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BGP churn evolution: A perspective from the core

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BGP and scalability

BGP is the current de facto standard routing protocol in the Internet.
BGP scalability is an issue in both *routing table size* and *number of update messages (churn)*.

Our main focus is to investigate and characterize BGP scalability with respect to churn.

Approach

This work studies BGP churn evolution during the past six years using monitors at 4 tier-1 ISPs.
We use an *explanatory approach* in analyzing observed time series to understand possible causes of churn.

Findings

- The most severe update bursts are caused by local effects in the monitor AS
- The most effective short-term solutions for limiting churn could be implementations' improvements that filter out redundant updates, and methods that can detect configuration mistakes

Raw churn time series

- Dominated by large and frequent spikes
- There are several long periods of sustained increase in churn (level shifts)
- Very weak correlation between different monitors

Duplicate updates

- *Redundant announcements are responsible for about 40% of the churn during the study period*
- Duplicates can be viewed as a pathology of BGP implementations
- Most spikes are caused by duplicates

Large events

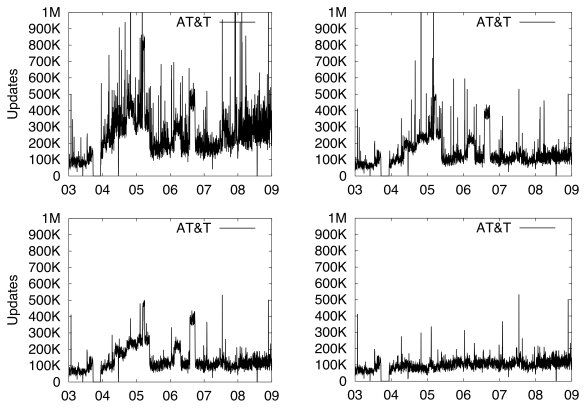
- We identified routing events that affect large number of prefixes simultaneously
- *Large events are found to have only a local impact and be responsible for most of the remaining spikes*

Level shifts

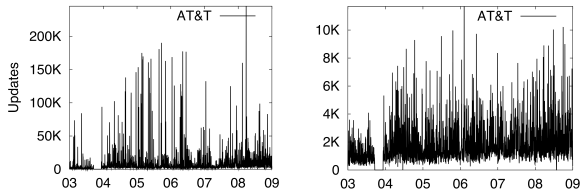
- The time series are still dominated by level shifts
- Our analysis show that level shifts are mainly caused by *misconfigurations* or persistent *flapping*

Baseline churn

- There is an increasing trend in the remaining churn after removing pathologies and local effects
- *The increase in the baseline churn is relatively slow compared to the growth in the routing table*



Top: raw time series (left), after removing duplicates (right).
Bottom: removing duplicates and large events (left), Baseline daily total churn (right)



1-minute peak churn per day in the raw churn(left) and baseline churn (right)

Daily peak activity

- Peak churn rates in shorter timescales are more important for scalability
- We examined the evolution of the peak daily churn rate (maximum 1-minute churn each day)
- *The daily 1-minute peak churn was an order of magnitude higher before removing pathologies and local effects*