

# The Value of a full route peer for a route collector project

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# What is RouteViews

- A tool that allows Internet network operators to look at the BGP table from different backbones and locations around the world to troubleshoot and to assess:
  - Reachability, hijacks, bugs, peer visibility, mass withdrawals, RPKI status,...
- Operators who find it a valuable tool also peer to contribute to the value
- RouteViews operates collectors strategically positioned at IXPs around the world.
  - It also hosts a few multi-hop collectors at UO for those operators who are not present at IXPs.



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# Background

- **RouteViews was first started in 1995**
- Now a growing network of 40+ collectors positioned strategically at Internet Exchange Points around the world
- RouteViews collaborates with the Center for Applied Internet Data Analysis (CAIDA) working with NSF grants that support Designing a Global Measurement Infrastructure to Improve Internet Security, GMI3S ([OAC-2131987](#)), and an Integrated Library for Advancing Network Data Science, ILANDS ([CNS-2120399](#)).
- RouteViews is supported with financial and in-kind donations by multiple organizations
- **RouteViews is based at the University of Oregon and operated by NSRC**
- NSRC supports the growth of global Internet infrastructure by providing engineering assistance, collaborative technical workshops, training, and other resources to university, research & education networks worldwide.
- NSRC is partially funded by the IRNC program of the NSF ([OAC-2029309](#)) and Google with other contributions from public and private organizations.
- The University of Oregon is a public research institution in Eugene, Oregon, USA founded in 1876.

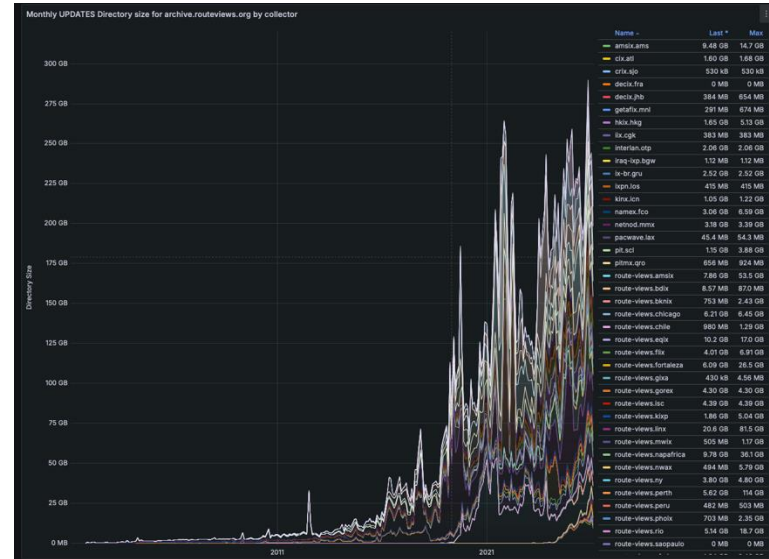
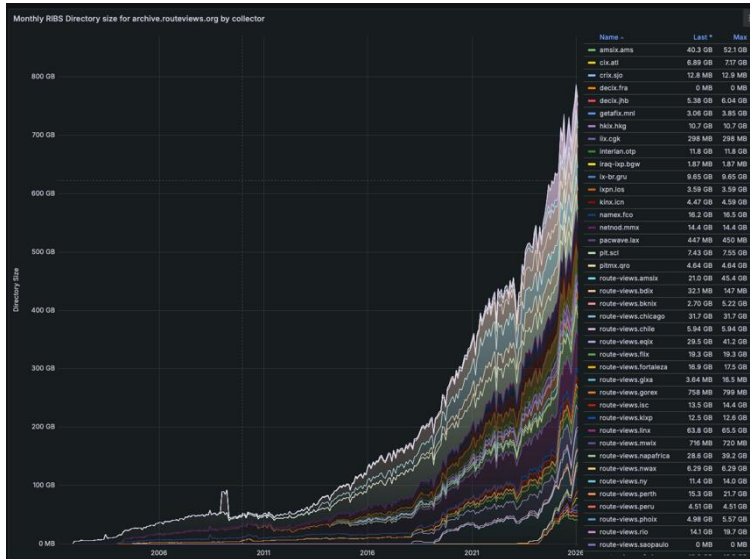


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# The Challenges

## Storage growth

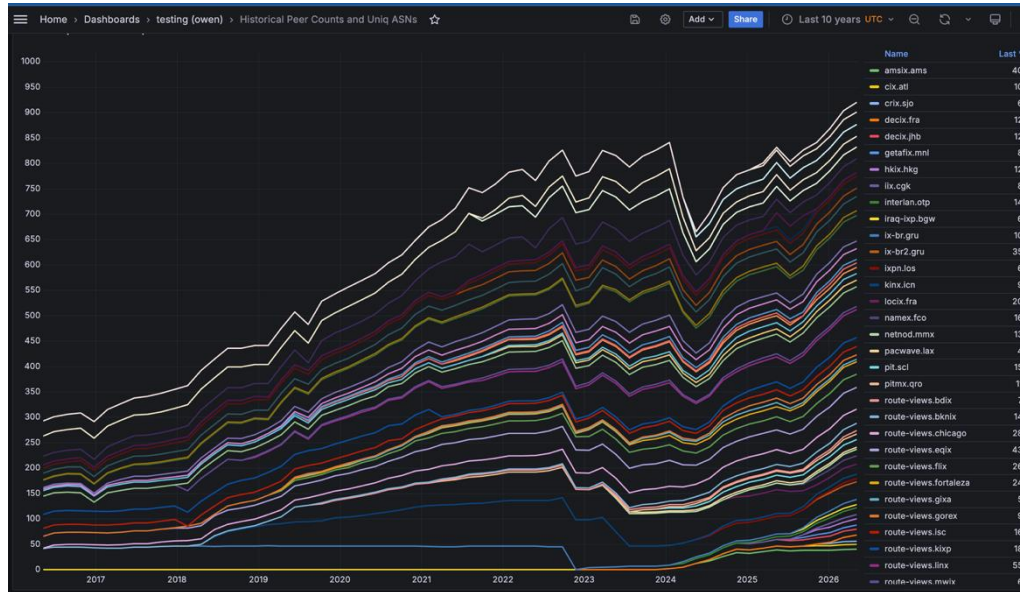


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# The Challenges

## Peer growth



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# Selective peering policy/strategy

**FULL ROUTES PEERS from the edge  
of the Internet**



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# The Value of a session

- What is the new information a session brings to the total dataset?
  - Unique prefixes
  - Unique origins
  - Unique edges
  - Unique paths
  - Shorter paths
- This can be rolled up to create a value of an ASN – the value of a peer



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# Edges

- Unordered pairs of adjacent ASNs in AS paths
- For path `[A, B, C, D]`, the edges are `{A,B}`, `{B,C}`, `{C,D}`.
- Captures: **AS-level connectivity** — which ASNs peer or transit with each other.



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# Paths

- AS paths with position 0 (the peer's own ASN) removed. For a target session with path `[16276, A, B, C]`, the path observation is `(A, B, C)`.

Position 0 is excluded because every path from a target session trivially starts with the target ASN — including it would make every path unique by definition, rendering the comparison meaningless.

- Captures: **\*\*routing policy diversity\*\***  
Two peers might contribute the same edges but show different paths, revealing distinct routing policies.



# Example - tier 1 provider AS3491

**Global baseline:** 26,890 sessions | 480,638 edges | 9,341,959 paths | 1,251,468 prefixes

## Session contributions

Peer IP	Collector	Edges	Paths	Prefixes	Origins	ShortPaths
123.255.90.244	hkix.hkg	1	170	0	2	1
196.216.148.94	ixpn.los	0	4	0	0	0
196.223.21.89	route-views.kixp	0	2	0	0	0
195.66.224.167	route-views.linx	1	30	0	1	14
196.60.8.152	route-views.napafrica	0	14	0	0	0
27.111.228.43	route-views.sg	0	6	0	0	0

## ASN 3491 aggregate (6 sessions)

Metric	Seen	Unique	% of global
Edges	121,615	11	0.00%
Paths	183,703	1,886	0.02%
Prefixes	1,037,193	0	0.00%
Origins	—	3	—
ShortPaths	—	2,854	—



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# Example - tier 1 provider AS3491

**Global baseline:** 20,393 sessions | 256,791 edges | 2,809,479 paths | 297,959 prefixes

## Session contributions

Peer IP	Collector	Edges	Paths	Prefixed	Origins	ShortPaths
2001:7fa:0:1::ca28:a0f4	hkix.hkg	0	29	0	0	0
2001:43f8:bb1::94	ixpn.los	0	0	0	0	0
2001:43f8:60:1::89	route-views.kixp	0	0	0	0	0
2001:7f8:4::da3:1	route-views.linx	1	10	0	1	1
2001:43f8:6d0::1b	route-views.napafrika	0	3	0	0	0
2001:de8:4::3491:1	route-views.sg	0	31	0	0	0

## ASN 3491 aggregate (6 sessions)

Metric	Seen	Unique	% of global
Edges	52,228	44	0.02%
Paths	76,038	852	0.03%
Prefixed	233,370	0	0.00%
Origins	—	1	—
ShortPaths	—	1,617	—



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# Example - content provider AS32590

**Global baseline:** 26,890 sessions | 480,638 edges | 9,341,959 paths | 1,251,468 prefixes

## Session contributions (1 of 2)

Peer IP	Collector	Edges	Paths	Prefixes	Origins	ShortPaths
206.71.12.85	cix.atl	72	2,570	169	170	2
123.255.90.17	hkix.hkg	160	15,787	4	7	36
86.104.125.165	interlan.otp	2	2,614	0	0	0
187.16.218.161	ix-br.gru	1,958	803	589	707	157
139.150.100.182	kinx.icn	21	443	8	11	246
185.1.166.191	locix.fra	0	375	0	0	0
194.68.123.224	netnod.mmx	133	2,175	0	0	96
45.68.16.190	pit.scl	67	1,829	3	4	87
208.115.136.103	route-views.chicago	103	5,352	0	0	2
206.126.237.32	route-views.eqix	73	772	4	5	1
195.66.226.130	route-views.linx	315	568	0	0	0
196.60.9.21	route-views.napafrika	389	10,393	0	0	15



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# Example - content provider AS32590

**Global baseline:** 26,890 sessions | 480,638 edges | 9,341,959 paths | 1,251,468 prefixes

## Session contributions (2 of 2)

Peer IP	Collector	Edges	Paths	Prefixes	Origins	ShortPaths
45.183.47.120	route-views.peru	88	11,960	80	232	467
27.111.228.176	route-views.sg	175	6,792	8	9	1
185.1.27.59	route-views.soxrs	686	297	63	70	3
185.1.8.55	route-views.uaeix	29	5,239	3	3	11

## ASN 32590 aggregate (16 sessions)

Metric	Seen	Unique	% of global
Edges	165,395	6,501	1.35%
Paths	943,958	83,786	0.90%
Prefixes	1,104,294	934	0.07%
Origins	—	1,222	—
ShortPaths	—	1,176	—



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# Example - content provider AS32590

**Global baseline:** 20,393 sessions | 256,791 edges | 2,809,479 paths | 297,959 prefixes

## Session contributions (1 of 2)

Peer IP	Collector	Edges	Paths	Prefixes	Origins	ShortPaths
2001:504:40:12::1:85	cix.atl	47	15	0	0	24
2001:7fa:0:1::ca28:a011	hkix.hkg	107	3,014	0	1	42
2001:7f8:64:225:0:3:2590:1	interlan.otp	3	124	0	0	0
2001:12f8::218:161	ix-br.gru	1,866	385	117	118	48
2001:7fa:8::5b	kinx.icn	15	526	0	0	22
2001:7f8:f2:e1:0:3:2590:1	locix.fra	0	104	0	0	0
2001:7f8:d:ff::224	netnod.mmx	120	154	2	2	4
2801:14:9000::3:2590:1	pit.scl	62	566	8	8	1
2001:504:0:4:0:3:2590:1	route-views.chicago	62	714	1	1	0
2001:504:0:2:0:3:2590:1	route-views.eqix	52	122	0	0	2
2001:7f8:4::7f4e:1	route-views.linx	226	161	0	0	1
2001:43f8:6d0::9:21	route-views.napafrica	176	285	1	1	0



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# Example - content provider AS32590

**Global baseline:** 20,393 sessions | 256,791 edges | 2,809,479 paths | 297,959 prefixes

## Session contributions (2 of 2)

Peer IP	Collector	Edges	Paths	Prefixes	Origins	ShortPaths
2803:cd60:6411:5::2c	route-views.peru	123	6,824	70	87	448
2001:de8:4::3:2590:1	route-views.sg	139	1,260	0	0	20
2001:7f8:1e::59	route-views.soxts	172	84	5	7	1
2001:de8:6::3:2590:1	route-views.sydney	113	1,855	0	0	2
2001:7f8:73::7f4e:0:1	route-views.uaeix	61	2,038	0	0	0

## ASN 32590 aggregate (17 sessions)

Metric	Seen	Unique	% of global
Edges	77,378	5,020	1.95%
Paths	298,588	23,940	0.85%
Prefixes	259,260	206	0.07%
Origins	—	228	—
ShortPaths	—	629	—



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# Example - content provider AS16276

**Global baseline:** 26,879 sessions | 481,023 edges | 9,384,044 paths | 1,254,898 prefixes

## Session contributions

Peer IP	Collector	Edges	Paths	Prefixed	Origins	ShortPaths
151.80.174.184	route-views7	3	41	0	0	0
151.80.174.185	route-views7	0	15	0	0	0
151.80.174.186	route-views7	14	339	0	1	32
151.80.174.187	route-views8	168	1,187	0	0	11
151.80.174.188	route-views8	163	4,129	0	0	0
151.80.174.189	route-views8	235	110,575	2	35	507

## ASN 16276 aggregate (6 sessions)

Metric	Seen	Unique	% of global
Edges	147,754	5,454	1.13%
Paths	461,190	116,817	1.24%
Prefixed	1,063,991	551	0.04%
Origins	—	608	—
ShortPaths	—	700	—



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# Example - content provider AS16276

**Global baseline:** 20,921 sessions | 257,608 edges | 2,841,900 paths | 298,124 prefixes

## Session contributions

Peer IP	Collector	Edges	Paths	Prefixed	Origins	ShortPaths
2001:41d0:d01:9600:1::1	route-views7	2	21	0	0	0
2001:41d0:d01:9600:1::2	route-views7	1	0	0	0	0
2001:41d0:d01:9600:1::3	route-views7	6	1,267	0	0	0
2001:41d0:d01:9600:1::4	route-views8	149	146	0	1	0
2001:41d0:d01:9600:1::5	route-views8	91	308	0	1	0
2001:41d0:d01:9600:1::6	route-views8	199	44,608	0	1	158

## ASN 16276 aggregate (6 sessions)

Metric	Seen	Unique	% of global
Edges	63,999	3,675	1.43%
Paths	161,910	46,684	1.64%
Prefixed	252,899	43	0.01%
Origins	—	51	—
ShortPaths	—	528	—



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# Example - regional peer AS9902

**Global baseline:** 26,780 sessions | 480,770 edges | 9,535,546 paths | 1,255,327 prefixes

## Session contributions

Peer IP	Collector	Edges	Paths	Prefixes	Origins	ShortPaths
27.111.228.211	route-views.sg	0	20	0	0	11

## ASN 9902 aggregate (1 sessions)

Metric	Seen	Unique	% of global
Edges	64	0	0.00%
Paths	63	20	0.00%
Prefixes	598	0	0.00%
Origins	—	0	—
ShortPaths	—	11	—



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# Example - regional peer AS9902

**Global baseline:** 20,868 sessions | 257,392 edges | 2,851,413 paths | 298,626 prefixes

## Session contributions

Peer IP	Collector	Edges	Paths	Prefixed	Origins	ShortPaths
2001:de8:4::9902:1	route-views.sg	238	6	0	0	1

## ASN 9902 aggregate (1 sessions)

Metric	Seen	Unique	% of global
Edges	16,783	238	0.09%
Paths	16,164	6	0.00%
Prefixed	62,037	0	0.00%
Origins	—	0	—
ShortPaths	—	1	—



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# Example - regional provider AS30844

**Global baseline:** 26,780 sessions | 480,770 edges | 9,535,546 paths | 1,255,327 prefixes

## Session contributions

Peer IP	Collector	Edges	Paths	Prefixes	Origins	ShortPaths
80.249.211.45	amsix.ams	0	0	0	0	0
196.216.148.55	ixpn.los	0	0	0	0	0
196.223.21.44	route-views.kixp	1	1	0	0	3
196.60.8.215	route-views.napafrica	1	0	0	1	0

## ASN 30844 aggregate (4 sessions)

Metric	Seen	Unique	% of global
Edges	114,868	153	0.03%
Paths	119,718	213	0.00%
Prefixes	1,042,193	0	0.00%
Origins	—	11	—
ShortPaths	—	599	—



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# Example - regional provider AS30844

**Global baseline:** 20,868 sessions | 257,392 edges | 2,851,413 paths | 298,626 prefixes

## Session contributions

Peer IP	Collector	Edges	Paths	Prefixes	Origins	ShortPaths
2001:7f8:1::a503:844:1	amsix.ams	0	0	0	0	0
2001:43f8:bb1::55	ixpn.los	0	0	0	0	0
2001:43f8:60:1::44	route-views.kixp	3	15	0	1	1
2001:43f8:6d0::215	route-views.napafrika	0	0	0	0	0

## ASN 30844 aggregate (4 sessions)

Metric	Seen	Unique	% of global
Edges	47,901	79	0.03%
Paths	48,545	1,041	0.04%
Prefixes	234,566	0	0.00%
Origins	—	1	—
ShortPaths	—	46	—



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# Summary - unique contributions per ASN

## Unique contributions per ASN

ASN	Description	Family	Unique Edges	Unique Paths	Unique Prefixes	Shorter Paths
AS3491	Tier 1 provider	IPv4	11	1,886	0	2,854
AS3491	Tier 1 provider	IPv6	44	852	0	1,617
AS32590	Content provider	IPv4	6,501	83,786	934	1,176
AS32590	Content provider	IPv6	5,020	23,940	206	629
AS16276	Content provider	IPv4	5,454	116,817	551	700
AS16276	Content provider	IPv6	3,675	46,684	43	528
AS30844	Regional provider	IPv4	153	213	0	599
AS30844	Regional provider	IPv6	79	1,041	0	46
AS9902	Regional peer	IPv4	0	20	0	11
AS9902	Regional peer	IPv6	238	6	0	1



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# Conclusion

Not all sessions are equal — value is the new information a session adds to the global dataset when considering the topology of the Internet

- Edge networks announcing full routes — content providers and regional providers — carry the unique signal: thousands of unique edges, paths, prefixes and origins.
- Tier-1 transit sessions are high-volume but low-novelty — their routes are already covered by other peers.
- “Standard peering” sessions (no full routes) contribute almost nothing, but are useful for other reasons

If you operate at the edge and announce full routes — peer with us. Your session is what makes the dataset useful.



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Thank you!

