Use of Cloud Computing in Grid Control

Swapnil Arun Namekar[1], Udbhav Singh[2]
[1]*Assistant Professor, Department of Electrical Engineering, Bharati Vidhyapeeth Deemed To Be University, College of Engineering, Pune, India*
[2]*Student, Department of Electrical Engineering, Bharati Vidhyapeeth Deemed To Be University, College of Engineering, Pune, India*

***Abstract*- The following paper is an introduction to electrical power grids & their basic working. It also introduces us to cloud computing and its induction in the working of power grids to prevent grid failure as well as efficient inter-communication of grids to overcome over generation or undergeneration of power and create a state of balance so that no single grid gets overloaded.**

INTRODUCTION

A. Introduction to electrical power grid:

An electrical grid can be defined as a connection of generating systems, electrical substations, transmission lines (High voltage) & distribution lines with the basic purpose of delivering electricity from producer to end consumers as efficiently as possible.

Basic Working

An electrical grid consists of the following main components:-

1.Generating stations:-They are the power source & are responsible for generation of power.

2.Electrical substation:-They are responsible for stepping up or stepping down the electrical voltage.

3.High voltage transmission line:- They are responsible for carrying power from source to distribution center.

4.Distribution lines:- They are responsible for carrying power to the consumer. Grids obtain their power supplies from power stations. These power stations are usually located near fuel source (in case of non-renewable resource) & energy source. The power generated is first stepped up to a higher voltage than what is supplied to compensate & prevent losses incurred during transmission. This high voltage power is supplied to distribution substation by means of high voltage transmission lines. The distribution substation will then step down the power from supply voltage to distribution voltage. After this the power exits the substation & reaches the service substation.

The power reaches the service substation by means of distribution lines. Service substations again step down the power to a lower voltage suitable to the requirement of the load.

B. Introduction to Cloud computing:

Cloud computing is a new & extremely efficient method of data and resource sharing. It enables us to store data on a main system (server) instead of multiple physical drives.

Basic working:

Cloud computing consists of main 2 components:-

1.Server:- A main powerful computer to which all the client systems are connected. They are responsible for sharing data or resources with all other systems connected to them.

2.Node:- A node is a client system which is connected to the server. The more the powerful server the more nodes it can handle.

Whenever a node on a network requires certain data or resource (hardware or software) for task completion or for performing an operation, the node then sends a request to the server demanding the data or resource to be used, the server then replies to the request and provides the node access to the data or resource.[2]

WORKING

In this paper we combine cloud computing with electrical grid control system. The power generated by each grid is sent to the main grid terminal where the data is stored. Each grid on the network has a terminal attached to it. Data from this terminal is then relayed to a main system on the cloud. Each terminal attached to the grid has a dynamic algorithm [1] which analyses the power generated as well as power

required by the load. In case the power required by load is less than the amount of power generated, in this case the data is relayed to the main server. For the sake of simplicity let's assume this condition to be '1'. The main server is provided with its own set of individual algorithms. These algorithms then search for a terminal which has sent '0' as a signal. In this case '0 is used to denote a situation where the power required by load is more than power generated [5]. In case the power generated is equal to power consumed by load in that case the signal sent by the terminal to the server is 'NULL'. This is the ideal condition & provides the best grid performance. The server , after analyzing all the above conditions asks all the terminals that replied '1' to divert power supplies to the grids where the terminals have sent '0' as a signal. The signals sent by the terminal are constantly relayed from the server to the terminals of each grid. This is done to prevent a situation where the power diverted from the grid whose terminal was replying '1' as a signal ie. the grid had excess power now ends up diverting such a vast amount of power that it is unable to suffice the demands of the load, in which case the terminal will now start sending '0' as a signal [3]. Vice versa will take place on the other grid which was earlier sending '0' as a signal ie. Demanding power. The constant data relay from the node to the server ensures that as soon as the condition turns ideal ie. Both the terminals send 'NULL' as a signal, the server instructs the server to stop the power transfer. But as we know such a condition is never reached due to the dynamic nature of load demands. So the server will continuously monitor and keep a check on the responses of the terminals from different grids and keep on sending them messages to transfer power from one grid to another depending on the responses attained from the grid terminals. It will keep on doing this in order to reach the ideal condition and create a balance [4].

If one of the grid does respond to repeated requests of power transfer the grid sending the signal can then switch to the next under loaded grid & retrieve the required amount of power.

CONCLUSION

The above system is helpful in eradicating human errors originated during the power transmission from one grid to another.

It also decreases overall grid response time therefore decreasing the load shedding period to balance the load on the grid.

ACKNOWLEDGEMENT

We would like to express our special thanks and gratitude to Dr.D.S. Bankar, Head, Department of Electrical Engineering for their guidance and support for completing my research paper. I would also like to thank the faculty members of the department of electrical engineering who helped us with extended support.

REFERENCE

[1] "V.R. Kanagavalli, G. Maheeja",'A study on the usage of data structure in information retrieval' by, arxiv, 2016

[2] "Richardo Puttini, Thomas Erl, and Zaigham Mahmood", 'Cloud Computing: Concepts, Technology & Architecture', Prentice Hall

[3] "Hongwei Bai , Zhiwei Ma , Yongli Zhu" , 'The Application of Cloud Computing in Smart Grid Status Monitoring', Communications in Computer and Information Science , volume 312

[4] "Berthold Bitzer, Enyew Sileshi Gebretsadik", 'Cloud computing framework for smart grid applications', 48th International Universities Power Engineering Conference , IEEE , 2013

[5] "Smaresh Bera, Sudip Misra, Joel J.P.C ROdrigues",'Cloud computing applications for smart grid', IEEE