



ASNs Missing in Action

A detailed look into
RIR statistics and RIS observations

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Motivation

- Routing table analyses: not all assigned ASN seen
- RIS report @ripe44:
 - routing table growth in 2002 ~2/3 of new assignments
 - ~1/3 missing in action?
- What is happening?
 - Compare RIR statistics and RIS routing data

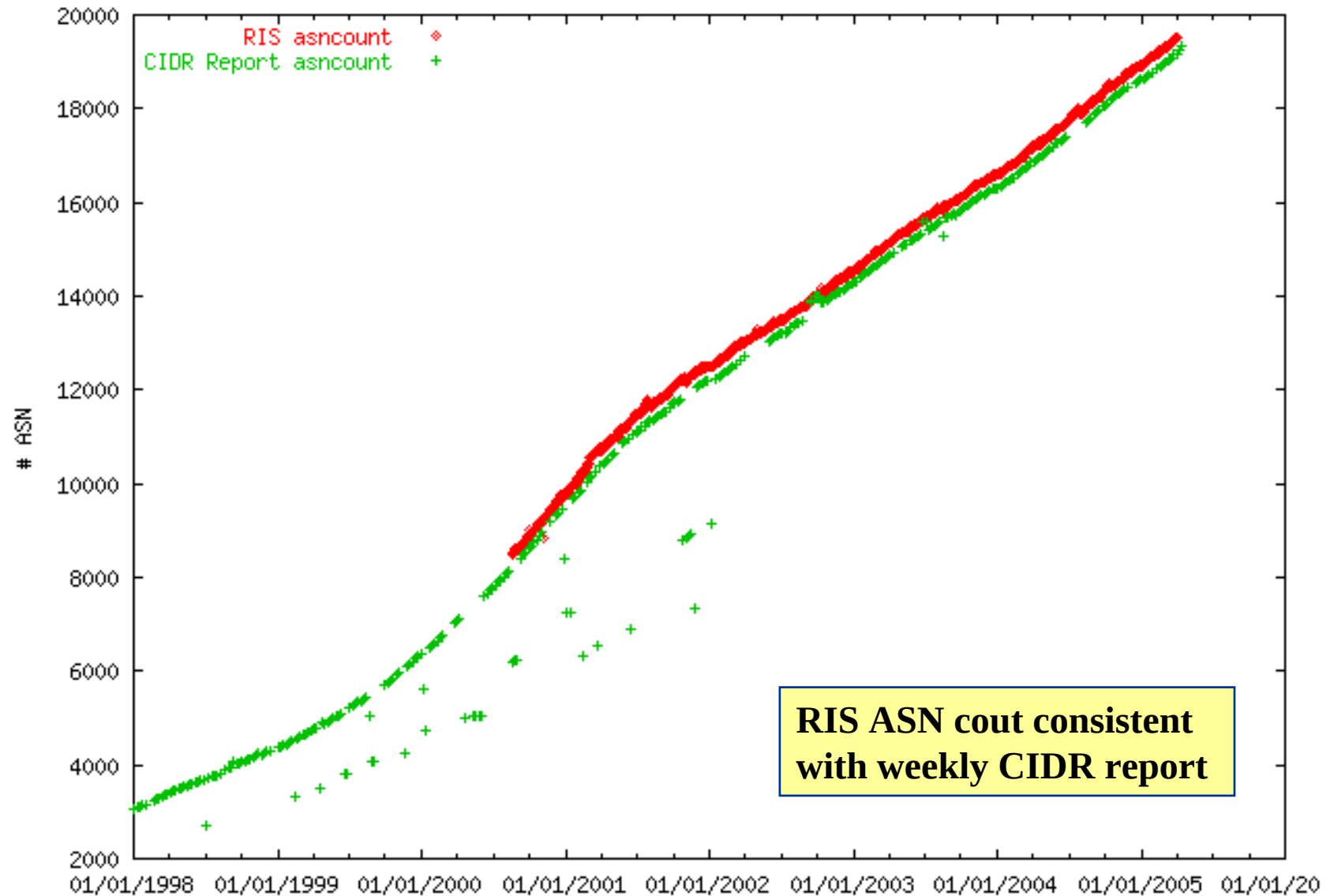
Data Selection - RIS (1)

- RIS = Routing Information Service
 - 13 remote route collectors at exchanges, 450 peers
 - most recent data (3 months) in a database
 - all raw data available on web, starting July 1999.
- Extract ASN info from raw data
 - for each day, process both updates and RIB dumps
 - split ASpath into components
 - flag every ASN seen, even if only appears in 1 update

Data Selection - RIS (2)

- Results are stored in relational database
- For each ASN seen (in updates or RIB dump):
 - first day seen in RIS
 - last day seen in RIS
 - total number of days seen
- Total ASN count for each day in separate table
- 4.5 years covered:
 - 18 August 2000 to 31 March 2005

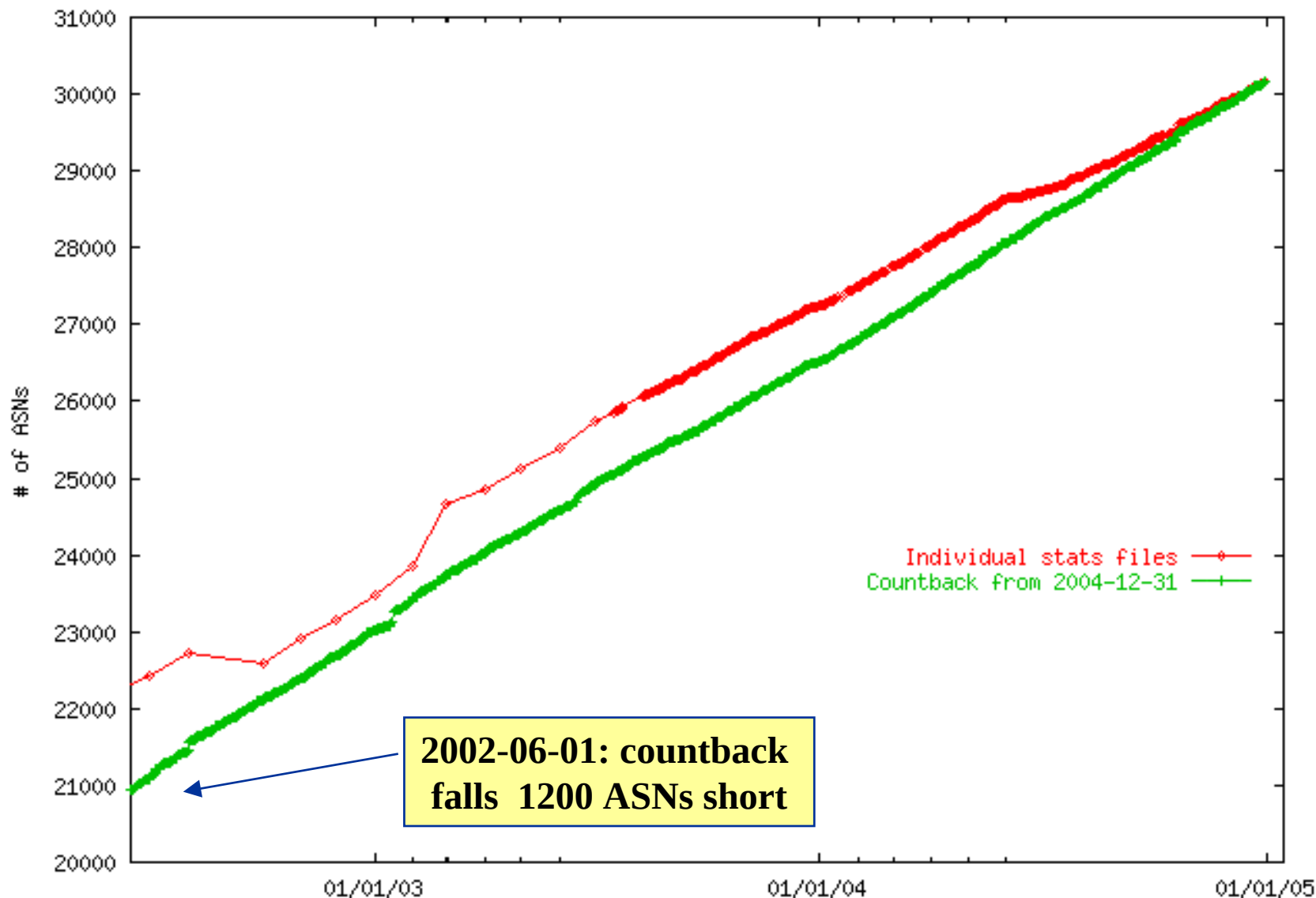
ASNs in routing system: RIS vs CIDR-report



Data Selection RIRs (1)

- RIRs publish IP & ASN statistics via ftp
 - for each ASN or ASN block: assigned date and country
 - since june 2002 ASN statistics from all RIRs
- Can create historical ASN count from latest stats
 - start with latest total, count back the days, subtract all ASNs assigned each day → per day ASN count
- But stats files provide a snapshot of current state
 - no info on returned IP/ASN resources
- Better to look at all old stats files
 - start countback from 2002-06-1, earliest day of stats

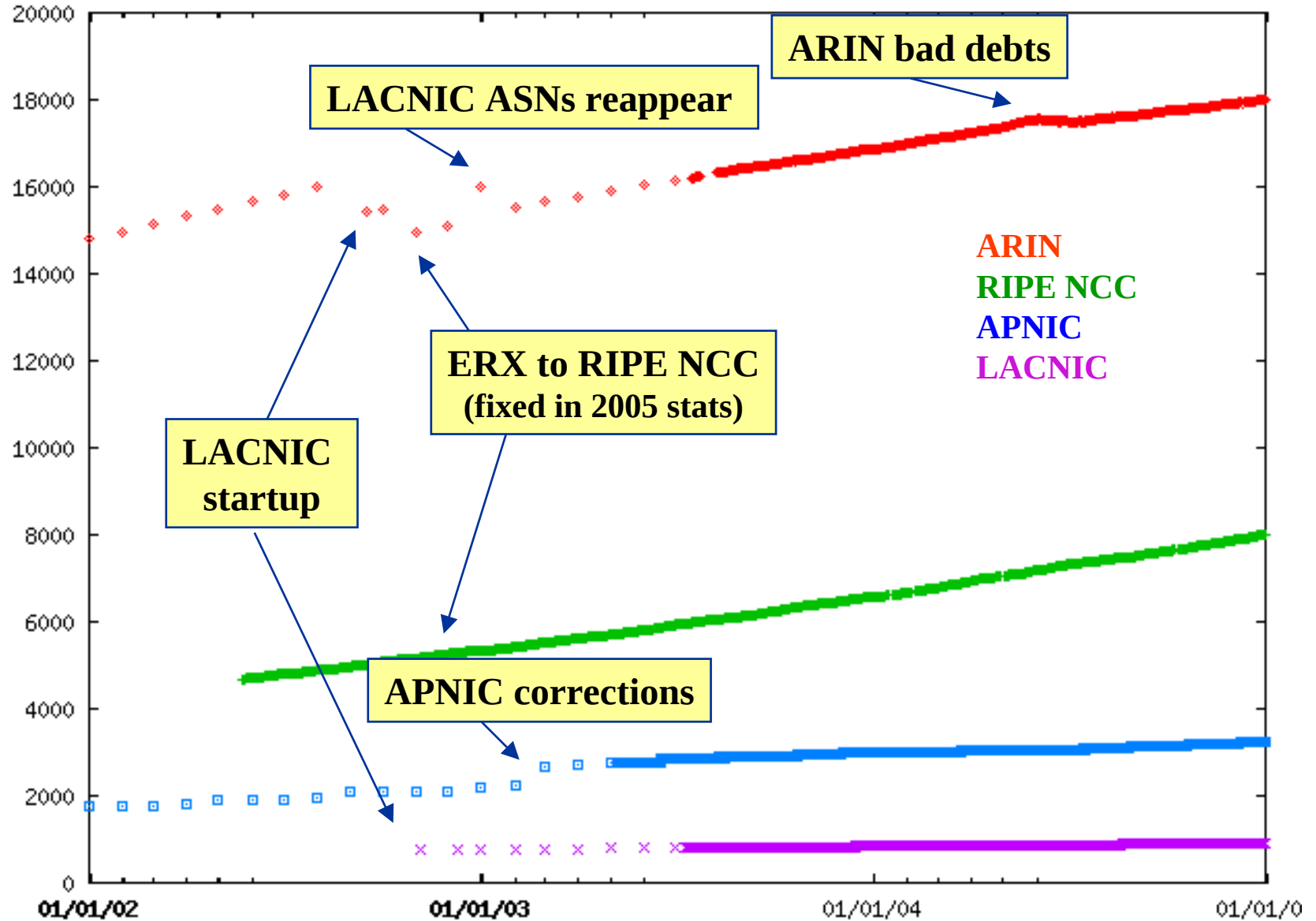
ASNs in stats vs. countback from 2004-12-31



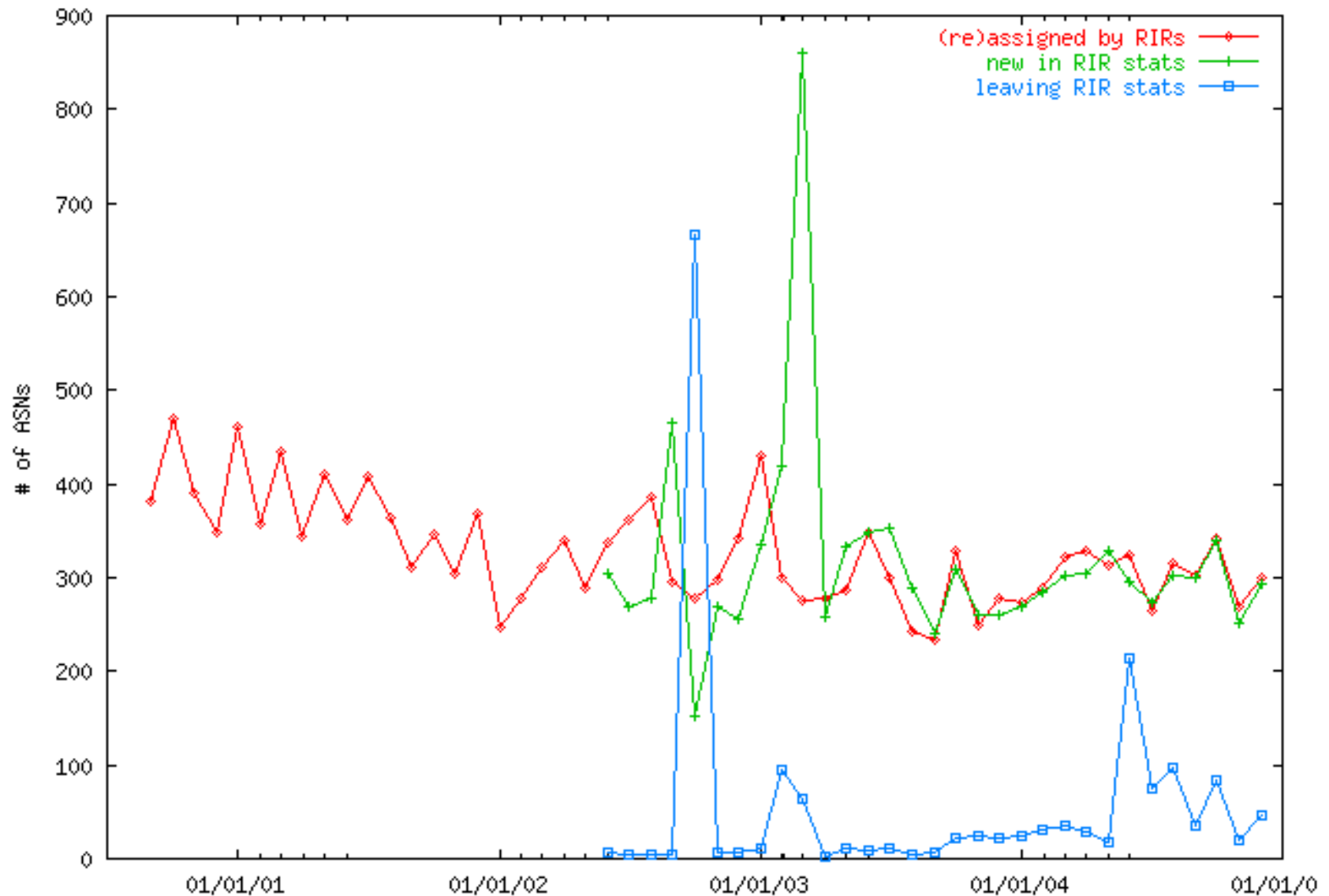
Data Selection RIRs (2)

- Process all RIR stats files up to 2004-12-31
 - RIS data processed until 2005-03-31
 - 3 months for very last assigned ASN to make it to RIS
- For each ASN, add following records in database
 - *first_stats, last_stats*
 - date of the *first / last* stats file listing ASN
 - *first_assign, last_assign*
 - assignment date in *first / last* stats file
 - *first_rir, last_rir*
 - RIR which assigned the ASN in *first / last* stats file

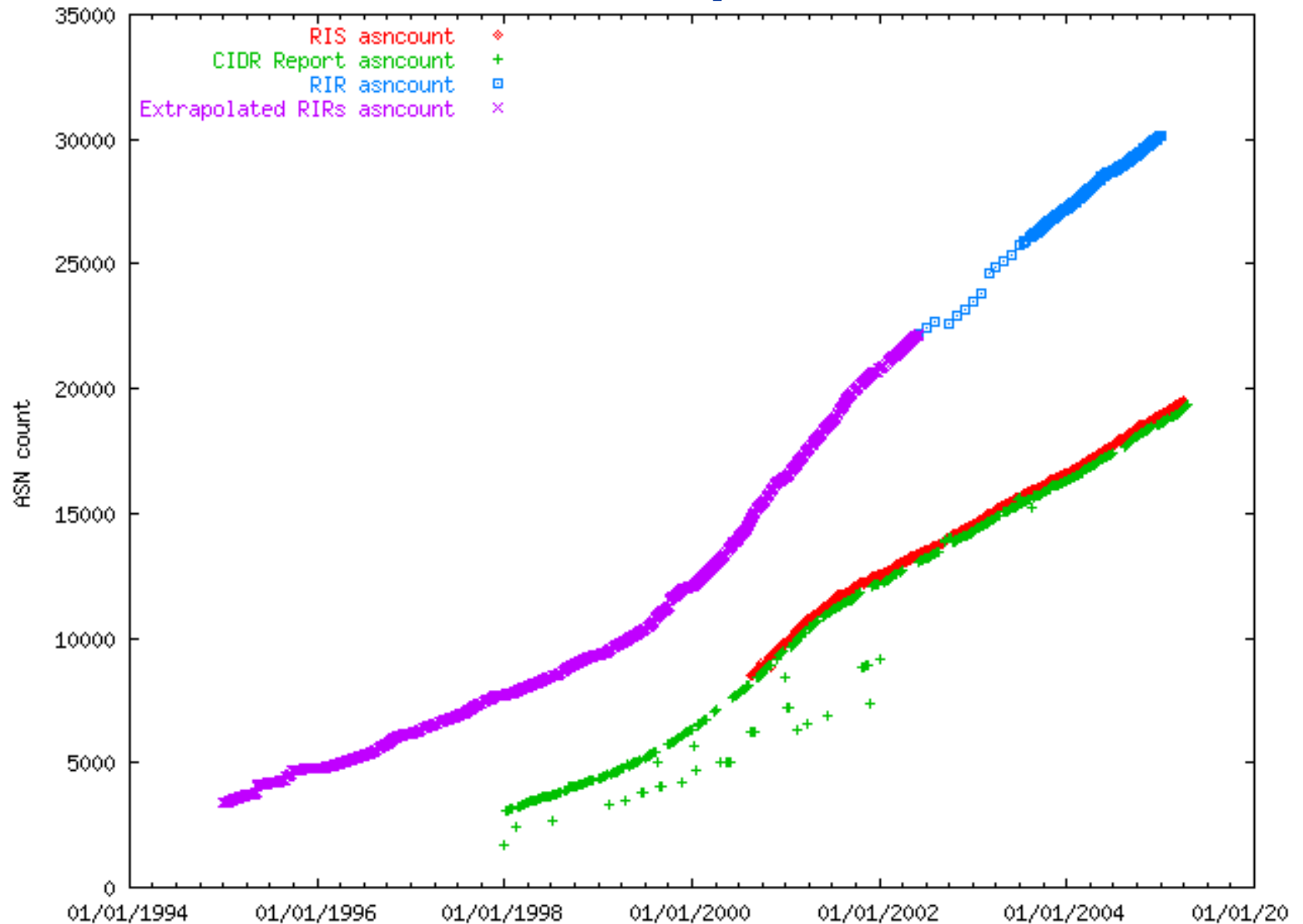
RIRs ASN count 2002 - 2005



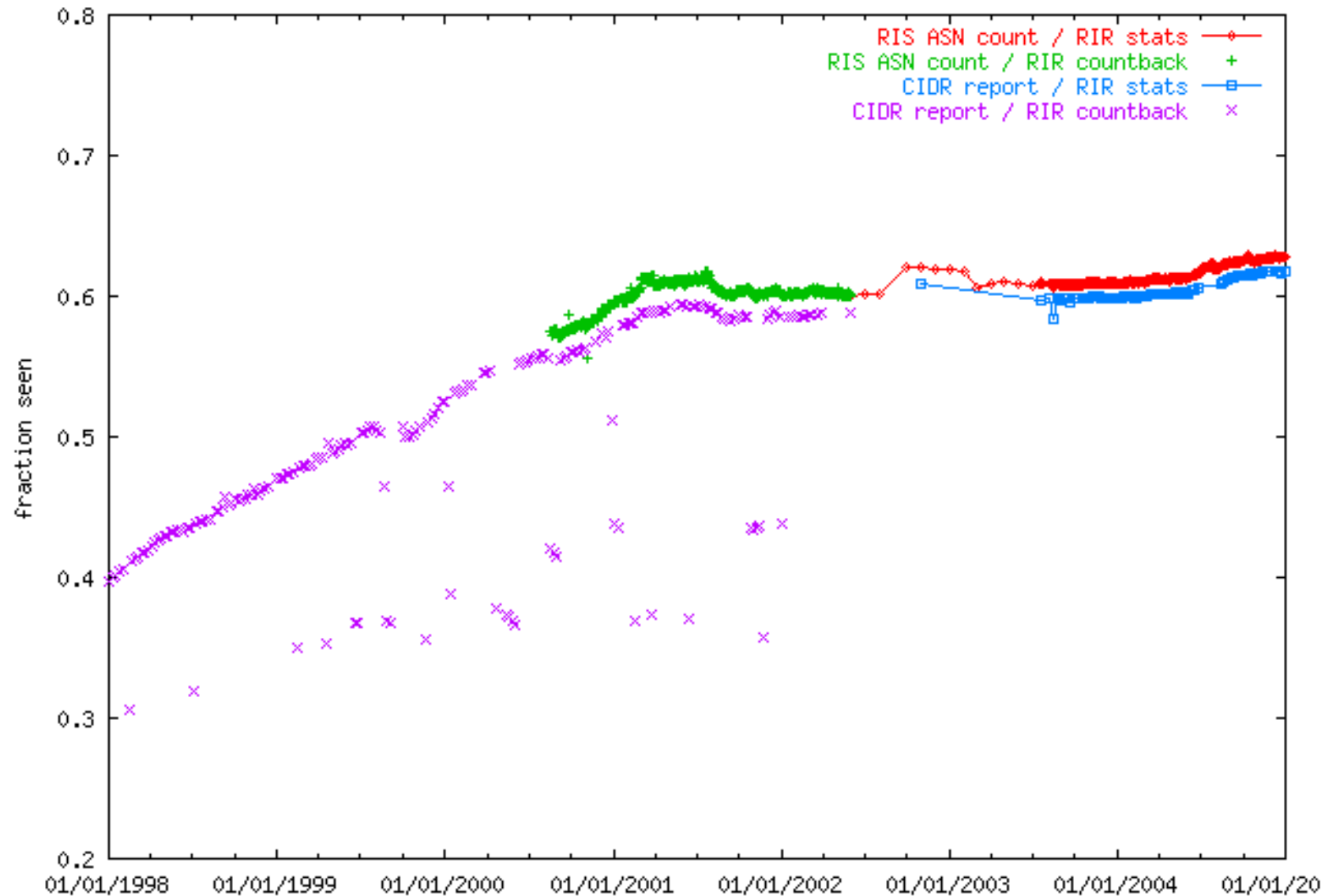
Monthly ASN assignments & stats changes



RIRs, RIS & CIDR report ASN count



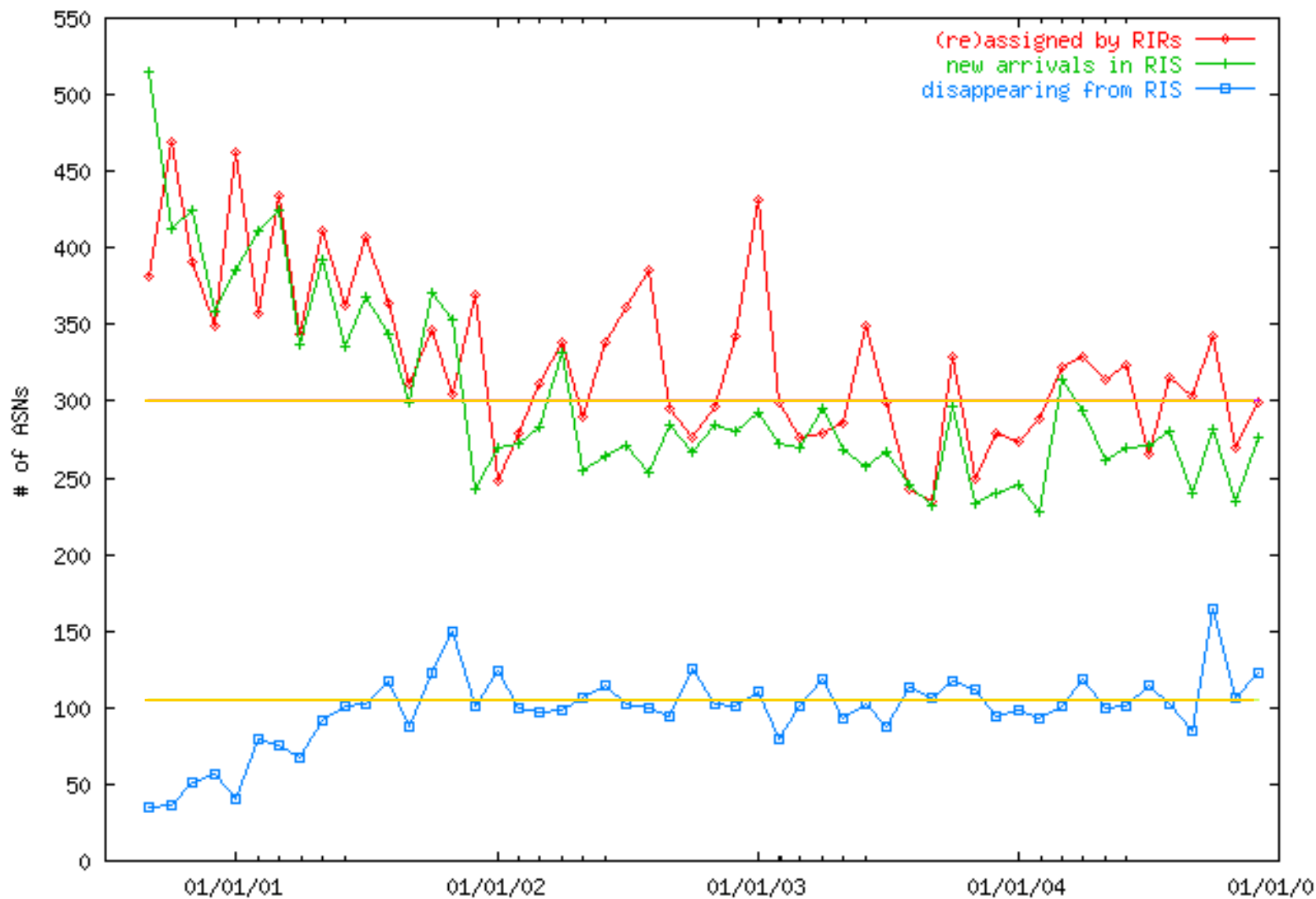
Fraction of assigned ASNs seen



Missing in Action

- 31 December 2004: Missing 11500 ASNs
 - 30000 assigned ASNs in the RIR statistics files
 - 18500 of those are seen in RIS
- Have all never been used on the Internet? No:
 - 5000 were in RIS before but no longer seen (Q1 2005)
 - 500 appeared for the first time in RIS in 2005
- 6000 assigned ASNs never seen in RIS
 - 5 to 10% of 2004 assignments still expected
 - but majority will not ever show up in global routing tables

Monthly RIR assignments, RIS observations

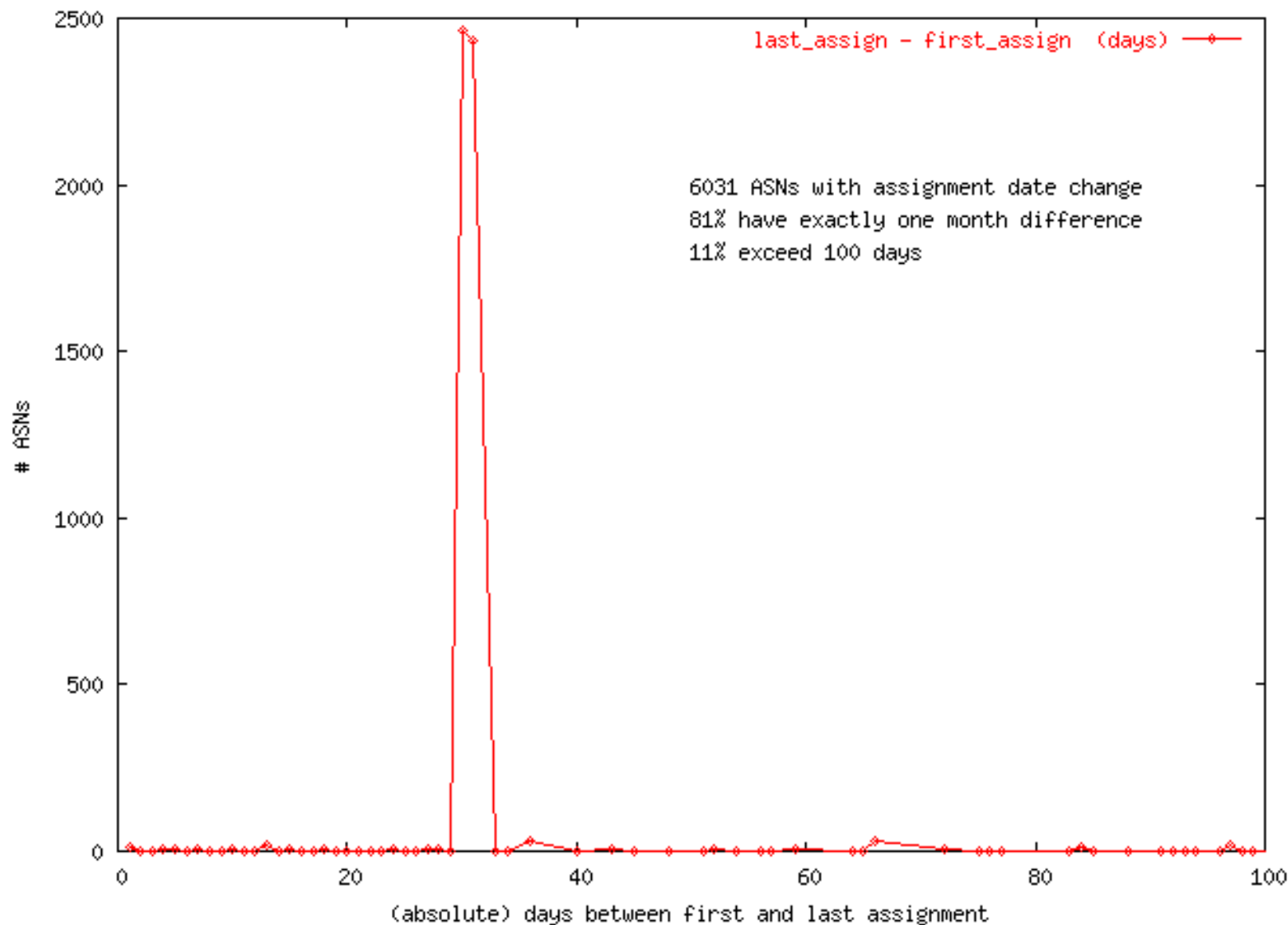


Time left for 16bit ASNs?

- Last three years more or less linear growth
 - 270 +/- 25 new ASNs in RIS per month
 - 105 +/- 15 ASN disappearing from RIS each month
 - net growth 165 +/- 30 per month
 - 300 +/- 40 RIR assignments per month
- **if** growth remains at these levels
 - unseen ASN not reclaimed; returned ASN not reused:
33000 left → RIRs run out in 8-10 years
 - **all** unseen ASN reclaimed, all returned ASN reused:
46000 left → RIRs run out in 20-28 years

Other statistics

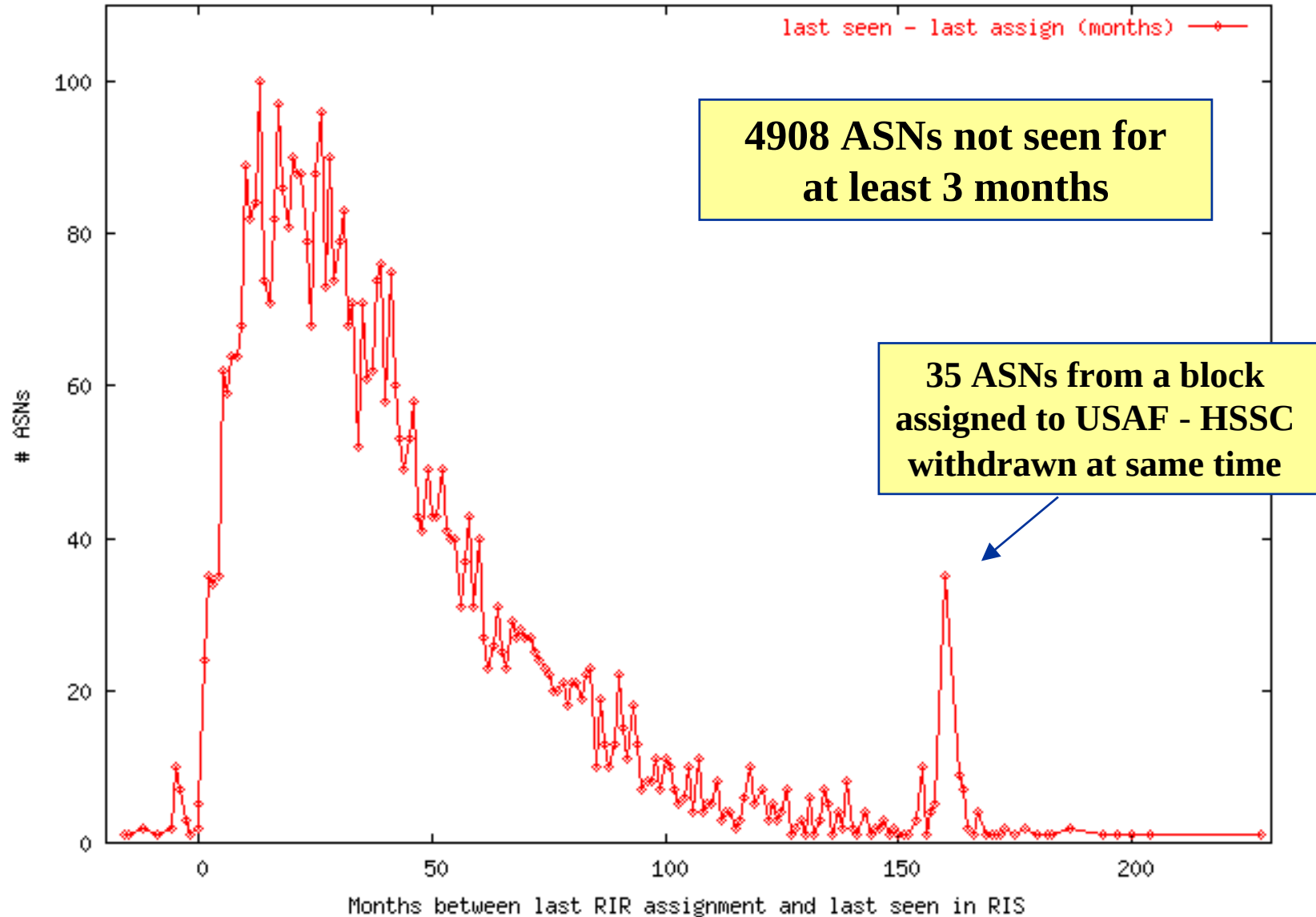
Reassigned AS Numbers ???



Reassigned AS Numbers ?? (2)

- Not really clear how to interpret the date changes
- Administrative reasons?
 - e.g. transfer of ownership in ISP merger, take over
- Difficult to asses true age of these ASNs
- Remainder of the analysis:
 - Only use ASNs with dates max 1 month apart
 - ASN at least 7 days in RIS to be counted as “seen”
(filter noise from unauthorized, accidental use of ASN)

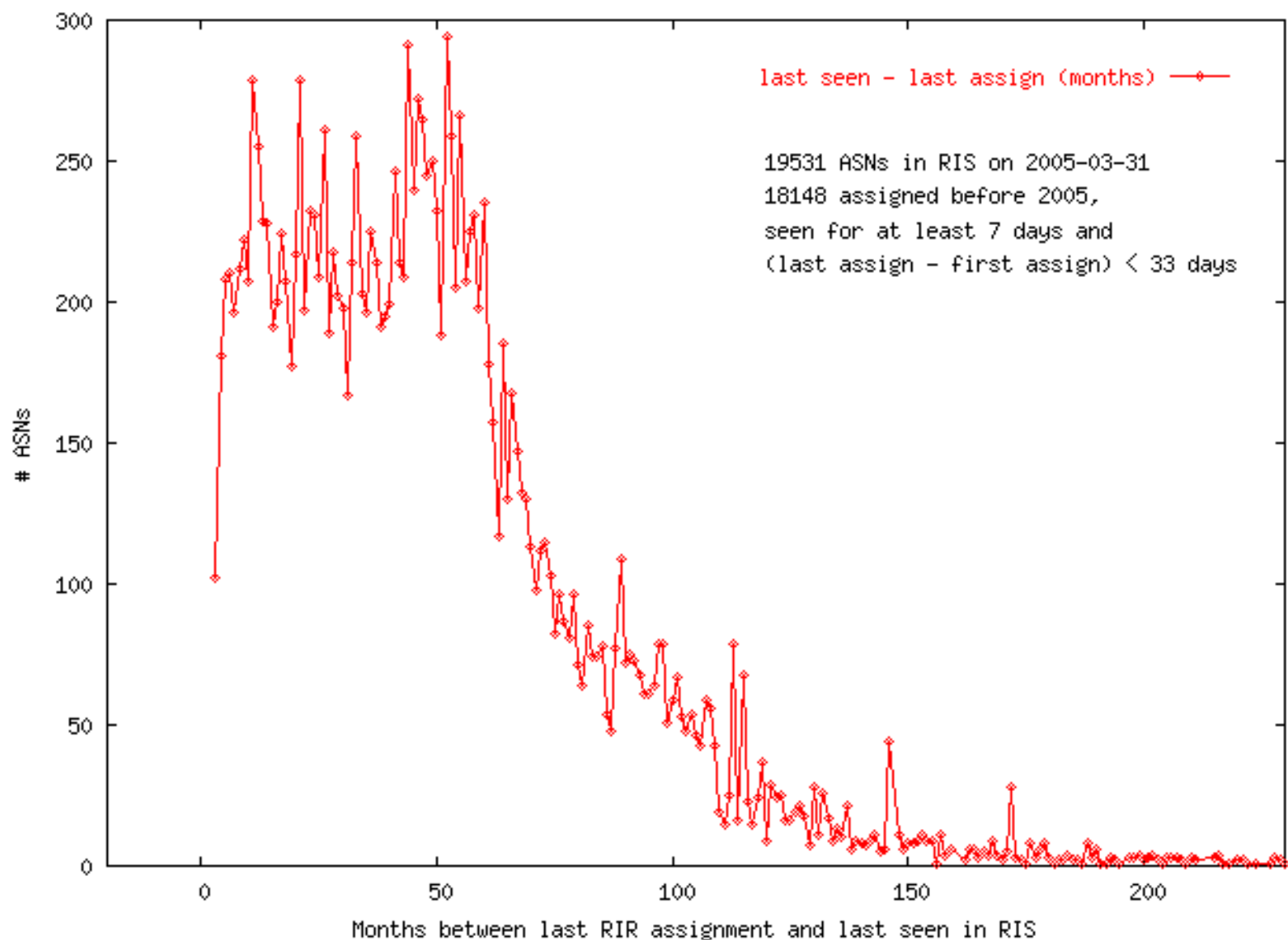
Lifetime in RIS of ASNs no longer seen



Lifetime of ASNs assigned after 2000-08-18



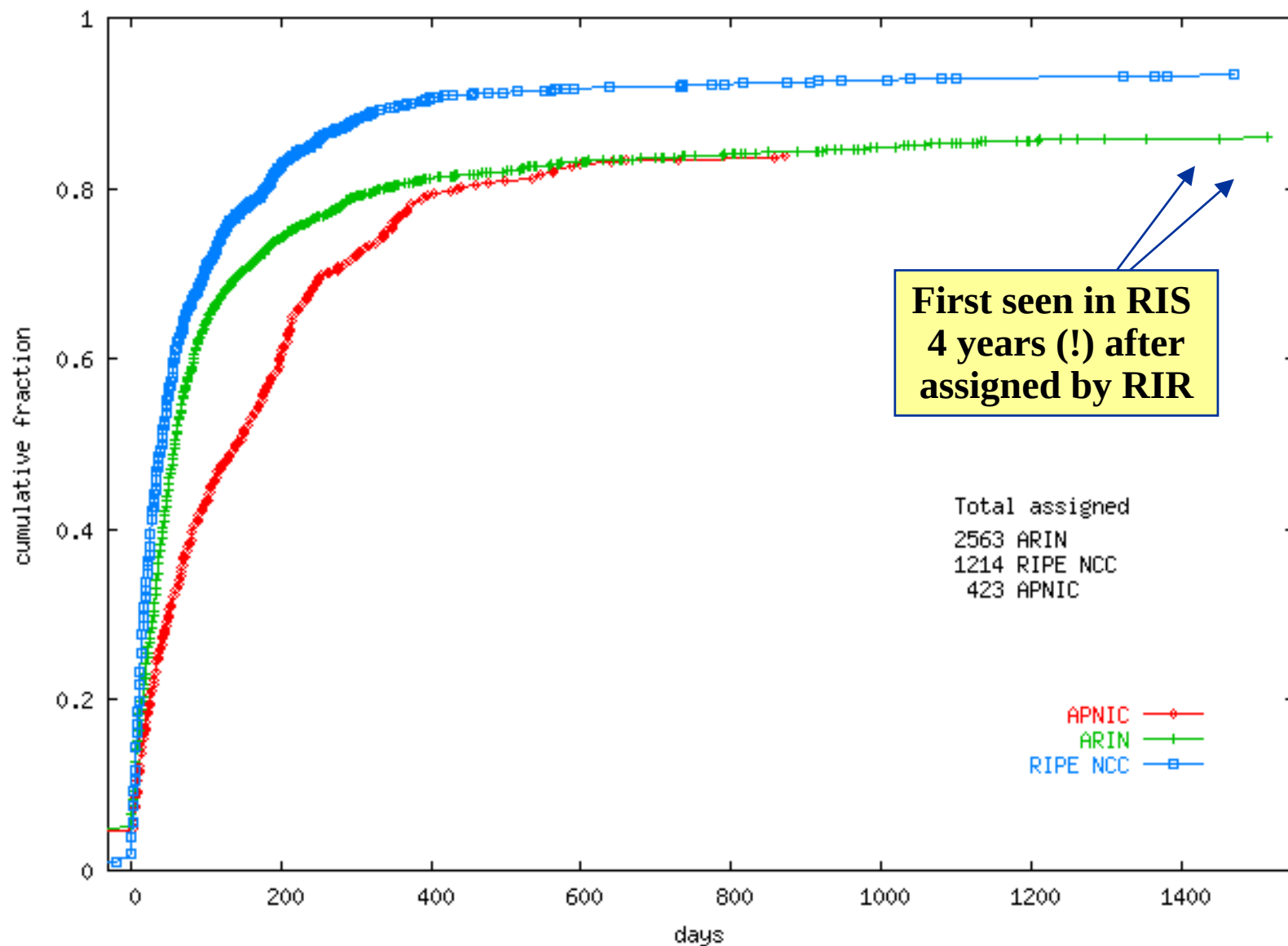
Age distribution of ASNs in RIS on 2005-03-31



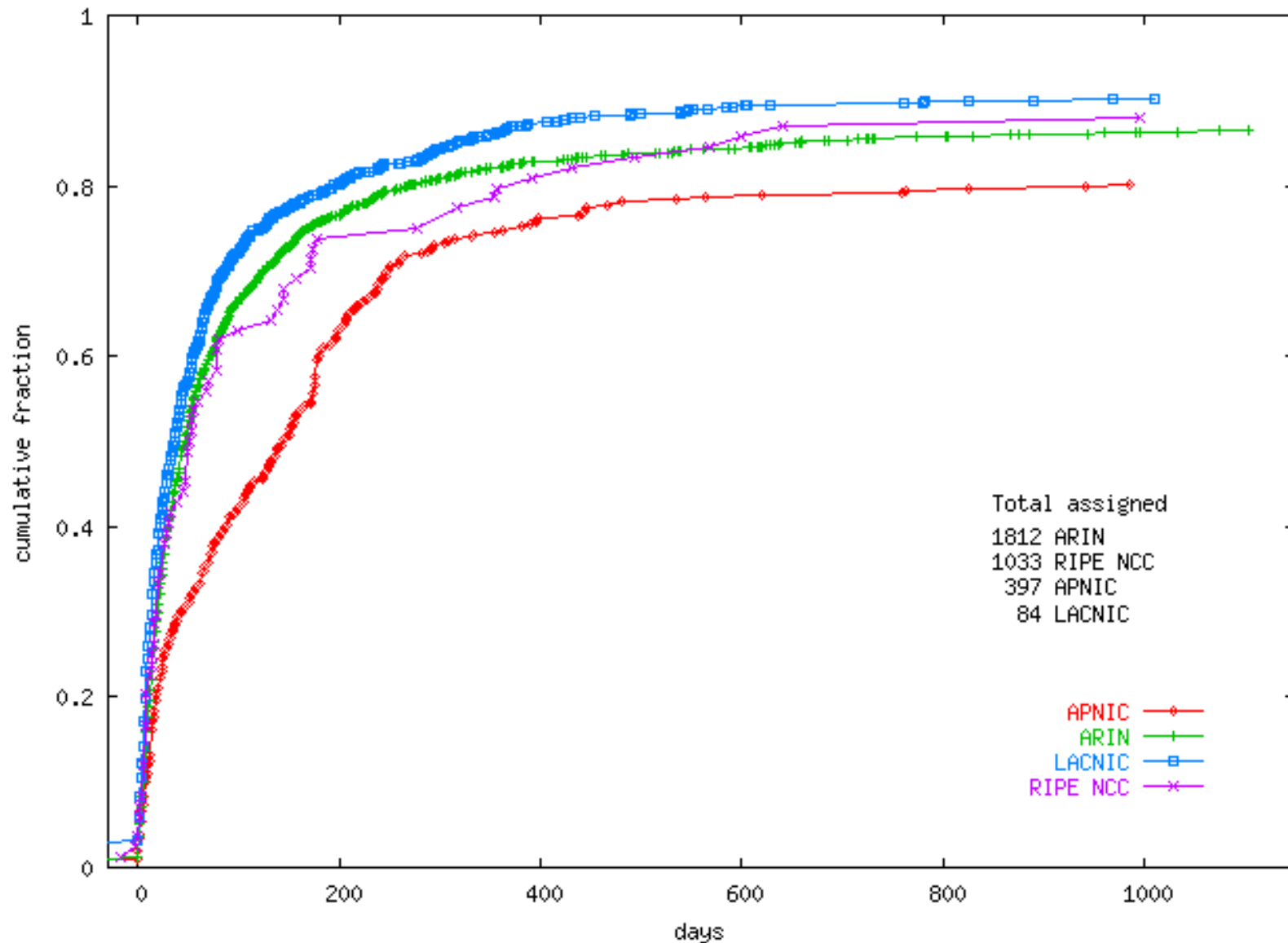
Activation delays

- How long does it take for an ASN to appear in the routing system after being assigned by a RIR?
- For each ASN assigned in 2001, 2002, 2003, 2004
 - calculate days between last assigned and first seen
 - for each delay, count number of ASNs
 - plot as cumulative fraction

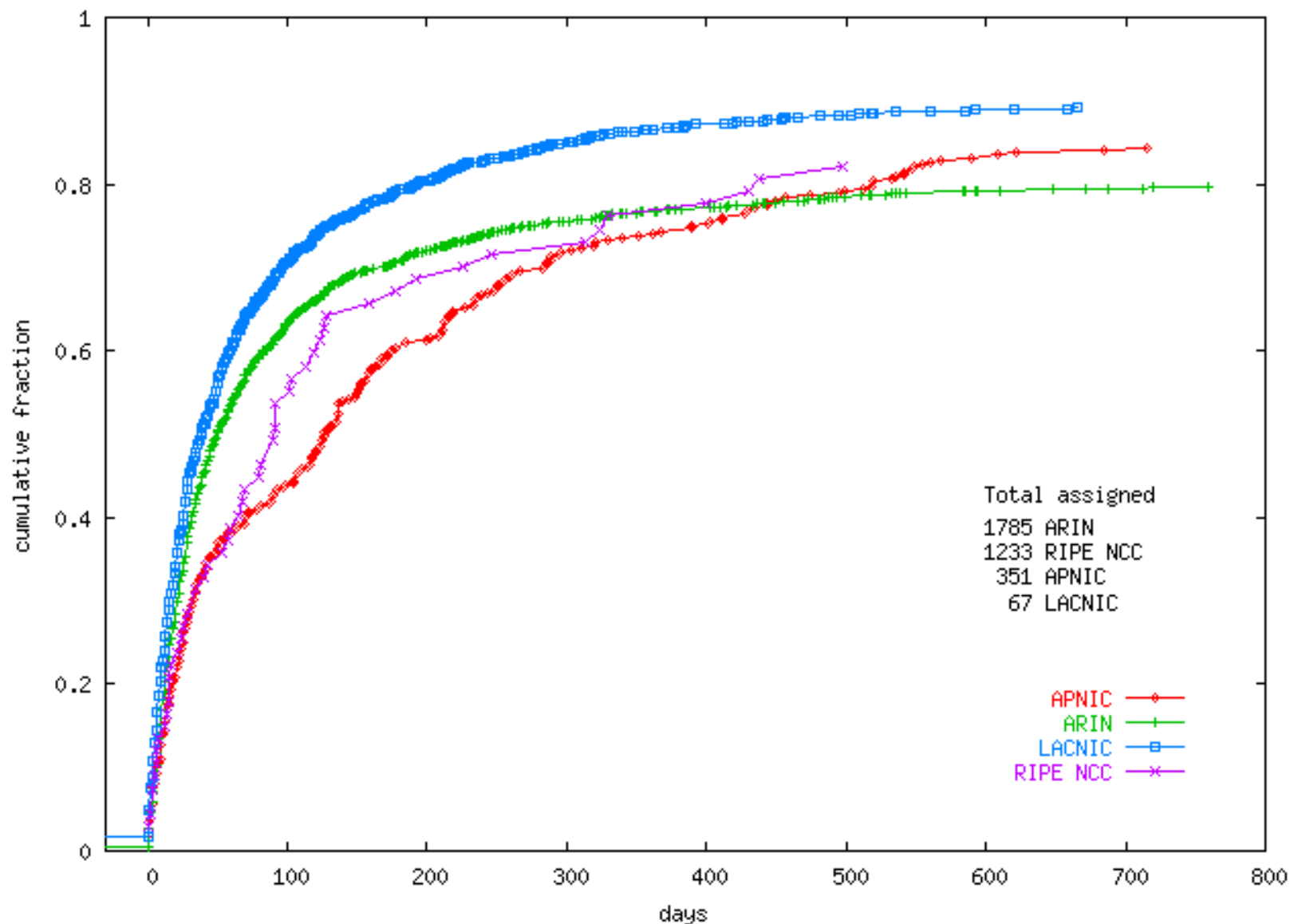
Activation delay - 2001 assignments



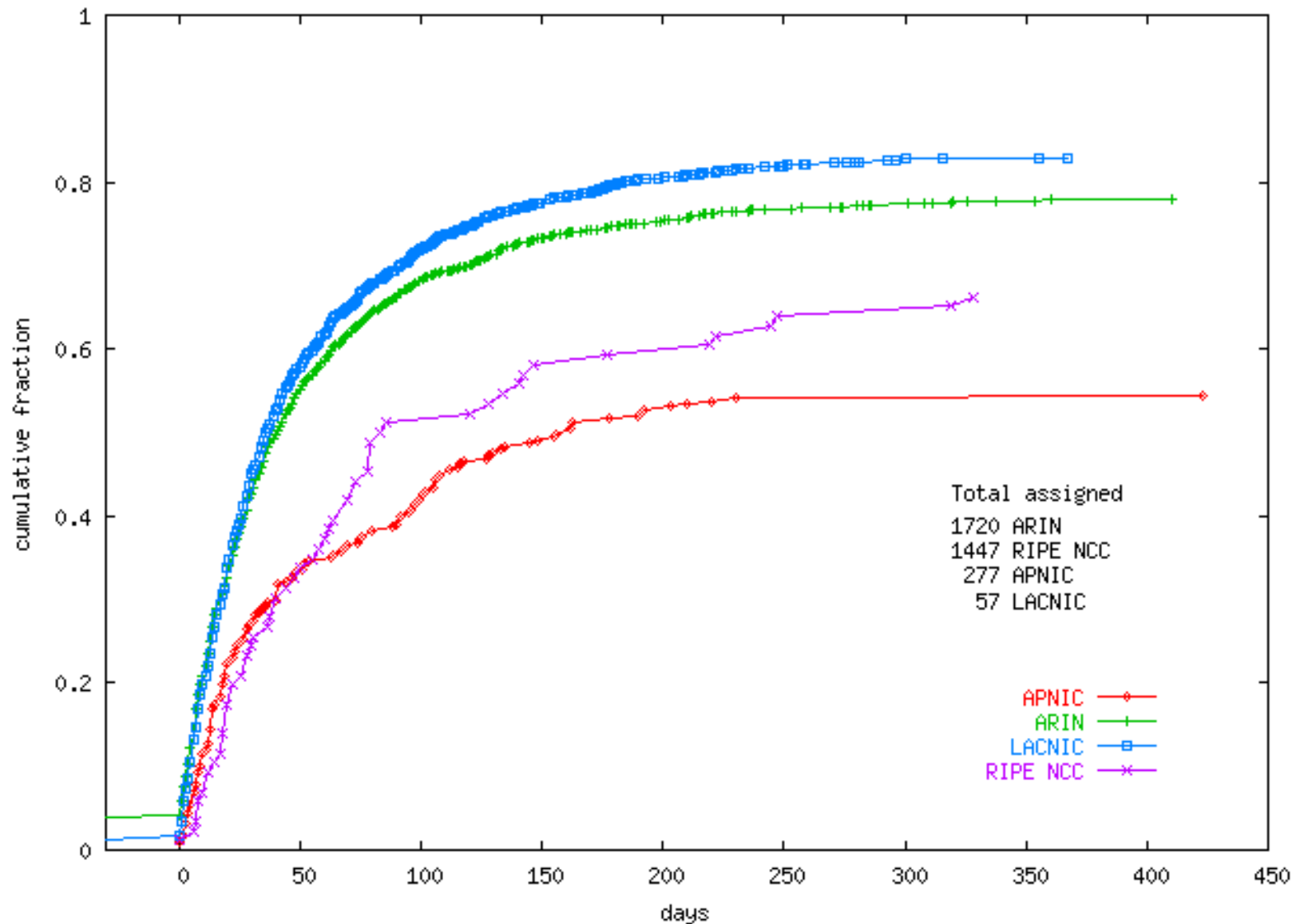
Activation delay - 2002 assignments



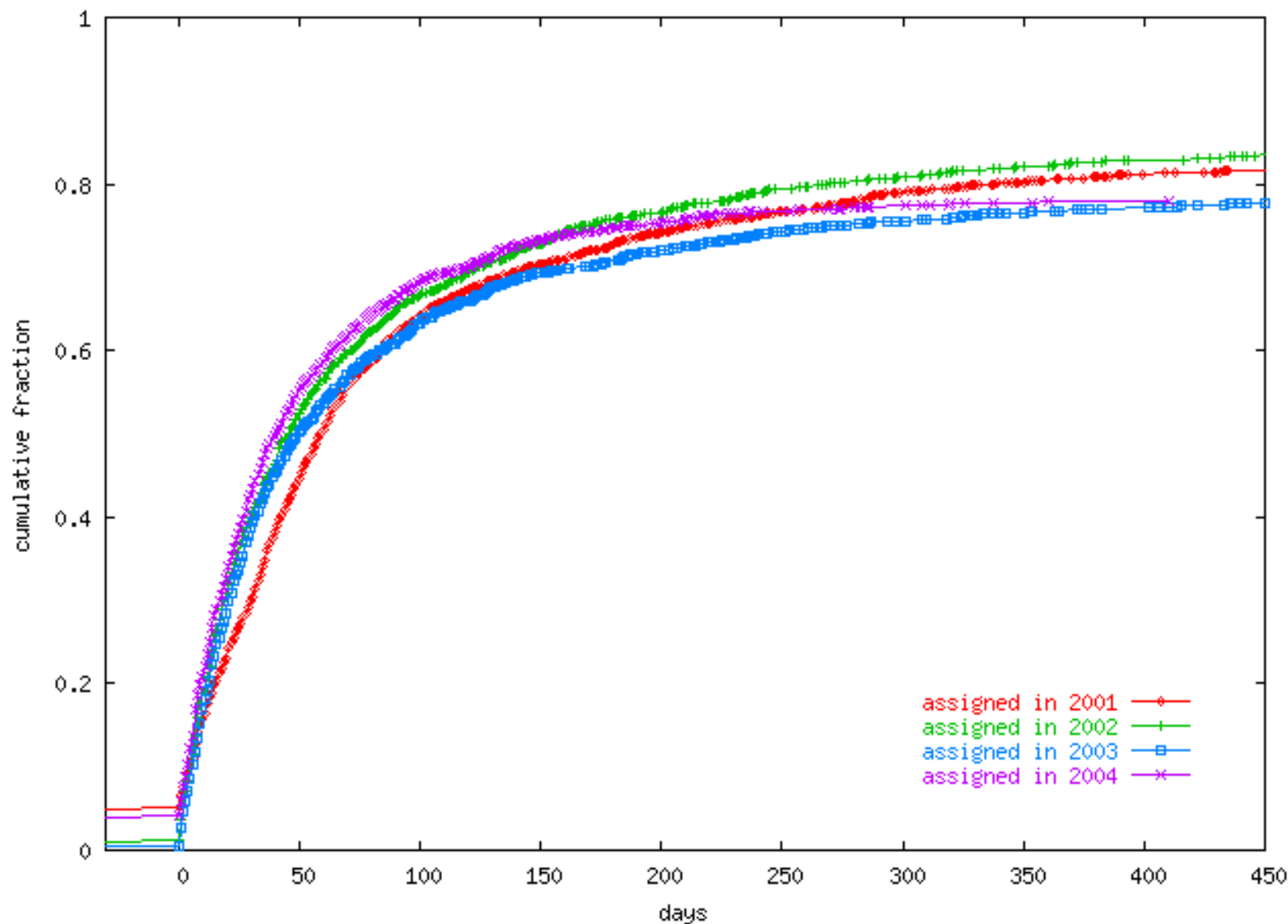
Activation delay - 2003 assignments



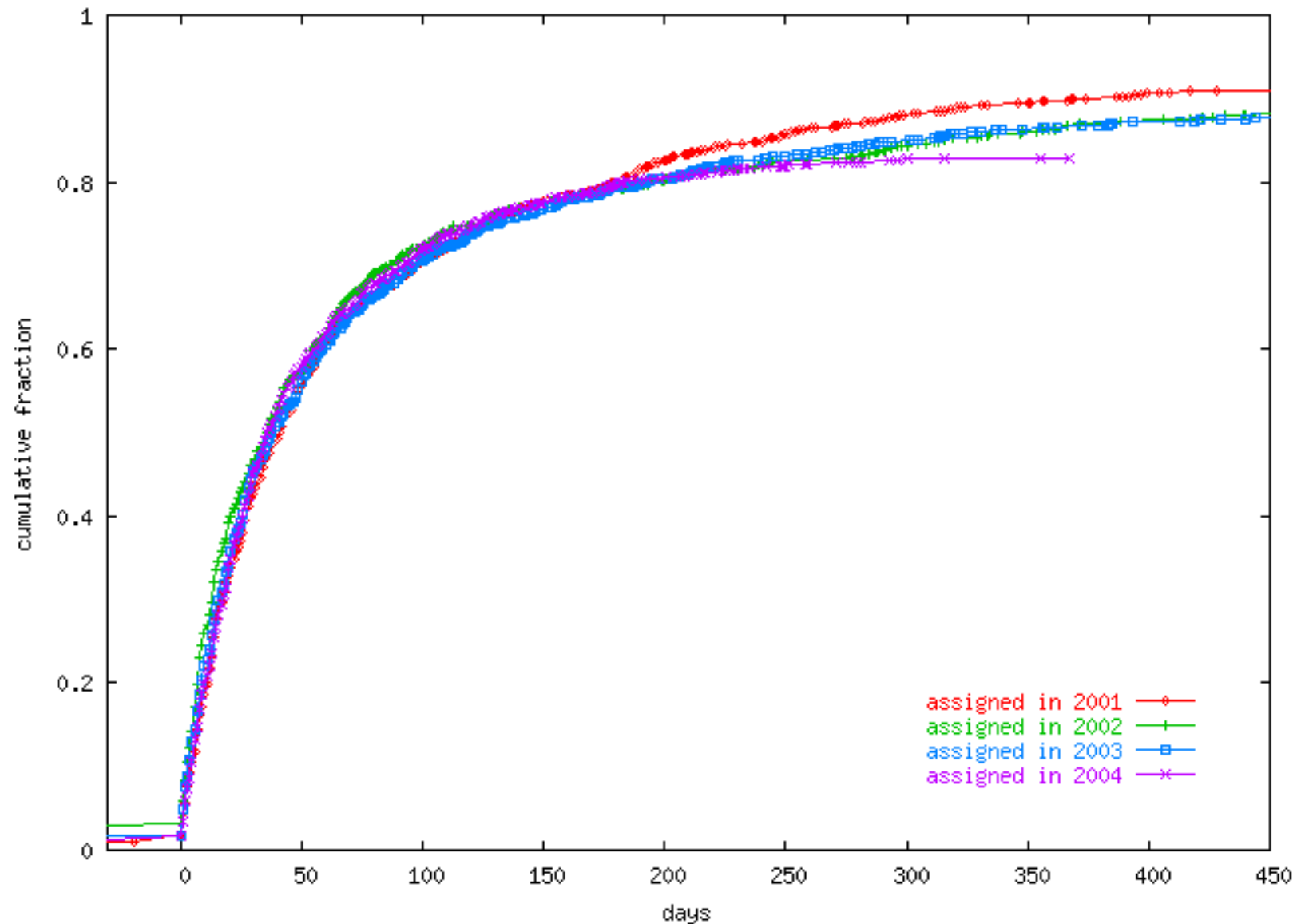
Activation delay - 2004 assignments



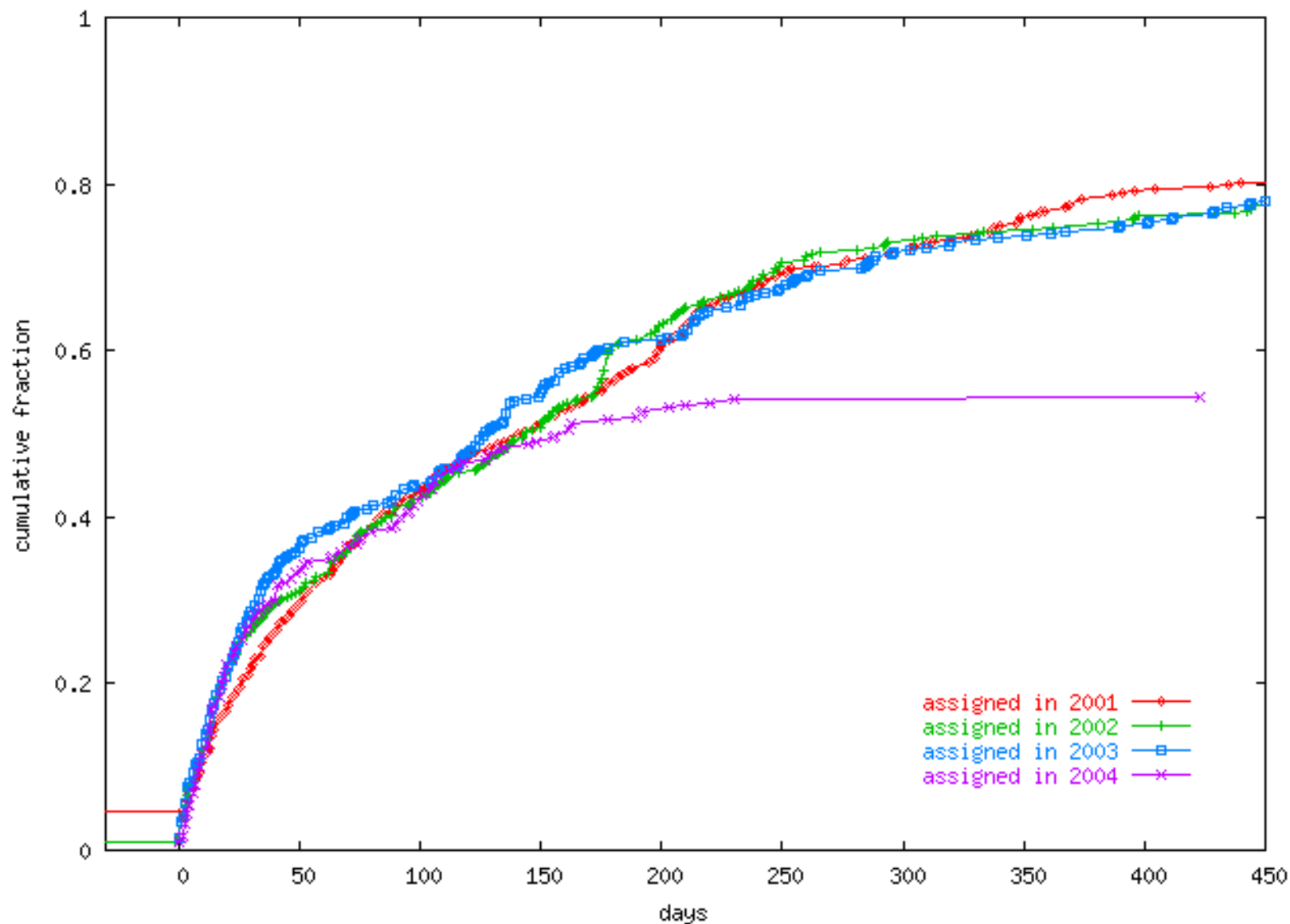
Activation delay - ARIN assignments



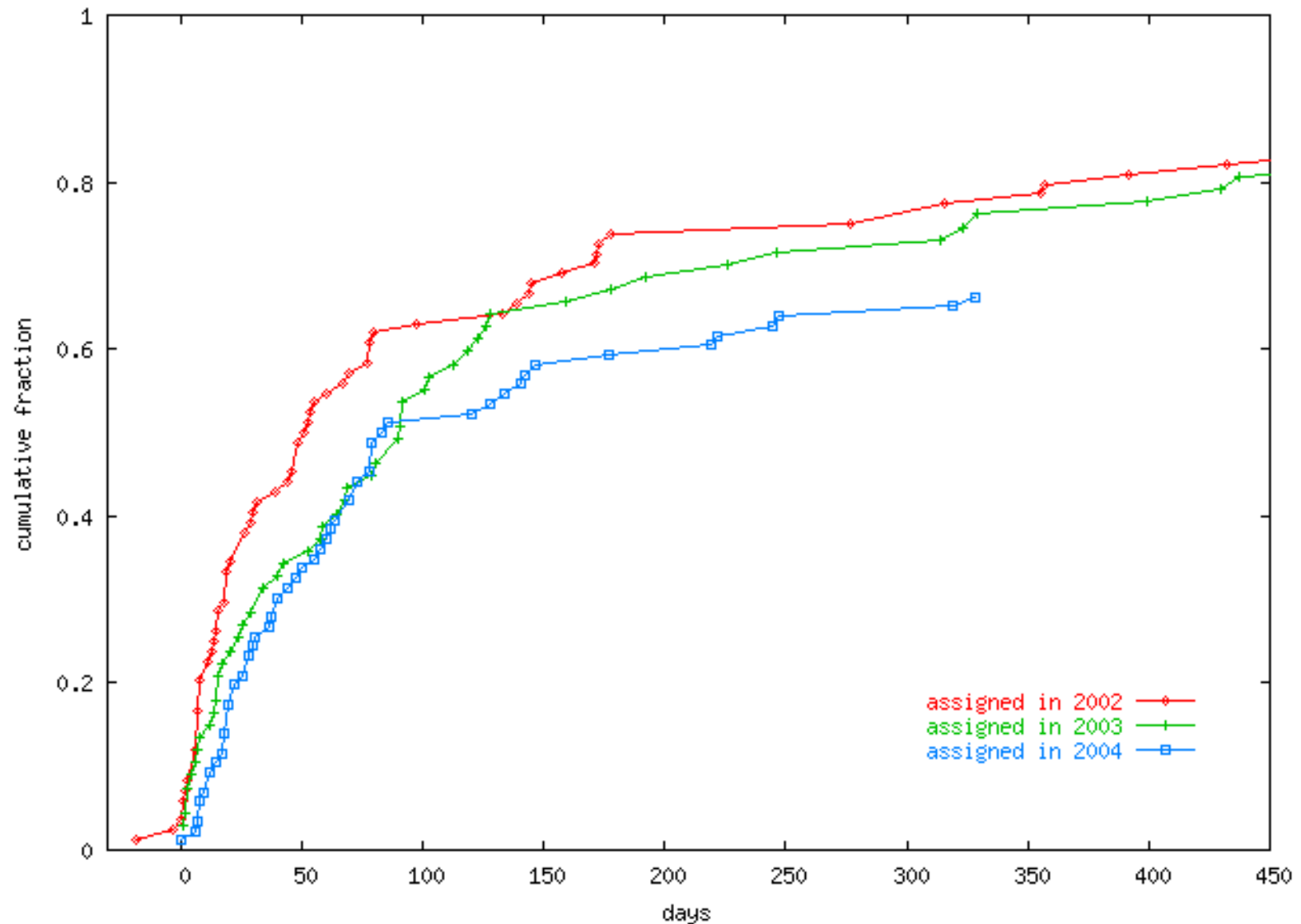
Activation delay - RIPE NCC assignments



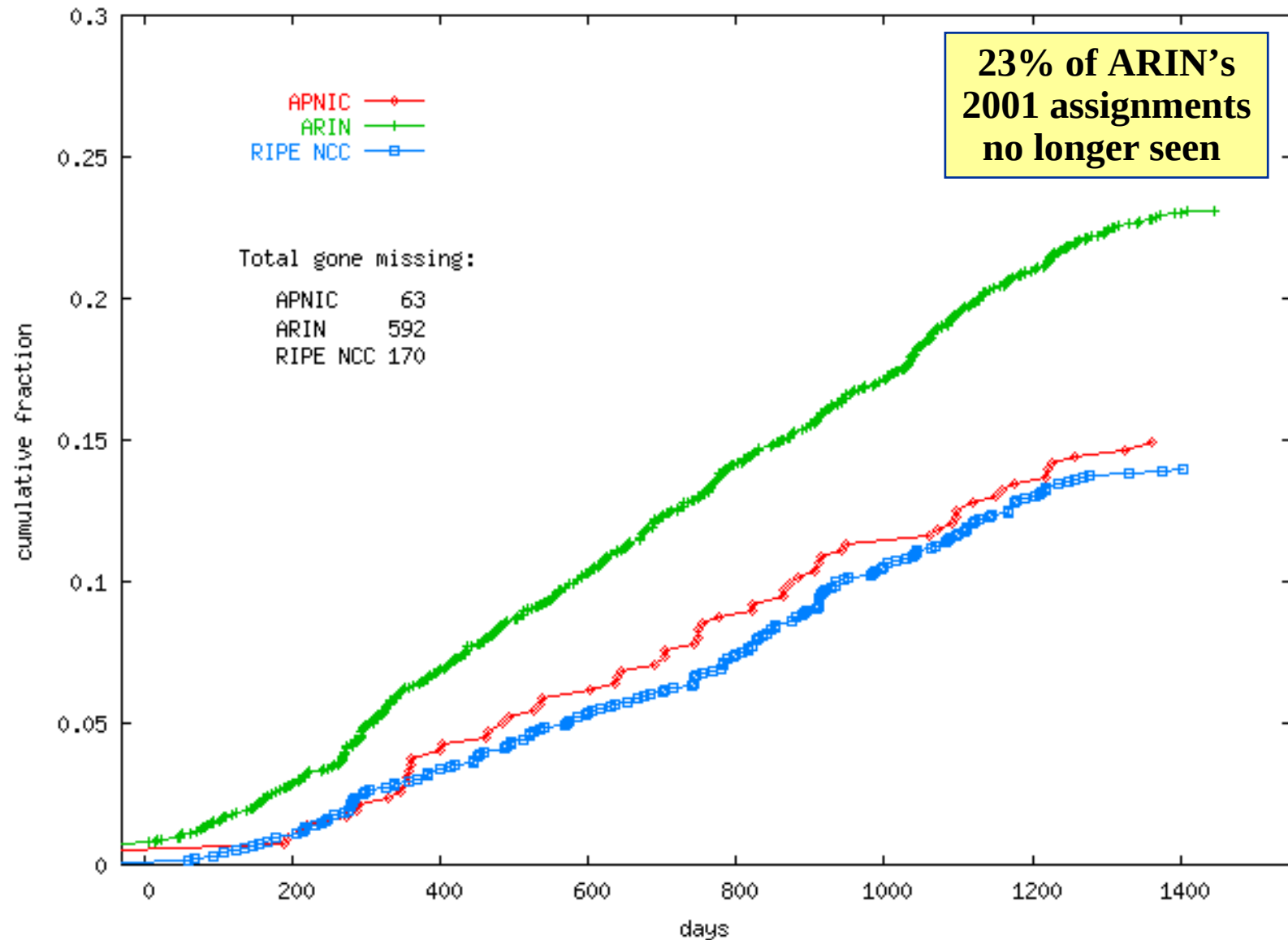
Activation delay - APNIC assignments



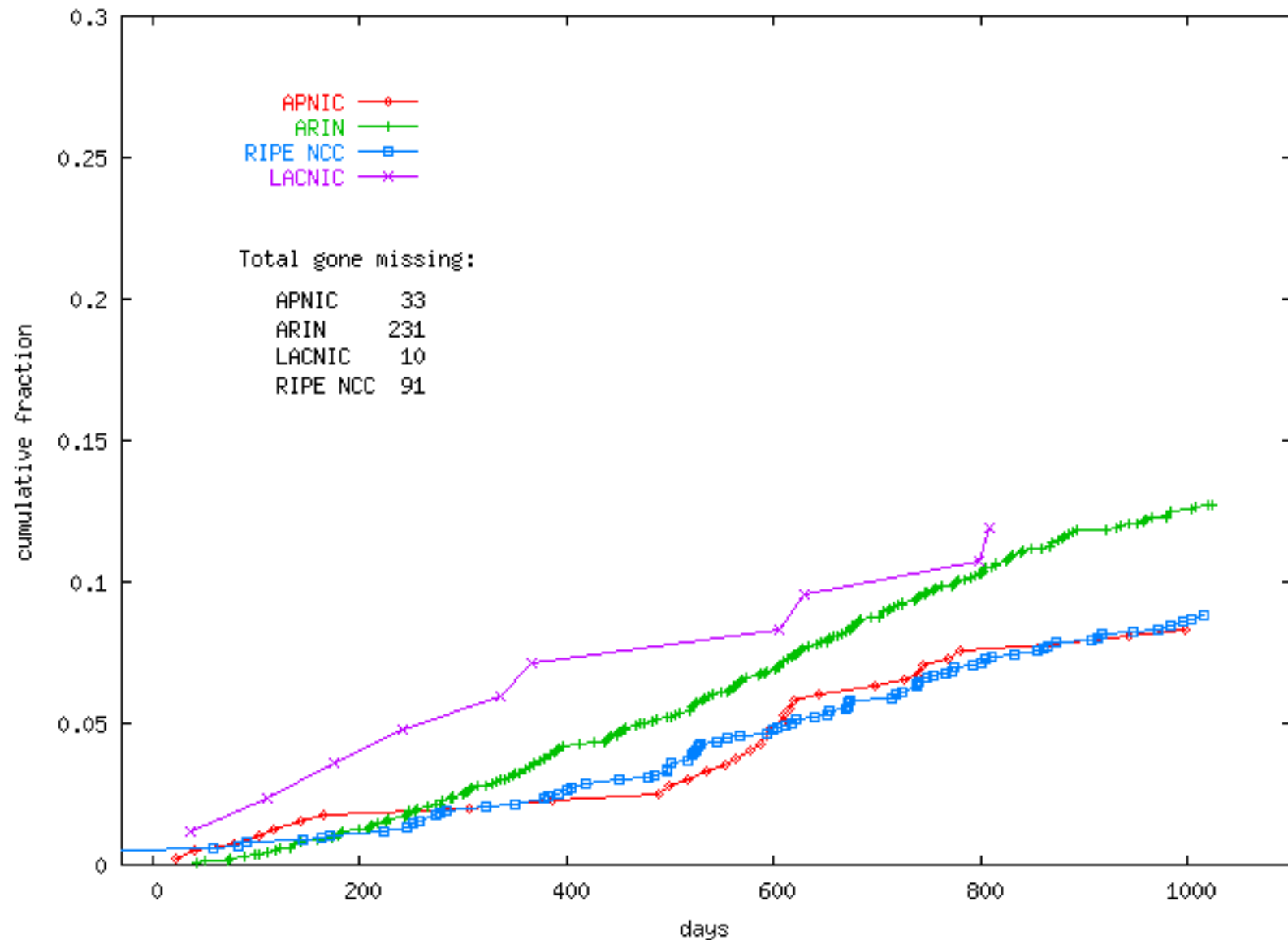
Activation delay - LACNIC assignments



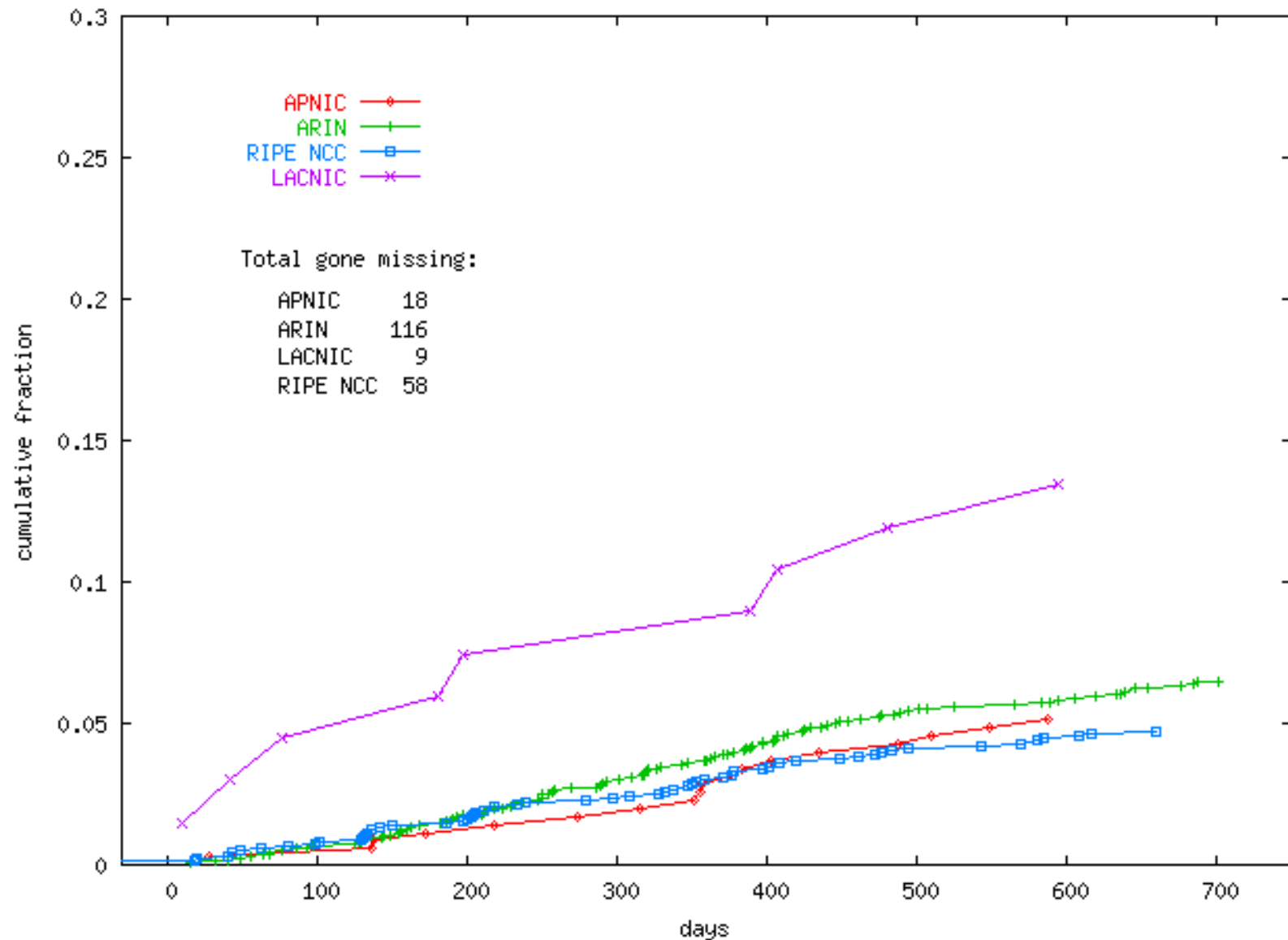
CDF of ASNs leaving RIS - 2001 assignments



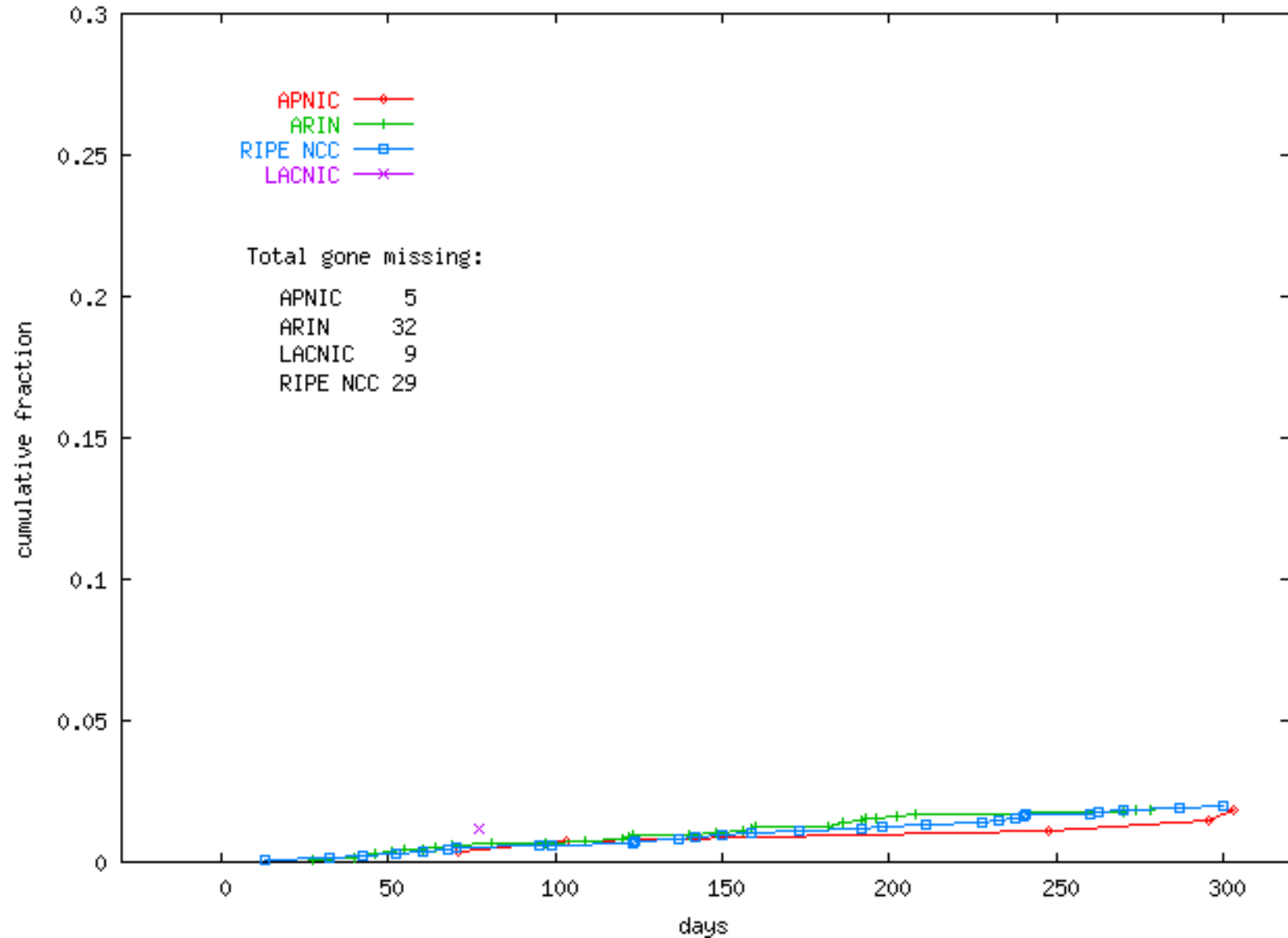
CDF of ASNs leaving RIS - 2002 assignments



CDF of ASNs leaving RIS - 2003 assignments



CDF of ASNs leaving RIS - 2004 assignments



Conclusions

- Comparing RIR and RIS statistics provides interesting views on dynamics of ASN usage
- Two classes of Missing in Action
 - ASNs once seen by RIS but stop being used
 - ASNs assigned by RIR but never seen by RIS
- Can take year(s) for assigned ASN to appear in RIS
- If current growth rate continues, ASNs could get scarce as early as 2013.



THE END