Updating DiffServ Service Class Guidelines
at IETF85

draft-polk-tsvwg-rfc4594-update-02.txt
draft-polk-tsvwg-new-dscp-assignments-01.txt

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Who's affected by DiffServ Guidelines?

- Service Providers
  - In their core, tier-up/lateral/down and enterprise and SMB interconnections, cellular, metro, access, and residential, etc
- Enterprises
  - In their core, WAN, access, Wifi/mobility, end-users
- Content builders
- Application writers
- Hardware and Software Partners
- Inter-vendor interoperability amongst all of this
- Etc…

Confusion about DiffServ Guidelines (1/2)

- confusion between RFC 4594 and RFC 5127, thinking they are the same
  - the latter of which is for aggregating many 6-bit DSCP values into a 3-bit (8 value) field used specifically by service provider (SP) networks.
- some believe both RFCs are for SPs, while others ignore RFC 5127 and use RFC 4594 as if it were standards track or BCP.
- some believe RFC 5127 is for SPs only, and want RFC 4594 to reduce the number of Service Classes/DSCPs assigned.
  - This seems to stem from a manageability and operational perspective.
- some know RFC 4594 is informational and do not follow its guidelines specifically because it is informational.

Confusion about DiffServ Guidelines (2/2)

- some use DSCP values that are not defined within RFC 4594
  - making mapping between different networks using similar or identical application flows difficult.
- some believe enterprise networks should not use either RFC except at the edge
  - where they directly connect to SP networks.
- some argue that the services classes guidance is not granular enough
  - per class is too broad and are therefore not sure in which service class a particular application is to reside.
- Video is now a dominant application on the Internet, and does not play nice with audio
  - Thus a separation within RTP is needed

Service Class vs. Treatment Aggregate

- RFC 4594 defines “Service Class”
- There can be more than one DSCP per “Service Class”
- Per RFC 4594: stated goal is to use a subset of available “Service Classes”
- RFC 5127 defines “Treatment Aggregate”
- Per RFC 5127: one or more “Service classes” are placed into one of four “Treatment Aggregates”

Purpose of the drafts, part I

- To group similar traffic expectations and behaviors into separate buckets and then mark these separate buckets differently at layer 3 to receive different treatment per hop.
- These buckets are NOT per application, but per (set of) traffic characteristics.
  - 1000s of applications
  - 100s of protocols
  - Only 64 markings
- These buckets are called “Service Classes”.
  - Focus of RFC 4594
- “Service Class” marking in IP uses DiffServ codepoint (DSCP) values.
- RFC 4594 defines 12 “Service classes”, this update draft defines 14 total.

Purpose of the drafts, part II

- Currently proposed as standards track to solidify IETF's position on this topic of guidance for the industry
- Second draft creates two new Service Classes and six new DSCPs needed by the update draft
- Fully understand (less radical/substantial) update to RFC 5127 is needed

Particulars within RFC 4594 update

- Differences of traffic characteristics between service classes requires too much time for this preso…

  … but I'll try if the WG wants me to get into that detail

  – Please read the draft for these details
  – If you don't fall asleep, send mail to the list if you have comments.

Open Issues

- Need to solidify on the ‘audio’, ‘video’, ‘Hi-Res’ and ‘A/V-Sig’ service class names.
- Other minor edits to make clearer…
- Need reviewers to spot other mods needed in document.

What's Next?

- Need more reviewers and comments
- Is this enough of a problem to be addressed formally?
  - or do we keep our heads in the sand... ;-)
- Solid enough to become a WG item?

Background Slides

- 2 groups of slides giving greater and greater detail within the existing drafts TSVWG is considering.

DiffServ Standards (by DSCP)

- RFC 2474 - CS0, CS1, CS2, CS3, CS4, CS5, CS6, CS7
- RFC 2597 - AF1x, AF2x, AF3x, and AF4x
- RFC 3246 - EF (101110)
- RFC 5865 - VOICE-ADMIT (101100)

- EF and VOICE-ADMIT have defined forwarding behavior per hop (called a Per Hop Behavior (PHB))
- AF has defined behavior only wrt adjacent other 2 in group per hop (i.e., AF4x only affecting other AF4x, etc)
- No other defined behaviors…. Until RFC 4594.

RFC 5127 Treatment Aggregate Behavior

Treatment Aggregate	Treatment Aggregate Behavior	DSCP
Network Control	CS (RFC 2474)	CS6
Real-Time	EF (RFC 3246)	EF, CS5, AF41, AF42, AF43, CS4, CS3
Assured Elastic	AF (RFC 2597)	CS2, AF31, AF21, AF11
		AF32, AF22, AF12
		AF33, AF23, AF13
Elastic	Default (RFC 2474)	Default, (CS0)
		CS1

Particulars within RFC 4594 update

- Built on text from RFC 4594 (from this WG)
- Updates to included Voice-Admit from RFC 5865
- Adds several more Capacity Admitted Service classes for
  - (newly modified) Realtime-Interactive
  - Broadcast
  - (new) Hi-Res service class
  - (newly modified) Multimedia-Conferencing
- Also adds non-capacity-admitted service classes:
  - (newly modified) Multimedia-Conferencing
  - (newly modified) Conversational Signaling

- **Not** married to new Service Class names (e.g., “audio”, “video”, “hi-res” and “a/v-sig”)

Example Change in Update Draft

- For example, changed “Telephony” service class to “Audio”

List of Service Classes Unchanged

- Multimedia-Streaming
  - Remains the same
- High-Throughput Data
  - Remains the same
- Low-Priority Data
  - Remains the same
- Default Forwarding
  - Remains the same
- Network Routing
  - Remains the same
- OAM
  - Remains the same

List of Service Classes Modified or New

Now "Conversational" traffic classes

- "Realtime-Interactive"
  - Moved to (near) realtime TCP-based apps
- "Audio"
  - Same as Telephony (which is now gone), adds Voice-Admit for capacity-admitted traffic
- "Video"
  - NEW for video and audio/video conferencing, was in Multimedia-Conferencing
- "Hi-Res"
  - NEW for video and audio/video conferencing
- "Multimedia-Conferencing"
  - Now without audio or human video
- "Broadcast"
  - Remains the same, added CS3-Admit for capacity-admitted
- "Low-Latency Data"
  - Remains the same, adds IM & Presence traffic explicitly
- "Conversational Signaling" (A/V-Sig)
  - Was 'Signaling'

New Figure 1. User/Subscriber Service Classes Grouping

Application Categories	Service Class	Signaled	Flow Behavior	G.1010 Rating
Application Control	A/V Sig	Not applicable	Inelastic	Responsive
Media-Oriented	Real-Time Interactive	Yes	Inelastic	Interactive
	Audio	Yes	Inelastic	Interactive
	Video	Yes	Inelastic	Interactive
	Hi-Res	Yes	Inelastic	Interactive
	Multimedia Conferencing	Yes	Rate Adaptive	Moderately Interactive
	Broadcast	Yes	Inelastic	Responsive
	Multimedia Streaming	Yes	Elastic	Timely
Data	Low-Latency Data	No	Elastic	Responsive
	High-Throughput Data	No	Elastic	Timely
	Low-Priority Data	No	Elastic	Non-critical
Best Effort	Standard	Not Specified		Non-critical

New Figure 2. Service Class Characteristics (1/2)

Service Class Name	Traffic Characteristics	Tolerance to Loss	Tolerance to Delay	Tolerance to Jitter
Network Control	Variable size packets, mostly inelastic short messages, but traffic can also burst (BGP)	Low	Low	Yes
Real-Time Interactive	Inelastic, mostly variable rate	Low	Very Low	Low
Audio	Variable-size small packets, inelastic	Very Low	Very Low	Very Low
Video	Bursty, small-large packets inelastic	Very Low	Very Low	Very Low
Hi-Res A/V	Bursty, small-large packets inelastic	Very Low	Very Low	Very Low

New Figure 2. Service Class Characteristics (2/2)

Service Class Name	Traffic Characteristics	Tolerance to Loss	Tolerance to Delay	Tolerance to Jitter
Multimedia Conferencing	Variable size packets, constant transmit interval, rate adaptive, reacts to loss	Low - Medium	Low - Medium	Low - Medium
Multimedia Streaming	Variable size packets, elastic with variable rate	Low - Medium	Medium	High
Broadcast	Constant and variable rate, inelastic, non-bursty flows	Very Low	Medium	Low
Low-Latency Data	Variable rate, bursty short-lived elastic flows	Low	Low - Medium	Yes
Conversational Signaling	Variable size packets, some what bursty short-lived flows	Low	Low	Yes
OAM	Variable size packets, elastic & inelastic flows	Low	Medium	Yes
High-Throughput Data	Variable rate, bursty long-lived elastic flows	Low	Medium - High	Yes
Standard	A bit of everything	Not Specified		
Low-Priority Data	Non-real-time and elastic	High	High	Yes

New Figure 3. DSCP to Service Class Mapping (1/2)

Service Class Name	DSCP Name	DSCP Value	Application Examples
Network Control	CS6&CS7	11xxxx	Network routing
Real-Time Interactive	CS5, CS5-Admit	101000, 101001	Remote/Virtual Desktop and Interactive gaming
Audio	EF Voice-Admit	101110 101100	Voice bearer
Hi-Res A/V	CS4, CS4-Admit	100000, 100001	Conversational Hi-Res Audio/Video bearer
Video	AF41,AF42 AF43	100010,100100 100110	Audio/Video conferencing bearer
Multimedia Conferencing	MC, MC-Admit	011101, 100101	Presentation Data and App Sharing/Whiteboarding

New Figure 3. DSCP to Service Class Mapping (2/2)

Service Class Name	DSCP Name	DSCP Value	Application Examples
Multimedia Streaming	AF31,AF32 AF33	011010,011100 011110	Streaming video and audio on demand
Broadcast	CS3, CS3-Admit	011000, 011001	Broadcast TV, live events & video surveillance
Low-Latency Data	AF21,AF22 AF23	010010,010100 010110	Client/server trans., Web-based ordering, IM/Pres
Conversational Signaling	A/V-Sig	010001	Conversational signaling
OAM	CS2	010000	OAM&P
High-Throughput Data	AF11,AF12 AF13	001010,001100 001110	Store and forward applications
Low-Priority Data	CS1	001000	Any flow that has no BW assurance
Best Effort	CS0	000000	Undifferentiated applications

New Figure 4. Summary of CoS Mechanisms Used for Each Service Class (1/2)

Service Class	DSCP	Conditioning at DS Edge	PHB Used	Queuing	AQM
Network Control	CS6/CS7	See Section 3.1	RFC2474	Rate	Yes
Real-Time Interactive	CS5, CS5-Admit*	Police using sr+bs [ID-DSCP]	RFC2474 [ID-DSCP]	Rate	No
Audio	EF, Voice-Admit*	Police using sr+bs	RFC3246 RFC5865	Priority	No
Hi-Res A/V	CS4, CS4-Admit*	Police using sr+bs [ID-DSCP]	RFC2474 [ID-DSCP]	Priority	No
Video	AF41*, AF42, AF43	Using two-rate, three-color marker (such as RFC 2698)	RFC2597	Rate	Yes per DSCP
Multimedia Conferencing	MC, MC-Admit*	Police using sr+bs [ID-DSCP]	[ID-DSCP]	Rate	No

New Figure 4. Summary of CoS Mechanisms Used for Each Service Class (2/2)

Service Class	DSCP	Conditioning at DS Edge	PHB Used	Queuing	AQM
Multimedia Streaming	AF31*, AF32 AF33	Using two-rate, three-color marker (such as RFC 2698)	RFC2597	Rate	Yes per DSCP
Broadcast	CS3, CS3-Admit*	Police using sr+bs [ID-DSCP]	RFC2474	Rate	No
Low-Latency Data	AF21 AF22 AF23	Using single-rate, three-color marker (such as RFC 2697)	RFC2597	Rate	Yes per DSCP
Conversational Signaling	AV-Sig	Police using sr+bs	[ID-DSCP]	Rate	No
OAM	CS2	Police using sr+bs	RFC2474	Rate	Yes
High-Throughput Data	AF11 AF12 AF13	Using two-rate, three-color marker (such as RFC 2698)	RFC2597	Rate	Yes per DSCP
Standard	DF	Not applicable	RFC2474	Rate	Yes
Low-Priority Data	CS1	Not applicable	RFC3662	Rate	Yes