Virtual Terminal Protocols
Transport Service and Session Control

by

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Abstract: The methods to identify the different terminal protocols for EURONET and the parameter selection mechanism in VPT-D, particularly the terminal mode, are discussed. Based on this, the problems concerning protocol shift are investigated. An integrated solution is outlined and the ISO Reference Model of Open Systems Interconnection is enhanced.

Contents:

1. INTRODUCTION.

In a general network architecture, as it is being considered within standardization bodies, the Transport Service is kept independent from the specialities of the data transmission facility being used underneath.

The network architecture is described by a seven layer reference model (ISO 78) (JAC 78), the Transport Service and the Communication Service being layer four and three, respectively.

The CENTERNET network is composed of Terminal Concentrators and Host Interfaces being interconnected by an X.25 packet switching network. A Transport Service is responsible for the End-to-End data transport, while the actual routing is performed by a Communication Service. The End-to-End resources are related with the concentrators and the host interfaces, and reside in a medium scale cluster of machines. These resources are implemented utilizing the INWG 96.1 Transport Station (IFI 78).

The data transmission facilities reside in a separate machine, an X.25 node, being attached to the Transport Service via an HDLC line (CCITT Recommendation X.25 level 2 LAP B (CCI 77)). The node machines are linked up by a number of HDLC lines.

As a result of this architecture, only a minor part of the CCITT Recommendation X.25 is necessary. This part includes the data transmission facilities and the flow control. The flow control is required because in CENTERNET several independent data flows share an X.25 virtual call. This architectural detail is different from the network architecture of EURONET.

In EURONET each terminal utilizes a virtual call of its own. In fact the terminal concentrator is part of the X.25 network, and so are the End-to-End resources.

Because of these differences the EURONET Transport Service is analysed and compared with the CENTERNET Architecture.

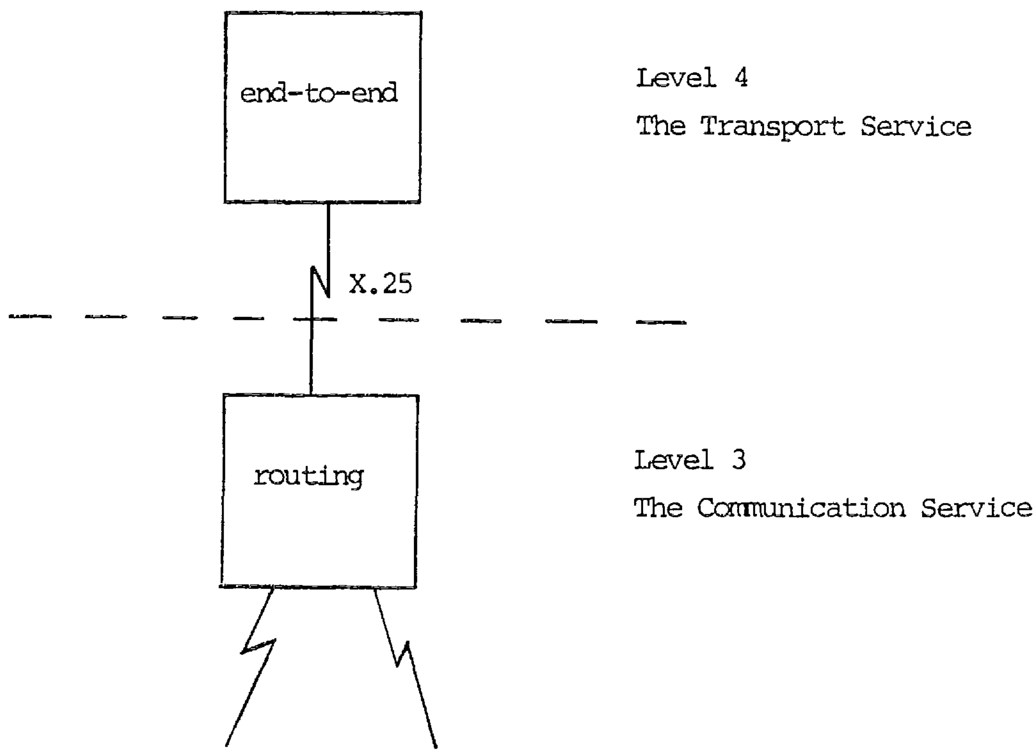


Fig. 1.1. CENTERNET Architecture.

The VTP-D/issue 3 virtual terminal protocol is a protocol designed for Data Entry Applications. The virtual terminal is based on a Control Unit and an attached Memory. In addition a screen is attached to the memory and a keyboard and some hard copy devices are directly connected with the control unit.

The mode of communication is alternate, but in addition at any time the command primitive PLEASE as well as interrupts may be issued.

The VTP-D/issue 3 protocol is based on the EIN Scroll Mode Virtual Terminal Protocol (EIN 77). The structure of the two protocols are equal and, with some exceptions, the representation of primitives and parameters in VTP-D/issue 3 is defined in such a way, that compatibility between the protocols is achieved. Thus a scroll mode subset of the VTP-D/issue 3 protocol may be defined in correspondence with the above mentioned EIN protocol.

In appendix C of VTP-D/issue 3, description of such a set of primitives has been given.

The VTP-D/issue 3 service may be based on one of the following three modes, Native mode, Scroll mode, and Data Entry. In native mode, text blocks are structured according to conventions specific to the terminal i.e. out of the scope of the virtual terminal protocol.

The VTP-D/issue 4 service has been reduced to one mode, the Data Entry, but a possibilities to invoke special protocols, exist in the establishment of a virtual link. One of these protocols may be a scroll mode protocol (JEG 79).

As stated in chapter 1, each EURONET terminal utilizes a virtual call of its own. A session is initiated by an X.25 call request operation, and stopped by an X.25 clear request. One may say, that the virtual link between a terminal and the application is mapped on a virtual call, and that the virtual link is maintained by the virtual call.

Because a EURONET DTE may simultaneously serve different types of protocols, a tool for identification has to exist. In fact several identifications exist.

First the EURONET protocol is identified as required by CCITT Recommendation X.29 (CCI 78), the first octet of the Call User Data Field being marked for a DTE-DTE use, i.e. transmission of a private protocol. In addition the octet is used as a protocol identification, the VTP-D protocol (EUN 78b) and, the RPP protocol (EUN 78a) being X'FE' and X'C2', respectively.

The identification for the ESP 20 bis protocol (EUN 77b) seems identical with the CCITT code for X.28-X.29 PAD service.

By issue 4 of the VTP-D protocol, the maintenance of a virtual link has been separated from the establishment of an X.25 virtual call. In fact two types of protocols utilize a virtual call. These protocols are the normal virtual terminal protocol , and a protocol for handling of the virtual link. These protocols may be associated with the presentation layer and the session layer of the ISO Reference Model of Open Systems Interconnection, respectively. But the protocols are intermixed, because the parameter negotiation for the virtual terminal protocol is part of the protocol for handling of the virtual link.

Each protocol is based on a unit, being a complete sequence of X.25 packets. This unit is composed of a header and a protocol block. The protocol is identified by the header, being X'01' for data transmission blocks and X'02' for handling of the virtual link.

The VPT-D/issue 4 protocol is the only EURONET protocol utilizing this session control. The RPP/issue 2 protocol has integrated the handling og the virtual link and the actual data transfer in one protocol.

EURONET ESP 20 bis is based on yet another principle. Like CCITT Recommendation X.29 the ESP 20 bis commands are marked by the X.25 qualifier bit set to one, while the data transmission packets have the qualifier bit set to zero. Thus ESP 20 bis utilizes yet another communication service facility. When doing so, care shall be taken, because other, very similar protocols may use the same facilities, but for rather different purposes. For instance the ESP 25 protocol (EUN 77a) utilizes the qualifier bit to indicate transparent transmission.

For a virtual data entry terminal protocol like VTP-D, parameters like the screen size, and the line length have to be selected. In VTP-D/issue 3, this selection was based on a negotiation between the application and the terminal. The negotiation had to take place as the first action after the virtual link was established. The application was supposed to ask for information about the parameter range, and then based on this information to select a proper set. Finally the terminal had to agree upon the parameters being selected.

Such a protocol is based on mutual suspicion, because the application is informed about a range, and the parameters selected are then verified and acknowledged.

The implementation of a scroll mode terminal in CENTERNET, using the previous mentioned VTP-D/issue 3 subset would imply the following negotiation scenario.

Upon request a scroll mode terminal has to set the range of the terminal class to scroll mode only, and to test if scroll mode actually is selected. This negotiation takes place after the establishment of a virtual link.

By issue 4, the protocol has been changed so to include the negotiation as a part of the actual establishment of the virtual link. In addition the negotiation has been simplified, being based on mutual confidence. When asking for a virtual link, the parameter range being signalled is part of the connection command. Then the application returns a disconnection command or a connection command. In the latter case the parameters selected are part of the answer. If the virtual link has to be disconnected, a reason is stated.

In such a protocol a scroll mode terminal has to state its capabilities and ask for a connection.

So far only one terminal mode has been defined, being the data entry mode. Thus native mode as well as scroll mode have been excluded. These modes have to be defined as separate protocols (JEG 79), and because the protocol used is no selectable parameter, no negotiation of the terminal mode may take place.

As a matter of fact by issue 4, no terminal having the capability of scroll mode as well as data entry mode is allowed to let the application decide the actual mode.

5. SESSION CONTROL.

In CENTERNET an independent and common Transport Service is introduced based on the IFIP INWG General Note 96.1 (IFI 78). As a consequence several virtual links are multiplexed on a virtual call. The type of service required is indicated utilizing a tool very similar to the X.25 Call User Data Field (CEN 79).

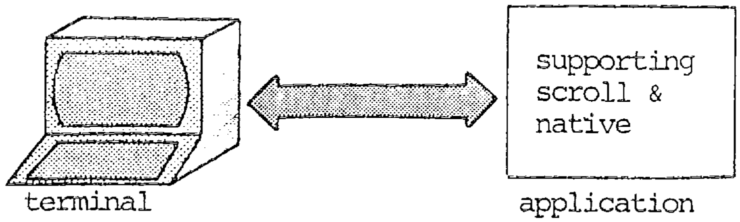
The X.25 virtual call is replaced by a liaison, but apart from this the protocol handling may be the same.

In this architecture each terminal and terminal service point are identified by a non-sharable port. Each terminal service port is mapped on a mainframe service. The type of service, i.e. the type of virtual terminal to be served, is uniquely identified by the address of the port. As a consequence problems may arise if a mainframe allows for further addressing above the transport layer, because the final address may have consequences for the terminal mode required. Operating systems of existing mainframes normally allow such a subaddressing, because the actual choice of service is part of the service offered.

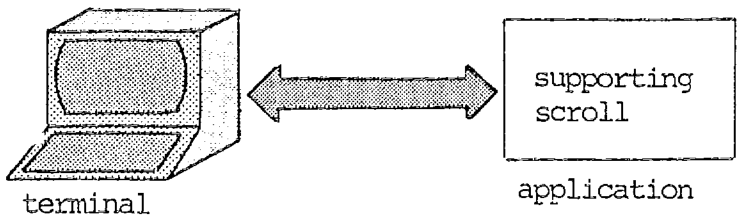
As an example one may think of a terminal user, who wants to access an APL-system under a certain operating system. Using the commands supported by this system, the user builds up some files, which he, later on, intends to use during an APL-session.

In supporting the total session the terminal handler will probably use a sequence of modes. To establish the session and building up the files for the APL-session, the handler will operate in scroll mode and later on switch to operate in native mode for supporting the APL-system.

If the terminal handler shall be able to perform the above mentioned sequence, there is a need for supporting either modeshift inside the VTP or switching between the different protocols without disconnecting/connecting the virtual link.



A. Desired connection.



B. Undesired connection.

Fig. 5.1. Terminal/application connection.

In VTP-D/issue 3 mode-shift is supported, but the method used causes some other problems. Fig. 5.1.A shows the desired situation: a session between the terminal handler and the right application. Fig. 5.1.B shows a case in which the user is unfortunate to get a session to an application which only supports one mode. If this is scroll mode, he may first discover this after having prepared the APL-session and the total session will then be wasted.

This situation may also rise, if it is the terminal handler, which only supports scroll mode. But most properly the user will know.

Using VTP-D/issue 4 it is not possible to negotiate the mode in the VTP. As shown in fig. 5.2.A a switch between two protocols is performed by a disconnection and a succeeding connection.

Because the existence of a session is based on the existence of a virtual link, the session is terminated and another has to be established, so to be able to continue. Apart from being peculiar to the user of the system, several practical problems may arise.

Instead the session should be allowed to survive the disconnect/ connect phase as shown in fig. 5.2.B. This solution would be like the one proposed in OSI (ISO 78) for transport connections and sessions.

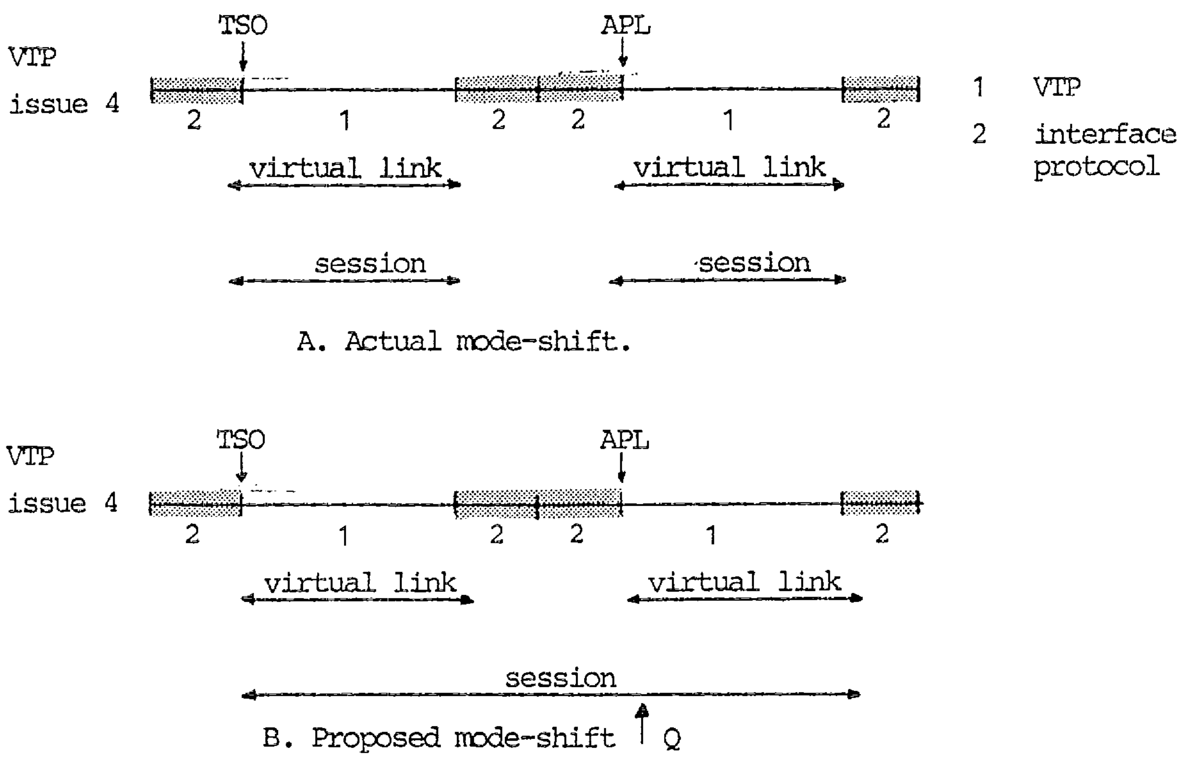


Fig. 5.2. Mode-shift in VTP-D/issue 4.

To implement such a solution it is necessary to enhance the interface protocol. The transport/session service would have to include the command:

switch-link : Preserve the session, but disconnect the virtual link and establish a new with a new set of services.

Even if this amendment is added to issue 4, the same problem as mentioned in connection with issue 3 still exists. At point Q in fig. 5.2.B one might be in a situation, where the service wanted is not available.

It seems most likely, that the problems in connection with shifting between applications are of a more fundamental nature. To obtain an integrated solution, the application layer (level 7) will be viewed in a slightly different way.

As mentioned in the articles (DES 78, ISO 79a, BAC 78), it might be an idea to form a group of related application processes. Furthermore, this group should be addressed as a unit (e.g. by a port address).

desJardins and White and others (DES 78, BAC 78) use one way to illustrate this grouping. The group is called a work station. A work station is addressed through a mailbox, which is an unambiguous, logical network address (fig.6.1). The responsibility to decide, which process actually should be activated, is placed in the session control. To be able to perform the defined functions, the work station presupposes access to different resources (hardware, software).

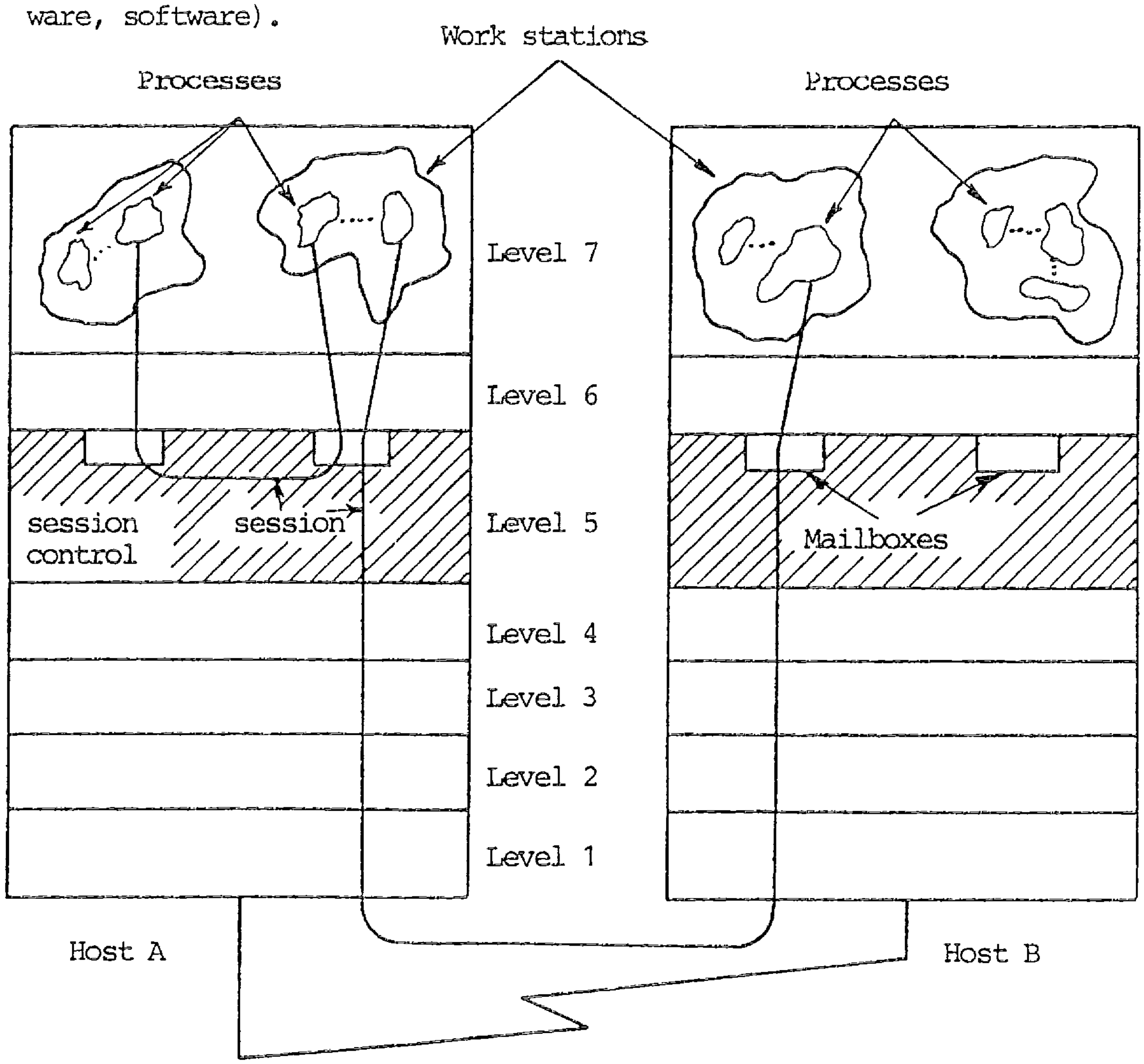


Fig. 6.1 Reference model (des Jardins).

Within this model the session control has to be viewed as part of the operating system. This because all communication between two work stations passes through the session control layer, even if both work stations are placed in the same machine.

It is also possible to describe the grouping using a quite different method. The reference model may be depicted as a plane (level 7) on top of a bar (level 6-1). In the plane the individual processes are scattered (fig. 6.2).

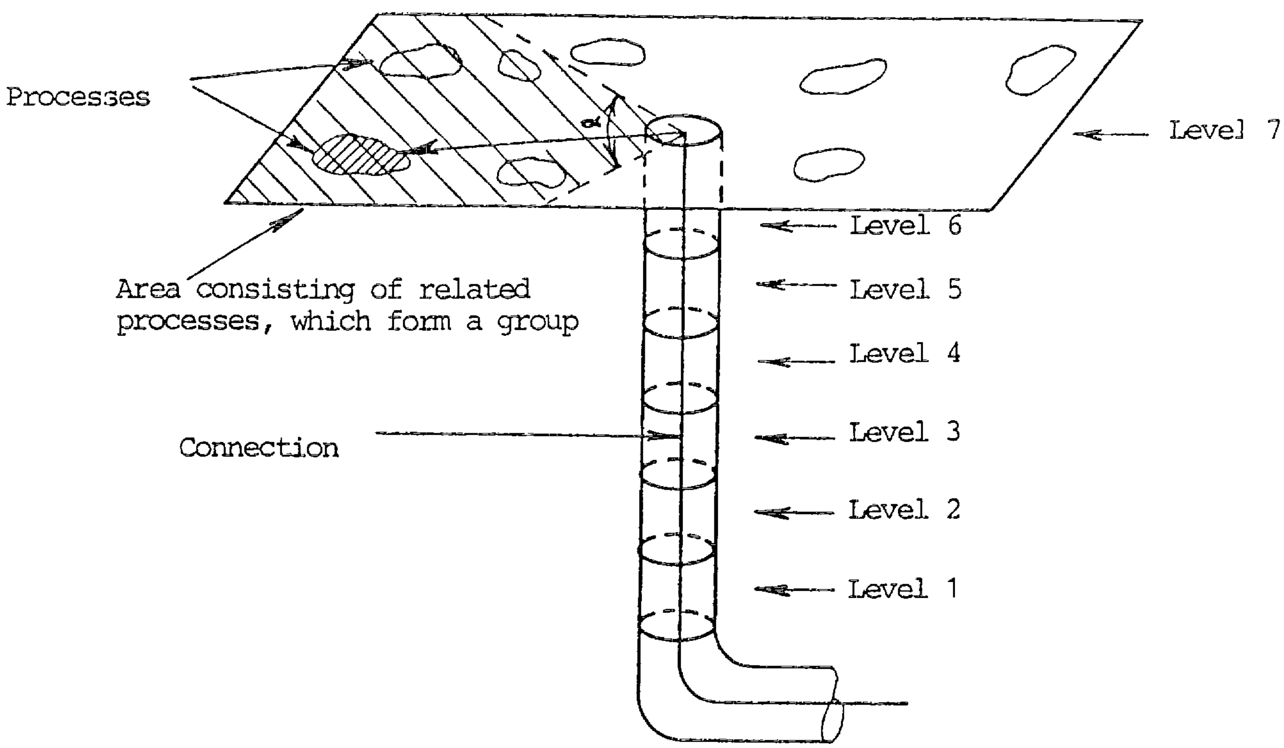


Fig. 6.2 Reference model.

The connection may be illustrated as an arc through the bar to the plane, and further on to the process in the plane. This arc may rotate with the center of the bar as rotation axe, and hit all processes in the plane.

The grouping is achieved by limiting the angle (α) the arc is able to turn. This is marked by dotted lines on figure 6.2. This limiting angle could be a session set-up parameter.

The reference model may be enhanced in two different ways.

1. The plane may be replaced by a frustum of a pyramid (consisting of level 7, 6 and 5) turned upside down.

2. Each level consists of a plane.

These two possibilities are shown in figure 6.3.

re 1. Within this model it is a lot easier to describe how the shift between application processes may cause shift between different presentation protocols, without at the same time to demand a new session.

Besides this, it would be possible to divide the presentation - and session layer into a sequence of processes without expanding the Reference Model of Open Systems Interconnection.

re 2. By developing the model in such a way that each layer consists of a plane, it is possible, as in 1, to divide a layer into individual processes without expanding the 7-layer reference model to consist of more layers. An example for level 2 is shown in fig. 6.3.

These models have a close relation to the problem of sublayering.

In CENTERNET and EURONET this grouping and the necessary protocols and interfaces are neither designed nor implemented. Therefore in these networks switching between applications may cause problems.

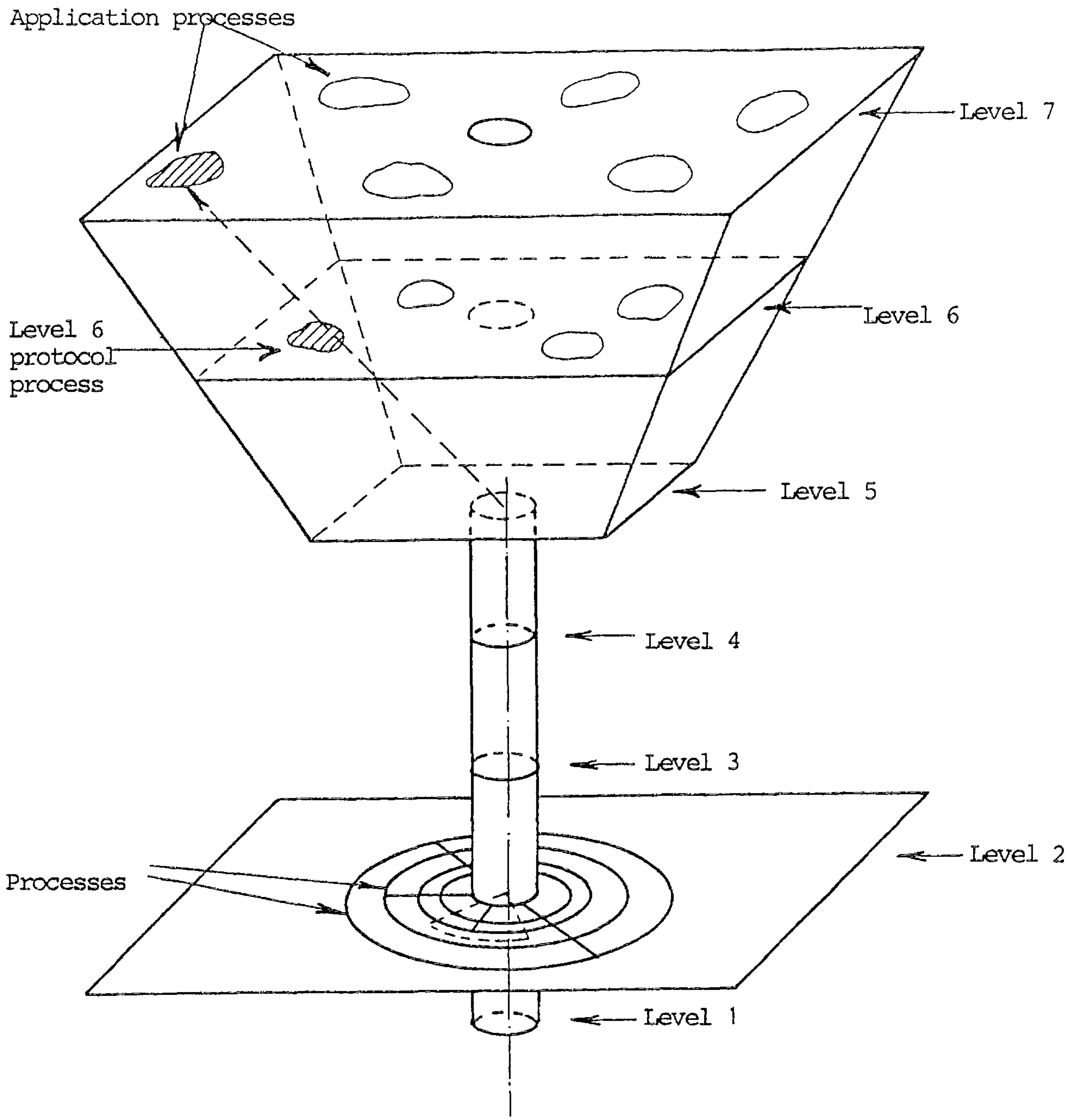


Fig. 6.3 Enhanced reference model.

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