Guidelines for DiffServ to IEEE 802.11 Mapping

draft-ietf-tsvwg-ieee-802-11-00

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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 IP DSCP and 802.11 UP interconnect QoS

Summary of Comments / Changes

Part 1 of 4

Comments on Section 4.3-Figure 1:

- "EF-Speaking formally, this is a PHB, not a DSCP"
- "EF-ADMIT is lengthy, so here you list a (decimal) DSCP. I understand the purpose of the table and can read it. This column is not formally correct, I guess."
- "You've asked me to decide for non ambiguous mappings in DiffServ Intercon. I ask you for the same here (noting that some decisions are difficult)."

Actions Taken:

- Made all corrections to Figure 4.1
- Selected only one mapping recommendation for High-Throughput Data (AF1 ␣ UP 0), which was the consensus recommendation from IETF96
- Changed Section 4.2.8 (High-Throughput Data Mapping) to match

https://tools.ietf.org/html/draft-ietf-tsvwg-ieee-802-11-00#section-4.3
https://tools.ietf.org/html/draft-ietf-tsvwg-ieee-802-11-00#section-4.2.8

Source:
5/3/16—R. Geib

Summary of Comments / Changes

Part 2 of 4

Comment on Section 10.1-Normative References:

- [Re: Reference to I-D.ietf-tsvwg-diffserv-intercon]
  "The RFC will be "Informational", so this is an Informative Reference.
  Please move this reference to the appropriate section."

Actions Taken :

- Moved reference to DiffServ-Intercon to Informative References section (Section 10.2)

https://tools.ietf.org/html/draft-ietf-tsvwg-ieee-802-11-00#section-10.2

Source:
5/3/16—R. Geib

Summary of Comments / Changes

Part 3 of 4

Comment on Section 4.2.2 (Signaling Mapping from CS5 ⇆ UP 5 (AC_VI):

- "We should consider CS5 mapping to same things as EF (6) but should map to at least 5 so that it is not less than the video flows."

Action Taken: Changed Signaling Mapping to UP 5

- Changed Signaling (CS5) mapping to UP 5 in Sections 4.2.2 and 4.3

https://tools.ietf.org/html/draft-ietf-tsvwg-ieee-802-11-00#section-4.2.2

Source:
7/7/15 & 5/4/16—C. Jennings

Summary of Comments / Changes

Part 4 of 4

Comment on Section 4.2.4 (Real-time Interactive Mapping from CS4 ⊟ UP 5 (AC_VI):

- "The practical use of AF4 vs CS4 for video phone calls has always been confusing. Over the past 4 years we have spent a huge amount of time getting the direction to be AF4. If this spec put CS4 above AF4, that would be a cause multiple manufactures to re-examine all of that and likely move to CS4 completely resetting the work we have done on this. The one thing I feel really strongly about is CS4 can't map higher than AF4.

  This draft will be downright harmful if it continues to map CS4 above AF4."

  (+ similar concerns for Broadcast Video (CS3 ⊔ UP 5)

Action Taken: Changed Real-Time Interactive and Broadcast Video Mappings to UP 4

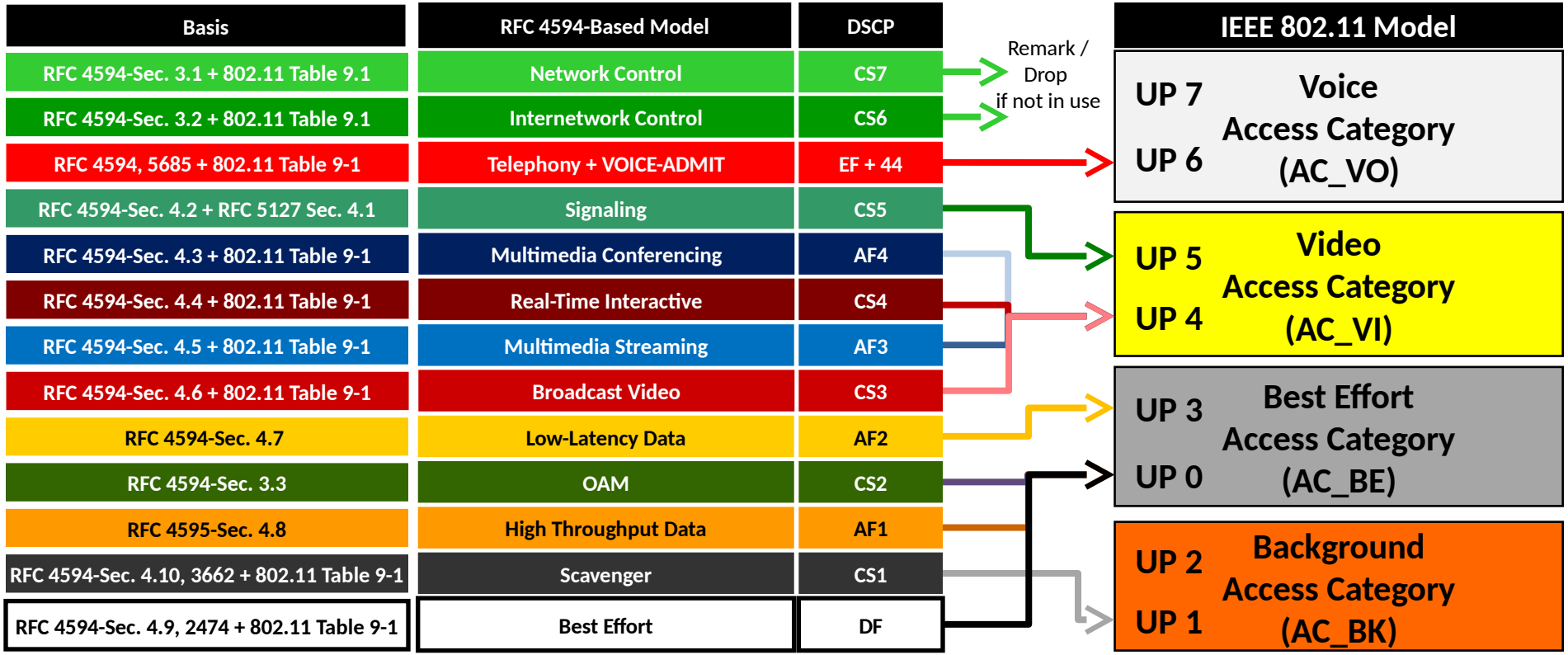
- All video classes (including Multimedia-Conferencing, Real-Time Interactive, Multimedia-Streaming and Broadcast Video) are now being mapped to the same UP value (UP 4) and thus admitted to the same Video Access Category (AC_VI), with no distinction in servicing between them

https://tools.ietf.org/html/draft-ietf-tsvwg-ieee-802-11-00#section-10.2
https://tools.ietf.org/html/draft-ietf-tsvwg-ieee-802-11-00#section-4.2.6

Source:
7/7/15 & 5/4/16—C. Jennings

Downstream DSCP-to-UP Mapping Model

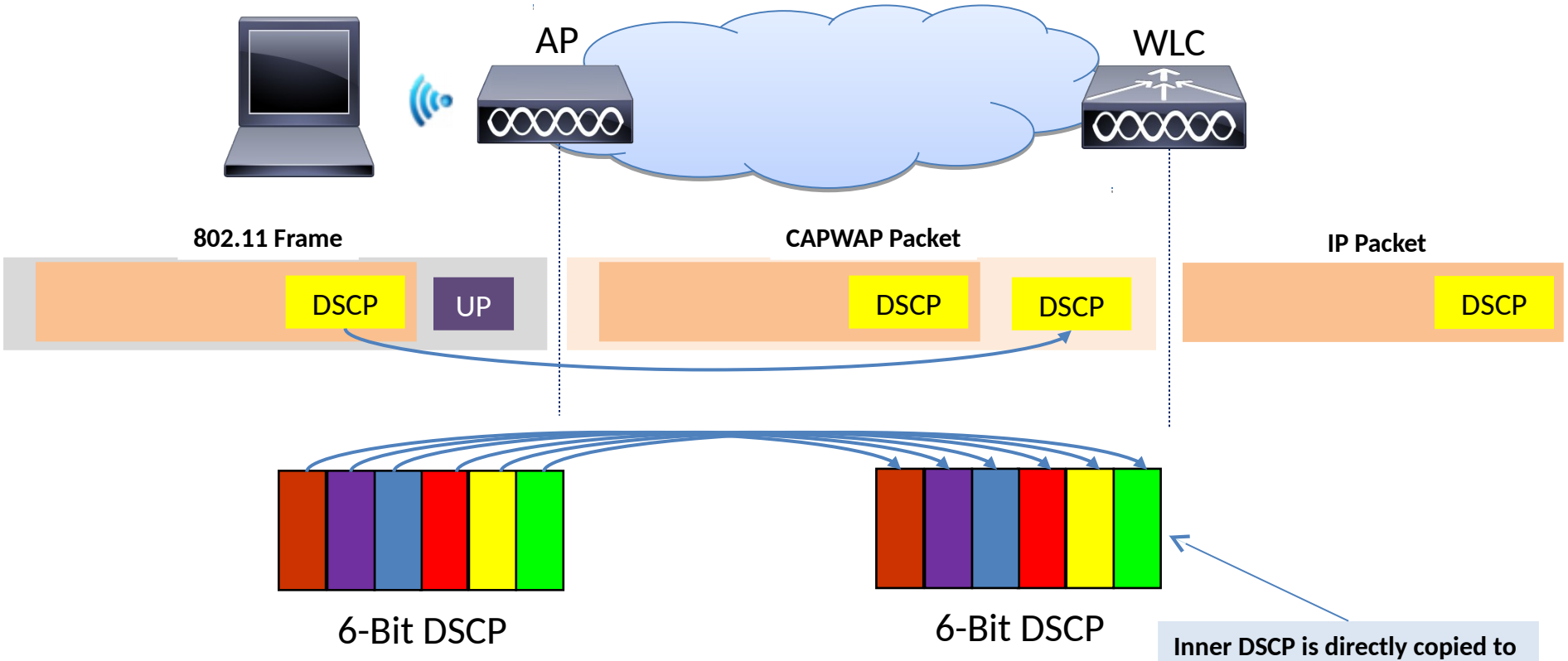
Proposal



https://tools.ietf.org/html/draft-ietf-tsvwg-ieee-802-11-00#section-4.3

Upstream Model:

DSCP Trust



https://tools.ietf.org/html/draft-ietf-tsvwg-ieee-802-11-00#section-5.3

Next Steps

- Request for Working Group Last Call

Appendix A:
WLAN QoS Considerations and Implementation Models

Why Consider Wireless QoS?

- 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

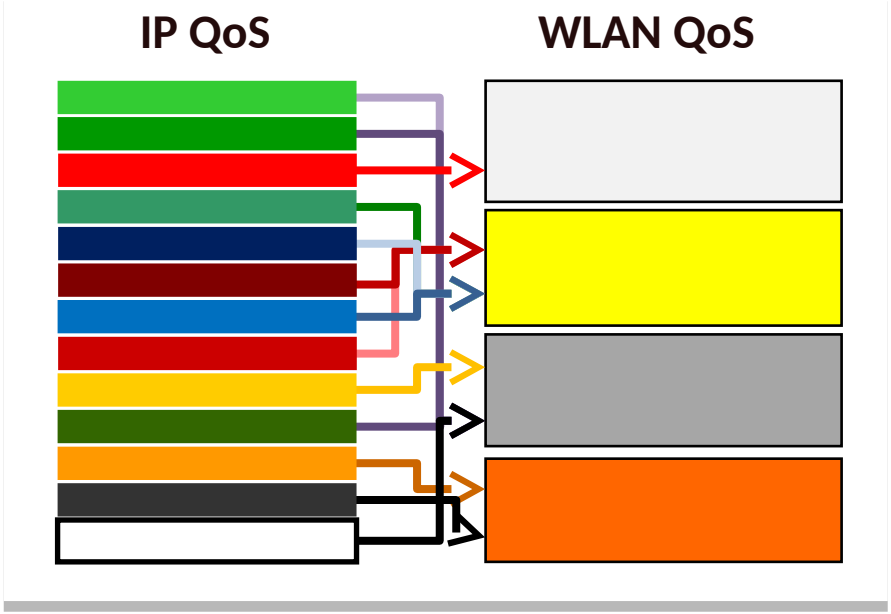
  2) Shift from full-duplex to half-duplex media

  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%

Reference: http://www.cisco.com/en/US/prod/collateral/wireless/cisco_avc_application_improvement.pdf

IEEE 802.11 User Priority (UP)

3 Bit Field allows for UP values 0-7

Reference: IEEE 802.11 Figure 8-1

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		

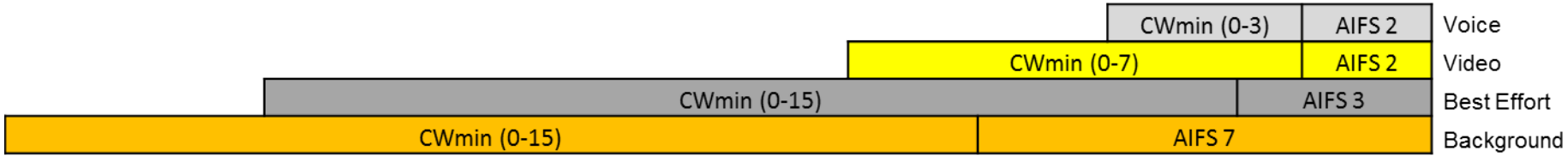
Reference: IEEE 802.11 Table 9-1

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

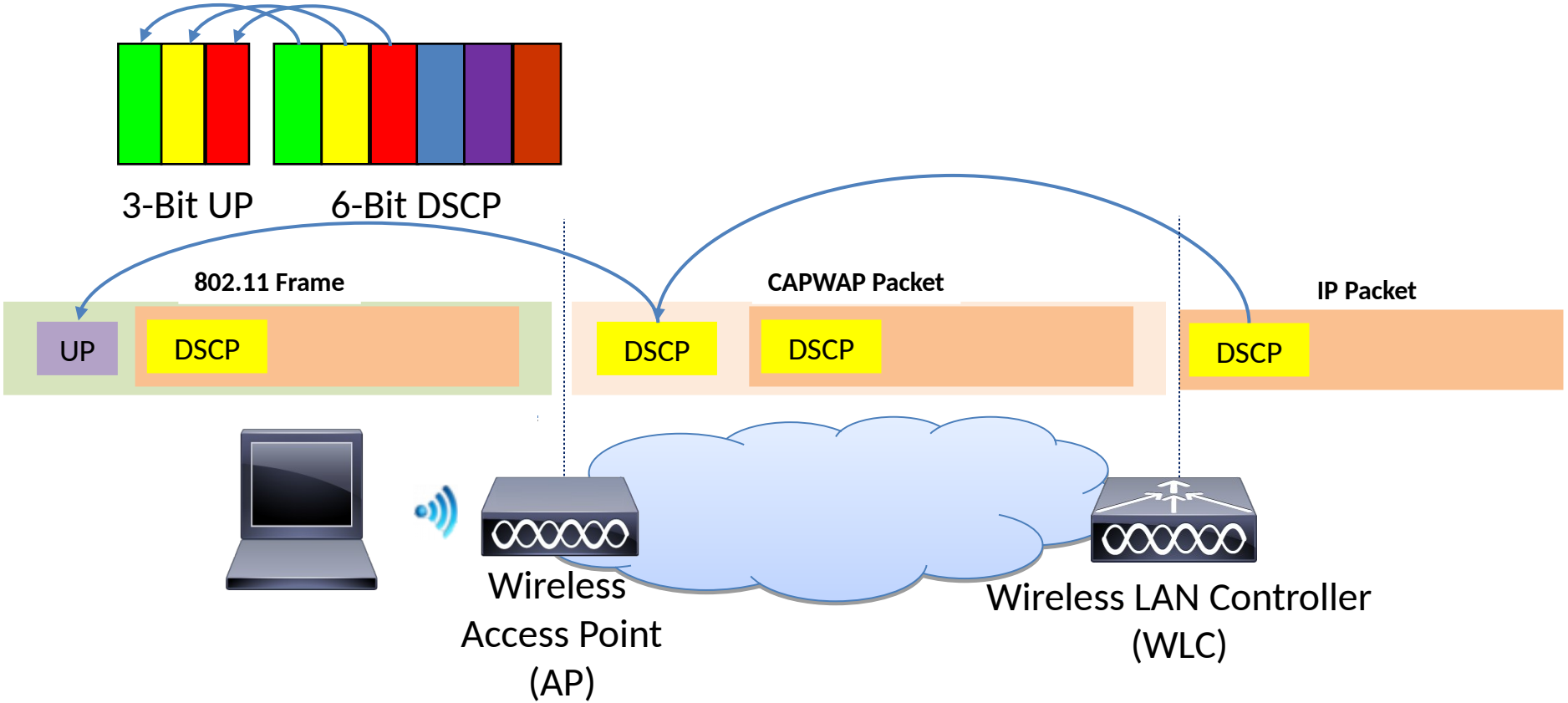
Access Category	AIFS (Slot Times)
Voice	2
Video	2
Best Effort	3
Background	7

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

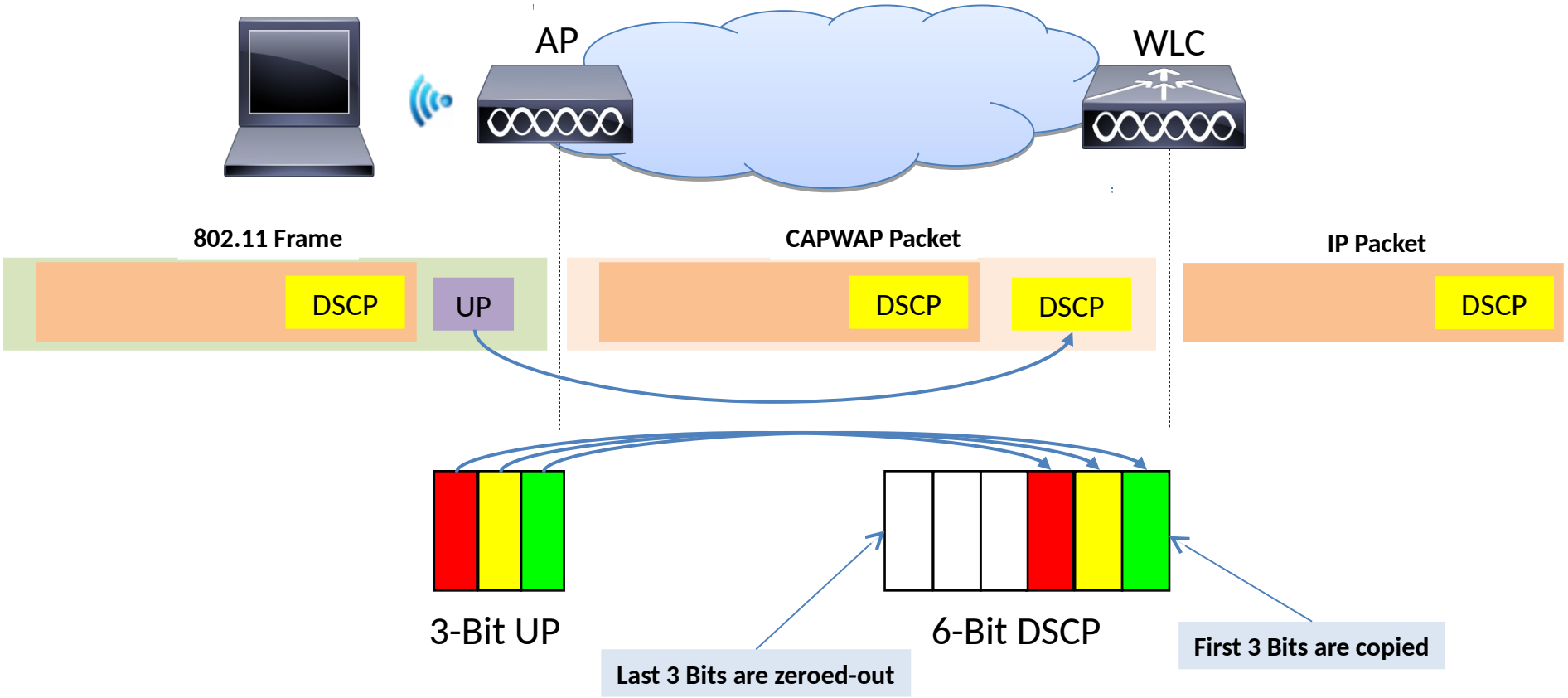


Reference: IEEE 802.11 Table 8-105

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



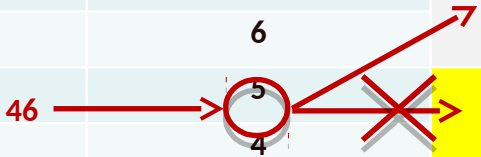
Upstream UP-to-DSCP **Default** Mapping



Default DSCP-to-UP Mapping Conflict Example

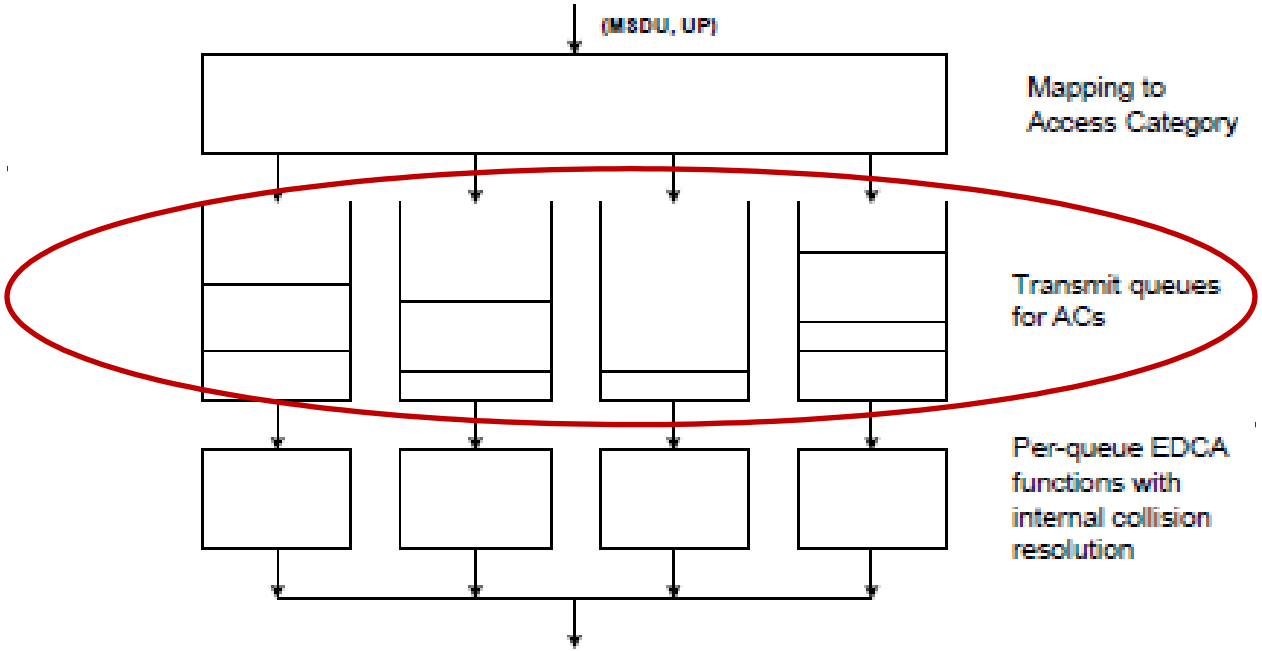
IETF PHB for VoIP: EF

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	



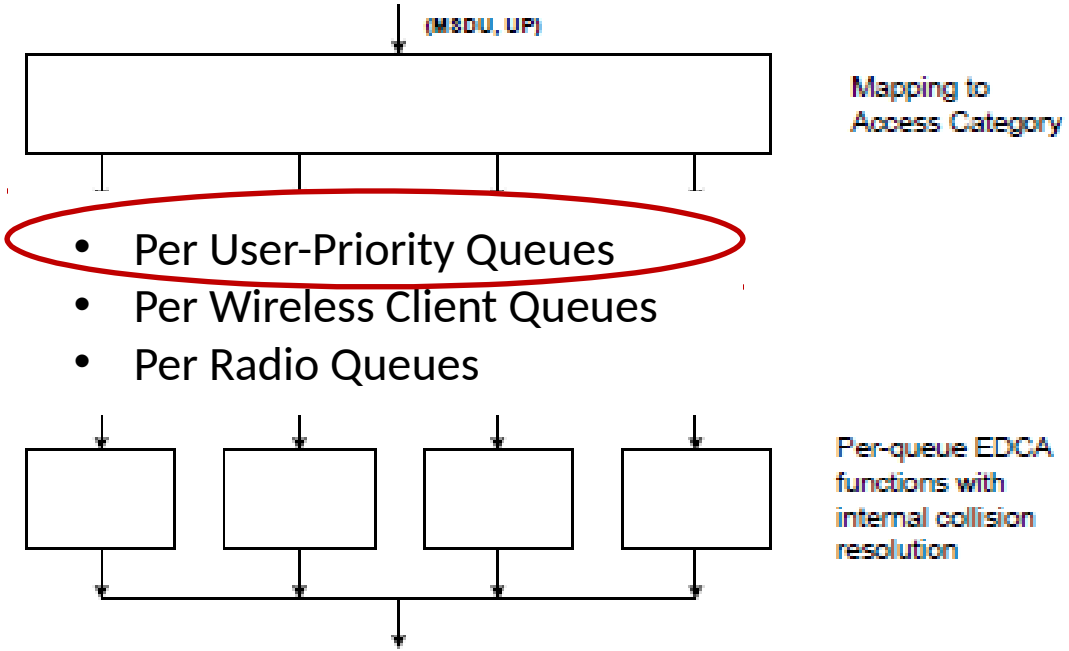
References: RRC 4594, RFC 3246, & IEEE 802.11 Table 9-1

IEEE 802.11 **Reference** Implementation Model



Reference: IEEE 802.11 Figure 9-19

802.11 **Practical** Implementation Models



Reference: (Modified) IEEE 802.11 Figure 9-19

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

References: RFC 4594 & IEEE 802.11 Table V-2

IEEE 802.11 UP to DSCP Range
Mapping Example

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

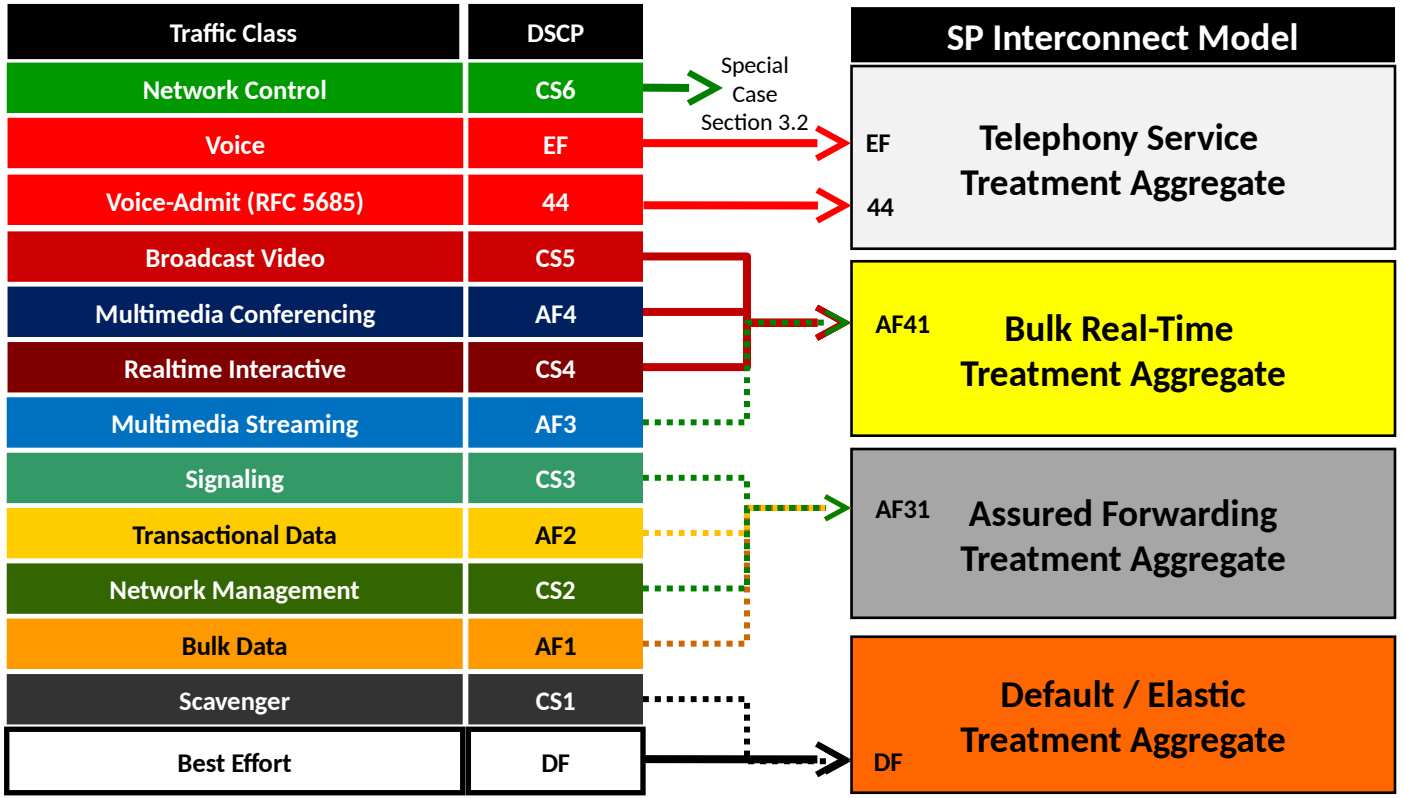
UP Range	DSCP Low		DSCP High
UP 0 Range	0	DF	0
UP 1 Range	1	CS1	9
UP 2 Range	10	AF1-CS2	16
UP 3 Range	17	AF2	23
UP 4 Range	24	CS3-AF3	31
UP 5 Range	32	CS4-AF4-CS5	40
UP 6 Range	41	EF	47
UP 7 Range	48	CS6-CS7	63

Notable PHB Inclusions

References: RFC 4594 & IEEE 802.11 Table V-3

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



References: draft-ietf-tsvwg-diffserv-intercon-01 & RFC 5127

Includes Recommendations from RFC 5127 (shown as dotted lines)