

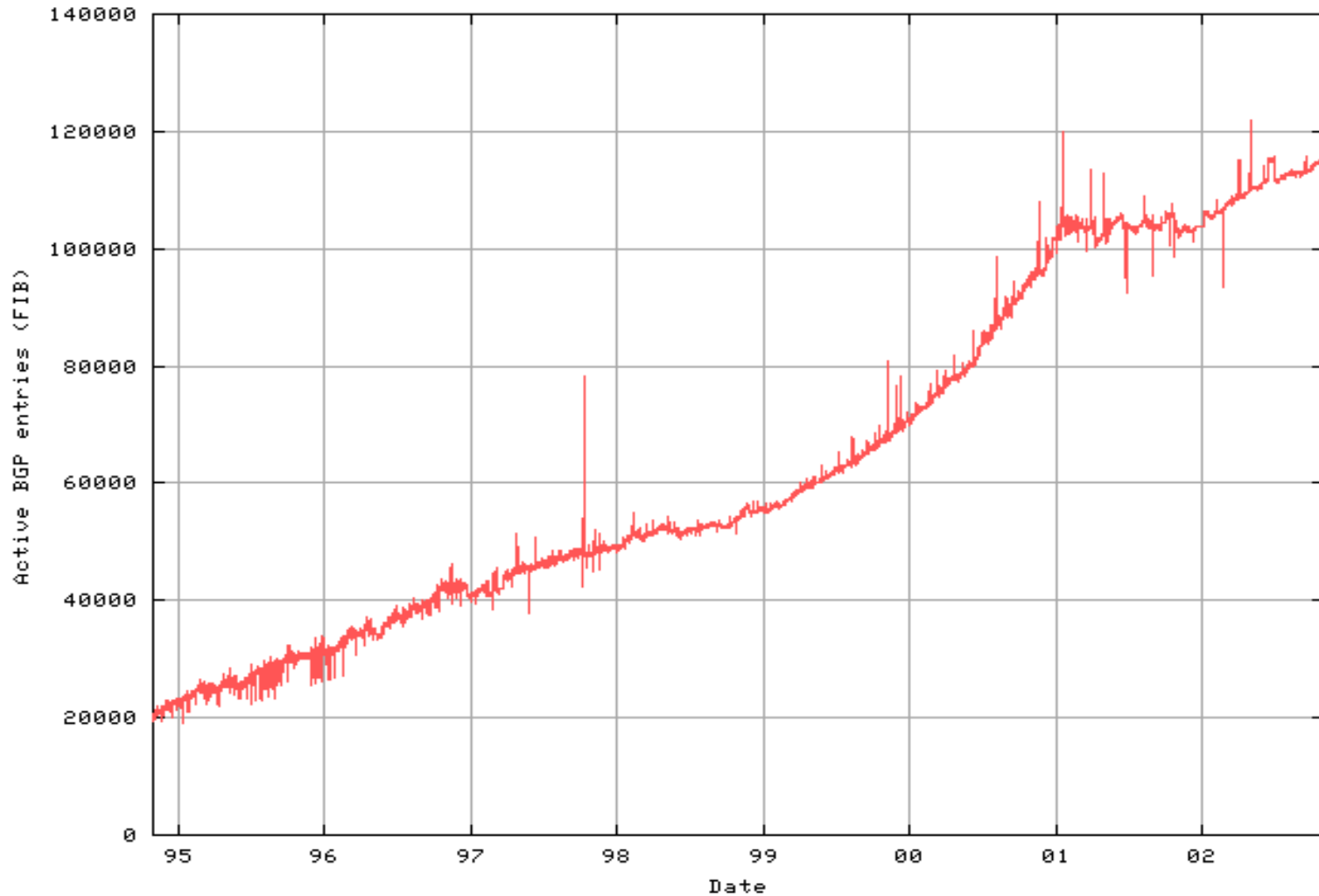
# BGP Routing Table Status Update



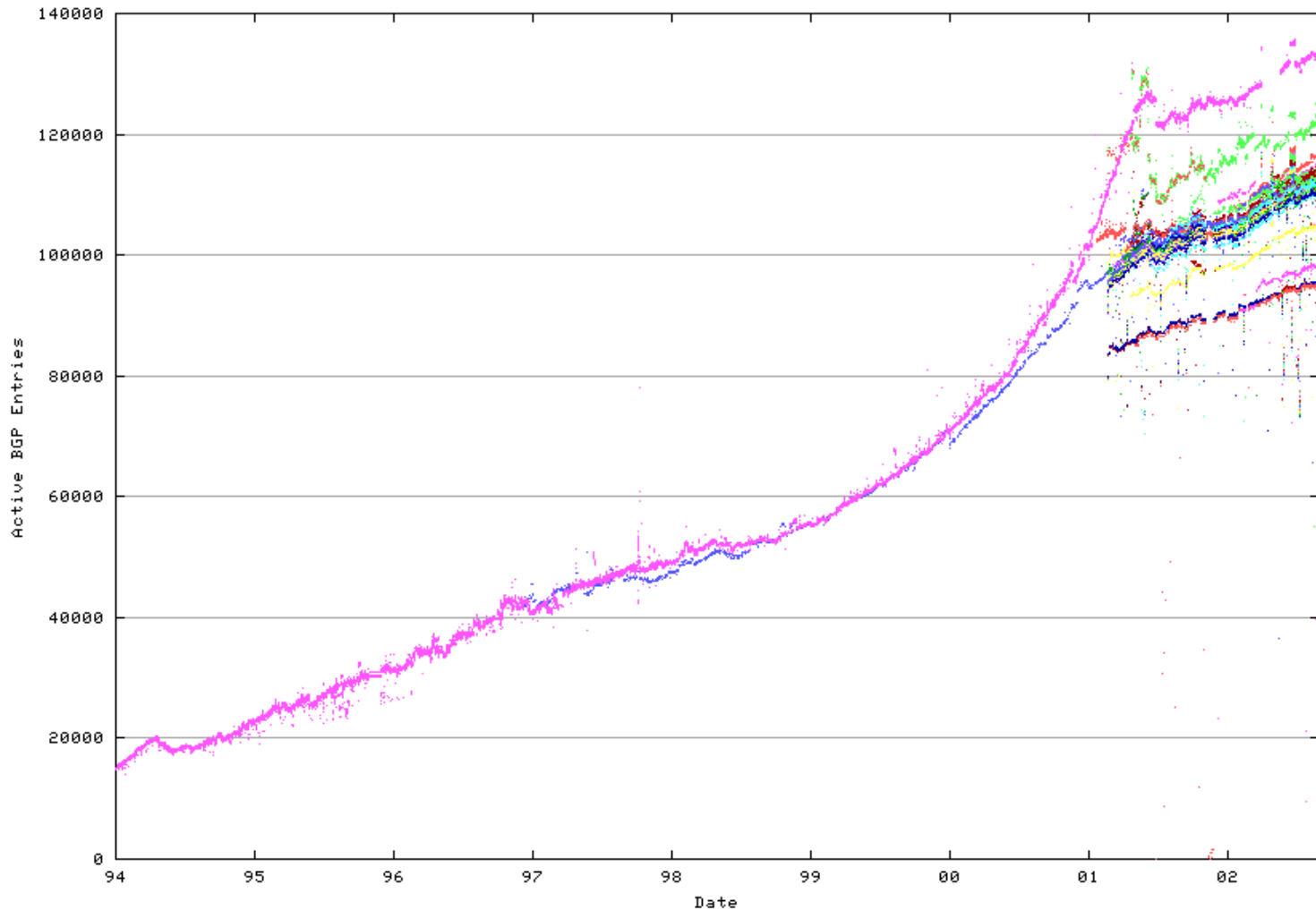
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Geoff Huston & Philip Smith  
October 2002

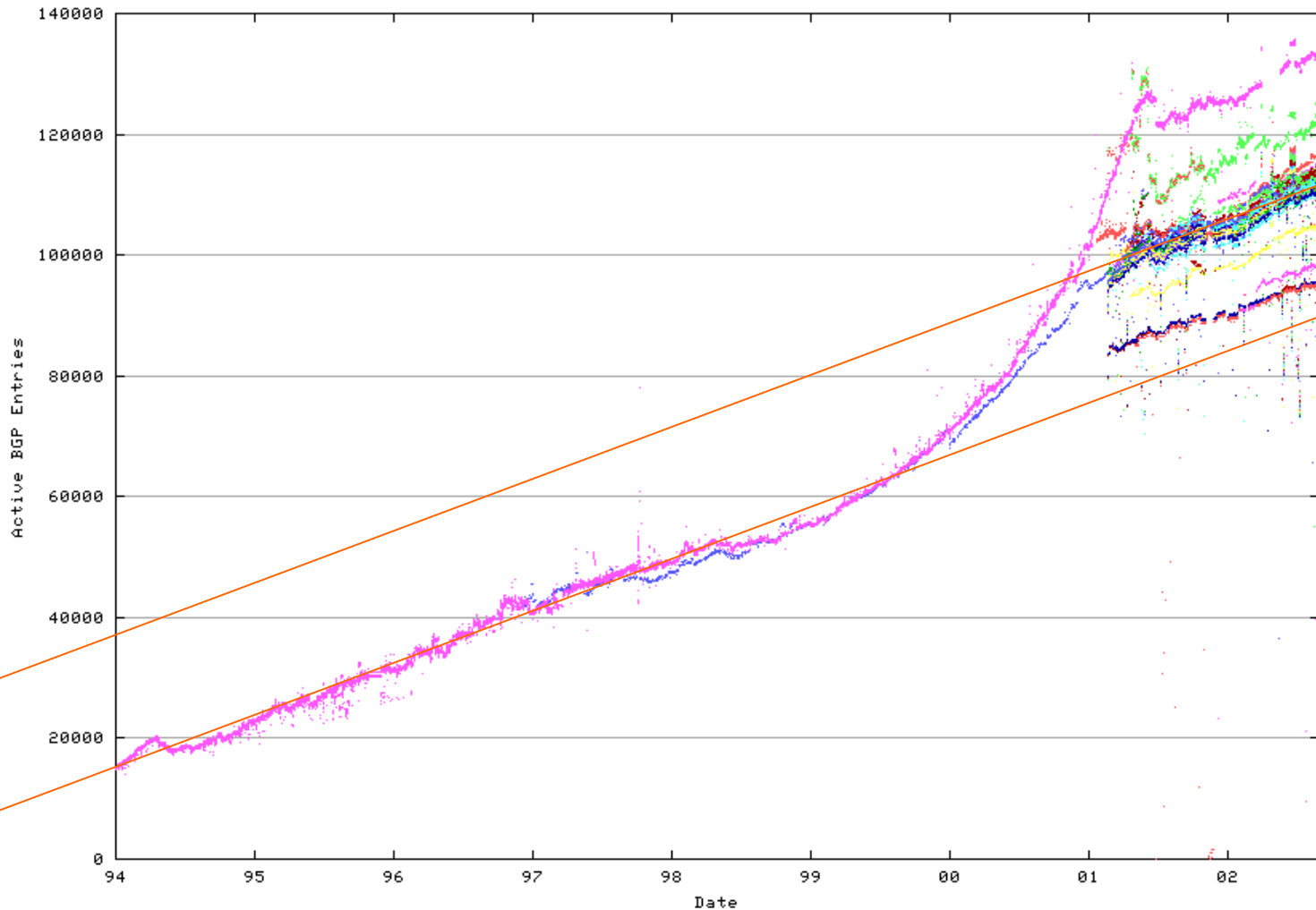
# What Happening (AS4637)



# The Route Views' View



# Route Views Data





# BGP Trends

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- Table growth appears to have resumed a linear growth rate of about 10,000 entries per year

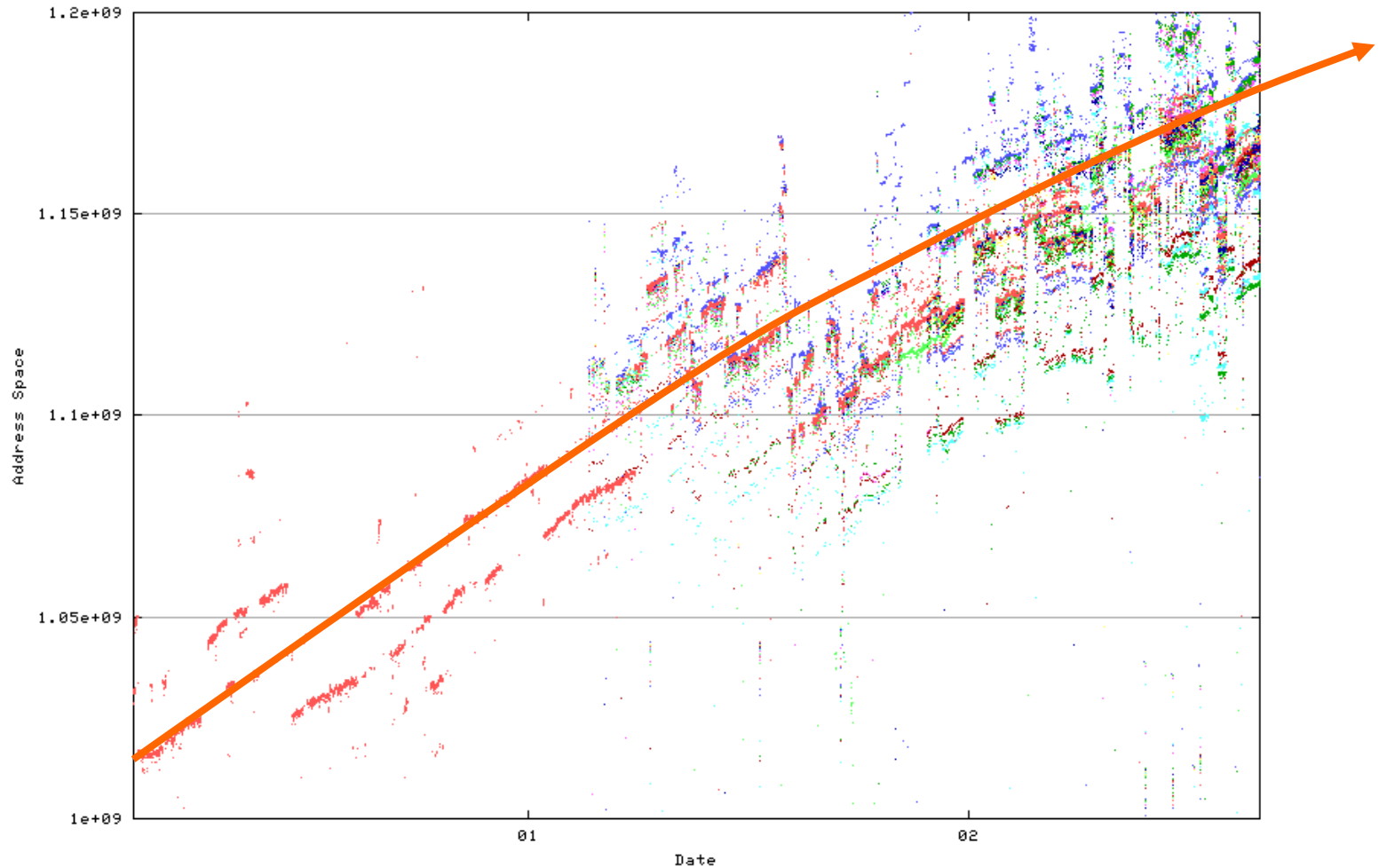
Is this a stable state?

For how long?

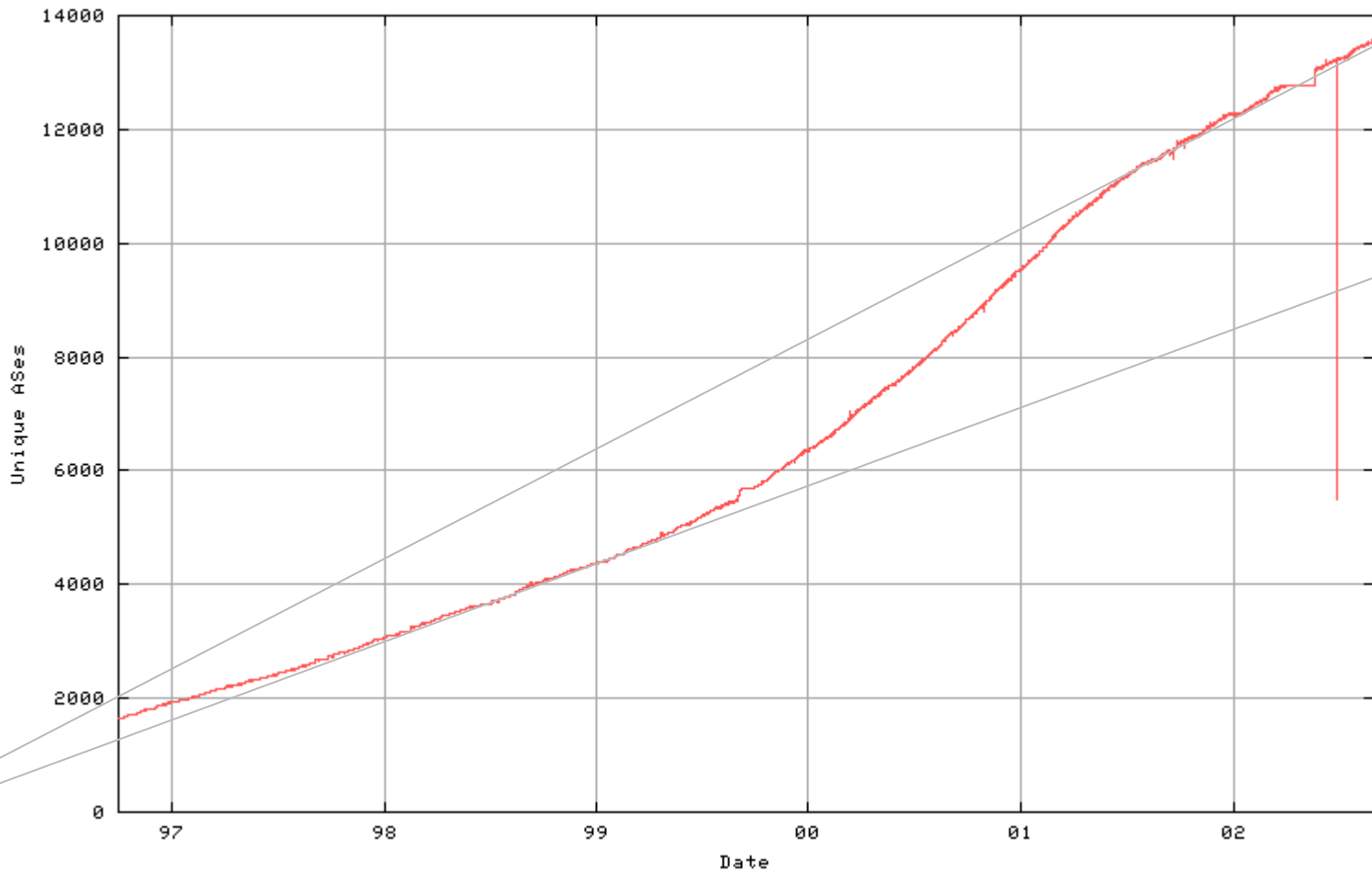
Will exponential growth resume?

If so, at what rate?

# Total Size of Address Space Advertised in the BGP Table



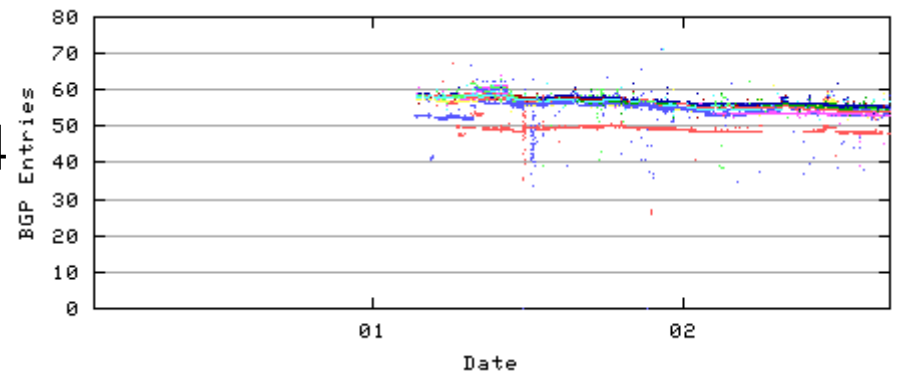
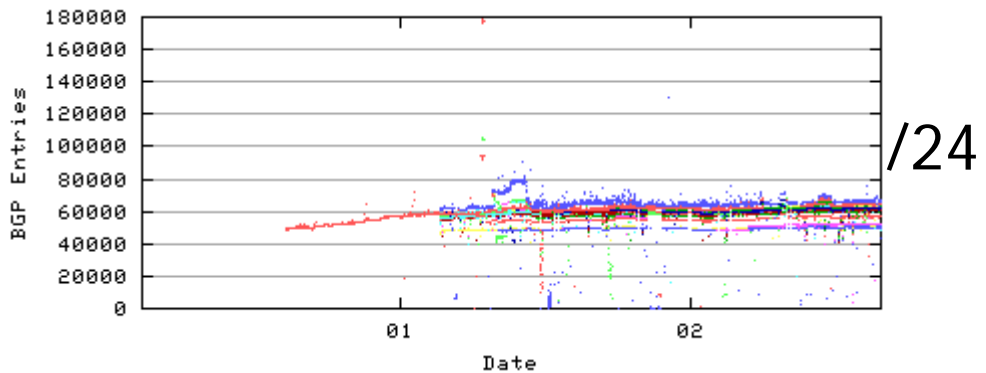
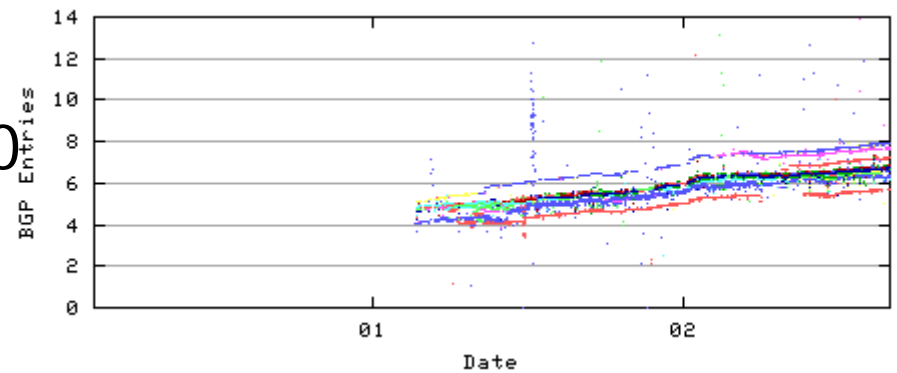
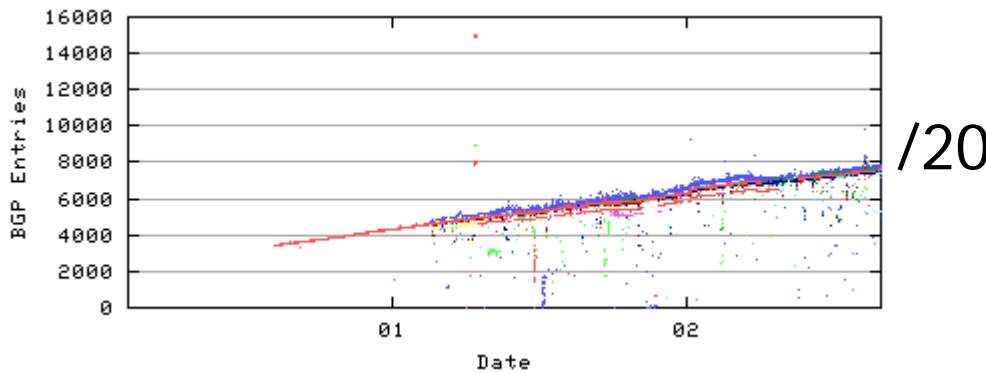
# Number of AS's



# Prefix Comparison /20 and /24

## Number of Entries

## % of BGP Table







# What Happened...

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- Growth rates have come down
- The routing space appeared to be better managed in 2001
  - Less routing “noise”
  - Better adherence to hierarchical aggregation in the routed address space



# Changes in the Routing Table

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- No major table growth from small prefixes (/24 and smaller)
- Table growth occurred using RIR allocation prefix sizes (/18 through /20)
- Growth in /18 - /20 prefix numbers even through the period



# The CIDR Report

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- Has moved its home!
- Rewritten to use the BGP Analysis as input
  - <http://bgp.potaroo.net/cidr>
  - <http://www.cidr-report.org>
- **Diagnosis not analysis**
  - Intended to show how greater efficiency in terms of BGP table size can be obtained without loss of routing and policy information
  - Show what forms of origin AS aggregation could be performed and the potential benefit of such actions to the total table size

## Status Summary

### Table History

Date	Prefixes	CIDR Aggregated
23-10-02	115086	82530
24-10-02	115044	82513
25-10-02	114752	82664
26-10-02	115193	82582
26-10-02	115135	82541
28-10-02	115001	82653
29-10-02	115335	82760
30-10-02	115374	82830

Plot: [BGP Table Size](#)

### AS Summary

13943	Number of ASes in routing system
5455	Number of ASes announcing only one prefix
1749	Largest number of prefixes announced by an AS <a href="#">AS701</a> : ALTERNET-AS UUNET Technologies, Inc.
73146368	Largest address span announced by an AS (/32s) <a href="#">AS568</a> : SUMNET-AS DISO-UNRRA

Plot: [AS count](#)

Plot: [Average announcements per origin AS](#)

Report: [ASes ordered by originating address span](#)

Report: [Autonomous System number-to-name](#) mapping (from Registry WHOIS data)

### Possible Bogus Routes and AS Announcements

No Bogus Routes

Report: [Allocated and Reserved IPv4 address blocks](#)

No Bogus ASs

Report: [Allocated and Reserved AS blocks](#)



# Bogus AS Announcements

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- (From Philip's Routing Report, AS4777 view)
- List of Unregistered ASNs (Global)

Bad AS Designation	Network	Transit AS	Description
65025 PRIVATE	81.26.65.0/24	11042	Orion Network System
65010 PRIVATE	168.167.21.0/24	11042	Orion Network System
65501 PRIVATE	200.73.24.0/24	18747	IFX Communication Ve
65501 PRIVATE	200.73.26.0/24	18747	IFX Communication Ve
65501 PRIVATE	200.73.27.0/24	18747	IFX Communication Ve
65501 PRIVATE	200.73.28.0/24	18747	IFX Communication Ve
5757 UNALLOCATED	207.19.224.0/24	701	UUNET Technologies,



# Bogus Route Announcements

- Exhaustive search of IPv4 address space outside of RIR blocks

39.0.0.0/8	4554	Exchange Point Blocks	192.119.135.0/24	270	NASA
132.0.0.0/10	568	DISO-UNRRA	192.135.50.0/24	7018	AT&T
134.137.0.0/16	7170	AT&T Government Markets	192.136.79.0/24	719	LANLINK autonomous system
135.0.0.0/13	10455	Lucent Technologies	192.136.86.0/24	719	LANLINK autonomous system
137.0.0.0/13	568	DISO-UNRRA	192.136.87.0/24	719	LANLINK autonomous system
138.94.0.0/16	1	GENUITY	192.136.88.0/24	719	LANLINK autonomous system
158.0.0.0/13	568	DISO-UNRRA	192.136.136.0/24	7046	UUNET Technologies, Inc.
164.233.0.0/16	6020	DISA NETWORK SERVICES	192.136.136.0/22	568	DISO-UNRRA
164.236.0.0/16	568	DISO-UNRRA	192.139.62.0/24	6539	GT Group Telecom Services Cor
192.31.242.0/24	771	NASA Ames Research Center	192.140.0.0/16	5511	France Telecom
192.44.0.0/19	702	UUNET - Commercial IP service	192.153.136.0/21	568	DISO-UNRRA
192.72.0.0/18	4780	Digital United Inc.	192.156.0.0/19	568	DISO-UNRRA
192.72.0.0/16	4780	Digital United Inc.	192.156.164.0/24	19548	Adelphia Business Solutions
192.83.16.0/20	5515	Sonera Solution Autonomous Sy	192.172.0.0/19	568	DISO-UNRRA
192.83.32.0/19	5515	Sonera Solution Autonomous Sy	192.208.29.0/24	3908	Supernet, Inc.
192.83.96.0/22	5515	Sonera Solution Autonomous Sy	192.208.30.0/23	3908	Supernet, Inc.
192.83.100.0/24	5515	Sonera Solution Autonomous Sy	192.243.36.0/23	2044	AUSNet, Inc.
192.91.198.0/24	2568	CTS Network Services			

## Aggregation Summary

The algorithm used in this report proposes aggregation only when there is a precise match using AS path so as to preserve traffic transit policies. Aggregation is also proposed across non-advertised address space ('holes').

--- 30Oct02 ---

ASnum	NetsNow	NetsAggr	NetGain	% Gain	Description
Table	115447	82817	32630	28.3%	All ASes
<a href="#">AS3908</a>	1068	556	512	47.9%	SUPERNETASBLK SuperNet, Inc.
<a href="#">AS701</a>	1749	1259	490	28.0%	ALTERNET-AS UUNET Technologies, Inc.
<a href="#">AS7843</a>	772	331	441	57.1%	ADELPHIA-AS Adelpphia Corp.
<a href="#">AS2828</a>	475	104	371	78.1%	XO-AS15 XO Communications
<a href="#">AS7018</a>	1346	996	350	26.0%	ATT-INTERNET4 AT&T WorldNet Services
<a href="#">AS6198</a>	419	71	348	83.1%	BATI-MIA BellSouth Network Solutions, Inc
<a href="#">AS4323</a>	518	181	337	65.1%	TW-COMM Time Warner Communications, Inc.
<a href="#">AS18566</a>	329	4	325	98.8%	COVAD Covad Communications
<a href="#">AS1221</a>	1197	875	322	26.9%	ASN-TELSTRA Telstra Pty Ltd
<a href="#">AS209</a>	628	336	292	46.5%	ASN-QWEST Qwest
<a href="#">AS7046</a>	585	296	289	49.4%	UUNET-CUSTOMER UUNET Technologies, Inc.
<a href="#">AS6347</a>	353	77	276	78.2%	DIAMOND SAVVIS Communications Corporation
<a href="#">AS4355</a>	386	125	261	67.6%	ERMS-EARTHLNK EARTHLINK, INC
<a href="#">AS4151</a>	330	86	244	73.9%	USDA-1 USDA
<a href="#">AS705</a>	442	203	239	54.1%	ASN-ALTERNET UUNET Technologies, Inc.
<a href="#">AS7132</a>	306	70	236	77.1%	SBIS-AS Southwestern Bell Internet Services
<a href="#">AS1239</a>	882	660	222	25.2%	SPRINTLINK Sprint
<a href="#">AS852</a>	689	467	222	32.2%	ASN852 Telus Advanced Communications
<a href="#">AS4814</a>	233	15	218	93.6%	CHINANET-BEIJING-AP China Telecom (Group)Beijing Telecom CompanyBeijing China
<a href="#">AS1</a>	652	436	216	33.1%	GNTY-1 Genuity
<a href="#">AS6197</a>	445	238	207	46.5%	BATI-ATL BellSouth Network Solutions, Inc
<a href="#">AS6140</a>	263	65	198	75.3%	IMPSAT-USA ImpSat USA, Inc.
<a href="#">AS22927</a>	215	20	195	90.7%	AR-TEAR2-LACNIC TELEFONICA DE ARGENTINA
<a href="#">AS17557</a>	311	117	194	62.4%	PKTELECOM-AS-AP APNIC ASN block
<a href="#">AS690</a>	517	326	191	36.9%	MERIT-AS-27 Merit Network Inc.
<a href="#">AS17676</a>	225	35	190	84.4%	GIGAINFRA APNIC ASN block
<a href="#">AS6595</a>	249	60	189	75.9%	DODDSEUR DoD Education Activity Network Assistance Center
<a href="#">AS4134</a>	295	113	182	61.7%	ERX-CHINALINK Data Communications Bureau
<a href="#">AS2048</a>	265	88	177	66.8%	LANET-1 State of Louisiana
<a href="#">AS2548</a>	402	244	158	39.3%	ICIX-MD-AS Business Internet, Inc.
Total	16546	8454	8092	48.9%	Top 30 total

**Top 20 Added Routes this week per Originating AS****Prefixes ASnum AS Description**

369	<a href="#">AS2828</a>	XO-AS15 XO Communications
70	<a href="#">AS6197</a>	BATI-ATL BellSouth Network Solutions, Inc
64	<a href="#">AS209</a>	ASN-QWEST Qwest
56	<a href="#">AS19029</a>	NEWEDGENETS New Edge Networks
41	<a href="#">AS4151</a>	USDA-1 USDA
29	<a href="#">AS93</a>	VRIO-93 Verio, Inc.
29	<a href="#">AS7637</a>	VICNET-AS-AP VICNET - State Library Of Victoria328 Swanston Street Melbourne 3000 AustraliaVICNET is a government funded ISP providingaccess for libraries, community organisations and individuals.
26	<a href="#">AS9809</a>	CHINATDT New Era Foundation System Co. Ltd
25	<a href="#">AS4637</a>	REACH Reach Network Border AS
24	<a href="#">AS6198</a>	BATI-MIA BellSouth Network Solutions, Inc
23	<a href="#">AS12880</a>	TCI Autonomous System
18	<a href="#">AS15105</a>	NETWORKTELEPHONE Network Telephone Corporation
18	<a href="#">AS23140</a>	CL-UNCH2-LACNIC Universidad de Chile
17	<a href="#">AS7843</a>	ADELPHIA-AS Adelpia Corp.
17	<a href="#">AS17557</a>	PKTELECOM-AS-AP APNIC ASN block
17	<a href="#">AS11919</a>	ONSI-NET2 Loral Orion Services Inc.
15	<a href="#">AS3464</a>	ASC-NET Alabama Supercomputer Network
15	<a href="#">AS11664</a>	AR-KESA-LACNIC Keytech SA
15	<a href="#">AS19108</a>	RUSTON Cox Internet Services
14	<a href="#">AS852</a>	ASN852 Tehs Advanced Communications

**Top 20 Withdrawn Routes this week per Originating AS****Prefixes ASnum AS Description**

-165	<a href="#">AS1791</a>	SPRINTLINK3 Sprint Government Systems Division
-144	<a href="#">AS7132</a>	SBIS-AS Southwestern Bell Internet Services
-115	<a href="#">AS1657</a>	LOUISVILLE University of Louisville
-60	<a href="#">AS852</a>	ASN852 Tehs Advanced Communications
-52	<a href="#">AS539</a>	STUTTGART-GW1-AS CDOIM Stuttgart
-39	<a href="#">AS3464</a>	ASC-NET Alabama Supercomputer Network
-24	<a href="#">AS8346</a>	SONATEL-AS Autonomous System
-23	<a href="#">AS6197</a>	BATI-ATL BellSouth Network Solutions, Inc
-21	<a href="#">AS5400</a>	CIPCORE BT Ignite European Backbone
-20	<a href="#">AS8717</a>	SPECTRUMNET Spectrum NET
-20	<a href="#">AS2007</a>	INFONET3 INFONET
-19	<a href="#">AS7018</a>	ATT-INTERNET4 AT&T WorldNet Services
-17	<a href="#">AS7046</a>	UUNET-CUSTOMER UUNET Technologies, Inc.
-17	<a href="#">AS22047</a>	CL-VPNS-LACNIC VTR PUNTO NET S.A.
-16	<a href="#">AS1239</a>	SPRINTLINK Sprint
-15	<a href="#">AS701</a>	ALTERNET-AS UUNET Technologies, Inc.
-15	<a href="#">AS12880</a>	TCI Autonomous System
-15	<a href="#">AS4788</a>	TMNET-AS Telekom MalaysiaInternet Service Provider
-15	<a href="#">AS11748</a>	TYLERNET Internet Tyler
-15	<a href="#">AS19753</a>	BSC-NET BSC-Net, Inc.

**Adds and Wds per Prefix Length**



## More Specifics

A list of route advertisements that appear to be more specific than the original Class-based prefix mask, or more specific than the registry allocation size.

### Top 20 ASes advertising more specific prefixes

More Specifics	Total Prefixes	ASnum	AS Description
817	1749	<a href="#">AS701</a>	ALTERNET-AS UUNET Technologies, Inc.
735	1068	<a href="#">AS3908</a>	SUPERNETASBLK SuperNet, Inc.
680	1346	<a href="#">AS7018</a>	ATT-INTERNET4 AT&T WorldNet Services
603	713	<a href="#">AS4637</a>	REACH Reach Network Border AS
593	772	<a href="#">AS7843</a>	ADELPHIA-AS Adelphia Corp.
482	517	<a href="#">AS690</a>	MERIT-AS-27 Merit Network Inc.
415	882	<a href="#">AS1239</a>	SPRINTLINK Sprint
404	628	<a href="#">AS209</a>	ASN-QWEST Qwest
394	475	<a href="#">AS2828</a>	XO-AS15 XO Communications
385	445	<a href="#">AS6197</a>	BATT-ATL BellSouth Network Solutions, Inc
377	585	<a href="#">AS7046</a>	UUNET-CUSTOMER UUNET Technologies, Inc.
353	518	<a href="#">AS4323</a>	TW-COMM Time Warner Communications, Inc.
346	419	<a href="#">AS6198</a>	BATT-MIA BellSouth Network Solutions, Inc
327	689	<a href="#">AS852</a>	ASN852 Telus Advanced Communications
324	329	<a href="#">AS18566</a>	COVAD Covad Communications
309	321	<a href="#">AS1580</a>	HQ, 5th Signal Command
304	442	<a href="#">AS705</a>	ASN-ALTERNET UUNET Technologies, Inc.
267	402	<a href="#">AS2548</a>	ICDX-MD-AS Business Internet, Inc.
259	306	<a href="#">AS7066</a>	ACCESS-VIRGINIA Virginia Polytechnic Institute and State University
259	652	<a href="#">AS1</a>	GNTY-1 Genuity

Report: [ASes ordered by number of more specific prefixes](#)

Report: [More Specific prefix list \(by AS\)](#)

Report: [More Specific prefix list \(ordered by prefix\)](#)

## Announced Prefixes

Rank	AS	Type	Originate	Addr Space (pfx)	Transit	Addr space (pfx)	Description
39	AS1221	ORG+TRN	Originate:	5255936 /9.67	Transit:	13726208 /8.29	ASN-TELSTRA Telstra Pty Ltd

## Aggregation Suggestions

This report does not take into account conditions local to each origin AS in terms of policy or traffic engineering requirements, so this is an approximate guideline as to aggregation possibilities.

Rank	AS	AS Name	Current	Wthdw	Aggte	Annce	Redctn	%
11	<a href="#">AS1221</a>	ASN-TELSTRA Telstra Pty Ltd	1198	473	151	876	322	26.88%

### AS 1221: ASN-TELSTRA Telstra Pty Ltd

Prefix (AS Path)	Aggregation Action
47.153.192.0/18	1221
61.9.128.0/17	1221
128.87.160.0/21	1221
129.223.0.0/16	1221
129.223.0.0/18	1221 - Withdrawn - matching aggregate 129.223.0.0/16 1221
129.223.64.0/19	1221 - Withdrawn - matching aggregate 129.223.0.0/16 1221
129.223.131.0/24	1221 - Withdrawn - matching aggregate 129.223.0.0/16 1221
129.223.160.0/19	1221 - Withdrawn - matching aggregate 129.223.0.0/16 1221
129.223.192.0/19	1221 - Withdrawn - matching aggregate 129.223.0.0/16 1221
129.223.224.0/19	1221 - Withdrawn - matching aggregate 129.223.0.0/16 1221
134.144.0.0/16	1221 + Announce - aggregate of 134.144.0.0/17 (1221) and exposed 'hole'
134.144.72.0/21	1221 - Withdrawn - aggregated across exposed 'hole' 134.144.64.0/21
134.159.2.0/24	1221
134.178.0.0/16	1221
136.153.0.0/16	1221
137.76.0.0/18	1221 + Announce - aggregate of 137.76.32.0/19 (1221) and exposed 'hole'
137.76.0.0/20	1221 + Announce - aggregate of 137.76.8.0/21 (1221) and exposed 'hole'
137.76.0.0/22	1221 + Announce - aggregate of 137.76.2.0/23 (1221) and exposed 'hole'
137.76.2.0/24	1221 - Withdrawn - aggregated with 137.76.3.0/24 (1221)
137.76.3.0/24	1221 - Withdrawn - aggregated with 137.76.2.0/24 (1221)
137.76.4.0/22	1221 + Announce - aggregate of 137.76.6.0/23 (1221) and exposed 'hole'
137.76.6.0/24	1221 - Withdrawn - aggregated across exposed 'hole' 137.76.7.0/24
137.76.8.0/24	1221 - Withdrawn - aggregated across exposed 'hole' 137.76.9.0/24
137.76.16.0/20	1221 + Announce - aggregate of 137.76.24.0/21 (1221) and exposed 'hole'
137.76.27.0/24	1221 - Withdrawn - aggregated across exposed 'hole' 137.76.26.0/24
137.76.28.0/23	1221 + Announce - aggregate of 137.76.28.0/24 (1221) and exposed 'hole'
137.76.28.0/24	1221 - Withdrawn - aggregated across exposed 'hole' 137.76.29.0/24
137.76.30.0/23	1221 + Announce - aggregate of 137.76.31.0/24 (1221) and exposed 'hole'
137.76.31.0/24	1221 - Withdrawn - aggregated across exposed 'hole' 137.76.30.0/24
137.76.60.0/24	1221 - Withdrawn - aggregated across exposed 'hole' 137.76.61.0/24
137.76.64.0/18	1221 + Announce - aggregate of 137.76.64.0/19 (1221) and exposed 'hole'
137.76.81.0/24	1221 - Withdrawn - aggregated across exposed 'hole' 137.76.80.0/24
137.147.0.0/16	1221

**Announced Prefixes**

Rank	AS	Type	Originate	Addr Space (pfx)	Transit Addr space (pfx)	Description
166	AS109	ORG+TRN	Originate:	985088 /12.09	Transit: 0 /0.00	CISCOSYSTEMS Cisco Systems, Inc.

**Aggregation Suggestions**

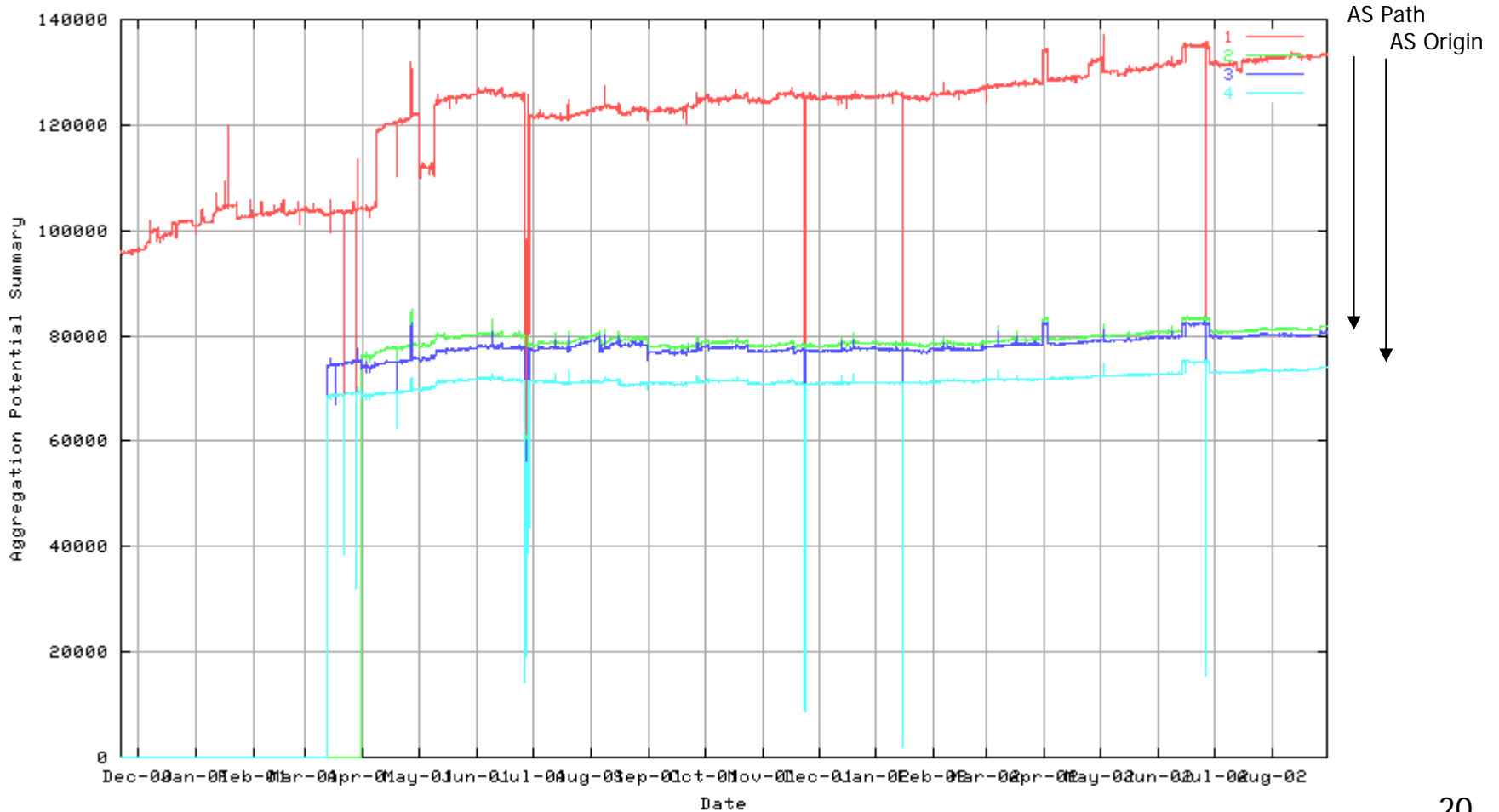
This report does not take into account conditions local to each origin AS in terms of policy or traffic engineering requirements, so this is an approximate guideline as to aggregation possibilities.

Rank	AS	AS Name	Current	Wthdw	Aggte	Annce	Redctn	%
769	<a href="#">AS109</a>	CISCOSYSTEMS Cisco Systems, Inc.	26	9	2	19	7	26.92%

AS 109: CISCOSYSTEMS Cisco Systems, Inc.

Prefix (AS Path)	Aggregation Action
64.100.0.0/14	1239 109
64.100.128.0/19	1239 109 - Withdrawn - matching aggregate 64.100.0.0/14 1239 109
64.100.160.0/20	1239 109 - Withdrawn - matching aggregate 64.100.0.0/14 1239 109
64.100.192.0/18	1239 109 - Withdrawn - matching aggregate 64.100.0.0/14 1239 109
64.101.192.0/19	1239 109 - Withdrawn - matching aggregate 64.100.0.0/14 1239 109
64.101.224.0/19	1239 109 - Withdrawn - matching aggregate 64.100.0.0/14 1239 109
64.102.0.0/16	1239 109 - Withdrawn - matching aggregate 64.100.0.0/14 1239 109
64.103.0.0/17	1239 109 - Withdrawn - matching aggregate 64.100.0.0/14 1239 109
64.104.0.0/16	1239 109
64.104.0.0/18	2914 109
64.104.192.0/18	1221 109
128.107.0.0/16	1239 109
144.254.0.0/16	1239 109
161.44.0.0/16	1239 109
171.68.0.0/14	1239 109
192.31.7.0/24	1239 109
192.118.76.0/22	1239 109 109 109
192.122.173.0/24	1239 109
192.122.174.0/24	1239 109
192.135.240.0/21	1239 109
192.135.250.0/24	1239 109
198.92.0.0/18	1239 109
198.133.219.0/24	1239 109
198.135.4.0/22	1239 109
204.69.192.0/20	1239 109 + Announce - aggregate of 204.69.192.0/21 (1239 109) and exposed 'hole'
204.69.198.0/23	1239 109 - Withdrawn - aggregated across exposed 'hole' 204.69.196.0/23
204.69.200.0/22	1239 109 + Announce - aggregate of 204.69.200.0/23 (1239 109) and exposed 'hole'
204.69.200.0/24	1239 109 - Withdrawn - aggregated across exposed 'hole' 204.69.201.0/24

# Aggregation Potential





# Mixed News

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- BGP Table growth has been slowed down considerably though the more careful use of aggregate routes in recently advertised networks.
- Despite this, it is still the case that up to 50% of the current BGP table is the outcome of inadequate control of routing information



# BGP Analysis Resources

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- <http://bgp.potaroo.net>
- <http://www.cidr-report.org>
- CIDR Report
  - Sent to NANOG list
- Routing Report
  - Sent to RTMA list