

(APNIC Project)

**Developing a Collaborative BGP Routing
Analyzing and Diagnosing Platform**

--The 4th Technical Committee Meeting

Sep 29, 2022

Outline

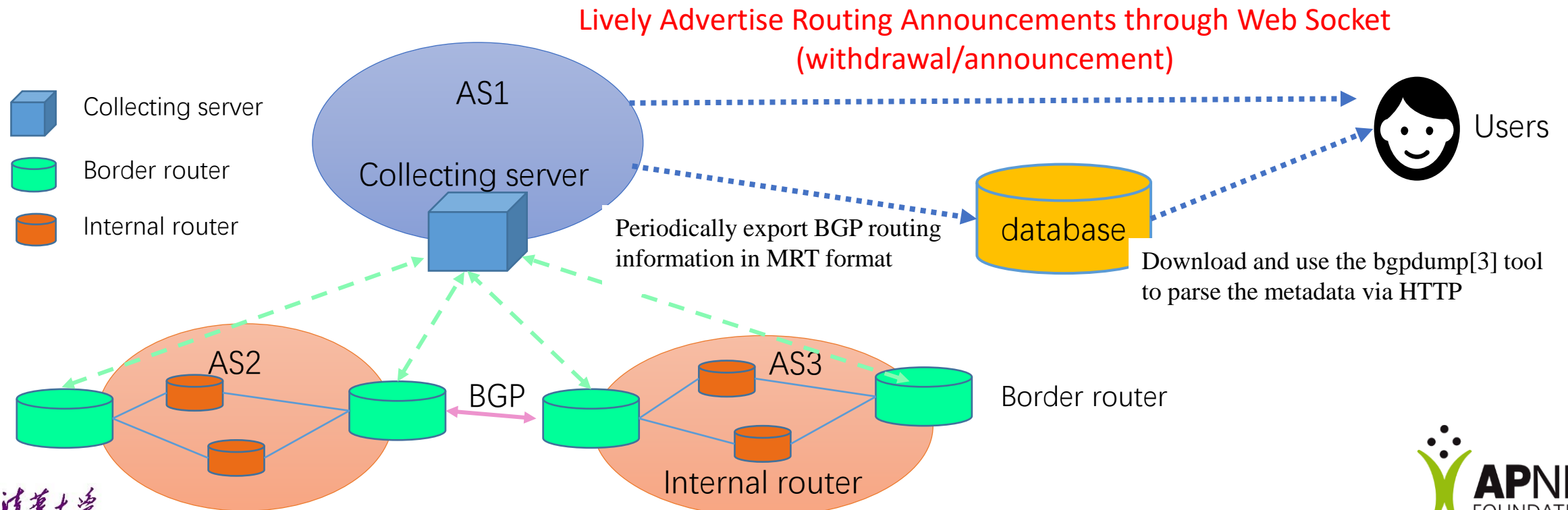
- **Progress and Plan**
- **Detailed Project Progress in Last Three Month**
 - BGP sharing platform
 - Looking Glass platform
 - Analyzing and Diagnosing Platform
 - Research Topic
- **Future Plan**
- **Comments/Suggestions**

Progress and Plan

Objectives	Detail work	Status
Build a collaborative community for enhancing the capacity of NRENs' network operation and measurement	Setting up project website	Finished in May
	Collaborative Work	See the next slides
	Platform development and deployment	See below
Establish a distributed BGP routing monitoring platform and a looking glass platform in the Asia-Pacific region	BGP Routing Information Sharing	13 partners
	Looking Glass Platform	6 partners
	Tools for operator(dashboard, routing path search, register and alarm email)	Partially done, still need improvement
Deploy a BGP hijacking detection and mitigation system and analyze the robustness of routing in the Asia-Pacific region	Development of prefix hijacking detection	Partially done, still need improvement
	Development of path hijacking detection	Oct – next June
	Research Paper: region resilience	The draft will be discussed in Oct
	Research Paper: routing hijacking detection	The draft will be discussed in Nov/Dec
Share knowledge and experience globally	RPKI, MANRS, BGPSEC, etc.(tbd)	Nov/Dec, next Apr/May
	paper, technical document	Keep updating

CGTF-RIS: Route Information Sharing

- Collecting server: Use routing FRR[2] to simulate a real BGP router
- Border routers: Connect with the collecting server by BGP peering
- Feature: Lively Advertise Routing Announcements



BGP Route Information Sharing

We have established BGP session with **13 partners**.

Data can be accessed at <https://bgp.cgtf.net>

Configuration manual can be accessed at
<https://www.bgper.net/index.php/document/>

Index of /ribs/2022/07

No.	Partner	No.	Partner
1	APAN-JP	8	MYREN
2	BDREN	9	PERN
3	CERNET	10	REANNZ
4	HARNET	11	SINGAREN
5	ITB	12	ThaiSARN
6	KREONET	13	TransPAC
7	LEARN		

	Name	Last modified	Size	Description
	rib.20220730.0600.mrt.bz2	2022-07-30 06:00	13M	
	rib.20220730.0800.mrt.bz2	2022-07-30 08:00	13M	
	rib.20220730.1000.mrt.bz2	2022-07-30 10:00	13M	
	rib.20220730.1200.mrt.bz2	2022-07-30 12:00	13M	
	rib.20220730.1400.mrt.bz2	2022-07-30 14:00	13M	
	rib.20220730.1600.mrt.bz2	2022-07-30 16:00	13M	
	rib.20220730.1800.mrt.bz2	2022-07-30 18:00	13M	
	rib.20220730.2000.mrt.bz2	2022-07-30 20:00	13M	
	rib.20220730.2200.mrt.bz2	2022-07-30 22:00	13M	
	rib.20220731.0000.mrt.bz2	2022-07-31 00:00	13M	
	rib.20220731.0200.mrt.bz2	2022-07-31 02:00	13M	
	rib.20220731.0400.mrt.bz2	2022-07-31 04:00	13M	
	rib.20220731.0600.mrt.bz2	2022-07-31 06:00	13M	
	rib.20220731.0800.mrt.bz2	2022-07-31 08:00	13M	
	rib.20220731.1000.mrt.bz2	2022-07-31 10:00	13M	

CGTF Looking Glass

- <https://lg.cgtf.net>
- Open Source:
 - <https://github.com/gmazoyer/looking-glass>
- 6 Education & Research network joined
- 5 commands
- Query speed limit for security
- More partners is welcomed

CGTF Looking Glass



Router to use

CERNET Juniper Router at CNGI-6IX
ThaiREN Cisco Router
BdREN Cisco Router
SingAREN Juniper Router
MYREN Cisco router

Command to issue

show route IP_ADDRESS
show route as-path-regex AS_PATH_REGEX
show route ^AS
ping IP_ADDRESS|HOSTNAME
tracert IP_ADDRESS|HOSTNAME

Parameter

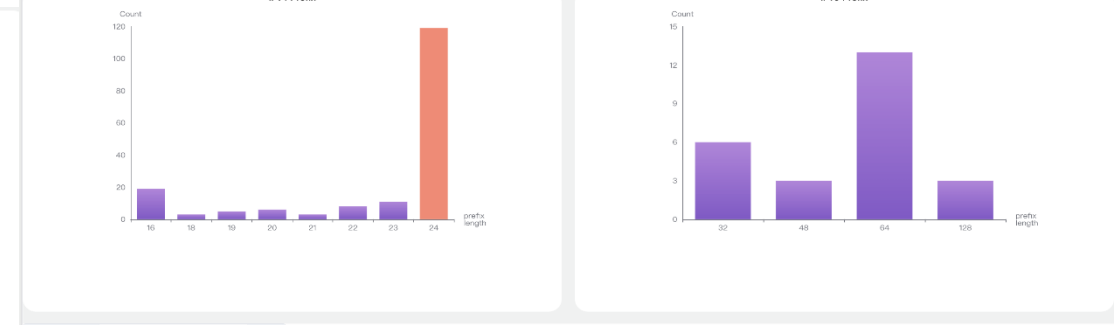
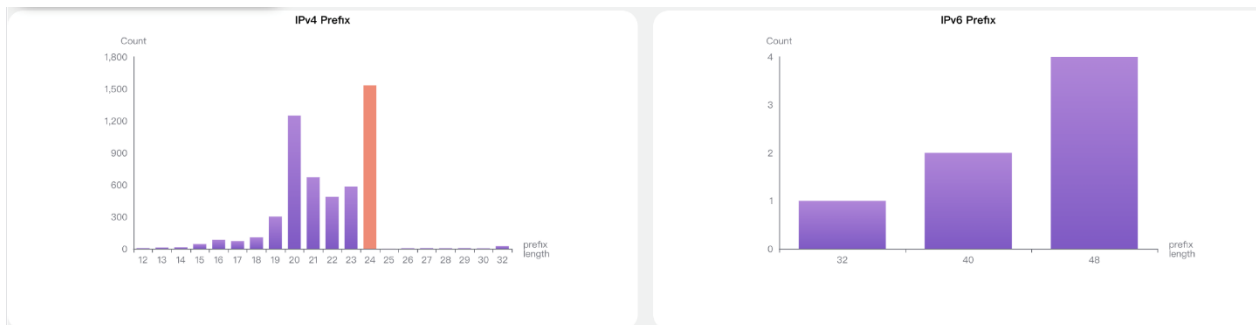
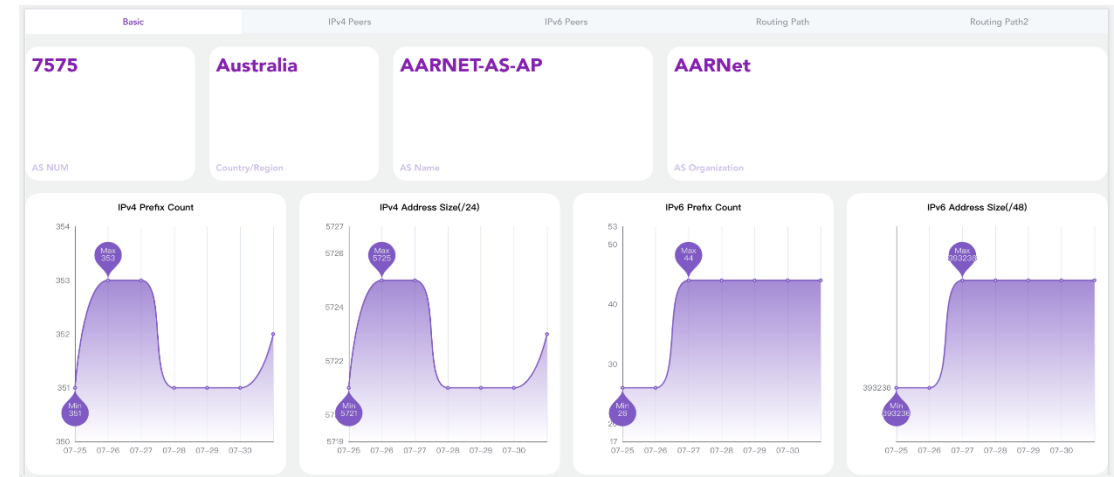
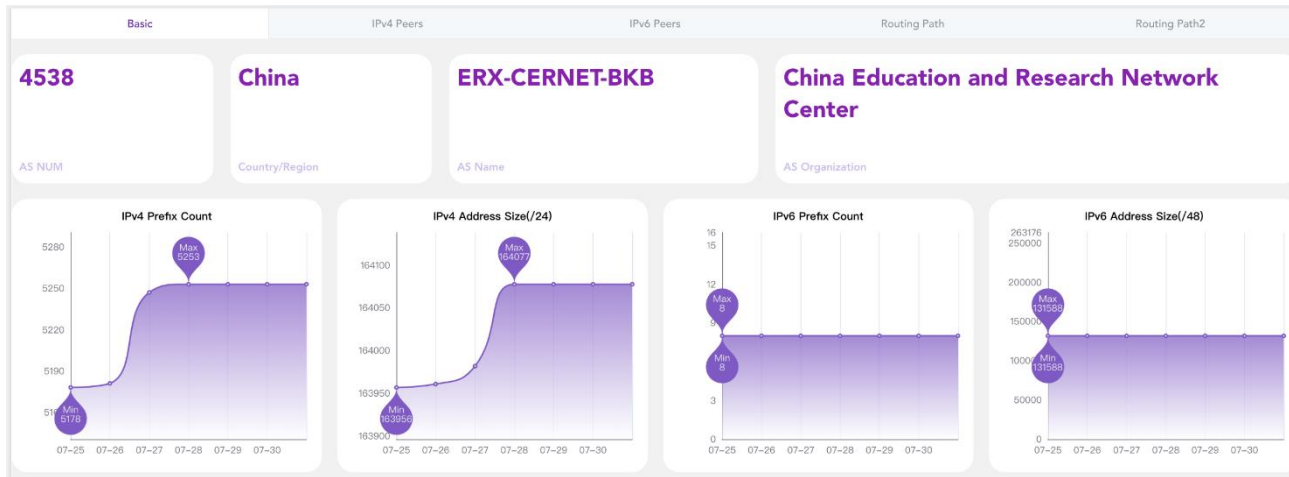
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Enter Reset

Help

We'll focus on this work in Oct to Dec

Tools for operator –Dashboard



Prefix Search for Prefix Q

Click on the column above, the corresponding prefix will be displayed in the table

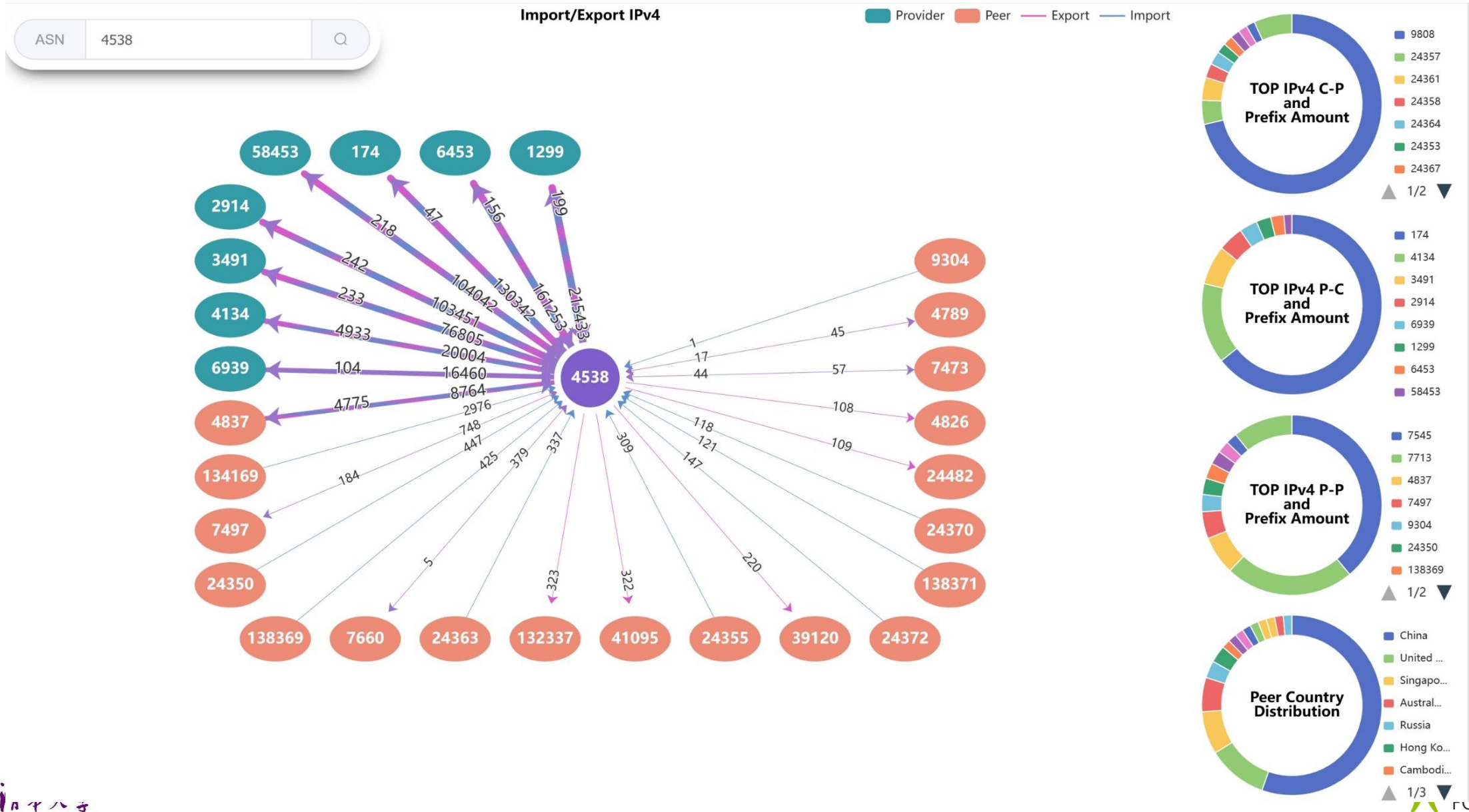
	Prefix	Prefix	Prefix
1	1.51.112.0/24	42.244.13.0/24	42.247.1.0/24
2	42.247.5.0/24	42.247.8.0/24	42.247.9.0/24
3	42.247.13.0/24	42.247.18.0/24	42.247.19.0/24

Prefix Search for Prefix Q

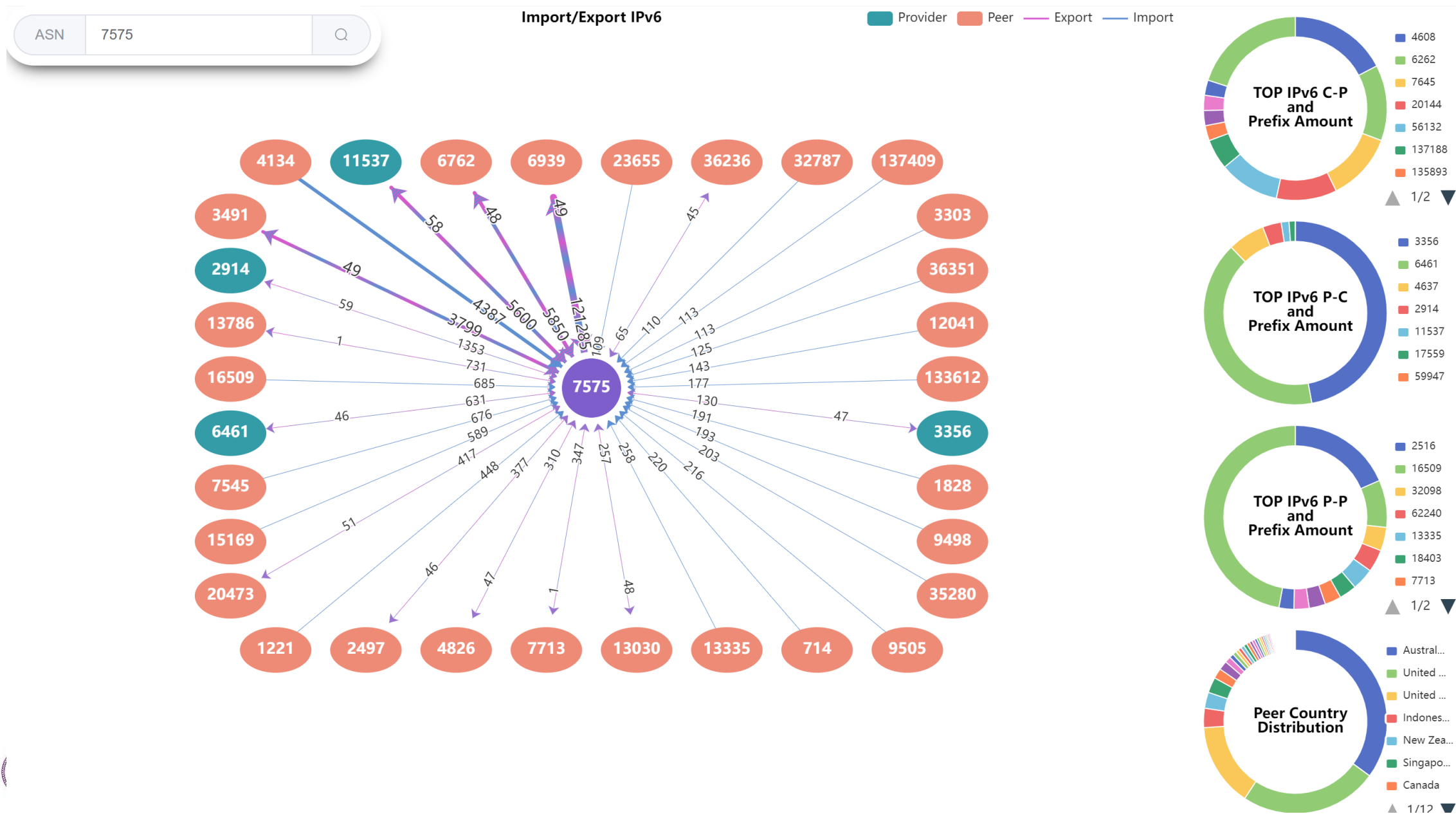
Click on the column above, the corresponding prefix will be displayed in the table

	Prefix	Prefix	Prefix
1	103.36.12.0/24	103.77.199.0/24	103.80.128.0/24
2	103.84.224.0/24	103.90.208.0/24	103.152.75.0/24
3	103.204.14.0/24	103.205.231.0/24	103.235.20.0/24
4	138.7.67.0/24	138.7.120.0/24	138.7.191.0/24
5	138.7.193.0/24	138.25.253.0/24	138.44.226.0/24

Tools for operator – IPv4 Key Peers



Tools for operator – IPv6 Peers



Tools for operator – Routing Path Search

APAN-JP

BDREN

CERNET

HARNET

ITB

KREONET

LEARN

MYREN

REANNZ

SINGAREN

ThaiREN

Basic

IPv4 Peers

IPv6 Peers

Routing Path

IP

165.124.0.0/16

Q

You can input an IP address or prefix address. For example:
1.0.0.1, 1.0.0.0/16. The system will return all the subset and superset network of it.

165.124.0.0/17

165.124.128.0/19

165.124.160.0/20

165.124.176.0/21

165.124.184.0/22

165.124.192.0/19

165.124.224.0/21

165.124.232.0/22

165.124.240.0/20

165.124.188.0/22

165.124.236.0/22

AS path

1061514

Prefix Total

24575

23911

11537

29384

22335

103

**Return paths of all sub networks and super networks of the input prefix.
Group Prefixes with the same routing path .**

Tools for operator – Register and Subscribe AS

Personal Information

* Username

Please input username

* Password

Please input password

* New password

Please input password again

* Email

Please input email

Register

DragonLab BGPWatch

Home

Anomaly

Overview

Dashboard

Resilience

Subscribe

aqc

ASN

24514

+

You can input an ASN expression , one or more ASN. For example:
[1,100]: will subscribe to ASes which ASN range from 1 to 100;
4538: will subscribe to AS which ASN is 4538;
4538,4134: will subscribe to ASes which ASN are 4538 and 4134

Delete All

ASN
38022

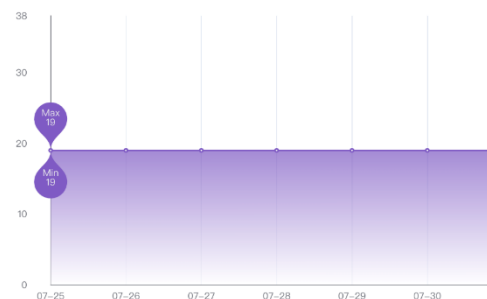
Country/Region
NZ

Name
REANNZ-NZ-AP

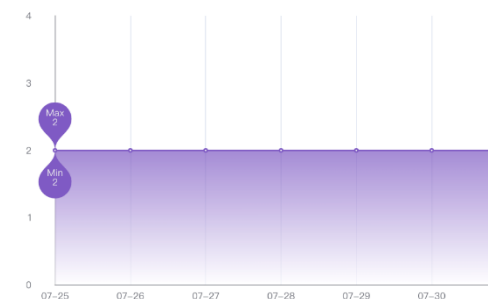
Organization
REANNZ Education and Schools

×

IPv4 Prefix Count



IPv6 Prefix Count



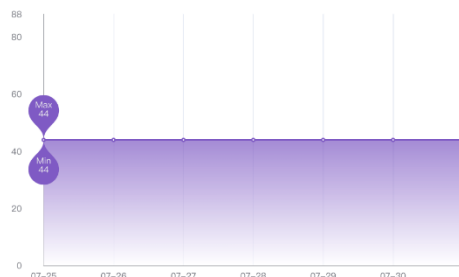
ASN
7473

Country/Region
SG

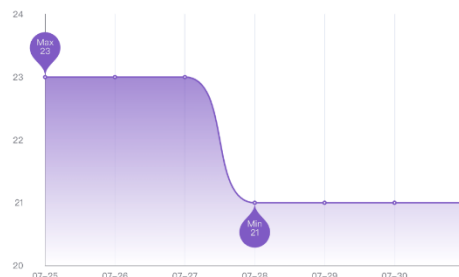
Name
SINGTEL-AS-AP

Organization
Singapore Telecommunications (SINGTEL Internet Exchange)

IPv4 Prefix Count



IPv6 Prefix Count



ASN
7575

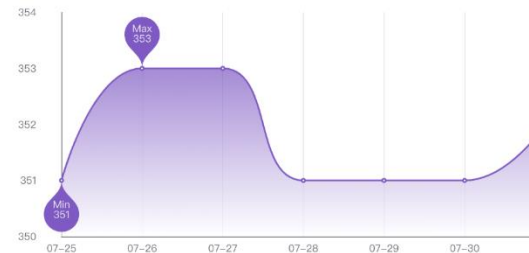
Country/Region
AU

Name
AARNET-AS-AP

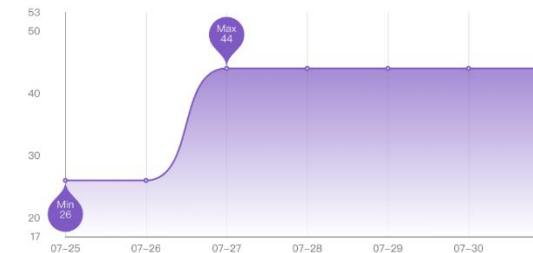
Organization
AARNet

×

IPv4 Prefix Count



IPv6 Prefix Count



Tools for operator – Send Alarm Email to Subscriber

ASN
4538

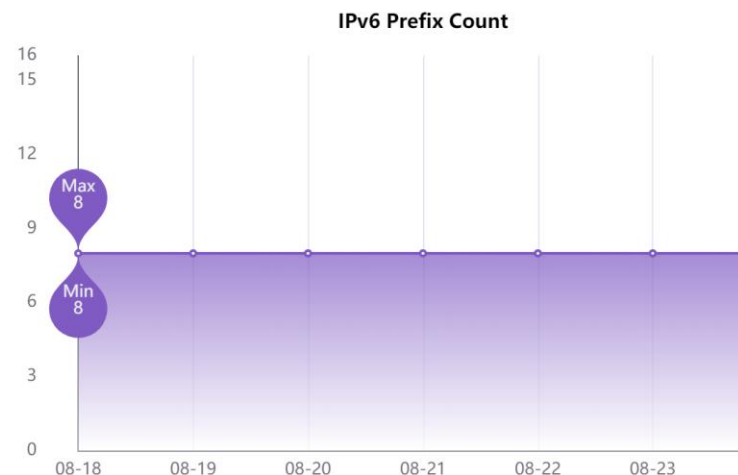
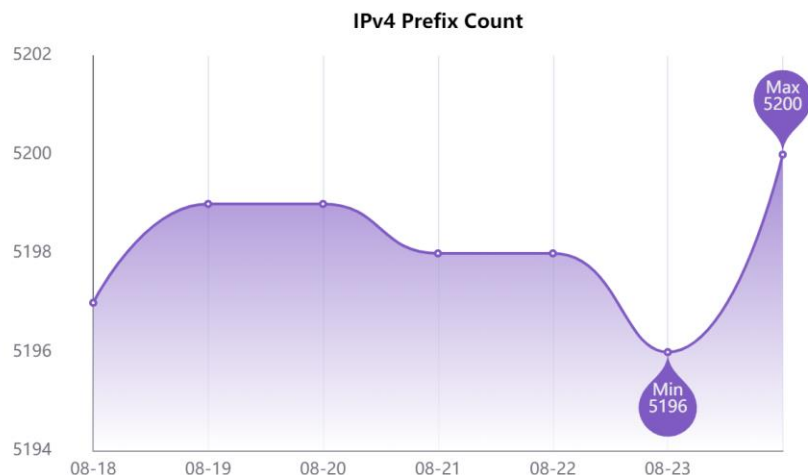
Country/Region
CN

Name
ERX-CERNET-BKB

Organization
**China Education and
Research Network
Center**

Prefixes Changed
+ 4 - 0

Prefix Change



+59.64.64.0/20

+121.194.32.0/20

+211.68.32.0/20

+211.82.96.0/20

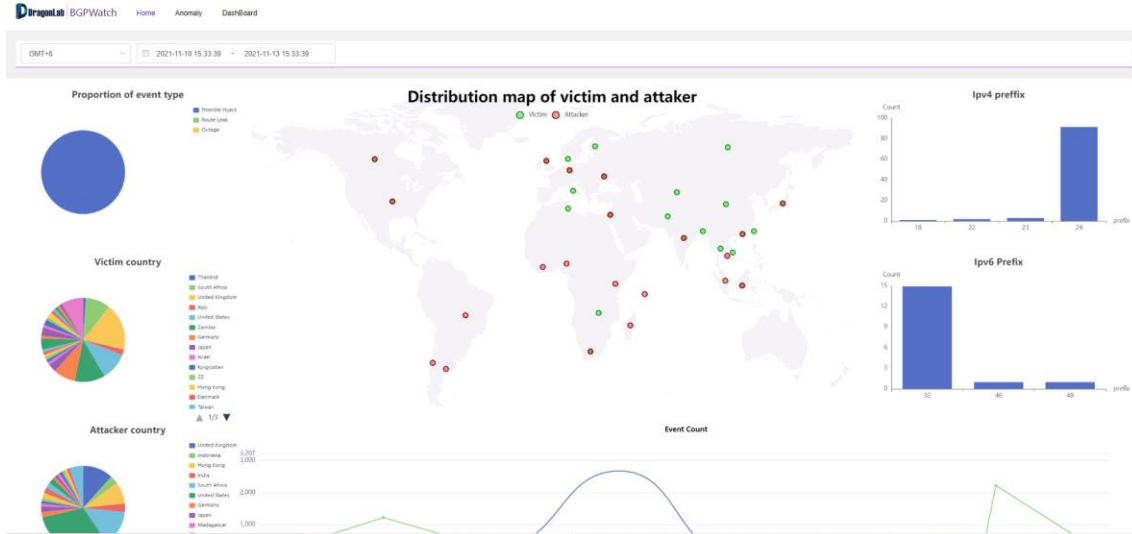
Announced prefixes changes between 2022-08-24 00:00:00 (GMT) and 2022-08-23 00:00:00 (GMT)

ASN 7575 #
+ 203.6.255.0/24

ASN 4538 #
+ 59.64.64.0/20
+ 121.194.32.0/20
+ 211.68.32.0/20
+ 211.82.96.0/20

BGP Routing Hijacking Detection

- <https://bgpwatch.cgtf.net>
- Knowledge-based real-time BGP hijacking Detection System
- Public BGP event reporting service
- Based on MOAS(subMOAS)
- Exclude legal MOAS by using domain knowledge and rules (ROA, IRR, AS relationship etc)



The screenshot displays the BGPWatch dashboard interface, showing a list of detected hijacking events. The table includes columns for ID, Event Type, Event Info, Prefix Num, Prefix, Level, Start Time, End Time, Duration, and Detail. The events listed are all 'Possible Hijack' events.

ID	Event Type	Event Info	Prefix Num	Prefix	Level	Start Time	End Time	Duration	Detail
1	Possible Hijack	Victim:AS4766 (KXS-AS-KR,KR) Possible Hijacker:AS45903(CMCTECOM-AS-VN,VN)	1	113.20.127.0/24	low	2021-11-16 14:33:52	2021-11-16 14:41:48	0:7:56	detail
2	Possible Hijack	Victim:AS749 (DNIC-AS-00749,US) Possible Hijacker:AS22085(BR)	3	21.23.13.0/24	low	2021-11-16 14:33:48	2021-11-16 14:41:01	0:7:13	detail
3	Possible Hijack	Victim:AS174 (COGENT-174,US) Possible Hijacker:AS12663(VODAFONE-GROUP,IT)	1	108.179.64.0/16	low	2021-11-16 13:37:25	2021-11-16 13:40:55	0:3:30	detail
4	Possible Hijack	Victim:AS133748 (CORETELNET-AS-AP,SG) Possible Hijacker:AS135026(THINKDREAM-AS-AP,HK)	1	203.208.22.0/24	low	2021-11-16 13:04:02	2021-11-16 13:21:24	0:17:22	detail
5	Possible Hijack	Victim:AS397464 (SAP-HYBRIS-WA1,US) Possible Hijacker:AS205356(SAP_DC_FRA,DE)	3	157.133.239.0/24	middle 2 websites in the prefix.	2021-11-16 13:03:58	2021-11-16 13:21:06	0:17:8	detail
6	Possible Hijack	Victim:AS63981 (NTDKL-HK,HK) Possible Hijacker:AS59805(NovaNetwork,CN)	1	116.214.132.0/24	low	2021-11-16 10:37:28	2021-11-16 11:37:40	1:0:12	detail
7	Possible Hijack	Victim:AS4766 (KXS-AS-KR,KR) Possible Hijacker:AS45903(CMCTECOM-AS-VN,VN)	1	113.20.127.0/24	low	2021-11-16 09:40:04	2021-11-16 10:25:04	0:45:0	detail

Research Paper

Evaluating and Improving Regional Network Robustness from AS TOPO Perspective

1st Given Name Surname
dept. name of organization (of Aff.)
name of organization (of Aff.)
City, Country
email address or ORCID

2nd Given Name Surname
dept. name of organization (of Aff.)
name of organization (of Aff.)
City, Country
email address or ORCID

3rd Given Name Surname
dept. name of organization (of Aff.)
name of organization (of Aff.)
City, Country
email address or ORCID

4th Given Name Surname
dept. name of organization (of Aff.)
name of organization (of Aff.)
City, Country
email address or ORCID

5th Given Name Surname
dept. name of organization (of Aff.)
name of organization (of Aff.)
City, Country
email address or ORCID

6th Given Name Surname
dept. name of organization (of Aff.)
name of organization (of Aff.)
City, Country
email address or ORCID

Abstract—Currently, national and regional networks are subject to various security attacks and threats, including various types of malicious behaviors and specific natural disasters. This paper borrows the quantitative ranking idea from the fields of economy and society and proposes a ranking method for evaluating regional resilience. A large-scale simulation was made and the sampling data were acquired from each AS and region. A significance tester that measures the impact of events from the overall level and variance aspect was also implemented. To improve a region's robustness, this paper proposes a greedy algorithm to optimize the resilience of regions by increasing key links among AS. This paper selects the AS topology of 50 countries/regions for research and ranking, evaluating the topology robustness from connectivity, user, and domain perspective, clustering the results, and searching for optimal links to improve the network resilience. Experimental results have shown that the resilience of regional networks can be greatly improved by slightly increasing the number of connections, which demonstrates the effectiveness of the optimization method.

Index Terms—Autonomous System (AS), network resilience, network security

Is there any difference in the resilience of each region, and if so, how big is the difference; what is the key weak topology that causes such a gap; how should the region optimize the topology to improve its own resilience? We conducted comprehensive assessment of the resilience of regional network to solve the above problems and made three major contributions.

Assess resilience in each region: To address these problems, we proposed a statistical method to evaluate the resilience of a region under attack. We simulated a damage event according to the probability of the event to approximate the damage caused by the simulated event in the real situation. For a comparative analysis of regional resilience, we implemented a significance tester using the Kruskal-Wallis test [21] method to make a comparison among regions and measure the impact of regional attack events from the overall level and variance aspect, respectively. To get the ranking and clustering results of fifty regions, we clustered the regional resilience at the overall level and variance aspect.

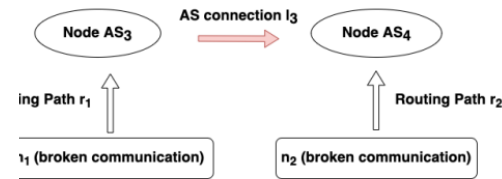


Fig. 2. The AS relationship and link optimization

$c2p[n]$,
 $c2p[0/n]$ & $p2p[0/1]$ & $p2c[0/n]$.
 $n > 1$. $r[n]$ means there are n consecutive connections
 $\geq r$ relationship in the routing path, $r[0/n]$ means there
or n consecutive connections with the r relationship in
ing path, $r[0/1]$ means there exists 0 or 1 connection
 $\geq r$ relationship in the routing path, and the symbol &
is that $c2p[0/n]$, $p2p[0/1]$, and $p2c[0/n]$ are adjacent
outing path.

Considering the valley-free principle, the following form
ing path relationship will not occur: $p2c[1/n]$ &
 $l/n]$ & $c2p[1/n]$, where $n > 1$. Fig. 3 shows the
nsition diagram.

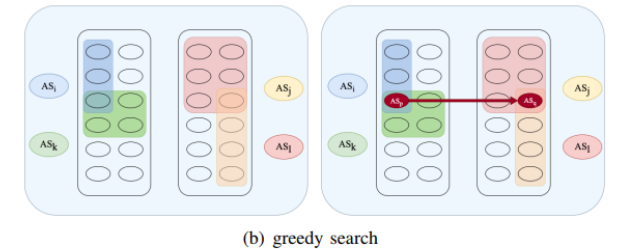
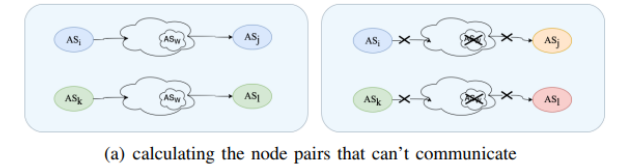
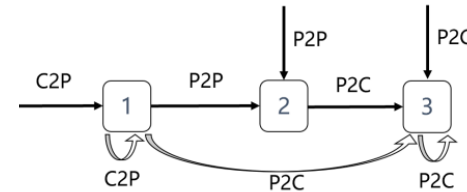


Fig. 4. Searching the optimal link

Based on the routing tree of each node, we compare the nodes on the routing tree before and after the weak group is destroyed, and obtain the node pairs that cannot communicate after the weak group is destroyed, as shown in Fig. 4(a). The weak group AS_W may consist of multiple AS nodes and links. When nodes and links in AS_W are destroyed, AS_i and AS_j can't communicate, neither can AS_k and AS_l .

We store pairs of nodes that cannot communicate according to certain rules. When the nodes are AS, the records are sorted according to the number of their customers, and the AS nodes with a higher number of customers are recorded on the left; when the nodes are region, the records are sorted according to the number of ASes in the region, and the regions with a higher number of ASes are recorded on the left.

Welcome partners to join in this work

Future Work

- Improve prefix hijacking detection algorithm
- Improve dashboard function
- Develop path hijacking detection function
- Continue on the research topic
- Knowledge sharing
- Documents

Next Month Plan

- Help partners connect with our looking glass platform
- Improve operator tools
- Discuss research paper

Todo List

Task	Detail	Todo
BGP Routing Information Sharing	Just 4 few partners have not peered with the BGP platform	Continue
Looking Glass Platform	Document info (How to implement, what partners need to do)	Executive Team :send manual to partners, discuss with each partner, and implement the connection. Partners : setup connection.
	Implement the connection (meeting, email, slack)	
Paper Discussion		Executive Team : Prepare and invite partners

Comments/Suggestions

- ??

Thanks!