Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**Global Service Flows Definitions**
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Re:	Response to IEEE 802.16e-03/23 (Call for Contributions on IEEE 802.16e/07r4) Response to Session 27 minutes call for creation of Global Service Flows Ad Hoc group to review and make recommendations'
Abstract	Proposal of transmission media neutral, global Service Flow definitions.
Purpose	Stimulate discussion on a more flexible definition and mechanism for facilitating multimedia Service Flow migration/hand-over between foreign networks.
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Global Service Flows Definitions

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Introduction

The Service Flow QoS definitions, provisioning, and operation structures in the *IEEE P802.16-REVd/D1-2003 "Part 16: Air Interface for Fixed Broadband Wireless Access Systems"*, section **6.4.13 QoS**, provide a framework for individual operators/implementers to support bi-directional multimedia data streams on their networks. Though the Service Flow QoS mechanisms defined may need additional refinement (see Vladimir's Contribution C80216e-03_58 *"Definition of Data Delivery Services"*), they basically succeed in achieving their stated goals of enabling multimedia Service Flows in the 802.16 transmission medium environment for single operator implementation.

However, as we introduce mobility concepts to the 802.16 operating environment and begin to expand our definition of network configuration and operation types supported through the standard, we begin to identify some critical areas of QoS definition that hinder our ability to maximize the utility of the proposed solution and limit the diversity of possible implementation models.

As we introduce mobility we begin to see the opportunity for MSS to move between disparate operator 802.16 networks, not just 802.16 intra-operator network hand-over or fixed operator network association. Operators may be interested in facilitating foreign network roaming through traditional inter-carrier arrangement or as part of some other, as yet envisaged foreign network affiliation. Indeed, it is possible to anticipate mobile devices moving not just between 802.16 operator networks, but between different 802 operator networks, and even between different mobile systems entirely (i.e. 802.16-to-802.11-to 802.15-to-3GPP, etc…). Unfortunately, the current omission of a common set of multimedia Service Flow definitions for Service Flow creation, operation, and dissolution, across differing transmission medium types (transport and network) or even just among 802.16 compliant networks, means no foreign network mobility is possible. Without a common set of definitions to facilitate migration/hand-over of persistent, active Service Flows as defined by ProvisionedQoSParamSet/AuthorizedQoSParamSet, identified through Service Class Name and encompassing a transmission medium neutral, minimal subset of **11.4.9 Service flow encodings,** foreign network roaming of any type shall not be possible. To the extent that a set of Global Service Flow definitions can be created transmission medium neutral and common, we can facilitate maximum foreign network roaming functionality and an explosion of multi-medium/system mobile devices.

This contribution seeks to provide an initial, minimal set of Global Service Flow transmission medium neutral definitions. The set of definitions would be provided as a 'Best Practices' annex to the standard.

Systemic Assumptions

Establishing some systemic assumptions grants us an opportunity to create criteria for evaluating the merit of various definitions. My simple set includes:

- Support the diversity of multimedia traffic types
    - Matrix of Data/Voice/Video and timing-sensitive/timing-insensitive traffic types
        - Voice and Video inherently timing-sensitive to some degree
        - Data may be either timing-sensitive or timing-insensitive
- Support a defined variety of popular/useful subset definitions within major types
    - Real-time video can have varying requirements based on expected payload (to support varying image size and compression mechanisms) and frame-rate
        - 56kbps, 10 fps
        - 128kbps, 10 fps
        - 192 kbps, 15 fps
        - 128 kbps, 30 fps
        - 384kbps, 30 fps
        - 768 kbps, 55 fps
    - Bi-directional voice
- Provide only the minimal set of payload data rate, burst, and timing requirements to provide the requested Service Flow type. Do not over specify out of scope.
- Support disparity in UL/DL multimedia service flow requirements
    - Service Flows frequently apply mismatched performance requirements based on differentiation between UL/DL traffic
        - A downlink multi-cast streaming video Service Flow may have high bandwidth requirements with high delay and jitter tolerance while the corresponding uplink Service Flow has vastly inferior requirements.
- Keep definition set minimal and transmission medium neutral
    - Avoid specification of medium specific parameters
        - Ignore transmission medium specific Service Flow provisioning, operation, and maintenance overhead. The rate is expressed in bits per second and pertains to the SDUs at the input to the system.
            - Bi-directional full-duplex voice on a GSM network may only require 9.6 kbps UL/DL of data throughput while SIP provisioned VoIP may require 40 kbps UL/DL, including overhead. Since we know that overhead is going to vary significantly by

transmission medium, it is better to ignore overhead and allow transmission medium specific standards groups and implementers to define overhead specific Service Flow requirements.

  - Do not specify the service flow creation/grant mechanism. Mechanisms are medium specific.

- Network is resource gatekeeper/master control for network resources
  - He who controls the resources has final say on the allocation of those resources
  - Only provide raw Service Flow requirements, allow network to make decisions on acceptance and implementation
  - Network may make decisions that reduce allocated QoS in order to maximize other performance criteria

C.5 Global Service Flow Definitions

Each Service Class is separately differentiated by its uplink and downlink Service Flow component. Service Flow parameters define the minimum required resources to accommodate the Service Flow payload and timing requirements only. Any and all additional transmission medium specific protocol, transport, and network resource requirements to establish, service, and maintain the requested Service Flows are specifically excluded. The Service Classes are defined by the following parameters:

Table C13—Global Service Flow Definition Parameters

Name	Size	Value
Global Service Class Name	128 bits	Zero-terminated string of ASCII characters. The length of the string, including zero-terminator may not exceed 128 bytes.
Maximum sustained traffic rate	32 bits	Rate (in bits per second)
Maximum traffic burst	32 bits	Bytes
Minimum reserved traffic rate	32 bits	Rate (in bits per second)
Tolerated jitter	16 bits	milliseconds
Maximum latency	16 bits	milliseconds
Fixed-length versus variable-length SDU indicator	1 bit	0=variable-length SDUs 1=fixed-length SDUs
SDU size	16 bits	Number of Bytes

Global Service Class Name—the ASCII name for the Global Service Class

Maximum sustained traffic rate—this parameter defines the peak information rate of the service. The rate is expressed in bits per second and pertains to the service data units (SDUs) at the input to the system. Explicitly, this parameter does not include transport, protocol, or network overhead such as MAC headers or CRCs, or non-payload session maintenance overhead like SIP, MGCP, H.323 administration, etc…. This parameter does not limit the instantaneous rate of the service since this is governed by the physical attributes of the ingress port. However, at the destination network interface in the uplink direction, the

service shall be policed to conform to this parameter, on the average, over time. On the network in the downlink direction, it may be assumed that the service was already policed at the ingress to the network. If this parameter is omitted or set to zero, then there is no explicitly mandated maximum rate. This field specifies only a bound, not a guarantee that the rate is available. The algorithm for policing to this parameter is left to vendor differentiation and is outside the scope of the standard.

Maximum traffic burst—this parameter defines the maximum burst size that must be accommodated for the service. Since the physical speed of ingress/egress ports, any air interface, and the backhaul will in general be greater than the maximum sustained traffic rate parameter for a service, this parameter describes the maximum continuous burst the system should accommodate for the service assuming the service is not currently using any of its available resources. Max traffic burst set to zero shall mean no Maximum traffic burst reservation requirement.

Minimum reserved traffic rate—this parameter specifies the minimum rate, in bits per second, reserved for this Service Flow. The BS should be able to satisfy bandwidth requests for a Service Flow up to its Minimum Reserved Traffic Rate. If less bandwidth than its Minimum Reserved Traffic Rate is requested for a Service Flow, the BS may reallocate the excess reserved bandwidth for other purposes. The aggregate Minimum Reserved Traffic Rate of all Service Flow may exceed the amount of available bandwidth. The value of this parameter is calculated excluding all protocol, transport, and network overhead. If this parameter is omitted, then it defaults to a value of 0 bits per second (i.e., no bandwidth is reserved for the flow by default).

Tolerated jitter— this parameter defines the Maximum delay variation (jitter) for the connection. A value of zero for Tolerated jitter shall be interpreted as infinite tolerance—timing insensitive traffic.

Maximum latency—the value of this parameter specifies the maximum latency between the reception of a packet into the network gateway or boundary network interface and the forwarding of the packet to its destination interface. If defined, this parameter represents a service commitment (or admission criteria) and shall be guaranteed. A network does not have to meet this service commitment for Service Flows that exceed their DL Minimum reserved traffic rate. A value of zero for Maximum latency shall be interpreted as infinite tolerance—timing insensitive traffic.

Fixed-length versus variable-length SDU indicator— the value of this parameter specifies whether the SDUs on the Service Flow are fixed-length or variable-length.

SDU size—the value of this parameter specifies the length of the SDU for a fixed-length SDU Service Flow. This parameter is used only if the Service Flow is indicated as carrying fixed-length SDUs. Default value of zero.

Table C14—Global Service Flow Definitions

Service Class Name	Maximum sustained traffic rate (bits per second)	Maximum traffic burst (Bytes)	Minimum reserved traffic rate (bits per second)	Tolerated jitter (ms)	Maximum latency (ms)	Fixed-length versus variable-length SDU indicator	SDU size (Number of Bytes)
ULBestEffortDat	0	0	0	0	0	0	0
DLBestEffortDat	0	0	0	0	0	0	0
ULBEDly50Dat	0	0	0	25	50	0	0

DLBEDly50Dat	0	0	0	25	50	0	0
ULBEDly100Dat	0	0	0	50	100	0	0
DLBEDly100Dat	0	0	0	50	100	0	0
ULBEDly150Dat	0	0	0	75	150	0	0
DLBEDly150Dat	0	0	0	75	150	0	0
ULBEDly200Dat	0	0	0	100	200	0	0
DLBEDly200Dat	0	0	0	100	200	0	0
ULBEDS0Dat	32768	4096	0	0	0	0	0
DLBEDS0Dat	32768	4096	0	0	0	0	0
ULBEDS1Dat	786432	98304	0	0	0	0	0
DLBEDS1Dat	786432	98304	0	0	0	0	0
ULBEE1Dat	983040	122880	0	0	0	0	0
DLBEE1Dat	983040	122880	0	0	0	0	0
ULBEDS3Dat	22020096	2752512	0	0	0	0	0
DLBEDS3Dat	22020096	2752512	0	0	0	0	0
ULBEOC3Dat	66060288	8257536	0	0	0	0	0
DLBEOC3Dat	66060288	8257536	0	0	0	0	0
ULBEOC12Dat	264241152	33030144	0	0	0	0	0
DLBEOC12Dat	264241152	33030144	0	0	0	0	0
ULBEOC48Dat	1056964608	132120576	0	0	0	0	0
DLBEOC48Dat	1056964608	132120576	0	0	0	0	0
ULBEOC192Dat	4227858432	528482304	0	0	0	0	0
DLBEOC192Dat	4227858432	528482304	0	0	0	0	0
ULResDS0Dat	32768	4096	32768	50	50	0	0
DLResDS0Dat	32768	4096	32768	50	50	0	0
ULResDS1Dat	786432	98304	786432	50	50	0	0
DLResDS1Dat	786432	98304	786432	50	50	0	0
ULResE1Dat	983040	122880	983040	50	50	0	0
DLResE1Dat	983040	122880	983040	50	50	0	0
ULResDS3Dat	22020096	2752512	22020096	50	50	0	0
DLResDS3Dat	22020096	2752512	22020096	50	50	0	0
ULResOC3Dat	66060288	8257536	66060288	50	50	0	0
DLResOC3Dat	66060288	8257536	66060288	50	50	0	0
ULResOC12Dat	264241152	33030144	264241152	50	50	0	0
DLResOC12Dat	264241152	33030144	264241152	50	50	0	0
ULResOC48Dat	1056964608	132120576	1056964608	50	50	0	0
DLResOC48Dat	1056964608	132120576	1056964608	50	50	0	0
ULResOC192Dat	4227858432	528482304	4227858432	50	50	0	0
DLResOC192Dat	4227858432	528482304	4227858432	50	50	0	0
ULBE0048Voi	4800	600	0	150	150	0	0
DLBE0048Voi	4800	600	0	150	150	0	0
ULBE0096Voi	9600	1200	0	150	150	0	0

DLBE0096Voi	9600	1200	0	150	150	0	0
ULBE0192Voi	19200	2400	0	150	150	0	0
DLBE0192Voi	19200	2400	0	150	150	0	0
ULBE0640Voi	64000	8000	0	150	150	0	0
DLBE0640Voi	64000	8000	0	150	150	0	0
ULBE1280Voi	128000	16000	0	150	150	0	0
DLBE1280Voi	128000	16000	0	150	150	0	0
ULBE2560Voi	256000	32000	0	150	150	0	0
DLBE2560Voi	256000	32000	0	150	150	0	0
ULRes0048Voi	4800	600	4800	150	150	0	0
DLRes0048Voi	4800	600	4800	150	150	0	0
ULRes0096Voi	9600	1200	9600	150	150	0	0
DLRes0096Voi	9600	1200	9600	150	150	0	0
ULRes0192Voi	19200	2400	19200	150	150	0	0
DLRes0192Voi	19200	2400	19200	150	150	0	0
ULRes0640Voi	64000	8000	64000	150	150	0	0
DLRes0640Voi	64000	8000	64000	150	150	0	0
ULRes1280Voi	128000	16000	128000	150	150	0	0
DLRes1280Voi	128000	16000	128000	150	150	0	0
ULRes2560Voi	256000	32000	256000	150	150	0	0
DLRes2560Voi	256000	32000	256000	150	150	0	0
ULBEStr024Vid	24000	3000	0	1000	2000	0	0
DLBEStr024Vid	24000	3000	0	1000	2000	0	0
ULBEStr048Vid	48000	6000	0	1000	2000	0	0
DLBEStr048Vid	48000	6000	0	1000	2000	0	0
ULBEStr056Vid	56000	7000	0	1000	2000	0	0
DLBEStr056Vid	56000	7000	0	1000	2000	0	0
ULBEStr065Vid	65536	8192	0	1000	2000	0	0
DLBEStr065Vid	65536	8192	0	1000	2000	0	0
ULBEStr100Vid	100000	12500	0	1000	2000	0	0
DLBEStr100Vid	100000	12500	0	1000	2000	0	0
ULBEStr131Vid	131072	16384	0	1000	2000	0	0
DLBEStr131Vid	131072	16348	0	1000	2000	0	0
ULBEStr196Vid	196608	24576	0	1000	2000	0	0
DLBEStr196Vid	196608	24576	0	1000	2000	0	0
ULBEStr262Vid	262144	32768	0	1000	2000	0	0
DLBEStr262Vid	262144	32768	0	1000	2000	0	0
ULBEStr300Vid	300000	37500	0	1000	2000	0	0
DLBEStr300Vid	300000	37500	0	1000	2000	0	0
ULBEStr393Vid	393216	49152	0	1000	2000	0	0
DLBEStr393Vid	393216	49152	0	1000	2000	0	0
ULBEStr786Vid	786432	98304	0	1000	2000	0	0

DLBEStr786Vid	786432	98304	0	1000	2000	0	0
ULResStr024Vid	24000	3000	24000	1000	2000	0	0
DLResStr024Vid	24000	3000	24000	1000	2000	0	0
ULResStr048Vid	48000	6000	48000	1000	2000	0	0
DLResStr048Vid	48000	6000	48000	1000	2000	0	0
ULResStr056Vid	56000	7000	56000	1000	2000	0	0
DLResStr056Vid	56000	7000	56000	1000	2000	0	0
ULResStr065Vid	65536	8192	65536	1000	2000	0	0
DLResStr065Vid	65536	8192	65536	1000	2000	0	0
ULResStr100Vid	100000	12500	100000	1000	2000	0	0
DLResStr100Vid	100000	12500	100000	1000	2000	0	0
ULResStr131Vid	131072	16384	131072	1000	2000	0	0
DLResStr131Vid	131072	16348	131072	1000	2000	0	0
ULResStr196Vid	196608	24576	196608	1000	2000	0	0
DLResStr196Vid	196608	24576	196608	1000	2000	0	0
ULResStr262Vid	262144	32768	262144	1000	2000	0	0
DLResStr262Vid	262144	32768	262144	1000	2000	0	0
ULResStr300Vid	300000	37500	300000	1000	2000	0	0
DLResStr300Vid	300000	37500	300000	1000	2000	0	0
ULResStr393Vid	393216	49152	393216	1000	2000	0	0
DLResStr393Vid	393216	49152	393216	1000	2000	0	0
ULResStr786Vid	786432	98304	786432	1000	2000	0	0
DLResStr786Vid	786432	98304	786432	1000	2000	0	0
ULBERt024Vid	24000	3000	0	100	200	0	0
DLBERt024Vid	24000	3000	0	100	200	0	0
ULBERt048Vid	48000	6000	0	50	100	0	0
DLBERt048Vid	48000	6000	0	50	100	0	0
ULBERt056Vid	56000	7000	0	50	100	0	0
DLBERt056Vid	56000	7000	0	50	100	0	0
ULBERt065Vid	65536	8192	0	33	65	0	0
DLBERt065Vid	65536	8192	0	33	65	0	0
ULBERt100Vid	100000	12500	0	25	50	0	0
DLBERt100Vid	100000	12500	0	25	50	0	0
ULBERt131Vid	131072	16384	0	25	50	0	0
DLBERt131Vid	131072	16348	0	25	50	0	0
ULBERt196Vid	196608	24576	0	16	33	0	0
DLBERt196Vid	196608	24576	0	16	33	0	0
ULBERt262Vid	262144	32768	0	16	33	0	0
DLBERt262Vid	262144	32768	0	16	33	0	0
ULBERt300Vid	300000	37500	0	16	33	0	0
DLBERt300Vid	300000	37500	0	16	33	0	0
ULBERt393Vid	393216	49152	0	16	33	0	0

DLBERt393Vid	393216	49152	0	16	33	0	0
ULBERt786Vid	786432	98304	0	16	33	0	0
DLBERt786Vid	786432	98304	0	16	33	0	0
ULResRt024Vid	24000	3000	24000	100	200	0	0
DLResRt024Vid	24000	3000	24000	100	200	0	0
ULResRt048Vid	48000	6000	48000	50	100	0	0
DLResRt048Vid	48000	6000	48000	50	100	0	0
ULResRt056Vid	56000	7000	56000	50	100	0	0
DLResRt056Vid	56000	7000	56000	50	100	0	0
ULResRt065Vid	65536	8192	65536	33	65	0	0
DLResRt065Vid	65536	8192	65536	33	65	0	0
ULResRt100Vid	100000	12500	100000	25	50	0	0
DLResRt100Vid	100000	12500	100000	25	50	0	0
ULResRt131Vid	131072	16384	131072	25	50	0	0
DLResRt131Vid	131072	16348	131072	25	50	0	0
ULResRt196Vid	196608	24576	196608	16	33	0	0
DLResRt196Vid	196608	24576	196608	16	33	0	0
ULResRt262Vid	262144	32768	262144	16	33	0	0
DLResRt262Vid	262144	32768	262144	16	33	0	0
ULResRt300Vid	300000	37500	300000	16	33	0	0
DLResRt300Vid	300000	37500	300000	16	33	0	0
ULResRt393Vid	393216	49152	393216	16	33	0	0
DLResRt393Vid	393216	49152	393216	16	33	0	0
ULResRt786Vid	786432	98304	786432	16	33	0	0
DLResRt786Vid	786432	98304	786432	16	33	0	0

Note that it is expected, even likely, that UL and DL Service Flow requests will not be made as related pairs. A request to establish a 30 fps downlink streaming video session would likely mean using a DLBEStr300Vid for the downlink and an ULBEDly150Dat for the uplink request.