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Considerations for the use of TEAS TE topology model in multi layer  
applications  
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## Abstract

This document briefly describes an important inter layer use case for TE topology information and considers requirements and operational considerations the derive from it.

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1. Introduction

One motivation for the definition and use of YANG models is to allow 'automation' of network configuration and operation. Automation is particularly attractive in when offering services like Network as a Service (NAAS). The word 'service' implies that an operator's customers have a high degree of flexibility in their use of the network resources provided by the service this leads to concepts such as Network on Demand (NoD). Automation is key to the effective realisation services of this type. Management/control of multilayer networks is also an area where automation may be useful. SDN is a key part of the automation toolkit and there is an emerging realisation that (standard) information and data models are a key part of this technology. It is important that we develop YANG models that support the needs of the application(s) and that we provide guidance as to their potential limitations as well. We point some simple additions to the current TEAS TE-topology model [IETF-TEAS-TOPO] which are necessary to support some applications.

2. Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [RFC2119].

3. Layer networks

We first illustrate a topology server/service in the context of a single layer network and then generalise to the multilayer case. You need to be able to reference and, therefore, name the thing you attach to.

### 3.1. Single Layer Network

Figure 1 shows an illustration of the major components of a single layer network. The management, control and data planes are familiar and well understood concepts in IETF and elsewhere. The 'Topology server' component is, perhaps, less familiar but its function is straightforward, it provides an interface - shown here as the 'Topology Service Interface' (TSI) - through which clients may examine and, perhaps, control the network's topology. The term 'client(s)' is used here solely to conotate an entity that uses the Topology Service Interface without further distinction. There are many ways in which a topology service could be implemented and many protocols and encodings that could be used for one. In this document consider the case where the objects can be manipulated via that interface are described by the YANG model described in [IETF-TEAS-TE-TOPO]. Note that 'YANG models' are but one component of TSI

In Figure 1 the nodes A and Z are border nodes of what may be an arbitrarily complex network which we illustrate and refer to on the line between them in the illustration as an 'abstract A-Z topology'. Further recognise that the notations CPA and CPZ stand for 'concrete' - to distinguish them from abstract - ports on nodes A and Z, i.e they are ports on those nodes which do not yet have links attached but which may eventually, in the case that is of particular interest to us here, have client equipment attached.

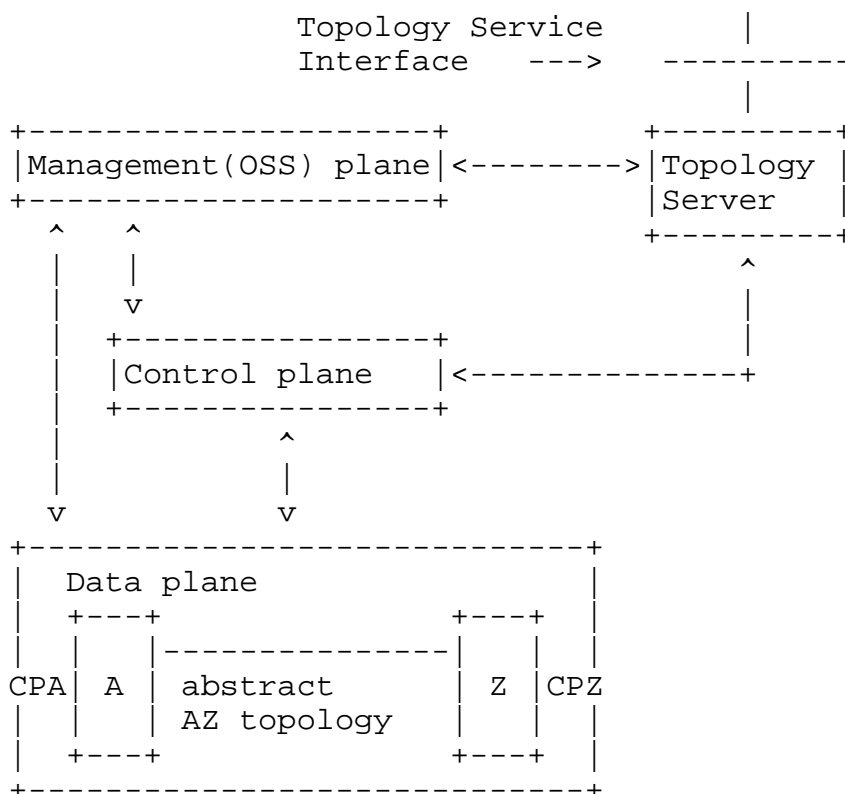


Figure 1

If we consider the layer network in Figure it should be clear that the topology server can only provide details of the topology of the network resources under its control.

### 3.2. Multi Layer Networks

Most networks or combinations of networks that are of practical interest have multiple layers and/or technologies. Figure 2 shows a hierarchical client/server arrangement of two networks; a specific example is a transport network - the server layer - providing connectivity to a - client layer - router network. The 'concrete' ports of figure 1 have here become client ports that are connected to ports in the server layer (SPA, SPZ).

Note that in general there may be multiple layers in such a hierarchy and we talk of being able to recurse through it i.e to find instances of the same model at the different layers. In Figure 2 we show the bottom two layers only, the server layer is recognizable as a layer where the recursion terminates because there is no server layer (or topology server) below it whereas the client layer, in contrast, has

a topology server with a TSI that is capable of supporting (higher) client layers.

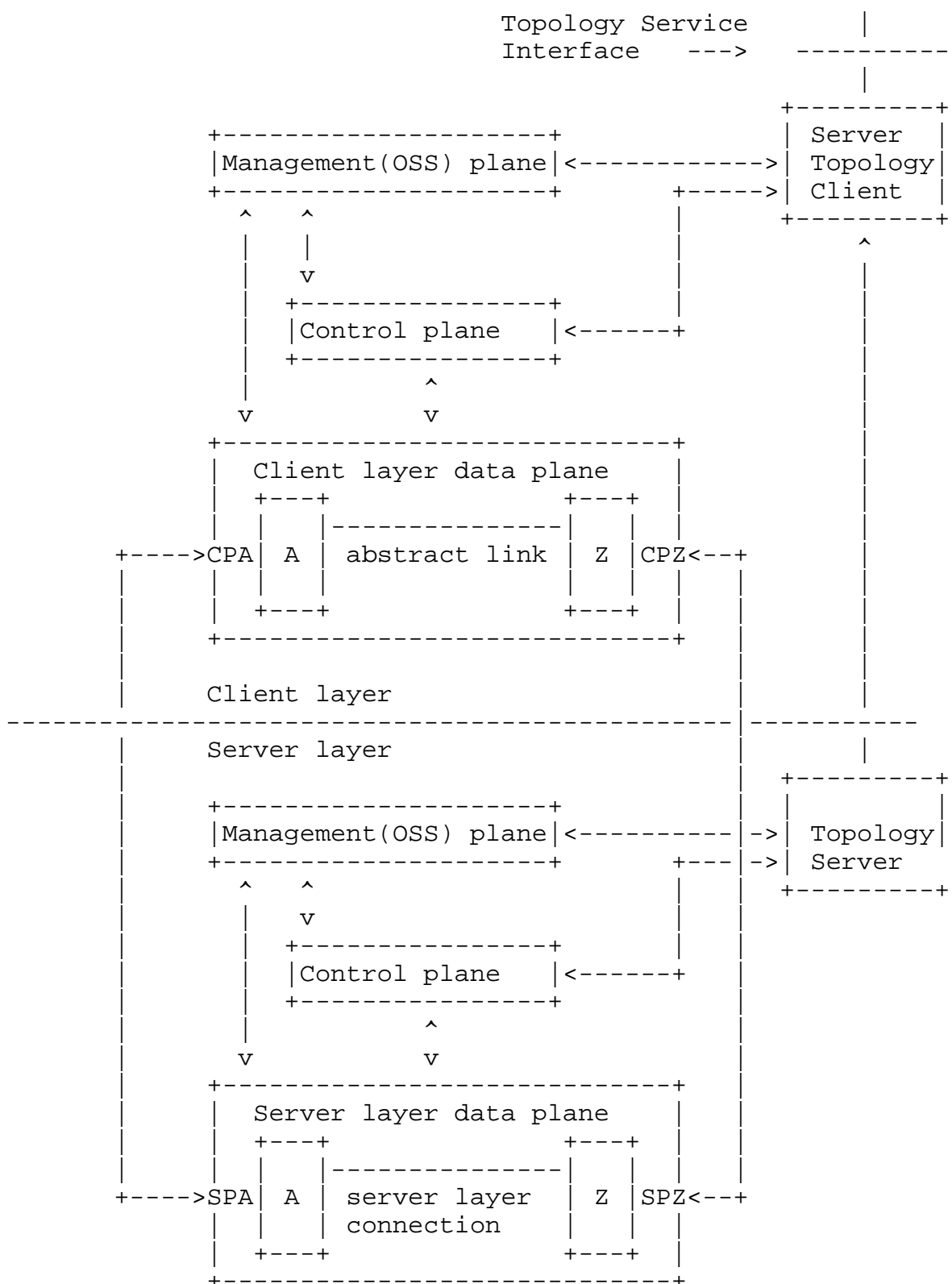


Figure 2

In Figure 2 the 'concrete' ports referred to previously have become 'client' ports and are connected to ports in the server layer (SPA, SPZ). In the general case the client and server networks may use different technologies (e.g Ethernet and OTN) and in that case adaptation between those must be effected somewhere.

In a multilayer network the ports we illustrate are on different sides of what is, in the general case, a policy boundary of some sort. Configurations of this sort have been studied in a number of other organizations [ITU-T\_G.8080] [OIF] and the ports and links joining them have various names therein e.g termination and adaptation point (TAP), transitional link etc. The coordination, translation, resolution of TAP names between client and server layer control entities is often a clerical operation of some kind and is thus a suitable candidate for automation.

It is well known that in SDN controllers provide interfaces to allow manipulation of objects representing the resources under their control, such as those represented by the data model in [IETF-TEAS-TOPO]. These interfaces are used by other SDN software components known variously as higher level controllers, orchestrators or applications and these may be adjuncts or extensions of the capabilities of existing EMS, NMS and OSS components.

We previously explained - in the single network layer example - that what we represent as an abstract link may be an arbitrarily complex network, the same applies at the server layer where what is shown as the server layer connection represents an arbitrarily complex path through that layer.

Although we allow abstract representation of an arbitrarily complex network and recognise that modelling of such should, subject to policy etc, allow examination of more or less detail of the underlying (real) resources many applications can be satisfied using a very abstract model. In the limit we can represent the network as an abstract or virtual switch. We examine this case below.

#### 4. Optical network as a virtual switch

In the case where a network operator is providing transport service for router interconnect a very simple i.e highly abstract representation of the topology may be adequate for a large class of customers, specifically we suggest that representing the (optical) network as a virtual switch is sufficient for many applications.

In such a highly abstract and therefore simple model the topology service of the optical server layer represents client ports (SPA and SPZ in Figure 2) as connected ports on a abstract virtual switch. By

making the virtual switch abstract, in the sense that is used in [IETF-TEAS-TOPO] arbitrary detail can be provided, subject to policy, to those clients that require it.

Support of this model requires a number of modifications to [IETF-TEAS-TOPO]. An object must be provided to model the ports; amongst the necessary attributes are that the ports MUST be capable of being 'named' and MUST support switching types as defined in [RFC7074]. A virtual switch object MUST be provided that supports port objects and connections between them.

Future versions of this draft will provide YANG definitions for these objects.

## 5. Acknowledgments

Xian Zhang of Huawei suggested the Network on Demand application. Bin Yeong Yoon of ETRI provided some early review and encouragement.

## 6. Normative References

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