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PERFORMANCE APPRAISAL FOR RENEWABLE POWER CONSUMPTION IN CLOUD COMPUTING USING SMART GRID

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Abstract:-

Power management playing a vital role in the today's environment due to lacking of renewable power and large power consumption in cloud data centers. Cloud data centers are great computing systems which obtain huge amount of power for running. By introducing smart grid technology, the consumption of power can be effectively managed. The smart grid technologies such as advanced communication, sensors, smart meters and decision intelligence applied for improving power consumption in cloud computing data centers. Smart grid works in the mode by collecting power information utilized by the data centers and process it for getting the maximum throughput with less power consumption. This paper discussed the smart grid approach applied in cloud data centers for enormous power saving. This paper also summarizes the benefits of smart grid in cloud computing.

Keywords:- Smart Grid, Cloud Computing, Energy, Efficiency, Data centers, Intelligent Monitoring System, Smart Grid Server (SGS), Intelligent Sensors (IS), Component, Renewable.

1. INTRODUCTION

Renewable energy is the most fundamental parts of our universe. In Today's environment data centers acquire large amount of power. Data centers fall within one of the following categories such as traditional enterprises, telecom, high performance computing, hosting, internet and hybrid. The data centers classes across these categories range from small server to thousands of servers collectively consume more energy. By introducing smart grid approach the energy consumption of data center is controlled and monitored. Thus the data center getting high performance with less power utilization. The basic principle of the Smart Grid implementation, prevent the depletion of resources and promote economic growth at the same time is the application of energy efficiency through energy management systems [1]. The Smart Grid which includes the components such as Smart Grid Server (SGS), Intelligent Monitoring System (IMS) and Intelligent Sensors (IS) [2].In this paper we describe about the renewable power consumption in cloud computing using smart grid.

2. RENEWABLE ENERGY SOURCES

Power generation depends mostly on large power plants, mainly using coal, nuclear and gas power generation. The scarcity of the primary energy resources has raised the cost of electricity generation. In the recent decades, the small and medium size generation has been gaining more attention. These distributed generations are connected to the distribution system close to the consumers' locations. With the emergence of technologies, Decumulator (DC) grid changed to Accumulator (AC) grid, reduce the loss in the transmission line allow carrying to a far distance, and decreasing the generation cost [4]. Large generation station with the vast transmission and distribution grid come to existence. This interconnection helps to solve demand/supply balancing problems, and reliability in the supplied power by counterbalance the breakdown of one generation plant by others in the power grid. Decentralized or distributed processing make the entire power system to be reliable, efficient, flexible and economical [4]

3. THE CLOUD COMPUTING TECHNOLOGY

Cloud computing software and data services that can be used by end users without knowledge of physical location or configuration of the systems. Cloud computing uses data centers around the world to provide services. Thus, many organizations and companies have developed their business by using the software applications, programming platforms, data-storage, computing infrastructure and hardware as services which are provided by the cloud computing providers. "Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction." [5]. End users and service providers can have benefits from the cloud computing. The end users can access the service anytime, anywhere, with any devices, share the data and collaborate more easily, and keep their data stored in the infrastructure.

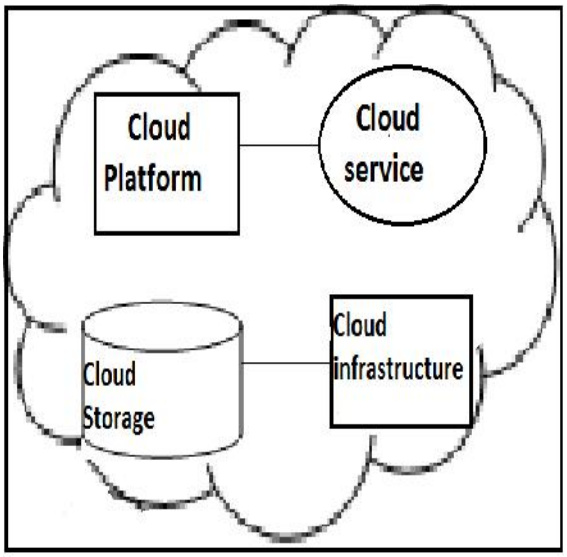

Figure 1: Cloud Computing Infrastructure

4. SMART GRID TECHNOLOGY

The term Smart Grid means more than a single technology or even a clear set of individual technologies. The specific technologies of the Smart grid are grouped in to the following five areas:

Integrated communications: It includes data acquisition, protection and control, and users to interact with intelligent electronic devices in an integrated system.

Sensing and measurement: This technology support acquiring data to evaluate the health and integrity of the grid and support automatic meter reading, elimination of billing and prevent energy theft.

Improved interfaces and decision support: It convert complex power system data into information that can be easily understood by grid operators.

Advanced components: These are used to determine the electrical behavior of the grid and can be applied to create complex systems such as micro grids.

Advanced control methods: It is used to analyze diagnose and predict grid conditions and self healing.

5. POWER MANAGEMENT SYSTEMS IN SMART GRID

The Smart Grid technologies require management systems to be smarter and able to respond to demands related to the charge control, energy management, and timing systems with micro grids. Supervisory Control and Data Acquisition systems (SCADA) technology helps the power companies to exchange information and data between different nodes in the entire network. This network comprises of Energy Management Systems (EMS) and Distribution Management Systems (DMS) . Some of the activities performed by EMS are transmission control, network analysis, load forecasting, power generation and control. Distributed computation, monitoring and control will offer an efficient method for power system operators to manage modern, and complex decentralized power systems within a short period of time. [3] The smart grid have computerized systems that give efficient and smooth information exchange for monitoring and control of the widely dispersed distributed power resources. Some of the basic application of cloud computing technology in smart grid application is using the cloud to manage smart meter data for EMS. The figure 2 shows the two way power flow using smart grid. The following table 1 explains the power management systems used in smart grid technology:

Sensor	Automated Switches, Smart Metering, Distribution Network Distributed Sensors
Communication	Wireless and Wired Networking, Control centers, Inter ISO communication
Power Flow Control	Volt/ Var Optimization, Flow Controls, HVDC
Decision Intelligence	Micro grid control, Wide-area monitoring, system events and alerts, end-user management, Supervisory control and data acquisition systems (SCADA)

Table1: Power management systems in Smart Grid Technology

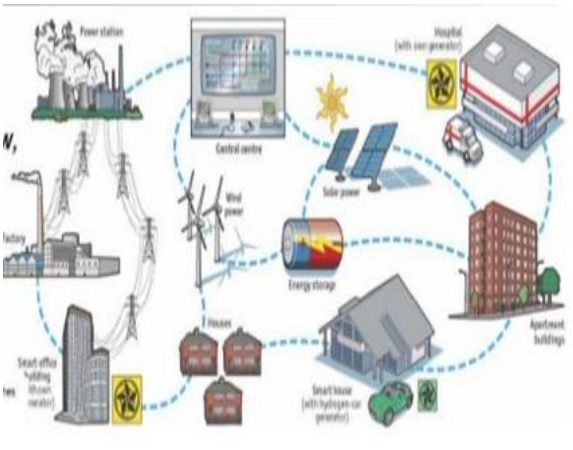

Figure 2: Two Way Power Flow in Smart Grid

6. COMPONENTS OF SMART GRID

The Smart Grid includes the following components:

Intelligent Monitoring System (IMS) : It is capable of deciding when to consume power based on pre –set customer preferences

Smart Grid Server (SGS): It controls the two way communication between consumer and power providers.

Smart Substations: It includes monitoring and control of critical and non critical operational data.

Smart Distribution: Low voltage energy is distributed from substations to residences and commercial buildings

Smart Generation: Electric power is generated in large- scale power plants and automatically maintain voltage, frequency and power factor standards based on the grids

Smart Transmission: High-voltage electrical energy is transported from the plant to substations closer to consumers

Consumer: Electricity used for consumer devices such as refrigerators, computers, lights, pumps and other devices used by residential, commercial, and industrial devices.

Smart Sensors: Smart power Grid may plant intelligent sensors at data centers and at local premises, which helpful to control complex power management and send control signals back to the grid station to accumulate energy. These components of Smart Grid made possible by applying sensing, measurement, and control devices by using intelligent systems via cloud data centers. This also helpful to optimize electricity production, transmission, distribution and consumption of electricity through Smart Grid in cloud environment.

7. SMART GRID BENEFITS

Self –Healing: The Smart Grid automatically detects and response to routine problems and quickly recovers without the technicians.

Resists Attack: The smart Grid has built-in security for the ground up.

Accommodates All Generation and Storage Options: The Smart Grid enables "Plug and Play" interconnections to multiple and distributed source of power and storage.

Motivates Consumers: The Smart Grid gives all customers- industrial, commercial and residential – visibility into real time pricing and gives them the opportunity to choose the volume of consumption and price that suit their needs.

Enable Markets: The Smart Grid supports energy markets that encourage both investment and innovation.

Operates Efficiently: The Smart Grid enable us to build less new infrastructure, transmit more power through existing systems.

Efficient Power Consumption: The Smart Grid collects the power information utilized by the data centers and processes it for getting the maximum throughput with less power consumption

CONCLUSION

This paper presents an overview of Smart Grid approach in cloud data centers to reduce the power consumption. The smart grids in cloud will result higher in performances and low power usage. The smart grid technologies that improve fault detection and allow self-healing of the network without the intervention of technicians. Using advanced sensors in Smart Grid will improve the better utilization of power in cloud environment.

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