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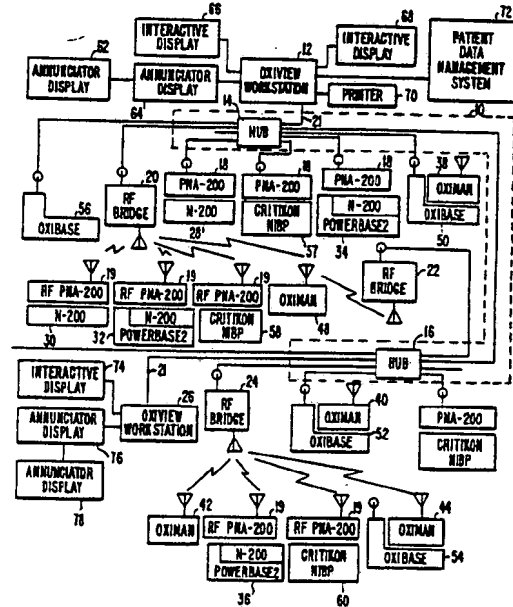International Bureau

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(54) Title: A SERIAL, LAYERED MEDICAL NETWORK

(57) Abstract

A network or telemetry system (10) which allows virtual services at the application or presentation layer to communicate with other virtual services without regard to the physical interconnections. Each message, called a parcel, includes the information to be transmitted along with a virtual address header. The parcel is provided to a gateway (12, 26), which inserts the parcel without modification into a packet with address information for the physical through session layers in the packet header. The packet is then transmitted to another network node (62, 64, 66, 68, 70, 72) which receives and delivers the unmodified parcel to the addressed destination virtual service. A number of parcels from the same or different virtual services can be packed into a signal packet (712) for transmission from the gateway in cases where these parcels are all directed to virtual services at the same destination node. Once a session is established, such as between a gateway and a workstation, virtual services at the gateway node and the workstation can communicate with each other without requiring a lot of header overhead for each transmission.

A SERIAL, LAYERED MEDICAL NETWORK

5   BACKGROUND OF THE INVENTION

The present invention relates to serial data communication networks, and in particular to networks for interconnecting medical instrumentation.

In a typical computer network, computers are connected together over a communication medium. Each computer has its own, unique physical address which

10   is used for identifying both the source and the destination of any transmission. Data and other information is typically sent in packets, with each packet containing a data field and a header setting forth the source and destination addresses, as well as other information. Different protocols exist for the header and for determining when a particular source can transmit.

15   In a number of fields, such as the medical field, it is desirable to be able to connect remote instruments to a central computer workstation. Typically, the instruments will gather data and have minimal processing power. The large bulk of data is typically transmitted from the instruments to the computer. In addition to the data, there may be alarm signals which need to be transmitted and immediately

20   received.

It would be desirable to have a system optimized for network communication from a number of medical or other instruments to a central computer.

SUMMARY OF THE INVENTION

25   The present invention provides a network or telemetry system which allows virtual services at the application or presentation layer to communicate with other virtual services without regard to the physical interconnections. Each message, called a parcel, includes the information to be transmitted along with a virtual address header. The parcel is provided to a gateway, which inserts the parcel without

30   modification into a packet with address information for the physical through session layers in the packet header. The packet is then transmitted to another network node, which receives and delivers the unmodified parcel to the addressed destination virtual service.

A number of parcels from the same or different virtual services can be packed into a single packet for transmission from the gateway in cases where these parcels are all directed to virtual services at the same destination node. Once a session is established, such as between a gateway and a workstation, virtual services at

5 the gateway node and the workstation can communicate with each other without requiring a lot of header overhead for each transmission. Instead, the session need simply be identified. Each gateway typically has one session at a time, but a workstation can support up to 64 sessions simultaneously.

For example, a gateway with a pulse oximeter attached may establish a

10 session with a workstation. The pulse oximeter would provide virtual services for real time data streams for oxygen saturation values, ECG values and pulse values. A separate virtual service called trend service would periodically store real time data for subsequent retrieval. These would communicate with virtual services in the workstation over a single established session. The oxygen saturation and ECG may

15 communicate with a display control virtual service at the workstation, while the pulse value service communicates with an annunciator service at the workstation, for instance. The workstation can simultaneously carry on other sessions with other pulse oximeters or other instruments. A single session may last the duration of a patient's stay in a hospital room.

20 Unlike the prior art, where separate sessions would typically be needed for transmissions between each pair of virtual services, the present invention supports transmissions between multiple virtual services in a single session. This eliminates the need for each instrument or virtual service to have a large amount of computing power to support its own session. By sharing a session, less overhead in the form of

25 computing power to support communication to and from multiple virtual services is required; while still permitting the virtual services to be unaware of data handling during the communication process.

The parcels can be of varying size and number. Each parcel includes precedence information in the header which indicates the relative delivery importance

30 of the information contained in the parcel. For example, an alarm indication parcel would have a highest precedence level, while real-time data would have lower precedence (with further distinctions between types of data: general data would be higher precedence than detailed data which would be higher precedence than stored

data that could be resent if necessary). The gateway transmits the highest precedence level parcels first. If buffer space at the gateway is exhausted, parcels having the lowest precedence level are discarded. If only high precedence parcels are present, older parcels are overwritten with the newer parcels from the same source.

5   Each virtual service sends parcels to the gateway with precedence information in the parcel header. The parcel header also identifies the length of the information field. The information field can contain data, a command requesting an action, or a reply to a request. If the information field contains data, a sequence number is included indicating the order in which the parcel was generated.

10   Each gateway has a table for indicating the location of virtual services local to that node and the internal addressing required to deliver parcels to those virtual services. This parcel routing is done transparent to the virtual service itself. The gateway also has a buffer for temporarily storing parcels while they are waiting to be multiplexed into a packet. The packet header identifies the number of parcels

15 included and the overall length of the packet information field containing the parcels. The packet header also contains source and destination handles identifying the physical source node and destination node, as well as the particular session (which is useful for nodes that support a plurality of sessions). A sequence number is included to identify the packet for detection of packets delivered more than once by the

20 physical network hardware.

          The present invention detects missing data at the application layer for each service. This is done with the assumption that there is a reliable physical/MAC layer underneath. In this context, "reliable" means that the physical and MAC layers are (when communication is possible) incapable of indicating packet delivery without

25 the packet having successfully reached the destination node (at the MAC layer). In order to do this, the MAC layer, by necessity, is capable of delivering the same packet twice.

          For fuller understanding of the nature and advantages of the invention, reference should be made to the ensuing detailed description taken in conjunction

30 with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

DOCKET ALARM

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