TOWARDS AN INTERPLANETARY INTERNET: A PROPOSED STRATEGY FOR SPACE DATA SYSTEMS STANDARDIZATION

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For the past twenty years, the Consultative Committee for Space Data Systems (CCSDS) has been developing standardized long-haul space link communications techniques that are now in use by over two hundred missions within the international space community. New CCSDS developments, shortly to be infused into several missions, include a proximity link standard and a store-and-forward file transfer protocol.

Recently, in cooperation with the US Defense Advanced Research Projects Agency (DARPA), NASA has been conducting an architectural study of a future InterPlaNetary Internet (IPN). In the same way that the underpinnings of the wired Internet are a small suite of standardized protocols, an Interplanetary Internet will need a similar set of capabilities that can support reliable communications across the highly stressed wireless communications environments of space.

The IPN architecture assumes that in short-delay environments – such as onboard a spacecraft, between close-flying spacecraft, and on and around other planets – standard Internet technologies will be adapted to the locally harsh environment and will be deployed within surface vehicles and orbiting relays. A long-haul interplanetary backbone network, that includes gateways into the terrestrial Internet, will interconnect these distributed internets that are scattered across the Solar System. Just as TCP/IP unites the Earth's "network of networks" to become the Internet, a new suite of delay-tolerant protocols known as "Bundling" will enable the IPN to become a "network of internets" to support true interplanetary dialog.

A strategy is being developed whereby the current set of standard CCSDS data communications protocols can be incrementally evolved so that true InterPlanetary Internet operations are feasible by the end of the decade. The strategy - which is already in progress via the deployment of Mars relay links - needs individual missions to each contribute increments of capability so that a standard communications infrastructure can rapidly accrete.

This paper describes the IPN architectural concepts, discusses the current set of standard data communications capabilities that exist to support advanced missions and reviews the proposed new developments. The end goal is a scalable set of standardized CCSDS communications protocols that can grow to support future scenarios where human intelligence is widely distributed across the Solar System and day-to-day communications dialog among planets is routine.