Flow Indexing

Making queries go faster

FloCon

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How is large scale flow data used?

“Selection” is the most generic and most popular query type. Selection queries specify a source IP address, a destination IP address, or both”

- Publication NetSA-2011-19

- When flow data is being searched to corroborate information from other sources, entry is often via an IP address or set of IP addresses.
- While other information (flowtype primarily) may limit the scope of the data pull, it is common to read through many files containing no relevant records.

Motivation: Alert Processing

- Alerts from IDS or similar sensors are often corroborated (or refuted) with flow data.
- The alert typically has a time window (stime / etime)and one or more IP addresses (or {src/dst} pairs}.
- Data pull for the alert examines all the data within the time window (+/- an error margin) for all of the IPs.
  - Many of the examined files have no relevant data
  - Sometimes there is no data satisfying the pull criteria (differences in sensor placement and source visibility).
- Avoid fruitless work whenever possible

Can we short circuit the data pull?

- Indices are the traditional mechanism for short circuiting sequential searches.
  - A book index usually points to a specific page.
  - SiLK flow files were not designed for random access, and the index terms (IP addresses) often take up 25% or more of each record so a traditional *term -> page* index is not a solution.
- On the other hand, absence of an index entry means that we don’t have to read the book.
  - If there are lots of missing entries, our reading list is limited.

The SiLK file repository (refresher)

- For the data set we are using, files are stored in a directory hierarchy

```
 <data_rootdir>/
     class/
          type/
              year/
                  month/
                      day/
```

- day/ directory contains per sensor hourly files with names of the form: <flowtype>-<sensor>_YYYYMMDD.HH
- May be up to (#class X #type X #sensor) files to search

```
rwfglob –start-date=YYYY/MM/DD:HH –flowtype=all/all
```

provides a complete list for a given hour

IPsets as indices

- For each flow file, we create IPsets for its source and destination addresses and a union containing both.
- Now, questions like

  “Which, if any, of the hourly files contains data with:

  a) Source IP == aaa.bbb.ccc.ddd or
  b) Destination address == mmm.nnn.ooo.ppp or
  c) Either source or destination address == www.xxx.yyy.zzz”

  and IPset queries can be answered from the indices.
- Index files are much much smaller than the flow files. Querying indices is much faster than filtering flows, especially when there are a small number of hits and we can avoid reading some flow files.

Automagic index creation

- We observe that flow data usually settles about 30 – 45 minutes after the close of the flow hour.
  - Run a script to create indices on a timed basis.
    - Can be done within the existing framework
    - Refresh if index is out of date (again timed) or
    - Refresh on attempt to use stale index (in access scripts)
  - Make index creation part of the packing process
    - Saves a pass over the data.
    - Index updated with late additions to the flow file.
    - Ensures consistency
    - Requires changes to packing process

Benefits

- Substantial savings in data pulls.
  - No need to pass files without selected IPs
  - Negative answers fast, no data, no waiting
  - Reduced processing and analyst workloads
- Potential for long term studies from indices alone
  - When did we first see www.xxx.yyy.zzz
  - How often are we visited by aaa.bbb.ccc.ddd
  - What sites were active in fff.ggg.0.0/16 in May 09
- Can even aid in “tuple” searches
  - If there is src -> dst traffic, it will be in files where src is in the sIPset and dst is in the dIPset.

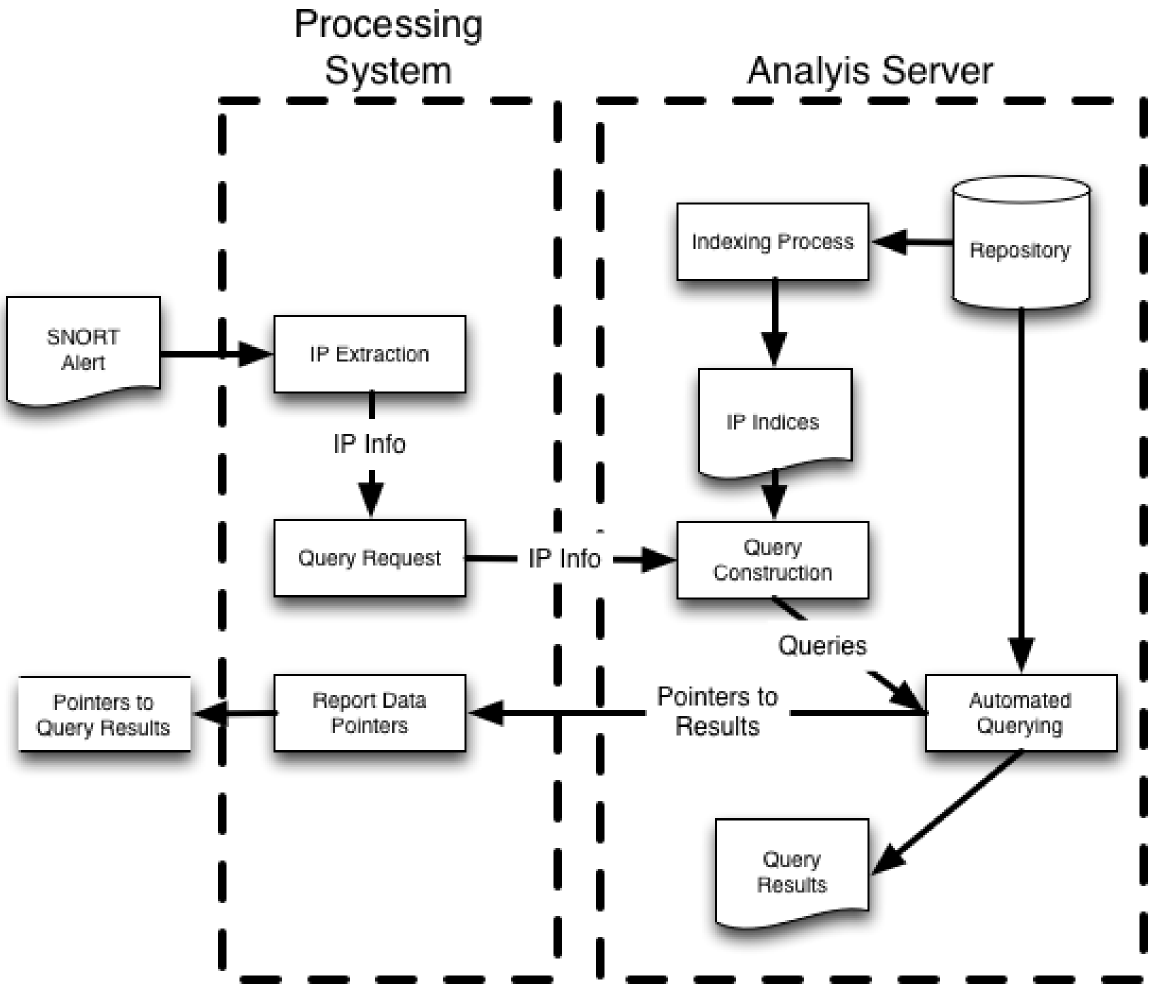
Possible Improvements / Extensions

- External IP set representation can be made much more compact allowing faster queries.
  - Set / Bag union / intersection can be streamed. Avoid building structures in memory.
- Consolidated hourly indices can be formed using bags. Up to 64 hourly files searched in 1 stream op.
- Dedicated index servers using large ram / SSD for processing recent indices.
- Index hierarchy with hourly, monthly, 5 year indices
  - hourly index detail for protocols, volumes, etc. if deemed useful.

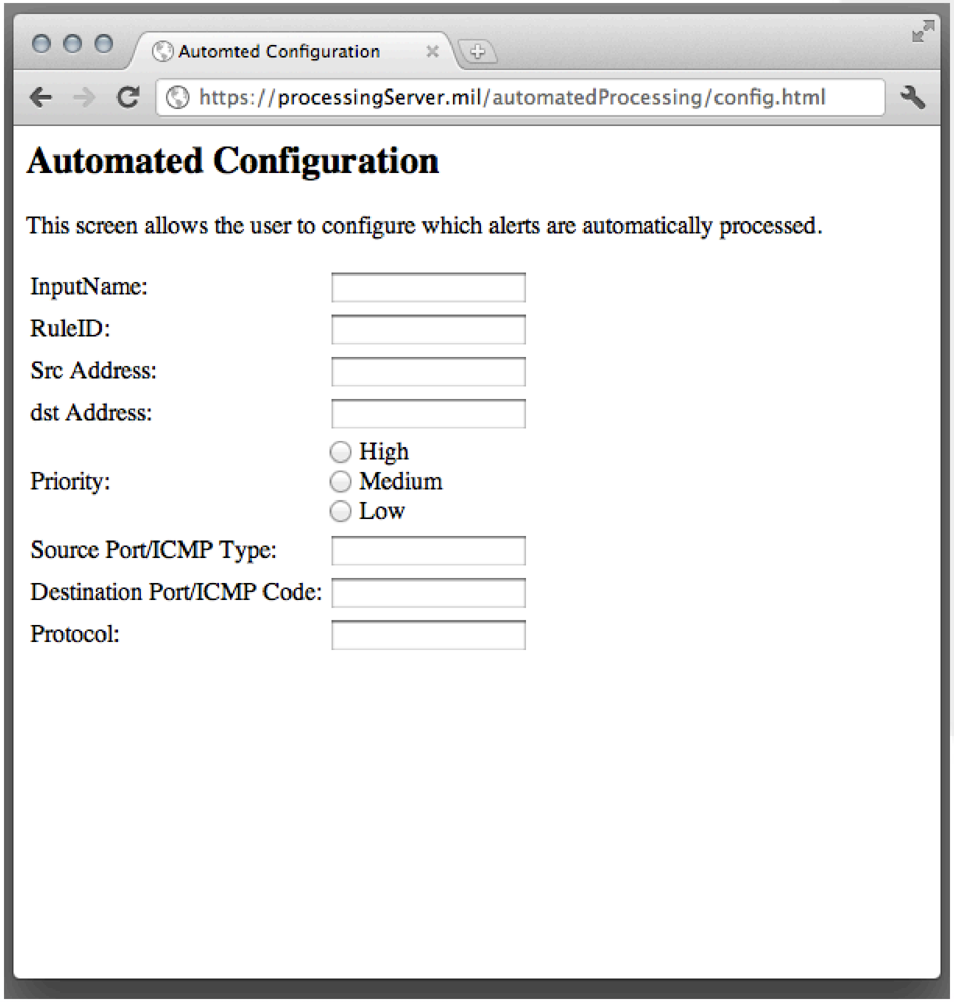
Current Status

- Currently have
  - An indexing script available on the analysis servers
  - A script for constructing repository queries using indexes
- We have 9 sensors, 4 flowtypes = 36 files/hour
  - being able to skip 2 files pays for the index search
  - big payoff most of the time based on limited trial
- Near-term goals
  - Deploy an automated tool for parsing IP address information out of SNORT alerts

Parsing Snort Alerts Automatically



Configuration Capability


Automted Configuration
https://processingServer.mil/automatedProcessing/config.html

Automated Configuration

This screen allows the user to configure which alerts are automatically processed.

InputName:

RuleID:

Src Address:

dst Address:

Priority: ○ High ○ Medium ○ Low

Source Port/ICMP Type:

Destination Port/ICMP Code:

Protocol:

- Tuning to what the analyst actually cares about
  - System ignores all alerts it is not explicitly configured to handle
- Automation will be configurable through a web interface
  - Filtering based on fields within the alert

Conclusions

- Indexing of flow is effective and inexpensive.
- For a large class of queries, it can significantly reduce query time by eliminating files from consideration.
- Everything can be done within the SiLK framework

but

- Some reorganization of the data and improvements in the tools (more efficient data structures, tool approaches, multi-key sets) could make things much better.
- Routine indexing of {sip,dip}, ports, protocols and of size, rate, frequency, etc., distributions with graphical presentation (RDD tool?) would be a big plus.

Questions

Talk to me!

- I’ll be around through Thursday noon
- You can reach me through RedJack