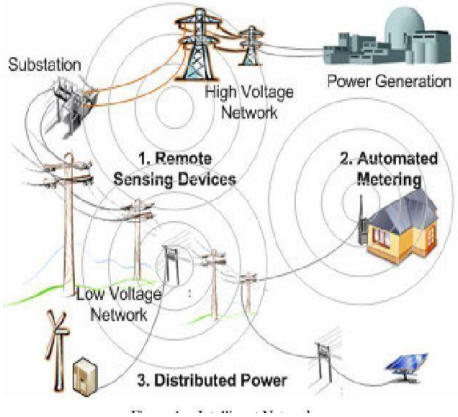

Figure 3.1 Implementing Smart Grid

3.4 Achieving the Communication using Wireless Network:

Communication between the devices is necessary for achieving the smart systems. Sensors use light emission and reflection techniques to detect objects without making physical contact with the object which makes it faster as well as dynamic communication. As we have seen in the previous section, sensors can be used for transferring data using wireless light emission technique. For implementing the automated meters, wireless techniques as wi-fi, zig-bee can be used to connect smart devices with the electric meter. Automated metering creates a home area network/personal area network ofsmart devices at home and the meter. It also helps intransferring data from user to generator and generator to user. It helps in providing two-way communication using wireless satellite communication. For the distributed power whenever the energy from any device is needed, the other devices needs to be informed with the requirement data which is achieved best by wireless communication. Unlike the wired structure, wireless structure is easy to implement and manage. Uninterrupted data transfer is the main challenge while using wireless communication which can be used using different security measures we will see in next sections.

4. Communication in Smart Grid

4.1 What Data to be Transferred

Smart Grid is all about managing the available resources efficiently and being able to handle peak loads properly. The main idea behind Smart Grid will be implemented if the correct data is transferred between consumer, distributor, substations and generators. The communication system should be able transfer real-time data. The data transferred between the system is in digital format. Now the question remains that what data is to be transferred between the system to enable the benefits of Smart Grid. The answer is as follows:1. Sending and Receiving the information about the electricity usage, generation, time consumed, nature of the use and cost required. This information is useful for the customer for managing their consumption and saving the cost. This can be achieved through automated metering and smart devices. 2. Data related to security threads should be transferred to avoid the attacks and threats tosecurity. Also, self-healing devices should be ableto detect the attacks and transfer the data so as to prevent similar attacks on other

devices. Cyber- Security Attacks can be prevented using this. 3. As we have seen in Chapter 2, Demand and Response data should be transferred between the consumer and generator to manage congestion. 4. Energy Transfer from the user to the network is also important as it creates multiple options of utilizing renewable sources of energy. 5.Data related to unintended events is transferred such as voltage spikes, irrelevant responses, errors while transferring data.

5. Architecture of Smart grid Wireless Model

5.1 General Idea of Architecture and Explanation:

A Home Area Network (HAN) is a type of network contained within a customer's house that connects customer's appliances and electrical vehicles to a single network. It also contains renewable energy resources and storage equipment to save the generated energy, as well assoftware applications to manage and control all these devices. Appliances are all devices in the house that can beattached to the electricity network, and they include a technology known as Smart Plug (SP), which allow appliances to communicate with other equipment. Anotherimportant device is the Plug-in Electrical Vehicle (PEV). Smart Grid should support the connection of large numberof PEV. So, this is a challenge that must be taken into account while designing a new network. Then, to control this network, the home is equipped with an In-Home Display (IHD). This is an interface between the customer and the HAN. It shows a list of all devices plugged in the network, and statistics about their energy consumption, allowing the user to send command to a specific device (power off), and visualize load equipmentdata in the home (such as air conditioner(AC), storage battery and EV) and controlling it properly. In addition, wefind the main component in the HAN: Energy Management System (EMS). It controls and optimizes the performance of energy generation, consumption and storage in the HAN. It delivers control commands or events from utilitiesto smart appliances, and gathers all types of information from HAN devices. So, to establish a secure communication connection between utilities and HAN, allHAN customer devices must register themselves firstly to EMS. In order to communicate with utility companies or any other entity that gives energy management services, HAN should be equipped with a gateway. The Energy Services Interface (ESI) plays this role, and routes data between the HAN and the NAN. Generally, the ESI is embedded in the Smart Meter device physically, but, it is logically separate from meter. In fact, the SM collects information about energy usage in customer side, as well as manages control services such as circuit disconnection. It is able to store the metering information internally, and send it to utility via ESI through a two-waycommunication. Multiple HANs can be grouped and forma NAN network. The NAN is the core of the Smart Grid. Itcollects sensed data from customers in a neighbourhood tosend it to an electric utility company after aggregation of the data. Sometimes, the NAN contains field devices suchas intelligent electronic devices (IEDs). In this case the NAN can be called Field Area Network (FAN). The trafficsent by Smart Meters is concentrated at Data Collection Unit (DCU) on the border between HAN and NAN. This equipment transfers the metering information receiving from a set of Smart Meters to equipment whose name is Head EndSystem (HES). This later is a central data collection point for AMI network. It receives data several times a day. Another main system in the NAN is the Meter/Load Controller. It routes commands, requests between the WAN and user side, and it is designed to perform demandresponse service. The last part of Smart Grid architecture is the WAN. It is a network with multiple systems and components connected to each other creating a complex architecture. It covers vast zone from NAN to controlcentre, and provides communication between the electric utility and substations. It also supports real-time monitoring, control and protection applications, which helpdetecting problems in real-time.

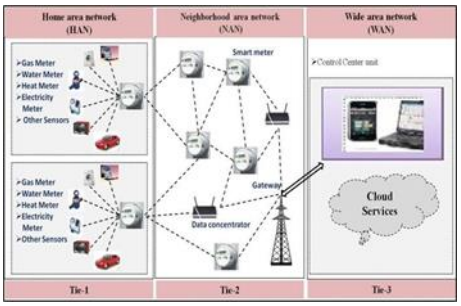

Figure 5.1 General Architecture

5.2 Flow of Data in Architecture:

As explained in the architecture, data is transferred from HAN to WAN and WAN to HAN as it is a two-way communication. The NAN acts as a mediator for datatransfer between HAN and WAN. The data flow in Smart Grid is two-way. Each network is connected within itself and to the other network using different wireless protocols.Flow of data/information is WAN to HAN and vice versa in architecture. Different gateways are used to interconnect the network. Also the efficiency of information transfer notonly depends on the distance between the sender and the recipient. Information passed from one node to the other can still get lost somewhere along the way, for example, anode that not cope with the fast data processing. Thetransmission rate of information depends on many parameters, for example: the network topology, place of data origin, brokering environment, fault tolerance and external interference or partial destruction of the network. The data flow should be secure and connection should be stable for efficiency.

6. Conclusion

Smart grid is next generation's grid which will help in many applications and making smart devices and reducingthe cost. Using wireless communication and network in Smart Grid will definitely help in managing the grid in easier way than wired network which is complicated. Alsocost of wiring complicated networks is reduced. Smart Grid will make our daily life more reliable and comfortable. Because of Smart Grid, now we will become smarter. Using wireless technologies, the implementation of Smart Grid covering the whole country will definitely succeed. Some of the problems of security for wireless networks needs to be addressed properly to make the system robust and compatible.

7. References

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