



# M2M

## gMUC Controller

Multi Utility Gateway for Smart Metering Applications



**Dr. Neuhaus**





## Agenda

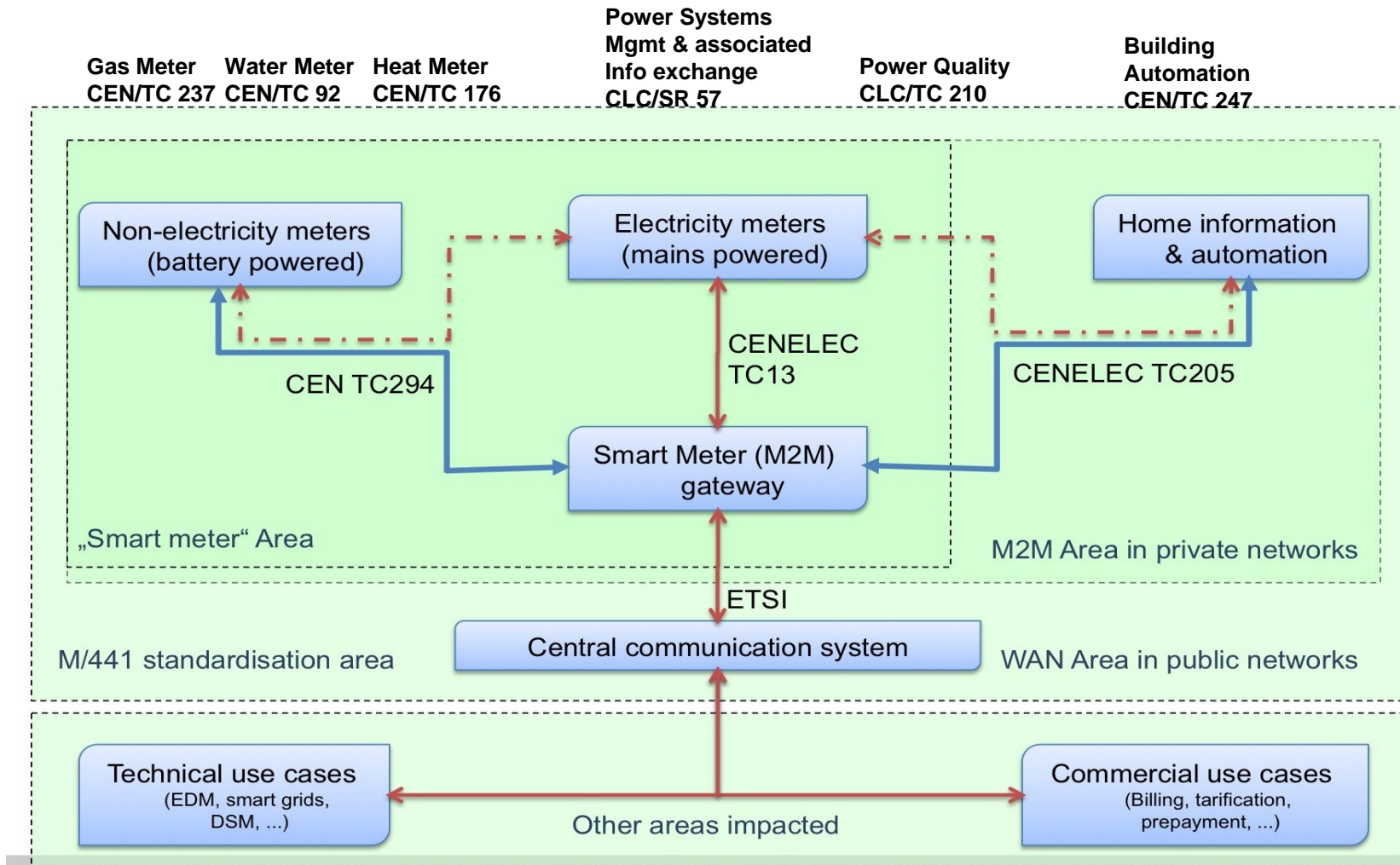
- Smart Metering Market and Standardization
- gMUC Controller Overview and Key Features
- Summary and Benefits

## Smart Metering Market Drivers

- European and national legislation
  - Deregulation (2006/32/EU, ...)
- Increasing network complexity
  - Integration of renewable energy sources
  - Convergence of communication-, sensor- and information technology (“smart grid“)
  - Demand side management
- Increasing complexity of business models
  - Introduction of new tariff structures
  - Integration of many small suppliers
  - Energy storage
- Increasing consumer awareness regarding energy consumption
- Non-technical losses

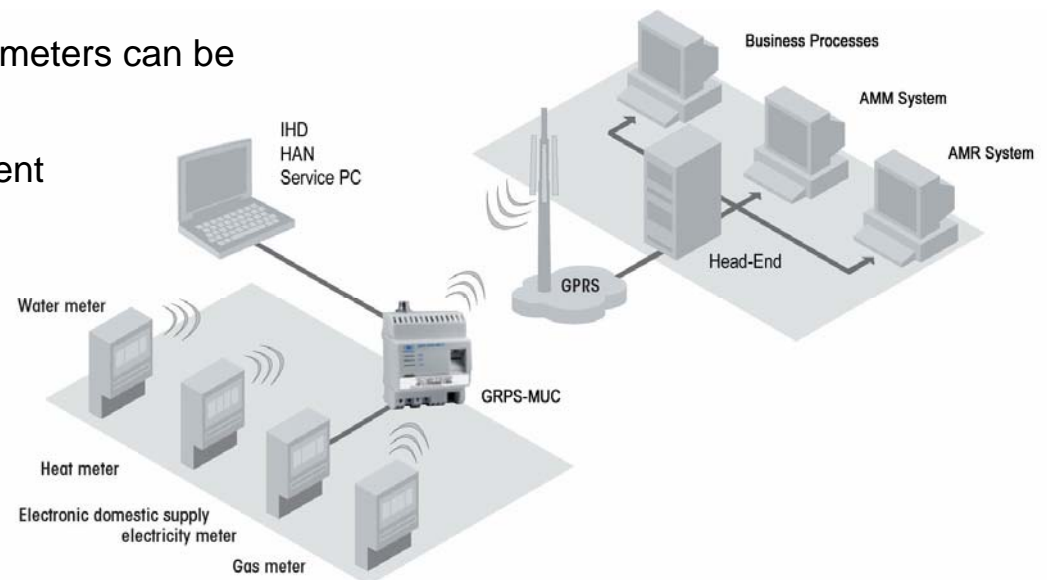


## European Standardization – M/441



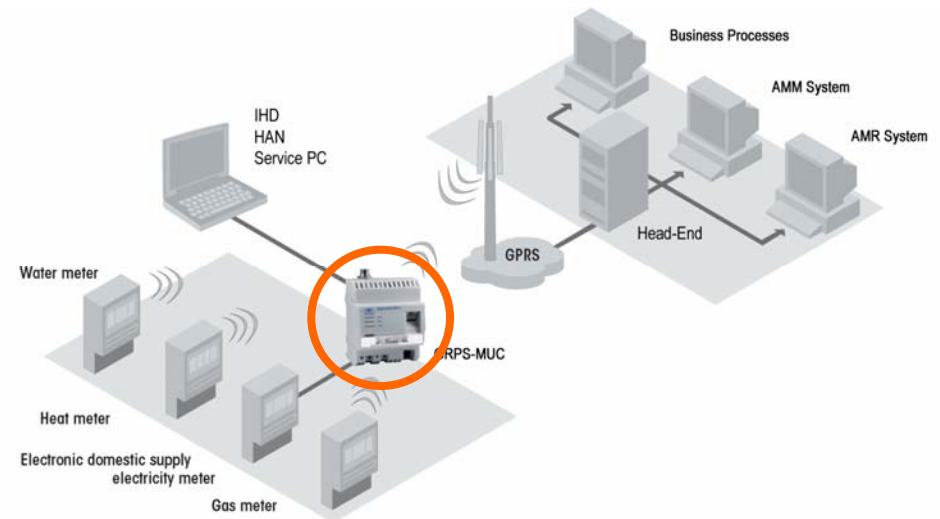
## Smart Metering Solution Overview

- Separation of communication module and meter
- IT standards for integration with central processes and home area network (HAN)
- Multi utility architecture with best possible efficiency gains
  - For single homes and for large buildings
- Investment protection
  - Meter and communication module can be changed independently
  - Roll-out can start with any medium, other meters can be added later
  - Meter- and HAN integration are independent from each other
- Match with roles in liberalized markets



## gMUC Controller Overview

- Multi utility gateway for smart metering applications
- Targeted at utilities and metering service providers (e.g. telcos)
- Modular architecture for investment protection
- Compliant with European smart metering standardization
- Flexible meter communication
- Flexible HAN/IHD integration
- Flexible AMI integration leveraging common IT standards



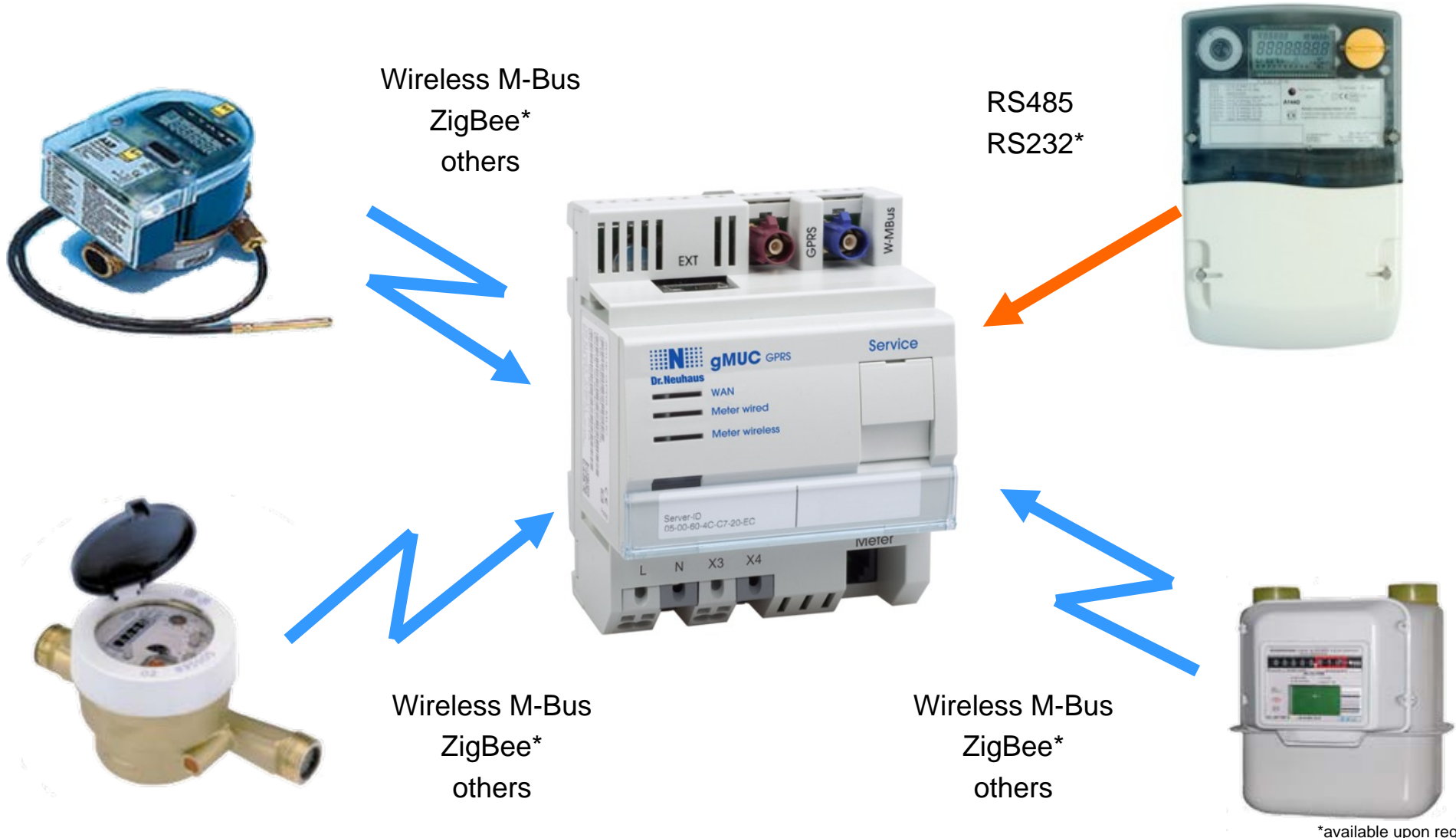


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## Communication with Meters



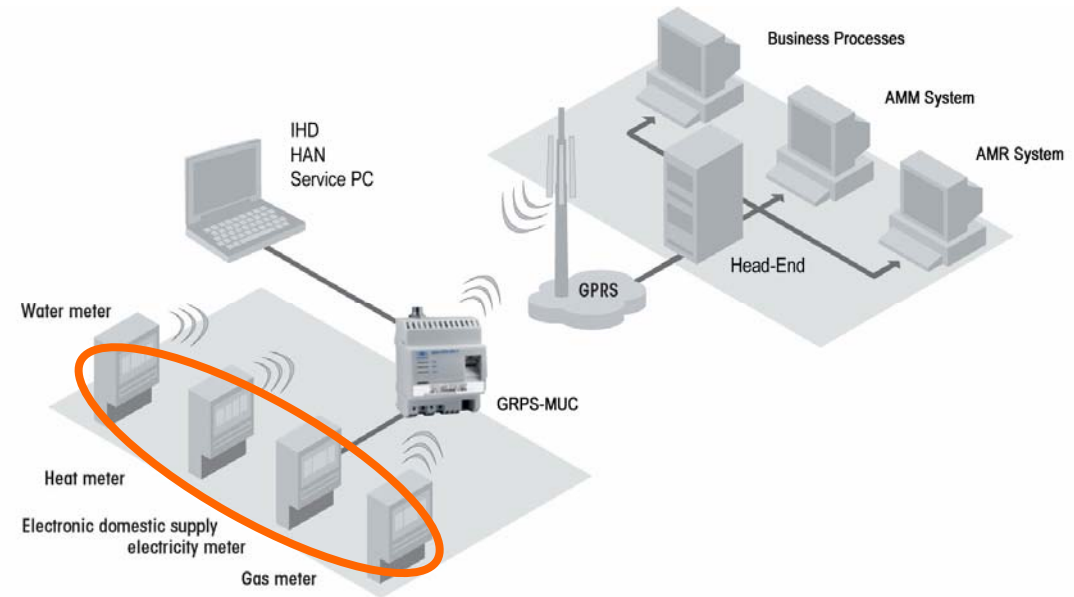
\*available upon request



## Supported Meters

Wireless MBus		
Vendor	Meter	Medium
EasyMeter	Q3DA1004	Electricity
EMH	eHZ 1.03 GW8E2AW00AK2	Electricity
Flonidan	G4SRT	Gas
Hydrometer	Hydrus Type 171	Water
Kampstrup	382Jx3	Electricity
Elster	BK-G4 with Sender IZAR Radio Extern 868 Standard	Gas
Diehl Metering	Heatmeter Type 447 Ray M-MKWZRHf	Water
Siemens / Qvedis	Siemeca WFC36	Water
Siemens / Qvedis	Siemeca WMH36	Hot Water
Siemens	WHE46x	Heat
Flonidan	G4ERV	Gas
Flonidan	G4ERV	Gas
Flonidan	UNIFLO G4EMV	Gas
Sensus	620 with HRF8 Sender	Water
Sensus	620 with HRF12 Sender	Water

05/2010



Wired RS485		
Vendor	Meter	Medium
Elster	A1 440-D1 6B-1 20-0SE-0006S-B0000	Electricity
Elster	A1 440-D1 7B-1 20-0SE-0007S-B0000	Electricity
Elster	A1 350-W1 41-522-0SL-1010S-V0000	Electricity
Elster	A1 500-W041-522-0SL-1015S-V1000	Electricity
ISKRA	MT1 73-D1 A51-M3KD3Z	Electricity

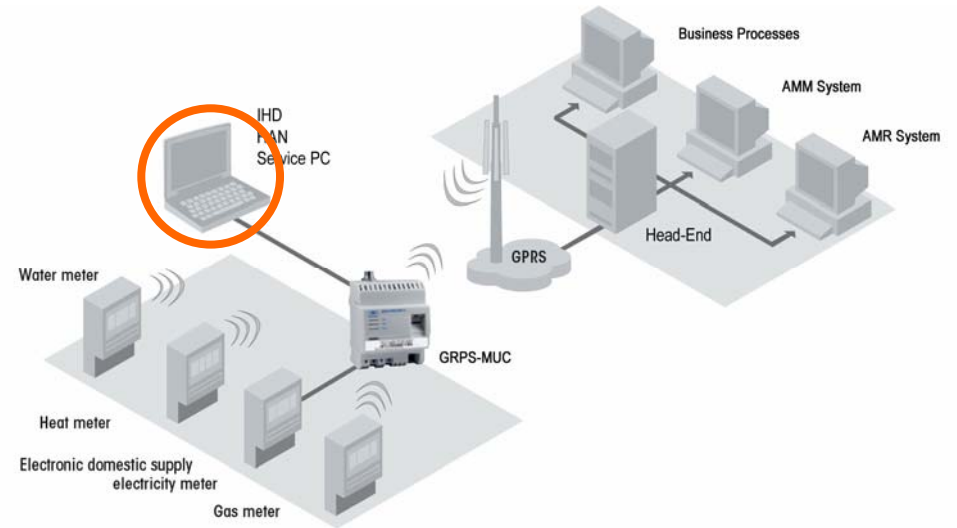
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Compliant with

- EN 62056-21 (IEC1107)
- EN 13757-3/4 (Wireless MBus)
- Other standards upon request

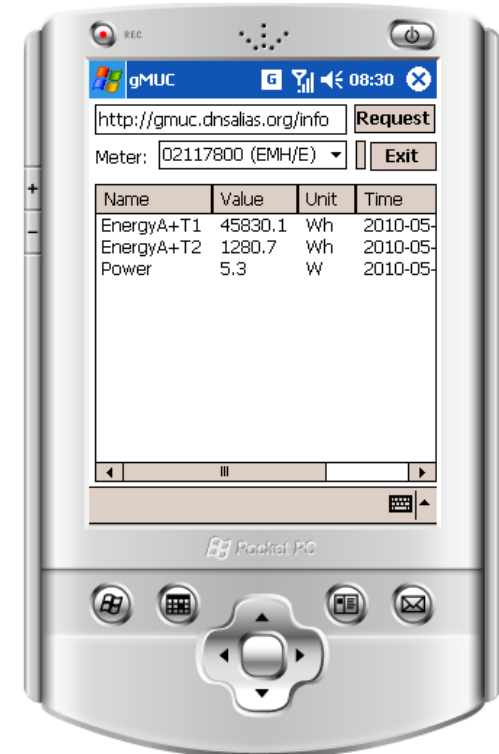
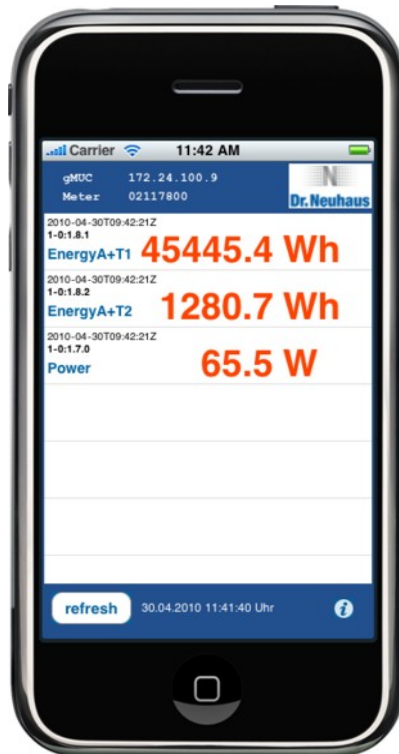
## Local Integration with IHD and Digital Home (HAN)

- LAN/WLAN connection
  - Direct connection between gMUC Controller and WLAN router
  - Inhouse PLC between MUC Controller and WLAN router
- Wireless M-Bus
  - Panels via KNX
  - ...



## Prototype Integration with iPhone, iPod, Windows Mobile

- Via Internet
- Via WLAN router

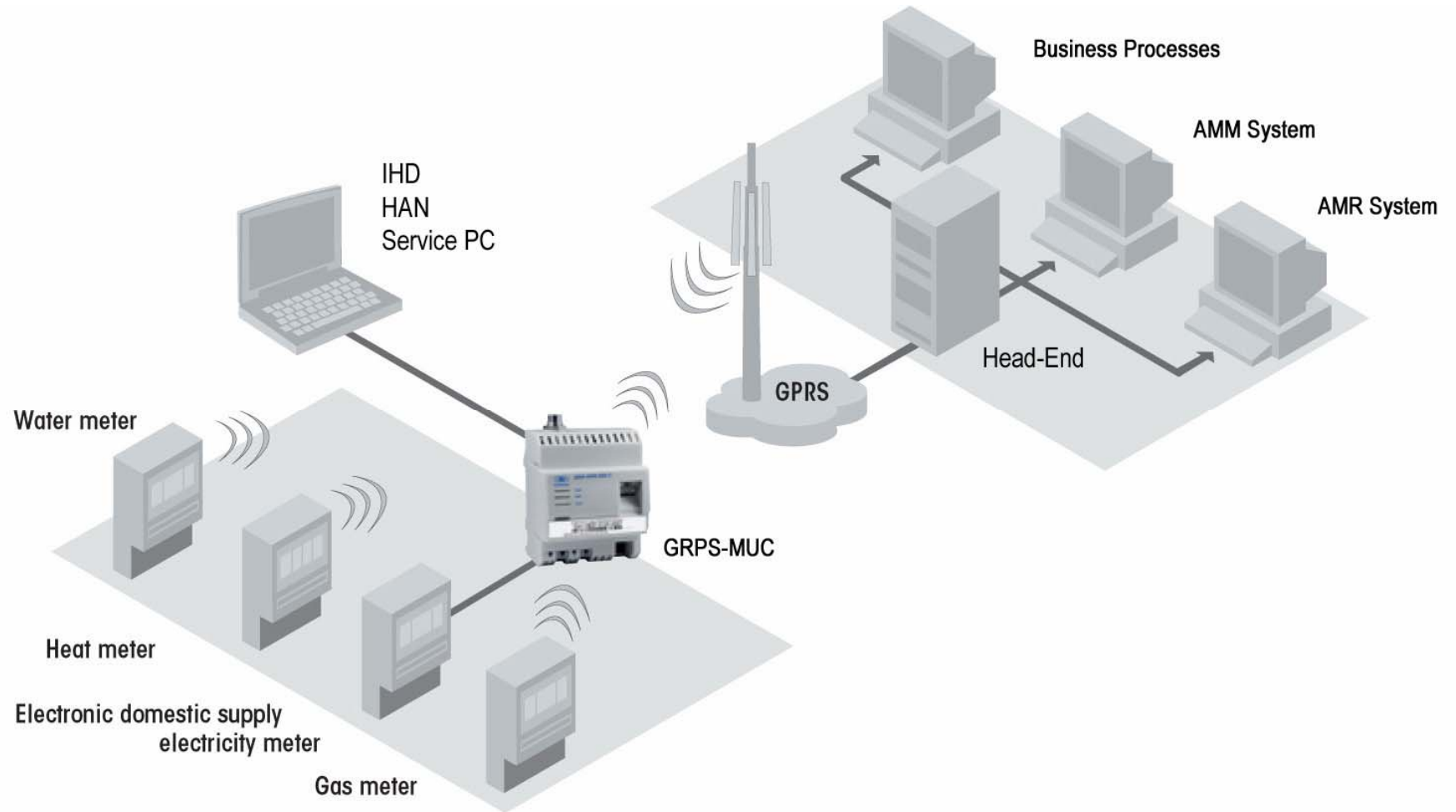


## Communication with Central Sites – Hardware Variants

- gMUC-DSL
  - Communication via LAN/DSL towards central system
  - Leverages DSL networks and connections (DHCP or PPPoE)
  - Installation in urban as well as rural environments
- gMUC-GPRS
  - Additional communication via GPRS towards central system
  - Installations mainly for single homes and/or rural environment
- gMUC-PLC\*
  - Installation mainly in residential buildings or urban environment
  - Communication with PLC to gMUC-DC Controller
- gMUC-DC\*
  - Installation mainly in urban substations
  - Communication with PLC towards gMUC-PLC Controller
  - Communication with GPRS/EDGE towards central system
  - Meter interfaces

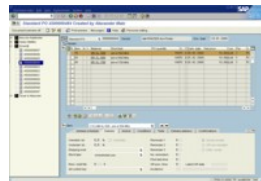
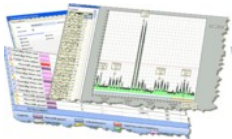
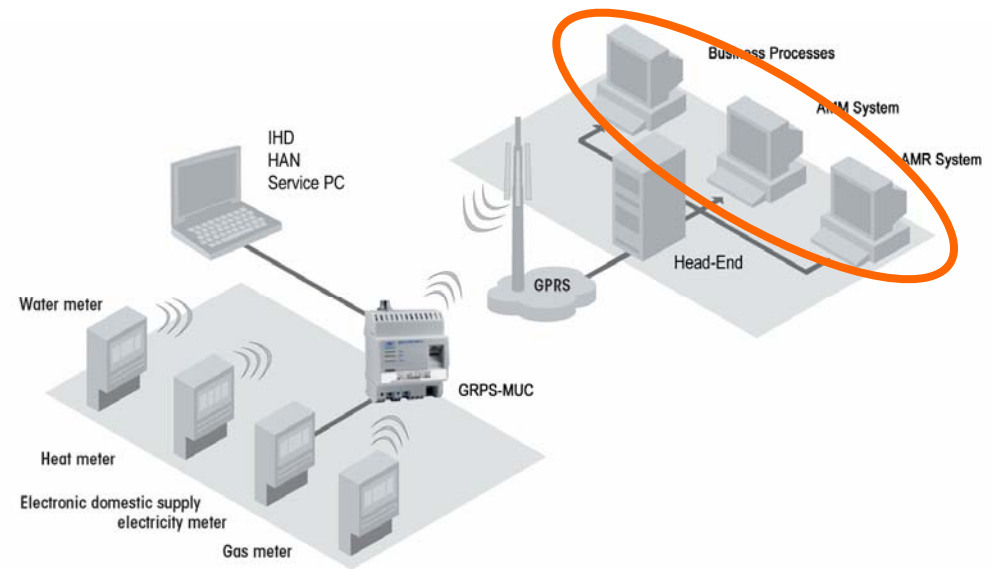


## GPRS Architecture

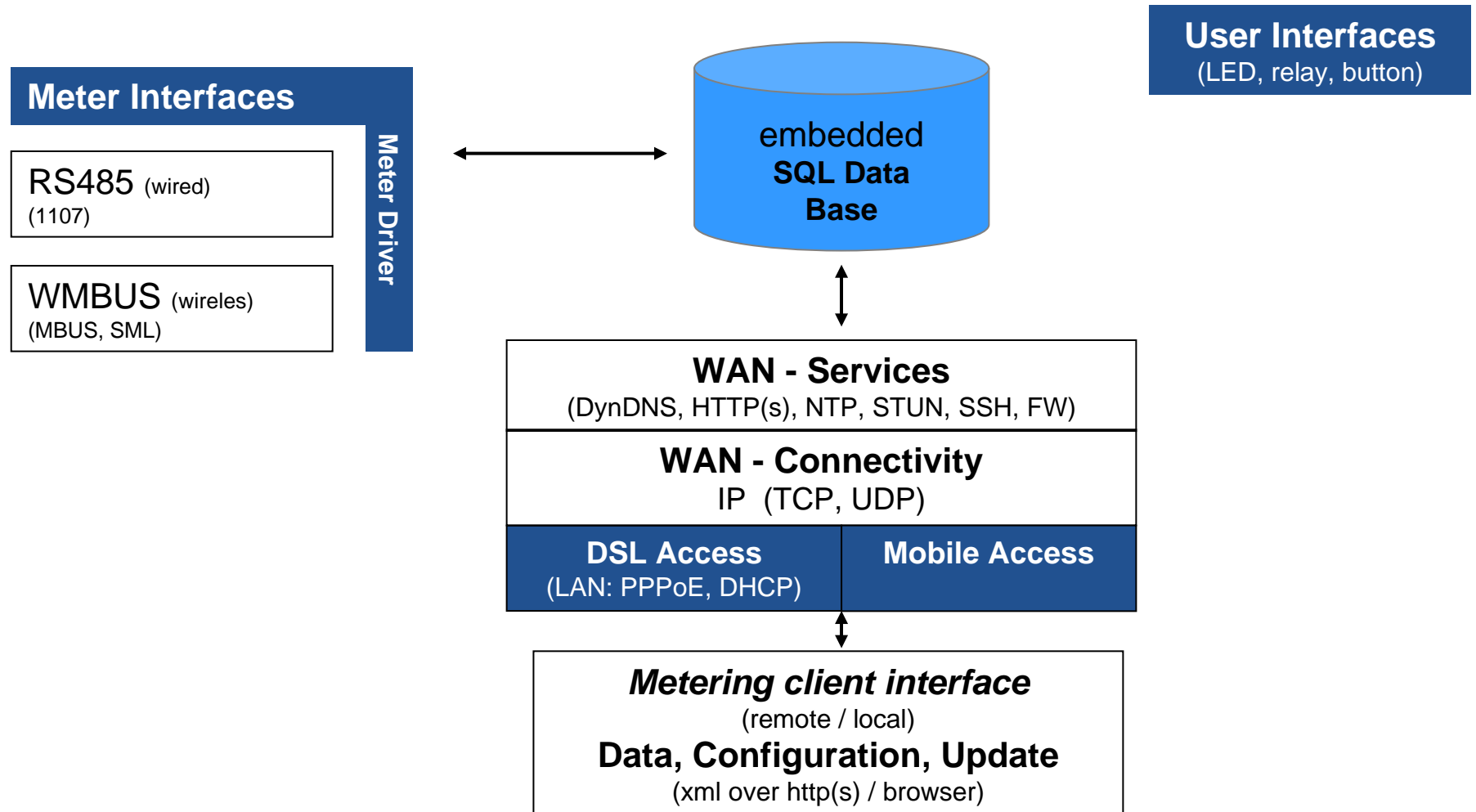


## Integration with AMI Solutions

- Based on common and proven IT standards
  - HTTP(s) protocol
  - XML data formats
  - Firewall and IP white list support
  - ...
- Lean head-end system
  - Handling of dynamic IPs



## gMUC Controller Firmware – Architecture





## gMUC Controller Firmware – Functional Coverage

- Meter services
  - Meter detection / registration / deregistration
  - Meter pre-configuration
  - Actual value read-out
  - Load profile registration / deregistration
  - Load profile read-out
- Application configuration services
  - WAN configuration
  - LAN configuration
  - Meter interface configuration
- Status information services
  - gMUC-Controller
  - Meter
- Log book services
- Remote firmware update



## Metering Interface – XML over HTTP(s) Example

http Request → gMUC <http://192.168.168.10/stored?METER-ADDR=37884655>

http Response with XML content ← gMUC

```
<Stored deviceID="102030405067" firmware="DNT8190-gMUC-1.00">
  <RequestTime utime="1271150187" iso8601="2010-04-13T09:18:07Z" osc="45989" source="RTC"/>
  <Meter id="37884665" addr="37884665" mfct="HYD" medium="w">
    <Datapoint>
      <DateTime utime="1271150187" iso8601="2010-04-13T09:18:07Z"
        osc="45989" source="RTC"/>
      <Entry name="WaterVolume" id="8-0:1.0.0">
        <Value unit="m3">240.000</Value>
      </Entry>
    </Datapoint>
    <Datapoint>
      <DateTime utime="1271150187" iso8601="2010-04-13T09:18:07Z"
        source="RTC"/>
      <Entry name="WaterVolume" id="8-0:1.0.0">
        <Value unit="m3">240.000</Value>
      </Entry>
      <Entry name="WaterVolume2" id="8-0:1.0.1">
        <Value unit="m3">241.000</Value>
      </Entry>
    </Datapoint>
  </Meter>
</Stored>
```


## Hardware Features

- Two Ethernet interfaces
  - In-house connectivity and service
  - LAN connection
- Switch
  - 230VDC relay / 100mA for breaker
- Antenna
  - FAKRA connector
- Real time clock
- GPRS Modul
  - Quadband GSM 850/ 900/1800/1900 MHz
  - Standard SIM card holder or SIM on board
  - CS-1, CS-2, CS-3, CS-4 coding schemes
- Housing
  - LED for status display
  - DIN rail mounting



## Browser-Based Configuration – Meter Communication

STATUS - METER


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START

STATUS

CONFIGURATION

[start](#) | [logout](#)
[status](#) | [meters](#) | [log](#)
[system](#) | [wan](#) | [lan](#) | [update](#) | [meters](#) | [interfaces](#)

METER 00000001 (01151846)

**COMMON**  
address: 00000001  
medium: E  
manufacturer: ABB  
options: RS485,1107,Baudrate=300,NTP,ADDR=00000001  
last: 2010-04-23T11:47:00Z

**VALUES (filtered by OBIS-Map)**  
1-0:1.8.1 (EnergyA+T1) 00000.00 2010-04-23T11:47:00Z (RTC)  
1-0:1.8.1\*31 (EnergyA+SDT1) 00000.00 2010-04-23T13:44:27Z (Meter)  
1-0:1.8.1\*30 (EnergyA+SDT1) 00000.00 2010-04-23T13:44:27Z (Meter)  
1-0:1.8.1\*29 (EnergyA+SDT1) 00000.00 2010-04-23T13:44:27Z (Meter)  
1-0:1.8.2 (EnergyA+T2) 00000.00 2010-04-23T11:47:00Z (RTC)  
1-0:1.8.2\*31 (EnergyA+SDT2) 00000.00 2010-04-23T13:44:27Z (Meter)  
1-0:1.8.2\*30 (EnergyA+SDT2) 00000.00 2010-04-23T13:44:27Z (Meter)  
1-0:1.8.2\*29 (EnergyA+SDT2) 00000.00 2010-04-23T13:44:27Z (Meter)

METER 14677811 (14677811)

**COMMON**  
address: 14677811  
medium: E  
manufacturer: KAM  
options: WMBUS,MBUS,ADDR=14677811  
no data received

**VALUES (filtered by OBIS-Map)**

METER 02117800 (02117800)


**COMMON**  
address: 02117800  
medium: E  
manufacturer: EMH  
options: WMBUS,SML,ADDR=02117800  
last: 2010-04-23T11:47:29Z  
RSSI: -77 dBm

**VALUES (filtered by OBIS-Map)**  
1-0:1.8.1 (EnergyA+T1) 44504.0 Wh 2010-04-23T11:47:29Z (RTC)  
1-0:1.8.2 (EnergyA+T2) 1280.7 Wh 2010-04-23T11:47:29Z (RTC)  
1-0:1.7.0 (Power) 5.3 W 2010-04-23T11:47:29Z (RTC)

ACTIVATE

## Browser-Based Configuration – WAN Interface

**CONFIGURATION - WAN**


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[start](#) | [logout](#)    [system](#) | [meters](#) | [log](#)    [system](#) | [wan](#) | [lan](#) | [update](#) | [meters](#) | [interfaces](#)

**WAN**

enable: ☒

max WAN connection delay:

gMUC-ID:

WAN restart period:

---

**WAN mode**

☐ IP  
☒ PPPoE  
☐ DHCP  
☐ GPRS

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**PPPoE**

username:

password:

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**STUN**

enable: ☐

server:

port:

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**DNS**

enable: ☐

server:

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**dynDNS**

enable: ☒

username,password:

domain:

update request:

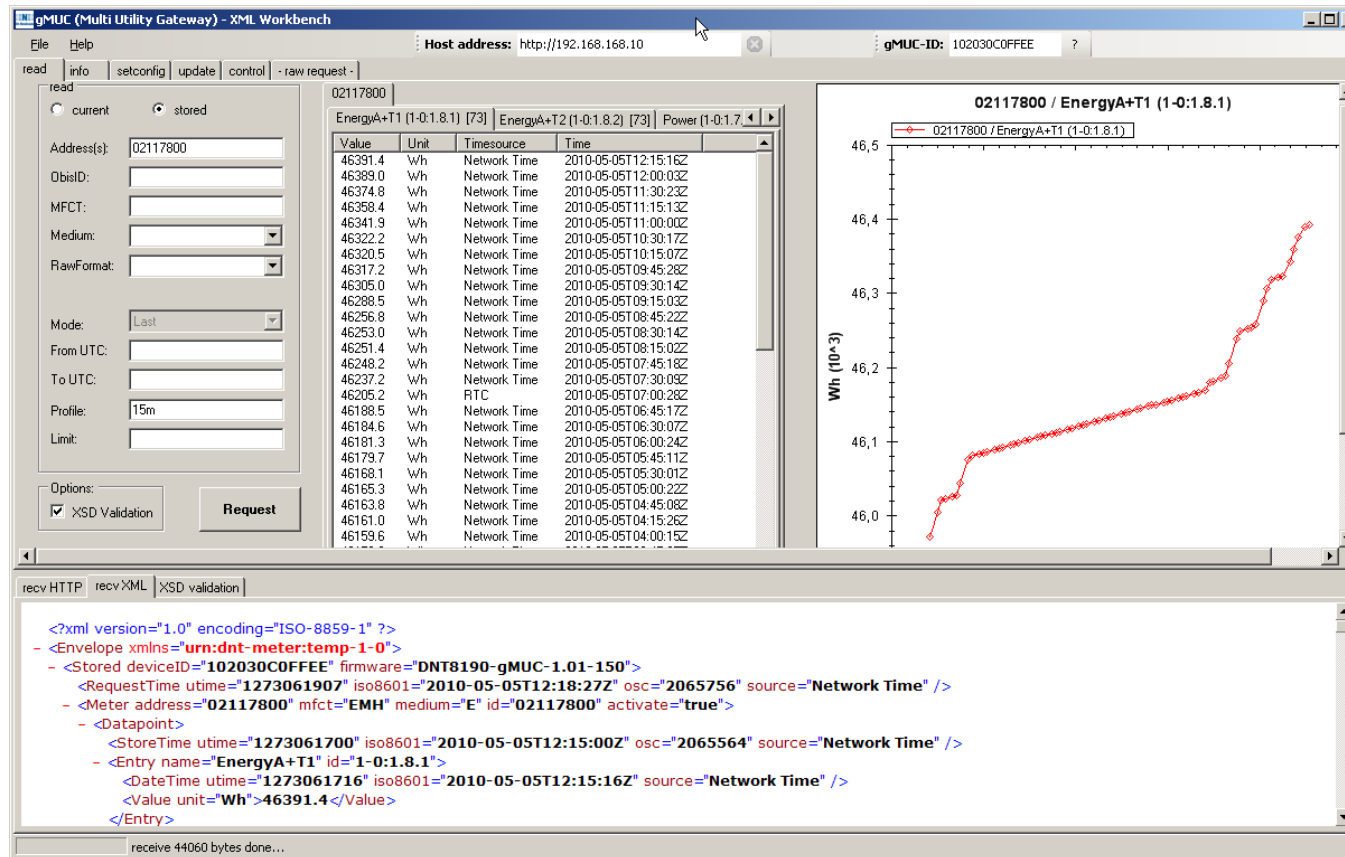
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**NTP**

timeserver:

interval:

## XML Workbench – Reading Load Profile



## XML Workbench – Reading Device Status

The screenshot displays the 'gMUC (Multi Utility Gateway) - XML Workbench' application window. The interface includes a menu bar (File, Help), a toolbar with buttons for 'read', 'info', 'setconfig', 'update', 'control', and 'raw request', and a status bar at the bottom.

The main window is divided into two panes. The left pane contains a 'status' section with the following controls:

- Device:** A checkbox that is checked.
- Meter addr:** An empty text input field.
- Interface Name:** A dropdown menu currently showing 'WAN'.
- Options:** A checkbox for 'XSD Validation' which is checked.
- Request:** A button to initiate the request.

The right pane displays the XML response from the device. The XML is color-coded and shows the following structure:

```
<?xml version="1.0" encoding="ISO-8859-1" ?>
- <Envelope xmlns="urn:dnt-meter:temp-1-0">
- <Info deviceID="102030C0FFEE" firmware="DNT8190-gMUC-1.01-150">
  <RequestTime utable="1273056070" iso8601="2010-05-05T10:41:10Z" osc="2059918" source="Network Time" />
  <Interface name="WAN" enable="true">
    <Address>78.54.38.154</Address>
    <ConnectedSince>2010-05-05T07:32:55Z</ConnectedSince>
    <Mac>10.20.30.C0.FF.EE</Mac>
    <Mode>DYNDNS,PPPoE</Mode>
  </Interface>
  <Device id="102030C0FFEE">
    <Hardware>RS485/WMBUS/LAN/WAN/GPRS</Hardware>
    <Firmware>DNT8190-gMUC-1.01-150</Firmware>
    <LastRebootReason>Application</LastRebootReason>
  </Device>
</Info>
```

The bottom pane shows the HTTP transaction details:

```
recv HTTP | recv XML | XSD validation
http://192.168.168.10/info?DEVICE=status&INTERFACE-NAME=WAN
waiting for response...
runtime = 120 ms

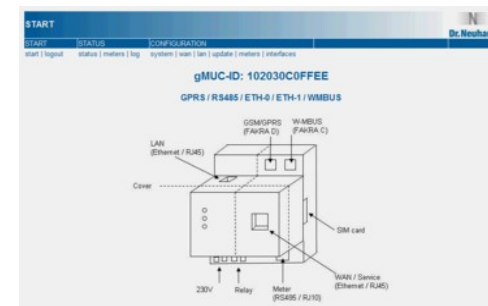
Pragma: no-cache
Connection: close
Content-Length: 621
Content-Type: text/xml
Date: Wed, 05 May 2010 10:41:10 GMT

receive 621 bytes done...
```



## Add-Ons

- Configuration Tool
  - Browser based
  - Not for end customer
- XML Workbench
  - Developer tool
- Antenna
  - Wireless M-Bus
  - GSM/GPRS
- Cable
  - Ethernet for customer interface and parameterization

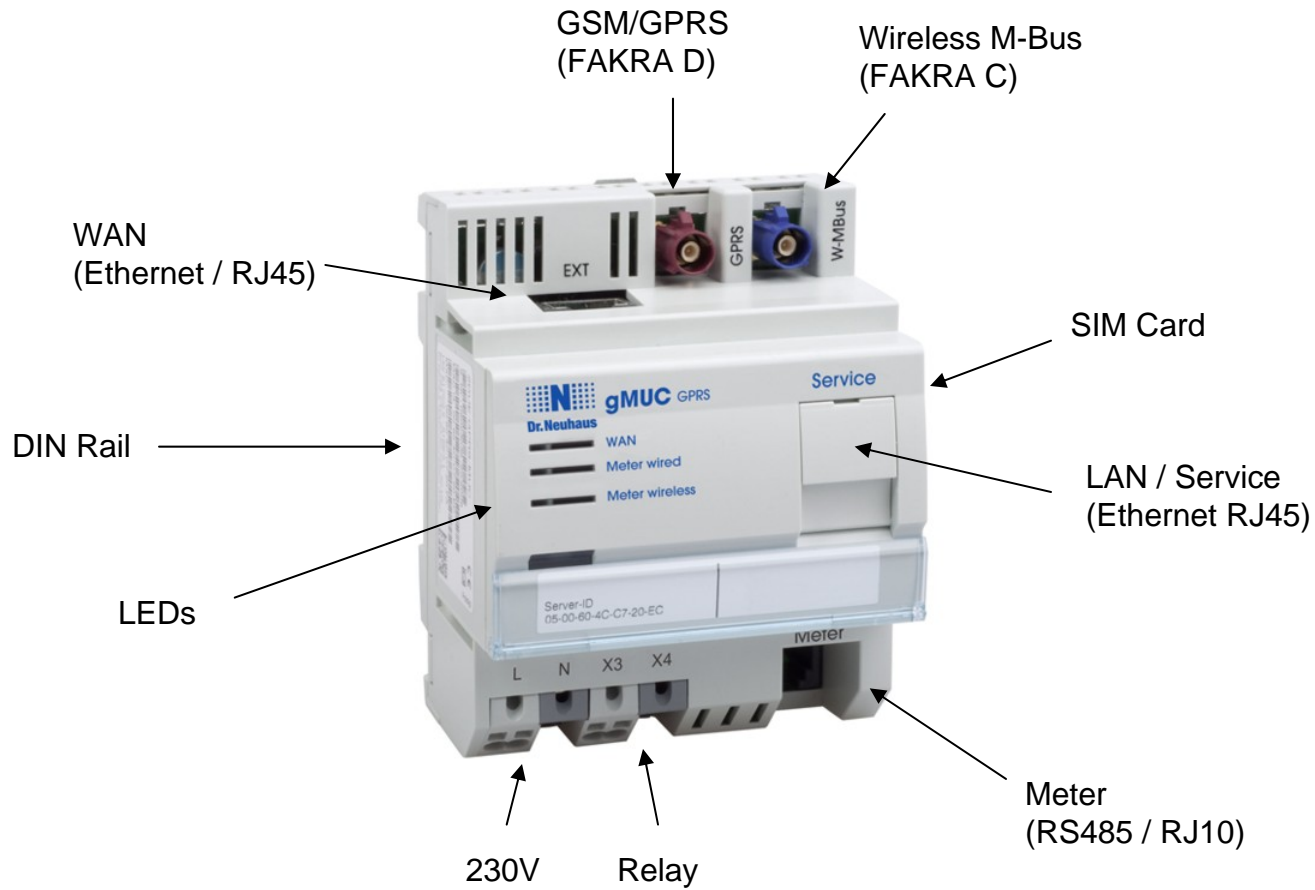




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## Summary Interfaces



## Summary Benefits

- Key component for efficient and future proof smart metering solutions
- Compliant with European standardization activities
- Flexible meter integration
  - Electricity, gas, water, heat
  - Wireless M-Bus, ZigBee
- Flexible HAN/IHD integration
  - Select meters and IHDs independently
- Open and modular software architecture
  - Leveraging proven IT standards
- Easy configuration and administration
  - Web based user interface
- Easy installation
  - DIN rail mounting in switch board
- Proven hardware
  - Commercially available since 2009
  - Deployment in 50+ projects, including Germany's largest smart metering pilot project



 Thank you very much for your attention!



## Contacts

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## Feature Comparison: gMUC Controller vs MUC Controller (FNN Compliance)

Feature	gMUC	MUC
eHZ Meter Support	Yes (optional)	Yes
1107 Meter Support	Yes	Yes (optional)
Wired Meter Interface	RS485 (RS232 optional)	RS232 (RS485 optional)
Wireless Meter Interface	Wireless M-Bus (ZigBee optional)	Wireless M-Bus (ZigBee optional)
Configuration Tool	Web based architecture	Fat client (exe)
Communication via GRPS	Yes	Yes
Communication via LAN/DSL modem	Yes	Yes
Data format and protocol on WAN interface	XML / HTTP(s)	SML / IP-T
Data format and protocol on local interface	XML / HTTP(s)	SML / IP
Interface on central site / How to read out meter values remotely	No TSC-3 needed. Meter reading via XML / http requests. Developer tool available, e.g. to read out and display load profile. Custom integrations via documented XML formats / http.	TSC-3 needed (e.g. hosted by DNT). Meter reading via SML/IP-T (push mode). Simple meter read out and display of load profiles e.g. via m.Center software. Custom integrations via "IPT-SDK".