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Resource Pooling Mechanism for Multi-Layer Operations
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Abstract

This memo proposes resource pooling mechanism for multi-layer operations. Resource pool is often discussed in the context of robustness and restoration. But, resource pooling mechanism should also be used for realizing flexibility in multi-layer network operations. Today, it takes days or weeks of lead time to change wide area networks composed of multiple network layers. One of the reasons is because communications between operators of different network layers are necessary before configuration of each layer is made. A network management system that uses resource pooling mechanism would get rid of communications made between operators of different network layers, and would realize flexible changes in multi-layer networks.

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1. Introduction

This memo proposes resource pooling mechanism for multi-layer network operations. Resource pool is often discussed in the context of robustness and restoration. But, resource pooling mechanism should also be used for realizing flexibility in multi-layer network operations. Today, it takes days or weeks of lead time to change wide area networks composed of multiple network layers. One of the reasons is because communications between operators of different network layers are necessary before configuration of each network layer is made. A network management system that adopts resource pooling mechanism would get rid of communications made between operators of different network layers, and would realize flexible changes in multi-layer networks.

2. Problem Statement

In general, wide area networks are composed of multiple network layers. For example, core of the carrier networks are made up of WDM (Wavelength-Division Multiplexing) devices. And, transport devices such as SONET/SDH (Synchronous Optical Network / Synchronous Digital Hierarchy) are surrounding them and providing reliability. Furthermore, IP devices such as routers and switches are deployed around these devices in order to accommodate users' traffic.

Today, each network layer is managed independently by different management systems or different operators. Thus, when there is a need to change wide area networks according to a user demand or traffic pattern, operators of each network layer need to communicate with each other. This takes large lead time. In the era when a user sporadically requires large bandwidth, such a long lead time in changing networks is not acceptable.

In order to reduce lead time and to realize flexibility in changing wide area networks, this memo proposes using resource pooling mechanism for multi-layer operations. By specifying resource pooling mechanism and by developing a network management system that uses the mechanism, communications made now between operators of different network layers would be done away with.

3. Use Case of Resource Pool

As an example of introducing resource pooling mechanism, this memo describes a case when MPLS-TP layer provides resource pool for IP layer. MPLS-TP (Multi Protocol Label Switching - Transport Profile) is a transport protocol that would replace SONET/SDH in wide area networks.

In the case when MPLS-TP provides resource pool, the resource would be LSP (Label Switched Path) or pseudo wire. These resources are able to provide reliable end-to-end connection with guaranteed bandwidth.

Currently, LSPs and pseudo wires are established according to the contract between users and operators of wide area networks. And the connection is used exclusively for one user once established. However, the bandwidth of this connection is not always used fully. Most of the bandwidth is left unused at some point in time. Under such a circumstance, these LSPs and pseudo wires should be managed as resource pool and assigned flexibly to other users who are accessing through IP layers.

When a user demands an end-to-end connection with guaranteed bandwidth at certain time, a network management system adopting resource pooling mechanism finds out an already established but unused LSP and pseudo wire from MPLS-TP layer and assigns it to the user who are accessing through IP layer.

This assignment mechanism is illustrated in generalized form at Figure 1. In order to assign resource of lower network layer to upper network layer, the status of the resource in lower network layer should be managed at network management system. And, the network management system should assign resource to upper network layer by matching the attributes of resource and topology information. The attributes of resource managed at the network management system should be defined, and this memo propose these in the next section. Based on the result of assignment, then the management system configures upper network layer accordingly.

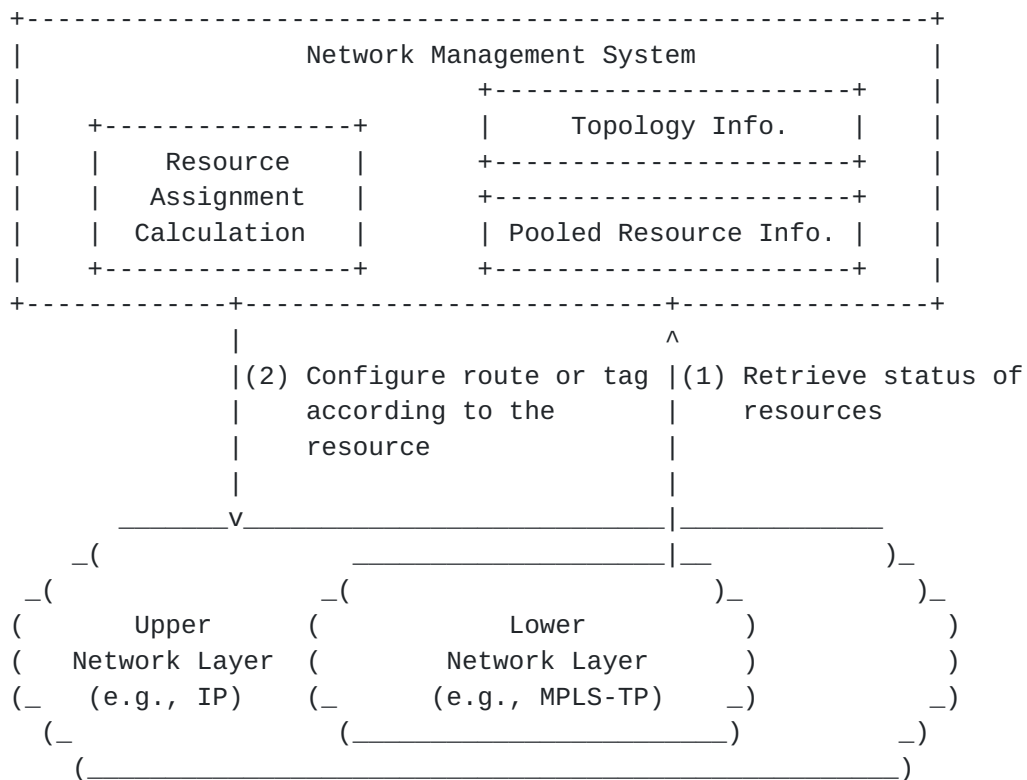


Figure 1: Resource Pool for Multi-layer operations

4. Attributes of Resource Pool

The basic attributes of resource should be defined as follows.

- o Identifier
- o Network Layer (HO-ODU, LO-ODU, LSP, pseudo wire, etc.)
- o QoS Level
- o Bandwidth
- o Source Point
 - * Node ID
 - * Port ID
- o Destination Point
 - * Node ID
 - * Port ID
- o Status (Unused, Used, Working, Error)

These attributes should be retrieved from lower network layer and held at network management system. Attributes such as Node ID and Port ID should be used with topology information when the network management system associates resource in lower network layer to a traffic in upper network layer.

5. IANA Considerations

This memo includes no request to IANA.

6. Security Considerations

The attributes about resource are confidential information. Thus, they need to be transported in a confidential manner.

7. Acknowledgements

This document was written using the xml2rfc tool described in [[RFC2629](#)].

8. References

8.1. Normative References

- [RFC4428] Papadimitriou, D. and E. Mannie, "Analysis of Generalized Multi-Protocol Label Switching (GMPLS)-based Recovery Mechanisms (including Protection and Restoration)", [RFC 4428](#), March 2006.

8.2. Informative References

- [RFC2629] Rose, M., "Writing I-Ds and RFCs using XML", [RFC 2629](#), June 1999.

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