Enrich NetFlow by Metadata

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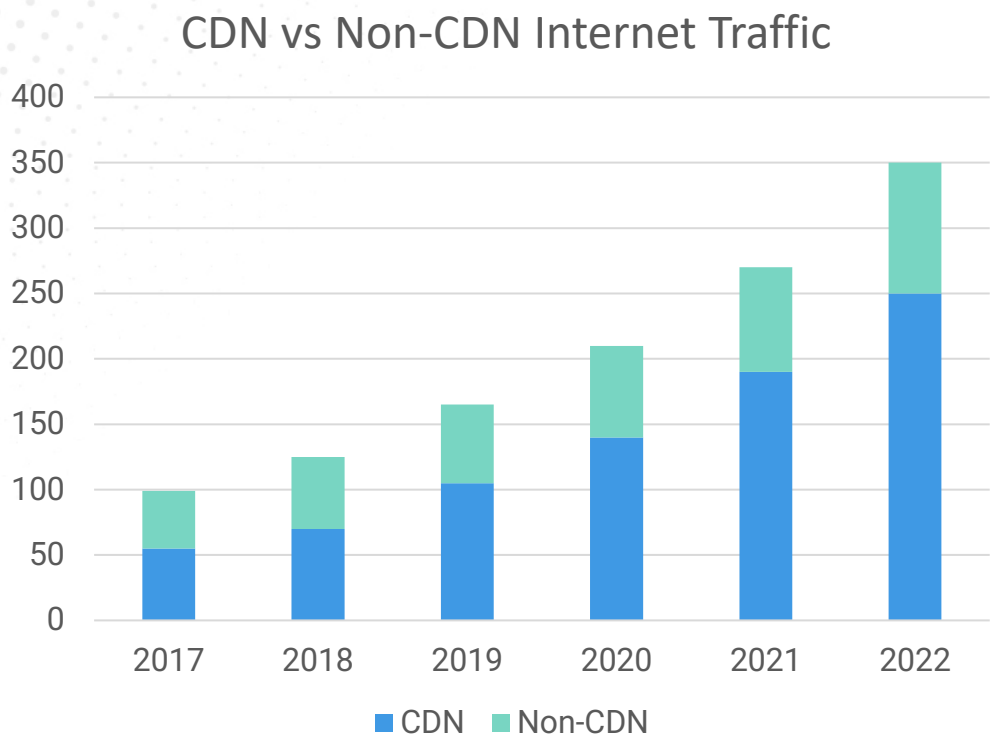
Application And Platform Visibility



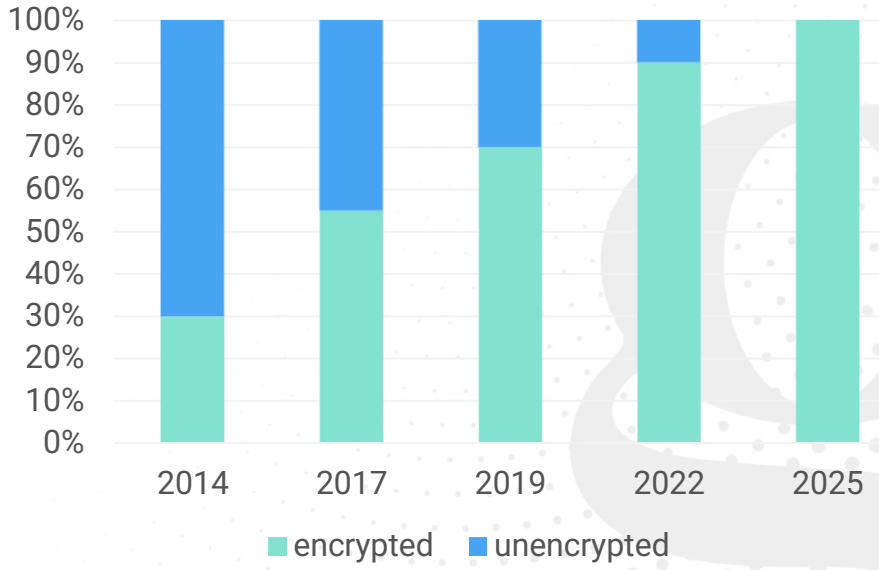
- CDN Planning
  - Which CDNs to be embedded or peered through which IXP? What applications can they deliver?
- CDN Monitoring
  - Do the embedded or peered CDNs deliver through agreed servers and link to agreed targets? How much bandwidth is delivered?
- Application Monitoring
  - How are critical applications delivered? Are there any anomalies?

Challenges of DPI

- ISPs have used DPI technology for more than a decade: lawful intercept, policy enforcement, quality of service, tiered services, copyright enforcement, statistics, etc.

- Almost all agree that at least 80% of the worldwide internet traffic is encrypted, and Google reports 95% encryption over all its services.

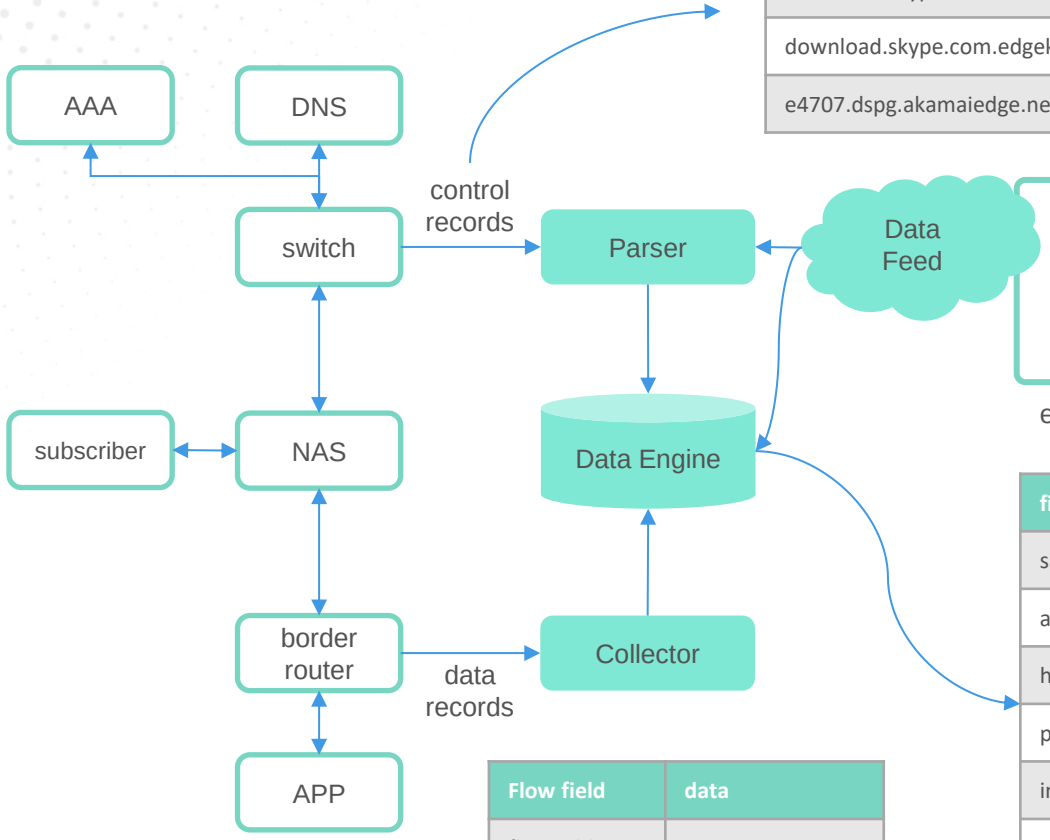
- More and more passive DPI solutions rely on DNS and other technologies coupled with AI/ML to infer applications.



Using NetFlow As Data Source

- If we can only infer the application of encrypted traffic, NetFlow is a more cost-effective data source.
- NetFlow is standardized and supported by all major router vendors. NetFlow can be collected from border, core, and access routers.
- NetFlow can sample packets to reduce data volume and thus reducing costs.
- Many ISPs are already collecting NetFlow enriched by BGP for route optimization, DDoS detection, and other applications.
- But NetFlow only collects L3/4 header fields. The requirement is to enrich it with metadata learned from the control plane and/or other sources.

Enrich NetFlow By Metadata



DNS name	type	data
download.skype.com	CNAME	download.skype.com.edgekey.net
download.skype.com.edgekey.net	CNAME	e4707.dspg.akamaiedge.net
e4707.dspg.akamaiedge.net	A	184.51.240.147

GEO/IRR/OTT…

prefix	city
184.51.240.0/24	Hong Kong

enriched flow records

AAA attribute	value
Framed-IP-Address	10.20.89.215
3GPP-IMSI	284011234567890
…	…

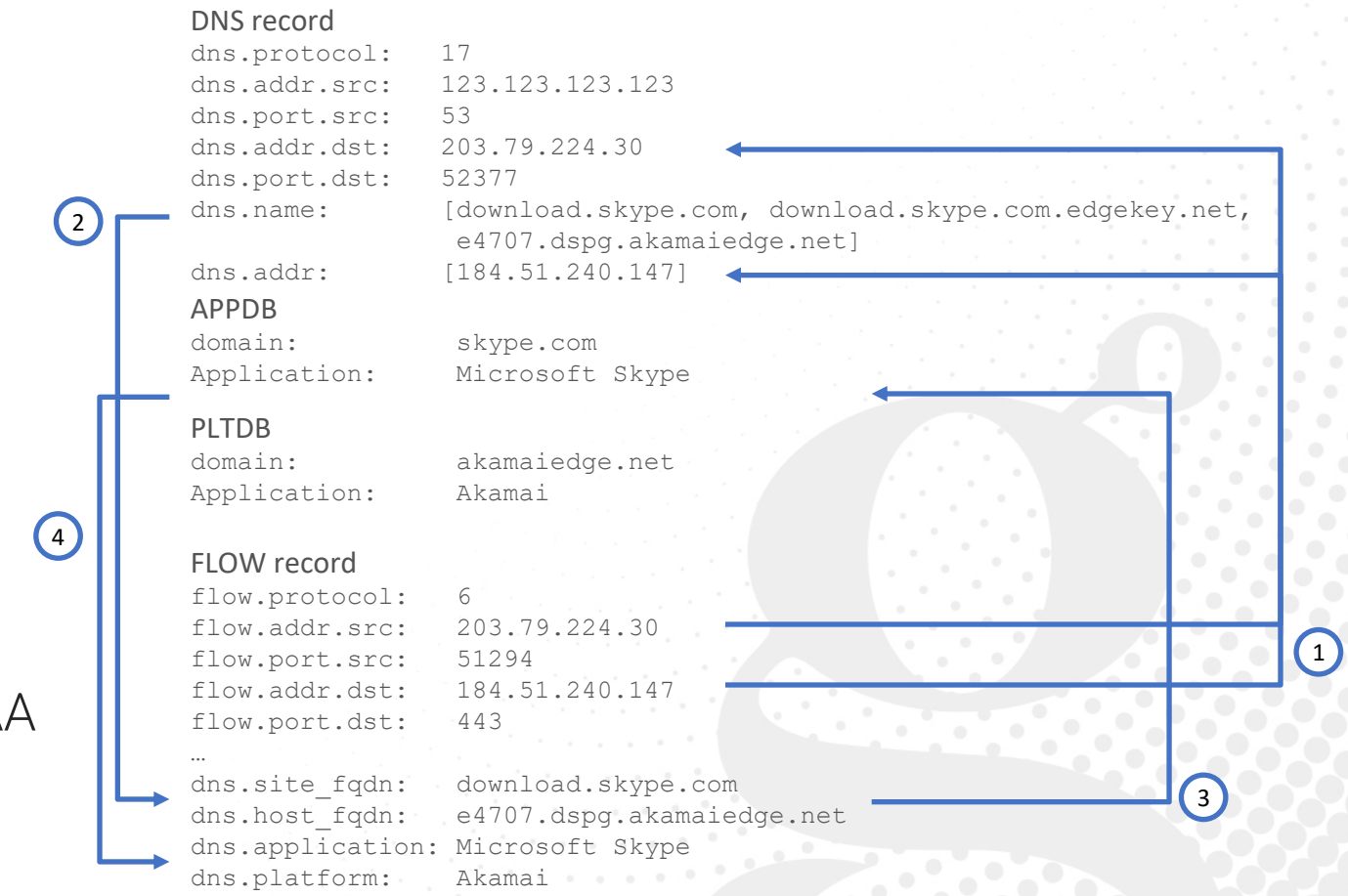
NAT attribute	value
IP-Port-Int-IPv4-Addr	10.20.89.215
IP-Port-Ext-IPv4-Addr	203.79.224.30
IP-Port-Range-Start	51200
IP-Port-Range-End	53247

Flow field	data
flow.addr.src	203.79.224.30
flow.addr.dst	173.222.180.229

field	203.79.224.30	173.222.180.229
site_fqdn	-	download.skype.com
application	-	Microsoft Skype
host_fqdn	-	e4707.dspg.akamaiedge.net
platform	-	Akamai
inside_addr	10.20.89.215	-
imsi	284011234567890	-
city	…	Hong Kong

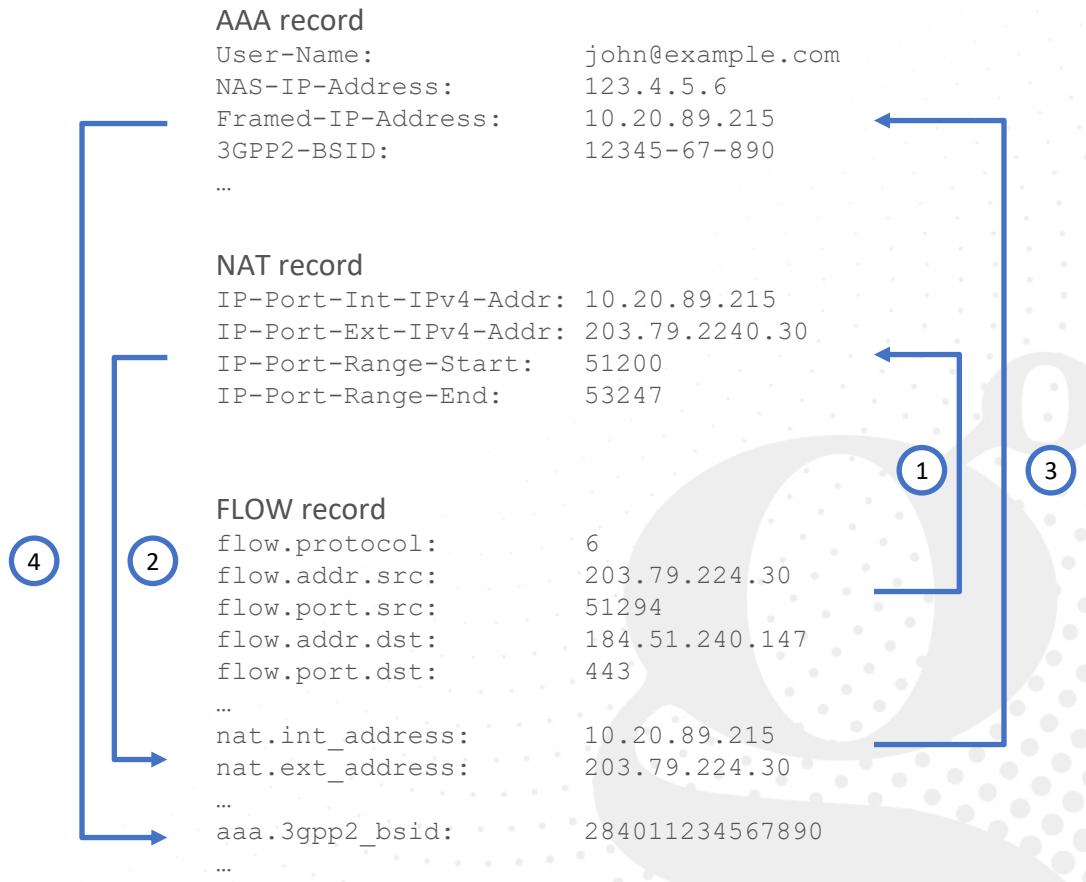
Enrich NetFlow By DNS/NAT

- Application – the first in CNAME chain
  - Site FQDN – download.skype.com
  - Application – Microsoft Skype
- Platform – the last in CNAME chain
  - Host FQDN – e4707.dspg.akamaiedge.net
  - Platform – Akamai
- Reverse DNS Table – A/AAAA
  - For dedicated servers
- Reverse DNS Table – CLIENTIP + A/AAAA
  - For shared servers



Enrich NetFlow By AAA/NAT

- NetFlow records enriched by AAA/NAT provides finer granularity of network traffic than CDR.
- Can be used to detect issues like congestion and provide insight to causes.
- Can be useful for access network planning.



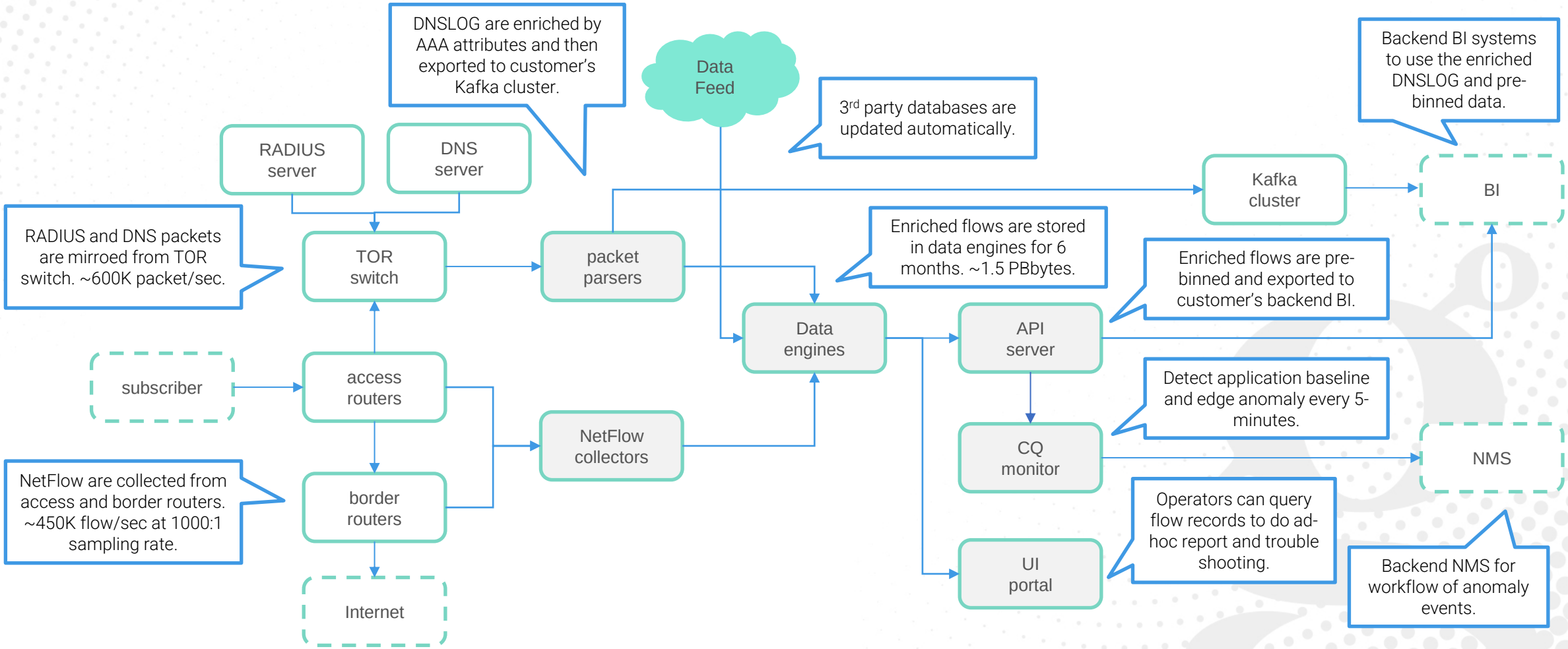
Enrich NetFlow By Data Feed

- NetFlow can be enriched by 3rd party data feed for more context information. Popular data feeds are :
- GEODB – To enrich NetFlow by GEO info such as country or city. Useful for peering or transit analysis.
- IRRDB – To enrich NetFlow by registrant information. Useful for forensic applications.

prefix	country	subdivisions	radius
122.175.164.0/32	India	[Madhya Pradesh]	20.0
12.144.146.128/25	United States	[Missouri]	100.0
84.86.49.128/25	The Netherlands	[South Holland]	100.0
2a09:bac1:76e1:17a2::/63	United States	[Alabama]	1000.0
74.103.194.0/23	United States	[Rhode Island]	5.0
12.196.19.88/29	United States	[Michigan]	20.0
2a02:a450:1200::/40	The Netherlands	[South Holland]	5.0
2a09:bac1:76e0:4b28::/61	United States	[Texas]	1000.0
170.169.126.0/23	Mexico	[Querétaro]	200.0
92.76.184.0/24	Germany	[Lower Saxony]	200.0
89.114.118.0/24	Portugal	[Porto]	20.0
78.99.193.0/24	Slovakia	[Bratislava Region]	20.0
50.45.10.0/23	United States	[Illinois]	100.0
2a02:26f7:bc08:50c6::/64	Canada	[New Brunswick]	100.0
2804:14c:ce87::/48	Brazil	[Sao Paulo]	10.0
2804:14c:ce88::/45	Brazil	[Sao Paulo]	10.0
45.63.78.182/32	United States	[Illinois]	20.0
2a02:26f7:f6f3:a62b::/64	United States	[Rhode Island]	100.0
24.111.33.0/25	United States	[Minnesota]	50.0
201.145.144.0/23	Mexico	[México]	20.0

Example: GEODB Data Feed

Case Study – 10M Subscribers ISPX



Conclusion

- Most Internet traffic is encrypted, and passive DPI can no longer peek at the data plane. Therefore, NetFlow is a more cost-effective data source.
- By enriching NetFlow with DNS, we can still maintain enough visibility for critical applications such as CDN planning, CDN monitoring, and application monitoring.
- By enriching NetFlow with AAA, we can have finer granularity compared with CDR, which is useful for access planning and troubleshooting.
- By enriching NetFlow with other external data, we can have traffic visibility on other dimensions, which is useful for operational or business intelligence.

FAQ

- Q: Is it mandatory to mirror DNS and AAA packets?
  A: DNS and AAA log are also feasible if they are exported in real-time.

- Q: CDN edge server serves many applications. How to resolve the ambiguity?
  A: Matching by CLIENTIP+A/AAAA reduces ambiguity significantly, but not to zero.

- Q: Can NetFlow monitor application performance?
  A: NetFlow can measure elephant flow throughput, but not for RTT.

- Q: Is it legal to sniff users' DNS and AAA packets?
  A: It is legal to sniff your own DNS and AAA servers.

- Q: Flow records with DNS and AAA info is sensitive. How to protect user privacy?
  A: Hash user identity to make them anonymous, or store tags instead of identity.

THANK YOU!

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