Cloud Computing: Report

Topic: ONE HEALTH CARD USING CLOUD

Submitted by:

Shashwat Singh Raghav (E19CSE109, EB11)

1. Introduction:

Have you ever thought about how most of the Hospitals and health centers save all our details and past medical history forever, which really helps you and them to fix appointments much faster and easier? And how our records move from one reception to another in no time. The answer to this is **"Cloud"**. Cloud gives us the ability to store an infinite amount of data which can be accessed in seconds from any point of the world and makes hospital or health centers' work a lot easier and that too in no time. So, we have to register ourselves in a hospital or a health center only once during the first visit.

Wait, it is not possible to reduce this process of registering and making new records every time for separate hospitals and health centers. Well, yes, under the new health project of our Prime Minister Mr. Narendr Modi, **"One Health Card,"** where he aims to have an unique health card number which will be valid pan India and used as a standard by all the hospitals and health centers.

Storing information of even 50% of 1.7billion population of our country will use a huge storage and server computation. But if done successfully, it can benefit all of us in terms of Time, Storage Space, Human Resources, and overall Cost.

- **Time:** Approximately 20 mins are consumed every time, whenever a new patient arrives at a hospital, in feeding his details and medical history, which can surely be utilized to reduce the time lap between a patient and doctor's appointment.
- **Storage:** Consider the average data size of each patient as "x" and the patient is registered in "y" numbers of hospitals and health centers. Here, the same data "x" is stored at "y" places, consuming memory at a number of places, resulting in creating more E-waste. This E-waste is a serious environmental health hazard in today's world.

- **Human Resource:** Every time we visit a hospital, the hospital has to appoint a staff to register us or update our information on their servers and maintain our records in the right order. Whereas this staff could have been used for serving patients in a better way effectively.
- **Cost:** Time, Storage and Human Resources have their individual cost for these, hospitals and patients have to pay in some or in another way. But "Cloud" can really help with the burden of bills on patients and may also benefit the hospitals and health centers.

"One Health Card Scheme" can be a very good solution to these problems and "Cloud" is surely the best tool to achieve this milestone. "Cloud" gives us the ability to reduce our costs, save our time, manage our resources better, and ultimately provide the best connectivity across.

2. Motivation:

After going through the "Cloud" properties, its advantages, and its ease of use, I got to know that there are still many more improvements possible in the virtual world of data.

Healthcare is one of the most important and essential sectors to be looked after. It is already using the technology to perform high-end and efficient tasks resulting in numerous successful treatments. But, there is still much more by which healthcare can adapt to provide a better, quick and efficient service to patients. "Cloud" is one of them. The Healthcare system still spends an ample amount of time in feeding, updating, and managing the records which are stored at a different location. As our PM shows us a way to solve this problem i.e. one Health Card and "Cloud" shows us the way to accomplish this milestone.

With the abilities of cloud-like:

- **Scalability:** The capability that increases or diminishes IT resources as required to meet up the changing demand at times.
- **Good Uptime:** The average time span a procedure (appliance/server) is functioning.
- **High Availability:** The time proportion for which a system or service is accessible.
- **Durability:** The measurement of how healthy and resilient your data/information is.
- **Firewall:** A cloud firewall gives you a layer of security around cloud support by stopping malicious web traffic.

- **Disaster Recovery:** A cloud-based service that supports you in quickly recovering your institution's critical systems after a disaster and delivers you remote access to your systems in a protected virtual domain.

"One Nation One Health Card" seems to be an achievable task.

3. Related work:

In the real world, there are many apps and websites available where one can easily find any doctor they want to consult and even book an appointment with them. Apps and websites like Practo and Medindia give very good connectivity with Doctors from all over India. Here one can search Doctors as per their own choice and requirements, their clinics, and even get support like consultancy.
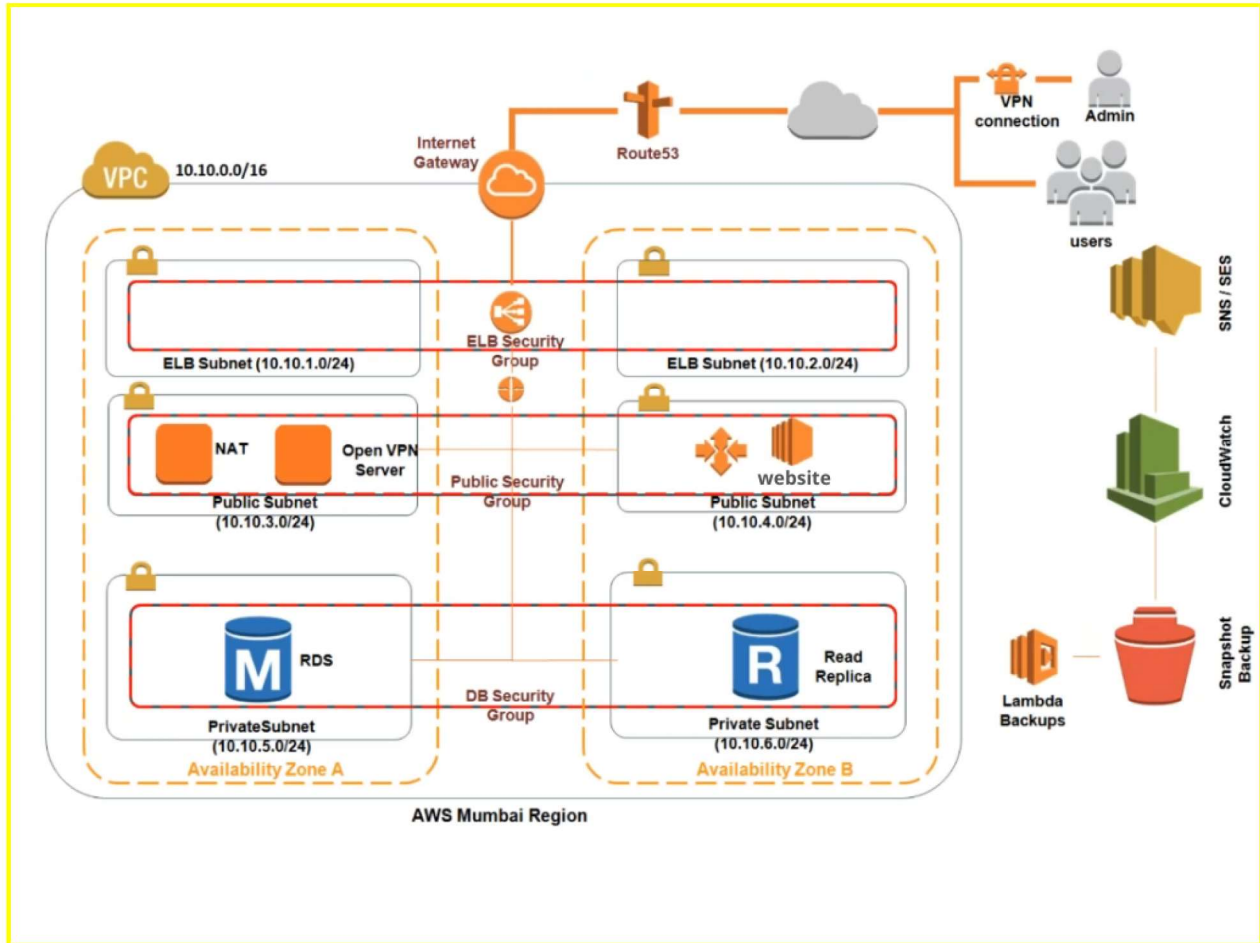
For maintaining Customer data there are also many platforms that provide service to customers to save their details and medical history on Cloud and even use it in hospitals and health centers whenever required. Apps and websites like HealthVault, MTBC PHR, and many more provide the service of storing medical details and history over the internet.

Even after having these apps, all hospitals unitedly can not rely on these apps, therefore, they still, use and rely on their own existing information stored in their data center. That is where the government scheme makes a difference and allows healthcare facilities not to manage any individual server for it and provide a 24/7 server access to patient details and help provide treatment at a faster speed.

Limitations:

- **Scalability**: Serving a large chunk of the population without cloud seems unachievable without facing the loss of extra unused infrastructure kept for utilization during scalability, whereas, technically it comes free with Cloud.
- The existing websites do not provide us the feature to automate the updating of on-time documents, eg if we are undergoing any treatment, we have to enter the details later by ourselves which may cause a delay or misinterpretation of information. Whereas if we provide a unique ID and legalize hospitals to automatically update our data.
- These websites do not allow access to all the hospitals, access and update of the user information, which can be done under this scheme and assist the process go much smoother.

4. Proposed Cloud Architectural Solution:

Functionality in terms of AWS:

- **Autoscaling**: As soon as the load is increased on our website, new instances will be created automatically to handle the load. It will get deleted automatically when the load is less to reduce the wastage of resources.
- **IAM Roles**: It will help us to access our data in case our instances go down.
- **Lambda**: To take snapshots of EC2 instance and to take a backup in real-time environment
- **Cloud watch**: If something goes off from or EC2 instances we can get notifications.
- **OpenVPN**: In order to access our data servers in a secured way.
- **Route53**: For mapping our domain on our website so that customers can access our website.

We will create the vpc and its components like public and private subnet, IGW, NAT gateway, etc at the beginning and followed by creating the EC2 instances for the AWS part of the project,

Thereafter, we create an RDS security group and an RDS subnet group with a private subnet. Thereafter, we will launch an RDS instance in multi-AZ.

Next, we have IAM roles and S3 buckets to keep out data BCS in case an instance goes down we can still get access to our data. We will also use IAM roles to copy our data from EC2 to the S3 bucket or from the S3 bucket to EC2. Thereafter, we will use the Route53 hosted zone to map our domain and create AMI for EC2 instances.

After all these actions we will create ELB so that we can attach all backend EC2 to the ELB and create Launch configuration and AutoScaling to scale up, depending upon the load on our website. In the end, we can enable ACM in ELB which is a part of security.

5. Strength of Proposed Cloud-based Architectural Solution:

Cloud computing can be chosen as a preferred partner at any stage of the project i.e. either in the beginning or even if the project is running. So it is very easy to utilize the cloud and make a gradual movement of projects in no time to save money and get all the good features of the cloud offered by AWS. Some of the main strengths of our proposed system are:

- **Cost-Effective:** primarily, it provides a way to pay as per the utilization of the services. It can also be called a consumption-based pricing model because you really do not have to pay any upfront predefined amount for the computing resources or hardware. It's just like renting the hardware, you just use them and then give it back to the AWS. In the end, you pay for the amount of time you have utilized it.
- **Cost- prediction:** In AWS, prices for individual resources and services are all predefined which gives us the ability to predict how much we have to spend in the given billing period and accordingly set our budget for the project.
- **Scalability:** You may have to increase or decrease the resources and services based on demand, which is not easy when the infrastructure is in the premises. If

we want to keep your infrastructure scalable then one needs to procure a lot of infrastructures. But on AWS scalability is done on demand.

- **Elasticity:** Considering our project, in case of season change, patients' information may be needed to retrieve in high amounts and may lead to a spike in traffic overnight. Because the AWS is elastic in nature, it will automatically allocate more resources to handle the increased traffic and when the traffic begins to normalize the AWS will automatically deallocate the additional resources to minimize the cost. So when there will be a load of traffic, there will be a rise in CPU usage, memory usage, network utilization. Here AWS automatically bounces up new instances in your infrastructure in the cloud and in the same way when the situation gets back to normal, AWS removes the extra added instances and helps reduce the cost.
- **Reliable:** While running a project like this, we have to be confident that the data is always going to be there i.e. the availability is provided by the AWS. AWS provides data backups, disaster recovery, and replication services to make sure your data is safe. In addition, redundancy is often built into cloud services architecture, so if one component fails, a backup component takes its place. It ensures that customers are not affected in case any disaster occurs.

6. Conclusion and Future direction for further Improvement:

In this fast-growing India, the Healthcare sector has also grown much. Serving 1.7 billion of the population, healthcare involves a lot of tasks including maintenance of records of each treatment occurring in present. Presently his data is stored separately with every individual hospital, doctor, and other health center leading to multiple clones of the same data. Instead our PM-inspired scheme "One Health Card" can be used as standard at all the healthcare centers and reduce the storage usage, human resources, cost invested and time utilized.

To build such a high-performing project there is a keen requirement of having good availability, cost-effective scalability, and minimum latency. For which the best possible solution is CLOUD. AWS is the most used and reliable platform to build, deploy and surve mega projects like this. Using AWS as our partners we can avail the benefits like Cost-effectiveness, scalability, elasticity, current running software and tool/ updated technology and resources, reliable environment, its global reach, and secured services.

To build a powerful, secured, scalable, and least latency project we can use multiple AWS services mainly: Route53 for hosting domain and record sets; VPC for subnets, internet gateways route tables, and security groups; SNS internally it will use SES; we will also use ELB where we will use an SSL certificate to secure our environment for which we will use ACM; EC2 instances with Elastic IP and autoscaling; RDS for RDS

master, read replica, snapshots, and RDS subnets; S3 buckets and IAM access; Lambda snapshots; cloud watch to monitor events and alerts to SNS and lastly OpenVPN for admin access.

In the future, there may be a chance for making more cost-optimized solutions using AWS itself. After running and understanding the market, optimal instance type and storage types can be used such as if we observe that at the time or season change there comes a sudden hike in the traffic, then by analyzing the graph we can make use of reserve instances and if there is a particular set of information which is not required to be accessed for a long time can be stored in glaciers to reduce cost.

7. References :

1) https://nvshq.org/scheme/one-nation-one-health-card-apply-online/#Health_ID_Card_Scheme_Complete_Overview
2) https://twitter.com/narendramodi/status/1294518493686054912?ref_src=twsrc%5Etfw%7Ctwcamp%5Etweetembed%7Ctwterm%5E1294518493686054912%7Ctwgr%5E%7Ctwcon%5Es1_c10&ref_url=https%3A%2F%2Fnvshq.org%2Fscheme%2Fone-nation-one-health-card-apply-online%2F
3) https://healthid.ndhm.gov.in/