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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 intelligentenergynetworkbutitimposesmultitudeofchallengesforinformationmanagementwhichisrelatedtoinformationgathering, information processing and information storing. Themain challenge of smart grid is to process huge amount of datareceivedfromhighendintelligentdevices.Formerly,hierarchicalstructuresofcloudcomputingcenterswereobtainable to provide different types of computing services forinformationmanagementbutitdefinitelylookslikeabigchallenge to manage a set of big data and moreover security isnot availed. Providing shelters to Smart Grid Information seemsveryimportantastheinformationmaybehighlynottobedisclosed and hence it need to be strictly protected. The basicidea at this juncture is to introduce Smart Frame based on cloudcomputingforbigdatainformationmanagementinSmartGrids. In addition to this, security solution is proposed for theframework based on identity-based encryption, signature andidentity-basedproxyre-encryptionschemes.So,thepresentSmart Grids provide not alone suppleness and scalability but aswellsafetymeasures.

Keywords:-Big data, cloud computing, information management,smartgrid,security

I. INTRODUCTION

Smartgridisaemergingtechnologicalinnovationthatiswidely play its major role in electricity services. There areseveral challenges behind smart grid and the main challengethat is discussed is about information management which isrelatedtoinformationgathering,informationstoringandinformation processing. In addition to this, it seems difficultformartgrid tomanageset of Bigdata.

Much of the information in smart grids are sensitiveand needs to be strictly protective. Information Leakage insmartgridleadtovulnerabilitiesthataffectnotonlyindividualsbutalsothewholenationbecauseleakedinformationcan affectmutuallybothindividualsandthewholesmartgridsatthe national level.

Cloudcomputinghasbecomeadmiredinrecenttimes due to numerous advantages over traditional computingmodels.Classicadvantagescompriseofelasticity,suppleness, energy effectiveness, and cost saving. For thiscause, it has been estimated to be a leading computing modelin the upcoming years. By employing cloud computing insmart grids, the issue of large information management is notonlyaddressedbutaswellitaffordsahighenergyandcost saving platform. It is because 1) the framework can scaleextremelyrapidtoworkwithchangesintheamountofprocessing information 2) it can endow with a sky-scrapingconsumptionofcomputingresources.

So, a secure cloud computing based framework forBigDatainformationmanagementinsmartgridcalledSmart-Frameisproposed.

The central idea at the back of the framework is tobuild a structure of cloud computing centers in a hierarchy toafford diverse types of computing services for informationmanagementandBigdataanalysis.

Theframeworkisatthreehierarchicallevels,

1) TopCloud
2) RegionalCloud
3) Enduserlevel

Where topcloudandregional cloudare in cloudcomputing centers and End user level is the high end smartdevices.

Inadditiontothisstructuralwork,asecuritysolutionispresented based on identity-based encryption, signature

andproxyre-encryption.

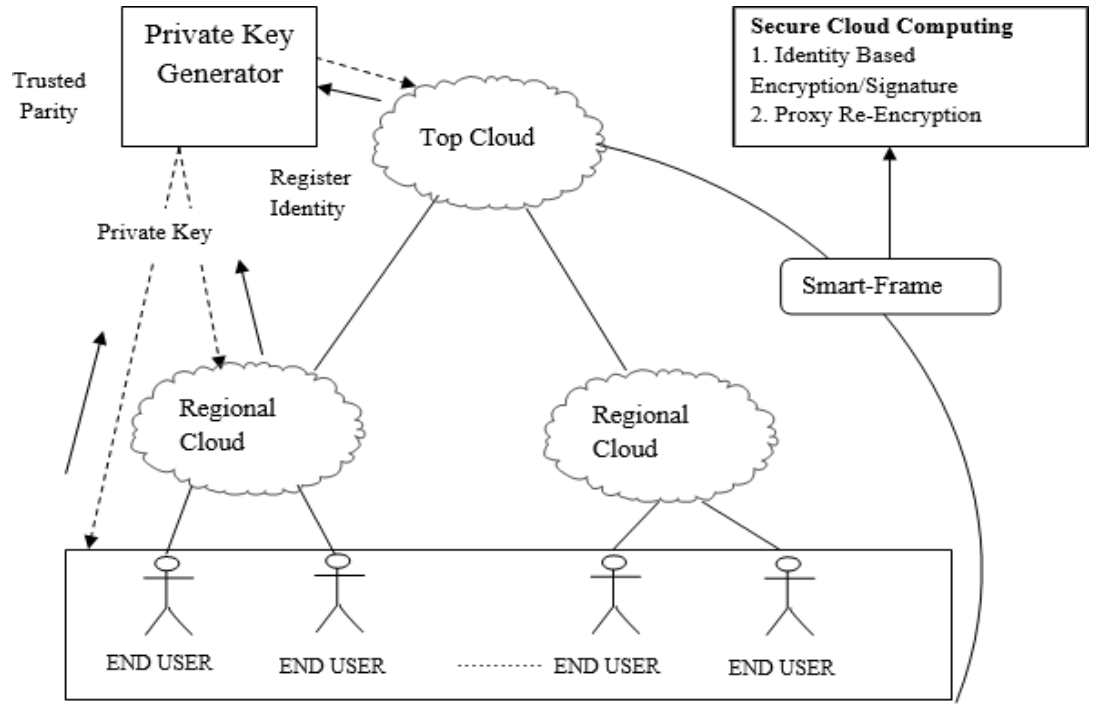
A.Contribution
Therearetwofold contributionsinthispaper:
Smart-Frame is introduced which is a cloud computing basedframework forbig datainformationmanagementinsmartgrids, which provides not alone the elasticity and scalabilitybutaswell safetymeasures.
Anotheroneissecuritysolutionfortheplannedframework rooted with the help of Identity-Based Encryptionandproxyre-encryptionschemes,whichprovidessecurecommunication servicesforthe Smart-Frame.

II. RELATEDWORKS

Several solutions have been made to address the challenge ofbuilding efficient communication architecture for informationgathering from heterogeneousdevices at different locations.Aproposalhasbeenmadeforstandardizingthedatastructures used in smart grid applications to address the issueof data inter-operability during information processing. But,processinglargeamountofdataefficientlyremainsabigchallenge. In order to address this issue, cloud computing
isusedandaswelltosatisfythechallengesofinformationstoring.Asaresult,propertiesofsmartgridandcloudcomputingh asbeenutilizedtoestablishthatthecloud
computingisasuperiorcandidateforinformationorganization in smart grids. Therefore, previous works havebeenmadeonlyforanalysisbutweintroduceaconcretedesignforthe platformaswellassecuritysolution.

III. GENERAL FRAMEWORK

Theproposedsmartframehasthreemainperspectives:systemarchitecture,logicalcomponentsandinformation management.



A. GeneralSystemArchitecture
In this structural design, smart grid can be separatedinto numerous regions each of which is directed by a cloudcomputingcenterwiththeintentionofsettingupfrommoreover a public cloud or a private cloud. The task of aregional cloud computing center is to administer smart frontenddevicesintheregionaswellastoaffordaninitialdispensation for data established as of these devices. Besidesregionalcloudcomputing centers,thereis aextraordinarycloud computing center named top level, which is responsibleof organizing and dealing out information for the entire grid.In every cloud computing centers, cloud

computing servicesIaas,Paas, SaaS and DaaScanbeset up.

B. CoherentSection View

Amidcloudcomputingservicesaccessible,IaaSisthebackboneofthesystem,otherservicesareclassifiedintoclusters according to functionality they provide in order toease the management. In our framework, four main functionalclustersasavailable:

– Informationstorages.Thesearemajorstoragesobserving every smart grid information establishedfromintelligentdevices.Thesestoragesareconsideredtorecognizeinformationfromdiversetransportation modes during both wired and wirelesschannels.

– General user services. This sort of services containsthe entire services an electricity consumer wants toemploy.ClassicexamplesforthisservicesaretoletControl and management services. This category ofservicesusuallyencompassesofallservicesnecessaryforsystemorganizationsuchassupremacy

service, examining service,assignmentschedulingservice, andsafety measuresservice.

– Electricity allotment services.This kindof servicesisstraightforwardlyassociatedtoelectricitydistribution.Examplesareallocationmanaging,optimizationservice,andvalueofservicemeasurement.

C. InformationFlowManagement

Smart grids necessitate to hold enormous amount ofdata;itisverysignificanttosuperviseinformationflowsefficiently. In the Smart-Frame, centralized service is used tomanage information flows. This examine acquire key in as incooperationwithinformationrequirementsasofserviceclusters and general statistics from data storage space. Bymeansoftheseinputs,theserviceproducesadataflowschedule,whichspellsoutresourcesandtargetsofinformation flowinadditiontohowtheyare processed.

D. KeyGeneration

– Private Key Generator produce a undisclosed masterkeyandparameters.PKGthensendparamstoboththe entities in cloud computing centers and as wellforthe endusers.

– After receiving the identity from all the three entitiessuch as top cloud (TC), regional cloud (RC) and enduser (EU), thePKG generates the privatekey byrunningtheprivatekeyextractionalgorithm.

– By this process, private keys such as KTC, KRC,KEU is extracted through the help of the parameter,masterkeyand aswelltheidentityoftheentities.

– In addition to this, private key is extracted for theinformationstorageandservicesintheregionalcloud.

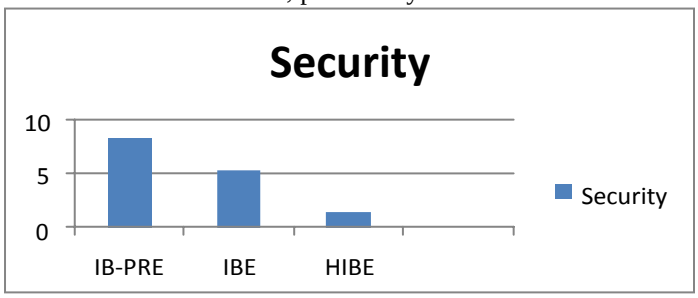


Fig2.SecurityAnalysis

Inpreviouspaper,HIBE(HierarchicalIdentityBased Encryption is used, where disclosing lower level user'sprivate key does not affect higher level's private key. Buttransferring of information from one level to other is not fullysecured. In turn, IBE (Identity Based Encryption) is used as itdoes not require to check the validity of certificates ratherPKG generates secret master key and parameter for everyindividual.

ProxyRe-Encryptionusuallytakesplaceininformation storage which is present in regional cloud. Whentheusersendsdatafromdifferentdevicessuchassmartmeters,intelligentsensorsandotherfrontenddevices,information storage in regional cloud encrypts the alreadyencrypted message and store it in services the user request,later it decrypts in order to send it to the top cloud and send itinoriginal encryptedformat.

Apartfromthis,tofacilitateandsustainsafetymeasures for the framework that have been urbanized, theservices such as identity registration, data encryption and datadecryption are used. By using this identity registration, theentitieswho wanttoswapoverinformationinthe frameworkcan register their identities. After registering the identity, theprivatekeythatisassociatedwiththeidentityoftheentitiesis generated. Data encryption service is used to encrypt thedata before sending it over the network in order to avoid theleakageorloss of

data.Datadecryptionserviceis usuallyused bythereceiverto obtaintheoriginal data.

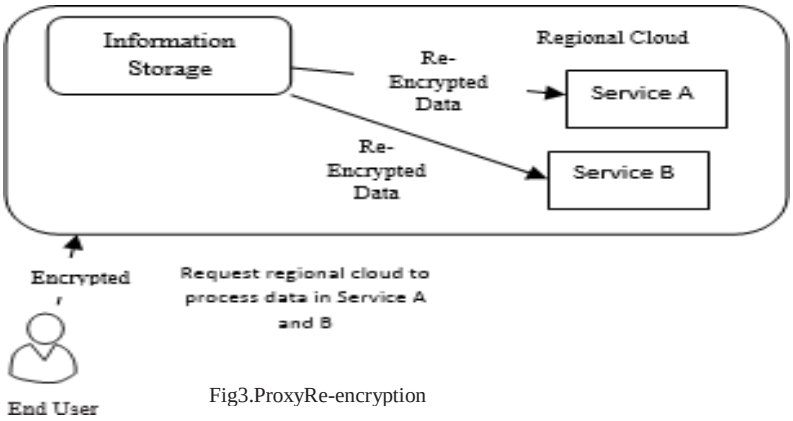


Fig3.ProxyRe-encryption

IV. CONCLUSION

Inthispaper,aframeworkhasbeenintroducedwhichiscalledasSmart-Frame,isusedtomanageBigdatainformation in smart grid using cloud computing. The basicidea behind this paper is to set up cloud computing centerssuch as top cloud and regional cloud, in which top cloudseems to have global view in the framework whereas regionalcloudperformstheworkofprocessingandmanagingregionaldata.Inadditiontothis,IdentityBasedCryptograp hyandIdentityBasedProxyRe-Encryptionisused to provide security to the framework. As a result, bothscalabilityandflexibilityalsogetaddedalongwithsecurity.

V. FUTURE ENHANCEMENT

Although, this paper provide security for the information thatget exchanged between end user and the cloud computingcenters such as top cloud and regional cloud. In future, thiswork will be extended by using different modeling techniquesto avoid the workload of the regional cloud as it gets datafrom different users and stores it in bulk before sending it totop cloud untilalltheotherservicesreceivethedata.

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