

Grafana at CERN

A brief view on how Grafana helps High Energy Physics

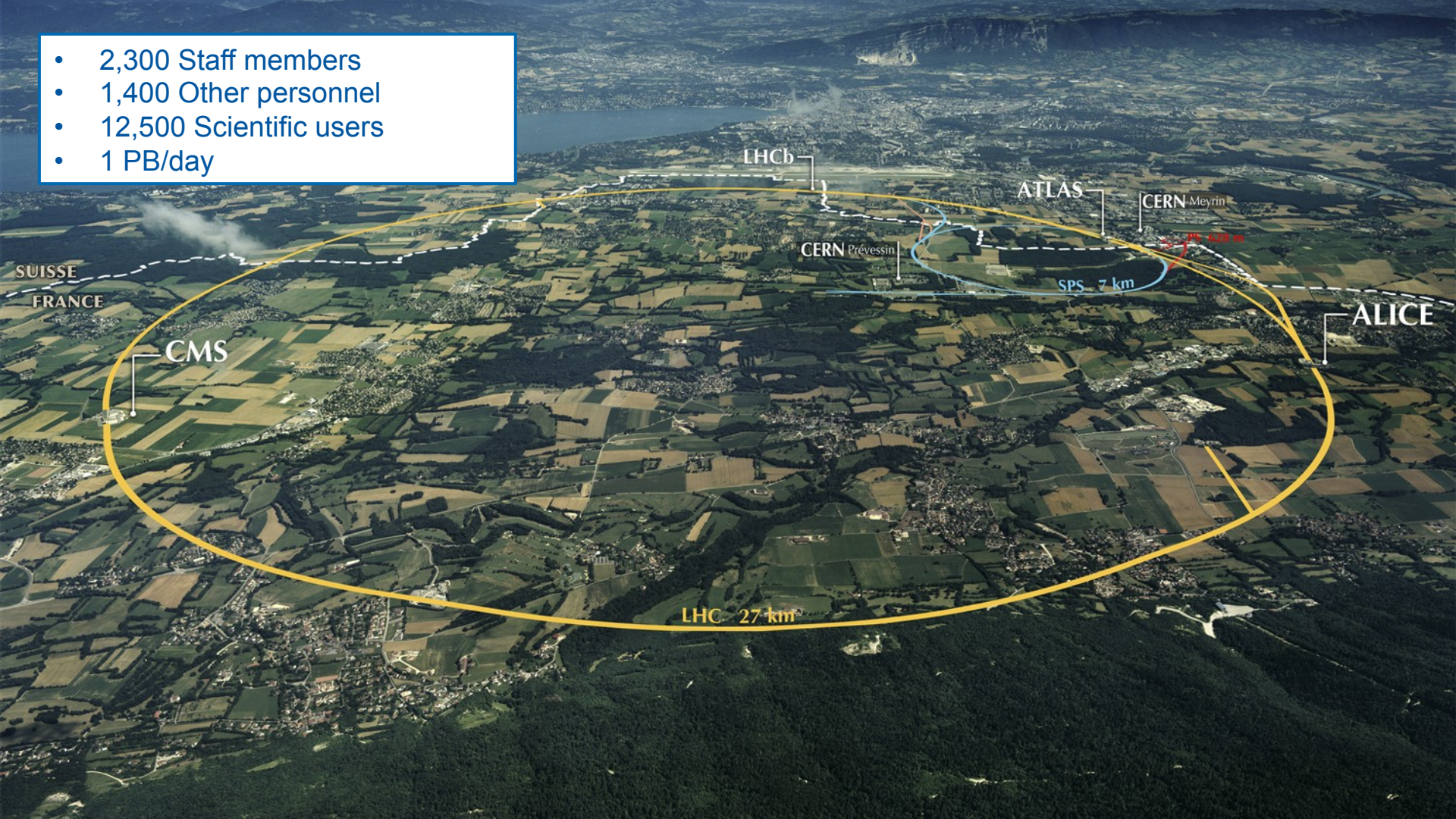
The twenty two Member States of CERN

Member states (date of accession)

	Austria (1959)
	Belgium (1963)
	Bulgaria (1999)
	Czech Republic (1993)
	Denmark (1963)
	Finland (1991)
	France (1953)
	Germany (1953)
	Greece (1953)
	Hungary (1992)
	Israel (2014)
	Italy (1963)
	Netherlands (1953)
	Norway (1953)
	Poland (1991)
	Portugal (1986)
	Romania (2016)
	Slovakia (1993)
	Spain (1961-1968, 1983-)
	Sweden (1953)
	Switzerland (1953)
	United Kingdom (1963)



- 2,300 Staff members
- 1,400 Other personnel
- 12,500 Scientific users
- 1 PB/day



What are we up to?

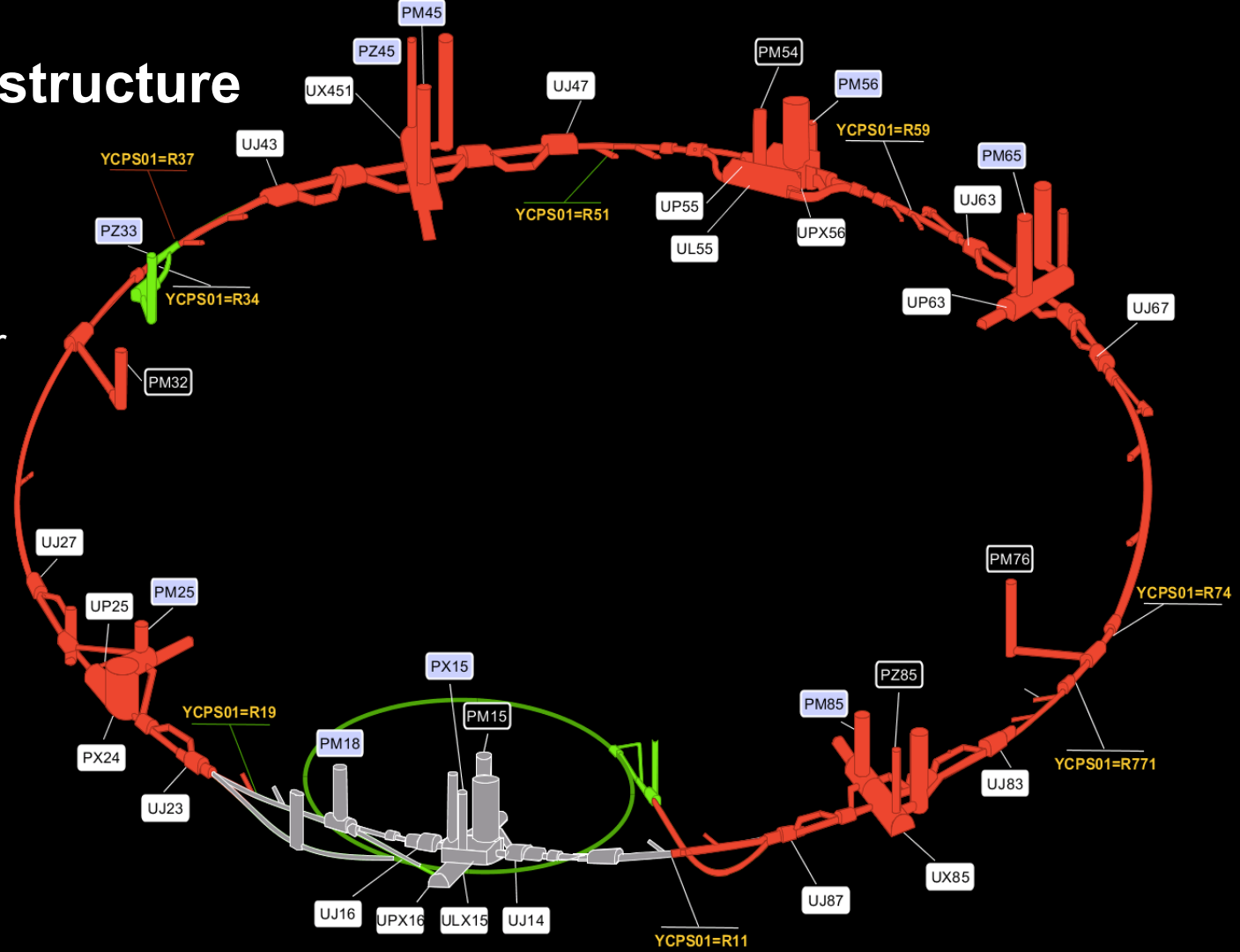
- Push forward the frontiers of knowledge
- Develop new technologies for accelerators and detectors
- Train the scientist and engineers of tomorrow
- Unite people from different countries and cultures
- Understand the very first moments of our Universe

What does CERN monitor?

- Technical infrastructure
- Accelerators
- Experiments
- Computing infrastructure

Technical Infrastructure

- Electrical Distribution Network
- Heating, cooling, Ventilation and Air Conditioning
- High Vacuum and Cryogenic systems



Grafana at Technical Infrastructure

- Based on C2MON
 - A highly scalable control and monitoring platform
- Elasticsearch backend
- Alarms service developed at CERN
 - ~ 40K alarms
- Dashboards for Control rooms and experts

513-R-050

20.6 °C

513-S-034

22.3 °C

513-R-060

25.8 °C

613-R-001

18.2 °C

34.2

%H

33.5

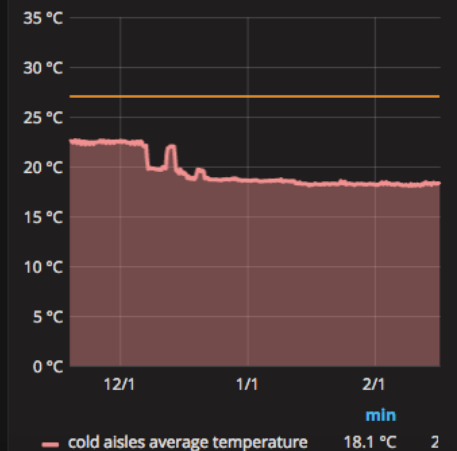
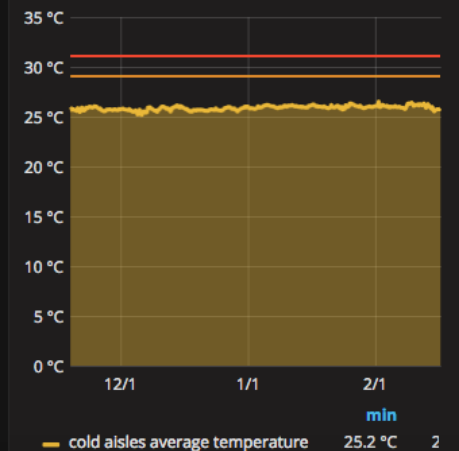
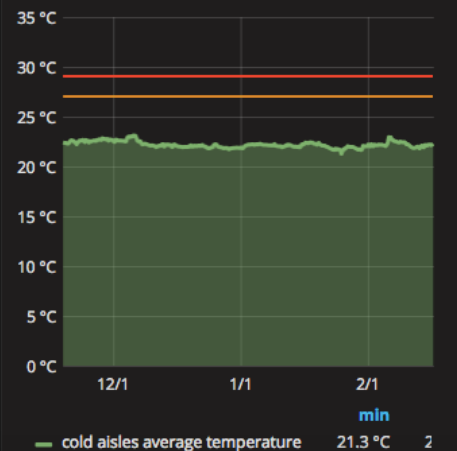
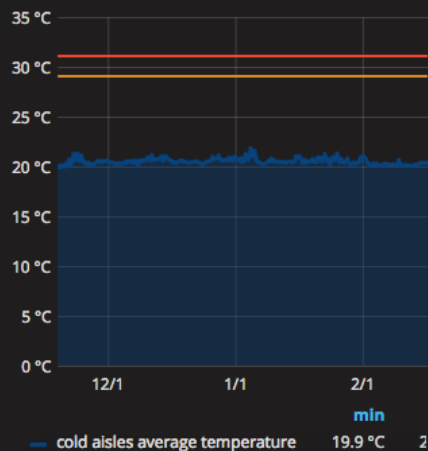
%H

34.9

%H

46.6

%H





Accelerators

- 100 meters underground
- 1,600 magnets
- -271 C
- Vacuum

Grafana at Accelerators

- CollectD, Nagios and Icinga2 metrics
 - CO systems, Crates, Quad enclosure, Servers
 - Monitoring components monitoring accelerators
- InfluxDB storage
- Docker + Openshift deployment





Experiments (ATLAS)

- 50 m long
- 25 m diameter
- 7,000 tonnes
- 1 Billion collisions / second

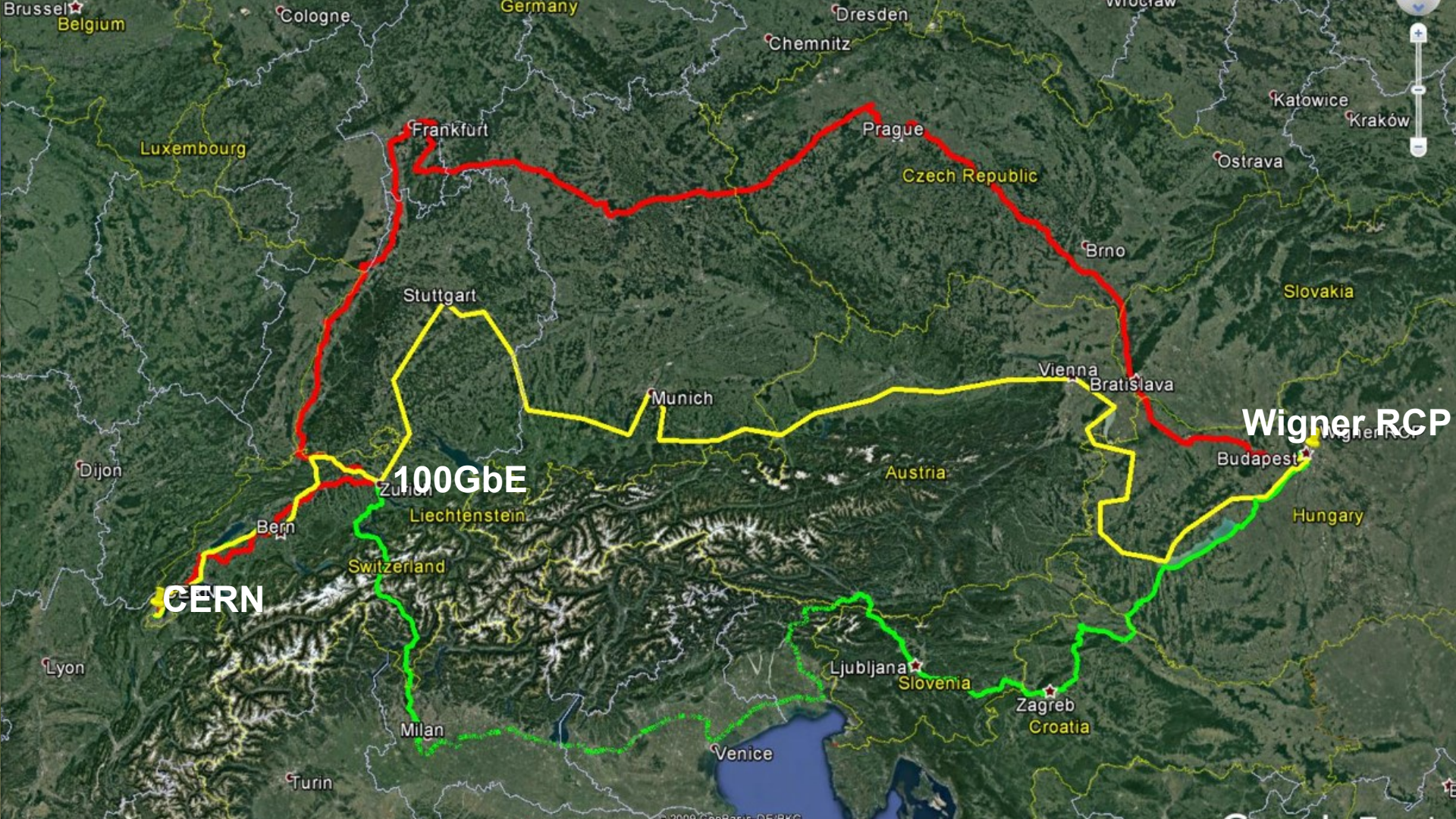
Grafana at Experiments

- Custom storage system P-Beast
 - In house time series storage
- 1.5TB of monitoring metrics per month
 - ATLAS Trigger and Data Acquisition
- Over 30 different dashboards
 - Used by shifters at Control room and experts

DataCentre

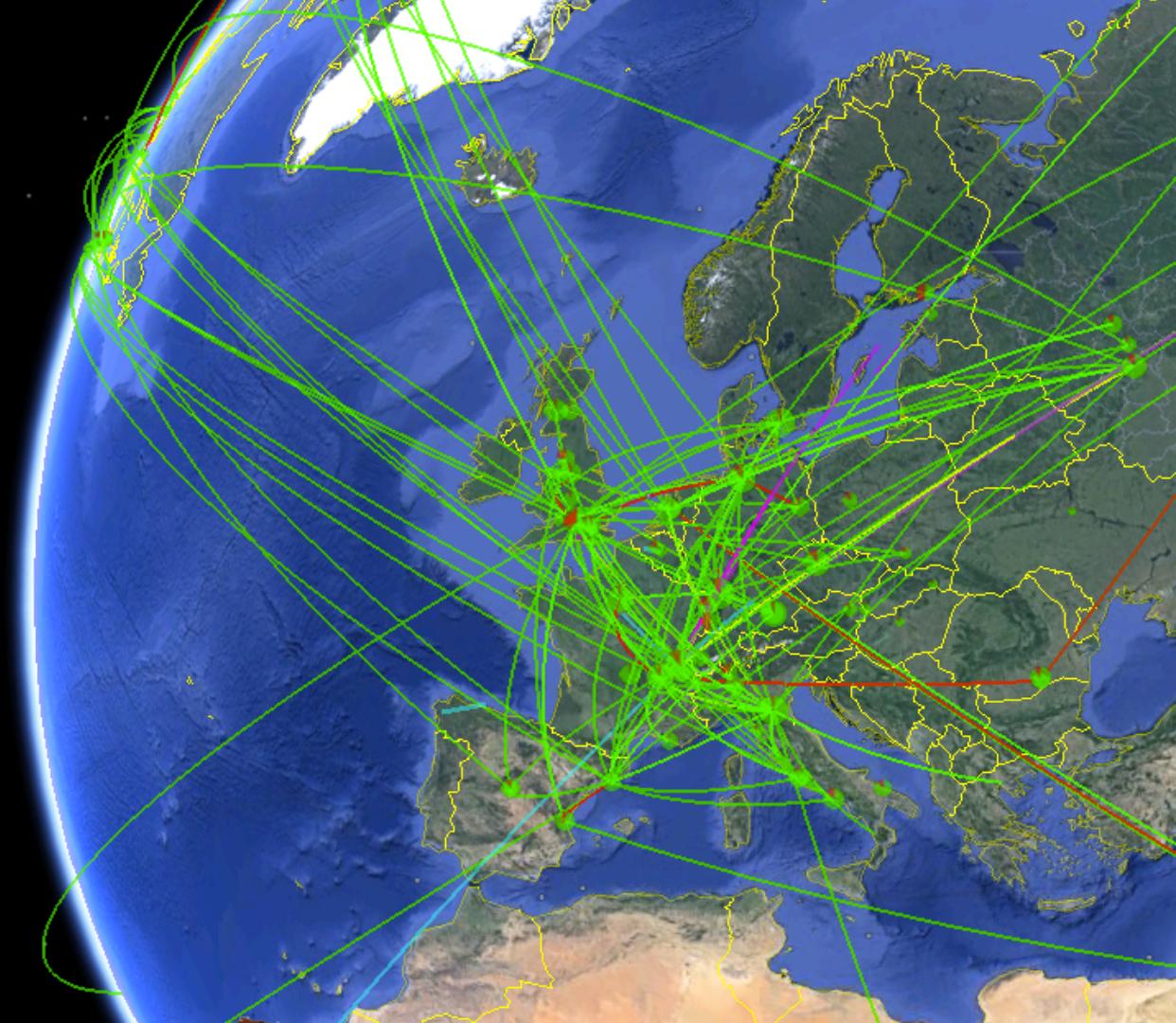
- 1 DataCentre – 2 sites
- 15,000 servers
- 230,000 cores



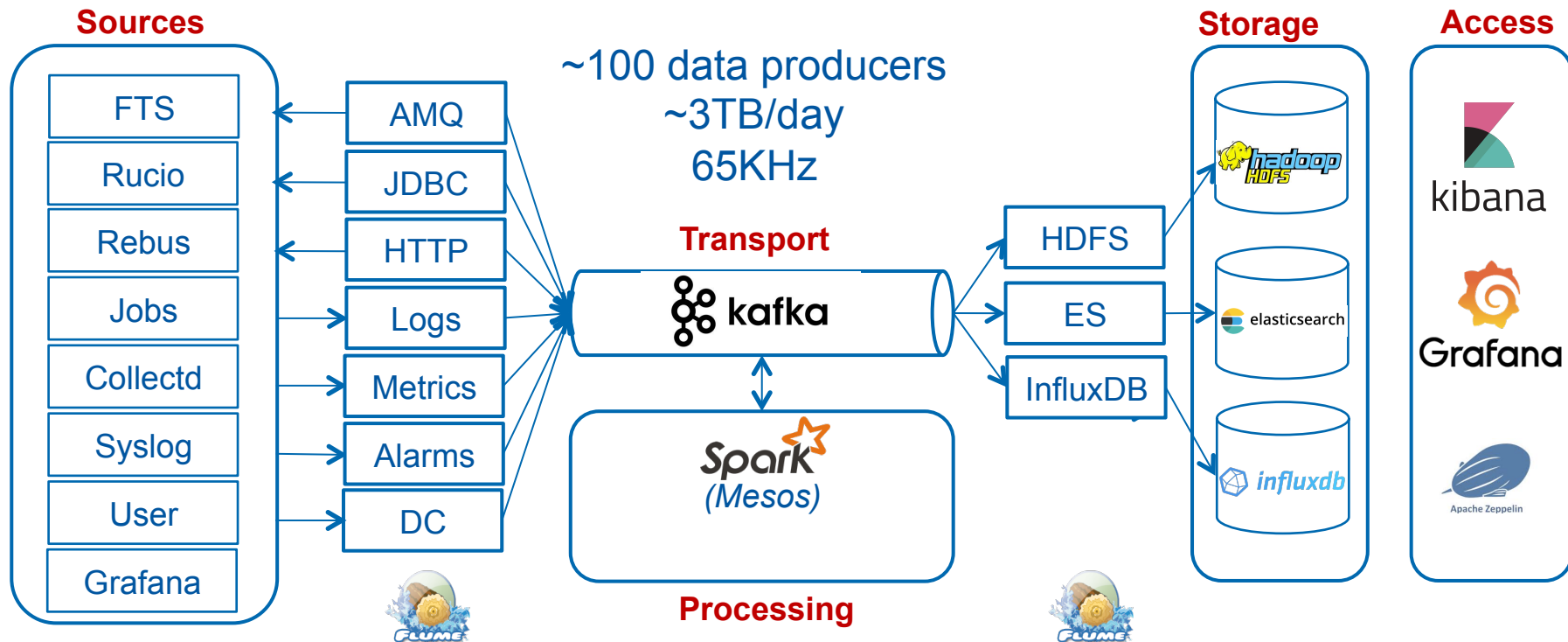


WLCG

- 10,000 physicists
- ~250,000 jobs concurrently running
- More than 170 datacentres all over the world
- 750,000 cores (CERN 20%)
- 800 PB storage



Monitoring Infrastructure



Grafana at Computing Infrastructure

- Central Grafana instance
 - ~ 1K users
 - 20+ organizations
 - Hundreds of dashboards
- InfluxDB and ElasticSearch (plus user provided datasources)
- Provide dashboards for HW, OS and services

COMPUTING

Servers (Meyrin)

11.5 K

Cores (Meyrin)

174 K

Servers (Wigner)

3.5 K

Cores (Wigner)

56.0 K

STORAGE

Disks (Meyrin)

61.9 K

Tape Drives

112

Disks (Wigner)

29.7 K

Tape Cartridges

29.7 K

NETWORK

Routers

238

Star Points

683

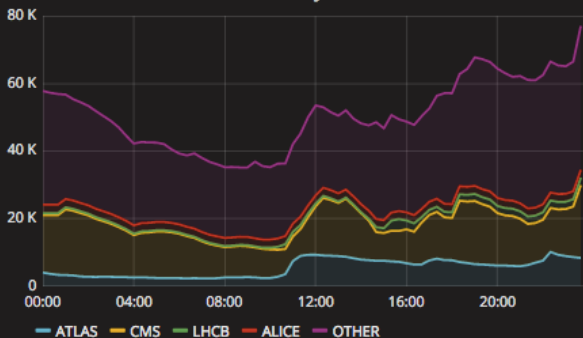
Switches

4.0 K

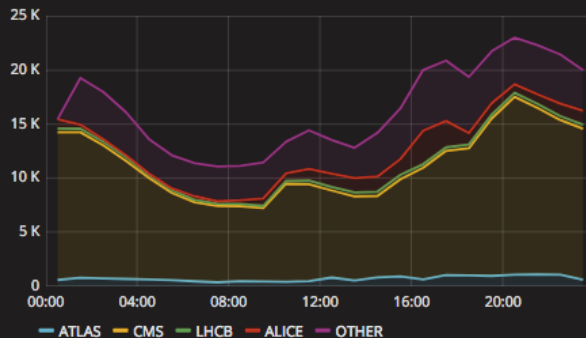
Wifi Points

1.6 K

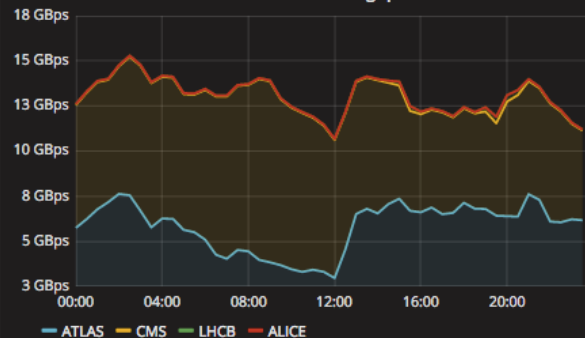
Batch Jobs



EOS Active Data Transfers



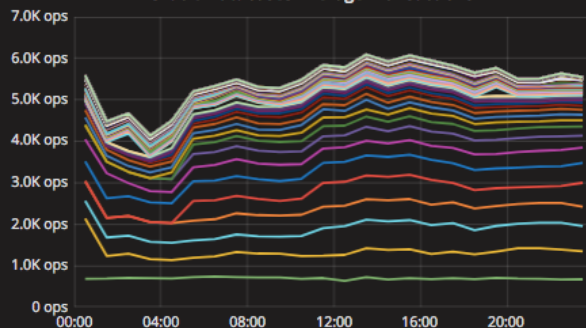
File Transfer Throughput



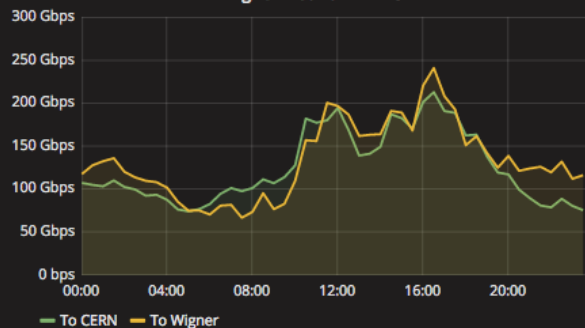
Virtual Machines Created (every 30 mins)



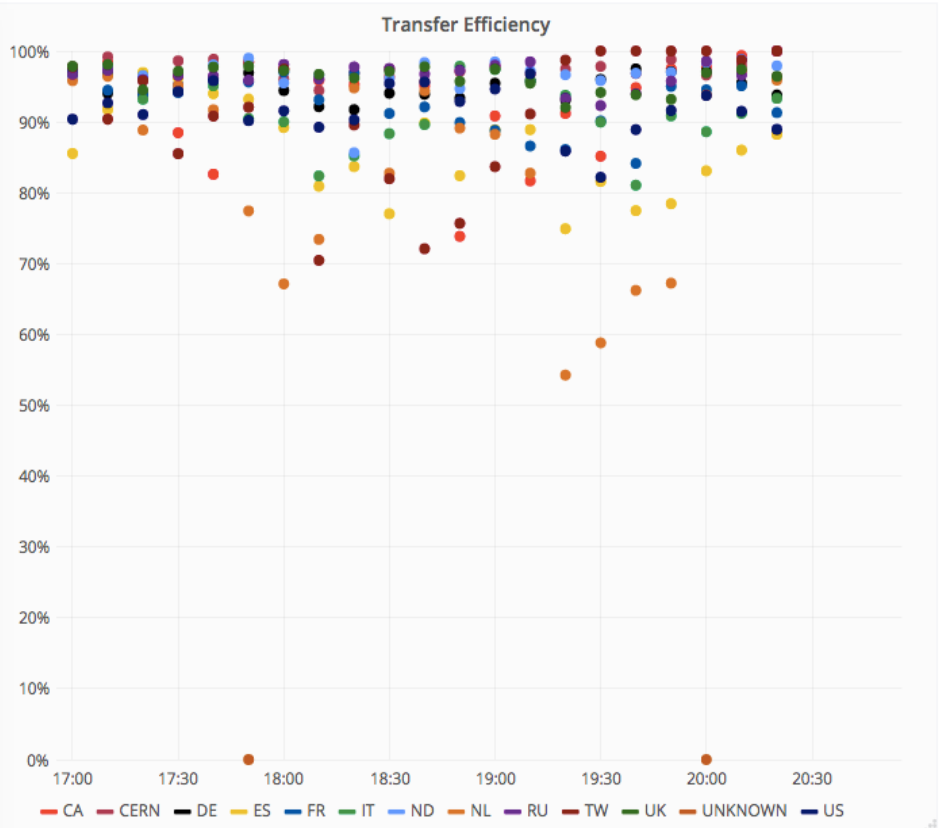
Oracle Databases Average Transactions



Wigner Network Links



Transfers



Efficiency												
	CA	CERN	DE	ES	FR	IT	ND	NL	RU	TW	UK	UNKNOWN
CA	81%	87%	81%	99%	96%	93%	92%	95%	100%	100%	87%	-
CERN	96%	86%	95%	79%	94%	94%	93%	97%	100%	95%	93%	0%
DE	90%	97%	94%	67%	83%	73%	97%	44%	85%	90%	96%	0%
ES	100%	93%	98%	97%	95%	99%	99%	31%	100%	100%	98%	-
FR	100%	99%	95%	91%	96%	96%	98%	98%	100%	95%	100%	-
IT	45%	99%	98%	76%	93%	97%	99%	99%	100%	100%	97%	-
ND	99%	100%	99%	92%	97%	97%	94%	100%	100%	100%	99%	-
NL	100%	100%	93%	96%	96%	96%	100%	39%	100%	100%	92%	-
RU	100%	100%	94%	89%	93%	97%	100%	100%	100%	100%	99%	-
TW	92%	98%	77%	92%	69%	86%	100%	100%	68%	-	89%	-
UK	99%	100%	96%	95%	94%	95%	97%	88%	96%	53%	97%	-
UNKNOWN	100%	100%	84%	100%	99%	97%	100%	63%	100%	100%	99%	-
US	95%	99%	97%	93%	95%	98%	96%	86%	98%	100%	91%	-

CQ (FTS)

♥ OK for 7 months



CQ (XRootD)

♥ OK for 5 months



Flume Channel (ALL)

♥ OK for a day



Flume Channel (MONIT)

♥ OK for a month



Flume Channel (TIMBER)

♥ OK for 3 months



InfluxDB (m_wlwg)

♥ OK for 5 hours



InfluxDB (w_ddmt)

♥ OK for 5 hours



Spark job (ATLAS JM RAW)

♥ OK for 19 hours



Spark job (DDM)

♥ OK for 6 days



Spark job (FTS)

♥ OK for 17 days



Spark job (Site Monitoring)

♥ OK for 31 minutes



Why Grafana?

- Great community support
- Mixed data sources
- User delegated control
- Templating
- Nice UI
- Easy to extend

Looking forward to...

- Dashboard ACLs (Folders are good too)
- Alarms over ElasticSearch
- High availability alarms
- Multiseries alarms
- Predefined color schemas
- Shared dashboards across organizations
 - Reusable plots

Our contributions

- Time range as legend on graphs ([PR-9124](#))
- Grouping to rows and columns transformation ([PR-8492](#))
- Discrete plugin: Legend information ([Issue-20](#))
- Timelion datasource: Lucene for variables interpolation ([PR-6](#))

Thank you!

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