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BUILDING RESILIENT NETWORKS ON MARS: STRATEGIES FOR ENHANCED INTRA-PLANETARY AND INTERPLANETARY CONNECTIVITY

Abstract

As the number of research instruments on the surface of Mars increases, the lack of communication between independent instruments may cause some limitations and problems in space exploration. If we consider the idea of colonizing Mars in the coming decades, the lack of an established network means that the colony we will establish on Mars will not develop as rapidly. In the past century, information sharing has become crucial for all disciplines, and it will be beneficial for humanity to not limit this information sharing only to the earth but extend it beyond our borders.

The aim of this research is to investigate the network that we can establish on the surface of Mars and to examine the potential factors of DTN (Delay-Tolerance networking) systems, which were developed especially for interplanetary data transfer, as well as protocols such as TCP/IP, and UDP/IP that we use now. Within the scope of our paper, we will delve into two main topics: the Mars surface network and the Mars-Earth network. While discussing the steps that can be taken regarding the Mars surface network, its potential difficulties, and its advantages, we will delve deeper into the challenges we encounter in the Mars-Earth network connection, such as distance and location. Therefore, it is apparent that using these protocols for communication between Mars and Earth will cause problems in terms of proximity and delays, hence it can be established using DTN. By doing so, we can provide efficient, reliable communications which preserve the data integrity. Furthermore, our research suggests that sending rovers dedicated to data transmission to Mars will shoulder the responsibility of sending data to Earth.

The method used in our research consists of standard literature review practices and an investigation into technical documents, such as Requests for Comments (RFCs). In our research, we will describe the communications rovers' specifications and explain how space missions could be adjusted to account for it. Moreover, our research will propose a plan for the transition period between our current situation and the desired outcome, and how we will synchronize it with the existing frameworks established by major space organizations.

In conclusion, while interplanetary communication allows many devices on the same planet to instantly share their findings with each other, using interplanetary communication to promptly send them to Earth will expand our understanding of the universe and will help us to take one step in our colonization goal.