DESIGN AND THE IMPLEMENTATION OF TECHNOLOGY CLOUD COMPUTING USING SOFTWARE AS A SERVICE (SaaS), PLATFORM AS A SERVICE (PaaS), INFRASTRUCTURE AS A SERVICE (IaaS) FOR HOSPITAL INFORMATION SYSTEM AS A HEALTH SERVICE

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ABSTRAK

Hospital is a health service provider of outpatient service, inpatient service, emergency service and other supporting health services. Example : Yadika Pondok Bambu Hospital, Yadika Kebayoran Lama Hospital and Natar Medika Lampung Hospital. That all is the hospital under Abdi Karya Foundation. The foundation over three hospitals said that there was no a system information technology communication that process and integrate medical records and and it is necessary to in developed, in reporting data activities in a hospital (RL 1) to (RL 5) sometimes the result is not appropriate. The reports will be submitted to Abi Karya foundation, provincial health department, city health department and ministry of health. Based on the existing problems in Abdi Karya Foundation, it needs Cloud Computing for hospital information system. The development of hospital information system begins with analysis procedure that runs in the hospital then do analysis architecture cloud computing that using three model services Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure As a Service (IaaS). Then analysis flow design of cloud computing technology and do design a database until interface. After analyzed and designed process was done, then go to flow design of Cloud Computing implementation phase as the resources of hardware, networks and media data storage in Virtual Private Server (VPS). The purpose of this research is to integrating medical records and report activities data of hospital for service improvement and quality. Based on the result of research and testing, it can be concluded that Cloud Computing of hospital information system be able to create uniformity and ease in process and storing information hospital data.

Kata kunci : *Cloud Computing*, *Software as a Service (Saas), Platform as a Service (PaaS)* and *Infrastructure as a Service (IaaS), Virtual Private Server (VPS).*

1. INTRODUCTION

Hospital was a body of service providers health of outpatient service, in-patient, emergency room and supporting other health**.** Example there was three hospital tahat under Abdi Karya Foundation like Yadika Pondok Bambu Hospital, Yadika Kebayoran Lama Hospital and Natar Medika Lampung Hospital.

Based on the results of interviews with the Heads of IT at Abdi Karya foundation tangerang explained that every Yadika Bambu Hospital, Yadika kebayoran lama Hospital, dan Natar Medika Lampung Hospital already has information systems for the hospital, but the perfomance is still not good enough in collecting, processing, and presentation the data and still have any lacking feature that may cause a problems.

The foundation over three the hospital state that there are several problems on the hospital information systems in three the hospital. The problems is there wasn't an information technology system communication that process and integrating records medical on Yadika Pondok Bambu Hospital, Yadika kebayoran lama Hospital, and RS Natar Medika Lampung Hospital. Which is to integrating medical records already becomes work programs of 'IT' central for all the yadika hospital as the main needs. All patient who has medical treatment in Yadika Hospital already listed in system record medical all over the house yadika hospital to service improvement and quality.

Information system of hospital is a collection process , processing , presentation of data in a hospital for the reporting activities of the hospital to the ministry of health .Which the data were obtained from a input to output process in the hospitals. After all data collected , the data will be used as reporting activities data in the hospital. The information systems of hospital reporting data

activities in hospital Abdi Karya foundation also needs to be developed, in reporting data activities at hospitals (RL1) to (RL5), sometimes the result is not appropriate. It cause the making of reporting activity data is not match.

In make data reporting activities in the hospitals, there was not only one type reporting, but there are many kinds of reporting that have to arranged and prepared to be submitted from the hospital to the Abdi Karya Foundation, Provincial health department, the city health department, districts and health ministry. Data reporting activities at hospitals (RL1) to (RL5) is the contents of report referring to book, Juknis Information systems of hospital, and RI health ministry.

Based on the problems that already described, it needs a system that have cloud computing to simplify when the, processing, presentation of data in three hospitals and focus in cloud server under the shade Abdi Karya Foundation. With an implement development cloud computing information system hospital , as hospital services to integrate medical records being uniform on Yadika Pondok Bambu hospital, Yadika kebayoran lama hospital, dan Natar Medika Lampung hospital. In addition, information system of hospital becomes services Software as a Service that make the three hospitals more easily in utilizing the resources software and also needs to be developed during reporting RL1 until RL5 be in accord by using a model of services Software as a Service, Platform as a Service and Infrastructure as a Service.

The hopes by applying cloud computing (Cloud Computing) is where information stored server centered on the internet allows information to upload , stored , accessed time and anywhere. Software as a Service (Saas) services is a way to solve the problem as a model service cloud computing in which three hospital can using one application the information systems of hospital that on-demand Self Service, ready to use, same , and already integrated to medical records on Yadika Pondok Bambu hospital, Yadika kebayoran lama hospital, dan RS Natar Medika Lampung hospital. with using service from Infrastructure As A Service as a virtual computer access with resources of hardware , network and hospital data storage that centralized in cloud server.

As for the purpose to be achieved to research to be performed is as follows :

1. Build an information the hospital are optimally when the, processing , presentation of data in three hospitals with using the service of Infrastructure as a Service As access virtual computers and media data storage hospital centralized in cloud server.
2. Implement construction of cloud computing with use information technology as a means of communication providers on the Abdi Karya Foundation To process and integrate data medical records being same on each Yadika Pondok Bambu hospital, Yadika kebayoran lama hospital, and Natar Medika Lampung hospital. Use the service of *Software as a Service* On information systems a hospital that is *on-demand Self Service*, ready to use, same and can be used in three hospital on the Abdi Karya Foundation that has already integrated with medical records.
3. Making data reporting events in three the hospital (Rl1) to (Rl5) at a man of work be in accord in data processing hospital.

2. THE CONTENTS OF RESEARCH

2.1 Hospital Definition

Hospital is a individuals health services facility that provides in-patient care and outpatient, providing short and longer term of health service that consists observation, diagnostic, therapeutic and rehabilitative treatments to the people who sick, injured and childbirth. In other words hospital is a health institution that provides health services and capable of being used to health workers and research [6].

Other definitions hospital is a institution health services that runs health services individuals in plenary serve outpatient, patient, and as an emergency [10].

Hospital are a hospital was a body of service providers of health service outpatient, patient, emergency room and supporting other health.

2.2 Hospital Information System

Hospital Information System is a process collection, processing and presentation of data hospital on Pasal 1 Ayat 2. [11]

Hospital Information System is application the reporting system of the hospital to the ministry of health in Pasal 2 Ayat 1 [9].

Based on the meaning of hospital information system according to Supriyantoro Juknis SIRS Direktur Jenderal Bina Upaya Kesehatan Pasal 1 Ayat 2 dan Peraturan Menteri Kesehatan Repulik Indonesia nomor 1171/MENKES/PER/VI/2011 pasal 2 ayat 1 says Hospital Information System is a process of gathering, processing and presentation of data to the reporting activities of hospitals to the Ministry of Health. Where the data is retrieved from a series of process input until output takes place in hospital [8].

2.3 Cloud Computing Definition

Cloud Computing is a model of client-server, where the Resource such as a server, storage, network, and software can be seen as a service that can be accessed by remote users and at any time. Users can enjoy the various services provided by the cloud computing provider, without needing too

much ask for technical help or support from the provider. Cloud Computing infrastructure, such as servers, storage, network, and a variety of software called cloud [1].

Cloud computing is a model computing or computin , where of resources as detector processor or computing power, storage, network, and software be abstract and given as for service on the or internet access remote using patterns .The availability of on-demand seseuai needs, easy to control , dynamic and scalabilit [4].

The other definitions of cloud computing is the utilization of technology computer (computing) and development based internet (cloud). Said cloud own refer to cloud symbol that is used to describe the internet network (the internet cloud) where technology based computing cloud , all information stored and focused on the server with a network of the internet where resource as server, storage, network, and software can be in the access by the user and at each time provided by provider.

2.4 Services Cloud Computing

Services cloud computing was divided into three part by what that serve as service that could be presented by cloud computing has included, Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a service (SaaS)

2.4.1 Infrastructure as a Service(IaaS)

Infrastructure as a service (IaaS) Is service of cloud computing where we can "hire" infrastructure it (computing, storage, memory, network, etc) .We can define large unit computing (cpu), data storage (storage), memory (ram), bandwith, and configuration other we rented [2].

Infrastructure as a service (IaaS) It is kind of service cloud computing that emphasizes to service infrastructure provision computer network (computer network), hardware network, computer servers , storage media (storage), detector processor , police chief comr with a virtual, that support the process of computing [3].

The other definitions Infrastructure as a service (IaaS) It is service infrastructure computing a cloud generally took the form of one package device hardware a computer (storage, memory, network, processor, etc.) of "virtualization" or computer server, along with the internet network bandwitch , with support the ip address, in disallow module loading (continuous use internet connection).

2.4.2 Platform as a Service (PaaS)

Platform as a Service (PaaS) is user can develop applications using application framework or application engine that provided by provider. Users freely can be in control applications , but could not control the operating system , hardware , or network [1].

Platform as a Service (PaaS) is is the type of services to cloud computing that emphasizes to the provision of a platform for help the process of development software quickly and easy [3].

Platform as a Service (PaaS) is service based cloud who accessed through internet .Paas give solution to all the needs, starting from infrastructure to device development [5].

The other definitions Platform as a Service (PaaS) Is the type a service that provides a platform (framework application , discuss programming and others) provided by via internet providers , starting from infrastructure to device development quickly and easy. Advantage of paas is that company that uses this service do not need to worry for installation, care, and security on server because providers paas will handle it all.

2.4.3 Software as a service (SaaS)

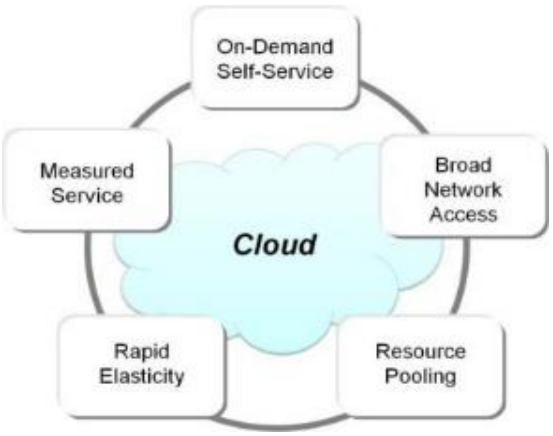
Software as a service (Saas) is users can use application but unable to make application, cannot control operating system, hardware, and network .Accessible via application web-browser or web based interface .An example is saas is googledoc and salesforce [1].

Software as a service (Saas) it is service of cloud computing where we live wearing software provided.

The other definitions Software as a service (Saas) it is set up a software of application or web based, ready to face can be used by consumers or owner the system , accessed through via internet and running in infrastructure cloud.

2.5 Characteristics Cloud Computing

As a technology and services on the computer, as a computer network itself, cloud computing also has special characteristics.There are five particular characteristic that could be owned by cloud computing. The fifth characteristic include On-Demand Selft-Service, Broad Network Access, Resource Pooling, Rapid Elasticity, Measured Service.



Gambar 1 Characteristics Cloud Computing

2.5.1 On Demand Self Service

On-Demand Selft-Service adalah Is characteristic cloud computing where service users cloud can independently provide all need and capabilities related to computation in cloud computing. Between of the availability of network storage (media a digital storage on a computer network), server time the time with computer server, and others with minimize interaction with health providers (service providers / server). This service can be used by the user in accordance with his need (on demand) [3].

On-Demand Selft-Service Were users can access cloud computing services in accordance with the need , without to be served by by other parties (the internet providers: technicians cloud computing) [1].

2.5.2 Broad Network Access

Broad Network Access is a characteristic of Cloud Computing where Cloud services require adequate computer network access, whether on the Internet, intranet, or combination of both, on a large scale, the capabilities available on a computer network and access to network, it will simplify the provision of services to users of various platforms and media access (like from desktop computers, laptops, mobile or smartphones, etc.) [3]

Broad Network Access is Cloud Computing available over the network and accessible by clients (mobile divice, thick or thun client) with generally accepted methods [1].

2.5.3 Resource Pooling

Resource pooling is the characteristics on cloud computing in which resources (resource) computing can be empowered together to the location of physical different do not focused on one location physical it.One of the keys main on technology cloud computing is andanya virtualization. With the virtualization this, supported also on the various server that is in many places, made cloud computing can serve the user with more optimal based on third types of services available. Computing resources from the healthcare providers cloud computing could provide and used together, although users and the location of a source of services are to a different location [3].

Resource pooling is cloud computing providers may serve users via multi-tenant model. Various resources, as: storage , cpu , memory , the bandwidth , and virtual machine that is in several locations and can be used by many client on same time [1].

2.5.4 Rapid Elasticity

Rapid elasticity is the characteristics on cloud computing where an its elasticity fast on the services cloud according to the needs of users who is on the demand side (suitable to your needs as user service). Based on the services cloud computing there are the the number of service that could be up and down in accordance with services dberikan to a user and in the rapid. This will ease in serve the needs of users to service of cloud to the three types of services provided, namely is SaaS, PaaS and IaaS [3].

Rapid elasticity is resources provided by the computing cloud can be increased or diminished (scale up and down) quickly .Users can be rented the computing power as much as is needed [1].

2.5.5 Measured Service

Measured Service Services provided is measurable. Providers cloud computing can control and monitor cloud service, suppose for the purpose of billing, access control, resource optimization, capacity and planning [1].

2.6 Systems Analysis

Systems analysis is decomposition of a information system whole into parts its components with a view to identify and evaluate problems, obstacles that happened and needs of the expected so that it can be proposed improvement is a stage in analysis a system. The stage that described in the systems analysis as follows :

2.6.1 Problem Analysis

Analysis of a problem is an identification of the problems will be elaborate on a procedure. From the research result conducted by then obtained the root of the problem consisting of :

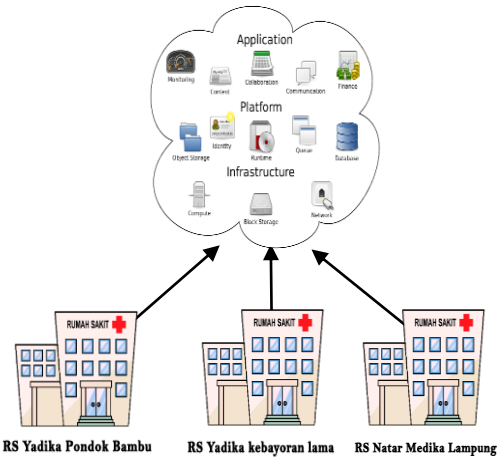
2.6.2 Analysis of Current System

Analysis of Current System defined as a way to study, evaluate and understand first the problems faced by the system. While the current system interpreted as one way to understand the case with the system being worn currently, as define - functional needs needs to the system it can be determined what for being yet in fill by the current system.

2.6.3 Analysis of cloud computing system architecture

Cloud computing has both front end and the back end cloud computing architecture. Two connected through a network (the internet) with its own cloud.front end includes a computer (or computer network) user, web browser needed to accessing services *Software as a Service* of information on the application of the hospital used

in three hospitals. While, back end is situated on the cloud server which is aimed at as data *(storage)* that created service cloud computing on the hospital is service *Infrastructure as a Service (IaaS).*



Gambar 2 Analisis Arsitektur Cloud Computing SIRS

2.6.3.1 Analysis Software as a Service (SaaS)

Analysis on the application of service Software as a Service is a cloud computing information system hospitals the databases kept in cloud and based on to needs , where cloud computing information system the hospital have ter-install and walks in the cloud .In this research , services Software as a Service That is given only and worn by three houses milky way

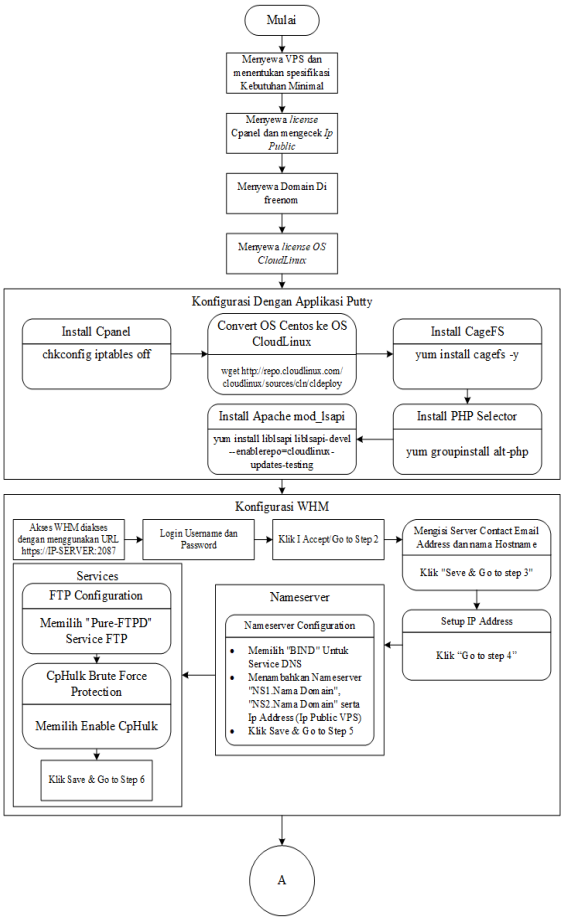
2.6.3.2 Analysis Platform as a Service(PaaS)

On the application of the analysis *Platform as a Service* Based on layer a platform used on the services *Software as a Service* Provided in cloud computing information system hospital

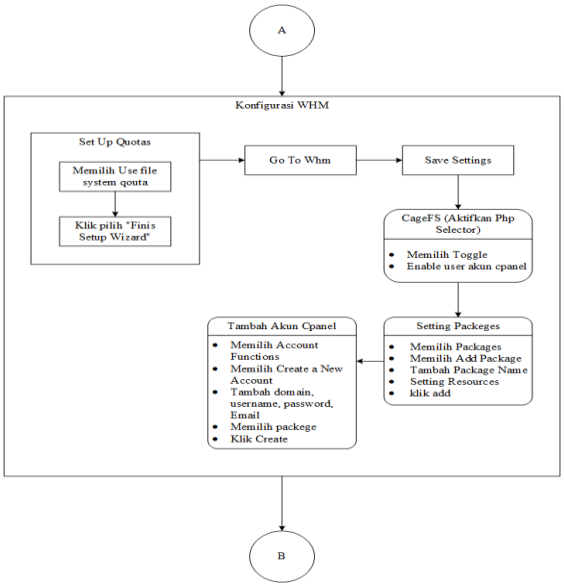
2.6.3.3 Analysis Infrastructure as a Service (IaaS)

The analysis of implementation cloud computing Infrastructure as a Service On information systems of hospital, is to provide infrastructure of IT (unit computing, storage, memory, network, and others). In other words, Infrastructure as a Service Such like hire a empty computer and we will configure the computers for use in according to their needs

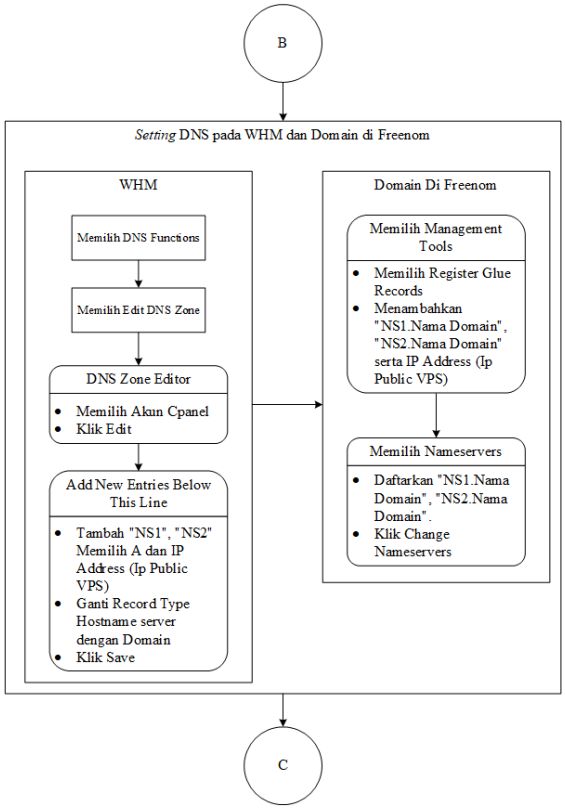
2.6.4 Analysis of a Technology Cloud Computing Flow Design



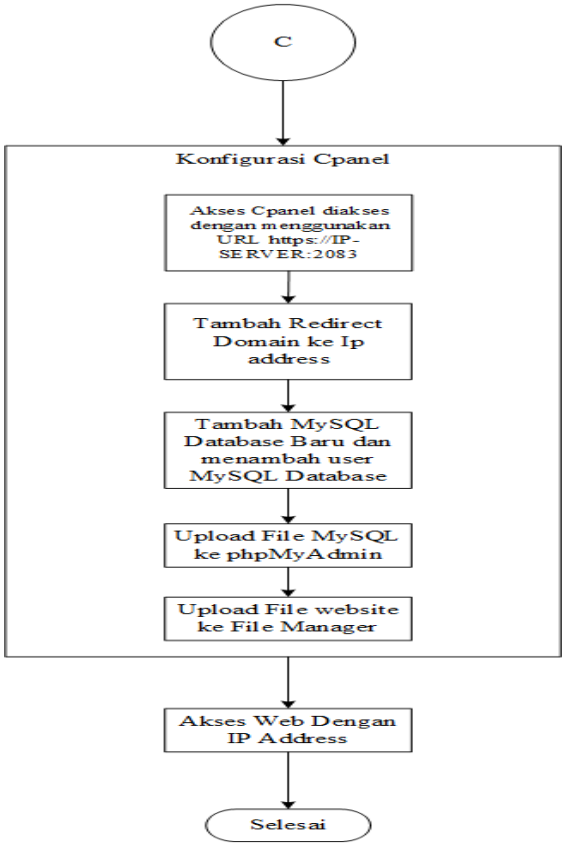
Gambar 3 Analysis a flow development Cloud Computing



Gambar 4 Analysis a flow development Cloud Computing *(A)*



Gambar 5 Analysis a flow development cloud computing (B)



Gambar 6 Analysis a flow development Cloud Computing (C)

Analysis a technology cloud computing flow design in the picture is the top is steps for the implementation on the services *Infrastructure as a Service (IaaS), Platform as a Service (PaaS)* dan *Software as a Service* (SaaS) which is ready by three hospital with one information systems hospital. The following is the elaboration briefly about the design and the cloud computing technology.

A. Hire Virtual Private Server

Hire virtual private servers and to determine channel minimum needs to provide service Software as a Service and Data storage centrally in cloud serve. So that, Abdi Karya foundation need not bothered with the provision of a computer server, storage and maintenace. As well as an operating system that is used is centos 6.5-x86 _ 64bit where to provide a service Platform as a Service.

B. Hire a license Cpanel and check on *IP Public*

Hire a license cpanel as the needs of hosting web that can be used for purposes of the back end the panel control and to check ip public given by using vps in facilities Platform as a Service.

C. Hire a A domain in Freenom

The domain will be used to manage webhosting .And so that the system can run we need to uploaded on the web hosting and to ease to perform as work in organizing a website such as making the domain new , make subdomain , email and other.

D. Hire a license *CloudLinux*

An operating system that is used is cloudlinux where as providing cloud computing service *Platform as a Service (PaaS)*. Vps used have been having an operating system but need to change to cloudlinux because necessary fiture cagefs to turn php selector. Php selector to change version php 5.6 down.

E. Configuration with *Putty Applicaton*

At this stage is where need internet connection a stable to do installation Cpanel, Convert OS Centos ke OS CloudLinux, installation CageFS, installation PHP Selector and installation Apache mod_lsapi. If it failed to install or internet disconnected in one stage configuration with applikasi putty will menggulai more from in the early stages by means of installation it again operating system in Virtual Private Server (VPS) and Do stage install cpanel come back until dengnan install apache mod _ lsapi.

F. Konfigurasi WHM

Do configuration whm special is dedicated to a division it yadika center with access URL https://IP-SERVER:2087. Which will give server contact email address and name hostname (standard for naming server using) name , and other - other.

G. Configuration Cpanel

Configuration cpanel is control panel web hosting in whm by using an operating system cloudlinux give the appearance of graphics and equipment automation made to ease the process of hosting.

2.7 Analysis of Non Functional Needs

Analysis of non functional needs is analysis that doing to produce specification system needs. This also includes specification components anything that is needed to a system which will be built up to the system implemented.

Analysis of non functional needs covering analysis encoding number patients, analysis needs hardware, analysis needs software, analysis needs using user.

As for analysis cloud virtual private server to be used information system hospital kebutuhkan hardware as server with vps is as the following:

Table 1 Specification hardware as server server Virtual Private Server (VPS)

Hardware	Specification
Virtual CPU Core	Minimum 1 Core
Virtual Harddisk	Minimum 30 GB
Virtual RAM (Memori)	Minimum 1 GB

As for the needs of software to be the server with vps is as follows :

Table 2 Specification hardware as server Virtual Private Server (VPS)

Hardware	Specification
Operating System	Cloud Linux
Bandwidth	*Unmetered*
Ip Address	Ip Public 1
Control Panel	Cpanel, WHM

As for needs hardware as client in hospitals are as follows :

Table 3 Hardware specifications as client in the hospital

Hardware	Specifications
Prosesor	Intel pentium 4 1,3 GHz to 3,8 GHz
Monitor	Tabung dan LCD 15 to 16 inch
RAM (Memori)	256 MB-2 GB DDR 1 dan 2
VGA	On Board
Harddisk	40-250 GB
Network Card, Hub/Switch, Router, Modem	As internet access
The supporters	Keyboard, Mouse, Printer dan Wi-fi

As for needs software to be client in hospitals are as follows :

Table 4 Specifications software on in the hospital as a client

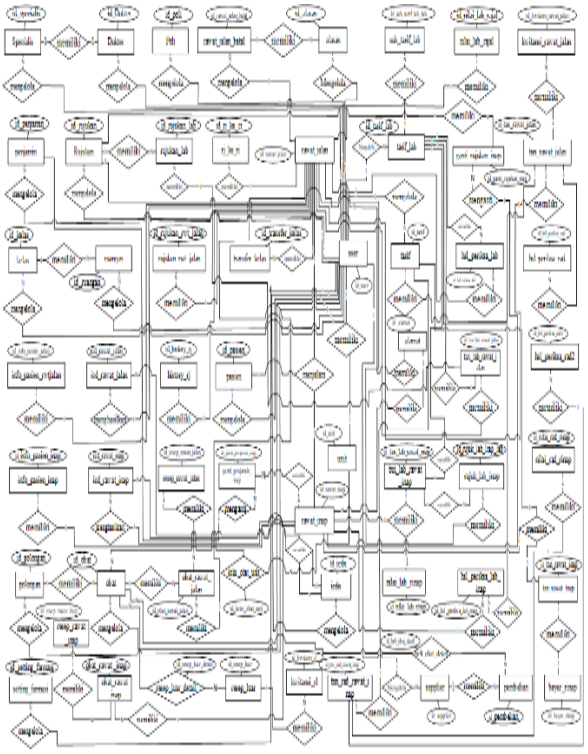
software	Specifications
Sistem Operasi	Windows XP, Windows 7
Browser	Mozilla Firefox, Google Chrome

2.8 Analysis of Functional Needs

Analysis of functional needs can defined as depiction of planning and making sketch or setting of several elements that separate into joined together and serves. The tools used to describe a system in general will be built covering Entity Relationship Diagram (ERD), Diagram The Context dan Data Flow Diagram (DFD) .

2.8.1 Analysis Database (Database)

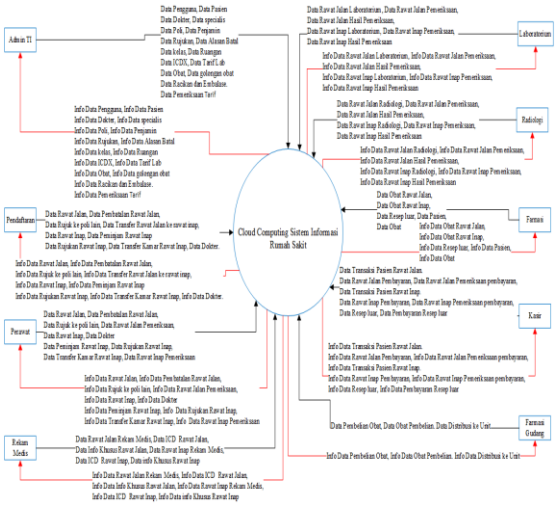
Among the main components of the formation of entity relationship diagram or commonly called Diagram E-R that is Entity (entitas) and Relation (relasi) That is a component - components entity and the set the set of relation which is described in terms of further through a number of attributes that describes the system.



Gambar 7 Entity Relationship Diagram (ERD)

2.8.2 Diagram Context

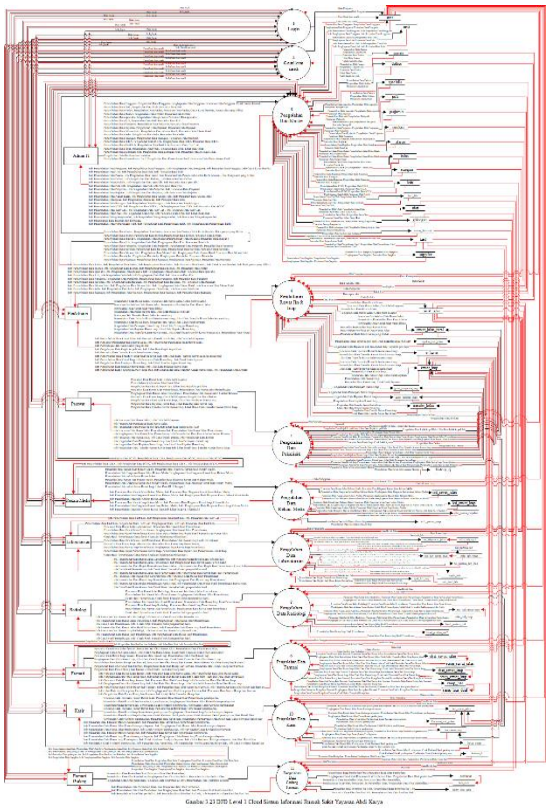
Diagram the context is a model that explained on how the data was used and transformed to the process or who described the data stream in and out of the system in global range.



Gambar 8 Diagram Context Cloud hospital system Information

2.8.3 Data Flow Diagram DFD

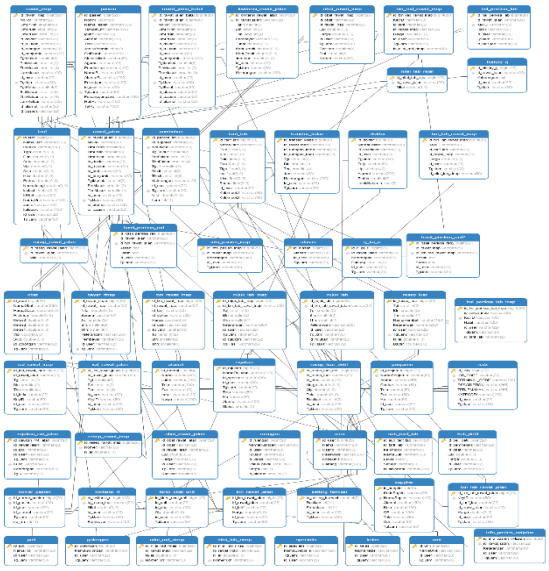
Data Flow Diagram (DFD) Is a technique describing of flow of data and transformation used as data flow of input to output. DFD made if on diagram the context of there are still process that should be explained more detailed



Gambar 9 Cloud hospital system Information

2.8.4 Relation Scheme

Relation scheme is a series of connection between two table or more on system database. And combines falsehood attributes have the key. So each attributes was connected by fileld the key. The following is a scheme relation to cloud computing information systems of hospitals are as follow:



Gambar 10 Relation scheme Cloud Computing hospital

2.9 The Implementation and testing

Phase implementation and testing is the stage to apply design based on the results of analysis have been done on the system so that the application of software that built in environment that actually and ready to be operated.

2.10 The Implementation of a Groove Design *Cloud Computing*

After conducted analysis on designing cloud computing then afterward will be conducted the implementation of stage out of analysis of beginning in early until all.

Implementation phase that will be conducted have a goals to solve the design and analysis that has been completed before.

3. CLOSING

3.1 Conclusions Research

Which a conclusion can be taken after through hence the implementation of development until by testing the system and services cloud computing to three hospitals, so that with the application is obtained conclusion as follows:

1. Build an information system of hospital for the Abdi Karya foundation be optimal when the, processing, presentation of data in three hospital. Using cloud computing on the services Infrastruktur as a Service As a medium data storage, services Platform as a Service Based on layer platform used on the services Software as a Service to ease the health employees in managing and stored data and the patient information medical record.
2. Implement the development concept of cloud computing information system of hospital that already intergrated to medical records for being same, to simplify patients with only use one card that patients has to get medical treatment in three Yadika Hospital.
3. Making the reports on the in the hospital RL1 to RL 5 that on the three hospital are much more easily, quickly and correctly.

3.2 Suggestions

Advice to the development of this software , by giving some point among others is as follows.

1. A system that has been built expected need to develop feature of the finance division and accounting where necessary as financial management at any hospitals to support the work of the information systems of hospital currently.
2. A system that has been built this better be developed on display interface which is relatively simple, so it is more would ease users in use this application.
3. Needs to be done making reserve data by means of copying medical records data of patients or application regularly both in the monthly and a year to avoid a loss of data due to damage to the system in Cloud Computing.

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