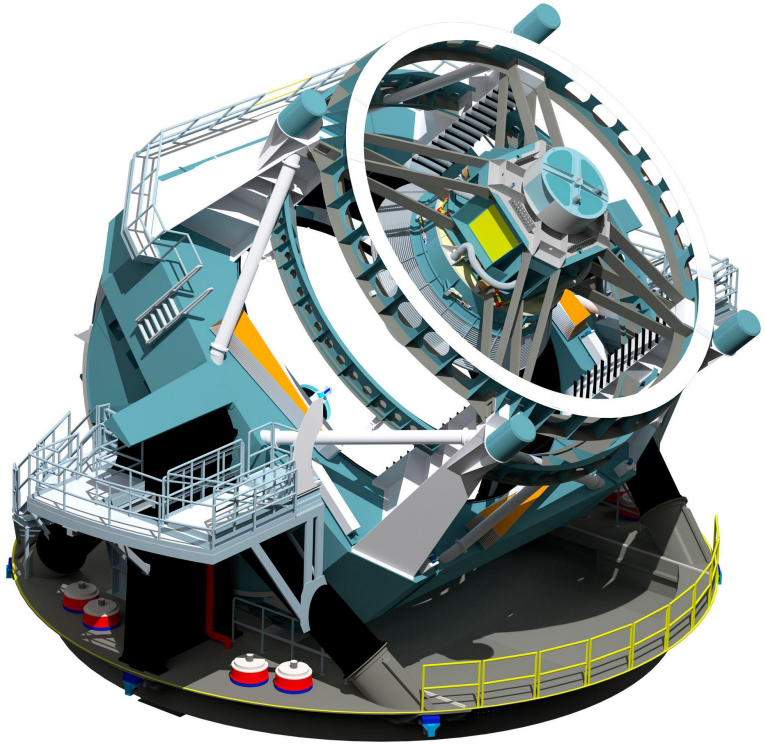
LSST alerts: Who, What, When, Where & Why.

Julien Peloton - CNRS/LAL

LSST Data Products



Now

Raw Data
Sequential 30s image, 20TB/night

60s

Prompt Data Product
Difference Image Analysis
Alerts: up to 10 million per night

Public data!

24h

Prompt Products DataBase
Images, Object and Source catalogs from DIA
Orbit catalog for ~6 million Solar System bodies

Year

Annual Data Release
Accessible via the LSST Science Platform &
LSST Data Access Centers.

End

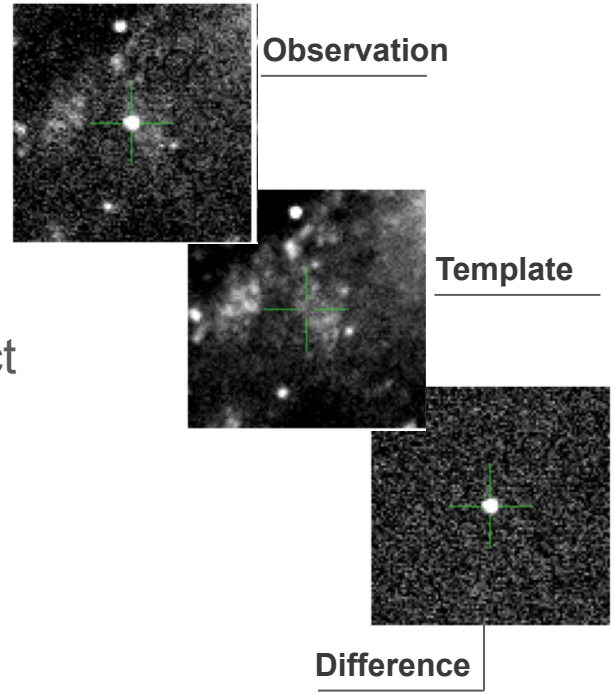
Final 10yr Data Release
Images: 5.5 million x 3.2 Gpx
Catalog: 15PB, 37 billion objects

Alert packet anatomy

Alert packet

- DIA Source record that triggered the alert
- Associated DIA object or SS object record
  - Timeseries features
  - Crossmatches to nearby LSST detected object
- 12 months of DIA source history
- Science and template cutouts (30x30 pixels).
- Serialisation using Apache Avro
- Transport using Apache Kafka
- Tested currently for the ZTF experiment.

Credits: E. Bellm



Alert packets and their contents are world-public and can be freely shared with anyone.

Some Data Challenges...

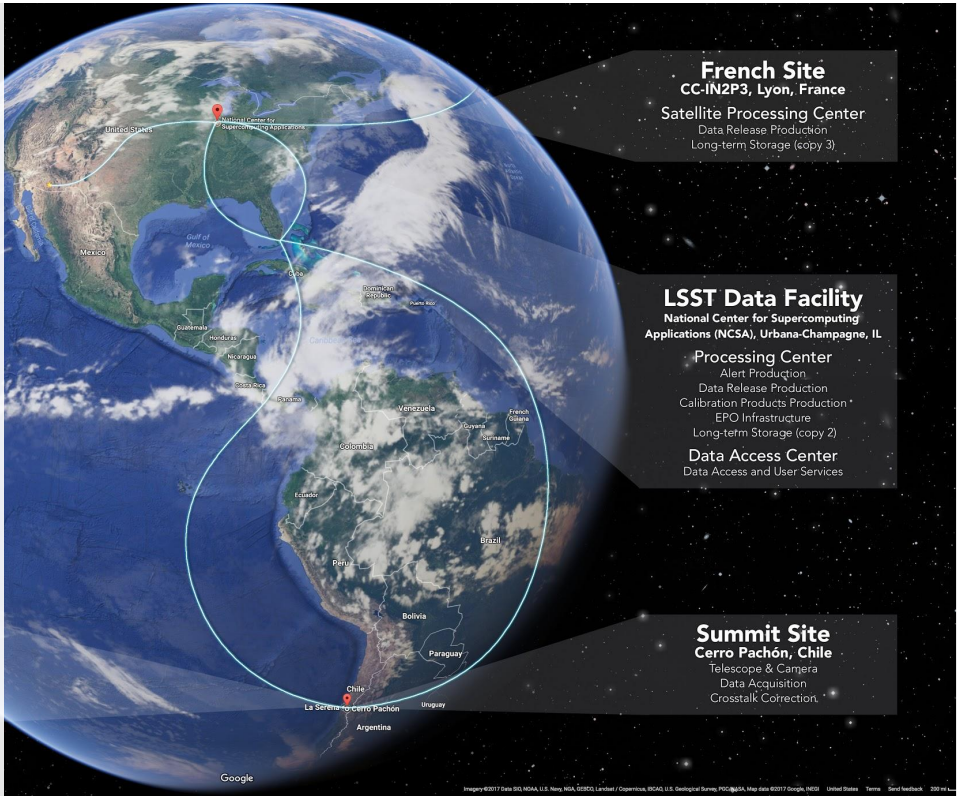
Forecasted: 10 million alerts per night…

- Current serialisation implies ~82KB/alert, 800 GB/night, 3PB in 2030.

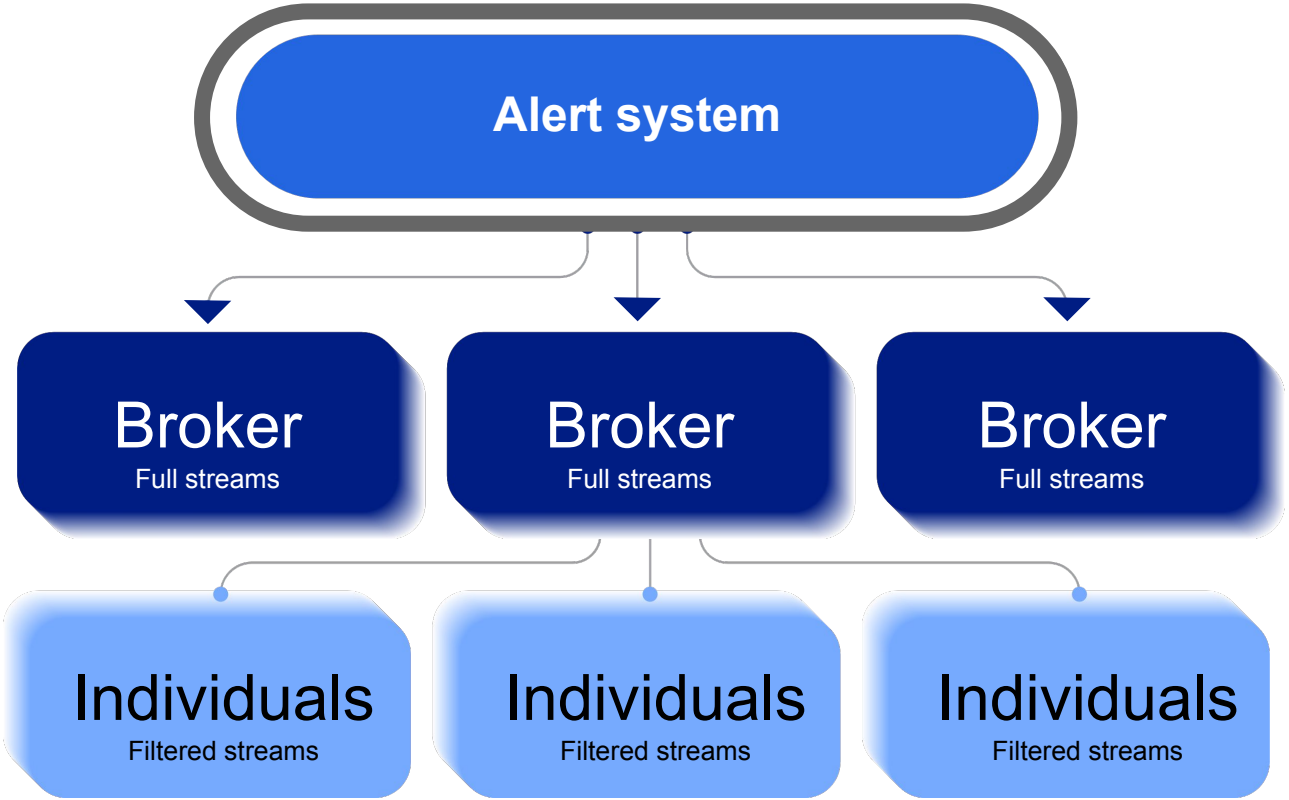
98% of alerts must be transmitted with 60 seconds of readout…

- … and processed before the next night!

Wires to send alerts worldwide are not infinitely big...



How to get alerts?



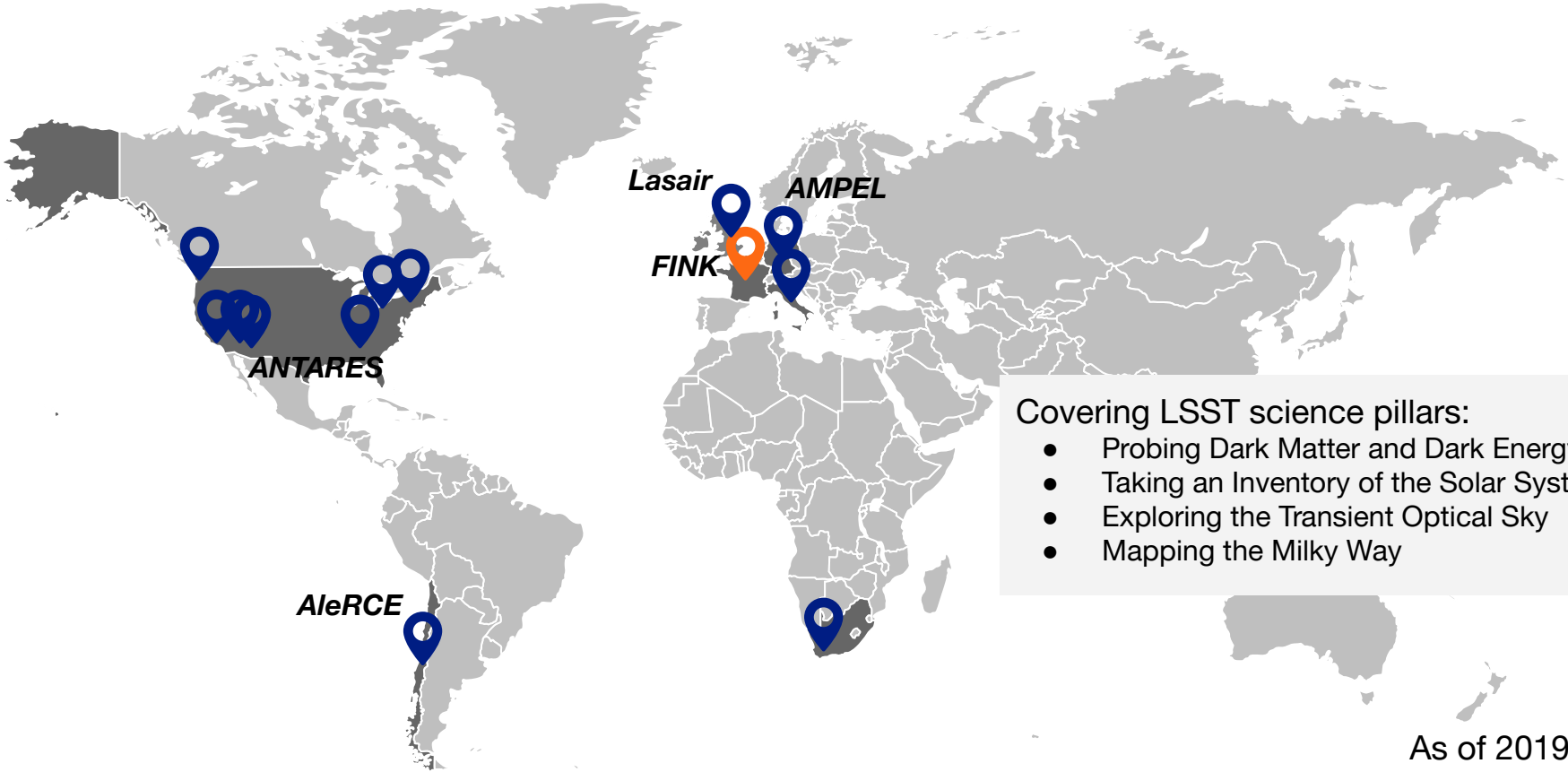
Brokers **MUST:**

- Collect
- Add value
- Distribute

Brokers **CAN:**

- Adapt
- Coordinate follow-up

LSST Broker landscape

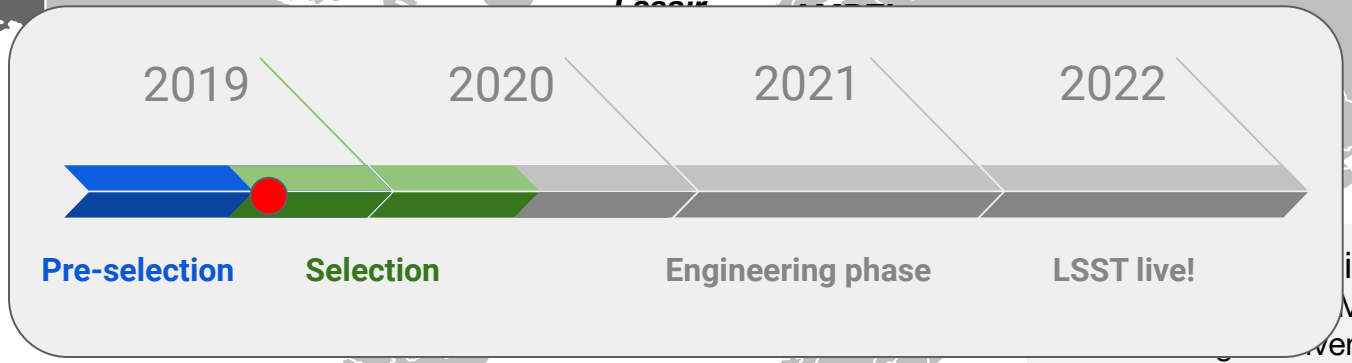


Covering LSST science pillars:

- Probing Dark Matter and Dark Energy
- Taking an Inventory of the Solar System
- Exploring the Transient Optical Sky
- Mapping the Milky Way

As of 2019

LSST Broker landscape



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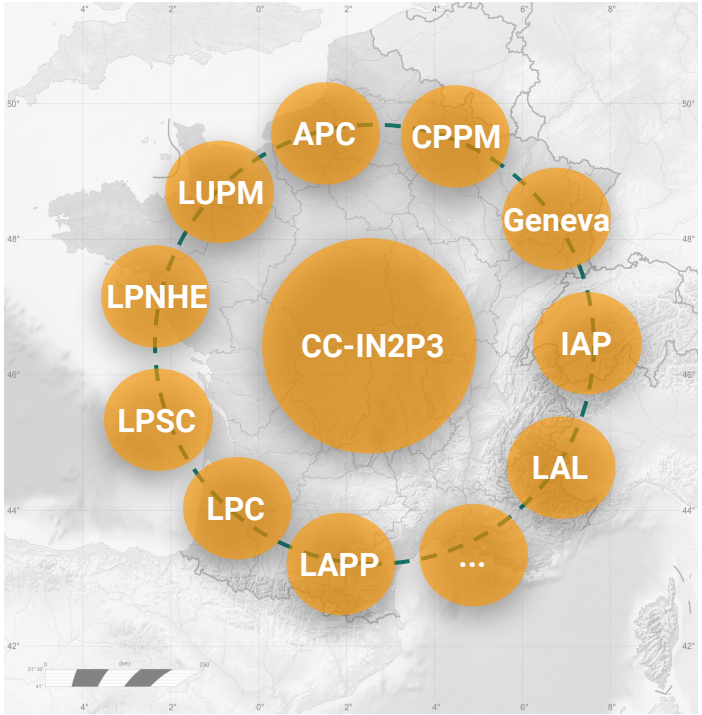
AleRCE

As of 2019

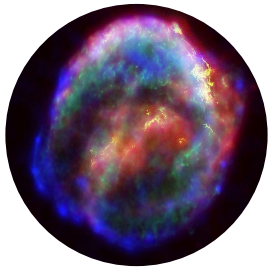
Fink Collaboration

IN2P3 initiative to propose a broker to serve the need of LSST-France as well as the different french multi-messenger astronomy actors.

LSST membership is not required



Fink Science & Goals



What we do (other than standard broker)

- **Science**: Supernovae, microlensing, anomaly detection, and multimessenger astronomy: GRB alerts, gamma ray, nu, GW events, ...
- **Methods**: Adaptive learning, Bayesian NN.
- **Technology**: big data, cloud.

Our goals for this workshop

- Accommodate our infrastructure for your needs and science cases (selection function, distribution, coordination, ...)
- Integration of Fink within existing efforts

We Can help you with

- Joining Fink and develop your science!
- Stay tuned for beta testing in Autumn.

Keys for success

- The structuration of communities beyond individual experiments.
- Insure a stable, long lasting solution for coordination of alerts in MMA landscape.
- Connect different communities with efficient frameworks.
- Sustain and benefit from activities already deployed or under development.
    - IVOA, standard tools, communication protocols, networks of telescopesv

We need you!

To conclude...

By investing now, the **French community** at large would secure a **prominent place** in this global effort, guaranteeing the scientific return on both LSST and collaborating scientists and experiments **for the next decade**.