Communications Research Centre

DESIGN METHODOLOGY AND DEVELOPMENT HISTORY OF AN ISO OSI LAYERED ARCHITECTURE FOR THE CANADIAN BROADCAST TELIDON SYSTEM

by

M. SABLATASH AND R. FITZGERALD

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CANADA

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ABSTRACT

To enable the Canadian Broadcast Telidon System to be compatible with many other data communications devices, systems and networks, it was deemed prudent to design a layered protocol for this system to be logically and conceptually consistent with the International Organization for Standardization's (ISO's) Reference Model for Open Systems Interconnection (OSI). The results are presented in this publication describing the layering of a proposed example for such a Teletext system. Previous broadcast Teletext systems appear not to have been designed with a layered architecture; this Technical Note documents the first such example of a broadcast Teletext system. It appears to be the first published work on this topic.

OSI is becoming essential in the design of all information systems, for it enables heterogeneous networks of computers, terminals and peripherals to be connected to each other to exchange meaningful information. By designing these varied systems according to OSI principles, their use will be enhanced, and produce new business techniques and opportunities, because adherence to the OSI architecture will enable a vast array of devices to communicate.

The features and functions of the proposed design example are described. The protocol control information (PCI) for each of the seven layers is described by giving specifications for services and functions provided in each layer, and additional descriptions and definitions as required. A general methodology for the design of ISO OSI layered information systems is briefly described.

The protocol described herein was used as the basis for a provisional Broadcast Specification 14 for Television broadcast Videotex.

NOTE

This Technical Note was written after developing an ISO OSI layered architecture for a Television Broadcast Specification in Canada as a means of broadcasting Telidon and other digital data. Since then discussions about common broadcast standards in the USA and Canada have resulted in a new compromise television broadcast standard which is to be published shortly. The new specification is expected to incorporate features of the CBS submission to the FCC as well as those discussed here.

This Technical Note is written to document the first known example of the design of a broadcast Teletext system layered according to the principles of the ISO OSI Reference Model, to illustrate the methodology for such a design, and to introduce a methodology for the design of ISO OSI layered information systems of more general types.

1. INTRODUCTION

Since 1977, when the International Organization for Standardization (ISO) Technical Committee 97 established a subcommittee, SC16, chartered to develop an architecture as a framework so that heterogeneous computer networks of computers, terminals and peripherals could be connected to each other to exchange meaningful information, a great deal of progress has been made towards establishing the International Standard Reference Model of Open Systems Interconnection ((OSI), [1], [2]). Figure 1 shows the seven layers, with brief reminders of their functions, and Figure 2 shows their relationships to each other and to the local system managers (LSMs) and applications, as well as the paths of message flow through the layers. Openness of systems connotes the potential to communicate with others subject to agreement. OSI will become extremely valuable and essential to the whole gamut of computer communications in the impressive information systems of the information society, from data processing and process control to electronic mail, teletex, the automated office, and Videotex and Teletext systems, such as the Canadian Telidon Systems. By designing these varied systems according to OSI, their use will be enhanced, and produce new business techniques and opportunities, because adherence to the OSI architecture will enable a vast array of devices to communicate. Equipment most appropriate to specific tasks can be chosen, without constraint to a main supplier. Terminals and other equipment can be manufactured according to a framework for the external intercommunication characteristics of the equipment, although designers will be at liberty to implement each function in a manner most appropriate to the internal characteristics of the computer terminal. The influence and universality of the seven-layered model for OSI is clearly growing in the data communications, computer and computer communications fields, as the recent book by Tanenbaum shows [3], for it follows the structure of the model to a considerable extent. Indeed, this may be only the first of many new works which will use the OSI model as a unifying framework within which to modularize and organize the complexity of computer and data communications.

In the intense race to pre-empt perceived lucrative markets for Videotex systems in the new Information Age, the designers of terminals and other equipment for such systems appear to have rushed headlong into the development of terminals which do not adhere to these important principles of OSI. Those who have committed themselves to such terminals may have to face the loss of many opportunities for applications resulting from communications with other terminals and computer communication systems due to this lack of foresight, and will become more and more isolated in the midst of the growing array of other terminals, devices, computers and communication systems that will surely be designed using the architecture for OSI. OSI is certainly essential in the burgeoning world of computer communications.

In a pioneering, far-sighted effort to produce a Canadian Videotex system which would be compatible and flexible, and have the potential for all conceivable applications, in the widest possible computer communications environment, a recent design of a protocol, which was used as the basis for a provisional Broadcast Specification 14 for Television Broadcast Videotex, has been created with an architecture following the reference model for OSI. This Technical Note describes, in layered format, the design and the justifications for allocating each of the many functions of the system to the appropriate one of the seven layers of the ISO model for OSI. The proposed design has been selected to provide: (1) terminal independence, permitting the use of terminals of varying capabilities, such as different resolutions; (2) compatibility with services carried over existing communication networks, and a common presentation format; (3) vertical blanking interval and full field transmission compatibility; (4) forward and backward (over time) compatibility; (5) adherence to national and international standards such as those in [1] and [4]–[6]. A general method for the design of layered information systems is also described. To the authors' knowledge this is the first publication describing a Videotex system with an architecture structured according to the OSI model.

The reader is referred to the growing number of reports, papers and books on the ISO OSI seven-layered reference model for detailed specifications, descriptions and discussions, [1]–[3], [10]–[31]. The presentation here will rely on the details in the references, and will be brief because of the limitations of space. Any reader familiar with the area will readily appreciate that much more could be written. It is also important to note that the ISO has not yet defined broadcast-oriented session and transport services, which are anticipated future extensions to the basic definitions, [1], [13]. Hence, in this section the proposed layering has been done to be logically and conceptually consistent with the principles of the existing ISO definitions, which are for connection-oriented services only.

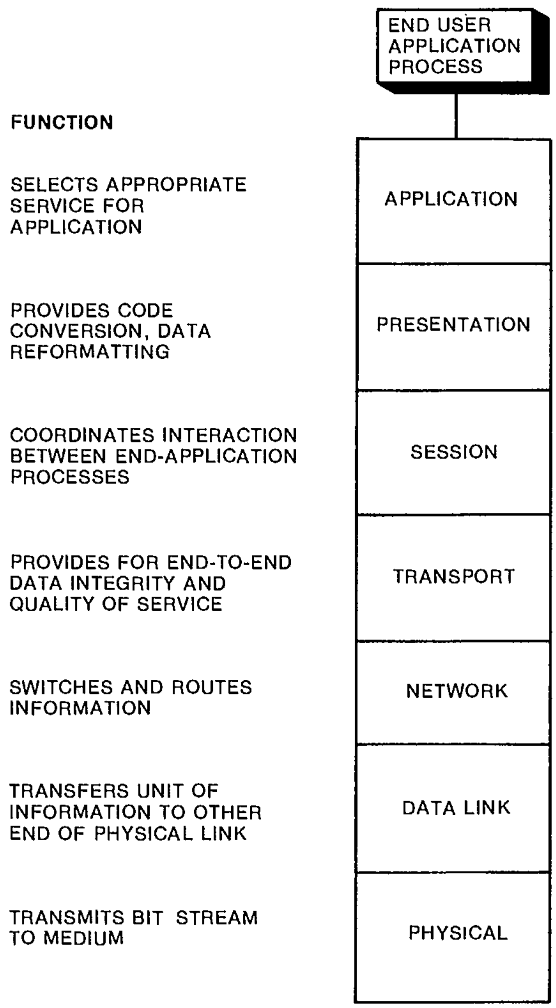

Figure 1. The Seven Functionally Separate Layers of the ISO OSI Model

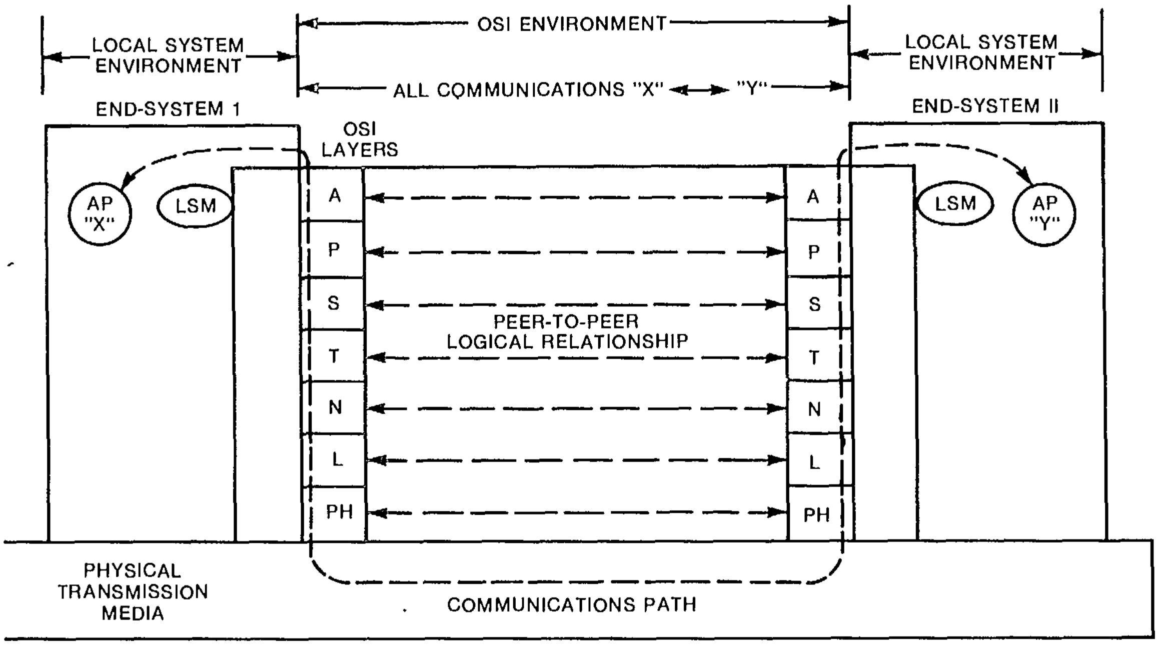

Figure 2. Message Flow and Local System Management Relationships in the ISO OSI Layered Model

2. PHYSICAL LAYER

In this layer signal properties such as bandwidth, bit rate, signal levels, and modulation techniques are specified. Some of these are described next.

Data may be transmitted in the active portion of a television line, commencing after the standard NTSC line synchronization and colour burst. Figure 3 shows a TV line which, according to [1], is the protocol data unit of the physical level in the OSI model.

Data transmission uses the field-blanking interval and/or the active part of the video signal. Lines 1 through 21 (fields 1 and 2) of the 525-line 60 field/sec NTSC television system are designated as the vertical blanking interval (VBI). Of these, the allocation of lines 10 through 21 (fields 1 and 2) for Canada is the subject of Broadcast Specification 13, [7]. Full-field data transmission is achieved through utilization of lines 10 through 262 (fields 1 and 2), which comprises the vertical blanking interval as well as the active part.

The transmission bit rate is 4,578,671±13 bits/sec which is the 291st multiple of the horizontal line frequency for colour transmission (15,734.264±.044 Hz). Any other bit rates and formats are possible.

The data is non-return-to-zero (NRZ) binary encoded. The least significant bit (b1) is always transmitted first. Other encoding schemes are possible.

The data line consists of 232 bits (29 bytes) having the format shown in Figure 4. This choice of terminology is consistent with that of the OSI model, for although a data line does not correspond to any protocol data unit or service data unit in that model, it has been chosen for perceived implementation methodology. It is "close" to the protocol data unit (PDU) for the physical layer, which has already been defined as the TV line.

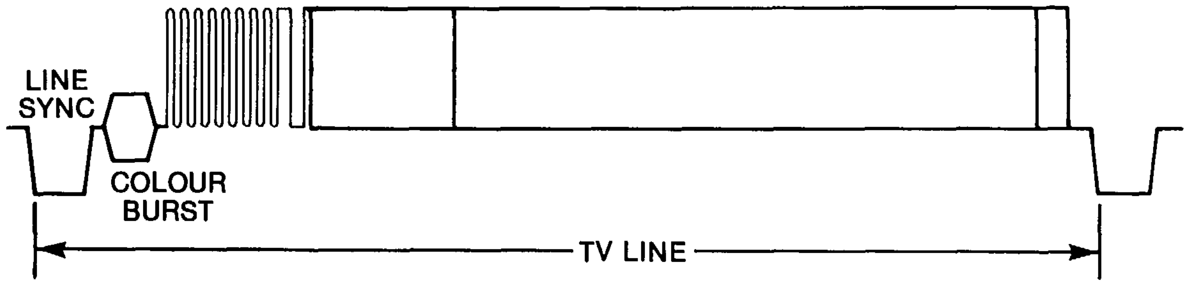

Figure 3. TV Line Used for Broadcast Telidon Transmission

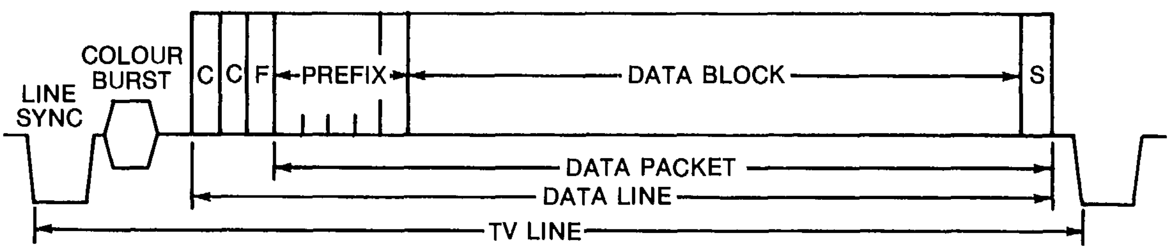

Figure 4. Definitions of Data Line, Packet and Block, and Their Relationships to a TV Line

Figures 16–18 show the protocol control information (PCI), service data unit (SDU) and protocol data unit (PDU) for the physical level, as well as for the other levels.

The first 16 bits of the data line contain a bit synchronization pattern (CC). The pattern consists of alternating 1s and 0s, leading with a "1". This pattern synchronizes the decoder's data clock and initializes the data slicer. The protocol control information (PCI) for the physical layer consists of these two bytes plus the colour burst and line sync. Thus, the service data unit (SDU) for the physical layer is the PDU for this layer without its PCI. This SDU is the PDU for the link layer.

Functionally, at this level a string of transparent bits is "grabbed" by using the line sync, colour burst and CC. According to some opinions, bit sync is allocated to the link layer. This seems to be at variance with the functional purposes of physical and link layers, and the fact that the bit is the fundamental data unit of the physical layer, [2], which would not be possible without bit synchronization.

Since the fundamental data unit at this level is the bit, these are the units moving across the interface between the physical and link layers.

The services provided to the data link layer include physical connection, bit reception and fault condition notification, [2], [13].

3. LINK LAYER

At this level, byte and PDU beginnings and endings must be identified, error correction and detection for the SDU done, data link connections established to transfer link SDU's over data link connections, and sequencing provided.

After CC, the next 8 bits of the data line constitute the framing code (F) and serve to define the byte structure for byte synchronization. There exist several triplets of optimal framing codes, for which the three codes of each triplet have low cross-correlation among themselves and with the bit synchronization pattern. The sequence identified for Telidon is:

$$1\ 0\ 0\ 0\ 0\ 1\ 1\ 1 \equiv 135_{10} \equiv 87_{16}$$

$$b_8\ b_7\ b_6\ b_5\ b_4\ b_3\ b_2\ b_1$$

The other compatible sequences reserved for future use are:

$$1\ 0\ 1\ 0\ 0\ 1\ 0\ 0 \equiv 164_{10} \equiv A4_{16}$$

$$0\ 1\ 1\ 0\ 1\ 1\ 1\ 1 \equiv 111_{10} \equiv 6F_{16}$$

$$b_8\ b_7\ b_6\ b_5\ b_4\ b_3\ b_2\ b_1$$

The byte sync enables beginnings and ends of bytes and of the link PDUs to be identified, and thus the link to the transmitter to be established.

The data packet (Figure 5) is defined as the set of bytes transmitted after the bit and byte synchronization codes, and is made up of a 5-byte prefix, a 20-byte data block and a single-byte suffix. It is the SDU for the link layer without the byte sync; hence, the terminology again does not correspond to any SDU or PDU in the OSI model. The data packet is defined at the link layer after byte synchronization is accomplished.

The prefix consists of 5 bytes, the first 3 of which are used for source identification (SI), and the other 2 of which are used as a continuity index (CI), (Figure 6).

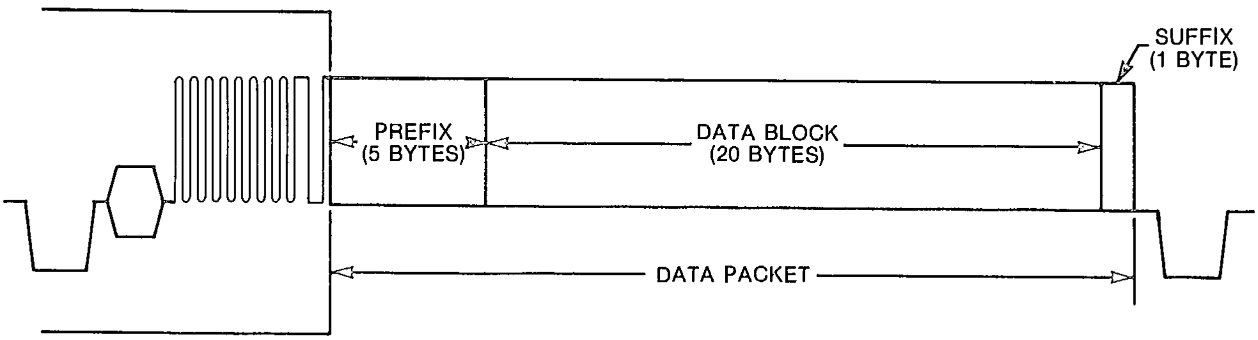

Figure 5. Data Packet and Its Relationships to the Data Block, Prefix and Suffix for the Broadcast Telidon System

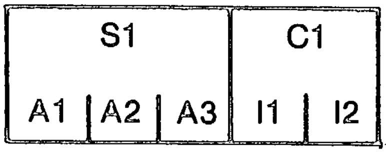

Figure 6. Structure of the 5-Byte Prefix

Three (8,4) Hamming-encoded bytes (A1, A2, A3) constitute the source identification or channel number, yielding 2^{12} (4096) possible data channels. These enable data link connections to be established by identification of the required channel number. This scheme allows for interleaving of packets from different services, and specifies a minimum time separation of 4 milliseconds between any two packets having the same channel number, for both VBI and full-field operation.

The continuity index (11,12) consists of 2 (8,4) Hamming-encoded bytes. Data blocks of any record are sequentially numbered, permitting 2^8 (256) blocks per record. This may be further extended through the implementation of record linking in order to compose a longer message.

It might be argued that the source identification bytes and continuity index belong to the network layer, as do the logical channel numbers and packet sequence numbers of X.25 packet headers. However, for broadcast Telidon the network address is the same as the link address. Furthermore, from one point of view, the link with the correct source cannot be established unless the source identification and continuity index bytes have been checked.

The data block is the same as the link SDU or network PDU. It contains 20 bytes of control information and/or data. Data blocks are the basic data units of the link layer which are transferred from the source, and to the network layer across the interface between link and network layers.

The control information is used in instructing the terminal and the network in processing the user data. All bytes are (8,4) Hamming-encoded.

The user data are the data to be passed to the application process. All bytes in the user data block contain an odd parity bit (b1), for Videotex applications.

The suffix byte in the final position of the data packet serves the purpose of error detection or correction in the data block. Interpretation of this byte by a terminal is optional. It is used for a longitudinal odd parity check of all bytes in the data block, as part of a product code which corrects single bit errors and detects double errors and other patterns, [8].

4. DEFINITIONS OF RECORDS, MESSAGES (PAGES) AND DOCUMENTS

Data blocks of information from the same source (same channel number) may be sequentially organized into identifiable groups known as records (Figure 7). These records may be linked to form messages, also known as pages. This process may be further extended to form documents (Figure 8). Each record is comprised of a series of up to 256 sequentially numbered data blocks. The format consists of a variable-length header, containing protocol information, followed by a series of user data blocks (Figure 9).

5. HEADER FORMAT

The format of the header is shown in Figure 10. The first 6 mandatory bytes must be processed correctly by all decoders. The optional bytes require that all encoders be able to generate them correctly, but that various levels of decoders decode a varying number of them.

The user data are inserted into the first byte following the header. In the event that the final byte of data does not coincide with the final (20th) position of a data block, the rest of the positions are filled with null characters. In case the record contains no presentation data, the header is followed by a sufficient quantity of null characters which fill the final data block.

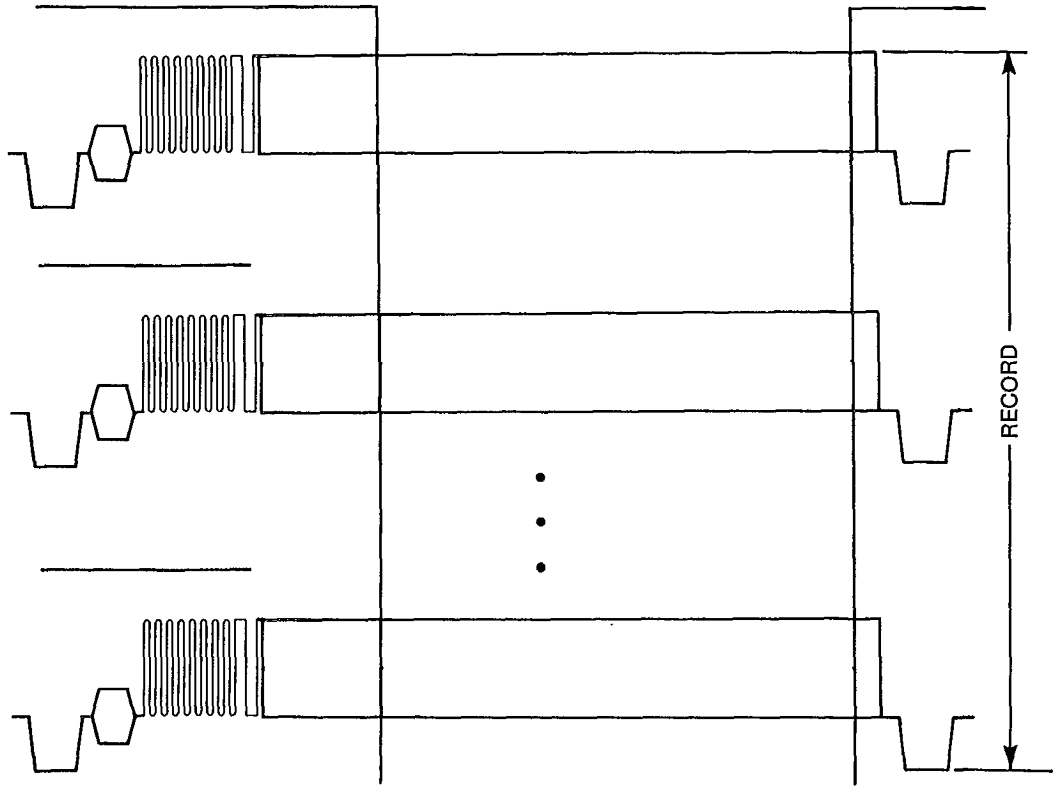

Figure 7. Organization of Data Blocks from the Same Source into a Record

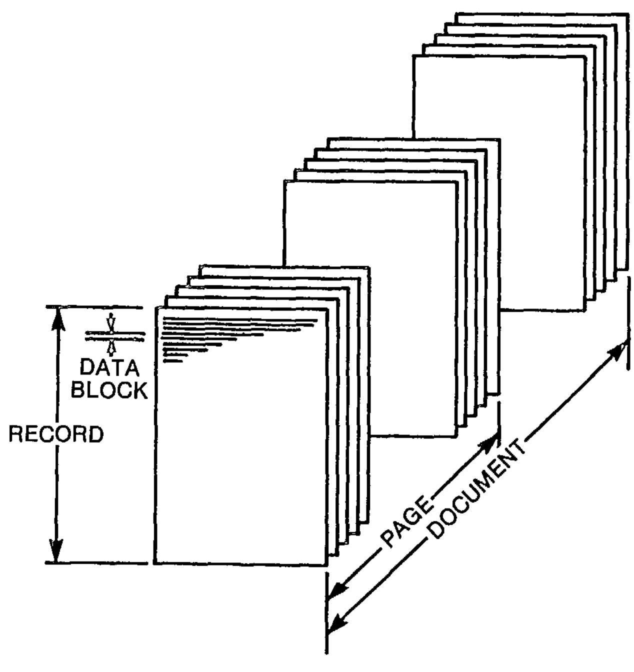

Figure 8. Linking of Records into Pages, or Messages and Pages into Documents

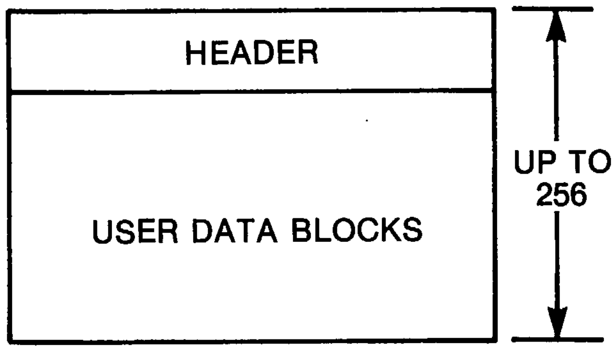

Figure 9. Format of a Record

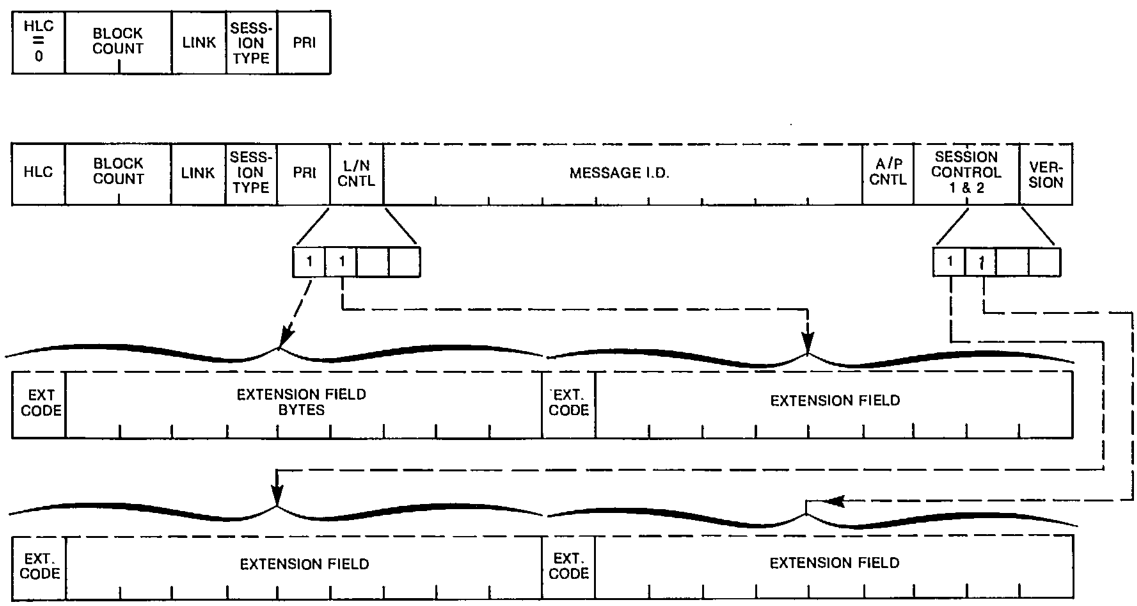

Figure 10. Format of Header

6. NETWORK LAYER

In this layer the functions provided by the network PCI are (analogously to the packet level of X.25) a specification of the manner in which headers and user data are structured into records or parts thereof, and records into pages, sequencing of records in a message, error correction and detection in records or in more than one data block at a time, and identification of a record addressed to a specific user or user group (analogously to the calling DTE address of an X.25 incoming call packet). The basic data unit is the network SDU, as shown in Figures 16–18. The following bytes have been allocated as PCI for the network layer.

1. *HLC*, the header length code, specifies the number of bytes in the header, according to Table 1.

TABLE 1

Definition of Functions Provided by the HLC Byte

Header Length Code	Header Length in Bytes	Header Contents
0	6	Minimum Header (Mandatory bytes)
1	16	Same + L/N Control and Message ID
2	20	Same + A/P Control, Session Control, Version
3	30	Same as above + Additional 10-byte Extension Fields
4	40	
5	50	
6	60	
7	70	
8–15	undefined	undefined

2. *Block count* comprises two hexadecimal digits indicating the number of data blocks in a record.

Both HLC and block count specify the manner in which headers and user data are structured into records or parts thereof, so they have been allocated to the network layer.

3. *Link* consists of a 2-bit continuity count, and a 2-bit sequence code used to sequentially link together all records belonging to one message. The structure of this byte is shown in Figure 11. The record continuity count, containing RC1 and RC2, is set to 0 for the first record of a message, and is incremented by 1 in each subsequent record. The other two information bits shown in Figure 11 comprise the sequence code, which is used to identify the first and last records of a message as shown in Table 2.

TABLE 2

Function Specifications for the Link Byte

RC2	RC1	Not First	Not Last	
0	0	0	0	First and only Record
0	0	0	1	First of several Records
0	1	1	1	2nd Record (or 6th, 10th etc.)
1	0	1	1	3rd Record (or 7th, 11th etc.)
1	1	1	1	4th Record (or 8th, 12th etc.)
0	0	1	1	5th Record (or 9th, 13th etc.)
0	1	1	0	2nd and last Record (or 6th etc.)
1	0	1	0	3rd and last Record (or 7th etc.)
1	1	1	0	4th and last Record (or 8th etc.)
0	0	1	0	5th and last Record (or 9th etc.)
0	1	0	0	Reserved for future use
1	1	0	0	Reserved for future use
1	0	0	0	Reserved for future use
1	0	0	1	Reserved for future use
1	1	0	1	Reserved for future use
0	1	0	1	Reserved for future use

Some broadcast Telidon transmissions contain messages which are repeated periodically in a cyclic manner. A decoder which detects an error which it is unable to correct in such a message can thus wait for a subsequent transmission in order to correct the error. In the case of non-cyclic messages such as closed captioning, for which no specific first or last record is needed, the aforementioned codes permit a message to be repeated as often as required while allowing a decoder to differentiate between the various repetitions of a record.

RC2		RC1		NOT FIRST		NOT LAST		BITS
b8	b7	b6	b5	b4	b3	b2	b1	

Figure 11. Structure of the Link Byte

4. Link/network control consists of four control bits, as shown in Figure 12. User address, b8=1, identifies a record addressed to a specific user. This requires that a 9-digit user identification number be contained within the header extension field having extension code=0. Record F.E.C., b6=1, signals that a record is protected by an advanced form of forward error correction, such as a Reed-Solomon code. In this event the header may optionally contain a 9-digit page number within the header extension field having extension code=2. This directs advanced decoders to a telesoftware package required to implement the additional error protection. Simple decoders, or those already containing the necessary software, will ignore the extension field. B4 and b2 are reserved for future use.

USER ADDRESS	H7	RECORD F.E.C.	H5	0	H3	0	H1	BITS
b8	b7	b6	b5	b4	b3	b2	b1	

Figure 12. Structure of the Link/Network Control Byte

With the link byte service provided in the network layer, the session layer can receive messages, or pages, across the boundary between it and the network layer (or transport layer in the interactive case).

7. TRANSPORT LAYER

There appears to be no transport PCI with end-to-end significance between correspondent transport entities, and so no transport layer, except in the interactive case, not considered here.

8. SESSION LAYER

In this layer session connections which bind and unbind two presentation entities in a cooperating relationship are established and released. The basic connection facility of the session layer transfers session SDUs over session connections. It transfers expedited SDUs across session connection endpoints. The size of data units transferred across the boundary with the presentation layer can be unbounded through document chaining. Since there is a one-to-one correspondence between presentation and session addresses, the message identification bytes need go only as far as the session layer. There are some current discussions about taking them as far as the application layer, a practice recommended by some ISO experts.

The following bytes appear to be most appropriately allocated to the session layer.

1. *Session type* is a single hexadecimal digit specifying the session type to which a record belongs. Its functions are specified in Table 3.

TABLE 3

Function Specifications for the Session Type Byte

Session	Session Type
0	For Broadcaster Use
1	Cyclic Broadcast
2	Non-Cyclic Broadcast
3	Interactive
4	Retransmission
5–15	Reserved for future use

2. *Priority* is a single hexadecimal digit used in expediting certain record types through a network. Priorities are sequentially ordered according to level of importance, with level 0 assigned the lowest priority. Priorities may also be used by decoders as shown in Table 4.

TABLE 4

Uses of Priority Byte

Priority	Action
0–3	Capture if no User Requests are Pending
4–11	Capture Upon User Request
12–15	Capture Immediately

3. *Message I.D.* consists of a 9-digit hexadecimal message number, the first 7 digits representing a document number, followed by 2 digits representing the number of a page within the document (Figure 13). The nine digits are each restricted to the range 0–9 for information retrieval. The range A–F is reserved for non-display control purposes.

4. *A/P control* consists of 4 bits reserved for advanced control functions. These are set to 0 until functions have been specified. Its layer location may be changed depending upon the functions specified for it.

5. *Session control* consists of 8 control bits, the first byte containing *session control 1* (Figure 14) and the second byte containing *session control 2* (Figure 15). In *session control 1*: (a) document chain, b8=1, identifies a page which is part of, but not the final page of, a multi-page document (not last), and finally amplifies the traffic, [13], to messages of unbounded size, by chaining pages which are part of a multi-page document; (b) cyclic marker, b6=1, identifies the first occurrence of any channel number in a cyclic information retrieval data base. This may be used by a decoder to abort a search for a requested page which is not present in the cycle; (c) new, b4=1, identifies material not previously included in the information retrieval index – this would permit advanced decoders to be programmed to capture all new pages or, alternatively, only those within a specific channel; (d) update, b2=1, identifies a change of contents of a previously identified page. In *session control 2*, (a) cross reference, b8=1, indicates that a "target page", whose number is contained in the extension field having extension code=1, is to be captured and displayed immediately following the current one without the requirement for any further user input; (b) auto read, b6=1, indicates that a "target page", whose number is contained in the extension field having extension code=1, is to be captured immediately following the current one; however, it requires user input (depression of the "proceed" key or equivalent) for display and (c) b4 and b2 are reserved for future use. Cross reference=1 and auto read=1 are mutually exclusive.

6. *Version* is a hexadecimal digit specifying a version number of an information retrieval page. It may be used by an advanced decoder, in conjunction with the "update" bit, to determine if the contents of a page have been updated since its last access by that decoder.

New, update, cross reference, auto read and version all identify the pages, or messages, with which sessions take place.

D6	D5	D4	D3	D2	D1	D0	P1	P0	=9 BYTES

Figure 13. Structure of the 9-Digit Hexadecimal Message I.D.

DOC CHAIN	H7	CYCLIC MARKER		NEW	H3	UPDATE	H1	BITS
b8	b7	b6	b5	b4	b3	b2	b1	

Figure 14. Structure of Session Control 1 Byte

CROSS REF	H7	AUTO READ			H3		H1	BITS
b8	b7	b6	b5	b4	b3	b2	b1	

Figure 15. Structure of Session Control 2 Byte

As seen from Figures 16–18, data in PDI form is transferred across the boundary from the session layer to the presentation layer, as possibly unbounded messages due to the document chain function.

9. HEADER EXTENSION FIELDS

Each of these consist of 10 hexadecimal digits, where the first digit comprises the extension code and specifies the type of information contained in the following 9 digits. The existence of extension fields is indicated in HLC. Extension fields are often associated with a bit in the main portion of the header. The codes shown in Table 5 have been defined.

TABLE 5

Functions of Extension Fields

Extension Code	Associated Bit	Function of 9-Digit Extension Field
0	"User Address" (L/N Control, b8)	User Identification Code
1	"Cross-Reference" or (Session Control 2, b8 or b6)	Message I.D. for a Record to be Captured After the Present One
2	"Record F.E.C." (L/N Control, b6)	Message I.D. of a Record Containing Details of How to Perform Record-Level Forward Error-Correction
3		Reserved for Future Use

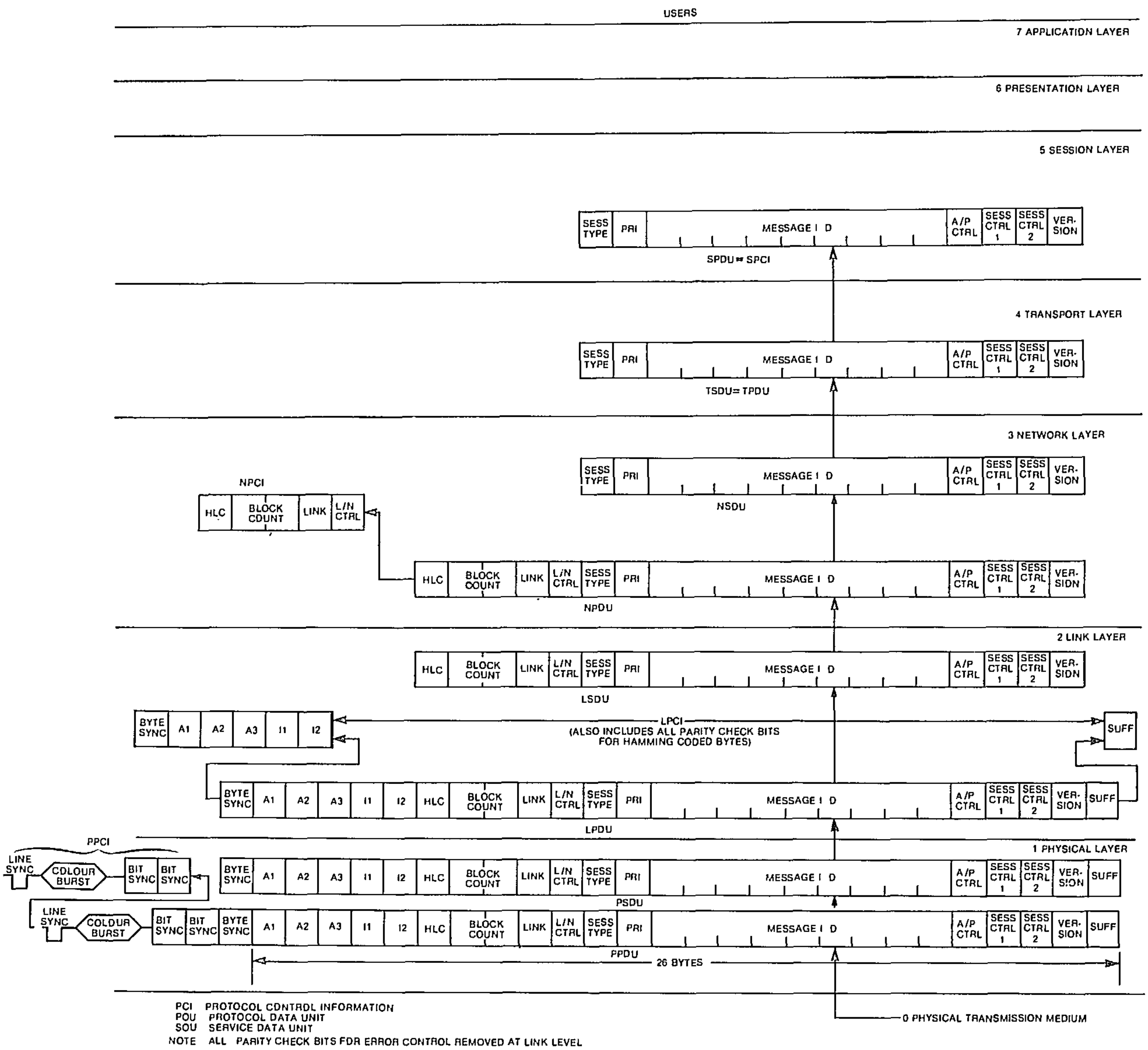

Figure 16. Functional Allocation of Full Header Bytes to Layers of the ISO OSI Model

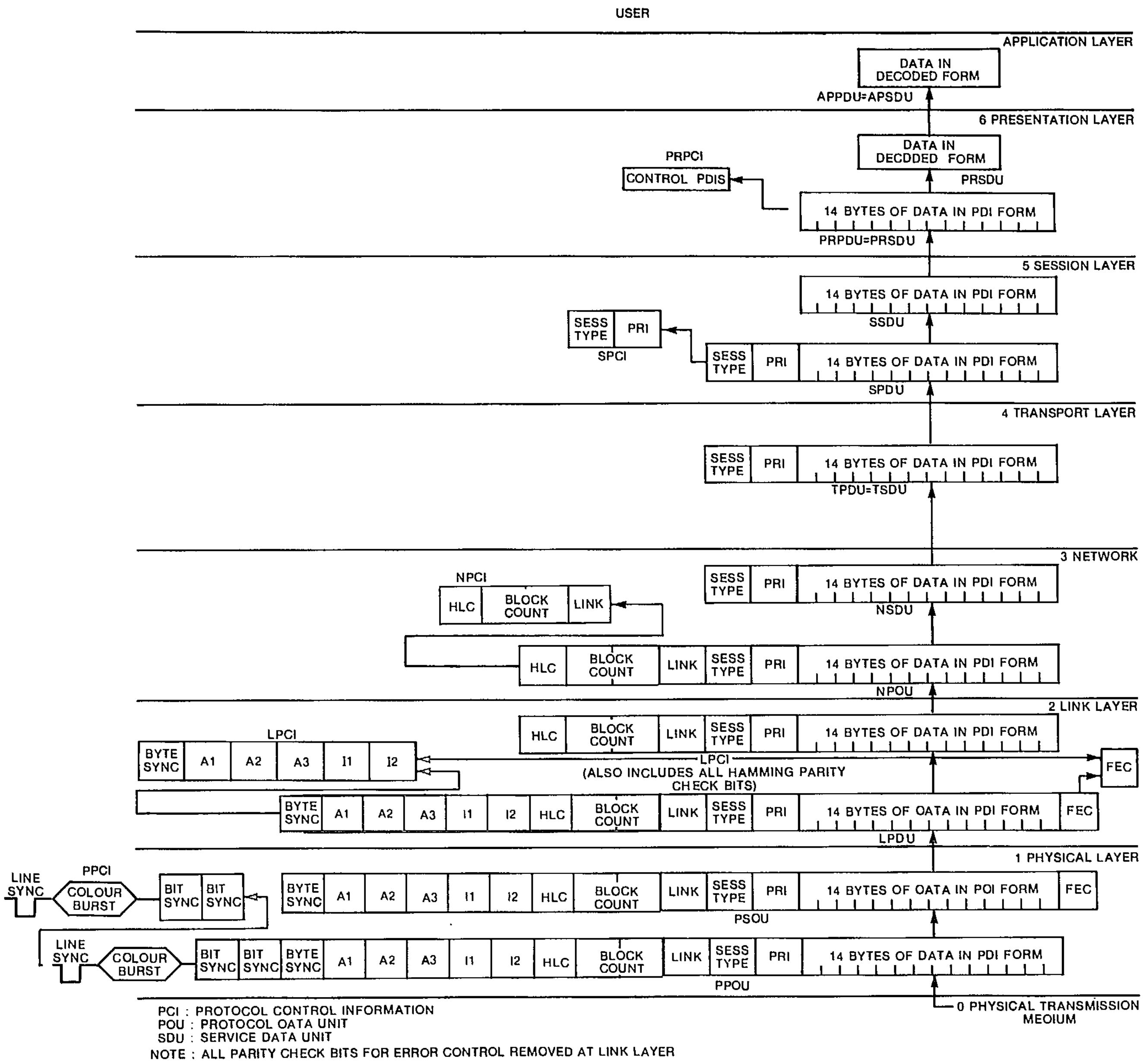

Figure 17. Functional Allocation of Bytes of Data Line with Mandatory Header to Layers of the ISO OSI Model

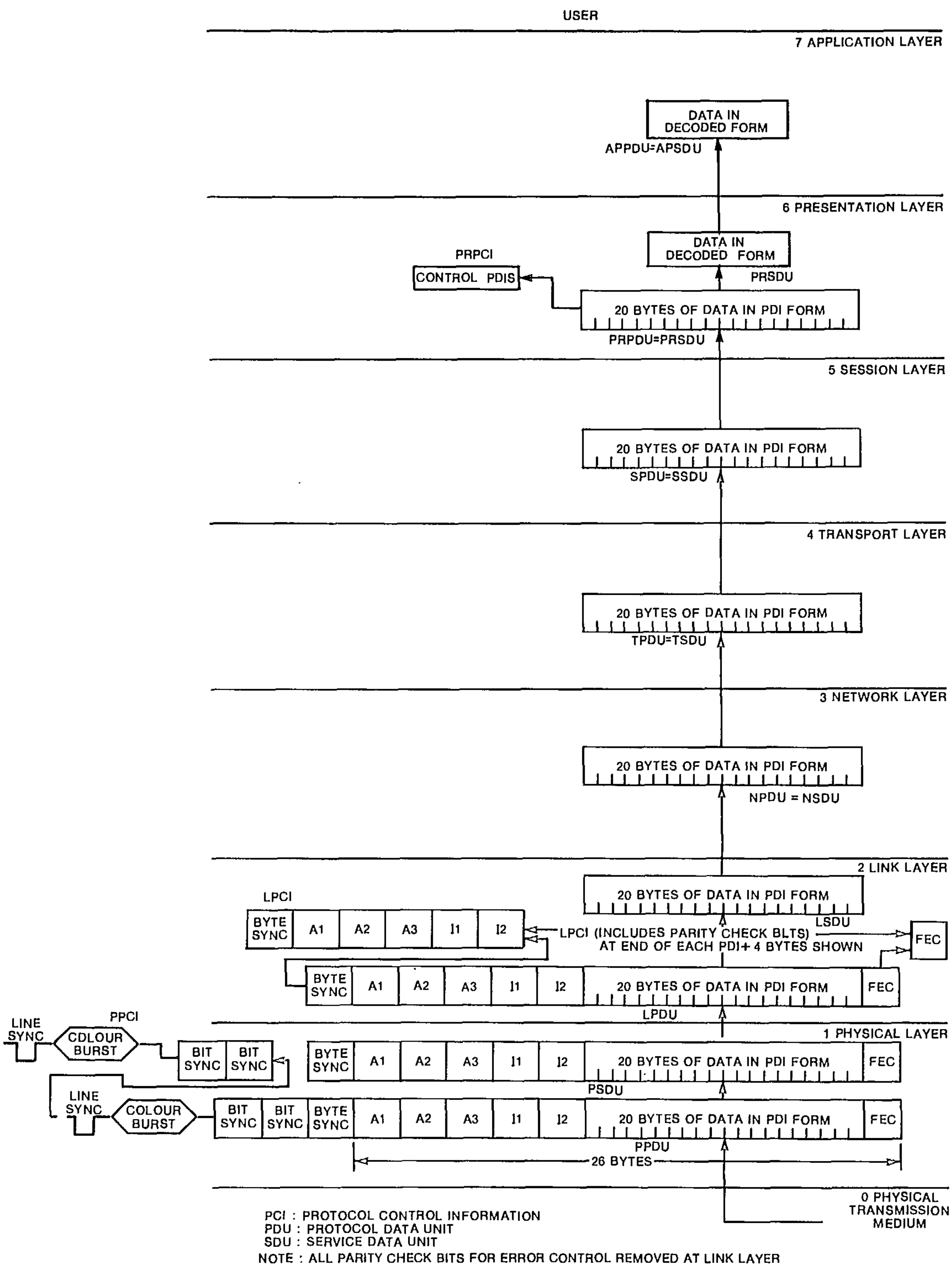

Figure 18. Functional Allocation of Bytes of Data Line with Full User Data Block to Layers of the ISO OSI Model

10. PRESENTATION LAYER

In this layer, as seen from Figures 17 and 18, control PDIs are used to offer various services in this layer, for example: display and character formats, a variety of character repertoires, a variety of colours, decoding of PDIs, layout function codes, extension codes (such as ESC, S0, S1, SS2, SS3), and display attributes.

The character repertoire consists of 26 small letters, 26 capital letters, 12 accented small letters, 12 accented capital letters, 10 digits, 10 punctuation marks and a space character, and 32 special signs and symbols. The code tables for the repertoire are as specified in [4] and ISO/DIP 6937.

The primary mode for presentation coding is that of alphageometric and alphanumeric as specified in [4] and [6].

The default display format is defined as 20 rows of 40 alphanumeric characters per row within the S.M.P.T.E. safe title area of the television screen, [9]. Other display formats are also permitted.

The various degrees of implementation of the display attributes for Videotex systems in [6] and [5] are used.

11. APPLICATION LAYER

The application so far is to broadcast Telidon, and to closed captioning. This layer comprises application entities which interwork with the OSI environment, provides services to users of the OSI environment and the means by which the user specifies the parameters which control operations in the OSI environment. Specifications are provided in [1] and [10], and a discussion of services and functions in [2] and [3], as well as in many other references.

12. A GENERAL METHODOLOGY FOR THE DESIGN OF ISO OSI LAYERED SYSTEMS, [15]

The first step is to make a list of user requirements, considering functions, performance, availability and flexibility. The next step is to decompose these functional requirements into layers, using criteria such as physical boundaries and available technology. The next step is to design specific algorithms for each function at each level, keeping in mind the goals and needs of the user and system. The next step is to design the protocol control information for each level to carry out the algorithm. Thus, the protocol and service data units for each layer are designed. The interactions between layers are examined, and available technologies and services investigated. Finally, the process is reiterated until a balance is reached among the user interface, system goals and available service mechanisms. For a system with which we are familiar, such as broadcast Telidon, the design process can be somewhat simplified by first making a list, for each layer (as much as is initially possible), of the services and functions to be provided by each layer, by thorough examination of functions and services provided by competing systems, and possible new, desirable features. One then begins with the application level, and works one's way down, creating protocol control information necessary to perform each function, and to provide each service at each level. The results will be a complete protocol data unit at the physical level.

In this manner, extremely advanced layered modern information systems for multi-media communications in the wide-band era may be designed.

13. DISCUSSION OF RESULTS AND CONCLUSIONS

A layered design example for an originally proposed, provisional Canadian Broadcast Telidon System has been described, following the rationale of the ISO OSI reference model. Although there are still a number of details that may not be completely satisfactory, some of this is due to the fact that no detailed work on broadcast systems seems to have been done by ISO as yet. This Technical Note seems to be the first one to employ the ISO OSI terminology in detail, for a broadcast Videotex system, and to offer rational explanations for the allocations of functions to layers. Any interworkings with other data systems adhering to the ISO OSI model should be possible with little cost in interfacing. This design enables the Canadian Broadcast Telidon system to fit into the widely pervading, strongly emerging world of modern data communications, in which the ISO OSI model is being widely followed.

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