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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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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.

FOREWORD

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

NOTE

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As of the date of approval of this Recommendation, 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/>.

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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.

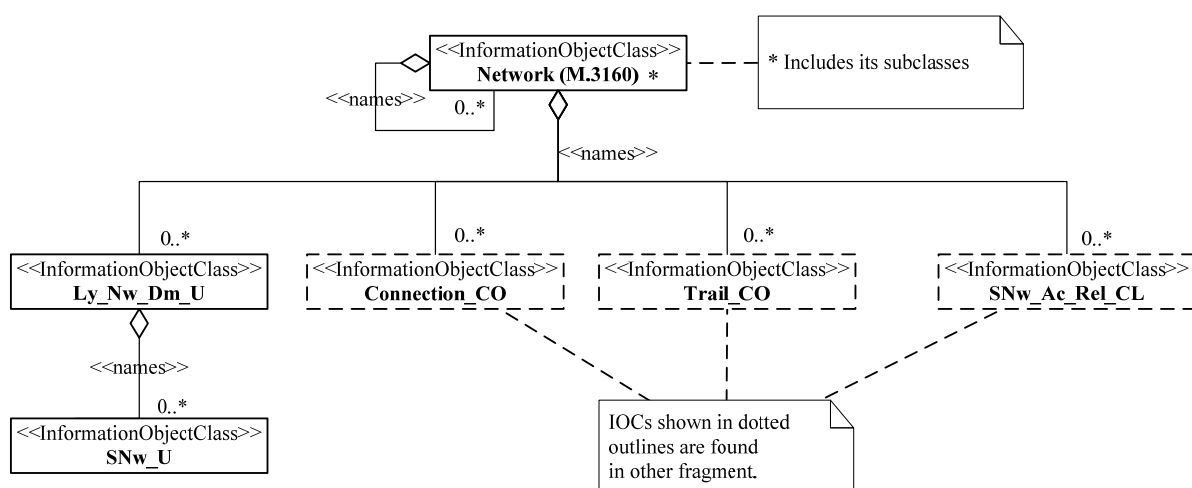


Figure 1 – Containment diagram of network fragment

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

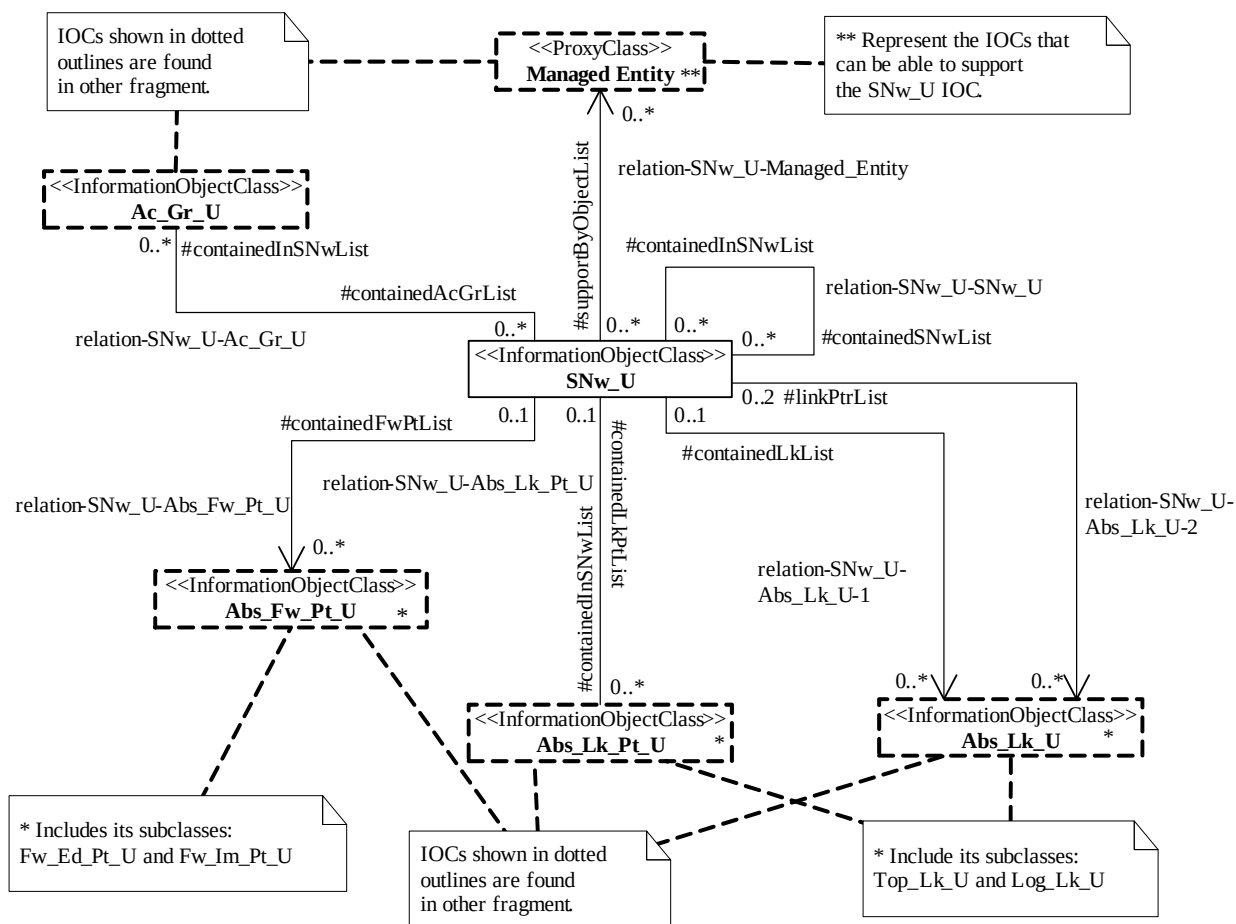


Figure 2 – ER diagram of network fragment

6.2.1.2 Forwarding point fragment

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

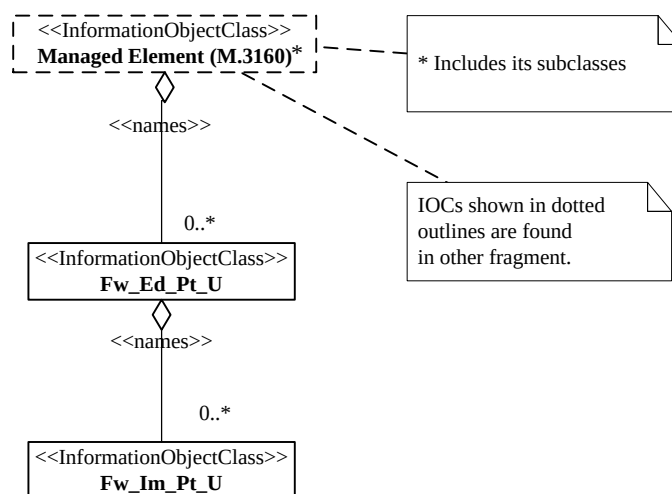


Figure 3 – Forwarding point fragment – Network element view

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

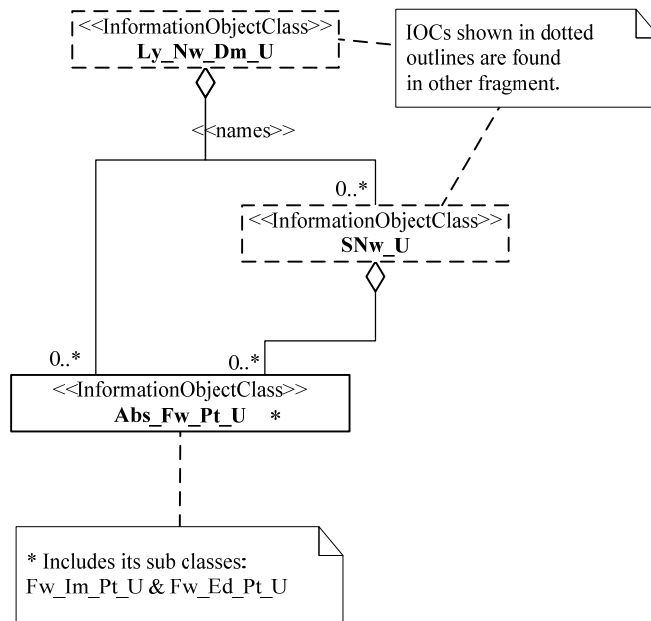


Figure 4 – Forwarding point fragment – Network view

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

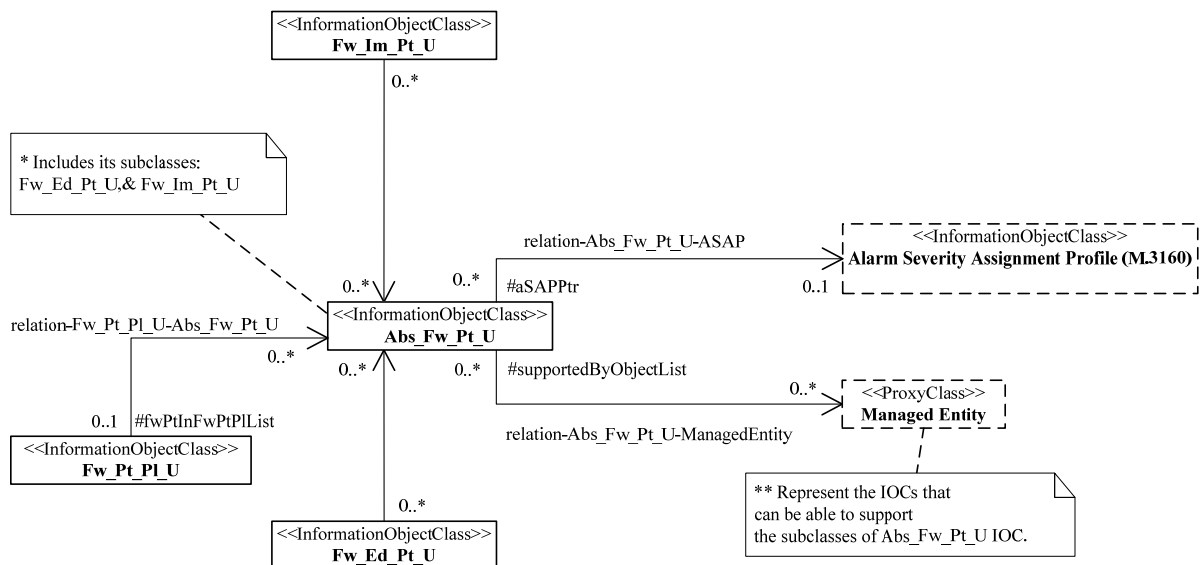


Figure 5 – ER diagram of forwarding point fragment

6.2.1.3 Topology and connectivity fragment

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

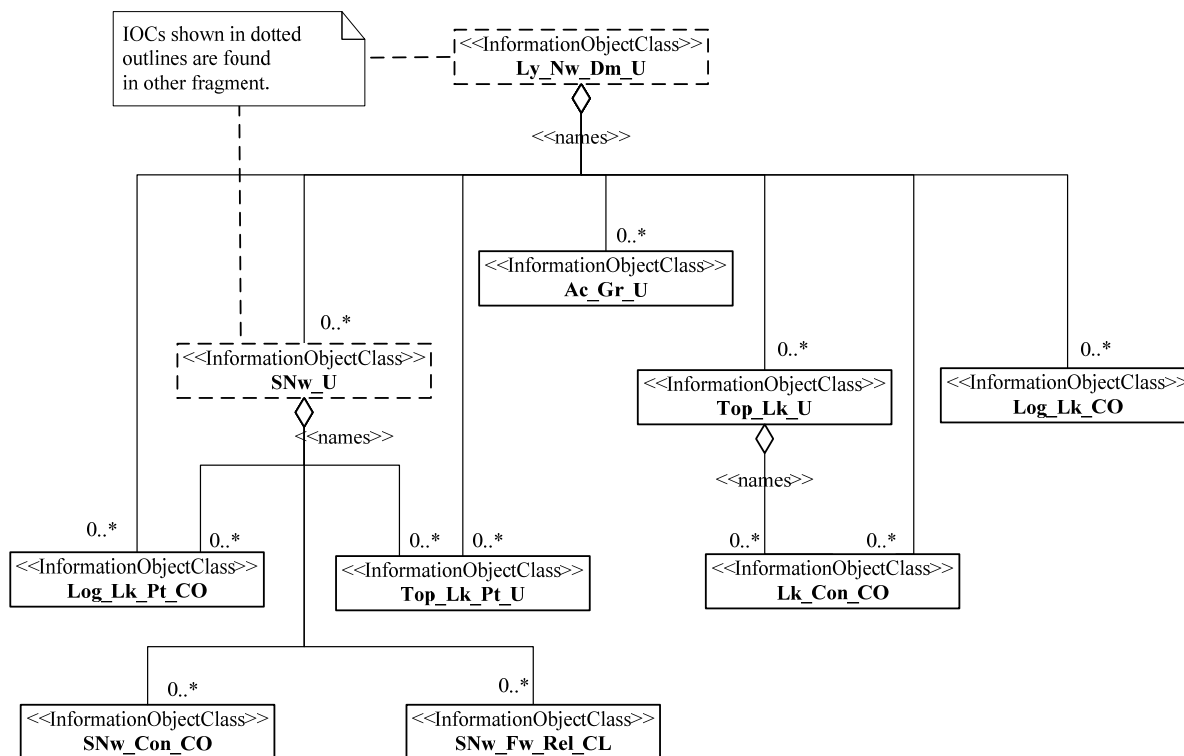


Figure 6 – Topology and connectivity fragment

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

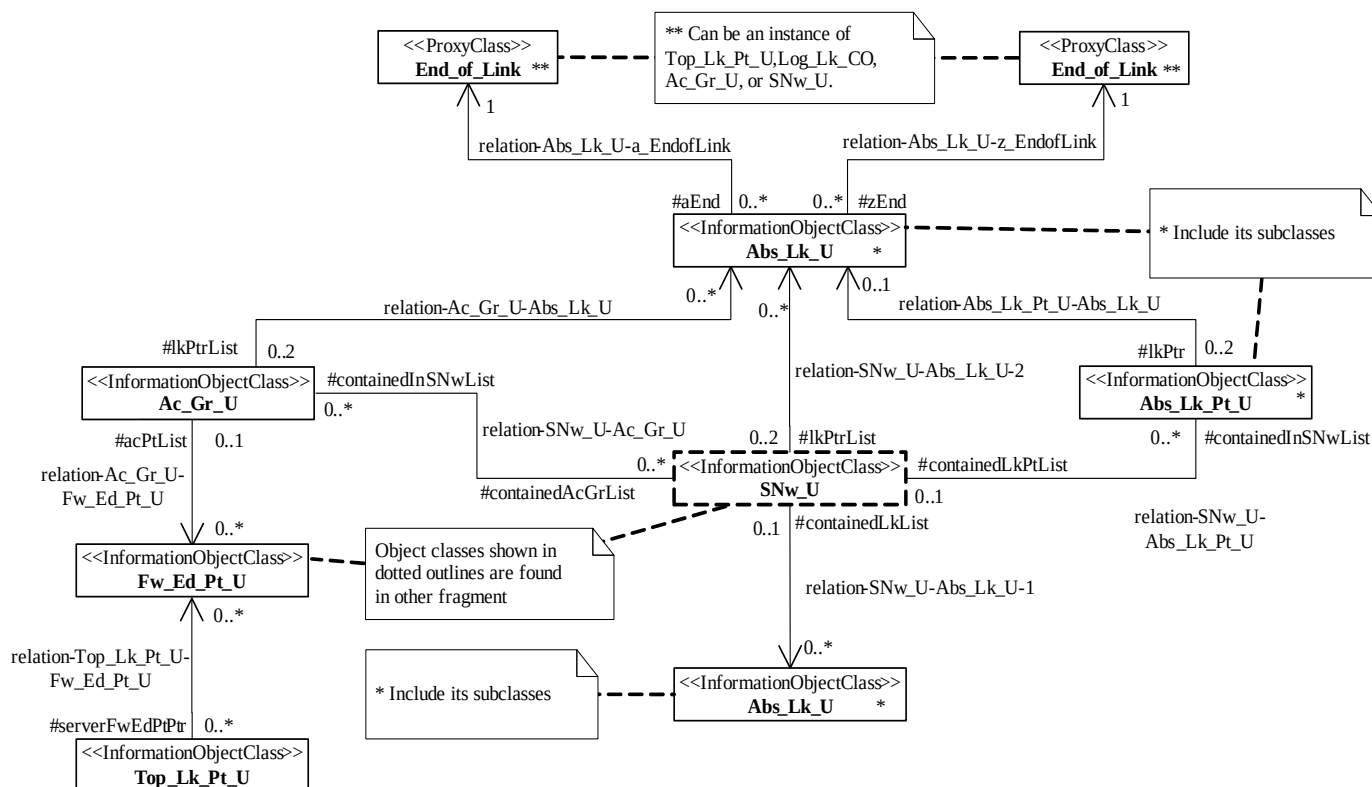


Figure 7 – ER diagram of topology and connectivity fragment (part 1)

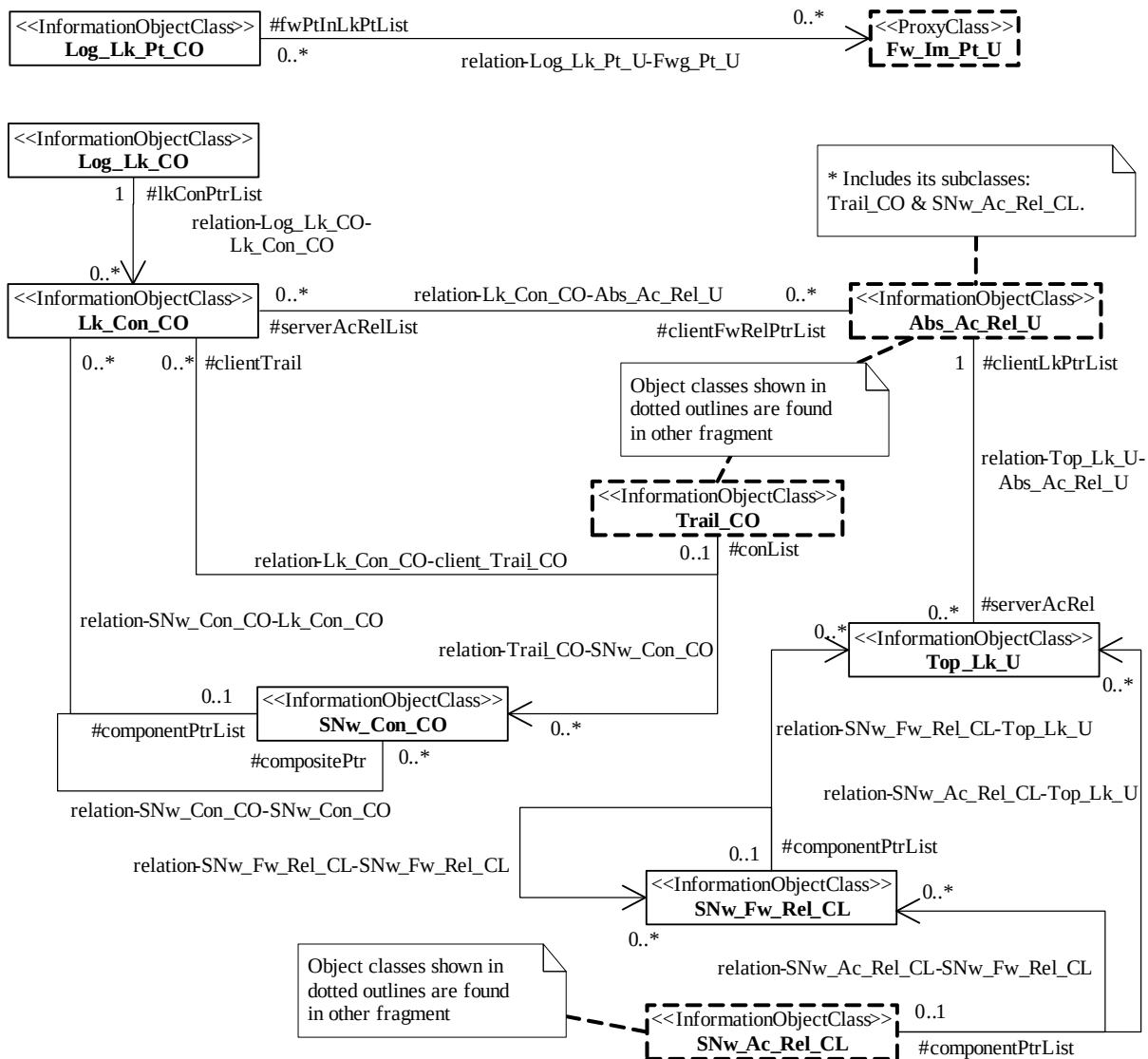


Figure 8 – ER diagram of topology and connectivity fragment (part 2)

6.2.1.4 Transmission fragment

IOCs in the transmission fragment are presented in Figure 9.

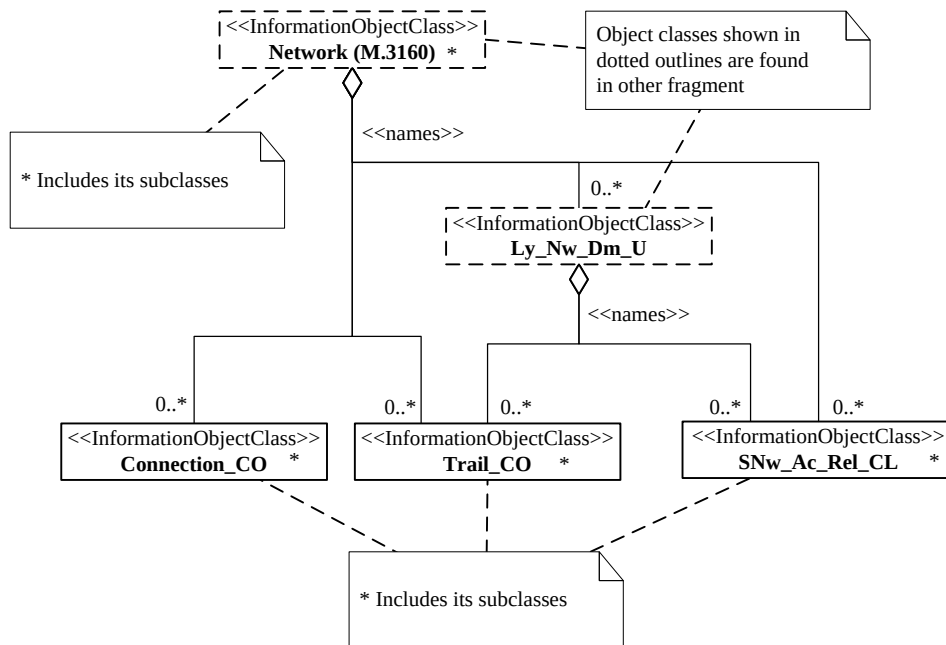


Figure 9 – Transmission fragment

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

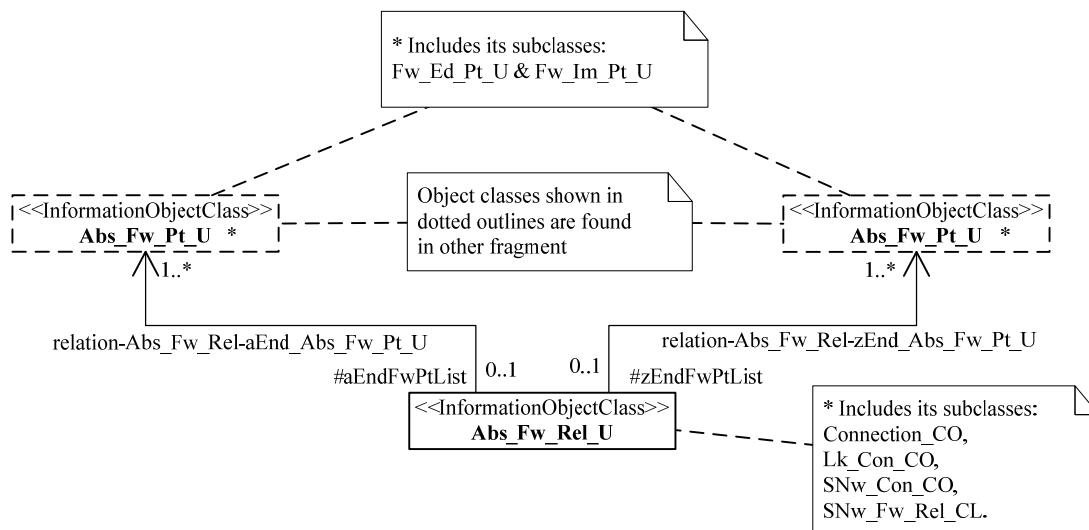


Figure 10 – ER diagram of transmission fragment (part 1)

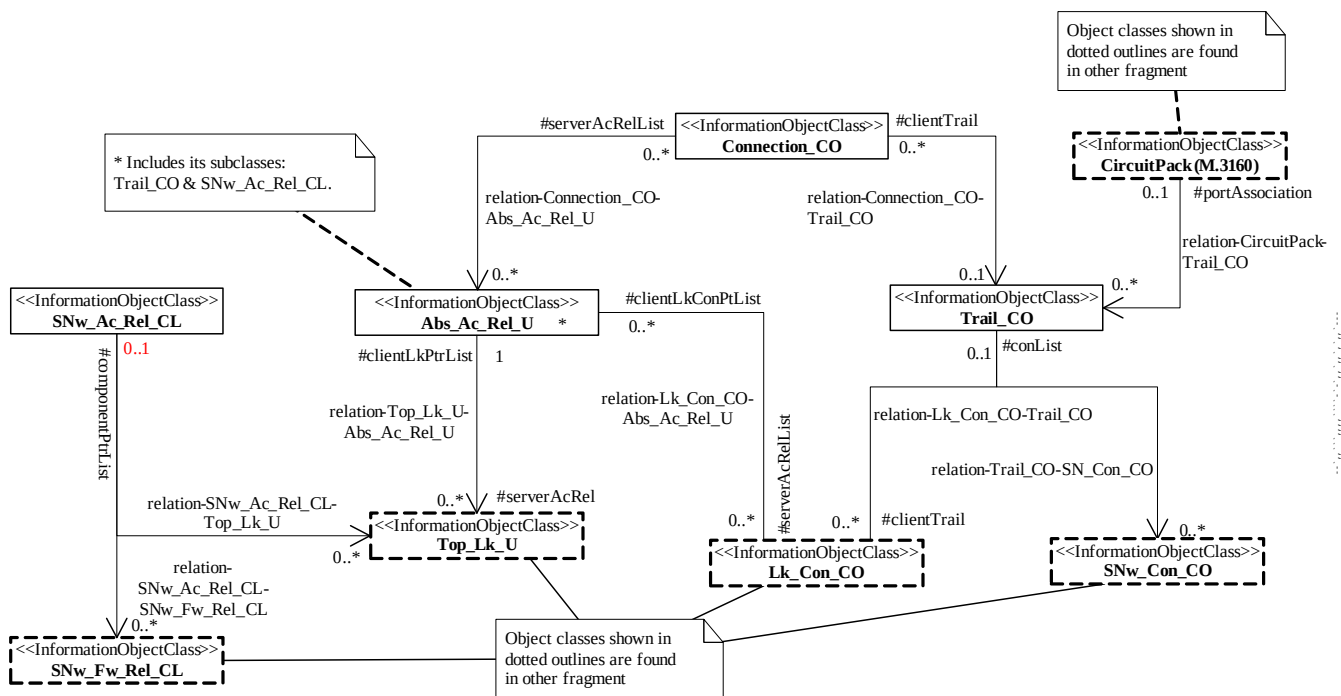


Figure 11 – ER diagram of transmission fragment (part 2)

6.2.2 Inheritance

6.2.2.1 Network fragment

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

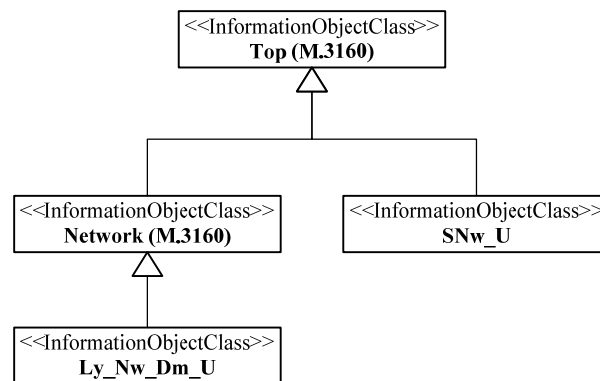


Figure 12 – Inheritance diagram of network fragment

6.2.2.2 Forwarding point fragment

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

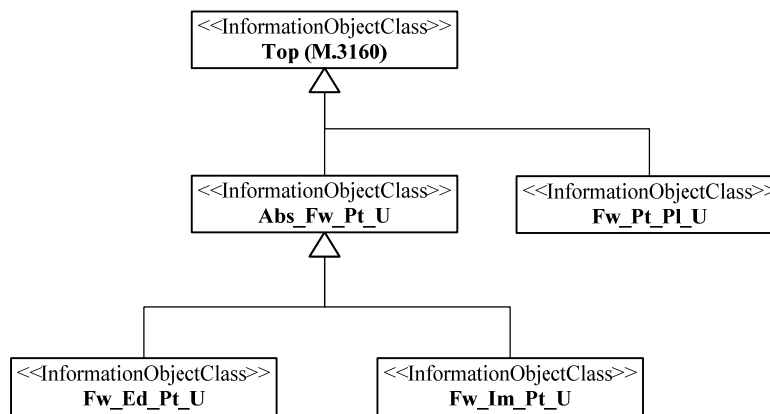


Figure 13 – Inheritance diagram of forwarding point fragment

6.2.2.3 Topology and connectivity fragment

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

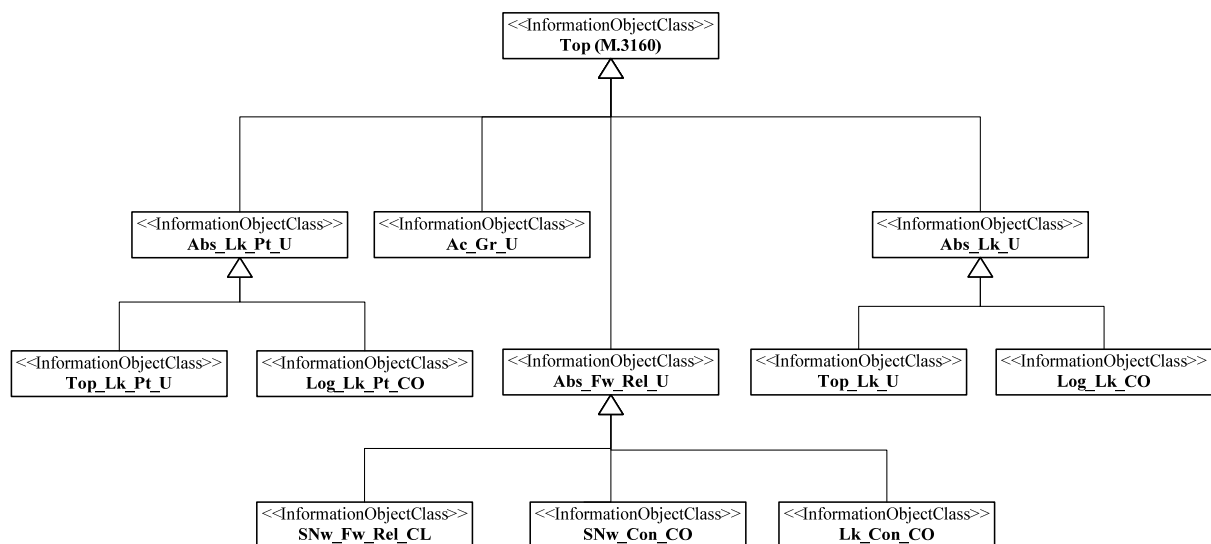


Figure 14 – Inheritance diagram of topology and connectivity fragment

6.2.2.4 Transmission fragment

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

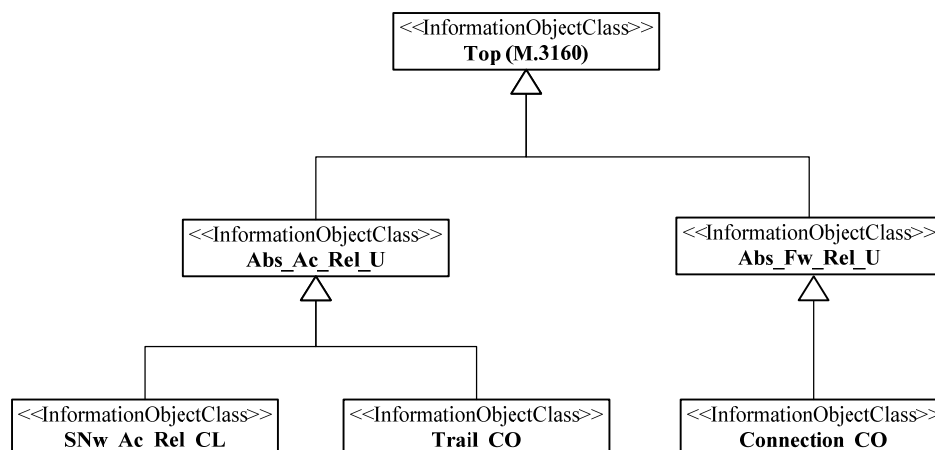


Figure 15 – Inheritance diagram of transmission fragment

6.2.3 Intra-layer and inter-layer relationships

6.2.3.1 Overview

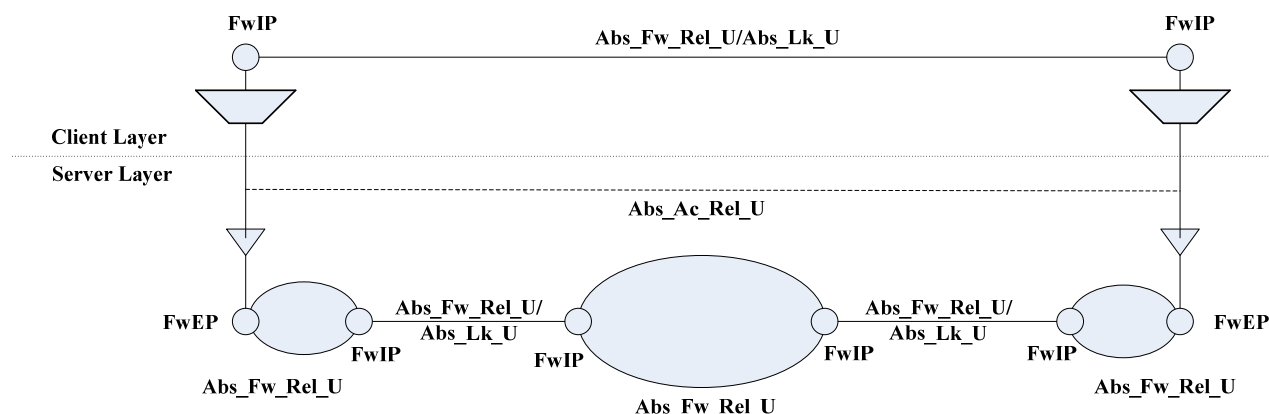


Figure 16 – General inter-layer layer relationship

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.

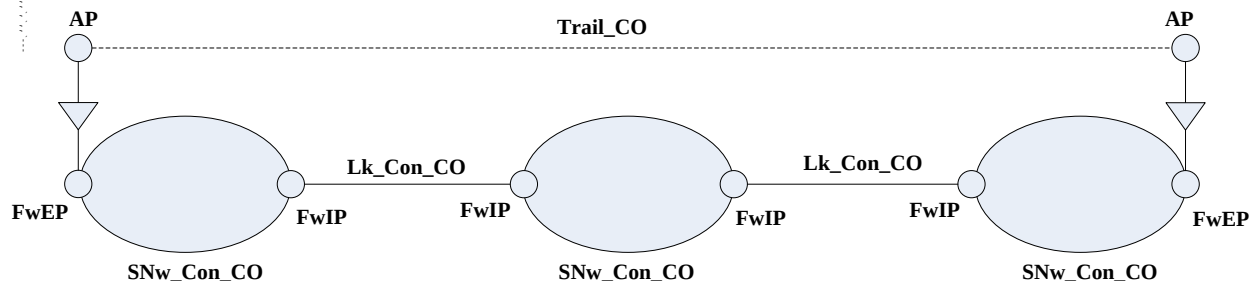


Figure 17 – Intra-layer relationship for CO networks – Trail_CO composition

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.

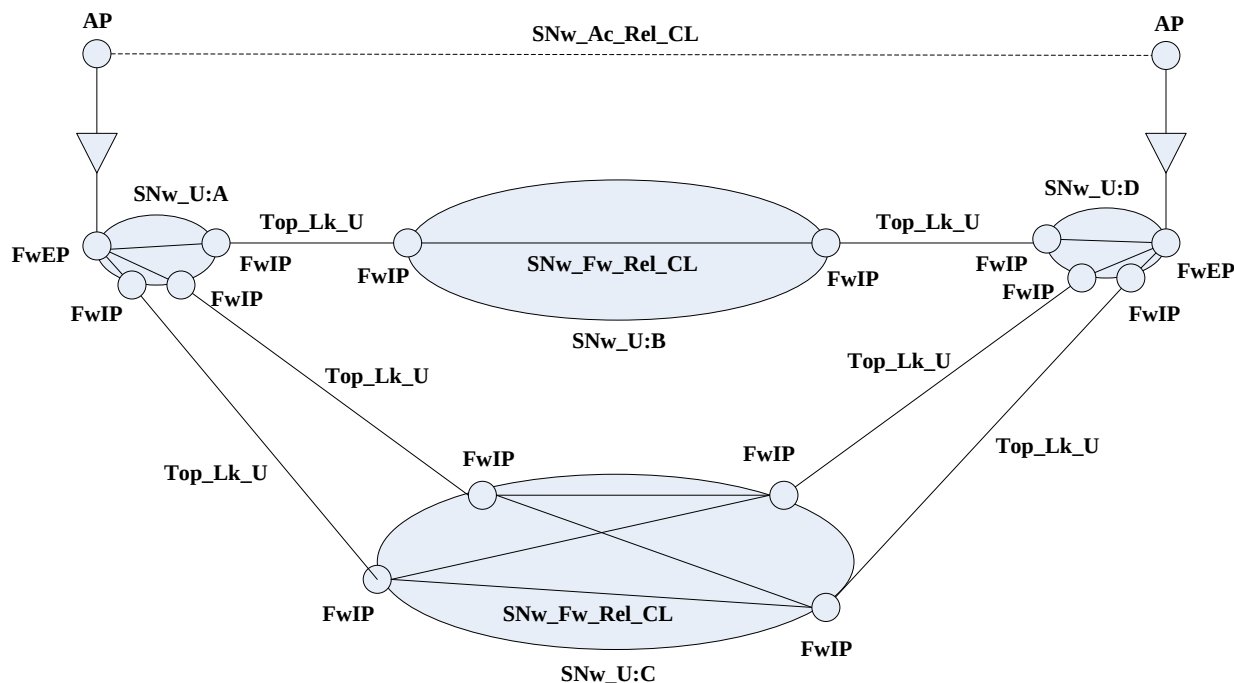


Figure 18 – Intra-layer relationship for CL networks – SNw_Ac_Rel_CL composition

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:

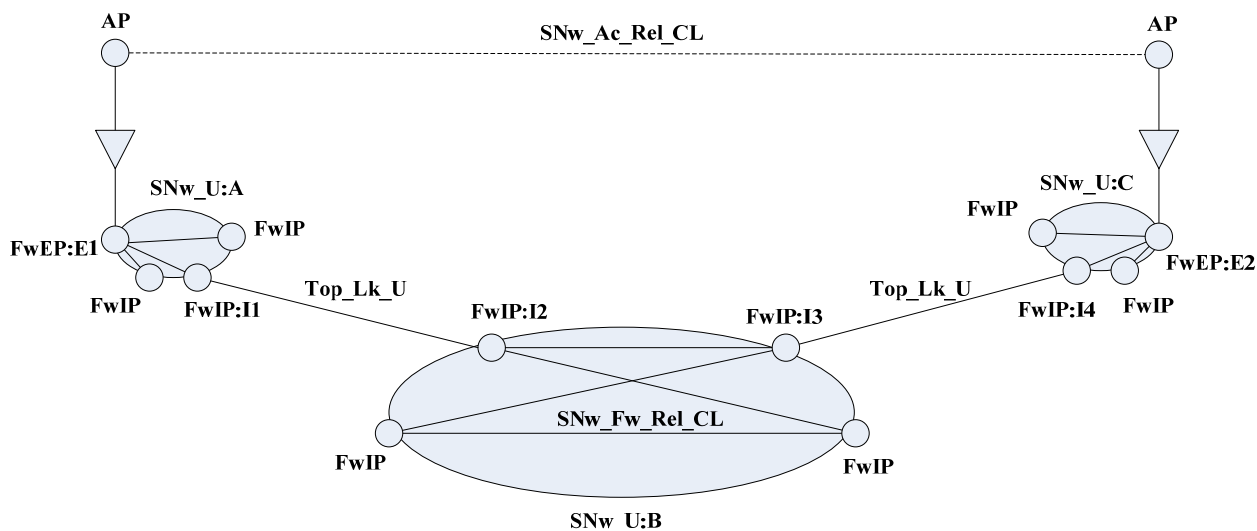


Figure 19 – Intra-layer relationship for CL networks – SNw_Ac_Rel_CL composition which supports ordered sequence

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.

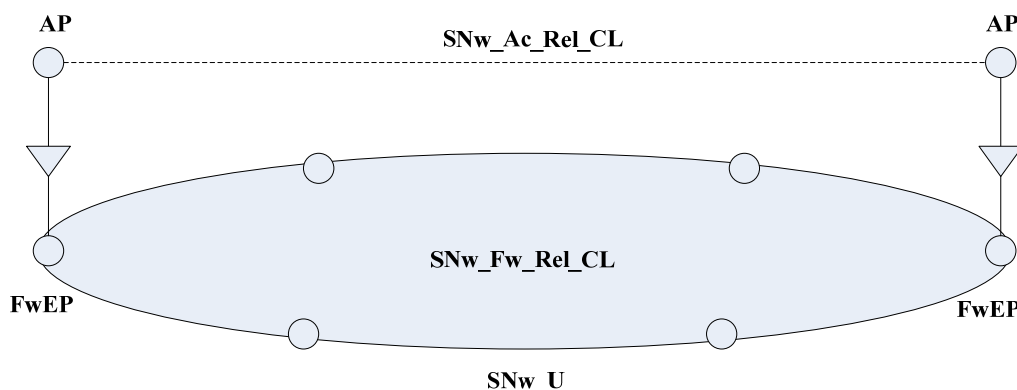


Figure 20 – Intra-layer relationship for CL networks – SubNetwork_Access_Relationship_CL supported by one SNw_Fw_Rel_CL

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.

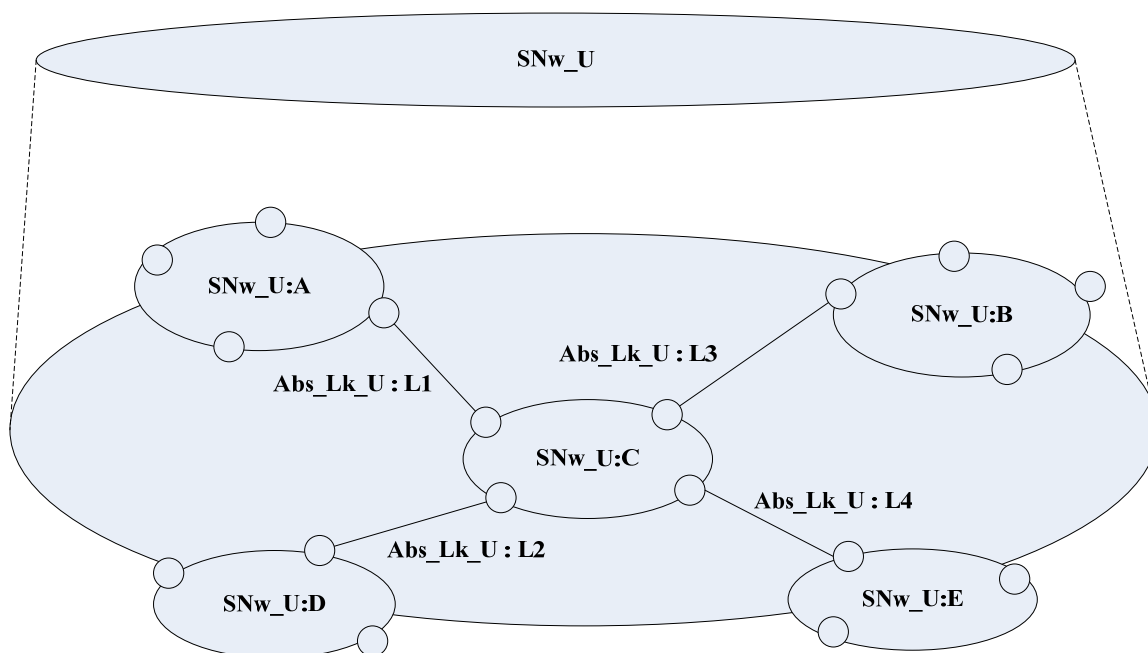


Figure 21 – Inter-layer relationship: Subnetwork partitioning

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.

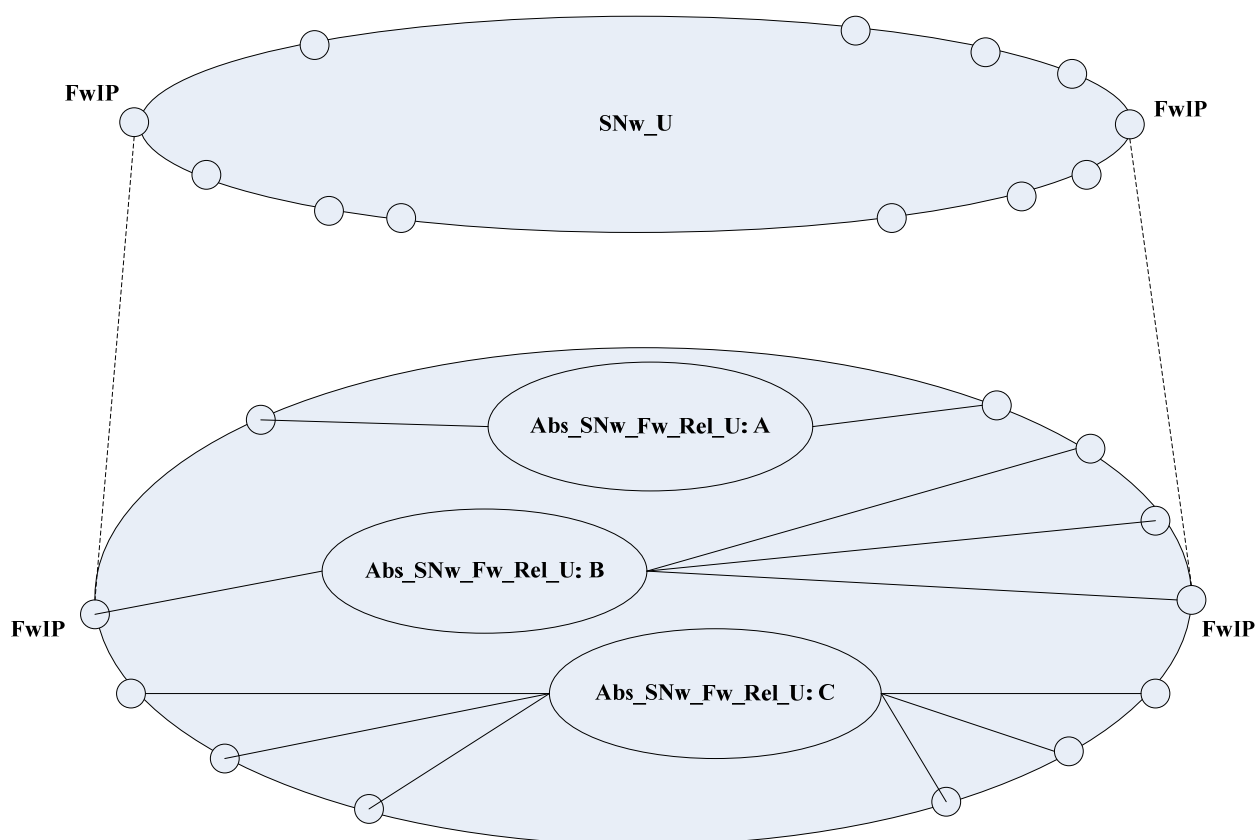


Figure 22 – Inter-layer relationship: Subnetwork and subnetwork forwarding relationship

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.

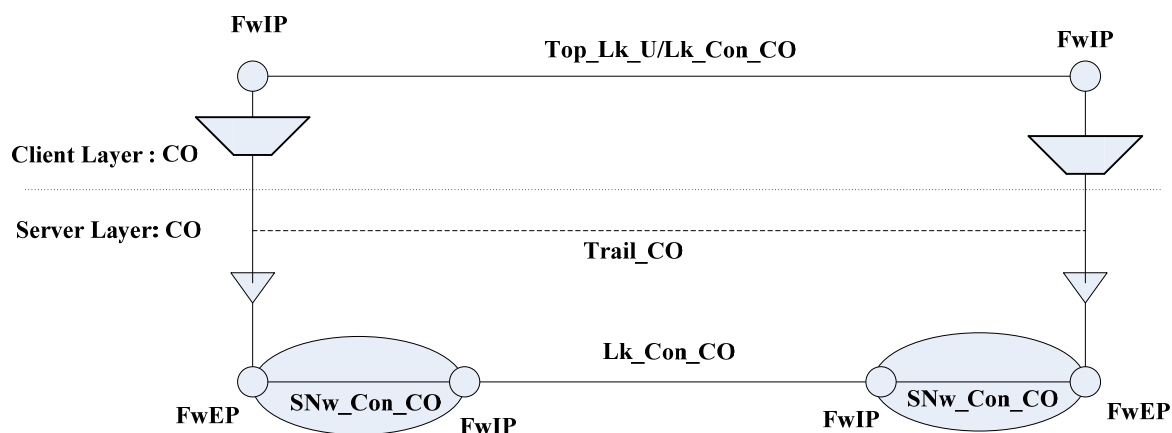


Figure 23 – Inter-layer relationship: CO over CO

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.

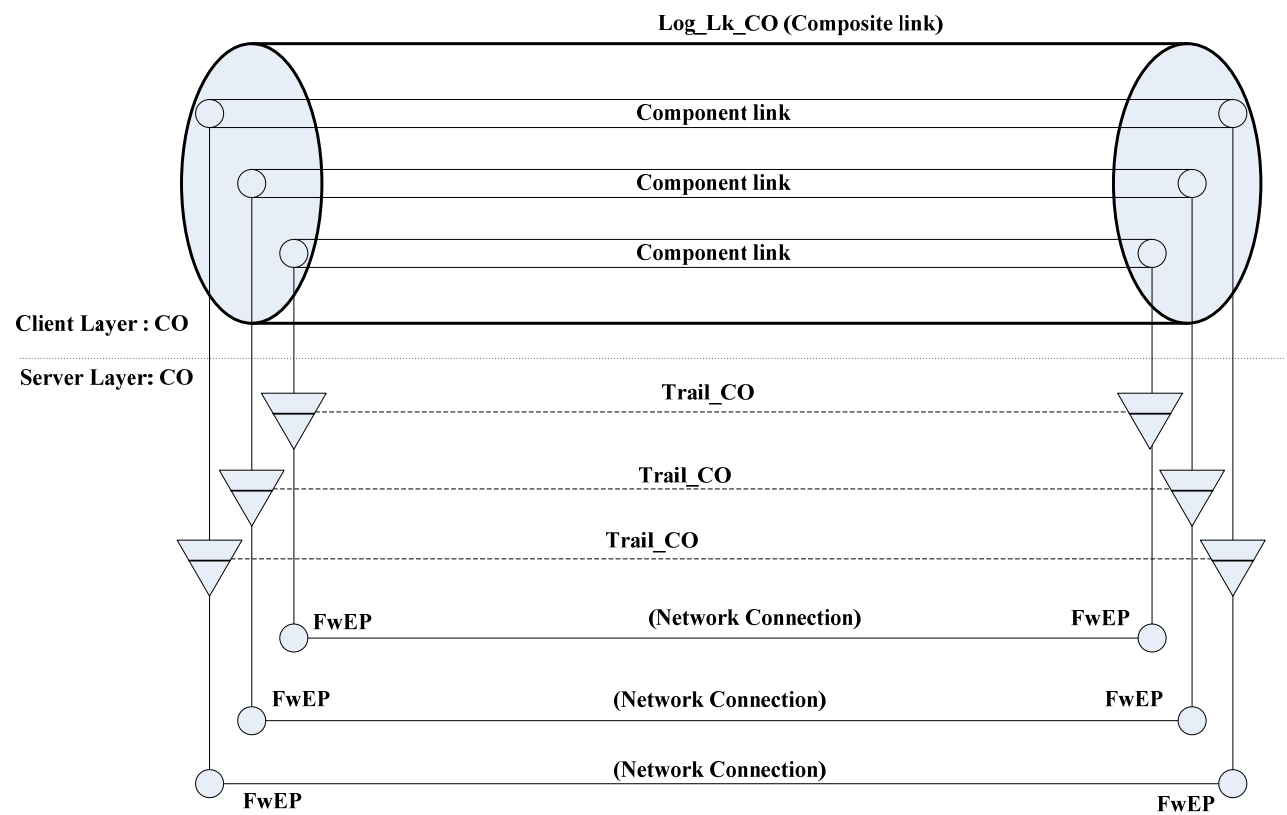


Figure 24 – Inter-layer relationship: Composite link

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.

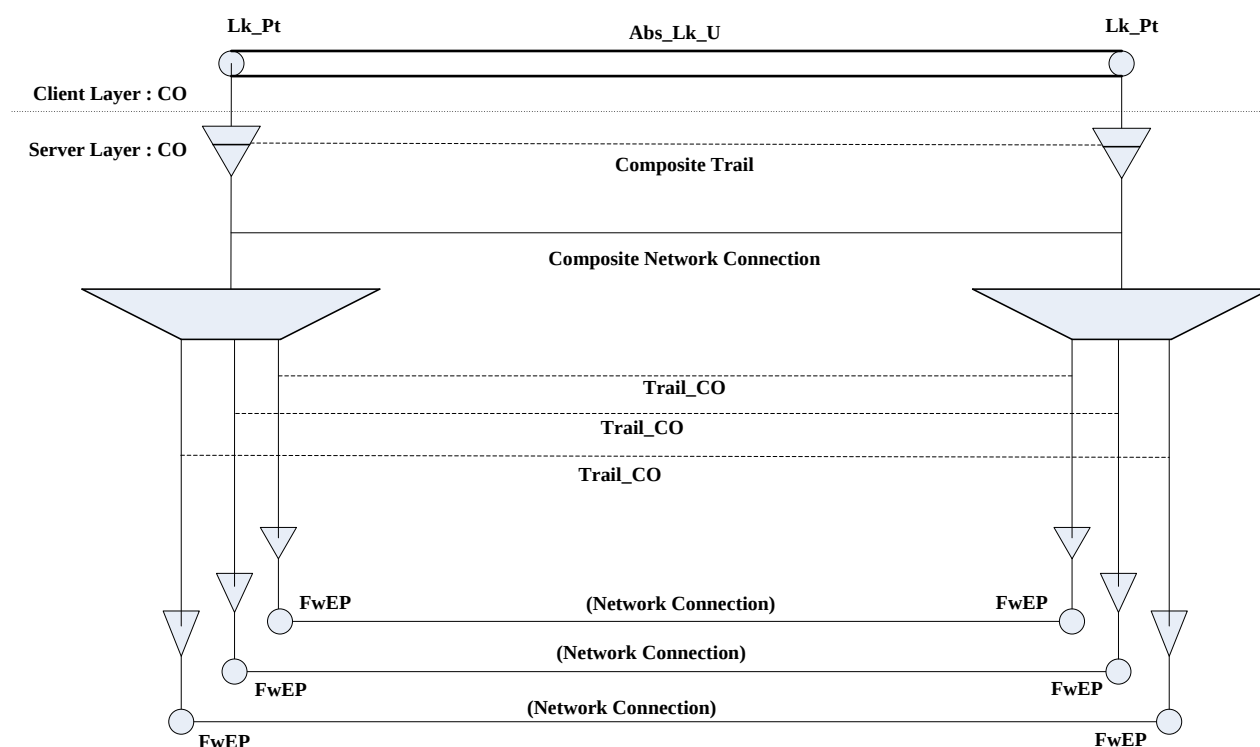


Figure 25 – Inter-layer relationship: Client link supported by inverse multiplexing

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.

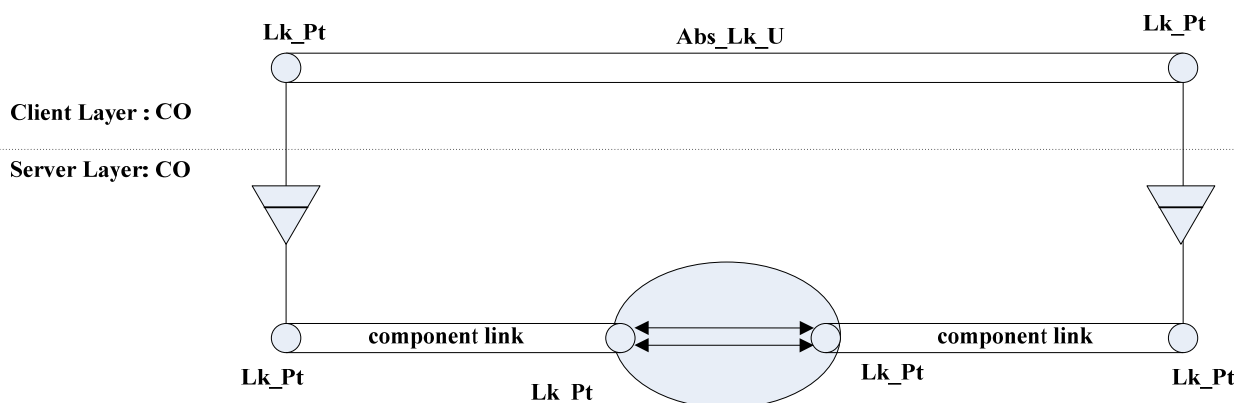


Figure 26 – Inter-layer relationship: Serial compound composed of component links and a subnetwork with configured channel forwarding relationships

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.

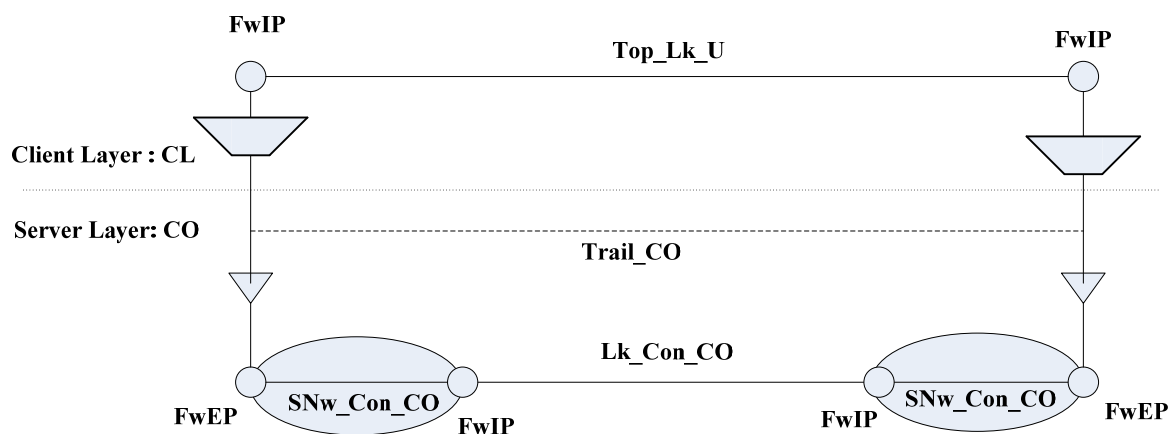


Figure 27 – Inter-layer relationship: CL over CO

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.

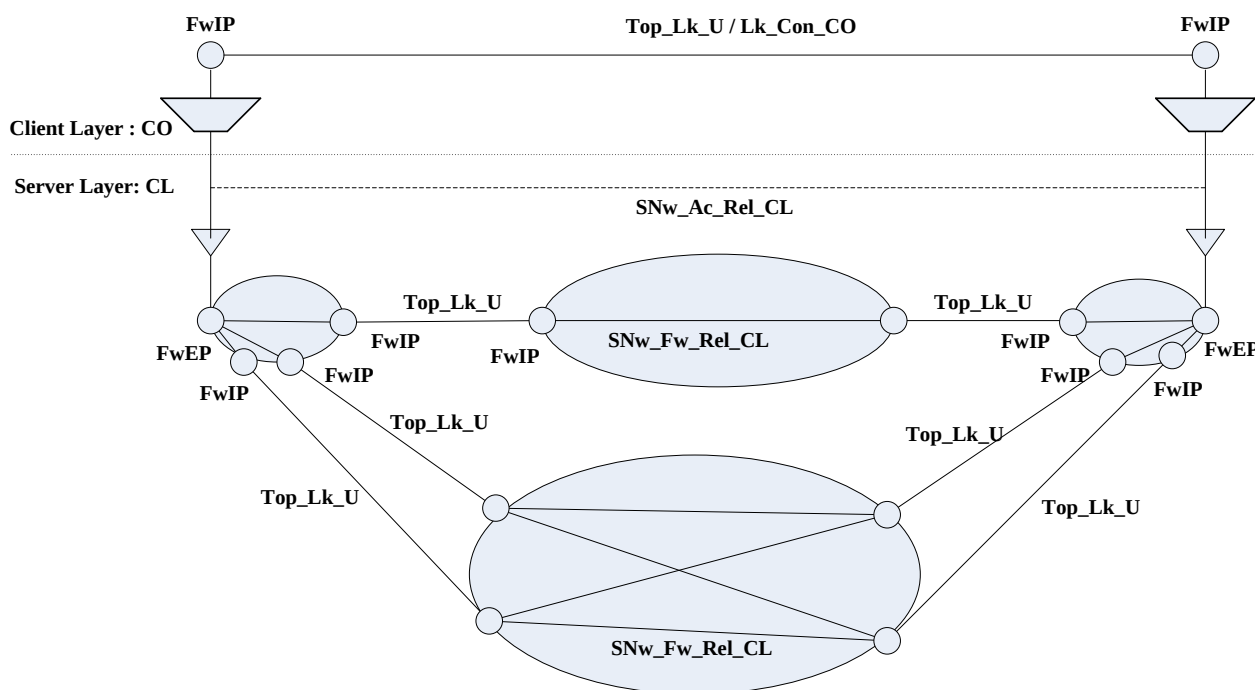


Figure 28 – Inter-layer relationship: CO over CL

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.

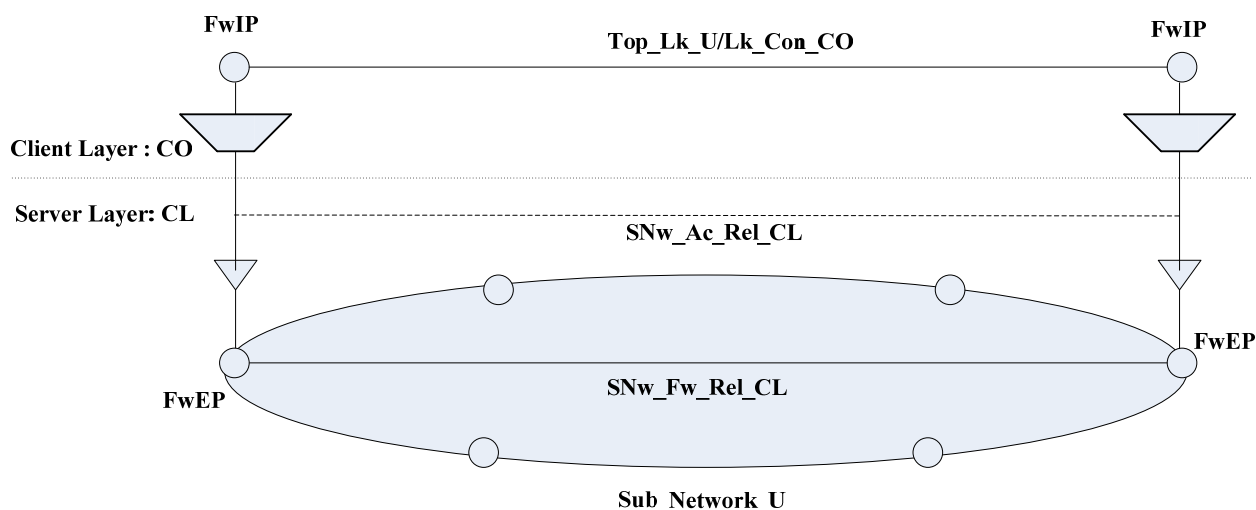


Figure 29 – Inter-layer relationship: CO over CL, supported by one SubNetwork_Forwarding_Relationship_CL

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.

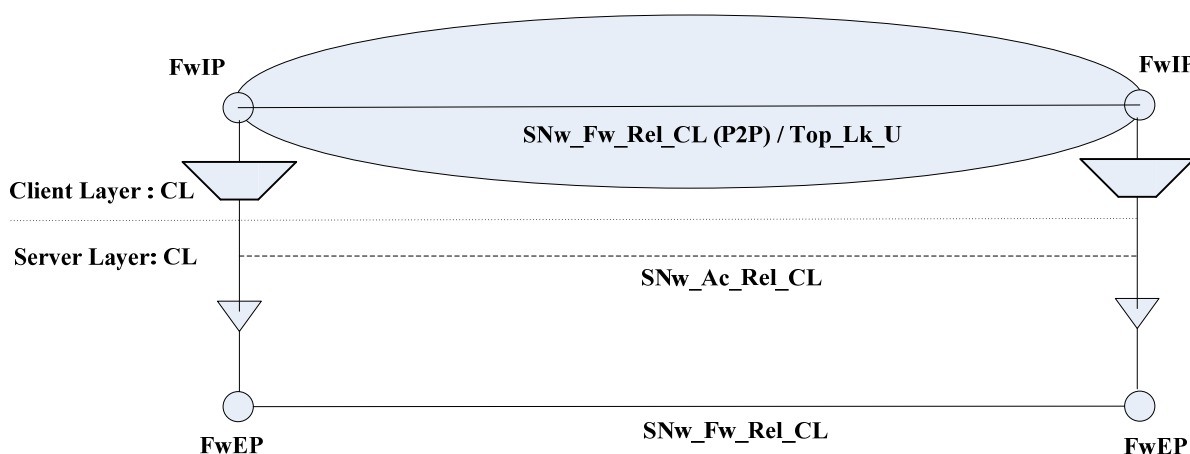


Figure 30 – Inter-layer relationship: CL over CL (P2P)

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.