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Speedup of Host-IMP Interface

I. Introduction

In order to make the full performance capabilities of the subnet available for interprocess communication, the host's IMP interface and the IMP's host interface should operate at the highest speed obtainable.

First, this high throughput will minimize the latency observed when RFNM's, control messages, and NVT (network virtual terminal) characters are queued behind full sized messages. A full-sized message currently ties up a 100 Kb interface for almost 100 msec. delaying short messages behind it by 100 msec. Speeding up the host interface to 300 kilobaud will shrink this latency to 30 msec.

Secondly, this high-speed operation minimizes the time that the IMP buffer and the host core buffer are locked down during message transfer. (One being emptied, one being filled). Being able to dispose of buffers far faster means that many fewer of them will suffice to carry the communications traffic: each buffer can be reused far more often.

Third, high-speed operation makes it possible to improve error control: currently, a destination IMP returns a RFNM after transmitting the first packet of a multipacket message to the destination host. If an error occurs during the transmission of the (up to seven) other packets into the destination host, the source host will not be informed of the error: it has already been given a positive message acknowledgement in the RFNM. The alternative, holding off the RFNM until all packets have been transmitted into the destination host, would add another 80 msec. to the round trip message - RFNM time with the current 100 kilobaud interface. A higher speed interface will reduce this delayed - RFNM cost to a more acceptable value, making it practical to eliminate this source of undetected message transmission errors.

Fourth, a high speed interface will permit greater host communications bandwidth. (Currently limited to 100 kilobaud). This increase in bandwidth will be essential for communications between hosts at a "network-structured" site, where different hosts on the same IMP are specialized to perform different parts of a computation.

Clearly, any new or retrofitted host interfaces should be very high

speed, and existing host interfaces should be adjusted to operate at their maximum speed, which is in excess of 300 Kilobaud.

II. Experimental Results

In support of the above predictions, the BBN TENEX staff performed an experiment in cooperation with the BBN IMP group to determine how fast the System A (BBN-TENEX) and System B (BBNB) distant interfaces would operate.

Results are as follows:

The Host-to-IMP connection is synchronized by a two-way handshake which has an available burst bandwidth of 1 bit/(2225 nsec + 3 nsec/ft.*<cable length>ft) For our cable length, this results in a bandwidth of 310 Kilobaud.

The IMP-to-Host connection is synchronized by a four-way handshake which has an available burst bandwidth of 1 bit/(1350 nsec + 6 nsec/ft.*<cable length>ft.) which results in a bandwidth of 290 Kilobaud for our installation.

Both System A and System B are now operating at this higher interface speed.

Since the propagation delay time through a distant host driver-receiver pair amounts to 250 nsec, it is expected that local host interfaces (<30ft) can be operated at speeds substantially faster than our 300 Kilobaud.

In addition to the above measurements of hardware speed, new results were obtained in measurements of file transfer performance, i.e. the CPU time and real time used per megabit of information transmitted over the network.

This experiment involved the movement of one-megabit data files to and from an FTP User process in System B communicating with the FTP Server Process in System A. The results are summarized in the following table:

Operation	Byte Size	Type	Bandwidth	User CPU seconds/megabit
Get	8	ASCII	47Kbaud	7.9
Send	8	ASCII	50Kbaud	7.9
Get	32	LocalByte	43Kbaud	1.80
Send	32	LocalByte	38Kbaud	1.70
Get	36	Image	79Kbaud	1.85
Send	36	Image	85Kbaud	.95

The 36-bit bandwidth of around 80 Kbaud is a great improvement from the (typically) 25Kbaud measured before the speedup of the interface hardware. The CPU time use has also decreased somewhat from that

reported in RFC #557 by Barry Wessler: this demonstrates continued improvement of system efficiency between TENEX version 1.31 and TENEX version 1.32.

In conclusion, the BBN-TENEX staff recommends that all host-IMP interfaces in the network be speeded up to the fastest operation obtainable.