that one of the UK's most prominent and dynamic universities, the University of Plymouth, has become the first Ex Libris LMS user to adopt Talis Keystone to integrate their Voyager LMS with their campus portal. Previously, the University's 30,000+ students were not able to access their library account details from within their Microsoft SharePoint University portal. In their aim to become "an enterprise-led university where innovation and creativity underpin all activities", the University has adopted the Talis Keystone Portal Integration module to enable users, via a single sign in, to access account details from within in the University portal.

This is possible as Talis Keystone communicates in simple, open standards that all systems can understand. This allows the relevant borrower account information (including the number of loans, fines information and overdue status) to be extracted from the Ex Libris LMS and displayed in the portal web pages.

Fiona Greig, E-Resources Development Manager at The University of Plymouth commented "Getting relevant information from Voyager into personalised portal sites has been a key requirement for the University for some time. With more resources available, and the increase in use of metasearch technologies, we have been aware that unique visits to the OPAC have been decreasing. This means borrowers sometimes miss key messages and information from the Library. By building a SharePoint integration we are maximising the positive impact of our new VLE and enhancing elements of the Library service."

Dave Errington, CEO at Talis commented "Talis Keystone has been very successful, as over 25 Talis Alto customers now utilise the integration solution. We hope to see many more projects with non-Talis Alto customers that will help 'join up' many more institutions in the future."

With the project now complete, the University of Plymouth are now evaluating their next steps to enhance integration at their library by adopting the online payment integration module of Talis Keystone, the ePayment Module.

## Integration solution, Talis Keystone continues to grow – 9th October 2008

Talis is delighted to announce that the integration solution, Talis Keystone has continued to grow, as a further 11 organisations have chosen the solution in the last six months, demonstrating the importance of integration of the library management system (LMS) with wider organisational systems.

Focused on generating back-office efficiencies and transforming end-user services, Talis Keystone enables integration of the LMS with other university or council-wide systems such as portals, web sites, online payment engines, finance and CRM systems via four modules.

Leeds Library and Information Service and the University of Central Lancashire are just a few of those who have recently chosen the Finance Integration module. Via this module, the libraries' ordering and invoicing operations are linked to the finance system to deliver significant process efficiencies and benefitting from greater accuracy, due to the seamless transfer of data.

By integrating the university portal or VLE with the LMS via the Portal Integration module, the students at The University of Plymouth and Birmingham City University can soon view all of their borrower account details in one place. These transactions include loans, reservations, inter-library loans, bookings, fines and charges alongside their course related materials.

Birmingham City University, University of Wolverhampton amongst others have recently chosen to enable users to make fines payments online, without investing in costly extended operating hours via the ePayments module. This enables a true 24 hour service to be given to students whilst also offering alternative payment channels to the traditional cash over the counter method.

Working with any system in the institution that manages identity for both staff and student (student registries, HR databases etc) the Identity Management module will enable the University of Salford and Manchester Metropolitan University to create, read, update and delete borrower records in real-time to realise significant efficiency savings.

Via these four modules, Talis Keystone delivers significant business benefits to libraries seeking a robust and easy to deploy integration solution helping to promote and make their library services more visible. Working closely with the Consultancy Team at Talis, Talis Keystone is implemented to meet individual requirements, unique to your institutions needs.

## The University of Salford - 26th January 2009

### The University of Salford optimises Talis Keystone to manage borrower identities

Talis is delighted to announce The University of Salford is the first University to adopt the Identity Management (IdM) module provided via Talis Keystone.

The University of Salford is in the process of transforming the way that the identities of its entire user population are managed across all key systems in the organisation. An essential part of the solution employed (using Sun Microsystems' IdM suite) is the transition and management of up to 23,000 Talis LMS borrower identities via Talis Keystone.

The University of Salford's far-reaching Integrated Information Infrastructure Strategy, first developed in 2003, highlighted the potential of an IdM system to solve many of the organisations administration challenges.

The Sun Microsystems IdM solution now integrates with the Talis LMS via Talis Keystone and the Talis IdM module. This is a REST web service, working in real-time to create, read, update and delete borrower records in Talis LMS.

As the first to adopt the solution, the University of Salford has played a prominent role in the development. David Kerr, Programme Manager for the Identity Management programme at the University of Salford commented "The benefits of our new Talis IdM module are mostly seen in the improvements in quality and accuracy of data held on our borrowers. In addition, it gives us significant security improvements through the immediate (real-time) disablement of library borrowing and library access. As an organisation, this will mean that we can adapt more quickly to new requirements involving changes to the level of borrowing that we provide for various staff, student and 'associate' institutional roles."

He continued, "From a technical point of view, the implementation of a real-time interface via a web service meant that our developers in the IdM team were working to an abstract specification that removed the need to understand the technical details of how transactions are actually implemented in the Talis database. We were extremely pleased with how well Talis consultants worked with us during this critical time in our programme."

The Identity Management solution now in place at the University of Salford – of which the Talis IdM Module is an integral part – and is transforming the way that access to resources of all kinds is created and managed for all staff, students and associates whilst delivering significant improvements in levels of customer service, customer experience, security, performance and efficiency.

Dave Errington, CEO at Talis commented "As a development partner, the University of Salford has paved the way for other institutions to follow suit in achieving substantial administration savings via the Identity Management module. As the adoption of Talis Keystone increases, it is clear integration is more important today than ever before."

Talis Keystone communicates in simple, open standards that all machines can understand. Each project is managed closely by the consultancy team, meeting individual requirements, unique to your institutions needs.

## Manchester Metropolitan University – 15th October 2009

Integration application enables single sign on, portal integration, identity management and e-payment facilities for Manchester Metropolitan University

Talis is delighted to announce that Manchester Metropolitan University has chosen the integration application, Talis Keystone, to enable single sign, integrate their library management system with their university portal, manage user identity throughout the university and facilitate integration with the university's online payment engine.

As one of the largest and most diverse Universities in the UK, Manchester Metropolitan University's 34,000 students and 4,400 staff will now benefit from a more 'joined up' institution, as a part of the 'Change Agenda' at the University. The agenda identifies the need to increase integration of services and build administrative capacity.

Angela Warlow, Library Services Manager at Manchester Metropolitan University Library commented "We have chosen to implement Talis Keystone to enhance the whole user experience for our students and staff whoever and wherever they are and not just inside libraries."

Dave Errington, CEO at Talis commented "We are delighted Manchester Metropolitan University has chosen to implement the integration solution across their campus. They join a total of 29 institutions across the UK and Ireland that utilise Talis Keystone to achieve greater efficiencies."

Talis Keystone communicates in simple, open standards that all machines can understand. Via these four modules, Talis Keystone delivers significant benefits to libraries seeking a robust and easy way to deploy an integration solution to help raise the visibility of your library services. Each project is managed closely by the consultancy team, working together to meet individual requirements, unique to your institutions needs.

## The University of Wolverhampton – 4th December 2008

### Online payments for students at the University of Wolverhampton

The University of Wolverhampton are the latest to benefit from the online payment integration solution, Talis Keystone - ePayments module. As a part of the University's drive to promote excellence and innovation, its 23,000+ students are now able to pay their library charges online, using either debit or credit cards, enabling further efficiency savings for library staff and improving student services.

Although already adopted by many other institutions, this implementation was slightly different. The University of Wolverhampton chose to link directly from the university web page to the e-Payment provider. Students and staff can discover the amount that they owe to the library and can conveniently pay their fines and charges online. This seamless transaction from the university web page to the e-Payment provider is enabled using Talis Keystone to integrate the two systems and provide an enhanced service for students.

Today, over 20 Universities and Councils have dramatically improved their service delivery and staff workflows by implementing Talis Keystone. The University of Wolverhampton joins other recent adopters of the ePayments module including Birmingham City University, the University of Ulster and Queens University Belfast.

Focused on generating back-office efficiencies and transforming end-user services, Talis Keystone enables you to integrate library management systems with other systems such as portals, web sites, payment engines, finance and CRM systems.

## Queen's University Belfast – 10th January 2008

### **Students at Queen's University Belfast can now pay their library fines online with debit and credit cards**

Talis is delighted to announce that Queen's University Belfast is now live with e-payments through Talis Keystone.

The 25,000 students at one of the largest Universities in the UK are now able to pay their library charges online using either debit or credit cards, enabling further efficiency savings for library staff and improving student services. As an increasing number of Queen's students access library resources and services off campus, delivering e-payment services was a high priority, and Talis Keystone was just the solution.

The Library has worked closely with Talis in recent months to be the first to integrate its library management system with the internet payment solution WorldPay, having already worked with Talis to successfully integrate library services into their campus portal.

Jane O'Neill, Library Systems Manager at Queen's University Belfast commented "Talis Keystone was easy to implement giving both the library and IT staff the confidence to explore further integration projects such as e-payments. Students now have real choice going beyond cheques, cash and Smartcards at the service desk. We had no hesitation in working with Talis to support this venture."

Paddy Daly, Portal Development Manager at Queen's University Belfast described the integration work with Talis as "Seamless and painless and it will no doubt be of great value to our students."

Focused on generating back-office efficiencies and transforming end-user services, Talis Keystone enables you to integrate library management systems with other systems such as portals, Web sites, payment engines, finance and CRM systems. Today, over 15 Universities and Councils have dramatically improved their service delivery and staff workflows by implementing Talis Keystone.

## Appendix B – Index of web services

As of publication date the following is a list of all of the current set of web services, taken from our API documentation, in the Talis SOA stack and as the system continues to evolve we will continue to add more and more functionality.

Each of these web services is RESTful and is deployed within the local institution and supports the perimeter based security of the local network. When appropriate the web services can be made available over HTTPS. Please note, that for all services which handle borrowers (patrons) that the services all support both the borrower barcode and also the institution identifier (registration number for example):

Web Service Name	Business Area	Description
Get Account Summary	My Account	Get a summary of current activity on a borrower account. Count of reservations, loans, ILL's etc
Get Loans	My Account	Get a detailed list of current loans
Get Reservations	My Account	Get a detailed list of current reservations
Get Fiscal Account	My Account	Get a detailed list of current charges
Get Single Sign-On link	My Account	Get a SSO link to the Prism OPAC
Get Requests	My Account	Get a detailed list of current requested items
Get bookings	My Account	Get a detailed list of current booked items
Get borrower messages	My Account	Get a detailed list of current borrower messages
Get invoice	Finance	Get a single invoice from the invoice number
Get invoices	Finance	Get all invoices, can be limited by status (i.e. completed) and date range
Get order	Finance	Get details of a specific order based upon the order id
Get orders	Finance	Get all orders on the system limited by data range
Make payment	e-pay	Pay off an amount against a borrower's account. This pays off all charges in date order up to the amount paid - making a part payment on the last one if necessary
Get payment properties	e-pay	A supporting service for e-pay to allow a client discover the minimum and maximum payment amount configured by the system
Authenticate borrower	Borrower Services	Authenticate a borrower based on their unique identifier and an optional PIN
Get borrowers	Borrower Services	Get all borrowers on the system. Can optionally be used in the context of borrower searching, by filtering on forenames, surname, address, postcode, DOB, telephone, email and barcode. Supports text/xml and text/plain response types
Get Borrower Locations	Borrower Services	Get a list of all location sites in the system that users can borrow from
Get Borrower	Borrower Services	Get all details known about a particular borrower (barcode, personal details, pin, borrower type/department etc, address and email details, guarantors)
Update Borrower	Borrower Services	Update all details known about a particular borrower (barcode, personal details, pin, borrower type/department etc, address and email details, guarantors)
Create Borrower	Borrower Services	Create a new borrower in the system with all details as known about them at the time of creation. If a barcode is not known the service created a dummy barcode as per the rules of the local system

Web Service Name	Business Area	Description
Delete Borrower	Borrower Services	Delete a borrower from the system. This service sets their status to "not active" rather than remove all data known about them.
Delete Borrower block	Borrower Services	Remove a block against a borrower in the system
Get all borrower analysis codes	Borrower Services	Get all 'borrower analysis' codes in the system, i.e. 'Disabled', 'OAP' etc
Get borrower's analysis codes	Borrower Services	Get the 'borrower analysis' codes for a particular borrower, i.e. 'Disabled', 'OAP' etc
Add to borrower's analysis codes	Borrower Services	Add an 'borrower analysis' code to a particular borrower, i.e. 'Disabled', 'OAP' etc
Remove borrower's analysis code	Borrower Services	Remove an analysis code from a particular borrower
Get collection Locations	Circulation	Get a list of all location sites a borrower can collect a specific work from
Place reservation	Circulation	Place a reservation for a borrower for a particular work at a specified collection site
Cancel reservation	Circulation	Cancel a borrower's reservation on the system
Get Reservations	Circulation	Get details of a specific borrower's reservation
Get reservation counts	Circulation	Get item and works counts for a specific reservation
Renew loans	Circulation	Renew one to many loans for a particular borrower
Item issue	Circulation	Checkout an item to a particular borrower at a particular location
Item discharge	Circulation	Check-in an item from a particular borrower at a particular location
Get item availability	Circulation	Get availability details of a work in particular collections
Get holdings	Circulation	Get holdings details of a work
Get loan	Loan Services	Get a loan from the loan id
Get loan due date	Loan Services	A supporting service to get a loan's due date from the loan id
Update loan due date	Loan Services	Change the due date of a loan to a new date
Get loan action type	Loan Services	A supporting service to get a loan's action type from the loan id
Update loan action type	Loan Services	Change the action type of a loan to a new action type
Get loans	Loan Services	Get all loans for a particular borrower or all loans for a particular item. Can be filtered by loan phase i.e. 'current'
Get loan counts	Loan Services	Get count of all loans, split by loan type allowed for the specified borrower
Get charges	Charge Services	Get all charges for a borrower
Get charge	Charge Services	Get details of a specific charge
Pay charge	Charge Services	Pay off a specific charge, or waive it (with a waive reason)
Get Messages	Message Services	Get all messages for a borrower, an item or a work
Get Message	Message Services	Get a specific borrower, item or work message based on message id
Create Message	Message Services	Create a new message in the system
Update Message	Message Services	Update a message in the system
Delete Message	Message Services	Delete a message from the system
Get Message Instance	Message Services	Get a message instance for a specific borrower, item or work
Update Message Instance	Message Services	Update a message instance for a specific borrower, item or work

Web Service Name	Business Area	Description
Create Message Instance	Message Services	Create a message instance for a specific borrower, item or work
Delete Message Instance	Message Services	Delete a message instance for a specific borrower, item or work
Get Item	Item Services	Get details of a specific item
Get Item reservation queue	Item Services	Get the reservation queue of a particular item
Get Item Shelf mark	Item Services	Supporting service to get the shelf mark of a particular item
Get Item queries	Item Services	Get all queries against a particular item
Get Item query	Item Services	Get a specific item query for an item
Update Item query	Item Services	Update a specific item query for an item
Create Item query	Item Services	Create a new item query for an item
Get release info	System	Get a information about the system and the release/version information of the current installed software (this is protected by HTTP authentication)
Diagnostics	System	Perform a self-diagnostic test to ensure the SOA modules are all working as expected
Get services descriptions	System	Get a feed of all services available in the system in the standard WADL format (in a similar way to how a SOAP service can return a WSDL) for service discovery