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**A Unified Control Channel for Pseudowires**  
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**Abstract**

This document describes a unified mode for Virtual Circuit Connectivity Verification (VCCV), which provides a control channel that is associated with a pseudowire (PW). VCCV applies to all supported access circuit and transport types currently defined for PWs, as well as those being transported by The MPLS Transport Profile. This new mode is intended to augment those described in [RFC5085](#), but this document describes new rules requiring this mode to be used as the default/mandatory mode of operation for VCCV. The older types will remain optional.

**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](#)].

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## [1.](#) Introduction

There is a need for fault detection and diagnostic mechanisms that can be used for end-to-end fault detection and diagnostics for a Pseudowire, as a means of determining the PW's true operational state. Operators have indicated in [[RFC4377](#)], [[RFC3916](#)], that such a tool is required for PW operation and maintenance. To this end, the IETF's PWE3 Working Group defined The Virtual Circuit Connectivity Verification Protocol (VCCV) in [[RFC5085](#)]. Since then a number of interoperability issues have arisen with the protocol as it is defined.

The variety of VCCV options or "modes" have been created to support legacy hardware, the use of the control word in some cases, while in others not, among others. The difficulty of operating these different combinations of "modes" have been detailed in an implementation survey the PWE3 Working Group conducted. Many of the motivations of this survey are detailed in [[MAN-CW](#)]. This document



and the implementation survey concluded that operators have had difficulty deploying the protocol given the number of combinations and options for its use.

In addition to the implementation issues just described, the ITU-T and IETF have set out to enhance MPLS to make it suitable as an optical transport protocol. The requirements for this protocol are defined as the MPLS Transport Profile (MPLS-TP). The requirements for this protocol can be found in [[RFC5654](#)]. In order to support VCCV when an MPLS-TP PSN is in use, the GAL-ACH had to be created; this effectively resulted in another mode of operation.

This document seeks to simplify the modes of operation of VCCV down to a single mode of operation we refer to as type 4 for the moment. This mode simply defines two ways to run VCCV: 1) with a control word or 2) without a control word, but with a ACH encapsulation making it easy to handle all of the other cases handled by the other modes of VCCV. In either case, it will be mandatory to implement and use that mode, thus simplifying the implementation and operation of the protocol.

Figure 1 depicts the architecture of a pseudowire as defined in [[RFC3985](#)]. It further depicts where the VCCV control channel resides within this architecture, which will be discussed in detail shortly.

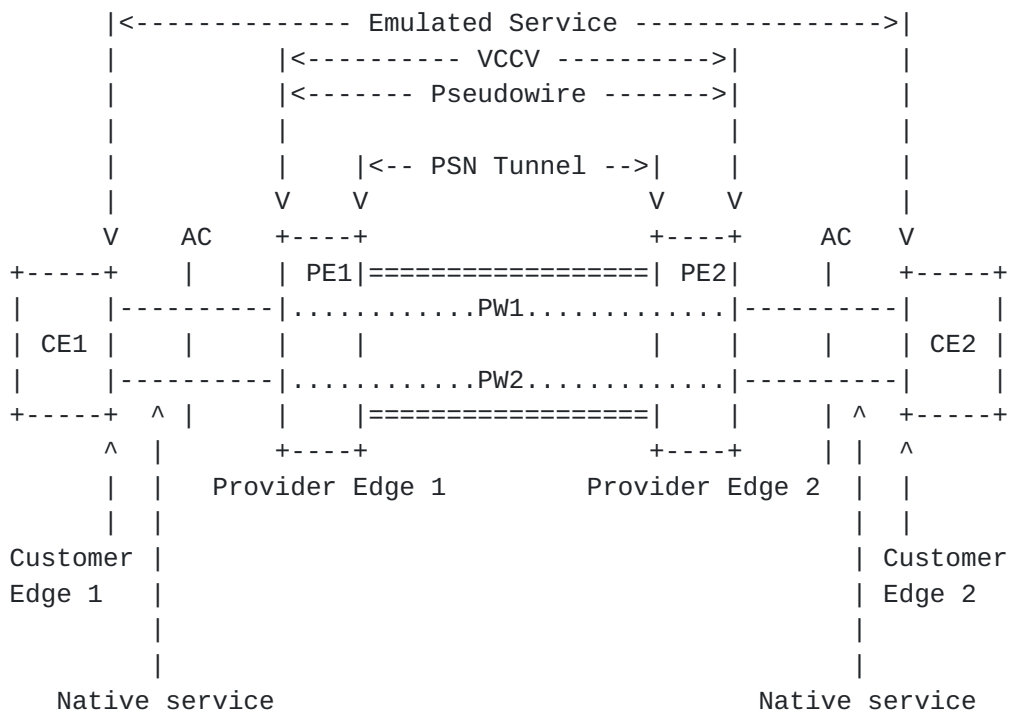


Figure 1: PWE3 VCCV Operation Reference Model

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From Figure 1, Customer Edge (CE) routers CE1 and CE2 are attached to the emulated service via Attachment Circuits (ACs), and to each of the Provider Edge (PE) routers (PE1 and PE2, respectively). An AC can be a Frame Relay Data Link Connection Identifier (DLCI), an ATM Virtual Path Identifier / Virtual Channel Identifier (VPI/VCI), an Ethernet port, etc. The PE devices provide pseudowire emulation, enabling the CEs to communicate over the PSN. A pseudowire exists between these PEs traversing the provider network. VCCV provides several means of creating a control channel over the PW, between the PE routers that attach the PW.

Figure 2 depicts how the VCCV control channel is associated with the pseudowire protocol stack.

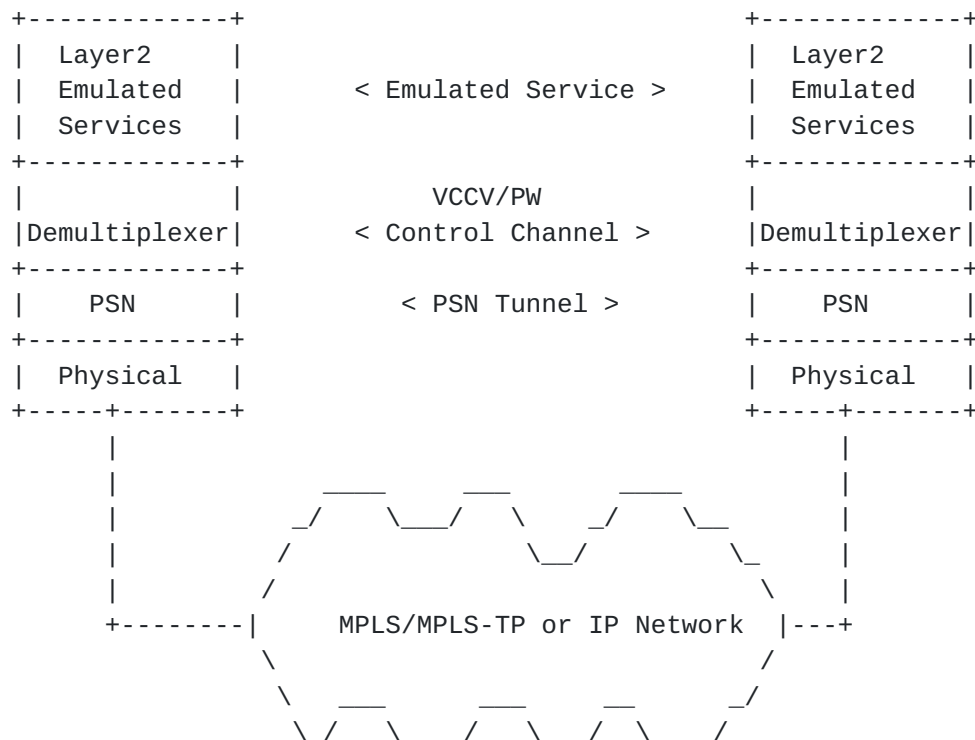


Figure 2: PWE3 Protocol Stack Reference Model including the VCCV Control Channel

VCCV messages are encapsulated using the PWE3 encapsulation as described in Sections 2 and 3, so that they are handled and processed in the same manner (or in some cases, a similar manner) as the PW PDUs for which they provide a control channel. These VCCV messages are exchanged only after the capability (expressed as two VCCV type spaces, namely the VCCV Control Channel and Connectivity Verification Types) and desire to exchange such traffic has been advertised

between the PEs (see Sections [5.3](#) and [6.3](#)), and VCCV types chosen.



## **1.2. Acronyms**

AC	Attachment Circuit [ <a href="#">RFC3985</a> ].
AVP	Attribute Value Pair [ <a href="#">RFC3931</a> ].
CC	Control Channel (used as CC Type).
CE	Customer Edge.
CV	Connectivity Verification (used as CV Type).
CW	Control Word [ <a href="#">RFC3985</a> ].
L2SS	L2-Specific Sublayer [ <a href="#">RFC3931</a> ].
LCCE	L2TP Control Connection Endpoint [ <a href="#">RFC3931</a> ].
OAM	Operation and Maintenance.
PE	Provider Edge.
PSN	Packet Switched Network [ <a href="#">RFC3985</a> ].
PW	Pseudowire [ <a href="#">RFC3985</a> ].
PW-ACH	PW Associated Channel Header [ <a href="#">RFC4385</a> ].
VCCV	Virtual Circuit Connectivity Verification [ <a href="#">RFC5085</a> ].

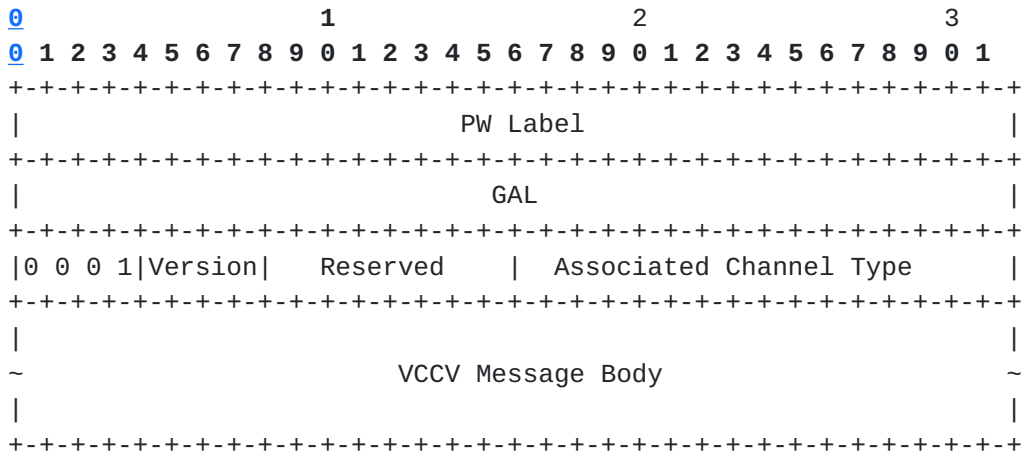
## **2. VCCV Control Channel When The Control Word is Used**

When the PWE3 Control Word is used to encapsulate pseudowire traffic, the rules described for encapsulating VCCV CC Type 1 as specified in [section 9.5.1 \[RFC6073\]](#) and [section 5.1.1 of \[RFC5085\]](#) MUST be used. In this case the advertised CC Type is 1, and Associated Channel Types of 21, 07, or 57 are allowed.

## **3. VCCV Control Channel When The Control Word is Not Used**

When the PWE3 Control Word is not used a new CC Type 4 is defined as follows.





The PW Label must set the TTL field to 1. In the case of multi-segment pseudo-wires, the PW Label TTL MUST be set to the correct value to reach the intended destination PE as described in [\[RFC6073\]](#).

The GAL field MUST contain the reserved label as defined in [\[RFC5586\]](#).

The first nibble of the next field is set to 0001b to indicate an ACH associated with a pseudowire (see [Section 5 of \[RFC4385\]](#) and [Section 3.6 of \[RFC4446\]](#)) instead of PW data. The Version and the Reserved fields MUST be set to 0, and the Channel Type is set to 0x0021 for IPv4, 0x0057 for IPv6 payloads [\[RFC5085\]](#) or 0x0007 for BFD payloads [\[RFC5885\]](#).

The "VCCV Messag Body" field is defined based on the Associated Channel Type and defined therein.

#### 4. VCCV Capability Advertisement

The capability advertisement MUST match that c-bit setting that is advertised in the PW FEC element. If the c-bit is set, indicating the use of the control word, type 1 MUST be advertised and type 4 MUST NOT be advertised. If the c-bit is not set, indicating that the control word is not in use, type 4 MUST be advertised, and type 1 MUST NOT be advertised.

A PE supporting Type 4 MAY advertise other CC types as defined in [RFC5085](#). If the remote PE also supports Type 4, then Type 4 MUST be used superceding the Capability Advertisement Selection rules of [section 7](#) from [RFC5085](#). If a remote PE does not support Type 4, then the rules



from [section 7 of RFC5085](#) apply. If a CW is in use, then Type 4 is not applicable, and therefore the normal capability advertisement selection rules of [section 7](#) from [RFC5085](#) apply.

## **[4.](#) IANA Considerations**

### **[4.1.](#) VCCV Interface Parameters Sub-TLV**

The VCCV Interface Parameters Sub-TLV codepoint is defined in [[RFC4446](#)]. IANA has created and will maintain registries for the CC Types and CV Types (bitmasks in the VCCV Parameter ID). The CC Type and CV Type new registries (see Sections [8.1.1](#) and [8.1.2](#), respectively) have been created in the Pseudo Wires Name Spaces, reachable from [[IANA.pwe3-parameters](#)]. The allocations must be done using the "IETF Consensus" policy defined in [[RFC5226](#)].

#### **[4.1.1.](#) MPLS VCCV Control Channel (CC) Type 4**

IANA is requested to augment the registry of "MPLS VCCV Control Channel Types" with the new type defined below. As defined in [RFC5058](#), this new bitfield is to be assigned by IANA using the "IETF Consensus" policy defined in [[RFC5226](#)]. A VCCV Control Channel Type description and a reference to an RFC approved by the IESG are required for any assignment from this registry.

MPLS Control Channel (CC) Types:

Bit (Value)	Description
=====	=====
Bit 3 (0x08) - Type 4	

The most significant (high order) bit is labeled Bit 7, and the least significant (low order) bit is labeled Bit 0, see parenthetical "Value".

## **[5.](#) Security Considerations**

This document does not by itself raise any particular security considerations that differ from those described in [RFC5085](#).

## **[6.](#) Acknowledgements**

## **[7.](#) References**



### **7.1. Normative References**

- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [BCP 14](#), [RFC 2119](#), March 1997.
- [RFC3931] Lau, J., Townsley, M., and I. Goyret, "Layer Two Tunneling Protocol - Version 3 (L2TPv3)", [RFC 3931](#), March 2005.
- [RFC4385] Bryant, S., Swallow, G., Martini, L., and D. McPherson, "Pseudowire Emulation Edge-to-Edge (PWE3) Control Word for Use over an MPLS PSN", [RFC 4385](#), February 2006.
- [RFC4446] Martini, L., "IANA Allocations for Pseudowire Edge to Edge Emulation (PWE3)", [BCP 116](#), [RFC 4446](#), April 2006.
- [RFC5085] Nadeau, T. and C. Pignataro, "Pseudowire Virtual Circuit Connectivity Verification (VCCV): A Control Channel for Pseudowires", [RFC 5085](#), December 2007.
- [RFC5586] Bocci, M., Ed., Vigoureux, M., Ed., and S. Bryant, Ed., "MPLS Generic Associated Channel", [RFC 5586](#), June 2009.
- [RFC5885] Nadeau, T., Ed., and C. Pignataro, Ed., "Bidirectional Forwarding Detection (BFD) for the Pseudowire Virtual Circuit Connectivity Verification (VCCV)", [RFC 5885](#), June 2010.
- [RFC5654] Niven-Jenkins, B., Brungard, D., and M. Betts, "Requirements of an MPLS Transport Profile", [RFC 5654](#), September 2009
- [RFC6073] Martini, L., Metz, C., Nadeau, T., Bocci, M., and M. Aissaoui, "Segmented Pseudowire", [RFC 6073](#), January 2011.

### **12.2. Informative References**

- [IANA.l2tp-parameters]  
Internet Assigned Numbers Authority, "Layer Two Tunneling Protocol "L2TP"", April 2007,  
<http://www.iana.org/assignments/l2tp-parameters>.
- [IANA.pwe3-parameters]  
Internet Assigned Numbers Authority, "Pseudo Wires Name Spaces", June 2007,  
<http://www.iana.org/assignments/pwe3-parameters>.





- [RFC5226] Narten, T. and H. Alvestrand, "Guidelines for Writing an IANA Considerations Section in RFCs", [BCP 26](#), [RFC 5226](#), May 2008.
- [RFC3916] Xiao, X., McPherson, D., and P. Pate, "Requirements for Pseudo-Wire Emulation Edge-to-Edge (PWE3)", [RFC 3916](#), September 2004.
- [RFC3985] Bryant, S. and P. Pate, "Pseudo Wire Emulation Edge-to-Edge (PWE3) Architecture", [RFC 3985](#), March 2005.
- [RFC4377] Nadeau, T., Morrow, M., Swallow, G., Allan, D., and S. Matsushima, "Operations and Management (OAM) Requirements for Multi-Protocol Label Switched (MPLS) Networks", [RFC 4377](#), February 2006.
- [MAN-CW] Del Regno, N., Nadeau, T., Manral, V., Ward, D., "Mandatory Use of Control Word for PWE3 Encapsulations", "Work in progress", October 2010.

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