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# A USE CASE STUDY ON PROVENANCE-BASED DATA ASSESSMENTS FOR MISSION CRITICAL SOFTWARE SYSTEMS

**Abstract**

Assessments about the quality, reliability, and trustworthiness of data used and generated in mission critical software systems are important. The Backbone Catalogue for Relational Debris information (BACARDI) provides a database related to orbit information about active and inactive objects in Earth orbit. For the products generated by BACARDI, external data from multiple sources may be necessary. At the same time, legal frameworks necessitate clear attribution of data and data products to its original contributors. The data products of BACARDI are exported and used in mission planning, collision warnings, and further mission critical applications. It is necessary to address the needs of these mission critical systems and ensure correct data attribution and valid products. This is achieved by recording provenance of BACARDI's data generation processes.

Recording provenance information of data processing steps means collecting information within the software system about the type and metadata of the processed data sets, all relevant activities (e.g., computation tasks or data storage operations), and the actors involved (e.g., humans or software). This information is recorded according to a well-defined provenance data model and stored into a provenance store. Evaluating the collected provenance information allows statements to be made about the quality of the annotated data as well as the detection of possible violations of privacy or confidentiality requirements.

Here we present a use case study that addresses different applications of recorded provenance data within the BACARDI software system. We discuss questions derived from those use cases and show how they can be answered using the provenance model applied in BACARDI. The described use cases focus on improving or supporting quality, reliability, and trustworthiness of generated data and data products. Collected use cases are analyzed and classified with regard to expected algorithmic complexity according to our provenance model, and importance to future application. Lastly, we discuss work needed to integrate and optimize the analysed use cases into the BACARDI software system and how developers of other aerospace software systems can utilize our study to make their own software "provenance-aware".