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DOSA, an Open-Source Dynamic Analyzer for Satlink

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Classical way of calculating link budgets consists of considering static values of every parameter taken at their worst-case scenarios. This usually provides a good overview for mission analysis, sizing of the communication sub-system and preliminary link design. However, considering geometry, the worst-case scenario mainly concerns station visibility windows limits when the Free Space Losses are maximum i.e at the beginning and end of the pass over the ground station. Adopting a dynamic approach to link budget calculation allows us to take advantage of more realistic margins available during a larger part of the pass duration. Therefore this can enable us to optimize the link, for example by selecting coding techniques according to available margins

DOSA (Dynamic Open-source Satlink Analyzer) is an open source (AGPL v3 licence) software tool dedicated to calculate a dynamic link budget, by computing some parameters as a function of time, over the course of the visibility window above a ground station. To the authors knowledge, no open source tool allows such calculations.

This tool calculates Free Space Loss, Pointing Loss and Doppler Shift values using orbital mechanics inputs such as satellite Orbit Ephemeris Message (OEM), Attitude Ephemeris Message (AEM) data files and Antenna Gain measurement values. As outputs of interest, we get C/N0 and Eb/N0 margin variations throughout the pass duration. Multiple passes over a period of time can also be calculated, which allow the possibility to forecast link performance during operation phase and select the most beneficial passes and adapt bitrates accordingly.

DOSA include Python and Octave source code and working example (https://sourceforge.isae.fr/projects/dosa_link_budget_analysis). OEM input files are expected to be in CIC protocol (based on CCSDS standard). In our case, Celestlab (Scilab open source CNES library - <https://logiciels.cnes.fr/fr/node/67?type=desc>) was used to generate the OEM files.

Primary authors: Mr NINGARAJU, Priyanka (ISAE-SUPAERO); Mr ROUX, Guillaume (ISAE-SUPAERO); GATEAU, Thibault

Presenter: Mr ROUX, Guillaume (ISAE-SUPAERO)

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