



# Determining 'Tier 1' through AS Path Analysis of Full Routing Tables

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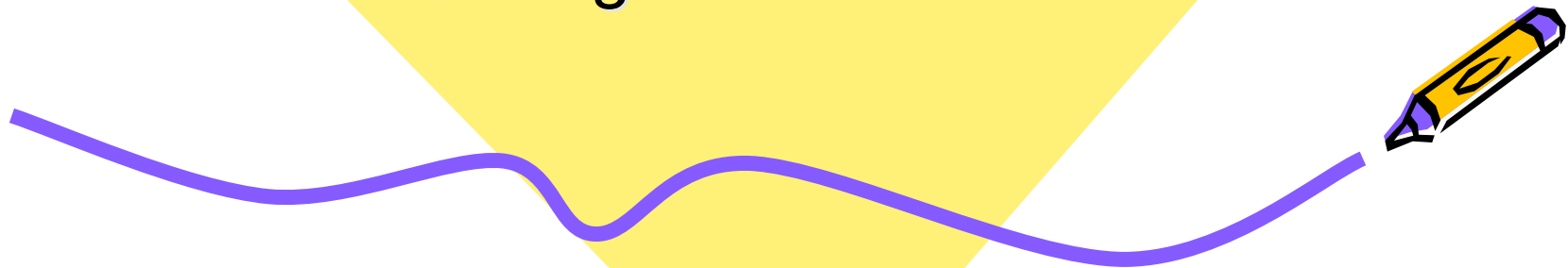
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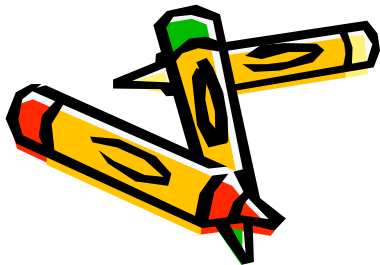
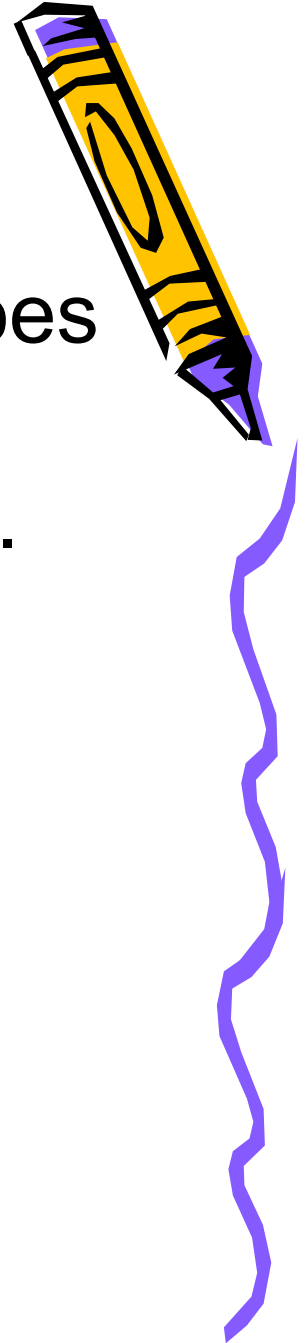
**“Tier 1 is not a binary property”**

Quoting Bill Woodcock



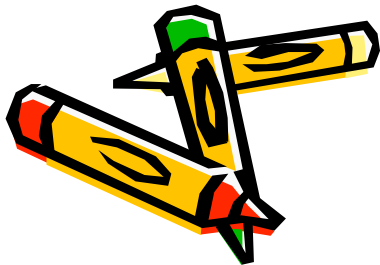
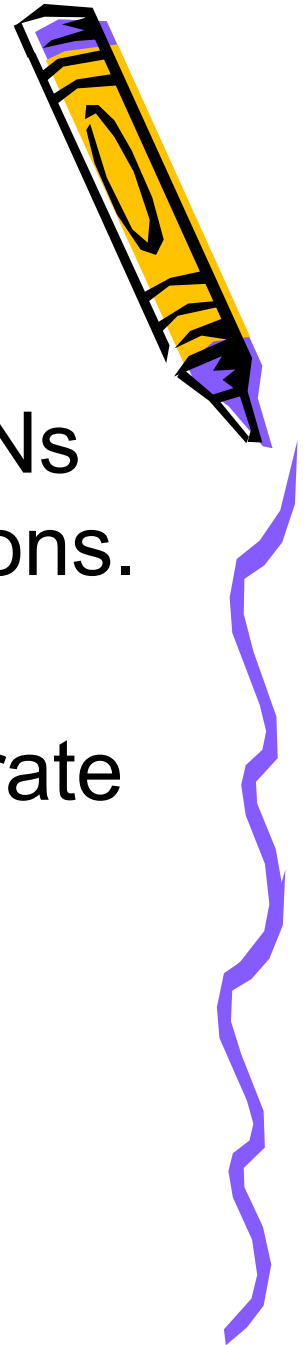
# Flame-Shield

- ‘THE’ single Internet routing table does not exist. Our analysis is based on multiple views from multiple sources.
- There is no such thing as ‘Tier 1’ across the entire Internet.
- Content providers are not proportionately represented in this analysis.



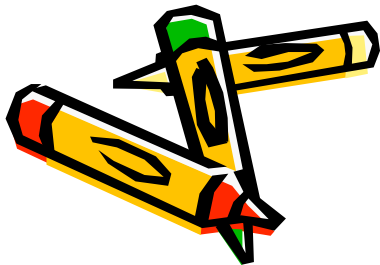
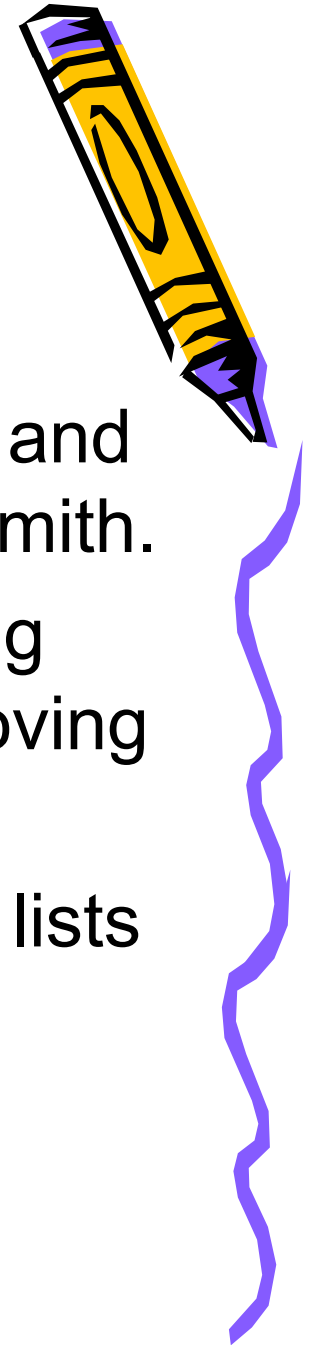
# Assumption

- There can be 'regional Tier 1' or ASNs which predominate in particular regions.
- By putting all available routing table views into the same bucket, we operate from a broad point of view.



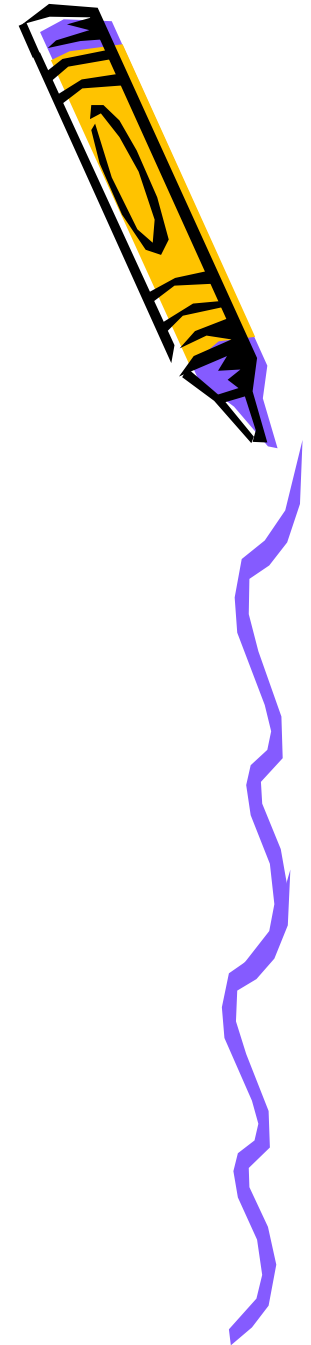
# Methodology

- Routing table archives from Route-Views and Tokyo transit routers provided by Philip Smith.
- We found the 20 most frequently-occurring ASNs in all observed AS paths after removing the immediate next-hop transit providers
- We then found the intersection of the two lists



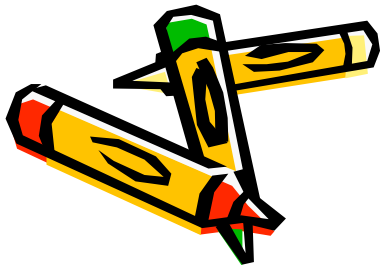
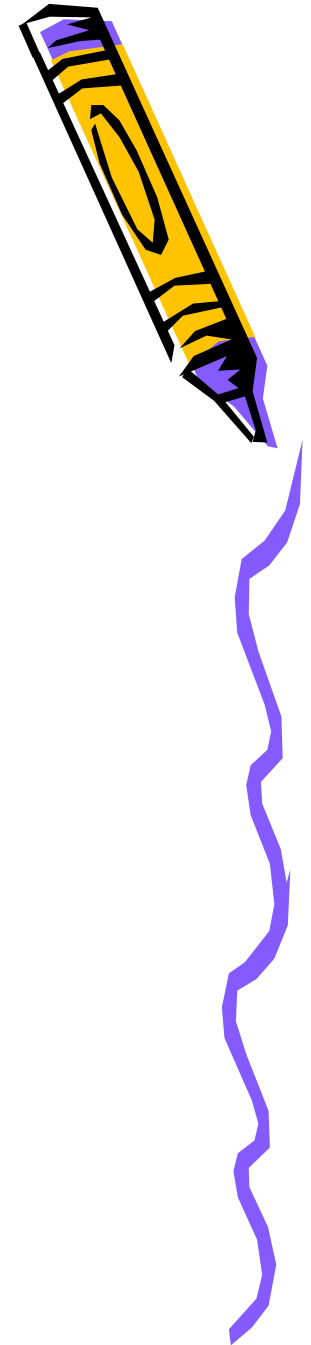
# Top 20 from Tokyo

- 2497 3320
- 2516 7473
- 701 6461
- 3356 5400
- 7018 702
- 209 4323
- 3549 2828
- 1239 7132
- 174 4766
- 2914 7911



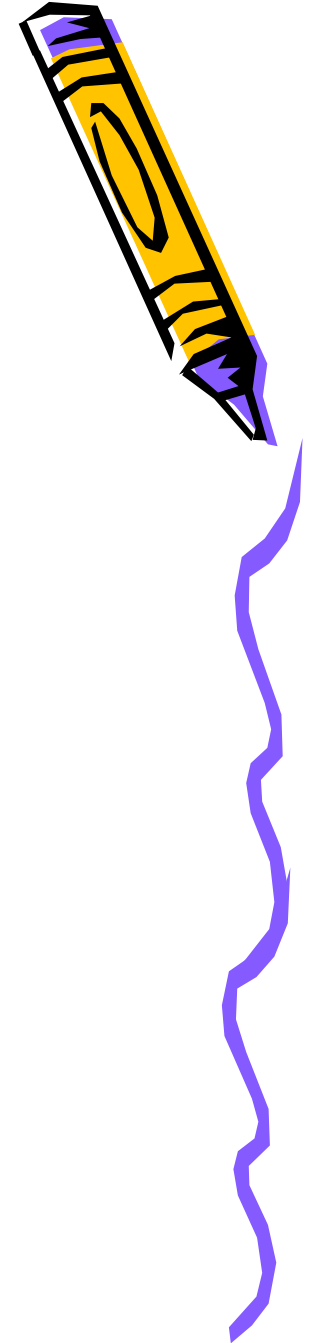
# Top 20 from Route-Views

- 701
- 3356
- 1239
- 2914
- 7018
- 1299
- 7911
- 3561
- 3549
- 209
- 6453
- 4513
- 6395
- 5650
- 174
- 11608
- 6079
- 2497
- 6461
- 5511



# Intersection of the two lists

- 2497 - IIJ (transit and feed provider)
- 701 - UUNET / MCI
- 3356 - Level 3
- 7018 - AT&T
- 209 - Qwest
- 3549 - Global Crossing
- 1239 - Sprint
- 174 -- Cogent
- 2914 - NTT/ Verio
- 6461 - MFN
- 7911 - Williams Telecom

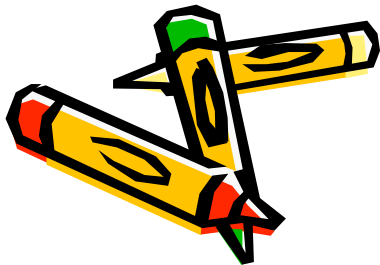
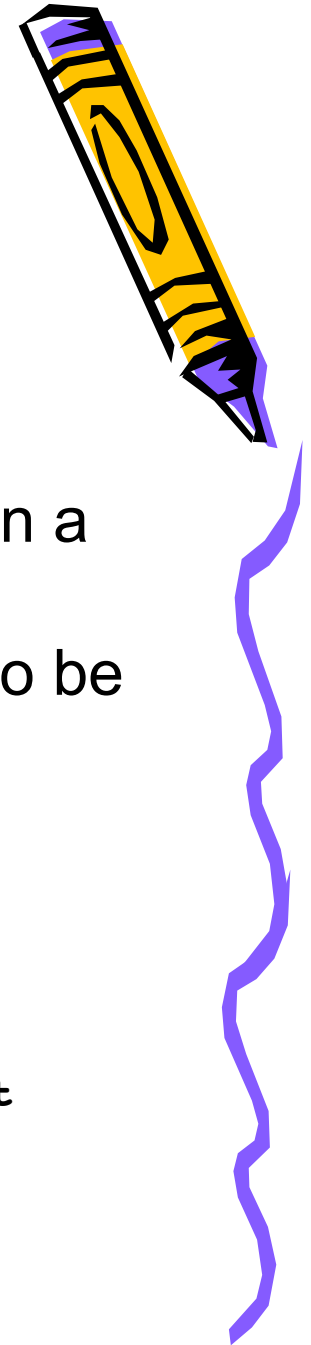


# Looking at ASPATH

- A hypothesis we tested
  - There cannot be more than two 'Tier 1' ASN in a single ASPATH.
  - With the original data, AS 174 doesn't seem to be an Tier 1 in the AP region.

```
2516      1239      2914      174      812      i
2497      2914      174       i
2516      1239      2914      174      812      800      i
```

Where 1239 = Sprint, 2914 = NTT / Verio, 174 = Cogent



# Point of Interest

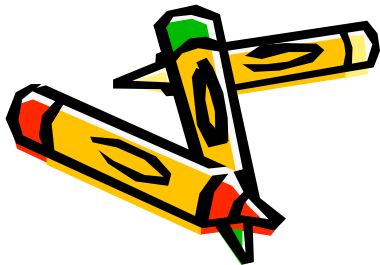
- AOL does not appear, because they do not provide transit to down-stream networks.
- When we add AS1668 to the previous list and ran the algorithm again, we got expected result, I.e, it is a tier One network.
  - Whenever AS1668 was on the ASPATH, at most one other ASN from our top 10 list were visible on the ASPATH.
- Aside from that, the usual 'tier 1' suspects are on the list.

With more data, it might be possible to get some further analysis.



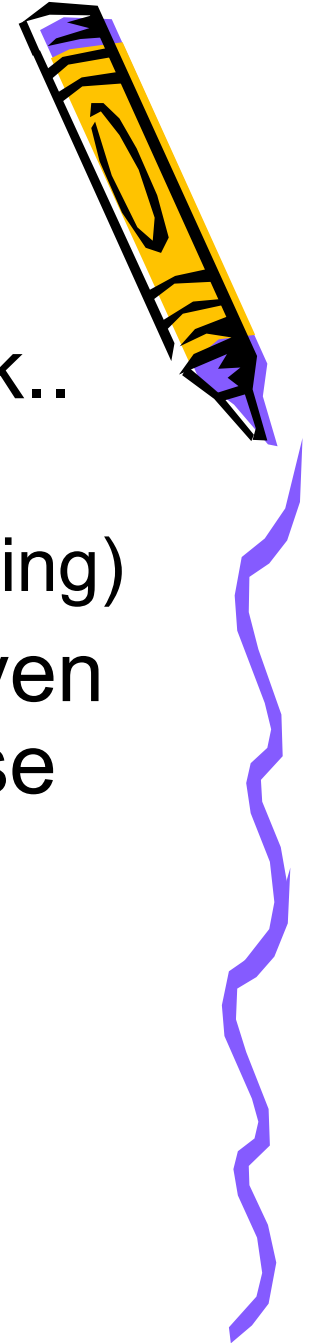
# Route-views Exception

- It's dump from multiple locations - so per region analysis on the data is not possible - but because it's such a large spread, using it as base is more useful.
- The hypothesis doesn't at all work on the full route-views dump. (natural conclusion - there can't be a global 'tier 1'. )



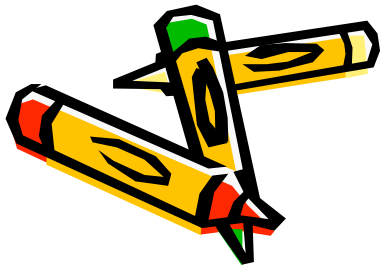
# What we think ?

- Our hypothesis may or may not work.. We don't know.. But time will tell.
  - (we'll tell more at the next APNIC meeting)
- This analysis method doesn't find even the largest content providers because they do not appear frequently in AS paths.
- At this point



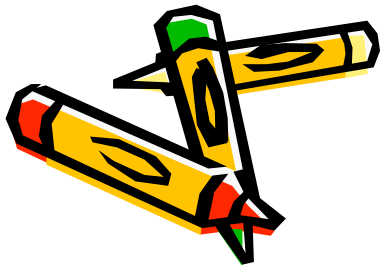
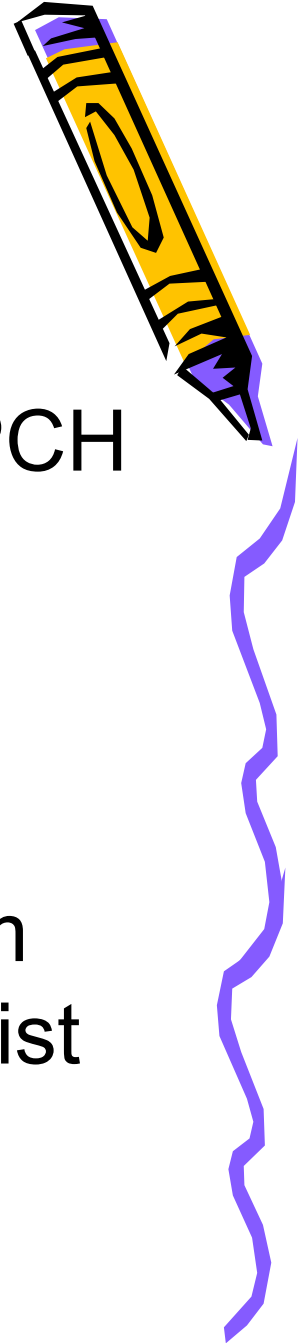
# What next ?

- We will need to run more tests over lot more data.
- We'd like to run the full routes intersection with peering routes at each IX we are present at and hopefully can give weight to well known 'content' Ases.



# Acknowledgement

- Bill Woodcock, Research Director, PCH
- Philip Smith, Cisco Systems
- Route-views Folks
- Over dinner last night, feedback from Joshua Snowhorn and Kurtis Lindqvist



Thanks

