International Telecommunication Union

# ITU-T

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OF ITU

# M.3102

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SERIES M: TELECOMMUNICATION MANAGEMENT, INCLUDING TMN AND NETWORK MAINTENANCE

Telecommunications management network

## Unified generic management information model for connection-oriented and connectionless networks

Recommendation ITU-T M.3102

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ITU-T M-SERIES RECOMMENDATIONS

**TELECOMMUNICATION MANAGEMENT, INCLUDING TMN AND NETWORK MAINTENANCE**

| | |
|---|---|
| Introduction and general principles of maintenance and maintenance organization | M.10–M.299 |
| International transmission systems | M.300–M.559 |
| International telephone circuits | M.560–M.759 |
| Common channel signalling systems | M.760–M.799 |
| International telegraph systems and phototelegraph transmission | M.800–M.899 |
| International leased group and supergroup links | M.900–M.999 |
| International leased circuits | M.1000–M.1099 |
| Mobile telecommunication systems and services | M.1100–M.1199 |
| International public telephone network | M.1200–M.1299 |
| International data transmission systems | M.1300–M.1399 |
| Designations and information exchange | M.1400–M.1999 |
| International transport network | M.2000–M.2999 |
| **Telecommunications management network** | **M.3000–M.3599** |
| Integrated services digital networks | M.3600–M.3999 |
| Common channel signalling systems | M.4000–M.4999 |

*For further details, please refer to the list of ITU-T Recommendations.*

# Recommendation ITU-T M.3102

## Unified generic management information model for connection-oriented and connectionless networks


### Summary

Recommendation ITU-T M.3102 provides a management information model for unified connection-oriented and connectionless networks, based on the unified functional architecture of transport networks specified in Recommendation ITU-T G.800. This model describes information object classes (IOCs) and their properties that are generic and useful to describe information exchanged across all interfaces defined in Recommendation ITU-T M.3010, TMN architecture. These generic information object classes are intended to be applicable across different technologies, architecture and services. The information object classes in this Recommendation may be specialized to support the management of various telecommunications networks.

This Recommendation follows Recommendation ITU-T M.3020, management interface specification methodology on the analysis phase. The information models provided in this Recommendation are in a protocol-neutral manner, and can be mapped to multiple protocol-specific information models (design phase).



### History

| Edition | Recommendation | Approval | Study Group |
|---|---|---|---|
| 1.0 | ITU-T M.3102 | 2011-01-13 | 2 |

### Keywords

Connectionless network, connection-oriented network, unified information model.

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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, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at http://www.itu.int/ITU-T/ipr/.

## Table of Contents

# Recommendation ITU-T M.3102

## Unified generic management information model for connection-oriented and connectionless networks

### 1 Scope

This Recommendation provides a unified management information model for both connection-oriented and connectionless networks. The information model is based on the unified functional architecture of transport network specified in [ITU-T G.800]. It is the scope of this Recommendation to define the following:

– the entities representing the abstraction of resources in unified connection-oriented and connectionless transport networks;

– the attributes of these entities; and

– the relationship among these entities, including the entities at the same layer and at different layers.

The above entities are defined in a protocol- and technology-neutral way, which is based on the methodology specified in [ITU-T M.3020]. But the management interactions are not the purpose of this Recommendation. It is outside the scope of this Recommendation to define the interactions across the management interface.

### 2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; 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. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[ITU-T G.800] Recommendation ITU-T G.800 (2007), *Unified functional architecture of transport networks*.

[ITU-T G.805] Recommendation ITU-T G.805 (2000), *Generic functional architecture of transport networks*.

[ITU-T G.809] Recommendation ITU-T G.809 (2003), *Functional architecture of connectionless layer networks*.

[ITU-T M.3020] Recommendation ITU-T M.3020 (2010), *Management interface specification methodology*.

[ITU-T M.3100] Recommendation ITU-T M.3100 (2005), *Generic network information model*.

[ITU-T M.3160] Recommendation ITU-T M.3160 (2008), *Generic, protocol-neutral management information model*.

[ITU-T M.3701] Recommendation ITU-T M.3701 (2010), *Common management services – State management – Protocol neutral requirements and analysis.*

## 3 Definitions

### 3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

**3.1.1 information object class** [ITU-T M.3020]

**3.1.2 information type** [ITU-T M.3020]

**3.1.3 managed entity** [ITU-T M.3100]

**3.1.4 management interface** [ITU-T M.3100]

### 3.2 Terms defined in this Recommendation

This Recommendation has no new definitions.

## 4 Abbreviations

This Recommendation uses the following abbreviations:

| | |
|---|---|
| Ac | Access |
| Abs | Abstract |
| AP | Access Point |
| CL | Connectionless |
| CO | Connection-Oriented |
| Con | Connection |
| Dm | Domain |
| Ed | End |
| ER | Entity Relationship |
| Fw | Forwarding |
| FwEP | Forwarding End Point |
| FwIP | Forwarding Intermediate Point |
| FwP | Forwarding Point |
| FwPP | Forwarding Point Pool |
| Gr | Group |
| Im | Intermediate |
| IOC | Information Object Class |
| Lk | Link |
| Log | Logical |
| Ly | Layer |
| MP2MP | Multipoint-to-Multipoint |
| NE | Network Element |
| Nw | Network |
| P2P | Point-to-Point |

| | |
|---|---|
| Pl | Pool |
| Pt | Point |
| Ptr | Pointer |
| Rel | Relationship |
| SNw | SubNetwork |
| Top | Topological |

## 5 Conventions

This Recommendation uses the conventions defined in [ITU-T M.3020] for requirements capture and analysis.

## 6 Information object classes

### 6.1 Imported information entities and local labels

None.

### 6.2 Class diagrams

#### 6.2.1 Attributes and relationships

##### 6.2.1.1 Network fragment

The network fragment is a grouping of information object classes (IOCs) that represents collections of interconnected telecommunications and management objects (logical or physical) capable of exchanging information. These objects have one or more common characteristics, for example, they may be owned by a single customer or provider, or associated with a specific service network. A network may be nested within another (larger) network, thereby forming a containment relationship. Layer_Network_Domain in this Recommendation can be either connection-oriented or connectionless.

IOCs in the network fragment are presented in Figure 1.

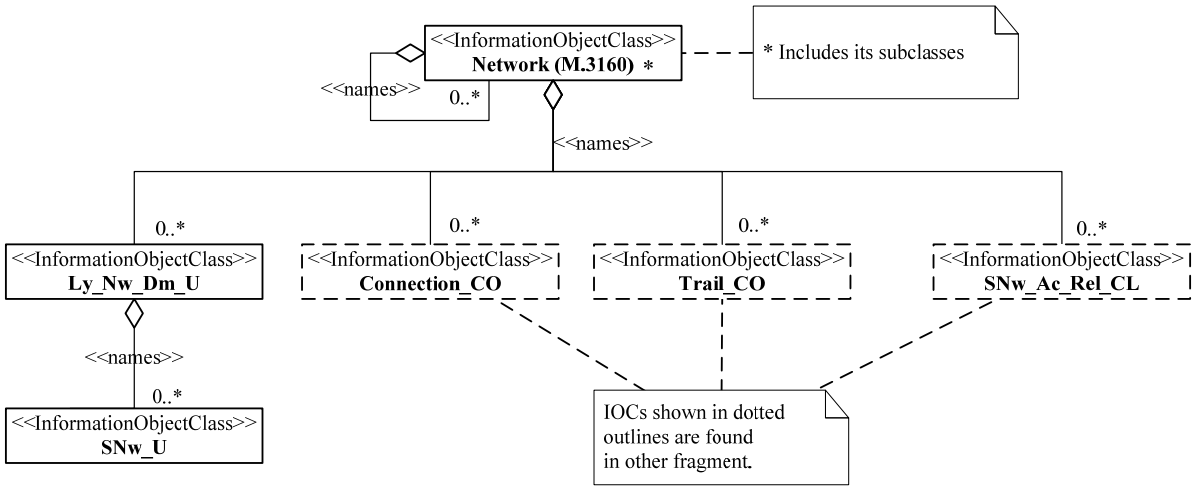


**Figure 1 – Containment diagram of network fragment**

The entity relationship (ER) diagram of the network fragment is presented in Figure 2.

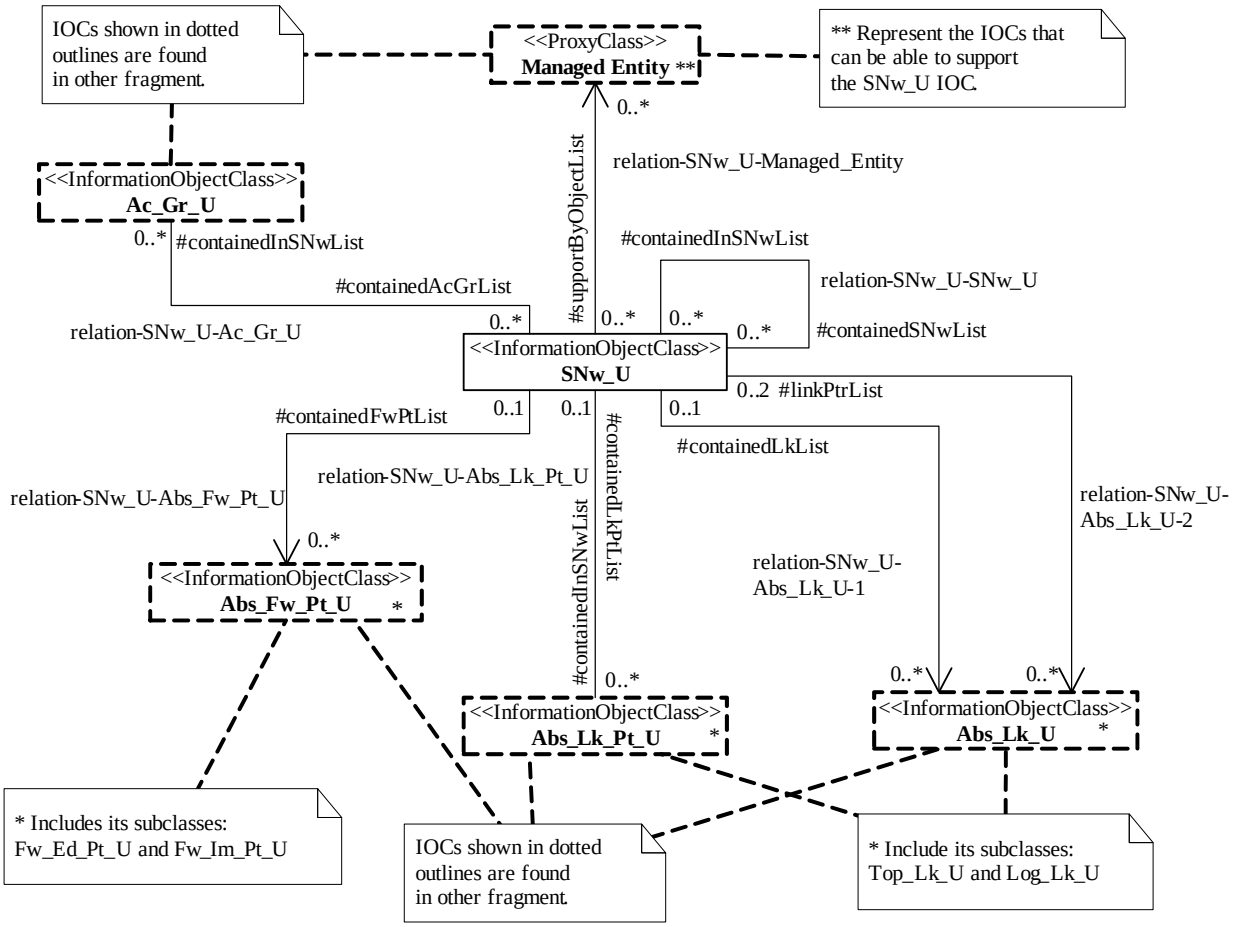


**Figure 2 – ER diagram of network fragment**

### 6.2.1.2 Forwarding point fragment

IOCs in forwarding point fragment for the network element view are presented in Figure 3.

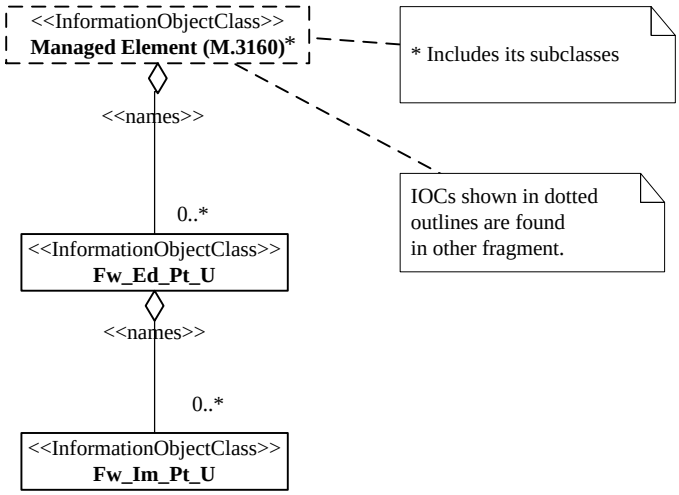


**Figure 3 – Forwarding point fragment – Network element view**

IOCs in forwarding point fragment for the network view are presented in Figure 4.

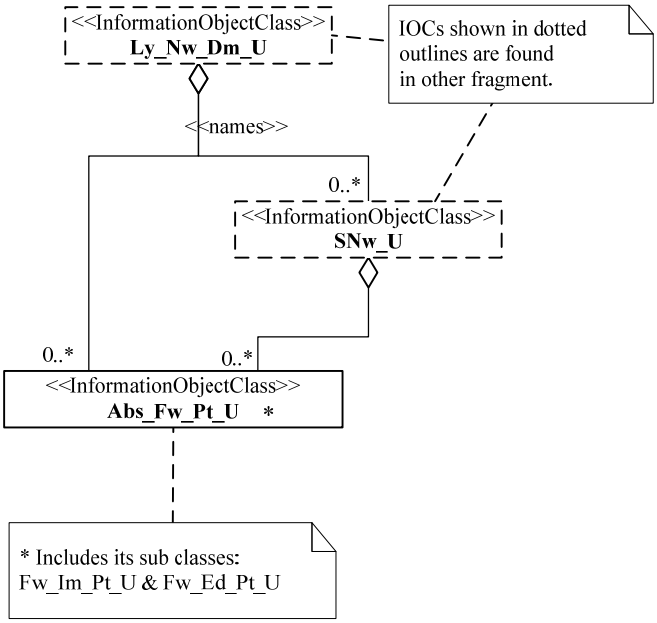


**Figure 4 – Forwarding point fragment – Network view**

The entity relationship (ER) diagram of the termination point fragment for the network element view is presented in Figure 5.

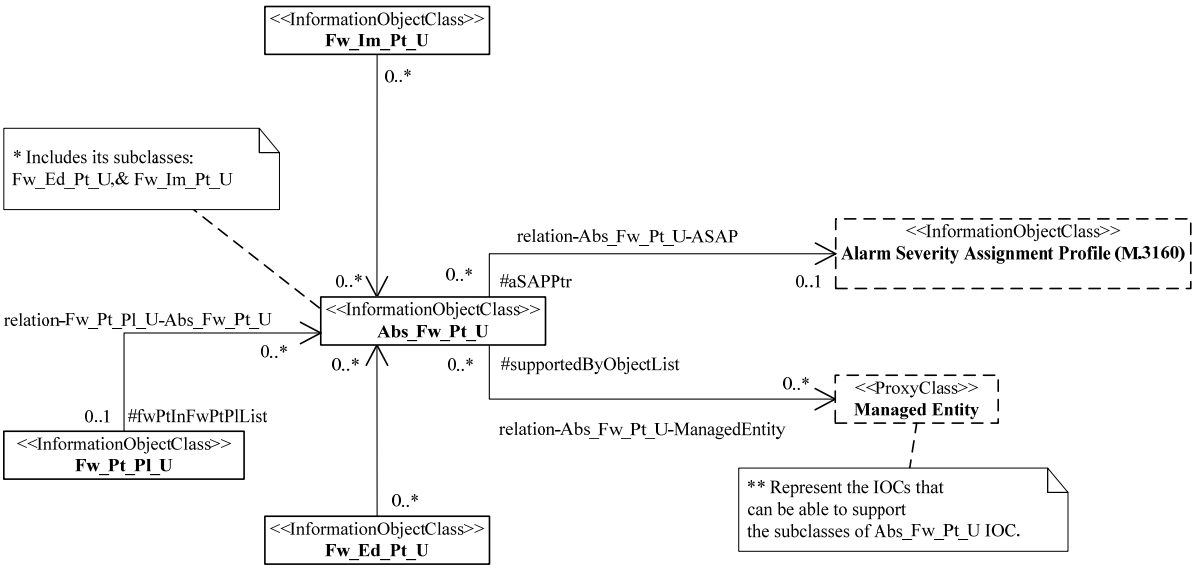


**Figure 5 – ER diagram of forwarding point fragment**

### 6.2.1.3 Topology and connectivity fragment

IOCs in the topology and connectivity fragment for the network view are presented in Figure 6.

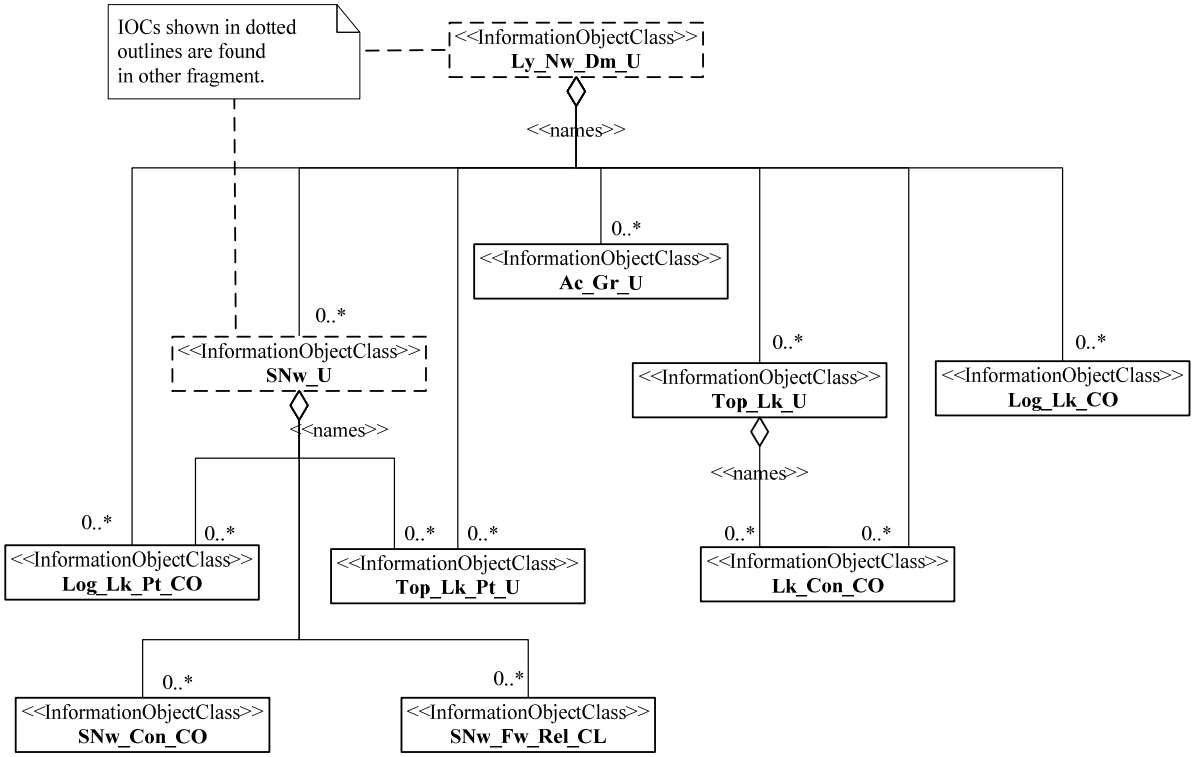


**Figure 6 – Topology and connectivity fragment**

The entity relationship (ER) diagrams of the topology and connectivity fragment are presented in Figures 7 and 8.

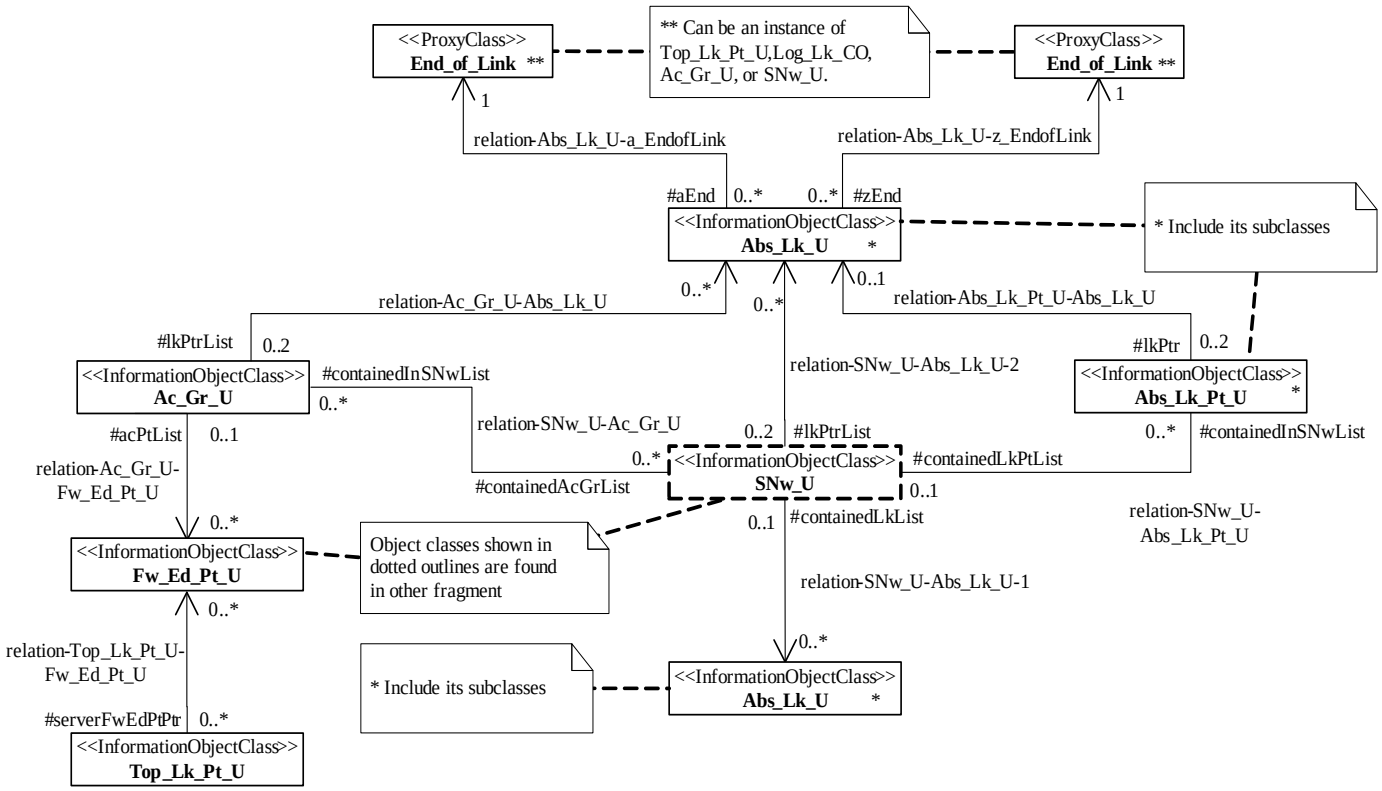


**Figure 7 – ER diagram of topology and connectivity fragment (part 1)**

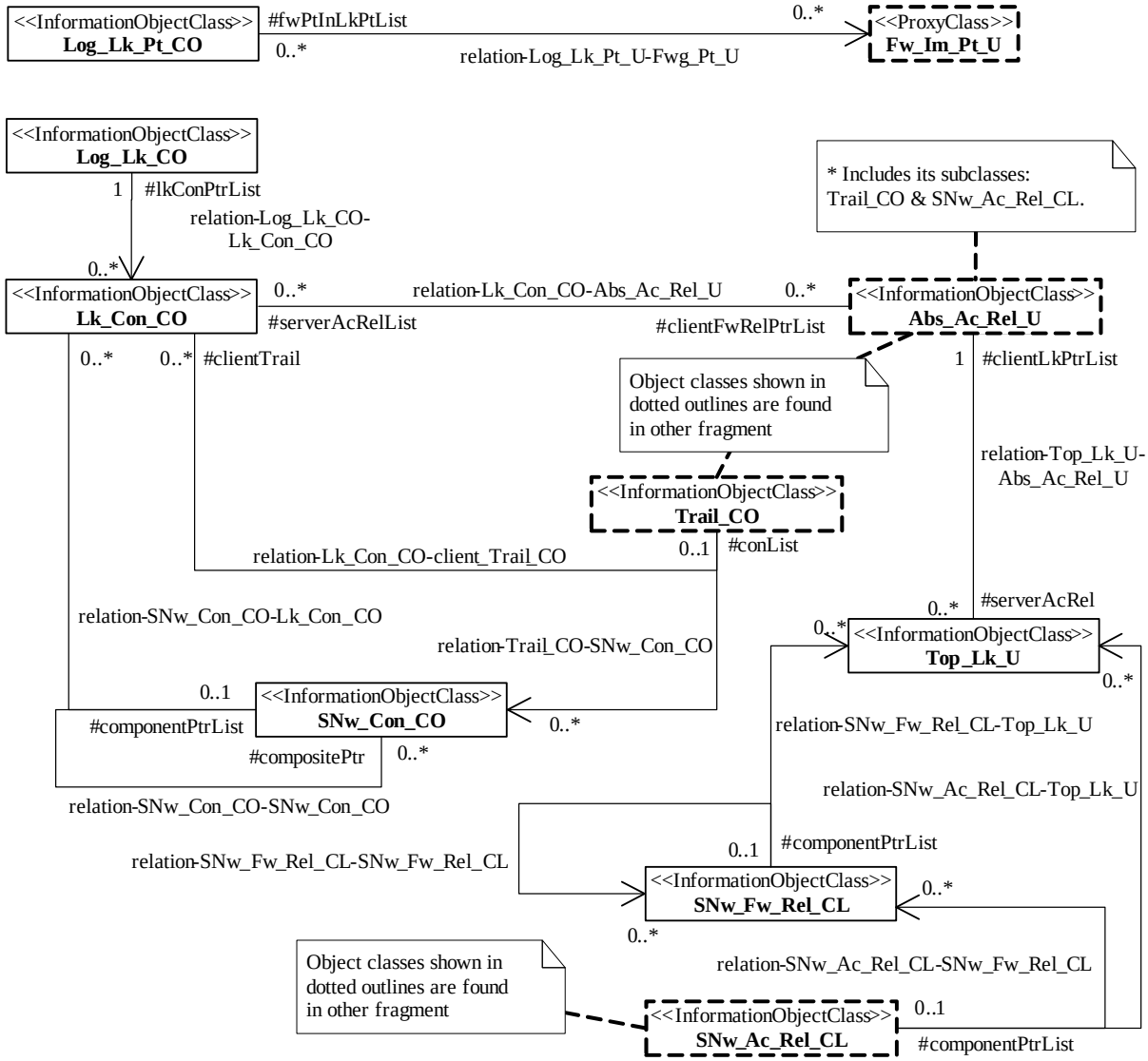


**Figure 8 – ER diagram of topology and connectivity fragment (part 2)**

### 6.2.1.4 Transmission fragment

IOCs in the transmission fragment are presented in Figure 9.

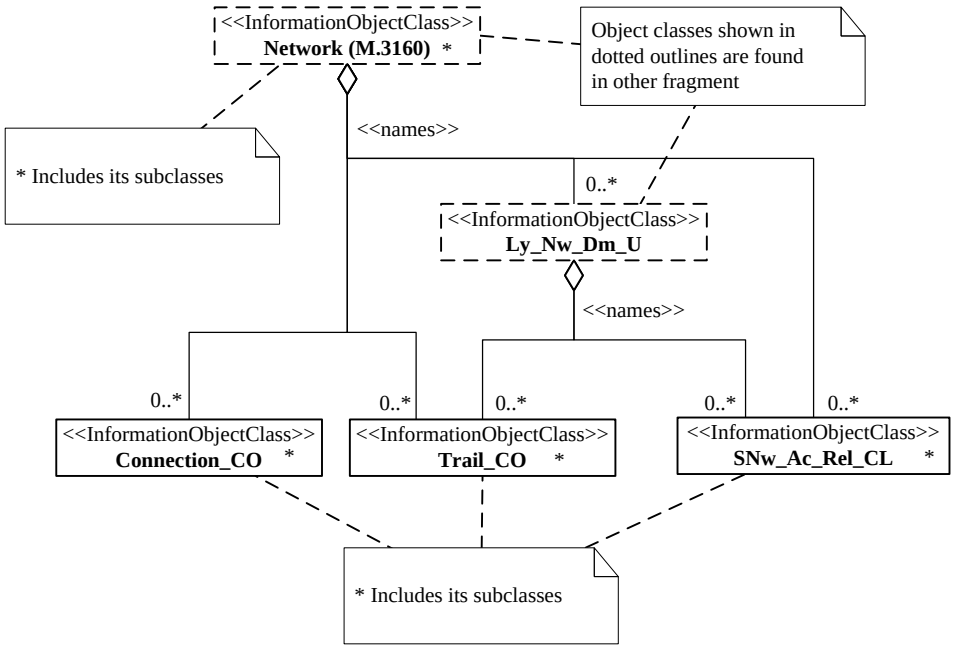


**Figure 9 – Transmission fragment**

The entity relationship (ER) diagrams of the transmission fragment are presented in Figures 10 and 11.

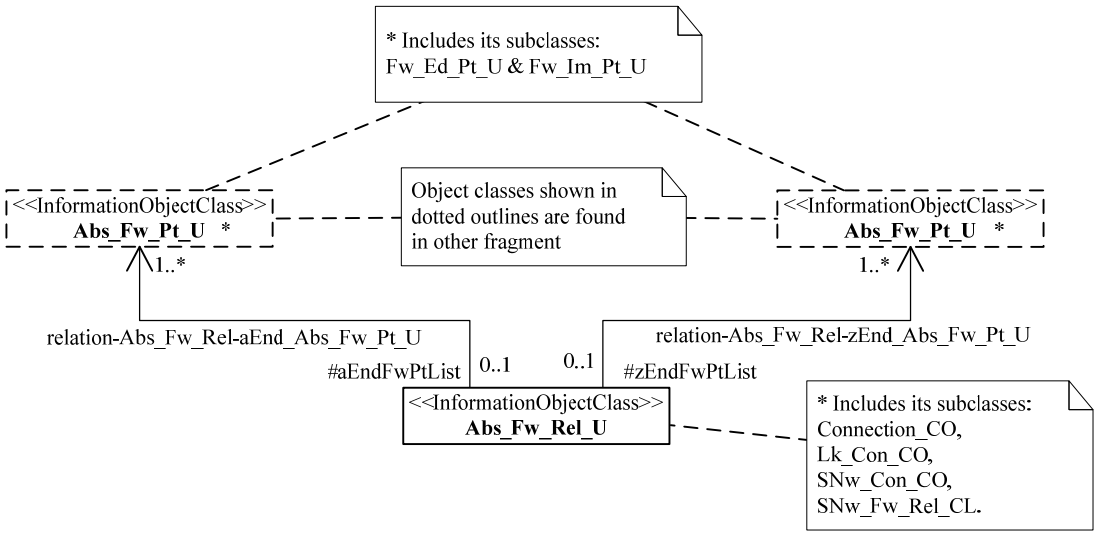


**Figure 10 – ER diagram of transmission fragment (part 1)**

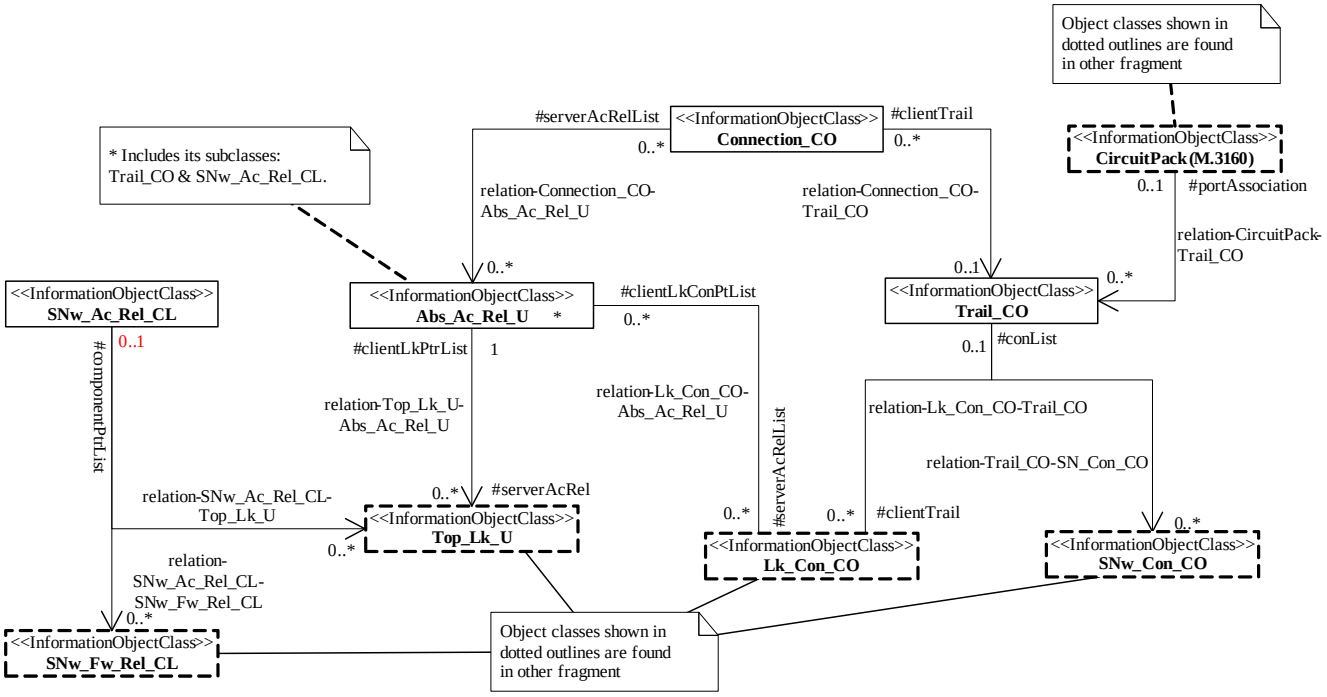


**Figure 11 – ER diagram of transmission fragment (part 2)**

### 6.2.2 Inheritance

#### 6.2.2.1 Network fragment

The inheritance diagram of the network fragment is presented in Figure 12.

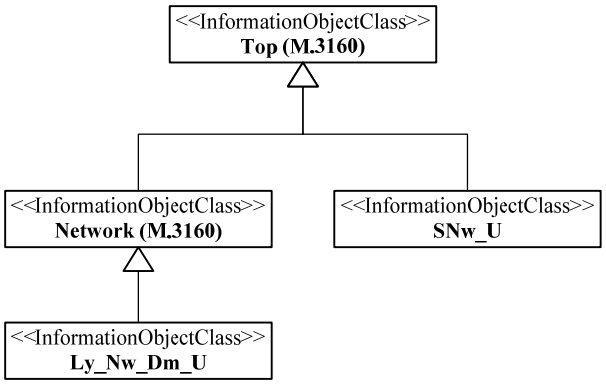


**Figure 12 – Inheritance diagram of network fragment**

#### 6.2.2.2 Forwarding point fragment

The inheritance diagram of the termination point fragment for the combined view is presented in Figure 13.

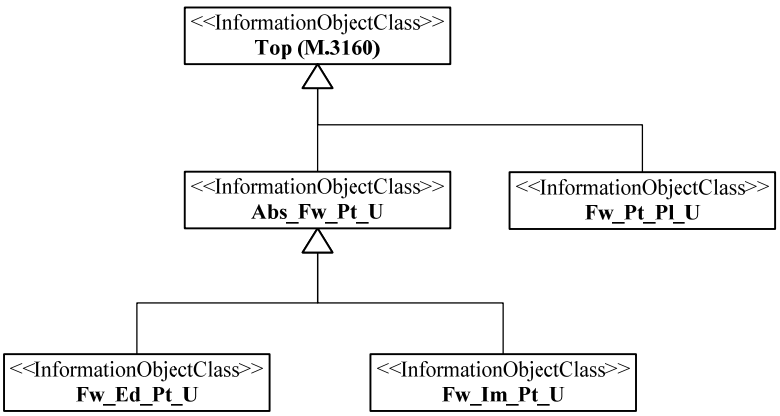


**Figure 13 – Inheritance diagram of forwarding point fragment**

### 6.2.2.3 Topology and connectivity fragment

The inheritance diagram of the topology and connectivity fragment is presented in Figure 14.

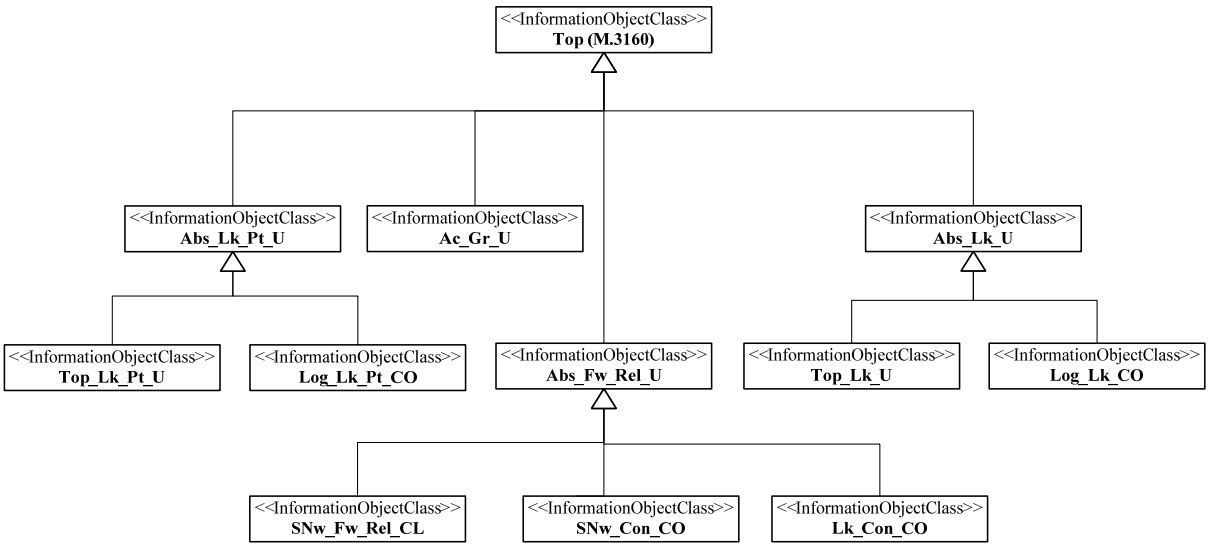


**Figure 14 – Inheritance diagram of topology and connectivity fragment**

### 6.2.2.4 Transmission fragment

The inheritance diagram of the transmission fragment is presented in Figure 15.

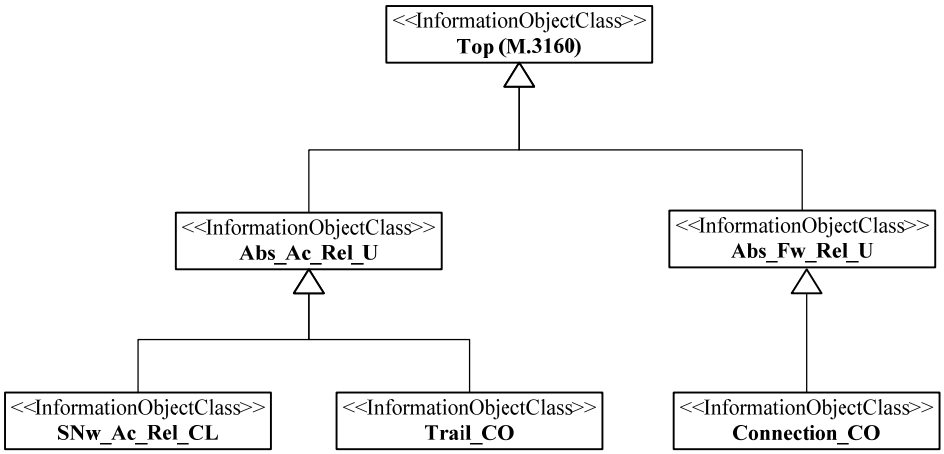


**Figure 15 – Inheritance diagram of transmission fragment**

### 6.2.3 Intra-layer and inter-layer relationships

#### 6.2.3.1 Overview

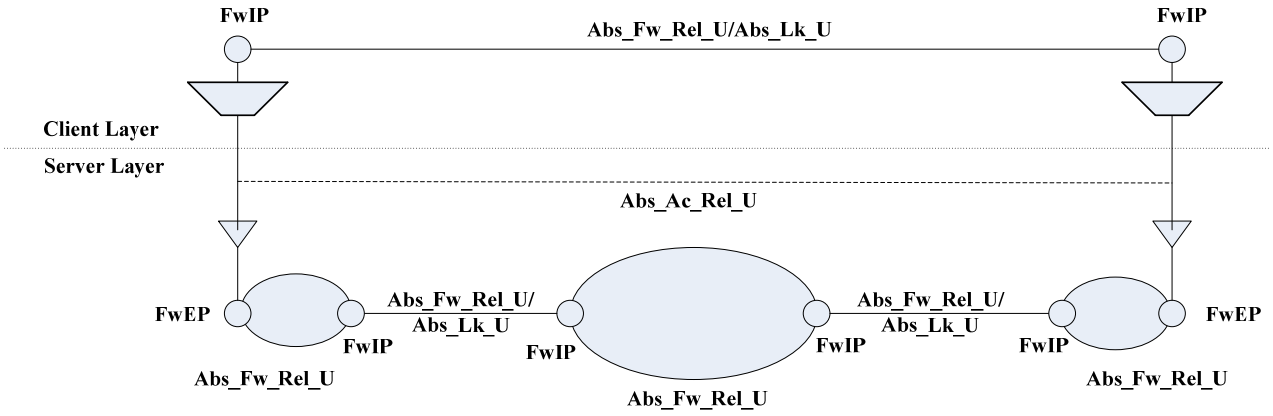


**Figure 16 – General inter-layer layer relationship**

Figure 16 shows the generic case of inter-layer and intra-layer relationships, applicable for both connection-oriented and connectionless networks in general.

For the inter-layer relationship, a client layer Abs_Fw_Rel_U or Abs_Lk_U may be supported by a server layer Abs_Ac_Rel_U. For intra-layer relationship, an Abs_Ac_Rel_U may be composed of one or more Abs_Fw_Rel_U(s) or Abs_Lk_U(s), and each Abs_Fw_Rel_U can be either a Lk_Con_CO or SNw_Con_CO for the connection-oriented case, or a SNw_Fw_Rel_CL for the connectionless case.

#### 6.2.3.2 Intra-layer relationship

There are mainly two cases for the intra-layer relationship: intra-layer relationship for connection-oriented networks, and intra-layer relationship for connectionless networks.

##### 6.2.3.2.1 Intra-layer relationship for connection-oriented networks

When a network layer is connection-oriented, an Abs_Ac_Rel_U can be instantiated using its subclasses Trail_CO, and the Trail_CO between two access points (APs) can be composed of an ordered sequence of following transport entities at the same layer: one or more Lk_Con_CO(s) and SNw_Con_CO(s). This is shown in Figure 17.

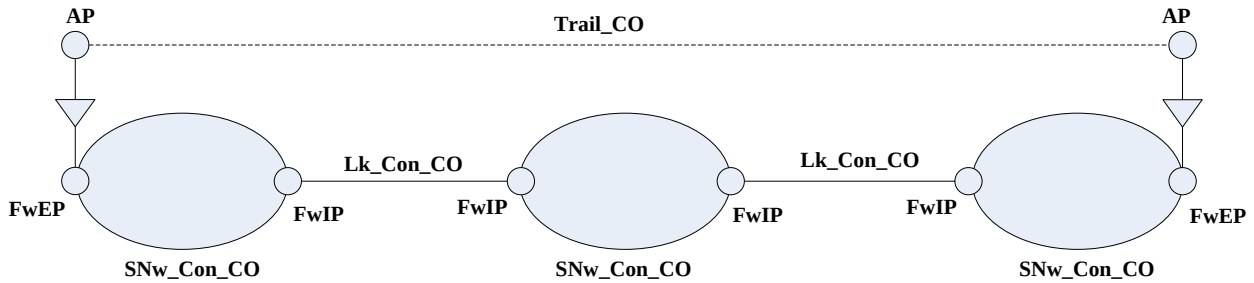


**Figure 17 – Intra-layer relationship for CO networks – Trail_CO composition**

#### 6.2.3.2.2 Intra-layer relationship for connectionless networks

When a network layer is connectionless, an Abs_Ac_Rel_U can be instantiated using its subclasses SNw_Ac_Rel_CL, and the SNw_Ac_Rel_CL between two or more access points (APs) can be composed of an unordered set of the following transport entities at the same layer: one or more Top_Lk_U(s) and SNw_Fw_Rel_CL(s). This is shown in Figure 18.

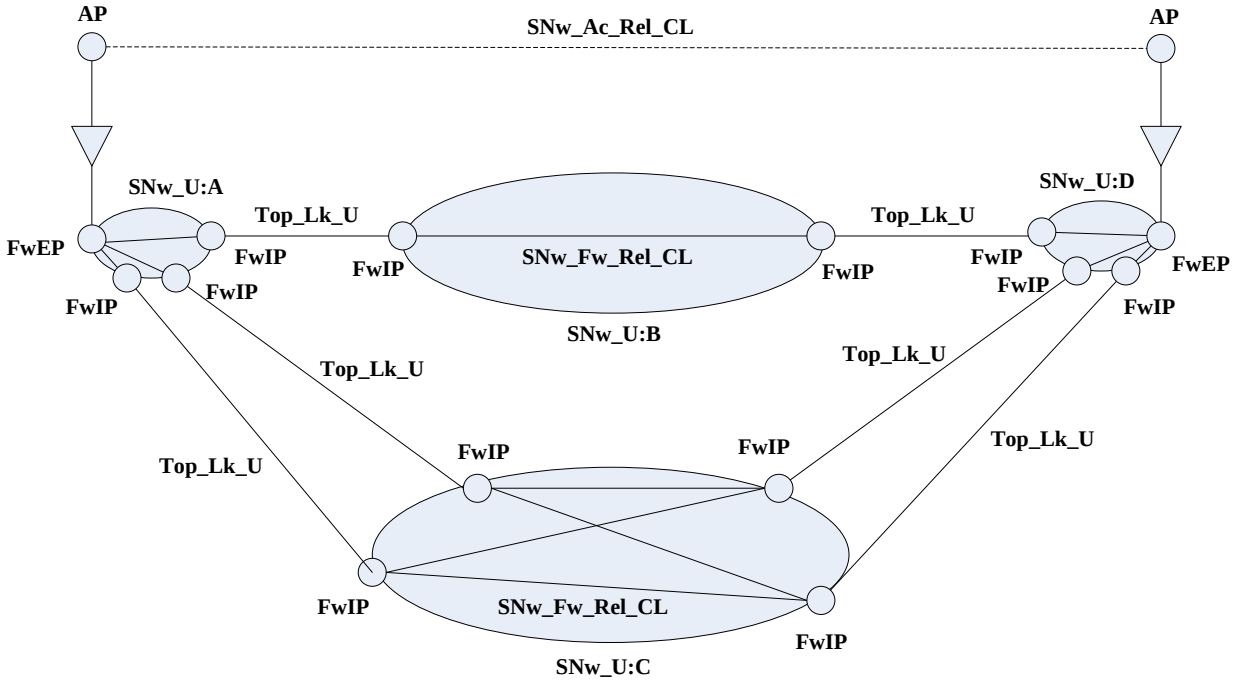


**Figure 18 – Intra-layer relationship for CL networks – SNw_Ac_Rel_CL composition**

Sometimes, resource reservation is supported by a connectionless layer network; in that case, the SNw_Ac_Rel_CL can be composed of an ordered sequence of Top_Lk_U(s) and Subnetwork_Forwarding_Relationship_CL(s), which can be shown in Figure 19:

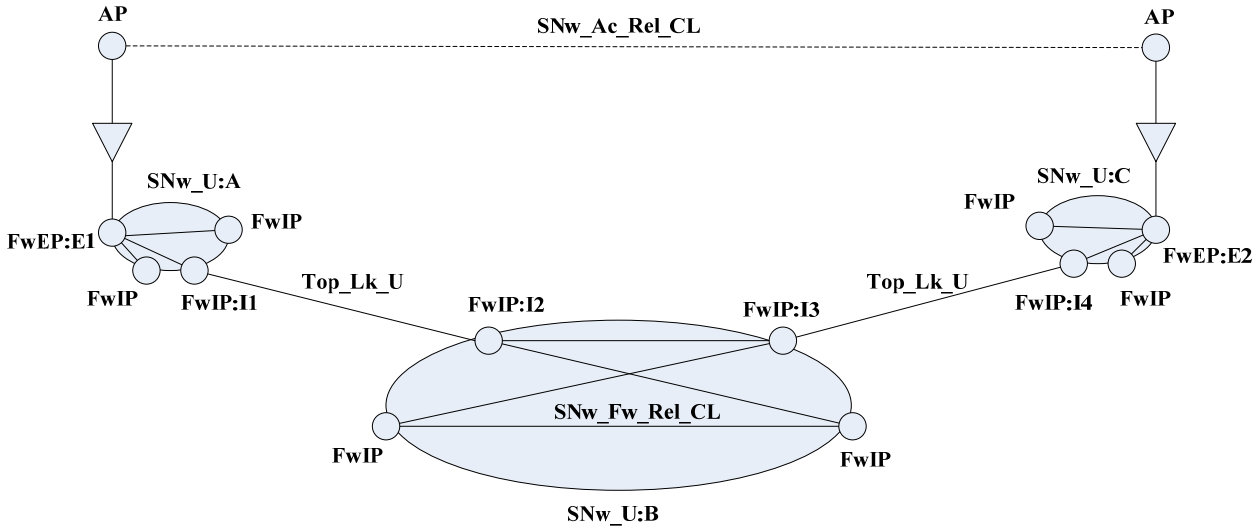


**Figure 19 – Intra-layer relationship for CL networks – SNw_Ac_Rel_CL composition which supports ordered sequence**

In a connectionless network, a SNw_Ac_Rel_CL can sometimes be represented by a corresponding SNw_Fw_Rel_CL in the largest subnetwork, thus providing a multiple access relationship, as shown in Figure 20.

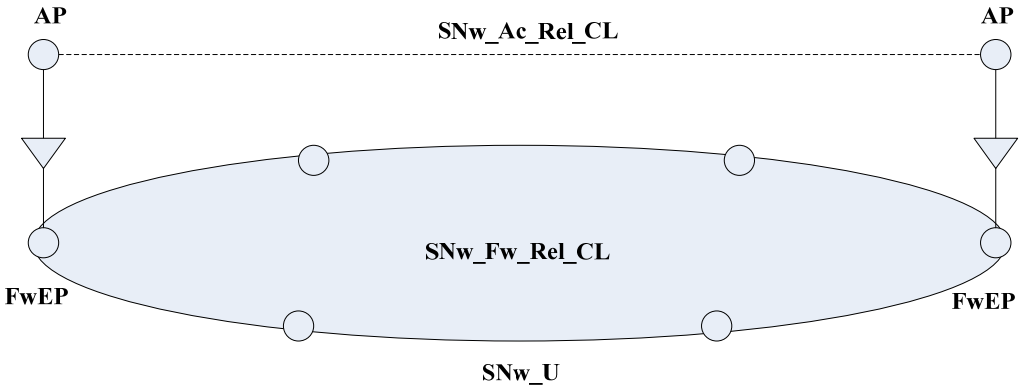


**Figure 20 – Intra-layer relationship for CL networks – SubNetwork_Access_Relationship_CL supported by one SNw_Fw_Rel_CL**

#### 6.2.3.2.3 Subnetwork partitioning and subnetwork forwarding relationship

If a SNw_U is dividable (e.g., matrix subnetwork), it can be vertically partitioned into smaller SNw_U(s) connected by the Abs_Lk_U(s). This is applicable for both connection-oriented layer networks and connectionless networks, which is shown in Figure 21.

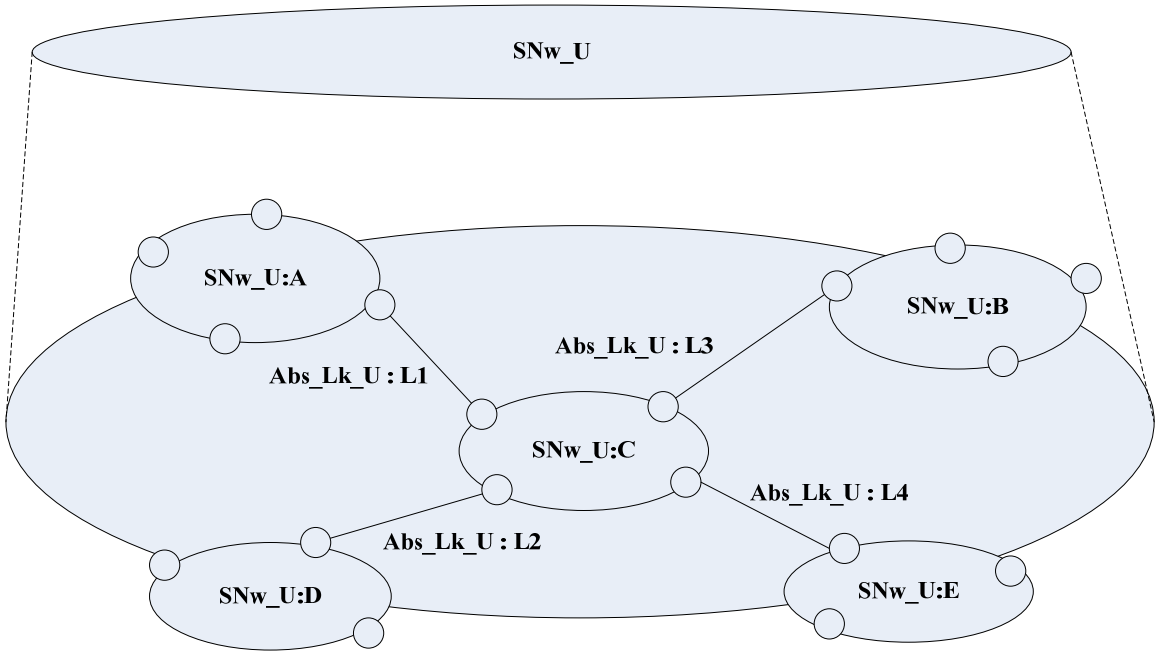


**Figure 21 – Inter-layer relationship: Subnetwork partitioning**

A SNw_U can also be fragmented by several Abs_SNw_Fw_Rel_U(s), and each of which only sets up the subnetwork forwarding relationship between a subset of the ingress points and egress points of the subnetwork, thus the SNw_U will be horizontally divided into smaller pieces. This is applicable for both connection-oriented layer networks and connectionless networks. An Abs_SNw_Fw_Rel can be one-to-one, one-to-multiple, or multiple-to-multiple associations between input and output forwarding points, and it will be represented by SNw_Con_CO for

connection-oriented networks, or SNw_Fw_Rel_CL for connectionless networks. The relationship between SNw_U and Abs_SNw_Fw_Rel is shown in Figure 22.

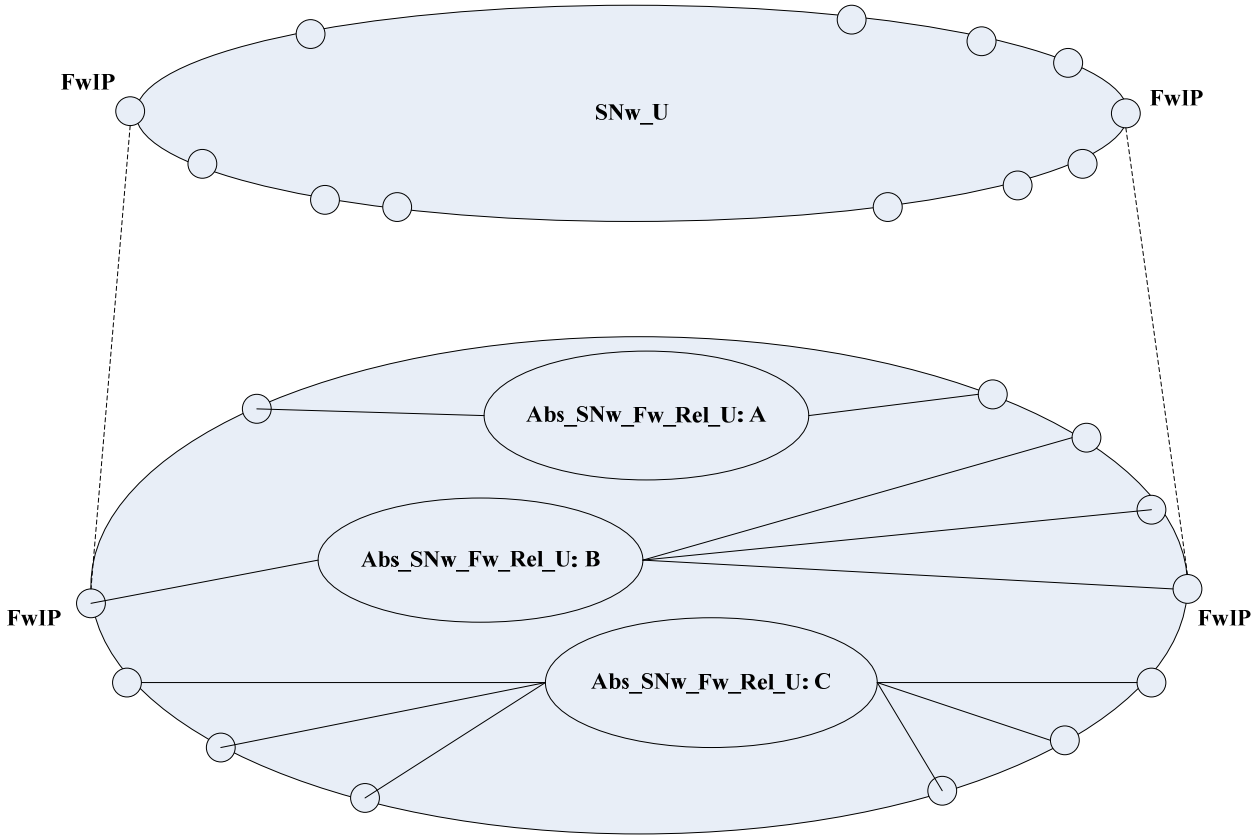


**Figure 22 – Inter-layer relationship: Subnetwork and subnetwork forwarding relationship**

### 6.2.3.3 Inter-layer relationship

There are mainly 4 cases for the inter-layer relationship: CO over CO, CL over CO, CO over CL, CL over CL. The following subclause will show these cases separately.

#### 6.2.3.3.1 Connection-oriented network over connection-oriented network

In this case, a client layer Lk_Con_CO or a Top_Lk_U is supported by a server layer Trail_CO, as shown in Figure 23.

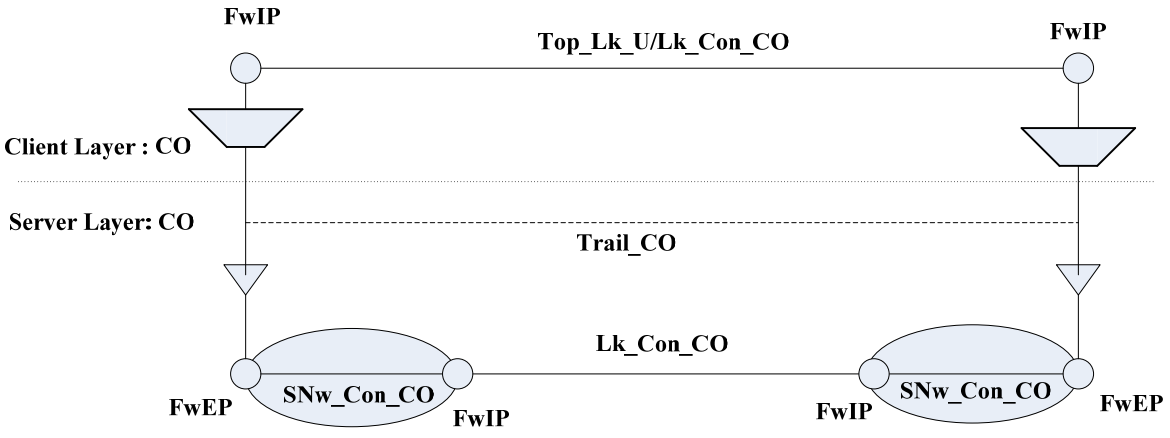


**Figure 23 – Inter-layer relationship: CO over CO**

In some cases, a link in the client layer can be a composite link, which is a bundle of multiple parallel component links between the same subnetworks. Each component link is supported by a separate server layer trail (see [ITU-T G.800]). The composite link is modelled as a Log_Lk_CO, which is supported by multiple server layer Trail_COs, as shown in Figure 24.

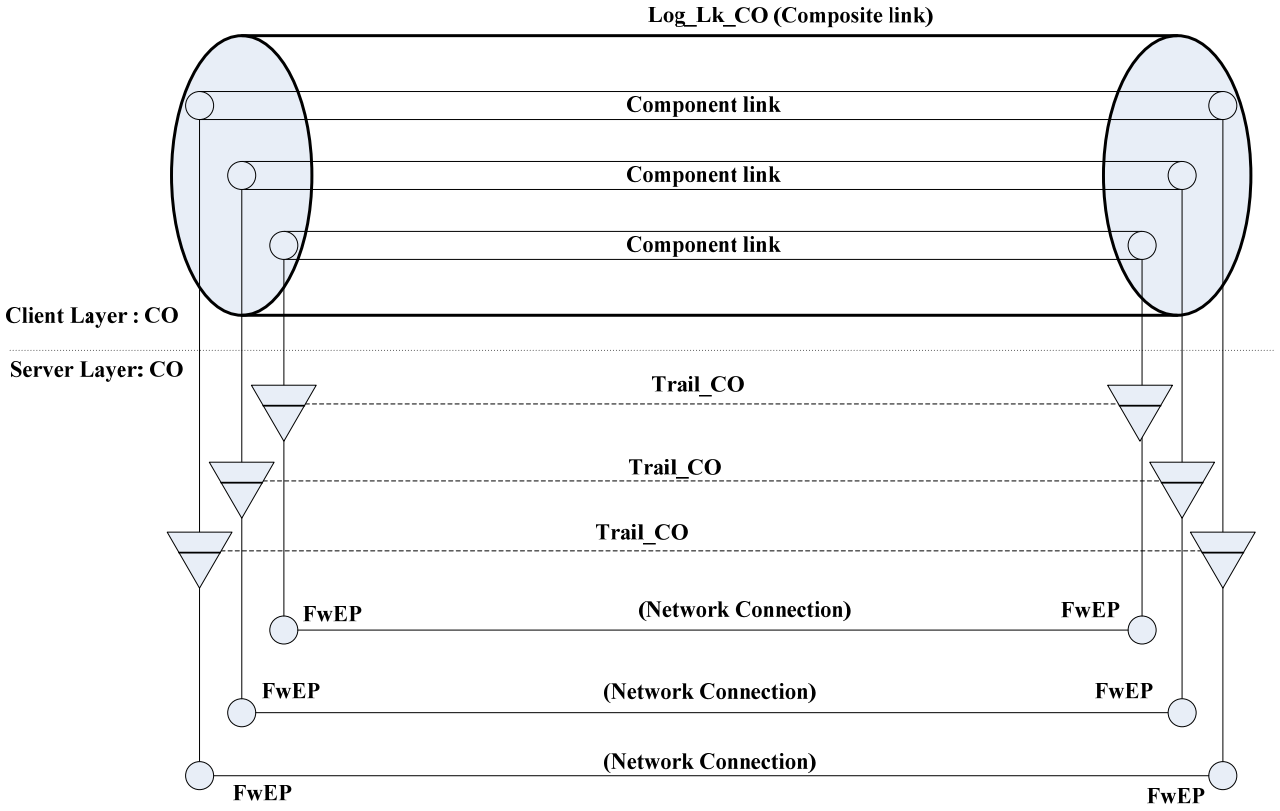


**Figure 24 – Inter-layer relationship: Composite link**

In some other cases, multiple server layer trails can be combined using the inverse multiplexing technique described in [ITU-T G.805]. This creates a new composite rate trail with a capacity that is the sum of the capacity of the component trails. The link in the client layer is supported by this composite trail (multiple component trails). This link may support a single link connection. This is shown in Figure 25.

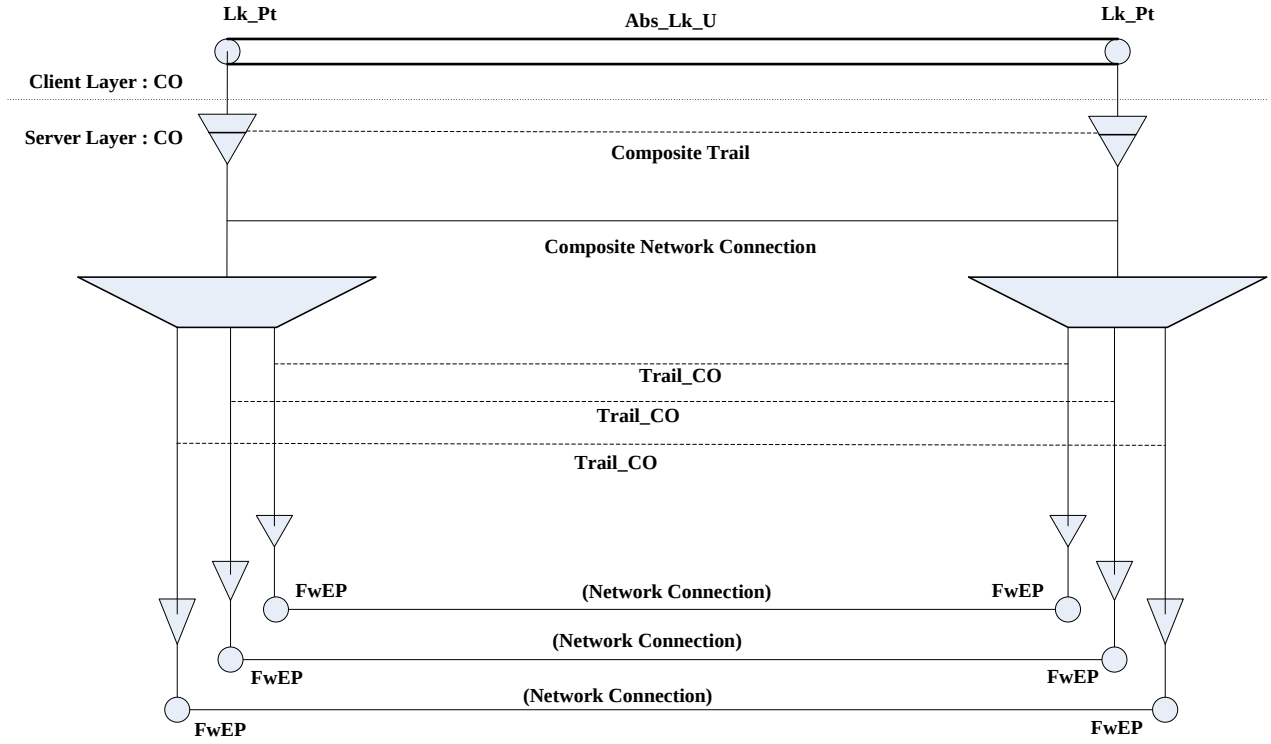


**Figure 25 – Inter-layer relationship: Client link supported by inverse multiplexing**

A client link can also be constructed by a concatenation of component links. The forwarding relationships must have a 1:1 correspondence to the link connections that will be provided by the client link. In this case, it is not possible to fully infer the status of the link by observing the server layer trails visible at the ends of the link ([ITU-T G.800]). This is illustrated in Figure 26.

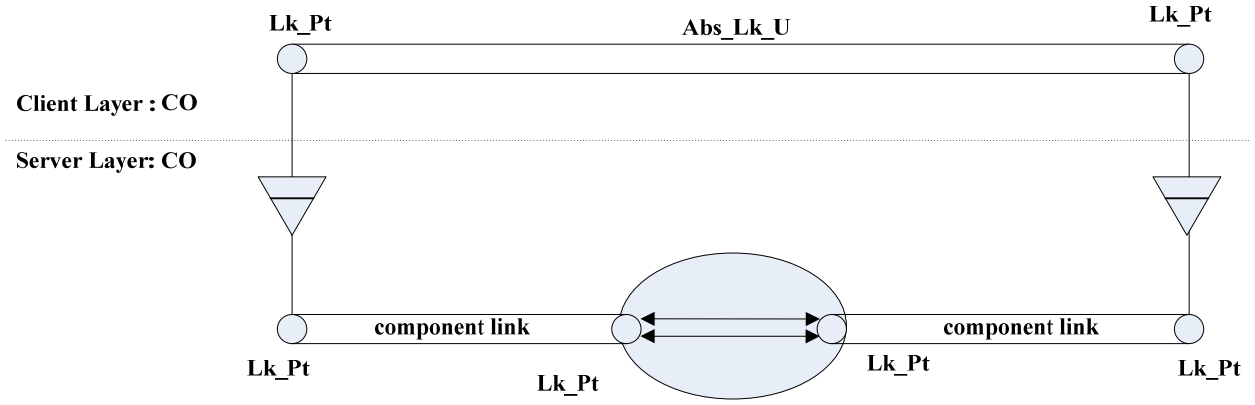


**Figure 26 – Inter-layer relationship: Serial compound composed of component links and a subnetwork with configured channel forwarding relationships**

#### 6.2.3.3.2 Connectionless network over connection-oriented network

In this case, a client layer Top_Lk_U (connectionless) is supported by a server layer Trail_CO, as shown in Figure 27.

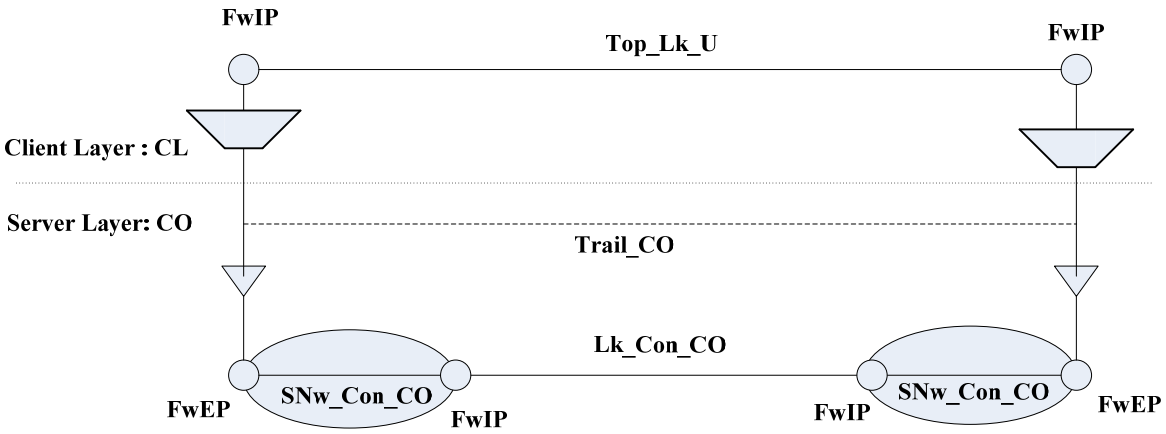


**Figure 27 – Inter-layer relationship: CL over CO**

#### 6.2.3.3.3 Connection-oriented network over connectionless network

In this case, a client layer Top_Lk_U (connection-oriented) is supported by a server layer SubNetwork_Access_Relationship_CL, as shown in Figure 28.

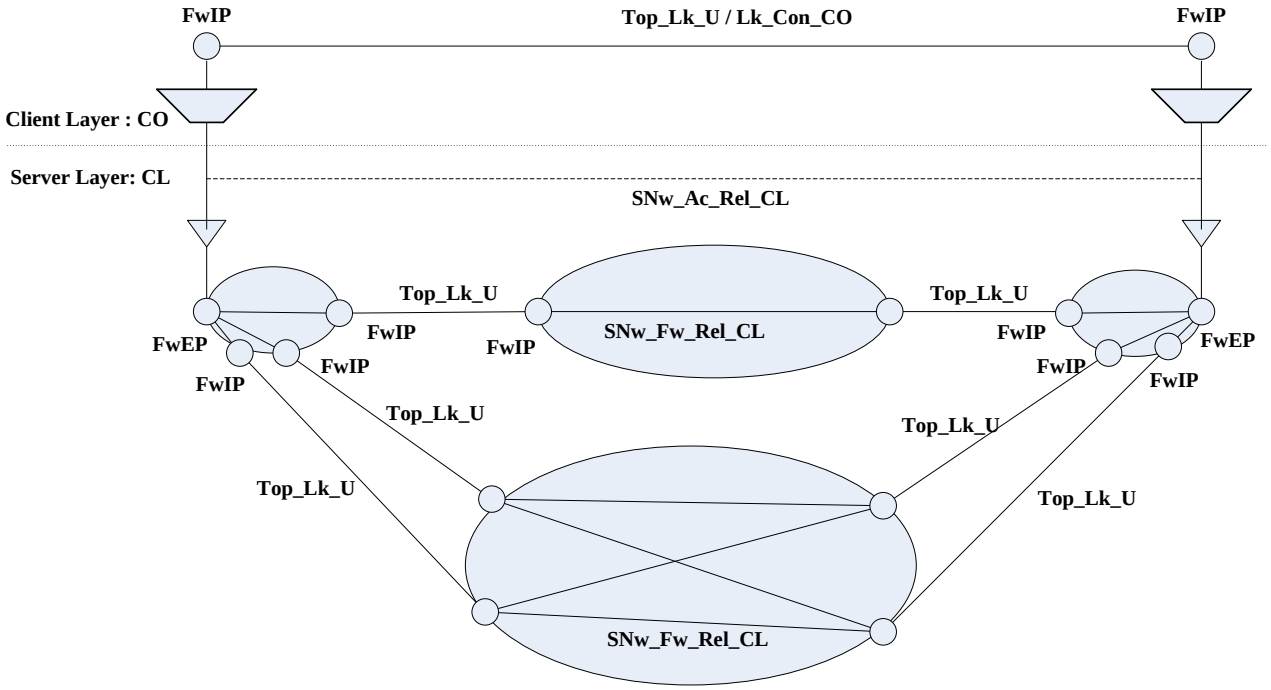


**Figure 28 – Inter-layer relationship: CO over CL**

In a special case, the server layer SubNetwork_Access_Relationship_CL may be represented by a corresponding SNw_Fw_Rel_CL in the largest subnetwork, as shown in Figure 29.

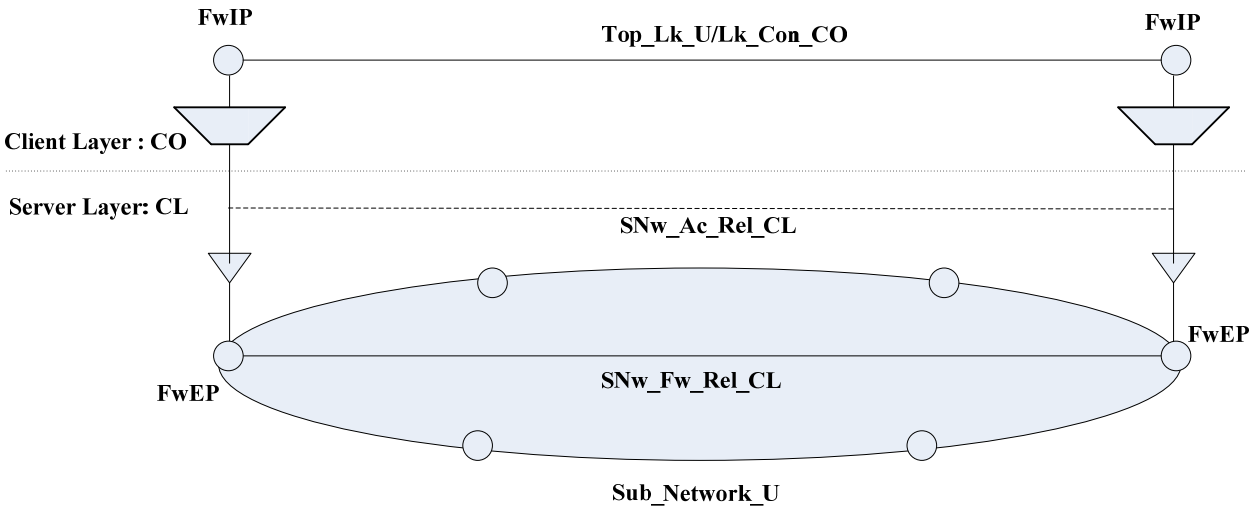


**Figure 29 – Inter-layer relationship: CO over CL, supported by one SubNetwork_Forwarding_Relationship_CL**

#### 6.2.3.3.4 Connectionless network over connectionless network

In this case, a client layer point-to-point SNw_Fw_Rel_CL or Top_Lk_U is supported by a server layer SNw_Ac_Rel_CL, as shown in Figure 30.

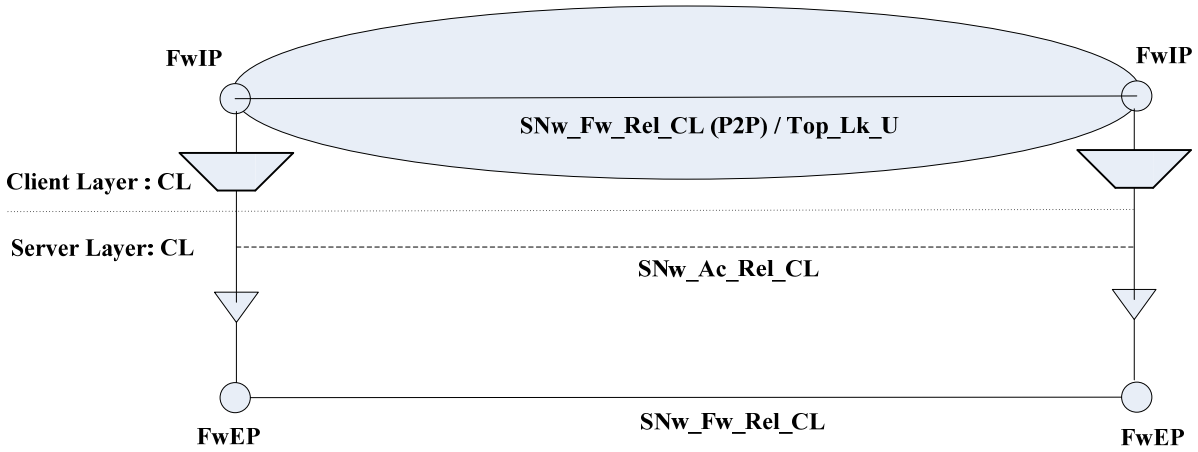


**Figure 30 – Inter-layer relationship: CL over CL (P2P)**

In a special case, the client layer network also needs to provide a multipoint-to-multipoint subnetwork forwarding relationship, which can be supported by a server layer SNw_Ac_Rel_CL. In such cases, instead of providing several individual point-to-point SNw_Fw_Rel_CL in the client layer subnetwork, the server layer SNw_Ac_Rel_CL can directly provide a multipoint-to-multipoint forwarding relationship to the client connectionless network layer, thus a simplified management information model can be achieved for such cases, as shown in Figure 31.

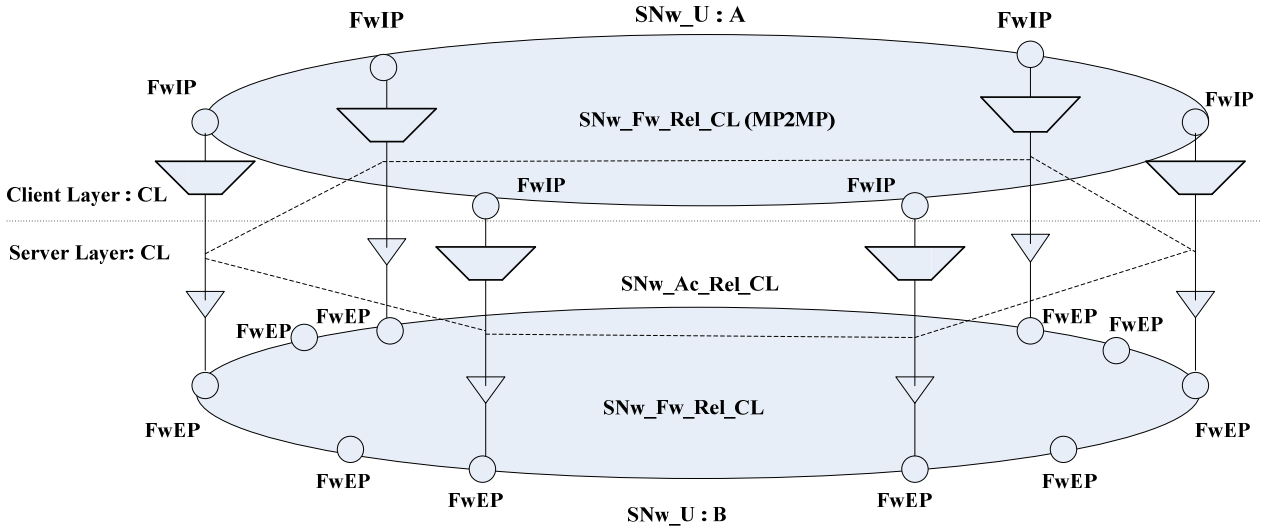


**Figure 31 – Inter-layer relationship: CL over CL (MP2MP)**

## 6.3 Information object class definitions

### 6.3.1 Ly_Nw_Dm_U[1]

#### 6.3.1.1 Definition

The Ly_Nw_Dm_U (layer network domain) IOC represents a transport administrative domain in which all resources pertain to the same ITU-T G.800 layer. It represents the topological aspects of the transport network layer. This IOC is derived from the IOC network ([ITU-T M.3160]). The signalId can be set upon creation of an instance of the Ly_Nw_Dm_U to support the following typical operations:

a) set the signalId value upon the creation of the layer network domain;

b) set the signalId attribute of a subnetwork (or abstract link, etc.) based on the value of the Ly_Nw_Dm_U instance referenced in the create request.

#### 6.3.1.2 Attributes

**Table 1**

| Attribute name | Support qualifier | Read qualifier | Write qualifier | Create qualifier | Requirements IDs |
|---|---|---|---|---|---|
| networkId* (Note) | M | M | – | – | |
| signalId | M | M | – | M | |
| systemTitle* | M | M | M | M | |
| userLabel* | O | M | M | M | |
| NOTE – An attribute mark with a "*" sign is inherited from its direct or indirect base class(es). | | | | | |

[1] The suffix "_U" of an IOC name in this Recommendation indicates that this IOC is defined for the unified purpose of both connection-oriented and connectionless network. The suffix "_CO" indicates that the IOC is only for the purpose of connection-oriented networks, and the suffix "_CL" indicates that the IOC is only for the purpose of connectionless networks.

#### 6.3.1.3 Notifications

There are no notifications defined for this IOC.

### 6.3.2 SNw_U

#### 6.3.2.1 Definition

The SNw_U (subnetwork) IOC represents logical collections of forwarding points; it represents the ITU-T G.800 subnetwork, and it can be a connection-oriented subnetwork as described in [ITU-T G.805], or a connectionless flow domain, as described in [ITU-T G.809].

If present, the attribute containedSNwList will be null if there are no contained subnetworks.

The attribute containedInSNwList will also be null if there are no containing (parent) subnetworks.

#### 6.3.2.2 Attributes

**Table 2**

| Attribute name | Support qualifier | Read qualifier | Write qualifier | Create qualifier | Requirements IDs |
|---|---|---|---|---|---|
| administrativeState | O | M | M | M | |
| availabilityStatus | O | M | – | – | |
| containedAcGrList | O | M | M | M | |
| containedInSNwList | O | M | M | M | |
| containedLkPtList | O | M | M | M | |
| containedLkList | O | M | M | M | |
| containedFwPtList | O | M | M | M | |
| containedSNwList | O | M | M | M | |
| lkPtrList | O | M | – | – | |
| operationalState | O | M | – | – | |
| signalId | M | M | – | M | |
| sNwId | M | M | – | – | |
| supportedByObjectList | O | M | M | M | |
| usageState | O | M | – | – | |
| userLabel | O | M | M | M | |

#### 6.3.2.3 Notifications

**Table 3**

| Name | Qualifier | Notes |
|---|---|---|
| attributeValueChange | O | |
| objectCreation | M | |
| objectDeletion | M | |
| stateChange | O | |

### 6.3.3 Abs_Lk_U

#### 6.3.3.1 Definition

The Abs_Lk_U (abstract link) IOC gives a topological description of the capacity between two adjacent subnetworks, or two link points, or a subnetwork and an access group. The Abs_Lk_U IOC represents the abstraction of the "link" functional architecture component as described in [ITU-T G.800], and it is only for the purpose of inheritance.

The use made of the individual attributes and notifications is detailed below:

– aEnd: the link point, subnetwork or access group which terminates one end of the link.

– zEnd: the link point, subnetwork or access group which terminates the other end of the link.

– availableLkCapacity: the number of free link connections (CO only) or free bandwidth (both applicable for CO and CL).

An attribute value change notification shall be emitted when the value of availableLkCapacity is changed.

#### 6.3.3.2 Attributes

**Table 4**

| Attribute name | Support qualifier | Read qualifier | Write qualifier | Create qualifier | Requirements IDs |
|---|---|---|---|---|---|
| aEnd | M | M | – | M | |
| availableLkCapacity | M | M | – | – | |
| linkId | M | M | – | – | |
| signalId | M | M | – | M | |
| usageCost | O | M | – | – | |
| userLabel | O | M | M | M | |
| zEnd | M | M | – | M | |

#### 6.3.3.3 Notifications

**Table 5**

| Name | Qualifier | Notes |
|---|---|---|
| attributeValueChange | O | |
| objectCreation | M | |
| objectDeletion | M | |

### 6.3.4 Top_Lk_U

#### 6.3.4.1 Definition

The Top_Lk_U (topological link) IOC is derived from the Abs_Lk_U IOC. It can represent a topological link in a connection-oriented network as described in [ITU-T G.805], or a flow point pool link as described in [ITU-T G.809].

The Top_Lk_U IOC represents a link in a client layer provided by one and only one server access relationship. The serverAcRel attribute is a pointer to the access relationship in the server layer network domain that supports this topological link. The serverAcRel attribute may be null if the trail in the server layer network domain that supports this topological link is not assigned.

The use made of the individual attributes and notifications is detailed below:

– totalLkCapacity: the total number of link connections (CO only) or the total amount of bandwidth available (both ingress and egress, applicable for both CO and CL);

– maxLkConCount: the maximum number of link connections available on connection with flexible bandwidth management;

– potentialLkCapacity: the number of potential link connections (CO only) or potential bandwidth (both CO and CL) that could be provisioned;

– provisionedLkCapacity: the number of provisioned link connections (CO only) or the provisioned bandwidth (CO and CL);

– provisionedLkConCount: the number of link connections assigned using flexible bandwidth management (CO only).

An attribute value change notification shall be emitted when the value of the totalLinkCapacity, maximumLinkConnectionCount, potentialLinkCapacity, provisionedLinkCapacity or provisionedLkConCount is changed.

#### 6.3.4.2 Attributes

**Table 6**

| Attribute name | Support qualifier | Read qualifier | Write qualifier | Create qualifier | Requirements IDs |
|---|---|---|---|---|---|
| aEnd* | M | M | – | M | |
| availableLkCapacity* | M | M | – | – | |
| linked* | M | M | – | – | |
| signalId* | M | M | – | M | |
| usageCost* | O | M | – | – | |
| userLabel* | O | M | M | M | |
| zEnd* | M | M | – | M | |
| directionality | M | M | – | – | |
| serverAcRel | M | M | – | – | |
| totalLkCapacity | O | M | – | – | |
| potentialLkCapacity | O | M | – | – | |
| provisionedLkCapacity | O | M | – | – | |
| maxLkConCount | CO (Note) | M | – | – | |
| provisionedLkConCount | CO (Note) | M | – | – | |
| NOTE – These optional attributes are only applicable for connection-oriented networks. | | | | | |

#### 6.3.4.3 Notifications

**Table 7**

| Name | Qualifier | Notes |
|---|---|---|
| attributeValueChange | O | |
| objectCreation | M | |
| objectDeletion | M | |

### 6.3.5 Log_Lk_CO

#### 6.3.5.1 Definition

The Log_Lk_CO (logical link) IOC represents a logical link that may be administratively composed of link connections or bandwidth that may be provided by one or more topological links or other logical links.

A composite link (formed by multiple component links) can be supported by multiple server layer trails.

#### 6.3.5.2 Attributes

**Table 8**

| Attribute name | Support qualifier | Read qualifier | Write qualifier | Create qualifier | Requirements IDs |
|---|---|---|---|---|---|
| aEnd* | M | M | – | M | |
| availableLkCapacity* | M | M | – | – | |
| linkId* | M | M | – | – | |
| signalId* | M | M | – | M | |
| usageCost* | O | M | – | – | |
| userLabel* | O | M | M | M | |
| zEnd* | M | M | – | M | |
| lkConPtrList | O | M | M | M | |
| lkDirectionality | M | M | – | – | |

#### 6.3.5.3 Notifications

**Table 9**

| Name | Qualifier | Notes |
|---|---|---|
| attributeValueChange | O | |
| objectCreation | M | |
| objectDeletion | M | |

### 6.3.6 Ac_Gr_U

#### 6.3.6.1 Definition

The Ac_Gr_U (access group) IOC is a class of objects which groups colocated forwarding end points (access points), for management purposes.

#### 6.3.6.2 Attributes

**Table 10**

| Attribute name | Support qualifier | Read qualifier | Write qualifier | Create qualifier | Requirements IDs |
|---|---|---|---|---|---|
| acGrId | M | M | – | – | |
| acPtList | M | M | M | M | |
| containedInSNwList | O | M | M | M | |
| lkPtrList | O | M | – | – | |
| signalId | M | M | – | – | |
| topEdDirectionality | M | M | – | – | |
| userLabel | O | M | M | M | |

#### 6.3.6.3 Notifications

There are no notifications defined for this IOC.

### 6.3.7 Abs_Fw_Rel_U

#### 6.3.7.1 Definition

The Abs_Fw_Rel_U (abstract forwarding relationship) IOC is an abstraction of transport entity forwarding relationship specified in [ITU-T G.800]. It establishes the relationship between one or more ingress forwarding points and one or more egress forwarding points. This IOC is defined only for inheritance purpose, and ensures the transfer of information between them.

The use made of the individual attributes and notifications is detailed below:

– directionality: indicates whether transmission is unidirectional or bidirectional.

– signalId: describes the signal that is transferred across a connectivity instance. The IOC instances representing the forwarding end points that are related by this instance must have signal Ids that are compatible.

– fwType: indicates an instance of this IOC is channel forwarding (CO) or destination forwarding (CL).

– If an instance of this IOC is bidirectional, the forwarding points specified by aEndFwPtList and zEndFwPtList attributes shall also be bidirectional. If an instance of this IOC is unidirectional, the aEndFwPtList shall be the source or bidirectional FwP(s) and the zEndFwPtList point shall be the sink or bidirectional FwP(s).

– For unidirectional connections, the aEndFwPtList attribute shall identify the source end. The operational state indicates the capability to carry a signal.

#### 6.3.7.2 Attributes

**Table 11**

| Attribute name | Support qualifier | Read qualifier | Write qualifier | Create qualifier | Requirements IDs |
|---|---|---|---|---|---|
| aEndFwPtList | M | M | – | M | |
| administrativeState | O | M | M | M | |
| alarmStatus | O | M | – | – | |
| asapPtr | O | M | M | M | |

**Table 11**

| Attribute name | Support qualifier | Read qualifier | Write qualifier | Create qualifier | Requirements IDs |
|---|---|---|---|---|---|
| availabilityStatus | O | M | – | – | |
| currentProblemList | O | M | – | – | |
| directionality | M | M | – | – | |
| fwType | M | M | – | – | |
| operationalState | O | M | – | – | |
| protected | O | M | – | M | |
| qualityOfConnectivityService | O | M | – | M | |
| signalId | M | M | – | M | |
| supportedByObjectList | M | M | – | M | |
| userLabel | O | M | M | M | |
| zEndFwPtList | M | M | – | M | |

#### 6.3.7.3 Notifications

**Table 12**

| Name | Qualifier | Notes |
|---|---|---|
| objectCreation | M | |
| objectDeletion | M | |
| attributeValueChange | O | |
| stateChange | O | |

### 6.3.8 Lk_Con_CO

#### 6.3.8.1 Definition

The Lk_Con_CO (link connection) IOC represents the transport entity that is created when a forwarding function is configured in a link. The link connection has exactly one ingress forwarding port and one egress forwarding port. It is responsible for the transparent transfer of information between a pair of forwarding points. A link connection can be unidirectional or bidirectional. A bidirectional link connection is a pair of link connections in opposite directions in the same bidirectional link. The link connection can be created in the link either before the forwarding point is bound to another forwarding point or at the time the binding is created. Changing the binding can only create or delete a link connection; it cannot modify an existing link connection.

#### 6.3.8.2 Attributes

**Table 13**

| Attribute name | Support qualifier | Read qualifier | Write qualifier | Create qualifier | Requirements IDs |
|---|---|---|---|---|---|
| aEndFwPtList* | M | M | – | M | |
| administrativeState* | O | M | M | M | |
| alarmStatus* | O | M | – | – | |

**Table 13**

| Attribute name | Support qualifier | Read qualifier | Write qualifier | Create qualifier | Requirements IDs |
|---|---|---|---|---|---|
| asapPtr* | O | M | M | M | |
| availabilityStatus* | O | M | – | – | |
| currentProblemList* | O | M | – | – | |
| directionality* | M | M | – | – | |
| fwType* | M | M | – | – | |
| operationalState* | O | M | – | – | |
| protected* | O | M | – | M | |
| qualityOfConnectivityService* | O | M | – | – | |
| signalId* | M | M | – | M | |
| supportedByObjectList* | O | M | M | M | |
| userLabel* | O | M | M | M | |
| zEndFwPtList* | M | M | – | M | |
| clientTrail | O | M | – | M | |
| compositePtr | O | M | – | – | |
| lkConId | M | M | – | – | |
| serverAcRelList | O | M | – | M | |

#### 6.3.8.3 Notifications

**Table 14**

| Name | Qualifier | Notes |
|---|---|---|
| attributeValueChange | O | |
| communicationsAlarm | O | |
| objectCreation | O | |
| objectDeletion | O | |
| stateChange | O | |

### 6.3.9 Connection_CO

#### 6.3.9.1 Definition

A Connection_CO (connection) IOC represents a channel forwarding relationship with the added constraint that all the link connection resources have been reserved for a specific communication. This IOC is derived from the IOC Abs_Fw_Rel_U. A connection has only one ingress forwarding port. Further, the user of a connection has complete control over the allocation of the capacity of the connection. A connection can be either unidirectional or bidirectional. A connection is a component of a trail. Several connections can be bundled into a higher rate trail. A sequence of one or more connections are linked together to form a trail.

#### 6.3.9.2 Attributes

**Table 15**

| Attribute name | Support qualifier | Read qualifier | Write qualifier | Create qualifier | Requirements IDs |
|---|---|---|---|---|---|
| aEndFwPtList* | M | M | – | M | |
| administrativeState* | O | M | M | M | |
| alarmStatus* | O | M | – | – | |
| asapPtr* | O | M | M | M | |
| availabilityStatus* | O | M | – | – | |
| currentProblemList* | O | M | – | – | |
| directionality* | M | M | – | – | |
| fwType* | M | M | – | – | |
| operationalState* | O | M | – | – | |
| protected* | O | M | – | M | |
| qualityOfConnectivityService* | O | M | – | – | |
| signalId* | M | M | – | M | |
| supportedByObjectList* | O | M | M | M | |
| userLabel* | O | M | M | M | |
| zEndFwPtList* | M | M | – | M | |
| clientTrail | O | M | – | M | |
| connectionId | M | M | – | M | |
| serverAcRelList | O | M | – | M | |

#### 6.3.9.3 Notifications

**Table 16**

| Name | Qualifier | Notes |
|---|---|---|
| attributeValueChange | O | |
| communicationsAlarm | O | |
| objectCreation | O | |
| objectDeletion | O | |
| stateChange | O | |

### 6.3.10 SNw_Con_CO

#### 6.3.10.1 Definition

The SNw_Con_CO (subnetwork connection) IOC is a class of objects that associate the forwarding point object identified in the aEndFwPtList attribute and the forwarding point object(s) listed in the aEndFwPtList attribute of this IOC instance. It is derived from IOC Abs_Fw_Rel_U for connection-oriented networks.

The subnetwork connection may be set up between forwarding points (or groups of forwarding points) specified explicitly, or implicitly between IOC instances acting as containers of forwarding points instances from which any idle forwarding point or group may be used.

If the IOC instances listed in the A End and Z End attributes represent groups, the nth element of the A end group is related to the nth element of every Z end group (for every n). There shall be n elements in each group involved in the subnetwork connection. For a group with n elements, the signal Id shall be taken to be a bundle of n times the characteristic information of the individual elements, all of which are the same.

An instance of the IOC SNw_Con_CO can be either unidirectional or bidirectional, and it can be made up of a number of component subnetwork connections, and link connections, within the same layer.

#### 6.3.10.2 Attributes

**Table 17**

| Attribute name | Support qualifier | Read qualifier | Write qualifier | Create qualifier | Requirements IDs |
|---|---|---|---|---|---|
| aEndFwPtList* | M | M | – | M | |
| administrativeState* | O | M | M | M | |
| alarmStatus* | O | M | – | – | |
| asapPtr* | O | M | M | M | |
| availabilityStatus* | O | M | – | – | |
| currentProblemList* | O | M | – | – | |
| directionality* | M | M | – | – | |
| fwType* | M | M | – | – | |
| operationalState* | O | M | – | – | |
| protected* | O | M | – | M | |
| qualityOfConnectivityService* | O | M | – | M | |
| signalId* | M | M | – | M | |
| supportedByObjectList* | M | M | – | M | |
| userLabel* | O | M | M | M | |
| zEndFwPtList* | M | M | – | M | |
| componentPtrList | O | M | – | – | |
| compositePtr | O | M | – | – | |
| relatedRoutingProfile | O | M | – | – | |
| sNwConId | M | M | – | – | |

#### 6.3.10.3 Notifications

**Table 18**

| Name | Qualifier | Notes |
|---|---|---|
| attributeValueChange | O | |
| communicationsAlarm | O | |
| objectCreation | O | |
| objectDeletion | O | |
| stateChange | O | |

### 6.3.11 SNw_Fw_Rel_CL

#### 6.3.11.1 Definition

The SNw_Fw_Rel_CL IOC is a class of objects that establish a destination forwarding relationship between forwarding point object(s) identified in the aEndFwPtList attribute and the forwarding point object(s) listed in the aEndFwPtList attribute of this IOC instance. It is derived from the IOC Abs_Fw_Rel_U for connectionless networks. It can provide P2P (point-to-point), P2MP (point-to-multipoint), or MP2MP (multipoint-to-multipoint) destination forwarding relationship between forwarding points.

An instance of the IOC SNw_Fw_Rel_CL can be either unidirectional or bidirectional, and it can be made up of either an unordered set of smaller SNw_Fw_Rel_CL(s) and internal Top_Lk_U(s), or an unordered set of SNw_Fw_Rel_CL(s) and internal Top_Lk_U(s) within the same layer, which provide all the connectivity possibilities to transfer the information between input forwarding points and output forwarding points.

#### 6.3.11.2 Attributes

**Table 19**

| Attribute name | Support qualifier | Read qualifier | Write qualifier | Create qualifier | Requirements IDs |
|---|---|---|---|---|---|
| aEndFwPtList* | M | M | – | M | |
| administrativeState* | O | M | M | M | |
| alarmStatus* | O | M | – | – | |
| asapPtr* | O | M | M | M | |
| availabilityStatus* | O | M | – | – | |
| currentProblemList* | O | M | – | – | |
| directionality* | M | M | – | – | |
| fwType* | M | M | – | – | |
| operationalState* | O | M | – | – | |
| protected* | O | M | – | M | |
| qualityOfConnectivityService* | O | M | – | M | |
| signalId* | M | M | – | M | |
| supportedByObjectList* | M | M | – | M | |
| userLabel* | O | M | M | M | |
| zEndFwPtList* | M | M | – | M | |
| connectionType | O | M | – | M | |
| sNwFwRelComponentPtrList | O | M | – | – | |
| sNwFwRelId | M | M | – | – | |
| serverAcRel | O | M | M | – | |

#### 6.3.11.3 Notifications

**Table 20**

| Name | Qualifier | Notes |
|---|---|---|
| objectCreation | M | |
| objectDeletion | M | |
| attributeValueChange | O | |
| stateChange | O | |

### 6.3.12 Abs_Fw_Pt_U (FwP)

#### 6.3.12.1 Definition

The Abs_Fw_Pt_U (abstract forwarding point) IOC represents the termination of a transport entity, such as a forwarding relationship or an access relationship. This IOC is the base class for IOCs Fw_Im_Pt_U and Fw_Im_Pt_U. Abs_Fw_Pt_U is an abstract IOC used for inheritance purpose, and should not be instantiated.

The connectivityPtr attribute points to the object instance that represents the IOC Lk_Con_CO, Trail_CO or SNw_Ac_Rel which relates this instance to other instance(s) representing the forwarding points.

The fwRelPtr attribute is used to point to a forwarding relationship such as SNw_Con_CO or a SNw_Fw_Rel_CL. However, not all forwarding points will have a flexible connection, and it may be more appropriate to point to another forwarding point. In this instance, the fwPtPtr shall be used. Both pointers are conditional.

The signalId attribute identifies the characteristic information of the signal passing through an instance of the Abs_Fw_Pt_U.

#### 6.3.12.2 Attributes

**Table 21**

| Attribute name | Support qualifier | Read qualifier | Write qualifier | Create qualifier | Requirements IDs |
|---|---|---|---|---|---|
| administrativeState | O | M | M | M | |
| asapPtr | O | M | M | M | |
| alarmStatus | O | M | – | – | |
| availabilityStatus | O | M | – | – | |
| configuredConnectivity | O | M | – | – | |
| connectivityPtr | O | M | – | – | |
| crossConPtr | C:O (Note 1) | M | – | – | |
| currentProblemList | O | M | – | – | |
| locationName | O | M | M | M | |
| neAssignmentPtr | O | M | – | – | |
| networkLevelPtr | O | M | M | M | |
| fwPtId | C:M (Note 2) | M | – | – | |

**Table 21**

| Attribute name | Support qualifier | Read qualifier | Write qualifier | Create qualifier | Requirements IDs |
|---|---|---|---|---|---|
| fwPtPtr | C:O (Note 3) | M | – | – | |
| fwRelPtr | C:M (Note 3) | M | – | – | |
| operationalState | O | M | – | – | |
| ptDirectionality | M | M | – | – | |
| signalId | M | M | – | M | |
| supportedByObjectList | M | M | – | – | |
| userLabel | O | M | M | M | |
| NOTE 1 – This optional attribute is only for connection-oriented networks.<br>NOTE 2 – The condition is if this IOC has an instance.<br>NOTE 3 – The existence of the two attributes fwPtPtr and fwRelPtr is mutually exclusive. | | | | | |

#### 6.3.12.3 Notifications

**Table 22**

| Name | Qualifier | Notes |
|---|---|---|
| attributeValueChange | O | |
| communicationsAlarm | O | |
| objectCreation | O | |
| objectDeletion | O | |
| stateChange | O | |

### 6.3.13 Fw_Im_Pt_U (FwIP)

#### 6.3.13.1 Definition

The Fw_Im_Pt_U (forwarding intermediate point) IOC originates/terminates link flows or link connection and/or originates/terminates forwarding relationships such as instance of SNw_Con or SNw_Fw_Rel_CL. This IOC is derived from IOC Abs_Fw_Pt_U.

#### 6.3.13.2 Attributes

**Table 23**

| Attribute name | Support qualifier | Read qualifier | Write qualifier | Create qualifier | Requirements IDs |
|---|---|---|---|---|---|
| administrativeState* | O | M | M | M | |
| asapPtr* | O | M | M | M | |
| alarmStatus* | O | M | – | – | |
| availabilityStatus* | O | M | – | – | |
| configuredConnectivity* | O | M | – | – | |
| connectivityPtr* | O | M | – | – | |

**Table 23**

| Attribute name | Support qualifier | Read qualifier | Write qualifier | Create qualifier | Requirements IDs |
|---|---|---|---|---|---|
| crossConPtr* | C:O (Note 1) | M | – | – | |
| currentProblemList* | O | M | – | – | |
| locationName* | O | M | M | M | |
| neAssignmentPtr* | O | M | – | – | |
| networkLevelPtr* | O | M | M | M | |
| fwPtId* | M | M | – | – | |
| fwPtPtr* | C:M (Note 2) | M | – | – | |
| fwRelPtr* | C:M (Note 2) | M | – | – | |
| operationalState* | O | M | – | – | |
| ptDirectionality* | M | M | – | – | |
| signalId* | M | M | – | M | |
| supportedByObjectList* | M | M | – | – | |
| userLabel* | O | M | M | M | |
| channelNumber | C:O (Note 1) | M | – | M | |
| serverFwEdPtPtr | O | M | – | – | |
| sub-partitionPtr | O | M | – | – | |
| superPartitionPtr | O | M | – | – | |
| NOTE 1 – This optional attribute is only for connection-oriented networks.<br>NOTE 2 – The existence of the two attributes fwPtPtr and fwRelPtr is mutually exclusive. | | | | | |

#### 6.3.13.3 Notifications

**Table 24**

| Name | Qualifier | Notes |
|---|---|---|
| attributeValueChange | O | |
| communicationsAlarm | O | |
| objectCreation | O | |
| objectDeletion | O | |
| stateChange | O | |

### 6.3.14 Fw_Ed_Pt_U (FwEP)

#### 6.3.14.1 Definition

The Fw_Ed_Pt_U (forwarding end point) IOC originates/terminates an access relationship such as Trail_CO or SNw_Ac_Rel_CL. This IOC is derived from IOC Abs_Fw_Pt_U.

### 6.3.14.2 Attributes

**Table 25**

| Attribute name | Support qualifier | Read qualifier | Write qualifier | Create qualifier | Requirements IDs |
|---|---|---|---|---|---|
| administrativeState* | O | M | M | M | |
| asapPtr* | O | M | M | M | |
| alarmStatus* | O | M | – | – | |
| availabilityStatus* | O | M | – | – | |
| configuredConnectivity* | O | M | – | – | |
| connectivityPtr* | O | M | – | – | |
| crossConPtr* | Co (Note 1) | M | – | – | |
| currentProblemList* | O | M | – | – | |
| locationName* | O | M | M | M | |
| neAssignmentPtr* | O | M | – | – | |
| networkLevelPtr* | O | M | M | M | |
| fwPtId* | O | M | – | – | |
| fwPtPtr* | Cm (Note 2) | M | – | – | |
| fwRelPtr* | Cm (Note 2) | M | – | – | |
| operationalState* | O | M | – | – | |
| ptDirectionality* | M | M | – | – | |
| signalId* | M | M | – | M | |
| supportedByObjectList* | M | M | – | – | |
| userLabel* | O | M | M | M | |
| clientFwImPtList | O | M | – | – | |
| clientLkPtPtrList | O | M | – | – | |
| supportableClientList | O | M | – | M | |
| NOTE 1 – This optional attribute is only for connection-oriented networks.<br>NOTE 2 – The existence of the two attributes fwPtPtr and fwRelPtr is mutually exclusive. | | | | | |

### 6.3.14.3 Notifications

**Table 26**

| Name | Qualifier | Notes |
|---|---|---|
| attributeValueChange | O | |
| communicationsAlarm | O | |
| objectCreation | O | |
| objectDeletion | O | |
| stateChange | O | |

### 6.3.15 Abs_Lk_Pt_U

#### 6.3.15.1 Definition

The Abs_Lk_Pt_U (abstract link point) IOC represents the abstraction of link point, which can be either topological link point or logical link point. It is a class of managed objects which contains FwIPs for the purpose of representing topology. This IOC is only for inheritance purpose.

The use made of individual attributes and notification is detailed below:

– availableLkEdCapacity: represents the spare capacity of the link point;

– lkPtr: is the identifier of the related link instance;

– containedInSNwList: is the identifier used to identify the parent SNw_U instance which contains this logical link.

An attribute value change notification shall be emitted when the value of the availableLkEdCapacity or the containedInSNwList is changed.

#### 6.3.15.2 Attributes

**Table 27**

| Attribute name | Support qualifier | Read qualifier | Write qualifier | Create qualifier | Requirements IDs |
|---|---|---|---|---|---|
| availableLkPtCapacity | M | M | – | – | |
| containedInSNwList | O | M | M | M | |
| lkPtId | C:M (Note) | M | – | – | |
| lkPtr | M | M | – | – | |
| signalId | M | M | – | – | |
| userLabel | O | M | M | M | |
| NOTE – The condition is if this IOC has an instance. | | | | | |

#### 6.3.15.3 Notifications

**Table 28**

| Name | Qualifier | Notes |
|---|---|---|
| attributeValueChange | M | |
| objectCreation | M | |
| objectDeletion | M | |

### 6.3.16 Top_Lk_Pt_U

#### 6.3.16.1 Definition

The Top_Lk_Pt_U (topological link point) IOC represents the end of a topological link when viewed from the point perspective. An instance of this IOC is related to one and only one FwEP in the server layer.

#### 6.3.16.2 Attributes

**Table 29**

| Attribute name | Support qualifier | Read qualifier | Write qualifier | Create qualifier | Requirements IDs |
|---|---|---|---|---|---|
| availableLkPtCapacity* | M | M | – | – | |
| containedInSNwList* | O | M | M | M | |
| lkPtId* | M | M | – | – | |
| lkPtr* | M | M | – | – | |
| signalId* | M | M | – | – | |
| userLabel* | O | M | M | M | |
| maxFwImPtCount | O | M | – | – | |
| ptDirectionality | M | M | – | – | |
| potentialLkPtCapacity | O | M | – | – | |
| provisionedLkPtCapacity | O | M | – | – | |
| provisionedFwImPtCount | O | M | – | – | |
| serverFwEdPtPtr | M | M | – | – | |
| totalLkPtCapacity | O | M | – | – | |

#### 6.3.16.3 Notifications

**Table 30**

| Name | Qualifier | Notes |
|---|---|---|
| attributeValueChange | M | |
| objectCreation | M | |
| objectDeletion | M | |

### 6.3.17 Log_Lk_Pt_CO

#### 6.3.17.1 Definition

The Log_Lk_Pt_CO (logical link point) IOC represents the end of a logical link. When present, the fwImPtInLkPtList attribute identifies the forwarding points that are present in the logical link point.

#### 6.3.17.2 Attributes

**Table 31**

| Attribute name | Support qualifier | Read qualifier | Write qualifier | Create qualifier | Requirements IDs |
|---|---|---|---|---|---|
| availableLkPtCapacity* | M | M | – | – | |
| containedInSNwList* | O | M | M | M | |
| lkPtId* | M | M | – | – | |
| lkPtr* | M | M | – | – | |
| signalId* | M | M | – | – | |

**Table 31**

| Attribute name | Support qualifier | Read qualifier | Write qualifier | Create qualifier | Requirements IDs |
|---|---|---|---|---|---|
| userLabel* | O | M | M | M | |
| logPtDirectionality | M | M | – | – | |
| fwImPtInLkPtList | O | M | – | – | |

### 6.3.17.3 Notifications

**Table 32**

| Name | Qualifier | Notes |
|---|---|---|
| attributeValueChange | M | |
| objectCreation | M | |
| objectDeletion | M | |

## 6.3.18 Fw_Pt_Pl_U (FwPP)

### 6.3.18.1 Definition

The Fw_Pt_Pl_U (forwarding point pool) IOC is a class of a collection of colocated forwarding points for the same management purpose.

### 6.3.18.2 Attributes

**Table 33**

| Attribute name | Support qualifier | Read qualifier | Write qualifier | Create qualifier | Requirements IDs |
|---|---|---|---|---|---|
| administrativeState | O | M | M | M | |
| alarmStatus | O | M | – | – | |
| availabilityStatus | O | M | – | – | |
| containedInSNwList | O | M | – | M | |
| currentProblemList | O | M | – | – | |
| fwPtInFwPtPlList | O | M | M | M | |
| fwPtPlId | M | M | – | M | |
| lkPtr | M | M | – | M | |
| directionality | M | M | – | M | |
| maxFwPtPlAssignableCapacity | M | M | – | M | |
| operationalState | O | M | – | – | |
| serverFwEdPtPtr | O | M | – | M | |
| supportedByObjectList | O | M | – | M | |
| totalFwPtPlCapacity | M | M | – | M | |
| userLabel | O | M | M | M | |
| connectedFwPtCount | M | M | – | – | |
| idleFwPtCount | M | M | – | – | |

#### 6.3.18.3 Notifications

**Table 34**

| Name | Qualifier | Notes |
|---|---|---|
| objectCreation | M | |
| objectDeletion | M | |
| attributeValueChange | O | |

### 6.3.19 Abs_Ac_Rel_U

#### 6.3.19.1 Definition

The Abs_Ac_Rel_U (abstract access relationship) IOC represents an access relationship established between two or more APs. This IOC is only for inheritance purpose.

In connection-oriented layer networks, it will be P2P access relationship as represented by an instance of Trail_CO, as described in [ITU-T G.805]. In connectionless layer networks, it will be a P2MP or MP2MP access relationship, as represented by an instance of SNw_Ac_Rel_CL.

#### 6.3.19.2 Attributes

**Table 35**

| Attribute name | Support qualifier | Read qualifier | Write qualifier | Create qualifier | Requirements IDs |
|---|---|---|---|---|---|
| aEndFwEdPtList | M | M | – | M | |
| administrativeState | O | M | M | M | |
| alarmStatus | O | M | – | – | |
| asapPtr | O | M | M | M | |
| availabilityStatus | O | M | – | – | |
| clientFwRelPtrList | O | M | – | – | |
| clientLkPtrList | O | M | – | – | |
| currentProblemList | O | M | – | – | |
| operationalState | O | M | – | – | |
| supportedByObjectList | O | M | M | M | |
| trafficDescriptor | O | M | M | M | |
| userLabel | O | M | M | M | |
| zEndFwEPList | M | M | – | M | |

#### 6.3.19.3 Notifications

**Table 36**

| Name | Qualifier | Notes |
|---|---|---|
| attributeValueChange | O | |
| objectCreation | O | |
| objectDeletion | O | |
| communicationsAlarm | O | |
| stateChange | O | |

### 6.3.20 Trail_CO

#### 6.3.20.1 Definition

The Trail_CO (Trail) IOC represents one kind of transport entity that supports the access relationship in the client layer. In this case, the server layer is connection-oriented. It is derived from the IOC Abs_Ac_Rel_U.

The Trail IOC is responsible for the integrity of transfer of characteristic information from one or more other layer networks.

A Trail is composed of two or more forwarding end points and one or more link connections or subnetwork connections, and associated forwarding intermediate points.

A point-to-point unidirectional Trail can be established between two unified directional FwEPs, between a unified directional FwEP and a bidirectional FwEP, or between two bidirectional FwEPs.

A point-to-point bidirectional Trail can be established between two bidirectional FwEPs. For all types of Trail, the FwEP(s) pointed to by the aEndFwEdPtList attribute is related to the FwEP(s) pointed to by the zEndFwEdPtList attribute in such a way that traffic can flow between the forwarding end points represented by these IOC instances in a unidirectional or bidirectional manner as indicated by the directionality attribute.

The layerConList attribute, when present, lists the subnetwork connections and link connections (in the same layer) which compose the trail. This represents a single partitioned view of the decomposition of a trail into its component subnetwork connections and link connections.

#### 6.3.20.2 Attributes

**Table 37**

| Attribute name | Support qualifier | Read qualifier | Write qualifier | Create qualifier | Requirements IDs |
|---|---|---|---|---|---|
| aEndFwEdPtList* | M | M | – | M | |
| administrativeState* | O | M | M | M | |
| alarmStatus* | O | M | – | – | |
| asapPtr* | O | M | M | M | |
| availabilityStatus* | O | M | – | – | |
| clientFwRelPtrList* | O | M | – | – | |
| clientLkPtrList* | O | M | – | – | |
| currentProblemList* | O | M | – | – | |
| operationalState* | O | M | – | – | |
| supportedByObjectList* | O | M | M | M | |
| trafficDescriptor* | O | M | M | M | |
| userLabel* | O | M | M | M | |
| zEndFwEdPtList* | M | M | – | M | |
| layerConList | O | M | – | M | |
| directionality | M | M | – | – | |
| protected | O | M | – | M | |

**Table 37**

| Attribute name | Support qualifier | Read qualifier | Write qualifier | Create qualifier | Requirements IDs |
|---|---|---|---|---|---|
| qualityOfConnectivityService | O | M | – | – | |
| signalId | M | M | – | M | |
| trailId | M | M | – | M | |

#### 6.3.20.3 Notifications

**Table 38**

| Name | Qualifier | Notes |
|---|---|---|
| attributeValueChange | O | |
| communicationsAlarm | O | |
| objectCreation | O | |
| objectDeletion | O | |
| stateChange | O | |

### 6.3.21 SNw_Ac_Rel_CL

#### 6.3.21.1 Definition

The SNw_Ac_Rel_CL (subnetwork access relationship) IOC represents the access relationship for connectionless networks in the server layer. It is derived from the IOC Abs_Ac_Rel_U.

It is formed by a combination of either unordered set or unordered sequence of instances of Top_Lk_U and SNw_Fw_Rel_U.

#### 6.3.21.2 Attributes

**Table 39**

| Attribute name | Support qualifier | Read qualifier | Write qualifier | Create qualifier | Requirements IDs |
|---|---|---|---|---|---|
| aEndFwEdPtList* | M | M | – | M | |
| administrativeState* | O | M | M | M | |
| alarmStatus* | O | M | – | – | |
| asapPtr* | O | M | M | M | |
| availabilityStatus* | O | M | – | – | |
| clientFwRelPtrList* | O | M | – | – | |
| clientLkPtrList* | O | M | – | – | |
| currentProblemList* | O | M | – | – | |
| operationalState* | O | M | – | – | |
| supportedByObjectList* | O | M | M | M | |
| trafficDescriptor* | O | M | M | M | |
| userLabel* | O | M | M | M | |

**Table 39**

| Attribute name | Support qualifier | Read qualifier | Write qualifier | Create qualifier | Requirements IDs |
|---|---|---|---|---|---|
| zEndFwEdPtList* | M | M | – | M | |
| sNwAcRelComponentPtrList | O | M | – | – | |
| sNwAcRelId | M | M | – | M | |

### 6.3.21.3 Notifications

**Table 40**

| Name | Qualifier | Notes |
|---|---|---|
| attributeValueChange | O | |
| objectCreation | O | |
| objectDeletion | O | |
| communicationsAlarm | O | |
| stateChange | O | |

## 6.4 Information relationship definitions

**Table 41**

| Relationship | Support qualifier | Requirement IDs | |
|---|---|---|---|
| Relation-Abs_Fw_Rel_U-aEnd_Abs_Fw_Pt_U | M | 14 | 1 |
| Relation-Abs_Fw_Rel_U-zEnd_Abs_Fw_Pt_U | M | 15 | 2 |
| Relation-Abs_Fw_Pt_U-ASAP | O | 27 | 3 |
| Relation-Abs_Fw_Pt_U-ManagedEntity | M | 28 | 4 |
| Relation-Abs_Lk_Pt_U-Abs_Lk_U | M | 3 | 5 |
| Relation-Abs_Lk_Pt_U-Fw_Ed_Pt_U | M | 31 | 6 |
| Relation-Abs_Lk_U-a_EndofLink | M | 1 | 7 |
| Relation-Abs_Lk_U-z_EndofLink | M | 2 | 8 |
| Relation-Ac_Gr_U-Abs_Lk_U | O | 4 | 9 |
| Relation-Ac_Gr_U-Fw_Ed_Pt_U | M | 5 | 10 |
| Relation-CircuitPack-Trail_CO | O | 6 | 11 |
| Relation-Connection_CO-Abs_Ac_Rel_U | O | 8 | 12 |
| Relation-Connection_CO-Trail_CO | O | 7 | 13 |
| Relation-Fw_Pt_Pl_U-Abs_Fw_Pt_U | M | 29 | 14 |
| Relation-Lk_Con_CO-Abs_Ac_Rel_U | O | 11 | 15 |
| Relation-Lk_Con_CO-Trail_CO | O | 9 | 16 |
| Relation-Log_Lk_CO-Lk_Con_CO | O | 13 | 17 |
| Relation-Log_Lk_Pt_CO-Fw_Im_Pt_U | O | 12 | 18 |
| Relation-SNw_Ac_Rel_CL-SNw_Fw_Rel_CL | O | 33 | 19 |

**Table 41**

| Relationship | Support qualifier | Requirement IDs | |
|---|---|---|---|
| Relation-SNw_Ac_Rel_CL-Top_Lk_U | O | 10 | 20 |
| Relation-SNw_Con_CO-Lk_Con_CO | O | 23 | 21 |
| Relation-SNw_Con_CO-SNw_Con_CO | O | 24 | 22 |
| Relation-SNw_Fw_Rel_CL-Top_Lk_U | O | 25 | 23 |
| Relation-SNw_Fw_Rel_CL-SNw_Fw_Rel_CL | O | 26 | 24 |
| Relation-SNw_U-Abs_Fw_Pt_U | O | 21 | 25 |
| Relation-SNw_U-Abs_Lk_Pt_U | O | 18 | 26 |
| Relation-SNw_U-Abs_Lk_U-1 | O | 16 | 27 |
| Relation-SNw_U-Abs_Lk_U-2 | O | 17 | 28 |
| Relation-SNw_U-Ac_Gr_U | O | 19 | 29 |
| Relation-SNw_U-Managed_Entity | O | 20 | 30 |
| Relation-SNw_U-SNw_U | O | 22 | 31 |
| Relation-Top_Lk_U-Abs_Ac_Rel_U | M | 30 | 32 |
| Relation-Trail_CO-SNw_Con_CO | O | 32 | 33 |

### 6.4.1 Relation-Abs_Fw_Rel_U-aEnd_Abs_Fw_Pt_U (M)

#### 6.4.1.1 Definition

This represents a unidirectional relation from the IOC Abs_Fw_Rel_U (including its child classes Connection_CO, Lk_Con_CO, SNw_Con_CO, and Trail_CO) to the IOC Abs_Fw_Pt_U (including its child classes Fw_Ed_Pt_U and Fw_Im_Pt_U).

The role of the relation shall be mapped to a reference attribute of the IOC. The name of the reference attribute shall be the role name.

#### 6.4.1.2 Roles

| Name | Definition |
|---|---|
| **aEnd** | This role represents the Abs_Fw_Rel_U (including its child classes Connection_CO, Lk_Con_CO, SNw_Con_CO, and Trail_CO) capability to identify the list of FwEPs or FwIPs to which this Abs_Fw_Rel_U points. When this role is present, the Abs_Fw_Rel_U.aEndFwPtList shall carry the set of identifier(s) of child classes of Abs_Fw_Pt_U (including Fw_Ed_Pt_U, and Fw_Im_Pt_U). |

#### 6.4.1.3 Constraint

| Name | Definition |
|---|---|
| **source_or_bidirectional_FwPs** | If the Abs_Fw_Rel_U is bidirectional, the aEndFwPtList shall also be bidirectional. If the Abs_Fw_Rel_U is unidirectional, the Abs_Fw_Rel_U shall be the source or bidirectional FwEPs or FwIPs. For unidirectional connections, the aEndFwPtList attribute shall identify the source end. |

### 6.4.2 Relation-Abs_Fw_Rel_U-zEnd_Abs_Fw_Pt_U (M)

#### 6.4.2.1 Definition

This represents a unidirectional relation from the IOC Abs_Fw_Rel_U (including its child classes Connection_CO, Lk_Con_CO, SNw_Con_CO, and Trail_CO) to the IOC Abs_Fw_Pt_U (including its child classes Fw_Ed_Pt_U, Fw_Im_Pt_U).

The role of the relation shall be mapped to a reference attribute of the IOC. The name of the reference attribute shall be the role name.

#### 6.4.2.2 Roles

| Name | Definition |
|---|---|
| **zEnd** | This role represents the Abs_Fw_Rel_U (including its child classes Connection_CO, Lk_Con_CO, SNw_Con_CO, and Trail_CO) capability to identify the list of sink or bidirectional FwEPs or FwIPs to which this Abs_Fw_Rel_U points. When this role is present, the Abs_Fw_Rel_U.zEndFwPtList shall carry the set of identifier(s) of child classes of Abs_Fw_Pt_U (including Fw_Ed_Pt_U, and Fw_Im_Pt_U). |

#### 6.4.2.3 Constraint

| Name | Definition |
|---|---|
| **sink_or_bidirectional_FwPs** | If the Abs_Fw_Rel_U is bidirectional, the zEndFwPtList shall also be bidirectional. If the Abs_Fw_Rel_U is unidirectional, the zEndFwPtList shall be the sink or bidirectional FwEPs or FwIPs. For unidirectional connections, the zEndFwPtList attribute shall identify the sink end. |

### 6.4.3 Relation-Abs_Fw_Pt_U-ASAP (O)

#### 6.4.3.1 Definition

This represents a unidirectional relation from the IOC Abs_Fw_Pt_U (including its child classes Fw_Im_Pt_U, Fw_Ed_Pt_U) to the IOC alarm severity assignment profile [ITU-T M.3160].

The role of the relation shall be mapped to a reference attribute of the IOC. The name of the reference attribute shall be the role name.

#### 6.4.3.2 Roles

| Name | Definition |
|---|---|
| **asapPtr** | This role (when present) represents the Abs_Fw_Pt_U (including its child classes Fw_Im_Pt_U, Fw_Ed_Pt_U) capability to identify the alarm severity assignment profile that is associated with this FwEP or FwIP. When this role is present, the Abs_Fw_Pt_U.asapPtr shall carry the identifier of alarm severity assignment profile. |

#### 6.4.3.3 Constraint

| Name | Definition |
|---|---|
| – | – |

### 6.4.4 Relation-Abs_Fw_Pt_U-ManagedEntity (M)

#### 6.4.4.1 Definition

This represents a unidirectional relation from the IOC Abs_Forwarding_Point_U (including its child classes Fw_Im_Pt_U, Forwarding_End_Point_Source_U) to the ProxyClass managed entity.

The role of the relation shall be mapped to a reference attribute of the IOC. The name of the reference attribute shall be the role name.

#### 6.4.4.2 Roles

| Name | Definition |
|---|---|
| **supportedByObjectList** | This role (when present) represents the Abs_Fw_Pt_U (including its child classes Fw_Im_Pt_U, Fw_Ed_Pt_U) capability to identify the list of managed entities that are capable of directly affecting this FwEP or FwIP. When this role is present, the Abs_Fw_Pt_U.supportedByObjectList shall carry the set of identifier(s) of managed entity (to be replaced by the actual IOCs). |

#### 6.4.4.3 Constraint

| Name | Definition |
|---|---|
| – | – |

### 6.4.5 Relation-Abs_Lk_Pt_U-Abs_Lk_U (M)

#### 6.4.5.1 Definition

This represents a unidirectional relation from the IOC Abs_Lk_Pt_U (including its child classes Abs_Lk_Pt_U and Log_Lk_Pt_CO) to the IOC Abs_Lk_U (including its child classes Top_Lk_U and Log_Lk_CO).

The role of the relation shall be mapped to a reference attribute of the IOC. The name of the reference attribute shall be the role name.

#### 6.4.5.2 Roles

| Name | Definition |
|---|---|
| **lkPtr** | This role (when present) represents the Abs_Lk_Pt_U (including its subclasses) capability to identify the Abs_Lk_U (including its subclasses) that is terminated by this link point. When this role is present, the Abs_Lk_Pt_U.lkPtr shall carry the identifier of Abs_Lk_U or one of its subclasses Top_Lk_U, Log_Lk_CO. |

#### 6.4.5.3 Constraint

| Name | Definition |
|---|---|
| – | – |

### 6.4.6 Relation-Abs_Lk_Pt_U-Fw_Ed_Pt_U (M)

#### 6.4.6.1 Definition

This represents a unidirectional relation from the IOC Abs_Lk_Pt_U to the IOC Fw_Ed_Pt_U.

The role of the relation shall be mapped to a reference attribute of the IOC. The name of the reference attribute shall be the role name.

#### 6.4.6.2 Roles

| Name | Definition |
|---|---|
| **serverFwEdPtPtr** | This role (when present) represents the Abs_Lk_Pt_U capability to identify the list of FwEPs that may serve this topological link point in another layer. When this role is present, the Abs_Lk_Pt_U.serverFwEdPtPtr shall carry the set of identifier(s) of the IOC: Fw_Ed_Pt_U. |

#### 6.4.6.3 Constraint

| Name | Definition |
|---|---|
| – | – |

### 6.4.7 Relation-Abs_Lk_U-a_EndofLink (M)

#### 6.4.7.1 Definition

This represents a unidirectional relation from the IOC Abs_Lk_U (including its subclasses Top_Lk_U and Log_Lk_CO) to the ProxyClass End_of_Link (can be child classes of Top_Lk_Pt_U, Log_Lk_CO, Ac_Gr_U and SNw_U).

The role of the relation shall be mapped to a reference attribute of the IOC. The name of the reference attribute shall be the role name.

#### 6.4.7.2 Roles

| Name | Definition |
|---|---|
| **aEnd** | This role (when present) represents the Abs_Lk_U (including its subclasses) capability to identify one end of link (the starting point for a unidirectional link). When this role is present, the Abs_Lk_U.aEnd shall carry the identifier of one of the following IOCs: child classes of Top_Lk_Pt_U, Log_Lk_CO, Ac_Gr_U and SNw_U. |

#### 6.4.7.3 Constraint

| Name | Definition |
|---|---|
| **fromEnd_for_unidirectional_ Link** | When the abstract link is a unidirectional link, the aEnd shall point to the starting point of the link. |

### 6.4.8 Relation-Abs_Lk_U-z_EndofLink (M)

#### 6.4.8.1 Definition

This represents a unidirectional relation from the IOC Abs_Lk_U (including its subclasses Top_Lk_U and Log_Lk_CO) to the ProxyClass End_of_Link (can be child classes of Top_Lk_Pt_U, Log_Lk_CO, Ac_Gr_U and SNw_U).

The role of the relation shall be mapped to a reference attribute of the IOC. The name of the reference attribute shall be the role name.

#### 6.4.8.2 Roles

| Name | Definition |
|---|---|
| **zEnd** | This role (when present) represents the Abs_Lk_U (including its subclasses) capability to identify the other end of link (the ending point for a unidirectional link). When this role is present, the Abs_Lk_U.zEnd shall carry the identifier of one of the following IOCs: child classes of Top_Lk_Pt_U, Log_Lk_CO, Ac_Gr_U and SNw_U. |

#### 6.4.8.3 Constraint

| Name | Definition |
|---|---|
| **toEnd_for_unidirectional_Link** | When the abstract link is a unidirectional link, the zEnd shall point to the ending point of the link. |

### 6.4.9 Relation-Ac_Gr_U-Abs_Lk_U (O)

#### 6.4.9.1 Definition

This represents a unidirectional relation from the IOC Ac_Gr_U to the IOC Abs_Lk_U (including its subclasses Top_Lk_U and Log_Lk_CO).

The role of the relation shall be mapped to a reference attribute of the IOC. The name of the reference attribute shall be the role name.

#### 6.4.9.2 Roles

| Name | Definition |
|---|---|
| **lkPtrList** | This role (when present) represents the Ac_Gr_U capability to identify the list of abstract links (including its subclasses) that are terminated by this access group. When this role is present, the Ac_Gr_U.lkPtrList shall carry the set of identifier(s) of child classes of Abs_Lk_U (Top_Lk_U, Log_Lk_CO). |

#### 6.4.9.3 Constraint

| Name | Definition |
|---|---|
| – | – |

### 6.4.10 Relation-Ac_Gr_U-Fw_Ed_Pt_U (M)

#### 6.4.10.1 Definition

This represents a unidirectional relation from the IOC Ac_Gr_U to the IOC Fw_Ed_Pt_U.

The role of the relation shall be mapped to a reference attribute of the IOC. The name of the reference attribute shall be the role name.

#### 6.4.10.2 Roles

| Name | Definition |
|---|---|
| **acPtList** | This role (when present) represents the Ac_Gr_U capability to identify the list of Fw_Ed_Pt_Us that are administratively grouped by this access group. When this role is present, the Ac_Gr_U.acPtList shall carry the set of identifier(s) of the IOC: Fw_Ed_Pt_U. |

#### 6.4.10.3 Constraint

| Name | Definition |
|---|---|
| – | – |

### 6.4.11 Relation-CircuitPack-Trail_CO (O)

#### 6.4.11.1 Definition

This represents a unidirectional relation from the IOC Circuit Pack [ITU-T M.3160] to the IOC Trail_CO.

The role of the relation shall be mapped to a reference attribute of the IOC. The name of the reference attribute shall be the role name.

#### 6.4.11.2 Roles

| Name | Definition |
|---|---|
| **portAssociations** | This role (when present) represents the Circuit Pack capability to identify the list of trails that is associated with the ports of this Circuit Pack. When this role is present, the CircuitPack.portAssociations shall carry the set of pairs of port number and the identifier of the associated Trail_CO. |

#### 6.4.11.3 Constraint

| Name | Definition |
|---|---|
| – | – |

### 6.4.12 Relation-Connection_CO-Abs_Ac_Rel_U (O)

#### 6.4.12.1 Definition

This represents a unidirectional relation from the IOC Connection_CO to the IOC Abs_Ac_Rel_U.

The role of the relation shall be mapped to a reference attribute of the IOC. The name of the reference attribute shall be the role name.

#### 6.4.12.2 Roles

| Name | Definition |
|---|---|
| **serverAcRelList** | This role (when present) represents the Connection_CO capability to identify the list of access relationships in a lower order network layer which may be used in parallel to serve this Connection. When this role is present, the Connection_CO.serverAcRelList shall carry the set of identifier(s) of Trail_CO. |

#### 6.4.12.3 Constraint

| Name | Definition |
|---|---|
| **connection_supported_by_ access-relationship** | The connection is supported by an access relationship. |

### 6.4.13 Relation-Connection_CO-Trail_CO (O)

#### 6.4.13.1 Definition

This represents a unidirectional relation from the IOC Connection_CO to the IOC Trail_CO.

The role of the relation shall be mapped to a reference attribute of the IOC. The name of the reference attribute shall be the role name.

#### 6.4.13.2 Roles

| Name | Definition |
|---|---|
| **clientTrail** | This role (when present) represents the Connection_CO capability to identify the trail in the same network layer as the connection served by this connection object. When this role is present, the Connection_CO.clientTrail shall carry the identifier of Trail_CO. |

#### 6.4.13.3 Constraint

| Name | Definition |
|---|---|
| **connection_serves_trail** | The connection serves a client trail. |

### 6.4.14 Relation-Fw_Pt_Pl_U-Abs_Fw_Pt_U (M)

#### 6.4.14.1 Definition

This represents a unidirectional relation from the IOC Fw_Pt_Pl_U to the IOC Abs_Fw_Pt_U (including its child classes).

The role of the relation shall be mapped to a reference attribute of the IOC. The name of the reference attribute shall be the role name.

#### 6.4.14.2 Roles

| Name | Definition |
|---|---|
| **fwPtInFwPtPlList** | This role (when present) represents the Fw_Pt_Pl_U capability to identify the FwEPs or FwIPs that are represented by this forwarding point pool. When this role is present, the Fw_Pt_Pl_U.fwPtInFwPtPlList shall carry the set of identifier(s) of child classes of Abs_Fw_Pt_U (Fw_Im_Pt_U, Fw_Ed_Pt_U). |

#### 6.4.14.3 Constraint

| Name | Definition |
|---|---|
| – | – |

### 6.4.15 Relation-Lk_Con_CO-Abs_Ac_Rel_U (O)

#### 6.4.15.1 Definition

This represents a bidirectional relation between the IOC Lk_Con_CO and the IOC Abs_Ac_Rel_U.

The role of the relation shall be mapped to a reference attribute of the IOC. The name of the reference attribute shall be the role name.

#### 6.4.15.2 Roles

| Name | Definition |
|---|---|
| **serverAcRelList** | This role (when present) represents the Lk_Con_CO capability to identify the list of Abs_Ac_Rel_Us in a lower order network layer which may be used in parallel to serve this Link Connection. When this role is present, the Lk_Con_CO.serverAcRelList shall carry the set of identifier(s) of the instance(s) of subclasses of Abs_Ac_Rel_U. |
| **clientFwRelPtrList** | This role (when present) represents the Abs_Ac_Rel_U capability to identify the list of Link Connections in the client layer network domain(s) that are supported by the access relationship. When this role is present, the Abs_Ac_Rel_U.clientFwRelPtrList shall carry the set of identifier(s) of Lk_Con_CO. |

#### 6.4.15.3 Constraint

| Name | Definition |
|---|---|
| **connection_supported_by_access-relationship** | The link connection is supported by an access relationship. |

### 6.4.16 Relation-Lk_Con_CO-Trail_CO (O)

#### 6.4.16.1 Definition

This represents a bidirectional relation between the IOC Lk_Con_CO and the IOC Trail_CO.

The role of the relation shall be mapped to a reference attribute of the IOC. The name of the reference attribute shall be the role name.

#### 6.4.16.2 Roles

| Name | Definition |
|---|---|
| **clientTrail** | This role (when present) represents the Lk_Con_CO capability to identify the trail in the same network layer as the connection served by this link connection object. When this role is present, the Lk_Con_CO.clientTrail shall carry the identifier of Trail_CO. |
| **layerConList** | This role (when present) represents the Trail_CO capability to identify the list of link connections and subnetwork connections in a given layer which may compose the trail in the same layer. When this role is present, the Trail_CO.layerConList shall carry the ordered sequence of identifier(s) of Lk_Con_CO and SNw_Con_CO. |

#### 6.4.16.3 Constraint

| Name | Definition |
|---|---|
| **connection_serves_trail** | The link connection serves a client trail. |

### 6.4.17 Relation-Log_Lk_CO-Lk_Con_CO (O)

#### 6.4.17.1 Definition

This represents a unidirectional relation from the IOC Log_Lk_CO and the IOC Lk_Con_CO.

The role of the relation shall be mapped to a reference attribute of the IOC. The name of the reference attribute shall be the role name.

#### 6.4.17.2 Roles

| Name | Definition |
|---|---|
| **lkConPtrList** | This role (when present) represents the Log_Lk_CO capability to identify the list of Lk_Con_COs in a given layer which may compose this Log_Lk_CO in the same layer. When this role is present, the Log_Lk_CO.lkConPtrList shall carry the set of identifier(s) of Lk_Con_CO. |

#### 6.4.17.3 Constraint

| Name | Definition |
|---|---|
| – | – |

### 6.4.18 Relation-Log_Lk_Pt_CO-Fw_Im_Pt_U (O)

#### 6.4.18.1 Definition

This represents a unidirectional relation from the IOC Log_Lk_Pt_CO to the IOC Fw_Im_Pt_U.

The role of the relation shall be mapped to a reference attribute of the IOC. The name of the reference attribute shall be the role name.

#### 6.4.18.2 Roles

| Name | Definition |
|---|---|
| **fwPointInLinkPointList** | This role (when present) represents the Log_Lk_Pt_CO capability to identify the list of forwarding points that are represented by this logical link end. When this role is present, the Log_Lk_Pt_CO.fwPtInLkPtList shall carry the set of identifier(s) of one Fw_Im_Pt_U. |

#### 6.4.18.3 Constraint

| Name | Definition |
|---|---|
| – | – |

### 6.4.19 Relation-SNw_Ac_Rel_CL-SNw_Fw_Rel_CL (O)

#### 6.4.19.1 Definition

This represents a unidirectional relation from the IOC SNw_Ac_Rel_CL to the IOC SNw_Fw_Rel_CL.

The role of the relation shall be mapped to a reference attribute of the IOC. The name of the reference attribute shall be the role name.

#### 6.4.19.2 Roles

| Name | Definition |
|---|---|
| **sNwAcRelComponentPtrList** | This role (when present) represents the SNw_Ac_Rel_CL capability to identify the list SNw_Fw_Rel_CLs and Top_Lk_Us in a given layer which may compose the subnetwork access relationship in the same layer. When this role is present, the SNw_Ac_Rel_CL. sNwAcRelComponentPtrList shall carry the ordered set of identifier(s) of Top_Lk_U and SNw_Fw_Rel_CL. |

#### 6.4.19.3 Constraint

| Name | Definition |
|---|---|
| **Forwarding-relationship_serves_access-relationship** | The subnetwork forwarding relationship serves a client access relationship. |

### 6.4.20 Relation-SNw_Ac_Rel_CL-Top_Lk_U (O)

#### 6.4.20.1 Definition

This represents a unidirectional relation from the IOC SNw_Ac_Rel_CL to the IOC Top_Lk_U.

The role of the relation shall be mapped to a reference attribute of the IOC. The name of the reference attribute shall be the role name.

#### 6.4.20.2 Roles

| Name | Definition |
|---|---|
| **sNwAcRelComponentPtrList** | This role (when present) represents the SNw_Ac_Rel_CL capability to identify the list of Top_Lk_Us and SNw_Fw_Rel_CLs in a given layer which may compose the SNw_Ac_Rel_CL in the same layer. When this role is present, the SNw_Ac_Rel_CL. sNwAcRelComponentPtrList shall carry the ordered sequence or unordered set of identifier(s) of Top_Lk_U and SNw_Fw_Rel_CL. |

#### 6.4.20.3 Constraint

| Name | Definition |
|---|---|
| **topological-link_serves_access-relationship** | The topological link serves a client access relationship (connectionless). |

### 6.4.21 Relation-SNw_Con_CO-Lk_Con_CO (O)

#### 6.4.21.1 Definition

This represents a bidirectional relation between the IOC SNw_Con_CO and the IOC Lk_Con_CO.

The role of the relation shall be mapped to a reference attribute of the IOC. The name of the reference attribute shall be the role name.

#### 6.4.21.2 Roles

| Name | Definition |
|---|---|
| **componentPtrList** | This role (when present) represents the SNw_Con_CO capability to identify the list of Lk_Con_COs that are components of the subnetwork connection, within a given layer. When this role is present, the SNw_Con_CO.componentPtrList shall carry the ordered sequence of identifier(s) of Lk_Con_CO and SNw_Con_CO. |
| **compositePtr** | This role (when present) represents the Lk_Con_CO capability to identify a SNw_Con_CO that is composed of a sequence of link connections or subnetwork connections in the same layer, including this link connection. When this role is present, the Lk_Con_CO.compositePtr shall carry the identifier of SNw_Con_CO. |

#### 6.4.21.3 Constraint

| Name | Definition |
|---|---|
| **composed_SubNetworkCon-nection** | This relation is present when a SNw_Con_CO is composed of other SNw_Con_COs and Lk_Con_COs in the same layer. |

### 6.4.22 Relation-SNw_Con_CO-SNw_Con_CO (O)

#### 6.4.22.1 Definition

This represents a bidirectional relation between the IOC SNw_Con_CO and the IOC SNw_Con_CO.

The role of the relation shall be mapped to a reference attribute of the IOC. The name of the reference attribute shall be the role name.

#### 6.4.22.2 Roles

| Name | Definition |
|---|---|
| **componentPtrList** | This role (when present) represents the SNw_Con_CO capability to identify the list of SNw_Con_COs that are components of this subnetwork connection, within a given layer. When this role is present, the SNw_Con_CO.componentPtrList shall carry the ordered sequence of identifier(s) of Lk_Con_CO and SNw_Con_CO. |
| **compositePtr** | This role (when present) represents the SNw_Con_CO capability to identify a SNw_Con_CO that is composed of a sequence of subnetwork connections or link connections in the same layer, including this subnetwork connection. When this role is present, the SNw_Con_CO.compositePtr shall carry the identifier of SNw_Con_CO. |

#### 6.4.22.3 Constraint

| Name | Definition |
|---|---|
| **composed_SubNetworkCon-nection** | This relation is present when a subnetwork connection is composed of other subnetwork connections and link connections in the same layer. |

### 6.4.23 Relation-SNw_Fw_Rel_CL-Top_Lk_U (O)

#### 6.4.23.1 Definition

This represents a unidirectional relation from the IOC SNw_Fw_Rel_CL to the IOC Top_Lk_U.

The role of the relation shall be mapped to a reference attribute of the IOC. The name of the reference attribute shall be the role name.

#### 6.4.23.2 Roles

| Name | Definition |
|---|---|
| **sNwFwRelComponentPtrList** | This role (when present) represents the SNw_Fw_Rel_CL capability to identify the list of Top_Lk_Us that can be viewed as possible components of the subnetwork forwarding relationship, within a given layer. When this role is present, the SNw_Fw_Rel_CL. sNwFwRelComponentPtrList shall carry the ordered sequence of identifier(s) of Top_Lk_U and SNw_Fw_Rel_CL, or an unordered set of identifier(s) of Top_Lk_U and SNw_Fw_Rel_CL. |

#### 6.4.23.3 Constraint

| Name | Definition |
|---|---|
| **composed_SubNetwork-Forwarding-Relationship** | This relation is present when a SNw_Fw_Rel_CL is composed of other SNw_Fw_Rel_CLs and Top_Lk_Us in the same layer. |

### 6.4.24 Relation-SNw_Fw_Rel_CL-SNw_Fw_Rel_CL (O)

#### 6.4.24.1 Definition

This represents a unidirectional relation from the IOC SNw_Fw_Rel_CL to the IOC SNw_Fw_Rel_CL.

The role of the relation shall be mapped to a reference attribute of the IOC. The name of the reference attribute shall be the role name.

#### 6.4.24.2 Roles

| Name | Definition |
|---|---|
| **sNwFwRelComponentPtrList** | This role (when present) represents the SNw_Fw_Rel_CL capability to identify the list of SNw_Fw_Rel_CLs that can be viewed as possible components of this subnetwork forwarding relationship, within a given layer. When this role is present, the SNw_Fw_Rel_CL.sNwFwRelComponentPtrList shall carry the ordered sequence of identifier(s) of Top_Lk_U and SNw_Fw_Rel_CL, or an unordered set of identifier(s) of Top_Lk_U and SNw_Fw_Rel_CL. |

#### 6.4.24.3 Constraint

| Name | Definition |
|---|---|
| **composed_SubNetwork-Forwarding-Relationship** | This relation is present when a SNw_Fw_Rel_CL is composed of other SNw_Fw_Rel_CLs and Top_Lk_Us in the same layer. |

### 6.4.25 Relation-SNw_U-Abs_Fw_Pt_U (O)

#### 6.4.25.1 Definition

This represents a unidirectional relation from the IOC SNw_U to the IOC Abs_Fw_Pt_U (including its child classes Fw_Im_Pt_U, Fw_Ed_Pt_U).

The role of the relation shall be mapped to a reference attribute of the IOC. The name of the reference attribute shall be the role name.

#### 6.4.25.2 Roles

| Name | Definition |
|---|---|
| **containedFwPtList** | This role (when present) represents the SNw_U capability to identify the list of forwarding (intermediate/end) points that are contained in this subnetwork. When this role is present, the SNw_U.containedFwPtList shall carry the set of identifier(s) of child classes of Abs_Fw_Pt_U (Fw_Im_Pt_U, Fw_Ed_Pt_U). |

#### 6.4.25.3 Constraint

| Name | Definition |
|---|---|
| – | – |

### 6.4.26 Relation-SNw_U-Abs_Lk_Pt_U (O)

#### 6.4.26.1 Definition

This represents a bidirectional relation between the IOC SNw_U to the IOC Abs_Lk_Pt_U (including its child classes Abs_Lk_Pt_U and Log_Lk_Pt_CO).

The role of the relation shall be mapped to a reference attribute of the IOC. The name of the reference attribute shall be the role name.

#### 6.4.26.2 Roles

| Name | Definition |
|---|---|
| **containedLkPtList** | This role (when present) represents the SNw_U capability to identify the list of Abs_Lk_Pt_Us (including its subclasses) that are contained in this subnetwork through partitioning. When this role is present, the SNw_U.containedLkPtList shall carry the set of identifier(s) of child classes of Abs_Lk_Pt_U (Abs_Lk_Pt_U, Log_Lk_Pt_CO). |
| **containedInSNwList** | This role (when present) represents the Abs_Lk_Pt_U capability to identify the list of parent subnetworks that contain this abstract link point. When this role is present, the Abs_Lk_Pt_U.containedInSNwList shall carry the set of identifier(s) of SNw_U. |

#### 6.4.26.3 Constraint

| Name | Definition |
|---|---|
| **partitioning_supported** | There are contained link points in the subnetwork instance (partitioning is supported). |

### 6.4.27 Relation-SNw_U-Abs_Lk_U-1 (O)

#### 6.4.27.1 Definition

This represents a unidirectional relation from the IOC SNw_U to the IOC Abs_Lk_U (including its subclasses Top_Lk_U and Log_Lk_CO).

The role of the relation shall be mapped to a reference attribute of the IOC. The name of the reference attribute shall be the role name.

#### 6.4.27.2 Roles

| Name | Definition |
|---|---|
| **containedLkList** | This role (when present) represents the SNw_U capability to identify the list of Abs_Lk_Us (including its child classes) that are contained in this subnetwork through partitioning. When this role is present, the SNw_U.containedLkList shall carry the set of identifier(s) of child classes of Abs_Lk_U (Top_Lk_U, Log_Lk_CO). |

#### 6.4.27.3 Constraint

| Name | Definition |
|---|---|
| **partitioning_supported** | There are contained links in the subnetwork (partitioning is supported). |

### 6.4.28 Relation-SNw_U-Abs_Lk_U-2 (O)

#### 6.4.28.1 Definition

This represents a unidirectional relation from the IOC SNw_U to the IOC Abs_Lk_U (including its subclasses Top_Lk_U and Log_Lk_CO).

The role of the relation shall be mapped to a reference attribute of the IOC. The name of the reference attribute shall be the role name.

#### 6.4.28.2 Roles

| Name | Definition |
|---|---|
| **lkPtrList** | This role (when present) represents the SNw_U capability to identify the list of Abs_Lk_Us (including its subclasses) that are terminated by this subnetwork. When this role is present, the SNw_U.lkPtrList shall carry the set of identifier(s) of child classes of Abs_Lk_U (Top_Lk_U, Log_Lk_CO). |

#### 6.4.28.3 Constraint

| Name | Definition |
|---|---|
| **link_terminated_by_ SubNetwork** | A link is terminated by this subnetwork. |

### 6.4.29 Relation-SNw_U-Ac_Gr_U (O)

#### 6.4.29.1 Definition

This represents a bidirectional relation between the IOC SNw_U and the IOC Ac_Gr_U.

The role of the relation shall be mapped to a reference attribute of the IOC. The name of the reference attribute shall be the role name.

#### 6.4.29.2 Roles

| Name | Definition |
|---|---|
| **containedAcGrList** | This role (when present) represents the SNw_U capability to identify the list of Ac_Grs that are contained in this subnetwork. When this role is present, the SNw_U.containedAcGrList shall carry the set of identifier(s) of Ac_Gr_U. |
| **containedInSNwList** | This role (when present) represents the Ac_Gr_U capability to identify the list of parent SNw_Us that contain this access group. When this role is present, the Ac_Gr_U.containedInSNwList shall carry the set of identifier(s) of SNw_U. |

#### 6.4.29.3 Constraint

| Name | Definition |
|---|---|
| **partitioning_supported** | This relation is present when an access group is contained in a subnetwork. |

### 6.4.30 Relation-SNw_U-Managed_Entity (O)

#### 6.4.30.1 Definition

This represents a unidirectional relation from the IOC SNw_U to the ProxyClass managed entity.

The role of the relation shall be mapped to a reference attribute of the IOC. The name of the reference attribute shall be the role name.

#### 6.4.30.2 Roles

| Name | Definition |
|---|---|
| **supportedByObjectList** | This role (when present) represents the SNw_U capability to identify the list of managed entities that are capable of directly affecting this subnetwork. When this role is present, the SNw_U.supportedByObjectList shall carry the set of identifier(s) of Managed Entity (to be replaced by the actual IOCs). |

#### 6.4.30.3 Constraint

| Name | Definition |
|---|---|
| – | – |

### 6.4.31 Relation-SNw_U-SNw_U (O)

#### 6.4.31.1 Definition

This represents a bidirectional relation between the IOC SNw_U and the IOC SNw_U.

The role of the relation shall be mapped to a reference attribute of the IOC. The name of the reference attribute shall be the role name.

#### 6.4.31.2 Roles

| Name | Definition |
|---|---|
| **containedSNwList** | This role (when present) represents the SNw_U capability to identify the list of SNw_Us that are contained in this subnetwork through partitioning. When this role is present, the SNw_U.containedSNwList shall carry the set of identifier(s) of SNw_U. |
| **containedInSNwList** | This role (when present) represents the SNw_U capability to identify the list of parent SNw_U that contain this subnetwork. When this role is present, the SNw_U.containedInSNwList shall carry the set of identifier(s) of SNw_U. |

#### 6.4.31.3 Constraint

| Name | Definition |
|---|---|
| **partitioning_supported** | This relation is present when a subnetwork is contained in another subnetwork. |

### 6.4.32 Relation-Top_Lk_U-Abs_Ac_Rel_U (M)

#### 6.4.32.1 Definition

This represents a bidirectional relation between the IOC Top_Lk_U and the IOC Abs_Ac_Rel_U.

The role of the relation shall be mapped to a reference attribute of the IOC. The name of the reference attribute shall be the role name.

#### 6.4.32.2 Roles

| Name | Definition |
|---|---|
| **serverAcRel** | This role (when present) represents the Top_Lk_U capability to identify the Abs_Ac_Rel_U in the server layer that supports the topological link in a client layer. When this role is present, the Top_Lk_U.serverAcRel shall carry the identifier of child class of Abs_Ac_Rel_U (Trail_CO, SNw_Ac_Rel_CL). |
| **clientLkPtrList** | This role (when present) represents the Abs_Ac_Rel_U capability to identify the Top_Lk_Us that reflect the capacity of the access relationship in the client layer network domain(s).<br>When this role is present, the Abs_Ac_Rel_U.clientLkPtrList shall carry the set of identifier(s) of Top_Lk_U. |

#### 6.4.32.3 Constraint

| Name | Definition |
|---|---|
| – | – |

### 6.4.33 Relation-Trail_CO-SNw_Con_CO (O)

#### 6.4.33.1 Definition

This represents a unidirectional relation from the IOC Trail_CO to the IOC SNw_Con_CO.

The role of the relation shall be mapped to a reference attribute of the IOC. The name of the reference attribute shall be the role name.

#### 6.4.33.2 Roles

| Name | Definition |
|---|---|
| **layerConList** | This role (when present) represents the Trail_CO capability to identify the list of SNw_Con_COs and Lk_Con_COs in a given layer which may compose the trail in the same layer. When this role is present, the Trail_CO.layerConList shall carry the ordered sequence of identifier(s) of Lk_Con_CO and SNw_Con_CO. |

#### 6.4.33.3 Constraint

| Name | Definition |
|---|---|
| **connection_serves_trail** | The subnetwork connection serves a client trail. |

## 7 Common information definitions

### 7.1 Attributes

Table 42 shows the common information definition of attribute:

**Table 42 – Common information attribute definition**

| Name | Information type | Description |
|---|---|---|
| acGrId | Name | This attribute is the identifier of an instance of the IOC Ac_Gr_U (access group). |
| acPtList | PointList ::= SET OF Name | This attribute lists all the forwarding end points within an instance of the IOC Ac_Gr_U (access group). |
| administrativeState | AdministrativeState ::= ENUMERATED {<br>locked,<br>unlocked,<br>shuttingDown<br>} | This attribute is to indicate the administrative state of a managed entity, which has three possible values: locked, unlocked, and shuttingDown. See [ITU-T M.3701] for details. |
| aEnd | ObjectInstance ::= Name | This attribute is a pointer to an instance of the IOC SNw_U (subnetwork), Abs_Lk_Pt_U (abstract link point) or Ac_Gr_U (access group) in the same network layer domain, which represents the source of the corresponding entity. |
| aEndFwEdPtList | ObjectList ::= SET OF Name | The value of this attribute identifies one or more instances of IOC Fw_Ed_Pt_U (forwarding end point), which represents the source end of an access relationship. This attribute cannot be null. |
| aEndFwPtList | ObjectList | The value of this attribute identifies one or more forwarding (end or intermediate) points of an instance of a subclass of the IOC Abs_Fw_Pt_U (abstract forwarding point). This attribute cannot be null. |

**Table 42 – Common information attribute definition**

| Name | Information type | Description |
|---|---|---|
| alarmStatus | AlarmStatus ::= ENUMERATED {<br>cleared,<br>activeReportable-Indeterminate,<br>activeReportable-Warning,<br>activeReportable-Minor,<br>activeReportable-Major,<br>activeReportable-Critical,<br>activePending<br>} | This attribute indicates the occurrence of an abnormal condition relating to an object. This attribute may also function as a summary indicator of alarm conditions associated with a specific resource. It is used to indicate the existence of an alarm condition, a pending alarm condition such as threshold situations, or (when used as a summary indicator) the highest severity of active alarm conditions. When used as a summary indicator, the order of severity (from highest to lowest) is:<br>activeReportable-Critical<br>activeReportable-Major<br>activeReportable-Minor<br>activeReportable-Indeterminate<br>activeReportable-Warning<br>activePending<br>cleared.<br>See also [ITU-T M.3701] for more details. |
| asapPtr | PointerOrNull ::= CHOICE {<br>pointer Name,<br>null NULL<br>} | This attribute identifies an instance of the IOC alarm severity assignment profile (see [ITU-T M.3160]). |
| availabilityStatus | AvailabilityStatus ::= SET OF INTEGER {<br>inTest (0),<br>failed (1),<br>powerOff (2),<br>offline (3),<br>offDuty (4),<br>dependency (5),<br>degraded (6),<br>notInstalled (7),<br>logFull (8)<br>} | This attribute indicates the availability status of instances of the corresponding IOC.<br>See also [ITU-T M.3701] for more details. |
| availableLkCapacity | Capacity ::= CHOICE {<br>numberOfLinkConnections INTEGER,<br>bandwidth Bandwidth<br>}<br>Bandwidth ::= SET OF SET {<br>ingress INTEGER,<br>egress INTEGER<br>} -- (Units: kbit/s) | This attribute indicates the available capacity of a link expressed as either the number of link connections that are available (CO only) or the bandwidth that is available to that link (both CO and CL). |
| availableLkPtCapacity | PointCapacity ::= CHOICE {<br>numberOfTPs INTEGER,<br>bandwidth Bandwidth<br>} | This attribute indicates the number of the forwarding (intermediate/end) points associated with a link point that have spare capacity, or the amount of spare bandwidth associated with a link point. |
| channelNumber | ChannelNumberType ::= INTEGER | |

**Table 42 – Common information attribute definition**

| Name | Information type | Description |
|---|---|---|
| characteristicInformation | CharacteristicInformation ::= OBJECT IDENTIFIER | The value of this attribute is used to verify the connectability of instances of the subclasses of the IOC Abs_Fw_Pt_U (abstract forwarding point). |
| clientFwImPtList | ObjectList | This attribute defines the FwIP or list of FwIPs which are clients of a FwEP or FwEPs in another layer. Usually a single FwEP in a higher order layer will support a number of FwIPs in a lower order layer. Alternatively, where concatenation is used, a number of FwEPs in a lower order layer may serve a FwIP or FwIPs in a higher order layer. |
| clientFwRelPtrList | ObjectList | This attribute is a set of pointers to the instances of the subclasses of IOC Abs_Fw_Rel_U (which can be Lk_Con_CO, or SNw_Fw_Rel_CL) in the client layer network that are supported by the instance of Abs_Ac_Rel_U (Trail_CO or SNw_Ac_Rel_CL). |
| clientLkPtPtrList | ObjectList | This attribute is a set of pointers to the instances of the subclass of IOC Abs_Lk_Pt_U that reflect the properties of a FwEP in the client layer network domain(s). |
| clientLkPtrList | ObjectList | This attribute is a set of pointers to the instances of the IOC Top_Lk_U (topological link) that reflect the capacity of an access relationship in the client layer network. |
| clientTrail | ObjectInstance | The value of this attribute identifies the instance of the IOC Trail_CO in the same network layer as the trail served by a connection instance. |
| componentPtrList | ObjectList | This attribute is used where the subnetwork connection is made up of a number of component subnetwork connections and link connections within the same layer. |
| compositePtr | RelatedObjectInstance ::= CHOICE {<br>notAvailable NULL,<br>relatedObject Name<br>} | This attribute is used where the connectivity instance is a component of a subnetwork connection within the same layer. |
| connectedFwPtCount | Count ::= INTEGER | This attribute indicates the total number of forwarding points associated with a FwPP that have been connected. |
| containedAcGrList | ObjectList | This attribute defines the list of Ac_Gr_U instances which are contained in a subnetwork. |

**Table 42 – Common information attribute definition**

| Name | Information type | Description |
|---|---|---|
| containedFwPtList | ObjectList | This attribute is a list of pointers to forwarding (intermediate/end) point instances that are contained in the Sub_Network_U instance. |
| containedInSNwList | ObjectList | This attribute defines the list of parent subnetworks which contain the access group, link point, or subnetwork in a given layer. |
| containedLkList | ObjectList | This attribute is used to describe the internal topology of a subnetwork (in a given layer). This topology comprises links and subnetworks. The links are listed in this attribute. |
| containedLkPtList | ObjectList | This attribute is used to describe the internal topology of a subnetwork from the point perspective (in a given layer). This topology comprises link points and subnetworks. The link points are listed in this attribute. |
| containedSNwList | ObjectList | This attribute is used to describe the internal topology of a subnetwork (in a given layer). This topology comprises links and subnetworks. The subnetworks are listed in this attribute. |
| configuredConnectivity | ConfiguredConnectivity ::=<br>ENUMERATED {<br>sourceConnect,<br>sinkConnect,<br>bidirectionalConnect,<br>noConnect<br>} | This attribute indicates the configured connectivity of an instance of the subclasses of Abs_Fw_Pt_U. The possible values for this attribute are sourceConnect, sinkConnect, bidirectionalConnect and noConnect. For an instance of Abs_Fw_Pt_U subclasses with ptDirectionality equal to sink, the allowed values for this attribute are noConnect and sinkConnect. For an instance of Abs_Fw_Pt_U subclasses with ptDirectionality equal to source, the allowed values for this attribute are noConnect and sourceConnect. For an instance of Abs_Fw_Pt_U subclasses with ptDirectionality equal to bidirectional, the allowed values for this attribute are noConnect and bidirectionalConnect. For some technologies, sinkConnect and sourceConnect may also be allowed for a bidirectional forwarding point. |
| connectionType | ENUMERATED {<br>p2p,<br>p2mp,<br>mp2mp<br>} | This attribute describes the connection type of the SNw_Fw_Rel_CL instance, the possible type can be:<br>– point-to-point,<br>– point-to-multipoint,<br>– multipoint-to-multipoint |

**Table 42 – Common information attribute definition**

| Name | Information type | Description |
|---|---|---|
| currentProblemList | CurrentProblemList ::= SET OF CurrentProblem<br>CurrentProblem ::= SET {<br>problem ProbableCause,<br>alarmStatus AlarmStatus<br>} | The current problem list attribute type identifies the current existing problems, with severity, associated with the managed object. |
| directionality | Directionality ::= ENUMERATED {<br>unidirectional,<br>bidirectional<br>} | This attribute specifies whether the associated IOC instance is unidirectional or bidirectional. |
| fwImPtInLkPtList | ObjectList | This attribute lists the forwarding intermediate points that are represented by a link point. |
| fwPtInFwPtPlList | ObjectList | This attribute lists the forwarding points that are represented by a forwarding point pool. |
| fwPtPlId | Name | This attribute lists the forwarding points that are represented by a forwarding point pool.<br>This attribute is the identifier of an instance of the IOC Fw_Pt_Pl_U (forwarding point pool). |
| fwType | ForwardingType ::= ENUMERATED {<br>channelForwarding,<br>destinationForwarding<br>} | This attribute indicates the transmission type of the corresponding IOC, which can be either channel forwarding (for CO), or destination forwarding (for CL). |
| idleFwPtCount | Count | This attribute indicates the total number of forwarding points associated with a FwPP that are in an operational state of enabled and that are available for cross connection. |
| layerConList | ObjectList | This attribute defines the list of link connections and subnetwork connections in a given layer which may compose a Trail_CO in the same layer. This composition of connectivity instances may be a simple sequence or, in the multipoint case, a tree structure. |
| lkConPtrList | ObjectList | This attribute defines the list of link connections in a given layer which may compose a logical link in the same layer. |
| lkDirectionality | LinkDirectionality ::= ENUMERATED {<br>unidirectional,<br>bidirectional,<br>undefined<br>} | The link directionality attribute type specifies whether the associated link managed object is uni- or bidirectional, or undefined. |
| lkPtr | RelatedObjectInstance | This attribute points to a link from a link point. |

**Table 42 – Common information attribute definition**

| Name | Information type | Description |
|---|---|---|
| lkPtrList | ObjectList | This attribute points to the links terminated by the subnetwork or the link terminated by an access group. |
| logPtDirectionality | PointDirectionality ::= ENUMERATED {<br>sink,<br>source,<br>bidirectional<br>} | The logical point directionality attribute type specifies whether the associated link point managed object is sink, source, or bidirectional. |
| maxFwImPtCount | Count ::= INTEGER | This attribute indicates the maximum number of forwarding intermediate points associated with a link point. |
| maxFwPtPlAssignable Capacity | Bandwidth | This attribute indicates the maximum amount of bandwidth assignable to the link related to the FwPP, in both the ingress and egress directions. |
| networkId | | This attribute is the identifier of an instance of the IOC network or its subclasses (including Ly_Nw_Dm_U). |
| operationalState | OperationalState ::= ENUMERATED {<br>enabled,<br>disabled<br>} | This attribute is to indicate the operability of the managed entity, which has two possible values: disabled and enabled. See [ITU-T M.3701] for details. |
| potentialLkPtCapacity | PointCapacity | This attribute indicates the number of forwarding intermediate points or the amount of bandwidth that have not yet been assigned to a link point, but that could be assigned to the link point from the server forwarding end point. |
| protected | BOOLEAN | This attribute identifies whether the associated managed object is protected or not. The value TRUE implies it is protected. |
| provisionedFwImPtCount | Count | This attribute indicates the number of forwarding intermediate points associated with a link point that has been assigned. |
| provisionedLkPtCapacity | PointCapacity | This attribute indicates the number of forwarding intermediate points assigned to a link point or the amount of bandwidth assigned to a link point. |
| ptDirectionality | PointDirectionality | This attribute indicates the directionality of a forwarding point managed object instance. |
| qualityOfConnectivityService | ObjectInstance | This attribute indicates the quality of service for connectivity and its subclasses, and requires further definition. |
| relatedRoutingProfile | ObjectInstance | |

**Table 42 – Common information attribute definition**

| Name | Information type | Description |
|---|---|---|
| serverAcRel | RelatedObjectInstance | This attribute points to an instance of the subclasses of the IOC Abs_Ac_Rel_U (Trail_CO, or SNw_Ac_Rel_CL) in the server layer that supports the instance of Abs_Lk_U, Lk_Con_Co or SNw_Fw_Rel_CL in a client layer. |
| serverAcRelList | ObjectList | The value of this attribute identifies the instance of the subclasses of IOC Abs_Ac_Rel (in most cases one) in a lower order network layer which may be used in parallel to serve a connection object. |
| serverFwEdPtPtr | ObjectList | This attribute defines the instance of Fw_Ed_Pt_U which may serve an instance of Fw_Im_Pt_U and/or link point in another layer. Usually one or more instances of Fw_Ed_Pt_U in a higher order layer will serve one or more instances of Fw_Im_Pt_U in a lower order layer. |
| signalId | SignalId ::= CHOICE {<br>simple CharacteristicInformation,<br>bundle Bundle,<br>complex SET OF Bundle<br>}<br>Bundle ::= SEQUENCE OF {<br>characteristicInfoType CharacteristicInformation,<br>bundlingFactor INTEGER<br>} | This attribute defines the characteristic information of the layer (in the ITU-T G.805 sense) to which the entity under consideration belongs. It is used to determine whether subnetwork connection/connectivity is possible. The signal Id may be a simple rate and format, a bundle of entities with the same characteristic information which form an aggregate signal, or a complex type containing groupings of different bundles. The complex type may be applicable to certain multimedia applications involving multiple parallel connections between endpoint locations. |
| sNwAcRelId | NameType | This attribute is the identifier of an instance of the IOC SNw_Ac_Rel_CL (subnetwork access relationship). |

**Table 42 – Common information attribute definition**

| Name | Information type | Description |
|---|---|---|
| sNwAcRelComponentPtrList | ComponentPtrList_CL ::= CHOICE<br>{ ordered OrderedComponents,<br>unordered UnorderedComponents<br>}<br>OrderedComponents ::= SEQUENCE OF Name<br>UnorderedComponents ::= SET OF Name | This attribute is used where the instance of SNw_Ac_Rel is made up of a number of component SNw_Fw_Rel and Top_Lk_U instances within the same layer.<br>The components can be either ordered or unordered. When they are ordered, the value of this attribute should be an ordered sequence of either SNw_Fw_Rel or Top_Lk_U instances that form this instance.<br>When they are unordered, the value of this attribute should be an unordered set of SNw_Fw_Rel and Top_Lk_U instances that provide all the connectivity possibilities for information to be transferred from the input FwEP(s) to the output FwEPs. |
| sNwFwRelComponentPtrList | ComponentPtrList_CL | This attribute is used where the instance of SNw_Fw_Rel is made up of a number of component SNw_Fw_Rel and Top_Lk_U instances within the same layer.<br>The components can be either ordered or unordered. When they are ordered, the value of this attribute should be an ordered sequence of either SNw_Fw_Rel or Top_Lk_U instances that form this instance.<br>When they are unordered, the value of this attribute should be an unordered set of SNw_Fw_Rel and Top_Lk_U instances that provide all the connectivity possibilities for information to be transferred from the input FwIP(s) and the output FwIP(s). |
| sNwId | Name | This attribute is the identifier of an instance of the IOC SNw_U (subnetwork). |
| subPartitionPtr | RelatedObjectInstance | This attribute is a pointer to an instance of Fw_Im_Pt_U which is in a lower level partition. Where the lowest level of Fw_Im_Pt_U instance points to a NE forwarding point via the NE assignment pointer, the value of the subPartitionPtr is null. |
| superPartitionPtr | RelatedObjectInstance | This attribute is a pointer to an instance of Fw_Im_Pt_U which is in a higher level partition. It will only be present for those Fw_Im_Pt_U instances in the lower partition which has a direct correspondence to the Fw_Im_Pt_U instances at the higher level. It can be null. |

**Table 42 – Common information attribute definition**

| Name | Information type | Description |
|---|---|---|
| supportableClientList | SupportableClientList ::= SET OF ObjectClass<br>ObjectClass ::= OBJECT IDENTIFIER | The value of this attribute is the list of IOCs representing the clients that the particular managed object is capable of supporting. This may be a subset of the client layers identified in [b-ITU-T G.803] by the particular server layer managed object. |
| supportedByObjectList | ObjectList | The supported by object List is an attribute type whose value identifies a set of object instances which are capable of directly affecting a given managed object. The object instances include both physical and logical objects. This attribute does not force internal details to be specified, but only the necessary level of detail required for management. If the object instances supporting the managed object are unknown to that object, then this attribute is an empty set. |
| systemTitle | SystemTitle ::= CHOICE {<br>distinguishedName Name,<br>oid OBJECT IDENTIFIER,<br>nothing NULL<br>} | This attribute may be used in naming instances of system managed object class. |
| topEdDirectionality | TopologicalEndDirectionality ::= ENUMERATED {<br>undefined,<br>sink,<br>source,<br>bidirectional<br>} | This attribute specifies whether the associated instance of the IOC Ac_Gr_U or Lk_Pt_U is sink, source, bidirectional, or undefined. |
| totalFwPtPlCapacity | Bandwidth | This attribute indicates the total amount of bandwidth supported on the forwarding point pool, which includes both assigned and unassigned bandwidth, based on the amount of bandwidth provided by the underlying server layer link. |
| totalLkPtCapacity | PointCapacity | This attribute indicates the total capacity of a link point which is either the total number of forwarding intermediate points associated with a link point or the total bandwidth of the link point. |
| trafficDescriptor | TrafficDescriptor ::= ObjectInstance | This attribute contains the traffic descriptor of an access relationship. It is to be used with flexible bandwidth allocation. |
| trailId | Name | This attribute is the identifier of an instance of the IOC Trail_CO. |

**Table 42 – Common information attribute definition**

| Name | Information type | Description |
|---|---|---|
| usageCost | UsageCost :: = INTEGER(0..255) | This attribute contains the costs for a transport entity. It is to be used as selection/routing criteria. |
| usageState | UsageState ::= ENUMERATED {<br>idle,<br>active,<br>busy<br>} | See also [ITU-T M.3701] for details. |
| userLabel | UserLabel ::= String | This attribute assigns a user friendly name to the associated IOC instance. |
| zEnd | ObjectInstance | This attribute is a pointer to a subnetwork, a link point, or access group in the same network layer domain. |
| zEndFwEdPtList | ObjectList | The value of this attribute identifies one or more forwarding end point instances, which represents the sink end of an access relationship. This attribute cannot be null. |
| zEndFwPtList | ObjectList | The value of this attribute identifies one or more forwarding (intermediate/end) points of an instance of a subclass of the connectivity object class. |

## 7.2 Notifications

See clause 8.2 of [ITU-T M.3160] for the definition of common notifications.

# Appendix I

## Relationship between IOCs and functional architecture entities

(This appendix does not form an integral part of this Recommendation.)

This appendix describes the relationships between IOCs defined in this Recommendation and the functional architectural entities described in [ITU-T G.800], [ITU-T G.805] and [ITU-T G.809]. These are described in Table I.1 below:

**Table I.1 – Relationships between the IOCs defined in this Recommendation and the architectural entities defined in [ITU-T G.800], [ITU-T G.805] and [ITU-T G.809]**

<table>
<tr><th colspan="2">IOCs from this Recommendation</th><th>Unified architecture [ITU-T G.800]</th><th>CL architecture [ITU-T G.809]</th><th>CO achitecture [ITU-T G.805]</th><th>Category</th></tr>
<tr><td colspan="2">Ly_Nw_Dm_U</td><td>Layer network</td><td>Layer network</td><td>Layer network</td><td rowspan="4">Topological components</td></tr>
<tr><td colspan="2">SNw_U</td><td>Subnetwork</td><td>Flow domain</td><td>Subnetwork</td></tr>
<tr><td rowspan="2">Abs_Lk_U</td><td>Log_Lk_CO</td><td rowspan="2">Link</td><td rowspan="2">Flow point pool link</td><td rowspan="2">Link</td></tr>
<tr><td>Top_Lk_U</td></tr>
<tr><td colspan="2">Ac_Gr_U</td><td>Access group</td><td>Access group</td><td>Access group</td></tr>
<tr><td rowspan="2">Abs_Ac_Rel_U</td><td>Trail_CO</td><td rowspan="2">Access relationship</td><td>–</td><td>Trail</td><td rowspan="5">Transport entities</td></tr>
<tr><td>SNw_Ac_Rel_CL</td><td>Connectionless trail</td><td></td></tr>
<tr><td rowspan="3">Abs_Fw_Rel_U</td><td>SNw_Con_CO</td><td>Channel forwarding relationship (single source)</td><td>Flow domain flow</td><td>Subnetwork connection</td></tr>
<tr><td>–</td><td>Channel forwarding relationship (multiple sources)</td><td>Flow domain flow</td><td>Not applicable</td></tr>
<tr><td>SNw_Fw_Rel_CL</td><td>Destination forwarding relationship</td><td>Flow domain flow</td><td>Not applicable</td></tr>
<tr><td colspan="2">Lk_Con_CO</td><td>Link connection</td><td>Link flow</td><td>Link connection</td><td></td></tr>
<tr><td colspan="2">–</td><td>Adaptation</td><td>Adaptation</td><td>Adaptation</td><td rowspan="4">Transport processing functions</td></tr>
<tr><td colspan="2">–</td><td>Termination</td><td>Flow termination</td><td>Trail termination</td></tr>
<tr><td colspan="2">–</td><td>Layer processor</td><td>Not described</td><td>Not described</td></tr>
<tr><td colspan="2">–</td><td>Forwarding</td><td>Not described</td><td>Not described</td></tr>
</table>

**Table I.1 – Relationships between the IOCs defined in this Recommendation and the architectural entities defined in [ITU-T G.800], [ITU-T G.805] and [ITU-T G.809]**

<table>
<tr><th colspan="2">IOCs from this Recommendation</th><th>Unified architecture [ITU-T G.800]</th><th>CL architecture [ITU-T G.809]</th><th>CO achitecture [ITU-T G.805]</th><th>Category</th></tr>
<tr><td colspan="2">The same as Fw_Ed_Pt_U</td><td>Access point</td><td>Access point</td><td>Access point</td><td rowspan="3">Reference points</td></tr>
<tr><td rowspan="2">Abs_Fw_Pt_U</td><td>Fw_Im_Pt_U</td><td>Forwarding point</td><td>Flow point</td><td>Connection point</td></tr>
<tr><td>Fw_Ed_Pt_U</td><td>Forwarding end point</td><td>Termination flow point</td><td>Termination connection point</td></tr>
<tr><td colspan="2">Connection_CO</td><td>Connection</td><td>–</td><td>–</td><td rowspan="4">Others</td></tr>
<tr><td rowspan="2">Abs_Lk_Pt_U</td><td>Top_Lk_Pt_U</td><td rowspan="2">–</td><td rowspan="2">–</td><td rowspan="2">–</td></tr>
<tr><td>Log_Lk_Pt_CO</td></tr>
<tr><td colspan="2">Fw_Pt_Pl_U</td><td>–</td><td>–</td><td>–</td></tr>
</table>

# Appendix II

## Relationship between IOCs from ITU-T M.3160 and this Recommendation

(This appendix does not form an integral part of this Recommendation.)

This appendix provides a table which indicates the relationship between the IOCs defined in [ITU-T M.3160] and this Recommendation.

**Table II.1 – Relationships between the IOCs defined in [ITU-T M.3160] and this Recommendation**

| IOCs from this Recommendation | IOCs from [ITU-T M.3160] |
|---|---|
| Ly_Nw_Dm_U<br>(Layer network domain – Unified) | Layer network domain |
| SNw_U<br>(Subnetwork – Unified) | Subnetwork,<br>Flow domain |
| Abs_Lk_U<br>(Abstract link – Unified) | Abstract link |
| Top_Lk_U<br>(Topological link – Unified) | Topological link,<br>Flow point pool link |
| Log_Lk_CO<br>(Logical link – CO) | Logical link |
| Lk_Con_CO<br>(Link connection – Connection oriented) | Link connection |
| Connection_CO<br>(Connection – Connection oriented) | Connection |
| Ac_Gr_U<br>(Access group – Unified) | Access group |
| Abs_Fw_Rel_U<br>(Abstract forwarding relationship – Unified) | – |
| SNw_Con_CO<br>(Subnetwork connection – Connection oriented) | Subnetwork connection |
| SNw_Fw_Rel_CL<br>(Subnetwork forwarding relationship – Connectionless) | Flow domain fragment |
| Abs_Fw_Pt_U<br>(Abstract forwarding point – Unified) | Termination point,<br>Network termination point,<br>Connectionless point |
| Fw_Im_Pt_U<br>(Forwarding intermediate point – Unified, FwIP) | Connection termination point source/sink/bidirectional,<br>Network CTP source/sink/bidirectional,<br>Flow point source/sink/bidirectional |
| Fw_Ed_Pt_U<br>(Forwarding end point – Unified, FwEP) | Trail termination point source/sink/bidirectional,<br>Network TTP source/sink/bidirectional,<br>Flow termination point Source/sink/bidirectional |
| Abs_Lk_Pt_U<br>(Abstract link point – Unified) | Abstract link end |

**Table II.1 – Relationships between the IOCs defined in [ITU-T M.3160] and this Recommendation**

| IOCs from this Recommendation | IOCs from [ITU-T M.3160] |
|---|---|
| Top_Lk_Pt_U<br>(Topological link point – Unified) | Topological link end |
| Log_Lk_Pt_CO<br>(Logical link point – Connection oriented) | Logical link end |
| Fw_Pt_Pl_U<br>(Forwarding point pool – Unified, FwPP) | Termination point pool<br>Flow point pool |
| Abs_Ac_Rel_U<br>(Abstract access relationship – Unified) | – |
| Trail_CO<br>(Trail – Connection oriented) | Trail |
| SNw_Ac_Rel_CL<br>(Subnetwork access relationship – Connectionless) | Connectionless trail |

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

[b-ITU-T M.3010] Recommendation ITU-T M.3010 (2000), *Principles for a telecommunications management network*.

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