



Sensus FlexNet[®] Head End

Regional Network Interface (RNI) Differentiators

It is difficult to directly compare Advanced Metering Infrastructure (AMI) networks given the difference in topologies, protocols and even their history. Functionally, they all deliver AMI data from metering devices and provide the ability for on-demand reads and commands. In comparing mesh systems, you would find many similarities in both deployment methodology and the structure of head end systems (HES).

Trying to compare a mesh network to the point-to-multipoint Sensus FlexNet[®] communication network is difficult. The systems are fundamentally architected differently—a direct comparison of head end sizing and functionality yields considerable differences. These systems diverge on how they manage operations from end to end, and the multiple applications that use the AMI network as their transport.

Data Routing

In a mesh architecture (utilized by Itron, Silver Spring Networks, Landis+Gyr and Elster), data routing to and from collectors to endpoints is determined by the elements in the network. Information is stored in these elements, essentially distributing the “brains” of the network. This enables the network to be “self-healing,” which means when an element loses connectivity, it has already stored its next path to a collector. This nondeterministic routing implementation can be troublesome during very large and/or lengthy power outages, as the network elements must rediscover their routes. Recovery can take several hours, where the network is in a stand-by mode while routes are determined. This routing methodology also requires each message to contain information, decreasing the amount of application data. This becomes even more inefficient as each message is repeated multiple times to get to its intended target meter, decreasing data rates by $1/(\text{number of hops})$ with each hop. The expressed data rate is only deliverable on the first hop, and much of that is taken up by overhead.

In a point-to-multipoint architecture used by Sensus, routing is very deterministic. All endpoints transmit their data and all collectors that receive the message pass it to the head end system. No routing is required, but a log is maintained as to the communication statistics and the collectors that each endpoint uses to communicate. The HES maintains the routes through the collector to the endpoints, and can try multiple collectors to communicate to the endpoint if required—but does so in an efficient serial manner. When an outage occurs and power restoration happens, the system is already completely operational as the network elements do not need to determine their routes. The HES maintains the endpoint connectivity providing the utility with instant capability to communicate (ping) the meter to verify power restoration. In most cases, because there is no inbound routing, the restoration messages are received in over 95 percent of the cases. As each endpoint communicates directly with



the collector, there is no extra overhead required for routing, and the expressed data rates apply to every endpoint.

From a HES equipment sizing perspective, mesh requires less hardware as it does not have to keep track of the routing. Instead, it is distributed throughout the network. The issue with this model is that it is operationally inefficient and in stand-by during critical times, making it less robust in times of emergency.

Data Transport and Prioritization

Mesh systems work in the Industrial, Scientific and Medical (ISM) unlicensed Federal Communications Commission (FCC) spectrum which is shared not only with other mesh system providers, but with Canopy broadband systems, baby monitors, garage door openers, security monitors and many other devices. Because of this, the mesh network uses the same frequencies to transmit and receive, essentially making it a shared data pipe that is half-duplex. This creates system data transport inefficiencies, but simplifies the HES as it only requires scheduling data transmission and reception.

Sensus' FlexNet network uses FCC primary use licensed spectrum which is delivered in channel pairs. This means that there is a dedicated channel for up-link communication, and a parallel channel for down-link communication. Both links operate simultaneously, making the system full duplex. Sensus deploys multiple channels of spectrum for each customer, allowing each application on the network to utilize dedicated application channels. This also enables each application to prioritize its messaging independently of others. A major advantage for increasing system capacity, you can add new applications and maintain high performance of each application over the life of the system. This architecture does require more HES hardware to manage the different applications and channels across the network, but also provides an enterprise system that is built for meeting utility needs now and in the future.

Data Acquisition Efficiency

Mesh systems are efficient in that the HES receives messages from a single collector for each endpoint in the network. They are inefficient given they must repeat that same message multiple times across the network for it to be received by the collector and passed to the HES. The same applies to transmitting a command from the HES to a meter; it must navigate multiple meters to get to the intended recipient in most cases. This enables the HES to be sized smaller as it does not have duplicate data to deal with, but does require data to be pushed more often throughout the day. Mesh systems also rely heavily on the meter data management system (MDMS) to be the gatekeeper in determining if there is missing data and requesting data backfill.

In a FlexNet system, all data that is received by the collectors is passed to Sensus' HES. Data can be duplicated in the HES as many times as the network has redundant coverage for the endpoint. This is a very robust and efficient mechanism for collecting data, as it provides the highest probability of receiving every message, greatly reduces the need to backfill data with additional polling, and provides a robust network as each endpoint has multiple communication paths to and from the HES. This methodology does require more processing capability at the HES to eliminate redundant messaging, but it is highly effective in getting the data faster with much less data missing. The Sensus HES also does much of the heavy lifting in ensuring that the data are complete before sending to the MDMS, which also requires more processing than mesh systems. This is important when it comes to meeting billing deadlines, and when powering pre-payment, demand response and customer portal applications.

Managing Multiple Applications

Mesh systems have been architected around electric metering and HAN (Home Area Network) applications with little ability to truly manage gas, water, distribution automation, lighting controls and



other applications due to inherent issues in reaching any endpoint and the lack of prioritization within the network.

Sensus' FlexNet system is architected to support electric, gas, water, distribution automation, lighting controls and many other applications meeting and exceeding the requirements for each, as they can be managed independently across the same infrastructure. This does require additional HES complexity and hardware to provide the specialization each requires to be industry-leading, but enables each application to stand alone with significant ROI within a utility, campus or municipality.

Summary

Millions of smart meters have been deployed using both point-to-multipoint and mesh technologies, and are delivering on their initial intended purpose effectively. Sensus FlexNet is differentiated by its ease in adding new applications to the existing deployed infrastructure, increased bandwidth over time, robustness during catastrophes, and in protection for the life of the system via FCC primary use licensed spectrum. These advantages were architected at the inception of the FlexNet System for which the HES plays a critical role.



8601 Six Forks Rd, Ste 700
Raleigh, NC 27615
1-800-638-3748
sensus.com

©2017 Sensus. All products purchased and services performed are subject to Sensus' terms of sale, available at either sensus.com/TC or 1-800-638-3748. Sensus reserves the right to modify these terms and conditions in its own discretion without notice to the customer.
The Sensus logo is a registered trademark of Sensus.

THIS DOCUMENT IS FOR INFORMATIONAL PURPOSES ONLY, AND SENSUS MAKES NO EXPRESS WARRANTIES IN THIS DOCUMENT. FURTHERMORE, THERE ARE NO IMPLIED WARRANTIES, INCLUDING WITHOUT LIMITATION, WARRANTIES AS TO FITNESS FOR A PARTICULAR PURPOSE AND MERCHANTABILITY. ANY USE OF THE PRODUCTS THAT IS NOT SPECIFICALLY PERMITTED HEREIN IS PROHIBITED.