SKA SRC - a data-centric point of view

Matteo Stagni - The Third National Workshop on the SKA Project - The Italian Route to the SKAO Revolution - Virtual - 8 October 2021

Establishing fundamental units

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- Scheduling Block (SB) = time allocated for an observation
- How much time? Depends on the project requirements
- How much data? Depends on the type of product

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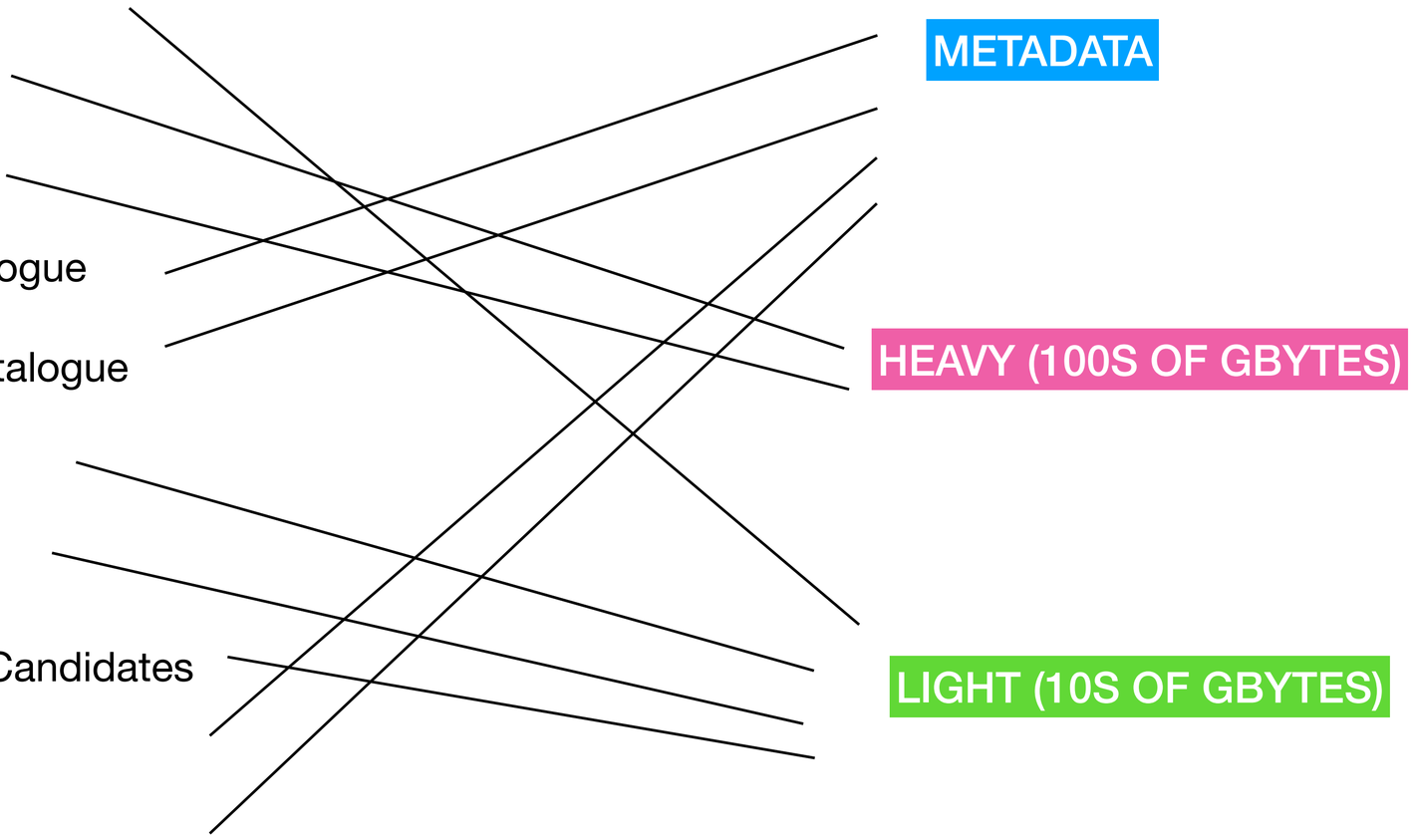
DATA PRODUCTS

- Image Products 1: Image Cubes
- Image Products 2: uv Grids
- Calibrated Visibilities
- Local Sky Model (LSM) Catalogue
- Imaging Transient Source Catalogue
- Pulsar Timing Solutions
- Transient Buffer Data
- Sieved Pulsar and Transient Candidates
- Science Alerts Catalogue
- Science Product Catalogue



METADATA

HEAVY (100S OF GBYTES)

LIGHT (10S OF GBYTES)

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DATA TYPES

SKAO
Observatory Data Products (ODPs)

Observation-level data products (OLDPs) are calibrated data products generated by SDP workflows and are based on data obtained from a single execution of a scheduling block (SB).

Project-level data products (PLDPs) are calibrated data products generated by combining several, related, observation-level data products, delivering the requirements of the PI as outlined in their original proposal.

SRC
Advanced Data Products (ADPs):

These are the user-generated products, produced through the detailed and rigorous analysis and modelling of Observatory data products (either at the observation or project level). The generation of ADPs will usually require some level of interactive visualisation and examination of data, as well as comparison to data from other SKA observations or other facilities.
Science users are responsible for the generation of ADPs.

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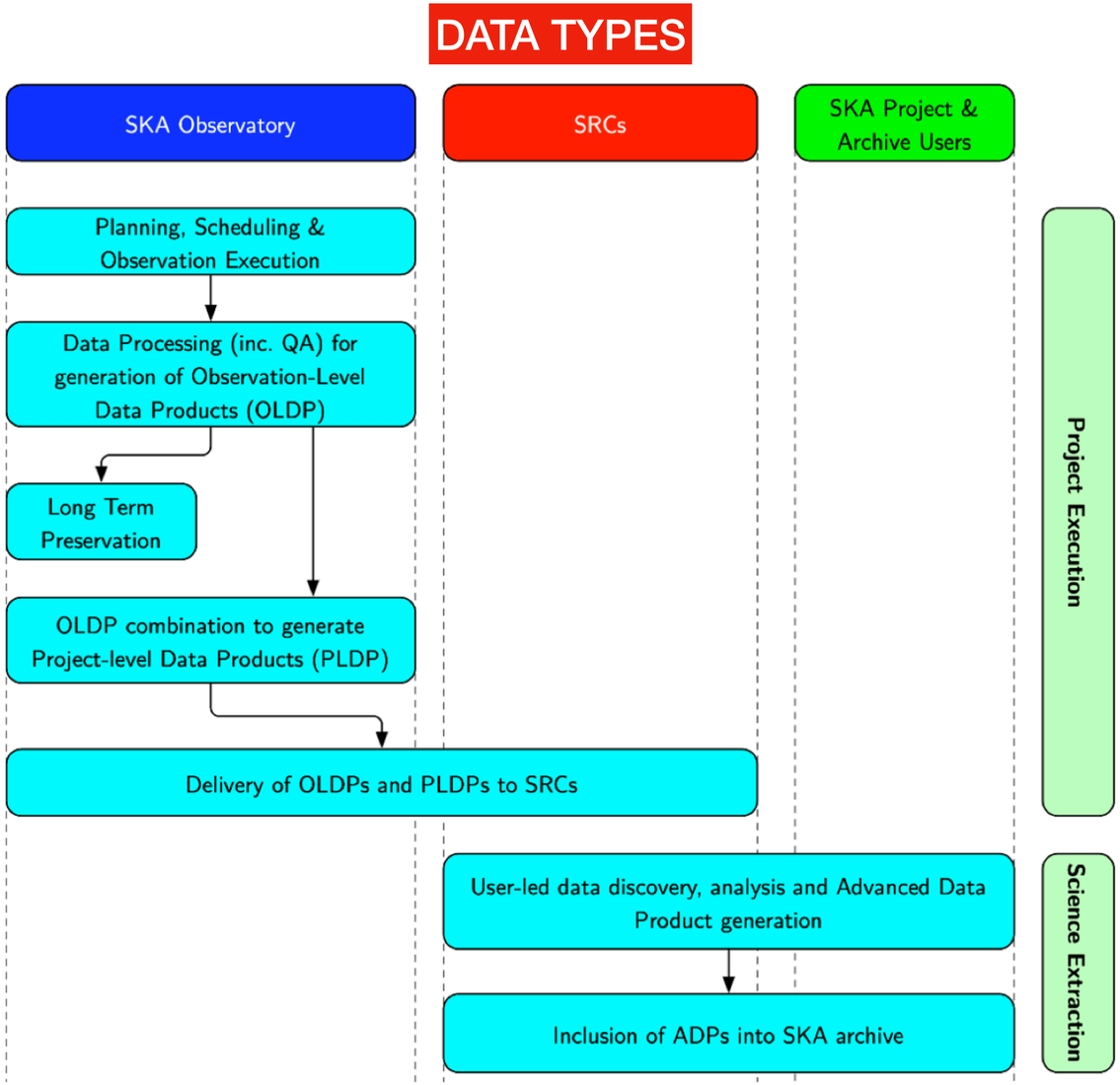

Swimlanes represent responsibilities according to SKAO

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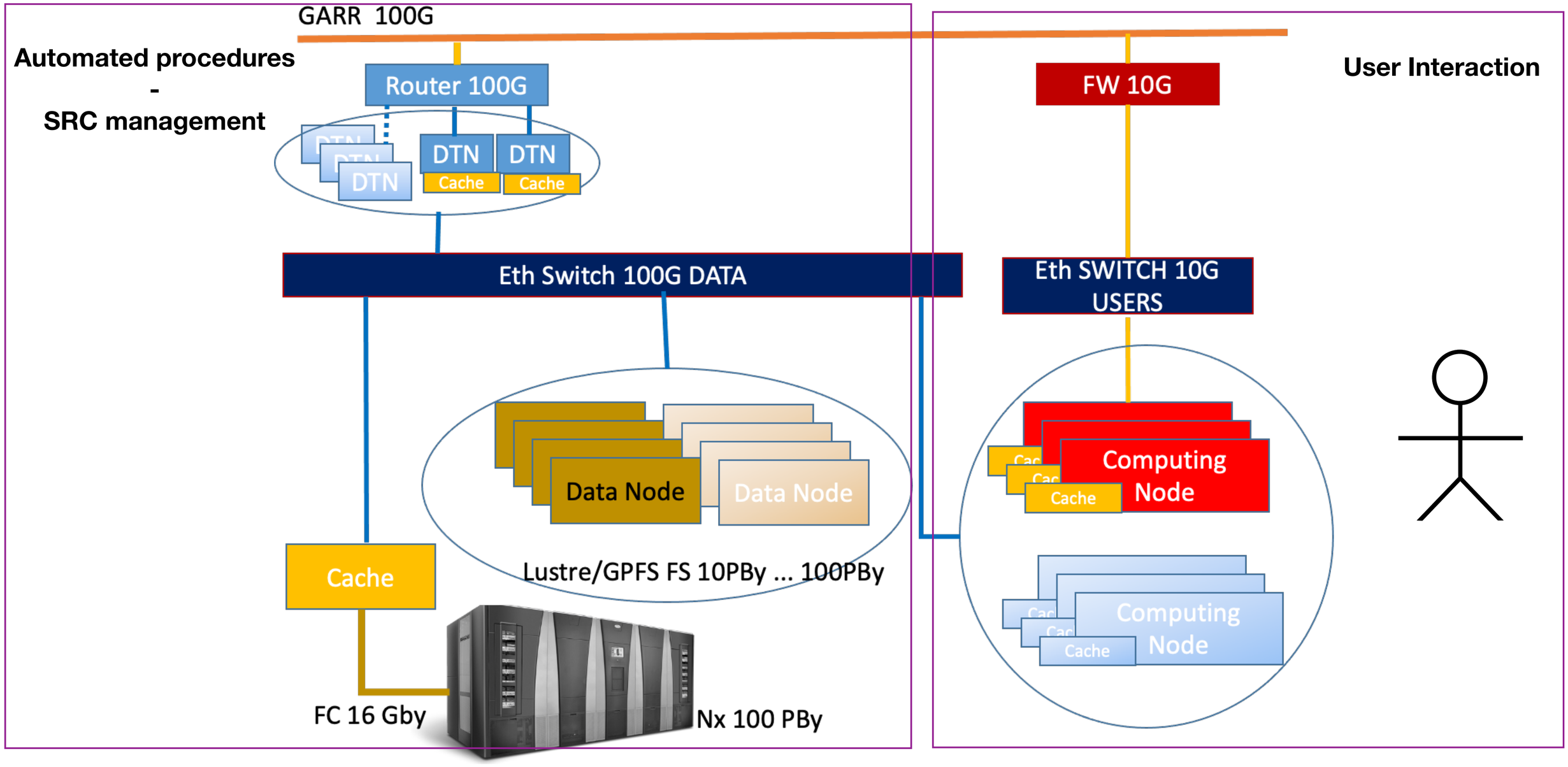
VISIBILITIES

“Delivery of raw visibility data as a data product (with or without averaging and/or calibration) is technically possible and is likely to be necessary for limited cases while the development of robust calibration pipelines continues in early Operations. However, in steady-state Operations, the SKAO is responsible for the delivery of calibrated data products and proposals requesting raw visibility data are expected to be very much the exception and will require a detailed plan for calibration and the generation of data products.”

Heaviest kind of data - maybe order of TB

SRC Architecture



Data products workflow

DTN

↓

Disk Storage

-

Working Node

↓

Tape

TWIN – System (2029BT-DNCOR) 20-22 Keuro

2 x [2x Xeon-Silver 4215, 3.5GHz, Ram 32GBy, 2x10Gbit/s, 2xSSD 7.6Gby Raid0]

Local write speed: about 16 Gbit/s (2000 MBy/s)

ODPs

To move a 1 TBy Dataset from Telescope to SKA-DC :

- Receive from telescope via Network [10Gbit/s efficency 80%] = 15 Min.
- From DTN to Local NFS [100 Gbit/s] = 5 Min. From NFS to Tape = 45 Min [LTO-8]
- From DTN-1 to DTN-2 [100 Gbit/s] = 10 Min

The 1 Tby space on the DTN can be cleared after 30 Min. (15 + 5 + 10)

ADPs

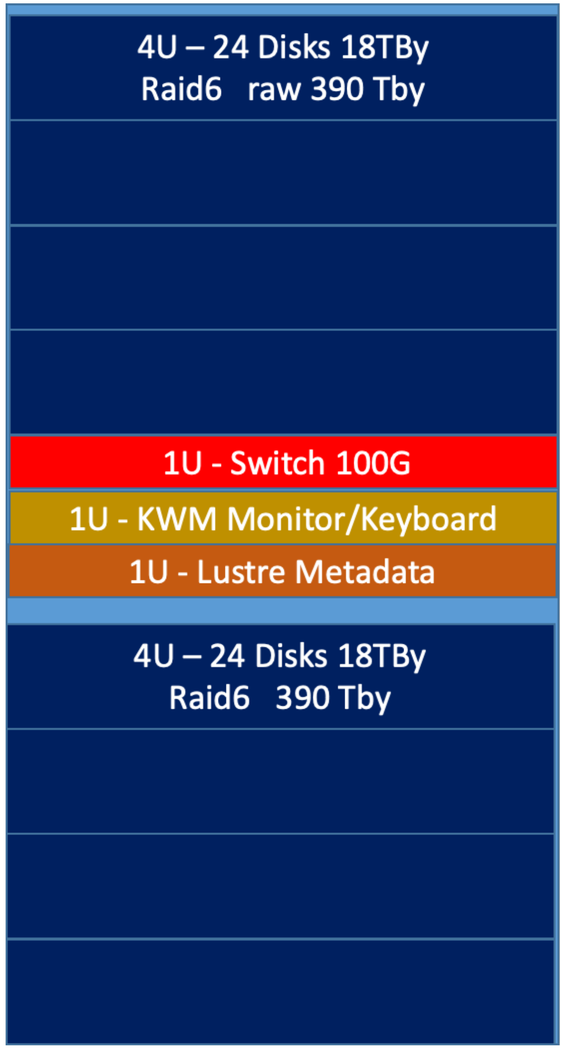
To balance the Disk and Tape speed are required :

- LTO-8: 3 Tape Units for DTN
- LTO-10: 2 Tape Units for DTN

ODPs & ADPs

In a Year (500.000 Min.) a single DTN can receive and move to archive on the tape library about 30 PBy

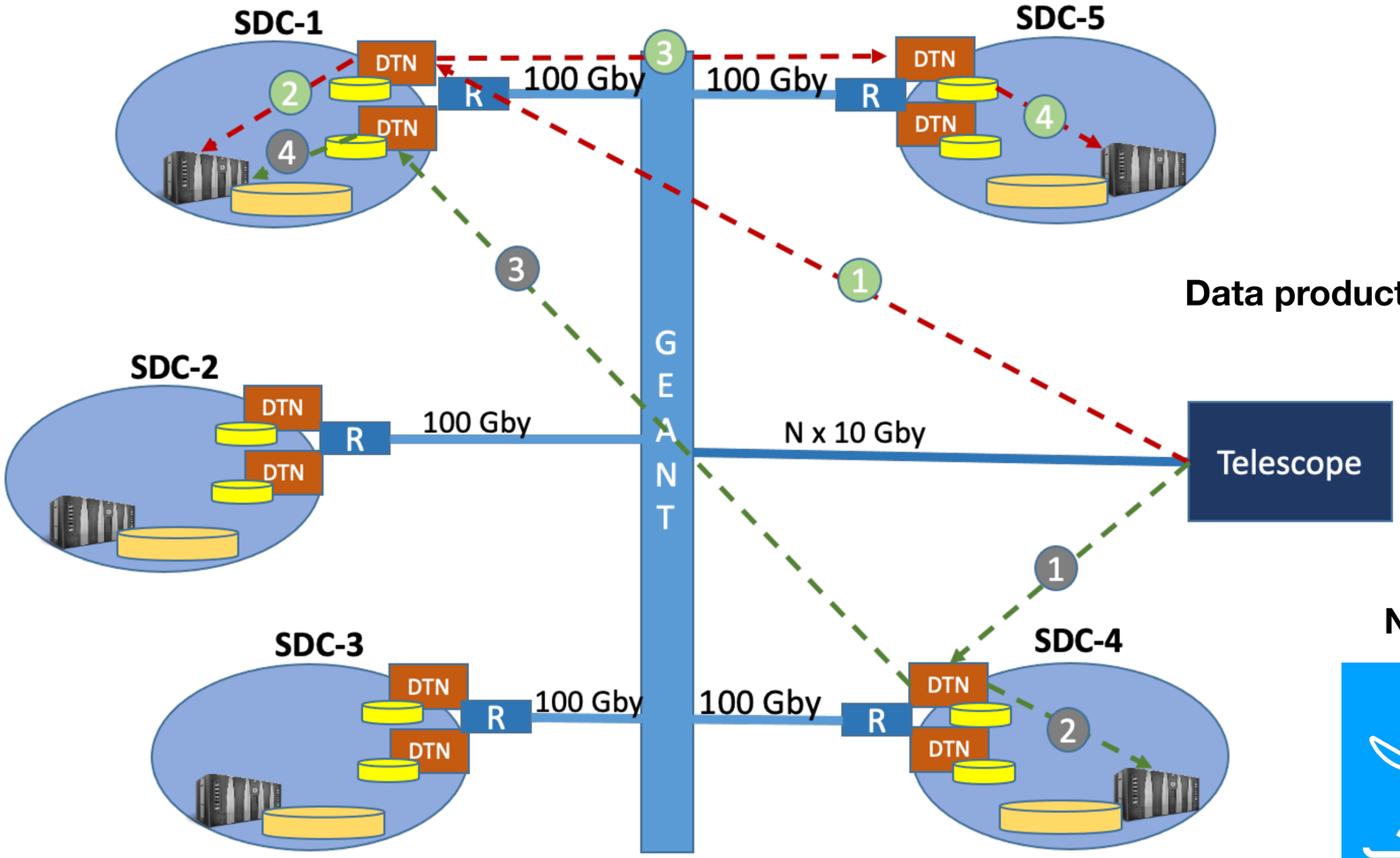
Data products workflow



Server rack sample - 42 U

- Available space 3.17 PB
- Estimated cost 175~200 K EUR
- Estimated energy consumption 3~4 KW/H

Data products workflow



Data products will be transferred from Telescopes to DTNs

Need for orchestrator in case of replicas

RUCIO

Data products workflow

PROs

CONs

- Abstraction layer simplifies management
- Agnostic about protocols and type of storage
- Easy replica of data

- Lack of documentation for deployment
- Still in heavy development
- Certificates tied (GRID alike)

Data management

Rucio is a possible candidate for managing data at high level, however at low level there are a number of open problems to be addressed

- Need to calculate checksum on data arrival (on TB data might require 30 min or more)
- Need to weigh data according to user requests (interest) to generate a number of replicas
- Establish a data format that contains useful metadata to be database friendly and could be as well parallel programming friendly

User support

- Establish common pipelines for data reduction at SRCs
- Establish minimum set of analysis tools to be supported
- Provide a user-friendly environment to allow development and testing

Questions - comments?

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