



## Protocols for Handling Messages Between Simulation Computers

Both time-critical and delivery-critical characteristics are accommodated.

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Practical Simulator Network (PSimNet) is a set of data-communication protocols designed especially for use in handling messages between computers that are engaging cooperatively in real-time or nearly-real-time training simulations. In a typical application, computers that provide individualized training at widely dispersed locations would communicate, by use of PSimNet, with a central host computer that would provide a common computational-simulation environment and common data. Originally intended for use in supporting interfaces between training computers and computers that simulate the responses of spacecraft scientific payloads, PSimNet could be especially well suited for a variety of other applications — for example, group automobile-driver training in a classroom. Another potential application might lie in networking of automobile-diagnostic computers at repair facilities to a central computer that would compile the expertise of numerous technicians and engineers and act as an expert consulting technician.

Heretofore, a message transported in a data-communication network has been of one of two types: delivery-critical or time-

critical. Networks that transport delivery-critical messages need protocols that assure the sending computers that delivery-critical messages are in fact delivered to the proper recipient computers. Networks that transport time-critical messages need protocols that deliver messages to the intended recipient computers as quickly as possible because the value of a time-critical message diminishes over time. (Typically, it is better to send an updated time-critical message than to time out and resend a stale time-critical message.) Prior to the conception of PSimNet, there was no available set of protocols that would enable a network to handle both time-critical and delivery-critical messages.

PSimNet is built on the Transmission Control Protocol/ Internet Protocol (TCP/IP) suite of protocols, which includes the TCP and the user datagram protocol (UDP). The TCP/IP and the UDP protocols offer offsetting advantages and disadvantages with respect to the reliability needed for transport of delivery-critical messages and the speed needed for transport of time-critical messages: TCP/IP provides some assurances of proper delivery of a delivery-critical mes-

sage, but at the cost of some overhead. UDP does not offer such assurances, but offers greater efficiency, which is an advantage for delivering time-critical messages.

The figure depicts the relationships among the hardware and software subsystems and a message in a data-communication system that uses PSimNet. The overall function of the system is to convey a message from the first computer to a second computer. The message begins with a header that, among other things, specifies a delivery characteristic (time-critical or delivery-critical). First, the message is received by a message receiver, then its delivery characteristic is analyzed by a message-type determinator. On the basis of the analyzed delivery characteristic, a message-delivery selector then selects the protocol to be used in transporting the message. In the present version of PSimNet, the preferred protocol for time-critical messages is UDP, while that for delivery-critical messages is a modified version of UDP that incorporates additions to make it more reliable.

A message transporter then transports the message to the second computer by use of the selected protocol. The message transporter can send the message to multiple computers if instructed to do so by the first computer.

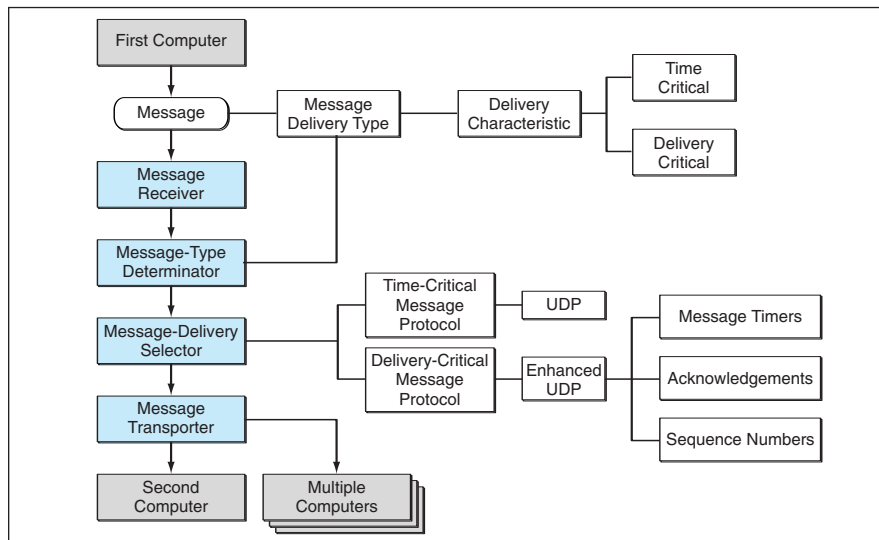
*This work was done by John P. Balcerowski and Milton Dunnam of Hughes Electronics Corp. (now Raytheon Corp. Aerospace Engineering Services Division) for Johnson Space Center. Further information is contained in a TSP (see page 1).*

*Title to this invention, covered by U.S. Patent No. 6,101,545, has been waived under the provisions of the National Aeronautics and Space Act {42 U.S.C. 2457 (f)}. Inquiries concerning licenses for its commercial development should be addressed to:*

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*Refer to MSC-23147, volume and number of this NASA Tech Briefs issue, and the page number.*



**A Message Is Sent From One Computer to Another** in a data-communication network that utilizes the PSimNet set of protocols. PSimNet makes it possible to handle both time-critical and delivery-critical messages in the same network.