BAS3E: A Framework to Conceive, Design and Validate Present and Future SST Architectures

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ABSTRACT

One of the main missions of a Space Surveillance system is the detection and cataloguing of resident space objects (RSO) having a size compatible with the detection constraints of its sensors. While radars are used to observe objects placed at Low Earth Orbits (LEO), and telescopes to observe objects orbiting in Medium (MEO) and Geostationary Orbits (GEO), for objects orbiting in Highly Elliptical Orbits (HEO), both types of sensors are suited for observations.

In addition of the pure observation of the RSO by a given sensor, the correlation of the acquired observation to an existing or non-existing object on the catalogue, the initial orbit determination and the improvement of the orbit accuracy to maintain a catalogue of sufficient accuracy are activities of key importance in order to be in a position to provided added-value services from the catalogue.

Additionally, and in order to optimize the observational resources for catalogue build-up and maintenance as well as for the provision of the added value services, the tasking and scheduling of a distributed network of sensors that may or may not be coordinated is also of paramount importance.

The goal of this paper is to introduce a complete SST simulation Framework developed by CNES with the goal to evolve existing Space Surveillance and Tracking (SST) network, both from a software and hardware point of view, and to define major evolutions of existing SST networks.

The simulation framework that we will introduce on the paper is called BAS3E, and works both with simulated or real observational data. It implements the capability to simulate ground and space based sensors via the integration of the following functions

- Detection, tracking and generation of observations of space objects
- Object identification and tracking correlation
- Orbit determination
- Maintenance of a space debris catalogue
- Centralized / de-centralized tasking and scheduling

In addition of the introduction of the simulation framework, results of the main constitutive functions will also be presented