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ENTERPRISE IT ORGANIZATION BASED ON SERVICE ORIENTATION FRAMEWORKS IN ALL TECHNICAL LAYERS AND STRUCTUReS

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***Abstract*— today, providing services in all fields of ICT technology is considered as a challenge for ICT organizations and IT providers. Managers of these organizations are seeking the establishment of service-oriented systems such as IT Infrastructure Library (ITIL). Executive and technical managers are seeking to implement new architectures based on services. The most recent architecture in software development is service-oriented architecture. In the information technology infrastructure, service-oriented approach has been ahead and topics such as service-oriented networks and data centers are emerging. All these show the importance of this approach in the field of Information Technology. In ICT service providing, all components with their distinct standards, templates, and systems move towards service orientation. Thus, establishing the relationship between architectures and formats and computing their correlations are biggest challenges in the deployment of these systems.**

In a comprehensive and integrated environment, how the relationship between these components can be kept? How the relationship and common points of the components can be identified? Do we need a new service-oriented architecture and comprehensive format for covering all the components? What are the cost-benefit and risks of this integration? This article has tried to look at an ICT organization and determine communications and position of components in any of these service-oriented formats and systems and answer to the mentioned questions. This research is done at the trustee ICT Company of Social Security Organization of Iran, the greatest non-governmental organization in Iran, and all experience and examples are related to this organization.[1]

Keywords- Service Oriented Architecture, ITIL, SONA, Service Oriented Data Center, Enterprise IT organization

I. INTRODUCTION

In recent years, the globalization and deregulation of markets have forced enterprises to react quickly to changing environments and to adapt their business processes continuously. IT architectures within organizations are often heterogeneous and develop towards a high complexity that is hardly manageable. A large amount of legacy systems, middleware platforms, programming languages, operating systems, and communication channels are the prevailing characteristics of these architectures. Thus only companies with high flexibility to adapt to new market conditions would survive in the long-term. In order to achieve flexible business processes, architectural support is required for integrating internal legacy systems, as well as the services of business partners. The Service Oriented Architecture (SOA) paradigm is often recommended as it enables agile business processes.

The SOA paradigm ensures agile implementations of business structures that are able to adjust flexibly to changes. However, SOA also poses new challenges. As common Enterprise Architecture (EA), being mostly structured heterogeneously, require high level management, i.e. IT Governance, so does SOA. Services as the smallest units of SOA systems provide the means necessary to enable an EA to adjust flexibly to changing business processes, on the one hand and on the other; they implicitly contribute towards system complexity. Along with the large number of new software artifacts, new challenges emerge, e.g., in the areas of enterprise organization, roles and responsibilities, service lifecycles, standards, finance, etc. on the other hand infrastructure of services such as Networks elements and Data Center components impact on flexibility and quality of services.

Usually infrastructures for different business services are the same that increases the complexity of service management. The chaotic growth of IT has created a technical challenge, which mirrors the process challenges in many organizations. Most IT infrastructures are comprised of a heterogeneous collection of software and hardware, each adequately performing its own tasks but linked together by patchwork processes and customized integration. As a result, any change to one component may have unpredictable and disastrous results for other parts of the infrastructure. Change is one of the most critical challenges for CIOs and IT managers, representing the highest risk to availability and performance of IT services. The rapidly increasing complexity of the infrastructure is compounding this challenge. For this reason some systems and formats like ITIL, TOGAF (The Open Group Architecture Framework), SONA (Service Oriented Network Architecture), etc. are created that help to align business to IT. These frameworks are deployed in enterprise IT organization separately and

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each one focuses on services based on place of deployment in organization. All of these frameworks have relationship with each other because they have dealt with services.

In this paper we describe related work that recognize relationship between service-oriented frameworks, standards and systems and determine the places of each system in Enterprise IT Organization; also propose a scenario of deployment to cover all services and ensure alignment between business and IT. The first part describes service oriented systems, the second part describes relationship between them and finally, the third part includes our proposed scenario.

II. SERVICE ORIENTED FRAMEWORK IN ENTERPRISE IT ORGANIZATION

The first question that must be answered is: "What is Service?" The Answer of this question is important because it can help to determine the relationship view of services in all sections of organization. Service is:" A unit of work done by a service provider to achieve desired end results for a service consumer". Services classified in organization as below:

1- Business services: contain each service that related to internal and external stockholders like application development.

2- Data services: contain services that are related to organization data like update and process of customer data.

3- Electronic Services: set of electronic services that provide for internal and external stockholders such as help desk, host administration console and etc.

4- Infrastructure services: set of services that provide via platforms, servers and networks such as video conferencing, email, VOIP, etc.

According to the service classification any service consumer, refers to one of four categories mentioned above. For example in technical department and software development team that uses SOA, both provider and consumer roles are played by software components

In other systems and frameworks, service provider and consumer change and this change cause indication difference between them. In this part we describe most popular and important system and framework and in the next part we categorize and show the relationship between them.

A. SOA

At first we discuss Service Oriented Architecture. Service Oriented Architecture is an approach to loosely coupled, protocol independent, standards based distributed computing, where software resources available on the network are considered as Services. SOA is believed to become the future enterprise technology solution that promises the agility and flexibility which the business users have been looking for by leveraging the integration process through composition of the services spanning multiple enterprises. Communication infrastructure used within an SOA should be designed to be independent of the underlying protocol layer [4][5]. SOA layers are shown in Figure 1.

You may well be considering deploying a Service Oriented Architecture across your enterprise organization. In such a deployment, there are complex challenges along the

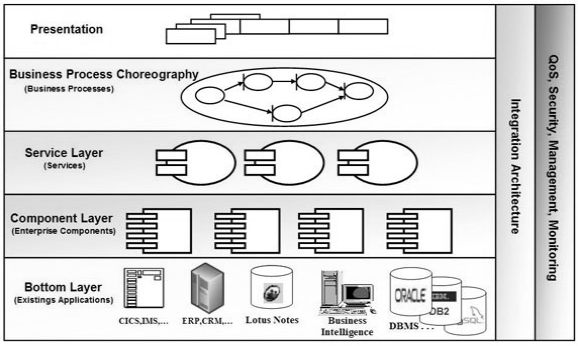

Figure 1. SOA Layers

way including ones unique to your industry and company. However, with a flexible road map for the implementation in hand, you're able to act quickly to meet and overcome the challenges as they occur.

Service Oriented Architectures are an important new paradigm that supports modularized implementation of solutions within a middle tier. These architectures are particularly applicable when multiple applications running on varied technologies and platforms have to communicate with each other.

B. SONA

Good network architecture helps ensure that business strategy and IT investments are aligned. As the backbone for IT communications, the network element of enterprise architecture is increasingly critical. SONA is Cisco's architectural approach to designing advanced network capabilities into your infrastructure. SONA provides guidance, best practices, and blueprints for connecting network services and applications to enable business solutions.

SONA is an open framework for network-based services used by enterprise applications to drive business results. This framework includes three interconnected layers [8].SONA adopts an architectural approach to connecting network-based services with applications to deliver business solutions. This approach focuses first and foremost on establishing a suite of application-centered design principles that define and characterize a flexible and resilient networking environment, which foundationally provides an integrated platform for business services. Using SONA elements and principles in conjunction with Cisco Validated Design (CVD) guides, network architects and engineers can deliver services-capable communications infrastructures that are reliable, scalable, secure, predictable, and can be replicated easily for simplified deployment. A network built on SONA principles and elements can enable and optimize the delivery of applications even in today's complex network environments. Additionally, the SONA framework shows how application architects and developers can make use of network-based capabilities exposed via public APIs to deliver services, functions, and data to the application and middleware layers of their enterprise architecture. These interfaces into the network allow application architects to

leverage information sources and services, which were not previously available, in order to better meet business requirements through innovative solutions.

SONA Technology Layers: SONA is comprised of three technology layers (see Figure 2).The Network Systems layer consists of foundational network designs and related essential services that create basic building blocks for the network infrastructure. This layer provides a sound technical blueprint for designing network modules or building blocks that can guarantee flexibility, security, resilience, scalability, and performance.

The next layer up in the SONA framework model is the Integrated Network Services layer. This layer establishes guidelines to enable, accelerate, and optimize applications deployment. Integrated Network Services can be categorized into two general service types, transparent services and exposed services. Transparent services can be used to accelerate or optimize the manner in which applications run across the network, and are characteristic of transport-type services. Transparent services operate in a manner that is transparent to application-level functions and systems. Some examples of transparent services include:

- Dynamic routing
- Switching and VLANs
- Server load balancing
- MPLS and MPLS VPNs
- Network Firewalls
- Intrusion Detection System (IDS) and Intrusion Prevention System (IPS)
- Wide Area Application Services (WAAS), such as Payload Compression
- XML Firewalls and Content-based Routing
- Email Spam and Virus Protection

The final layer in the SONA model is the Application layer. This layer represents application systems typically operating as connected entities, both physically and logically, to the network infrastructure. These applications act as the "consumers" of the network services, both transparent and exposed. While Cisco produces a number of systems that operate at the Application level, systems in this space are also currently developed and delivered by Cisco ecosystem partners and various other third-party vendors. Some examples of currently available application-level services include:

- Unified Communications Directory Access (with AXL/XML/SOAP)
- Unified Communications Click-to-Dial
- IP Phone Web Services (using XML/HTTP)

By building a network as outlined by the SONA framework, an enterprise can simultaneously meet its current network and communications infrastructure needs, while investing in a services platform that will, in the long term, be an integral part of a comprehensive enterprise IT architecture.

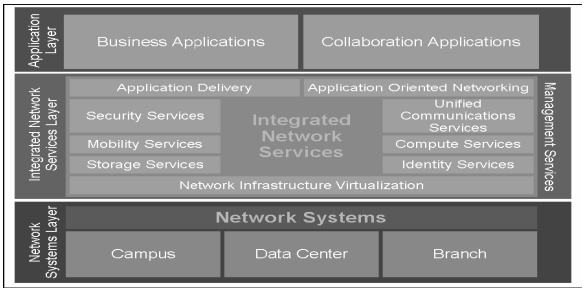

Figure 2. The SONA Framework: High-Level View

C. ITIL

The Information Technology Infrastructure Library (ITIL) is the most widely accepted approach to IT Service Management (ITSM) in the world. ITIL provides a cohesive set of best practices, drawn from the public and private sectors internationally. It is supported by a comprehensive qualifications scheme, accredited training organizations, and implementation and assessment tools.

ITIL facilitates the delivery of high-quality IT services. ITIL outlines an extensive set of management procedures that are intended to support businesses in achieving both quality and value – in a financial sense – in IT operations. These procedures are supplier-independent and have been developed to provide guidance across the breadth of IT infrastructure, development, and operations [3]. The ITIL Framework includes some components as shown in Figure 3.

The IT Infrastructure Library is a set of best practice documents that provide IT organizations with guidance on establishing and implementing processes for overcoming current and future technology challenges. Companies with the good fortune to have implemented ITIL processes during the inception of their IT organization undoubtedly reap the benefits of outstanding efficiency. However, most IT organizations are not that lucky, being built before ITIL was available, from small grassroots shops that were initially too small to adopt formalized ITIL processes or constructed ad hoc from disparate IT groups created from mergers and acquisitions. In these cases, ITIL processes must be adapted to already existing procedures. This requires a challenging balance between pragmatism and theory and a detailed understanding of both the business and ITIL. An additional challenge for wide scale adoption is mapping ITIL processes with currently available IT management tools. The most important impacts of deployment of ITIL are:

- Customer satisfaction improved (through services delivery).
- Productivity improved.
- Costs reduced.
- IT services through the use of proven best practice processes (one of them Service Level Management).
- Skills and experience better used standards and guidance.
- Third party services improved delivery.

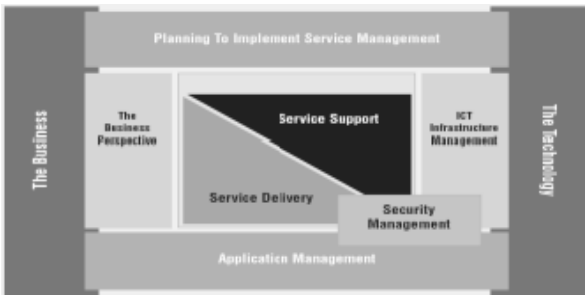

Figure 3. ITIL Component

D. *Service Oriented Enterprise Architecture*

Enterprise architecture has the purpose of effectively to align the strategies of enterprises with their business processes and their (business and IT) resources. Enterprise architecture is important because organizations need to adapt increasingly fast to changing customer requirements and business goals. This need influences the entire chain of activities of an enterprise, from business processes to IT support. Moreover, change in architecture may influence other architectures. In order to define the field and determine the scope of enterprise architecture both researchers and practitioners have produced a number of architecture frameworks. Frameworks provide structure to the architectural descriptions by identifying and sometimes relating different architectural domains and the modeling techniques associated with them. Well-known examples of architectural frameworks are [6]:

- Zachman's framework for enterprise architecture. The Zachman framework is widely known and used. The framework is a logical structure for classifying and organizing the representations of enterprise architecture that are significant to its stakeholders. It identifies 36 views on architecture (.cells.), based on six levels (scope, enterprise, logical system, technology, detailed representations and functioning enterprise) and six aspects (data, function, network, people, time, motivation).
- The Reference Model for Open Distributed Processing (RM-ODP) is an ISO/ITU Standard (ITU, 1996) which defines a framework for architecture specification of large distributed systems. It identifies five viewpoints on a system and its environment: enterprise, information, computation, engineering and technology.
- TOGAF is completely incorporated in the TOGAF methodology. TOGAF has four main components, one of which is a high-level framework defining these three views: Business Architecture, Information System Architecture and Technology Architecture.

Service oriented enterprise architecture is a way to design and develop enterprise software by communicating between loosely coupled and reused services. The most important impacts of execute Service Oriented Enterprise Architecture are [7]:

- New products and process are executed easily by IT.(CEO)
- The flexible system will not preventive of change and improvement of processes.(CEO)
- The system integration problem will be resolved in enterprise organization.(CIO)
- Division of data system project to small components that causes to increases the computability of progress.(Project Manager)
- Connect and create relation between data systems by using Web Services.(Software Developer)

III. RELATION AND OVERLAP OF SERVICE ORIENTATION FRAMEWORKS

- In this part we describe the relation and overlap between services oriented frameworks. We used related works and research for this part and finally according these studies we suggest set of service oriented frameworks for best alleging business and IT in enterprise IT organization.

A. *SONA in Enterprise IT Architectures*

The SONA model outlines how a flexible, services-oriented communications network can be built, and identifies the high-level relationship and interfaces between the network and general application level systems. As a result, the SONA framework is not intended as a comprehensive enterprise IT architecture framework and should not be used to supplant or considered as a substitute for more inclusive high-level enterprise architecture, such as TOGAF. Instead, SONA should be used to provide structured design guidance at all appropriate stages within an enterprise's overall architecture process. [9]

Using TOGAF as an example, it is clear that the SONA framework can be applied as a component of the TOGAF Architecture Development Method (ADM) cycle to provide a structured basis behind the decision and design processes surrounding the Technology Architecture phase (see Figure 4). In this case, TOGAF does not specify specific design methodologies for the communications infrastructure, but rather references other existing architectures such as SONA Places in the Network (PINs) and Cisco Validated Designs (CVDs). Additionally, architecture frameworks typically revolve around creating systems that can be replicated easily. TOGAF recommends this approach by providing guidance on developing a building block approach that is suited to replication.2 PINs are highly modular and provide the details of a structured, pre-tested, predictable network design. Also, the TOGAF ADM model does not outline the detailed specific interactions or interfaces between the information systems and the communications infrastructure, which are depicted at a high level.

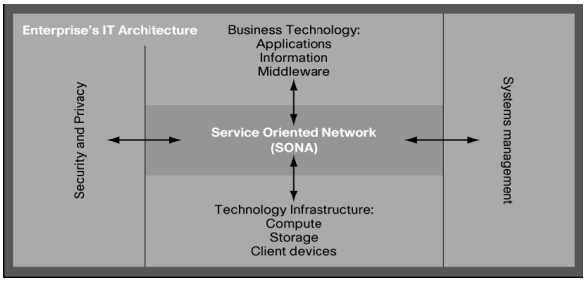

Figure 4. Relative Contextual View of SONA within IT Architecture

This is an area where SONA can contribute to the options available to the enterprise network architect. By providing interfaces and APIs to specific services accessible within the network, the architect can expand the service IT organization.

B. ITIL with SOA

Service Oriented Architectures are rapidly being accepted by the IT world as a sound, modularized approach for building and deploying services across the extended enterprise. However, practical implementation of these architectures requires careful planning. Interested enterprises must first make sure that they're geared up to implement and support them in the long-term.

By developing and following an implementation road map, companies can proactively address a range of challenges that they will encounter along the way. Each enterprise will face a unique set of challenges; corresponding approaches for solving those challenges will vary, as well. The impact of the challenges—both during and after the implementation also depends on the context of the given enterprise. Challenges in deployment of ITIL with SOA are [1]:

- SOA / ITIL from technology to business impact
- SOA / ITIL hierarchy of services
- Business and IT people have to collaborate!
- IT Development and IT Operation have to collaborate!

C. ITIL and TOGAF

Business and IT alignment continues to be a challenge and a top priority for CIOs. Alignment problems occur because there is a lack of effective collaboration. A collaborative environment ensures that business requirements are understood by the business and IT. Enabling business/IT alignment through effective collaboration requires adherence to three primary principles: trust (having a neutral facilitator who establishes transparency and integrity in dealing with parties); communication (ensuring that all parties have the same understanding of the terminology involved); and context (maintaining and displaying the relationships between components in the project).

After achieving collaboration, it is important that business requirements are translated into services that meet business expectations. Misunderstanding the business requirements can result in a deployment that cannot service the uptime requirements. Two complementary disciplines are available to govern service delivery: ITIL and TOGAF. While neither service management nor enterprise architecture are new concepts, the business service focus of their latest version, TOGAF Version 9 and ITIL Version 3, enables a standard, effective approach to integrated service delivery and business/IT unit alignment. Both TOGAF and ITIL have a common focus in the integration of IT services and the business processes that they support. This common service focus enables an integrated approach to aligning business and IT.

ITIL and TOGAF are both architecture frameworks, but they address different concerns. ITIL is primarily focused on the delivery of IT services, and TOGAF is a methodology and set of tools for developing enterprise architecture. TOGAF should be considered as being on top of ITIL as it covers the product conception lifecycle, and ITIL as the way product services are managed for users and customers [2].

ITIL defines service as a “means of delivering value to customer by facilitating outcomes customers want to achieve.” TOGAF’s enterprise architecture methods focus on optimizing the use of people, processes and technology to meet common business objectives. The integration of the two provides an encompassing framework for delivery of IT services. TOGAF provides the structured framework for strategy and design of the organization and the roles, processes and tools required for service delivery. ITIL service management practices focus on governing, standardizing and simplifying the delivery of IT services to the business [10].

An excellent style manual for science writers is [7].

IV. PROPOSED SCENARIO

As we mentioned in the previous section; for deploying Service orientation in all sections of the organization we proposed a scenario for Tamin Company (company for social security organization) based on the structure of this company. First we categorized frameworks in two sections:

- Strategic and Management frameworks: TOGAF and ITIL
- Technical Frameworks: SOA and SONA

Enterprise Architecture is in the top level and first step design for organization .TOGAF is selected for Service Oriented Enterprise architecture. TOGAF covers the product conception lifecycle and execute on time at first. TOGAF provides the structured framework for strategy and design of the organization and the roles, processes and tools required for service delivery

In next step we deployed ITIL in Tamin Company. ITIL service management practices focus on governing, standardizing and simplifying the delivery of IT services to the business. TOGAF guarantees a consistency for the building of new products or services and addresses business requirements. ITIL guarantees the consistency of services between them through the use of standard processes, such as Change Management. TOGAF can be based on an enterprise architecture repository and ITIL can be based on a Configuration Management Database (CMDB) as shown in figure 5.

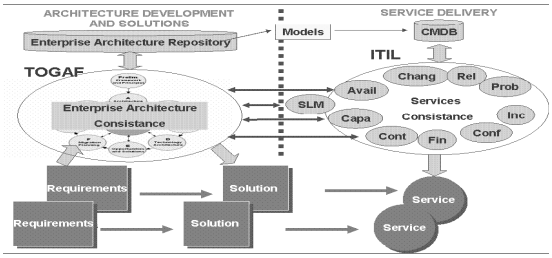

Figure 5. TOGAF and ITIL relationship

The TOGAF Architecture Development Method (ADM) is the result of continuous contributions from a large number of architecture practitioners. It describes a method for developing enterprise architecture, and forms the core of TOGAF. It integrates elements of TOGAF – as well as other available architectural assets – to meet the business and information technology needs of an organization.

Architectural assets can also be software and hardware components, people, and even documentation. In ITIL, the Configuration Management Database (CMDB) is the database which holds a record of all Configuration Items (CIs) associated with IT infrastructure.

The infrastructure includes hardware, software, and any associated documentation. A CI is a component of an infrastructure or item, such as a Request For Change (RFC), associated with an infrastructure that is (or is to be) under the control of Configuration Management.

According to ITIL, a CMDB manages:

- Hardware, including network components, where relevant
- System software, including operating systems
- Business systems (custom-built applications)
- Software packages
- Database products
- Physical databases
- Environments
- Feeds between databases, applications, and EDI links
- Configuration baselines
- Software releases
- Configuration documentation (e.g., system and interface specifications, licenses, maintenance agreements, Service Level Agreements (SLAs), decommissioning statement)
- Change documentation, deviations, and waivers
- Other resources (e.g., users, suppliers, contracts)
- Other documentation (e.g., IT business processes, workflow, procedures)
- Network components
- Service management components and records (such as capacity plans, IT service continuity plans, incidents, problems, known errors, RFCs, etc.)

The CMDB is the repository which supports the ITIL services from an operational perspective. An Enterprise Architecture Repository is used to also store the reference patterns and the Architecture Building Blocks and is used during the architecture development process. From there, two different approaches could be taken into consideration depending on the IT Service Management and enterprise architecture maturity of the company and the tools already in place.

In this Scenario Tamin Company owns an Enterprise Architecture Repository and a CMDB, and extends it with Architectural Views (shown in figure 6). Some companies may be tempted to extend the meta-model of

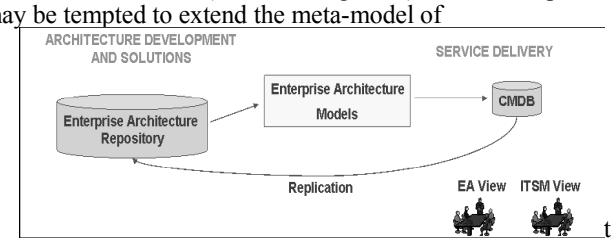

Figure 6. Extend CMDB for EA Model

heir CMDB. Some vendors provide tools to allow the CMDB model to be extended. This would allow adding new tables and views. Therefore, a CMDB could be also used to store the architectural assets of the enterprise architecture. The meta-model of a CMDB being extended could integrate the missing information related to the enterprise architecture. As we know the goals of Configuration Management are:

- To identify, record, and report on all IT components that are under the control and scope of Configuration Management
- To provide a logical model of the infrastructure or a service by identifying, controlling, maintaining, and verifying the versions of CIs in existence in the CMDB.

The ADM method could integrate the Configuration Management process in order to populate "the CMDB repository" with reference architecture, models, and patterns, and also architecture assets.

The Architecture Building Blocks could be new types of CI in the CMDB. If possible, the meta-model of the CMDB could be extended and a new category created. Standard categories include: Programs/Projects, Services , Systems , Hardware , Software , Documentation , Environment , People , Data .

A new category could be created named "Architecture Building Blocks". An IT service could also have relationships with one-to-many Architecture Building Blocks. This will be managed through the Configuration Management process.

We extract mapping of TOGAF component with ITIL process and based on design EA and deploy Service management System. TOGAF determine Application and services in Organization and update CI in CMDB. According to CI's in CMDB, technical deployment based on SOA and SONA (shown in figure 7) for internal services executed.

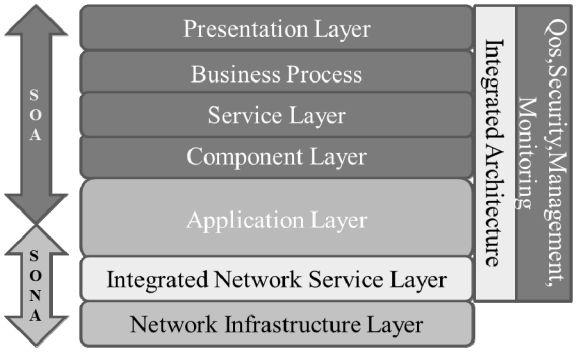

Figure 7. SONA and SOA layer integrated

V. CONCLUSION

a) By standardizing IT services and integrating their use through effective business processes, your enterprise will support costs down while increasing responsiveness. According to our scenario, separating Service Oriented Frameworks to two sections helps us to integrate heterogeneous framework and create relationship with them. Also causes the parallel process and element in these frameworks to be integrated like CMDB.

b) Integration and adoption of these frameworks within an infrastructure and collaborative environment to support them will go a long way to ensure that business and IT alignment will no longer need to be the top priority for CIOs in the coming years. Although, practical implementation of these architectures requires careful planning, we think our scenario guarantied organization move on service oriented way and we propose the analyses of the result of implementing this scenario and updating the scenario by applying other service oriented frameworks with different integration for further research.

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