

Enterprise Security Planning using Zachman Framework: Designer's Perspective

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Abstract - An effective Enterprise Architecture framework can help an organization or an enterprise deal with the ever-changing business and technology needs and Zachman Framework is one such Enterprise Architecture framework. With Organizations having to operate businesses in a rapid changing climate, security is the biggest concern and an urgent issue for all organisations. Zachman Framework gives a structured tool enabling organizations to manage security at an enterprise level in a systematic, predictable, and adaptable way that fits their unique strategic drivers. This paper discusses how Zachman Framework can be used to secure an enterprise effectively. This paper attempts to present the understandings of the designers' perspective in detail. This paper proposes some entries which can be appropriate for the cells in row 3 from Enterprise security planning point of view.

Index Terms - Enterprise Architecture, Zachman Framework, Enterprise Security Planning.

1 Introduction

The term "enterprise architecture" is used in many contexts. It can be used to denote both the architecture of an entire enterprise, encompassing all of its information systems, and the architecture of a specific domain within the enterprise. In both cases, the architecture crosses multiple systems and multiple functional groups with the enterprise [4] [5].

Enterprise Architecture is a complete expression of the enterprise; a master plan which "acts as a collaboration force" between aspects of business planning such as goals, visions, strategies and governance principles; aspects of business operations such as business terms, organization structures, processes and data; aspects of automation such as information systems and databases; and the enabling technological infrastructure of the business such as computers, operating systems and networks[1].

The main goal of this paper is to discuss and understand Zachman Framework for enterprise architecture and also the roles and perspective of a designer in the Enterprise security planning. This paper has been organized as follows. Section 2, describes the enterprise architecture framework followed by definition, reason and benefits. Section 3, briefly describes the Zachman framework for enterprise architecture followed by definition, history, reason and brief overview of rows and

columns. Section 4, discusses the row 3 in detail with possible security related entities. Finally, in section 5, conclusion is given.

2 Enterprise Architecture Framework

Enterprise Architecture Framework provides a structured tool that manages and aligns an organization's business processes, Information Technology, application, people, operations and projects with the organization's overall strategy and goal. It provides a comprehensive view of the policies, principles, services & solutions, standards and guidelines in an enterprise [6].

2.1 Why Enterprise Architecture?

In today's time when the business competition is cut throat and with so many components attached to the business operation, if there is enterprise architecture and a framework that uses this architecture business can survive critical situations and achieve its overall organizational goal. Enterprise Architecture aligns an organization's business processes, Information Technology, application, people, operations and projects with the organization's overall strategy and goal and thus leading the organization to the success. Well defined and properly constructed Enterprise architecture helps an organization for future growth in response to the needs of the business.

2.2 Benefits of Enterprise Architecture

A well defined, property constructed and maintained enterprise architecture offers following benefits [3]:

- Highlighting opportunities for building greater quality and flexibility into applications without increasing the cost
- Supporting analyses of alternatives, risks, and trade-offs for the investment management process, which reduces the risks of building systems and expanding resources [3].

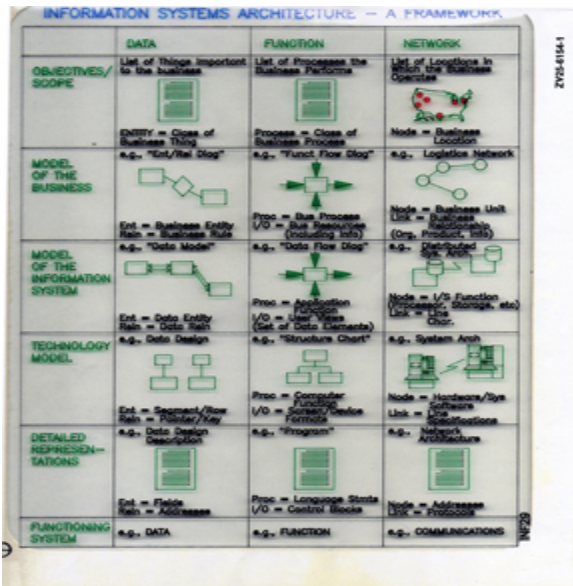
3 Zachman Framework for Enterprise Architecture

3.1 Definition

The Zachman Framework™ is a schema - the intersection between two historical classifications that have been in use for literally thousands of years. The first is the fundamentals of communication found in the primitive interrogatives: *What, How, When, Who, Where, and Why* [8][14]. It is the integration of answers to these questions that enables the comprehensive, composite description of complex ideas. *The Zachman Framework™ is not a methodology for creating the implementation (an instantiation) of the object. The Zachman Framework™ is the ontology for describing the Enterprise* [8].

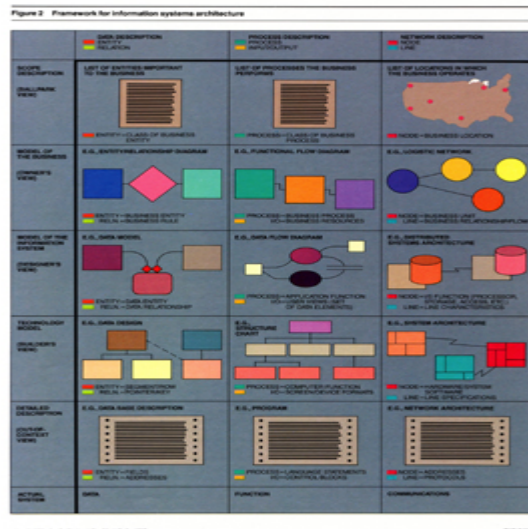
3.2 Zachman Framework Evolutions

History of Zachman Framework dates back to 1984 (see Fig 1). Since the time of the inception to today's time, there have been no change in the basic concepts of the framework but the basic changes that can be seen over the years are related to the graphical representation.



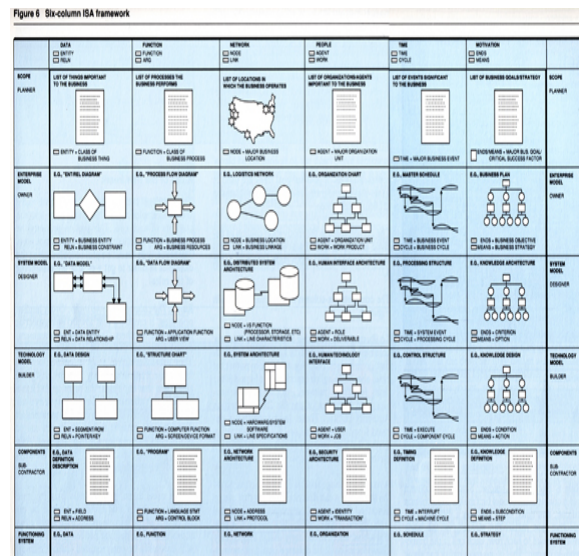
Source: www.zachmaninternational.com
 Figure 1- Zachman Framework in 1984

1984: Figure 1 above shows the Zachman Framework in 1984, an original drawing where it has just 3 columns and it was named as "Information System Architecture". John Zachman had an idea of framework of 6 columns but he presented only 3 column framework because at that time people did not know much about Enterprise [14].



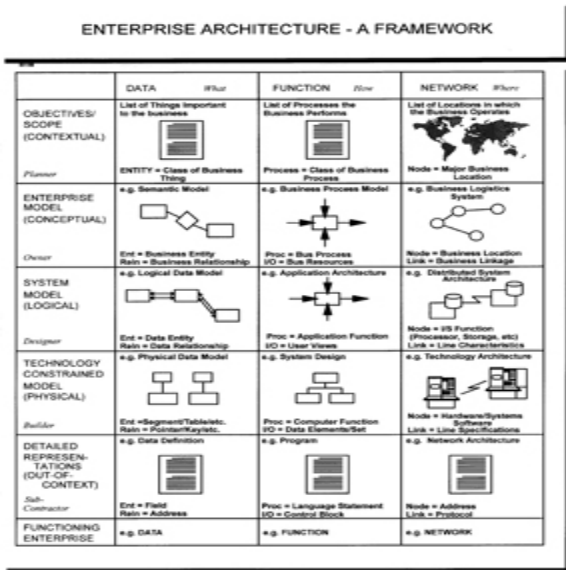
Source: www.zachmaninternational.com
 Figure 2- Zachman Framework in 1987

1987: Figure 2 above shows the Zachman Framework in 1987. The original *Framework for Information Systems Architecture*. This is the original version published in the 1987 IBM Systems Journal. Notice that only the first 3 Columns made it in spite of all 6 existing [14].



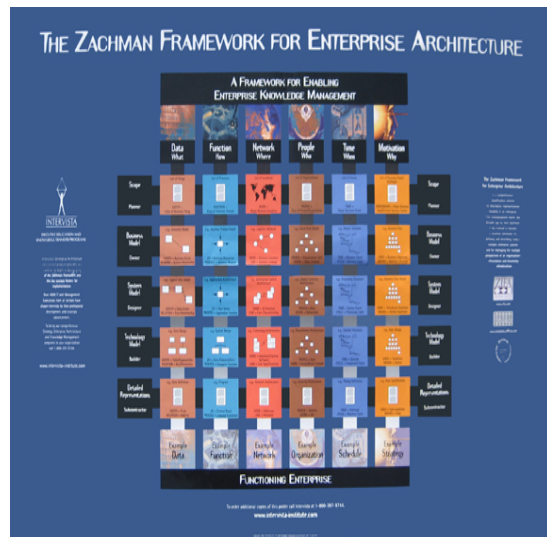
Source: www.zachmaninternational.com
 Figure 3- Zachman Framework in 1992

1992: Still called *A Framework for Information Systems Architecture* in this 1992 IBM Systems Journal article. From above Fig 3, Note that John added the words "Owner," "Designer," and "Builder" to Rows 2, 3 and 4 for clarification [14].



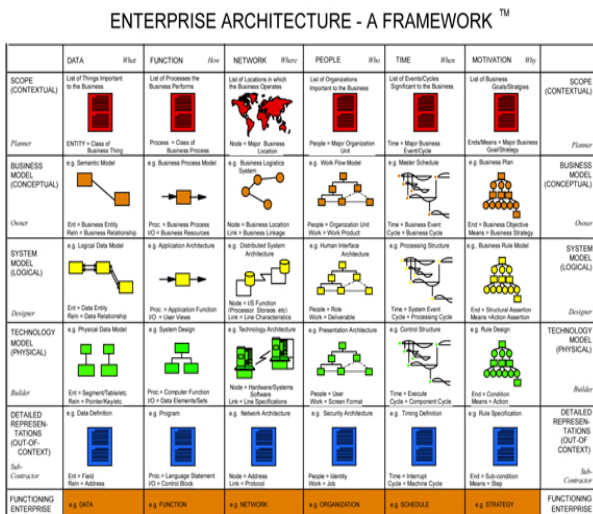
Source: www.zachmaninternational.com
 Figure 4- Zachman Framework in 1993

1993: It was at this point that John decided to officially call *The Zachman Framework™: Enterprise Architecture - a Framework*. This version is still a minor carry-over from the 1987 article since it is only 3 columns. Notice from figure 4 above, that in this version is the first to use the adjectives "Contextual," "Conceptual," "Logical," "Physical" and "Out-of Context" defining the Rows [14].



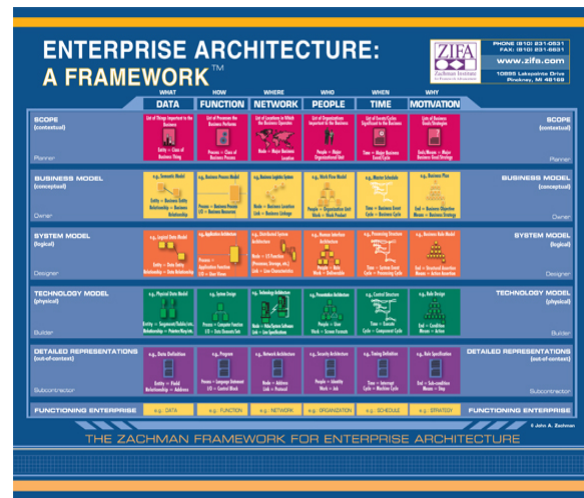
Source: www.zachmaninternational.com
 Figure 6- Zachman Framework in 2002

2002: As shown in Fig. 6, one significant improvement in this version however, is the use of the black to white gradient between the cells - which works its way down the columns. The movement down each column has nothing to do with granularity; it has everything to do with *transformation* [14].



Source: www.zachmaninternational.com
 Figure 5- Zachman Framework in 2001

2001: During this time, Enterprise Architecture was really gaining ground based on John's thoughts about the subject. Fully recognized as *The Zachman Framework™*, this version was very widely distributed and had many of the refinements from the previous 10 years of research (See Fig 5) [14].



Source: www.zachmaninternational.com
 Figure 7- Zachman Framework in 2003

2003: This *Framework* (see Fig 7) does have some significant shortcomings. In addition, the colors of Rows 2 and 3 became inverted. Because of the colors of each Row, this *Framework* illustration emphasizes the Rows. [14].

THE ZACHMAN ENTERPRISE FRAMEWORK²™

	WHAT	HOW	WHERE	WHO	WHEN	WHY	
SCOPE	Inventory Identification Inventory Types	Process Identification Process Types	Network Identification Network Types	Organization Identification Organization Types	Timing Identification Timing Types	Motivation Identification Motivation Types	STRATEGISTS AS PARTICIPANTS
BUSINESS	Inventory Definition Business Entity Business Relationship	Process Definition Business Transform Business Input	Network Definition Business Location Business Connection	Organization Definition Business Role Business Work	Timing Definition Business Cycle Business Moment	Motivation Definition Business End Business Means	EXECUTIVE LEADERS AS OWNERS
SYSTEM	Inventory Representation System Entity System Relationship	Process Representation System Transition System Input	Network Representation System Location System Connection	Organization Representation System Role System Work	Timing Representation System Cycle System Moment	Motivation Representation System End System Means	ARCHITECTS AS DESIGNERS
TECHNOLOGY	Inventory Specification Technology Entity Technology Relationship	Process Specification Technology Transform Technology Input	Network Specification Technology Location Technology Connection	Organization Specification Technology Role Technology Work	Timing Specification Technology Cycle Technology Moment	Motivation Specification Technology End Technology Means	ENGINEERS AS BUILDERS
COMPONENT	Inventory Configuration Component Entity Component Relationship	Process Configuration Component Transform Component Input	Network Configuration Component Location Component Connection	Organization Configuration Component Role Component Work	Timing Configuration Component Cycle Component Moment	Motivation Configuration Component End Component Means	TECHNICIANS AS IMPLEMENTERS
OPERATION	Inventory Instantiation Operations Entity Operations Relationship	Process Instantiation Operations Transform Operations Input	Network Instantiation Operations Location Operations Connection	Organization Instantiation Operations Role Operations Work	Timing Instantiation Operations Cycle Operations Moment	Motivation Instantiation Operations End Operations Means	WORKERS AS PARTICIPANTS
Released October 2007	INVENTORY SETS	PROCESS TRANSFORMATIONS	NETWORK NODES	ORGANIZATION GROUPS	TIMING PERIODS	MOTIVATION REASONS	Revised August 2011

Source: www.zachmaninternational.com
Figure 8- Zachman Framework in 2004

2004: After significant research starting in 2001, this copy of *The Zachman Framework™*, also known as *The Zachman Framework²™*, was developed in 2004 and is fairly recognizable (see Fig 8) [14].

3.3 Why Zachman Framework

With the use of Zachman Framework the costs are decreased, revenues are increased, processes are improved and business opportunities are expanded. Closer partnership between business and IT groups. Consistently proven itself [14][8]. It helps an organization achieve its business strategy; it gives the organization faster time to market for new innovations and capabilities [16].

3.4 Rules of Zachman Framework

- Rule 1:** Columns have no order [17].
- Rule 2:** Each column has a simple, basic model [17].
- Rule 3:** Basic model of each column is unique [17].
- Rule 4:** Each row represents a distinct view [17].
- Rule 5:** Each cell is unique [17].
- Rule 6:** Combining the cells in one row forms a complete description from that view [17].
- Rule 7:** Do not Create Diagonal Relationships between Cells [17].

3.5 Zachman Framework Rows Overview

- Row 1** – Scope - External Requirements & Definition of the Enterprise
- Row 2** – Enterprise Model - Business Process Modeling and Function Allocation
- Row 3** – System Model - Logical Models Requirements Definition
- Row 4** – Technology Model - Physical Models Solution Definition and Development
- Row 5** – As Built - As Built Deployment
- Row 6** – Functioning Enterprise - Functioning Enterprise Evaluation

THE ZACHMAN ENTERPRISE FRAMEWORK²™

	WHAT	HOW	WHERE	WHO	WHEN	WHY	
SCOPE CONTEXTS	Inventory Identification Inventory Types	Process Identification Process Types	Network Identification Network Types	Organization Identification Organization Types	Timing Identification Timing Types	Motivation Identification Motivation Types	STRATEGISTS AS PARTICIPANTS
BUSINESS CONCEPTS	Inventory Definition Business Entity Business Relationship	Process Definition Business Transform Business Input	Network Definition Business Location Business Connection	Organization Definition Business Role Business Work	Timing Definition Business Cycle Business Moment	Motivation Definition Business End Business Means	EXECUTIVE LEADERS AS OWNERS
SYSTEM LOGIC	Inventory Representation System Entity System Relationship	Process Representation System Transition System Input	Network Representation System Location System Connection	Organization Representation System Role System Work	Timing Representation System Cycle System Moment	Motivation Representation System End System Means	ARCHITECTS AS DESIGNERS
TECHNOLOGY PARADIGMS	Inventory Specification Technology Entity Technology Relationship	Process Specification Technology Transform Technology Input	Network Specification Technology Location Technology Connection	Organization Specification Technology Role Technology Work	Timing Specification Technology Cycle Technology Moment	Motivation Specification Technology End Technology Means	ENGINEERS AS BUILDERS
COMPONENT ASSEMBLIES	Inventory Configuration Component Entity Component Relationship	Process Configuration Component Transform Component Input	Network Configuration Component Location Component Connection	Organization Configuration Component Role Component Work	Timing Configuration Component Cycle Component Moment	Motivation Configuration Component End Component Means	TECHNICIANS AS IMPLEMENTERS
OPERATIONS INSTANCES CLASSES	Inventory Instantiation Operations Entity Operations Relationship	Process Instantiation Operations Transform Operations Input	Network Instantiation Operations Location Operations Connection	Organization Instantiation Operations Role Operations Work	Timing Instantiation Operations Cycle Operations Moment	Motivation Instantiation Operations End Operations Means	WORKERS AS PARTICIPANTS
Released October 2007	INVENTORY SETS	PROCESS TRANSFORMATIONS	NETWORK NODES	ORGANIZATION GROUPS	TIMING PERIODS	MOTIVATION REASONS	Revised August 2011

Source: www.zachmaninternational.com
Figure 9- Zachman Framework in 2008

2008: Figure 9 is the most current evolution of *The Zachman Framework™* developed and is the version handed out to anyone who attends the *Complete MasterClass* in the *Zachman Certified™ – Enterprise Architect* program, which makes this representation a bit of a collector's item because of it's limited availability through the *Zachman Courses* [14].

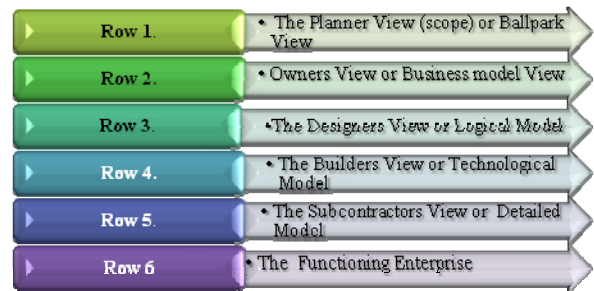


Figure 10- Rows of Zachman Framework

3.6 Zachman Framework Columns Overview

The basic model of each column is uniquely defined, yet related across and down the matrix. In addition, the six categories of enterprise architecture components, and the underlying interrogatives that they answer, form the columns of the Zachman Framework. Figure 11 shows clearly the description of each column.

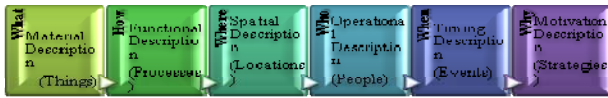


Figure 11- Columns of Zachman Framework

4 Designers Role (Row 3) – In Detail

Designer is responsible for designing a part of the system, within the constraints of the requirements, architecture, and development process for the project. This row was originally called “information system designer’s view” in the original version of the ZF (see Fig. 10) [18]. The functionality of this fully attributed model is to reflect the enterprise model of the above (owner) row [2].

Who is a designer? The system analyst (Designer) represents the business in a disciplined form. Due to the increase in the number of users and complex IT environment, installing a firewall can no longer be the solution of security measures. Therefore, in this row the Designer hardens the applications and the operating system of the enterprise to ensure reliable security operations [18] [2].

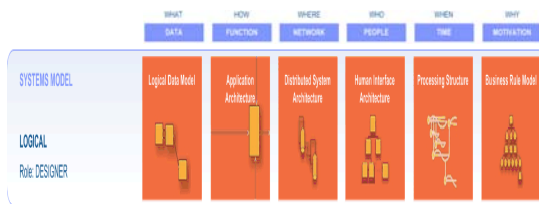


Figure 12- Row 3 of Zachman Framework

4.1 Row3/Column 1 : Data/What

The first cell of Row 3 represents the logical data model, which describes the systems view of interest by transforming the real description of the product into its built in specifications. All the entries from owner go through validation over here. Figure 13 shows the possible entities of logical system model [2]:

Data Verification Model: Data Verification is a process wherein the data is checked for accuracy and inconsistencies.

Verification ensures that the specification is complete and that mistakes have not been made in implementing the model [15].

Data Workflow Model: A workflow consists of a sequence of connected steps. Workflow may be seen as any abstraction of real work, segregated in work share, work split or other types of ordering.



Figure 13- Entities of Zachman Framework Row 3/ Column 1

Data Relationship Model: Relationships are the logical connections between two or more entities .E-R (entity-relationship) Diagrams are used to represent Data relationship Models.

Data Backup Model: Data recovery is required because of the following reasons: Disaster recovery, virus protection, hardware failure, application error and user errors.

Identity-Theft Model: Identity theft is the wrongful use of another person’s identifying information—such as credit card, social security or driver’s license numbers—to commit financial or other crimes.

Data Privacy Model: The main challenge in data privacy is to share some data while protecting personal information. This privacy policy model combines user consent, obligations, and distributed administration [12].

Data Security Model: Data security is the practice of keeping data protected from corruption and unauthorized access. The focus behind data security is to ensure privacy while protecting personal or corporate data [12].

4.2 Row3/Column 2 : Function/How

The second cell of Row 3, application architecture, discusses the information security policy function of enterprises which needs to mandate the backups of all data available at all times. The major things under consideration are the overall security of the data including the assurance of no data loss. Figure 14 shows the possible entities of application architecture.

Disaster Recovery Process: Figure 15 shows the key elements of disaster recovery planning process. A disaster recovery plan covers both the hardware and software required to run critical business applications and the associated processes to transition smoothly in the event of a natural or human caused disaster [11].



Figure 14- Entities of Zachman Framework Row 3/ Column 2



Figure 15- Disaster Recovery Planning Process

Access Control Planning: Access Control is any mechanism by which an authority grants the right to access some data, or perform some action. Access control systems provide the essential services of identification, authentication (I&A), authorization, and accountability [19].

Data Archiving: Data archiving is the process of moving data that is no longer actively used to a separate data storage device for long-term retention.

Confidentiality, Integrity & Availability: Confidentiality refers to limiting information access and disclosure to authorized users -- "the right people" -- and preventing access by or disclosure to unauthorized ones -- "the wrong people." Integrity refers to the trustworthiness of information resources. Availability refers, unsurprisingly, to the availability of information resources [20].

Internal and External Processes: This process is to define and control the value contribution of enterprise architecture and to integrate enterprise architecture into business.

4.3 Row3/Column 3 : Network/ Where

The third cell of Row 3, Distributed System Architecture defines the geographical boundaries and specification of the enterprise. The possible entries of this cell are as follows:

Physical Security: Physical security describes both measures that prevent or deter attackers from accessing a facility, resource, or information stored on physical media and guidance on how to design structures to resist various hostile acts[11].

Link Security: The types of links that fall under this category are Internet, Satellite Internet, Wireless and VPN.

End to End Security: End-to-end security relies on protocols and mechanisms that are implemented exclusively on the endpoints of a connection. End-to-End refers to hosts identified by IP (internet protocol) addresses and, in the case of TCP (transmission control protocol) connections, port numbers [12].

Logistic security: Logistics is the science of planning and implementing the acquisition and use of the resources necessary to sustain the operation of a system.

4.4 Row3/Column 4: People/ Who

The fourth cell of Row 3, Human Interface Architecture defines all the roles of the Individuals which are involved into the Enterprise. Figure 16 below lists all the possible entities [2].



Figure 16- Entities of Row 3/ Column 4

4.5 Row3/Column 5: Time / When

The fifth cell of Row 3, Processing Structure will define all the Timeline, Milestones, and Dependencies and other things for the Enterprise.

4.6 Row3/Column 6: Constraints/ Why

The sixth cell of Row 3 is a Business Rule Model. Figure 17 below lists the possible constraints for row 3.



Figure 17- Entities of Row 3/ Column 6

5 Conclusion

In this paper, Row 3 of Zachman framework (System model) helps organizations to standardize and control the processes that have a great impact upon both technical and non-technical departments. During the course of exploring Zachman framework we realized that though the logical concepts of this framework gives a look and feel of simplicity, it is far beyond that just that. For the effective application of Zachman Framework, We learnt that viewpoint of each player should be clearly defined and well structured. Zachman framework is helpful to achieve a better and stable design for later stage of development specially in situations where important changes are necessary and modifications are performed regularly. It is shown that Zachman Frame work can be used to plan security for Enterprises.

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