Internet Draft
Intended status: Informational
Expires: September 2020

Dave Allan, Ericsson ed.
Donald Eastlake, Futurewei
David Woolley, Telstra
July 2020

5G Wireless Wireline Convergence User Plane Encapsulation (5WE)

draft-allan-5g-fmc-encapsulation-05

Abstract

As part of providing wireline access to the 5G Core (5GC), deployed wireline networks carry user data between 5G residential gateways and the 5G Access Gateway Function (AGF). The encapsulation method specified in this document supports the multiplexing of traffic for multiple PDU sessions within a VLAN delineated access circuit, permits legacy equipment in the data path to snoop certain packet fields, carries 5G QoS information associated with the packet data, and provides efficient encoding.

Status of this Memo

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

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF), its areas, and its working groups. Note that other groups may also distribute working documents as Internet-Drafts.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress".

The list of current Internet-Drafts can be accessed at http://www.ietf.org/ietf/1id-abstracts.txt.

The list of Internet-Draft Shadow Directories can be accessed at http://www.ietf.org/shadow.html.

This Internet-Draft will expire on January 2021.

Copyright and License Notice

Copyright (c) 2020 IETF Trust and the persons identified as the document authors. All rights reserved.

This document is subject to BCP 78 and the IETF Trust's Legal Provisions Relating to IETF Documents (http://trustee.ietf.org/license-info) in effect on the date of publication of this document. Please review these documents carefully, as they describe your rights and restrictions with respect to this document. Code Components extracted from this document must include Simplified BSD License text as described in Section 4.e of the Trust Legal Provisions and are provided without warranty as described in the Simplified BSD License.

Table of Contents

1. Introduction....2
1.1. Requirements Language....3
1.2. Acronyms....4
2. Data Encapsulation Format....4
3. Acknowledgements....5
4. Security Considerations....5
5. IANA Considerations....6
6. References....6
6.1. Normative References....6
6.2. Informative References....6
7. Authors' Addresses....7

1. Introduction

Converged 5G ("fifth generation") wireline networks carry user data between 5G residential gateways (5G-RG) and the 5G Access Gateway Function (identified as an Fixed-AGF (FAGF) by 3GPP in [TS23716]) across deployed access networks based on Broadband Forum [TR101] and [TR178].

The transport encapsulation used needs to meet a variety of requirements including the following:

- The ability to multiplex multiple logical connections (Protocol Data Unit (PDU) Sessions as defined by 3GPP) within a VLAN identified point to point logical circuit between a 5G-RG and an FAGF.

- To allow unmodified legacy equipment in the data path to identify the encapsulation and snoop specific fields in the payload. Some access nodes in the data path between the 5G-RG and the FAGF (Such as digital subscriber loop access multiplexers (DSLAMs) and optical line terminations (OLTs)) currently snoop into packets identified by specific Ethertypes to identify protocols such as the point to point protocol over ethernet (PPPoE), IP, ARP, and

IGMP. This may be for the purpose of enhanced QoS, policing of identifiers and other applications. Some deployments are dependent upon this snooping. Such devices are able to do this for PPPoE or IP over ethernet (IPoE) packet encodings but would be unable to do so if a new encapsulation, or an existing encapsulation using a new Ethertype, were used.

- To carry per packet 5G QoS information.

- Fixed access is very sensitive to the complexity of residential gateways, therefore encapsulation overhead and efficiency is an important consideration.

A modified [RFC2516] PPPoE data encapsulation (referred to as the 5G WWC user plane Encapsulation or 5WE) can address these requirements. Currently deployed access nodes do not police the VER, TYPE and CODE fields of an RFC 2516 header, and only perform limited policing of stateful functions with respect to the procedures documented in RFC 2516. Therefore, these fields may be repurposed to:

- Identify that the mode of operation for packets encapsulated in such a fashion uses non-access stratum (NAS, a logical control interface between user equipment (UE) and 5GC as specified by 3GPP) based 5G WWC session establishment and life cycle maintenance procedures as documented in [TS23502][TS23716] instead of legacy PPP/PPPoE session establishment procedures (i.e. PADI discipline, LCP, NCP etc.).

- Permit the session ID field to be used to identify the 5G PDU session the encapsulated packet is part of.

- Communicate per-packet 5G QoS Flow Identifier (QFI) and Reflective QoS Indication (RQI) information from the 5GC to the 5G-RG.

This 5G specific repurposing of fields results in an encapsulation uniquely applicable to the requirements for the communication of PDU session traffic between the subscriber premises and the 5G system over wireline networks. The 8 byte RFC 2516 data packet header is also the most frugal of the encapsulations that are currently supported by legacy access equipment that could be adapted to meet these requirements. This encapsulation is not suitable for other network environments, e.g., general use over the public Internet.

1.1. Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14 [RFC2119] [RFC8174] when, and only when, they appear in all capitals, as shown here.

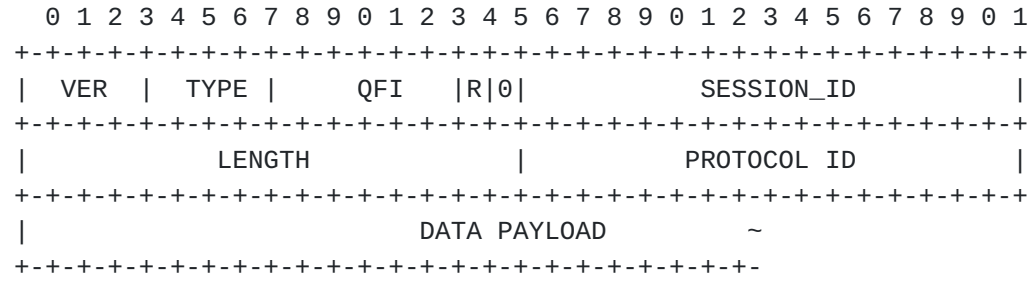
1.2. Acronyms

This document uses the following acronyms:

3GPP	3rd Generation Partnership Project
5WE	5G WWC Encapsulation
5GC	5th Generation Core (network)
DSLAM	Digital Subscriber Loop Access Multiplexer
FAGF	Fixed Network Access Gateway Function
IPoE	IP over Ethernet
NAS	Non-Access Stratum
OLT	Optical Line Termination
PDU	Protocol Data Unit
PPPoE	PPP over Ethernet
QFI	QoS Flow Identifier
QoS	Quality of Service
RG	Residential Gateway
RQI	Reflective QoS Indicator
WWC	Wireless Wireline Convergence

2. Data Encapsulation Format

The Ethernet payload [IEEE802] for PPPoE [RFC2516] is indicated by an Ethertype of 0x8864. The information following that Ethertype uses a value of 2 in the VER field for the repurposing of the PPPoE data encapsulation as the 5G WWC user plane encapsulation (5WE). The 5G WWC User Plane encapsulation is structured as follows:



The description of each field is as follows:

VER is the version. It MUST be set to 2.

TYPE is the message type. It MUST be set to 1.

QFI encodes the 3GPP 5G QoS Flow Identifier[TS38415] to be used for mapping 5G QoS to IP DSCP/802.1 P-bits[IEEE802].

R (short for RQI) encodes the one bit Reflective QoS Indicator.

0 indicates the bit(s) MUST be sent as zero and ignored on receipt.

SESSION_ID is a 16-bit unsigned integer in network byte order. It is used to distinguish different PDU sessions that are in the VLAN delineated multiplex.

LENGTH is the length in bytes of the data payload including the initial Protocol ID. It is 16 bits in network byte order.

PROTOCOL ID is the 16 bit identifier of the data payload type encoded using values from the IANA PPP DLL protocol numbers registry. (https://www.iana.org/assignments/ppp-numbers/ppp-numbers.xhtml#ppp-numbers-2)

The following values are valid in this field for 5G WWC use:

0x0021: IPv4

0x0031: Ethernet (referred to in PPP as "bridging")

0x0057: IPv6

DATA PAYLOAD is encoded as per the protocol ID.

3. Acknowledgements

This memo is a result of comprehensive discussions by the Broadband Forum's Wireline Wireless Convergence Work Area.
The authors would also like to thank Joel Halpern and Dirk Von Hugo for their detailed review of this draft.

4. Security Considerations

5G NAS procedures used for session life cycle maintenance employ ciphering and integrity protection. They can be considered to be a more secure session establishment discipline than existing RFC 2516 procedures, at least against man in the middle attacks.

The document's re-purposing of the RFC 2516 data encapsulation will not circumvent existing anti-spoofing and other security procedures in deployed equipment. The existing access equipment will be able to identify fields that they normally process and police as per existing RFC 2516 traffic.

Therefore, the security of a fixed access network using 5WE will be equivalent or superior to current practice.

5. IANA Considerations

IANA is requested to create a registry on the Point-to-Point (PPP) Protocol Field Assignments IANA Web page as follows:

Registry Name: PPP Over Ethernet Versions
Registration Procedure: Expert Review
References: [RFC2516] [this document]

VER	Description	Reference
0	reserved	[this document]
1	Classic PPPoE	[RFC2516]
2	5G WWC User Plane Encapsulation	[this document]
3-15	unassigned	[this document]

IANA is requested to add [this document] as an additional reference for Ethertype 0x8864 in the Ethertypes table on the IANA "IEEE 802 Numbers" web page.(https://www.iana.org/assignments/ieee-802-numbers/ieee-802-numbers.xhtml#ieee-802-numbers-1)

6. References

6.1. Normative References

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.

[RFC8174] Leiba, B., "Ambiguity of Uppercase vs Lowercase in RFC 2119 Key Words", BCP 14, RFC 8174, DOI 10.17487/RFC8174, May 2017, <https://www.rfc-editor.org/info/rfc8174>.

[RFC2516] "A Method for Transmitting PPP Over Ethernet (PPPoE)", IETF RFC 2516, February 1999

[TS38415] 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; NG-RAN; PDU Session User Plane Protocol (Release 15), 3GPP TS38.415

6.2. Informative References

[TS23502] 3rd Generation Partnership Project; Technical

Specification Group Services and System Aspects; Procedures for the 5G System (Release 16), 3GPP TS23.502

[TS23716] 3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Study on the Wireless and Wireline Convergence for the 5G system architecture (Release 16), 3GPP TR23.716, November 2018

[TR101] "Migrating to Ethernet Based Broadband Aggregation", Broadband Forum Technical Report: TR-101 issue 2, July 2011

[TR178] "Multi-service Broadband Network Architecture and Nodal Requirements", Broadband Forum Technical Report: TR-178, September 2014

[IEEE802] 802, IEEE, "IEEE Standard for Local and Metropolitan Networks: Overview and Architecture", IEEE Std 802-2014.

[RFC4937] "IANA Considerations for PPPoE", IETF RFC 4937, June 2007

7. Authors' Addresses

Dave Allan (editor)
Ericsson
2455 Augustine Drive
San Jose, CA 95054 USA
Email: david.i.allan@ericsson.com

Donald E. Eastlake 3rd
Futurewei Technologies
2386 Panoramic Circle
Apopka, FL 32703 USA
Phone: +1-508-333-2270
Email: d3e3e3@gmail.com

David Woolley
Telstra Corporation
242 Exhibition St
Melbourne, 3000
Australia
Email: david.woolley@team.telstra.com