Empowering Measurement
Users at ESnet

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ESnet
Internet2 TechEx 2023
Stardust
Network Measurement and Analysis for ESnet

Extensible / Open Architecture
NSF NetSAGE project derived Approach
→ Integrate where we can, innovate where it makes a difference.
  ◆ metadata and viz
→ Loose coupling to avoid lock in

Authenticated access methods for many user groups.
Dashboards, Indexed APIs and “Raw”
→ Grafana user editable dashboards
→ Elasticsearch Query API access
→ Kafka feeds
→ RBAC with 2 Factor

Multi Datasource
Low and High Cardinality
→ Network Traffic Flows
→ Interface Usage
→ Optical Line System Performance
→ perfSONAR
→ High Touch measurements
→ LHC Firefly measurements

Flexible aggregation
Variable time buckets and dimension reduction
→ Summarize in time
  ◆ Hourly summary
→ Summarize by dimension
  ◆ All NERSC traffic
→ Variable retention
  ◆ hourly data for a year
  ◆ 30 sec data for 90 days
Setting the Stage

We collect tons of network data... but we haven’t have good mechanisms to securely share sensitive info with external users.
Adding External Users

Grafana

ESnet SSO

Keycloak

Lab A SSO

Admin View, All Dashboards

User View, Lab A Dashboards

Lab A User

Me

Roles

<table>
<thead>
<tr>
<th>Role Name</th>
<th>Composite</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>grafana</td>
<td></td>
<td>View all roles</td>
</tr>
<tr>
<td>grafana-admin</td>
<td>False</td>
<td>Admin permissions for Grafana Enterprise</td>
</tr>
<tr>
<td>grafana-editor</td>
<td>False</td>
<td>Editor permissions for Grafana Enterprise</td>
</tr>
<tr>
<td>grafana-viewer</td>
<td>False</td>
<td>Viewer permissions for Grafana Enterprise</td>
</tr>
</tbody>
</table>

Teams / Ames

Manage members and settings

External group sync

External Group ID

Ames

Data Sources / DEV Flow Ames

Permissions
External Users

**Dashboards**

Create and manage dashboards to visualize your data

- **Browse**
- **Playlists**
- **Snapshots**
- **Library panels**

Search for dashboards

- Filter by tag
- Starred

- General
- Team AMES - Ames National Laboratory

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Lab User

Admin User
Internal Observability

Who dunnit?

Visualize Events

Syslog events, Logstash

Grafana

elasticsearch
Starflakes

What if you wanted to extract data and do your own, arbitrarily complex analysis?

Working on building a Jupyter environment for researchers

- SQL interface to Elastic, lower barrier to entry
- Python, Pandas, Numpy, etc, the usual suspects for data analysis
Covering New Ground

Examples of using the Prophet library in python for forecasting and capacity planning of the network
Visualizing the Network

Current maps maintained by software developers, not network engineers.

Lots of hand tuning, games of telephone, brittle, etc.

Lack of consistent, structured “source of truth” for maps.
Moving Beyond ESnet

StellaNOVA
- A consortium for the Advancement of Network Observation, Visualization, and Analysis.
- Develop and socialize technical capabilities in the measurement space for R&E community
- Focus on developing tools, tactics, and techniques but will not offer measurement service

Open Sourcing
- Data ingest pipeline and index configurations made publicly example as reference - [https://github.com/esnet/stardust-snmp-pipeline](https://github.com/esnet/stardust-snmp-pipeline)
perfSONAR flavored Stardust

**Throughput (Max)** 7.97 Gb/s

**Packet Loss (Max)** 0.333%

**Jitter (Max)** 8.35 ms

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**Test Result Summary**

<table>
<thead>
<tr>
<th>Source</th>
<th>Destination</th>
<th>IP Version</th>
<th>Packet Loss (Max)</th>
<th>Throughput (Min)</th>
<th>Latency (Min)</th>
<th>RTT (Min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ps-dev-staging-el9-tk-1.c....</td>
<td>ps-dev-staging-u20-tk-1.c....</td>
<td>4</td>
<td>0%</td>
<td>7.93 Gb/s</td>
<td>0.0400 ms</td>
<td>-</td>
</tr>
<tr>
<td>ps-dev-staging-el9-tk-1.c....</td>
<td>ps-dev-staging-el8-tk-1.c....</td>
<td>4</td>
<td>0.333%</td>
<td>7.87 Gb/s</td>
<td>0.0400 ms</td>
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</tr>
<tr>
<td>ps-dev-staging-el9-tk-1.c....</td>
<td>ps-dev-staging-el7-tk-1.c....</td>
<td>4</td>
<td>0.167%</td>
<td>7.94 Gb/s</td>
<td>-0.310 ms</td>
<td>-</td>
</tr>
</tbody>
</table>
perfSONAR flavored Stardust

perf5ONAR Toolkit on ps-dev-staging-el9-tk-1.c.esnet-perfsonar.internal

Service Up/Down Metrics

Current Service Status
- elmond: Up
- grafana-server: Up
- httpd: Up
- logstash: Up
- node_exporter: Up
- opensearch-dashboards: Up
- opensearch: Up
- perfsonar-configdaemon: Up
- perfsonar-lscached daemon: Up
- grafana: Up
- postgres: Up
- schedulers-archiver: Up
- schedulers-rundie: Up
- schedulers-scheduler: Up
- schedulers-ticker: Up
- psconfign-scheduler-agent: Up

OS Info
- OS: Rocky Linux 9.2 (Blue...
Thank You

Questions, comments, tomatoes, etc all welcome.

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