

Data Through Paging Technology

The Data Through Paging software, which is licensed to HP by Data Critical Corporation, allows patient information in the form of a binary file (the clinical message file) to be transmitted through a conventional alphanumeric paging system and received on a palmtop computer equipped with a NewsCard paging receiver.

Transmission Data Structure

Two types of pages are generated and transmitted by the dispatch station application. The first type is the file identification packet. This page is sent redundantly as the first and last packets. It identifies the clinical message file and provides the clinical callback phone number and the name of the institution. This page is sent as readable text and is displayed when the clinical message is not received successfully.

The second type of page is the clinical message packet. The clinical message file is divided into clinical message packets using the processing step outlined below. The clinical message packets can be transmitted redundantly if that feature is selected in the dispatch station application.

Clinical Message File Compression

The clinical message file is compressed using a lossless compression algorithm. The approach, which is based on industry-standard concepts and algorithms, is referred to as LVSS. The algorithm employs dictionary-based and Huffman encoding processes. This combined algorithm is similar to the commercially available LHARC program and the widely used PKZIP. The compression is intended to decrease the number of pages sent through the paging service provider by about 50%. As part of the compression process, a 16-bit CRC error detection code is computed and included with the compressed clinical message file. The CRC serves both to check the integrity of the compression process and to detect errors that might have been introduced by the transmission process.

Encoding

The compressed clinical message file, which is in the form of 8-bit binary data, is translated into 7-bit printable ASCII characters. The binary-to-ASCII encoding step is necessary to use the paging system, which was originally intended for the transmission of only printable ASCII characters. The algorithm is similar to the uuencode utility used with many UNIX[®] email programs. This process tends to introduce an overhead of 30% in the clinical message file size. This encoding overhead is more than offset by the gains obtained through compression.

Packetization

The encoded clinical message file is divided into small blocks of ASCII characters. The size of a block is dictated by the maximum page length allowed by the specific paging service used. Each block contains header

information for later identification of the data block, which allows correct reconstruction of the clinical message file after reception in the palmtop. The header contains a clinical message file filename, a block sequence number, the total number of blocks in the clinical message file, and error detection codes. Each block is then packaged into a page with Telocator Access Protocol (TAP) control characters embedded in preparation for sending to the paging service by modem. Each page also contains information that is used later in the RF transmission stage to target specific receiving pagers.

Data Transmission

A telephone line connection is established between the dispatch station modem and the central paging switch modem. TAP is used to upload the packetized clinical message file to the paging switch. TAP establishes communication handshaking, performs forward-acting error correction using checksum calculation, and retransmits erroneous packets when requested. The uploaded pages are then RF-transmitted to the target pager device (or devices) by the central paging system. The order of transmission of the packets is not necessarily the same as the order of reception by the paging switch.

Receiving Pages

On the receiving end of the RF link, the process is reversed to recreate the original clinical message file. All pages in a clinical message file are stored by the NewsCard paging receiver in its local memory, where they can be downloaded into the receiving palmtop computer. The relevant clinical message file pages are then redirected to a temporary incoming clinical message file page file based on the header information supplied with each page. The last page sent contains a coded message that activates a palmtop macro to start processing.

Clinical Message File Reconstruction

The HP PalmVue application accesses the incoming clinical message file page file and, using the page header information, reorders and reassembles the received pages. The reassembled page message is then translated from 7-bit ASCII to 8-bit binary data to reverse the pretransmission encoding process. The decoded clinical message file page file is then decompressed to reconstruct the original clinical

message file, which is then stored. It is displayed by the palmtop application only if the CRC sent with the clinical message file matches the CRC computed by the palmtop.

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