CERNET2 IPv6 experience

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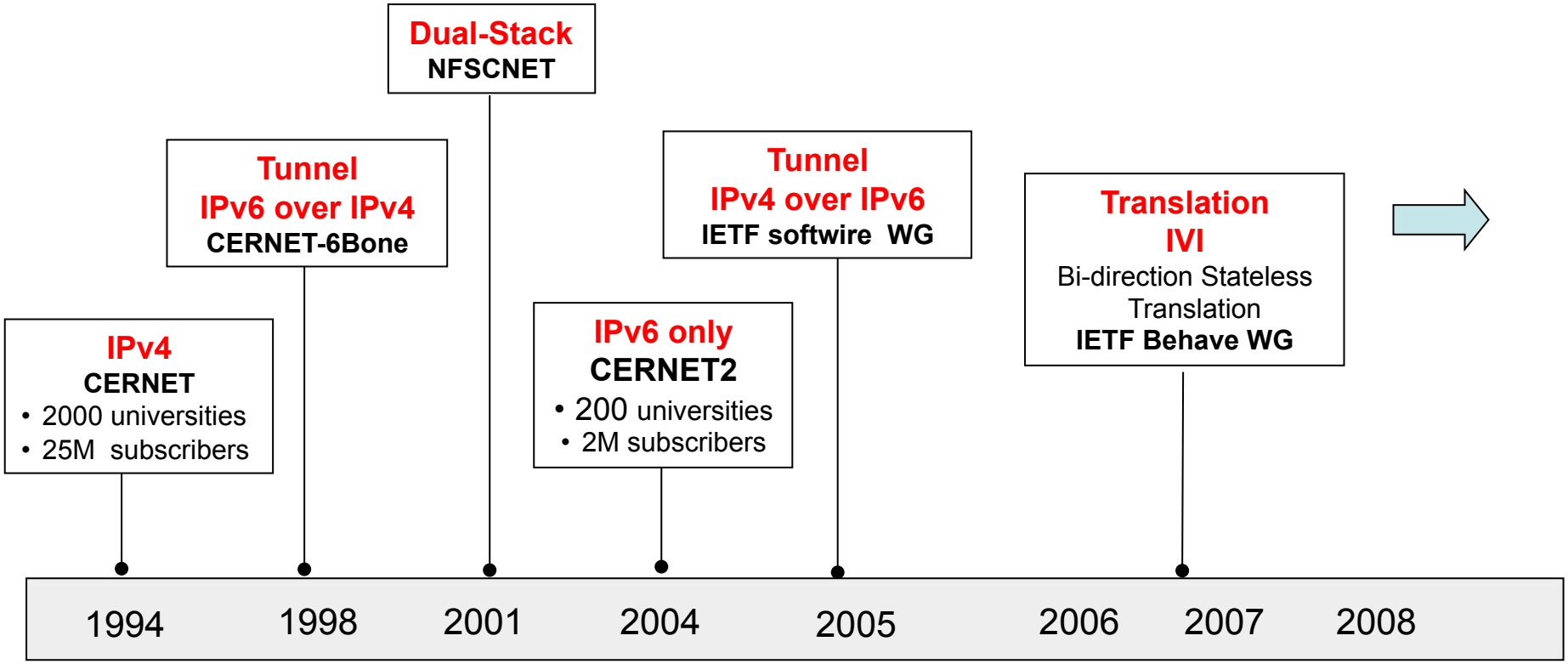
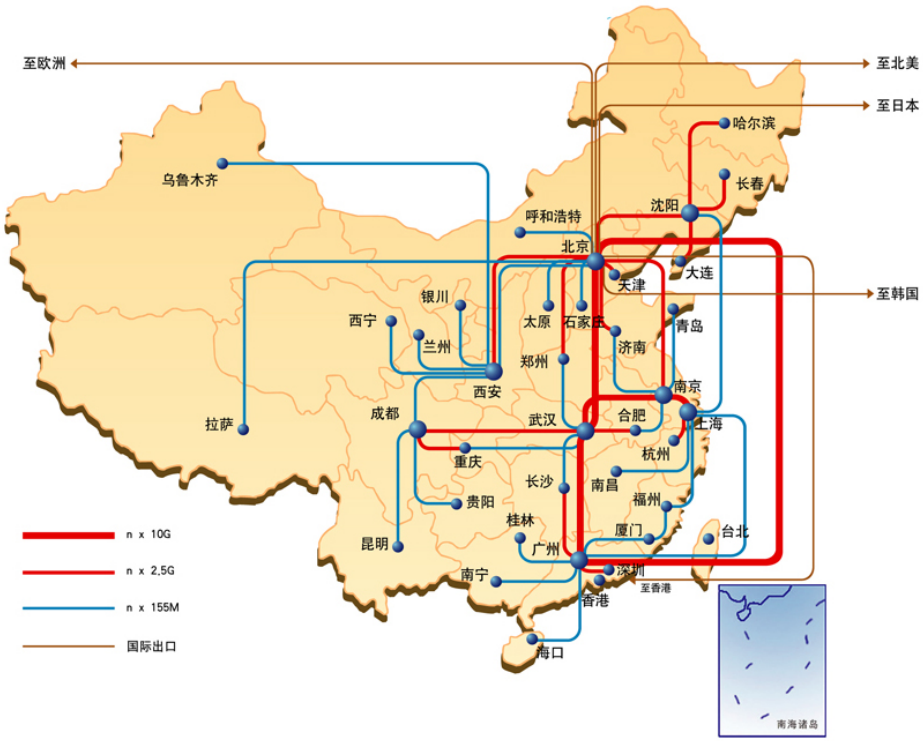
2011-02-22

CERNET IPv6 transition experience



CERNET (IPv4)

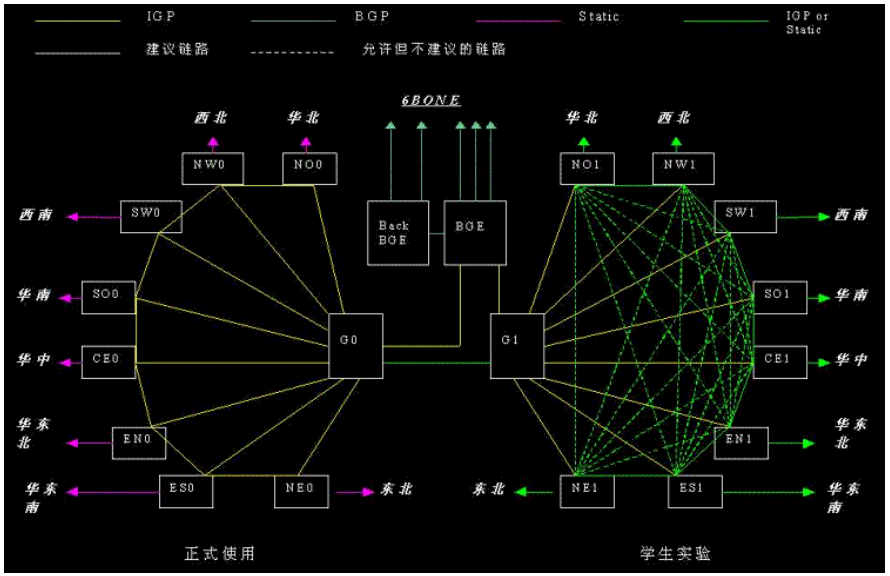


- CERNET is the first (1994) nation wide Internet backbone in China.
- CERNET ranks 30 in global IPv4 CIDR report.
- Over 2,000 universities on CERNET with about 25M subscribers.

CERNET-6Bone

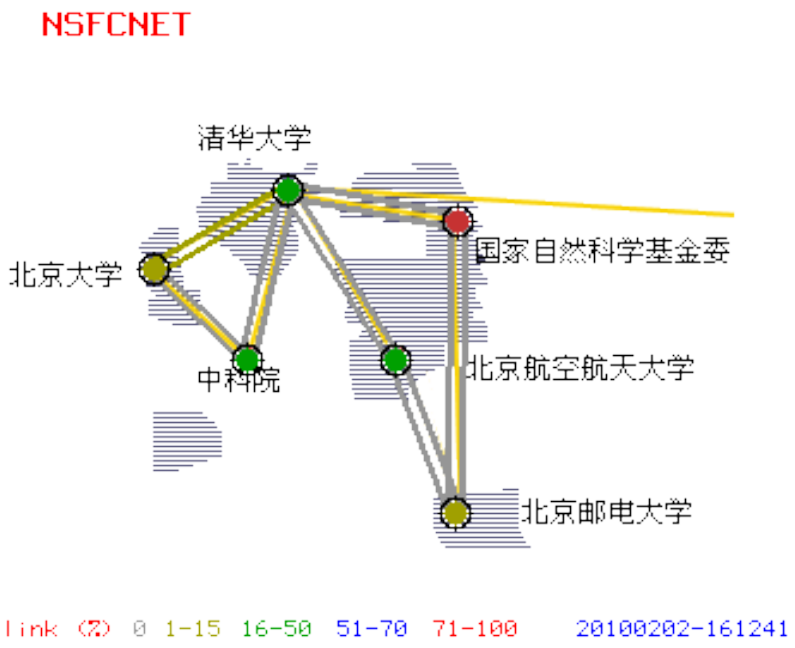
Location: http://www.cs-ipv6.lancs.ac.uk/ipv6/6Bone/Whois/CERNET.html

ipv6-site	CERNET						
origin	AS4538 **CERNET-BKB**						
descr	China Education and Research NETwork						
country	CN - **CHINA**						
prefix	3FFE:3200::/24 **Aggregatable Global Unicast Address** **TEST-TLA-6BONE;CERNET:**						
application	ping cernet.ipv6.net.edu.cn						
tunnels	**type**	**source**	**dest**	**dest site**	**dest prefix**	**protocol**	**comment**
	IPv6 in IPv4	202.112.55.92 gloria.ipv6.net.edu.cn	202.117.114.59	NW-CERNET	3FFE:3212::/32	BGP4+	
	IPv6 in IPv4	202.112.0.80 6bone.ipv6.net.edu.cn	198.108.0.3 6bone.merit.edu	MERIT	3FFE:1C00::/24	BGP4+	
	IPv6 in IPv4	202.112.0.80 6bone.ipv6.net.edu.cn	208.19.223.30 sl-bb1-6bone.sprintlink.net	SPRINT	3FFE:2900::/24	BGP4+	
	IPv6 in IPv4	202.112.0.80 6bone.ipv6.net.edu.cn	158.43.248.49 6r1.doc.london.pipex.net	UUNET-UK	3FFE:1100::/24	BGP4+	
	IPv6 in IPv4	202.112.0.80 6bone.ipv6.net.edu.cn	193.63.94.6 ulcc.ipv6.ja.net	JANET	3FFE:2100::/24	BGP4+	
	IPv6 in IPv4	202.112.0.80 6bone.ipv6.net.edu.cn	128.176.191.66 6bone.uni-muenster.de	JOIN	3FFE:400::/24	BGP4+	
contact	LX1-6BONE						



- CERNET-6bone is the first (1998) IPv6 network in China.
- There is only ICMPv6 traffic

Dual stack NSFCNET



- NSFCNET is the first (2000) IPv4/IPv6 high-speed academic network in China.
- It provides IPv4/IPv6 unicast and multicast services to the education and research community, but very, very few IPv6 traffic.

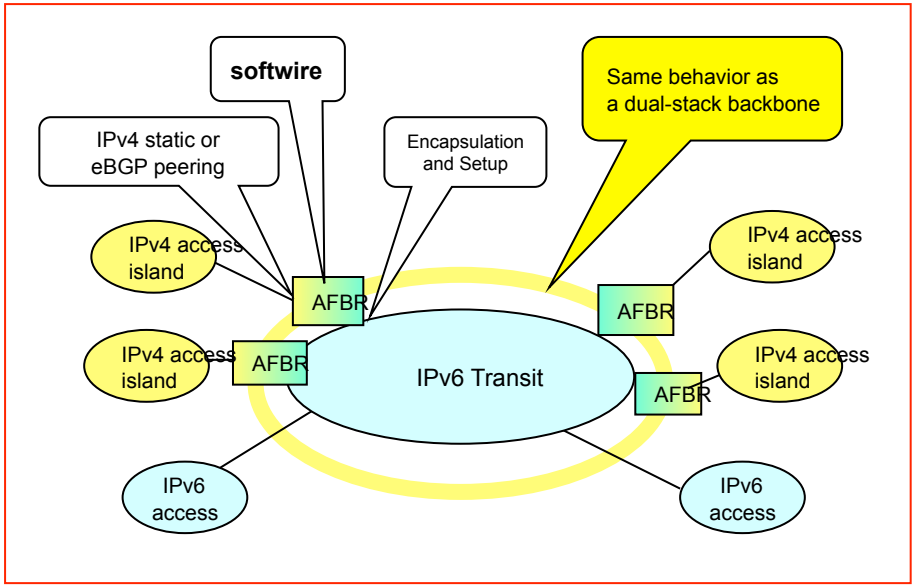
CERNET2 (IPv6)

- Built in 2004, with national coverage
- CERNET2 is the largest IPv6 backbone in China.
- About 200 universities connected to CERNET2 with about 2M subscribers.

Be unique, be different

- Protocol selection
  - Pure IPv6
- Equipment
  - Multiple vendors
- Complexity
  - Multiple ASs
- Transition
  - IPv4 over IPv6 (IETF softwire)
  - IVI stateless translation (IETF behave)
- Architecture
  - Source address authentication (IETF SAVI)

Softwire IPv4 over IPv6



IPv4 over IPv6

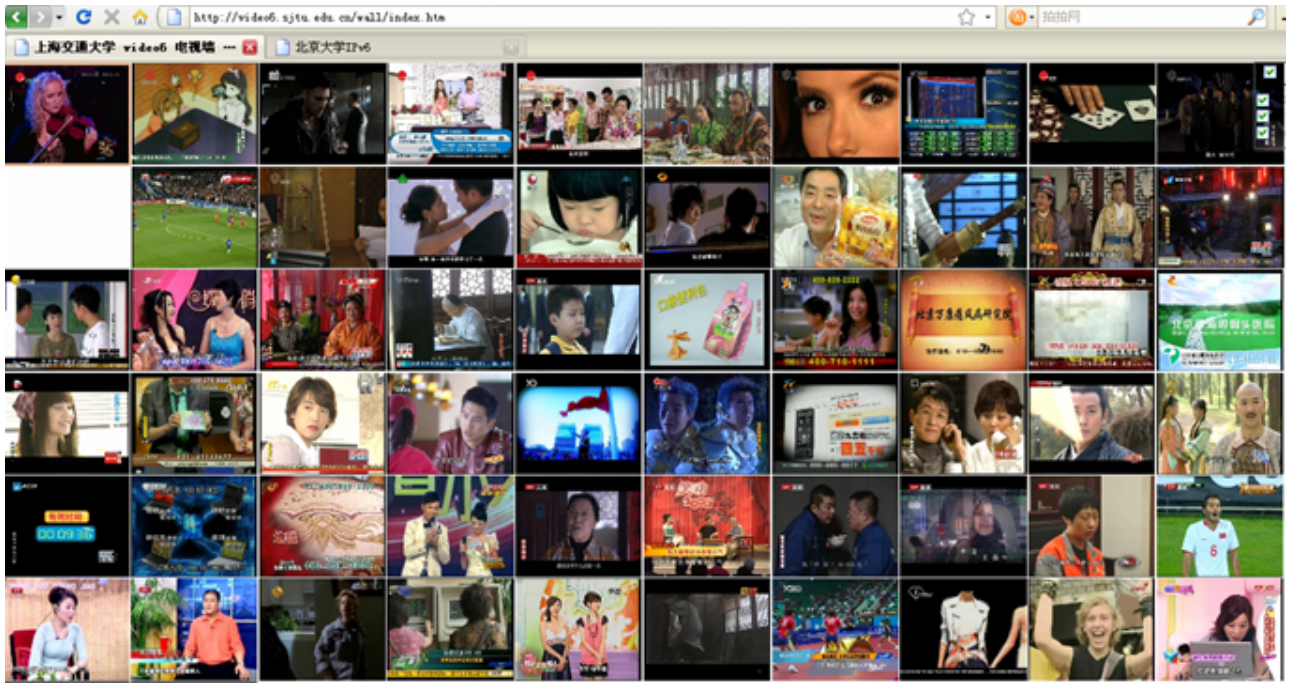
- Provide IPv4/IPv6 dual-stack service in PE, but run IPv6-only in P routers
  - IETF softwire WG
- Save operation cost.

To encourage transition

- CERNET (IPv4)
  - Congested and charged.
- CERNET2 (IPv6)
  - Light loaded and free of charge.

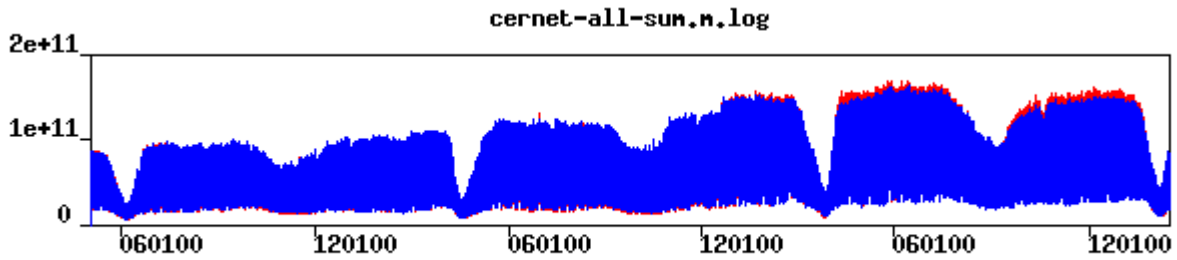
- So, for using high quality and free network, port your application to IPv6.

IPv6 applications



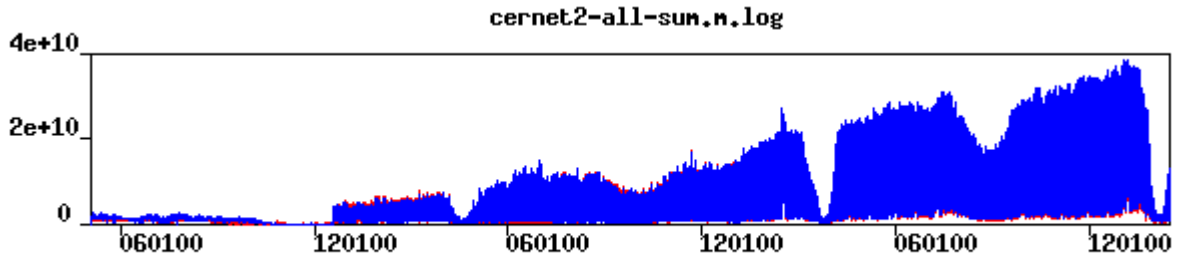
IPv4 and IPv6 traffic

IPv4



2008 2009 2010

IPv6



2008 2009 2010

- **IPv6' traffic is about 20% of IPv4**

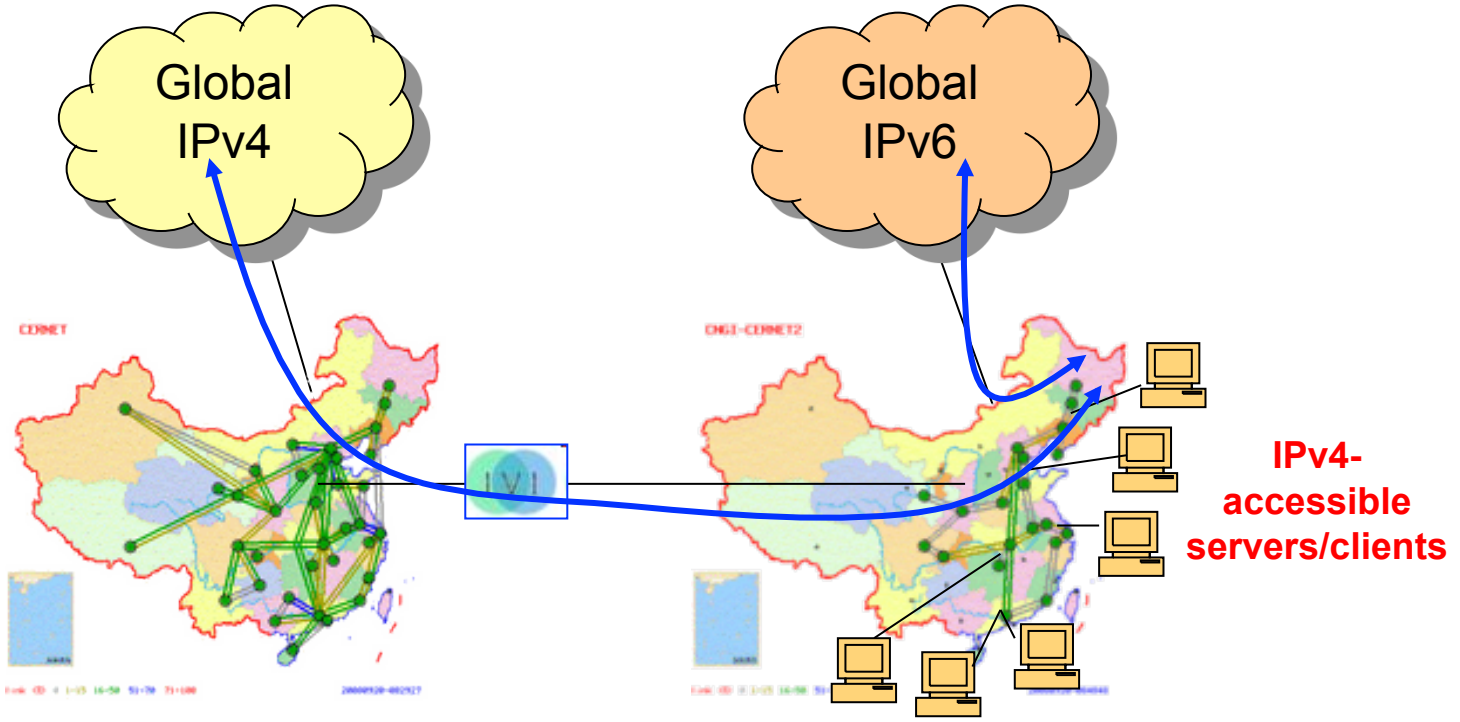
Remarks

- Upgrading network to dual stack does not mean transition. The IPv6 traffic is still very small.
  - NSFCNET
- Promotion IPv6 can help, but does not help to fully solve the transition problem.
  - CERNET2

The killer application

- Video?
- P2P?
- Internet of Things?
- The intercommunication with the IPv4 Internet is the killer application of IPv6.

We invented IVI



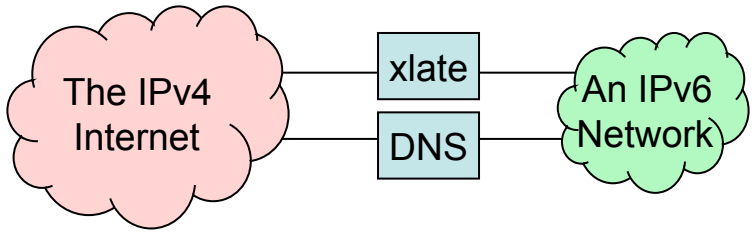
Transition technologies

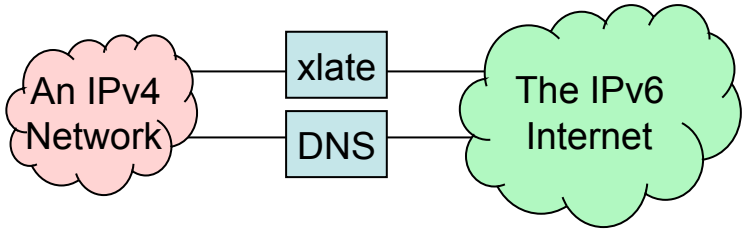
- Dual stack
  - IPv4 address depletion problem
  - N^2 problem
- Tunnel
  - Still need dual stack
  - IPv4 address depletion problem
  - Upgrade tunnel points
- Translation
  - Add a translator

IETF standards

- RFC 6052
  - IPv6 Addressing of IPv4/IPv6 Translators
- RFC 6144
  - Framework for IPv4/IPv6 Translation
- RFC 6145
  - IP/ICMP Translation Algorithm
- RFC 6146
  - Stateful NAT64: Network Address and Protocol Translation from IPv6 Clients to IPv4 Servers
- RFC 6147
  - DNS64: DNS extensions for Network Address Translation from IPv6 Clients to IPv4 Servers
- RFC
  - The CERNET IVI Translation Design and Deployment for the IPv4/IPv6 Coexistence and Transition

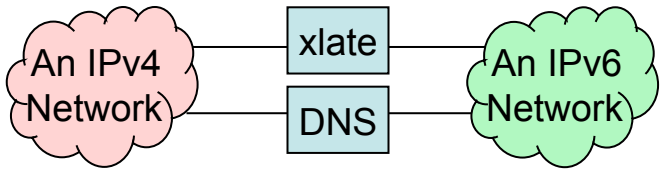
Translation scenarios

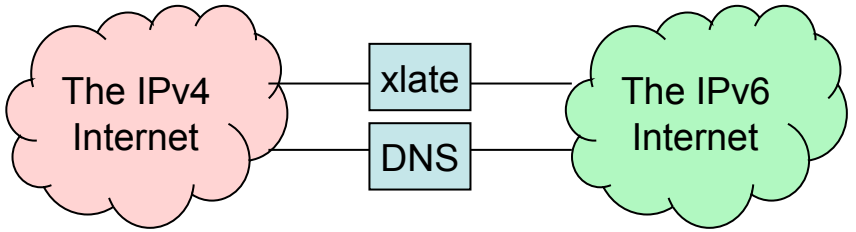




IVI { Scenario 1 “an IPv6 network to the IPv4 Internet” **< NAT64**
Scenario 2 “the IPv4 Internet to an IPv6 network”

Scenario 3 “an IPv4 network to the IPv6 Internet” **< NAT64**
Scenario 4 “the IPv6 Internet to an IPv4 network”

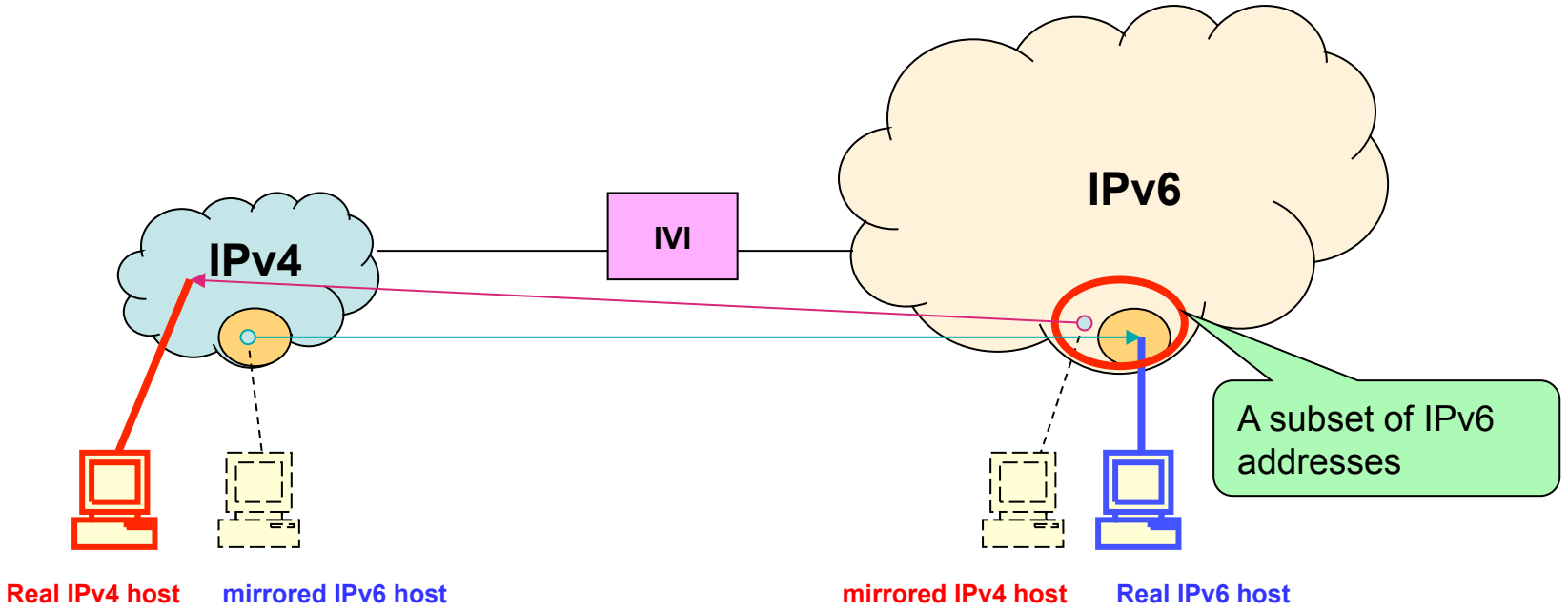




IVI { Scenario 5 “an IPv6 network to an IPv4network” **< NAT64**
Scenario 6 “an IPv4 network to an IPv6 network”

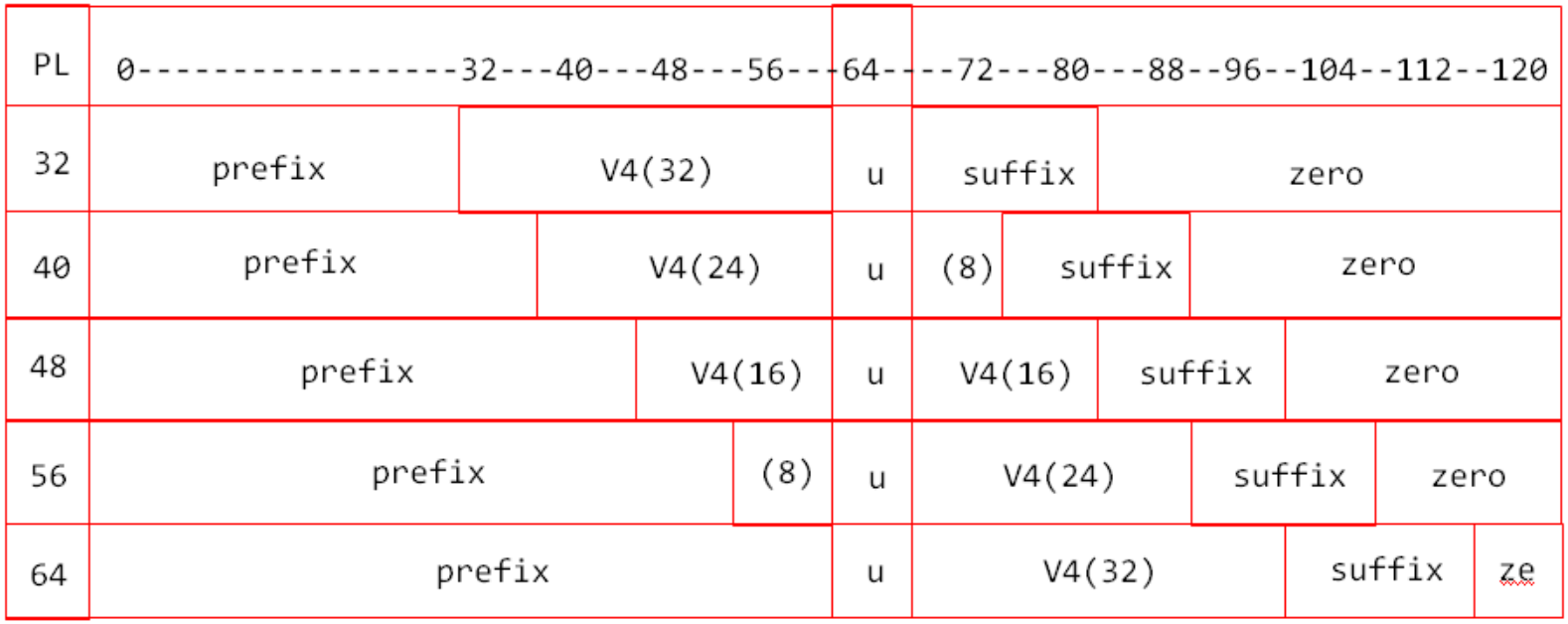
Scenario 7 “the IPv6 Internet to the IPv4 Internet”
Scenario 8 “the IPv4 Internet to the IPv6Internet”

Stateless translation (IVI)



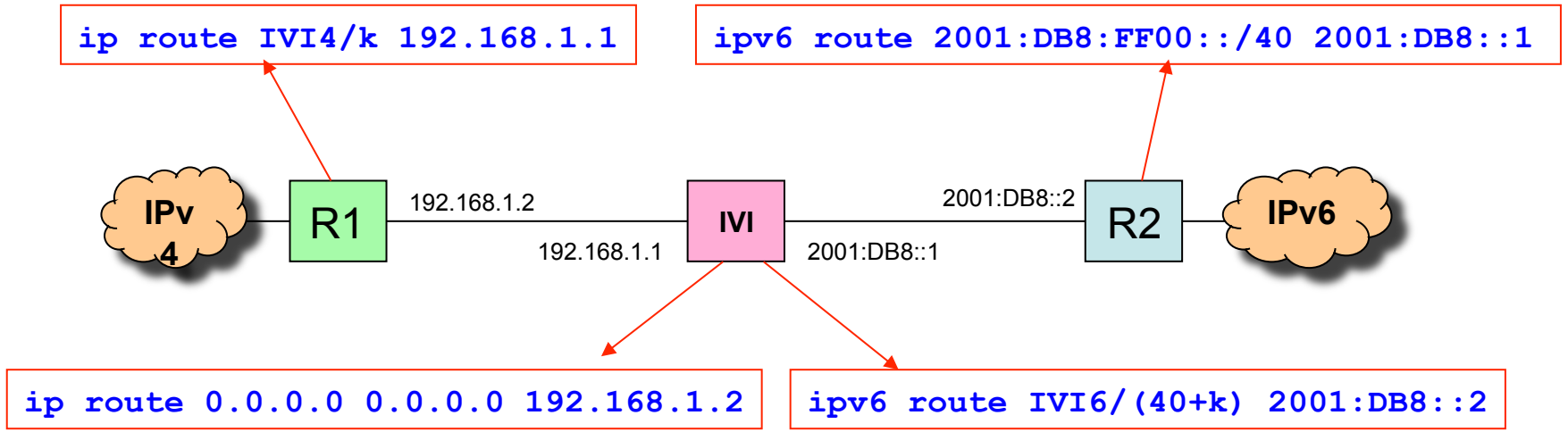
A subset of IPv6 addresses

IVI address format



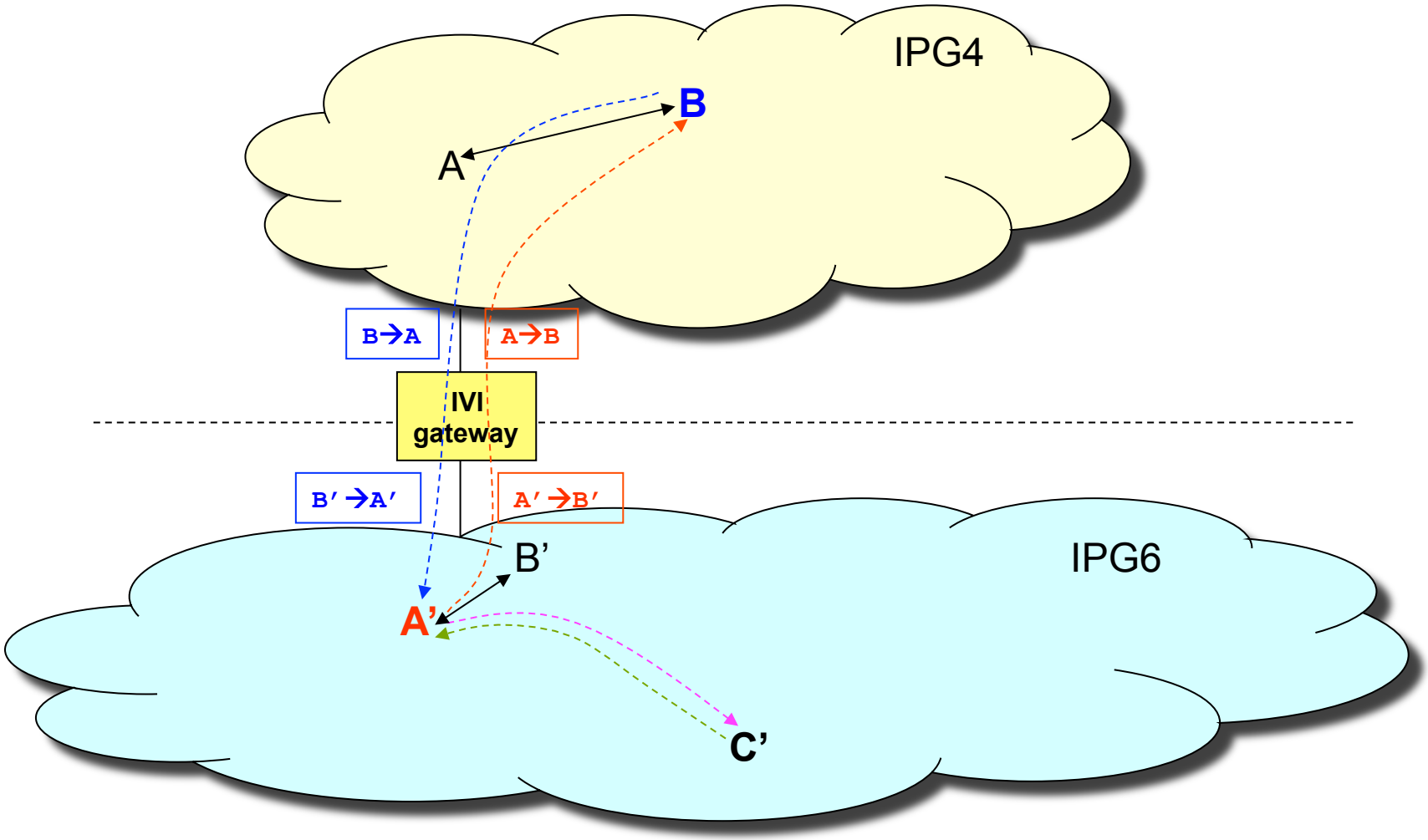
IVI routing

Routing and mapping configuration example

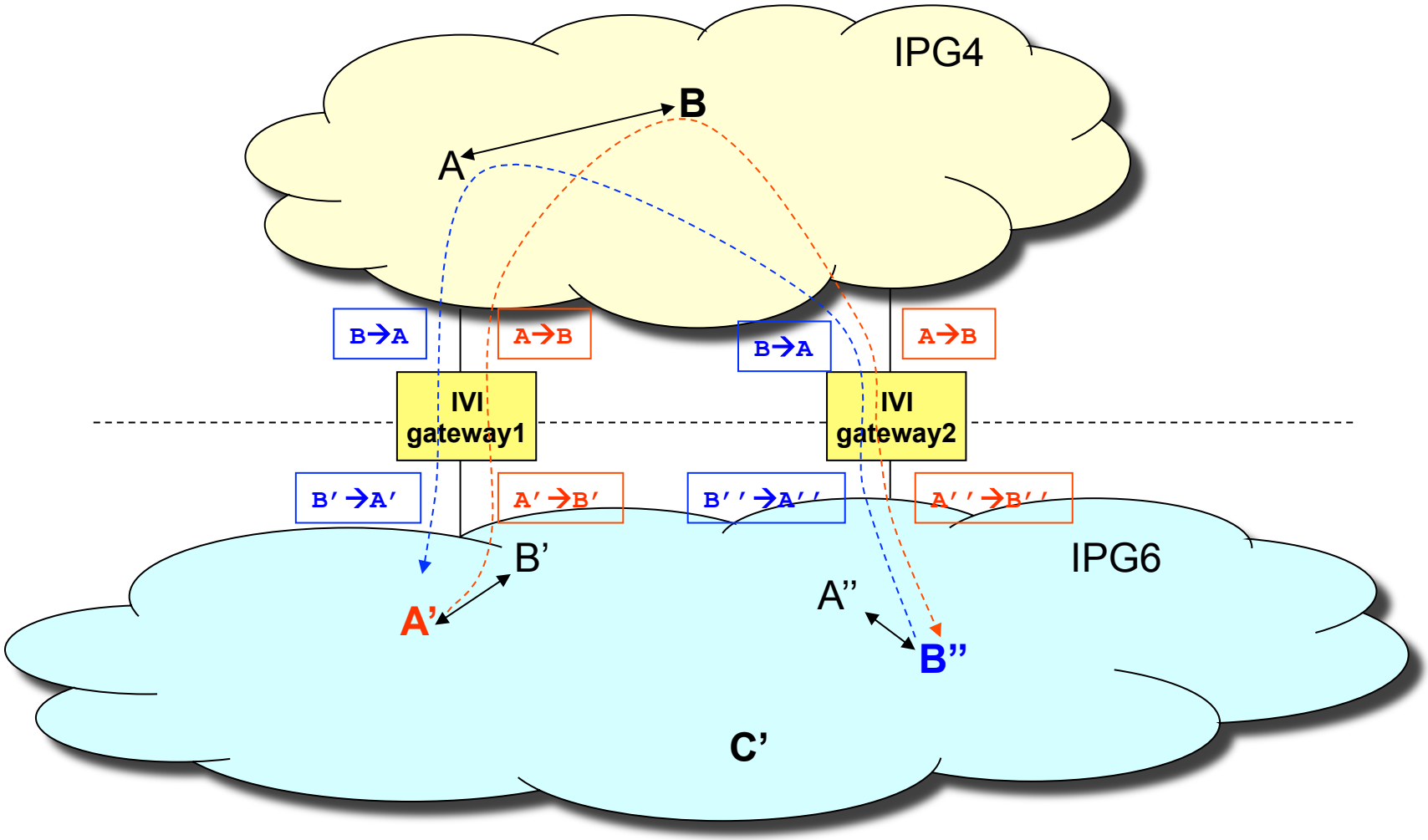



```
mroute IVI4-network IVI4-mask pseudo-address interface source-PF destination-PF
mroute6 destination-PF destination-PF-pref-len
```

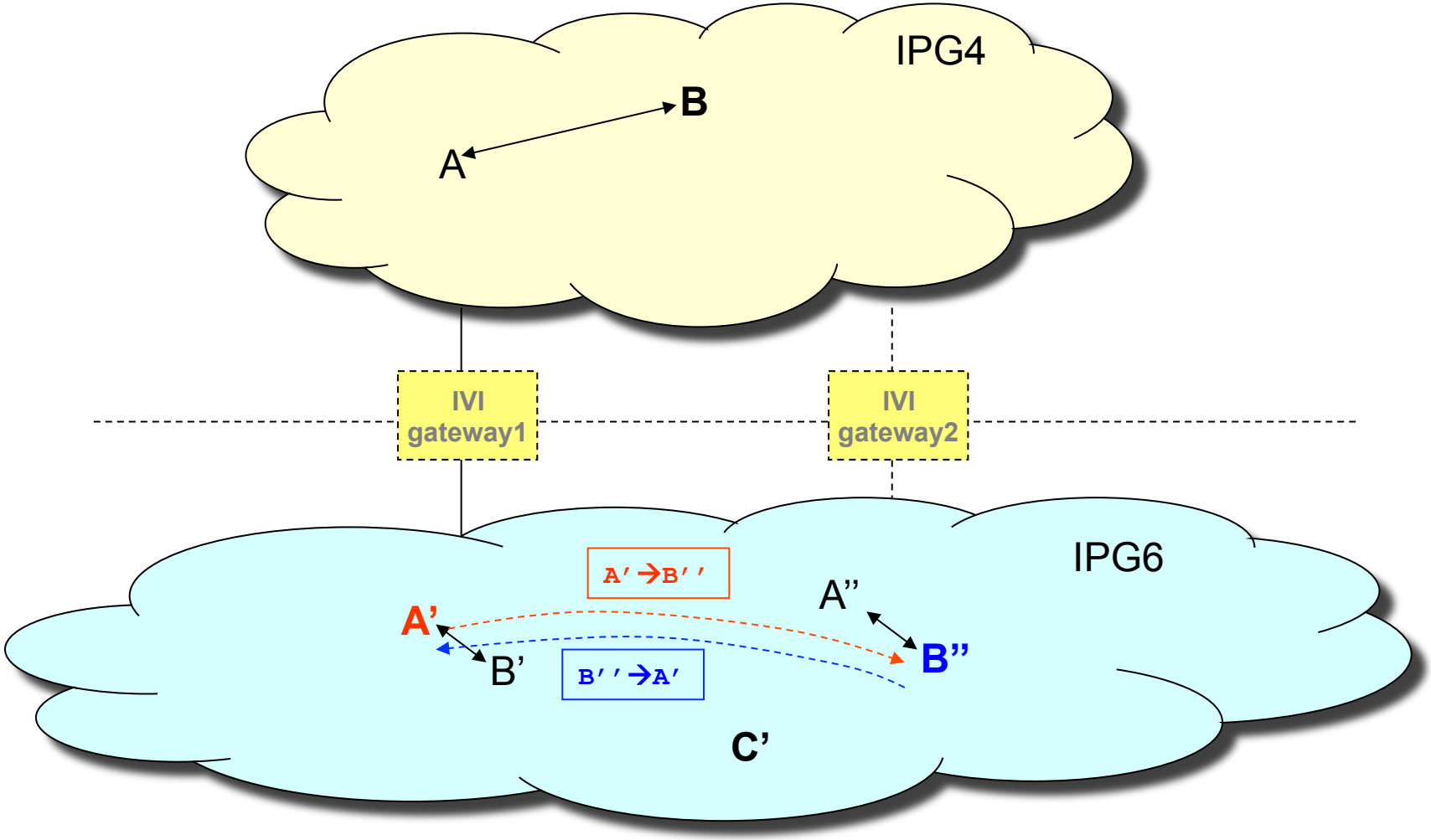
IVI incremental deployment (1)



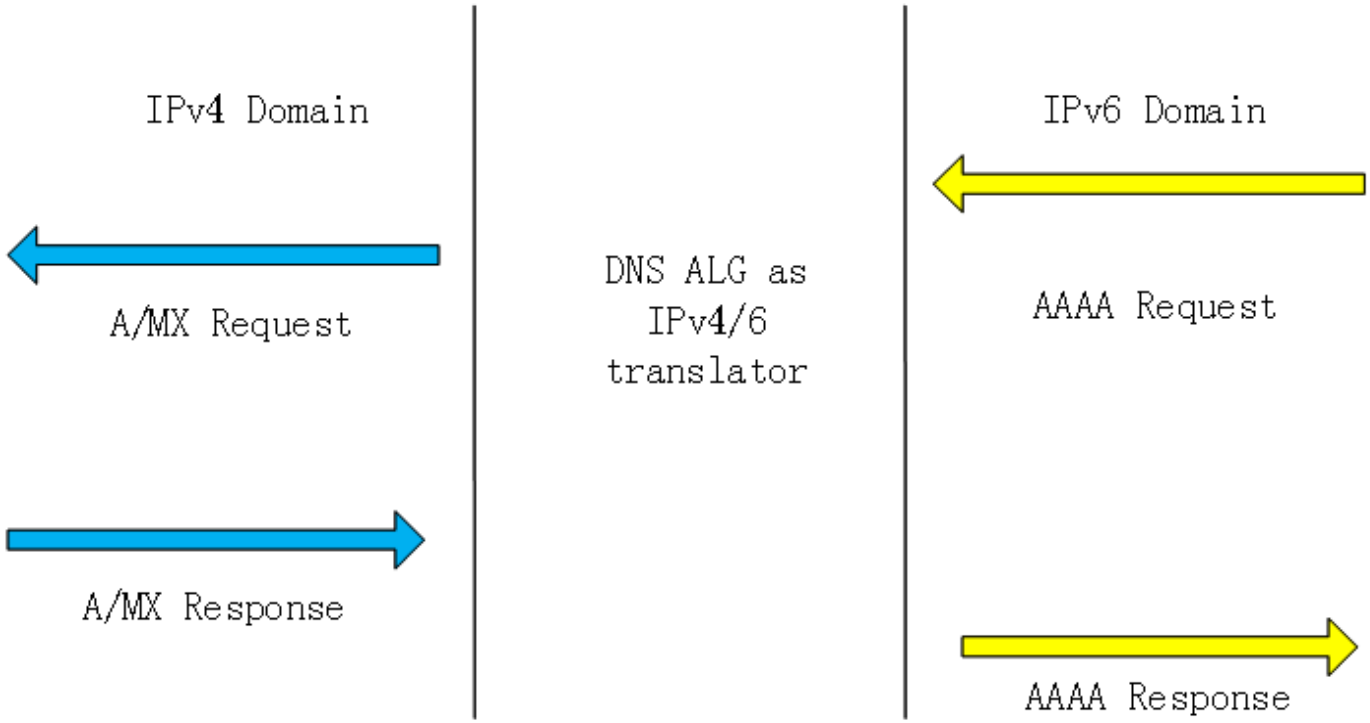
IVI incremental deployment (2)



IVI incremental deployment (3)



DNS64


IPv4 Domain
IPv6 Domain
DNS ALG as
IPv4/6
translator
A/MX Request
AAAA Request
A/MX Response
AAAA Response

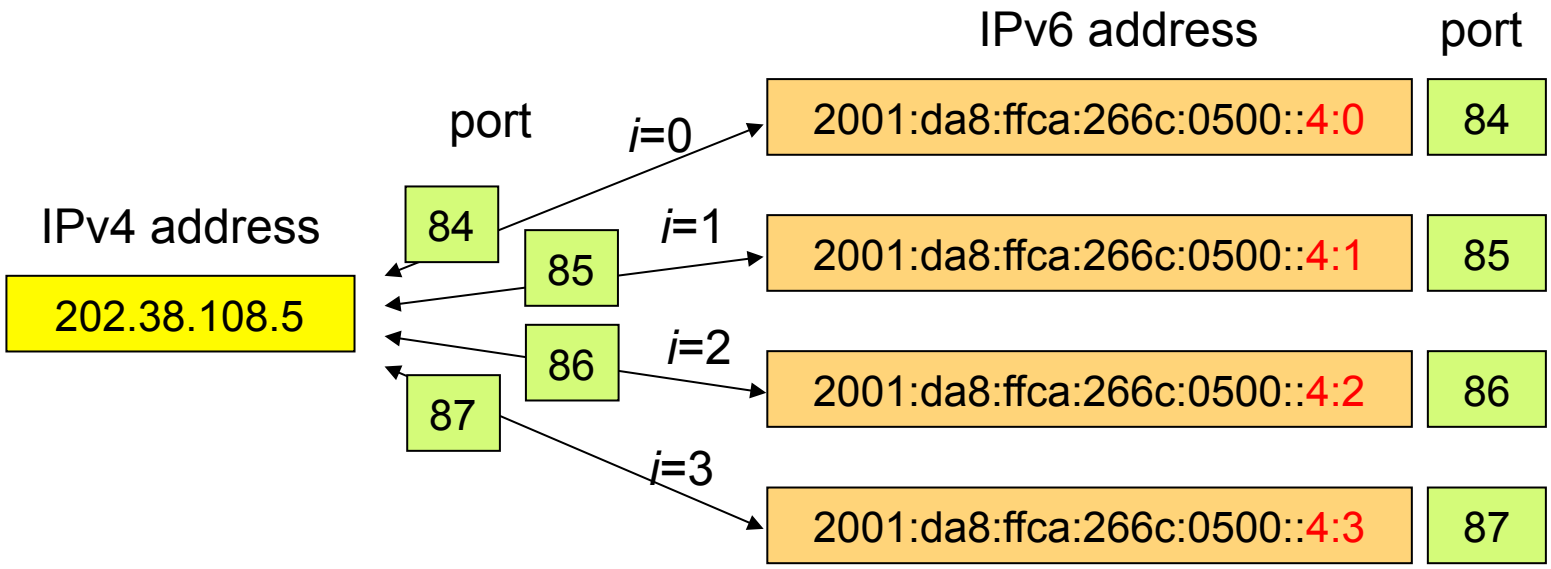
ALG issue

- IVI supports
  - web：ssh，telnet、DVTS，vlc，email
- ALG requirements
  - ftp
  - URL contains IPv4 literals

www.ivi2.org

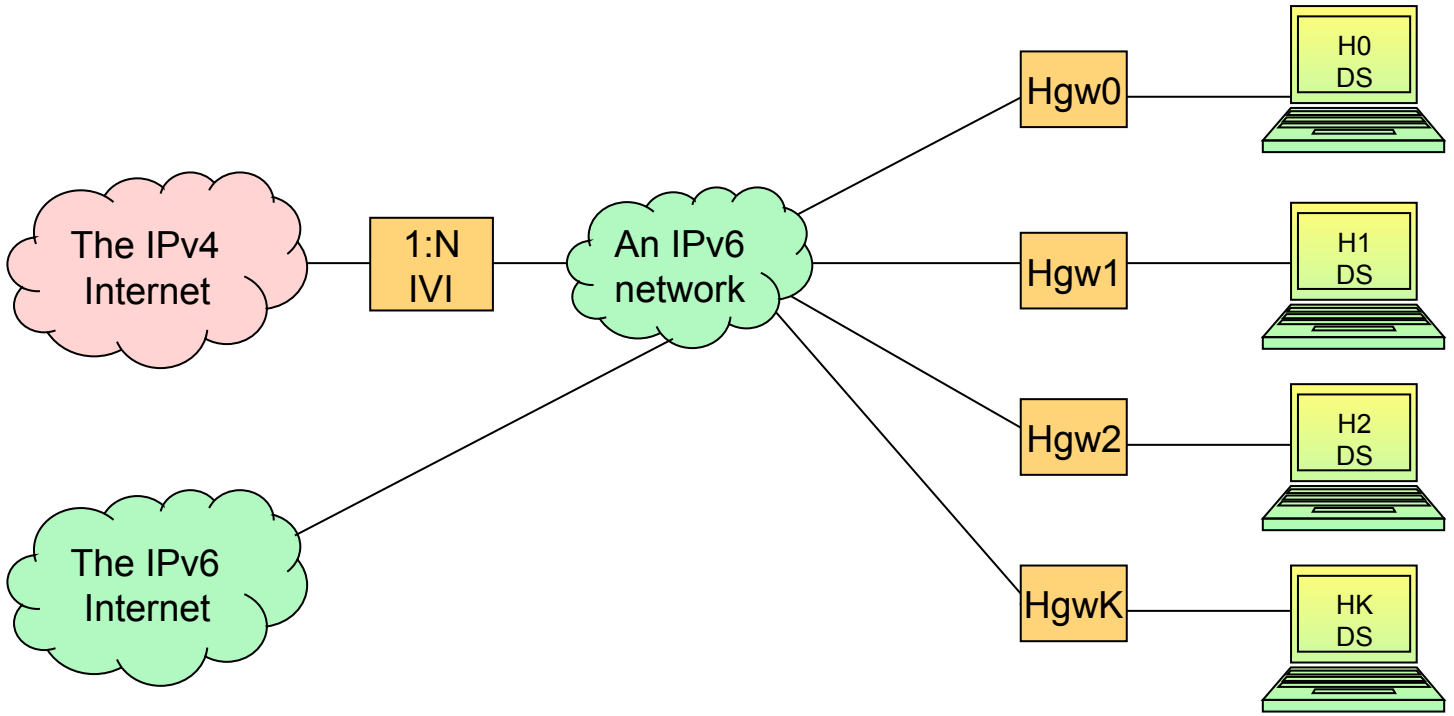

IVI - Mozilla Firefox
文件(F) 编辑(E) 查看(V) 历史(S) 书签(B) 工具(T) 帮助(H)
http://www.ivi2.org/
Back 访问最多 Windows Media Windows 免费 Hotmail 自定义链接
IVI
Prefix-specific and Stateless IPv4/IPv6 Translation
IVI address mapping calculator
• From IPv4 to IPv6
• From IPv6 to IPv4
IVI source code download
The IVI IPv4/IPv6 packet translation implementation as a Linux kernel patch is available below.
• IVI v0.5 kernel patch for Linux kernel 2.6.12
• IVI v0.5 kernel patch for Linux kernel 2.6.18
The IVI A/AAAA DNS proxy implementation is available below.
• IVIDNS v0.1 C code
• IVIDNS v0.2 C code
For installing and configuration, please follow the instructions in the source code packages.
Or have a quick look at IVI README and Linux README.
• code
IVI test servers
• Access single-stack IPv6 server [2001:250:ffca:2672:100::] = 202.38.114.1 via IPv4
• Access single-stack IPv6 sever [2001:250:ffca:2672:100::] via IPv6
• Access IPv4 server (202.38.114.129) cross single-stack IPv6 network
• Address-sharing dIVI demo
IVI references
IETF drafts
• Prefix-specific and Stateless Address Mapping (IVI) for IPv4/IPv6 Coexistence and Transition (02)
• Google: IPv6+IVI+translation+transition
Copyright CERNET Center 2005-2009
完成
McAfee SiteAdvisor
开始
100%
10:36

1:N IVI

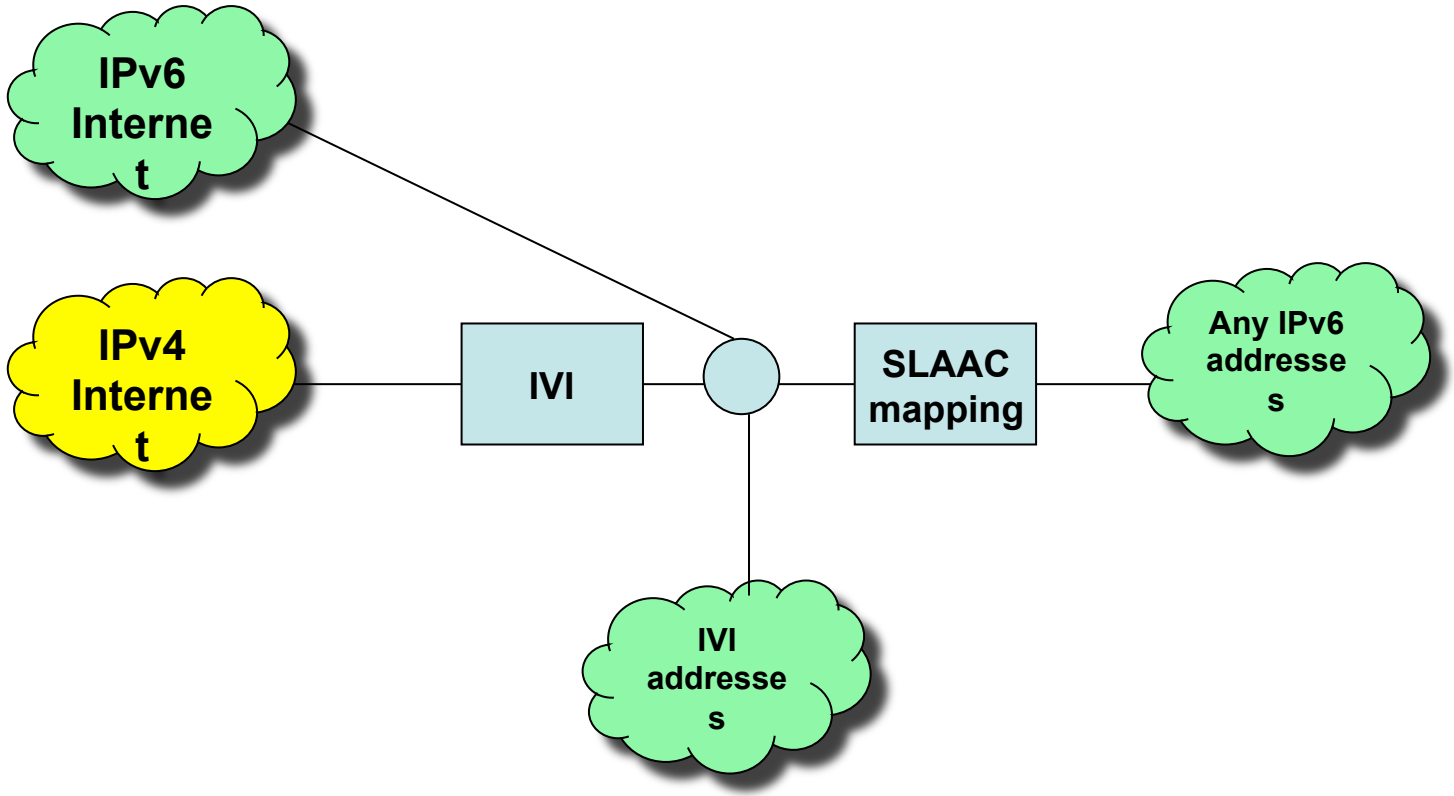


- If R=256
- A /24 is equivalent to a /16

1:N dIVI


The IPv4
Internet
1:N
IVI
An IPv6
network
The IPv6
Internet
Hgw0
Hgw1
Hgw2
HgwK
H0
DS
H1
DS
H2
DS
HK
DS

IVI66


IPv6 Internet
IPv4 Internet
IVI
SLAAC mapping
Any IPv6 addresses
IVI addresses

Experimental networks in IETF79

The IETF supports several experimental networks to deploy our own work. Enjoy that dogfood!

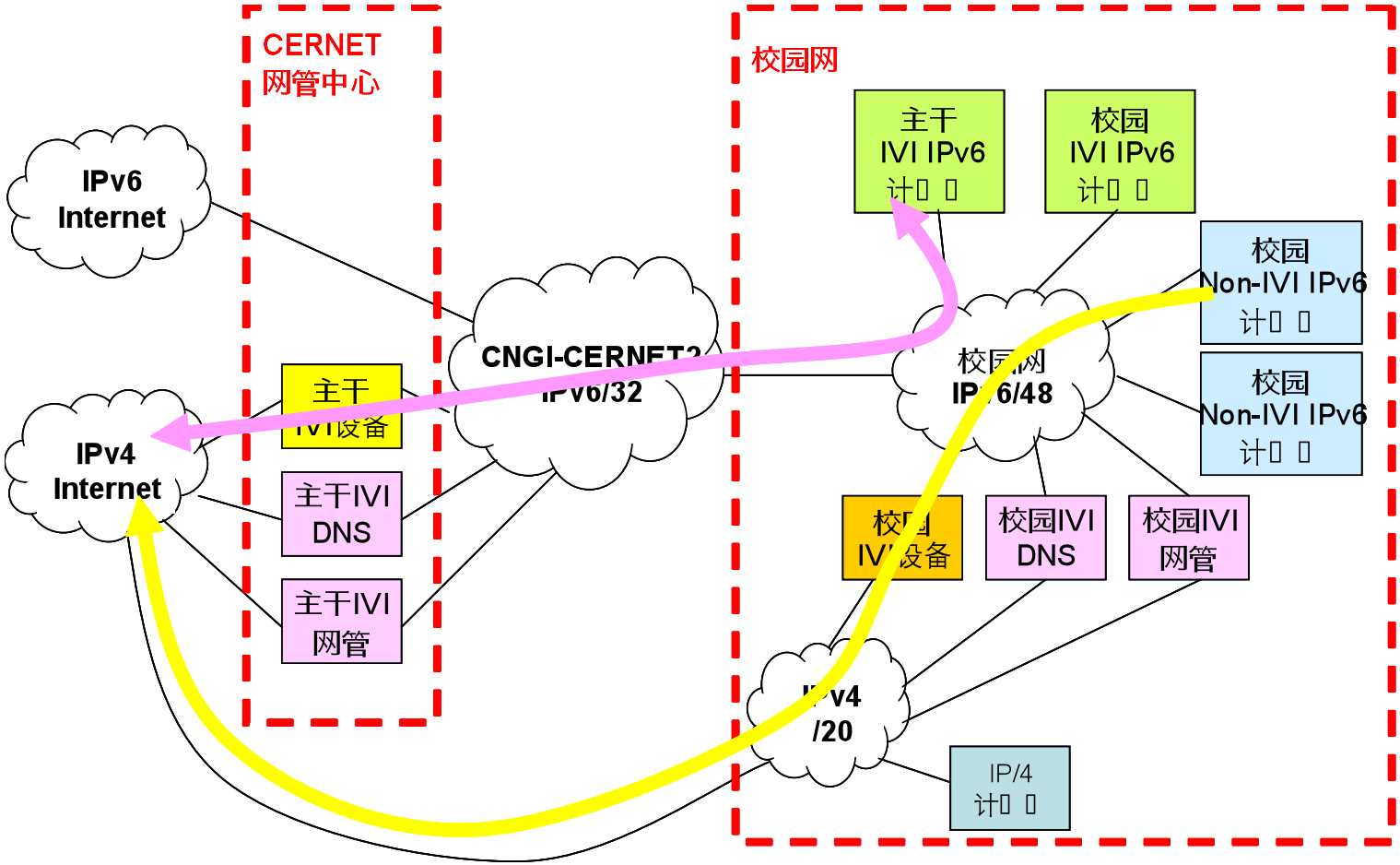
SSID	Access Credentials	Purpose	Location
ietf-v6ONLY	WPA/WPA2 Enterprise w/ normal IETF credentials	A IPv6-only network for investigating IPv6 in the absence of IPv4	IETF Meeting Area
ietf-nat64	None	A demonstration of NAT64	IETF Meeting Area
ivi-dhcpv6	None, for Windows 7/Windows Vista/Linux? with DHCPv6 client	A demonstration of stateless translation (IVI) (only available in exhibition area).	Expo Centre
ivi-slaac-dhcpv4	None	A demonstration of stateless translation (IVI) when Windows XP or MAC OS are used (only available in exhibition area).	Expo Centre

v6ONLY
(27 associations)

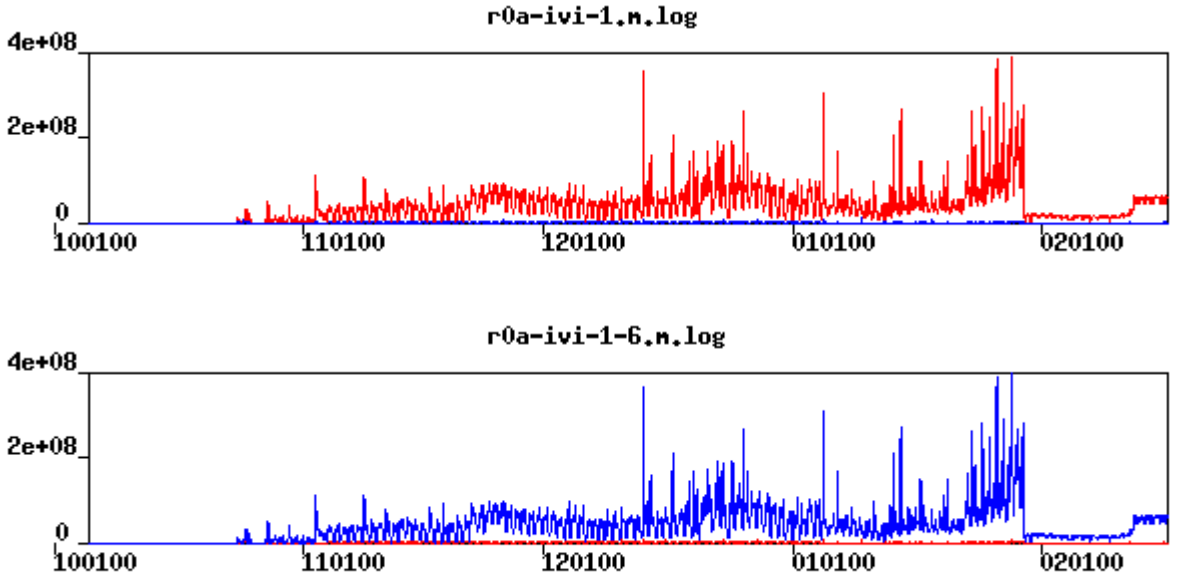
NAT64
(36 associations)

Stateless translation (IVI) in Expo Centre
(10 associates)

CERNET2 100 campus project



IVI traffic


r0a-ivi-1.m.log
4e+08
2e+08
0
100100
110100
120100
010100
020100
r0a-ivi-1-6.m.log
4e+08
2e+08
0
100100
110100
120100
010100
020100

Comparison of transition technologies

- Dual stack
  - Require NAT44 because of IPv4 address depletion
  - N^2 problem
- Tunnel
  - Still need dual stack
  - Require NAT44 because of IPv4 address depletion
  - Upgrade two tunnel points
- Translation
  - The only one which interconnects two address families
  - Add a single translator

IVI IPv4/IPv6 transition