Title: The Medical Information Bus: A Proposed Standard for Medical Device Interconnection.

Authors: SW Stead M.D. and MM Shabot M.D.

Affiliation: Department of Anesthesiology, UCLA School of Medicine and Department of Surgery, Cedars-Sinai Medical Center, Los Angeles, CA

Introduction: The absence of interface standards between computing systems and bedside medical instruments has severely limited automated acquisition and transmission of medical data from patient monitors. Each new instrument has required a unique physical connection and software protocol for data transfer. The Medical Information Bus (MIB) is a proposed standard (IEEE P1073) for communication between patient-connected devices and host computer systems. This abstract reports our work on the MIB Committee and describes the design objectives, architecture and a working prototype implementation of the proposed MIB standard.

Methods: The MIB is designed to meet several objectives: (1) Provide a standard, vendor-independent method of communicating between medical devices; (2) Ensure ease of use by non-technical users; (3) Handle frequent connection and disconnection of devices to the MIB without the need for user interaction; (4) Provide real-time alarm annunciation and (5) support a variety of medical devices and computers.

Architecture: The MIB consists of the components shown in Fig 1. The Device Communications Controller (DCC) is the interface between the MIB and a bedside instrument. A DCC samples and processes data received from the medical instrument, and responds to host computer queries. The Bedside Communication Controller (BCC) provides the connection between bedside instruments, DCCs and the host computer system. The BCC is patient specific and may be integrated into a bedside monitor or a gateway to an Intensive Care Unit or Operating Room computer. Communication between the DCC, BCC and host computer occurs via established network protocols. Physically the DCC to BCC is connected by a serial (RS-485) cable. Each BCC and a centralized host is connected by a high-speed Ethernet.

The Medical Device Data Language (MDDL) provides a programmatic application interface. It is a simple, yet flexible language for host-device transactions which encompasses current international standards for data communications and networking and allows for future development. The MDDL uses tables of parameters to convey information. A DCC/instrument which attaches to the MIB network needs knowledge only of its specific application area, allowing low cost devices to implement only as much MDDL as needed. Host computers will usually have a full implementation of parameters for more extensive query capabilities.

Prototype: The DCC prototype consisted of a serial interface combined with an Intel 80188 microprocessor. The BCC prototype was similar hardware, designed to accommodate sixteen DCC bedside devices. The prototype BCC to host computer link was a serial interface, rather than an Ethernet network, as specified. MDDL software for the DCC prototype was written in three logical units, a communication module that utilized the MIB network protocol and two data modules that sampled and processed data from the medical device.

MDDL was implemented for an example host computer, an IBM PC. Utilizing the MDDL grammar, a compiler was constructed which allowed generation of appropriate MDDL commands from host to device and back.

Results: The DCC/BCC interface was adequate for all types of data. The host/BCC interface was functional, but the serial communication speed between the BCC and host computer was inadequate. This is not expected to be a problem in the future, since a high speed (10 Megabits/second) Ethernet network connection will be used. The full MDDL language was implemented in a small amount of memory (30k bytes) on the host. Parameter tables had similar space requirements. No significant problems were encountered in developing the prototype.

Conclusions: This prototype design was intended to determine the feasibility of the MIB as a method of medical device communication. The prototype hardware used was more expensive and powerful than will be required for an instrument-specific implementation. Software on the host computer demonstrated the utility of MDDL as a communication language. This effort has proven the feasibility of building an MIB network and using the MDDL language for data exchange. The MIB proposed standard is a feasible design for medical device interconnection.