IPv6 Router Support

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Contents

• Introduction
• Japanese IPv6 Market Update
• Hitachi’s IPv6 Development and deployment
• “Real world” IPv6 Gigabit Router Implementation
Introduction of Hitachi

✈ Headquarters in Tokyo, Japan
✈ 1,069 Subsidiary Companies - 355 outside Japan
Japanese Market Update

Why IPv6 in Japan?

• IPv4 address
  – Not enough IPv4 address space assigned to Japan and other Asian countries

• IT Growing Rapidly
  – Always On
  – Mobile
  – Consumer Electronics Products

• Japan needs more IP address!
‘Always on’ in Japan

- ADSL subscribers
- Ready to FTTH service

<table>
<thead>
<tr>
<th>Type</th>
<th>NSP / Carrier</th>
<th>Speed (bps)</th>
<th>Price (JPY/month)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADSL</td>
<td>NTT-/W, DION TOKYO-metallic, e-access, So-net, etc.</td>
<td>Uplink: 288K - 512K, Downlink: 1.5M</td>
<td>4600-6200</td>
</tr>
<tr>
<td>FTTH(10)</td>
<td>NTT-E/W</td>
<td>10M bps</td>
<td>5900</td>
</tr>
<tr>
<td>FTTH(100)</td>
<td>YusenBroadNetworks, NTT-E/W</td>
<td>100M bps</td>
<td>6100-11000</td>
</tr>
</tbody>
</table>

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xDSL Subscribers in Japan

http://www.mpt.go.jp/eng/
### Life Duration of IPv4 Address

#### Estimated IPv4 Life Duration

- **APNIC Determined Data**
- **Approximate Data**
- **Total IPv4 Address Available**
- **Number of IPv4 address assigned to Information Appliance / Mobile**
- **Number of IPv4 address assigned to Conventional Products** (Client PC, Server, Router etc.)

[Graph showing estimated IPv4 life duration with years from 1999 to 2008, and IP address availability in millions.]

'99-01/1: from APNIC beyond 01/1 is Hitachi Estimation
## Problems Caused By Scarcity of IP addresses

Ad-hoc methods (e.g. NAT) has been used to resolve scarcity of IP addresses in last 5 years. However, issues such as duplication of private IP addresses, restriction on applications, etc. still exist.

<table>
<thead>
<tr>
<th>Solutions in last 5 years</th>
<th>Current Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Company/Campus</strong></td>
<td></td>
</tr>
<tr>
<td>・ Using private IP addresses for intranet</td>
<td>・ VPN construction is difficult, because NAT is unidirectional (“private” to “global”)</td>
</tr>
<tr>
<td>・ Translate global IP address, when internal hosts access to external WWW servers.</td>
<td>・ Duplication of IP addresses, on merger etc.</td>
</tr>
<tr>
<td></td>
<td>・ Application restriction (e.g. ftp isn’t available)</td>
</tr>
<tr>
<td></td>
<td>・ Increasing operational/administrative costs</td>
</tr>
<tr>
<td><strong>Carrier/ISP</strong></td>
<td></td>
</tr>
<tr>
<td>・ Temporary assignment of IP addresses to users, when the session is linked up.</td>
<td>・ Semi-static address assignment because of permanent connection services</td>
</tr>
<tr>
<td>・ Using private IP addresses and NAT</td>
<td>・ Difficulty to service as users, hosts and network equipment increases</td>
</tr>
<tr>
<td></td>
<td>・ Increasing operational/administrative costs</td>
</tr>
</tbody>
</table>

NAT : Network Address Translator
e-Japan

  – For example:
    JGN (Japan Gigabit Network) will support IPv6 service for R&D in 2001.
    By Ministry of Public Management, Home Affairs, Posts and Telecommunications
IPv6 Deployment in Japan

IPv6Network

Public Service e-Japan

Common Carrier NTT-C, KDDI, etc.

iDC

Global Center Japan + HnB+Hitachi

ISP/CATV... IIJ, etc.

Enterprise

Mobile

Home e-Japan
IPv6 Case Study: ISID Large Scale Enterprise Network

- Information Services International (ISID) – Dentsu, Ltd. 
- Building Japan's first 5,000-machine company-wide network using IPv6
- New network is expected to begin operating at the end of July 2001
- Voice and video to be distributed to all 5,000 terminals over Gigabit Ethernet
- IPv4/IPv6 dual-stack technology
Hitachi’s IPv6 Deployment (1)

- A Founding Member of IPv6 forum
- 5 Years Development of IPv6 routers.
- World’s First IPv6 Protocol Translation Router
  “NR60” in 1997. (Sorry, NR60 was Sold Out !)

- IETF contributions.
  – Especially RFC2767 (BIS).
Hitachi’s IPv6 Deployment (2)

• Early stage (1996-97) Interoperability Testing in UNH IOL. University of New Hampshire, Interoperability Laboratory

• A Member of KAME Project and USAGI project.
  – http://www.kame.net

• Interoperability Testing in Tahi Project.
  – http://www.tahi.org

• “Toolnet6” - Free Hitachi Software.
  – Driver Software For IPv6 Support - Windows 95/98/NT.
IPv6 Software for Windows “Toolnet6”

- Software Tool For Existing Windows (R) Applications Over IPv6.
- Enhancement For Network Interface Card Driver Software
- Free distribution from Hitachi home page
  - http://www.hitachi.co.jp/Prod/comp/network/pexv6-e.htm
- RFC2767 (Bump-in-the-Stack)
Hitachi’s IPv6 Deployment (3)

- Hitachi Gigabit router “GR2000” Series currently shipping
- IPv6 - Released and Supported Protocol For The GR2000.
- Dual-stack approach
  - IPv4 & IPv6 Available Across All Models & Interfaces
Gigabit Router GR2000

Key Features

• Layer-3 non-blocking switching performance
  • Up to 40Mpps Forwarding Rates (GR2000-20H)
  • Up to OC48c (2.4Gbps)
• Distributed processing architecture
• Scalable WAN/LAN services
• Carrier class hardware and software assure system reliability
• Full suite of routing protocols ensures interoperability
  • OSPF, RIP, BGP4, IP, IPX, IPv4, DVMRP, PIM, MPLS & IPv6
• Hardware based QoS (priority & bandwidth control)
• Hardware based filtering
Gigabit Router GR2000 IPv6 Deployment

  - More than 100 units, 40 sites, 20 users deployed worldwide
  - Global Center Japan will start IPv6 iDC service with GR2000.
  - ISID (Information Services International Dentsu, Ltd.) is planning to deploy their IPv6 network with GR2000.
  - CRL (Communications Research Laboratory) has already started wide area and high speed IPv6 network with GR2000.
GR2000 IPv6 (Current Status)

- GR2000 IPv6 software is based on KAME stack.
- Software based with some hardware assist
  - Low cost to start for early adopters
  - Flexibility for Additional IPv6 Functionality
- Maintains IPv4 high-speed forwarding rates
- Standards Driven
  - RFC2460: Internet Protocol, Version 6 (IPv6)
  - RFC2473: Packet Tunneling
  - RFC2080: RIPng
  - RFC2858, 2545: Extensions for BGP-4
  - RFC2462: Address autoconfiguration
  - RFC1972, 2472 2492: IPv6 packets over Ethernet, PPP, ATM
  - RFC2465, 2466, 2452, 2454: MIB
  - etc.
“Real World” IPv6
What is Needed to Routers?

• High Performance (like IPv4 performance)
  – High speed forwarding rates
  – High speed QoS and Filtering

• Routing Protocols
  – RIPng, BGP4+, OSPFv3, Static

• Network Management System, Operation tools

• Scalable
  – Support on all models
  – Support for a wide range of network interfaces
GR2000 New Release for IPv6

- High Performance IPv4 and IPv6 Dual Stack
  - IPv6 packet routing and forwarding by dedicated ASIC
  - Up to 26Mpps (GR2000-20H)
  - Up to OC-48c [2.4Gbps] Wire Speed
  - Hardware Based QoS Control (including IPv6 Diff-Serv)
  - Hardware Based Packet Filtering
  - High Speed IPv6 Tunneling

- OSPFv3 supported for Large Scale Intra-domain

- Release Date: 3Q/2001 in Japan
  - Overseas: There might be delay depending on regulatory issue
“Real World”
IPv6 Network Management System

- IPv4+IPv6 Network using GR2000
  - Manageable by IPv4 NMS
- GR2000 supports IPv6 MIBs
  - Gathered by SNMP Over IPv4
    - IPv6 MIB (RFC2465)
    - IPv6 ICMPMIB (RFC2466)
    - tcp on IPv6 MIB (RFC2452)
    - udp on IPv6 MIB (RFC2454)

- IPv6 Native NMS: under development

MIB: Management Information Base
SNMP: Simple Network Management Protocol
GR2000 Enhancement Plan
Terabit Class Router (Preliminary Info.)

- Further More Broad band Internet
  - FTTH (10/100Mbps) for subscribers
- Further More Subscribers
- “movie class” Rich Contents

Terabit class router of
GR2000 series (under planning)
- Up to OC768(40Gbps)
- IPv4/IPv6 Dual Stack
Conclusion

- IPv6 - Already Started at Commercial Stages.
- Implemented at several Japanese customer sites in a production environment
- As a Vendor, Hitachi Has Released IPv6 Products.
- Positive Feedback Received From Many Evaluation & Testing Sites Deploying GR2000 & IPv6.
  - UP to 26Mbps, UP to OC48c
  - OSPFv3
  - Manageable by IPv4 NMS
- Next Step: Terabit Class IPv4/IPv6 Dual Stack Router
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