EMBEE NEIGHBORHOOD AREA NETWORK (NAN)

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Introduction

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Distributed renewable power through the use of control systems microgrid, energy storage and smart technologies needs efficiently manage decentralized electricity production. One of the important features of smart grid technology that makes it smart is the integration of bi-directional flow of information along with electricity, which can be used to provide effective and controlled power generation and consumption. The components of distributed generating that need control and monitoring are smart meters, inverters, batteries, DC coupled subsystem, ets., All of distributed components have different communication protocols from manufacturers and have different type supply AC/DC, DC/DC, DC/AC. One of challenge for NAN combines these components into a single communications network. The second task is to ensure easy, fast deployment and reliable operation with minimal cost for at least 20 years. Solutions provider for smart energy network offers different type of communication like 433MHz, 868MHz, Zigbee, PLC, WiFi, ets. Each of communication

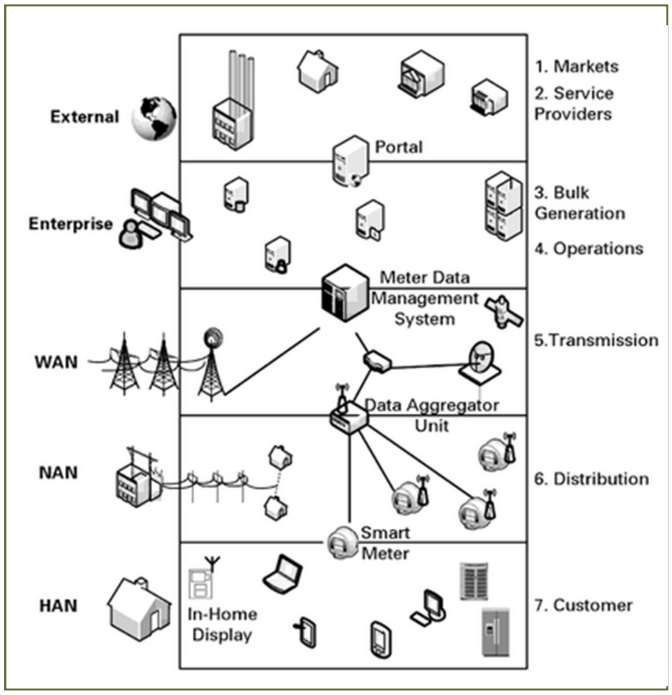

Fig.1 Overview of smart grid communication

technologies for NAN has advantages and disadvantages to a greater or lesser extent. The advantages and disadvantages of communication technology can compensate for the technological and organizational. Company Embee Ltd found midway among the many technologies that meets the simplicity, reliability and low cost.

Embee mesh network is reliable, low cost, large scale NAN

Embee Company is manufacturer of large scale **Zigbee wireless mesh network** for AMI, Self-healing Grids, Microgrids, Demand Response, Distribution Management Systems solutions.

Embee NAN as Product is reliable, with transparent network layer, ready to use communication for Smart Grid, Microgrid solutions. The Embee NAN allows you to combine in single wireless radio network: smart meters, inverters, batteries, a variety of energy storage devices that have an interface RS485 or another.

Fig.2 The components of mesh network is Embee modems with embedded software and AT command and Data aggregator unit with Ethernet/3G communication to WAN.

Embee NAN is reliable

Embee NAN as Product had tested and debugged during 2 years. (see Fig.3). The program of testing NAN included about 150 points. Today Embee NAN ensures 100% communication in the mesh network between devices. Often it can be seen that the communication technology 433MHz, 868MHz, 928MHz use a star topology, with increased output power and extend beyond unlicensed band. Embee NAN uses Ember (Silab) Zigbee stack with **200 hops** and **every minute route change**. These two advantages Embee NAN override the lack of weak radio propagation inherent in that range 2,4-2.48 GHz. We debugged addressing probabilistic algorithm, which allowed us to get away from the problem of poor propagation "point-to-point" in Embee mesh network layer.

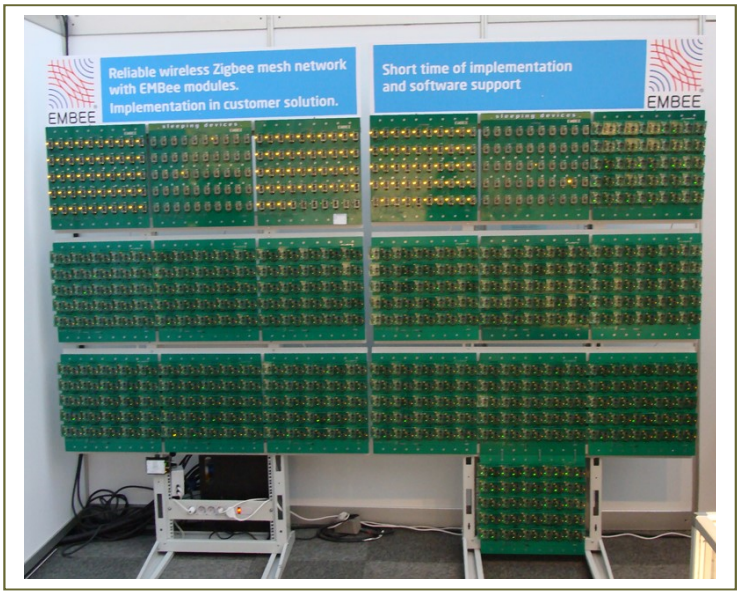

Fig.3 Embee NAN 1000 nodes per coordinator at the exhibition in Amsterdam (2012)

Embee NAN easy implement, fast deploy, no maintenance

The component network and point of entrance in Embee mesh network is Embee modem with UART, 12 ports I/O, full transparent API mode for any protocols of different devices (smart meters, inverters, batteries, ets.). Data aggregator unit (Data concentrator) with Ethernet/3G communication to WAN, switches between protocols of devices one network.

Average time of data reading one electricity meter in the network 50-200 pieces is about 3-7 sec.; 300-600 pieces is about 10-15 sec; 1000+ is about 20 sec. per smart meter. The coordinator of network sends very fast broadcast "one-to-all" (about 2-3 seconds).

The distance between distributed devices in network 200-800 meters in urban-suburban territory and 20-30 meters at home.

Output power of module is 2 or 100 mW.

The user can select any address format with devices in a Embee radio network. It can be either a numeric or string format. The user selects addressing format in step integration Embee radio module to the network device.

Embee network easy deploy.
For example in AMR/AMI solution:
- Install smart meters to customer.
- install Data concentrator in any place of mesh network.
- Install secure parameters of mesh network from WAN.
- Install communication link with Data Concentrator through Ethernet/3G.
- network ready to use.

«Embee mesh network has largest pilot 3860 pcs smart meters per one Data concentrator in suburban city. From 2010, Embee has 120 000 pcs installed smart meters in AMR solutions».

Radio propagation is not a problem for Embee NAN.

Fig. 4 The smart meters is in the metal cases along the street without external antennas. Distance between metal boxes is 40-50 meters.

Fig. 5 In the metal box is 4 smart meters with integrated Embee modems. Modems have chip antennas. Output power of modems are 100mW.

Fig. 6 The smart meters install in metal box in ferroconcrete wall at 5 floors (4 porches).

Fig. 7 Embee modems integrates in smart meters. Output power of Embee modems are 2 mW.

After smart meters and data concentrator are installed, the Embee mesh network ready for communicates within 5 minutes.

In one Embee NAN can communicate different devices: Smart meters, invertors, battery, home IoT devices.

The first Embee mesh network works reliably for more than 7 years.

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