LOFAR2.0 LTA
Planning for a new site

LTA Development Workshop

Utrecht 02-07-2026

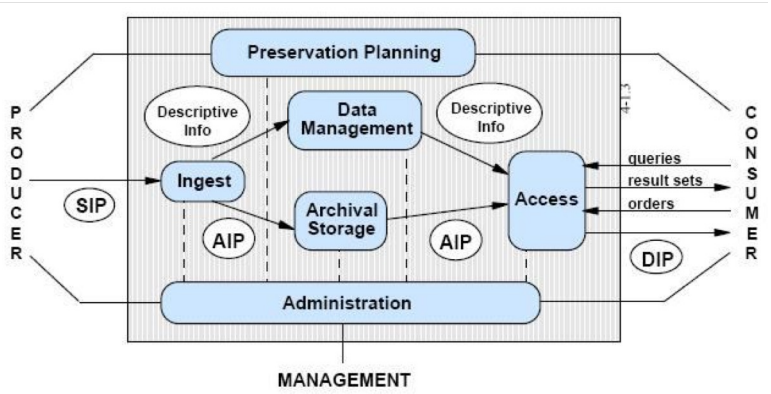
Hanno Holties

ASTRON
Netherlands Institute for Radio Astronomy

Planning for a new LTA site

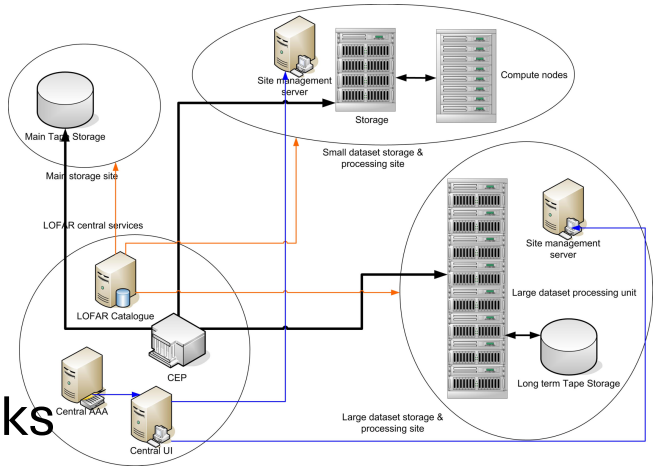
- Who for?
  - Please raise a (virtual) hand
  - Provide a short introduction
  - Indicate what would you like to learn or discuss

Early LTA design decisions



- **Follow OAIS** (Open Archival Information System) model
  - a.o. ingest data as a self-contained SIP (Submission Information Package)
- **Build on WLCG** (Worldwide LHC Computing Grid) technology for storage and compute
  - Use SURLs (SRM-URLs *now deprecated*) as ‘global unique identifiers’
- **Additional components**:
  - Single catalogue of LTA content based on AstroWise technology
  - HTTP based data access
  - Require users to stage data before retrieval through a central stager service

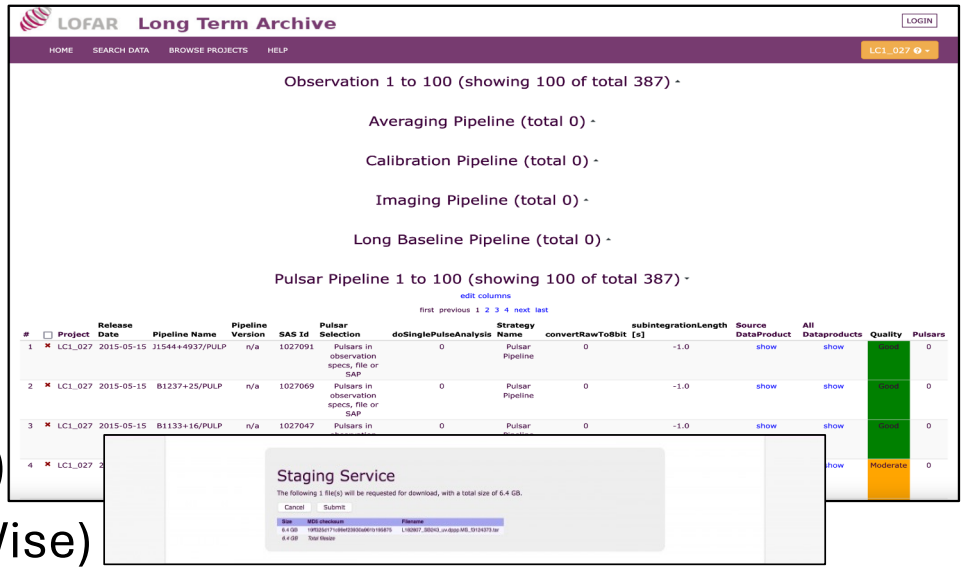
Early LTA design decisions



- **CEP – LTA** site connections as **exclusive networks** over dedicated (guaranteed bandwidth) 10 Gbps links
- Support for the **LOFAR data access policy**, specifically
  - Access restrictions to be applied in accordance with LOFAR **proprietary period**
  - Access control (authentication & authorization) based on LOFAR user administration (**users, projects, roles**)
  - Allow users to share access to data products
    - Implemented by providing '**security through obscurity**' – paths include a random hash and regular users are not allowed to browse storage content
- **Data placement policy**
  - **Single replica** on tape (deviation from blueprint archive, which stated redundancy to be required)
  - Disk capacity for **caching ca 3 months** of LOFAR data

LTA user interfaces

- **LTA Portal** (discovery)
  - Supports requests to stage
- LOFAR **LTA Python client** (discovery)
  - Interact directly with catalogue (AstroWise)
- **Stager client** library (retrieval)
  - Wrapper around stager API
- **dCache** supported protocols (retrieval)
  - Legacy: GridFTP (X509)
  - Recent: WebDAV (X509 + **Macaroons**)
  - REST API – SURF ADA client




```python
# Python3 code
from pprint import pprint
from awlofar.main.aweimports import Observation, Pointing, SubArrayPointing
from common.database.Context import context
result = {}
for project in sorted(context.get_projects()) :
    print("Project %(project)s" % vars())
    ok = context.set_project(project)
    # do your query
    obs_ids = set()
    query = (Pointing.rightAscension > 95)  & \
            (Pointing.rightAscension < 105) & \
            (Pointing.declination    > 20)  & \
            (Pointing.declination    < 30)
    print("Total Pointings %d" % len(query))
    for pointing in query :
        print("Pointing found RA %f DEC %f" % (pointing.rightAscension, pointing.declination))
        query_subarr = SubArrayPointing.pointing == pointing
        for subarr in query_subarr:
            query_obs = Observation.subArrayPointings.contains(subarr)
            for obs in query_obs :
                obs_ids.add(obs.observationId)
    result[project] = sorted(list(obs_ids))
    print(result[project])
```

LTA Current developments - Evolving technology

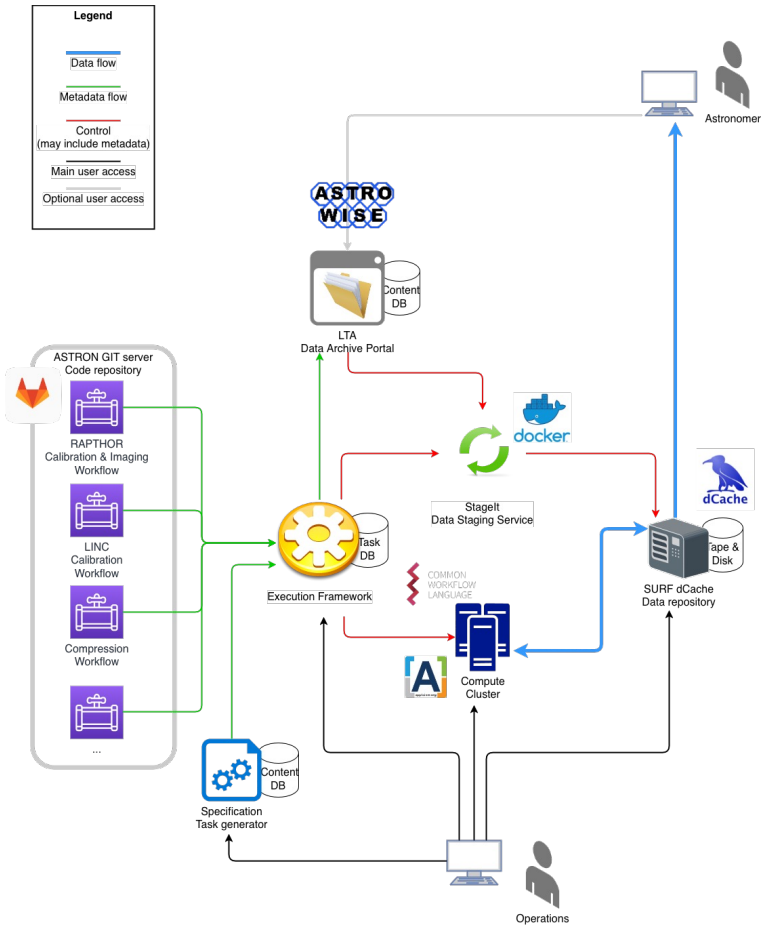
- All sites now at least on **dCache 9.2** – *keep up to date*
- **StageIt** (Python – replaced old SRM-based JAVA service)
  - Support dCache **WebDAV** protocol
  - Support dCache **Macaroon tokens**
- LOFAR download servers phased out (replaced by native WebDAV)
- Migration to **FAAI/SRAM** (Portal & stager)
- Data processing capabillities

LOFAR Processing Framework - Site deploy

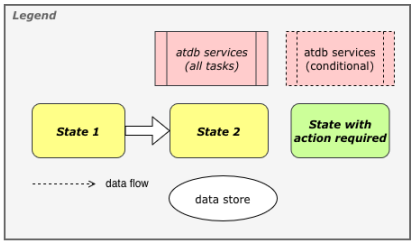
- **Datacenter** requirements[1]
  - Good **network to (local) LTA storage**
  - **Disk** capacity for caching/buffering inputs & outputs
    - LTA
    - Shared (local) filesystem
  - Deploy & execute **data management service**
    - Python
    - Connect to central task database @ASTRON
    - Handles transfers between LTA & local (shared) file system
    - Pre-fetch input data from external data sources
  - Deploy & execute **job workflow execution service**
    - Python
    - Connect to central task database @ASTRON
    - Access to local (shared) filesystem
    - Interact with (local) job scheduler
    - Execute Singularity/Apptainer based software[2]
  - **Service account**
    - local deploy, management, troubleshooting
    - Accessible for (small) operations team

[1] Current implementation – may adopt SKA/SRCnet technology in future

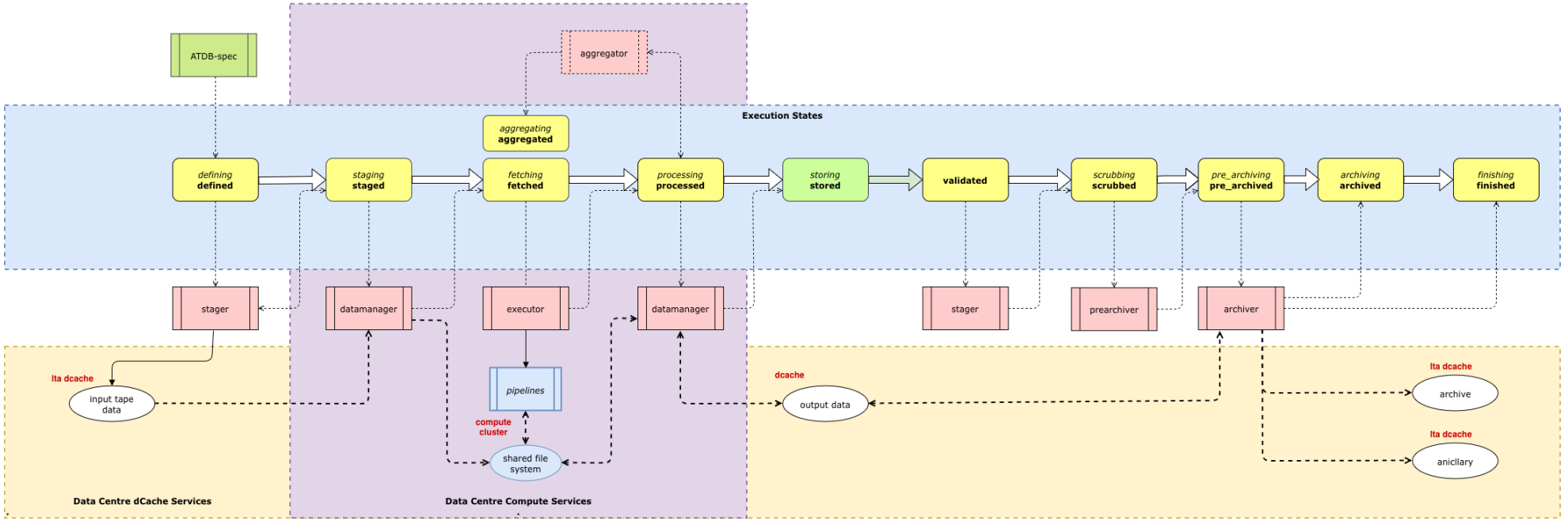
[2] Containers fetched from (ASTRON) gitlab – looking into CVMFS & EESSI/EasyBuild



Processing Framework - Site Deploy



- Archive: regular products stored on tape
- Ancillary: smaller products on disk for e.g. inspection & QA



Planning for a new site

- Familiarize with LTA Site Requirements (SDC-038)

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LOFAR LTA Site Requirements

	Organisatie / Organization	Datum / Date
Auteur(s) / Author(s): John D. Swinbank Hanno Holties Roberto Pizzo	 ASTRON ASTRON ASTRON	 2025-07-29
Controle / Checked: Michiel P. van Haarlem	 LOFAR ERIC	 2025-05-08
Goedkeuring / Approval: ...	 ...	 ...
Autorisatie / Authorization: ... **Handtekening / Signature:**	 ...	 ...

This technical note expresses the opinions of the authors on the date of writing.
It is not binding on the SDC Program, and may not accurately reflect future developments.

Doc. Nr.: SDC-038
Rev.: 2.0-1-gba68514
Date: 2025-07-29
Doc. Type: Tech. Note

LTA Site Requirements

3 Technical Requirements

3.1 Storage

- Provide a dCache-managed storage environment.
- Provide file access using WebDAV.
- Provide file management using the dCache API.
- Support automatic migration of data to slow storage (if used).
- Provide sustained average speed between fast and slow storage (if used) of at least 4 Gbps.

3.2 Compute

- Provide a Linux-based compute cluster.
- Support Singularity/Apptainer based containers on both head and compute nodes.
- Support Python-based daemonic services on head nodes.
- The SLURM workload manager is preferred; use of others is subject to evaluation & test.
- Provide a shared (POSIX) filesystem, accessible from all nodes.
- Provide at least 30 x86-64 compute cores per node.
- Provide at least 8 GB RAM per core.
- Provide at least 200 GB fast local “scratch” storage per core.

3.3 Network

- Support a dedicated connection from LOFAR central processing supporting a data rate of at least 10 gigabit/second.
- Provide a connection of at least 10 gigabit/second between storage and processing systems located at the same site.
- Provide data access to other LTA sites and general users supporting a total of at least 10 gigabit/second transfer rate.

3.4 Support

- A commitment of resources for a period of at least five years is recommended.
- In the event of termination (early or scheduled) of site operations, the site must support migration of data to another site. This includes agreement of a migration plan with LOFAR ERIC and allowing at least one year for the transfer to take place.
- Service availability of 95% is expected, as is response to issues within one working day.

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- Familiarize with LTA Site Requirements (SDC-038)
- Contact the observatory
  - John, Roberto, me
  - And/or submit ticket (communication & progress tracked) https://support.astron.nl/sdchelpdesk

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- Get involved in LTA Collaboration channels
  - Confluence
  - Slack
  - LTA Operations telecons (bi-monthly)

Planning for a new site

- Build & Commission
  - Storage
    - Set up access (X509 & VOMS – primarily for operational access)
    - Configure for LOFAR capabilities
    - SDC Development Program configures services with site details
    - SDC Operation commissions functionality
  - Compute
    - Set up access (initial allocations, development/deploy/service accounts)
    - Ensure connectivity
      - LTA
      - Central task database
      - External connections (git, other data sources – in principle ‘public internet’)
    - SDC Development Program configures services & deploys LOFAR daemons
    - SDC Operations commissions functionality