

University's Enterprise Architecture Design Using Enterprise Architecture Planning (EAP) Based on the Zachman's Framework Approach

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Abstract

Information Technology Organization of an enterprise must have a framework of guidelines for the development of information system and adequate documentation of the systems and technology, so that further information could be given to devising a comprehensive and integrated system. Enterprise architecture is a conceptual blueprint that defines the structure and operation of an organization. There are numbers of processes or methodologies that can be used in the development of enterprise architecture products, one of them is an Enterprise Architecture Planning (Enterprise Architecture Planning/EAP) based on the Zachman's framework. Enterprise Architecture Planning is a compilation consisting of the following business model documents, IRC documents, data architecture applications, Data architecture blueprints, architectural blueprints, and the roadmap plan technology of Enterprise Architecture Planning.

Keywords: enterprise architecture, Zachman's framework, enterprise architecture planning (EAP), the blueprint of information systems, data architecture, application architecture, technology architecture, roadmap implementation plan, private company

1. Introduction

A. Background

Information Technology (IT) nowadays is not only a set of tools to organize activities but also part of an organization's strategy to achieve their goals. But the problem in this era is how to align between business strategy and technology strategy.

The following guidelines should be followed by an organization if they experience difficulty with carrying out the planning of enterprise information system architecture (enterprise architecture). This will provide a framework to make long-term information technology decisions that are supportive with the concerns of the organization. Enterprise Architecture is the organizing activities of data used and generated by organizations that include the purpose of the organization's business processes. Whereas the organization's information architecture (EA) is a blueprint that defines how IT and information management elements work together as a single unit. This framework would describe the infrastructure needed by the organization to achieve its goal and vision.

University is an academic organization that can assist with information technology to help various businesses. Its typical that an organizational form has its own character, so the shape of the required information system also must have its own character.

In many organizations that are in operation, various information system applications are used with a variety of technology platforms and supporting information technology devices. These systems are known as "legacy systems". Typically, these systems are separated from each other and consist of many "islands of data" within the organization. This dis-junction has a negative impact such as a low level of availability, consistency and effectiveness of the provision of data.

This paper will discuss the design of the enterprise architecture colleges using the Zachman framework approach with Universitas XYZ as the case study.

B. Universitas XYZ

Universitas XYZ is a scientific institution which organizes academic or professional education programs in a number of scientific disciplines. Universitas XYZ that has the most diverse program of study, from the field of exact sciences to the social, from technology to language

The dynamics of research, innovation, and industry cannot be released by the growth of human civilization. In connection with industry, universities were reasonably likely to be a source of innovation for the sustainability of the industry. How to get the innovation is to do research. In regard to industry, research carried out is always associated with the technology in the sense tends to hardware or also the concepts for the growth of the service industry or even the knowledge services industry.

If formed and managed correctly, the university will qualify related, so the relationship between higher education, science, and technology in the industrialization of the country can be managed effectively and efficiently.

C. Research Questions

To analyze the needs of information technology and information systems, the writers ask questions as follows:

1. Why Enterprise Architecture is required by Universitas XYZ?
2. What are the benefits of Enterprise Architecture for Universitas XYZ?
3. What should be done so that organizations such as Universitas XYZ can be better defined?
4. Why Enterprise Architecture Design using Enterprise Architecture Planning (EAP) Based on the Zachman's Framework approach is used to define Universitas XYZ's Enterprise Architecture?
5. How to design information systems architecture for university such as Universitas XYZ?

D. Research Objectives

The objectives to design the information systems architecture are:

1. Analyze and document the Enterprise Architecture using EAP approach within the framework of Zachman's Framework. Final results are expected namely Enterprise Architecture documentation that describes the current state of Universitas XYZ.
2. Designing Enterprise Architecture and Business Informatics University of Indonesia in order to support the achievement of the goals of Universitas XYZ.

E. Scope and Limit to the Research

Scope of research's problem in the development of information systems architecture for university that will be developed, such as:

1. Marketing and Promotion
2. Academic Information System, includes:
 - a. Admissions (PMB).
 - b. Learning process
 - c. Evaluation and assessment of students portfolio
 - d. Graduates
3. Financial Information Systems
4. HRIS

The model that we will be built is a model of Enterprise Architecture based on the methodology used is approach to Enterprise Architecture Planning (EAP) in the Zachman's framework. The model will be built including:

1. Model data architecture
2. Model application architecture and
3. Model technology architecture
4. People Column or WHO

F. Research Methodology

Architectural models development methodology that we will be used is Enterprise Architecture Planning based on the Zachman's framework, stages of the development are:

1. Planning Initiation
2. Business Modeling
3. Current systems and Technology
4. Data Architecture
5. Applications Architecture
6. Technology Architecture
7. Implementation Plan
8. People or WHO

2. Literature Review

A. The Literature Architecture

Understanding the architecture here is not just limited to general knowledge related to physical construction, but also in the context of business and architecture for software engineering, following some sense related architecture:

1. Architecture (Architecture) are the components of a system consisting of network, hardware and software are structured. (Electronic Industry Association, 2008)

The overall design of this type of construction of both physical and context, real or virtual. (ICH Architecture Resource Center, 2008) and a tangible manifestation of the implementation results.

2. From the definition above we can therefore conclude what basically describes the architecture of the system construction form embodied in a model (blueprint) as viewed from several perspectives.

B. Enterpris

Here are some definition of enterprise:

1. Organizations that support the business environment and the mission that has been set.
2. The proper functioning of the overall component of an organization that operates under the control of the organization.

Enterprise is not only a profit-oriented organization/profit (profit oriented) but also non-profit organizations such as educational institutions. Enterprise can be in an organization as a whole or a part of the organization. (Electronic Industry Association, 2008)

C. Enterprise Architecture

Definition of Enterprise Architecture, such as:

1. Descriptive representation (model) that is relevant to describe an enterprise and what should be produced to meet the needs of management or organization (Electronic Industry Association, 2008).
2. The mapping of blueprint that show the relationship between components and all the people working in the company consistently to improve cooperation/collaboration, and coordination among them (Ward, John and Peppard, Joe, 2002).
3. A mechanisms to ensure information technology resources of an organization might be in line with the strategy of the organization (Riverton Corp., 2008)

D. Zachman Framework (ZF)

Zachman Framework or ZF is a classification scheme for organizing artifacts enterprise (Jurnal Pemamfaatan Enterprise Architecture Planning Untuk Perencanaan Strategis Sistem Informasi, Krisdanto Surendro, 2007). ZF consists of 6 columns and 6 rows. Each column represents the focus, abstraction, or enterprise architecture topics, namely: data, function, network, people, time, and motivation. Each line represents the following perspectives:

1. Perspective Planner: establish the context, background, and destination.
2. Perspective Owner: establishing conceptual model of the enterprise.

3. Designer Perspective: establish a model of information systems and bridge the desirable things owners and things that can be realized technically and physically.
4. Perspective Builder: defining the technical and physical design that is used in overseeing the technical and physical implementation.
5. Perspectives Subcontractors: assign roles and reference for the responsible parties to undertake the construction of information systems.
6. Functional Perspective: represent the perspective of the user



Figure 1. Zachman Framework (ZF)

E. Enterprise Architecture Planning (EAP)

EAP is a method used to build the information architecture. According to Steven H Spewak, EAP is a business definition and architecture, not the business design and architecture.

EAP is an architecture in data architecture, application and technology needed to support the organization's business. Steven H Spewak stated that the architecture here is intended like a blueprint, drawing, or model.

Components of the EAP according Spewak basic use of two layers of John Zachman's framework, namely of reviews planner and owner. EAP component can be described as picture below:

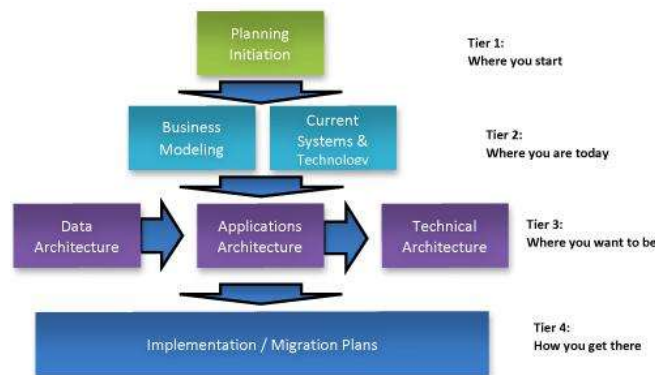


Figure 2. Enterprise Architecture Planning (EAP) Components

F. Design of Enterprise Architecture Planning Initiation

At the initiation stage of planning there are four stages that must be passed, such as:

1. Defining the Scope and the goal of the EAP.
2. Defining the vision of the company
3. Election Planning Methodology Approach
4. The use of computer resources

From above, then we can start to define the organization's function business.

3. Data Collection and Analysis

A. Identifying and Defining Business Functions

Based on observations in the company, there are seven major functions that occur in Universitas XYZ namely:

1. Marketing and Promotion
2. Admissions
3. Learning Centre Process
4. Graduate Students
5. Financial Management and Accounting
6. Human Resource Management and General
7. Academic Section

Identification of main and supporting activities of Universitas XYZ can be indicated by using the value chain of Michael E.Porter that looks like the image below:

Candidates Entity Data

Candidates entity based on existing business functions in the organization that has been described previously, in order to obtain candidate entities as follows:

1. Admissions
2. Learning Centre Process
3. Graduate Students
4. The Bureau of Public Administration, Finance and Human Resources
5. Administrative Bureau of Academic and Student Affairs
6. Assistant Dean
7. Program
8. Head of the Laboratory

Definition Entity Sets, Attributes and Relationships

The depiction of the relationship between conceptual data entities using E-R diagram looks like the images below:



Figure 3. Universitas XYZ 's Value Chain

B. Business modeling

Stages in the development of Universitas XYZ’s business models, are:

1. An overview of the organizational structure
2. Identify Business Functions and market shared
3. Business Function Hierarchy Chart of Universitas XYZ
4. Process Flow Information System

C. Existing Systems Architecture and Technology

The process that is being done at this stage is to make efforts to know the system architecture and technology that are running by creating a collection of IRS (Information Resource Catalog) and architectural schemes underway in Universitas XYZ.

Data Architecture

Data architecture aims to define the data that will be used to develop and build the application architecture. Based on existing measures in the EAP, data architecture defines two (2) things:

1. Candidates Entity Data
2. Entity Sets, Attributes and the relationship

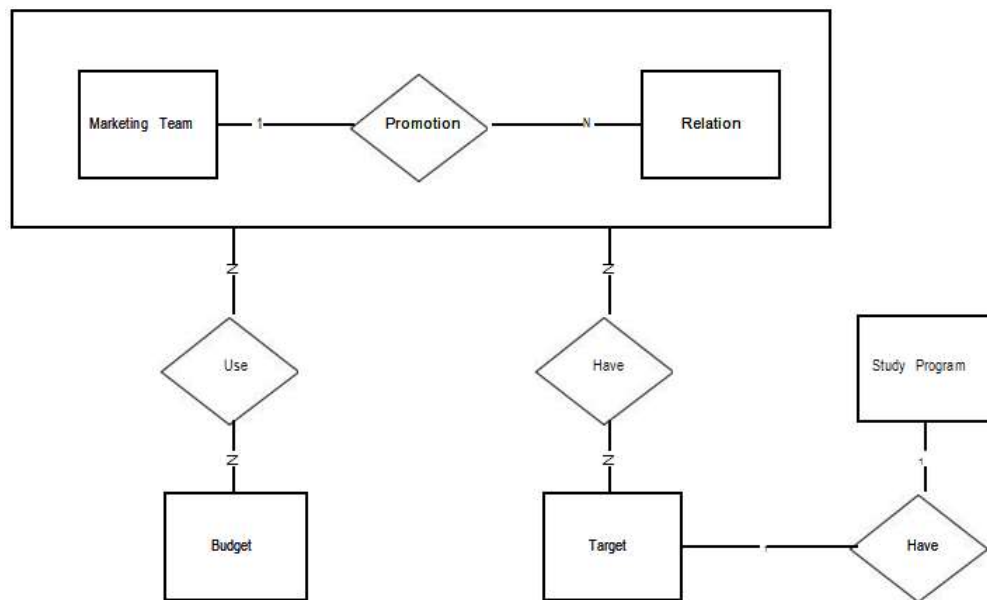


Figure 4. Marketing and Promotion’s Diagram

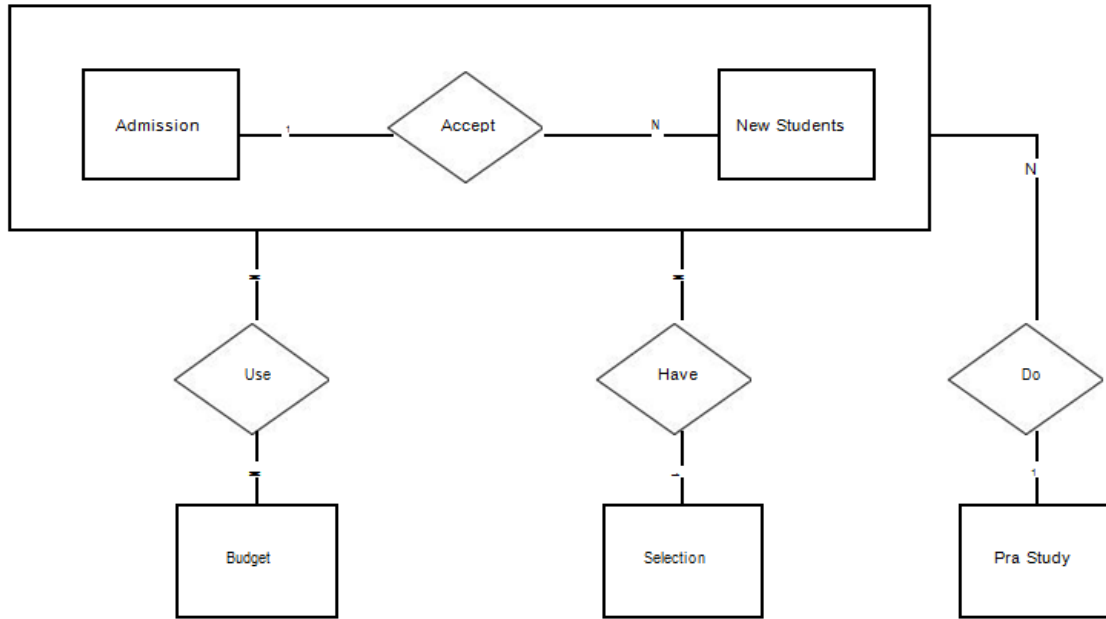


Figure 5. Admission's Diagram

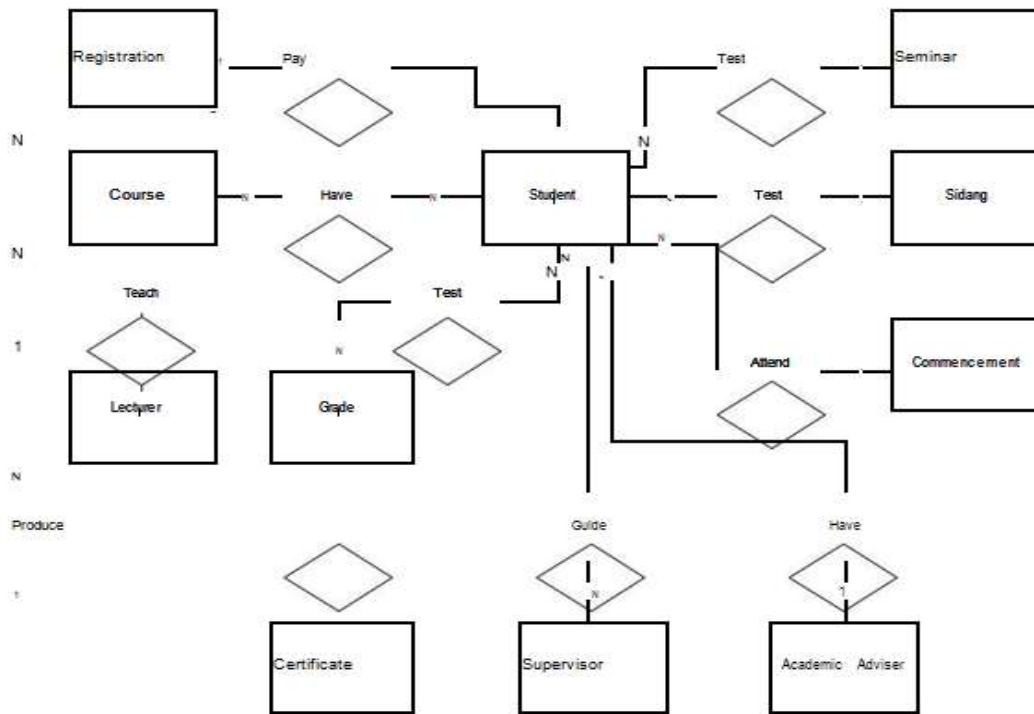


Figure 6. Learning Centre's Diagram

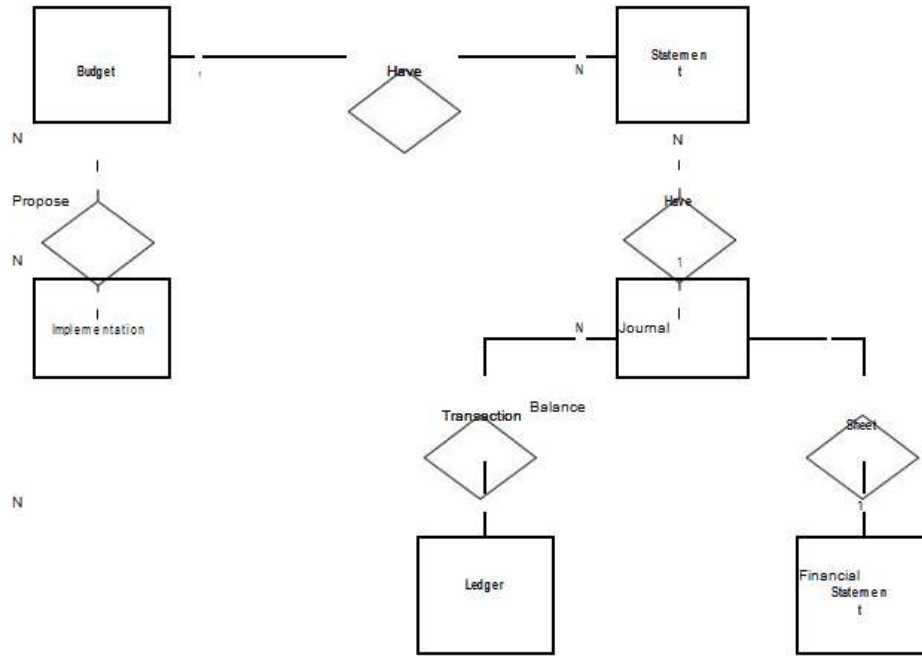


Figure 7. Financial Management and Accounting's Diagram

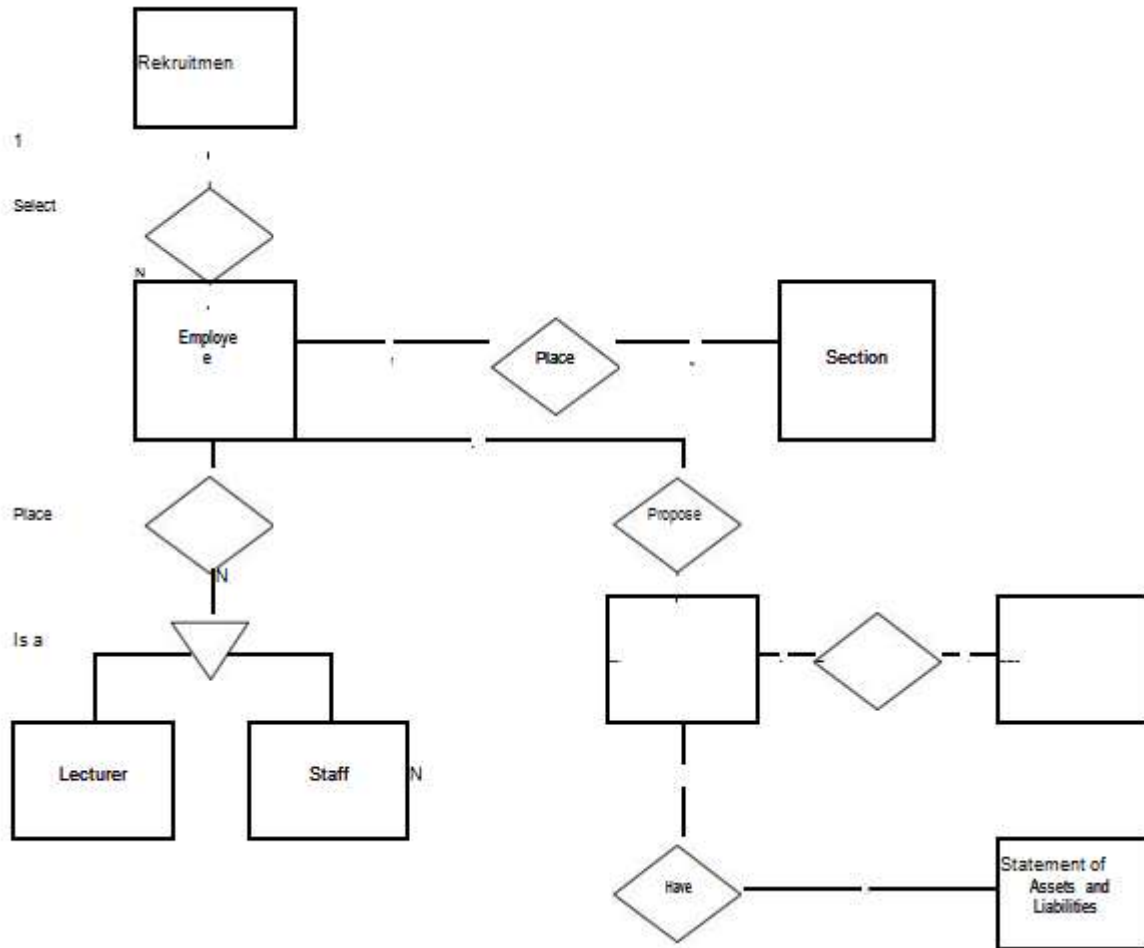


Figure 8. Human Resource Management and General's Diagram

Application Architecture

Steps being taken to make the architecture of the application required by the organization, as mentioned below:

1. Candidate application
2. Relationship between application and business function
3. Relationship between application and organization

Table 1. System Candidate

STATE OF SYSTEM	CANDIDATE
Existing system	<ol style="list-style-type: none"> 1. Admissions 2. Processing Selection Log 3. Registration of New Students Plan 4. Lecture Schedule Plan 5. Processing Study Plan 6. Change Study Plan 7. Processing Academic Leave administration and Quitting Students 8. The enforcement of student tests 9. Payment of Seminar, final work and Commencement 10. The enforcement of Seminar and final work 11. Processing of Academic Transcripts 12. Recording of Receipts and Expenditures 13. Organization 13. Recording Transactions 14. Financial Statements 15. Inventory of Assets Organization 16. Usage Report Assets Organization 17. Statement of Assets and Liabilities 18. Organizational Asset Report 19. Online admission
System under development	<ol style="list-style-type: none"> 20. Online library 21. HRD Report 22. Budgeting Report 23. Development of Skill and Knowledge
Planned system	<ol style="list-style-type: none"> 24. Certificates Production

-
- Potential system to be developed
25. Preparation Academic Calendar
 26. Planning of Marketing Budget and Cooperation
 27. Promotion Strategy
 28. Monitoring and Evaluation Promotion Strategy
 29. Implementation, Monitoring and Evaluation of Marketing and Promotion
 30. Prediction of Admissions , day-1, day, day+1
 31. Relation of Marketing and Cooperation
 32. Report Activity of Marketing and Cooperation
 33. Budgeting Analysis
 34. Financial Analysis
 35. Learning Centre Process Analysis
 36. Management of Curriculum
 37. Management of Analysis & Design Object Oriented
 38. Management of Asset
 39. Monitoring and Evaluation of Human Resource Performances
 40. Student Administration
 41. Test Administration (Mid Test/Final Test)
 42. Administration of Job Training seminar and Final Work
 43. Selection of General Ability Test
 44. Processing of General Ability Test
 45. Mobile Academic Information System
 46. E-learning
 47. Asset Management Organization
 48. HRD Management
 49. Stationery Office Management
-

Architecture Technology

After identification of the data architecture and application architecture, the next step which proposes the development of a technology architecture that is owned in order to improve system performance, as shown below:

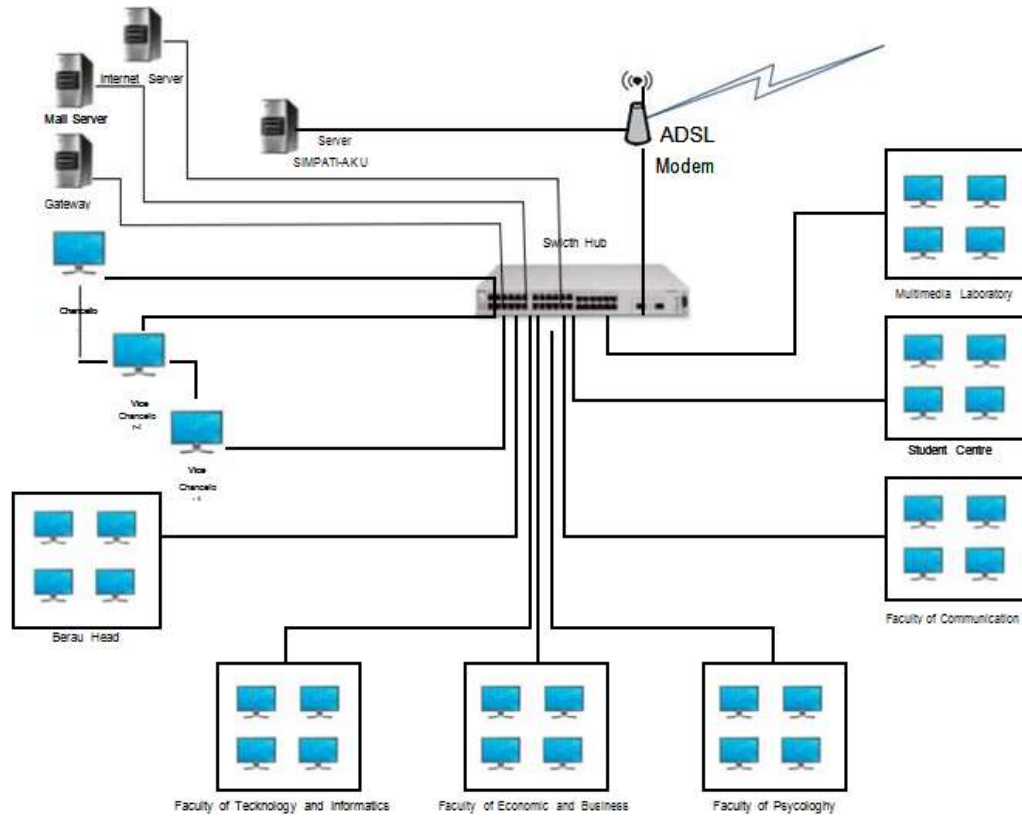


Figure 9. Universitas XYZ’s Technology Architecture

Implementation Planning

Implementation planning is an important part of the EAP, in which all planning applications to be built can be applied according to the time, cost and according to need.

Table 2. Sequence Planning of Application Implementation

STAGE	SEQUENCE PRIORITY	CONDITION STATE
I	1. Admission of New Students	Online Academic Information
	2. Systems	Online Under development process
	3. Online library	Under development process
	4. Budgetary Marketing and Promotion	
	5. Payment of Tuition Fees	
	6. Marketing and Promotion’s Potential to be	

	Monitoring and Evaluation	
		developed
	7. E-Learning	
	Preparing academic	
	8. calendar	To be planned
	Administration of Job	
	9. Training	
	seminar and Final Work	
	Students Centre Proces	
	10. Analysis	
II		Potential to be
	11. Curriculum management	
		developed
	12. HRD Management	
	Monitoring and Evaluation	
	13. of	
	Human Resource	
	Performances	
	14. Creation of certificate	To be planned
	15. Management of Analysis &	
	Design Object Oriented	
	Stationery Office	
III	16. Management	Potential to be
	Management of Fixed	
	17. Assets	developed
	and Current Assets	
	18. Stationery Office Reporting	
	19. Reporting Budget	To be planned
	20. Financial Budgeting	Potential to be
IV	21. Budget Analysis	developed
	Organization Asset	
	22. Management	
	Research and Development	
	23. of	To be planned
	Human Resource	
	Performance	

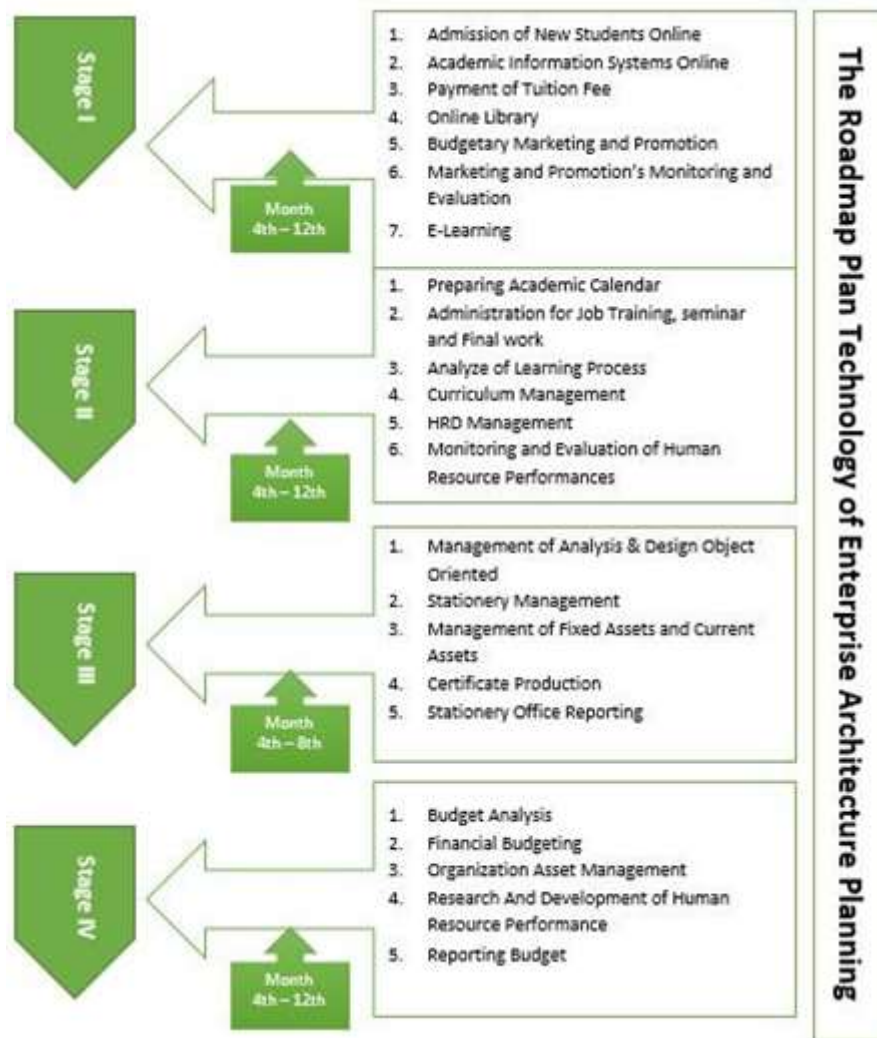


Figure 10. The Roadmap Plan Technology of Enterprise Architecture Planning

D. Implementation of Critical Success Factor and Guidelines Recommendation for Information System Construction and Development

The success of the implementation will be influenced by many factors, and therefore the need identified the factors that determines the success of the implementation of this system, described as below:

1. Strong commitment and consistent also direct involvement will greatly help good implementation.
2. Approval of the implementation plan.
3. Develop SOP
4. Availability of resources, technology and infrastructure.
5. Develop of understanding, skills and knowledge of human resources through special training.

E. Zachman Framework (People Column or WHO)

In the field of who, will discuss the human resources play an important role in Universitas XYZ. The parts described are:

1. Scope
2. Enterprise Model
3. System Model
4. Functional System

4. Conclusions

A. Conclusions

Based on the stage that has been done in the previous chapter, it can be concluded as follows:

1. Proposed Strategy and analysis high potential applications for institution (organization) is needed to formulate medium and long term policy in accordance with the Master Plan Development's organization.
2. The results of SWOT analysis helps identify where the Universitas XYZ exact nowadays, both with regard to resources that can be utilized and the problems that will not be resolved yet. By doing this Universitas XYZ can identify where or when new resources, skills or new partners will be needed.
3. The results obtained that the existing application to date is 20 (twenty) applications that supports the organization's business functions.
4. To generate roadmap implementation plan which can be used as a reference in the development of applications that support the business functions of the organization. Roadmap implementation plan suggested by the EAP is based on data-driven, such as applications that generate data should be built first followed by applications using the data.

B. Suggestion

As a reference to create the next EAP, we submitted some suggestions, as follows (Jabarullah et al., 2019):

1. Selection of the next application should be appropriate and support the organization's business functions so that the benefits that will be generated optimal.
2. Commitment management should always be focused and consistent on the development of this information system in order to achieve organizational goals faster and according to expectations.
3. Socialization construction or development of information systems must be provided to each unit of organizational that can provide very useful contribution to the next development.
4. The next of chosen application should be appropriate and support the organization's business functions so that the benefits that will be generated optimal.

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