THE IMPLEMENTATION OF CLOUD COMPUTING AT ANGKASA

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ABSTRACT

You have big ideas to streamline your business, drives sales to the roof. You also need to have a business application. Business application always too expensive especially these day. You need datacenter, office space, power, cooling, bandwidth, network, servers and storage. A complicated software and team of expert to configure them. You need development, testing and staging. When there have a problem, you contact technical support and if they don't know how to solve it, they will blame someone else. For software, when new version come out, you would like to upgrade it or your system will crash down. One solution not to headache is cloud computing. Cloud computing is one solution better way to run your business instead of running yourselves. Cloud computing is the next stage in the Internet's evolution. It's provides everything from computer power to computing infrastructures, applications, business process to personal collaboration and can be delivered to user as a service wherever and whenever needed. In general, cloud computing can be defined as the set of hardware, network, storage, services and interface that combine to deliver aspects of computing as a service that include the delivery of software, infrastructure and storage over the Internet. Nowadays companies are struggling to implement cloud computing to enhance their IT values in the industries. It became an explosive technology throughout the whole world as people are all talking and focusing in this area combining of the awareness of green computing.

*"Today, for the most part, IT must plug into cloud-based services individually, but cloud computing aggregators and integrators are already emerging."(Eric Knorr, 2011).*This report will highlight the issues, challenges and recommendation for ANGKASA which is an organization that plan to take a step forward to implement cloud computing in running their daily business and services. Several studies through journals and articles have been done to get the appropriate information on proposing the best practices on implementing the technology.

Keywords- Cloud Computing;Database;System;

1. Introduction

Cloud computing has been identified as one of the major IT trends for upcoming years. It will transform the information and communication technologies same as the first wave of the Internet. The implementation of cloud computing technology will

change the way how people work, how company operate and also allow the digital technology to penetrate all dimension of economy and society. The emergence of cloud computing encourage the ANGKASA to implement it in running their businesses. They have ANGKASA Payroll Deduction System (SPGA) which is a system where all the pieces of cooperatives and others are managed through a channel in order to facilitate the work of wage cuts in government departments. This system also facilitates co-operatives and other bodies for payments such as fees, shares, loans and others with more systematic and secure. For members of cooperatives, the system gives them pleasure to repay all that owed or that should be paid to the cooperative or other. This system is also designed to facilitate all parties in the business of their own, the Department in the preparation of salary each month, co-operatives in the business get loan repayments and fees, while members in the business of resolving payment to be made each month.

1.1 Organization background

Angkatan Koperasi Kebangsaan Malaysia Berhad or ANGKASA is the apex co-operative society that protects all types of basic, secondary and higher throughout the country. ANGKASA is recognized by the Government as a body representing the Malaysian Co-operative Movement in national and international level. ANGKASA governed cooperative manner, but not engaged in business activities like other cooperatives. As an apex cooperative ideals they fought and the rights of the importance of cooperative movement in this country. ANGKASA offers a lot of services that used an online system such as ANGKASA Payroll Deduction System (SPGA), Registration System and Digital Vote Count General Meeting, ANGKASA Computerized Accounting System (SPBA), Cooperative School Accounting System (SEKKOP) and other applications. But, the core service of this company is SPGA. This company has a lot of branches over Malaysia includes Sabah and Sarawak. As a company that run businesses, currently ANGKASA have about seven hundred of staff and a part of it, there are only fifteen of IT staff.

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1.3 Business Objective

The objectives of ANGKASA:

1.2.1 Consolidate the cooperatives in Malaysia in order to protect and champion the rights and interests of the cooperative movement.
1.2.2 Representing the cooperative movement at national and international level.
1.2.3 Implement the cooperative education program and the concepts and principles of cooperatives among Malaysians.
1.2.4 Provide a variety of affordable services that help ANGKASA for the operation and administration of cooperatives.

1.4 Business flow

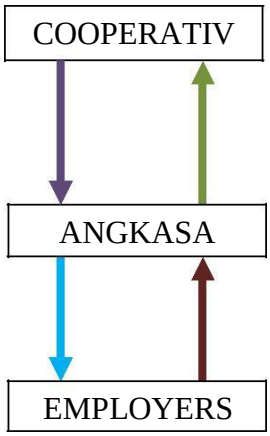


Figure 1: Business Flow of ANGKASA

Figure 1 shows the main business flow embrace by ANGKASA. Firstly, Cooperative will send data of customer that need to deduct the salary. Next, ANGKASA will send salary deduction of related customer to employers. Here, Employers send data and check the deduction from ANGKASA system. Then, ANGKASA transfer the money and send the slip deduction payment.

Currently, ANGKASA used local hosting network environment to run their system. The environment consists of one mainframe and many servers. The server used are Antivirus Server, web server for Bank Rakyat, web server for ANGKASA Payroll Deduction System (SPGA), many application server, share point server, staging server, antivirus server, exchange server and database server. ANGKASA also using modem NT, router, firewall, Citrix and core switch to connect each other. ANGKASA have rented DRC (Database Recovery Center) services at one another place a far from ANGKASA. DRC

will backup and save database of business activity of ANGKASA. Every two weeks, IT staff will manually do a backup data and send to DRC via using the network connection. Every end of month, major business transaction will process. The process already specified above. Meanwhile, in application part, they fully use SPGA that uses LINC as backdoor and Visual Dot Net to access the LINC. The application is fully modified and operate by IT staff. The fully existing network can be seen in Figure 2.

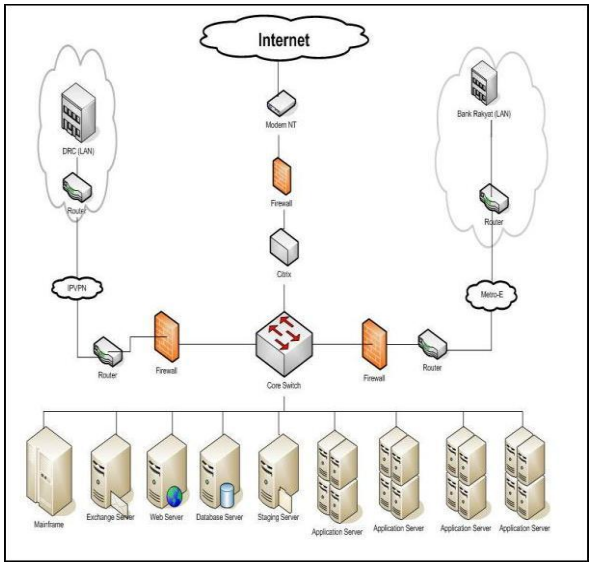


Figure 2: Traditional Local Hosting Network

2.0 Problem statement

2.1 Operational Cost

Cost is the major or main values in all companies include the public and private sector. ANGKASA is one of the companies which are currently struggling with this factor. The aspect which has been included are maintaining of hardware, software and network. Every five years, ANGKASA will need to change the out-of-warranty of mainframe, server and upgrade the software. The cost that they need to cover was about RM 10 million. Furthermore, the cost will be increased from time to time suitable to the requirements that need to be implemented. At the same time, they also need to pay the maintenance cost yearly such as Citrix. They have to pay about RM x 70,000.00 per year and others.

2.2 Lack of expertise

ANGKASA also lack of expertise of the IT staff. Currently, they only have about fifteen IT staff. The staff has been divided into several departments which are network, software and hardware division. Most of them are not specialized in the hardware maintenance. This company fully depends on vendor to do the maintaining of hardware and this also has increase the waste of human resource.

2.3 Security

ANGKASA also counter problem of malware infection and vulnerability exploits of server and also spam, malicious email attachments or download of unsafe internet contents for desktop. Besides, it's hard to manage the glut of security products because higher hardware spend can limit security budget.

3.0 Literature Review

3.1 Cloud Computing

Cloud computing is one of the most powerful trends in modern IT. It is a way of provisioning IT resources that increase business agility and flexibility. A simple cloud computing definition is the use of Internet to access software and infrastructure resources rather than hosting them on site [1]. It is also as a paradigm that focuses on sharing data and computations over a scalable network of nodes such as end

user computers, data centre and web services.

"Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction."(Hannah Wald, 2010)

Some of the company like Google, Amazon and Microsoft have already ventured into cloud computing. In cloud computing system there's a significant workload shift where local computer have no longer to do all the heavy lifting when it comes to run application. The network of computer that makes up the cloud handle them in which make hardware and software demands on the user's side decrease. The only things that the user's need to run is the cloud computing system interface software which can be as simple as a web browser. For example, an e-mail account with a web-based e-mail service like Hotmail, Yahoo! Mail or Gmail. Instead of running an e-mail program on a computer, the users have to log in to a web e-mail account remotely. Here, the software and storage for the account doesn't exist in the user's computer but it's on the service's computer cloud. Most importantly, cloud computing is delivered on demand without the capital expense and the long cycles of hardware or software procurement and management.

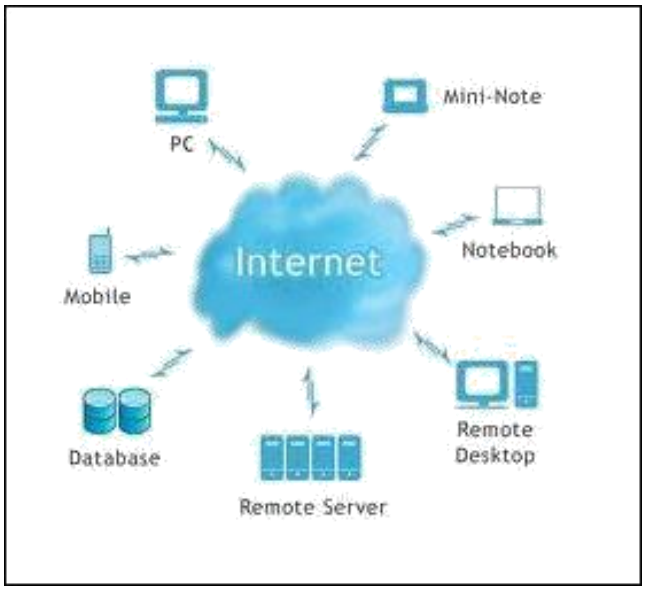


Figure 3: Cloud Computing

3.2 Cloud Computing Architecture

Cloud computing architecture can be divided into two sections which are front end and back end that connect each other via network usually the Internet. The front end is the side of computer user or client and the back end is the cloud section of the computer. On the back end of the system can be various computers, servers and data storage systems that create the cloud of computing services. In theory, a cloud computing system could include any computer such as from data processing to video games. Usually, each application will have its own dedicated server.

The function of central server is to administer the system, monitoring traffic and client demands to ensure that everything runs smoothly. It will follow a set of rules called protocols and uses specials software known as middleware. Middleware allows networked computers to communicate with each other. Most of the time, servers don't run at full capacity, means there's unused processing power going to waste. It's possible to fool a physical server into thinking it's actually multiple servers, each running with its own independent operating system. This kind of technique is called server virtualization. By maximizing the output of individual servers, server virtualization reduces the need for more physical machines.

If a cloud computing company has a lot of clients, there's likely to be a high demand for a lot of storage space. Some companies require hundreds of digital storage devices but cloud computing systems need at least twice the number of storage devices it requires to keep all its clients' information stored. This is because these devices, like all computers, occasionally break down. A cloud computing system must make a copy of all its clients' information and store it on other devices. The copies enable the central server to access backup machines to retrieve data that otherwise would be unreachable.

3.3 Category of Cloud Computing

There are 3 categories of cloud computing which are Software as a Service (SaaS), Infrastructure as a Service (IaaS) and Platform as a Service (PaaS). In SaaS, software and all its associated data are hosted centrally in the Internet and normally accessed by users using a web browser. The software can be downloaded to a customer device, where it can be used. Usually the software will expires after the contract between customer and provider ends. Meanwhile in Iaas, infrastructural resources are available on rental basis. Example infrastructural resources such as computer infrastructure (server), data storage, rack space, power and cooling. In others, the application is also rented as a service and that means the application offered is totally free. For example, 1TB of resources is charged for $500 per month. However, rather than paying a flat monthly fee for the service, IaaS is charge to the customer based on the resources used only. In PaaS, it facilitates the platform that usually comprises of hardware architecture, an operating system, required runtime libraries and programming language platforms. PaaS allow application can be written and deployed, without having to worry about the structure of hardware. PaaS is often used by software developers providing multiple user

concurrency and team based development. Access is provided by an Internet browser over the internet. Figure 4, will show the components and connections of these three categories.

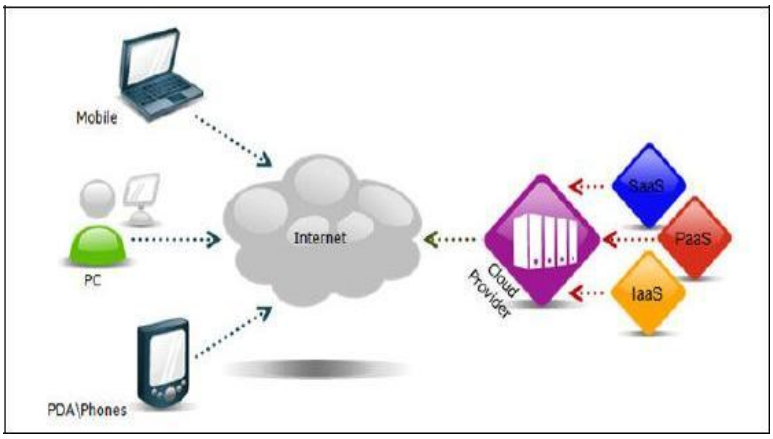
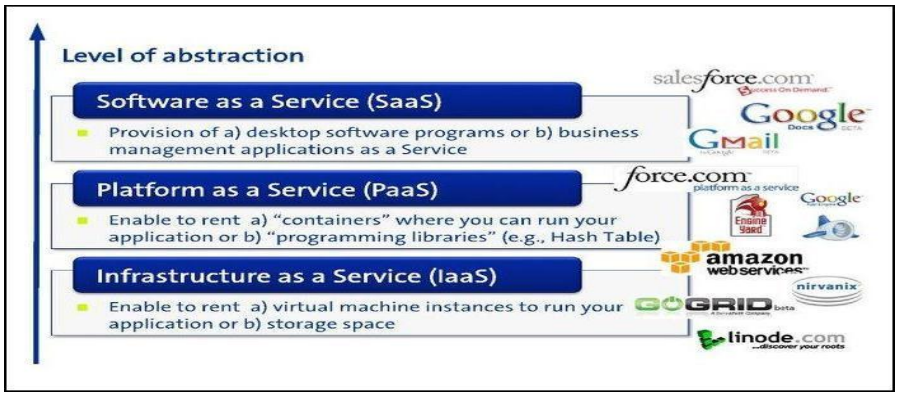


Figure 4: Typical cloud components and connections

Figure below illustrates the category of cloud computing.



3.4 Cloud Delivery Model

There are three different deployment models for cloud computing which are private, public and hybrid. Hybrid model is the combination of private and public model. Whichever approach and IT organization takes, cloud computing is designed to heighten responsiveness with outstanding efficiency. In addition, cloud computing enables exceptional flexibility to provide the computing power and capacity business users need to dynamically support products and services.

Cloud models also give IT departments the opportunity to implement alternative deployment strategies that help optimize costs to align with business goals. For example, a hosted software service can be paid for by the transaction with no capital investment required, or a disaster recovery site can be maintained by a service provider.

Different types of cloud model are appropriate for different usage scenario of

business. Each has its own advantages, drawbacks and potential use cases.

3.4.1 Private cloud computing

Private cloud computing platform is designed for single organization. This platform can be operated and hosted by IT department or an external provider. Although they enable greater control over security and data availability than public and hybrid cloud, private cloud may require IT organizations to make significant up-front capital investment. In addition, the physical infrastructure does not offer limitless scalability. Driven by cost, many federal agencies are moving some functions to private clouds run by external providers. Moving to cloud computing platform promises to be more cost-effective than maintaining data canters dedicated to each agency's exclusive use. At the same time, maintaining these services on private clouds within the shared data canters helps protect sensitive data.

Selected software vendors are also using private clouds to accelerate service deployment while maintaining strict control of their data. Delivering services rapidly can create a significant competitive advantage. Besides, private clouds are designed to make computing resources available to these services on demand without IT administrator intervention, they also streamline IT effort while keeping sensitive data within the confines of their own dedicated hardware.

3.4.2 Public cloud computing

Public cloud computing platforms are based on shared infrastructure that is not dedicated to a single organization or user. They require no up-front capital investment or associated risk and enable agile which is highly efficient use of computing resources. However, the shared of resources require security and regulatory concern. Besides, organization must trust their cloud provider implicitly because they work through the provider to resolve any problem.

A public cloud-based IT infrastructure can be installed almost overnight without capital investments. This approach is valuable to business start-ups that need to be launched with minimal ramp-up time. It also allows organizations to focus on core competencies without the risk of building their own data centre. Travel industry is the example of the organization that used public cloud.

3.4.3 Hybrid cloud computing

Hybrid cloud computing platforms allow for data and application portability between private and public platforms. In this model, an application that require additional processing capacity and unable to find it on the private cloud platform could access the public cloud platform for resources.

In general, hybrid cloud model provide the advantages from both private and public cloud platform. Hybrid cloud approach is popular among institution of higher education. It is because universities almost face with a sudden burst of activity at the start of each term that demands enormous server capacity but in the months between enrolments, that capacity may not be needed. The ability to use a public cloud means the university can meet its seasonal needs without investing in IT hardware infrastructure that it does not need to use year-around.

3.5 Benefit of Cloud Computing

Traditional customer infrastructures have been implemented locally or internally centralised resource. The purchase for resources such as server, storage, networking components is underutilized and may have been over specified in resources requirement to meet the business activities.

By using of cloud computing, firstly no upfront hardware need to be purchased as only pay for what resource you require. These allow companies an easy and potentially more cost efficient point in to scalable computing platforms and applications whilst lowering management overhead. Many people rely on this application, secondly clients can access their applications or data from anywhere and at any time needed as long as the computer linked to the Internet. Thirdly, it increased storage where it allows organizations to store more data than on a private network. Next, cloud computing is highly automated means that IT personnel no need to worry about keeping software up to date and the last advantage is it flexibility where cloud computing offers much more flexibility than past computing method.

3.6 Cloud Negatives

Some negatives effect does exist with cloud computing. Companies are used to control the access to their data themselves often with data centralised where the customer can get direct physical access. With data being stored in cloud, customers have to be aware that they themselves cannot guarantee who does or does not have access to their data. This is under control of the provider. The bad is a cloud customer places their privacy as well as data in the hands of the provider.

4.0 Methodology

Implementation of cloud computing is not trouble-free and a lot of factors and information need to be looked into. All information needs to be analyzed and be narrow down to specific view. This paper mainly focusing on the implementation of the cloud computing into the company which has not realize and implement the basic of cloud computing ideas such as public sector. Currently private sector are battling and struggling to implement this technology as they appreciate it and have the knowledge of the benefit to the company. Gathering information from this company using the interview method provide us a lot of better understanding and from the data we able to provide a problem statement that suit on the topic. As review by McNamara interviews are mostly useful for obtaining the story behind a participant's experiences. The interviewer can be tracked in detail the information regarding the topic. Interviews may be useful as record to confident respondents to questionnaires. Online resource such as the Internet is one of important method that is used to attain more information about the implementation of cloud computing. This kind of method is fast and borderless due to countless numbers of sources. However it provides us challenge where bunch of information need to be narrow and it might lead us to get confuses on what is the exact and relevant knowledge need to be included. This method will not affect the main idea as we are always referring to the problem statement that has been provided.

5.0 Recommendation

Based on the information gather, ANGKASA are highly suggested to apply the cloud computing as it benefit to the company by reducing cost. Implementing cloud computing will reduce cost of maintaining the physical mainframe and servers itself

also the space used by it. Using virtual machine as an example will decrease the maintenance factor and it is easy to be sustained. If we can see from traditional network diagram, we can see many servers. So in private cloud infrastructure, the servers can be resizing. In existing environment, not all servers are fully utilized. So when we use private cloud infrastructure, they can share the servers and fully utilized it. The resources can simply move from one server to others server based on the utilizing. All the servers will maintain by professional technical person. The company also might put under consideration on evaluating and implementing cloud computing by outsourcing another company to hold the IT department. This represent another IT company can be the focal point for them to retain the cloud computing as the technology never being implemented in the company. Once the technology comes to stabilize period they might build their IT department that holds the knowledge and master on it. This to ensure all data integrity and security is not abuse. Cloud computing need to be implement phase by phase to guarantee this is not a failure. Company can start with the public cloud which hold and contribute by part. Once it successfully implemented they may take the private cloud into their consideration. There are two things that set a private cloud apart from the commercially used public cloud; where the hardware is kept and how it is maintained. In a public cloud data is stored with a third party, in their data center with other organization's data as well. In this phase organizations that choose private are utilizing the cloud and the benefits to being virtual but also have the comfort and security of storing and handling their own data. The ultimate objective of the private cloud is to allow a company to manage their own technology infrastructure.

The benefits of a private cloud are undeniable; you have direct control over all aspects of the cloud's implementation including the hardware, the networking, the operating system, the way security is implemented and even the APIs used. The cost, ease of operation and management automation, and easy scalability are all considered advantages to private cloud as well. Locality and security also set private clouds apart from the traditional public cloud. You are hosting your own cloud infrastructure on a private LAN with no connections externally, so other people cannot access your data. You still physically have possession over your own data which is comforting to a lot of organizations with highly sensitive information.

Based on Figure 5 below, this is one of example that can be implemented private cloud to ANGKASA. The figure shows the red cloud is in private cloud infrastructure. From the diagram, we can see similar setup as traditional network infrastructure, we have internet to access in our data center, we still have NT modem, firewall and core switch. The server from current traditional network of twenty servers consolidated them down to ten servers or less than that utilized the private cloud technologies. If we need to add additional resources, we can add more servers and we only simply add at our private cloud and expand the private cloud. We also can move our resources around from one server to other server. If the first server using a lot of resources and others underutilized, with private technology, we just simply move around the server because it's flexible. Meanwhile, we still have locally traditional environment. We need to add the firewall to access our local network. We still have our high level of security access to our database and data segregation. In private cloud, we can also put our database there. The technologies offered high security technologies and they have policy that organization can look down. This is one other method that ANGKASA can consider it.

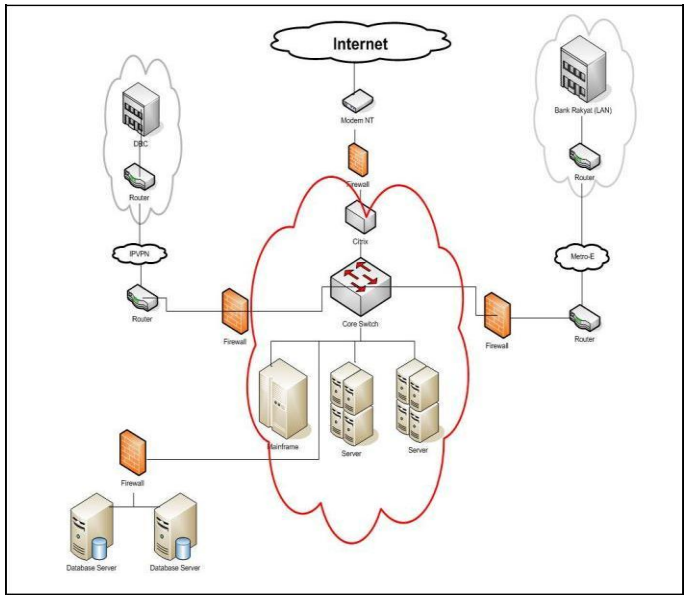


Figure 5: Propose layout of private cloud to ANGKASA

So as a recommendation there are many steps to implementing an effective private cloud. Below is a short list of 11 key steps to deployment:

Step 1: Begin by assessing the existing infrastructure and current requirements

The key to a successful private cloud implementation is to utilize as much of the existing infrastructure as possible. If the existing internet connections, data centers, firewalls etc. can be utilized then the project costs and lead times can be significantly reduced.

Step 2: Find the best IT partner

In order to be successful, practice some due diligence and find an IT partner with the expertise to design and implement a private cloud. That includes the infrastructure and IT management software for shared infrastructure, shared platforms and shared software.

Step 3: Test different virtual platforms

Once company have select IT partner the next stage is to test the platform that best fits your business requirements and budget. For example many larger organizations choose VMW are for its scalability and resilience, whilst smaller businesses choose Hyper V due to its lesser cost and ease of the company.

Step 4: Choose a hardware platform

A key element, and there are many variables, Nas or SAN, Fibre Channel, SAS or SATA drives, again each one has its own strengths and weaknesses in different environments.

Step 5: Standardized and documented procedures

It is important to have standardized and documented procedures clearly outlined for operating, deploying and maintaining the cloud. Everyone will need to follow the same guidelines to ensure proper execution and smooth operation.

Step 6: Determine scale

Take note of all the systems was plan on moving over to the company private cloud. Do not want to overestimate and pay for something that will go unused or underestimate and not have enough room in company datacenter for all your data.

Step 7: Plan the project and migration

Agree on timeframes, procedures and contingency. Check with existing software vendors that their applications are compatible with company chosen virtual platform.

Step 8: Supportability and compatibility check

Verify every operating system and application that your organization will be running in the cloud is supported by the environment. This means doing a system compatibility check. Ensure that the systems currently use will work in the cloud environment. It is important that to verify all of the systems are compatible, not only on paper and theoretically, but also on a Proof of Concept (POC) system and a lab. This way is able to identify any problems and find the solutions to those problems.

Step 9: Run in parallel

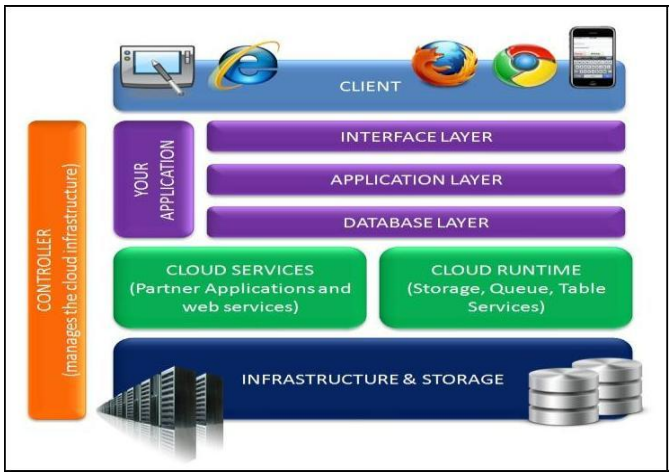
A great advantage of moving to a private cloud is that can run in parallel during the migration and after the migration. If an issue is experienced its can instantly access the old physical environment.

Step 10: Ensure that platform is resilient

There are many advantages to a centralized private cloud however as all of your eggs are in one basket it is even more important to make sure that you have hardware and software resilience in place and that you have a solid backup and recovery strategy in place.

Step 11: Update Company Disaster Recovery plan

To reflect that change in company environment it is essential to update company disaster recovery plan and perform a disaster recovery test to ensure that company recovery time objectives and recovery point objectives are met. This may require a long period but if this can also successfully run into the operation company can moving forward into hybrid. The major and main concentration on this company is more refer to the infrastructure itself. Therefore, they have to implement and explore the Infrastructure as a Service (IaaS) which is make available an infrastructure together with (virtual) platforms, networking, *etc.* on which applications can be employed. Recently enterprises are struggling on this phase and as the other two categories need to be planned and review in a different way that can be view in Figure 6 below.



In a way of security issue company need to build a trust in cloud computing. This technology has proof on the security matter. There will always high expectation on security and privacy that has become an argument on cloud computing. However need to be included that the developers are searching for the solution on security matter. This is very subjective as the growth of technology is too fast and all major issue always being discussed and studied and the reliability always been questioned. The solution must be plan once the best solution has been chose. All advantages and disadvantages need to be list out and all major challenges need to be analyzed. It would be best if the company can come out with a proper model for their own business. However this need to be consult by the expertise or model might not fit the company and result of plan failure. Based on the best-fit solution company have to develop implementation work plan and consistent support required for structure maintenance and sustainable program.

5.1 Challenges

New infrastructure implementation consist a lot of challenges. Information assurance and operational security is one of the biggest measures. This is important as this company is dealing a lot with financial sector. Loss of information may cause a serious effect to the company itself. They also need to refer back to their security policy and procedures that have been agreed with the related agencies handle by their company.

As ANGKASA is the intermediate between bank and government sector, they are bounded by the privacy requirement provides by government. This requires them to control of the privacy of individual data they hold in their basket. Privacy and confidentiality important as nowadays people can make money by stealing the privacy and confidential data.

Looking into the technical aspect company should provide a backup team under this subject. Trained and high knowledgeable supports are really critical on the implementation phase. Lots of companies take this topic as minor aspect and during the implementation they already failed to implement the technology as there is no one can support on technical part. Under this technical support they need to be master in technical skill such as bandwidth issue, malicious attacks and also need to do the network monitoring. Therefore, for the beginning ANGKASA should hire a vendor to support on this matter. In the meanwhile, company should provide relevant training to their own staff to hold the technical issue by themselves. New implementation is a new requirement with a new technology. Therefore,

implementation phase required high installation cost at once. This may also a one of the challenge for ANGKASA. Nevertheless, need to be highlighted this is only once and the company may save cost throughout the year once implementation has been completed.

5.2 Benefit to ANGKASA

Cloud computing has provide a lot of benefit to all company who has implemented it. First and foremost benefit on reducing cost. Implementing this technology can reduce cost as it provides resource elasticity. Company may provide the specific requirement without any wastage. In other term, it will reduce capital expenditures and operational overhead. This will make available of better business flexibility all the way through an on-demand, pay-as-you-go model that scales with the business.

Technology also allows company to have an option on choosing provider. They may consider having in-house provider or third party. However, ANGKASA need to have a certified IT employee who will be managed and maintaining the technology if they are choosing in-house provider.

Cloud computing allow multifactor authentication such as combining password, biometric and also hard device and this will provide a secure environment rather than using only password for authentication. Physical security also can be attained as nowadays most of vendors have stronger physical control with meaningful certification. Majority of business needs requires the certification for verification on how the system can be secured. In a real life we also unable to measure the exact level of security as this issue become subjective and it will always change from time to time depend on how fast the technology growth. This also include how fast the intelligent guru in IT growth to cater and put the security the same level of the technology expansion moving forward to the future. As the example on the security matter we can looked into the banking system. Nowadays almost all banks apply the online banking and the pages are secured. The major issue now is how much people put their trust on the technology itself.

Benefit on cloud computing mostly may provide a better solution to ANGKASA even though there is still several issues that need an argument for a better implementation. Failure in implementing the technology may reflect the analysis done before fully utilize the cloud computing.

5.3 Future remark

Study on this paper may provide a basic and recommendation on how cloud computing may be implement into ANGKASA. However, there are a lot of analysis needs to be done. Therefore, it would be good if we can gather the exact analysis or data from the company to measure on the technology level that has been implement until present day.

Once all data has been analyzed we can propose a model sample on cloud computing implementation. All major and minor factor need to be evaluated and specific statistic can provide a better idea on applying the technology.

Budget is also need to be considered as this is the most important factor to guide the next step on the implementation planned. Lots of reading and research can provide more useful information. This paper is mostly appearing to focus on infrastructure category. By include the platform and software category of cloud computing it will

result a healthier technology. Investigating the implementation of cloud computing from other company may also be helpful. This will offer a real life situation and the successful of the technology can be measure. Other significant factor may be review such as trust on cloud computing, certification and accreditation, vulnerability assessment processes and so forth.

ANGKASA is currently having part of cloud computing such as CITRIX and DOTNET but they may not realize it. Nevertheless, these two applications have been separated and specify by the IT guru as a cloud computing solution application. Using these applications as an example it would be easier on transferring the knowledge to their focal IT. Therefore recommendation to the IT department on providing their staff on better understanding on the cloud computing can be one of the biggest step for the company to moving forward while analysis running through the company. It would be great if they can have in-house provider as they need the privacy and confidential on the resource data to avoid decrease of trust from their major business client which is the government.

5. Conclusion

The research and analysis done for cloud computing has proven that technology provide a lot of benefit to the company and the business flow. Implementation can be successfully applied by preparing a complete work plan with all relevant information about the company. Solution can be varies but the difficult part is to choose the best-fit solution on the business flow. Therefore, by applying and combining steps provide in this study company may have a better idea on implementing the cloud computing. ANGKASA may also take into their accountability on the level of security they want from the technology to avoid any harm to their current data. Information given by the company data accuracy, privacy and confidential is the most critical part they rely on as this is the main factor of government have a high trust on the company.

However, the technology is growing fast and the work plan need to be change based on future requirement. Cloud computing is the best solution on managing IT environment and it needed to not be ignored.The decision to implementing a Private Cloud solution or hybrid as opposed to using a strictly public cloud infrastructure depends on many variables. When it boils down to reality it's a question of costs vs security, followed by accessibility, control, expansion, flexibility, and efficiency. The more security you need, the more you will have to pay for it; there's really no way around that current industry reality. Taking that into consideration and factoring the risks will help guide to make decision on implementing the best solution for the organization. Private storage cloud technology is rapidly advancing to the point where data is continually accessible at the required performance, with never-ending space to store it. As we edge closer to that reality, increasing numbers of organizations have recognized that a private storage cloud is the right fit for the organization. Implementing a storage cloud solution can greatly optimize ANGKASA storage infrastructure and increase efficiency to help reduce storage. ANGKASA can take their first step with cloud computing and private cloud data centers. ANGKASA should start with applicable and manageable use cases as initial points of entry into cloud. They can start with identifying potential opportunities for cloud infrastructure. ANGKASA should also consider and develop ancillary aspects of their IT organization to adopt private cloud architectures. Some of these aspects could be:

- Map cloud architecture to enterprise architecture as part of an IT roadmap
- Create a cloud task force or steering committee as part of current architecture boards to evaluate cloud adoption
- Develop a cost and agility business case to justify further adoption
- Evaluate technical and organization alignment to aid cloud adoption
- Perform an information inventory to assess which data assets can be hosted in external clouds

Finally, in addition to the initial steps, ANGKASA should investigate utilizing external virtual private clouds for burst or new applications. Cloud service providers will offer both public and private cloud services in the form of virtual private clouds that will be consumed and controlled within private cloud data centers. Finally the entire step must deliver comprehensive cloud data center architectures, as IT infrastructures evolve and deliver cost-effective, ubiquitous, easily accessible, reliable, and efficient services. Cloud Computing holds a lot of promise and we believe that it is likely to be a major influence on hosting and application development. Cloud compatibility in the future because we have confidence that the incumbent issues will be satisfactorily resolved as this new technology matures.

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