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☐ **NEO Characterization**

The Aegis orbit determination and impact monitoring system architecture

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The Near-Earth Objects Coordination Centre (NEOCC) is the main component of the Planetary Defence Office (PDO) within ESA's Space Safety Programme. Its mission is to support and coordinate the observations of small Solar System bodies and to assess and track the threats they may pose to Earth. Central to this mission is Aegis (1), an automated orbit determination and impact monitoring system developed by SpaceDyS s.r.l. under ESA contract and operated by NEOCC.

Aegis operates on an hourly basis, continuously downloading new astrometric data from the Minor Planet Center. It relies primarily on two components: orbit determination and impact monitoring. The orbit determination component maintains a dynamic catalogue of near-Earth asteroids, which includes orbital parameters with associated uncertainties, physical properties, residuals, close approaches, and ephemerides. The impact monitoring component computes the impact probabilities of near-Earth asteroids over the next 100 years. Objects with non-zero impact probabilities are listed in the NEOCC Risk List (2). When an object's impact probability exceeds a certain threshold, Aegis also computes the associated impact corridor, further refining the risk assessment.

This poster will focus on the architectural foundation of the software system, highlighting its infrastructure and deployment. The system is maintained within a structured GitLab repository, enabling efficient version control. An integrated and automatic GitLab pipeline ensures quality assurance by incorporating static code analysis with SonarQube, the generation of Docker images, regression and integration testing, and deployment into pre-operational and operational environments.

The software infrastructure is built on a robust and scalable framework. It employs Docker services for containerization and Redis for handling queues and messages among different services. The infrastructure operates on multiple nodes within ESA's cloud environment and uses an NFS file system to ensure synchronized and reliable data handling across all nodes. Additionally, REST APIs support internal operations and allow external users to access the system's data and services. Traefik is implemented as a reverse proxy to efficiently route these requests.

This poster will detail the system's design and operation, demonstrating how the integration of modern DevOps practices and cloud-based services ensures reliability, scalability, and seamless automation in the continuous monitoring of near-Earth objects.

(1) https://doi.org/10.1007/s10569-024-10225-z
(2) https://neo.ssa.esa.int/risk-list

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