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The Session Description Protocol (SDP) 'trafficclass' Attribute
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Abstract

This document proposes a new Session Description Protocol (SDP) attribute to identify the traffic class a session is requesting in its offer/answer exchange.

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Table of Contents

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [RFC2119].

1. Introduction

The Session Description Protocol (SDP) [RFC4566] provides a means for an offerer to describe the specifics of a session to an answerer, and for the answerer to respond back with its session specifics to the offerer. These session specifics include offering the codec or codecs to choose from, the specific IP address and port number the offerer wants to receive the RTP stream(s) on/at, the particulars about the codecs the offerer wants considered or mandated, and so on.

There are many facets within SDP to determine the Real-time Transport Protocol (RTP) [RFC3550] details for the session establishment between one or more endpoints, but identifying how the underlying network should process each stream still remains under-specified.

The ability to identify a traffic flow by port number gives an indication to underlying network elements to treat traffic with dissimilar ports in a different way, the same or in groups the same - but different from other ports or groups of ports.

Within the context of realtime communications, the labeling of an RTP session based on media descriptor lines as just a voice and/or video session is insufficient, and provides no guidelines to the underlying network on how to treat the traffic. A more granular labeling helps on several fronts to

- inform application layer elements in the signaling path the intent of this session.

- inform the network on how to treat the traffic if the network is configured to differentiate session treatments based on the type of session the RTP is, including the ability to provide call admission control based on the type of traffic in the network.

- allow network monitoring/management of traffic types realtime and after-the-fact analysis.

Some network operators want the ability to guarantee certain traffic gets a minimum amount of network bandwidth per link or through a series of links that perhaps makes up a network such as a campus or WAN, or a backbone. For example, a call center voice application gets at least 20% of a link as a minimum bandwidth.

Some network operators want the ability to allow certain users or devices access to greater bandwidth during non-busy hours, than during busy hours of the day. For example, all desktop video to operate at 1080p during non-peak times, but curtail a similar session between the same users or devices to 720p or 360p during peak hours. This case is not as clear as accepting or denying similar sessions during different times of the day, but tuning the access to the bandwidth based on the type of session. In other words, tune down the bandwidth for desktop video during peak hours to allow a 3-screen telepresense session that would otherwise look like the same type of traffic (RTP, and more granular, video).

RFC 4594 established a guideline for classifying the various flows in the network and the Differentiated Services Codepoints (DSCP) that apply to many traffic types (table 3 of [RFC4594]), including

RTP based voice and video traffic sessions. The RFC also defines the per hop network behavior that is strongly encouraged for each of these application traffic types based on the traffic characteristics and tolerances to delay, loss and jitter within each traffic class.

Video was broken down into 4 categories in that RFC, and voice into another single category. We do not believe this satisfies the technical and business requirements to accomplish sufficiently unique labeling of RTP traffic.

A question arises about once we properly label the traffic, what does that get us? This is a fair question, but out of scope for this document because that answer lies within other RFCs and IDs in other WGs and/or Areas (specifically the Transport Area). That said, we can discuss some of the ideas here for completeness.

If the application becomes aware of traffic labeling,

- this can be coded into layer 3 mechanisms.

- this can be coded into layer 4 protocols and/or mechanisms.

- this can be coded into a combination of mechanisms and protocols.

The layer 3 mechanism for differentiating traffic is either the port number or the Differentiated Services Codepoint (DSCP) value [RFC2474]. Within the public Internet, if the application is not part of a managed service, the DSCP likely will be best effort (BE). Within the corporate LAN, this is usually completely configurable and a local IT department can take full advantage of this labeling to shape and manage their network as they see fit. Communications between enterprise networks will likely have to take advantage of MPLS.

Within a network core, where only MPLS is used, Diffserv typically does not apply. That said, Diffserv can be used to identify which traffic goes into which MPLS tunnels [RFC4124].

Labeling realtime traffic types using a layer 4 protocol would likely mean RSVP [RFC2205] or NSIS [RFC4080]. RSVP has an Application Identifier (app-ID) defined in [RFC2872] that provides a means for carrying a traffic class label along the data path. An advantage with this mechanism is for the label to inform each domain along the media path what type of traffic this traffic flow is, and allow each domain to adjust the appropriate DSCP (set by each domain for use within that domain). Meaning, if a DSCP is set by an endpoint or a router in the first domain and gets reset by a SP, the far end domain will be able to reset the DSCP to the intended traffic class. There is a proposed extension to RSVP which creates individual profiles for what goes into each app-ID field to describe these traffic classes [ID-RSVP-PROF], which will take advantage of what is described in this document.

There are several proprietary mechanisms to take advantage of this labeling, but none of those will be discussed here.

The idea of traffic - or service - identification is not new; it has been described in [RFC5897]. If that RFC is used as a guideline, identification that leads to stream differentiation can be quite useful. One of the points within RFC 5897 is that users cannot be allowed to assign any identification (fraud is but one reason given). In addition, RFC 5897 recommends that service identification should be done in signaling, rather than guessing or deep packet inspection. The network will have to currently guess or perform deep packet inspection to classify and offer the service as per RFC 4594 since such service identification information is currently not available in SDP and therefore to the network elements. Since SDP understands how each stream is created (i.e., the particulars of the RTP stream), this is the right place to have this service differentiated. Such service differentiation can then be communicated to and leveraged by the network.

[Editor's Note: the words "traffic" and "service" are similar enough that the above paragraph talks about RFC 5897's "service identification", but this document is only wanting to discuss and propose traffic indications in SDP.]

This document proposes a simple attribute line to identify the application a session is requesting in its offer/answer exchange. This document uses previously defined service class strings for consistency between IETF documents.

This document modifies the traffic classes originally created in RFC 4594 in Section 2, incrementing each class with application identifiers and optional adjective strings. Section 3 defines the new SDP attribute "trafficclass". Section 4 discusses the offerer and answerer behavior when generating or receiving this attribute.

2. Traffic Class Framework and String Definitions

The framework of the traffic class attribute will have at least two parts, allowing for several more to be included. The intention is to have a parent class (e.g., Conversational) that merely serves as the anchor point for an application component that when paired together, form the highest level traffic class. An adjective component provides further granularity for the application.

The traffic class label will have the following structure,

parent.application(.adjective)(.adjective)(.admitted/non-admitted)

[Editor's Note: the above is not exactly the ABNF to be used.
The order is right. The parent and application

MUST appear (each only once) and zero or more
adjectives can appear.]

Where
1) the 1st component is the human understandable category;
2) the 2nd component is the application;
3) an optional 3rd component or series of components are adjective(s) used to further refine the application component; and
4) an optional 4th component is to classify this flow as a CAC admitted or non-admitted traffic flow. The default is non-admitted, whether present or not.

The construction of the traffic class label for Telepresence video would follow the form like this:

    Conversational.video.immersive

There is no traffic class or DSCP value associated with just "Conversational". There is a traffic class associated with "Conversational.video", creating a differentiation between it and a "Conversational.video.immersive" traffic class, which would have DSCP associated with the latter traffic class, depending on local policy. Each parent component is defined below, as are several of application and adjective strings.

[Editor's Note: We're not yet sure how much of what's below will be proposed for IANA registration, but the 5 parent components will be, as well as at least some application components per parent component. Some adjective components will also likely be proposed for IANA registration.

The 5 parent components of the traffic class attribute are as follows:

- o Conversational
- o Multimedia Conferencing
- o Real-Time Interactive
- o Multimedia Streaming
- o Broadcast

The following application components of the traffic class attribute are as follows:

- o Audio
- o Video
- o Text
- o application-sharing
- o Presentation-data
- o Whiteboarding

o Web (conference) chat/instant messaging
o Gaming

o Virtual-desktop (interactive)
o Remote-desktop
o Telemetry (e.g., NORAD missile control)
o Multiplex (i.e., combined streams)
o (something to cover theater quality Netflix movies)
o (something to cover YouTube)
o Webcast
o IPTV
o Live-events (though not the buffered ones)
o surveillance

The following adjective components of the traffic class attribute are as follows:

o Immersive
o Desktop-video
o Realtime-Text
o web

Each of the above 3 lists will be defined in the following subsections.

2.1 Conversational Parent Traffic Class

The Conversational traffic class is best suited for applications that require very low delay variation and generally intended to enable real-time, bi-directional person-to-person or multi-directional via an MTP communication, such as the following application components:

o Audio (voice)

o Video

o Text (i.e., real-time text required by deaf users)

With adjective substrings to the above (which may or may not get IANA registered)

Immersive (TP) - An interactive audio-visual communications experience between remote locations, where the users enjoy a strong sense of realism and presence between all participants by optimizing a variety of attributes such as audio and video quality, eye contact, body language, spatial audio, coordinated environments and natural image size.

Desktop-video - An interactive audio-visual communication experience that is not immersive in nature, though can have a high resolution video component.

Realtime-Text (RTT) - a term for real-time transmission of text in a character-by-character fashion for use in conversational services, often as a text equivalent to voice-based conversational services. Conversational text is defined in the ITU-T Framework for multimedia services, Recommendation F.700 [RFC5194].

Web - for realtime aspects of web conferencing; mutually exclusive of both Immersive and Desktop video experiences

The above substrings might also be used within Multimedia Conferencing

Traffic Class Name	Traffic Characteristics	Tolerance to Loss	Tolerance to Delay	Tolerance to Jitter
Conversational	High priority, typically small packets (large video frames produce large packets), generally sustained high packet rate, low inter-packet transmission interval, usually UDP framed in (S)RTP	Very Low	Very Low	Very Low

2.2 Multimedia-Conferencing Parent Traffic Class

Multimedia-Conferencing traffic class is best suited for applications that are generally intended for communication between human users, but are less demanding in terms of delay, packet loss, and jitter than what Conversational applications require. These applications require low to medium delay and may have the ability to change encoding rate (rate adaptive) or transmit data at varying rates, such as the following application components:

o application-sharing (that webex does or protocols like T.128) - An application that shares the output of one or more running applications or the desktop on a host. This can utilize vector graphics, raster graphics or video.

o Presentation-data - can be a series of still images or motion video.

o Whiteboarding - an application enabling the exchange of graphical information including images, pointers and filled and unfilled parametric drawing elements (points, lines, polygons and ellipses).

o (RTP-based) file transfer

o Web (conference) chat/instant messaging

Traffic Class Name	Traffic Characteristics	Tolerance to Loss	Tolerance to Delay	Tolerance to Jitter
Multimedia Conferencing	Variable size packets, Variable transmit interval, rate adaptive, reacts to loss, usually TCP-based	Low - Medium	Low - Medium	Low - Medium

2.3 Realtime-Interactive Parent Traffic Class

Realtime-Interactive traffic class is intended for interactive variable rate inelastic applications that require low jitter and loss and very low delay, such as the following application components:

o Gaming - interactive player video games with other users on other hosts (e.g., Doom)

o Virtual desktop (interactive) - similar to an X-windows station, has no local hard drive, or is operating an application with no local storage

o Remote Desktop - controlling a remote node with local peripherals (i.e., monitor, keyboard and mouse)

o Telemetry - a communication that allows remote measurement and reporting of information (e.g., post launch missile status or energy monitoring)

Traffic Class Name	Traffic Characteristics	Tolerance to Loss	Tolerance to Delay	Tolerance to Jitter
Realtime Interactive	Inelastic, mostly variable rate, rate increases with user activity	Low	Very Low	Low

2.4 Multimedia-Streaming Parent Traffic Class

Multimedia-Streaming traffic class is best suited for variable rate elastic streaming media applications where a human is waiting for output and where the application has the capability to react to packet loss by reducing its transmission rate, such as the following application components:

o Audio

o Video

o Multiplex (i.e., combined streams)

With adjective substrings to the above (which may or may not get IANA registered)

(something to cover theater quality Netflix movies)

(something to cover YouTube)

Webcast

The primary difference from the Multimedia-streaming parent class and the Broadcast parent class is about the length of time for buffering. Buffered streaming audio and/or video (e.g., Netflix or previously-recorded videos on web sites like CNN, ESPN or from an internal corporate server). Buffering here can be from seconds to hours (as opposed to Broadcast buffering which is minimal). The buffering aspect is what differentiates this parent class from the Broadcast class (which has minimal or no buffering).

Traffic Class Name	Traffic Characteristics	Tolerance to Loss	Tolerance to Delay	Tolerance to Jitter
Multimedia Streaming	Variable size packets, elastic with variable rate	Low - Medium	Medium - High	High

2.5 Broadcast Parent Traffic Class

Broadcast traffic class is best suited for inelastic streaming media applications that may be of constant or variable rate, requiring low jitter and very low packet loss, such as the following application components:

o IPTV

o Live events (though not the buffered ones)

o Video surveillance

Traffic Class Name	Traffic Characteristics	Tolerance to Loss	Tolerance to Delay	Tolerance to Jitter
Broadcast	Constant and variable rate, inelastic, generally non-bursty flows, generally sustained high packet rate, low inter-packet transmission interval, usually UDP framed in (S)RTP	Very Low	Low - Medium	Low - Medium

3. SDP Attribute Definition

This document proposes the 'trafficclass' session and media-level SDP [RFC4566] attribute. The following is the Augmented Backus-Naur Form (ABNF) [RFC5234] syntax for this attribute, which is based on the SDP [RFC4566] grammar:

```
attribute               =/ traffic-classification

traffic-classification  = "trafficclass" ":" [SP] parent-class
                           "." app-type *( app-param )

parent-class            = "Broadcast" /
                          "Realtime-Interactive" /
                          "Multimedia-Conferencing" /
                          "Multimedia-Streaming" /
                          "Conversational" /
                          extension-mech

extension-mech          = token

app-type                = "audio" / "video" / "text" /
                          "application-sharing" /
                          "presentation-data" /
                          "whiteboarding" / "webchat/IM" /
                          "gaming" / "virtual-desktop" /
                          "remote-desktop" / "telemetry"/
                          "multiplex" / "Netflix" / "youtube" /
                          "webcast" / "IPTV" / "live-events" /
                          "surveillance"

app-param               = "." adjective / "." cac-class

adjective               = "immersive" / "desktop-video" /
                          "Realtime-Text" /"web" /
                           generic-param ; from RFC3261
```

```
   cac-class               = "admitted" / "non-admitted"
```

The attribute is named "trafficclass", for traffic classification, identifying which one of the five traffic classes applies to the media stream. There MUST NOT be more than one trafficclass attribute per media line. Confusion would result in where more than one exists per m= line.

The parent classes in this document are an augmented version of the application labels introduced by table 3 of RFC 4595 (which will be rewritten based on the updated labels and treatments expected for each traffic class defined in this document).

Application Labels Defined in RFC 4594	Parent Classes Defined in this document
Broadcast-video	Broadcast
Realtime-Interactive	Realtime-Interactive
Multimedia-Conferencing	Multimedia-Conferencing
Multimedia-Streaming	Multimedia-Streaming
Telephony	Conversational

Table 6. Label Changes from RFC 4594

As is evident from the changes above, from left to right, two labels are different and each of the meanings are different in this document relative to how RFC 4594 defined them. These differences are articulated in Section 2 of this document.

A parent class is a human understandable categorization, and MUST NOT be the only part of the traffic class label present in the attribute. The parent class string MUST always be paired with an application type, with a "." as the string separator.

The application types (app-type) define the application of a particular traffic flow. The application types are listed both in the ABNF and defined in Section 2 of this document. Not every combination parent class is paired with application types, at least as defined in this document. Section 2.1 through 2.5 list many of the expected combinations.

For additional application type granularity, adjective strings can be added (also listed in Section 2). One or more adjectives can be within the same traffic class attribute. It is also permitted to include one or more non-IANA registered adjective label, but these MUST be prefaced by the additional delimiter "_", creating a possibility such as

```
parent-class.application-type.adjective._non-standard-adjective
                                          ^^^^
                                     See the underscore
```

For example, this is valid:

```
m=audio 50000 RTP/AVP 112
a=trafficclass Conversational.video.immersive._foo._bar
```

where both "foo" and "bar" are not IANA registered adjectives, but "immersive" is IANA registered. However, including non-registered adjectives without the "_" delimiter are not valid, such as the following:

```
m=audio 50000 RTP/AVP 112
a=trafficclass Conversational.video.immersive.foo.bar
```

There is no limit to the number of adjectives allowed, without regard for whether they are registered or not. These non-registered adjectives can be vendor generated, or merely considered to be proprietary in nature.

It is important to note that the order of components matters, but only for the components. In other words, the parent class component MUST be before the application component, which MUST be before the adjective component, which MUST be before the cac-class component. If there are no adjective components, the cac-class component is immediately after the application component.

If there is more than one adjective component describing a traffic class, the order of the adjectives MUST NOT matter. Some algorithm such as alphabetizing the list and matching the understood strings SHOULD be used.

In addition to, or as an alternative to one or more adjectives, a cac-class value MAY be present indicating whether or not a session has had call admission control applied to it. The following two values are created by this document for the cac-class value:

- admitted
- nonadmitted

The default cac-class value for any trafficclass attribute is nonadmitted, even if not present. There MUST NOT be more than one cac-class sub-string per m=line.

Any application, adjective or cac-class string component within this attribute that is not understood MUST be ignored, leaving all that is understood to be processed. Ignored string components SHOULD NOT be deleted, as a downstream entity could understand the component(s) and use it/them.

Not understanding the parent class string SHOULD mean that this attribute is ignored.

The following is an example of media level description with a 'trafficclass' attribute:

```
m=audio 50000 RTP/AVP 112
a=trafficclass conversational.video.immersive.admitted
```

The above indicates a multiscreen telepresence session that has had call admission control applied to the media flow.

4. Offer/Answer Behavior

Through the inclusion of the 'trafficclass' attribute, an offer/answer exchange identifies the application type for use by endpoints within a session. Policy elements can use this attribute to determine the acceptability and/or treatment of that session through lower layers. One specific use-case is for setting of the DSCP specific for that application type (say a Broadcast instead of a conversational video), decided on a per domain basis - instead of exclusively by the offering domain.

4.1 Offer Behavior

Offerers include the 'trafficclass' attribute with a single well string comprised of two or more components (from the list in Section 2) to obtain configurable and predictable classification between the answerer and the offerer. The offerer can also include a private set of components, or a combination of IANA registered and private components within a single domain (e.g., enterprise networks).

Offerers of this 'trafficclass' attribute MUST NOT change the label in transit (e.g., wrt to B2BUAs). SBCs at domain boundaries can change this attribute through local policy.

Offers containing a 'trafficclass' label not understood are ignored by default (i.e., as if there was no 'trafficclass' attribute in the offer).

4.2 Answer Behavior

Upon receiving an offer containing a 'trafficclass' attribute, if the offer is accepted, the answerer will use this attribute to classify the session or media (level) traffic accordingly towards the offerer. This answer does not need to match the traffic class in the offer, though this will likely be the case most of the time.

In order to understand the traffic class attribute, the answerer MUST check several components within the attribute, such as

1 - does the answerer understand the parent component?

If not, the attribute SHOULD be ignored.

If yes, it checks the application component.

2 - does the answerer understand the application component?

If not, the answerer needs to check if it has a local policy to proceed without an application component. The default for this situation is as if the parent component was not understand, i.e., the attribute SHOULD be ignored.

If yes, it checks there are any other component present in this attribute to start its classification.

3 - does the answerer understand the adjective component or components if any are present?

If not present, see if there is a cac-class component, and before processing classification.

If yes, determine if there are more than one. Alphabetize all of the adjective components and match the traffic classification.

4 - does the answerer understand the cac-class component if present?

If not, consider the media flow for this m= line to be nonadmitted.

If yes, classify whether this component is CAC admitted or nonadmitted.

The answerer will answer the offer with its own 'trafficclass' attribute, which will likely be the same value, although this is not mandatory (at this time).

The answerer should expect to receive RTP packets marked as indicated by its 'trafficclass' attribute in the answer itself.

An Answer MAY have a 'trafficclass' attribute when one was not in the offer. This will at least aid the local domain, and perhaps each domain the session transits, to categorize the application type of this RTP session.

Answerers that are middleboxes can use the 'trafficclass' attribute to classify the RTP traffic within this session however local policy determines. In other words, this attribute can help in deciding which DSCP an RTP stream is assigned within a domain, if the answerer were an inbound SBC to a domain.

5. Security considerations

RFC 5897 [RFC5897] discusses many of the pitfalls of service classification, which is similar enough to this idea of traffic classification to apply here as well. That document highly recommends the user not being able to set any classification. Barring a hack within an endpoint (i.e., to intentionally mis-classifying (i.e., lying) about which classification an RTP stream is), this document's solution makes the classification part of the signaling between endpoints, which is recommended by RFC 5897.

6. IANA considerations

6.1 Registration of the SDP 'trafficclass' Attribute

This document requests IANA to register the following SDP att-field under the Session Description Protocol (SDP) Parameters registry:

```
Contact name:   jmpolk@cisco.com

Attribute name:   trafficclass

Long-form attribute name:   Traffic Classification

Type of attribute:   Session and Media levels

Subject to charset:   No

Purpose of attribute:   To indicate the Traffic Classification
                        application for this session

Allowed attribute values:   IANA Registered Tokens

Registration Procedures: Specification Required

Type            SDP Name                     Reference
----            ------------------           ---------
att-field (both session and media level)

                trafficclass                [this document]
```

6.2 The Traffic Classification Application Type Registration

This document requests IANA to create a new registry for the traffic application classes similar to the following table within the Session Description Protocol (SDP) Parameters registry:

Registry Name: "trafficclass" SDP Application Type Attribute Values
Reference: [this document]
Registration Procedures: Specification Required

Parent Values	Reference
Broadcast	[this document]
Realtime-Interactive	[this document]
Multimedia-Conferencing	[this document]
Multimedia-Streaming	[this document]
Conversational	[this document]

6.3 The Traffic Classification Application Type Registration

This document requests IANA to create a new registry for the traffic application classes similar to the following table within the Session Description Protocol (SDP) Parameters registry:

Registry Name: "trafficclass" Attribute Application Type Values
Reference: [this document]
Registration Procedures: Specification Required

Application Values	Reference
Audio	[this document]
Video	[this document]
Text	[this document]
application-sharing	[this document]
Presentation-data	[this document]
Whiteboarding	[this document]
Webchat/instant messaging	[this document]
Gaming	[this document]
Virtual-desktop	[this document]
Remote-desktop	[this document]
Telemetry	[this document]
Multiplex	[this document]
Netflix*	[this document]
YouTube*	[this document]
Webcast	[this document]
IPTV	[this document]
Live-event	[this document]
surveillance	[this document]

[Editor's Note: these are placeholders until a more generic string can be agreed to by the WG]

6.4 The Traffic Classification Adjective Registration

This document requests IANA to create a new registry for the traffic application classes similar to the following table within the Session Description Protocol (SDP) Parameters registry:

Registry Name: "trafficclass" Attribute Adjective Values
Reference: [this document]
Registration Procedures: Specification Required

Application Values	Reference
Immersive	[this document]
Desktop-video	[this document]
Realtime-Text	[this document]
web	[this document]

6.5 The Traffic Classification Attribute Call Admission Control Class Registration

This document requests IANA to create a new registry for the Call Admission Control Class similar to the following table within the Session Description Protocol (SDP) Parameters registry:

Registry Name: "trafficclass" SDP Call Admission Control Class (cac-class) Attribute Values
Reference: [this document]
Registration Procedures: Specification Required

Attribute Values	Reference
Admitted	[this document]
Non-admitted	[this document]

7. Acknowledgments

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