

Re: Interplanetary communications protocols

Source: <http://sci.tech-archive.net/Archive/sci.space.history/2005-01/1987.html>

From: Tom Kent (*teeks99stuff_at_yahoo.com*)

Date: 01/19/05

To: sci-space-tech@moderators.isc.org

Date: Wed, 19 Jan 2005 21:35:29 GMT

"Ami Silberman" <silber@mitre.org> wrote in
news:csmdul\$os\$1@newslocal.mitre.org:

>
> "Henry Spencer" <henry@spsystems.net> wrote in message
> news:IAIuML.C7s@spsystems.net...
>> In article <1105902023.240764.257410@z14g2000cwz.googlegroups.com>,
>> <dave.harper@gmail.com> wrote:
>> >I was wondering what communications protocols have been used in the
>> >past with probes traveling beyond the earth-moon system?
>>
>> The CCSDS protocols <<http://www.ccsds.org>> are essentially universal
>> in deep-space missions, although there is some interest (mostly
>> outside the traditional deep-space organizations) in TCP/IP as an
>> alternative. --
>> "Think outside the box -- the box isn't our friend." | Henry
>> Spencer
>> -- George Herbert |
> henry@spsystems.net
> Blech! I once assigned my Operating System class an assignment to look
> at changes that would need to be made to TCP/IP to be used over
> interplanetary distances. It makes a radio network look pretty awful.
> A cursory glance at "Next-Generation Space Internet: Prototype
> Implementation" from the ccsds site leads me to believe that the
> authors propose to use TCP/IP for communication among and to/from a
> constellation of NEO satellites. (Currently there are applications
> that do use a modified TCP/IP over satcom.) Fundamentally, it isn't
> much different in concept than running it over a radio net -- you have
> less bandwidth than in the wired world, and much longer end-to-end
> delays.
>
> I don't see the point, however, for deep space missions. TCP/IP adds a
> lot of overhead, mostly to manage routing and reliable delivery. Deep
> space missions are essentially fixed to point to one of a small set of
> fixed points, and the long time delay really prevents a sliding window
> acknowledgement-based protocol. Ideally, you just want the ability to,

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- > *if you really have to get some data you missed in transmission, to*
- > *request the probe resend it. The only acknowledgements per se you need*
- > *are those from the probe in response to commands sent from earth.*
- >
- > *One place that TCP/IP might be useful in a deep space mission is if*
- > *you have a constellation of sub-probes. Possibly a situation like*
- > *Huygens where one probe is acting as a relay for another might benefit*
- > *from a stream-based TCP/IP connection between the two probes, but for*
- > *communication over interplanetary distances it is probably a very*
- > *suboptimal protocol.*
- >
- >
- >

I agree that TCP is a crappy solution for extreme distances, but how about UDP over IP? This way the DSN could be more like a router, some controller at mission control would send and receive messages to/from an IP address over the internet, the routing tables would eventually end up at the DSN which would use their (PPP type? or whatever) modem for the last leg. I like the idea of using standard internet protocols, that way controllers can use tools that have been developed for other purposes, but people designing for earthly IP protocols have a very different set of requirements, so it's not surprising that things don't work great.