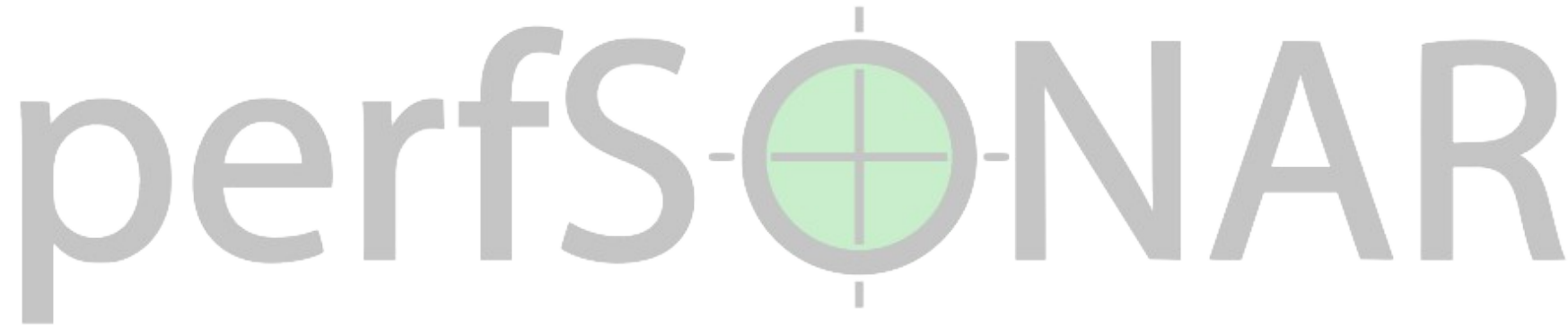




Microdep deployment for perfSONAR 5.3 users

- for event based data analysis

5th European perfSONAR User Workshop

May 6th-7th 2026, Paris

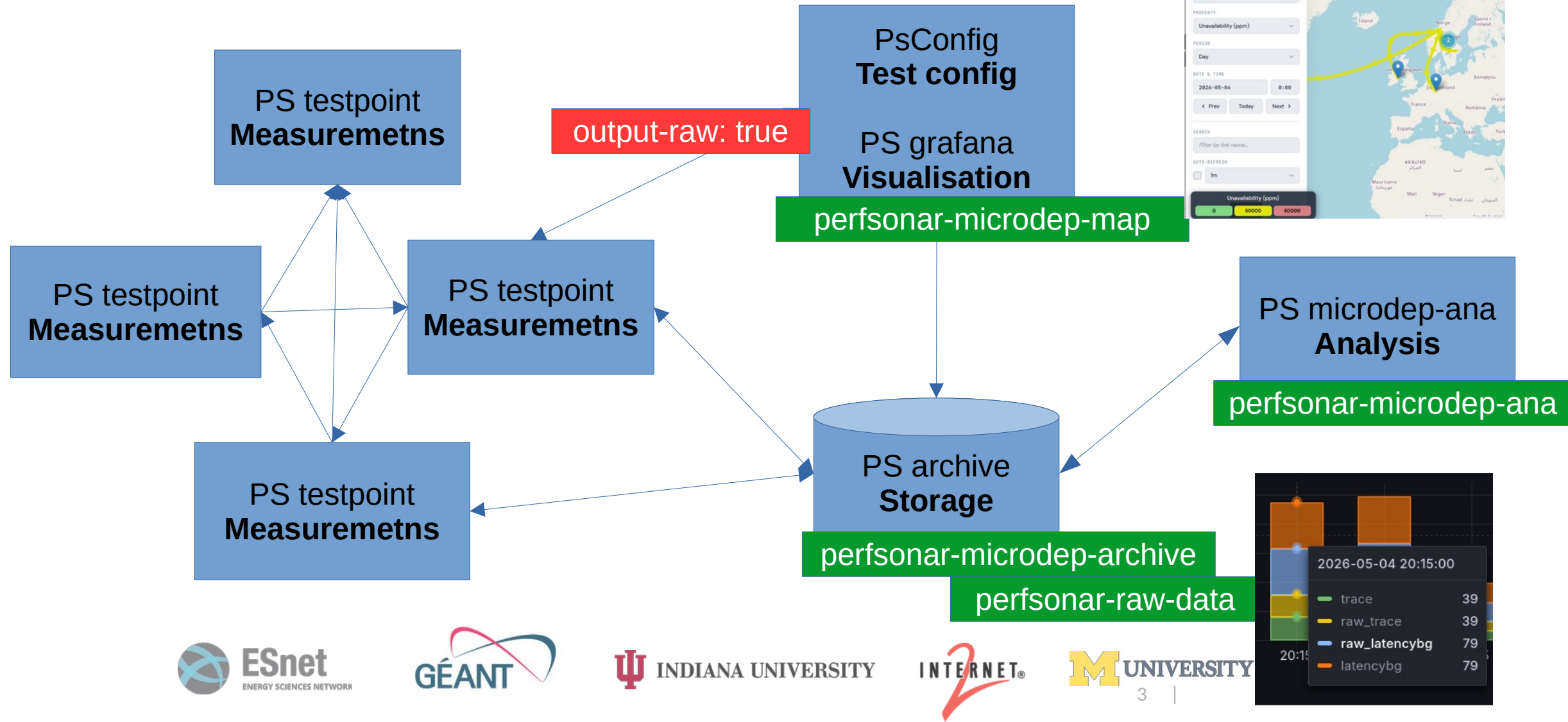
Otto J Wittner, Sikt



Microdep – an add-on for *event based* data analysis

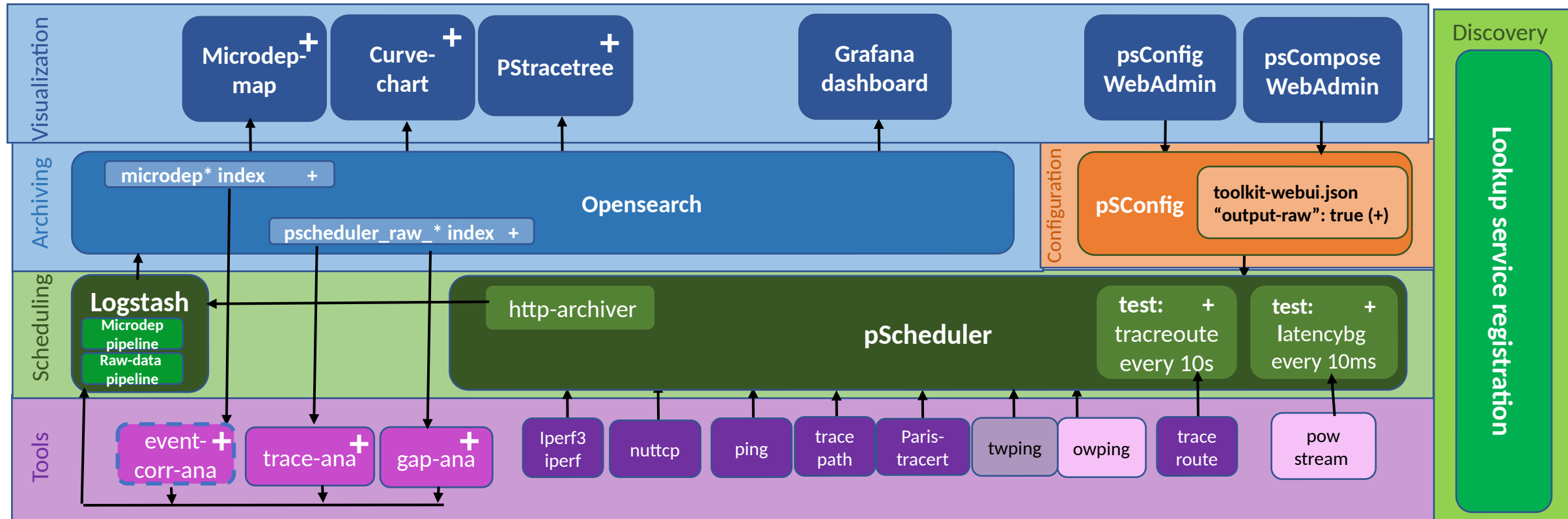
- “Vanilla” perfSONAR installation
 - **Configures, runs and collects** end-2-end performance measurements
 - **Visualizes** collected data points in various ways (line plots, heatmaps, tables ...)
 - ... but also **some simple statistical analysis** (e.g. powstream’s delay distribution, avg, std, ...)
- The Microdep add-on **expands simple analysis** by ...
 - Basic rule-based “anomaly” detection generating events, e.g.
 - **Large gaps**: 5 or more consecutive packets lost
 - **Queues**: Relative increase >10ms in end-2-end delay
 - **Route error**: Destination host not reached (normally being reached)
 - **Route change**: Significantly new ips have appeared in one or more hops along route
- GIS-based (map) web-gui for presentation of event-data

perfSONAR with Microdep – example a



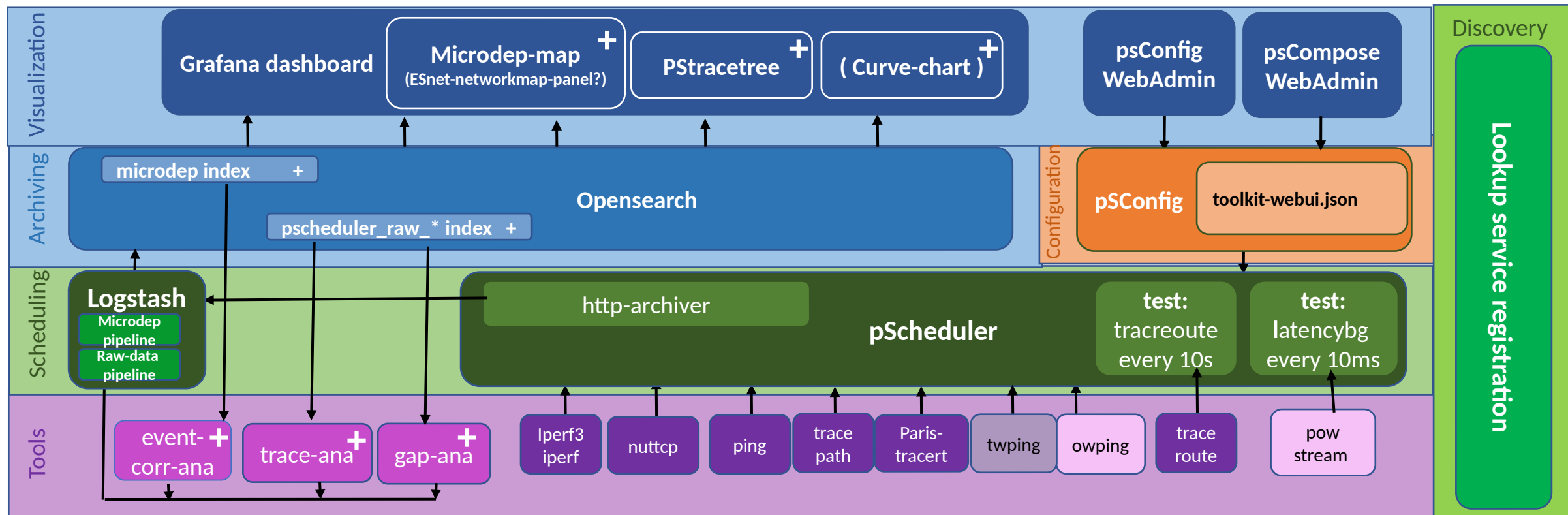
Microdep add-on for perfSONAR 5.3

Additional components marked with +



...but in a future release perhaps like this?

PerfSONAR 5.X and Microdep add-on (+)



Add-on installation

- Meta packages for perfsonar nodes
 - *perfsonar-microdep-archive*: Logstash pipeline, raw-data indices
 - *perfsonar-microdep-map*: Map GUI and traceroute viewer
 - *perfsonar-microdep-ana*: Event analysis scripts
 - *perfsonar-microdep-toolkit*: “All-in-one” for toolkit installations
- Installation
 - Add perfsonar repo (see <https://docs.perfsonar.net/index.html#installation>)
 - rpm/deb: `dnf/apt install perfsonar-microdep-<variant>`

Add-on configuration I

- **Tests and tasks**
 - *latencybg*: “Feeds” gap-, queue- and jitter-analytics
 - Important! **Enable output-raw** in test spec, either via psCompos GUI or by adding “output-raw: true” in JSON spec file.
 - *traceroute*: “Feeds” route-error and reoute-change analysis
 - Separate analysis for UDP and TCP traceroutes

Add-on configuration II

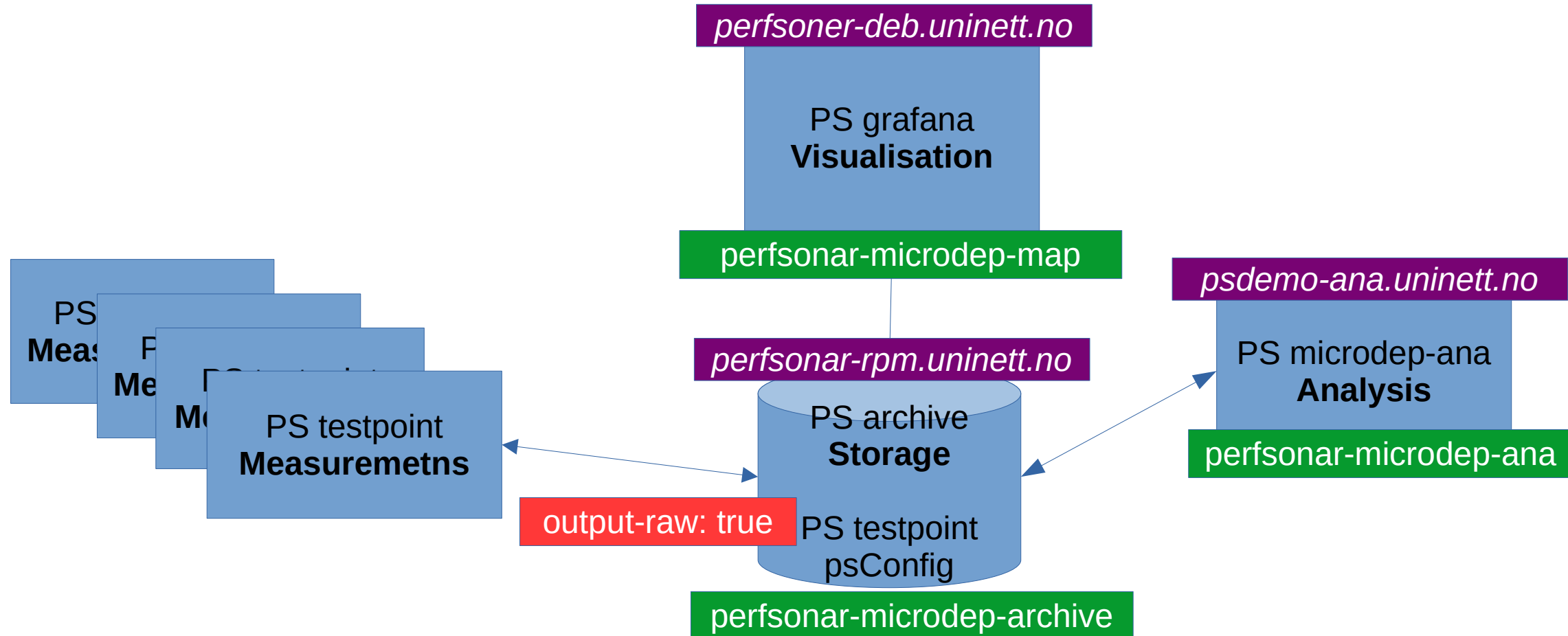
- **Connecting “things” together**
 - *microdep-map* ← *microdep-archive*
 - In `/etc/perfsonar/microdep/mapconfig.yml` an “archive:” specification routes the map gui to a certain archive, e.g. `https://psdemo-archive.uninett.no/opensearch`
 - *microdep-ana* → *microdep-archive*
 - *psconfig_archive_ana.sh* on archive node generate a spec to be placed in `/etc/perfsonar/microdep/microdep-ana-archive.json` on analytic node
 - *Microdep-ana* ← *microdep-archive*
 - *<next slide>*

Add-on configuration III

- **Tuning analytic scripts**
 - /etc/perfsonar/microdep/microdep-**gap**-ana.yml
 - Holds “**owamp:**” which **specifies the archive** to look for raw data in
 - Hold a set of tuning parameters for gap, queue and jitter detection.
 - /etc/perfsonar/microdep/microdep-**trace**-ana.yml
 - Holds “**pssrc:**” which **specifies the archive** to look for raw data in
 - Hold a set of tuning parameters for route-error and route-change detection.

Demo time!

perfSONAR with Microdep – example architecture



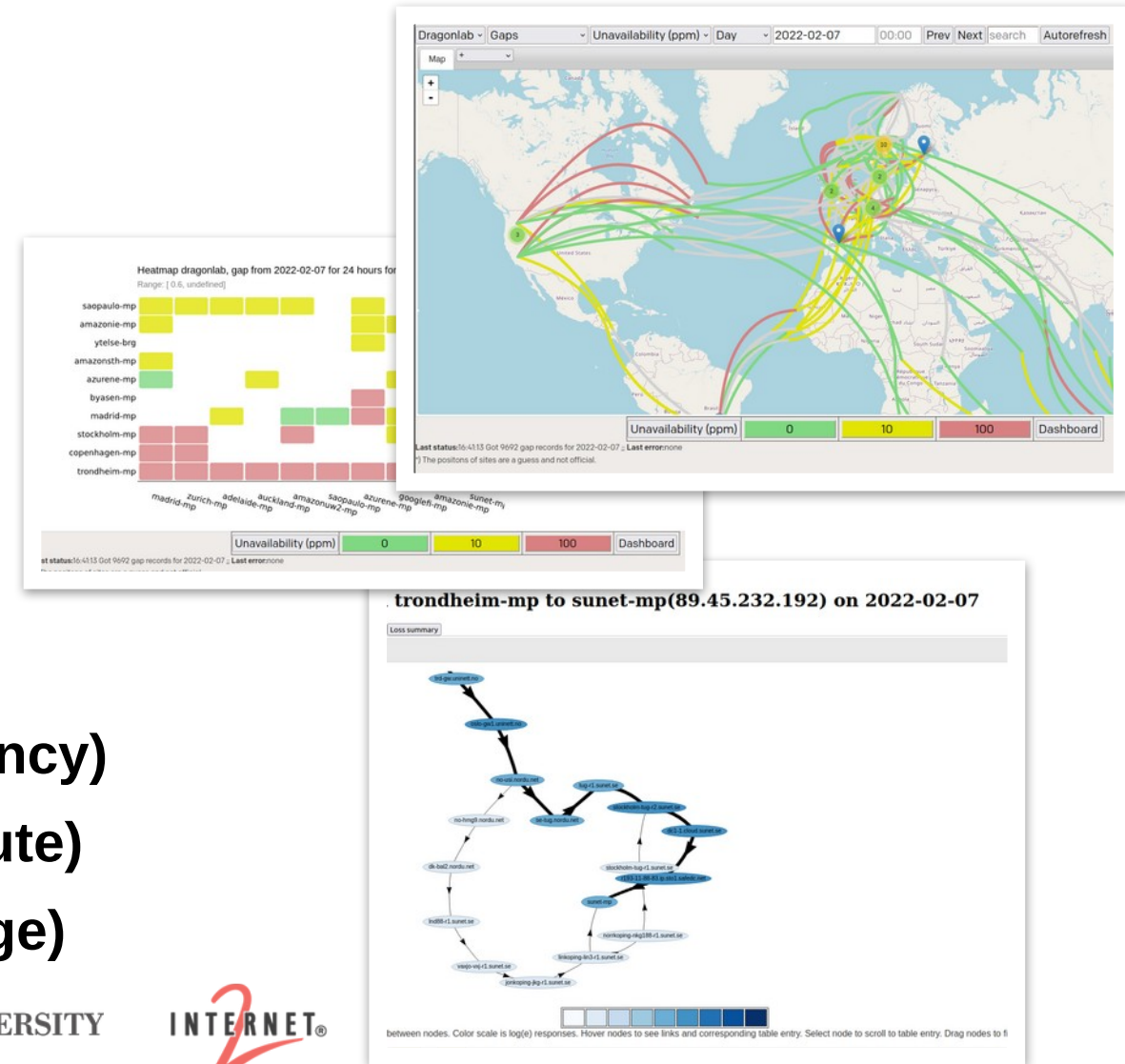
The end

(... or more slides with misc details ...)

Microdep packet sensor in production

<https://microdep.sikt.no>

- End-to-end 24/7 latency measurements
 - UDP probes: 100 pkt/s
 - traceroutes: 10 s intervals
 - ICMP “back scatter” monitoring
- ~240 end-to-end flows in global topology
 - 8 DC nodes (amazon, azure, google)
- **Real-time event analysis**
 - Gaps (>5 packets lost, > 50ms)
 - Queues (diff in latency from min latency)
 - Route changes and failures (traceroute)
 - Event correlations (gap + routechange)



Toolset history

- 15 years ago:
 - **perfSONAR**'s focus: performance tests + scheduled measurements
 - **Uninett (Sikt) Microdep**'s focus: small time scale outages + 24/7 measurements
 - perfSONAR impractical for Microdep => “home grown” system
 - ~10 years later: Microdep adopts Elasticsearch, scale of prod-system increases, event based analysis pioneered and map-based web-GUI development begins
- 2024:
 - perfSONAR 5 supports latencybg test (since long) and adopts Opensearch as database.
 - Microdep merging into perfSONAR as addon package.
 - Grafana as visualisation GUI also fro Microdep

Gaps / packet loss events

- Windows of 2000 pkts studied
- Gap event = 5 or more pkts lost, i.e. 50 ms downtime
 - 5 successfull pkts ends gap
- Stats on head and tail of gaps (50 pkts)
- Smaller gaps + other stats in daily summary reports

amazonuw2-mp to trondheim-mp

Unavailability (ppm)	1297.33
Queue (ms)	0.1
Jitter (ms)	0.04
Min delay (ms)	98.33
Big gaps (#)	87
Big gap time (s)	92.6
Small gaps (#)	1366
Small gap time (s)	19.44

See [Routes](#) [All gaps](#)

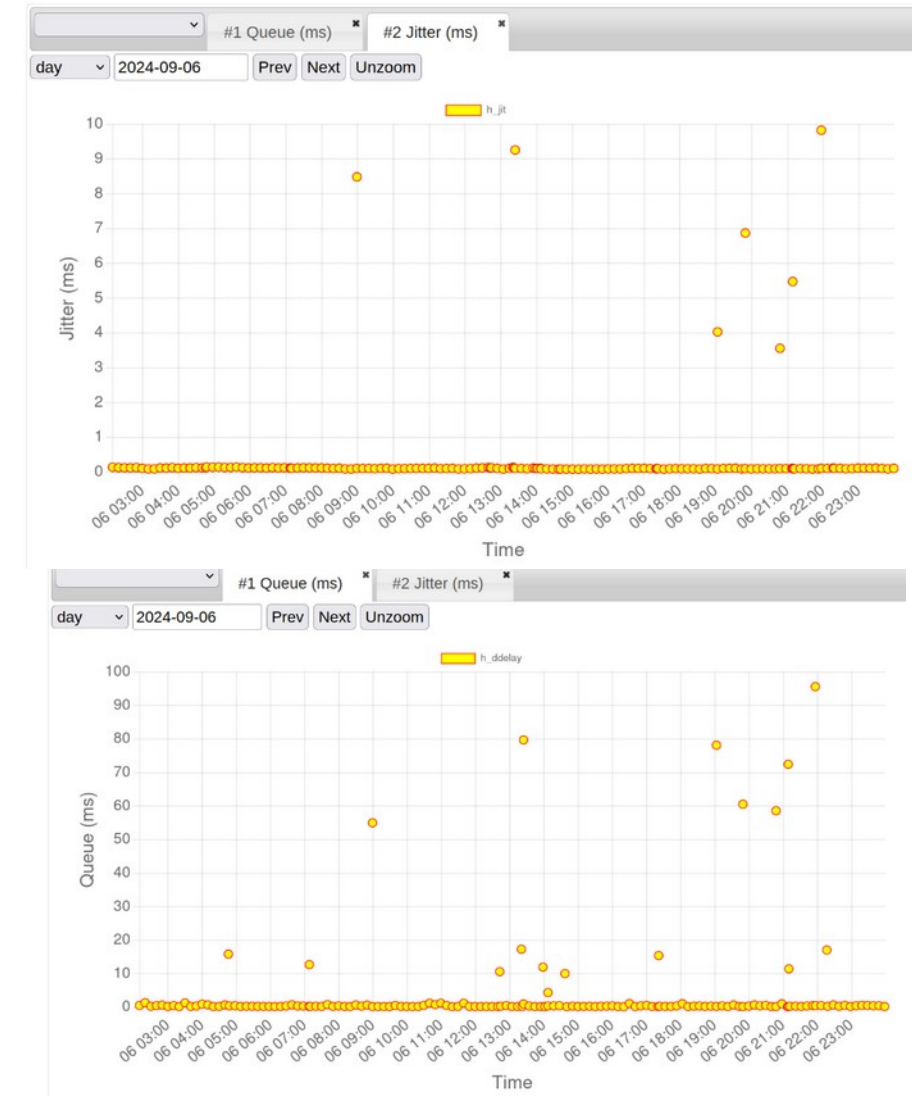
Plot [Queues](#) [Unavailability \(ppm\)](#)

Day	Time	Time lost (ms)	Queue (ms)
06	06:51	8720	4.438
06	07:05	8160	0.356
06	07:03	7250	543.544
06	06:56	6690	4.358
06	02:46	5370	0.103
06	06:44	5120	0.091
06	06:47	4900	3.907
06	07:00	4370	1518.258
06	07:04	3800	19.705
06	04:40	3730	0.041
06	06:59	3010	1911.002

Queues / Jitter events

- Mindelay = min one-way delay in window
- Jitter definition from RTCP (rfc3550)
 - ... but show only minor variances
 - Order of few ms
- Queue-buildup events by change in differential one-way delay
 - $(\text{delayB} - \text{delayA}) - \text{mindelay}$
 - Order of 10-100 ms

From azure-mp to trondheim-mp



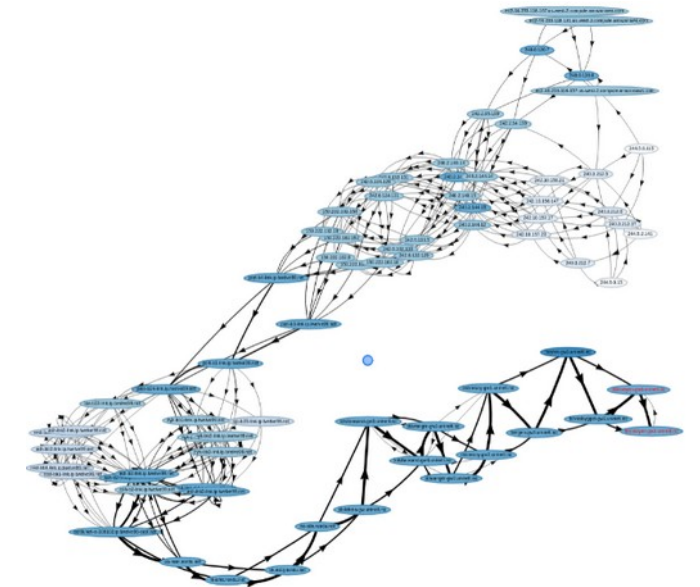
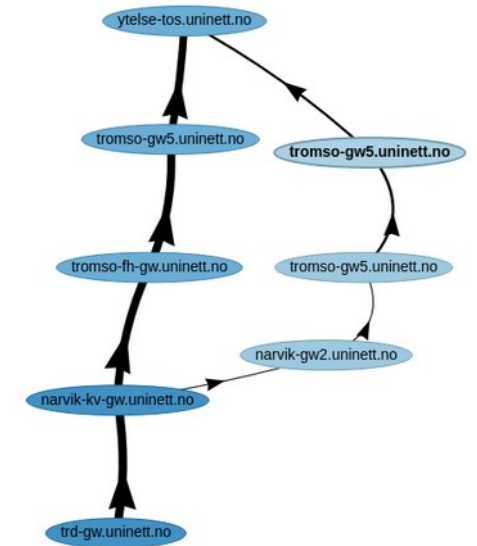
Route failure events

- Route failure = «never ending» traceroute
- Detect periodes with route failures
 - Find «* * * * *
- Report ICMP errors
 - Network unreachable (N!)
 - ...

```
1649029226 starttime 01:40:26
traceroute to 109.105.116.52 (mp-cph.nordu.net) 30 hops max, 60 byte packets
 1 100.64.102.1 (100.64.102.1) 0.424 ms 100.64.102.2 (100.64.102.2) 0.584 ms 100.
 2 100.64.0.1 (100.64.0.1) 0.718 ms 195.178.64.232 (195.178.64.232) 2.856 ms 2.86
 3 195.113.235.89 (195.113.235.89) 3.886 ms 3.861 ms 195.178.64.232 (195.178.64.2
 4 62.40.124.29 (cesnet.mx1.pra.cz.geant.net) 0.403 ms 195.113.235.89 (195.113.23
 5 62.40.124.29 (cesnet.mx1.pra.cz.geant.net) 0.595 ms 0.487 ms 0.681 ms 0.613 ms
 6 62.40.98.69 (ae0.mx1.ham.de.geant.net) 15.240 ms 62.40.98.192 (ae8.mx1.fra.de.
 7 62.40.125.206 (nordunet-bckp2-gw.mx1.ham.de.geant.net) 15.527 ms 15.486 ms 62.
 8 62.40.125.206 (nordunet-bckp2-gw.mx1.ham.de.geant.net) 15.366 ms 109.105.97.56
 9 109.105.97.56 (dk-ore.nordu.net) 20.216 ms 25.275 ms 20.303 ms 109.105.97.197
10 109.105.99.180 (dk-ore-fw.nordu.net) 20.115 ms 109.105.97.207 (dk-ore-sw-a01.n
11 109.105.99.180 (dk-ore-fw.nordu.net) 20.509 ms 20.161 ms 20.542 ms 20.113 ms 2
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```

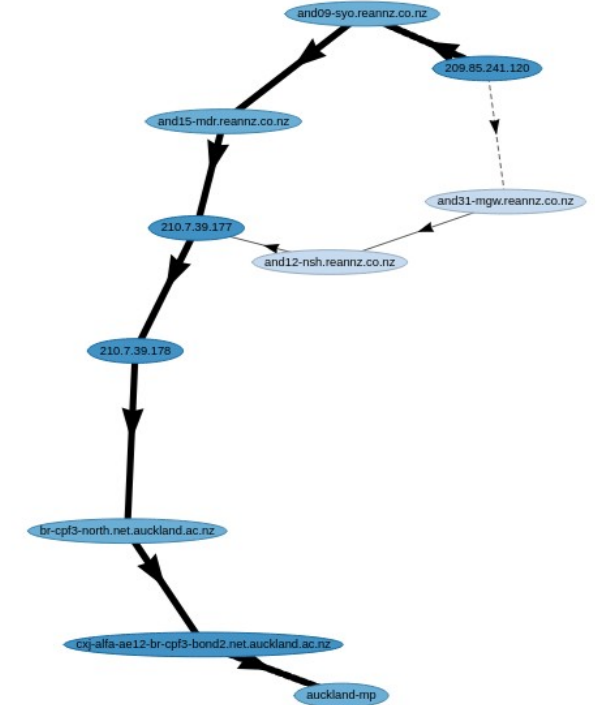
Route change events

- Route change = **significant** new route
- Detects **change in distribution of seen ip** addresses for each traceroute hop
 - Differential cross entropy
- «Learns» which route changes are normal



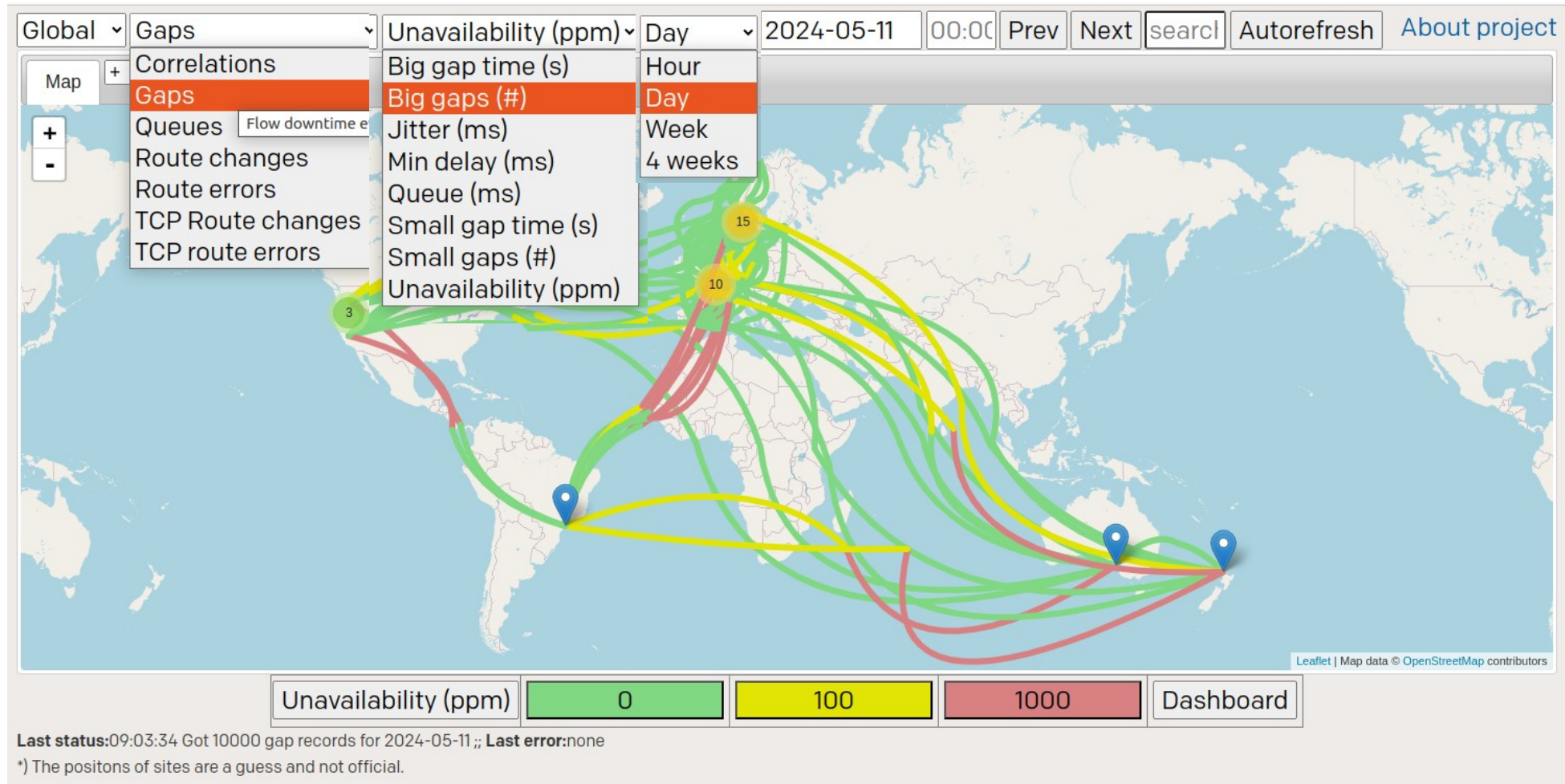
Correlated events

- Gap and routechange in same time window
- Downtime + path anomaly
- Identity and ASN of responsible router

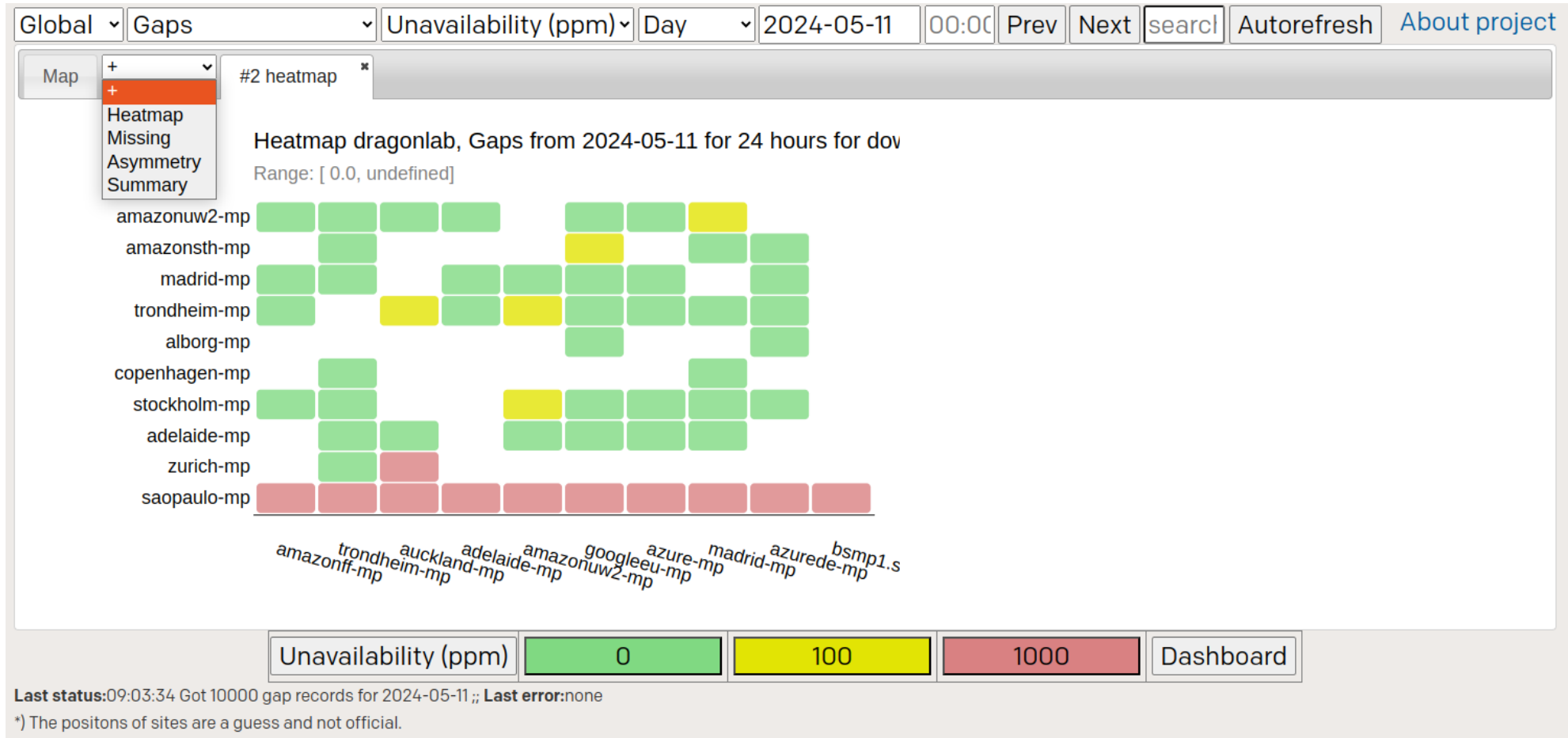


Day Time	Events	Time lost (ms)	ASN IP
20 15:17	gap, routechange, gap	5270	224 128.39.230.104
20 15:17	routechange, gap, routechange	3970	224 128.39.230.104

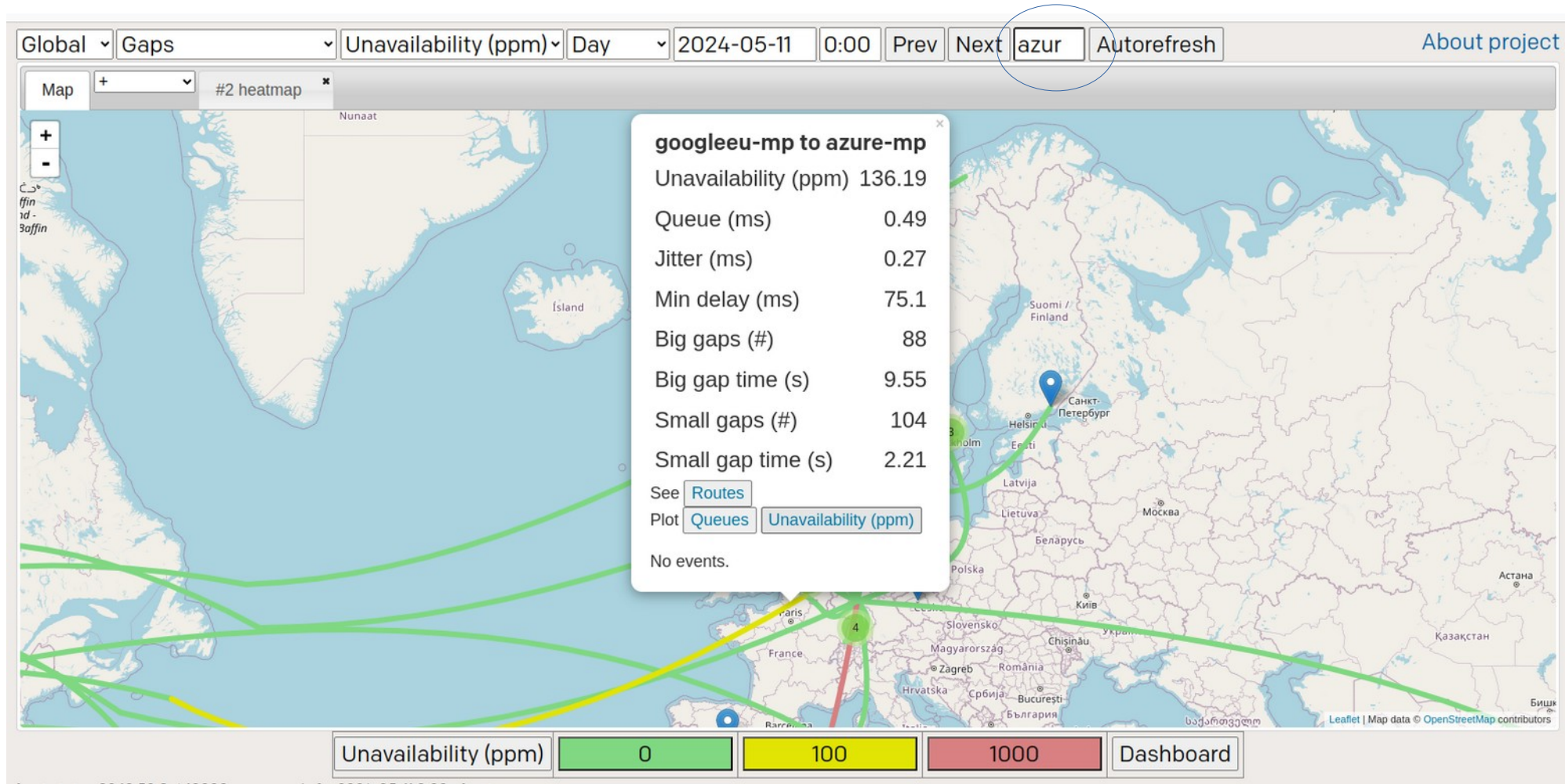
Web GUI - map



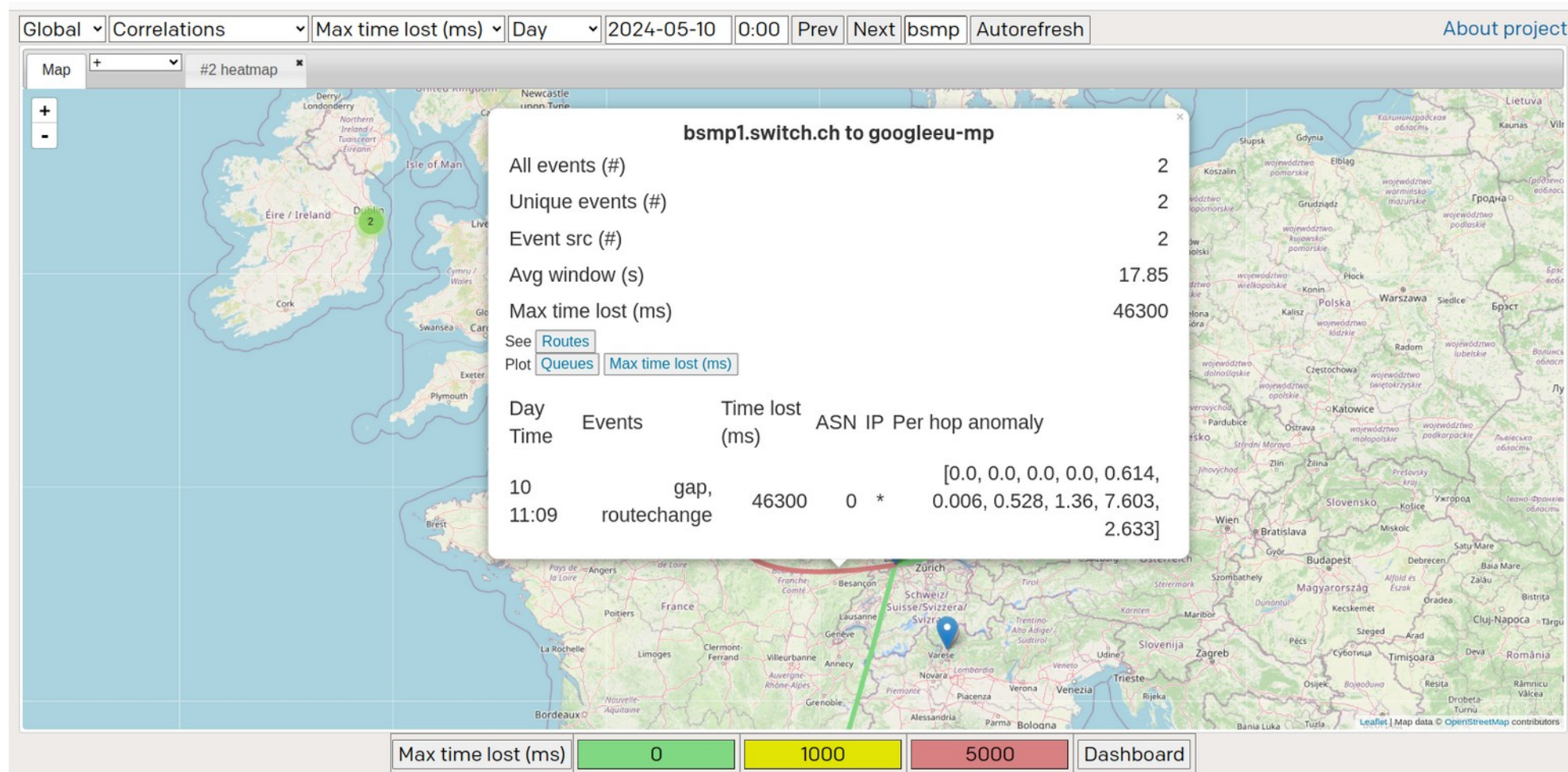
Web GUI - reports



Web GUI – popups and filters

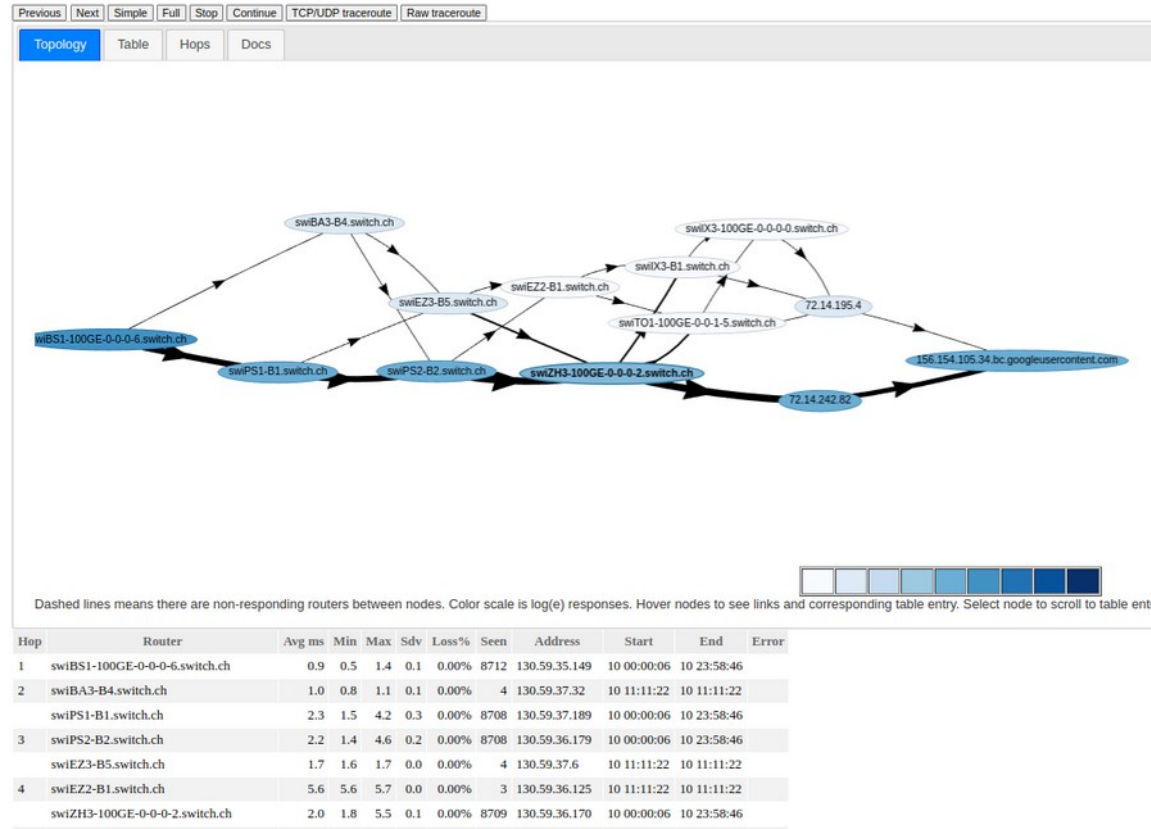


Web GUI – Correlations

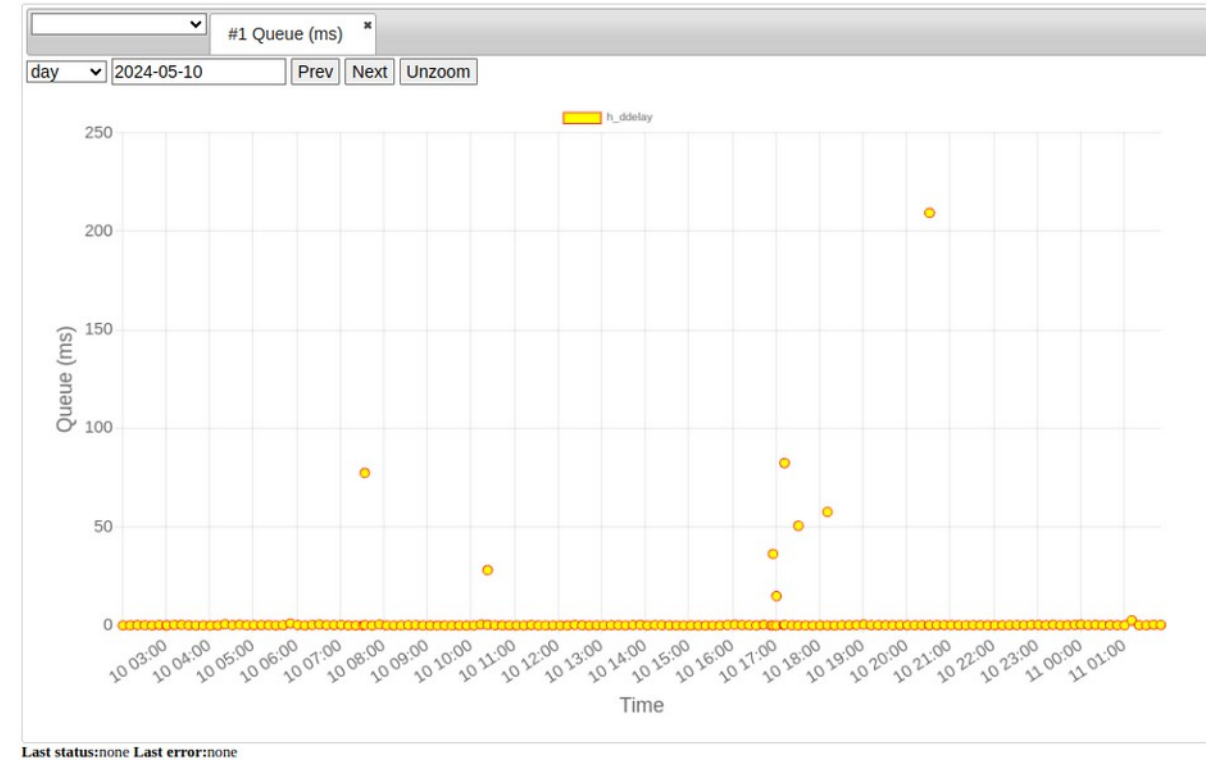


Web GUI – pstracetre and curve chart

Summary for traceroute charts from bsmpl1.switch.ch to googleeeu-mp(34.105.154.156) on 2024-05-10



From azurede-mp to bsmpl1.switch.ch



Thank you

www.geant.org



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