HomePlug Technology Seminar
COMPUTEX 2014
Speaker Presentations
HomePlug Market & Technology Roadmap
Rob Ranck, President, HomePlug Alliance
HomePlug Overview

- HomePlug technology enables **RELIABLE, PLUG & PLAY, WIRED** connections using powerlines throughout the home.
  - **Global standard:** HomePlug products distributed worldwide – currently 95% share of powerline networking
    - Major retailers in every region
    - Dozens of operators / service providers use HomePlug for IPTV connectivity
  - Next generation **HomePlug AV2 MIMO** brings gigabit-class connectivity to homes (i.e. faster than most Ethernet connections).
  - HomePlug offers a key technology suite for the **Smart Home and Smart Grid – enabler for the “Internet of Everything”**

- Alliance fast facts
  - Established in 2000: currently ≈60 member companies
  - Member roster: [www.homeplug.org/about/roster/](http://www.homeplug.org/about/roster/)
  - Robust and growing product certification programs
Vision & Strategy: Making HomePlug a mainstream networking technology for the “Internet of Things”

- HomePlug industry ecosystem: Build a large PLC technology ecosystem for all applications -- push adoption of PLC within the home & outside in the smart grid.

- HomePlug in hybrid networks: Establish HomePlug as a critical element for enabling whole-home Wi-Fi coverage.

- Embedded HomePlug: drive adoption of HomePlug into embedded applications for CE, smart appliances, electric vehicles.
  - current examples: Hisense, BMW, TATUNG

- Smart homes and “internet of everything”: HomePlug Green PHY & Netricity products will help to enable M2M connectivity.
HomePlug Alliance -- Key ORG Ingredients

- Technology
- Product Certification
- Brand & Marketing
New Alliance Members

- **BMW Technology Corporation**: Supports HomePlug **Green PHY** for electric vehicle charging
- **CATR**: Part of MIIT - will certify products implementing **nVoy®** technology
- **enverv**: Supports **Netricity™** for outside-the-home smart metering and distribution automation applications.
- **Harman International**: premium audio products & technology
- **Hisense**: Embedding HomePlug technology directly into products
- **Hong Kong Applied Science and Technology Institute (ASTRI)**
- **Huawei**: certifying new HomePlug products
- **Mitsumi**: Green PHY products
- **Texas Instruments**: Supports **Netricity**
- **UL Verification Services, Inc.**: Will provide testing and verification services for products implementing (Smart Energy Profile 2).
Strong Silicon Vendor Support

Silicon Vendors that are HomePlug Alliance members

- Broadcom
- MStar Semiconductor
- Qualcomm Atheros
- TI
- enVerv
- Marvell
- Renesas
- Sigma Designs
- Texas Instruments
HomePlug in Retail

Breadth of products from a variety of manufacturers

Consumers can easily find HomePlug products at a nearby retailer
HomePlug Enabled Service Provider Deployments

HomePlug = Successful real-world, high volume deployments

[List of logos from various service providers]
HomePlug’s Certification Programs: Benefits to the ecosystem

- Market Awareness
- Interoperability
- Quality of Products

- Any device with the HomePlug Certified logo has passed rigorous testing to ensure high performance, reliability and interoperability.

- The HomePlug Certified logo is an important industry validation of reliability for powerline networking products with more than 325 products certified.
Develop + Promote + Collaborate
Key Liaisons and Memberships

- WiFi Alliance
- DLNA
- IEEE
- CSEP Consortium for SEP 2 Interoperability
- MoCA Multimedia over Coax Alliance
- ZigBee Alliance
- WiSUN Alliance
- SGIP Smart Grid Interoperability Panel
HomePlug AV2

- Next-generation, Gigabit-class connectivity
- Certification program launch in 2014
- Member companies making AV2 product announcements:

- Broadcom
- D-Link
- GigaFast
- TRENDnet
- Linksys
- Qualcomm Atheros
- ZyXEL
- TP-LINK
Product certification and marketing for interoperable solutions implementing the IEEE 1905.1 hybrid home networking standard

Testing program is being finalized

Test houses: NTS, CATR in China

HomePlug, MoCA and Wi-Fi Alliance member companies with products certified to each underlying technology will be eligible for nVoy certification

Key Benefits of nVoy Technology

- Synergy of wired performance with wireless mobility
- Ease of use
- Advanced diagnostics
- Topology discovery
- Energy management
- Simplified security setup
- Automatic configuration of Wi-Fi access points
- Universal connectivity and coverage
Interoperable Technologies Deliver True Connected Home

HomePlug brings it all together.

- Complete wired and wireless coverage for a true connected home
- Supports all applications from digital entertainment to smart energy management
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<thead>
<tr>
<th>Company</th>
<th>Location</th>
<th>booth / room</th>
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<tr>
<td>Actiontec Electronics, Inc.</td>
<td>Exhibition Hall 1 1 F</td>
<td>C0523</td>
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<td>Askey Computer Corporation</td>
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<td>Billion Electric Co., Ltd</td>
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<td>Broadcom Corporation</td>
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<td>Qualcomm Atheros, Inc.</td>
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<td>Shenzhen GEEYA Technology Co., Ltd.</td>
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<td>ST&amp;T Electric Corporation</td>
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<td>TP-Link Technologies, Ltd.</td>
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Media and industry quotes

- “I come down strongly on the side of HomePlug technology. The HomePlug Powerline standard sends network data over a building's AC power at near-Ethernet speeds. I've yet to find another networking technology as easily plug-and-play as HomePlug.”
  
  – Lincoln Spector, PCWorld

- “HomePlug technology has been around for years and dominates PLC technology. While several other PLC standards were developed, they all failed to gain market acceptance, leaving this space to HomePlug. HomePlug is a proven PLC method readily available today.”
  
  – Lou Frenzel, Electronic Design

- “While the standards battle may have held back the overall market, it is estimated that HPA accounts for around 95% of Powerline Communications (PLC) versus competing technologies, with millions of devices shipped out in the field.”
  
  – Goran Nastic, CSI Magazine
THANK YOU
Internet Everywhere – Overcoming Barriers to Whole Home Coverage

David Wang, Director of Marketing, Qualcomm Atheros
Demand for Home Connectivity is Exploding

- Digital Entertainment
- Mobile Data
- Broadband Access
- Smart Home
The Growing Need for Internet Everywhere

- More devices in more places: Increasing need for high throughput connectivity throughout the home.
- Proliferation of mobile devices and need for Wi-Fi coverage in every room.
- Evolution of HD Video Streaming (e.g. OTT, IPTV, Ultra-HD 4k).
- Convergence of voice, video and data.
- Smart Home trends will continue to increase the strain on home networks and the need for a singular network for entertainment and IoT products.
A proliferation of connected devices throughout the home

Solutions

- Faster WIRED networks
- Hybrid networks: seamless connectivity between WIRELESS + WIRED technology
Next Generation: HomePlug AV2

- HomePlug AV2 silicon now available from major silicon vendors.
- Faster speeds and better coverage than any other powerline technology in the market.
- Interoperable with the millions of HomePlug AV products already deployed.
- Brings new level of performance and coverage for the benefit of consumers, retailers and service providers.
- HomePlug AV2 products currently undergoing field trials by carriers worldwide.
# HomePlug AV2 Features & Benefits

<table>
<thead>
<tr>
<th>AV2 Feature</th>
<th>Benefits</th>
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<tr>
<td>MIMO with Beamforming</td>
<td><strong>Improves peak data rates</strong> and expands coverage throughout the home</td>
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<tr>
<td>Additional spectrum</td>
<td>Significantly <strong>increases application throughput</strong> for applications such as multiple HD streams</td>
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<td>Repeating</td>
<td><strong>Expands coverage</strong> by repeating the signal on paths with better SNR (Signal to Noise Ratio)</td>
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<td>Efficient Notching</td>
<td>Dynamically increases throughput by <strong>efficiently notching tones</strong> while complying with regulatory requirements</td>
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<tr>
<td>Power Control</td>
<td><strong>Enhanced coverage and throughput by managing transmission power</strong></td>
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<tr>
<td>Power Save</td>
<td><strong>Improves energy efficiency</strong> when the device is in standby</td>
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HomePlug AV2: Benefits for Service Providers

- Whole home coverage with Gigabit-class speeds
  - Significant coverage improvements to ensure high speeds in more locations for whole home IPTV/OTT/VoD video distribution.

- High speed Wi-Fi extension
  - HomePlug AV2 serves as a high bandwidth backbone ideal for extending carrier-grade Wi-Fi connections everywhere in the home.

- Consumer friendly
  - Push button security mechanisms, no running new wires throughout the home and reliable high speed connective provide a great experience with no professional help required.

- Interoperability with field deployed products
  - Compliance with the HomePlug AV2 standard validates interoperability with HomePlug AV and Green PHY products in the market.
HomePlug: Carrier-Grade Powerline

- Carriers use HomePlug to enable premium connected services
  - Over 60 Carriers around the world have installed HomePlug solutions
  - Enable new services for the Internet of Everything with interoperable HomePlug AV, AV2 and Green PHY
HomePlug AV2 Retail/End User Benefits

- Gigabit-class speeds everywhere
- Push button security mechanisms
- Plug & Play
- No running new wires
- No professional help needed
HomePlug Family Relationships

To enhance performance and reliability while maintaining interoperability, HomePlug AV2 builds on AV to include several new features.

- 30-86 MHz additional bandwidth
- MIMO with beamforming
- Efficient notching
- Higher order modulation and code rate
- Power save modes
HomePlug is also a critical element of hybrid networks per its inclusion in nVoy™/IEEE 1905.1

- The nVoy™ program is a certification and marketing initiative for HomePlug®, MoCA®, Wi-Fi and Ethernet products implementing the IEEE 1905.1 hybrid networking standard
IEEE 1905.1 defines an abstraction layer that provides a common interface for the most compelling and deployed home networking technologies in the market.

A broad base of industry-leading chipmakers, equipment manufacturers and service providers are collaborating to bring IEEE 1905.1 to fruition.

1905.1/nVoy standards based chipsets are available from multiple suppliers.

Great for the industry: Enhances user experience and enables next generation connected services for consumers.
nVoy Enabled Hybrid Home

HomePlug, Ethernet, MoCA and Wi-Fi integrate to promote whole-home connectivity whether wired or wireless.
IEEE 1905.1 Key Features

- Automatic configuration of secondary Wi-Fi Access Point(s)
- Topology Discovery (to help identify bottlenecks & mis-configuration)
- Diagnostics (both locally and thru WAN accessible TR-069 data model)
- Simplified security setup (Push Button and NFC)
- Enabler for enhanced path selection (link metrics information)
- Enabler for enhanced power management (by optimizing network power usage across different technologies)
Simplified Security Setup

- Just push button on each device
- Different network technologies OK
Automatically Configure Wi-Fi Extenders

- Wi-Fi Extenders can be self-installed
- Just push 2 buttons
- All Wi-Fi Configuration Automatically copied
In-Home Diagnostics

- Detailed home networking diagnostic data provided to call center
  - Nodes
  - Topology
  - Data rates
- Reduce truck rolls
IEEE 1905.1 Standard Timeline

- Dec 2010  1st WG Meeting
- Dec 2011  Draft 1.0 Approved by the WG
- Jun 2012  Sponsor Ballot Passed
- Apr 2013  1905.1 included into DLNA Diagnostics
- Fall 2013  nVoy Certification program announcement
nVoy Certification

- nVoy Certification Labs in USA and China
- nVoy Certification first requires MoCA, Wi-Fi or HomePlug Certification for the respective interfaces
nVoy Demonstration

Gateway

Wi-Fi Range Extender

89/95 Mbps

90/97 Mbps

93/95 Mbps

WRE-112940

WRE-18F012

N-CB60B6

GW-083404

Wi-Fi 11n24

Wi-Fi 11n5

Eth

PLC

PLC

Wi-Fi 11n5

Wi-Fi 11n24

Eth

Wi-Fi Range Extender
Summary – Internet Everywhere

- The demand for connectivity everywhere in the home is growing rapidly.

- Hybrid wired + wireless networks are needed to connect the vast array of devices being used in the home.

- HomePlug AV2 enables gigabit-class speeds and extended coverage while remaining interoperable with already deployed HomePlug AV products.

- The nVoy program brings wired and wireless technologies together seamlessly: HomePlug, Wi-Fi, MoCA and Ethernet.
THANK YOU
HomePlug and the Internet of Things

Oleg Logvinov
Industrial and Power Conversion Division
Director, Special Assignments
STMicroelectronics
Introduction – The Internet of Things

The Internet of Things includes not only computers, smart mobile devices and smart TVs, but is growing to include connected cars, smart home applications and more

source: BI Intelligence
Interoperable Technologies Deliver True Connected Home

HomePlug brings it all together.

- Complete **wired** and **wireless** coverage for a true connected home
- Supports all applications from **digital entertainment** to **Internet of Things** applications
HomePlug Green PHY (HPGP) is a subset of HP AV plus additional features for Smart Home and Electric Vehicle applications.
HomePlug Green PHY Key Attributes

- Requirements driven by energy/utility & appliance companies
- Fully interoperable with HomePlug AV and AV2 network deployments
- Shares time on wire with higher priority IPTV/media traffic
- Has robust coverage & a simple, cost effective architecture
- Power save mechanisms greatly reduce average power
- Expected to have up to 75% lower cost and 75% less power consumption than HomePlug AV
- Scalable to support up to 255 nodes
HomePlug Green PHY Enables the Internet of Things

- Smart Energy
  - Home energy management
  - Solar inverters (DC-AC)
  - Electric vehicles (EV) and EV charging systems

- Smart Home
  - Home control / automation
  - Lighting Control & Automation
  - Home Security
  - Smart Plugs
HomePlug and EV Charging

- Plug-in Electric Vehicle (PEV) charging is an important Smart Grid application
- Seven automotive manufacturers support Combined Charging Systems with HomePlug Green PHY

“Providing a harmonized, single-port fast charging approach for electric vehicles in the US and Europe ensures the integration of all charging scenarios into one vehicle inlet/charging connector and uses identical ways for the vehicle to communicate with the charging station.”
Solar Panel Inverter with HPGP

DC-AC Inverter
HPGP-Enable

AC power line with communication signal

Gateway or Display
HPGP-Enable
HomePlug and Home Security

- HomePlug technology has been implemented in home security camera systems
- Systems are easy to set up, without the need to install new wires
- Monitoring can be accessed anywhere from computers or smart phones
Smart Air Conditioner

Introducing the New Hisense Smart Airconditioner
Power Line Communication (PLC)
Wall Mount Model
海信智能空调 电力线网络安装指南

第1步 网线两端分别连接电力线适配器的网口和路由器的LAN口；

第2步 将电力线适配器插在插座上；

第3步 空调开机后，显示屏指示灯常亮为蓝色即正常

注：空调需先用遥控器开启“智能”功能（长按“智能”键切换）
Smart Refrigerator

海信博纳智能冰箱
智慧科技 健康管家

Hisense 海信 SMART

享你所想

SIMPLY CONNECT
Netricity™: For Smart Metering and Distribution Automation Applications

- A certification and branding program created by the HomePlug Alliance
- Compliance and interoperability testing for the IEEE 1901.2 Standard (Main body and Coexistence)
- Creates market confidence
  - Certification assures compliance with the Standard
  - Interoperability is verified among products
- Certification program is managed by the experienced and successful HomePlug organization
Netricity™ product applications:

- Utility grid modernization
- Load control
- Distribution automation
- Demand response
- Meter-to-Grid connectivity
- Net metering
- Micro-grids
- Street Lighting control
- Grid sensor communications
- Photovoltaic panel monitoring

The Netricity™ program addresses the need for long range powerline networking for outside-the-home, smart meter-to-grid, and industrial control applications.

The use of Power Line Communications (PLC) systems for smart grid applications will grow steadily -- with annual revenue growing from $283 million in 2012 to more than $418 million by 2020, according to Pike Research.
IEEE 1901.2 Standard - Overview

- “Standard for Low Frequency (less than 500 kHz) Narrow Band [NB-LF] Power Line Communications for Smart Grid Applications”

- Builds on field-proven OFDM technologies, as already used within IEEE 1901, 4G/LTE, and IEEE 802.11.

- The IEEE Project was approved March 2010
  - P1901.2’s working group roster included nearly all of the world’s narrowband PLC experts: Utilities, Manufacturers: meter and communications, Semiconductor vendors

- IEEE 1901.2 was published by IEEE-SA, December 2013
The Netricity™ program is supported by HomePlug Alliance member companies:
Summary

- HomePlug technologies enable Internet of Things connectivity linking billions of devices which plug in to the home’s electrical system
  - IoT applications enabled by **HomePlug Green PHY** technology include electrical vehicle charging, smart appliance, smart thermostat, lighting controls, security camera systems, etc.
  - **HomePlug Green PHY interoperability with HomePlug AV/AV2** for broadband applications allows for whole-home connectivity

- **Netricity** by HomePlug addresses the need for long range powerline networking for outside-the-home
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Certification Program Update

Scott Willy
PLC & EoC Applications & Standardization Manager
MStar Semiconductor
HomePlug Certified Logo

- Gives consumers, retailers, and service providers confidence that any product they use/carry with the HomePlug Certified logo has passed rigorous interoperability testing and will work reliably.

- Being HomePlug certified:
  - Test suite to pass inside an independent lab
  - Certification logo on packaging

- HomePlug = most established, mature certification program for powerline networking:
  - AV test matrix products based on 11 chipsets from 4 different vendors
  - 325 different products and devices have been HomePlug certified
Over 325 HomePlug Certified Products
Certification Working Group

- The Certification Working Group (CWG) is chartered by the Board of Directors to:
  - Create and maintain test specifications (aka “test plans”)
  - Manage and maintain the certification processes
  - Manage the interoperability test device matrix
  - Resolve certification conflict/issues as necessary

- CWG membership is for Participant and Sponsor members
Certification Working Group

Board of Directors

Certification WG

President and Operations

Technical WG

Marketing WG

AV/AV2 WG

Green PHY WG

Legal

WG=Working Group
Test Specifications

- CWG Certification Process document
- HomePlug AV
  - AV Compliance Test Spec.
  - AV Interoperability Test Spec.
- Green PHY 1.1
  - Green PHY Compliance Test Spec. (errata update)
  - Green PHY Interoperability Test Specification
- HomePlug AV2
  - AV2 Compliance Test Spec.
  - AV2 Interoperability Test Specification
Additional Test Specifications

- nVoy™
  - Draft certification test specification (combined Compliance and Interoperability) has been approved and is available
  - Additional updates are anticipated as a result of PlugFests

- Netricity™
  - Netricity Task Force is created
    - The Netricity MRD has been approved to guide the Task Force
  - Chartered to draft the Compliance and Interoperability Test Specifications
    - Will submit the result to the CWG for approval, and then forwarded to the BoD for additional approvals
Testing for Certification

- PHY/MAC testing is done in two steps:
  - Compliance testing – “Does the design (e.g. Silicon solution) meet the specifications?”
    - Usually done by Silicon vendors to confirm chip design
  - Interoperability testing – “Do different products work with each other?”
    - Done by product companies (OEM, ODM, Silicon vendors)
  - Required to be a HPA member (any level)

- Testing is done by 3rd party test houses
  - Current test houses: LAN, NTS and CATR for nVoy

- Certification awards
  - Certification occurs after successful interoperability testing is achieved
  - Certification only for products not chip sets