ECONOMICAL GROUND DATA DELIVERY

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Data delivery in the Deep Space Network (DSN) involves transmission of **a small** amount of constant, high-priority traffic and a large amount of bursty, low priority data. The bursty traffic may be initially buffered and then metered back slowly as bandwidth becomes available. Today both types of data are transmitted over dedicated leased circuits.

The authors investigated the potential of saving money by designing a hybrid communications architecture that uses leased circuits for high-priority network communications and dial-up circuits for low-priority traffic. Such an architecture may significantly reduce costs and provide an emergency backup. The **arc hi** tecture presented here may also be applied to any ground station-to-customer network within the. range of a common carrier. The authors compare estimated costs for various scenarios **and** suggest security safeguards that should be considered.

INTRODUCTION

The DSN is a geographically distributed antenna network with antenna complexes in Canberra, Australia; Goldstone, California; and Madrid, Spain. The DSN is managed, technically directed, and operated for the National Aeronautics and Space Administration (NASA) by the Jet Propulsion Laboratory (JPL) of the California Institute of Technology in Pasadena, California. Data communications between the complexes and JPL include telemetry, command, tracking, radio science, and monitor and control information. Downlink telemetry data are usually acquired at the remote complexes and transmitted to JPL for further processing, and ultimately delivered to customers located anywhere in the world.

GROUND NETWORK TECHNOLOGY

Spacecraft data arc usually delivered over carefully engineered data networks because of their high scientific value and irreplacibility. The DSN is in the midst of upgrading its ground networks to use the Transmission Control Protocol/Internet Protocol (TCP/IP) **suite** of networking standards, and intermediate buffers. This new architecture provides useful services such as automatic error detection, recovery, now control, and fault-tolerance. This transition to TCP/IP makes it possible to use commercial, off-the-shelf network devices such as routers and bridges to interconnect local and wide area networks. in addition, the architecture enables NASA to potentially use emerging cost-saving technologies. One such technology that we have investigated provides dial-up bandwidth-on-demand. The enabling devices are dial-up routers and inverse multiplexers, which are an advancement of dial-up router technology.

Dial-up routers are very similar to traditional routers, only they include a network interface to a switched circuit. Whenever the user attempts to send data to a predefined