An Enterprise Architecture Plan for Training Center of IIB Darmajaya

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Abstract: The Training Center of Institute of Informatics and Business (IIB) Darmajaya was one of the technical implementation units that facilitated the needs of IIB Darmajaya and stakeholders to achieve superior quality graduates. This Training Center had prospective alumni who were distributed their training skills needed by stakeholders. This Training Center was not able to provide integrated services, e.g., optimizing the inadequate service. The objective of this study was to design the enterprise architecture (EA) using TOGAF framework to solve the problem. The procedure of this study was carried out through the preliminary phase, architecture vision, business architecture, information systems and technology architecture. The result of this study was designing novel models by using TOGAF EA.

Keywords: TOGAF, Enterprise Architecture, Darmajaya

1.   INTRODUCTION

Information systems encouraged transformation in companies and organizations on a more competitive direction. The use of information systems became a common place when a company or organization wanted to optimize the productivity of the process running. Implementation of information systems to optimize existing business processes and break the traditional business model [1].Not only do companies or organizations use IT to optimize the productivity, the government institutions and universities also took advantage of IT to support performance and productivity.

Some studies showed the importance of strategic planning of an organization or institution used to increase productivity when the implementation the IS/IT [2]. Planning / IT was indispensable to the framework in planning, designing, and managing infrastructure / IT known as Enterprise Architecture (EA). EA was seen as a logical approach, comprehensive and holistic approach to defining, designing and implementing systems and system components simultaneously. EA functions to integrate IS / IT with business processes in an architecture [3]. To implement EA, it was necessary to adopt a method / framework that was able to be used as a reference in managing complex systems

There were many alternative frameworks that were used, e.g., the Zachman Framework, EAP, EAS, BEAM, TOGAF ADM, GEAF, and others. Zachman Framework was a scheme for classifying the organization of enterprise artifacts. Zachman Framework consisted of 6 columns and 6 rows. Each column represented the focus, abstraction, or enterprise architecture topics, e.g., data, function, network, people, time, and motivation [4].

The implementation of IIB Darmajaya training and competency testing services used a stand-alone information system and had not been integrated with the finance, department, academic, postgraduate and student affairs departments. This caused the services to students to be hampered. From this problem, this study was designed an enterprise architecture using the TOGAF framework to solve the problems of the training centre unit in order to build an integration of each unit.

2.   LITERATURE REVIEW

According to Suhendro, The Open Group Architecture Frame (TOGAF) was a detailed framework and support tool for developing an Enterprise Architecture (EA) that was freely used by any organization developing to design, evaluate, and build an IT blueprint. 11]. Methodology for architectural design inside the TOGAF was called the architecture development method (ADM)

ADM was the comprehensive, integrated process for developing and maintaining an EA. EA was defined as a blueprint that described all elements of information technology (IT) and management worked together in one unit and provided an explicit picture of the relationship between current and expected IT management processes [12].

EA must provide a strategy that enabled the organization to support the enterprises and also acted as a roadmap towards a targeted environment. Architecture was a management practice to maximize the contribution of company resources, IT investment, and system development activities to achieve its performance goals. In order to achieve the mission of the organization through optimal performance of business processes with an efficient IT environment, the implementation of the framework must be included in the roadmap of the company. IT integrated systems architecture provided a strategic context for the evolution of IT systems in response to the changing needs of the business environment. TOGAF in general had the following structure and components:

Architecture must be in line with IT and business. This allowed the business unit to innovate and achieve a competitive advantage simultaneously and drive synergies across the company's business units. The advantages of a good corporate architecture were as follows:
  a. More efficient IT operations
  b. Profitable investment
  c. Reducing the risk of deviating from the rules.
  d. Faster, simpler, and more efficient business operations.

Table 1. Comparison

No	Remark	Zachman	FEAF	TOGAF
1	Definition architecture and its understanding	Partial	No	Yes At the phase preliminary
2	Support towards architecture evolution	Yes	Yes	Yes ADM With detailed
3	Standardization	No	Yes	Yes There are migration planning phases
4	*Architecture Knowledge Base*	No	Yes	Providing TRM, standards information
5	supports Business	No	Yes	Yes
6	Technological Input	Partial	No	Yes
7	Business supports	Yes	Yes	Yes
8	Transitional Design	Yes	Yes	Yes Result of migration planning phases

Table 1. Comparison (continue)

No	Remark	Zachman	FEAF	TOGAF
9	Neutrality	No	Yes	Yes Result of migration planning phases
10	Providing architecture principles	Yes	No Only for character FEAF	Yes

1. ADM provided a detailed description of how to determine an architecture specifically based on business needs
2. Foundation Architecture (Enterprise Continuum) was a "Framework-within-a- Framework" in which there was a description of the relationship for the collection of relevant architects, as well as providing guidance assistance when there was a shift in level abstraction. Foundation Architecture was submitted through ADM. There were three parts to the foundation architecture e.g., the Technical Reference Model, Standard Information and the Building Block Information Base.
3. Resource Base contained the information on guidelines, templates, checklists, and background information and detailed support materials that helped architects to use ADM. ADM was a key element of TOGAF. ADM was an important feature that enabled companies to define business requirements and built specific architectures to meet those needs. ADM had basic stages as it was shown in Figure 1 below:

Figure. 1. ADM Phases (The Open Group, 2012)

Figure 1 TOGAF 9.1 ADM Stages (The Open Group, 2012) was as a core component, TOGAF ADM provided a series of iterative processes ranging from building an architecture, transitions, to managing the architectural realization process. The following was an explanation of the ten phases of the TOGAF ADM.

1. Preliminary Phase. This phase included preparation activities for building architectural capabilities e.g., TOGAF customization and architectural principles. The purpose of this phase was convincing everyone that this approach was making the architectural process successful. (TOGAF 2009) In this phase, who, what, why, when, and where of the architecture were specified. (TOGAF. 2009) What the scope of the effort was. Who model it. Who was responsible for working on the architecture. Where they will be allocated and how their role was. How to develop and determine EA. What framework and methods will be used to capture information. When the architectural completion will be done. Why this architecture was built. This related to organizational goals - the architecture met organizational goals.

2. Phase A: Architecture Vision created a uniform view of the importance of enterprise architecture in order to achieve organizational goals formulated in the form of a strategy and to determine the scope of the architecture to be developed. This phase contained questions to get the ideal architecture. This phase was the initiation phase of the architectural development cycle e.g, defining the scope, identifying stakeholders, compiling an architectural vision, and submitting an agreement to initiate architectural development. Some of the objectives of this phase were as follows

   a. Ensuring the evolution of the architectural development cycle so that the recognition and support from enterprise management were received.
   b. Approving the business principles, business objectives, and strategic business movements of the organization.
   c. Defining the scope and identify and prioritize components of the current architecture.
   d. Defining the business requirements to be achieved in this architectural venture and its limitations
   e. Producing an architectural vision that showed a response to their needs and limitations. Some of the steps taken in this phase were as follows:
      - Determining / defining the project.
      - Identifying business goals and movements. If this had been defined, these definitions must be still in line and were able to clarify any parts.
      - Reviewing architectural principles including business principles. This review was based on the current architecture in order to be developed. If this had been defined, this definitions must still be appropriate and were able to clarify all parts
      - Defining what was inside and outside the scope of the current business e.g., time, schedule, resources, and so on.
      - Identifying stakeholders, business needs, and architectural vision

3. Phase B: Business Architecture defined the initial conditions of business architecture and determined the desired business model or business activity based on the business scenario. This phase included development of business architecture to support the agreed architectural vision. At this stage, general tools and methods for modeling were Integration Definition (IDEF) and Unified Modeling Language (UML) used to build the required model. Some of the objectives of this phase were as follows:
   a. Describing a basic business architecture description
   b. Developing a business objective architecture, outlining product and / or service strategies and geographic, informational, functional and organizational aspects of the business environment based on business principles, business objectives.
   c. Selecting relevant viewpoints that allowed architects to demonstrate stakeholder intent in the business architecture

    d. Select relevant tools and techniques to be used in the selected viewpoint.
    e. Developing a description of the current business architecture to support the target business architecture
    f. Identifying reference models, viewing angles and tools.
    g. Complementing the business architecture
    h. Conducting gap analysis and preparing reports.

4. Phase C: Information Systems Architectures. At this stage there was more emphasis on the activities of how the information system architecture was developed. The definition of information system architects in this stage included the data architecture and application architecture be used by the organization. Data architecture focused on how data was used for the needs of business functions, processes and services. Techniques that were used were: ER-Diagrams, Class Diagrams, and Object Diagrams. The aim of this phase was developing the destination architecture in the data and application domains. The scope of the business processes supported in phase C was limited to the processes supported by IT and the interfaces of the processes related to non- IT. The implementation of this architecture was not in the same order. The goal of a data architecture was defining the main types and sources of data needed to support the business in a way that was understandable to stakeholders, complete, consistent, and stable. It was important to note that this architecture did not pay attention to database design. Its purpose was to define entity enterprise-relevant data, not to design physical and logical storage systems. Some of the steps required to create a data architecture were as follows: Developing a description of the basic data architecture. Reviewing and validating of principles, reference models, viewpoints and tools. Creating architectural models. Choosing a data architecture. Completing data architecture. Performing gap analysis of current data architecture with target data architecture and generate reports. The purpose of this application architecture was defining the main types of application systems that are essential for processing data and supporting business. (Open Group, 2009). It was important to note that this application architecture did not pay attention to application system design. The aim was to define the types of application systems that were relevant to the enterprise and what applications were needed to organize data and present information to human and computer actors in the enterprise. Applications were not described as computer systems but as a logical group of the ability to organize data objects in the data architecture and support business functions in the business architecture. Applications and capabilities were defined without reference to specific technologies. An application was stable and relatively unchanging over time, whereas the technology used to implement it changed over time,

5. Phase D: Technology Architecture Building. The desired technology architecture, starting from determining the type of technology candidates by using the Technology Portfolio Catalog which included software and hardware. In this stage. the alternatives were needed in selecting technology. Some of the steps needed to create technology architecture were creating a basic description in TOGAF format. Considering different architectural reference models, viewpoints and tools. Creating architectural models. Selecting the required services portfolio. Confirming that business objectives are achieved. Determining the criteria for selecting specifications. Completing the architectural definition. Conducting a gap analysis between the current technology architecture and the target technology architecture.

6. Phase E: Opportunities and Solutions. At this stage, the model that had been built for the current architecture and objectives was evaluated, the main projects were identified. This phase also reviewed the gap analysis that was carried out in phase D. The objectives of this

phase were as follows:
a. Evaluating and selecting implementation options identified in the development of the various target architectures
b. Identifying the strategic parameters for changes and projects carried out in the movement from the current environment to the destination
c. Interpreting the dependencies, costs and benefits of the various projects.
d. Producing an overall implementation and migration strategy and a detailed implementation plan.

7. Phase F: Migration and Planning. In this phase, a risk and cost analysis were carried out. The purpose of t h i s phase was selecting various implementation projects in order of priority. Activities included interpreting the dependencies, costs, benefits of various migration projects. A list of project priorities was run to form the basis of   a detailed implementation planning and migration plan.

8. Phase G: Implementation Governance. This phase included the supervision of the implementation of architecture. The objectives of this phase were formulating recommendations for each implementation project. Establishing an architecture contract to govern the overall deployment and implementation process. Carrying out the supervisory function appropriately while the system was being implemented and deployed. Assuring compatibility with the architecture defined by implementation projects and other projects

9. Phase H: Architecture Change Management. This phase included the preparation of procedures for managing changes to the new architecture. This phase described the drivers of change and how to manage these changes, from simple maintenance to architectural redesign. ADM outlined the strategy and recommendations for this phase. The purpose of this phase was defining an architecture change management process for the newly achieved enterprise architecture that complements from phase G. This process specifically provided continuous monitoring of such issues as new technology developed and changed in business environment and determined whether to formally initialize the new architectural evolution cycle. Phase H also provided changes to the framework and the establishment of disciplines in the Preliminary phase. Requirements Management Test the process of maintaining architecture requirements throughout the ADM cycle. Based on the explanation above, it was known that TOGAF ADM was a generic method that contained a set of activities used in modeling the development of enterprise architecture. This method was also able to be used as a guide or a tool to plan, design, develop and implement an information system architecture for an organization [3].

TOGAF ADM was the framework that enabled and was widely used to be implemented in various forms and fields of organization e.g., banking, manufacturing industry and also education.
TOGAF was divided into four architectural development sections.
a. System development
b. Defining the existing business architecture in the organization
c. Defining the data architecture to be used,
d. Defining the application architecture to be built as well.
e. Defining the technology architecture [6]. TOGAF has detailed methods and tools.
The advantage of using TOGAF was that it was flexible and open source. TOGAF ADM was a flexible method that was able to identify various kinds of modeling techniques used in the design because this method was able to be adapted to changes. TOGAF ADM also stated

a clear vision and principles on how to develop enterprise architecture. These principles were used as a measure in assessing the success of developing an enterprise architecture by an organization (Open Group, 2009). These principles were explained as follows:

Phase A: Architecture Vision. At this stage the scope of the EA was defined. At this stage the activities that occurred at Training Centre were identified and grouped into two categories e.g., main activities and supporting activities

- a. Enterprise Principles. The architectural development that was carried out was expected to support all parts of the organization, including organizational units in need.
- b. Principles of Information Technology (IT) convinced the consistent use of IT in all parts of the organization, including organizational units that will use it.
- c. Architectural Principles Design. The architecture was based on the needs of business processes and how to implement them. The first step that needed to be considered when implementing TOGAF ADM was identifying the architectural context in order to be developed. The second step was defining the strategy of the architecture and determining the architectural parts in order to be designed e.g., starting from business architecture, information system architecture, technology architecture, and determining the capabilities of the architecture to be designed and developed (Open Group, 2009).

3. METHOD

The research methodology was indicated by the research steps that must be carried out e.g., literature studies, data collection. IS / IT architecture design through the TOGAF framework with the architectural development method was ADM (Architecture Development Method), results and discussion and final stage of drawing conclusions of Architectural Planning Methods. Preliminary Phase Preliminary Phase was an activity to gather information related to training units.

- a. Preliminary Phase Preliminary phase was the activities to collect information related to the unit training
- b. Phase A: Architecture Vision. At this stage the scope of the EA was defined. At this stage the activities that occurred at training center were identified and grouped into two categories, e.g., main activities and supporting activities
- c. Phase B: Business Architecture. This stage described the current organizational architecture and developed it by compiling its strategy in order to achieve the business goals that have been set by creating a business solution concept based on information systems based on current conditions.
- d. Phase C: Information System Architecture. This phase involved two architectures e.g., data architecture and application architecture with a focus on identifying and defining applications and data that supported the business architecture.
- e. Phase D: Technology Architecture. This stage defined the technology architecture that supported the vision. The current computer network architecture w a s adequate
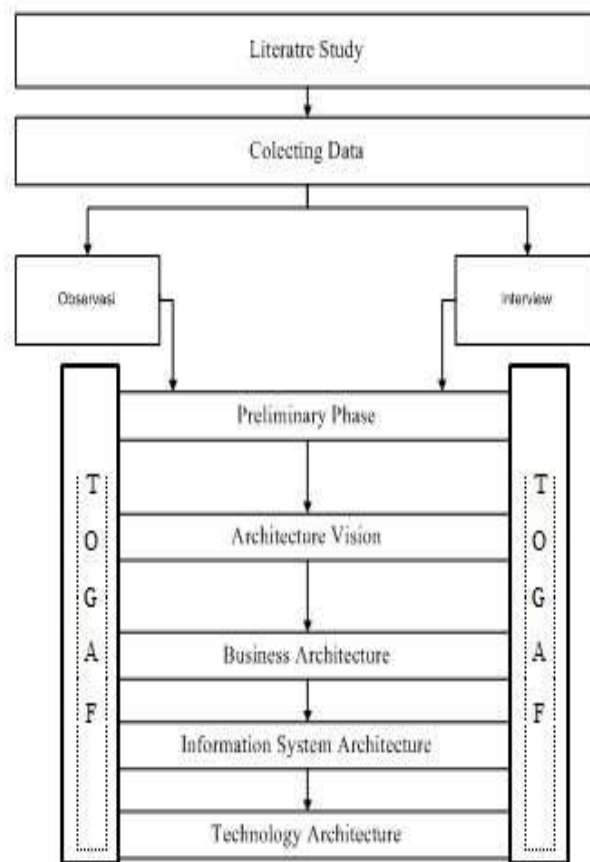
Figure 2. Research Steps

    f.   Training participant schedule information system
    g. Information system activities carried out d UPT Training
    h. Information system for final exam schedules and requirements
    i.   Final project payment information system

Figure. 3. Diagram of the revision of the business solution Concept

4. RESULT AND DISCUSSION

The design of an enterprise architecture was based on TOGAF ADM. This design produced a blueprint architecture consisting of the preliminary phase, architecture vision, business architecture, data architecture, application architecture, technology architecture.

4.1 *Preliminary Phase*

This phase was an initial phase consisting of several stages which are described in more detail in the sub-chapters below.

4.1.1 Organization's Enterprise Scope

The scope of the enterprise at the training and language center of IIB Darmajaya had supporting activities related to management. The definition of the area of the training centre and language centre of IIB was illustrated using the value chain (Michael Porter) as shown in Figure 4.1.
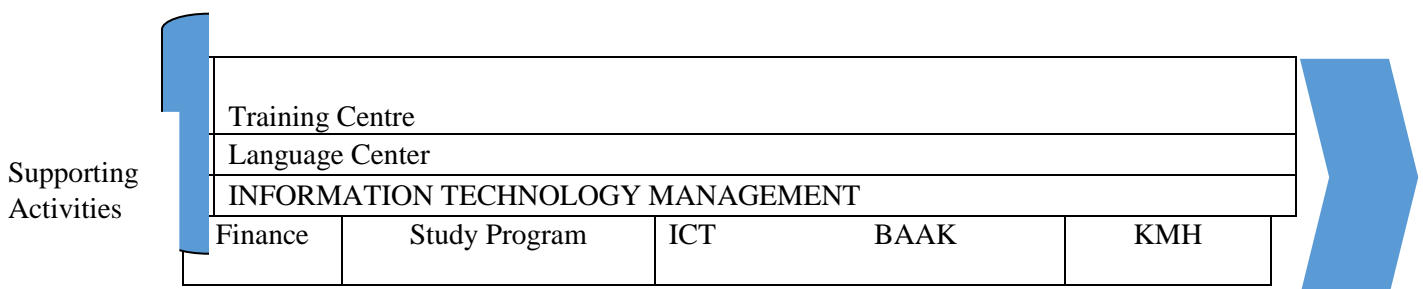

Figure 4.1 Value Chain of training and language center of IIB Darmajaya

4.2 Phase A Architecture vision

The needs that explained the architecture vision stage were the profile of the organization, the organizational unit, the definition of the vision and mission, the organizational goals, the organizational goals, the current architectural conditions.

4.2.1. Training Center Profile

The Training Center of IIB Darmajaya was a Technical Implementation Unit that facilitated the link and match between IIB Darmajaya and Stakeholders who require superior quality graduates. Darmajaya IIB alumni were equipped with abilities in accordance with the needs of stakeholders through core skills training such as skills in programming, databases, computer networks, assembly and installation as well as mastery of applications (accounting, office). In addition, the IIB Darmajaya Training Center also organized soft skills training which provided provision for prospective alumni to face the post campus world, such as motivation, business ethics, job application techniques, interviews and entrepreneurship.
In 2004, IBI Darmajaya cooperated with Microsoft as a partner in the use of software licenses. This proved IIB Darmajaya's commitment to respect IPR as an effort to optimize the use of Microsoft-based applications. In 2008 IIB Darmajaya again entered into a collaboration as an academic partner with PT. Zahir Internasional for Accounting training that had been recognized by the international community in more than 3,000 companies

4.3 Phase B. Business Architecture
The Business Architecture described in this thesis included the determination of internal user stakeholders and external users, and a hierarchical chart of functions

4.3.1 Stakeholder User Internal and External User
In general, stakeholder relationships with business functions were described through the use case diagram modeling which was seen in Figure 4.4
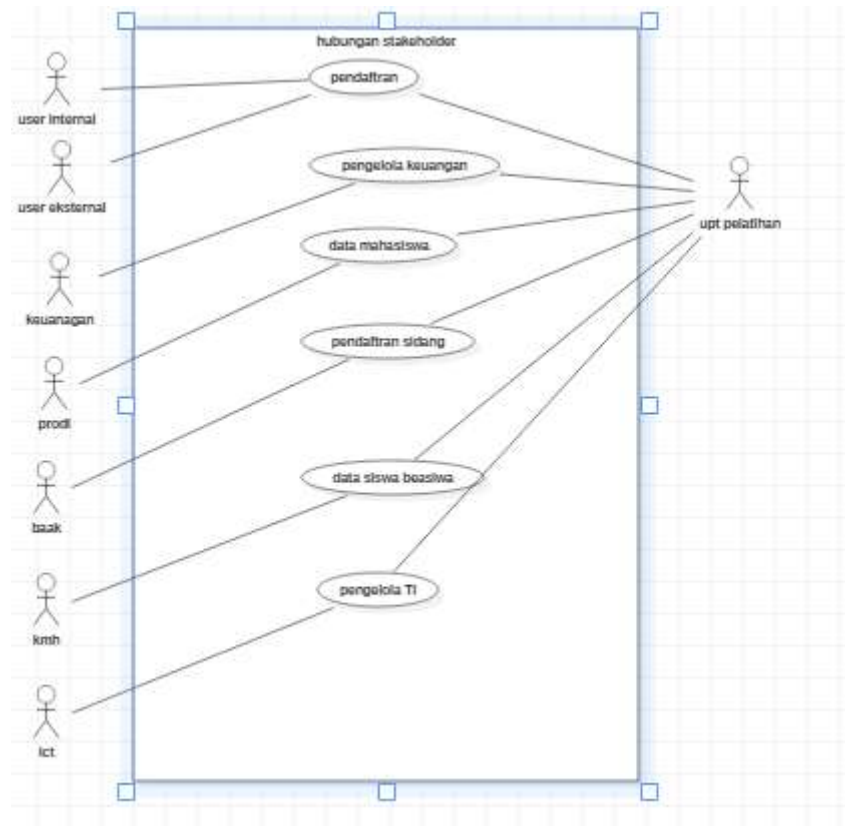
4.4 Phase C. Information System Architecture
4.4.1 Data Architecture

The data architecture design aimed to define the data requirements used in the application architecture. The stages in creating a data architecture were as follows.
a. Defines an entity
The definition of entities was based on business functions that had been defined through the previous value chain. The following were the candidate entities obtained.
1) Training center
2) Language center
3) Financial
4) Study Program
5) Academic Affairs
6) Student Affairs
7) ICT

Based on the candidate entities above, the following was a detailed the data entities for each candidate core business process entity.

4.5 Phase D. Technology Architecture
Based on the results of a direct assessment of the current technological conditions, the proposed technology architecture was described in the sub-chapters below.

4.5.1 Flow of Information between Application Systems

The flow of information between application systems was a model that described the information transformation process between applications systems that had been designed in the application architecture sub-chapter, the flow of information between applications were seen in Figure 11.
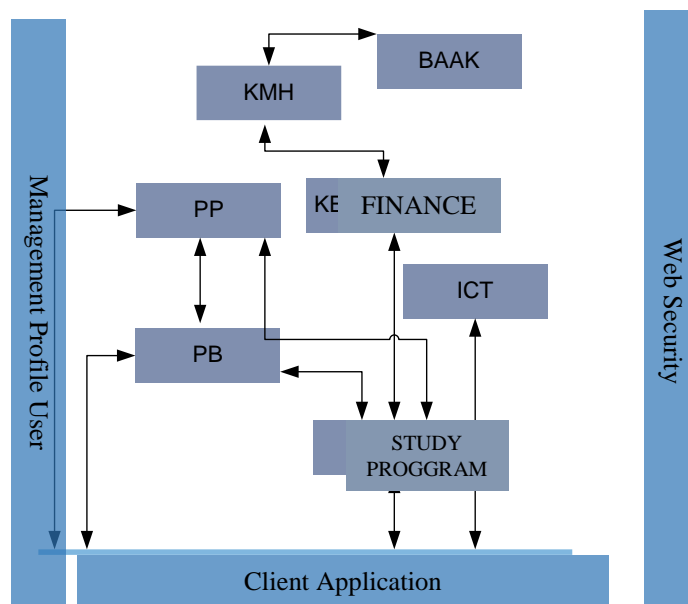

Figure 4.12. Information flow between application systems based on business function groups.

4.5.2 Application Platform

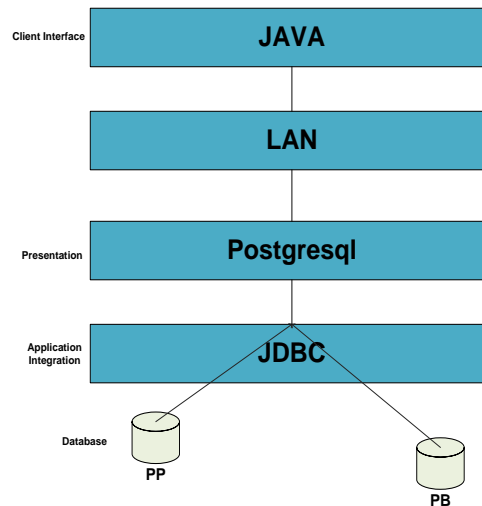The proposed application platform was seen in the following figure.

Figure 4.13 Proposed application platform

5. CONCLUSION

This research generated an enterprise IT architecture design in designing the architecture business and formation systems to optimize the use of IS / IT. Furthermore, enterprise architecture design was done by making automation and integration of all business processes between divisions / work units at IIB Darmajaya. Information systems that existed in IIB Darmajaya had been identified before the implementation of TOGAF was carried out according to the steps of the TOGAF. It was expected that the TOGAF design facilitated the development of an information system that provided convenience to stakeholders.

REFERENCES

[1]   Y. Kustiyahningsih, "PERENCANAAN ARSITEKTUR ENTERPRISE MENGGUNAKAN METODE TOGAF ADM (STUDI KASUS: RSUD Dr.SOEGIRI LAMONGAN)," Pros. Semin. Nas. Manaj. Teknol. XVIII, pp. 1–8, 2013.

[2]   B. Rianto, L. Lidya, and G. Nurcahyo, "Pemodelan Arsitektur Enterprise Menggunakan Metode Togaf ADM Studi Kasus Dinas Kesehatan Kabu- paten Indragiri Hilir," J. Komput. Terap., vol. 2, no. 1, pp. 55–68, 2016.

[3]   A. Wedhasmara, "Langkah-Langkah Perencanaan Strategis," J. Sist. Inf., vol. 1, no. 1, pp. 14–22, 2009.

[4]   S. Kasus, D. Manajemen, F. Pt, and P. Soepomo, "Perancangan Enter- prise Architecture Planning (Eap) Pada Proses Manajemen Aset Dengan Zachman Framework (Studi Kasus Divisi Manajemen Fasilitas Pt. Xyz)," vol. 1, no. 1, pp. 97–110, 2013, doi: 10.12928/jstie.v1i1.2509.

[5]   D. P. Caesario, E. Darwiyanto, G. Agung, and A. Wisudiawan, "Peren- canaan Strategis Sistem Informasi menggunakan The Open Group Archi- tecture Framework (TOGAF) dan Architecture Development Method   (ADM) Studi Kasus: Lembaga Kursus Topography Training Centre Strategic Information System Planning using The Open Gro," vol. 2, no. 2, pp. 6614–6621, 2007.

[6]   E. B. Setiawan, "Pemilihan EA Framework," Semin. Nas. Apl. Teknol. Inf., no. SNATI,

pp. 114–119, 2009, [Online]. Available: jour-nal.uii.ac.id/index.php/Snati/article/view/.../979?

[7]　C. R. Mardiansyah, "Arsitektur Menggunakan Framework Togaf Pada Pengadilan Agama Bandung," pp. 1–188, 2012.

[8]　L. Retnawati, "Perancangan Enterprise Architecture Menggunakan TO- GAF di Universitas ABC," J. IPTEK, vol. 22, no. 1, p. 13, 2018, doi: 10.31284/j.iptek.2018.v22i1.221.

[9]　C C. Y. Rusli, R. Risqiati, and P. Sulistyorini, "Penerapan Model the Open Group Architectural Framework (Togaf) Untuk Perancangan Arsitektur Enterprise (Studi Kasus Stmik Widya Pratama Pekalongan)," Pros. Semin. Nas. Int., vol. 1, no. 1, pp. 1–8, 2018.

[10]　R. Yunis and K. Surendro, "Implementasi Enterprise Architecture Per- guruan Tinggi," Semin. Nas. Apl. Teknol. Inf., vol. 2010, no. 022, pp. 1907–5022, 2010.

[11]　R. Yunis, K. Surendro, and E. S. Panjaitan, "Pengembangan Model Arsitektur Enterprise Untuk Perguruan Tinggi," JUTI J. Ilm. Teknol. Inf., vol. 8, no. 1, p. 9, 2010, doi: 10.12962/j24068535.v8i1.a70.

[12]　N. Ambarsari and N. Setyoutami, "Perancangan Blueprint Sistem Infor- masi Menggunakan Metodologi Enterprise Architecture Planning (Eap) Pada Sman 3 Surakarta," J. Rekayasa Sist. dan Ind., vol. 1, no. 01, pp. 141–143, 2014.