



AS Consumption Patterns

Routing SIG
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APNIC20, Hanoi, Vietnam

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AS Numbers

- The 16 bit AS number field in BGP has 64,510 available values to use in the Internet's public routing space
- Some 38,910 AS numbers have already been assigned by the RIRs – 25,600 remain in the unallocated number pool
- This number space will be exhausted at some point in the future

32 Bit AS Number Proposal

- Use a 32 bit field for this value
 - draft-ietf-idr-as4bytes-10.txt describes how
 - This is proposed for publication as Proposed Standard

Has been in draft state for some years. Awaiting implementation report of two implementations before proceeding to initial publication as a proposed Internet Standard



The Issue – Transition Planning

- At some point we will need to:
 - start testing various transition plans and vendor implementations,
 - set up a new AS number registry, and
 - commence deployment of these extended length protocol objects in BGP



When?

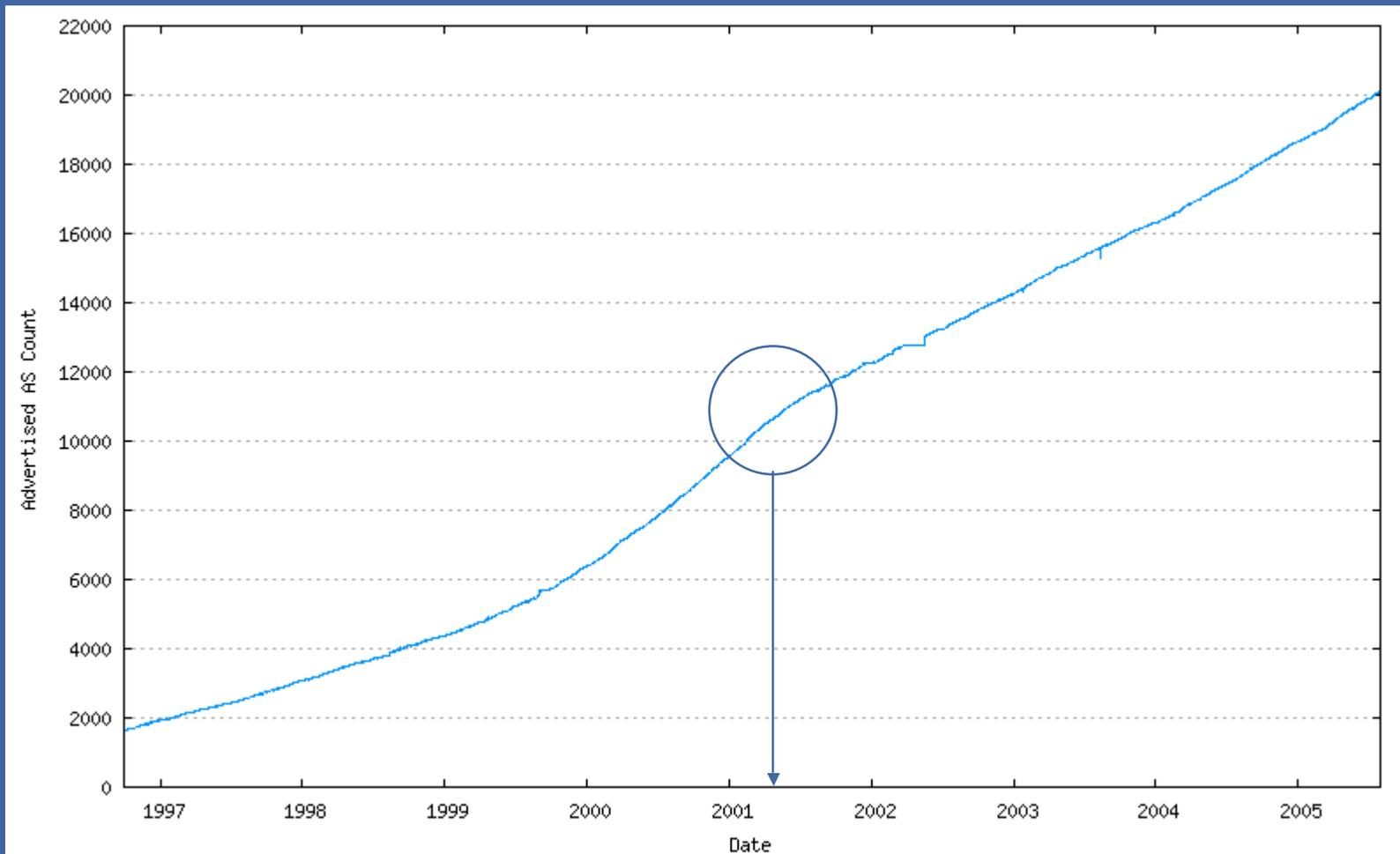
- Before we run completely out of 16 bit AS numbers
- Need to allow a lead time for testing, deployment of 4-byte AS BGP implementations and development of appropriate transition arrangements and open up the 4byte allocation registry
 - Allow some 3-4 years to undertake this work smoothly
- So we'd like to know when we have around 4 years to go before we run out of AS numbers

4 years before when?

- A number of views can be used to make forward projections:
 - The growth of the number of announced AS's in the BGP routing table
 - The rate at which AS number blocks are passed from IANA to the RIRs
 - The rate at which RIRs undertake assignments of As's to LIRs and end users

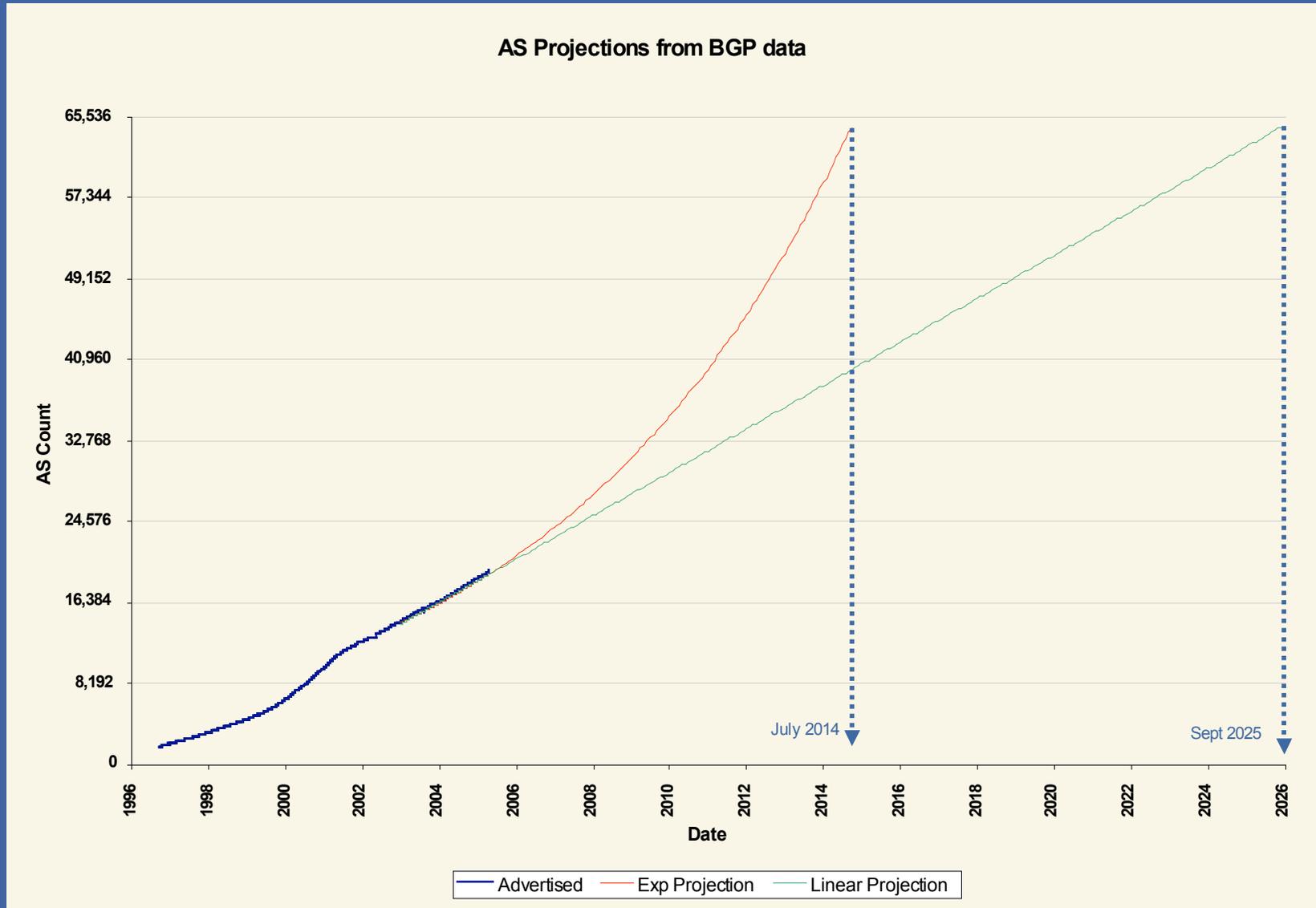


The BGP Routing Table: Announced AS's



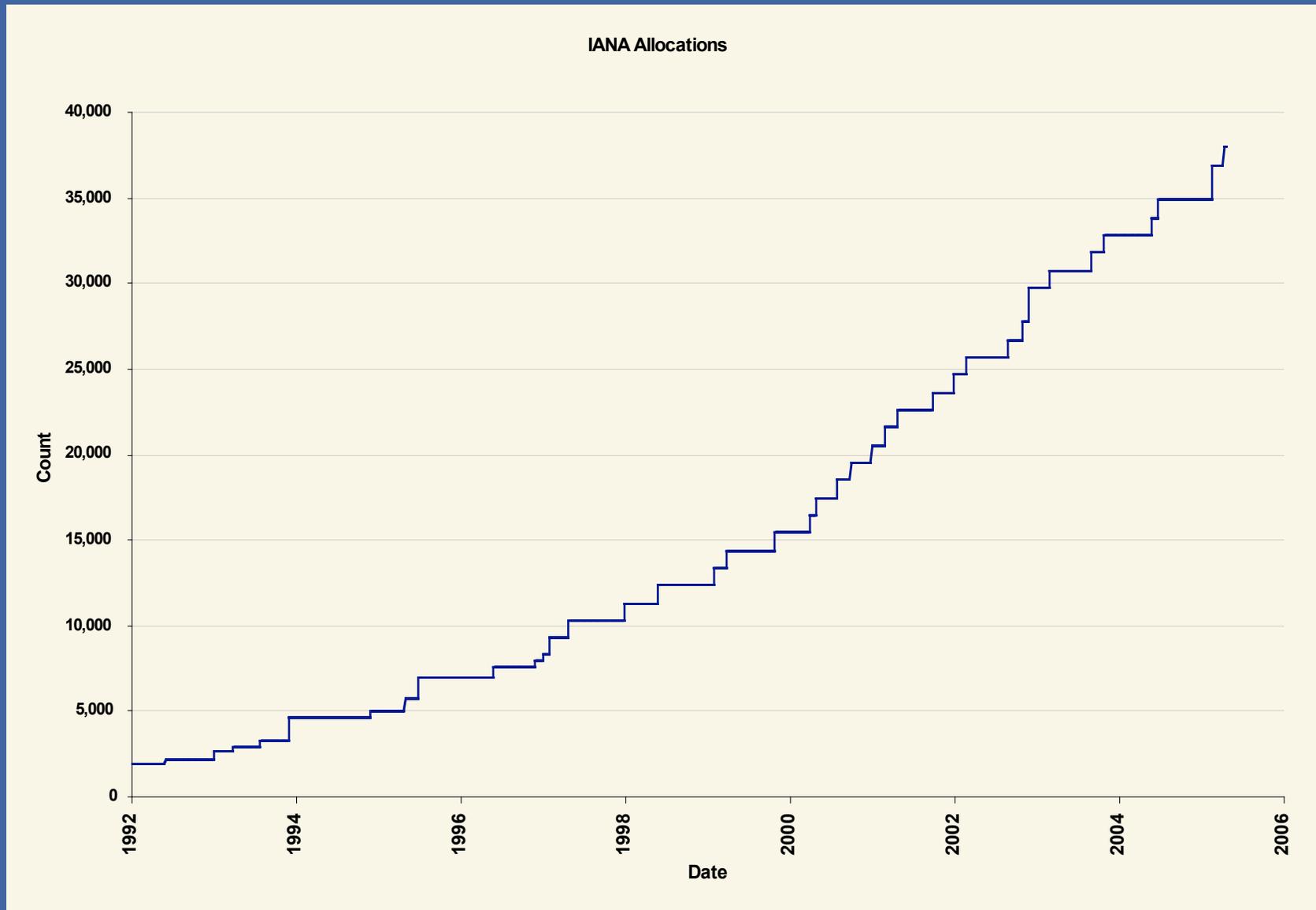


The BGP Routing Table: Growth Projections



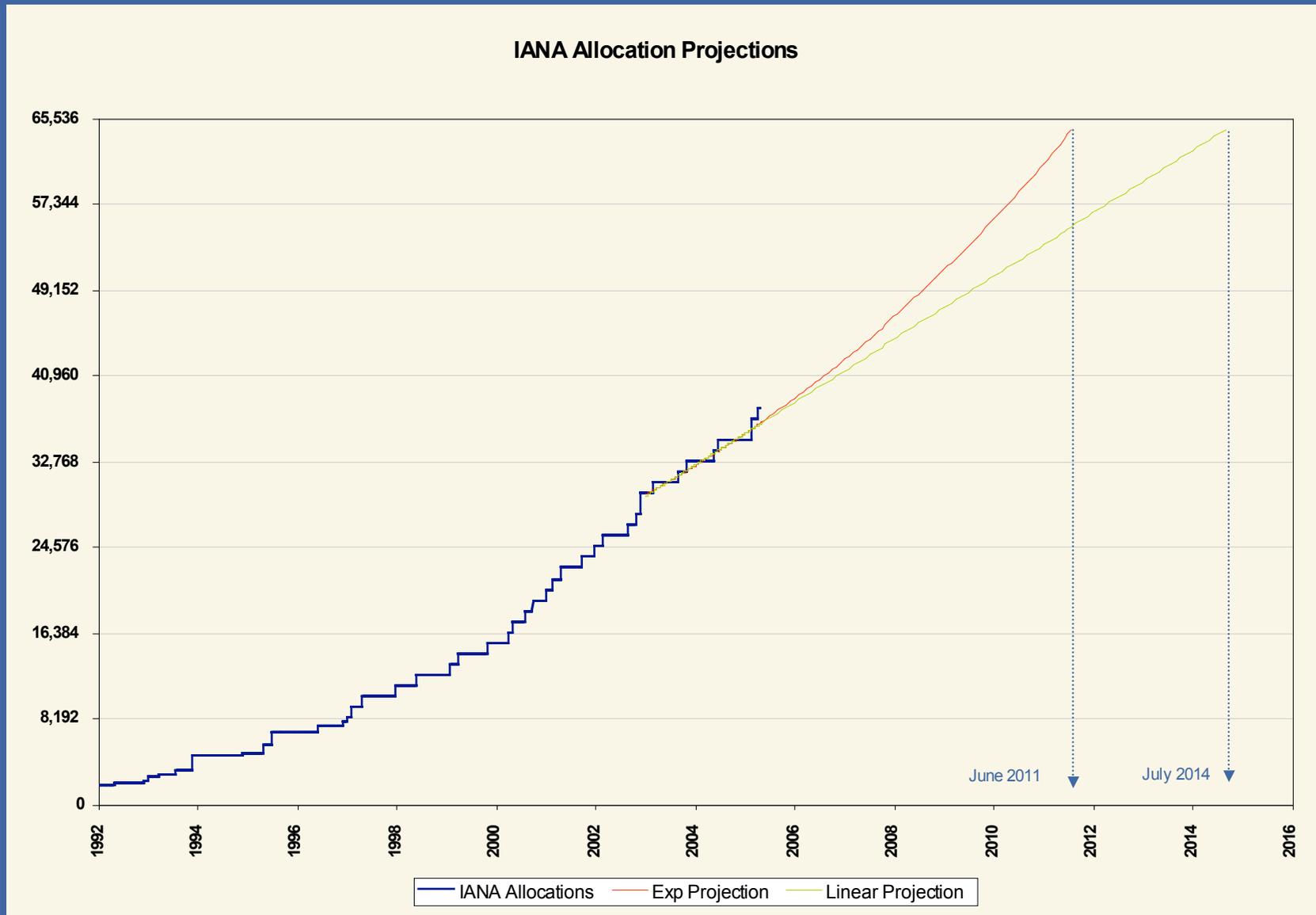


IANA AS block allocations to RIRs



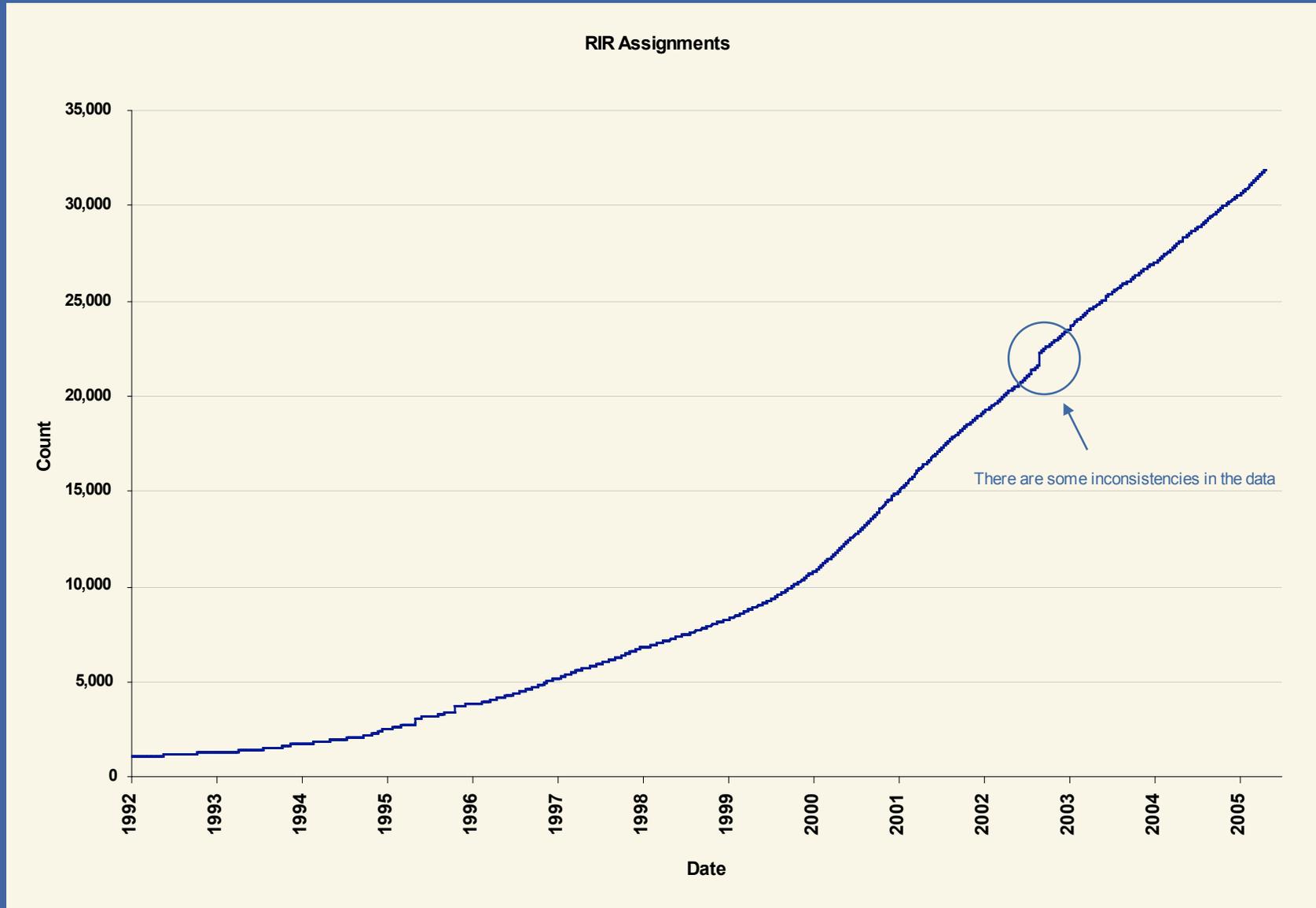


IANA AS Allocation Projection



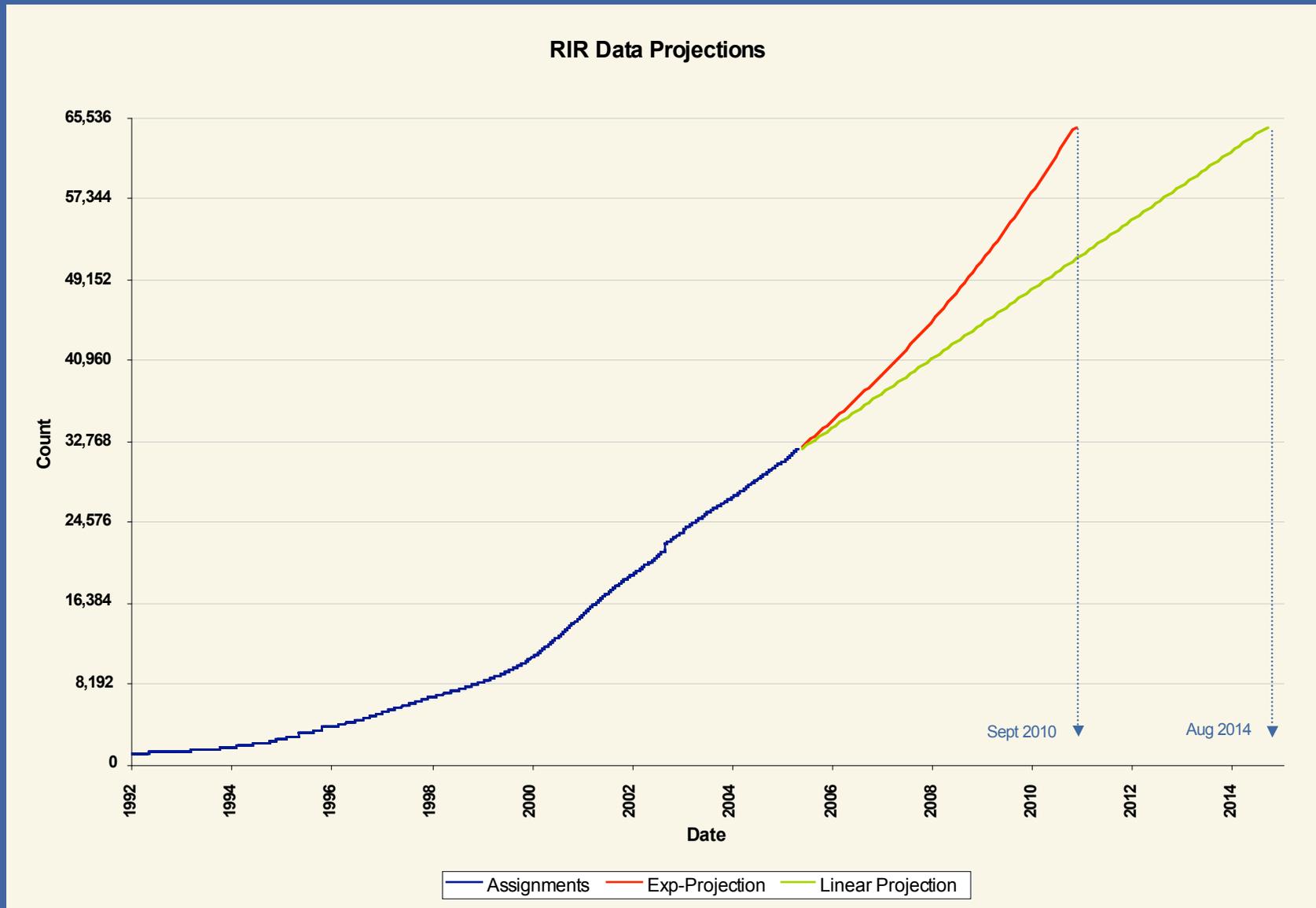


RIR Assignments



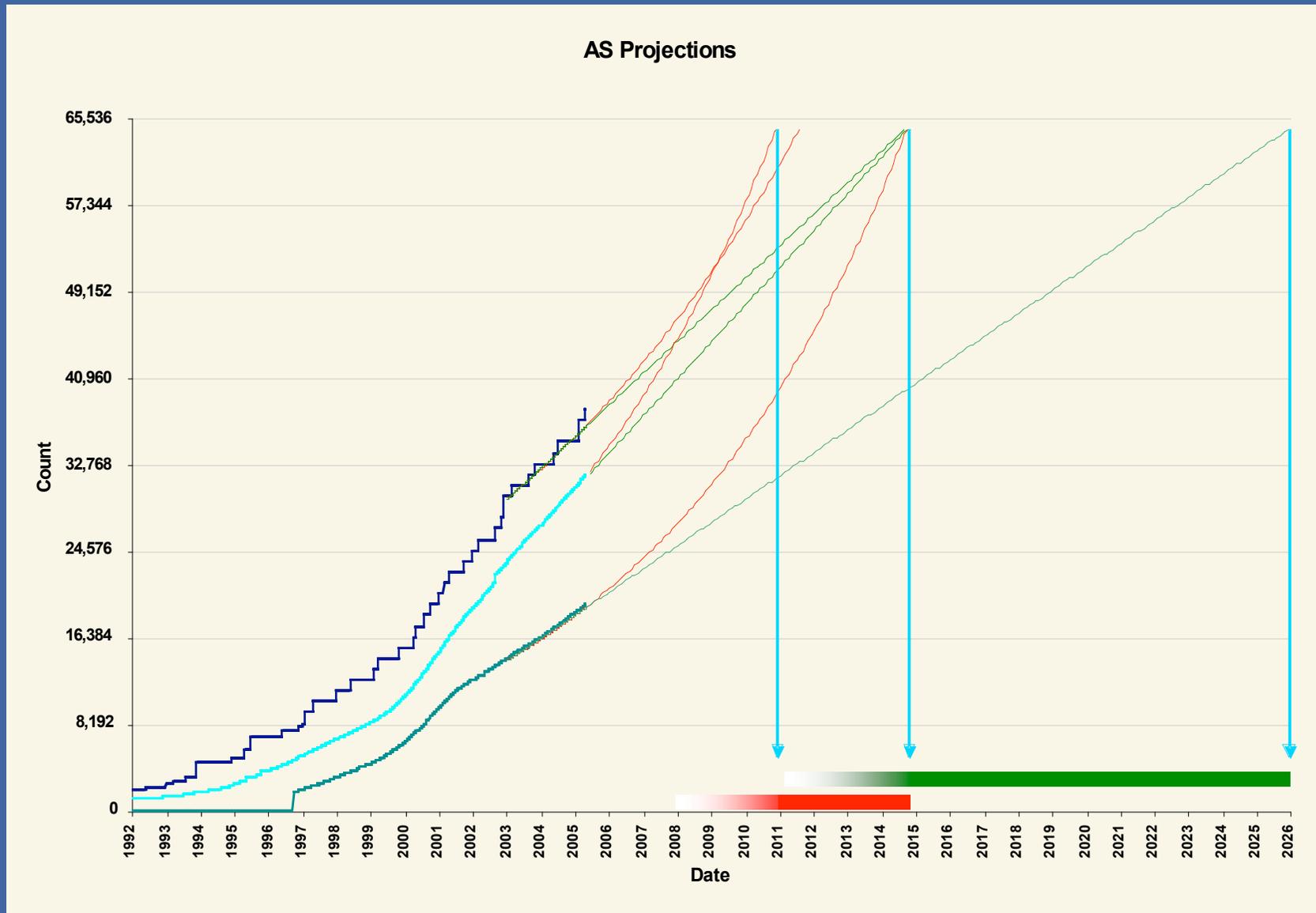


RIR Allocation Projection



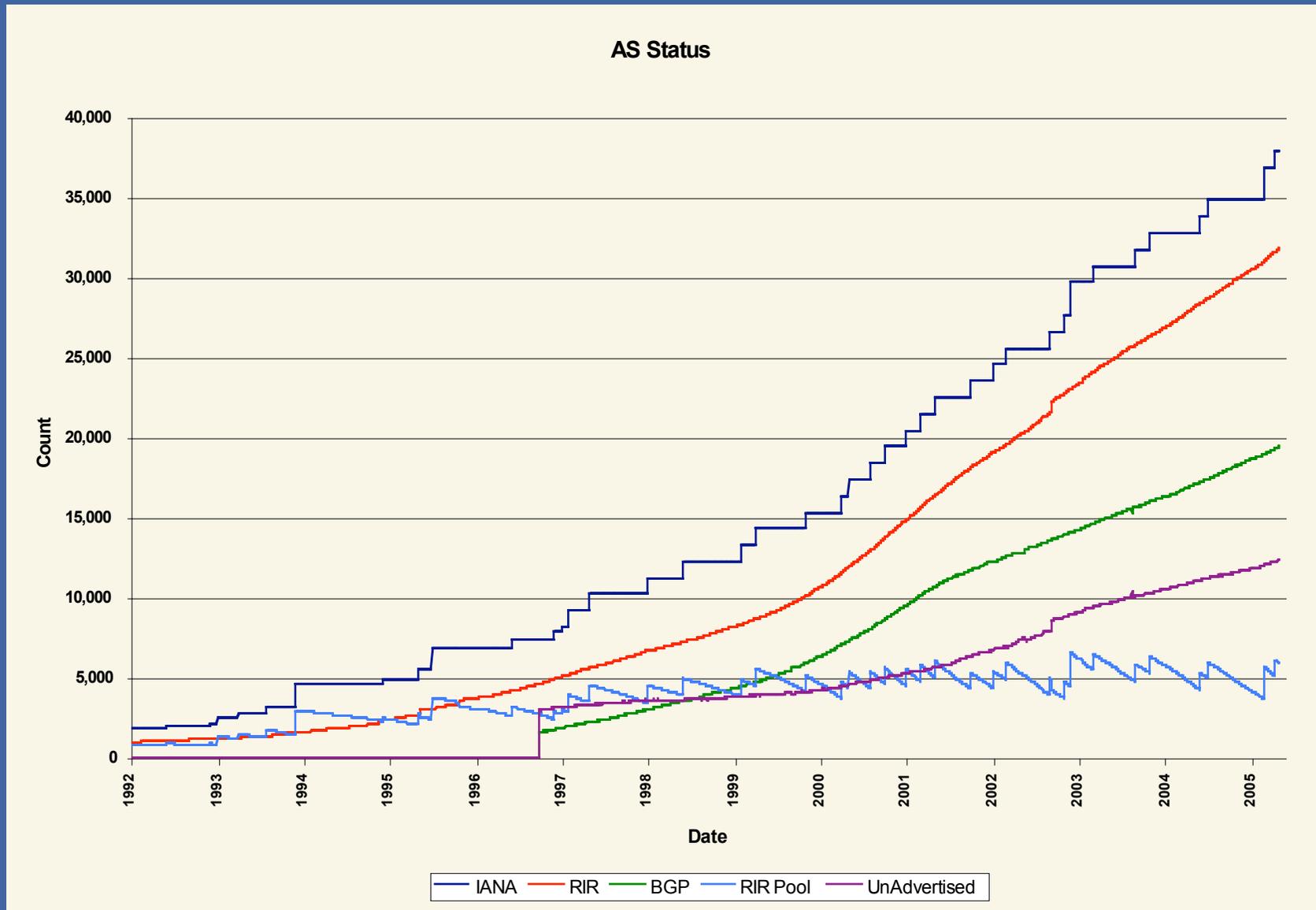


Combining these views





Combined View + Differences



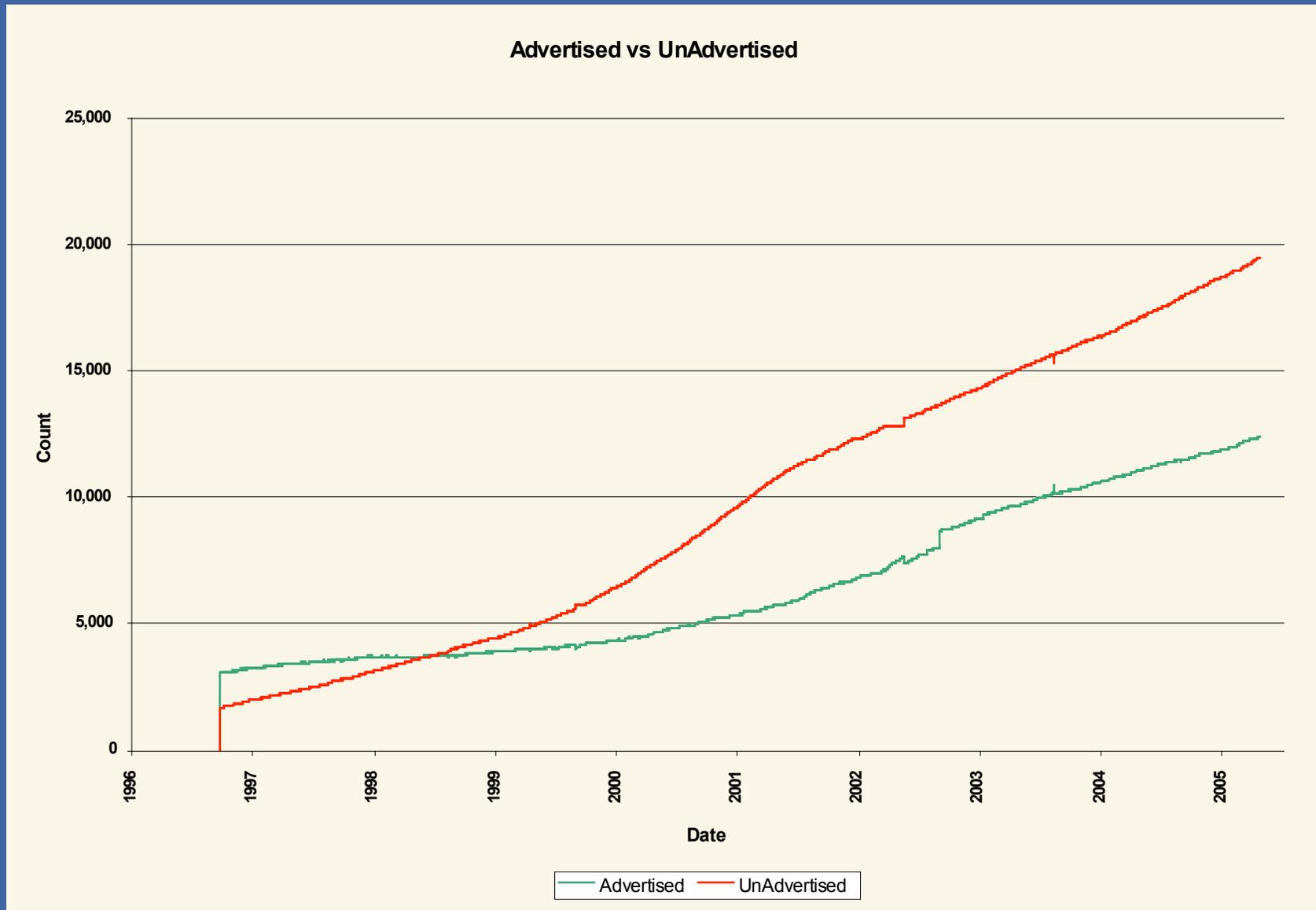


Observations

- RIRs operate with an allocation buffer of an average of 5,000 numbers
- 12,348 AS numbers (39% of the assigned AS numbers) are not announced in the BGP table.
 - Is this the result of old AS assignments falling into disuse?
 - Or recent AS assignments being hoarded?
 - This pool creates uncertainty in AS number pool exhaustion predictions

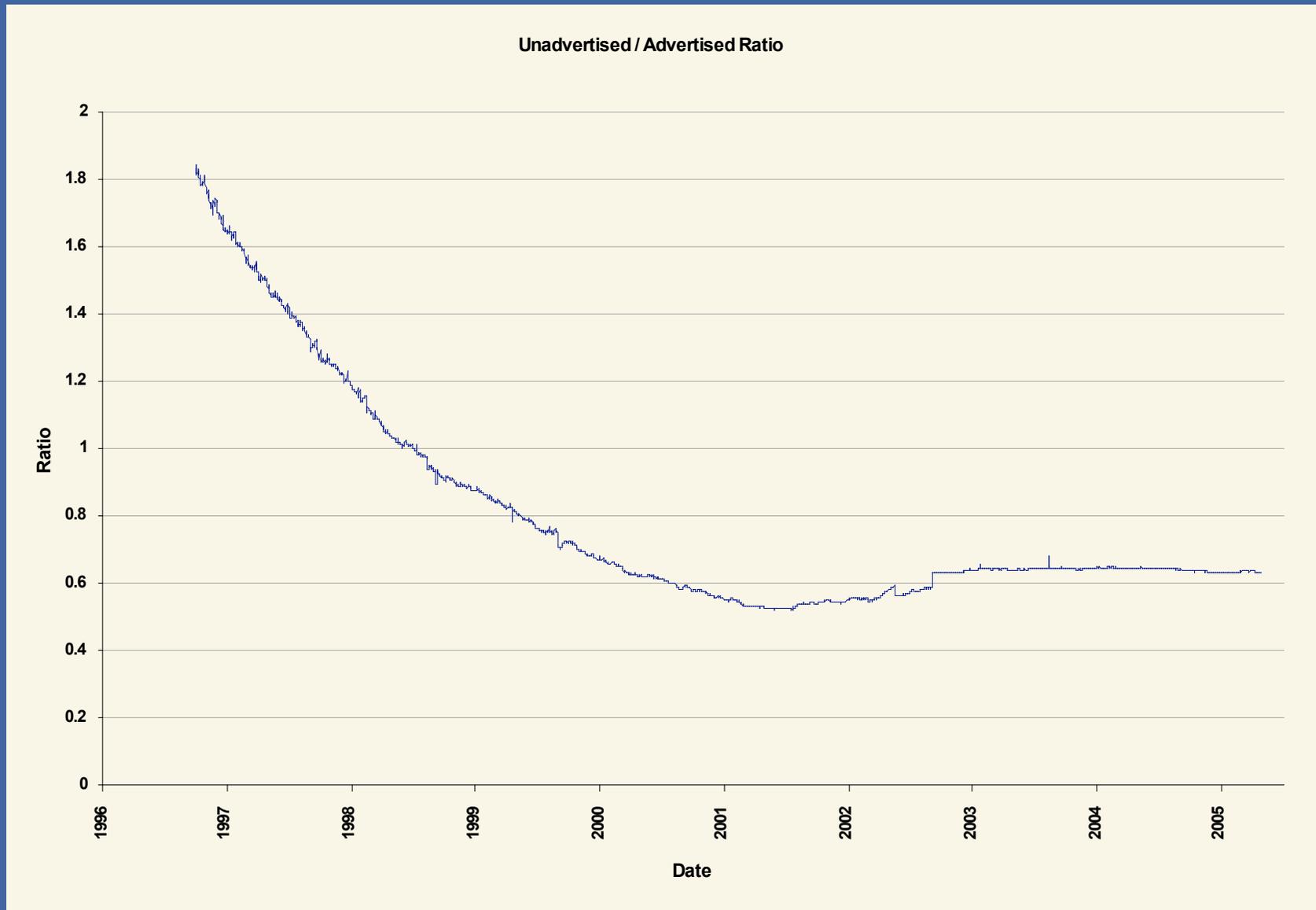


UnAdvertised and Advertised ASes



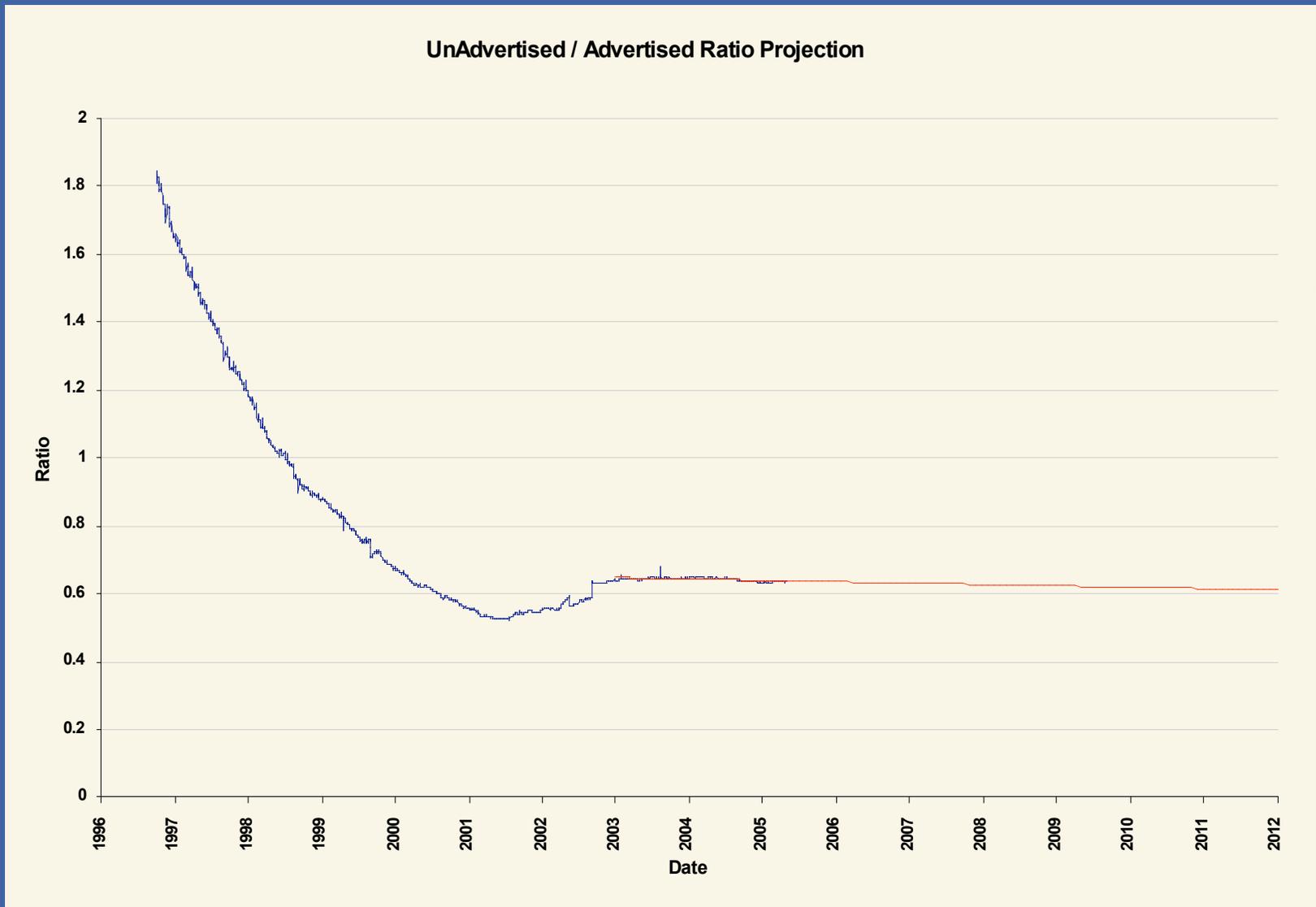


UnAdvertised : Advertised ASes



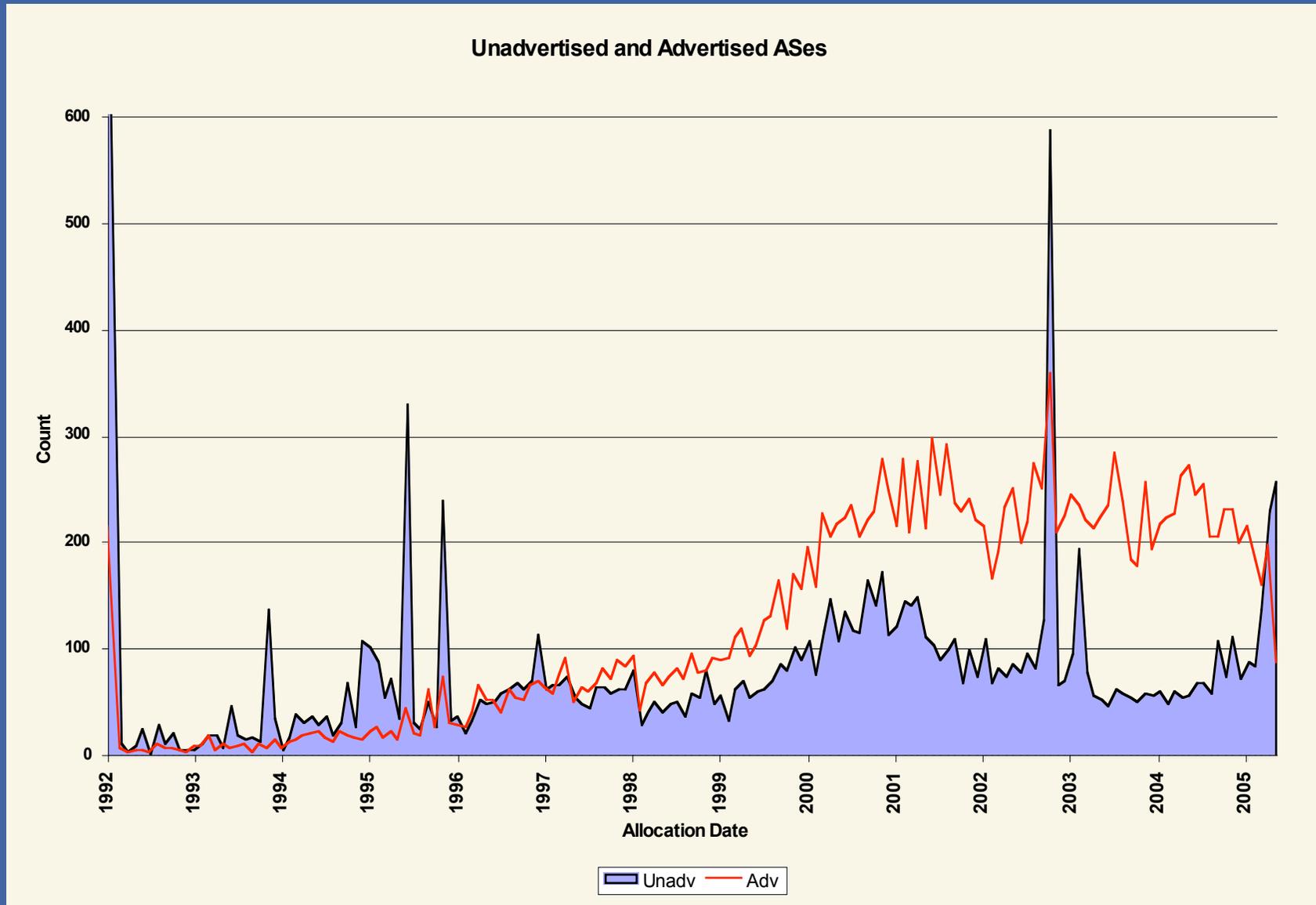


Trend: UnAdvertised : Advertised Ratio



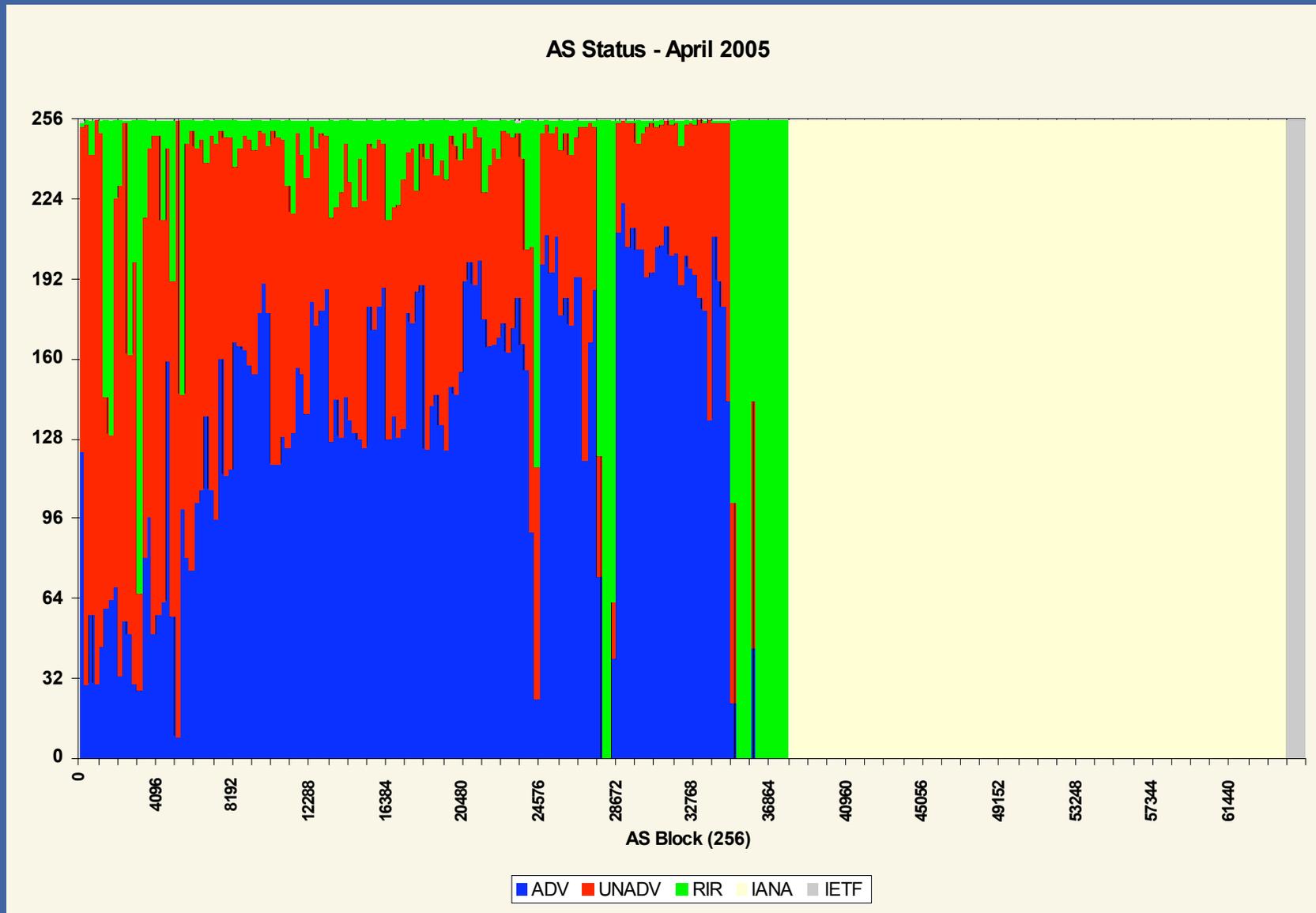


UnAdvertised / Advertised Distribution by Date



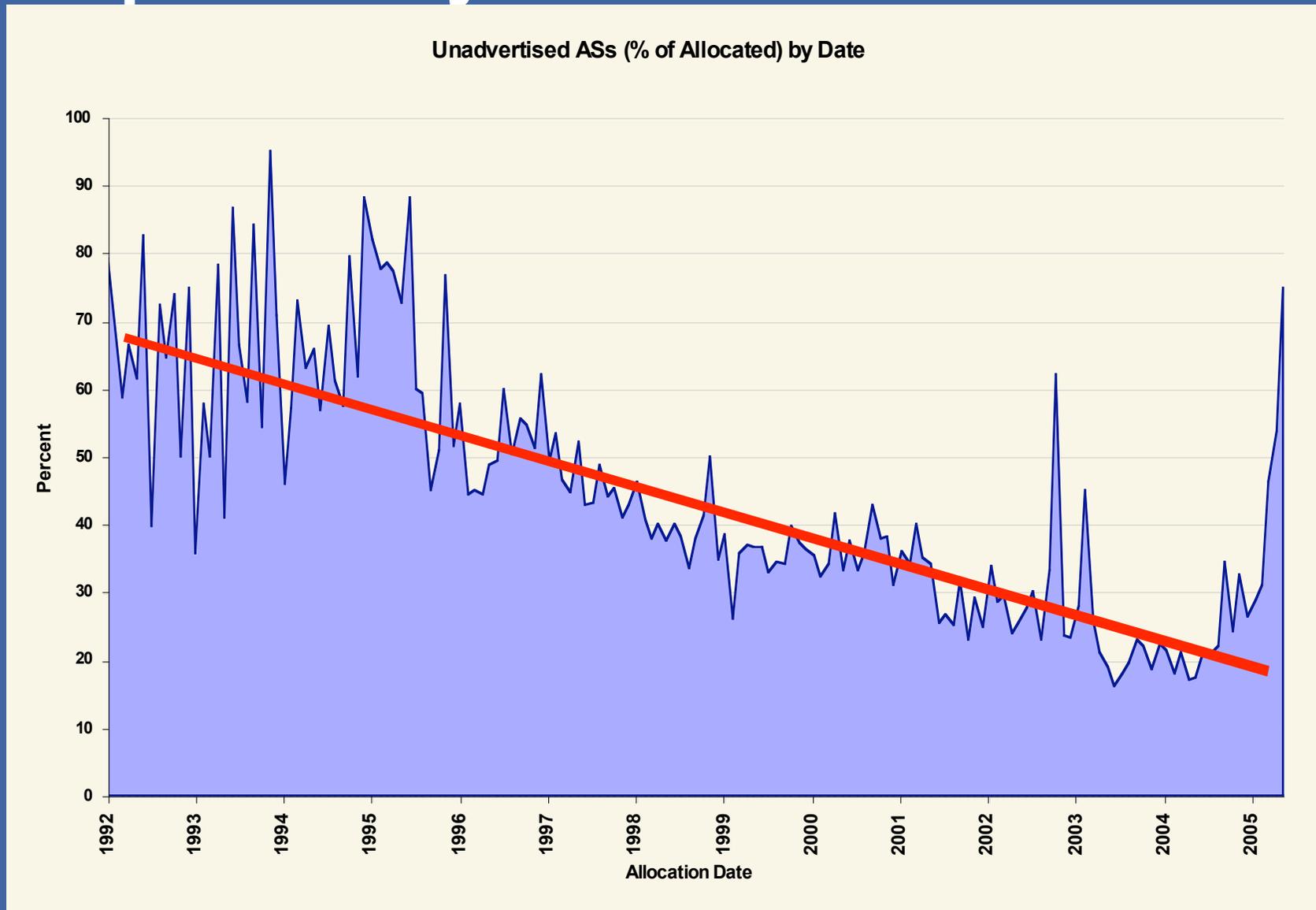


Distribution by AS Number Range





UnAdvertised / Advertised Relative Proportion by Date



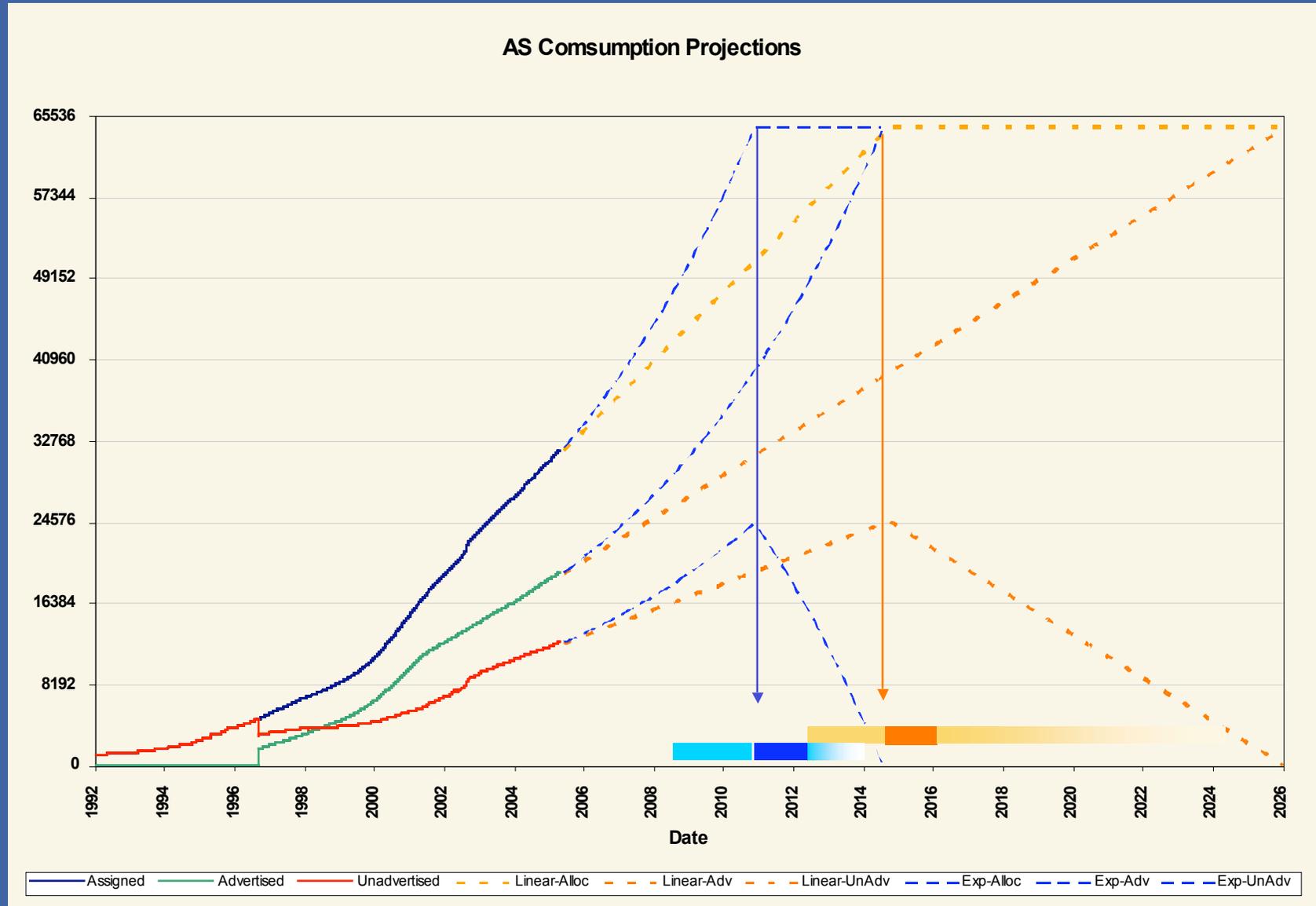


Observations

- AS numbers age out and disappear
 - 5% attrition rate per year
- Old (low) AS number ranges have the highest unannounced / announced ratios
- Recent assignments take some 4 months to be advertised
 - LIR staging point factors
- Projections of AS number consumption should include a factor for Unadvertised / Advertised ratio that has a linear best fit (negative slope)



Combining Allocation and Advertised AS Data Projections

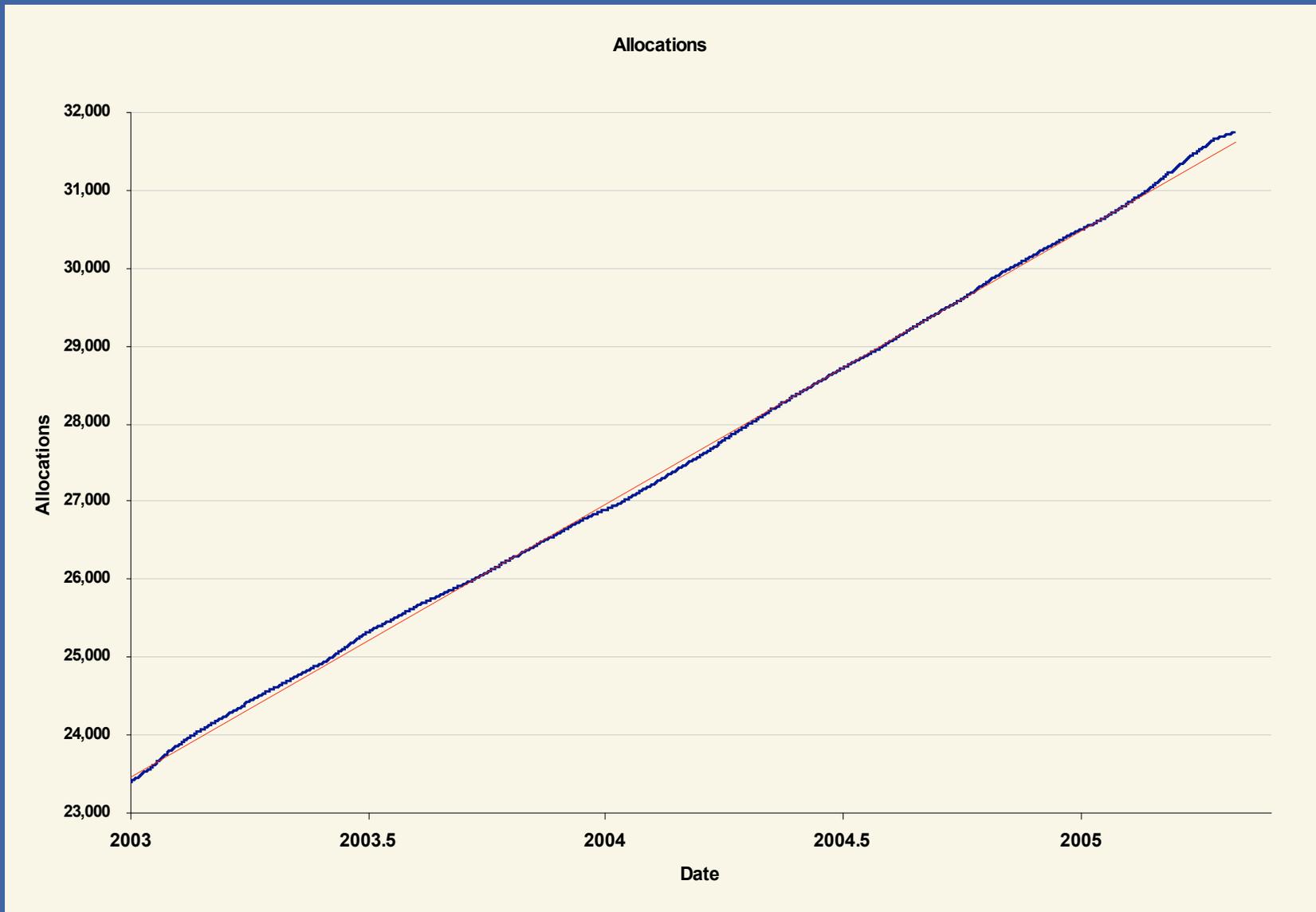


Selecting a best fit to the data

- A Linear growth model will have a constant first order differential
- An exponential growth model will have a linear best fit to the log of the data
- The data set for the best fit is to a smoothed (moving average) time series of the cumulative sum of RIR AS allocations

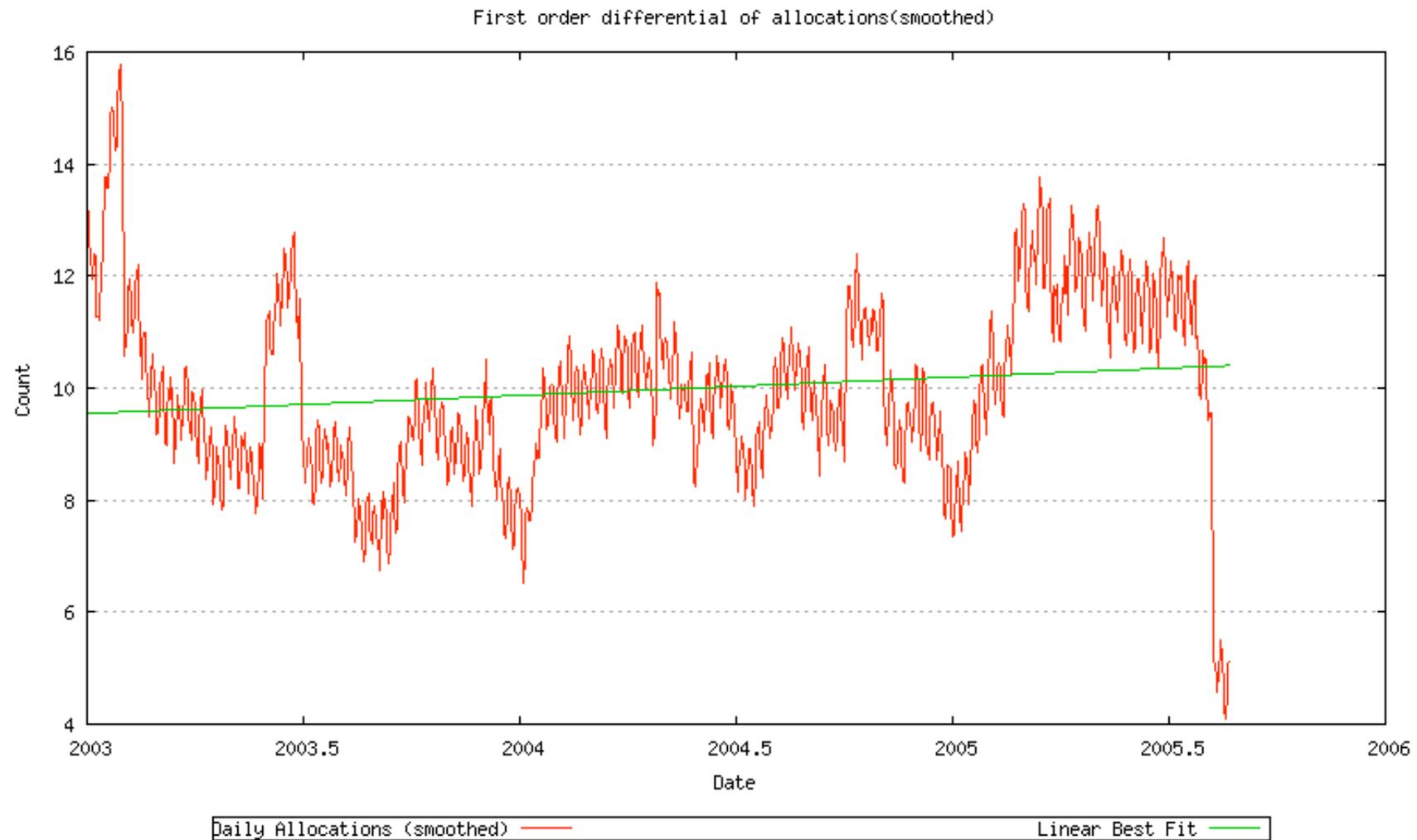


Linear Model fit

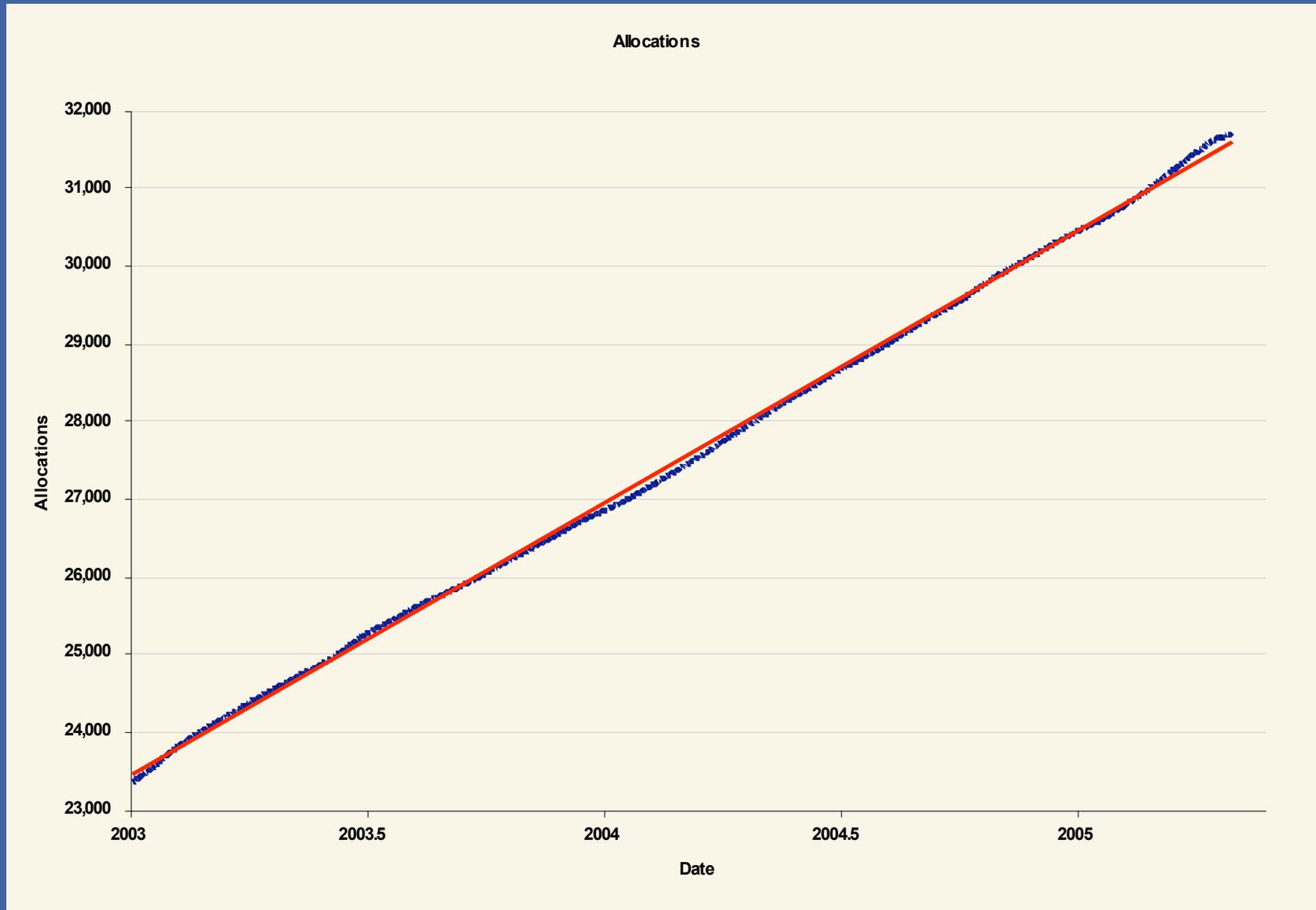




Linear Model fit

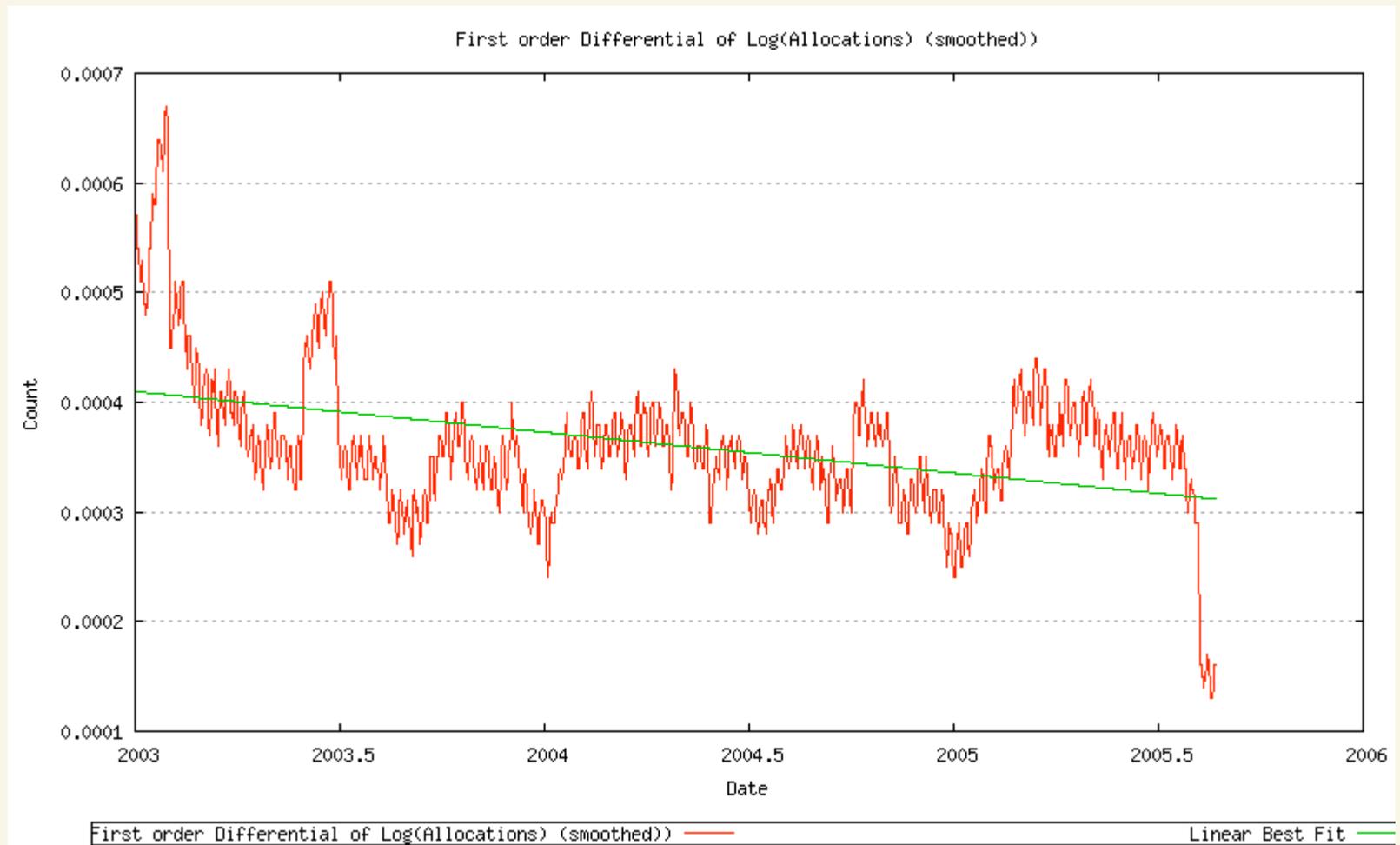


Exponential Model fit





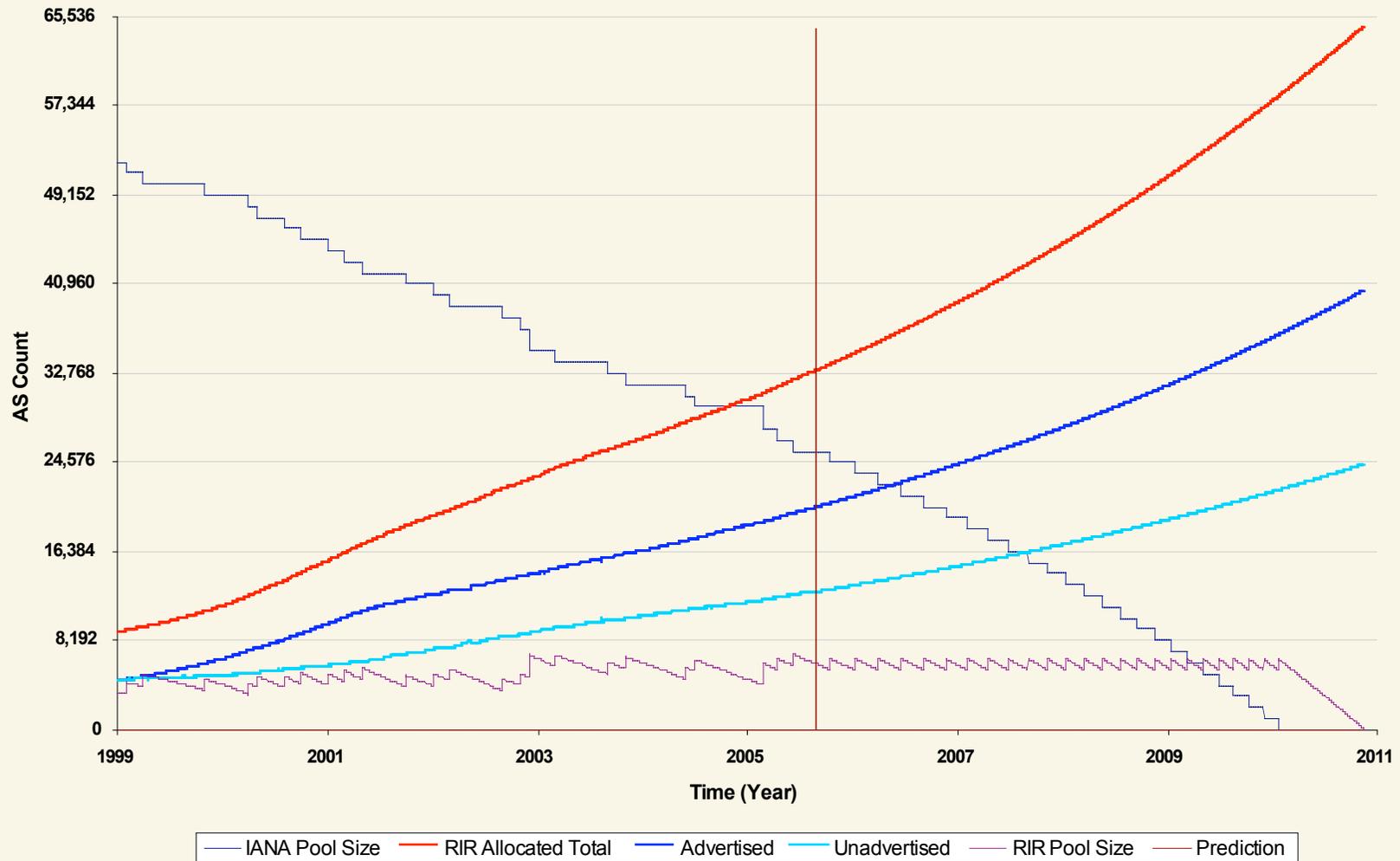
Exponential Model fit





AS Consumption Prediction

AS Consumption Model



Current AS Use Projections

- The available AS number pool will exhaust in the timeframe of late 2010 if current AS use trends continue
 - No significant reclamation in old AS number space
 - No coordinated effort to increase utilization density of AS numbers
 - Increasing consumption trend



Planning considerations (again)

- Need to allow a lead time for testing, deployment of 4-byte AS BGP implementations and development and testing of appropriate transition arrangements
 - Allow some 3-4 years to undertake this smoothly
- So we'd like to know when we have around 4 years to go before we run out of AS numbers
- In the most likely consumption projection that advance planning date looks like being in 2006



Questions?

Thank you