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Framework For Sheltering Smart Grid Information Using Cloud Computing

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***Abstract*—**Smart Grid is novel concept that describes intelligent energy network but it imposes multitude of challenges for information management which is related to information gathering, information processing and information storing. The main challenge of smart grid is to process huge amount of data received from high end intelligent devices. Formerly, hierarchical structures of cloud computing centers were obtainable to provide different types of computing services for information management but it definitely look like a big challenge to manage a set of big data and moreover security is not availed. Providing shelters to Smart Grid Information seems very important as the information may be highly not to be disclosed and hence it need to be strictly protected. The basic idea at this juncture is to introduce Smart Frame based on cloud computing for big data information management in Smart Grids. In addition to this, security solution is proposed for the framework based on identity-based encryption, signature and identity-based proxy re-encryption schemes. So, the present Smart Grids provide not alone suppleness and scalability but as well safety measures.

Keywords—Big data, cloud computing, information management, smart grid, security

I. INTRODUCTION

Smart grid is a emerging technological innovation that is widely play its major role in electricity services. There are several challenges behind smart grid and the main challenge that is discussed is about information management which is related to information gathering, information storing and information processing. In addition to this, it seems difficult for mart grid to manage set of Big data.

Much of the information in smart grids are sensitive and needs to be strictly protective. Information Leakage in smart grid lead to vulnerabilities that affect not only individuals but also the whole nation because leaked information can affect mutually both individuals and the whole smart grids at the national level.

Cloud computing has become admired in recent times due to numerous advantages over traditional computing models. Classic advantages comprise of elasticity, suppleness, energy effectiveness, and cost saving. For this cause, it has been estimated to be a leading computing model in the upcoming years. By employing cloud computing in smart grids, the issue of large information management is not only addressed but as well it afford a high energy and cost saving platform. It is because 1) the framework can scale extremely rapid to work with changes in the amount of processing information 2) it can endow with a sky-scraping consumption of computing resources.

So, a secure cloud computing based framework for Big Data information management in smart grid called Smart-Frame is proposed.

The central idea at the back of the framework is to build a structure of cloud computing centers in a hierarchy to afford diverse types of computing

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services for information management and Big data analysis.

The framework is at three hierarchical levels,

1) Top Cloud
2) Regional Cloud
3) End user level

Where top cloud and regional cloud are in cloud computing centers and End user level is the high end smart devices.

A. Contribution

There are twofold contributions in this paper: Smart-Frame is introduced which is a cloud computing based framework for big data information management in smart grids, which provides not alone the elasticity and scalability but as well safety measures.

Another one is security solution for the planned framework rooted with the help of Identity-Based Encryption and proxy re-encryption schemes, which provides secure communication services for the Smart-Frame.

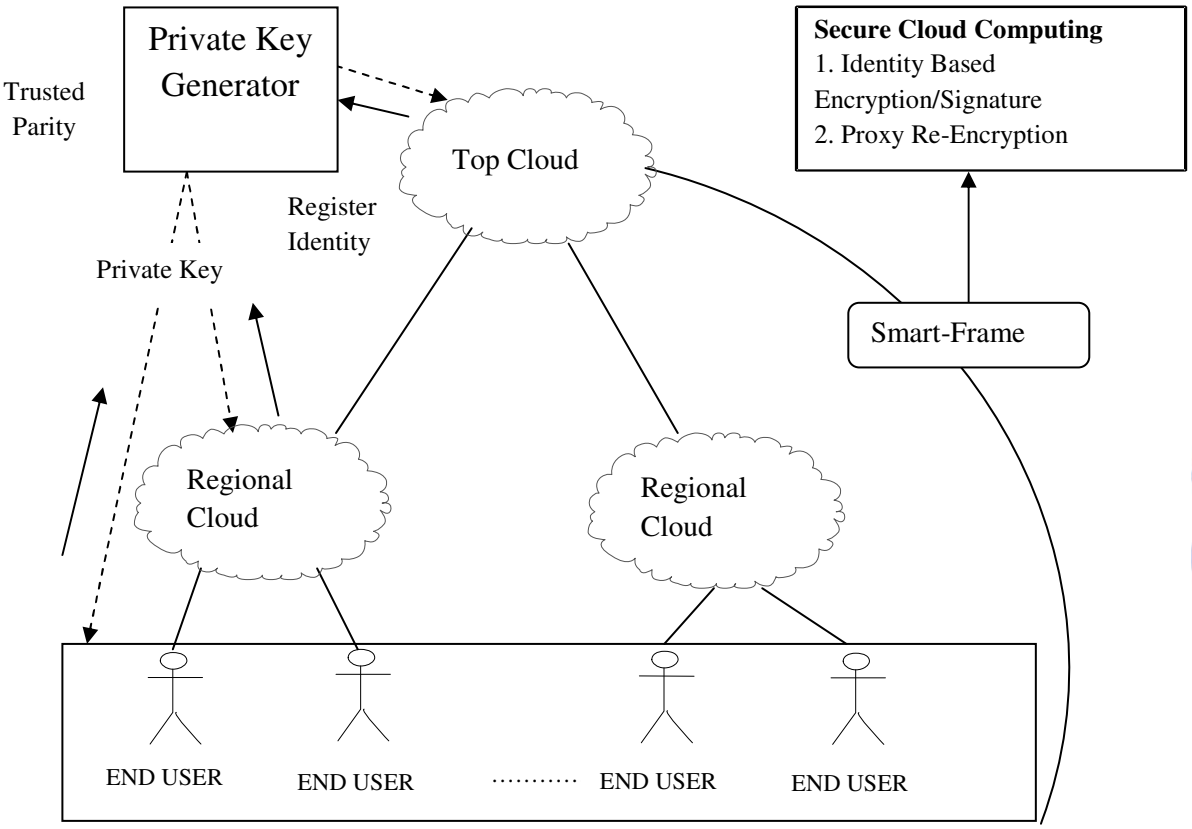

Fig 1. Overall System Architecture

In addition to this structural work, a security solution is presented based on identity-based encryption, signature and proxy re-encryption.

II. RELATED WORKS

Several solutions have been made to address the challenge of building efficient communication architecture for information gathering from heterogeneous devices at different locations. A

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proposal has been made for standardizing the data structures used in smart grid applications to address the issue of data inter-operability during information processing. But, processing large amount of data efficiently remains a big challenge. In order to address this issue, cloud computing is used and as well to satisfy the challenges of information storing. As a result, properties of smart grid and cloud computing has been utilized to establish that the cloud computing is a superior candidate for information organization in smart grids. Therefore, previous works have been made only for analysis but we introduce a concrete design for the platform as well as security solution.

III. GENERAL FRAMEWORK

The proposed smart frame have three main perspectives: system architecture, logical components and information management.

A. General System Architecture

In this structural design, smart grid can be separated into numerous regions each of which is directed by a cloud computing center with the intention of setting up from moreover a public cloud or a private cloud. The task of a regional cloud computing center is to administer smart front end devices in the region as well as to afford an initial dispensation for data established as of these devices. Besides regional cloud computing centers, there is a extraordinary cloud computing center named top level, which is responsible of organizing and dealing out information for the entire grid. In every cloud computing centers, cloud computing services Iaas, Paas, SaaS and DaaS can be set up.

B. Coherent Section View

Amid cloud computing services accessible, IaaS is the backbone of the system, other services are classified into clusters according to functionality they provide in order to ease the management. In our framework, four main functional clusters as available:

- Information storages. These are major storages observing every smart grid information established from intelligent devices. These storages are considered to recognize information from diverse transportation modes during both wired and wireless channels.
- General user services. This sort of services contain the entire services an electricity consumer wants to employ. Classic examples for this services are to let users to supervise, manage or optimize the practice of their electric utilities.
- Control and management services. This category of services usually encompass of all services necessary for system organization such as supremacy service, examining service, assignment scheduling service, and safety measures service.
- Electricity allotment services. This kind of services is straightforwardly associated to electricity distribution. Examples are allocation managing, optimization service, and value of service measurement.

C. Information Flow Management

Smart grids necessitate to hold enormous amount of data, it is very significant to supervise information flows efficiently. In the Smart-Frame, centralized service is used to manage information flows. This examine acquire key in as in cooperation with information requirements as of service clusters and general statistics from data storage space. By means of these inputs, the service produces an data flow schedule, which spells out resources and targets of information flow in addition to how they are processed.

D. Key Generation

- Private Key Generator produce a undisclosed master key and parameters. PKG then send params to both the entities in cloud computing centers and as well for the end users.
- After receiving the identity from all the three entities such as top cloud (TC), regional cloud (RC) and end user (EU), the PKG generates the private key by running the private key extraction algorithm.

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- By this process, private keys such as KTC, KRC, KEU is extracted through the help of the parameter, master key and as well the identity of the entities.
- In addition to this, private key is extracted for the information storage and services in the regional cloud.

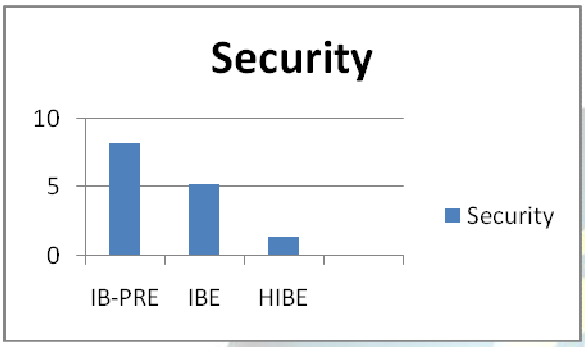

Fig 2. Security Analysis

In previous paper, HIBE (Hierarchical Identity Based Encryption is used, where disclosing lower level user's private key does not affect higher level's private key. Christo Ananth et al. [1] discussed about creating Obstacles to Screened networks. In today's technological world, millions of individuals are subject to privacy threats. Companies are hired not only to watch what you visit online, but to infiltrate the information and send advertising based on your browsing history. People set up accounts for facebook, enter bank and credit card information to various websites. Those concerned about Internet privacy often cite a number of privacy risks events that can compromise privacy which may be encountered through Internet use. These methods of compromise can range from the gathering of statistics on users, to more malicious acts such as the spreading of spyware and various forms of bugs (software errors) exploitation.

Apart from this, to facilitate and sustain safety measures for the framework that have been urbanized, the services such as identity registration, data encryption and data decryption are used. By using this identity registration, the entities who want to swap over information in the framework

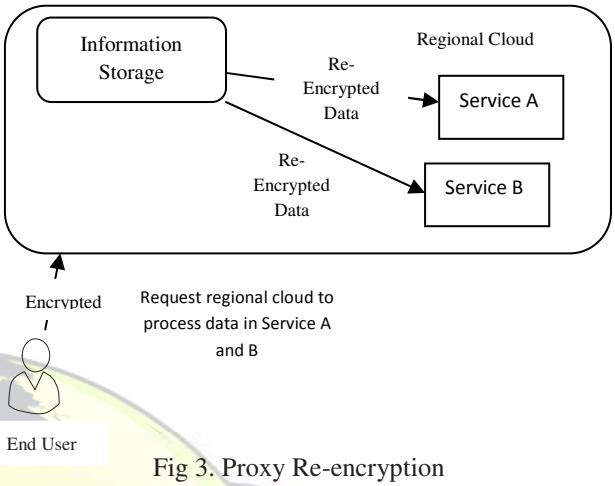

Fig 3. Proxy Re-encryption

can register their identities. After registering the identity, the private key that is associated with the identity of the entities is generated. Data encryption service is used to encrypt the data before sending it over the network in order to avoid the leakage or loss of data. Data decryption service is usually used by the receiver to obtain the original data.

IV. CONCLUSION

In this paper, a framework has been introduced which is called as Smart-Frame, is used to manage Big data information in smart grid using cloud computing. The basic idea behind this paper is to set up cloud computing centers such as top cloud and regional cloud, in which top cloud seems to have global view in the framework whereas regional cloud performs the work of processing and managing regional data. In addition to this, Identity Based Cryptography and Identity Based proxy Re-Encryption is used to provide security to the framework. As a result, both scalability and flexibility also get added along with security.

V. FUTURE ENHANCEMENT

Although, this paper provide security for the information that get exchanged between end user and the cloud computing centers such as top cloud and

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regional cloud. In future, this work will be extended by using different modeling techniques to avoid the workload of the regional cloud as it gets data from different users and stores it in bulk before sending it to top cloud until all the other services receive the data.

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