What can IXPs do about IPv4 exhaustion ??

Japan Internet Exchange Co., Ltd.

Masataka MAWATARI <mawatari[at]jpix.ad.jp>

Agenda

1. What we will talk here
2. Motivation
3. IPv6/IPv4 Translator in IXP
4. The way we consider about IPv6/IPv4 Translation
5. Transition Scenario
6. Pros and Cons
7. Request for Comments

1. **What we will talk here**
2. Motivation
3. IPv6/IPv4 Translator in IXP
4. The way we consider about IPv6/IPv4 Translation
5. Transition Scenario
6. Pros and Cons
7. Request for Comments

What we will talk here

- ## What can IXPs do about IPv4 address exhaustion
  - ### This is unprecedented crisis?
    - Please, prepare IPv4 -> IPv6 transition immediately.
  - ### We want to think about cooperation between ISPs and IXPs.
    - Major carrier ISPs...
      - They will solve IPv4 address exhaustion in only its own backbone network. (out of scope)
    - But, smaller ISPs...
      - Not easy to solve IPv4 address exhaustion in only their own backbone network.

1. What we will talk here
2. **Motivation**
3. IPv6/IPv4 Translator in IXP
4. The way we consider about IPv6/IPv4 Translation
5. Transition Scenario
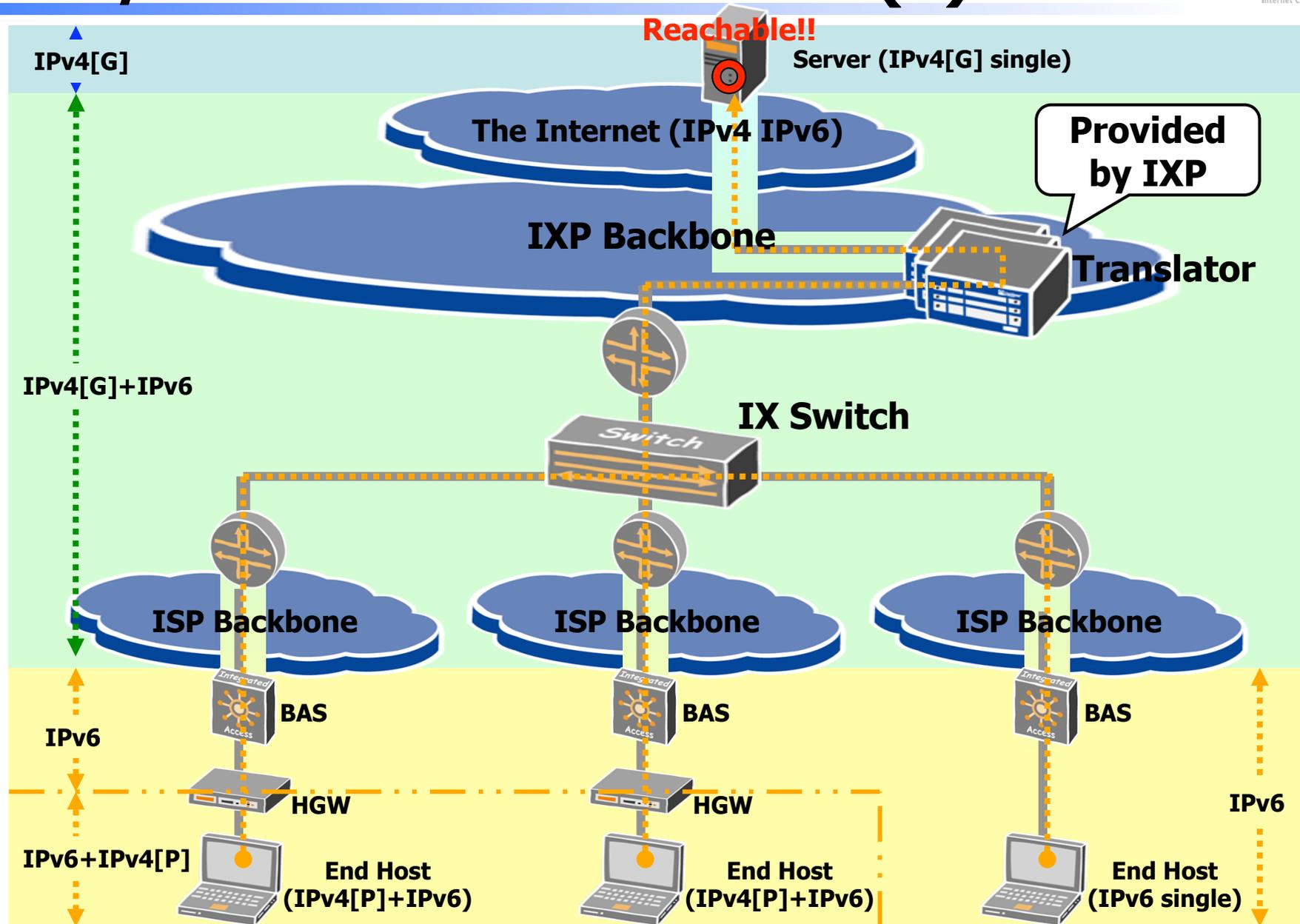6. Pros and Cons
7. Request for Comments

Motivation

- **Shortage of IPv4 global address is coming.**
  - IANA IPv4 address pool exhaustion at 2010 late ~ 2011 early.
  - Most ISPs are preparing IPv4/IPv6 dual stack backbone.
  - There are many proposals of IPv4/IPv6 transition technology.
- **What can IXPs do for ISPs.**
  - IPv4/IPv6 dual stack port service is available at most of IXPs.
  - Besides, what can IXPs do? (not enough?!)
- **First impact of the exhaustion will be expanding subscriber ISPs.**
  - Can IXP help or ease the problem?

1. What we will talk here
2. Motivation
3. **IPv6/IPv4 Translator in IXP**
4. The way we consider about IPv6/IPv4 Translation
5. Transition Scenario
6. Pros and Cons
7. Request for Comments

IPv6/IPv4 Translator in IXP (1)

- **After exhausting IPv4 global address…**
  - ISPs can't assign IPv4 global address to new subscriber's end host.
  - So, ISPs assign IPv6 address to new subscriber's end host.

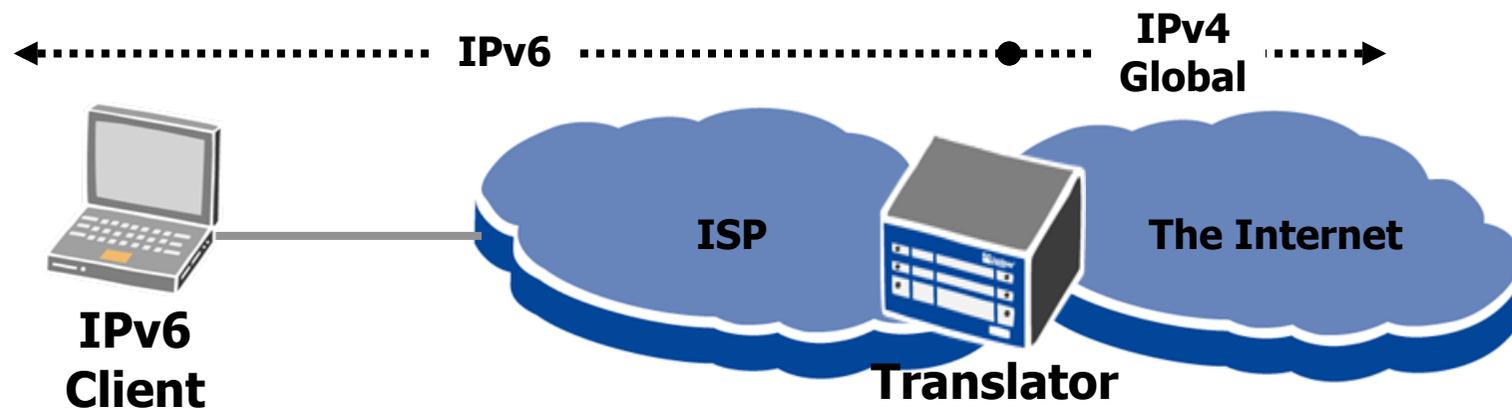- **IPv6/IPv4 Translator provides IPv4 global reachability to the IPv6 single stack end host.**

1. What we will talk here

2. Motivation

3. IPv6/IPv4 Translator in IXP

4. **The way we consider about IPv6/IPv4 Translation**

5. Transition Scenario
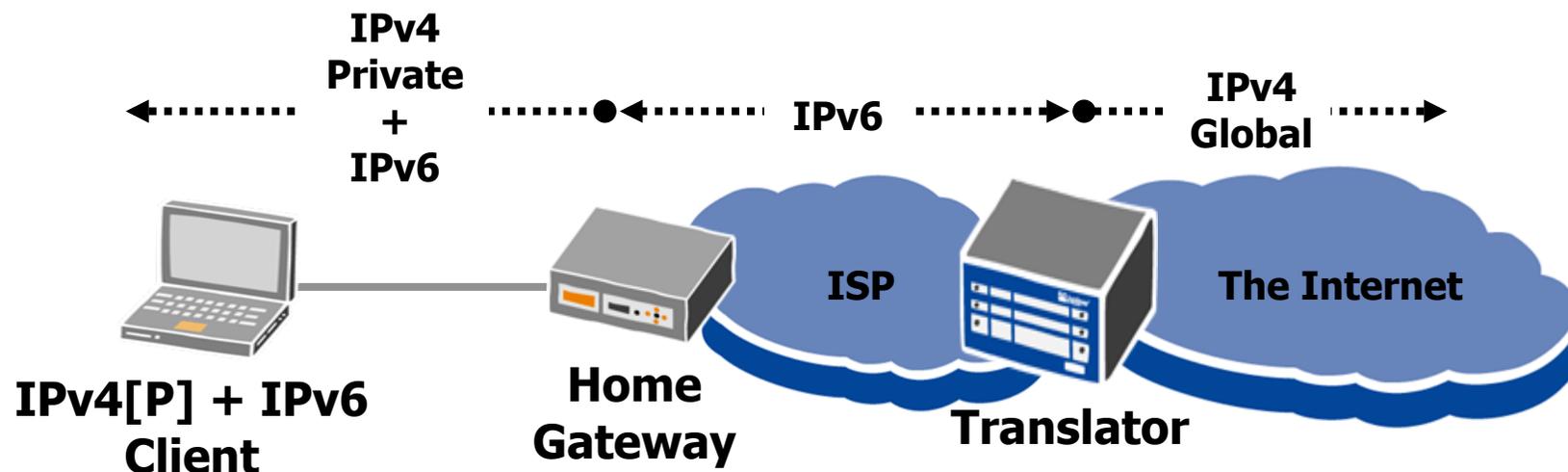
6. Pros and Cons

7. Request for Comments

The way we consider about IPv6/IPv4 Translation (1)

- ## v6 → v4[G]

    - **Directly assign IPv6 address to customer's end clients**

    - **The packets from the IPv6 single stack end clients is translated to IPv4 global packets**

IPv6 .... IPv4 Global

ISP   The Internet
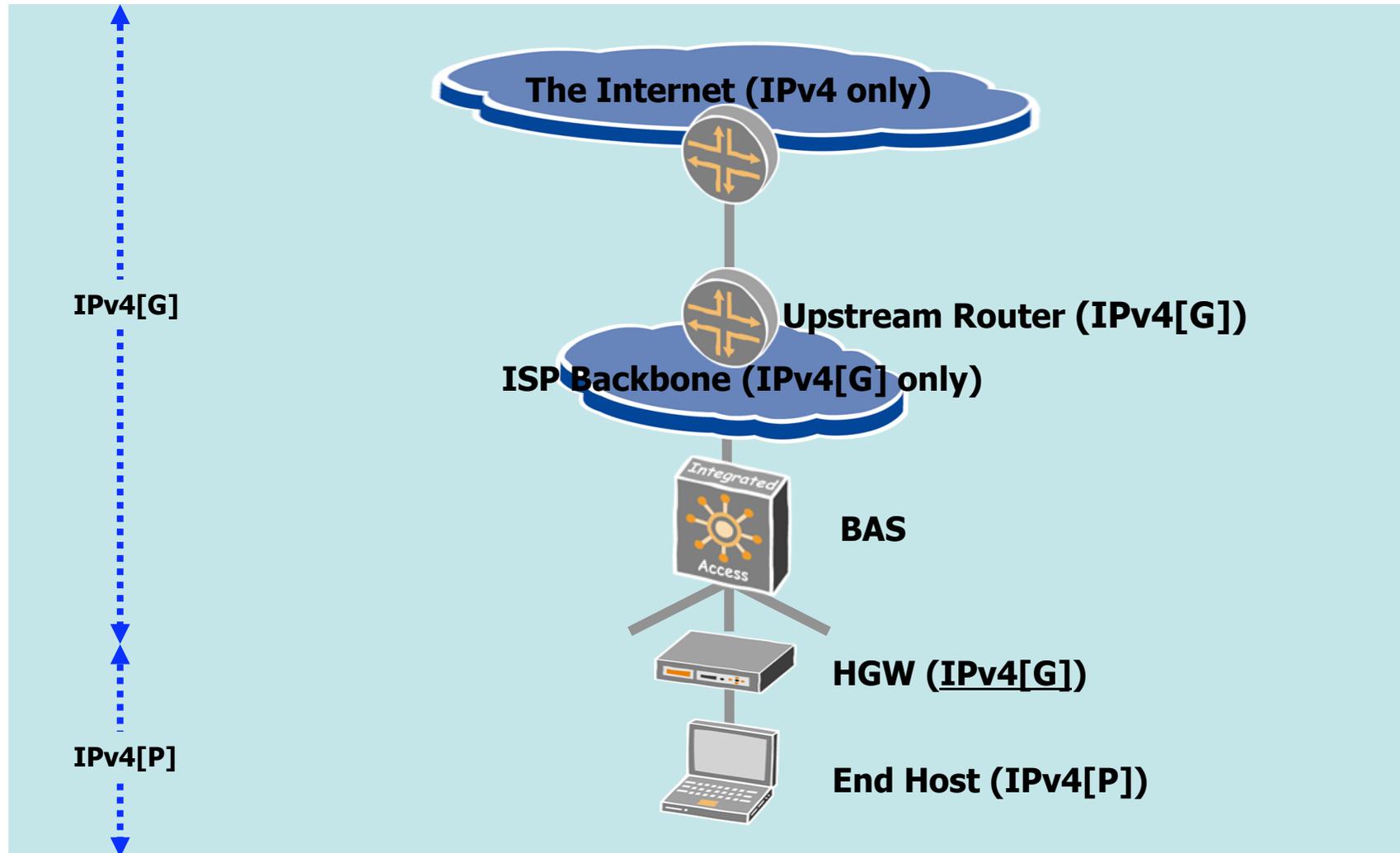
IPv6 Client   Translator

jpix

- ## v4[P] → v6 → v4[G]
  - ### Customer's end host (IPv4 private+IPv6 dual stack) behind HGW delegated IPv6 prefix
  - ### The packets translated from IPv4 private to IPv6 at HGW is translated to IPv4 global packets.

IPv4 Private + IPv6

IPv6

IPv4 Global

ISP

The Internet

IPv4[P] + IPv6 Client

Home Gateway

Translator

1. What we will talk here
2. Motivation
3. IPv6/IPv4 Translator in IXP
4. The way we consider about IPv6/IPv4 Translation
5. **Transition Scenario**
6. Pros and Cons
7. Request for Comments

Transition Scenario (step1)

IPv4 only Internet

IPv4[G]

IPv4[P]

The Internet (IPv4 only)

Upstream Router (IPv4[G])

ISP Backbone (IPv4[G] only)

Integrated

Access

BAS

HGW (IPv4[G])

End Host (IPv4[P])

Transition Scenario (step2)

IPv4/IPv6 dual stack ISP backbone

The Internet (IPv4 IPv6)

IPv4[G] IPv6

Upstream Router (IPv4[G] IPv6)

ISP Backbone (IPv4[G] IPv6)

BAS

IPv4[G]

HGW (IPv4[G])

IPv4[P]

End Host (IPv4[P])
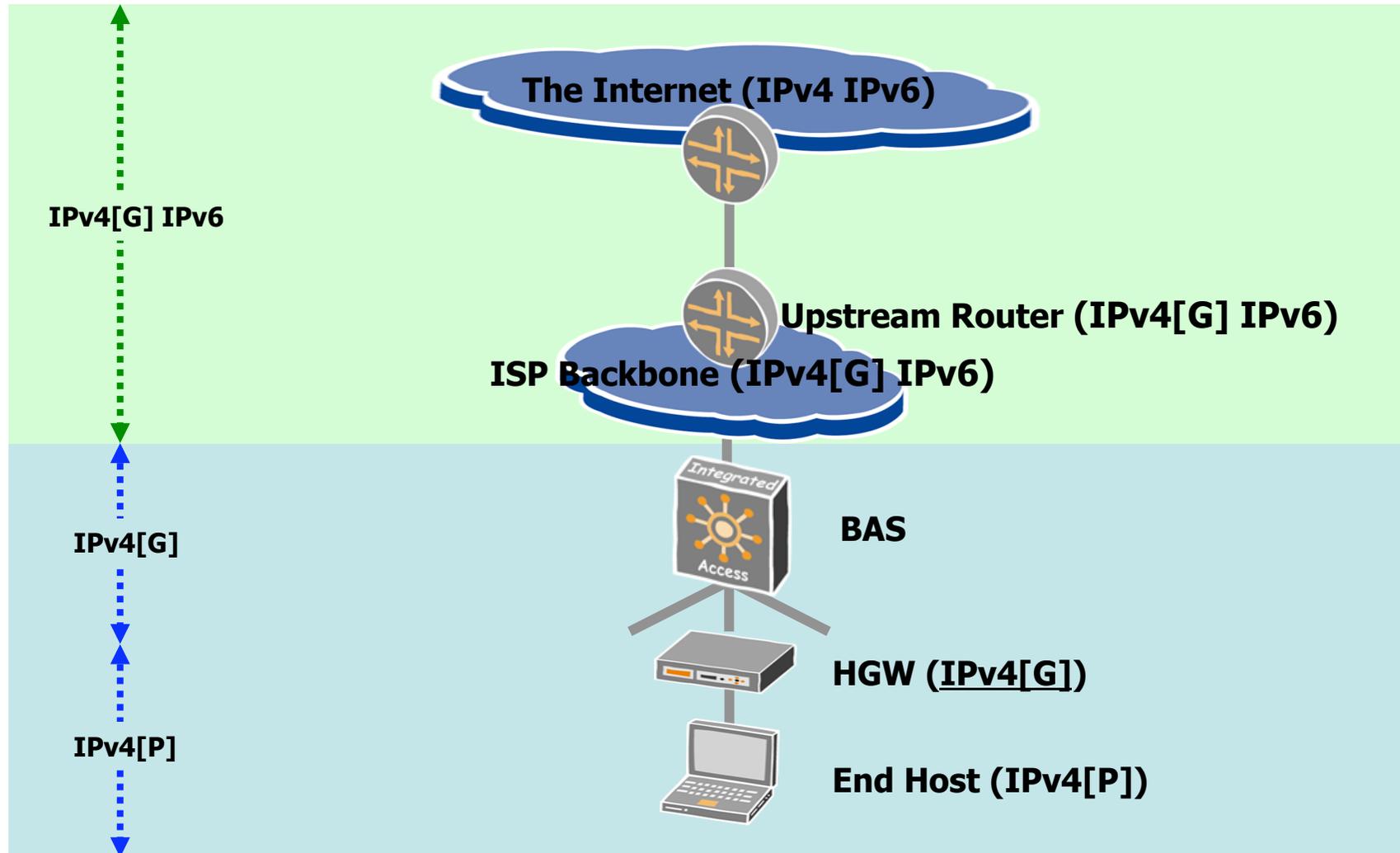
Number of ISP's end customers increase, IPv4 global address exhausts

The Internet (IPv4 IPv6)

IPv4[G] IPv6

Upstream Router (IPv4[G] IPv6)

ISP Backbone (IPv4[G] IPv6)

IPv4[G]

BAS

lack of IPv4 global address assigned to end customers

HGW (IPv4[G])

IPv4[P]

End Host (IPv4[P])
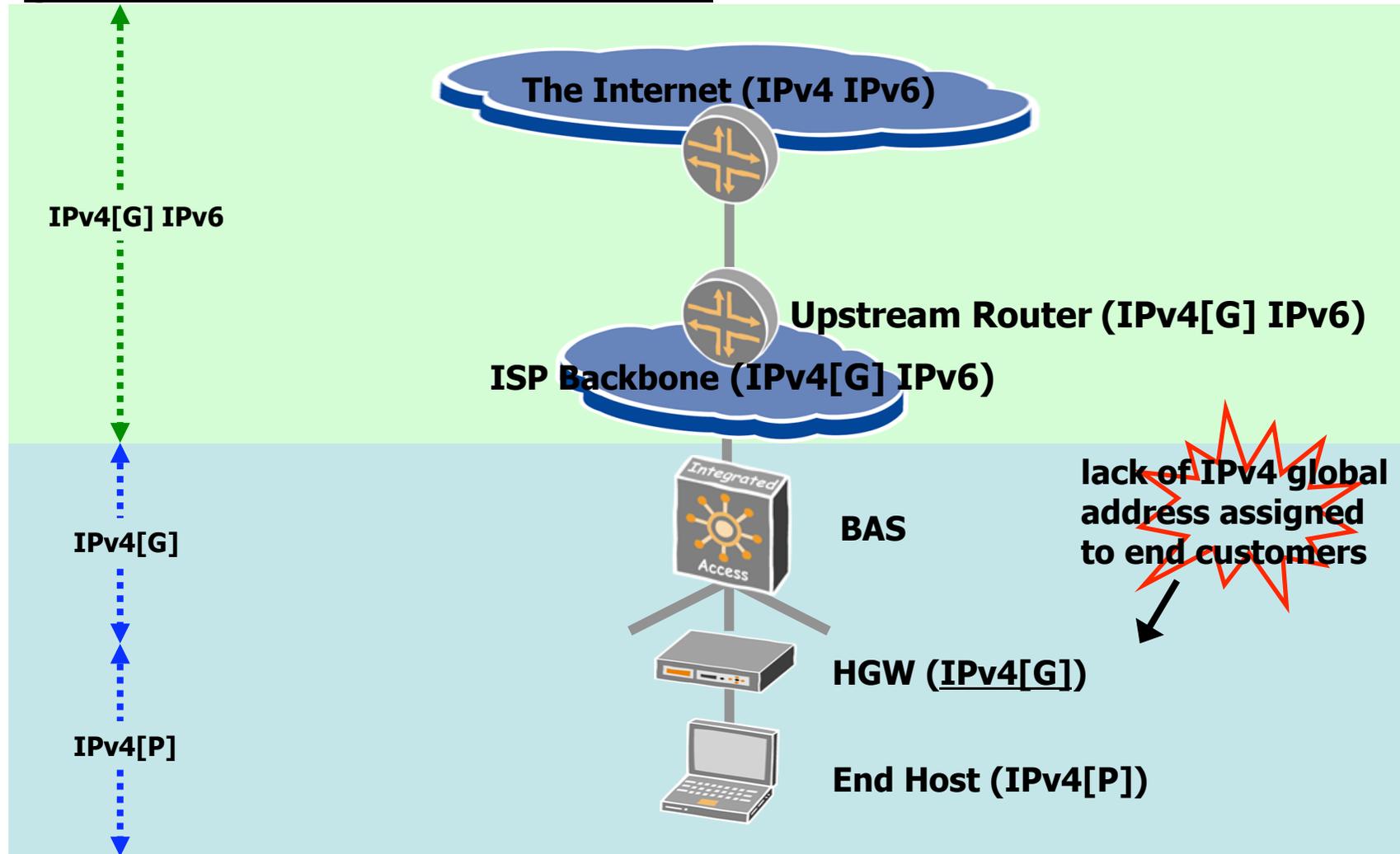
Assign IPv6 address to new ISP's end customers...

The Internet (IPv4 IPv6)

Upstream Router (IPv4[G] IPv6)

ISP Backbone (IPv4[G] IPv6)

IPv4[G] IPv6

IPv4[G]

IPv4[P]

IPv6

IPv6 IPv4[P]

Existing Customer

BAS

BAS

New Customer

HGW (IPv4[G])

HGW (IPv6)

End Host (IPv4[P])

End Host (IPv4[P] IPv6)

Problem occurs!

Server (IPv4[G] Single Stack)

OK

NG

The Internet (IPv4 IPv6)

IPv4[G]

IPv4[G] IPv6

Upstream Router(IPv4[G] IPv6)

ISP Backbone (IPv4[G] IPv6)

IPv4[G]

Existing Customer

BAS

BAS

New Customer

IPv6

HGW (IPv4[G])

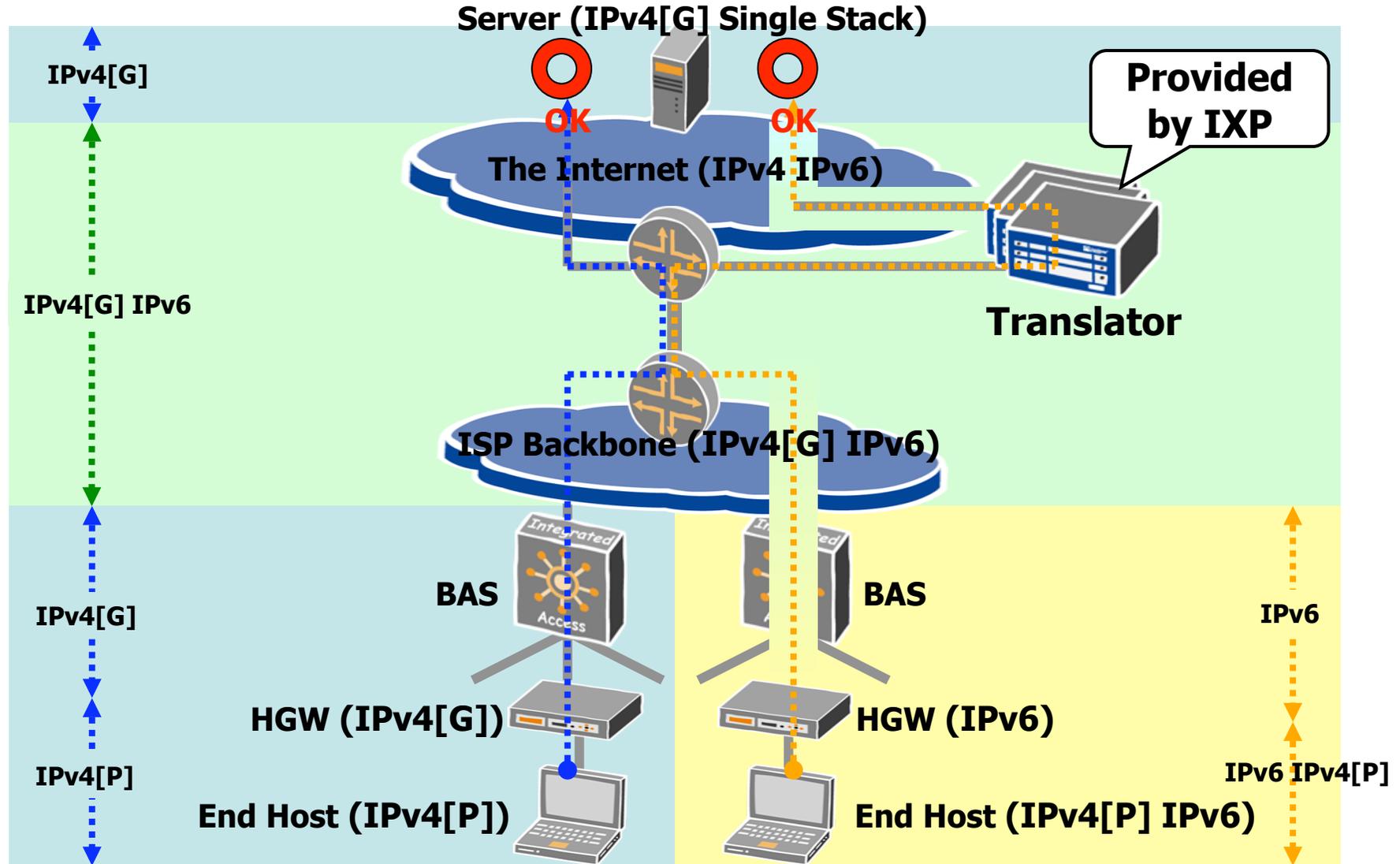HGW (IPv6)

IPv4[P]

End Host (IPv4[P])

End Host (IPv4[P] IPv6)

IPv6 IPv4[P]

IPv6 End hosts can't reach IPv4 single stack servers…

Transition Scenario (step5)

IXP provides IPv6/IPv4 Translator for ISPs

Server (IPv4[G] Single Stack)

IPv4[G]

OK

OK

Provided
by IXP

The Internet (IPv4 IPv6)

Translator

IPv4[G] IPv6

ISP Backbone (IPv4[G] IPv6)

BAS

BAS

IPv4[G]

IPv6

HGW (IPv4[G])

HGW (IPv6)

IPv4[P]

IPv6 IPv4[P]

End Host (IPv4[P])

End Host (IPv4[P] IPv6)
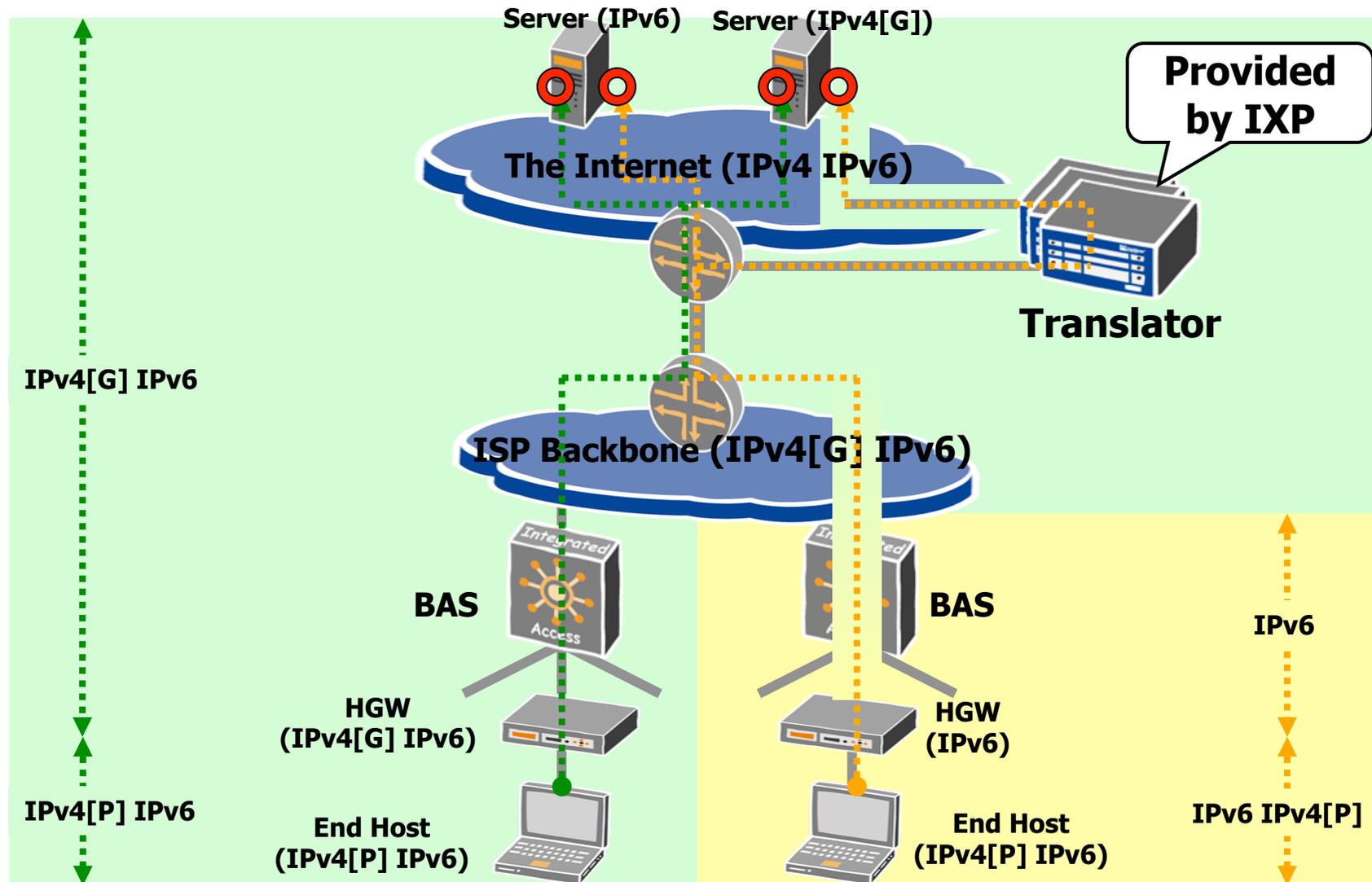
ISPs don't need to replace its own backbone network.

Transition Scenario (step6)

IPv4 global end customers gradually migrate to IPv4/ IPv6 dual stack service

Server (IPv6)   Server (IPv4[G])

Provided by IXP

The Internet (IPv4 IPv6)

Translator

IPv4[G] IPv6

ISP Backbone (IPv4[G] IPv6)

IPv4[G]

IPv6

IPv4[P]
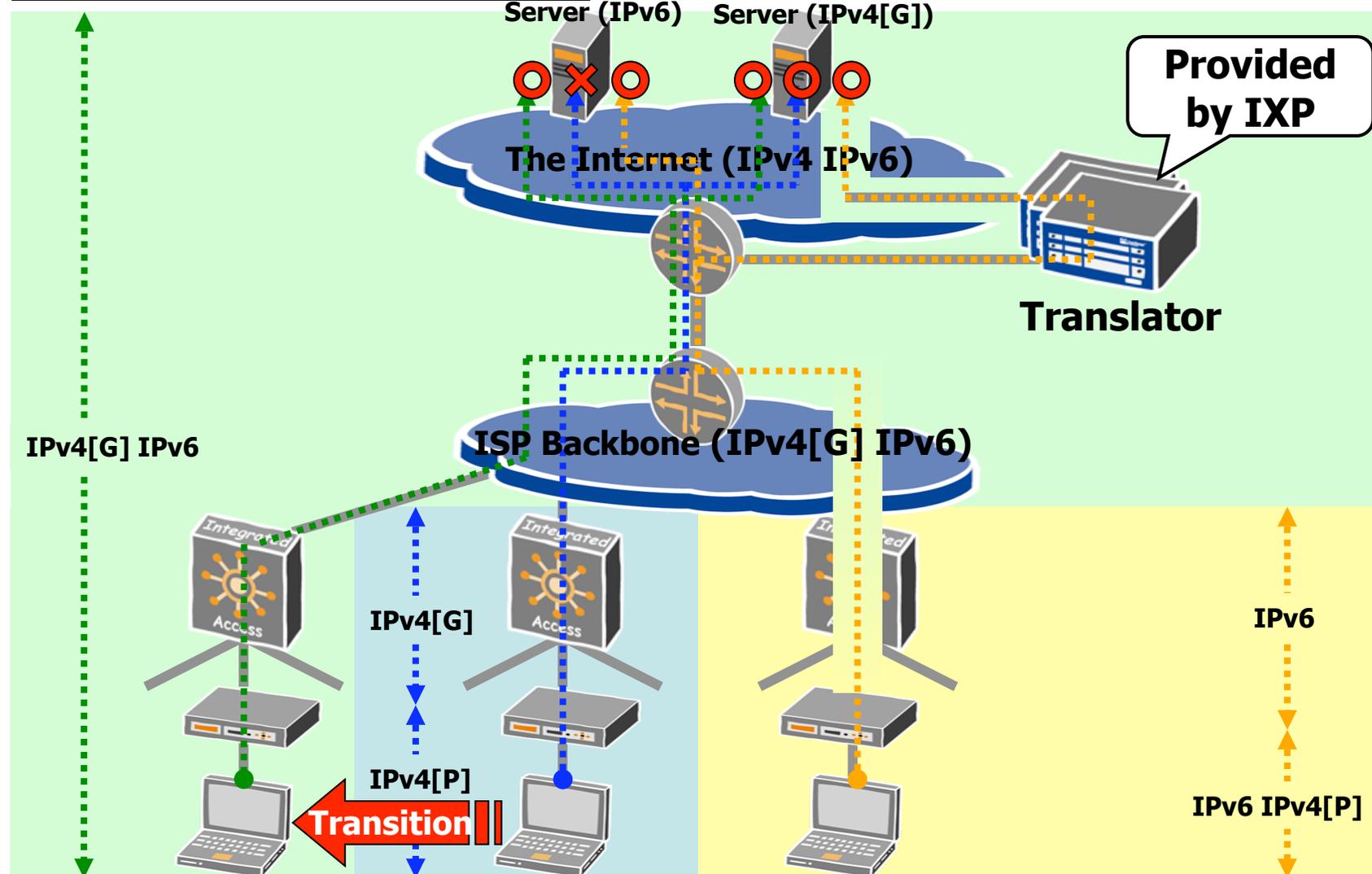
Transition

IPv6 IPv4[P]

IPv4/IPv6 dual stack migration is completed

Server (IPv6)   Server (IPv4[G])

Provided
by IXP

The Internet (IPv4 IPv6)

Translator

IPv4[G] IPv6

ISP Backbone (IPv4[G] IPv6)

BAS

BAS

IPv6

HGW
(IPv4[G] IPv6)

HGW
(IPv6)

IPv4[P] IPv6

End Host
(IPv4[P] IPv6)

End Host
(IPv4[P] IPv6)

IPv6 IPv4[P]

1. What we will talk here
2. Motivation
3. IPv6/IPv4 Translator in IXP
4. The way we consider about IPv6/IPv4 Translation
5. Transition Scenario
6. **Pros and Cons**
7. Request for Comments

Pros and Cons of the translator in IXP

- **Pros**
  - **This solution will save CAPEX/OPEX.**
    - **ISP doesn't need IPv6/IPv4 translator or Large Scale NAT in its own backbone network.**
  - **Before IPv4 global address exhaustion (2010-2011), ISPs can make preparations well in advance.**
  - **Traffic goes through IXP any way so Translator may be suitable located at exchange point.**

- **Cons**
  - **Some ISPs are going to share the IPv6/IPv4 translator resource.**
    - **Dealing with translator resources to each ISPs.**
      - **IPv6/IPv4 mapping table**
      - **IPv4 Pool Address**
      - **Access Logging System...etc...**
  - **We are trying to find means for solving the problems.**

1. What we will talk here
2. Motivation
3. IPv6/IPv4 Translator in IXP
4. The way we consider about IPv6/IPv4 Translation
5. Transition Scenario
6. Pros and Cons
7. **Request for Comments**

Request for Comments

- **Consideration about IPv6/IPv4 Translator**
  - **Transparency**
    - **Support application is enough, isn't it?**
  - **Scalability**
    - **Maximum number of sessions in IPv6/IPv4 Translator**
  - **Security**

- **JPIX's status**
  - **Planning to provide the IPv6/IPv4 Translation service for ISPs now.**

- **Any comments.**

Thank you