Consideration on IPv6 Address Management

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CNNIC
中国互联网络信息中心
CHINA INTERNET NETWORK INFORMATION CENTER

Outline

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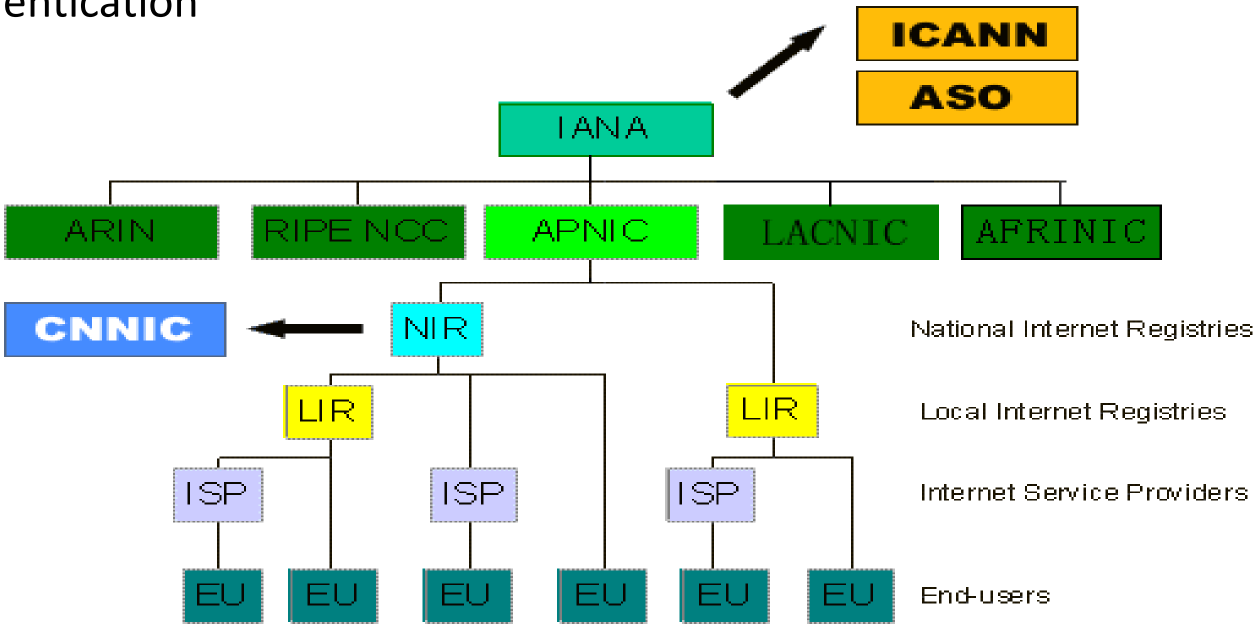
- CNNIC’s Mission on Address Management
- Current Address Management
- Considerations on Address Management
- Conclusion

CNIC's Mission on Address Management

- From the perspective of a NIR, CNNIC values the following targets
  - Address Aggregation
  - Address Administration
    - Allocation
    - Renumbering
    - Statistics
  - Address Authentication
  - …


ICANN
ASO
IANA
ARIN
RIPE NCC
APNIC
LACNIC
AFRINIC
CNNIC
NIR
National Internet Registries
LIR
LIR
Local Internet Registries
ISP
ISP
ISP
Internet Service Providers
EU
EU
EU
EU
EU
EU
End-users

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IPv4 Address Allocation

283 members of CNNIC IP Address Allocation Confederation

Allocation Window is 4B

More than 181 million IPv4 addresses in China, 26% of them are allocated by CNNIC

IPv4 Addresses

Country/Region	Number of IPv4 Addresses
USA	1480545792
Mainland China	205031168
Japan	155271963
Germany	85760152
Canada	76549888
Korea	72320768
UK	71075160
France	68283072
Australia	37630208
Italy	33116608

By June of 2009

IPv4 Address Management in China

National Internet Registry

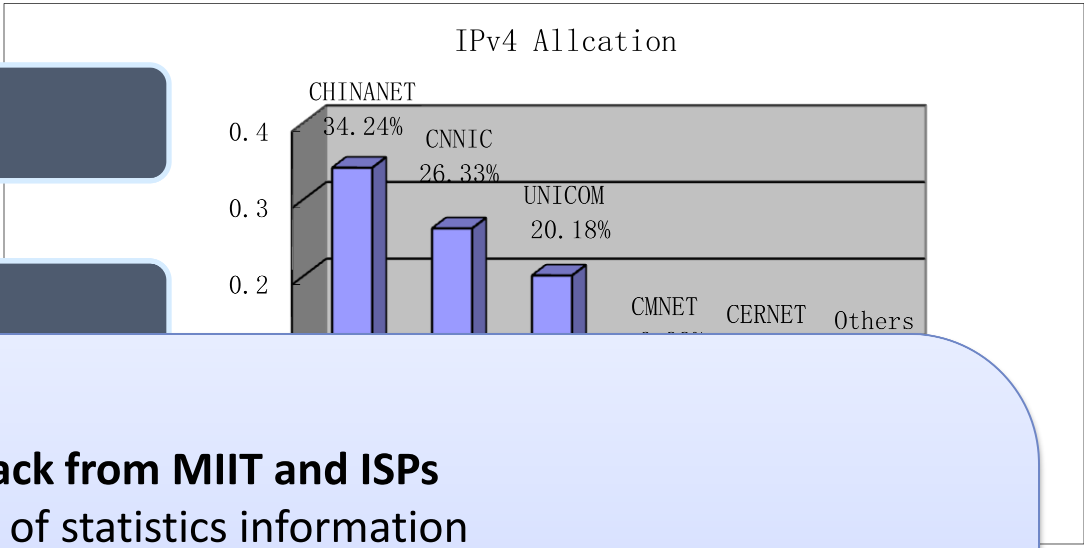
- CNNIC

Confederations

- China Telecom
- China Unicom
- CERNET

Common ISP

- Request from RIR
  - China Mobile
- Request from NIR or other
  - 263 Organizations

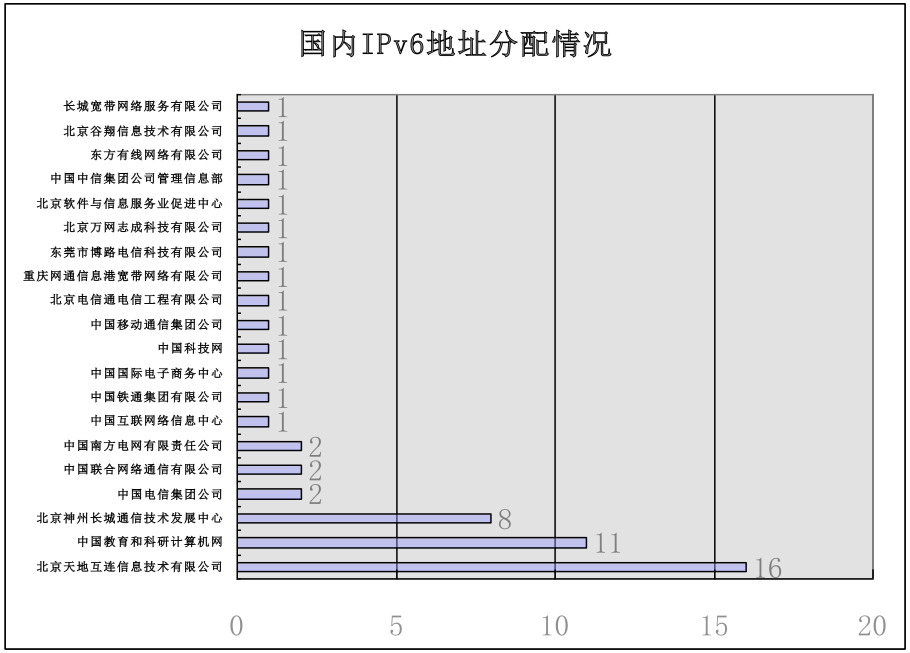


Feedback from MIIT and ISPs

- Lack of statistics information
  - For governance
  - For ISPs
- Inefficiency
  - Manual configuration
  - Address block number and BGP entries
  - The idleness of address
- User Identity Management
  - Billing
  - Customization

IPv6 Address Management in China

- The more organizations, the more complicated
- IPv6 brings some new features, providing some solutions to the above problems
  - Stateless address auto-configuration
  - Prefix Delegation
  - ID/locator split
  - Portable address



Goals for Address Management

Automation

- Automatic block allocation and end-point address assignment

Flexibility

- Support the change of network topology and scale

Information Sharing

- IP address Information sharing mechanism for Internet Governance
- IP address Information sharing mechanism inside the ISPs

Authentication

- Address is authorized and authenticated

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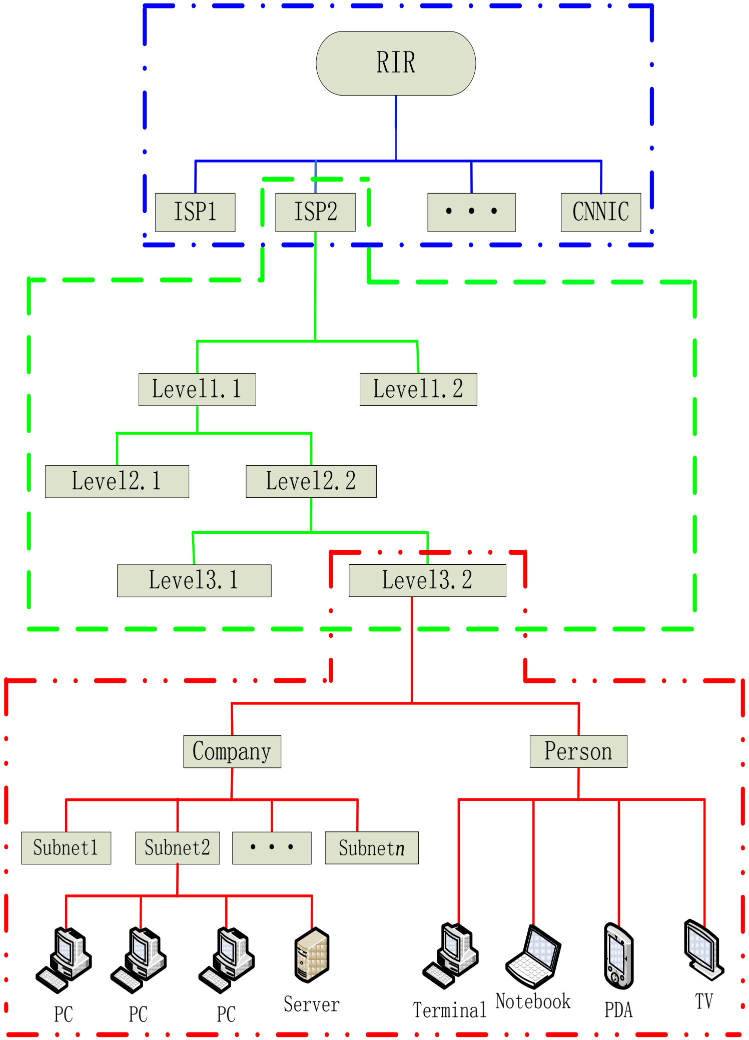
Address Management Structure

- Internet governance
  - NIR & LIR
  - Request IP address from RIR
- ISPs
  - ISPs get IP addresses from NIR & LIR
  - Downstream ISPs
- Access network
  - Terminals
  - Get IP addresses from upstream


RIR
ISP1
ISP2
• • •
CNNIC
Level1.1
Level1.2
Level2.1
Level2.2
Level3.1
Level3.2
Company
Person
Subnet1
Subnet2
• • •
Subnetn
PC
PC
PC
Server
Terminal
Notebook
PDA
TV

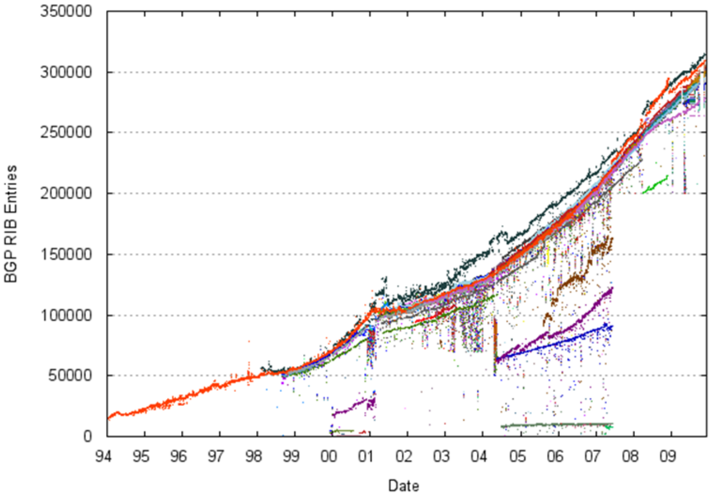
for Governance

Unified Allocation Plan

- block allocation and coordination system
- To minimize the size of routing table
- To meet the growth-based requirements
  - Topology-independent solutions, GAP
  - Topology-dependent solutions, not necessary, but it is important for ISP.

Address block information acquisition

- The statistics for the address usage
  - The number of address and block
  - Ratio of usage
  - Topology
  - Geo-location
  - ...



For ISPs

Automatic address block management

Initial allocation, fairness

- Plan on demand
  - Meet the requirement based on ISP’s future change
  - Need topology-dependent solutions
- Configuration
  - Prefix delegation is a good idea in IPv6

Renumbering, efficiency

- Topology-independent solutions
- Topology-dependent solutions, NONE

For Access Network

Authenticated and Trustworthy management

authorized address assignment and control

- To prevent fake IP addresses
- SAVI

Address information acquisition and validation

- To eliminate the abusage of IP address
- IP Whois? Reverse DNS ?
  - ISP, Geo-location, user identity, etc
- Challenge from dynamic address management
  - In China, 62.4% of IPv4 addresses are dynamic address
  - Stateless address auto-configuration is available in IPv6

Privacy preserving

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Conclusion

A rational algorithm is important for initial allocation and renumbering

- Topology independent
- Topology dependent

Automatic address delegation solutions are desirable

- DHCP is used for terminal IP address assignment
- DHCP is extended to support prefix delegation in IPv6
  - Combined with allocation algorithm

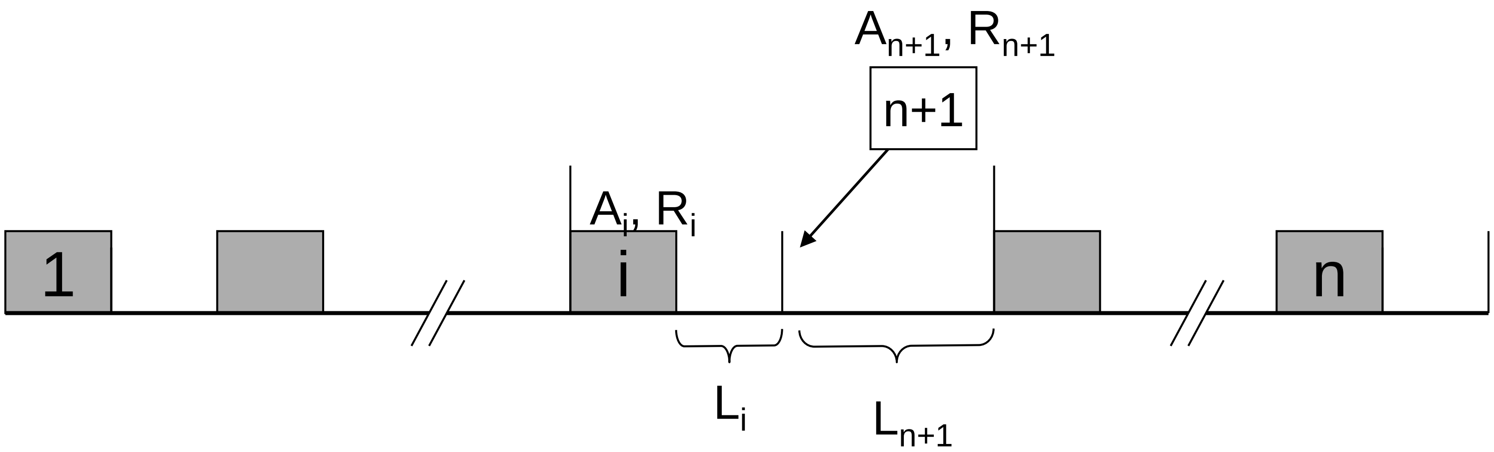
Hierarchical IP address storage and query system

- Statistics data for internet governance
- Supportive data for Internet business
- Validated data for trustworthy application

CNNIC-Cisco Addressing Research Lab, Oct.2009

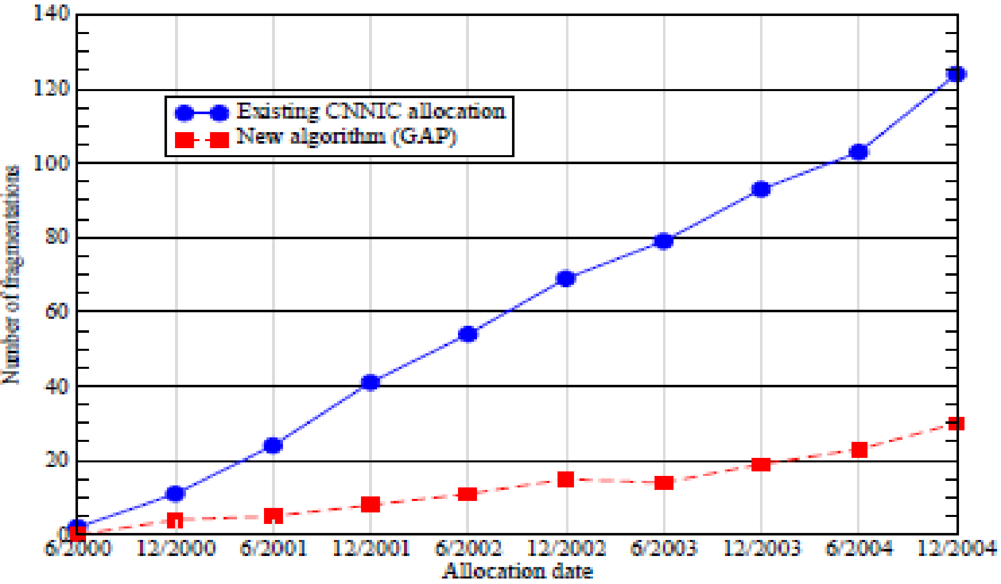
Thank you!

GAP: Growth-based Address Partitioning

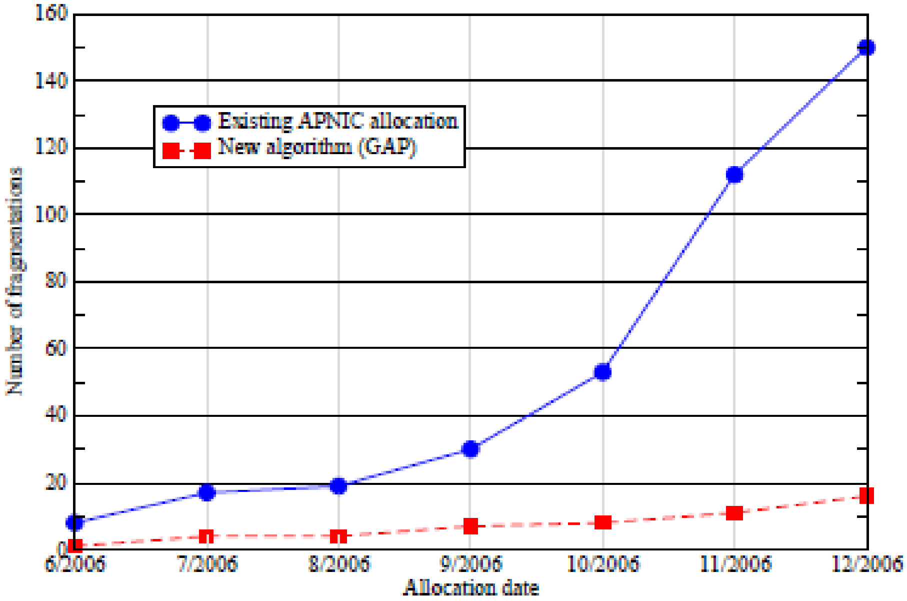


$$\max\{\min[t(L_i, A_i, R_i),\ t(L_{n+1}, A_{n+1}, R_{n+1})],\ i=1,\dots,n\}$$

Comparison using CNNIC allocation data



Comparison using APNIC allocation data



Renumbering Overview (RFC 4192)

1. Plan for the renumbering process
    A. Develop a new addressing plan
    B. Prepare address assignment and DNS
2. Configure network elements with the new prefix
    A. Modify ACLs, filters and other security
    B. Assign prefixes to links and addresses to interfaces
    C. Add new prefixes to routing infrastructure
3. Configure hosts with addresses of new prefix
4. Transition from use of the old prefix to the new prefix
5. Remove the old prefix

CNNIC-Cisco Addressing Research Lab

Focus on network addressing-related research:

- address allocation
- address management and administration
- address identification
- address security
- IPv6 addresses
- …

To identify potential issues and provide solutions for the next generation internet.

http://hdl.cnnic.cn/