Periodic Behavior in Internet Measurements

A Hybrid Technique for the Periodicity Characterization

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# Do periodicities impact network management?

- How to characterize the **stability** between hosts?

- Are **load balancing policies** properly working?

- What is the impact of **BGP instability**?

- What are the differences between **anomalies** and **noise**?

- What are the most common **routing patterns**?

- Where are the **unstable internet regions**?

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Traceroute data collection

10.0.0.1,10.0.0.**4**,...

10.0.0.1,10.0.0.**3**,...
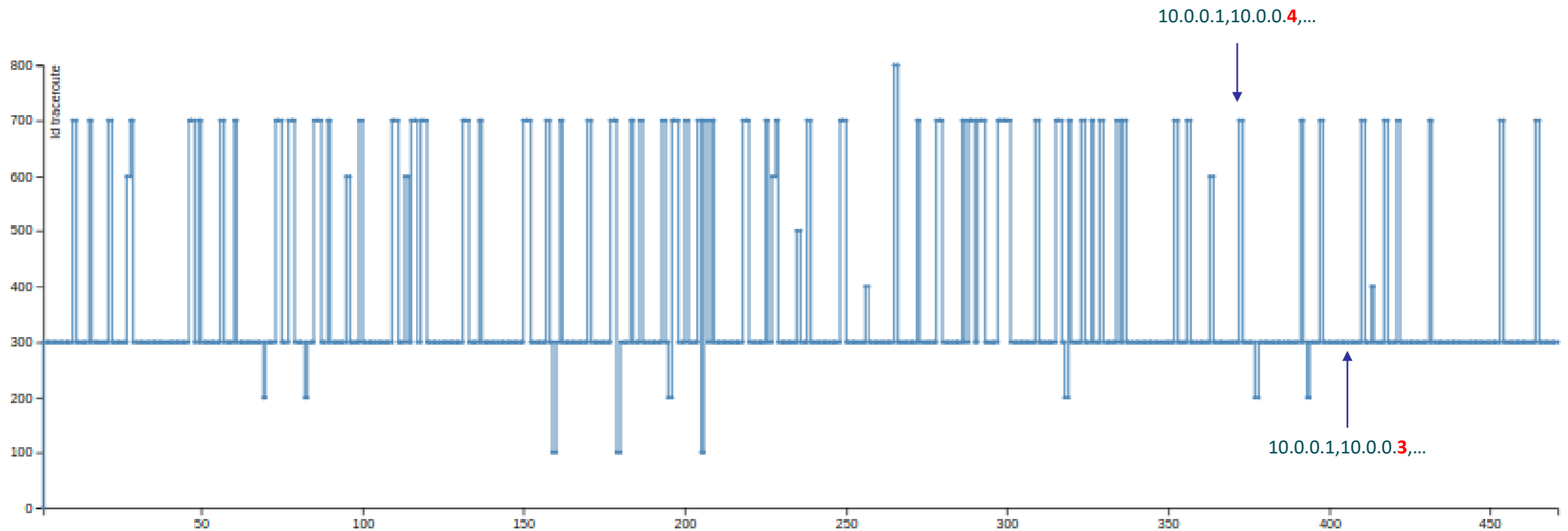
- 72 h observation
  - Y axis: IDs of different traceroutes
  - X axis: sampling instants

- Each horizontal segment represents a sampled traceroute value

Periodicity Detection

900 s sampled signal, similar to time-series, but without a metric

Discrete Fourier Transform

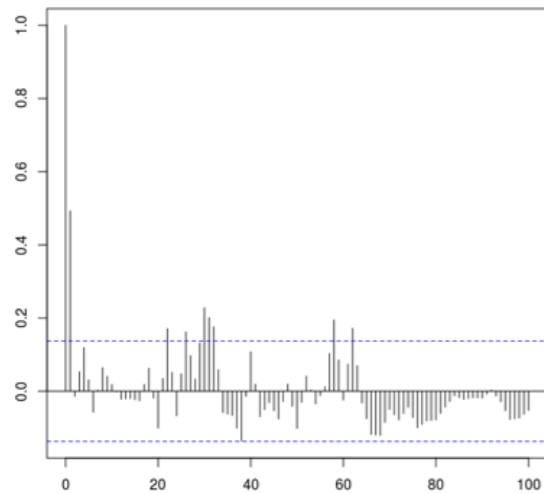$$X(\omega) = \sum_{n=-\infty}^{\infty} x[n]\, e^{-i\omega n}$$

Autocorrelation

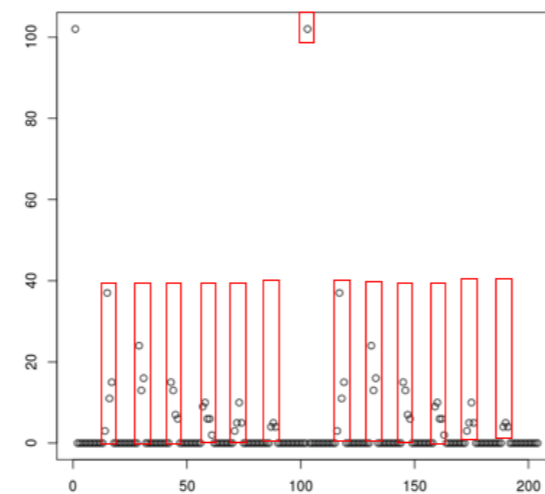$$R_{ff}(\tau) = \int_{-\infty}^{\infty} f(u)\overline{f}(u-\tau)\,\mathrm{d}u$$

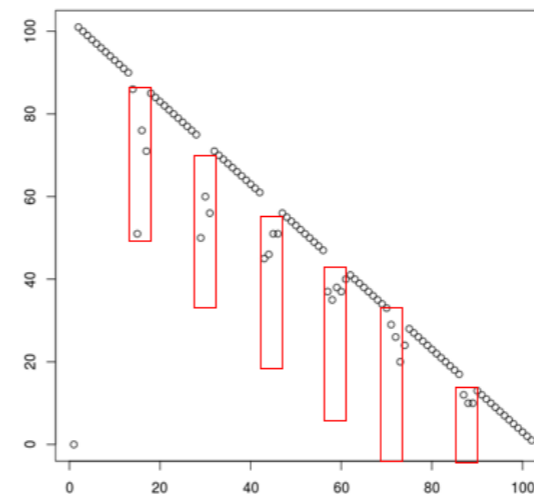Traceroutes are ordered by Levenshtein distance from most common path

A new version of the Autocorrelation to the pursuit of independence from metrics
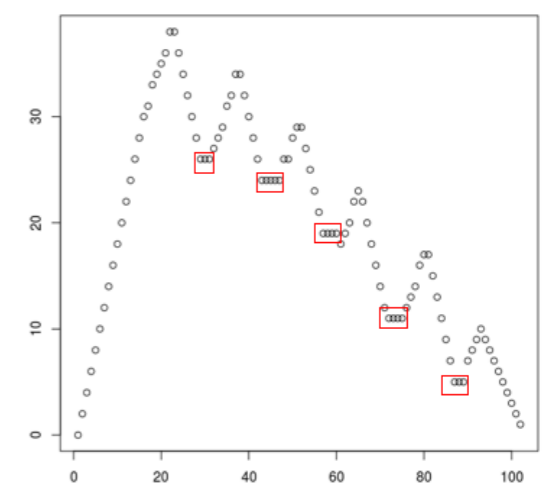

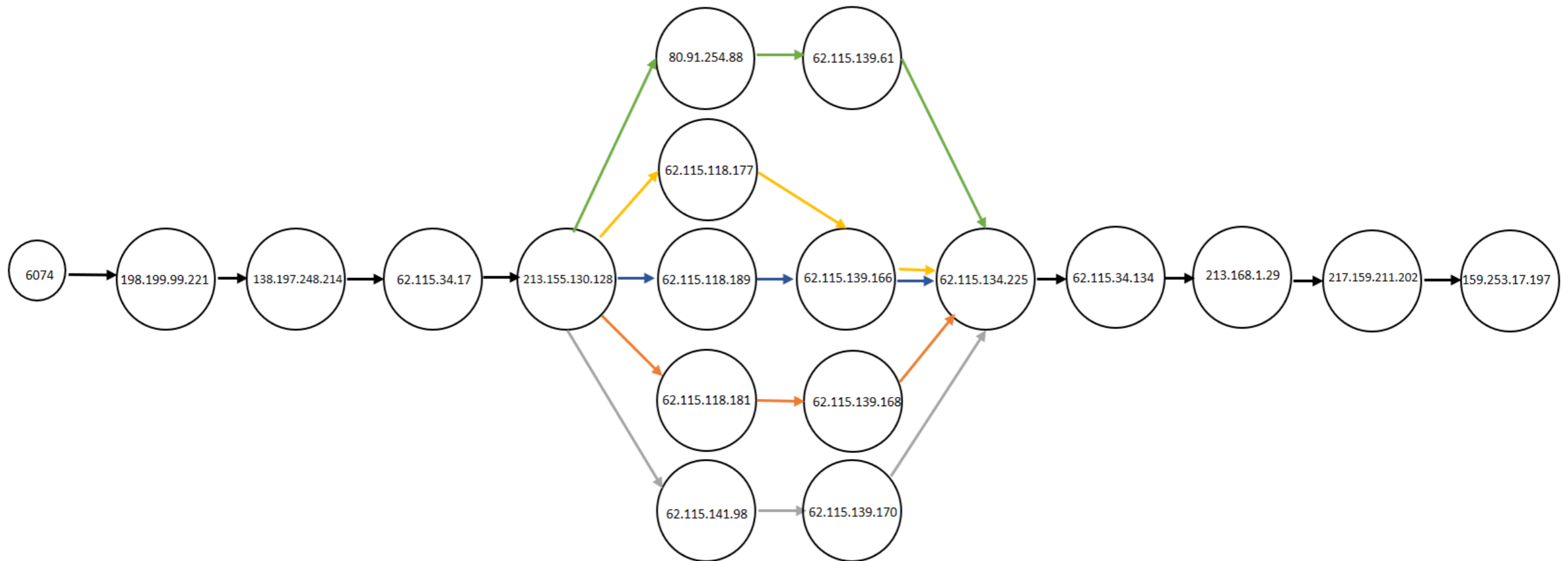Classic autocorrelation　　　　　Exact Match　　　　　Hamming　　　　　Levenshtein

What do you get?
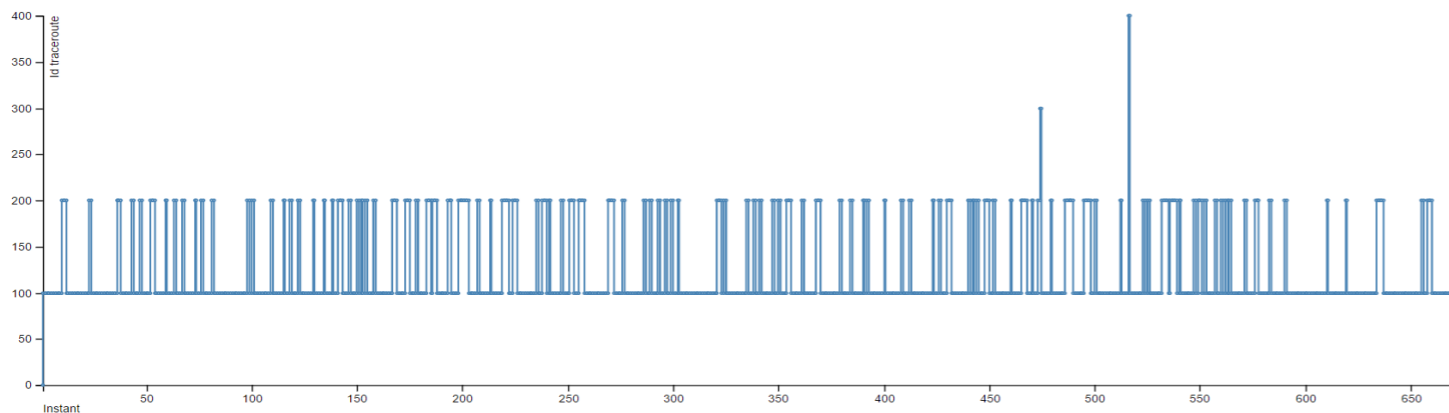
A characterization of the periodicity, if present:
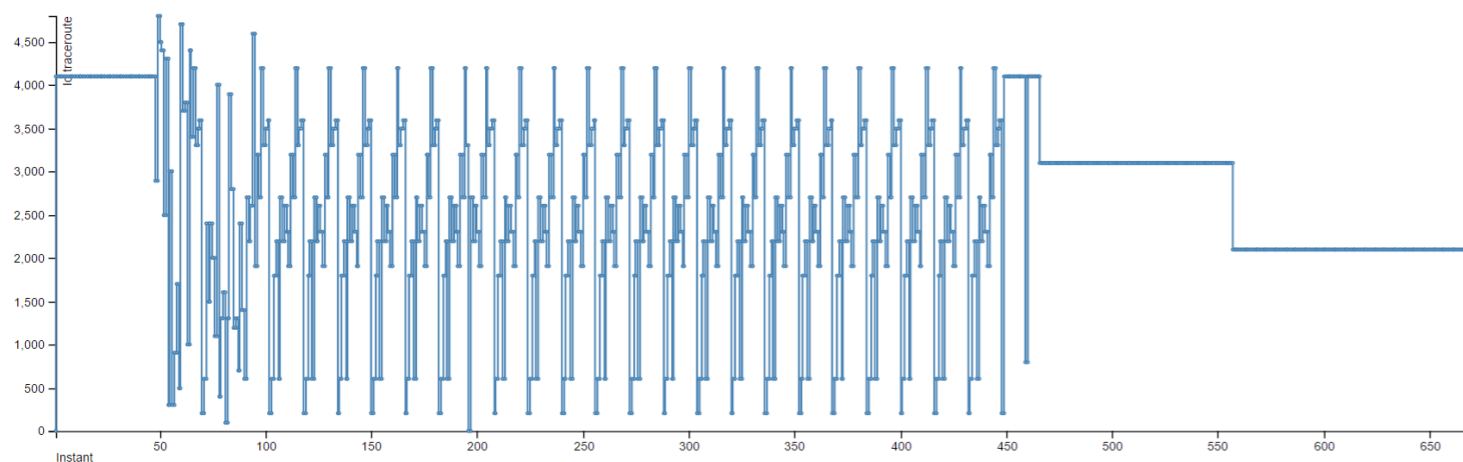

A typical load balancing policy

t1, t2, t3, t4, t5

What is the periodicity of Internet? (1)

- Periodicity analysis on 20K traceroute sequences

  -20% of RIPE ATLAS ipV4 data

  -7 days observation

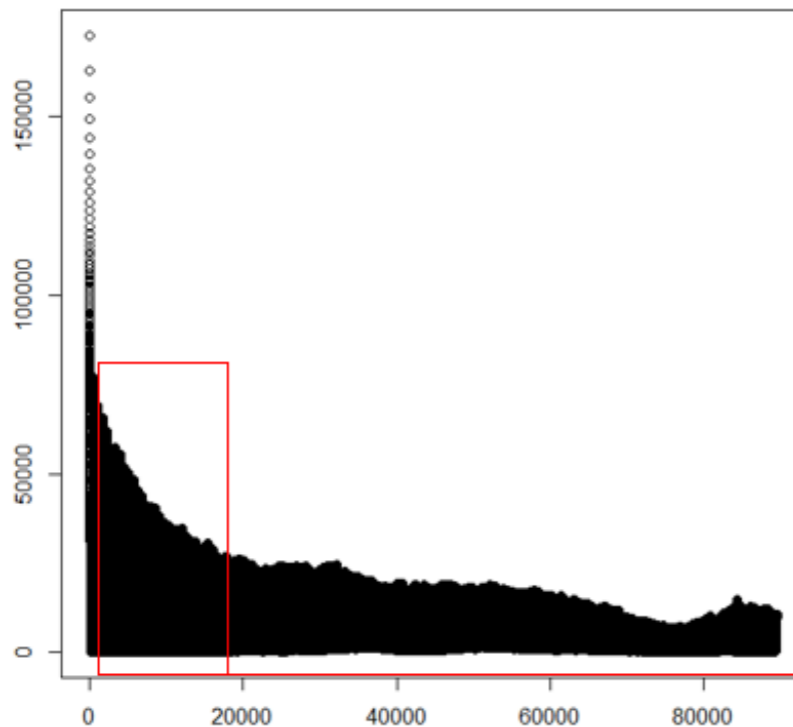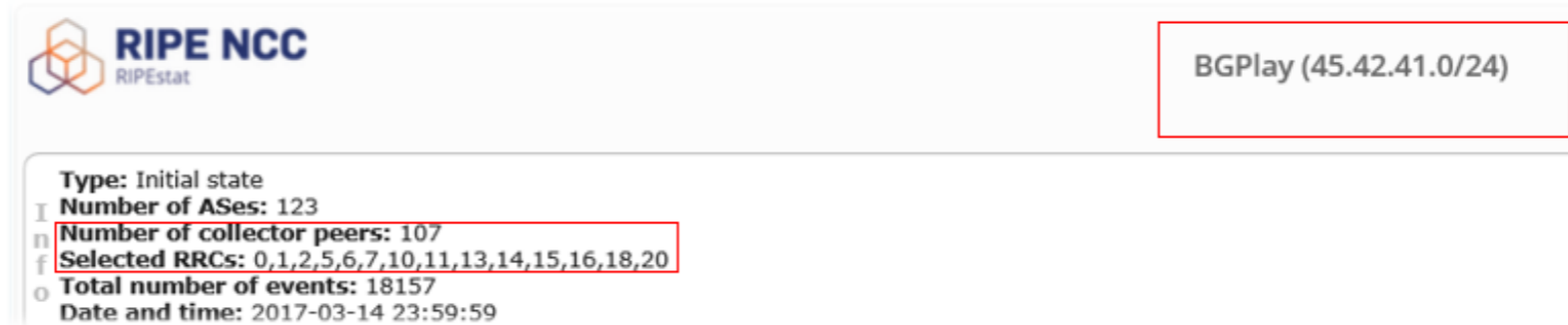- <u>2K pairs showed a periodic behaviour</u>

1,5K two-state periodicity

5 K more-than-two-state periodicity

What is the periodicity of Internet? (2)

- Technique also applied to BGP updates

X= lag
Y= count of positions with the same state

RIPE NCC
RIPEstat

BGPlay (45.42.41.0/24)

Info

Type: Initial state
Number of ASes: 123
Number of collector peers: 107
Selected RRCs: 0,1,2,5,6,7,10,11,13,14,15,16,18,20
Total number of events: 18157
Date and time: 2017-03-14 23:59:59

It has been detected a periodic behavior, with cycles of 570s.

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What is the periodicity of Internet? (3)

+575/2 s

+575/2 s

+575/2 s

+575/2 s

+575/2 s

+ 15 h
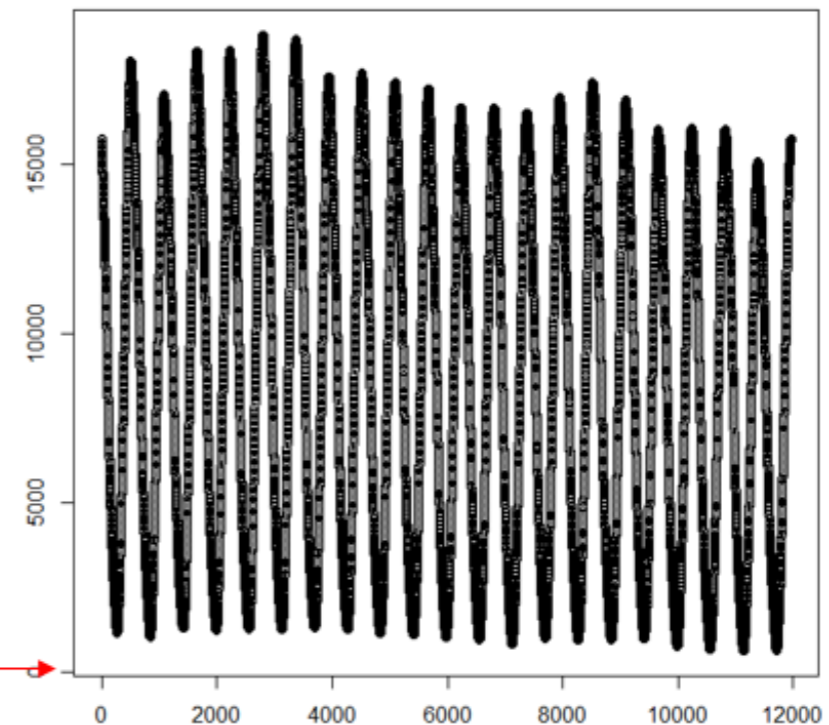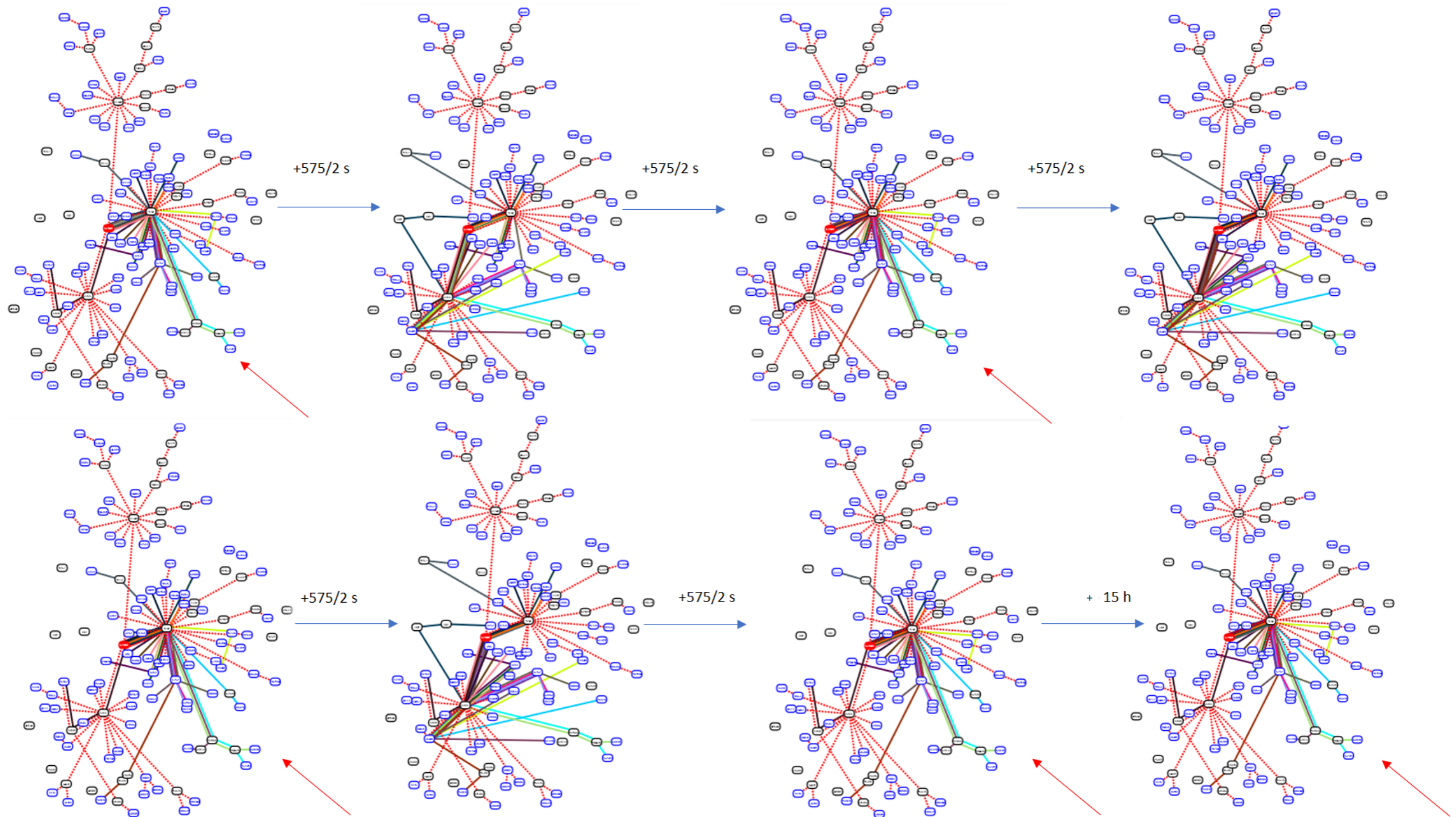
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Periodicity as a Service (PaaS 2.0)

RIPE TraceMON

periodicity

irregularities
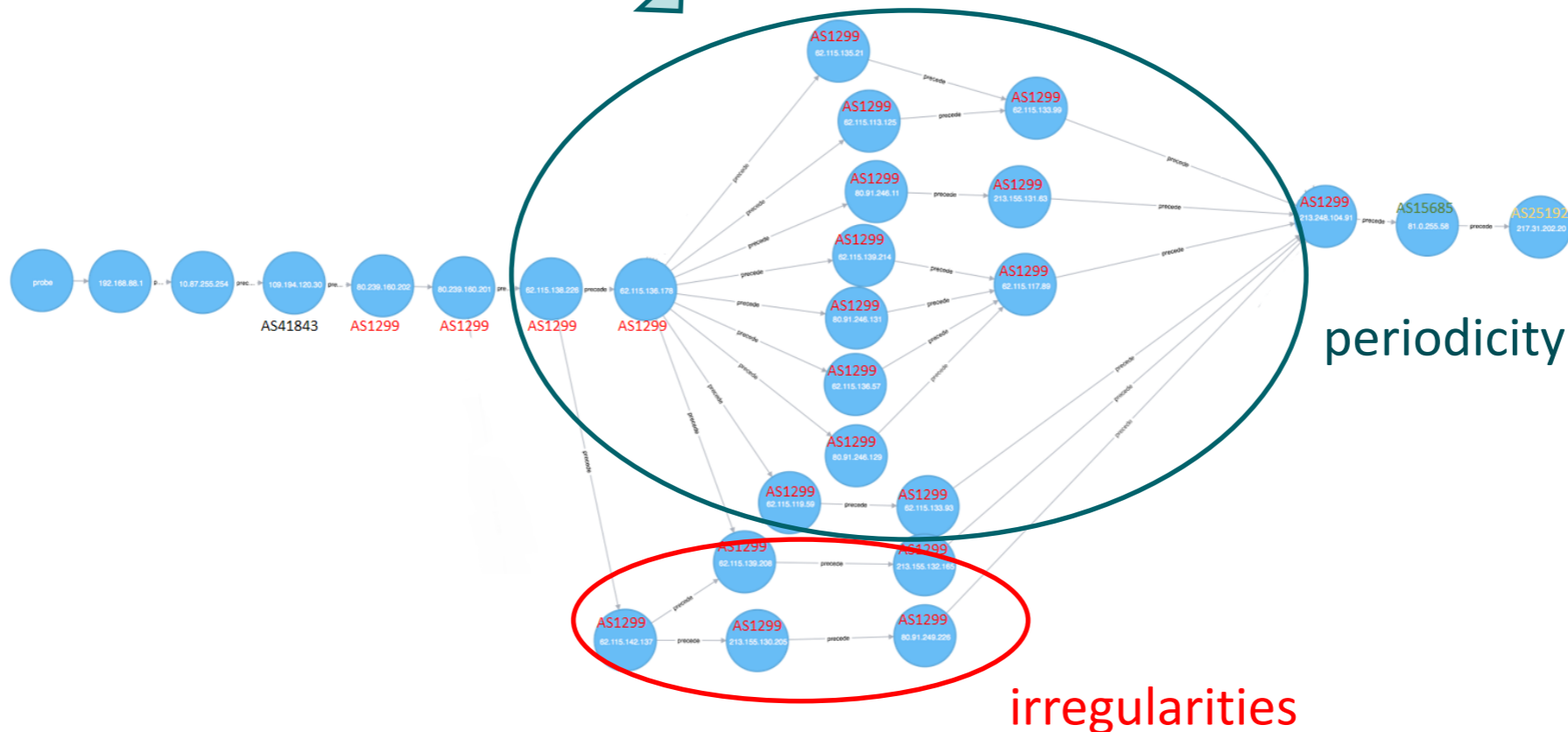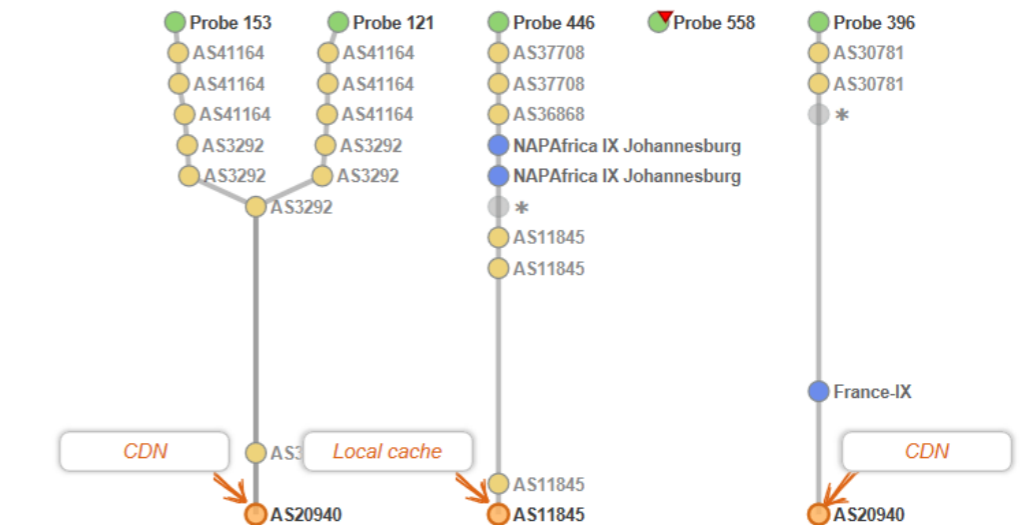
Questions?

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