Moving to a Service-Oriented Architecture

by K. Vanholst, J. Wilmaers and J. Cattersel

Kris Vanholst
Inno.com, Beersel

Jan Wilmaers
Inno.com, Beersel

Johan Cattersel
Inno.com, Beersel

ABSTRACT

Much has already been written about Web Services. But just implementing this within some parts of your IT environment does not offer a real competitive advantage. Implementing services as part of a Service-Oriented Architecture however will lead to a more flexible IT system, which assists in the improved execution of the business strategy. Moreover, it will not achieve this by throwing away existing IT resources, but by helping businesses to get more value out of them.

After defining the concept of a Service-Oriented Architecture, this article explains the business imperatives for starting this multi-year effort. Next the challenges are highlighted that must be overcome in order to be successful. Finally, the Service-Oriented Architecture approach is situated in an Enterprise Architecture framework, a holistic method for architecting your complete enterprise IT.

I. INTRODUCTION

In recent years, there has been a lot of talk about Web Services and the technologies surrounding them. Although very promising, it is most often limited to relative simple examples without real business value. This article positions Web Services as merely a concrete implementation of services, a key concept in a Service-Oriented Architecture (SOA). This article takes one step up from the technical aspects, and looks at what is involved with the move to a SOA.

On an enterprise level, we believe that a SOA provides an answer to many of the questions currently high on the executive's (business and IT) agendas.

We start off with a definition of a SOA, and explain why a SOA represents the most feasible solution today for the problems that many companies face. Next we describe the most important challenges that need to be faced in order to be successful on this multi-year journey. We conclude by positioning services in an Enterprise Architecture framework, a holistic method for architecting your complete enterprise IT.

II. DEFINITION OF SERVICE-ORIENTED ARCHITECTURE

A multitude of definitions exists for a Service-Oriented Architecture, all covering more or less the same content while putting some emphasis on particular parts. We prefer considering a SOA as a strategic direction in IT that organizes the functionality as offered by enterprise applications into a set of discrete functions. Every such function is called a service, and constitutes a well-defined, self-contained, interoperable and standards-based building block which can be invoked on a standalone basis and can be easily combined with other services to meet business needs. As such a SOA is an example of an architectural style that promotes flexibility, loose coupling between enterprise applications and consistent processing.

III. REASONS OF EXISTENCE FOR A SOA

The core idea of a SOA is nothing new, but the increased interest for SOA however is. Studies show that one out of 3 large companies already started an effort in the SOA area – ranging from a pilot project to implementation of a considerable amount of enterprise functions – and that most foresee SOA to become mainstream in 3 to 5 years time.

The emergence of technology standards for connecting applications (Web Services) will partly explain this increased interest, but there are some

important business drivers that force enterprises to rethink their current IT strategy. SOA at this moment promises to provide the most viable answer to those challenges.

Changing business landscape

Businesses are becoming more and more global, and are changing at an ever increasing pace. Together with rapidly changing customer needs and expectations, this explains why information technology is becoming a key differentiator in many industries. In order to remain competitive, IT must be able to shorten the delivery time and at the same time improve the delivered business value.

Need for integration

This is mainly a technical argument: over the years a multitude of systems have been built that end up being complex to understand, hard to maintain, and even more difficult to extend. Most enterprise IT environments today are a mix of legacy applications, packages and new developments. Add this to the silos that have originated in enterprises, and it becomes clear that the situation becomes hard to oversee.

Business benefit of IT

Many IT budgets are increasing every year again, whereas the CEO continuously has the feeling that IT is not delivering up to expectations. Information technology is becoming strategic for most enterprises, but IT is still struggling with its high complexity and is focusing on managing and maintaining the existing infrastructure rather than on delivering new business value.

Governance

Laws such as Sarbanes-Oxley hold the business responsible for the IT processes, something that cannot be realised in the ongoing divergence between business and IT.

A. *Case study: finance sector*

To illustrate how a SOA could provide a strategic advantage, we provide the actual case of a large banking and insurance company that beside organic growth has made some major acquisitions in the last years as an answer to increasing international competition and consolidation. The result is that today they have a multitude of IT systems with different technologies and running on many platforms. There is much overlap between the different applications and it is currently very costly to develop new services and products.

As an answer, the organisation started an ambitious program for reengineering its current IT environment with the following goals:

- Consolidation of functionality provided by the applications
- Streamlining technology infrastructure
- Re-orientation of the application portfolio from mainly structured around the different financial products (insurance, banking), towards a more customer process oriented view

SOA was a key aspect within this new IT strategy, as it provided a way of re-using as much as possible the existing IT assets and at the same time introducing new functionality and increasing flexibility.

First results are becoming visible and can be situated on two levels:

- *Business* benefits are the ability to provide new products and services for customers at an increasing speed. Consolidation of application functionality has also created the awareness between the different business units concerning common business needs and the need for a more holistic customer view. This is a first result of a better alignment between business and IT.

- *IT* has been able to deliver higher quality at a lower cost by consolidating the application portfolio and the ability to deliver complex functionality as services towards the different applications. Although the complete reengineering program has a large impact on the current IT organisation and will take many years to complete, the first results are impressive and have strengthened the position of the IT department as a strategic partner within the enterprise.

IV. CHALLENGES WHEN MOVING TO A SOA

Once the problems above have been recognized, an enterprise can take the decision to start the implementation of a SOA. Given the impact of a SOA, it must be clear that this is a decision to be made and sponsored by top management.
On the road to creating a SOA, a number of challenges have to be overcome, as described in this section.

A. *Alignment of business and IT*

To date, many companies still have a business strategy that is implemented through a separate IT strategy, often even working on completely different timescales. Applications are often implemented as line-of-business applications (LOBAs), enforcing the creation and existence of silos.

In order to achieve the productivity gain of a SOA – services are by definition cross-LOBA – an enterprise-wide alignment of business and IT strategies and organization is necessary. To realize this alignment, a multi-year program will be required. An incremental implementation is strongly preferred as the early gains will help in building the much needed momentum and they will stimulate the collaboration between business and IT.

As services are at a level of abstraction high enough to be understood by business owners, they are the key instrument to improve communication between business and IT stakeholders. Ultimately this will lead to the situation where the implementation of a business process is as simple as a set of services that are linked together.

B. *The bottom line: benefits and costs*

Most benefits will come from the increased cooperation between business and IT stakeholders. This will make it more and more clear that a SOA is really a business-driven process and not an IT-driven process: IT budgets are often in the range of 10 % - not neglectable of course, but still limited – so most benefits will be in the business areas. As such, benefits such as increased customer retention or shorter time to market outweigh the technical benefits such as a reduction in the number of applications that need to be maintained.

There are of course considerable costs involved. Moving to a SOA will require an initial investment in changing the organization, in people and in technology that is higher than with the traditional approach. However, it is our strong believe that this initial cost will be outweighed once the SOA infrastructure (measured as the number of available services) matures. This is illustrated in **Fout! Verwijzingsbron niet gevonden.** below. This is due to the ability to re-use existing functionality within different business processes, increased flexibility in application delivery, business consistency and improved quality.

FIGURE 1
Cost difference when comparing traditional application delivery with SOA
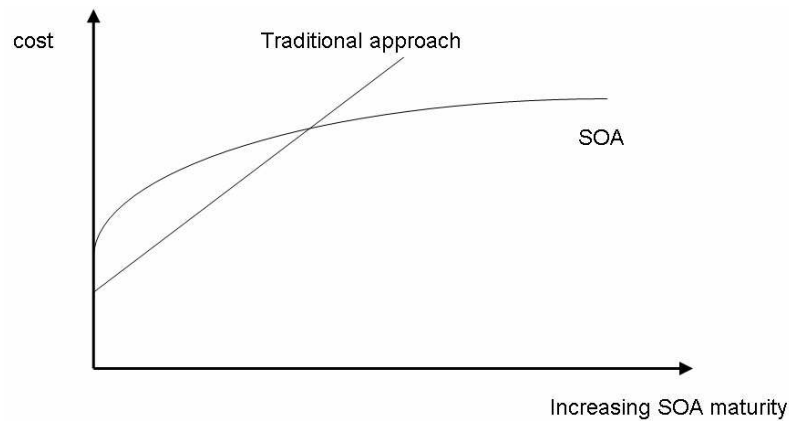
In order to maintain sufficient visibility and momentum, the implementation order of the services must be correctly prioritized to ensure early gains and to support the long-term SOA plan.

C. *Determining which services to build*

All enterprise applications together contain a large amount of potential services. In order to determine which services need to be built, a roadmap is to be created.

First step of the roadmap is the creation of the "as-is" enterprise architecture, the architecture as it exists at this moment. Next, an overview is to be created of all ongoing projects and of projects that are in the pipeline. Finally, the "to-be" enterprise architecture is to be determined, a recommended approach here is starting from the business strategy and high-level business processes and their information requirements. From this a high-level mapping can be made on required application support and functionality.

Based on this input, the list of services to create can be distilled based on the potential for use, needed business flexibility in the different business processes and implementation feasibility. It is advised to maintain a catalogue of available services, in order to stimulate re-use (next to just knowing what is available as building block) and as an instrument for service governance.

Once the services to be built have been determined, they can be prioritized according to complexity. The distinction between fine-grained and coarse-grained can be a measure for complexity, just as well as strategic importance and organizational scope.

This prioritization can be used in the incremental development approach. It is recommended to start the creation of your catalogue with the creation of simple, low-risk services. The advantage of this approach is that it realizes early visibility of business value together with the creation of base services early in the SOA lifecycle, combined with more complex application delivery as the SOA infrastructure matures.

The described process should not be limited to a one time effort but instead be implemented on a continuing basis, as one of the key challenges in the implementation of a SOA is the matching (business and IT) of the implementation and delivery of services with the needs of service users. Again, this requires a close collaboration between business and IT on a long term basis.

D. *Governance*

Governance as a whole and IT governance in particular are getting increased attention. An interesting description of governance by the ISACA organisation is that "IT governance is the responsibility of the board of directors and executive management. It is an integral part of enterprise governance and consists of the leadership and organisational structures and processes that ensure that the organisation's IT sustains and extends the organisation's strategies and objectives." IT governance is important as IT becomes more and more critical to organisations (increasing dependency on IT; increased potential of technologies to dramatically change organisations etc).

As a SOA is by definition an enterprise-wide effort, it is obvious that governance is required here as well. A few of the areas where IT governance is important are described below.

Adherence to standards
SOA will only be successful if standards are defined and enforced on an enterprise-wide basis. These standards are supplementary to the technical standards that are being worked on in the Web services area, such as SOAP, WSDL and UDDI. Other areas that need standardization within the enterprise are business processes modelling, application development, deployment and infrastructure together with a consensus on the semantics of common business entities (corporate information model).

Ownership & funding
In a SOA, it will be less clear which business entity is owner of a service or application, as a service will support different business processes, maybe even not envisaged at the creation of the service. This will require a new funding model, in which shared services are funded by different business entities (based on use) or

by IT (seen as a common infrastructure). Different ownership models exists, from assigning the ownership of a service to the most important user to setting-up a dedicated organization for the delivery of services with clear separation between service users and service providers.

Roadmap of services

SOA requires the enterprise-wide definition of a service roadmap, to ensure consistency and correct reuse of available services. Analysts indicate that there is a substantial probability that reuse reaches 100 % in a few years time for companies that fully concentrate on Service-Oriented Development of Applications (SODA). Also part of a roadmap is management of the complete life-cycle of the provided services.

Change management

Changing business needs will have to be correctly propagated to IT, but in a controlled and managed way. This does not seem to be a new aspect to take into account except from the fact that from now on the scale on which change management is to be executed is much larger. Because of the implementation of enterprise-wide offered services, the scope of change management will evolve from departmental level to enterprise level. Again, a long term view on the implementation of a SOA will be needed with the commitment of senior management (business and IT).

Culture of cooperation

The cooperation between business and IT stakeholders is not a one-off effort, but something that requires continuous / permanent attention. The formation of multi-disciplinary teams is a step in the right direction.

Organisation

In order to manage governance on this large scale, a tiered governance model may deliver great benefits. "Core" services covering the essential functionalities are managed and handled by a single central architecture team, whereas the business applications using the different services on the other hand are architected by the business teams, while keeping the central architecture team informed.


V. THE PLACE OF SERVICES IN ENTERPRISE ARCHITECTURE

The discussion concerning services and the implementation of a Service-Oriented Architecture can not be separated from other enterprise wide architectural initiatives, commonly referenced as Enterprise Architecture. To illustrate the

relation, we provide a description of an Enterprise Architecture framework, together with the relations with a SOA in the next following sections.

A. *Definition of an Enterprise Architecture framework*

Based on our experience, we have found the framework as depicted in Figure 2 of great value.
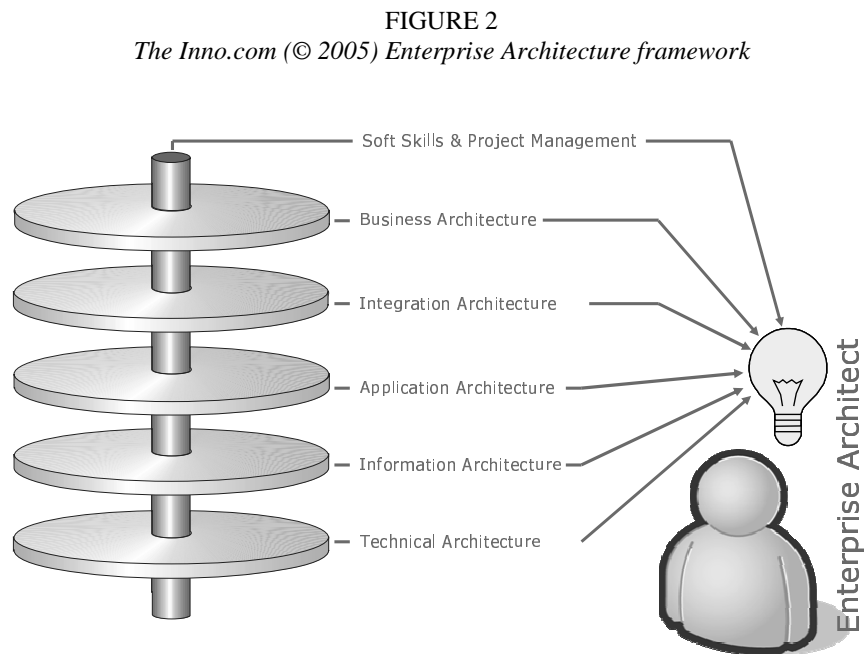
The framework comprises 5 architectural aspects (represented as discs) that are tied together by Project Management and Soft Skills (represented as the vertical bar).

Business Architecture
At this level, the way the business processes are structured is investigated. A variety of business process modelling techniques such as Six Sigma or city planning is used here. For years, the manufacturing industry is working with

processes and their optimisation, whereas for the service industry (e.g. finance) the notion of a process is a completely new concept.

Integration Architecture

At this layer, we take a look at how the different enterprise applications are linked together. In some companies the technical integration options are controlled by a corporate technology division, in others every department decides case by case the preferred option.

Application Architecture

The application architecture is concerned with the architecture of a single application and the interface it exposes to the external world. An application is often defined as a set of functionality that has the ownership of a specific set of data. Ownership is to be interpreted as "having the right to modify data", so this does not prevent read-access by other applications.

Information Architecture

Information architecture deals with 2 aspects of information structure: on the one hand it aims at determining a single enterprise-wide data model and data dictionary; on the other hand it aims at standardizing the structure and semantics of the information exchanged between the different applications. In the financial sector for example, large investments are made to adhere to the ISO15022 standard, both in the database schemas as in the message structure.

Technical architecture

We consider operational and deployment aspects to be part of this architectural view. This concerns hardware platform selection, choice of technology stack, monitoring, etc.

Project management and soft skills

This represents the glue between the different architectural points of view as determining a holistic view requires input and cooperation from many people, both in IT and business areas. Governance aspects are covered here as well.

B. *Linking services and Enterprise Architecture*

The EA model described above goes beyond a pure SOA view. However, none of the architectural layers can be neglected, as they are vital to the overall health of the enterprise as a whole. After all, a key characteristic of a SOA is that it allows the leveraging of existing resources, which is crucial in the current complex IT

environments with their mix of legacy application, packages and new developments.

For every architectural view described in the previous section, we will describe the points where it touches an aspect of the SOA.

Business Architecture

As services reflect a process-oriented view, this architectural layer is of great importance. Once the processes are determined and the services defined, this layer will allow the classification of services in the strategic frame of the overall business. Based upon knowledge of how the particular services are used by the processes, the optimal granularity and targets for re-use can be determined.

Integration Architecture

From a SOA point of view, this layer will determine the technical integration infrastructure (e.g. based on web services) and the overall technical complexity of the integration process. One can split the required functionality in transport oriented features (reliability, security, and scalability), interfacing requirements (central repository, management of service contracts, etc.) and operational capabilities (monitoring and management).

Application Architecture

During the SOA program, the internals of an application are less important. However, a service oriented approach will have an impact on the development process as all application boundaries and interfaces have to be specified with much more rigour. In general, is recommended to split the definition of the service interfaces and the implementation in different teams in order to guarantee the independence between service interface and implementation. Non-functional requirements (monitoring, scalability, deployment) will play also a more important role in the development of a stand-alone application.

Information Architecture

Every service owns part of the single enterprise-wide data model. So although the data model is hidden behind the service, this is to be taken into account as data needs will influence the dependency of a service upon other services that hold the needed data.

Technical architecture

The deployed services obviously require monitoring because of technical reasons such as availability. However, technical parameters such as average response time or histograms of used functionality may offer a competitive advantage: more important customers may be redirected to services running on faster machines, or

management may receive hints for the creation of new, viable services based on services that showed to be popular.

Project management and soft skills
These aspects are essential in a SOA program, and can be found in multiple places: a culture of cooperation between business and IT stakeholders, communication between traditional separated development teams (application silos), all aspects of governance etc.

To summarize the link between a SOA initiative and Enterprise Architecture, following table provides an overview of mapping the key SOA aspects handled in this article and the described Enterprise Architecture framework:

TABLE 1
Mapping Enterprise Architecture framework and key SOA aspects

Enterprise Architecture layer	Key SOA aspects handled
Technical architecture	Scalable and reliable infrastructure Service monitoring and management
Information architecture	Contract definition Semantics business interfaces
Application architecture	Separation interface and implementation Development standards
Integration architecture	Technical integration infrastructure Service contract implementation
Business architecture	Business and IT alignment Service selection and definition Process orientation
Soft skills & Project Management	SOA governance

	Collaboration culture

VI. CONCLUSIONS

In an ever accelerating business landscape, a Service-Oriented Architecture seems at this moment to be the only viable answer to the problems that many enterprises are currently facing. Although SOA is currently still in an early adopter stage, the benefits are already so convincing that denying this solution may very well lead to a competitive disadvantage.

A SOA is not a panacea, as technology in isolation it does not create any strategic value. But the mere fact that it allows for modular support of business processes and the leveraging of existing resources makes it a means to overcome the rigidity traditionally found in IT organizations and systems.

Starting a SOA program is not an easy task. Utilising an Enterprise Architecture framework allows for the much needed assistance and allows for improving the Enterprise Architecture beyond the immediate SOA needs.