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Controlling pre-standard coherent Optical Interfaces
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Abstract

Modulated optical interfaces with coherent detection receivers are in widespread use in Internet networking equipment. Various implementations are in deployment since 2012 but there is no standard available defining those interfaces, nor their capabilities. This document identifies the need for work on control plane aspects pre-standard coherent optical DWDM applications.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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1. Introduction

The dominant interconnection technology in the Internet is based on fiber and optical transceiver interfaces. Multiple SDOs are working on control-plane and data-plane standards in this field. Some are covering LAN applications (IEEE), while others work on WAN and in particular DWDM based applications (ITU-T SG15). Those DWDM related recommendations are based on non-coherent detection schemes and do not cover modulated optical suignals and coherent detection. DWDM wavelengths of 40Gb/s, 100Gb/s and beyond use higher order modulation techniques with coherent detection schemes and are used throughout the industry. Current implementations are already heading towards capacities of 400Gb/s and 1Tb/s per Interface. The gap between standards availability and practical deployment creates a mounting need in the industry for a common data model that can be used to control Pre Standard Coherent Optical (PRESCO) DWDM interfaces. This document addresses the issue of progressing control plane work related to PRESCO-DWDM technology.

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. Abbreviations

- DWDM: Dense Wavelength Division Multiplexing
- PRESCO-interface: PRE-Standard-Coherent-Optical DWDM interface
- PRESCO-wavelength: pre-standard coherent DWDM signal with phase modulated transmitter and coherent detection receiver
- PRESCO-Module: Transmitter/receiver Module of pre-standard coherent DWDM signals
- SDO: Standards Developing Organization

4. Motivation

As data plane standards for standard coherent optical interfaces are in flux, there is a lack of common ground on modeling and encoding interface parameters related to higher order modulation techniques with coherent detection schemes. This unnecessarily burdens control systems with complexity in coping with incompatible implementations and complex operation. As data plane standards are insufficient to provide guidance on control plane work for PRESCO devices, work on data models for PRESCO applications need to proceed independently of data plane standards.

5. Applicability to CCAMP

"The CCAMP working group is responsible for standardizing a common control plane and a separate common measurement plane for non-packet technologies found in the Internet and in the networks of telecom service providers (ISPs and SPs)."" As such CCAMP is chartered with "the definition of management objects (e.g., as part of MIB modules or YANG models) and control of OAM techniques relevant to the protocols and extensions specified within the WG" [ccamp-charter]. Hence work to control PRESCO devices is in the scope of ccamp.

6. State of Standards

6.1. Data Plane

The first version of [superseded-ITU.G698.2] was published July 2007. A key role plays the concept of "application codes" to characterize transmitters and receivers using an character-string. When a Tx/Rx pair, with the same code, is connected over a link with specific optical properties, the DWDM connection is guaranteed to interoperate regardless of their origin, i.e. their manufacturer within the conditions set out in this recommendation.

The now in-force [ITU.G698.2] recommendation "includes unidirectional DWDM applications at 2.5 and 10 Gbit/s with 100 GHz channel frequency spacing as well as applications at 10 Gbit/s with 50 GHz channel frequency spacing." No comparable Recommendation exists for higher bitrates and higher modulated signals and the current vesionof [RFC7581] is based on those codes as well. Also related standards like [ITU.G697] "Optical monitoring for dense wavelength division multiplexing systems" and [ITU.G680] "Physical transfer functions of optical network elements" are written based on 2.5G and 10G technology using direct detection.

ITU-T Study Group 15 set out in 2010 to begin work toward "revision of [SG15-2012], establishing sets of parameters and associated values to enable multi-vendor interoperability for 40 Gbit/s application codes with various modulation formats". At the time this work began, there were several candidate modulation formats e.g DQPSK, PM-QPSK, OFDM-QPSK. NRZ modulation used for 2.5G and 10G is simpler than the so called advanced phase modulation schemes required for higher bitrates. For DP-QPSK, for example, it is necessary to determine and specify suitable parameters for the characterization of the polarization and phase components of the signal. The challenge experts had in advancing that work has been brought to the attention of ccamp in 2013 when it was reported that progress have been made such that "there is only 1 modulation format candidate for 100G standardization" and "what we’re struggling with is doing fundamental work on standardizing phase modulated transmission"[IETF-86-ccamp-minutes].

We recognize the complex nature of the task and acknowledge the amount of diligent work that has been put, and is still being put into coherent DWDM data-plane standardization. Still, at the time of this writing, the fundamental underlying problem in standardizing phase modulated optical signals is not yet solved. Even when that work would be completed, the relevant aspects of the link and receiver, together with an appropriate FEC standardization, will need to be addressed as well. By Sept 2016 there is no deadline communicated by when this work is expected to be finalized.

6.2. Control Plane

Standardization control aspects in relevant SDOs naturally follows the work on data plane which provides the base for monitoring capabilities and identification of critical parameters. Available recommendations utilize application codes defined in [ITU.G698.2]. Such application code can be considered a character based abbreviation (such as e.g. DScW-ytz(v) from [ITU.G698.2]) to characterize transceiver characteristics. Consequently control information in WSON (see [RFC3591] and [ITU.G874.1]) is also based on the use of such application codes. [RFC3591] is based on [ITU.G872]. and provides a starting point for the definition and structuring of objects. However, given that [RFC3591] is also a standards track document, it naturally based on standard definitions and can not include parameters required to describe PRESCO devices. In parallel, individual contributions in ccamp (e.g. [draft-2012]) were proposing to work by introducing extensions for parameters describing PRESCO devices. As data-plane standards did not conclude, such extensions were considered pre-mature. So by Sept. 2016 no common reference model exists as a basis that would allow to define a data model for modulated optical interfaces with coherent detection receivers.

7. Addressing the gap in controlling PRESCO-DWDM interfaces

As the Industry is surpassing standards development in providing PRESCO applications, it would benefit from commonality in implementing yang data models to control PRESCO-DWDM Modules. Existing PRESCO Modules already provide extensive FCAPS capabilities and are used to provide commercial services. Data models for such devices are in active development but suffer from commonality. On the positive side this situation allows defining PRESCO related data models based on those FCAPS functionalities.

8. Progressing PRESCO related work

PRESCO related work should be based on creating a common abstracted model based on PRESCO-FCAPS implementations, rough consensus and running code. The aim is provide the basis to enable PRESCO applications in a consistent manner by reducing implementation differences in the data structure.

As PRESCO data models would need to evolve in parallel or even precede a data-plane standard the following list of considerations should be applied going forward:

1. Control work for PRESCO SHALL have the status INFORMATIONAL or EXPERIMENTAL as it is not standards based

2. A PRESCO model SHOULD be based on control parameters available PRESCO DWDM modules

3. PRESCO modeling SHOULD aim to fit into existing data models in IETF

4. the model SHOULD allow augmentation of parameters by vendor specific extensions

5. the model SHOULD re-using existing standard parameter definitions and encoding where possible

6. Since the full set of parameters needed to characterize PRESCO modules and their encoding are undefined, application codes are not available for use in PRESCO. Therefore controlling PRESCO Modules SHALL NOT mandate the use application codes.

7. threshold levels derived from measurement values SHOULD be adjustable such that a comparable system behaviour can be achieved.

PRESCO related work evidently needs to be separate from standards related work and we need to outline what PRESCO work is not about:

- PRESCO is NOT suggesting to perform data-plane work in IETF.
- PRESCO is NOT providing data models for non-PRESCO interfaces
- PRESCO does NOT propose to utilize Data models defined for PRESCO modules to be re-used for standard models when those become available
- PRESCO does NOT require multi-vendor compatibility of PRESCO-Modules on data plane. I.e. a pair of PRESCO-DWDM interfaces having identical parameter sets describing the data-plane is not guaranteed to be compatible by ITU-T standards.

9. Contributors

10. Acknowledgements

TBD

11. IANA Considerations

This memo includes no request to IANA.

12. Security Considerations

This document discusses the need for a non-standard YANG data Model. It has no security impact on the Internet.

13. References

13.1. Normative References

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Appendix A. Additional Stuff

Parameters that need to be encoded addressing PRESCO applications are:

- Modulation Format
- Spectral efficiency or Bit per symbols
- baud rate
- bandwidth required by the PRESCO-DWDM carrier
- Carrier central frequency (this might not follow the ITU-T grid)
- Forward Error Correction code
- Tx and Rx power
- Frequency/Wavelength
- ...

As for PRESCO applications the completeness of these Parameters to fully characterize PRESCO interfaces is not guaranteed, additional parameters will be added as needed.

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