Update on IPv6 activity in CERNET2

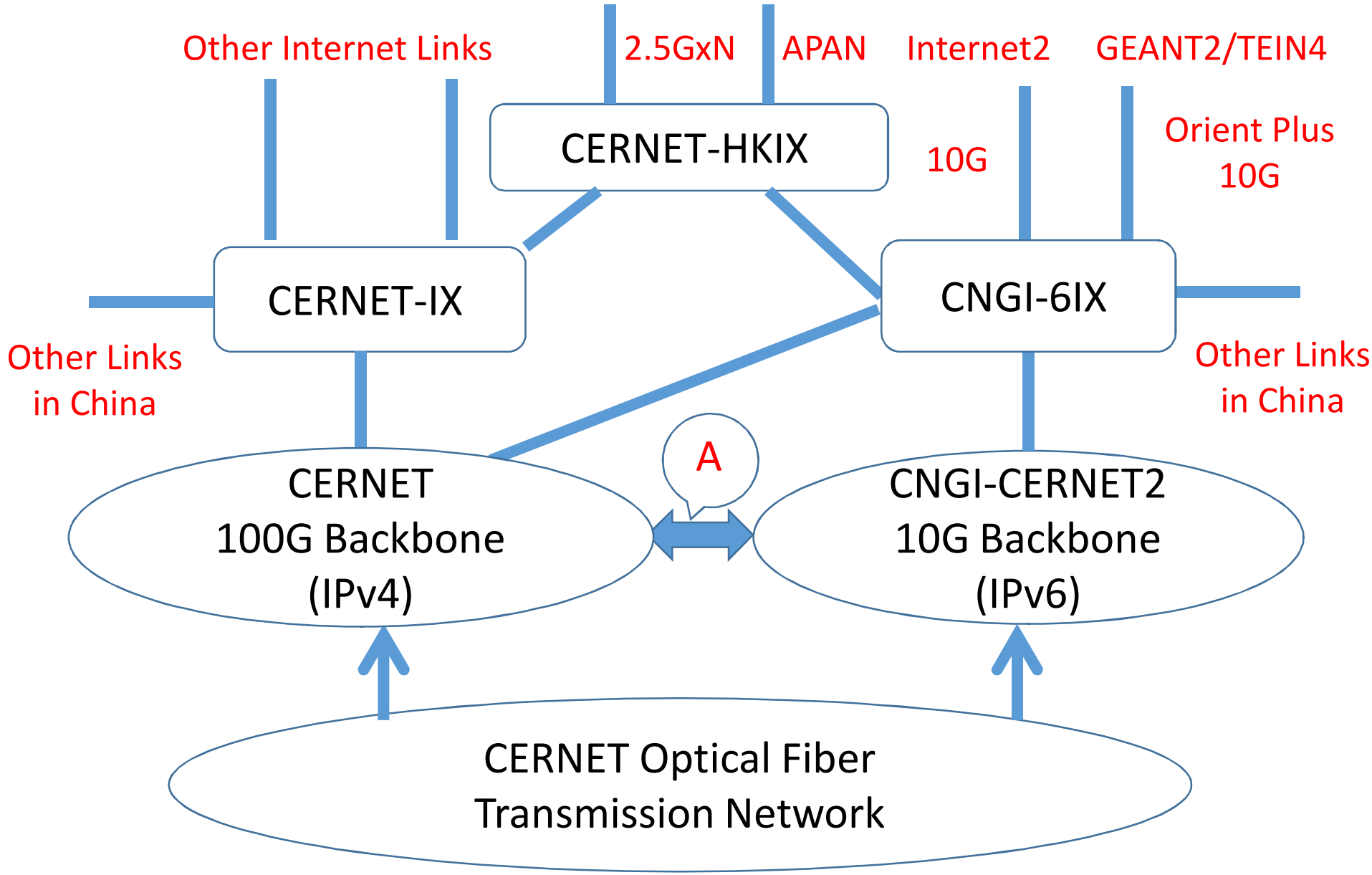
APAN39, Fukuoka

BUPT and BII

5 March, 2015

20's Anniversary of CERNET

- China Education and Research Network - CERNET project started in 199
- Over 2000 member university and educational institute
- CNGI-CERNET2 is running with pure IPv6 backbone, over 600 member universities connected since 2003
- IPv6 related research and experiment conducted on CERNET2
- Close collaboration with device manufacture, service provider and othe Internet Industry community to promote IPv6


Other Internet Links
2.5GxN
APAN
Internet2
GEANT2/TEIN4
CERNET-HKIX
10G
Orient Plus
10G
CERNET-IX
CNGI-6IX
Other Links
in China
Other Links
in China
A
CERNET
100G Backbone
(IPv4)
CNGI-CERNET2
10G Backbone
(IPv6)
CERNET Optical Fiber
Transmission Network

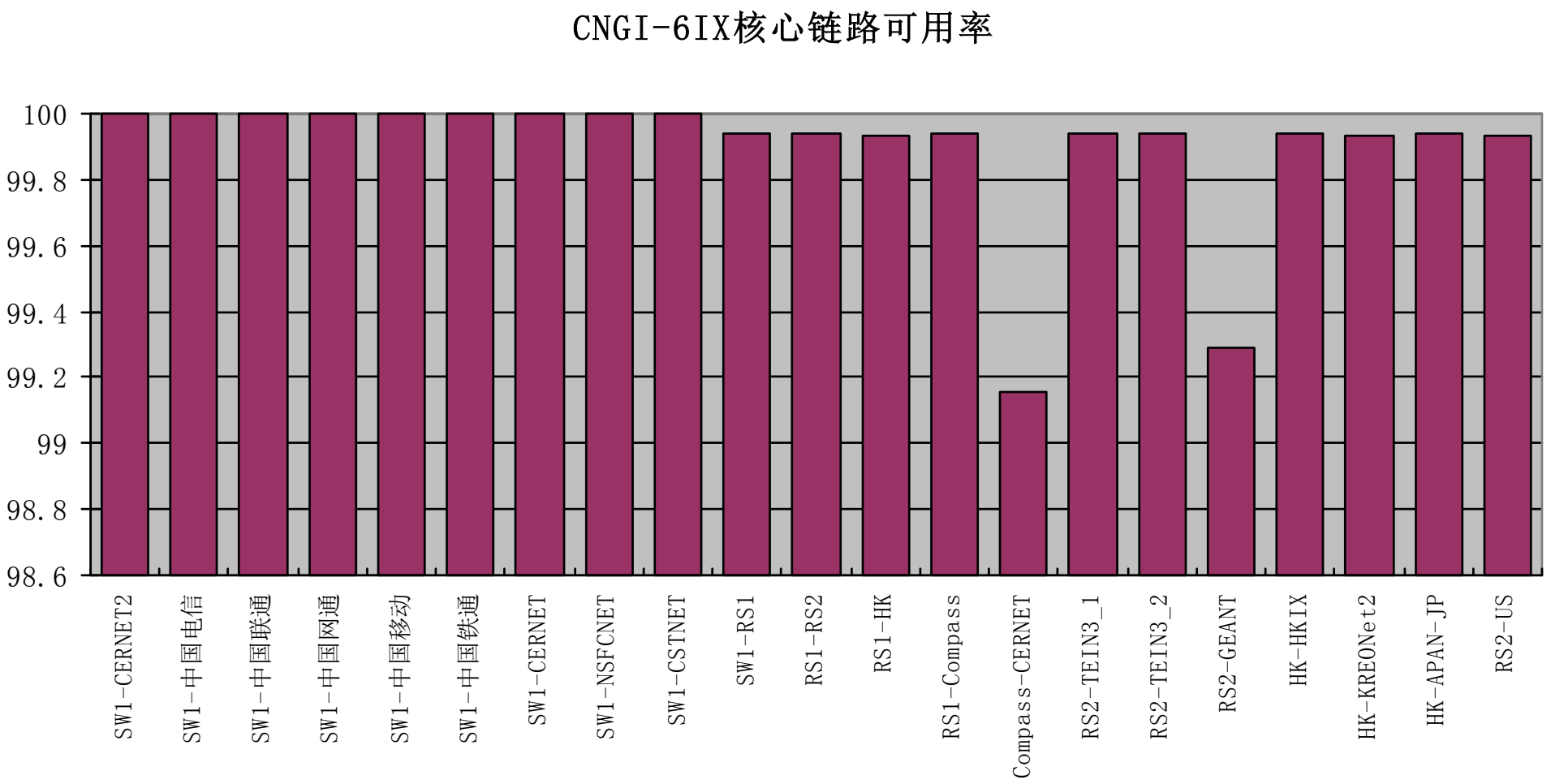
IPv6 CNGI—CERNET2 Backbone

Pure IPv6 Backbone
25 PoPs in 20 cities
Bandwidth 2.5G /10
Over 400 IPv6 acce
networks, most of th
/48 IPv6 addresses
4M end users

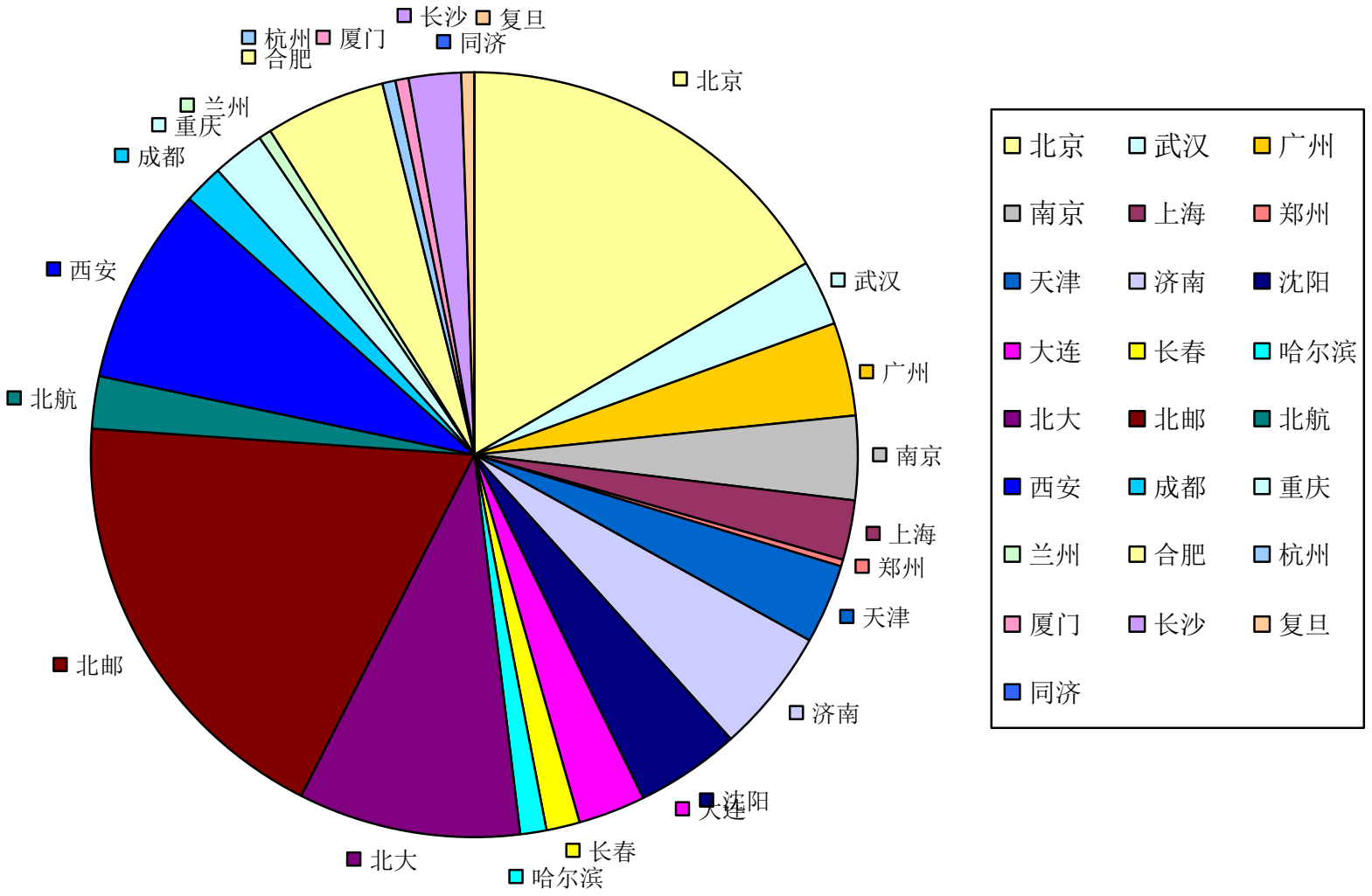
Some measurement stats

in Jan.2015

CNGI-6IX connection availability ratio

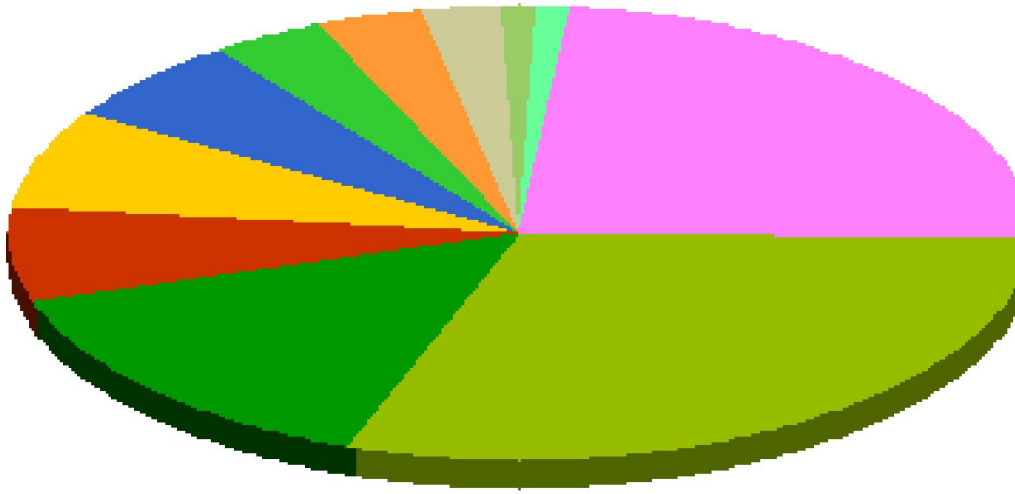


Backbone outbound traffic



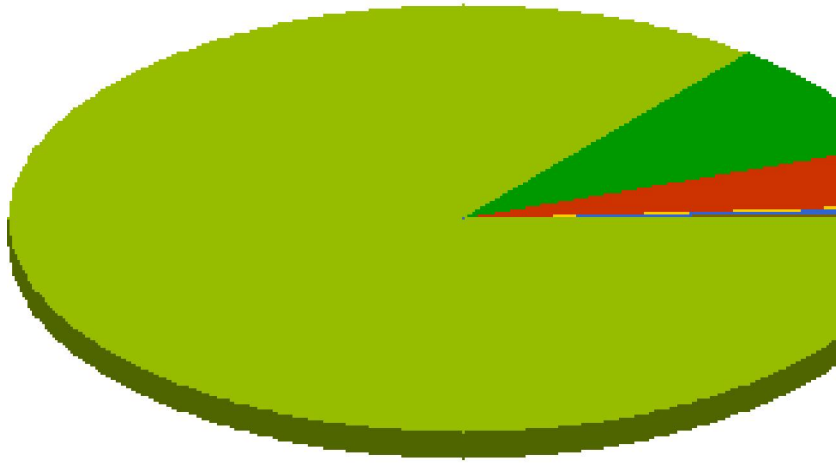
Traffic origin by AS

AS	PKTS SRC	PKTS DST	OCTS SRC	OCTS DST
786	900.8M	0	1.2T	0
789	382.9M	0	568.3G	0
1103	305.0M	0	273.7G	0
137	293.1M	0	270.7G	0
680	237.8M	0	236.7G	0
70	101.6M	0	140.0G	0
2200	107.5M	0	137.1G	0
513	327.2M	0	102.1G	0
34878	39.5M	0	47.2G	0
194	27.7M	0	41.4G	0
Other	934.0M	3.7G	949.7G	3.6T

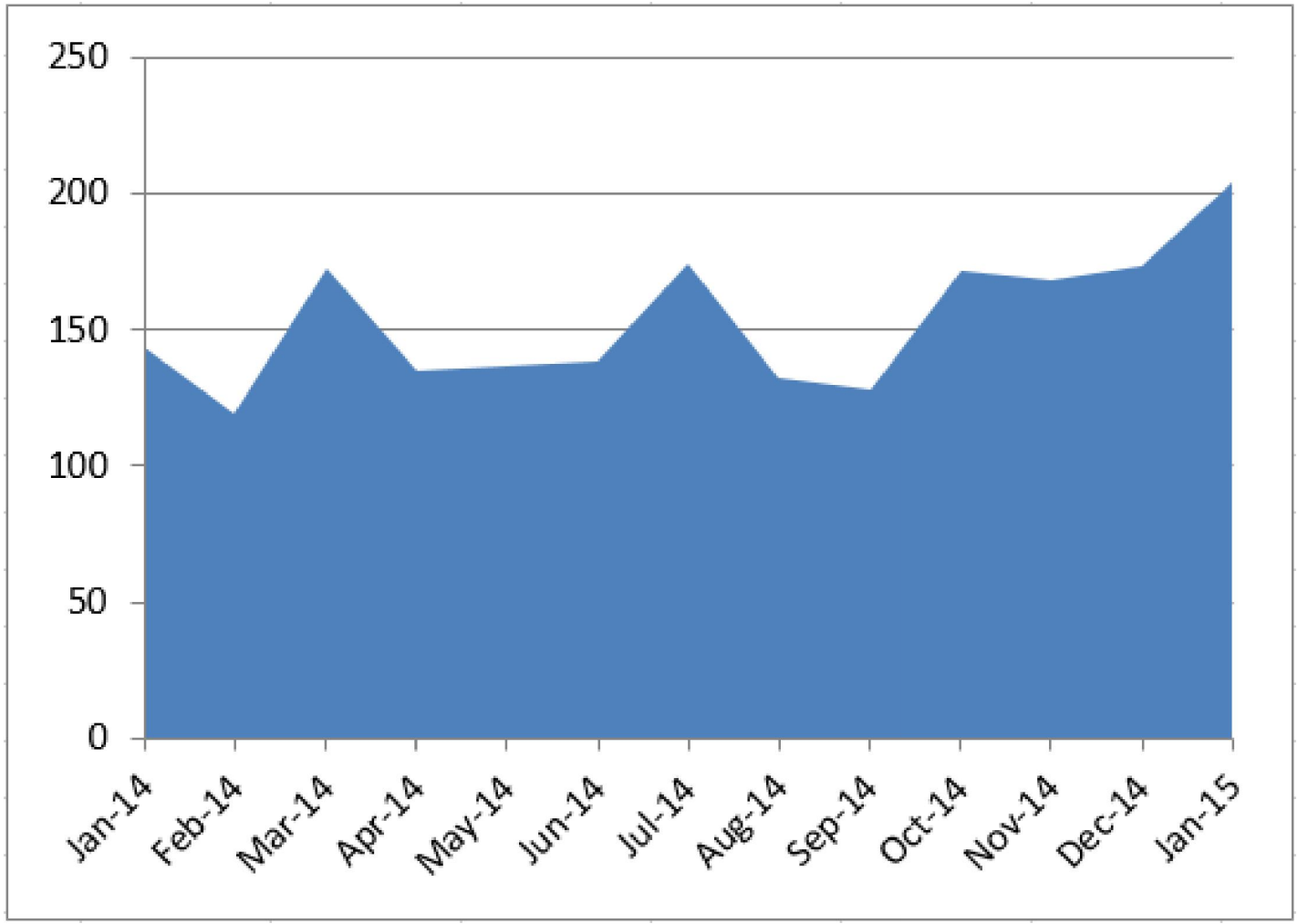


Traffic by protocol type

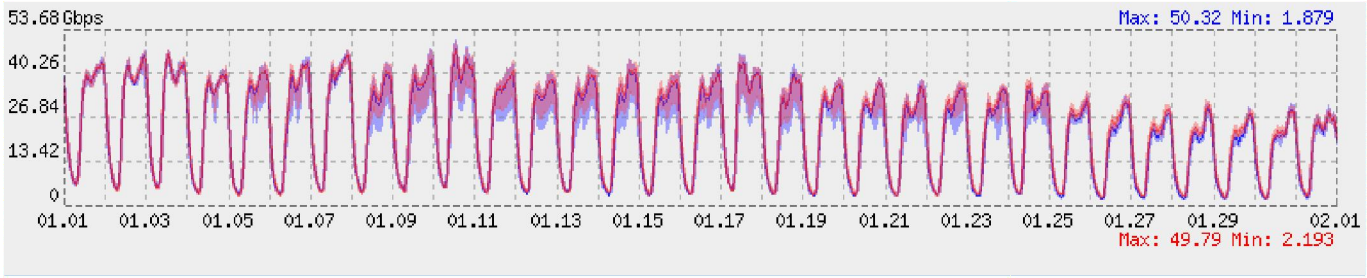
Protocol	PKTS IN	PKTS OUT	PKTS ALL	OCTS IN	OCTS OUT	OCTS ALL
6/TCP	2.8G	2.6G	5.5G	3.0T	2.4T	5.4T
17/UDP	506.7M	403.0M	909.7M	391.2G	167.4G	558.6G
41/IPV6	261.6M	154.5M	416.0M	223.5G	65.9G	289.3G
47/GRE	21.4M	19.2M	40.6M	14.5G	5.8G	20.3G
50/ESP	15.4M	11.6M	26.9M	12.2G	7.3G	19.5G
1/ICMP	11.7M	16.3M	27.9M	646.9M	4.8G	5.4G
103/PIM	1.6K	0	1.6K	238.4K	0	238.4K
2/IGMP	5.6K	0	5.6K	153.6K	0	153.6K
4/IPIP	0	1.1K	1.1K	0	92.3K	92.3K
51/AH	1	53	54	1.5K	8.2K	9.6K
Other	1	50	51	304	7.8K	8.1K



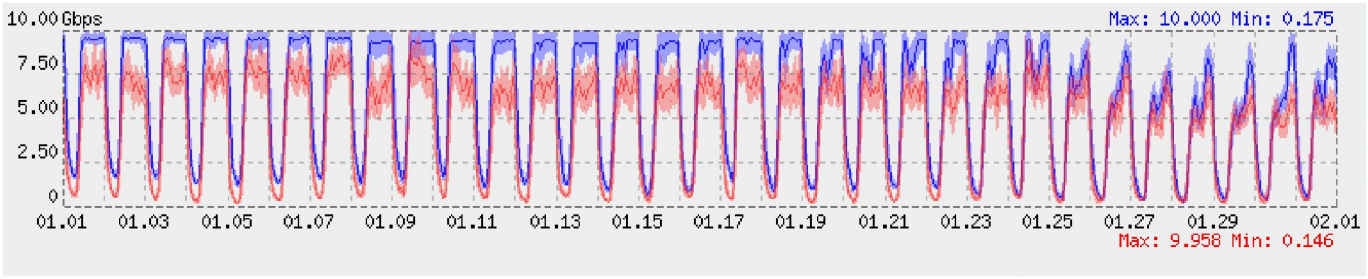
Inbound traffic from RS2-GEANT_10G (TB)



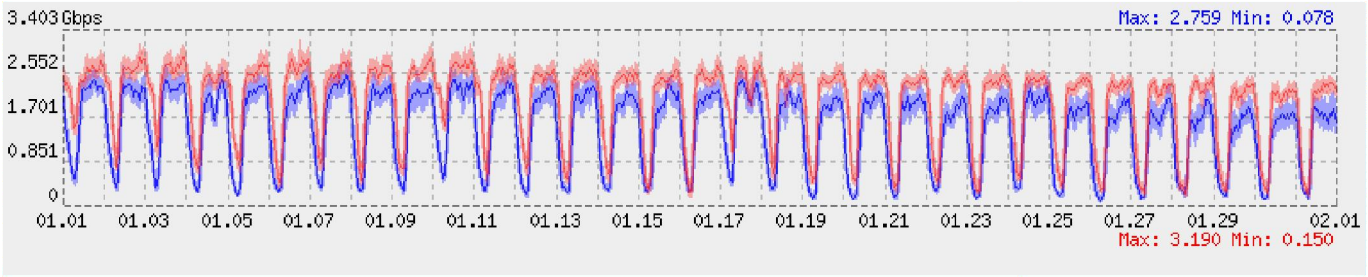
Traffic stats, Jan.2015



Aggregated traffic
Over 40Gbps

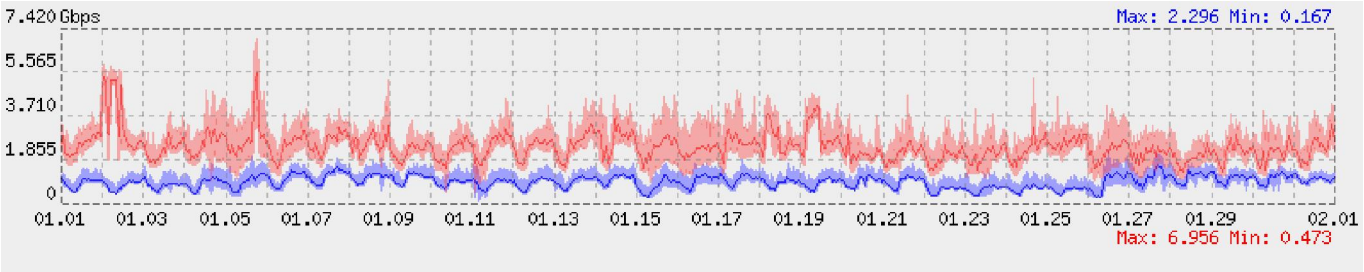


Traffic in BUPT POP
10Gbps, sometimes congested

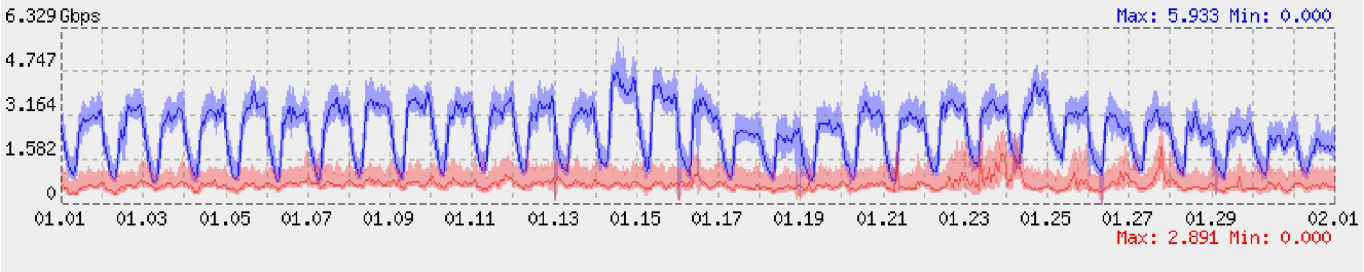


Traffic in Xi'An POP

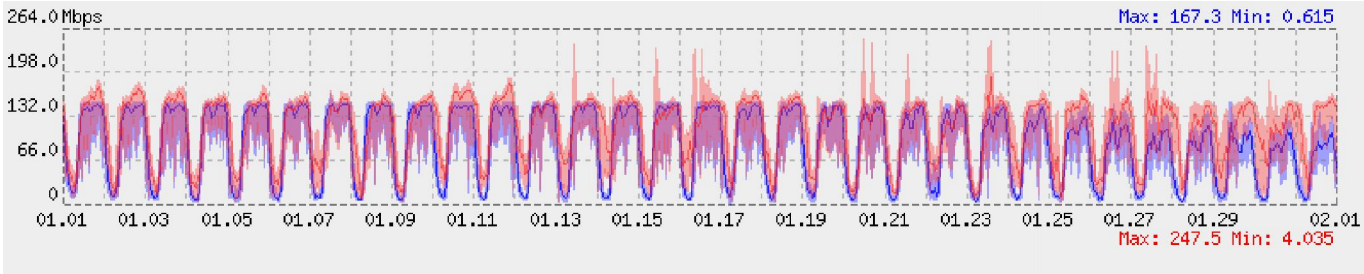
Traffic with in CERNET6-6IX with International partners



Traffic with HK-IX



Traffic with Internet2 4Gbps around



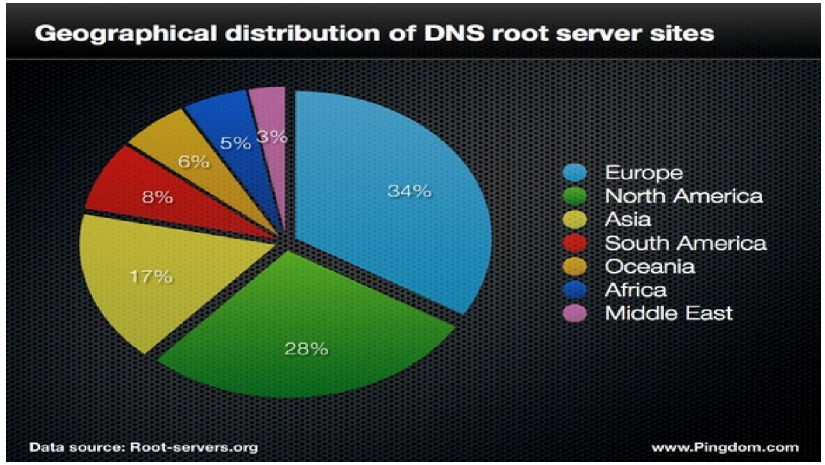
Traffic with ChinaTelec

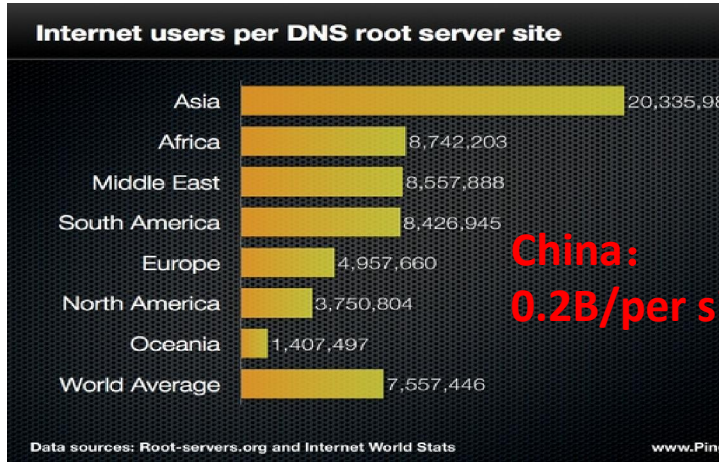
The Current Distribution of DNS Root Server

he (very) uneven
stribution of DNS root
ervers on the Internet

The number of Root server
limited to 13 due to
chnical reason (IPv4 MTU)

400+Anycast Root instance,
nly 4 in China（I,J,L）





Why not increase more Root server

- The number of Root server is limited to 13 due to technical reason
  - 512B limitation on packets size in RFC1035 (20+ years ago in IPv4 MTU specification RFC791)
  - Performance consideration(UDP/ query&response pattern)

- Anycast Root instance development heavily relies on BGP networking which is based on autonomous system and policy

"it (root scaling issue) could be regarded as a byproduct of a single hierarchical name space, the centralization of root information in the DNS is operationally problematical and does not cleanly fit within a distributed and decentralized peer model of a network architecture." --- Geoff Huston

Ways to Scale the Root system

- Increase the capability of the system (more machines)
  - More anycast root instance
  - Slave the root by Localized cache
    - http://datatracker.ietf.org/doc/draft-ietf-dnsop-root-loopback/
  - Universal Anycast (unowned anycast like AS112)
    - https://tools.ietf.org/html/draft-lee-dnsop-scalingroot-00
- Increase the “letter” (more Root operators)
  - Priming exchange via TCP or Http (break the limitation of 512B)
    - http://datatracker.ietf.org/doc/draft-song-dnsop-tcp-primingexchange/
  - More Root server for pure IPv6 network (experimental)
    - http://tools.ietf.org/id/draft-davey-sunset4-ipv6onlydns-00.txt

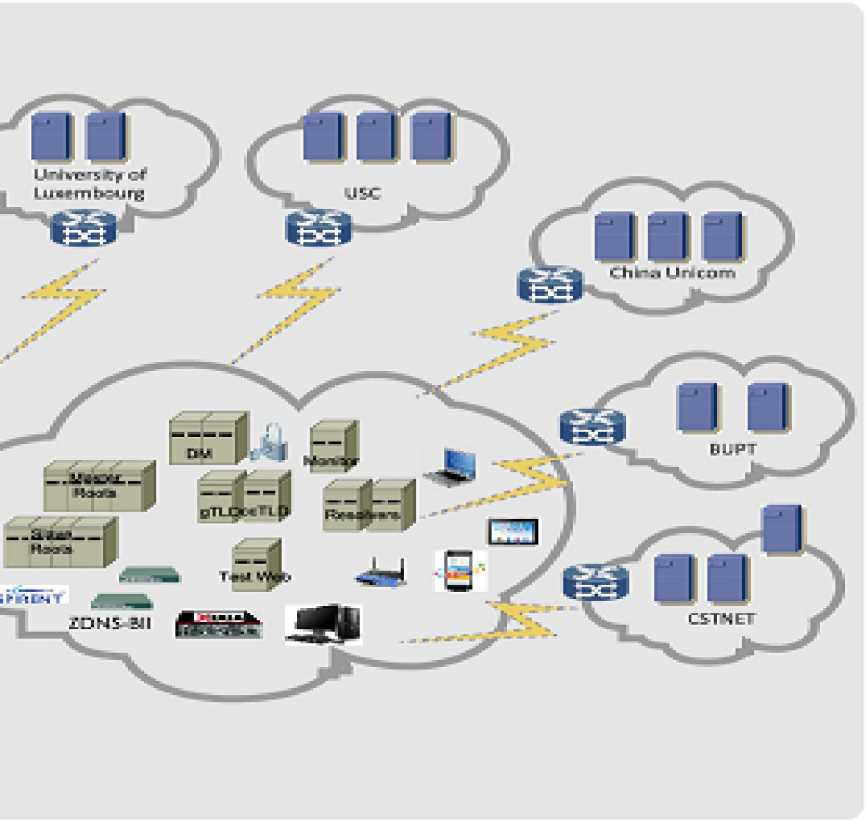
Recent Workshop on DNS Future Root Service

- Held at the start of December 2014 in Hong Kong, Looking at means to enable further scaling of the root server system
  - Reference: http://www.potaroo.net/ispcol/2014-12/futureroots.html

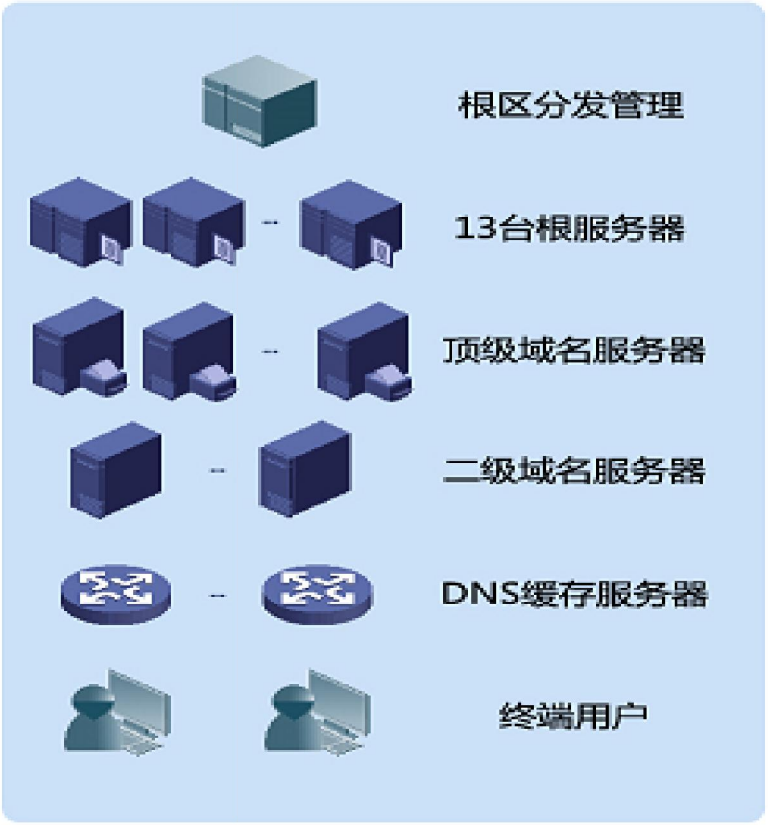
- IEEE work on root server scaling
  - 1） http://datatracker.ietf.org/doc/draft-ietf-dnsop-root-loopback/
  - 2） https://tools.ietf.org/html/draft-lee-dnsop-scalingroot-00
  - 3） http://datatracker.ietf.org/doc/draft-song-dnsop-tcp-primingexchange/

A Testbed on IPv6 DNS Root System

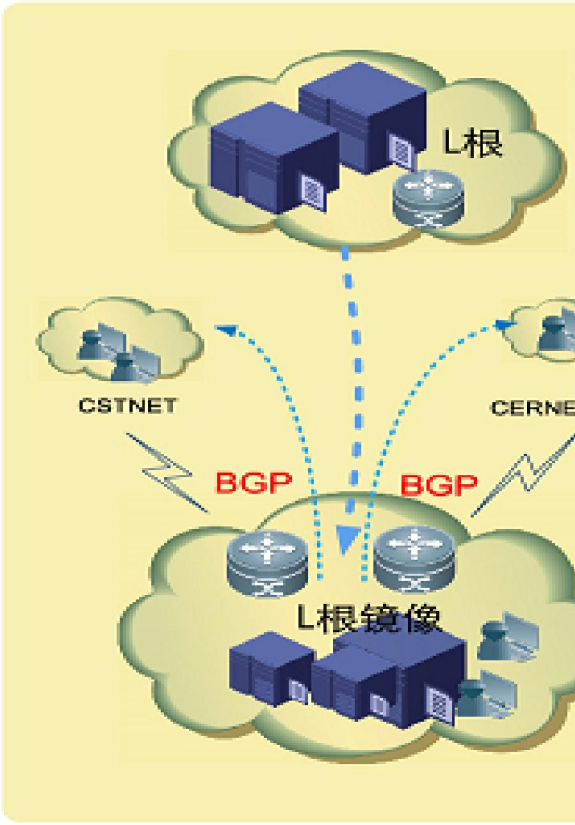
st & Experiment environment



A research Root testbed in IPv6

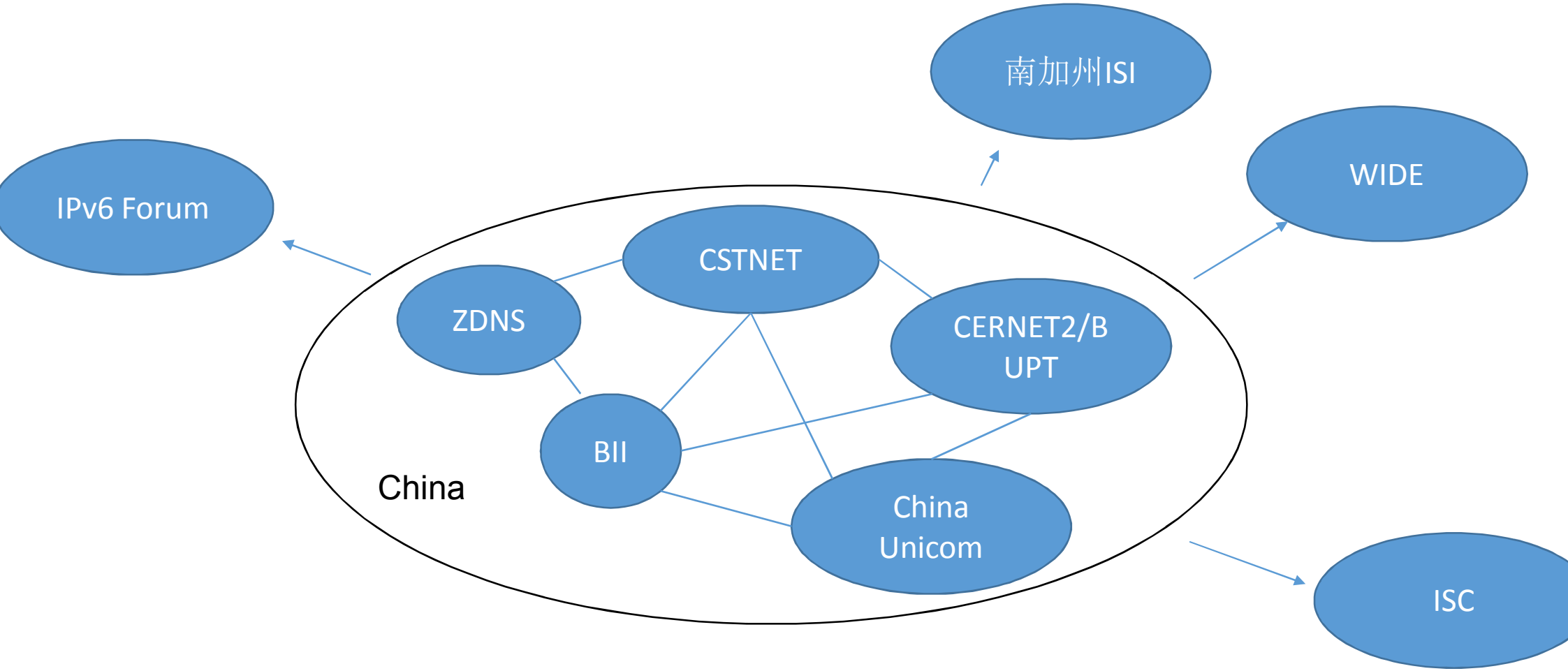


L-Root instance



A Pure IPv6 environment for Root and Resolve

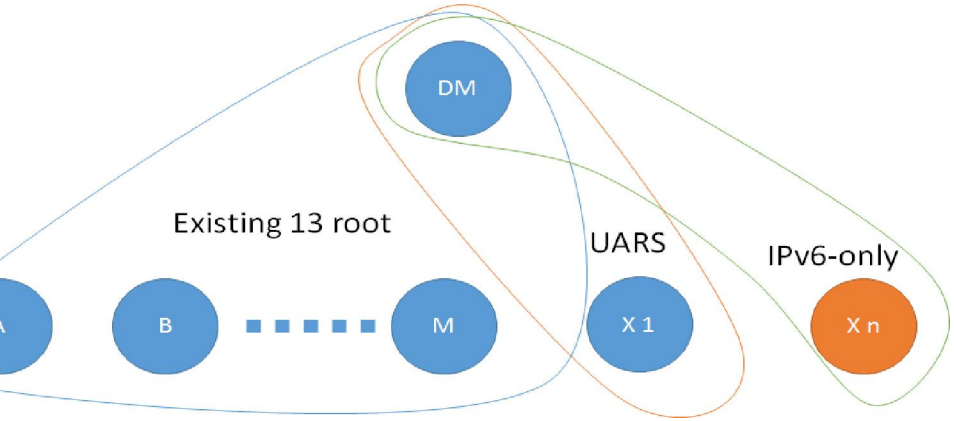
IPv6 DNS Root System Testbed Connectivity

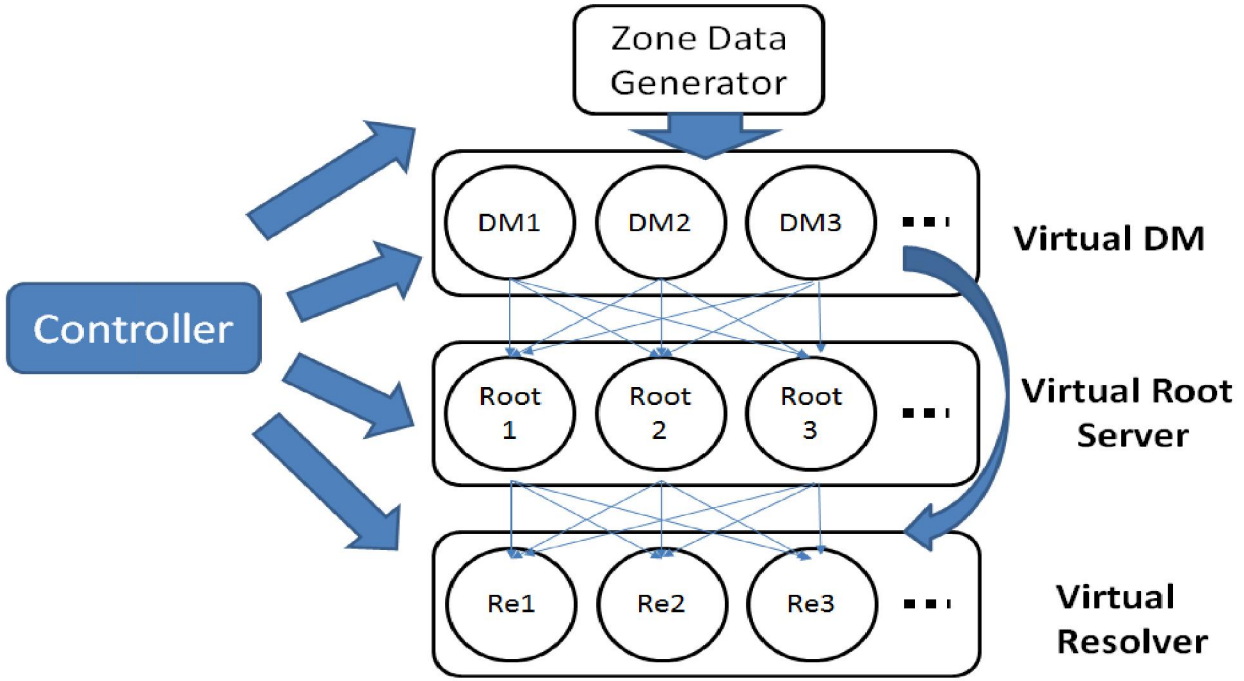


The paralleled Root Zones operation

Running paralleled Root zones and root scaling schemes to expand the nur
of root server beyond 13 root (13 to infinity)

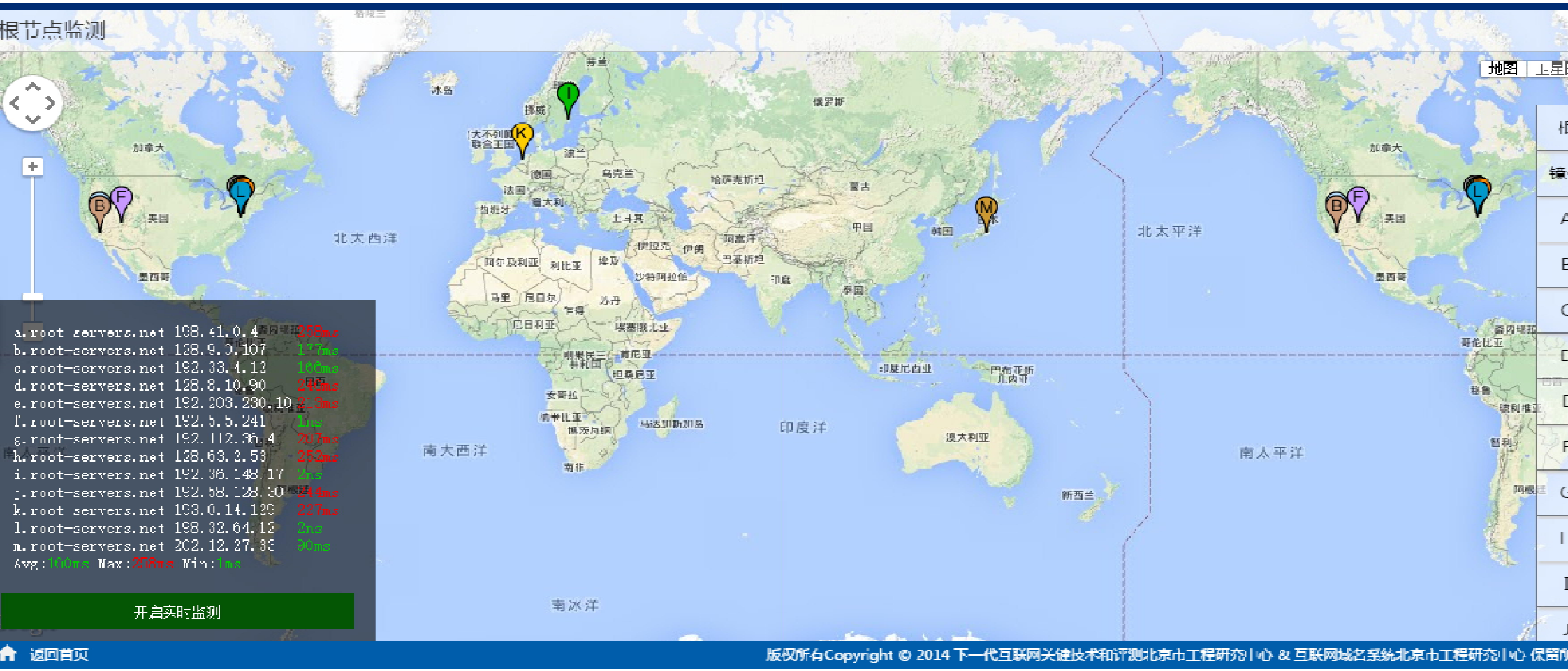
- Pervasive deployment of Root services via Universal Anycast
- IPv6-only experiment and operation research





IPv6 Root Service Monitoring

abpage Screenshot



http://221.123.163.10/rcoc/monitor Wed Mar 04 2015 06:36:35 GMT+0800 (中国标准时间)

A Testbed on IPv6 DNS Root System

- A flexible testbed to verify newly proposed protocol, implementation and operation practice on DNS Root
- Provides test cases, data, analysis for research and specifications on new ideas on IPv6 and DNS Root scaling issue
  - Root operation and IPv6-ony experiments
- An open platform collect insights from the very group of people and make effort to contribute the internet

Conclusion

- Proportion of websites having AAAA in China is still low
- Much work has been done in education network
- The IPv6 users mainly in large cities
- IPv6 DNS root testbed and research on the way
- More work is needed on IPv6

Future Plan

- Improve the solution: test the HTTP latency after verifying the website has AAAA record
- Gathering of statistical data for a long time to spot trends
- Contribute the tools as open source
- Collaborate with the community