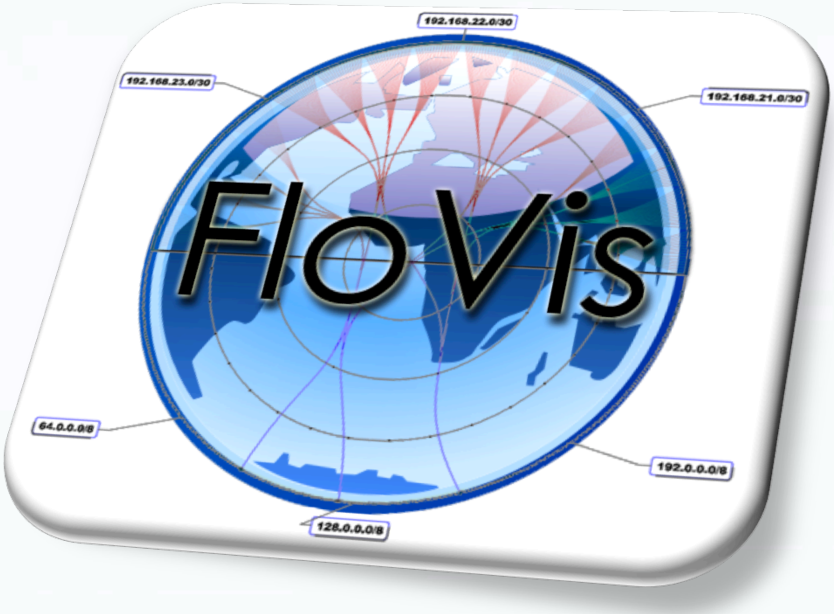


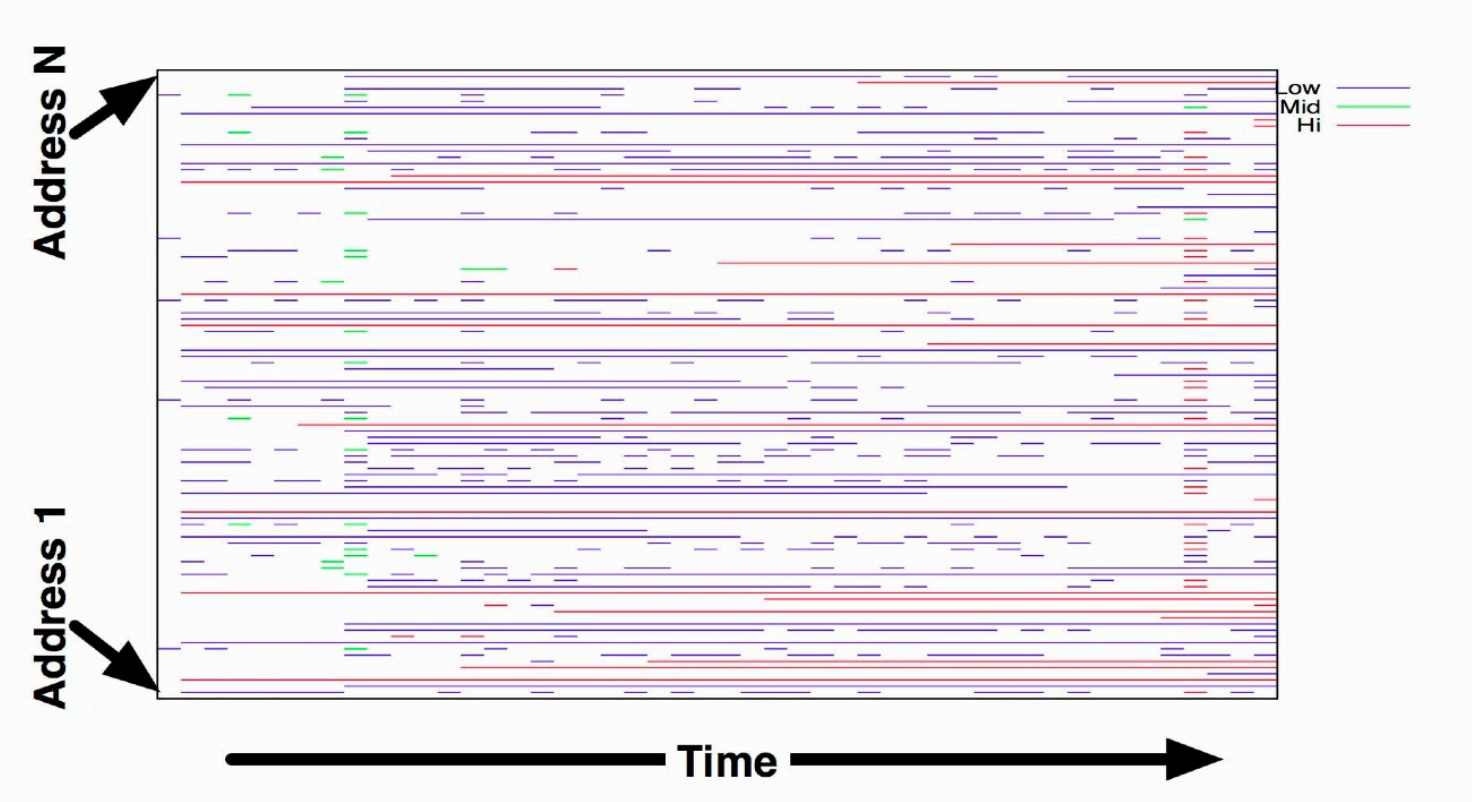
Activity Plot

Diana Paterson

Presentation Summary:

- This presentation will introduce a new visualization for Netflow data called Activity Plot.
- Activity Plot displays host activity as a function of time using a small selection of colors to capture a limited number of activity categories.
- This presentation will:
  - Provide background for the implementation, and review related work
  - Detail the raw data
  - Review the structure of the activity plot
  - Describe a prototype implementation
  - Present two case studies
  - Offer future work and conclusions

Background: Existence Plots



- Introduced by Phil Groce and Jeff Janies at FloCon 2008

Activity Plot – Activity Viewer

- A visualization for displaying host activity as a function of time.
- Activity can be host related, time related, simple, complex etc.
- Individual hosts are plotted against time in a simple two dimensional grid.

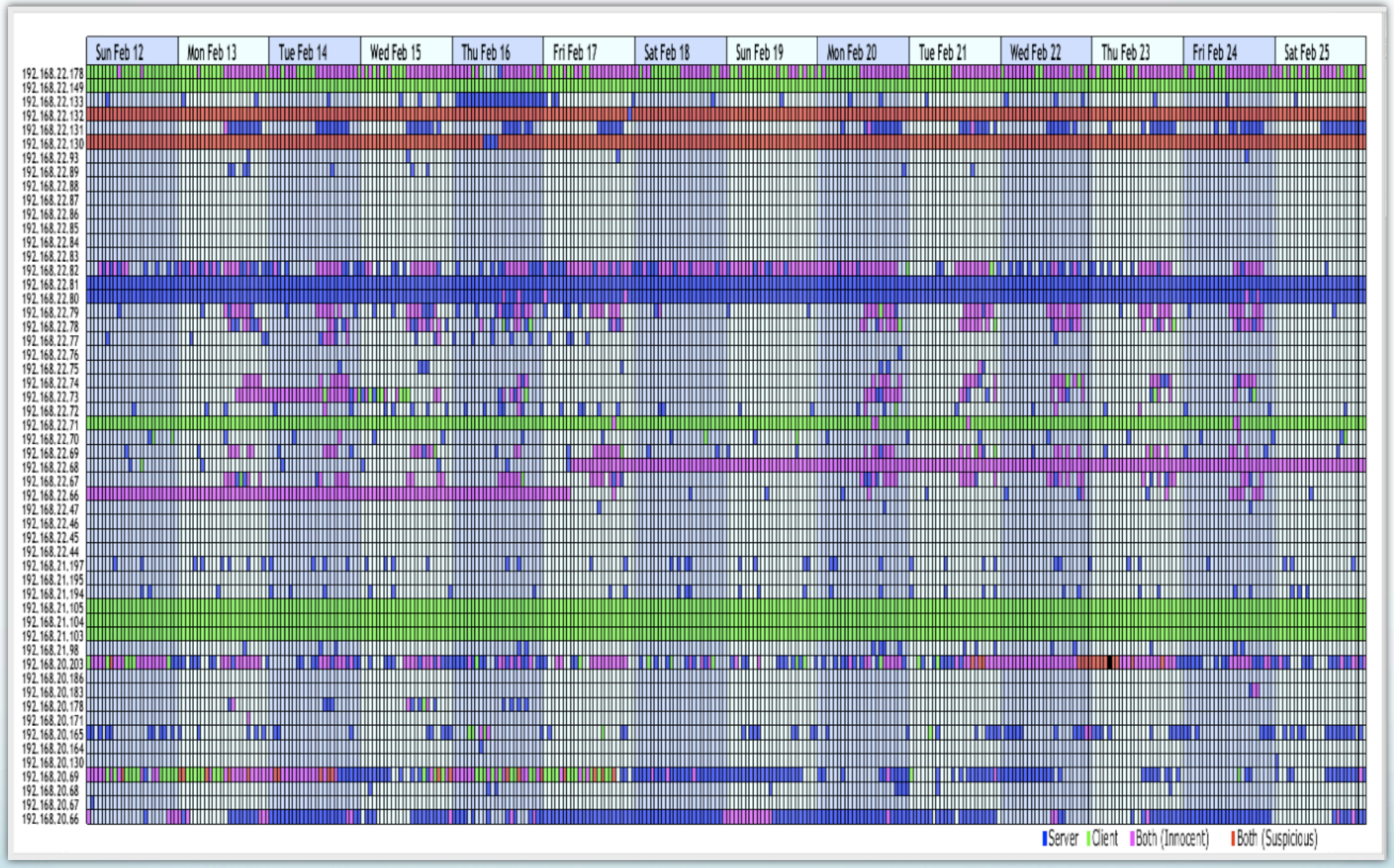
Raw Data

- NetFlow data collected using the SiLK tool's flow collector.
- Payload data was not collected or examined.
- Two UNIX scripts used to process the data and generate the input information for the visualization.
  - These scripts use set and bag tools to generate the data required to determine the activity classifications.

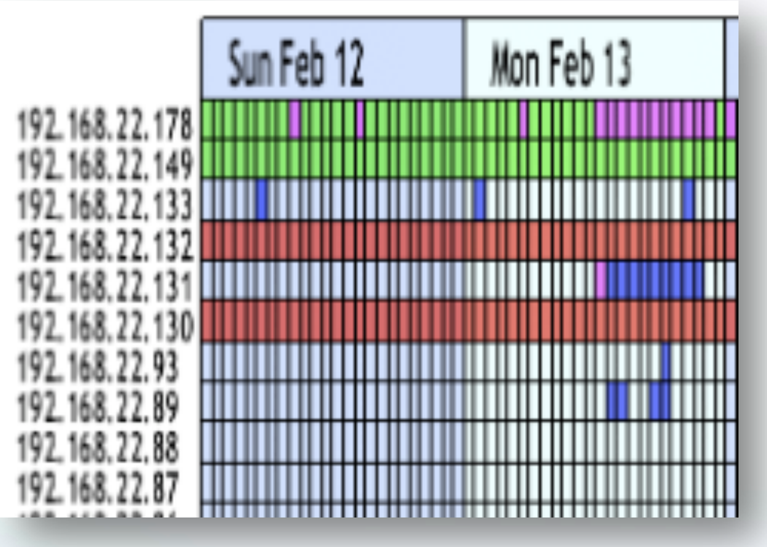
Sample Network Description

- Four /24s address spaces.
- Hosts consist of a combination of standard traditional users and temporary development/ experimental machines.
- Addresses have been anonymized to protect the identity of both the network and the external hosts.
- The visualization presented contains 1 month (the first month captured) of network activity.

Visualization: Activity Plot

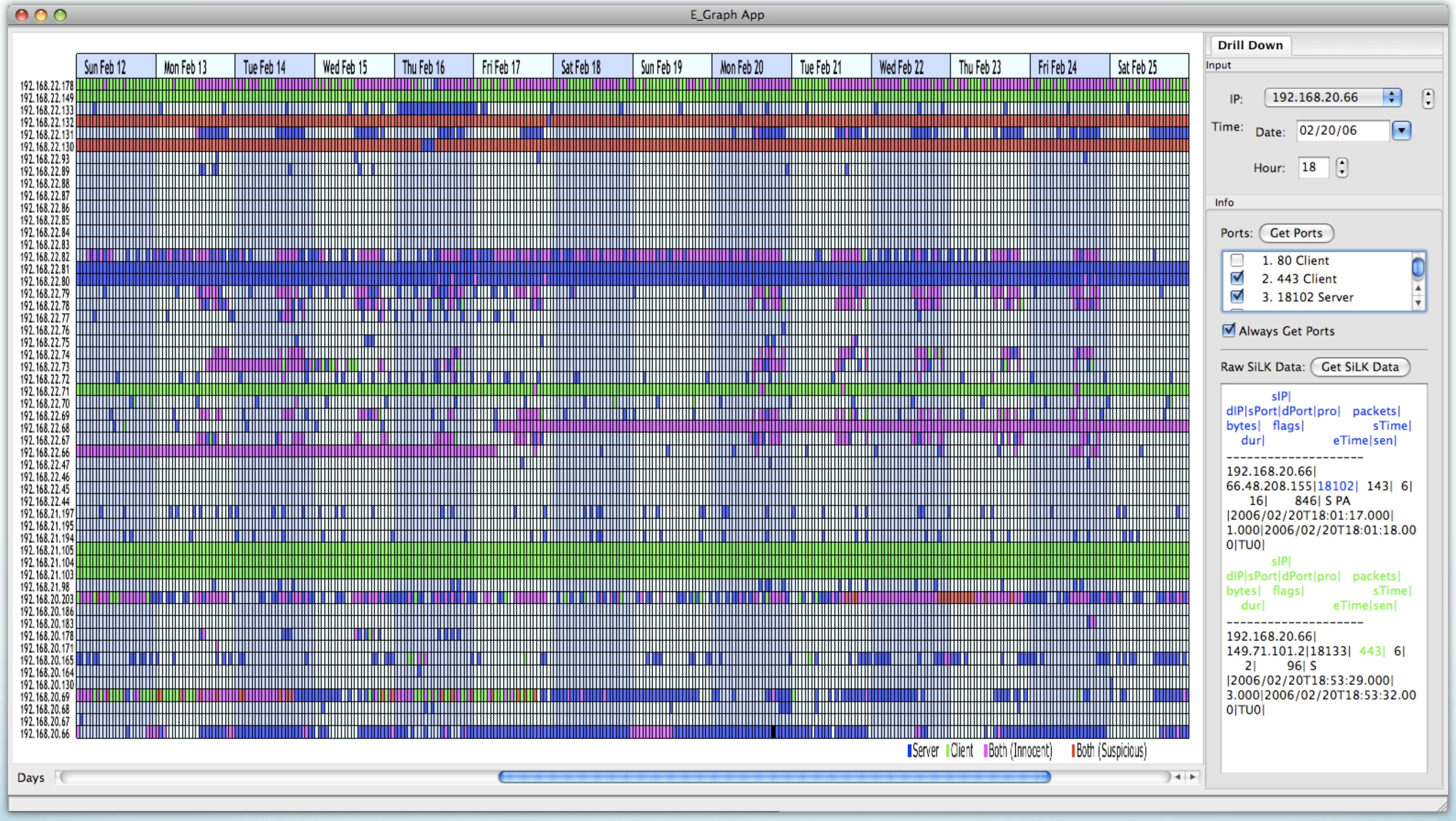


Visualization structure:



- Grid format used to display activity and non-activity.
- 14 days of data visible at one time at an hourly resolution.
- Days of the week used in the time labels
- Small number of activities visualized.
- Background highlighting used to group hours in a day.

Implementation: Activity Viewer



IP: 192.168.20.66

Time: Date: 02/20/06

Hour: 18

Ports:

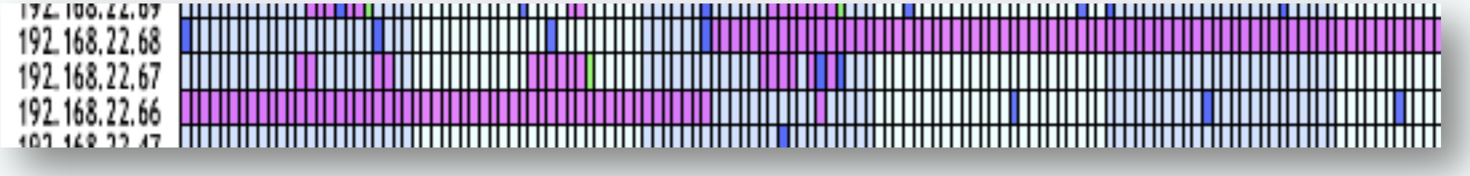
- ☐ 1. 80 Client
- ☑ 2. 443 Client
- ☑ 3. 18102 Server

☑ Always Get Ports

Raw SiLK Data:

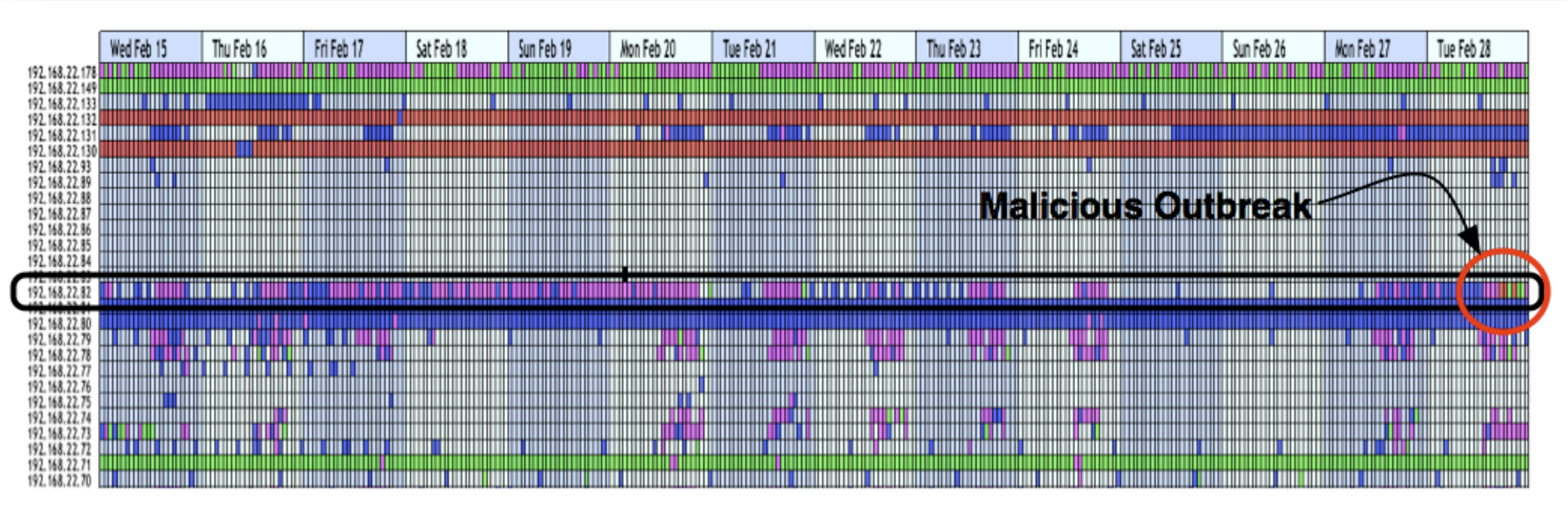
```
          sIP|
dIP|sPort|dPort|pro|   packets|
bytes|   flags|                sTime|
   dur|               eTime|sen|
--------------------
192.168.20.66|
66.48.208.155|18102|  143|  6|
     16|       846| S PA
|2006/02/20T18:01:17.000|
1.000|2006/02/20T18:01:18.00
0|TU0|
          sIP|
dIP|sPort|dPort|pro|   packets|
bytes|   flags|                sTime|
   dur|               eTime|sen|
--------------------
192.168.20.66|
149.71.101.2|18133|  443|  6|
     2|       96| S
|2006/02/20T18:53:29.000|
3.000|2006/02/20T18:53:32.00
0|TU0|
```

Case Study 1: Lease Switching?



- Host 192.168.22.68 and 192.168.22.66
- Significant changes in the time based activity patterns of both hosts.
- Further investigation with the SiLK tools supports the conjecture.

Case Study 2: Malicious Activity



- February 28, 2007 at 17:00 host 192.168.22.82 started using the same port as a client and a server.

Case Study 2: Malicious Activity

- Significant changes in the time based activity patterns with respect to its prior activity.
- Further examination with the tool revealed that the host had activity on 9000 ports during that first hour.
- Most of the activity was client based directed at another internal server.
- Further analysis with the SiLK tools showed that ~9000 ports were involved in a typical scanning activity of another internal host.

Conclusions

- The prototype was able to visualize interesting networking features.
- It has been decided to include the visualization in the FloVis tool set.
- Visualization is generic and can represent other types of categorical information (e.g., not just servers/clients)

Future work 1

- Investigate scalability options (e.g., aggregation)
- Addition of basic filtering on time, IP, port and/or activity.
- Negative and positive filtering.
- Implementation of different activities to be plotted e.g. volume, scan response, etc.
- Further encoding of other features within categories.

Future Work 2

- More annotation.
- Bird’s eye view.
- User study to:
  - obtain feedback,
  - gain insight into the things the user likes, dislikes, would like to see added, feels that is missing.