



e-Nations, The Internet for All

An IPv6 Business Case

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**This presentation is based on the paper
“e-Nations, The Internet for All, An IPv6 Business Case” by
Patrick Grossetête, Sr. Product Manager IPv6, Cisco Systems
Jim Bound, HP Fellow, Hewlett Packard
Tony Hain, Technical Leader, Cisco Systems**

http://www.nav6tf.org/RIR_eNations/e-Nations.pdf

Agenda

- **Global Internet Success**
- **A look at the numbers**
- **How to sustain Internet Growth ?**
- **Conclusion**

IPv6 Drivers—IP Convergence

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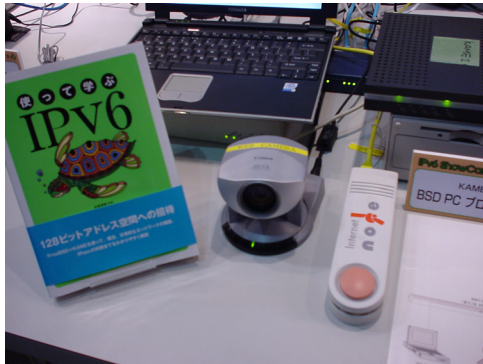


Millions of new devices becoming IP aware, not just PCs.

A Need for increased addressing and “plug and play” networking !

Explosion of New Internet Appliances

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Source: N+I Tokyo, July 2002

“In 2005, all Sony products will be IPv6-enabled”

Mario Tokoro

Corporate Executive Vice President,

Co-CTO and President of Network & Software Technology

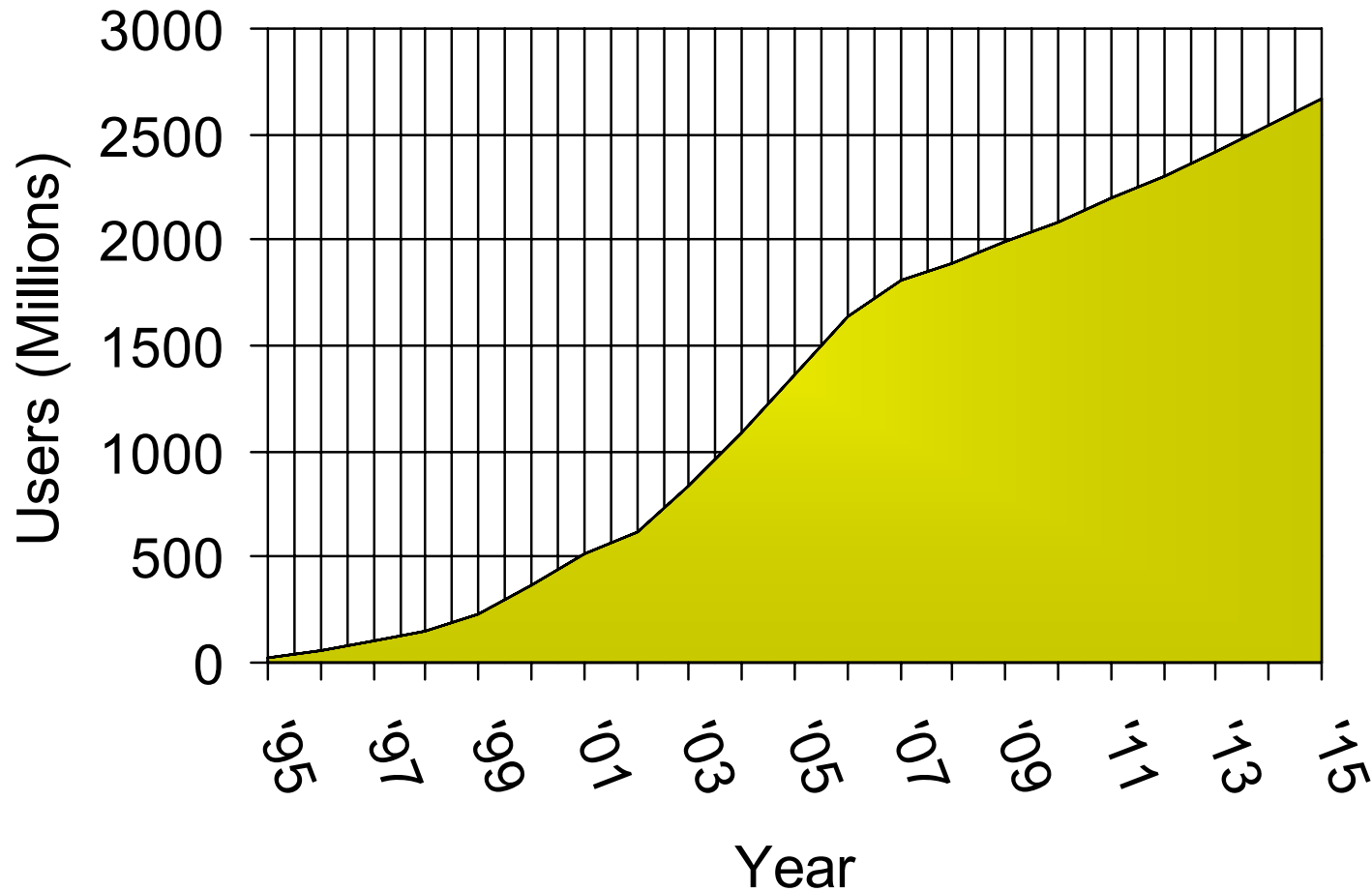
Centre at Sony Corporation

February 12th, 2003

<http://www.ipv6style.jp/en/interviews/20030212/index.shtml>

Internet User Trends

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Source: Nua Internet Surveys + vgc projections

IPv4 Address Allocation History

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1981 - IPv4 protocol published

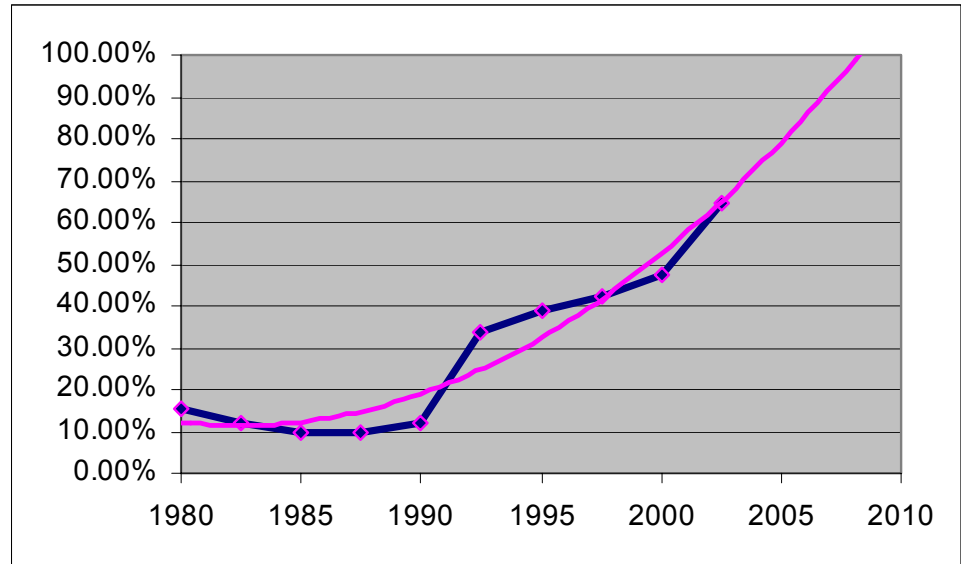
1985 ~ 1/16 of total space

1990 ~ 1/8 of total space

1995 ~ 1/3 of total space

2000 ~ 1/2 of total space

2003 ~ 2/3 of total space



- **This despite increasingly intense conservation efforts**

PPP / DHCP address sharing

CIDR (classless inter-domain routing)

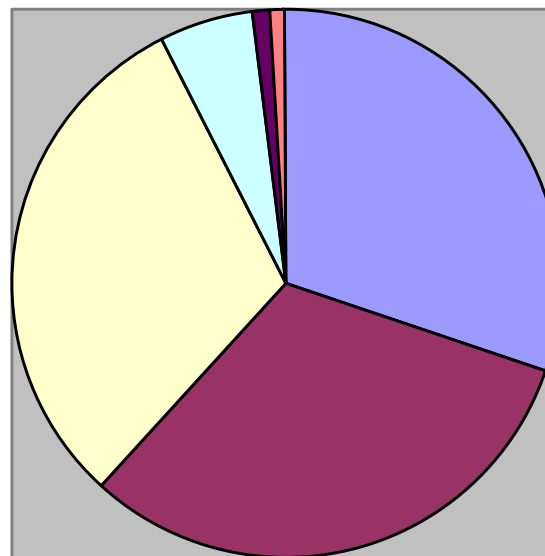
NAT (network address translation)

plus some address reclamation

Users on the Internet – Sept 2002

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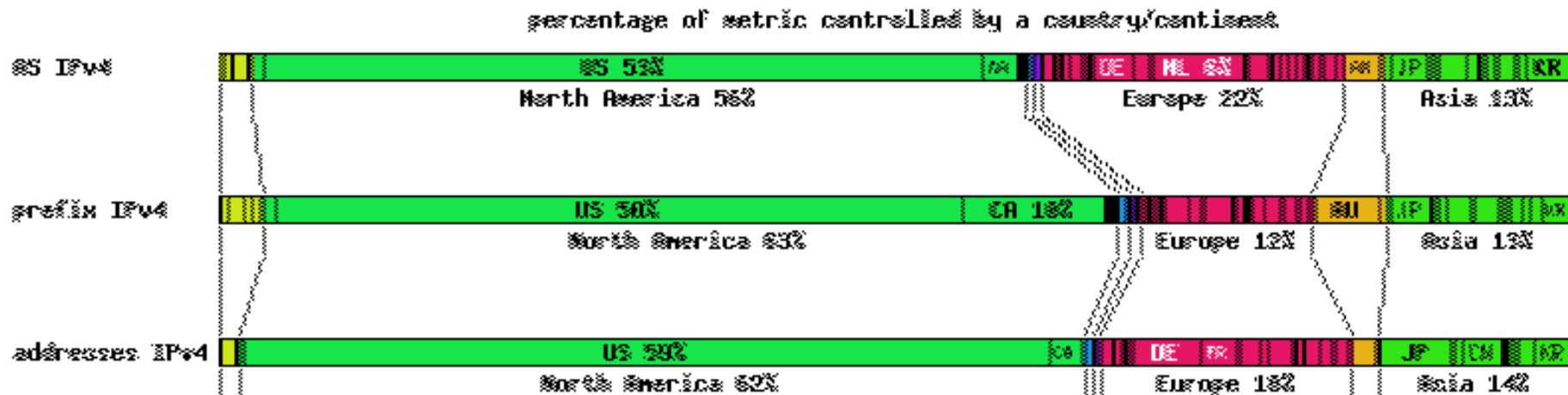
- CAN/US - 182.67M
 - Europe - 190.92M
 - Asia/Pac - 187.24M
 - Latin Am - 33.35M
 - Africa - 6.31M
 - Mid-east - 5.12M
-
- Total - 605.6 M



(Source www.nua.ie)

IPv4 address and prefix distribution by region

Cisco.com



Source: <http://www.caida.org/analysis/geopolitical/bgp2country/ipv6.xml>

How to sustain growth ?

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- **Internet Population**
~600M users in Q4 CY2002, ~950M by end of CY 2004
- **Mobile Industry**
Currently 1.2 Billion subscribers
- **How to address the future Worldwide population?**
Current population ~ 6.3 Billion (UN 2002 revision report)
Expected growth to ~ 9 Billion by 2050
- **Emerging Internet countries need address space**
China uses nearly 2 /8 blocks (11/2002), ~20 /8 needed if every student (320M) has to get an IP address
- **Mass Market ?**
Only 36 out of 208 countries exceed 20% user penetration (4 close)
139 countries forced to use NAT !

IPv6 Drivers—Network's Architecture

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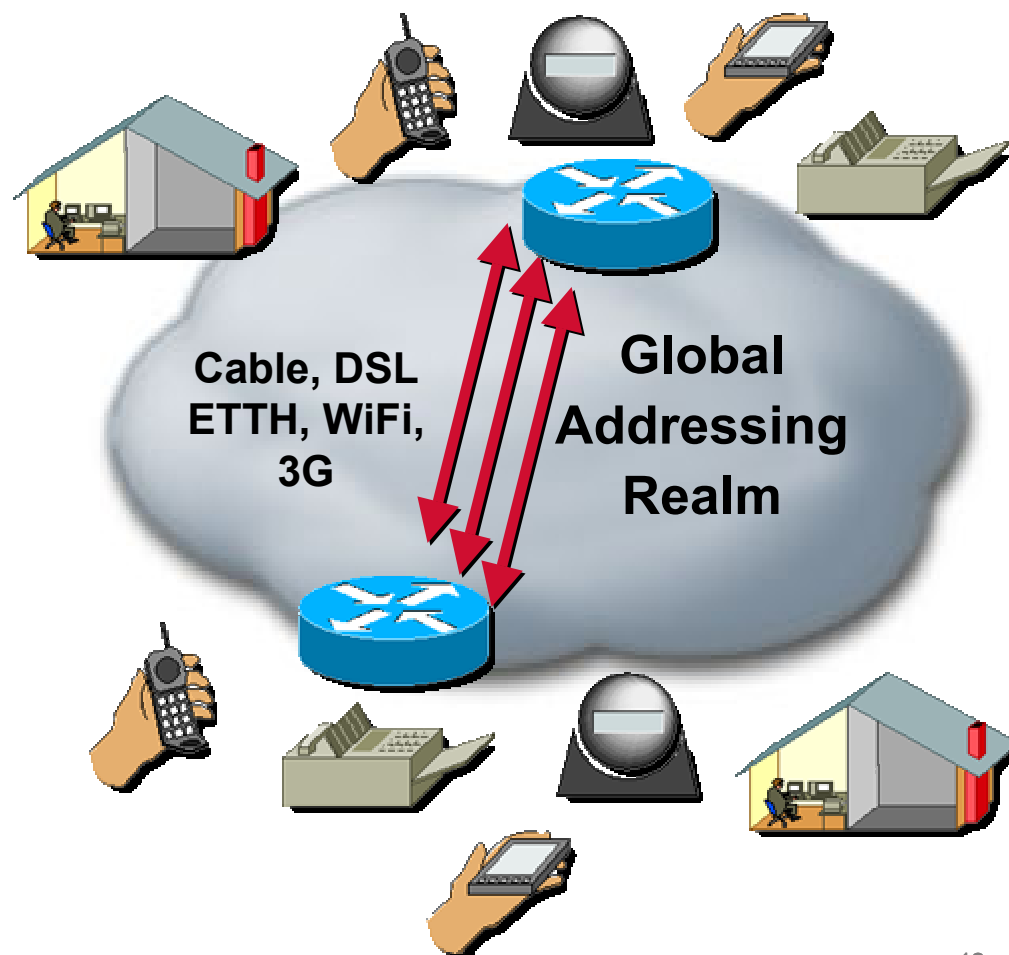
“Always-on” technologies enable new application environments

- Today, Network Address Translation (NAT) and application-layer gateways connect disparate networks

Internet started with end-to-end connectivity for any application

- Peer-to-peer or server-to-client applications mean global addresses

IP telephony, fax, video
Mobility
Distributed gaming
Remote monitoring
Instant messaging



Host-Density (HD) Ratio – RFC3194

- **Measure the efficiency of address allocation**
- **Values between 0 and 1, usually expressed in percentages**

$$\text{HD} = \frac{\text{LOG (number of allocated objects)}}{\text{LOG (max number of allocatable objects)}}$$

0 just one allocation

1 one object allocated to each available address

- **US Telephone System**
 - 9.2 Digits HD = 87% (linear quotient 10%)**
 - 10 Digits HD = 80% (linear quotient 3.2%)**
- **Theoretical limit of 32-bit address space: ~ 4 Billion**
- **Practical limit of 32-bit address space: ~ 250 Million**

How many addresses ?

- Expectation is that users will need 1 to 5 IP addresses

PC, Phone, Car, Internet-enabled Home Appliances

- Very painful HD ratio 90% assumed, reasonable would be 80%
- 20% penetration
- Only 5 countries would have enough address space to support 5 addresses per user !

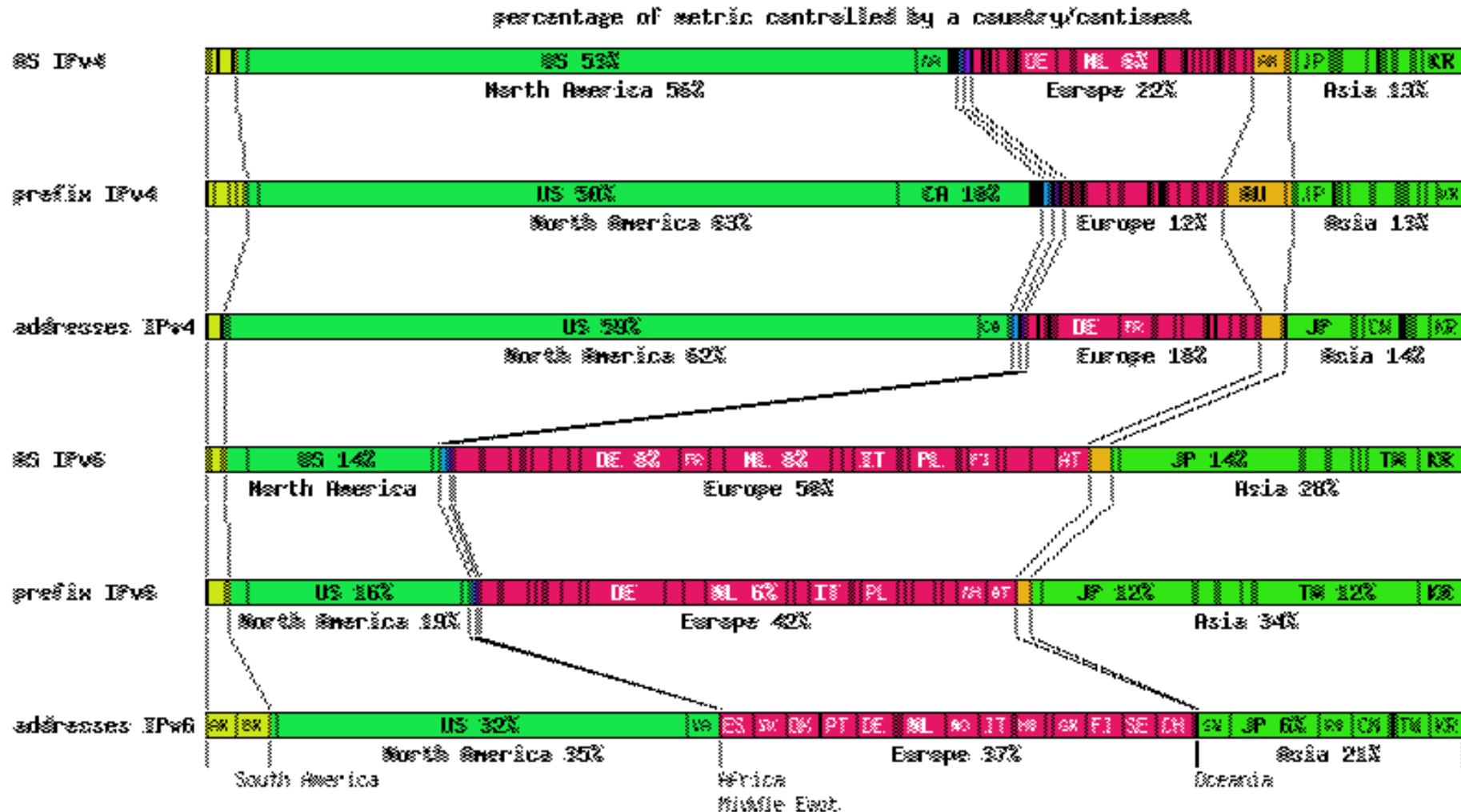
	/8 for 20% penetration , 1 address per user	/8 for 20% penetration, 5 addresses per user
China	116.5	779.7
India	105.5	637.8
Global	413	2763
IPv4 limit	221	

Conclusion

- **The success of the Internet is built on an open and global model**
- **Internet economy is a reality that smoothly reaches all nations worldwide**
- **None want to be isolated**
- **Even less developed countries see IP as a chance to improve their economy and education**
- **Even though currently in its infancy, only IPv6 with its 128-bit address space is able to sustain the growth of the Internet to enable a **global e-Nation****
- **It will take several years to achieve, but we need to start NOW !**

IPv4 and IPv6 address and prefix distribution by region

Cisco.com



Source: <http://www.caida.org/analysis/geopolitical/bgp2country/ipv6.xml>

Pointers

- **IPv6 Forum**

<http://www.ipv6forum.com>

- **IPv6 Task Force**

<http://www.ipv6tf.org>

- **Vendor Sites**

[**http://www.cisco.com/go/ipv6**](http://www.cisco.com/go/ipv6)

