How Cisco is preparing for IPv6

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What is IPv6? Basic Perspectives

The Network Manager Perspective

Infrastructure evolution

Stable specifications, commercial implementations
Cost of deployment and operations

The Software Developer Perspective

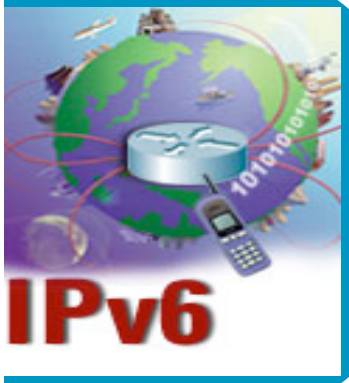
IP agnostic

Library call, Naming services, GUI,…

The End-User Perspective

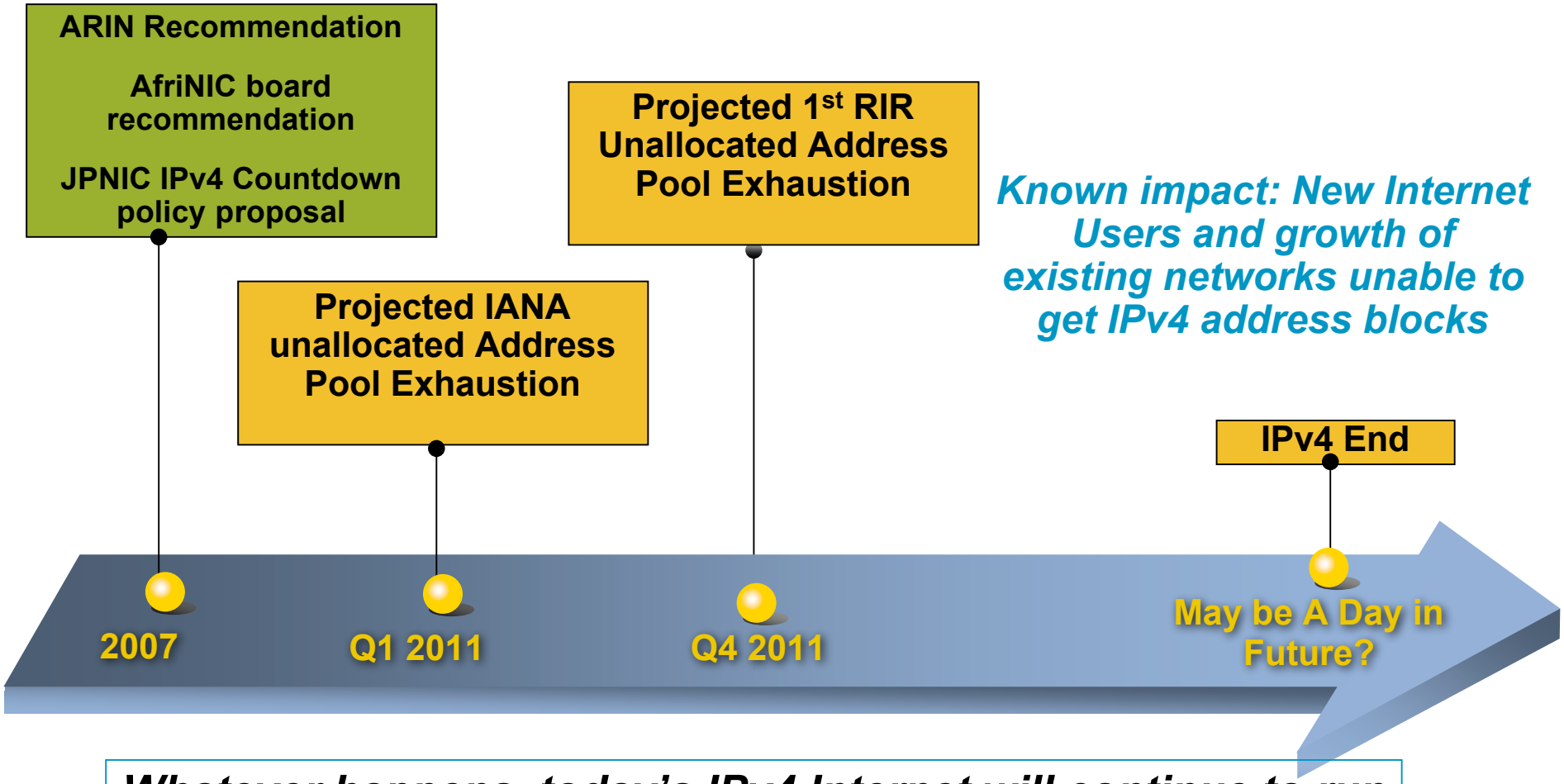
Applications & Services evolution

Key Aspects Reminder



- **IPv6 is NOT a feature**. It is about the fundamental IP network layer model developed for end-to-end services and network transparency
  - But it doesn't necessarily solve all Internet issues
- Deployments of production IPv6 infrastructures are under way, the time has come to move our focus to edge, access and usage
  - 6Bone is phased out, 6NET is closed,…
- Today's IPv6 deployment drivers do not rely on uncovering the "future killer application" anymore, they focus instead on:
  - *Performing the same as on IPv4 but on a larger scale*
  - *Operational cost savings or simpler network models when deploying applications*
  - *Leading the innovation*

Impacts of IPv4 Address Space Exhaustion



Known impact: New Internet Users and growth of existing networks unable to get IPv4 address blocks

Whatever happens, today's IPv4 Internet will continue to run as now – but Carrier-class NAT and market for IPv4 address may get developed (ref. OECD report)

IPv4 Technology in Transition

- Evolution of Broadband technologies – "Always-on Wired and Wireless" enables new Application environments

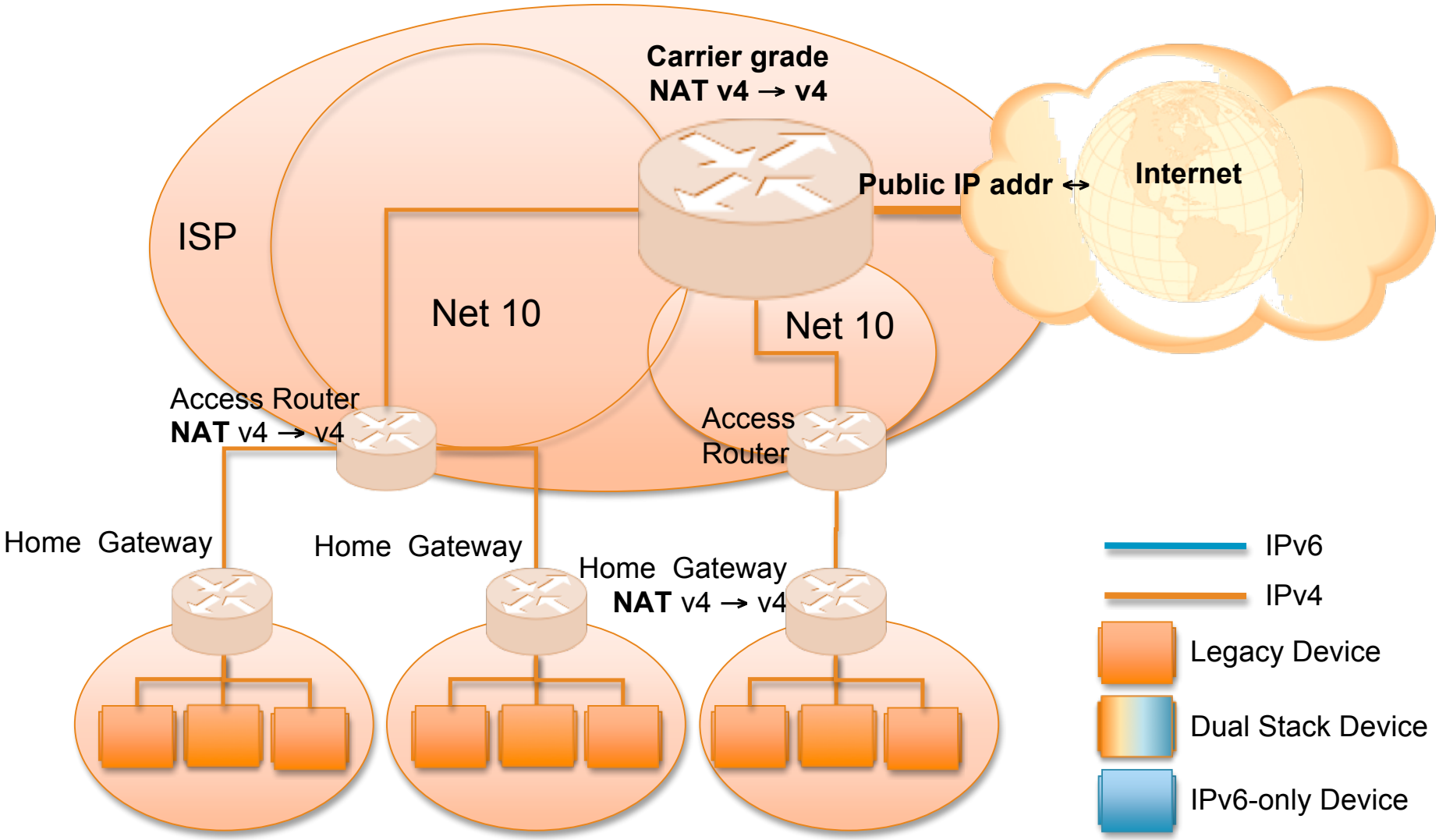
  Web 2.0, Social networking, P2P framework, IP/HDTV,…

- IPv4 address exhaustion plaguing service providers
  - – Broadband and Cable providers don't have enough address in private space
    - • 20+ Million legacy boxes installed
  - – Service providers can't get IP4 allocations
- Transition to native IPv6 stalled by
  - – Devices and applications are not yet dual-stack everywhere
  - – Internet resources (MSN, Yahoo, YouTube, CNN,…) are severely lagging in term of IPv6 connectivity
- Must find way to enable more IPv4 customers during transition
- Must find way to keep IPv4 only customers able to continue w/ legacy OS' and access new IPv6 world transparently
- Must give IPv6 customers access to IPv4 world (to do anything useful)
- Potential Carrier-Class solutions

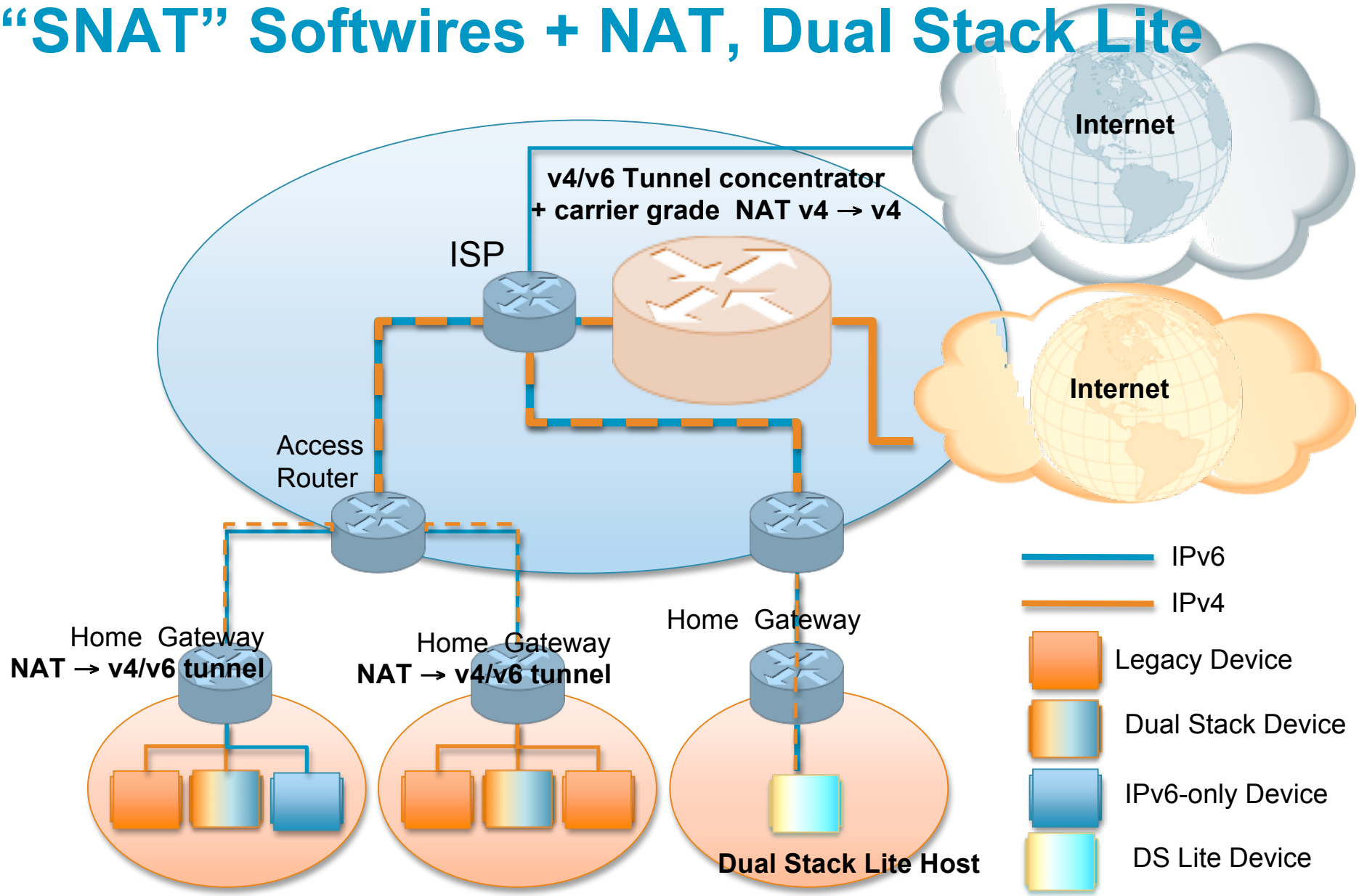
  Double NAT IPv4, Double NAT-PT, Softwire + NAT, Dual-Stack Lite

Double NAT v4v4v4

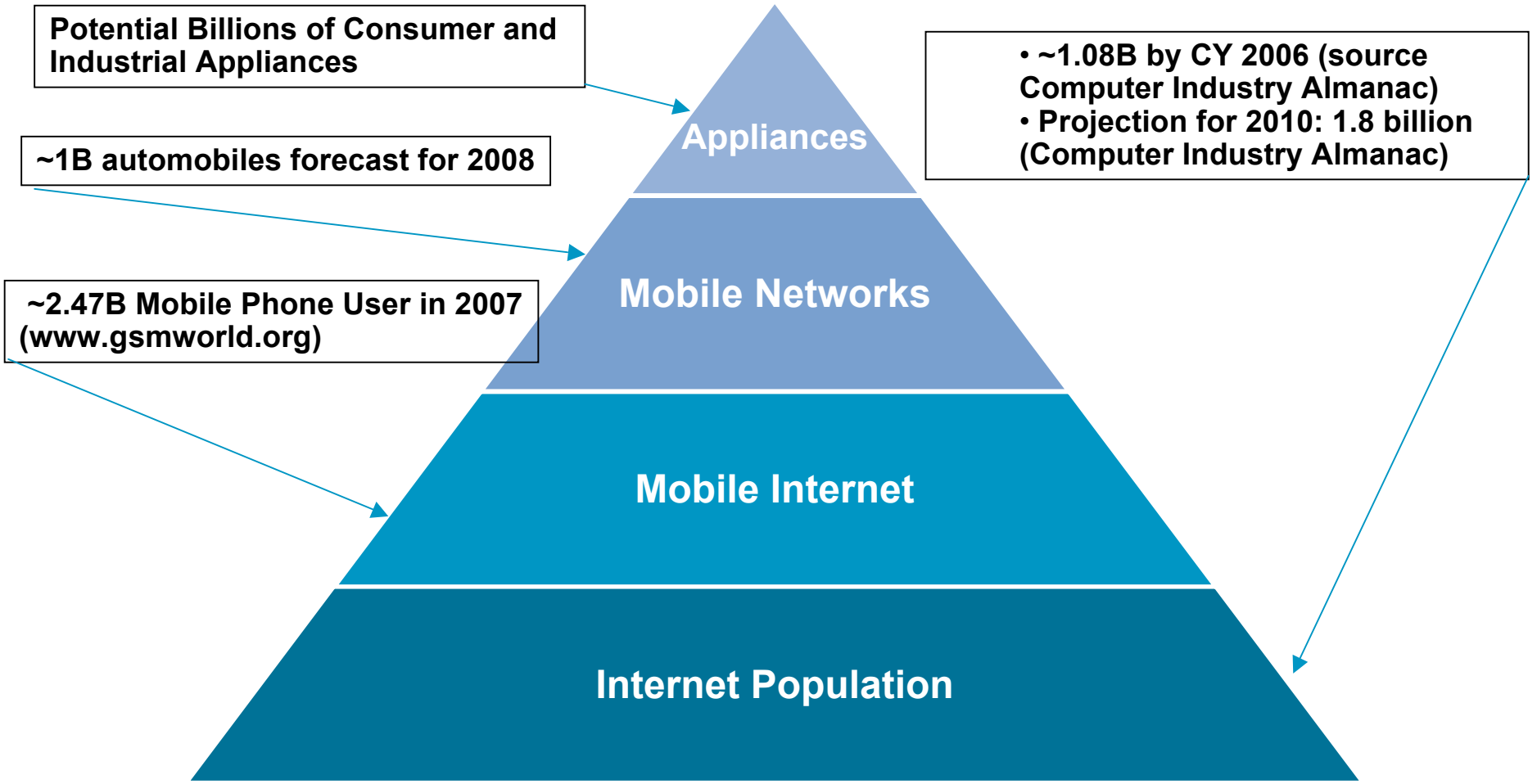
Increasingly complex networks with hierarchical Net 10



“SNAT” Softwires + NAT, Dual Stack Lite

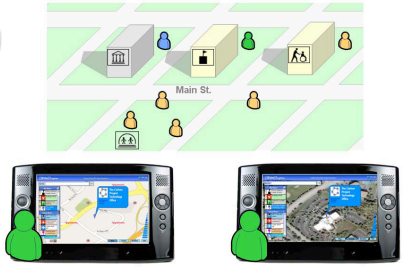


Need for a Larger Address Space?



During the life cycle of a technology, a new product is often considered to have reached the early majority – or the mass market – after achieving 22 percent penetration.

Explosion of Appliances with Embedded IP



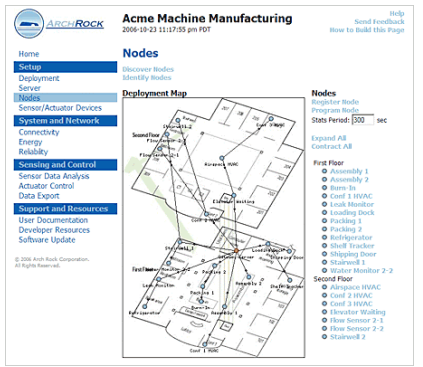
Innovation's

Business – Applications - Services

Expanding the Internet with IPv6
Integration & Co-Existence

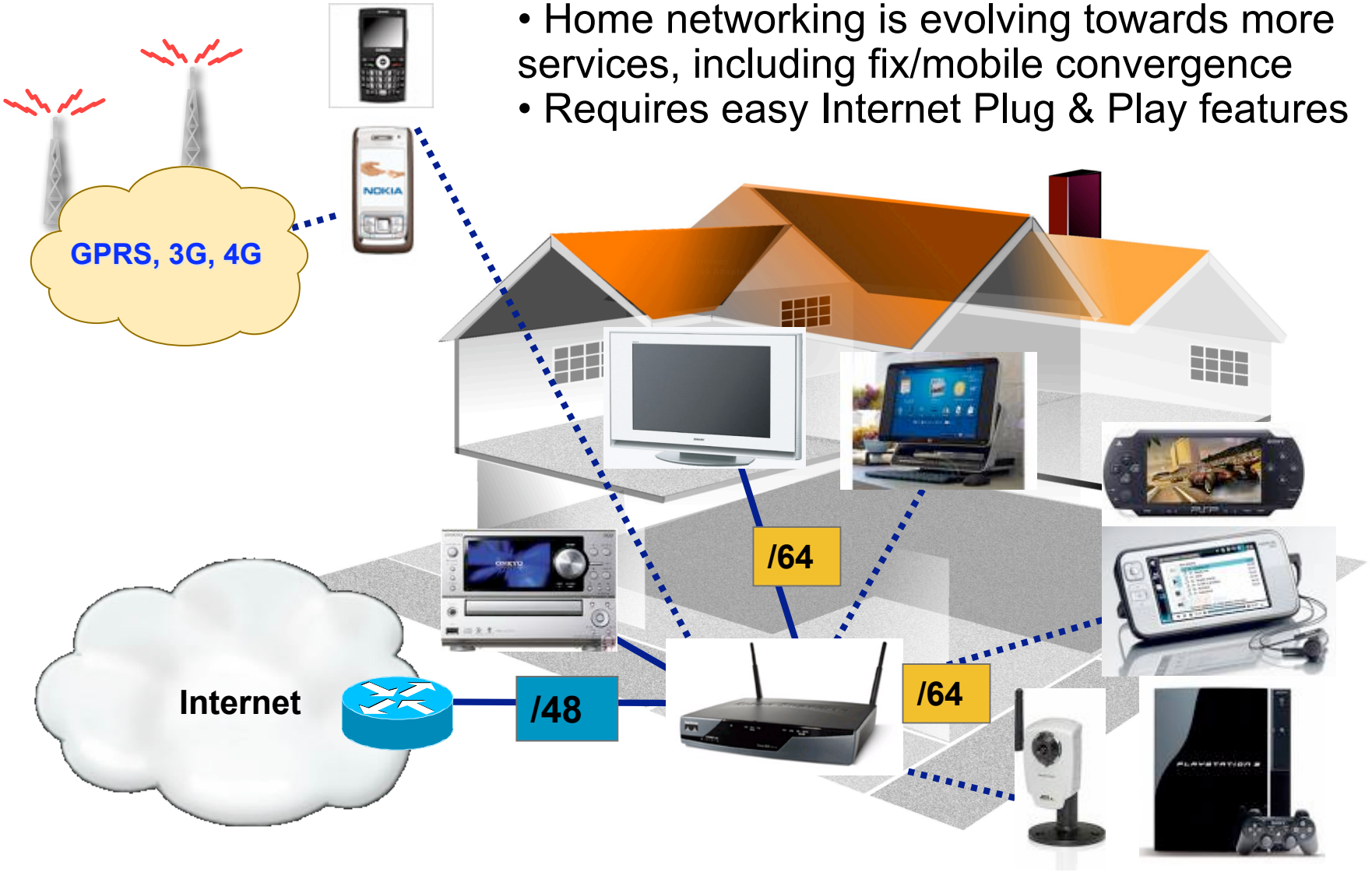
Infrastructures for New Services

New Market Places



Home Networking & IPv6 – a Must

- Home networking is evolving towards more services, including fix/mobile convergence
- Requires easy Internet Plug & Play features



Traffic Evolution

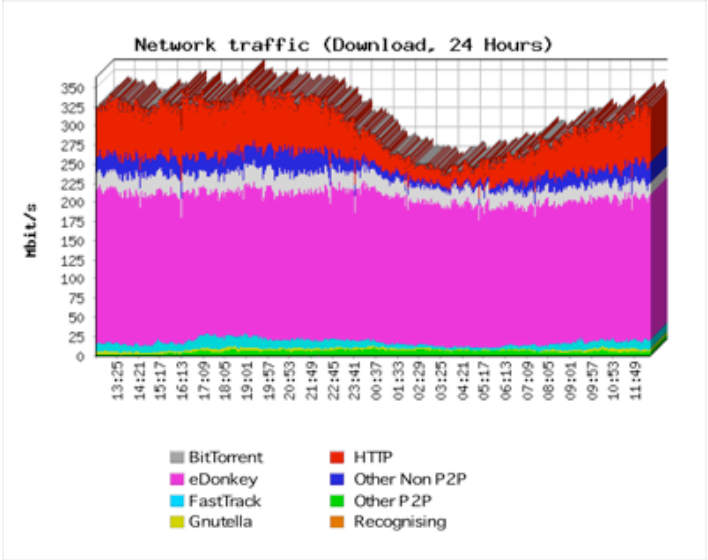
- Applications – Server/Client, P2P, GRID – generate different traffic patterns than Client/Server

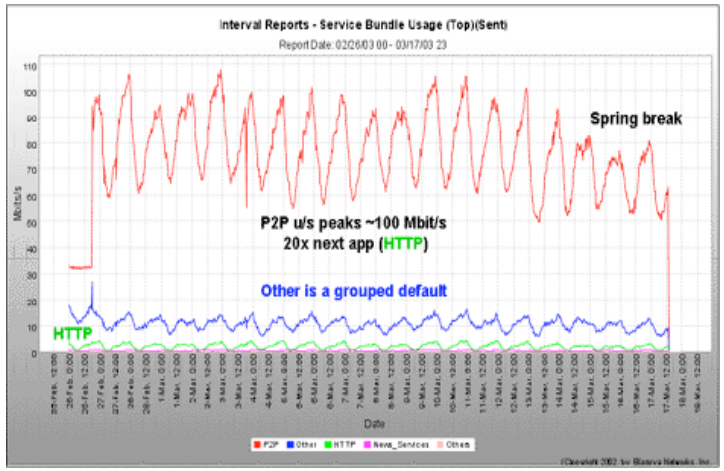
  Symmetrical – as much upstream as downstream traffic (users become servers)

  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

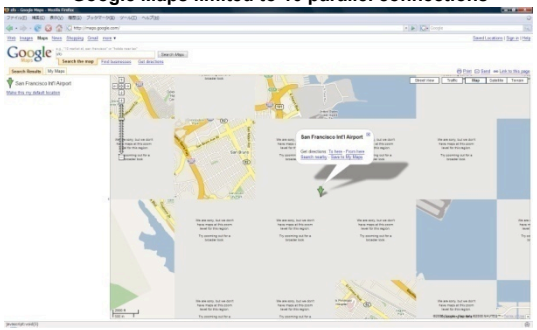
  Non-local – Traffic travels globally, and between ISP networks, hence putting load on the peering points (est. 60% of traffic) and expensive long haul links.





AJAX Applications

Google Maps limited to 10 parallel connections



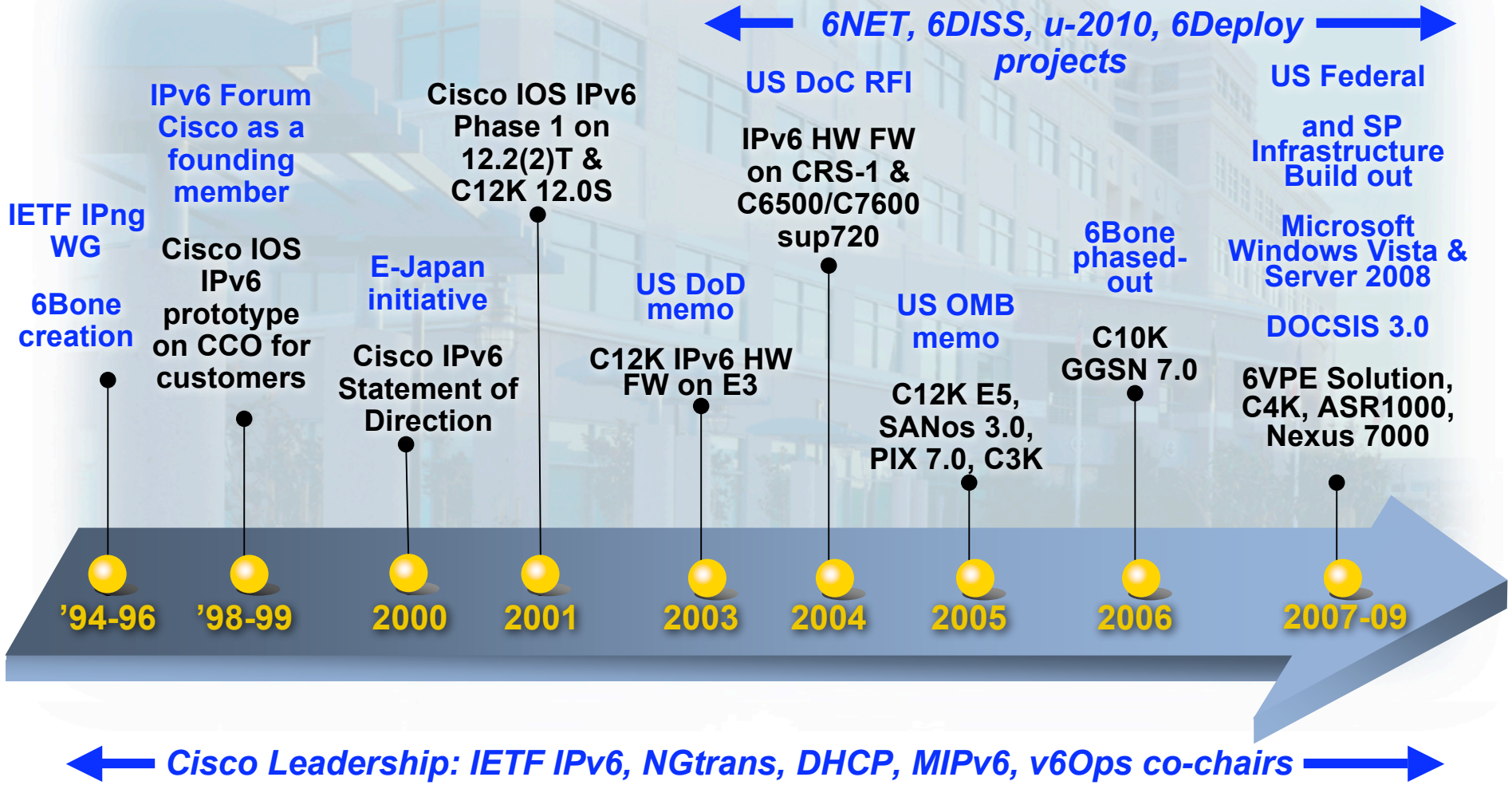
Source: Shin Miyakawa , Ph.D. NTT Communications Corporation

- Google Maps opens ~ 70 parallel connections
- iTunes store has been shown to open as many as 300 parallel connections
- New apps that have not emerged yet ???

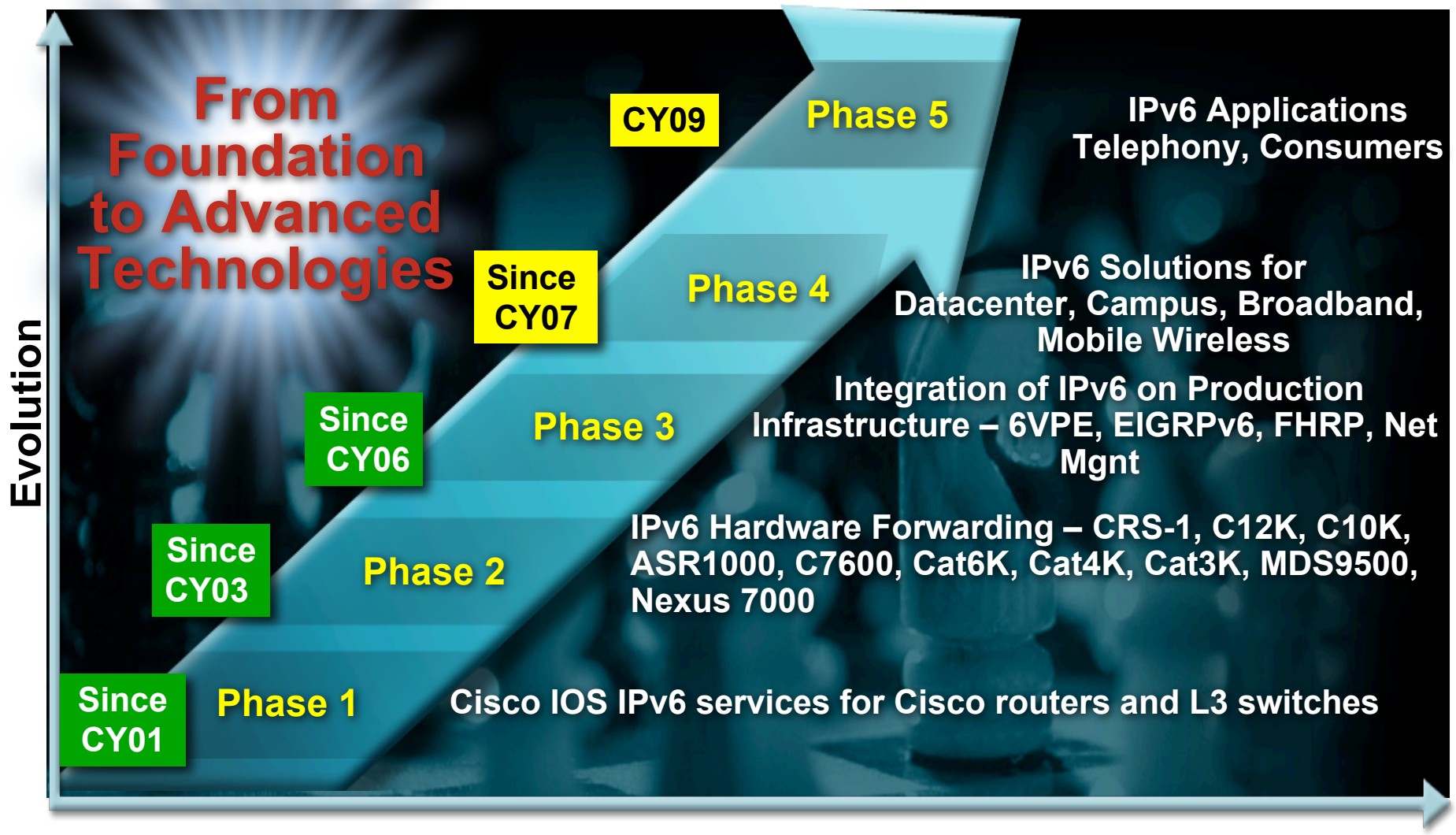
- IPv4/nat multiplexes multiple users through the port range, so 64k divided by 300 parallel connections results in ~200 customers per ISP based nat address (assuming each customer is only allowed to run one simultaneous instance of iTunes or similar apps). Restricting the number of connections impacts utiliy of the app. Consensus wisdom is to plan on at most 8 customers per public IPv4 address.
- Services generally don't allow connections from the same host to span multiple public side addresses, so when a port pool is exhausted, the subsequent connections on another address will cause the application to fail.
- Reuse of port pairs can't be guaranteed with a high rate of churn in the port pool, so the likelihood of matching src/dst port pairs to popular sites will expose the probability of TCP sequence number overlap between unrelated connections, and/or a port sitting in TCP Time-Wait at the server.

www.cisco.com/go/ipv6

Scaling the Internet for our Future Generations



Cisco IPv6 – 5 Phases Plan



Cisco IOS IPv6 Status

Positioning	Cisco IOS Release	Notes
General Production	12.3 – 12.4 – Next	CY09
Technology development	12.2T – 12.3T – 12.4T – Next	CY09
Core	12.0S – 12K, 10720 IOS-XR – CRS-1, 12K	Feb 2002 May 2004
Edge & Enterprise Infrastructure	12.2SB – 7304, 10000 12.2SR – 7600, 7200, ASR1000	**12.2SRC for 7200 support** **IOS-XE on ASR1000 gets subset of 12.2SR feature set**
L3 switches	12.2SX – 6500 12.2SG – 4500 12.2SE – 3750/3560	Initially 12.2SX also supported 7600

IPv6 Start Here documents the IPv6 feature set per Cisco IOS releases

http://www.cisco.com/en/US/products/sw/iosswrel/ps5187/products_configuration_guide_chapter09186a00801d65ed.html

Industry's Broadest Platform Support

Cisco IOS 12.0S

Cisco 12000 Series Routers

Cisco 10720 Series

Cisco IOS 12.4/12.4T

Cisco 800 Series Routers

Cisco 1700 Series Routers

Cisco 1800 Series Routers

Cisco 2600 Series Routers

Cisco 2800 Series Routers

Cisco 3600 Series Routers

Cisco 3700 Series Routers

Cisco 3800 Series Routers

Cisco 7200 Series Routers

Cisco 7301 Series Routers

Cisco NX-OS

Nexus 7000, 5000

Cisco IOS-XR

CRS-1, Cisco 12000, ASR9000

Cisco IOS 12.2S family

Cisco ASR1000 series

Cisco 72/7300 Series Routers

Cisco 75/7600 Series Routers

Cisco 10000 Series Routers

Catalyst 3750/3560/2960 Series

Catalyst 4500 Series

Catalyst 6500 Series

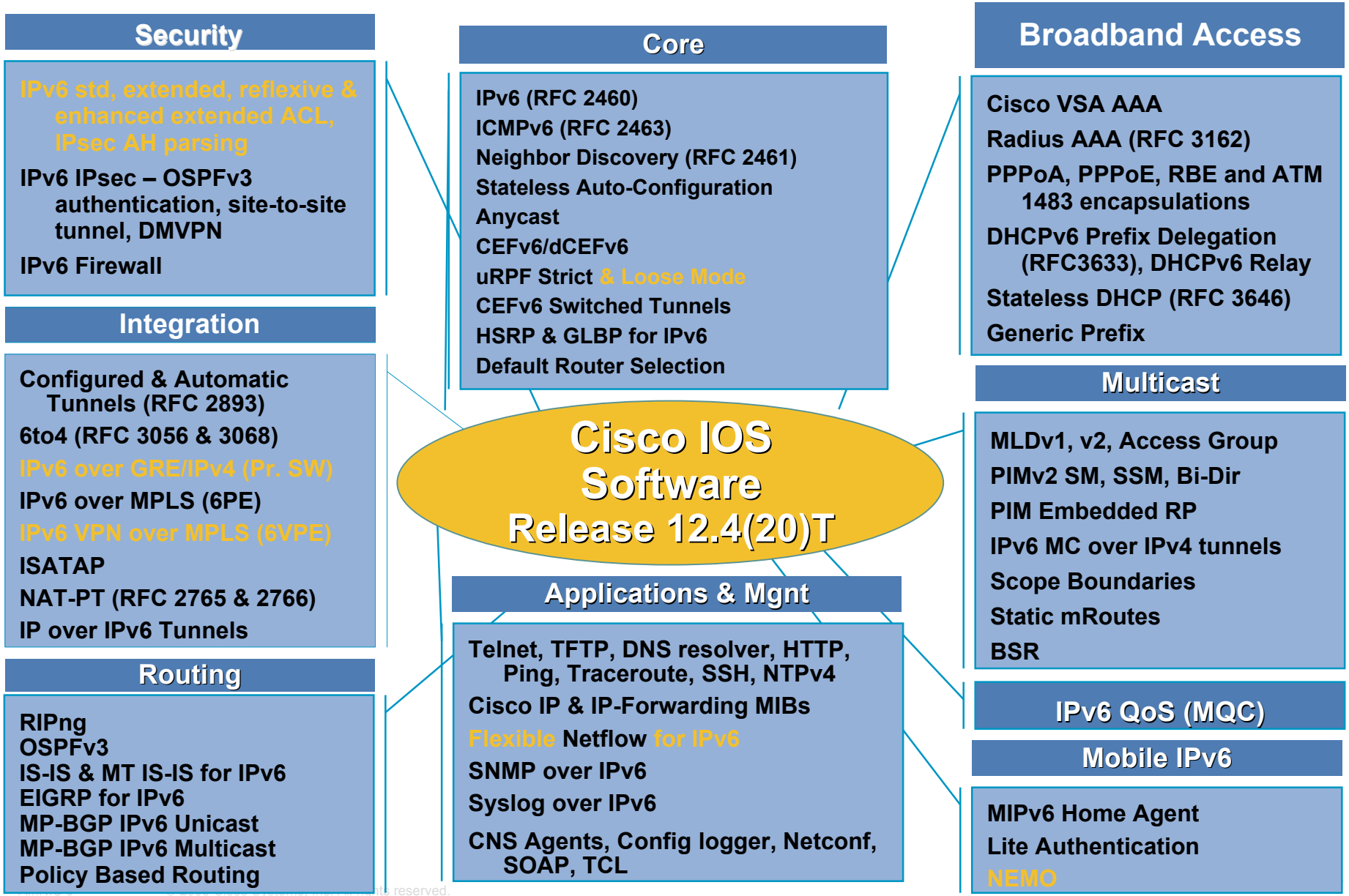
Cisco Product Portfolio

ASA Firewall (8.x), FWSM 4.0,

LMS 2.5, CNR 7.0, NFC 5.x, NAM 3.x,

MDS9500 series, Nexus 7000, GGSN 8.0

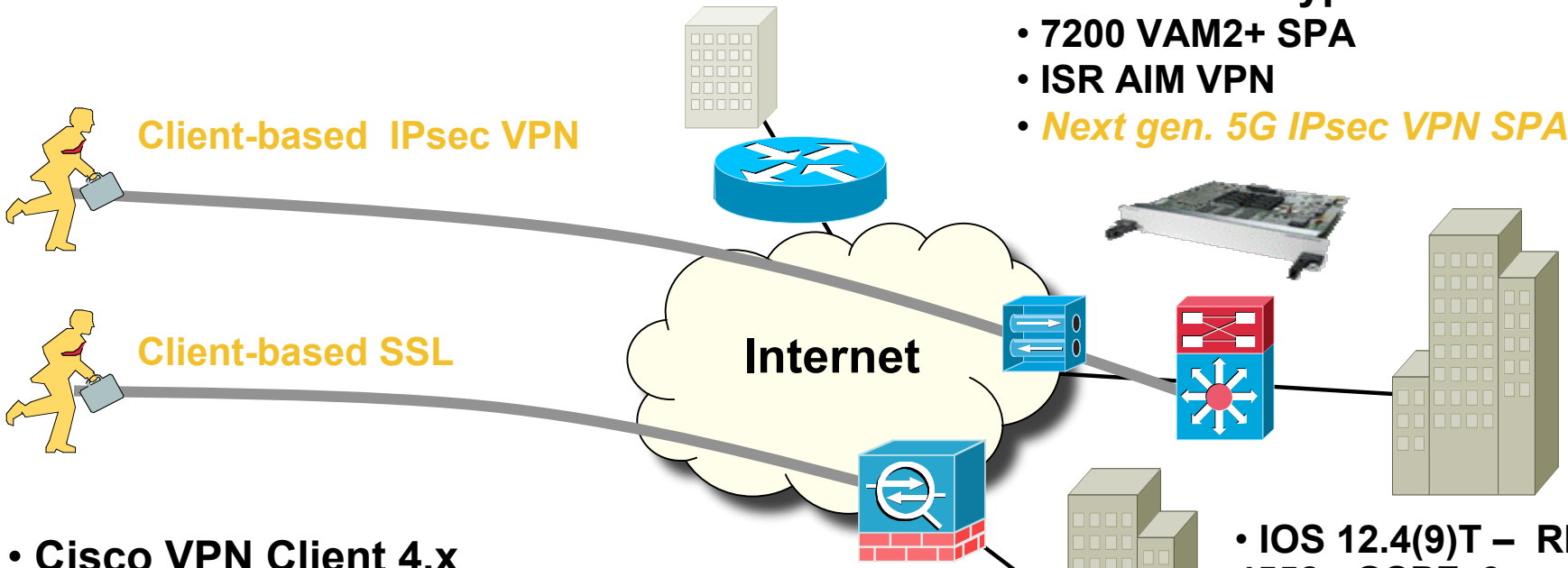
Cisco IOS – IPv6 Feature Overview



Cisco IPv6 compliance

- Conformance tests + Interoperability tests
  - IPv6 Ready Logo – www.ipv6ready.org
  - US DoD JITC conformance - http://jitc.fhu.disa.mil/apl/ipv6.html
  - Cable Labs DOCSIS 3.0 conformance
  - Microsoft Vista/Server 2008 interoperability – *Vista logo*
- Cisco IOS Release certification
  - Cisco IOS 12.4(11)T, C7600, C6500, C4500, IOS Firewall achieved JITC certification
  - Cisco IOS 12.3, 12.3T, 12.2SX, 12.0S and XR (3.2) are compliant with the IPv6 Ready Logo Phase I
  - Cisco IOS 12.4(9)T is compliant with IPv6 Ready Logo Phase II core specs
  - DOCSIS 3.0 Bronze qualified
  - Effort ongoing to have Catalyst product applying for Logo Phase II

Cisco IPv6 Security



IPv6 IPSec Tunnels
- IOS 12.4(4)T

IPv6 HW Encryption
- 7200 VAM2+ SPA
- ISR AIM VPN
- *Next gen. 5G IPsec VPN SPA*

- **Cisco VPN Client 4.x**
  - IPv4 IPSec Termination (PIX/ASA/IOS VPN/ Concentrator)
  - IPv6 Tunnel Termination (IOS ISATAP or Configured Tunnels)
- **AnyConnect Client 2.x**
  - SSL/TLS or DTLS (datagram TLS = TLS over UDP
  - Tunnel transports both IPv4 and IPv6 and the packets exit the tunnel at the hub ASA as native IPv4 and IPv6.

- IOS 12.4(9)T – RFC 4552 - OSPFv3 Authentication
- All IOS – packet filtering e-ACL
- *IPv6 over DMVPN – 12.4(20)T*

IPv6 Firewall
- IOS Firewall 12.3T, 12.4, 12.4T
- FWSM 3.x
- PIX 7.x, including ASA 5500 series

Future IDS

Network Management & IPv6

- In a dual-stack network, both IPv4 and IPv6 environments must be managed with the best optimization to decrease the cost of operations
- IPv6 impacts 3 areas of Network Management

  Instrumentation (MIBs, Netflow record, IPv6 SLA,…)

  Updated IP MIBs, RFC 4001 compliancy,…

  – Applications running over IPv6 (SNMP, TFTP, Syslog, Telnet, SSH, NTP, CNS Agents, Config logger, HTTP, Netconf, SOAP, TCL …over IPv6)

  – NMS & Tools for IPv6

  DNS/DHCP server (CNR 6.2), Netflow Collector 5.x, Ciscoworks LMS 2.5 (Topology, User Tracking,…), NAM

Cisco IPv6 Solutions
IPv6 enabled CPE routers

- The Linksys WRT600N; RVS4000; & WRVS4400 include 6to4 capability to enable IPv6 home and small business networks today, while service providers complete their deployments.

- Cisco has been instrumental in helping CableLabs define IPv6 capabilities for the next generation Docsis 3 devices.

Hot News!

- IPv6 feature parity with IPv4 for Catalyst 6500

  http://www.cisco.com/en/US/prod/collateral/iosswrel/ps8802/ps6970/ps6017/ps9673/product_bulletin_c25-503086.html

- **12.2(33)SXI IPv6 repackaging**

  IPbase image – base IPv4 and IPv6 features

  IPservices image – fully featured IPv4 and IPv6 (as previous AdvancedIPServices images)

Summary

Markets Perspective

IPv6 enables innovation and will guarantee the Internet growth but its adoption is a multi-year, complex integration process

Software Developer Perspective

Applications must be "*IP agnostic*"

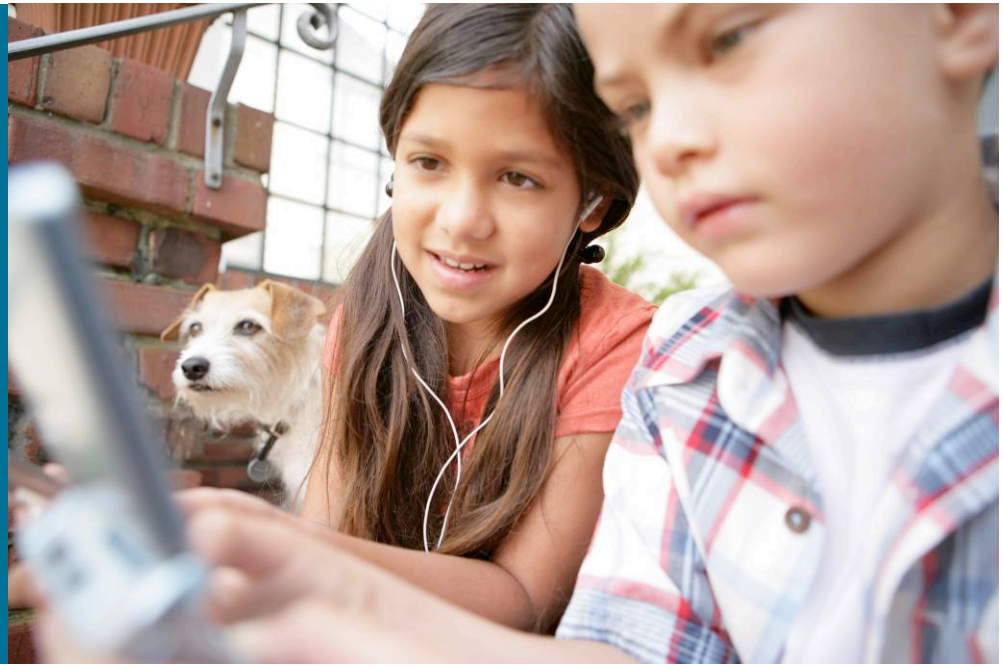
Network Manager Perspective Infrastructure must be deliver IPv6 up to the edge/access layer

The End-User Perspective

IP version needs to be transparent

Ensure an orderly and secured transition using Cisco IPv6 Solutions

Q and A



More Information

- CCO IPv6

  http://www.cisco.com/go/ipv6

- Cisco IPv6 Solutions

  http://www.cisco.com/en/US/technologies/collateral/tk648/tk872/tk373/technologies_white_paper_09186a00802219bc.html

- Deployment guides

  http://www.cisco.com/en/US/products/ps6553/products_data_sheets_list.html

- IPv6 Application Notes

  http://www.cisco.com/warp/public/732/Tech/ipv6/ipv6_techdoc.shtml

- Cisco IOS IPv6 manuals

  http://www.cisco.com/en/US/docs/ios/12_2t/ipv6/ipv6_c.html