

Project	<b>IEEE 802.16 Broadband Wireless Access Working Group</b> < <a href="http://ieee802.org/16">http://ieee802.org/16</a> >	
Title	<b>Changes in Definition of Data Delivery Services</b>	
Date Submitted	<b>07-July-2004</b>	
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Re:		
Abstract	The document suggests changes in definitions of Data Delivery Services to adjust the definitions to the latest revision of 802.16REVd document.	
Purpose	The document is contributed to support certain comment on the 802.16e Working Document	
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# Changes in Definition of Data Delivery Services

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## 1. References

- [1] IEEE P802.16e/D3, Draft Amendment to IEEE Standard for Local and Metropolitan Area Networks Part 16: Air Interface for Fixed and Mobile Broadband Wireless Access Systems — Amendment for Physical and Medium Access Control Layers for Combined Fixed and Mobile Operation in Licensed Bands
- [2] IEEE P802.16-REVd/D5-2004, IEEE Standard for Local and metropolitan area networks Part 16: Air Interface for Fixed Broadband Wireless Access Systems ((Draft Revision of IEEE Std 802.16-2001)

## 2. The Document's Goal

The document's goal is to adjust definitions of Data Delivery Services in IEEE 802.16e/D3 to the latest revision of 802.16REVd document.

Definitions in REVd/D5 has the following problems from the prospect of applicability to mbile networks

- They refer mainly to UL service flows (except 6.3.5.1 “Outbound transmission scheduling” which is not sufficient). For example, section 6.3.5.2.3 on nrtPS describes only policy of unicast polls and unicast request opportunities
- They allow for too much flexibility as specified set of QoS parameters is referred to as “mandatory” (therefore, there may be more parameters). For example, in 6.3.5 “The mandatory QoS service flow parameters for this scheduling service [BE – V.Y] are Maximum Sustained Traffic Rate (11.13.6), Traffic Priority (11.13.5), and Request/Transmission Policy (11.13.12)”
- Time Base parameter is absent, so it is not clear at which time interval traffic rate is measured
- No support for applications with constant bit rate (with not necessary fixed SDU size)

As REVd/D5 document is closed, seems reasonable to keep in 802.16e “Data Delivery Services” part with certain changes to avoid inconsistencies with REVd/D5.

## 3. Comparison of definitions in 802.16e/D3 and 802.16REVd/D5

The following table contains elements of comparison between definitions in [1] and [2]. Parameters absent in another column are marked by red/blue color.

Term	IEEE 802.16REVd/D5	IEEE 802.16e/D3
Service name	UGS (Unsolicited Grant Service)	CG (Continuing Grant Service)
Service parameters	UGS (Unsolicited Grant Service)	CG (Continuing Grant Service)

Term	IEEE 802.16REVd/D5	IEEE 802.16e/D3
	<ul style="list-style-type: none"> <li>• Maximum Sustained Traffic Rate</li> <li>• Maximum Latency</li> <li>• Tolerated Jitter</li> <li>• Request/Transmission Policy</li> </ul>	<ul style="list-style-type: none"> <li>• Maximum Latency</li> <li>• Tolerated Jitter</li> <li>• Minimum Reserved Traffic Rate</li> <li>• Minimum tolerable traffic rate</li> <li>• SDU Size</li> <li>• Time Base</li> </ul>
Service name	rtPS (real-time Polling Service)	RT-VR (Real Time – Variable Rate service)
Service parameters	rtPS (real-time Polling Service) <ul style="list-style-type: none"> <li>• Minimum Reserved Traffic Rate</li> <li>• Maximum Sustained Traffic Rate</li> <li>• Maximum Latency</li> <li>• Request/Transmission Policy</li> </ul>	RT-VR (Real Time – Variable Rate service) <ul style="list-style-type: none"> <li>• Minimum Reserved Traffic Rate</li> <li>• Maximum Sustained Traffic Rate</li> <li>• Maximum Latency</li> <li>• Minimum tolerable traffic rate</li> <li>• Time Base</li> </ul>
Service name	nrtPS (non-real-time Polling Service)	NRT-VR (Non-Real Time – Variable Rate service)
Service parameters	nrtPS (non-real-time Polling Service) <ul style="list-style-type: none"> <li>• Minimum Reserved Traffic Rate</li> <li>• Maximum Sustained Traffic Rate</li> <li>• Traffic Priority</li> <li>• Request/Transmission Policy</li> </ul>	NRT-VR ((Non-Real Time – Variable Rate service) <ul style="list-style-type: none"> <li>• Minimum Reserved Traffic Rate</li> <li>• Maximum Sustained Traffic Rate</li> <li>• Minimum tolerable traffic rate</li> <li>• Time Base</li> </ul>
Service name	BE (Best Effort)	BE
Service parameters	BE (Best Effort) <ul style="list-style-type: none"> <li>• Maximum Sustained Traffic Rate</li> <li>• Traffic Priority</li> <li>• Request/Transmission Policy</li> </ul>	BE (Best Effort) <ul style="list-style-type: none"> <li>• Maximum Sustained Traffic Rate</li> <li>• Time Base</li> </ul>

## 4. Suggestions

It is suggested

- To align names of services where logical (names like rtPS refer to Polling Service which would be misleading for DL service flows)
- To align definitions in [1] to definitions in [2] from the prospect of parameters set
  - Exclude Minimum tolerable traffic rate
  - Add Request/Transmission Policy as optional parameter
  - Add Traffic priority where relevant

A special consideration is needed for UGS (CG) service. SDU size parameter (if at fixed size SDUs) is important for the BS to provide allocations of optimal size, so it is suggested to keep it.

## 5. Specific changes in the Standard

This chapter contains specific changes suggested in [1] .

### 6.3.18 Data Delivery Services for Mobile Network

Data delivery service is associated with certain predefined set of QoS-related Service Flow parameters.

Note that definition of Data Delivery Service does not include assignment of specific values to the parameters.

#### 6.3.18.1 Types of Data Delivery Services

Type of Data Delivery Service identifies specific set of QoS parameters – see Table 130a.

Table 130a - Type of Data Delivery Services

Type	Symbolic Name of Service Type	Meaning
0	<del>CG</del> UGS	<del>Continuing-Unsolicited</del> Grant Service For UL connections should be supported by UGS Scheduling Service
1	RT-VR	Real Time – Variable Rate service For UL connections should be supported by rtPS Scheduling Service
2	NRT-VR	Non-Real Time – Variable Rate service For UL connections should be supported by nrtPS Scheduling Service

Type	Symbolic Name of Service Type	Meaning
3	BE	Best Efforts service For UL connections should be supported by BE Scheduling Service

See below detailed definitions for the data delivery services of different types.

#### 6.3.18.1.1 **Continuing Unsolicited Grant (CGUGS) Service**

This type of service is to support real-time applications generating fixed-size data packets on a periodic basis.

The following are the parameters of the service:

Table 130b - **Unsolicited Continuing Grant Service (CGUGS) Parameters**

Parameter	Meaning
<del>SDU Size</del>	<del>According to 11.4.9.16.</del>
Tolerated Jitter	<u>According to 11.13.13</u>
If (Fixed length <del>PDUSDU</del> )	
<del>SDU Size</del>	<u>According to. 11.13.16</u>
<del>Minimum Tolerable Traffic Rate</del>	<del>Optional parameter described in 11.4.9.10 (defaults to Minimum Reserved Traffic Rate)</del>
<del>else</del>	
Minimum Reserved Traffic Rate	<u>According to 11.13.8</u>
Maximum Latency	<u>According to 11.13.14</u> <u>As specified in 11.4.9.14</u>
<u>Request/Transmission Policy</u>	<u>According to 11.13.12</u>
<u>Time Base</u>	<u>Parameter T as specified in 11.4.9.9; should be much larger than Maximum Latency</u>

#### Description of the service

The BS is supposed during each time interval of the length (Time Base) to grant to the connection resources sufficient for transferring at least N SDUs of the given size where  $N = (\text{Time Base}) / (\text{SDU Inter-arrival Interval})$  so that each SDU shall be delivered within time interval (Maximum Latency).

#### 6.3.18.1.2 **Real-Time Variable Rate (RT-VR) Service**

This service is to support real-time data applications with variable bit rates which require guaranteed data rate and delay. The following are the parameters of the service:

Table 130c. Real Time Variable Rate Service Parameters

Parameter	Meaning
Maximum Latency	As specified in <u>11.13.14</u> <del>11.4.9.15</del>

Parameter	Meaning
Minimum Reserved Traffic Rate	As defined <del>according to 11.13.8</del> <u>11.4.9.9</u> with <u>averaging over time at</u> time base = T
<del>Minimum Tolerable Traffic Rate</del>	<del>(Optional), defaulting to Minimum Reserved Traffic Rate. As specified in 11.4.9.10, with time base = T. This value should be less than Minimum Reserved Traffic Rate. The difference between these two values reflects SDUs' loss rate</del>
Maximum Sustained Traffic Rate	<del>(Optional), if absent defaulting to Minimum Reserved Traffic Rate. As specified in 11.4.9.10, with <u>averaging over time at</u> time base = T. This value <del>should</del> <u>shall</u> be less than Minimum Reserved Traffic Rate. <del>The difference between these two values reflects SDUs' loss rate.</del></del>
<u>Traffic Priority</u>	<u>According to 11.13.5</u>
<u>Request/Transmission Policy</u>	<u>According to 11.13.12</u>
<u>Time Base</u>	<u>Parameter T as specified in 11.4.9.9; should be much larger than Maximum Latency</u>

#### Description of the service

Let S denote the amount of data arrived to the transmitter's MAC SAP, during time interval  $T = \text{Time Base}$ ;  $R = \text{Minimum Reserved Traffic Rate}$ . Then the BS is supposed during each time interval of the length (Time Base) to grant-allocate to the connection resources sufficient for transferring amount of data according to the value of Minimum Reserved Traffic Rate (11.3.8) i.e. at least  $\min \{S, R * T\}$ . Any SDU should be delivered within time interval  $D = \text{Maximum Latency}$ . In the case when the amount of data submitted to the transmitter's MAC SAP exceeds  $(\text{Maximum Sustained Traffic Rate}) * T$ , delivery of each specific SDU is not guaranteed.

#### 6.3.18.1.3 Non-Real-Time Variable Rate (NRT-VR) Service

This QoS profile shall support applications that require a guaranteed data rate but are insensitive to delays. It is desirable in certain cases to limit the data rate of these services to some maximum rate. The QoS profile is defined by the ~~following~~ parameters defined ~~as~~ in the following Table DDD (~~note absence of Maximum Latency parameter~~):

- ~~□ Time Base~~
- ~~□ Minimum Reserved Traffic Rate~~
- ~~□ Minimum Tolerable Traffic Rate~~
- Maximum Sustained Traffic Rate

Table DDD. Non-Real Time Variable Rate Service Parameters

Parameter	Meaning
<u>Minimum Reserved Traffic Rate</u>	<u>As defined in 11.13.8 with averaging over time at time base = T</u>
<u>Maximum Sustained Traffic Rate</u>	<u>Optional, if absent defaulting to Minimum Reserved Traffic Rate. As specified in 11.4.9.10, with averaging over time at time base = T. This value shall be less than Minimum Reserved Traffic Rate.</u>

<u>Parameter</u>	<u>Meaning</u>
<u>Traffic Priority</u>	<u>According to 11.13.5</u>
<u>Request/Transmission Policy</u>	<u>According to 11.13.12</u>
<u>Time Base</u>	<u>Parameter T as specified in 11.4.9.9; should be much larger than system latency</u>

### **Description of the service**

Let S denote the amount of data arrived to the transmitter's MAC SAP, during time interval  $T = \text{Time Base}$ ;  $R = \text{Minimum Reserved Traffic Rate}$ . Then the BS is supposed during each time interval of the length (Time Base) to grant-allocate to the connection resources sufficient for transferring amount of data according to the value of Minimum Reserved Traffic Rate (11.3.8) i.e at least  $\min \{S, R * T\}$ . In the case when the amount of data submitted to the transmitter's MAC SAP exceeds (Maximum Sustained Traffic Rate) \* T, delivery of each specific SDU is not guaranteed

### **6.3.18.1.4 Best Effort (BE) Service**

This service is for applications with no rate or delay requirements. The following are the parameters of the service:

**Table 130d. Best Effort Service Parameters**

<u>Parameter</u>	<u>Meaning</u>
Maximum Sustained Traffic Rate	As specified in <u>11.13.6+11.4.9.7</u>
<u>Traffic Priority</u>	<u>According to 11.13.5</u>
<u>Request/Transmission Policy</u>	<u>According to 11.13.12</u>
<u>Time Base</u>	<u>Parameter T as specified in 11.4.9.9; should be much larger than system latency</u>

### **Description of the service**

The BS should do best possible for transferring the data arrived to MAC SAP with restrictions provided in definition of Maximum Sustained Traffic Rate in 11.13.6, using for averaging over time interval  $T = \text{Time Base}$