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Digital terminal equipments – Operations, administration and maintenance features of transmission equipment

Synchronous digital hierarchy (SDH) – Management of the subnetwork connection protection for the network element view

ITU-T Recommendation G.774.4

(Formerly CCITT Recommendation)

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ITU-T Recommendation G.774.4

Synchronous digital hierarchy (SDH) – Management of the subnetwork connection protection for the network element view

Summary

This Recommendation provides an information model for the management of subnetwork connection protection of Synchronous Digital Hierarchy (SDH) subnetwork. This model describes the managed object classes and their properties for the subnetwork connection protection function, as defined in ITU-T G.803 and as related to SDH network elements. These objects are useful to describe information exchanged across interfaces defined in M.3010 Telecommunications Management Network (TMN) architecture for the management of the subnetwork connection protection function.

Document history	
Issue	**Notes**
2001	First revision incorporated the changes documented in the G.774.4 Corrigendum 1.
7/1995	Initial version of the Recommendation.

Source

ITU-T Recommendation G.774.4 was revised by ITU-T Study Group 15 (2001-2004) and approved under the WTSA Resolution 1 procedure on 9 February 2001.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. 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.

The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 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

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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As of the date of approval of this Recommendation, 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

ITU-T Recommendation G.774.4

Synchronous digital hierarchy (SDH) – Management of the subnetwork connection protection for the network element view

1 Scope

This Recommendation addresses the management of the automatic protection switching within network element at the high and low order path layers. It covers the subnetwork connection protection as described in ITU-T G.803 and G.841.

This Recommendation provides an information model, as related to the subnetwork connection protection function for the Synchronous Digital Hierarchy (SDH). It identifies the Telecommunications Management Network (TMN) object classes required for the management of the subnetwork connection protection function for SDH network elements. These objects are relevant to information exchanged across standardized interfaces defined in ITU-T M.3010 TMN architecture.

This Recommendation applies to SDH network elements which perform the subnetwork connection protection function and those systems in the TMN that manage SDH network elements.

The new objects defined in this Recommendation supersede those defined in ITU-T G.774.4 (1995). For each object class, attribute, action, notification, parameter defined in this Recommendation it shall be indicated what the impacts upon the existing ITU-T G.774.4 (1995) are.

Structure of this Recommendation

Clause 5.1 provides an overview of the SDH subnetwork connection protection information model. Clauses 6-14 describe the information model using the notation mechanisms defined in ITU-T X.722, Guidelines for the Definition of Managed Objects. Clause 14 contains the syntax definitions of the information carried in the protocol using Abstract Syntax Notation One (ASN.1) defined in ITU-T X.680-X.683. Naming and Inheritance are illustrated in Annex A. The state transition diagrams are provided in Annex C. Diagrams illustrating the subnetwork connection protection are provided in Annex B.

2 References

The following 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: 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.

- ITU-T G.707/Y.1322 (2000), *Network node interface for the synchronous digital hierarchy (SDH)*.
- ITU-T G.773 (1993), *Protocol suites for Q-interfaces for management of transmission systems*.
- ITU-T G.774 (2001), *Synchronous digital hierarchy (SDH) – Management information model for the network element view*.
- ITU-T G.783 (2000), *Characteristics of synchronous digital hierarchy (SDH) equipment functional blocks*.

– ITU-T G.784 (1999), *Synchronous digital hierarchy (SDH) management*.

– ITU-T G.803 (2000), *Architecture of transport networks based on the synchronous digital hierarchy (SDH)*.

– ITU-T G.831 (2000), *Management capabilities of transport networks based on the synchronous digital hierarchy (SDH)*.

– ITU-T G.958 (1994), *Digital line systems based on the synchronous digital hierarchy for use on optical fibre cables*.

– ITU-T M.60 (1993), *Maintenance terminology and definitions*.

– ITU-T M.2120 (2000), *PDH path, section and transmission system and SDH path and multiplex section fault detection and localization procedures*.

– ITU-T M.3010 (2000), *Principles for a telecommunications management network*.

– ITU-T M.3013 (2000), *Considerations for a telecommunications management network*.

– ITU-T M.3100 (1995), *Generic network information model*.

– ITU-T Q.811 (1997), *Lower layer protocol profiles for the Q3 and X interfaces*.

– ITU-T Q.812 (1997), *Upper layer protocol profiles for the Q3 and X interfaces*.

– ITU-T Q.822 (1994), *Stage 1, Stage 2 and Stage 3 description for the Q3-interface – Performance management*.

– ITU-T X.680 to X.683 (1997), *Information technology – Abstract Syntax Notation One (ASN.1)*.

– ITU-T X.701 (1997), *Information technology – Open Systems Interconnection – Systems management overview*.

– ITU-T X.710 (1997), *Information technology – Open Systems Interconnection – Common management information service*.

– ITU-T X.711 (1997), *Information technology – Open Systems Interconnection – Common management information protocol: Specification*.

– ITU-T X.720 (1992), *Information technology – Open Systems Interconnection – Structure of Management Information: Management information model*, *plus* Amd.1 (1995) and Cor.1 (1994).

– ITU-T X.721 (1992), *Information technology – Open Systems Interconnection – Structure for management information: Definition of management information*, *plus* Cor.1 (1994), Cor.2 (1996), Cor.3 (1998) and Cor.4 (2000).

– ITU-T X.722 (1992), *Information technology – Open Systems Interconnection – Structure of management information: Guidelines for the definition of managed objects*, *plus* Amd.1 (1995), Amd.2 (1997) and Cor.1 (1996).

– ITU-T X.730 (1992), *Information technology – Open Systems Interconnection – Systems Management: Object management function*, *plus* Amd.1 (1995) and Amd.1/Cor.1 (1996).

– ITU-T X.731 (1992), *Information technology – Open Systems Interconnection – Systems Management: State management function*, *plus* Amd.1 (1995), Cor.1 (1995) and Amd.1/Cor.1 (1996).

– ITU-T X.733 (1992), *Information technology – Open Systems Interconnection – Systems Management: Alarm reporting function*, *plus* Cor.1 (1994), Amd.1 (1995), Amd.1/Cor.1 (1996) and Cor.2 (1999).

– ITU-T X.734 (1992), *Information technology – Open Systems Interconnection – Systems Management: Event report management function*, *plus* Cor.1 (1994), Amd.1 (1995), Amd.1/Cor.1 (1996) and Cor.2 (1999).

– ITU-T X.735 (1992), *Information technology – Open Systems Interconnection – Systems Management: Log control function*, *plus* Amd.1 (1995) and Amd.1/Cor.1 (1996).

3 Terms and Definitions

This Recommendation uses the terms and definitions defined in ITU-T G.774, ITU-T G.784 and ITU-T M.3100.

4 Abbreviations

This Recommendation uses the following abbreviations:

APDU	Application Protocol Data Unit
APS	Automatic Protection Switching
BSHR	Bidirectional Self Healing Ring
CMIP	Common Management Information Protocol
CMIS	Common Management Information Service
CTP	Connection Termination Point
ISO	International Organization for Standardization
ITU-T	International Telecommunication Union – Telecommunication Standardization Sector
LOS	Loss Of Signal
MS	Multiplex Section
MSP	Multiplex Section Protection
NE	Network Element
OS	Operations System
OSI	Open Systems Interconnection
Pkg	Package
RDN	Relative Distinguished Name
RRP	Reliable Resource Pointer
SD	Signal Degrade
SDH	Synchronous Digital Hierarchy
SF	Signal Fail
SNCP	Subnetwork Connection Protection
STM-N	Synchronous Transport Module N
TMN	Telecommunications Management Network
TP	Termination Point
TTP	Trail Termination Point
URP	Unreliable Resource Pointer

WTR Wait-To-Restore

5 Subnetwork connection protection management model

5.1 Overview

The model is based on those generic classes and modelling principles outlined in ITU-T M.3100 and on those common classes from ITU-T G.774.3.

It provides a similar way to control and operate the subnetwork connection protection function as the other protection functions. The model defines three subclasses of the generic protection model:

– connectionProtectionGroupR1 which represents the association of unreliable resources for the purpose of automatic protection switching and which is the focal point for all management operation related to the protection function.

– connectionProtection which represents the protected or the protecting unit and which represents the assignment of an unreliable resource to one reliable resource. The connectionProtection is contained by a connectionProtectionGroupR1.

– mpConnectionProtection used to model protected broadcast. Each leg of the protected broadcast is represented by individual crossConnection contained by the mpConnectionProtection.

It defines also a subclass of the fabric: sncpFabric derived from the M.3100 fabric. The sncpFabric is used to handle by means of the protectedConnect and protectUnprotect action, in addition to the connect and disconnect actions of the fabric, the following capabilities:

– Configure protected cross connections using the connection protections and multipoint connection protections.

– Change from unprotected to protected connection without traffic cut.

– Change from protected to unprotected connection without traffic cut.

5.2 SDH subnetwork connection protection requirements

The management of the subnetwork connection protection function shall provide the following management capabilities:

– The ability to manage a 1 + 1 single ended subnetwork connection protection for unidirectional and/or bidirectional subnetwork connection.

– The ability to manage the protection of broadcast where all legs are protected altogether and they do not act independently.

– The ability to manage the protection of broadcast where a part of the legs are protected altogether and the other part of the legs are not protected.

– Support of inter-connection of rings using add and drop multiplexer where no interaction between rings exists and where subnetwork connection protection exists in each ring.

– Support of inter-connection of rings using add and drop multiplexer where no interaction between rings exists and where a subnetwork connection protection exists in one ring and a Multiplex Section Shared Protection Ring exists in the other ring.

– Support of inter-connection of rings using add and drop multiplexer where no interaction between rings exists and where a Multiplex Section Shared Protection Ring exists in both rings.

– Support of inter-connection of rings/subnetwork using cross-connects where subnetwork connection protection exists in each ring/subnetwork.

– The ability to configure the protection before activating it.

– The ability to configure the protection without any traffic flow and to resume the traffic afterwards.
– The ability to change the unreliable (alternate routes) resource while the protection is configured.
– The ability to pass from an existing non-protected connection to a protected connection without traffic cut.
– The ability to pass from a protected connection to an unprotected connection without any traffic cut on the transmit direction.
– The ability to pass from a protected leg of a protected broadcast to an unprotected leg without any traffic cut on the transmit direction.
– The ability to pass from an unprotected leg of a broadcast to a protected leg without any traffic cut.
– The ability when passing from a protected connection to an unprotected connection to select which of the two connections will carry the traffic afterwards.
– The ability to initiate and terminate forced and manual switch.
– The ability to lock out the protected and the protecting connection.
– The ability to suspend and resume the traffic on the protected and the protecting connections.
– The ability to configure the switching criteria.
– The ability to control a switch hold off time and a wait to restore time.
– The ability to configure the protection in a single management operation at each end of the subnetwork connection.
– The ability to add or remove a leg to/from a protected broadcast.
– The network element should not store any historical information about connection configuration before it has been configured in the protection state.

NOTE – Throughout this Recommendation the terms protecting and protected are used, it is considered that these terms are respectively equivalent to terms used in ITU-T G.841, protection and working, which are no longer used in that Recommendation.

6 Managed object class definitions

The following object class can be used to model an automatic 1 + 1 single-ended protection system for subnetwork connection protection.

Revisions that require re-registration

This clause provides replacement managed object class definitions for the existing ITU-T G.774.4 (1995). Any managed object class replaced by one in this clause is considered to be deprecated. The reasons for the replacement of a managed object class are as follows:

1) The replaced managed object class is faulty and must be fixed.
2) The replaced managed object class includes an attribute, package, notification or action which has been re-registered in this or another Recommendation.
3) The replaced managed object class inherits from a managed object class which has been re-registered in this or another Recommendation.

In each case where a class is replaced, the new class will be registered within this Recommendation. The textual label for the class will be revised to include the text "R1". For example, in the revision of the G.774.4 (1995) managed object class "connectionProtectionGroup", the revised label will become "connectionProtectionGroupR1".

Below is a table of classes deprecated from ITU-T G.774.4 (1995) and the G.774.4 classes which replace them:

Deprecated G.774.4 (1995) Classes	*Replacement G.774.4 Classes*
connectionProtectionGroup	connectionProtectionGroupR1

6.1 Connection protection group

```
connectionProtectionGroupR1  MANAGED OBJECT CLASS
     DERIVED FROM  "Recommendation G.774.03":protectionGroupR1;
     CHARACTERIZED BY
          connectionProtectionGroupPkgR1   PACKAGE
               BEHAVIOUR connectionProtectionGroupR1Behaviour;
               ATTRIBUTES
                    protectionCriteria      GET-REPLACE ADD-REMOVE;
               NOTIFICATIONS
               "Recommendation G.774.03":protectionSwitchReportingR1
               switchStatusParameter;;;
     CONDITIONAL PACKAGES
          holdOffTimePackage
          PRESENT IF "an instance supports it";
REGISTERED AS { g774-04MObjectClass 5 } ;

connectionProtectionGroupR1Behaviour BEHAVIOUR
     DEFINED AS    "This object class is used to model an automatic protection
system for subnetwork connection protection. The protectionGroupType attribute
indicates that the protection scheme used is 1+1 (plus). This object class is a
focal point for management operations and notifications related to management of
the protection system. Actual signal flow across the subnetwork connection
protection is reflected by the connectivity pointers of the TPs involved in the
subnetwork connection protection. At instantiation time of an instance of this
class the protectionCriteria attribute is intitialized by
local initial value.";
```

6.2 Connection protection

```
connectionProtection  MANAGED OBJECT CLASS
     DERIVED FROM  "Recommendation G.774.03": protectionUnit;
     CHARACTERIZED BY
     connectionProtectionPkg  PACKAGE
     BEHAVIOUR connectionProtectionBehaviour;
     ATTRIBUTES
     switchStatus  GET,
     "Recommendation X.721": administrativeState GET-REPLACE,
     "Recommendation X.721": operationalState GET,
     "Recommendation M.3100": signalType  GET,
     "Recommendation M.3100": directionality GET;
     NOTIFICATIONS
     "Recommendation X.721": stateChange,
     "Recommendation X.721": objectDeletion,
     "Recommendation X.721": objectCreation;;;
REGISTERED AS { g774-04MObjectClass 2 };
connectionProtectionBehaviour BEHAVIOUR
     DEFINED AS    "This object class is used to represent the assignment between
an unreliable resource (TP) and a reliable resource (TP) for the purpose of
subnetwork connection protection. This object class has properties of a cross-
connection since it represents a flexible assignment of termination points in the
context of subnetwork protection, according to Recommendation G.803. The
directionality attribute represents the type of traffic which flows through the
connection protection (CP). It can be either:
-    Bidirectional - The traffic flow is passing between the unreliable and the
     reliable resource in both directions.
```

- Unidirectional - The traffic flow is unidirectional and passing from the unreliable to the reliable resource.

The Unreliable Resource Pointer (URP) points to one termination point which represents one of the alternatives for the protection system. The URP points to a TP according to the directionality of the CP, i.e.:

- the URP of a Bidirectional CP must point to a Bidirectional TP or GTP;
- the URP of an Unidirectional CP must point to a Sink TP or GTP, or to a Bidirectional TP or GTP.

The Unreliable Resource Pointer points to Null when the corresponding (unreliable) TP has been temporarily disconnected from the connection protection.
The **crossConnectionObjectPointer** of the corresponding TP points to the **connectionProtection**.
The Reliable Resource Pointer points either:

- to Null in the case of a Protecting Connection Protection; or
- to a Termination Point (CTP or TTP) or GTP instance that represents one end of the subnetwork connection in the case of a protected Connection Protection.

This termination point shall have the same signal type than the CTP or GTP representing the unreliable resource used for protection.
The **crossConnectionObjectPointer** of the corresponding TP points to the **connectionProtection**.
The attribute Signal Type describes the signal that is cross-connected. The termination points or GTPs that are cross-connected must have signal types that are compatible.
If the objects listed in the Unreliable Resource Pointer and Reliable Resource Pointer attributes are GTPs, the nth element of the Unreliable Resource GTP is related to the nth element of the Reliable Resource GTP (for every n).

Administrative state

- *Unlocked* - The Connection Protection object is administratively unlocked. Traffic is allowed to pass through the Connection Protection.
- *Locked* - No traffic is allowed to pass through the Connection Protection. The traffic flow is suspended between the termination points representing the reliable and the unreliable resources. The connectivity pointers in the corresponding unreliable resources and reliable resources are updated to reflect the suspension of traffic flow.

Setting the administrative state to locked does not prevent the protection function from attempting to operate.

Operational state

The operational state reflects only the connection capability of the connection protection:

- *Enabled* - The Connection Protection is performing its normal cross-connection function.
- *Disabled* - The Connection Protection is incapable of performing its normal cross-connection function.

The operational state of Disabled is considered as a signal failure on the corresponding connection and as such it must be taken into account in the protection mechanism.
The **switchStatus** indicates the status of the switching requests.";

6.3 Multipoint connection protection

```
mpConnectionProtection  MANAGED OBJECT CLASS
     DERIVED FROM  "Recommendation G.774.03": protectionUnit;
     CHARACTERIZED BY
     mpConnectionProtectionPkg  PACKAGE
     BEHAVIOUR mpConnectionProtectionBehaviour;
     ATTRIBUTES
     switchStatus  GET,
     "Recommendation X.721": administrativeState GET-REPLACE,
     "Recommendation X.721": operationalState GET,
     "Recommendation X.721": availabilityStatus GET,
```

```
     "Recommendation M.3100": signalType  GET;
     NOTIFICATIONS
     "Recommendation X.721": stateChange,
     "Recommendation X.721": objectDeletion,
     "Recommendation X.721": objectCreation;;;
REGISTERED AS { g774-04MObjectClass 3 };
mpConnectionProtectionBehaviour BEHAVIOUR
     DEFINED AS    "This object class is used to represent the assignment between
an unreliable resource, which is the termination point or GTP object listed in
the Unreliable Resource Pointer attribute, and a set of reliable resources for
the purpose of protection of point-to-multipoint connection. The reliable
resources are the termination point or GTP objects listed in the To Termination
attributes of the crossConnectionmanaged objects contained by protected mp
Connection Protection.
This object class has properties of a multipoint cross-connection since its
represents a flexible assignment of termination points in the context of
subnetwork protection according to Recommendation G.803.
The Unreliable Resource Pointer (URP) points to one termination point or GTP
which represents one of the two alternatives for the protection system.
The URP must point to a Sink CTP or GTP, or to a Bidirectional TP or GTP.
The Unreliable Resource Pointer points to Null when the corresponding
(unreliable) TP has been temporarily disconnected from the multipoint connection
protection.
The crossConnectionObjectPointer of the corresponding TP points to the
mpConnectionProtection.
The Reliable Resource Pointer has always the value NULL. The reliable resources
are represented by all the termination point or GTP objects pointed to by the To
Termination attribute of the crossConnection managed objects contained by the
protected mpConnectionProtection.
The attribute Signal Type describes the signal that is cross-connected. The
termination points or GTPs that are cross-connected must have signal types that
are compatible.
```

Administrative state

- *Unlocked* - The Multipoint Connection Protection object is administratively unlocked. It allows traffic to pass through each contained cross-connection depending on its administrative state.
- *Locked* - No traffic is allowed to pass through the Cross-Connection between the cross-connected termination points. The effect of this value overrides the effect of the administrative state of each contained cross-connection.

Setting the administrative state to locked does not prevent the protection function from attempting to operate.

Operational state

The operational state of a Multipoint Connection Protection object reflects the overall health of the cross-connection including all the Cross-Connection objects contained in the Multipoint Connection Protection.

- *Enabled* - The Cross-Connection is performing its normal function. Note that some (but not all) of the cross-connection objects contained in the protected Multipoint Connection Protection may be disabled.
- *Disabled* - The Cross-Connection is incapable of performing its normal cross-connection function. All the cross-connection objects contained in the protected Multipoint Connection Protection are disabled.

The operational state of Disabled is considered as a signal failure on the corresponding connection and as such it must be taken into account in the protection mechanism.

Availability status

```
The supported values for this attribute are:
-    Degraded - The Multipoint Connection Protection is degraded in some respect.
     For instance, if one or more (but not all) Cross-Connection objects
     contained in the protected Multipoint Connection Protection are disabled,
     the Multipoint Connection Protection will be considered as degraded. The
     Multipoint Connection Protection remains available for service (i.e. its
     operational state is enabled) while it is degraded. No automatic protection
     switch occurs.
-    Empty SET.
The switchStatus indicates the status of the switching requests.";
```

6.4 Subnetwork connection protection fabric

```
sncpFabric MANAGED OBJECT CLASS
     DERIVED FROM  "Recommendation M.3100": fabric;
     CHARACTERIZED BY
     sncpFabricPackage PACKAGE
     BEHAVIOUR sncpFabricBehaviour;
     ACTIONS
     protectUnprotect,
     protectedConnect;;;
REGISTERED AS { g774-04MObjectClass 4 };
sncpFabricBehaviour BEHAVIOUR
     DEFINED AS    "The subnetwork connection protection fabric object represents
the function of managing the establishment and release of protected cross-
connections.";
```

7 Packages

7.1 Hold off time package

```
holdOffTimePackage PACKAGE
     ATTRIBUTES
     holdOffTime GET-REPLACE;
REGISTERED AS { g774-04Package 1 };
```

8 Attributes

8.1 Hold off time

```
holdOffTime   ATTRIBUTE
     WITH ATTRIBUTE SYNTAX SDHSNCPASN1.HoldOffTime;
     MATCHES FOR EQUALITY;
     BEHAVIOUR holdOffTimeBehaviour;
REGISTERED AS { g774-04Attribute 1 };
holdOffTimeBehaviour BEHAVIOUR
     DEFINED AS    "This attribute specifies the amount of 100 ms periods which
represents the time to wait before performing a protection switch after a defect
has occurred on either the protecting or protected protection unit. The minimum
value is zero (no hold off time) and the maximum value is 100 (representing 10
seconds). The hold off time is defined in G.841.";
```

8.2 Protection criteria

protectionCriteria ATTRIBUTE
WITH ATTRIBUTE SYNTAX SDHSNCPASN1.ProtectionCriteria;
MATCHES FOR EQUALITY;
BEHAVIOUR protectionCriteriaBehaviour;
REGISTERED AS { g774-04Attribute 2 };
protectionCriteriaBehaviour BEHAVIOUR
DEFINED AS "This attribute specifies the list of configurable criteria that are to be used for automatic switch decision supplementing those criteria which are defined as mandatory and fixed within the SNCP function as stated in G.841. ";

8.3 Switch status

switchStatus ATTRIBUTE
WITH ATTRIBUTE SYNTAX SDHSNCPASN1.ProtectionStatus;
MATCHES FOR EQUALITY;
BEHAVIOUR switchStatusBehaviour;
REGISTERED AS { g774-04Attribute 3 };
switchStatusBehaviour BEHAVIOUR
DEFINED AS "The following is a list of all the possible status values of the **switchStatus** attribute for protected connection protection or protected **mpConnectionProtection**:

- *No request* - There is no outstanding request. An active switch hold off time is considered a no request.
- *Do Not Revert* - The protected connection protection has been switched to the protecting connection protection and the request to do so has been subsequently cleared. This status is only applicable to 1 + 1 non-revertive systems.
- *Wait-to-Restore* - The protected connection protection has recovered from an auto switch condition and the WTR timer is activated.
- *Manual switch to the protecting connection protection completed* - The protected connection protection has been switched to the protecting connection protection by a manual switch request.
- *Auto switch to the protecting connection completed* - The protected connection protection has been switched to the protecting connection protection due to an auto switch condition.
- *Auto switch pending* - An auto switch request cannot been completed due to the unavailability of the protecting connection protection.
- *Forced switch to the protecting connection protection completed* - The protected connection protection has been forced to switch to the protecting connection protection.
- *Forced switch to the protecting connection protection completed - auto switch pending* - An auto switch request cannot be completed due to a completed forced switch (to protecting connection protection).
- *Lockout of protected connection protection* - The protected connection protection is prevented from switching to protection.
- *Lockout of protected connection protection - auto switch pending* - An auto switch request cannot be completed due to the lockout of the protected connection protection.

The following is a list of all the possible status values of the **switchStatus** attribute for protecting connection protection or protecting **mpConnectionProtection**:

- *No request* - There is no outstanding request. An active switch hold off time is considered a no request.
- *Do Not Revert* - The protected connection protection has been switched to the protecting connection protection and the request to do so has been cleared. This status is only applicable to 1 + 1 non-revertive systems.
- *Manual switch to the protecting connection protection completed* - The protected connection protection has been switched to the protecting connection protection by a manual switch request.

- *Auto switch to the protecting connection protection completed* - A protected connection protection has been switched to the protecting connection protection due to an auto switch condition.
- *Signal fail* - A signal fail condition exists on the protecting connection protection (no traffic is being carried on the protecting connection protection).
- *Forced switch to the protecting connection completed* - The protected connection protection has been forced to switch to the protecting connection protection.
- *Lockout of protection* - The protecting connection protection is prevented from providing protection.
- *Lockout of protection - auto switch condition on protecting connection protection* - A lockout of protection is in place, and an auto switch condition exists on the protecting connection protection.";

9 Actions

9.1 Protected connect action

```
protectedConnect   ACTION
     BEHAVIOUR     protectedConnectBehaviour;
     MODE CONFIRMED;
     WITH INFORMATION SYNTAX SDHSNCPASN1.ProtectedConnectInformation;
     WITH REPLY SYNTAX  SDHSNCPASN1.ProtectedConnectResult;
REGISTERED AS { g774-04Action 1 };
protectedConnectBehaviour BEHAVIOUR
     DEFINED AS    "This action offers the capability, in a single action, to:
1)   Establish a protected connection between termination points/GTPs (connect
     Choice of the syntax). The connection to be established is part of a
     subnetwork connection protection. The Termination Points/GTP involved in
     this protected connection must not be already connected for the concerned
     direction. In this case this connection establishment is done according to
     the following rules:
     -    The protecting TP is used to describe the unreliable TP(s) of the
          protecting connection. This must be done according to the description
          of the protection Connection Type.
     -    The protection Connection Type is used to describe the type of
          connection to be established, i.e. unidirectional or bidirectional. The
          protection Connection Type describes the connection between the
          unreliable TPs and the reliable TPs for the protected connection.
     -    If the protection Connection Type is bidirectional, a
          connectionProtectionGroupR1 is created. The To TP part of the syntax
          represents the reliable resource.
     -    If the protection Connection Type is unidirectional, it can concern
          either:
          -    A unidirectional point-to-point subnetwork connection protection.
               In this case a connectionProtectionGroupR1 is created.
          -    A unidirectional point-to-multipoint subnetwork connection
               protection where all legs are protected altogether. In this case a
               connectionProtectionGroupR1 is created, containing:
               a)   the mpConnectionProtection of the working channel, connecting
                    the unreliable TP. The reliable TPs are connected by
                    crossConnection objects contained by the
                    mpConnectionProtection.
               b)   the mpConnectionProtection of the protecting channel. This
                    mpConnectionProtection does not contain crossConnection
                    object.
The administrative state of the created connections objects is specified as an
optional parameter of this action. If this parameter is omitted, the
administrative state will be set to 'unlocked'.
```

2) Add TPs/GTPs as destinations of a point-to-multipoint connection. (**addLeg** Choice of the syntax).
   - The legs may be added as part of the protected legs (corresponding to the sub-choice protected Legs of the syntax). In that case each **crossConnection** object corresponding to each individual leg is created, these **crossConnections** are contained by the protected **mpConnectionProtection** contained by the **connectionProtectionGroupR1**.
   - The legs may be added as non-protected legs (corresponding to the sub-choice unprotected Legs of the syntax). In that case each **crossConnection** object corresponding to each individual leg is created, these **crossConnections** are contained by the **mpCrossConnection** representing the unprotected broadcast. If no unprotected **mpCrossConnection** exists then an **mpCrossConnection** is created, containing all the specified unprotected legs (if only one unprotected leg exists, then a point-to-point unidirectional cross-connection is created). If this action concerns an existing unidirectional point-to-point cross-connection then a point-to-multipoint cross-connection is created which contains the **crossConnections** representing legs.

The administrative state of the created cross-connection or connection protection objects will be the same as that of the containing multipoint cross-connection or multipoint connection protection object unless otherwise specified in the action parameters.

3) Connect a TP as the unreliable resource of an existing protected connection (protected or protecting **connectionProtection** or **mpConnectionProtection** contained in a **connectionProtectionGroupR1**). (**addUnreliable** Choice of the syntax)
   - If the specified TP is not already connected for the corresponding direction (**notConnected** sub-choice of the syntax), it will be connected by the specified **connectionProtection** or **mpConnectionProtection**.
   - If the specified TP is already connected for the corresponding direction (connected sub-choice of the syntax) by a unidirectional connection (point-to-point or multipoint), the TP will point to the **connectionProtection** or **mpConnectionProtection** in addition to the existing connection(s).";

9.2 Protect unprotect connection action

```
protectUnprotect ACTION
     BEHAVIOUR  protectUnprotectBehaviour;
     MODE CONFIRMED;
     WITH INFORMATION SYNTAX SDHSNCPASN1.ProtectUnprotectInformation;
     WITH REPLY SYNTAX  SDHSNCPASN1.ProtectedConnectResult;
REGISTERED AS { g774-04Action 2 };
protectUnprotectBehaviour BEHAVIOUR
     DEFINED AS     "This action offers the capability, in a single action, to:
1)   Protect an existing unprotected connection (protect Choice of the syntax).
     The description for protecting an existing connection uses the same syntax
     as the establishment of a new protected connection, and follows the same
     rules, except that all the TPs or GTP specified in the
     protectionConnectionType part must be explicitly specified by their object
     instances (i.e. no tpPool, no GTP expressed by a sequence of TPs). The
     connectivity specified by the protectionConnectionType part of the syntax
     must reflect the same connectivity (signal flow expressed by the
     connectivity pointers) as the existing one, i.e.:
     -    For a unidirectional point-to-point, the TP specified as the From and
          the To must be already cross-connected the same way as described and
          they should not be already protected for the concerned direction.
     -    For a bidirectional point-to-point, the TPs specified as the from and
          the To must be already cross-connected the same way as described, i.e.:
          a bidirectional cross-connection connecting the From TP and the To TP
          (reliable TP) must already exist.
     -    For a point-to-multipoint, the TP specified as the From and all the TPs
          specified as the To must be already cross-connected the same way and
          none of them should be already part of a protection scheme for the
```

concerned direction. Only those legs which are specified as part of the **protectedConnect** Information will be involved in the protection scheme. A **connectionProtectionGroupR1**, two **mpConnectionProtection's** and each **crossConnection** representing each leg are created as the result of this action. If all legs are involved in the protection scheme then the existing **mpCrossConnection** is deleted. The administrative state of the new created connection objects will be the same as that of the existing one they are to replace, unless otherwise specified in the action parameters. The result, if OK is given by the connected Choice of the syntax.

2) Unprotect an existing protected connection (unprotect Choice of the syntax). The description for unprotecting an existing connection uses the same syntax as the establishment of a new unprotected connection, i.e. the **ConnectionType** and **ConnectionTypeBi**, and follows the same rules, except that all the described connections must already exist, and all the TPs or GTP specified in this action must be explicitly specified by their object instances. The connectivity specified by the syntax must reflect the same connectivity as the existing one for either the working or the protect part of the **ConnectionProtectionGroupR1**, i.e.:

- For a unidirectional point-to-point connection protection, the TP specified as the From and the To must be respectively the unreliable TP and the reliable TP of the (protected or protecting) **connectionProtection**.
- For a bidirectional point-to-point, the TPs specified as the From and the To must be respectively the unreliable TP of either the protected or protecting **connectionProtection** and the reliable TP of the protected **connectionProtection**. When the choice single of the syntax is used, a bidirectional cross-connection is created (uniform route) connecting the specified Unreliable TP and the Reliable TP. When the choice multiple of the syntax is used, two unidirectional cross-connections are created (diverse route), one connecting the specified Unreliable TP to the Reliable TP, and the other connecting the Reliable TP to the specified Unreliable TP.
- For a point-to-multipoint, the TP specified as the From and all the TPs specified as the To must be respectively the unreliable TP of the protected mp Connection Protection and the To TPs of the cross-connects contained in the mp connection protection. If TPs are specified which do not pertain to the protection scheme, the requests fail with the logical problem mismatching TP Instances. Only those TPs which are explicitly specified as part of the **protectedUnprotectInformation** will be unprotected, and if no **mpCrossConnection** was already existing then one is created which holds each **crossConnection** corresponding to each unprotected leg. If no other TP remains in the protected scheme, then the **connectionProtectionGroupR1** is deleted and consequently all its contained objects. The administrative state of the new created connection objects will be the same as that of the existing one they are to replace, unless otherwise specified in the action parameters.";

10 Parameters

10.1 Switch status

```
switchStatusParameter   PARAMETER
     CONTEXT EVENT-INFO;
     WITH SYNTAX    SDHSNCPASN1.ProtectionStatusParameter;
     BEHAVIOUR switchStatusParameterBeh;
REGISTERED AS { g774-04Parameter 1 };
switchStatusParameterBeh BEHAVIOUR
     DEFINED AS     "This parameter is included in the additional info parameters
of the protection switching reporting notification. This notification is sent by
the protection group according to the following rules. There are several cases:
```

- The switch from protected to protecting or protecting to protected has been done without preempting an existing switch. In this case, the old and new values of the Switch status attribute of the protecting channel shall be reported in the notification by means of the **oldSwitchStatus** and **newSwitchStatus** parameters respectively.
- A switch is performed by preemting an exiting one. In this case, the old and new values of the Switch status attribute of the protecting channel shall be reported in the notification by means of the **oldSwitchStatus** and **newSwitchStatus** parameters respectively.
- An auto switch condition exists on a channel but the auto switch cannot be served due to the unavailability of the channel that otherwise protects it. In this case the **oldSwitchStatus** and **newSwitchStatus** parameters refer to the switch status attribute value of the channel on which the auto switch condition arises. The exception is when the channel is already forced or locked out, in which case no notification is sent.
- A working channel (protected unit) has been locked out or released from lockout without modifying any existing switch. In this case the **oldSwitchStatus** and **newSwitchStatus** parameters refer to the switch status attribute value of the working channel which has been locked out.
- A protection channel (protecting unit) has been locked out or released from lockout without modifying the existing switch. In this case, the **oldSwitchStatus** and **newSwitchStatus** parameters refer to the switch status attribute value of the protection channel which has been locked out.

The **protectionSwitchReporting** is not sent when the automatic switch condition is toggling between SF and WTR condition. While in the lockout of forced switch state no notification is sent except for ending of release failure.";

11 Name bindings

Revisions that require re-registration

This clause provides replacement namebinding definitions for the existing ITU-T G.774.4 (1995). Any namebinding replaced by one in this clause is considered to be deprecated. The reasons for the replacement of a namebinding are as follows:

1) The replaced namebinding is faulty and must be fixed.
2) The replaced namebinding refers to a superior managed object class which has been re-registered in this or another Recommendation.
3) The replaced namebinding refers to a subordinate managed object class which has been re-registered in this or another Recommendation.
4) The replaced namebinding refers to a naming attribute which has been re-registered in this or another Recommendation.

In each case where a namebinding is replaced, the new namebinding will be registered within this Recommendation. The textual label for the namebinding will be revised to include the text "R1". For example, in the revision of the G.774.4 (1995) namebinding "connectionProtection-connectionProtectionGroup", the revised label will become "connectionProtection-connectionProtectionGroupR1". Note the "R1" is placed immediately following the revised class which impacts the namebinding.

Below is a table of namebindings deprecated from ITU-T G.774.4 (1995) and the G.774.4 namebindings which replace them:

Deprecated G.774.4 (1995) Namebindings

connectionProtection-connectionProtectionGroup
connectionProtectionGroup-sncpFabric
mpConnectionProtection-connectionProtectionGroup

connectionProtection-connectionProtectionGroupR1
connectionProtectionGroupR1-sncpFabric
mpConnectionProtection-connectionProtectionGroupR1

11.1 Connection protection

```
connectionProtection-connectionProtectionGroupR1 NAME BINDING
     SUBORDINATE OBJECT CLASS         connectionProtection AND SUBCLASSES;
     NAMED BY SUPERIOR OBJECT CLASS connectionProtectionGroupR1
          AND SUBCLASSES;
     WITH ATTRIBUTE"Recommendation G.774.03":protectionUnitId;
     BEHAVIOUR
          connectionProtection-connectionProtectionGroupR1Beh BEHAVIOUR
               DEFINED AS    "The connection protection is contained by a
connection protection Group managed object instance. There must be two and only
two CP (Connection Protection) in the CPG (Connection Protection Group), with the
same signal type and the same directionality. This is used to represent a
point-to-point unidirectional or bidirectional connection protection. One of
these CPs must be the protected one (protecting attribute with the value
'FALSE'), and the other must be the protecting one (protecting attribute with the
value 'TRUE')." ;;
REGISTERED AS { g774-04NameBinding 7 }
;
```

11.2 Connection protection group R1

```
connectionProtectionGroupR1-sncpFabric NAME BINDING
     SUBORDINATE OBJECT CLASS
          connectionProtectionGroupR1 AND SUBCLASSES;
     NAMED BY SUPERIOR OBJECT CLASS
          sncpFabric AND SUBCLASSES;
     WITH ATTRIBUTE     "Recommendation G.774.03":protectionGroupId;
     BEHAVIOUR  connectionProtectionGroupR1-sncpFabricBeh BEHAVIOUR
          DEFINED AS     "A Connection Protection Group is created as the
result of the establishment of a protected connection (point-to-point or point-
to-multipoint) or of the protection of an existing non-protected connection. When
disconnecting a TP involved in a protected connection:
-    if the TP is the reliable resource of a point-to-point connection
     protection, or the last reliable resource (last leg) of a multipoint
     connection protection, this leads to the disconnection of the protection,
     resulting in the deletion of the connection protection group and all
     contained objects.
-    if the TP is the unreliable resource of a connection protection or
     multipoint connection protection, the corresponding Unreliable Resource
     Pointer is set to NULL. Such a disconnection shall be considered as a signal
     failure. A new unreliable resource (TP) may be connected using the
     capability to add a new unreliable resource of the protected connect action.
     When both unreliable TPs are disconnected, this leads to the disconnection
     of the protection, resulting in the deletion of the connection protection
     group and all contained objects. ";;
REGISTERED AS { g774-04NameBinding 8 };
```

11.3 Cross connection

```
crossConnection-mpConnectionProtection NAME BINDING
     SUBORDINATE OBJECT CLASS "Recommendation M.3100":
crossConnection AND SUBCLASSES;
     NAMED BY SUPERIOR OBJECT CLASS mpConnectionProtection AND SUBCLASSES;
     WITH ATTRIBUTE  "Recommendation M.3100":crossConnectionId;
     DELETE ONLY-IF-NO-CONTAINED-OBJECTS;
REGISTERED AS { g774-04NameBinding 3 };
```

```
crossConnection-sncpFabric NAME BINDING
     SUBORDINATE OBJECT CLASS "Recommendation M.3100":
crossConnection AND SUBCLASSES;
     NAMED BY SUPERIOR OBJECT CLASS sncpFabric AND SUBCLASSES;
     WITH ATTRIBUTE  "Recommendation M.3100":crossConnectionId;
     DELETE ONLY-IF-NO-CONTAINED-OBJECTS;
REGISTERED AS { g774-04NameBinding 5 };
```

11.4 Multipoint connection protection

```
mpConnectionProtection-connectionProtectionGroupR1 NAME BINDING
     SUBORDINATE OBJECT CLASS         mpConnectionProtection AND SUBCLASSES;
     NAMED BY SUPERIOR OBJECT CLASS
          connectionProtectionGroupR1 AND SUBCLASSES;
     WITH ATTRIBUTE1    "Recommendation G.774.03":protectionUnitId;
     BEHAVIOUR mpConnectionProtection-connectionProtectionGroupR1Beh
          BEHAVIOUR
               DEFINED AS    "MultiPoint Connection Protection are created as
the result of the establishment of a protected multipoint connection or of the
protection of an existing non-protected multipoint connection. The multipoint
connection protections are contained directly by the connection protection Group
managed object instance. There must be two and only two mpConnectionProtections
in the connectionProtectionGroup, with the same signal type. This is used to
represent the point to multipoint unidirectional connection protection.
One of these mpConnectionProtection must be the protected one (protecting
attribute with the value FALSE), and the other must be the protecting one
(protecting attribute with the value TRUE).
Only the protected mpConnectionProtection can contain cross-connections
representing the reliable resources. The configuration may be done prior to any
existing cross-connection or on an existing multipoint cross-connection." ;;
REGISTERED AS { g774-04NameBinding 9 };
```

11.5 Multipoint cross connection

```
mpCrossConnection-sncpFabric NAME BINDING
     SUBORDINATE OBJECT CLASS "Recommendation M.3100":
mpCrossConnection AND SUBCLASSES;
     NAMED BY SUPERIOR OBJECT CLASS sncpFabric AND SUBCLASSES;
     WITH ATTRIBUTE "Recommendation M.3100":mpCrossConnectionId;
REGISTERED AS { g774-04NameBinding 6 };
```

12 Subordination rules

None.

13 Pointer constraints

None.

14 Supporting ASN.1 productions

```
SDHSNCPASN1 { itu-t(0) recommendation(0) g(7) g774(774) hyphen(127) sncp(04)
informationModel(0) asn1Module(2) sdhsncp (0) }
DEFINITIONS IMPLICIT TAGS  ::=
BEGIN
--  EXPORTS everything  --
IMPORTS
ObjectInstance
FROM CMIP-1 { joint-iso-ccitt ms(9) cmip(1) modules(0) protocol(3) }
```

```
AdministrativeState, OperationalState
FROM Attribute-ASN1Module { joint-iso-ccitt ms(9) smi(3) part2(2) asn1Module(2) 1
}
AddLeg, Connected, ConnectionType, ConnectionTypeBi, Directionality,
ExplicitPtoMP,
ExplicitPtoP, ExplicitTP, Failed, PointToMultipoint, PointToPoint, PtoMPools,
PtoTPPool
FROM ASN1DefinedTypesModule { ccitt recommendation m(13) gnm(3100)
informationModel(0) asn1Modules(2) asn1DefinedTypesModule(0) }
Boolean, Integer, ProtectionStatus, ProtectionStatusParameter
FROM SDHProtASN1 { itu-t(0) recommendation(0) g(7) g774(774) hyphen(127) prot(03)
informationModel(0) asn1Module(2) sdhmsp(0) };
sdhSNCP OBJECT IDENTIFIER ::= { itu-t(0) recommendation(0) g(7) g774(774)
hyphen(127)
sncp(04) informationModel(0) }
g774-04MObjectClass OBJECT IDENTIFIER ::=  { sdhSNCP managedObjectClass(3) }
g774-04Attribute OBJECT IDENTIFIER ::=  { sdhSNCP attribute(7) }
g774-04Action OBJECT IDENTIFIER ::=  { sdhSNCP action(9) }
g774-04NameBinding OBJECT IDENTIFIER ::=  { sdhSNCP nameBinding(6) }
g774-04Parameter OBJECT IDENTIFIER ::=  { sdhSNCP parameter(5) }
g774-04Package OBJECT IDENTIFIER ::=  { sdhSNCP package(4) }
g774-04StandardSpecificExtension OBJECT IDENTIFIER ::=  { sdhSNCP
standardSpecificExtension(0) }
--  The following value assignments are for the Protection Criteria in the
--  context of SDH.
--  These values shall always be assigned by this Recommendation in the context
--  of SDH.
sncpProtectionCriteria  OBJECT IDENTIFIER ::=
{ g774-04StandardSpecificExtension 0 }
sncpPathTraceMismatchCriteria   OBJECT IDENTIFIER ::= { sncpProtectionCriteria 1 }
sncpExcessiveErrorCriteria  OBJECT IDENTIFIER ::= { sncpProtectionCriteria 2 }
ConnectUnreliableTP ::= CHOICE {
     notConnected  [0]  UnreliableTp,
     connected     [1]  UnreliableTp
     }
HoldOffTime ::=    INTEGER
PointToPointProtection ::=  SEQUENCE {
     protectedPointToPoint   PointToPoint,
     protectingPointToPoint  ProtectingConnection
     }
--  The object Instance of the xCon of PointToPoint represents the object
--  instance of the created connectionProtection
PointToMultipointProtection ::=  SEQUENCE {
     protectedPointToMultipoint  PointToMultipoint,
     protectingPointToMultipoint ProtectingConnection
     }
--  The object Instance of the xConnections and mpXCon of PointToMultipoint
--  represents the object instances of the created crossConnections and
--  mpConnectionProtection
--  The protectingPointToMultipoint represents the object instance of the
--  unreliable TP and the object instance of the created mpConnectionProtection
--  of the protecting connection
ProtectedAddLeg ::=  CHOICE {
     protected     [0]  AddLeg,
     unProtected   [1]  AddLeg
     }
--  The object Instance of the mpXCon of AddLeg represents the object instance of
--  the mpConnectionProtection to which new legs are added
```

```
ProtectedConnectInformation ::=  SEQUENCE OF SEQUENCE {
     CHOICE    {
     connect        [0]  ProtectedConnection,
     addleg         [1]  ProtectedAddLeg,
     addUnreliable  [2]  ConnectUnreliableTP
     },
     administrativeState     AdministrativeState OPTIONAL
     }
ProtectedConnection ::=  SEQUENCE {
     protectionConnectionType    ProtectionConnectionType,
     protectingTP  ExplicitTP,
     revertive     Boolean,
     waitToRestore      [0]  Integer       OPTIONAL,
     holdOffTime        [1]  HoldOffTime   OPTIONAL
     }
ProtectionConnectionType ::=  CHOICE {
     unidirectional     [0]  ConnectionType,
     bidirectional      [1]  ConnectionTypeBi
     }
ProtectedConnectionResult ::=  SEQUENCE {
     CHOICE    {
     pointToPoint       [0]  PointToPointProtection,
     pointToMultipoint  [1]  PointToMultipointProtection
     },
     connectionPG       ObjectInstance
     }
ProtectedConnectResult ::=  SEQUENCE OF CHOICE {
     failed         [0]  Failed,
     protected      [1]  ProtectedConnectionResult,
     unprotected    [2]  Unprotected
     }
--  the n-th element in the "SEQUENCE OF" is related to the n-th element in the
--  "SEQUENCE OF" of the "ProtectedConnectInformation" type.
ProtectingConnection ::=  SEQUENCE {
     unreliableTp  ObjectInstance,
     conProt       ObjectInstance
     }
ProtectionCriteria  ::=  SET OF Criterion
Criterion ::=  OBJECT IDENTIFIER
ProtectUnprotectInformation ::=  SEQUENCE OF SEQUENCE {
     CHOICE {
     protect   [3]  ProtectedConnection,
     unprotect [4]  UnprotectConnection
     },
     administrativeState  AdministrativeState OPTIONAL
     }
Unprotected ::=  CHOICE {
     uniform   [0]  Connected,
     divers    [1]  UnprotectedMultiple
     }
UnprotectedMultiple ::=  SEQUENCE {
     sending       PointToPoint,
     receiving     PointToPoint
     }
UnprotectConnection ::=  CHOICE {
     uniPToP       [0]  ExplicitPtoP,
     pToMp         [1]  ExplicitPtoMP,
     bidirectional [2]  UnprotectBi
     }
UnprotectBi ::=  CHOICE {
     uniformRoute       [0]  ExplicitPtoP,
     diverseRoute       [1]  UnprotectMultiple
     }
```

```
UnprotectMultiple ::=  SEQUENCE {
     firstXCon      ExplicitPtoP,
     secondXCon     ExplicitPtoP
     }
UnreliableTp ::=  SEQUENCE {
     unreliableTp   ExplicitTP,
     connectionProtection    ObjectInstance
     }
END
```

ANNEX A

Inheritance and naming diagrams

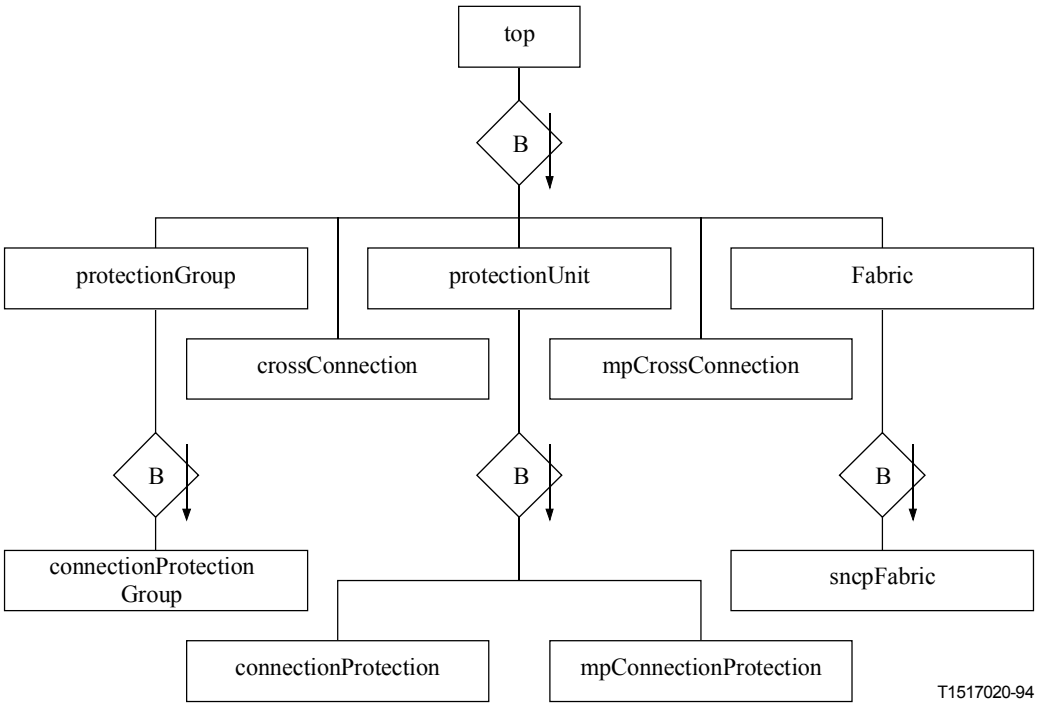


Figure A.1/G.774.4 – Inheritance subtree of subnetwork connection protection

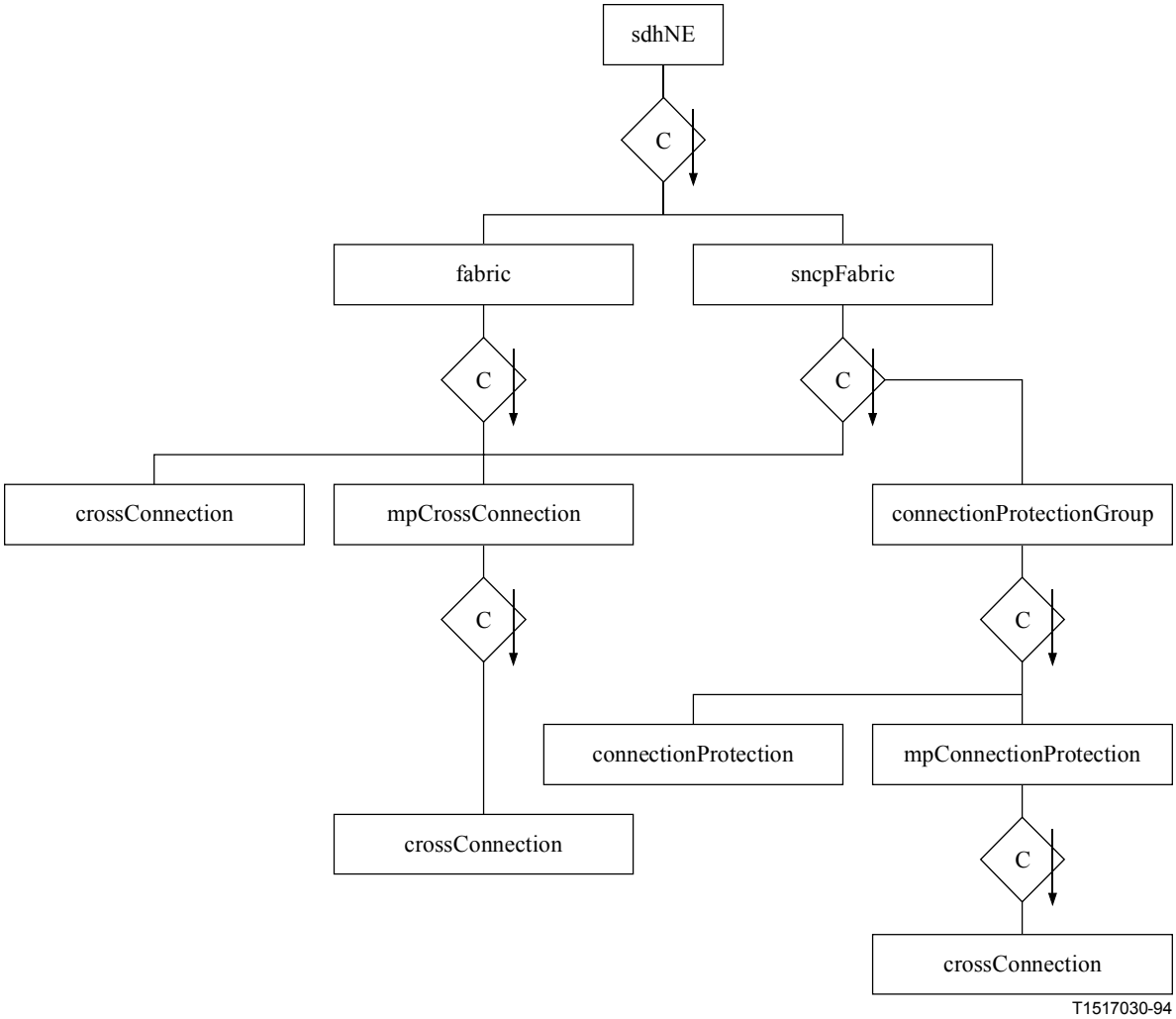


Figure A.2/G.774.4 – Containment tree of the subnetwork connection protection

ANNEX B

Examples of subnetwork connection protection

B.1 Legends

In the following figures, the following legends and symbols will be used as described in Figure B.1.

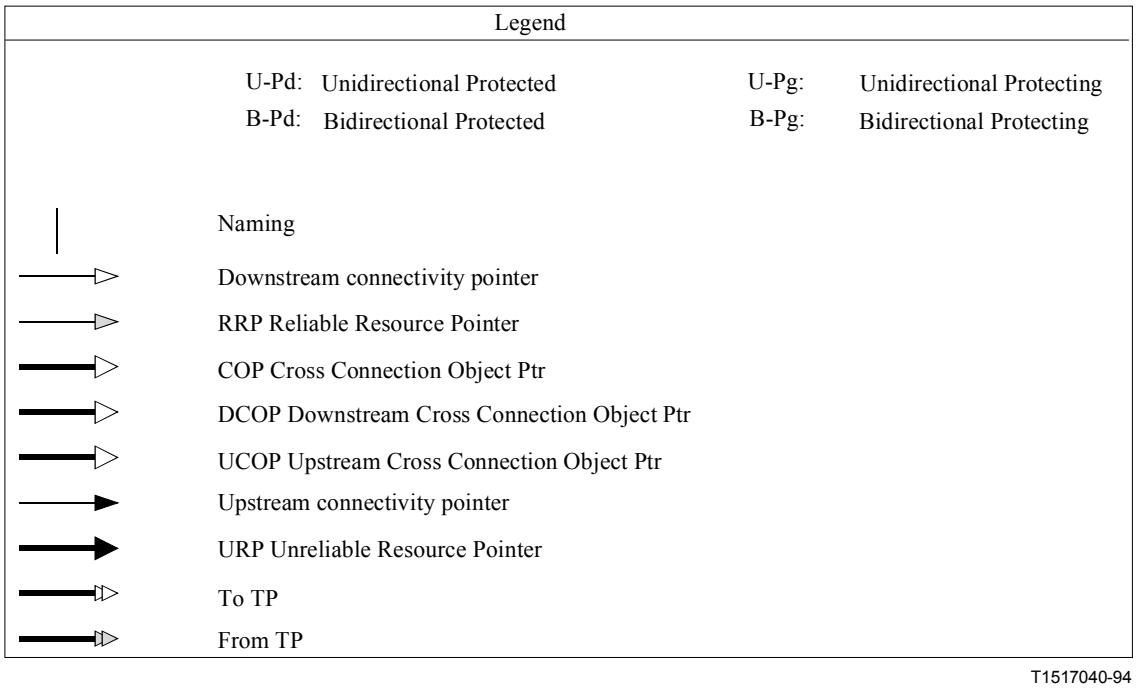
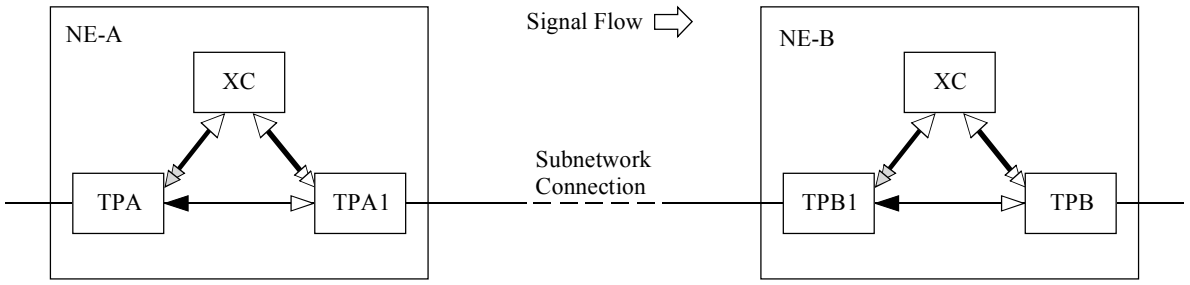


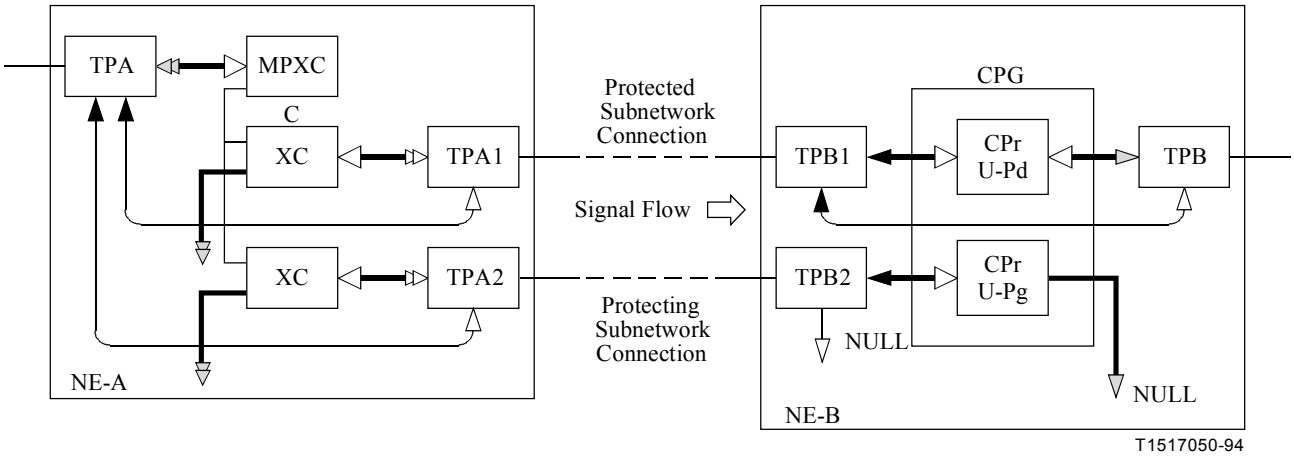
Figure B.1/G.774.4 – Legend

B.2 Subnetwork connection protection examples

See Figures B.2 to B.7.

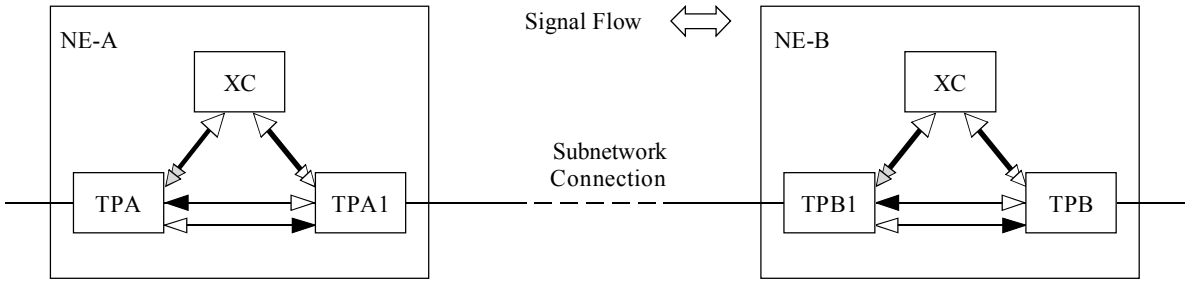


a) Non-protected unidirectional subnetwork connection between NE-A and NE-B

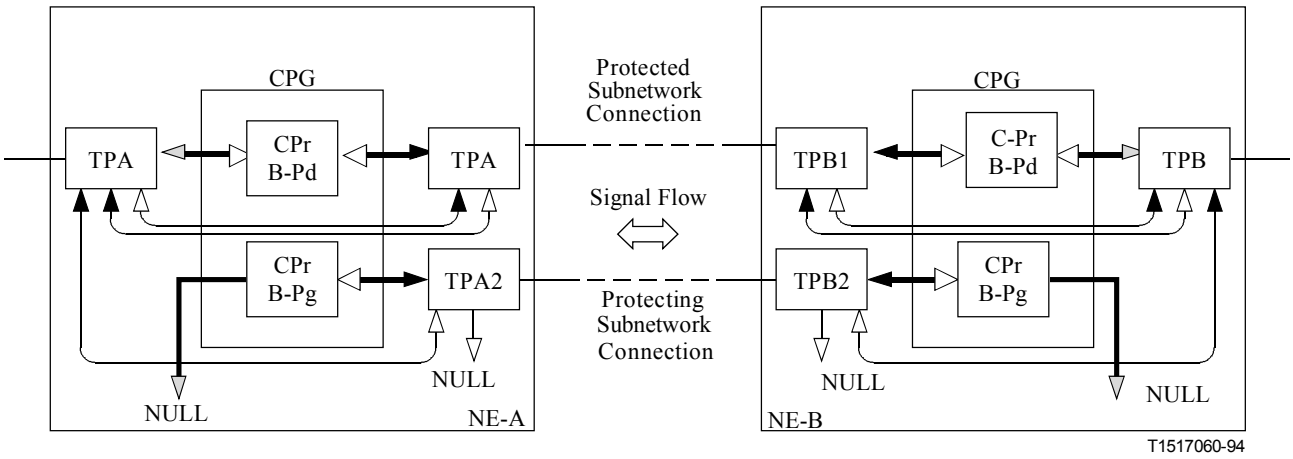


b) Protected unidirectional subnetwork connection between NE-A and NE-B

Figure B.2/G.774.4 – Unidirectional cross-connection and connection protection modelized at the transmit end as a normal broadcast and at the receiving end by connection protection group

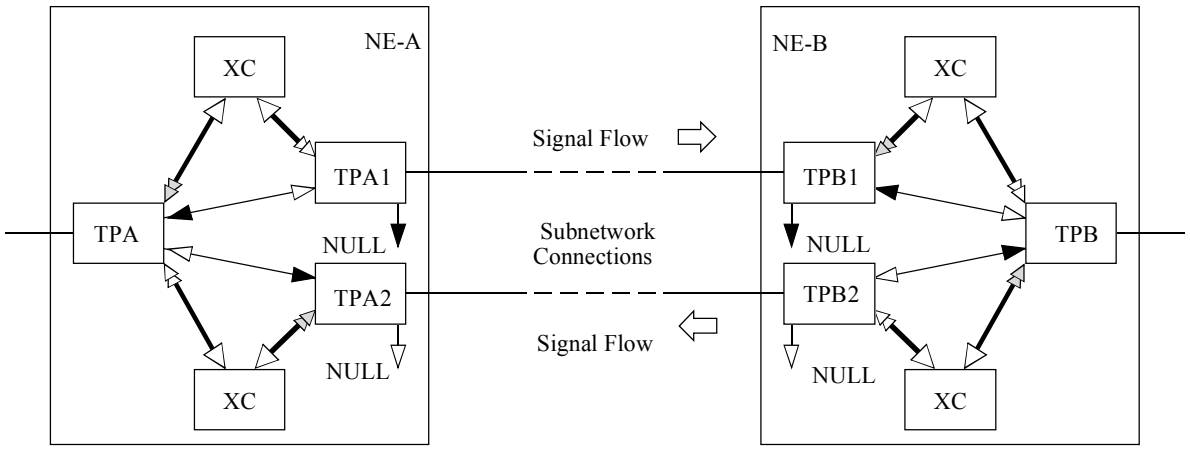


a) Non-protected bidirectional subnetwork connection between NE-A and NE-B

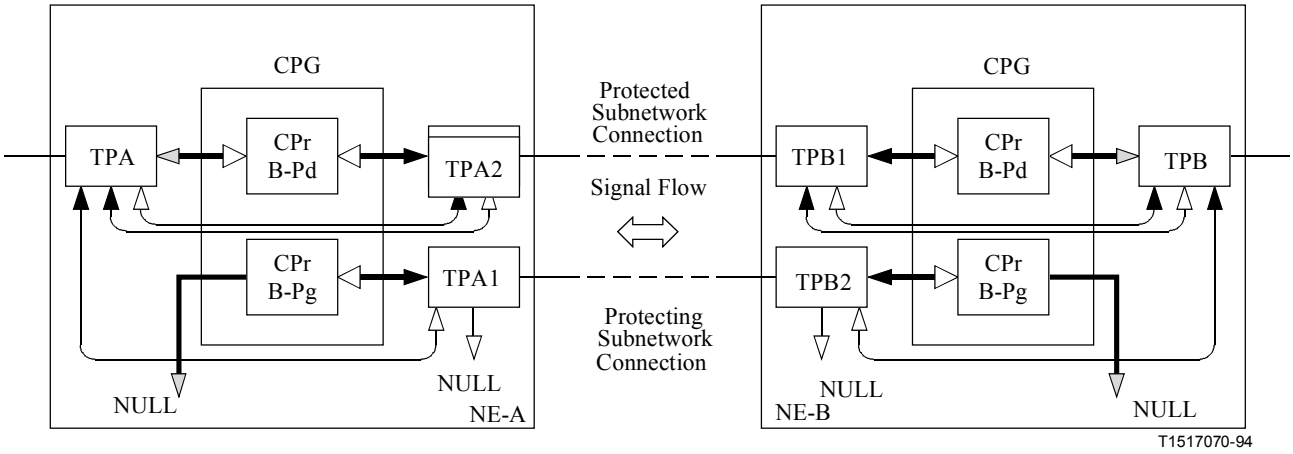


b) Protected bidirectional subnetwork connection between NE-A and NE-B

Figure B.3/G.774.4 – Bidirectional cross-connection and connection protection (uniform route)

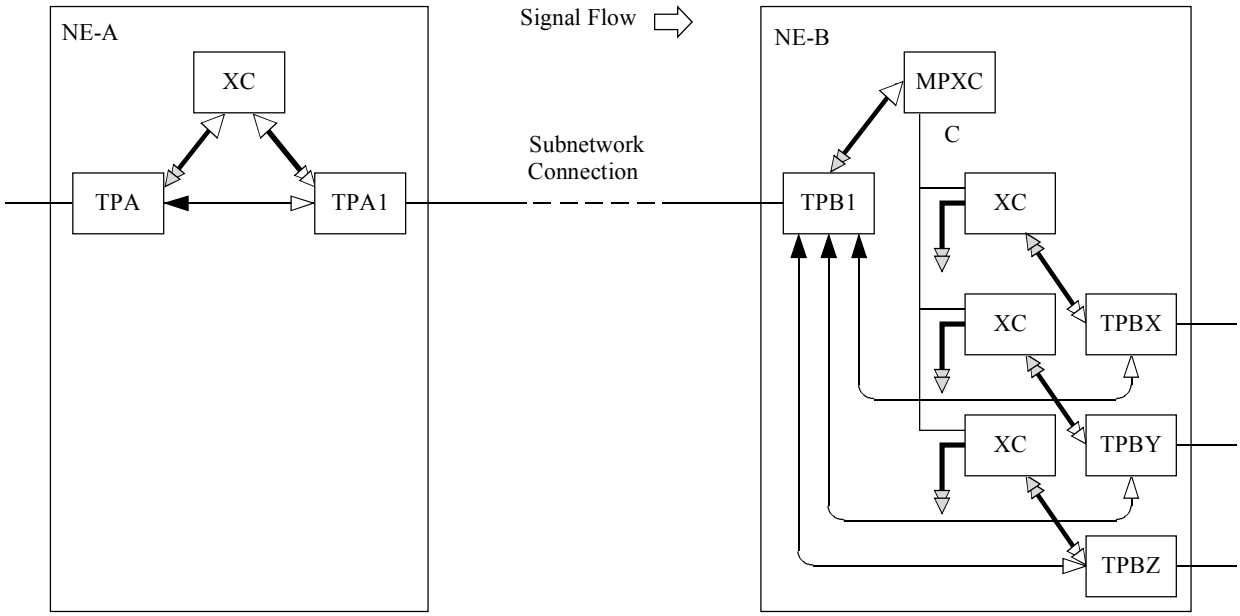


a) Non-protected bidirectional subnetwork connection diverse route between NE-A and NE-B

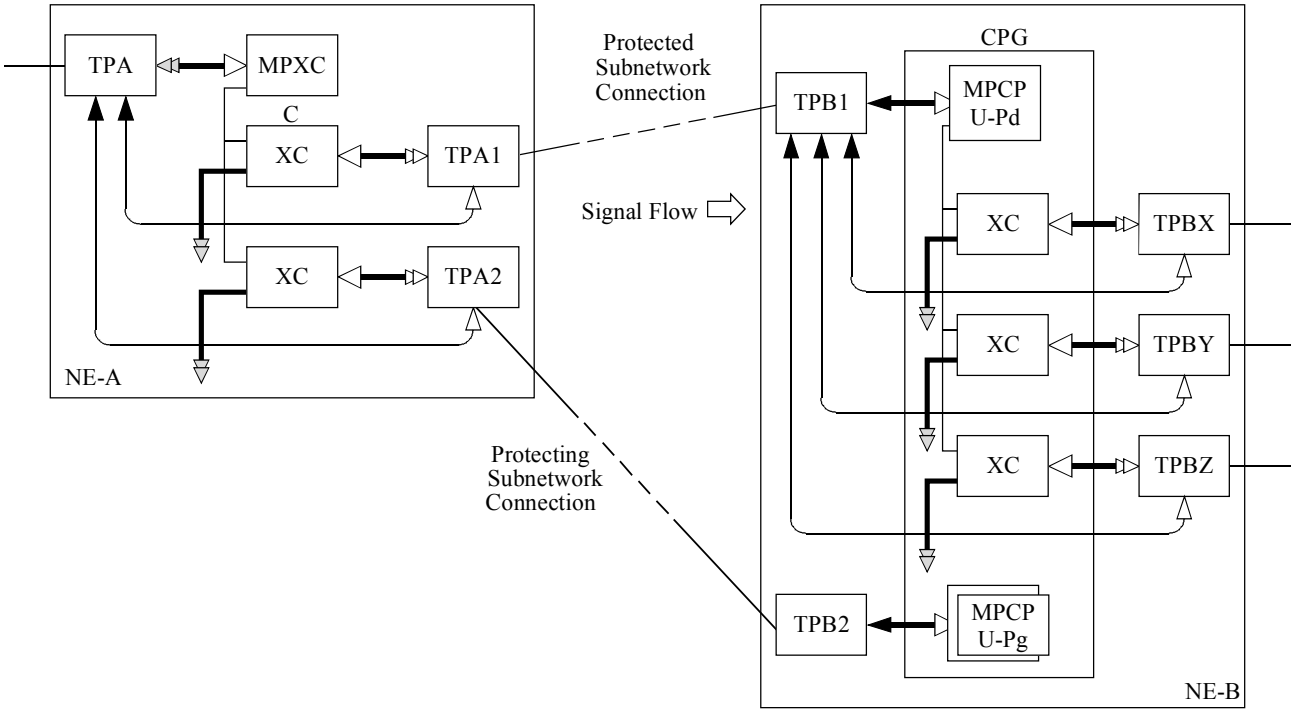


b) Protected bidirectional subnetwork connection between NE-A and NE-B

Figure B.4/G.774.4 – Cross-connection and connection protection (diverse route)

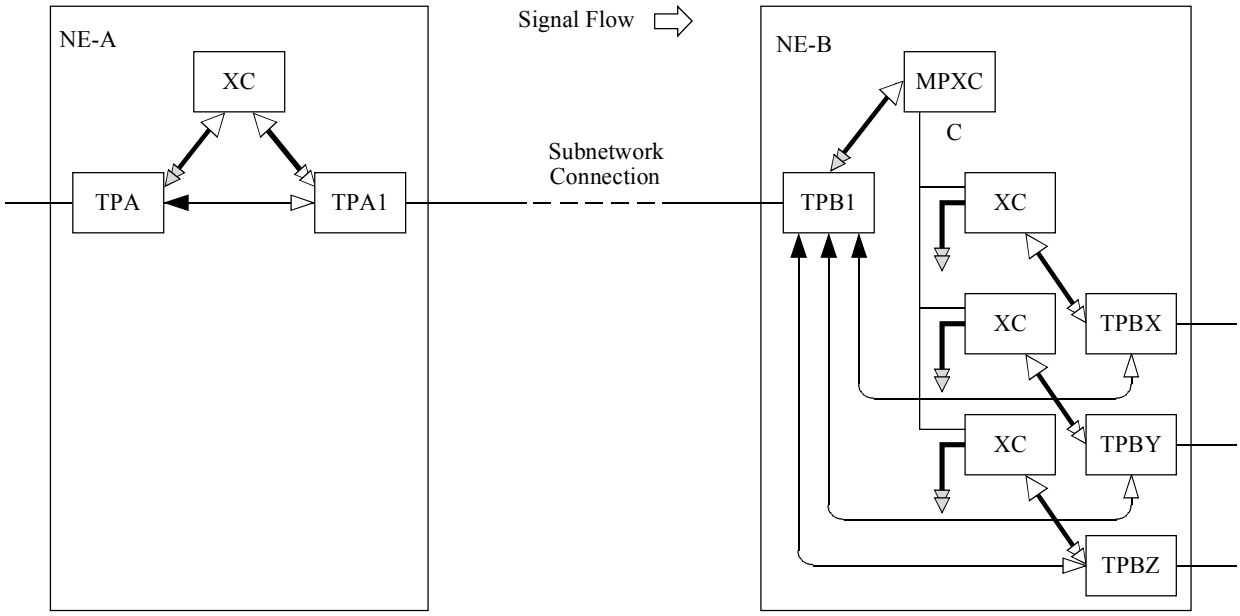


a) Non-protected unidirectional subnetwork connection between NE-A and NE-B with broadcast in NE-B

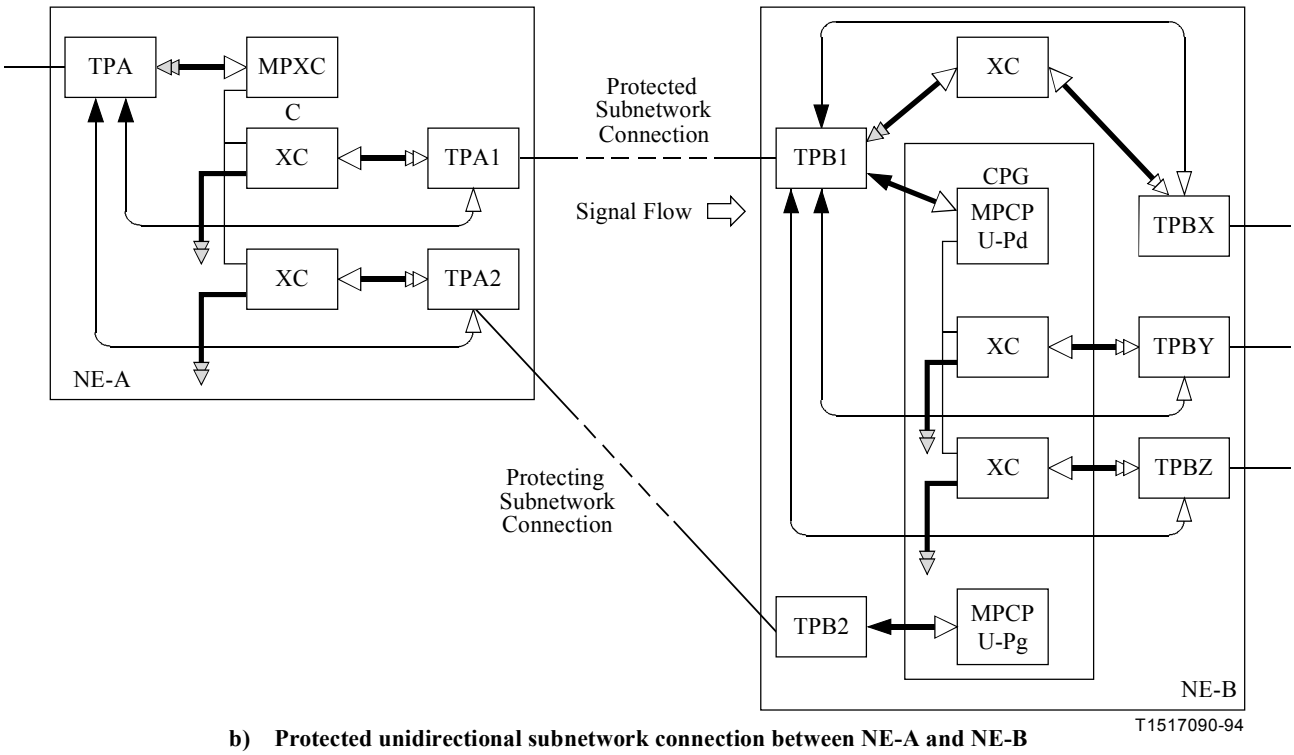


b) Protected unidirectional subnetwork connection between NE-A and NE-B with broadcast in NE-B

Figure B.5/G.774.4 – Unidirectional upstream point-to-multipoint cross-connection and connection protection (All the legs (TPBX, TPBY and TPBZ) are protected as a whole)

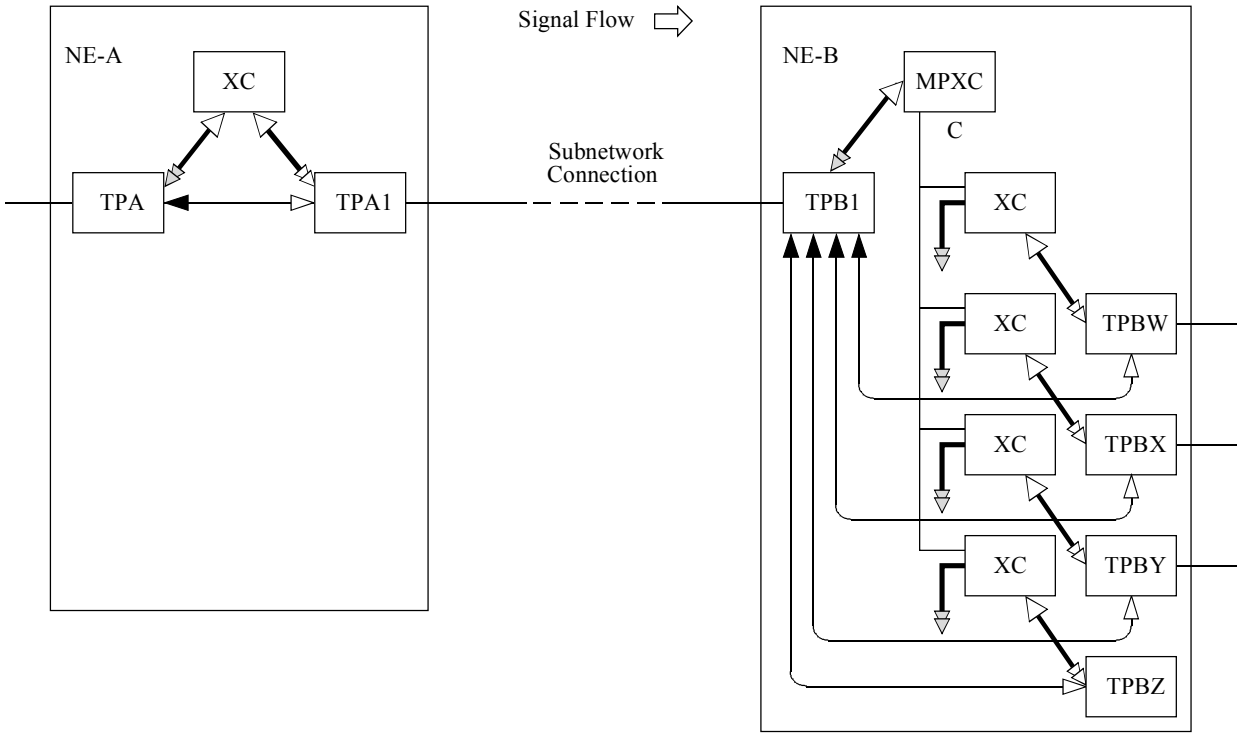


a) Non-protected unidirectional subnetwork connection between NE-A and NE-B with broadcast in NE-B

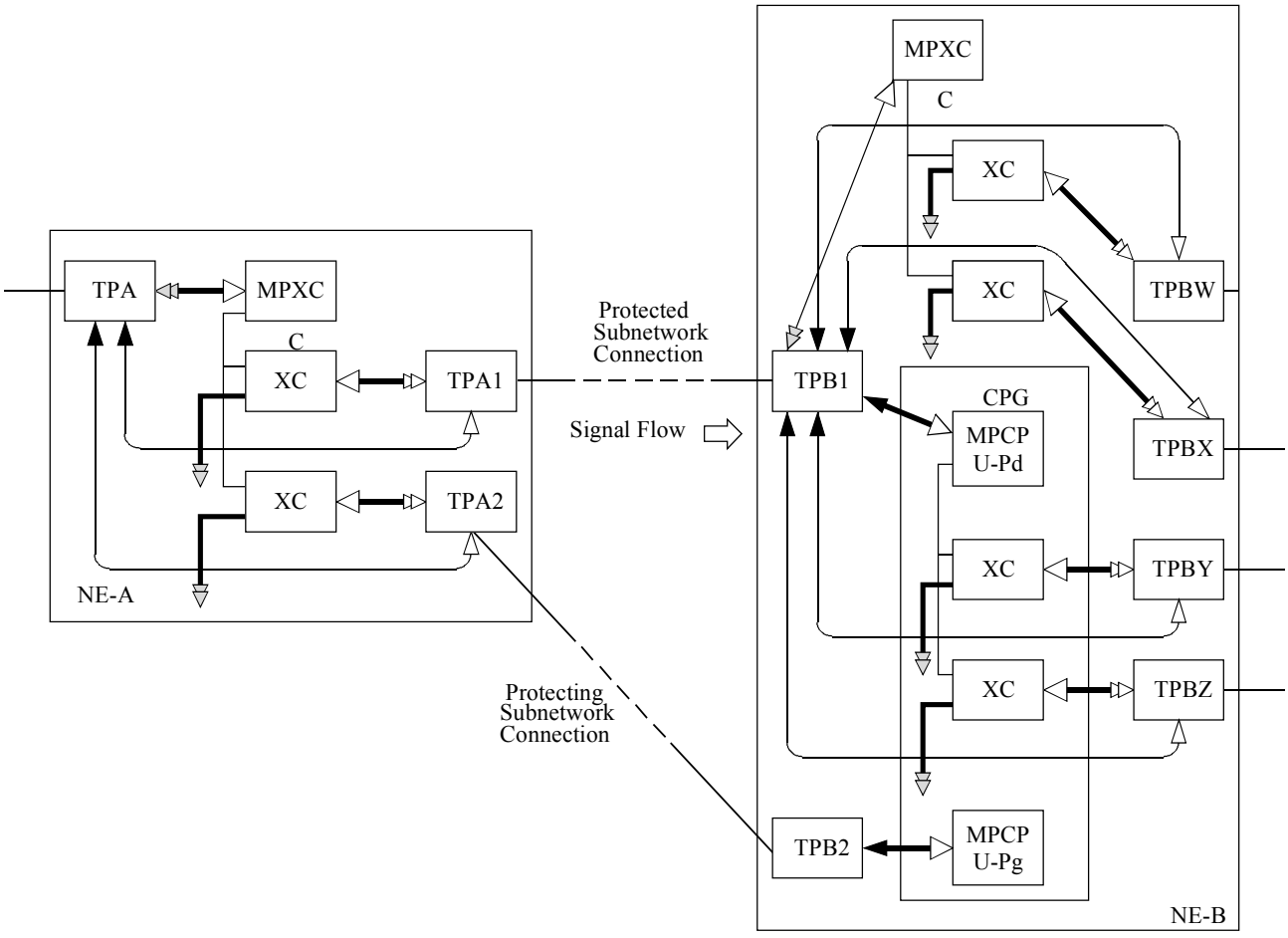


b) Protected unidirectional subnetwork connection between NE-A and NE-B with broadcast in NE-B

Figure B.6/G.774.4 – Unidirectional upstream point-to-multipoint cross-connection and connection protection (Only the legs TPBY and TPBZ are protected)



a) Non-protected unidirectional subnetwork connection between NE-A and NE-B with broadcast in NE-B

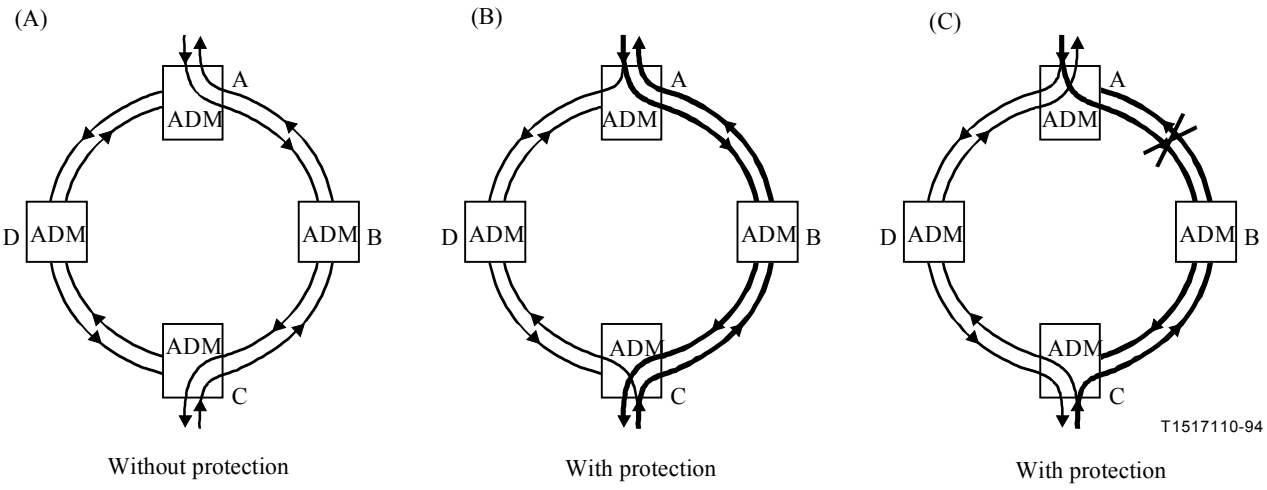


b) Protected unidirectional subnetwork connection between NE-A and NE-B with broadcast in NE-B

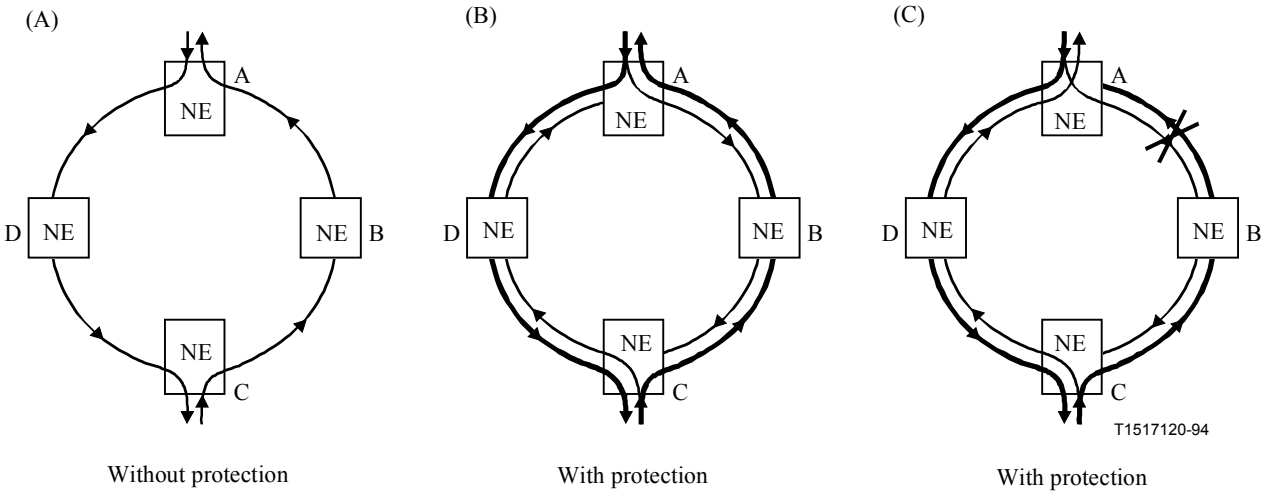
Figure B.7/G.774.4 – Unidirectional upstream point-to-multipoint cross-connection and connection protection (Only the legs TPBY and TPBZ are protected)

B.3 Bidirectional subnetwork connection protection in rings

See Figure B.8.



a) Uniform Route



b) Diverse route: counter clockwise

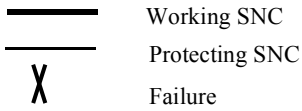


Figure B.8/G.774.4 – Bidirectional subnetwork connection protection

B.4 Interconnection of protected rings by a cross-connect

See Figures B.9 and B.10.

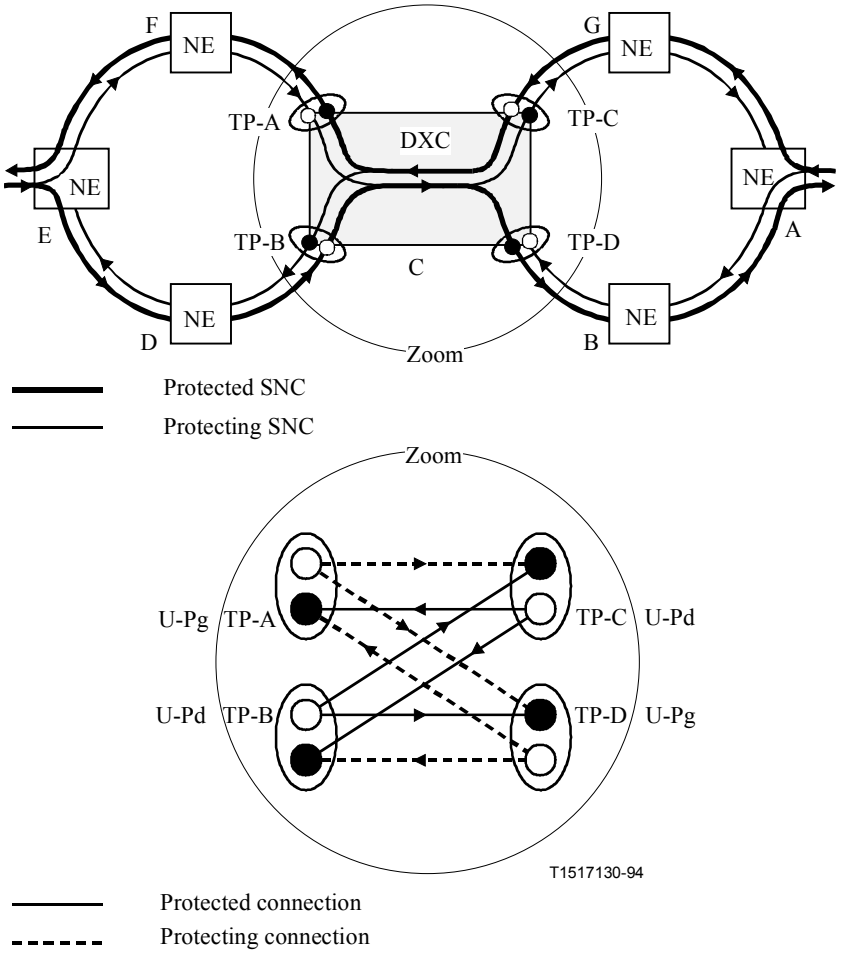


Figure B.9/G.774.4 – Interconnection of protected rings by a cross-connect

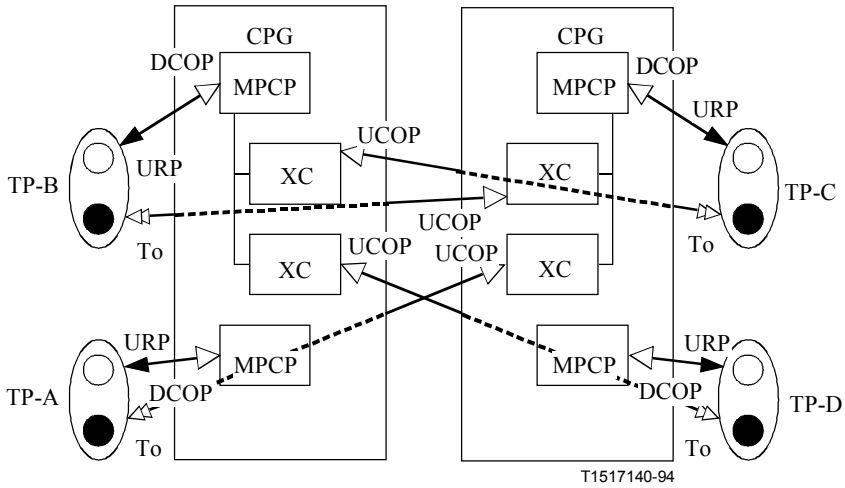


Figure B.10/G.774.4 – Interconnection of protected rings by a cross-connect: managed objects view

B.5 Interconnections of subnetwork with ADMs (SNCP/SNCP) in SNCP interworking

See Figure B.11.

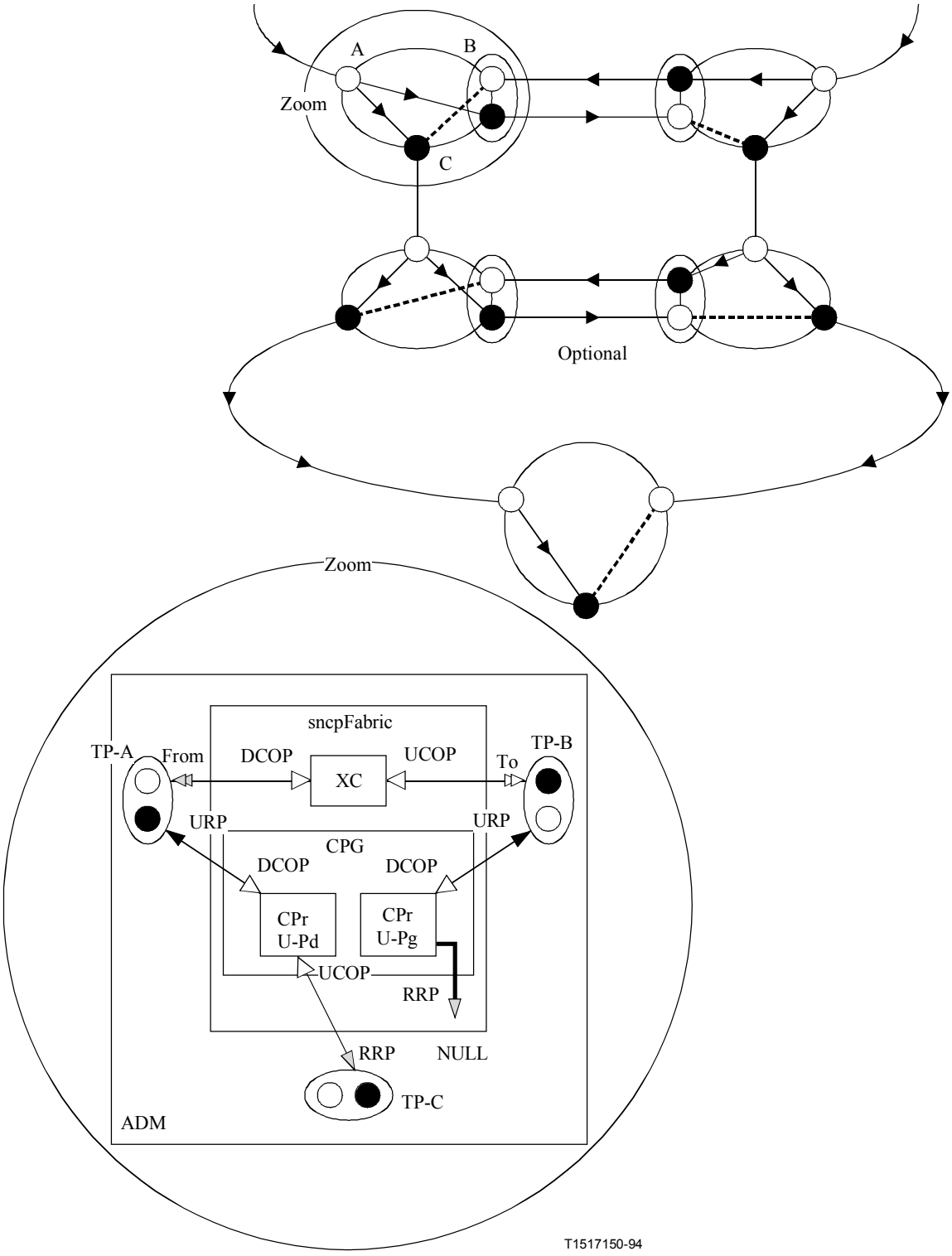


Figure B.11/G.774.4 – Interconnection of subnetwork with ADMs (SNCP/SNCP) in SNCP interworking

B.6 Logical connections in SNCP interworking rings

See Figures B.12 and B.13.

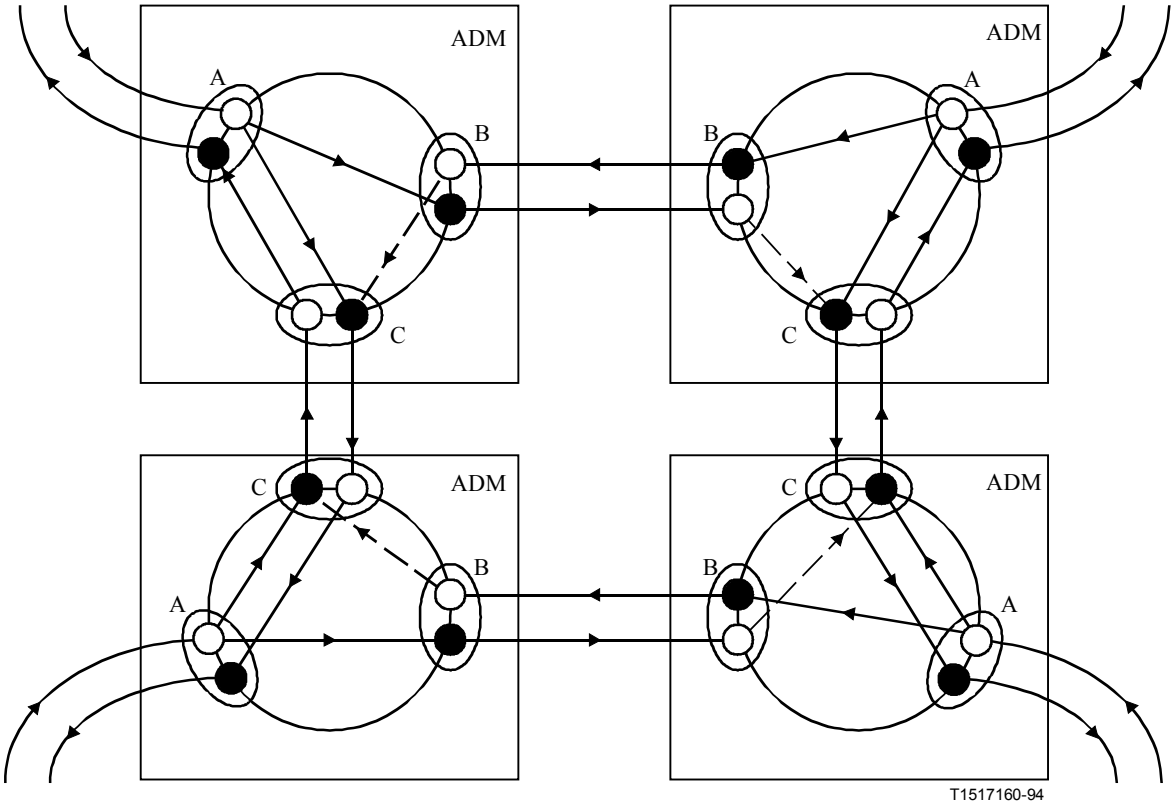


Figure B.12/G.774.4 – Logical connections in SNCP interworking rings connectivity view

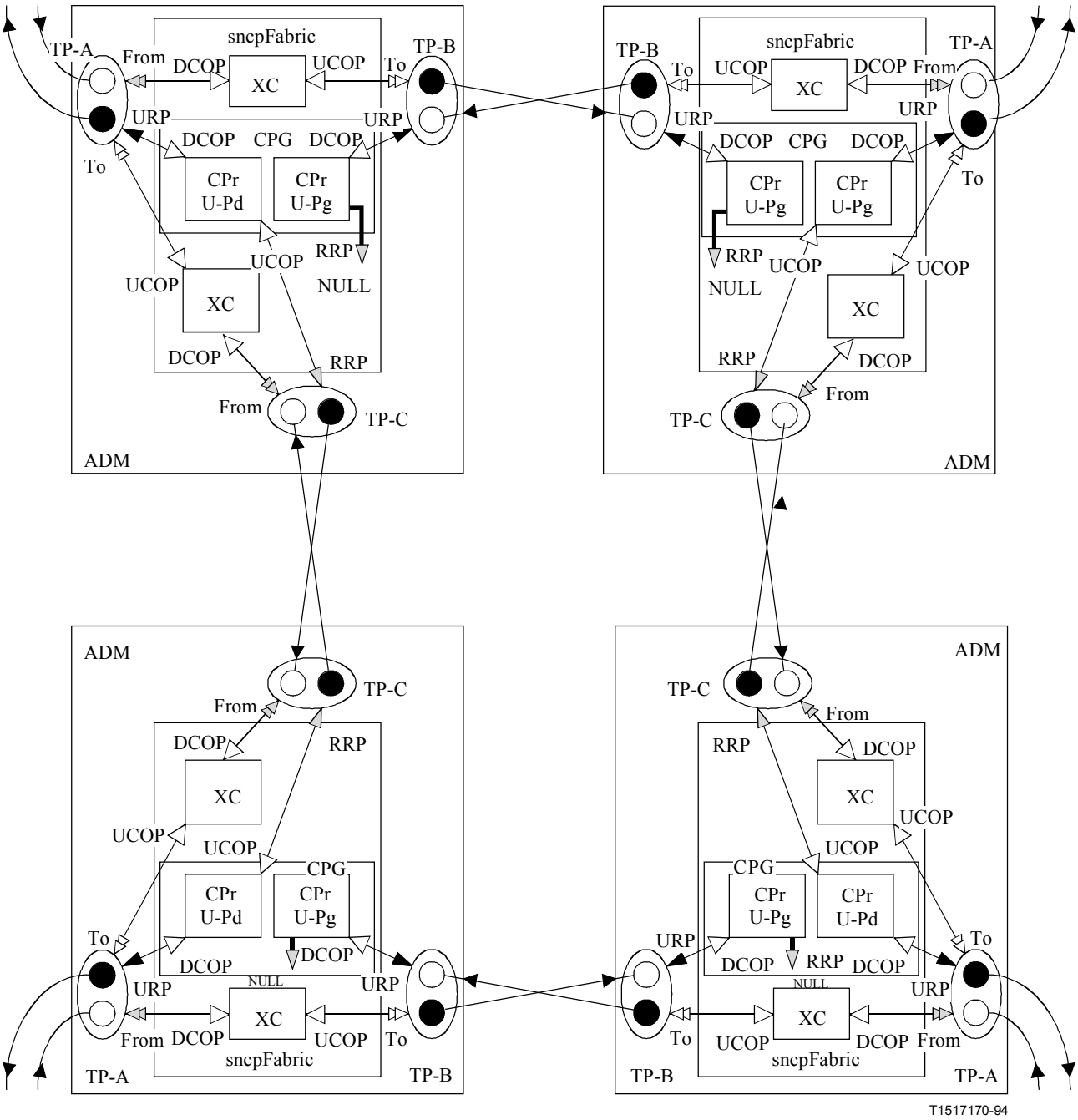


Figure B.13/G.774.4 – Logical connections in SNCP interworking rings: management view

B.7 Logical connections in MS SHARED RINGs interworking

See Figures B.14 and B.15.

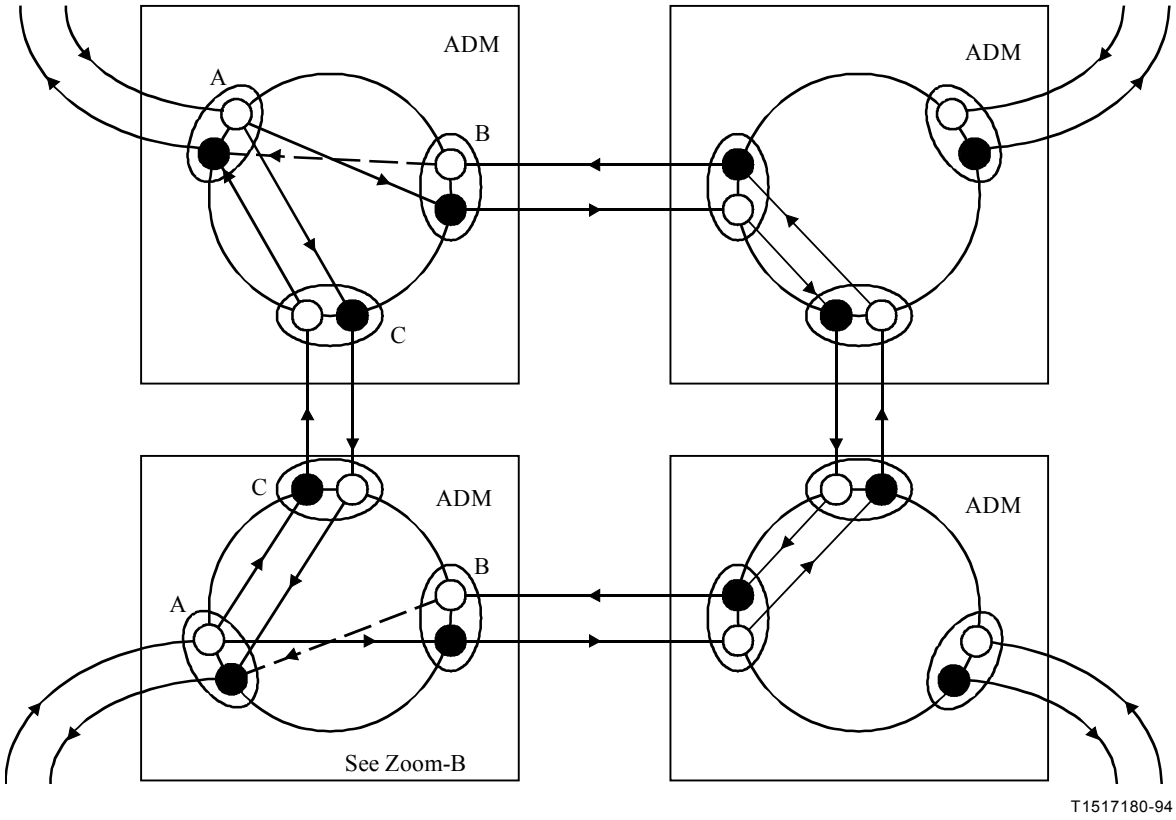


Figure B.14/G.774.4 – Logical connections in MS SHARED RINGS interworking: connectivity view

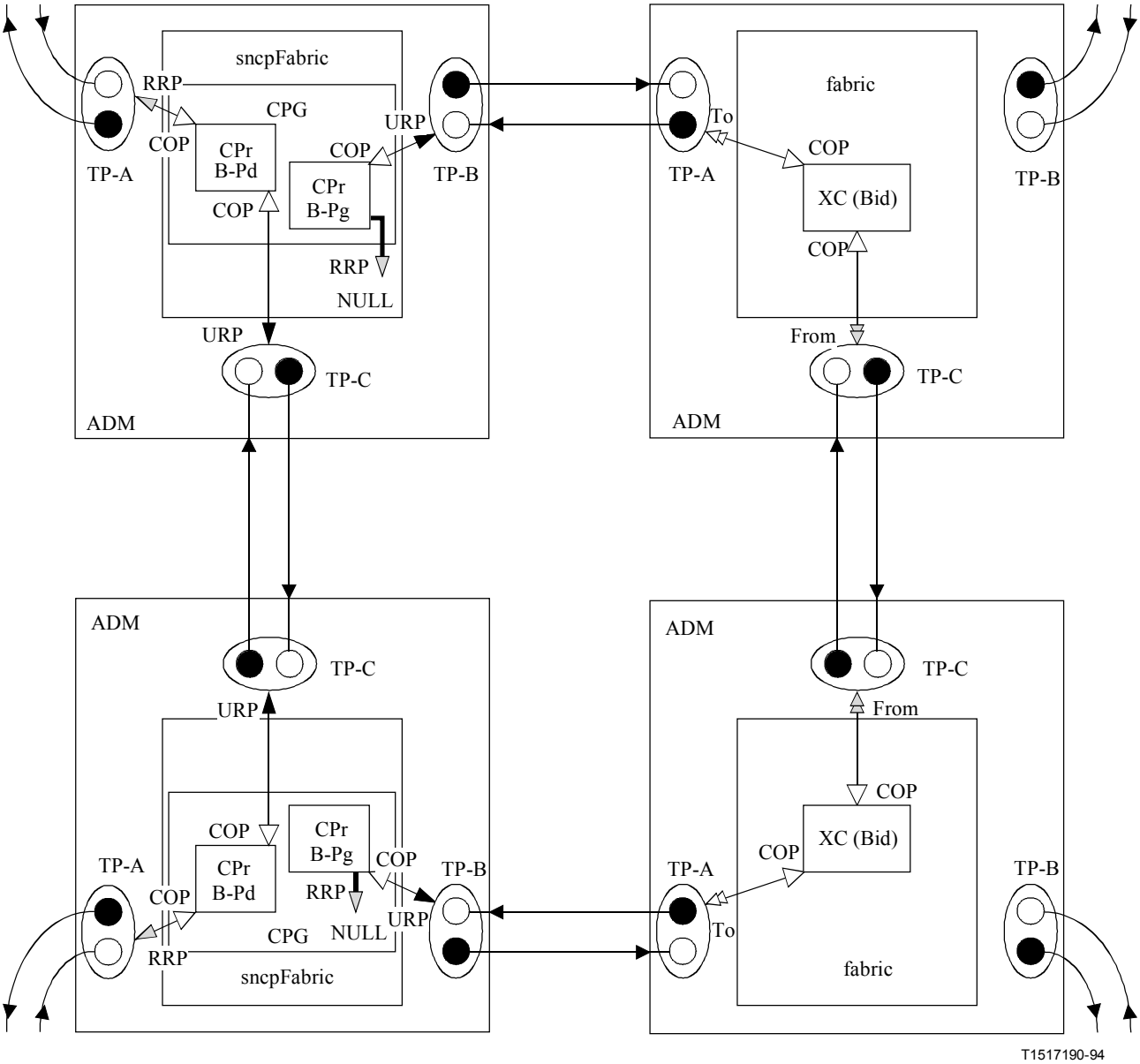


Figure B.15/G.774.4 – Logical connections in MS SHARED RINGS interworking: management view

B.8 Logical connections in SNCPRing and MS SHARED RING interworking

See Figures B.16 and B.17.

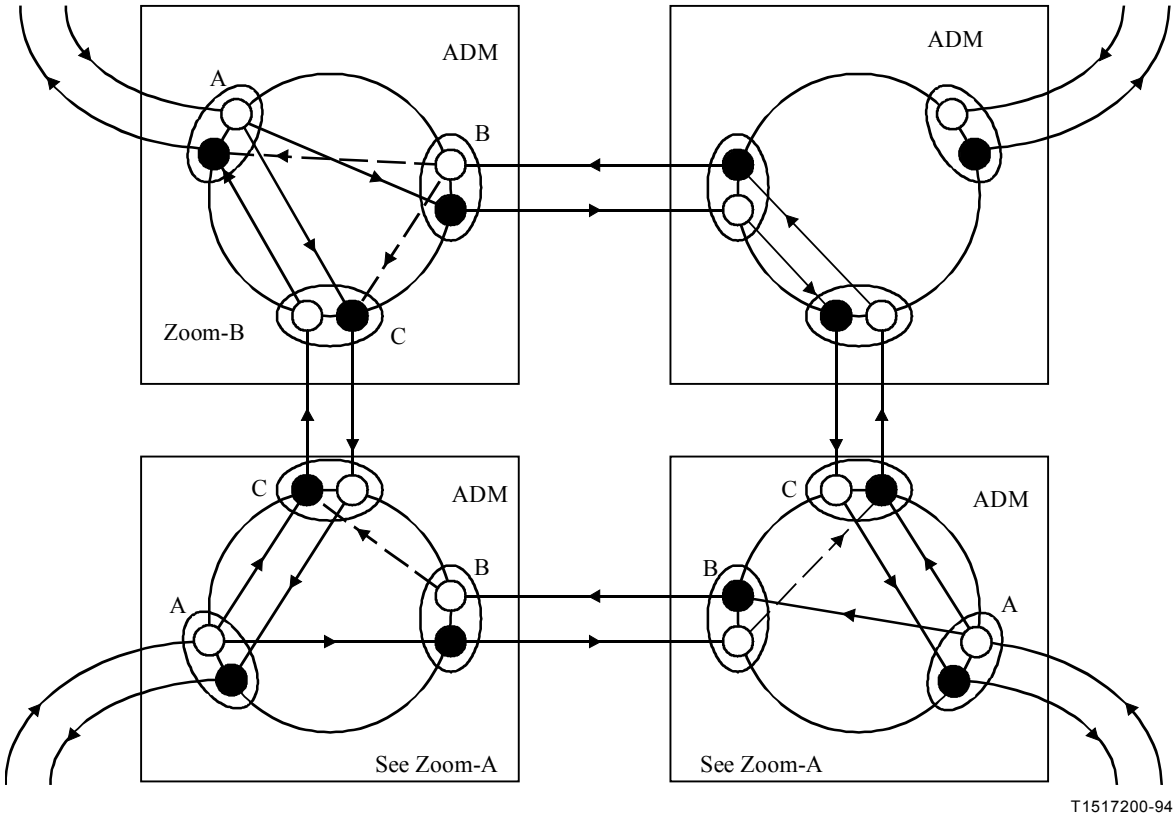


Figure B.16/G.774.4 – Logical connections in SNCP Ring and MS SHARED RING interworking: connectivity view

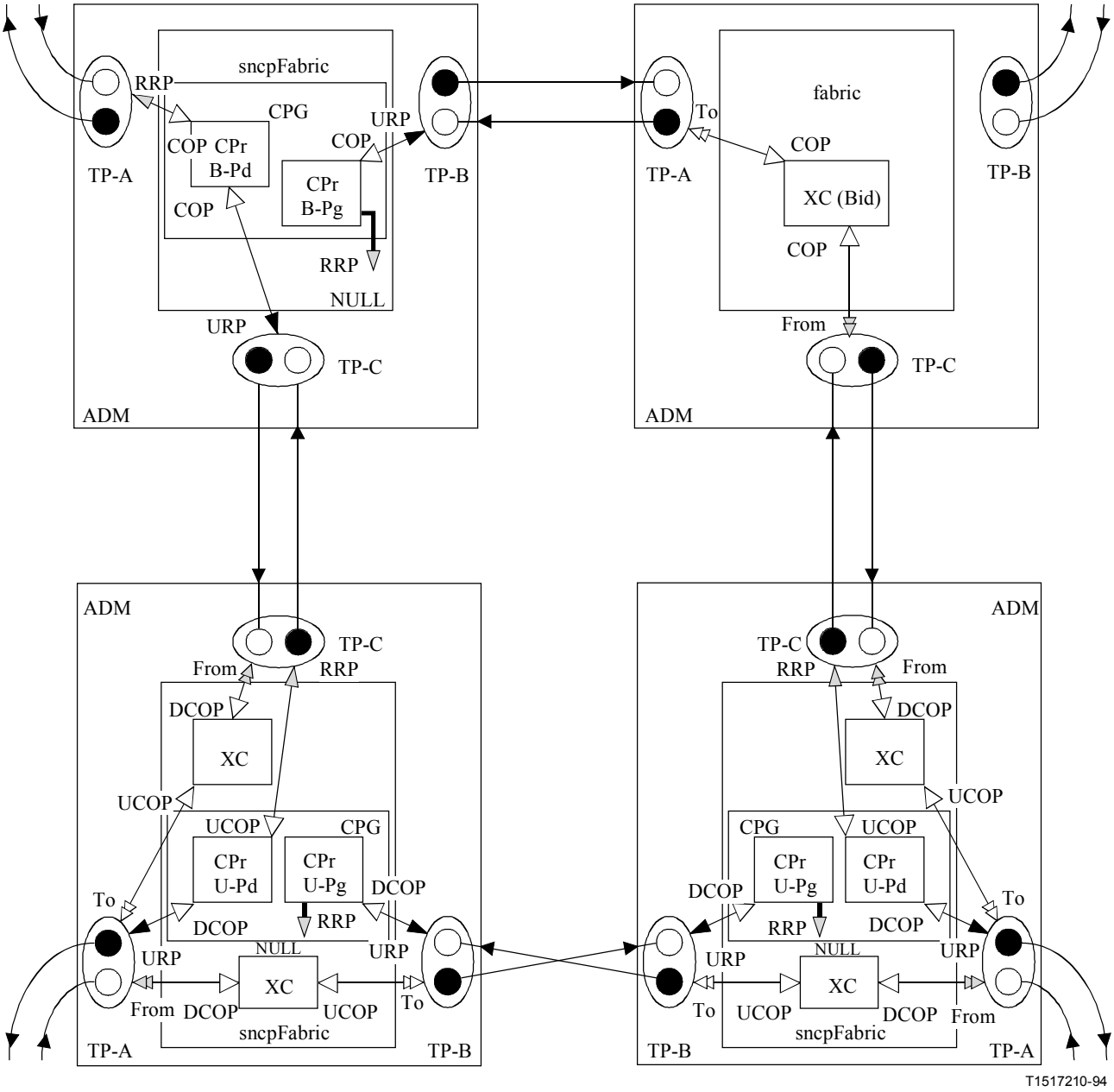


Figure B.17/G.774.4 – Logical connections in SNCP Ring and MS SHARED RING interworking: management view

ANNEX C

State transition diagrams

C.1 State diagrams

C.2 Allowable values of switchStatus for a protected (mp) connection protection

State	Protection status	Description of the state
STA01	noRequest	No request is currently active on the protected connection protection. The traffic is passed through on the protected connection protection.
STA02	AutoSwitchSFPending	An automatic switch Signal Failure condition is active but could not be protected due to the unavailability of the protecting connection protection.
STA03	AutoSwitchSFComplete	An automatic switch has been successfully completed to the protecting connection protection due to a Signal Failure condition on the protected connection protection.
STA04	ForcedSwitchComplete	A forced switch has been completed successfully to the protecting connection protection.
STA05	ForcedSwitchComplete-AutoSwitchSFPending	A forced switch to the protecting connection protection has been completed successfully. Additionally, an automatic switch Signal Failed condition is active on the protected connection protection.
STA06	LockoutComplete	The protected connection protection has been locked out.
The following are additional values for 1 + 1 non-revertive systems		
STA07	DoNotRevert	The protected connection protection has been switched to the protecting connection protection and the request to do so has been released. The switch to the protecting connection protection is maintained.
The following are additional values for 1 + 1 revertive systems		
STA08	manualSwitchToProtectingComplete	The protected connection protection has completed a manual switch to the protecting connection protection.
STA09	AutoSwitchCompleteWaitToRestore	An automatic switch has been successfully completed to the protecting connection protection. The switch condition has cleared on the protected connection protection, and the wait to restore timer is started for switching back (revertive systems only).

C.3 Allowable values of switchStatus for a protecting (mp) connection protection

State	Protection status	Description of the state
STA01	noRequest	No request is present on the protecting connection protection.
STA02	AutoSwitchSFToProtectingComplete	The protected connection protection has completed an automatic switch (SF) to the protecting connection protection.
STA03	ForcedSwitchToProtectingComplete	The protected connection protection has completed a Forced Switch to the protecting connection protection.
STA04	ForcedSwitchToProtecting-CompleteSFPresentOn-Protecting	The protected connection protection has completed a Forced Switch to the protecting connection protection. Additionally the protecting connection protection has an SF condition present (1 + 1 unidirectional systems only).
STA05	LockoutComplete	The protecting connection protection has been locked out.
STA06	AutomaticSwitchSFToProtectedPending	A Signal Failure condition is active on the protecting connection protection.
The following are additional values for 1 + 1 non-revertive systems		
STA07	DoNotRevert	The protected connection protection has been switched to the protecting connection protection and the request to do so has been released. The switch to the protecting connection protection is maintained.
The following are additional values for 1 + 1 revertive systems		
STA08	manualSwitchToProtectingComplete	The protected connection protection has completed a manual switch to the protecting connection protection.
STA09	AutoSwitchCompleteWaitToRestore	An automatic switch has been successfully completed to the protecting connection protection. The switch condition has cleared on the protected connection protection, and the wait to restore timer is started for switching back (Only for Revertive Systems).

C.4 State diagram for a protected connection protection (non-revertive)

Condition

c1: The request on the protected connection protection has a higher priority than the existing one on the protecting connection protection. (Refer to the protection switch decision table.)

c2: There is an auto switch condition present on the protected connection protection.

c3: The request has been completed.

c4: There is an auto switch condition present on the protecting connection protection.

Process

p1: Request switch to protecting connection protection.

p2: Release the current switch.

p3: Notify switch report. (The protection switch report is sent by the protection group however the condition under which such notification is sent is specified in the connection protection state diagram using such process.)

States

STA01	noRequest
STA02	AutoSwitchSFPending
STA03	AutoSwitchSFComplete
STA04	ForcedSwitchComplete
STA05	ForcedSwitchCompleteAutoSwitchSFPending
STA06	LockoutComplete
STA07	DoNotRevert

Event

Req. Lock.	A lockout request has been issued on the protected connection protection.
Rel. Lock.	A release request of lockout has been issued on the protecting connection protection.
Req. Force	A Forced Switch request has been issued to switch from the protected connection protection to the protecting connection protection.
Rel. Force	A release request of Forced Switch has been issued on the protected connection protection.
Req. Man.	A Manual Switch request has been issued to switch from the protected connection protection to the protecting connection protection.
Rel. Man.	A Release Manual Switch request has been issued. As Manual Switch is not memorized, this will result as a failed request.
A-S Cond.	An automatic switch condition has occurred on the protected connection protection.
A-S Clr	The automatic switch condition on the protecting connection protection has disappeared.
P-ing Avail.	One or more requests (including Lockout request) have disappeared on the protecting connection protection, so that the protecting connection protection becomes available for use in the protection scheme (i.e. the highest priority request that could remain on the protecting connection protection has lower priority than existing ones on the protected connection protection).
P-ing Unav.	One or more requests (including Lockout request) have appeared on the protecting connection protection, so that the protecting connection protection becomes unavailable for use in the protection scheme (i.e. the highest priority request on the protecting connection protection has higher priority than existing ones on the protected connection protection).
Man. P-ing	A Manual Switch request has been issued to switch from the protecting connection protection to the protected connection protection.
Set Rev.	The connection protection group mode has been changed from non-revertive mode to revertive mode.

State diagram for a protected connection protection in a 1 + 1 non-revertive system							
Event	STA01 No Req.	STA02 A-S Pend.	STA03 A-S Comp.	STA04 F-S Comp.	STA05 F-S Comp A-S Pend.	STA06 LockComp (Note 1)	STA07 Do not revert
Req. Lock.	p3:STA06	p3:STA06	p2,p3: STA06	p2,p3: STA06	p2,p3: STA06	STA06	p2,p3: STA06
Rel. Lock.	STA01 (Note 2)	STA02 (Note 2)	STA03 (Note 2)	STA04 (Note 2)	STA05 (Note 2)	c1&c2&c3 p1,p3:STA03	STA07 (Note 2)
						(^c1V^c3)& c2:p3:STA02	
						^c2:p3:STA01	
Req. Force	c1&c3:p1, p3:STA04	c1&c3:p1, p3:STA05	p3:STA05	STA04	STA05	STA06 (Note 2)	p3:STA04
	^c1V^c3: STA01 (Note 2)	^c1V^c3: STA02 (Note 2)					
Rel. Force	STA01 (Note 2)	STA02 (Note 2)	STA03 (Note 2)	p3:STA07	c1&c3:p3: STA03	STA06 (Note 2)	STA07 (Note 2)
					^c1V^c3:p2, p3: STA02		
Req. Man.	c1&c3:p1, p3:STA07	STA02 (Note 2)	STA03 (Note 2)	STA04 (Note 2)	STA05 (Note 2)	STA06 (Note 2)	STA07
	^c1V^c3: STA01 (Note 2)						
Rel. Man.	STA01 (Note 2)	STA02 (Note 2)	STA03 (Note 2)	STA04 (Note 2)	STA05 (Note 2)	STA06 (Note 2)	STA07 (Note 2)
A-S Cond.	c1&c3:p1, p3:STA03	c1&c3:p1, p3:STA03	STA03	STA05	STA05	STA06	p3:STA03
	^c1V^c3: p3:STA02	^c1V^c3: STA02					
A-S Clr	–	^c2:p3: STA01	^c2 &^c4: p3:STA07	–	^c2:STA04	STA06	–
			^c2 &c4:p2, p3:STA01		c2:STA05		–
		c2:STA02	c2&^c1:p2, p3:STA02				
			c2&c1: STA03				
P-ing Unav.	STA01	STA02	p2,p3: STA02	p2,p3: STA01	p2,p3: STA02	STA06	p2,p3: STA01
P-ing Avail.	STA01	c3:p1,p3: STA03	–	–	–	STA06	–
		^c3:STA02					
Man. P-ing	STA01	–	–	–	–	–	p2,p3: STA01
Set Rev.	STA01 (Note 3)	STA02 (Note 3)	STA03 (Note 3)	STA04 (Note 3)	STA05 (Note 3)	STA06 (Note 3)	p2,p3: STA01 (Note 3)

NOTE 1 – An automatic switch condition may be pending.

NOTE 2 – It results as a failed request.

NOTE 3 – The state table to be considered after having changed the state is the state table of the revertive system.

C.5 State diagram for a protecting connection protection (non-revertive)

Condition

c1: The request on the protected connection protection has a higher priority than the existing one on the protecting connection protection. (Refer to the protection switch decision table.)

c2: There is an auto switch condition present on the protected connection protection.

c3: The request has been completed.

c4: There is an auto switch condition present on the protecting connection protection.

Process

p1: Request switch to protecting connection protection.

p2: Release switch.

p3: Notify switch report. (The protection switch report is sent by the protection group; however, the condition under which such notification is sent is specified in the connection protection state diagram using such process.)

Event

Req. Lock.	A lockout request has been issued on the protecting connection protection.
Rel. Lock.	A release request of lockout has been issued on the protecting connection protection.
Req. Force	A Forced Switch request has been issued to switch from the protected connection protection to the protecting connection protection.
Rel. Force	A release request of Forced Switch has been issued on the protected connection protection.
Req. Man.	A Manual Switch request has been issued to switch from the protected connection protection to the protecting connection protection.
Rel. Man.	A Release Manual Switch request has been issued. As Manual Switch is not memorized, this will result as a failed request.
A-S Cond.	An automatic switch condition has occurred on the protecting connection protection.
A-S Clr	The automatic switch condition on the protecting connection protection has disappeared.
P-ted Lock	The protected connection protection has been locked out.
P-ted Avail.	One or more A-S requests have disappeared on the protected connection protection, so that the protected connection protection becomes available for use in the protection scheme (i.e. the highest priority request that could remain on the protected connection protection has lower priority than existing ones on the protecting connection protection).
P-ted Unav.	One or more A-S requests have appeared on the protected connection protection, so that the protected connection protection becomes unavailable for use in the protection scheme (i.e. the highest priority request on the protected connection protection has higher priorities than existing ones on the protected connection protection).
Set Rev.	The connection protection group mode has been changed from non-revertive to revertive mode.
Req. Man. To P-ted	A Manual Switch request has been issued to switch from the protecting connection protection to the protected connection protection.

States

STA01	noRequest
STA02	AutoSwitchSFToProtectingComplete
STA03	ForcedSwitchToProtectingComplete
STA04	ForcedSwitchToProtectingCompleteSFPresentOnProtecting
STA05	LockoutComplete
STA06	AutomaticSwitchSFToProtectedPending
STA07	DoNotRevert

State diagram for a protected connection protection in a 1 + 1 non-revertive system							
Event	STA01 No Req.	STA02 A-S Comp.	STA03 F-S Comp.	STA04 F-S Comp. A-S Pend.	STA05 LockComp (Note 1)	STA06 A-S Pend.	STA07 Do Not Revert
Req. Lock.	p3:STA05	p2,p3: STA05	p2,p3: STA05	p2,p3: STA05	STA05	p3: STA05	p2,p3: STA05
Rel. Lock.	STA01 (Note 2)	STA02 (Note 2)	STA03 (Note 2)	STA04 (Note 2)	^c4:STA01 c4: STA06	STA06 (Note 2)	STA07 (Note 2)
Req. Force	p1,p3: STA03	p3:STA03	STA03	STA04	STA05 (Note 2)	p1,p3: STA04	p3:STA03
Rel. Force	STA01 (Note 2)	STA02 (Note 2)	^c2:p3: STA07 c2:p3: STA02	^c1:p3: STA02 ^c1:p2,p3: STA06	STA05 (Note 2)	STA06 (Note 2)	STA07 (Note 2)
Req. Man.	p1,p3: STA07	STA02 (Note 2)	STA03 (Note 2)	STA04 (Note 2)	STA05 (Note 2)	STA06 (Note 2)	STA07
Rel. Man.	STA01 (Note 2)	STA02 (Note 2)	STA03 (Note 2)	STA04 (Note 2)	STA05 (Note 2)	STA06 (Note 2)	STA07 (Note 2)
A-S Cond.	STA06	c1:STA02 ^c1:p2,p3: STA06	STA04	STA04	STA05	STA06	p2,p3: STA06
A-S Clr	–	STA02	–	c4:STA04 ^c4:STA03	STA05	c1:p1,p3: STA02 ^c1^c4:p3: STA01 ^c1&c4: STA06	–
P-ted Lock	STA01	^c4:p2,p3: STA01 c4:p2,p3: STA06	p2,p3: STA01	p2,p3: STA06	STA05	STA06	p2,p3: STA01
P-ted Unav.	c3:p1,p3: STA02 ^c3:STA01	STA02	STA03	STA04	STA05	c1&c3:p1, p3:STA02 ^c1V^c3: STA06	p3:STA02
P-ted Avail.	STA01	^c4:p3 STA07 c4:p2,p3: STA06	STA03	STA04	STA05	STA06	STA07
Req. Man. To P-ted	STA01	STA02 (Note 2)	STA03 (Note 2)	STA04 (Note 2)	STA05 (Note 2)	STA06 (Note 2)	p2,p3: STA01
Set Rev.	STA01 (Note 3)	STA02 (Note 3)	STA03 (Note 3)	STA04 (Note 3)	STA05 (Note 3)	STA06 (Note 3)	p2,p3: STA01 (Note 3)

NOTE 1 – An automatic switch condition may be pending.

NOTE 2 – It results as a failed request.

NOTE 3 – The state table to be considered after having changed the state is the state table of the revertive system.

C.6 State diagram for a protected connection protection (revertive)

Condition

c1: The request on the protected connection protection has a higher priority than the existing one on the protecting connection protection. (Refer to the protection switch decision table.)

c2: There is an auto switch condition present on the protected connection protection.

c3: The request has been completed.

c4: There is an auto switch condition present on the protecting connection protection.

Process

p1: Request switch to protecting connection protection.

p2: Release the current switch.

p3: Notify switch report. (The protection switch report is sent by the protection group; however, the condition under which such notification is sent is specified in the connection protection state diagram using such process.)

p4: Start wait to restore timer.

p5: Stop wait to restore timer.

States

STA01	noRequest
STA02	AutoSwitchSFPending
STA03	AutoSwitchSFComplete
STA04	ForcedSwitchComplete
STA05	ForcedSwitchCompleteAutoSwitchSFPending
STA06	LockoutComplete
STA08	manualSwitchToProtectingComplete
STA09	AutoSwitchCompleteWaitToRestore

Event

Req. Lock.	A lockout request has been issued on the protected connection protection.
Rel. Lock.	A release request of lockout has been issued on the protected connection protection.
Req. Force	A Forced Switch request has been issued to switch from the protected connection protection to the protecting connection protection.
Rel. Force	A release request of Forced Switch has been issued on the protected connection protection.
Req. Man.	A Manual Switch request has been issued to switch from the protected connection protection to the protecting connection protection.
Rel. Man.	A Release of Manual Switch request has been issued.
A-S Cond.	An automatic switch condition has occurred on the protected connection protection.
A-S Clr	The automatic switch condition has disappeared.
P-ing Avail.	One or more requests (including Lockout request) have disappeared on the protecting connection protection, so that the protecting connection protection becomes available for use in the protection scheme (i.e. the highest priority request that could remain on the protecting connection protection has lower priority than existing ones on the protected connection protection).

P-ing Unav.	One or more requests (including Lockout request) have appeared on the protecting connection protection, so that the protecting connection protection becomes unavailable for use in the protection scheme (i.e. the highest priority request on the protecting connection protection has higher priority than existing ones on the protected connection protection).
WTR	The Wait-to-Restore Time has elapsed.
Set Non-Rev.	The connection protection group mode has been changed from revertive to non-revertive mode.

State diagram for a protected connection protection in a 1 + 1 revertive system								
Event	STA01 No Req.	STA02 A-S Pend.	STA03 A-S Comp.	STA04 F-S Comp.	STA05 F-S Comp A-S Pend.	STA06 LockComp (Note 1)	STA08 M-S Comp.	STA09 A-S Comp WTR
Req. Lock.	p3:STA06	p3:STA06	p2,p3: STA06	p2,p3: STA06	p2,p3: STA06	STA06	p2,p3: STA06	p2,p3,p5: STA06
Rel. Lock.	STA01 (Note 2)	STA02 (Note 2)	STA03 (Note 2)	STA04 (Note 2)	STA05 (Note 2)	c1&c2&c3 p1,p3: STA03	STA08 (Note 2)	STA09 (Note 2)
						(^c1V^c3)& c2:p3: STA02		
						^c2:p3: STA01		
Req. Force	c1&c3:p1, p3:STA04	c1&c3:p1, p3:STA05	p3:STA05	STA04	STA05	STA06 (Note 2)	p3:STA04	p3,p5: STA04
	^c1V^c3: STA01 (Note 2)	^c1V^c3: STA02 (Note 2)						
Rel. Force	STA01 (Note 2)	STA02 (Note 2)	STA03 (Note 2)	p2,p3: STA01	c1:p3: STA03	STA06 (Note 2)	STA08 (Note 2)	STA09 (Note 2)
					^c1:p2,p3: STA02			
Req. Man.	c1&c3:p1, p3:STA08	STA02 (Note 2)	STA03 (Note 2)	STA04 (Note 2)	STA05 (Note 2)	STA06 (Note 2)	STA08	p3,p5: STA08
	^c1V^c3: STA01 (Note 2)							
Rel. Man.	STA01 (Note 2)	STA02 (Note 2)	STA03 (Note 2)	STA04 (Note 2)	STA05 (Note 2)	STA06 (Note 2)	p2,p3: STA01	STA09 (Note 2)
A-S Cond.	c1&c3:p1, p3:STA03	c1&c3:p1, p3:STA03	STA03	STA05	STA05	STA06	p3:STA03	p3,p5: STA03
	^c1V^c3: p3:STA02	^c1V^c3: STA02						
A-S Clr	–	^c2:p3: STA01	^c2 &^c4: p3,p4: STA09	–	^c2:STA04	STA06	–	–
			^c2 &c4:p2, p3:STA01					
		c2:STA02	c2&^c1:p2, p3:STA02		c2:STA05			
			c2&c1: STA03					

State diagram for a protected connection protection in a 1 + 1 revertive system								
P-ing Unav.	STA01	STA02	p2,p3: STA02	p2,p3: STA01	p2,p3: STA02	STA06	p2,p3: STA01	p2,p3,p5: STA01
P-ing Avail.	STA01	c3:p1,p3: STA03 ^c3:STA02	–	–	–	STA06	–	–
WTR	–	–	–	–	–	–	–	p2,p3: STA01
Set Non-Rev.	STA01 (Note 3)	STA02 (Note 3)	STA03 (Note 3)	STA04 (Note 3)	STA05 (Note 3)	STA06 (Note 3)	p3:STA07 (Notes 3, 4)	p3,p5: STA07 (Notes 3, 4)
NOTE 1 – An automatic switch condition may be pending. NOTE 2 – It results as a failed request. NOTE 3 – The state table to be considered after changing the state is the state table of the non-revertive system. NOTE 4 – This state pertains to the state diagram for a protected connection protection in a 1 + 1 non-revertive system.								

C.7 State diagram for a protecting connection protection (revertive)

Condition

c1: The request on the protected connection protection has a higher priority than the existing one on the protecting connection protection. (Refer to the protection switch decision table.)

c2: There is an auto switch condition present on the protected connection protection.

c3: The request has been completed.

c4: There is an auto switch condition present on the protecting connection protection.

Process

p1: Request switch to protecting connection protection.

p2: Release switch.

p3: Notify switch report. (The protection switch report is sent by the protection group; however, the condition under which such notification is sent is specified in the connection protection state diagram using such process.)

p4: Start wait to restore timer.

p5: Stop wait to restore timer.

Event

Req. Lock.	A lockout request has been issued on the protecting connection protection.
Rel. Lock.	A release request of lockout has been issued on the protecting connection protection.
Req. Force	A Forced Switch request has been issued to switch from the protected connection protection to the protecting connection protection.
Rel. Force	A release request of Forced Switch has been issued on the protected connection protection.
Req. Man.	A Manual Switch request has been issued to switch from the protected connection protection to the protecting connection protection.
Rel. Man.	A Release of Manual Switch request has been issued.
A-S Cond.	An automatic switch condition has occurred on the protecting connection protection.
A-S Clr	The automatic switch condition on the protecting connection protection has disappeared.
P-ted Lock	The protected connection protection has been locked out.
P-ted Avail.	One or more A-S requests have disappeared on the protected connection protection, so that the protected connection protection becomes available for use in the protection scheme (i.e. the highest priority request that could remain on the protected connection protection has lower priority than existing ones on the protecting connection protection).
P-ted Unav.	One or more A-S requests have appeared on the protected connection protection, so that the protected connection protection becomes unavailable for use in the protection scheme (i.e. the highest priority request on the protected connection protection has higher priorities than existing ones on the protected connection protection).
WTR	The Wait-to-Restore Time has elapsed.
Set Non-Rev.	The connection protection group mode has been changed from revertive to non-revertive mode.

States

STA01	noRequest
STA02	AutoSwitchSFToProtectingComplete
STA03	ForcedSwitchToProtectingComplete
STA04	ForcedSwitchToProtectingCompleteSFPresentOnProtecting
STA05	LockoutComplete
STA06	AutomaticSwitchSFPending
STA08	manualSwitchToProtectingComplete
STA09	AutoSwitchCompleteWaitToRestore

State diagram for a protecting connection protection in a 1 + 1 revertive system								
Event	STA01 No Req.	STA02 A-S Comp.	STA03 F-S Comp.	STA04 F-S Comp. A-S Pend.	STA05 F-S Comp Comp (Note 1)	STA06 A-S Pend.	STA08 M-S Comp.	STA09 A-S Comp WTR
Req. Lock.	p3:STA05	p2,p3: STA05	p2,p3: STA05	p2,p3: STA05	STA05	p3: STA05	p2,p3: STA06	p2,p3,p5: STA06
Rel. Lock	STA01 (Note 2)	STA02 (Note 2)	STA03 (Note 2)	STA04 (Note 2)	^c4:STA01 c4: STA06	STA06 (Note 2)	STA08 (Note 2)	STA09 (Note 2)
Req. Force	p1,p3: STA03	p3:STA03	STA03	STA04	STA05 (Note 2)	p1,p3: STA04	p3: STA03	p3,p5: STA03
Rel. Force	STA01 (Note 2)	STA02 (Note 2)	p2,p3: STA01	p2,p3: STA06	STA05 (Note 2)	STA06 (Note 2)	STA08 (Note 2)	STA09 (Note 2)
Req. Man.	p1,p3: STA08	STA02 (Note 2)	STA03 (Note 2)	STA04 (Note 2)	STA05 (Note 2)	STA06 (Note 2)	STA08	p3,p5: STA08
Rel. Man.	STA01 (Note 2)	STA02 (Note 2)	STA03 (Note 2)	STA04 (Note 2)	STA05 (Note 2)	STA06 (Note 2)	p2,p3: STA01	STA09 (Note 2)
A-S Cond.	STA06	c1:STA02 ^c1:p2,p3: STA06	STA04	STA04	STA05	STA06	p2,p3: STA06	p2,p3,p5: STA06
A-S Clr	–	STA02	–	c4:STA04 ^c4:STA03	STA05	c1:p1,p3: STA02 ^c1&^c4: p3:STA01 ^c1&c4: STA06	–	–
P-ted Lock	STA01	^c4: p2,p3: STA01 c4:p2,p3: STA06	p2,p3: STA01	p2,p3: STA06	STA05	STA06	p2,p3: STA01	p2,p3,p5: STA01
P-ted Unav.	c3:p1,p3: STA02 ^c3: STA01	STA02	STA03	STA04	STA05	c1&c3:p1, p3:STA02 ^c1V^c3: STA06	p3: STA02	p3,p5: STA02
P-ted Avail.	STA01	^c4:p2,p3: STA06 c4:p2,p3, p4:STA09	STA03	STA04	STA05	STA06	STA08	–
WTR	–	–	–	–	–	–	–	p2,p3: STA01
Set Non-Rev.	STA01 (Note 3)	STA02 (Note 3)	STA03 (Note 3)	STA04 (Note 3)	STA05 (Note 3)	STA06 (Note 3)	p3:STA07 (Notes 3, 4)	p3,p5: STA07 (Notes 3, 4)

NOTE 1 – An automatic switch condition may be pending.

NOTE 2 – It results as a failed request.

NOTE 3 – The state table to be considered after having changed the state is the state table of the revertive system.

NOTE 4 – This state pertains to the state diagram for a protected connection protection in a 1 + 1 non-revertive system.

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