

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

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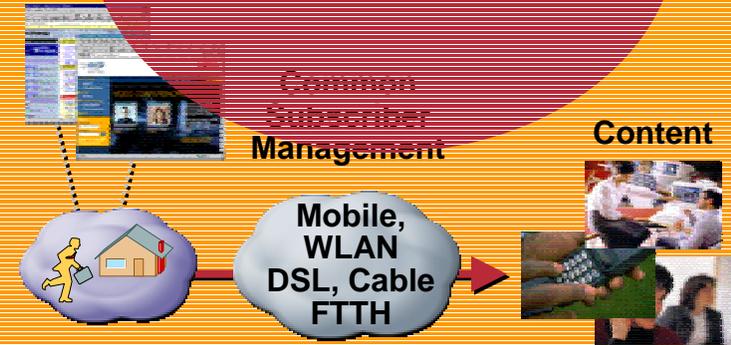
APPLICATION CONVERGENCE

Enabling Integration of D/V Services



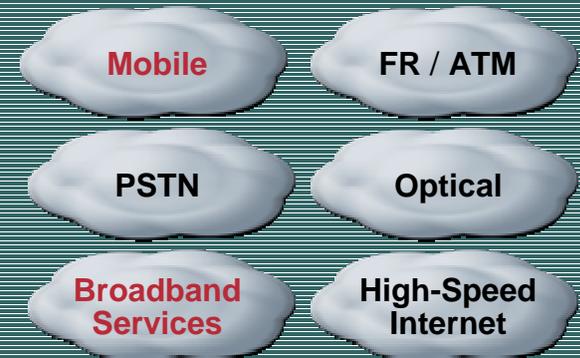
SERVICE CONVERGENCE

Service Continuity across access;
Customer Loyalty



NETWORK CONVERGENCE

Eliminate Network Layers; Reduce TCO



Networking Trends

Cisco.com

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

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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”

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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

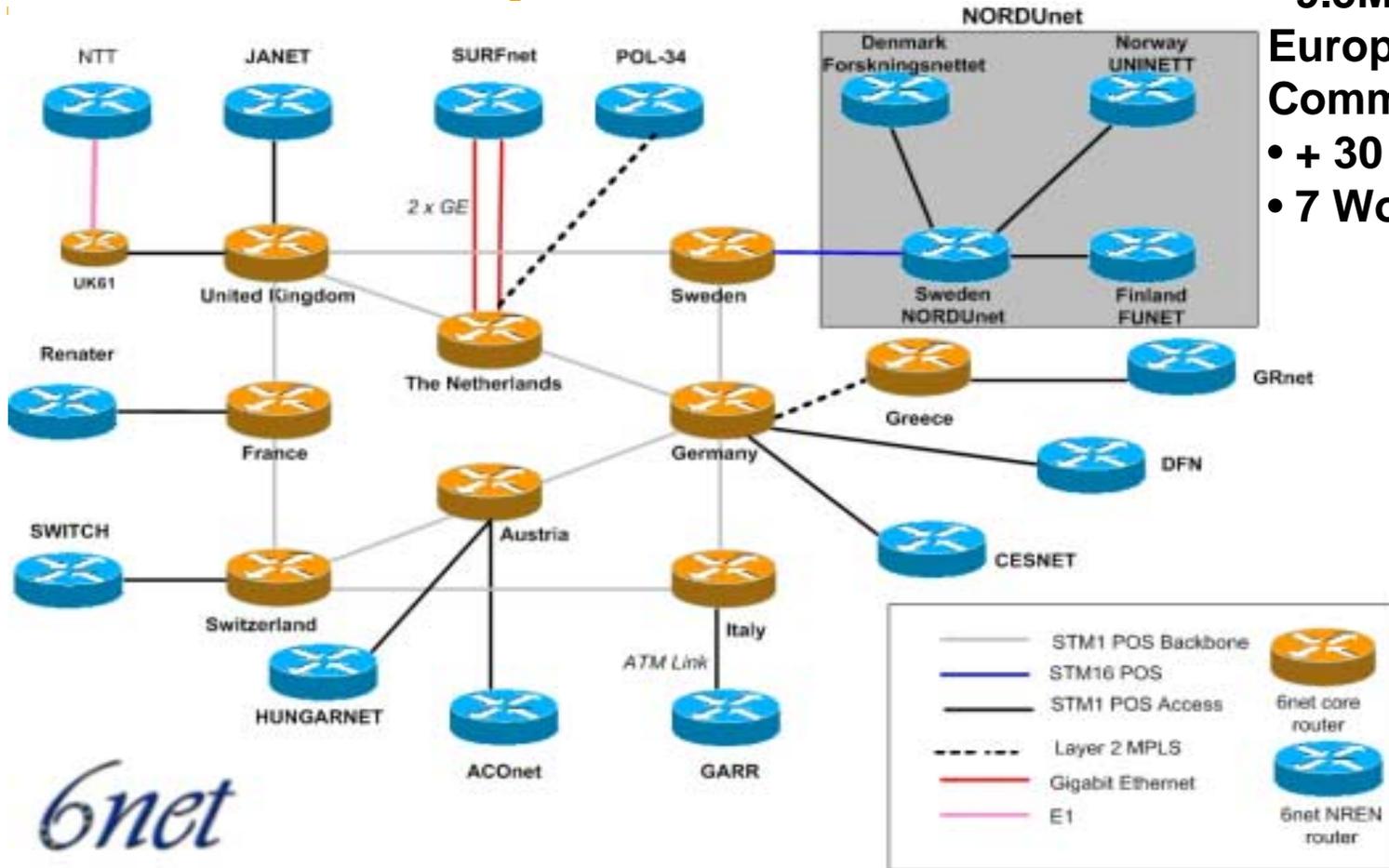
2004-2008

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
- 9.5M € from European Commission
- + 30 partners
- 7 Work Packages



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

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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

IP Video



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



Wireless Gaming

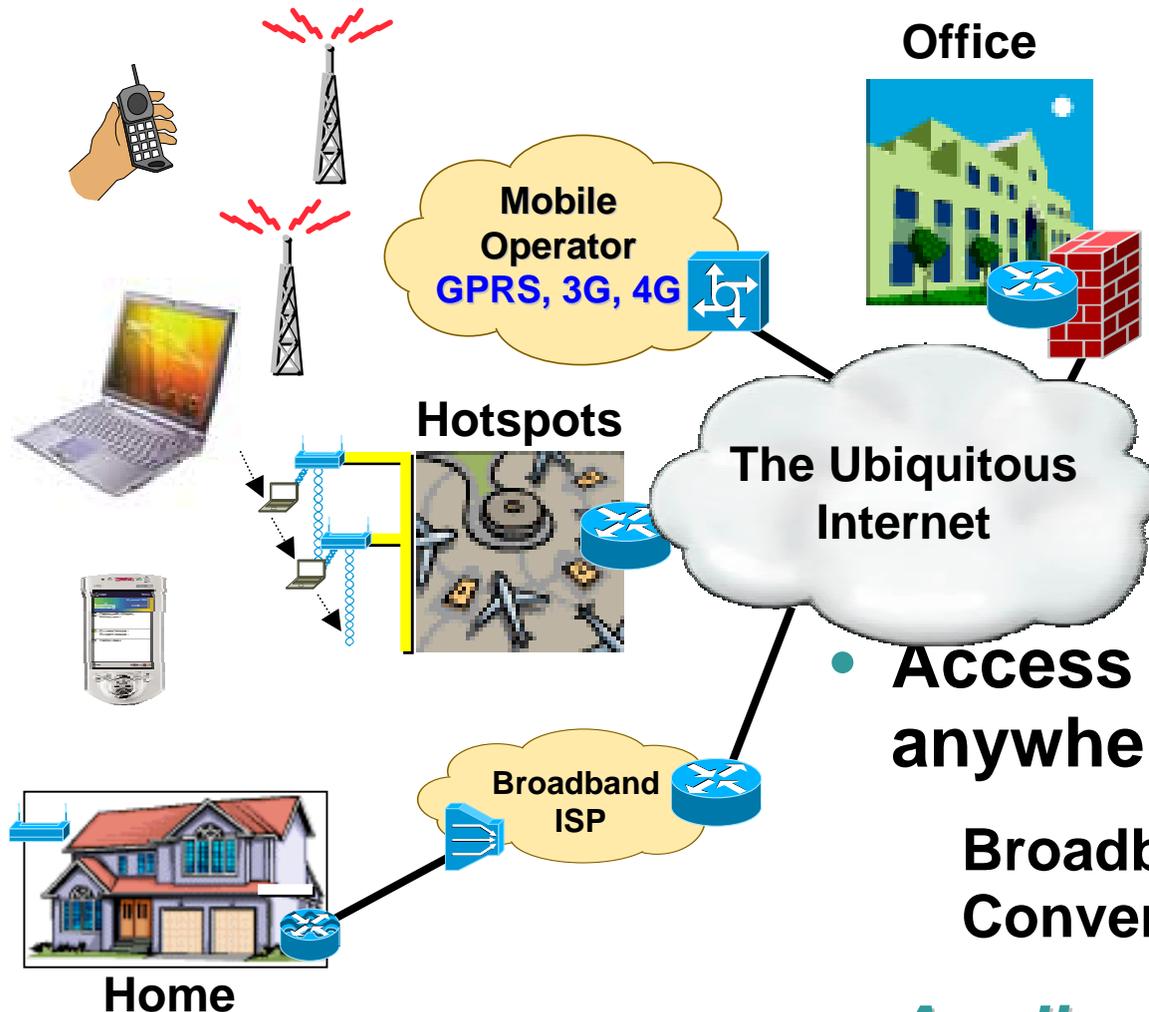


Broadband Access Point

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

IPv6 Mobility Vision

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Independent from the Access Technologies

- **Unlicensed Band (WiFi,...)**
Personal mobility
high data rate
incremental infrastructure
- **Licensed Band (GPRS, 3G, WiMax, DVB-T,...)**
Full mobility
New infrastructure

- **Access resources from anywhere – always-on**

Broadband/Wireless services Convergence

- ***Applications and Services have to become “Mobile”***

Traffic Evolution

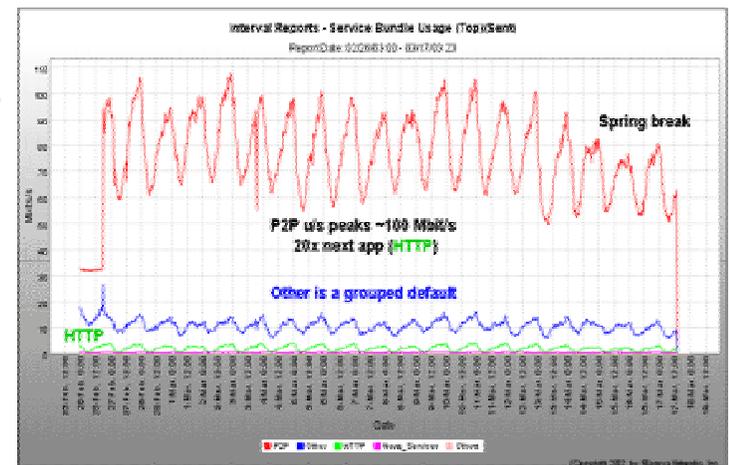
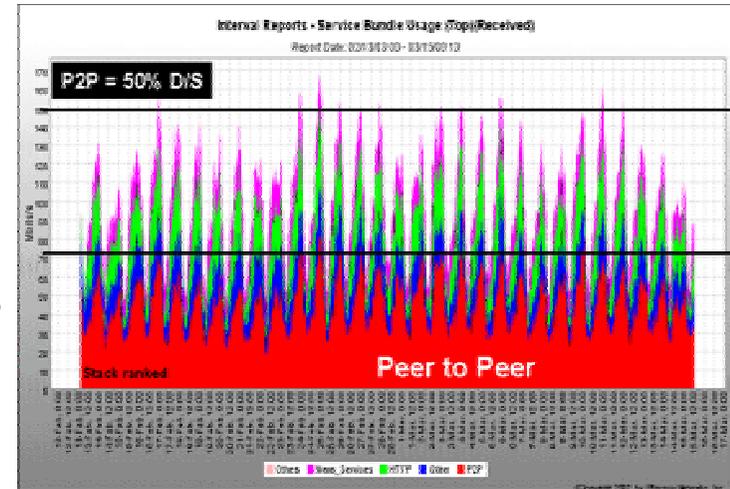
- Applications – Server/Client, P2P, GRID – generate different traffic patterns than Client/Server

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

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- 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

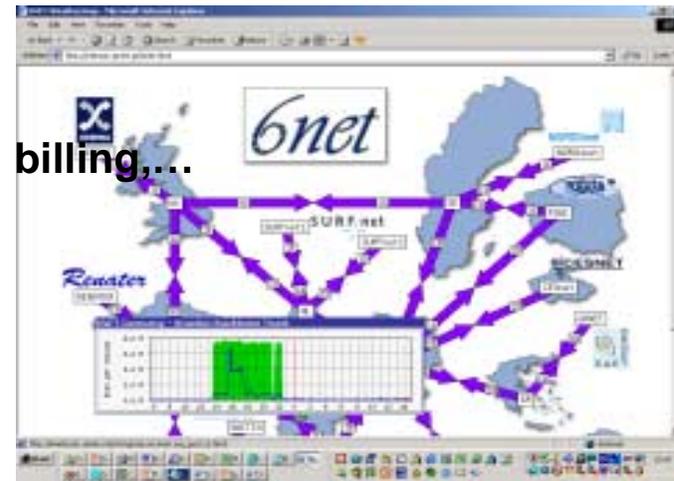
- Dual Stack Network Management

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

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Innovation's

Business – Applications - Services

Community
Grid

Triple Play
RFID

**Adding IPv6 to the Internet
*Integration & Co-Existence***

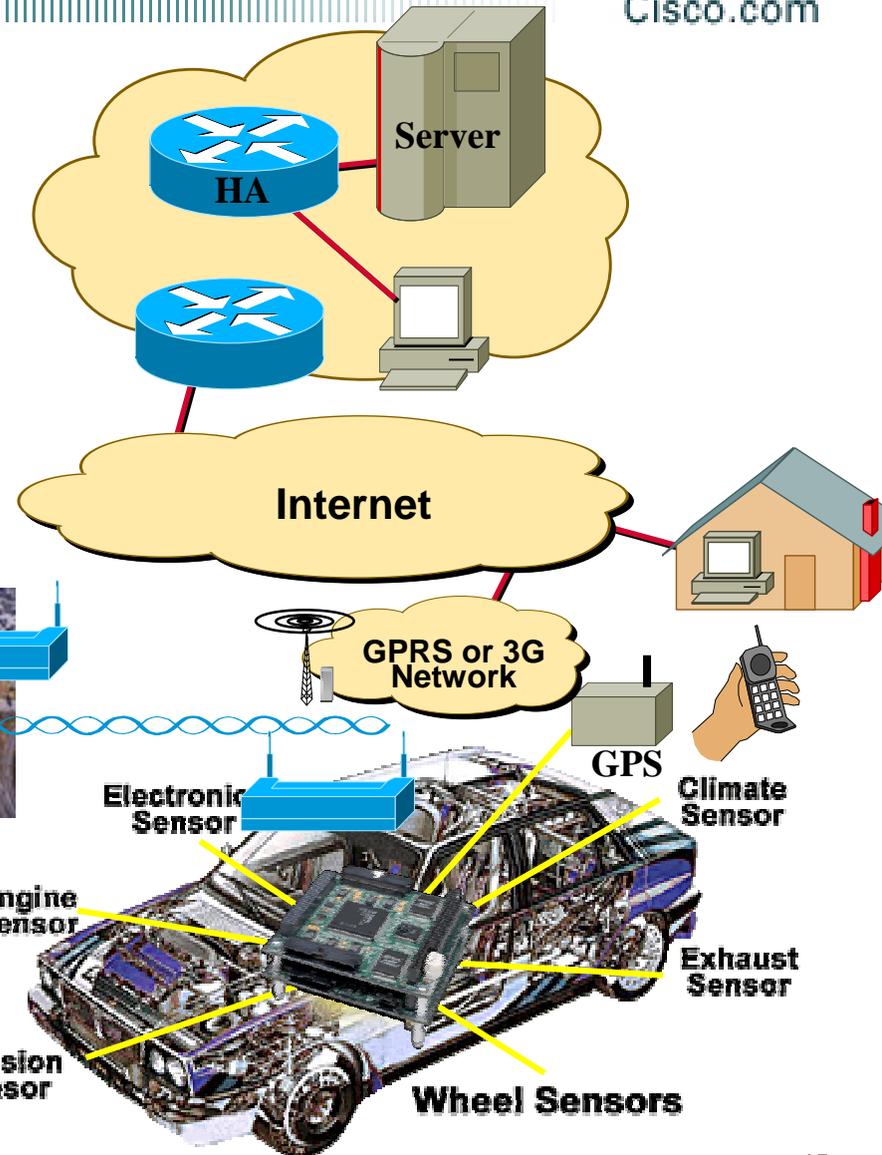
New Market
Places

Networks in
Motion

Infrastructures for new Services

Networks in Motion

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Telematics:

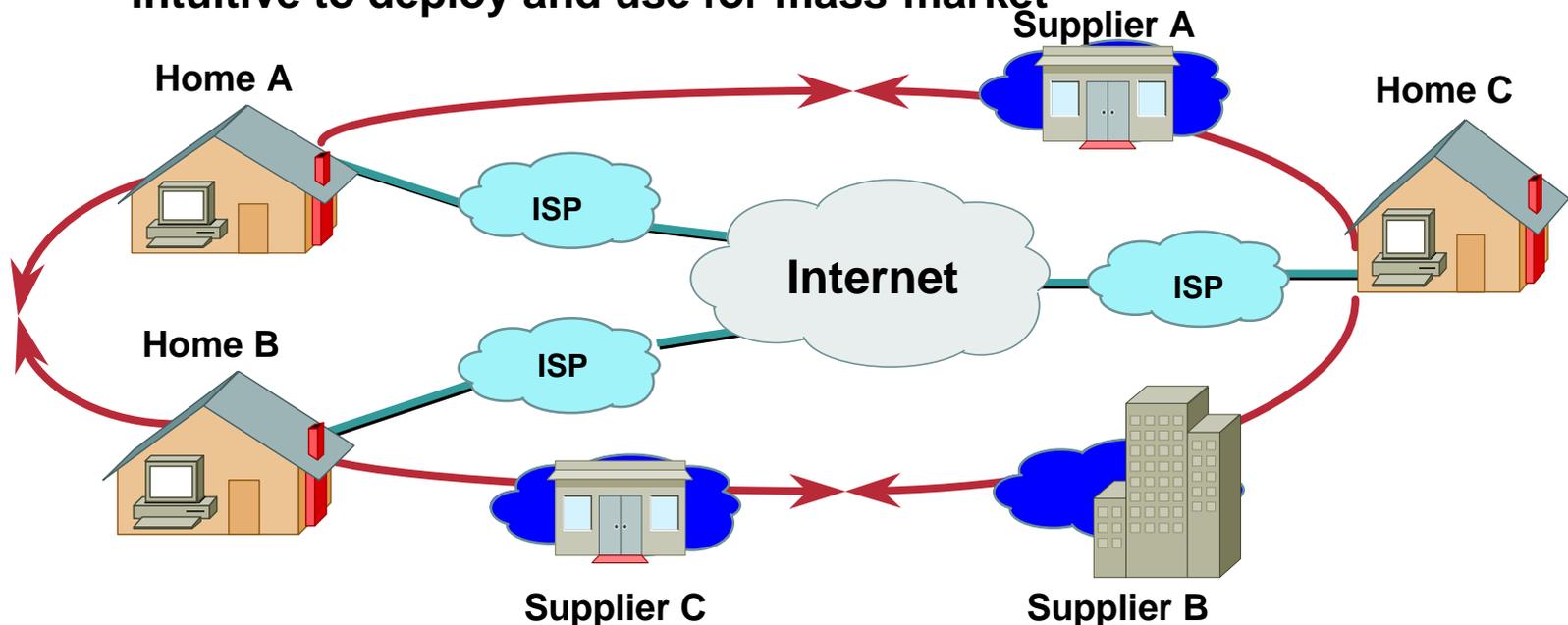
Industry related to using computers in concert with telecommunications systems. This includes Internet access, as well as all types of networks that rely on a telecommunications system to transport data.

“Telematics to Become \$8 Billion Industry by 2005, According to New Study from Allied Business Intelligence”

<http://www.telematicsupdate.com>

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



Today, all O.S. are Dual-Stack

Name	Status	Class	Version	Notes	Released	Updated
6net	Streaming	1	IP6-enabled content packaging system	6net is being developed by LUG in Europe, but will be made available to 6NET. Existing users will be notified when available.	2003-03-16	
Open Network	E-business	0	Platform for open research	Available in Java. Initial work: Microsoft not tested and available. Change limited to Java and API. Also planned to support MultiPath.	2003-03-24	
AAAC2	Streaming	0	Adaptive All-Media Transport Environment	Experimental product with IPv6 support for Windows. Needs several build for Linux/Free.	2003-03-27	
AARS	E-business	0	Application Virtualization	Experimental product with IPv6 support for Windows. Needs several build for Linux/Free.	2003-03-14	
Amplitude	Streaming	0	Internet phone sending and receiving SIP messages	Code version released.	2003-03-10	
CDN	Edge Service	0	Content Distribution Networks	No specific work at the moment.	2003-03-10	
CVT2	Streaming	0	Application-to-streaming and receiving Digital Video	The source and format for DVTS on various platforms are available from the CVT2 LUG.	2003-03-16	
Edge Server	Edge Service	0	6NET Edge Server	Working on IPv6 integration.	2003-03-10	
ESF	Streaming	0	Experimental Streaming Platform	Code has stopped working on ESF. This activity has been dropped.	2003-03-27	
Free4MP	Streaming	0	Free and open multimed MP3 player	The code had been released on the web. Both a website and a multimed MP3 player will be released in a website which will be available to all 6NET partners.	2003-03-24	
FunVideo	E-business	0	Application-to-streaming video content	Implemented as a Java application. Available on request within the project.	2003-03-16	
Genie	E-business	0	6NET/6NET (Genie)	Release 2.0 available. Release 3.0 is expected early 2003. 6NET expansion is to get IPv6 support enabled in a patch for Release 3.0. See also an original post at 6NET LUG.	2003-03-10	
GreenStreaming	Streaming	0	Open source VOD Linux WebTV	Deployment and support in progress for Trade Research. (6NET community)	2003-03-08	

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

Call for Applications – protocol agnostic peer-to-peer versus client-server transaction



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,...

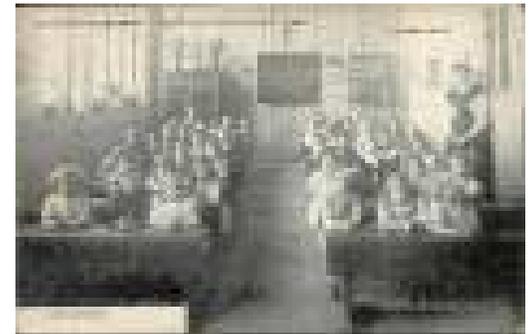
Linked to NRN or local government

- **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

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- **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

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Business



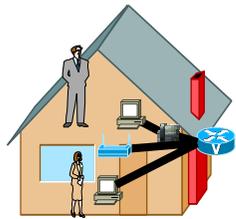
Innovations



Mobility



The Ubiquitous Internet



Consumer & Services



Services



Manufacturing



Higher Ed./Research

Agriculture/Wildlife



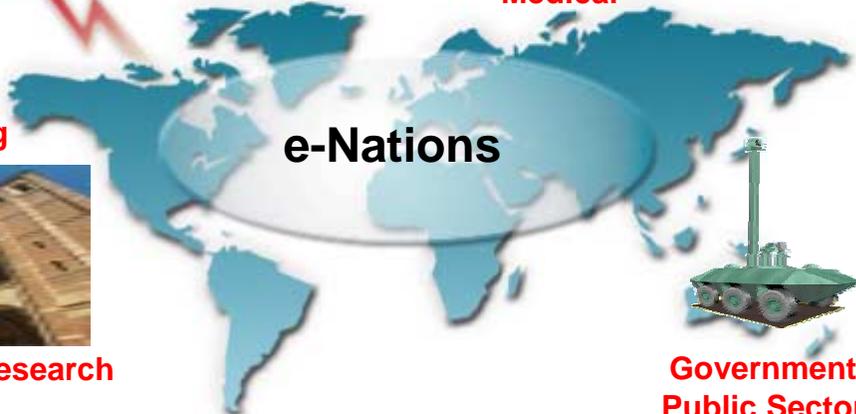
Medical



Transportation



e-Nations



Government Public Sector



Cisco Systems – Leading the Evolution

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- 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”

CISCO SYSTEMS



EMPOWERING THE
INTERNET GENERATION

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/ios123/123cgcr/ipv6_vcg.htm