Adoption Perspectives of IPv6

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Why a New Internet Protocol?

Only *compelling* reason: more addresses!

- for billions of new devices,
  e.g., cell phones, PDAs, appliances, cars, etc.
- for billions of new users,
  e.g., in China, India, etc.
- for “always-on” access technologies,
  e.g., xDSL, cable, ethernet-to-the-home, etc.

But Today … IPv6 is about RESTORATION and INNOVATION

- We make use of methods like NAT, PPP, etc. to share addresses
- NAT won't work for large numbers of "servers", i.e., devices that are "called" by others (e.g., IP phones)
- They inhibit deployment of new applications and services
- They compromise the performance, robustness, security, and manageability of the Internet
- But new types of applications and new types of access need unique addresses!
- We need end-to-end (security) … is about rediscovering the Internet principles
  - Removing tunnels
- We need efficient mobility
- In addition, IPv6 is an extensible protocol, open to what we need now and in the future

Broadband for ALL ?

- 25 Million New Global DSL Subscribers Added In 12 Months
  - 55 million at the end of September 2003
  - Exceed projections in more than 3 Million subscribers
  - 62 million homes at the end of 2003
  - Only 20% of the world phone lines at the time being
- China led subscriber growth in 2003, increasing from 2.2 million a year ago - a growth rate of 354%. "On this basis, during 2004, we expect China to overtake Japan as the country with the most DSL subscribers".
- Latin American countries showed strong growth, along with China and Australia.
  - Brazil (22,2%) and Argentina (18,5%), position 7 and 10, respectively
- 200 Million global DSL subscribers by end of 2005
  - Can we provide each home 25 IPv4 addresses ?

*** Source International DSL Forum

The Transition to IPv6

- Already 12 years since we started to work on IPng
- IPv6 has been designed with coexistence in mind
- During this time, a lot of doubts about the success of IPv6
- Since a couple of years, the “picture” has radically changed
- Look for last 24, 12 and 6 months …
- Now nobody has doubts
- But the question is still when?

Is the Cost a Problem ?

- Not anymore
  - No additional cost for networks with maintenance
  - No additional cost for Operating Systems
  - Some networking equipment might imply some cost
  - Education is always the bigger cost
  - Existing applications just work with dual stack
- Saving cost:
  - Some Telcos already report 30-35% management cost reduction

What Happens with IPv4 ?

- Remember, IPv6 designed to coexist with IPv4
- Until when? Difficult to say: 20-25 years (probably)
  - Is this important ?
- IPv4 survives because we took measures
  - Technical and policy
- Internet, victim of its own success !
  - But with restrictions ☹
- Can't say that IPv4 will finish in 2, 5, 10 or xx years
  - Possibly never, may be in part thanks to IPv6 ? Will see …
- No "Y2K" effect
  - But not doing the transition to IPv6 is an opportunity lost
- Requires some planning: 6 to 24 months
  - Depending on the network and expertise

New or Old Applications ?

- IPv6 is an opportunity for new advances applications
  - P2P
  - GRID
  - Ambient Intelligence
- But, is this the chicken and egg thing?
  - Not always …
- May be this has been one of the IPv6 deployment mistakes
- We can (must) take advantage of IPv6 with the IPv4 Internet already
- Transition mechanism are there
- Lots of applications didn't succeed with IPv4
- Let's give them a new chance with IPv6?
- We are already doing so ...

Why IPv6 ?

- The most simple thing:
  - Addresses!
    - Proliferation of devices, merging cell phones and handhelds
    - Deployment of Internet in developing economies
- Remote control, monitoring, automation, surveillance, teledetection, alarms, ...
  - Home/Industry automation
- Applications that haven't got the expected success, because was not easy to use them remotely with leased lines, modems, etc.
- The solution with Internet is to assign ports instead of addresses
  - But what we do with proxies?
- VPNs aren't a good solution, because the private addresses
  - What we do when there is a conflict in the visited network?

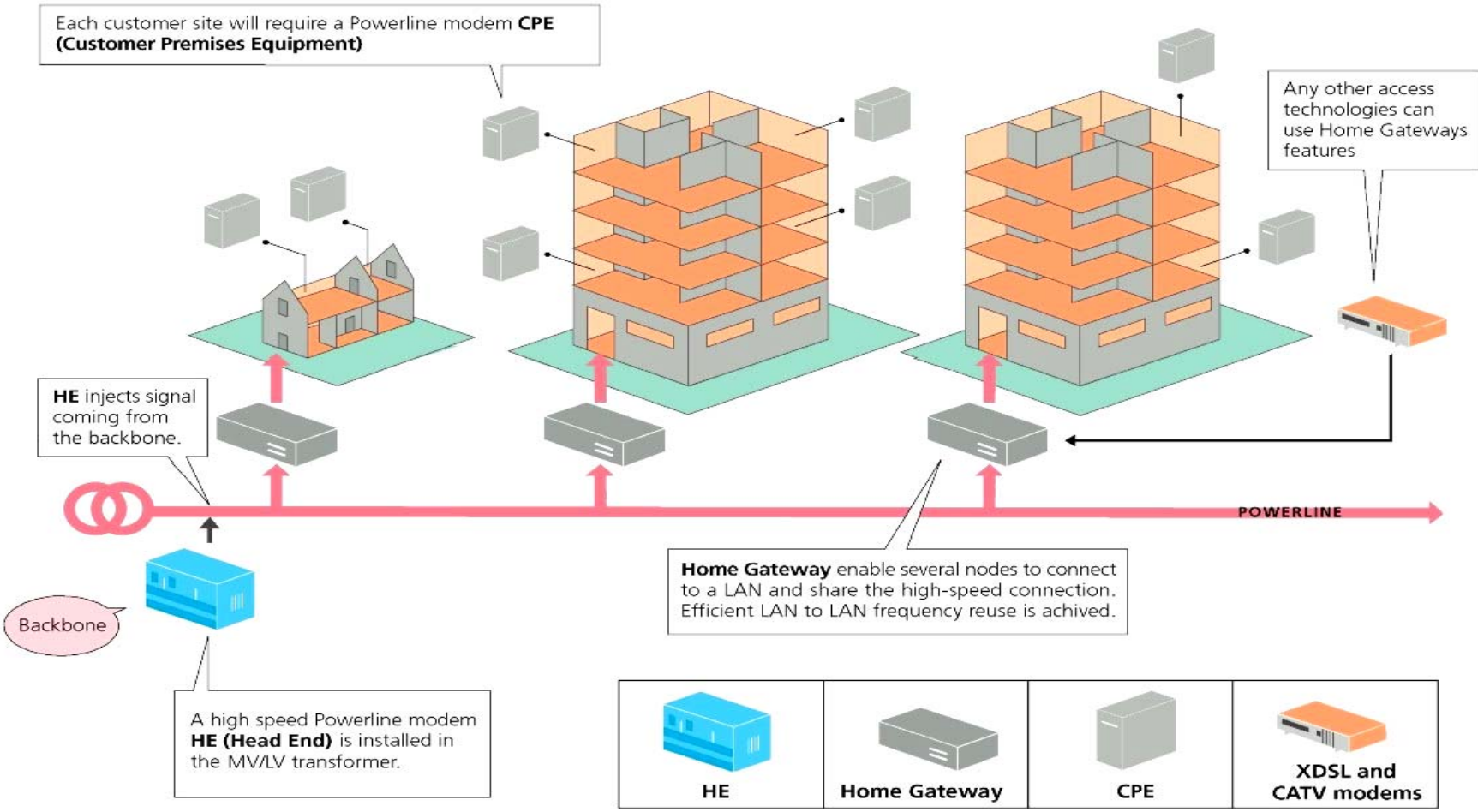
When? Is not the Right Question

- It’s not when but “when and where”
- Geography vs. sectors vs. networks
- A prediction (20-30% traffic):
  - Asia Pacific: 2005-2006
  - Europe: 2006-2007
  - North America: 2007-2008
  - Latin America: 2008-2009
  - Rest of the World: 2009-2010
- Cost analysis vs. maintenance/operation
- Capex vs. Opex
- Initial need of native IPv6 ?
- Old applications, using end-2-end, or new advanced apps?

How IP can reach …
… all the Planet

IPv6, QoS & Power Line Integration

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.

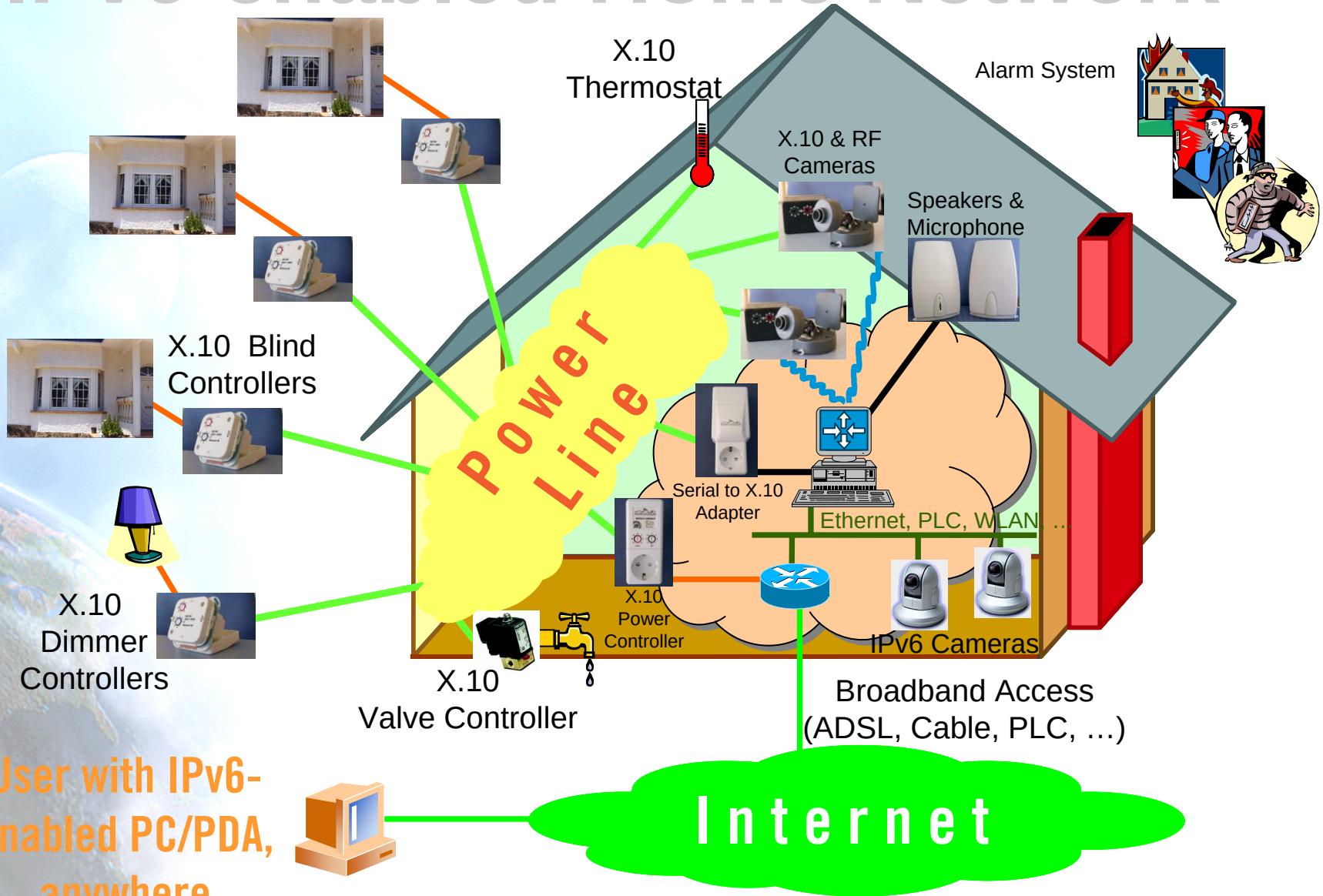
PLC & WLAN Deployment

- 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 …

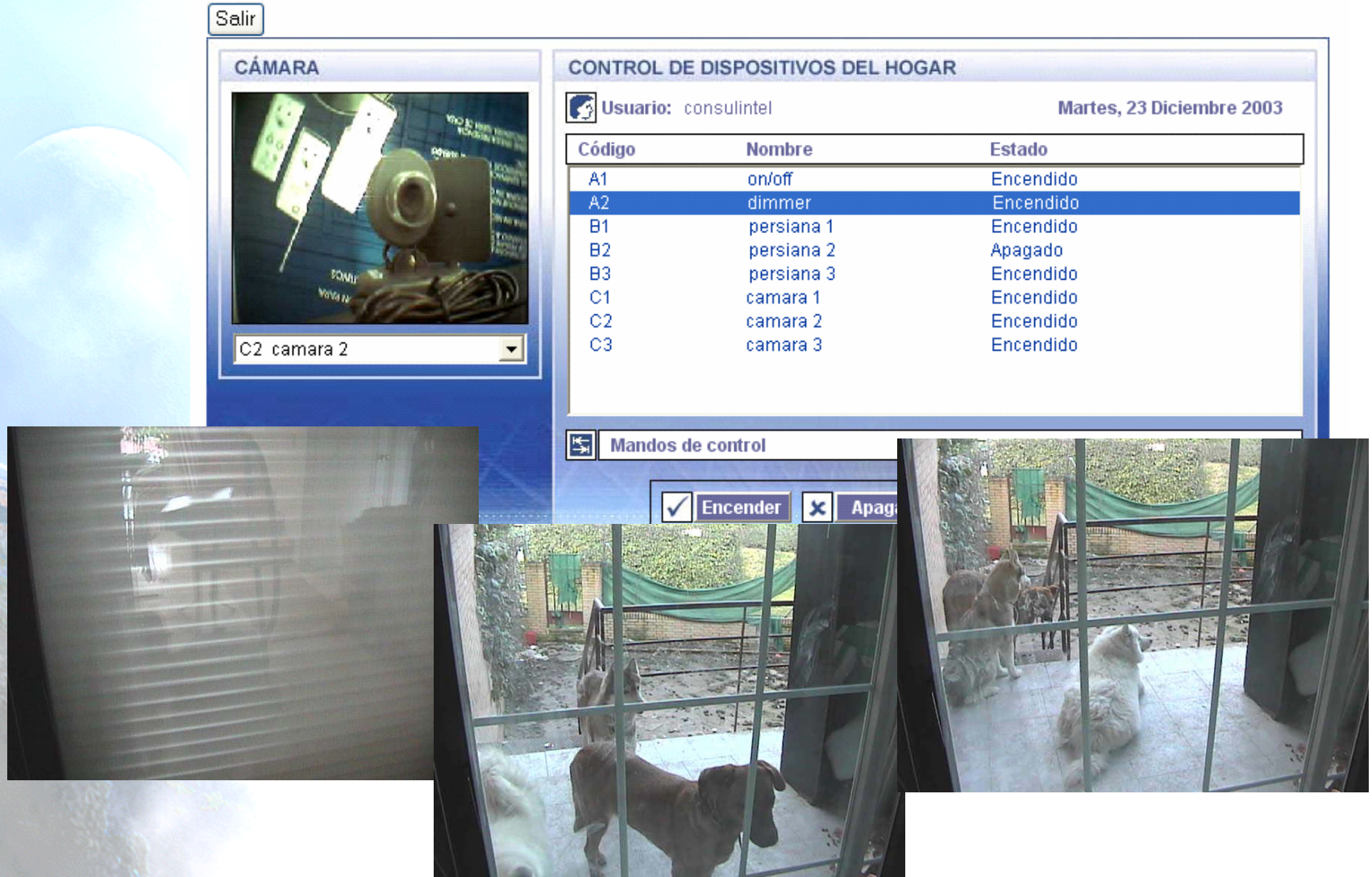
For the user …

- 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
  - …

IPv6-enabled Home Network



The Demonstration



IPv6-enabled Home Appliances

- There is an incredible market for any kind of IPv6-enabled appliances, with technologies like PLC and WiFi:
  - Cameras
  - Audio
  - Alarm systems
  - Sensors (intrusion, smoke, gas, water, ...)
  - Controllers
  - Dimmers
  - Switches
  - Electro-valves
  - Door-locks
  - Temperature
  - Pet feeders ;-)
- What about the kitchen and the living room ?
- Ambient Intelligence is HERE !

Are you missing your piece of the cake ?

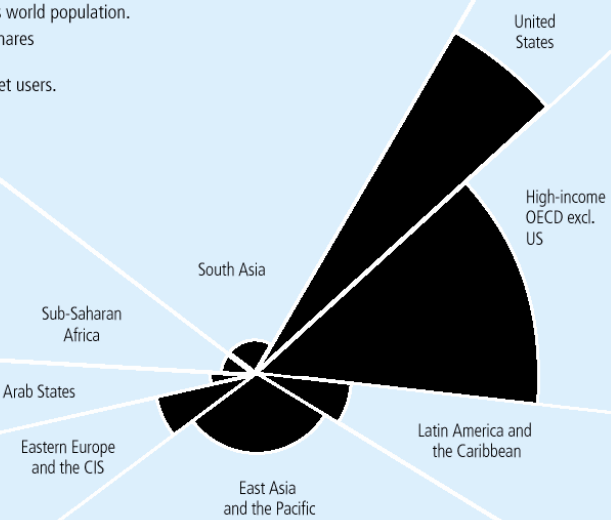
The Digital Divide

FEATURE 2.3

UNEVEN DIFFUSION OF TECHNOLOGY—OLD AND NEW . . .

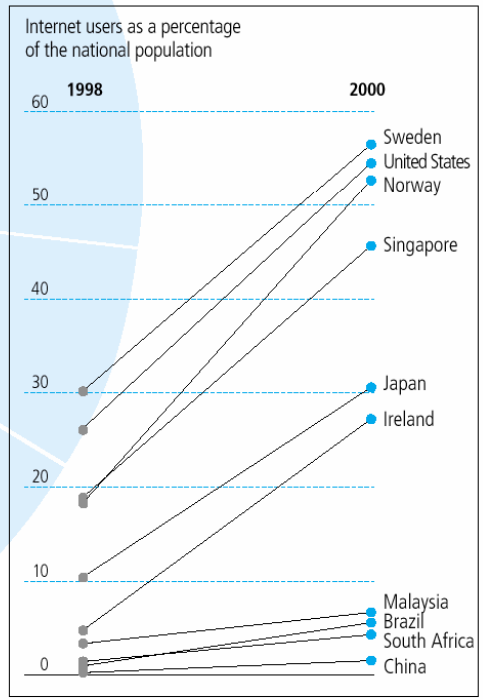
INTERNET USERS—STILL A GLOBAL ENCLAVE

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



Internet users
(as percentage of population)

	1998	2000
United States	26.3	54.3
High-income OECD (excl. US)	6.9	28.2
Latin America and the Caribbean	0.8	3.2
East Asia and the Pacific	0.5	2.3
Eastern Europe and CIS	0.8	3.9
Arab States	0.2	0.6
Sub-Saharan Africa	0.1	0.4
South Asia	0.04	0.4
World	**2.4**	**6.7**



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

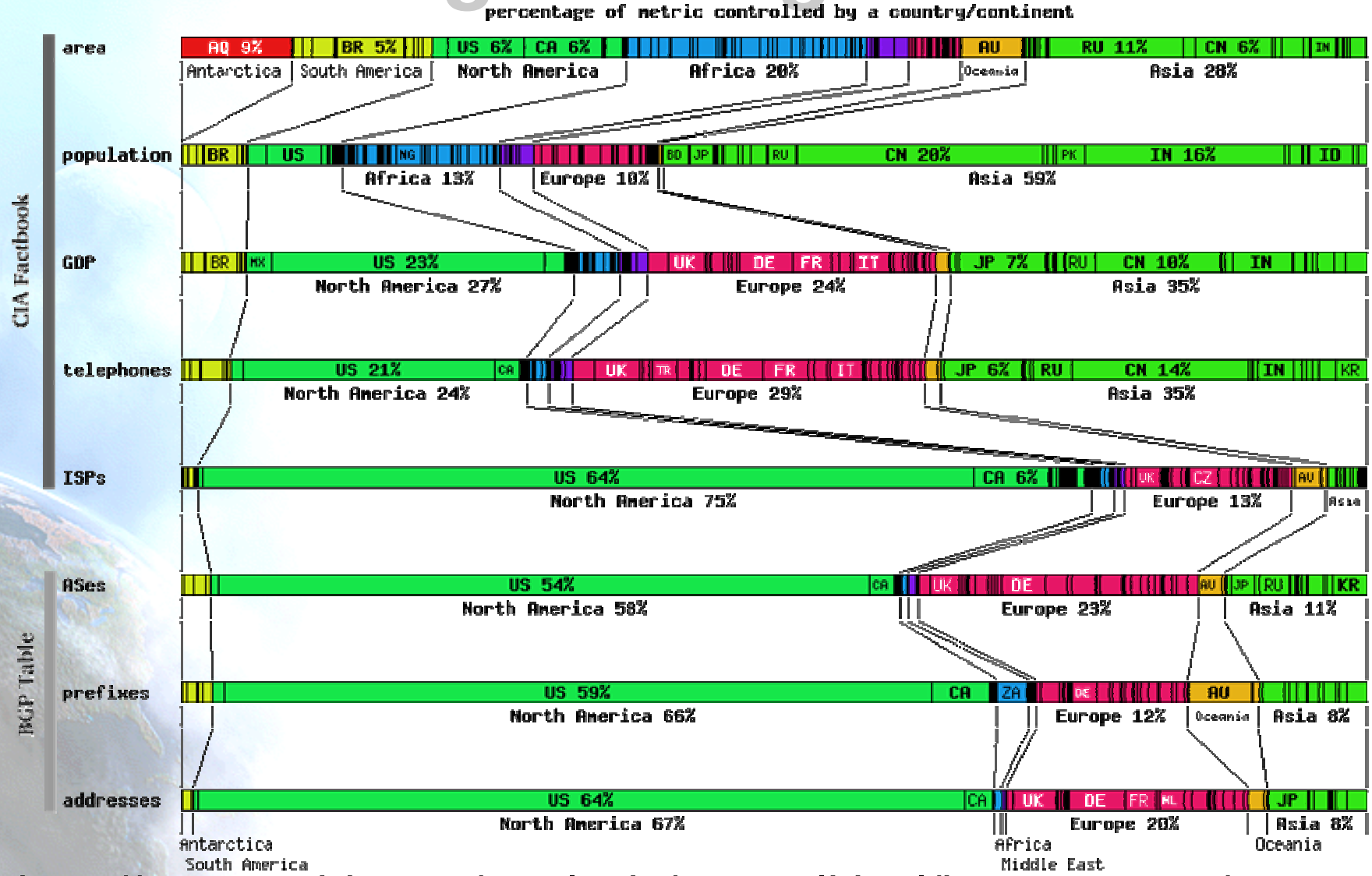
- United Nations studies suggest:
  - US has about a 60% share of existing Internet resources
  - Europe a further 20%
  - The other rich countries taking at least half the rest
- The distribution is much more skewed than for telephony, and certainly more skewed than for electricity distribution, which 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.

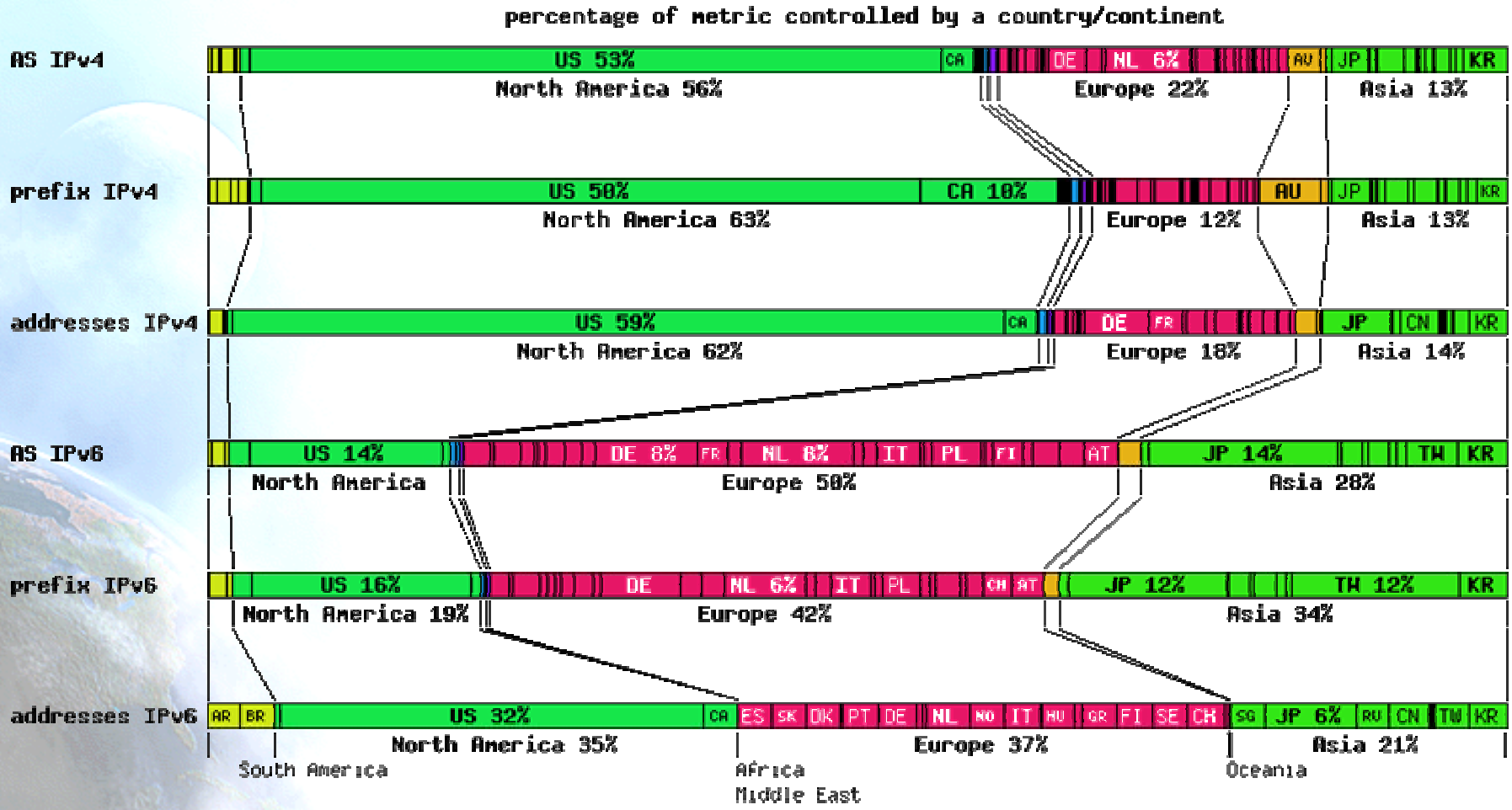
- http://www.cyberschoolbus.un.org/infonation/info.asp?theme=tec&id1=156&id2=724&id3=999&id4=999&id5=999).

Addressing the Digital Divide?



- 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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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/rao3.html
http://www.isoc.org/oti/articles/0601/wang.html

Conclusion

- We can use IPv6 with only-IPv4 networks
  - Not a show stopper
- Take advantage already of old applications, even if they didn't succeed previously
- The key is simple: Extensive usage of address space
- Transition is a slow process
  - Not a show stopper
- In less than ONE YEAR will see the explosion of new consumer electronic devices with IPv6
- New applications will come soon
- The "2nd key" will be the usage of the new IPv6 features, till to be fully explored

Thanks !

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- Madrid 2004 Global IPv6 Summit, more info soon at:
  http://www.ipv6-es.com