

as2org+ : Enriching AS-to-Organization Mappings with PeeringDB

Augusto Arturi, Esteban Carisimo and Fabián E. Bustamante



An Organization-level Internet

Why *orgs* with multiple ASes?

- Subsidiaries
- Different business units
- (de)mergers & acquisitions

What's our goal?

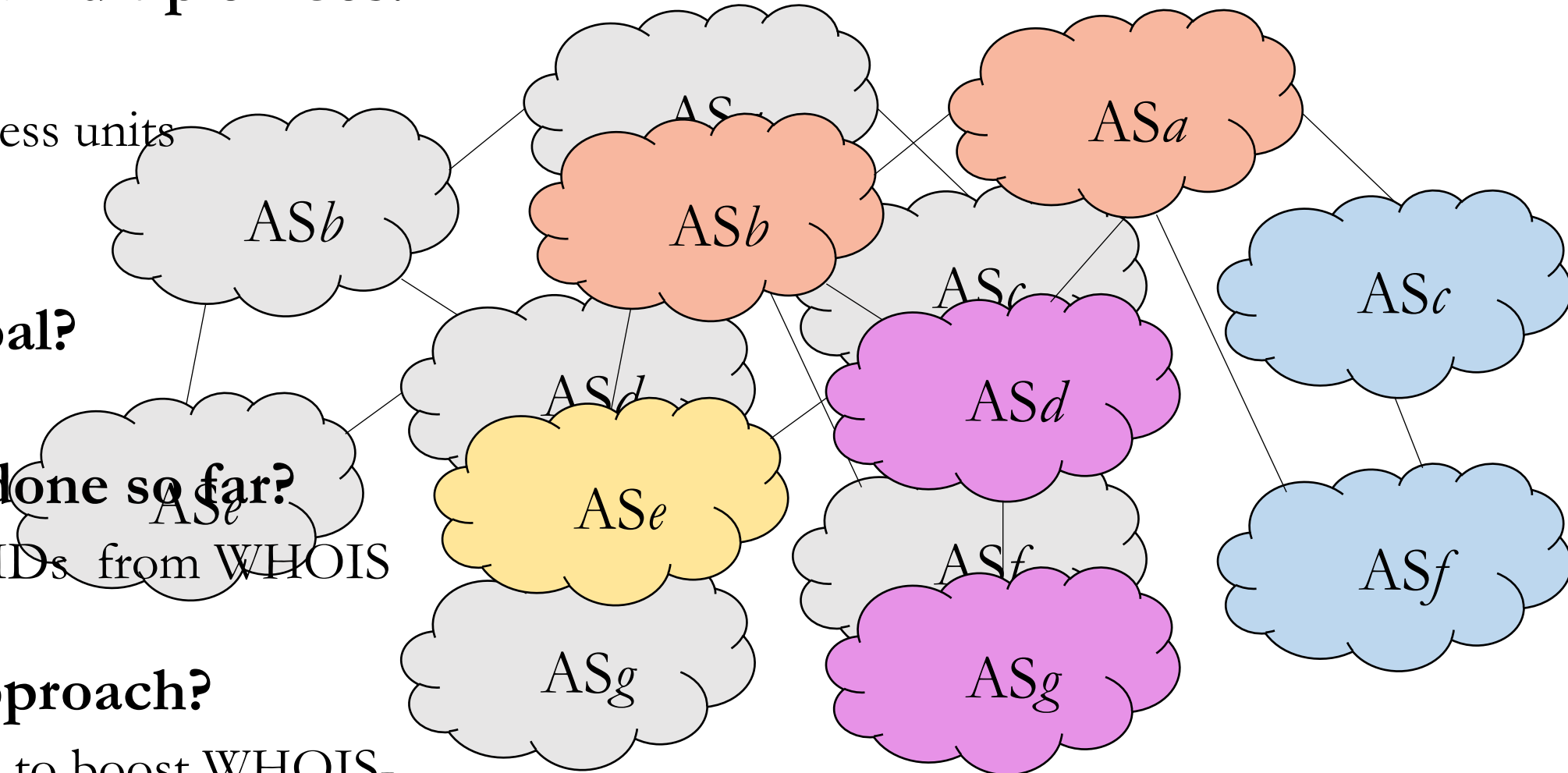
- Identify *siblings*

What's been done so far?

- Leveraged OrgIDs from WHOIS records

What's our approach?

- Use PeeringDB to boost WHOIS-based methods



Challenges in WHOIS data

Corporate business segmentation ➡ Claro Argentina (AS19037: AR-CCTI1-LACNIC)
Claro Chile (AS27995: CL-CCSA39-LACNIC)

Outdated records ➡ Movistar Costa Rica → Liberty
(AS262202: @aut-262202-LACNIC)

RIR-level allocations, use of companies' legal names and so on...
The paper describes more examples

Challenges and Opportunities with PeeringDB

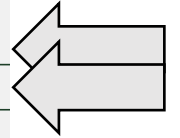
Challenges

- Limited coverage ($\approx 34.5\%$)
- Geographic bias
- Completeness, correctness and use of fields

Opportunities

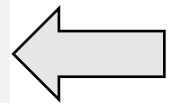
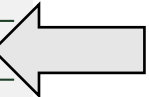
GTT Communications (AS4436)

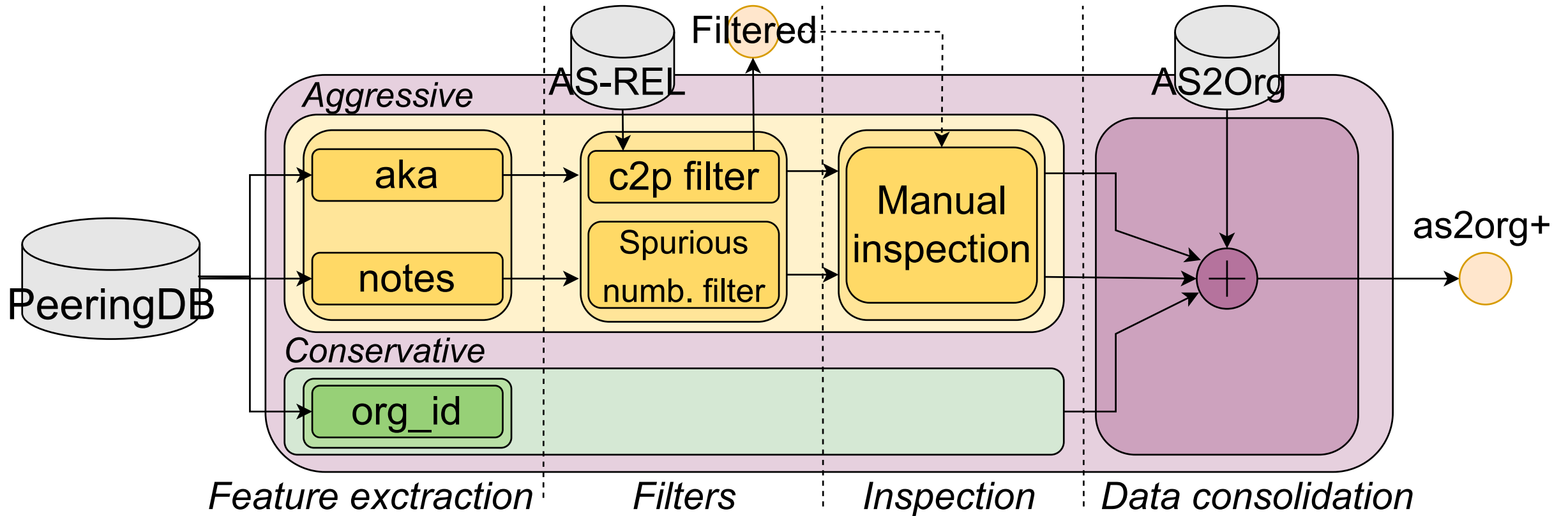
Organization	GTT Communications, Inc.
Also Known As	Formerly known as nLayer Communications
Long Name	
Company Website	http://www.gtt.net
ASN	4436
IRR as-set/route-set ?	



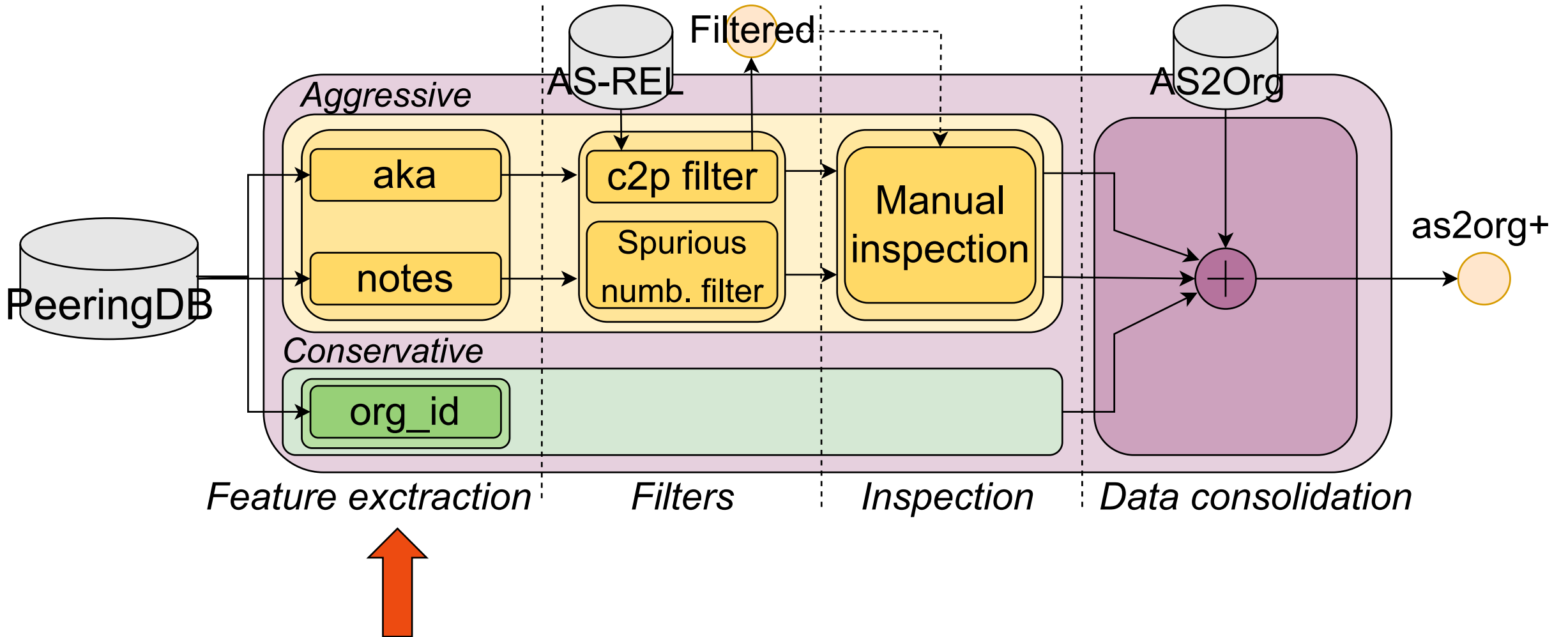
TELECOM ARGENTINA

Organization	TELECOM ARGENTINA
Also Known As	FiberCorp, Cablevision (other ASN: 10481 and 10318)
Long Name	
Company Website	http://www.telecom.com.ar
ASN	7303
Protocols Supported	<input checked="" type="radio"/> Unicast IPv4 <input type="radio"/> Multicast <input checked="" type="radio"/> IPv6 <input type="radio"/> Never via route servers ?
Last Updated	2022-07-27T05:33:22Z
Public Peering Info Updated	2021-09-22T00:06:59
Peering Facility Info Updated	2016-09-19T05:47:27Z
Contact Info Updated	2016-03-14T21:53:18Z
Notes ?	nLayer / AS4436 has been acquired by GTT Communications / AS3257 and is no longer directly peering. Please refer all peering related inquiries to peering [at] gtt [dot] net.





- Extracts sibling information embedded in PeeringDB records
- Combines it with pre-existing AS-to-Org methods



Feature extraction

org_id

notes

Name ↓	ASN
Black Lotus	32421
Lumen AS 3356	3356
Lumen AS 3549	3549
Lumen AS200	200
Lumen AS202818	202818
Lumen AS209	209
Lumen AS3561	3561
tw telecom	4323

Notes ⓘ

Peering Requests: <https://isp.google.com/iwantpeering>

Peering Operational Issues: Contact noc@google.com 24x7

We have a generally open peering policy:
<https://peering.google.com/#/options/peering>

This link also has information about our traffic delivery and management practices.

Please note: not all Google content and services may be available at each PoP or Exchange.

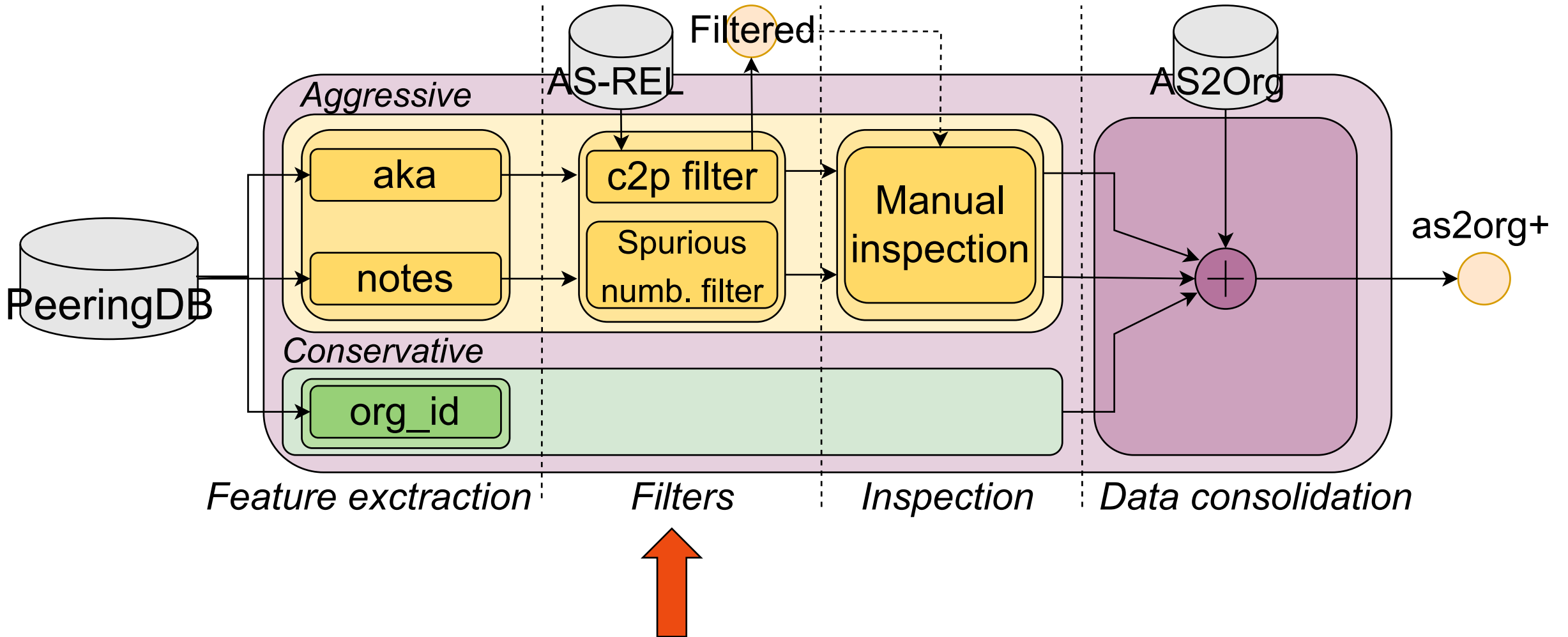
Google manages the following ASNs: AS11344, AS16550, AS19527, AS36040, AS36561, AS43515, AS139070, AS139190

[32421, 3356, 3549, 200, 202818, 209, 3561, 4323] [11344, 16550, 19527, 36040, 43515, 139070, 139190]

aka

Also Known As	
	26617 Navega.com -23243 Comcel Guatemala S.A.- 27773 Millicom El Salvador S.A. - 17079 Telemóvil El Salvador S.A. - 52262 Telefónica Celular S.A. - 23383 Metrored S.A. - 20299 Newcom Limited - 262197 Millicom Costa Rica SA - 52362 SICESA-18809 Cable Onda

[26617, 23243, 27773, 17079, 52262, 23383, 20299, 52326, 18809]



Challenges and filter design

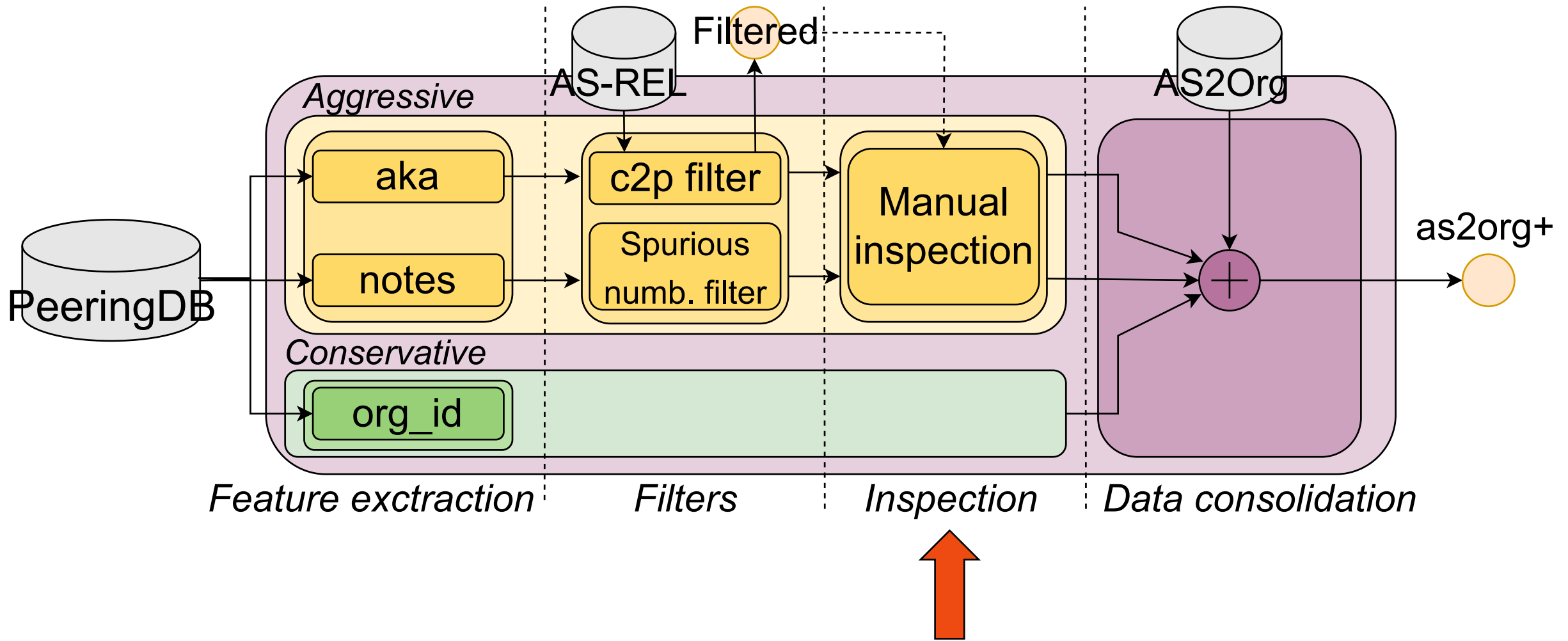
Challenge: Lack of context

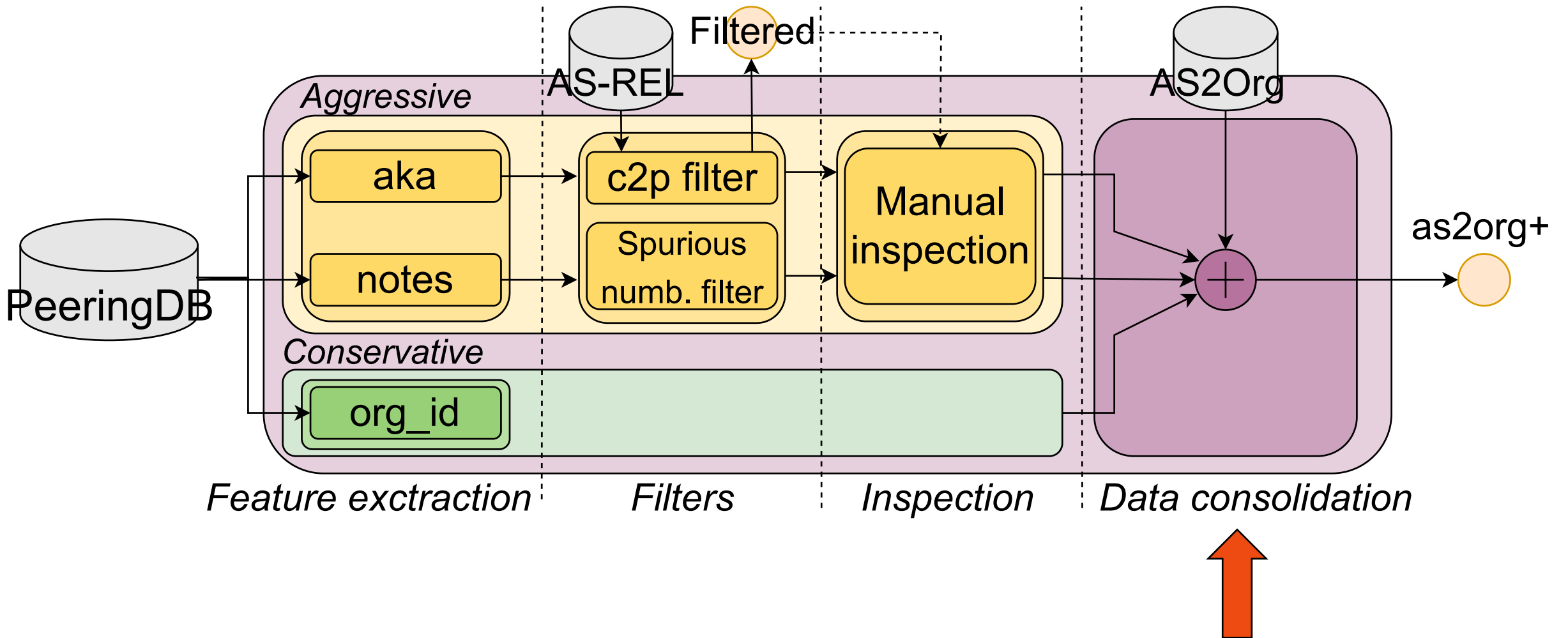
- Unrelated numbers
- ASNs of networks under different managements
 - Partnerships (AS42/AS112)
 - Upstreams

Solutions

- Spurious-number filter
- c2p filter
- Manual inspection

Latitude.sh AS262287	
Organization	Latitude.sh
Also Known As	Latitude.sh
Long Name	
Company Website	https://latitude.sh
ASN	262287
IRR as-set/route-set ?	RADB::AS-MAXIHOST
Route Server URL	
Looking Glass URL	https://lg.latitude.sh
Network Type	Content
IPv4 Prefixes ?	5000
IPv6 Prefixes ?	2000
Traffic Levels	300-500Gbps
Traffic Ratios	Mostly Outbound
Geographic Scope	Global
Protocols Supported	<input checked="" type="radio"/> Unicast IPv4 <input type="radio"/> Multicast <input checked="" type="radio"/> IPv6 <input type="radio"/> Never via route servers ?
Last Updated	2023-01-05T22:55:16Z
Public Peering Info Updated	2022-06-06T17:59:21
Peering Facility Info Updated	2022-11-29T16:39:41
Contact Info Updated	2022-08-15T21:55:26
Notes ?	<p>Through the Bare Metal Cloud proprietary platform, Latitude.sh deploys high-performance physical servers in multiple regions around the globe. Latitude.sh owns a Tier 3 compliant Datacenter in São Paulo, where its headquarter is located. See more at https://www.maxihost.com/</p> <p>We connect directly with the following ISPs,</p> <ul style="list-style-type: none"> • Algar (AS16735) • Sparkle (AS6762) • Voxility (AS3223) • GTT (AS3257) • Cogent (AS174) • FL-IX (Florida Internet Exchange) • IX.br (Brazilian Internet Exchange) • Equinix Exchange • Any2 California (CoreSite Exchange) • DE-CIX New York • DE-CIX Dallas • NSW-IX (Australia Internet Exchange) <p>Latitude.sh operates through ASN 396356 (https://www.peeringdb.com/net/20665) in the following locations: Dallas, New York, Los Angeles, Sydney, Tokyo, Santiago, and Mexico City.</p>





Scattered information

StarHub AS38861	
Organization	StarHub Internet Pte Ltd
Also Known As	
Long Name	
Company Website	http://www.starhub.com
ASN	38861
IRR as-set/route-set ?	
Route Server URL	
Looking Glass URL	
Network Type	Not Disclosed
IPv4 Prefixes ?	0
IPv6 Prefixes ?	0
Traffic Levels	Not Disclosed
Traffic Ratios	Not Disclosed
Geographic Scope	Not Disclosed
Protocols Supported	<input checked="" type="radio"/> Unicast IPv4 <input type="radio"/> Multicast <input checked="" type="radio"/> IPv6 <input type="radio"/> Never via route servers ?
Last Updated	2023-01-18T22:55:27Z
Public Peering Info Updated	2021-09-22T00:07:53
Peering Facility Info Updated	2020-04-29T05:28:13Z
Contact Info Updated	
Notes ?	Please refer to as4657 PDb for Contact & Peering Info. Thanks.

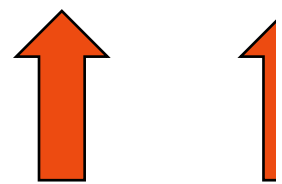
StarHub AS10091	
Organization	StarHub Internet Pte Ltd
Also Known As	
Long Name	
Company Website	http://www.starhub.com
ASN	10091
IRR as-set/route-set ?	
Route Server URL	
Looking Glass URL	
Network Type	Not Disclosed
IPv4 Prefixes ?	0
IPv6 Prefixes ?	0
Traffic Levels	Not Disclosed
Traffic Ratios	Not Disclosed
Geographic Scope	Not Disclosed
Protocols Supported	<input checked="" type="radio"/> Unicast IPv4 <input type="radio"/> Multicast <input checked="" type="radio"/> IPv6 <input type="radio"/> Never via route servers ?
Last Updated	2023-01-18T22:55:27Z
Public Peering Info Updated	
Peering Facility Info Updated	
Contact Info Updated	
Notes ?	Please refer to as4657 PDb for Contact & Peering Info. Thanks.

**No cross
reference**

as2org+ contribution

Identified clusters

				non-atomic clusters										
				# clusters(AS2Org)		# clusters		# ASes						
				field	year	all	unmodif.	as2org+ AS2Org	as2org+ AS2Org	migrant ASes				
				aka						org				
				\overline{AC}	#					notes	aka			
'18	39	128	1	notes	2018	71288	70806	5529	5729	20994	21373	1518		
'19	44	160	1	notes	2019	75223	74979	5925	5932	22498	22348	759	0	(585)
'20	45	188	1	notes	2020	79126	78870	6407	6424	24529	24385	815	8	(796)
'21	44	208	1	notes	2021	86565	86255	6833	6856	26052	25872	1149	7	(988)
'22	48	234	2	notes	2022	90508	90144	7272	7324	27771	27580	1444	8	(1171)
				aka	2018	71288	70921	5528	5729	20917	21373	1348	7	(988)
				aka	2019	75223	75122	5935	5932	22413	22348	363	8	(988)
				aka	2020	79126	79022	6420	6424	24446	24385	367	8	(1171)
				aka	2021	86565	86454	6849	6856	25936	25872	401	8	(1171)
				aka	2022	90508	90402	7311	7324	27635	27580	712	7	(1384)
				org	2018	71288	70382	5526	5729	21261	21373	3168		
				org	2019	75223	74358	5946	5932	22906	22348	2659		
				org	2020	79126	78154	6438	6424	25002	24385	2991		
				org	2021	86565	85474	6865	6856	26561	25872	3613		
				org	2022	90508	89251	7338	7324	28387	27580	4150		

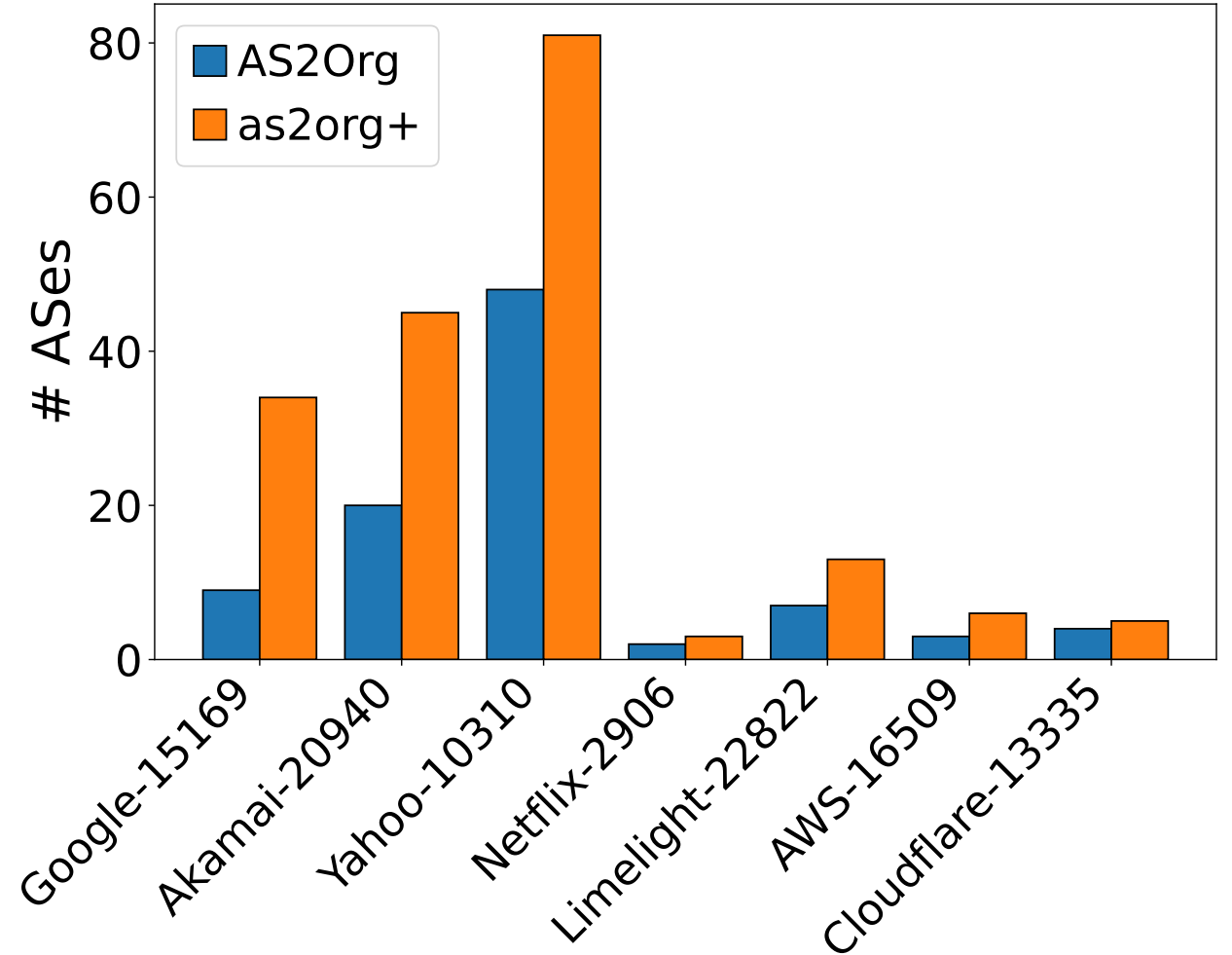
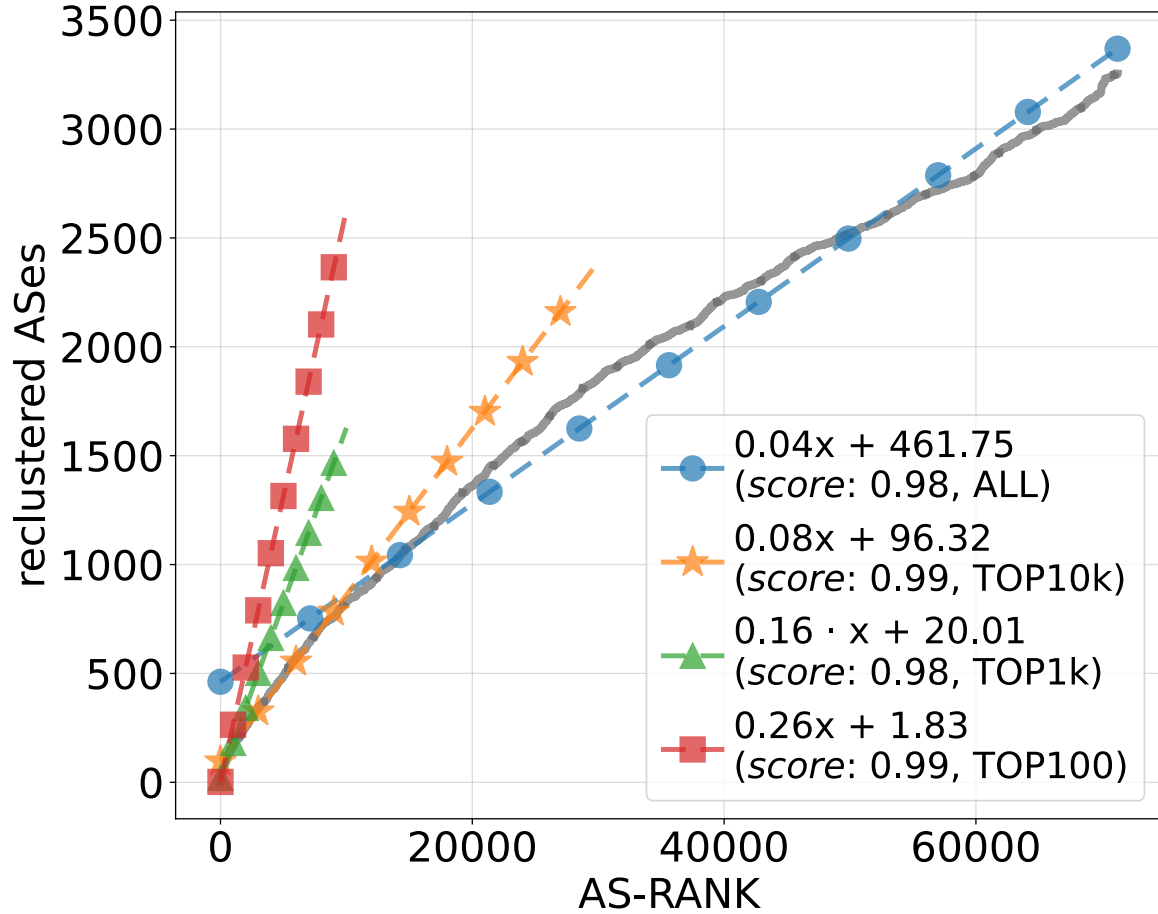


Number of

clusters identified

clusters

Practical implications



Conclusions

We created a new framework for AS-to-Organization mappings

- Leverages *self-reported* information on PeeringDB
- Identifies common practices to report *ASes under the same management*
- Generates a better representation at the Organization level
 - Large transit networks
 - Hypergiants
 - Multinational conglomerates

Thanks!

<https://github.com/NU-AquaLab/as2orgplus>

Extra material

Challenges in WHOIS data

Corporate business segmentation → Claro Argentina (AS19037: AR-CCTI1-LACNIC)
Claro Chile (AS27995: CL-CCSA39-LACNIC)

Outdated records → Movistar Costa Rica
(AS262202: @aut-262202-LACNIC)

RIR-level allocations → Yahoo! (AS10310: OH-207-ARIN)
Yahoo! Japan (AS23816: @aut-131898-JPNIC)

Commercial names vs registration data → Internexa (AS262195) registered as
Transamerican Telecommunication S.A