



The peer 2 peer internet

The IPv6 Road to uncharted territories of revenue opportunities

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April 17 – 21, 2005





Some tidbits

“There is a kind of capacity problem. How is the Net going to support billions of additional users and devices, and new data-hungry applications?”

Vint Cerf (Intel Development Conference, San Francisco sept 7-9)

« ...A big chunk of R&D money is being used to develop equipment for an upgraded version of the Net called Internet protocol version 6 (IPv6). Beijing is heavily pushing IPv6, an initiative that could help China catch up with the U.S., which has dominated Net development so far. »

Business Week 75th Anniversary issue , oct 11th « The innovation Economy »

"When 26 Chinese share one Internet Protocol (IP) address, each American possesses six IP addresses. This is the quandary facing China in the IPv4 (Internet Protocol Version 4) era,"

Zhao Houlin, Director ITU, IPv6 Summit Beijing, april 4th 2005



Agenda

- Any urgency ?
- Some perceived drivers
- Case Study Teleglobe



Any urgency ?

- Coming out of the telecom recession: An industry desperate for renewed revenue growth
 - Consensus : the next multibillion revenue opportunities imply **IP based network convergence, multi-functional end-devices, always on, always p2p reachable, mobile and endowed with end to end security.**
 - Continuing pressure on existing carrier business models with the advent of VoIP and new broadband wireless technologies
 - Visions of ubiquitous communications between billions of devices ranging from home networks to global sensor and RFID networks.



What does IPv6 bring to the table?

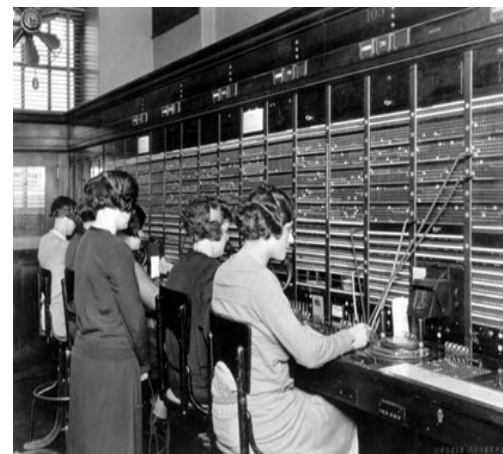
- Solves address shortage
- Restores p2p
- Mobility
 - Better spectrum utilization
 - Better battery life!
- Security
 - Isec mandatory
- Multicast
- Neighbour discovery
 - Ad-Hoc networking
 - Home networks
 - Plug and play
 - Auto configuration
- Permanent addresses
 - Identity (CLID)
 - Traceability (RFID)
 - Sensors and monitoring

ADSL, cable, 3G, Wi-Fi, Wi-Max provide the always-on



Is the address shortage for real?

- IPv4 addresses are effectively being rationed and will likely run out by 2008-2010
- The shortage is hidden by the proliferation of NAT's which allow re-use of addresses.
- Internet in 2005 is in dire need of permanent addresses and peer 2 peer communications and faces the same growth bottleneck as telephony back in the 1920's
- Status quo would stunt revenue growth ; unacceptable scenario – the address dam will burst





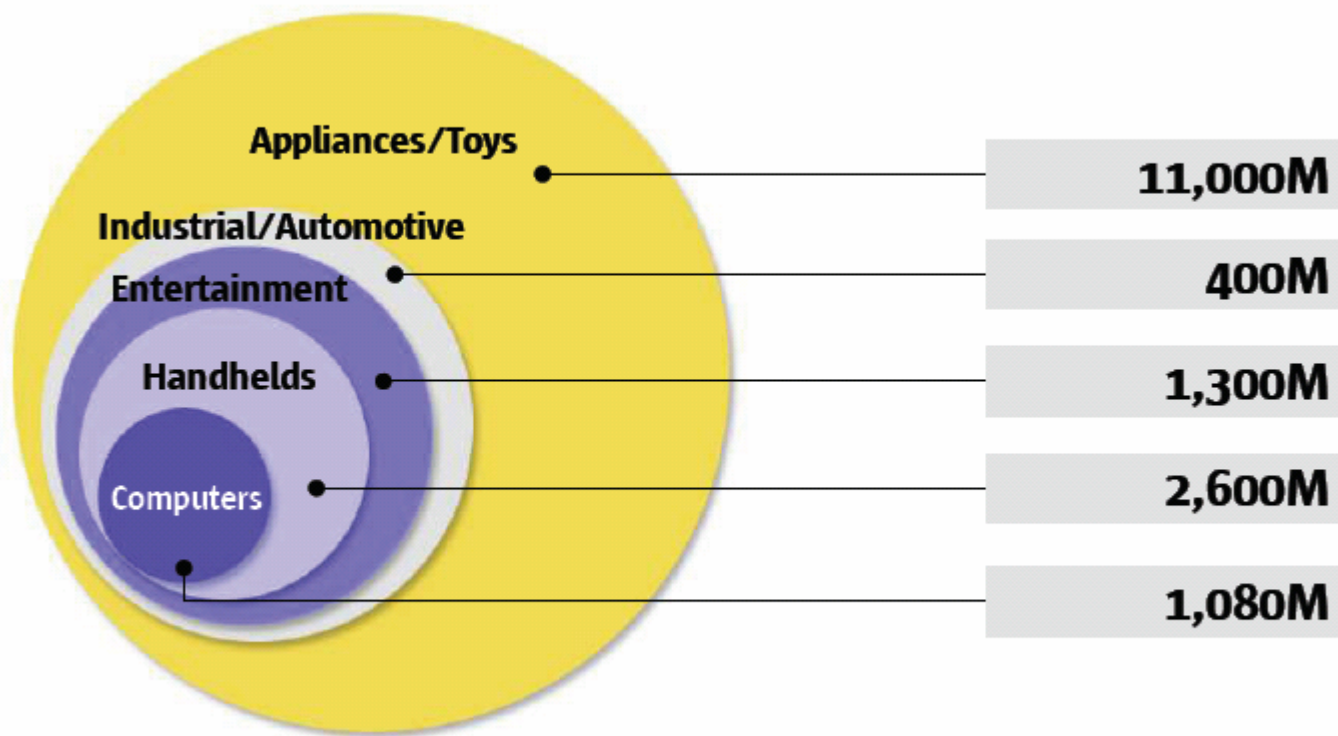
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17 billion Traditional Networkable Devices!

WW Installed, 2012



Source: IDC Estimates, 2004

Sun Microsystems estimates that including sensor and RFID networks the world could have a trillion communicating devices in a decade!



Some perceived IPv6 drivers

- Mobile IP
 - Voice, radio, TV over IP
 - Grid and Infiniband
 - Massive multiplayer games
 - RFID, control and sensor networks
 - Microsoft
 - Critical mass of:
 - digital communicating end-user devices
 - high speed always on access
 - Research and Education networks
 - National Defense
 - National policies and economic weight
- Disruptive potential on existing carrier business models??**



Mobile IP as IPv6 driver

- “Adoption of IPv6 in mobile infrastructure deployments will be the biggest driver in the migration to IPv6”
 - Gartner Dataquest sept 2004 -
- Mobile nodes must be able to move from router to router without losing end-to-end connection
 - A home address to maintain connectivity
 - Many, many care-of address to maintain route-ability
 - billions of care-of addresses needed in the future: forget v4
 - Not to mention that IPv6 saves spectrum and battery power!
- Nokia 7700 one of the first commercially available IPv6 capable terminals, 2005 will certainly see many more

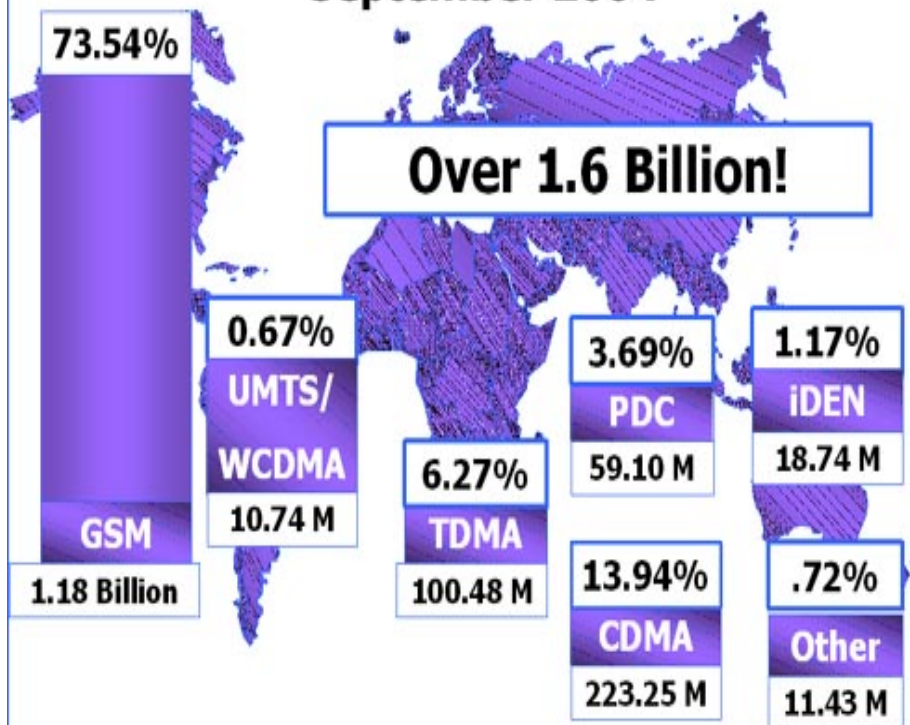




What a market!

World Cellular Subscribers September 2004

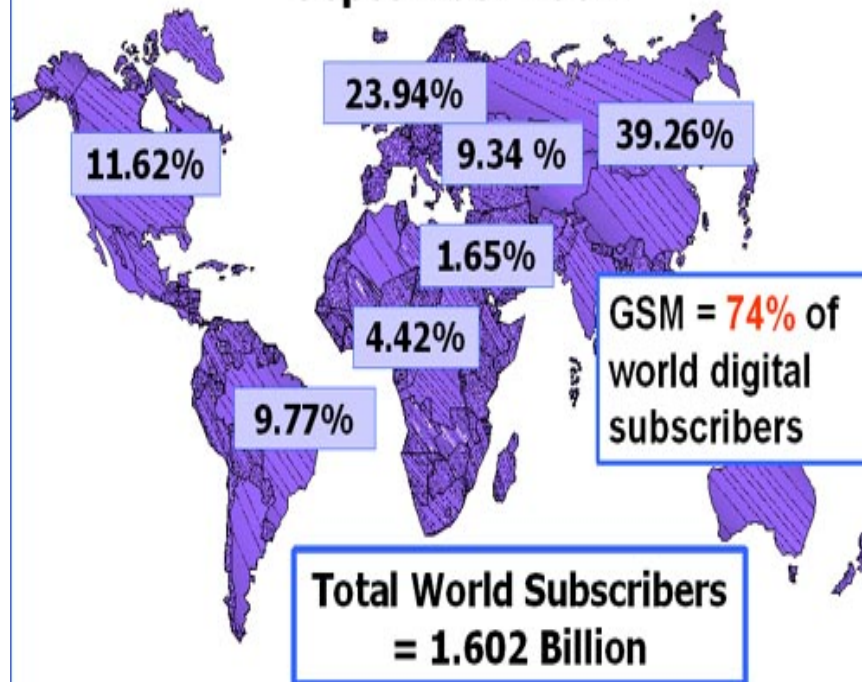
Over 1.6 Billion!



Source: EMC World Cellular Database Sept '04

World Cellular Subscriber Distribution

World Cellular Subscriber Distribution September 2004



Source: EMC World Cellular Database Sept 2004



3G : Mobile Broadband IP as IPv6 driver



3RD GENERATION
PARTNERSHIP
PROJECT 2
"3GPP2"



- After the European bidding excesses and initial equipment delays 3G finally take off
- Number of 3G/UMTS users reached 16 million end 2004 up from 10 million end Q3-04 (UMTS forum); 70 million units by end 2005 !?
- 3GPP and 3GPP2 share a vision: high speed value added applications, seamless wireless mobility, portability, location information for the world's GSM and CDMA cellphones
- 3GPP mandates IPv6 support in the Internet Multimedia subsystem(IMS) and the UMTS Terrestrial Remote Access Network (UTRAN)



Mobile IP broadcast as IPv6 driver

- DMB : Digital Media Broadcasting
- TV phones: cellphone + built-in digital TV receiver
 - Add to jargon: mobisode = mobile episode
- The promise:
 - Potentially 270 million subs worldwide by 2009 (Visiongain)
 - US revenue : from 32.7mil in 2005 to 1.9bil in 2009 (Im-Stat)
- IP datacast over DVB-H standards being finalized
 - DVB-H standard finalized at ETSI (dec 2004)
 - Implies full e2e solution and scaleable multicast! IPv6?
- The television industry considers mobile TV a major potential revenue producer





Peer to peer VoIP as IPv6 Driver



- Aug 29th 2003: Skype set up in Stockholm by Niklas Zennstrom and Janus Friis, founders of Kazaa. Promises high quality p2p phone calls over the internet to always on customers.
- April 6th 2004: launches PocketSkype for Wi-Fi hotspot access
- Based on e2e VoIP, good algorithm for voice, PC's with headsets.
- mid April 2005 Skype reaches 100 million downloads, has 30+ million users, 1,500,000+ connected anytime, carried 7 billion+ free minutes!!
- "We have a big ambition with Skype: it is to make it the global telephone company" (Int'l Herald Tribune oct 13th 2003).
- July 2004: Teleglobe, Level3, iBasis provide Skype PSTN termination; mid april 05 : Skypeout reaches 1,000,000 customers.
- Not bad at all for a 20 months old – Congratulations –



IP Telephony



- Consumer VoIP: Choose your internet voice provider service plan
 - In North-America: Vonage, AT&T CallVantage, Packet8, Primus
 - 5+ million subscribers worldwide; expected to double in 2005
 - Japan's Yahoo BB is the biggest VoIP provider
 - Newer home routers such as D-Link 1402 router include VoIP routing
 - Problem : box is often locked to a particular service provider
 - Service provider tries to restrict free SIP to SIP calling to customers within his domain, wants to coral customers.
 - Market will really explode with dual wi-fi/cellphone end-devices
- Enterprise VoIP:
 - IP PBX: 5.5 million lines installed in 2003
 - IP centrex: perfect match for IPv6





Digital radio as IPv6 driver

- Other neologism : podcast(ing): producing your own radio show on the internet.
- Radio delivered by web, satellite and cellphones.
- HD-Radio : CD quality sound; digital plus data alongside existing AM or FM channels.
- Barriers to entry to a 21 billion \$ industry (in the US) go down; XM, Sirius, Yahoo, MSN new names in broadcasting.
- Standards battle : DAB (Digital Audio Broadcasting) vs DRM (Digital Radio Mondiale) vs HD-Radio's IBOC (in-band on-channel)
- Next : Visual Radio Broadcasting ?





iTV and IPTV as IPv6 driver

- 30 million TV's in the USA alone with digital set-top boxes and interactive capability
- iTV and IPv6 : targeted ad and content delivery, tracking of consumer data (ITA)
- Forecasts of 200 million digital TV's worldwide by 2007 and 20 million IPTV subscribers by 2008 (IPTV News)





Grid and Infiniband

- Grids: going mainstream
 - IBM : 11 datacenters around the world as computing grid
 - Sun Microsystems; grid on demand service since oct 1st
 - Globus Consortium predicted (BW oct18th): HP, Intel, Sun IBM would rally around common standard.
- Infiniband: gaining momentum in R&E world
 - I/O specification to deliver channel based, switched fabric technology. Used to have distributed servers communicating at high speed to form highly scaleable clusters.
 - Infiniband standards define a global ID (GID) which has an IPv6 format (RFC2373) to communicate across an IB subnet





Grids and IPv6



Grid Consortium Japan



- A key IPv6 attribute for the grid world is easy address renumbering
 - A grid needs reconfigurable uniform address spaces spanning physically dispersed virtual organizations
- The GGF has an IPv6 WG
 - OGSA based Globus toolkit v3 to be fully IPv6 capable
- Trials under EGEE and 6GRID projects



P2P multiplayer games as IPv6 Driver

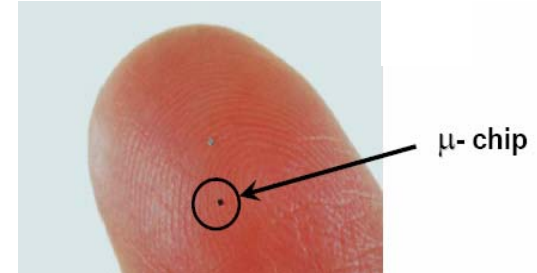
- New acronym : (M)MOG : (Massive) Multiplayer Online Game allows for easier differentiation with on-line gaming (gambling)
- (M)MOG's today are mostly client/server: creates serious bandwidth and processing bottlenecks
- Sony's Everquest: (per Asian WS Journal nov 26th 03)
 - 500,000 users worldwide; 22 hours/user.week on-line
- Number one on-line game in China has 800,000 concurrent users!
- Jupiter Research foresees that by 2006, connected consoles will surpass on-line action-PC gamers!
- IGDA (International Game Developers Association) papers reflect the growing importance of on-line
- Xbox and Playstation are IPv6 ready





RFID's as IPv6 driver

- January 2005: The bandwagon started
 - Wal-Mart Stores and DoD mandatory RFID support programs started.
- RFID associations and forums are increasingly active
- Generalized use of RFID implies terabytes of traffic daily.
- RFID considered for authentication and for traceability
- RFID tags on passports, banknotes, secure papers, concert entry ticket, casino chips, luggage tags
- ISO and EPC sorting out standards





Control Networks as IPv6 driver

- Control Systems for process, factory and building automation have their own standards bodies with network technologies as key component
- ethernet and IP fields are defined
- Huge number of small nodes (sensors and actuators)
- Acute need for autoconfiguration





Sensor networks as IPv6 driver



- Self organizing sensor networks
 - Darpa sensit, Smart Dust, motes and follow-up projects
 - Pervasive computing, context-aware computing etc.
 - Habitat, water&pollution levels, structural integrity, biomedical
- Intel's vision
 - Radio Free Intel: vision of adding wireless capabilities to every device by integrating the radio circuits and systems directly into every component
 - Intel Deep Network projects: "Locally networking billions of embedded nodes, driving computing deeper into the infrastructure that surrounds us."



Microsoft as an IPv6 driver



- Motivation: expand application domains and revenue sources
 - Multiplayer games (Xbox on-line)
 - Peer 2 peer (end of NAT issues)
 - Mobility (session continuity , mobile VPN, VoIP)
 - End to end security: temporary addresses and Ipsec
 - Secure neighbor discovery
 - Plug and play (instant network)
- Microsoft IPv6 support and developments:
 - Tools and API's to facilitate IPv6 application migration
 - Windows XP SP1, PocketPC, CE.NET have an IPv6 stack
 - Messenger, Windows Media Player, Direct Play, Threedegrees
 - Longhorn will have IPv6 as default protocol (release 2006?)



The age of digital communicating devices



- The SIA (Semiconductor Industry Association) estimates that in 2004 chip sales to the consumer industry surpassed sales for corporate gear for the first time in history!
- Everything goes digital : chips into everything
 - next : communication capable chips into everything
- Your cellphone, the computer
 - colour screen, extra memory, fast processors, built in cameras etc. and the advent of 3G spawn new uses like multiplayer games, remote monitoring/surveillance, “mobisodes”, push services etc.
 - Approx 650 million handsets sold in 2004!



The battle for the communicating living-room

- Consumer Electronic Show Vegas January 2004
 - first serious salvos in a titanic battle between the computer industry (Intel, Microsoft) and the electronics industry (Sony, Philips, Toshiba, Panasonic..)
 - Bill Gates called it « seamless computing »; Panasonic's Ohtsubo called it « lifestream »
 - The essence of the battle is a kind of a home « mediacenter » with all devices connected in a plug and play mode, preferably wireless.
- Consumer Electronic Show january 2005
 - Sony confirms that all its products will be IPv6 enabled this year under the name "New internet"
 - Nokia and Panasonic show IPv6 enabled end devices, Kodak promotes a wi-fi ready camera
 - Huge stakes: \$113 billion consumer electronics market in the US alone for 2005 (Consumer Electronics Association)





Prevalence of fast digital access

- 150 million subscribers end 2004
 - 136.4 million by end Q3-04, up 53% from 89 million end Q3-03 (source: Point Topic)
- DSL:
 - 85.3 million DSL subscribers end Q3 04
 - Reached probably 100 million jan 2005
- Cable:
 - 51.1 million subscribers ; remains prevalent in North-America
- It took mobile phones 5.5 years to go from 10 to 100 million subscribers worldwide; Broadband achieved this in 3.5 years.





Powerline Communication

- A Universal Powerline Association announced at the Jan 2005 Vegas CES
 - Delivers a 200mbps power line product today
 - IPv4 and IPv6 supported for QoS
 - Will accelerate standardization process
- Promoted in Europe by the European Union funded 6Power and OPERA projects, in Japan by the PLC-J
- Opens the way to networking for the myriad home appliances all the way to the individual lightbulbs.





Software Defined Radio as IPv6 driver

- SDR promises seamless interoperability across virtually any wireless standard
- Makes software control of operating frequencies and output power possible..
- Allows for multimode, multiband, multifunctional devices to be adapted, updated or enhanced by software
- Mandated by the US DoD under JTRS (Joint Tactical Radio System) program
- European Union formed a very active SDR group: E2R (End 2 End Reconfigurability)





Wi-Fi, Wi-Max, ZigBee, Mobile-Fi, Ultrawideband....

- Disruptive even if a fraction of these market projections are achieved
- Constant re-evaluation of current business models both for access and service revenues is essential.

A WEB OF WIRELESS INNOVATION Cutting-edge technologies are being pushed along by upstarts and tech giants alike. Here are some of the leaders in each area:		ZigBee Industry giants Motorola, Royal Philips Electronics, and Samsung, as well as upstarts Millennial Net and Ember, are expected to reap big benefits from making ZigBee sensors.	
		2003 REVENUES	2007 REVENUES
		\$0	\$3.5*
Wi-Fi Intel is the big winner here, after using its marketing muscle to build demand for Wi-Fi chips in laptops and other devices last year. Wireless carrier T-Mobile has been the most aggressive in rolling out public Wi-Fi service, with 5,200 locations.	WiMax Trying to repeat its Wi-Fi success, Intel threw its weight behind the standard last year. Telecom-equipment giants Alcatel and Siemens and upstart radio-equipment makers Alvarion and Aperto also stand to gain.		
2003 REVENUES	2007 REVENUES	2003 REVENUES	2007 REVENUES
\$3.3*	\$6.4**	\$0	\$5.4*
Mobile-Fi Infighting between Japanese wireless giant NTT DoCoMo and startup equipment makers Flarion and Navini is expected to delay the standard until 2005 or 2006. Still, the upstarts are conducting trials with wireless carrier Nextel and South Korea's KT Telecom.	Ultrawideband A war over competing technologies between chipmakers Texas Instruments and Intel on one side and Motorola on the other has stalled work on this standard. Both sides may simply release their products and let the market sort out which is best.		
2003 REVENUES	2007 REVENUES	2003 REVENUES	2007 REVENUES
\$0	\$918*	\$0	\$1.1*

All figures in billions *Estimates **Includes preliminary IDC estimate

Data: Ruiberg & Co., Wireless Data Research, Parks Associates, IDC, Visant Strategies Inc.



Wi-Fi as IPv6 driver

- Slowly reaching a critical amount of coverage and a critical mass of end-user devices
 - spectacular success of Wi-Fi routers at home and adoption in hotspots : 30 million hotspot users, 40K public hotspots
 - Wi-fi alliance has 1500+ wi-fi certified products
 - 30% of laptops shipped now have a Centrino chip
 - Wi-fi ready cell phones phones are coming
 - New Kodak digital camera has wi-fi access!
 - Some Wi-fi routers now integrate VoIP and VPN functionality
 - Some wi-fi routers are IPv6 ready!





Wi-Max as IPv6 driver

- Wi-Max: potentially disruptive!
 - radius of up to 8km (100m for Wi-Fi) at speed of 75mbps; rival to DSL and cable for fixed BB, to 3G in its mobile version
 - Intel Wi-Max ready chipset expected for Centrino chip for Wi-Max
 - Intel and AT&T join forces on Wi-Max (BW dec 20th)
 - Deployments are starting:
 - Clearwire Inc plans nationwide US Wi-Max network
 - World's first mobile Wi-Max: Korea's WiBro later in 2005
 - Interesting struggle: mobile Wi-Max (802.16e) versus 3G





Zigbee as IPv6 driver

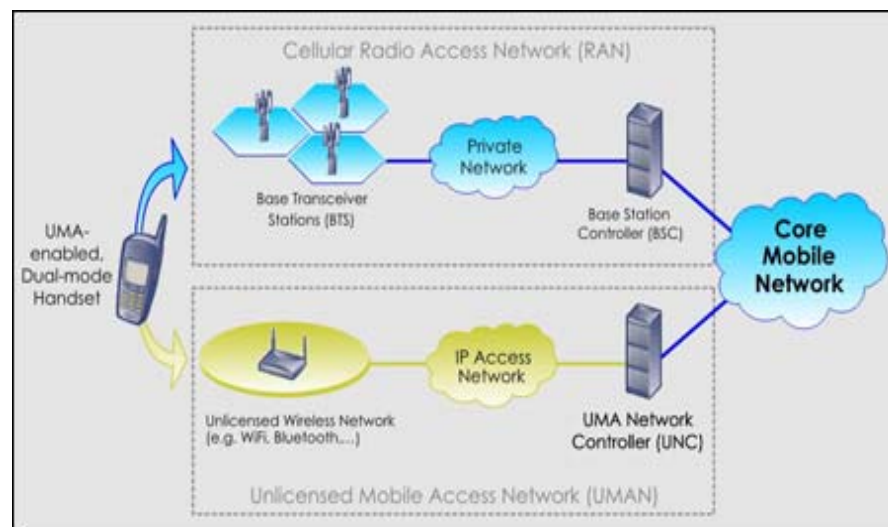
- Addresses need of short range (70m), remote monitoring and control with meshed sensor networks with many nodes, low cost, very long battery life
- Compact protocol stack, 250kbit speed
- Zigbee standard ratified mid dec 2004
- Potential market of billions of end devices
- Divergent market projections: 5 to 50 million for 2005
- Zigbee and RFID complementary? Bluetooth?





Unlicensed Mobile Access (UMA)

- UMA provides access to GSM and GPRS mobile services from unlicensed spectrum technologies such as Bluetooth and Wi-Fi
- Requires a dual-mode handset
- Handset exchanges current location information with the UMA Network Controller; all mobile voice and data traffic is routed to handset over UMAN rather than cell network





R&E networking as IPv6 Driver

- R&E networks broke the IPv6 chicken and egg dilemma
 - USA's Abilene and Canada's Ca*net4 dual stack IPv4/IPv6 since mid 2002 as well as most major European and Asian R&E networks
 - Major European and Asian networks are dual stack
 - The R&E community has proven the operational viability of dual stack networks
- Adoption on Research Center and University Campus level starts to accelerate
- IPv6 p2p attributes are taken for granted in most "big science" applications

CANARIE



Asia-Pacific Advanced Network





National Defense as IPv6 driver

- US DoD decision to mandate IPv6 support was major catalyst in the US
 - Resulted in Moonv6 test network

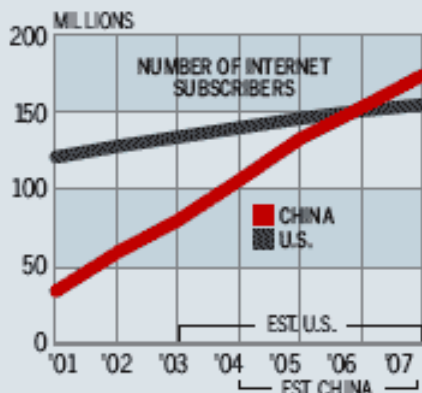


- Australian, Canadian, German, Japanese, UK and other defense ministries plan for IPv6
- NATO Interoperable Networks for Secure Communication (INSC) project has an IPv6 focus
- Defense mobile networking needs: adhoc networks (MANET), networks in motion (NEMO) and end system mobility are just not achievable without IPv6



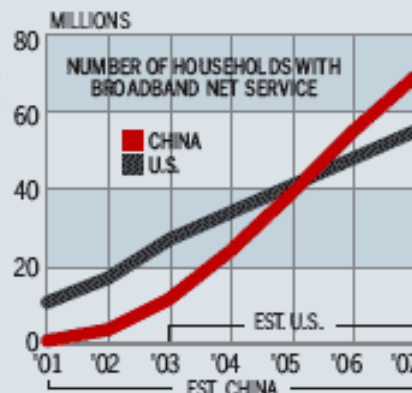
WHY CHINA IS A GROWING FORCE ON THE NET

China will soon have the most Web users in the world...



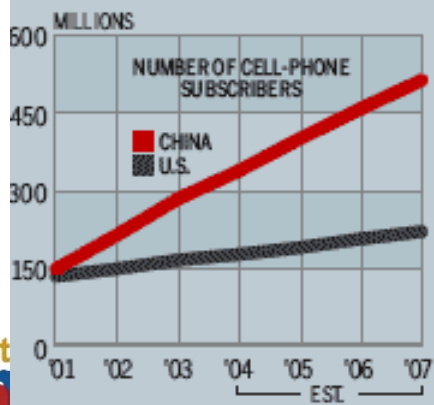
Data: Piper Jaffray & Co., Forrester Research

...and the most broadband households



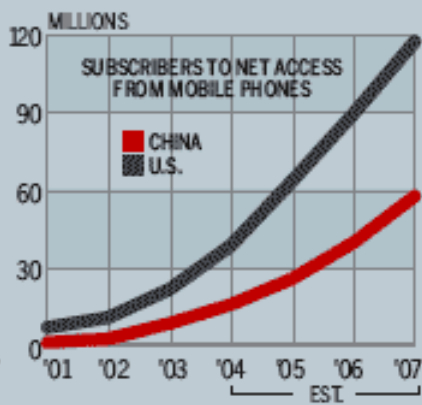
Data: Point Topic

It has the most mobile phone users...



Data: Pyramid Research

...and is a growing player in the mobile Web



Data: Pyramid Research

China tips the scales of the internet balance

Source: Business Week
March 15th 2004 issue

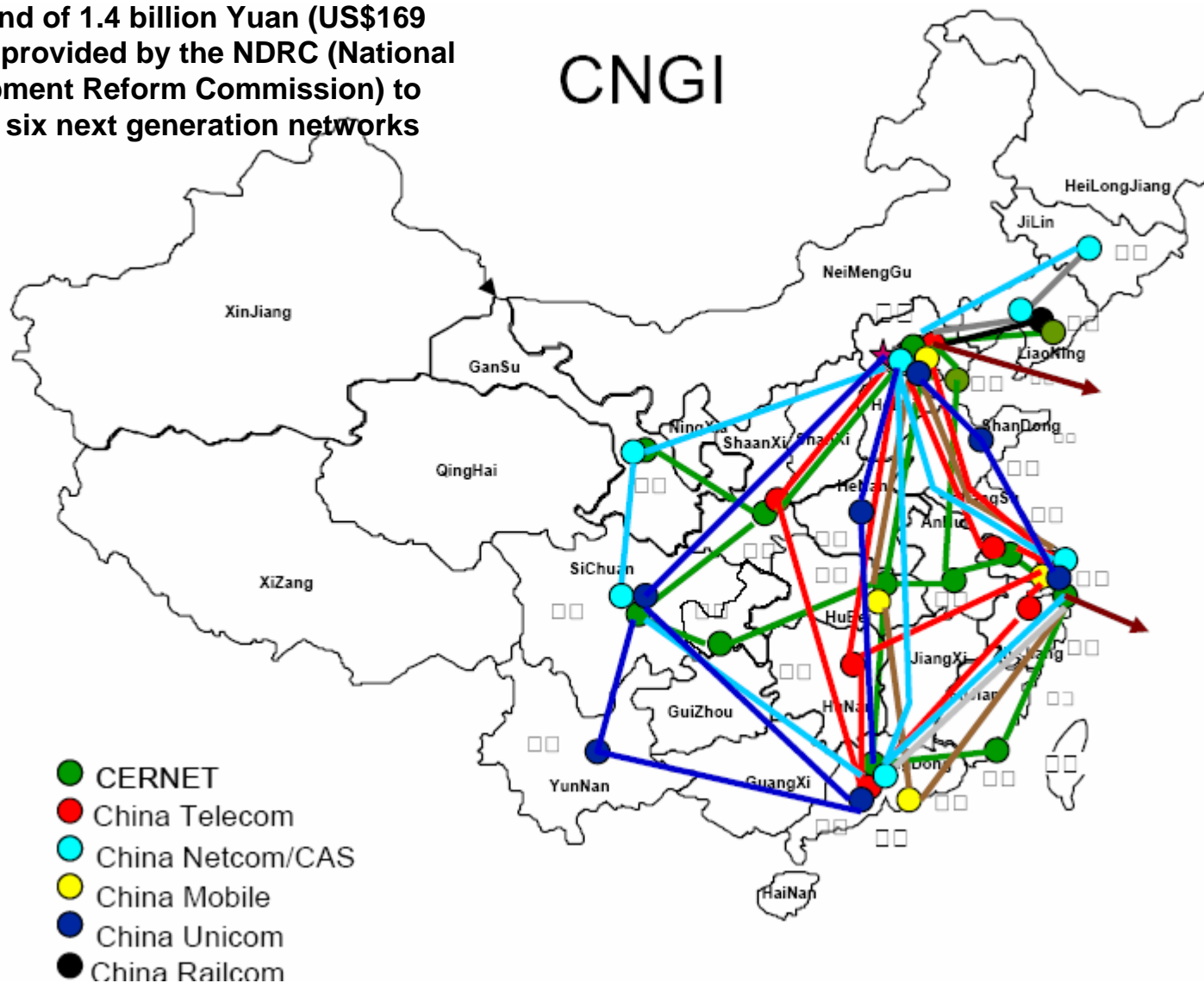


National policies and economic weight

各 中 国

- With the support from the Chinese government, China's five major Carriers started to build the CNGI :China Next Generation Internet
- China 2004 IPv6 Summit : **"CNGI Ongoing, China IPv6 Engine"**
- Stated objective: " It will become one of the largest IPv6 networks in the world by the year of 2005, speeding up the IPv6 R&D in China and providing tremendous business opportunities for industry global wide. "
- CERnet2, China's new R&E network will be IPv6 only and connect 20 cities at speeds of 2.5 and 10 gigabit per second. Became operational in dec 2004.
- Chinese officials restated that they want the Chinese internet to be completely IPv6 in time for the 2008 Olympics
- China 2005 IPv6 Summit Theme: **"IPv6 & CNGI---Innovation in Action, Connecting Everything"**

CNGI fund of 1.4 billion Yuan (US\$169 million) provided by the NDRC (National Development Reform Commission) to support six next generation networks





Agenda

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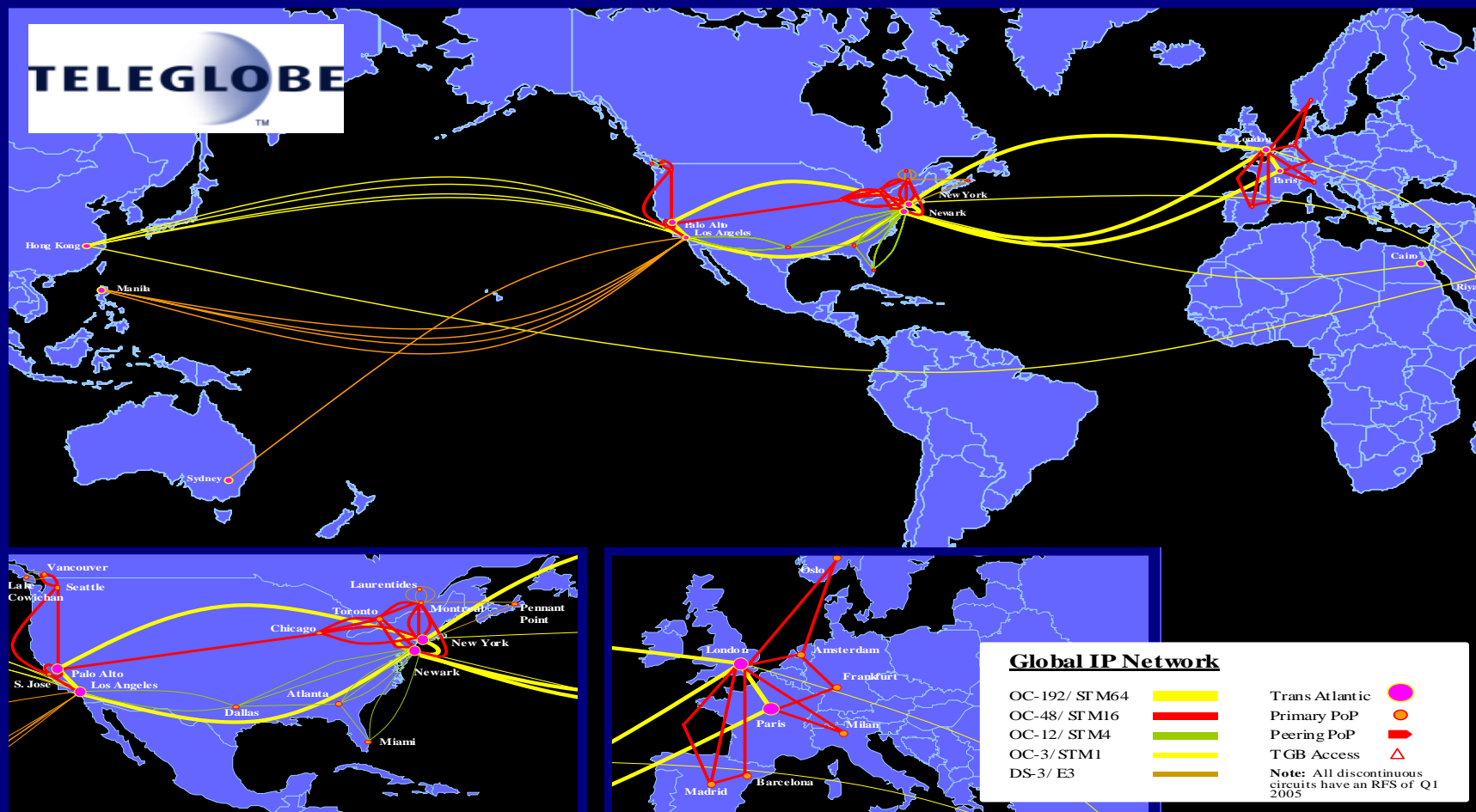
Teleglobe

- Canada's international Carrier; operates a worldwide voice and data network; major VoIP provider through ITXC acquisition.
- Teleglobe provides the first Next Gen internet intercontinental connection in 1995 for the Brussels G7 summit.
- A member of the Canarie Policy Board, Teleglobe promotes the experimentation of IPv6 and the 6bone/6TAP initiative
- Teleglobe facilitates the world's first intercontinental native IPv6 connection ; becomes a founding member of the IPv6 forum.
- Teleglobe presents its original IPv6 plans at the Telluride March 2000 IPv6 Forum
- 2003: Teleglobe starts an IPv6 pilot and is the first Canadian carrier to announce commercial IPv6 introduction.



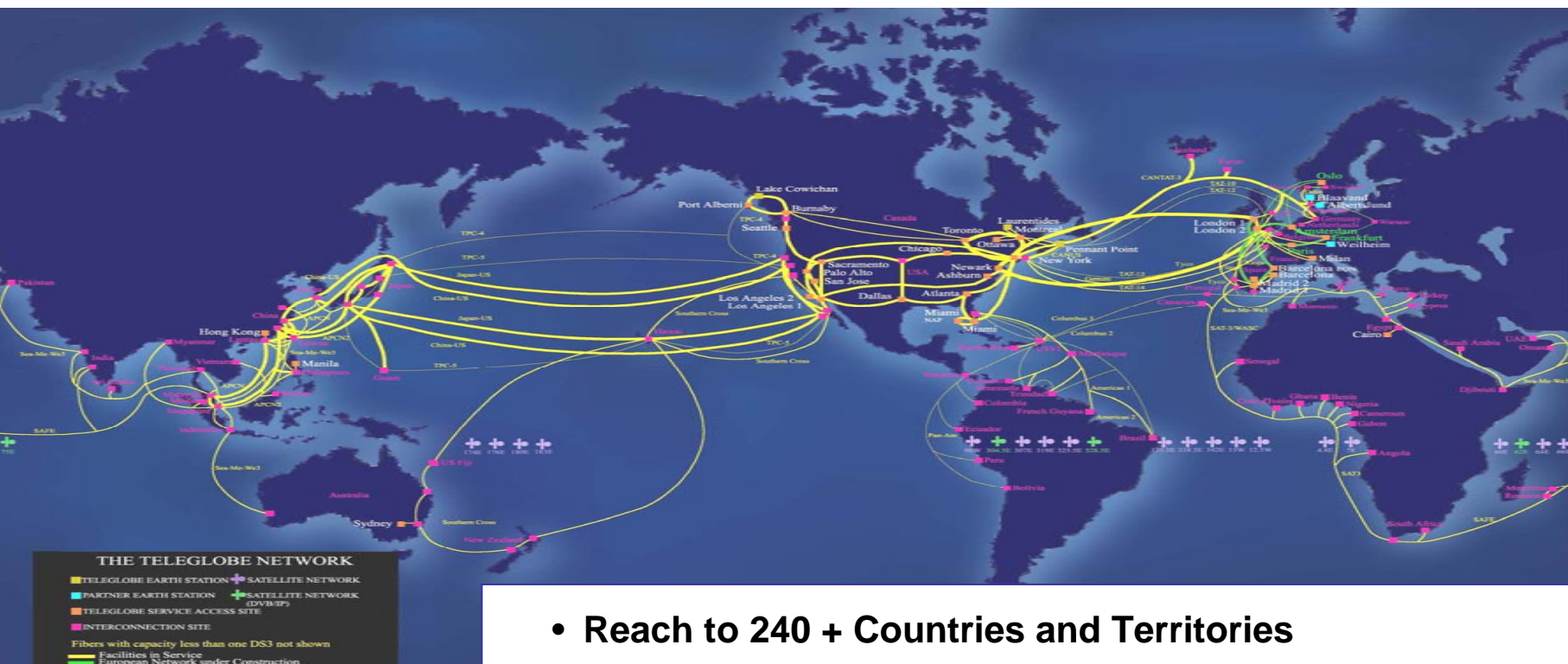


A Global IP Network....





...Based on a global backbone



- Reach to 240 + Countries and Territories
- Ownership in 100+ Cable Systems
- Dedicated Assets in Satellite Systems
- 70+ Internet “Peering” Agreements
- 275 direct and bilateral relations
- 300+ Voice over IP Interconnects
- 500+ SS7/C7 Signaling Interconnects
- Centralized, Global Network Monitoring... Tier 1 Quality



Most extensive IP Reach (93 Countries)

1 Algeria	32 Germany	63 Norway
2 Andorra	33 Ghana	64 Oman
3 Angola	34 Greece	65 Pakistan
4 Argentina	35 Guatemala	66 Palau
5 Armenia	36 Haiti	67 Panama
6 Aruba	37 Honduras	68 Paraguay
7 Australia	38 Hong Kong	69 Philippines
8 Bahamas	39 Iceland	70 Poland
9 Bahrain	40 India	71 Puerto Rico
10 Bangladesh	41 Iran	72 Qatar
11 Bolivia	42 Ireland	73 Romania
12 Botswana	43 Israel	74 Russia
13 Brazil	44 Italy	75 Rwanda
14 Brunei	45 Jamaica	76 Samoa
15 Burkina Faso	46 Japan	77 Saudi Arabia
16 Cameroon	47 Jordan	78 Senegal
17 Canada	48 Kenya	79 South Africa
18 China	49 Korea	80 Spain
19 Colombia	50 Lebanon	81 Sudan
20 Cook Islands	51 Libya	82 Syria
21 Cuba	52 Malaysia	83 Taiwan
22 Denmark	53 Mali	84 Tanzania
23 Dominican Republic	54 Mexico	85 Thailand
24 Ecuador	55 Micronesia	86 Tonga (Kingdom of)
25 Egypt	56 Mozambique	87 Trinidad and Tobago
26 El Salvador	57 Nepal	88 Turkey
27 Faroe Islands (DK)	58 Netherlands	89 Uganda
28 France	59 Netherlands Antilles	90 Ukraine
29 French Polynesia	60 New Caledonia	91 United Kingdom
30 Gabon	61 Nicaragua	92 United States of America
31 Gambia	62 Nigeria	93 Zimbabwe



How to Migrate a network this size to IPv6?

- Alternatives considered:
 - Going dual stack all the way
 - Going partially dual stack
 - 6PE access , MPLS through the core
 - Tunnel brokers
 - Just wait and see
- IPv4/IPv6 coexistence, interworking and transition are non trivial issues.

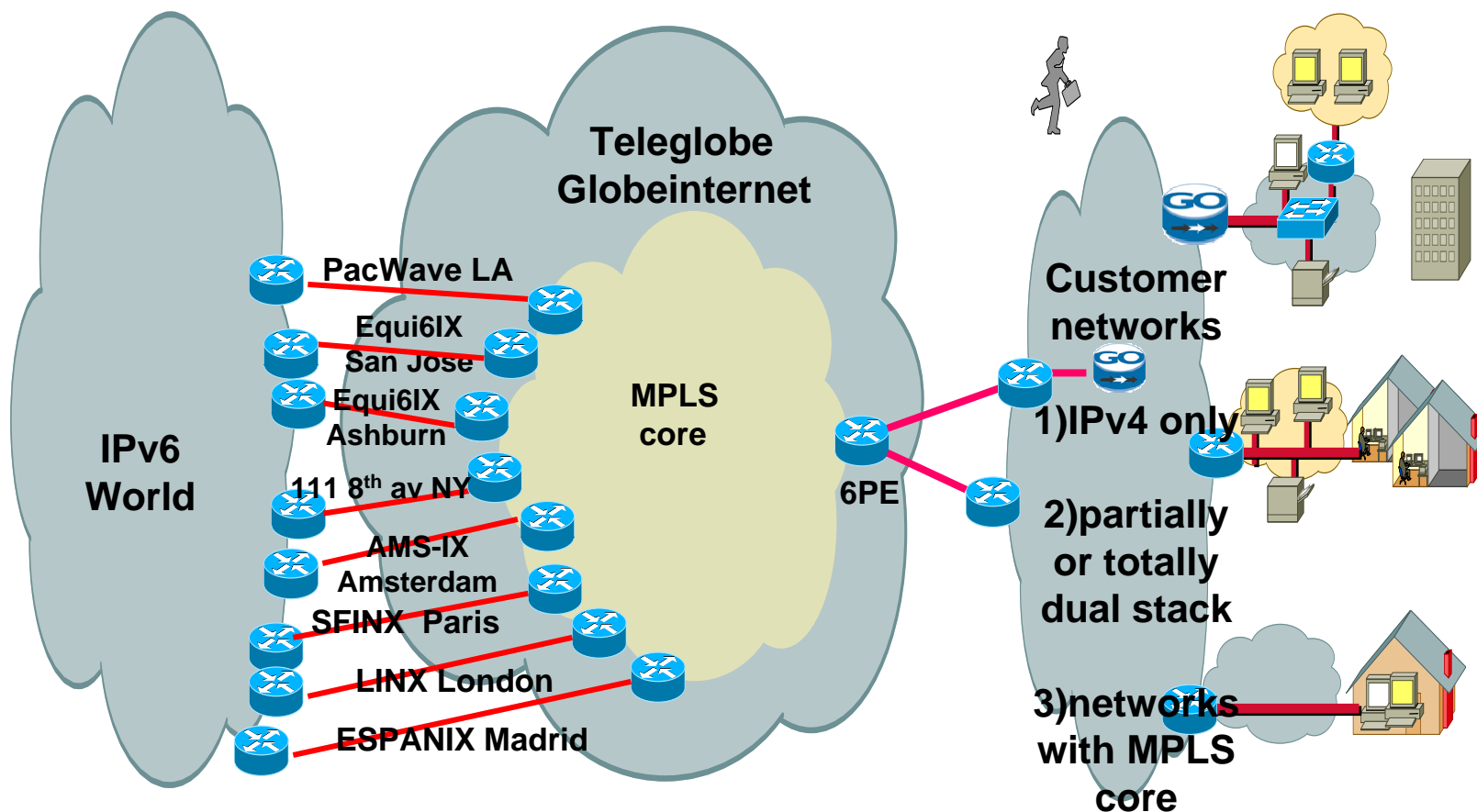


Selected path toward IPv6

- Major points of consideration:
 - Speed of transition to pervasive IPv6? major unknown
 - Need for a positive customer IPv6 experience.
 - Customer exposure to IPv6 : from nil to advanced.
- Approach minimizing investment and operational risk:
 - Quality native peering with the IPv6 world using dedicated routers at multiple sites in North-America, Europe and Asia.
 - MPLS transport through the core
 - Customer access:
 - Teleglobe provided IPv6 over IPv4 Hexago tunnel broker using TSP (Tunnel Set-up Protocol) with AAA
 - Native IPv6 access to Teleglobe Cisco 6PE enabled dual-stack access routers.

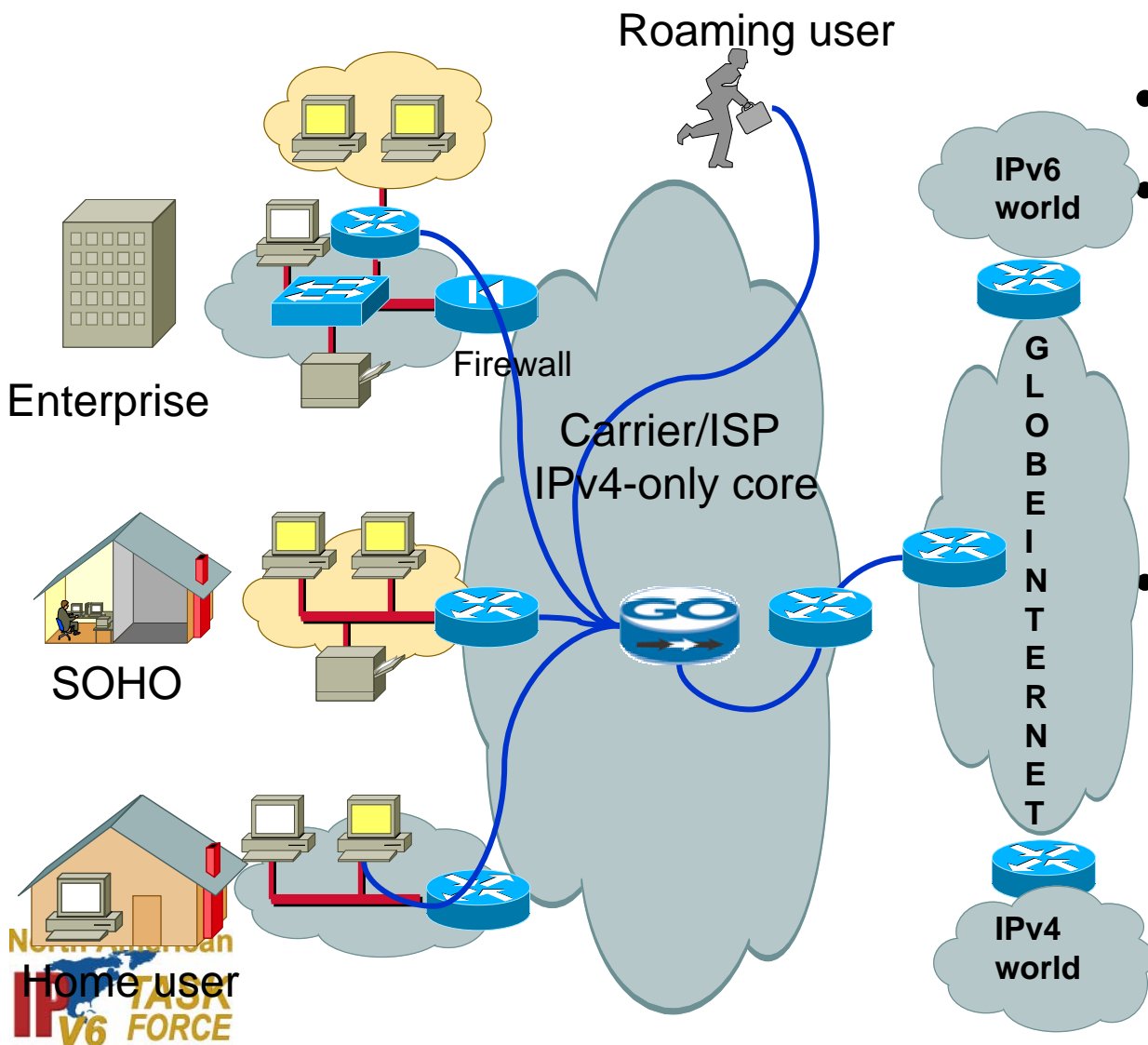


1.5 Gig connectivity to the IPv6 world





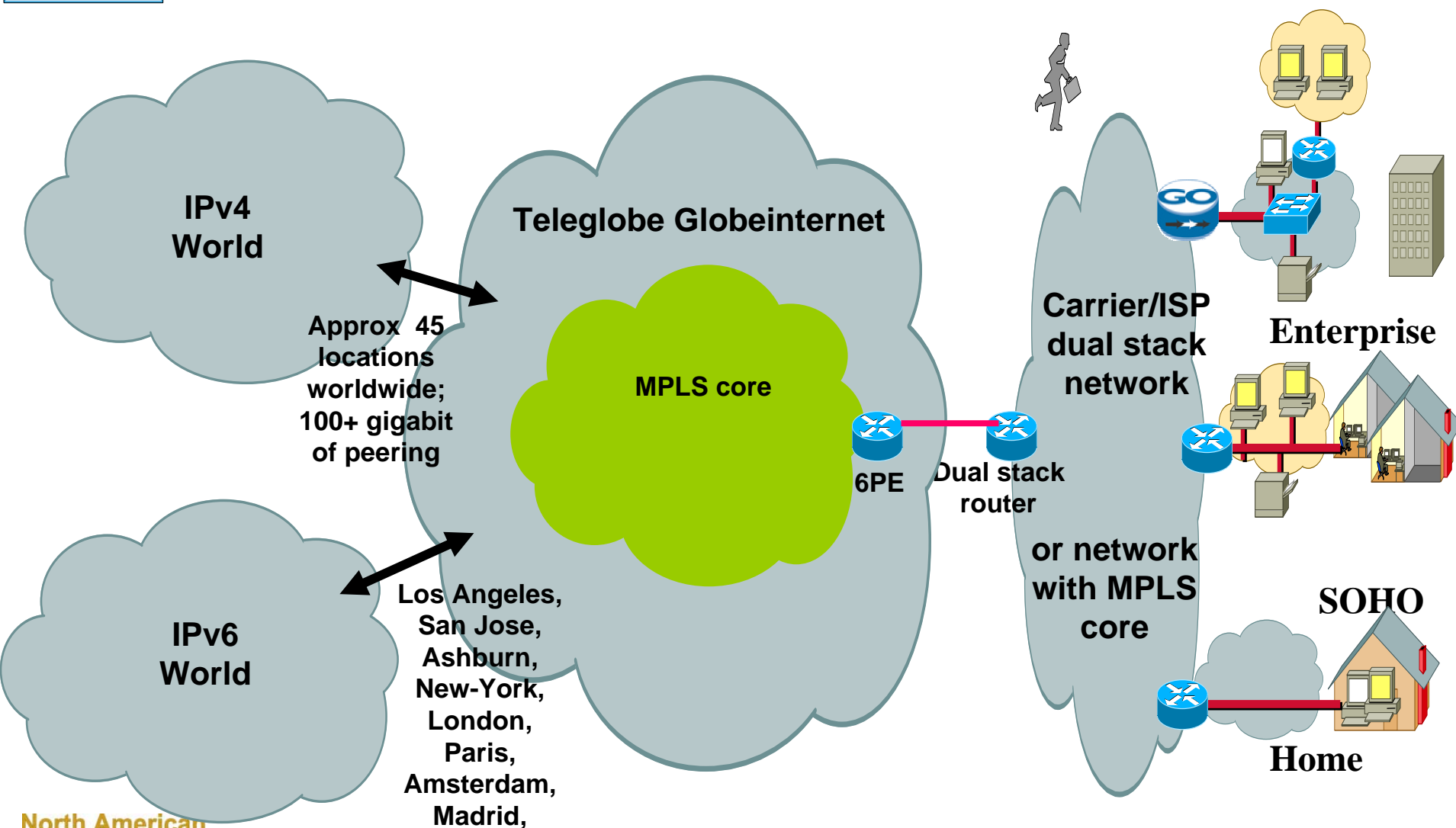
Carrier/ISP – Teleglobe IPv6 Tunneling service



- IPv4 core
- Migration Broker used in the core or aggregation points for major customers
- Carrier/ISP end-users are authenticated and assigned a fixed (stable) IPv6 prefix

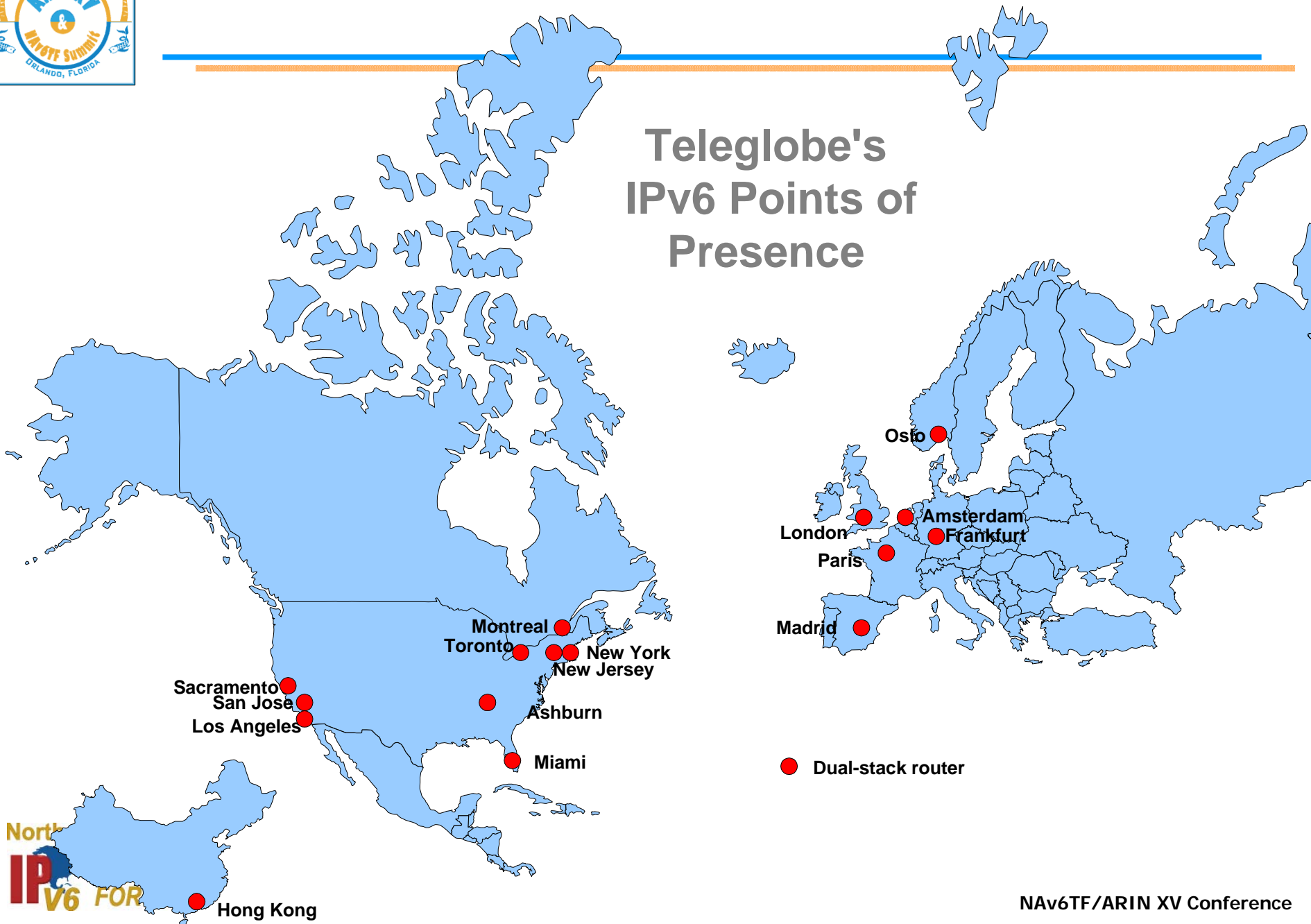


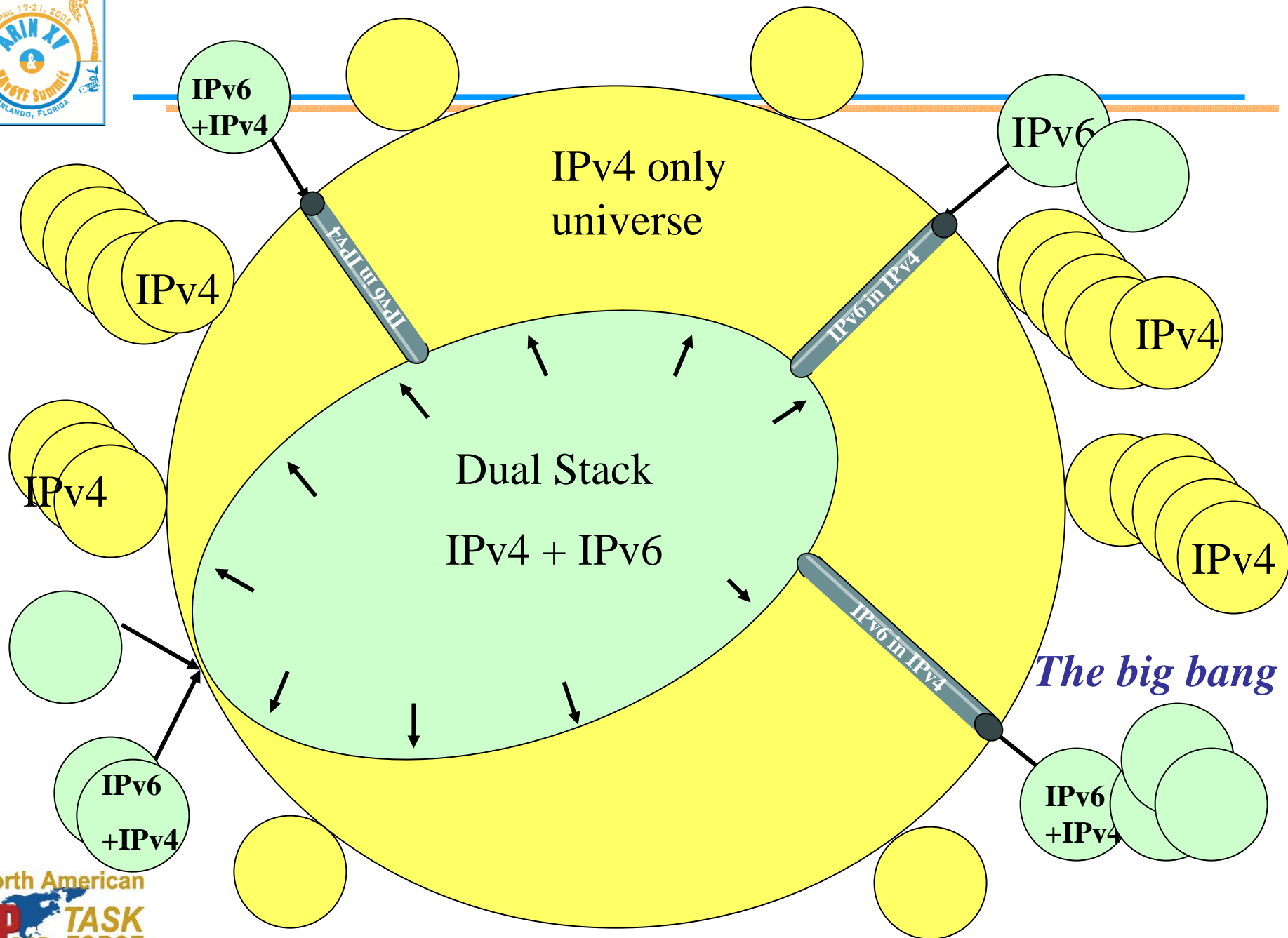
Carrier/ISP - Teleglobe IPv6 native service





Teleglobe's IPv6 Points of Presence







Early assessment

- IPv6 is shaping up as a powerful differentiator and is becoming a mandatory feature in an increasing number of Requests for Quotation.
- Most carriers/ISP's want to somehow get on the IPv6 bandwagon but with minimum risk and exposure.
- Twenty two beta customers in 11 countries have been connected. Migration Brokers have been shipped and native connections (dual stack to dual stack) set-up.

The uncharted territories are within reach



Thank you for your attention