Definition of zachman framework cells based on service oriented architecture

Vahid Barekat[*], Ebrahim Behrouzian Nejad[**], Seyed Enayattolah Alavi[***]

[*]Department of Computer, Science and Research Branch, Islamic Azad University, Khouzestan, Iran
[**] Department of Computer, Shoushtar Branch, Islamic Azad University, Shoushtar, Iran
[***] Department of Computer, Shahid Chamran University, Ahvaz, Iran

Abstract- One of the favorite frameworks which is increasingly introduced for solving the problems of complex information systems and improving their management is John Zachman Framework. This framework is currently used for understanding Enterprise Architecture and business. Service Oriented Architecture is a standard framework in which services are created, implemented, and settled. Its main objective is accelerating agility of information technology towards fast and effective reply to the changes in business environments. As the organizations and companies are increasingly moving to the Service Oriented Architecture, its complexities and dimensions are more highlighted. Therefore, it is needed to take into account the expansion of criteria and models used in designing architecture. Since Service Oriented Architecture is the newest generation of Information System Architecture and it can be used in different areas like Enterprise Architecture, in this article it is intended show different models of Service Oriented Architecture and also demonstrate the position of this service in Zachman Framework. On the other hand, it is attempted to introduce Zachman's Service Oriented Framework.

Index Terms- OASIS, Reference Model for SOA (SOA-RM), Service Oriented Architecture (SOA), Zachman Framework (ZF), Zachman's Service Oriented Framework (ZSOF).

I. INTRODUCTION

An Enterprise Architecture (EA) is a plan of record, a blueprint of the permitted structure, arrangement, configuration, functional groupings / partitioning, interfaces, data, protocols, logical functionality, integration, technology, of IT resources needed to support a corporate or organizational business function or mission. The Zachman Framework for Enterprise Architecture is a widely used approach for developing or documenting an enterprise wide architecture. John Zachman based his framework on practices in traditional architecture and engineering. The framework is a logical structure for classifying and organizing those elements of an enterprise that are significant to both the management of the enterprise and the development of its information systems.

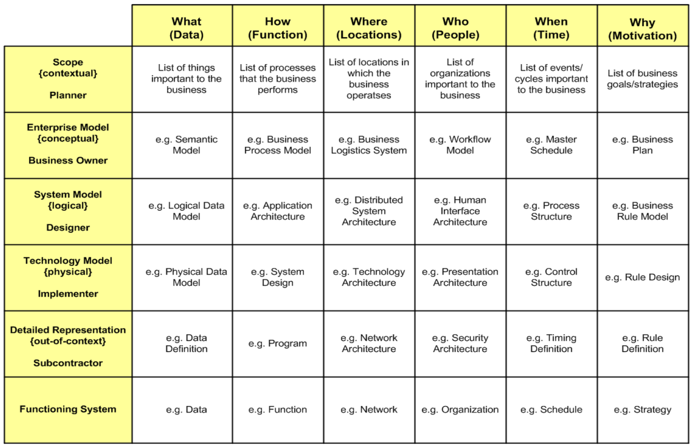
In 1987, John Zachman wrote, "To keep the business from disintegrating, the concept of information systems architecture is becoming less of an option and more of a necessity." From that assertion over 20 years ago, the Zachman Framework has evolved and become the model through which major organizations view and communicate their enterprise information infrastructure. The Zachman Framework draws upon the discipline of classical architecture to establish a common vocabulary and set of perspectives, a framework, for defining and describing today's complex enterprise systems. Enterprise architecture provides the blueprint, or architecture, for the organization's information infrastructure.

Service Oriented Architecture techniques are applicable to the system layer (domain) of enterprise architecture as a system development methodology. SOA is an approach to building IT systems out of common software modules (parts), called services. The goal of SOA-based development is to enable organizations to assemble business systems out of simpler cataloged modules. SOA methods are now being explored by enterprises with the goal of achieving flexibility, agility, and productivity enhancements in IT development. Indeed, in allowing reuse, SOA lowers long-term integration costs and provides faster delivery of business applications. This approach to development may typically require more upfront effort in design and planning when the paradigm is first adopted and applied, but, in theory, it enables organizations to increasingly build systems more rapidly and cheaply as the inventory of reusable modules grows over time.

II. THE PLAN OF WORK (PROCEDURE)

The Zachman Framework intends to provide an understanding of any particular aspect of a system at any point in its development. The tool can be useful in making decisions about changes or extensions. The framework contains six rows and six columns yielding 36 cells or aspects (Table 1).

Table 1: Zachman Framework



	What (Data)	How (Function)	Where (Locations)	Who (People)	When (Time)	Why (Motivation)
Scope {contextual} Planner	List of things important to the business	List of processes that the business performs	List of locations in which the business operatses	List of organizations important to the business	List of events/ cycles important to the business	List of business goals/strategies
Enterprise Model {conceptual} Business Owner	e.g. Semantic Model	e.g. Business Process Model	e.g. Business Logistics System	e.g. Workflow Model	e.g. Master Schedule	e.g. Business Plan
System Model {logical} Designer	e.g. Logical Data Model	e.g. Application Architecture	e.g. Distributed System Architecture	e.g. Human Interface Architecture	e.g. Process Structure	e.g. Business Rule Model
Technology Model {physical} Implementer	e.g. Physical Data Model	e.g. System Design	e.g. Technology Architecture	e.g. Presentation Architecture	e.g. Control Structure	e.g. Rule Design
Detailed Representation {out-of-context} Subcontractor	e.g. Data Definition	e.g. Program	e.g. Network Architecture	e.g. Security Architecture	e.g. Timing Definition	e.g. Rule Definition
Functioning System	e.g. Data	e.g. Function	e.g. Network	e.g. Organization	e.g. Schedule	e.g. Strategy

Nearly all of today's modeling languages offer design capabilities that reflect a futuristic state of software architecture. These languages illustrate future scenarios; some even introduce a road map for implementation.

OASIS (Organization for the Advancement of Structured Information Standards) is a non-profit consortium that drives the development, convergence and adoption of open standards for the global information society.The OASIS Reference Model for SOA [SOA-RM] provides a common language for understanding the important features of SOA. The SOA-RAF (Reference Architecture follows) ,follows the recommended practice of describing architecture in terms of models, views, and viewpoints, as prescribed in the ANSI/IEEE 1471-2000.

In this article it is intended to take into account different dimensions of service oriented architecture (e.g., web services) and also apply OASIS Service Oriented Architecture Reference models in the cells of Zachman Framework show Zachman's Service Oriented framework.

III. Moving to the Zachman's Service Oriented Framework (ZSOF)

In this part service oriented actions in each row of Zachman Framework is reviewed.

3-1 Analysis First Row in ZSOF:

The first row of the framework identifies the field and theme of architecture without regard to the output. Since here there is a combination of Zachman Framework and Service Oriented, it is obvious that primary concepts that represents Zachman Framework change. Accordingly, after making service oriented, contents of first row are suggested as given in Table 2.

Table 2: The Comparison of Concepts of the ZF and ZSOF

Zachman Framework Concept	Data ("what")	Function ("how")	Location ("where")	People ("who")	Time (when")	Motivation ("why")
Zachman's Service Oriented Framework	Data and Information Flowing	Services and Processes	Network and Valuable Resources	Consumer services, Service Provider, User interfaces ...	Events and Time	The need for service and Policies

3-2 Analysis Second Row in ZSOF:

Second row (Owner's perspective) in Zachman Framework, identifies descriptive representation from the enterprise owners' perspectives. In this row, business is described in accordance with what business stakeholders in the organization (managers, staffs, reporters) explain. Third row (designer's perspective) in Zachman Framework identifies given data for saving and the relationship between these data. Since OASIS Service Oriented models to a high degree are the combination of both owner and planer's perspectives in relation to the business, in this article the second row (Business Model) and third row (Information System Model) are composited and a new compound row 'Business Model' is suggested in Table 3. Therefore, in new composited row (Business Model) what is modeled includes people (participants and stakeholders) who are involved in business, and also consists of objectives, activities, interpersonal relationships, and instruments and actions influenced by these people. In Business Model row, Service Oriented Models (OASIS models) are located. In the following these models and their features for each cell will be explained.

3-2-1 The Business row and First column in ZSOF:

All the components participated in Service Oriented Architecture are frequently in contact with business processes in order to offer exact and suitable services to the participants. In the development of Service Oriented, a collection of components are used which in relation and cooperation with each other expand the business of complex and developing workshops. In interface, transferring messages is an instrument by which service participants are interacting. Since in this cell we have transformation of information, 'Semantics of Communication Model' can be a suitable model for representing the concepts and dimensions of this cell. In the following, features and characteristics of 'Semantics of Communication Model' based on OASIS consortium will be explained (Figure 1). Location of this model is depicted in Table 3.

Semantics of Communication Model:

Interaction is a form of communication. In this Reference Architecture, we use messages as the medium of interaction between service participants. Messages are exchanged that represent actions, and messages are exchanged that represent the reporting of events. In this model, we outline one way that this can be modeled effectively – in terms of shared vocabularies, shared semantics and shared understanding of communicated intent. Since service consumers and providers are not directly acting against each other, they must do so indirectly – primarily by means of some form of communication. Speaking to someone is an action; if the speech conveys a request or a pronouncement of some kind, the former actions are used as vehicles to convey the true actions. Thus in Figure 1, we see Action appear twice – once in modeling the communicative actions needed to support interaction and once as the intended or conveyed action.

Message exchange is the means by which service participants (or their delegates) interact with each other. There are two primary modes of interaction: joint actions that cause real world effects and notification of events that report real world effects. The notion of "joint" in joint action implies that you have to have a speaker and a listener in order to interact. A message exchange is also used to communicate event notifications. An event is an occurrence that is of interest to some participant; in our case when some real world effect has occurred.

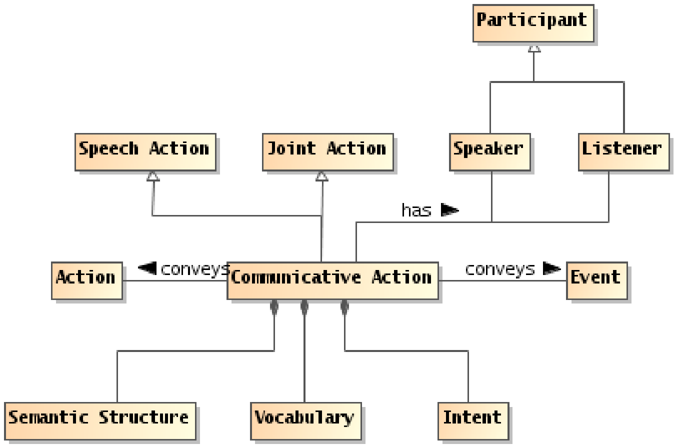


Figure 1: Semantics of Communication Model

Communicative Action: Communicative actions are joint actions where service participants communicate with each other. A Communicative Action has a speaker and a Listener; each of whom must perform their part for the communicative action to occur.

Semantic Structure: A communicative action has an aspect which conveys the meaning of the content being communicated. Typically, a semantic structure takes the form of a proposition which is either true , false or intended to be true or false. The concept of semantic structure is quite abstract. However, in many cases involving machines, the semantic structure will be conveyed as some form of highly regular tree structure, with a well defined method for interpreting the structure. For example, an invoice will often follow pre-established standards for communicating invoices.

Intent: The purpose of the communicative action is its intent. The intent, together with the semantic structure convey either an action – such as a request from a service consumer to the service – or an event – which typically reports on the results of previous communicative acts.

Vocabulary: In order for there to be any communication, there must be sufficient shared understanding of the elements of interaction and of terms used in communication. A shared vocabulary may range from a simple understanding of particular strings as commands to a sophisticated collection of terms which are formalized in shared ontologies.

Action: Participants' principal mode of participation in a SOA ecosystem is action; typically action in the interest of achieving some desired real world effect. The application of intent by an actor to cause an effect .

Event: An event is made visible to interested consumers by means of an event notification message exchange that reports a real world effect; specifically, a change in shared state between service participants.

Joint Action: The coordinated set of actions involving the efforts of two or more actors to achieve an effect.

3-2-2 The Business row and Second column in The ZSOF:
This cell indicates a model of processes and services of Service oriented organizational systems in relation to the business. In previous approaches, data was used for communication; however, in this model message is used for request which shows that this model is based on process. Among the protocols and Service Oriented Standards BPEL, UDDI, WSDL, and SOAP can be mentioned. Though in this model protocols and standards are not explained in details, however, using the capacities of services and processes in direction of reaching the services confirms that 'Service Reachability Model' can suitably cover this cell .

Service Reachability Model:
Service reachability, as modeled in Figure 2 enables service participants to locate and interact with enables service participants to locate and interact with one another. To support service reachability, the service description should indicate the Endpoints.to which a service consumer can direct messages to invoke actions and the protocol to be used for message exchange using that Endpoint. As generally applied to an action, the endpoint is the conceptual location where one applies an action; with respect to service description, it is the actual address where a message is sent. Reachability involves knowing the endpoint, protocol, and presence of a service. At a minimum, reachability requires information about the location of the service and the protocol describing the means of communication. Location of this model is depicted in Table 3.

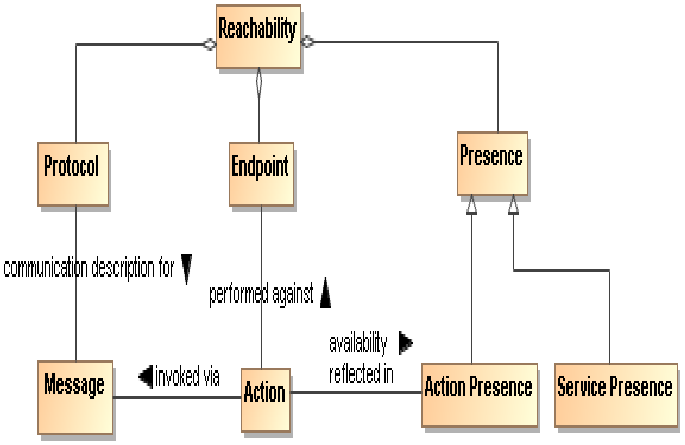


Figure 2: Service Reachability Model

Endpoint: A reference-able entity, processor or resource against which an action can be performed.

Protocol: A structured means by which details of a service interaction mechanism are defined.

Presence: The measurement of reachability of a service at a particular point in time.
A protocol defines a structured method of communication. Presence is determined by interaction through a communication protocol. Presence may not be known in many cases until the interaction begins. To overcome this problem, IT mechanisms may make use of presence protocols to provide the current

up/down status of a service. Each action may have its own endpoint and also its own protocols associated with the endpoint and whether there is presence for the action through that endpoint. Presence of a service is an aggregation of the presence of the service's actions, and the service level may aggregate to some degraded or restricted presence if some action presence is not confirmed. For example, if error processing actions are not available, the service can still provide required functionality if no error processing is needed. This implies reachability relates to each action as well as applying to the service/business as a whole.

3-2-3 The Business row and Third column in ZSOF:

In Zachman Framework, geographical distribution of physical resources of business, organizational functioning, and the way of relationship between locations were located in this cell; however, after combining Zachman Framework with Service Oriented Architecture, contents of this cell are being expanded and contains more than physical themes. The model located in this cell must represent properties, resources, and valuable stocks comprehensible for the Service Oriented Enterprise. Therefore, description of network and its valuable resources can be presented by the Service Oriented 'Resources'.

Resource Model:

A resource is generally understood as an asset: it has value to someone. Key to this concept in a SOA ecosystem is that a resource must be identifiable (Figure 3). Location of this model is depicted in Table 3.

Resource: An identifiable entity that has value to a stakeholder.

A resource may be identifiable by different methods but within a SOA ecosystem a resource must have at least one well-formed identifier that may be unambiguously resolved to the intended resource. Codified (but not implied) contracts, policies, obligations, and permissions are all examples of resources, as are capabilities, services, service descriptions, and SOA-based systems. An implied policy, contract, obligation or permission would not be a resource, even though it may have value to a stakeholder, because it is not an identifiable entity.

Identifier: A sequence of characters that unambiguously indicates a particular resource. Identifiers are assigned by social structures according to context, policies and procedures considered sufficient for that structure's purposes.

Service description: The information needed in order to use, or consider using, a service. Reachability is an inherently pairwise relationship between service providers and service consumers. However, a service description should include sufficient data to enable a service consumer and service provider to interact with each other. This may include metadata such as the location of the service and what information protocols it supports and requires. It may also include dynamic information about the service, such as whether it is currently available.

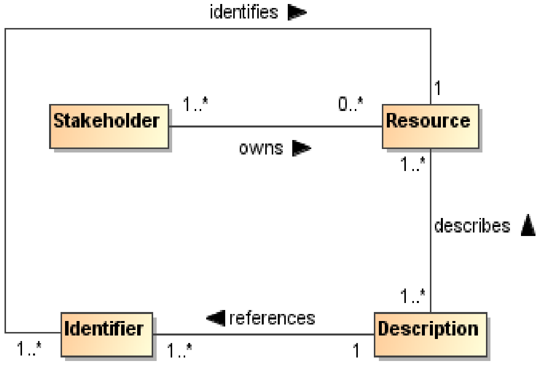


Figure 3: Resource Model

3-2-4 The Business row and Fourth column in ZSOF:

This cell identifies people and participated units in the service and shows the specification of their responsibilities and interrelations in the Service Oriented Enterprise. So, 'Stakeholders and Participants Model' can finely cover Zachman's Service Oriented Framework. A person or a system which interacts with system (uses the system or transfer some information with it) is called agent. In this model, Service Agents are not identified. So, it can be extended. This model can be seen as series of steps that start with customer's request and its purpose is satisfying shareholder, participant, and non-participant stakeholder in service.

Stakeholders and Participants Model:

A SOA-based system is deployed in the context of human and non-human entities capable of action. In this section we focus on the relationship between these ultimate actors and the services that they use and deploy (Figure 4). Location of this model is depicted in Table 3.

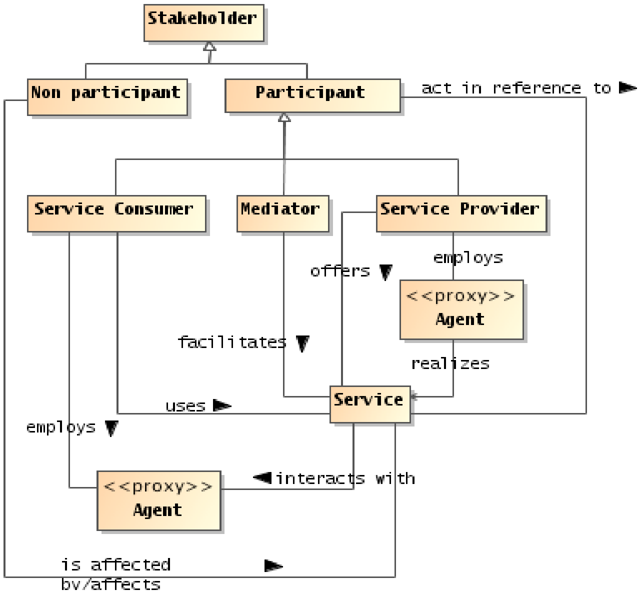


Figure 4: Stakeholders and Participants Model

Stakeholder: A stakeholder is an individual entity, human or non-human, or organization of entities that has an interest in the states of services and/or the outcomes of service interactions.

Stakeholders do not necessarily participate in service interactions. For example, a government may have an interest in the outcomes of commercial services deployed in a SOA-based system without actively participating in the interactions (e.g., the government may collect tax from one or more participants without being part of the interaction itself).

Participant: A participant is a stakeholder that has the capability to act in the context of a SOA-based system. A participant is a stakeholder whose interests lie in the successful use of and fulfillment of services.

However, human participants always require representation in an electronic system – they require agents. Note that we admit non-human agents that have no identifiable representative as an extreme case: the normal situation is where participants are either human or organizations.

It is convenient to classify service participants into service providers and service consumers. The reason for this is twofold: an extremely common mode of interaction is where a provider participant offers some functionality as a service and a consumer participant uses that service to achieve one of his or her goals. Secondly, it helps to illustrate the dominant situation where the participants in an interaction are not truly symmetric: they each have different objectives and often have different capabilities. However, it should be noted that there are patterns of interactions where it is not clear that the distinction between service provider and consumer are valid.

Service Provider: A service provider is a participant that offers a service that permits some capability to be used by other participants. In normal parlance, the service provider commonly refers to either the ultimate owner of the capability that is offered or at least an agent acting as proxy for the owner. For example, an individual may own a business capability but will enter into an agreement with another individual (the proxy) to provide SOA access to that business so that the owner can focus on running the business itself.

Note that several kinds of stakeholders may be involved in provisioning a service. These include but are not limited to the provider of the capability, an enabler that exposes it as a service, a mediator that translates and/or manages the relationship between service consumers and the service, a host that offers support for the service, a government that permits the service and/or collects taxes based on service interactions.

Service Consumer A service consumer is a participant that interacts with a service in order to access a capability to address a need. It is a common understanding that service consumers typically initiate service interactions. Again, this is not necessarily true in all situations (for example, in publish-and-subscribe scenarios, a service consumer may initiate an initial subscription, but thereafter, the interactions are initiated by publishers). As with service providers, several stakeholders may be involved in a service interaction supporting the consumer.

Service mediator: A service mediator is a participant that facilitates the offering or use of services in some way.

There are many kinds of mediator, for example a registry is a kind of mediator that permits providers and consumers to find each other. Another example might be a filter service that enhances another service by encrypting and decrypting messages. Yet another example of a mediator is a proxy broker that actively stands for one or other party in an interaction.

Agent: An agent is any entity that is capable of acting on behalf of a person or organization.

In order for people to be able to offer, consume and otherwise participate in services, they require the use of an agent capable of directly interacting with electronic communications – a service agent. Common examples are software applications that make use of services, hardware devices that embody an agent with a particular mission , and enterprise systems that offer services.

Non-participant stakeholder: A non-participant is any stakeholder who may be affected by the use or provisioning of services or who has an interest in the outcome of service interactions but does not directly participate in and may not be aware of the interactions.

There are two main classes of such non-participatory stakeholders: third parties who are affected by someone's use or provisioning of a service, and regulatory agencies who wish to control the outcome of service interactions in some way (such as by taxation).

3-2-5 The Business row and Fifth column in ZSOF:

Timing Model:

This cell represents a model which includes occurring event and elapsed time in relation to the servicing. In other words, this cell describes events and cycles related by time which are covered by Timing Figure. Timing Model which is introduced in the second version of Unifies Modeling Language completely covers the requirements of this phase of Zachman's Service Oriented Framework. This model does not belong to the OASIS Service Oriented models but it is a good option for covering this cell. (Figure 5).Location of this model is depicted in Table 3.

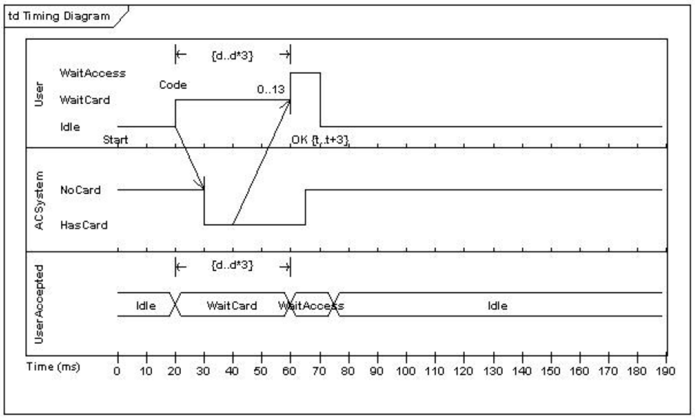


Figure 5: Timing Diagram (Model)

3-2-6 The Business row and Sixth column in The ZSOF

The cell represents aims, needs, capabilities, motivations, limits, and business rules in Service Oriented Enterprise. A model which represents these cases is introduced by OASIS Consortium. 'Needs and Capabilities Model' can finely put the mentioned cases in Zachman's Service Oriented Framework. Nevertheless, the output of this cell is not a distinct model; rules and functioning limits of enterprise in the form of condition, feature, and explanation in other models of business row is also located. The location all six mentioned models can be observed in Table 3.

Needs and Capabilities Model:

The motivation for participants interacting is the satisfaction of needs. From a consumer perspective, the motivation for interacting with a service is to satisfy a business objective, which in turn, is often related to the role they represent in the social structure; for the provider, the need is to gain satisfaction, monetary or otherwise, for other participants' use of the service.

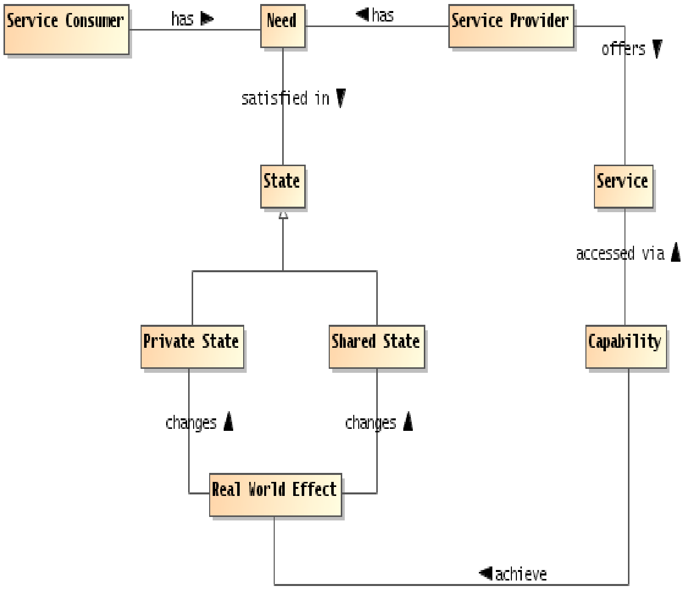


Figure 6: Needs and Capabilities Model

Capability:

A capability is a resource that may be used by a service provider to achieve a real world effect on behalf of a service consumer. The model in Figure 6 show that there is an inherent indirection between needs and having them satisfied. Both needs and the effects of using capabilities are expressed in terms of state: a need is expressed as a condition on the desired state and the Real World Effect of using capabilities is a change in the state of the world. As noted in the Reference Model, the Real World Effect is couched in terms of changes to the state that is shared by the participants in the service; in particular the public aspects of that state. By making a capability available for use, via the Service, the owners aim to address their needs as well as the needs of other participants who use the service. The extent to which a capability is exposed via a service (or via multiple services) is controlled by the owner of the capability.

Real World Effect:

A measurable change to the shared state of pertinent entities, relevant to and experienced by specific stakeholders of an ecosystem .

Need:

A need is a measurable requirement that a service participant is actively seeking to satisfy. A need may or may not be publicly measurable; the needs that this Reference Architecture finds in scope are those that are publicly measurable. However, the satisfaction of a participant's need can only be determined by that participant. A need is characterized by a proposition. However, the extent to which a need is captured in a formal way is likely to be very different in each situation.

State:

The condition of an entity at a particular time.State is characterized by a set of facts that is true of the entity. In principle, the total state of an entity (or the world as a whole) is unbounded. In practice, we are concerned only with a subset of the state of an entity that is measurable and useful in a given context. For example, the total state of a light bulb includes the temperature of the filament of the bulb, the composition of the glass, the dirt that is on the bulb's surface and so on. However, someone needing more light to read is only interested in whether the bulb is 'on' or 'off' and if it is working properly. That individual's characterization of the state of the bulb reduces to the fact: "bulb is now on". In a SOA ecosystem, there is a distinction between the set of facts about an entity that only that entity can access and the set of facts that may be accessible to others, notably actors in the SOA-based system.

Private State:

That part of an entity's state that is knowable by, and accessible to, only that entity.

Shared State:

That part of an entity's state that is knowable by, and may be accessible to, other actors. Note that shared state does not imply that the state is accessible to other actors. It simply refers to that subset of state that may be accessed by other actors. This will principally be the case when actors need to participate in joint actions. It is the aggregation of the shared states of pertinent entities that constitutes the desired effect of a joint action. Thus the change to this shared state is what is experienced in the wider ecosystem as a real world effect.

3-3 Analysis Third Row in ZSOF:

About fourth row of Zachman Framework (Builder's view) which is currently located in the third row of Zachman's Service Oriented Framework, it must be said that this row describes enterprise implementation based on the technologies of CGI, PHP, ASP, etc. it should be said that Independent Service Oriented Architecture is a type of Technology, Platform, and Operating System that uses a concept called Web Service. Therefore, it seems that separation of Web Service sections in one by one business cells is impossible. That's why we resist presenting a model for each cell but all the focused row is covered by a layer of Web Service.

3-4 Analysis Forth Row in ZSOF:

Fourth row (Builder's view) in Zachman's Service oriented Framework (ZSOF) includes, implementation of Service oriented sections, of previous models. This process consists of programming actions, protocols, and service oriented rules.

WEB SERVICE:

A Web Service is a software system designed to support interoperable machine to machine interaction over a network. It has an interface described in a machine processable format (specifically WSDL). Other systems interact with the Web service in a manner prescribed by its description using SOAP messages, typically conveyed using HTTP with an XML serialization in conjunction with other Web related standards.

The key standards with Web services are XML, WSDL, and SOAP.

- XML (eXtensible Markup Language) is a special language that enables programmers to define data in a way that any program can understand. It can also be used to standardize the commands that programs send each other.
- WSDL (Web Services Description Language) is a special language that describes all the commands (and the data that must be associated with them) that a software component will accept from another software component.
- SOAP (Simple Object Access Protocol) is a standard language that enables software components to talk to each other.

It was no small achievement for the industry to find a way to standardize these three things: a common definition language (XML), a common format for defining interfaces (WSDL), and a common format for messages between software components (SOAP). The idea of publishing Web services is critical to SOA. You can only reuse services that are available for reuse.

3-5 Analysis Fifth Row in ZSOF:

Fifth row represents working Service Oriented Enterprise. This row does not include a model or an architecture product. This row can be seen as the picture of five higher rows that shows 'working Service Oriented Enterprise'.

IV. Suggested Framework and Its Analysis

In Table 3, final results of actions done by service orientation on Zachman Framework are depicted. A Questionnaire was used to analyze the suggested Service Oriented framework. People familiar with Enterprise Architecture and Service Oriented like professors and authorities of technology units which are involved in this field were asked to comment on the focused framework on the basis of clarity, relation to the business and service orientation, suitability of models for the cells, generalizability of models, etc. Analyzing their views and comments indicated that the suggested framework was acceptable.

Table 3: The ultimate Zachman's Service Oriented Framework (ZSOF)

ZSOF	Data and Information Flowing	Services and Processes	Network and Valuable Resources	Consumer services, Service Provider, User interfaces	Events and Time	The need for service and Policies
Scope (contextual)	SOA Scope	SOA Scope	SOA Scope	SOA Scope	SOA Scope	SOA Scope
Business Model (OASIS Model)	Semantics of Communication Model	Service Reachability Model	Resource Model	Stakeholders and Participants Model	Timing diagram	Needs and Capabilities Model
Technology Model	Service Oriented Technology (Web Service)					
Detailed Representation	The implementation of Service Oriented Elements (Web services, protocols and standards, etc.)					
Functioning System	working Service Oriented Enterprise					

V. CONCLUSION

In this article Zachman's Service Oriented Framework (ZSOF) was analyzed. The discussed points in the article led to:

- ✓ Architects will gain a better understanding when planning and designing enterprise systems of the principles that underlie Service Oriented Architecture.
- ✓ Standards architects and analysts will be able to better position specific specifications in relation to each other in order to support the goals of SOA.

- ✓ Decision makers will be better informed as to the technology and resource implications of commissioning and living with a SOA-based system

- ✓ Users will gain a better understanding of what is involved in participating in a SOA-based system.

REFERENCES

[1] Reference Architecture Foundation for Service Oriented Architecture Version 1.0. 04 December 2012. OASIS Committee Specification 01, http://docs.oasis-open.org/soa-rm/soa-ra/v1.0/cs01/soa-ra-v1.0-cs01.html

[2] Reference Architecture for Service Oriented Architecture Version 0.3. March 4,2008, http://docs.oasis-open.org/soa-rm/

[3] Reference Model for Service Oriented Architecture 1.0, OASIS Standard, 12 October 2006, http://docs.oasis-open.org/soa-rm/v1.0/

[4] OASIS site : www.oasis-open.org

[5] K, Holley and A, Arsanjani, *100 SOA Questions*,2010, pp.101-103.

[6] J. Hurwitz, R Bloor,C Baroudi and M, Kaufman, *Service Oriented Architecture For Dummies*,2007,pp.5-14.

[7] D, Minoli,E, *Enterprise Architecture A to Z*,2008, pp.57-58,111-118.

[8] T, Erl,*SOA Principles of Service Design*,2008, pp.23-66.

[9] M,Bell,*SOA Modeling Patterns for Service Oriented Discovery and Analysis*,2010, pp.1-20.

AUTHORS

First Author – Vahid Barekat, Department of Computer**,** Science and Research Branch**,** Islamic Azad University**,** Khouzestan**,** Iran, e- mail : v_data@yahoo.com
Second Author – Ebrahim Behrouzian Nejad, Department of Computer, Shoushtar Branch, Islamic Azad University, Shoushtar, Iran, e-mail:
E.behrozian@Iau-shoushtar.ac.ir
Third Author – Seyed Enayattolah Alavi, Department of Computer, Shahid Chamran University, Ahvaz, Iran, e-mail: se_alavi@yahoo.co.uk