IPv6 Implementation Planning
Share Orlando Session : 09277

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Applications are Changing
Number 1 Application Driver: Mobile IP

LTE stands for Long Term Evolution – Technology to provide all IP networking; in other words, IP from Mobile terminal to support growing mobile broadband needs.
IPv6 – New Information Types – Critical to LTE

Voice is 12% of usage
**LTE – 4G**

- Flat IPv6 network
- High Through-put
- Low Latency
- Increased spectrum flexibility
Future of LTE

<table>
<thead>
<tr>
<th>Market impact</th>
<th>HSPA Evolution</th>
<th>LTE</th>
<th>Future releases of LTE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2009</td>
<td>2010</td>
<td>~2014</td>
</tr>
<tr>
<td>Peak rate</td>
<td>42 Mbps</td>
<td>~150 Mbps</td>
<td>~1000 Mbps</td>
</tr>
<tr>
<td>Typical user rate downlink</td>
<td>1-10 Mbps</td>
<td>10-100 Mbps</td>
<td>Operator dependent</td>
</tr>
<tr>
<td>Typical user rate uplink</td>
<td>0.5-4.5 Mbps</td>
<td>5-10 Mbps</td>
<td>Operator dependent</td>
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</tbody>
</table>
Enterprise Driver of IPv6 – CLOUD Computing

<table>
<thead>
<tr>
<th>Enterprise Class</th>
<th>Global class</th>
</tr>
</thead>
<tbody>
<tr>
<td>On-premise</td>
<td>Hybrid/off-premise</td>
</tr>
<tr>
<td>100s-1000s of nodes</td>
<td>10,000+ nodes</td>
</tr>
<tr>
<td>Proprietary</td>
<td>Commodity</td>
</tr>
<tr>
<td>HW resiliency</td>
<td>SW resiliency</td>
</tr>
<tr>
<td>Max performance</td>
<td>Max efficiency</td>
</tr>
<tr>
<td>Silo’ed Resources</td>
<td>Shared Resources</td>
</tr>
<tr>
<td>Clusters</td>
<td>Grids/Cloud</td>
</tr>
<tr>
<td>Static</td>
<td>Elastic</td>
</tr>
<tr>
<td>Shared storage</td>
<td>Replicated storage</td>
</tr>
<tr>
<td>Facility costs</td>
<td>Power Usage Efficiency</td>
</tr>
</tbody>
</table>

Cost-Center

Value/Revenue-Center

Courtesy: John Rhoton
Distinguished Technologist
HP EDS CTO Office
NAT Makes IPv4 Enterprise Successful

NAT Breaks Cloud Computing

Overhead due to Translation

Protocol incompatibilities

Peer-Peer breakage
  Instant messaging
  Interactive games
  VOIP
  Netmeeting
  BitTorrent

Scalability
## IPv6 Technology Scope

<table>
<thead>
<tr>
<th>IP Service</th>
<th>IPv4 Solution</th>
<th>IPv6 Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Addressing Range</td>
<td>32-bit, Network Address Translation</td>
<td>128-bit, Multiple Scopes</td>
</tr>
<tr>
<td>Autoconfiguration</td>
<td>DHCP</td>
<td>Serverless, Reconfiguration, DHCP</td>
</tr>
<tr>
<td>Security</td>
<td>IPSec</td>
<td>IPSec Mandated, works End-to-End</td>
</tr>
<tr>
<td>Mobility</td>
<td>Mobile IP</td>
<td>Mobile IP with Direct Routing</td>
</tr>
<tr>
<td>IP Multicast</td>
<td>IGMP/PIM/Multicast BGP</td>
<td>MLD/PIM/Multicast BGP, Scope Identifier</td>
</tr>
</tbody>
</table>
Business IPv6 Demand Drivers

More network appliances
Mandates for Government Agencies
Control operation expenses for IT
Elimination of complex NAT networks
Strong intrinsic security
Robust mobility support
Greater flexibility and simplicity
Business process improvements
IPv6 Address Importance

IANA IPv4 /8s remaining
February 3, 2011 = 0!

~ .7 addresses/person

ARIN

50%

5%

~ 5 addresses/person

APNIC IPv4 /8s remaining
April 15, 2011 = 0!

56%

23%

~ .2 addresses/person

China ~ 0.2 addresses/person
India ~ 0.02 addresses/person

LACNIC

9%

4%

~ .3 addresses/person

AfriNIC

14%

3%

~ .1 addresses/person

Regional IPv4 depletion will occur unevenly
(see www.ipv4depletion.com for details)
History Repeats!

It will always take longer than planned

The best plans are always changed

It will always be more complicated than planned

Why deploy something if you cannot manage it

Why deploy something if you cannot secure it
Deployment Considerations

Compatibility issues between IPv4 and IPv6

Vendor interoperability issues

Potential security issues

Service management

Existing hardware and software support of IPv6

Cost of potential hardware and software upgrades

Cost of education

Global public routing practices continue to evolve
DNS Issues Behind Many IPv6 Rollout Problems

Poor DNS Planning

Well documented

- RFC 3596
  (DNS extensions to support IPv6)
- RFC 3901 and 4472
  (DNS transport operational guidelines)
- RFC 4074
  (Common misbehavior for IPv6 responses)
- RFC 5211
  (An Internet Transition Plan)

Be sure to consider

- Transport
- Dedicated vs dual stack resolvers
- Name space fragmentation
- Placement related to NAT devices, load balancers, etc
- Applications
IPv4 Dependencies

DNS – inserting AAAA records

Operational support and maintenance

FCAPS – Fault, Configuration, Availability, Performance and Security systems for measurement and reporting

IP address tools and automated deployment systems

Education

Infrastructure components – DNS, firewalls, IDSs, routers, switches
IPv6 Risk Mitigation

Security organizations need to be early adapters

Increase level of security controls during initial IPv6 deployment

Monitor for false router advertisement

Authenticate routers and other infrastructure devices

Develop filtering strategies

Enforce multicast scope limits at appropriate boundaries
IPv6 transition is a process: a time-phased, iterative endeavor. Safeguard business continuity during the process.

Requirements analysis:
- GAP assessment
- Planning and Design
- Implementation

IPv6:
- Infrastructure updates
- Security system updates
- Process and procedure changes
- Competency development

Infrastructure logic enhancements:
- Business logic enhancements
- IT logic enhancements
Critical Success Factors for any Transition

Effects of missing factors:

- Vision → Incentives → Resources → Skills → Action Plan → Change
- Vision → Incentives → Resources → Skills → Action Plan → Confusion
- Vision → Incentives → Resources → Skills → Action Plan → Gradual Change
- Vision → Incentives → Resources → Skills → Action Plan → Frustration
- Vision → Incentives → Resources → Skills → Action Plan → Anxiety
- Vision → Incentives → Resources → Skills → Action Plan → False Starts

From Enterprise Corporation a consulting firm no longer in existence
Building the Transition Plan

**Where do we Start?**
- Setting the context for IPv6
- IPv6 Maturity Assessment

**Where are we now?**
- Process Assessment
- People & Organization Assessment
- Technology & Tool Assessment

**Where do we want to go?**
- Business Requirements
- Infrastructure Requirements
- Technology Requirements

**How do we get there?**
- GAP analysis
- IPv6 Process Prioritization
- IPv6 Conceptual Design

**Taking it live**
- IPv6 Strategic Plan
- IPv6 Enablement Plan

**Build IPv6 business case**

**Conceptualizing IPv6 business case**
IPv6 Preliminary Assessment

Educational services on IPv6 transition
– Presentations covering industry trends
– Case studies including lessons learned and caveats

Situational analysis and requirements elicitation
– Review of overall market-specific business context and drivers for IPv6
– Preliminary assessment of existing network infrastructure: architecture, deployed components and systems
– Preliminary assessment of business logic systems, applications, and services
– Review of IT and network operations management
– Review of security management

Development of strategic IPv6 roadmaps
IPv6 Assessment

Detailed assessment of network capabilities and systems
  Hardware, software, associated management tools
Identification of business and technical drivers for IPv6 transition
Detailed assessments and compliance analysis
  Site survey, network logic, business logic, security management and compliance, evolution plans
Education and competency development
  Benefits, industry directions, standards, compliance, vendor roadmaps
Training, reports on IPv6 readiness findings, detailed transition roadmaps
IPv6 Planning
*A comprehensive, enterprise-wide migration strategy*

Provide vertical-specific industry analysis and best practices
Identify technologies and develop a target compliant architecture
Develop a POC lab simulation environment prior to migration
Define IP addressing framework, automated tools, management processes
Develop detailed project management plan
Develop detailed pre and post-migration test plans and success criteria
Recommend migration paths for non compliant network devices
Develop the detailed implementation plan and related documents
Provide education, coaching, and training
IPv6 Transition Technologies

- **Phase 1**: Establish IPv6 Internet presence
- **Phase 2**: Enable internal users to access IPv6 Internet
- **Phase 3**: Migrate WAN to dual-stack
- **Phase 4**: Application migration
- **Phase 5**: Complete move to IPv6
## Have a Report Card

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Define IPv6 support levels for infrastructure components</td>
<td></td>
<td>Device activation</td>
<td></td>
</tr>
<tr>
<td>Baseline existing server, application, and infrastructure (DNS, routers, etc) elements for key KPI's</td>
<td></td>
<td>Zero Downtime Upgrades</td>
<td></td>
</tr>
<tr>
<td>Deploy Infrastructure on IPv6</td>
<td></td>
<td>Baseline core network elements before and after</td>
<td></td>
</tr>
<tr>
<td>Perform IPV6 infrastructure “internal move”</td>
<td></td>
<td>Datacenter upgrades</td>
<td></td>
</tr>
<tr>
<td>Perform IPv6 infrastructure “external move”</td>
<td></td>
<td>Increased infrastructure to administrator ratio</td>
<td></td>
</tr>
<tr>
<td>Connect and test external IPv6 connections</td>
<td></td>
<td>Reduced deployment times</td>
<td></td>
</tr>
<tr>
<td>Define items that will never support IPv6</td>
<td></td>
<td>Infrastructure cost savings</td>
<td></td>
</tr>
<tr>
<td>Failover testing of the management modules</td>
<td></td>
<td>Labor cost savings</td>
<td></td>
</tr>
<tr>
<td>Failover testing of the network switches</td>
<td></td>
<td>Centralized management of IPv6 infrastructure</td>
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IPv6 Design Motto

Tunnel where you must!

Go Native where you can!
Tunneling Issues

Latency

Where are the tunnel endpoints

Distant 6to4 relays

Broken Teredo servers
IPv6 Design Mistakes

Assuming you need feature parity – you want functional parity

Assuming you need your entire network running IPv6

Assuming that your existing security, logging and monitoring products support IPv6

Challenges
Managing and monitoring transition services

Inconsistent advice from vendors
IPv6 Transition Plan

Physical and logical implementations of the developed IPv6 transition plan

Detailed project management of every aspect of implementation and Management

- Physical installations
- Device configurations
- Execute pre and post-test plans
- Documentation
- Design and configurations procedures
- Fine-tune network elements
IPv6 Security

Hardware: Routers, servers, switches, firewalls, etc.

Software: Applications, tools, scripts, databases, etc.

Documentation: Policies, procedures, best practices

Access Control: Authentication, Authorization, Accounting

Forensics: preservation of evidence, data privacy protection

Business and Legal (SOX, HIPPA, GLB, etc)

Business Continuity
IPv6 Security Types of Attacks

Layer 1: (primarily physical) wiretapping, tapping, console access, rogue devices, etc.

Layer 2 attacks: VLAN “hopping”; MAC, DHCP, ARP, spoofing; ..... 

Layer 3: IP spoofing, DoD/DDoS, routing, smurf, tunneling, translation, transition

Layer 4-7: viruses, worms, application, rogue software, Man in the Middle

All Layers reconnaissance, unauthorized access sniffing
Implementation Snapshot

Acquire Provider Independent IPv6 space
Do native IPv6 peering or use a tunnel service
Get external firewall and external routing working
Trial public IPv6 with external DNS and Mail
Evaluate transition services as needed
Test your applications in a lab
Get internal IPv6 routing, DNS & DHCP working
Dual stack your servers
Provide dual stack to your workstation vlans
Deploy VPN dual stacked
AES Sessions at Share

Aug 8, 2011: 1:30-2:30 9288: [Keeping Your Network at Peak Performance as You Virtualize the Data Center](#)

Aug 10, 2011: 8:00-9:00 9266: [IPv6 Basics](#)

Aug 10, 2011: 4:30-5:30 9270: [Managing an IPv6 Network](#)

Aug 11, 2011: 3:00-4:00 9273: [CSI Maui: Forensics in The Case of the Attacked Browsers](#)

Aug 11, 2011: 11:00-12:00 9277: [Implementing IPv6 on Windows and Linux Desktop](#)

Aug 11, 2011: 1:30-2:30 9290: [Network Problem Diagnosis with OSA Examples](#)

Aug 12, 2011: 8:00-9:00 9308: [TCP/IP Performance Management in a Virtualized Environment](#)
QUESTIONS?

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650-617-2400
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IPv6 Source/Dest Address selection process -
Microsoft Infrastructure Planning and Design Guides -
Microsoft Exchange: Understanding IPv6 Support in Exchange 2010 -
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Cisco Validated Design -
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RIPE IPv6 Address Planning Guide -
http://www.ripe.net/training/material/IPv6-for-LIRs-Training-Course/IPv6_addr_plan4.pdf
Deploying IPv6 in Campus Networks:
- Deploying IPv6 in Branch Networks:
- CCO IPv6 Main Page:
  http://www.cisco.com/go/ipv6
- Cisco Network Designs:
  http://www.cisco.com/go/designzone
- ARIN IPv6 Wiki:
  http://www.getipv6.info/index.php/Main_Page
- World IPv6 Day (June 8, 2011):
  http://isoc.org/wp/worldipv6day/
- IPv6 at IBM
- IBM IPv6 Compliance
- Security for IPv6 Routers
  www.nsa.gov/ia/_files/routers/I33-002R-06.pdf
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http://www.ipv6.org.uk

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