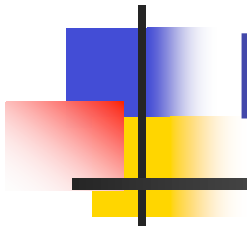


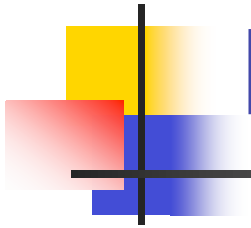
BGP Deaggregation Report

Philip Smith

NANOG 39

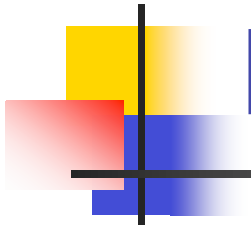
Toronto, February 2007

Route Aggregation Recommendations

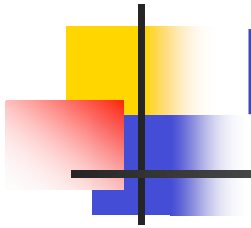


- LINX attempted aggregation policy for members
  - It failed even though most members voted for policy
- RIPE Routing Working Group work item from early 2006
  - Based on early LINX concept
  - Authored by Philip Smith, Mike Hughes (LINX) and Rob Evans (UKERNA)

Route Aggregation Recommendations

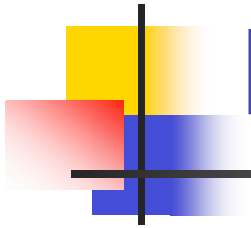


- RIPE Document — RIPE-399
  - http://www.ripe.net/ripe/docs/ripe-399.html
- Discusses:
  - History of aggregation
  - Causes of de-aggregation
  - Impacts on global routing system
  - Available Solutions
  - Recommendations for ISPs



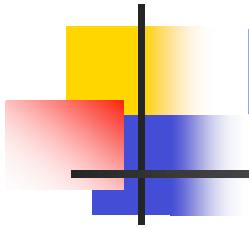
RIPE-399 Recommendations:

- Announcement of initial allocation as a single entity
- Subsequent allocations aggregated if they are contiguous and bit-wise aligned
- Prudent subdivision of aggregates for Multihoming
- Use BGP enhancements already discussed
- (Oh, and all this applies to IPv6 too)



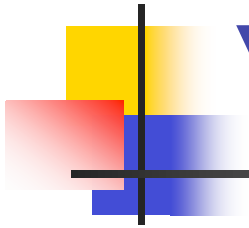
Looking at Deaggregation

- CIDR Report
  - mid-90s: Encouraged aggregation following CIDRisation of Internet
  - Today: extensive suite of reports and tools covering state of BGP table
- Routing Report
  - BGP table status on per RIR basis
  - Original CIDR Report and a whole lot more



Deaggregation Factor

- Routing Report
  - One summary takes BGP table and aggregates prefixes by origin AS
    - Called "Max Aggregation" in report
  - Global and per RIR basis
- New Deaggregation Factor:
  - Measure of Routing Table size/Aggregated Size
  - Global value has been increasing slowly and steadily since "records began"



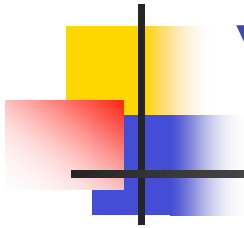
“Original Internet” — 2007/02

Total Prefixes

- Global BGP Table
  - 210k prefixes
- North America
  - 103k prefixes
- Europe & Middle East
  - 44k prefixes

Deaggregation Factor

- Global Average
  - 1.85
- North America
  - 1.69
- Europe & Middle East
  - 1.53



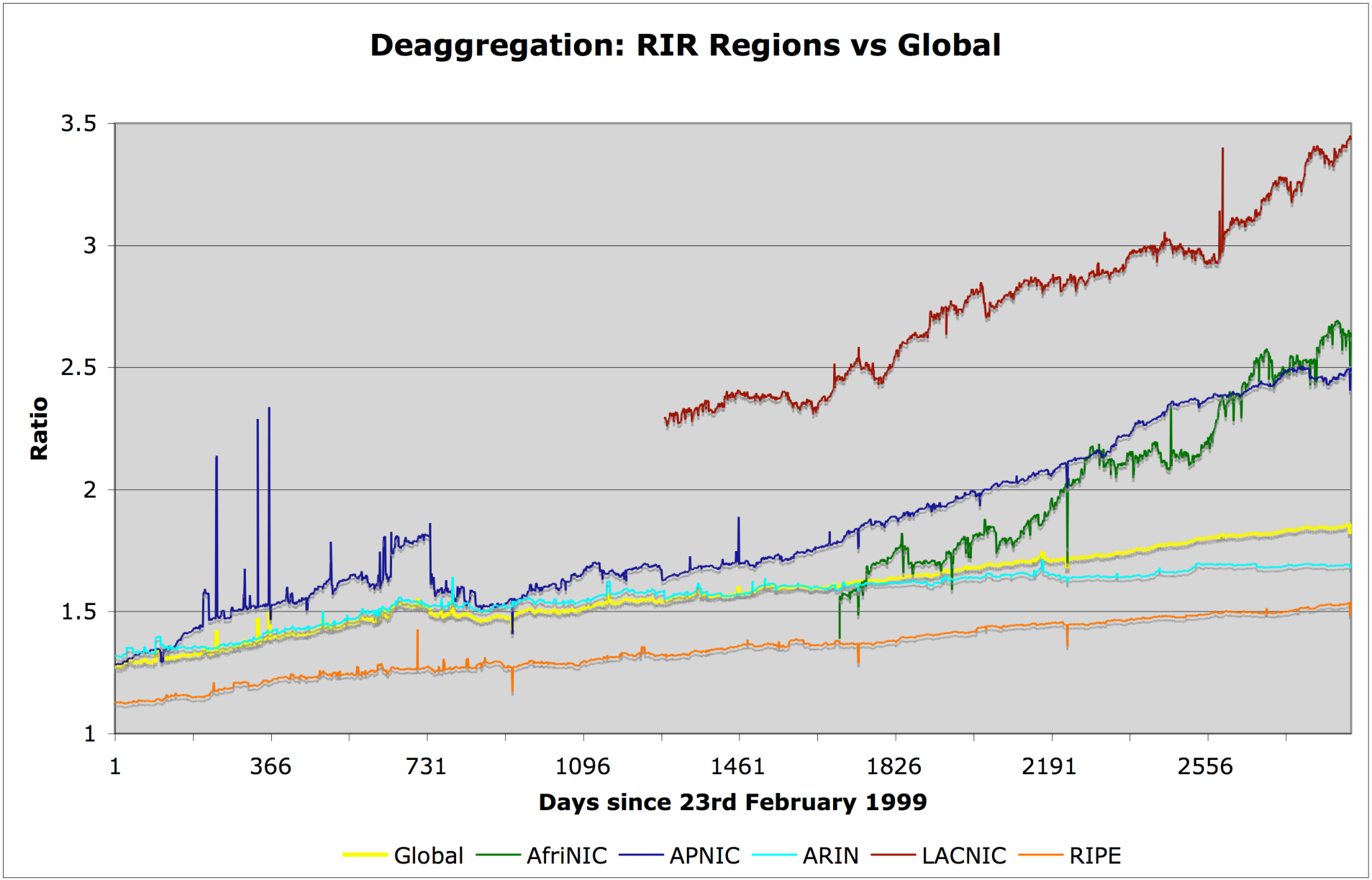
“Newer Internet” — 2007/02

Total Prefixes

- Global BGP Table
  - 210k prefixes
- Asia & Pacific
  - 47k prefixes
- Africa
  - 3k prefixes
- Latin America & Caribbean
  - 14k prefixes

Deaggregation Factor

- Global Average
  - 1.85
- Asia & Pacific
  - 2.48
- Africa
  - 2.58
- Latin America & Caribbean
  - 3.40


Deaggregation: RIR Regions vs Global
Ratio
3.5
3
2.5
2
1.5
1
1
366
731
1096
1461
1826
2191
2556
Days since 23rd February 1999
Global
AfriNIC
APNIC
ARIN
LACNIC
RIPE

Africa Aggregation Savings Summary

ASN	No of Nets	Poss Savings	Description
8452	237	231	TEDATA
15475	154	150	Nile Online
6713	144	133	Itissalat Al-MAGHRIB
33783	114	109	EEPAD TISP TELECOM & INTERNET
5536	123	108	Internet Egypt Network
24835	86	80	RAYA Telecom - Egypt
2561	62	60	Egyptian Universities Network
3741	290	58	The Internet Solution
15706	55	51	Sudatel Internet Exchange Aut
23889	52	39	MAURITIUS TELECOM
33766	33	32	Nyala Communications Pty Ltd
2018	138	25	Tertiary Education Network
8524	30	24	AUCEGYPT Autonomous System
12455	26	23	Jambonet Autonomous system
33776	27	22	Starcomms Nigeria Limited
21280	26	22	Swift Global Kenya Ltd.Is an
21491	21	19	UTL On-line is RF broadband I
15804	19	18	AS of The Way Out Internet So
33774	38	16	AS Number for Telecom Algeria
14988	16	15	Botswana Telecommunications C

Asia & Pacific Aggregation Savings Summary

ASN	No of Nets	Poss Savings	Description
9583	1043	1027	Sify Limited
4755	1092	1016	Videsh Sanchar Nigam Ltd. Aut
4134	1280	1003	CHINANET-BACKBONE
9498	943	878	BHARTI BT INTERNET LTD.
17488	592	571	Hathway IP Over Cable Interne
18101	515	492	Reliance Infocom Ltd Internet
7545	561	488	TPG Internet Pty Ltd
4766	763	450	Korea Telecom (KIX)
17676	504	438	Softbank BB Corp.
4812	439	369	China Telecom (Shanghai)
9443	442	368	Primus Telecommunications
17974	363	349	PT TELEKOMUNIKASI INDONESIA
10139	302	295	Meridian Telekoms
9829	278	266	National Internet Backbone
17849	354	260	Telecommunications Technology
9929	281	245	China Netcom Corp.
4780	274	245	Digital United Inc.
4668	254	245	LG-EDS Systems Inc.
9394	250	243	CHINA RAILWAY Internet(CRNET)
9800	277	225	CHINA UNICOM

North America Aggregation Savings Summary

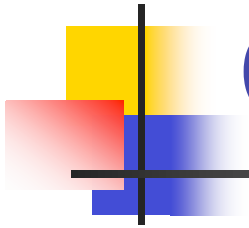
ASN	No of Nets	Poss Savings	Description
18566	988	979	Covad Communications
11492	919	905	Cable One
4323	1055	757	Time Warner Telecom
22773	724	683	Cox Communications, Inc.
19262	809	629	Verizon Global Networks
5668	580	563	CenturyTel Internet Holdings,
6197	1024	521	BellSouth Network Solutions,
19916	568	514	OLM LLC
855	561	488	Canadian Research Network
15270	505	471	PaeTec.net -a division of Pae
3602	530	422	Sprint Canada, Inc.
7029	496	419	Alltel Information Services,
721	684	404	DLA Systems Automation Center
33588	425	402	Bresnan Communications, LLC.
6517	419	386	Yipes Communications, Inc.
20115	797	383	Charter Communications
2386	1107	375	AT&T Data Communications Serv
6467	413	367	E.Spire Communications, Inc.
16852	394	325	Focal Data Communications of
11139	341	315	Cable & Wireless Dominica

Latin America Aggregation Savings Summary

ASN	No of Nets	Poss Savings	Description
8151	980	777	UniNet S.A. de C.V.
11830	482	463	Instituto Costarricense de El
16814	329	321	NSS, S.A.
22047	307	296	VTR PUNTO NET S.A.
11172	363	287	Servicios Alestra S.A de C.V
11556	235	229	Cable-Wireless Panama
14117	238	225	Telefonica del Sur S.A.
6471	254	224	ENTEL CHILE S.A.
6147	227	207	Telefonica Del Peru
7303	235	200	Telecom Argentina Stet-France
10481	181	173	Prima S.A.
18822	145	135	TELEFONICA MANQUEHUE
6503	220	128	AVANTEL, S.A.
20299	145	128	NEWCOM AMERICAS
14522	137	128	SatNet S.A.
19169	142	118	Telconet
7910	151	117	ANDINET ON LINE
23216	148	106	RAMtelecom Telecomunicaciones
19429	139	105	E.T.B.
14259	116	103	GTD Internet S.A.

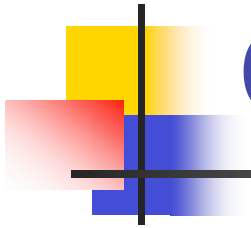
EU & Middle East Aggregation Savings Summary

ASN	No of Nets	Poss Savings	Description
24863	307	282	LINKdotNET AS number
20858	197	194	EGYnet
5416	205	192	BATELCO-BH
8551	200	171	Bezeq International
12479	177	171	Uni2 Autonomous System
3352	192	161	Ibernet, Internet Access Netw
3215	236	143	France Telecom Transpac
3269	213	142	TELECOM ITALIA
9121	168	139	TTnet Autonomous System
6830	164	126	UPC Distribution Services
30890	215	123	SC Kappa Invexim SRL
25233	140	123	Awalnet
702	546	122	UUNET - Commercial IP service
9116	139	116	Goldenlines main autonomous s
12715	140	115	Jazz Telecom S.A.
5486	129	111	Euronet Digital Communication
8866	123	105	Bulgarian Telecommunication C
9051	143	91	INCONET Autonomous System
3300	180	90	AUCS Communications Services
12302	120	88	MobiFon S.A.



Observations

- Huge gulf in operational good practices between “older” and “newer” Internet
  - Threatens the very existence of the Internet as we know it
- RIPE-399 is only a recommendation
  - Hopefully all the RIRs will include pointers to it with each address allocation
  - Hopefully more ISPs will pay attention to it
  - Training is there — most ISPs choose to ignore it



Conclusion

- "Newer" Internet is growing rapidly
  - Could threaten the Internet as we know it
- RIPE-399 now exists
- Make it your BGP good practice document