

Telephony

DSCP & TOS

Note: I'm perfectly happy for this table and associated information to be used anywhere by anyone, that's why it's been published here, I couldn't find an easy reference, so I created one and published it for everyone, but, if you do republish the information, please attribute the source and don't try to pass it off as original work. Thanks.

You're trying to get QoS working smoothly on your network and you have a DSCP tag on your packets, but, you can only see ToS when capturing packets? How do you work out which ToS value equates to which DSCP value? Or... You are tagging using DSCP/PHB classes but only seeing DSCP hex or decimal tags on your packets? What does it all mean?

The following table shows common decimal, hex and binary values for TOS, broken down into the meaning of the parts of that byte including DSCP values when interpreting that byte as DSCP.

TOS (Dec)	TOS (Hex)	TOS (Bin)	TOS Precedence (Bin)	TOS Precedence (Dec)	TOS Precedence Name	TOS Delay flag	TOS Throughput flag	TOS Reliability flag	DSCP (Bin)	DSCP (Hex)	DSCP (Dec)	DSCP/PHB Class
0	0x00	00000000	000	0	Routine	0	0	0	000000	0x00	0	none
4	0x04	00000100	000	0	Routine	0	0	1	000001	0x01	1	none
8	0x08	00001000	000	0	Routine	0	1	0	000010	0x02	2	none
12	0x0C	00001100	000	0	Routine	0	1	1	000011	0x03	3	none
16	0x10	00010000	000	0	Routine	1	0	0	000100	0x04	4	none
32	0x20	00100000	001	1	Priority	0	0	0	001000	0x08	8	cs1

TOS (Dec)	TOS (Hex)	TOS (Bin)	TOS Precedence (Bin)	TOS Precedence (Dec)	TOS Precedence Name	TOS Delay flag	TOS Throughput flag	TOS Reliability flag	DSCP (Bin)	DSCP (Hex)	DSCP (Dec)	DSCP/PHB Class
40	0x28	00101000	001	1	Priority	0	1	0	001010	0x0A	10	af11
48	0x30	00110000	001	1	Priority	1	0	0	001100	0x0C	12	af12
56	0x38	00111000	001	1	Priority	1	1	0	001110	0x0E	14	af13
64	0x40	01000000	010	2	Immediate	0	0	0	010000	0x10	16	cs2
72	0x48	01001000	010	2	Immediate	0	1	0	010010	0x12	18	af21
80	0x50	01010000	010	2	Immediate	1	0	0	010100	0x14	20	af22
88	0x58	01011000	010	2	Immediate	1	1	0	010110	0x16	22	af23
96	0x60	01100000	011	3	Flash	0	0	0	011000	0x18	24	cs3
104	0x68	01101000	011	3	Flash	0	1	0	011010	0x1A	26	af31
112	0x70	01110000	011	3	Flash	1	0	0	011100	0x1C	28	af32
120	0x78	01111000	011	3	Flash	1	1	0	011110	0x1E	30	af33
128	0x80	10000000	100	4	FlashOverride	0	0	0	100000	0x20	32	cs4
136	0x88	10001000	100	4	FlashOverride	0	1	0	100010	0x22	34	af41
144	0x90	10010000	100	4	FlashOverride	1	0	0	100100	0x24	36	af42
152	0x98	10011000	100	4	FlashOverride	1	1	0	100110	0x26	38	af43

TOS (Dec)	TOS (Hex)	TOS (Bin)	TOS Precedence (Bin)	TOS Precedence (Dec)	TOS Precedence Name	TOS Delay flag	TOS Throughput flag	TOS Reliability flag	DSCP (Bin)	DSCP (Hex)	DSCP (Dec)	DSCP/PHB Class
160	0xA0	10100000	101	5	Critical	0	0	0	101000	0x28	40	cs5
176	0xB0	10110000	101	5	Critical	1	0	0	101100	0x2C	44	voice-admit
184	0xB8	10111000	101	5	Critical	1	1	0	101110	0x2E	46	ef
192	0xC0	11000000	110	6	InterNetwork Control	0	0	0	110000	0x30	48	cs6
224	0xE0	11100000	111	7	Network Control	0	0	0	111000	0x38	56	cs7

So, there you have it, one byte in a packet header, two ways to look at it...

If dealing with TOS (Type of Service), the first 3 bits indicate the precedence, the 4th bit indicates the whether or not low delay is preferred, the 5th bit indicates whether or not high throughput is preferred, the 6th bit indicates whether or not high reliability is preferred and the 7th and 8th bits are reserved... More info can be found in [RFC 791](#), written in 1981, which defines IP.

If dealing with DSCP (Differentiated Services (Diffserv) Codepoint) only the first 6 bits are used and the last 2 are ignored, these can be used for ECN (Explicit Congestion Notification) [RFC 3168](#) ... More info can be found in [RFC 2474](#), written in 1998, which defines the Differentiated Services Field (DS Field) which is what the TOS byte is referred to when talking about differentiated services and specifically DSCP. Also, [RFC 2597](#) and [RFC 3246](#) which define some of the PHB (Per-hop Behaviour) classes may be useful reading...

Update 2013-04-21: Added voice-admit as defined in [RFC 5865](#) and listed at the [IANA DSCP Registry](#). Added various TOS flag only options as used in certain software, e.g. openssh and old versions of asterisk.

Examples

tcpdump