SOA - An Architecture Which Creates a Flexible Link between Business Processes and IT

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To be viable, a company must be adapted continously to the market's requirements. The adaption of a company to the market's requirements means also changes in the business processes of the firm. Till several years ago, in any enterprise there was a strong link between business processes and IT applications. Any changes in the business processes lead to a change in the IT applications. This means that any change in the business side involves time, human resources and material resources consumption.This fact can be translated in a slow adapting to the market changes and a cost increasing for changing IT applications side necessary for their adaptation to new business market. Today the market changes quickly and it has a great development; this means that the enterprise adaptation to the market's requirements must be done quickly and with low consumption of either human or material resources. Also, the market changes which cause changes in the business processes should not cause major changes in the IT area. This goal can be achieved using an architecture services-based (SOA) for the enterprise. This architecture allows us, like in a puzzle game, to use the same pieces of material ("services") to build different models ("business processes").

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1. The need of integration. In every enterprise, focus of business environment is concentred to relationships with their partners, customers and suppliers, as well as new compliance regulations and compliance with applicable laws.
In point of view IT, in major part of enterprises was developped over time, many applications as:Supply Chain Management), CRM(Customer Relathionship Management), Human Resources),ERP(Enterprise Ressources Planning) and other applications as Health and Safety Managment,Communication Management etc,).These systems use: different platforms, operating system and program languages.As is defined in [1] "*...old method, technology, computer system, or application program that continues to be used, typically because it still functions for the users' needs, even though newer technology or more efficient methods of performing a task are now available....*" this are legacy systems.These legacy systems was built to support one business process or part of business processes and comprise computers, programs, databases, networking and so on.This IT systems was develloped in decentralized manner. Every IT system was built for one department as own application, without taking into consideration applications built by other departments within the company.So these IT systems cannot comunicate each others.For this reason when a business processes is changed, all IT system which support those business processes have to be modified.This lot of IT systems has become a brake for business process enhancing. For this reason IT systems and Business processes have to be linked into an integrated system, which can ensure operational performance and competitive advantages.It should be better as every department of enterprise to share accurate and reliable data , to integrate their IT systems , in order to offer a better support to the decision making process concerning the overall organization's activity.

2. SOA-Scope,Goals and Benefits.

In some words it have to find a solution which have to solve some challanges [2] from Chapter 1: Alignment of IT with business goal, Responding quickly to new business opportunities,Getting the competitive advantage,Handling the launch of new products/services , while managing existing ones an Handling regulatory and government requirements with ease.

The solutions at problems above can be solved using SOA which is defined in [3]:

„SOA is an architectural paradigm for dealing with business processes distributed over a large landscape of existing and new heterogeneous systems that are under the control of different owners".

SOA is essentially a distributed architecture, with systems that include computing platforms, data sources, and technologies. A distributed architecture requires integration.

Integration software provides the bridge between the legacy systems and SOA,SOA represents a software architecture that is business-oriented and integrates the business tasks as a set of interconnected and reusable services, which communicate with one another.

„SOA establishes an architectural model that aims to enhance the efficiency, agility, and productivity of an enterprise by positioning services as the primary means through which solution logic is represented in support of the realization of the strategic goals associated with service-oriented computing". [4]. Strategic goals and benefits are:

-<u>Increased Intrinsic Interoperability</u>- Interoperability refers to the sharing of data and more interoperable programs exchange easier information.In this case it can say that integration is a process that enables interoperability.

-<u>Increased Federation</u>- A federated IT environment is one which resources and applications are united and have individual autonomy and self-governance.This is succeded through deployment of standardized and composable services each representing a piece of the enterprise and expresses it in a consistent manner.

- <u>Increased Vendor Diversification Options</u>. Vendor diversification refers to the ability an organization to choose best technology innovations and use them within one enterprise. when is required.This help enterpise to change quicly business processes to at changes of market.

- <u>Increased Business and Technology Alignment</u>

-<u>Increased ROI</u> – Services have increased reuse potential that can be realized by allowing them to be repeatedly assembled into different compositions.Once created a service can be used as simple service or as composed service .In this way cost for design services is decreasing

-<u>Increased Organizational Agility</u>- Enterprise agility, on refers to efficiency with which an organization can respond to change. Because services have developed as reusable IT assets, they can be repeatedly composed into different configurations. As a result, the time and effort required to automate new or changed business processes is reduced.

- <u>Reduced IT Burden</u>- Applying service-orientation approach in an IT enterprise it can reduce redundancy, size and operational cost, and overhead associated with its governance and future evolution.In this case IT enterprise is agile department which contribute at increases in efficiency ,cost-effectiveness and to realisation of strategic goals.

3.Services

In the context of SOA, a *service* is a function performed by an application. A function is coded only once and then reused wherever it is needed. "Basically, [5] service is a self-contained (offers different functionalities related to one business or technical area/sub-area), cohesive (all related functionalities are placed together), black box (consumers know nothing about its internals, and underlying technologies) software component that encapsulates a high level business/technical concept that can cover specific area of whole system".

In point of view of granularity, a service can be designed to *be fine-grained* or *coarse-grained.* A fine-grained service can handle small and specific functionality (e.g. log service, database access service, fees calculation service). Fine-grained services are reusable. A coarse-grained service is more powerful service that usually is composed of many fine-grained services and handle more complex and wide range of related functionalities (e.g. loan management service, purchase order service, etc). Coarse-grained services are hard to reuse.

A service might be *stateful* or *stateless.* Stateful service retains and manages service states during its execution, between different requests (e.g. a service that is responsible for handling loans must be stateful in order to keep state information about the loan being processed for client). A stateless service does not retain its states between different requests. This type of service is the most used type of services in SOA, because it allows loose-coupling between requestors and offered services.

Also, a service can be *short-lived* or *long-lived.* The execution of transactions offered by a short-lived service can take sub-seconds or seconds to finish working and returning back the generated results (e.g. getting or updating a database record such as customer information). Execution of long-lived service may take some minutes for starting and will take some days or even months to reach the final state (e.g. a loan management service may take months to grant a new loan to one customer).

Technically, a service is composed of three parts shown as

Fig:

• **Contract:** It provides both *formal* and *informal* specifications of service. Formal specifications use description languages WSDL to describe information related to technical areas of service such as underlying programming language(s), middleware(s), network protocol(s), and other runtime aspects.

Informal specifications are textually presented to provide general information such as the purpose, functionality, constraints, usage of exposed service, and expected response time. A contract [3] is the complete specification of a service between a specific provider and a specific consumer. From a consumer's point of view, it defines "everything you have to know when using this service," so that (ideally) no doubts remain.

•**Interface:** It provides technical representation of service operations (contain information about public operations, parameters and return types) that are available to be invoked by clients.

•**Implementation:** It contains logic of service that might be related to accessing data, business logic, etc. This implementation logic could be encapsulated internally within service itself or it may be provided by other external artifacts (e.g. other programs, code libraries, components, legacy systems, etc). Implementation of Service as Web service can be written in any language and in any platform. The technologies of Web service makes this implementation logic accessible using standard Web technologies, such as HTTP and Web browser, and result in a faster and more dynamic communication for connected applications. Web services architecture is service-oriented and is shown in Figure 2.A consumer searches(using message SOAP- Simple Object Access Protocol specific format for exchanging Web Services data over HTTP) for an

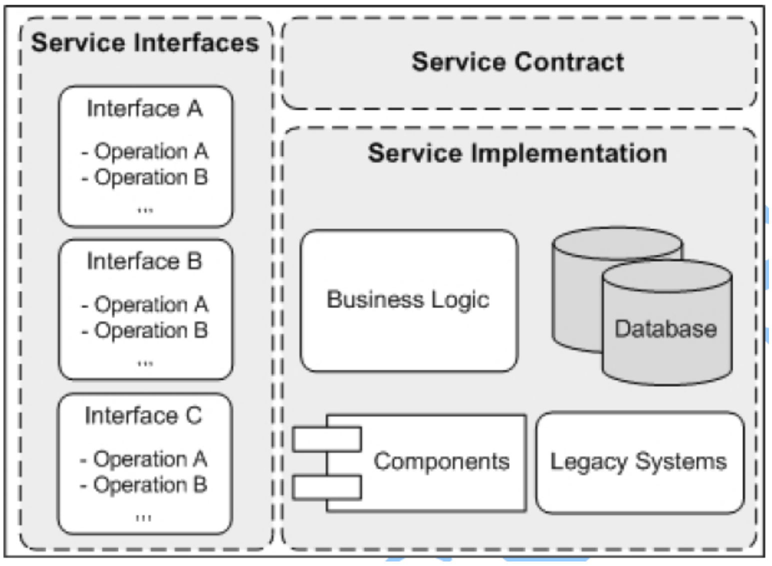

Fig.1. Essential Service Elements [5]

available provider of a service to execute a certain function. A service registry(UDDI- Universal Description, Discovery, and Integration specification can be used by the service providers to advertise the existence of their services and by requesters to search and discover already registered services) contains published services and when there is a request for a service, it returns back the information which allows requestor to locate and invoke the service.

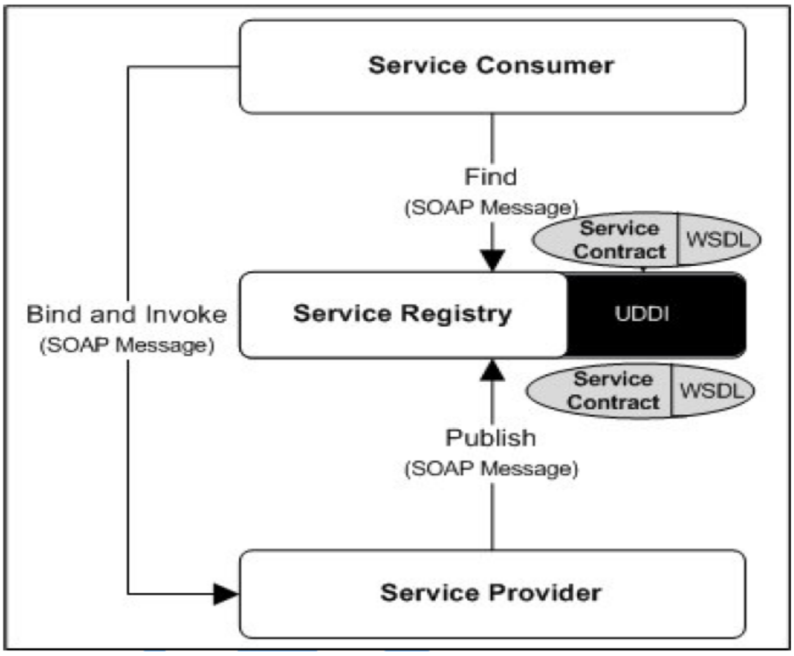

Fig.2. Web Service Arvhitecture

4. SOA Architecture

The structure of a Service-Oriented Architecture can be mapped with a layer model. SOA is an n-layer architectural model as is shown

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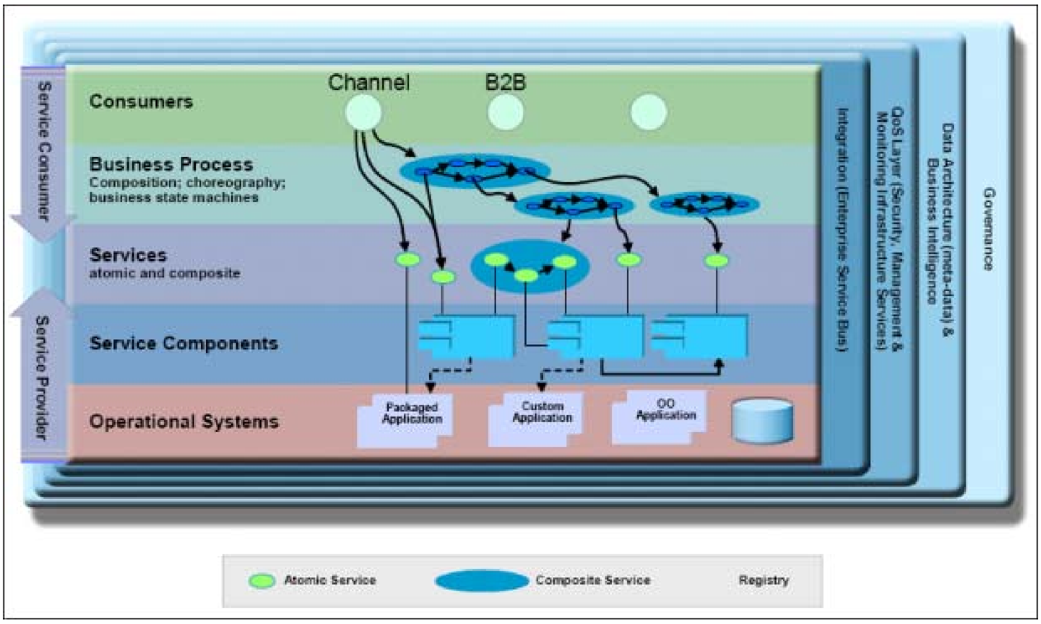

Fig.3. SOA Foundation Reference Architecture [6]

SOA layers are:

Operational Systems Layer: This layer contains existing applications of enterprise as object-oriented systems, business intelligence etc.These applications are known as Custom or Legacy application. These applications provide the background for services and each of them has its own proprietary structures, databases and other system resource access. This layer contain also technolocical layer which contain: Application Platform,Technology platform,Operating system.

Enterprise Components Layer: These are specialized components to provide certain functions and requirements for services. They are the business assets for service implementations, and other system necessities such as management, availability and load balancing of services.

Services Layer: This layer contains the actual services which can be discoverable and invoked by other applications to provide a specific business function for enterprises.Services are held in Enteprise Repository Services.Services are splited in three categories:Local Services(intenal developed in enterprise),Remote services(outsources services) and Enterprise Information system services(internal developed in enterprise using components of Enterprise Information system(legacy systems)).

Business Process Layer: The services can be composed into a single application through service *orchestration* or *choreography*, which supports specific use cases and business processes.

Presentation Layer: It provides user interfaces for:internal users,customers and providers of enterprise.They are consumers [6] of the processes and services.

Comunication between services and Business Processes is facilitated [6] by ESB(Enterprise Service Bus)-Fig

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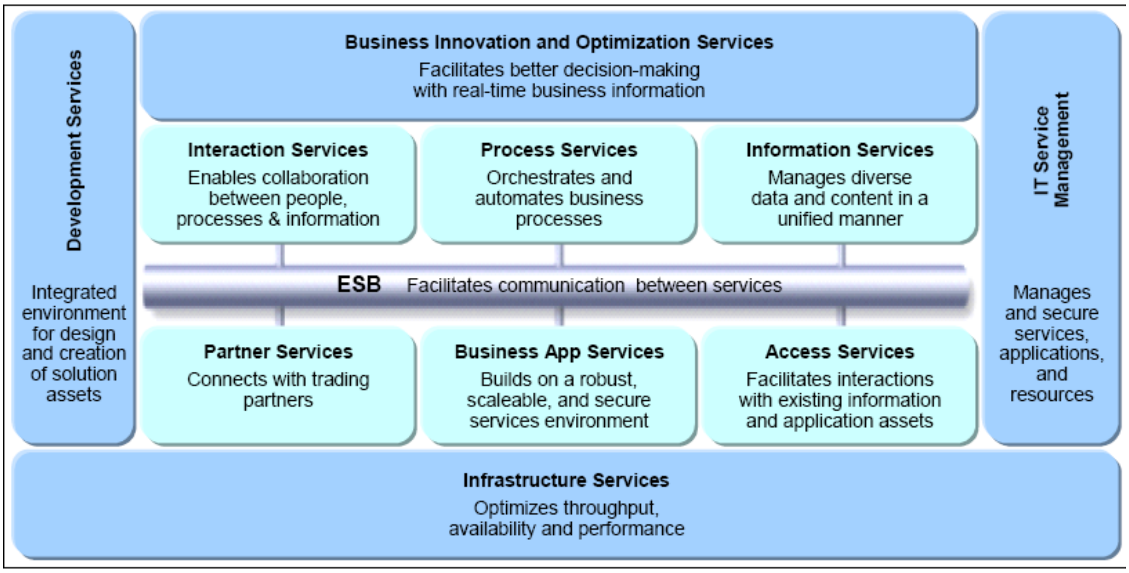
Development Services
Integrated environment for design and creation of solution assets
Business Innovation and Optimization Services
Facilitates better decision-making with real-time business information
Interaction Services
Enables collaboration between people, processes & information
Process Services
Orchestrates and automates business processes
Information Services
Manages diverse data and content in a unified manner
ESB Facilitates communication between services
Partner Services
Connects with trading partners
Business App Services
Builds on a robust, scaleable, and secure services environment
Access Services
Facilitates interactions with existing information and application assets
IT Service Management
Manages and secure services, applications, and resources
Infrastructure Services
Optimizes throughput, availability and performance

Fig.4. SOA Foundation Reference Architecture: Middleware Services view [6]

Core components of Middleware Services are:

- Interaction services- provide the capabilities that are required to deliver IT functions and data to users;
- Process services- provide the required control to manage the flow and interactions of services for implement business processes;
- Business application services- are used by service consumers for access to portal or business processes.
- Information services-Manage disparate data source in unified manner.
- Access services- provide a link between core applications of enterprise, enterprise data stores and the ESB to incorporate services delivered by these applications
- Partner services- Partner services provide capabilities for business processes which interact with outside partners and suppliers.

Part of SOA,an ESB is defined as [7]
„... an open standards, message based, distributed integration infrastructure that provides routing, invocation and mediation services to facilitate the interactions of disparate distributed applications and services in a secure and reliable manner."

Main properties of ESB are:
Invocation-Is the ability of an ESB to send requests and receive responses from services.That means that an ESB has to support the standards for web service communication including SOAP,UDDI and the WS-* family of standards.
Routing-is the ability of ESB to decide the destination of a message during its transport.
Mediation-refers to all transformations or translations between disparate resources including transport protocol, message format and message content.
Adapters- connect to the native APIs and data structures of legacy applications and present a standard interface, which makes it easy to reuse business logic and data.
Security-means for an ESB that is able to encrypt and decrypt the content of messages, handle authentication and access control for messaging endpoints .
Management-ESB has to provide: audit and logging facilities for monitoring infrastructure,a mechanism for configuration and administration of bus and also tools for usage metering.
Process Orchestration-ESB may include an engine to execute business processes described with the Web Services Business Process Execution Language (WS-BPEL) which coordinates the collaboration of the services connected to the bus.

Complex Event Processing-ESB may include mechanisms for event interpretation, event correlation and event pattern.

5. SOA-Flexible link between Business Processes and IT

A business process is a set of specific, tasks performed by people and systems and designed to achieve a predetermined outcome. Companies are trying continuu to improve their business processes , to adapt at market changes, using new technology. As tool for modelling processes, companies are adopting BPM (Business Process Management) which helps to align IT systems with business's strategic goals by creating well defined enterprise business processes, monitoring their performance, and optimizing for increase efficiencies. Each business process is modeled as a set of individual processing tasks. These tasks are typically implemented as *services* within the enterprise. BPELs are the languages for process management. Business Process Execution Languages (BPELs) are XML(eXtensible Markup Language) used for modeling business processes using orchestrating, coreography, and controlling web services.

As is shown in figure 3,4 and 5, SOA based system is composed of Service Consumer, Service Bus(Enterprise Service Bus), and Service Provider.Service Provider start at level Framework and application.System Applications, based on various implementations of language and platform, provide Application Services which use adapters to comunicate with ESBApplication services are exposed in Regpository of ESB. Here are exposed also Created services which are new services which don't use functionalities of legacy System Applications..These can be Internal services(create within enterprise) and External services(create outside enterprise).

Business processes are composed of sub-processes and activity.If activity is simple can be executed by one service, else is complex can be executed by a composed service from Service Orchestartion Layer of ESB.In generally Sub-processes are executed by composed services from Orchestration layer.

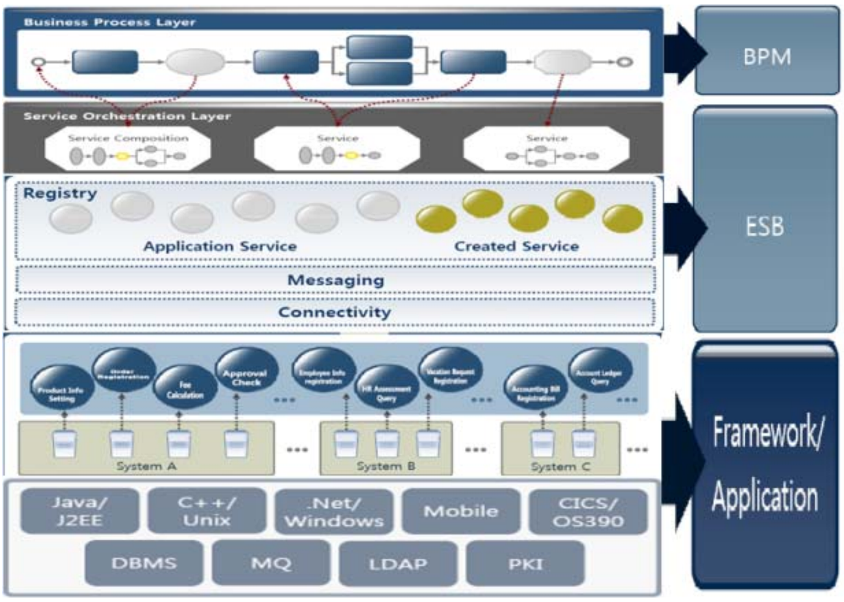

Fig.5. SOA Architecture [Adapted [8]]

6. Conclusions

BPM and SOA provide a good combination for enterprise. BPM provides a tool for defining businesses processes and also other important posibilities of monitoring and managing these processes. Services provide the functions that support these processes.

SOA provides infrastructure(ESB) and the capabilities for services to be combined and to support and create an agile, flexible enterprise.

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