



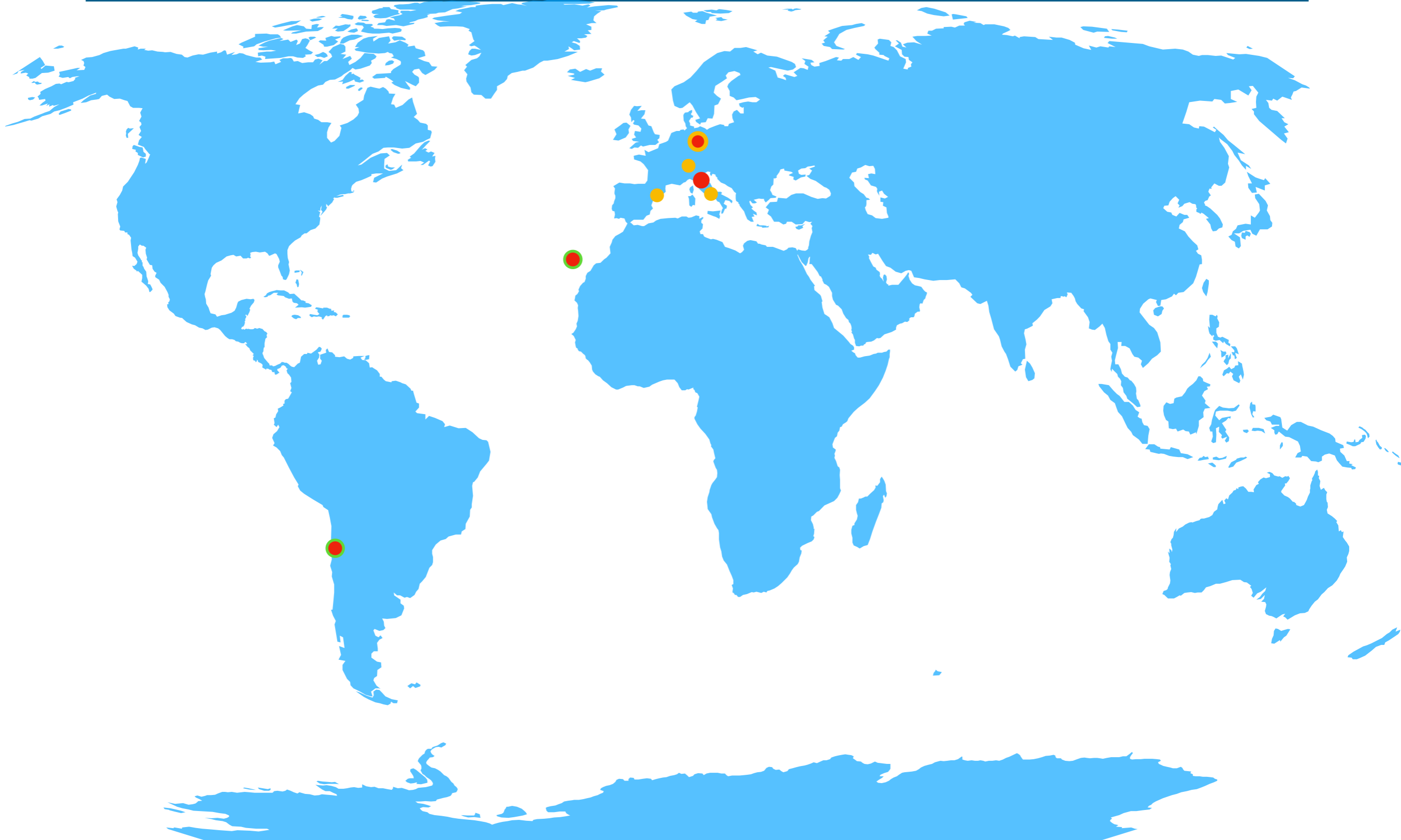
cherenkov
telescope
array

the observatory for
ground-based
gamma-ray astronomy

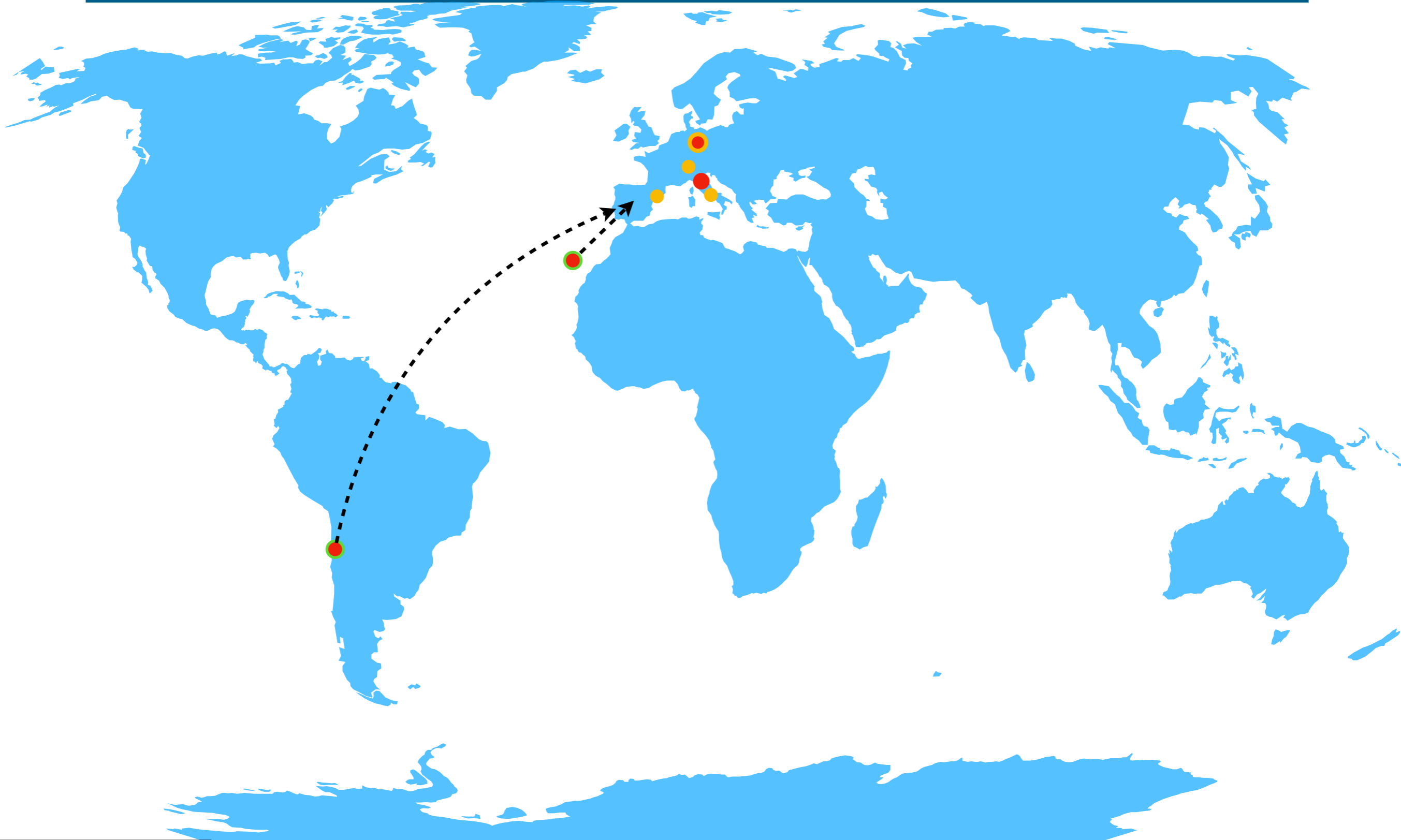
CTAO

COMPUTING

Cherenkov Telescope Array Observatory

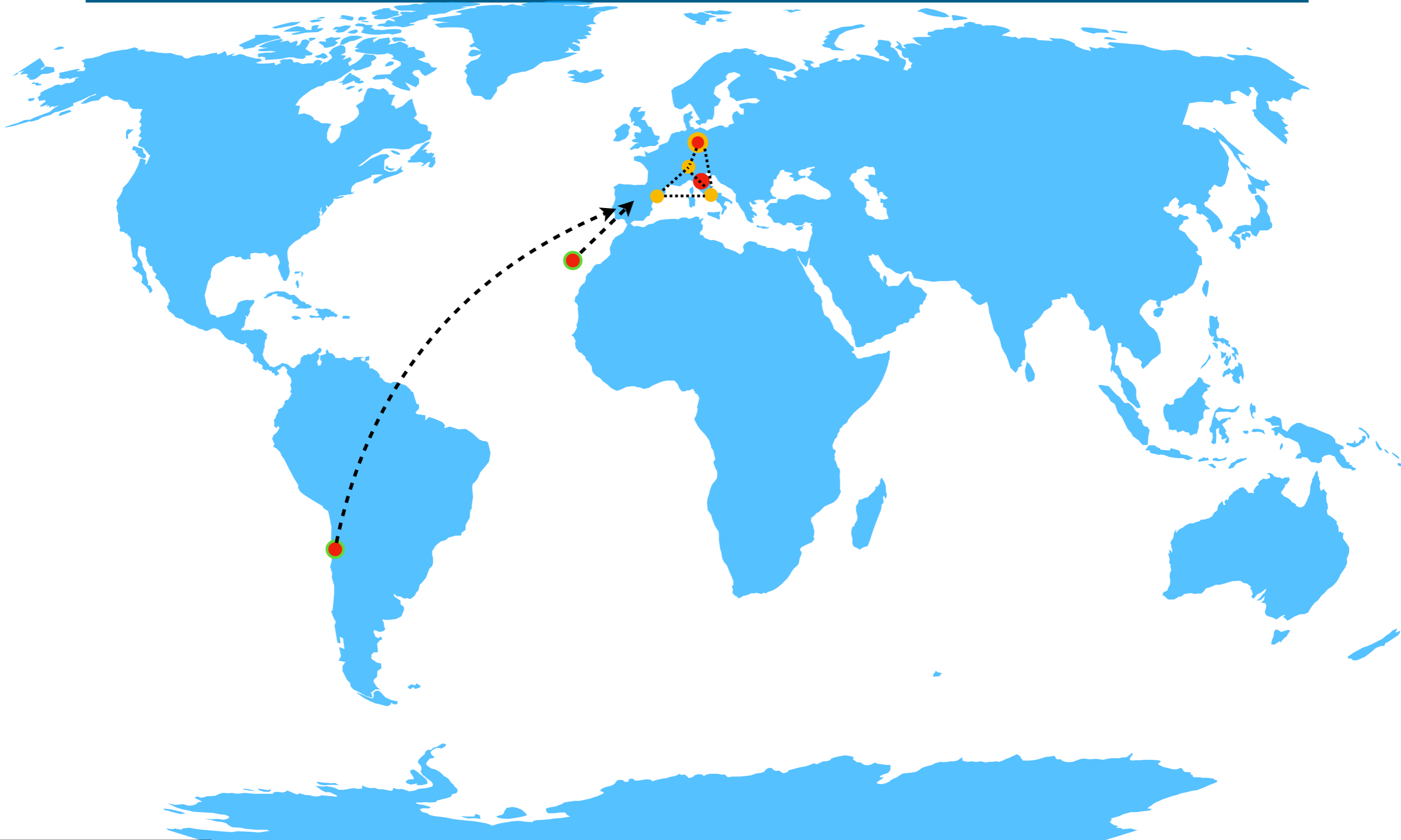


Cherenkov Telescope Array Observatory



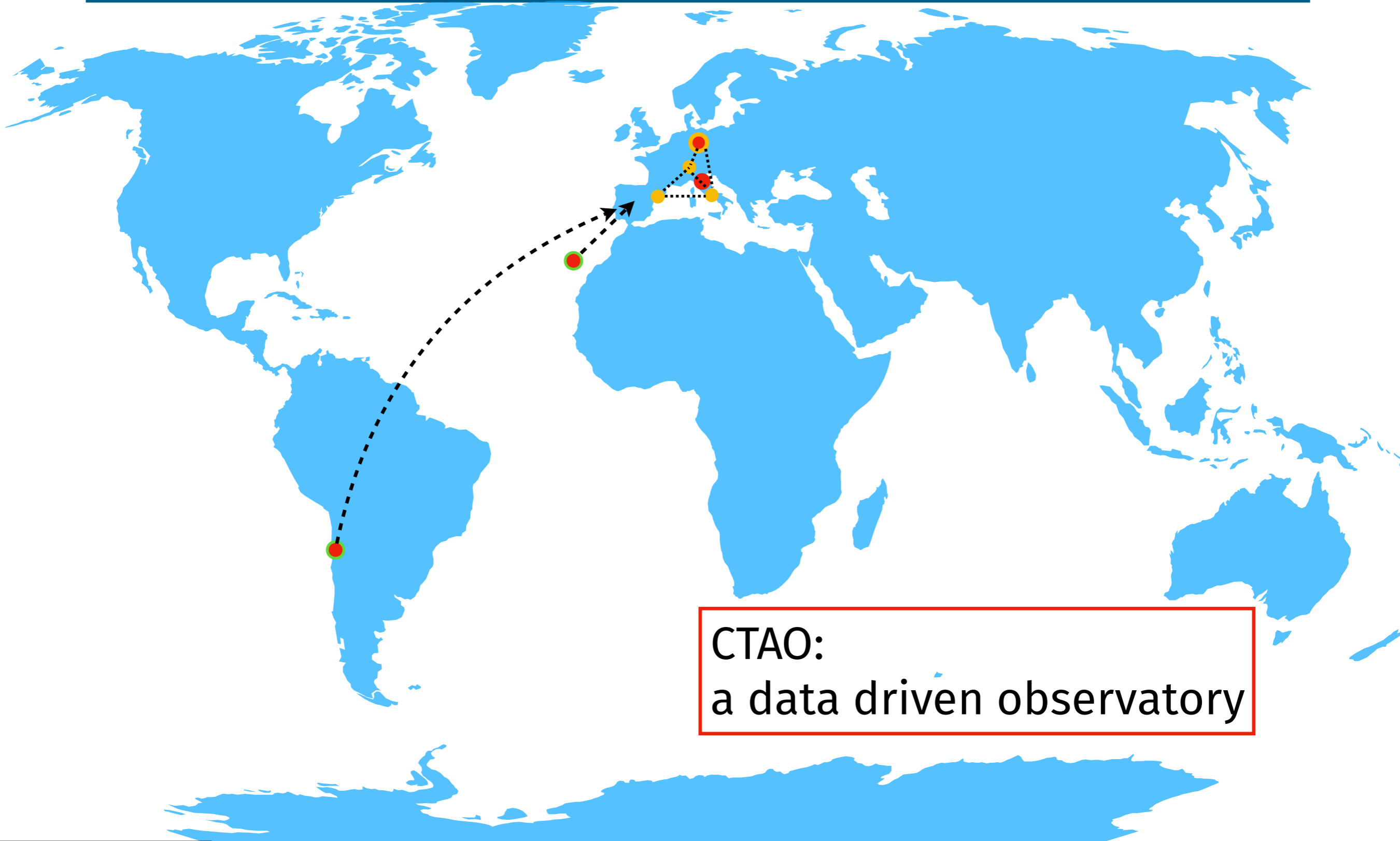
--- on-site → off-site data centres
... between off-site data centres

Cherenkov Telescope Array Observatory



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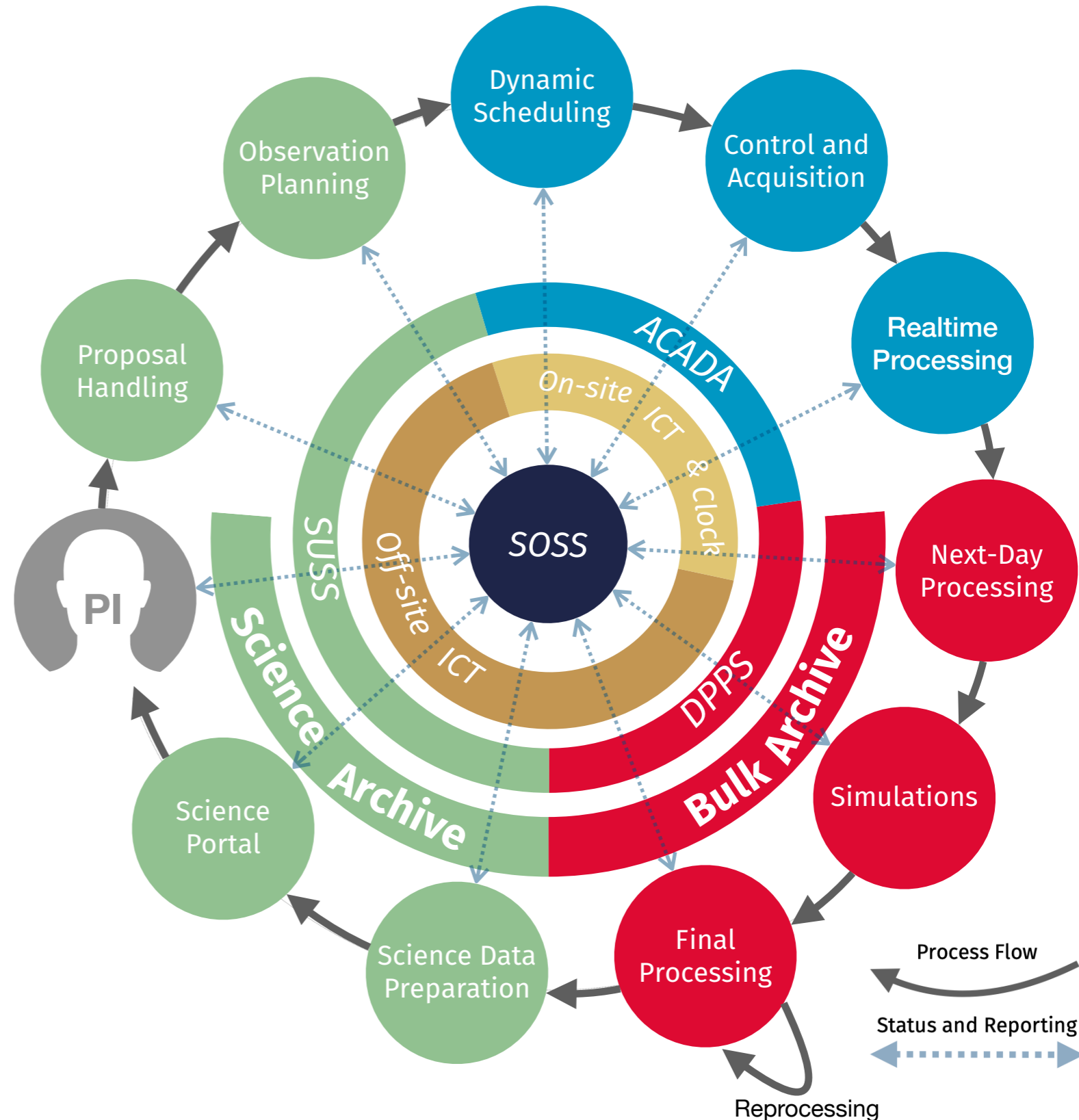
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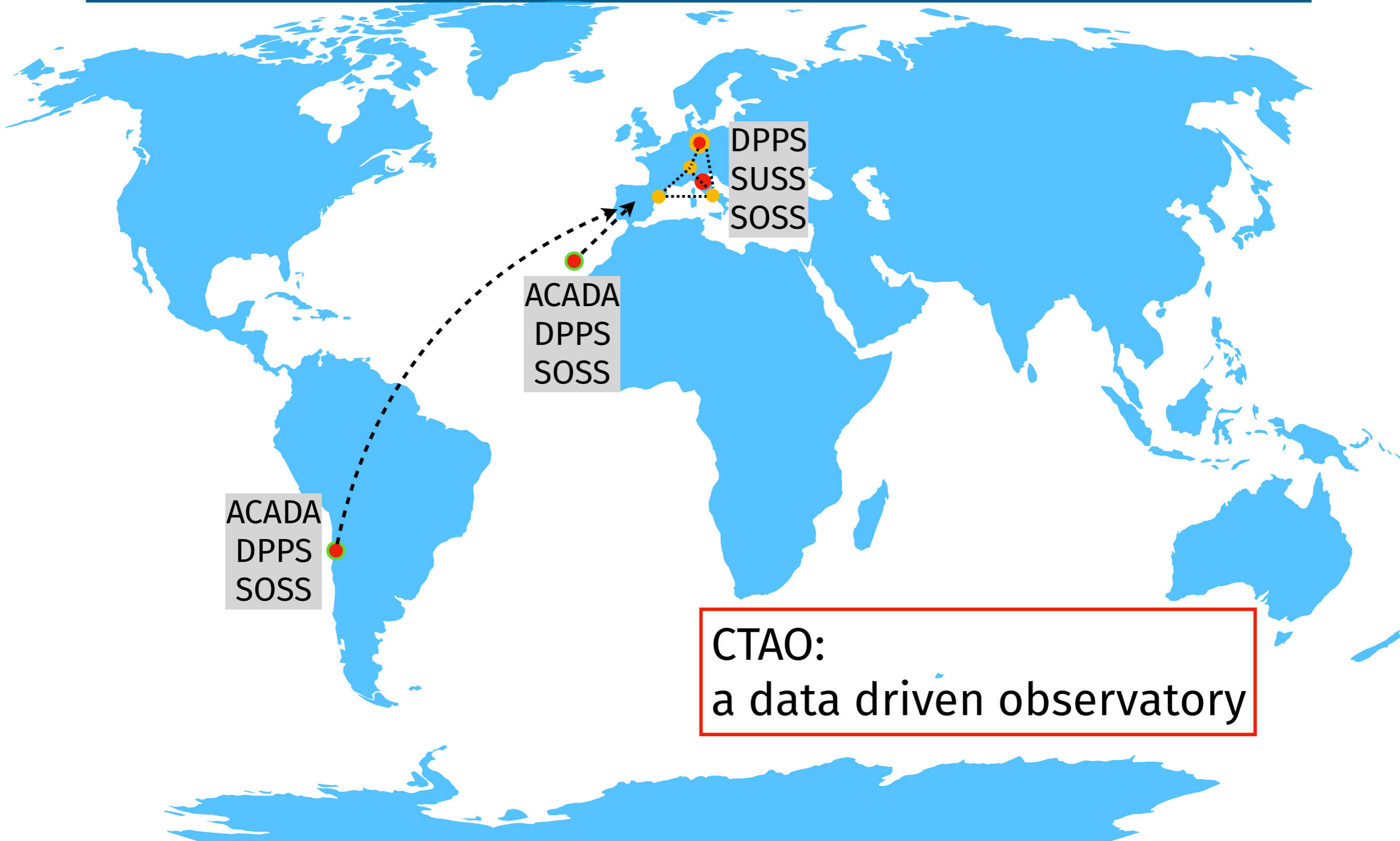
CTAO:
a data driven observatory

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Coordination, integration, testing and release of in-kind contributions as well as in-house developments, for the technical and scientific hardware and software needed for CTAO operation



Cherenkov Telescope Array Observatory



CTAO:
a data driven observatory

CTAO Computing

Five Year Construction



Cost Book 2021

- Person-power
 - total 530 FTEy – In-kind contribution (IKC) fraction 88%
 - IKCs ~120 FTEy per big software WPs ACADA, DPPS, SUSS in about 10 sub-WPs each → requires a lot of coordination
 - about 15% missing

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 - total 13.8 M€
 - IKCs for CTAO-N on-site 2.2 M€, four off-site data centres 3.4 M€, test clusters for continuous integration of all software 440 k€

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 - systems engineers, data model, architecture support, ...
 - common software, integration, some full sub-WPs, ...
 - ✓ some efforts taken up by coordinators and seconded colleagues

CTAO Computing

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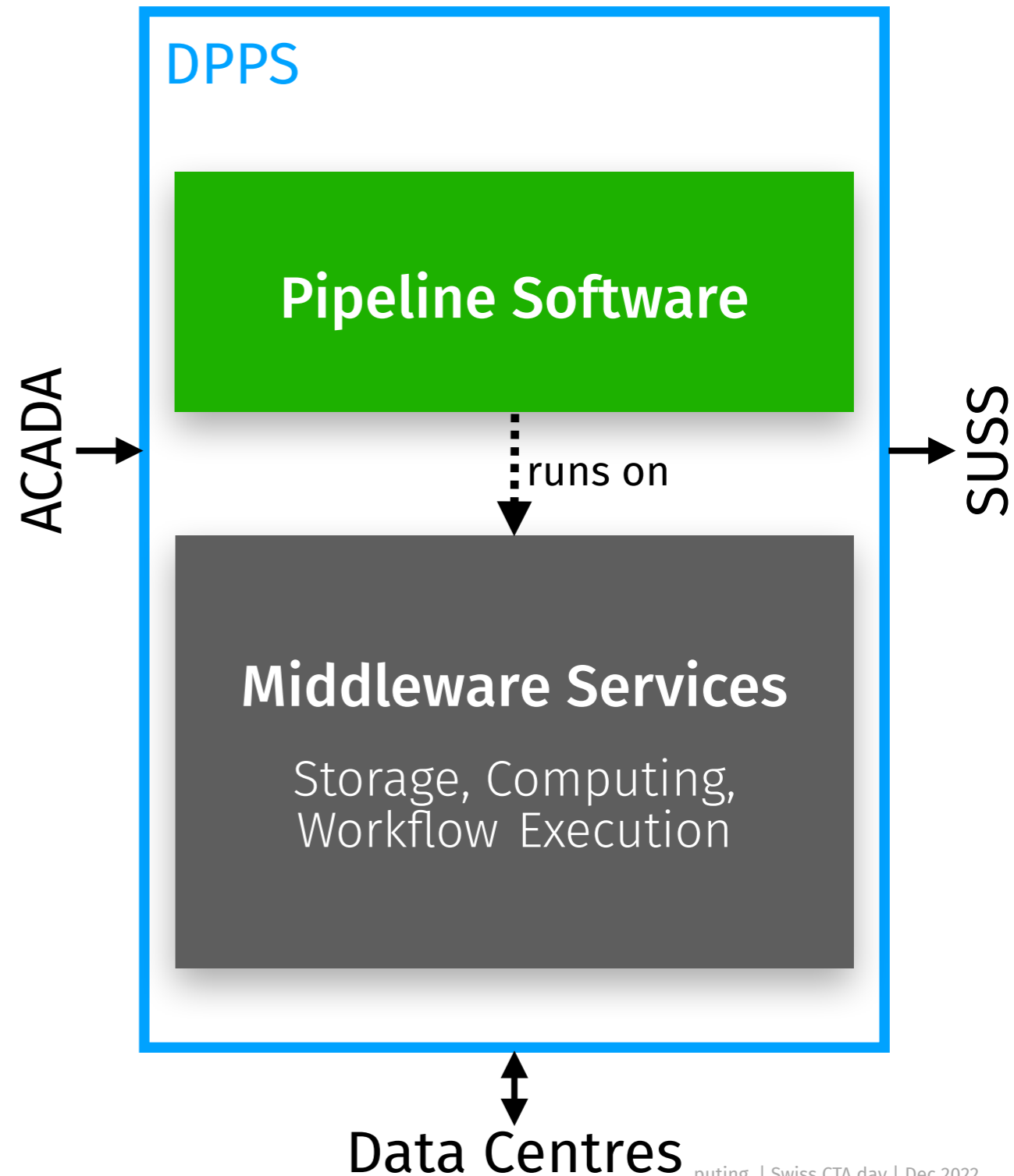
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- ~15 missing staff positions currently partially covered by Secondments
 - full staffing expected with ERIC

Array Control and Data Acquisition System

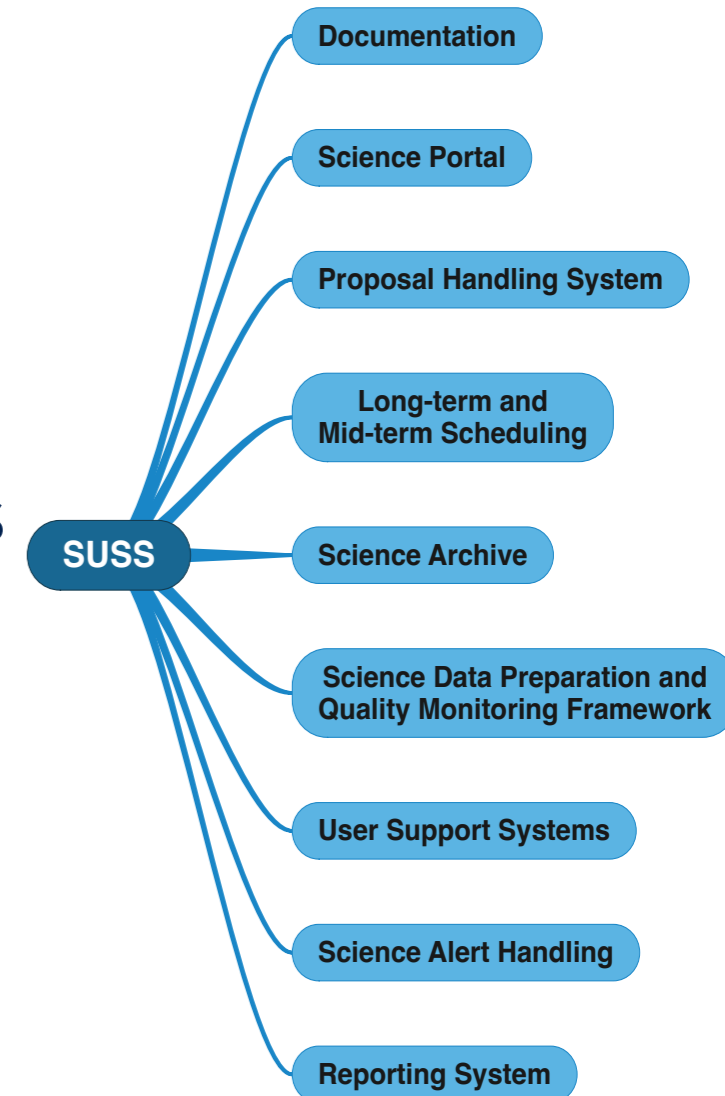
- Team: highly motivated, professional, joint effort and sharing burden, focused on the goals, good communication
 - new IKC: Array Configuration System
- Reviews: PDR Jun 2020 very successful – Internal Design Review
Feb 2022: assessment of readiness of Detailed Design Documents for all subsystems – CDR in 2023
- Releases:
 - integration Release 0 “Mini-ACADA” Jun 2021
 - consolidate existing software in the official code repository, under configuration control, fully documented, continuous integration, QA
 - Release 1 (LST integration) mid 2023
 - good progress, nightly builds working
 - on-site test campaign using LST1 planned for summer 2023
- External ICDs: seven released (few CREs) - intense work on five new
- Long-term planning (missing&fluctuating personnel, external dependencies...) → extend to longer period (or reduce functionality?)

Data Processing and Preservation System

- Product Definition and requirements
- WP Management Plan
 - PBS and WBS
- Concept Document
 - system decomposition
 - pipeline software
 - management middleware
 - functionality
- Use-cases
- Prototypes → products by sub-WP teams
- IKC teams quickly ramping up
- Prepare Release 0



- IKC partners identified and constructive discussions
 - sub-system functionality e.g. for Science Portal, Science Archive, Proposal handling
 - SUSS WP governance, IKC team involvement
 - very positive feedback: ready to start, however need time ramping up personnel
 - lead institutions discussed
 - active collaboration with Science Analysis Tools team (e.g. on DL3, interfaces)
 - preparing first $\gamma\pi$ release for CTAO (focus on SDC)
 - CTAO member of coordination committee
- Significant contribution to Sci Ops definitions (e.g. MM/MWL needs)
- WP Management Plan, Use Cases, Architecture and Concept documents, Product Definition and requirements
 - strong overlap with or dependency on Sci Ops definitions



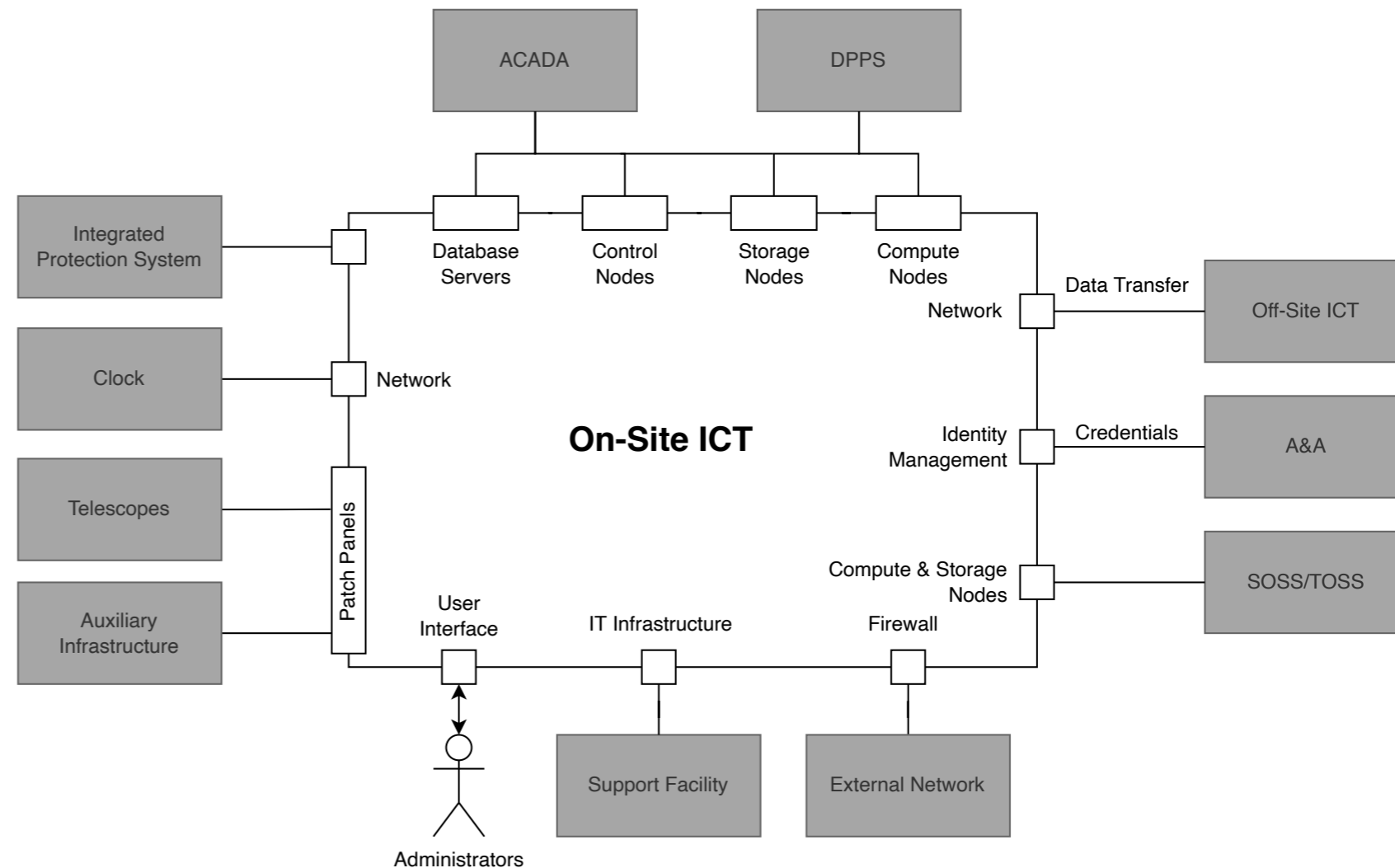
- Moving forward formalizing many years of discussions pre-CTAO into detailed designs, standards and other documents
- CLK concept established (prototype demonstrators: CTAO and H.E.S.S.)
- Requirements and product definition: approved
- “CTAO Timing Standards”
 - clock synchronization methods
 - time stamps: ms (NTP) and ns (WR) accuracy
- Discussion for formal IKC commitment ongoing
- CLK workshop with Cherenkov Camera teams mid November
 - very constructive discussions with camera teams
 - first step towards a formal interface between CLK and TEL
 - next steps: drafting ICD as a collaborative work involving CLK, SE, and camera teams – and revisit requirements

Processing, preservation, hosting data

- CTAO Computing Model study 2019 → Computing Model 2022
 - distributed data centre solution
 - Computing applications remotely controlled and monitored from CTAO Science Data Management Center (SDMC)
 - network from Array site to GEANT and between data centres/ SDMC
- Following the money matrix process: Off-site data centre agreement with DESY, INAF/INFN, PIC, CSCS
- Questionnaire Jan-Mar 2022
- Off-site data centre meetings in Jan, Apr; visits in Jun, Jul 2022. Series of detailed meetings started in Nov (on deployment), next in Jan
- Create a technical team with data centre representatives (IKC) and DPPS, SUSS, SOSS (CTAO Computing)
- Agreements to define commitment for construction, scalability, capacity planning process, quality of service, support

Activities ramping up:

- ICDs:
 - to ACADA released
 - Network to MST on CTAO-S draft
- Planning for data network on CTAO-S
- Requirements:
 - compiled, updated
 - Product Definition drafted
- IKCs: CTAO-N data centre and On-System ICT Services
- CTAO: CTAO-S data centre



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- Off-site ICT: data centre software and computing model deployment planning