Project	IEEE 802.16 Broadband Wireless Access Working Group <**http://ieee802.org/16**>
Title	A Generic Packet Convergence Sublayer for Supporting Multiple Protocols over 802.16 Air Interface
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Re:	This contribution proposes a generic packet convergence sublayer for 802.16g.
Abstract	We are concerned that the 802.16 protocol cannot easily be extendable to transport new protocols over the 802.16 air interface. It would appear that a convergence sublayer is needed for every type of protocol transported over the 802.16 MAC. Every time a new protocol type needs to be transported over the 802.16 air interface, the 802.16 standard needs to be modified to define a new CS type. We need to have a generic Packet convergence sublayer that can support multi-protocols and which does not require further modification to the 802.16 standard to support new protocols. We believe that this was the intention of the Packet CS.
Purpose	The purpose of this contribution is to define a Generic Packet Convergence Sublayer for Supporting Multiple Protocols over 802.16 Air Interface.
Notice	
Release	
Patent Policy and Procedures	

A Generic Packet Convergence Sublayer Supporting Multiple Protocols over 802.16 Air Interface

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1. Introduction

We are concerned that the 802.16 protocol cannot easily be extendable to transport new protocols over the 802.16 air interface. It would appear that a convergence sublayer is needed for every type of protocol transported over the 802.16 MAC. Every time a new protocol type needs to be transported over the 802.16 air interface, the 802.16 standard needs to be modified to define a new CS type. A good example of the proliferation of CS's is found in Section 11.13.19.1 CS Specification. Version 802.16e/D6 of the standard has added 12 new Convergence Sublayers. The new Convergence Sublayers deal with ROCH and ECRTP; both are IETF header compression protocols. This is in addition to the 9 Convergence Sublayers already defined in 802.16 – 2004, that brings the total of Convergence Sublayers in 802.16e to 21!

Furthermore, we see an architectural issue related to header compression protocols. In particular, ROHC compresses all the information used by 802.16 to classify a packet to a CID and thus requiring that the implementation of ROHC (from standardization perspective at least) must be done after the 802.16 classification and thus within the 802.16 protocol stack.

We need to have a generic Packet convergence sublayer that can support multi-protocols and which does not require further modification to the 802.16 standard to support new protocols. We believe that this was the intention of the Packet CS.

A Generic Packet Convergence Sublayer (GPCS) would allow us to decouple the 802.16 link layer protocol from the higher layer protocols. In other words, instead of forcing 802.16 to know everything about all the protocols it caries and possibly repeat some of the higher layers protocols functions within the 802.16 layer, the higher layers protocols need only to pass few parameters to enable 802.16 to classify the SDU.

This knowledge can be limited to three parameters:

Logical Link identifier - identifies a logical interface within the scope of the Generic Packet CS. Therefore, the Logical Link identifier must be unique within the scope of the Generic Packet CS. There may be more than one interface over a 802.16 air link, and these interfaces may be logical or physical. An example of a logical interface is an embedded management channel between an SS and an external management entity. A logical interface may be addressed using IP/Ethernet addressing thus allowing routers and bridges to learn the existence of such interface, but the addressing scheme of the interface is above the scope of the 802.16 standard.

CoS ID – indicates the class of service as perceived by the higher application. This COS ID may be accepted by the 802.16 layer, but if it's not, the 802.16 layer can perform its own classification to determine the 802.16 COS.

Protocol Type – indicates the protocol type of the upper layer data SDU passed to the convergence sublayer. The protocol type is published in IANA (Internet Assigned Number Authority) as approved protocols for 802.16, but should not be part of the standard. 802.16 should register some of the basic protocols we think we need to transport over 802.16, but any organization or individuals can also register their favorite protocols. See www.iana.org and table below for examples of protocol Types.

While the Generic Packet CS can be used to carry IP and Ethernet packets, it is particularly suitable for protocols above the 802.16 MAC that compress the addressing and CoS fields. It allows the implementations of header compression protocols, such as, ROHC, to be done above the 802.16 convergence sublayer.

Example table of IANA protocol Types

Number	Protocol
xxxx	IPv4
yyyy	IPv6
Zzzz	802.3
	802.1Q
	ATM
	ROHC
	ECRTP

2. References

IEEE-Std 802.16 – 2004

IEEE 802.16g-04/03r3

3. Motivations

A Generic Packet Convergence sublayer would decouple the 802.16 link layer from the higher layers protocols thus enabling the transport of new multiple upper layer protocol data over 802.16 air interface without requiring any modifications to 802.16 protocol.

4. Suggested Changes

In 802.16g-04/03r3, we propose the following changes (new text in blue):

1. page 2, line 40, insert the following line:

GPCS Generic Packet Convergence Sublayer

2. page 2, line 50, insert the following:

5. Service-Specific CS

5.2 Packet CS

5.2.7 Generic Packet Convergence Sublayer (GPCS)

The Generic Packet CS supports multiple protocols over 802.16 air interface.

5.2.7.1 Generic Packet CS SDU Format from the higher layer service entity to 802.16 GPCS

It required that the higher layer service entity indicate to the 802.16 GPCS the Protocol Type (PT) of each SDU. In addition, the higher layer entity may also indicate its perception of the class of service and the logical Link layer ID.

Protocol Type indicates the outermost protocol of the SDU. The protocol type may be used by the Generic Packet CS to inspect packets to further classify the SDU to a particular CID.

The Logical Link ID identifies a logical interface on the receiver side. The Logical Link identifier must be unique within the scope of the Generic Packet CS. The 802.16 GPCS may use the Logical Link ID to perform the classification.

The Class of Service ID indicates the class of service as perceived by the higher application. The 802.16 GPCS may use the COS ID to perform the classification.

Figure 17a shows the Generic Packet CS SDU format. Note that the prepend information (indicated by dotted line) is communicated between the transmitter side and the receiver side for the connection through TLVs in

DSx messages, but it shall not be transmitted over the air with each SDU.

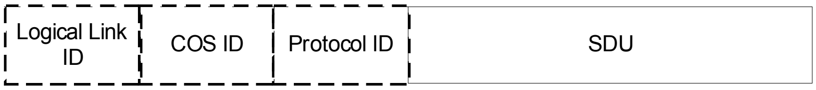

Figure 17a: SDU format between the higher layer entity and the 802.16 layer

11. TLV encodings

11.13.19 CS specific service flow encodings

11.13.19.1 CS specification

Type	Length	Value	Scope
[145/146].28	1	0: No CS 1: Packet, IPv4 2: Packet, IPv6 3: Packet, 802.3/Ethernet 4: Packet, 802.1Q VLAN 5: Packet, IPv4 over 802.3/Ethernet 6: Packet, IPv6 over 802.3/Ethernet 7: Packet, IPv4 over 802.1Q VLAN 8: Packet, IPv6 over 802.1Q VLAN 9: ATM 10: Packet, IPv4 with Header Compression (ROHC) 11: Packet, IPv4 with Header Compression (ECRTP) 12: Packet, IPv6 with Header Compression (ROHC) 13: Packet, IPv6 with Header Compression (ECRTP) 14: Packet, IPv4 over 802.3/Ethernet with Header Compression (ROHC) 15: Packet, IPv4 over 802.3/Ethernet with Header Compression (ECRTP) 16: Packet, IPv6 over 802.3/Ethernet with Header Compression (ROHC) 17: Packet, IPv6 over 802.3/Ethernet with Header Compression (ECRTP) 18: Packet, IPv4 over 802.1Q VLAN with Header Compression (ROHC) 19: Packet, IPv4 over 802.1Q VLAN with Header Compression (ECRTP) 20: Packet, IPv6 over 802.1Q VLAN with Header Compression (ROHC) 21: Packet, IPv6 over 802.1Q VLAN with Header Compression (ECRTP) 22: GPCS (Generic Packet Convergence Sublayer) ~~10~~ 23~255: reserved	DSx-REQ

11.13.19.2 CS Parameter encoding rules

CST	CS

98	No CS
99	ATM
100	Packet, IPv4
101	Packet, IPv6
102	Packet, 802.3/Ethernet
103	Packet, 802.1Q VLAN
104	Packet, IPv4 over 802.3/Ethernet
105	Packet, IPv6 over 802.3/Ethernet
106	Packet, IPv4 over 802.1Q VLAN
107	Packet, IPv6 over 802.1Q VLAN
108	Packet, IPv4 with header compression (ROHC)
109	Packet, IPv4 with header compression (ECRTP)
110	Packet, IPv6 with header compression (ROHC)
111	Packet, IPv6 with header compression (ECRTP)
112	Packet, IPv4 over 802.3/Ethernet with header compression (ROHC)
113	Packet, IPv4 over 802.3/Ethernet with header compression (ECRTP)
114	Packet, IPv6 over 802.3/Ethernet with header compression (ROHC)
115	Packet, IPv6 over 802.3/Ethernet with header compression (ECRTP)
116	Packet, IPv4 over 802.1Q VLAN with header compression (ROHC)
117	Packet, IPv4 over 802.1Q VLAN with header compression (ECRTP)
118	Packet, IPv6 over 802.1Q VLAN with header compression (ROHC)
119	Packet, IPv6 over 802.1Q VLAN with header compression (ECRTP)
120	Packet, Generic Packet CS (GPCS)

11.13.19.3.4.3 Protocol Type Encoding

The encoding of the value field is that defined by the IANA document "Protocol Numbers".

Type	Length	Value	Scope
[1445/146].cst.3.3	2	Protocol number as defined by IANA (Internet Assigned Numbers Authority)	DSx-REQ, DSx-REP

For IPv4, the value of the field specifies a matching value for the IP Protocol field. If this parameter is omitted, then the comparison of the IP header Protocol field for this entry is irrelevant.

For IPv6 (IETF RFC 2460), this refers to next header entry in the last header of the IP header chain. If this parameter is omitted, then the comparison of the IP header Protocol field for this entry is irrelevant.

For "no CS", the value field specifies the protocol type of the MAC SDUs that are transported over the no-CS connection. This parameter shall be specified for a no-CS connection.

For a Generic Packet CS, this TLV shall be used to indicate the protocol carried over the CID connection.

11.13.19.3.4.19 Logic Link Identifier

For a Generic Packet CS, this TLV may be used to identify a logical interface within the scope of the Generic Packet CS when it has more than one interface. An example of a logical interface is an embedded management channel between an SS and an external management entity. A logical interface may be addressed using IP/Ethernet addressing thus allowing routers and bridges to learn the existence of such interface, but the addressing scheme of the interface is above the scope of the 802.16 standard.

Type	Length	Value	Scope
[1445/146].cst.3.19	1	Logical Link Identifier	DSx-REQ, DSx-REP

11.13.19.3.4.20 Class of Service (CoS) Identifier

For a Generic Packet CS, this TLV may be used to indicate the class of service as perceived by the higher application, and the 802.16 GPCS may use it to perform the classifications. If it's not, the 802.16 layer can perform its own classification to determine the 802.16 CoS. The encoding of CoS for a Generic Packet CS is left for vendors' implementation and is beyond the scope of the standard.

Type	Length	Value	Scope
[1445/146].cst.3.20	1	Class of Service ID	DSx-REQ, DSx-REP