

# SaaS Layer Framework for Cloud Based EHealth Services in Uttarakhand

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**Abstract-**Cloud computing based framework makes convenient, on-demand network access to a shared pool of configurable computing devices like networks, servers, storage, applications, services etc. which can be achieved with minimum managerial effort or service provider. In the existing paper we have introduced a model which describes the working of SaaS layer for delivering EHealth services through cloud computing in Uttarakhand.

**Keywords:** Cloud Computing, SaaS, PaaS, IaaS, E-Health, Uttarakhand.

## I. INTRODUCTION

This research paper has proposed the architecture which describes the working of the SaaS layer of EHealth framework based upon the present geographical conditions of Uttarakhand [1] by using the concept of cloud based technology. This proposed EHealth [2] framework consists of all the three service layers of Cloud [3] i.e. IaaS, PaaS and SaaS, which are connected with a common networking platform.

## II. ABOUT UTTARAKHAND

Uttarakhand, the 27th state of India, is bounded by Nepal in the east, the Tibet Autonomous Region of China in the north, Himachal Pradesh in the west and Uttar Pradesh in the south. It was carved out of the state of Uttar Pradesh on November 9, 2000. The total geographical area of the state is about 53,483 sq. km. According to the Census [4], the State's population was 1.01 Crore in 2011. The state has been created with the inclusion of 13 districts of undivided Uttar Pradesh. It is further divided into 49 subdivisions and 95 development blocks in order to ensure rapid human development through effective administration. There are 15,638 inhabited villages and 86 urban settlements in the state.

However, it is very tough to create policies based upon health care conditions due to everly constrained hilly regions of this state as well as due to various physical, geographical and environmental problems in Uttarakhand.

## III. CLOUD COMPUTING

Cloud Computing is a combination of using existing ICT enabled technologies. Some of these technologies include: grid computing; utility computing and most recently virtualization technology. This is an emerging computing technology aimed of running the services over the internet with flexibility and scalability.

It is a framework that makes convenient, on-demand network access to a shared pool of configurable computing devices like networks, servers, storage, applications, services etc. which can be achieved with minimum managerial effort or service provider. The entire cloud architecture is being divided under three service models (IaaS, PaaS & SaaS) and four deployment models (Public, Private, Hybrid & Community) which have been discussed in further part of this paper.

## IV. EHEALTH CLOUD FRAMEWORK FOR SAAS LAYER (OF PROPOSED MODEL)

We are proposing the SaaS framework for providing EHealth services to end-user in the state of Uttarakhand. The framework will define the SaaS based health services including the interaction policy of SaaS provider and Uttarakhand government.

This proposed SaaS framework for Uttarakhand state will define the details required for communication with SaaS provider and further to the Uttarakhand government.

Some features supported by SaaS based applications are:

**Multi-Tenancy [5]:** When SaaS based EHealth applications are typically supporting more than one user in a single instance of that application is known as multi-tenancy.

**Security and Privacy:** These are the main concerns for any user as patients' data is very much sensitive; therefore various measures are to be take-care by SaaS provider.

**Scalability [5]:** Scalability is another feature of any SaaS based EHealth apps/ services. Wide and narrow growing of data as per the requirement of the citizens should be there in application.

**User Interface:** Interface of the application should be good and easy to use. Today, SaaS applications are developing in such a way that they are more-or-less customized by the users like font, graphic etc.

**Use Case Model for EHealth SaaS Framework (of proposed model)**

This use case model figure 1.0 is a part of our proposed EHealth cloud architecture. In this proposed model we have shown as how the system responds as per the user’s observation/requests.

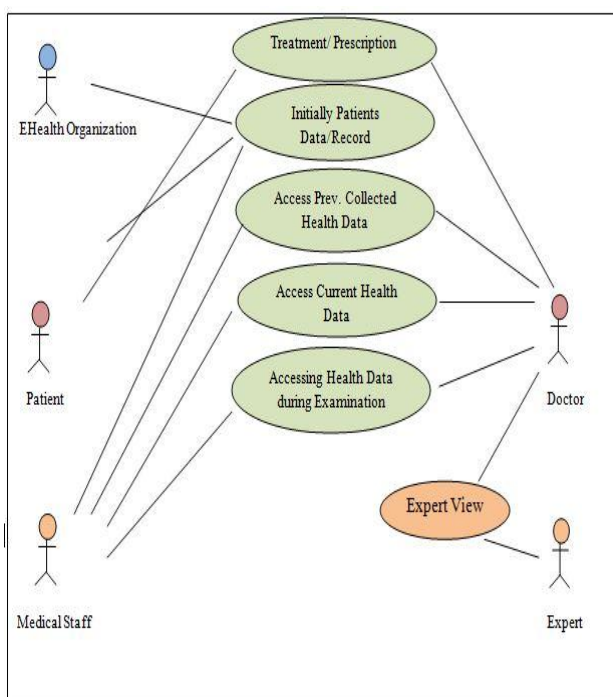


Figure 1.0: Use Case for EHealth Architecture

**V. USERS OF THE PROPOSED LAYER**

As per the proposed EHealth model the users are classified under the following three heads as citizen of Uttarakhand, Govt. Staff or IT administrator and SaaS architecture provider.

**End User/Citizen of State:** This category of users belongs to the citizens of Uttarakhand state who are willing to use EHealth services.

**SaaS Provider:** These are the external service provider that delivers the software as a service through the internet. Uttarakhand government could select these SaaS providers [6] to provide its EHealth based applications through them.

In the proposed model patient information is being collected and sent to the government data centre by these service providers.

**Government Staff/ IT-administrator:** This category of users consists of the government staff available at different hospitals or sub centres. The IT administrator responsible for data management at government end is also comes under this category. So to implement this, we required a private cloud environment. These users are also bounded with a well-defined SLA for the necessary terms and conditions decided by SaaS service provider.

**Reference/Working Architecture of EHealth SaaS Framework (of proposed Model)**

As shown in figure 2EHealth SaaS offers the basic working which is based upon SaaS layer. It consists of exchange of data between public and private cloud.

**Flow of working in the proposed architecture [Phases]:**  
**[For Citizens/Users]**

1. Citizens/End users login to government health portal system and create the profile (for first time user) [Patient is required to wait for 24 hours for using services]

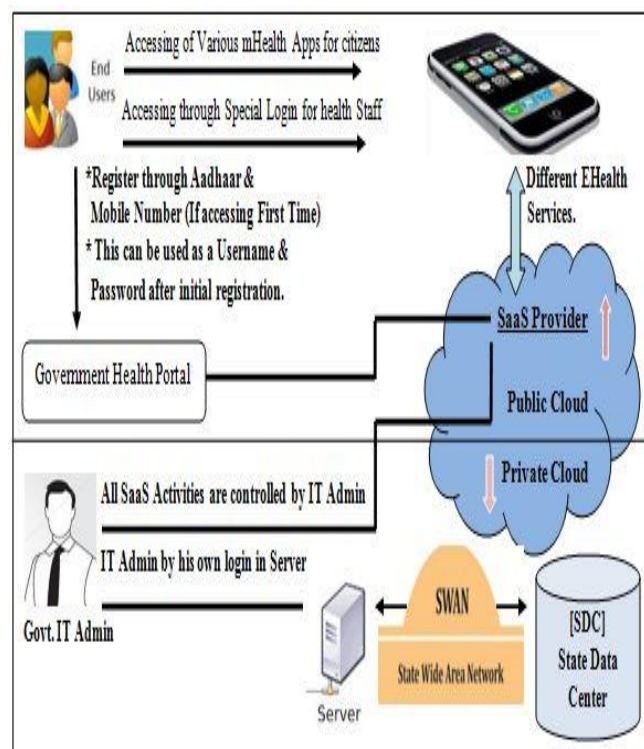


Figure 2.0: SaaS Framework for EHealth Services

2. Authentication Check (by checking logging credentials of the user) [By gov. IT Admin]

- a. If user exist then move on to User’s screen at step 3
- b. Else citizen request/create login.
  - End user will create its login by using its Aadhaar / PAN/Ration card etc. for its genuine identification.

- Government IT administrator view the client/user request at support desk
- IT Administrator check the given details from database server connected to SWAN (State wide Area Network) & SDC (State Data Centre)
- If the details given are correct then login detail generated and provided to SaaS user through its mobile/email.
- SaaS provider manages the login detail according to their application and provides the detail to citizen via support desk.
- Citizen gets the login credentials for secure login into the system.

### 3. Citizens get the following facility in its Dashboard

- Smart Phone Apps for availability of Doctors in respective hospitals of Uttarakhand state.
- Smart Phone Apps for availability of Doctors based upon disease / specialization
- Smart Phone Apps for availability of Facilities at various government hospitals
- Manage own Account (Change password etc.)

#### [For IT Staff/ Government Staff]

- Staff members are provided with login/password as per their roles i.e. doctors/Nurses/ANM's/ASHA etc.
- PDA's/ Smart Phones are to be provided to field staff i.e. ANM/ASHA worker to overcome the situation of IT infrastructure.
- Apps/Application relevant to them are installed in their devices and after making a login they can use them.
- Higher authorities can use this data as per their requirements i.e. for making the policies related to health care services in Uttarakhand.

Data interchanging in this architecture is of the main concern. SaaS provider is a third party vendor in the proposed model and data associated to patient's health must be secure in-between the transaction.

### Layered architecture of SaaS Framework for EHealth services (of proposed Model) [7]

According to Figure 3, the layered architecture provides the distributed tier of a SaaS based EHealth application. These distributed layers/tiers are:

**Citizen/ End-User Layer:** This layer of SaaS framework represents the interface for accessing the cloud based EHealth services for the end users of varying capacities. These services usually works with the web-browser already installed free on various smart devices.

**Application layer/Middle Layer:** This is the secondary/intermediary tier of our proposed cloud based SaaS layer for EHealth services. This is also known as *application layer* or *middle layer* which consists of some technical aspects of the EHealth services like.

- **Exception handling:** This part deals with the errors, which may occur during the usage of various EHealth services. This section is responsible to make the health care services robust such that any kind of problems could be undertaken easily.
- **Security & Performance layer:** This layer is responsible for showing the mechanism that measures the performance of an entire EHealth system including all the security concerns.
- **Data encryption:** This technique is use for providing the ample amount of security while using patient information over the Internet.
- **User authorization:** This could be done by providing valid login credentials before using the EHealth services. An OTP mechanism could be proposed to be use for verifying the validity of end user while using of some important applications.

**Infrastructure layer/Data layer:** This layer of proposed EHealth model constitutes the physical layer in which the data get resides before moving to the IaaS layer.

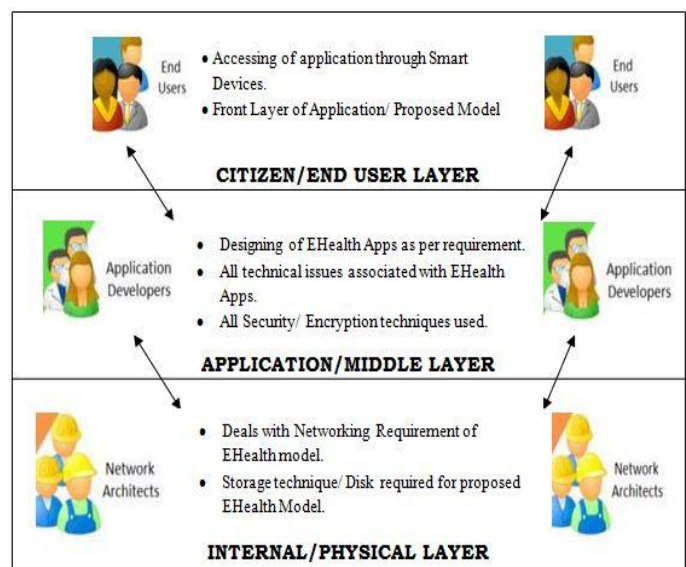


Figure 3: SaaS Framework of EHealth cloud

For our proposed EHealth model this is the virtual layer through which public cloud layer get connected to private cloud layer through SWAN (State Wide Area Network) in Uttarakhand. Some of its components are:

- **Database:** As we already know cloud computing provides multi-tenant architecture, so as its database. Therefore database should be available for all tenants independently.
- **Network:** Same as the database services, network is also shared among all the tenants. As our EHealth application architecture uses government provided network model known as SWAN (State Wide Area Network), the same must be virtualized to support multi-tenant architecture for the current proposed model.

- **Storage:** We are giving services in remote and mountainous region through this EHealth model for the betterment of health services of Uttarakhand state. Therefore storage must be shared securely and privately among the tenants.

## VI. CONCLUSION

Proposed SaaS framework has an objective to deliver various health care services to the peoples in remote and hilly areas of Uttarakhand state. The practice of using cloud based smart phone Apps in present health system is at initial stage but its future aspects in providing medical education and specialist healthcare will revolutionize the healthcare sector of Uttarakhand state. This paper purposed the development of basic cloud based EHealth system.

## VII. REFERENCES

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