AMR systems

Communication technologies used by AEM

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Types of AMR systems

For three phased, industrial consumers

- Argus 3: meters are read via GSM/GPRS

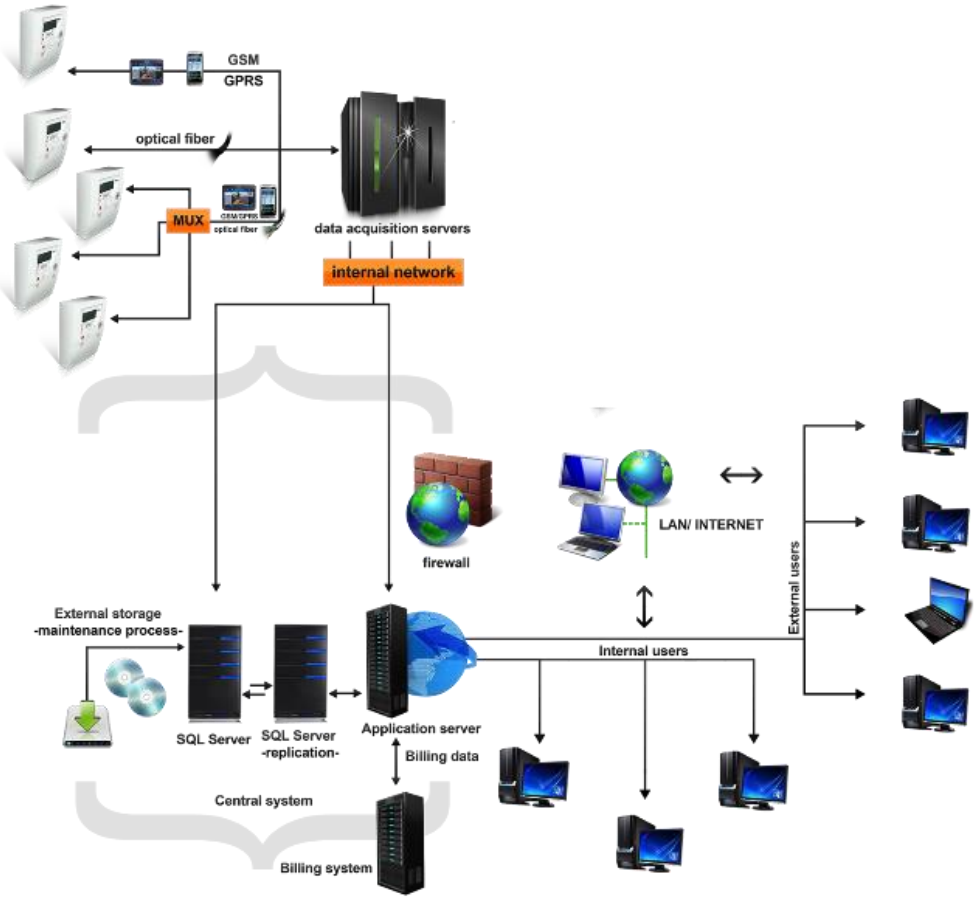
For residential consumers and small businesses:

- Argus TS2: uses Turtle TS2 as a communication protocol
- Argus PLC: can read meters via current loop, band A PLC or RF

ARGUS 3

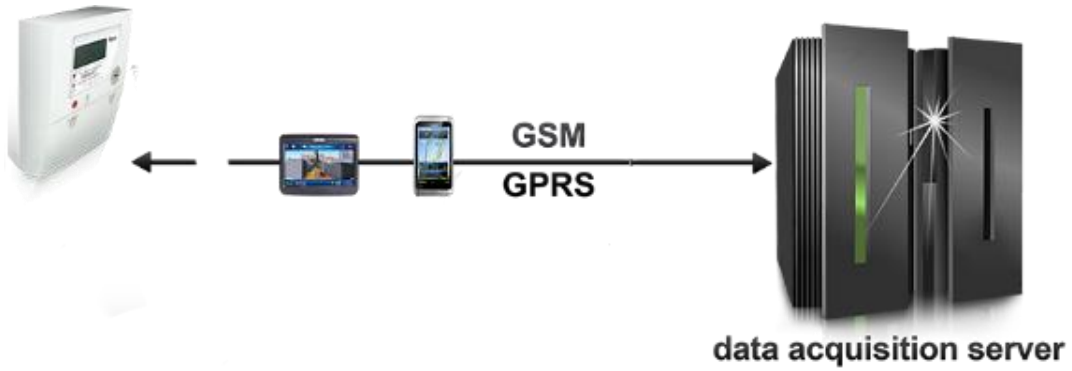
AMR SYSTEM FOR INDUSTRIAL CONSUMERS

ARGUS 3


GSM
GPRS
optical fiber
MUX
optical fiber
data acquisition servers
internal network
firewall
LAN/ INTERNET
External users
External storage
-maintenance process-
SQL Server
SQL Server
-replication-
Application server
Internal users
Billing data
Central system
Billing system

Communication channels

- GSM and GPRS
  - Bidirectional communication channel, with very good coverage.
  - Advantages:
    - Mature technology, requires no cabling costs.
    - In the case of GPRS, all meters and DCs are connected in a private network (VPN), increasing overall security.
  - Disadvantages:
    - Requires a monthly subscription with a GSM carrier
    - Cost is relatively high, especially for GSM

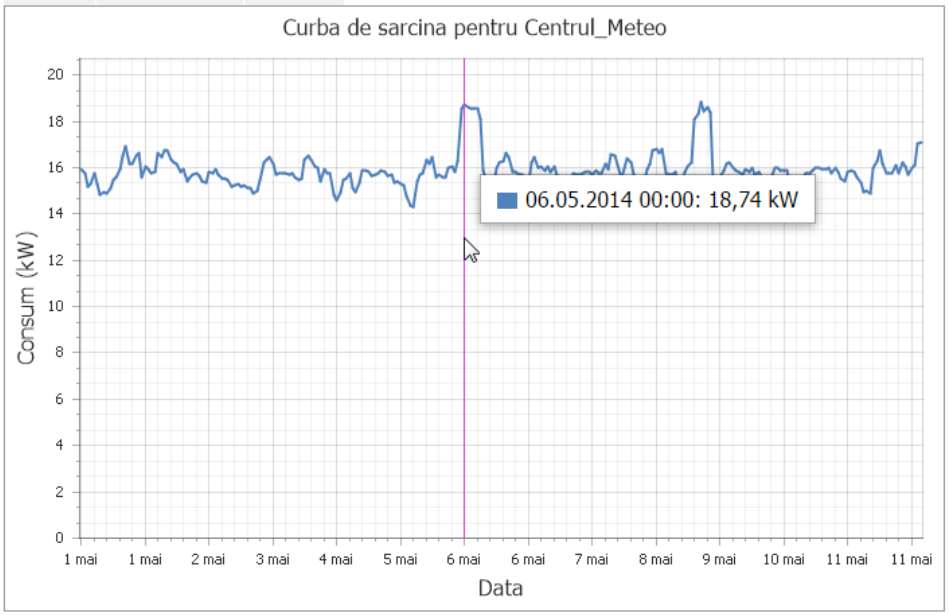


Features

- The system can be easily adapted to customer requirements
- Allows collecting data from a large amount of meters, both automatically, based on a preconfigured schedule, as well as manually, at the request of a system operator
- Offers centralized storage and communication: all data is stored in a central database (Microsoft SQL Server type)
- The system is interoperable and scalable, capable of collecting data from different types of meters
- Offers data exchange with different billing systems, based on customer requirements

Features

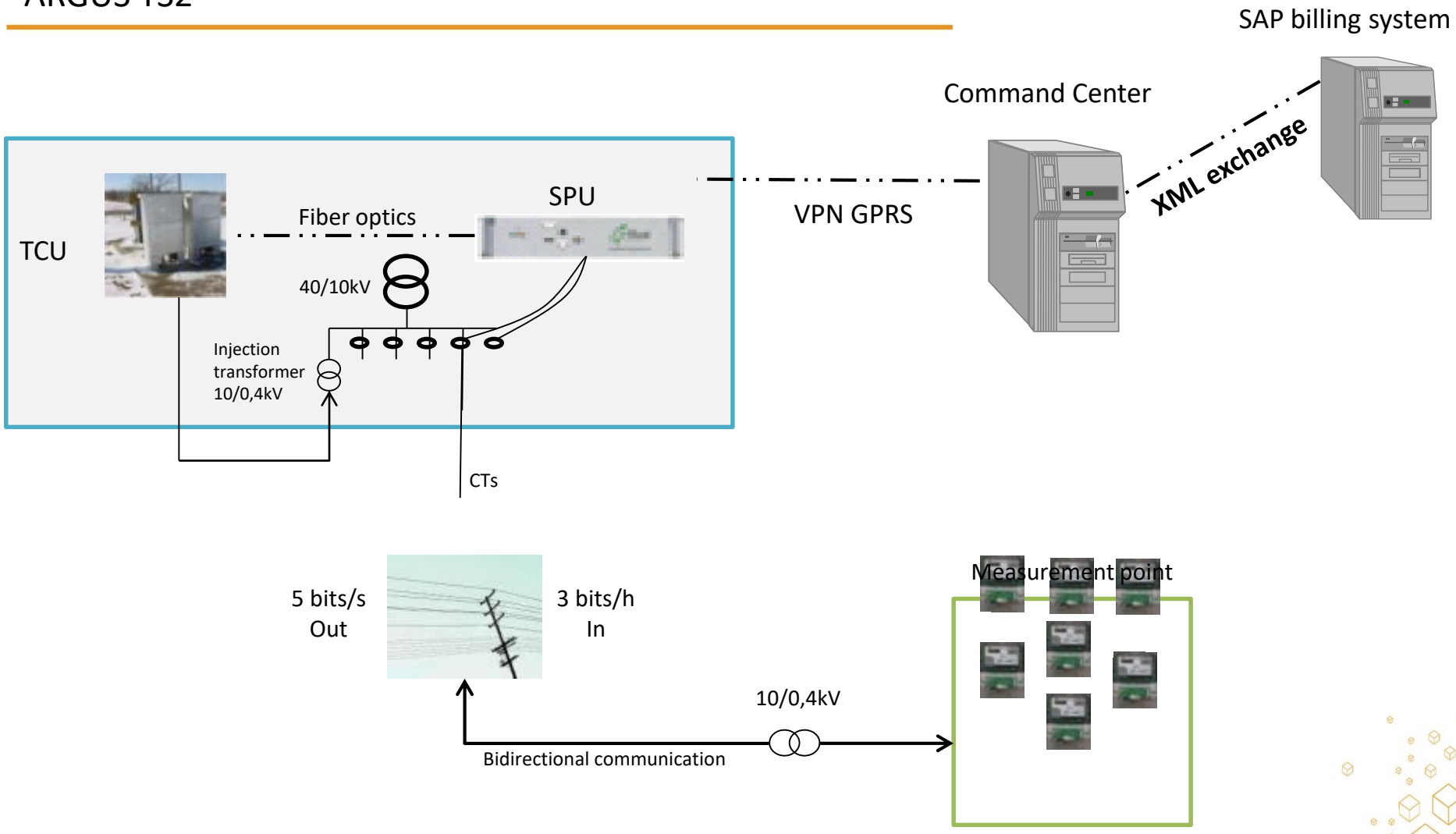
- Data in the system can be aggregated and presented in the form of configurable reports:
  - Balances
  - Reports with indexes
  - Event and power outage reports
  - Load and voltage profile reports
- The system allows the automatic sending of reports via email



ARGUS TS2

AMR SYSTEM FOR RESIDENTIAL CONSUMERS – TURTLE TS2

ARGUS TS2


SAP billing system
Command Center
XML exchange
VPN GPRS
TCU
Fiber optics
SPU
40/10kV
Injection
transformer
10/0,4kV
CTs
5 bits/s
Out
3 bits/h
In
Measurement point
10/0,4kV
Bidirectional communication

Communication channel

- Turtle TS2 (PLC)
  - Communicates over great distances using power lines, including through LV to MV transformers – ideal for rural areas
  - Uses low frequencies for increased reliability
  - Working frequency spectrum is between the 17th and 19th mains harmonics, where noise is lower
  - Uses FDMA technology (Frequency Division Multiple Access), allowing all endpoints to communicate at the same time
  - Communication is bidirectional
  - Synchronized data transfer. Readings are performed at 00:00 for every meter, or on demand

Communication channel

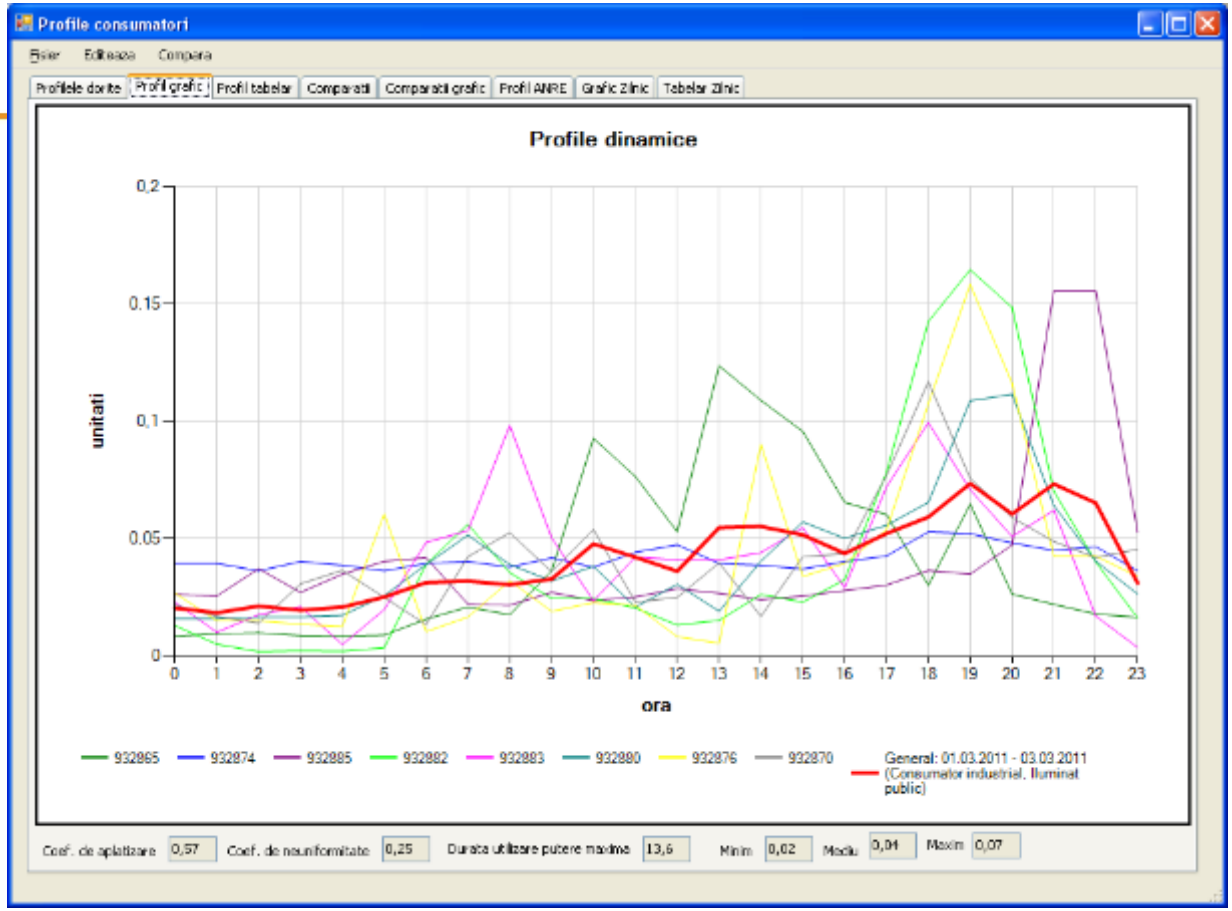
- Turtle TS2 (PLC)
  - Advantages
    - Uses the existing infrastructure as a communication channel
    - Data can go through the LV to MV transformer; the data concentrator is located in the MV transformer substation
    - Low sensitivity to noises in the mains line
    - Does not require repeaters
  - Disadvantages
    - Low transmission speed; the load profile does not contain a lot of data (in general, only the active energy is sent)

Features

- Automatic Data collecting from a large number of meters based on a predefined schedule.
- Data is stored in a central Microsoft SQL Server database
- Customers can be disconnected and reconnected using Command Center
- Endpoint firmware can be upgraded remotely
- Billing information can be exported to SAP automatically
- The system allows generating short , medium, or long term forecast based on collected values.
- Several reports can be generated based on the collected data:
  - Index reports
  - Events reports
  - Load profiles
  - Balances

Argus

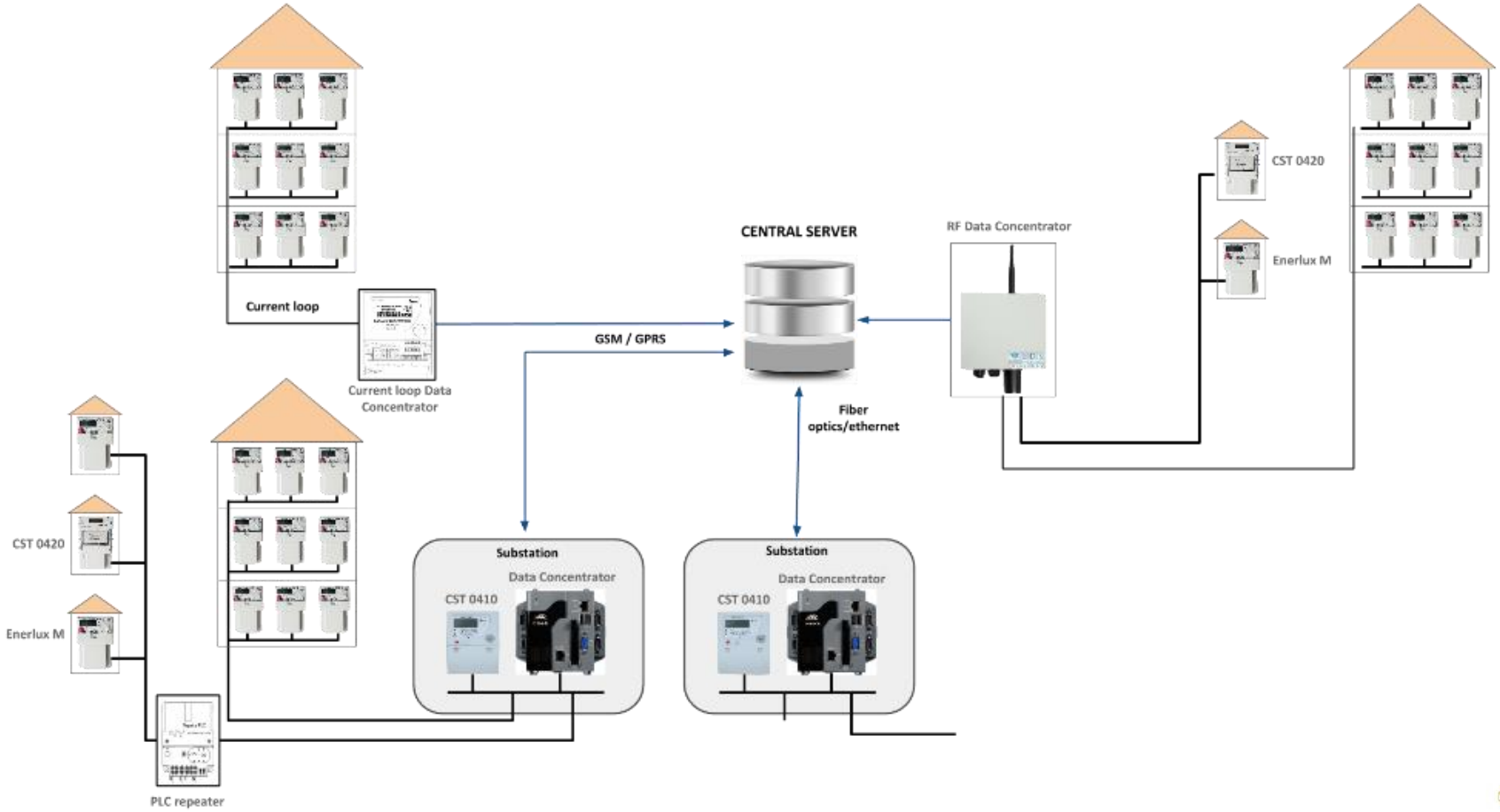
Graphical comparison between customer average load profiles and the dynamic load profile of their chosen consumer type



ARGUS PLC

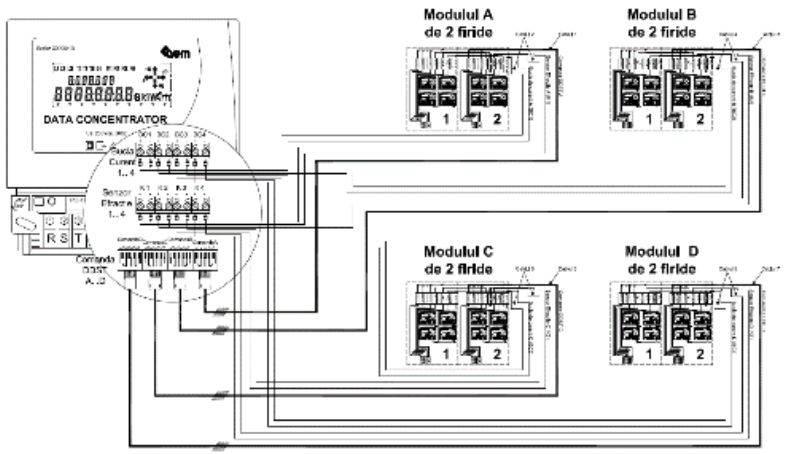
AMR SYSTEM FOR RESIDENTIAL CONSUMERS - PLC

System architecture



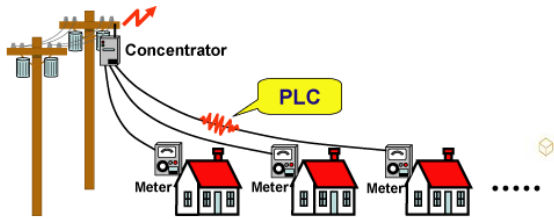
Communication channels

- **Current loop:**
  - Advantages:
    - Extremely low sensitivity to noise
  - Disadvantages:
    - The maximum distance between a meter and its DC is limited
    - A DC can only have up to 32 meters allocated to it
    - High initial cabling costs



Communication channels

- **Band A PLC**
  - Communication of the PLC modem is **CENELEC EN 50065-1**, band A (reserved for the power distributor)
  - Advantages
    - Uses the existing infrastructure as a communication backbone
    - Requires no additional cabling or communication costs
    - Balances are easy to do because of the DCs mounted in the MV to LV transformer stations
  - Disadvantages
    - Old electronic equipment can introduce a ot of noise in the network
    - Large distances between PLC modems can lead to the need for repeaters



Communication channels

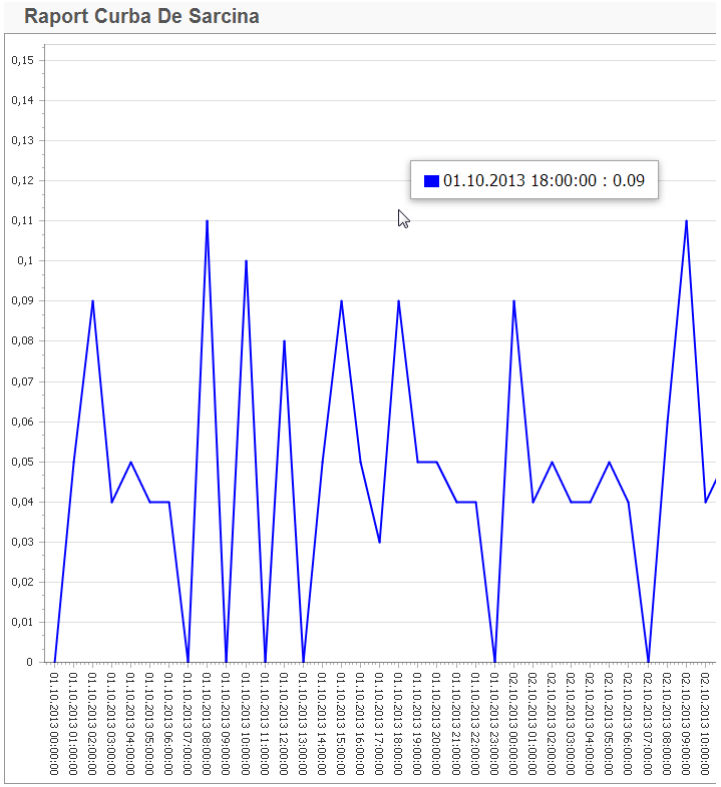
- **RF 868 MHz**
  - Mesh radio, with self-configuration and automatic routing
  - Advantages
    - No cabling or communication costs
    - A single Data Concentrator can handle a large number of meters (up to 4000 meters)
    - High communication speeds (over 50 kb/s)
  - Disadvantages
    - Radio communication is susceptible to interference

Features

- System suited for residential consumers and small businesses in direct connection
- PLC communication is used between the meter and the DC
- Allows connecting/disconnecting users remotely
- The following data is read:
  - Self readings (billing data)
  - Load profiles
  - Instantaneous values
  - Instrumentation values (voltages, currents, power factors)
  - Events
- Allows acquisition of data from balance meters

Features

- The following reports can be generated:
  - Synthetic and analitic balance reports
  - Consumption analysis
  - Connection/disconnection history
  - Commands history
  - Load profile reports
  - Instrumentation values reports
  - System events
  - Integrated meters
  - Graphical meter localization
- All reports can be saved as Excel or PDF files



CONCLUSIONS

Conclusions

Argus AMR systems offer:

- Bidirectional communication between the system operators and the equipment system
- Automated meter reading based on a predefined schedule
- Consumer Remote disconnection/reconnection
- Load profile reading and storing
- Tampering detection: open lid, magnetic field detection
- Events reading: power outages, low battery

Conclusions

Argus AMR systems offer:

- Balance reports
- Various communication technologies using secured communication channels
- Data storage in meters, communication interfaces, DCs and the central system for adequate periods of time
- Clock synchronization for both meters and communication interfaces and DCs
- Remote firmware updates for DCs and communication interfaces

THANK YOU