(APNIC Project)

Developing a Collaborative BGP Routing Analyzing and Diagnosing Platform

Mar. 15, 2023
APAN 55

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Outline

- Project Overview
- Project Progress
- Feedback from partners
- Future Plan
- Comments/Suggestions

Project Information

- Name: Developing a Collaborative BGP Routing Analyzing and Diagnosing Platform

- Co-PI: Jilong Wang, (Tsinghua University, CERNET, China)
  Co-PI: Chalermpol Charnsripinyo (ThaiREN, Thailand)
  Co-PI: Simon Peter Green (SingAREN, Singapore)

- Date: 2022.2.24 - 2023.8.24 (tbc with APNIC Foundation)
- APNIC ISIF Grants : US$150,000.00
- Tsinghua University In-Kind Contribution: US$69,660.00

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Objectives & Deliverables

- Build a collaborative BGP routing analyzing and diagnosing platform
  - Looking Glass platform
  - BGP routing sharing platform
  - BGP monitoring and diagnosing platform, focusing on routing hijacking detection and mitigation system
  - BGP analysis platform, focusing on invulnerability analysis of regional routing
- Set up a website for sharing knowledge
- Enhance the NREN capacity of network operation and measurement in Asia Pacific area and promote international collaborations

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Partnership

- **19 Partner Organizations (listed alphabetically)**
  - AARNET(AU)
  - APAN-JP(JP)
  - BdREN(BD)
  - CERNET(CN)
  - DOST-ASTI(PREGINET)(PH)
  - ERNET(IN)
  - Gottingen University(DE)
  - HARNET(JUCC, HK)
  - ITB(ID)
  - KREONET(KR)
  - LEARN(LK)
  - MYREN(MY)
  - NREN(NP)
  - PERN(PK)
  - REANNZ(NZ)
  - SingAREN(SG)
  - Surrey University(UK)
  - ThaiREN(TH)
  - TransPAC(US, APAN/GNA-G Routing WG)
- **Keep open till June, 2023**

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Project Governance

The Responsibilities

	Who	Responsibility	Meetings
Coordination Committee	Representatives from all partner organizations	policy, strategy, project activity plan, monitoring project management and financial issues	quarterly meeting
Technical Committee	Representatives from all partner organizations	technical activity plan, technical discussion of project development and implementation, research paper/reports	monthly meeting
Project Executive Team	Programming, engineering, coordination and management, documentation, secretariat	service/platform program development, engineering collaboration, coordination of the committees and partners, and different teams, website and documentation, project management	bi-weekly meeting

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The Coordination Committee

- **Co-Chairs**
  - **Jilong Wang (CERNET)**
    Shinji Shimojo (APAN-JP)
    Francis Lee (SingAREN)
- **Members:**
  - **AARNET: David Wilde**
  - **CERNET team: Jie An, Changqing An, Xiaohong Huang**
  - **BdREN: Mohammad Tawrit**
  - **DOST-ASTI(PREGINET): Bayani Lara**
  - **ERNET: Paventhan Arumugam**
  - **Gottingen University: Xiaoming Fu**

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The Coordination Committee(Cont'd)

- **Members:**
  - **HARNET/JUCC: Wai Man Cheung**
  - **ITB: basuki Suhardiman**
  - **KREONET: Buseung Cho**
  - **LEARN: Roshan Ragel**
  - **MYREN: Mohd Noh Jasmani**
  - **PERN: Kamran Abid**
  - **REANNZ: Culley Angus**
  - **Surrey University: Ning Wang**
  - **ThaiREN: Chalermpol Charnsripinyo**
  - **TransPAC: Hans Addleman**

The Technical Committee

- **Co-Chairs**
  - **Changqing An (CERNET)**

    Chalermpol Charnsripinyo(ThaiREN)

    Simon Green (SingAREN)
- **Members**
  - **AARNET: Warrick Mitchell**
  - **APAN-JP: Sato-san, Ikeda-san, MA Jian**
  - **CERNET: Zhonghui Li, Xiaohong Huang, Hui Hao, Jie An**
  - **BdREN: Md. Ariful Islam Arman, Abu Naser Md. Nafew, Md. Ariful Islam, Jamilur Rahman, Shamim Ahmed, Kamrul Hasan Shakil, Md. Sajidul Islam**
  - **DOST-ASTI(PREGINET): Bayani Lara, Jaros Lacerna, Mark Quilala**
  - **ERNET: Hari Krishna Atluri**

The Technical Committee(Cont'd)

- **Members:**
  - **Gottingen University: Xiaoming Fu**
  - **HARNET/JUCC: David Choi, KW Pong, Wai Man Cheung**
  - **ITB: Gulam**
  - **KREONET: Chanjin Park, Seongjin Park, Buseung Cho**
  - **LEARN: Dhammika Lalantha**
  - **MYREN: Hafizi Jalil, Mohd Noh Jasmani**
  - **PERN:Yahya Khan**
  - **REANNZ: Yeshaswini Ramesh, Dylan Hall**
  - **Surrey University: Ning Wang**
  - **ThaiREN: Sittichai Sangdee, Kriangsak Lekdee**
  - **TransPAC: Brenna Meade**

Project Executive Team

- **Team leaders**
  - **Jie An (CERNET), Changqing An(CERNET)**
- **Members(currently 10 members)**
  - **Chinese team will take the most responsibilities:**
    - **Zhonghui Li, Bei Zhang, Hui Hao, Zhiyan Zheng, Weiqi Zhao, Linmei Zu, Chengwan Zhang, Zhiquan Wang, Zidong Pei, Hang zhao**
  - **Welcome any contribution from other NREN partners**
- **Responsibility**
  - Coordination between the committees and partners
  - Programmer work of the platform development
  - Engineering collaboration
  - Coordination between technical and engineering teams
  - Project Management
  - Project Secretariat

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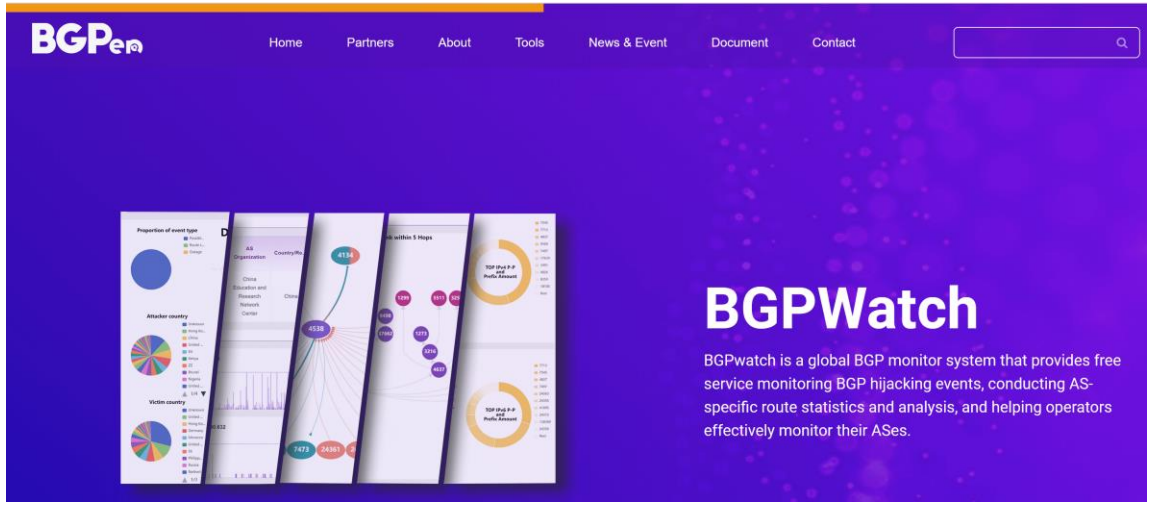
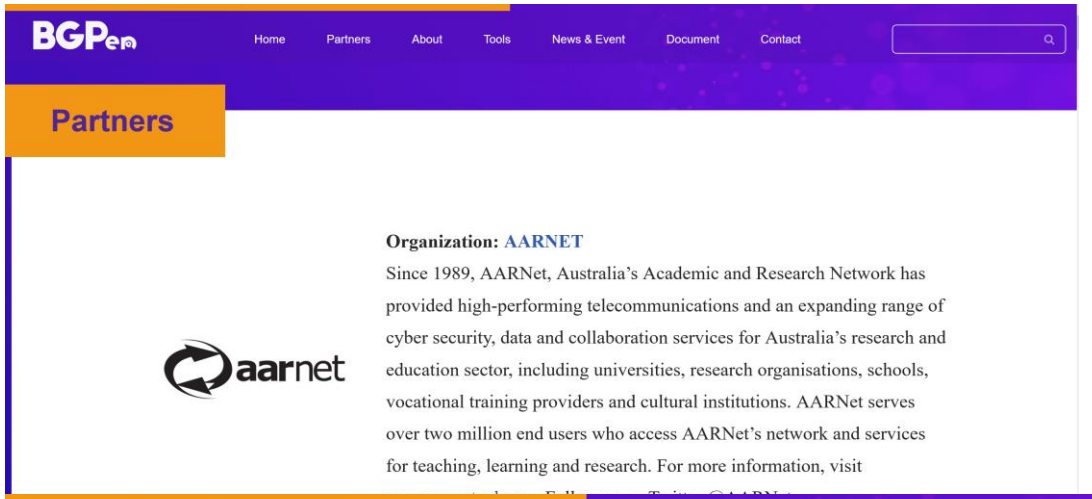
Project Progress

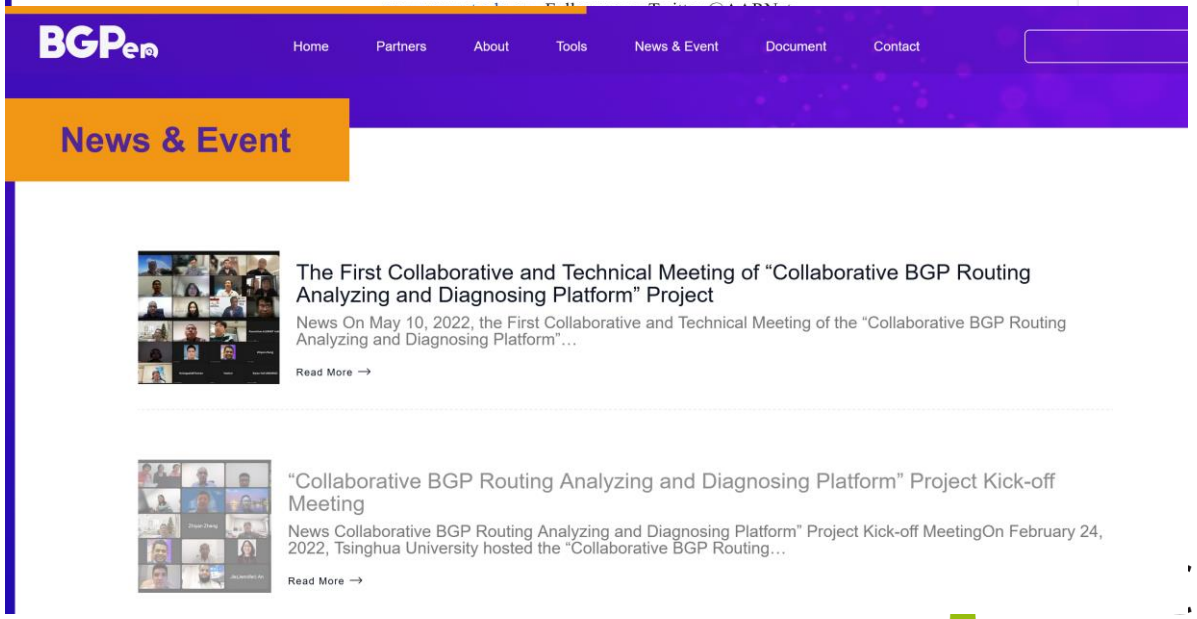
- Project web site implementation
- Established BGP session with 15 partners
- Looking Glass connected with 7 Education & Research network
- BGPWatch: Analyzing and Diagnosing Platform
- Paper accepted by NOMS 2023
- Prefix Hijacking Annual Report
- Community Building and Knowledge Sharing

Project Web Site

https://bgper.net







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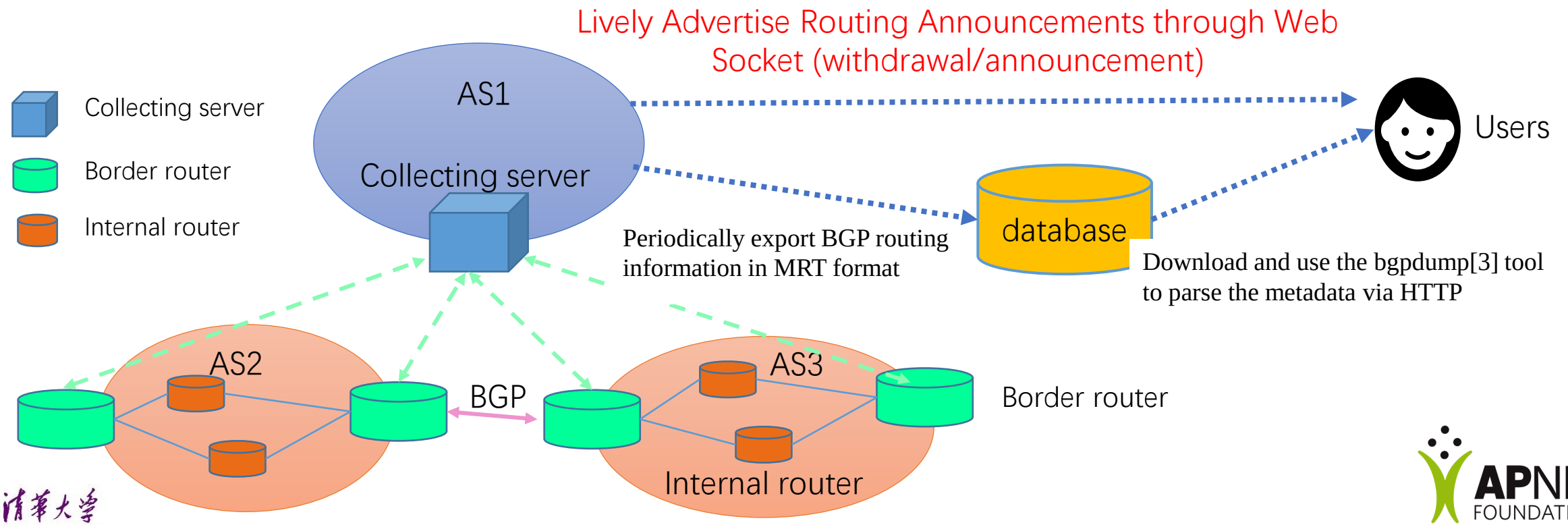
BGP Routing Sharing: CGTF RIS

https://bgp.cgtf.net

- 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



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CGTF RIS

https://bgp.cgtf.net

We have established BGP session with 15 partners.
Configuration manual can be accessed at
https://www.bgper.net/index.php/document/

No.	Partner	No.	Partner
1	APAN-JP	9	MYREN
2	AARNET	10	PERN
3	BDREN	11	REANNZ
4	CERNET	12	SINGAREN
5	HARNET	13	ThaiSARN
6	ITB	14	TransPAC
7	KREONET	15	NREN
8	LEARN		

Index of /ribs/2022/07

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	
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rib.20220731.0800.mrt.bz2	2022-07-31 08:00	13M	
rib.20220731.1000.mrt.bz2	2022-07-31 10:00	13M	

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CGTF RIS Collector

- Just have your border router **establish an eBGP session** with our collector:
- Our Collector ASN：65534

- Our Collector1 IPv4 address：47.241.43.108
- Our Collector1 IPv6 address: 240b:4000:b:db00:8106:7413:738f:e9ed

- Our Collector2 IPv4 address：203.91.121.227
- Our Collector2 IPv6 address：2001:da8:217:1213::227

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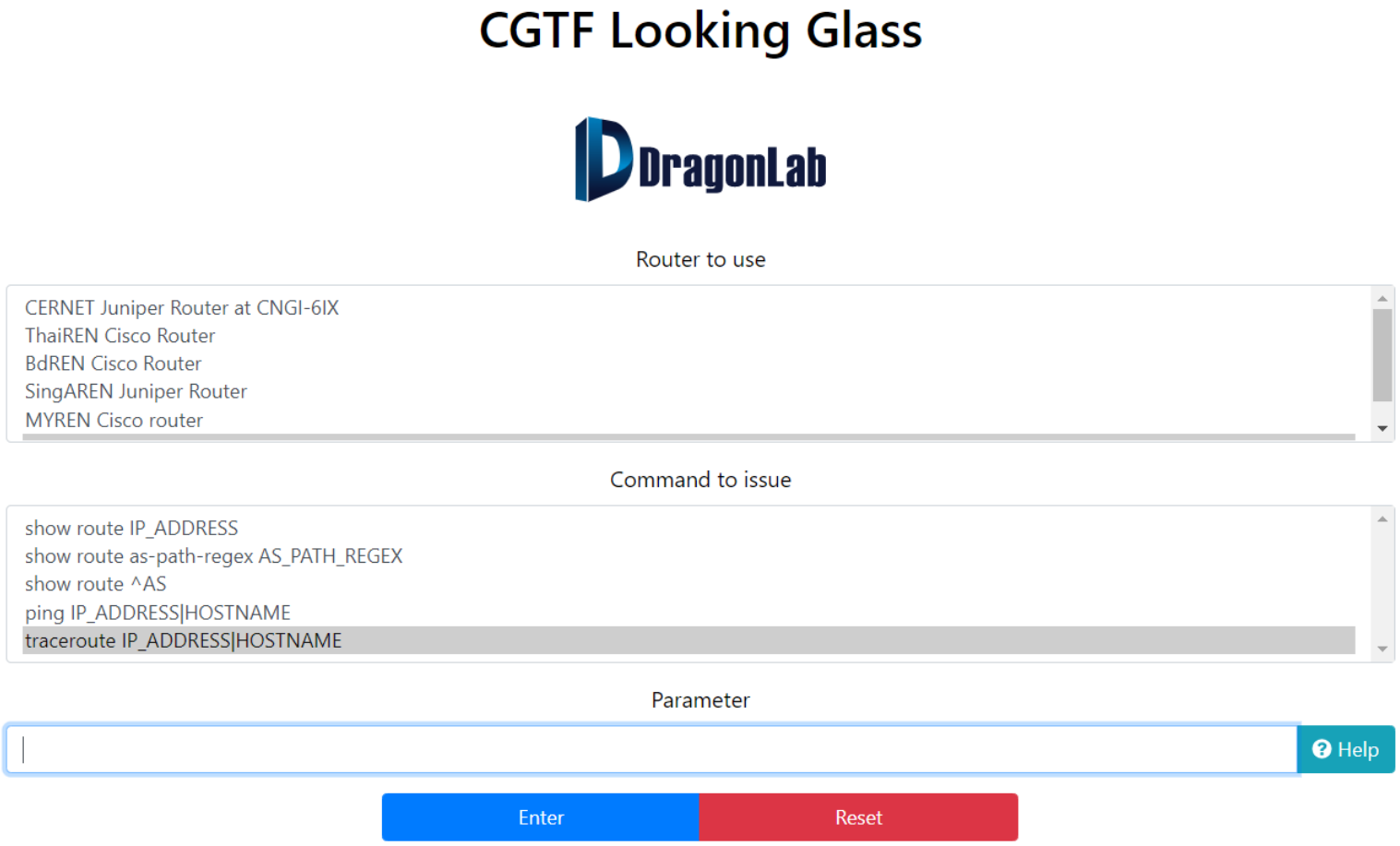
CGTF Looking Glass

- https://lg.cgtf.net
- Open Source:
  - https://github.com/gmazoyer/looking-glass
- 5 commands
- Query speed limit for security
- More partners are welcome



- 7 Education & Research network joined

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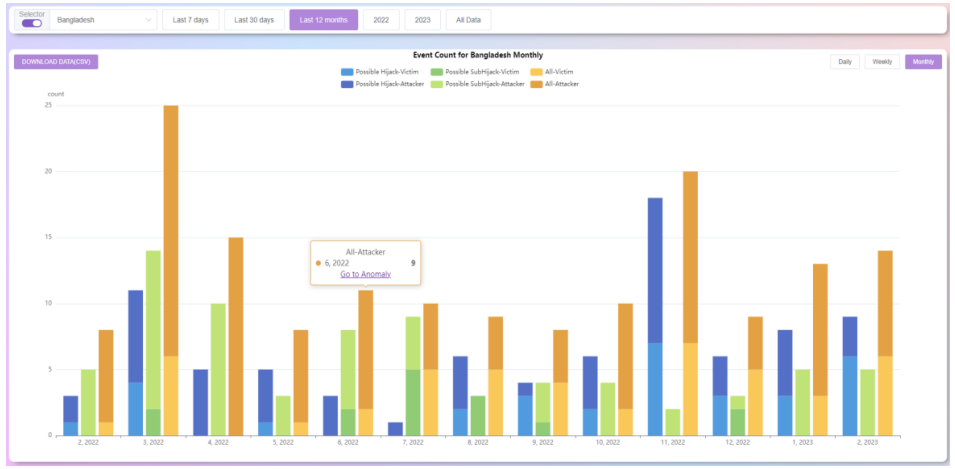
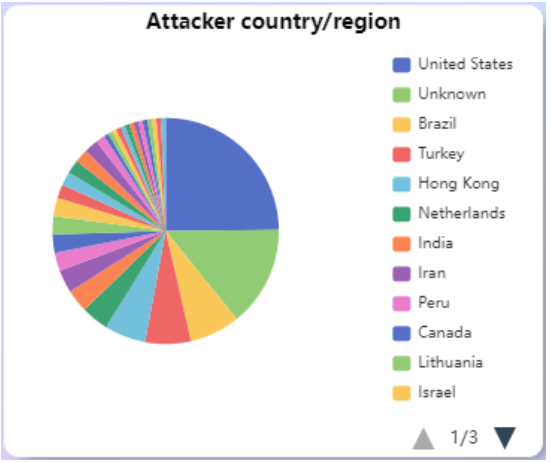
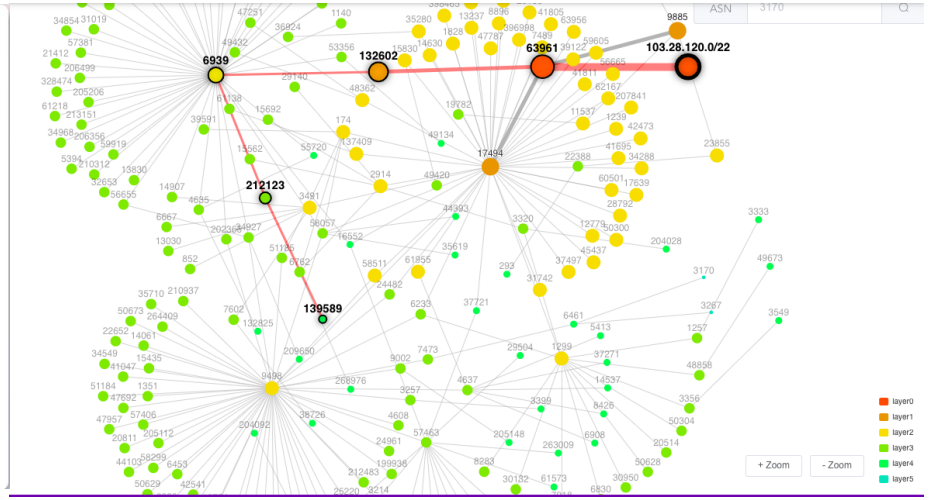
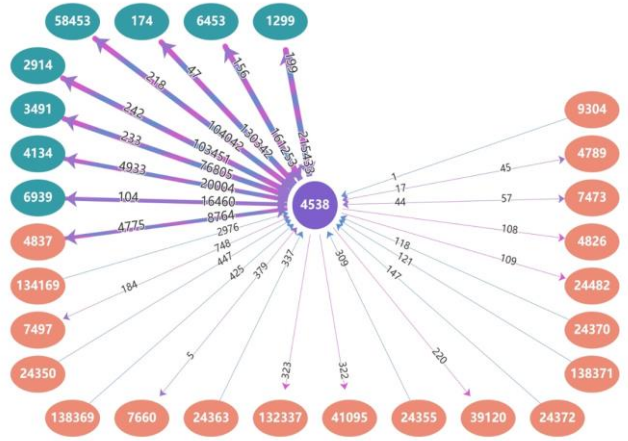
BGP Routing Monitoring and Analysis: BGPWatch

- Hijacking Detection
- Hijacking Statistics
- Dashboard:AS info
- Routing Search：
  - forward, reverse, bi-direction
- Subscribe, Alarming









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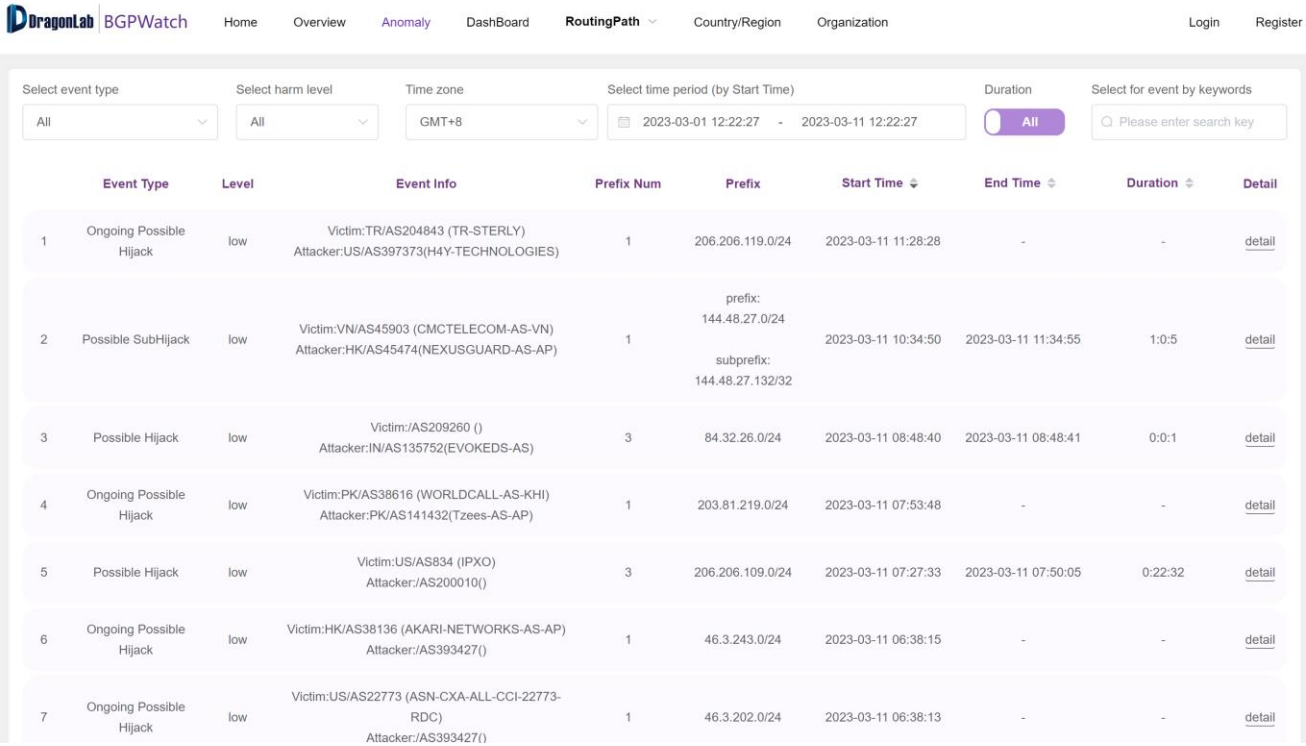
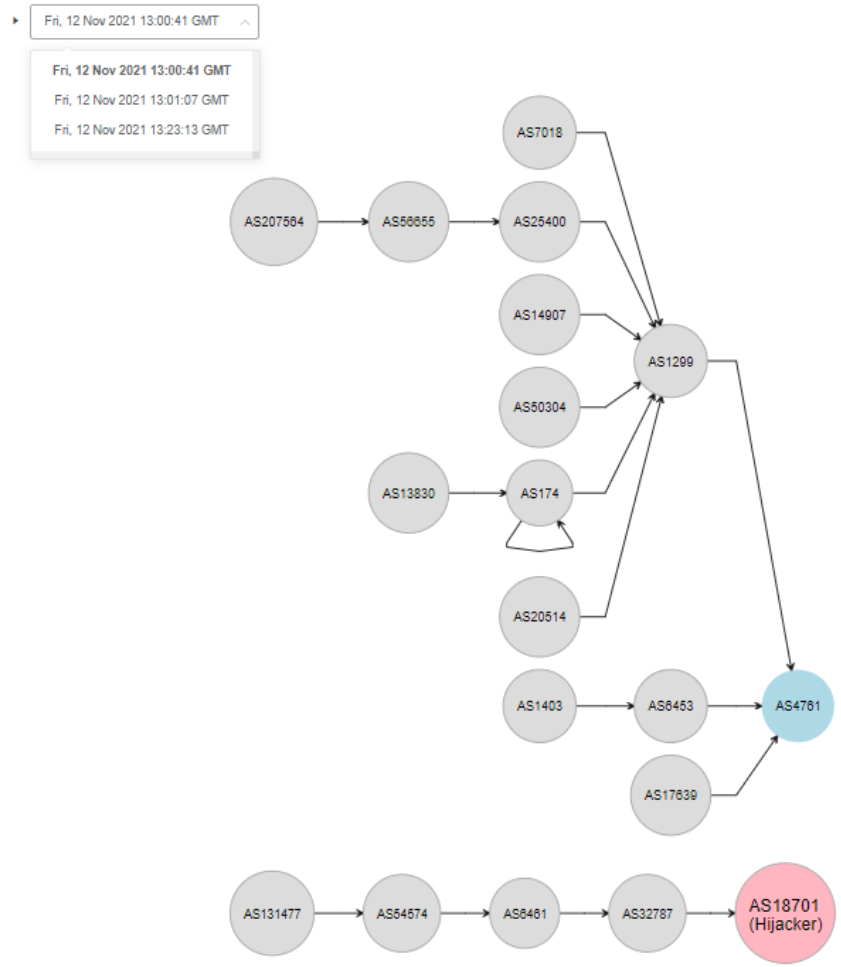
Hijacking Detection

- Knowledge-based real-tIme BGP hIjacking Detection System
- Public BGP event reporting servcie
- Based on MOAS(subMOAS)
- Rely on Domain Knowledge （ROA，IRR，AS relationship etc)
- URL: https://bgpwatch.cgtf.net



Features --- Quick Response, Event replay

- About 5 mins delay, much better than other systems
- Notify immediately when an event is detected, minimizing damage from hijackings
- Understanding how the BGP routing changes
- Analyze the extent of the impact of the event



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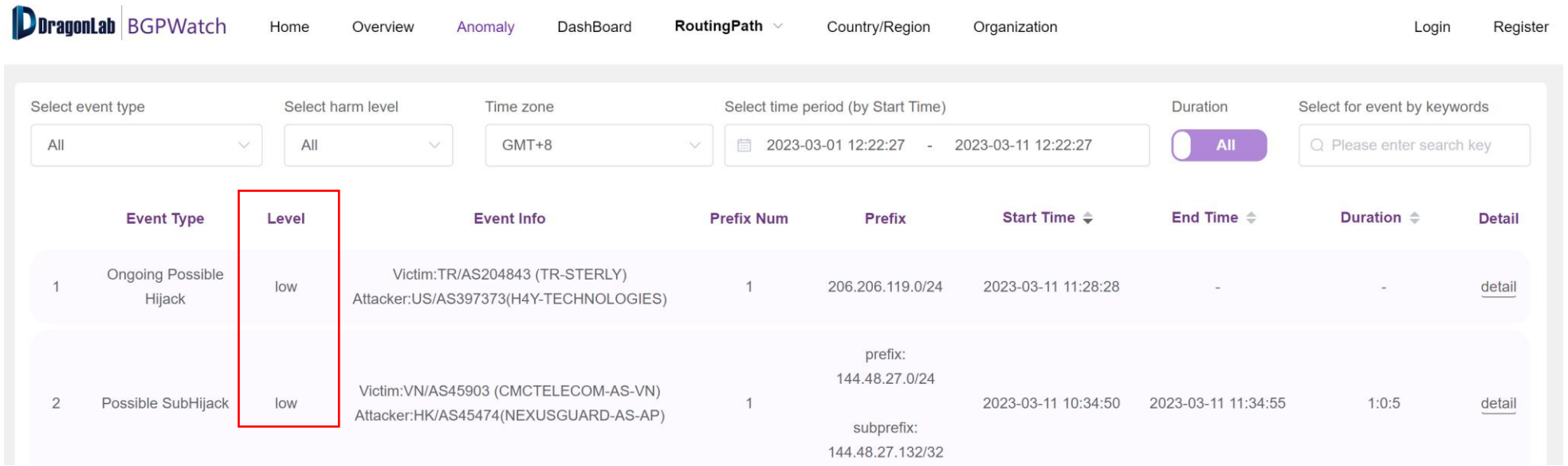
Features --- Event Level Evaluation

- **Evaluate event impact based on importance of AS and prefix.**



middle level

Possible Hijack Events

124.156.136.0|22-0 Possible Hijack Events

Victim AS: 132203

Victim Country: CN (China)

Victim Description: TENCENT-NET-AP-CN

Start Time: 2021-11-08 17:03:38

During Time: 0:10:8

Hijacker AS: 64

Hijacker Country: US (United States)

Hijacker Description: MITRE-AS-2

End Time: 2021-11-08 17:13:46

Features --- Event Statistics Analysis

- Statistical analysis of event time,affected prefix, AS, country, etc.
- Global routing system security situational awareness

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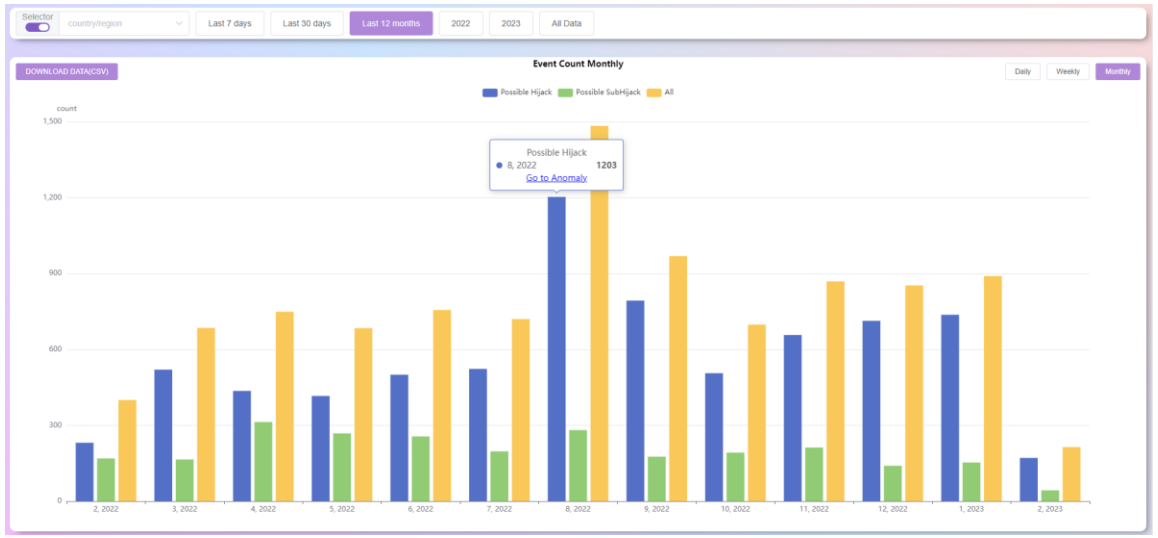
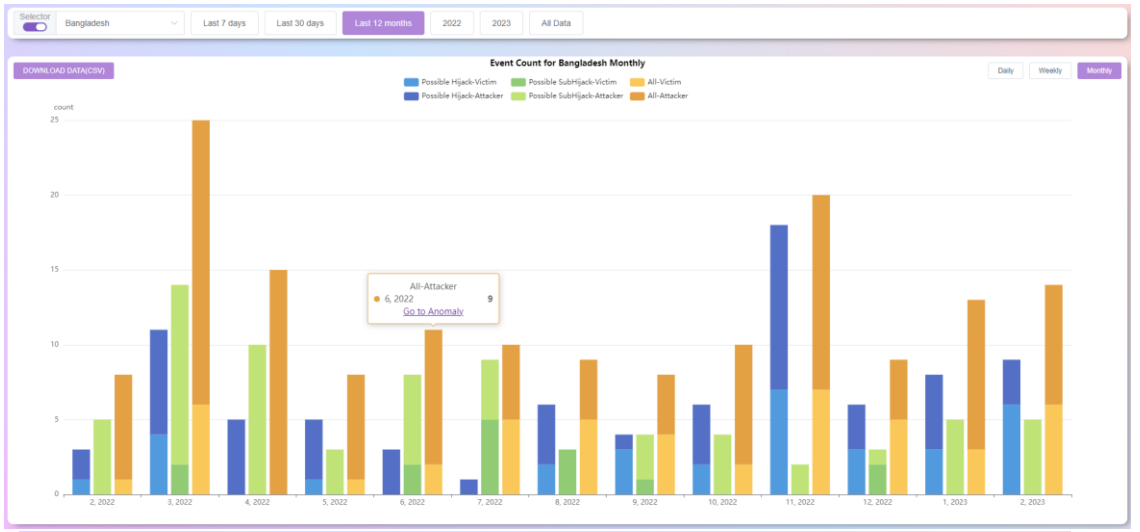
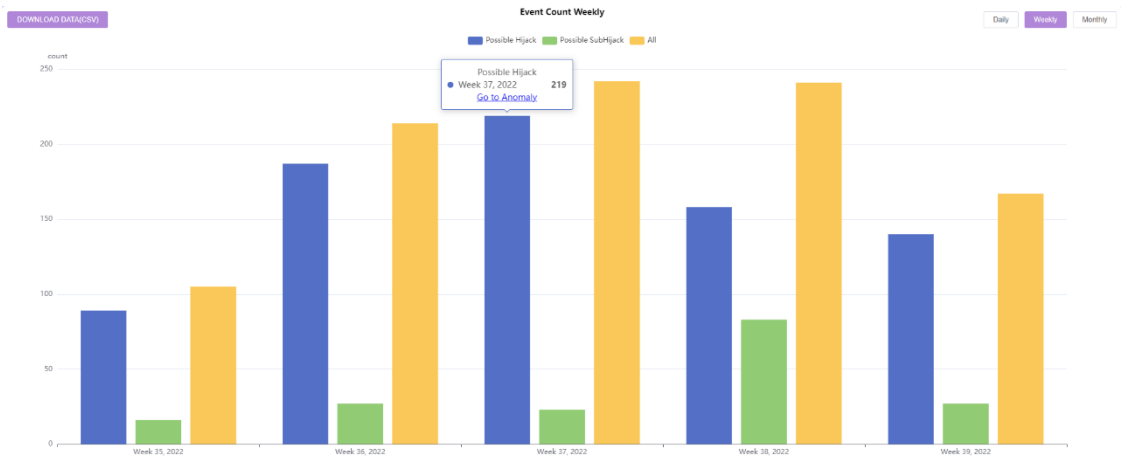
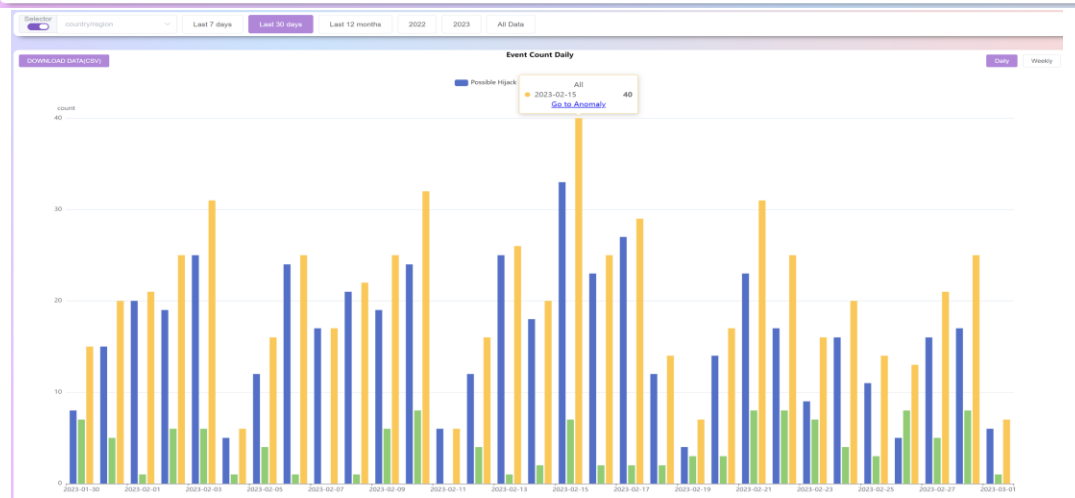
Overview--Statistics for Anomaly Events



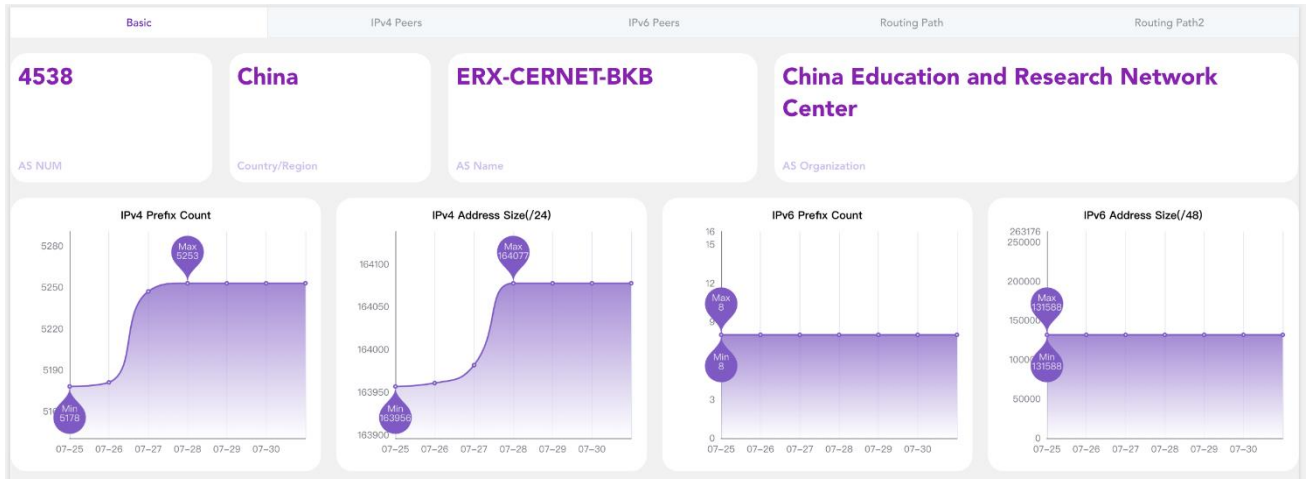


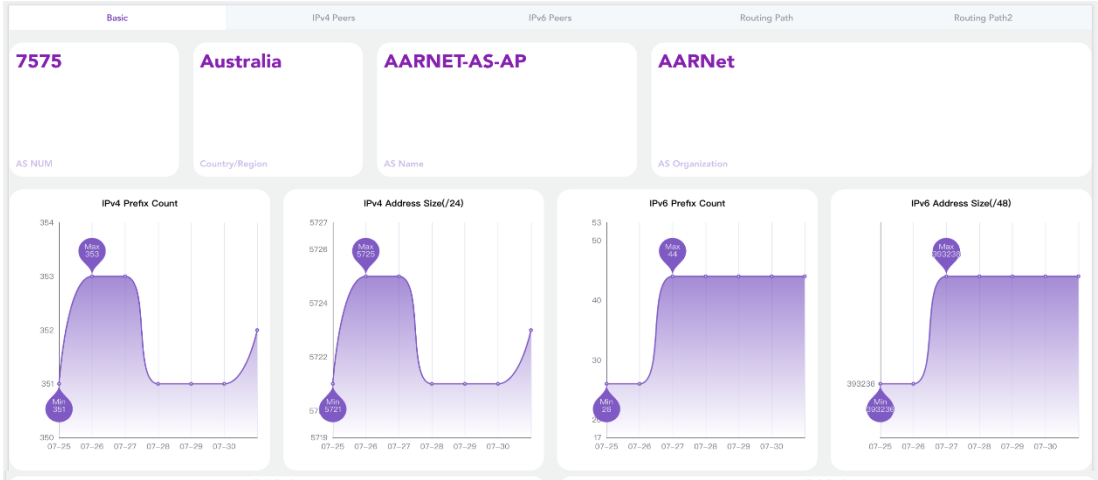


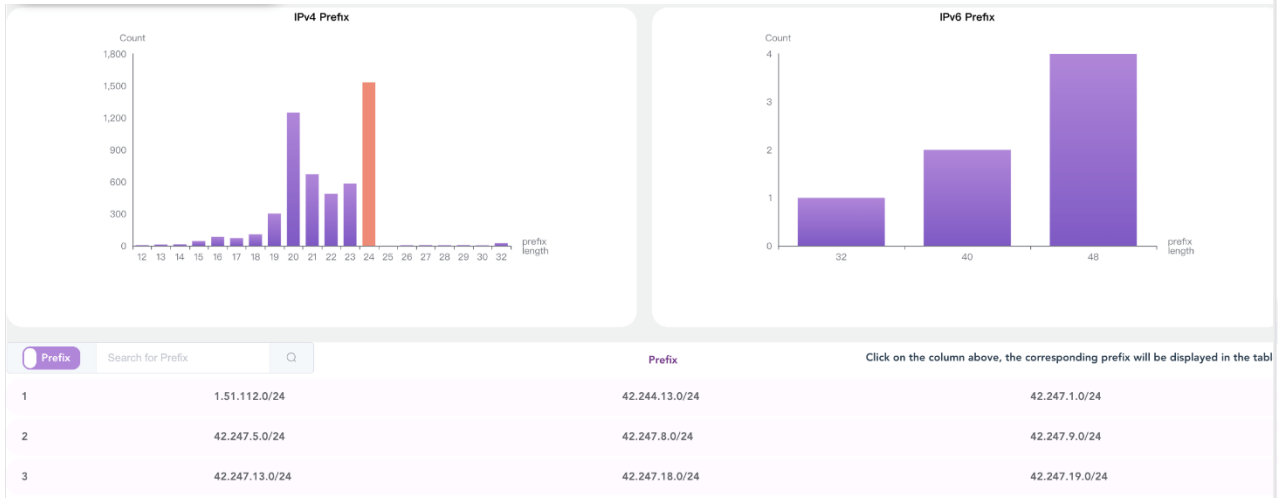


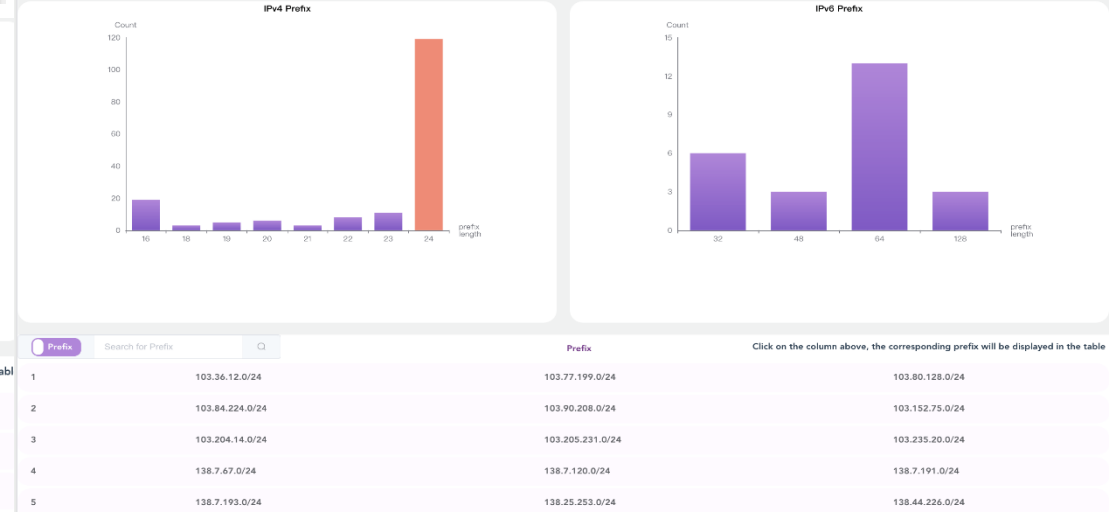
Do statistics by country/region, AS, and by yearly, monthly, weekly, and daily

DashBoard --Basic Info









Support Prefix Search

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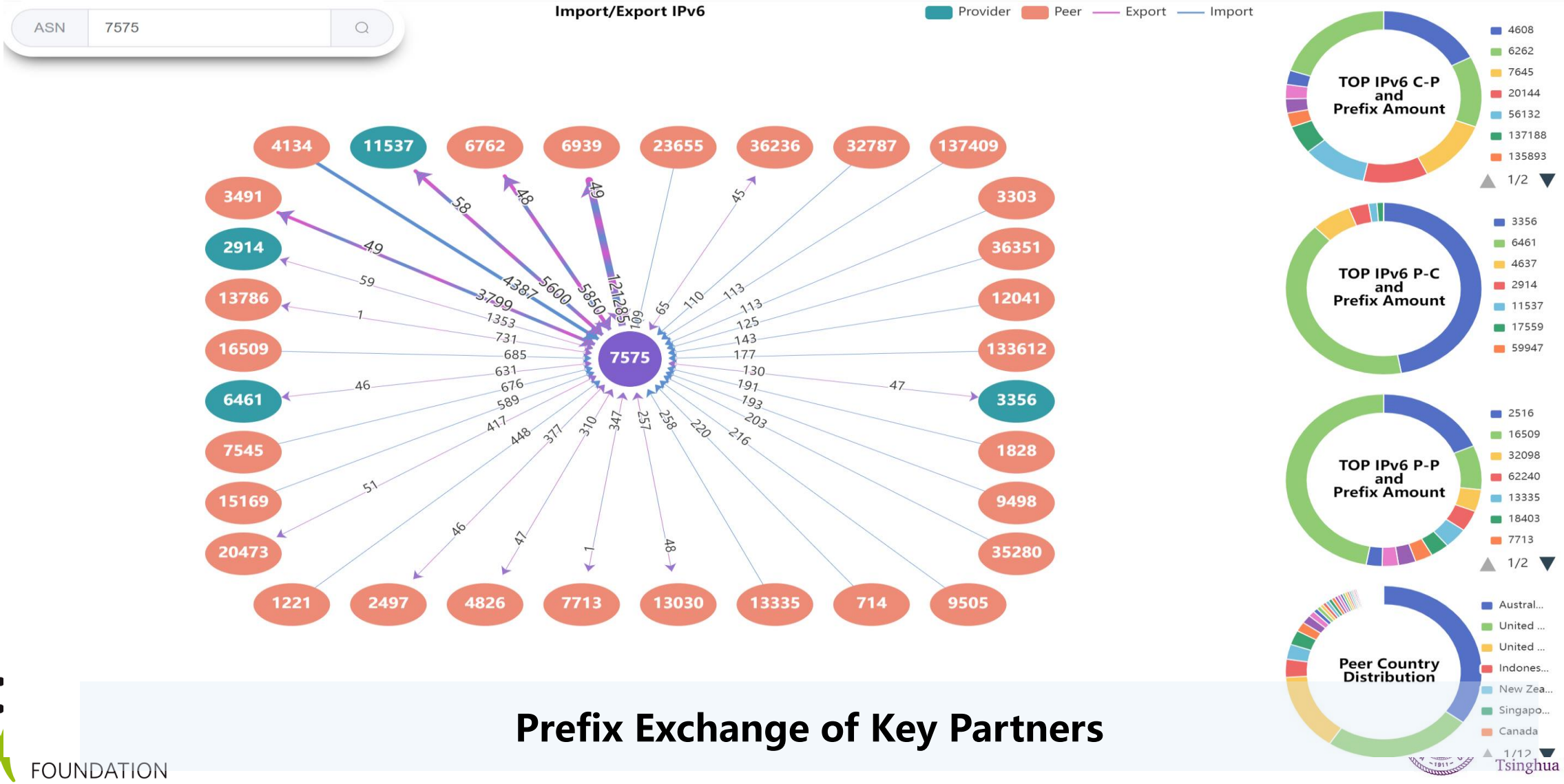
IPv6 Key Peers Information



Prefix Exchange of Key Partners

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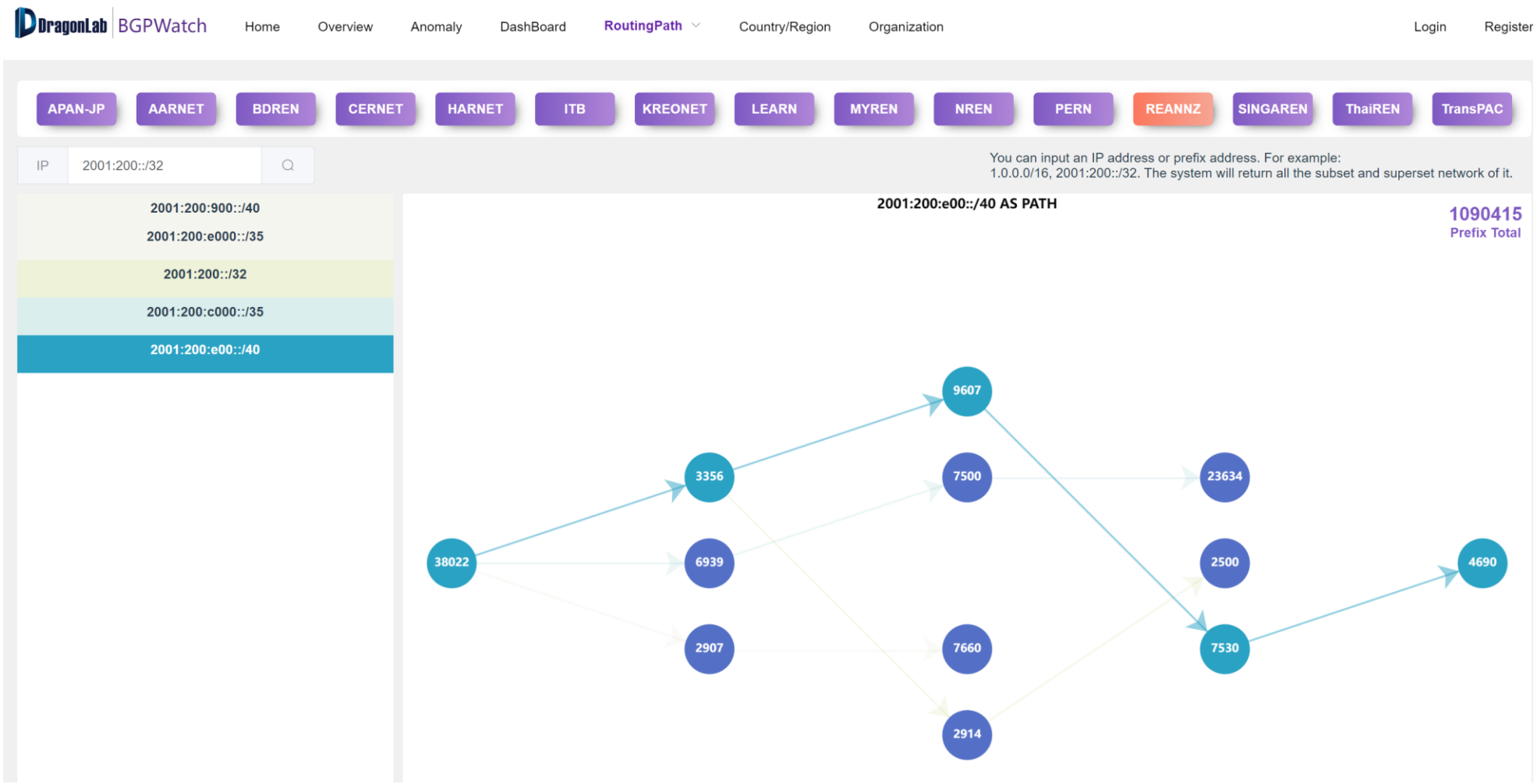
Routing Path Search



Put a prefix or an IP, they can be either IPv4 or IPv6. Return paths of all sub networks and super networks of the input prefix. Group Prefixes with the same routing path.

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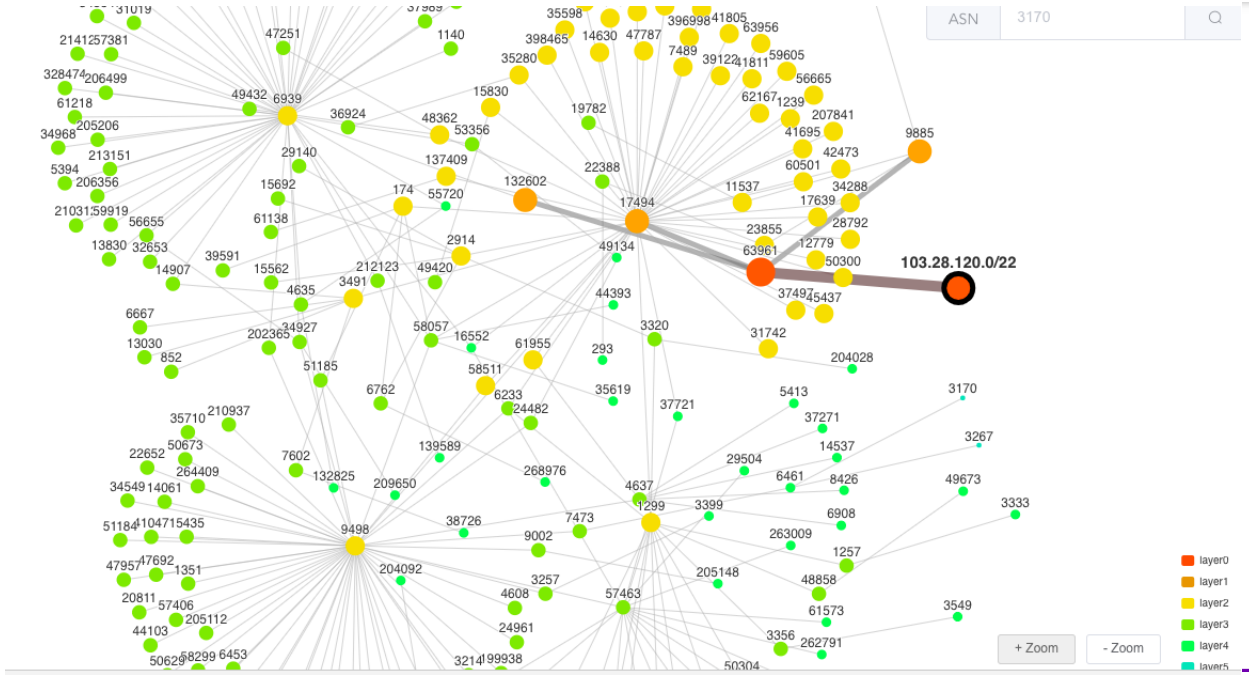
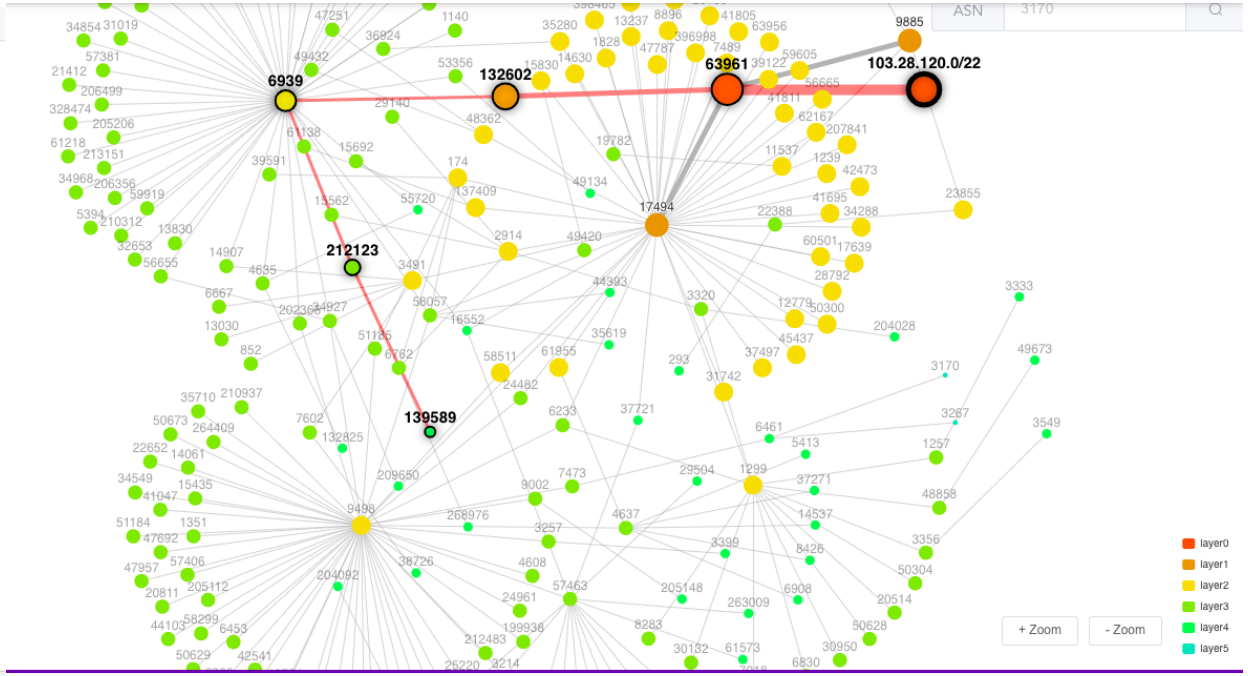
Reverse Routing Path (TOPO)





- With better interactivity
- Can display the path to an AS
- Support search
- The number of layers to display can be selected

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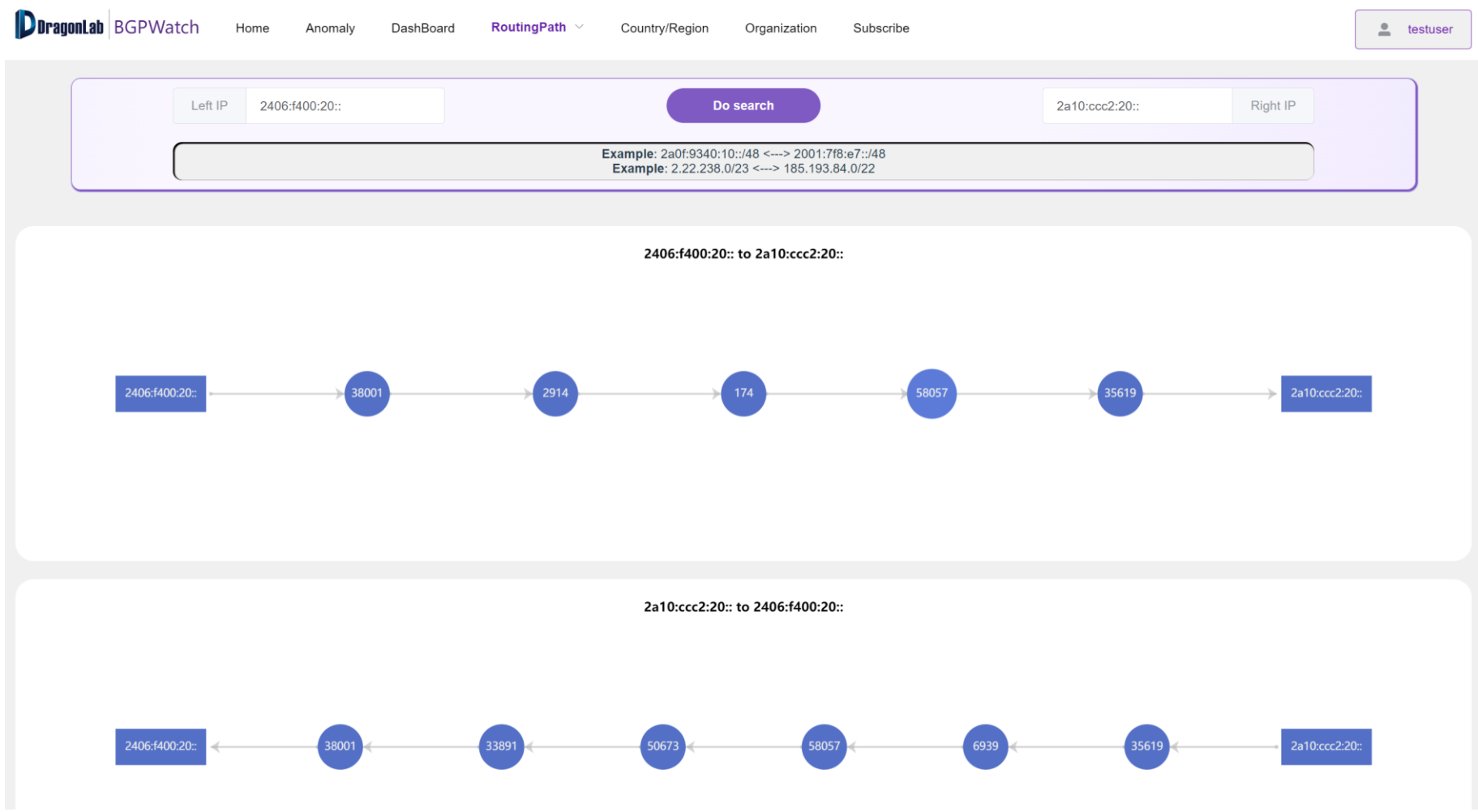
Bi Direction Routing Path



Put a prefix or an IP, they can be either IPv4 or IPv6.
The system will search the best matched prefix and return the reverse routing tree.

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Subscribe and Send Alarm Email

ASN **4538**

Country/Region **CN**

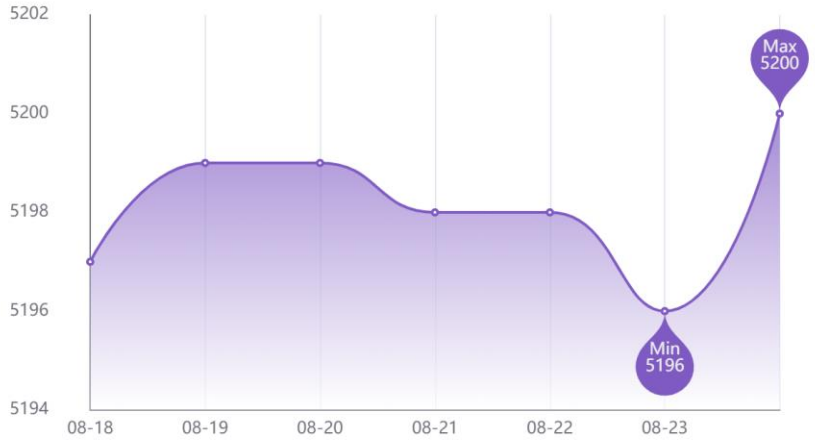
Name **ERX-CERNET-BKB**

Organization **China Education and Research Network Center**

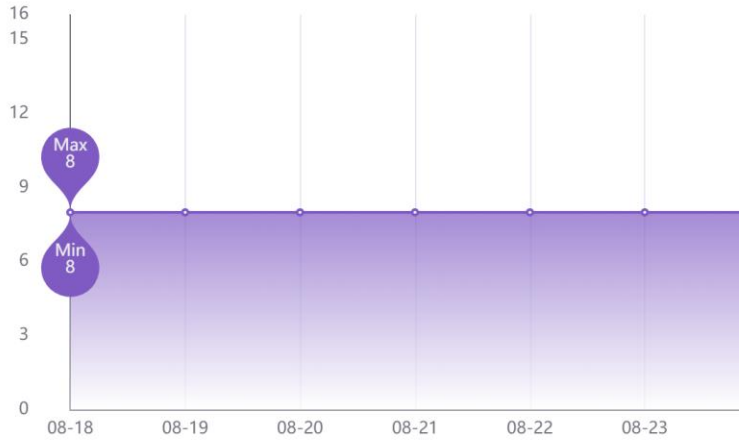
Prefixes Changed **+ 4 - 0**

Prefix Change

IPv4 Prefix Count



IPv6 Prefix Count



+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

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Research Paper

Evaluating and Improving Regional Network Robustness from an AS TOPO Perspective

Yujia Liu*, Changqing An*, Tao Yu*†, Zhiyan Zheng*, Zidong Pei*, Jilong Wang*†, Chalermpol Charnsripinyo‡
*Institute of Network Sciences and Cyberspace, BNRist, Tsinghua University, Beijing, China
†Peng Cheng Laboratory, No.2, Xingke 1st Street, Nanshan District, Shenzhen, Guangdong Province, China
‡National Electronics and Computer Technology Center,
National Science and Technology Development Agency, Pathum Thani 12120, Thailand
Email: liuyujia19@tsinghua.org.cn, {acq,zhzhy,wjl}@cernet.edu.cn,
{yu_tao,peizidong}@tsinghua.edu.cn, chalermpol.charnsripinyo@nectec.or.th

***Abstract*—Currently, regional networks are subject to various security attacks and threats, which can cause the network to fail. This paper borrows the quantitative ranking idea from the fields of statistics and proposes a ranking method for evaluating regional resilience. Large-scale simulated failure events based on probabilistic sampling is performed, and a significance tester that measures the impact of events from the overall level and variance aspect is also implemented. To improve a region's robustness, this paper proposes a greedy algorithm to optimize the resilience of regions by adding 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 influence perspectives, clustering the results and get typical region types, and adding optimal links to improve the network resilience. Experimental results illustrate that the resilience of regional networks can be greatly improved by establishing a few new connections, which demonstrates the effectiveness of the optimization method.**

***Index Terms*—Autonomous System (AS), network resilience, network measurement**

I. Introduction

The Internet has become one of the key infrastructures on which all aspects of people's lives depend. As the basis for ensuring stable Internet communication, network availability is critical. The network of a country or region is subject to various security attacks and threats. Various types of malicious people, such as hackers and terrorists, are attempting to find method to evaluate the resilience of a region under attack. We simulate failure 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 implement a significance tester using the Kruskal-Wallis test [21] and Levene's test [26] on the resilience samples to rank them at the overall level and the variance level, and finally get ranking of 50 regions. We cluster the regional resilience at the overall level and variance aspect and get several typical types of invulnerability.

Optimize the topology of each region: After finding the key weak components, we propose an optimization objective formula for improving regional resilience and an algorithm based on greedy search. The optimal AS links that should be added for fifty regions to improve intra-region network topology are rendered. Also, we give the optimal suggestion for the boundary AS connection to improve inter-region resilience. Experiments illustrate that the proposed algorithm would improve the resilience of the regions to a large extent while controlling the cost of establishing connections.

Construct an AS topology with region labels: Based on the measurement data obtained from open measurement platforms, we propose a voting-based IP geolocation method and a lightweight AS geolocation method and construct an AS topology with region labels.

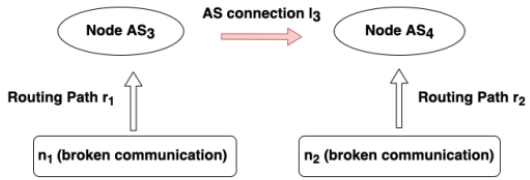
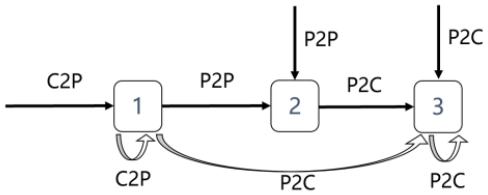


Fig. 2. The AS relationship and link optimization

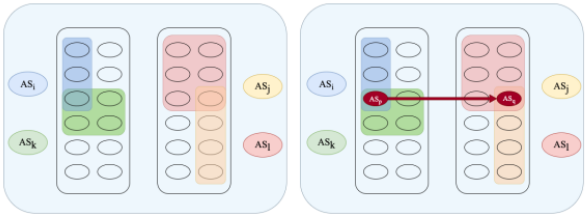
- $s_1 : c2p[n]$,
- $s_2 : c2p[0/n]$ & $p2p[0/1]$ & $p2c[0/n]$.

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

Considering the valley-free principle, the following form of routing path relationship will not occur: $p2c[1/n]$ & $p2p[0/1/n]$ & $c2p[1/n]$, where $n > 1$. Fig. 3 shows the state transition diagram.



(a) calculating the node pairs that can't communicate



(b) greedy search

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

- Accepted by NOMS 2023
- https://github.com/thudragonlab/Resilience

Tsinghua University

APNIC FOUNDATION

The Online Training in February

RPKI Basic Knowledge		
Date/Time	Length	Trainer/APNIC
1st Feb. 2023 (Wednesday) 0500-0700 GMT	2 hours	Warren Finch(trainer), Awal Haolader(assistant)
RPKI Hands-on		
3rd Feb. 2023 (Friday) 0500-0730 GMT	2.5 hours	Warren Finch, Awal Haolader(assistant)
Remarks		

Open Links via APNIC Academy:

https://academy.apnic.net/en/events?id=a0B2e000000cg1jEAA

https://academy.apnic.net/en/events?id=a0B2e000000cg3BEAQ

80 Engineers and Technicians take part in

清華大學 Tsinghua University

APNIC FOUNDATION

APNIC ISIF Project – RPKI & MANRS Training at APAN55

13th, 15th and 16th March, 2023 Kathmandu, Nepal

13th March, 2023 (Monday)

Time (GMT+5:45)	Topic	Trainer
09:00 - 10:30	RPKI - Theory	Dibya Khatiwada APNIC Community Trainer
10:30 - 11:00	Tea/Coffee Break	
11:00 - 12:30	RPKI - Theory RPKI - Hands-on	Dibya Khatiwada APNIC Community Trainer
12:30 - 13:30	Lunch Break	
13:30 - 15:00	RPKI - Hands-on	Dibya Khatiwada APNIC Community Trainer
15:00 - 15:30	Tea/Coffee Break	
15:30 - 17:00	RPKI - Hands-on	Dibya Khatiwada\ APNIC Community Trainer

15th March, 2023 (Wednesday)

Time (GMT+5:45)	Topic	Trainer/Speaker
13:30 - 15:00	Panel: RPKI User Cases and Experienc eSharing	**Jamie Gillespie**
15:00 - 15:30	Tea/Coffee Break	
15:30 - 17:00	APNIC ISIF Project Progress and BGPWatch Platform Demonstration	**BdREN&Tsinghua University**

16th March, 2023 (Thursday)

Time (GMT+5:45)	Topic	Trainer/Speaker
09:00 - 10:30	MANRS - What, Why and How	**Warrick Mitchell**
15:30 - 17:00	Panel: MANRS User Cases and Experience Sharing	**Warrick Mitchell**

8 Sessions, 58 Registrants

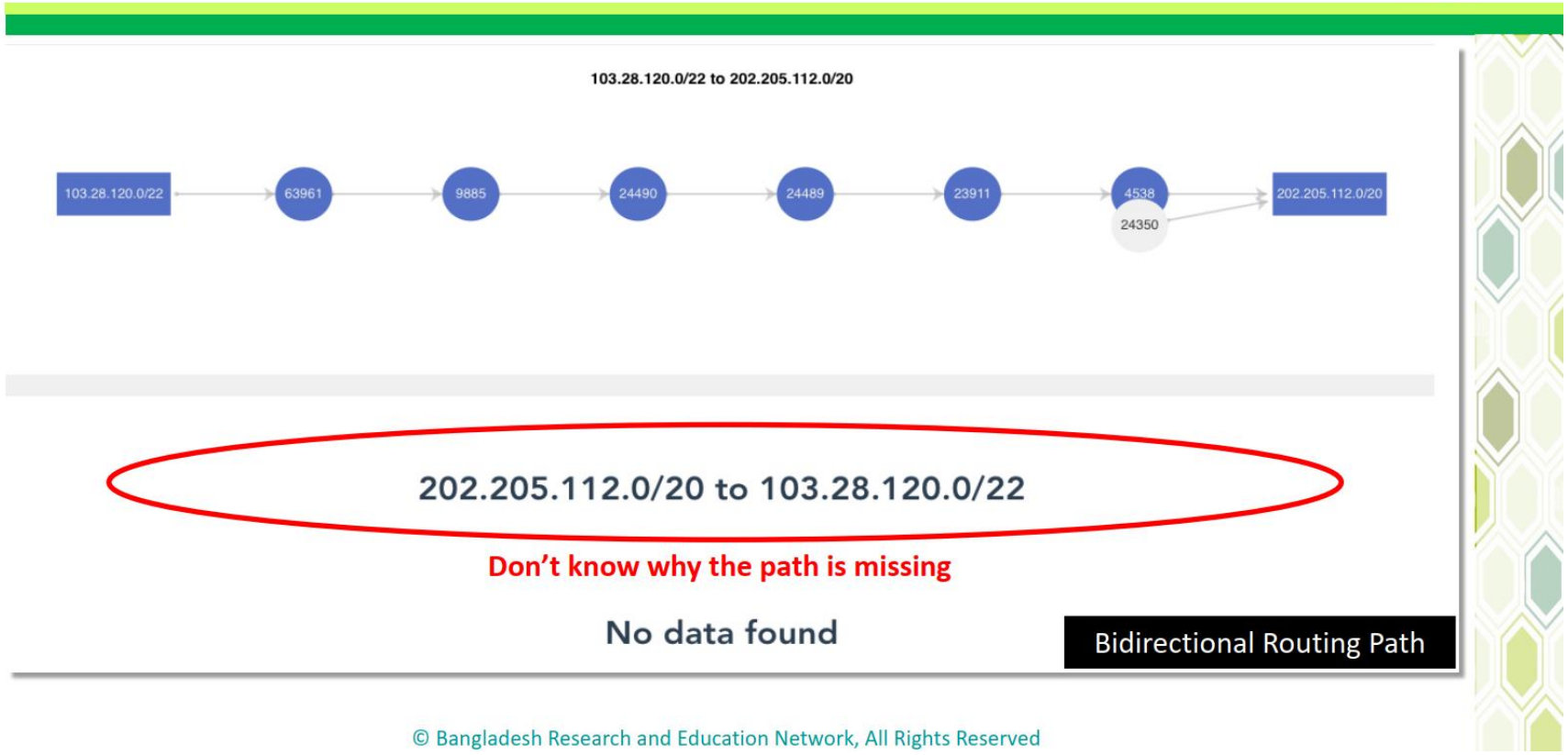
Feedback from Partners

- Some bugs and imperfect
- Fault alarm
- Improve hijacking events information showing
- Configure interested prefix/AS, and send alert when anomaly/hijacking
- More bgp related alert, such as peer change/path change
- Send message by slack channel
- Show alternative routing path/track multi path
- Path performance
- Open API

Suggested Changes

- If you want to search an “Organization” using name, AS-name or AS-number you have to go to the “Organization” menu
  - Organization Name is “Case sensitive”, better if it is made “Case insensitive”
- The prefixes in “Dashboard=>IPv4 Peers” and that of “Routing Path” should match.
- Needs to put the “last date of update” for the records which will be periodically updated.

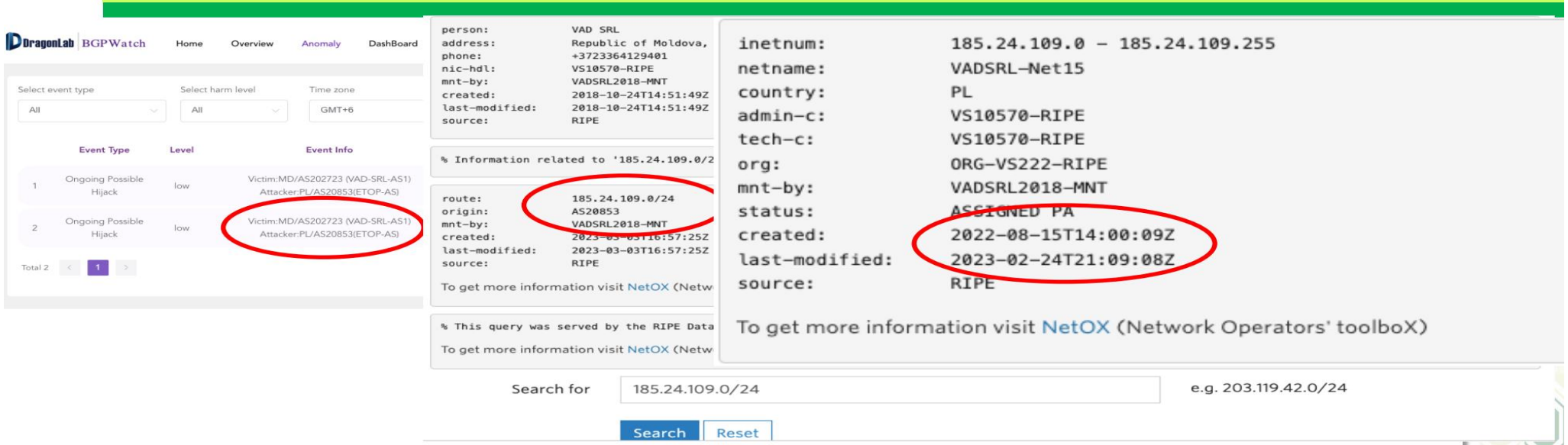
Bidirectional Routing Path



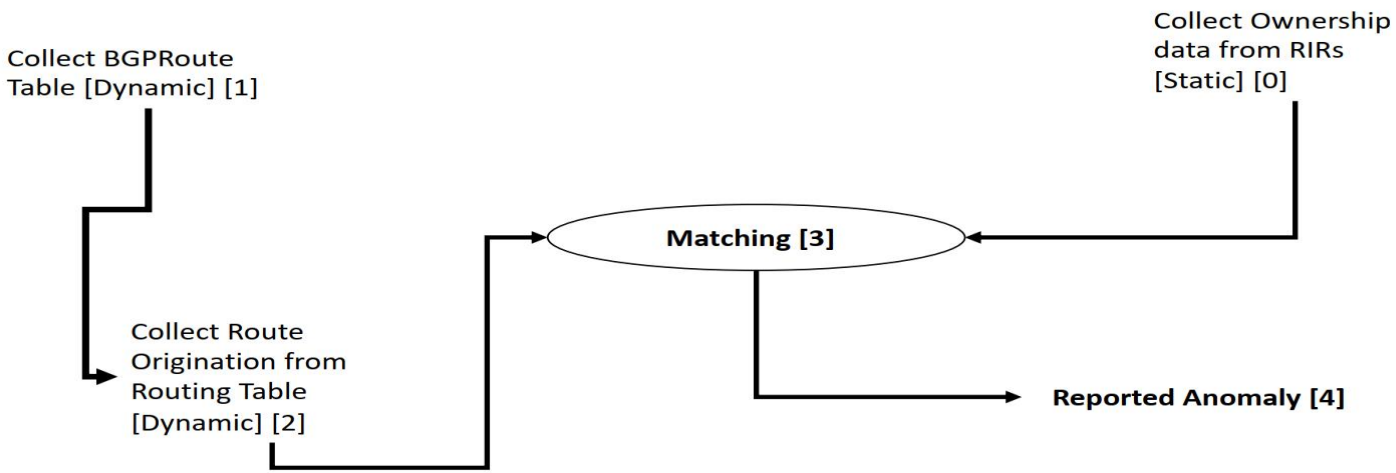
First, there are huge amount routing data from RouteViews, RIS, PCH, CGTF. Now we only use part of there data. We'll try to process all the data by Parallel Computing and Clusters.

Even though, no one can get all the path information, so it's a best effort system.

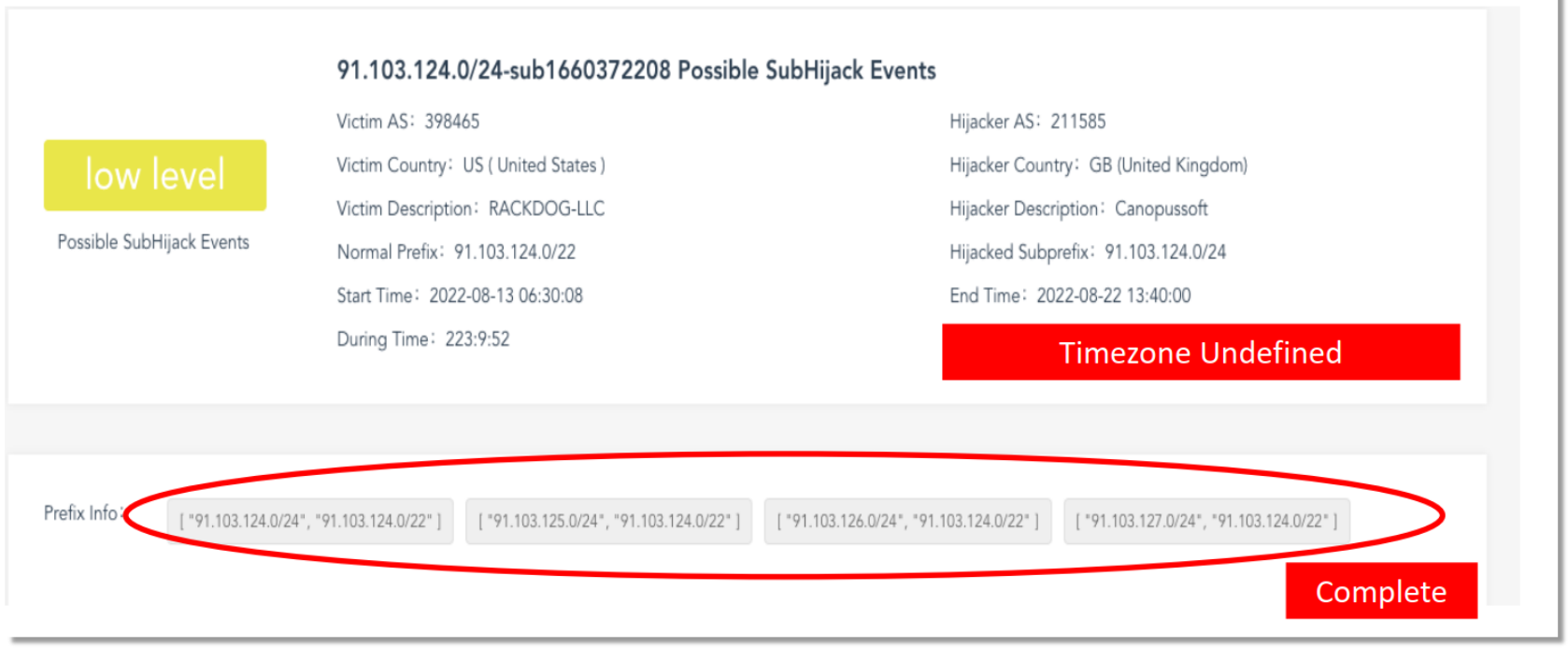
False Alarm



Needs to verify the problems in the algorithm, if any.



Suggested Changes=>Anomaly and Prefixes



Some more suggestions

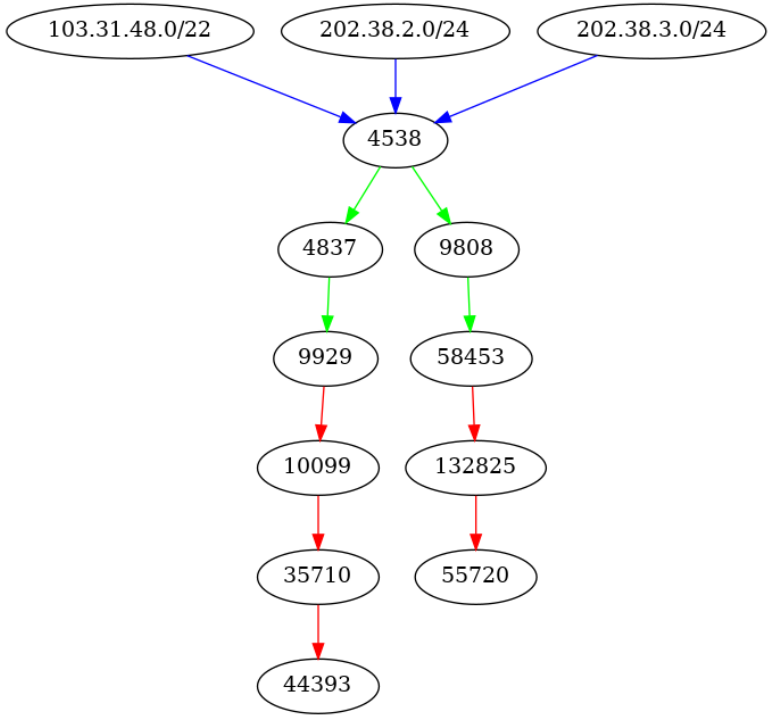
- Mitigation feature support is highly required
- Monitoring or alerting system for AS path change to a selected destination
- API for receiving data to display on partner customized applications and monitoring systems
- Some topologies does not show ASN details when hovering over the ASN nodes

Future Work

- Suggestion from partners
- Routing tree clustering
- Path hijacking detection

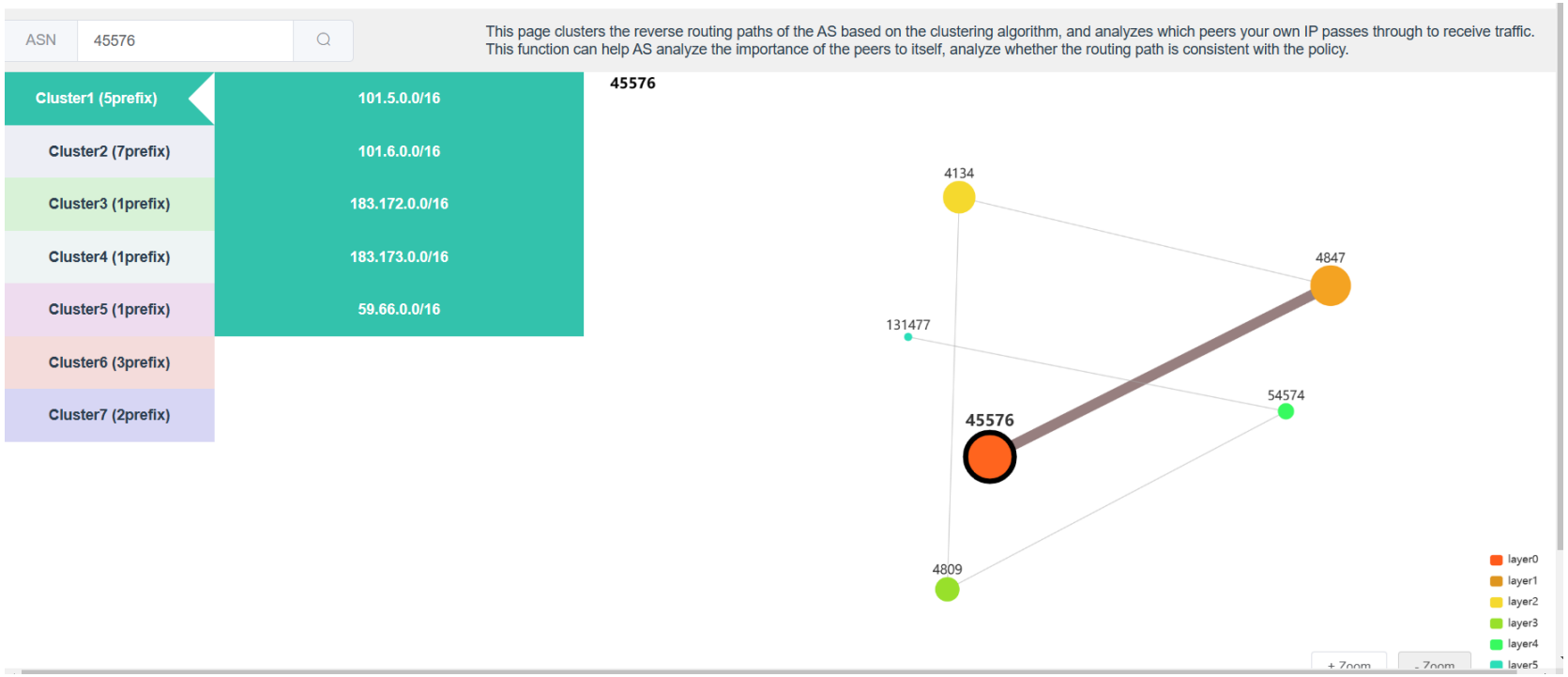
Routing tree Clustering

- Routing tree consists of all AS-PATHs from BGP monitors to target prefix.
- Observation: AS will set different routing policies for different groups of prefixes. Different policy lead to different routing trees.
- Routing tree clustering: grouping of identical or similar routing trees.



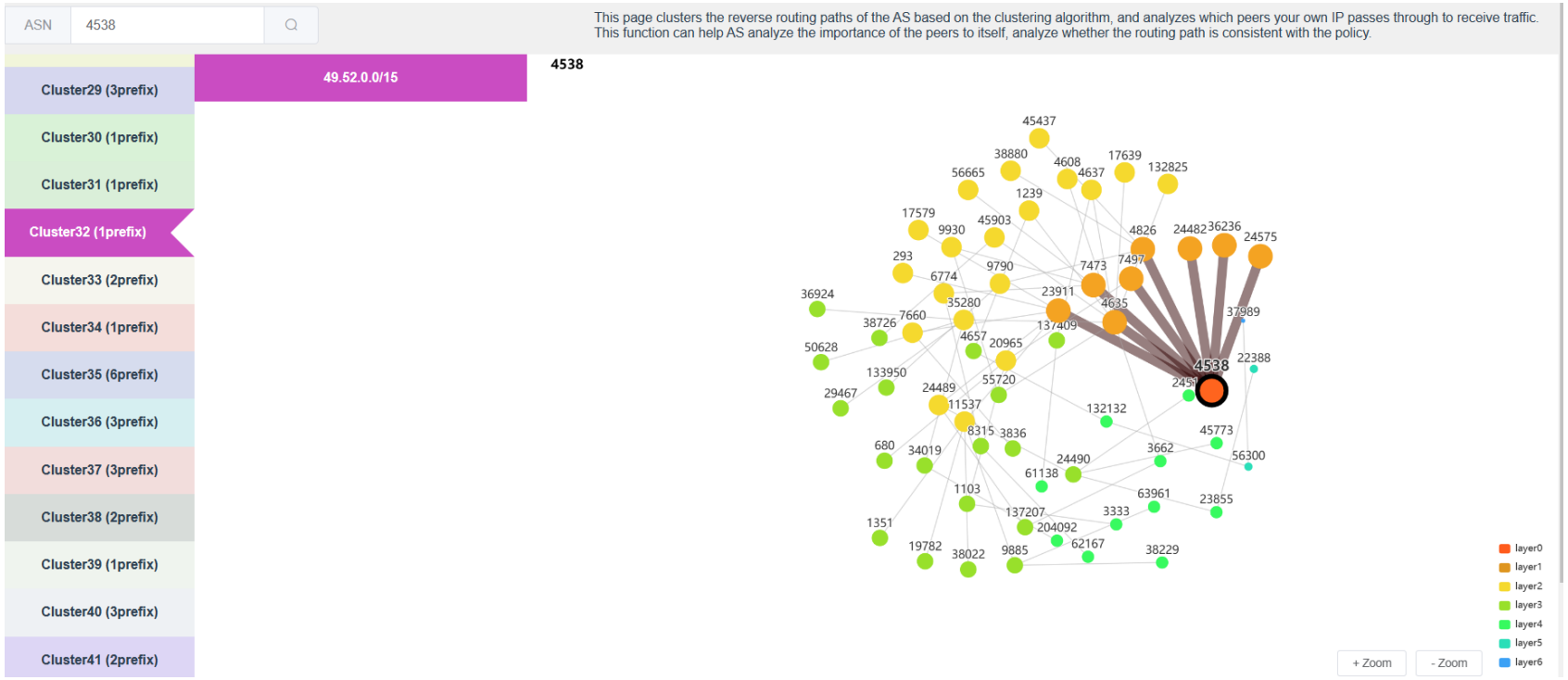
Application of Routing tree clustering

- Routing policy configuration consistency check
  - Administrators can check the consistency of external observations and internal routing policy configuration with the clustering result.



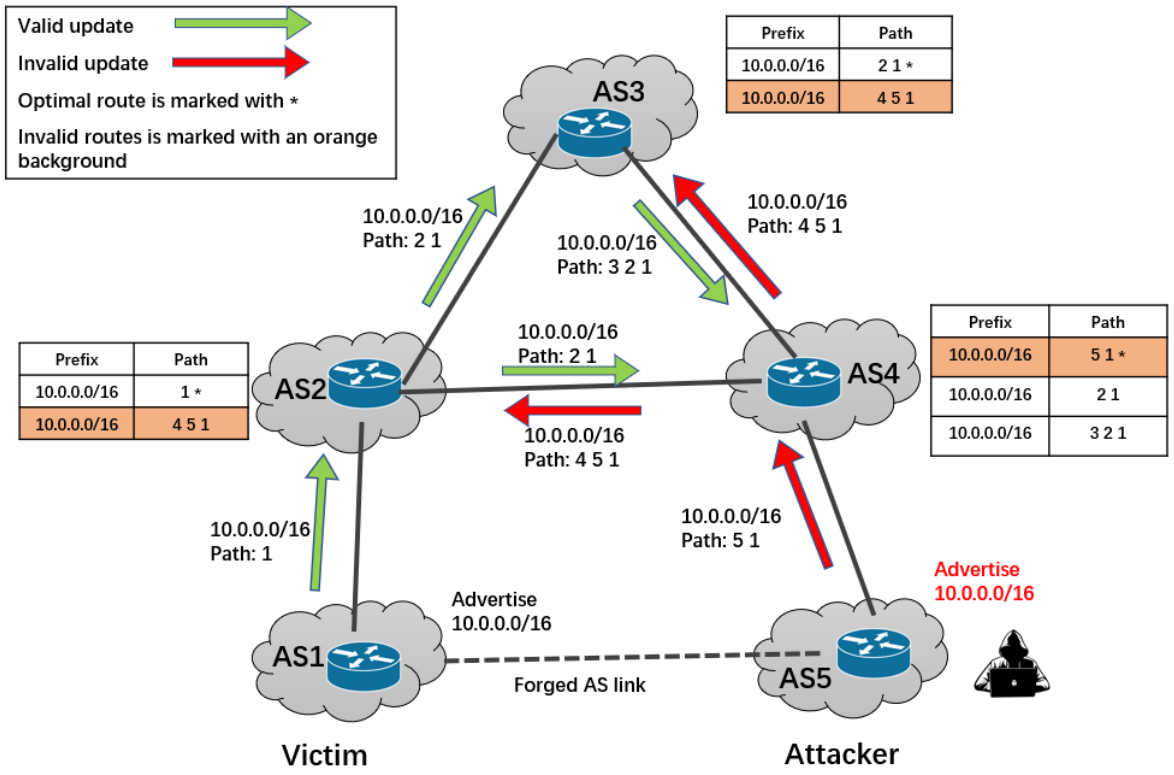
Application of Routing tree clustering

- Important prefix/special prefix discovery
  - Some AS configure separate routing policies for a small number of prefixes, which may be some important prefixes or special prefixes.



Path hijacking detection

- Path hijacking : the attacker announces the victim's prefix while manipulating the AS-PATH.
- Observation: path hijacking usually causes unseen links, For example, the link AS5-AS1 in the figure is an actual non-existent link forged by the attacker.
- Existing path hijacking detection methods are based on unseen links, including Argus[IMC'12], Fingerprint-based[S&P'07], ARTEMIS[ToN'18], etc.

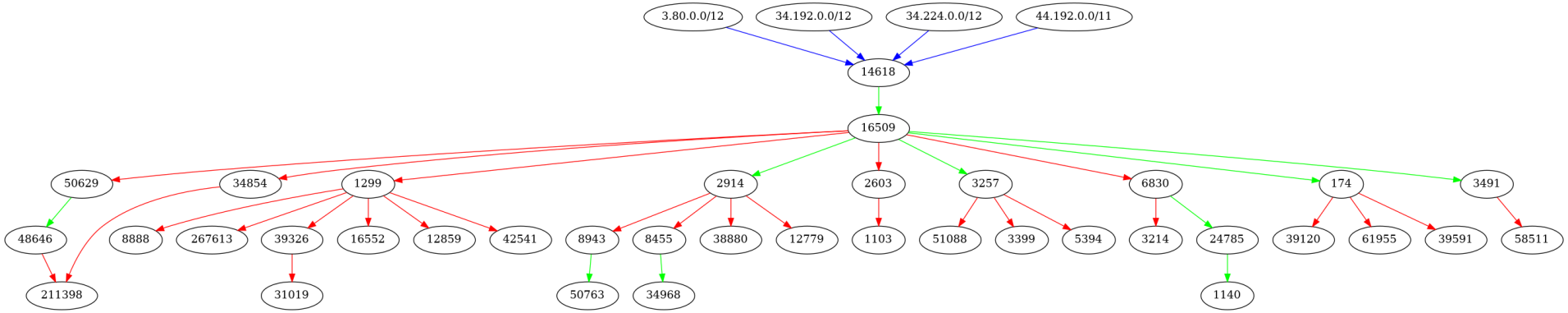


Application of Routing Tree Clustering

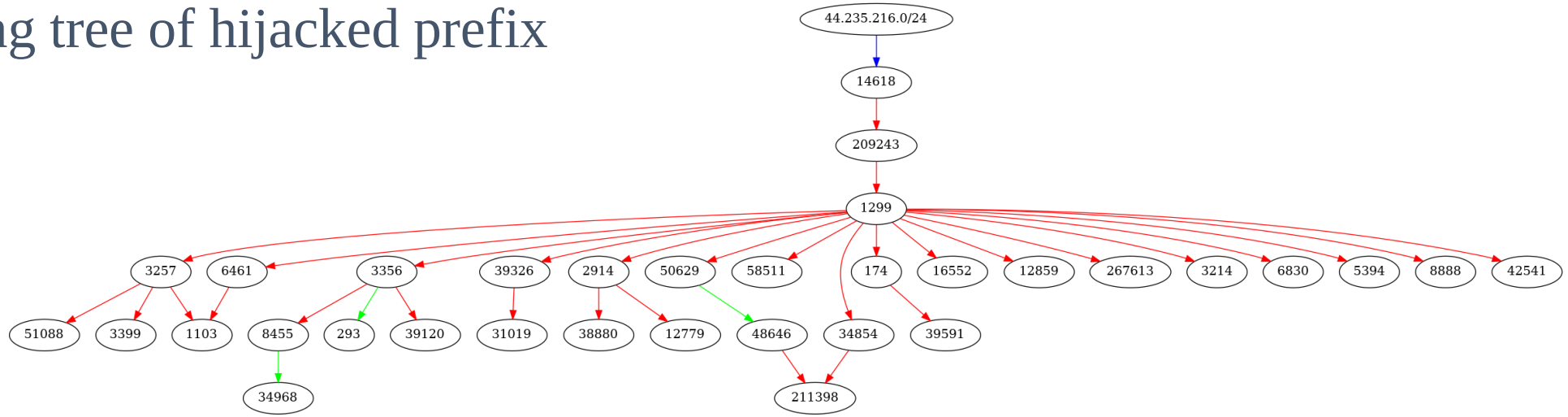
- Anomaly detection or Event review
  - Prefix hijacking or link failure, etc. can cause changes in clustering results, which can be used to detect anomalies.
  - For example, On August 17, 2022, 44.235.216.0/24 （belong to Amazon） was maliciously hijacked by attacker AS20943.
  - The results of clustering all prefixes of AS14618 by next-hop AS before and after hijacking.
  - 18:00 (before hijacking): 1 cluster, all paths go through AS16059 before arriving at AS14618.
  - 20:00 (during hijacking): 2 clusters， the hijacked prefixes form a separate cluster.
  - 24:00 (after hijacking recovery): 1 cluster.

Application of Routing Tree Clustering

- Routing tree of normal prefixes



- Routing tree of hijacked prefix



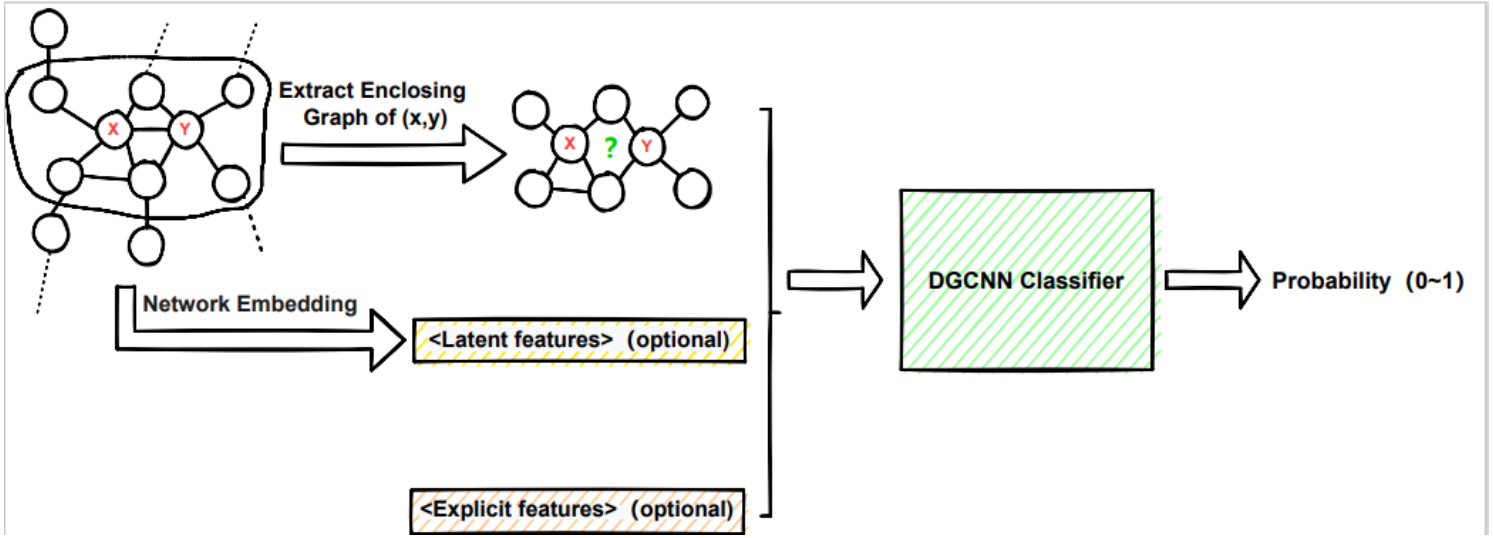
Path hijacking detection by link prediction

- Problem
  - Argus, fingerprints, and other methods directly treat unseen links as suspicious events, and then verify the events by data plane detection
  - Most unseen links are normal, and as the size of the Internet grows, the number of unseen links observed daily is increasing, and doing so would waste a lot of overhead and make it difficult to ensure real-time performance.

- Our idea
  - Evaluate the authenticity of unseen links and filter the links with high authenticity
- Our method
  - Use link prediction. Link prediction is used to evaluates the likelihood of the existence of an unseen link from the observed links.

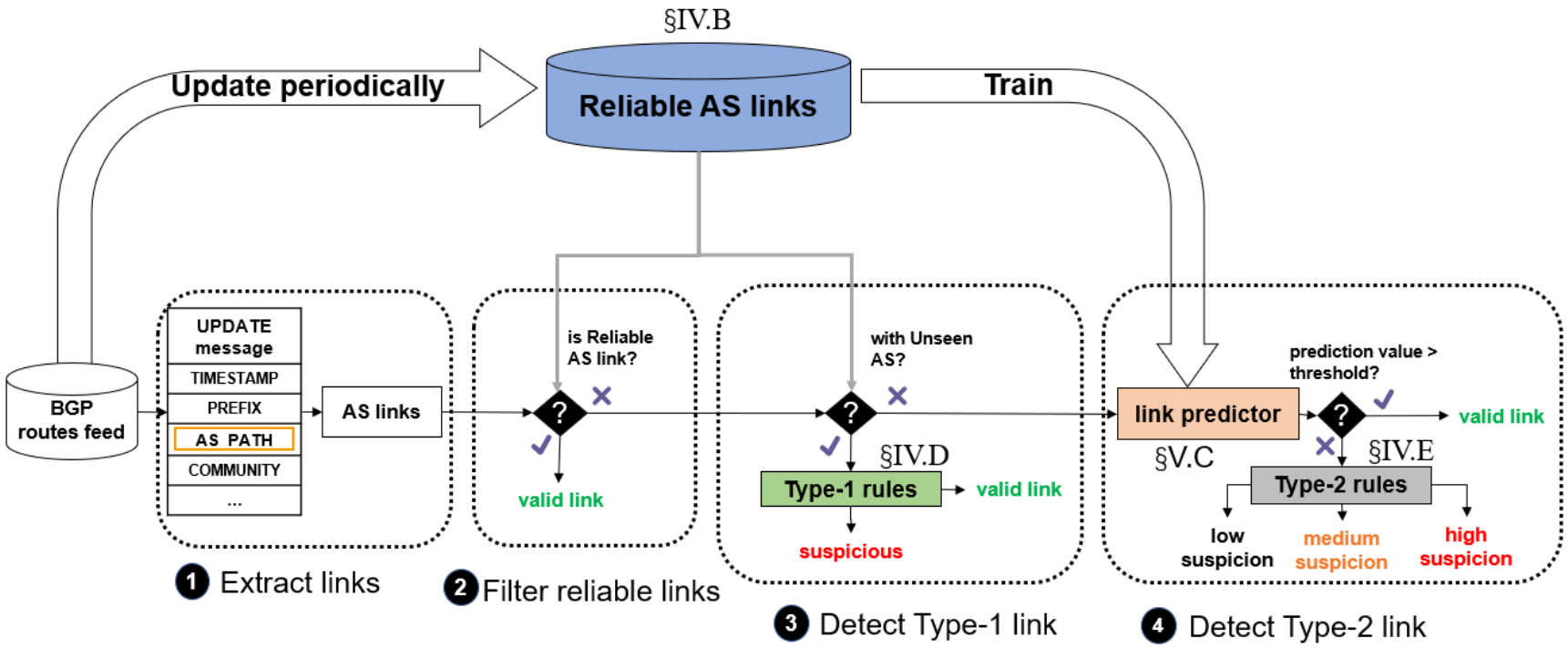
Path hijacking detection

- We use SEAL, a link prediction framework based on graph neural networks, for our experiments.
- Get AS topology data from CAIDA, train the model using 80% of the links, and then go to predict the remaining 20% of the links (training requires negative samples, i.e., non-existent links, which can be randomly sampled from the invisible links).
- Experimental results: the accuracy and AUC of classifying unseen links was 0.95, 0.98,respectively.



Path hijacking detection

- Further, we combine the characteristics of false AS-PATH to design a series of rules and further propose a framework for detecting false AS-PATH under the control plane, METIS.



Experiment

- We extract the AS-PATHs in RIB as GREEN samples, and then simulate the actual scenario to craft some fake AS-PATHs as RED samples.
- The experimental results show that METIS can effectively detect the forged AS-PATH caused by path hijacking, misconfiguration, and BGP poisoning.

TABLE III: Result of crafted AS-PATHs

Type of AS-PATH	Number	Reliable link	Type-1 link	Type-2 link	valid AS-PATH	Suspicious AS-PATH				Accuracy
						Type-1	high	medium	low	
GREEN AS-PATHs	7000	11181	358	187	6966	5	3	6	**20**	**99.5%**
Type-1 Misconfiguration	1000	2231	108	985	167	0	924	0	0	92.4%
Type-2 Misconfiguration	1000	2174	496	582	256	247	528	0	0	77.5%
Type-1 hijacking	1000	2213	163	940	125	3	345	481	46	**87.5%**
Type-2 hijacking	1000	3018	153	984	493	2	322	176	7	50.7 %
Type-3 hijacking	1000	3706	160	935	700	0	250	50	0	30.0%
Type-1 BGP poisoning	1000	2237	236	940	107	14	879	0	0	89.3%
Type-2 BGP poisoning	1000	2241	372	2731	11	15	974	0	0	98.9%

Comments/Suggestions

Welcome more partners join the community

Contact us: sec@cgtf.net

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