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ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

G.852.2

(03/99)

SERIES G: TRANSMISSION SYSTEMS AND MEDIA, DIGITAL SYSTEMS AND NETWORKS

Digital transmission systems – Digital networks – Management of transport network

Enterprise viewpoint description of transport network resource model

ITU-T Recommendation G.852.2

(Previously CCITT Recommendation)

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ITU-T RECOMMENDATION G.852.2

ENTERPRISE VIEWPOINT DESCRIPTION OF TRANSPORT NETWORK RESOURCE MODEL

Source

ITU-T Recommendation G.852.2 was prepared by ITU-T Study Group 4 (1997-2000) and was approved under the WTSC Resolution No. 1 procedure on the 26th of March 1999.

FOREWORD

ITU (International Telecommunication Union) is the United Nations Specialized Agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the ITU. The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

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The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

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As of the date of approval of this Recommendation, the ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

CONTENTS

Recommendation G.852.2

ENTERPRISE VIEWPOINT DESCRIPTION OF TRANSPORT NETWORK RESOURCE MODEL

(Geneva, 1999)

1 Scope

The objective of this Recommendation is to provide a set of definitions of management abstractions of G.805 transport networks architectural components. The resources defined in this community provide a basis for the description of enterprise specifications of transport network-level management services. A resource can be defined as what is to be managed at the network level, something which is used by a transport network-level management service.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; all users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published.

[1] ITU-T Recommendation G.851.1 (1996), *Management of the transport network – Application of the RM-ODP framework.*

[2] ITU-T Recommendation G.852.1 (1996), *Enterprise viewpoint for simple subnetwork connection management.*

[3] ITU-T Recommendation G.852.3 (1999), *Enterprise viewpoint for topology management*.

[4] ITU-T Recommendation G.852.6 (1999), *Enterprise viewpoint for trail management*.

[5] ITU-T Recommendation G.852.8 (1999), *Enterprise viewpoint for pre-provisioned adaptation management*.

[6] ITU-T Recommendation G.852.10 (1999), *Enterprise viewpoint for pre-provisioned link connection management.*

[7] ITU-T Recommendation G.852.12 (1999), *Enterprise viewpoint for pre-provisioned link management.*

[8] ITU-T Recommendation G.853.1 (1999), *Common information elements of the information viewpoint for the management of a transport network.*

[9] ITU-T Recommendation G.853.2 (1996), *Subnetwork connection management information viewpoint*.

[10] ITU-T Recommendation G.853.3 (1999), *Information viewpoint for topology management*.

[11] ITU-T Recommendation G.853.6 (1999), *Information viewpoint for trail management*.

[12] ITU-T Recommendation G.853.8 (1999), *Information viewpoint for pre-provisioned adaptation management*.

[13] ITU-T Recommendation G.853.10 (1999), *Information viewpoint for pre-provisioned link connection management.*

[14] ITU-T Recommendation G.853.12 (1999), *Information viewpoint for pre-provisioned link management*.

[15] ITU-T Recommendation G.854.1 (1996), *Computational interfaces for basic transport network model*.

[16] ITU-T Recommendation G.854.3 (1999), *Computational viewpoint for topology management*.

[17] ITU-T Recommendation G.854.6 (1999), *Computational viewpoint for trail management*.

[18] ITU-T Recommendation G.854.8 (1999), *Computational viewpoint for pre-provisioned adaptation management*.

[19] ITU-T Recommendation G.854.10 (1999), *Computational viewpoint for pre-provisioned link connection management.*

[20] ITU-T Recommendation G.854.12 (1999), *Computational viewpoint for pre-provisioned link management.*

[21] ITU-T Recommendation G.855.1 (1999), *Management information generic network level model*.

[22] ITU-T Recommendation M.3100/Amd.1 (1999), *Generic Network Information Model – Amendment 1*.

3 Definitions

None.

4 Abbreviations

This Recommendation uses the following abbreviations:

AP	Access Point
CP	Connection point
CTP	Connection Termination Point
LC	Link Connection
SNC	Subnetwork Connection
TCP	Trail Connection point
TTP	Trail Termination Point

5 Conventions

None.

6 Transport network resource model

6.1 Community TEM "transport network enterprise model"

6.1.1 Purpose

The objective of this community is to provide a set of definitions of management abstractions of G.805 transport networks architectural components. The resources defined in this community provide a basis for the description of enterprise specifications of transport network-level management services. A resource can be defined as what is to be managed at the network level, something which is used by a transport network-level management service.

6.1.1.1 General policy

Resource Identifier general permission: Each TEM resource has a *Resource Identifier* that needs to be unique, in the domain in which it is used. A user responsible to create a resource, may use a *User Identifier* that may be attached to the resource at creation time and gives the value for the Resource Identifier. This user identifier (if it is defined) has then to be used by the user in all operations attached to the resource as the resource identifier. The User Identifier may change during the life of the resource and all change shall be reported.

User label general permission: As a general policy, user labels may be associated with TEM entities. For a given community, these names are assigned by the caller and may be changed. They are not guaranteed to be unique. They carry no semantic information, but are used to "label" the physical or logic resource for purposes understood by the caller and perhaps by other potential callers who have a common understanding of the semantics carried by the user label. The User Label is an optional string attached to a resource which may be defined at creation time or later. This string (if it is defined) must not be used by the caller to identify the resource in an operation.

6.1.1.2 Relationships between specifications

All resources defined in this Recommendation will be used by the management components described in other specifications (as in Recommendations G.852.3, G.852.4, G.852.5, ...). These resources will be used as roles in each community. That can be explained by the fact that the TEM concept represents the actual resource, independently of all management action. Each resource may play a role in the description of a management component. For example, looking at Figure 1, it can be seen that a TEM connection termination point that represents the managed view of G.805 functions (adaptation and trail termination) will play the role of port in the simple subnetwork connection configuration service (G.852.1) and the role of connection termination point in the adaptation management service. A set of management components will be defined in Recommendations to allow the management of a transport network. Each organization will be able to use the components it wishes, independently from the others. An activity may be defined that relates all these management components in order to construct a management application, but it is not a standardization process to describe this overall activity. The components studied so far are:

- simple subnetwork connection configuration (G.852.1): allows to connect or release a subnetwork connection across a subnetwork;
- trail management: allows to connect or release a trail across a layer network domain;
- topology management: allows to create, delete and modify the topology resources (subnetworks, links, link ends, access groups);
- pre-provisioned link management: allows to manage the capacity of a link by adding or removing link connections;

- pre-provisioned link connection management: allows to assign the link connections inside a link to several users;
- pre-provisioned adaptation management: allows to manage the adaptation between a client layer network and a server layer network by creating the link connections served by a trail.

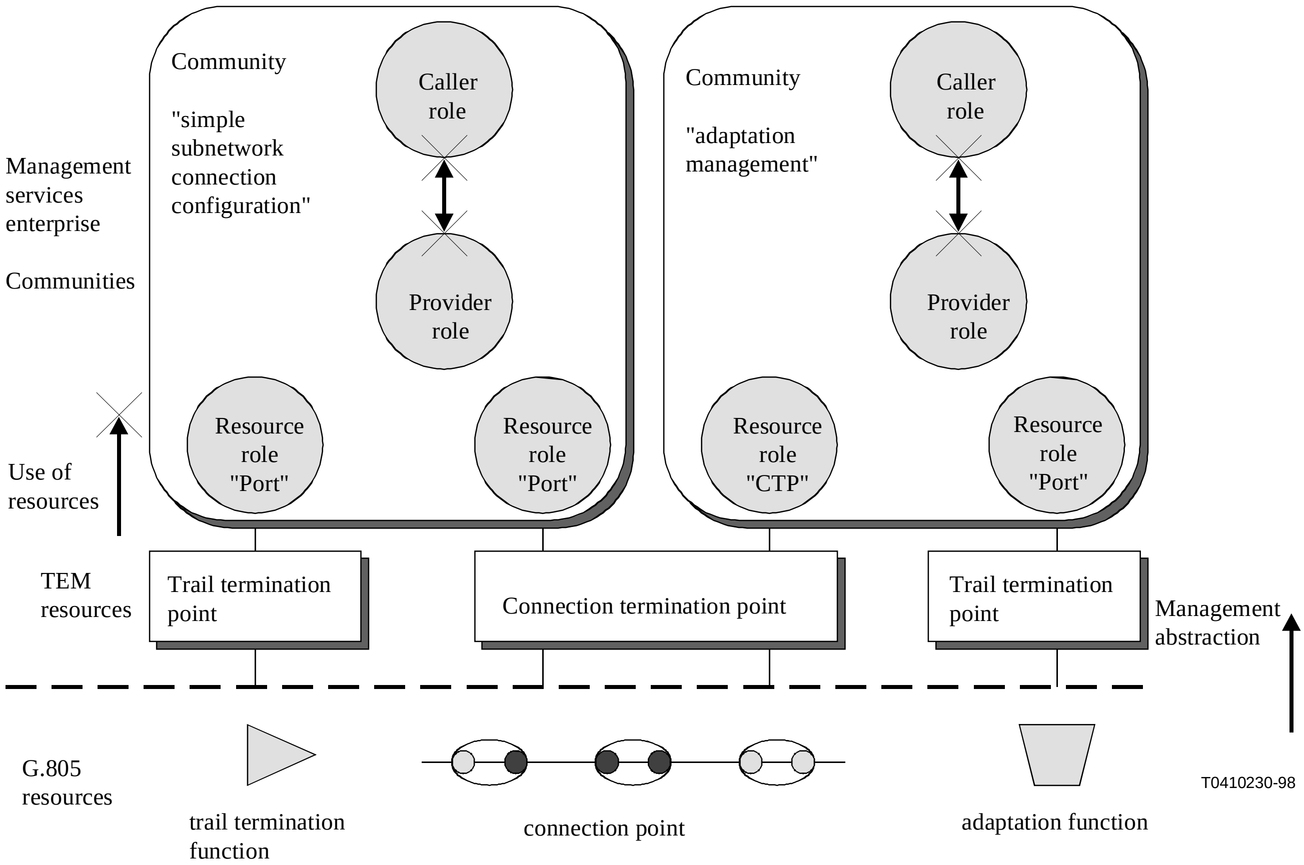


Figure 1/G.852.2

The resources are:

- access group;
- administrative domain;
- connection termination point;
- equipment;
- layer network domain;
- link;
- link connection;
- link end;
- node;
- physical port;
- subnetwork;
- subnetwork connection;

– tandem connection;

– topological link;

– topological link end;

– trail;

– trail termination point.

They appear in Figure 2:

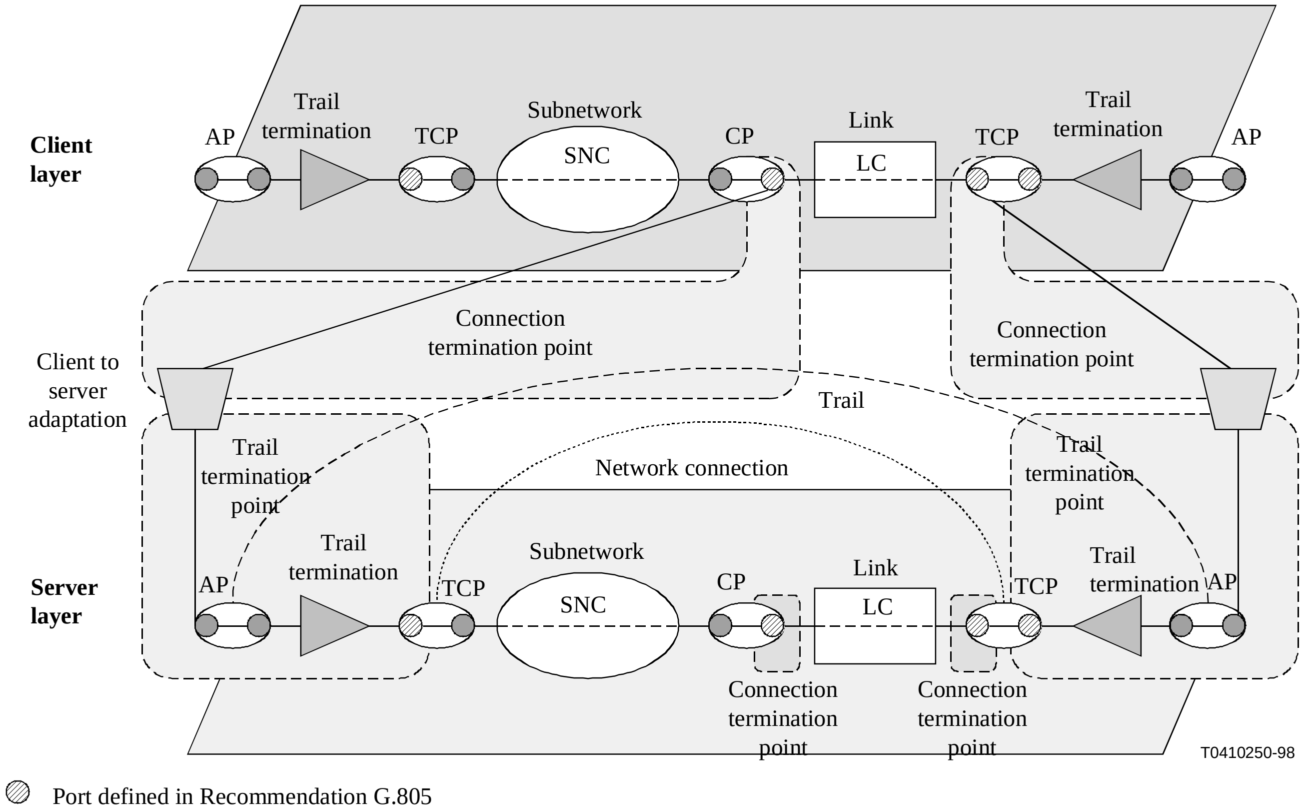


Figure 2/G.852.2

6.2 Resources

6.2.1 Access group

An access group represents a group of co-located trail termination points that are bound to one subnetwork or link.

Properties

SIGNAL_IDENTIFICATION: An access group has a signal identification which represents the specific signal format that the resource carries. The specific format values will be defined in the technology specific extensions.

GROUPING: An access group is a set (possibly empty) of trail termination points.

GROUPING_CONSTRAINT: The trail termination points of a given access group have all the same signal identification as the access group.

GROUPING_CRITERIA: Criterion to group trail termination points in an access group may be multiple, including: same client subnetwork or link, same routing, etc. As a consequence, a given trail termination point may be part of zero, one or more access groups.

For example, an access group may contain a number of trail termination points that are equivalent for routing purposes, i.e. from this access group originates a unique link towards a unique subnetwork in the same layer network. Or the group may be made according to the client layer network: all trail termination points of this access group serve connection termination points at the boundary of an unique subnetwork in the client layer.

TOPOLOGICAL_END_DIRECTION: An access group has a directionality that characterizes its ability to originate or/and terminate the traffic to be carried. It may be source, sink, bidirectional or undefined. An access group sink shall contain trail termination points sink. An access group source shall contain trail termination points source. An access group bidirectional shall contain trail termination points bidirectional. An access group undefined shall contain trail termination points sink, source or/and bidirectional.

6.2.2 Administrative domain

An administrative domain is a domain in which the resources are grouped for a management purpose by an administrator. A transport administrative domain contains only transport network resources, excluding service-level resources.

The administrative domain defines the allocation of responsibility for managing a collection of resources between operators, or between different parts of an operator's organization. A transport network resource may pertain to several transport administrative domains, according to the management function considered. An administrative domain may contain resources belonging to several layer network domains.

Typical applications are the allocation of individual operators' responsibilities in a multi-operator (e.g. international) network context, or regional responsibilities within one operator's organization, or the allocation of access rights (responsibilities) to customers for managing the resources available within e.g. a Virtual Private Network.

6.2.3 Connection termination point

A connection termination point represents the potential extremity of a link connection. It relates to the G.805 port and its associated part of the adaptation function that is in the server layer (Figure 3).

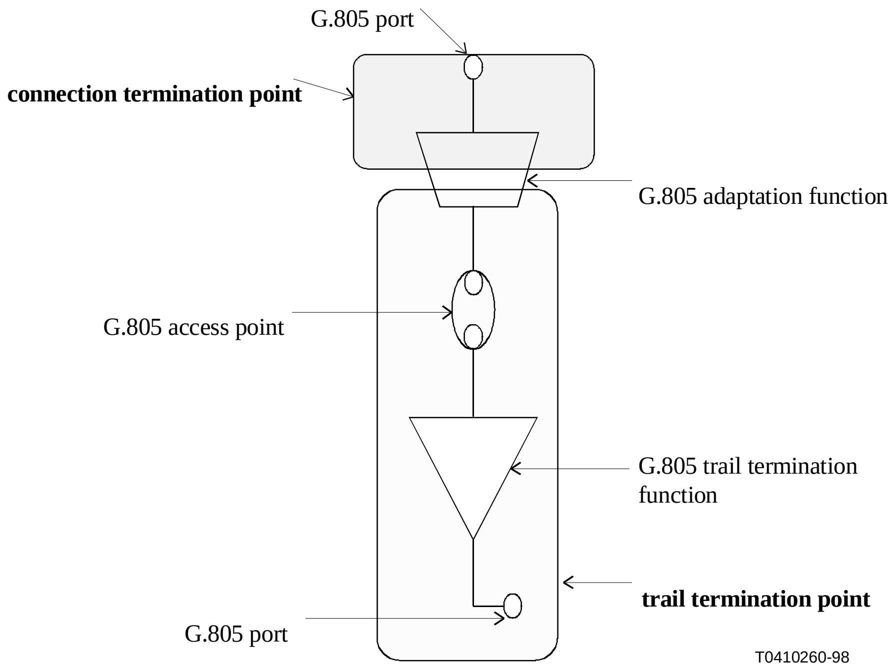


Figure 3/G.852.2

Properties

POINT_DIRECTIONALITY: A connection termination point has a directionality that characterizes the ability of a connection termination point to originate and/or terminate the traffic to be carried. It may be source, sink or bidirectional. A connection termination point source originates a unidirectional link connection. A connection termination point terminates a unidirectional link connection. A connection termination point bidirectional originates and terminates the same bidirectional link connection.

SIGNAL_IDENTIFICATION: A connection termination point is characterized by a signal identification that describes the signal transferred at the connection termination point.

CONNECTIVITY_CONSTRAINTS: At a given moment in time, a connection termination point A_end, which sends the signal through the link connection, or a connection termination point Z_end, which receives the signal through the link connection, may be bound either to:

- a subnetwork connection (Figure 4);

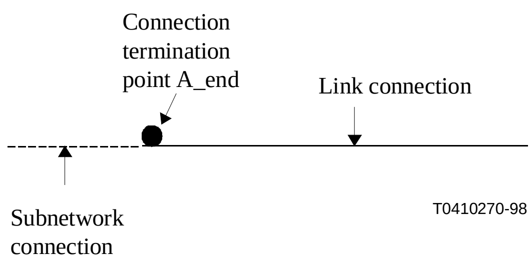


Figure 4/G.852.2

• a link connection (it is the arc view and it means that the subnetwork connection that should be there is not manageable) (Figure 5);

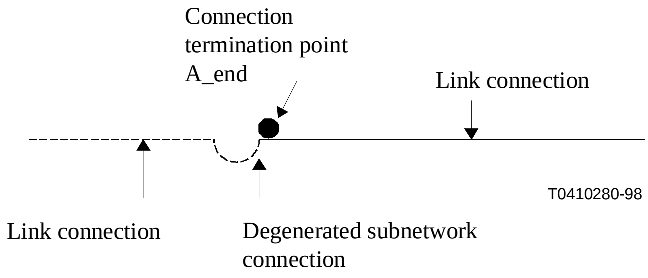


Figure 5/G.852.2

• a connection termination point (it is the point view and it means that the subnetwork connection that should be there is not manageable) (Figure 6);

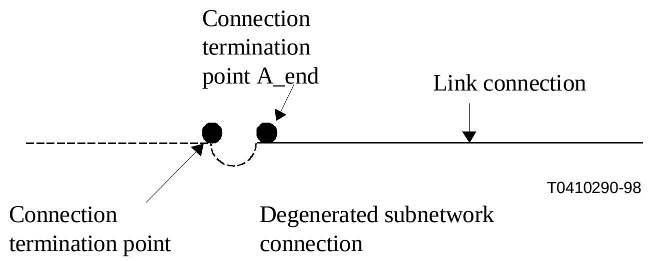


Figure 6/G.852.2

• or a trail termination point (if at the border of the layer network) (Figure 7);

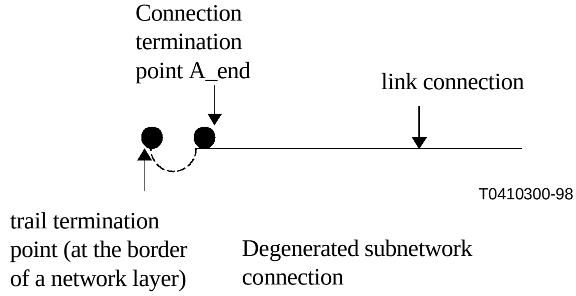


Figure 7/G.852.2

• or nothing (nothing has been provisioned yet).

TOPOLOGICAL_CONSTRAINTS: A connection termination point may be bound to one subnetwork, (or a set of subnetworks related by partitioning), or one access group (Figure 8).

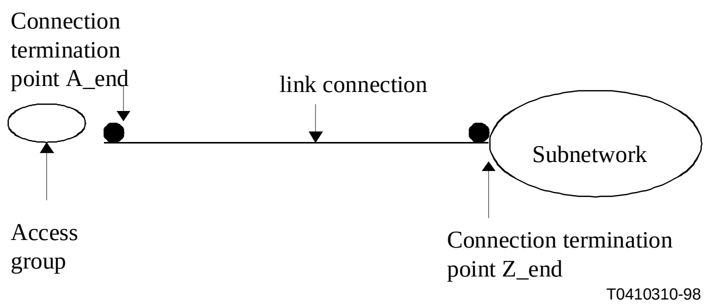


Figure 8/G.852.2

ADAPTATION_RELATION: Connection termination points may be supported by a trail termination point. In such a case, the connection termination points pertain to a given layer network (known as the client layer network) and the trail termination point that supports them pertain to a server layer network, as shown in Figure 9.

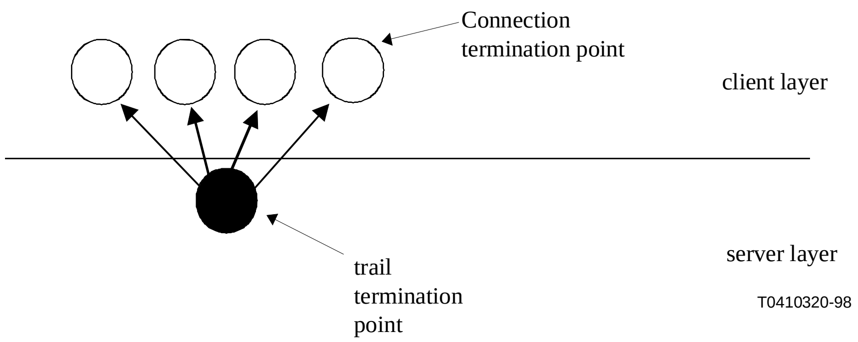


Figure 9/G.852.2

BUNDLING: A connection termination point may bundle other connection termination points. In the context of SDH, bundling of connection termination points may be used for contiguous or virtual concatenation, but is not restricted to these. In the context of ATM, it may be used to group a connection termination point carrying end-user information and a connection termination point carrying OAM cells.

6.2.4 Equipment

An equipment represents physical components of a managed element, including replaceable components. It may be nested within another equipment. (see M.3100 definition). Examples of equipment are multiplexers, cards, fibres, switches, etc.

Properties

LOCATION: An equipment has a location that permits to locate where transport functions are.

6.2.5 Layer network domain

A layer network domain is a transport administrative domain in which all resources pertain to the same G.805 layer. It represents the network entities which together provide communication services with one signal identification.

Properties

RELATIONS: A layer network domain may be related to other layer network domains as server or client. The corresponding signal identifications shall have an adaptation relationship. For example, an SDH VC4 layer network domain may serve SDH VC11, VC12, VC3 or ATM VP layer network domains or an ATM VP layer network domain may serve an ATM VC layer network domain.

6.2.6 Link

A link represents capacity between two subnetworks, two access groups or one subnetwork and one access group (Figure 10). This capacity will be defined in accordance with the technology.

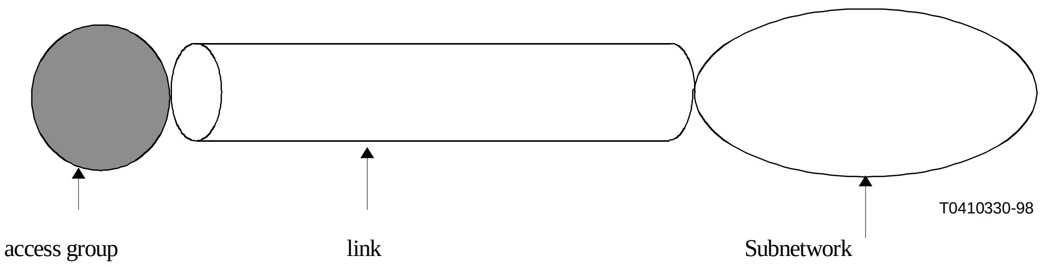


Figure 10/G.852.2

Properties

SIGNAL_IDENTIFICATION: A link has a signal identification that describes the signal transferred across the link.

LINK_DIRECTIONALITY: A link has a directionality that characterizes its ability to carry traffic in one, two or undefined directions. In case of a unidirectional link, traffic goes from A_end to Z_end. In case of a bidirectional link, traffic goes from A_end to Z_end and from Z_end to A_end. In case of an undefined link, nothing can be said.

EXTREMITIES: A link is terminated by two extremities referred to as link_ends. The link_ends have the same signal identification as the link. In case of a unidirectional link, the link_end A shall be source and the link_end Z shall be sink. In case of a bidirectional link, the link_ends A and Z shall be bidirectional. In case of an undefined link, the link_ends A and Z shall be undefined.

PRE-PROVISIONED CAPACITY: For some technologies (e.g. SDH), capacity can be expressed by a certain number of link connections (Figure 11). The link connections have all the same signal identification. These link connections do not have to be served by the same trail.

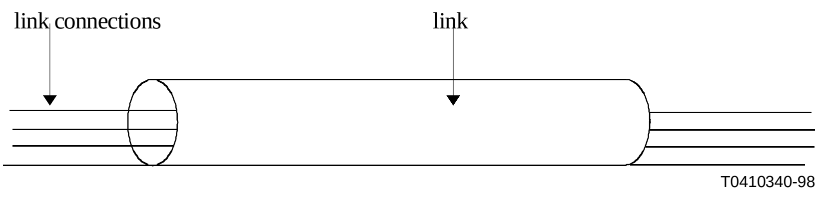


Figure 11/G.852.2

DYNAMIC CAPACITY: For some technologies (e.g. ATM), capacity can be characterized by name space and bandwidths.

DIRECTIONALITY_AND_CAPACITY: In case of a unidirectional link, the link connections pertaining to it shall be unidirectional and from A_end to Z_end. In case of a bidirectional link, the link connections pertaining to it shall be bidirectional. In case of an undefined link, the link connections pertaining to it may be unidirectional (from one side or the other) and/or bidirectional.

PARALLEL_COMPOSITION: A compound link is made of component links (Figure 12). The container and the elements must have both the same signal identification and the same directionality. Decomposition of links may be recursive, i.e. component links may be themselves composed of component links, and so on. All links (compound and component) must have the same extremities.

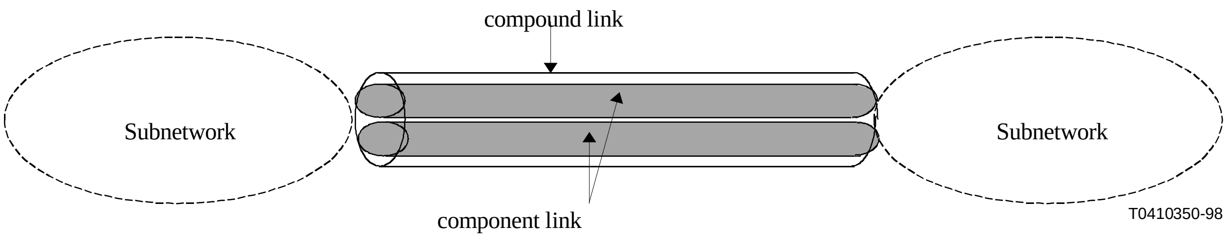


Figure 12/G.852.2

COMPOUND CAPACITY: The capacity of the compound link shall be equal to the sum of the capacities of all the component links.

SERIAL_COMPOSITION: A serial-compound link is made of component links that are contiguous. The container and the components must have the same signal identification and the same directionality. Although only the component links are captured by this relationship, a serial-compound link is made of not only links but also subnetworks, as shown in Figure 13.

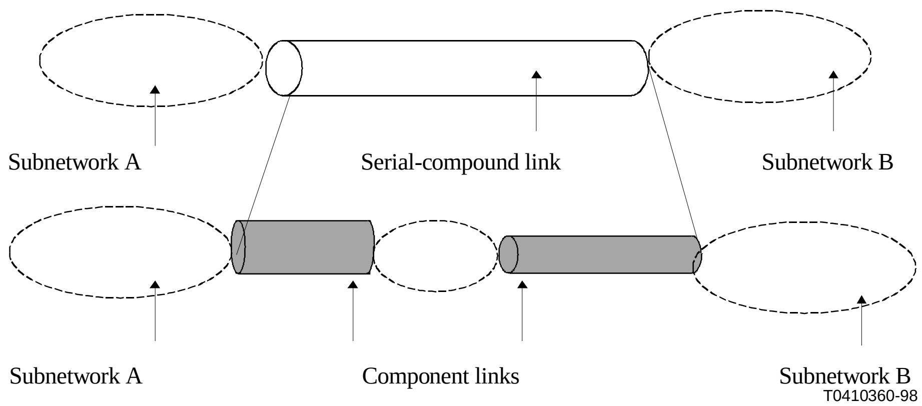


Figure 13/G.852.2

SERIAL_COMPOSITION CAPACITY: The capacity of the serial-compound link shall be lower than the lowest capacity of the component links.

6.2.7 Link connection

A link connection represents the transparent capacity of transfer of information characterized by a given signal identification between two fixed points.

Properties

EXTREMITIES: A link connection is terminated by two and only two extremities, the connection termination points which are its A_end and Z_end. Through a unidirectional link connection, traffic goes only from the A_end to the Z_end; through a bidirectional one, traffic goes from A to Z and from Z to A.

SIGNAL_IDENTIFICATION: A link connection is characterized by a signal identification. The signal identification describes the signal that is transferred across the link connection.

DIRECTIONALITY: A link connection is characterized by a directionality. The directionality characterizes the ability of a link connection to carry traffic in one (for unidirectional link connection) or two directions (for bidirectional link connection).

CONNECTIVITY_CONSTRAINTS: A link connection may be bound at one extremity either to

- a subnetwork connection (Figure 14);

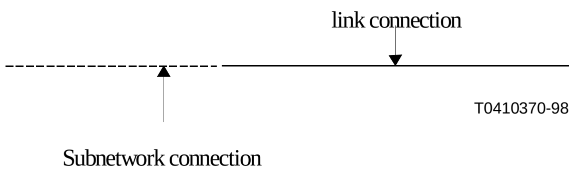


Figure 14/G.852.2

- a link connection (if the subnetwork is not managed) (Figure 15);

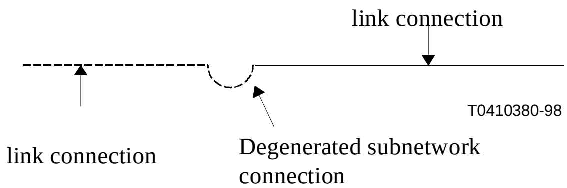


Figure 15/G.852.2

- a connection termination point (it is the point view and it means that the subnetwork connection that should be there is not manageable) (Figure 16);

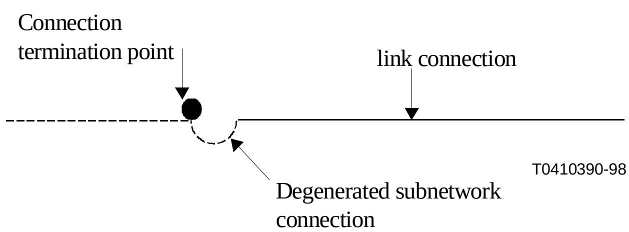


Figure 16/G.852.2

• or to a trail termination point (at the border of a layer network) (Figure 17).

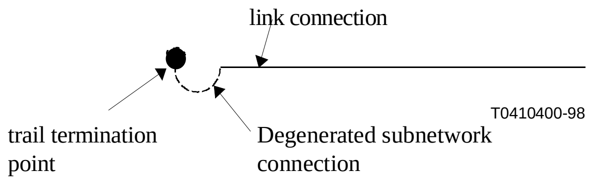


Figure 17/G.852.2

TOPOLOGICAL_CONSTRAINTS: A link connection may be managed without having to manage a link and may be bound to a subnetwork (or a set of partitioned subnetworks), or an access group (Figure 18).

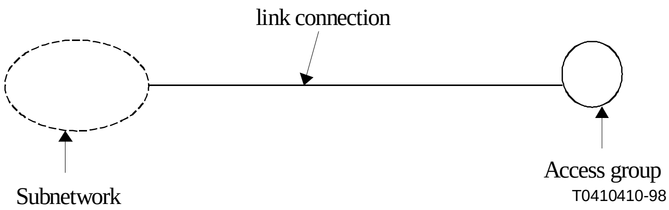


Figure 18/G.852.2

ADAPTATION_RELATION: Link connections may be supported by a trail. In such a case, the link connections pertain to a given layer network (known as the client layer network) and the trail that supports them pertain to a server layer network, as shown in Figure 19.

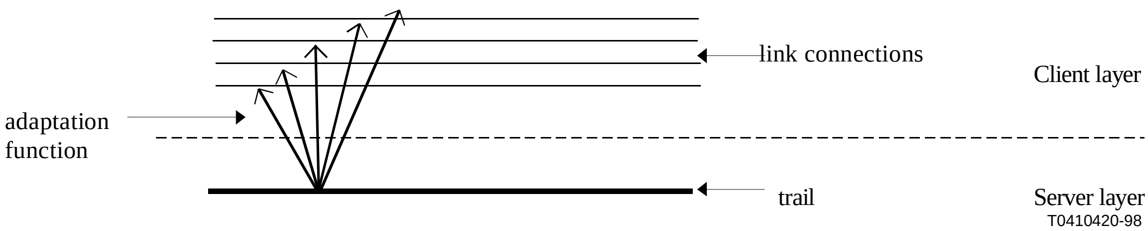


Figure 19/G.852.2

SERIAL_COMPOSITION: A serial-composed link connection is made of other link connections and possibly subnetwork connections as shown in Figure 20.

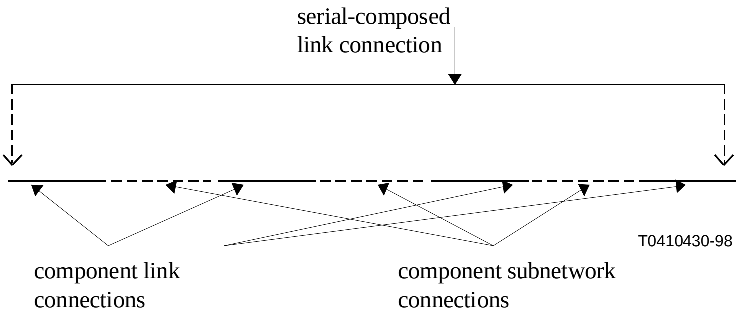


Figure 20/G.852.2

SERIAL_COMPOSITION_CONSTRAINT: In the case where a link connection is serial composed, the component connections have to be contiguous. As a link connection "represents a pair of adaptation functions", both the first and the last one of that series must be link connections (not subnetwork connections). The serial-composed link connection is not served directly by a trail though all the component link connections may be.

BUNDLING: A link connection may bundle other link connections, as shown in Figure 21. In the context of SDH, bundling of link connections may be used for contiguous or virtual concatenation, but is not restricted to. In the context of ATM, it may be used to group a link connection carrying end-user information and a link connection carrying OAM cells. Bundled link connections may be considered as parallel to each others.

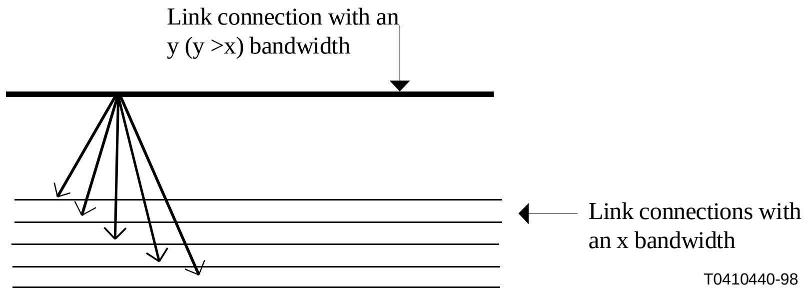


Figure 21/G.852.2

6.2.8 Link end

A link end represents the extremity of a link.

Properties

SIGNAL_IDENTIFICATION: A link end has a signal identification that characterizes all signals transferred at the link end.

EXTREMITIES: A link end terminates one link. The link has the same signal identification as the link end.

PRE-PROVISIONED CAPACITY: For some technologies (e.g. SDH), a link end is a (possibly empty) set of connection termination points (Figure 22). The connection termination points shall have the same signal identification. These connection termination points do not have to be adapted from the same trail termination point.

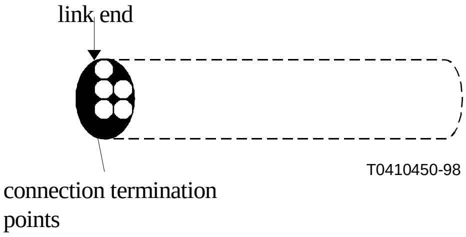


Figure 22/G.852.2

DYNAMIC CAPACITY: For some technologies (e.g. ATM), a link end can be characterized by name space and bandwidth.

TOPOLOGICAL_END_DIRECTION: A link end has a directionality that characterizes its ability to originate or/and terminate the traffic to be carried. It may be source, sink, bidirectional or undefined. A link end source or sink is intended to be bound to a unidirectional link. A link end bidirectional is intended to be bound to a bidirectional link. A link end undefined is intended to be bound to an undefined link. A link end source shall contain connection termination points source. A link end sink shall contain connection termination points sink. A link end bidirectional shall contain connection termination points bidirectional. A link end undefined shall contain connection termination points sink, source or/and bidirectional.

PARALLEL_COMPOSITION: A compound link end is made of component link ends if the corresponding link is made of component links (Figure 23). The container and the components must have both the same signal identification and the same directionality. Decomposition of link ends may be recursive, i.e. component link ends may be themselves composed of component link ends, and so on.

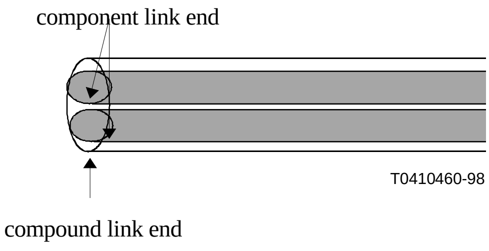


Figure 23/G.852.2

BOUNDING: One link end is bound to one topological component that can be one subnetwork or one access group (if at the border of the layer network).

6.2.9 Node

A node is an administrative domain that represents a collection of G.852.2 (TEM) resources that are grouped in a single geographical location, and could pertain to several layer network domains. It can for example, be one town, one building or an equipment.

Properties

GROUPING: The policy to group the resources is up to the network administrator.

6.2.10 Physical port

A physical port represents the potential capacity provided by a physical access.

Properties

CAPACITY: A physical port will always be characterized by a given capacity. For example, a 2-Mbit/s physical port represents the fact that a capacity of 2 Mbit/s is available.

6.2.11 Subnetwork

A subnetwork represents a topological component used to effect routing of a specific signal identification (see G.805 definition). It may be characterized by a set of related extremities, which can be link connections, connection termination points or trail termination points, and which shall be connectable.

Properties

SIGNAL_IDENTIFICATION: A subnetwork carries a signal identification. The signal identification will be defined in the technology specific extensions.

COMPOSITION: A subnetwork may be composed of smaller subnetworks that are part of its decomposition, due to partitioning, as shown in Figure 24. Decomposition of subnetworks may be recursive, i.e. component subnetworks may be themselves composed of inner subnetworks, and so on. The smaller component subnetwork is associated to a G.805 matrix.

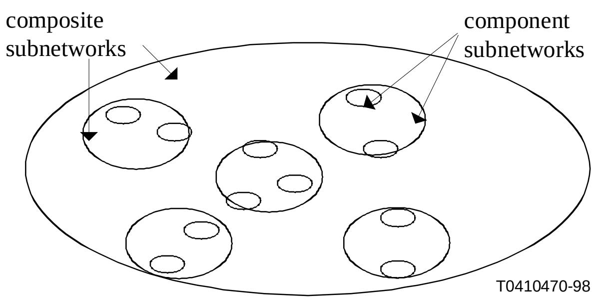


Figure 24/G.852.2

COMPOSITION_CONSTRAINT: The component subnetworks must have the same signal identification as the composite one.

CONNECTIVITY: A subnetwork may be crossed by subnetwork connections, as shown in Figure 25. At some point in time, the number of subnetwork connections crossing a given subnetwork may be zero.

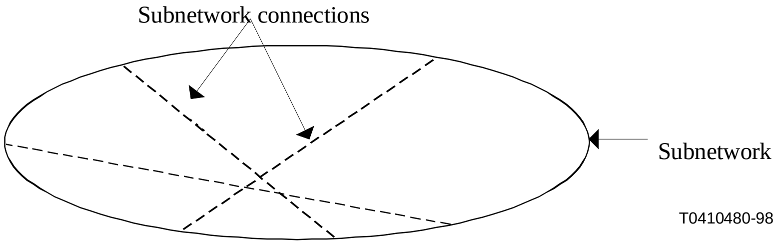


Figure 25/G.852.2

RELATED_EXTREMITIES: A subnetwork can be defined by a set of related extremities (e.g. connection termination point, trail termination, link connection) (Figure 26). This set represents the potential connectivity of the subnetwork.

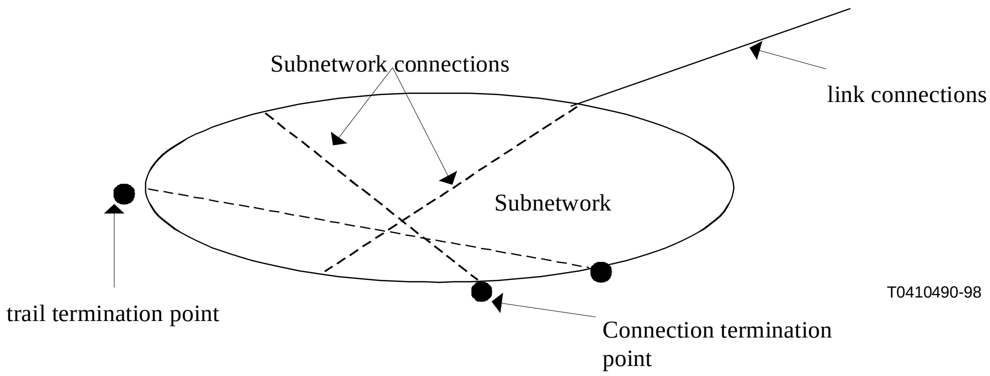


Figure 26/G.852.2

PROTECTED SUBNETWORK: A subnetwork may be considered as protected if all its subnetwork connections are protected.

6.2.12 Subnetwork connection

A subnetwork connection represents a transport entity that transfers information across a subnetwork.

Properties

SIGNAL_IDENTIFICATION: A subnetwork connection is characterized by a signal identification. The signal identification describes the signal that is transferred across the subnetwork connection.

DIRECTIONALITY: Any subnetwork connection is characterized by a directionality. The directionality characterizes the ability of a subnetwork connection to carry traffic in one or two directions.

CONNECTIVITY_CONSTRAINTS: The A_end, which sends the signal through the subnetwork connection, shall be associated to a sink connection termination point. The Z_end, which receives the signal through the subnetwork connection, shall be associated to a source connection termination point.

BIDIRECTIONAL_CHARACTERISTIC: A bidirectional subnetwork connection may be supported by two unidirectional (one of which being codirectional and the other one contradirectional with regard to an orientation reference) subnetwork connections that together provide bidirectionality (e.g. case of a unidirectional SDH ring), as shown in Figure 27.

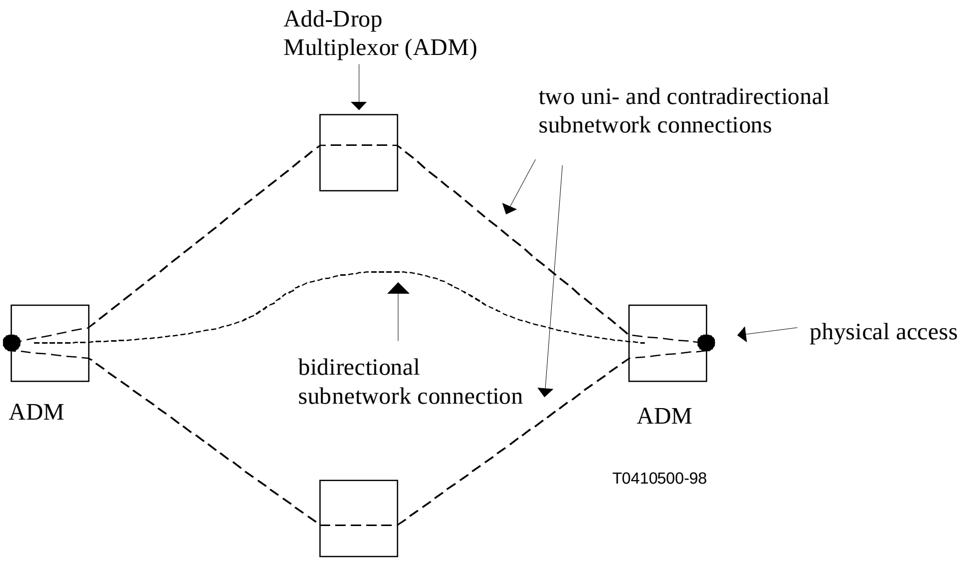


Figure 27/G.852.2

BUNDLING: A subnetwork connection may bundle other subnetwork connections. In the context of SDH, bundling of subnetwork connections may be used for, but not restricted to, contiguous or virtual concatenation. In the context of ATM, it may be used to group a subnetwork connection carrying end-user information and a subnetwork connection carrying OAM cells. Bundled subnetwork connections may be considered as paralleled to each other.

SERIAL_COMPOSITION: A serial composite subnetwork connection may be made of other subnetwork connections and link connections. The components being contiguous, both the first and the last one must be subnetwork connections, as shown in Figure 28. The component subnetwork connections may be considered as arranged in a series.

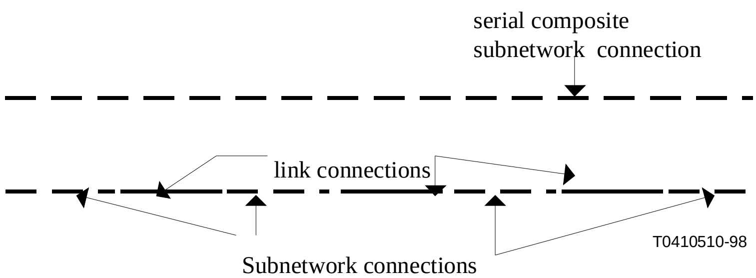


Figure 28/G.852.2

DEGENERATED SNC: A subnetwork connection may be considered as degenerated, and so not managed, if it is a fixed transfer capacity. In this case, the associated subnetwork is also degenerated.

PROTECTED SNC: A subnetwork connection is considered as protected if it can be replaced by a protecting subnetwork connection if the working subnetwork connection fails or if the performance falls below the required level. It is a protection switching method applied in the client layer network when a defect condition is detected in a server layer network, sub-layer or other transport layer network.

6.2.13 Tandem connection

A tandem connection represents an arbitrary series of contiguous link connections and/or subnetwork connections (for definition, see Recommendation G.805). A tandem connection is created for monitoring purposes.

Properties

SIGNAL_IDENTIFICATION: A tandem connection is characterized by a signal identification. The signal identification describes the signal that is transferred across the tandem connection.

DIRECTIONALITY: Any tandem connection is characterized by a directionality. The directionality characterizes the ability of a tandem connection to carry traffic in one or two directions.

CONNECTIVITY_CONSTRAINT: A tandem connection being a series of contiguous link connections and/or subnetwork connections, both the first and the last one of such a series may be either a link connection or a subnetwork connection, as shown in Figure 29.

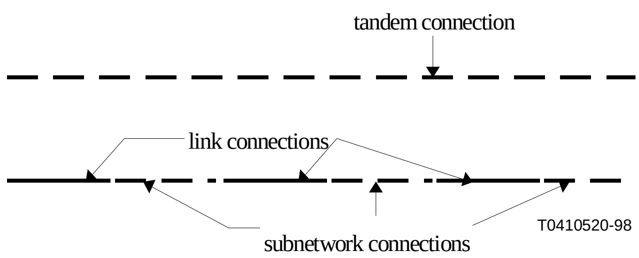


Figure 29/G.852.2

6.2.14 Topological link

A topological link is a link provided by one and only one server trail, in a client layer.

Properties

SIGNAL_IDENTIFICATION: A topological link has a signal identification that describes the signal transferred across the topological link.

DIRECTIONALITY: A link has a directionality that characterizes its ability to carry traffic in one or two directions. The directionality is the same as the directionality of the server trail. In case of a unidirectional topological link, traffic goes from A_end to Z_end. In case of a bidirectional topological link, traffic goes from A_end to Z_end and from Z_end to A_end.

EXTREMITIES: A topological link is terminated by two extremities referred to as topological link_ends. The topological link_ends have the same signal identification as the topological link. In case of a unidirectional topological link, the topological link_end A shall be source and the topological link_end Z shall be sink. In case of a bidirectional topological link, the topological link_ends A and Z shall be bidirectional.

ADAPTATION_RELATION: A topological link is supported by one and only one trail. In such a case, the topological link end pertains to a given layer network (known as the client layer network) and the trail that supports it pertains to a server layer network, as shown in Figure 30.

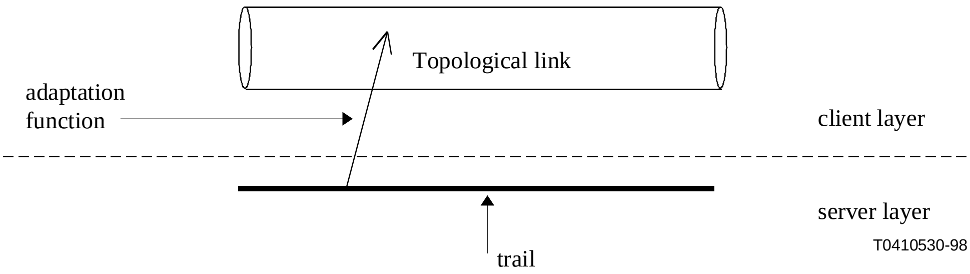


Figure 30/G.852.2

PRE-PROVISIONED CAPACITY: For some technologies (e.g. SDH), capacity can be expressed by a certain number of link connections (Figure 31). The link connections have all the same signal identification. These link connections must be served by the same trail.

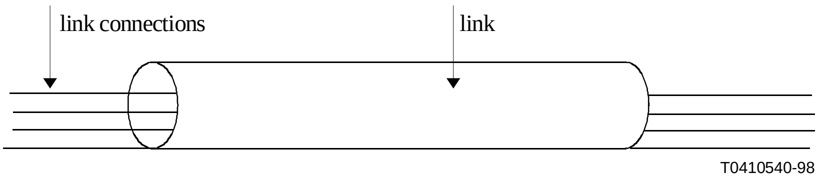


Figure 31/G.852.2

DYNAMIC CAPACITY: For some technologies (e.g. ATM), capacity can be characterized by name space and bandwidths.

DIRECTIONALITY_AND_CAPACITY: In case of a unidirectional topological link, the link connections pertaining to it shall be unidirectional and from A_end to Z_end. In case of a bidirectional topological link, the link connections pertaining to it shall be bidirectional.

PARALLEL_COMPOSITION: A compound topological link is made of component links (Figure 32). The container and the elements must have both the same signal identification and the same directionality.

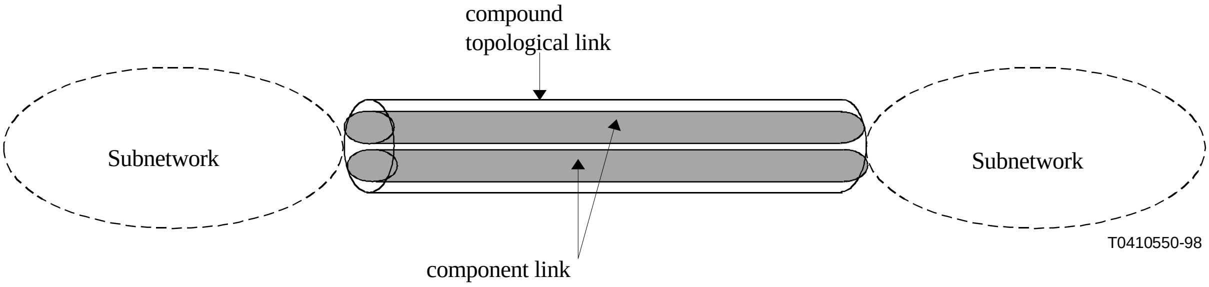


Figure 32/G.852.2

6.2.15 Topological link end

A topological link end represents the extremity of a topological link.

Properties

SIGNAL_IDENTIFICATION: A topological link end has a signal identification that characterizes all signals transferred at the topological link end.

EXTREMITIES: A topological link end terminates one topological link. The topological link has the same signal identification as the topological link end.

ADAPTATION_RELATION: A topological link end is supported by one and only one trail termination point (Figure 33). In such a case, the topological link end pertains to a given layer network (known as the client layer network) and the trail termination point that supports it pertains to a server layer network, as shown below.

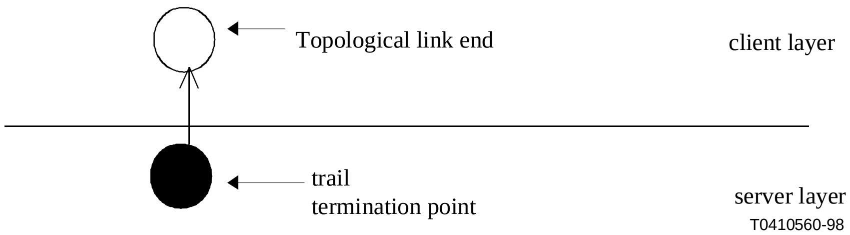


Figure 33/G.852.2

PRE-PROVISIONED CAPACITY: For some technologies (e.g. SDH), a link end is a (possibly empty) set of connection termination points (Figure 34). The connection termination points shall have the same signal identification. These connection termination points must be adapted from the same trail termination point.

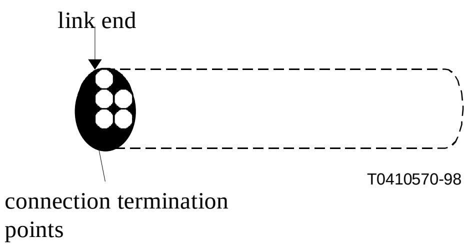


Figure 34/G.852.2

DYNAMIC CAPACITY: For some technologies (e.g. ATM), a topological link end can be characterized by name space and bandwidth.

TOPOLOGICAL_END_DIRECTION: A topological link end has a directionality that characterizes its ability to originate and/or terminate the traffic to be carried. It may be source, sink or bidirectional. A topological link end source and sink originate and terminate a unidirectional link, respectively. A topological link end bidirectional originates and terminates a bidirectional link. A topological link end source shall contain connection termination points source. A topological link end sink shall contain connection termination points sink. A topological link end bidirectional shall contain connection termination points bidirectional.

PARALLEL_COMPOSITION: A compound topological link end is made of component link ends if the corresponding topological link is made of component links (Figure 35). The container and the components must have both the same signal identification and the same direction.

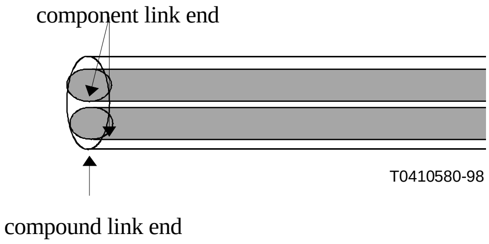


Figure 35/G.852.2

BOUNDING: One topological link end is bound to one topological component that can be one subnetwork or one access group (if at the border of the layer network).

6.2.16 Trail

A trail represents a transport entity which is responsible for the transfer and integrity of information between two trail termination points (for definition, see Recommendation G.805).

Properties

EXTREMITIES: A trail is terminated by two extremities, the trail termination points which are its A_end and Z_end. Through a unidirectional trail, traffic goes only from the A_end to the Z_end; through a bidirectional one, traffic may go from A_end to Z_end and from Z_end to A_end.

SIGNAL_IDENTIFICATION: A trail is characterized by a signal identification. The signal identification describes the signal that is transferred across the trail.

DIRECTIONALITY: Any trail is characterized by a directionality. The directionality characterizes the ability of a trail to carry traffic in one (unidirectional) or two directions (bidirectional).

COMPOSITION: A trail is made of contiguous link connections and/or subnetwork connections, as shown in Figure 36. Both the first and the last one of such a series may be either a link connection or a subnetwork connection.

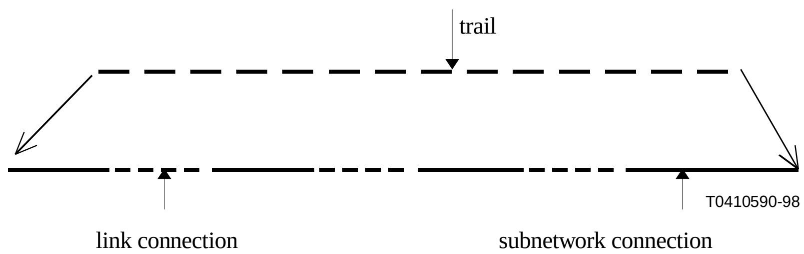


Figure 36/G.852.2

ADAPTATION_RELATION: A trail may support link connections (case of pre-provisioned link, e.g. in SDH, where link connections exist when the equipment is installed) or a topological link (case of dynamic link, e.g. in ATM where link connections will exist only when a connection is required). In such a case, the trail pertains to a given layer network (known as the server layer network) and the link connections or topological link that are supported pertain to one (or more) client layer network, as shown in Figure 37.

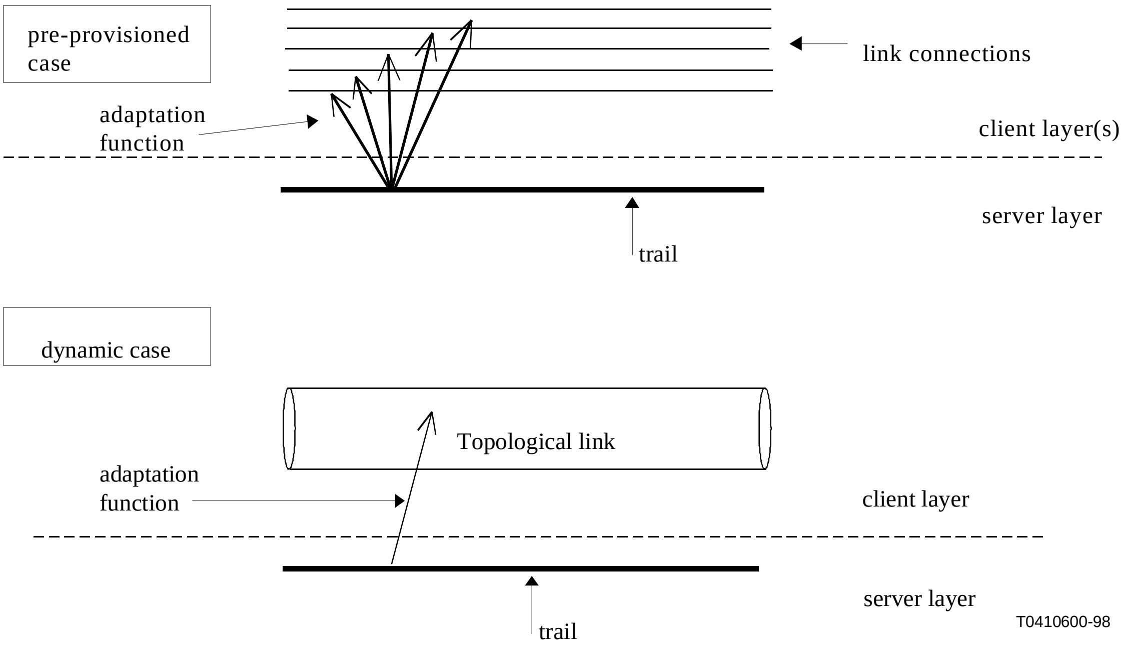


Figure 37/G.852.2

BUNDLING: A trail may bundle other trails. In the context of SDH, bundling of trails may be used for, but not restricted to, contiguous or virtual concatenation. In the context of ATM, it may be used to group a trail carrying end-user information and a trail carrying signal information. Bundled trails may be considered as paralleled to each other.

6.2.17 Trail termination point

The trail termination point represents an extremity of a trail. It is the combination of a part of the adaptation function, the access point and the trail termination function (see Figure 3).

Properties

SIGNAL_IDENTIFICATION: A trail termination point has a signal identification which describes the signal that is transferred across the trail termination point.

POINT_DIRECTIONALITY: A trail termination point has a directionality. The direction characterizes its ability to originate and/or terminate the traffic to be carried. It may be source, sink or bidirectional. A trail termination point source originates a trail. A trail termination point sink terminates a trail. A trail termination point bidirectional may either originate or terminate a trail, or both.

ADAPTATION: A trail termination point source takes as input adapted signal identification from a number of client connection termination points or from a client topological link end (Figure 38). A trail termination point sink delivers adapted signal identification to a number of client connection termination points or to a client topological link end. In such a case, the connection termination points or the topological link end pertain to one (or more) given layer network (known as the client layer network) and the trail termination point that supports them pertain to another layer network (known as the server layer network).

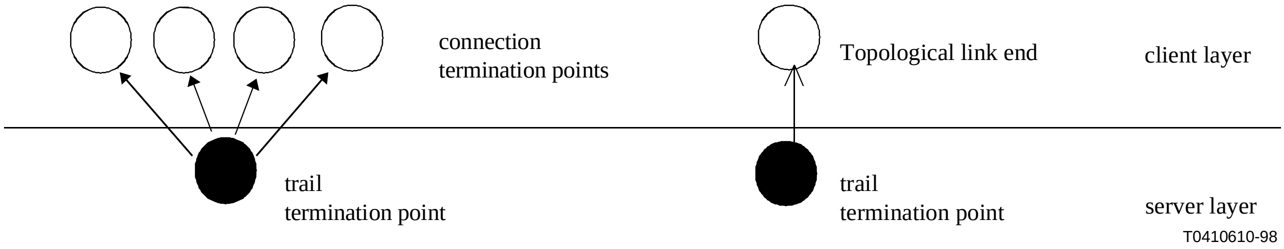


Figure 38/G.852.2

6.3 Policy

OBLIGATION RESOURCES_USE

The resources defined in this community provide a basis for the description of enterprise specifications of transport network-level management services.

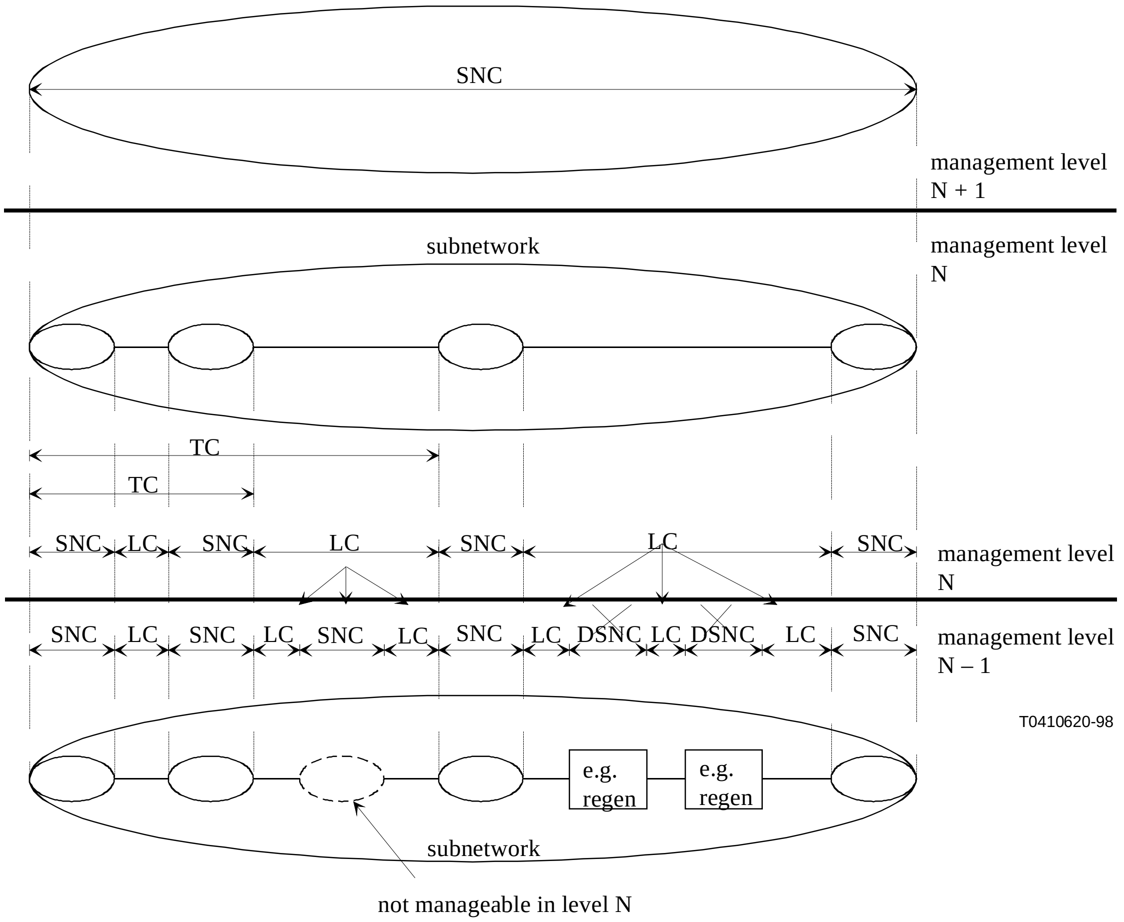
OBLIGATION RETRIEVAL

For any service operating on resources defined in this specification, the provider shall provide retrieval facilities of the following resource properties: identity of the resource, directionality (if any) and signal identification.

ANNEX A

Illustration of a tandem connection

Figure A.1 illustrates that a tandem connection is any series of contiguous link connections and/or subnetwork connections. It differs from link connections and subnetwork connections in that in order to be able to set up a tandem connection, monitoring capabilities must be available in the equipment that support its terminations (e.g. HCS function for SDH Higher-Order Path Layer).



DSNC Degenerate Subnetwork Connection
SNC Subnetwork Connection
LC Link Connection
TC Tandem Connection

Figure A.1/G.852.2

ANNEX B

Examples of use of TEM resources

The aim of this annex is to give examples of how and by which services all the resources we have been describing will be used in their management life. It is a non-normative part of this Recommendation. The services which are referred later are all described in standards which are independent each from the other; their use in such or such way is let to the discretion of the provider of applications who will use them. All that is described later on is only given as example in order to help to understand the reason of being of each G.852.2 (TEM) resource.

An activity may be defined that relates all these management components in order to construct a management application, but it is not a standardization process to describe this overall activity. The components studied so far are:

- simple subnetwork connection configuration (G.852.1): allows to connect or release a subnetwork connection across a subnetwork;
- trail management (tm): allows to connect or release a trail across a layer network domain;
- topology management (topman): allows to create, delete and modify the topology resources (subnetworks, links, link ends, access groups);
- pre-provisioned link management (plm): allows to manage the capacity of a link by adding or removing link connections;
- pre-provisioned link connection management (plcm): allows to assign the link connections inside a link to several users;
- pre-provisioned adaptation management (pam): allows to manage the adaptation between a client layer network and a server layer network by creating the link connections served by a trail.

The following principles on arc-oriented and point-oriented resources are applied:

i) Linking entity and client transport entity can be played by either an arc-oriented resource (link, topological link, link connection) or a point-oriented resource (link end, topological link end, CTP). Note that only point-oriented resource can be at the edge of the network.

ii) On the other hand, both arc-oriented resource (trail) and point-oriented resource (TTP) can play a role of server transport entity simultaneously in one community.

A typical management scenario is described in Figures B.1 through B.4 with the corresponding explanatory text below. Note that this management scenario is assuming that arc-oriented resources are within the client layer network and that point-oriented resources are at the edge of the client layer network.

1) Creation of network topology of a client layer network (Figure B.1)

   Topman Caller creates network topology resources of one client layer network domain as follows. Note that this network topology represents a typical non-partitioning case.

   (a-1) Create access group.

   (a-2) Create subnetwork.

   (a-3) Create link: This action creates topological link #1 between access group and subnetwork, which are previously created. The value of each attribute of topological link #1, such as pamMaxProvisionableCapacity, is zero.

   (a-4) Create link: This action creates a link between access group and subnetwork, which are previously created.

(a-5) Create link end: This action creates a topological link end bound to a subnetwork at the edge of a network. The value of each attribute of the topological link end, such as pamMaxProvisionableCapacity, is zero.

(a-6) Create link end: This action creates a link end bound to a subnetwork at the edge of a network.

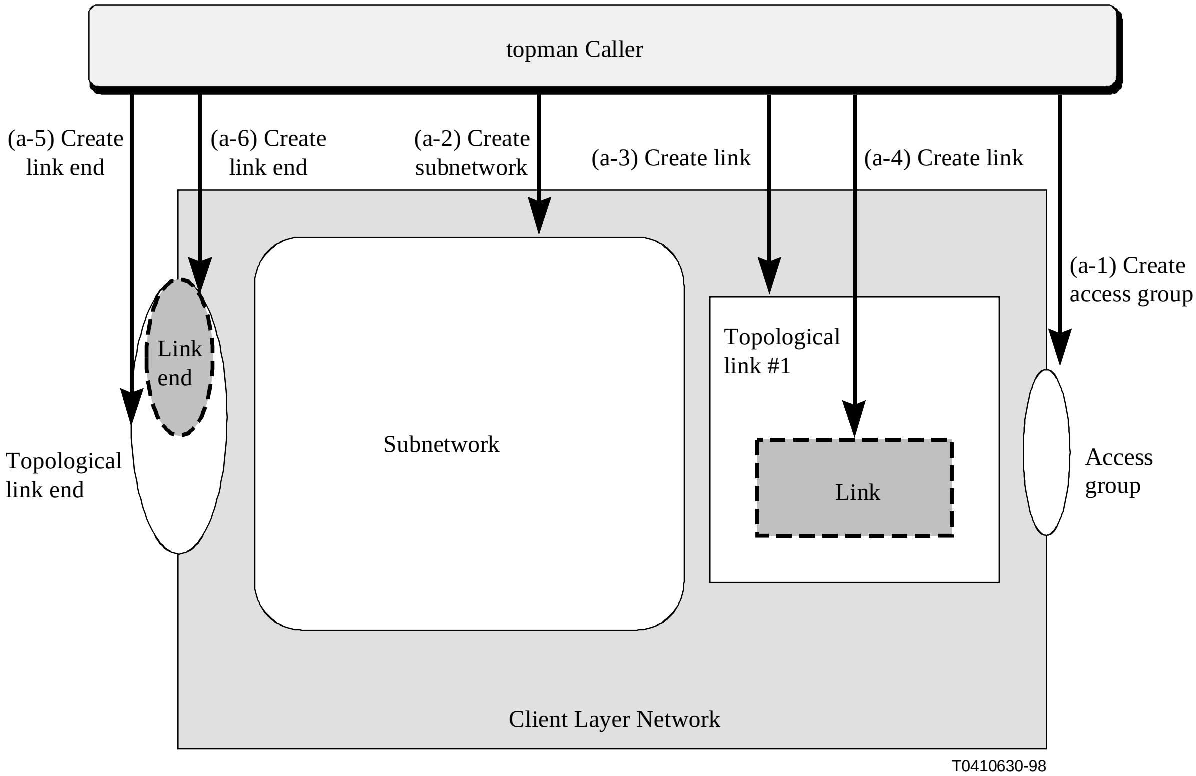


Figure B.1/G.852.2 – Creation of network topology

2) Creation of trail and TTP of a server layer network (Figure B.2)

Tm Caller creates TTPs and a trail of one server layer network domain as follows.

(b-1) Create TTP: This action creates TTP#1.

(b-2) Create TTP: This action creates TTP#2.

(b-3) Set up point-to-point trail: This action creates a trail between TTP#1 and #2.

(b-4) Create TTP: This action creates TTP#3.

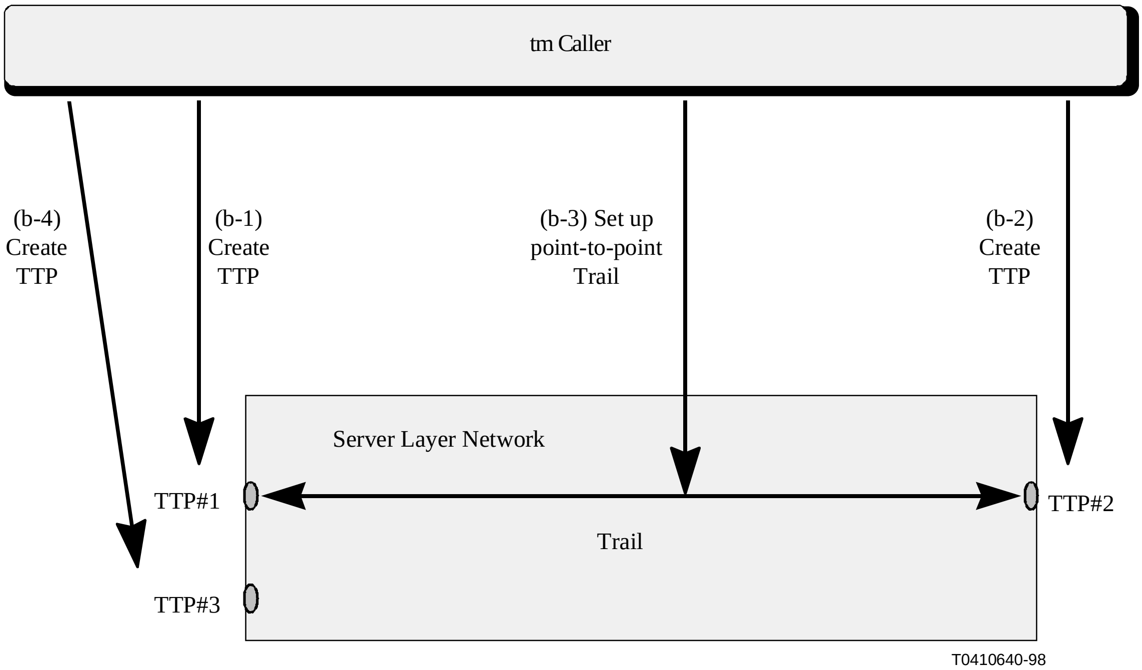


Figure B.2/G.852.2 – Creation of a trail and TTPs of a server layer network

3) Association between server layer and client layer network (Figure B.3)

As mentioned before, this management scenario is assuming that arc-oriented resources are within the client layer network and that while point-oriented resources are at the edge of the client layer network. pam Caller associates a trail and a TTP with a topological link and a topological link end, respectively. The former is called Scenario #A, while the latter is called Scenario #B in this Recommendation.

There are two cases for adaptation function: one case where the adaptation is fixed and all the client transport entities have been already provisioned during the creation of the server transport entity, the other where the adaptation is flexible. Scenario #A addresses the latter, while Scenario #B addresses the former.

Scenario #A

Two client topological linking entities, topological links #1 and #2, share one server trail. The following management scenario addresses this situation.

(c1-11) Assign server transport entity to client linking entity (pam): This action is used to assign a server trail to a client topological link #1. In this case, client link connections are not provisioned yet.

(c1-12) Provision capacity to client linking entity (pam): This action provides a capacity in terms of a number of client link connections from the server trail to a client topological link #1. The value of pamMaxProvisionableCapacity is equal to the maximum number of client link connections from the server trail. The pamProvisionedLinkCapacity is equal to the number of client link connections that the caller requested to provision.

(c1-2) Add transport entities to linking entities (plm): This action adds client link connections of client topological link #1 to the link. Note that a topological link is not a role of plm community. The link connections contained in the link shall be changed in terms of linkHasLinkConnections, while pamAvailableLinkCapacity shall increase accordingly.

(c1-3) Assign transport entity (plcm): This action assigns client link connections inside the link. Note that a topological link is not a role of plcm community. pamAvailableLinkCapacity shall decrease accordingly.

(c2-11) Assign server transport entity to client linking entity (pam): This action is used to assign a server trail to a client topological link #2. In this case, client link connections are not provisioned yet.

(c2-12) Provision capacity to client linking entity (pam): This action provides a capacity in terms of a number of client link connections from the server trail to a client topological link #2. As the trail is shared by client topological links #1 and #2, the number of link connections that the caller can request to provision in client topological link #1 will be affected by the number of provisioned link connections in client topological link #2. pamPotentialLinkCapacity represent this capacity.

Scenario #B

(d-1) Assign server transport entity to client linking entity (pam): This action is also used to cover the case where the adaptation is fixed and all the client transport entities have been already provisioned during the creation of the server transport entity. All the CTPs are provisioned in the client topological link end.

(d-2) Add transport entities to linking entities (plm): This action adds client CTPs to the link end.

(d-3) Assign transport entity (plcm): This action assigns CTPs inside the link end. Note that a topological link end is not a role of plcm community.

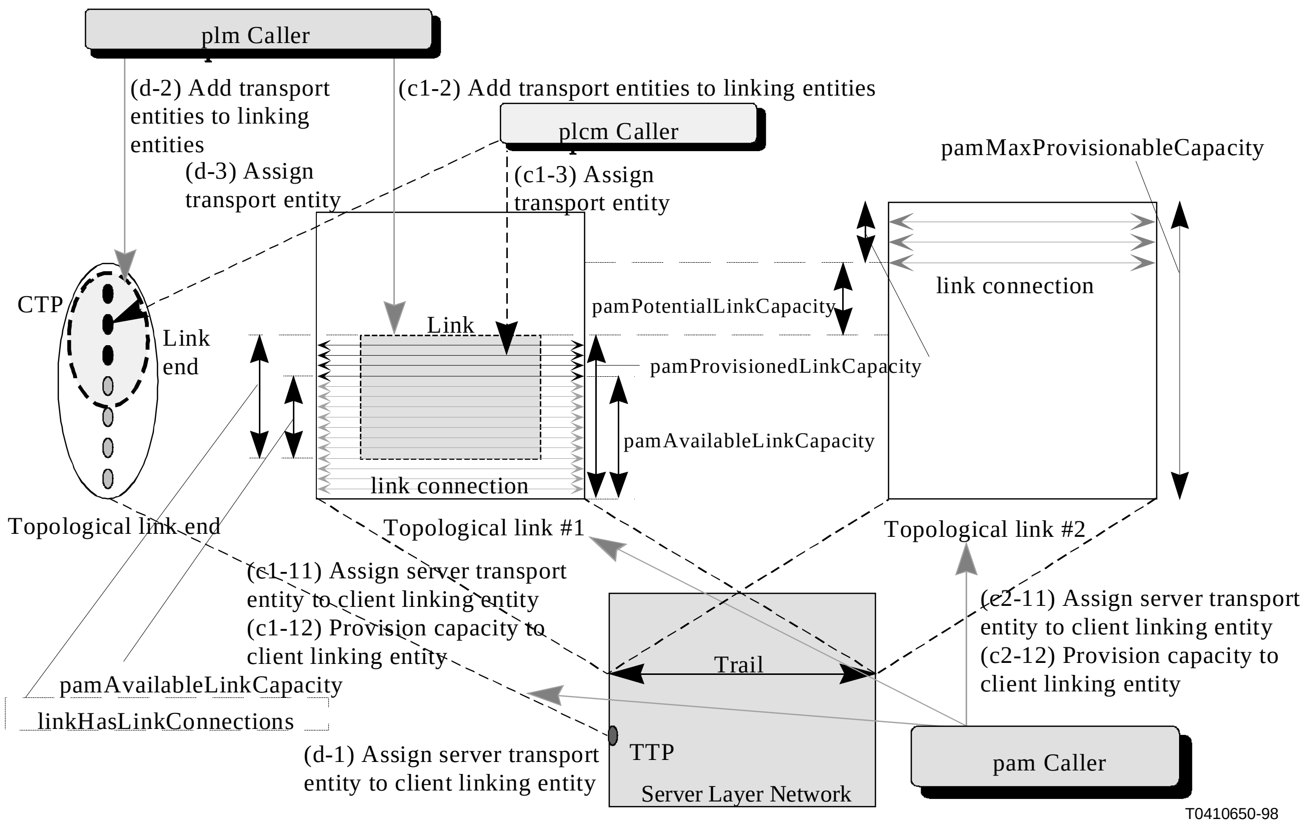


Figure B.3/G.852.2 – Association between server layer and client layer network

4) Creation of transport entities in client layer network (Figure B.4)

(e) Set up point-to-point SNC (sscc): This action sets up subnetwork connection between CTP and link connection.

(f-1) Create TTP (tm): This action creates a TTP, associating this TTP with a link connection.

(f-2) Associate TTP with access group (tm): This action associates TTP with access group.

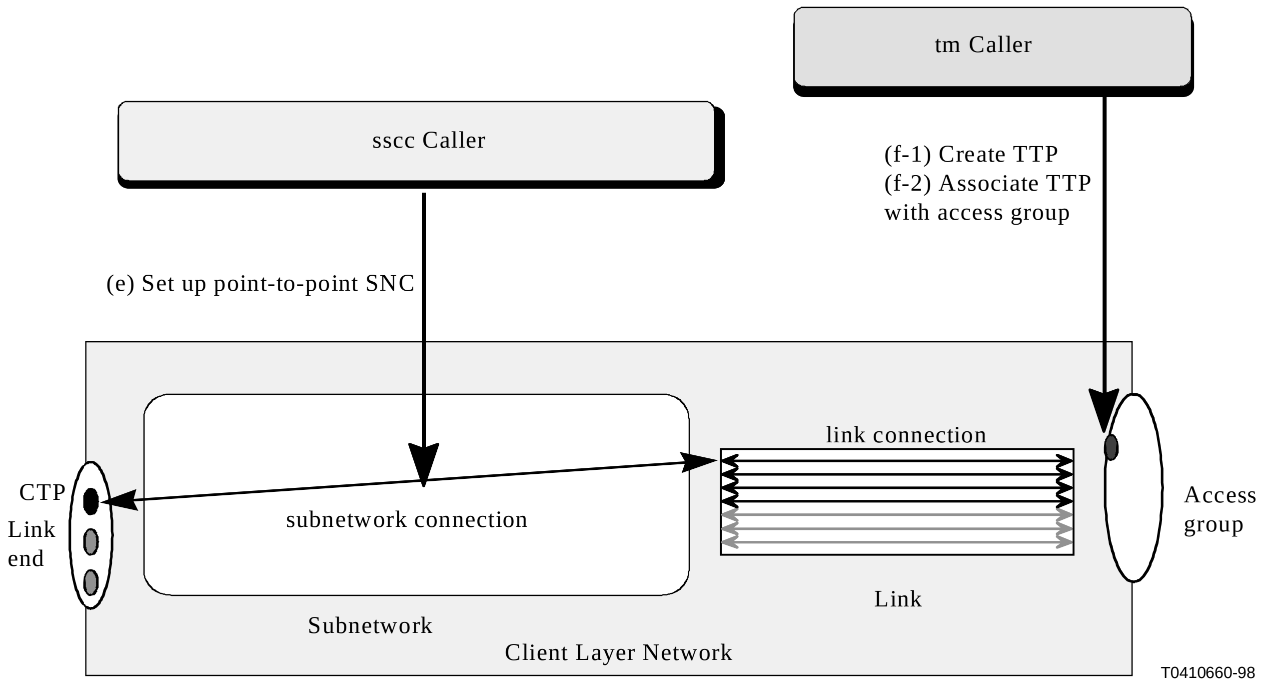


Figure B.4/G.852.2 – Creation of transport entities in client layer

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