Hybrid, IP-backbone Embedding Multi-communication Equipment for Smart Home and Smart Grid Applications

Dr. Michael Koch, devolo AG
The company
The company. History & Milestones

2002
- Company founded

2003
- Forerunner in the launch of HomePlug 1.0 products
- Worldwide market leader for HomePlug products

2004
- Establishment of a trans-European sales organization

2005
- World's first HomePlug highspeed adapter (85 Mbps)
- Completion of carrier projects with HomePlug products in Europe

2006
- Introduction of HomePlug AV adapter (200 Mbps)
- Completion of carrier projects with HomePlug AV products

2007
- Introduction of Business Solutions

2008
- World's first HomePlug DVB-S-Receiver

2009
- In-Stat study: devolo confirmed as global market leader in HomePlug technology
- Move into a new company building in Aachen, Charlottenburger Allee

2010
- Launch of dLAN® TV Sat 1300-HD
The company. A team of specialists

- Specialist staff in the areas of market research, product management, development, buying, sales and marketing
- Staff with precise product knowledge and extensive market experience
- Autonomous and independent project management
- Work in a climate of open dialogue and mutual respect

45% Research & Development
41% Sales & Marketing
14% other Departments
The company. **Sales development**

![Graph showing sales development from 2003 to 2011](image_url)
devolo has shipped over 8 million dLAN® adapters – Trend towards home networking over the electrical wiring continues

devolo has passed the milestone of shipping over 8 million HomePlug adapters, no other International powerline company has reached this goal! According to GfK (German based research company) 70% of German powerline customers choose devolo.

7 out of 10 powerline customers choose a devolo adapter!

Market Shares Germany in August 2010

Source: GfK-RT
The company. **Sales figures**

*Status 31.12.2010*

- **Number of delivered devolo Powerline products since 2003***:
  - **Total** 9,122,292 Pieces
  - dLAN® 14MBit: 1,399,915 Pieces
  - dLAN® 85MBit 3,755,747 Pieces
  - dLAN® 200MBit 3,966,630 Pieces

- **Branding**
  - devolo 5,298,247 Pieces
  - OEM 3,824,045 Pieces
The company. **Sales figures**

*Status 31.12.2010*

- **Main Markets**
  - DE 3.408.473 Pieces
  - FR 3.267.979 Pieces
  - BeNeLux 1.046.536 Pieces
  - CH 435.731 Pieces
  - UK 393.653 Pieces
  - Other EU 569.920 Pieces

- **Markets**
  - Retail 5.253.292 Pieces
  - B2B 178.992 Pieces
  - IPTV Rollouts 3.690.008 Pieces
The Products. Awards

- dLAN® 200 AVmini
- dLAN® 200 AVplus
- dLAN® 200 AVsmart+
- dLAN® 200 AV Wireless N
The Products. **Awards**

- **Vianect AIR TV**
  - SFT: 10/2010, GUT 2.1
  - PC Wacht: Dezember 2010, NOTE 5 SEHR GUT

- **dLAN® TV Sat**
  - Testeo.de: 06/2010, sehr gut
  - SATVISION: SEHR GUT 92.4%
  - DEVOLO DLAN TV SAT 1300-HD

- **dLAN® TV Sat 1300-HD**
  - Testeo.de: 06/2010, sehr gut
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### The Products. Product portfolio Business Solutions

<table>
<thead>
<tr>
<th>Coax- / Powerline</th>
<th>dLAN® 200 AVpro WP</th>
<th>dLAN® 200 AVpro2</th>
<th>dLAN® 200 AVpro2 i</th>
<th>dLAN® 200 AVpro host</th>
<th>dLAN® i</th>
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<tr>
<td>Integration</td>
<td>dLAN® 200 AVmodule</td>
<td>dLAN® 200 AVmini PCI</td>
<td>dLAN® Power supply 85-18</td>
<td>dLAN® Power supply 200-18</td>
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<td>Management Software</td>
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<td>Modems</td>
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<td>MicroLink® 56k i</td>
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devolo sets great store by environmentally compatible development and production.

In accordance with the EU directive, devolo products do not contain any hazardous substances.

Each product should be recycled optimally at the end of its service life.

devolo’s products with the Highly Recyclable logo uses a high percentage of recycled materials.

devolo’s intelligent PowerSave technology provides energy savings of 30 percent—automatically.
Participate from devolo’s high quality requirements

- Incoming inspection of each product according ISO 9001
- Failing rate below 0.7%
- German quality assurance over all operating systems, country versions, media, and protocols
- Reliable and optimized products in relation to protection, performance, and design
- Successful interoperability tests with products of other PLC suppliers and other IP network devices
- Intuitive tools in Microsoft style
The Smart Grid engagement
dLAN® Smart Metering. Revolution in measuring points

Changes on the energy market

- In Germany smart meters have to be installed in new buildings, since 2010
- Integration of additional energy sources (gas, water, heat)
- Reduction of energy consumption by 20% and elimination of energy intensive devices until 2020

Targets

- Efficient implementation of applications to comply with current and future legal regulations in accordance with EnWG § 21b and §40
- Real-time availability of energy data
- Integration of additional energy sources (gas, water, heat)
- Consistent system for connecting all meters in a building
Requirements to smart metering & multi utility systems

- Reachability of all meters (power, gas, water, heat) in a multi dwelling unit via wM-Bus technology
- Connection of any numerous devices to the powerline IP network (backbone)
- Automated data transfer between meters within the apartments and the centralized MUC (Multi Utility Communication)
- Transfer of consumption data to utility companies
- Visualization of current consumption curves, e.g. on PC, notebook, display, and smart phones
- Low investment per meter point
- Reliable and quick installation
- Secure energy data transfer through data encryption
- Development of customized energy rate offerings for customers with regards to harvesting energies
Why do customers benefit?

- More transparency about the energy consumption
- Customized consumption profile allows possible savings
- Real-time consumption monitoring
- Reduction of energy costs through adapted energy consumption
- Improved services, e.g. with consumption statistics, consumption profile, customized rate consultancy and the use of temporary cheap energy prices
- Increased reliance to the utility provider
Wie funktioniert der „Intelligente Stromzähler“?

› Austausch des „alten“ Zählers gegen einen neuen elektronischen Zähler mit integrierten Kommunikationsmodul.

› Sekundärlich liefert der Zähler einen Meßwert. Diese Sekundenwerte können direkt im lokalen Netzwerk über die Strom-Radar-Software analysiert werden.

› Kunde kann über einen Internet-Zugang seine ¼-Stunden Verbrauchsdaten aufbereitet betrachten und Vergleiche in Form von Tages-, Monats- und Jahresansichten erstellen.

› Weitere Applikationen: Alarm-Funktion per SMS, Anzeigegerät (noch in Entwicklung)
The power meter is visible for the utility through the combination of DSL in the access and PLC in the house.

• The power meter that has an integrated PLC module that sends the data on the power grid.

• The devolo PLC adaptor receives the signal at a socket close to the DSL router.

• The devolo PLC adaptor is connected through a RJ-45 plug to the DSL router.
Participation in the EC funded research project DLC-VIT4IP

- IP Traffic in Smart Grids
- PLC access technology
- Using spectrum lower than 500 kHz
- High data rate in low frequency range
## European Dimension of the Consortium

### Research partners
- AAS (AUT)
- CRAT (ITL)
- UoL (UK)
- TUD (GER)
- VITO (BEL)

### Industrial partners
- KEMA (NL)
- HWC (UK)
- iAd (GER)
- devolo (GER)
- Yitran (ISR)

### Utilities
- IEC (ISR)
- Vattenfall (GER)

### End User Group

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*IEEE ISPLC 2011 Udine/Italy - April 4th 2011* Dr. Michael Koch, devolo AG
DLC field test on the low voltage network

A number of 20-25 LV nodes (terminals, repeaters and head-ends such as shown) is seen as sufficient to evaluate the quality of the communication system.

Middle voltage tests are not planned, as the MV voltage topology with point-to-point connections and much less interference from power loads is less challenging for the communication system.
DLC show case in Hamburg - Bramfeld

In Hamburg-Bramfeld Vattenfall Europe owns an area with a LV and a MV distribution network. The HV transformer station is located within a distance of about 2 km away.

This area has perfect network conditions for a DLC show case:

- Real physical noise and impedance conditions on the LV and MV network
- Long distance urban MV line from HV transformer
- Mashed LV network conditions
- Industrial with urban domestic buildings around
- Possibility of additional inhouse smart grid applications

Based on standardized smart meters, switched public street lights and IP based communication modules a real looking show case can be constructed.
Integration of Private Premises into Smart-Grid Management

IEEE ISPLC 2011 Udine/Italy - April 4th 2011
Dr. Michael Koch, devolo AG
The products
dLAN® connects energy and telecommunication industry

- MUC customer interface enhancement to IP network devices via power line
- IP network (backbone) is set up via the existing power line. Field bus based IP system can be extended to any room
- Automated Meter Reading
- Backbone for Open Meter Systems via wM-Bus interface
- Real-time energy consumption data transfer to the customer
- Optional: Automated data transfer to utility companies via Internet connection (connection between smart meter and DSL modem via power line)
Visualisation of energy data in perfection

- Complete solution for energy data collection, transfer, and visualization
- Connection between smart meter & MUC (Multi Utility Controller)
- Data transfer via power line
- Comprehensive visualization

Benefits
- Integrated complete, enclosed system which covers all areas of smart metering
- Easy & quick installation by existing meter replacement through a smart meter with integrated dLAN® PLC module
- Increased data transparency improves customer assurance and loyalty
Overview

Smart Meter – data collection / transfer
- Installation of a smart meter with integrated dLAN® PLC (Power Line Communication) technology
- Automated energy data collection and real time data transfer to the customer
- 200 Mbps data transfer

Energy data reception via dLAN® adapter
- Customers get provided with an dLAN® adapter to receive the energy consumption data
- The device works plug-and-play, it just has to be plugged into a free socket within the apartment
- Connection with the visualization device
- 200 Mbps data transfer

Visualization of energy data
- Comprehensive visualization option, e.g. for meter reading, current consumption curve, diagrams, rate information
**Innovative dLAN® smart metering products**

- **dLAN® DINrail**
- **dLAN® Energy Monitor**
- **dLAN® 200 AVpro Module 6400**
- **dLAN® 200 OMS Repeater**
Overview

- HomePlug AV adapter for DIN rail installation within electrical installations
- IP network via PLC as backbone
- PLC enhancement of the MUC-C customer interface
- Data transfer over the existing power line
- 200 Mbps data transfer
- Size 4 units width
- 1 Fast Ethernet Port
- Overvoltage category 3
- 3phase/1phase power supply, internal phase coupling, AES data encryption via button on the device
- 3 LED status display
Professional dLAN® integration

- Standard interfaces allow a seamless integration into the electronic meter
- Easy installation by replacement of the meter through a smart meter with embedded dLAN® PLC module
- Data transfer via power line

Benefits
- Compliance to the own branding
- Highest customization flexibility
- Enclosed solution provides protection from theft and vandalism
- Easy & quick installation
- Low investment per meter point
Overview

- Integration via MII standard interface
- Open API for status information and device configuration
- Integrated HomePlug AV network controller including MII (MAC or PHY mode) interface
- Simplifies development, production, tests, and certification
- Developed for small-footprint embedded applications
- Data transfer up to 200 Mbps
- AES data encryption
- INT6400 chipset
- Dimensions: 27.5 x 69.5 mm
Meter reading in a multi utility system

- Gateway between wM-Bus and PLC communication
- OMS (Open Metering System) interface for wireless-based meter reading
- M-Bus systems will be connected via PLC based IP network
- Energy data will be collected at a central point and forwarded to the MUC via wM-Bus wireless connection

Benefits
- Data collection anywhere in a building, e.g. gas, water, and heat data
- Integration of a huge number of devices into the power line IP network
- Easy installation
dLAN® in the Multi Utility System

- Gas, water, and warmth meters offers a m-bus interface for OMS (Open Metering System) setup
- Within Multi Dwelling Units the wireless connection is often not able to reach the MUC (Multi Utility Controller) to transmit energy data

The Solution - dLAN® 200 OMS Repeater

- The wireless m-bus systems are connected via PLC (Power Line Communication) based IP network
- Any dLAN® 200 OMS Repeater works as a gateway between wireless M-Bus and PLC connection – positioning where maximal meter quantity can be reached
- OMS conform transmission of collected data to a central point, where another dLAN® 200 OMS Repeater sends the data via wireless M-Bus connection to the MUC
- Through OMS conformity data can be sent via DSL internet connection to a backend
Overview

- Supported standards: HomePlug AV / IEEE 1901
- wM-Bus Repeater over PLC, according to OMS specification 2.0
- wM-Bus EN 13757-4: 2005
- Frequency range: 863.03 – 868.95 MHz
- Data transfer rate: 2,4/16,384/66,66 Kbps
- Coding: Manchester/3-off-6xxx
- Operation mode S2, optional S1, S1m, T1, T2, R2
- Available in 2011
Solution

• Complete Solution, including 3 components:
  • Smart meter with integrated dLAN® 200 AVpro Module 6400 for automated data collection and real time data transfer to the customer
  • Customer receives energy data via dLAN® 200 AV Wireless N-Adapter
  • Comprehensive visualization of energy data
  • Visualization via smart phone and notebook

Benefits

• Pre-configurated system with ideal calibration of the several components
• Quick installation
• Low investment per meter point
• Secure data transfer
• Increased assurance and customer loyalty through data transparency
• Compliance with current and future legal regulations

Requirements

• Complete solution, including innovative components for collection, transmission, and visualization of energy consumption data
• Compliance to legal regulations in accordance with EnWG § 21b
• Quick installation
Solution

- On dLAN® technology based IEQualize complete solution: UNIEQ-Box
  - Smart meter with integrated dLAN® 200 AVpro Module 6400 for automated data collection and real-time data transfer to the customer
  - Customer receives energy data via dLAN® 200 AV Wireless N-Adapter
  - Comprehensive visualization of energy data

Benefits

- Complete solution for easy and quick installation within customers infrastructure
- Low investment per meter point
- Customers can directly influence their energy consumption
- Increased assurance and customer loyalty through data transparency
- Consequently existing UEWAG customers recognize the benefit and want a contract extension
- Compliance with current and future legal regulations

Requirements

- Customer retention through offering an additional benefit with real-time availability of energy consumption data
- Compliance to legal regulations in accordance with EnWG § 21b
- Low costs per meter point
- Easy & quick installation
Solution

- dLAN enables a secure and reliable connection between inverted rectifier and Solar-Log-Metering.

Benefits

- Easy hardware integration for monitoring and earning analysis for photovoltaic systems
- Ideal technology for smart metering concepts
- Easy installation and configuration on-site
- Secure and reliable operation
- Low investment
- Instead of power line cable you can use coaxial cable or telephone cable

Requirements

- For the monitoring of a solar system and energy data transfer to the utility company along the intention of a smart grid concept a data connection between inverted rectifier and the Solar-Log system is required.
- Especially in commercial used buildings it is not possible to install an additional cable infrastructure. Therefore another reliable solution is needed.
Thank you for your attention.