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Technologies de l'information — Interconnexion de systèmes ouverts — Définition du service physique

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

International Standard ISO/IEC 10022 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*.

Introduction

ISO/IEC 10022 is one of a set of International Standards produced to facilitate the interconnection of information processing systems. It is related to other standards in the set as defined by the Open Systems Interconnection (OSI) Basic Reference Model (ISO 7498). The OSI Basic Reference Model subdivides the area of standardization for interconnection into a series of layers of specification, each of manageable size.

This International Standard defines the service provided by the Physical Layer to the Data Link Layer at the boundary betweeen the Physical and Data Link Layers of the OSI Basic Reference Model. It provides for the designers of Data Link Protocols a definition of the Physical Service existing to support the Data Link Protocol and for the designers of Physical Protocols a definition of the services to be made available through the action of the Physical Protocol over the underlying physical media, which are external to the OSI Physical Layer. The relationship of the Physical Layer with the Data Link Layer is illustrated in figure 0.1.

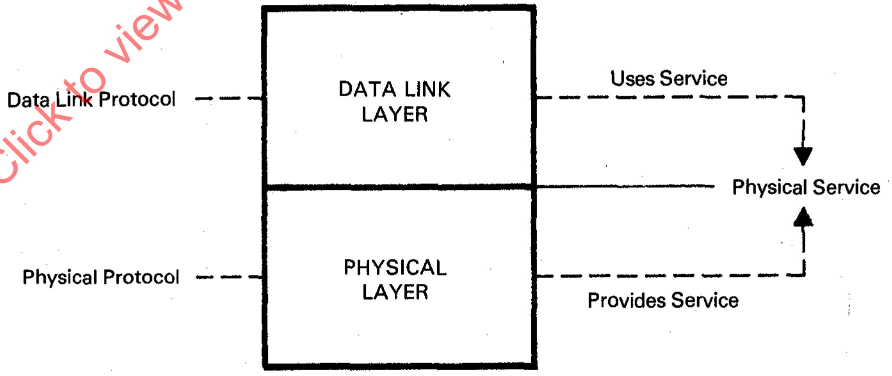


Figure 0.1 — Relationship of ISO/IEC 10022 to other OSI Standards

NOTE 1 It is important to distinguish the specialized use of the term "Service" within the set of OSI Standards from its use elsewhere to describe the provision of a service by some organizations (i.e. the provision of a service by an Administration as defined in Recommendations of the CCITT).

Information technology — Open Systems Interconnection — Physical Service Definition

Section 1: General

1.1 Scope

This International Standard defines the OSI Physical Service in terms of

a) the primitive actions and events of the Service;

b) the parameters associated with each primitive action and event, and the form which they take;

c) the interrelationship between, and the valid sequences of, these actions and events.

The principal objective of this International Standard is to specify the characteristics of a conceptual Physical Service and thus supplement the OSI Basic Reference Model in guiding the development of Physical Layer protocols.

This International Standard does not specify individual implementations or products nor does it constrain the implementation of entities and interfaces within an information processing system.

There is no conformance of equipment to this Physical Service Definition standard. Instead, conformance is achieved through implementation of conforming OSI Physical protocols that fulfil the Physical Service defined in this International Standard.

1.2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 7498:1984, *Information processing systems — Open Systems Interconnection — Basic Reference Model.*

ISO/TR 8509:1987, *Information processing systems — Open Systems Interconnection — Service conventions.*

CCITT Recommendation X200:1989, *Reference Model of Open Systems Interconnection for CCITT Applications.*

CCITT Recommendation X210:1989, *Service Conventions of Open Systems Interconnection for CCITT Applications.*

1.3 Definitions

NOTE 2 Terms and definitions for Data communication and Open Systems Interconnection Architecture are given in ISO 2382-9 and ISO/IEC 2382-26.

1.3.1 Basic Reference Model definitions

This International Standard is based on the concepts developed in the OSI Basic Reference Model, ISO 7498, and makes use of the following terms defined in it:

a) Data circuit;

b) Physical connection;

c) Physical layer;

d) Physical media;

e) Physical service;

f) Physical service access point;

g) Physical service data unit.

1.3.2 Service convention definitions

This International Standard also makes use of the following terms defined in the OSI Service Conventions Standard, ISO/TR 8509, as they apply to the Physical Layer:

a) Physical Service User;

b) Physical Service Provider;

c) primitive;

d) request;

e) indication.

1.4 Abbreviations

OSI	Open Systems Interconnection
Ph	Physical
PhC	Physical connection
PhL	Physical Layer
PhPDU	Physical Protocol data unit
PhS	Physical Service
PhSAP	Physical Service access point
PhSDU	Physical Service data unit
QOS	Quality of Service

1.5 Conventions

1.5.1 General conventions

This International Standard uses the descriptive conventions given in the OSI Service Conventions Standard (ISO/TR 8509), see CCITT Recommendation X210.

The layer service model, service primitives, and time-sequence diagrams taken from those conventions are entirely abstract descriptions; they do not represent a specification for implementation.

1.5.2 Parameters

Service primitives, used to represent service-user/service-provider interactions (see ISO/TR 8509) may convey parameters that indicate information available in the user/provider interaction.

The parameters which apply to each group of Physical Service primitives are set out in table 1 to table 4 (see clause 2.1 to clause 2.4). The tables also indicate the association of which parameters can be carried by each respective primitive.

Some entries are further qualified by items in brackets. These may be

a) an indication that the parameter is conditional in some way:

   (C) indicates that the parameter is not present on the primitive for every connection; the parameter definition describes the conditions under which the parameter is present or absent;

b) a parameter specific constraint:

   (=) indicates that the value supplied in an indication primitive is always identical to that supplied in a previous request primitive issued at the peer service access point;

c) an indication that some note applies to the entry:

   (note x) indicates that the referenced note contains additional information pertaining to the parameter and its use.

In any particular interface, not all parameters need be explicitly stated. Some may be implicitly associated with the PhSAP at which the primitive is issued.

1.5.3 PhC endpoint identification convention

If at a PhSAP there is more than one PhC and distinction among them is needed by the PhS user, PhC endpoint identification must be provided. All primitives issued at such a PhSAP would be required to use this mechanism to identify PhCs. Such an implicit identification is not described as a parameter of the service primitives in this Physical Service Definition.

When the PhC traverses relays which are controlled through a separate PhC, this implicit identification mechanism must provide additionally for identification of these dependencies.

1.6 Overview and general characteristics

The Physical Service provides for the transparent transfer of data between PhS users. It makes invisible to the PhS users the way in which supporting communication resources are utilized to achieve this transfer. Service classes are defined to categorize the distinctions that are visible to the PhS user.

The PhS provides for PhCs between PhS users. Since connections cannot be established through the protocol at the Physical Layer but rather are configured when the service is created, the PhC, which is a logical concept, nevertheless must relate directly to the real physical media paths provided to the Physical Layer. For this reason

a) there is no distinction between connection-mode and connectionless-mode at the Physical Layer. The service is independent of whether the higher layers operate in connection-mode or connectionless-mode;

b) each PhC is identified within the Physical Layer;

c) a PhC can only relate to a particular PhSAP (i.e. a PhC implies a specific source PhSAP, and a specific destination PhSAP or group of PhSAPs if a multi-endpoint connection).

The PhC may traverse Physical Layer Relay, or Intermediate Systems when several physical media are used in tandem. Such relaying may be controlled through a management function exercised over a separate, but related, PhC, or may be controlled from the Network Layer, as specified in ISO 7498, 7.5.4.1 (see CCITT Recommendation X200), for the interconnection of data circuits. The Physical Layer does not make any routing decisions. Intermediate systems may also be used for mapping different Physical Layer protocols associated with a PhC.

The Quality of Service provided by the Physical Service is pre-defined, in accordance with the class of service, though it may optionally be varied through management control of the configuration.

Actual data transmission takes place over the physical media. The mechanical, electromagnetic and other media dependent characteristics of the physical media connection are defined at the boundary (interface) between the Physical Layer and the physical media. Definitions of these characteristics are found in other International Standards and CCITT Recommendations.

1.7 Features of the Physical Service

1.7.1 The Physical Service offers the following features to a PhS user:

a) the means to activate a PhC with another PhS user for the purpose of exchanging PhSDUs. More than one PhC may exist between the same pair of PhS users. The PhC Activation Service is optional and need not apply for duplex or simplex transmission (i.e. continuous Data Transfer Phase);

b) the means of transferring PhSDUs on a PhC. A PhSDU consists of one bit or a string of bits. PhSDUs are transferred in PhPDUs transparently over a PhC without change to the content (within the Quality of Service) or constraint on their data values. PhSDUs are delivered in the same order in which they are submitted;

c) the means to identify, when necessary, individual PhCs at the PhSAPs. Note that the parameters to identify a particular PhC within the PhSAP are implicit (see 1.5.3);

d) the means for unconditional, and therefore possible destructive, deactivation of a PhC by either the PhS user or by the PhS provider. The PhC Deactivation Service is optional and need not apply for duplex or simplex transmission (i.e. continuous Data Transfer Phase).

1.7.2 Other aspects of the Physical Service include

a) the transfer of PhSDUs may be either duplex (two-way simultaneous), half-duplex (two-way alternate), or simplex (one way); either point-to-point or multi-endpoint; and either synchronous or asynchronous, as appropriate (see clause 1.8);

b) the data signalling rate on the physical media may not correspond with the PhSDU throughput rate due to the inclusion of Physical Layer protocol control information, multiplexing function, encoding mechanisms, or other transmission control functions;

c) PhSDU synchronization is provided by the Physical Service. This includes bit synchronization. Other delimiting may be available, which is a variable feature;

d) Physical Connection endpoint identifiers are not globally known. In the case of multiplexing they will be conveyed implicitly via the Physical Protocol;

e) fault condition notifications to the PhS user, beyond conveying a PhC deactivation indication, are for further study.

1.8 Classes of Physical Service

Distinctions of Physical Service are necessary to identify features that relate to the requirements of the service as seen by the Data Link Layer. These distinctions are

a) type of transmission: synchronous and asynchronous;

b) mode of operation: duplex, half-duplex, and simplex;

NOTE 3 While these modes describe the operation at the Physical Layer Service boundary between the

Physical Layer and the Data Link Layer, they do not necessarily imply the specific mode of operation of the Physical Layer Entity and the interface between the Physical Layer and the underlying physical media. This applies to operations associated with specific Physical Service Provider implementations, such as collision detection and multiplexing, which may map on to certain service primitives (for example, Activation and Deactivation) but are otherwise transparent to the Physical Service User.

c) topology: point-to-point and multi-endpoint.

NOTE 4 This encompasses various forms of LAN topology (ring/bus).

1.9 Model of the Physical Service

1.9.1 Model of the layer service

This International Standard uses the abstract model for a layer service defined in the OSI Service Conventions Standard (ISO/TR 8509, clause 4). The model defines the interactions between the PhS users and the PhS provider that take place at PhSAPs. Information is passed between the PhS user and the PhS provider by service primitives, which may convey parameters. The description of the model is applicable to point-to-point PhCs (linking two PhSAPs). The extension of the model for multi-endpoint PhCs is for further study.

NOTE 5 When there are more than two PhSAPs, activation procedures ensure that only one user is transmitting at any one time.

1.9.2 Model of a point-to-point PhC

The operation of a PhC is modelled in the abstract by a pair of bit streams linking the two PhSAPs. There is one bit stream for each direction of transmission (see figure 1). Each bit stream conveys Physical Protocol Data Units (PhPDUs). Bits within each bit stream are delivered in the same order in which they were submitted.

1.9.3 Model of a relayed point-to-point PhC where the relay is controlled within the PhS Provider

The operation of the PhC is modelled exactly as described in 1.9.2 except for the interposition of the relay within the data circuit to support tandem physical media (see figure 2).

1.9.4 Model of a relayed point-to-point PhC where the relay is controlled from the Network Layer

The operation of each of the relay-controlling PhCs can be accomplished by the Network Layer control information being conveyed either via the same PhC (in-band signalling), or via a separate PhC (out-of-band signalling), see figure 3. Physical Layer relay systems do not complete the end-to-end PhC until Network Layer control actions are completed among the Network Layer entities en route. Deactivation may be accomplished through either Network Layer protocol or management actions.

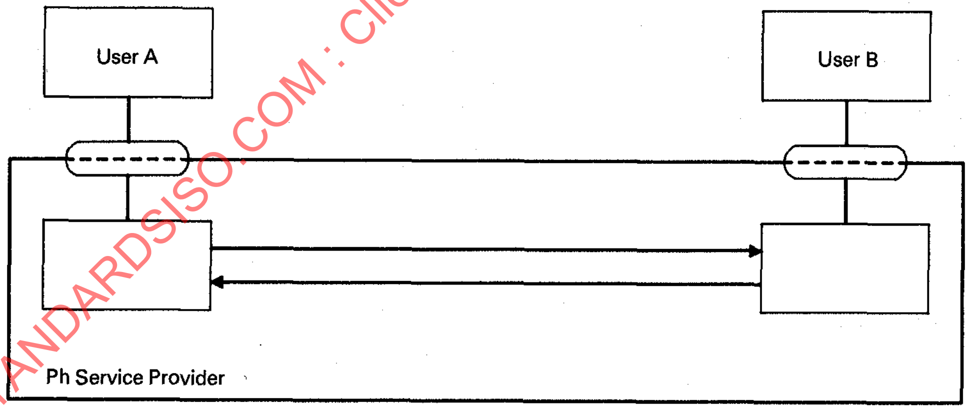


Figure 1 — Simple model of a PhC

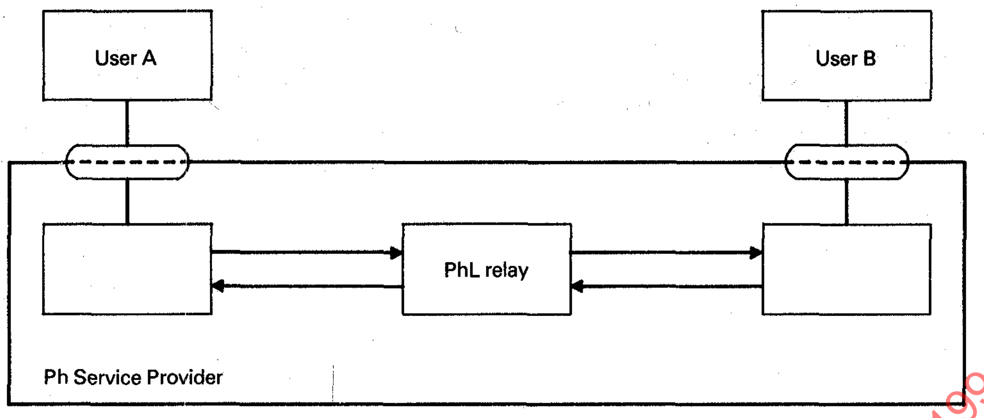


Figure 2 — Simple model of a PhC relayed within PhS Provider

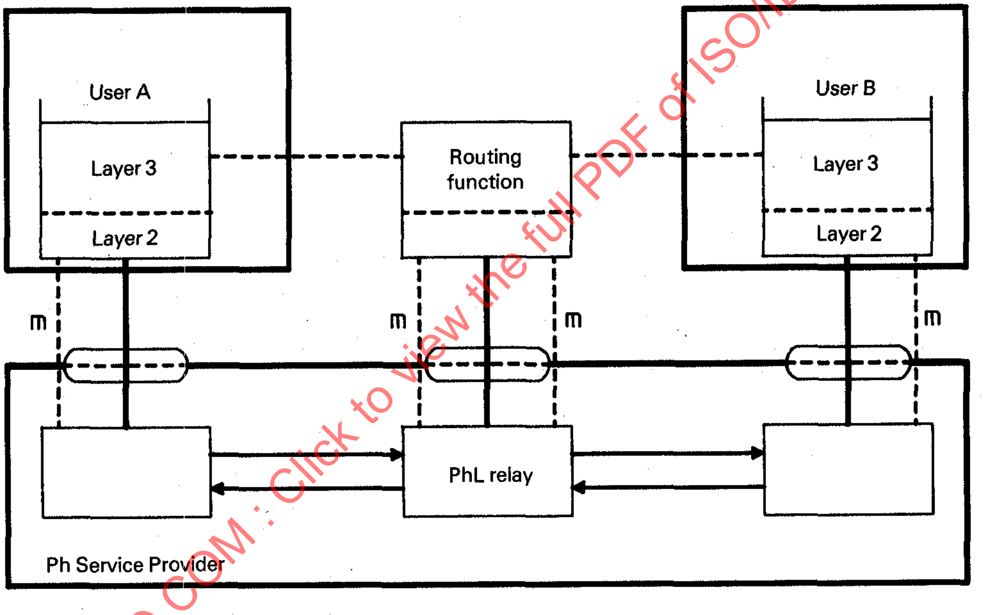


Figure 3 — Simplified model of a PhC relayed with control from the Network Layer

1.10 Quality of Physical Service

The term "Quality of Service" (QOS) refers to certain characteristics of a PhC as observed between the connection endpoints. QOS describes aspects of a PhC that are attributable solely to the PhS provider; it can only be properly determined in the absence of PhS user behaviour (which is beyond the control of the PhS provider) that specifically constrains or impairs the performance of the Physical Service.

The PhS users have knowledge of the relevant QOS of the PhC. This is true even in the case of a PhC spanning several physical circuits.

The Quality of Service of a PhC is dependent on the physical media of interconnection. It may be characterized by

a) service availability;

b) error rate, where errors may arise from alteration, loss, creation and other causes;

c) throughput;

d) transit delay;

e) protection (e.g. through encryption).

QOS is described in terms of QOS parameters. These parameters are selected and determined by methods other than Physical Service primitives, although they may be determined in some cases through layer management primitives.

There is no guarantee that the originally agreed upon QOS values will be maintained throughout the lifetime of the PhC. The PhS user should be aware that a change in QOS is not explicitly signalled in the Physical Service, although in some cases it may be signalled through layer management primitives.

Section 2: Definition of the primitives

2.1 Sequence of primitives

This clause defines the constraints on the sequences in which the primitives defined in clause 2.2 to clause 2.4 may occur. The constraints determine the order in which primitives occur, but do not fully specify when they may occur. Table 1 is a summary of the PhS primitives and their parameters, and defines the phases in which they occur (Activation, Data Transfer, and Deactivation).

2.1.1 Relation of primitives at the two PhC Endpoints

A primitive issued at one PhC endpoint will, in general, have consequences at the other PhC endpoint. The relations of primitives of each type to primitives at the other PhC endpoint are defined in the appropriate subclause in clause 2.2 to clause 2.4; these relations are summarized in the diagrams in figure 4. Additional sequences and relationships are for further study.

2.1.2 Sequence of primitives at one PhC Endpoint

The recognized sequence of primitives at PhC endpoints is defined in the composite state transition diagram, figure 5. Specific primitive sequences that apply to individual modes of operation and topologies are shown in figure 6 to figure 14.

Table 1 — Summary of Physical Service primitives and parameters

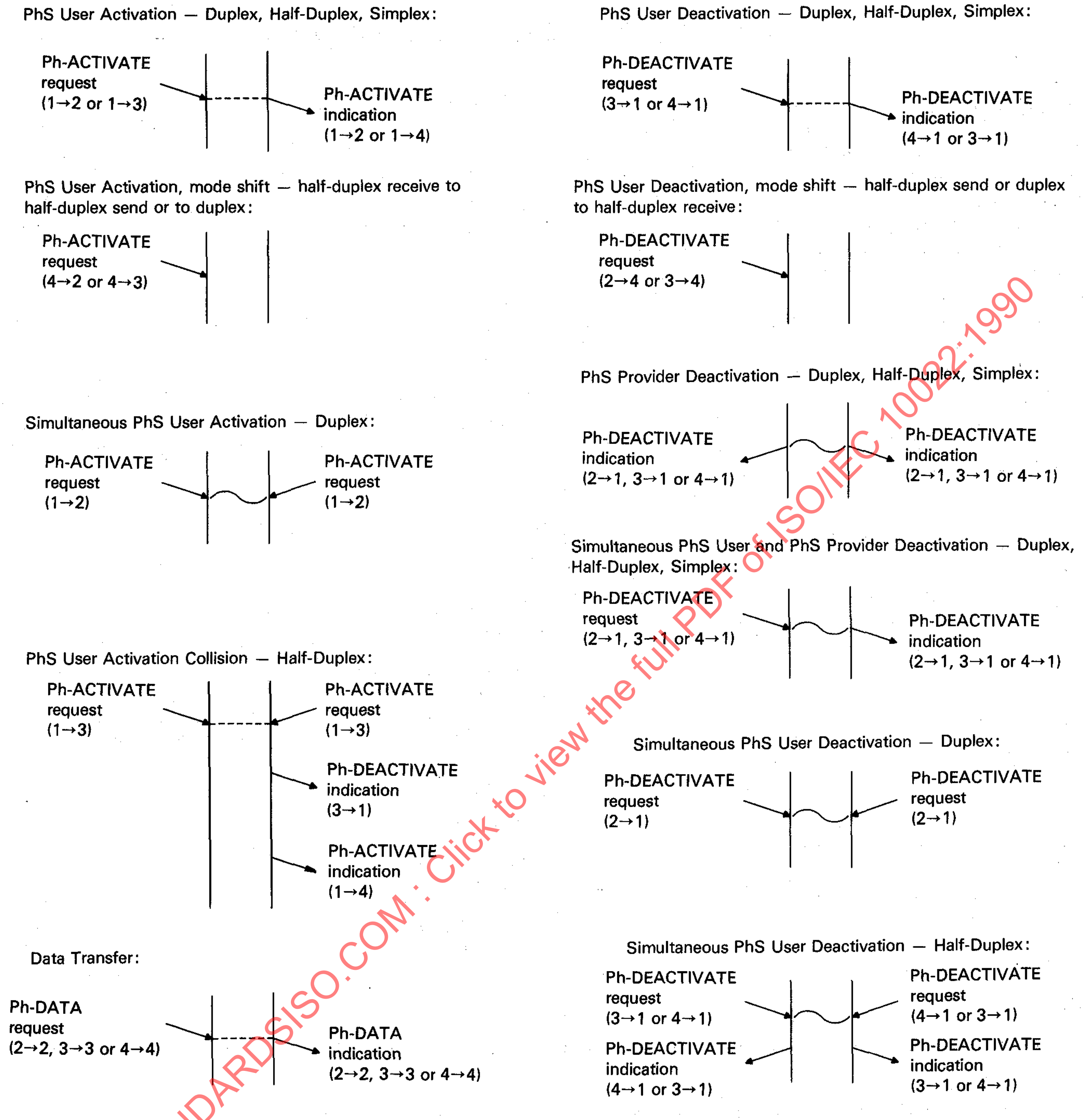
Phase	Service	Primitive	Parameters
PhC Activation (see note 1)	PhC Activation	Ph-ACTIVATE request	(see note 2)
		Ph-ACTIVATE indication	
Data Transfer	Data Transfer	Ph-DATA request	PhS — User Data
		Ph-DATA indication	
PhC Deactivation (see note 1)	PhC Deactivation	Ph-DEACTIVATE request	(see note 3)
		Ph-DEACTIVATE indication	

NOTES

1 The PhC Activation and PhC Deactivation services are optional and need not apply for duplex or simplex transmission.

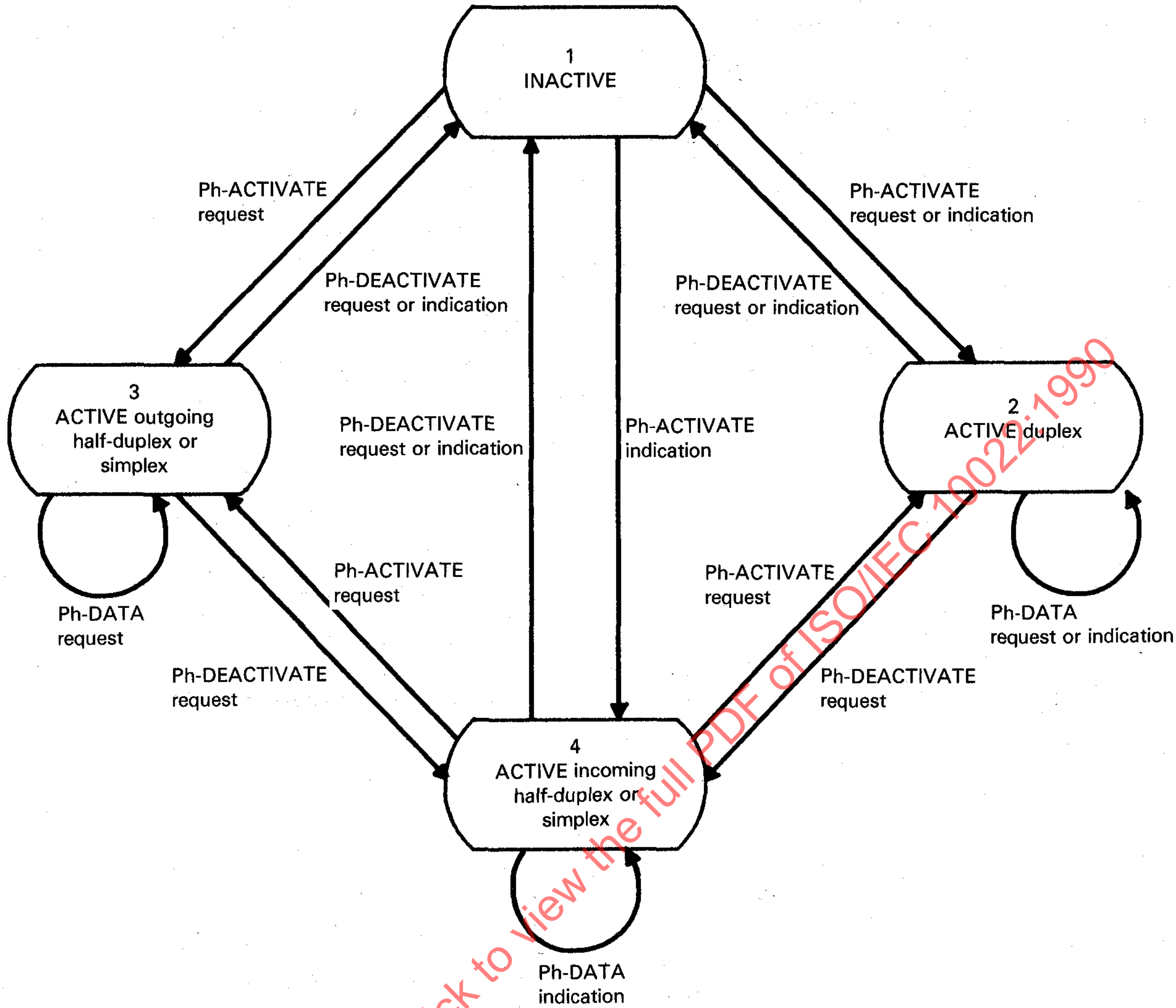
2 Parameters associated with the classes of service (see clause 1.8) are for further study.

3 Parameters associated with PhC Deactivation are for further study.



NOTE — Figures in parentheses refer to the applicable transitions between the states indicated in figure 5 for the related PhC Endpoint.

Figure 4 — Summary of Physical Service Primitive time sequence diagrams



NOTE — The parameters associated with the Activation and Deactivation primitives (which are for further study) will differentiate the constituent elements of this composite diagram such that the particular state transition sequences in figures 6 to 14 (only one of which need be provided) are distinguished. The detailed relationship between these distinctions and those in clause 1.8 is also for further study.

Figure 5 — Composite state transition diagram for sequences of primitives at a PhC Endpoint

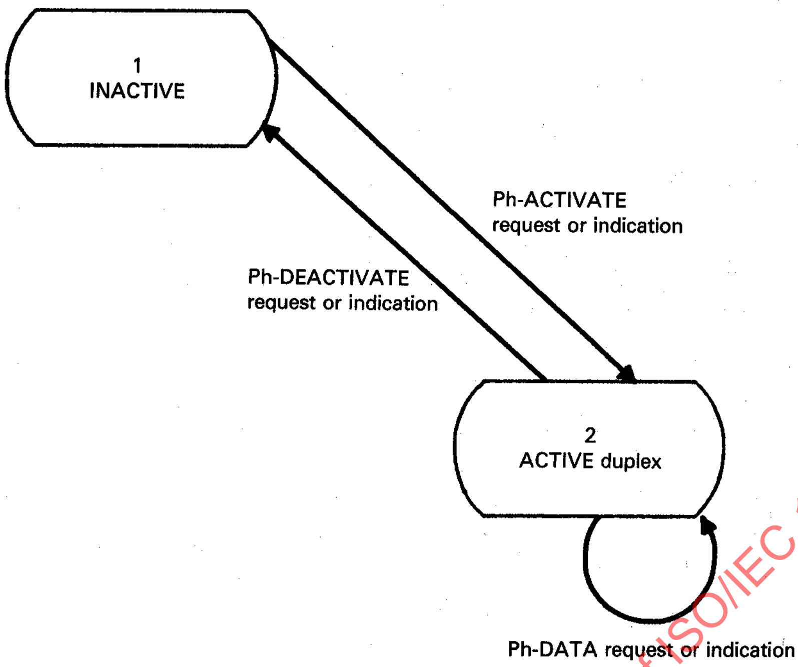


Figure 6 — State transition diagram for Duplex Mode with Activation/Deactivation

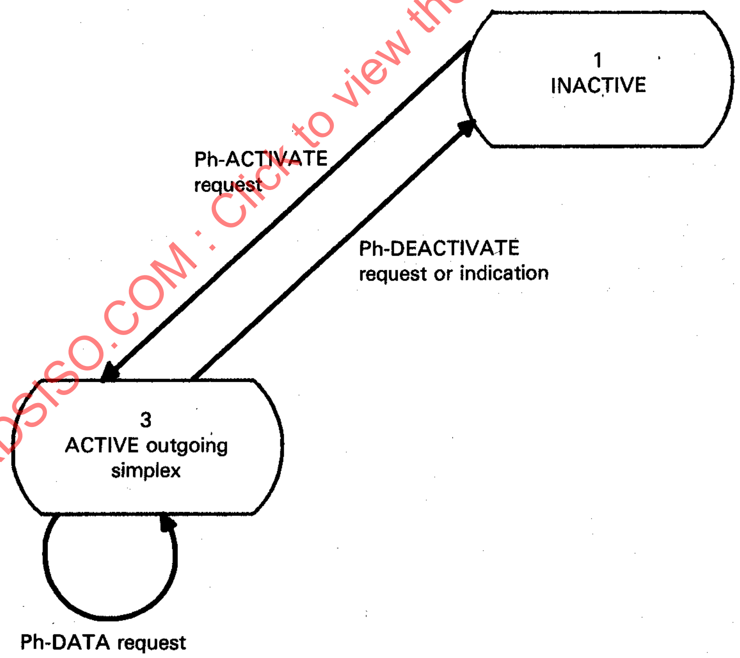


Figure 7 — State transition diagram for Simplex Mode, Outgoing

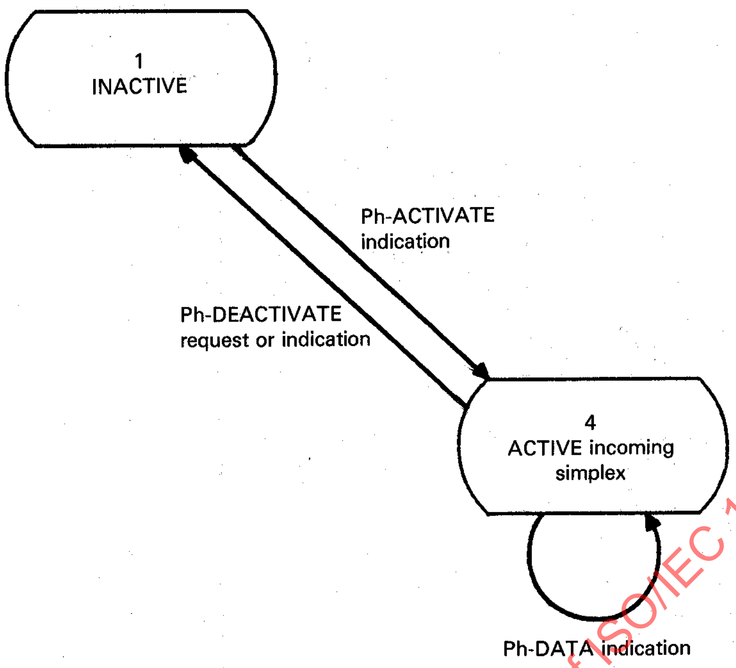


Figure 8 — State transition diagram for Simplex Mode, Incoming

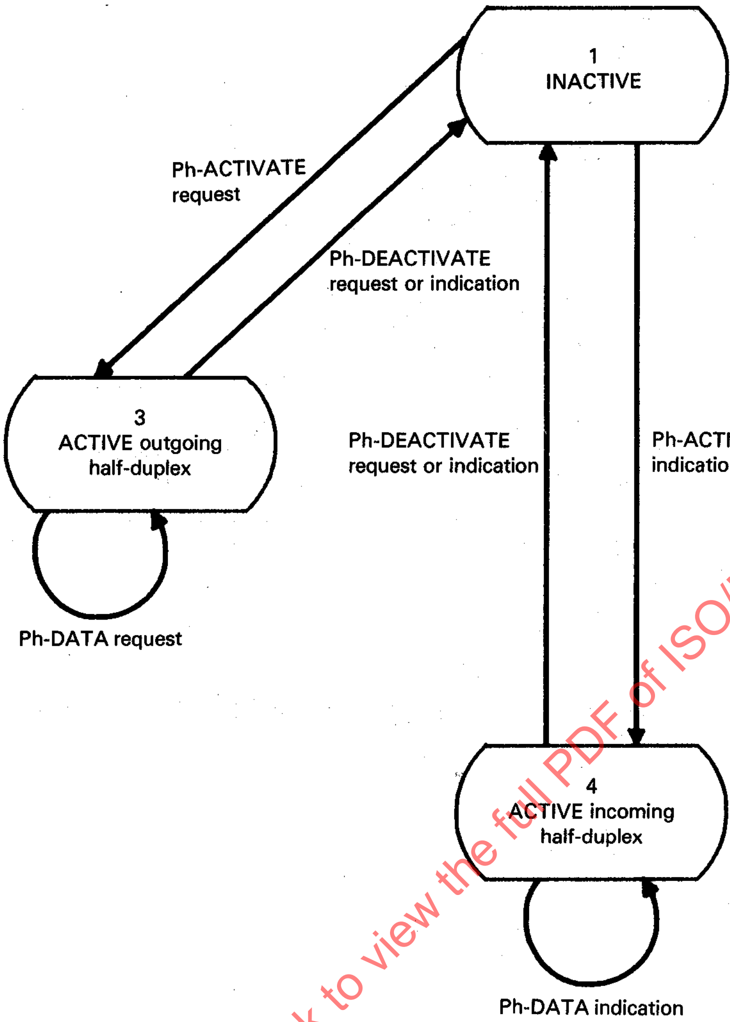


Figure 9 — State transition diagram for Half-Duplex Mode

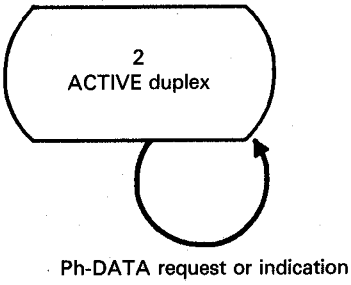


Figure 10 — State transition diagram for Duplex Mode, Data Transfer Phase only

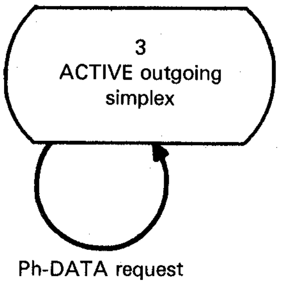


Figure 11 — State transition diagram for Simplex Mode, Outgoing, Data Transfer Phase only

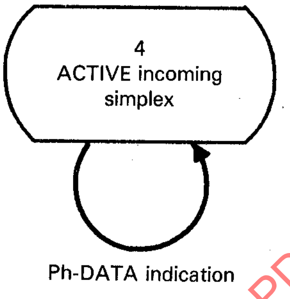


Figure 12 — State transition diagram for Simplex Mode, Incoming, Data Transfer Phase only

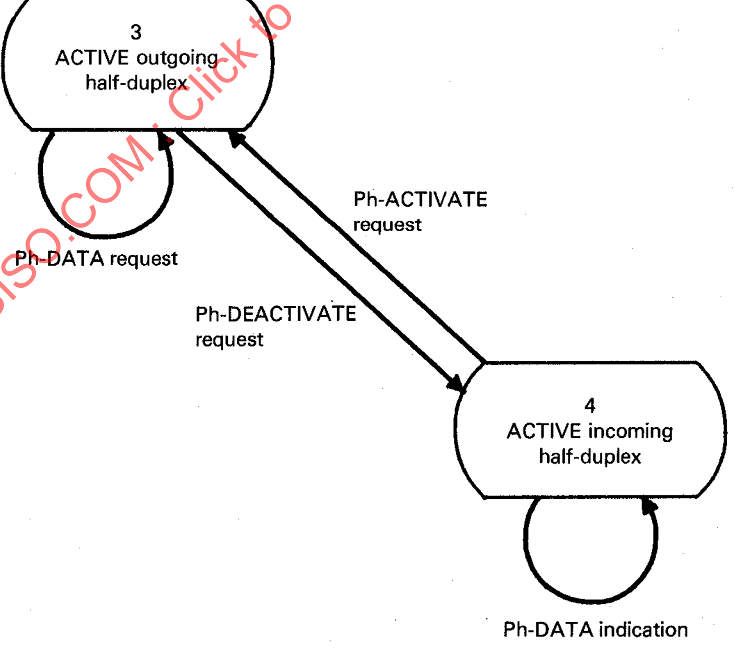


Figure 13 — State transition diagram for Half-Duplex Mode without Inactive State

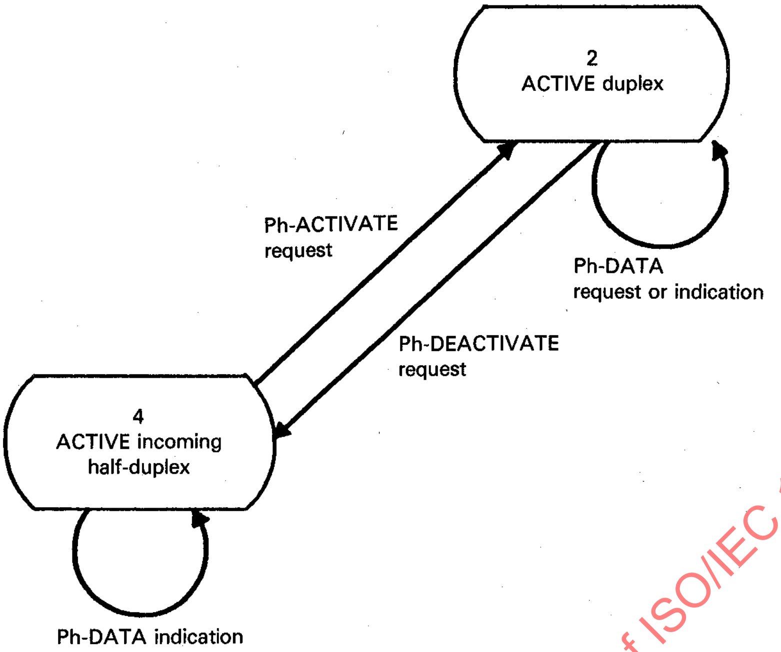


Figure 14 — State transition diagram for Half-Duplex/Duplex Mode Shift

2.2 PhC activation phase

2.2.1 Function

The PhC activation service primitives are used for activating directions of PhPDU transmission. They are required for half-duplex and are optional for duplex and simplex. The Ph-ACTIVATE request primitive requests activation of the PhC. Each direction of transmission is activated independently for half-duplex operation, and both directions of transmission are activated for duplex operation. For half-duplex and simplex operation, the Ph-ACTIVATE request primitive activates the outgoing direction of transmission, and the Ph-ACTIVATE indication primitive indicates activation of the incoming direction of transmission. During half-duplex operation, a Ph-ACTIVATE request cannot be issued by the PhS user after receipt of the Ph-ACTIVATE indication and before the receipt of a Ph-DEACTIVATE indication primitive.

2.2.2 Types of primitives and parameters

The PhC activation service involves two primitives as shown in table 2. The parameters in the table are for further study.

2.2.3 Sequence of primitives

The sequence of primitives in a successful activation of a direction of transmission is defined by the time sequence diagram in figure 15.

Table 2 — Physical Service Activate primitives and parameters

Parameter	Primitive	
	Ph-ACTIVATE request	Ph-ACTIVATE indication
(see note)		

NOTE — Parameters associated with the classes of service (see clause 1.8) are for further study.

2.3 PhC deactivation phase

2.3.1 Function

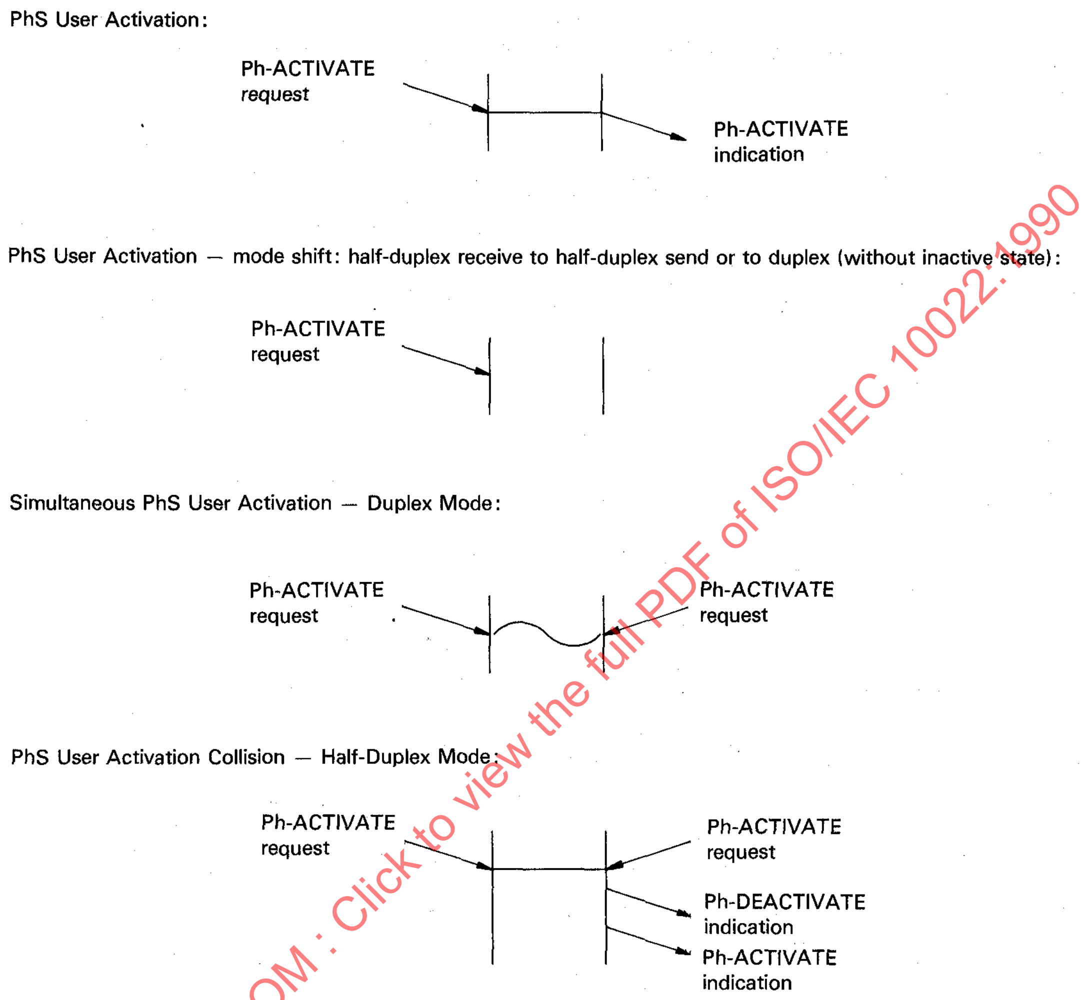
The PhC deactivation service primitives are used for deactivating directions of PhPDU transmission. They are required for half-duplex and are optional for duplex and simplex. The Ph-DEACTIVATE request primitive requests deactivation of the PhC. Each direction of transmission is deactivated independently for half-duplex operation, and both directions of transmission are deactivated for duplex operation. For half-duplex and simplex operation, the Ph-DEACTIVATE request primitive deactivates the outgoing direction of transmission, and the Ph-DEACTIVATE indication primitive indicates deactivation of the incoming direction of transmission. During half-duplex operation, a Ph-ACTIVATE request primitive can be issued by a PhS user after receipt of the Ph-DEACTIVATE indication primitive.

2.3.2 Types of primitives and parameters

The PhC deactivation service involves two primitives as shown in table 3.

2.3.3 Sequence of primitives

The sequence of primitives for deactivation are expressed in the time sequence diagrams in figure 16.



NOTE — There is no indication to the PhS user, who issued the ACTIVATE request, when the PhS provider is unable to activate the direction of transmission.

Figure 15 — Sequence of primitives for Activation