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**M.3100**

**Amendment 5**  
(08/2001)

SERIES M: TMN AND NETWORK MAINTENANCE:  
INTERNATIONAL TRANSMISSION SYSTEMS,  
TELEPHONE CIRCUITS, TELEGRAPHY, FACSIMILE  
AND LEASED CIRCUITS

Telecommunications management network

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Generic network information model

**Amendment 5: Enhanced cross-connect model**

ITU-T Recommendation M.3100 – Amendment 5

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**TMN AND NETWORK MAINTENANCE: INTERNATIONAL TRANSMISSION SYSTEMS, TELEPHONE  
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# **ITU-T Recommendation M.3100**

## **Generic network information model**

### AMENDMENT 5

## **Enhanced cross-connect model**

### **Summary**

This amendment defines an enhanced cross-connect capability that allows splitting of bidirectional cross-connects into unicast, changing between unicast and broadcast cross-connects and joining of unicast cross-connects into broadcast cross-connects.

### **Source**

Amendment 5 to ITU-T Recommendation M.3100 was prepared by ITU-T Study Group 4 (2001-2004) and approved under the WTSA Resolution 1 procedure on 13 August 2001.

### **Keywords**

Actions, ASN.1, Attributes, Cross-connect, Managed Object Class, Notifications, Requirements.

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## NOTE

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# ITU-T Recommendation M.3100

## Generic network information model

### AMENDMENT 5

## Enhanced cross-connect model

### 1 Scope

This amendment defines an enhanced cross-connect capability that allows splitting of bidirectional cross-connects into unicast, changing between unicast and broadcast cross-connects and joining of unicast cross-connects into broadcast cross-connects.

**1.1** This feature applies to unicast, bidirectional and broadcast cross-connects.

### 2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions for 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.

- [1] ITU-T M.3010 (2000), *Principles for a telecommunications management network*.
- [2] ITU-T M.3020 (2000), *TMN interface specification methodology*.
- [3] ITU-T M.3100 (1995), *Generic network information model*.
- [4] ITU-T M.3120 (2001), *CORBA generic network and NE level information model*.
- [5] ITU-T M.3400 (2000), *TMN management functions*.
- [6] ITU-T G.774.4 (2001), *Synchronous digital hierarchy (SDH) management of the subnetwork connection protection for the network element view*.

### 3 Terms and definitions

This Recommendation defines no new terms or definitions.

### 4 Abbreviations

This Recommendation uses the following abbreviations:

ASN.1	Abstract Syntax Notation One
GDMO	Guidelines for the Definition of Managed Objects
TMN	Telecommunications Management Network

## 5 Business requirements

This clause describes the enhanced cross-connect business requirements. The current cross-connect model as defined by fabric (including revisions R1-R3) needs to be enhanced to support the following features:

- 1) Splitting a bidirectional cross-connect into two unidirectional cross-connects;
- 2) Changing from unidirectional cross-connect to broadcast;
- 3) Changing from broadcast to unidirectional cross-connect; and
- 4) Joining two unidirectional cross-connect into a single bidirectional cross-connect.

### 5.1 High-level use cases

The terminology used in the use cases is based on terminology defined in this Recommendation and terminology defined in ITU-T M.3400: 2000, *TMN Management Functions*.

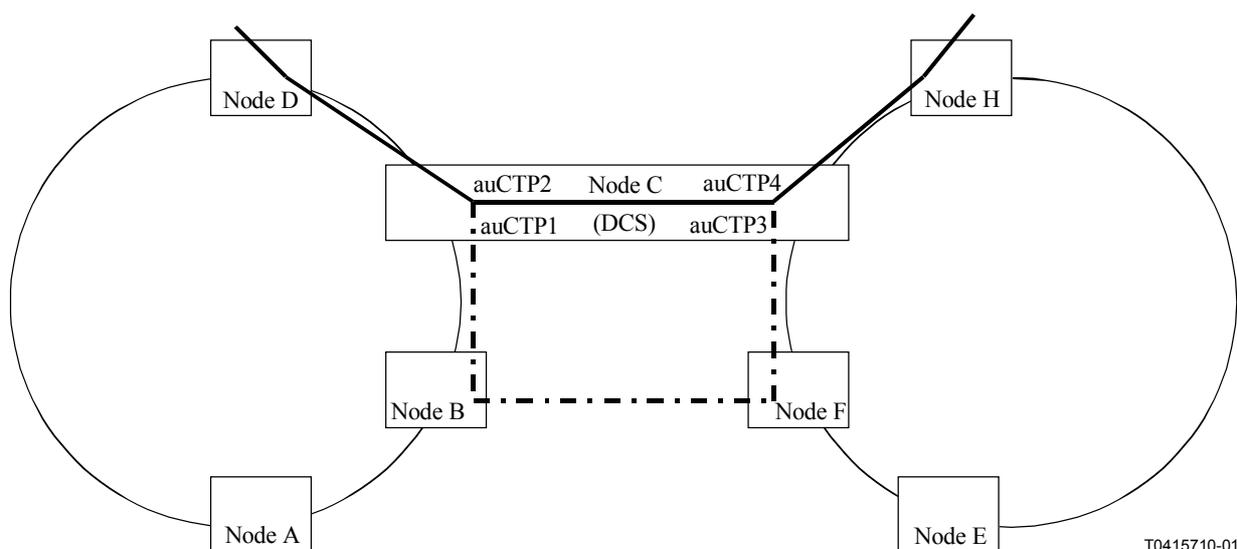
The set of use cases provided here is not exhaustive and is left as an exercise to the reader. Only that which was deemed necessary to clarify the need and the feature requirements is included.

This clause describes some considerations related to interconnecting rings within a single network element, as well as some proposed additions to the M.3100 fabric model related to interconnecting rings.

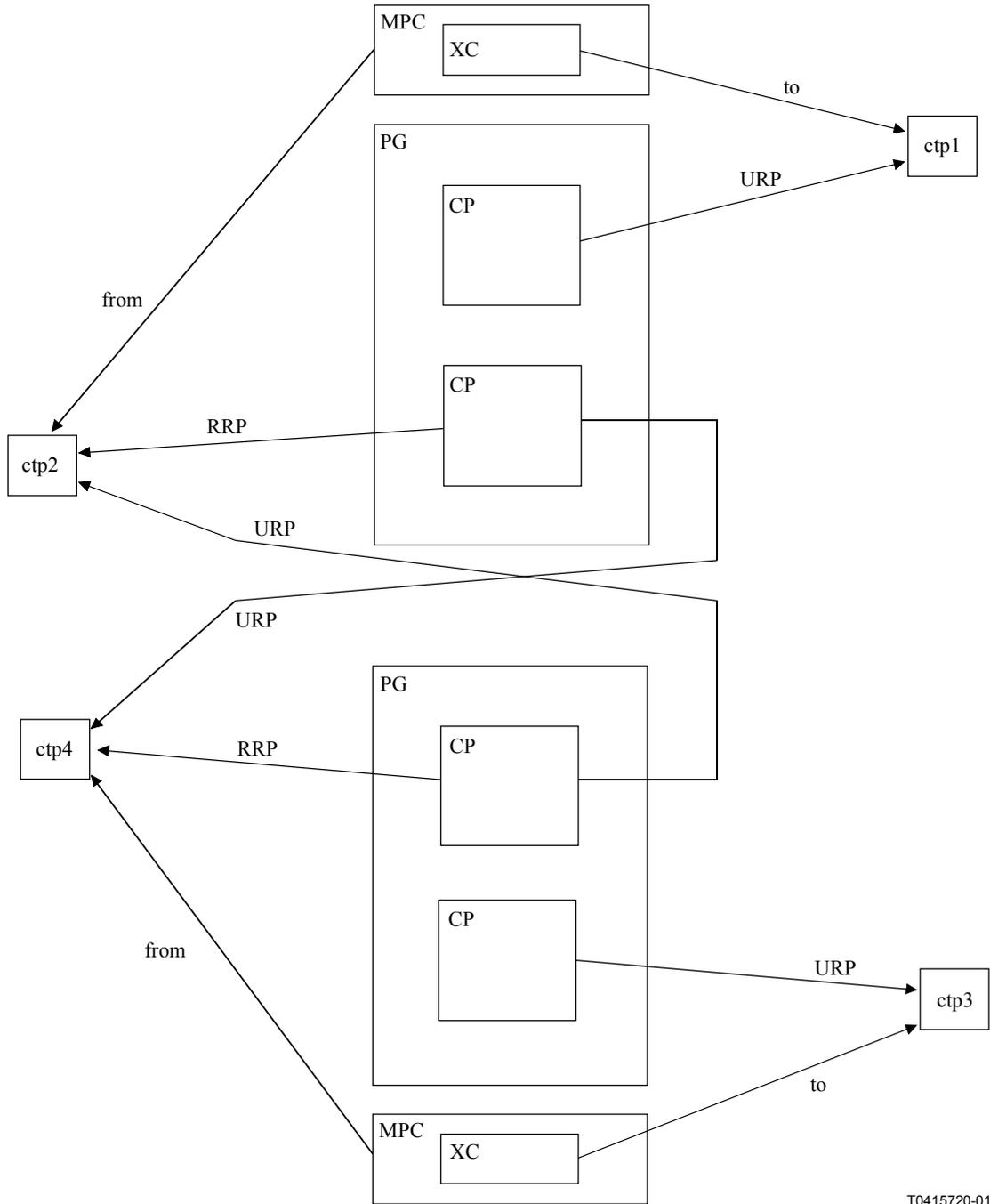
#### 5.1.1 Use case 1 – Interconnection considerations

In general, ring interconnection is accomplished the same objects that are used for other cross-connections. Dual-homed, drop-and-continue, same-side interconnection requires some special handling; to create the necessary connections for that scheme, unidirectional connections must be used.

Figure 1 shows the interconnection scenario from a network view. The solid line is the primary circuit; the dashed line is the secondary circuit. Thus, node C performs two independent connection protection functions in this scheme. In the  $D \rightarrow H$  direction of transmission, the traffic is selected from node D or node F and in the  $H \rightarrow D$  direction connections must be used, as shown in Figures 2 and 3.

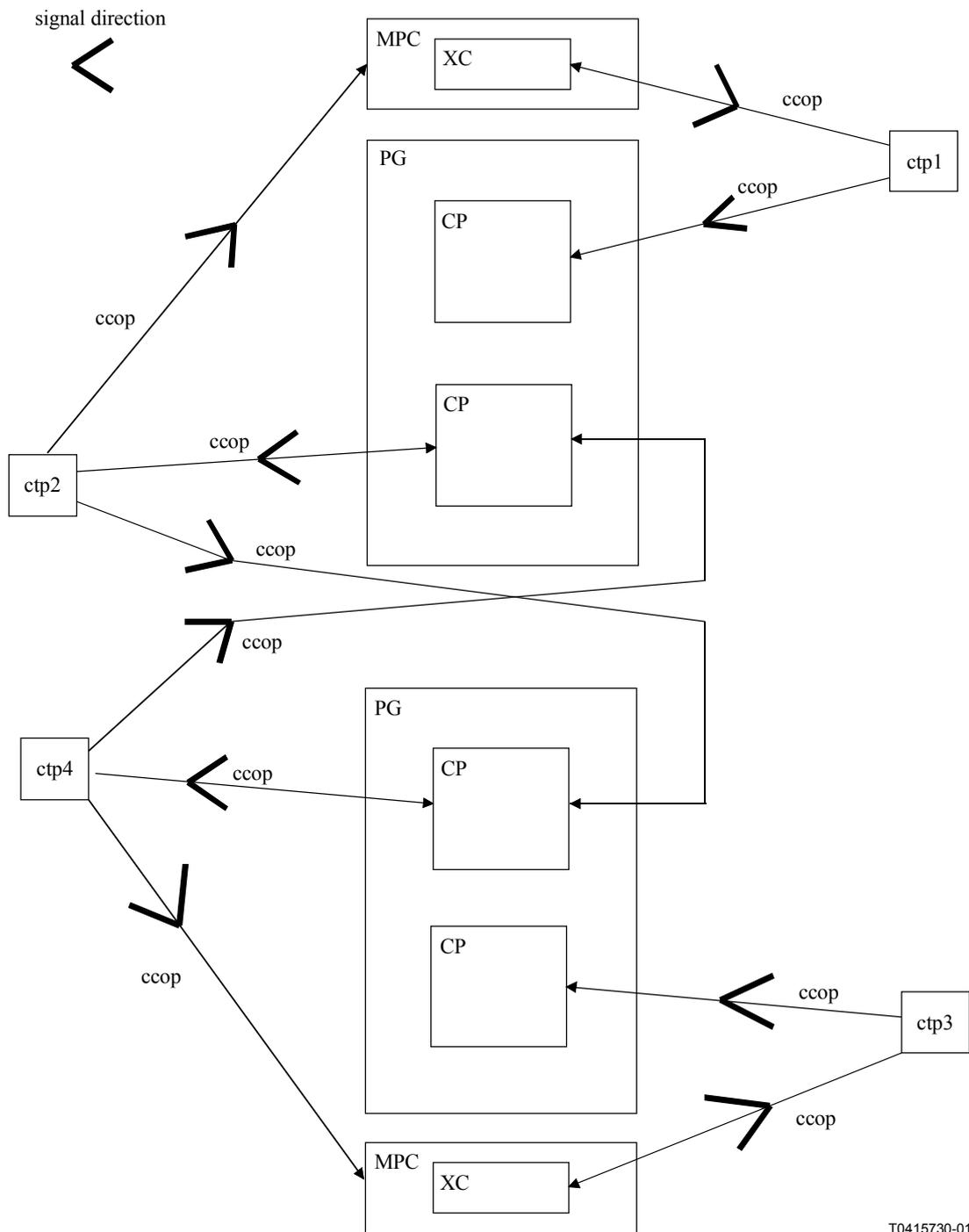


**Figure 1/M.3100 – Network view of same-side interconnection**



T0415720-01

**Figure 2/M.3100 – Connections in Node C, connection pointers view**



T0415730-01

**Figure 3/M.3100 – Connection in Node C, termination point pointers**

### Analysis

The requirement to use unidirectional connections for certain interconnection schemes poses a problem, in that it is not possible with the current fabric model (M.3100:fabricR2) to migrate from single-homed interconnection (which would be created as a simple bidirectional crossConnectionR1) to dual-homed, drop-and-continue, same-side interconnection (which uses unidirectional connections) without disrupting traffic.

To solve that problem, and create a fully flexible set of connection management functions, the following extensions are proposed to the fabric:

- ability to convert a bidirectional connection into a pair of unidirectional connections;
- ability to convert a pair of unidirectional connections between the same termination points into a single bidirectional connection;
- ability to convert a unidirectional point-to-point connection into a multicast connection with a single leg;
- ability to convert a multicast connection with a single leg into a unidirectional point-to-point connection.

All of these operations would be accomplished by deleting and creating the appropriate objects, without affecting traffic.

## 6 Design

This clause defines GDMO and CORBA IDL designs (both fine-grained and coarse-grained) for the enhanced cross-connect capability.

NOTE – In this version of this Recommendation, only the GDMO model is available.

### 6.1 GDMO model

This clause defines the new fabric and supporting ASN.1 productions.

#### 6.1.1 Fabric R4

```
fabricR4 MANAGED OBJECT CLASS
  DERIVED FROM fabricR3;
  CHARACTERIZED BY fabricR4Pkg PACKAGE
    BEHAVIOUR fabricR4PkgBeh BEHAVIOUR
    DEFINED AS
      "This fabric extends the previous fabrics by adding the
      ability to migrate between bidirectional and unidirectional
      connections, between point-to-point and multicast connections,
      and between unprotected and protected connections. If the
      fabric supports these features, the appropriate conditional
      packages are instantiated.";;;
  CONDITIONAL PACKAGES
    splitJoinPkg PRESENT IF
      "the fabric supports migration from a bidirectional point-to-point
      connection to two unidirectional connections, and vice versa",
    multicastConversionPkg PRESENT IF
      "the fabric supports migration from a unidirectional
      point-to-point connection to a multicast connection with a single
      leg, and vice versa",
    sncpPkg PRESENT IF
      "the fabric supports subnetwork connection protection";
REGISTERED AS {m3100ObjectClass 74};

splitJoinPkg PACKAGE
  BEHAVIOUR splitJoinPkgBeh BEHAVIOUR
  DEFINED AS
    "This package provides actions that allow a bidirectional
    connection to be converted to two unidirectional connections, or
    two unidirectional connections between the same termination points
    to be converted to a single bidirectional connection. In both
    cases the conversion is done without disrupting traffic, unless a
    particular implementation indicates otherwise.";;
```

```

ACTIONS
    splitXC,
    joinXC;
REGISTERED AS {m3100Package 101};

multicastConversionPkg PACKAGE
    BEHAVIOUR multicastConversionPkgBeh BEHAVIOUR
    DEFINED AS
        "This package provides actions that allow a unidirectional
        point-to-point connection to be converted into a multicast
        connection with a single leg, or vice versa. In both cases the
        conversion is done without disrupting traffic, unless a particular
        implementation indicates otherwise.";;
    ACTIONS
        convertPtoPToMulticast,
        convertMulticastToPtoP;
REGISTERED AS {m3100Package 102};

sncpPkg PACKAGE
    BEHAVIOUR sncpPkgBeh BEHAVIOUR
    DEFINED AS
        "This package provides actions to establish protected connections
        and to migrate between protected and unprotected connections.";;
    ACTIONS
        "ITU-T Recommendation G.774-04":protectUnprotect,
        "ITU-T Recommendation G.774-04":protectedConnect;
REGISTERED AS {m3100Package 103};

convertMulticastToPtoP ACTION
    BEHAVIOUR convertMulticastToPtoPBeh BEHAVIOUR
    DEFINED AS
        "This action is used to convert a multicast connection with a
        single leg into a point-to-point unidirectional cross-connection.
        This action can be applied to either protected or unprotected
        connections. The action argument indicates the existing multicast
        (mpCrossConnection or mpConnectionProtection) that is to be
        converted. When this action is successfully performed, the
        existing multicast is deleted, and replaced with a unidirectional
        point-to-point. This action fails if the specified multicast
        contains more than one subordinate connection.";;
    MODE CONFIRMED;
    WITH INFORMATION SYNTAX M3100ASN1TypeModule6.ConvertMultiToPtoPInfo;
    WITH REPLY SYNTAX M3100ASN1TypeModule6.ConvertMultiToPtoPReply;
REGISTERED AS {m3100Action 23};

convertPtoPToMulticast ACTION
    BEHAVIOUR convertPtoPToMulticastBeh BEHAVIOUR
    DEFINED AS
        "This action is used to convert a unidirectional point-to-point
        cross-connection into a multicast connection with a single leg.
        This action can be applied to both protected and unprotected
        connections. When this action is successfully performed, the
        existing connection (or subclass) is deleted, and replaced with a
        multicast connection and a subordinate connection to represent the
        leg.";;
    MODE CONFIRMED;
    WITH INFORMATION SYNTAX M3100ASN1TypeModule6.ConvertPtoPToMultiInfo;
    WITH REPLY SYNTAX M3100ASN1TypeModule6.ConvertPtoPToMultiReply;
REGISTERED AS {m3100Action 24};

```

```

joinXC ACTION
  BEHAVIOUR joinXCBeh BEHAVIOUR
  DEFINED AS
    "This action is used to convert two unidirectional connections
    into a single bidirectional connection. This conversion is only
    allowed if the two connections are between the same bidirectional
    endpoints. This action can be applied to both protected and
    unprotected connections. When this action is successfully
    performed, the existing connections are deleted, and a
    bidirectional connection is created.";;
  MODE CONFIRMED;
  WITH INFORMATION SYNTAX M3100ASN1TypeModule6.JoinXCInfo;
  WITH REPLY SYNTAX M3100ASN1TypeModule6.JoinXCReply;
REGISTERED AS {m3100Action 25};

```

```

splitXC ACTION
  BEHAVIOUR splitXCBeh BEHAVIOUR
  DEFINED AS
    "This action is used to convert a bidirectional connection into
    two unidirectional connections. This action can be applied to both
    protected and unprotected connections. When this action is
    successfully performed, the existing bidirectional connection is
    deleted, and two unidirectional connections are created.";;
  MODE CONFIRMED;
  WITH INFORMATION SYNTAX M3100ASN1TypeModule6.SplitXCInfo;
  WITH REPLY SYNTAX M3100ASN1TypeModule6.SplitXCReply;
REGISTERED AS {m3100Action 26};

```

## 6.1.2 Supporting productions

```

M3100ASN1TypeModule6 {itu-t recommendation m gnm(3100) informationModel(0)
asn1Modules(2) asn1Module6(5) }
DEFINITIONS IMPLICIT TAGS ::=
BEGIN
-- EXPORTS everything
IMPORTS
  ObjectInstance FROM CMIP-1 {joint-iso-itu-t ms(9) cmip(1) modules(0)
  protocol(3) }

  ManagementExtension, AdditionalInformation FROM Attribute-ASN1Module {
  joint-iso-ccitt ms(9) smi(3) part2(2) asn1Module(2) 1}F

  Failed, ProblemCause, PointerOrNull FROM ASN1DefinedTypesModule {ccitt
  recommendation m gnm(3100) informationModel(0) asn1Modules(2)
  asn1DefinedTypesModule(1) };

CoincidentProtectedUnidirectionalConnections ::= SEQUENCE {
  protectedXC      ProtectedXC,
  multicastXC      MulticastXC }

CoincidentUnidirectionalConnections ::= CHOICE {
  unprotected      [0] CoincidentUnprotectedUnidirectionalConnections,
  protected         [1] CoincidentProtectedUnidirectionalConnections }

CoincidentUnprotectedUnidirectionalConnections ::= SEQUENCE {
  xcA      ObjectInstance,
  xcB      ObjectInstance }
-- the term "coincident" is used to describe unidirectional connections between
-- the same bidirectional termination points.

```

```

ConvertMulticastToPtoPInfo ::= SEQUENCE OF ObjectInstance

ConvertMulticastToPtoPReply ::= SEQUENCE OF CHOICE {
    failed      Failed,
    success     ObjectInstance }
-- the ith element of the reply corresponds to the ith element of the information
-- syntax

ConvertPtoPtoMulticastInfo ::= SEQUENCE OF ObjectInstance

ConvertPtoPtoMulticastReply ::= SEQUENCE OF CHOICE {
    failed      [0] Failed,
    success     [1] SEQUENCE {
        mpXC      ObjectInstance,
        xC        ObjectInstance } }
-- the ith element of the reply corresponds to the ith element of the information
-- syntax

JoinXCInfo ::= SEQUENCE OF CoincidentUnidirectionalConnections

JoinXCReply ::= SEQUENCE OF CHOICE {
    failed      [0] Failed,
    success     [1] CHOICE {
        unprotected ObjectInstance,
        protected   ProtectedXC } }
-- the ith element of the reply corresponds to the ith element of the information
-- syntax

MulticastXC ::= SEQUENCE {
    mpXC      ObjectInstance,
    xcA      ObjectInstance,
    xcB      ObjectInstance }

ProtectedXC ::= SEQUENCE {
    conProtGroup ObjectInstance,
    conProtA     ObjectInstance,
    conProtB     ObjectInstance }

SplitXCInfo ::= SEQUENCE OF ObjectInstance

SplitXCReply ::= SEQUENCE OF CHOICE {
    failed      Failed,
    success     CoincidentUnidirectionalConnections }
-- the ith element of the reply corresponds to the ith element of the information
-- syntax

-- additional integer values of ProblemCause:

notMulticastWithOnlyOneSubordinateLeg      ProblemCause ::= integerValue : 14
endpointsNotTheSame                        ProblemCause ::= integerValue : 15
notUnidirectional                          ProblemCause ::= integerValue : 16
notBidirectional                            ProblemCause ::= integerValue : 17

-- notMulticastWithOnlyOneSubordinateLeg is used with the convertMulticastToPtoP
-- action
-- endpointsNotTheSame is used in the joinXC action
-- notUnidirectional is used in the convertPtoPtoMulticast action
-- notBidirectional is used in the splitXC action

```

END

## 6.2 CORBA model

```
#ifndef _itut_m3120_enhanced_cross_connect_idl_
#define _itut_m3120_enhanced_cross_connect_idl_

/**
This fabric fragment is added to the itut_m3120 module that contains IDL
definition based on objects defined in M.3100 and G.855.1.
*/

/**
The IDL code contained in this fragment is intended to be stored in a file named
"itut_m3120_enhanced_cross_connect.idl" located in the search path used by the
IDL compilers on your system. The M.3120 main module (defined in M.3120) is
contained in separate files "itut_m3120.idl" and itut_m3120_bridge_and_roll.idl.
*/

module itut_m3120
{
/**
```

### 6.2.1 Imports

```
*/
/**
```

### 6.2.2 Structures and typedefs

```
*/
/**
```

### 6.2.3 Exceptions and constants for conditional packages

```
*/
/**
```

### 6.2.4 Interfaces – Fine-grained

```
*/
/**
```

#### 6.2.4.1 Fabric R4

This interface supports the FabricR4 with enhanced cross-connect capability.

```
*/
    valuetype FabricR4ValueType: FabricR3ValueType {
}; // valuetype FabricR4ValueType

    interface FabricR4: FabricR3
    {
//Editor's Note: The 6 operations will be defined here.
//Make sure the operations have the Noxxx exceptions for the corresponding
//conditional packages.

}; // interface FabricR4
```

```

interface FabricR4Factory: itut_x780::ManagedObjectFactory
{
    itut_x780::ManagedObject create
        (in NameBindingType nameBinding,
         in MONameType superior,

         in string reqID, // auto naming if empty string
         out MONameType name,
         in StringSetType packageNameList,
         in MONameSetType supportedByObjectList,
          // may be empty set type
          // fabricPackage
          // GET-REPLACE, ADD-REMOVE
         in CharacteristicInfoSetType characteristicInfoList,
          // fabricPackage
          // GET, SET-BY-CREATE
         in AdministrativeStateType administrativeState)
          // fabricPackage
          // GET-REPLACE
        raises (itut_x780::ApplicationError,
              itut_x780::CreateError);

}; // interface FabricR3Factory

```

```
/**
```

## 6.2.5 Interfaces – Facade

```
*/
```

```
/**
```

### 6.2.5.1 Fabric R4 facade

This interface supports the FabricR3 facade with bridge-and-roll capability.

```
*/
```

```

interface FabricR4_F: FabricR3_F
{

//Editor's Note: Same operations as the fine-grained ones, except having
//the extra input parameter MONameType.

}; // interface FabricR4_F

}; // module itut_m3120

#endif // _itut_m3120_facade_enhanced_cross_connect_idl_

```



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