iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 4 **Issue:** IV **Month of publication:** April 2016

DOI:

www.ijraset.com

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)

Smart Grid Management Using Big Data In Cloud

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Abstract— Smart grid is a technological innovation that improves efficiency, reliability, and sustainability of electricity services. The main challenges of smart grids are how to manage different types of front-end intelligent devices such as power assets and smart meters effectively. Big data is used to process these huge amounts of data received from various devices. We propose a secure cloud computing based framework using Triple Data Encryption Algorithm (TDEA or Triple DEA).The data stored (or) collected from the smart grids can be used to estimate the future power consumption by using Map-Reduce Algorithm. In addition to this framework, we present a security solution based on Identity-based encryption, Signature and Proxy re-encryption to address critical security issues of the proposed framework.
Keywords—smart grid, big data, TDEA, map-reduce algorithm, identity based encryption.

I. INTRODUCTION

Power Consumption is a very important terminology which makes India to be in bright. Power Consumption refers to the electrical energy supplied over time to operate the electrical appliances like mobile, fridge, desktops, light, fan etc… where smart grid comes into existence. Smart grid is an electric grid which includes a variety of operational and energy measures including smart meters, smart appliances which is used to measure the power consumption of those devices, and it consists of renewable energy resources, and energy efficiency resources which can be used by those devices. From these devices a huge amount of data are received. That information is very complex, and the data processing over those data is inadequate. It is not an easy task to manage these set of data, which includes selection, monitoring, and analysis of smart grid data. The information,
apart from users, it is also usable for the management services, distribution services etc…
There are many challenges while processing data in big data include analysis, capture, search, sharing, storage, transfer, visualization, and information privacy. In real time, information processing is very difficult and it is required by smart grid. Delay in information processing may cause serious sequences to the whole system. To make use of those data effectively and efficiently across the globe, we go for cloud computing technology where the information from those smart devices is maintained in cloud storage. Smart-Frame is used as a general framework for big data information management. Our basic idea is to set up cloud computing centers at three hierarchical levels to manage information: top, regional, and end-user levels. While each regional cloud center is in charge of processing and managing regional data, the top cloud level provides a global view of the framework. The information storage performs heavy tasks of distributing confidential data. Data which are processing over devices and cloud will be more secure. We can provide security in data processing by using encryption algorithms.

II. BIG DATA

Big data is a concept which is used to describe a huge amount of data which is collected from various individuals, organizations etc… that may either be structured or unstructured. It becomes very difficult to process such data using traditional database models like (DBMS, RDMS) and software methodologies. A most important concern is that, if the volume of data is too big or it moves too fast or it exceeds current processing capacity, then it becomes a risky one. Big data has the ability to provide, improve operations and it makes process faster, and take more intelligent decisions for the organizations. It gets origin from Web search companies who had the problem of querying very large distributed

III. CLOUD COMPUTING

Cloud computing is a technology to access the resources available in the servers through Internet. Cloud computing technology becomes popular in the recent years due to its several advantages over traditional methods, like flexibility, scalability, agility, elasticity, energy efficiency, transparency, and cost saving. Cloud resources are shared resources which can be accessed by any one, anytime and anywhere. It is accessible through any devices like mobile, desktops, laptops, tablets etc... The resources and

information are provided for the users based on on-demand services. It allows the users to pay only for the resources and workloads they use. Cloud is nothing but a server and a number of servers interconnected through it. Cloud providers are the one who own large data centers with massive computation and storage capacities. They sell these capacities on-demand to the cloud users who can be software, service, or content providers for the users over the internet. In the recent years the major cloud providers are Google, Microsoft, and Amazon etc...

IV. BIG DATA IN CLOUD

Vertical scaling achieves elasticity by adding additional instances with each of them serving a part of the demand. Software like Hadoop is specifically designed as distributed systems to take advantage of vertical scaling. They process small independent tasks in massive parallel scale. Distributed systems can also serve as data stores like NoSQL databases, e.g. Cassandra or HBase, or file systems like Hadoop's HDFS. Alternatives like Storm provide coordinated stream data processes in near real-time through a cluster of machines with complex workflows. The interchangeability of the resources together with distributed software design absorbs failure and equivalently scaling of virtual computing instances unperturbed. Spiking or bursting demands can be accommodated just as well as personalities or continued growth. Renting practically unlimited resources for short periods allows one-off or periodical projects at a modest expense. Data mining and web crawling are great examples. It is conceivable to crawl huge web sites with millions of pages in days or hours for a few hundred dollars or less. Inexpensive tiny virtual instances with minimal CPU resources are ideal for this purpose since the majority of crawling the web is spent waiting for IO resources. Instantiating thousands of these machines to achieve millions of requests per day is easy and often costs less than a fraction of a cent per instance hour. A poorly planned data mining operation is equivalent to a denial of service attack. Lastly, cloud computing is naturally a good fit for storing and processing the big data accumulated form such operations.

V. OBJECTIVE

To estimate the future power consumption by using Map-Reduce Algorithm and to address the critical security issues of the proposed framework using Proxy Re-encryption algorithm.

A. Existing System

Security for the data is the main concern while transmitting or receiving the data between end user devices and the cloud. While providing security, the important is that, it will degrade the efficiency and performance of the system. Algorithms provide security by means of data encryption. The limitations of this framework are it does not address the security issues and large amount of information management.

B. Proposed System

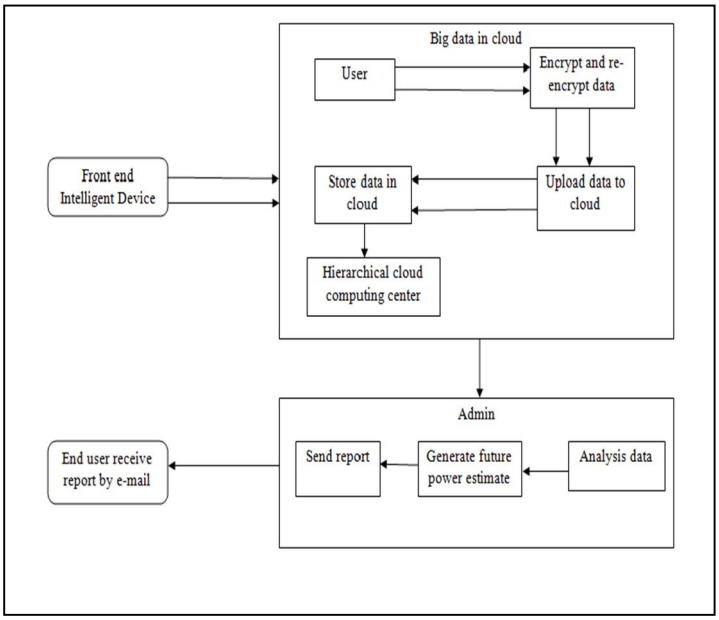
Our main idea is to estimate the future power consumption by using MR algorithm. To address the critical security issues, we use identity-based encryption and signature and proxy re-encryption which converts the encrypted text into binary format. To retrieve the data easily, we propose a "Smart-Frame" concept using big data. The benefits of proposed system are:

1. Highly secured based on Identity based encryption and Proxy re-encryption.
2. Process the huge amount of data received from these devices.
3. Hierarchical structure of cloud computing.
4. We can save significant amount of resources for computation and resolve scalability issues.
5. It provides triple time more secure and increases the efficiency of the system.

VI. SYSTEM DESIGN

A. System Architecture

Authentication begins with secure login using IBE algorithm. Initially the User Upload files to the Local System. Then the user upload the file to the real Cloud Storage (In this application, we use Dropbox). While uploading to the Cloud the file got encrypted by using IES (Identity Based Encryption Standard) Algorithm and generates Private Key. Again the Encrypted Data is converted as Binary Data for Data security and Stored in cloud. The data stored are used to estimate the future power consumption by using Map-Reduce Algorithm and the result is reported to the user.



VII. SYSTEM IMPLEMENTATION

A. Authentication and File Encryption.

Authentication and Authorization begins with secure login using IBE algorithm. Initially the User Upload files to the Local System. Then the user upload the file to the real Cloud Storage (In this application, we use Dropbox).While uploading to the Cloud the file got encrypted by using IES (Identity Based Encryption Standard) Algorithm and generates Private Key.

B. Proxy re-encryption and Data Storage to Cloud.

The information stored in cloud can generate a signature for a message using the private key associated with its identity. The sender uses their identity as a key to encrypt the data before sending data into the network. The receiver will decrypt the sender's private key. In Proxy re-encryption, the encrypted data is converted as binary data for data security and stored in cloud.

C. Information management and big data analysis

Here we are getting the user information from Public data set. There is an estimate that, the amount of data required to process transaction of 2 million customers will reach 22GB/day. So, there is a big challenge for selecting, monitoring and analysis of smart grid data since any delay causes serious consequences in whole system.

D. Future Power Estimation and Reporting Result to User

Map Reduce is a programming paradigm that allows for massive job execution scalability against thousands of servers or clusters of servers. It increases the execution speed to a greater extent for processing millions of records. Thus it estimates the future power consumption of each user which can be reported via e-mail or sms.

VIII. CONCLUSION

We have introduced the Smart-Frame, a general framework for big data information management in smart grids based on cloud computing technology. The secure aggregation protocols followed the bottom-up traffic model (i.e., device-to centre), which is spread widely in power systems in earlier system. We focused specifically on providing our Smart-Frame with security framework based on identity- based encryption/signature and identity-based proxy re-encryption schemes. Already, the proxy re-encryption

technique is applied to provide mobile applications in clouds with security. Now we specifically apply identity-based cryptographic techniques to address the scalability issues of smart grid applications. One of the obvious benefits we can gain from applying identity-based cryptography to the Smart-Frame is that through using identities rather than digital certificates which depend on traditional Public Key Infrastructure (PKI).

IX. FUTURE ENHANCEMENT

From this proposal we identified the few limitations while increasing the number of user. If top level data centre handled all the device information & user data, the performance will be weaken. So we built the regional and zone level data centre for maintaining the data. The top cloud level provides a global view of the framework and other will provide the information to parent cloud. From the above 3DES algorithm, we provided a solution based on "identity-based cryptography and identity-based proxy re-encryption" which provides secure communication services with the Smart-Frame. This will achieve not only scalability and flexibility but also security features.

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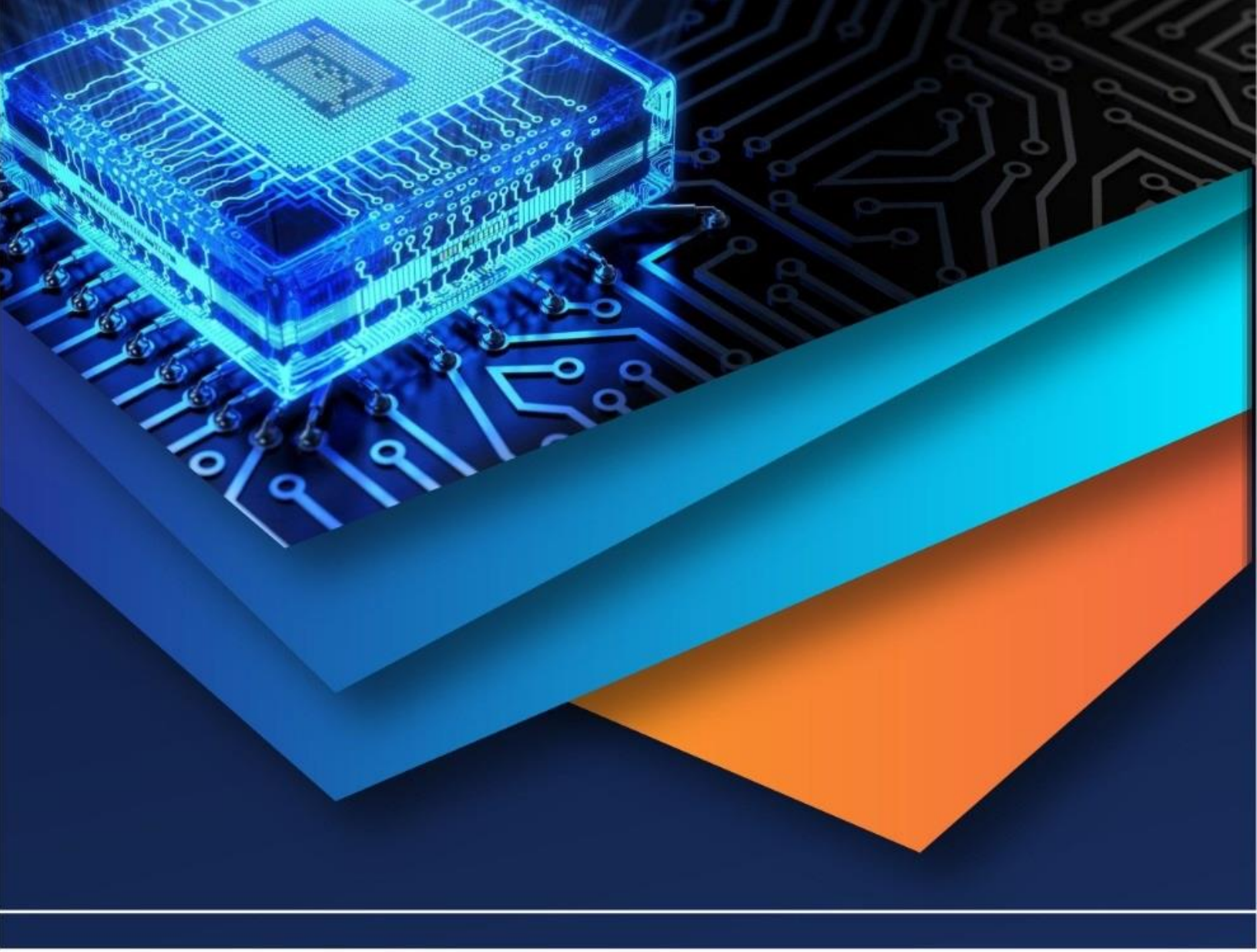

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