

# Action plan for IPv4 address exhaustion

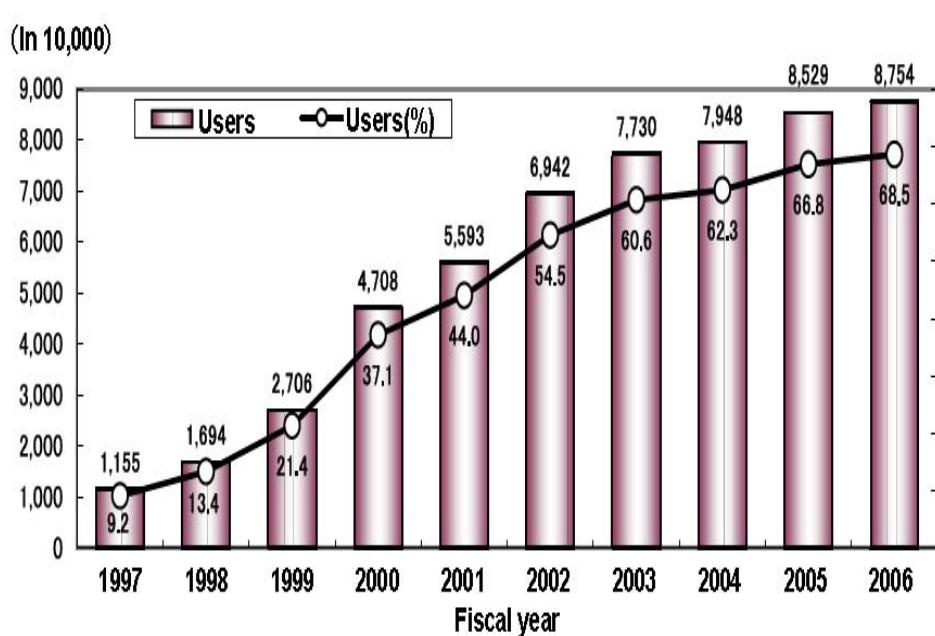
*~ IPv6 as a BASIC Internet Service ~*

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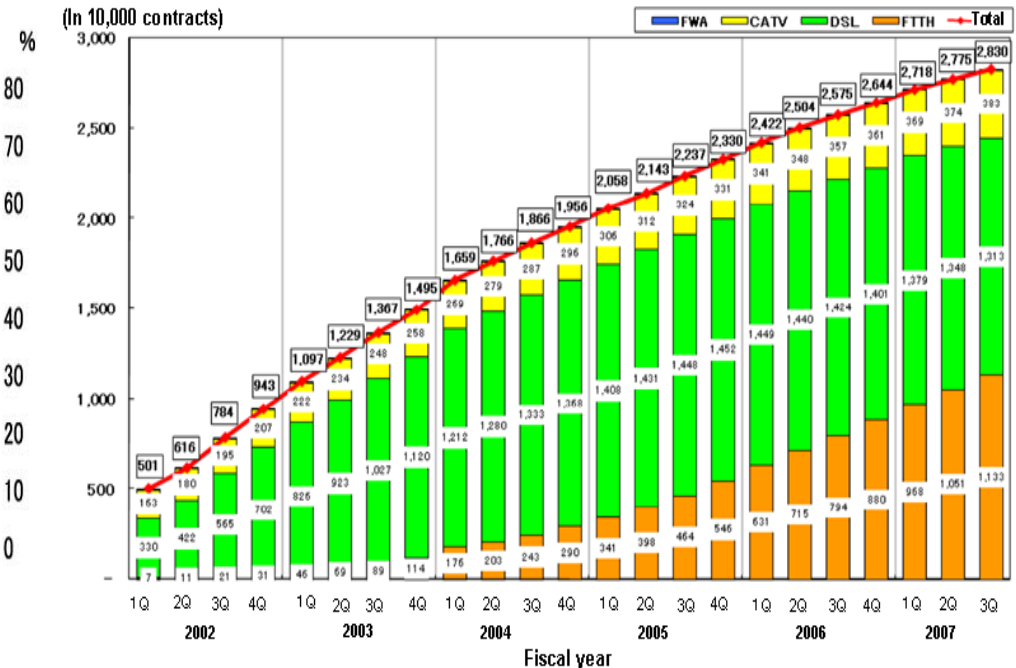
25 June, 2008  
Ministry of Internal affairs and Communications  
JAPAN

# Internet users in Japan

1. **87 million Internet users** (over 2/3 of total population), and **28.3 million broadband contracts** (more than 50% of total households)
2. The market size of the electronic commerce through the Internet totaled 147 trillion yen (about 1.4 trillion US\$) in 2006 (survey by METI)
3. The Internet is **essential for socioeconomic** activities in Japan



The number of Internet users  
 (Communication utilization trend, 2006)

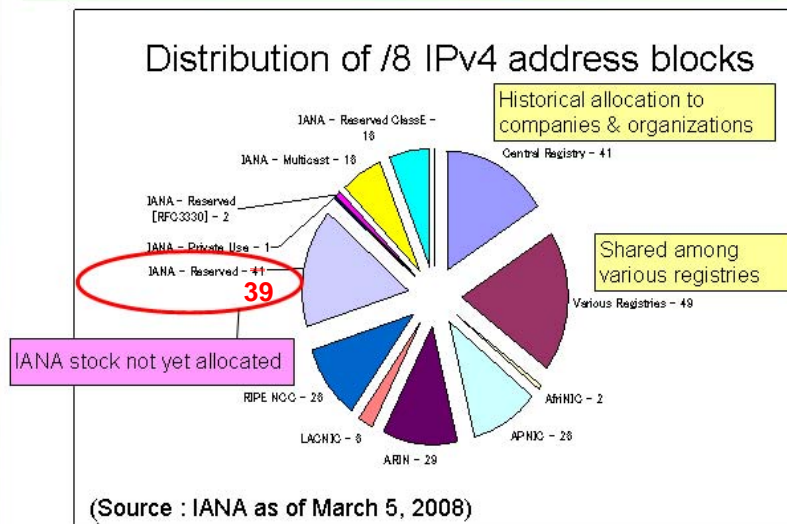


The number of broadband contracts  
 (Survey by MIC)

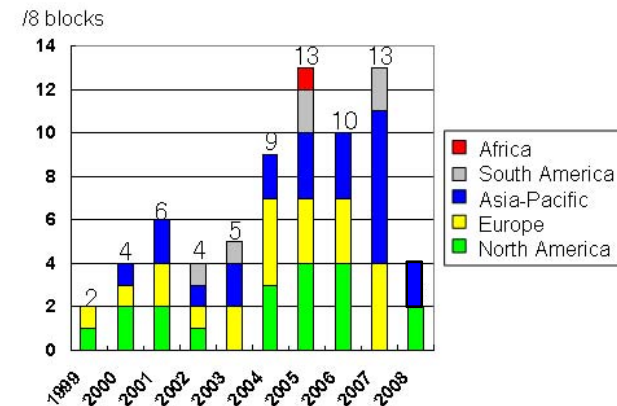
# Current consumption of IPv4 addresses

1. The total number of IPv4 addresses is 4,300 million. There are about 700 million (39 blocks) remaining.
2. About 80 million (5 blocks) were consumed every year until about 2003. Consumption has doubled (more than 10 blocks) since around 2004.

## IPv4 address allocation as of Mar. 2008



## IPv4 address allocation to each RIRs



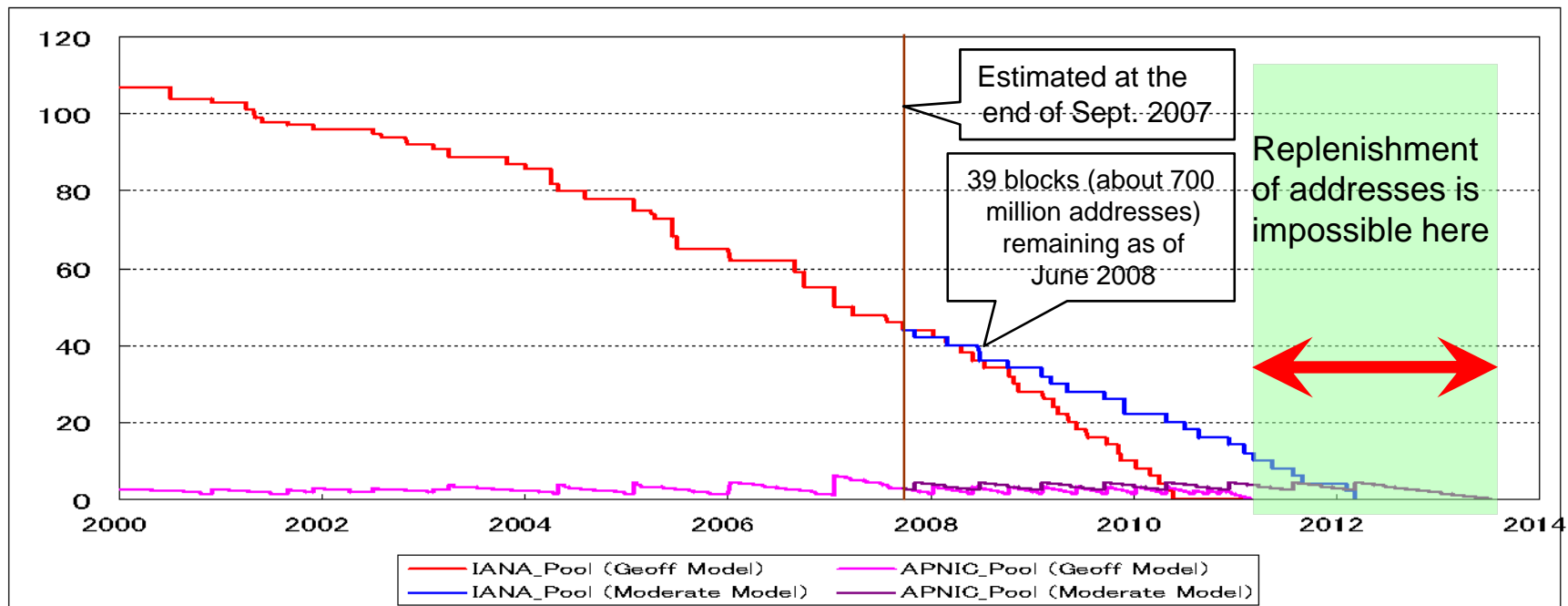
(Source : IANA as of March 5, 2008)

“/8” is 1/256 of the whole addresses, equivalent to about 16.8 million addresses

# Estimated date of the IPv4 address exhaustion

Unless there will be no significant changes in the circumstances  
 (there will be no change in the rules concerning international address allocation or address maintenance, and that those to whom addresses are allocated will not try to retain surplus addresses arbitrarily),  
 the following is estimated:

- IANA pool exhaustion : mid 2010 ~ beginning of 2012
- The end of allocation **in Japan : beginning of 2011** ~ mid 2013



(The vertical axis is shown in blocks called "1/8". "1" is equivalent to about 16.8 million addresses)

# Influence of address space exhaustion

1. After the IPv4 address space is exhausted, it is possible to maintain the Internet but it is impossible to develop the Internet further.
2. The influence widely reaches across various areas, and the services that users receive via the Internet are also greatly influenced.



# Actions for address space exhaustion (1/2)

1. Because the initial action must be **completed by the beginning of 2011**, the three actions that are possible with the existing technology were examined
  - i. Share one address among multiple nodes (saving of IP addresses)  
⇒ Use **NAT/NAPT** (Sharing of IPv4 addresses)
  - ii. Use all addresses (maximum density of IP address usage)  
⇒ **Reallocate** the distributed IPv4 addresses
  - iii. Utilize new address resources  
⇒ Transition to **IPv6**

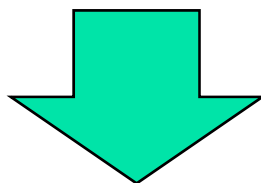
NAT : Network Address Translation, NAPT : Network Address Port Translation

2. These are compared from the following viewpoints
  - i. Feasibility within a time limit:  
Problems can be solved **within about 3 years**.
  - ii. Continuity of service:  
The uses provided in the current Internet will **continue to be used**.
  - iii. Continuance of effect:  
**Reattempt actions are unnecessary** because general users are influenced.

# Actions for address space exhaustion (2/2)

## Evaluation of the measures

	Utilization of NAT/NAPT (Sharing of IPv4 addresses)	Reallocation of the assigned IPv4 addresses	Transition to IPv6
Feasibility within a time limit	✓	Doubtful	Extremely difficult
Service continuity	Limited	✓	✓
Permanent effect	Doubtful	NG	✓



- Essential action: **Transition to IPv6**
  - Initial action: **Utilization of NAT/NAPT**
- should be carried out in combination.

# 3 stage actions for address space exhaustion

**[Preparation]** (up to 2010)  
Before exhaustion

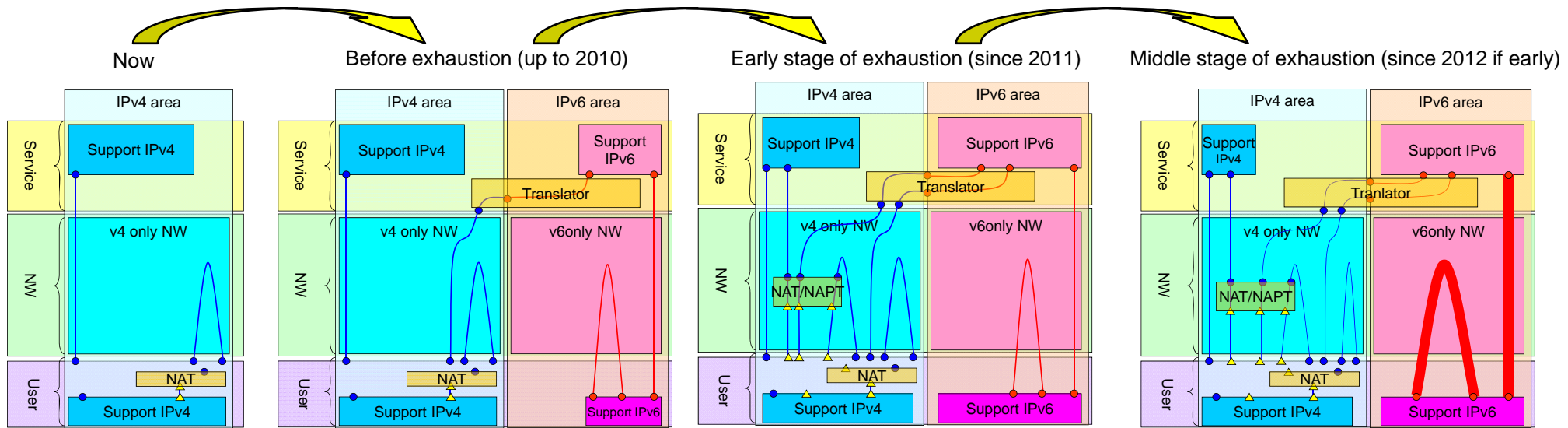
Support of IPv6 by networks and services

**[Initial action]** (since 2011)  
Early stage of exhaustion

- All users will be allocated IPv6 addresses (as a **BASIC service**)
- New users will share one IPv4 addresses by multiple users
- Support of NAT/NAPT by services

**[Full-scale action]** (since 2012 if early)  
Middle stage of exhaustion

- Full-scale utilization of IPv6
- Existing users will be accommodated under NAT/NAPT



NAT: Network Address Translation, NAPT: Network Address Port Translation

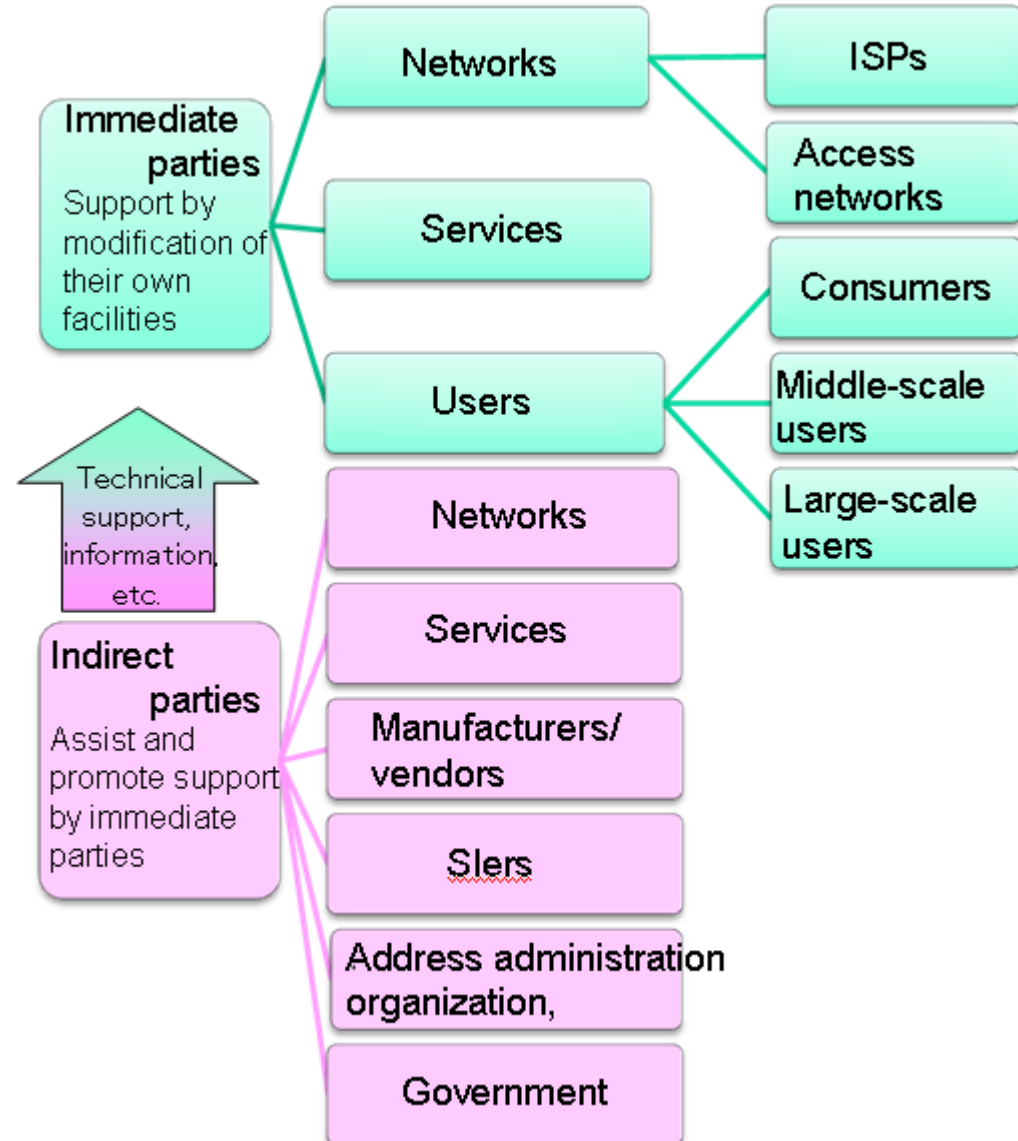
- ▲ : Private v4 addresses
- : Global v4 addresses
- : Global v6 addresses
- Blue line: v4 Red line: v6

**Model of the procedure for introduction of measures for address space exhaustion**

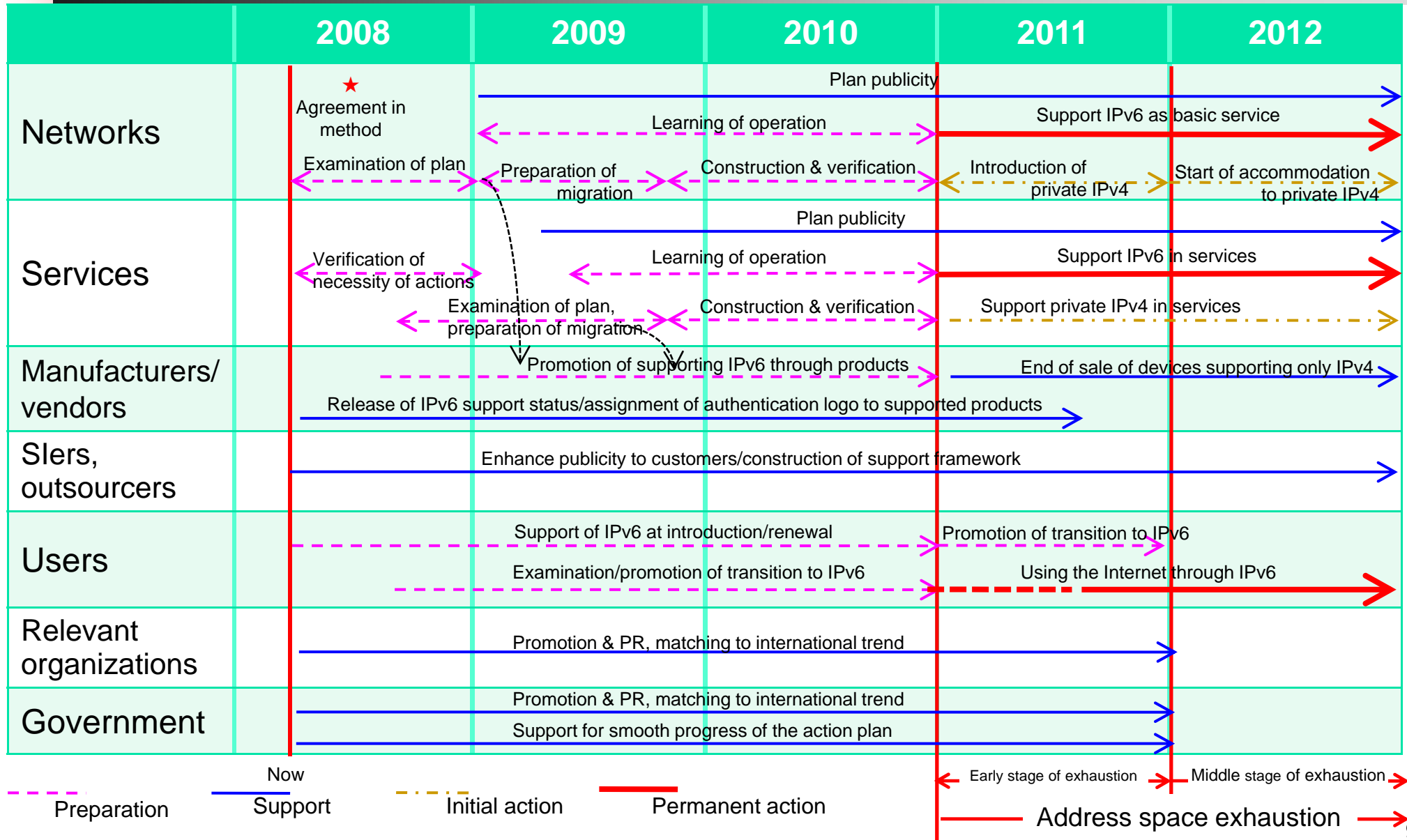


# Action plan (1/3: Organizing players)

1. The measures for IPv4 address exhaustion will be expected to implement by **networks, services, and users (immediate parties)** primarily.
2. The above three elements contain technical problems that cannot be solved by themselves. **Indirect parties need to cooperate to solve them.**



# Action plan (2/3: Overview)

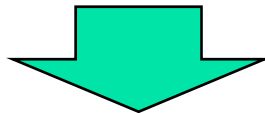


## Action plan (3/3: promotion framework)

1. **The government will not force** each player to perform what is described in the action plan. It is extremely important that **each player recognizes its role and promotes the actions itself.**
2. However, while the information about the method of introduction should be shared widely, it is necessary to establish a framework for grasping the progress and urging those who are behind schedule to take action.
3. Therefore, **the IPv6 Promotion Council** should strengthen the functions regarding
  - Grasping the status of promotion of the action plan
  - Information sharing in the promotion of the action plan
  - Improvement of knowledge by related parties through the construction and employment of the test bed
  - Examination of amendments to the action plan as requiredand it should be reconstructed as a promotional framework in cooperation with the government and the private sector.

# Role of the government in the action plan

1. **Publicize** the Japanese policy **internationally** so that international trends will confirm to
2. **Publicize** the necessity of the transition to IPv6 **to users**
3. **Pay attention to the promotion** of the action plan and **improve the environment** so that the adjustment and negotiation go smoothly between players.
4. **Promote the development of** Ipv6-compatible supporting communication **devices**.
5. **Examine the support for the initial cost** burden in cooperation with relevant organizations.
6. **Support the enhancement of education programs for engineers** to learn the appropriate skills.
7. **Examine the creation of tests for engineers** on the development capability for IPv6-compatible systems to offer the basis of selection to users, services, and Sler's.



Such approaches may be required in each country.

# Actions for IPv4 address space exhaustion

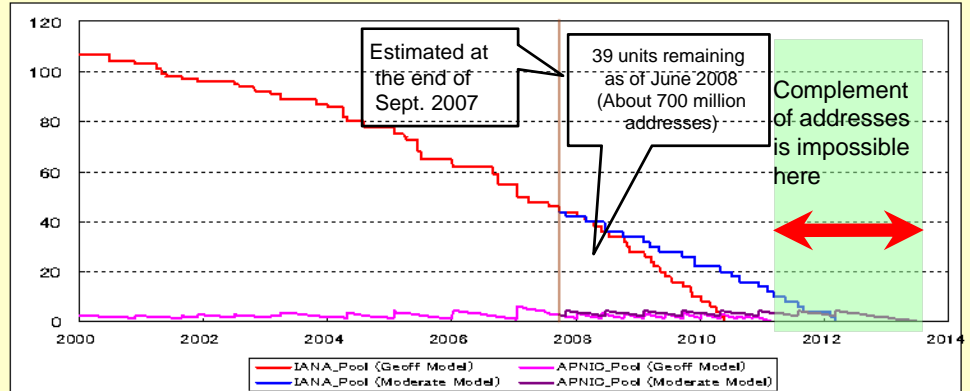
International stock of addresses (equivalent to telephone numbers) based on the communication protocol (IPv4) used on the Internet will be exhausted in about three years.

- Even if IPv4 addresses are exhausted, existing Internet users can continue to use it.
- On the other hand, **it will be difficult to accept new users or services.**

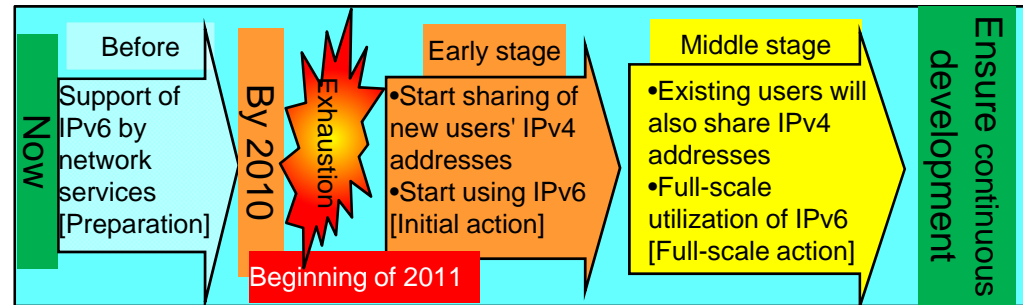
- For continuous development of the Internet, from three viewpoints of feasibility within a time limit, continuity of service on the Internet, and continuance of effect, **the transition to a new address system (IPv6) and sharing of one address by multiple users** must be combined and carried out.
- It is appropriate to **introduce the countermeasures in three stages**: before exhaustion, early, and middle stages of exhaustion.

- **Create the action plan** consisting of 68 items, concerning networks, services, and users, which are involved in the Internet, and manufacturers/vendors, system integrators, relevant organizations, and the government, which support them.
- **Reconstruct IPv6 Promotion Council as the promotion framework** of the action plan in Japan in cooperation of the government and the private sector

Number of the remaining IPv4 addresses in international stock



The unit is the number of blocks each of which contains 1/256 of the whole IPv4 address space. One block is equivalent to 16,770,000 addresses.



Example of the action plan:

- Networks and services should support IPv6 by 2010. The plan for the transition should be created and released in 2008
- Manufacturers/vendors should promote the support of IPv6 by products. Authentication system (IPv6 Ready Logo Program) should be used to indicate support.
- Considering that IPv6 will start in 2011 or later, users should promote the transition to IPv6 when the devices and software are replaced.
- The government and relevant organizations should promote the action plan, while seeking consistency with international trends.

# Overview of the report

1. The total number of **addresses** (separate numbers required for devices connecting to the Internet) **of IPv4**, which is the basic technology supporting the current Internet system, is **4,300 million**.
2. Among them, **3,600 million have already been allocated**, and the remaining are at most 700 million. If there are no particular changes in the circumstances, **IPv4 addresses will run short as early as the beginning of 2011**.
3. **To cope with IPv4 address exhaustion, the transition to IPv6 as an essential action**, and sharing of the IPv4 addresses as an initial action are required.
4. Because both of these actions require the modification of networks and systems,
  - ① The providers of **networks and services should create an action plan in 2008 for compliance completion by the end of 2010**.
  - ② It is important for **users to advance the supporting IPv6 through to the modification or system renewal**, assuming that the Internet connection with IPv4 will be limited after 2011.
  - ③ It is also important for **product suppliers**, such as vendors/manufacturers, **and technology suppliers**, such as system integrators/outsourcing companies, **to strengthen the support system for Networks and Services**.
  - ④ It is important for **the government and relevant organizations, such as an address administration organizations, to support the whole progress**.

*Thank you!*

For more information, please visit the MIC's website at:

[http://www.soumu.go.jp/joho\\_tsusin/eng/index.html](http://www.soumu.go.jp/joho_tsusin/eng/index.html)

Internet Policy Office  
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