The Livermore Interactive Network Communication System

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Abstract

The Livermore Interactive Network Communication System (LINCS), is a protocol suite that supports a location independent application environment. The Livermore Computing Center at the Lawrence Livermore National Laboratory has a large heterogeneous network. A network operating system NLTSS is being developed on this network. LINCS provides not only the communication services necessary to support location transparent applications but also provides translation for machines of varying word lengths and data representation.

This paper will describe the protocols that comprise LINCS. The ISO- OSI network model will be used as a point of reference. In the reference model, LINCS occupies the application, presentation, session, transport, network, and link layers.

The application layer has customers and servers. A server is a program that provides a service, and a customer is a program that needs some service. A server may need other services from other servers, in which case the server becomes a customer of another server. Customers and servers communicate through ports. A port is simply a network address. A pair of addresses form an association through which two processes, customer and server, can communicate.

The presentation layer takes requests from a customer in the form of two data structures, a monologue control record and a token map and transforms the request into a machine independent bit stream called a token stream. The server's presentation layer interprets the token stream and fills the server's monologue control record according to the specifications of the token map. The server would then usually issue a reply via the presentation layer in the same fashion.

The session layer places synchronization marks on the token stream. There is a begin (B) mark, and end (E) mark and a wakeup (W) mark. Requests begin with a B and end with an E. This prevents partial requests or replies from being acted on. The W mark

wakes a process at a point where servicing can begin.

The transport layer consists of the connectionless timer based transport protocol Delta-t. Delta-t requires no open and close negotiation or hand shake. It provides a reliable, flow controlled channel between two ports. No bits are lost, damaged, duplicated or missequenced. When the channel has not been used for some time, the channels state reverts to a default state, and all connection records are reclaimed automatically.

The network layer routes packets produced and consumed by the transport layer. It also checks for damaged packet headers and enforces packet lifetimes. Timer based protocols must have strictly enforced packet lifetimes to operate correctly.

The link layer protocol is ALP. A simple sliding window, sequenced packet protocol. It provides more rapid retries than the transport layer could, in the event of damaged or lost packets.

LINCS has been implemented on the Cray-XMP, Cray-1s, VAX-Unix 4.2bsd, VAX-VMS, and SEL32. It is being implemented on an IBM-PC, LSI-11, SUN workstation, and CYB68000. The communication mediums include 50-Mbit NSC Hyperchannel, Ungermann-Bass Net-One broadband, 10-Mbit Ethernet and synchronous and asynchronous lines ranging in speed from 1/4Mbit to 9600 baud.