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USE OF OPEN SPACE BOX: SUPPORTING TELE-MEDICINE IN SPACE THROUGH EFFICIENT DATA TRANSMISSION

**Abstract**

This paper presents a framework for a denormalized data ingestion and egress method which can be used among several types of in-space devices. Open Space Box is a novel model of communication that supports the data processing required to transform this data into products for utilization by the requesting stakeholders. One such set of data is the data that could be generated from a space-based 3D scanner. We provide an overview of 3D scanning technologies and discuss the storage/transmission needs and types of data generated by an optical 3D scanner developed and deployed at the University of North Dakota. Prospective usage patterns are discussed, as might be applicable to its use for regularly assessing astronauts' health and performing scientific experiments.

Communication of this sort of data may be critical to the health of astronauts and to scientific mission goals and ongoing operations. Some of this data may be processed even before it is transmitted to the attending healthcare provider or requesting scientist. Given that the data communications to and from a spacecraft or space station happens at a limited rate and the massive amounts of data that could be generated from 3D scanning, the receiver or egress application to prepare data needs to be designed to transmit and receive data via an application with a flexible protocol base. We consider the amount of data that could be generated by using the system for astronaut health monitoring, human experiments, non-human experiments and space station (or experiment, etc.) maintenance.

We discuss the efficacy of the Open Space Box approach for serving this need and discuss the particulars of the communications process. Serving these needs is enabled by the Open Space Box design. Under this, the request response happens in batch mode and the communication from 3D Scanner to the database, which is a NoSQL to store any type of data is done using YARN and MapReduce over a Hadoop cluster. The cost, reliability and efficacy of this approach are assessed and compared to conventional approaches.