

# 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 39,934 AS numbers have already been assigned by the RIRs – 24,576 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
  - Existing BGP speakers do not need to change immediately
  - BGP speakers in AS's using 4-Byte ASNs will need to deploy “4-Byte BGP”

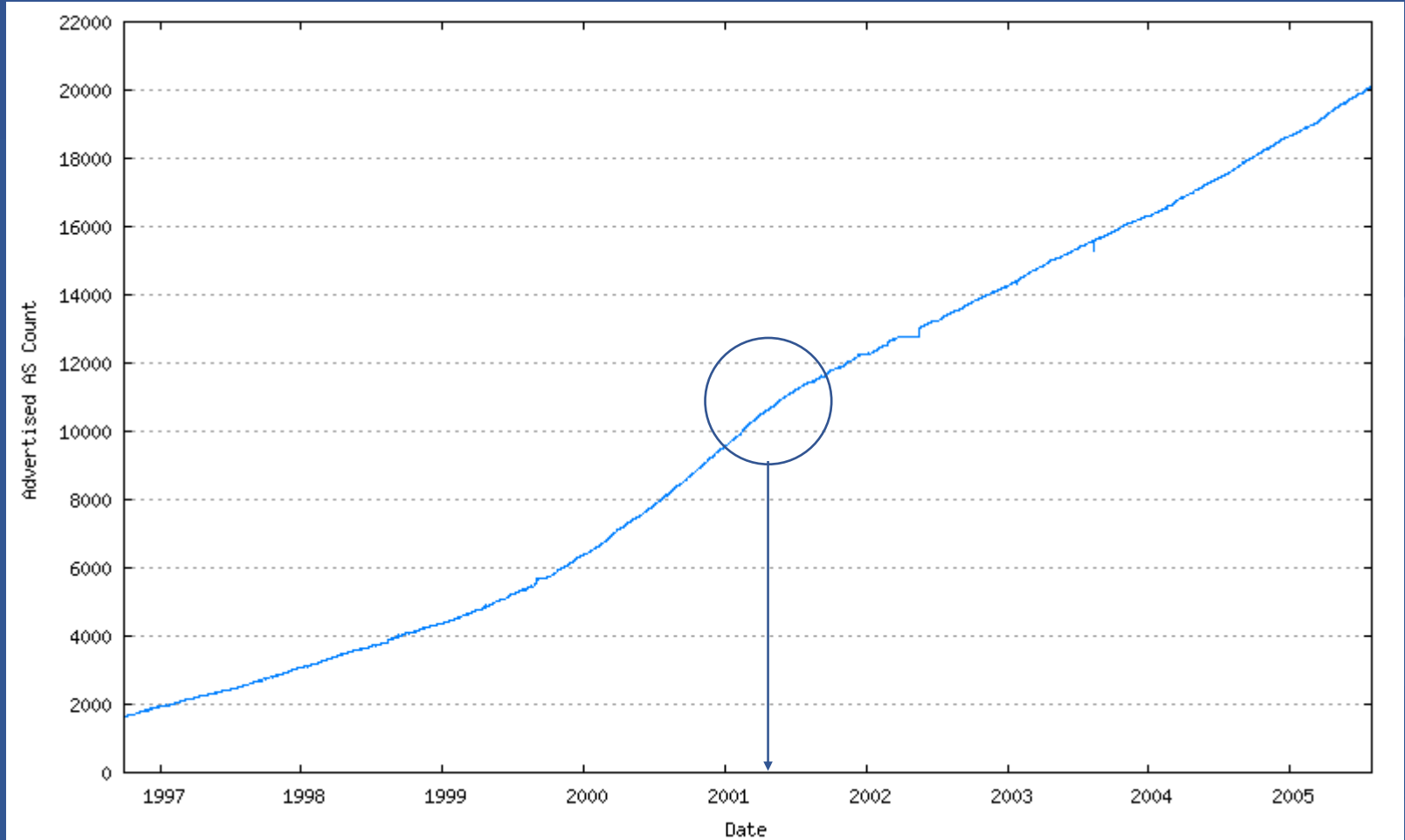
# When?

- 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

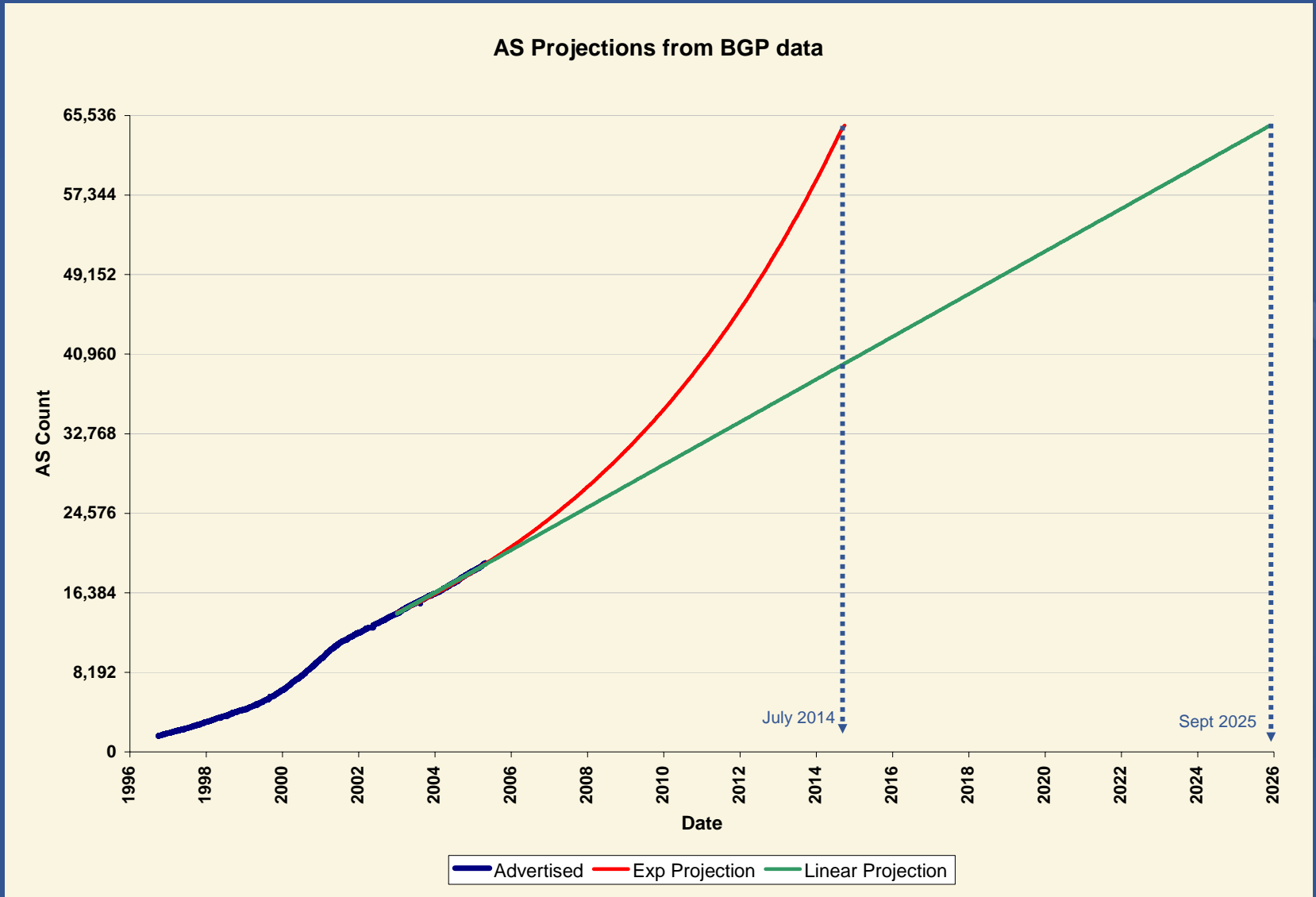
# 4 years before when?

- 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



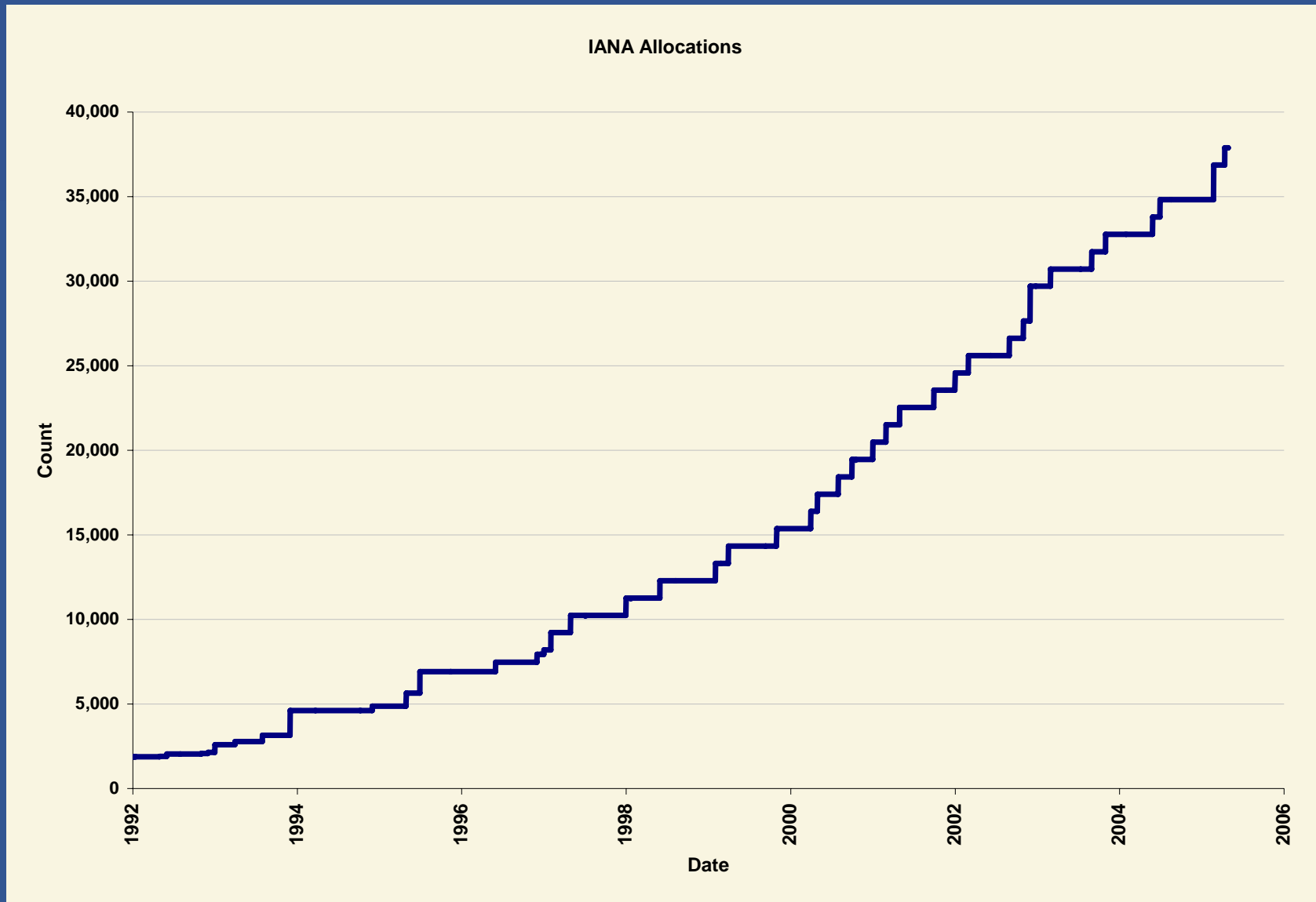
# The BGP Routing Table: Growth Projections



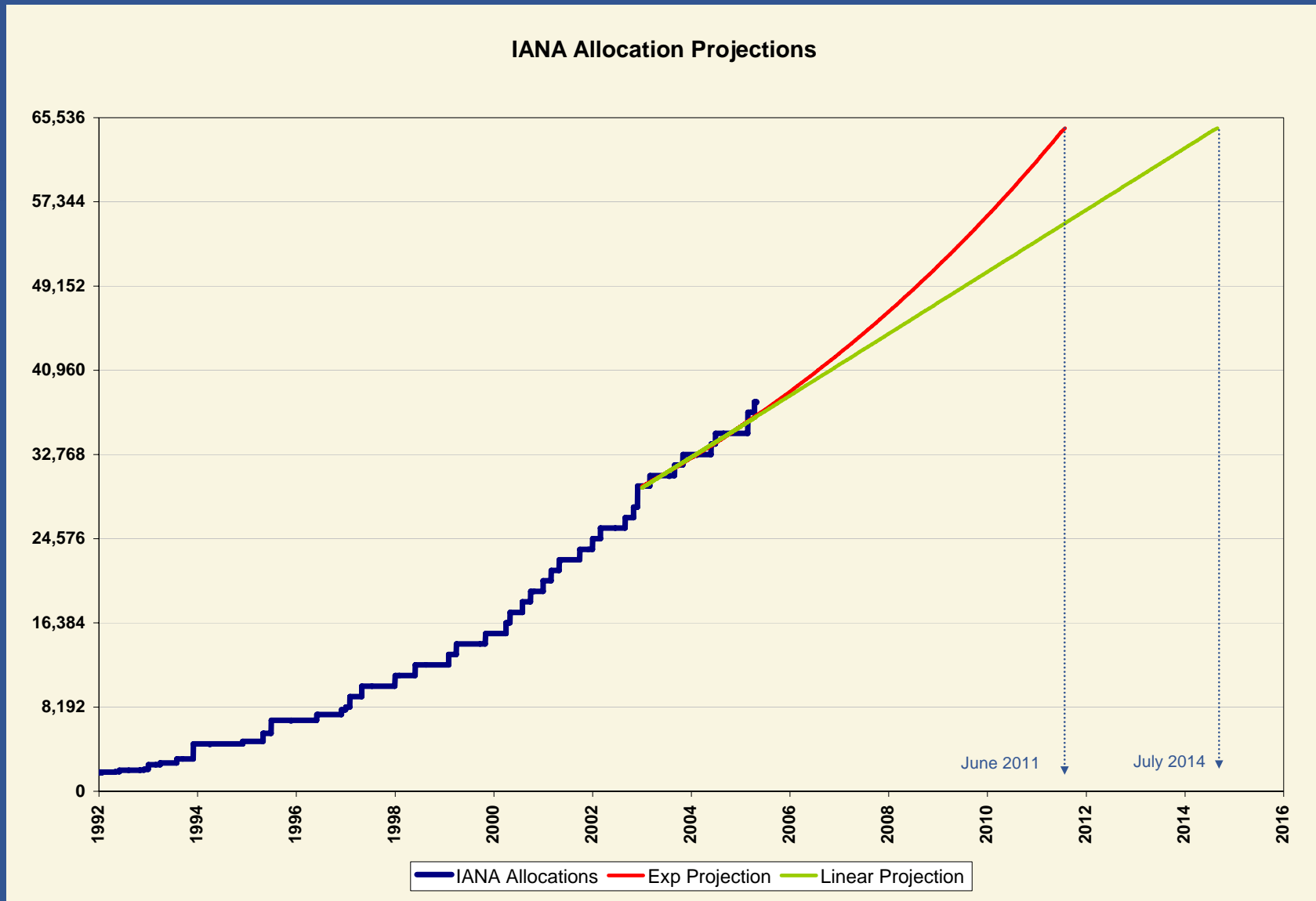




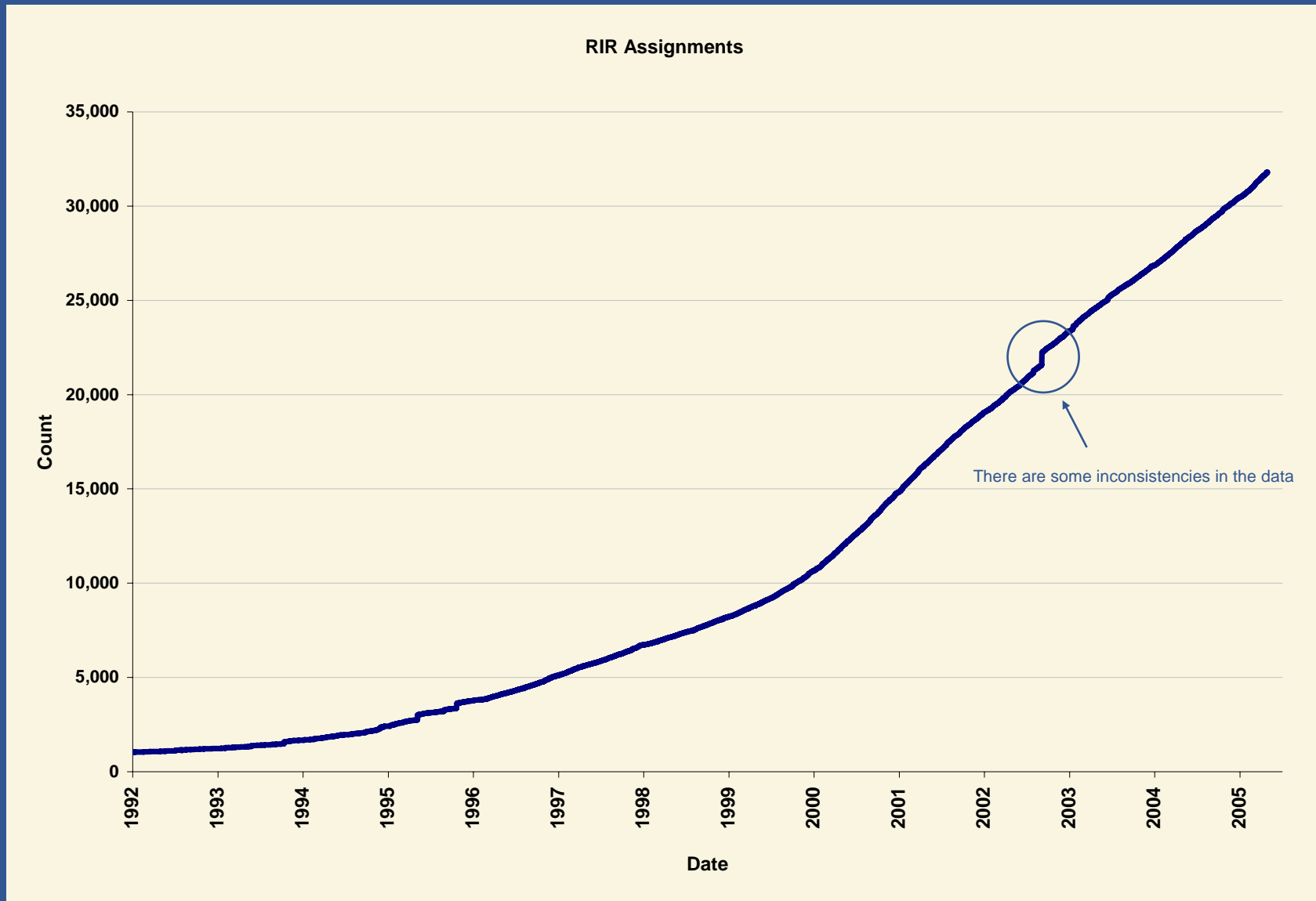
# IANA AS block allocations to RIRs



# IANA AS Allocation Projection

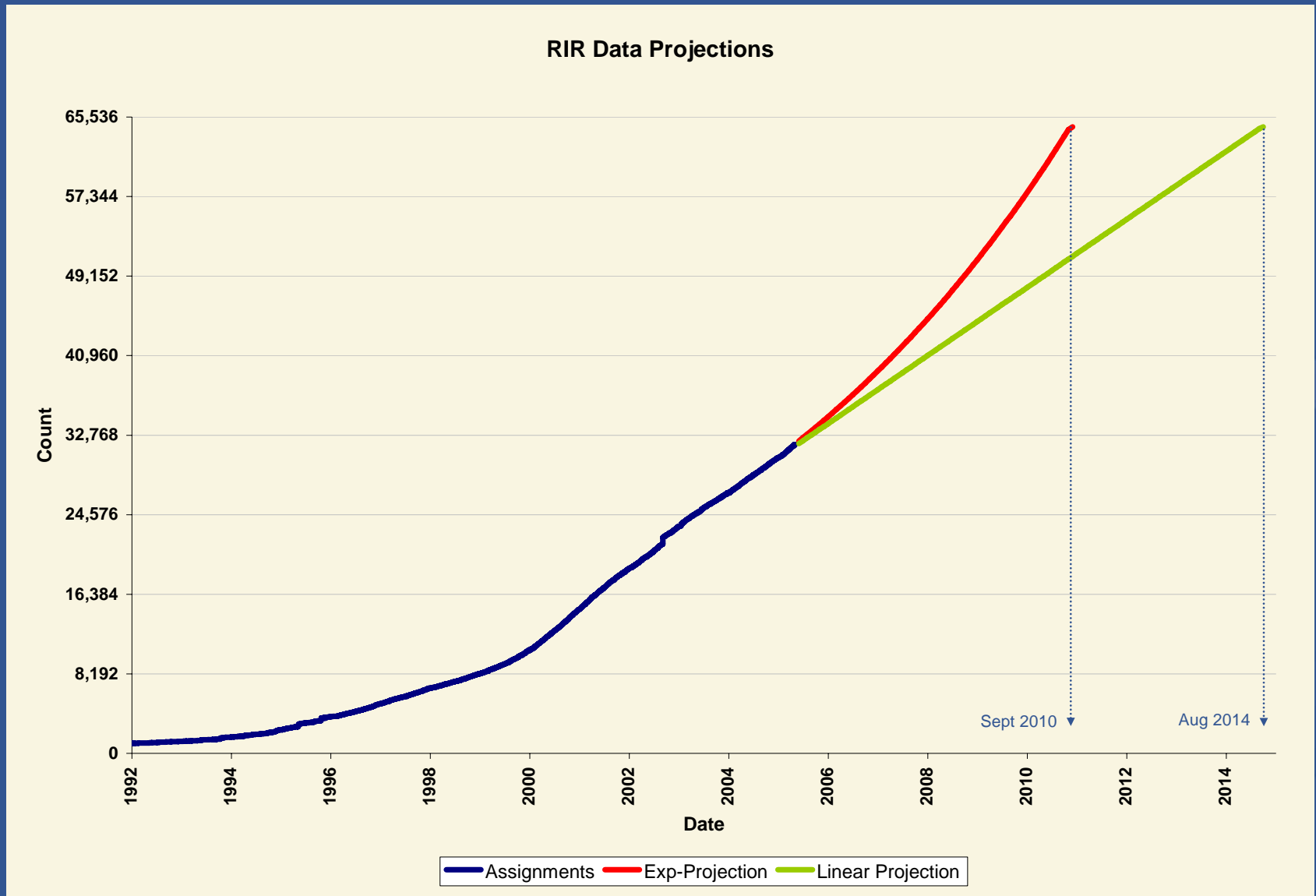


# RIR Assignments

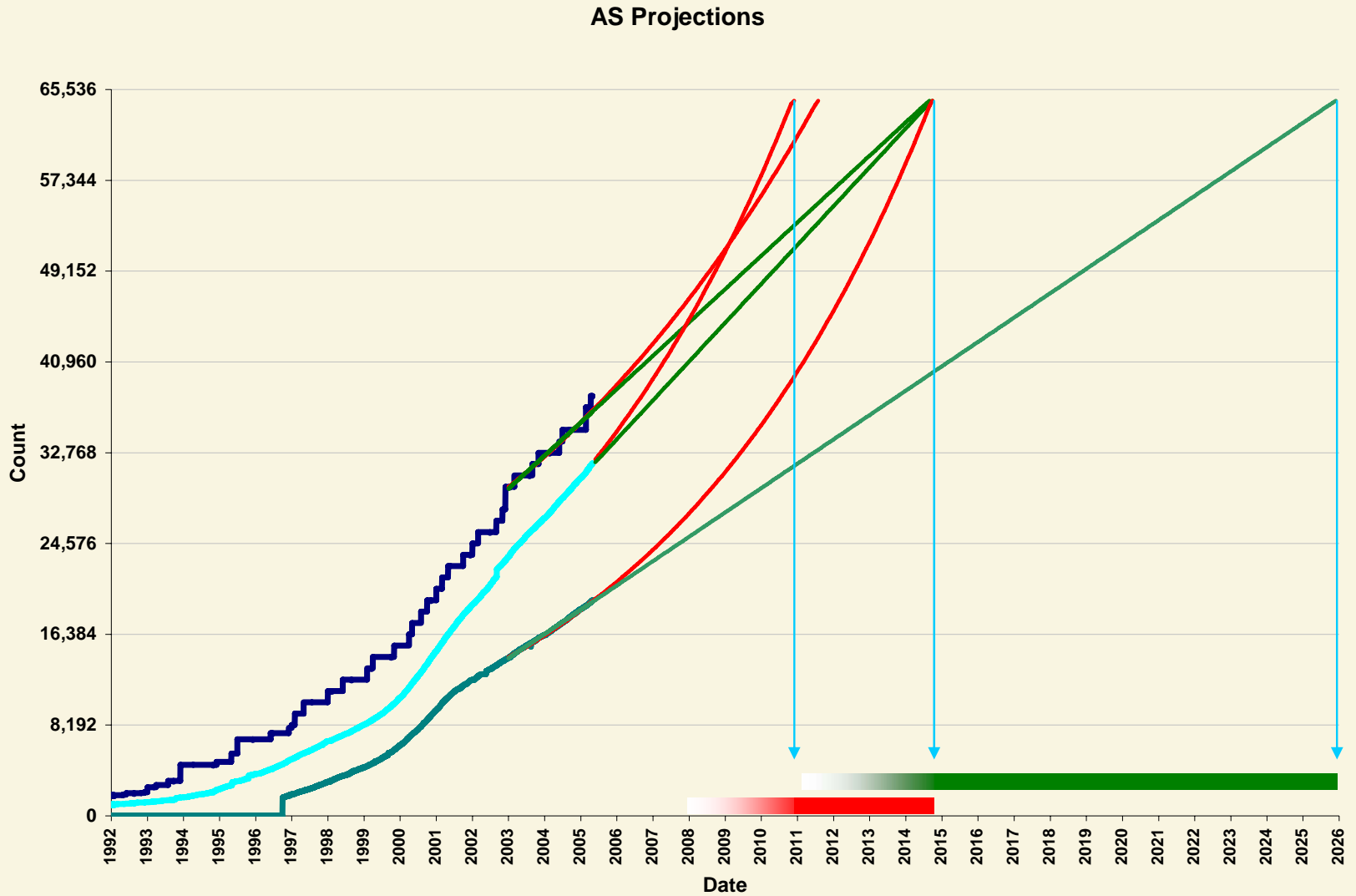


There are some inconsistencies in the data

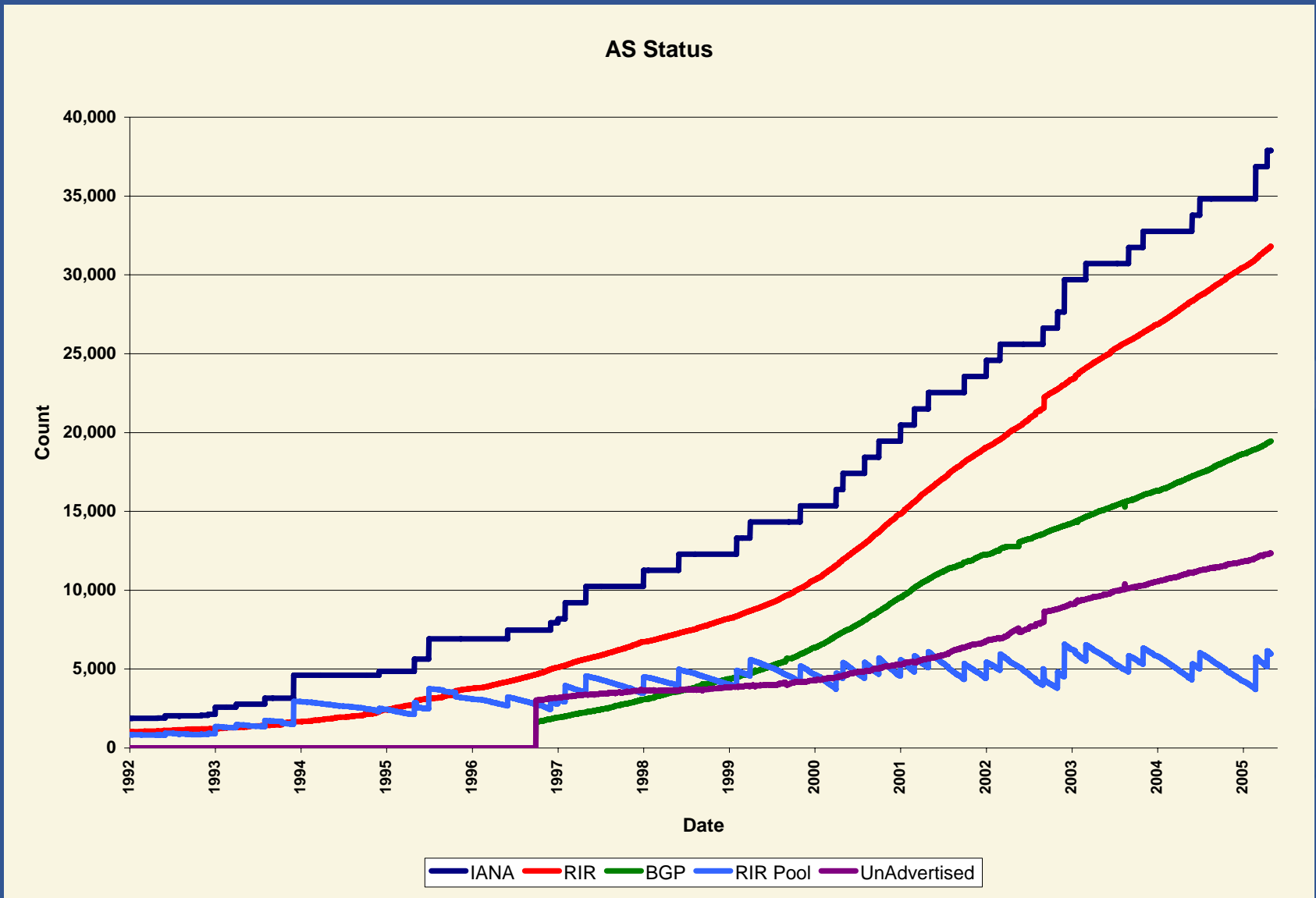
# RIR Allocation Projection



# Combining these views



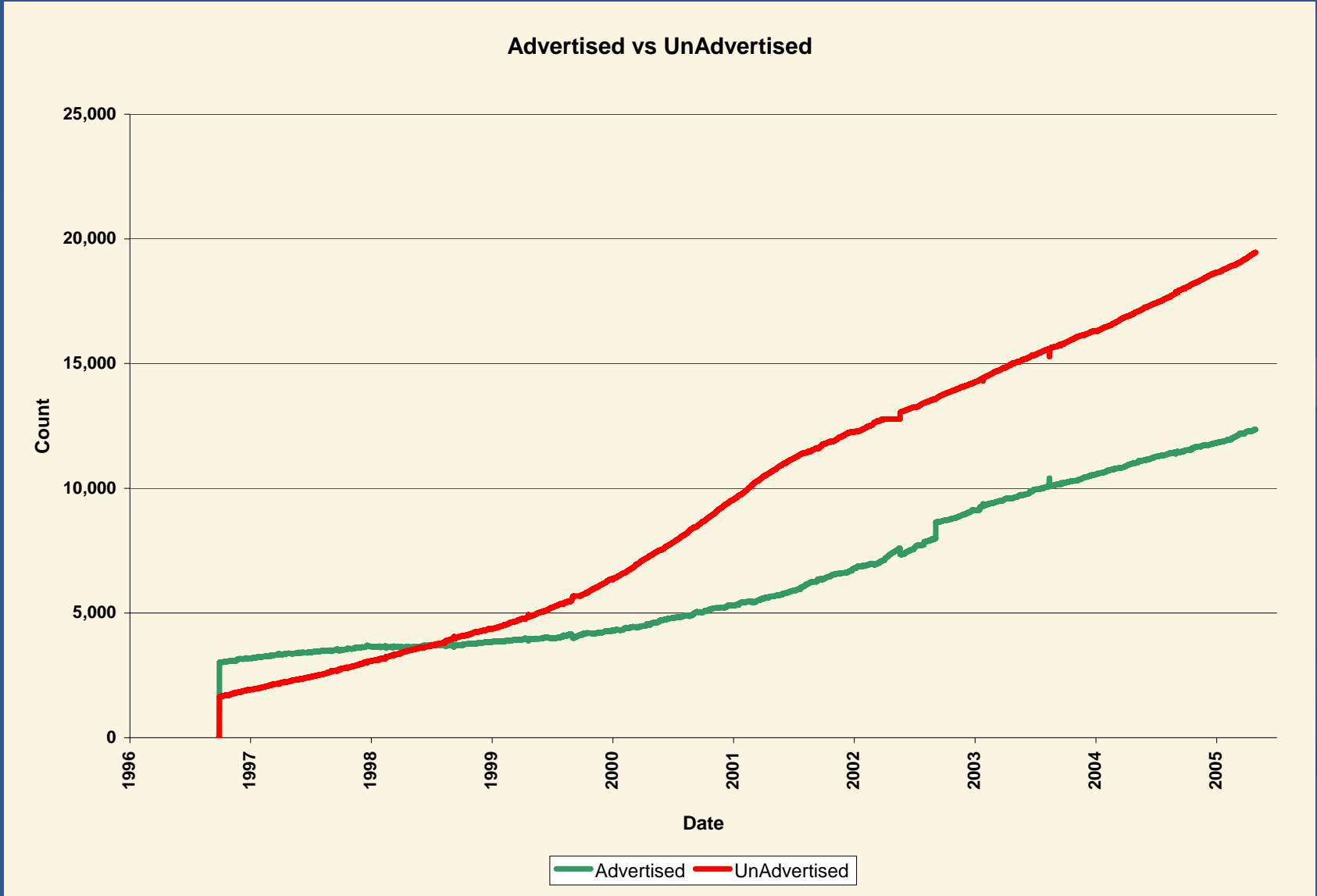
# Combined View + Differences



# Observations

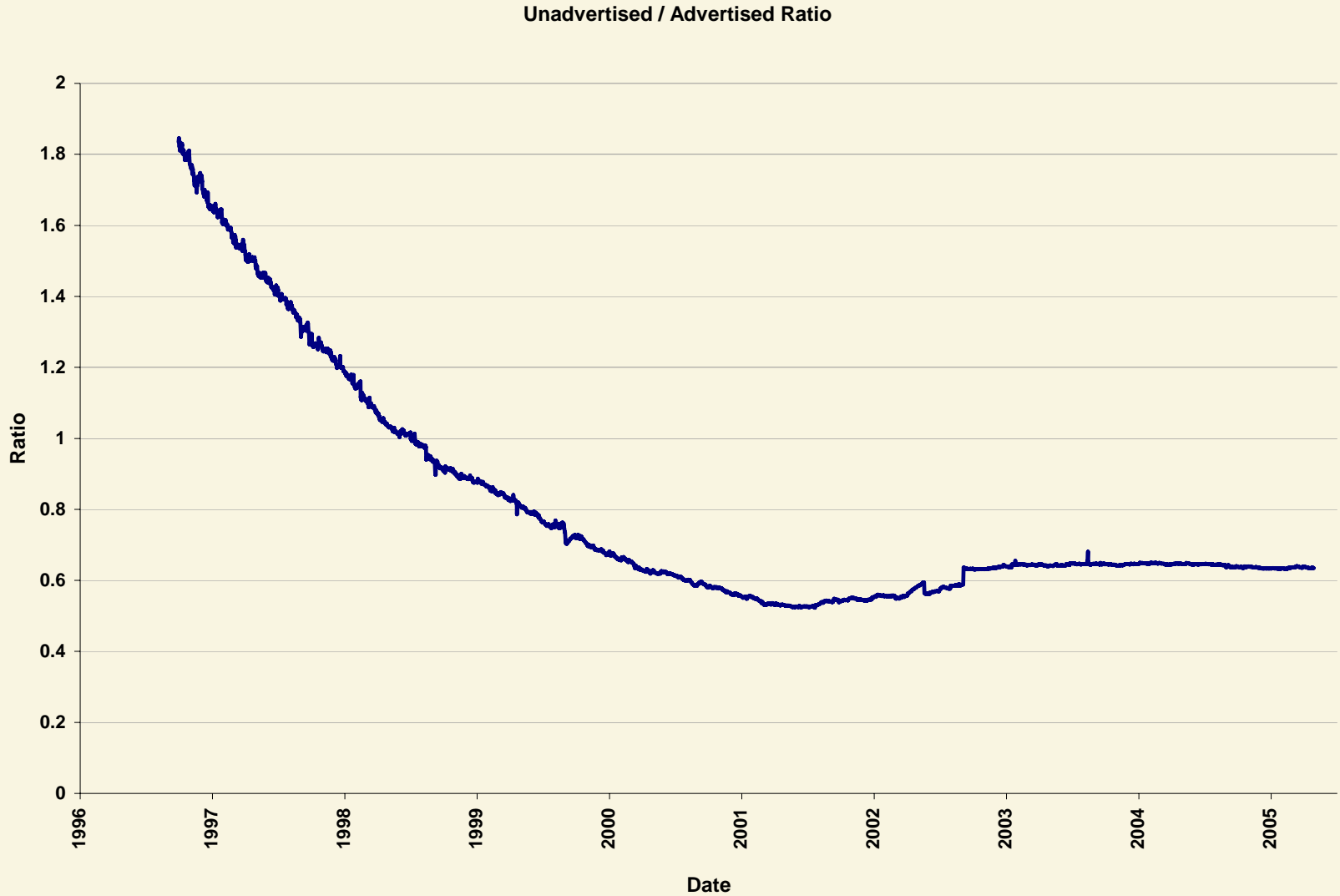
- RIRs operate with an allocation buffer of an average of 5,000 numbers
- 12,741 AS numbers (39% of the assigned AS numbers) are not announced in the BGP table.
  - Is this the result of old AS assignments falling into disuse?
  - Or recent AS assignments being hoarded?
  - This pool creates uncertainty in AS number pool exhaustion predictions

# UnAdvertised and Advertised ASes



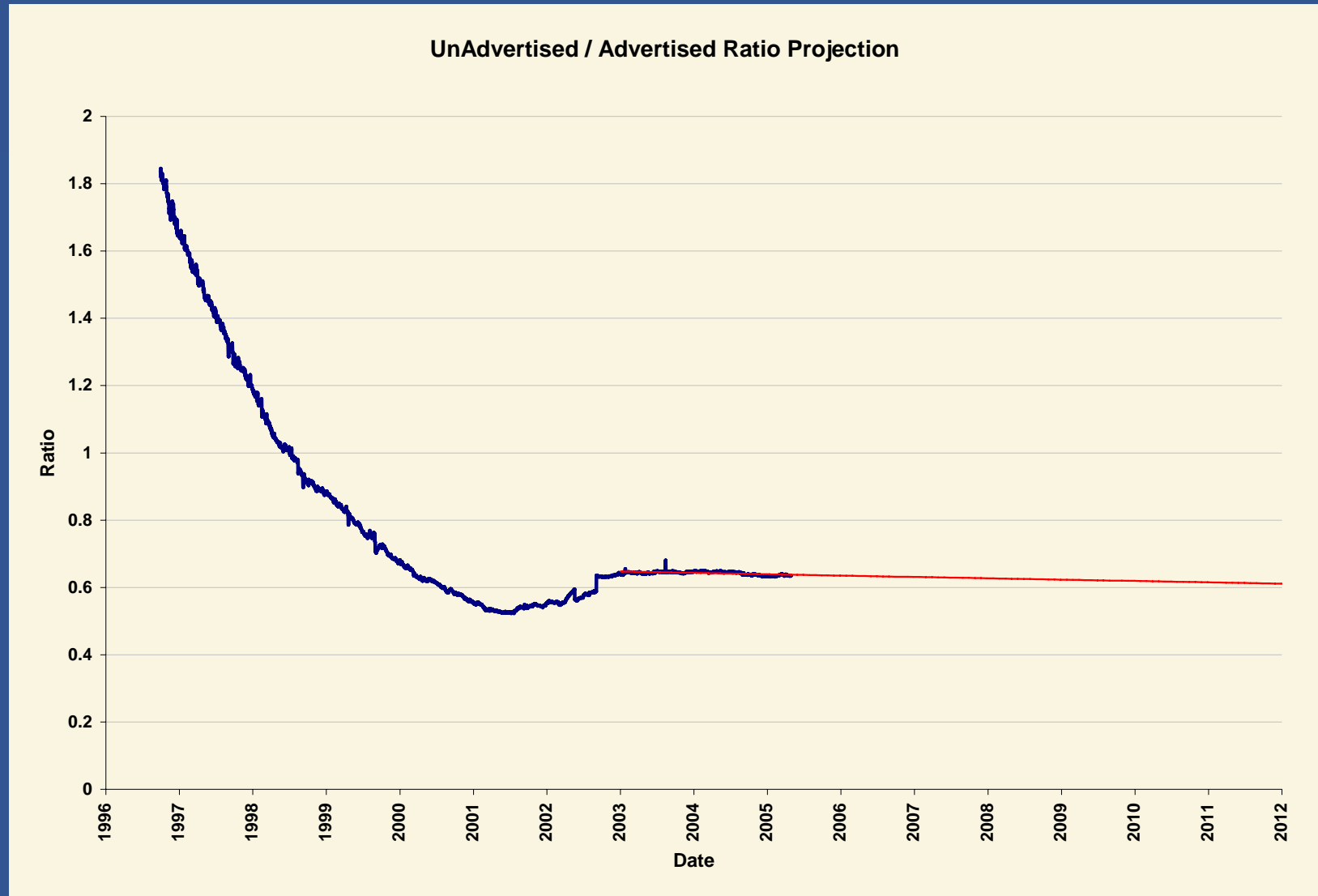


# UnAdvertised : Advertised ASes



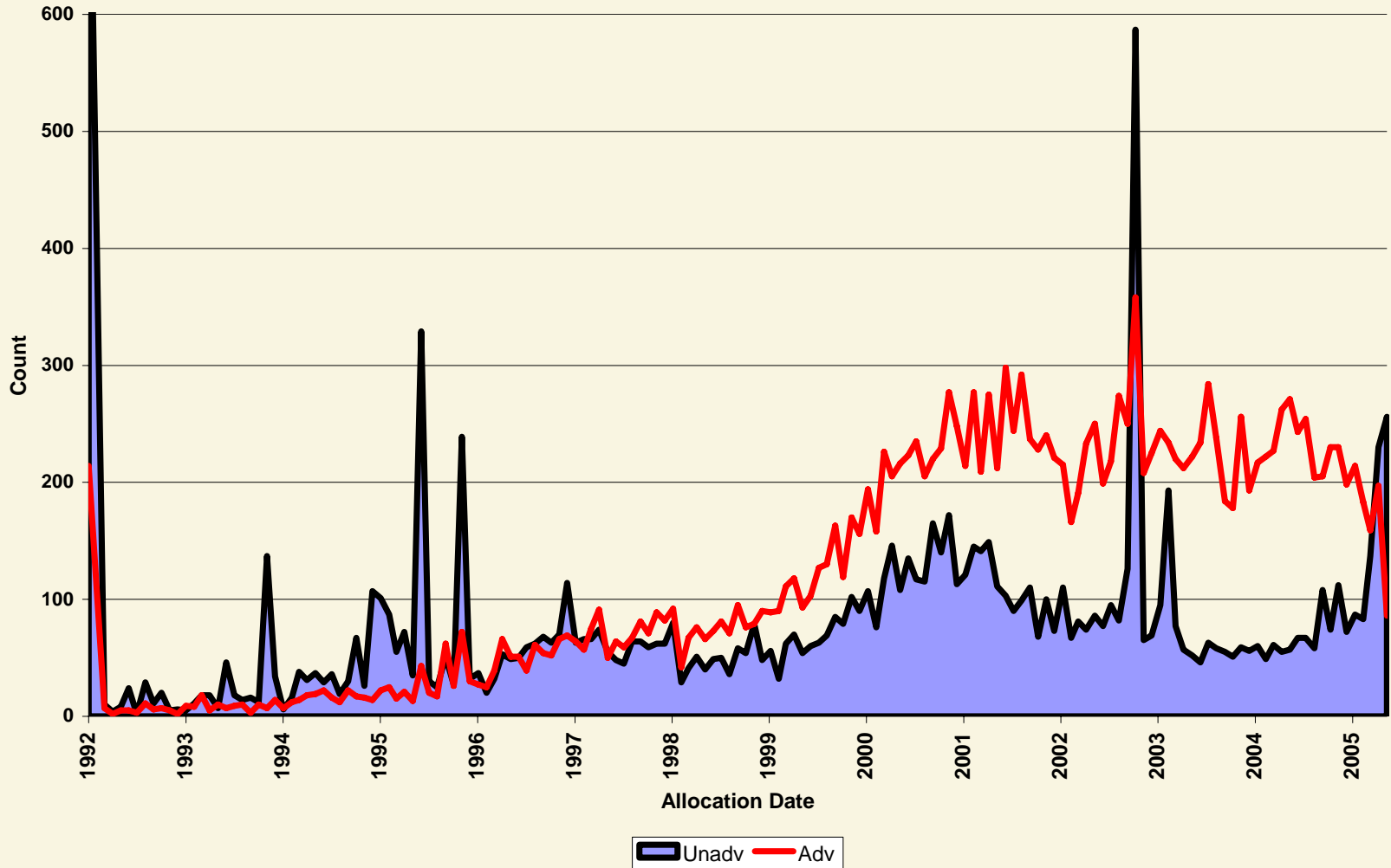


# Trend: UnAdvertised : Advertised Ratio

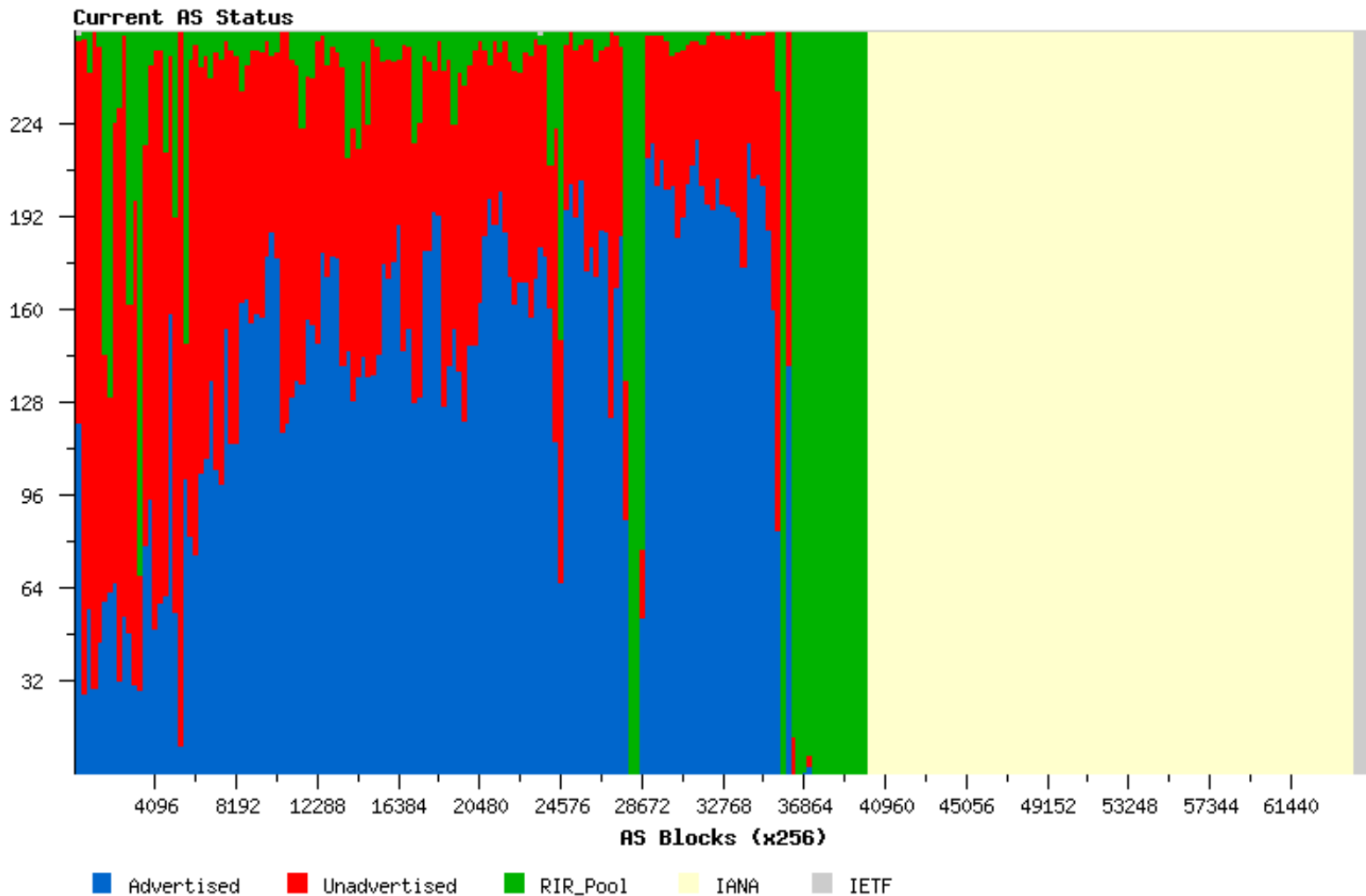


# UnAdvertised / Advertised Distribution by Date

Unadvertised and Advertised ASes

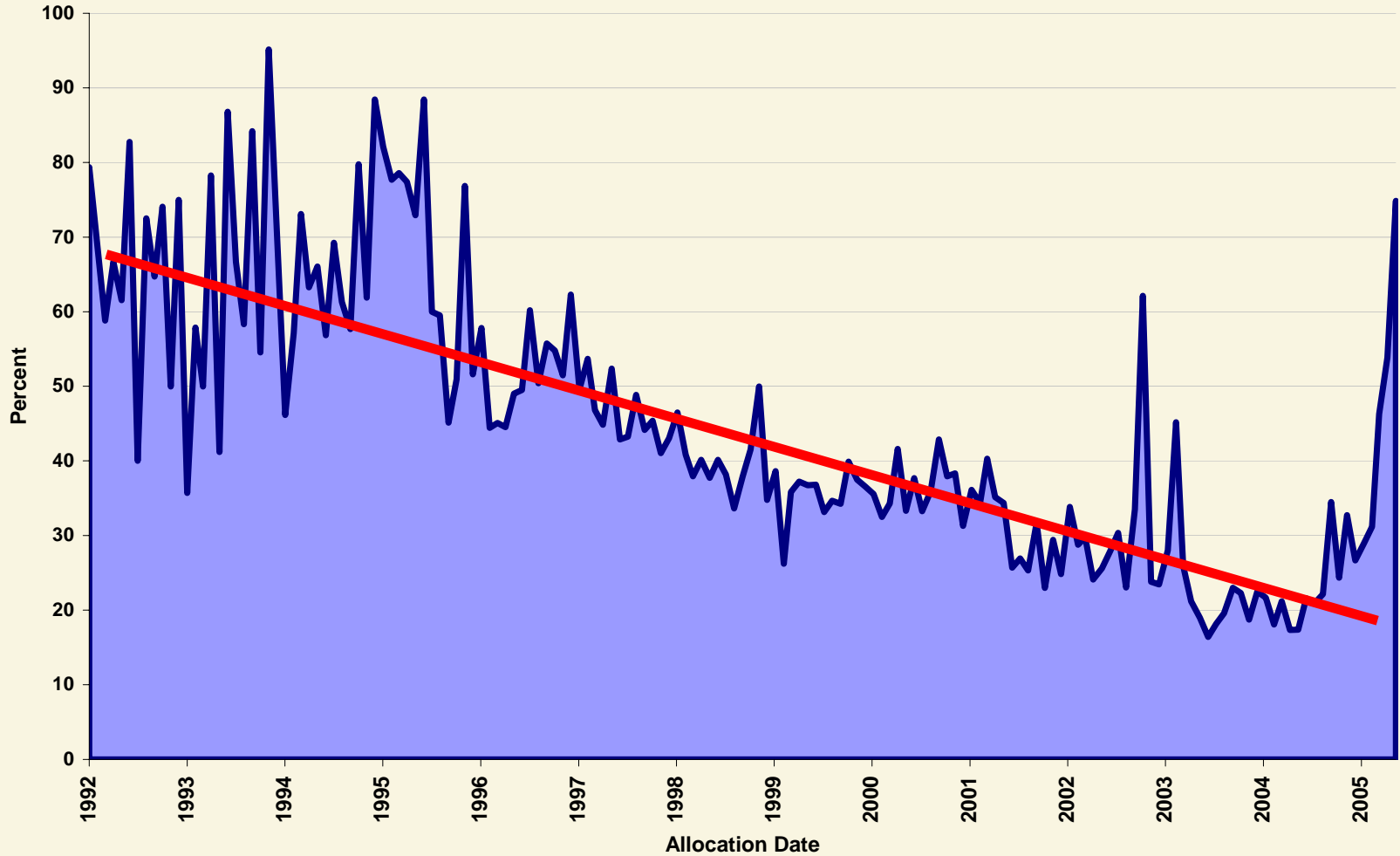


# Distribution by AS Number Range



# UnAdvertised / Advertised Relative Proportion by Date

Unadvertised ASs (% of Allocated) by Date

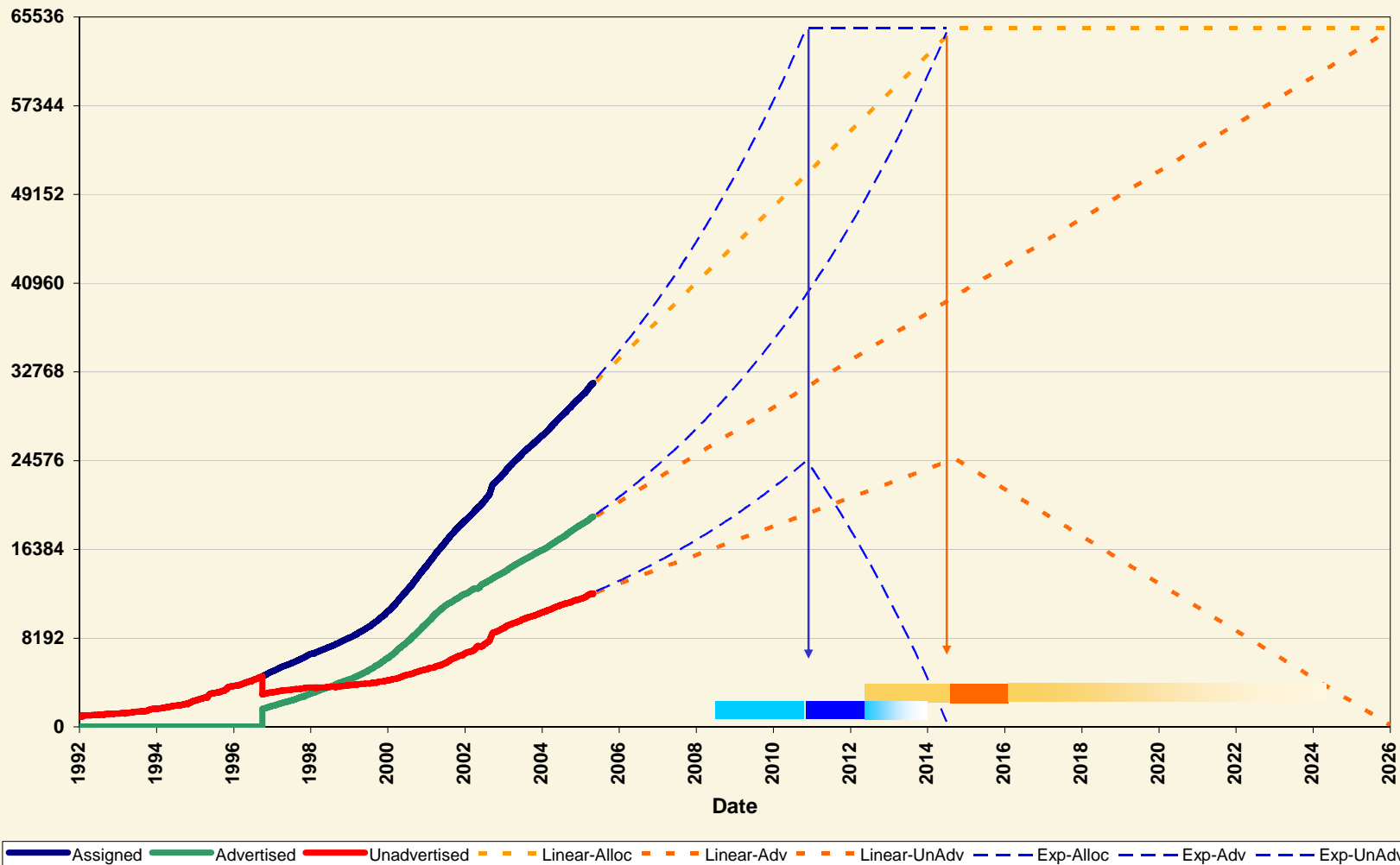


# Observations

- 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

AS Consumption Projections

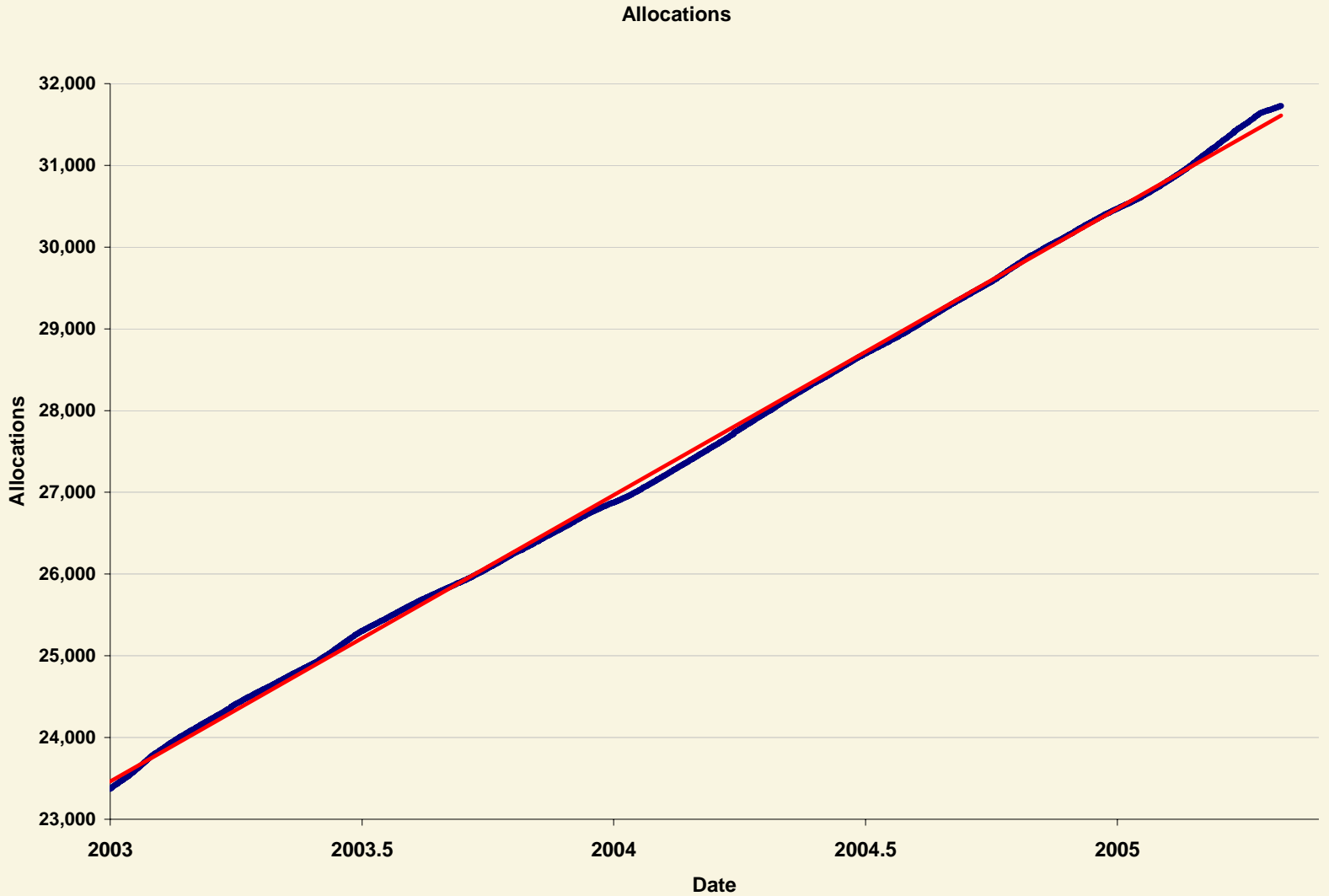


# Selecting a best fit to the data

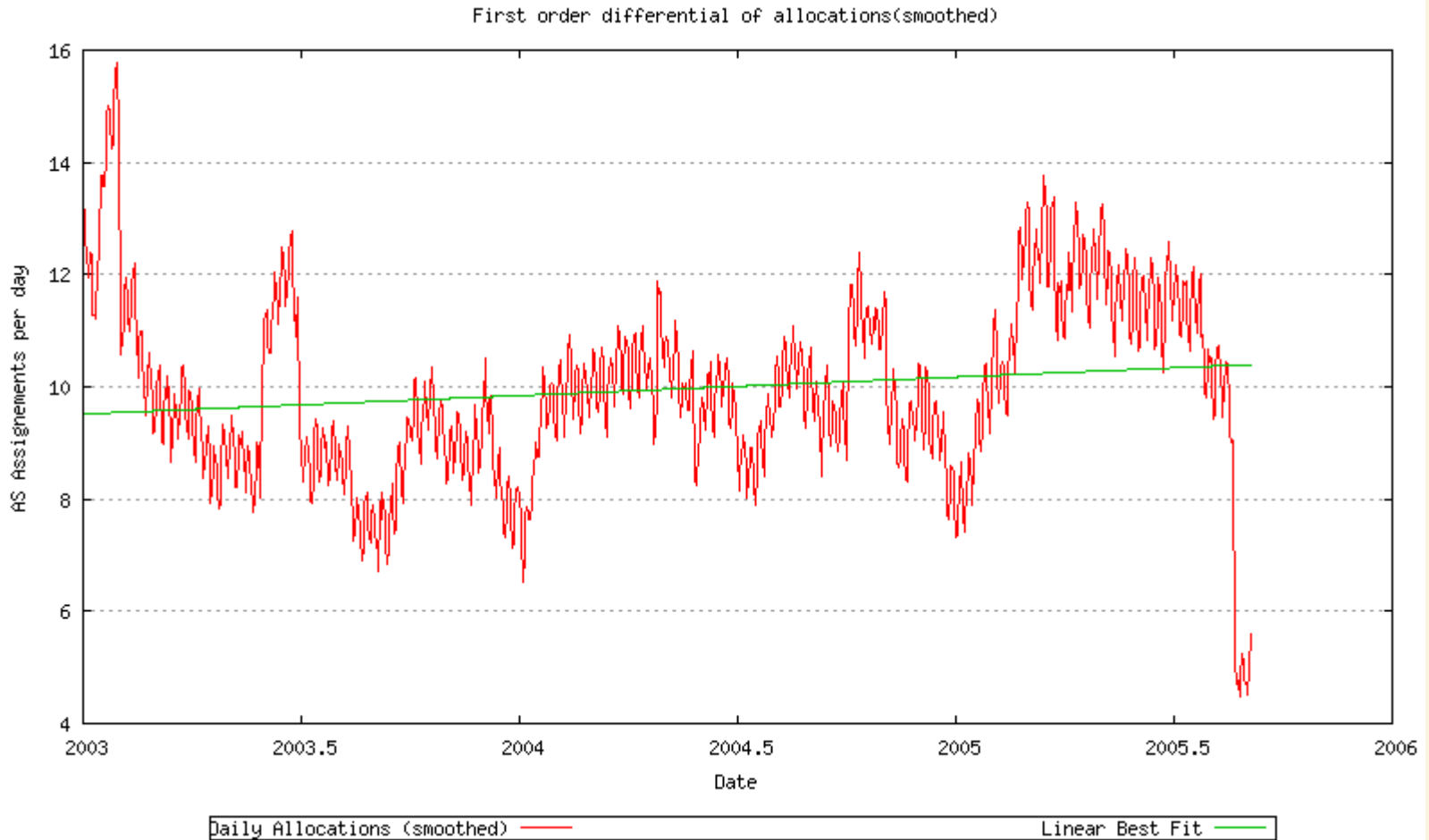
- A Linear growth model will have a constant first order differential
- An exponential growth model will have a linear best fit to the log of the data
- The data set for the best fit is to a smoothed (moving average) time series of the cumulative sum of RIR AS allocations



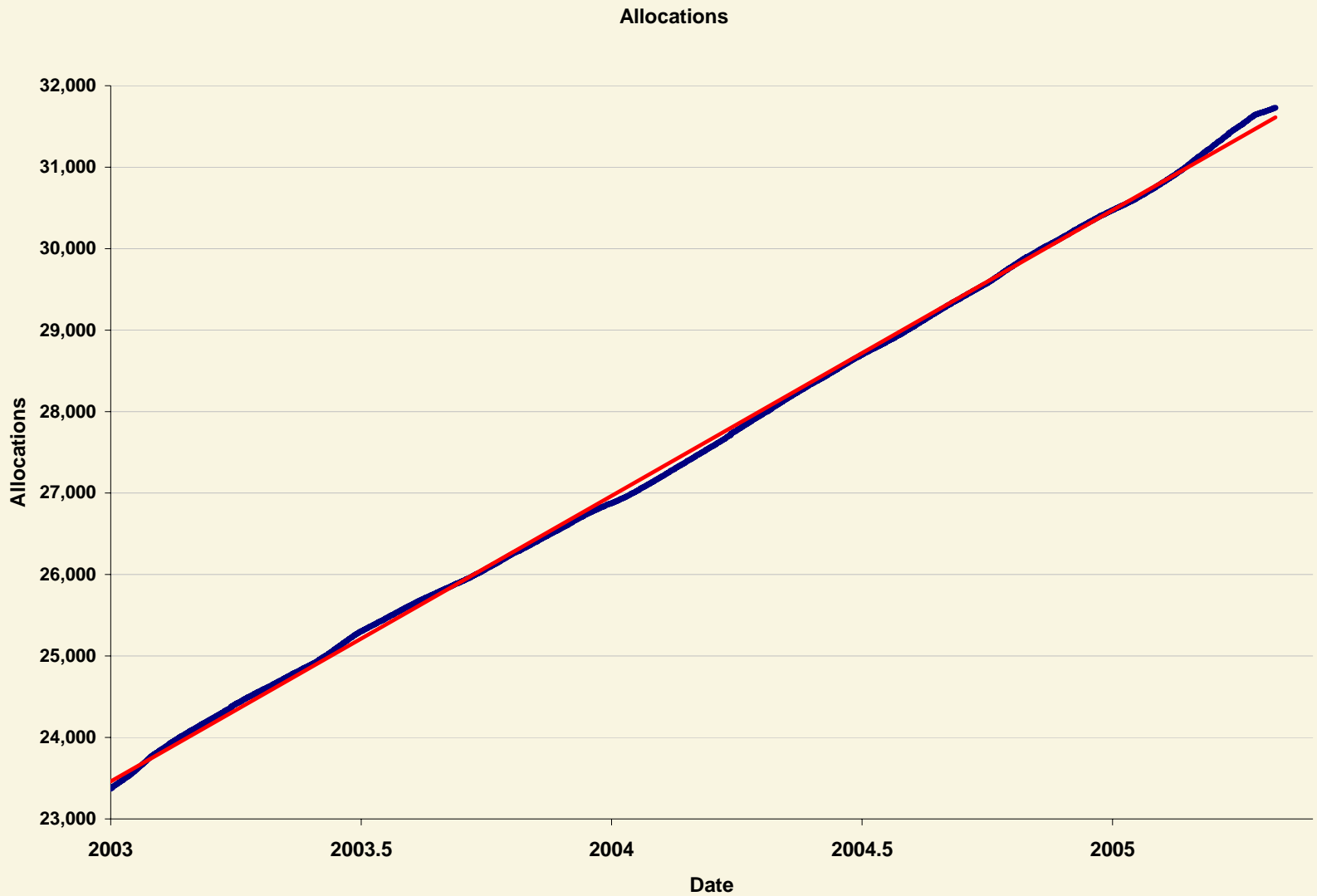
# Linear Model fit



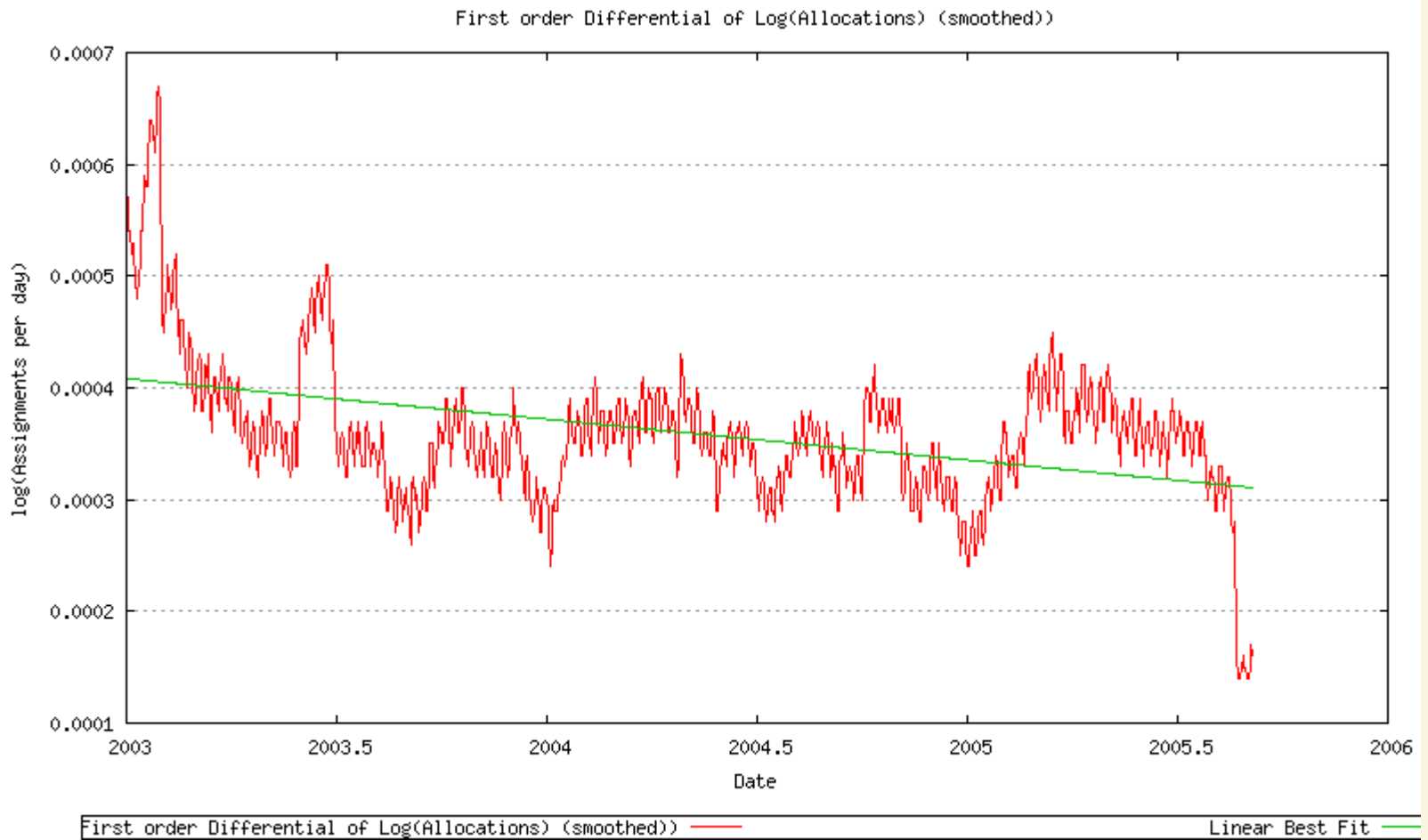
# Linear Model fit



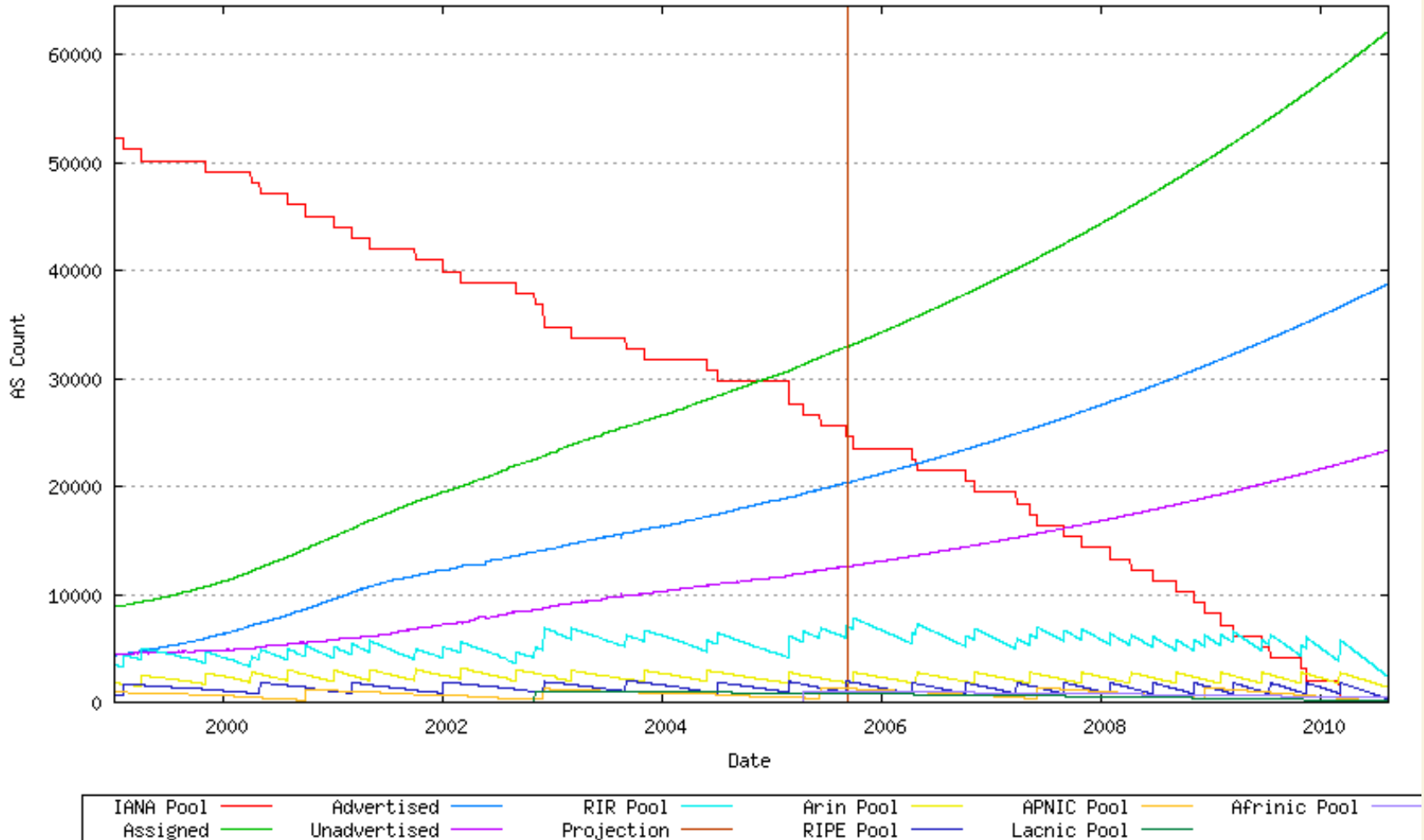
# Exponential Model fit



# Exponential Model fit



# AS Consumption Prediction



# Current AS Use Projections

- The available AS number pool will exhaust in the timeframe of late 2010 (11 August 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



APNIC

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