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# IPv6 Router Support

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- Introduction
- Japanese IPv6 Market Update
- Hitachi's IPv6 Development and deployment
- "Real world" IPv6 Gigabit Router Implementation

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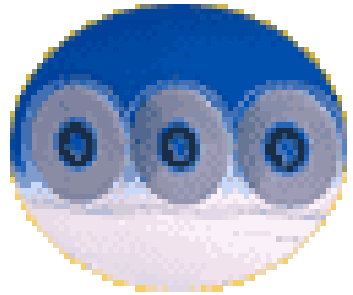
# Introduction of Hitachi



- Headquarters in Tokyo, Japan
- 1,069 Subsidiary Companies - 355 outside Japan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# 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!

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# ‘Always on’ in Japan

- ADSL subscribers
- Ready to FTTH service

| Type | NSP / Carrier | Speed (bps) | Price (JPY/ month) |
|---|---|---|---|
| ADSL | NTT-/W, DION TOKYO-metallic, e-access,So-net,etc. | Uplink: 288K – 512K Downlink:1.5M | 4600-6200 |
| FTTH(10) | NTT-E/W | 10Mbps | 5900 |
| FTTH(100) | YusenBroadNetworks, NTT-E/W | 100Mbps | 6100-11000 3800 (Shared) |

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# xDSL Subscribers in Japan

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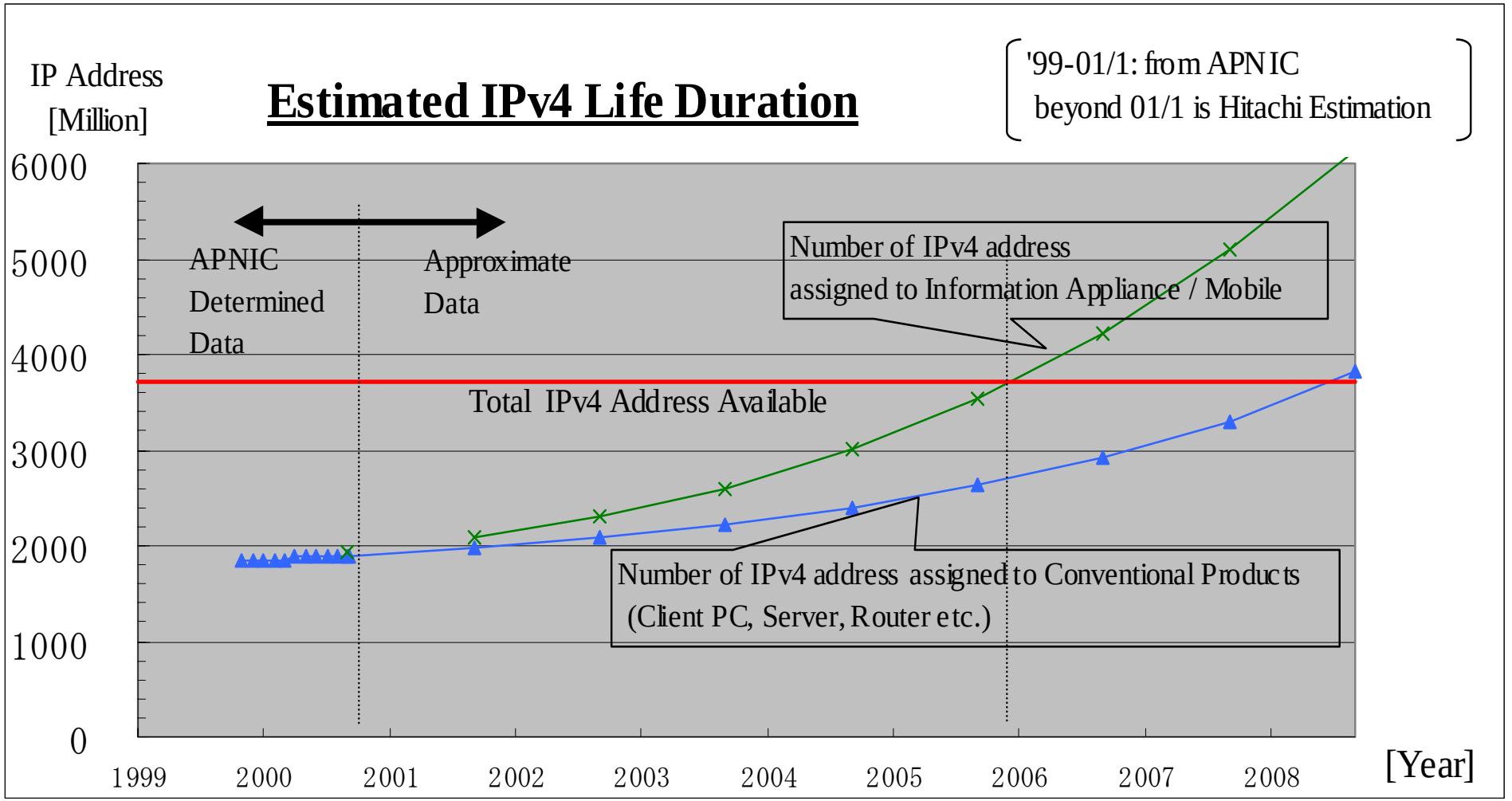
# Life Duration of IPv4 Address



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# 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.

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

NAT : Network Address Translator

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# e-Japan

- The Japanese former prime Minister announced
  " IPv6…" (21.Sep.2000)
  – 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

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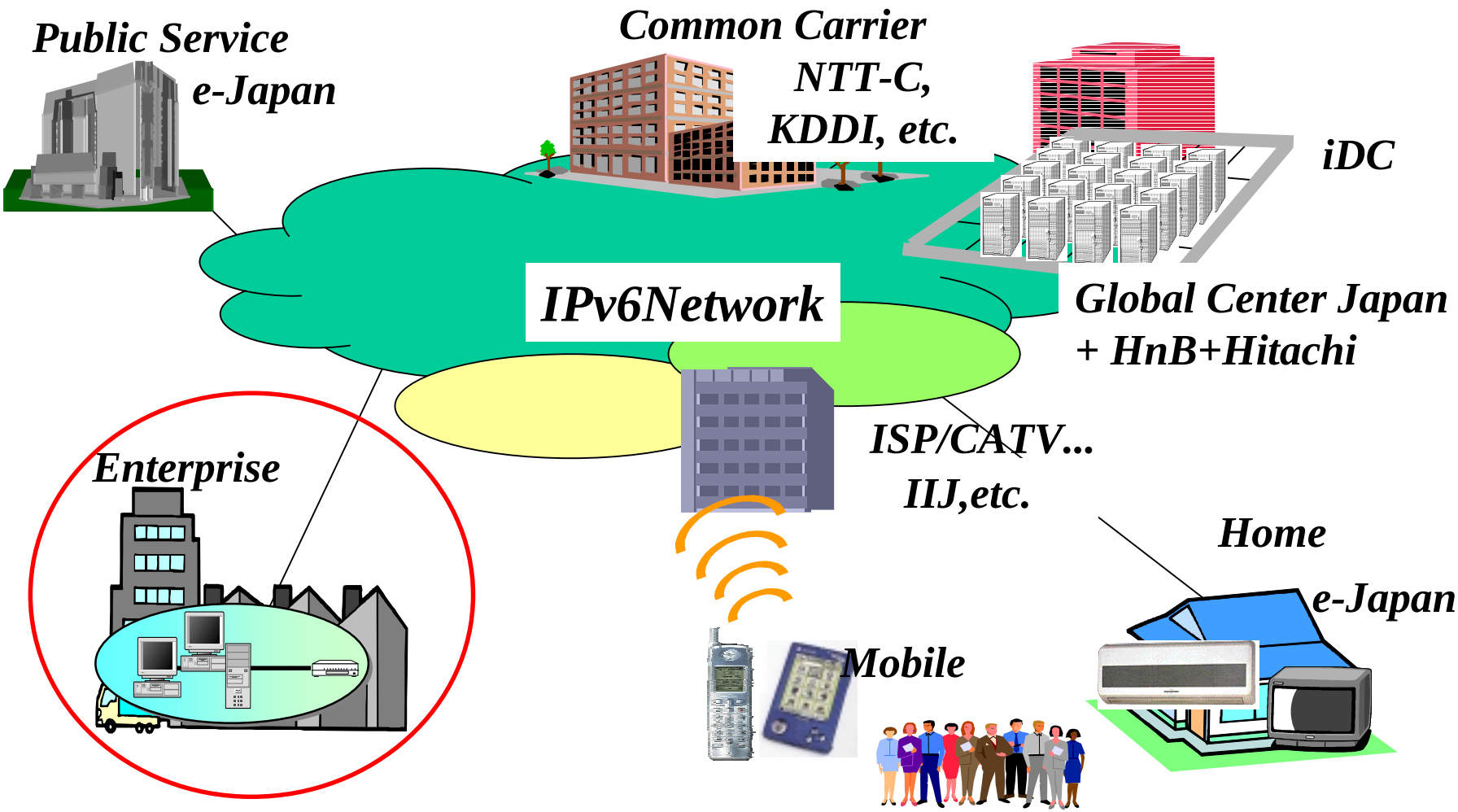
# IPv6 Deployment in Japan



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# IPv6 Case Study: ISID Large Scale Enterprise Network

- Information Services International (ISID) – Dentsu, Ltd.

  http://www.isid.co.jp/english/news/ipv6.html

- 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

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# 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).

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# 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
  - http://www.linux-ipv6.org/
- Interoperability Testing in Tahi Project.
  - http://www.tahi.org
- "**Toolnet6**" - Free Hitachi Software.
  - Driver Software For IPv6 Support - Windows 95/98/NT.

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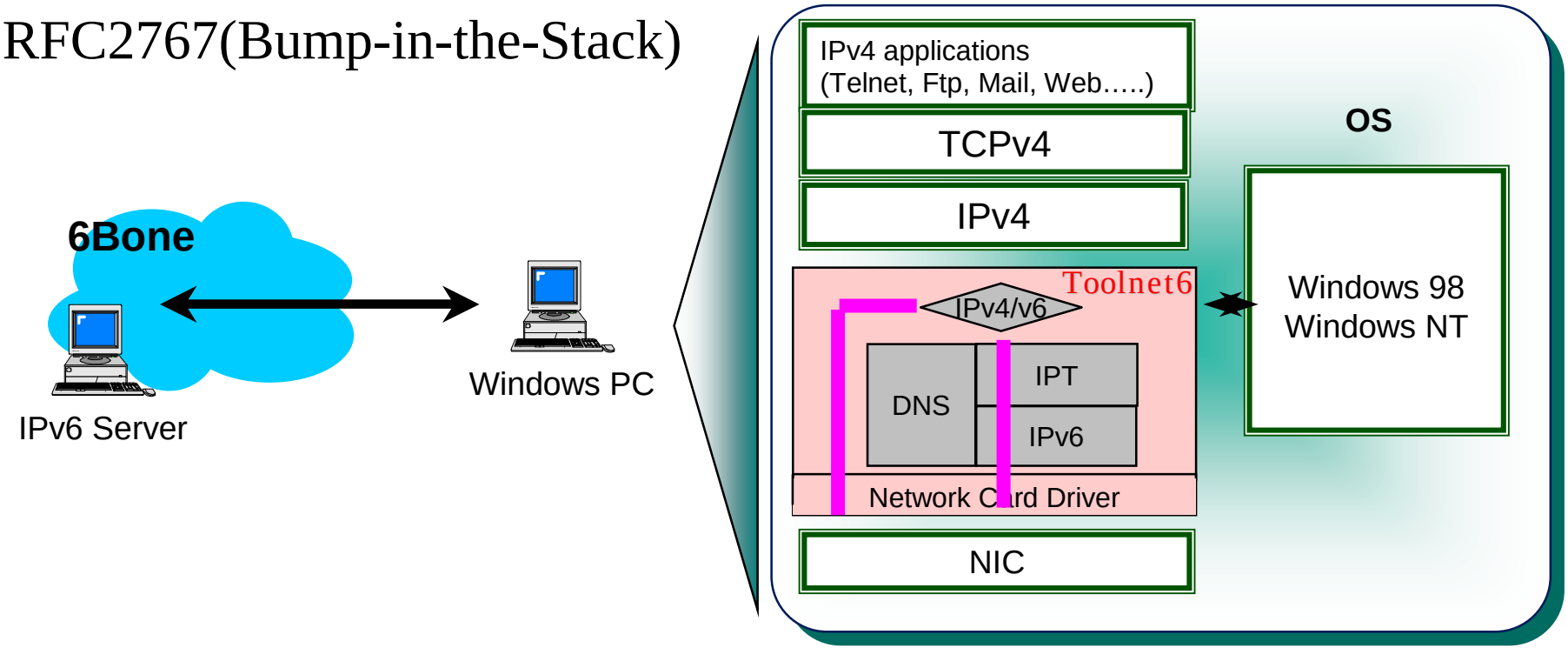
# IPv6 Software for Windows "Toolnet6"

- 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)



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# 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

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# 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

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# Gigabit Router GR2000
# IPv6 Deployment

- Many Japanese and worldwide Service Providers, Enterprises are already using GR2000 IPv6.
  - **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.

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# 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.

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# “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

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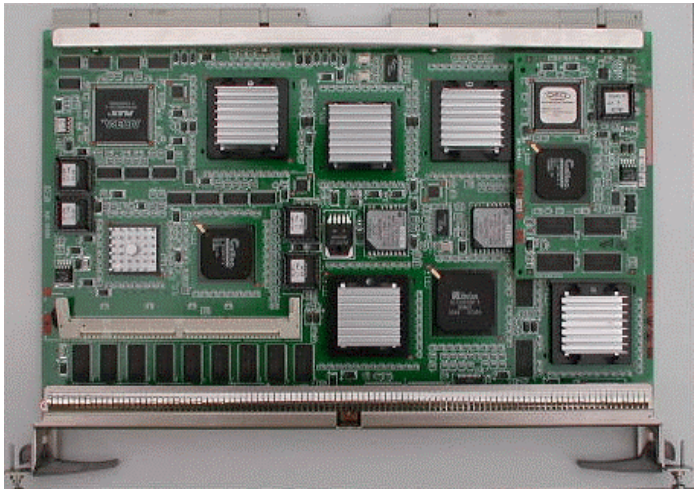
# GR2000 New Release for IPv6

- 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

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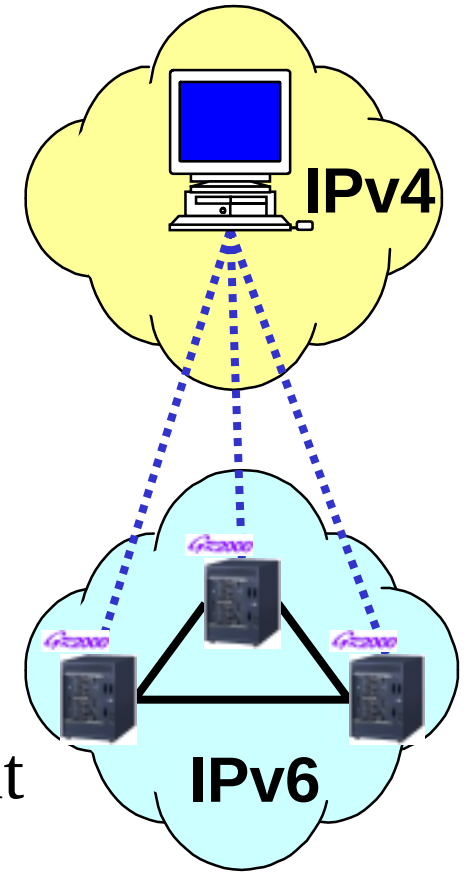
# “Real World” IPv6 Network Management System

- 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

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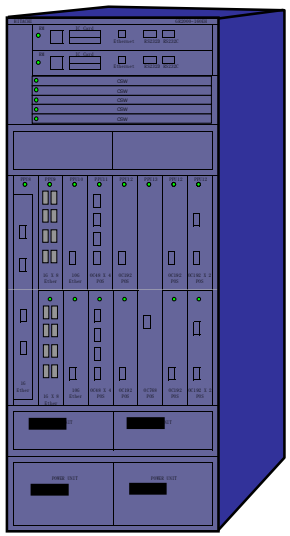
# GR2000 Enhancement Plan
## Terabit Class Router (Preliminary Info.)

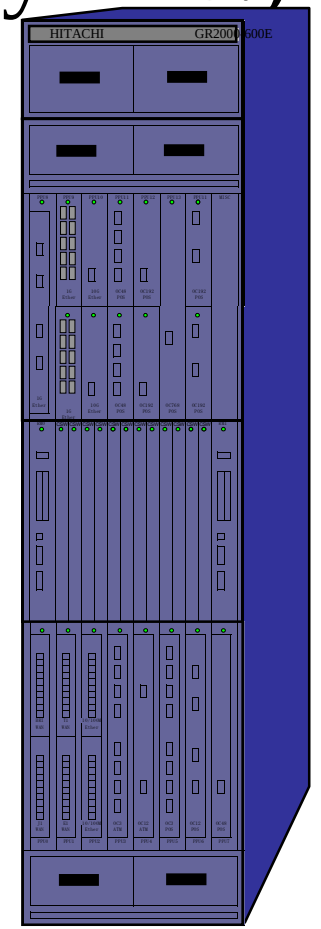
- Further More Broad band Internet
  - FTTH (10/100Mbps) for subscribers
- Further More Subscribers
- “movie class” Rich Contents

Terabit class router of
GR2000 series (under planning)

- Up to OC768(40Gbps)
- IPv4/IPv6 Dual Stack



GR2000-316E




GR2000-630E

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# 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.
- GR2000 New Release: Hardware Based IPv4/IPv6 Dual Stack Gigabit Router
  - UP to 26Mbps,UP to OC48c
  - OSPFv3
  - Manageable by IPv4 NMS
- Next Step: Terabit Class IPv4/IPv6 Dual Stack Router

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# Thank you!