

LASER RANGING – EVOLUTION TOWARDS ACTIVE SENSOR NETWORKING FOR DEBRIS OBSERVATION

Laura Aivar (GMV)

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on Laser Ranging

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Laser ranging – Evolution toward active sensor networking for debris observation

- **Introduction**
- **Background**
- **Objectives of the activity**
- **Planning**
- **Current status**
- **Next steps**

Background

- Satellite Laser Ranging (SLR) of orbital targets is a **well-established technology** in the scientific community with **precision ranging to operational satellites equipped with retroreflectors**, as to the Moon.
- Introduction of more sensitive receivers, more powerful transmission systems and improvement of track initialization → **possible to track uncooperative targets**.
- Relevant application for **Space Surveillance & Tracking (SST)** as a complement for catalogue maintenance of specific objects of interest (where **precise orbits** are required) or to **support Collision Avoidance and Re-entry Prediction** operations.
- **Support to future Laser Momentum Transfer** operations.

Objectives

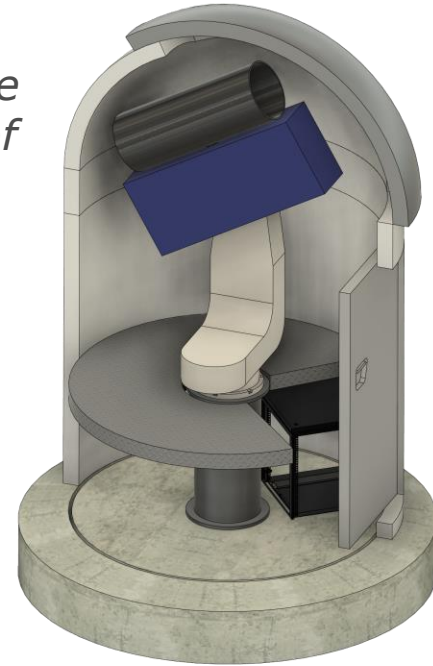
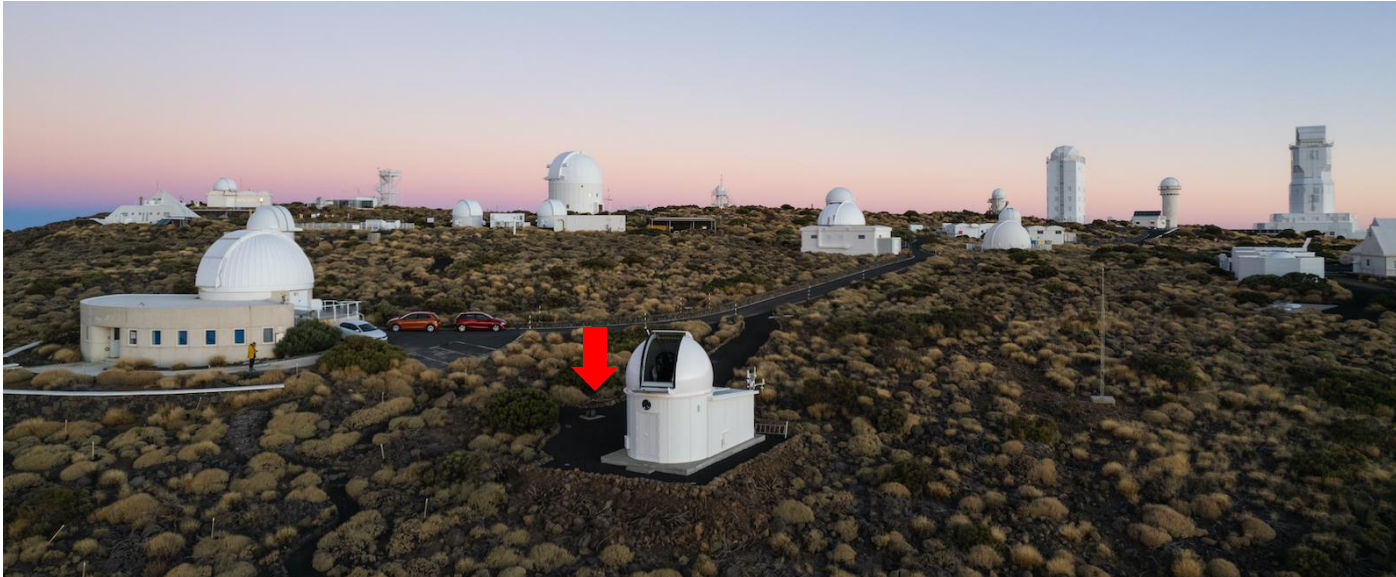
- Establish a “proof-of-concept” for **fully automatized SLR stations**
- **Upgrade ESA’s IZN-1** station to track non-cooperative targets
- Develop a **Debris Laser Tracking Network (DLTN)** connecting users and contributing SLR stations that could be operated commercially
- Run a number of **test campaigns** to validate the concept

Objectives: Debris Laser Ranging Network - DLTN

- Develop, deploy and test the **online sensor network platform** (DLTN-OP) for near real-time **requesting, scheduling, analyzing, displaying** and providing **SST related data products** for the end user.
- The networking approach is essential to achieve a quality of orbit information that will add significant value as compared to traditional tracking.
- Rely on existing and evolving assets in Europe and beyond.
- Operations shall be as automated as possible.
- Reuse experience from other networks like SatNOGS (LSF).

Objectives: Upgrade of ESA's IZN-1 station

- Upgraded for **daytime tracking to space debris objects**
- Led by **DiGOS** and covered in the previous presentation (*Space Debris Laser Ranging – Challenging and Rewarding – Update of the Izaña-1 station*)



Planning and main milestones



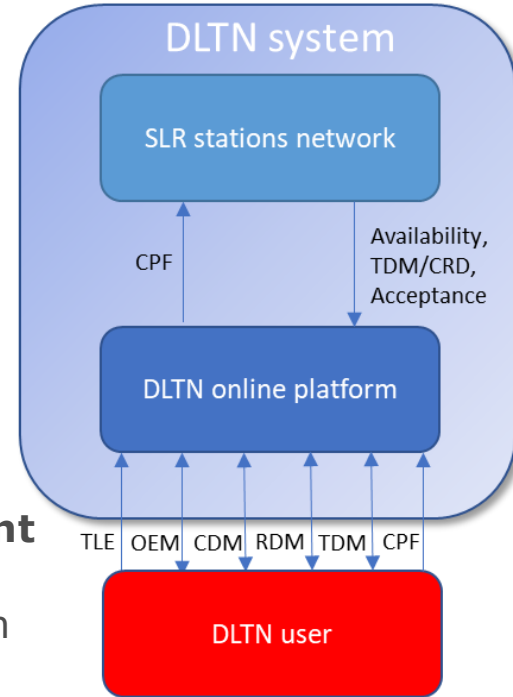
Current status: DLTN system design

■ Functional components

- **SLR stations network (DLTN-SN)**: SLR stations within the network participating to observation collection.
- **DLTN online platform (DLTN-OP)**: an online SLR station network platform for near real-time requesting, scheduling, analysing, displaying and providing space safety related data products for the end user.

■ General **capabilities** of the DLTN system

- requests for **tracking SLR observations** among all the SLR station network
- requests for **orbital information, CDM and RDM improvement** based on the tracking data collected by the SLR station network
- requests for **chasing SLR observations** after a **stare** campaign
- a GEO, MEO and LEO **objects catalogue maintenance** with a certain pre-defined level of accuracy based on SLR observations,
- **SLR station calibration**

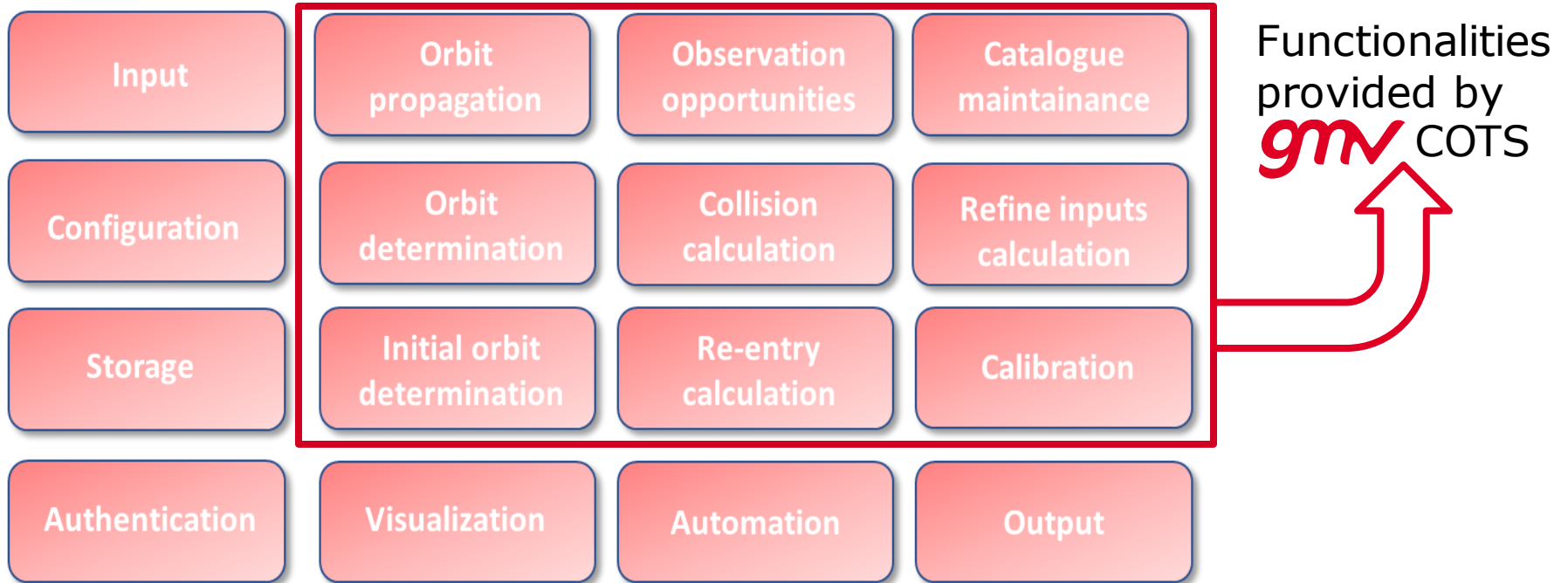


Current status: DLTN system design

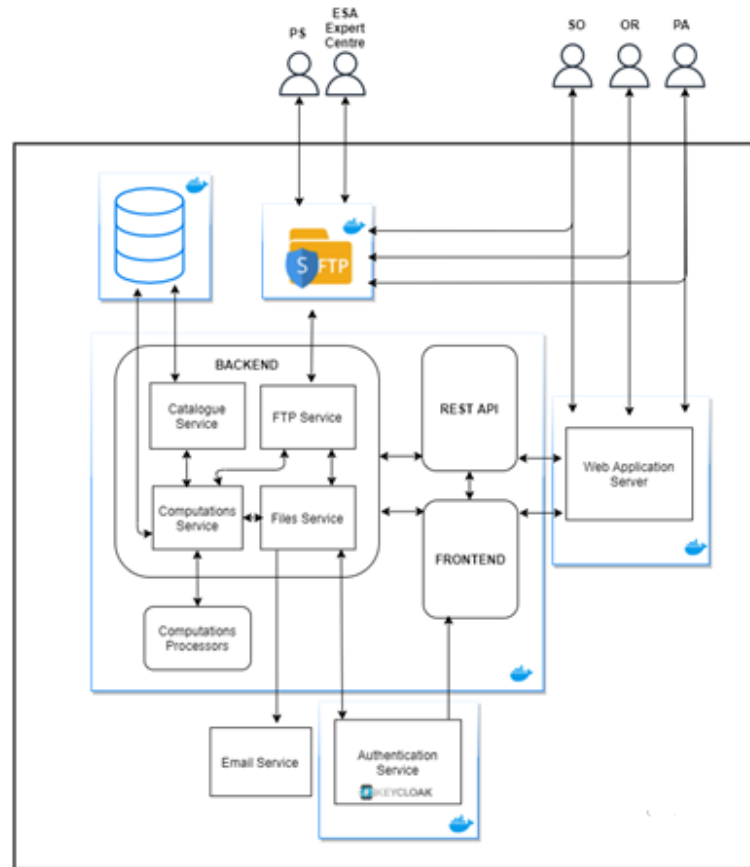
Types of actors that will be interacting with the DLTN system are identified.

- **Observation Requestors (OR):** satellite owners, satellite operators, individuals interested in refining orbits, research institutes, students, national entities, defense entities, etc. In general, they will be entities interested in the collection of laser data and, potentially, derived products from the SLR stations in the DLTN.
- **Platform Administrators (PA):** ESA, GMV, Expert Centre, etc. They would be allowed to perform additional activities with the DLTN such as tasking specific SLR stations, performing calibration campaigns, managing users, including new stations in the network, etc.
- **Supporting Observatories (SO):** optical or radar station which are supporting in staring phase of the stare and chase campaigns.

Current status: DLTN-OP design – functional components



Current status: DLTN-OP design - architecture



Current status: SLR stations for validation campaign



IZN-1, Spain



Zimmerwald,
Switzerland



Graz, Austria



Borowiec, Poland



Kunming, China



Mt Stromlo, Australia

Next steps

- Design Review in December 2022
- Start of DLTN-OP implementation in January 2023 (Agile SW development)
- Elaboration of a business case for the commercialization of the DLTN
- Agree the SLAs with the participating SLRs in the validation campaign
- Definition of validation campaign (1st semester 2024)

Contact us if you want to be part of it!!!

Thank you

Laura Aivar

laivar@gmv.com

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