Advanced Role of Internet of Things in the Smart Grid Technology

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Abstract : Internet of things (IOT) is the process of inter connection between computer devices, digital and mechanical machines, classes and other things which will provide different identifiers. Smart technology is emerging technology for the smart grid, transport, and environment. Some of the major smart grid devices are smart home appliances and current substations etc are belongs to smart devices. All these are developed with smart technology. The aim of the smart grid is to provide unique id for the each object in the grid by using IOT. In this paper, the proposed work focuses on the theoretical model for smart grid within the IOT environment. Based on IPV6 model is the backbone for smart grid communication layer.

Keywords : Smart Grid; Smart Homes; Internet of Things; 6 Low PAN; Conceptual Model.

1. INTRODUCTION

In 20th century smart grid is the combination of regular electric power grid and from 21st century onwards is called as software engineering and telecommunication. The combination of effective resource usage of consumption of energy, install and manage distributed power resources and also transfer the outcome power. At the tip of the day, the force stream and interchanges are going to be in two-ways [1-3]. Various service organizations round the world began to introduce renewable vitality sources, as an example, sun battery-powered and wind vitality close-by the use destinations. Likewise, property holders began to introduce good home machines and renewable vitality assets in their premises to provide and expend electric power profitably [4],[5]. Because the smart grid concepts emerged as a quickly developing innovative work theme within the most up-to-date few years, the National Institute of Standards and Technology (NIST) engineered up an inexpensive model for the smart grid to line the section for a superior comprehension to the good lattice innovation. The government agency theoretical model includes of seven areas [6], to be specific: mass eras, transmissions, conveyances, customers, markets, operations and administration suppliers. Smart grid shoppers impart in two-route bearings by employing a few remote and wired correspondence conventions, as an example, Zigbee, WiFi, Homeplug, power cable transporter, GPRS, WiMax, LET, Lease line and Fibers [7],[8]. a number of programming bundles were overhauled and diverse are being created to oblige the new framework operation, support and administration, as an example, dissemination administration framework (DDF), geographic information frameworks (GIF), blackout administration frameworks (BAF), shopper information frameworks (SIF), and superior management and data procurance framework (SMADP). As a consequence of the smart grid advancement, some late empowering innovations have developed to diminish the number of correspondence conventions and handle huge measures of data. The Internet of Things (IoT) is one the newest empowering influence

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for the good network. This paper proposes an inexpensive model for the good framework within the IoT affiliation. no matter is left of the paper consists as takes after: Section 2 explores the smart grid existing communication protocols, Section 3 introduces the proposed conceptual model for the smart grid within the IoT context and Section 4 concludes the paper major contribution.
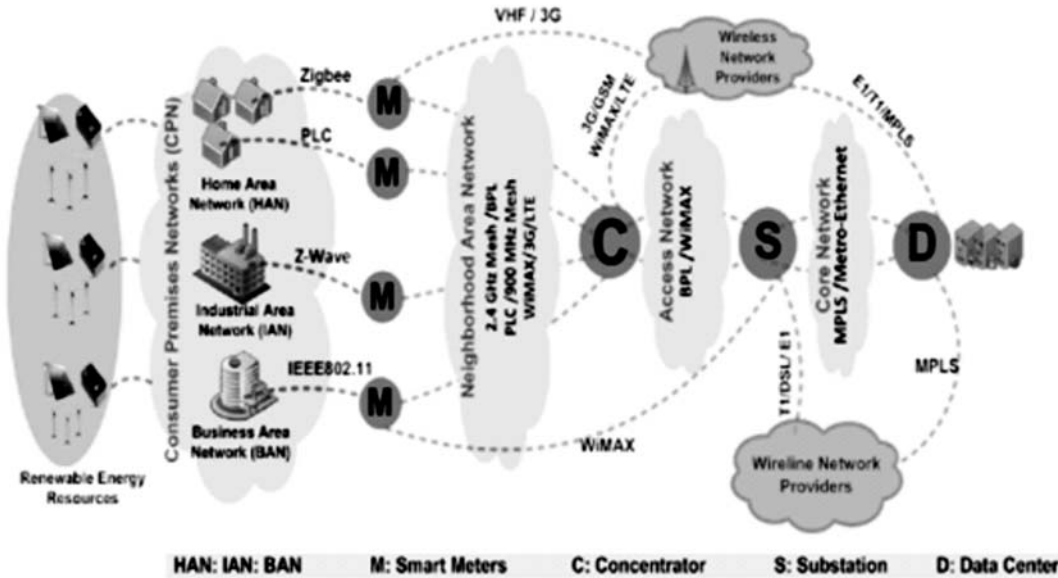
2. SMART GRID COMMUNICATION PROTOCOLS

Fig. 1. Smart grid communications protocols [7] [8].

The communications of the smart grid are of two types that are wired and wireless. Based on the working process of the smart grid these are divided. The related works of classifications are: home place system, neighborhood region system, access system, backhaul system, centre and outer systems [7]. These network associate varied smart grid protests, as an example, home apparatuses, keen meters, switches,

Table. 1. Smart gird applications bandwidth and latency requirements.

Smart Grid Application	Bandwidth	Latency
Substation Automation	9.6–56 kbps	15–200 ms
WASA	600–1500 kbps	15–200 ms
Outage Management	56 kbps	2000 ms
Distribution Automation	9.6–100 kbps	100 ms –2 sec
Distributed Energy Resources	9.6–56 kbps	100 ms –2 sec
Smart Meter Reading	10–100 kbhps/meter	2000 ms
	500 kbhps/concentrator	
Demand Response	14–100 kbps	500 ms–min
Demand Side Management	14–100 kbps	500 ms–min
Assests Management	56 kbps	2000 ms

recloses, capacitors bank, incorporated electronic gadgets (IEDs), electrical device, transfers, actuators, access focuses, concentrators, switches, PCs, printers, scanners, cameras, field testing gadgets, and totally different gadgets. All of those appliances and devices square measure topographically sent in the course

of the framework, starting from non-public units to substations and up to utility info and war rooms. As per the presentation, each convenience will get to and trade info through numerous correspondence conventions. Figure 1 demonstrates the smart grid communications conventions layers [7],[8]. The transmission capability and idleness stipulations for the keen network apparatuses and gadgets fluctuate from few milliseconds to few numbers of minutes and from few kbps to couple of hundred kbps as appeared in Table 1 [9].

3. IOT SMART GRID CONCEPTUAL MODEL

From the previous research, smart homes have a number of apparatuses and a few kind of renewable power resources. These apparatuses and assets are often thought of as IoT advancements. Each will transfer and download data and orders from utilities and property holders. Also, the network everyplace has varied gadgets which will be thought of as IoT protests, as an example, recloses, switches, electrical device banks, transformers, IEDs, smart sensors, and actuators within the substations. By and enormous, smart grids for substantial urban communities or nations might have a good several home machines and a good several gridgadgets.

In this paper, each and every device and item have the unique IP address. Take an example of computer 2 GB ram which has unique IP address as transformers IP address. This is not a difficulty because the IPV4 is reaching out from 32-bits to 128-bits address size IP addresses. The IPV4 will deliver up to 232 gadgets (4-billion unique locations). Also, IPV6 will deliver up to (Trillions of novel locations) [10] [11].

One results of such tending to pattern is that the 6 Low PAN communication technique. It leaves on prime of IPV6 and is meant to be utilized over the IEEE 802.15.4 normal [10] [11]. The 6 Low PAN edge calculable is affected to 127 bytes as well as a payload of twenty one bytes for communications protocol and thirty three bytes for UDP [10] [11]. With many procedures, the payload could increment to 65 - 75 bytes. This is often comfortable for the keen smart grid apparatuses and gadgets observant and dominant applications. This convention is that the foundation of the IoT correspondence media.

To model the smart grid within the IoT context, smart home appliances, renewable energy resources, substation devices and workforce tools will be assigned IPV6 address as follows:

(*a*)   **Smart home appliances:**

Each item in the smart home appliances consider as smart things and these are equipped with smart items (objects). Some of the smart items are cooling system, water-radiator, dishwasher, icebox, smart vitality/gas/water meters, in home-show, mechanized lights, sun minded vitality cell, wind plant, electrical reversible vehicle, and capability battery [9]-[11]. In this paper, the proposed model and for each and every item a unique IP address is assigned for every item. Each machine or item may be gotten to through the net by associate approved workers, as an example, associate utility's administrator or house owner. The equipment standing may be transmitted (transferred) or management charge to be received (downloaded). The trade data and management orders use the payload little bit of the 6LowPAN edge as appeared in Figure 2.

(*b*)   **Substations devices:**

In the smart grid devices power station devices plays a major role and some of the smart grid devices are (things, for instance, transformers, breakers, switches, recloses, meters, transfers, IEDs, condenser banks, voltage controllers, cameras, and many various things. so to good homes, each appliance (thing) within the station is taken into account as an editorial and is meted out a unique ip number address. Each item (thing) will transmit its standing and find management summons from the utility approved administrator by suggests that of the web. The payload is number of bytes and may be obligated utilizing the 6 LowP AN convention as appeared in Figure 3.

(c)   Distributed renewable energy resources

For the smart grid the distributed renewable energy resources which are arranged between the neighborhoods, distributed transformers and substations. It supplements power sources that may be introduced apace to be used amid the head hours, and additionally on completely different times of the day once is needed. All of that supply will provide energy to handle, screen and management. Associate degree of unique ip number may be apportioned to each equipment and device. The payload size and different connected 6 Low PAN edges area unit appeared in Figure 2 [11].

(d)   Mobile workforce tools and devices

The mobile should work for 24 x 7 and 7 days to solve the issues which are related to the households such as house current blackouts, feeders, transformers, meters, electrical cables, and other related issues for operating grid effectively. The workforce administrators are outfitted with battered tablet, power meters, cellular telephone, and cameras. Each of these gadgets is appointed an IP address and can be gotten to as in the previously mentioned gadgets and apparatuses in Sections 1 - 3.
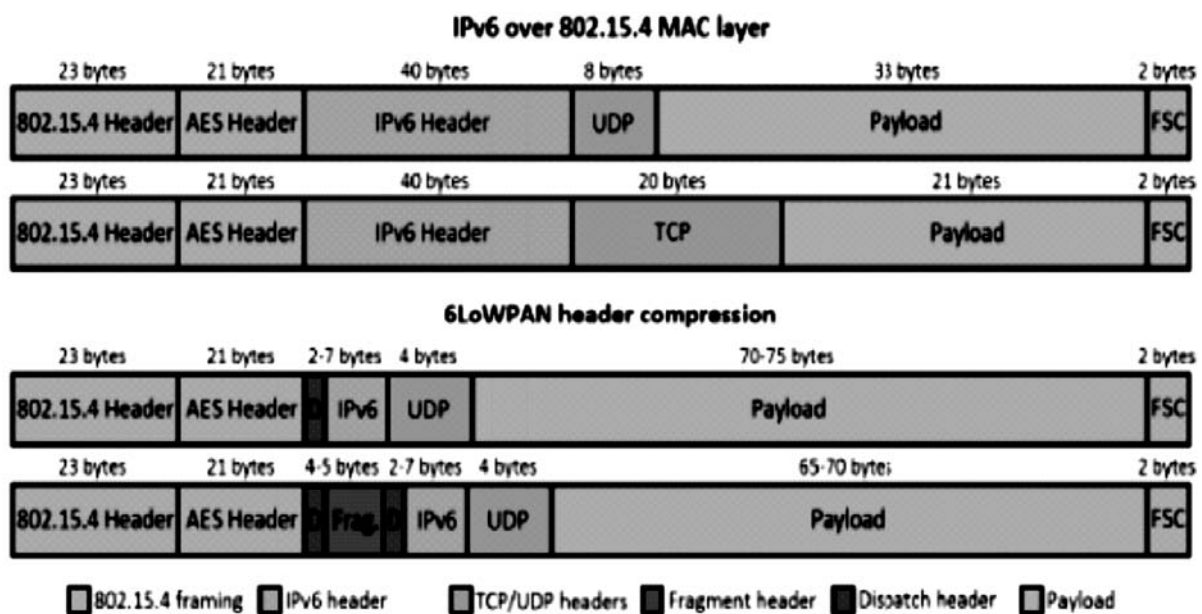

Fig. 2. The structure for smart grid applications frame in 6 Low PAN.

(e)   Utility data and control center infrastructure

This center has many applications and database services such as, distribution management system (DMS), geographic information systems (GIS), outage management systems (OMS), customer information systems (CIS), and supervisory control and data acquisition system (SCADA). Each service has its own IP address.

(f)   Echo systems

In the smart grid appliances echo systems are the service providers for external devices and are providers of third party. Every item need to have purpose of access through a unique ip number. Figure 3 delineates the antecedent mentioned planned applied model for the shrewd framework within the net of Things connections. It copies and coordinates the concerning apparatuses and gadgets in model that's versatile. The skilled postured theoretical model presents completely different difficulties in security and taking care of giant data that are past the extent of this paper. It deserves specifying that distributed computing could be a worldview that empowers a solution for the smart grid atmosphere conditions known with process force, storage, and high accessibility of assets.
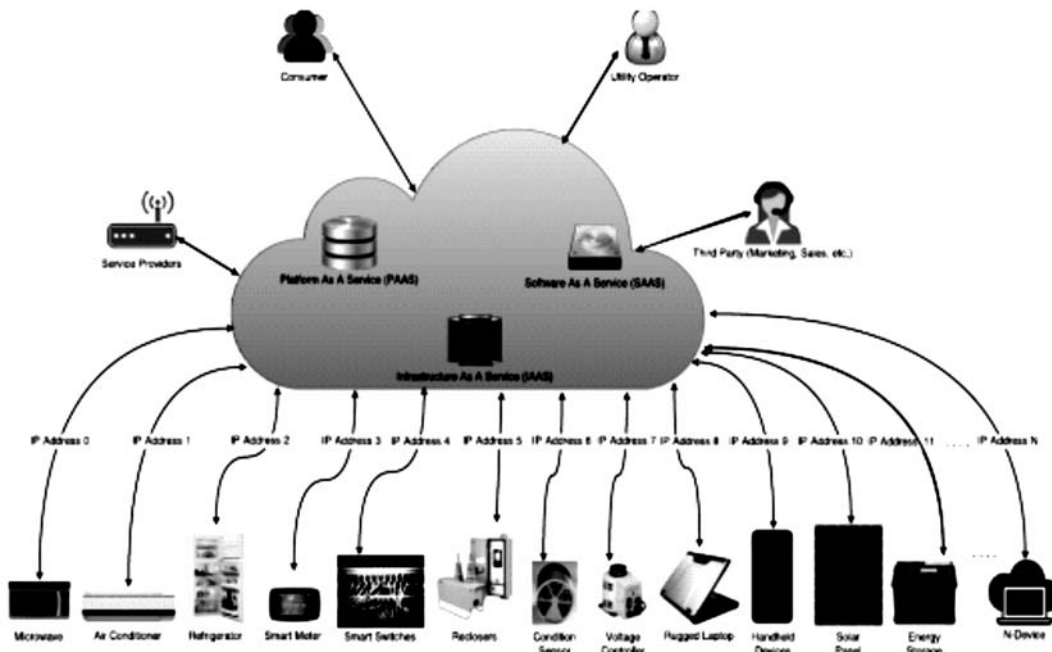
Fig. 3. The structure for smart grid applications frame in 6LowPAN [11].

4. CONCLUSION

In this paper, the theoretical model for smart grid within the IOT environment. Objects like home appliances and devices are used. Every object in this context contains unique IP address which is based on 6 Low PAN distributed protocol. Some of the contributions of other protocols are Bluetooth, WiMax, LTE, PLC etc. Thus our theoretical model works.

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