IP addressing Design in Practice

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What we will talk here from now on

- IP Addressing is one of the components of network design
  - It's basic to networking, but really important, and not easy
  - Know-how is not shared enough, is it?

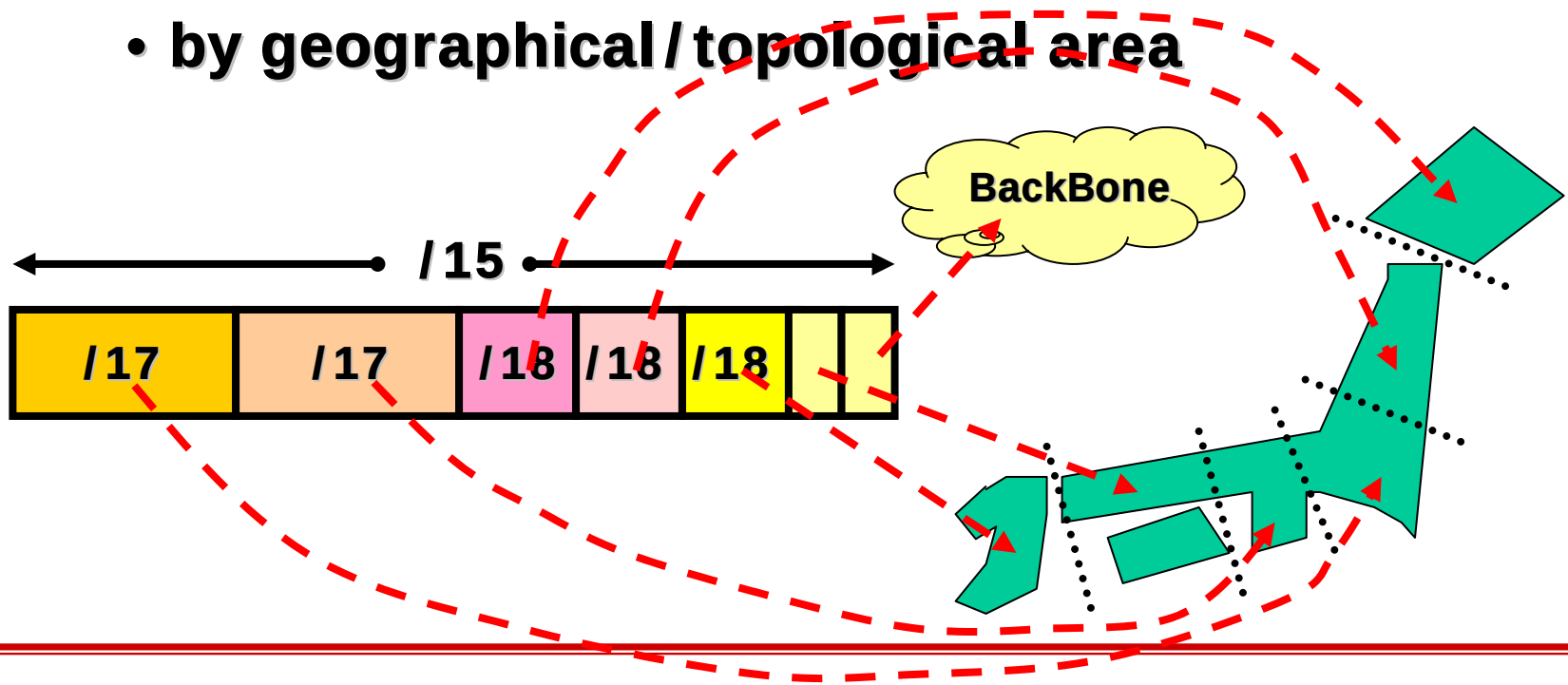
- Here will be presented about
  - Practical and current IPv4 Addressing
  - IPv6 Addressing in comparison with IPv4

IPv4 Addressing

which we should have been familiar with...

Addressing Plan is like...

- Segment and reserve address block for several attributes
  - by link category (user address pool, backbone link, loopback addresses ...etc)
  - by service (broadband, dialup ...etc)
  - by geographical / topological area

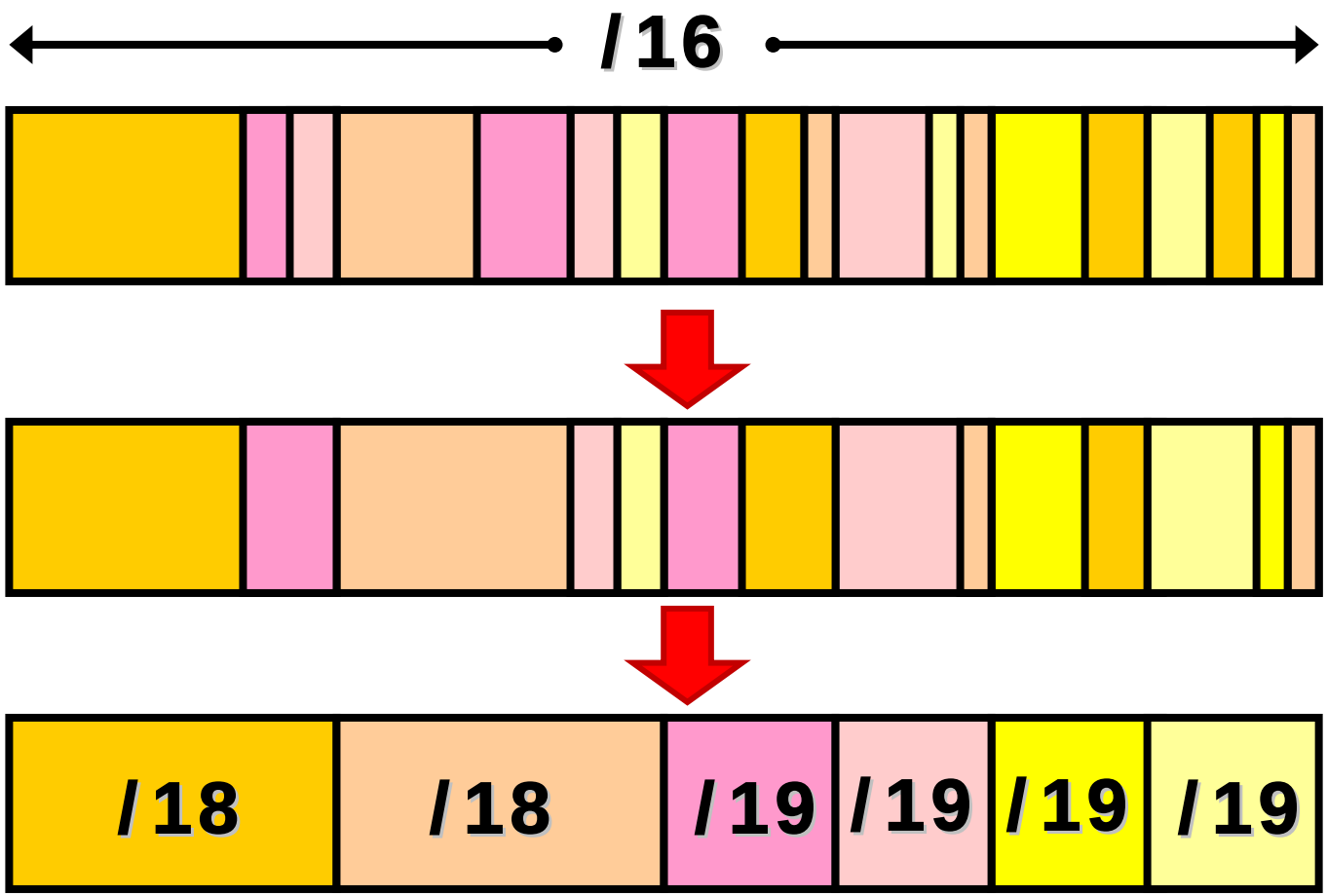


But reality is…

- Addressing plan needs to be fit as increase of users and services
  - Not easy to operate as planned.
  - Reality is often very different from the assumption
- Not easy to change design while operating.
  - We often have very little spare IP address for change operations
- IP address management starts getting disordered
- An unnecessary loss is generated.
  - It gets more trouble some to make sure routing works fine.
  - Configuring ACL becomes more difficult.

Reduce the present problem.

- Renumbering -> Aggregation

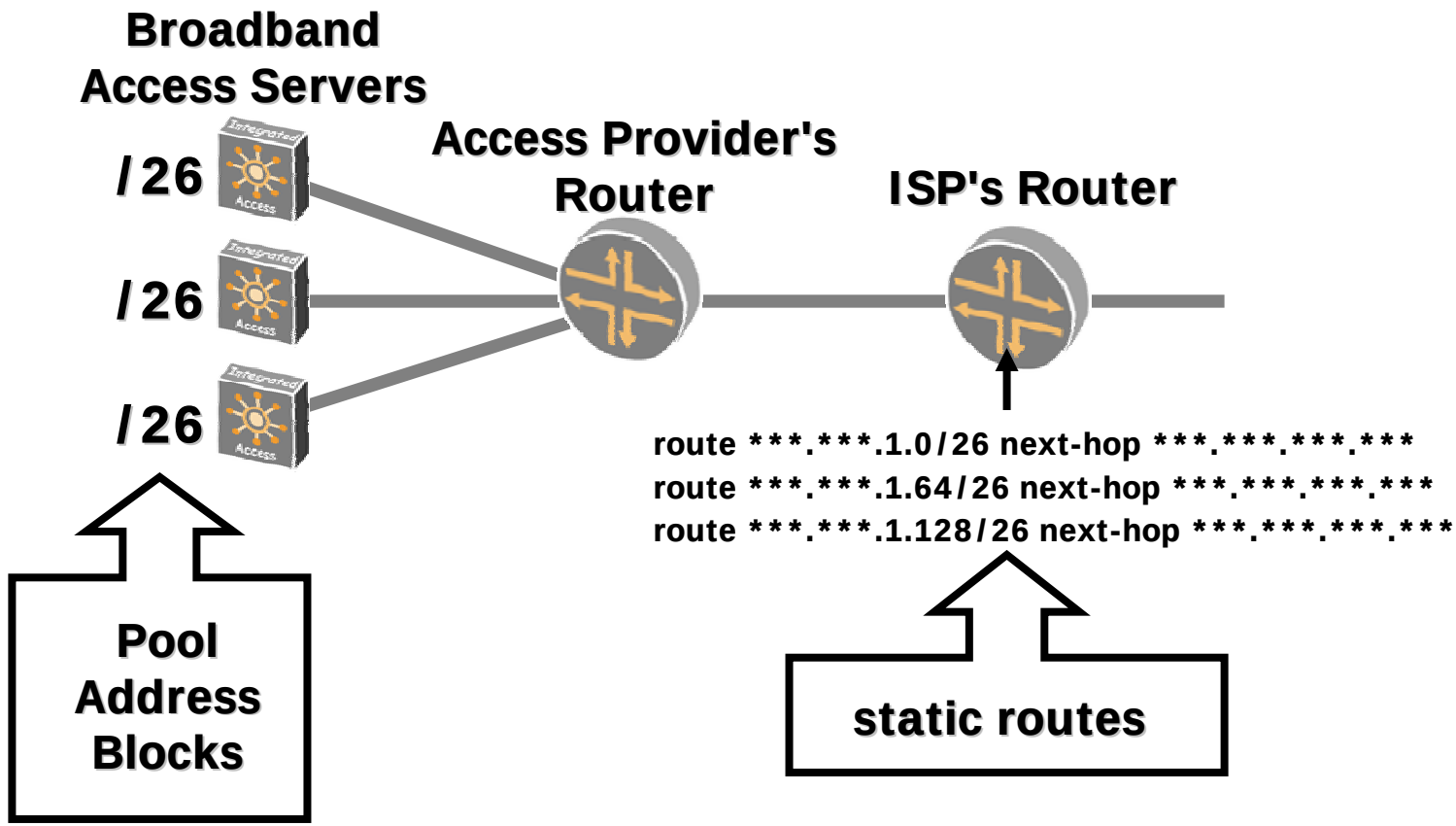


How we can do that?

- Revisiting the addressing plan
  - Situations differs by each xSPs
    - Consumer ISP
      - The biggest blocks are assigned for the client address pool
    - iDC
      - Fixed address or address blocks is assigned to customers.
    - Leased Line Service
      - Various size of address block are connected to Access Routers
  - The later to fix it, the more difficult to improve the order
    - The availability of IP address is always changing.
    - The situation of service is always changing, too.

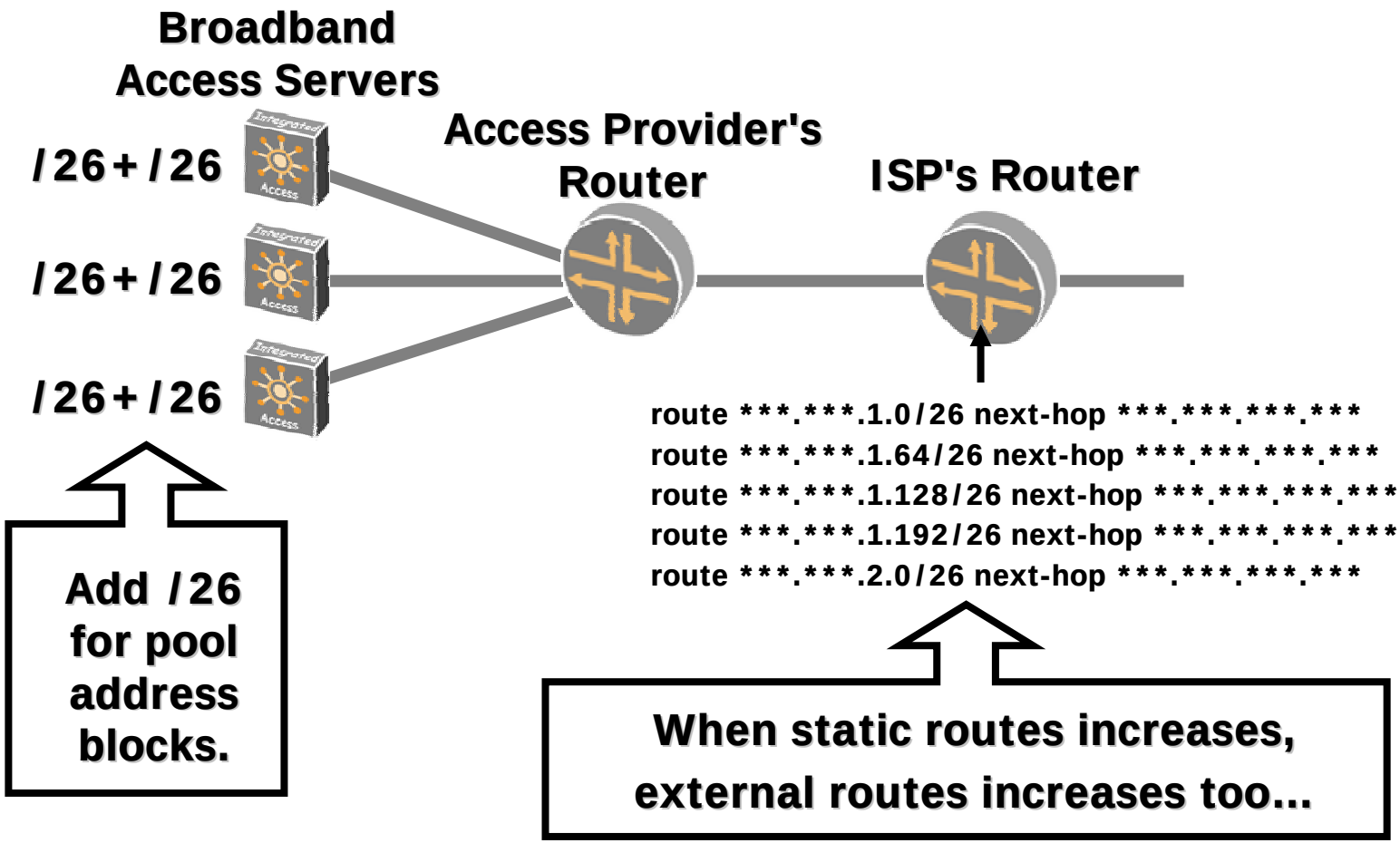
One of methods...

- Initial Condition



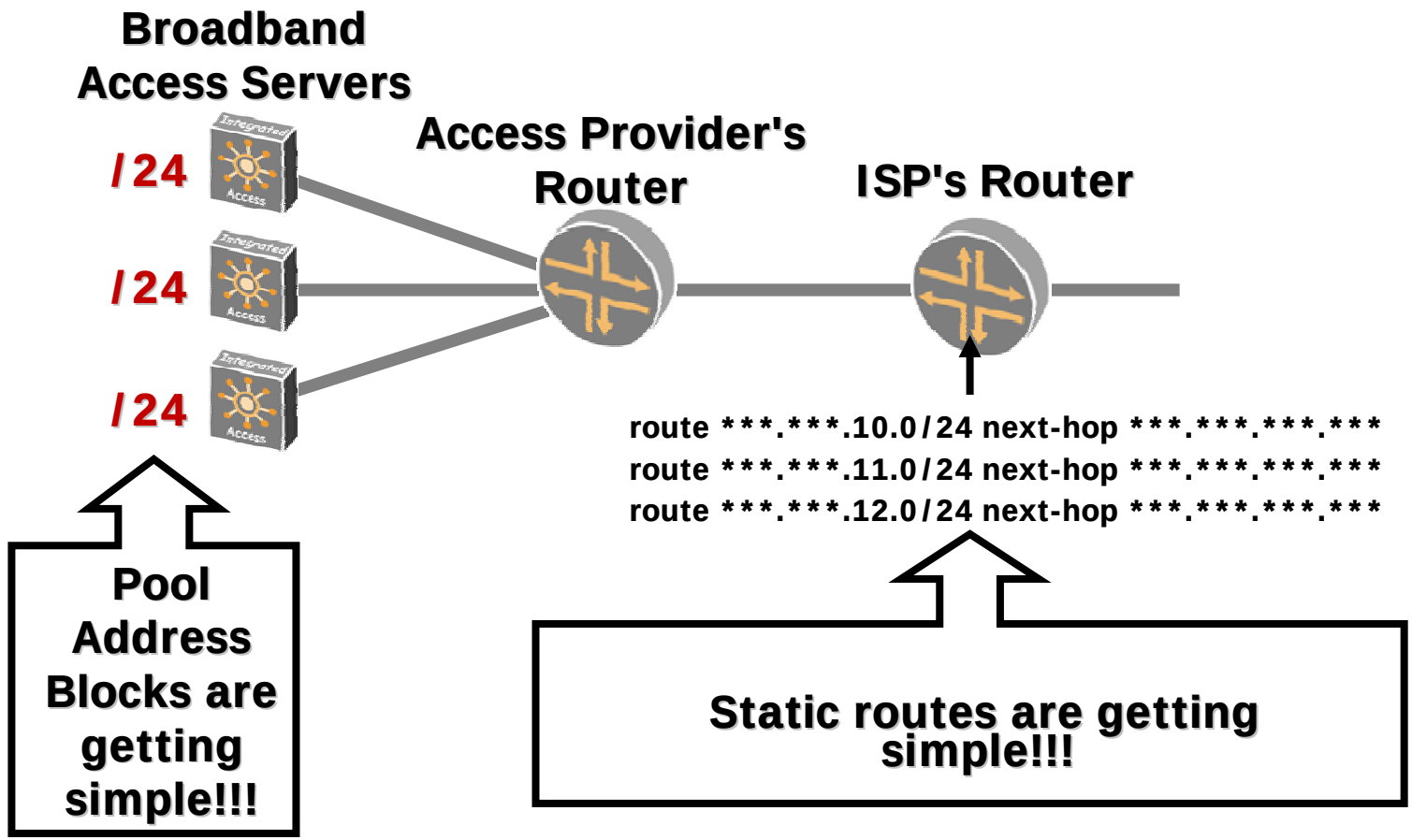
One of methods...(cont.)

- Users increasing...



One of methods...(cont.)

- **Renumbering!!**



To change the address plan...

- Renumber, defragment and aggregate!!
- Renumbering is painful, but...
  - Together with other maintenances
    - Redundant network configuration will help easier maintenance
  - It's still very good to execute renumbering little by little.
    - We can sometimes have a sufficient margin for renumbering. Keep track of amount of available IP address!
    - Day-to-day checks will work for planning tiny renumbering
  - It will result in reducing the division loss of IP address.

Summary so far

- Your IPv4 network is already rather old.
  - It's necessary to review the IP address design
    - Clues for the improvement may come out although it is still not found.
  - You still need to keep operating your IPv4 network.
- IPv6 is coming ! It is being as troublesome as IPv4 is now!
  - Think about IPv6 addressing now, and the trouble will be less!
  - Don't repeat the same mistake as IPv4.

Considering IPv6

The way we consider about IPv6 addressing

- Only dual stuck network is to be focused on
- Do we need any special consideration on IPv4 addressing when IPv6 is added on the network?
- The method for transition of IPv6 which you suppose
  - First, while considering IPv6 transition, improvement of IPv4 network
  - Secondly, Introduction for IPv6
    - We would like to examine whether consideration (1) is necessary

Care for IPv6 introduction Is necessary?
Which items we should care for?

Items to be considered

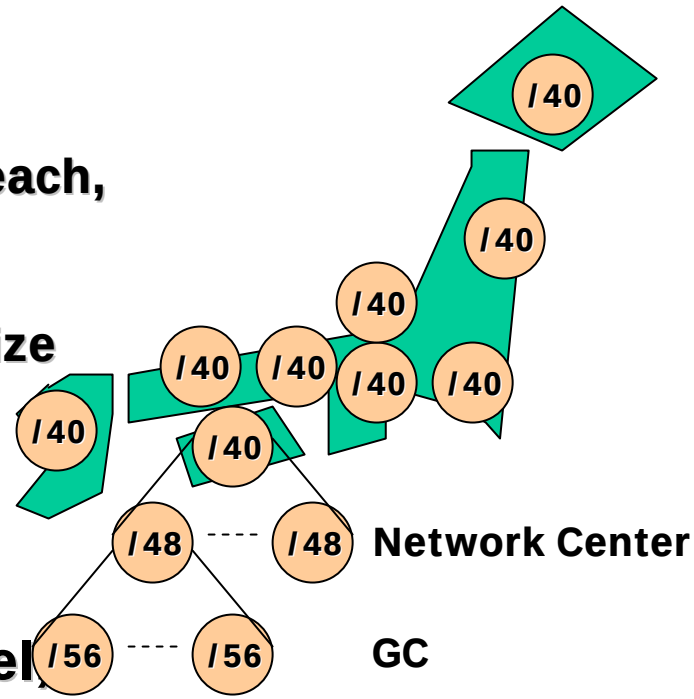
- Addressing
  - Links
    - Point-to-Point Link
    - LAN segment
  - Logical interfaces
- Area segmentation of address block
- Router ID
- Renumbering

Addressing

- Point-to-Point Links
  - /64 – as one segment
  - /126 – just like as /30 in case of IPv4,
  - /127 – was said okay originally, but…
    - RFC3627 - Use of /127 Prefix Length Between Routers Considered Harmful
  - or unnumbered
- LAN segments
  - Don‘t think! It is definitely /64!
  - 2^64 hosts can be connected (theoretically ☺)
    - we don't need to care about the number of hosts!
- Loopback address
    - /64（wasting? yes) or /128

Area

- fixed size block can be allocated to every area
  - For example /40 for an area
    - 256 PoPs, with 2^16 LAN segment each, ... don't think about the number of hosts!
    - No consideration needed for block size to be allocated
    - Network center level
      - East/West Japan
      - District, etc.
    - Prefecture level, Central PoP level, etc.
  - Implication to the segmentation of IPv4?
    - Much much easier than IPv4. Forget about that!



Consideration on dual stack network

- To embed IPv4 numbers to an IPv6 address

IPv4

192	0	2	222

(Likely) Host ID on a single segment

IPv6

/32 prefix

Host ID on a single segment

2001 : 0D88											02	22

64bit

Request For Comments

- While operating IPv4 addressing, do you have any points that you pay attention and you have devised?
  - The Point of caution and device in case of renumbering
  - The Point of caution and device in case of managing IPv4 addressing
- At the time of IPv6 introduction, the influence to addressing and the like of the IPv4 and consideration point does not seem so many.
  - First, do we have to consider this kind of consideration?
  - The influence and consideration point is not many. Is it right?
  - What items we should consider?