Design of Enterprise Architecture of FEAF Standards on The Academic Information System Based on Website

Irwan Dawil Fahmi [1], Sudin Saepudin[2], Carti Irawan[3]
irwan.dawil_si21@nusaputra.ac.id[1], sudin.saepudin@nusaputra.ac.id[2], carti@nusaputra.ac.id
[1,2,3] Information Systems Faculty of Computer Engineering and Design Nusa Putra University, Indonesia

Abstract

Academic Information System (SIAKAD) is a crucial element in supporting efficiency and effectiveness academic data management in educational institutions. Research This aims To analyze and apply Federal Enterprise Architecture Framework (FEAF) standards on designing Information Systems Academics at MA Bumi The Kingdom by using a website-based platform. FEAF was chosen as framework Work To ensure integration, interoperability, and sustainability of SIAKAD. Methods study This involves analysis of user needs, business process identification, and data modeling. The implementation of FEAF is integrated in stage design system, combining aspects such as business, data, applications, and technology architecture. The results of the study show that Application of FEAF in Information Systems MA Bumi Academic The Kingdom gives clarity supporting structure planning, development and maintenance of systems in a more systematic way. Implementation website based provides greater accessibility good and more interactive user experience. The application of FEAF also allows more good alignment between business needs and information technology, as well as increasing the system's adaptation ability to change environmental education. Success project This shows that implementation of the FEAF standard can become a strong foundation for designing Information Systems Sustainable and responsive academics in the formal education environment such as MA Bumi Persada. This research makes an important contribution in developing information systems that can increase efficiency and quality academic data management in educational institutions.

2502

A. Introduction

In the rapidly evolving digital era, information technology has become one of the main pillars supporting various aspects of life, including education. This development encourages educational institutions to adopt technology-based information systems to improve efficiency and effectiveness in data management and academic services. One form of information technology implementation that is increasingly being used is a web-based academic information system. This system not only enables more structured and efficient academic data management but also provides easy access for students, teachers, and administrative staff to obtain the necessary information quickly and accurately.

As the demand for well-integrated academic information systems increases, many educational institutions, including MA Bumi Persada, face challenges in designing efficient system architectures. Existing systems often lack clear standards in data management and business processes, leading to difficulties in integration, data inconsistencies, and obstacles in future system development. Moreover, academic information systems that are not designed with proper architectural standards often face limitations in terms of scalability, data security, and the ability to adapt to changes in academic needs and regulations. The lack of interoperability between existing systems also presents a major challenge, where various platforms and applications used by the madrasah cannot communicate optimally with each other. As a result, academic administration processes become more complex and prone to errors in data management, such as data duplication and inaccuracies in academic reports. Therefore, a more systematic approach is needed in designing academic information systems to create a more reliable and efficient technological infrastructure.

To address these issues, an in-depth analysis of the challenges faced in implementing the academic information system at MA Bumi Persada is required. One of the main problems is the lack of clear architectural standards in managing academic data, which causes data inconsistencies, difficulties in integration, and limitations in future system development. Additionally, existing systems often lack proper interoperability, so various applications and platforms used cannot communicate optimally with each other. This leads to more complex academic administration processes, increases the risk of data duplication, and reduces the accuracy of academic reports.

On the other hand, data security is also a crucial issue in academic information systems. Without standardized architecture, systems are vulnerable to security threats such as data breaches and unauthorized access. Limited system scalability also becomes a barrier in adapting the system to the growing number of users and changes in academic regulations. With these various challenges, a more systematic approach to designing academic information systems is necessary to create an infrastructure that is more reliable, secure, and easily integrated with the continuously evolving academic needs.

The main contribution of this research is to provide a comprehensive solution for more efficient management of academic information systems that are responsive to user needs. By implementing FEAF (Federal Enterprise Architecture Framework), the developed academic information system can achieve a high level

of integrity, good interoperability, and long-term sustainability. Furthermore, this research is expected to serve as a guideline for other educational institutions in adopting a similar approach to improve the quality of academic services.

This research aims to produce a FEAF-based academic information system that not only improves the efficiency of academic data management but also contributes to the field of science and educational institutions. From a scientific perspective, this research implements the concept of Enterprise Architecture Integration learned in coursework and contributes to the literature in the field of technology, particularly in Enterprise Architecture. Meanwhile, for the institution, this research produces a design of an Enterprise Architecture-based Academic Information System that can be applied at Madrasah Aliyah Bumi Persada to support more structured and efficient academic data management. Moreover, this system is expected to enhance accessibility and effectiveness in managing academic data, making it easier for students, teachers, and administrative staff to access and manage academic information quickly and accurately. It can also serve as a system architecture model that can be adapted by other educational institutions.

Although web-based academic information systems have provided many benefits, some weaknesses still need to be addressed. Some shortcomings in the implementation of the SIAKAD (Academic Information System) include lack of integration with other systems, data security risks, and potential errors in data input and management. Additionally, not all users have sufficient digital literacy levels, so training and guidance are needed to ensure that the system can be optimally utilized by all stakeholders. Furthermore, although the implementation of FEAF can provide a better structure in academic information systems, its implementation requires significant resources in terms of cost, time, and expertise to understand this framework in depth. The complexity in designing and implementing FEAF can also become a challenge for educational institutions with limited technological infrastructure and expertise in system architecture.

In the long term, the expectation from this research is the creation of an academic information system that is not only efficient and structured but also capable of evolving according to dynamic educational needs. With a FEAF-based system, it is hoped that SIAKAD at MA Bumi Persada can continue to improve in terms of functionality, scalability, and data security. Additionally, this system is expected to serve as a model for other madrasahs in developing more modern academic information systems based on clear standards.

B. Research Method
1. Method of collecting data

The research methods of observation, interview, and literature study are three research methods used in this study. Here is the definition of the three methods:

a. Observation is a method of collecting data by observing the object or phenomenon being studied directly. Observation can be done using tools such as cameras or field notes. This method is often used in qualitative and

quantitative research to collect data on human behavior, the environment, or other objects [2].

b. Interviews are a method of collecting data by conducting direct Q&A with respondents. Interviews can be conducted face-to-face or over the phone. This method is often used in qualitative research to collect data about a person's experiences, attitudes, or views on a topic.

c. Literature study is a method of collecting data by reading and analyzing written sources such as books, journals, or articles. This method is often used in qualitative and quantitative research to collect data on theories, concepts, or previous research findings [3].

2. System Design Model

The technique of compiling the data framework in handling this letter uses the FEAF (Government Endeavor Design System) standard. (FEAF) is a system presented in 1999 by the Government CIO Gathering . FEAF is planned to create EA within the Government Organization or a framework that transcends various office boundaries. FEAF provides norms for creating and archiving techniques for describing the area of need. FEAF is suitable for describing engineering for the Central Government [4]. FEAF creates four levels of the Government Endeavor Engineering System. Each level provides a setting or reference for the following year. The four levels of the Federal Enterprise Architecture Framework are as follows:

1) FEAF Level I This stage is an important stage in the FEAF association because it is the underlying cycle for describing what kind of big business plan is needed as indicated by the prerequisites of the agency/organization's objectives.[4] At this stage, the PEST analysis tool is used.

2) FEAF Level II At this stage, business needs and supporting technologies will be identified and then contrasted with the proposed supporting innovations. [4] This stage uses Value Chain analysis .

3) FEAF Level III At this stage, creating a business design model, data, applications and technology will be made based on the identification and analysis in the previous stage, analysts use the Value Chain for grouping based on technology for core business activities and supporting technologies. .[4] Level III creates data engineering that demonstrates as an outline of the data set that will be used to require the data framework that we will configure according to the needs and objectives of the organization. At this stage, utilizing the BSP (Business System Planning) tool.

4) FEAF Level IV At this stage, recognize the object details of each architectural model, especially data, applications, and technology that utilize the FEAF matrix. The FEAF matrix divides four models into 5 viewpoints, to be more specific, namely the planner perspective,

owner perspective, designer perspective, builder perspective, and subcontractor perspective. [4]
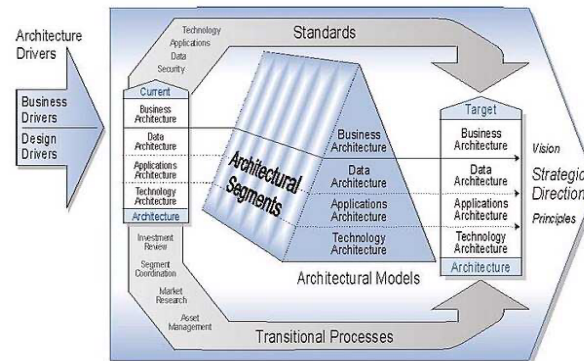
Figure 1. FEAF Framework

C. Result and Discussion

Based on the Federal Enterprise Architecture Framework (FEAF), the work is done based on four levels and at the last level there is a 5x3 matrix which is a derivative of the Zachman Framework. The model produced at level four is the final picture of the proposed enterprise architecture [5].

1. Level I, using PEST analysis tools. The results are as follows:

Table 1. PEST

PEST Analysis (Political, Economic, Social, Technological)	
Political	• Education Regulations, Changes in government education policies may affect the requirements and standards that the Academic Information System must comply with. • Data Security, Political aspects can also influence data security policies, such as privacy protection and related regulations.
Economy	• Education Budget, Fluctuations in the education budget can affect the availability of resources for the development and maintenance of Academic Information Systems. • Implementation Costs, Economic conditions can affect the availability of funds for initial investment in system implementation.
Social	• Educational Trends, Changes in educational preferences and societal expectations regarding information accessibility can influence the design and features of Academic Information Systems. • Stakeholder Involvement, The level of involvement and expectations of students, teachers, parents, and administrative staff can influence the success of implementation.
Technology	• Technological Developments, Advances in information technology, especially in the field of websites and web-based applications, can influence the design and functionality of

Academic Information Systems.
- Integration with Other Technologies Integration with other technologies in the school (e.g., security systems, supporting hardware) must take into account changes in technology.

2. Value Chain tool . The results of the Value Chain analysis are as follows:
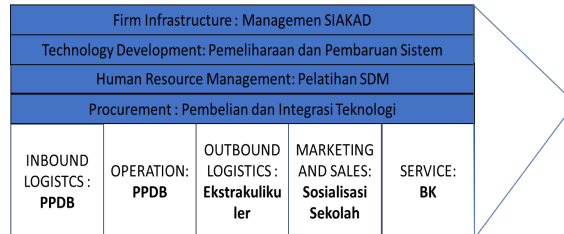
Figure 2. Value Chain

3. Business System Planning engineering tools . The results are as follows:
    a. Identifying business objectives, business objectives are usually stated in the vision and mission, then working with coordination, forming a hierarchical design and division of efforts, principles and capacities for each position.
    b. Identifying business processes, at this stage the exercises needed to recognize all business measures identified with the data framework to be created. At this stage, the results of the analysis using the Value Chain technique will be described again in more detail[6].
    c. Identifying data classes, This stage is carried out to distinguish and describe data classes in building a collection of information. The relationship between data classes and business sizes is identified with the letters C, R, and U to indicate which cycles produce (create) data, (read carefully) and use it (customers)[7]. The results are as follows:

Table 2. Relationship between Data Class and Business Process

Business Process | Data Class	Admin	Headmaster	Teacher	Homeroom Teacher	Student	Student Data	Absence	Absence Data	Finance	Guidance Type Data	Extracurricular	Counseling	Report
New Student Admissions	C				C				C				
Out And In Mutation	C	R		R	C	R							
Student Data	C	R				R	R						
Value Enterprise			C	C	R								
Student Values		R	R	R	R								R

	Admin	Headmaster	Teacher	Homeroom Teacher	Student	Student Data	Absence	Absence Data	Finance	Guidance Type Data	Extracurricular	Counseling	Report
Odd Semester Report		R	R	R	R								R
Even Semester Report		R	R	R	R								
Recapitulation Of Values			R	R	R								
Absence Input			C	C			R	R					
Meeting List			C				R	R					
Absence List			R	R	R		C	R					
Daily Report			R	R			C	R					
Monthly Report			R	R			C	R					
Semester Report			R	R			C	R					R
Annual Report			R	R			C	R					
Payment History	R				R				C				
Transaction Data	R								C				
Spp									R	C			
Student Council									R	C			
Test	C								R	C			
Additional Payment	R								R	R			
Payment Report									C				
Extracurricular	C				R	R					C		
Publication	C				R								
Counseling			C		C							C	C
Report	C	R	R	R	R								C

Table 3. Grouping of Business Processes and Data Classes

Business Process | Data Class	Admin	Headmaster	Teacher	Homeroom Teacher	Student	Student Data	Absence	Absence Data	Finance	Guidance Type Data	Extracurricular	Counseling	Report
New Student Admissions	C				C				C				
Out And In Mutation	C	R		R	C	R							
Student Data	C	R			R	R							
Value Enterprise			C	C	R								
Student Values		R	R	R	R								R
Odd Semester Report		R	R	R	R								R
Even Semester		R	R	R	R								

	Admin	Headmaster	Teacher	Homeroom Teacher	Student	Student Data	Absence	Absence Data	Finance	Guidance Type Data	Extracurricular	Counseling	Report
Report													
Recapitulation Of Values			R	R	R								
Absence Input			C	C			R	R					
Meeting List			C				R	R					
Absence List			R	R	R		C	R					
Daily Report			R	R			C	R					
Monthly Report			R	R			C	R					
Semester Report			R	R			C	R					R
Annual Report			R	R			C	R					
Payment History	R				R				C				
Transaction Data	R								C				
Spp									R	C			
Student Council									R	C			
Test	C								R	C			
Additional Payment	R								R	R			
Payment Report									C				
Extracurricular	C				R	R					C		
Publication	C				R								
Counseling			C		C							C	
Report	C	R	R	R	R								C

Next, determine the data flow from the business process.

Tabel 4. Data Flow

Business Process | Data Class	Admin	Headmaster	Teacher	Homeroom Teacher	Student	Student Data	Absence	Absence Data	Finance	Guidance Type Data	Extracurricular	Counseling	Report
New Student Admissions	C				C				C				
Out And In Mutation	C	R		R	C	R							
Student Data	C	R			R	R							
Value Enterprise			C	C	R								
Student Values		R	R	R	R								R
Odd Semester Report		R	R	R	R								R

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Even Semester Report		R	R	R	R											
Recapitulation Of Values			R	R	R											
Absence Input			C	C			R	R								
Meeting List			C				R	R								
Absence List			R	R	R		C	R								
Daily Report			R	R			C	R								
Monthly Report			R	R			C	R								
Semester Report			R	R			C	R								R
Annual Report			R	R			C	R								
Payment History	R					R					C					
Transaction Data	R										C					
Spp											R	C				
Student Council											R	C				
Test	C										R	C				
Additional Payment	R										R	R				
Payment Report											C					
Extracurricular	C					R	R							C		
Publication	C					R										
Counseling			C		C										C	
Report	C	R	R	R	R											C

a. Level IV, This level is the creation and classification of enterprise architecture models based on the FEAF matrix [8]. As explained in the previous chapter, each cell in the matrix produces different products.

1) Planner's Perspective
   - What (List Of Business Objects)
     Contains things needed for the continuity of business functions in schools. These things are: - Student Biodata - Assessment and Attendance Data - Extracurricular - School Socialization - BK - Financial Management - Report Cards
   - How (List of Business Processes)

Contains business processes that occur in schools. These business processes are identified through Value Chain Analysis as discussed in the previous section so that they are divided into main and supporting business processes[9]. Both main and supporting business processes certainly have several activities. These activities are the main business processes (New Student Admissions, Assessment and Attendance, Extracurricular and School Socialization) and supporting business processes (Financial Management and Student Management).

- Where (List of Business Locations)

  MA Bumi Persada is located in Cimanggu Village, RT 21 RW 05, Langkapjaya Village, Lengkong District, Sukabumi Regency.

2) Perspective Owner

- What (Semantic Model)
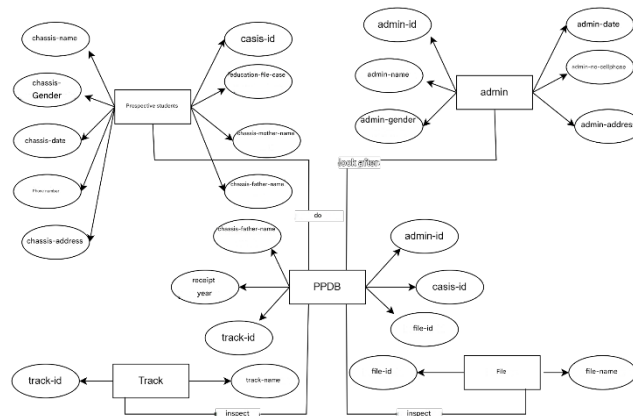
Figure 7. Semantic New Student Admissions
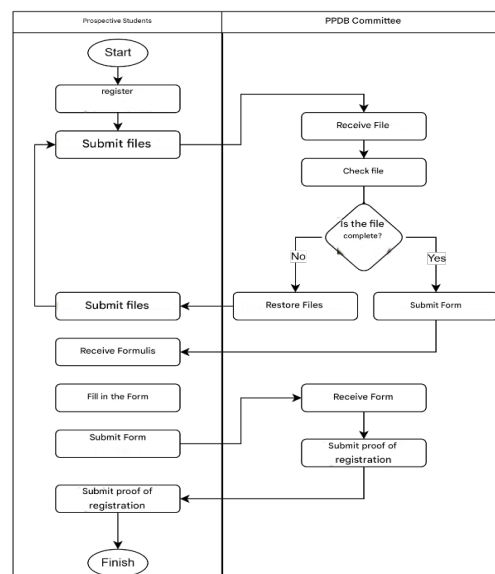
Figure 8. Business Logistics System

This column contains a more detailed description of the location

used to conduct the process.
business at school. The location is as follows.

1) NEW STUDENT ADMISSIONS is carried out in the school administration room
2) Assessment and Attendance activities are carried out in the classroom and teacher's room.
3) Extracurricular activities are carried out at activity locations such as in the field or in a designated room.
4) Report cards are carried out in the classroom
5) BK is carried out in the BK room

3) Designer's Perspective
- What (Logical Data Model)
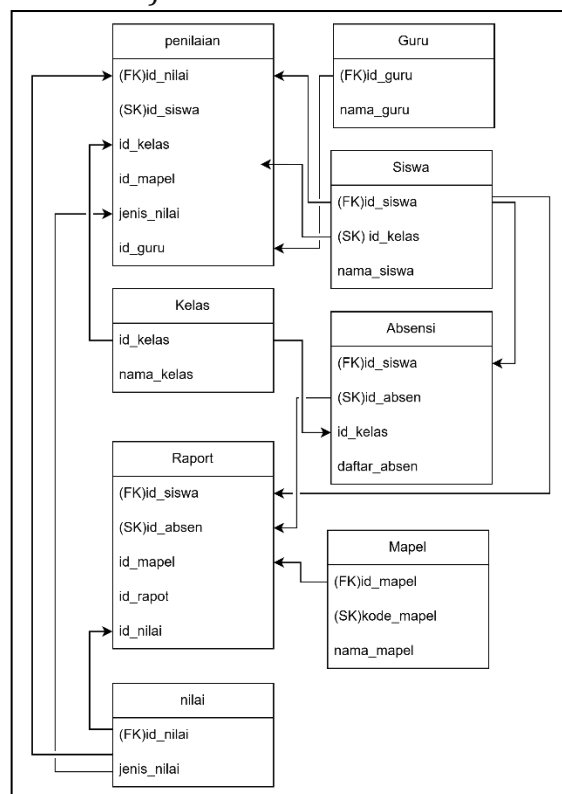
Figure 9. ERD Siakad School

- How (Application Architecture) This column contains applications presented in the form of a proposed information system sitemap.
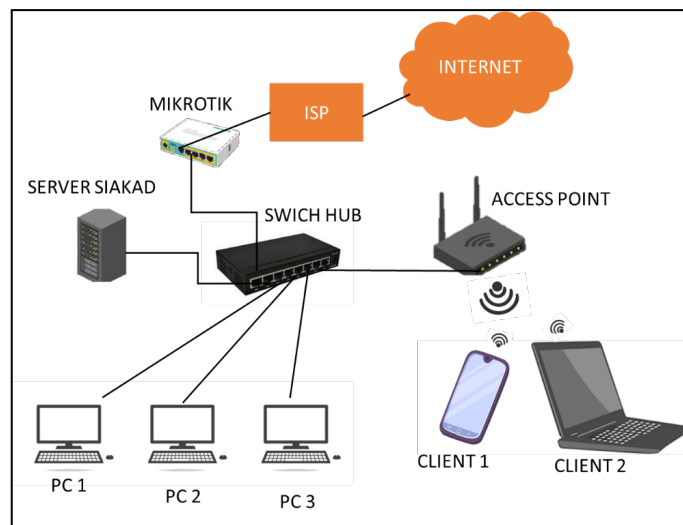- Where (System Geographic Development Architecture)

Figure 10. Network Technology

4) Builder's Perspective

Table 5. Builder's Perspective

Table Name	Field Name	Data type	Wide
New Student Admissions	id_New Student Admissions (pk)	Integer	5
	th track id (fk) receipt	Integer	5
	admin_id (fk)	Integer	5
	casis_id (fk)	Integer	5
Prospective Students	Case_id_(pk)	Integer	5
	Chassis_name	Varchar	255
	Casis_jenkel	Varchar	255
	Chassis_tmp_thr	Varchar	255
	chassis_date_Ihr	date	8
	chassis_address	Varchar	255
	chassis_file_pend	Varchar	255
	chassis_status_build	Varchar	255
	casis_parents	Varchar	255
	id_New Student	Varchar	5
	Admissions_(fk)	Integer	5
	Admin	Integer	5
	id_login_(fk)		
Admin	id_admin_(pk)	Integer	5
	admin_name	Varchar	255
	admin	Varchar	255
	admin_Ihr_date	date	8
	admin_address	Varchar	255
	admin_position	Varchar	255
	id_New Student	Integer	5
	Admissions_(fk)	Integer	5
	id_login_(fk)	Integer	5

	id_out_(fk)	Integer	5
	id_pemb_(fk)		
Track	track_id_(pk)	Integer	5
	track_name	Varchar	225
	id_admin_(fk)	Integer	5
	casis_id_(fk)	Integer	5
File	File_id (pk)	Integer	5
	file_name	Varchar	255
Teacher	Teacher_id (pk)	Integer	2
	teacher name	Varchar	255
	jenkel_teacher	Varchar	255
	Teacher's Eid date	date	8
	teacher address	Integer	255

- How (System Design)

Table 6. System Input Output

NO	Information Systems Name	Sub Process	Input	Output	Information
1	information Systems Student Registration	Data collection student	Registration form and completeness form	Student data and data completeness of files	Manage data of prospective students who register
2	information Systems incoming and outgoing mutations	Data collection mutation	Mutation form in and out student	Student incoming and outgoing mutation data	Manage data on incoming and outgoing student transfers
3	information Systems Student Data	Student data collection	Student data forms such as student profiles	Student data	Managing student data at school

- Where (Technology Architecture)

This column provides a physical description of the technology needs of the school. These needs include hardware, software, etc.

5) Subcontractor Perspective

Table 7. Data Definition Language (DDL)

Table Name	Data Definition Language
Prospective Students	Create Table Calon_Siswa (Casis_Id Integer Not Null, Casis_Nama Varchar(255), Casis Jenkel Varchar(255), Casis_Tmp_Lhr Varchar(255), Casis Tgl_Lhr Date(8), Casis_Address Varchar(255), Casis Berkas Varchar(255),

	Casis_Ortu Varchar(255), Primary Key (Casis_Id));
Admin	Create Table Admin (Id_Admin Integer Not Null, Nama_Admin Varchar(255), Jenkel_Admin Varchar(255), Tgl Lhr_Admin Date(8), Alamat_Admin Varchar(255), Posisi Admin Varchar(255), Primary Key (Id Admin));
Student	Create Table Admin (Id_Siswa Integer Not Null, Nama_Siswa Varchar(255), Jenkel Siswa Varchar(255), Date_Lhr_Siswa Date(8), Alamat_Siswa Varchar(255), Primary Key (Id_Siswa));
Teacher	Create Table Teacher (Teacher_Id Integer Not Null, Teacher Name Varchar(255), Teacher Sex Varchar(255), Teacher Birthday_Date Varchar(255), Teacher Address Varchar(255), Primary Key (Teacher_Id));
Evaluation	Create Table Assessment (Value_Id Integer Not Null, Value Type Varchar(255), Value Name Varchar(255), Primary Key (Value_Id));

6)

7) Blueprint (Framework)

The architectural blueprint is obtained from the results of modeling and analysis of information technology performance. [10] The acquisition of the blueprint is expected to provide maximum results in the Design of FEAF Standard Enterprise Architecture in the Academic Information System at MA Bumi Persada Based on the Website. The results are as follows:
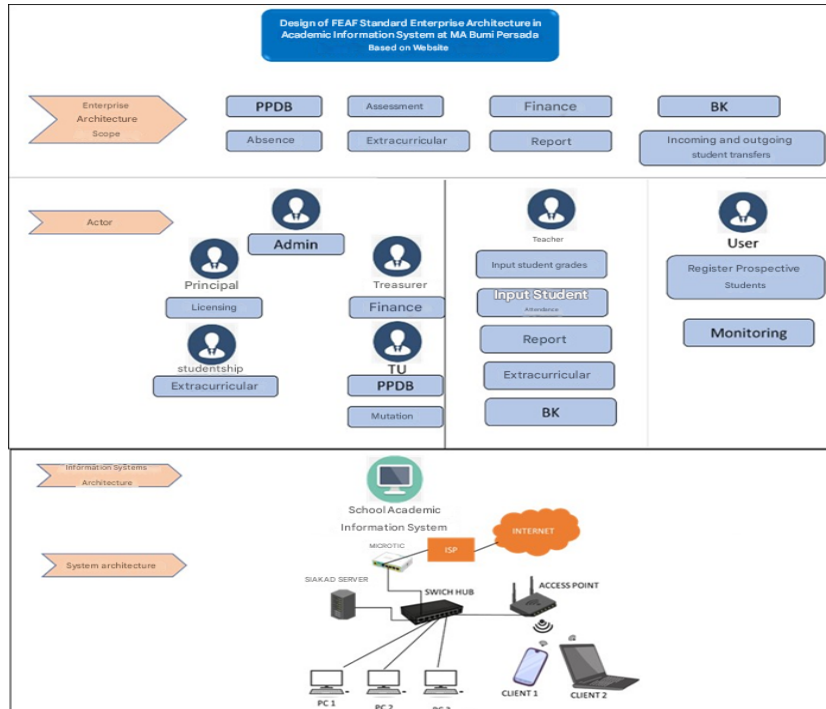

Figure 14. Blue Print

D. Conclusion

Based on the results of the research that has been done, it can be concluded that the application of the Federal Enterprise Architecture Framework Standard with four levels in this study, namely the First Level (PEST and SWOT), Second Level (Value Chain), Third Level (BEST) and Fourth Level (5 Zachman Perspectives). Through the design of the school's academic information system using the Federal Enterprise Architecture Framework, Bumi Persada has an online information system reference that combines business and technology. So if implemented, the management of the MA Bumi Persada school's academic information system will be more effective and efficient.

E. References

[1] Sukmawan, D. (2023). "Design Of Website-Based Electricity Bill Data Collection System Using Federal Enterprise Architecture Framework," Journal of Information Systems and Information Technology Research (JURSISTEKNI), 5, 165-177.

[2] Defriani, M., & Resmi, M. G. (2019). "E-government Architecture Analysis Using Federal Enterprise Architecture (FEA) Framework," SNIA 2019 National Conference, 3(2), 1–16.

[3] Rahayu, R., et al. (2023). "Application Of Feaf Standards In The Design Of Web-Based School Academic Information Systems," Journal of Information Systems and Information Technology Research (JURSISTEKNI), 5(3), 275-286.

[4] Kareksi, S. T. (2021). "Enterprise Architecture Design for Mail Management Using Feaf Standards," Technoinfo Journal, 15(2), 88-96.

[5] Hudha, Y. S., Utami, E., & Luthfi, E. T. (2019). "Enterprise Architecture Design of Billing Information System of PT. Time Excelindo Using TOGAF ADM," Creative Information Technology Journal, 5(1), 40-48.

[6] Thomas, K. (2014). "Strategic Planning of Information Systems in Increasing Competitive Advantage Using Ward & Peppard Method (Case Study of SMK Diponegoro Salatiga)," Journal of Information Systems, 10(2), 120-134.

[7] Entas, S. (2016). "Design of Higher Education Enterprise Architecture Using TOGAF ADM (case study of STP Sahid Jakarta)," Paradigma, 18(1), 67-78.

[8] R. Ahmad & A. N. Nugroho. (2022). "Implementation of Enterprise Architecture Framework in Higher Education Academic Systems," Journal of Information Technology and Computer Science, 14(3), 215-230.

[9] P. S. Putra et al. (2021). "Development of Academic Information System Using Enterprise Architecture Framework," International Journal of Advanced Computer Science and Applications (IJACSA), 12(5), 157-168.

[10] L. Widodo et al. (2020). "Comparison of FEAF and TOGAF in Designing Higher Education Information System," Journal of Information Systems Engineering and Business Intelligence, 6(2), 90-102.

[11] M. Rinaldi & H. Saputra. (2023). "Systematic Review of Enterprise Architecture in Education Sector," Indonesian Journal of Information Systems and Technology, 5(1), 45-60.

[12] W. Sari & Y. Anwar. (2019). "Adoption of Federal Enterprise Architecture Framework in Government Agencies," International Journal of Information and Communication Technology Research, 11(4), 310-325.

[13] R. Santoso et al. (2021). "Academic Information System Development Using Zachman and FEAF," International Journal of Computer Science and Information Security (IJCSIS), 19(2), 78-92.
[14] Y. H. Prasetyo & D. Wardhana. (2022). "A Case Study on the Implementation of Enterprise Architecture in a University," Journal of Computing and Software Engineering, 7(1), 55-69.
[15] A. Setiawan et al. (2020). "Integration of Academic Information Systems Using Enterprise Architecture Principles," Indonesian Journal of Computer Science and Engineering, 8(3), 125-138.
[16] B. Nugroho & H. Kurniawan. (2023). "Evaluating Academic Information System Using FEAF: A Case Study," Journal of Educational Informatics and Technology, 10(2), 89-102.
[17] R. Wijaya & A. Hakim. (2021). "Enhancing Educational Institution Information Systems with Enterprise Architecture," International Journal of Business and Information Technology, 9(4), 200-215.