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The PPP Compression Control Protocol (CCP)

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Abstract

The Point-to-Point Protocol (PPP) [1] provides a standard method for transporting multi-protocol datagrams over point-to-point links. PPP also defines an extensible Link Control Protocol.

This document defines a method for negotiating data compression over PPP links.

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1. Introduction

In order to establish communications over a PPP link, each end of the link must first send LCP packets to configure and test the data link during Link Establishment phase. After the link has been established, optional facilities may be negotiated as needed.

One such facility is data compression. A wide variety of compression methods may be negotiated, although typically only one method is used in each direction of the link.

A different compression algorithm may be negotiated in each direction, for speed, cost, memory or other considerations, or only one direction may be compressed.

2. Compression Control Protocol (CCP)

The Compression Control Protocol (CCP) is responsible for configuring, enabling, and disabling data compression algorithms on both ends of the point-to-point link. It is also used to signal a failure of the compression/decompression mechanism in a reliable manner.

CCP uses the same packet exchange mechanism as the Link Control Protocol (LCP). CCP packets may not be exchanged until PPP has reached the Network-Layer Protocol phase. CCP packets received before this phase is reached should be silently discarded.

The Compression Control Protocol is exactly the same as the Link Control Protocol [1] with the following exceptions:

Frame Modifications

The packet may utilize any modifications to the basic frame format which have been negotiated during the Link Establishment phase.

Data Link Layer Protocol Field

Exactly one CCP packet is encapsulated in the PPP Information field, where the PPP Protocol field indicates type hex 80FD (Compression Control Protocol).

When individual link data compression is used in a multiple link connection to a single destination, the PPP Protocol field indicates type hex 80FB (Individual link Compression Control Protocol).

Code field

In addition to Codes 1 through 7 (Configure-Request, Configure-Ack, Configure-Nak, Configure-Reject, Terminate-Request, Terminate-Ack and Code-Reject), two additional Codes 14 and 15 (Reset-Request and Reset-Ack) are defined for this protocol. Other Codes should be treated as unrecognized and should result in Code-Rejects.

Timeouts

CCP packets may not be exchanged until PPP has reached the Network-Layer Protocol phase. An implementation should be prepared to wait for Authentication and Link Quality Determination to finish before timing out waiting for a Configure-Ack or other response. It is suggested that an implementation give up only after user intervention or a configurable amount of time.

Configuration Option Types

CCP has a distinct set of Configuration Options.

2.1. Sending Compressed Datagrams

Before any compressed packets may be communicated, PPP must reach the Network-Layer Protocol phase, and the Compression Control Protocol must reach the Opened state.

One or more compressed packets are encapsulated in the PPP Information field, where the PPP Protocol field indicates type hex 00FD (Compressed datagram). Each of the compression algorithms may use a different mechanism to indicate the inclusion of more than one uncompressed packet in a single Data Link Layer frame.

When using multiple PPP links to a single destination, there are two methods of employing data compression. The first method is to compress the data prior to sending it out through the multiple links. The second is to treat each link as a separate connection, that may or may not have compression enabled. In the second case, the PPP Protocol field MUST be type hex 00FB (Individual link compressed datagram).

Only one primary algorithm in each direction is in use at a time, and that is negotiated prior to sending the first compressed frame. The PPP Protocol field of the compressed datagram indicates that the frame is compressed, but not the algorithm with which it was compressed.

The maximum length of a compressed packet transmitted over a PPP link is the same as the maximum length of the Information field of a PPP encapsulated packet. Larger datagrams (presumably the result of the compression algorithm increasing the size of the message in some cases) may be sent uncompressed, using its standard form, or may be sent in multiple datagrams, if the compression algorithm supports it.

Each of the compression algorithms must supply a way of determining if they are passing data reliably, or they must require the use of a

reliable transport such as LAPB [3]. Vendors are strongly encouraged to employ a method of validating the compressed data, or recognizing out-of-sync compressor/decompressor pairs.

3. Additional Packets

The Packet format and basic facilities are already defined for LCP [1].

Up-to-date values of the CCP Code field are specified in the most recent "Assigned Numbers" RFC [2]. This specification concerns the following values:

14	Reset-Request
15	Reset-Ack

3.1. Reset-Request and Reset-Ack

Description

CCP includes Reset-Request and Reset-Ack Codes in order to provide a mechanism for indicating a decompression failure in one direction of a compressed link without affecting traffic in the other direction. A decompression failure may be determined by periodically passing a hash value, performing a CRC check on the decompressed data, or other mechanism. It is strongly suggested that some mechanism be available in all compression algorithms to validate the decompressed data before passing the data on to the rest of the system.

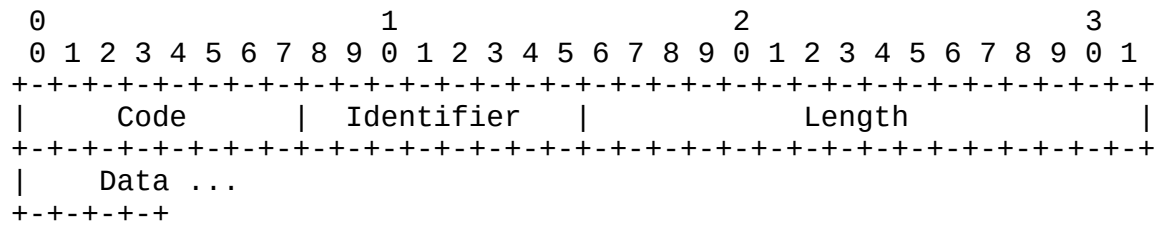
A CCP implementation wishing to indicate a decompression failure SHOULD transmit a CCP packet with the Code field set to 14 (Reset-Request), and the Data field filled with any desired data. Once a Reset-Request has been sent, any Compressed packets received are discarded, and another Reset-Request is sent with the same Identifier, until a valid Reset-Ack is received.

Upon reception of a Reset-Request, the transmitting compressor is reset to an initial state. This may include clearing a dictionary, resetting hash codes, or other mechanisms. A CCP packet MUST be transmitted with the Code field set to 15 (Reset-Ack), the Identifier field copied from the Reset-Request packet, and the Data field filled with any desired data.

On receipt of a Reset-Ack, the receiving decompressor is reset to an initial state. This may include clearing a dictionary, resetting hash codes, or other mechanisms. Since there may be several Reset-Acks in the pipe, the decompressor MUST be reset for

each Reset-Ack which matches the currently expected identifier.

A summary of the Reset-Request and Reset-Ack packet formats is shown below. The fields are transmitted from left to right.



Code

14 for Reset-Request;

15 for Reset-Ack.

Identifier

On transmission, the Identifier field MUST be changed whenever the content of the Data field changes, and whenever a valid reply has been received for a previous request. For retransmissions, the Identifier MAY remain unchanged.

On reception, the Identifier field of the Reset-Request is copied into the Identifier field of the Reset-Ack packet.

Data

The Data field is zero or more octets and contains uninterpreted data for use by the sender. The data may consist of any binary value and may be of any length from zero to the peer’s established MRU minus four.

4. CCP Configuration Options

CCP Configuration Options allow negotiation of compression algorithms and their parameters. CCP uses the same Configuration Option format defined for LCP [1], with a separate set of Options.

Configuration Options, in this protocol, indicate algorithms that the receiver is willing or able to use to decompress data sent by the sender. As a result, it is to be expected that systems will offer to accept several algorithms, and negotiate a single one that will be used.

There is the possibility of not being able to agree on a compression algorithm. In that case, no compression will be used, and the link will continue to operate without compression. If link reliability has been separately negotiated, then it will continue to be used, until the LCP is re-negotiated.

We expect that many vendors will want to use proprietary compression algorithms, and have made a mechanism available to negotiate these without encumbering the Internet Assigned Number Authority with proprietary number requests.

The LCP option negotiation techniques are used. If an option is unrecognized, a Configure-Reject MUST be sent. If all protocols the sender implements are Configure-Rejected by the receiver, then no compression is enabled in that direction of the link.

If an option is recognized, but not acceptable due to values in the request (or optional parameters not in the request), a Configure-NAK MUST be sent with the option modified appropriately. The Configure-NAK MUST contain only those options that will be acceptable. A new Configure-Request SHOULD be sent with only the single preferred option, adjusted as specified in the Configure-Nak.

Up-to-date values of the CCP Option Type field are specified in the most recent "Assigned Numbers" RFC [2]. Current values are assigned as follows:

CCP Option	Compression type
0	OUI
1	Predictor type 1
2	Predictor type 2
3	Puddle Jumper
4-15	unassigned
16	Hewlett-Packard PPC
17	Stac Electronics LZS
18	Microsoft PPC
19	Gandalf FZA
20	V.42bis compression
21	BSD LZW Compress
255	Reserved

The unassigned values 4-15 are intended to be assigned to other freely available compression algorithms that have no license fees.

4.1. Proprietary Compression OUI

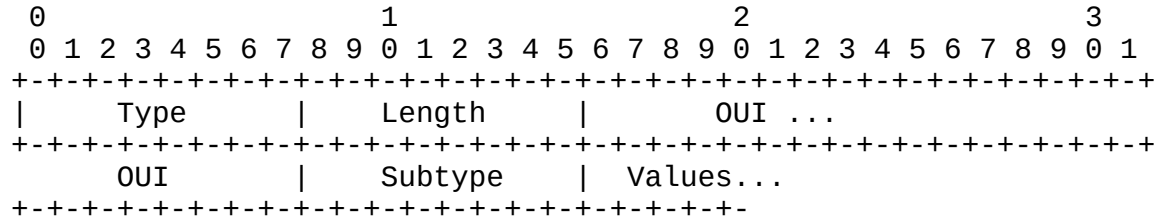
Description

This Configuration Option provides a way to negotiate the use of a proprietary compression protocol.

Since the first matching compression will be used, it is recommended that any known OUI compression options be transmitted first, before the common options are used.

Before accepting this option, the implementation must verify that the Organization Unique Identifier identifies a proprietary algorithm that the implementation can decompress, and that any vendor specific negotiation values are fully understood.

A summary of the Proprietary Compression OUI Configuration Option format is shown below. The fields are transmitted from left to right.



Type

0

Length

>= 6

IEEE OUI

The vendor’s IEEE Organization Unique Identifier (OUI), which is the most significant three octets of an Ethernet Physical Address, assigned to the vendor by IEEE 802. This identifies the option as being proprietary to the indicated vendor. The bits within the octet are in canonical order, and the most significant octet is transmitted first.

Subtype

This field is specific to each OUI, and indicates a compression type for that OUI. There is no standardization for this field. Each OUI implements its own values.

Values

This field is zero or more octets, and contains additional data as determined by the vendor's compression protocol.

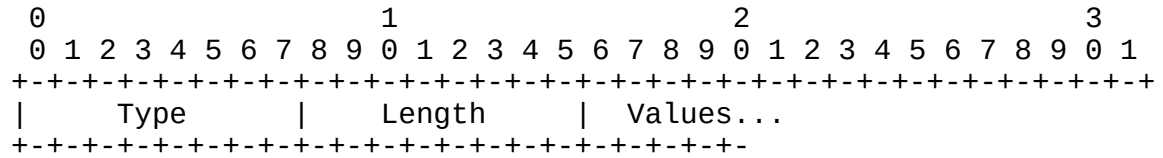
4.2. Other Compression Types

Description

These Configuration Options provide a way to negotiate the use of a publicly defined compression algorithm. Many compression algorithms are specified. No particular compression technique has arisen as an Internet Standard.

These protocols will be made available to all interested parties, but may have certain licensing restrictions associated with them. For additional information, refer to the compression protocol documents that define each of the compression types.

A summary of the Compression Type Configuration Option format is shown below. The fields are transmitted from left to right.



Type

1 to 254

Length

>= 2

Values

This field is zero or more octets, and contains additional data as determined by the compression protocol.

Security Considerations

Security issues are not discussed in this memo.

References

[1] Simpson, W., Editor, "The Point-to-Point Protocol (PPP)", STD 51, RFC 1661, July 1994.

[2] Reynolds, J., and Postel, J., "Assigned Numbers", STD 2, RFC 1700, USC/Information Sciences Institute, October 1994.

[3] Rand, D., "PPP Reliable Transmission", RFC 1663, July 1994.

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