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Implementation of Smart Grid to Conserve Energy in Cloud Computing Infrastructure

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Abstract: *Utilization of power increased day by day, due to large power utilization in IT sectors. This needs to be managed and control. The power distribution in such huge computing environment needs to be properly utilized. This will helps in balancing and saving natural resources. Cloud data centers are powerful computing system which acquire huge amount of electrical energy for running. The consumption of energy can be effectively managed by introducing smart grids. Smart grid works in the manner by collecting information of the energy utilized by the data centers and process it accordingly for getting the maximum throughput with less energy utilization. Smart grid monitors on electricity distribution. This paper is brief study on introducing smart grids in cloud data centers for much more economical cloud model. The paper also proposes a method for better implementation of smart grids in cloud data centers. The paper explains areas through which smart grid implementation will help in huge power saving.*

1. Introduction

India and many other countries are suffering from power shortage and generation which is likely to degenerate over the next few years. Lots of technological development is going under research to develop smarter way for managing the power in terms of various fields. In IT sectors and infrastructure management this requires and acquire huge amount of electricity. Data centre in cloud computing can acquires electricity up to small towns for running. Smart grid monitors the power consumption by organization and also interact with market, energy bulk generation unit etc. for distributing information about energy flowing through the system. This information can be helpful in making more energy in greener manner which helps in consuming environmental resources for power generation. Smart grid helps in delivering energy to individual units in economical and secure manner. Clouds infrastructure is very strong and utilizes high amount of electricity, this electricity is managed by smart grids. If smart grids are

properly managed by cloud computing then this will lead to a better system for cloud computing and which also save a huge amount of money and manpower. Controlling and economic maintenance of IT assets are also helpful to reduced by introducing smart grids [1]. The information gained by smart grid can be managed by clouds the work will be paralleled executed.

2. ROLE OF SMART GRID IN CLOUD ENVIRONMENT

Current cloud computing environment does not consider the power constraints. The heating and cooling is not considered by testing the data centers environment. Large Data centre can acquire as much electric power required for running a small town [2], [3]. The power consumption of data centers are totally depends on the overall data processed by data centers. Data centers are not configured with energy and powers source management. Data centre are not configured with this kind of services. Data centers act as a house for several

component such as networking components, data storage component etc. This all component utilizes the energy and it's important to manage this electricity. A data centre can occupy one room of a building, one or more floors, or an entire building. Most of the equipment is often in the form of servers mounted in 19 inch rack cabinets, which are usually placed in single rows. A smart grid is an electrical grid that uses information and communications technology to gather and act on information, such as information about the behaviors of suppliers and consumers, in an automated fashion to improve the efficiency, reliability, economics, and sustainability of the production and distribution of electricity. The smart grid uses of technologies that improve fault detection and allow self-healing of the network without the intervention of technicians. This will ensure more reliable supply of electricity, and reduced vulnerability to natural disasters or attack. Implementing cloud industries, with smart grids two-way communications and advanced sensors, will improve the efficiency, reliability and safety of power delivery to cloud data centers.

3. PROPOSED ARCHITECTURE

The architecture proposed for smart gird implementation in cloud environment is a conceptual model based on the basic study of smart grid and cloud environment. The proposed architecture for introducing smart grid in cloud is shown in figure 1. This shows an interaction between cloud data centre and smart gird. Smart gird in cloud will monitor the overall energy consumed by cloud data centers. Data centers and smart grid integration will increase huge amount of power which has been utilized unnecessary by different components and services of data centers. Underlying all these technical approaches is a common challenge. But the next level of data centre energy optimization will lead to green computing environment. Seeing more and more integration of energy data into the way data centers are run today with a huge loss of power which can be consumed by the proposed model. The proposed architecture integrates smart grids in cloud environment which work in manner to the electricity used by different data centres for particular organization and which requires a lot of effort to manage. The number of electricity consumed by smart grid will be used with several other organizations. This results in saving of natural resources. Many different concepts have been used to model intelligent power grids [4], [5]. They are generally studied within the framework of complex systems. In a recent session the power grid was considered within the context of optimal control, ecology, human cognition, glassy dynamics, information theory, microphysics of clouds, and many others. But if

appeared in cloud computing can make smart grid works in saving huge amount of energy. With smart grids customers can choose their electricity suppliers, depending on their different tariff methods, the focus of transportation costs will be increased. Reduction of maintenance and replacements costs will stimulate more advanced control. Smart grid precisely limits electrical power down to the residential level, network small-scale distributed energy generation and storage devices, communicate information on operating status and needs, collect information on prices and grid conditions, and move the grid beyond central control to a collaborative network.
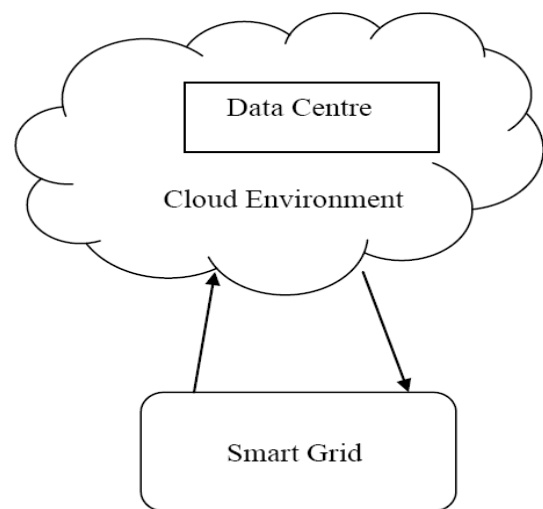

Figure 1: Proposed Architecture

4. DESIGN COMPONENTS OF SMART GRID

The proposed study gives design view of Smart Grid in figure 2, which includes the following components

- Smart Grid Server (SGS)

- Intelligent Monitoring System (IMS)

- Intelligent Sensors (IS)

5. BENEFITS OF SMART GRID

Smart grid and its implementation in terms of cloud computing environment is mentioned below

5.1 Consistency

In terms of consistency after implementation of smart grids in cloud will result higher in performances and low power usage [6]. The smart grid will make use of technologies that improve fault detection and allow self-

healing of the network without the intervention of technicians. This will ensure more reliable supply of electricity, and reduced vulnerability to natural disasters or attack.

5.2 Load adjustment

Smart grid consist feature of load adjustment which helps in reducing the different load from different data centre attached to cloud computing network. The total load connected to the power grid can vary significantly over time. Although the total load is the sum of many individual choices of the clients, the overall load is not a stable, slow varying, average power consumption. Imagine the increment of the load if a popular data starts access by the millions of user which will draw current instantly. This situation can be handled by smart grid load adjustment.

5.3. Advanced services

Smart grid consist some advance feature as with other industries, use of robust two-way communications, advanced sensors, and distributed computing technology will improve the efficiency, reliability and safety of power delivery and use [7]. It also opens up the potential for entirely new services or improvements on existing ones, such as fire monitoring and alarms that can shut off power, make phone calls to emergency services, etc. this all can be implemented in cloud environment.

5.4 Competence

The competence factory is also been considered in smart grid for power distribution in cloud data centres. A smart grid aims to manage these situations which require an efficient system. Electricity distribution can harm various devices evolved in the network and need to be managed in reliable and efficient manner so for the same smart grid are managed to design this type of situations. The overall improvement of the efficiency of energy infrastructure is anticipated from the deployment of smart grid technology, in particular including demand-side management, for example turning off air conditioners during short-term spikes in electricity price [8], [9]. The overall effect is less redundancy in transmission and distribution lines, and greater utilisation of generators, leading to lower power prices.

6. PURPOSE OF SMART GRID

In present scenario protection of environment is a global issue for human being. The whole world tried to reduce the effect of global warming. In this context, every one

tried to consume and control wastage of energy. Thus proper utilization of energy resources is need of an hour in cloud environment. This motivates to save energy and its distribution in efficient manner, which may fulfils the dream of Green Energy. Smart power Grid may plant intelligent sensors at data centres and at local premises, which helpful to control complex power management and send control signals back to the grid station to accumulate energy. In the future view of Smart Grid made possible by applying sensing, measurement, and control devices by using intelligent systems via cloud data centres. This also helpful to optimize electricity production, transmission, distribution and consumption of electricity through Smart Grid in cloud environment.
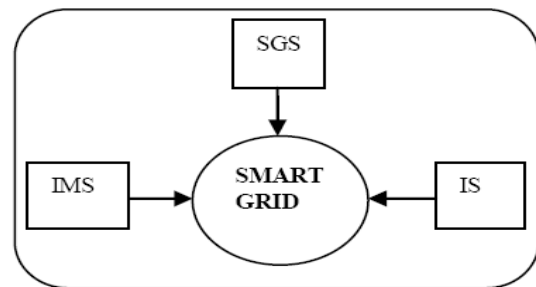

Figure 2: Components of Smart Grid

7. CONCLUSIONS

Implementation of smart grid will basically change the way of power utilization in cloud computing environment. This motivates to improve energy consumption towards green computing. The proposed concepts explain in the paper describes about smart gird and its implementation which is research based on decreasing the power utilization by huge IT architecture. The proposed architecture based on implementing such structure which can manage the power distribution by introducing smart grid. This imposes the need for smart grid technology to minimize the power losses which is a recent issue across all power distribution utilities in world. Existing power sector is not in the order and requires close monitoring and improvement. It is required to strengthen the existing architecture using advanced technology for better power utilization for better services. This paper concludes with the purpose and benefits of smart grid in cloud computing environment.

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