

Automated Scheduling, Configuration and Monitoring of Ground Station Network Services

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Status: Final

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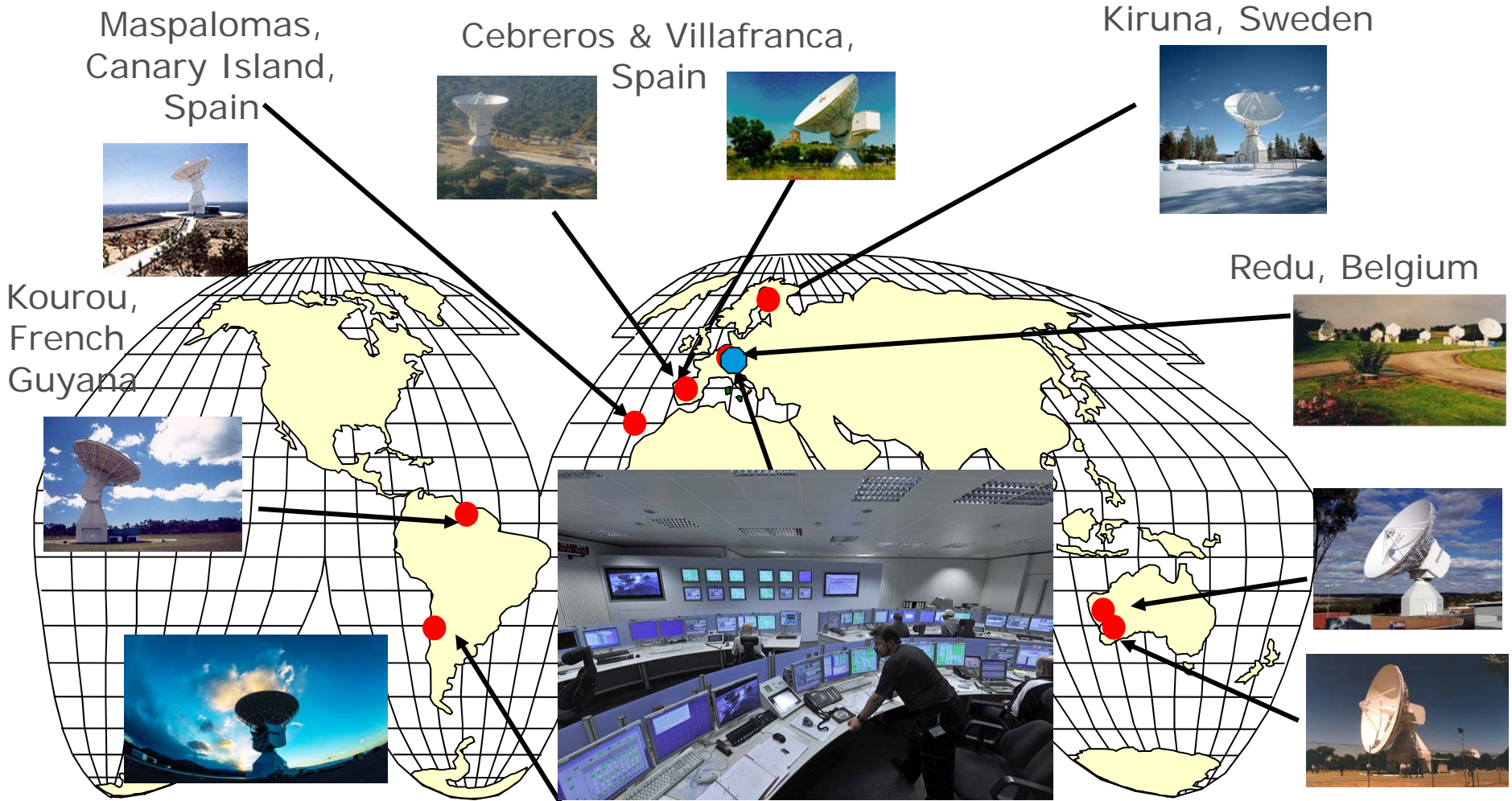
Agenda



- Introduction
- Automated ground station network configuration
- Cross Support aspects
- Future Directions
- Conclusion

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ESA Tracking Network (ESTRACK)



Maspalomas,
Canary Island,
Spain



Cebreros & Villafranca,
Spain



Kiruna, Sweden



Kourou,
French
Guyana



Redu, Belgium



New Norcia & Perth,
Australia

Malargue,
Argentina

ESTRACK
Control Centre
Germany

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Introduction - Context



Spacecraft



Ground stations



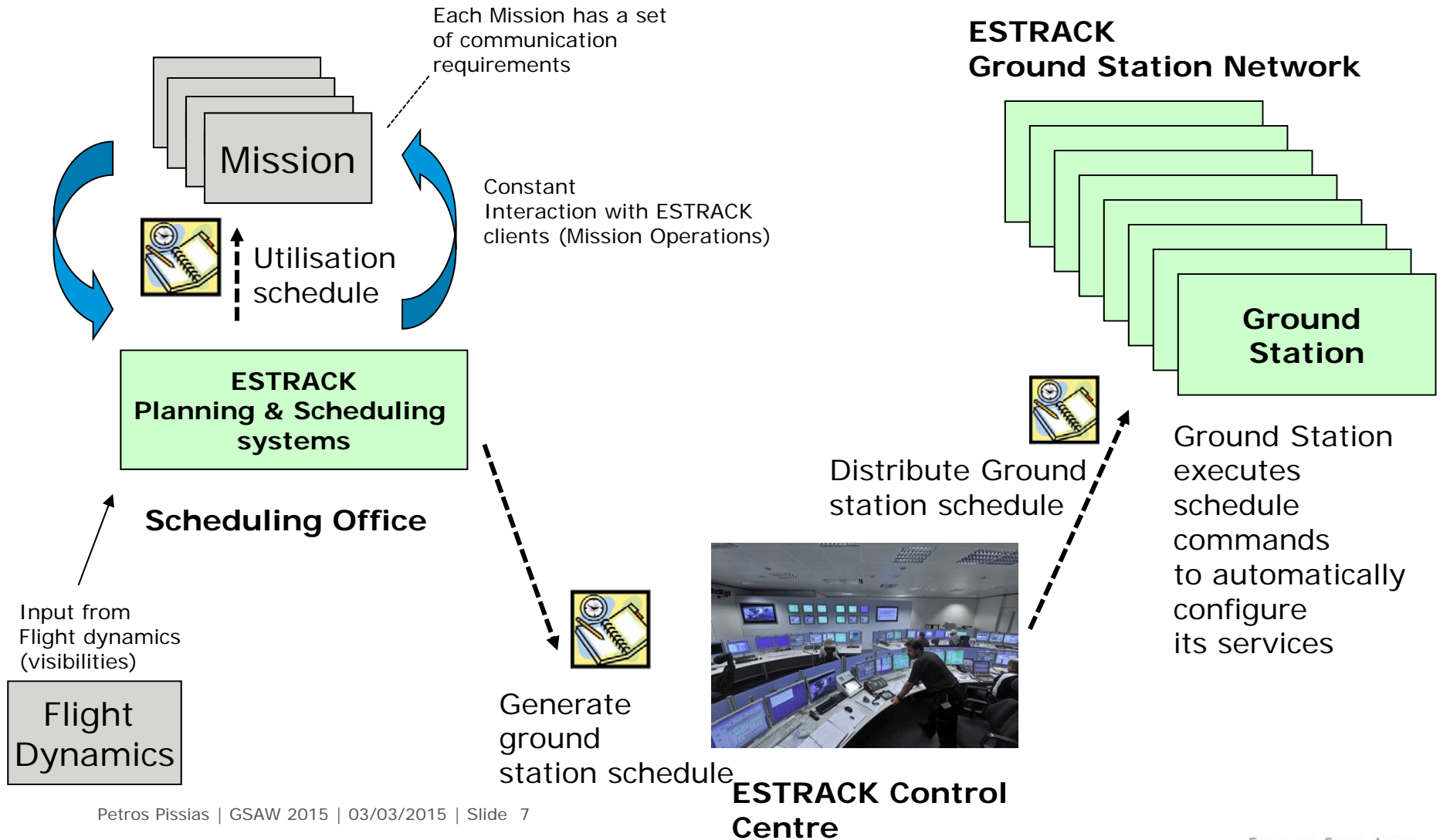
Spacecraft Operations



Context:
How we have automated our ground station configuration

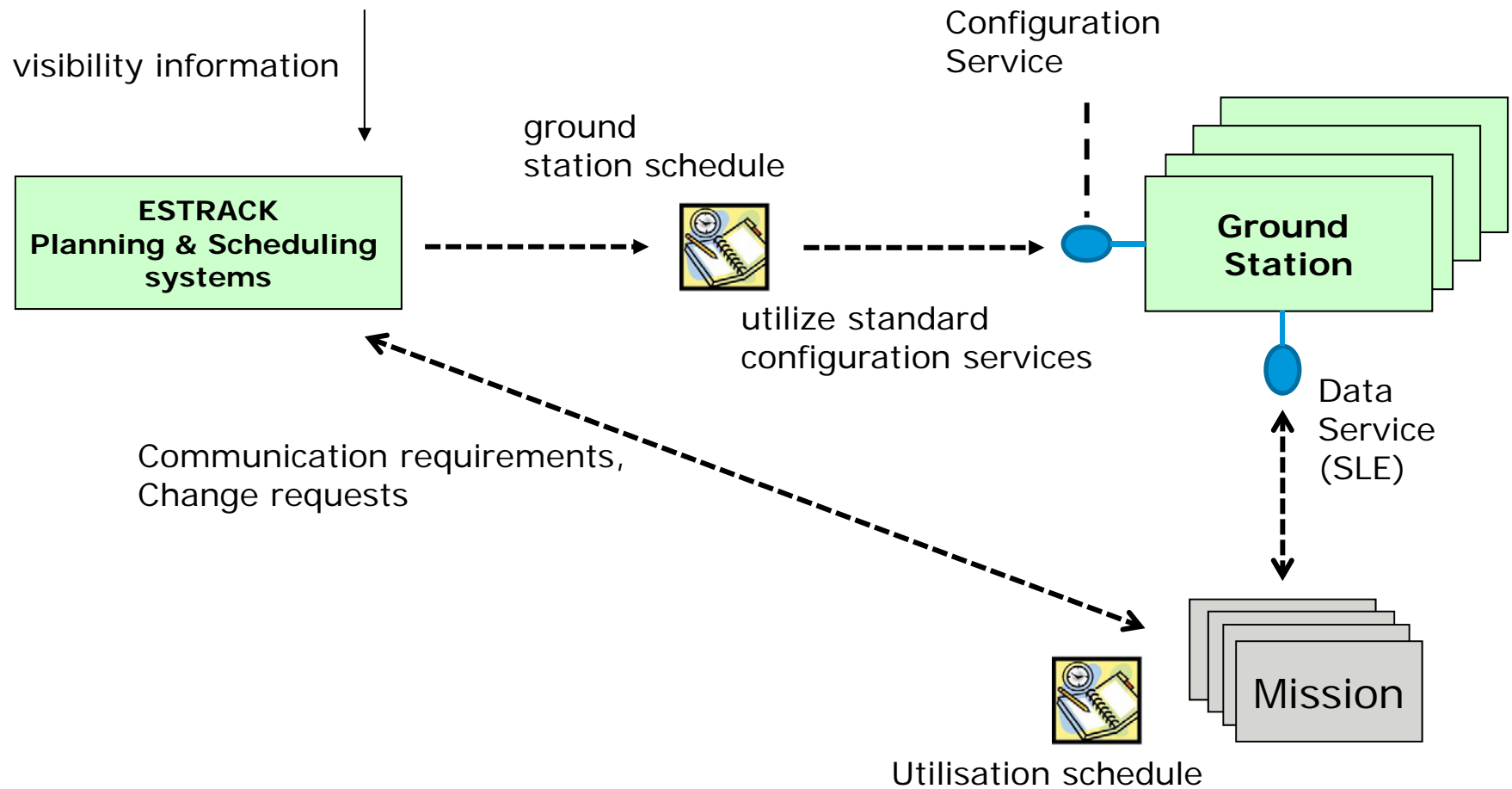
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Overview of automation

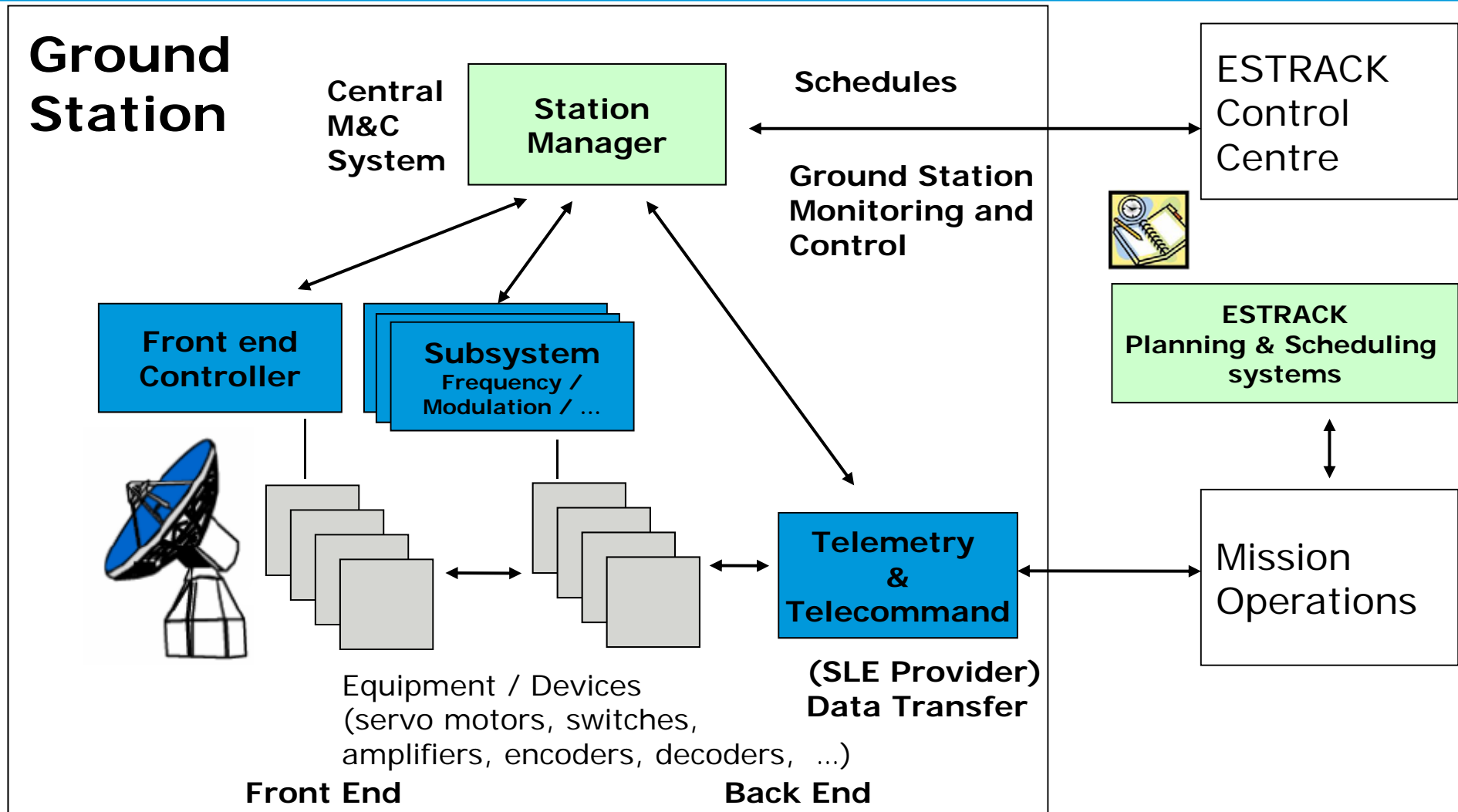


- Each mission has a set of communication requirements called a “standing order”
 - How often communication is needed, Preferences to days / times , ...
- ESTRACK Planning and scheduling systems receive input from flight dynamics on spacecraft / ground station visibility and produce an optimized conflict free schedule of the utilization of the tracking network.
 - contains detailed instructions on how and when to configure each ground station. Typically it is generated on a weekly basis and covers 2 weeks of operations into the future.
- Schedule is distributed to ground station network for execution.

Overview of automation

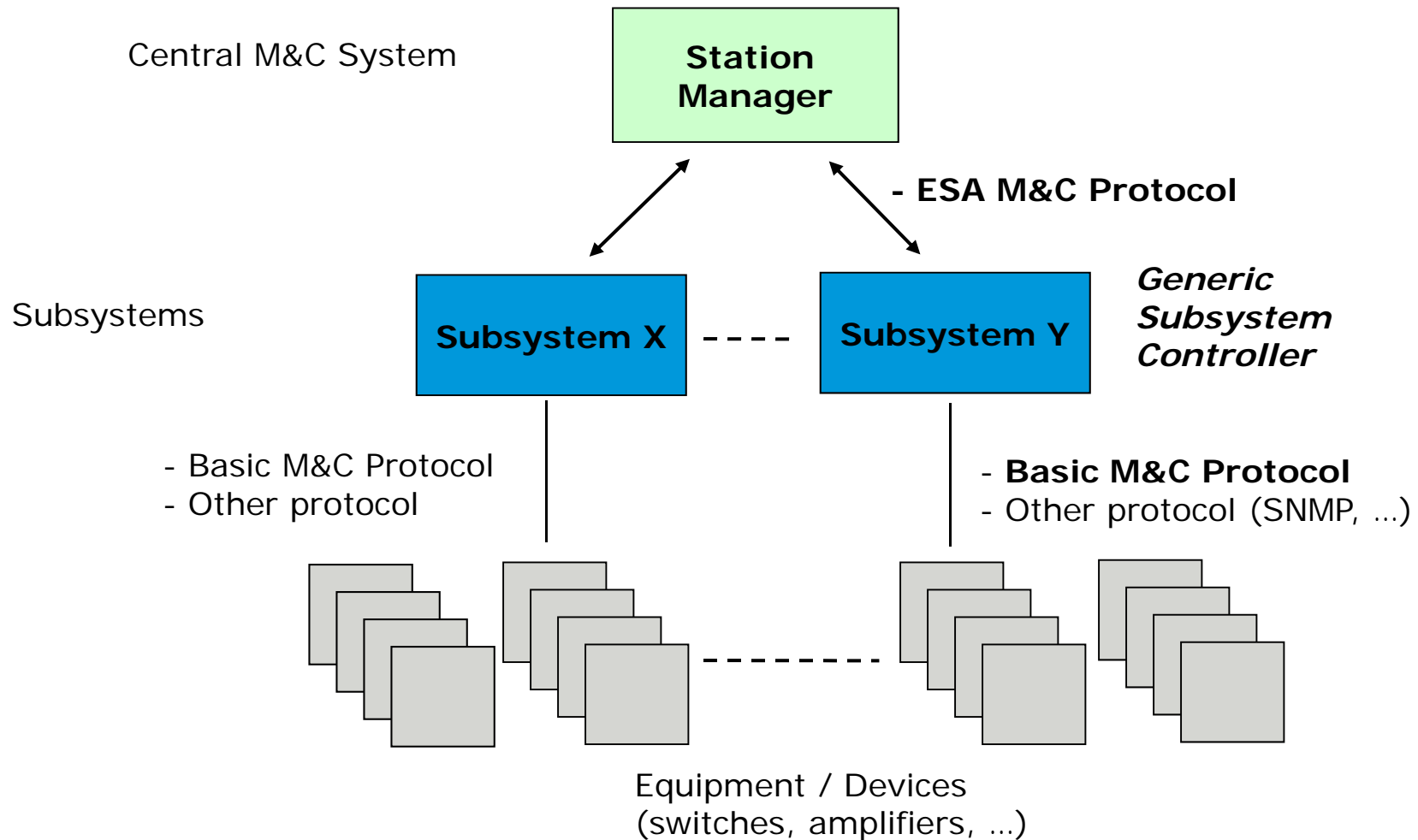


Ground Station Overview

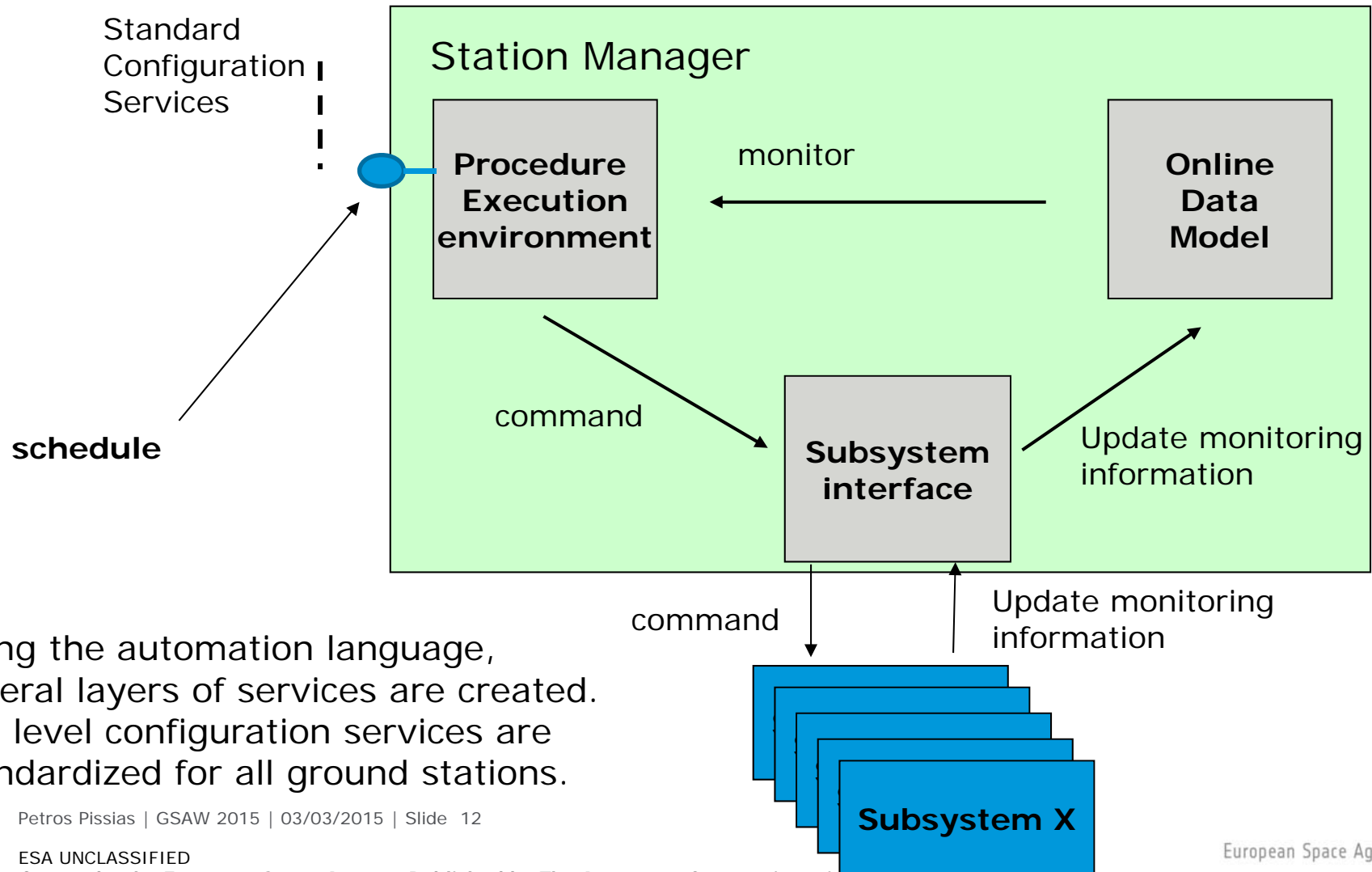


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Ground Station Subsystem Layers



Station Manager - Automation High Level Architecture



Using the automation language, several layers of services are created. Top level configuration services are standardized for all ground stations.

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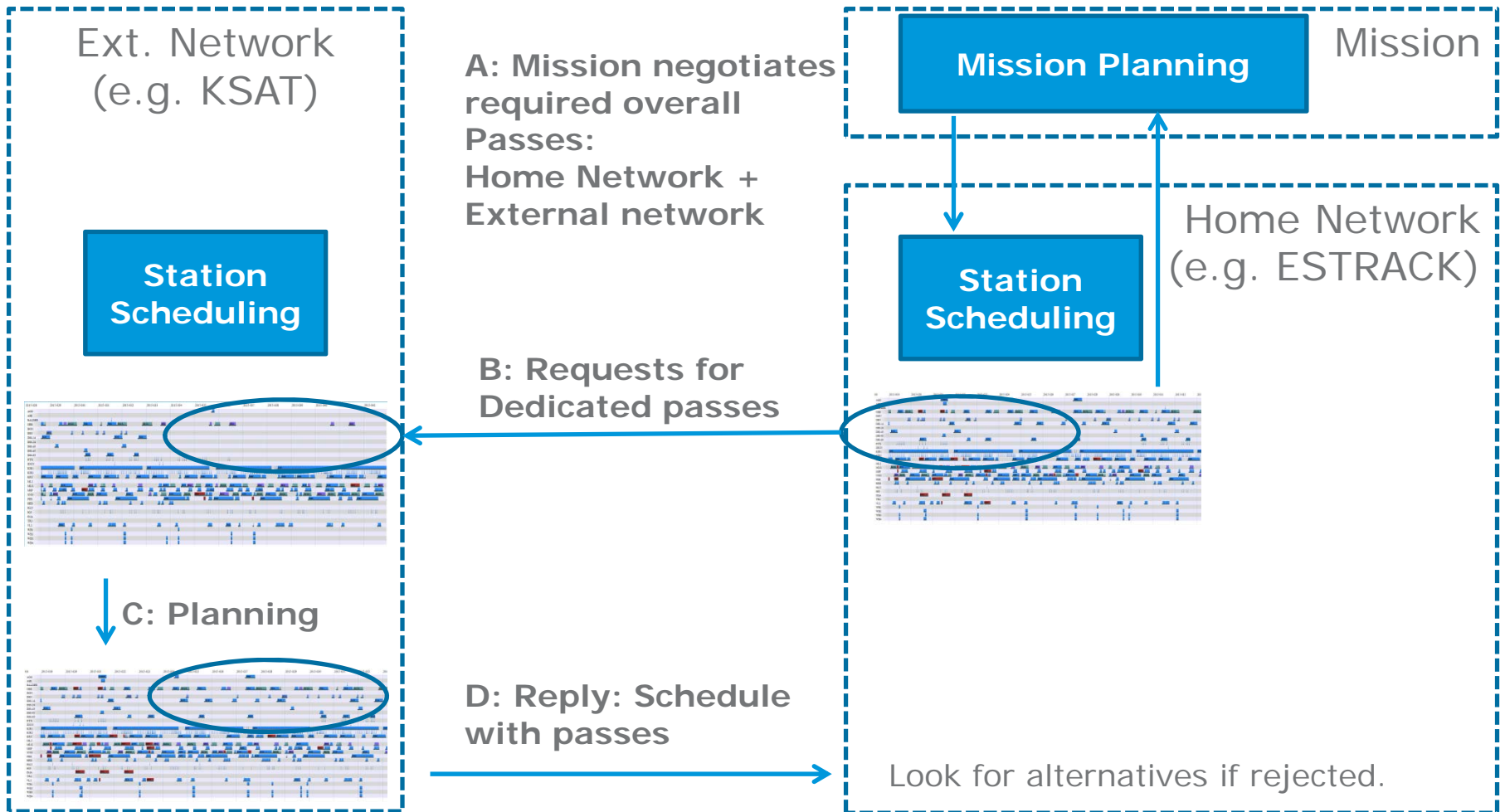
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- Data Transfer
 - CCSDS SL Services for the space link
 - CCSDS SLE for telemetry and telecommands
 - CCSDS CSTS MD for monitoring of ground stations
 - Future CCSDS CSTS services
- Service Management and Service Configuration
 - Service Agreement and Agreement of Configuration: CSS SM
 - Service Schedule: CSS SM, Simple Schedule (currently Red-1)
 - Service Schedule Requests: CSS SM, ???

- How to plan ground station services (routine case)
- Assumptions
 - Each network (ESTRACK, DSN, etc.) might have their own scheduling system which might have different concepts.
 - Each network is doing scheduling for ground stations shared by several missions.
- How to organise the routine planning and scheduling process?
- Let's look at some (non-exhaustive) options

Cross Support – Dedicated external Pass Requests

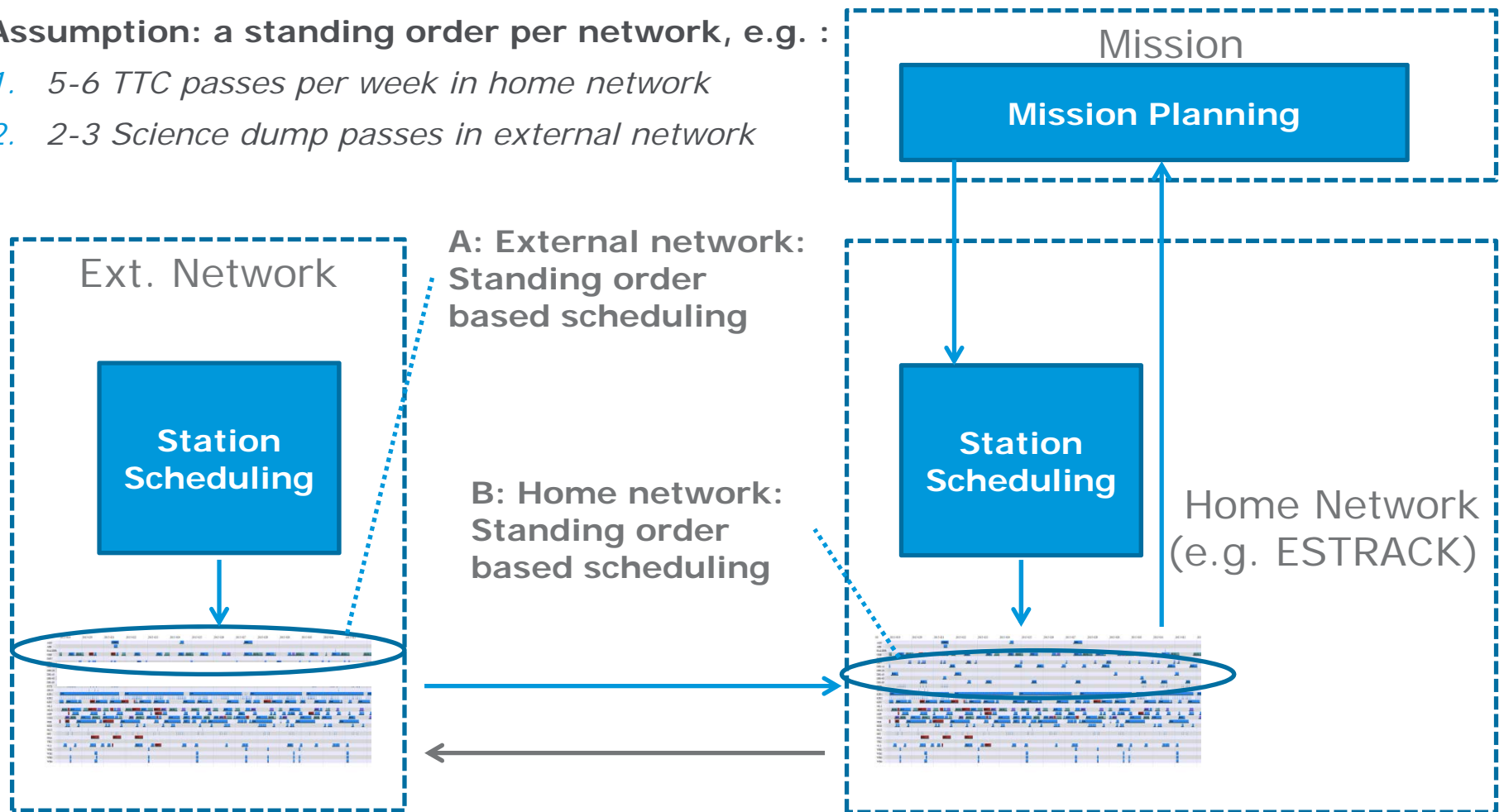


Cross Support – Standing Order based Scheduling



Assumption: a standing order per network, e.g. :

1. 5-6 TTC passes per week in home network
2. 2-3 Science dump passes in external network



**A: External network:
Standing order
based scheduling**

**B: Home network:
Standing order
based scheduling**

**C: Confirmation / Adjustments via
Dedicated requests – if necessary**

Agenda

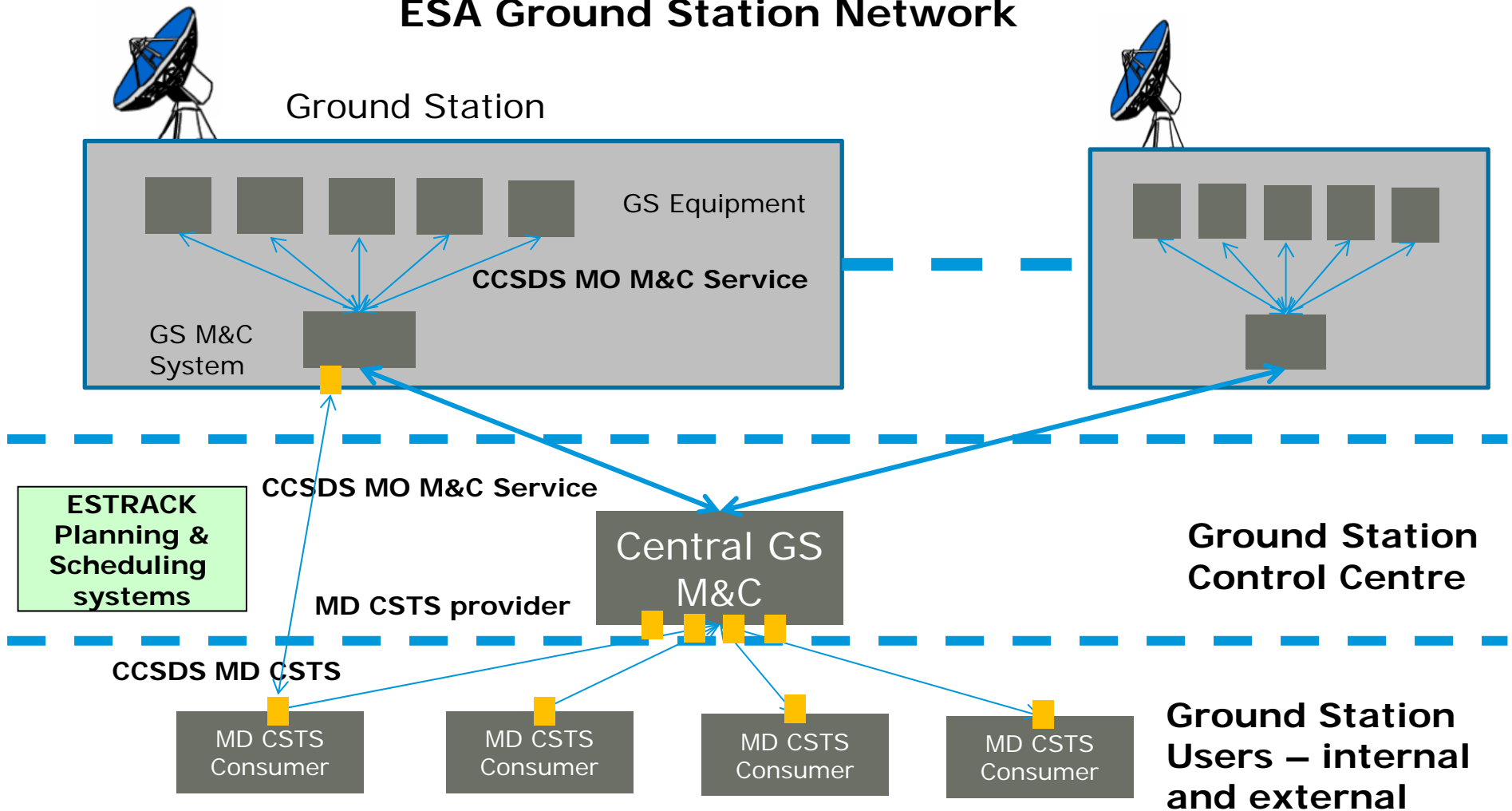


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Potential Future deployment at ESOC



ESA Ground Station Network



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- ESTRACK configuration is automated.
 - Standardisation of M&C protocols, abstract representation of equipment, and automation (procedure) language has enabled this automation.
- Cross support in scheduling still evolving and will require standardisation for efficient usage.
- Potential Future Usage of the MO M&C Service for managing our ground station network. MD CSTS for ground station monitoring.

THANK YOU



New Norcia Ground Station
Credit: C. Lannes

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