IPv6 Value Proposition

An Industry view of IPv6 Advantages

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Agenda

What is IPv6
IPv6 Value Proposition
IPv6 Status Update
What is Internet Protocol version 6?

• IPv6 is the Next-Generation Internet Protocol
• The current version (IPv4) is running out of addresses
• The current version has become too complex to manage
• IPv6 leaps from 32 to 128-bit addressing

IPv6 facilitates

The global move toward

anywhere, anytime, anyway Internet access
Where we are Today issues with IP?
IPv4 a 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
  - Instant messaging
  - Interactive games
  - VoIP
  - Real-time collaboration and sharing

10.1.1.1:4143 – 15.22.111.32:25
10.1.1.2:5213 – 15.22.111.32:80
10.1.1.3:4003 – 16.43.211.112:110
n.n.n.n:1 – 15.22.111.32:25
n.n.n.n:2 – 15.22.111.32:80
n.n.n.n:3 – 16.43.211.112:110
IPv6 - Why do we Care?
Wireless and Internet Converge

Mass market global adoption of mobile communications

Customer demand for Quality of Service and increased security

Convergence

Accelerating growth
New Internet usages

IPv4 is out of addressing space

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
Where we want to be?
IPv6: Driving the Internet

“Everything to the Internet”

- Pervasive Internet

Solve many of the problems caused by the IPv4 success and more...

IPv6 deployment

- For the continued growth and success of the Internet
- A natural evolution from IPv4
  - Designed with extensibility and scalability in mind
**IPv6 Value Proposition**

**Engineered to Perform and Protect**

<table>
<thead>
<tr>
<th>IPv4</th>
<th>IPv6</th>
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<tbody>
<tr>
<td>- Uses a 32-bit address</td>
<td>- Uses 128-bit addressing</td>
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<td>- Running out of internet addresses</td>
<td>- Enough address space to give every human on the planet a unique IP address</td>
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<td>- Security was an add-on</td>
<td>- Mandatory and effective IP security</td>
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<td>- System management is complex and slow</td>
<td>- Less Infrastructure Maintenance and complexity required</td>
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<td>- Incredibly successful</td>
<td>- More efficient Mobile IP = seamless service availability</td>
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<td>- 20 + years old</td>
<td>- Architecture of the future = Next Generation internet protocol</td>
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IPv6 Immediate Benefits

Increased Address Space - 128 bits
  – $2^{128}$ is a really big number
  – Enough unique addresses for all devices
Efficient and Extensible IP datagram
Efficient Route Computation and Aggregation

And while we’re at it, we might as well make a few other improvements…
**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
IETF IPv6 Standardization Status

- Core IPv6 specifications are IETF Draft Standards level
  - Some specifications are a little behind on the standards track: mobile IPv6, header compression, DHCPv6
  - See playground.sun.com/ipng for more info
- UMTS R5 cellular wireless standard mandates IPv6
- MWIF recommends IPv6
Address selection
Address allocation
DNS discovery
Anycast addressing
Scoped address
Flow Label semantics
API issues
  • Flow Label, Traffic Class, Scoping etc

DHCPv6 (dhcp wg)
Multihoming (multi6 wg)
Transition Mechanisms (v6ops wg)
DNS operational discussion (dnsops wg)
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 in the 21st Century

Will provide an Internet evolution to support the connectivity of devices and people worldwide

– At a scale that is beyond the dreams of the Internet when it was created, or as it exist now, where devices are pervasive and ubiquitous and people are mobile
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IPv6
Everything is possible