



Bringing AMR and AMI Systems into a Smarter Grid

A safe path that protects investments while migrating to a smart grid infrastructure

Overview

Utilities throughout the world have invested hundreds of millions of dollars over the last few decades to deploy Automatic Meter Reading (AMR) systems to collect billing information from electricity, gas, and water meters. More recently, utilities have begun to invest comparable amounts in deploying Advanced Meter Infrastructure (AMI) systems that can send more flexible Time of Use metering data to the utility's data center — a good step toward a smarter grid. While useful, these single-application systems weren't designed to be integrated with other devices and applications to deliver the information needed to build a smarter smart grid. And replacing these solutions before the end of their useful life is usually not an option. Without a way to integrate the information from these systems into the next-generation smart grid infrastructure, some utilities are considering delaying or scaling back their smart grid plans.

Echelon provides an innovative solution for utilities to integrate their AMR and AMI meters into a smarter grid with the introduction of the Echelon Control Operating System (COS). Built on Echelon's 20 years of proven, trusted, and unmatched experience in control networking and software innovation, COS provides an open, secure multiapplication framework that hosts much-needed smart grid applications. Taking advantage of the intelligent distributed control capabilities of the COS platform, COS apps can integrate information from many different types of devices and deliver control at the edge of the grid

— the critical point where the distribution network connects with customers.

COS runs on Echelon's Edge Control Node (ECN) 7000 series of open, extensible hardware installed at the distribution transformer. The ECN 7000 series hardware is ruggedized and purpose-built for integrating any asset into a smarter grid by providing open, published interfaces that let third parties develop additional hardware components for it. Any electricity, gas, or water meter, whether AMR or AMI, can be supported with a third-party expansion card installed in the ECN. Now, instead of replacing entire AMR or AMI infrastructures, utilities can simply change an expansion card in the ECN to support any deployed technology, now and as it changes in the future.

Seamless Migration Path to a Smarter Grid

The ECN can seamlessly integrate AMR and AMI systems to enable a smarter grid. For utilities with drive-by AMR systems, the ECN provides a common network infrastructure for transporting meter data to the enterprise that eliminates the costs of the drive-by system. The utility can continue to operate existing meters and, if desired, replace them gradually over time with more capable meters that provide additional smart grid-oriented data (such as phase, power factor, reactive energy, and total harmonic distortion) that can be used by COS apps to provide additional valuable services. For all communicating meter types, regardless of how smart they are, the ECN enables meter data to be

used locally as well, to improve many aspects of the edge of the grid. For example, consumption information might be used by a microdistribution management app. Or, voltage information available from an AMI meter could be used as part of a volt/VAR control optimization app.

Open, Secure, and Extensible Hardware

The ECN provides an open, secure, and extensible hardware platform designed to meet the needs of utilities today and long into the future. To support AMR and AMI system integration, the ECN was designed from the ground up to support wireless transceivers and antennas commonly used in these systems. Up to nine antennas are supported, and four of the six available expansion slots include an extra layer of RF shielding to provide a quiet RF environment that optimizes the performance of the radio.

The ECN also provides built-in connectivity to a wide variety of devices, including power line networked devices for utility use (CENELEC 50065-1 LV PLC), as well as commercial and consumer devices (ISO/IEC 14908-3 LV PLC). A number of other connectivity options are available, such as Ethernet, 2.4/5GHz IEEE 802.11bgn (Wi-Fi) access point and Node-to-Node network, ISO/IEC 14908-2 twisted pair network, serial ports for connecting to DNP/DNP3 distribution automation devices or any other device with a serial interface, and digital I/O interfaces.

A community of third-party hardware developers use the published hardware and software interfaces to create function- and geography-specific expansion cards, whether wired or wireless, to meet any integration need. The ECN is thus a flexible platform that preserves investment, allows greater value to be extracted out of those investments, and enables new systems to be seamlessly integrated in the future.

Unleashing the Power of Apps

As an application-ready platform, COS empowers a new generation of application development that can share data from every device, over any protocol, at the last mile of the grid — so utilities can protect assets deployed today long

into the future and reduce costs. Like loading apps onto a smart phone, utilities and their partners can quickly build and easily deploy applications to preserve their investment in AMR and AMI systems while migrating to a smarter grid.

Utilities and their partners can rapidly develop COS apps using the COS SDK. Echelon also provides comprehensive training and support to ensure development efficiency and app quality. Scalable COS management software running at the utility operations center lets utilities deploy new apps to ECNs in the field quickly and easily.

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This rich development and management environment promotes an ever-growing selection of applications developed for the COS platform. Instead of replacing an asset, utilities will be able to respond to new needs or opportunities by simply adding a new app, upgrading software, or adding new hardware to the ECN.

The Power of Intelligent Distributed Control for a Smarter Grid

COS apps running on the ECN can collect information from and manage any device, communicating over any protocol, with intelligent distributed control embedded throughout the edge of the grid to enable local autonomous decision-making in nearly real time. For example, an COS app could simultaneously confirm wire integrity using the low-voltage power line signal strength, power quality, and distortion parameters, letting utilities quickly validate restoration of service to a consumer without having to visit the premise.

COS apps can not only share data with other apps locally, but also with apps on other ECNs using the optional Wi-Fi Node-to-Node network. This gives utilities the unprecedented ability to know what's happening across many low-voltage grids and onto the medium-voltage network. And it provides improved reliability, survivability, and faster response time — all at a lower cost.

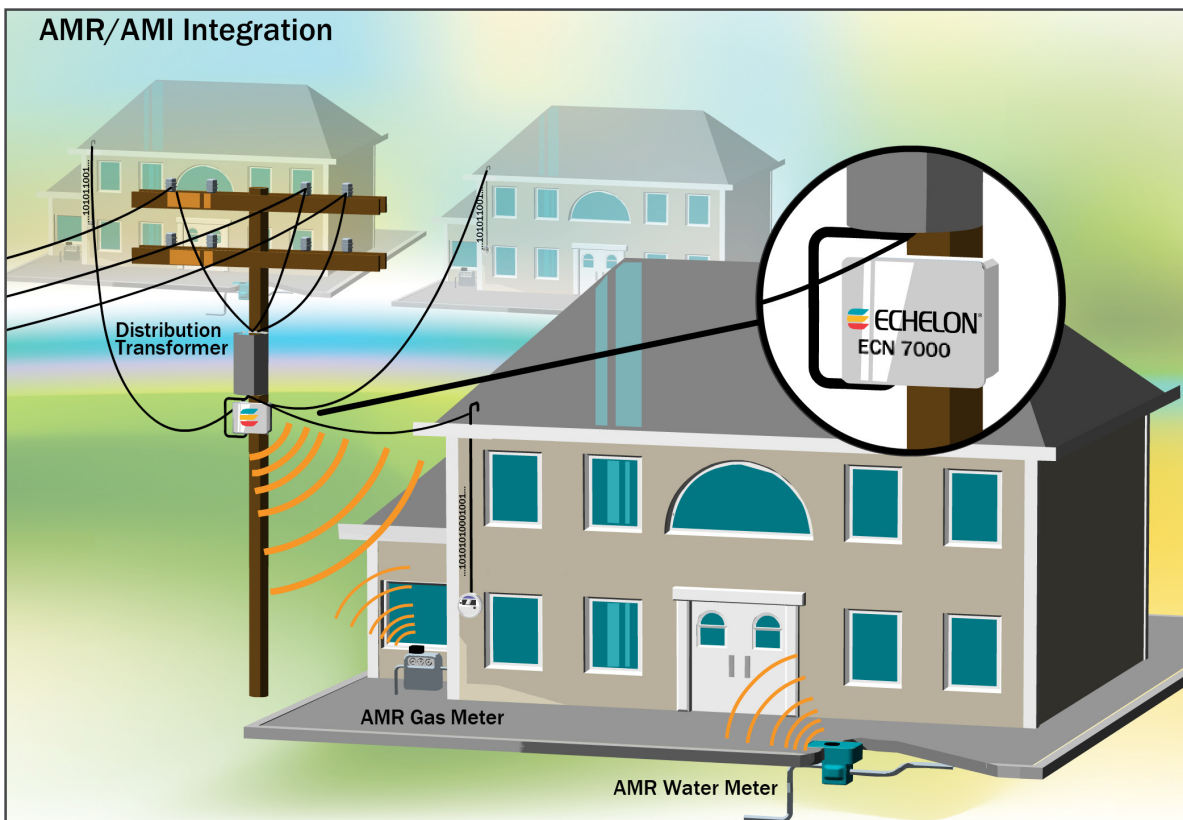
How It Works

COS enables the distribution of mission-critical intelligent control to the edge of the grid by providing a secure, managed framework for third-party COS apps that integrate AMR and AMI systems. These apps eliminate the costly AMR drive-by systems, preserve investment in AMR and AMI, and allow the collected data to be repurposed to solve emerging grid problems directly, out at the edge of the grid. Here's how this solution would be implemented by third-party COS apps running on the ECN:

1. An AMR/AMI receiver/transceiver expansion card is installed into the ECN. (In the case of the ECN 7650, the antennas can also be installed inside the enclosure.)
2. An COS driver communicates with the AMR/AMI expansion card and expresses AMR/AMI data as data points.
3. The built-in Data Logger app logs the received data, creating a load profile. Many redundant meter reads are received by a single ECN every day, so the Data Logger is configured to record meter reads only as frequently as needed, both locally and for the meter data management system.
4. Since the AMR/AMI meters are likely to be in communication with more than one ECN due to the proximity, meter reads are likely to be redundant across

multiple ECNs in the area. The Meter Data app performs de-duplication of the meter reads both locally and with the Meter Data apps running on other ECNs in the area using the Wi-Fi Node-to-Node network. The Meter Data apps do this by performing an election, and then one of them consolidates the meter reads from the data logs.

5. The consolidating Meter Data app uses the built-in Data Transporter service to send the consolidated data package to the meter data management system only as often as required. This conserves network bandwidth and reduces transmission costs, as well as reduces data processing requirements at the operations center.
6. The electricity meter data points are also shared with the Microdistribution Management app to coordinate power usage on the low-voltage network.
7. The Outage Management app would also use the shared electricity meter data points to detect and report small-scale electricity outages to the outage management system at the operations center. The app also coordinates with the outage management system to speed the confirmation of service restoration. It does this by verifying that meter reads are again being received from the electricity meters.



With the application-ready COS platform powering the open and extensible ECN 7000 series hardware, utilities can now deploy a new era of smart grid applications that leverage existing AMR and AMI assets while moving forward with their smart grid projects.

Enabling a Smarter Grid and Improving Customer Experience

Stranded assets hurt both utilities and consumers. But the world's energy needs have changed and utilities must evolve rapidly to meet new stresses that the grid was never designed to handle – from electric vehicle fast chargers and intermittent customer-owned renewables to community energy storage. By integrating existing AMR and AMI assets into a smarter grid, the COS platform lets utilities leverage data from these systems long into the future. This eliminates the burden on utilities – and, ultimately, consumers – to pay for replacing fully functioning and productive assets before the end of their useful lives.

Now utilities have a safe path forward to smart grid projects that can lower consumer energy bills and provide new services. Fewer stranded assets, happier customers, and a more intelligent grid: That's the power of control at the edge of the grid, delivered by COS apps running on the ECN.

For more information about Echelon and our smart grid solutions, call +1 408 938 5200 or visit us online at www.echelon.com.

