Packet based sensing with perfSONAR

Detecting and localizing anomalies in EUMETSAT’s global network

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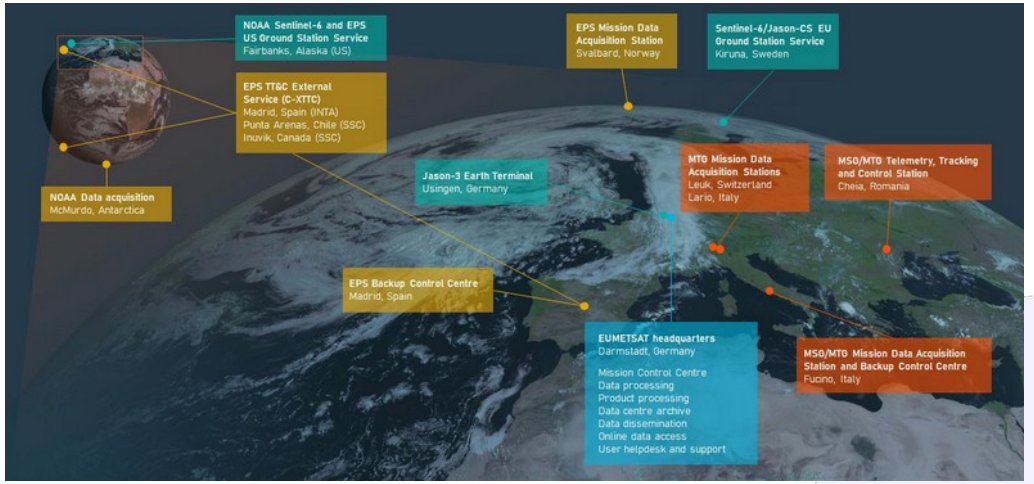
Network challenges for Global service providers

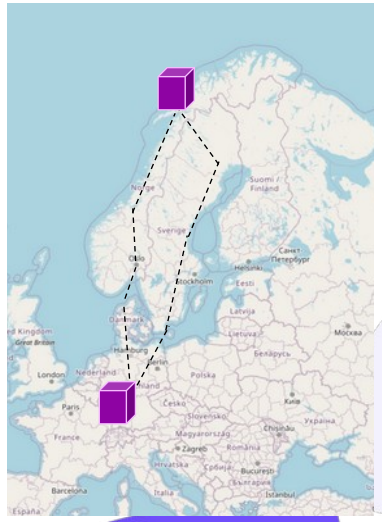
- Many geographical location implies
  - Large number of access network providers
    - Many different contracts / SLAs
  - Large number of core networks involved
    - No contracts /SLAs => no quaranties
- What is the actual QoS end-to-end ?
  - Between service endpoints ?
  - Between customers and service endpoints ?
  - Between service endpoints and storage/computation resources ?



Source: EUMETSAT web

Packet based sensing

- Active layer 3 (ip packet) measurements
  - Tailored probe packets are pushed into operational network
    - Both **intra**-domain and **inter**-domain flows
  - Both source and destination test host examine packet responses
  - perfSONAR
- **Significant alterations** of expected packet flow are reported as events
- Event correlation analysis
  - **Events** with **similar** properties (e.g. time stamps) are combined and reported



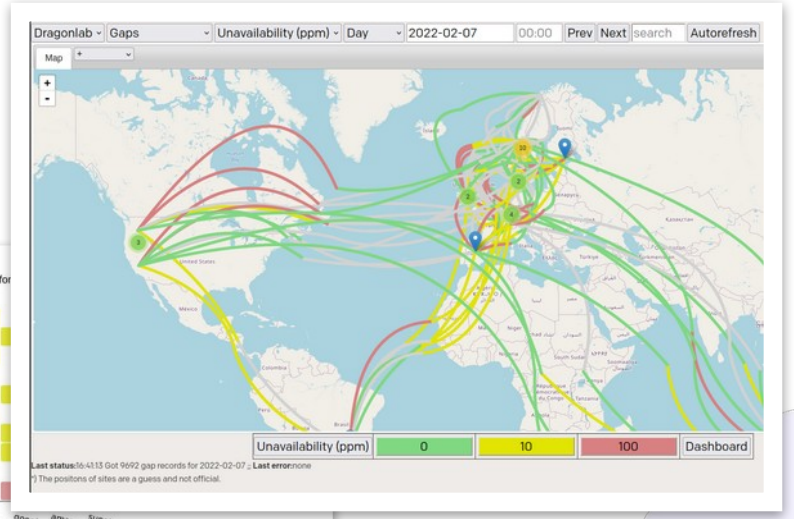
Packet based sensing for monitoring global network QoS

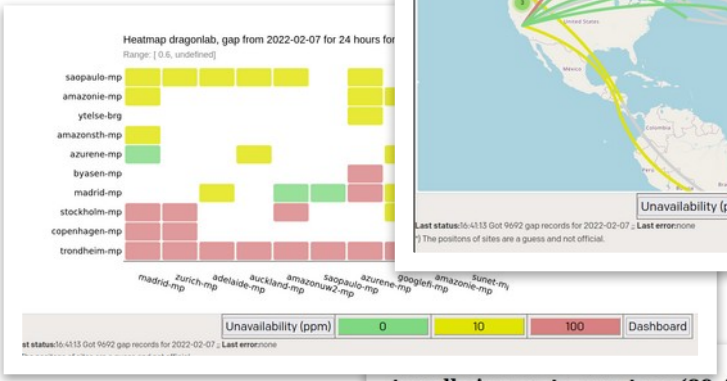
- Provides data sets to help differentiate local (intra-domain) and global (inter-domain) issues
- Improves troubleshooting efficiency
  - Quantative values documenting errors can be presented network providers
  - Fault locations (by cross correlating data sets from multiple sensing flows) enable potential contact directly with responsible operator
  - Transient and re-occuring errors logged in event data base which enables hard-to-detect anomalities to be discovered

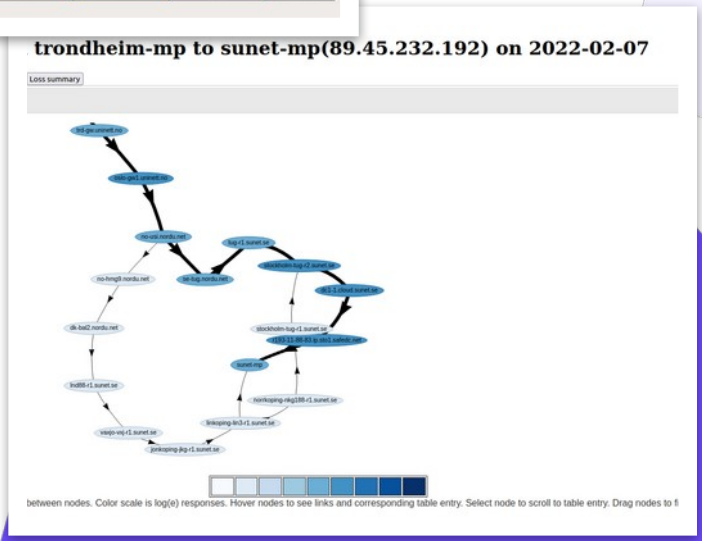
Microdep packet sensor

https://microdep.sikt.no

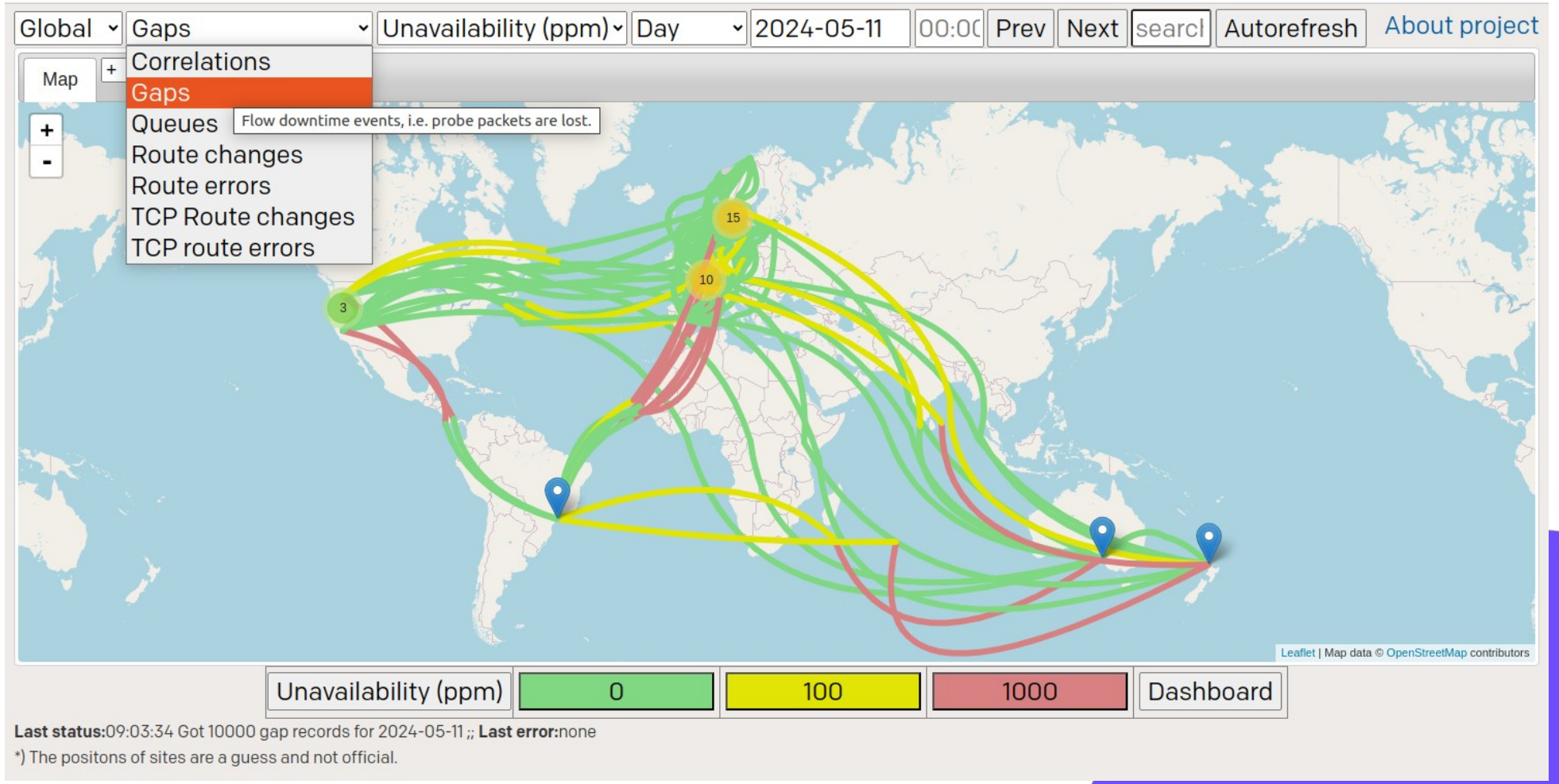
- End-to-end 24/7 latency measurements
  - UDP probes: 100 pkt/s
  - traceroutes: 10 s intervals
- Scales to large topologies
  - Sikt's production system:
    - ~240 end-to-end flows in global topology
    - 8 DC nodes (amazon, azure, google)
- Real-time event analysis
  - Gaps (>5 packets lost, > 50ms)
  - Queues (difference in latency)
  - Route changes and failures (traceroute)
  - Event correlations (gap + routechange)



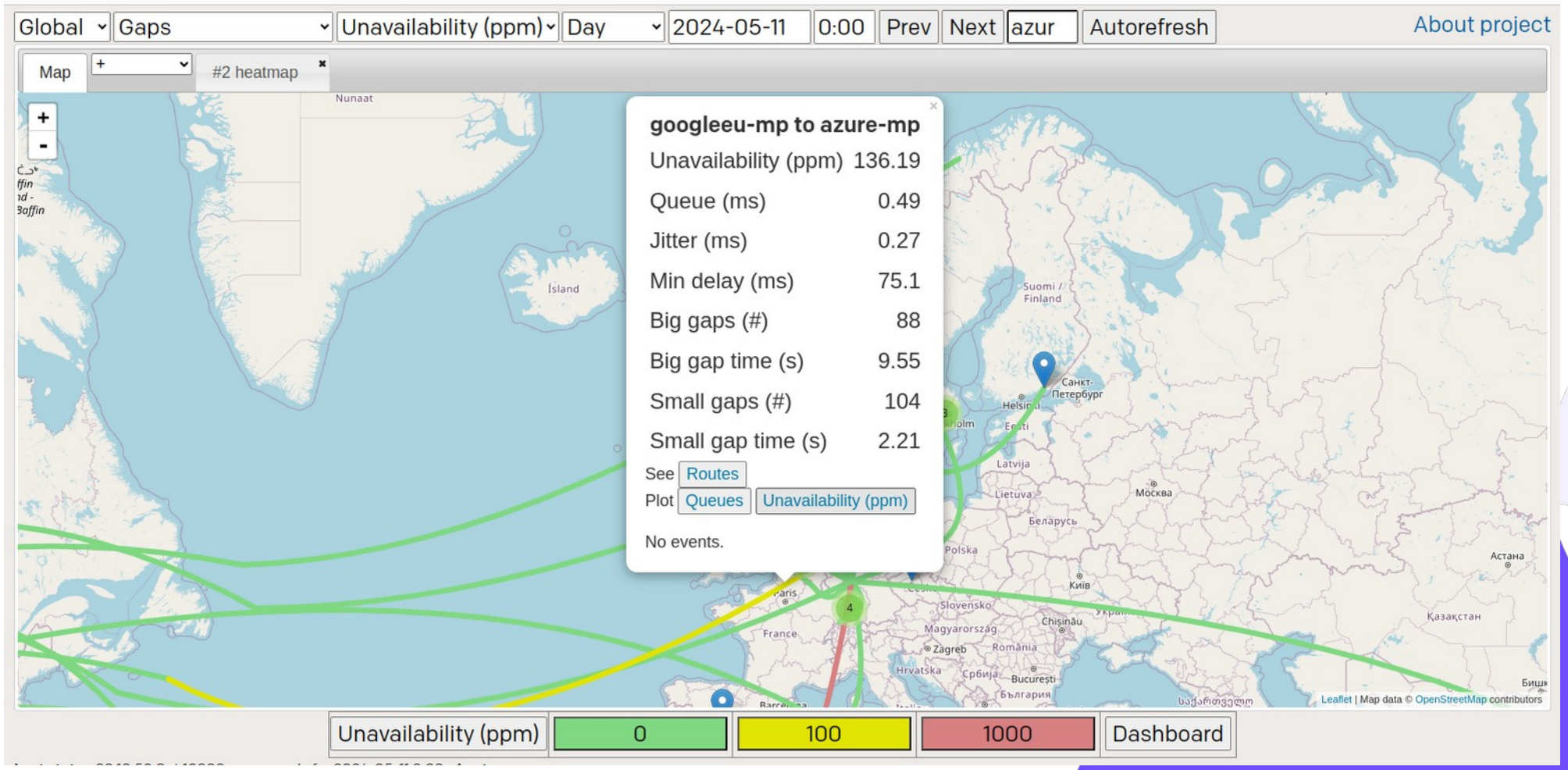




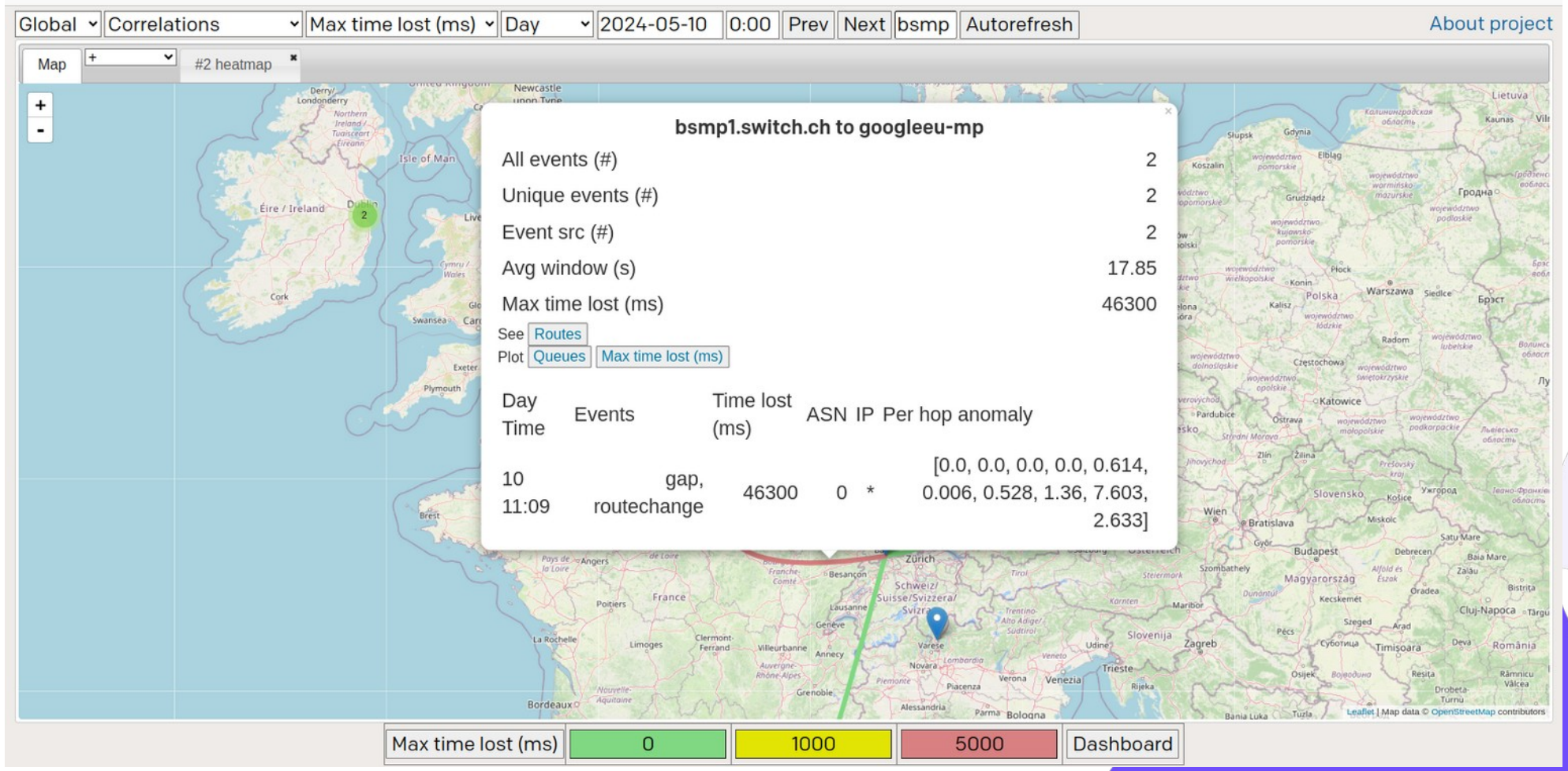
Web GUI - map


Global
Gaps
Unavailability (ppm)
Day
2024-05-11
00:00
Prev
Next
search
Autorefresh
About project
Map
Correlations
Gaps
Queues
Route changes
Route errors
TCP Route changes
TCP route errors
Flow downtime events, i.e. probe packets are lost.
15
10
3
Leaflet | Map data © OpenStreetMap contributors
Unavailability (ppm)
0
100
1000
Dashboard
Last status:09:03:34 Got 10000 gap records for 2024-05-11 ;; Last error:none
*) The positons of sites are a guess and not official.

Web GUI – popups and filters

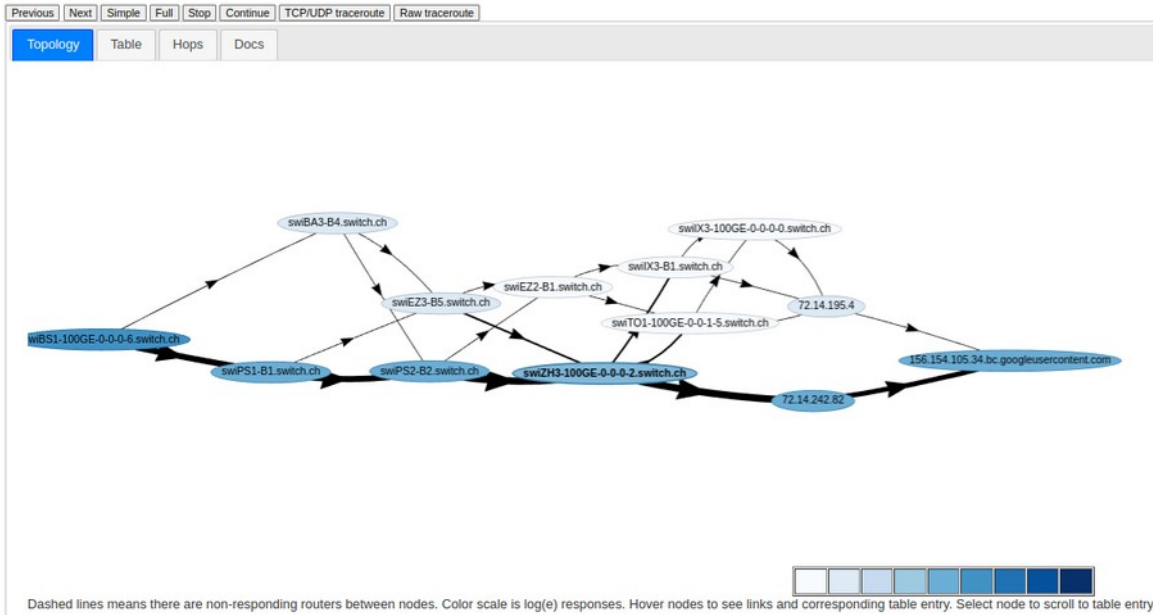


Web GUI – Correlations



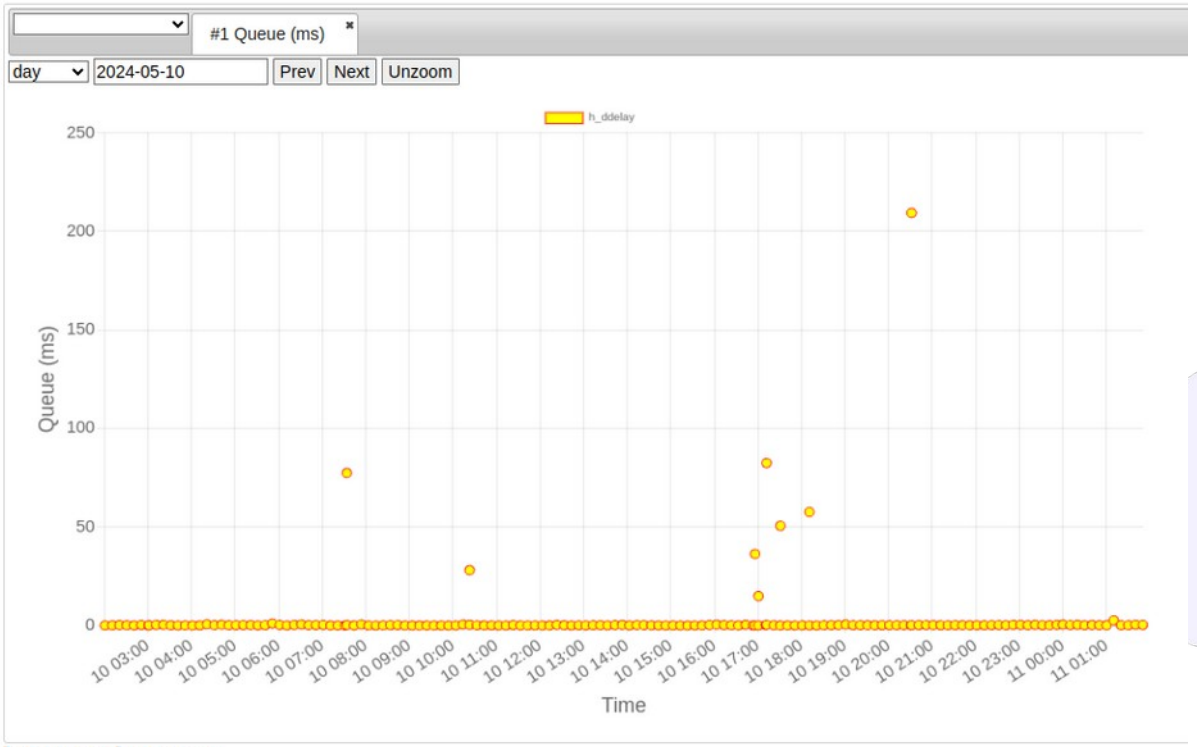
Web GUI – pstracetree and curve chart

Summary for traceroute charts from bsmp1.switch.ch to googleeu-mp(34.105.154.156) on 2024-05-10



Hop	Router	Avg ms	Min	Max	Sdv	Loss%	Seen	Address	Start	End	Error
1	swiBS1-100GE-0-0-0-6.switch.ch	0.9	0.5	1.4	0.1	0.00%	8712	130.59.35.149	10 00:00:06	10 23:58:46	
2	swiBA3-B4.switch.ch	1.0	0.8	1.1	0.1	0.00%	4	130.59.37.32	10 11:11:22	10 11:11:22	
	swiPS1-B1.switch.ch	2.3	1.5	4.2	0.3	0.00%	8708	130.59.37.189	10 00:00:06	10 23:58:46	
3	swiPS2-B2.switch.ch	2.2	1.4	4.6	0.2	0.00%	8708	130.59.36.179	10 00:00:06	10 23:58:46	
	swiEZ3-B5.switch.ch	1.7	1.6	1.7	0.0	0.00%	4	130.59.37.6	10 11:11:22	10 11:11:22	
4	swiEZ2-B1.switch.ch	5.6	5.6	5.7	0.0	0.00%	3	130.59.36.125	10 11:11:22	10 11:11:22	
	swiZH3-100GE-0-0-0-2.switch.ch	2.0	1.8	5.5	0.1	0.00%	8709	130.59.36.170	10 00:00:06	10 23:58:46	

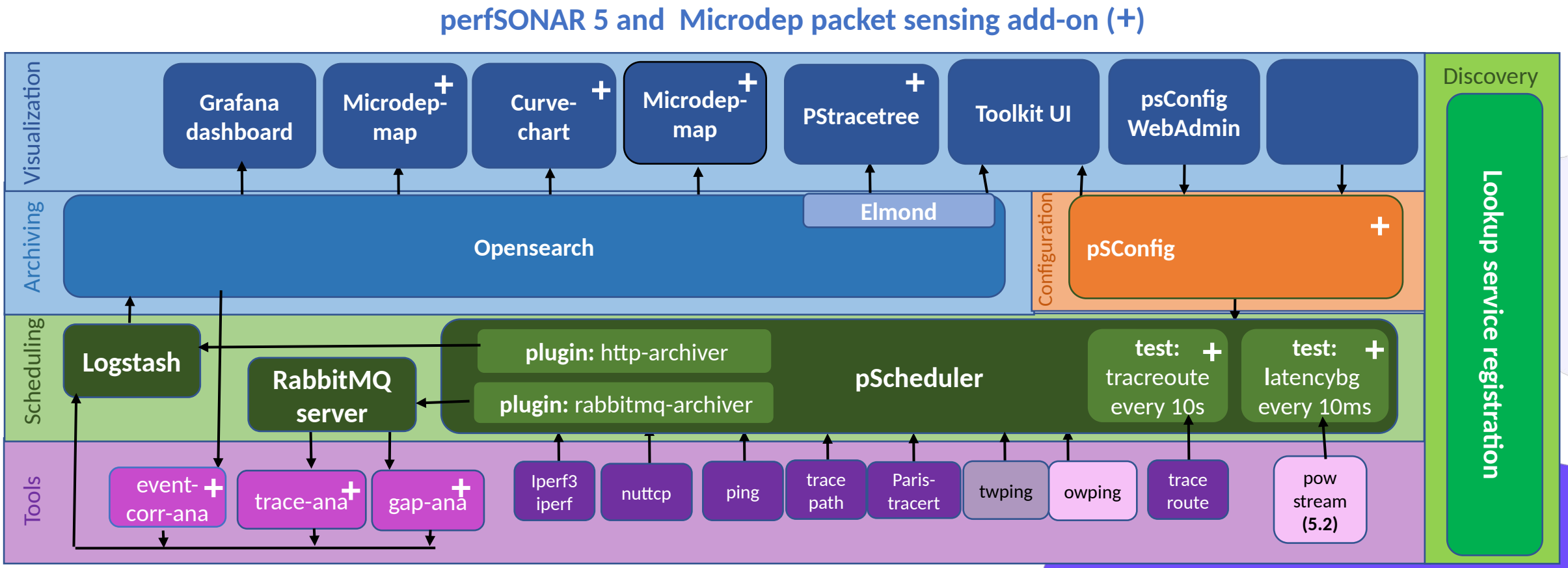
From azurede-mp to bsmp1.switch.ch



Last status:none **Last error:**none

Microdep packet sensing
Part of the perfSONAR suit

perf2ONAR years



perfSONAR Tests

Type	Tools	Description
clock	psclock	Measure the clock difference between hosts
disk-to-disk	curl, globus	Network testing of throughput and Read/Write speeds
dns	dnspy	Measure DNS transaction time
http	curl	Measure HTTP response time
latency	owping	Measure one-way latency and associated statistics between hosts
latencybg	powstream	Continuously measure one-way latency and associated statistics between hosts and report back results periodically
rtt	ping	Measure the round trip time and related statistics between hosts
simplestream	simplestreamer	Used primarily for testing, sends a simple “HELLO” message between two hosts using TCP
throughput	iperf3, iperf2, nuttcp	A test to measure the observed speed of a data transfer and associated statistics between two endpoints
s3throughput	s3-benchmark	A test to measure the throughput of S3 web service storage
trace	traceroute, tracepath, paris-traceroute	Trace the path between IP hosts

EUMETSAT pilot proposal

- 2-10 **perfSONAR test points** in selected EUMETSAT pops
  - Small hardware nodes (Raspberry Pies) provided by Sikt
  - VMs (or containers) provided by EUMETSAT
- Dedicated **perfSONAR toolkit**
  - Measurement archive
  - Presentation frontend
  - Hosted in VM by Sikt (or EUMETSAT)
- System configuration by Sikt with assistance from EUMETSAT
- Full access to GUI and backend DB for EUMETSAT
- Pilot period of 1 year
- Potential future production version as part of the forthcoming SPOC coordinated by GEANT