FloCon 2019

Using Data to Defend

Graph Measures for Network Traffic Analysis

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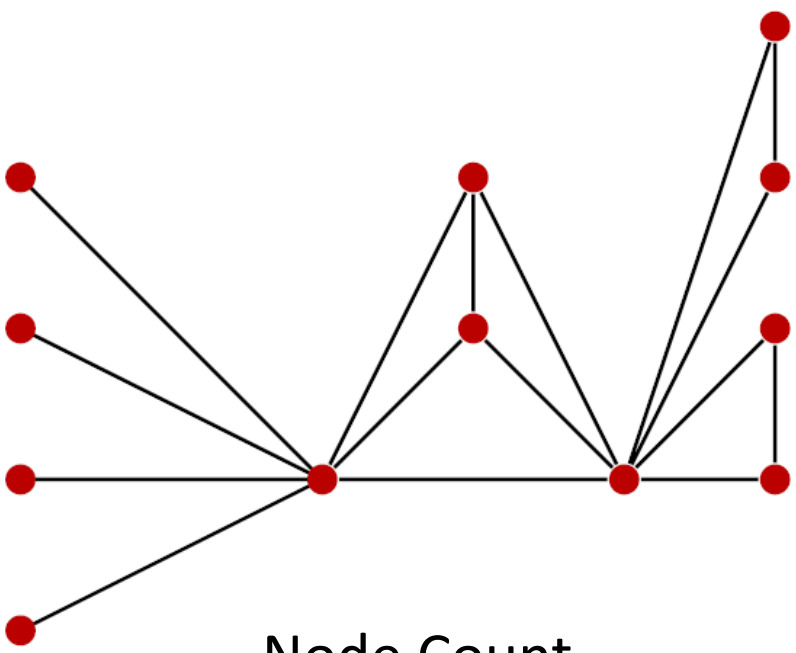
Agenda

Graph Measures

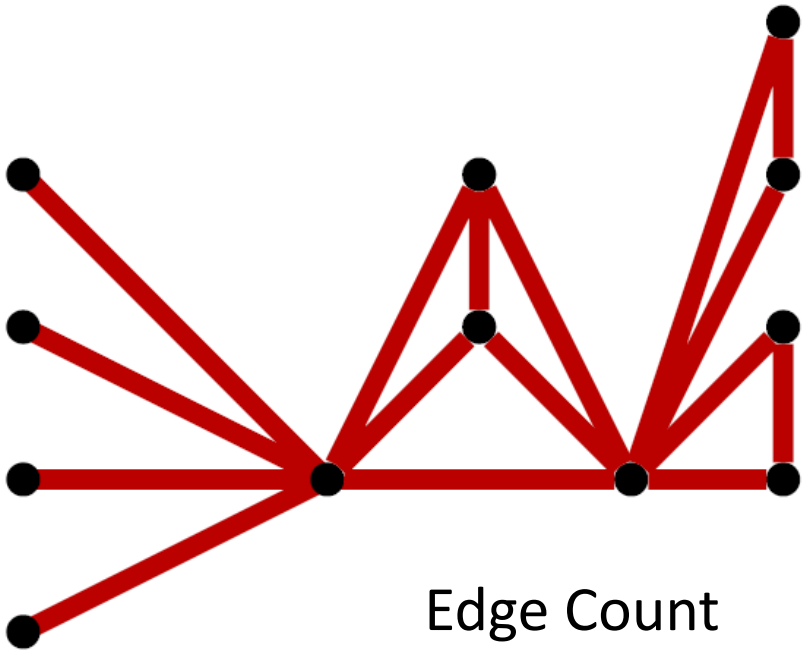
Assessing Network Traffic

Example

Node and Edge Count

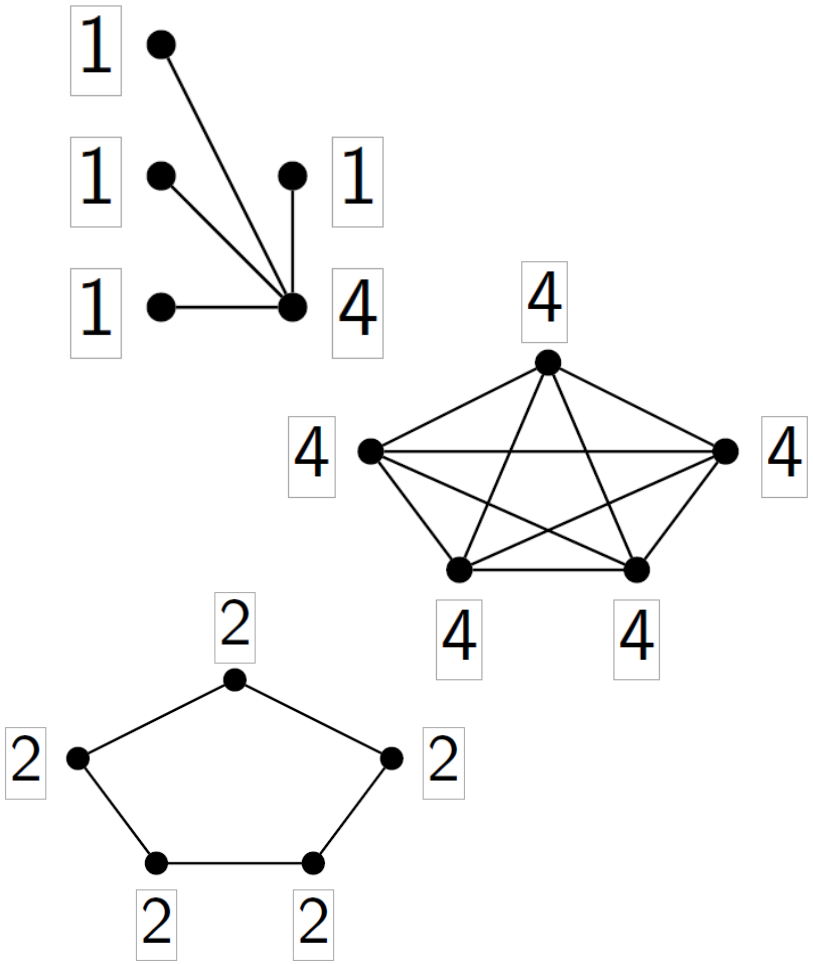


Node Count



Edge Count

Components

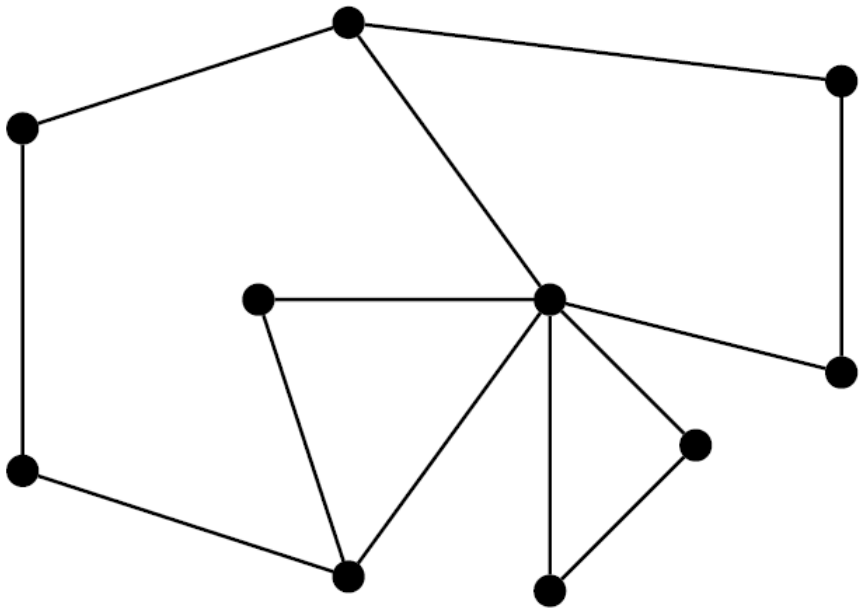


3 Components

Average Degree ~ 2.53

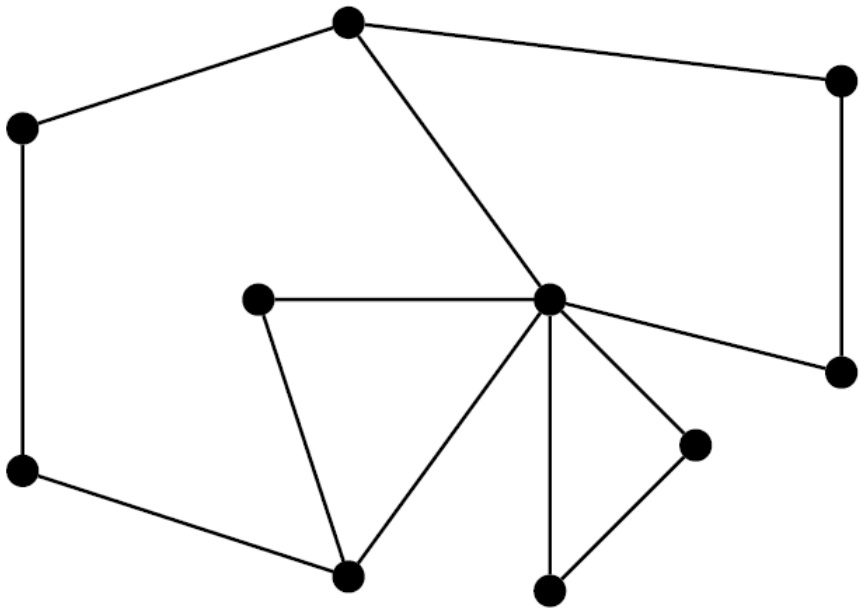
Link Density ~ 0.18

Ego Network



Fragmentation: Describes how much of the network is in highly-connected communities

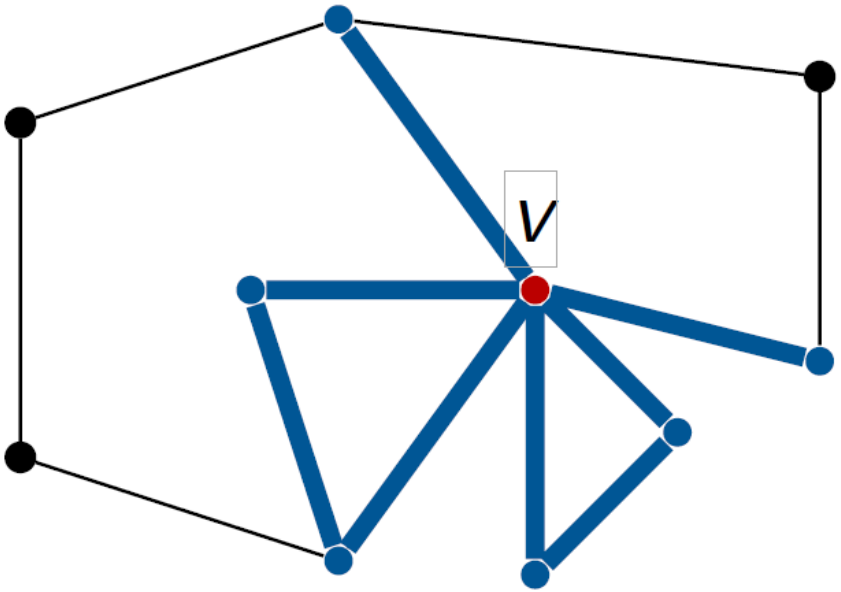
Ego Network



Fragmentation: Describes how much of the network is in highly-connected communities

Local Clustering Coefficient: Link density among a node's neighbors

Ego Network



Fragmentation: Describes how much of the network is in highly-connected communities

Local Clustering Coefficient: Link density among a node's neighbors

Ego Network: The local network defined by a node and its neighbors

Assessing Network Traffic

Bin protocols

Subdivide by autonomic and human-directed traffic (and other)

Take measures

Follow up ego networks for hosts of interest

Advantages:

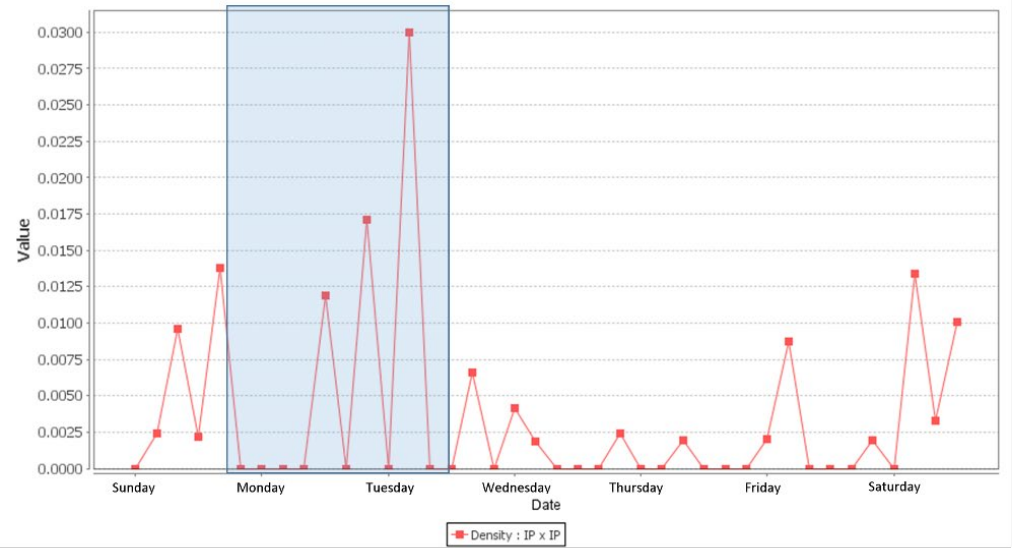
- Speed of analysis: faster operations restrict focus of slower ones
- Objectivity: very data-driven analysis
- Repeatability: over time, thresholds and break points will be known

Issues:

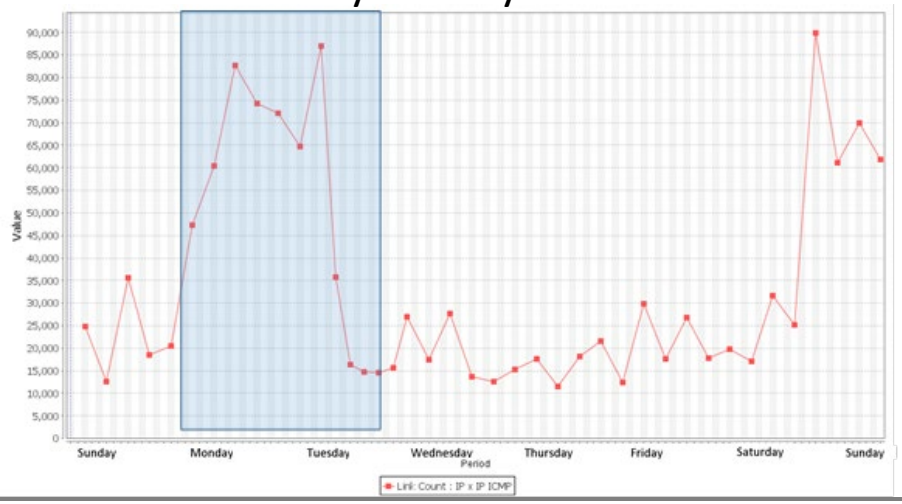
- Which are the best measures?
- How much is organization dependent?
- How much is an artifact of sensors, placement, or data format?

Example

TCP Link Density – 7 days



ICMP Link Density – 7 days



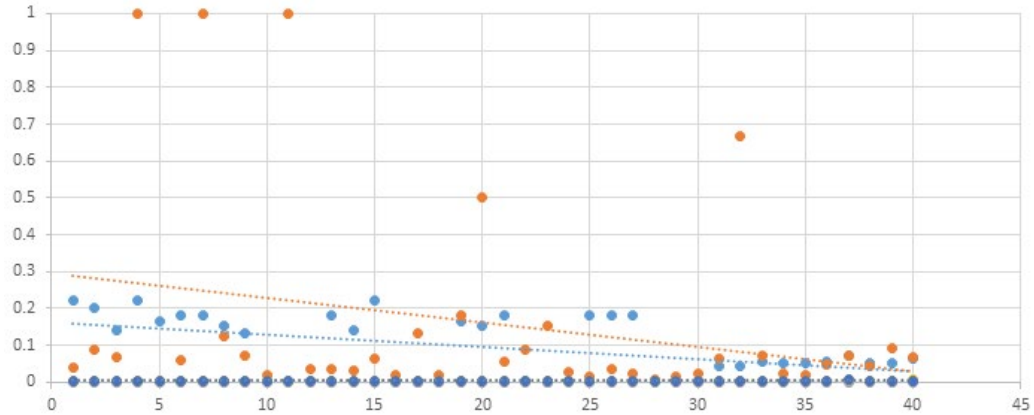
Data from a large-scale enterprise network

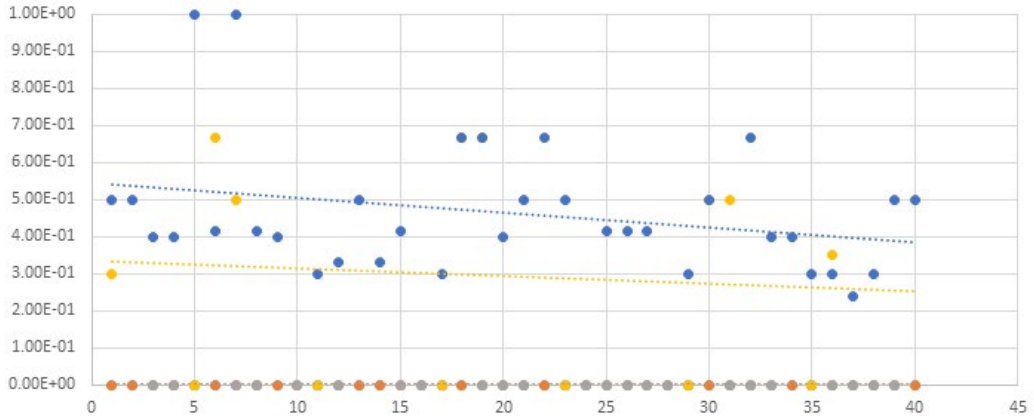
Flash crowd event over two days

Network impacted, but delivered service

Example Ego Network Data

TCP Non-abuse node Link Density





TCP Abuse node Link Density

- Subdivided most changed TCP nodes based on watch list
- Generated ego networks
- Time series of link density color coded by node identity

Summary

Graph models allow repeatable assessment of network traffic

Community and relational perspective – patterns in relationships on nodes and links, rather than record-specific issues

Binning data matters: aggregation interval, types of traffic, groups of nodes

Ongoing work to understand how this can be generalized