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S. Bryant, Ed.
Cisco Systems

L. Andersson, Ed.
Acreo AB

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Joint Working Team (JWT) Report on MPLS Architectural Considerations for a Transport Profile

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Abstract

This RFC archives the report of the IETF - ITU-T Joint Working Team (JWT) on the application of MPLS to transport networks. The JWT recommended of Option 1: The IETF and the ITU-T jointly agree to work together and bring transport requirements into the IETF and extend IETF MPLS forwarding, OAM (Operations, Administration, and Management), survivability, network management and control plane protocols to meet those requirements through the IETF Standards Process. This RFC is available in ASCII (which contains a summary of the slides) and in PDF (which contains the summary and a copy of the slides).

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1. Introduction

For a number of years, the ITU-T has been designing a connection-oriented packet switched technology to be used in Transport Networks.

A Transport Network can be considered to be the network that provides wide area connectivity upon which other services, such as IP or the phone network, run. The ITU-T chose to adapt the IETF's MPLS to this task, and introduced a protocol suite known as T-MPLS.

Quite late in the ITU-T design and specification cycle, there were a number of liaison exchanges between the ITU-T and the IETF concerning this technology. These liaisons can be found on the IETF Liaison Statement web page [LIAISON]. In addition, the chairs of the MPLS, PWE3, BFD, and CCAMP working groups as well as the Routing and Internet Area Directors attended a number of ITU-T meetings. During this process, the IETF became increasingly concerned that the incompatibility of IETF MPLS and ITU-T T-MPLS would "represent a mutual danger to both the Internet and the Transport network". These concerns led the chairs of the IESG and IAB to take the step of sending a liaison to the ITU-T, stating that either T-MPLS should become fully compliant MPLS protocol, standardized under the IETF process (the so-called "Option 1"), or it should become a completely disjoint protocol with a new name and completely new set of code points (the so-called "Option 2") [Ethertypes].

Option 1 and Option 2 were discussed at an ITU-T meeting of Question 12 Study Group 15 in Stuttgart [Stuttgart], where it was proposed that a Joint (ITU-T - IETF) Team should be formed to evaluate the issues, and make a recommendation to ITU-T management on the best way forward.

Following discussion between the management of the IETF and the ITU-T, a Joint Working Team (JWT) was established; this was supported by an IETF Design Team and an Ad Hoc Group on T-MPLS in the ITU-T [ahtmpls]. The first meeting of the Ad Hoc group occurred during the ITU-T Geneva Plenary in February 2008. As a result of the work of the JWT and the resulting agreement on a way forward, the fears that a set of next-generation network transport specifications developed by ITU-T could cause interoperability problems were allayed.

The JWT submitted their report to the ITU-T and IETF management in the form of a set of Power Point slides [MPLS-TP-22]. (See the PDF of this RFC.) The ITU-T have accepted the JWT recommendations, as documented in [MPLS-TP]. This RFC archives the JWT report in a

format that is accessible to the IETF.

This RFC is available in ASCII (which contains a summary of the slides) and in PDF (which contains the summary and a copy of the slides). In the case of a conflict between the summary and the slides, the slides take precedence. Since those slides were the basis of an important agreement between the IETF and the ITU-T, it should further be noted that in the event that the PDF version of the slides differs from those emailed to ITU-T and IETF management on 18 April 2008 by the co-chairs of the JWT, the emailed slides take precedence.

2. Executive Summary

Slides 4 to 10 provide an executive summary of the JWT Report. The following is a summary of those slides:

The JWT achieved consensus on the recommendation of Option 1: to jointly agree to work together and bring transport requirements into the IETF and extend IETF MPLS forwarding, OAM, survivability, network management, and control plane protocols to meet those requirements through the IETF Standards Process. The Joint Working Team believed that this would fulfill the mutual goals of improving the functionality of the transport networks and the Internet and guaranteeing complete interoperability and architectural soundness. This technology would be referred to as the Transport Profile for MPLS (MPLS-TP).

The JWT recommended that future work should focus on:

In the IETF:

Definition of the MPLS "Transport Profile" (MPLS-TP).

In the ITU-T:

Integration of MPLS-TP into the transport network,

Alignment of the current T-MPLS ITU-T Recommendations with MPLS-TP and,

Termination of the work on current T-MPLS.

The technical feasibility analysis concluded there were no "show stopper" issues in the recommendation of Option 1 and that the IETF MPLS and Pseudowire architecture could be extended to support transport functional requirements. Therefore, the team believed that there was no need for the analysis of any other option.

The JWT proposed that the MPLS Interoperability Design Team (MEAD Team), JWT, and Ad Hoc T-MPLS groups continue as described in SG15 TD515/PLEN [JWTcreation] with the following roles:

- Facilitate the rapid exchange of information between the IETF and ITU-T,
- Ensure that the work is progressing with a consistent set of priorities,
- Identify gaps/inconsistencies in the solutions under development,
- Propose solutions for consideration by the appropriate WG/ Question,
- Provide guidance when work on a topic is stalled or a technical decision must be mediated.

None of these groups would have the authority to create or modify IETF RFCs or ITU-T Recommendations. Any such work would be progressed via the normal process of the respective standards body. Direct participation in the work by experts from the IETF and ITU-T would be required.

The JWT recommended that the normative definition of the MPLS-TP that supports the ITU-T transport network requirements be captured in IETF RFCs. It proposed that the ITU-T should:

- Develop ITU-T Recommendations to allow MPLS-TP to be integrated with current transport equipment and networks, including in agreement with the IETF, the definition of any ITU-T-specific functionality within the MPLS-TP architecture via the MPLS change process [RFC4929],
- Revise existing ITU-T Recommendations to align with MPLS-TP,
- ITU-T Recommendations will make normative references to the appropriate RFCs.

The executive summary contains a number of detailed JWT recommendations to both IETF and ITU-T management together with proposed document structure and timetable.

These JWT recommendations were accepted by ITU-T management [MPLS-TP1].

3. Introduction and Background Material

Slides 11 to 22 provide introductory and background material.

The starting point of the analysis was to attempt to satisfy Option 1 by showing the high-level architecture, any show stoppers, and the design points that would need to be addressed after the decision had been made to work together. Option 1 was stated as preferred by the IETF and because Option 1 was shown to be feasible, Option 2 was not explored.

The work was segmented into five groups looking at: Forwarding, OAM, Protection, Control Plane, and Network Management. The outcome of each review was reported in the following sections and is summarized below.

There follows a detailed description of the overall requirements and architectural assumptions that would be used in the remainder of the work.

4. High-Level Architecture

Slides 23 to 28 provide a high-level architectural view of the proposed design.

The spectrum of services that the MPLS-TP needs to address and the wider MPLS context is described, together with the provisioning issues. Some basic terminology needed in order to understand the MPLS-TP is defined and some context examples are provided.

5. OAM and Forwarding

Slides 29 to 32 describe the OAM requirements and talk about segment recovery and node identification.

Slides 33 to 38 introduce OAM hierarchy and describe Label Switched Path (LSP) monitoring, the Maintenance End Point (MEP) and Maintenance Intermediate Point (MIP) relationship and the LSP and pseudowire (PW) monitoring relationship.

Sides 39 to 46 introduce the Associated Channel Header (ACH) and its generalization to carry the OAM over LSPs through the use of the "Label for You" (LFU).

Slides 47 to 48 provide a description of how the forwarding and the ACH OAM mechanism work in detail. A significant number of scenarios are described to work through the operation on a case-by-case basis. These slides introduce a new textual notation to simplify the description of complex MPLS stacks.

Note that the MPLS forwarding, as specified by IETF RFCs, requires no changes to support MPLS-TP.

6. Control Plane

Sides 79 to 83 discuss various aspects of the control plane design.

Control plane sub-team stated that existing IETF protocols can be used to provide required functions for transport network operation and for data-communications-network/switched-circuit-network operation. IETF GMPLS protocols have already applied to Automatic Switched Optical Network (ASON) architecture, and the JWT considered that any protocol extensions needed will be easy to make. The slides provide a number of scenarios to demonstrate this conclusion.

7. Survivability

The survivability considerations are provided in slides 95 to 104.

The survivability sub-team did not find any issues that prevented the creation of an MPLS-TP, and therefore recommended that Option 1 be selected. Three potential solutions were identified. Each solution has different attributes and advantages, and it was thought that further work in the design phase should eliminate one or more of these options and/or provide an applicability statement.

After some clarifications and discussion, there follow in the slide set a number of linear and ring protection scenarios with examples of how they might be addressed.

8. Network Management

Slide 106 states the conclusion of the Network Management sub-team : that it found no issues that prevent the creation of an MPLS-TP and hence Option 1 can be selected.

9. Summary

Slide 113 provides a summary of the JWT report.

The JWT found no show stoppers and unanimously agreed that they had identified a viable solution. They therefore recommend Option 1. They stated that in their view, it is technically feasible that the existing MPLS architecture can be extended to meet the requirements of a Transport profile, and that the architecture allows for a single OAM technology for LSPs, PWs, and a deeply nested network. From probing various ITU-T Study Groups and IETF Working Groups it appears that MPLS reserved label 14 has had wide enough implementation and deployment that the solution may have to use a different reserved label (e.g., Label 13). The JWT recommended that extensions to Label 14 should cease.

The JWT further recommended that this architecture appeared to subsume Y.1711, since the requirements can be met by the mechanism proposed in their report.

10. IANA Considerations

There are no IANA considerations that arise from this document.

Any IANA allocations needed to implement the JWT recommendation will be requested in the Standards-Track RFCs that define the MPLS-TP protocol.

11. Security Considerations

The only security consideration that arises as a result of this document is the need to ensure that this is a faithful representation of the JWT report.

The protocol work that arises from this agreement will have technical security requirements that will be identified in the RFCs that define MPLS-TP.

12. The JWT Report

In the PDF of this RFC, there follows the JWT report as a set of slides.

13. Informative References

[Ethertypes] IESG and IAB, "T-MPLS use of the MPLS Ethertypes", 2006, <https://datatracker.ietf.org/documents/LIAISON/file470.txt>.

[JWTcreation] Chairman, ITU-T SG 15, "Proposal to establish an Ad Hoc group on T-MPLS", 2008, <http://www.itu.int/md/T05-SG15-080211-TD-PLEN-0515/en>.

[LIAISON] Liaison statements to and from the IETF can be found at: <https://datatracker.ietf.org/liaison/>.

[MPLS-TP] "IETF and ITU-T cooperation on extensions to MPLS for transport network functionality", May 2008, <https://datatracker.ietf.org/liaison/446/>.

[MPLS-TP-22] IETF - ITU-T Joint Working Team, "MPLS Architectural Considerations for a Transport Profile", April 2008, <http://www.ietf.org/MPLS-TP_overview-22.pdf>.

[MPLS-TP1] "IETF and ITU-T cooperation on extensions to MPLS for transport network functionality", ITU-T SG15, May 2008, <https://datatracker.ietf.org/documents/LIAISON/file553.pdf>.

[RFC4929] Andersson, L. and A. Farrel, "Change Process for Multiprotocol Label Switching (MPLS) and Generalized MPLS (GMPLS) Protocols and Procedures", BCP 129, RFC 4929, June 2007.

[Stuttgart] IETF - IESG and IAB Chairs, "Report of interim meeting of Q.12 on T-MPLS", Stuttgart, Germany, Annex 4, 12-14 September 2007, 2008, <http://ties.itu.int/u//tsg15/sg15/xchange/wp3/200709_joint_q12_q14_stuttgart/T-MPLS/wdt03_rapporteur_report-final.doc>. This document is available on request from the ITU-T.

[ahtmpls] "Ad Hoc group on T-MPLS", 2008, <http://www.itu.int/ITU-T/studygroups/com15/ahtmpls.html>.

Editors' Addresses

Stewart Bryant (editor)
Cisco Systems
250, Longwater, Green Park,
Reading RG2 6GB
UK

EMail: stbryant@cisco.com

Loa Andersson (editor)
Acreo AB
Isafjordsgatan 22
Kista,
Sweden

EMail: loa@pi.nu