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 802.16e.
Abstract	[Description of document contents.]
Purpose	The purpose of this contribution is to define a Generic Packet Convergence Sublayer for Supporting Multiple Protocols over 802.16 Air Interface.
Notice	
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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, then bring up the total of Convergence Sublayers in 802.16e to 21!

Furthermore, the newly added convergence sublayers have no procedures or TLVs associated with them. It seems that all that was done in 802.16e/D6 was to reserve code points for future use. Second, and more severely, 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 classify the SDU.

This knowledge can be limited to three parameters:

Logical Link identifier - identifies a logical interface on the receiver side of the air link. The Logical Link identifier must be unique within the scope of the Generic Packet CS. The receiver side of the air link can have more than one interface, 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 .

The protocol type is required for two purposes:

> Because multi-protocols cannot be transported over a single CID, we need to use the protocol type when selecting the CID.

To allow the 802.16 CS to inspect packets to further classify the them to a particular CID/COS

In addition, we propose that any classification rules used within the Generic Packet CS can be left to vendors' implementation and need not be standardized. Some vendors may choose to use extensive classification algorithms within the CS or simply accept the Link Layer ID and COS ID as indicated by the upper layer.

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
	Yair's Favorite Protocol
	Lei's Protocol

2. References

IEEE-Std 802.16 – 2004

IEEE P802.16e/D8

3. Motivations

A Generic Packet Convergence sublayer would decouple the 802.16 link layer from the higher layers protocols thus enabling the transport of multiple protocols over the same convergence sublayer.

4. Suggested Changes

In 802.16e/D8, we propose the following changes (new text in blue):

1. page 12, line 1, 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 should indicate its perception of the class of service and the destination Link layer ID.

Protocol Type indicates the outermost protocol of the SDU. The protocol type shall be used by the Multi-Protocol 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.

The classification rules within the Generic Packet CS are left to vendors' implementation and are beyond the scope of the standard.

Figure 17a shows the Generic Packet CS SDU format. Note that the prepend information shall not be transmitted over the air.

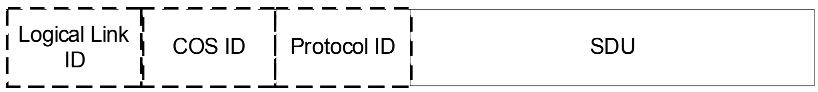

Figure 17a: SDU format from the higher layer entity to the 802.16 layer

5.2.7.2 Generic Packet CS SDU format from the 802.16 GPCS to the higher layer entity

It is required that the 802.16 GPCS indicate to the higher layer the protocol type as shown in Figure 17b. Note that the Generic Packet CS needs to determine the Protocol type based on the CID that transported the SDU since the Protocol Type is not transferred over the air.

Figure 17b: SDU format from the 802.16 layer to the higher layer entity

2. page 552, line 55, append one new row in Table 383 as follows:

Table 383 Service Flow Encoding

Type	Parameter
1	Service Flow Identifier
2	CID
3	Service Class Name
4	reserved MBS service
5	QoS Parameter Set Type
6	Traffic Priority
7	Maximum Sustained Traffic Rate
8	Maximum Traffic Burst
9	Minimum Reserved Traffic Rate
10	Minimum Tolerable Traffic Rate reserved
11	Service Flow Scheduling Type
12	Request/Transmission Policy
13	Tolerated Jitter
14	Maximum Latency
15	Fixed-length versus Variable-length SDU Indicator
16	SDU Size
17	Target SAID
18	ARQ Enable
19	ARQ_WINDOW_SIZE
20	ARQ_RETRY_TIMEOUT - Transmitter Delay
21	ARQ_RETRY_TIMEOUT - Receiver Delay
22	ARQ_BLOCK_LIFETIME
23	ARQ_SYNC_LOSS
24	ARQ_DELIVER_IN_ORDER

25	ARQ_PURGE_TIMEOUT
26	ARQ_BLOCK_SIZE
27	reserved
28	CS Specification
29	Type of Data Delivery Services
30	SDU Inter-arrival Interval
31	Time Base
32	Paging Preference
33	MBS zone identifier assignment
34	Traffic Indication Preference
35	Unsolicited grant interval
36	Unsolicited polling interval
37	SN Feedback Enabled
38	H-ARQ Service Flows
39	CID allocation for Active BSs
40	Protocol Type

3. page 554, line 3, replace the table by the following table:

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

4. page 561, line 39, insert a new section 11.13.34

11.13.34. Protocol Type Encoding

This TLV shall be used to indicate the protocol carried over the CID connection. The Protocol type TLV is mandatory whenever the convergence layer is used for the CID is the Generic Packet CS.

Type	Length	Value	Scope
[1445/146].xx	2	As defined by IANA (Internet Assigned Numbers Authority)	DSx-REQ, DSx-REP

5. page 11, line 19, insert the following line:

GPCS Generic Packet Convergence Sublayer