



Improving Billing and Load Management Communications For Energy Meter Manufacturers and Service Providers

By Ajai Gambhir
Software & Systems Technology Division
Analog Devices, Inc.
September, 2001

INTRODUCTION

Deregulation, new technologies, energy shortages, price increases, heightened attention to conservation and increased global competition are all causing sweeping changes to the utility industry, in both residential and commercial sectors. These changes heighten the importance of load management and motivate consumers to change their usage patterns to balance the loads. To efficiently adapt to these changes and facilitate load balancing, utility companies and their customers require new management and control capability. Advanced communications techniques can provide these new capabilities and improve operating efficiency.

To enable efficient management and pricing of energy distribution, Energy Service Providers (ESPs) or utility companies must adopt new systems to help them monitor and improve the service quality, billing, billing lead-time and dissemination of detailed information about usage patterns. Consumers in this increasingly competitive and changing market need to understand their own energy usage patterns, meter faults, and other related information within sufficient time to be able to modify their usage pattern and balance their own loads.

Moreover, the ultimate aim of any utility company is to improve profits while providing an excellent level of service and customer satisfaction. In particular, the expense management of such a company depends significantly on the way they manage their billing. Improving the quality of billing can certainly improve customer satisfaction.

In certain parts of the world, one of the most common problems that a service provider faces is access to the metering units for meter reading and timely billing. The problem of accessing the meters could be related to location of the meters inside a locked building, the distance between the buildings or the meter reader's reluctance to travel to each individual apartment or house, resulting in estimated or delayed billing.

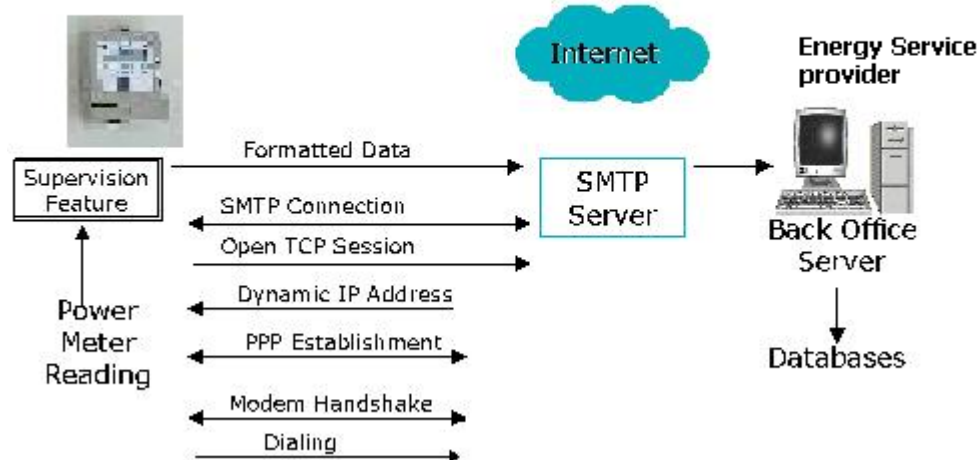
ADDING COMMUNICATIONS TO METERING

Analog Devices' single-chip Internet-enabled modem helps in adding this communications to energy meters.



Internet Enabled
Meter at Customer
Premises

Internet
Service
Provider



An Internet-enabled modem within a meter helps communicate the billing information periodically, enabling the service provider to not only generate timely bills, but also to understand energy demand patterns, failure and tamper identification. In addition, it enables the utility to offer energy at lower tariffs by adding the total demand of groups of companies or users.

The Internet-enabled energy meter can automatically:

- ❖ Upload the consumption directly from the meter to the service provider's database
- ❖ Upload fault and tamper information to the service provider
- ❖ Optionally download the actual billing data to the meter (and to the customer)

KEY BENEFITS TO THE END USER:

- ❖ A consumer pays the utility or service provider with the exact amount as per the regularly uploaded billing data.
- ❖ The meter reader does not intrude upon the privacy of the consumer.
- ❖ The service provider is automatically notified of power failures so that faults can be rectified in a timely manner.
- ❖ Timely information on usage patterns facilitates load balancing, which can both lower energy costs and prevent blackouts and brownouts during peak demand periods.

KEY BENEFITS TO THE SERVICE PROVIDER:

- ❖ The electricity demand patterns can be monitored regularly.
- ❖ Triggers can be set to prompt the supervisory staff to enunciate alarms if and when the energy consumption pattern is abnormal.
- ❖ The service provider can easily control the distribution of power on the grid based on demand information.
- ❖ Billing costs are reduced at the same time that their accuracy increases and their delivery time quickens.



KEY BENEFITS TO THE MANUFACTURER:

- ❖ Value addition to the meter manufacturers at minimal cost increase.
- ❖ Complete Internet connectivity with various protocols already built into the firmware
- ❖ Easy integration with the meter hardware and software.

DESCRIPTION:

Analog Devices' single-chip Internet-enabled modem enables original equipment manufacturers (OEMs) to modify existing energy meter designs to add Internet communications capability quickly and easily. The single-chip Internet modem includes an engine that executes the modem and stack protocols for Internet connectivity. SmartStack[®] integrates a software modem, TCP/IP stack and client application on a single chip, implementing the Internet link, network, transport and application layers.

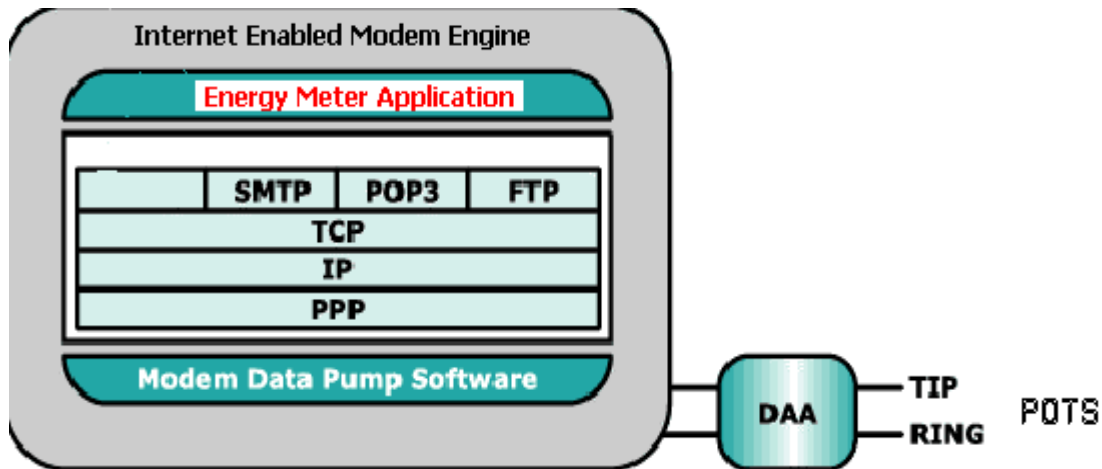
The host processor on the meter executes commands to control the single-chip Internet modem, and does not have to execute the Internet protocols. The energy meter can be programmed to periodically dial the Internet service provider and email the energy consumption data to the pre-assigned address or location. During this process, depending upon the options set by the utility company, the meter may also be reconfigured for various parameters including access, password protections, tariff, and demand settings.

To keep system costs low, the modem and the Internet protocols are executed from the on-chip memory. An external FLASH memory stores the object code and various other configuration parameters.

Analog Devices' technology partner eDevice has integrated V.32bis/V.34/V.90 modem software, Internet protocols (PPP, IP, TCP, SMTP and POP3) and the project-specific supervision level in a single chip.

This off-the-shelf design contains the design documents and the related software, and is currently available. Support by Analog Devices and its partners can help OEMs to create an inexpensive Internet-enabled energy meter within a short span of time and with minimal resources. Designs for Internet-enabled Energy meters are also available from Analog Devices.

To learn more about Internet-enabled modems, applications and technical specifications, send Email to Ajai Gambhir at ajai.gambhir@analog.com



TECHNICAL SPECIFICATIONS

Chip-set packaging

The complete design including the modem and the DAA (telephone line interface) is composed of:

- One DSP (100-pin TQFP)
- One FLASH memory [1, 2, or 4 Mbits, depending on the modem speed, the protocols selected and the application] (TSOP 40 or TSOP 48 or PLCC 32)
- The DAA

Internet protocols available

PPP
IP
TCP
SMTP
POP3
FTP

Modem data rate

14,400 bps (V.32bis)
33,600 bps (V.34)
56,000 bps (V.90)

Electrical and environment characteristics

Operating voltage: 3.3 V or 5.0 V
Power consumption: < 50mA (typical, 3.3 V, connected)
< 8mA (typical, 3.3 V, idle)
Commercial operating temperature range: (0° C to +70 °C)
Industrial operating temperature range: (-40 °C to +85 °C)



Countries of operation

Argentina, Australia, Austria, Belgium, Brazil, Bulgaria, Canada, Chile, China, Cyprus, Czech Republic, Denmark, Finland, France, Hungary, Germany, Greece, Iceland, Ireland, Israel, Italy, Japan, Liechtenstein, Luxembourg, Malaysia, Mexico, the Netherlands, New Zealand, Norway, Philippines, Poland, Portugal, Singapore, Slovakia, Slovenia, South Africa, South Korea, Spain, Sweden, Switzerland, Taiwan, the United Kingdom, USA, etc.

DEMONSTRATION / EVALUATION PLATFORM

The evaluation platform includes sockets for a serial connection, a DB-9 connector RS-232 input, an RJ-11 connector for telephone line connection, a power supply (9-12 VAC modular wall transformer), and power-on reset circuitry. It also includes a full TCP/IP stack from Analog Devices' technology partner eDevice and modem software from technology partner Telindus.

Ordering Information

The price of the evaluation platform is US\$200. It includes the single-chip Internet modem, an evaluation copy of SmartStack, which includes the Telindus software, and schematics. It does not include the energy meter hardware or software. Designers of products using this reference design will be required to sign a license agreement with Analog Devices before the final product can be shipped to them. The final product will be shipped from Analog Devices and will include the modem chipset and software.

SmartStack is a registered trademark of eDevice, Inc.