The future data center for e-governance

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The Future Data Center for E-Governance

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Abstract – **Data center facilitates the e-governance system. Data center is a huge repository of data that is required by every stakeholders of e-governance system. It consists of many sensitive governments' data. Access of these data by every authorized stakeholder is one of the mandatory features of data center. At the same time, it has many challenges like the cost, management and updating it and also encounters with many threats from intruders. Providing reliable data to its users in terms of services in low cost is the main objectives of data center. This paper tries to address the challenges with the concept of cloud computing. We discuss the features of cloud computing and its use in data center in this paper.**

Keywords – **Cloud Computing, Data Center, E-Governance, Services, Virtualization**

1. Introduction

Data Center is a place for data. It consists of millions of Megabytes of data. Each set of data may be in different format and use for different purpose. It is also considered as a huge data repository where multiple organizations have accessed these data for their daily activities. It consists of hundreds of servers working together. Data center has two main parts; first one is **Collection of Servers** and second one is making these servers accessible to the outside world i.e. **Networking Infrastructures**. Users can access the data from servers of data center with the help of available networking infrastructures without knowing the status of servers inside the data center especially in the case of e-governance system.

E-governance is the proper use of Information and Communication Technology (ICT) in the government body of any nation to improve the quality of services given to the citizen. The ICT involves Internet, local area network (LAN), wide area network (WAN), mobile, software etc.

Cloud computing is the collection of scalable, virtualized resources, which is capable of hosting application and providing required services to the users and can charge as per the uses like utility. The main goal of cloud computing is to provide ICT services with shared infrastructure and the collection of many systems. In cloud computing every facility is provided in terms of service. It provides infrastructure as a service, software as a service, platform as a service, network as a service, and data storage as a service. The main philosophy of cloud computing is to provide every required things as a service.

2. Data Center

Data Center is a secured place where all relevant data of governments are kept. It is the central repository where the collections of data are stored for future use. It is also known as **Data Bank**. It consists of set of different servers and network architecture. Server holds the data from different organizations or ministries in the government and network architecture facilitates the services to use, store, and update the contents of the servers. There are three main components in data center i.e. users, middleware and servers. As per this nature, the basic three tier architecture of data center in this paper as per given in Figure 1.
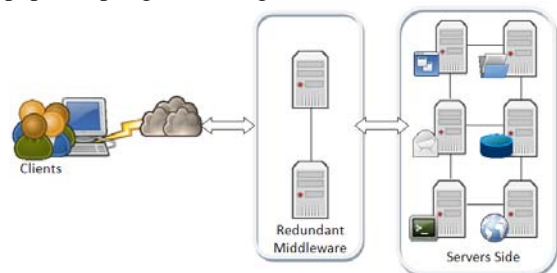

Figure 1: The 3 Tier Layers in Data Center

In the Figure 1, there are three layers. Layer 1 belongs to users and Internet, layer 2 belongs to middleware that bridges the gap between clients and servers. Two dedicated machines have been implemented to provide high availability. The last one is layer 3 that belongs to a set of servers.

Authorized users can use the features of data center. Authorization of using the data center depends upon the types of the users which are described in section2.1. These machines act as a bridge between remaining two layers. These machines take user request as an input, analyses it and forwards user request to the server side to get the service done. In order to give high availability and reliability in the data center more than one dedicated machines has been implemented in the layer 2. If one machine goes down the second machine takes care of it without making system down. In layer 3, there are many servers. Each server

contains the data. One server can interact with another server to get some service done. The interoperability in this layer is very high so that there is no problem in understanding each others.

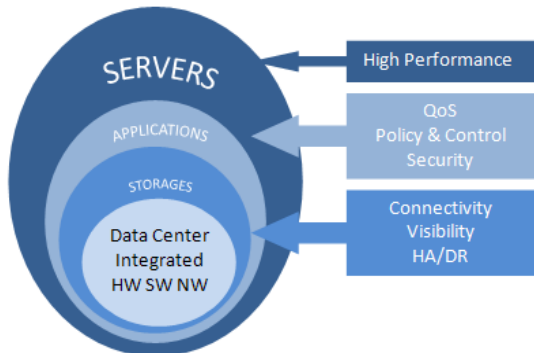## 2.1. Major Features of Data Center

Figure 2 Center Network Features Design Model

The feature of data center network design model considers key design attributes as given in figure 2. Each of these attributes is summarized here in this section. As data center become consolidated, more servers become centralized. The data center can be viewed from the perspective of the different groups of people interacting to create a highly available and functional end user requirement for the enterprise. These groups typically comprise storage, server, application and network groups. Observing all of the installed devices in the data center, we obviously see large racks of servers (X86 servers, blade servers or mainframe systems), different types of storage switches that use Fiber Channel (FC) and InfiniBand, and a variety of applications (Oracle, SAP, Microsoft) that utilize these resources to deliver business requirements.

Data center is the core of e-government system. The performance and reliability of e-government system depends upon the standardization of data center. The better data center makes better e-government system. These are the main features of data center. [1]

- High Availability/Disaster Recovery (HADR) – the function that ensure network operations and business continuity.
- Visibility—not only in network traffic and security events, but also into application traffic that make the system easier to maintain and manage the resources.
- Connectivity—ubiquitous connectivity to disparate sets of resources
- Security —security and compliance
- Policy and Control—centralized policy and control
- Quality of Service (QoS) to assure the communication link
- High Performance—applications, storage, servers and the network
- User Level Access Authentication – giving permissions, ownership, and inheritance permission must be consider.

3. Use of Data Center in E-Governance System

E-Governance system is not possible to survive without considering or using data center. E-governance system uses information to provide services to its users. The required set of information can be obtained only if there are sufficient amount of required reliable data. It is not wise idea to run for every organization to collect the data and also not possible to get data from many different organizations in a required time frame. Many organizations are very reluctant to share the data and also doubt on the authentication. The best way to overcome this problem is to use of data center that provides sufficient data to its users where common repository is built and data are kept. This common repository is nothing but data center.
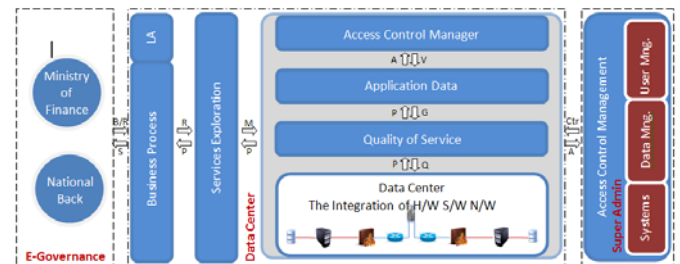

Figure 3: Modeling Data Center for E-Governance

We propose our model for datacenter in figure 3. There are three main components in this model:

- Each ministry of government will work closely with the data center with the facilitation from the backend of Access Control Management. In this case we assume all of the requirements of the ministries have been implemented and either the level of agreement.
- Middleware play a very important role that will consider as a whole data center and consists of:
  - o Business Level Agreement i.e. conflates form Business Process and Service Level Agreement
  - o Services Exploration
  - o Management applications i.e. Access Control Manager, Application Data, Quality of Service
- Access Control Manager handles other 3 components i.e. Systems, Data Management, and User Control Management.

So the Super Admin will be responsible for facilitates any further concerning about each ministry configuration related to the data center such as new business requirements, access control permission, reports, tracking transaction, networking management, etc.

The Figure 3 shows the used of data center in e-governance system. In the left side of the figure, there are two ministries surrounded by thick dotted line. It represents the e-governance system. There can be many numbers of ministries

inside the dotted line. Each ministry needs its data to be stored somewhere with safe and integrity. The data can be shared among the ministries. Data sharing between one to another is possible regarding to the policies, access level agreements, and the access authentication that has mentioned above within the section 2.1. So solution for this is having the data center.

Each ministry is connected to the data center. It means each of them store their data, share other data through the help of data center. Data center does not only store the data but also protects from different possible threats or attacks. Data center also takes the responsibility of managing the problems of interoperability among the different set of data.

4. Challenges of Data Center

There are many challenging factors for building a dependable data center but in this paper we point out two majors co-related concerned that data center within the developing countries such as Cambodia and Nepal face:

- Initializing, operating and maintaining cost is high
- Disasters add more cost

4.1. The economic factors

Cost is one of the prime challenges in e-government system especially in data center. As the matter of fact, that the world is facing economic crisis, the cost is the big factor. We have to try to get maximum services in minimum cost. In order to address such challenges we identify three categories of cost in data center. They are as follows:

- Development cost: It is the cost that requires making master plan, building infrastructure, buying hardware and software, making database, building security mechanism etc.
- Operating cost: It is the cost of operating the system. It includes ht cost for electricity, cooling system, hiring manpower all the time, paying software license, network cost etc.
- Maintenance cost: It is the cost of maintaining the system. System life time is large and system is cyclic in nature in e-government system. Software has to be modified, updated, and changed frequently. Hardware has to be replaced, configuration has to be changed. The cost that is required in these activities belongs to maintenance cost. It is well known that maintenance cost is more than development cost.

4.2. Disasters

This is another problem related to the first issue needs to be pointed out here. In order to provide the backup system we need to have a separate redundant data center working in parallel. This extra data center makes cost very high. Not just only adding extra cost but keeping it safe from natural disasters likes typhoon, earthquake, and tsunami is very big problems. This issue has given extra stress to the people who are working in the position of system engineer and system design in the term of providing an efficiency disaster recovery in data center architecture. That is the why we propose the concept of cloud in addressing such problems.

5. The Cloud computing over view

What is Cloud?
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. [2]

Inside the Cloud we can see the 3 main different perspectives:

- Software as a Service
- Platform as a Service
- Infrastructure as a Service

Within these 3 layers, the Cloud providers can provide many services following by the model of pay-as-you-go. Furthermore, we also can see from the business model that the Cloud provides:

- Private
- Public
- Hybrid Clouds

All are interoperated and using the technology of Virtualization.
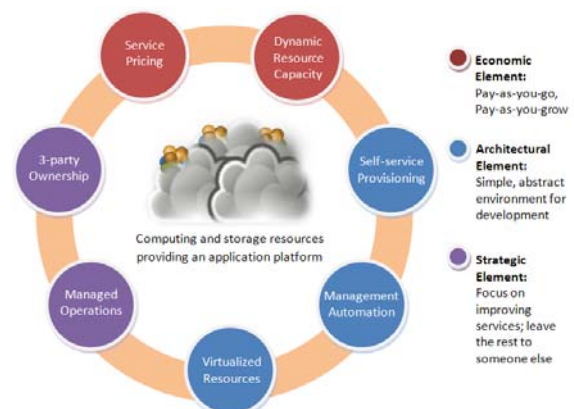
6. The Values from the Cloud

Figure 4: Cloud values

In order to know the importance of cloud we have shown it in figure 4. [3] In this Figure 4 shows the three value types: economic, architectural and strategic that really meets for e-governance system, they are:

- The economic value of Cloud is largely about being able to align the timing and size of the investments you make with the value you receive - variously referred to as "pay as you go", "pay as you grow". You don't pay $millions for infrastructure that only

delivers value months or years later; you pay for what you actually need, when (or soon after) you use it. And you don't purchase an asset that then depreciates later on.

- The architectural value of Cloud is about having a simple, consistent abstract environment presented to developers and operations folks that hides a lot of complexity, making it much quicker and easier to develop and deploy applications. It seems work like a black box. What you need only knows how to input then get your output, don't care about the systematic inside the black box.
- The strategic value of Cloud might be easily conflated with the economic value, but more than that Cloud platforms help us focus on what makes our organization more effective and gives good service clients, and leave all the other stuff to a third party that is dedicated to doing a great job for a competitive price. This is about focus and it's also about avoiding having to train people to do things that fundamentally don't add value to the organization.

6.1. The Solution for the huge cost and recovery

Nepal Government: As per the report said, it is estimated that it requires more than $30 million just to initiate the data center project which is the huge amount.

Report posted by John Foley:
- On 2009, June 12: In the topic of Cloud Computing Vs. $100 Million Data Center, Citizens of Holyoke, Mass., had reason to celebrate this week as the governor of Massachusetts and other dignitaries-- including Cisco CEO John Chambers, EMC CEO Joe Tucci, and the presidents of Boston University, MIT, and the University of Massachusetts-- announced plans to build a $100 million data center in their town.[6]
- On 2009, August 06: The state of Washington is investing $180 million to build a new data center. [6]

Base on these costs, millions of dollars are needed for implementing a data center.

In contrast, these types of costs will be drastically reduced in cloud computing since it is based upon "pay-as-go" and "pay-as-you-grow" without CAPEX – that needs to worry about spending money to buy fixed assets such as servers, racks, blade server or mainframe system, etc. Secondly, Clouds are based on virtualization technology that transforms the world of information technology. Virtualization allows multiple operating system instances to run concurrently on a single server; it is mean of separating hardware from a single operating system. *Virtualization* has proved to be a successful tool for the management of complex IT-environments and it is emerging as a technique to increase system reliability and availability [4]. Surprisingly, a *Virtual*

Machine behaves exactly like a physical computer and contains its own virtual (i.e. software-based) CPU, RAM, hard drive and network interface card. This has been leaded to the approach of having process migration easily (i.e. if one server down, another server that has the same instance can start within a minute.) [5]

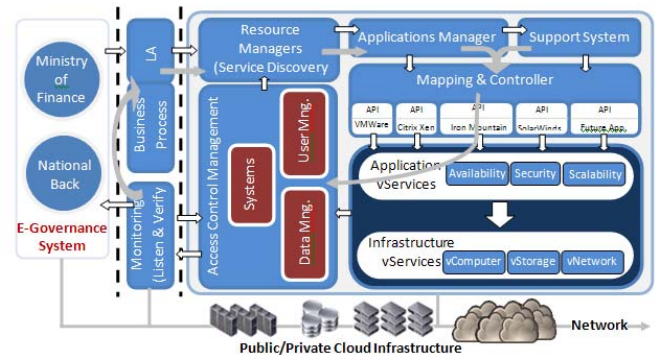## 7. Proposed Modeling for E-Governance

Figure 5: E-Government Cloud Data Center

The Above architecture divided into three parts: the e-government system, system automation monitoring and manage business level agreement, and the last one is the cloud data center.

7.1. E-Governance System

This system belongs to each ministry's architecture. Users in a ministry put their request for services at the beginning. The request goes to through the system automation and forwards the request to the cloud data center. The Resource Manger searching for the matching service and authenticate with the system to make sure the requested user has permission to gain access to the center. If it is the valid user, the system will continue to the application manager by cooperate with the Mapping system because the requested can be done from different cloud providers that the user used so we have a controller here to map the request to the internal system. After everything has done and matched, the service will return to the requester with its secure path.

7.2. The Automation/Manual Monitoring

This system will work closely with the module Access Control Management in order to orchestrate what the exact needs from each ministry and link to the data center. It has two major functions: Listening - Verifying and Managing Business Level Agreement. This task can be done by automatically or manually depend on the requirements of the users.

7.3. The Central Cloud Data Center

This is the heart of the entire architecture, so it contains many sub-systems such as Resource Managers, Application Managers, Support System, Mapping and Controller, Access Control Management, and the v-structures of the data center itself. All the sub-systems coordinate to each other systematically in order to provide system automation. This part is very crucial, so redundant corporate data centers must be needed in order to have all the system more high reliable, always available, and at least 99% survival.

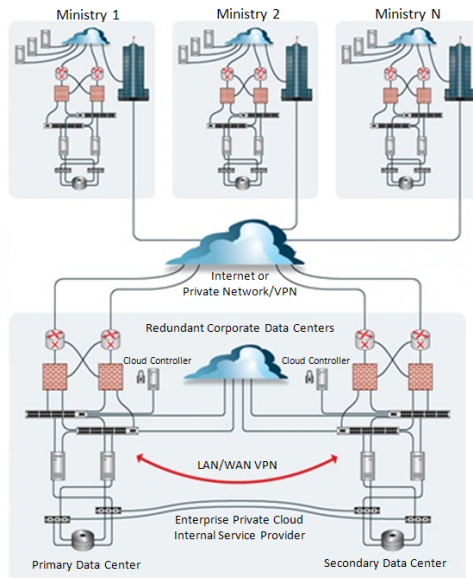So below is the simplification of redundant data center. [7]

Figure 6: Simplification of E-Governance Redundant Corporate Data Centers

8. Conclusion

The data center is the core part of the e-governance system. The success, failure as well as popularity of e-governance depend upon the quality of the data center. Data center has the main function of keeping the relevant data, and to provide these data to its users as per the demand. Along with these data center also should assure the protection of data.
We have proposed the data center using cloud computing paradigm. Since cloud computing is based upon the virtualization our proposed solution increases the availability and reliability of entire data center and also protects it from intruders and especially providing the high disaster recovery with high cost effectiveness. There are still some more challenges in cloud computing like security and privacy. We have decided to give more emphasize on it as our future works.

9. Future Works

Even though, many of the Cloud providers such as Amazon, Microsoft, Google App, Saleforce etc. have been introduced and assured that their Cloud security level is very high but it still abstracted for researchers in this field. So persuading people to put their value data in the Cloud or hand over to the third party, conceptual is risky. And it is one of the most challenging. On the other hand, to experience the Cloud is very critical to all researchers because the network infrastructure is very abstractive.

We will continue this work with the consideration of using open source tools such as Eucalyptus, Open Nebula and providing with more accurate data analysis in order to promote the cloud data center more effective and efficient and finally e-governance system will be benefited and also reveal the abstraction part of network infrastructure. We will address all these issues in our future works.

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