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Hierarchical Interconnection Network Architecture for Real-Time Systems

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Abstract: A hierarchical network suitable for interconnection of real-time client processes in a distributed multiprocessor environment is presented in this paper. A multi-layer {it Communication Unit} (CU) prototype is developed for this purpose. This unit offers the client processes communication services for real-time operation. These services are structured in such a way that they do not depend on the characteristics of the communication medium. The basic hardware of the CU consists of a PC compatible card connected to the VME Bus. Client processes run on target cards (Motorola MVME-162) which are attached to the same bus. Target cards together with a CU form a node. Communication between nodes is handled by the CUs over an FDDI based hierarchical multi-ring structure. Routers handle the message transfer between these rings. A 3-layer protocol is designed for this purpose. The Network Service Layer (NSL), the lowest layer of this protocol provides connectionless communication and routing services for the Transport Layer (TL) using a real-time Timed Token Protocol. The establishment and release phases of these connections are managed by a novel dynamic bandwidth allocation scheme. The TL enables real-time end-to-end communication over established connections. The Session Layer (SL), the topmost layer of the protocol provides to client processes location independent connection-oriented services and necessary support for migration. The Management Unit (MU) of the node enables cooperation between these layers and keeps the real-time clock. Clock synchronization in the network is handled by a hierarchical clock maintenance mechanism.

Key Words: Network Architecture, Real-Time Communication, Transport Protocol, Session Protocol, Timed Token Protocol, Routing.

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