POWERLINE NETWORKING

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Web location for this presentation:
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EXECUTIVE SUMMARY

"Powerline networking" has improved greatly in speed and reliably. It is now comparable in speeds to "Gigabit Ethernet" so you can now use it to extend your local network without a slowdown relative to "Gigabit Ethernet".
A demonstration of some techniques for extending the reach and speed your home or business network:
A physical diagram of our demonstration:
An equipment description of our demonstration:
"Wireless Internet Service Provider" (WISP) provided by IRWD
wirelessly connects to the Internet side ("WAN" side) of an Edimax wireless 802.11ac router
AC1200 Multi-Function Concurrent Dual-Band Wi-Fi Gigabit Router
Three Essential Networking Tools in One
BR-6478AC
connects by means of a "Cat 6" cable to a D-Link "HomePlug AV2000" device
connects over the "house" 110-VAC power lines to a D-Link "HomePlug AV2000" device
connects by means of a "Cat 6" cable to a TP-Link wireless 802.11ac router
House Electrical Wiring
TOPICS

• Extending A Network with Powerline Networking Devices

• Powerline Networking Standards
  - "HomePlug AV2"
  - "G.hn"
TOPICS (continued)

- Manufacturers of Powerline Networking Kits
- Mesh Network By Default
- Setting Up Independent Groups of Powerline Networking Transceivers
TOPICS (continued)

- Reviews of Powerline Networking Kits
- Hands-On Experiences With "HomePlug AV2"
"PLC"

- "PLC" means "Power-line communications"
- "Powerline networking" is one of many technologies that utilize carriers riding on conductors used for power distribution
1. Electricity (Hz)

2. Data Signal (MHz)

3. The two signals are combined

4. The overlapping electrical and data signals are divided and extracted
"PLC" (continued)

- Source for the previous illustration: http://www.powerethernet.com/product/what-is-powerline.html
"PLC" (continued)

- See
  https://en.wikipedia.org/wiki/Power-line_communication
EXTENDING A NETWORK WITH POWERLINE NETWORKING DEVICES

• Add in powerline networking devices and then put a wired network switch or a wireless router at the far end of the powerline networking link.
Betty Waring calls this technique the "secret sauce" for resolving network problems in her article at http://windowssecrets.com/top-story/get-wired-performance-from-your-wi-fi-network/
COMPETING STANDARDS FOR POWERLINE NETWORKING

• HomePlug Alliance's "HomePlug AV2"
• HomeGrid Forum's "Gh.n"
COMPETING STANDARDS FOR POWERLINE NETWORKING (continued)

• http://electronicdesign.com/communications/whats-the-difference-between-homeplug-and-ghn
"HOMEPLUG AV2" STANDARD

- HomePlug Alliance's "HomePlug AV" standards are alive and well
  - Their latest standard is called "HomePlug AV2"
"HOMEPLUG AV2" STANDARD
(continued)

• HomePlug Alliance's "HomePlug AV" standards (continued)

  o However, some manufacturers call it
    "HomePlug AV2 500",
    "HomePlug AV2 600",
    "HomePlug AV2 1200",
    and
    "HomePlug AV2 2000"
"HOMEPLUG AV2" STANDARD (continued)

- HomePlug Alliance's "HomePlug AV" standards (continued)
  - And, some manufacturers call it "Powerline AV2 500",
    "Powerline AV2 600",
    "Powerline AV2 1200",
    and
    "Powerline AV2 2000"
"HOMEPLUG AV2" STANDARD
(continued)

• The numbers after "AV" are the nominal data transmission rates in Megabits per second

• Some manufacturers put in the nominal data transmission rate value without prepending it with "AV"
The current "AV1200" and "AV2000" monikers imply that "HomePlug AV2" equipment is now comparable in data transmission speeds to "Gigabit Ethernet" which is the current standard for network switches and routers.
"HOMEPLUG AV2" STANDARD  
(continued)

• Do not buy equipment that was manufactured in accordance with the old "HomePlug AV" standard: These models are now obsolete and their reliability and capabilities nowhere as good as the current "HomePlug AV2" models.
Advantages of power line networking:
No signal attenuation by walls and furniture
No signal attenuation by radio frequency interference
"HOMEPLUG AV2" STANDARD
(continued)

- To search for transceivers that are compliant with HomePlug Alliance's "HomePlug AV2":
  Go to http://amazon.com
  Search for homeplug
Installing "Homeplug AV2" transceivers is a trial and error process: You plug them in and look at the three LEDs on the transceivers.
"HOMEPLUG AV2" STANDARD
(continued)

• You can install more than two "Homeplug AV2" transceivers and they all will communicate with each other with some loss in data throughput.
**POWERLINE NETWORKING**

**Home Office**
- HomePlug AV 500Mbps Pass Through: HL115EP

**Bedroom 1**
- HomePlug AV 200Mbps Wireless-N Extender: HL110EW

**Bedroom 2**
- HomePlug AV 200Mbps Ethernet Adapter: HL112E

**Stylish & Compact HomePlug**
With Aztech HomePlug, you are now empowered to turn any power outlet into an Ethernet point without the use of additional wiring. Simply plug Aztech HomePlug AV 200Mbps Ethernet Adapter into any available power outlet to connect your PC, game console or IP camera.
Free Up Your Power Outlet

Designed to provide additional convenience, Astar HomePlug AV 500Mbps Pass Through is built with a noise-filtered power outlet for plugging in a power strip to connect home office equipment.

Stylish & Compact HomePlug

With Astar HomePlugs, you are now empowered to turn any power outlet into an Ethernet point without the use of additional wiring! Simply plug Astar HomePlug AV 200Mbps Ethernet Adapter into any available power outlet to connect your PC, game console or IP camera.
Home Office

HomePlug AV
500Mbps
Pass Through
HL115EP

Outlet

For added convenience, Aztech Power Through is built with a plug that plugs into a power strip to connect it.
Bedroom 2

Mini HomePlug AV
200Mbps Ethernet Adapter
HL112E

Stylish & Compact

With Aztech HomePlugs, convert any power outlet into an Ethernet jack without additional wiring! Simply plug your Aztech 200Mbps Ethernet Adapter (HL112E) into a power outlet to connect your PC, games console, or Internet 3D TV.
• The competing **Universal Powerline Association** ceased to exist at the end of 2010.

• "HomePlug" equipment and "Universal Powerline Association" equipment are NOT compatible so do not put them both on the same home or small business network.
Mix and match strategies?

- The equipment of the various "HomePlug AV" manufacturers inter-communicate well with each other. However, you lose proprietary, non-standard functions when you mix the equipment of different manufacturers.
"HOMEPLUG AV2" STANDARD (continued)

- "Homeplug AV2" uses sub-carriers in the 1.8 to 86 Megahertz frequency range
"HOMEPLUG AV2" STANDARD (continued)

• According to http://www.hindawi.com/journals/jece/2013/892628/ the "HomePlug AV2" standard divides the 1.8 to 86.13 MHz frequency range into 3455 subcarriers that are 24.414 kilohertz apart.
"HOMEPLUG AV2" STANDARD (continued)

• The 1.8 MHz to 86MHz frequency range of "HomePlug AV2" equipment covers the legacy 3 to 30 Mhz shortwave radio band so there may be interference BETWEEN shortwave radio receivers & transmitters AND "HomePlug AV2" equipment. However, there are lots of interference sources, both natural and man-made in the 3 to 30 Mhz shortwave band.
"HOMEPLUG AV2" STANDARD (continued)

- Based on various reviews, some of the best performing and lowest priced "HomePlug AV 1200" products are available from TP-Link
  
  - See
    
    http://www.newegg.com/Product/ProductList.aspx?Submit=ENE&DEPA=0&Order=BESTMATCH&N=-1&isNodeId=1&Description=homeplug+tp-link&x=0&y=0
HOMEGRID'S G.hn STANDARD

• An emerging new standard with lots of support from "Best Buy" and other companies:
  http://www.homegridforum.org/
HOMEGRID'S G.hn STANDARD (continued)

• Only one product available at the present time:
  Comtrend PG-9172
HOMEGRID'S G.hn STANDARD (continued)

• http://www.amazon.com/COMTR ENDPKG9172KIT-POWERLINE-ADAPTER-STARTER/dp/B00X3GX99C/ref=sr_1_1?ie=UTF8&qid=1434888307&sr=8-1&keywords=g.hn
HOMEGRID'S G.hn STANDARD (continued)

- http://www.pcmag.com/article2/0,2817,2484232,00.asp
- http://www.comtrend.com/links/201$product.htm
POWERLINE NETWORKING KITS

- "Powerline networking kits" consist of a pair of transceivers of the exact same model and firmware revision. You usually get a better price by buying a pair as a "..kit" relative to buying each transceiver separately.
MANUFACTURERS OF POWERLINE NETWORKING KITS

- Zycel
- D-Link
- Trendnet
ZyXEL Communications, Inc. - North America Headquarters

Tel: +1-800-255-4101 (free), +1-714-632-0882
Fax: +1-714-632-0858
Address: 1130 North Miller Street Anaheim, CA 92806-2001
Email: sales@zyxel.com
D-link Systems Inc
17595 Mount Herrmann St
Fountain Valley, CA 92708
TRENDnet Inc.
20675 Manhattan Place
Torrance, CA 90501 USA
Tel.: (310) 961-5500
DEFAULT MESH NETWORK

• When you install more than two powerline networking transceivers, they will default to a "mesh network" where each transceiver communicates with every other transceiver
DEFAULT MESH NETWORK (continued)

- Source for the previous illustration:
  http://www.digi.com/technology/rf-articles/wireless-zigbee
SETTING UP INDEPENDENT GROUPS OF POWERLINE NETWORKING TRANSCEIVERS

• By using the "Encrypt" button of powerline networking transceivers, you can set up independent groups of powerline networking transceivers that "clannishly" only communicate with each other:
SETTING UP INDEPENDENT GROUPS OF POWERLINE NETWORKING TRANSCEIVERS (continued)

- "Transceiver A" communicates with "Transceiver B"
- "Transceiver C" communicates with "Transceiver D"
- "Transceiver E", "Transceiver F", and "Transceiver G" communicate with each other.
SETTING UP INDEPENDENT GROUPS OF POWERLINE NETWORKING TRANSCEIVERS (continued)

• Trendnet's owners manuals refers to this configuration as "overlapping powerline networks". See http://www.trendnet.com/download_manager/default.asp?iFile=17356
REVIEWS OF POWERLINE NETWORKING KITS

• The best and most up-to-date review is located at http://www.techhive.com/article/2868314/the-essential-guide-to-buying-a-homeplug-ethernet-adapter-including-6-hands-on-reviews.html
Some of the models in the following review are 2014 models that are now considered to be obsolete: http://www.cnet.com/topics/networking/best-networking-devices/power-line-adapters/
HANDS-ON EXPERIENCES WITH "HOMEPLUG AV2"

• See http://aztcs.org/meeting_notes/winhardsig/networks/powerline/powerline-experiences.pdf