Examining the validity of IRR data

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Oh great, its another IRR presentation

- At nearly every NANOG, someone tells you that:
  - Nobody uses IRR
  - Everybody uses IRR
  - You're a horrible person if you don't use IRR
  - IRR is inherently broken, and full of garbage data
- This time, lets try to quantify things a little
  - Is IRR inherently broken?
  - Is it full of garbage data?
  - And if it is, exactly how broken it is?

Quick recap for those living under a rock

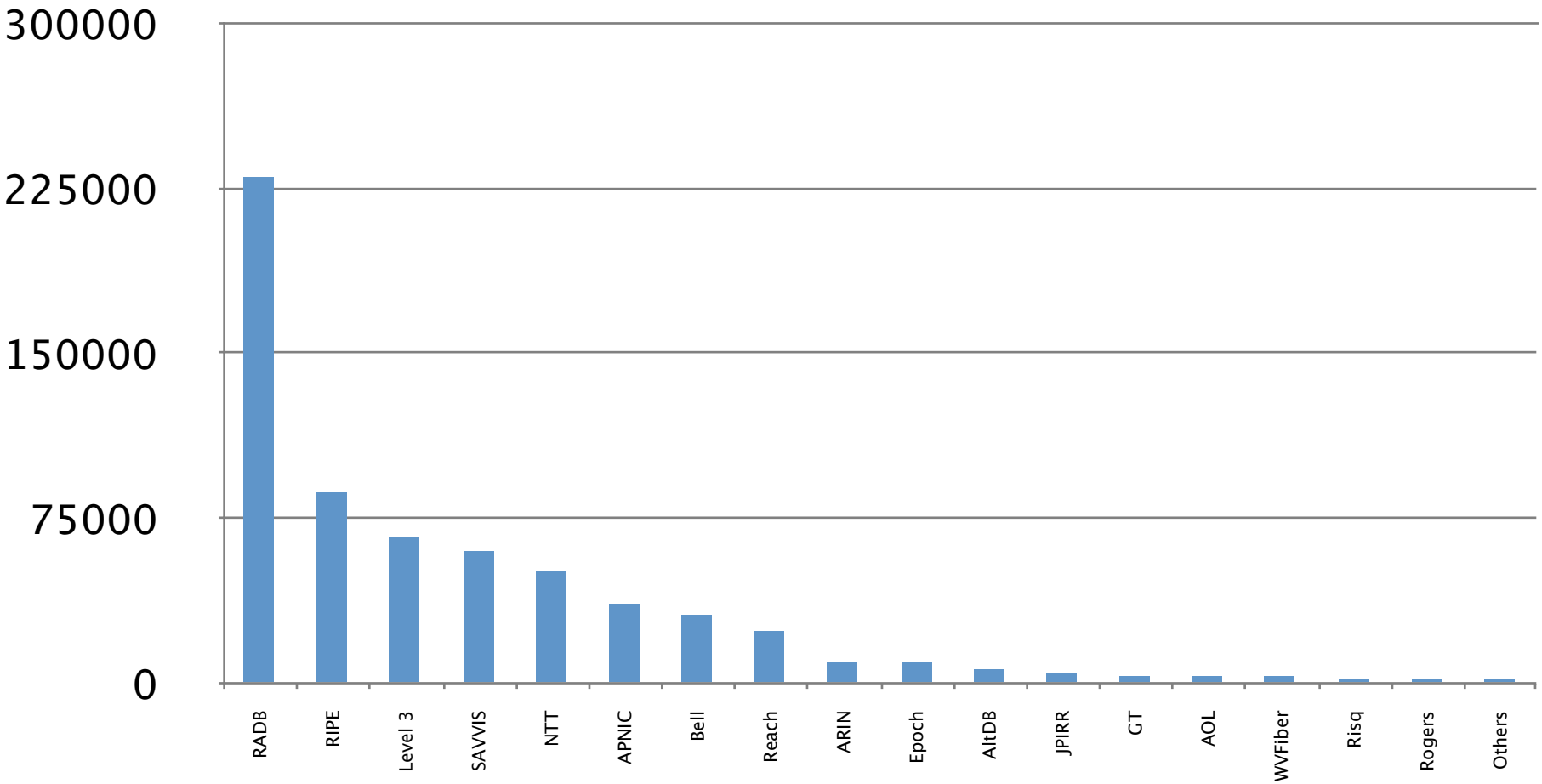
- IRR stands for the Internet Routing Registry
  - Essentially a distributed database where networks can describe their routing policies, and the IP routes they will announce via BGP, for public viewing.
  - Intended to simplify inter-network communication, by allowing another network to build router configurations from this published data, in an automated fashion.
  - As pragmatic network operators we mostly care about prefix filtering, but RPSL can describe almost anything.
- But many people say it is broken
  - For the purpose of this talk, we're concerned about the validity of the data, rather than any other faults.

So what's wrong with the IRR data?

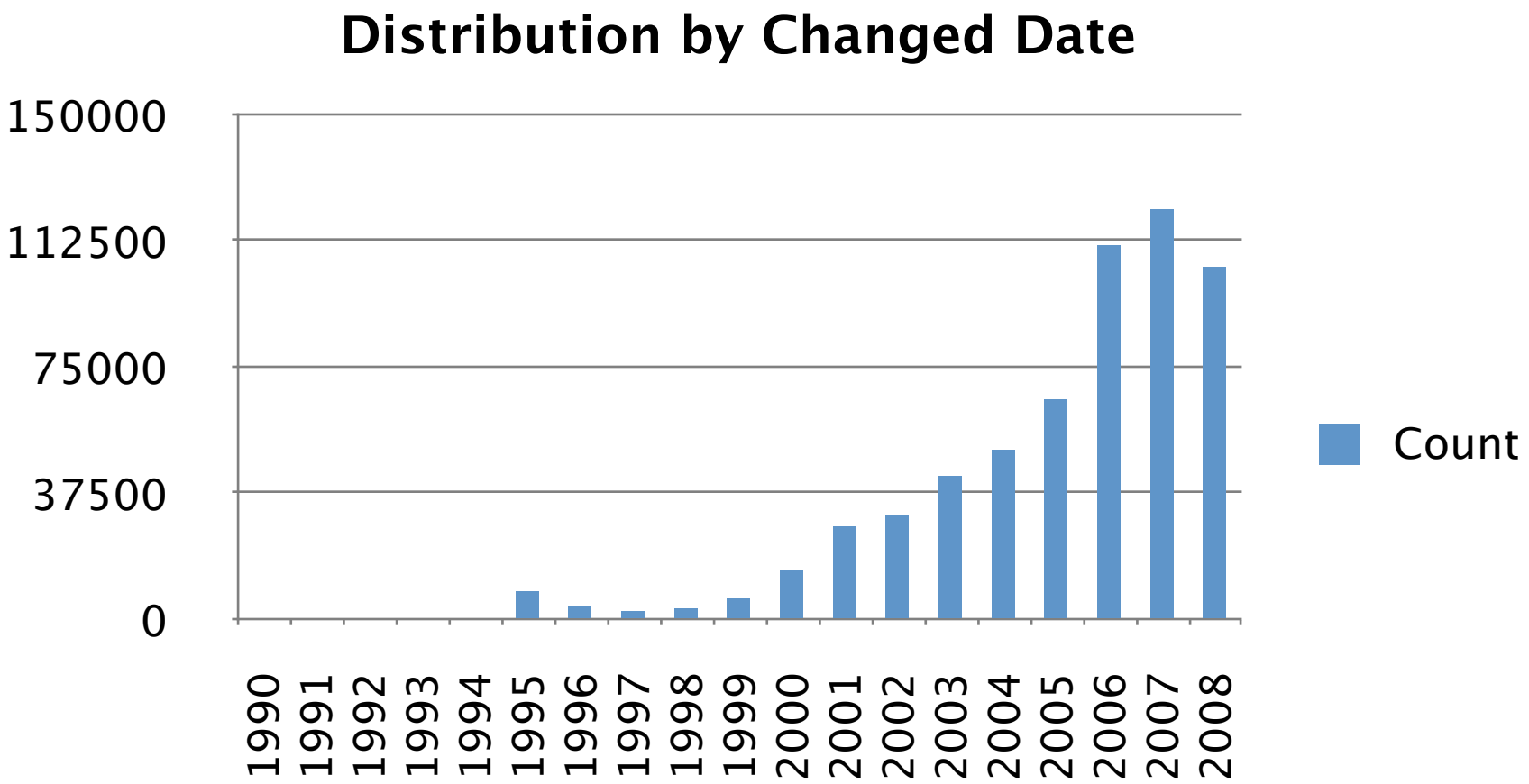
- Distributed Databases
  - No central authority, so no authentication for the data.
    - Anyone can inject anything anywhere.
  - Easy for old defunct records to creep up in any of the dozens of different IRR databases out there.
- Complexity Problems
  - Many BGP users can't figure IRR out, leads to proxy registration where an ISP injects data for their customer.
    - Sometimes too aggressively, resulting in bad/trash data.
  - Users are incented to insert new data (to route their prefix), but have no incentive to remove old stale data.

Analysis of IRR Databases

Which IRR Databases do people use?

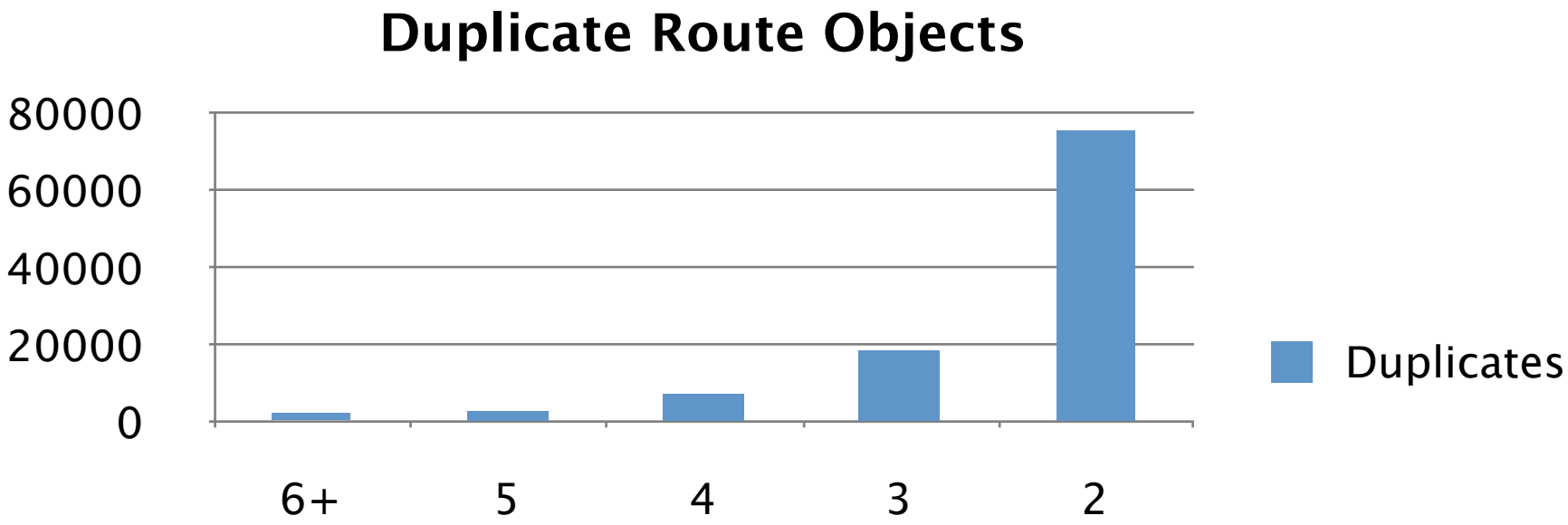


Distribution by Changed Date

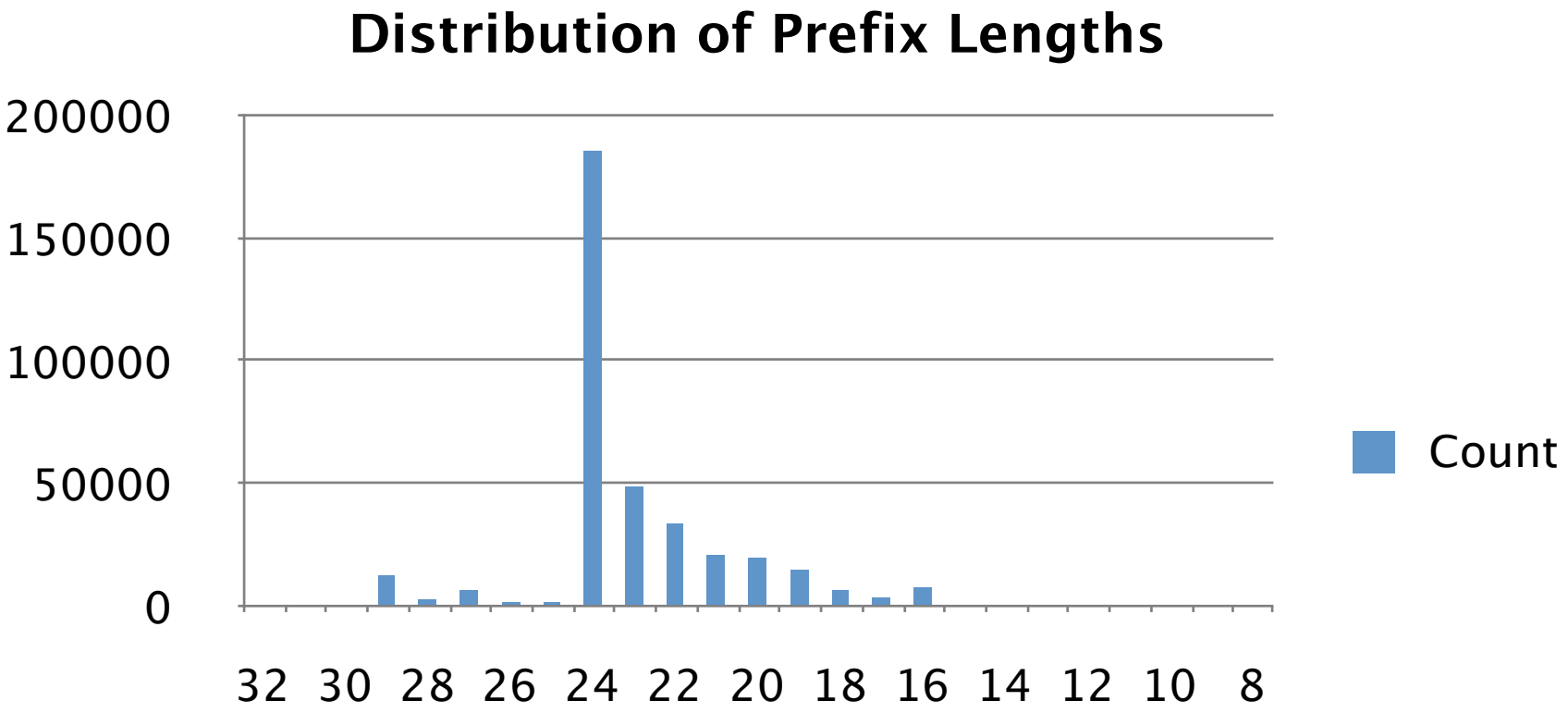


How many objects are duplicates?

- Non-Duplicates: 265230
- Duplicates: 272332



Distribution of Prefix Lengths



Pure Comedy Value

route: 0.0.0.0/8
descr: Proxy-registered route object
origin: AS20406
remarks: This route object is for a BtN customer route
remarks: which is being exported under this origin AS.
remarks:
remarks: This route object was created because no existing
remarks: route object with the same origin was found, and
remarks: since some BtN peers filter based on these objects
remarks: this route may be rejected if this object is not created.
remarks:
remarks: Please contact peering@cais.net if you have any
remarks: questions regarding this object.
mnt-by: MAINT-AS3491
changed: sajwani@pccwbtn.com 20080620
source: RADB

Analysis of IRR Accuracy by Network

Questions Which Need to be Asked

- How effective are filters based on IRR data
  - How many valid routes will we accidentally reject
  - How many invalid routes will we accidentally allow
  - How easy is it for an accidental invalid registration to occur.
  - How easy is it for a malicious registration to occur.
  - How easy is it to build this filter based on IRR data.
  - How badly would it break if we deployed this today.

Conditions for Tests

- Queried from RADB whois server
  - Mirrors everyone, but some people with duplicate misconfigured objects in different DBs may see different results.
- Assumes more-specific prefix matching allowed
  - i.e. if you register a /19, and I see 2 /20s, it counts.

IRR Accuracy Analysis

Network	AboveNet (AS6461)
IRR Object	AS-MFNX
Total routes in IRR Object	174932
Total routes in BGP view	8397
BGP routes in IRR (accepted)	4103
BGP routes not in IRR (rejected)	4294
IRR routes not in BGP (unused)	170829
IRR routes not in global routing table	106117
AUT-NUMs referenced but missing	231
False Rejection Rate	51.14%
False Acceptance Rate	20.3x
Notes	AUT-NUM and documentation claims AS-ABOVE, but that doesn't exist.
Grade	F

IRR Accuracy Analysis

Network	British Telecom (AS5400)
IRR Object	AS-BT-EU
Total routes in IRR Object	55861
Total routes in BGP view	3944
BGP routes in IRR (accepted)	3832
BGP routes not in IRR (rejected)	112
IRR routes not in BGP (unused)	52029
IRR routes not in global routing table	29444
AUT-NUMs referenced but missing	97
False Rejection Rate	2.84%
False Acceptance Rate	14.1x
Notes	
Grade	C-

IRR Accuracy Analysis

Network	Cable and Wireless (AS1273)
IRR Object	AS-CW
Total routes in IRR Object	266548
Total routes in BGP view	16387
BGP routes in IRR (accepted)	16124
BGP routes not in IRR (rejected)	263
IRR routes not in BGP (unused)	250424
IRR routes not in global routing table	137596
AUT-NUMs referenced but missing	906
False Rejection Rate	1.60%
False Acceptance Rate	15.2x
Notes	Takes over 2 hours to pull this as-set!
Grade	D

IRR Accuracy Analysis

Network	Deutsche Telekom (AS3320)
IRR Object	AS3320:AS-DTAG
Total routes in IRR Object	178778
Total routes in BGP view	13342
BGP routes in IRR (accepted)	12576
BGP routes not in IRR (rejected)	766
IRR routes not in BGP (unused)	167116
IRR routes not in global routing table	
AUT-NUMs referenced but missing	614
False Rejection Rate	5.74%
False Acceptance Rate	13.4x
Notes	
Grade	D

IRR Accuracy Analysis

Network	France Telecom (AS5511)
IRR Object	AS-OPENTRANSIT
Total routes in IRR Object	46918
Total routes in BGP view	9169
BGP routes in IRR (accepted)	5993
BGP routes not in IRR (rejected)	3176
IRR routes not in BGP (unused)	42398
IRR routes not in global routing table	24895
AUT-NUMs referenced but missing	203
False Rejection Rate	34.64%
False Acceptance Rate	5.1x
Notes	
Grade	F

IRR Accuracy Analysis

Network	Global Crossing (AS3549)
IRR Object	AS-GBLX
Total routes in IRR Object	73735
Total routes in BGP view	84230
BGP routes in IRR (accepted)	22481
BGP routes not in IRR (rejected)	61749
IRR routes not in BGP (unused)	51254
IRR routes not in global routing table	59559
AUT-NUMs referenced but missing	152
False Rejection Rate	73.31%
False Acceptance Rate	
Notes	Incorrectly references all customer objects as AUT-NUMs, not proper AS-SETs.
Grade	F

IRR Accuracy Analysis

Network	Hurricane Electric (AS6939)
IRR Object	AS-HURRICANE
Total routes in IRR Object	36272
Total routes in BGP view	6997
BGP routes in IRR (accepted)	6718
BGP routes not in IRR (rejected)	279
IRR routes not in BGP (unused)	29551
IRR routes not in global routing table	14161
AUT-NUMs referenced but missing	41
False Rejection Rate	3.99%
False Acceptance Rate	5.1x
Notes	
Grade	C-

IRR Accuracy Analysis

Network	Level 3 (AS3356)
IRR Object	rs-Level3-Transit
Total routes in IRR Object	103930
Total routes in BGP view	126985
BGP routes in IRR (accepted)	87640
BGP routes not in IRR (rejected)	39345
IRR routes not in BGP (unused)	31214
IRR routes not in global routing table	14100
AUT-NUMs referenced but missing	0
False Rejection Rate	30.98%
False Acceptance Rate	
Notes	Doesn't seem to have an AS-SET, only a route-set, which doesn't auto-update.
Grade	F

IRR Accuracy Analysis

Network	nLayer (AS4436)
IRR Object	AS-NLAYER
Total routes in IRR Object	7992
Total routes in BGP view	1221
BGP routes in IRR (accepted)	1215
BGP routes not in IRR (rejected)	6
IRR routes not in BGP (unused)	6892
IRR routes not in global routing table	3151
AUT-NUMs referenced but missing	42
False Rejection Rate	0.49%
False Acceptance Rate	5.6x
Notes	
Grade	B+

IRR Accuracy Analysis

Network	NTT/America (AS2914)
IRR Object	AS2914:AS-GLOBAL
Total routes in IRR Object	289926
Total routes in BGP view	48964
BGP routes in IRR (accepted)	48943
BGP routes not in IRR (rejected)	21
IRR routes not in BGP (unused)	240291
IRR routes not in global routing table	166518
AUT-NUMs referenced but missing	852
False Rejection Rate	0.04%
Leak Potential	74465
Notes	
Grade	C

IRR Accuracy Analysis

Network	SAVVIS (AS3561)
IRR Object	AS-SAVVIS-TRANSIT
Total routes in IRR Object	101325
Total routes in BGP view	48719
BGP routes in IRR (accepted)	21168
BGP routes not in IRR (rejected)	27551
IRR routes not in BGP (unused)	83796
IRR routes not in global routing table	55791
AUT-NUMs referenced but missing	289
False Rejection Rate	56.55%
False Acceptance Rate	2.07x
Notes	
Grade	F

IRR Accuracy Analysis

Network	Tiscali (AS3257)
IRR Object	AS-TISCALI
Total routes in IRR Object	61114
Total routes in BGP view	28346
BGP routes in IRR (accepted)	13997
BGP routes not in IRR (rejected)	14349
IRR routes not in BGP (unused)	48452
IRR routes not in global routing table	30286
AUT-NUMs referenced but missing	301
False Rejection Rate	50.62%
False Acceptance Rate	2.15x
Notes	
Grade	F

IRR Accuracy Analysis

Network	Telecom Italia (AS6762)
IRR Object	AS-SEABONE
Total routes in IRR Object	165919
Total routes in BGP view	16257
BGP routes in IRR (accepted)	11468
BGP routes not in IRR (rejected)	4789
IRR routes not in BGP (unused)	156898
IRR routes not in global routing table	119908
AUT-NUMs referenced but missing	289
False Rejection Rate	29.46%
False Acceptance Rate	10.2x
Notes	
Grade	F

IRR Accuracy Analysis

Network	TeliaSonera (AS1299)
IRR Object	AS-TELIANET
Total routes in IRR Object	256485
Total routes in BGP view	37224
BGP routes in IRR (accepted)	35980
BGP routes not in IRR (rejected)	1244
IRR routes not in BGP (unused)	224023
IRR routes not in global routing table	145258
AUT-NUMs referenced but missing	1123
False Rejection Rate	3.34%
False Acceptance Rate	6.9x
Notes	
Grade	D

IRR Accuracy Analysis

Network	Tata/VSNL/Teleglobe (AS6453)
IRR Object	AS-GLOBEINTERNET
Total routes in IRR Object	298603
Total routes in BGP view	13596
BGP routes in IRR (accepted)	13375
BGP routes not in IRR (rejected)	221
IRR routes not in BGP (unused)	286776
IRR routes not in global routing table	193619
AUT-NUMs referenced but missing	926
False Rejection Rate	1.63%
False Acceptance Rate	21.9x
Notes	Best left to run overnight!
Grade	D

IRR Accuracy Analysis

Network	Qwest (AS209)
IRR Object	AS-QWEST
Total routes in IRR Object	123071
Total routes in BGP view	17841
BGP routes in IRR (accepted)	11523
BGP routes not in IRR (rejected)	6318
IRR routes not in BGP (unused)	113965
IRR routes not in global routing table	68713
AUT-NUMs referenced but missing	752
False Rejection Rate	35.41%
False Acceptance Rate	6.9x
Notes	Incorrectly references all customer objects as AUT-NUMs, not proper AS-SETs.
Grade	F

IRR Accuracy Analysis

Network	WVFiber (AS19151)
IRR Object	AS-WVFIBER
Total routes in IRR Object	41328
Total routes in BGP view	2719
BGP routes in IRR (accepted)	2272
BGP routes not in IRR (rejected)	447
IRR routes not in BGP (unused)	39334
IRR routes not in global routing table	22032
AUT-NUMs referenced but missing	141
False Rejection Rate	16.44%
False Acceptance Rate	15.2x
Notes	
Grade	D

IRR Accuracy Analysis

Network	Global Routing Table
IRR Object	All route objects in IRR
Total routes in IRR Object	372818
Total routes in BGP view	265168
BGP routes in IRR (accepted)	184008
BGP routes not in IRR (rejected)	81160
IRR routes not in BGP (unused)	235823
False Rejection Rate	30.61%

Tier 1(ish) Summary

Network	ASN	Grade
AT&T	7018	No IRR
ATDN	1668	F
Global Crossing	3549	F
Level 3	3356	F
NTT/America	2914	D
SAVVIS	3561	F
Sprint	1239	No IRR
Qwest	209	F
Verizon Business	701	No IRR

Tier 2 Summary

Network	ASN	Grade
AboveNet	6461	F
British Telecom	5400	C-
Cable and Wireless	1273	D
Deutsche Telekom	3320	D
France Telecom	5511	F
Hurricane Electric	6939	C-
nLayer	4436	B+
Tiscali	3257	F
TeliaSonera	1299	F
Tata/VSNL/Teleglobe	6453	D
WVFiber	19151	D

Insert Obligatory Free Software Here

- Shameless Plug:
  - Use IRR Power Tools, a software package I wrote to help ISPs use IRR data to prefix filter their customers.
  - http://www.nanog.org/mtg-0602/pdf/steenbergen.pdf
  - http://sourceforge.net/projects/irrpt/
- By the time this is presented, the latest version of IRRPT will include the software used in this presentation to compare an IRR object to real BGP announcements to check for accuracy.

Send questions, complaints, hate mail, etc to:

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