Detecting and Characterizing Exposed BGP Routers

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Based on a paper in TMA'26 conference

Exposed BGP router

- RFC 7454 on BGP Operations and Security
  - Restrict BGP (TCP 179) to configured peers only.

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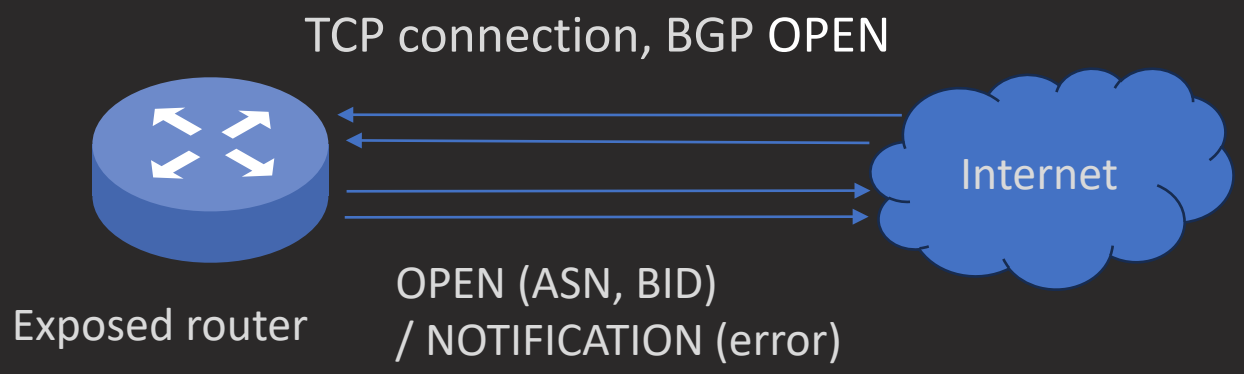
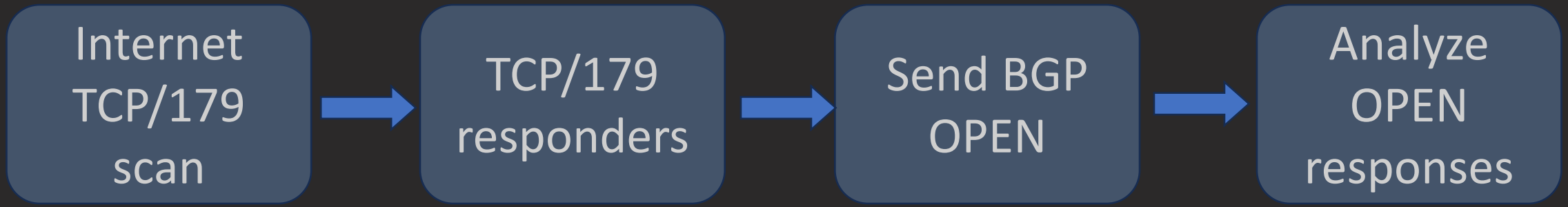


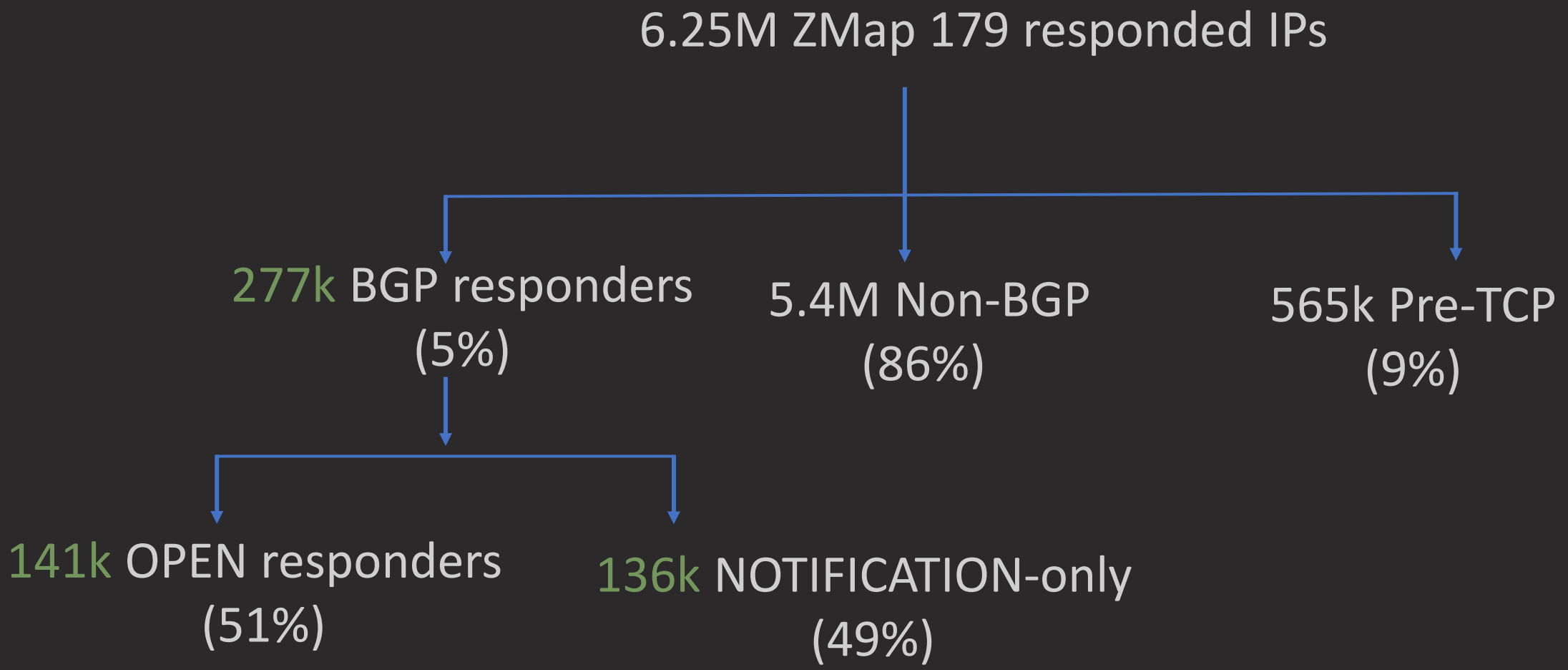
A router that responds to unsolicited BGP OPEN messages.

Scan-179: Detecting exposed routers



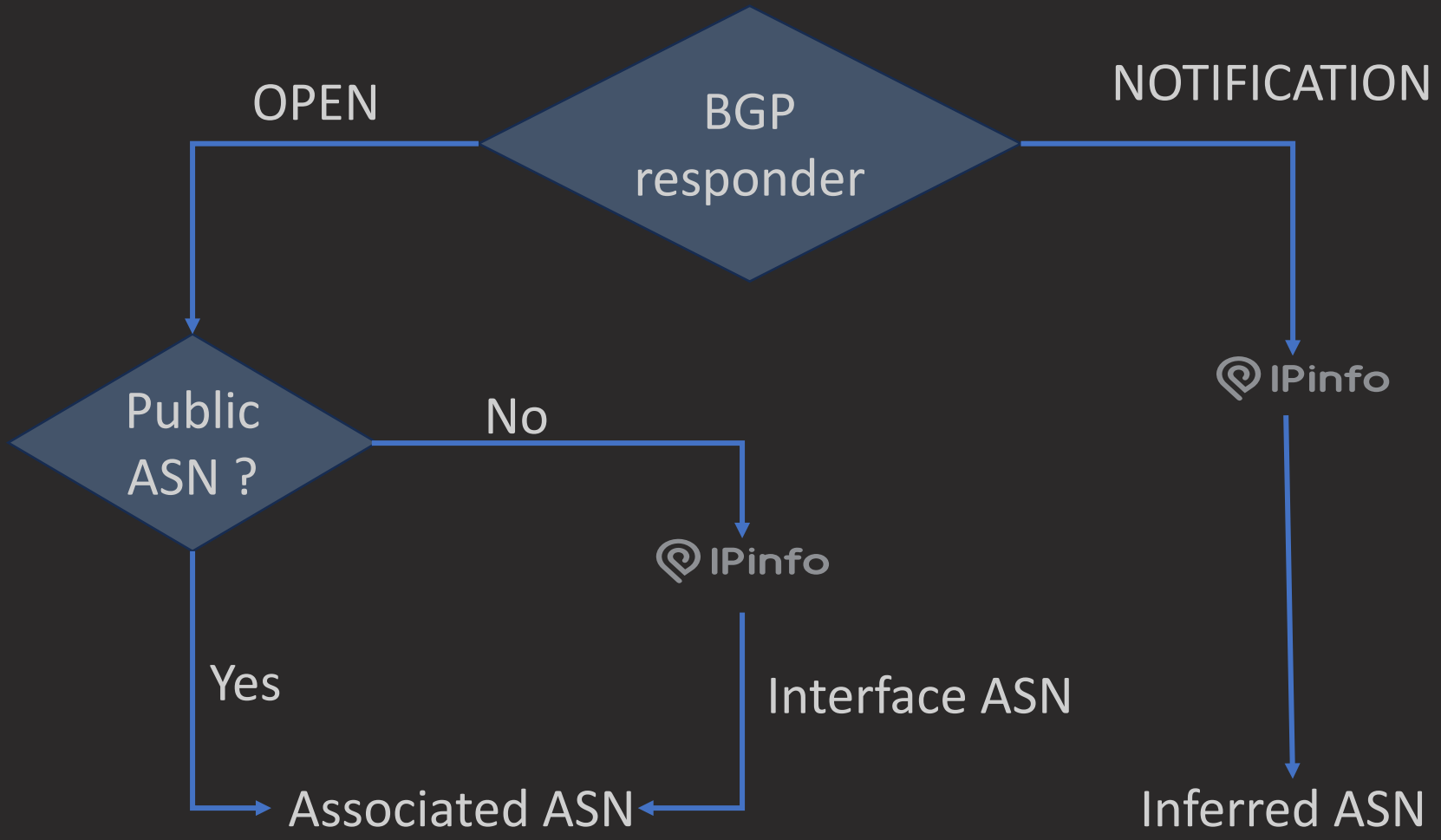
One-shot Internet-wide IPv4 measurement in February 2026.

Responses to Scan-179

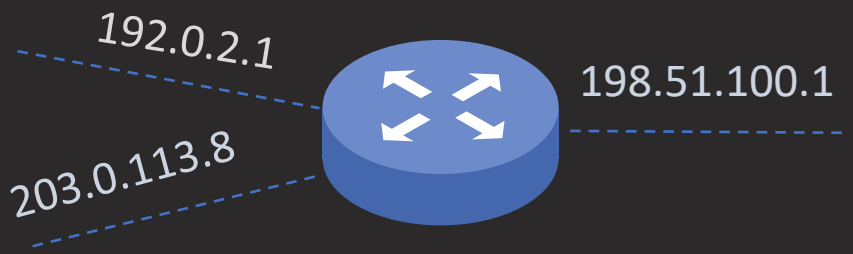


OPEN responders formed the basis of our subsequent analysis.

Identifying associated ASes



Mapping OPEN responder IPs to routers



AS 64500

OPEN message

IP	BID	OPEN ASN
192.0.2.1	192.0.2.254	64500
203.0.113.8	192.0.2.254	64500
198.51.100.1	192.0.2.254	64500

- RFC 6286 states BID is unique per router in an ASN.
- Public OPEN ASN: BID + OPEN ASN -> Router.
- Non-public OPEN ASN: BID + OPEN ASN + Interface ASN -> Router.

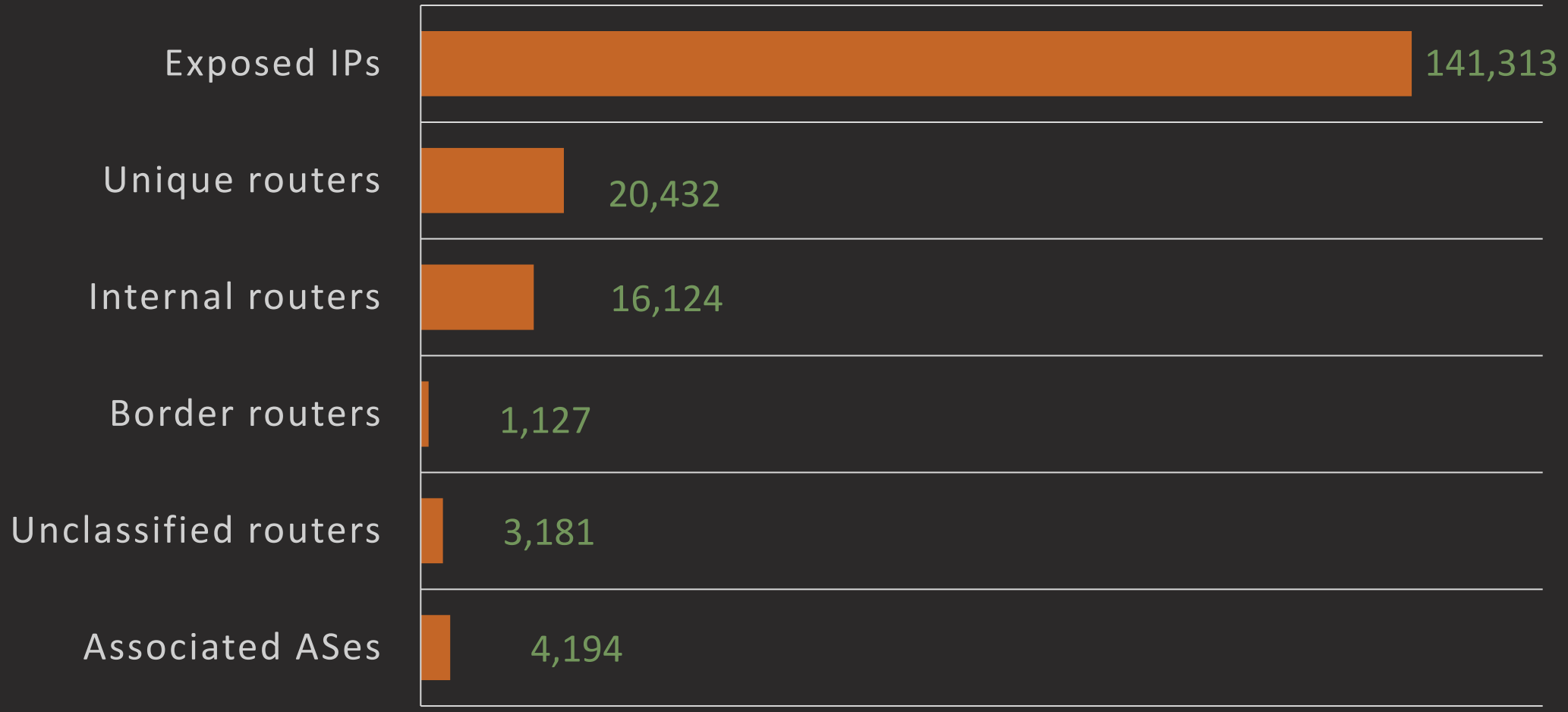
Classifying router: internal and border

- Internal: Non-public OPEN ASN, AS confederations.

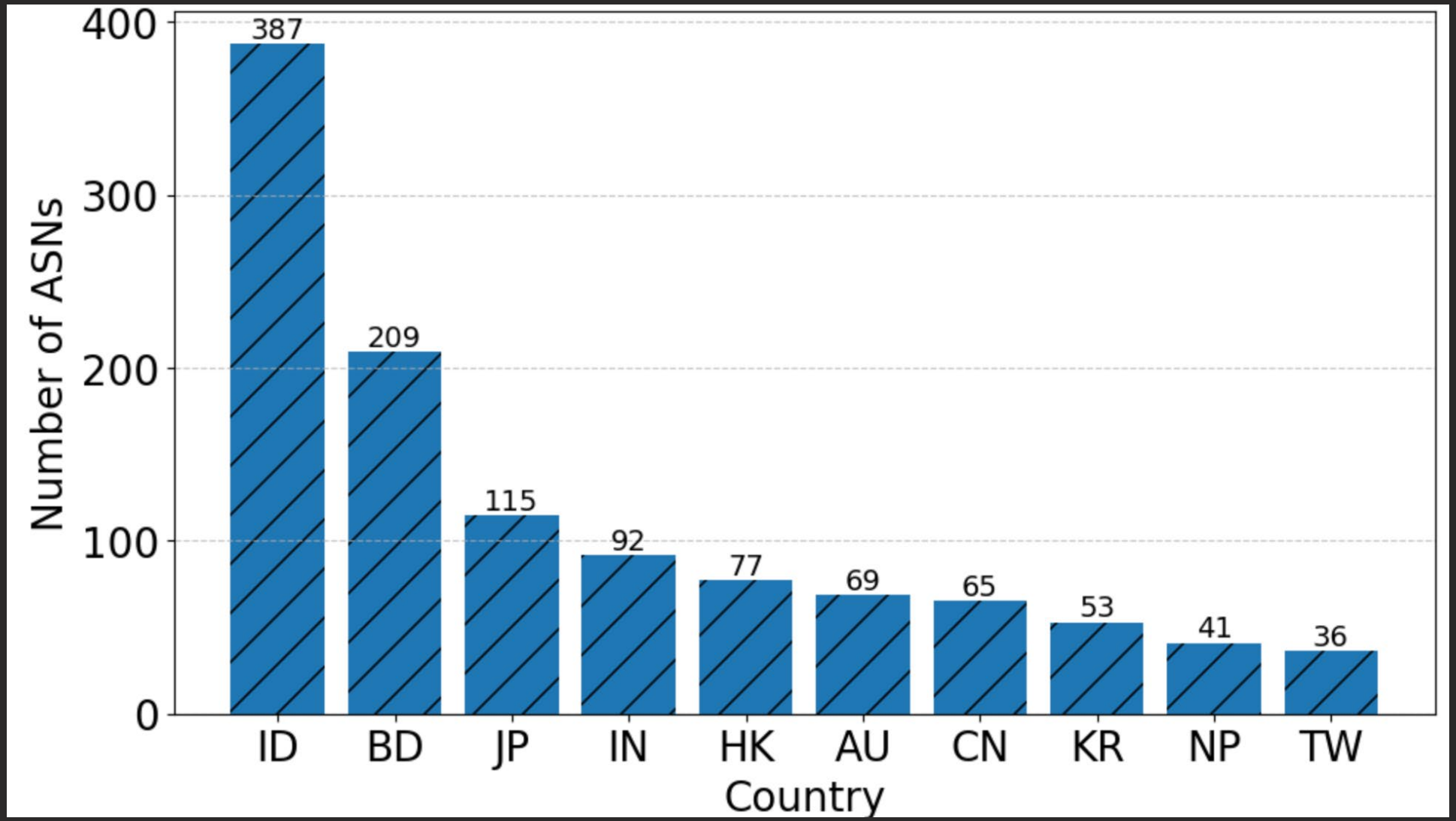
- Border: eBGP peering.
  - Public OPEN ASN + one interface IP belongs to another ASN.

- Unclassified:
  - Public OPEN ASN, but all interface IPs map to the same ASN.
  - Could be iBGP peering or the host AS is providing the IP.

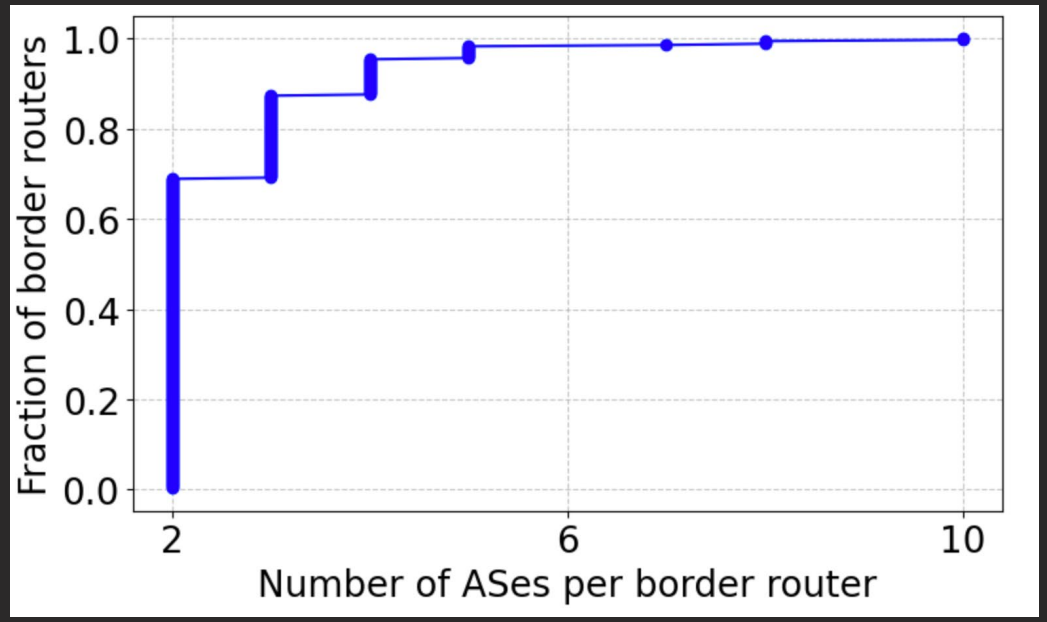
Finding on IPs, routers, and ASes



Top 10 countries in APNIC



Criticality of routers in APNIC



- Around 70% of border routers connect to one AS.
- A border router connects to 10ASes.

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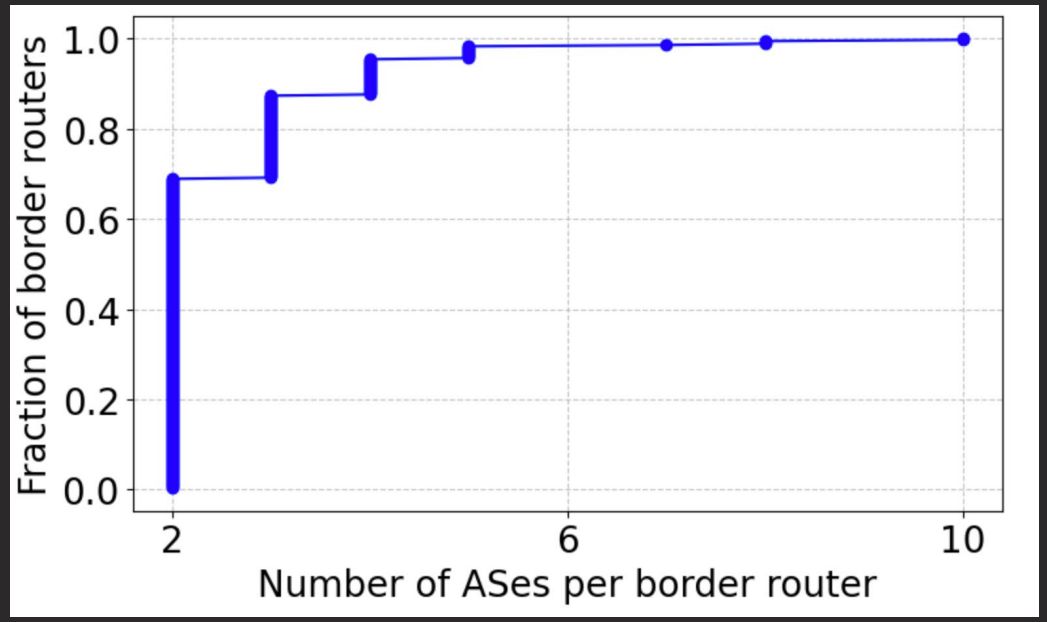

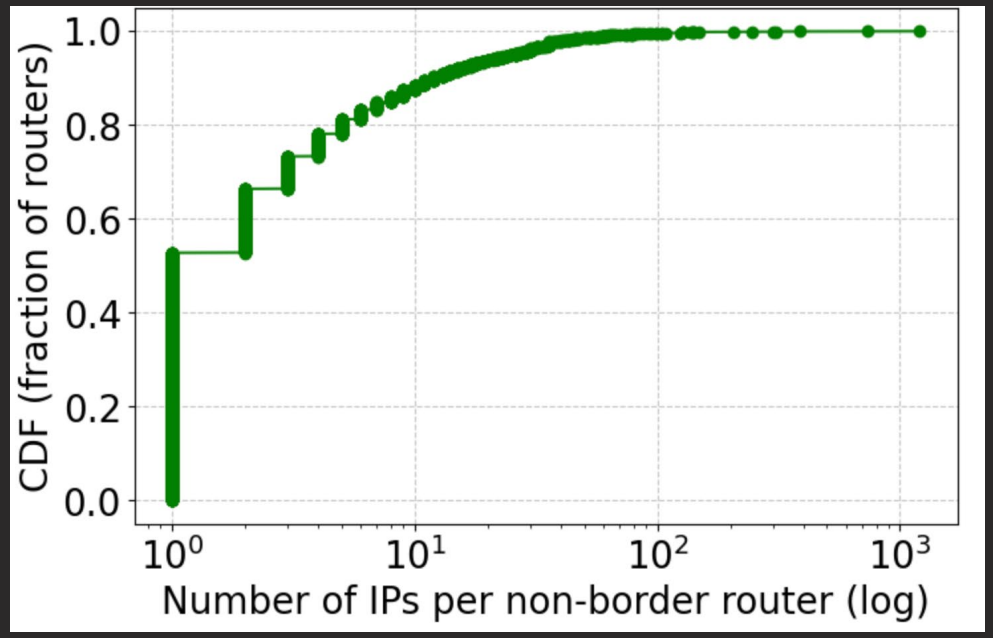

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- 55% have one IP, and around 85% have fewer than 10 IPs.
- A non-border router has 1,208 IPs.

Takeaways and call for operators

- A non-trivial number of BGP routers are exposed.
- 20,432 routers across 4,194 ASes.
- APNIC: 4,611 routers managed by 1,343 ASes, 347 border routers.
- More on paper: router vendors, vendor diversity within ASes etc.
- Seeking operator insights into the reasons of open ports.

THANK YOU

Questions & Discussions

Paper

Personal website

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