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AUSTRALIAN IT / CUTTING EDGE

E-mail: the final frontier

GIVEN that three quarters of the earth's population does not have a telephone, let alone access to the World Wide Web, talk of extending the Internet to the moon, Mars and possibly an asteroid or two may sound rather premature.

But plans for an interplanetary internet (IPN) are already being drawn up.

According to the scheme's proponents, extending the network into space will reduce the cost of future space missions by, for example, making it easy for several Marslanders to share a single relay satellite to send data back to earth.

At the same time, it could also benefit terrestrial users by encouraging research into ways of making wireless connections more reliable.

The problem is that outer space is likely to be as hostile to the networking protocols that underpin the Internet as it is to air-breathing humans.

For a start, TCP/IP — the common language spoken by every device on the network — is a very chatty protocol. A constant buzz of greetings, acknowledgments and farewells flits between computers as they locate each other, exchange information and then disconnect.

In space, however, such chattiness is a bad way of conversing.

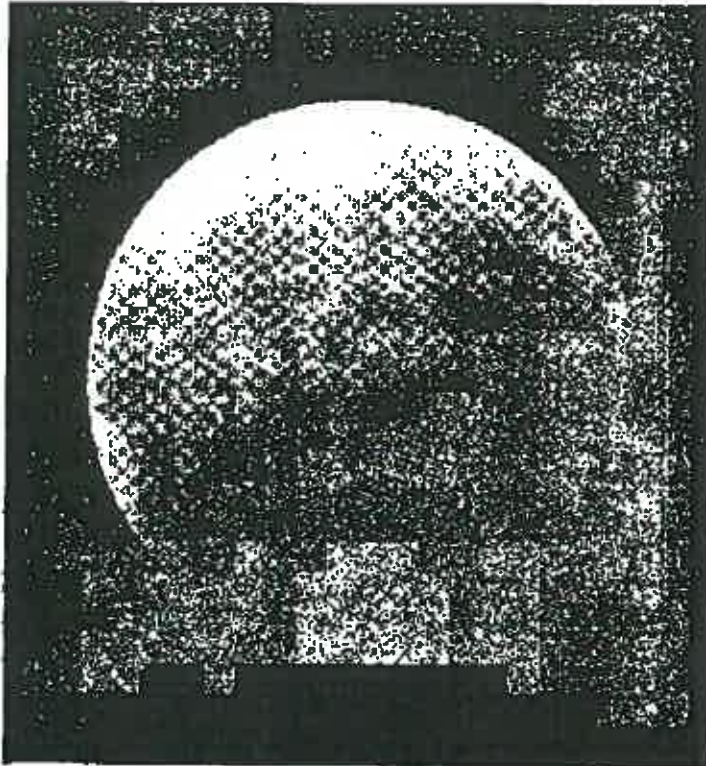
Radio signals take a second to reach the moon, and several minutes to reach Mars. So, a new, terse protocol will be needed, to save both time and energy.

Another difficulty is that TCP/IP was designed to work over networks in which transmission errors are rare, but congestion is common.

On earth, when one device sends a packet of data to another and fails to receive an acknowledgment, it assumes the link has become congested.

It therefore reduces the rate at which it sends subsequent packets, only ramping up that rate again when the congestion has eased.

In space, however, different rules apply. If a packet of data sent to a distant spacecraft in a hostile environment fails to get through, the cause is more likely to be a transmission error, in which case the correct response is to retrans-



Say cheese: Overtake the moon about being on the Universe Wide Web

Plans are already in train to extend the Internet to the moon and Mars, **The Economist** reports

mit the packet as quickly as possible, rather than assuming that the link is congested and backing off.

File transfer is another area in which new approaches will be required. At the moment, sending a file (an image, for example) from one computer to another using the Internet's file transfer protocol (FTP) involves establishing a connection between the source and destination machines, and then passing the file across in chunks.

But if a rover on the Martian surface wants to send a file back to earth, this is an inefficient way of doing it.

It would make more sense for the rover to hand the whole file over to a lander, which could pass it in chunks to orbiting relay satellites for transmission home.

Consideration of such matters sounds whimsical

But similar problems arise, in less drastic form, with wireless Internet devices on earth.

Handheld computers and wireless Net-phones would also benefit from a less chatty protocol, more efficient use of their limited battery power, the ability to cope in noisy environments, and an easier way to send files while on the move (from, say, digital cameras).

So, rather than reinventing the wheel, the scientists working on IPN — a consortium that includes researchers from America's space agency, NASA, the Defence Advanced Research Projects Agency, the British National Space Centre and Britain's Defence Evaluation and Research Agency — hope to collaborate with researchers in the terrestrial telecoms industry to establish new standards.

The IPN working group has al-

ready drawn up a list of problems that need to be solved. A few weeks ago it began the process of presenting them to other researchers at a series of seminars, the second of which was held on November 12 at the University of Maryland.

So far, the plans include the development of the delivery protocol (PDP), a modified form of FTP, and a new idea based around bundles of data in which multiple packets, requests, files and messages can be sent in one go.

Dr Adrian Hooke of NASA's Jet Propulsion Laboratory in Pasadena, who is in charge of the scheme, hopes that devising new protocols in conjunction with the telecoms industry will enable NASA to use existing (and therefore cheaper) hardware in future IPN-capable systems, the first of which could be flying by 2005.

Eventually, the idea is that separate Internets should exist on earth, the moon, Mars and so on, connected by gateways that communicate over an interplanetary backbone using new spacetime protocols. Probes landing on asteroids and comets would also connect to the IPN.

The fact that different bodies in the solar system change their relative positions as they orbit the sun will complicate routing a bit, Hooke concedes. When the earth and Mars are on opposite sides of the sun, for example, it might be best to send e-mail via Venus.

There is also the question of names and addresses. The IPN plans call for an extension to the domain naming system to cover different planets and solar systems.

The Economist's Web site would, for example, then be found at www.economist.com.earth.net

But establishing these new domains (even for experimental purposes) could prove rather difficult.

When Hooke asked the International Standards Organisation committee that assigns country codes about establishing codes for the moon and Mars, he was told that he would need to provide a letter from the relevant sovereign representative.

What planet did they think he was on?