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1. INTRODUCTION

1.1 General. The Signalling Connection Control Part (SCCP) provides additional functions to the Message Transfer Part (MTP) to cater to both connectionless as well as connection-oriented network services to transfer circuit related and non-circuit related signalling information and other types of information between exchanges and specialized centers in telecommunication networks (e.g., for management and maintenance purposes) via a Signalling System No. 7 network.

A functional block situated above the Message Transfer Part, the latter being described in Recommendations Q.701 through Q.707, performs the functions and procedures of the SCCP. Thus the Message Transfer Part remains unchanged (Figure 1/Q.711). The combination of the MTP and the SCCP is called the "Network Service Part."

The Network Service Part meets the requirements for Layer 3 services as defined in the OSI-Reference Model, Recommendation X.200.

1.2 Objectives. The overall objectives of the Signalling Connection Control Part are to provide the means for

a. logical signalling connections within the Common Channel Signalling Network, and

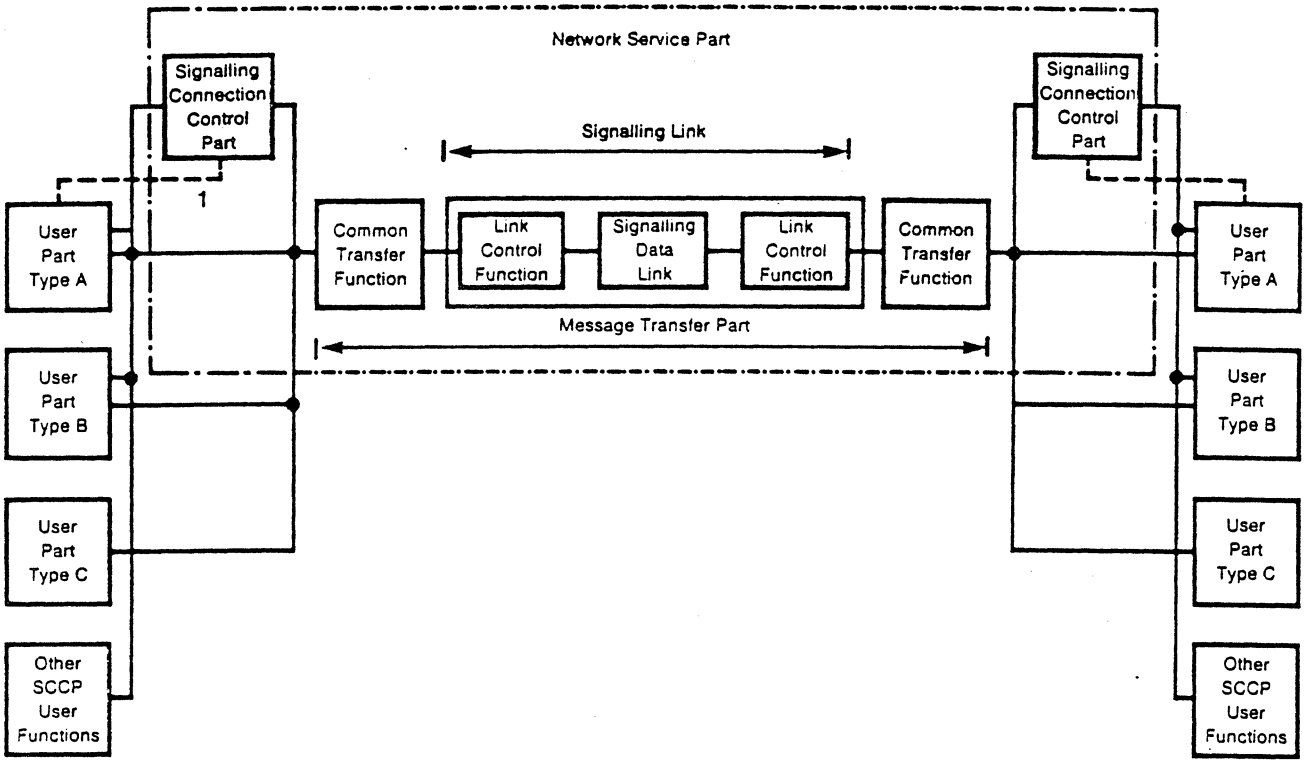
b. a transfer capability for Signalling Data Units with or without the use of logical signalling connections.

The Network Services are employed by users like the Operation, Administration and Maintenance Application as defined in the Recommendation Q.795.

Functions of the SCCP are used for the transfer of circuit related and non-circuit related signalling information of the ISDN-User Part with or without setup of end-to-end signalling connections. These functions are described in Recommendations Q.714 and Q.764. Figure 1/Q.711 illustrates the embedding of the SCCP within the common channel signalling system.

An asterisk '*' indicates a change from the CCITT Red Book, Vol. VI, that is specific to U.S. Networks.

A bar '|' indicates a change from Issue 1 of Bell Communications Research Specification of Signalling System Number 7, Vol. 1 and 2.



Note - The ISDN-UP, as defined in Recommendation series Q.76x, is a User Part Type A.

1 = Functional interface.

Figure 1/Q.711. Functional diagram for the common channel signalling system

1.3 General characteristics.

1.3.1 Technique of description. The Signalling Connection Control Part (SCCP) is described in terms of

- services provided by the SCCP
- services assumed from the MTP, and
- functions of the SCCP

The functions of the SCCP are performed by the SCCP-protocol between two systems that provide the NSP-service to the upper layers.

The service interfaces to the upper layers and to the MTP are described by primitives and parameters recommended in Recommendation X.200. Figure 2/Q.711 illustrates the relationship between the SCCP protocol and the adjacent services.

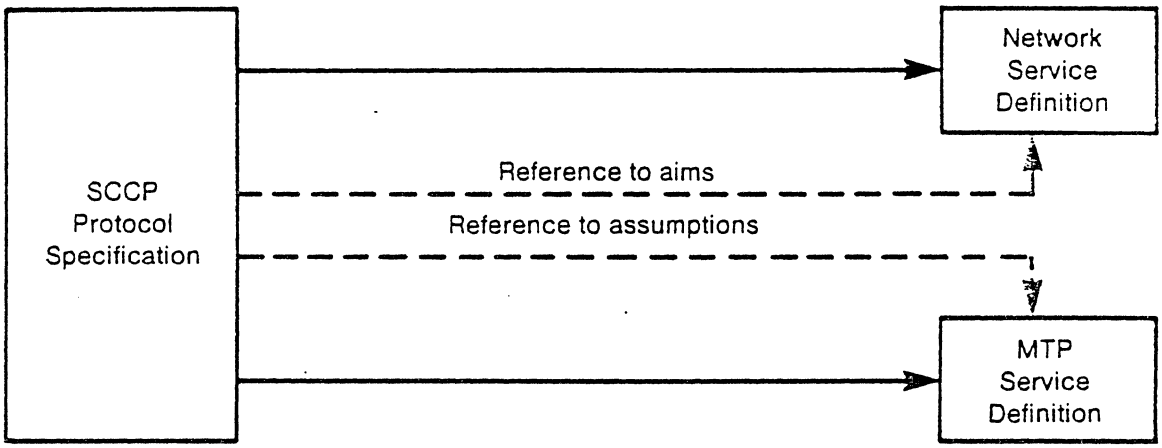


Figure 2/Q.711. Relationship between the SCCP protocol and adjacent services

1.3.2 Primitives. Primitives consist of commands and their respective responses associated with the services requested of the SCCP and of the MTP, see figure 3/Q.711. The general syntax of a primitive is shown below:

X	Generic Name	Specific Name	Parameter

- "X" designates the functional block providing the service ("MTP" for MTP, "N" for NSP)
- "Generic Name" describes the action that should be performed by the address layer.
- "Specific Name" indicates the direction of the primitive flow.
- "Parameters" are the elements of information elements that are to be transmitted between layers.

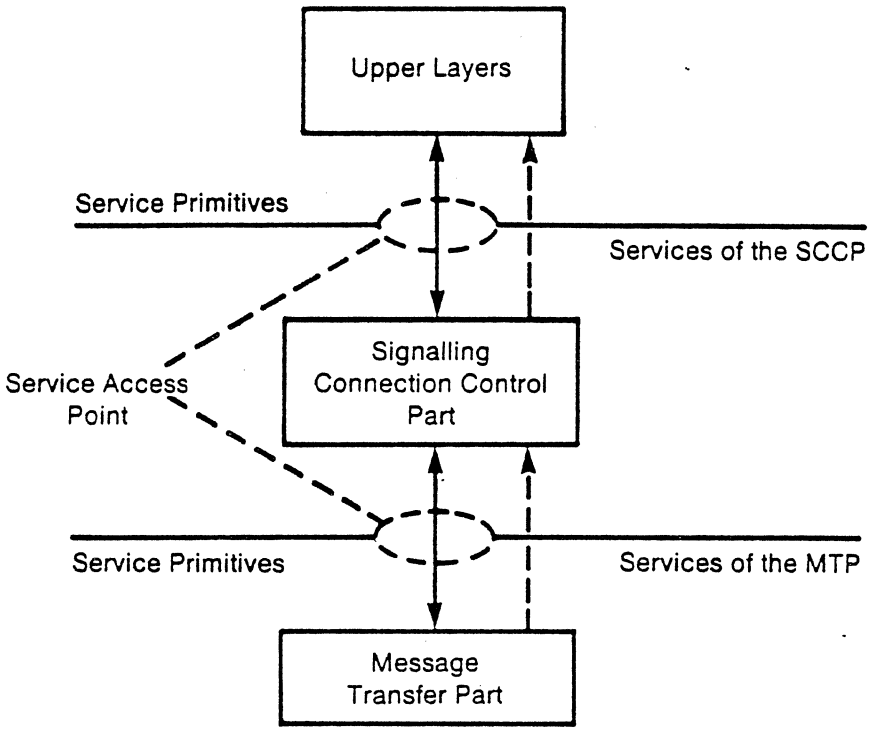


Figure 3/Q.711. Service primitives

Four Specific Names exist in general (Fig. 4/Q.711)

- Request,
- Indication,
- Response, and
- Confirmation.

Not all Generic Names are associated with all four Specific Names.

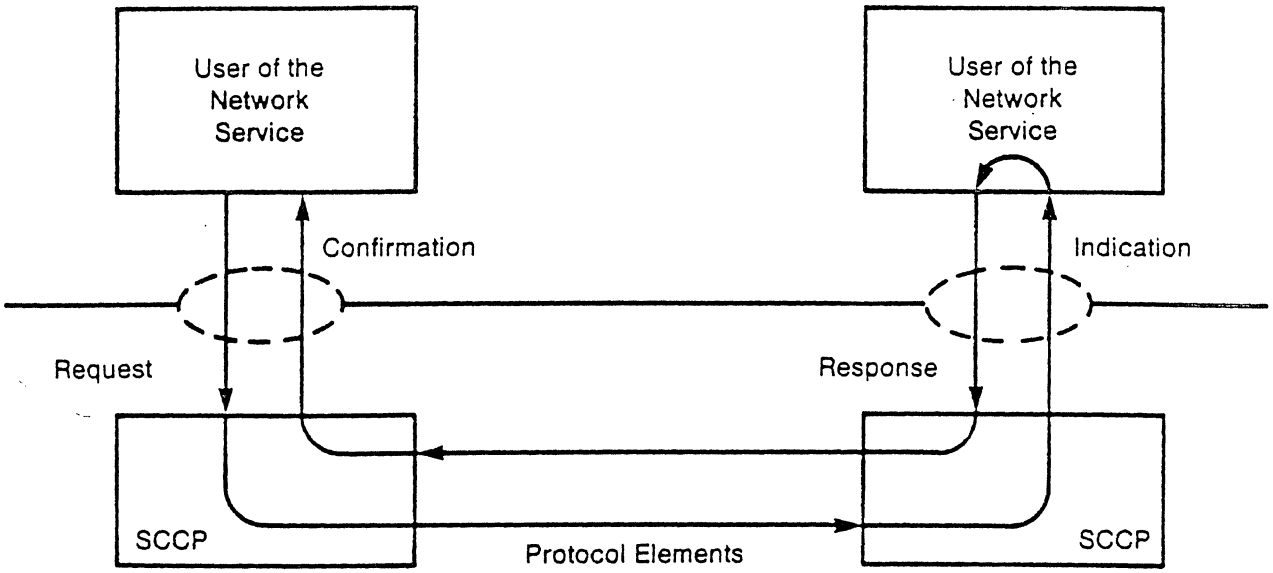


Figure 4/Q.711. Specific names of service primitives

1.3.3 Peer to peer communication. Exchange of information between two peers of the SCCP is performed by means of a protocol. The protocol is a set of rules and formats by which the control information (and user data) is exchanged between the two peers. The protocol caters for:

- the establishment of logical signalling connections,
- the release of logical signalling connections, and
- the transfer of data with or without logical signalling connections.

A signalling connection is modeled in the abstract by a pair of queues. The protocol elements are objects on that queue added by the origination service user and removed by the destination service user. Each queue represents a flow control function. Figure 5/Q.711 illustrates the modes described above. (Model for the connectionless service is for further study.)

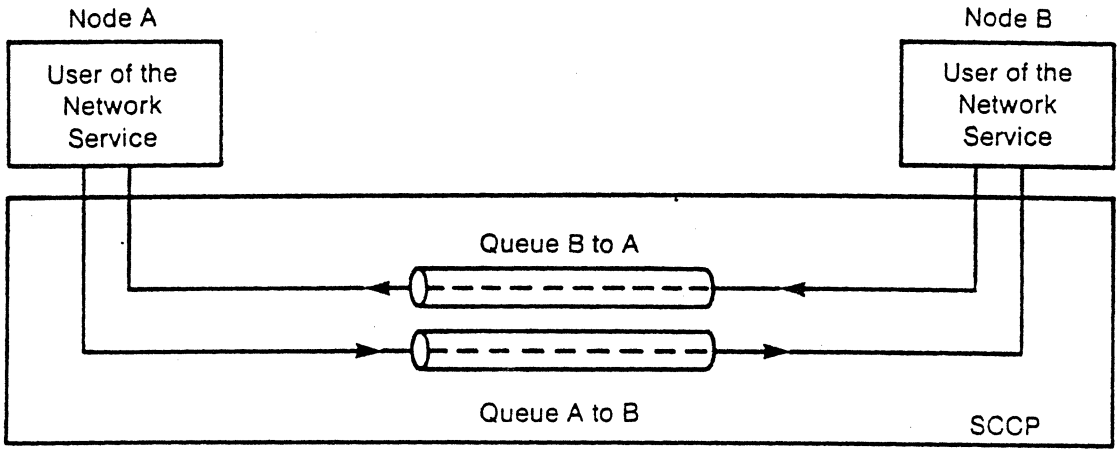


Figure 5/Q.711. Model for the internode communication with the SCCP (Connection oriented service)

1.3.4 Contents of the Recommendation Series Q.711-Q.714. Recommendation Q.711 contains a general description of the services provided by the MTP, the services provided by the SCCP and the functions within the SCCP.

Recommendation Q.712 defines the set of protocol elements and their embedding into messages.

Recommendation Q.713 describes the formats and codes used for the SCCP messages.

Recommendation Q.714 is a detailed description of the SCCP procedures as a protocol specification.

2. SERVICES PROVIDED BY THE SCCP

The overall set of services is grouped into

- connection-oriented services
- connectionless services

Five classes of service are provided by the SCCP protocol, two for connectionless services and three for connection-oriented services.

2.1 Outline of removed text - connection-oriented services. The current implementation of the SCCP provides for connectionless service only, using protocol classes 0 and 1. Thus, the text pertaining to connection-oriented procedures and protocol classes 2, 3, and 4 has been removed. In order to put the text provided at this time into perspective, an outline is given below which lists sections which have been temporarily removed. *

2.2 Connectionless services. The SCCP provides the service user with the ability to transfer signalling messages via the signalling network without setup of a signalling connection. In addition to the MTP-capability "Routing," a function must be provided within the SCCP which maps the called address to the Signalling Point Codes of the MTP-Service.

This mapping function may be provided within each node, or might be distributed over the network, or could be provided in some special translation centers.

2.2.1 Description. There are two possibilities for transferring data without a connection setup, with regard to the sequence control mechanisms provided by the MTP.

a. The MTP guarantees (to a high degree of probability) an in-sequence delivery of messages that contain the same Signalling Link Selection (SLS) code. The NSP-user can demand this MTP-service by allocating a parameter "sequence control" into the primitive to the SCCP. The SCCP will put the same SLS-code into the primitive to the MTP for all primitives from the SCCP user with the same "sequence control parameter".

b. If the in-sequence delivery is not required, the SCCP can insert SLS codes randomly or with respect to appropriate load sharing within the signalling network.

2.2.2 Primitives and parameters of the connectionless service. The text of Section 2.2.2 in CCITT Recommendation Q.711 relating to the primitives and parameters of the connectionless service has been removed and replaced with the following sections. *

2.2.2.1 Overview. Table 8/Q.711 gives an overview of the primitives to the upper layers and the corresponding parameters for the connectionless service. *

Primitives		
Generic Name	Specific Name	
N-UNITDATA	Request Indication	Called Address Calling Address Sequence control 1) Return option User data
N-NOTICE	Indication	Called Address Calling Address Reason for return User data
N-COORD	Request Indication Response Confirmation	Called Address Calling Address
N-STATE	Request Indication	User status Affected user Subsystem multiplicity
N-TRAFFIC	Indication	Traffic mix Affected user

1) Note: An integration of the parameter Sequence Control into the Quality of Service parameter set is for further study.

Figure 8/Q.711. Primitives and parameters of the connectionless service

2.2.2.2 Parameters.

2.2.2.2.1 Address. The parameters "Called Address" and "Calling Address" serve to identify the destination and origination, respectively of the connectionless message. These parameters may contain some combination of global titles, subsystem numbers, and Signalling Point Codes.

2.2.2.2.2 Sequence control. The parameter "sequence control" indicates to the SCCP whether the user wishes the service "sequence guaranteed" or the service "sequence not guaranteed". That is an indication to the SCCP that a given stream of messages has to be delivered in sequence by making use of the features of the MTP. The user should choose the "sequence control" parameter in such a way that an even distribution of SLS codes will result.

2.2.2.2.3 Return option. The parameter "return option" parameter is used to determine the handling of messages encountering transport problems.

"Return option" may assume the following values:

- discard message on error, or
- return message on error.

2.2.2.2.4 Reason for return. The parameter "reason for return" identifies the reason why a message was not able to be delivered to its final destination.

"Reason for return" may assume the following values:

- no translation for an address of such nature,

- no translation for such address,
- network congestion,
- network failure,
- unequipped user,
- subsystem congestion, and
- subsystem failure.

2.2.2.2.5 Affected user. The parameter "affected user" identifies an affected (i.e., failed, withdrawn, congested, or allowed) user. The "affected user" parameter contains the same type of information as the "called address" and "calling address".

2.2.2.2.6 User status. The parameter "user status" is used to inform a user of the status of its replicates.

"User status" may assume the following values:

- User-in-service, or
- User-out-of-service

2.2.2.2.7 Traffic mix. The parameter "traffic mix" is used to inform a user what traffic pattern it is receiving.

"Traffic mix" may assume the following values:

- All-primary/No-backup,
- All-primary/Some-backup,
- All-primary/All-backup,
- Some-primary/No-backup,
- Some-primary/Some-backup, and
- No-primary/No-backup.

2.2.2.2.8 Subsystem Multiplicity Indicator. The parameter "subsystem multiplicity indicator" identifies the number of replications of a subsystem.

2.2.2.2.9 User data. The parameter "user data" is information which is to be transferred transparently between SCCP users.

2.2.2.3 Primitives.

2.2.2.3.1 UNITDATA. The "N-UNITDATA request" primitive is the means by which an SCCP user requests the SCCP to transport data to another user.

The "N-UNITDATA indication" primitive informs a user that data is being delivered to it from the SCCP.

Parameter	Primitive	
	N-UNITDATA request	N-UNITDATA indication
Called Address	X	X
Calling Address	X	X
Sequence control	X	
Return option	X	
User data	X	X

TABLE 8a/Q.711. Parameters of the primitive UNITDATA

2.2.2.3.2 NOTICE. The "N-NOTICE indication" primitive is the means by which the SCCP returns a message which could not reach the final destination to the originating user.

Parameter	Primitive
	N-NOTICE indication
Reason for return	X
User data	X
Called Address	X
Calling Address	X

TABLE 8b/Q.711. Parameters of the primitive NOTICE

2.2.2.3.3 COORD. The "N-COORD" primitive is used by replicated subsystems to coordinate the withdrawal of one of the subsystems.

The primitive exists as: a "request" when the originating user is requesting permission to go out of service; an "indication" when the request to go out of service is delivered to the originator's replicate; a "response" when the originator's replicate announces it has sufficient resources to let the originator go out of service; and as a "confirmation" when the originator is informed that it may go out of service.

Parameter	Primitive			
	N-COORD request	N-COORD indication	N-COORD response	N-COORD confirmation
Called Address	X	X	X	X
Calling Address	X	X	X	X

TABLE 8c/Q.711. Parameters of the primitive COORD

2.2.2.3.4 STATE. The "N-STATE request" is used to inform SCCP Management about the status of the originating user. The "N-STATE indication" primitive is used to inform a user about the status of the affected user.

Parameter	Primitive	
	N-STATE request	N-STATE indication
User status	X	X
Affected user	X	X
Subsystem multiplicity		X

TABLE 8d/Q.711. Parameters of the primitive N-STATE

2.2.2.3.5 TRAFFIC. The "N-TRAFFIC indication" primitive is used to inform a local user what traffic pattern it is receiving.

Parameter	Primitive
	N-TRAFFIC indication
Traffic mix	X
Affected user	X

TABLE 8e/Q.711. Parameters of the primitive TRAFFIC

3. SERVICES ASSUMED FROM THE MTP

3.1 Description. This paragraph describes the functional interface offered by the MTP to the upper layer functions, i.e, the SCCP and the User Parts. In order to align the terminology with the OSI-Model, the description uses the terms "*primitives*" and "*parameters*".

3.2 Primitives and parameters. The primitives and parameters are shown in Table 9/Q.711.

Primitives		Parameters
Generic Name	Specific Name	
MTP-TRANSFER	Request Indication	OPC DPC SLS SIO User Data
MTP-PAUSE	Indication	Affected DPC
MTP-RESUME	Indication	Affected DPC
MTP-STATUS	Indication	Congestion Level Affected DPC

TABLE 9/Q.711. Message transfer part service primitives

3.2.1 Transfer request/indication. In Figure 23/Q.704 the interface signals between Level 3 (SMH) and Level 4 are shown. These are

- MTP-TRANSFER request, and
- MTP-TRANSFER indication.

3.2.2 MTP-Pause/MTP Resume/MTP Status. The primitive "PAUSE" indicates to the SCCP the inability * | to provide the MTP-service for a certain destination. The primitive "RESUME" indicates recovery from that | status.

The primitive "STATUS" indicates that the congestion status of the signalling route to the indicated * destination has changed and the current value is as indicated.

4. FUNCTIONS PROVIDED BY THE SCCP

This chapter is an overview of the functional blocks within the SCCP.

4.1 Outline of removed text - connection-oriented functions. The current implementation of the SCCP * provides for connectionless service only, using protocol classes 0 and 1. Thus, the text pertaining to * connection-oriented procedures and protocol classes 2,3, and 4 has been removed. In order to put the text * provided at this time into perspective, an outline is given below which lists sections that have been * temporarily removed. *

4.1	Connection-oriented functions	*
4.1.1	Functions for temporary signalling connections	*
4.1.1.2	Data transfer phase function	*
4.1.1.3	Release phase functions	*
4.1.2	Functions for permanent signalling connections	*
4.1.2.1	Connection establishment phase and connection release phase functions	* *
4.1.2.2	Data transfer phase functions	*

4.2 Connectionless service functions. The functions of the connectionless service listed below:

- mapping the network address to signalling relations,
- segmenting (for further study), and
- sequence service classification.

Glossary

1. Definitions

- *Application*
  The set of a user's requirements.
- *Address*
  A name that indicates the source or destination (in the sense of current location) of an intended instance of communication.
- *Global Title*
  An address such as dialed digits which does not explicitly contain information that would allow routing in the signalling network, i.e., the translation function is required.
- *Sub-system Number*
  A number to identify a SCCP user in the SCCP, like the ISDN user part.
- *Called/Calling Party Address*
  Addresses within SCCP messages. They may consist of one or any combination of the following elements:
  - Signalling Point Code,
  - Global Title, and/or
  - Sub-system Number.
- *Layer service elements*
  An indivisible component of the layer service made divisible to the service user via layer service primitives.
- *Layer service primitives*
  Layer service primitives are a means for specifying in detail the adjacent layer interactions.
- *Peer entities*
  Entities in the same layer but in different systems (nodes) which must exchange information to achieve a common objective.
- *Peer protocol*
  A formal language used by peer entities to exchange user data.
- *Function*
  A logical object that accepts one or more inputs (arguments) and produces a single output (value) uniquely determined by the combination of the inputs and the formal specification of the function.
- *(N) Entity*
  A set of functions invoked by a given layer for an instance of intersystems communication in which that system is involved. An entity may be partitioned into several sub-entities. For each instance of intersystems communications, the set of functions invoked will be a part or all of the functional capability of the given system within the layer in accordance with the functionality required for that instance of inter-system communication.
- *Layer*
  A group of one or more entities contained within an upper and lower logical boundary. Layer N has boundaries to the layer N+1 and to the layer N-1.
- *Layer interface*
  The boundary between two adjacent layers in the Model.

- *Layer service*
  A capability of the (N) layer and the layers beneath it, which is provided to (N+1) entities at the boundary between the (N) layer and the (N+1) layer.
- *Local Reference*
  A number unambiguously identifying — locally within one SCCP entity — an SCCP-connection.
- *User functions*
  Functional entities which use the services of the SCCP.
- *Connection Identity*
  A number that unambiguously identifies unambiguously a certain connection at the interface between the SCCP and a user function.
- *Connection Section*
  A section of an SCCP connection between the endpoint and such type of intermediate point where a coupling has to be provided between two adjacent sections.
- *Class of service*
  A set of services provided by the SCCP and offered to the user of the SCCP. Five classes are provided by the SCCP, two of them connectionless and three of them connection oriented. The five classes are:

  0: basic connectionless class,
  1: sequenced (MTP) connectionless class,
  2: basic connection-oriented class,
  3: flow control connection-oriented class, and
  4: error recovery and flow control connection-oriented class.

2. Relationship among the terms Layer, Entity, Layer Service, Layer Boundary, Layer Service Primitive and Peer Protocol

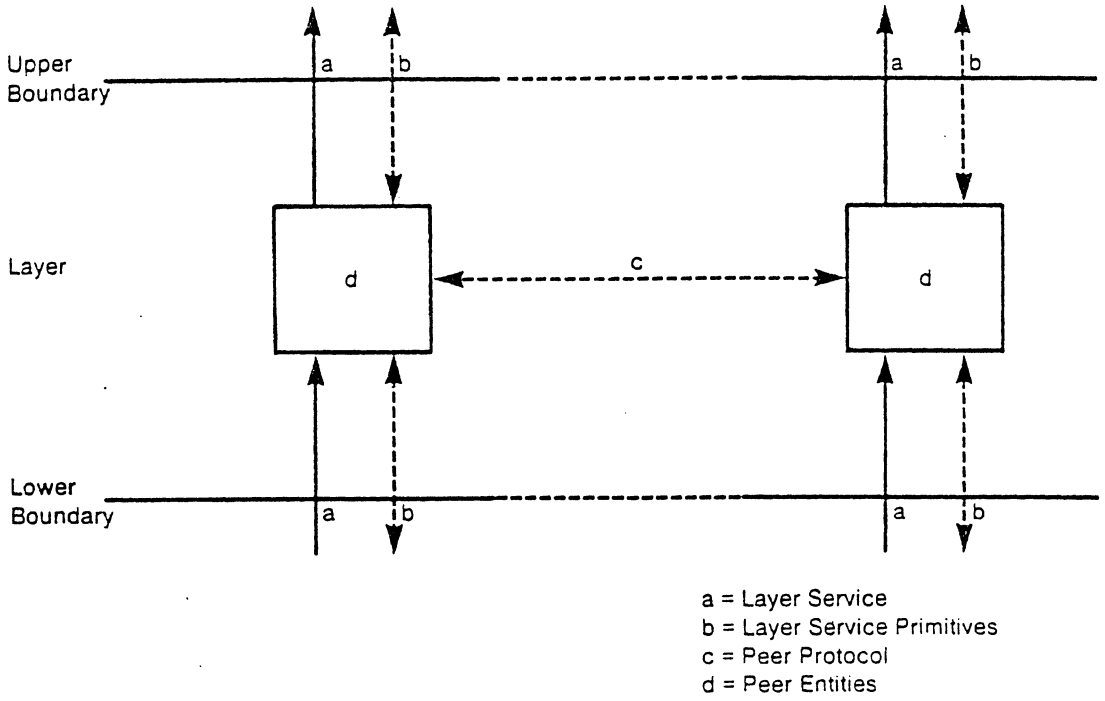


Figure A1/Q.711. Relationships

The basic purpose of a given layer is to offer a service (i.e., the layer service) to the layer above. The (N) layer service is composed of (N) layer service elements and the cumulative result of the services of the underlying layers. These layer service elements are invoked or indicated by means of layer service primitives. There are four types of layer service primitives which constitute the interactions across the layer boundary.

These are:

a) request - a primitive issued by a service used to invoke a service element;

b) indication - a primitive issued by a service provider to advise that a service element has been invoked by the service user at the peer service access point or by the service provider;

c) response - a primitive issued by a service user to complete at a particular service access point, some service element whose invocation has been previously indicated at that service access point;

d) confirmation - a primitive issued by a service provider to complete at a particular service access point some service element previously invoked by a request at that service access point.

There may be more than one entity in the same layer in the same system. Peer protocols, however, are only employed to exchange information between entities in the same layer but in different systems. (Additional explanation for information exchange between two entities in the same layer and in one and the same system is for further study.)

he interface between two peers consists of the

col Control Information (NPCI) and the

e Data Unit (NSDU)

Protocol Control Information supports the joint operating of the SCCP-peer o nodes communicating with each other.

ervice Data Unit is a certain amount of information from the NSP-User that has ween two nodes using the service of the SCCP.

col Control Information and Network Service Data Unit are put together and age (figure A2/Q.711). If the size of user data is too big to be transferred within ta are segmented into a number of portions. Each portion is mapped to a separate f a NPCI and the Network Service Data Unit (figure A3/Q.711).

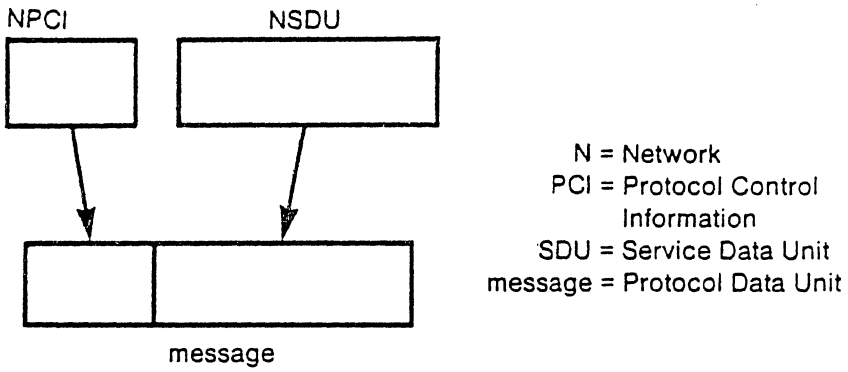


Figure A2/Q.711. Relation between NSDU and message neither Segmenting nor Blocking

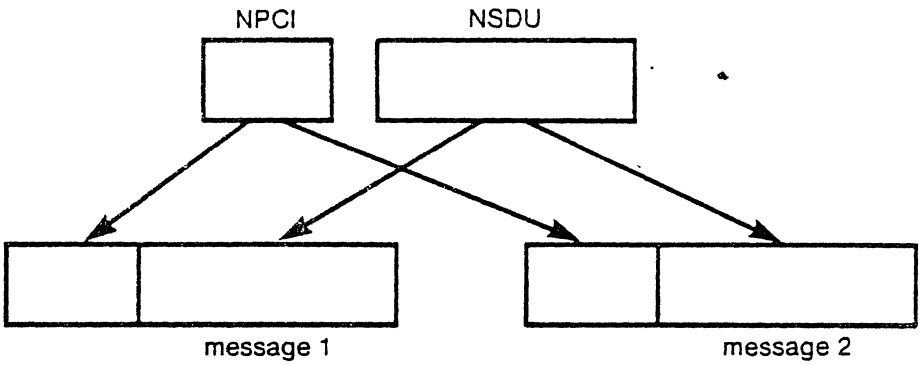


Figure A3/Q.711. Segmenting

4. Flow Control

The rate of data flow may be controlled

a. between adjacent layers (i.e., between the NSP-user and the SCCP), or

b. between the two peers.

The flow control function permits a receiving entity to limit the data flow from the sending entity.

5. Sequencing

The user of the SCCP may ask for preservation of a given sequence of SDUs. The MTP guarantees sequence integrity for messages using the same SLS-code, refer to Recommendation Q.704. Also, the SCCP provides a means for sequence integrity.

6. Acknowledgement

To achieve a higher probability of detecting a message loss than is already provided by the MTP, an acknowledgement function may be used. The receiver of the message has to inform the sender of their correct receipt. The message needs to be uniquely identifiable. This may be achieved by a numbering mechanism.

7. Reset

To recover from a loss of synchronization between two entities, a reset function has to be provided to return to a predefined state with possible loss or duplication of data.

8. Restart

Definition for further study.

9. Expedited Data

Expedited Data are transferred with priority and bypass the normal data flow. The expedited data flow is necessarily very small, so that simpler flow control may be applied.

10. Routing

This function is based on the called party address information. Depending on the type of address, the routing function has to:

- evaluate the address information,
- translate it to an address type that can be used within the common channel network,
- check the availability of the addressee, and
- check the need for an association of connection sections.

— *User functions*
Functional entities that use the services of the SCCP.

— *Connection Identity*
A number that unambiguously identifies a certain connection at the interface between the SCCP and a user function.

— *Connection Section*
A section of an SCCP connection between the end point and such type of intermediate point where a coupling has to be provided between two adjacent sections.

— *Class of service*
A set of services provided by the SCCP and offered to the user of the SCCP. Five classes are provided by the SCCP: two of them connectionless and three of them connection-oriented. The five classes are

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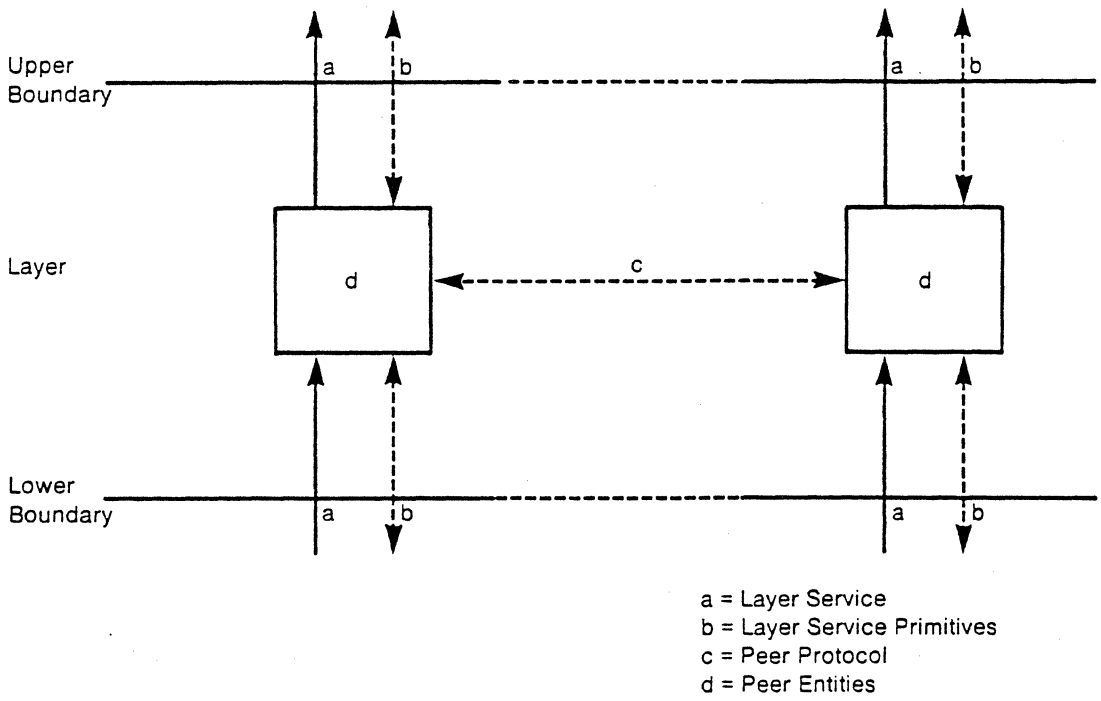

Figure A1/Q.711 - Relationships.

The basic purpose of a given layer is to offer a service (i.e., the layer service) to the layer above. The (N) layer service is composed of (N) layer service elements and the cumulative result of the services of the underlying layers. These layer service elements are invoked or indicated by means of layer service primitives. There are four types of layer service primitives which constitute the interactions across the layer boundary.

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There may be more than one entity in the same layer in the same system. Peer protocols, however, are only employed to exchange information between entities in the same layer but in different systems. (Additional explanation for information exchange between two entities in the same layer and in one and the same system is for further study.)

3. Data Transport

A message at the interface between two peers consists of the

— Network Protocol Control Information (NPCI) and the

— Network Service Data Unit (NSDU).

The Network Protocol Control Information supports the joint operating of the SCCP-peer entities within the two nodes communication with each other.

The Network Service Data Unit is a certain amount of information from the NSP-User that has to be transferred between two nodes using the service of the SCCP.

Network Protocol Control Information and Network Service Data Unit are put together and transferred as a message (figure A2/Q.711). If the size of user data is too big to be transferred within one message, user data are segmented into a number of portions. Each portion is mapped to a separate message, consisting of an NPCI and the Network Service Data Unit (figure A3/Q.711).

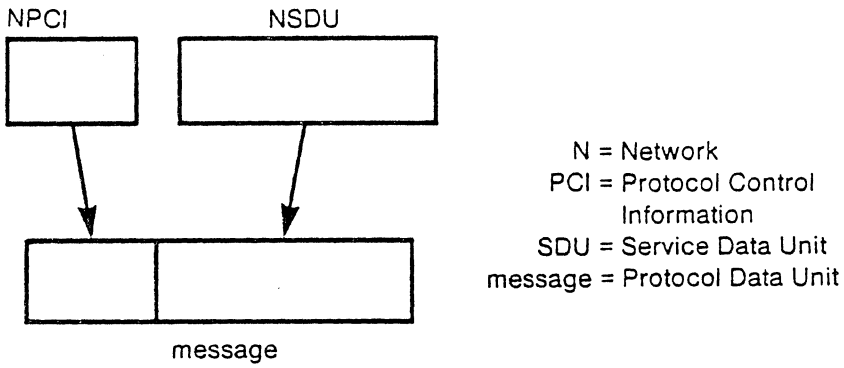

Figure A2/Q.711 - Relation between NSDU and message: neither segmenting nor blocking.

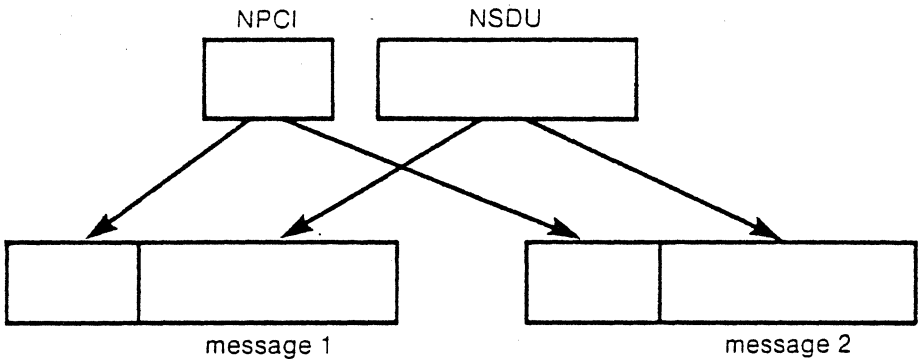

Figure A3/Q.711 - Segmenting.

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