




Scaling the Internet for our Next Generations

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“ I truly believe that the Internet will change the way we work, live, play and learn in ways we are just beginning to explore. Our industry is maturing rapidly with the convergence of data, voice and video technology over one network. This convergence is creating a world in which technology is used to connect everyone to everything “

John Chambers, CEO, Cisco Systems

Pillars of Convergence

APPLICATION CONVERGENCE

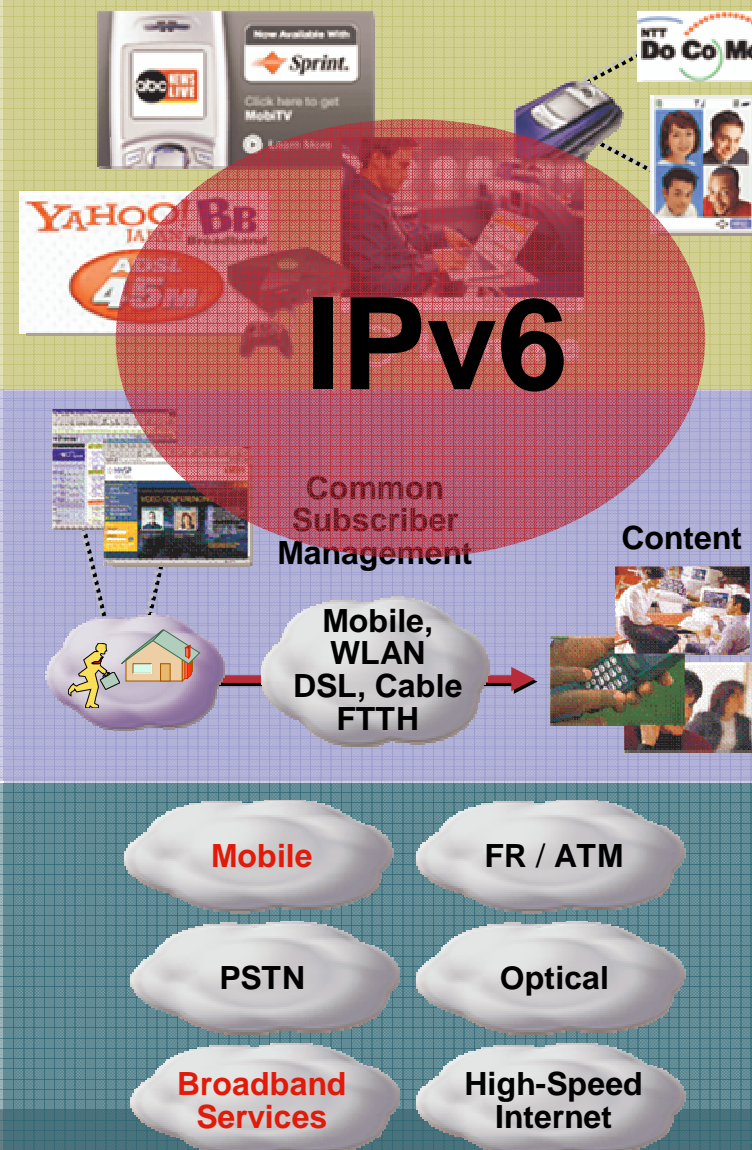
Enabling Integration
of D/V/V Services

SERVICE CONVERGENCE

Service Continuity
across access;
Customer Loyalty

NETWORK CONVERGENCE

Eliminate Network
Layers; Reduce TCO



Networking Trends

Mobility



Ubiquity of the Internet



Security and Privacy of a Network

Next Generation Networks
“IP Agnostic”

Simplicity of Access Technologies



Bandwidth Capacity

Cisco CRS-1 – up to OC768

Content Richness of Multimedia



What is IPv6? Basic Perspectives

The Network Manager Perspective

Infrastructure focus

- Stability of a given technology, implementations and benefits
- Cost of deployment and operation

Care but...has to get confident



The End-User Perspective

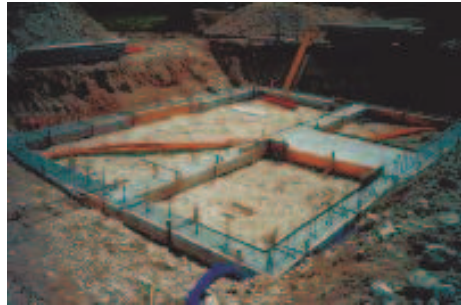
Applications focus

- The network capability to provide the desired services
- It's all about the applications, and their services

Don't care about IPv6!!!



Building the “IPv6 House”



IESG
IPng WG
creation

1994

IETF IPv6 WG
Core Specs

1995-1998

Commercial
Products &
Infrastructures
(6NET, GEANT,...)

2001-2004

More IETF specs
(Mobile IPv6,
DHCPv6 PD,
Flow Label...),
Applications
port

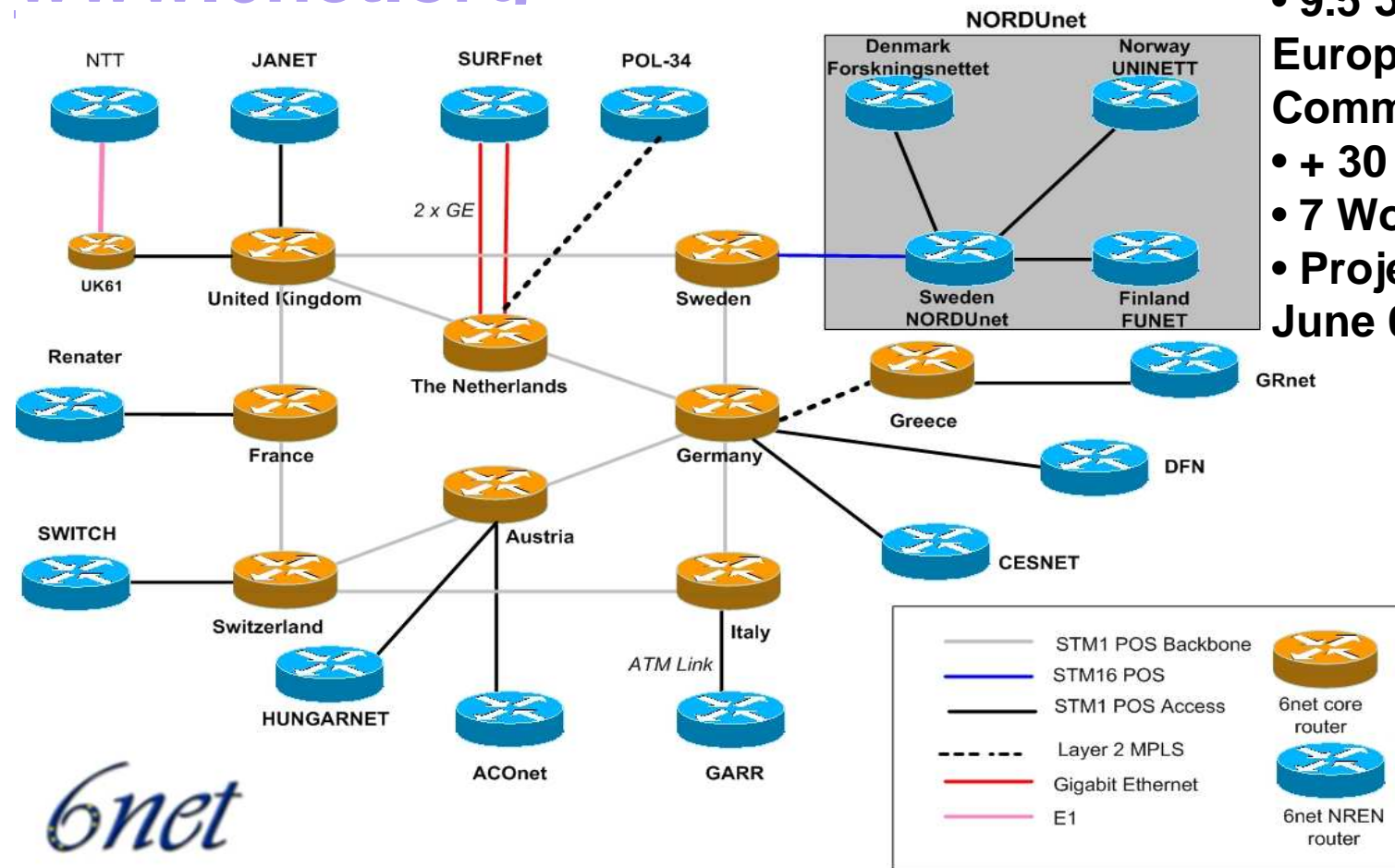
2004-2008

***Today, Core IPv6 specifications are IETF Draft Standards
well-tested & stable, enabling a move to “full production”***

6NET Project Overview



www.6net.org



- 3 years project
- 9.5 5M €from European Commission
- + 30 partners
- 7 Work Packages
- Project ended in June 05

Cisco 12400 and 7200 series

Business Model – Basic Perspectives

- **Revenues from analog voice and bandwidth are decreasing on long term**
- **A need for different address allocation and charging model**
 - IPv6 prefix (/48 to /64) versus a single dynamic or static IPv4 address
 - Provisioning for always-on technologies does not really allow over-subscription
- **ISP added values/revenues need to shift to End-Points and associated services**
 - le: NTT-Comms m2m-x
 - www.ipv6style.jp/en/apps/20040224/index.shtml

Next Generation Broadband Home vision

IP Video



Home Networking

- IPv6 enables bi-directional reachability for multiple devices, is not intended to a single PC
- Bandwidth increase and symetric access to generate contents
- Easy plug and play

Printer



PDA

IP Phone & Fax



Wireless Laptop

- Distance learning
- Video calls
- MP3/MP4 downloads

Wired Devices

- Streaming Video/Audio
- Print/file sharing

Broadband Internet Access



Triple Play Services

- Multiple devices served in a Home
- Commercial download
- TV guide

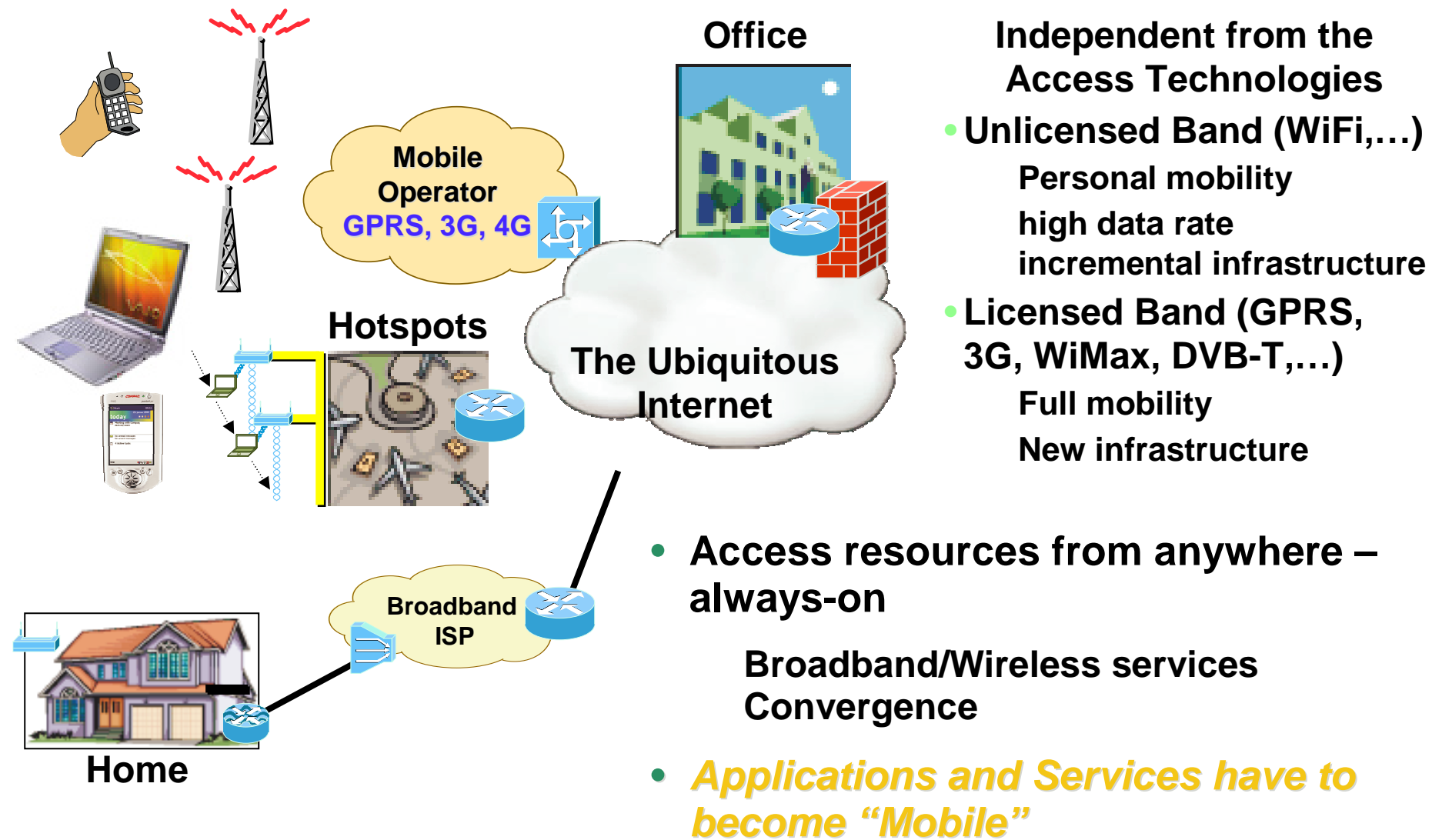
Broadband Access Point

- Multiplayer gaming
- Video on demand
- Home security
- Digital audio
- Domestic appliances

Wireless Gaming



IPv6 Mobility Vision



Traffic Evolution

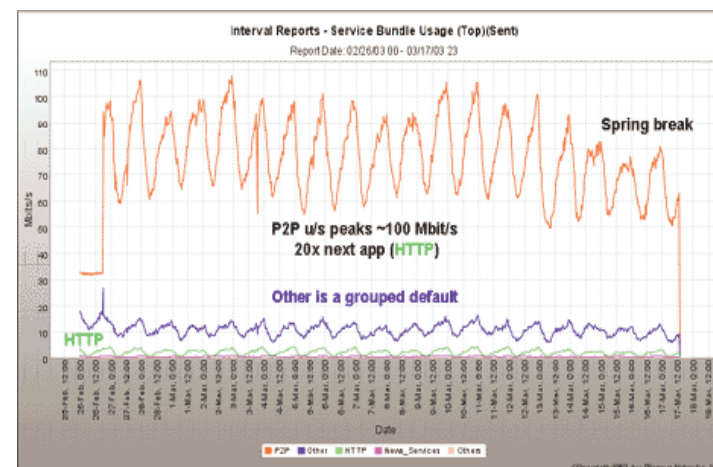
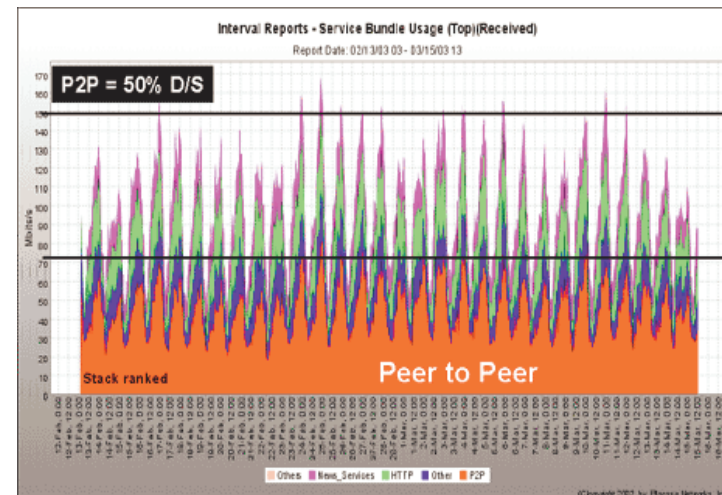
- Applications – Server/Client, P2P, GRID – generate different traffic patterns than Client/Server

Symmetrical – as much upstream as downstream traffic (users become servers as they deliver contents)

Very long sessions – Always-on devices may be left unattended. Streaming applications can run for a long period of time. Often 24/7.

Sustained high bandwidth – many devices can now use all bandwidth available. Multiple video sessions require high bandwidth capacity

Non-local – Traffic travels globally, and between ISP networks, hence putting load on the peering points (est. 60% of traffic) and expensive long haul links.



Some Technical Challenges – Opportunities

- IPv6 Core specifications are stable and implemented
- Multi-Homing

From IETF Multi6 WG charter

The multihoming approaches currently used in IPv4 can of course be used in IPv6, but IPv6 represents an opportunity for more scalable approaches.

- Security

Though IPsec is mandatory in IPv6, Security is a much broader topic than just IPsec as same issues remain from IPv4:

Configuration complexity, Key management...

Centralized (Firewall) – Distributed (IPsec on hosts) co-existence

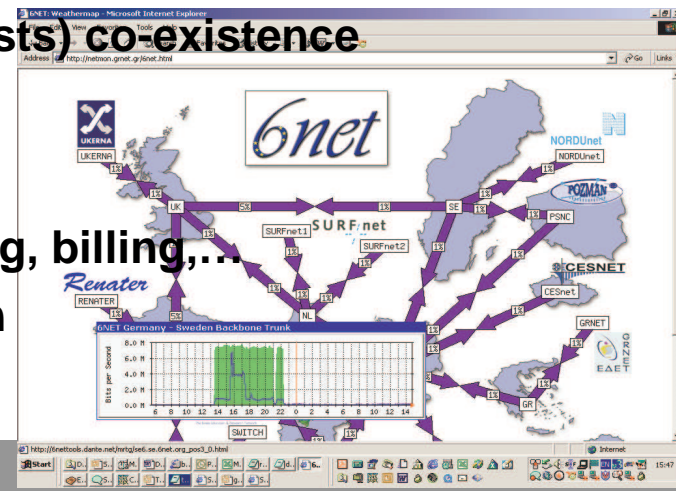
- Dual Stack Network Management

MIB's dependencies – RFC 3796

Net Mgmt Applications – provisioning, monitoring, billing,...

Renumbering on large scale Internet population

An opportunity for Research



Some non-Technical Challenges

- **The Internet is “highly decentralized” – Regional modes of adoption**

IPv6 impacts the overall infrastructure

**Status Quo (no change) versus Co-Existence (Niche)
versus Full Integration**

- **Education**

Next generation’s graduates are key for IPv6 deployment

**IPv6 knowledge represents job’s opportunity for tomorrow (ie:
Cisco Network Academy)**

- **Social impacts of the Internet environment**

Privacy, Usage,...

- **Intellectual Property Rights (IPR)**

Not related to IPv6 but may be highlighted by usage

Expanding the Internet with IPv6

Innovation's

Business – Applications - Services

Community
Grid

Triple Play
RFID

Adding IPv6 to the Internet
Integration & Co-Existence

New Market
Places

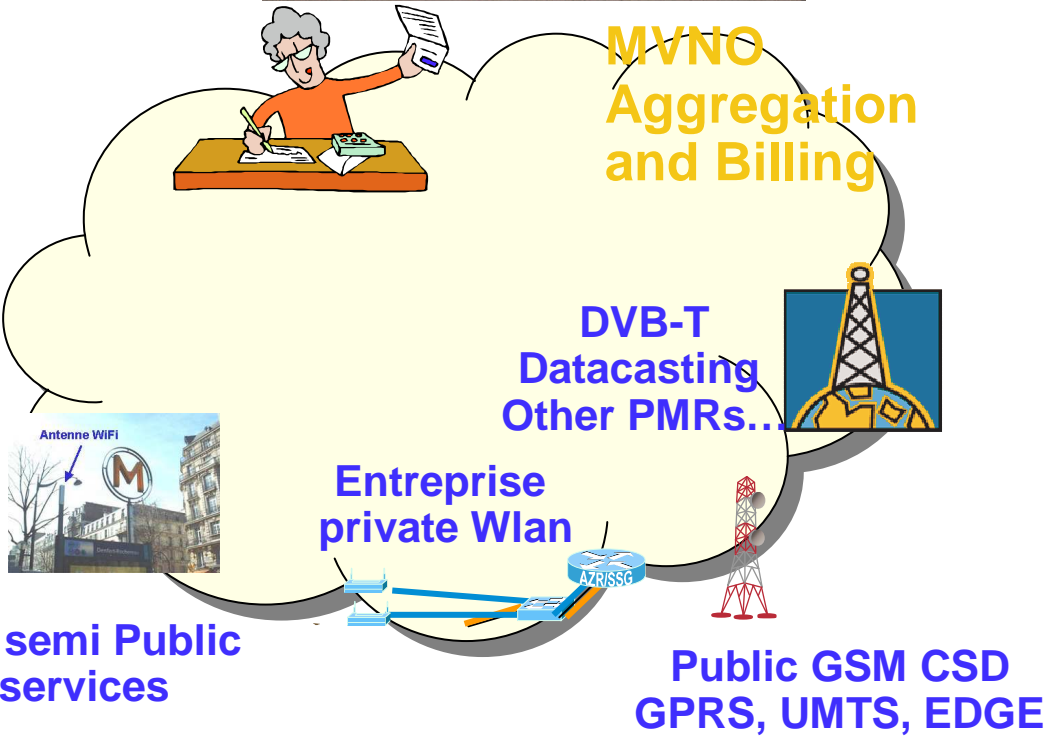
Networks in
Motion

Infrastructures for new Services

Networks in Motion

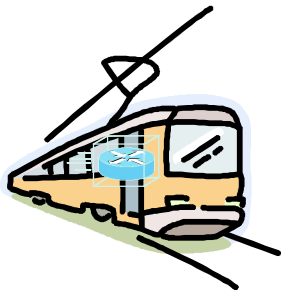
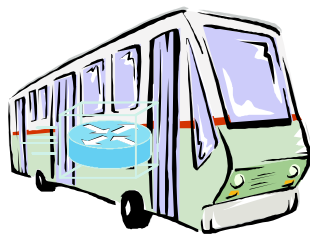
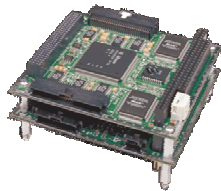


Pure M2M	2 ways apps wit UI	Hot Spots in vehicles
Safety Vehicles	Public Transport	Profes. Fleets
MVNO – Authentication, Mobile IP, Billing		
GSM, UMTS, EDGE, public coverage	WLANs, DVB-T, PMR	Satellites

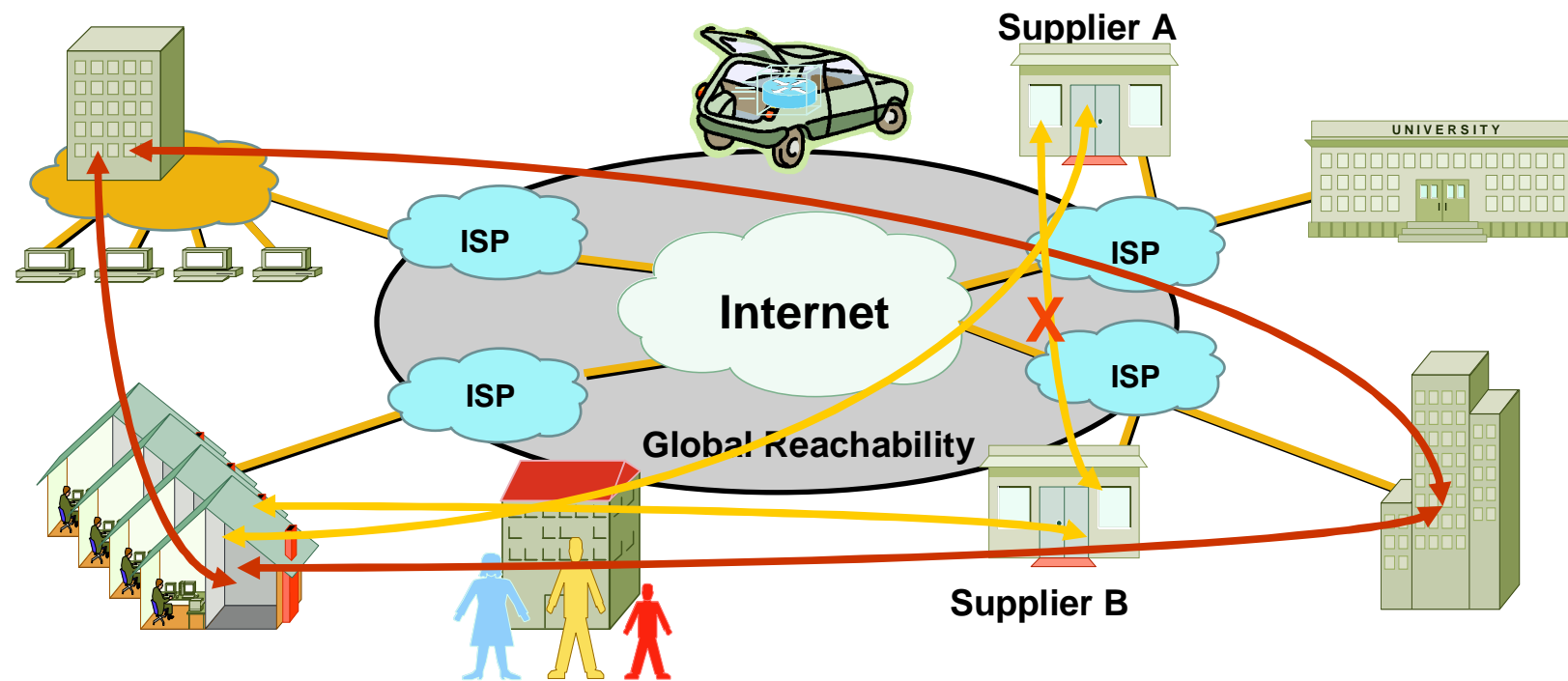


Public and semi Public
WLAN services

Public GSM CSD
GPRS, UMTS, EDGE



Community of Interest Overview



- IPv6 global addressing does NOT necessarily mean Universal Reachability for all devices
- IPv6 Community of Interest should enable Customers/suppliers, families/friends or communities of interest to share the network infrastructure to dedicate their devices/apps access
 - Plug & Play and Secure
 - Intuitive to deploy and use for mass-market

IPv6 Integration – Per Application Model



- As soon as the infrastructure is IPv6 capable...IPv6 integration can follow a non-disruptive “per application” model

Internet Applications database - Microsoft Internet Explorer

Address: http://inet.isa-eres.info/app-portal

6net Applications summary

Click on the column headers to change sorting order

name	category	class	summary	status	responsible	modified
BUMS	Streaming	C	IPv6-enabled unified messaging system	BUMS is being developed by UoS in Euro6X, but will be made available to 6NET. Existing tools will be re-used where appropriate.	UoS	2003-01-16
Agent Framework	E-business	C	Framework for agent research	Available, in Java. Unicast works. Multicast not tested yet.	UoS	2003-01-24
AMUSE	Streaming	C	Adaptive Multimedia Support Environment	Available. Usage limited to Sony and WPS. Work planned to support MobileIPv6.	Sony	2003-01-27
AWM	E-business	No	Application Workload Modeler	Released product with IPv6 support for zSeries. Needs special build for Linux/Intel.	IBM	2003-04-14
Bonephone	Streaming	B	Internet phone sending and receiving SIP messages	Demo version released.	FhG	2003-04-10
CDN	Edge Services	C	Content Distribution Networks	No specific work at the moment.	Cisco	2003-01-16
DVTS	Streaming	C	Application for sending and receiving Digital Video	The source and binaries for DVTS on various platforms are available from the DVTS URL.	UCL	2003-01-16
Edge Server	Edge Services	C	IBM Edge Server	Porting to IPv6 in progress.	IBM	2003-01-16
EGP	Gaming	No	Experimental Gaming Platform	Sony has stopped working on EGP. This activity has been dropped.	Sony	2003-03-27
FreeAMP	Streaming	A/B	Free unicast/multicast MP3 player	The code has been released on the web. Both a unicast and a multicast MP3 source will be activated in a network which will be available to all 6Net partners.	GARR	2003-01-24
FunnelWeb	E-business	C	Application level active services	Implemented as a Java application. Available on request within the project.	UCL	2003-01-16
Globus	E-business	C	GLOBUS toolkit (Grid)	Release 2.0 available. Globus 3.0 is expected early 2003. 6NET expectation is to get IPv6 support enabled as a patch for Globus 2.0, later as an integral part of Globus 3.0.	UCL	2003-01-16
GnomeMeeting	Streaming	C	Open source H323 Linux application	Deployment and support in progress for Greek Research Network community	GRNET	2003-02-05

Tool for confirm and replace MP3 HAT under on MCD IDE start. Another version which works on



New Generation of Internet Appliances

A Case Study – IP in Schools Today

- **School's business is Education**

Read, Write, Maths, Foreign Languages as foundations to Knowledge

The above are minimum end-users requirements to access the Internet

Analytic mind is key to value the data retrieved from the Internet

- **Schools are part of the Information Society**

Today, more and more schools get an Internet connection – a Must

Lease lines, Broadband Access,...

Linked to NRN or local government

- **Today, Applications and Services**

Client-Server: e-mails, web browsing

Servers generally hosted externally

Most of the time using PAT (a single global IPv4 address)



A Case Study – IPv6 in Schools Tomorrow

- **Developing new Class of Applications and Services**

Class to Class collaboration – internal to the school, between schools (national & international)

Sharing Database, creating server's,...

Teachers-Students collaboration

“After-time” support, digital pupil desk, foreign languages class,...

Content delivery between schools or Information Providers – Multimedia streaming

IP Telephony between schools

Tele-surveillance – Physical security

Secure Information – Transfer between schools-academy, teachers-school

- **Integrating those services over IPv6**

IPv6 could easily be configured on (Cisco☺) routers connecting the schools

NRN or Local Government can delegate production IPv6 prefixes to the schools.

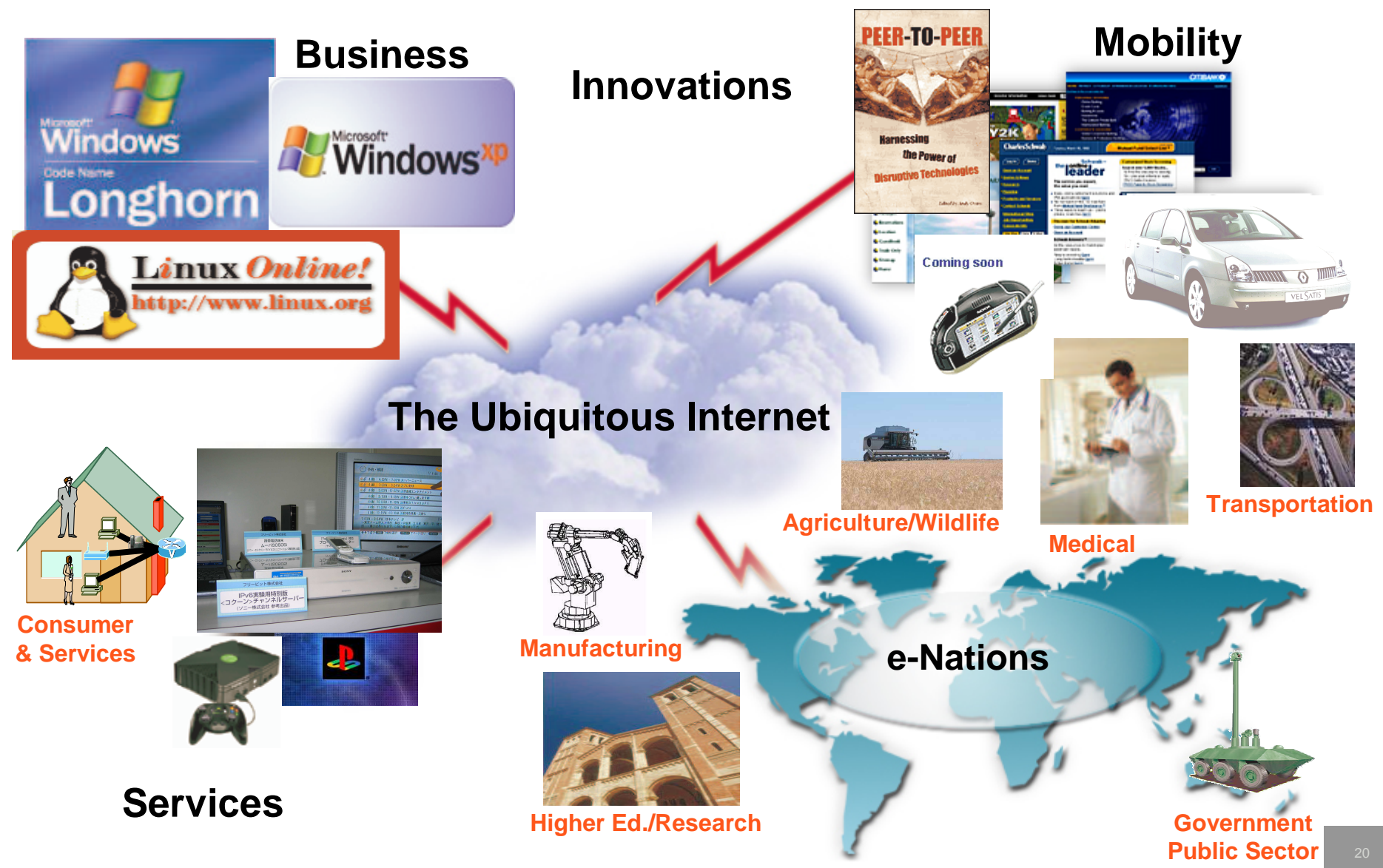
- **It must be done Today**

IPv4 applications do not get disturbed

Keep IPv4 as it is, even using PAT



IPv6 - Key driver for next generation ubiquitous networking



Cisco Systems – Leading the Evolution

- Cisco IOS based networks are IPv6-enabled since 2001
- Cisco IPv6 Solutions now include Routers, Layer 3 switches, Firewall, Network Management,...
- Cisco and IETF standardization
 - Co-chairs IETF IPv6, NG Trans WG co-chair for several years
 - Today, co-chair v6Ops, DHCPv6, MIPv6 WG
 - Author/co-authors many IETF proposals
 - MP-BGP4, NAT-PT, 6PE/6VPE, DHCPv6 PD,...
- Founding member of the IPv6 Forum
- Partnership on large scale IPv6 deployment/trials
 - 6Net, Moonv6,...
- Mobile Networking– IPv6 Promotion council “Jun Murai award”



Q and A



More Information

- CCO IPv6 - <http://www.cisco.com/ipv6>
- Cisco IPv6 Solutions
http://www.cisco.com/en/US/tech/tk872/technologies_white_paper09186a00802219bc.shtml
- The ABC of IPv6
http://www.cisco.com/en/US/products/sw/iosswrel/ios_abcs_ios_the_abcs_ip_version_6_listing.html
- IPv6 Application Notes
http://www.cisco.com/warp/public/732/Tech/ipv6/ipv6_techdoc.shtml
- Cisco IOS IPv6 manuals
http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123_cgcr/ipv6_vcg.htm