Action Plan and Milestone
Toward IPv4 Address Exhaustion
ver. 2010.10

October 8, 2010
Task Force on IPv4 Address Exhaustion, Japan
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About this document

This document describes a series of recommended action plans and milestones to prepare toward IPv4 address exhaustion, which is estimated to occur in 2011, as a reference for industry players in Japan, but it should be informative also for those in other countries.

The Task Force on IPv4 Address Exhaustion, Japan expects that industry players will study and address the issues in IPv4 address exhaustion on the basis of this reference, and create and execute individual action plans accordingly. We hope the Internet industry as a whole will smoothly overcome this problem as a result.

In order to take the latest situation into consideration, this document is supposed to be updated on a regular basis.

Revision history

<table>
<thead>
<tr>
<th>Date</th>
<th>Version</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feb. 17, 2009</td>
<td>2009.2</td>
<td>First release</td>
</tr>
<tr>
<td>Oct. 5, 2009</td>
<td>2009.10</td>
<td>Second release; Modified diagrams based on estimated commencing time of the IPv6 access network services on the NGN services.</td>
</tr>
<tr>
<td>June 4, 2010</td>
<td>2010.6</td>
<td>Each industrial player’s situation is not reviewed. Evaluation of ongoing situation and latest information are added.</td>
</tr>
<tr>
<td>Oct 8, 2010</td>
<td>2010.10</td>
<td>Assessment of the latest status and refinement of action plans for business users (incl. government agencies and local government etc)</td>
</tr>
</tbody>
</table>

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Background of the Creation of this document

The target date in this document is set as early 2011, unchanged from The Ministry of Internal Affairs and Communications of Japan’s Report ”Study Group on Sophisticated Use of the Internet by IPv6” (March 2010) *.

- The above report predicts the exhaustion date of the remaining IPv4 address pool on the following assumptions:
  - Around mid to late 2011, exhaustion of the international address stock (IANA Pool)
  - the acquisition of new IPv4 addresses in Japan will be impossible in the mid 2012.
  - Geoff Huston currently estimates (as of September, 2010):
    - 2Q 2011 as the IANA exhaustion date
    - 1Q 2012 as the APNIC exhaustion date (exhaustion dates are updated every day.)
  - The exhaustion date may be delayed by reduced capital investment in the current recessionary environment, while it may also accelerate the consumption of IPv4 address through such factors as the faster deployment of wireless broadband, expanding demand mainly in Asian region, the last minute demand etc..
  - At present the target date is set as early 2011, as a result.
  - *Study Group on Sophisticated Use of the Internet by IPv6 (http://www.soumu.go.jp/main_content/000058238.pdf)

This Action Plan and Milestone is a model example with a margin of time. Each player should set its own schedule in consideration of risks and environments.

Even the latest movers should complete preparation before JPNIC/APNIC exhaustion.

This Action Plan will be updated as necessary based on changing address consumption trends, IPv6 technology issues, etc.
Current Progress Review

✓ ISPs are getting ready for IPv6 connectivity
  • NTT NGN IPv6 connectivity method (tunneling method and native method) details have been decided.
  • There are some moves related to native method in promotion of IPv6 migration, such as establishment of new companies.
  • Each ISP is preparing IPv6 transition to be ready by April 2011, the starting date of NGN IPv6 connection.
  • Each ISP is currently preparing to provide information on their status of readiness for IPv4 address exhaustion.

✓ Diverse status observed for iDC, ASP/CSP
  • While some iDCs, ASPs/CSPs are in progress with IPv6 support, it is unsupported in others, and their status is diverse in two opposite directions.

✓ Business users (including government agencies and local government) will start to prepare for IPv6 transition from now.
  • Not enough information is getting across to them, and most of them are at the stage of starting to consider preparation for IPv4 address exhaustion from now on.(although this delay will not make a big impact right now).
Recent topics on IPv4 address exhaustion (after April 2010)

✓ Pace of /8 block allocations is much faster than projected.
  • Since January 2010, total 12 /8 addresses are allocated (APNIC (Asia and Pacific): 6, ARIN (North America): 2, RIPE NCC (Europe): 2, LACNIC (Latin America): 2) and current /8 address stock at IANA is 14 blocks (5 percent of the total)

✓ MIC published guidelines for ISPs to disclose information about their readiness on IPv4 address stock exhaustion
  • Published in April 2010 (http://www.soumu.go.jp/menu_news/s-news/02kiban04_000022.html, Japanese Only)
  • None of ISPs have disclosed Information according to the guideline yet. ISPs are now preparing for IPv4 address exhaustion, so we expect their information disclosure in the early timing.

✓ 3 companies of NGN IPv6 native connection are considering to provide IPv4 connection service by common method, on IPv6 environment.
  • 3 companies: BBIX, JPIX, Internet Multifeed are now considering to provide IPv4 connection service over IPv6 by common method based on SAM (Stateless Address Mapping). Their aim is to promote transition to IPv6.

✓ KDDI CORPORATION and other companies established a new company on IPv6 business
  • 6 companies (KDDI CORPORATION, Japan Internet Exchange Co., Ltd. (JPIX), NEC BIGLOBE, Ltd., NIFTY Corporation, ASAHI Net, Inc. and VECTANT Ltd.) established a new company Japan Network Enabler Corporation (JPNE).
  • They collaborate on a project for IPv6 Internet Roaming Services on NGN IPv6 native connection. They aim at early widespread deployment of IPv6, and support IPv6 connection business for ISPs.

✓ Japan Cable Laboratories published detailed version of action plans on IPv4 address exhaustion for CATVs.
  • More detailed action plan guidelines and model cases for IPv6 adaptation are introduced. (http://www.kokatsu.jp/blog/ipv4/data/jlabs-guideline-2010.html, Japanese Only)
Milestone: Network Area (ISP, iDC etc.)

The following represents recommendations of typical actions for network operators in dealing with IPv4 address exhaustion. (* Refer to the action items in the diagram on the next page.)

1. Policy Development, Decision Making by Management
   i. Analyze the impact of the exhaustion on your organization.
   ii. Perform the business decision for the preparation policy.
      ➢ i.e.: ignore this exhaustion issue?, how to solve? (IPv6?, LSN?, etc.), When?, which type of access network? etc.

2. Business Planning/Review, Service Planning
   i. Policy detailing and the business plan development.
      ➢ i.e.: service planning, basic network design, consideration of operating procedures and systems, etc.

3. Design, Technology Verification

4. Equipment Selection, Procurement, System Building, Preparation of O&M system

5. Workforce training

6. Launch Basic Services
### Action Plan: Network Area (ISPs)

#### Action Plan for Network Players (ISPs)

<table>
<thead>
<tr>
<th>Year</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
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<tr>
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<td>1</td>
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<td>6</td>
<td>7</td>
</tr>
</tbody>
</table>

#### Policy development
- Decision making by Management
- Business plan making, service planning
- Business plan decision
- Design, Technology verification
- Equipment selection
- Equipment procurement, system building
- O&M system preparation
- Workforce training
- Launch basic services

#### Recommended Schedule

- **Present time**: Policy development
- **Q3 2008**: Business planning, service planning
- **Q4 2008**: Decision making
- **Q1 2009**: Design, Technology verification
- **Q2 2009**: Equipment selection
- **Q3 2009**: Equipment procurement, system building
- **Q4 2009**: Operational system preparation
- **Q1 2010**: Workforce training
- **Q2 2010**: Start of IPv6 access services via NTT’s IPv6 internet access over NGN is planned to be launched in April 2011, which will enable ISP’s IPv6 services.
- **Q3 2010**: Launch basic services
- **Q4 2010**: Service launch

#### Latest start Schedule

- **Present time**: Policy development
- **Q3 2009**: Business planning, service planning
- **Q4 2009**: Decision making
- **Q1 2010**: Design, Technology verification
- **Q2 2010**: Equipment selection
- **Q3 2010**: Equipment procurement, system building
- **Q4 2010**: Operational system preparation
- **Q1 2011**: Workforce training
- **Q2 2011**: Start of IPv6 access services via NTT’s IPv6 internet access over NGN is planned to be launched in April 2011, which will enable ISP’s IPv6 services.
- **Q3 2011**: Launch basic services
- **Q4 2011**: Service launch

#### Key Points

- **Since possible service development period is 2 years, this is a recommended time to start the process.**
- **Most Japanese companies plan the next financial year (starting in April)’s budget in 1Q.**
- **NTT’s IPv6 internet access over NGN is planned to be launched in April 2011, which will enable ISP’s IPv6 services.**
- **At latest, ISPs need to start new services before JPNIC exhaustion, i.e. IPv6–ONLY users may appear.**
- **Some companies (e.g. CATV) can start new services earlier via their own access network.**
Present Status of Progress: Network Area (ISPs)

- **Policy development**
  - Management decision
  - Business planning
- **Decision making by Management**
  - Business plan decision
- **Business plan making, service planning**
  - Design, Technology verification
  - (Testbed verification)
- **Equipment selection**
- **Equipment procurement, system building**
- **O&M system preparation**
- **Workforce training**
- **Launch basic services**

Information disclosure on IPv4 address exhaustion is slower pace than projected.

If the management decision is delayed by one year, the entire schedule will be set back one year.

Most ISPs have set a target at this point to start IPv6 services.

Recommended Schedule

Latest start Schedule

Ver. 2010.10

- Start of IPv6 access services via NTT’s
- NGN tunneling method/ native method specs were decided.

IANA Exhaustion
JPNIC Exhaustion
△ Predicted IANA exhaustion
△ Predicted RRs exhaustion time
△ Start of IPv6 access services via NTT’s

Recommended Schedule

Latest start Schedule

Ver. 2010.10

- Start of IPv6 access services via NTT’s
- NGN tunneling method/ native method specs were decided.

IANA Exhaustion
JPNIC Exhaustion
△ Predicted IANA exhaustion
△ Predicted RRs exhaustion time
△ Start of IPv6 access services via NTT’s

Recommended Schedule

Latest start Schedule

Ver. 2010.10
### Action Plan: Network Area (iDC)

**Action Plan for Network Players (iDC)**

*This page is especially for BtoC (The plan for enterprise can be found in Business user Area page)*

<table>
<thead>
<tr>
<th>Year</th>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
<th>Q4</th>
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<tr>
<td>2012</td>
<td>7</td>
<td>9</td>
<td>10</td>
<td>12</td>
</tr>
</tbody>
</table>

- **Policy development**
- **Decision making by Management**
- **Business plan making, service planning**
- **Business plan decision**
- **Design, Technology verification**
- **Equipment selection**
- **Equipment procurement, system building**
- **O&M system preparation**
- **Workforce training**
- **Launch basic services**

#### Key Points:

- In iDC plan, preparation required is relatively simple in comparison with ISP’s. Possible preparation period is one year or so.
- ASP/CSP’s demands for verification are expected. (See p.10.)
- As at the latest, iDCs need to start new service before IPv6 user packets begins to arrive.
- If the management decision is delayed by one year, the entire schedule will be set back one year.

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**Recommended Schedule**

**Latest start Schedule**

**IANA Exhaustion**

**JPNIC Exhaustion**

**Predicted IANA exhaustion**

**Predicted RIRs exhaustion time**

**Start of IPv6 access services via NTT’s**

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### Present Status of Progress: Network Area (iDC)

<table>
<thead>
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<th>Quarter</th>
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<td>3Q</td>
<td>Policy development</td>
</tr>
<tr>
<td></td>
<td>4Q</td>
<td>Decision making by Management</td>
</tr>
<tr>
<td>2009</td>
<td>1Q</td>
<td>Business plan making, service planning</td>
</tr>
<tr>
<td></td>
<td>2Q</td>
<td>Business plan decision</td>
</tr>
<tr>
<td></td>
<td>3Q</td>
<td>Design, Technology verification</td>
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<td>4Q</td>
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<td>2010</td>
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<td>O&amp;M system preparation</td>
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<tr>
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<td>4Q</td>
<td>Launch basic services</td>
</tr>
<tr>
<td></td>
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<td>Recommended Schedule</td>
</tr>
<tr>
<td></td>
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<td>Latest start Schedule</td>
</tr>
<tr>
<td>2011</td>
<td>1Q</td>
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<tr>
<td></td>
<td>2Q</td>
<td>Predicted RIRs exhaustion time</td>
</tr>
<tr>
<td></td>
<td>3Q</td>
<td>Start of IPv6 access services via NTT’s</td>
</tr>
</tbody>
</table>

- **Policy development**
- **Decision making by Management**
- **Business plan making, service planning**
- **Business plan decision**
- **Design, Technology verification**
- **Equipment selection**
- **Equipment procurement, system building**
- **O&M system preparation**
- **Workforce training**
- **Launch basic services**

Some of iDCs are already ready for IPv6.
Action Plan: Service Area (ASP/CSP)

The following represents recommendations of typical actions for Service (ASP/CSP: Application Service Provider/Contents Service Provider) Area are as follows.

1. Policy Drafting, Management Decision Making
2. Technology Verification, System Building
   i. Platform verification, selection, and building
      ➢ Server OS, Middleware
   ii. Service infrastructure design, verification and building
      ➢ DNS, Load Balancer, Firewall etc.
3. Application, Content
   i. Verify applications and contents under exhaustion situations (i.e. under such environments as IPv6, LSN)
4. O&M System
   i. Verify correct behavior of system log, database, operation system under the exhaustion situation (i.e. under such environments as IPv6, LSN)
5. Connection Line Procurement
   i. Selection of Internet connection line (dual stack access etc.), procurement, etc.
6. Workforce training
7. Launch Basic Services
### Action Plan: Service Area (ASP/CSP)

**Action Plan for Service (ASP/CSP) Area**

<table>
<thead>
<tr>
<th></th>
<th>2008</th>
<th>2009</th>
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<tr>
<td>2012</td>
<td></td>
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</tr>
</tbody>
</table>

#### Key Points:

- **Policy development**: Decision making by Management
  - Platform verification, Selection, Building
    - Server OS, Middleware
  - Service infrastructure design, verification, building
    - DNS, LB, FW
  - Application, Content (Web, DB) verification
  - O&M system (Log system, DB, Operation system) verification
- **Connection line procurement**
- **Workforce training**
- **Launch basic services**

**Recommended timeline of management decision can be flexible depending on complexity of the ASP/CSPs configuration, iDC service launch date, customer demand, and ISP trend.**

**Connecting line procurement**

**O&M system verification**

**Launch your service before IPv6 user packets begin to arrive**.

**In most ASP/CSPs, verification can be done within a relatively short time.**

**Recommended Schedule**

**Latest start Schedule**

**Predicted IANA exhaustion time**

**Start of IPv6 access services via NTT’s**

**Recommended Schedule**

**Latest start Schedule**

**Ver. 2010.10**

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Currently, not many IPv6 users exist, so many of ASPs/CSPs do not make a decision right now (some of them prepare for IPv6, their status is diverse in two opposite directions.)
**Action Plan: Business users** (incl. government agencies and local government)

As not many business users (including government agencies and local government etc.) require new IPv4 addresses, IPv4 address exhaustion will not make a big impact for them, but they should think about following issues carefully.

<table>
<thead>
<tr>
<th>✓ Preparation of IPv6/IPv4 dual stack on DMZ for public servers</th>
</tr>
</thead>
<tbody>
<tr>
<td>• After April 2011, starting time of IPv6 connection service on NGN, IPv6 users for consumer side will appear for real, therefore, public servers should be accessible by IPv6.</td>
</tr>
<tr>
<td>• Most of the standard equipment for DMZ (router/switch, firewall, load-balancer and servers etc) is ready for IPv6, so IPv6/IPv4 dual stack preparation is not so difficult now.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>✓ IPv6 utilization for WAN line (IP-VPN etc)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• NGN of NTT or coming Next Generation mobile communication “LTE”, will provide services based on IPv6, such as NGN IPv6 Native Connection. After 2011, cases where even co-operate users utilize IPv6 for IP-VPN, etc, are likely to emerge.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>✓ Getting IP addresses when a company’s new overseas branch establishment</th>
</tr>
</thead>
<tbody>
<tr>
<td>• In a region such as Asia where IP address demand is rapidly rising, it may be necessary to consider the use of IPv6, as it is expected to be difficult to obtain new IPv4 addresses, or extremely high priced even if they can be obtained.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>✓ IPv6 communication inside of the intranet</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Most of the applications which are used by corporate users do not take account of IPv6, so it is not realistic to transit to IPv6 for whole intra-net. However, IPv6 support should be taken into consideration when deploying new equipment and software.</td>
</tr>
<tr>
<td>• Furthermore, as some equipment such as a PC is ready for IPv6 by default, corporate users need to manage security matters like IPv6 communication monitoring.</td>
</tr>
</tbody>
</table>

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### Action Plan and Progress situation for Business User Area

<table>
<thead>
<tr>
<th>Year</th>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
<th>Q4</th>
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<tr>
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<tr>
<td>2011</td>
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</tbody>
</table>

#### Key Points:

- **Dualization of Disclosed server and DMZ**
- **Remote access via IPv6**
- **Enabling IPv6 over IP-VPN**
- **ASP/SaaS usage**
- **Enabling IPv6 in Internet**

### Observations:

- Most of corporate users take no big actions.
- However, after starting of IPv6 connection service by NGN, it can be expected to have some users to start considering about utilizing IPv6.

### Recommended Start Time:

- **ISP launch IPv6 access via NGN** (IPv6 users start growing)
- **Predicted IANA exhaustion time**
- **Recommended start time of iDC’s IPv6**
- **Recommended start time of ASP’s IPv6**
Action Plan: Other Players’ Area

✔ System Integrator / Outsourcee
  • System Integrators and outsourcees basically follow the demands of their customers. Development and verification of solution for the IPv4 address exhaustion, preempting customer's schedule and action plan, may give some advantages to their business
    ➢ For Enterprise customer service -> Start Preparation based on the Milestone for Business User Area
    ➢ For ISP/iDC -> Start Preparation based on the Milestone for Network Area

✔ Consumer electronics company etc.
  • UPnP will not go through in some part of the internet when IPv6 connection or IPv4 connection through LSN services are launched with IPv4 address exhaustion. At this timing, all devices to be connected to the internet should be ready for IPv6. It should be noted that the life cycle of home electronics is long, so those products should be ready for IPv6 in the earlier timing.

✔ Home users
  • Required actions depend on the ISP that each user connects to.
  • Basically, ISPs are trying to minimize influences to customers.