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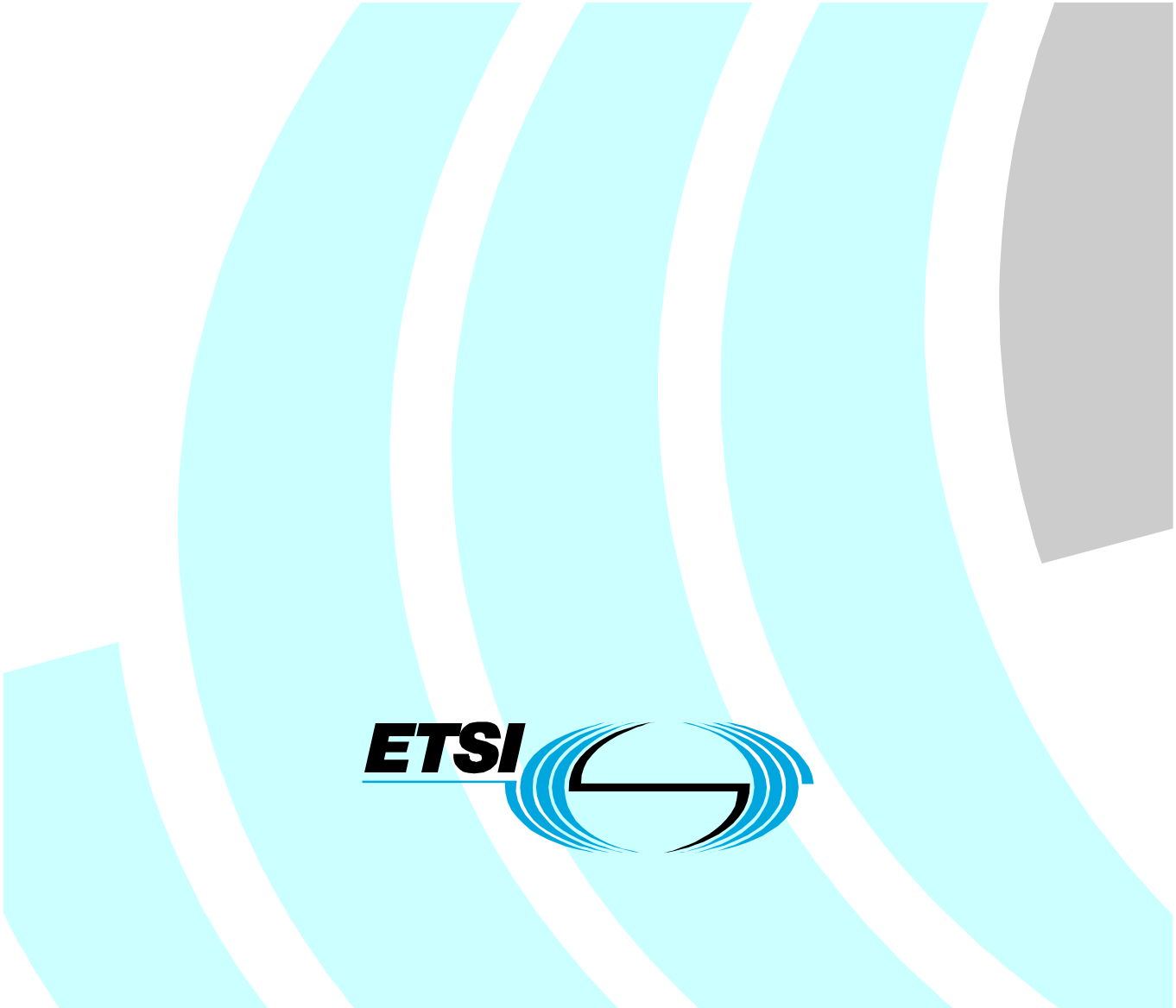
Technical Specification

Satellite Earth Stations and Systems (SES);
Broadband Satellite Multimedia (BSM)
services and architectures;
BSM Traffic Classes



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Contents

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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Satellite Earth Stations and Systems (SES).

Introduction

The present document presents the traffic classes that are going to be used to define and control Quality of Service (QoS) and Performance levels in a BSM. These classes are defined by the services operators who want to offer over BSM while being independent of the BSM implementation. In particular they do not depend on the system specific priorities at the satellite dependant layers by rely on lower layer mapping function to ensure each traffic class is given appropriate quality of service. They are used by policy enforcement, queuing and resource allocation mechanisms to ensure that traffic entering the BSM is sorted and processed according to its characteristics. In order to characterize current and future Internet traffic flowing through the BSM, the classes contain both connection oriented and connectionless traffic classes.

1 Scope

The scope of the present document is the definition of qualitative classes to sort the traffic entering the BSM according to generic class descriptors. The quantitative performance levels expected from a BSM link for each of these classes is beyond the scope of the present document.

2 Void

3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

3GPP	Third Generation Partnership Project
AF	Assured Forwarding
BSM	Broadband Satellite Multimedia
Diffserv	Differentiated services (IETF)
EF	Expedited Forwarding
IETF	Internet Engineering Task Force
IP	Internet Protocol
IPR	Intellectual Property Rights
ITU	International Telecommunication Union
ITU-R	ITU-Radiocommunication sector
ITU-T	ITU-Telecommunication standardization sector
MAC	Medium Access Control
MPLS	MultiProtocol Label Switching
OSPF	Open Short Path First
QoS	Quality of Service
RFC	Request For Comments
RSVP	ReSerVation Protocol
SI	Satellite Independent
SI-SAP	Satellite Independent-Service Access Point
TC	ETSI Technical Committee
TC	Transfer Capability (ITU-T Recommendation Y.1221)
TIPHON	Telecommunications and Internet Protocol Harmonization over Networks
TR	Technical Report
TS	Technical Specification
VoIP	Voice over IP
WG	Working Group
VTC	Video TeleConferencing
PHB	Per Hop Behaviour
BE	Best Effort
EH	Expedited Forwarding
SLA	Service Level Agreements

4 Basis for the BSM traffic classes

4.1 Service categories

The BSM as any other broadband technology is going to offer a number of services that require variable levels of delay, delay variation and loss in order to offer the appropriate quality of service see TR 101 984 and TR 101 985. Traffic classes are used to queue and police traffic but also to set Diffserv markings and negotiate transport level contracts across operators. TS 123 107 and ITU have defined traffic classes that allow the BSM work to profit from solid heritage. The BSM traffic classes are defined at the SI-SAP interface as introduced in the BSM Functional Architecture TS 102 292. Clause 4 presents the basis for the definition of the BSM traffic classes.

The applications most likely to be offered over the BSM fall in the following categories:

- real time or conversational services such as voice and live video;
- non real time services relating to streaming (with caching) and web surfing;
- and traditional Internet traffic relating to email, newsnet etc.

Figure 1 taken from the ITU-T Recommendation G.1010 gives an overview of these services based on error and delay tolerance.

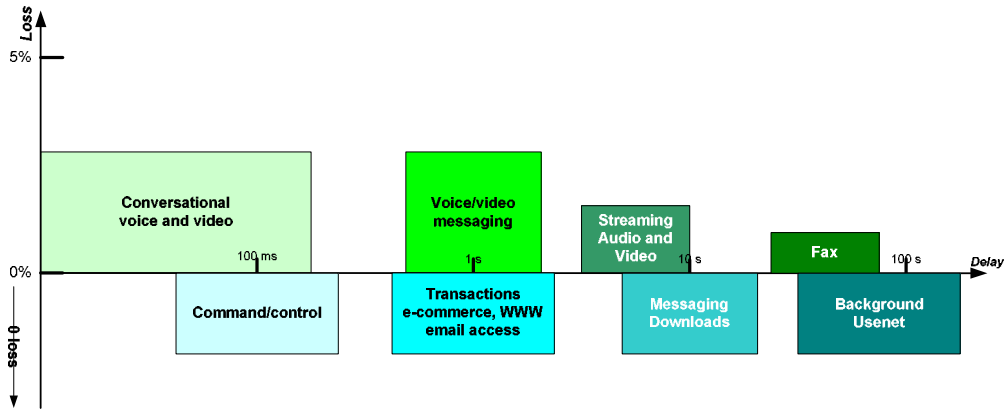

Figure 1: ITU-T Recommendation G.1010 mapping of BSM services to performance goals

These service categories in turn define traffic classes when taking into account connectivity requirements and loss and jitter (delay variation) tolerance. Hence, the definition of BSM traffic classes follows general service category guidelines that have been used in the ITU, TS 123 107 and TS 101 329-2 (figure 2):

- type of traffic: connection oriented and connectionless;
- type of interaction: real time interactive, interactive or non-interactive; and
- quality of service indicators: degree of acceptable loss, delay and delay variations.

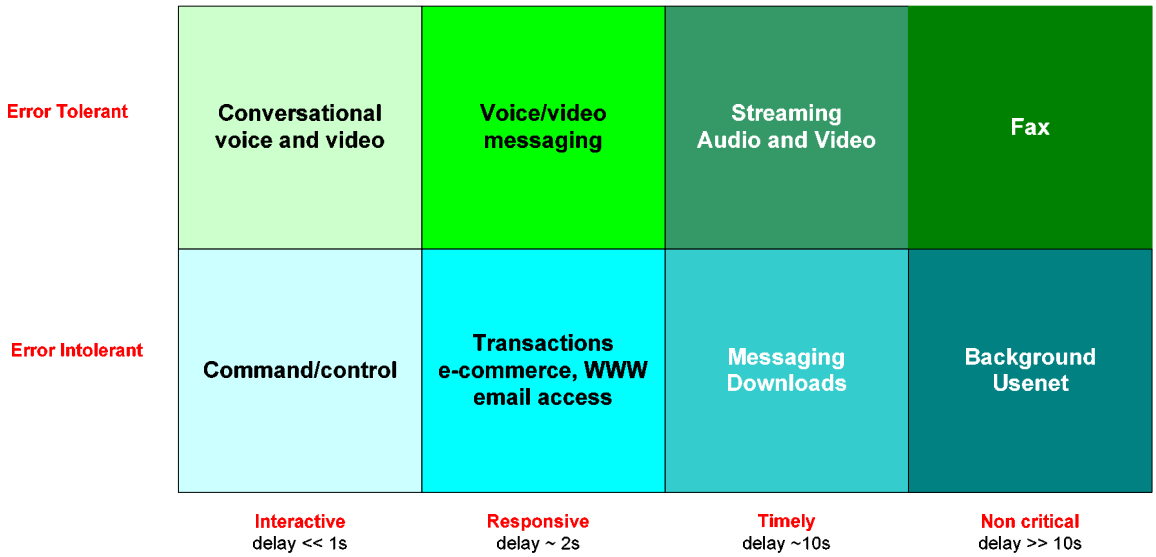

Figure 2: Mapping of QoS requirements to class characteristics

In addition to keep simple queues, minimize the number of queues and when appropriate limit switching hardware complexity, the number of classes should be kept fairly small and each class should represent the aggregate characteristics of fairly large flows. It is accepted in the BSM industry that at the IP level (above the SI "SAP" interface) between 4 and 16 queues are manageable for different IP classes. Below the SI/SAP these classes can further be mapped into the satellite dependant priorities within the BSM which can be from 2 to 4 generally.

4.2 ITU traffic classes

A recommendation of the TR 102 157 on Availability and Quality of Service was to follow the ITU-T Recommendation Y.1541 for traffic classes to define BSM specific classes. The ITU classes apply to international end-to-end IP network paths. It takes the 8 service categories defined in the previous clause and maps them onto 6 classes with 4 node mechanisms and recommendation for network techniques appropriate to each. In the context of the BSM, where only the BSM segment is of interest, the end to end approach of ITU-T Recommendation Y.1541 must be supplemented by BSM specifics like resource management mechanisms.

ITU-T Recommendation Y.1541 provides an abstraction of the service category (see table 1) and concentrates on implementable and measurable quantity. In addition ITU-T Recommendation Y.1541 provides support to the signalling that is needed for QoS management (some traffic engineering messages for example) within a generic transactional class. It does not distinguish between fixed packet size (like voice) and variable packet size (data and video) applications but provides 2 level of QoS for real time conversational services. The ability to segregate fixed size packets (cells) could be used to better specify required network resources especially in those environments where flexible bandwidth management is available.

Table 1: Guidance for IP QoS classes from the ITU-T Recommendation Y.1541

QoS class	Applications (examples)	Node mechanisms	Network techniques
0	Real-Time, Jitter sensitive, high interaction (VoIP, VTC)	Separate Queue with preferential servicing, Traffic grooming	Constrained Routing and Distance
1	Real-Time, Jitter sensitive, interactive (VoIP, VTC).		Less constrained Routing and Distances
2	Transaction Data, Highly Interactive (Signalling)	Separate Queue, Drop priority	Constrained Routing and Distance
3	Transaction Data, Interactive		Less constrained Routing and Distances
4	Low Loss Only (Short Transactions, Bulk Data, Video Streaming)	Long Queue, Drop priority	Any route/path
5	Traditional Applications of Default IP Networks	Separate Queue (lowest priority)	Any route/path

In addition, the recent work in ITU-T has linked the ITU-T Recommendation Y.1541 traffic classes to the ITU-T Recommendation Y.1221 transfer capabilities. This in turn allows linking the BSM traffic classes to diffserv Per Hop Behaviour (PHB) (see table 2).

Table 2: Y.1541 Classes, Y.1221 transfer capabilities and differentiated services Per Hop Behaviour (PHB) Adapted from

ITU-T Recommendation Y.1221 transfer capability	Associated differentiated services PHBs (RFC 2475 and RFC 2597)	ITU-T Recommendation Y.1541 QoS class
Best Effort (BE)	Default	Unspecified; Class 5
Under Study (new or modified capability)	Assured Forwarding (AF)	Classes 2, 3, 4
Dedicated Bandwidth	Expedited Forwarding (EH)	Classes 0 and 1

When compared to the BSM QoS requirement however the ITU-RecommendationY.1541 is not fully compliant, hence the need for a specific BSM traffic class classification.

4.3 Pre-emption

ITU-T Recommendation Y.1541 has no provision for emergency messages and some time sensitive messages related to the essential time critical management of the BSM (neighbour discovery, times RSVP messages OSPF HELLO messages, etc.). Hence it was the recommendation of TR 102 157 to add a pre-emption class and provision for variable size packets. The use of a pre-emption class is not unique to the BSM. All technologies that need to support voice and especially lifeline voice have more or less specified a traffic class that allow marked traffic to pre-empt any other reservation and get ahead in the queue. The pre-emption (on admitted class) can be implemented at the level of call/session admission. Hence the pre-emption class could be supported at a higher layer.

While there has been fairly little research on the impact of such a low traffic class on the QoS of impacted traffic (loss and or delay), some operators are reluctant to implement it mainly for legal reasons as it would violate some Service Level Agreements (SLAs).

Both the Routing and Addressing TR 102 155 and the QoS TR 102 157 recommend a class that can access the BSM at any time, hence take the place of another SDU when necessary to access the satellite air interface. For the BSM a pre-emption class can be of two types:

- high quality connectionless class (but with constrained routing hence engineered paths as those message are most likely to have specific destinations) with low volume and high priority similar to the ITU class 2; or
- the highest quality class (independent of connection type), a superclass "0"; this is the one that could be implemented at higher layers and not being visible at the IP Layer; however a mechanism must be envisaged to pass these packet to the BSM MAC with highest priority.

The "pre-emption" class should be tied to QoS signalling but could also be extended to IPv6 neighbour discovery, emergency messaging, essential routing messages, MPLS traffic engineering messages etc. as long as the overall traffic using the class remains a small percentage (nominally 1 % to 5%) of overall traffic.

5 BSM traffic classes

The proposed 8 traffic classes for the BSM are presented in table 3. They represent an adaptation of the ITU-T Recommendation Y.1541 classes at the SI-SAP using the ITU-T Recommendation G.1010 service categories and the BSM characteristics. In addition, they are also referring to the ITU-T Recommendation Y.1221 Transfer Capabilities (TC) and differentiated services Per Hop Behaviour (PHB). The 8 classes (one of which is unassigned and leaves room for future expansion) can support most of the currently envisaged traffic over the BSM and allow for the convergence functions to quickly allocate and manage bandwidth. In addition it allows for simple mapping to and from the ITU-T classes. While it is still a possibility to use the ITU-T classes at the IP layer the definition of BSM specific classes at the SI-SAP will help overall BSM resource allocation, admission and congestion control and network management.

Table 3: BSM traffic classes

BSM traffic class	Service categories	Node mechanisms	BSM resource management (see note 1)	Network techniques (informative only)	Y.1541 class	Y.1221 transfer capability	PHB (see note 2)
0	Pre-emption, emergency services, essential network services	Pre-empts any traffic that has allocated BSM bandwidth	Strict admission control with pre-emption	Strict admission control with pre-emption	N/A	N/A New Traffic Class	EF
1	Real-Time, Jitter sensitive, high interaction – Fixed size cells (VoIP)	Separate queue with preferential servicing, traffic grooming, strictly admitted	Dedicated or requested bandwidth	Constrained routing and distance	0	Dedicated Bandwidth	EF
2	Real-Time, Jitter sensitive, interactive - Variable size packets (Real Time Video)	Separate queue with preferential servicing, traffic grooming, loosely admitted	Dedicated or requested bandwidth	Less constrained routing and distances	1 (with no reference to variable size packets)	Dedicated Bandwidth	EF
3	Transaction Data, Highly Interactive, (Signalling, traffic engineering, PEPs)	Separate queue, drop priority, strictly admitted	Requested or contended bandwidth	Constrained Routing and Distance	2	N/A New Traffic Class	AF
4	Transaction Data, PEP, Interactive	Separate queue, drop priority, flow controlled	Requested or contended bandwidth	Less constrained routing and distances	3	N/A New Traffic Class	AF
5	Low Loss Only (Short Transactions, Bulk Data, Video Streaming)	Long queue, drop priority, flow controlled	Requested or contended bandwidth	Any route/path	4	N/A New Traffic Class	AF
6	Medium loss, higher delay (Traditional Applications of IP Networks)	Separate queue, flow controlled	Requested or contended bandwidth	Any route/path	5	Best Effort	Default
7	Not specified Could be used for low priority broadcast/multicast traffic or storage networks (with reliable higher layer)	Separate queue	Requested or contended bandwidth	Any route/path	N/A	Best Effort	Default

NOTE 1: The BSM resource management descriptions are informative examples only and they shall not preclude a different resource management implementation. The 3 types of resource (bandwidth) allocation are indicated as dedicated, reserved and contended.
NOTE 2: Per Hop Behaviour (PHB) are defined in RFC 2475 and RFC 2597.

Annex A (informative): Bibliography

- Lloyd-Evans, Robert (2002): "QoS in Integrated 3-G Networks".
- IETF RFC 2475 (1998): "An Architecture for Differentiated Service".
- IETF RFC 2597 (1999): "Assured Forwarding PHB Group".
- ETSI TS 123 107: "Universal Mobile Telecommunications System (UMTS); Quality of Service (QoS) concept and architecture (3GPP TS 23.107)".
- ETSI TR 101 984: "Satellite Earth Stations and Systems (SES); Broadband Satellite Multimedia; Services and Architectures".
- ETSI TR 101 985: "Satellite Earth Stations and Systems (SES); Broadband Satellite Multimedia; IP over Satellite".
- ETSI TR 102 155: "Satellite Earth Stations and Systems (SES); Broadband Satellite Multimedia; IP interworking over satellite; Addressing and routing".
- ETSI TR 102 156: "Satellite Earth Stations and Systems (SES); Broadband Satellite Multimedia; IP interworking over satellite; Multicasting".
- ETSI TR 102 157: "Satellite Earth Stations and Systems (SES); Broadband Satellite Multimedia; IP Interworking over satellite; Performance, Availability and Quality of Service".
- ETSI TS 102 292: "Satellite Earth Stations and Systems (SES); Broadband Satellite Multimedia (BSM) services and architectures; Functional architecture for IP interworking with BSM networks".
- ETSI TS 101 329-2: "Telecommunications and Internet Protocol Harmonization Over Networks (TIPHON) Release 3; End-to-end Quality of Service in TIPHON systems; Part 2: Definition of speech Quality of Service (QoS) classes".
- ITU-T Recommendation G.1010: "Transmission Systems and Media, Digital Systems and Network - Quality of Service and Performance - End-user multimedia QoS categories".
- ITU-T Recommendation Y.1541: "Network performance objectives for IP-Based services".
- ITU-T Recommendation Y.1221: "Traffic Control and Congestion Control in IP based networks".
- ITU-T Recommendation Y.1541 (Amendment 1): "Revised Appendix VI: Applicability of the Y.1221 transfer capabilities and IETF differentiated services to IP QoS classes".

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