

Guidelines for
DiffServ to IEEE 802.11 Mapping

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Tim Szigeti

szigeti@cisco.com

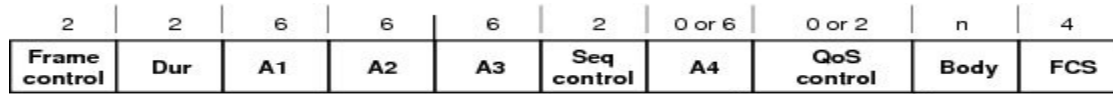
Fred Baker

fred@cisco.com

Problem Statement

- traffic is increasingly sourced-from and destined-to wireless endpoints
- Quality of Service is not aligned between these networks by default
 - two independent standards bodies provide QoS guidance on these networks
- the purpose of this draft is to reconcile QoS recommendations
 - so as to optimize wired-and-wireless interconnect QoS

IEEE 802.11 User Priority (UP)



3 Bit Field allows for UP values 0-7

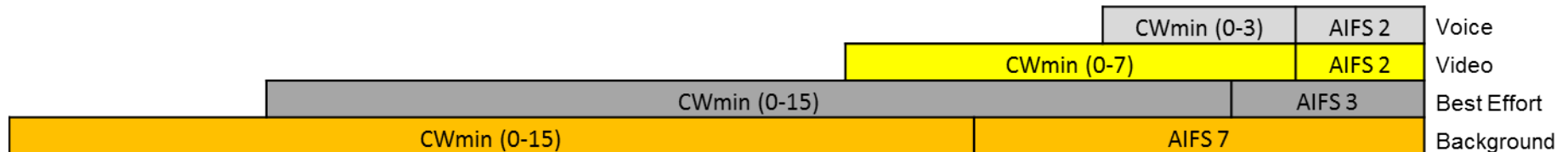
IEEE 802.11 UP Values and Access Categories (AC)

IEEE 802.11 UP Value	IEEE 802.11 Access Category	Wireless Multimedia (WMM) Designation
7	AC_VO	Voice
6		
5	AC_VI	Video
4		
3	AC_BE	Best Effort
0		
2	AC_BK	Background
1		

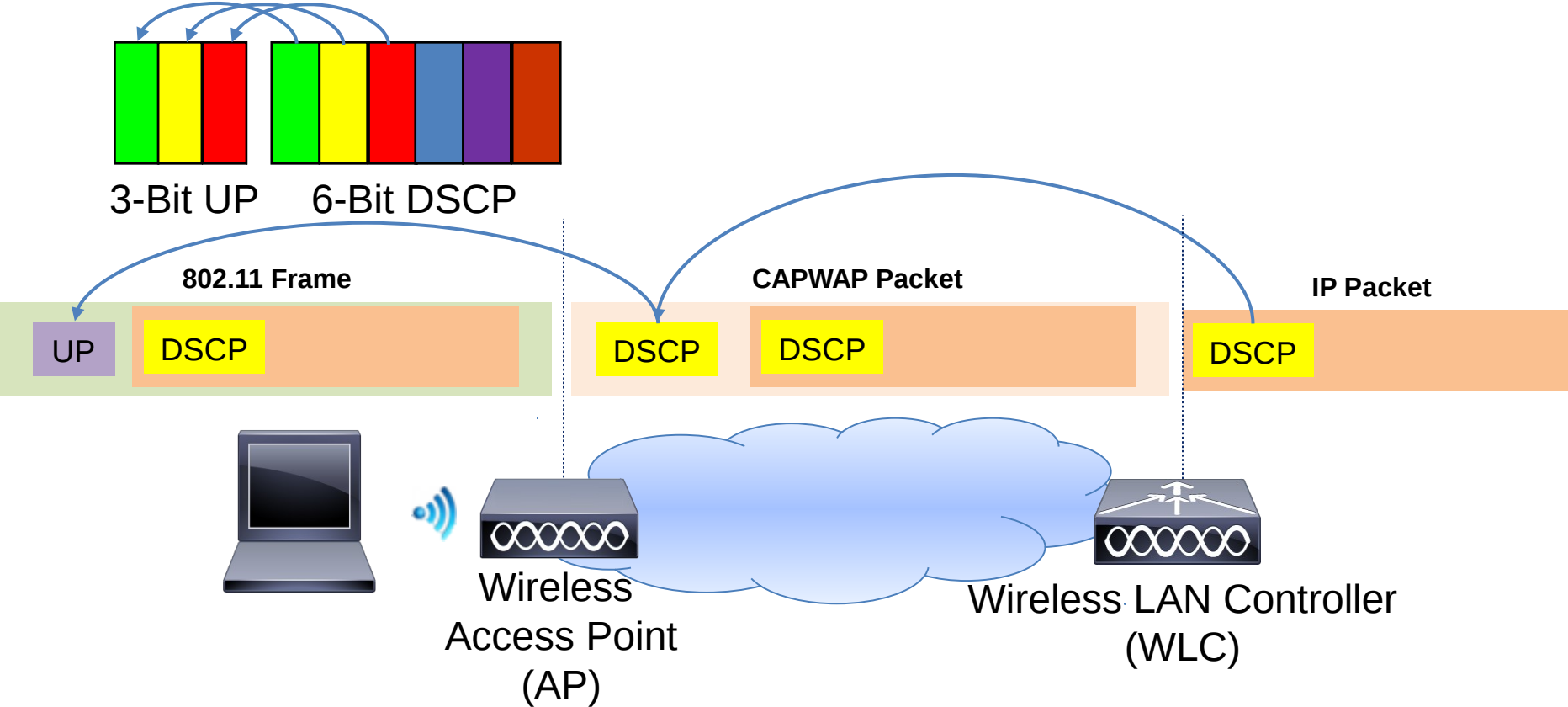
IEEE 802.11 Arbitration Inter-Frame Space (AIFS) & Contention Windows (CW)

- due to the nature of wireless as a shared media, a Congestion Avoidance algorithm (CSMA/CA) must be utilized
- wireless senders have to wait a **fixed amount of time** (the AIFS)
- wireless senders also have to wait a **random amount of time** (bounded by the Contention Window)
- AIFS and Contention Window timers vary by Access Category

Category	(Slot Times)	Access Category	(Slot Times)	(Slot Times)
Voice	2	Voice	3	7
Video	2	Video	7	15
Best Effort	3	Best-Effort	15	1023
Background	7	Background	15	1023



Downstream DSCP-to-UP **Default** Mapping



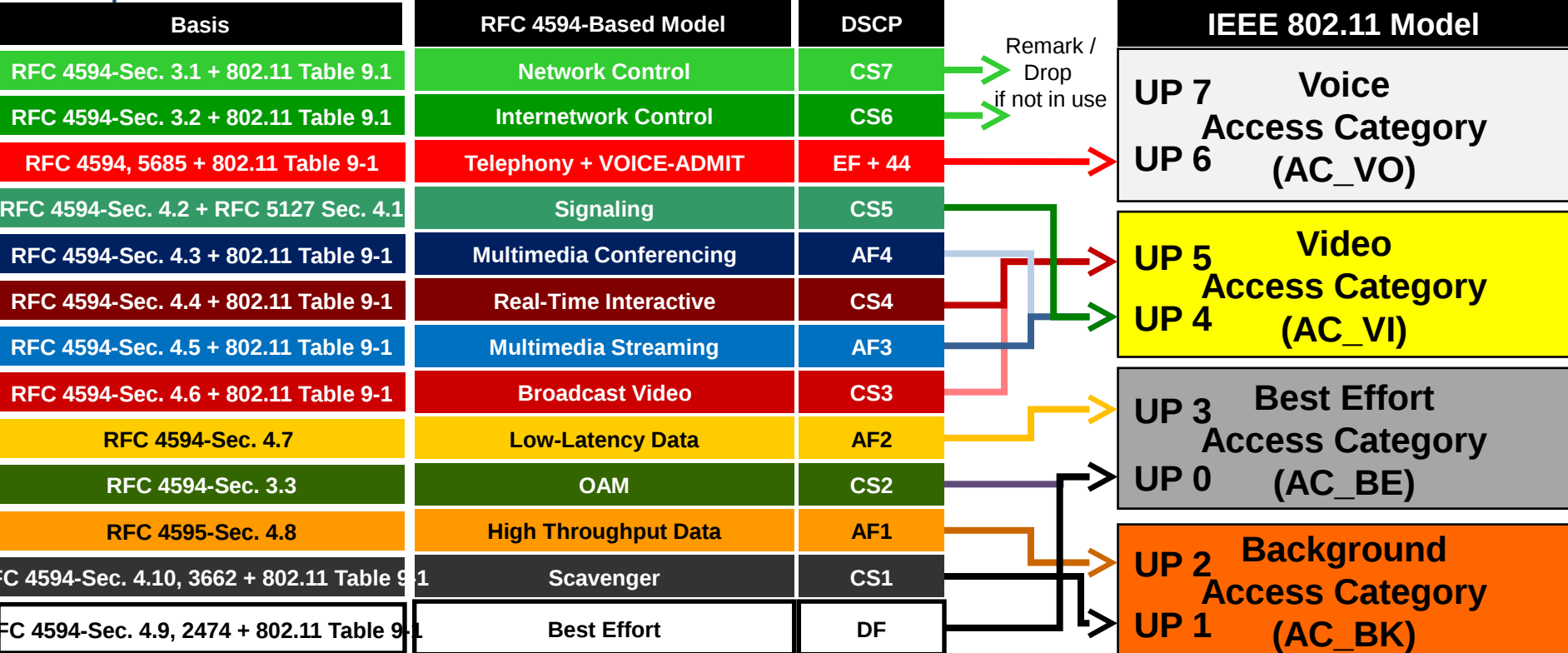
Default DSCP-to-UP Mapping Conflict Example

DSCP	802.11 User Priority	802.11 Access Category
56-63	7	Voice (AC_VO)
48-55	6	
40-47	5	Video (AC_VI)
32-39	4	
24-31	3	Best Effort (AC_BE)
0-7	0	
16-23	2	Background (AC_BK)
8-15	1	

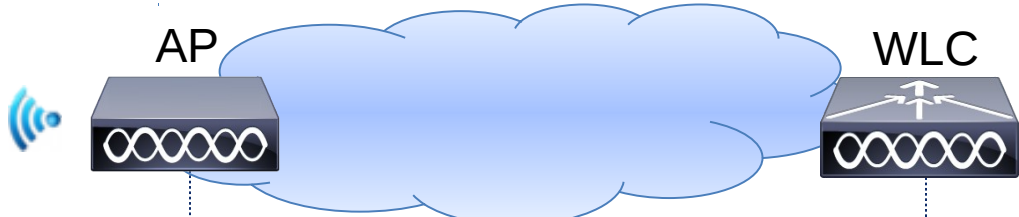
IETF PHB for VoIP: EF → 46 → 5

Downstream DSCP-to-UP Mapping Model

Proposal



Upstream UP-to-DSCP Default Mapping



802.11 Frame

CAPWAP Packet

IP Packet

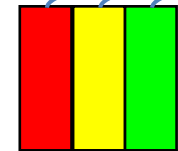
DSCP

UP

DSCP

DSCP

DSCP



3-Bit UP



6-Bit DSCP

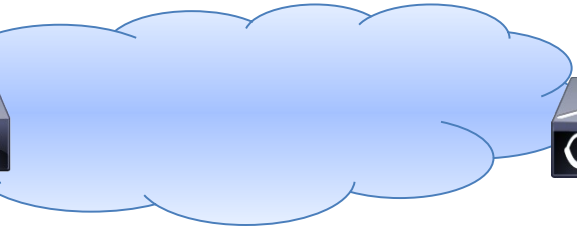
Last 3 Bits are zeroed-out

First 3 Bits are copied

Upstream DSCP Trust Model



AP



WLC



802.11 Frame

CAPWAP Packet

IP Packet

DSCP

UP

DSCP

DSCP

DSCP



6-Bit DSCP



6-Bit DSCP

Inner DSCP is directly copied to Outer (e.g. CAPWAP) DSCP

Next Steps

- Requesting comments, criticisms, questions, feedback, discussion on this draft
- Goal is to get WG to adopt the draft

Appendix A: WLAN QoS Considerations and Implementation Models

Why Consider Wireless OoS?

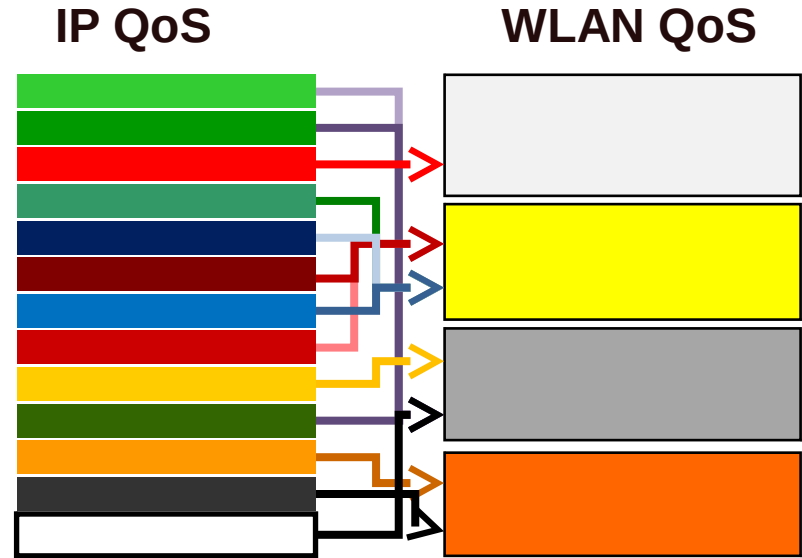
- QoS is like a chain
 - It's only as strong as the weakest link
- the WLAN is one of the weakest links in enterprise QoS designs for three primary reasons:
 - 1) Typical downshift in speed
 - 2) Shift from full-duplex to half-duplex media
 - 3) Shift from a dedicated media to a shared media
- WLAN QoS policies control **both** jitter and packet loss



Wireless QoS-Specific

Limitations

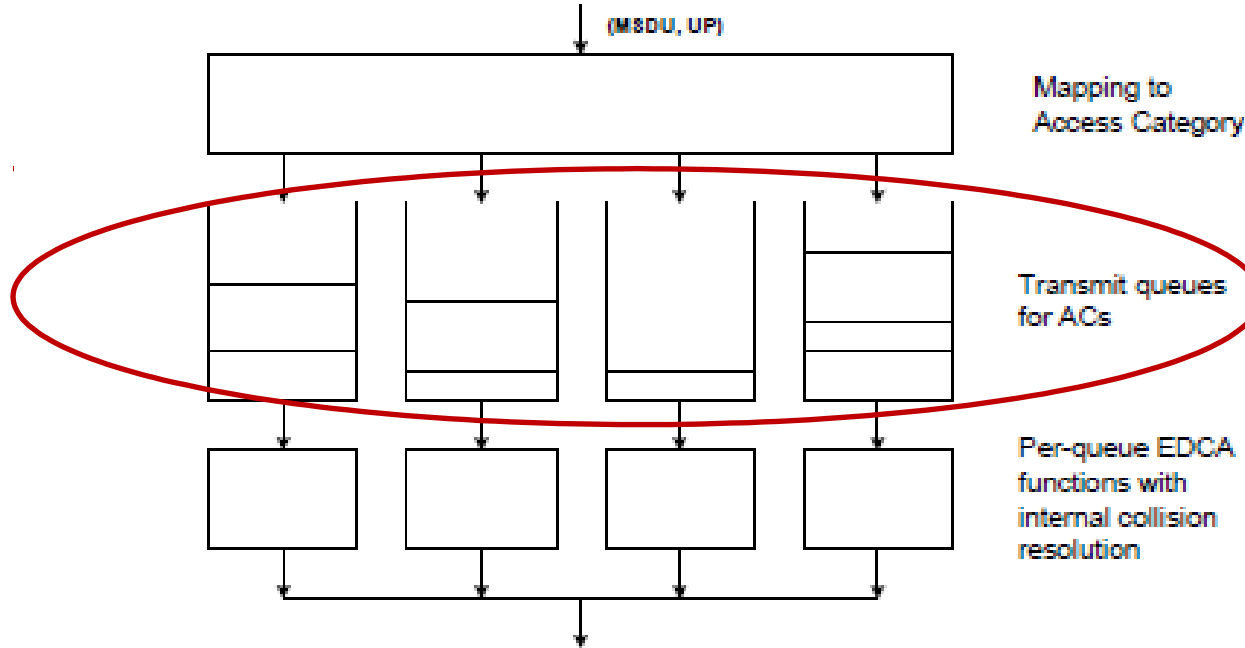
- No EF PHB
- No AF PHB
- Non-deterministic media access
- Only 4 levels of service



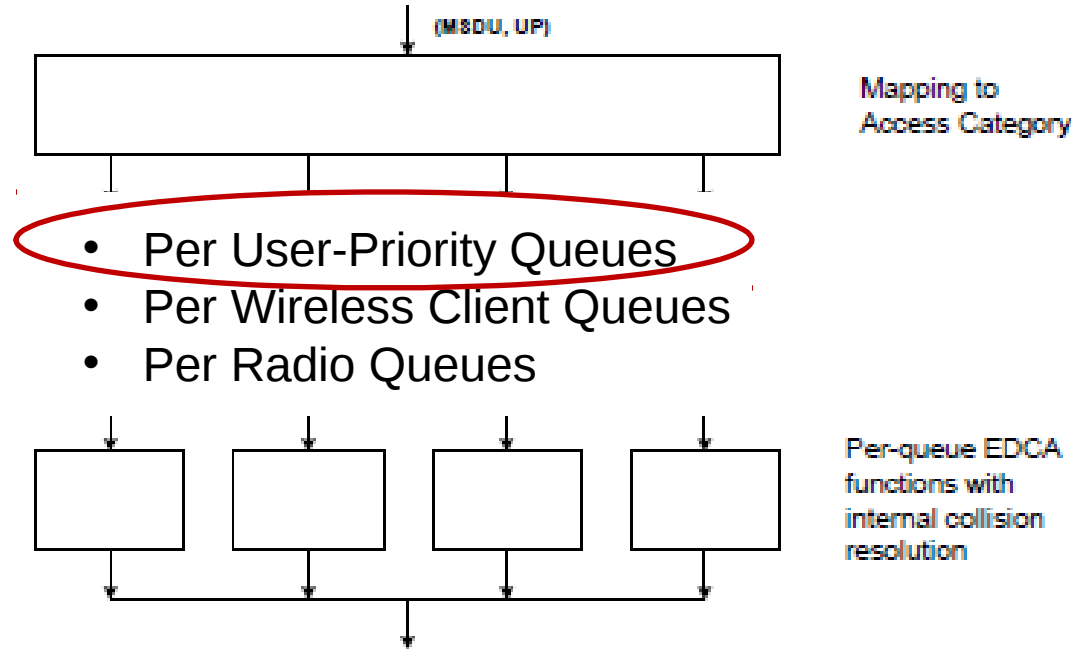
WLAN QoS Improvements Quantified

Application	Original Metric	Improved Metric	Percentage Improvement
Voice	15 ms max jitter	5 ms max jitter	300%
	3.92 MOS (Cellular Quality)	4.2 MOS (Toll Quality)	
Video	9 fps	14 fps	55%
	Visual MOS: Good	Visual MOS: Excellent	
Transactional Data	14 ms latency	2 ms latency	700%

IEEE 802.11 Reference Implementation Model



802.11 Practical Implementation Models



Appendix B: Related Mapping Models

802.11 Example Enterprise
 DSCP to UP/AC mapping

- These is an “example” mapping—not a “recommended” mapping per se
- Inconsistent interpretation of RFC 4594
- Inconsistent interpretation of 802.11
- Misleading to use 802.1d UP (vs. 802.11e UP)

Application Class	Per-hop behavior (PHB)	IEEE 802.1d User Priority	Access Category
Network Control	CS6	7	AC_VO
Telephony	EF	6	AC_VO
RT Interactive	CS4	6	AC_VO
Multimedia Conference	AF4x	5	AC_VI
Signaling	CS5	5	AC_VI
Broadcast Video	CS3	4	AC_VI
Multimedia Stream	AF3x	4	AC_VI
Low Latency Data	AF2x	3	AC_BE
High Throughput Data	AF1x	2	AC_BE
OAM	CS2	2	AC_BE
Standard	DF	0	AC_BE
Low Priority/Background	CS1	1	AC_BK

IEEE 802.11 UP to DSCP Range
Mapping Example

- These are examples;
not recommendations
- Several examples
inconsistent with RFC
4594-expressed intent

UP Range	DSCP Low	DSCP High
UP 0 Range	0	DF
UP 1 Range	1	CS1
UP 2 Range	10	AF1-CS2
UP 3 Range	17	AF2
UP 4 Range	24	CS3-AF3
UP 5 Range	32	CS4-AF4-CS5
UP 6 Range	41	EF
UP 7 Range	48	CS6-CS7

Notable PHB Inclusions

DiffServ Interconnection Classes & Practice

- Proposes a simplified model for interconnecting SPs
- “Draws heavily” on RFC 5127
- Is intended for MPLS, but “is applicable to other technologies”
- This approach “is not intended for use *within* the interconnected (or other) networks”
- DSCPs may be remarked at the interconnection

