

RIPE

Periodic Behavior in Internet Measurements

A Hybrid Technique for the Periodicity Characterization

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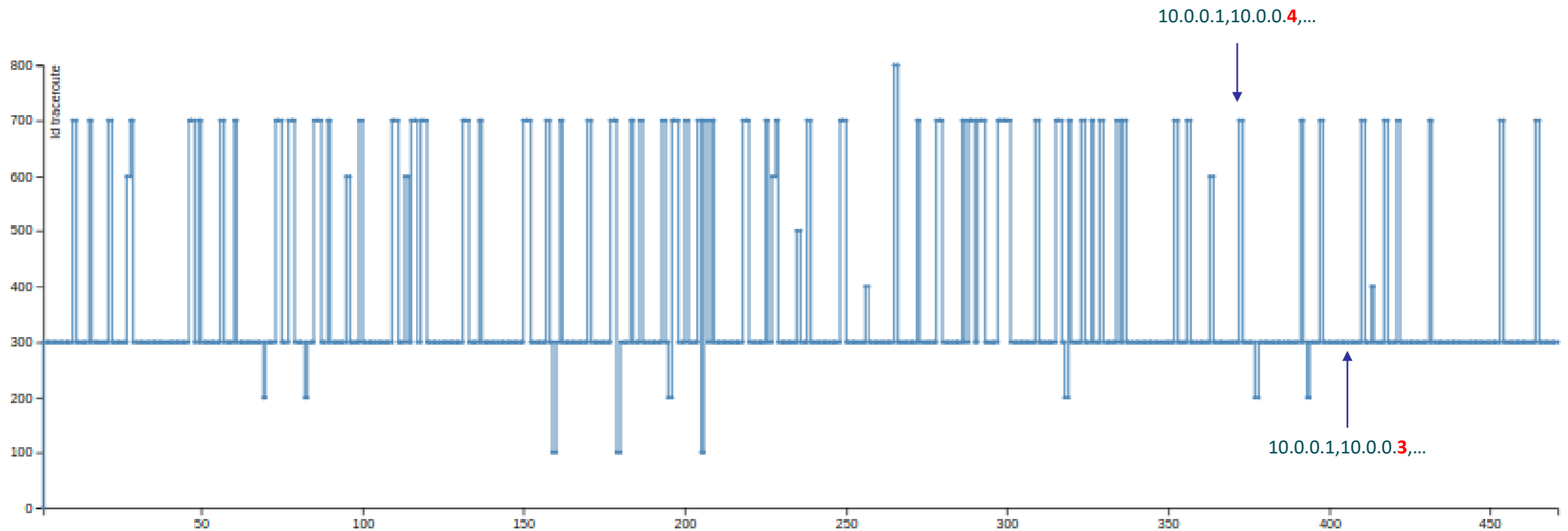
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Do periodicities impact network management?

- 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**?

Traceroute data collection



- 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

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

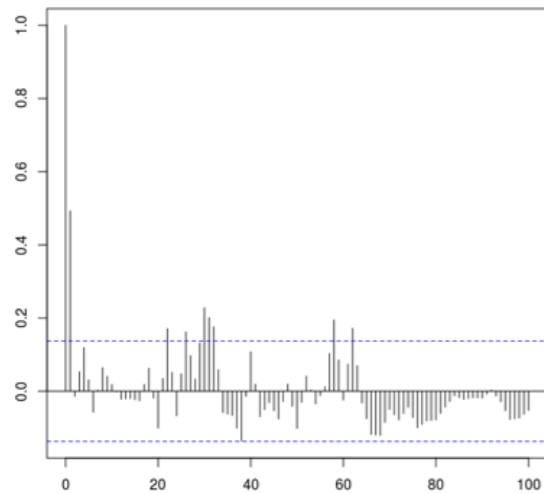
Autocorrelation

$$R_{ff}(\tau) = \int_{-\infty}^{\infty} f(u) \bar{f}(u - \tau) du$$

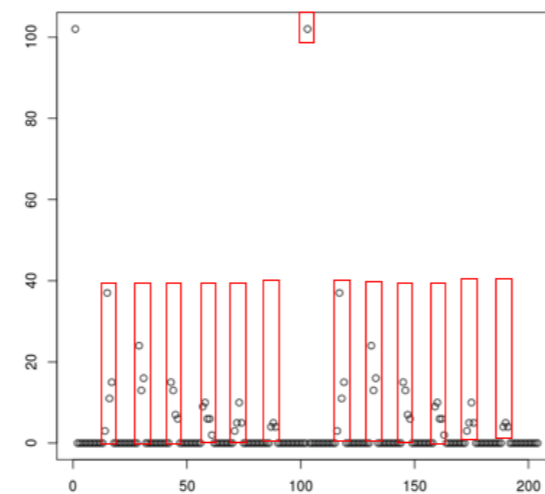
Traceroutes are ordered by Levenshtein distance from most common path



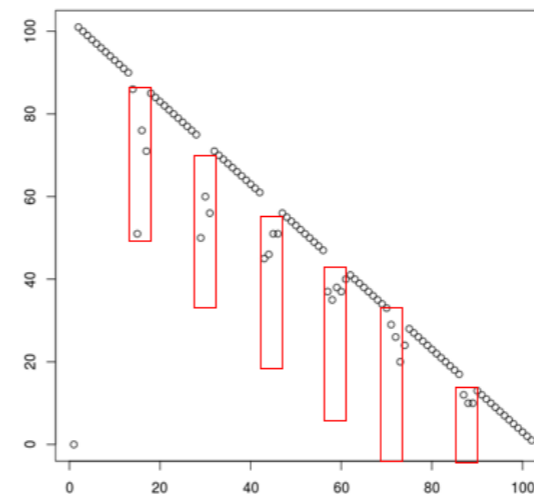
A new version of the Autocorrelation to the pursuit of independence from metrics



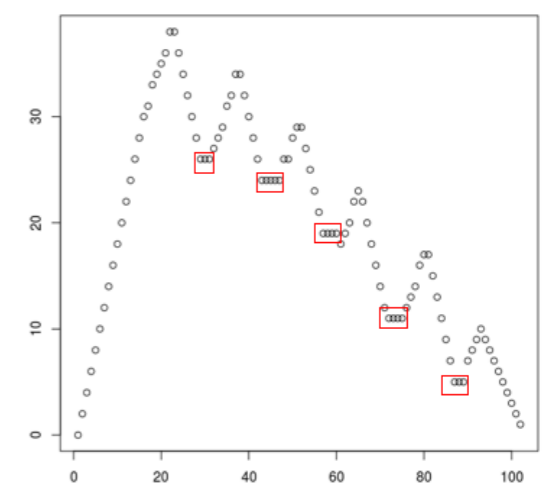
Classic autocorrelation



Exact Match



Hamming

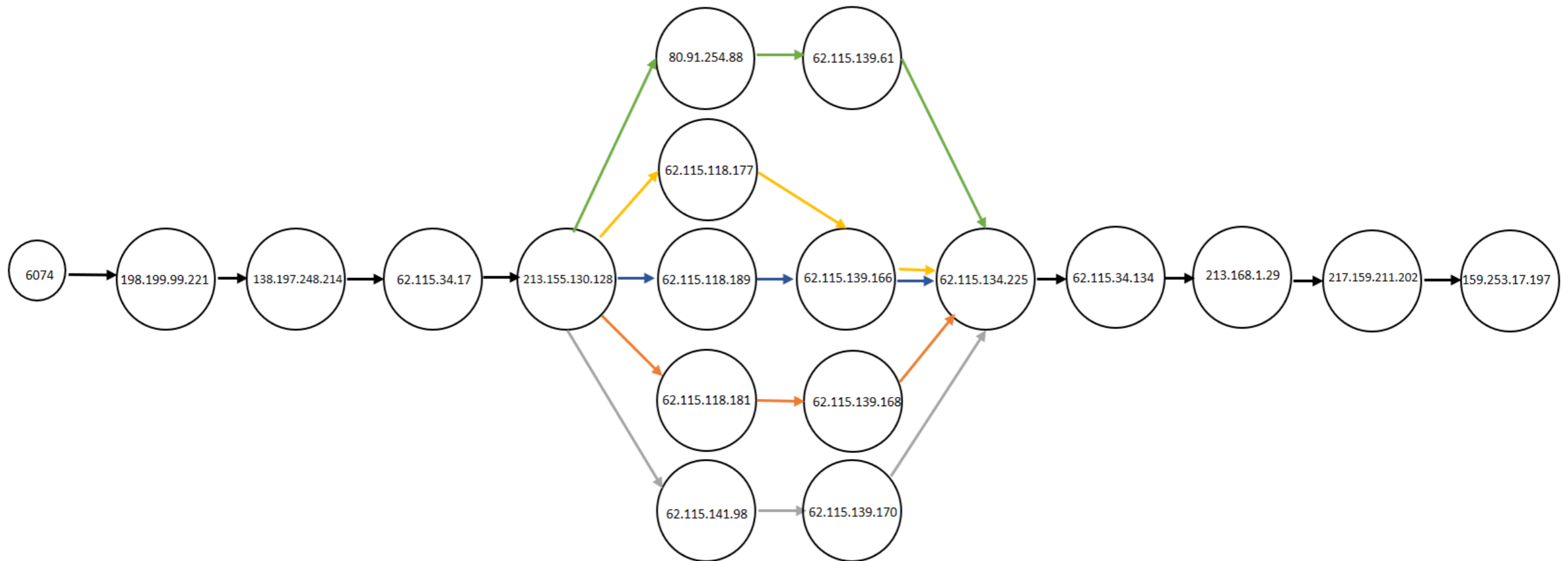


Levenshtein



What do you get?

A characterization of the periodicity, if present:

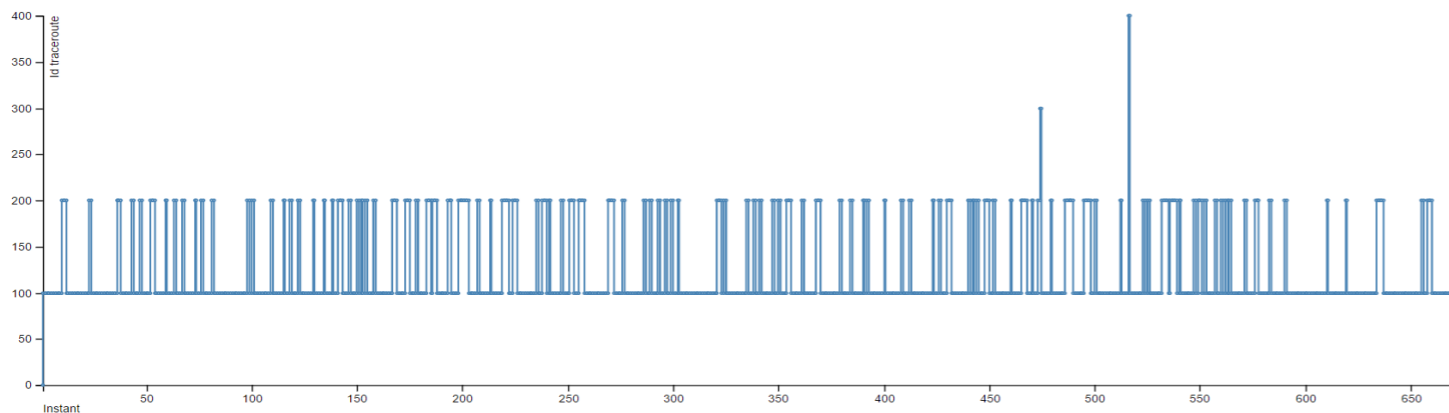


A typical load balancing policy

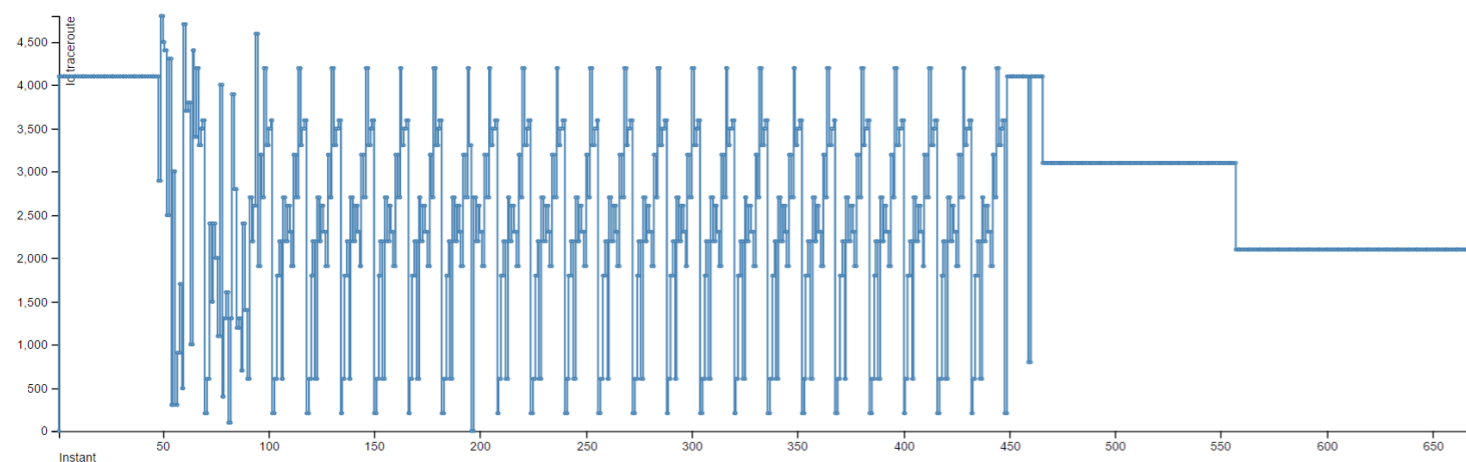
t1, t2, t3, t4, t5

What is the periodicity of Internet? (1)

- Periodicity analysis on 20K traceroute sequences
 - 20% of RIPE ATLAS IPv4 data
 - 7 days observation
- 2K pairs showed a periodic behaviour



1,5K two-state periodicity



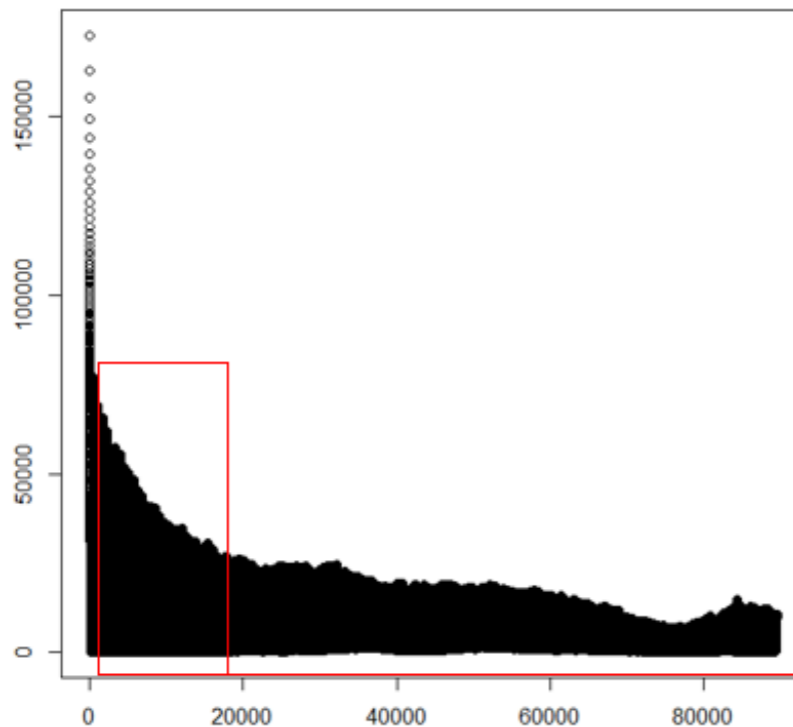
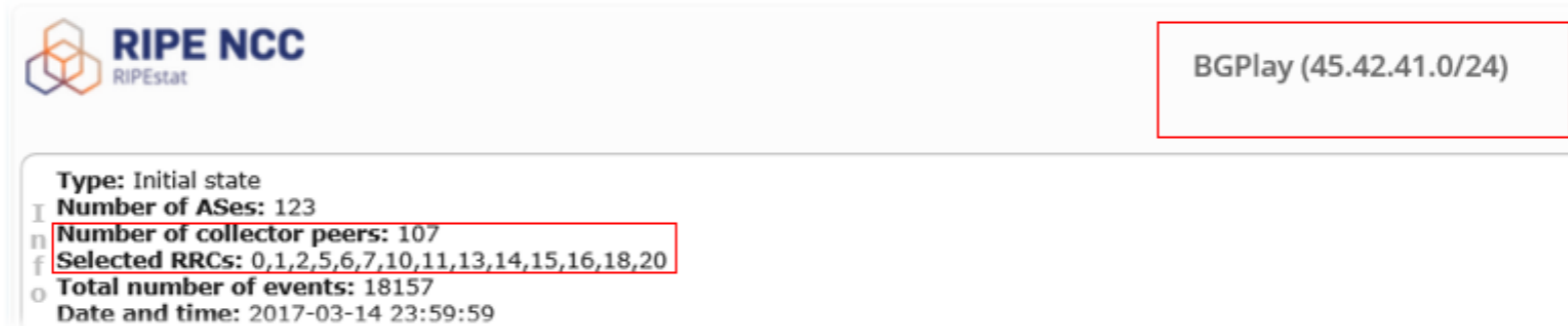
5 K more-than-two-state periodicity



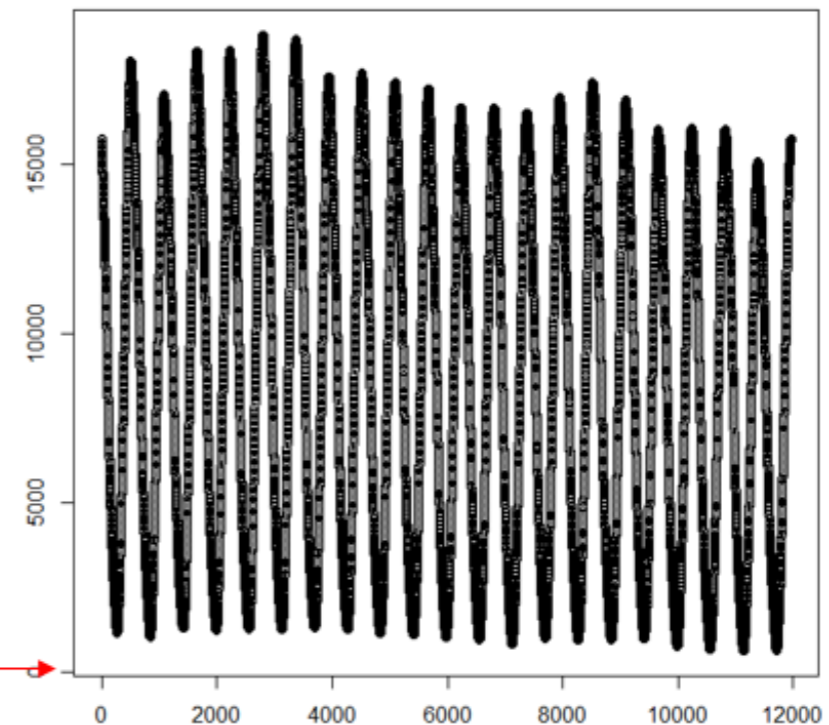
What is the periodicity of Internet? (2)

- Technique also applied to BGP updates

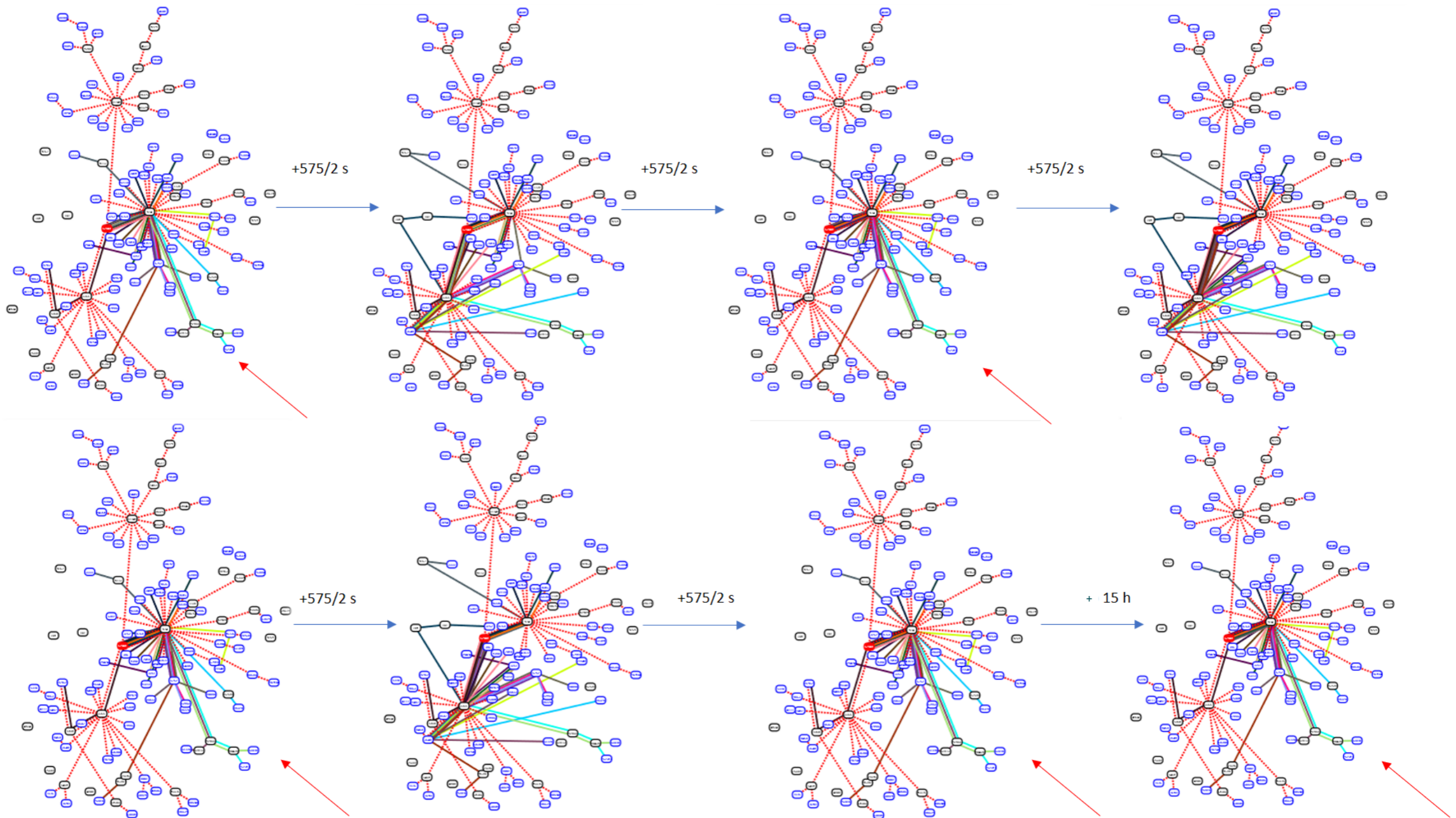
X= lag
Y= count of positions with the same state



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



What is the periodicity of Internet? (3)



Periodicity as a Service (PaaS 2.0)

RIPE TraceMON

Get anomalies alert

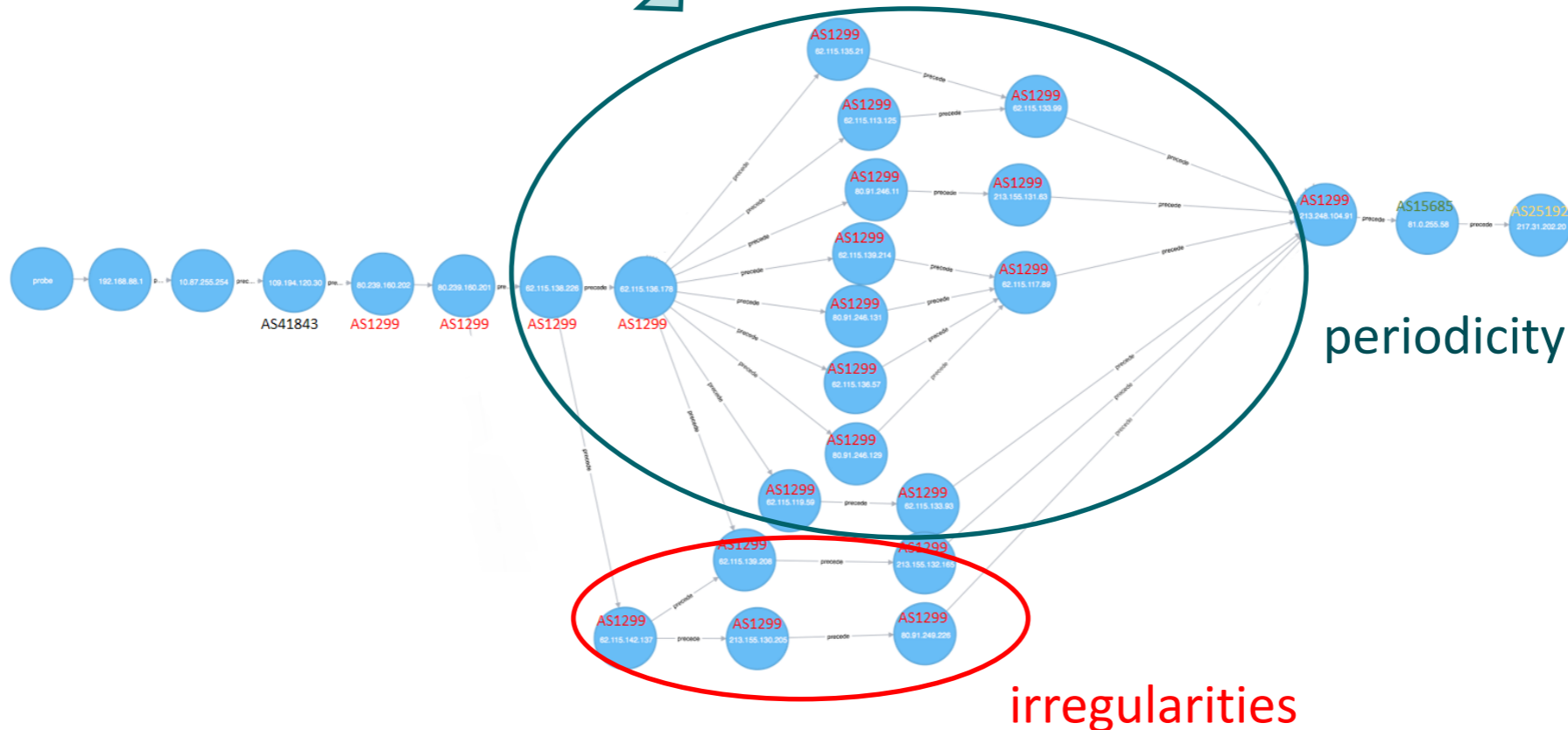
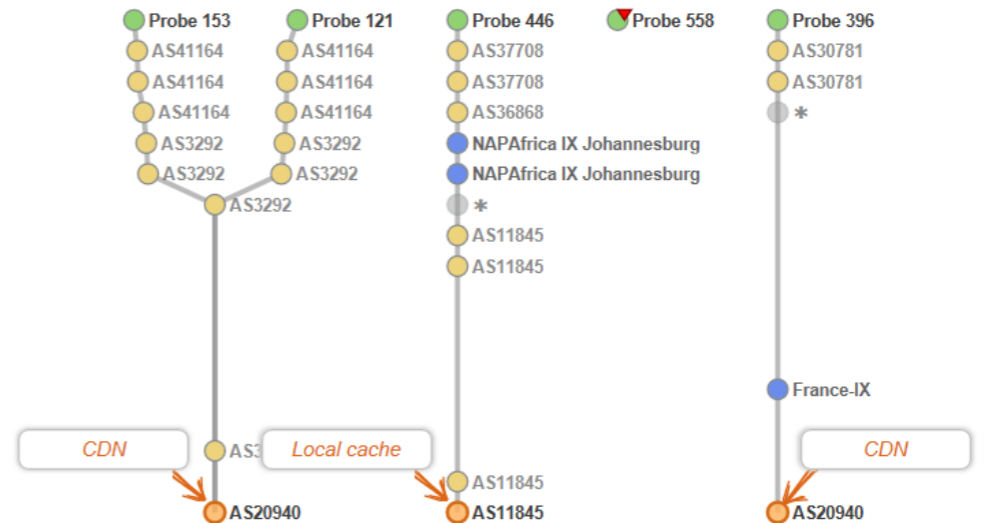
* indicates required

probes set *

target *

start (yyyy-mm-dd,hh:mm),end(yyyy-mm-dd,hh:mm) *

Get data!



Questions?

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