THE AMI FUTURE

By Elena Turanscaia

It appears that the AMI future that was looked forward to with such impatience and that was debated at such length is already here. It confidently enters our lives in the form of standards (some of them already accepted, others still being developed), innovative technical solutions and even as the first successfully implemented projects. A harmonious, self-sufficient and quite general concept is being formed little-by-little out of these separate fragments. The one who would be among the first to discern its principal features and add them to their armoury can fully expect to be in the dominant position in the field of AMI during the nearest decade.

So what are the basic elements of the broad AMI concept? We will try to explain our vision concerning this development in general terms.

The cornerstone of AMI is undoubtedly data exchange between different components of the system. In order to put this requirement into perspective, consider the following question: "How do I see a perfect data transmission network for AMI?" Your answer will undoubtedly include the following points: data transmission over long distances, communication in two directions, openness, scalability, support of a dynamically changing structure of the metering system, reliability, etc. As a result your imagination will draw a picture of a miniature, Internet-like network, bounded by the AMI's operating zone. And this is, naturally, the protocol stack TCP/IP, which is already the standard for the "global net", and will probably remain the uncontested standard for remote message delivery for a very long time to come. This is precisely why, for example, the TCP-UDP/IP profile is recommended by the DLMS/COSEM User Association as one of the two basic communication profiles for electricity metering systems.

In the Internet network, the protocol stack TCP/IP is realised over the so-called public communication network and is accessible for a wide number of subscribers, while the company providing the communication services addresses support of this public network. It would seem that this is the easy way of solving the remote data exchange problem, when each end-point device (meter) becomes a subscriber. However, for economic reasons, it is unreasonable to transpose such an approach on the AMI field in the large scale. Otherwise, the utility supplying electricity (or water, gas or heat) would permanently support at its own expense a large number of stationary or mobile public network "subscribers". This is not a very optimistic perspective for, for example, a multimillion dollar city.

A more rational approach would be the combined use of public environments for data transmission over large distances and free, specific environments on the "last mile" site. Mass access to the network by the end-point devices is carried out exactly through these specific environments and this is why it does not incur any notable operating costs.

"Could one imagine a more rational solution than TCP/IP being realised PL?"

These trends can be found, most clearly and naturally, in the field of electricity metering. Here the "specific environment" suitable for data exchange that was present from the beginning was power line (PL). Could one imagine a more rational solution than the one where the most popular protocol stack, i.e. TCP/IP, is being realised over the natural physical environment, i.e. PL?

At present the DLMS User Association is working intensively on the development of Lower Layers Communication Profile for Power Line Carrier. It is expected that the developed Profile will be able to transport both DLMS traffic and TCP/IP traffic and that it would be able also to use several modulation techniques like S-FSK and MCM/OFDM. After the acceptance of this standard all the manufacturers would be able to propose open, interoperable solutions to their customers. However, and in spite of the absence of the accepted standard, some manufacturers have already developed and are now using appropriate technical solutions.

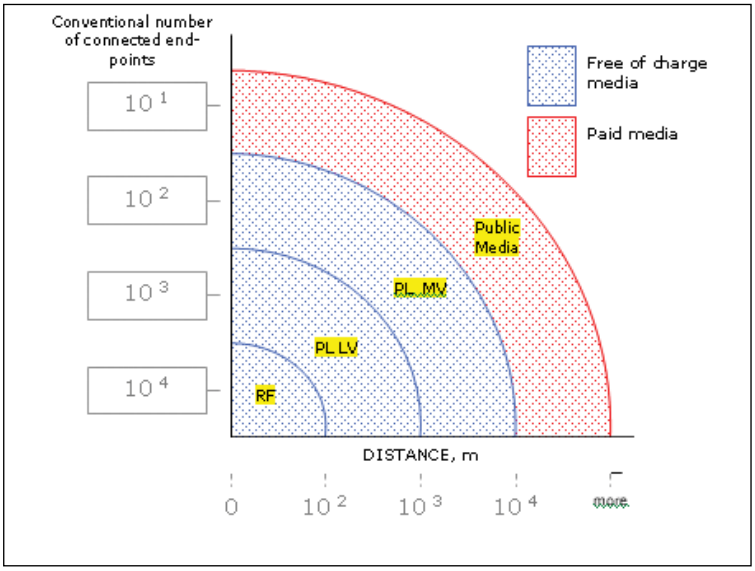

Figure 1 – Data transmission communications options

ADD GRUP Company was one of the firsts to opt for this solution, with its proprietary communication solution ADDAX.Net. ADDAX.Net is a distributed TCP-UDP/IP network built around a base of specialised routers by overlapping dissimilar environments such as specific communications (power line, RF, wire), and public environments (fibre optic, GSM/GPRS, CDMA, etc.). At present ADDAX.Net unites more than 1

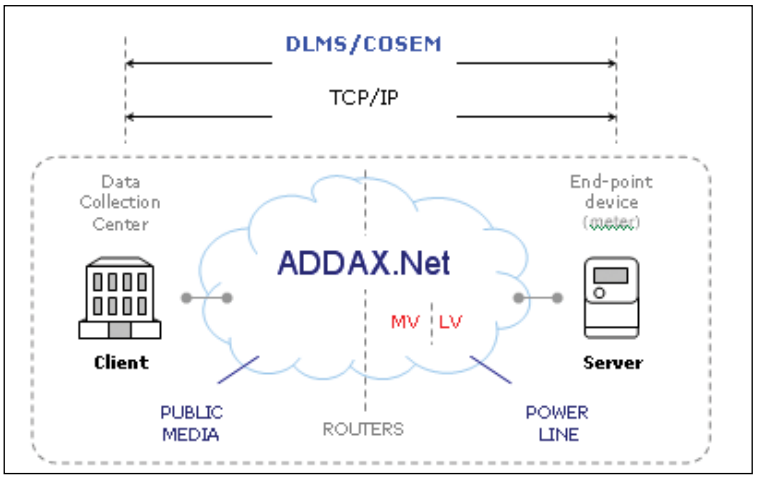

Figure 2 - DLMS/COSEM and TCP-UDP/IP Profile implementation over the network

million different devices – energy meters, customer displays, routers, etc.

Energy metering systems based on ADDAX.Net use low voltage PL (LV PL) and medium voltage PL (MV PL) as their specific environments. Two modulation techniques are planned in the new versions – S-FSK and MCM/OFDM. Both of them operate in the 9 to 95 kHz frequency range (A-Band, CENELEC), but have different data transmission rates – S-FSK from 1.2 to 4.8 kbps and MCM/OFDM from 32 to 128 kbps. On the LV side both S-FSK and MCM/OFDM modulation types are used, on the MV side, MCM/OFDM only.

These solutions allow us to implement the support of DLMS/COSEM and TCP-UDP/IP Profile over the whole network, including the power line segment. Thus, a truly unified distributed data transmission network is created, which benefits from the full range of advantages offered by the combination of both public and private-specific environments, as discussed above and illustrated in Figure 2.

The situation differs slightly for the metering of water, gas and heat. The RF solutions are more appropriate here. The ZigBee standard for wireless networks is an indisputable and, by all appearances, the sole leader in this field and it opens many new operation areas.

The ZigBee values are:

- Reduced energy consumption
- Reliability of data transfer
- Ability of ZigBee network to self organise and self restore
- Information security
- Compatibility between the solutions of different manufacturers
- Moderate deployment and operational expenses.

It is important that ZigBee is already operating in similar fields: buildings management systems (BMS), intrusion alarm systems, home automation systems, etc. This fact creates the promise for a more extended integration of the systems in the future.

However, the ZigBee network is a local solution, with a coverage zone extending only to several tens or hundreds of metres. Besides, the ZigBee and TCP/IP networks are different. So how can data exchange be assured between the meters on one side and a remote Data Collection Centre on the other side?

The solution is obvious. ADD GRUP Company has developed and will prepare for implementation a ZigBee/TCP/IP over PLC gateway. These gateways will allow connecting multiple local ZigBee networks to the power line segment of the “large scale” network. Further access to one of the public networks will allow data to be transmitted over large distances.

To summarise, the basic elements of a future AMI are as follows:

- The system will be orientated towards the most popular stack of protocols – TCP/IP.
- The power line environment will be used on the “last mile” site for electrical energy metering systems.
- Full realisation of DLMS/COSEM, TCP/IP over power line will be the most cost effective and beneficial approach.
- ZigBee will be used as a local solution for water, gas and heat metering systems.
- ZigBee and TCP/IP networks will be united through special gateways.

Taking another look at the basic elements mentioned above, one will get the impression that these have been met and discussed before, but separately. These things are not new to us any more, and they are a part of our day-to-day life. The future of AMI has arrived! Are you ready for it? MI

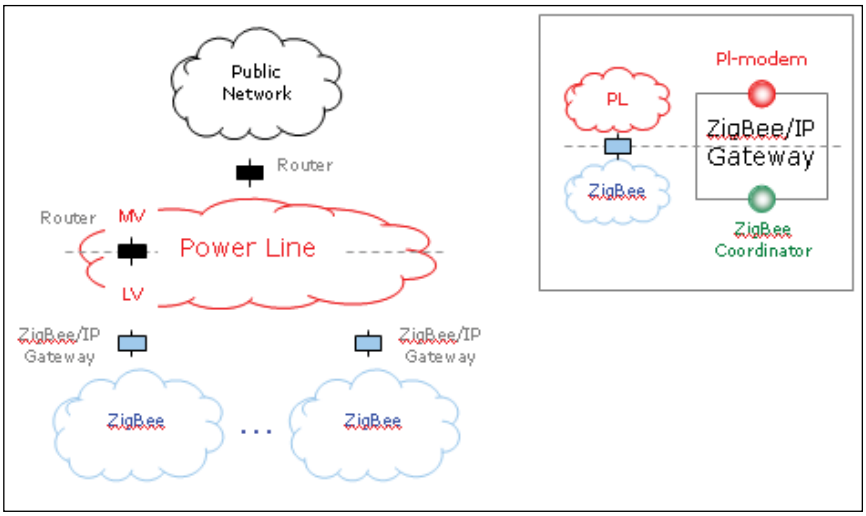

Figure 3 - ZigBee/TCP/IP over PLC gateway

ABOUT THE AUTHOR: Elena Turanscaia joined ADD GRUP in 1998 as a marketing specialist. In 2005 she assumed the position of Executive Director in which she coordinates both the production and marketing activities of the company. She has two BSc degrees in General Management and Political Science from State University of Moldova and a Master’s in Business Administration from New Port University, USA.

ABOUT THE COMPANY: ADD GRUP is a developer and manufacturer of the AMI system, ADDAX IMS, for electricity, gas, water, heat and street lighting. ADD GRUP was one of the pioneers in AMI with communications based on high-speed data transmission over LV and MV PLC alongside other known communication media.

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