Home Smart Metering

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A. Background

The introduction of intelligent metering systems is promoted by the European Union through different recent legislations which should lead to a wide rollout of electricity and gas meters offering additional functionalities .Smart meters are intelligent digital energy meters that allow remote readings and make energy consumption for the user transparent and directly manageable. The function of a smart metering is divided to three steps: Data producing, Data transferring and Data processing.

Automated meter reading (AMR) and more recently smart metering (which can be defined as a system which provides two-way (or bi-directional) communication with the customer's meter) offer the prospect of radically changing the relationship between the customer and the supplier.

The immediate feedback of consumption and other information available from smart meters is widely expected to make customers more aware of their consumption and so encourage energy conservation. In the case of electricity, there is also the possibility of time-of-use tariffs, which can be used to encourage load-shifting to cheaper, off-peak periods.

B: Aims

In this article at first we describe Smart meters‹then we survey three methods with advantages and disadvantages of them and select the best of them.

C. Methods

C.1 Counter Operation

Our meters have a Magnet that is placed in the first digit of the counter and Read switch transports rotating information of the counter to a digital module.

C.2 Counter Specifications

Meters have some characteristics witch are selected under the project's conditions, and are following:

• Easy Installation

• Having a LED as a power consuming indicator for meter testing

• Capability of saving different parameters (Control Alarms, encryption key and multi- tariff tables)

 • Capability of operating with multi Tariff

• Having Watchdog timer to prevent anything can cause the system to hang

• Temperature correction

C.2.1 Digital Counter Specifications

Digital part of meters should be adopted by following conditions:

•Tamper detection by sensors and saving date and time of tampering

•Having Watchdog timer to prevent anything can cause the system to hang

•Having nonvolatile memory

•Making an RF communication with collector in 868-870 MHz frequency band

• Having mesh protocol to communicate with other devices in the network

•Long battery life- time – 15 years

•Proper to sever climate

•Capability of calculating average of daily consumption in every 15 minutes and registering the maximum of consumption average with time and date to identify the exceeding

C.3 Data Transferring (Fixed Network)

In this method the communicational module with short or long range is added to the meter, fixed network is installed in the covered zones & the meter is read distantly. In this structure the gas company can read the meters daily from far distances without needing to individuals to read & issues the bills in desired periods and determined days.

By this way consumers not only are able to see details of their bills but also can monitor the warnings & consumption diagrams daily & on-line from a control center.

C.3.1 Mesh Topology (Remote Reading network model)

In this topology, meters are connected to each others and send their data to neighbor meters, in next stage data are sent to collector before they are transmitted to control center.
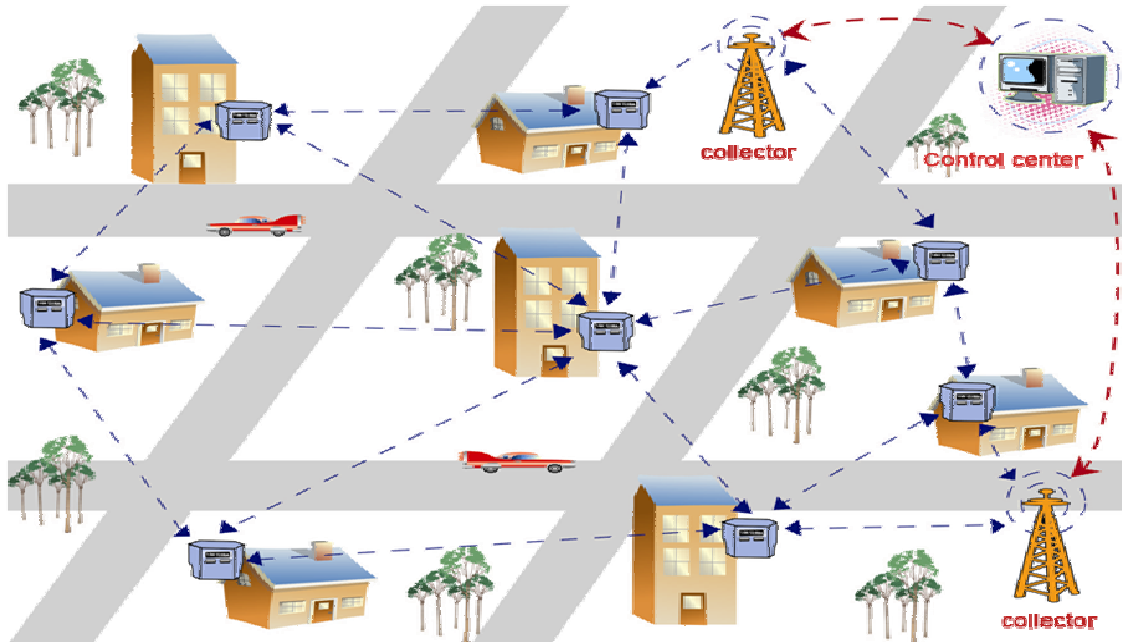
Fig 1- Mesh Topology

This topology has some Advantages and disadvantages
Advantages:
• Low Implementation costs

• Low Maintenance Costs

• Using ISM band

• High security (AES-128)

• Network Long life-time (because of Low consumption of different devices)

• Low dependency to communication infrastructures

• Having bidirectional communication with other meters

• Capability to create a Real time communication with meter

Disadvantages:
• Dependency of nodes (meters) on neighbor operations

• Having more delay than stand alone topology

C.3.2 Stand Alone Topology (Remote Reading network model)
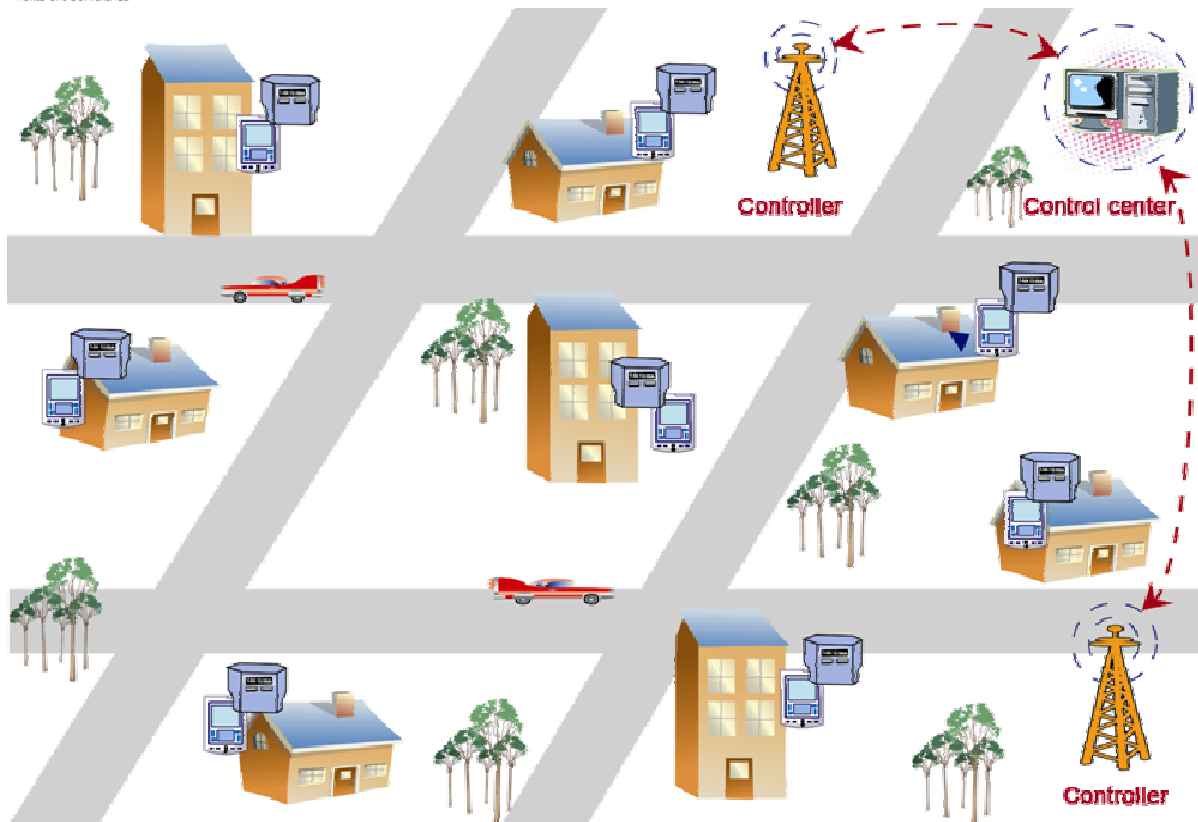In this topology, meter sends their data to collector directly, then data are sent to control center.

Fig 2- Stand Alone Topology

Advantages and Disadvantages of Stand alone topology
Advantages:
• Having less delay than mesh topology

• Having bidirectional communication with other meters

• Capability to create a Real time communication with meter

Disadvantages:
• Having more power consumption than Mesh topology

• Dependency on communication infrastructures

• Having less network life-time

• High Implementation costs

• High Maintenance Costs

D. Results
The result achieved by remote home smart meter project shows that stand alone topology is more efficient because of each node (meter) operate independence of others, and data are protected from missing in meters communications.

E. Conclusions

It is clear that smart meters play a pivotal role in smart grids and it is hard to overstate the importance of this development.

In low population density area first structure (mesh topology) is better due to reduction of collector's numbers and decrease the primary cost.

These advanced metering systems, initially considered in electricity but applicable also to gas, can transform metering and billing by eliminating manual meter reading and estimated bills, enabling real-time, accurate billing. They minimize the need to visit customers' premises and may also offer improvements in customer switching and other operational activities. For example two-way communication can assist in the identification of fraud.