

An API to filter network flows in the web to use as plugin in web based network visualization apps

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Outline

- Background
- API Web Interface
- API Backbone
- Visualizations

Previous work

- FlowScan
- NetFlow Sensor (tied to nfdump)
- NVisionIP (FloCon 2005)
- FloVis (FloCon 2009)
- Stager (FloCon 2010)
- FlowViewer (FloCon 2013)
- Rayon & Prism (FloCon 2014)

Previous work: Rayon & Prism

- Prism is a tool for quickly visualizing flow data as a time-series broken down into several configurable bins by SiLK's rwfilter tool.
- It uses Rayon to visualize the network flows.
- Rayon is a Python library and set of tools for generating basic two-dimensional statistical visualizations.
 - Scatterplots
 - Bar plots
 - Time series visualizations

Previous work: Flowbat

- “...analyst-focused graphical interface for analyzing flow data.”
- Features:
 - Multiple Deployment Scenarios
 - Quick Query Interface
 - Graphing and Statistical Capability
 - Generate bar, line, column, and pie charts

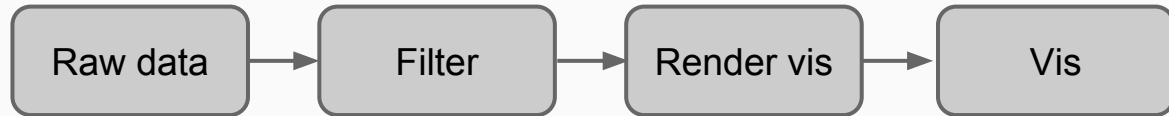
Goal

- To create an API that allow system administrators to manage network flows data in the web, to provide a bridge between the processing of big network data and visualization analytics researchers and provide network analysis as a web service in the cloud.
- The API will be part of Toa which was presented in
 - J. Ortiz-Ubarri, H. Ortiz-Zuazaga, A. Maldonado, E. Santos, J. Grullón. Toa: A Web-Based NetFlow Data Network Monitoring System. In Proceedings FloCon 2015, Portland Oregon. January 2015.

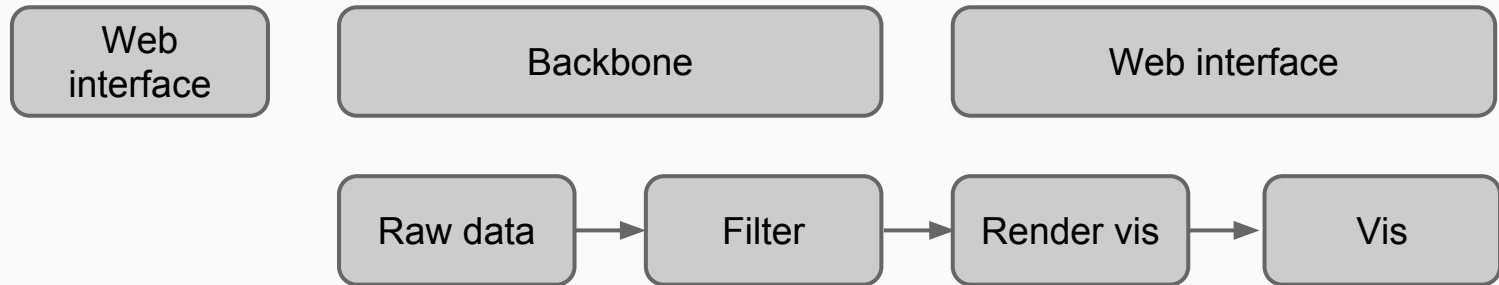
Features

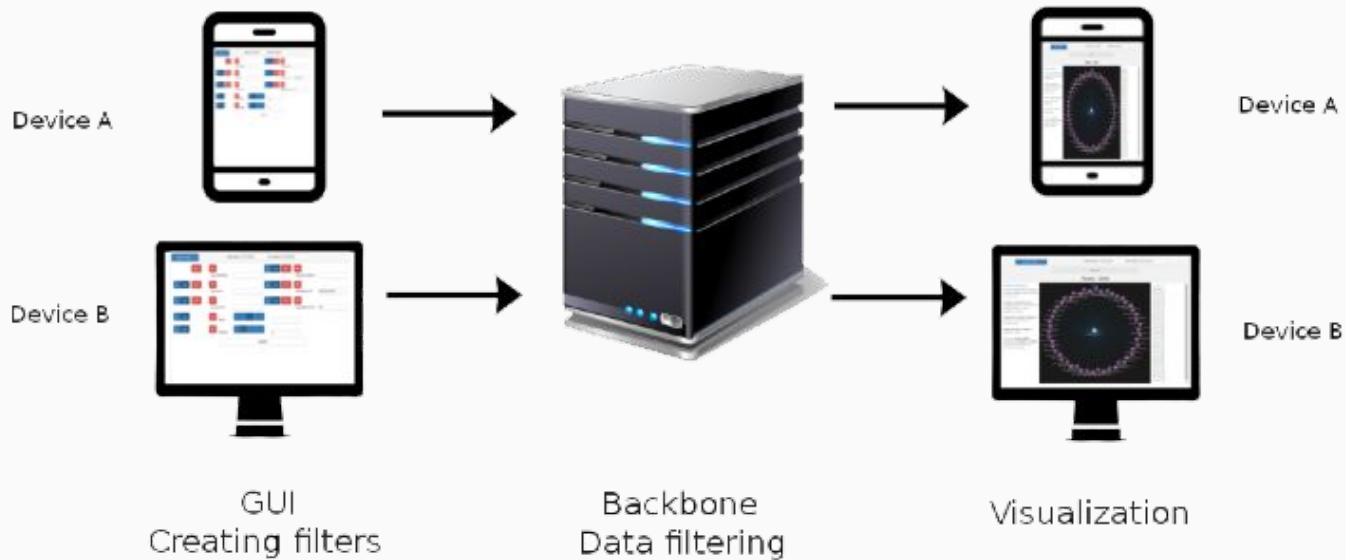
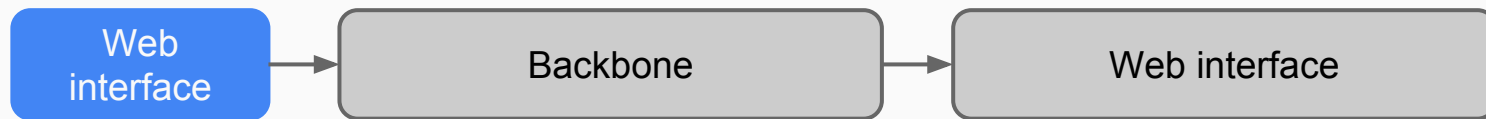
- It can be implemented with Python CGI's or Flask and with Javascript
- Web interface implementation based in bootstrap
 - Query interface
- Allows to pivot the data by applying filters to the already filtered results
- Graphing capability
- Visualization developers can create their own graphs to use with the API functions

Generic data preparation process



Our API data preparation process





API: Web interface

- **AngularJS**
 - “...is a structural framework for dynamic web apps. It lets you use HTML as your template language and lets you extend HTML's syntax to express your application's components clearly and succinctly.”
- **Bootstrap**
 - “...is the most popular HTML, CSS, and JavaScript framework for developing responsive, mobile-first web sites.”

API: Web interface

--- Select Filter --- ▾

Start date **End date**

Start time **End time**

Source IP **OR** **AND** **Destination IP**

Source Port

IP version **Entries** **Visualization**

Filters

- Input and Output interface
- Source and destination IP
- Source and destination Port
- Bytes
- Packets



API: Backbone

- Python CGI
- Flask
- Javascript

API: Backbone

- Receive and translates the query created by the user to the actual filters that are applied to the network data.
- Utilizes PySilk extension to retrieve the network flows stored in the file system generated in the given time frame.
- At the same time it applies the filters to the flows.
- Results are returned to the Web Interface



API: Web interface

--- Select Filter --- ▾

Start date End date
Start time End time

IP version Entries Visualization

Graph Operations

In this (advanced) example a static graph is fed into the visualization.

Custom Animations are triggered when clicking on a node's label or when deleting a node.

Click on a **node's label** to select a node and its connections.

Click on the **'x'** link to delete a node.

You can **drag nodes** around and **zoom** and **pan**, just like you did in the previous example.



The user is able to either query the already filtered data or query the entire database again.

Visualizations: Force Directed

Graph Operations

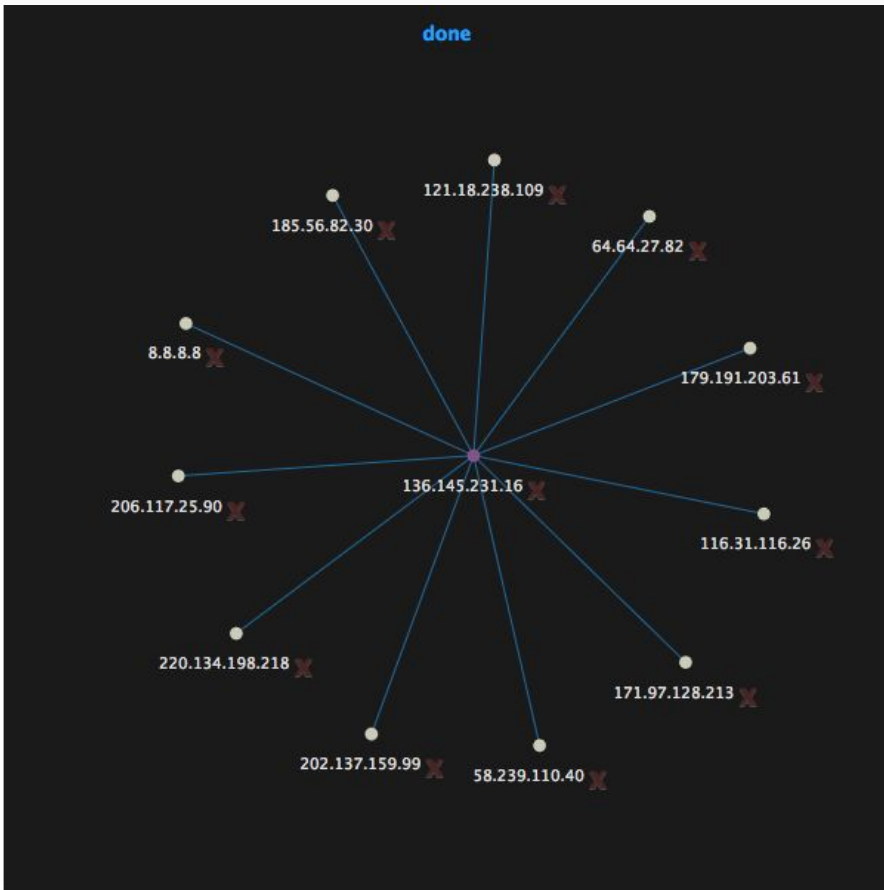
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The Force Directed Graph is used for finding botnets, and DDoS.

Visualizations: Tree Map

Animated Squarified, SliceAndDice and Strip TreeMaps

In this example a static JSON tree is loaded into a Squarified Treemap.

Left click to set a node as root for the visualization.

Right click to set the parent node as root for the visualization.

You can choose a different tiling algorithm below:

Squarified
Strip
Slice And Dice

Go to Parent



The Tree Map is used to find the top computers generating traffic

Options:

- Squarified

Visualizations: Tree Map

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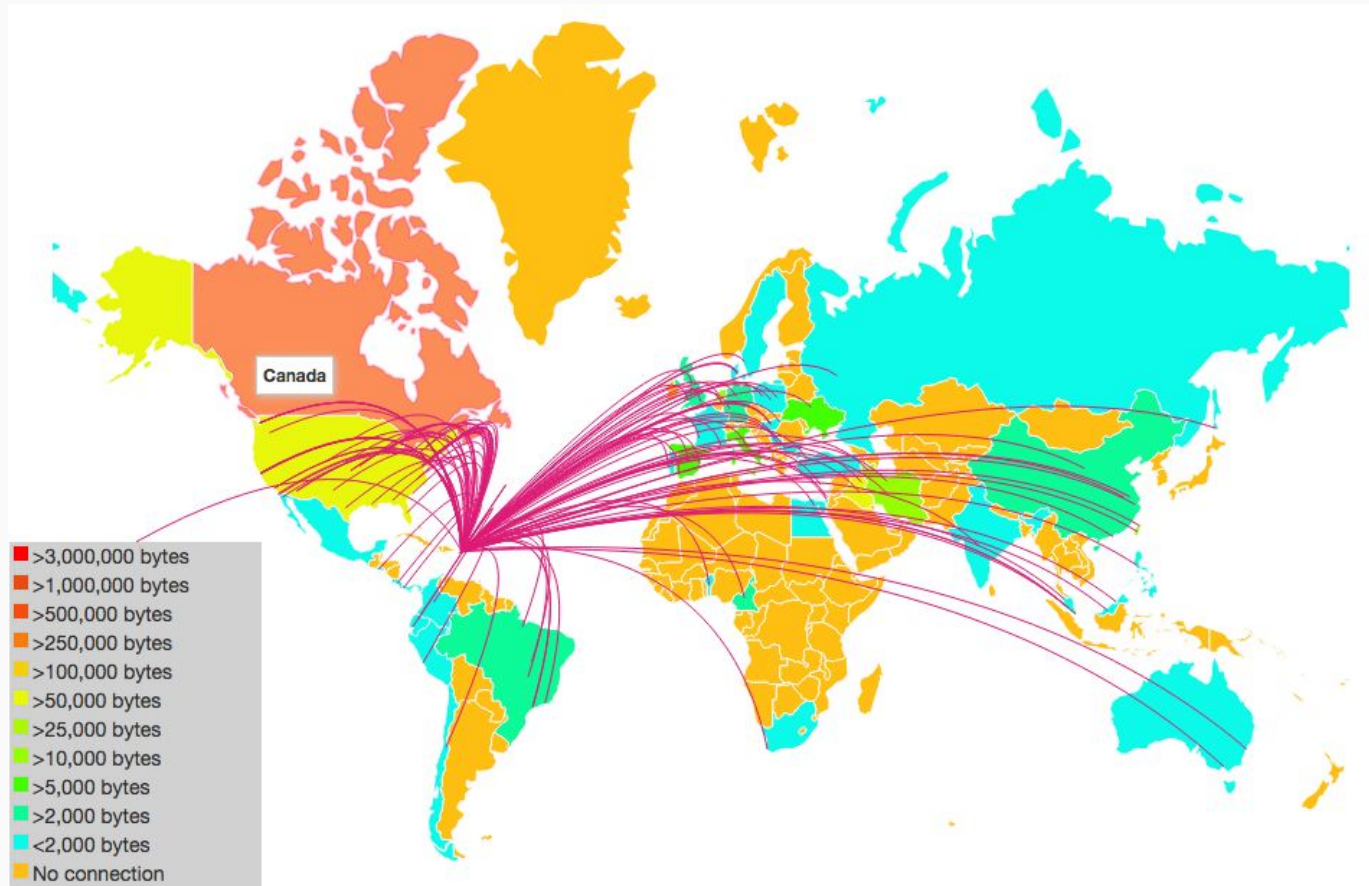


The Tree Map is used to find the top computers generating traffic

Options:

- Squarified
- Strip
- Slice and Dice

Visualizations: Data Map



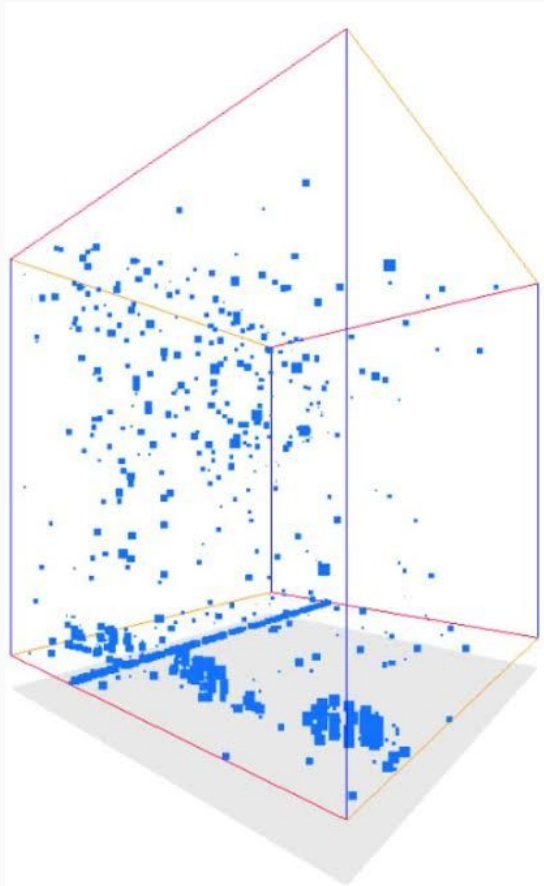
The Data Map is used to find the top countries generating traffic and to detect unexpected connections

Visualizations: Table

Show entries

Source IP	Destination IP	Source Port	Destination Port	Bytes	Packets
2291263297	3365153350	80	43855	46	1
2291263294	3699687351	80	32990	714	4
2291263293	998128980	80	42126	717	4
2291263297	3026283169	80	36732	46	1
2291263294	3699687351	80	37740	46	1
2291263293	2195832932	80	52866	546	6
2291263293	2195832932	80	52898	546	6
2291263293	3026283169	80	43279	46	1
2291263293	998128980	80	52411	46	1
2291263293	1093885455	80	60306	546	6
2291263293	1093885455	80	33824	546	6
2291263293	875009471	80	48332	546	6
2291263293	875009471	80	48356	546	6
2291263263	3026283045	80	50815	46	1
2291263293	2533281863	80	41486	546	6
2291263293	2533281863	80	41469	546	6
2291263293	1285882578	80	60151	546	6
2291263293	1285882578	80	60163	546	6
2291263267	2054482497	80	46525	138	3

Visualizations: Cube



The Cube uses WebGL and Three.js. Threats such as network and port scan can be detected.

References

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Questions?

Thank you!