

## ENTERPRISE ARCHITECTURE OF EDUCATION WITH THE TOGAF FRAMEWORK

Prastiwi<sup>1</sup>, Sam Vicarya Widagdo<sup>2</sup>, Made Kamisutara<sup>3</sup>

Fakultas Ilmu Komputer, Universitas Narotama Surabaya  
INDONESIA

Email: <sup>1</sup>prastiwi.damayanti@yahoo.com, <sup>2</sup>samvicarya3@gmail.com,  
<sup>3</sup>[made.kamisutara@narotama.ac.id](mailto:made.kamisutara@narotama.ac.id)

### ABSTRACT

*Increasingly the age and technology, the crime rate also grew, especially a crime that affects children. A variety of efforts undertaken by one of the elementary schools in Surabaya in prevent and minimize those crimes, by periodically to the socialization of parents. But the busyness of parents makes the parents do not understand the obstacles experienced by students while in school. From these problems raised an idea to create a child monitoring system while in school environment, resulting in the design of enterprise architecture or blueprint, with the TOGAF framework (The Open Group Architecture Framework). And can help parents in supervising the actions and behaviors of students at school environment, in processing activities and transactions that students do while in school, including activities at the time of teaching and learning, borrowing of book at libraries and transactions purchase food in the cafeteria. The results obtained in this enterprise architecture, can be a strategy as a school that applies technology to improve student supervision when in school.*

**Keywords:** *Enterprise Architecture, Blueprint, TOGAF (The Open Group Architecture Framework).*

### INTRODUCTION

In March 2003 the ministry of communication and information (KOMINFO) drafted the ITE legislation (Triginarsa, 2016). To prevent cases of crimes that occur in cyberspace, especially those that attack children such as cyber bullying, child exploitation, and child trafficking is done through social media. But it is exacerbated by crime cases that also lurk children that occur in the school environment, such as bullying, and the theft of allowance. So parents are expected to participate in preventing the occurrence of such crimes, but some parents, have different levels of activity, so not infrequently children are often victims of crime. Therefore, it is necessary to utilize information technology and information system that is positive in order to make the beneficial impact to the society.

As is done by one of public elementary schools in Surabaya (SDNS), in preventing the occurrence of crime in children, by way of socializing the parents of students on a regular basis. However, this method has not been effective due to the busyness and routine of the parents of everyday students, often many parents of students who do not know the obstacles or problems experienced by children while in the school environment. Not infrequently, the school found students with problems interfere with friends around, to disturb the teacher during the learning process. Which resulted in other students can not follow the lesson with the maximum.

This research will discuss the use of technology that can help parents to monitor the activities and transactions carried out the student at the time at school, the technology used is called Near Field Communication (NFC) embedded in a media and used on children while at school, which is integrated with information systems that are in school. The workings of this technology, the embedded NFC in the media, are close to an NFC reader connected to the information system, as a medium for transacting children while in school (Wikipedia, n.d.). It is expected that with the

application of this NFC technology parents can monitor the activities undertaken at the time of school, so crime cases that attack children can be minimized. With the information quickly and accurately stakeholder can immediately respond to the incident by making the appropriate program (Made Kamisutara, 2017). To implement the NFC technology, a framework of enterprise architecture that has four main components or domains is required, ie business architecture, information architecture, technology architecture and application architecture. The framework used in this research is The Open Group Architecture Framework (TOGAF), which is one of the most commonly used IT blue print methods and has the flexibility and focus on implementation and process (Suhartono, 2015). So the resulting output is, the IT blue print is expected to solve the problems currently faced.

### **Problems**

The research problems that arise as research questions are :

1. Why use NFC technology ?
2. Is the media used in children, does not interfere with activities and learning activities while in school ?
3. Is there any impact on schools, when implementing NFC technology ?

## **LITERATURE REVIEW**

### **Enterprise Architecture**

Enterprise architecture is a structured strategy or design in an organization that is used to support business processes to achieve business goals (Pertiwi, 2014). Enterprise architecture is a complete expression of a company, a master plan that acts as a collaborative force between aspects of business planning, goals, vision, strategy and principles of governance. Aspects of business operations, organizational structure, processes and data, aspects of automation, information systems and databases.

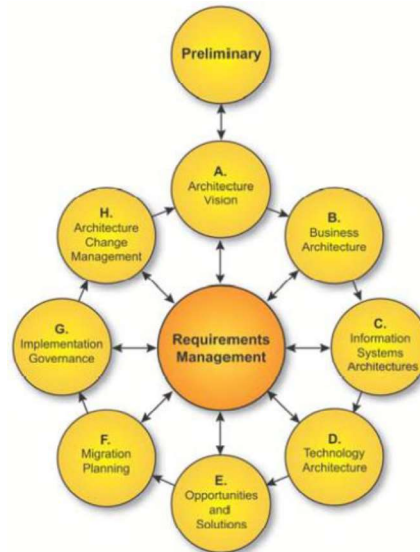
Enterprise architecture products will be graphics, models or narratives that explain the environment and enterprise design. It can be concluded that the enterprise architecture is a way to draw an operational model of enterprise that includes aspects of business planning, business operations, automation, to the supporting information technology infrastructure or blue print that determines a business, information, and technology, to achieve the goals or mission of an organization.

### **The Open Group Architecture Framework (TOGAF)**

TOGAF is a framework architecture - open group architecture framework, which provides methods and tools to help reception, production, use, and maintenance of enterprise architecture. TOGAF can be freely used by any organization that wants to develop enterprise architecture within the organization (The Open Group, 2009).

### **Architecture Development Method (ADM)**

The TOGAF Architecture Development Method (ADM) provides a time-tested and repeatable process for developing architecture. All of these activities are carried out in an iterative cycle of the definition and realization of a continuous architecture that allows organizations to transform them in a controlled way to respond to business objectives and opportunities (The Open Group, 2009).



**Figure 1. TOGAF ADM Structure**  
Source : The Open Group

Stages in ADM are as follows :

1. Preliminary phase : is the initial stage of preparing the design of enterprise architecture.
2. Requirement management : is the process of managing the architectural needs in the TOGAF ADM phase.
3. Phase A (architecture vision) : is the early phase of the architecture development cycle. To create alignment of enterprise architecture planning.
4. Phase B (business architecture) : is a phase that describes the development of business architecture to support the architectural vision.
5. Phase C (information system architecture) : is a phase that describes the development of information systems including the development of data and application architecture.
6. Phase D (arsitektur teknologi) : Is the development stage of architectural technology, for the development of target technology architecture that will become the basis of further implementation.
7. Phase E (opportunities and solutions) : is the first step directly related to the target architecture, implementation planning and identification for the architecture defined in the previous phase.
8. Phase F (migration planning) : A series of detailed transition architecture sequences with execution plans and supportive changes.
9. Phase G (implementation governance) : It is a step to formulate recommendations for each project implementation.
10. Phase H: (architecture change management) : Is a procedure for management to a new architecture.

### **Near Field Communication Framework**

NFC It stands for Near Field Communication. NFC is widely used in smartphones and is intended as a tool to share documents, music, photos, games, multi player until payment. NFC itself can be defined as a form of short-range wireless communication, with the antenna used shorter than the operator signal wave, the working principle of NFC is actually the same as Bluetooth looking for the signal pair using the same communication facility. (Zakaria, n.d.).

How NFC works ?

Like Bluetooth or wifi, NFC works on the principle of sending data through radio wave signals, the technology used by NFC is based on RFID (Radio Frequency Identification) which uses electromagnetic induction to transmit information. The data transmission frequency of NFC is 13.56 MHz and data can be sent at speed of

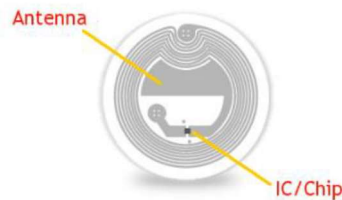
106.212 or 424 Kbps. NFCs can induce passive NFC currents such as those on stickers that do not have power or power alone, so that passive NFC components can work (De-Tekno, 2016).

#### Type NFC

By type, NFC is classified into two parts as follows (De-Tekno, 2016):

##### 1. NFC Passive :

This NFC does not require any power or power by itself, and is known as an NFC tag. NFC tags contain a powerless component chip commonly attached to a card, sticker, key chain or other. NFC tags only store data that can be read or written by NFC devices active.



**Figure 2. NFC Tags**  
Source : de-tekno.com

##### 2. NFC Active :

Widely available on smartphones or tablets or other portable devices. This type of NFC requires power to be able to communicate with other active NFCs, or with passive NFC.



**Figure 3. NFC Active and NFC Passive**  
Source : de-tekno.com

## RESEARCH METHODS

### Research sites

This research was conducted in one of the public elementary schools in the eastern region of Surabaya, and performed more or less for six months.

### Method Used

TOGAF Architecture Development Method (ADM) as enterprise architecture planning. With the following steps:

- a. Preliminary Phase  
In the preliminary phase, the definition of how to design the enterprise architecture
- b. Requirement Management  
In this phase, the user needs analysis. With the aim of analyzing and managing architectural requirements throughout the phase.
- c. Architecture Vision  
In the architecture vision phase aims to create uniformity of view of enterprise architecture planning to achieve research objectives in the form of strategy.
- d. Business Architecture  
It is the step taken to determine the desired activity model for determining future strategies.
- e. Information System Architecture  
In the deciding phase how to build the information system architecture including the data architecture and application architecture used.
- f. Technology Architecture  
In this phase it describes the technological structure needed to support the operational application.

- g. Opportunity And Solutions  
In this phase we describe the results of GAP analysis in order to make preparation and migration planning for the implementation of the new application architecture.
- h. Implementation Governance  
In this phase it will be ensured that the solution program is successfully implemented, with the conformity of the solution propagated to the target architecture
- i. Architecture Change Management  
In this phase will review the architectural performance and make recommendations for change. And make an assessment of changes to the framework and principles set out in the previous phase

**RESULT AND DISCUSSION**

**A. Preliminary Phase**

The principles of enterprise architecture planning, which describe the characteristics and objectives of architecture are as follows:

- 1. Architecture designed to prevent the perpetrator or trigger the occurrence of crime in children.
- 2. Architecture is designed to assist parents in supervising children's activities while in school environment
- 3. Architecture designed to foster a sense of independence to students, with the utilization of NFC technology

**B. Requirement Management**

The results of interviews and observations carried out there are business processes on the SDNS namely the enrollment of new students, new transfer students, writing of report, lending books, book returns, food and beverage purchases. With various problems faced. In table 1. Is a table of problems and solutions initiated by the author are as follows :

**Table 1. Solutions activity and information systems**

Issue	workaround
The activities of oprasional are still performed with two steps	<ul style="list-style-type: none"> <li>1. conduct an inventory of the means of information technology</li> <li>2. Required an information system and information technology that is integrated with a database</li> </ul>
Too many systems that are used but not well-integrated,	<ul style="list-style-type: none"> <li>1. Do a breakdown of the system and the database used on each system that is used</li> <li>2. Perform the design of system and database that can be integrated with both</li> </ul>
The absence of documentation of student activities conducted during your stay in schools	<ul style="list-style-type: none"> <li>1. Melakukan inventaris sarana teknologi informasi</li> <li>2. Kegiatan yang dilakukan siswa selama berada disekolah, terkomputerisasi dengan baik</li> </ul>

**C. Arsitektur vision**

Architecture Proposed Vision

A new vision that became a proposal for SDNS. Is realizing a school that has an IT technology insight in 2028 The design of enterprise architecture based on the proposed new vision plan, that any design of enterprise architecture is determined as a proposal for SDNS.

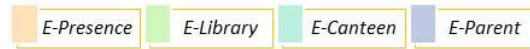


Figure 4. Design of enterprise architecture

**D. Business Architecture**

Model of activities to define the SDNS strategy in the future



Figure 5. Aktifitas Strategi SDNS

All activities performed by students are done using NFC Tag embedded in bracelets or bracelets in the form of chips and must be used when in the school environment. the way of operation that is NFC Bracelet used by students is scanned during the activity. All activities that students do when they are in the environment are stored on the server and parents can access all activities that have been done while in school. Based on the strategy activities that have been formulated, here are some applications contained in business architecture, among others :

1. E-presence

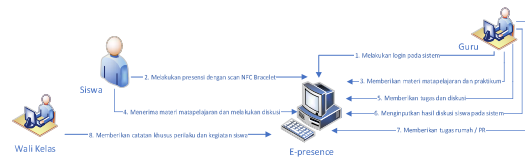


Figure 6. Design of E-Presence Business Application Architecture

The e-presence app's business architecture design involves three student stakeholders, homeroom teacher, and teacher. With homeroom teachers and teachers as responsible for the implementation of teaching and learning process.

2. E-Canteen

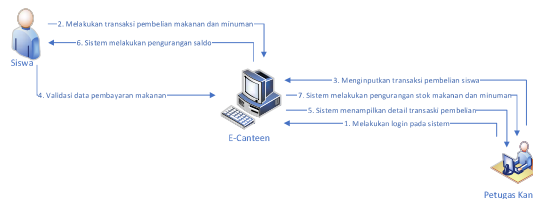


Figure 7. Design of E-Canteen Business Application Architecture

The design of business architecture of e-canteen application involves two stakeholders ie cafeteria officer and student, with canteen officer as responsible for implementation and processing of food and beverage purchasing.

3. E-library

The design of business architecture of e-library applications involves two stakeholders: librarians and students. With lending and return transaction activities.

Borrowing book



Figure 8. Design of Business Architecture E-Library Application of Loan Activities

Return book



Figure 9. Business Architecture Design E-Library Application Return Activities

4. E-Parent

Activities undertaken by students while in school, can be accessed by parents of students through e-parent application. The design of e-parent business application architecture involves two stakeholders namely parents and students.

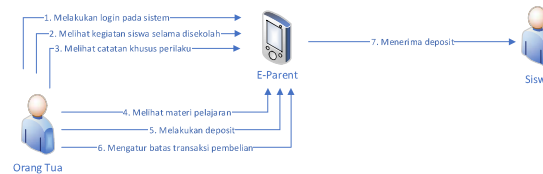


Figure 10. Design of E-Parent Business Application Architecture

The student transaction menu presented on the E-Parent feature is library lending transactions, food and beverage transactions on the canteen, and tasks or activities undertaken while in school.

E. Information Architecture

1. Application architecture

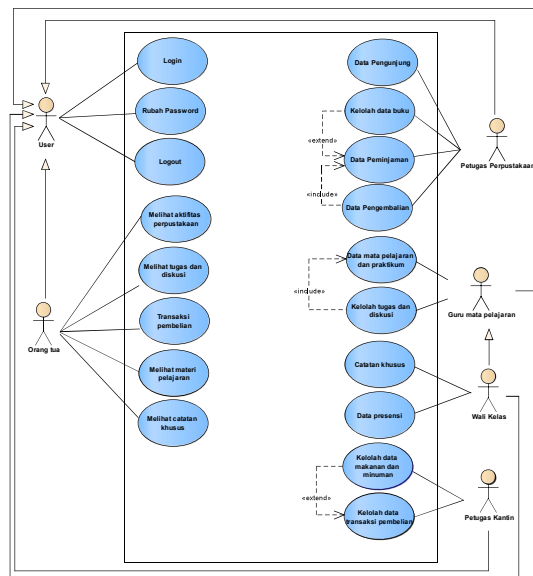
Based on predetermined architecture vision and business architecture. the following is an explanation of some applications and functions of the application.

Table 2. Application Design and Application Functions

Application Name	Function Application
E-Presence	Dissemination presence teachers and students, subject matter, practicum tasks and discussions, students are done at the moment is the school's surroundings. A special series of notes along with the activities and tasks of homework
E-Canteen	Dissemination of food and food

	and beverage purchase transaction made by students
E-Library	Dissemination of books, library visitors data and transaction data loaning and restoration of book
E-Parent	See the detail transaction undertaken by students at the time were in the school environment as well as see the subject matter, particular note sequences of activities and duties of the homework. And make a deposit that functions as a medium of transaction of purchase food and drinks
Website	Integrate all applications based on the access rights of each application e-presence, e-canteen, e-library, e-parent as well as the promotion of media and information to SDNS

Based on Table 2. application design and application function, in the picture below is an application architecture design for SDNS which is described using usecase diagram. With parental user access, canteen officers, librarians, homeroom teachers and subject teachers.



**Figure 11. SDNS Application Architecture**

The description of various features of the menu presented on the application architecture e-presence, e-canteen, e-library, and e-parent include:

- a) Student Presentation  
Presence is done by performing NFC bracelet scan on NFC reader.
- b) Subject material and practicum  
subject matter and practicum are done by inputting the material in the e-presence application.
- c) Duties and discussions



- tasks and discussions are conducted on the learning process, and the results of tasks and student discussions by entering on e-presence applications.
- d) Special note  
special notes of inputs or obstacles or problems that are being experienced on the students, based on information of teachers, as well as staff of SDNS management.
  - e) Food and beverage data processing  
data processing and drinks is done by entering all the details of food and beverages are lent.
  - f) Processing transaction data of food and beverage purchases  
payment of food and beverages by input details of the purchase then students do a scan NFC Bracelet as a method of purchasing food and beverages.
  - g) Visitor data  
attendance of library visitors, done by performing a scan of NFC bracelet.
  - h) Process the book data  
Manage of book data is a submenu that contains the addition of book data, change of book data, and deletion of book data,
  - i) Book lending data  
book lending is done by entering the details of lending transaction book.
  - j) Book return data  
the return of the book is done by searching the lending transaction transaction data. The student then scans the NFC bracelet for validation of the return of the book.
  - k) View library activities  
is a description of activities undertaken by students at the time in the library, which includes information on the number of visits, and borrowing books.
  - l) Viewing tasks and discussions  
is the information tasks and discussions that have been accepted by students during the learning process, and has been entered previously.
  - m) Looking at the subject matter  
subject material is a list of subject materials that have been entered by the teacher during the learning process.
  - n) View special notes  
is a description of input or obstacles or problems that feel students
  - o) Purchase transaction  
a description of the balance usage that students used by students to purchase food and beverage transactions.

Based on the architecture of SDNS applications that have been made before, there are 20 user interface. Some of the user interfaces are shown in Figure 12 and Figure 13, in the form of user interface of SDNS information system main page, and user interface of e-parent application.



**Figure 12. Main page of SDNS Information System**



Figure 13. E-Parent Application user interface

## 2. Data Architecture

is the elaboration of related application architecture that has been presented before. Discussion architecture data include entities, attributes, data type, and the relation is used to describe the relationship of the entities on the proposed architecture

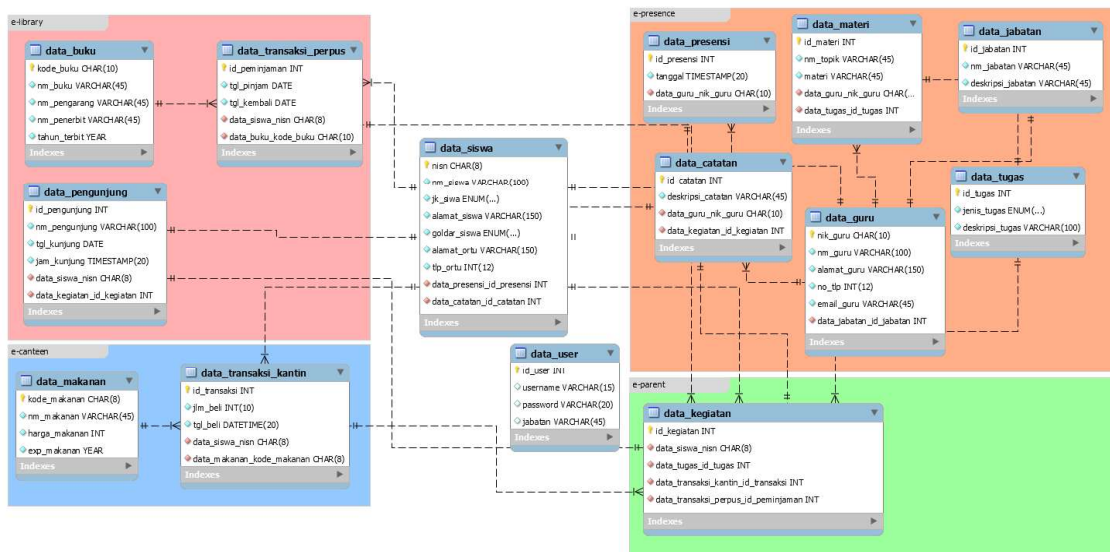


Figure 14. SNDS Data Architecture

## F. Technology architecture

### 1. Network technology architecture

recommendations related to general network technology architecture that can be used. There is a limitation of the scope of the network technology based on the activities and transactions conducted by students while in school. All areas connected with local server via switch and wireless. And in every school environment there is CCTV that serves as a media for student supervision while in school. In Figure 15 is a network technology architecture proposed by the author, to support NFC technology that will be implemented in SDNS.

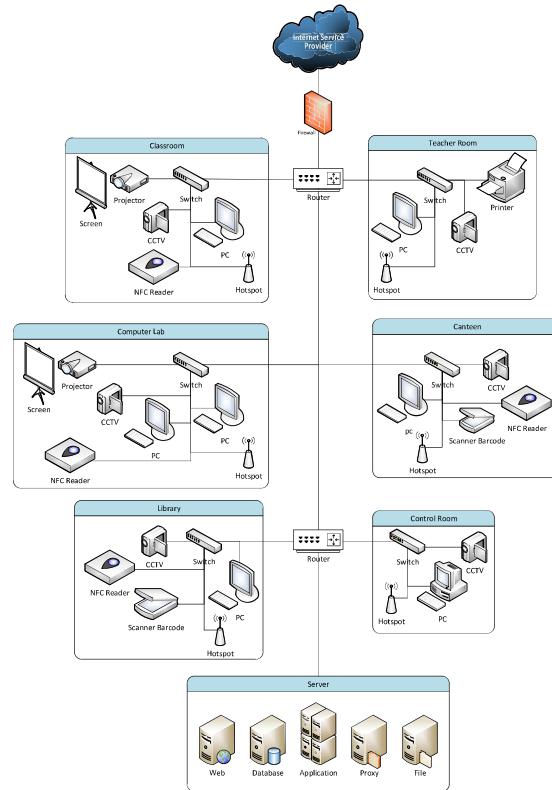


Figure 15. Network Technology Architecture

2. Architecture of Bracelet NFC technology illustrations of the use of NFC Bracelet, which students use to engage in learning and transactional activities, while in the school environment.

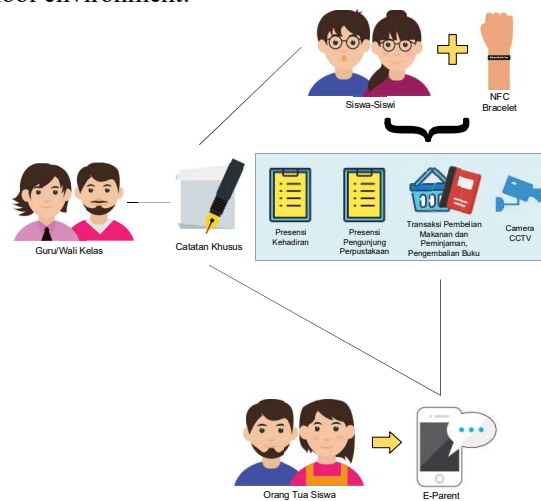


Figure 16. NFC Bracelet Technology Architecture

Figure 16 is an NFC bracelet technology architecture, which students use when in school, and is used at the time of attendance presences, library end presentations, validation of food purchase transactions, and validation of lending and return transactions. Every transaction and activities the student undertakes, and special notes containing a set of problems faced by students while in school, and accessible or monitored by parents, using e-parent applications.

**G. Opportunity and Solutions**

GAP analysis is conducted to describe what components should be defended or eliminated from the running system, and components that must be replaced or added with new components from the proposed architecture.

1. Business Architecture

The GAP analysis of business architecture is divided into 4 sub-applications e-presence, e-canteen, e-library, and e-parent. With gap replace student presences, attendance of library visitors, validation of food and beverage payment data and special note viewing, previously done manually, and then done with NFC Bracelet on the new system.

2. Application Architecture

The e-presence application architecture with the retain gap in the dapodik app as a series of student data, which is still used in the new system and replace the previously manually executed e-library, and then done with NFC Bracelet on the new system.

3. Data architecture

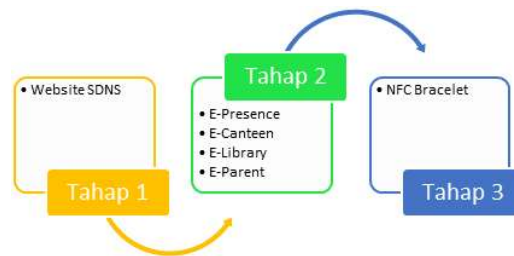
GAP re-analysis of data on borrowing or returning books, where on the system that is running, the process of borrowing and returning the book is recorded manually, and at the time of changes in lending data is still done recording again.

4. Technology architecture

GAP analysis on the Internet network menu, where in the new system is done the addition of internet network to support NFC Bracelet.

**H. Migration Planning**

The sequence of information system application implementation and information technology for SDNS.



**Figure 17. Roadmap Order Implementation Information System Applications And Information Technology**

roadmap sequence implementation of information system application and information system technology divided into three stages. This is stage 1 the implementation of the SDNS website, with implementation estimate from January to 2019. Phase 2 e-presence, e-canteen, e-library and e-parent implementation with implementation estimate in March to December 2019. And Stage 3 implementation of NFC Bracelet with implementation estimates from January to April 2020.

**I. Implementation Governance**

Important information that includes a brief description of the enterprise architecture to be implementation.

**Table 3. Summary of Enterprise Architecture**

Introduction	
The Purpose Of The IT Strategy	Assist parents in supervising activities conducted on students while the school surroundings.
Description Of The IT Strategy	The use of NFC technology in conducting surveillance activities of students at the time were the school's surroundings

The constraints of the problem	<p>Transactions or activities that students can do with NFC technology include:</p> <ul style="list-style-type: none"> <li>• Students presence</li> <li>• library visitors presence</li> <li>• transaction or return the book</li> <li>• Food and beverage purchase transaction</li> </ul>
Justification	
Business Needs	<p>SDNS information systems with applications:</p> <ol style="list-style-type: none"> <li>1. E-presence with sub menu:             <ol style="list-style-type: none"> <li>a. Subject Matter</li> <li>b. assignments and discussion</li> <li>c. special notes</li> <li>d. student presence data</li> </ol> </li> <li>2. The E-library with sub menu:             <ol style="list-style-type: none"> <li>a. the visitor data</li> <li>b. manage book data</li> <li>c. loan data</li> <li>d. data returns</li> </ol> </li> <li>3. E-canteen with sub menu:             <ol style="list-style-type: none"> <li>a. kelolah data on food and drink</li> <li>b. the purchase transaction data kelolah</li> </ol> </li> <li>4. E-parent with sub menu:             <ol style="list-style-type: none"> <li>a. the subject matter</li> <li>b. assignments and discussion</li> <li>c. the activity library</li> <li>d. special notes</li> <li>e. purchase transaction</li> </ol> </li> </ol>
The Impact Of Enterprise Architecture	<p>Additions to the inventory of information technology:</p> <ol style="list-style-type: none"> <li>a. NFC Bracelet</li> <li>b. NFC Reader</li> <li>c. the addition of internet network</li> </ol>
Management Needs	
Time Use Of Technology	<p>The use of information systems with application of SDNS e-presence, e-canteen, and e-library used in teaching and learning business hours. Every Monday to Friday at haru 06.00-14.00. Whereas, in the application of e-parent who accessed the parents used daily for 24 h in a week or any time according to your needs.</p>

The duration of the use of technology	In a sub menu that is accessed on e-applications e-presence, e-library, canteen, and e-parent is accessible for 3 to 5 minutes using the internet network
Period Of Implementation	Enterprise architecture implementation period is divided into three phases phase 1: SDNS website with estimated time of completion in January – February 2019 phase 2: application to e-presence, e-canteen, e-library and e-parent with an estimated time of completion in March – December 2019 Phase 3: integration of NFC technology bracelet and NFC reader with an estimated time of completion in January – April 2020
The constraints and risks	There is the possibility of the implementation of the enterprise architecture is not timely Technology adjustment occurs between students, teachers, staff, and parents or caregivers
Recommendations	Provide counseling and training related the use of NFC technology to students, teachers, staff and parents or caregivers

**J. Architecture change management**

change management process on SDNS. as for the scheme of change management process architecture.

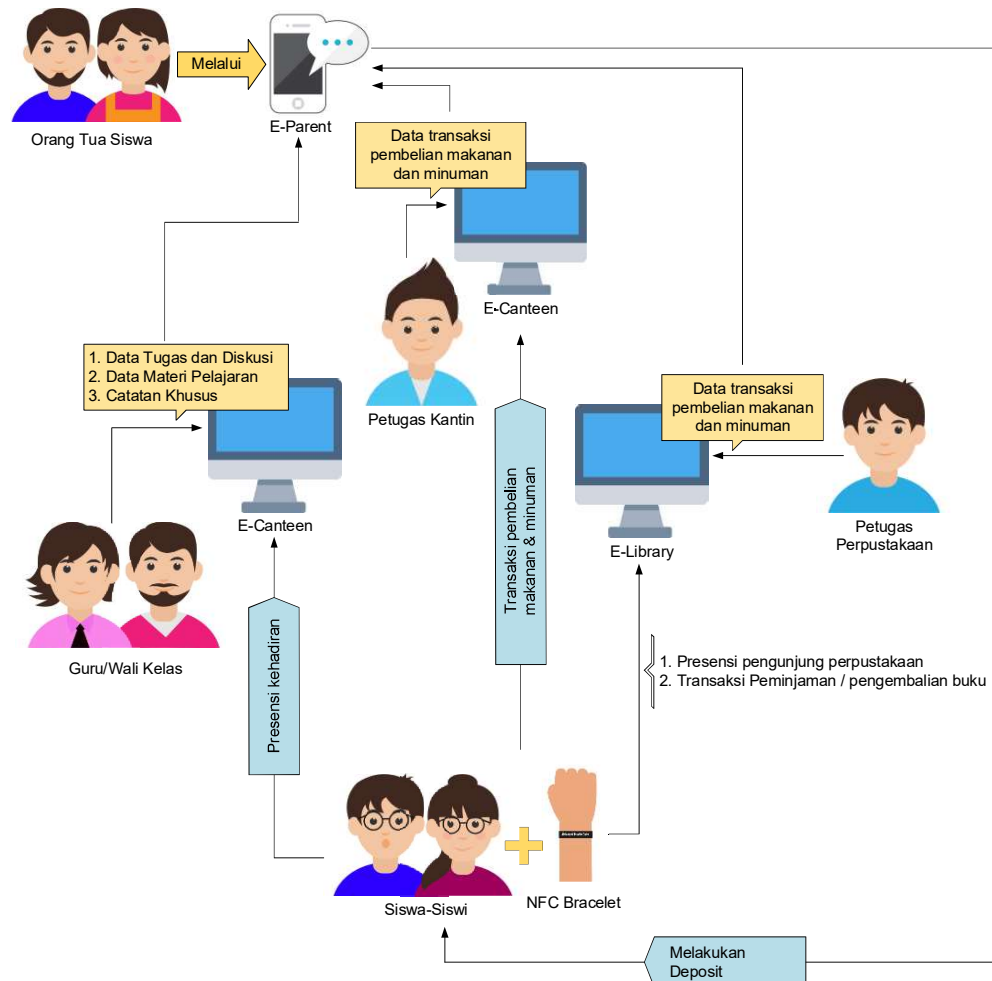


Figure 18. New SDNS Management Process Scheme

By implementing enterprise architecture, it is hoped that the parents can monitor the activity and receive information related to the activities of the students when they are in the school environment. And can help SDNS, as a media campaign and recommendation for parents of prospective students to enroll their children on SDNS.

## CONCLUSIONS AND RECOMMENDATIONS

### Conclusion

Based on the results and discussion of designing enterprise architecture on SDNS with TOGAF framework, it can be concluded that:

1. Enterprise architecture planning in SDNS can be a reference strategy in improving the supervision of the activities of students at school.
2. Enterprise architecture planning on SDNS can be a promotional strategy, as a school that applies NFC bracelet technology to student's student media during schooling that can be accessed by parents with smartphones.

### Recommendation

For further development of enterprise architecture design on SDNS with this TOGAF framework, some suggestions can be made:

1. The research has not yet included site monitoring, it is expected that the development of enterprise architecture can be added feature on NFC Bracelet which is able to monitor student location at school environment and outside school environment, and give accurate information to parents.

2. The research has not yet covered the cost measurement, it is expected that the measurement of return of investment is the preliminary investment cost estimation of the use of technology as well as the required system maintenance on the proposed enterprise architecture, so that SDNS can know the budget provided if it will apply NFC technology.

## **REFERENCES**

- De-Tekno. (2016, Mei). *Apa Itu NFC Dan Cara Menggunakannya*. Retrieved from [www.google.co.id/amp/s/de-teknokom.com/2016/05/apa-itu-nfc-dan-cara-menggunakannya/amp/](http://www.google.co.id/amp/s/de-teknokom.com/2016/05/apa-itu-nfc-dan-cara-menggunakannya/amp/)
- Made Kamisutara, P. A. (2017). Early Warning Of Expectant Mother And Baby Using Softwares Based SMS Gateway. *ICOEN* (p. 1). Surabaya: ICOEN.
- Pertiwi, K. D. (2014, Desember). *Framework Arsitektur Enterprise (TOGAF & FEAF)*. Retrieved from <http://catatan-risma.blogspot.co.id/2014/09/framework-arsitektur-enterprise-togaf.html>
- Suhartono, B. (2015, Mei). *TOGAF, Salah satu Metodologi dalam pembuatan IT Blue Print*. Retrieved from <https://bambangsuhatono.wordpress.com/2014/02/26/togaf-salah-satu-metodologi-dalam-pembuatan-it-blue-print/>
- The Open Group. (2009). TOGAF Version 9. In T. O. Group, *The Open Group Architecture Framework (TOGAF)* (pp. 3 - 5). The Open Group.
- The Open Group. (2009). TOGAF Version 9. In T. O. Group, *The Open Group Architecture Framework (TOGAF)* (pp. 51-54). The Open Group.
- Triginarsa, A. (2016, Maret). *Latar Belakang dan Sejarah UU ITE Serta RESUME CHAPTER 1&2 "THE E-POLICY HANDBOOK"*. Retrieved from <http://www.simpleflux.blogspot.co.id/2016/03/latar-belakang-dan-sejarah-terbentuk-uu.html/>
- Wikipedia. (n.d.). *Near Field Communication*. Retrieved from [http://id.wikipedia.org/wiki/Near\\_field\\_communication](http://id.wikipedia.org/wiki/Near_field_communication)
- Zakaria, M. (n.d.). *Pengertian NFC dan Fungsi NFC*. Retrieved from [www.nesabamedia.com/pengertian-nfc-dan-fungsi-nfc/](http://www.nesabamedia.com/pengertian-nfc-dan-fungsi-nfc/)