Recently, the Argentinean Space Agency (CONAE) has developed a concept known as Segmented Architecture in which sets of satellites will form a series of missions with common components and characteristics and the ability to interact with each other and share resources. The development of this architecture would reduce costs and would allow for a gradual access to space with better performance and higher fault-tolerance with respect to traditional monolithic satellite applications.

Although there are multiple potential benefits, it is necessary to solve technological challenges like the distribution of functions (storage, data download, processing), the distribution of instruments, and the network communications among satellite segments. In this paper we will put the focus on the networking protocols and strategies.

In general, these communications can be modeled as Delay/Disruption Tolerant Networks (DTNs) which have been recently recognized as a promising architecture for distributed satellite systems, where traditional solutions based on persistent connectivity either fail or show serious weaknesses. DTN nodes are able to overcome the disruptive connections by using a store-carry-and-forward scheme in which a node is capable of storing traffic data in its buffer, carrying it for some time and forwarding it to another node when a communication opportunity arises. Due to the predictable nature of the satellite's position and attitude, communication opportunities also result predictable, and a routing and forwarding strategy can take advantage of this knowledge of the network topology in the future (contact plan) to take efficient decisions in order to convey the traffic data to its destination.

Among the proposed routing schemes, the Contact Graph Routing (CGR) has received the most attention in the space community. CGR is part of an open source software implementation of the DTN architecture called Internet Overlay Network (ION) developed by the Jet Propulsion Laboratory in a collaborative international effort. Although this implementation has been capable of tackling the basic needed functionalities, there are still many challenges, open issues and potential improvements that deserve further research and discussion. Among them, the computing performance of CGR has been criticized by the community due to the inherent complexity of the calculations of time-evolving route paths.

In this work we propose and implement strategic modifications to CGR in order to improve its performance in terms of computing resources utilization. The improvement is mainly achieved by sorting the route table, which allows to obtain significant execution time savings when there are multiple data packets for the same destination. In general, this is a common scenario since the traffic pattern in segmented architecture networks is generally from orbiting satellites to the mission operation control center on ground. We also make a comparative study by executing CGR in different
scenarios and in different software-hardware platforms. Among these platforms, we include one emulating the highly constrained systems used in space applications that consists of a Leon3 processor and a Real-Time Operating System RTEMS. Finally, we discuss the implications of the results and propose future research lines to contribute to the development of the segmented architecture.