Studying Internet Outages from Data and Control Plane

Anant Shah, Ela Sienkiewicz, Christos Papadopoulos
{akshah,ela,christos}@cs.colostate.edu

Background and Motivation

- Past research has shown at any given time 0.3% of internet is unavailable

- Outages can be detected using either data or control plane traffic

- Since all outages are not visible in both planes, we need ways to correlate outages from both planes and better understand relationships

Methodology

- We collect outages detected by the Trinocular[1] project (3.5M /24s)

- We then fetch BGP updates from RouteViews for prefixes covering given /24s

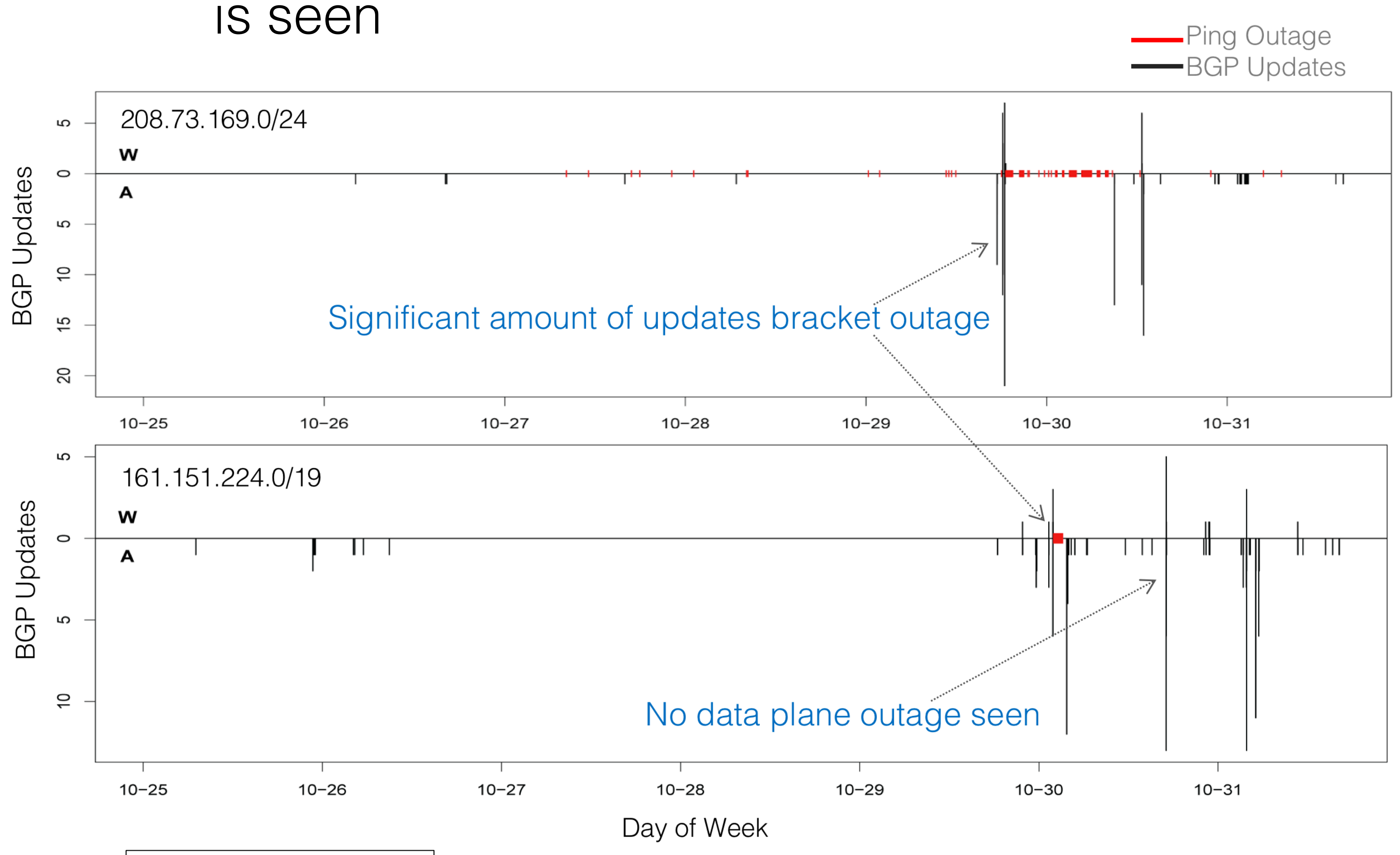
- Finally, we map how each data plane outage was seen by peers in RouteViews

[1] L. Quan et al. "Trinocular: Understanding Internet Reliability through Adaptive Probing", SIGCOMM'13
[2] A. Shah et al. "Disco: Fast, Good, and Cheap Outage Detection", TMA'17
* Contributed by Yingnan Liu, Randy Paffenroth (Worcester Polytechnic Institute)

Preliminary Findings

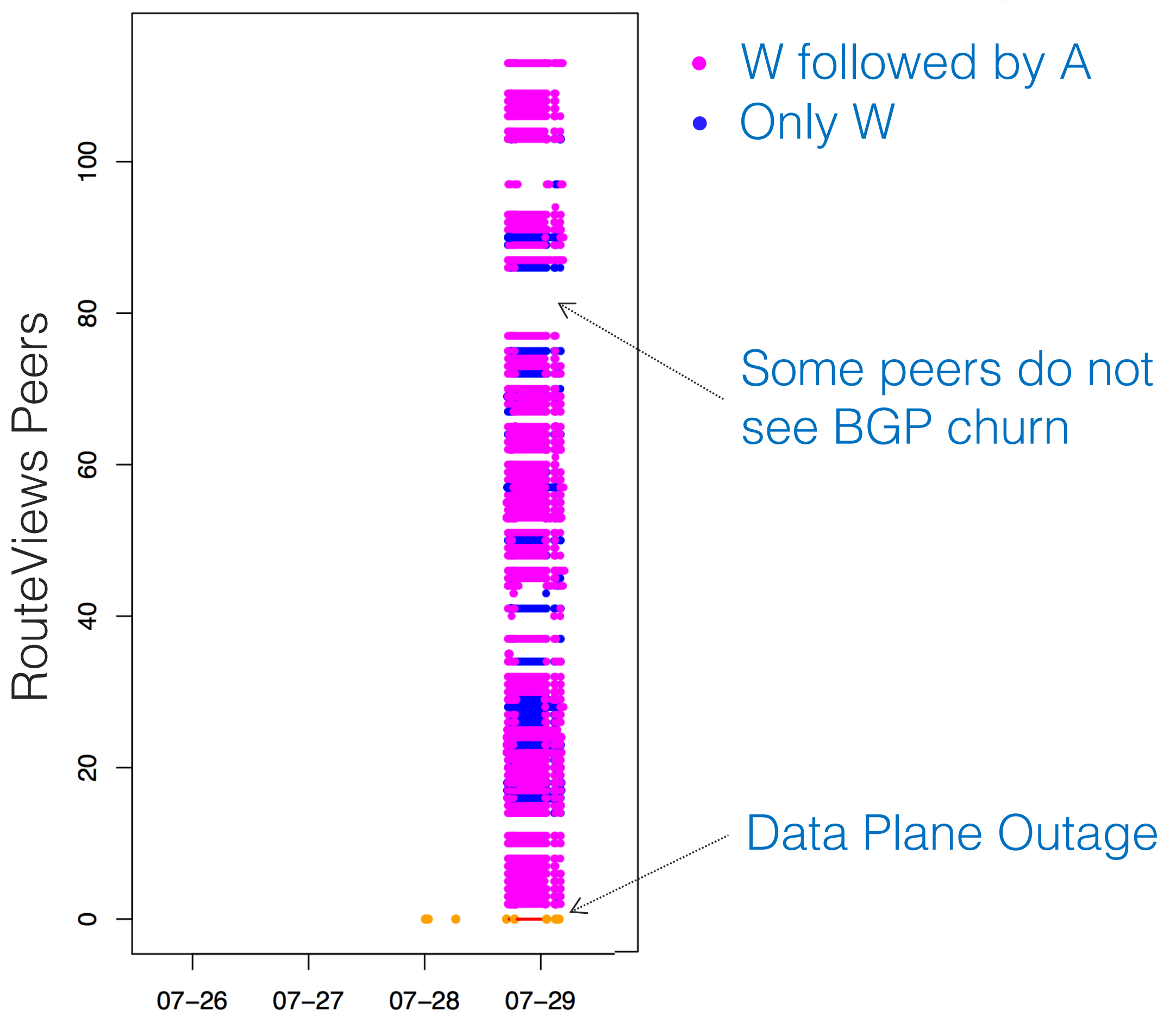
- In more than 40% cases a large churn of BGP updates is observed before and after outage

- However, there are cases where either no BGP churn is seen or no data plane outage is seen



Significant amount of updates bracket outage

No data plane outage seen



Some peers do not see BGP churn

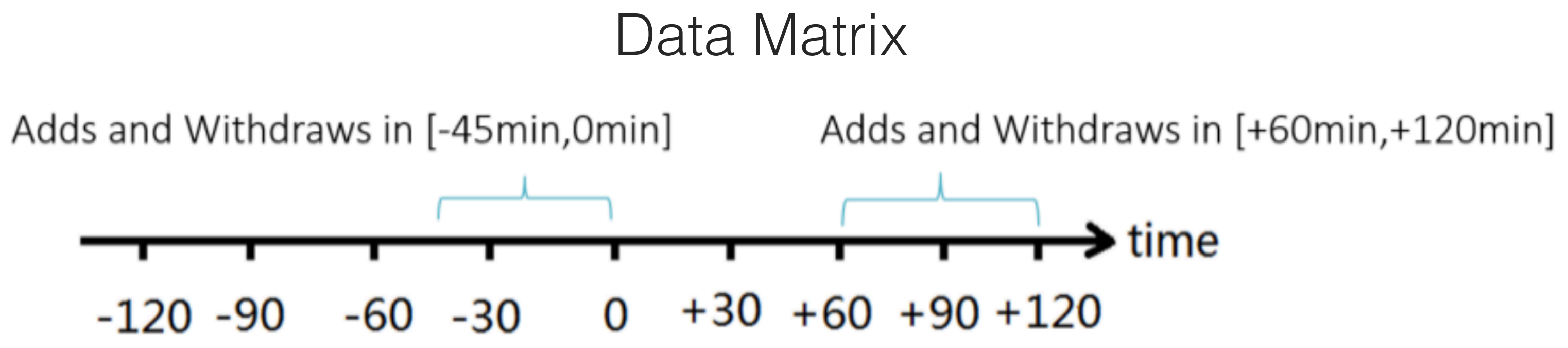
Data Plane Outage

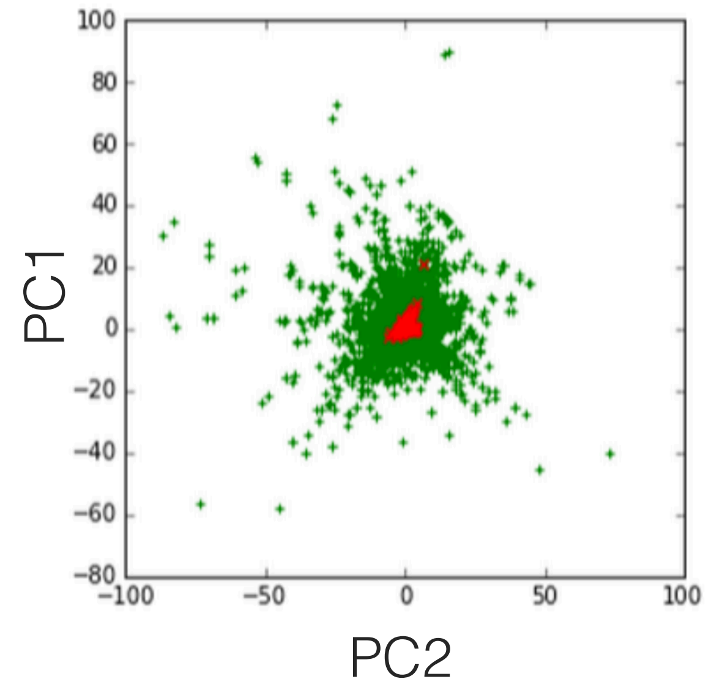
- Some BGP peers do not see any activity during the outage

- In most cases, peers see `Withdraw` followed by `Announcement`

Modeling BGP Activity

- Can we mathematically model BGP activity during outage?


Data Matrix
Adds and Withdraws in [-45min,0min]
Adds and Withdraws in [+60min,+120min]
time
-120
-90
-60
-30
0
+30
+60
+90
+120



- PCA analysis shows PC component values clustered during outages*

- This characteristic helps separating the anomalous space to detect anomalies

Further Directions

- Create predictive models to detect outages using BGP churn

- Provide more statistics on how often overlap in outages occurs per peer

- Use data plane outage from RIPE Atlas[2]

- Prototype visualization on Google Maps: `iodb.netsec.colostate.edu`