Guidelines for DiffServ to IEEE 802.11 Mapping

draft-szigeti-tsvwg-ieee-802-11-00
(Formerly: draft-szigeti-tsvwg-ieee-802-11e-01)

Tim Szigeti szigeti@cisco.com

Fred Baker fred@cisco.com

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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 8

Comments:

- Multiple objections to recommendation that Bulk Data SHOULD be mapped to UP 2 (AC_BK)

Sources:
7/15—C. Jennings
7/15—R. Geib
7/22—TSVWG93-6.4

Action: Changed Section 4.2.6:

- Bulk Data MAY be mapped to UP 0 (AC_BE) or
- Bulk Data MAY be mapped to UP 2 (AC_BK)
- The mapping chosen will depends on business-requirements and administrative preference

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

Summary of Comments / Changes

Part 2 of 8

Comment:

- Explicitly mention that devices should be able to override these new/default recommendations

Source:
7/15—C. Jennings

Action: Added a new section (Section 3):

- “Having made the assumptions and recommendations above, it bears mentioning while the mappings presented in this document are RECOMMENDED to replace the current common default practices … these mapping recommendations are not expected to fit every last deployment model, and as such may be overridden by network administrators, as needed.”

https://tools.ietf.org/html/draft-szigeti-tsvwg-ieee-802-11-00#page-8

Summary of Comments / Changes

Part 3 of 8

Source: 7/22—TSVWG93-6.4

Comment:

- Request to add details of new IEEE mechanism for exchanging DSCP←→UP mapping information between wireless access points and wireless endpoint devices

Action: Added a new section (Section 6.3):

- Introduced and overviewed IEEE 802.11u QoS Map Set function
- Also provided recommendations on how this function could be utilized in line with the recommendations made in Section 4.3 of this draft

https://tools.ietf.org/html/draft-szigeti-tsvwg-ieee-802-11-00#section-6.3

Summary of Comments / Changes

Part 4 of 8

Source: 7/22—TSVWG93-6.4

Comment:

- Request to research and add guidance on how gaming traffic is to be treated (assuming such is not considered Scavenger)

Action: Added guidance on gaming to Section 4.2.3

- “Specifically, the Real-Time Interactive traffic class is RECOMMENDED for applications that require low loss and jitter and very low delay for variable rate inelastic traffic sources. Such applications may include inelastic video-conferencing applications, but may also include gaming applications (as pointed out in [RFC4594] Sections 2.1 through 2.3, and Section 4.4). “

https://tools.ietf.org/html/draft-szigeti-tsvwg-ieee-802-11-00#section-4.2.3

Summary of Comments / Changes

Part 5 of 8

Comment:

- Requests to move 802.11 overview to the back (as an appendix)

Sources:
7/15—C. Jennings
7/15—R. Geib
7/22—TSVWG93-6.4

Action: Moved 802.11 overview to the back as an Appendix (Section 6)

https://tools.ietf.org/html/draft-szigeti-tsvwg-ieee-802-11-00#section-6

Summary of Comments / Changes

Part 6 of 8

Comment:

- Recommended changes in wording

Action: Made miscellaneous changes in wording throughout the draft, per suggestions and recommendations

Sources:
7/13—K. Carlberg
7/15—C. Jennings
7/15—R. Geib
10/11—Nits Tool

Summary of Comments

Part 7 of 8

Comment:

- Disputes on RFC 4594 recommendations

Action: Deferred to RFC 4594-bis discussions

- This draft does not seek to propose new QoS recommendations, but to reconcile existing IETF and IEEE QoS recommendations already made
- As such, it is dependent on RFC 4594 (as well as IEEE 802.11)
- Any changes that need to be made to RFC 4594 should be discussed as RFC 4594-bis proposals
  - And any changes implemented from such an initiative will have a ‘trickle-down’ effect to this draft, due to its dependency on RFC 4594

Sources:
7/15—C. Jennings
7/15—R. Geib
7/22—TSVWG93-6.4

Summary of Comments

Part 8 of 8

Comment:

- Request to add a mapping of DSCP to 802.1p

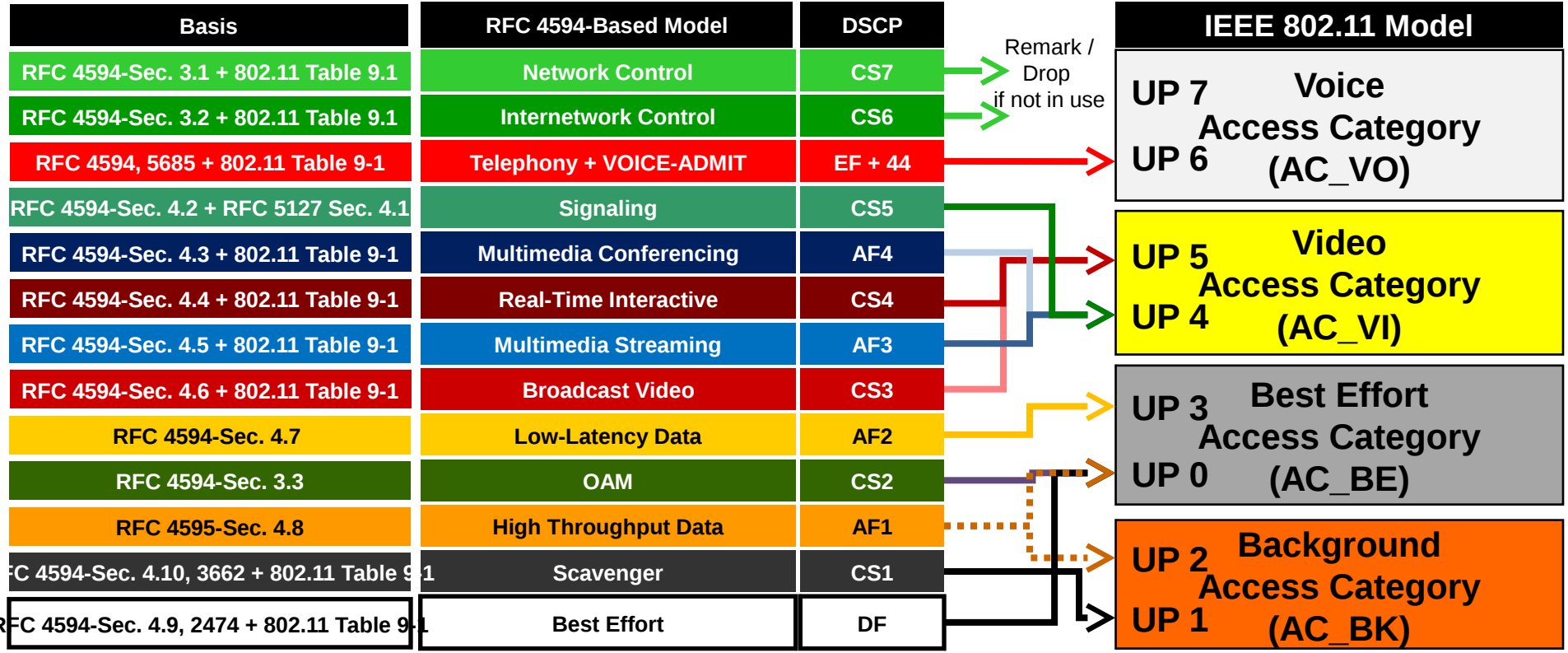
Sources:
8/17—K. Carlberg

Action: Out-of-scope for this draft; perhaps a new draft is needed?

- This draft's scope is limited to DSCP and 802.11
- Possibly another draft would be better suited to address DSCP-to-802.1p mapping?
  - QoS mechanisms are significantly different

Downstream DSCP-to-UP Mapping Model

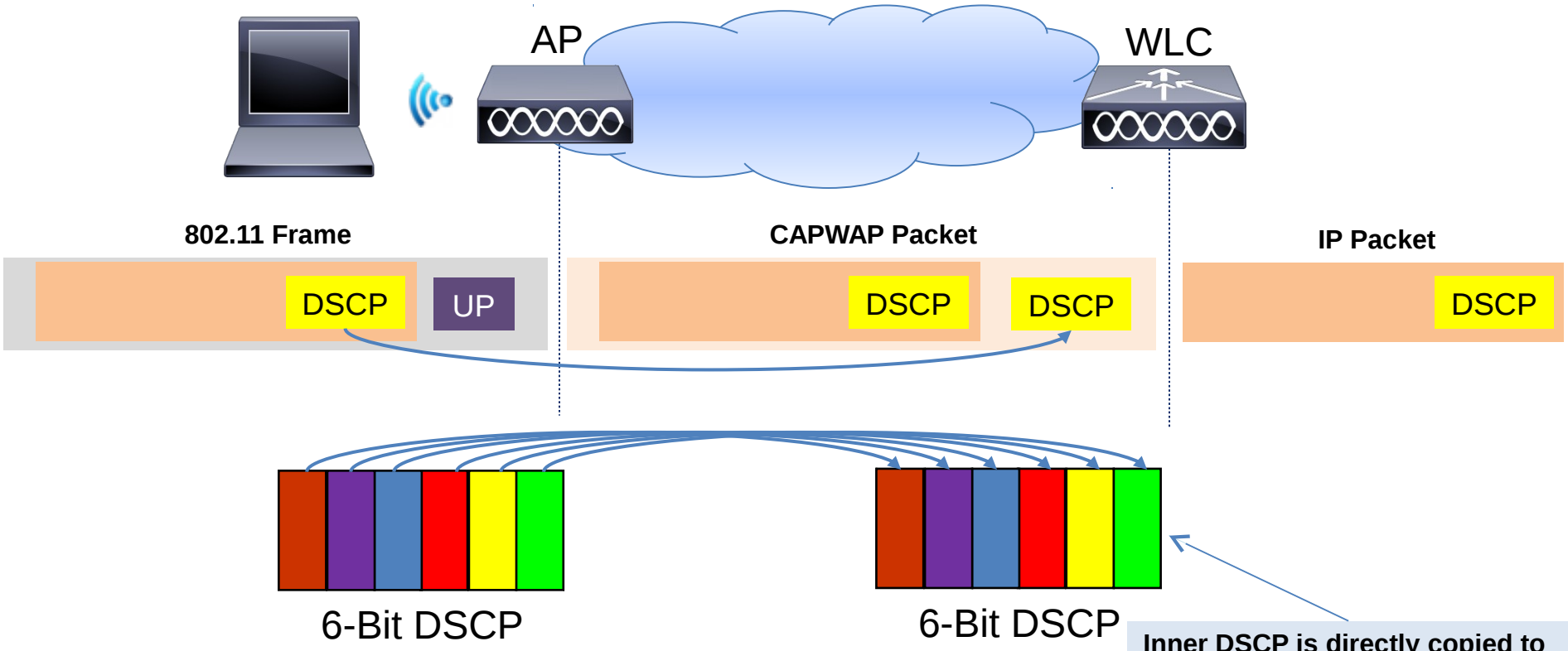
Proposal



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

Upstream Model:

DSCP Trust



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

Next Steps

- Request adoption of this as a Working Group draft
- Request to take that draft to Working Group Last Call

Appendix A: WLAN QoS Considerations and Implementation Models

Why Consider Wireless QoS?

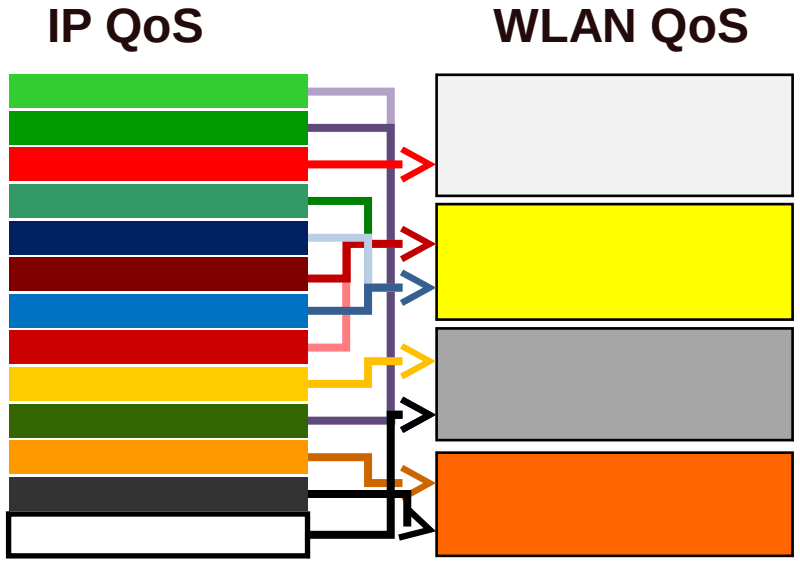
- QoS is like a chain
  - It's only as strong as the weakest link
- the WLAN is one of the weakest links in enterprise QoS designs for three primary reasons:

  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	AC_VI	Video
5		
4	AC_BE	Best Effort
3		
0	AC_BK	Background
2		
1		

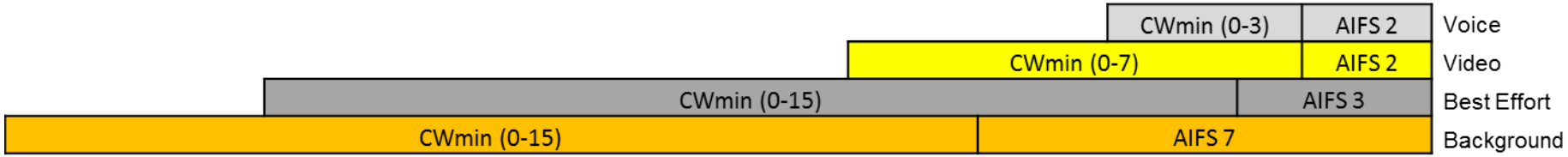
Reference: IEEE 802.11 Table 9-1

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

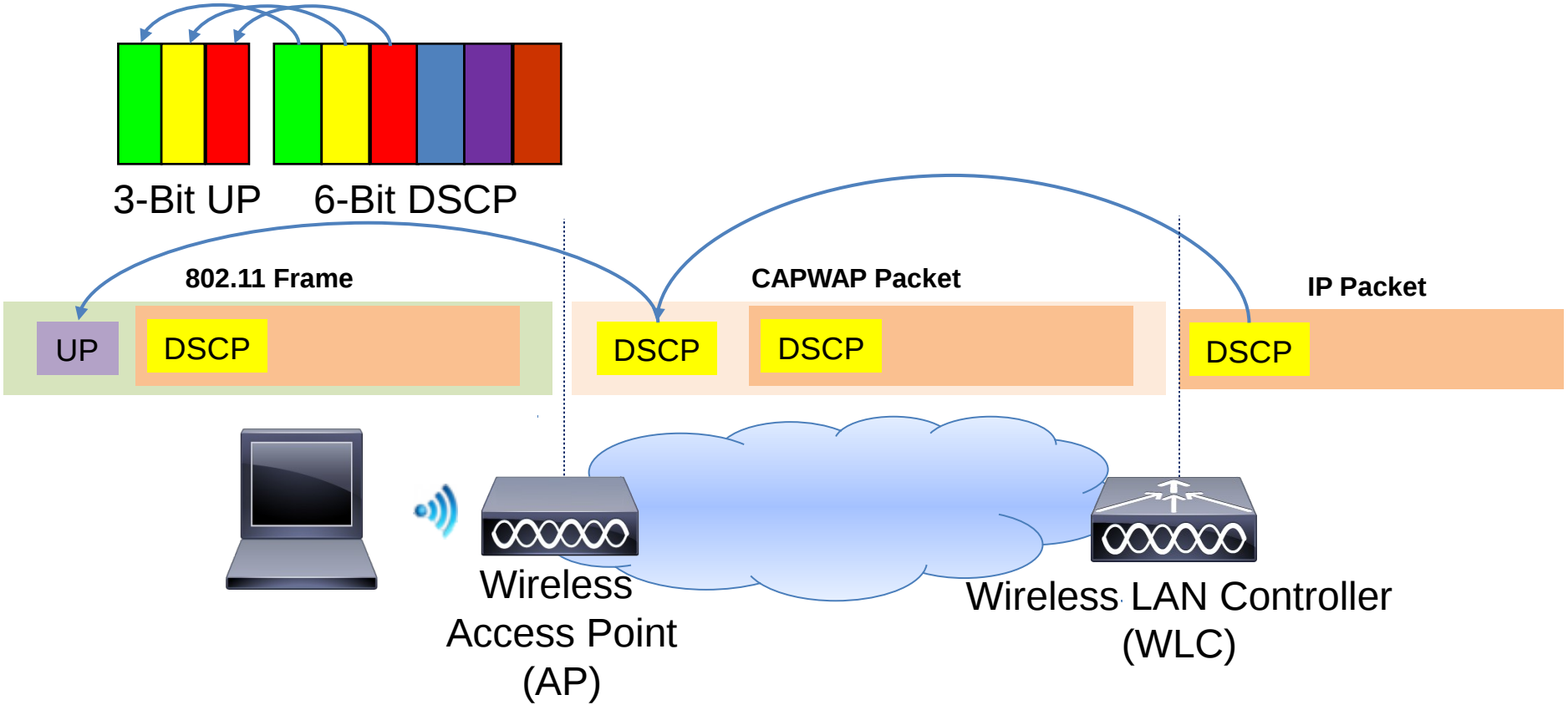
Category	(Slot Times)
Voice	2
Video	2
Best Effort	3
Background	7

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

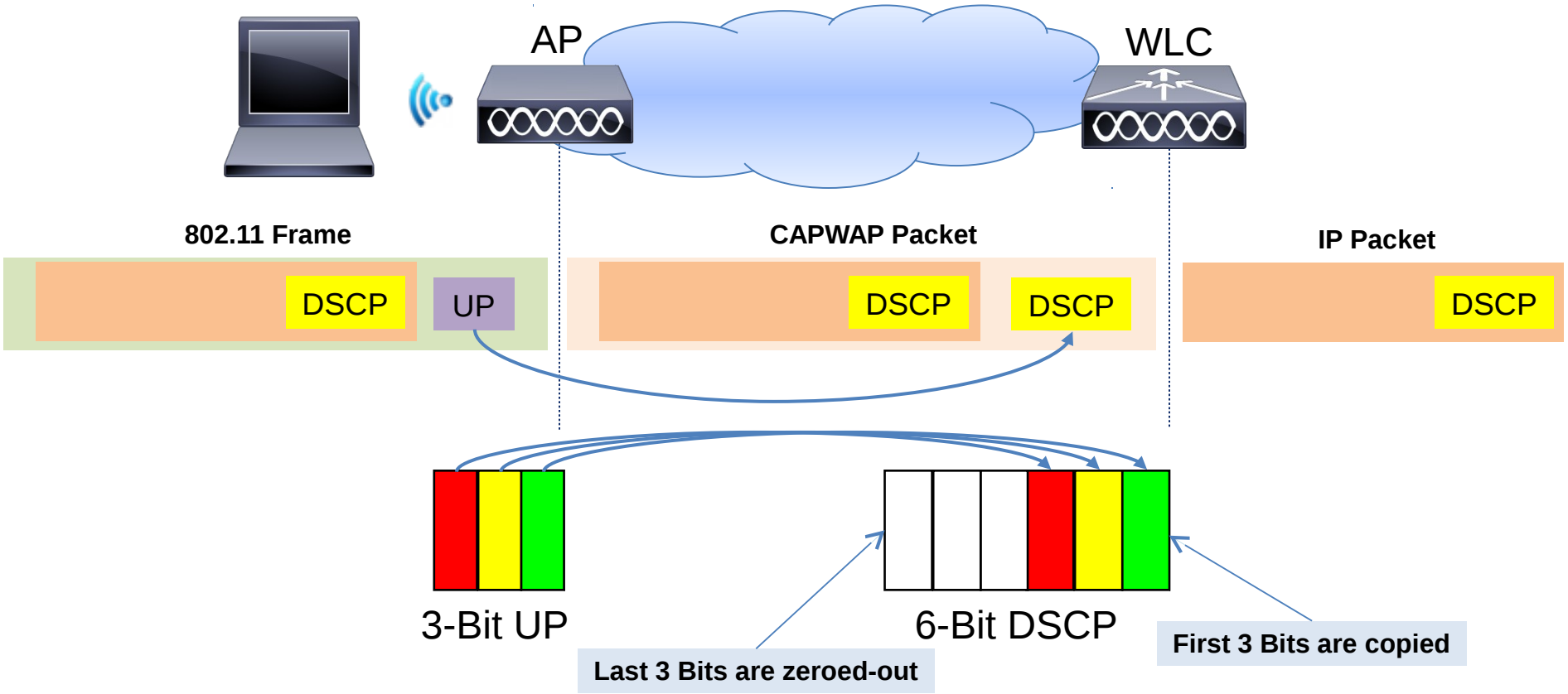


Reference: IEEE 802.11 Table 8-105

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



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



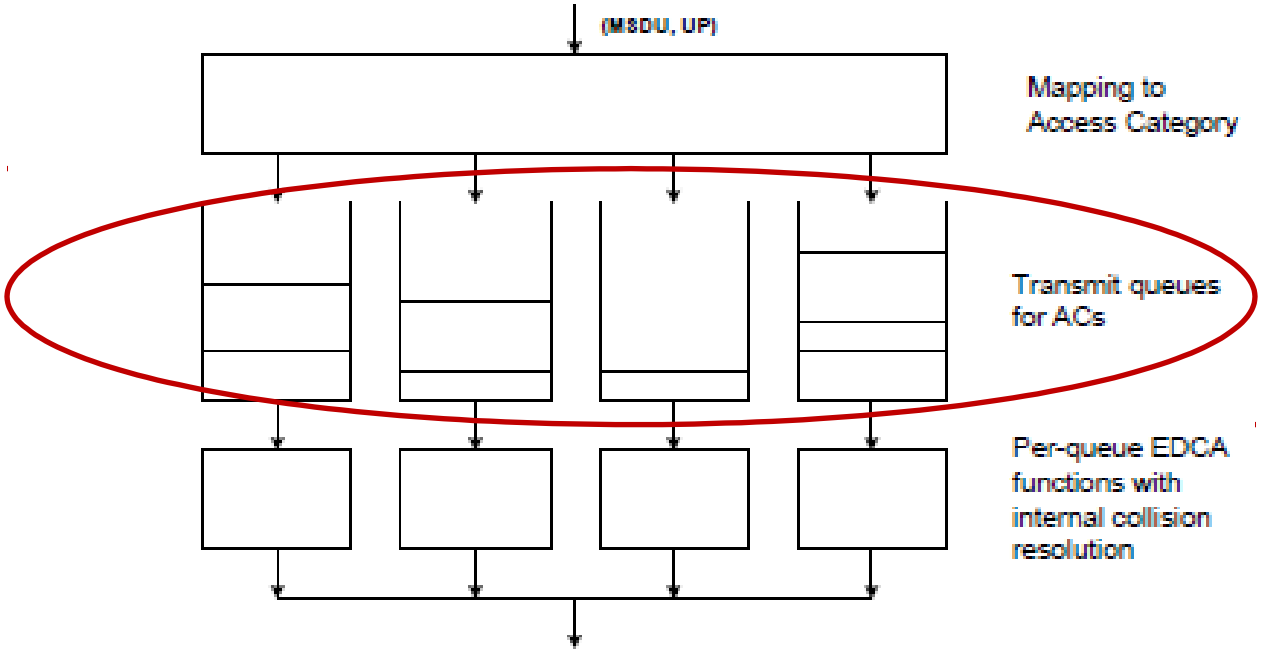
Default DSCP-to-UP Mapping Conflict Example

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 46	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	

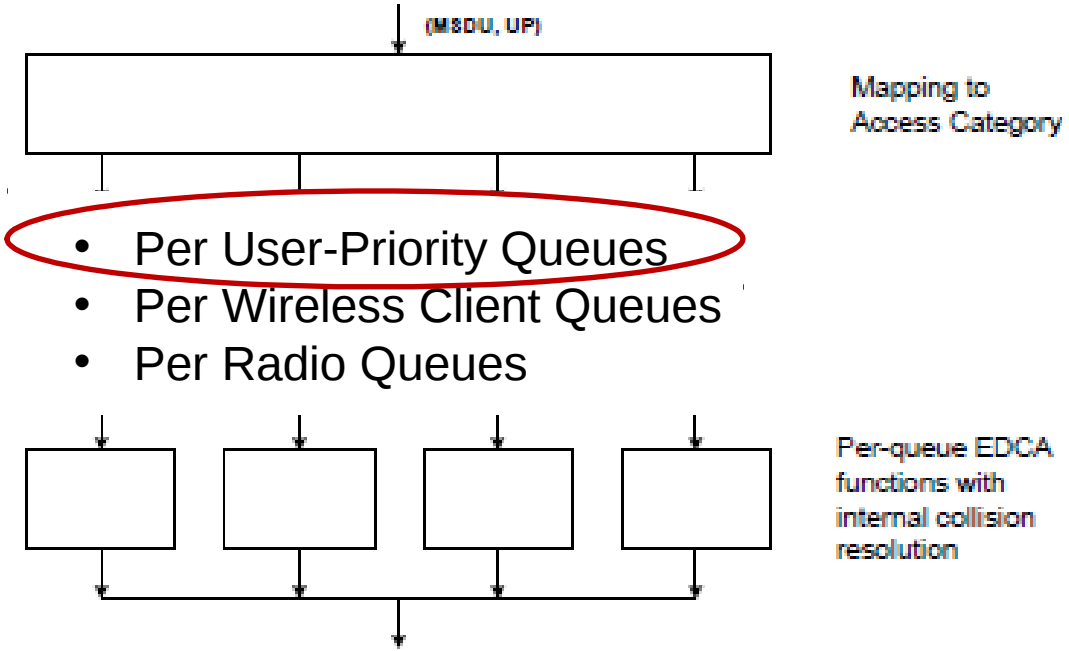
ferences: RRC 4594, RFC 3246, & IEEE 802.11 Table 9-1

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

eferences: 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

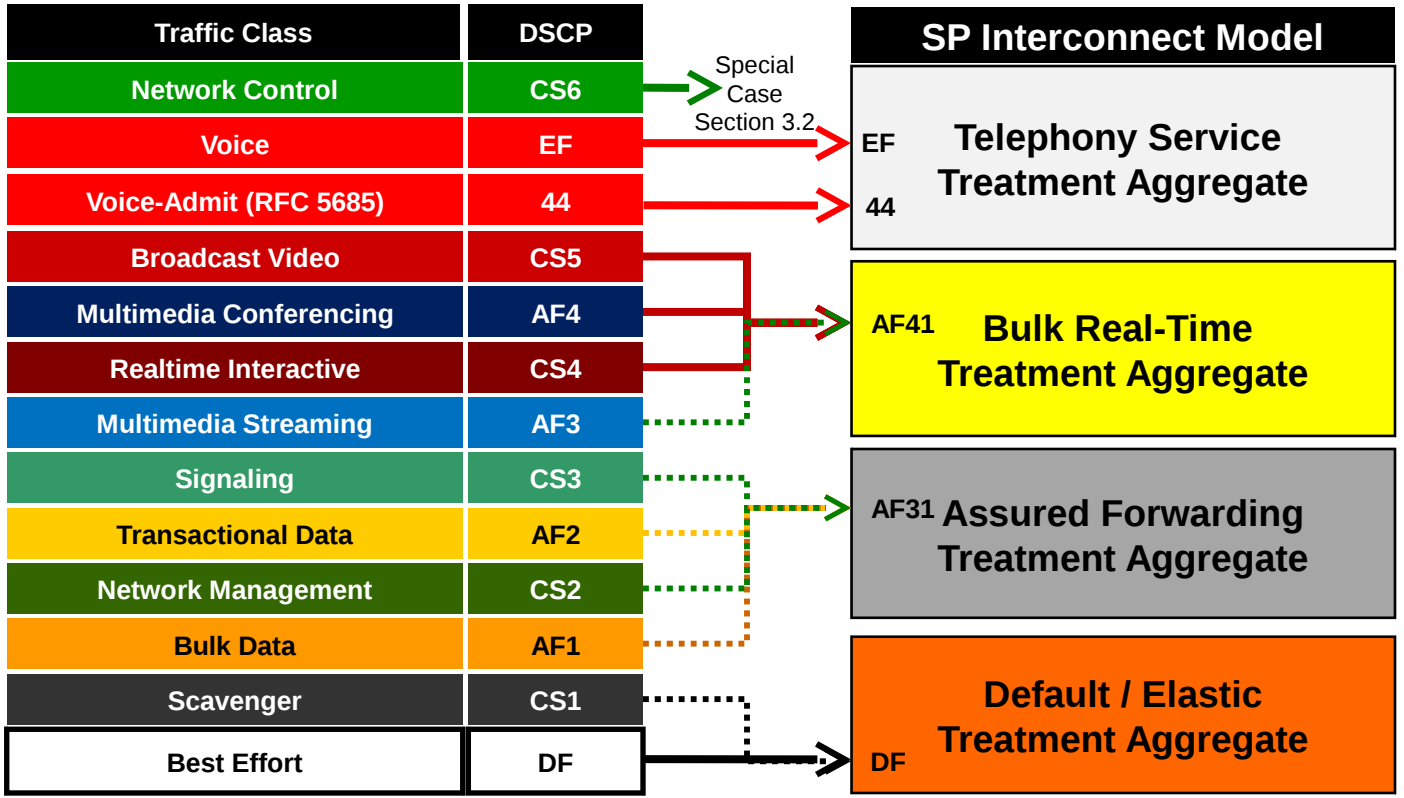
UP Range	DSCP Low		DSCP High
UP 0 Range	0	DF	0
UP 1 Range	1	CS1	9
UP 2 Range	10	AF1-CS2	16
UP 3 Range	17	AF2	23
UP 4 Range	24	CS3-AF3	31
UP 5 Range	32	CS4-AF4-CS5	40
UP 6 Range	41	EF	47
UP 7 Range	48	CS6-CS7	63

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)