7.3.4.2 Most of the functions required are readily implied by the services provided. Additional description is given below for the following functions:

a) session-connection to transport-connection mapping; and

b) session-connection flow control.

7.3.4.3 Session-connection to transport-connection mapping

There is a one-to-one mapping between a session-connection and a transport-connection at any given instant. However, the lifetime of a transport-connection and that of a related session-connection can be distinguished so that a transport-connection supports several consecutive session-connections.

7.3.4.4 Session-connection flow control

There is no peer flow control in the Session Layer. To prevent the receiving presentation-entity from being overloaded with data, the receiving session-entity applies back pressure across the transport-connection using the transport flow control.

7.4 Transport Layer

7.4.1 Definitions

No Transport Layer specific terms are identified.

7.4.2 Purpose

7.4.2.1 The transport-service provides transparent transfer of data between session-entities and relieves them from any concern with the detailed way in which reliable and cost effective transfer of data is achieved.

7.4.2.2 The Transport Layer optimizes the use of the available network-service to provide the performance required by each session-entity at minimum cost. This optimization is achieved within the constraints imposed by the overall demands of all concurrent session-entities and the overall quality and capacity of the network-service available to the Transport Layer.

7.4.2.3 All protocols defined in the Transport Layer have end-to-end significance, where the ends are defined as transport entities having transport associations. Therefore, the Transport Layer is OSI end open system oriented and transport-protocols operate only between OSI end open systems.

7.4.2.4 The Transport Layer is relieved of any concern with routing and relaying since the network-service provides data transfer from any transport-entity to any other, including the case of tandem subnetworks (see 7.5.1).

7.4.2.5 The transport functions invoked in the Transport Layer to provide a requested service quality depend on the quality of the network-service. The quality of the network-service depends on the way the network-service is achieved (see 7.5.3).

7.4.3 Services provided to the Session Layer

7.4.3.1 Introduction

7.4.3.1.1 The Transport Layer uniquely identifies each session-entity by its transport-address. When providing the connectionless-mode service, the Transport Layer provides a connectionless-mode service which maps a request for transmission of a transport-service-data-unit onto a request to the connectionless-mode network-service. In connection-mode, the transport-service provides the means to establish, maintain, and release transport-connections. Transport-connections provide duplex transmission between a pair of session-entites (through transport-SAPs).

7.4.3.1.2 More than one transport-connection can be established between the same pair of transport-addresses. A session-entity uses transport-connection-endpoint-identifiers provided by the Transport Layer to distinguish between transport-connection-endpoints.

7.4.3.1.3 The operation of one transport-connection is independent of the operation of all others except for the limitations imposed by the finite resources available to the Transport Layer.

7.4.3.1.4 The quality of service provided on a transport-connection depends on the service class requested by the session-entities when establishing the transport-connection. The selected quality of service is maintained throughout the lifetime of the transport-connection. The session-entity is notified of any failure to maintain the selected quality of service on a given transport-connection.

7.4.3.1.5 In connection-mode, the following facilities provided by the Transport Layer are described below:

a) transport-connection establishment;

b) transport-connection release;

c) data transfer;

d) expedited data transfer; and

e) suspend facility.

7.4.3.1.6 In connectionless-mode, segmentation and resassembly are not provided in the Transport Layer. Thus, the size of transport-service-data-units is limited by the size of transport-protocol-data-units and transport-protocol-control-information.

7.4.3.2 Transport-connection establishment

7.4.3.2.1 Transport-connections are established between session-entities identified by transport-addresses. The quality of service of the transport-connection is negotiated between the session-entities and the transport-service.

7.4.3.2.2 At the time of establishment of a transport-connection the class of transport-service to be provided can be selected from a defined set of available classes of service.

7.4.3.2.3 These service classes are characterized by combinations of selected values of parameters such as throughput, transit delay, and connection set-up delay and by guaranteed values of parameters such as residual error rate and service availability.

7.4.3.2.4 These classes of service represent globally predefined combinations of parameters controling quality of service. These classes of service are intended to cover the transport-service requirements of the various types of traffic generated by the session-entities.

7.4.3.3 Transport-connection release

This facility provides the means by which either session-entity can release a transport-connection and have the correspondent session-entity informed of the release.

7.4.3.4 Data transfer

This facility provides data transfer in accordance with the agreed quality of service. When the quality of service cannot be maintained and all possible recovery attempts have failed, the transport-connection is terminated and the session-entities are notified.

a) The transport-service-data-unit transfer service provides the means by which transport-service-data-units of arbitrary length are delimited and transparently transferred in sequence from one sending transport-service-access-point to the receiving transport-service-access-point over a transport-connection. This service is subject to flow control.

b) The expedited transport-service-data-unit transfer service provides an additional means of information exchange on a transport-connection. The expedited transport-data-units are subject to their own set of transport-service and flow control characteristics. The maximum size of expedited transport-service-data-units is limited.

7.4.3.5 Expedited Data

An expedited service is provided by the Transport Layer. However, it should be used in accordance with the constraints described in 5.8.8.3.

7.4.4 Functions within the Transport Layer

7.4.4.1 General

7.4.4.1.1 In connection-mode, the Transport Layer functions may include:

a) mapping transport-address onto a network-address;

b) multiplexing (end-to-end) transport-connections onto network-connections;

c) establishment and release of transport-connections;

d) end-to-end sequence control on individual connections;

e) end-to-end error detection and any necessary monitoring of the quality of service;

f) end-to-end error recovery;

g) end-to-end segmenting, blocking, and concatenation;

h) end-to-end flow control on individual connections;

j) supervisory functions;

k) expedited transport-service-data-unit transfer; and

l) suspend/resume.

7.4.4.1.2 In connectionless-mode, the Transport Layer provides the following functions to support connectionless-mode transmission:

a) mapping between transport-addresses and network-addresses;

b) mapping end-to-end transport-connectionless-mode transmissions on to network-connectionless-mode transmissions;

NOTE – There may be specific situations where performing conversion from connection-mode to connectionless-mode operation in the Transport Layer can be justified and may thus be permitted provided that this requires only limited extensions to existing protocols. In such cases it is accepted that communication using such conversions can only take place betweeen OSI end systems supporting them (see 6.4).

c) end-to-end error detection and monitoring of the quality of service;

d) transport-service-data-unit delimiting; and

e) supervisory functions.

7.4.4.2 Addressing

7.4.4.2.1 When a session-entity requests the Transport Layer to establish a transport-connection with another session-entity identified by its transport-address, the Transport Layer determines the network-address identifying the transport-entity which serves the correspondent session-entity.

7.4.4.2.2 Because transport-entities support services on an end-to-end basis no intermediate transport-entity is involved as a relay between the end transport-entities. Therefore the Transport Layer maps transport-addresses to the network-addresses which identify the end transport-entities (see Figure 13).

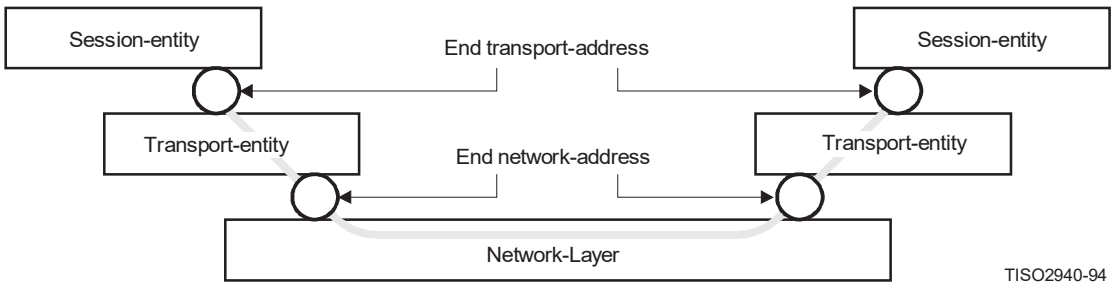

Figure 13 – Association of transport-addresses and network address

7.4.4.2.3 One transport-entity may serve more than one session-entity. Several transport-addresses may be associated with one network-address within the scope of the same transport-entity. Corresponding mapping functions are performed within the transport-entities to provide these facilities (see Figure 14).

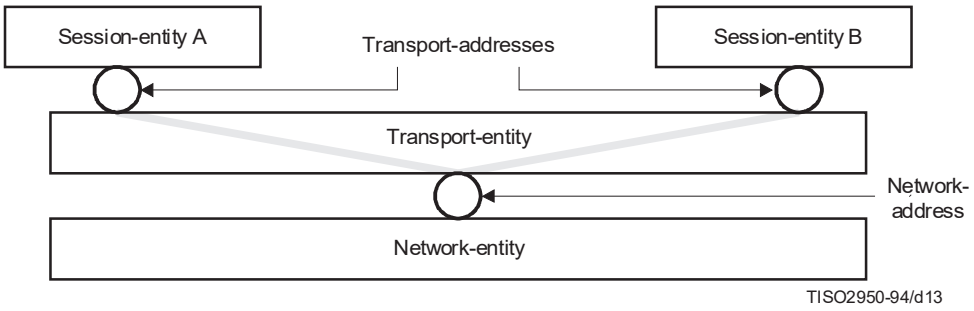

Figure 14 – Association of one network address with several transport addresses

7.4.4.3 Connection multiplexing and splitting

In order to optimize the use of network-connections, the mapping of transport-connections onto network-connections need not be on a one-to-one basis. Both splitting and multiplexing may be performed, namely for optimizing the cost of usage of the network-service.

7.4.4.4 Phases of operation

In connection-mode operation, the phases of operation within the Transport Layer are:

a) establishment phase;

b) data transfer phase; and

c) release phase.

The transfer from one phase of operation to another is specified in detail within the protocol for the Transport Layer.

7.4.4.5 Establishment phase

During the establishment phase, the Transport Layer establishes a transport-connection between two session-entities. The functions of the Transport Layer during this phase match the requested class of service with the services provided by the Network Layer. The following functions can be performed during this phase:

a) obtain a network-connection which best matches requirements of the session-entity, taking into account cost and quality of service;

b) decide whether multiplexing or splitting is needed to optimize the use of network-connections;

c) establish the optimum transport-protocol-data-unit size;

d) select the functions that will be operational upon entering the data transfer phase;

e) map transport-addresses onto network-addresses;

f) provide identification of different transport-connections between the same pair of transport-service-access-points (connection identification function); and

g) transfer of data.

7.4.4.6 Data transfer phase

The purpose of the data transfer phase is to transfer transport-service-data-units between the two session-entities connected by the transport-connection. This is achieved by the transportation of transport-protocol-data-units and by the following functions, each of which is used or not used according to the class of service selected in the establishment phase:

a) sequencing;

b) blocking;

c) concatenation;

d) segmenting;

e) multiplexing or splitting;

f) flow control;

g) error detection;

h) error recovery;

j) expedited data transfer;

k) transport-service-data-unit delimiting; and

m) transport-connection identification.

7.4.4.7 Release phase

The purpose of the release phase is to release the transport-connection. It may include the following functions:

a) notification of reason for release;

b) identificaton of the transport-connection released; and

c) transfer of data.

7.4.4.8 Transport Layer management

The Transport Layer protocols deal with some management activities of the layer (such as activation and error control). See clause 8 and ITU-T Rec. X.700 | ISO 7498-4 for the relationship with other management aspects.

7.5 Network Layer

7.5.1 Definitions

7.5.1.1 real subnetwork: A collection of equipment and physical media which forms an autonomous whole and which can be used to interconnect real systems for the purpose of data transfer.

7.5.1.2 subnetwork: An abstraction of a real subnetwork.

NOTES

1 A subnetwork is a representation within the OSI Reference Model of a real network such as a carrier network, a private network, or a local area network.

2 A subnetwork may itself be an open system, although this is not necessarily always the case. See ISO 8648 – Internal Organization of the Network Layer.

7.5.1.3 subnetwork-connection: A communication path through a subnetwork which is used by entities in the Network Layer in providing a network-connection.

7.5.2 Purpose

7.5.2.1 The Network Layer provides the functional and procedural means for connectionless-mode or connection-mode transmission among transport-entities and, therefore, provides to the transport-entities independence of routing and relay considerations.

7.5.2.2 The Network Layer provides the means to establish, maintain, and terminate network-connections between open systems containing communicating application-entities and the functional and procedural means to exchange network-service-data-units between transport-entities over network-connections.

7.5.2.3 It provides to the transport-entities independence from routing and relay consideration associated with the establishment and operation of a given network-connection. This includes the case where several subnetworks are used in tandem (see 7.5.4.2) or in parallel. It makes invisible to transport-entities how underlying resources such as data-link-connections are used to provide network-connections.

7.5.2.4 Any relay functions and hop-by-hop service enhancement protocols used to support the network-service between the OSI end systems are operating below the Transport Layer, i.e. within the Network Layer or below.

7.5.3 Service provided to the Transport Layer

7.5.3.1 Introduction

7.5.3.1.1 The basic service of the Network Layer is to provide the transparent transfer of data between transport-entities. This service allows the structure and detailed content of submitted data to be determined exclusively by layers above the Network Layer.