

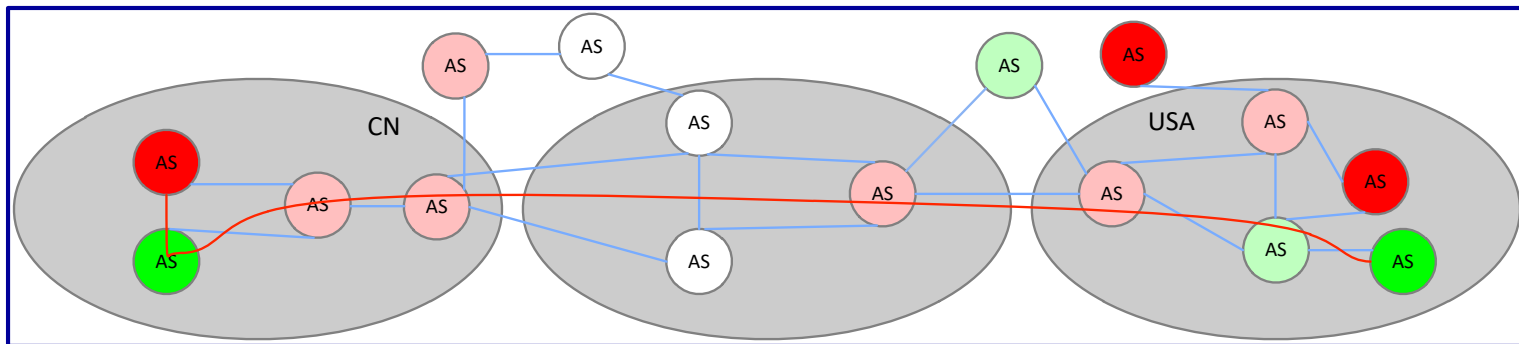
Asia Pacific Advanced Network 50th Meeting (APAN)

Joint Research on Active Measurement Technologies for IPv6 Networks

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Network measurement provides indispensable information for network applications.



Independent

Autonomous

Cross-domain



Problem:

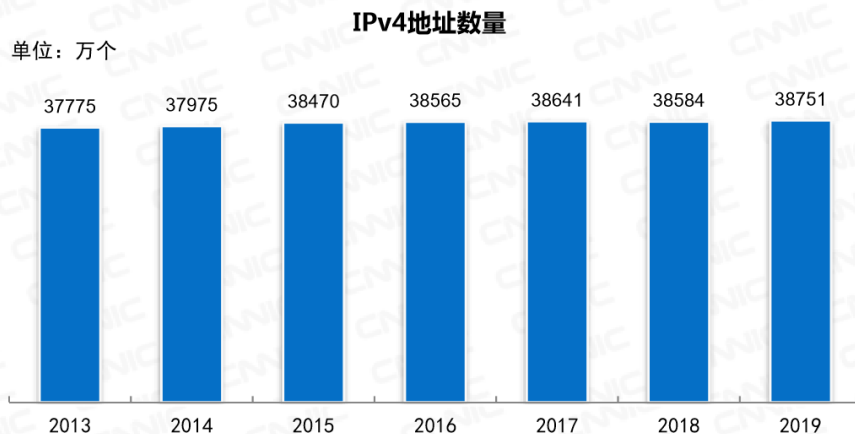
- How to achieve cooperative measurement among independent and autonomous domains?

■ State of the art

No.	Organization	Research topics	Research results
1	Center for Applied Internet Data Analysis (CAIDA)	Internet active and passive measurement; Internet inter-domain flow measurement and control	Archipelago (Ark): Network detection architecture and detection tool BGPStream: routing monitoring platform.
2	Reseaux IP Europeens Network Coordination Center (RIPE NCC)	EU Internet number resources allocation and management; distributed network measurement and routing monitoring	RIPE Atlas: a distributed measurement framework and probe tool. The organization has deployed nearly 10,000 entity probes worldwide for network measurement.
3	University of Michigan	Network measurement and analysis, attack and anomaly detection, traffic classification	Zmap: Address scanning tool; ZMapv6: Internet Scanner with IPv6 capabilities

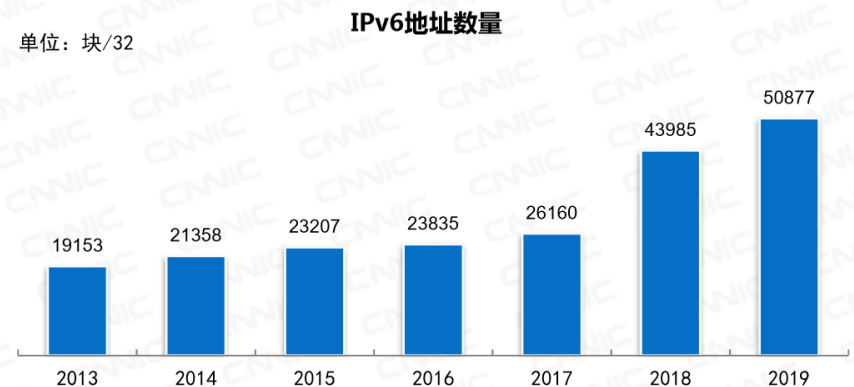
IPv6 Updates in China

- The number of Internet netizens in China has reached 0.904 billion, occupying 64.5% of whole population.
- Mobile Internet users are 0.897 billion, occupying 99.3% of whole netizens.
- IPv4 addresses: 387,510,000, rise 0.4% than 2018.
- IPv6 addresses: 50877 /32, rise 15.7% than 2018



来源：CNNIC 中国互联网络发展状况统计调查

2019.12



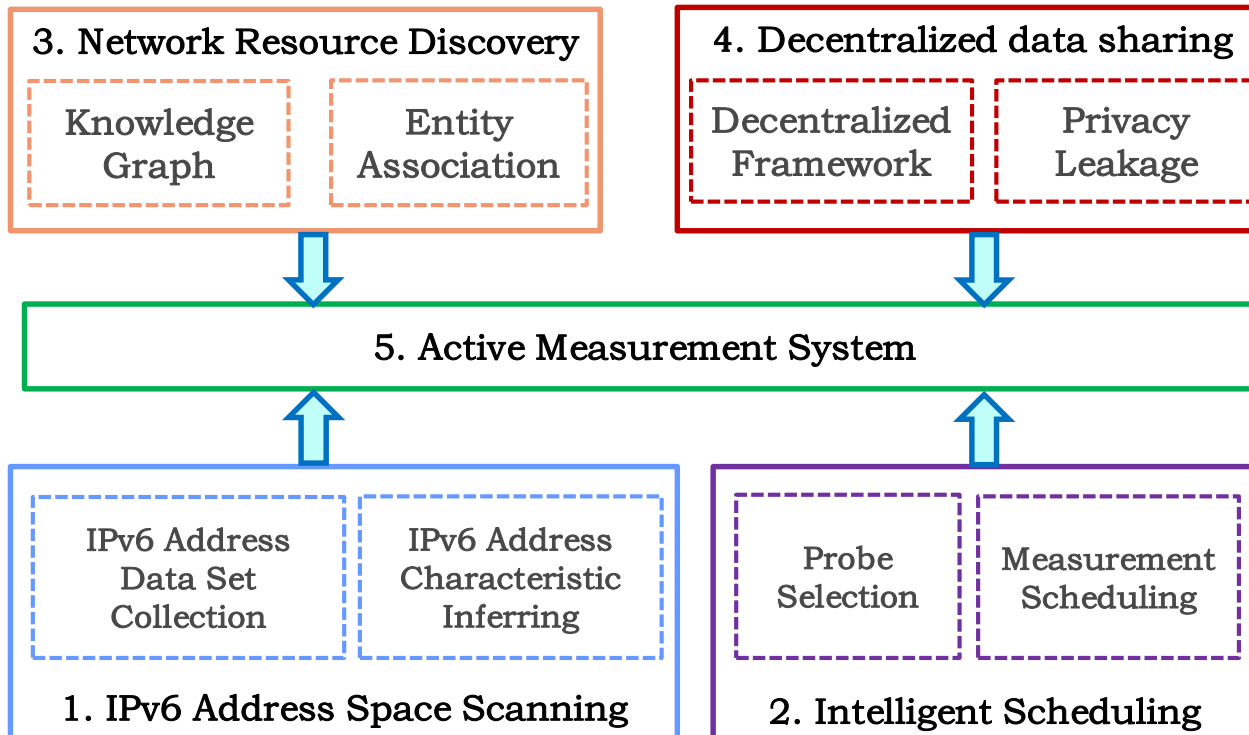
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2019.12

■ Challenges

- **IPv6 network operations**: vast address space and IPv6 address assignment features.
- **Cooperative and autonomous measurement**: support the on-demand and controllable scheduling of measurement resources,
- **Privacy**: support the secured sharing the measurement data

Active Measurement Technologies for IPv6 Network



1. IPv6 Address Space Scanning

■ Challenges

- **Vast** IP address space
- **Complicated** and **undiscovered** characteristics of structure and space

■ Targets:

- Develop an efficient and flexible scanning tool

2. Intelligent Scheduling Mechanism for Probe Nodes

■ Challenges

- Heterogeneous, discrete, and resource constrained measurement resources
- Cooperation and competition among measurement nodes

■ Targets:

- Intelligent scheduling algorithm in inter-domain network

3. Network Resource Discovery

■ Challenges

- **Cross-layer** entity association

■ Targets:

- IPv6 address based knowledge graph building

4. Decentralized Data Sharing

■ Challenges

- Secured sharing of measurement data

■ Targets:

- Establish a federated data alliance
- Realize secure, effective and efficient data sharing

5. Active Measurement System

■ Measurement framework

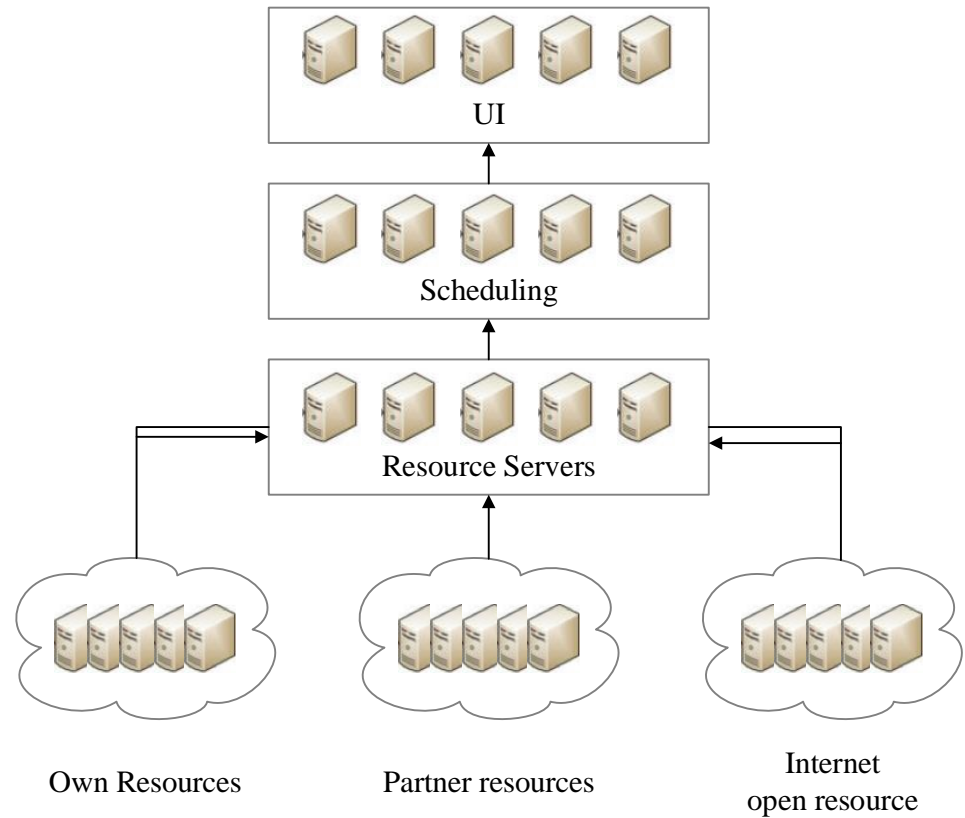
- Cooperative, alliance and open.

■ Measurement functionalities

- network digital asset management, topology discovery, performance and security measurement

■ Functionalities

- Cross-layer
- Association



Chinese Partners



Beijing University of Posts and Telecommunications

IPv6 network construction, network operation, network management, mobile IP and network security.

- CERNET (China Education and Research Network, the biggest R&D network in China)
- CERNET2 (the biggest native IPv6 network in the world at present)
- CNGI (China Next Generation Internet, the biggest IPv6 network in the world)
- NSFCnet (Network of National Science Foundation of China, a High-speed IPv4/IPv6 dual-stack network)



Shandong University

Big data, artificial intelligence, data mining, blockchain

Schedule

Mid-term

End of project

2020.6

2021.12

2023.5

Investigate
Collaborative
Management
Architecture
Model for IPv6
Cyberspace and
other key
technologies

1st year
Breakthrough key
technologies

Develop
prototype and
systems, and
design
demonstration

2nd year
Prototype and
systems

Integrate
prototype and
systems, large-
scale
demonstration
and evaluation

3rd year
Demonstration

Thanks