HP and IPv6

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OUTLINE

- Today issues with IP? Why IPv6?
- IPv6 Features
- IPv6 Industry Status and Deployment
- HP IPv6 Support
- HP Strategy for IPv6

Today issues with IP? Why IPv6?

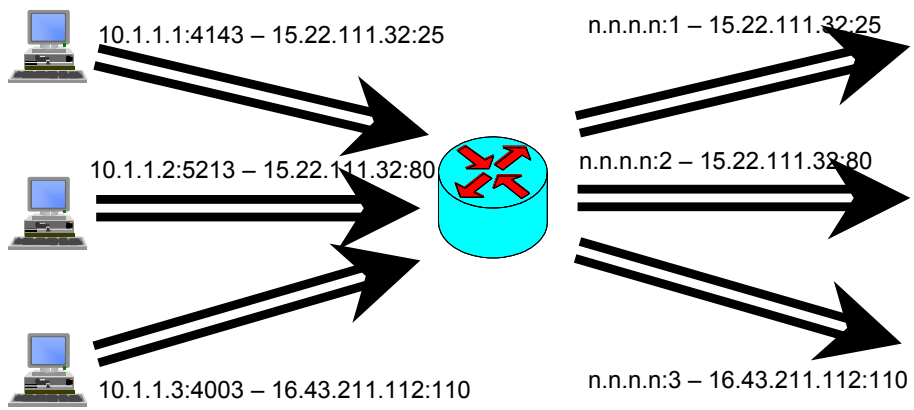
IPv4
Victim of its Own Success

- IPv4 addresses consumed at an alarming rate
  - Interim measures in place have helped
    - Eased the routing table growth (CIDR)
    - Reduced the pressure on address space (NAT)
  - But at the cost of lost transparency (End-to-End) model
- IPv4 System administration is Labor intensive, complex, slow, and error prone
- Security is optional; no single standard
- QoS is optional

NAT: The broken IPv4 Solution to Scalability

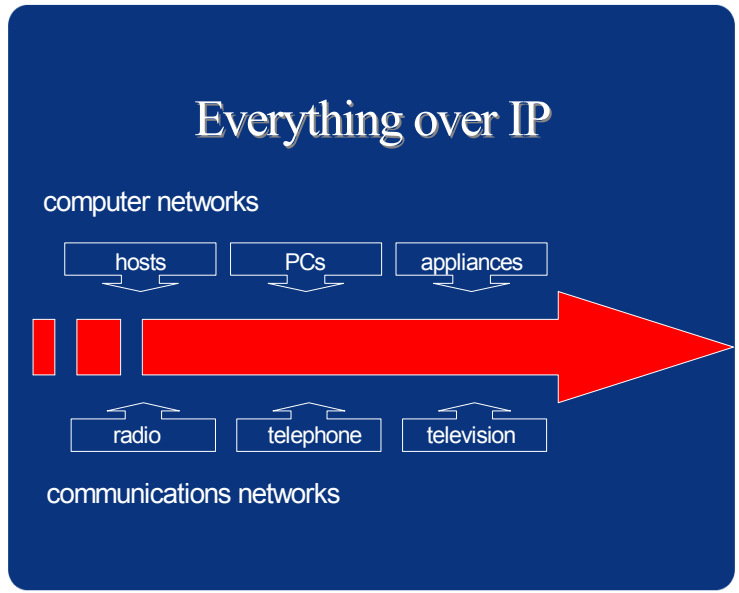
- Translates IP addresses to ports
  - But unidirectional session initiation from within
- Overhead of unnecessary translation
- Protocol incompatibilities
- Limits implementation of application servers

- Breaks peer-to-peer applications
  - Interactive games
  - VoIP
  - Real-time collaboration and sharing



But … IPv4 unable to drive the future Internet

- Accelerating growth of existing Internet usage
  - 1B Internet users by 2005
- Accelerating growth of New Internet usages
  - Always-on devices
  - Internet appliances devices
  - 1B mobile users by 2005
- Sub-optimal conditions for continued evolution of the Internet



How to Catch the Next Internet Wave?

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Challenges

- the number of Internet users dramatically increasing
- mobile handsets will turn into main Internet devices
- network routing today is inefficient
- system management manually is costly
- new applications are more demanding

IPv4 has difficulty facing the challenge!

IPv6

IPv6 with extensibility and scalability is the answer!

IPv6
Driving the Internet

- "Everything to the Internet"
  - Pervasive Internet
- IPv6 solves many of the problems caused by the IPv4 success and more...
- Where we want to be: IPv6 deployment
  - For the continued growth and success of the Internet
  - A natural evolution from IPv4
    - Designed with extensibility and scalability in mind

IPv6 facilitates
The global move toward
anywhere, anytime, anyway Internet access

IPv6
Why do we Care?

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Mass market global adoption of mobile communications

Customer demand for Quality of Service and increased security

Convergence

IPv4 is out of addressing space

Accelerating growth New Internet usages

1 billion mobile users by 2005, Always-on devices, Internet appliances devices, Home networks

Accelerating growth of existing Internet usage and New Internet usages

1 billion Internet users by 2005

IPv6 Advantages

IPv6 Immediate Benefits

- Increased Address Space - 2^128 is a really big number
  - Enough unique addresses for all devices
- Reduce common-case processing cost of packet handling
- Efficient and Extensible IP datagram
  - Fixed Size IPv6 Header, Fewer fields in basic header
- Efficient option processing
  - Processing of most options limited performed
  - only at destination
- Performance Wins Processing
  - Remove checksum from Network Layer
  - No fragmentation in the network
- Efficient Route Computation and Aggregation

IPv6 Impact on the Communications Industry

- Complexity is reduced
- Optimal conditions for continued evolution of the Internet
  - To provide seamless Internet connectivity anytime, anywhere, always-on
  - To provide as many pervasive services as possible to as many users as possible
- New End-to-End Applications can now evolve again

Internet End-to-End

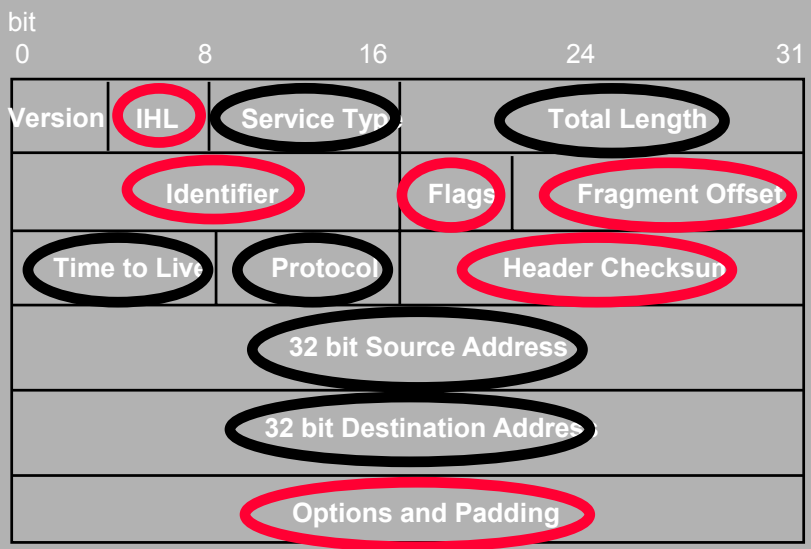
+ Pervasive Services

+ New Applications

+ Reduced Cost

= Profit

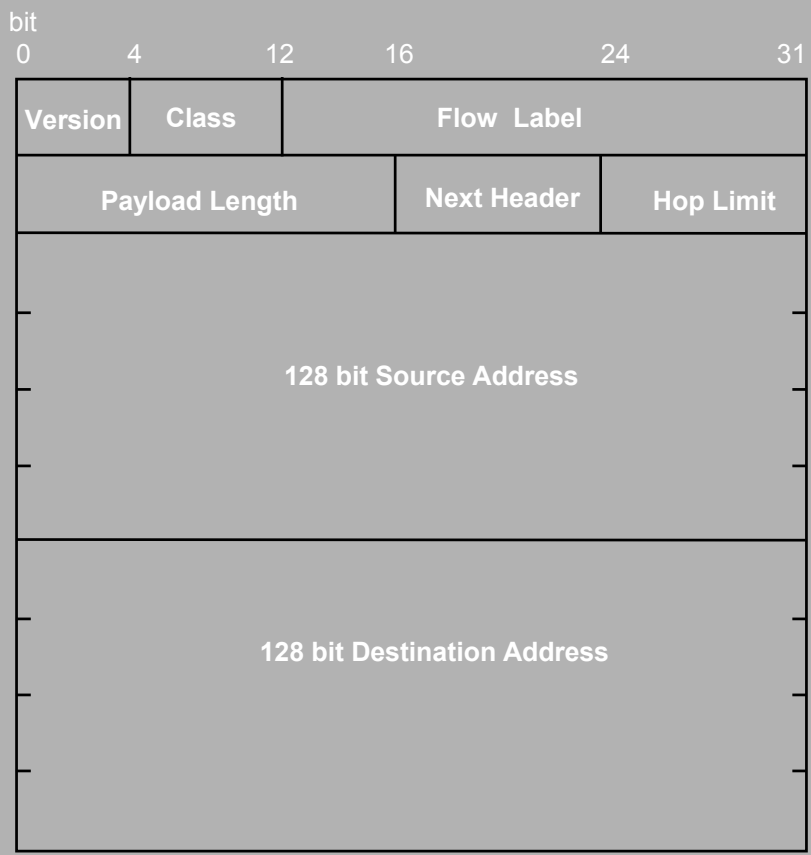
IPv6 Base Technology
IPv6 Header



IPv4 Header
20 octets, 12 fields, including 3 flag bits
+ fixed max number of options

Changed

Removed



IPv6 Header
40 octets, 8 fields
+ Unlimited Chained Extension (options) Header

IPv6 Design Philosophy Learning from Experience

- Recognizable yet simplified header format
- Reduce common-case processing cost of packet handling
- Keep bandwidth overhead low in spite of increased size of the address
- Flexible and extensible support for option headers
  - IP options have been moved to a set of optional Extension Headers
  - Extension Headers are chained together

IPv6 Header Performance Wins Layout

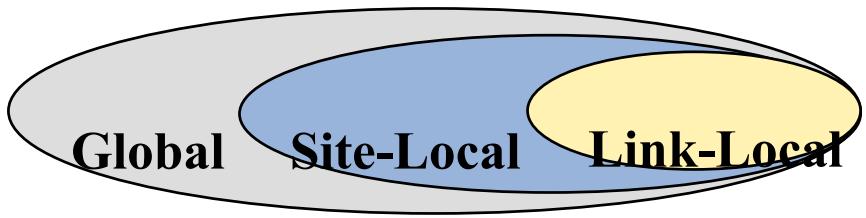
- Fixed Size IPv6 Header
- Fewer fields in basic header
  - faster processing of basic packets
- 64 Bit Alignment Header/Options
- Efficient option processing
  - Option fields processed only when present
    - Options not limited at 40 bytes
  - Processing of most options limited performed only at destination

IPv6 Header Performance Wins Processing

- Remove checksum from Network Layer
  - Datalinks are more reliable these days
  - Upper Layer checksums are now mandatory (for example, TCP, UDP, ICMPv6)
- No fragmentation in the network
  - Reduce load on routers
  - Easier to implement in hardware
  - Easy for Layer 3 switching of IP

IPv6 Addressing Model RFC 2373

- Many kinds of Address
  - No change from IPv4 model
  - Addresses assigned to interfaces
  - Interfaces have multiple addresses
- IPv6 addresses have scope and lifetime



IPv6 Unicast Address

- Address = prefix of n bits + interface ID of 128-n bits
  - Separate “who you are” from “where you are connected to”

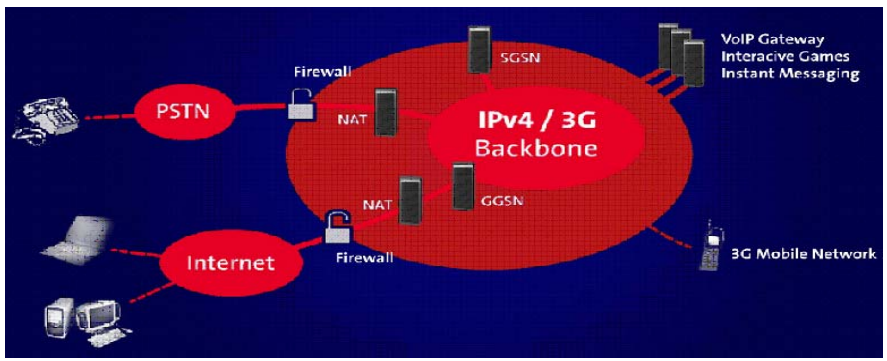
Prefix Representation <prefix>::/<n-bits>

- Aggregatable Global Unicast Address format

3FFE:0301:DEC1:: 0A00:2BFF:FE36:701E

IPv6 Advantage
Restoration of End-to-End Model

- With NAT (IPv4):
  - Need to learn IP address "outside the NAT"
  - Need to provide that address to peer
  - 3rd party registration servers could be needed to find peers
  - Because NAT changes the IP address, IPSec will not work



- With IPv6
  - Just use the IPv6 address
- IPSec in IPv6:
  - It's mandatory
  - Provides end-to-end security
  - Authentication
  - Encryption
- Peer-to-Peer Apps:
  - Instant messaging
  - Interactive games
  - VoIP

IPv6 Advantage
Automatic Connectivity

- Provides Network Stateless and Stateful plug-and-play
  - Link Local Address (No router or server required)
  - Stateless mechanism - Router advertisements provide prefix
  - Stateful mechanism - Server provides address (DHCP)
- Simplified Network Administration
  - Lower network maintenance
- Easy Renumbering
  - Designed to happen!
  - Improved Competition and an end of ISP “lock in”!

IPv6 Advantage
Improved Mobile IP support

- IPv6 Mobility is based on core features of IPv6
  - IPv6 is designed to support Mobility
  - Mobility is not an “Add-on” features
  - No single point of failure
  - More Scalable : Better Performance

IPv6 Advantage Mandates IP Security

- Security features are standardized and mandated
  - All implementations must offer them
- Extensions to the IP protocol suite
- Operates at the IP layer
  - Invisible to applications
- Protects all upper layer protocols

IPv6 Advantage
Inbuilt Quality of Service

- Support for DiffServ (Differentiated Service)
  - Class field enables a source to identify desired class of service / delivery priority of its packets
    - Correspond to Type-Of-Service in IPv4
- Support for IntServ (Integrated Service)
  - Enable a source to identify flows needing special QoS
    - Flow is a sequence of packets which need special handling
    - Not fully defined yet

IPv6 Advantage
Simple IPv4/IPv6 Interoperations

- Many solutions to deliver IPv6 services
  - One size does not fit all
- Many tools
  - Dual IP layer
  - Tunnels
    - Configured, automatic, 6to4, ISATAP, Teredo
  - DSTM
  - Protocol Translation

IPv6 Deployment - Keys to Deploying IPv6 Successfully

- Facts:
  - Millions of nodes are running IPv4 today
  - Some nodes will never upgrade to IPv6
    - Large investment in IPv4 applications
- Consequences:
  - IPv4 and IPv6 will coexist for an extended period
  - Transition should prevent isolation of IPv4 nodes
- No disruption - no Flag Day
  - IPv6 and IPv4 routers and hosts can interoperate
- No Dependencies - Incremental upgrade and deployment
  - IPv6 routers and hosts can be deployed in a highly diffused and incremental fashion
- Low start-up costs
  - Make transition as easy as possible for end-users, system administrators, and network operators

Practical Aspects of IPv6 Deployment

- Analyze your infrastructure
- Obtain addresses
  - Your IPv6 Internet Service Provider will delegate a block of address space
- Pick appropriate deployment scenario
  - Routing/subnet layout
  - DNS
  - Network Management
- And then plan for hosts …..
- Expect most systems will be software upgradeable
  - Beware of IPv4 implementations in hardware
  - Ask your vendors about their IPv6 plans before buying new hardware
- New and modified software
  - IP stack, DNS, DHCP, routing protocols
- Transparent for end users
- Network Administrator
  - Quite a lot to learn, but much has a familiar feel

IPv6 Industry Status and Deployment

Industry IPv6 Forum

- International Forum to promote and Drive IPv6 deployment www.ipv6forum.com
- Regional IPv6 Task Forces exist across the world.
  - North American IPv6 Task Force supports the U.S. and Canada www.nav6tf.org
  - URL below for information http://www.nav6tf.org/slides/repository.html
  - Mission is to promote, influence, and provide technical/business expertise and guidance for the deployment of IPv6

Vendors IPv6 Status

- Most Networking companies already ship IPv6 products
- All software vendors officially support IPv6 products in their latest O.S. releases
- 2003 and beyond: Call to Action for Applications
  - Applications must be agnostic regarding IPv4 or IPv6
  - Successful deployment is driven by Applications

- Microsoft - http://www.microsoft.com/ipv6/
- Sun - http://www.sun.com/solaris/ipv6
- IBM - http://www.ibm.com/software/ipv6
- Linux, BSDi, NetBSD, FreeBSD
- Many ISPs
- Mandated / deployed in some markets
  - Japan, Korea, China
  - 3G Mobile operators etc

- Cisco - http://www.cisco.com/ipv6
- Ericsson
- Nokia - http://www.nokia.com/ipv6
- Juniper
- 3Com
- Nortel Networks http://www.nortelnetworks.com/ipv6

Theoretical vs. Practical

- The Internet has 36% of the IPv4 address space left
  - But China or Mobile IP Cell Phones could use it up in one year
- IPv4 and IPv6 use the same IPsec Protocol
  - But IPv4-NAT prevents peer-to-peer security
- IPv4 has stateful autoconfiguration
  - But 101st Airborne Rangers require IPv6 stateless autoconfiguration at point of entry for an engaged operation

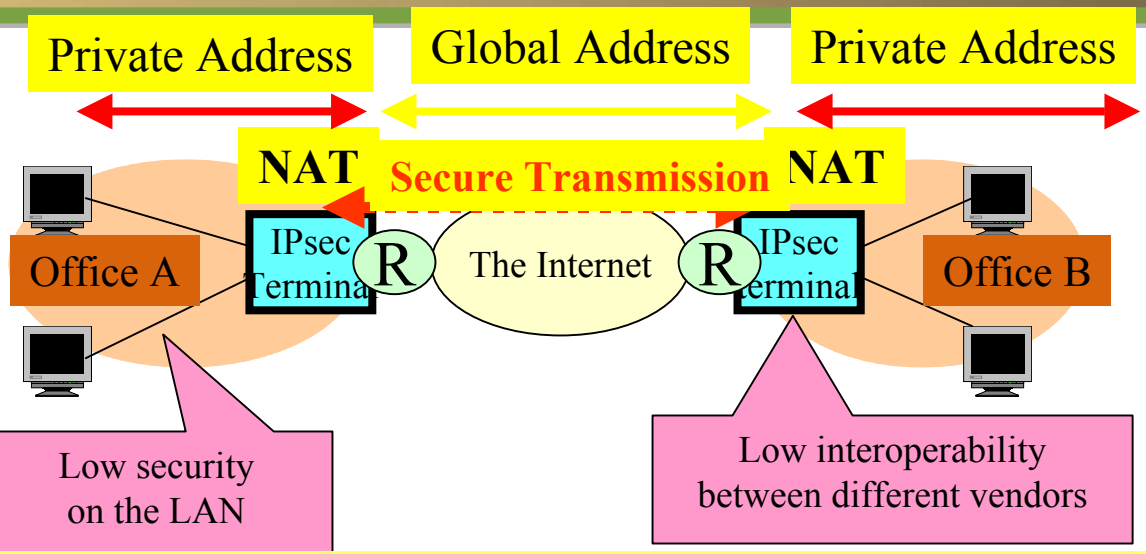
IPv6 vs. IPv4 analysis must be viewed from both a theoretical and a practical deployment perspective

IPv6 Deployment Advantages

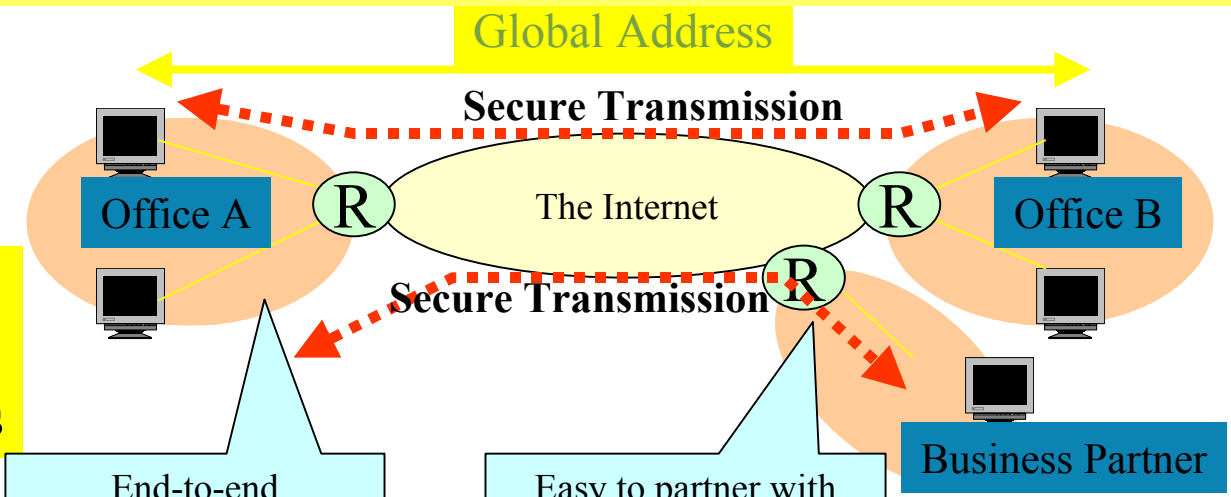
- Larger Address Space
- Stateless Autoconfiguration of Addresses
- Mobile IPv6 Security and Routing Optimizations
- IPsec is MANDATORY for compliance

These are just some of the IPv6 advantages over IPv4 IPv6 increases the opportunity for a more secure deployment of Cyber Space for Home Land Defense, Military, Consumers, and Businesses in the U.S., and creates new business opportunity for Internet Service Providers

Large-Scale End-to-End Security



Easy to setup IP-VPN between end-to-end terminals with IPv6



IPv6 Markets Examples

MANUFACTURING

FINANCE

ENTERPRISES

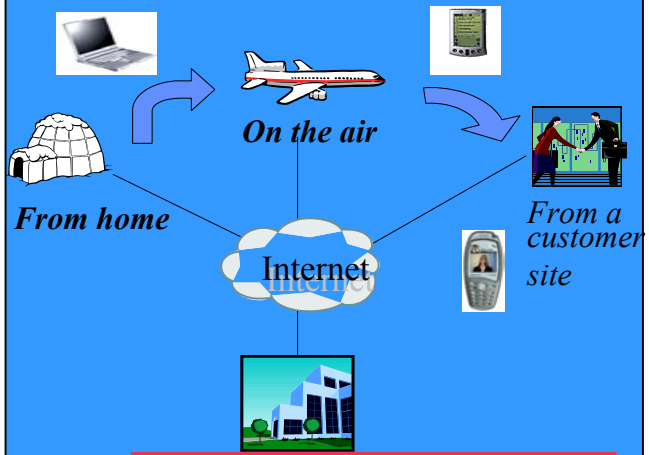
MANAGEABILITY/ADMINISTRATION=
Low Cost of Ownership

LOW COST OF OWNERSHIP = INCREASED PROFIT

HEALTH CARE

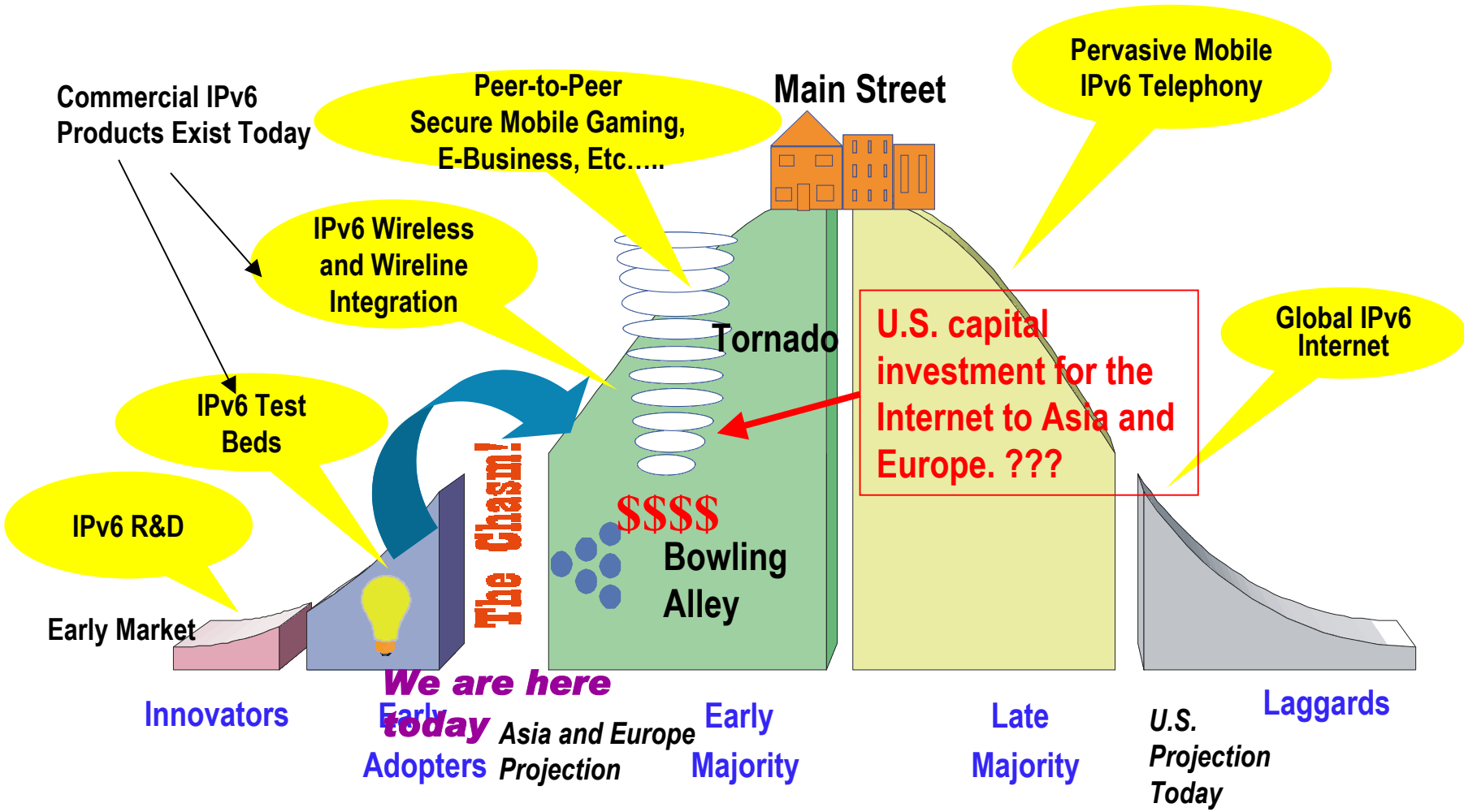
GOVERNMENT

MOBILITY



HP is committed to
Secure Mobile Infrastructure

IPv6 Secure Deployment Opportunity



USA Breaking News IPv6 to Enable Net-Centric Operations

- Implementation of the next-generation Internet protocol that will bring the Department of Defense closer to its goal of net-centric warfare and operations was announced today by John P. Stenbit, assistant secretary of defense for networks and information integration and DoD CIO.
- The new Internet protocol, known as IPv6, will facilitate integration of the essential elements of DoD's Global Information Grid -- its sensors, weapons, platforms, information and people. Secretary Stenbit is directing the DoD-wide transition.
- The current version of the Internet's operating system, IPv4, has been in use by DoD for almost 30 years. Its fundamental limitations, along with the world-wide explosion of Internet use, inhibit net-centric operations. IPv6 is designed to overcome those limitations by expanding available IP address space, improving end-to-end security, facilitating mobile communications, enhancing quality of service and easing system management burdens.
- "Enterprise-wide deployment of IPv6 will keep the warfighter secure and connected in a fast-moving battlespace," Secretary Stenbit said. "Achievement of net-centric operations and warfare depends on effectively implementing the transition."
- Secretary Stenbit signed a policy memorandum on June 9 that outlines a strategy to ensure an integrated, timely and effective transition. A key element of the transition minimizes future transition costs by requiring that, starting in October 2003, all network capabilities purchased by DoD be both IPv6-capable and interoperable with the department's extensive IPv4 installed base.

IPv6 Extended Standards Work

- IETF core IPv6 standards, Mobile IPv6, and IPsec are ready for deployment
- IETF Near Term Requirements:
  - Multihoming for IPv6
  - Authentication, Authorization, and Accounting (AAA)
  - Multicast Routing Protocols with Multicast Security
  - Additional IPv6 Transition Work
- 3GPP Near Term Requirements:
  - Add IPv6 as requirement to core in 3GPP+ Release Strategy
  - Add Mobile IPv6 to core in 3GPP+ Release Strategy
  - Add 802.11b integration to 3GPP+ Release Strategy
- IEEE POSIX 1003 should be doing new APIs for IPv6 and Security not the IETF, but work with the IETF and 3GPP as liaison

These standards are not required to begin initial deployment of IPv6,
But need to be done in a time-to-market and expedient manner

HP's IPv6

Commitment & Readiness

HP is committed to leading IPv6 deployment

1993 Prototypes help define the IP Next Generation protocol in the IETF

1995 Publics demos & experiments verify core IPv6 interoperability

1996 Participants in 6bone worldwide experimentation on the Internet

1999 HP is a founding member of the IPv6 Forum and chairs the IPv6 Forum Technical Directorate and on the Board of Directors

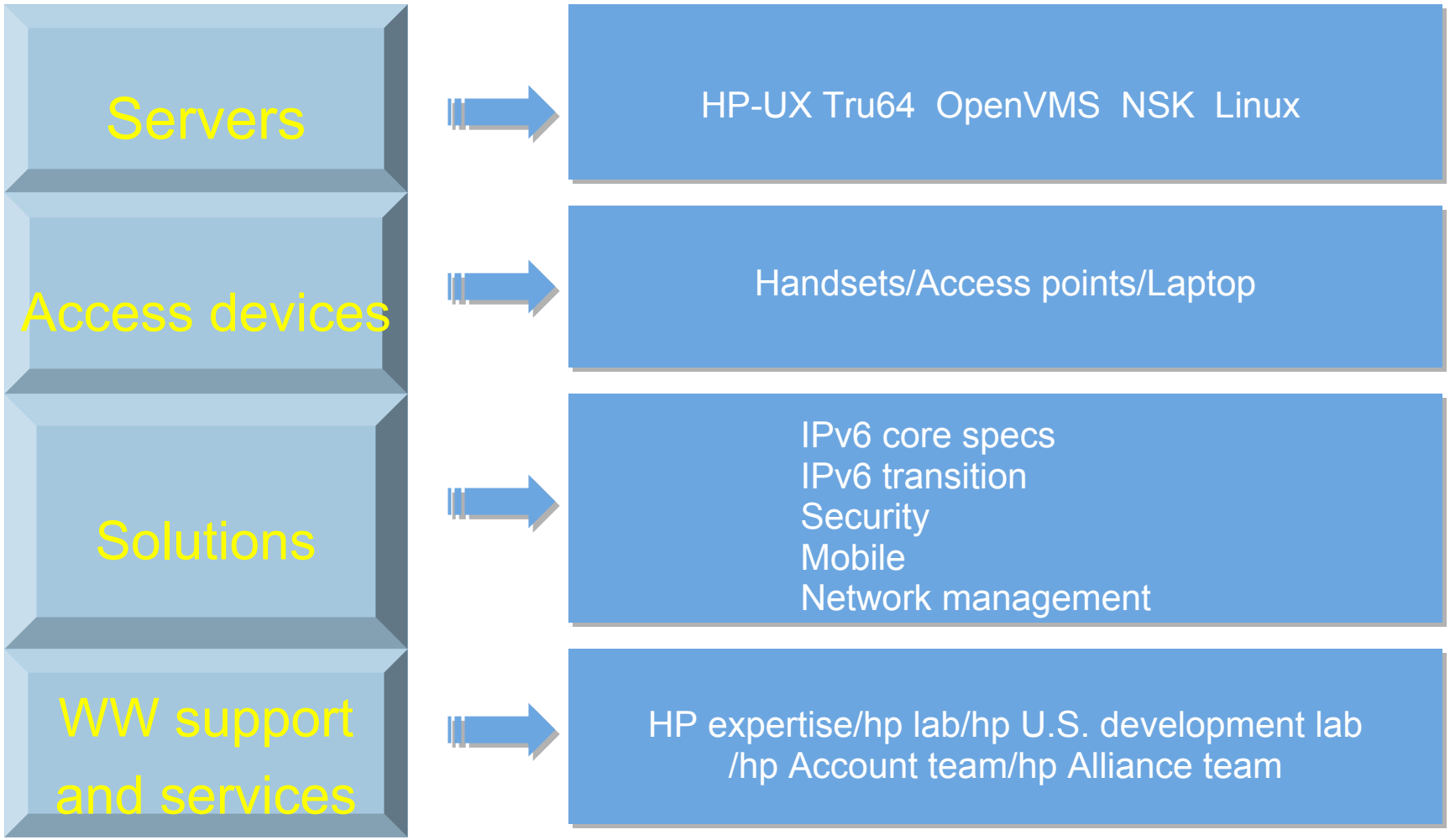
2000 Ships IPv6 products

2001 HP launches industry leading IPv6 solution demos

2002 HP helps to launch the North American IPv6 task force

HP launches a world wide IPv6 test bed

HP is ready for IPv6 Deployment



HP is ready for IPv6 Deployment

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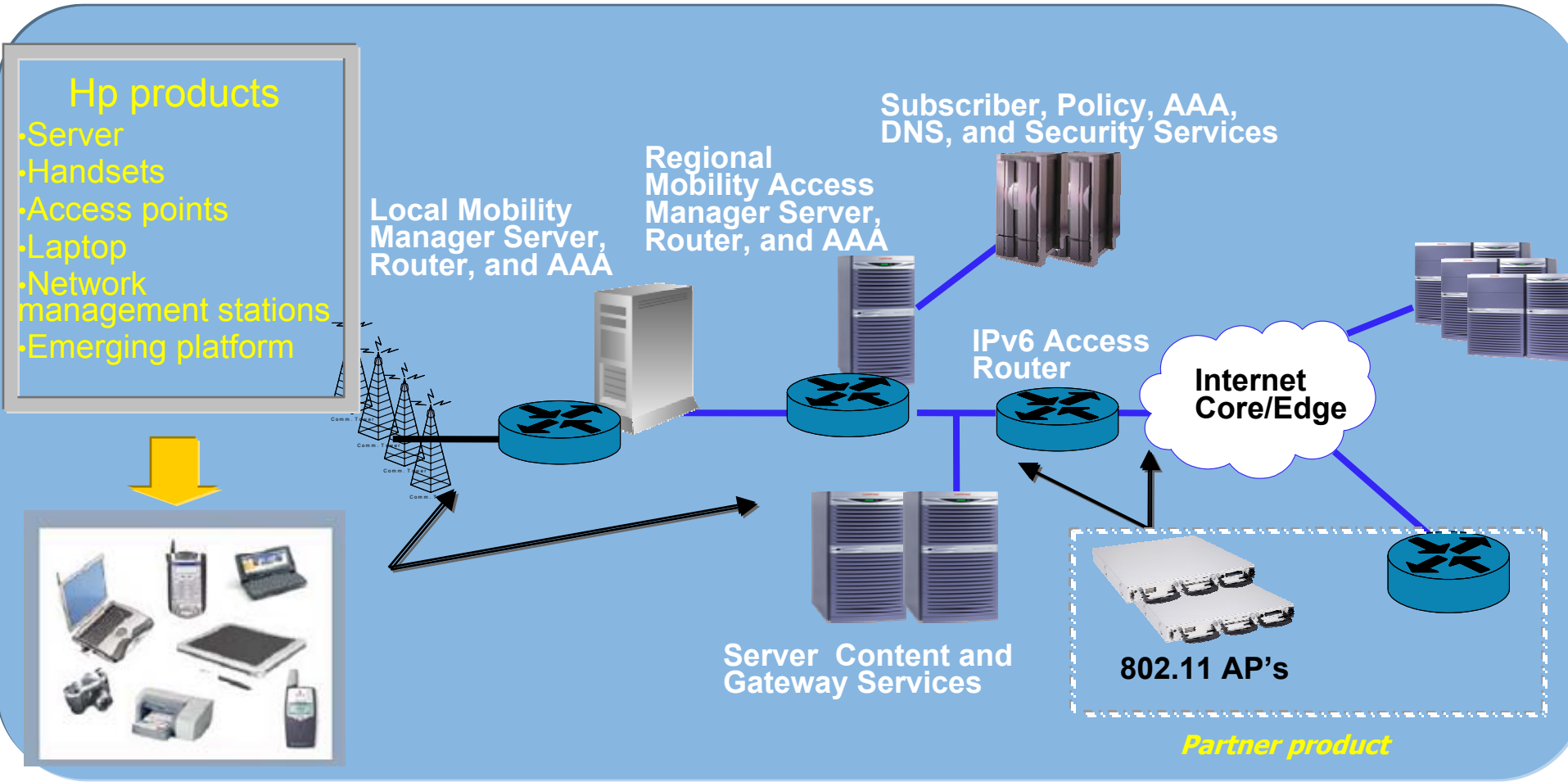
Example: End-2-End IPv6 Mobile Wireless Services



IPv6 Roadmap

2001

HP-UX 11i v.1

IPv6 Base Functions

- Dual Stack
- Basic and Advanced Socket APIs
- 32/64 bit support
- Ethernet Links
- BIND 9.2
- Sendmail
- DHCPv6
- FTP

2002

HP-UX 11i v.1

Security Enhancement

- IPSec (IPv6)
- Sam (IPv6)
- JVM
- Apache Web Server
- Secure Shell
- SNMP Agent
- Glance and MeasureWare

Updated: June 2003

Middle of 2003

HP-UX 11i v.1

System Management Enhancement

- FDDI
- OpenView NNM
- MC ServiceGuard
- EMS

Middle of 2003

HP-UX 11i v.2

For Itanium Base Systems

- IPv6 Base Functions on IPF
- X server
- xlib
- Online Diagnostics
- Kerberos Client
- CDE/Motif
- SharedX

New Features for End of 2003:

Mobile IPv6, 6to4, Generic Tunneling, MLDv1, RFC 2893

Tru64 UNIX IPv6 History & Roadmap

1997-1999

Early Adopter Kits

- IPv4/v6 Dual Stack
- IPv6 base protocol and addressing
- Stateless Address Autoconfiguration
- Neighbor Discovery
- 32/64bits support
- Ethernet / FDDI / PPP
- Basic IPv6 services

2000

V5.0

- Add to EAK offering
- Update to latest RFCs
- RIPng
- Basic socket APIs
- Applications: BIND8.*, SMTP, TELNET, FTP, RSH, RCP, REXEC, RLOGIN, Network Management, RSVP, Apache Web Server, Mozilla
- Simple Transition Mechanisms: Tunneling dual stack

2001

V5.1A

- Add to Rel 1 offering
- Update to latest RFCs
- Advanced socket APIs
- Mobile IPv6 correspondent node and Home Agent (EAK)
- IPSEC IPv6 support (EAK)

2002

V5.1B

- Add to Rel 2 offering
- Update to latest RFC
- IPSEC
- BIND9
- Generic tunneling IP-in-IP
- Transition Mechanism: 6to4 transition
- SCTP (separate product)
- Java IPv6 support

200x

Future Plan

- Add to Rel 3 offering
- Update to latest RFCs
- Mobile IPv6 Correspondent Node and Home Agent
- More IPv6 Routing

Note:
Common TCP/IP code across Tru64 UNIX / OpenVMS / NSK
(**) Subject to change without any notice

OpenVMS IPv6 History & Roadmap

1997- 2000

Early Adopter Kits

- IPv4/v6 Dual Stack
- IPv6 base protocol and addressing
- Stateless Address Autoconfiguration
- Neighbor Discovery
- 32 / 64 bits support
- Ethernet / FDDI
- Basic IPv6 services

2001

TCP/IP Services V5.1

- Add to EAK
- Update to latest RFCs
- RIPng
- Basic socket APIs
- Applications: BIND8.*, SMTP, TELNET, FTP, RSH, RCP, REXEC, RLOGIN, Network Management
- Simple Transition Mechanisms: Tunneling and dual stack

2002

TCP/IP Services V5.3

- Add to Rel 1
- Advanced socket APIs
- Mobile IPv6 Correspondent Node (EAK)
- Generic tunneling IP-in-IP
- Transition Mechanism: 6to4 transition
- Apache web server (Separate Product)
- Mozilla IPv6 support (Separate Product)

2003

TCP/IP Services V5.3

- Add to Rel 2
- Update to latest RFCs
- BIND9
- Mobile IPv6 Home Agent (EAK)
- SCTP (separate product)
- Java IPv6 support (separate Product)

200x

Future Plan (**)

- Add to Rel 3
- Itanium support
- Update to latest RFCs
- Mobile IPv6 Correspondent Node and Home Agent
- More IPv6 Routing
- SSH IPv6 support
- IPSEC IPv6 support
- Additional RFCs as per customer demand
- Leverage of public domain BSD and hp-ux

Note:
Platforms: Alpha / VAX / Itanium (CY04)
Common TCP/IP code across Tru64 UNIX / OpenVMS / NSK
(**) Subject to change without any notice

NonStop TCP/IPv6 History & Roadmap

Jun 2003

NonStop TCP/IPv6 Release 1

- IPv4/v6 Dual Stack
- IPv6 base protocol and addressing
- Stateless Address Autoconfiguration
- Neighbor Discovery
- 32 bits support
- Ethernet
- Basic IPv6 services
- Basic socket APIs
- Applications: BIND, SMTP, FTP, PING, TELNET, Network management
- Simple Transition Mechanisms: Tunneling and dual stack

Dec 2003

NonStop TCP/IPv6 Release 2.1

- Add to Rel 1
- SNMP, r*cmd
- Logical Network Partitioning

Jun 2004

NonStop TCP/IPv6 Release 2.2

- Add to Rel 2.1
- Advanced Socket API for IPv6
- IPv6Ready Logo

1H 2005

Future Plan (**) Release 3

- Add to Rel 2.2
- Update to latest RFCs (code rebase)
- 6to4 transition mechanism
- IPSEC IPv6 support
- IPsecReady Logo
- Additional RFCs as per customer demand

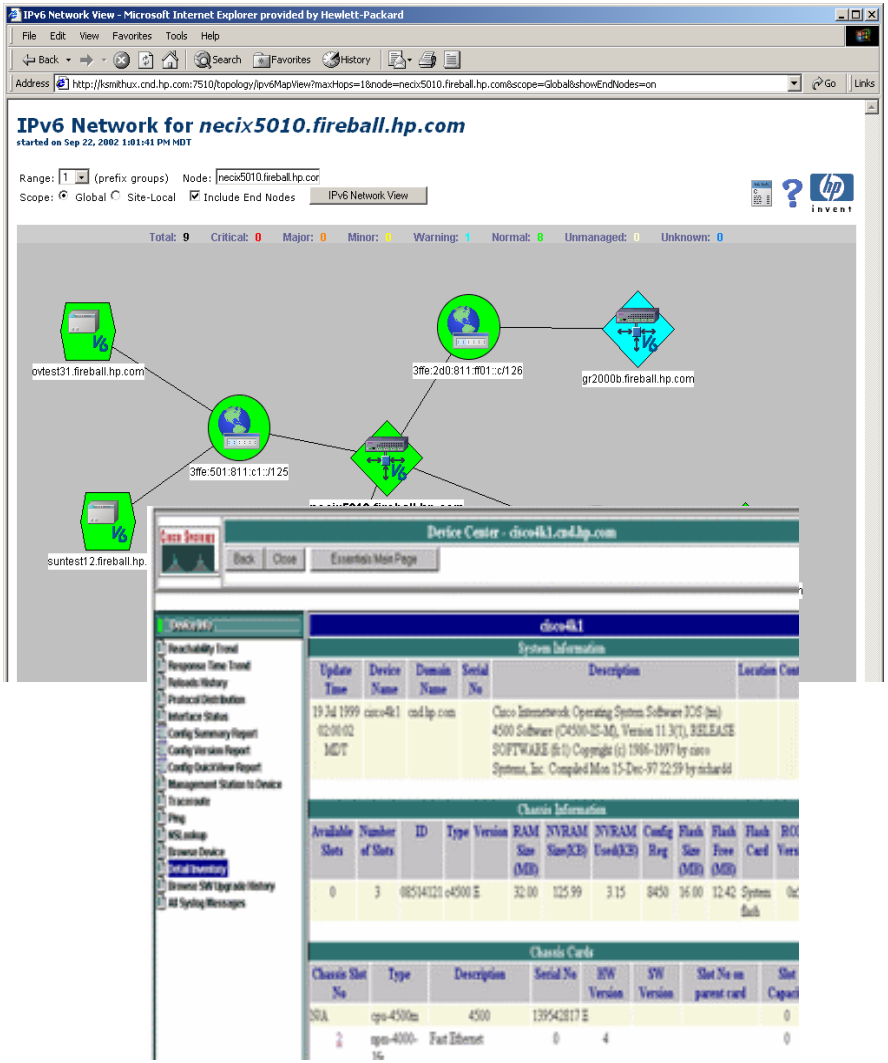
TBD

Future Plan (**) Release n

- Mobile IPv6
- Correspondent node and Home Agent (EAK)
- Security extensions for Mobile IPv6
- Additional RFCs as per customer demand

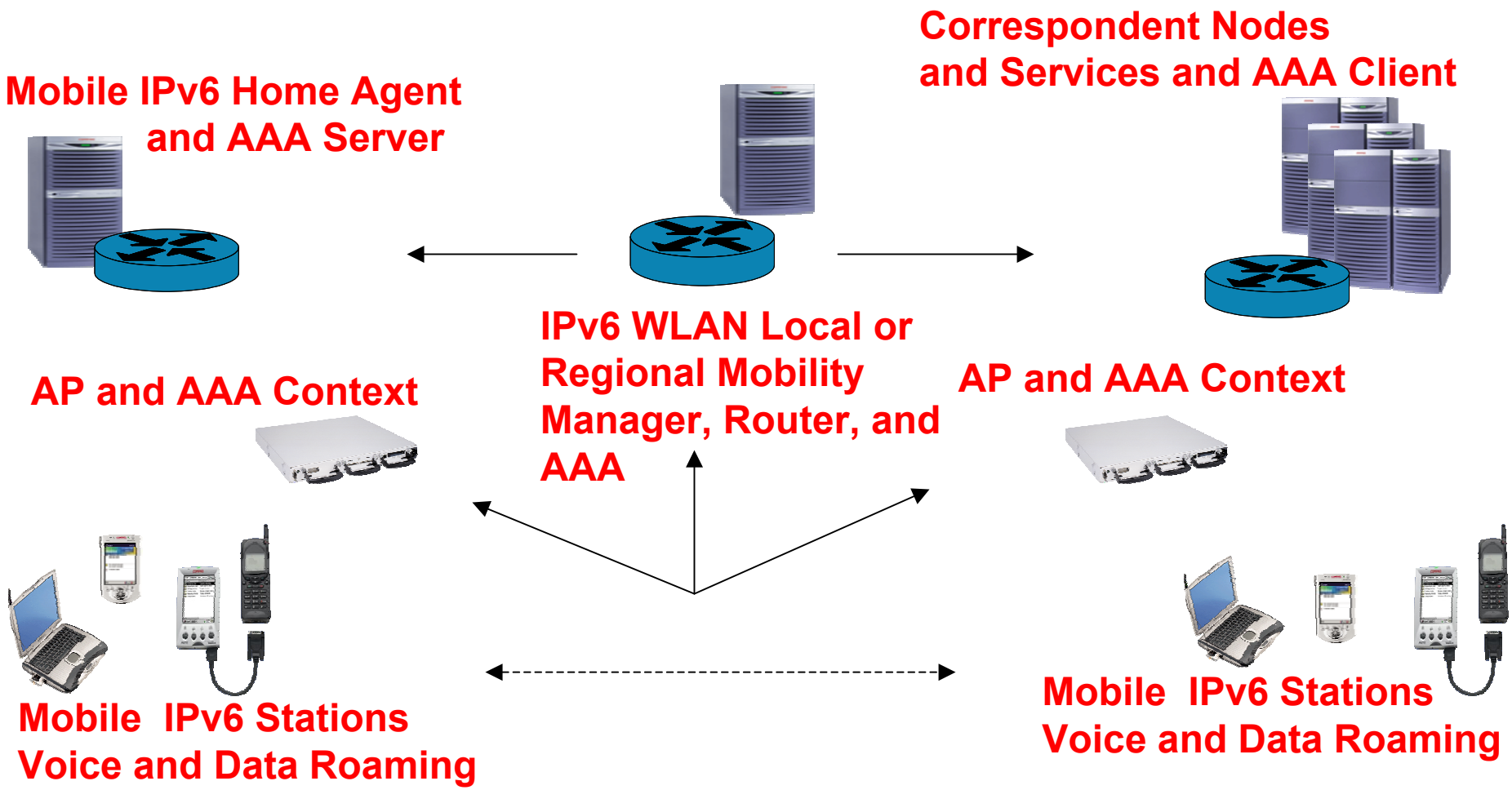
Note:
Common TCP/IP code across Tru64 UNIX / OpenVMS / NSK
(**) Subject to change without any notice

OpenView - Capabilities to manage IPv6 Networks

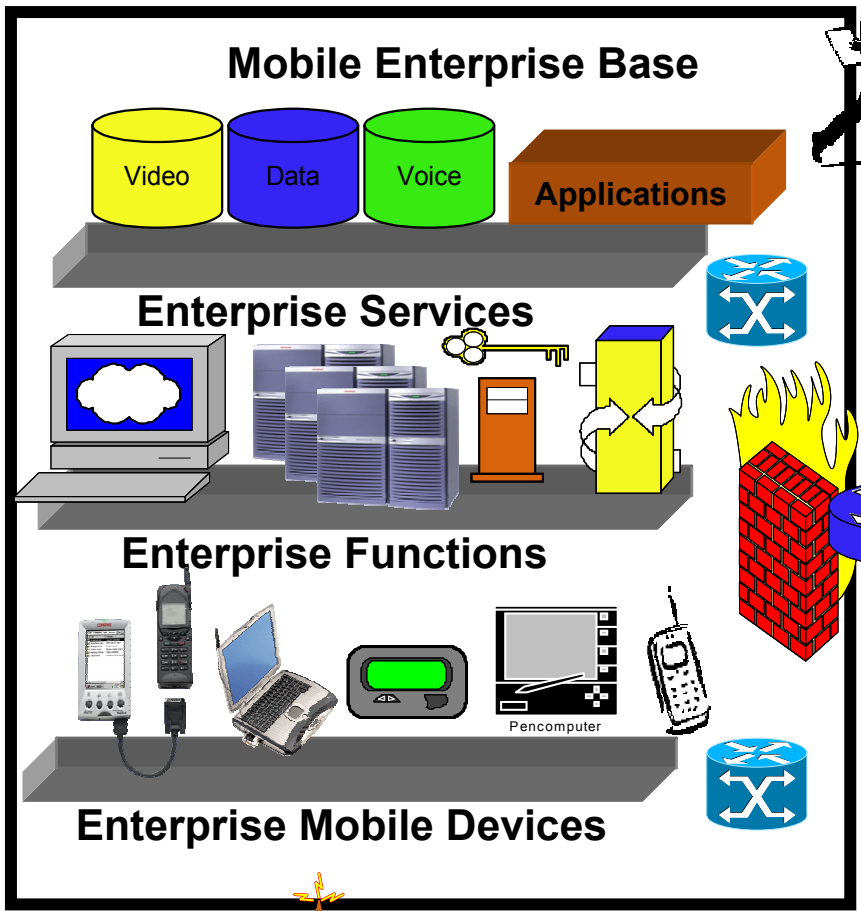


- Adopt recent standards and technology
  - IPv6 (OV new functionality)
  - HSRP
  - SNMPv3
  - Multicast
  - OSPF
  - Integration with all leading equipment vendors
- World class Mgmt Capabilities
  - Global backbone to LAN mgmt
  - Complex VLAN structures
  - Complex Layer2 topology
  - Manage converged networks
  - Root-cause & Impact analysis

WLAN Internet Mobile IPv6 Network



Enterprise IPv6 Network Mobility



Comm. Tower

Comm. Tower

Comm. Tower

Comm. Tower

Telecommute Enterprise Site

Internet

Remote Enterprise Site

HP's Experience with IPv6: HP IPv6 in Japan

IPv6 technology is widely recognized and growing fast in the Japanese market!

-- government support

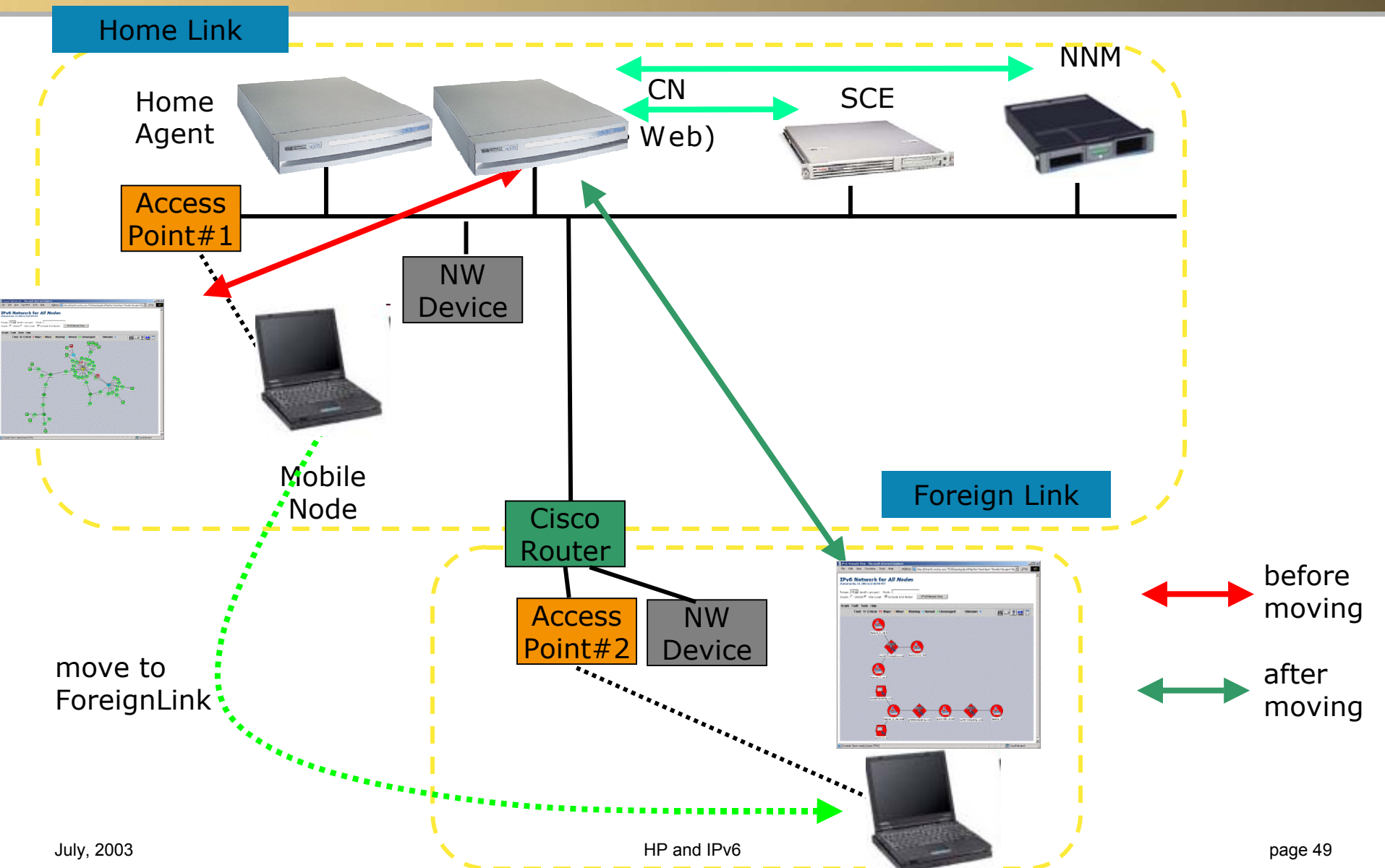
-- operators and vendors promotion

HP is accelerating IPv6 deployment in Japan with strong technology and cooperation with Japanese Telecom operators, ISPs, partners and our enterprise customers!

HP mobile IPv6 demo environment

HP is cooperating with Japan operators to deploy IPv6 in Japan

Mobile IPv6 & OpenView NNM demo Overview



Demo Equipment

H/W	S/W	
HA rp2400 /1cpu 	hp-ux11i + required patches	draft 20
	ipv6 products	
	mobileipv6 software	
CN rp2400 / 1cpu 	hp-ux11i + required patches	draft 20
	ipv6 products	
	mobileipv6 software	
MN#1 (LapTo EvoN410c ob500 	Redhat Linux 2.4.20 kernel	draft 20 Orinoco Wireless LAN(IEEE802.11b)
	MIPL-0.9.5 for v2.4.20	
Router Cisco3620 64MB DI 16MB FI 	IOS 12.2(8)T IP Plus	
Service Correlation Engine 	RedHat Linux 7.2 HP Application Server 8.1	
NNM/ET WorkStation	hp-ux11i + required patches	
	NetworkNodeManager v6.4	

HP IPv6 Strategy

HP Strategy for IPv6

- Support new transition mechanisms to enable widespread IPv6 deployment, Tunnel Broker
- Provide a release package to enable new IPv6 features in all HP products
- Continue to expand IPv6 test bed
- Continue to deploy IPv6 within HP

http://www.hp.com/network/ipv6

HP's IPv6 Strategy in the 21st Century

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- Will provide an Internet evolution to support connectivity of devices and people worldwide
  - At a scale that is beyond the dreams of the Internet when it was created, or as it exists now, where devices are pervasive and ubiquitous and people are mobile
  - Advanced Industry adoption of IPv6
    - Services
    - Solutions
    - Platforms
    - Secure Infrastructure
    - Network Management infrastructure
    - Research and Development

      (e.g. Multimedia, Grid Computing, Sensor Devices)

IPv6 Value Proposition
Engineered to Perform & Protect

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IPv4

- Uses a 32-bit address
- Running out of internet addresses
- Security was an add-on
- System management is complex and slow
- Incredibly successful
- 20 + years old

IPv6

- Uses 128-bit addressing
- Enough address space to give every human on the planet a unique IP address
- Mandatory and effective IP security
- Less Infrastructure Maintenance and complexity required
- More efficient Mobile IP = seamless service availability
- Architecture of the future = Next Generation internet protocol

Q & A

“Remember TIMING is an important factor in any success story”

IPv6 Everything is possible

Thank You


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