

Bridging the Digital Divide with IPv6-enabled Power Line Communications and Wireless LANs

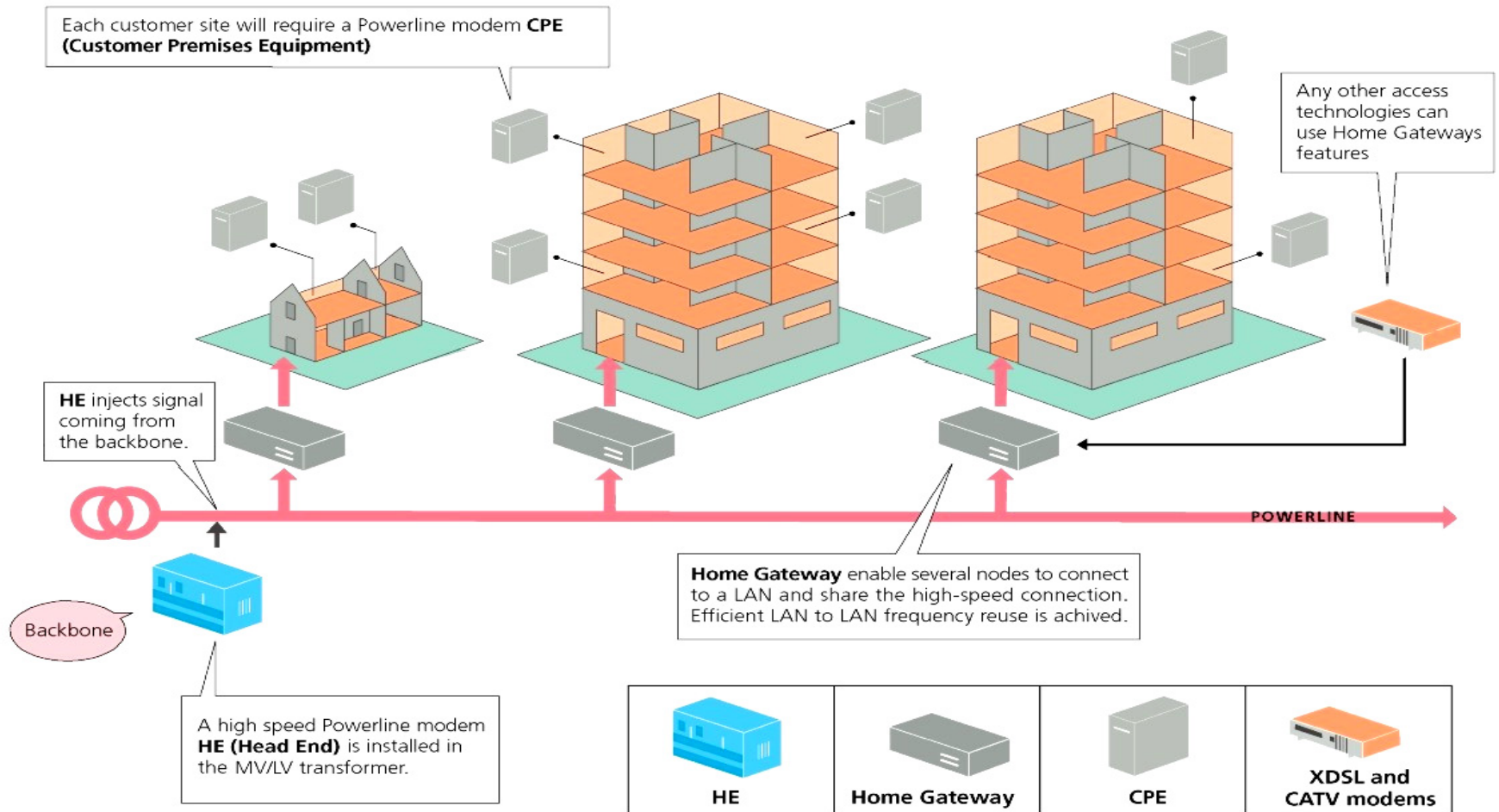
**WSIS, New Internet (IPv6) workshop
Geneva, December 2003**

**Jordi Palet, EU IPv6 Task Force Steering Committee
& CEO/CTO, Consulintel**

6POWER: Objectives

- Research native IPv6/IPv4 and related protocols or advanced network services (QoS, security, multicast, mobility, ...) support over broadband Power Line.
- Large-scale deployment of very high speed broadband PLC over 45 Mbps !
- Support for emerging technologies: VoIPv6, multi-conferencing, audio/video streaming, advanced “next generation” digital set-top-boxes, next generation services (high-speed interactive TV, secure e-commerce, virtual shopping, infotainment and related applications)
- Field Trial and Evaluation, network prototypes, interconnected with other IPv6 trials.

Typical PLC Network Topology



PLC and WLAN for Broadband

- PLC Key advantage:
 - Power wires are already installed in any location where information could be delivered (access).
 - Traffic lights
 - Information panels
 - Metering systems
 - Vending machines
 - PLC offer today speeds up to 200 Mbps.
- WLAN
 - Easy to deploy
 - Today speeds up to 54/108 Mbps.

PLC & WLAN Deployment

- New service providers
 - “Uti-telcos” ;-), ISPs over PLC
 - WISPs
- WLAN Open Communities
 - Neighborhoods sharing bandwidth
- Reaching everywhere
 - 3G+ base stations!
 - WLAN Access Points!
 - Security, surveillance
 - “New” Vending machines
 - Only the imagination say where is the limit ...

For the user ...

- Higher competition
- Better services, better prices
- True QoS
- True Interactive TV
- Intelligent environments
- Example: Door-opening system (voice or voice&video)
 - Can be easily “upgraded”
 - Can be installed at every place in the home
 - Connectivity with Internet (remote opening/control)
 - Several people using it simultaneously
 - Same device as the computer, PDA, cellular, VoIP phone, etc.
 - Can be used to communicate between neighbors
 - ...

Enough Bandwidth?

- Next generation applications are hungry of Mbps.
 - User and applications ask for more and more ...
 - Most probably will never stop !
 - Streaming (audio/video, multiconferencing, gaming, ...)
- Mechanisms for optimizing bandwidth
 - Multicast
 - QoS/CoS (TE?)
 - IPv6 for intelligent networks
- With IPv6 we “enable” intelligent devices
 - Today p2p means human intervention
 - With IPv6 is end-to-end, restoring Internet paradigms

IPv6, PLC & WLAN: good “room-mates”

- IPv6 Compelling reason: More Addresses
 - Billions of devices, users, “always-on” technologies
- Main IPv6 Benefits:
 - Expanded addressing capabilities
 - Server-less autoconfiguration (“plug-n-play”) and reconfiguration
 - More efficient and robust mobility mechanisms
 - Built-in, strong IP-layer encryption and authentication
 - Streamlined header format and flow identification
 - Improved support for options / extensions

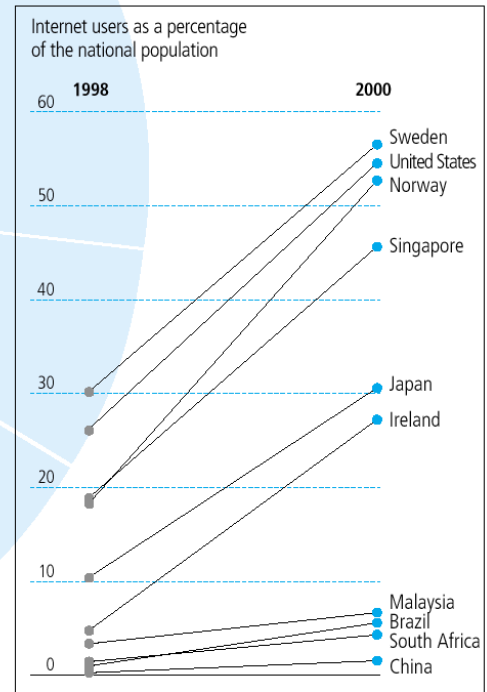
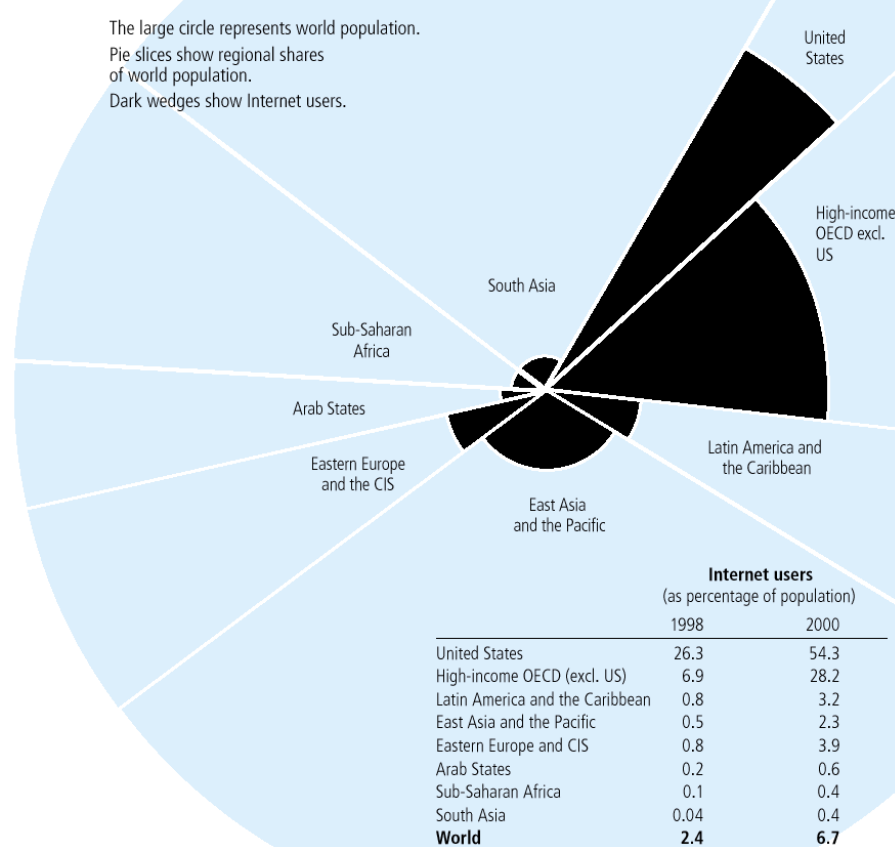
The Digital Divide

FEATURE 2.3

UNEVEN DIFFUSION OF TECHNOLOGY—OLD AND NEW . . .

INTERNET USERS—STILL A GLOBAL ENCLAVE

The large circle represents world population.
Pie slices show regional shares
of world population.
Dark wedges show Internet users.



Source: Human Development Report Office calculations based on data supplied by Nua Publish 2001 and UN 2001c.

- <http://hdr.undp.org/reports/global/2001/en/>

Internet Figures

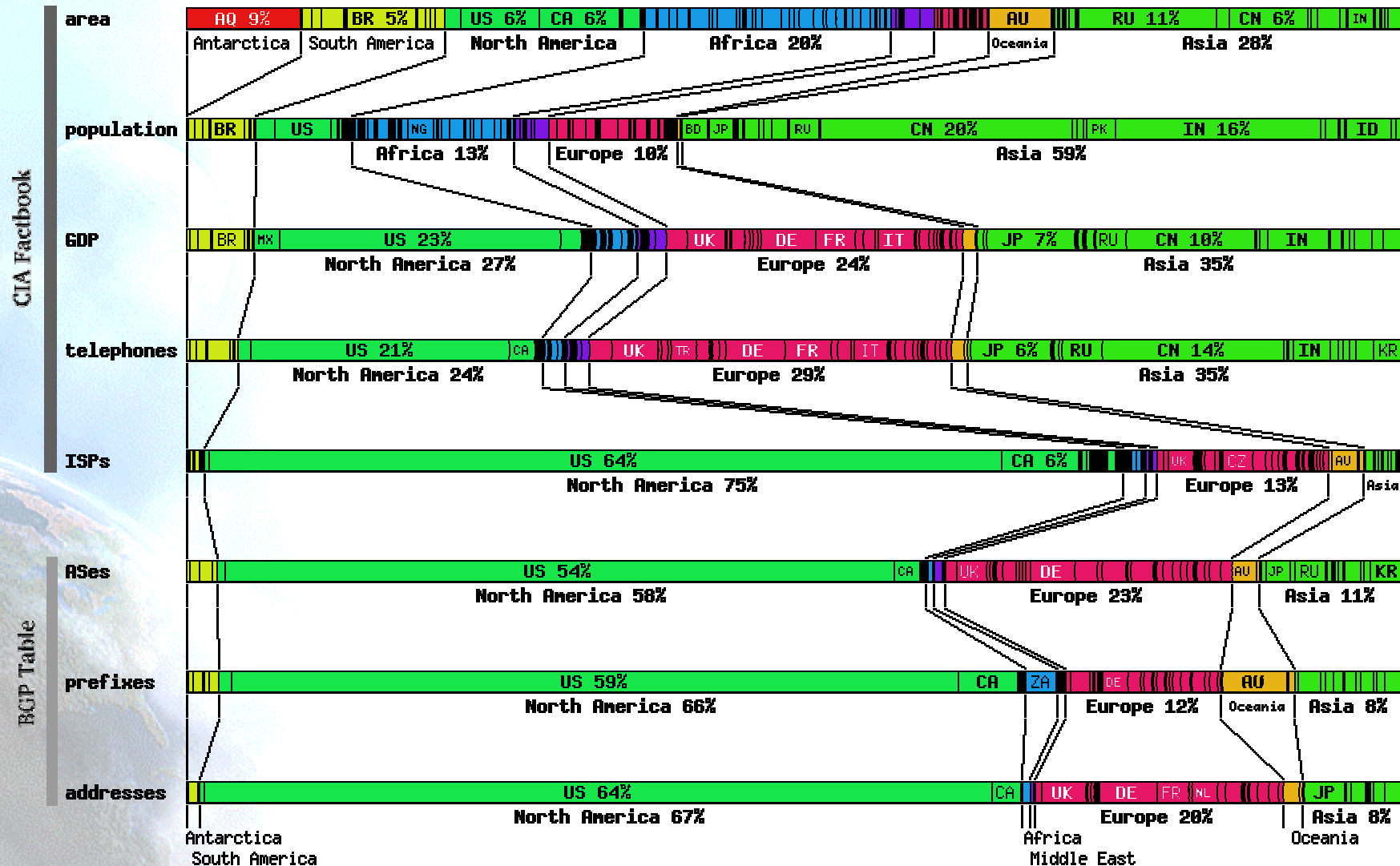
- United Nations studies suggest:
 - US has about a 60% share of existing Internet resources
 - Europe a further 20%
 - The other rich countries taking at least half the rest
- The distribution is much more skewed than for telephony, and certainly more skewed than for electricity distribution, which is available at least in the permanent buildings of almost every city in the world.
- While it is true that some countries have low electricity coverage, and that PLC is not the solution for the entire digital divide problem, it has the potential to vastly extend Internet coverage without additional "last mile" cabling.

Teledensity (example)

- China:
 - 9 phones for every 100 inhabitants (low copper/phone penetration), but 32.1 TVs (better electricity coverage).
- Spain
 - 41 phones and 40.7 TVs per 100 people.
- In an emerging economy like China (20% of the global population) the electricity network penetration is very high (about the same as in Spain) although the telephone coverage (teledensity) is quite low.
- The effect of using the electricity network for communications would be to substantially enhance the teledensity.
- <http://www.cyberschoolbus.un.org/infonation/info.asp?the me=tec&id1=156&id2=724&id3=999&id4=999&id5=999>).

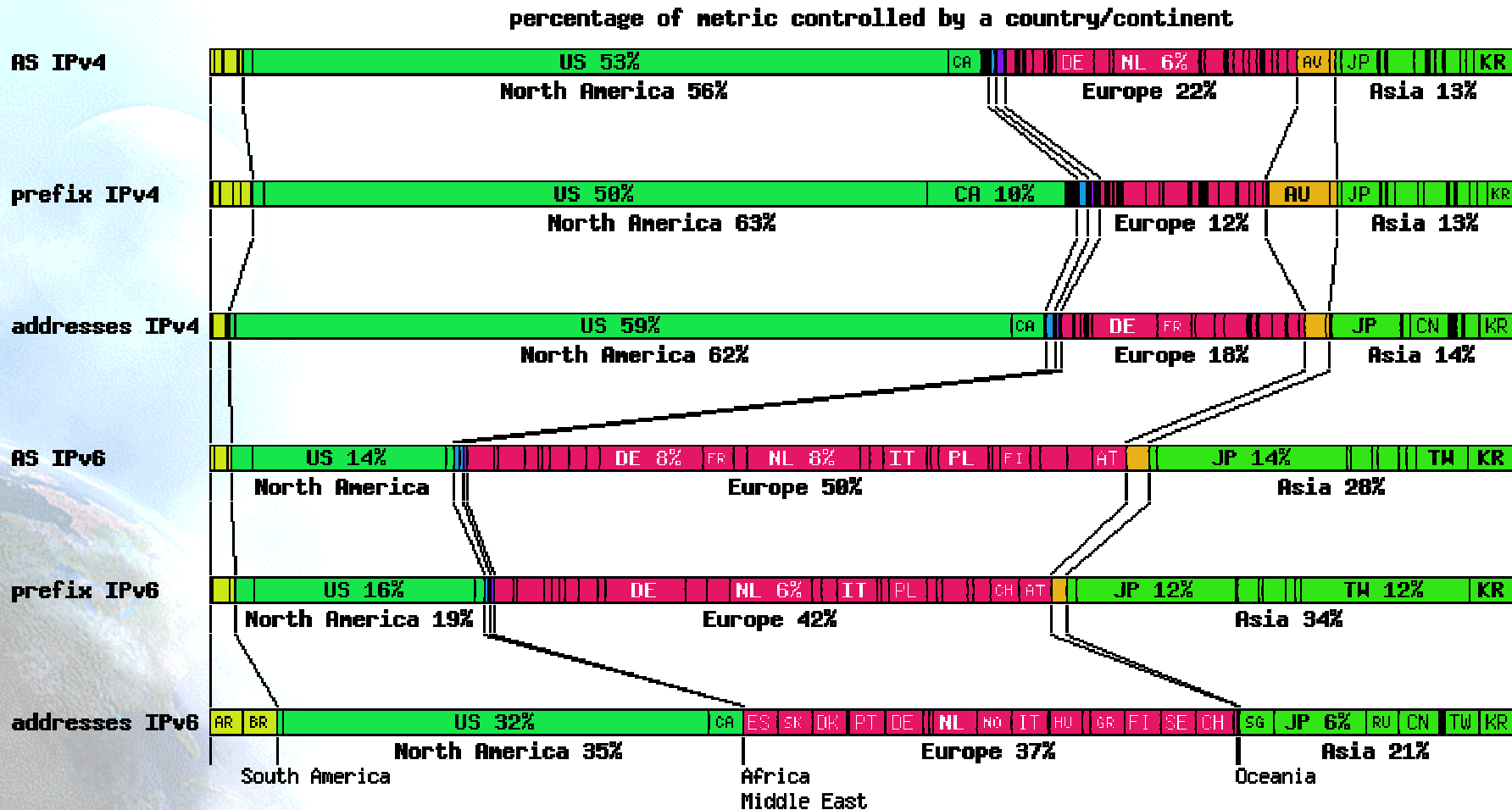
Addressing the Digital Divide?

percentage of metric controlled by a country/continent



- <http://www.caida.org/analysis/geopolitical/bgp2country/>

Addressing the Digital Divide



- <http://www.caida.org/analysis/geopolitical/bgp2country/ipv6.xml>

ISOC Paper

<http://www.isoc.org/briefings/013>



Addressing the Digital Divide with IPv6-enabled Broadband Power Line Communications

ISOC MEMBER BRIEFING #13

May 5, 2003

by Jordi Palet

Definition

Power Line Communications (PLC) allows transmission of data over power lines. PLC is potentially the network with the deepest capillarity in the world, since power lines are almost ubiquitous.

IPv6 provides a package of highly scaleable enhancements to the Internet compared to the capabilities of the existing IPv4 protocol, which is today only sustained by Network Address Translation (NAT). NAT has unfortunately created unexpected barriers during the massive growth of the Internet, consequently breaking the initial end-to-end communications concept.

However, this massive IPv4 deployment happened mainly in rich countries, creating a digitally divided society. IPv6, associated with other scaleable technologies like PLC, is key to redressing the balance and alleviating the digital divide, enabling more people and entire countries to access information and knowledge, which in turn will allow them to benefit from the global economy, and create new knowledge and services.

Background

New access technologies, like PLC, that have been evaluated for some years, have failed to support the legacy Internet paradigm. These technologies now have a new opportunity with IPv6, because IPv6 will give value to their deployment.

Power Line Communications has been around since the 1930's but was never seriously thought of as a medium for communication due to its low speed, low functionality and high deployment cost. However, new modulation techniques supported by recent technological advances have finally enabled this medium to become a realistic and practical means of communication.

Recently, new technology has led to integrated circuits and modems entering the market, providing high speeds over power line infrastructure at reasonable and falling cost.

Although several broadband PLC technologies have been successfully developed, there is no standard yet. Some vendors provide "low-speed" (up to 2 Mbps) data rates using single-carrier technologies (GMSK, CDMA). Some technologies are based on multicarrier modulations (OFDM) and offer higher data rates, notably a 45 Mbps OFDM PLC chipset, which is the highest data rate available at this time.

In December 2002, at least one PLC technology vendor announced that during the second half of 2003, a new generation of broadband PLC technology providing 200 Mbps of physical layer data rate would be available as a commercial product.

Technical Issues of PLC

The main advantage of PLC over other technologies is that no new cabling is required, as all the cables are already there. Every building, be it offices, apartments or houses, has the network already installed. This permits a computer,

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Examples in the News

<http://www.ipcf.org/>
http://www.plcforum.com/docs/Italia_Oggi.pdf
http://www.plcforum.com/docs/Com_World.pdf
http://www.plcforum.com/docs/Cinco_Dias.pdf
http://www.plcforum.com/docs/PLCforum-PR_Mannheim.pdf
http://www.6power.org/noticias_6power.php
http://www.6power.org/noticias_ipv6.php
<http://the.honoluluadvertiser.com/article/2002/Nov/22/bz/bz01a.html>

Relevant IETF RFCs

Over 50 RFCs have been published by different IETF Working Groups, including those directly implicated in the standardization of IPv6, but also some others. A new WG is being formed, Zerouter, that will facilitate the large scale deployment of networks, facilitating the autoconfiguration of the devices at both, the customer end, and the ISP network itself.

From OnTheInternet

<http://www.isoc.org/oti/articles/1201/g8.html>
<http://www.isoc.org/oti/articles/1201/wilkinson.html>
<http://www.isoc.org/oti/articles/0601/rap3.html>
<http://www.isoc.org/oti/articles/0601/wang.html>

Thanks !

Contact:

- **Jordi Palet (Consulintel):** jordi.palet@consulintel.es
- **Madrid 2004 Global IPv6 Summit, soon more info at:**
<http://www.ipv6-es.com>
- **6POWER Project Coordinators**
 - **Jordi Palet Martínez (Consulintel):** jordi.palet@consulintel.es
 - **Chano Gómez (DS2):** chano.gomez@ds2.es