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IOT ENABLED SMART GRID INTEGRATION WITH EDGE COMPUTING

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ABSTRACT

Smart grid is an innovative technique to enable traditional power grid system into bidirectional flow of electricity and data. The potential of SG will be increased by artificial intelligent embedded devices. Utilities are needed for collecting data with high resolution. A large amount of data will generate as part of the data collection. This was the major drawback of this system. processing this huge amount of data will cause latency and cost issues. This issue is rectified by edge computing. It acts as a median that helps in storage and communication between smart grid and resources. This paper includes the literature reviews of the related terms like edge computing and IoT-based smart grid.

KEYWORDS: IoT, Smart grid, Edge computing, HANs, WANs, Nans, Power grid

INTRODUCTION

Power grids are combined networks of transmission and distribution networks that can be large and complex systems made in main stations, substations, transmission towers and distribution infrastructures carrying the electricity. enables only one directional transfer of power from producer to consumer. Some conditions may cause power continuity such as wind, cold temperatures, ice, drought tree and other external Agent. Utilities needed for real time monitoring systems to ensure immediate response to critical situations sensors deployed in the field can generate huge amounts of data, managing all that Data's in a single place or data server increase significant transmission cost and latency issues there is a need for more distributed system to collect, store and process data closer to its source. For this, an edge computing eco system is provided to enable high performance computing solution. That enable large amount of monitoring of power grid in the local processing of data. Iot gateways with minimal edge computing capabilities conducting sensors installed on wires and transmission tower for initial data processing and filtering.

Data collected by gateways is then aggregated in the edge servers, they provide more processing capacity and virtualization capabilities to enable hyperconvergence infrastructures. High performance edge computers bring data centre capabilities to the field to turn smart grids into autonomous grids. They provide immediate responds to critical situations. An AI driven analytics performed at the edge with software solutions.

OUTLINE FOR EDGE ENABLED IOT SMART GRID

The Internet of Things defines the real objects with detector, processing power, set of programs, and other technologies that connect and exchange data with other devices and systems over the Internet or other communications networks. In the case of Iot smart grid, Data about energy usage is come from sensor enabled Iot smart appliances. This data is used to calculate electricity usage, cost, make decisions on load distribution and finding malfunctions. some modules of smart grid such as smart meter will send data that collected from the sensor since if there any service is disconnected then it will be known. In this scenario, the IoT acts a major role in the smart grid because it will have an IP address and it should support two-way communication. Iot implementation in smart grid is achieved by the three-layer architecture.

Table: Three layer and four-layer architecture if Iot smart grid				
Layer 4		application	social	Master station system
Layer 3	application	Cloud management	application	Remote communication
Layer 2	network	network	network	Field network
Layer 1	perception	perception	perception	terminal

The three-layer architecture consist of three layers: perception, network, and application layer. The perception layer includes different kinds of detectors, tags, and readers to collect data from devices. It is also known as the device layer. The network layer includes of different kinds of wired and wireless communication networks and the Internet. The information collected by the sensors in the perception layer to the communication protocols is mapped by the network layer. Then it is transferred to application layer. Where the information produced from the network layer troubleshoots and monitors the IoT devices on the basis of processed information. It uses different kind of IoT technologies to deal a wide variety of Iot applications

Under the IoT technology and communication technologies smart grid network layer contain three communication networks like home area networks (HANs), neighbour area networks (NANs) and wide area networks (WANs)

HOME AREA NETWORKS (HANs)

A home area network (HAN) as its name implies it's a network inside the house for provide energy consumption observe and control. It also provides a connection between the utility's meter and electric devices also it observes the energy usage since the user can notice what amount of energy is getting used and where. Three major components of HANs are: gateways, communication protocols, and devices. Interaction between all the devices is formed possible by the gateways, communication protocol ensures the affinity between hardware devices and therefore the exchange of knowledge. The devices are consumed to bring information.

NEIGHBOUR AREA NETWORKS(NANs)

The neighbour area network access network that attaches smart meters and distribution automation devices to wide-area network from outside.it perform as how over in between HANs and WANs

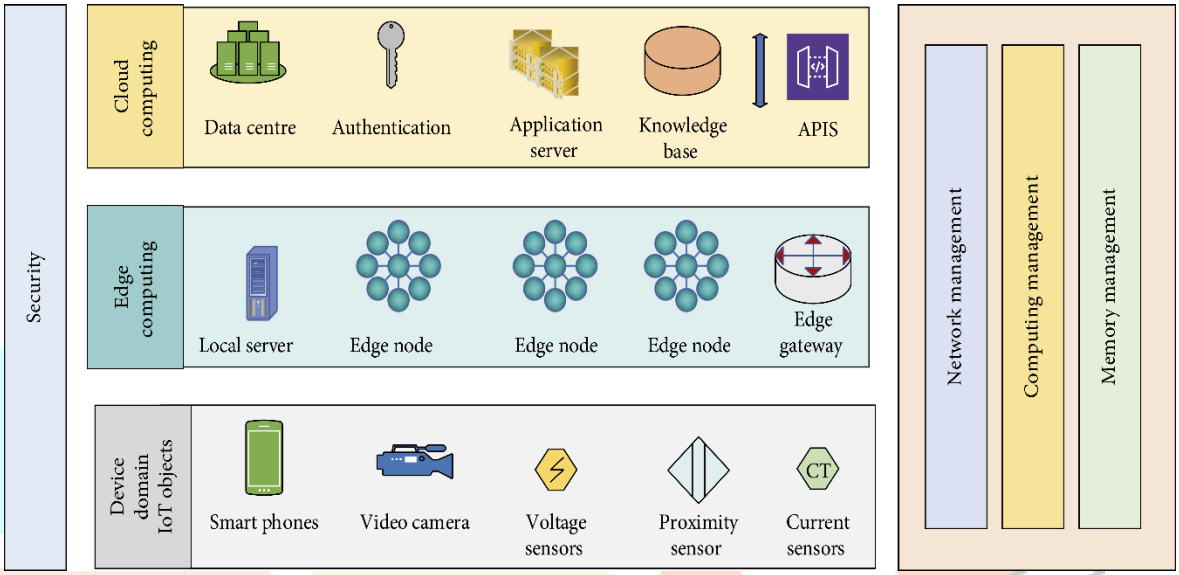
WIDE AREA NETWORKS (WANs)

WAN facilitates control and protection of the state of the smart grid.

HOW EDGE COMPUTING COMBINE WITH IoT SMART GRID

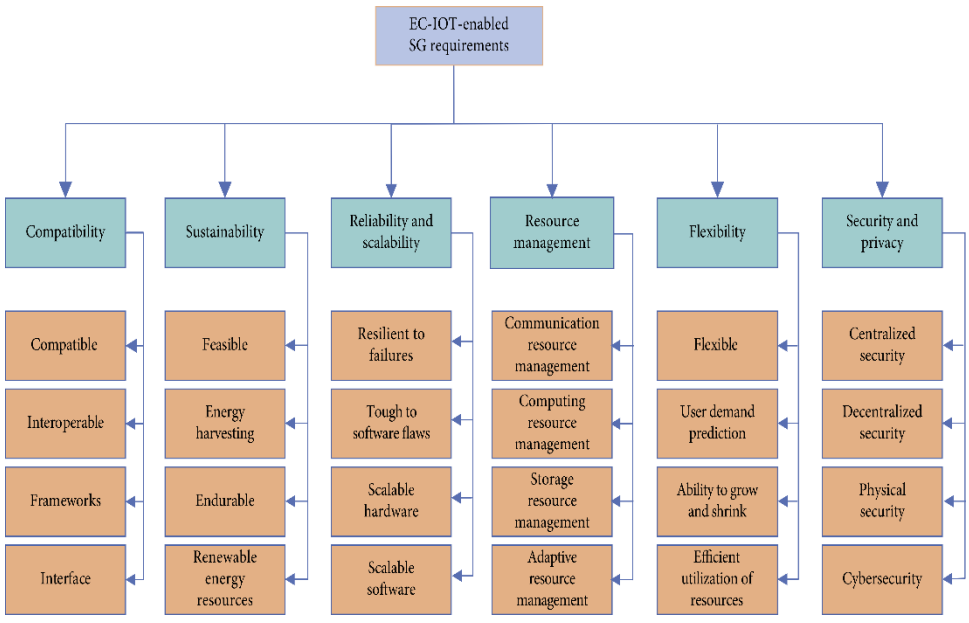
Smart grid is an innovative technique to enable traditional power grid system into bidirectional flow of electricity and data. managing all that datas in a single place or data server increase significant transmission cost and latency issues there is a need for more distributed system to collect, store and process data closer to its source. For this, an edge computing eco system is provided to enable high performance computing solution. That enable large amount of monitoring of power grid in the local processing of data. A solution to overcome the disadvantages of cloud computing in the smart grid edge computing is being used and it provides storage resources and computation facilities at the network edge.

FRAMEWORK FOR EDGE ENABLED SMART GRID



To overcome the demerits of current cloud computing leads to the development of edge enabled Iot smart grid. SG framework consist of 5 layers. Edge is the core layer in the framework. Placed at the edge of the network and consist of number of edge nodes. The secure access of various objects in the device layer are promised by the edge computing. Edge computing overcomes high-latency, huge energy consumption of the cloud and provide security.

EDGE INTEGRATED SMART GRID REQUIREMENTS



CONCLUSION

Smart grid is an innovative technology that made an inevitable change to the conventional power grid system. Edge computing technique in Iot smart grid provide more effective conveyance of electricity. faster restoration of electricity after power disturbances. minimised operations and management costs for utilities, and lower power costs for user energy consumption. Various sensors, and image capturing devices are placed on the transmission lines and transmission towers for observing conveyance of power. Since, there is a critical issue that is energy source for power consumption. By placing computing closer to the source of the data thereby edge computing improves network devices and web applications. which minimize latency and bandwidth usage. The edge mediates in storage and communication between computing resources and the smart grid that controls the core elements. A full-scale review or an outline on edge computing in Iot enabled smart grid is presented.

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