Question(s):	12		**Meeting, date:**	Darmstadt, 1 – 5 March 2010	
Study Group:	15	**Working Party:** 3	**Intended type of document** (R-C-TD):		WD10r 5
Source:	Editing group				
Title:	G.872 Draft amendment 2				
Contact:	Malcolm Betts Rapporteur Q.12.		Tel: +1 678 534-2542 Email: malcolm.betts@zte.com.cn		
Contact:			Tel: Email:		

Please don't change the structure of this table, just insert the necessary information.

INTRODUCTION

Contribution C443 "Text proposal to align clause 9/G.872 with draft revised G.709" (Q12/15, Sept. 2009) provides some initial text to update G.872 to align with the draft version of G.709. As a result, Q12 agrees to use this contribution as the starting point to develop an amendment for G.872 and consent this amendment at the next SG15 meeting.

This document is based on C443 and reflects the results of drafting at the Q.12/15 meeting in Darmstadt.

PROPOSED TEXT:

The text provided is proposed as draft of amendment for G.872.

ITU-T Recommendation G.872

Architecture of optical transport networks

Amendment 2

1) Clause 9.1, Introduction

*Modify the following paragraph*s *as follows:*

Furthermore, due to the limitations of the current optical technology it is not possible to build a worldwide pure optical network. 3R regeneration of the optical channel signals is required after a certain distance and it will be used at domain borders in order to decouple the domains concerning optical signal impairments and to get an accurate assessment of the signal quality.

For this reason ITU-T Rec. G.709 implements the Optical Channel by means of a digital framed signal with digital overhead that supports the management requirements for the OCh listed in clause 6. Furthermore this allows the use of Forward Error Correction for enhanced system performance. An optical channel may support a single client mapped into an ODU. In addition, in order to allow transport of several lower bit-rate ODUs over a higher bit-rate Optical Channel and maintain the end-to-end trail for these lower bit-rate channels, Time Division Multiplexing (TDM) of ODUs is defined. Client signals are mapped into lower order ODUs, these lower order ODUs are either mapped directly into an OTU, or multiplexed into a higher order ODU that has a 1:1:1 relationship with the OTU and OCh. Each higher order ODU has a defined number of tributary slots (TS) at either a bit-rate of nominally 1.25Gbit/s or 2.5Gbit/s. Lower order ODUs which are mapped into higher order ODUs are mapped into the required number of TSs. This results in the introduction of two digital layer networks, the ODU and OTU.

Table 2 enumerates the set of ODU and OTU signals at the time of publication, the full set of is provided by the current version of G.709.

Table 2/G.872 –Set of ODU clients and their ODU servers

ODU Clients	ODU Server
1.25 Gbit/s bit-rate area	ODU0
-	
2.5 Gbit/s bit-rate area	ODU1
ODU0	
10 Gbit/s bit-rate area	ODU2
ODU0,ODU1,ODUflex	
10.3125 Gbit/s bit-rate area	ODU2e
-	
40 Gbit/s bit-rate area	ODU3
ODU0,ODU1,ODU2,ODU2e,ODUflex	
100 Gbit/s bit-rate area	ODU4
ODU0,ODU1,ODU2,ODU2e,ODU4,ODUflex,	
CBR clients from greater than 2.5 Gbit/s to 100 Gbit/s: or GFP-F mapped packet clients from 1.25 Gbit/s to 100 Gbit/s.	ODUflex
-	

Table 2.1/G.872 –ODU clients and their OTU server

ODU client	OTU server
ODU0	-
ODU1	OTU1
ODU2	OTU2
ODU2e	-
ODU3	OTU3
ODU4	OTU4
ODUflex	-

2) Clause 9.2, Digital OTN layered structure

*Modify the following paragraph*s *as follows:*

The digital OTN layered structure is comprised of digital path layer networks (ODU) and digital section layer networks (OTU).

An OTU section layer supports one ODU path as a client and provides the monitoring capability for the OCh.

A higher order ODU path layer supports a heterogeneous assembly of lower order ODUs. For this case it is recommended that the number of hierarchical levels of ODU path layer networks that are managed within a domain be limited to two in order to reduce the overall network operational complexity.

For example, within an administrative domain that supports both ODU1 services over ODU2 and ODU1 and ODU2 services over ODU3, only one-stage multiplexing (ODU1 → ODU2) or (ODU1, ODU2 → ODU3) is used. An ODU2 with ODU1s that are individually networked within the domain (ODU1 services) are terminated and the ODU1s are multiplexed directly into the ODU3 in case of transport via an ODU3. Transport of the ODU1s in the ODU2s via the ODU3 is not recommended.

Note that in the case of multi domain networks more than two levels of ODU multiplexing may be present. However, it is recommended that only two levels are managed within a single domain..

Figures 16 and 17 show the client/server relationships without and with ODU multiplexing.

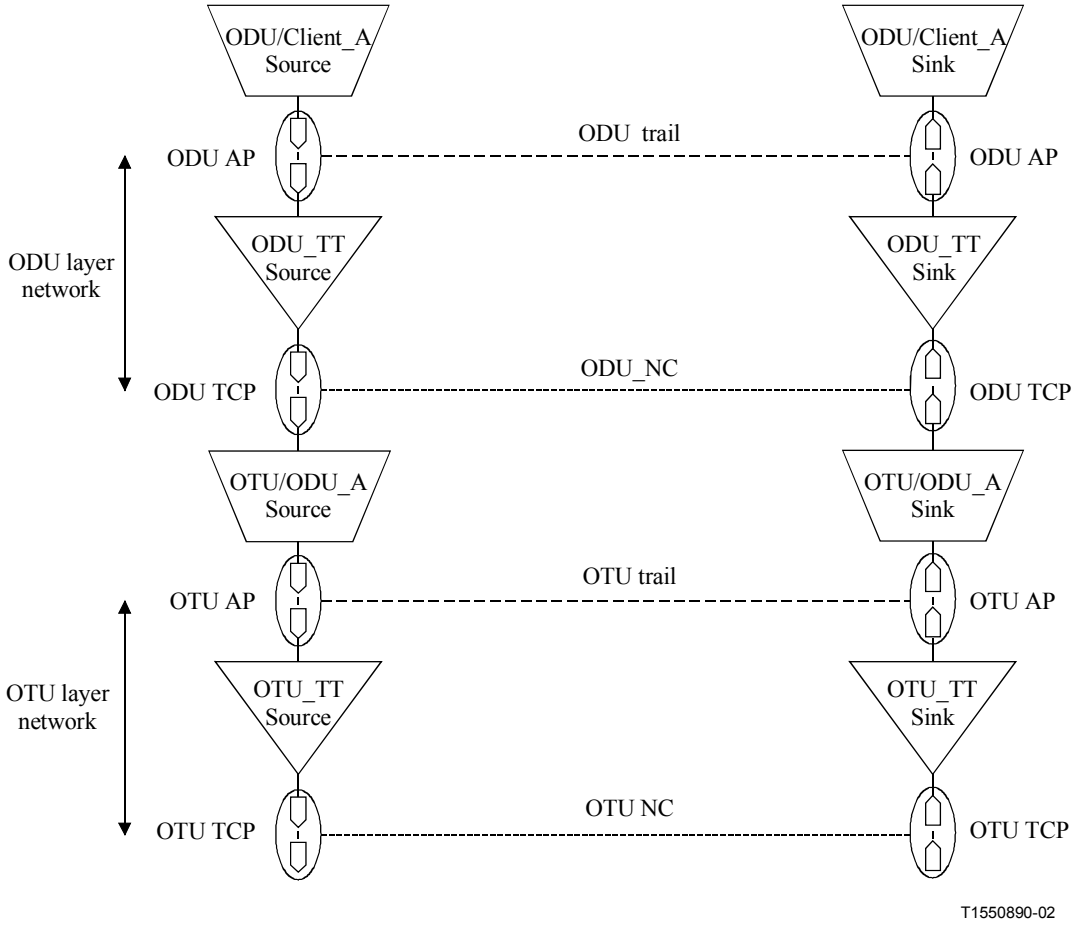

Figure 16/G.872 – Client server association of the digital OTN layers without ODU multiplexing

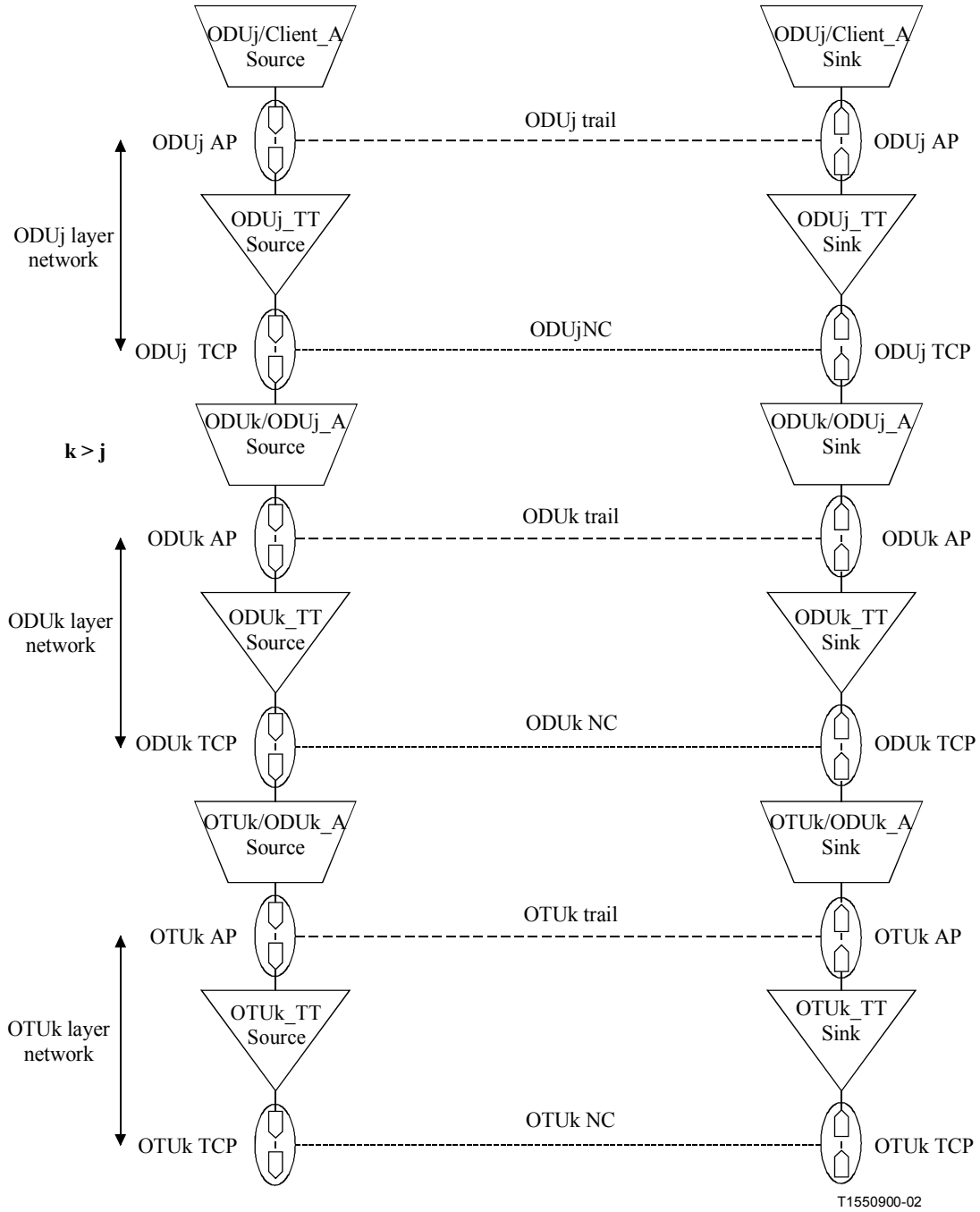

Figure 17/G.872 – Client server association of the digital OTN layers with ODU multiplexing

Motivation for this layer structure is as follows:

ODU layer network: This layer network provides functionality for end-to-end networking of digital path signals that transparently convey client information of varying format as described in table 2. The description of supported client layer networks is outside the scope of this Recommendation. The topological components of the ODU layer network are subnetworks and links. The links are supported by an OTU trail or a higher order ODU trail. Since the resources that support these topological components support a heterogeneous assembly of ODUs, the ODU layer is modelled as a single layer network that is independent of bit-rate. The ODU bit-rate is a parameter that allows the number of Tributary Slots (TS) for the ODU link connection to be determined. To provide end-to-end networking, the following capabilities are included in the layer network:

– ODU connection rearrangement for flexible network routing;
– ODU overhead processes for ensuring integrity of the ODU adapted information;
– ODU operations, administrations, and maintenance functions for enabling network level operations and management functions, such as connection provisioning, quality of service parameter exchange and network survivability.

OTU layer network: This layer network provides functionality for networking of digital section signals. It transparently conveys a single ODU client signal. The capabilities of this layer network include:

– OTU overhead processes and conditioning for the transport over optical channels for ensuring integrity of the OTU adapted information;
– OTU operations, administrations, and maintenance functions for enabling section level operations and management functions, such as OTU survivability.

The detailed functional description of the layer networks is given in the following clauses.

3) Clause 9.3, Optical channel layer network (OCh)

*Modify the following paragraph*s *as follows:*

With the introduction of the ODU and OTU the OCh as described in 5.3 is limited to the analogue transport of the digital client payload signal (OTU) between 3R points of the OTN. It supports in this case only a subset (see Table 3) of the OCh management requirements defined in clause 6. The OCh supports a single OTU.

4) Clause 9.6, ODU Time Division Multiplexing

*Modify the following paragraph*s *as follows:*

ODUj can be clients of an ODUk (k > j). Note that the ODUj may be an ODUflex. The TSs of the ODUk server may be allocated to any combination of ODUj clients up to the capacity of the ODUk. For the currently defined ODUks the following TS are defined:

Table 5/G.872 – Number of TS for each ODUk

Nominal TS capacity	1.25Gbit/s	2.5Gbit/s
ODU1	2	1
ODU2	8	4
ODU3	32	16
ODU4	80	-

5) Clause 9.13, Multi-domain OTN

Add new Clause 9.13 with the following texts:

Domain A may have an OTN network comprised of lower order ODUi and higher order ODUj, i < j. The higher order ODUj may be carried over the network of domain B, interconnected by OTUj. Domain B may carry the ODUj as a lower order ODU over higher order ODUk, j < k. Each of domain A and B sees two hierarchal ODU levels within their respective domains. The ODUj plays the role of a higher order ODU in domain A and the role of a lower order ODU in domain B.

A higher order ODUj of domain A can also be carried as a lower order ODUj domain B directly over OTUj in domain B using TCM to manage the segments of the ODUj path in each domain.

6) Appendix IV: Examples of multi-domain OTN applications

Add new Appendix IV with the following texts and figures:

This appendix provides examples of multi-domain OTN applications.

Figure IV.1 illustrates the case of interconnection of two disjoint domains (domain A) through another domain (domain B). Domain A has requested ODUi service from domain B. This ODUi service from domain A's perspective is a HO ODUi, carrying multiple LO ODUk signals. This same ODUi service from domain B's perspective is a LO ODUi of which the endpoints are outside the domain of domain B. Within domain B's network the LO ODUi is carried over a HO ODUj.

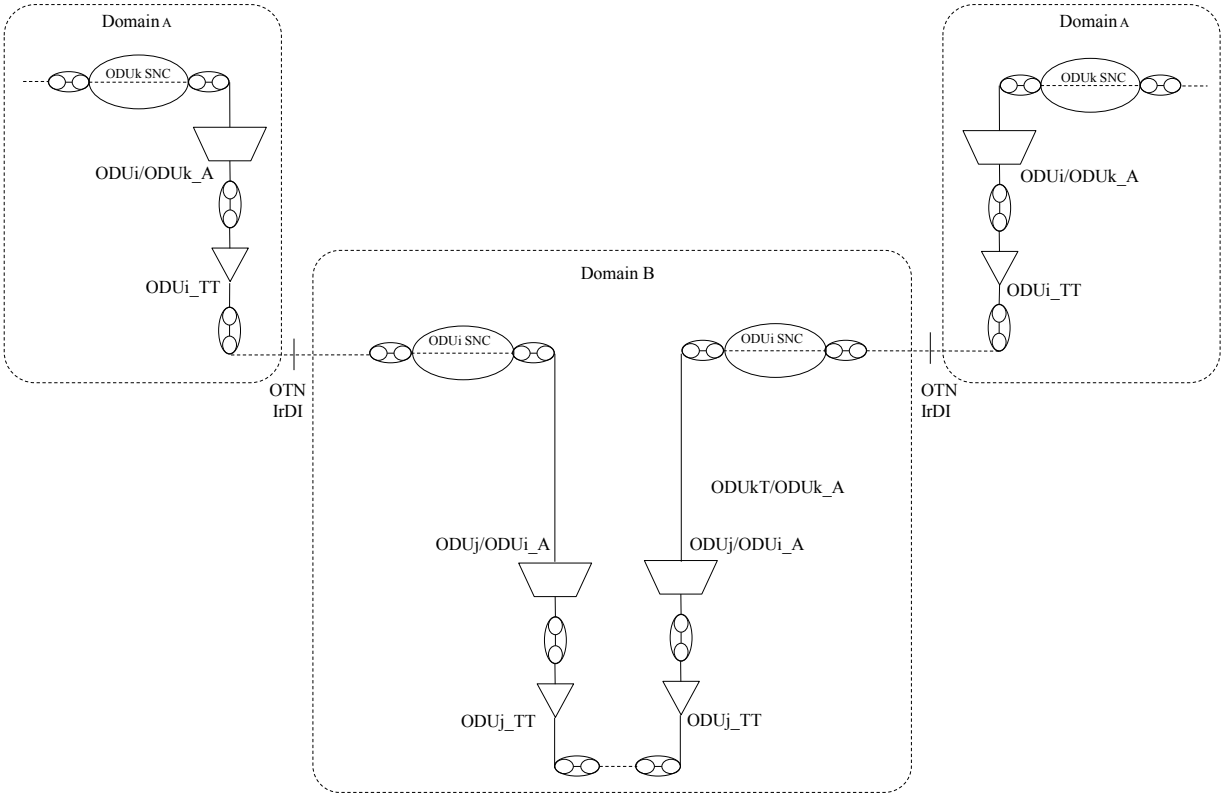

Figure IV.1/G.872 –Multi-domain OTN scenario 1

Figure IV.2 illustrates the above case with additional TCM function.

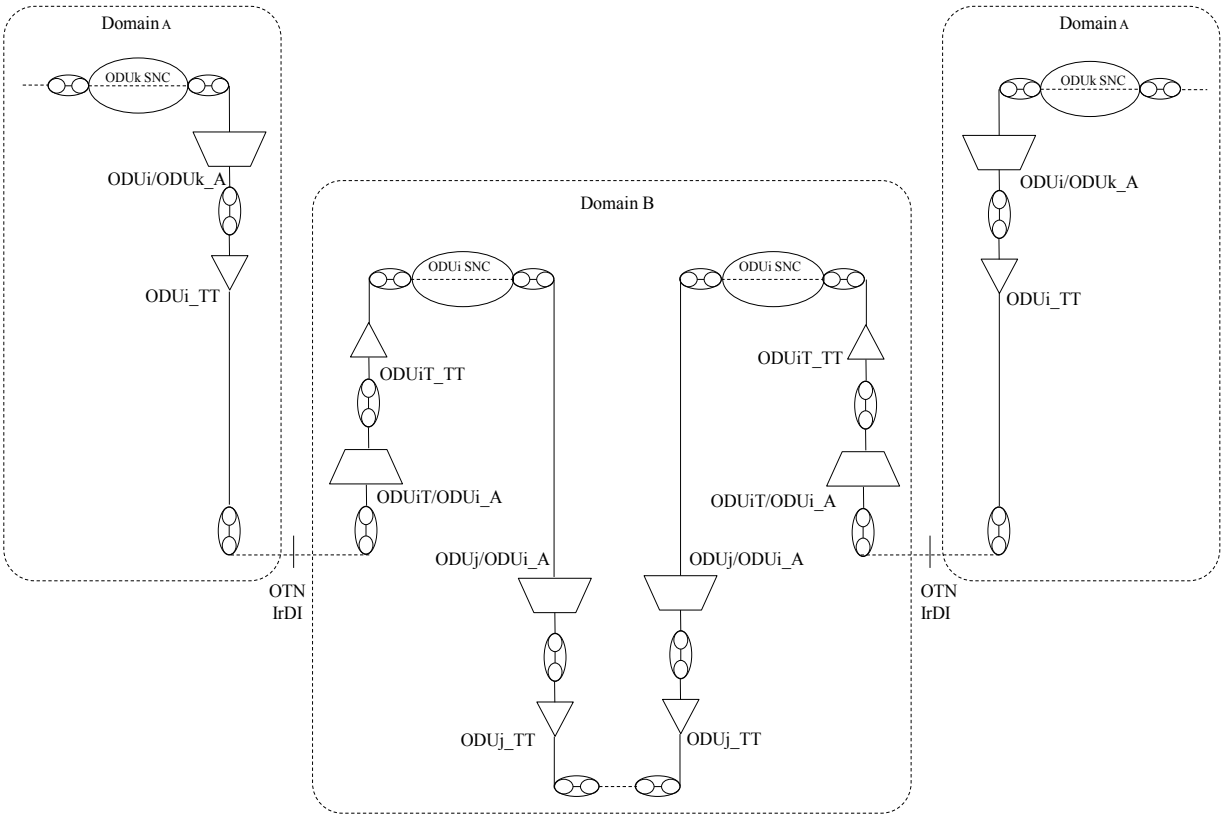

Figure IV.2/G.872 –Multi-domain OTN scenario 2

Figure IV.3 illustrates the case of higher order ODUi of domain A carried as a lower order ODUj domain B directly over OTUj in domain B.

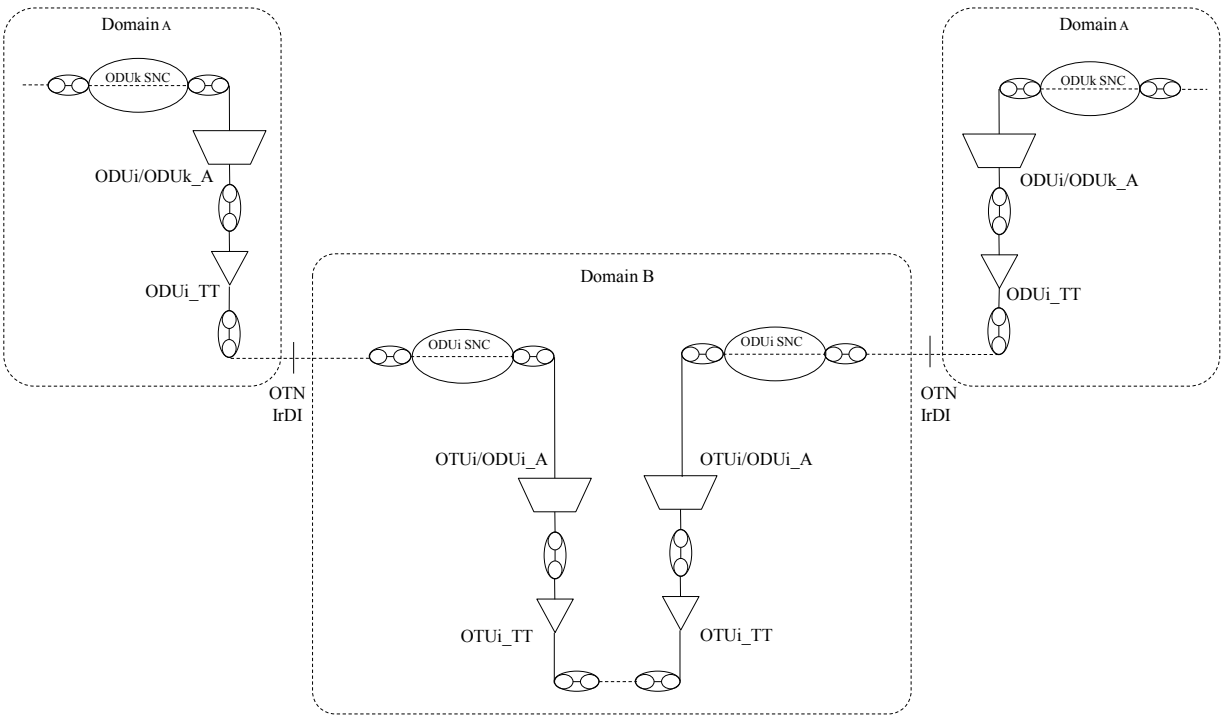

Figure IV.3/G.872 –Multi-domain OTN scenario 3