How to Read the 802.11 Standard

Karsten Iwen















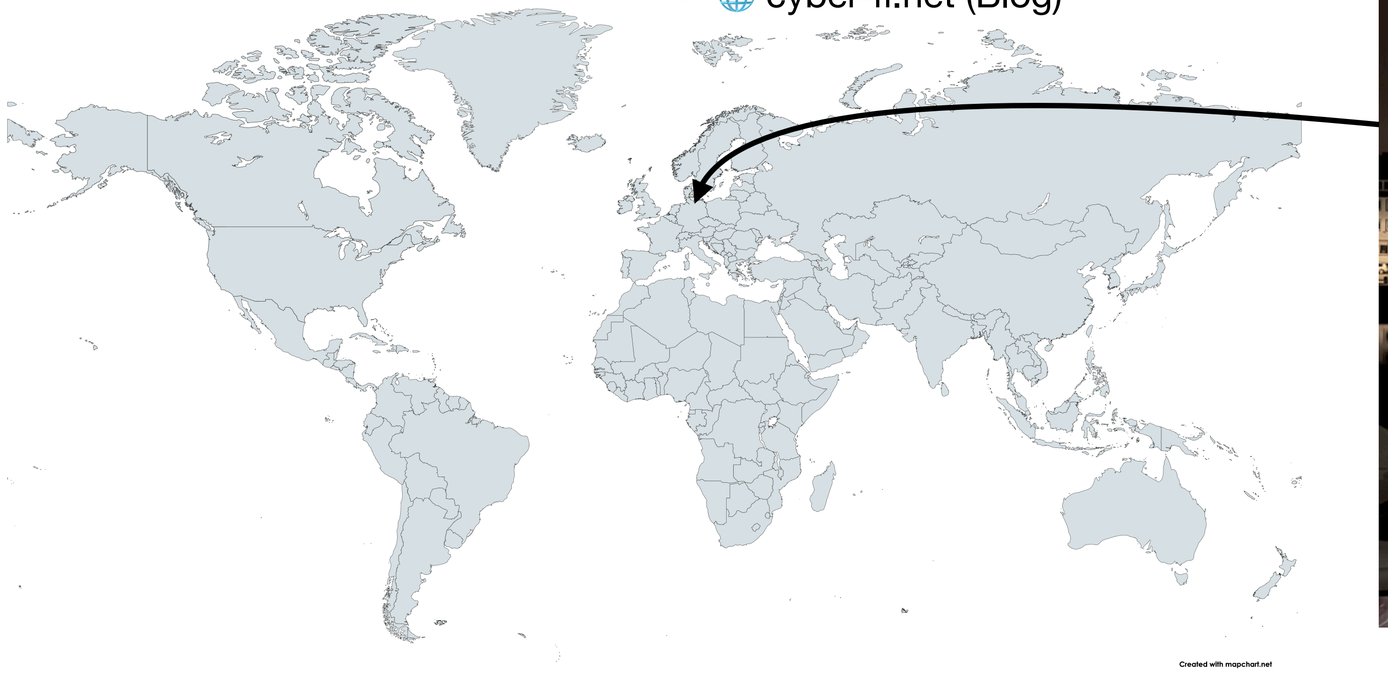


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CISCO CERTIFIED CCIE SECURITY

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CWNE Certified Wireless Network Expert

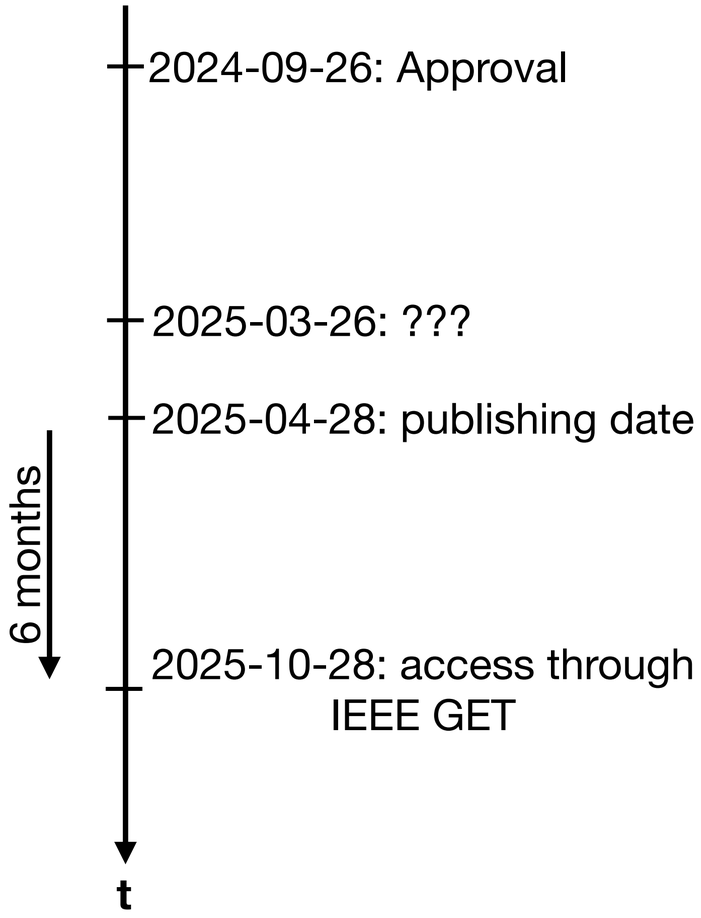
CWNT Certified Wireless Network Trainer

How to Read the 802.11 Standard

- **Read the standard!**
- **Yes, it's hard!**
- **Stop whining!**

- The End -

Download the Standard



What’s Included?

IEEE Std 802.11™-2024

(Revision of IEEE Std 802.11-2020)

This revision is based on IEEE Std 802.11-2020, into which the following amendments have been incorporated:

— IEEE Std 802.11ax™-2021: Enhancements for High Efficiency WLAN (Amendment 1)

— IEEE Std 802.11ay™-2021: Enhanced Throughput for Operations in License-exempt Bands above 45 GHz (Amendment 2)

— IEEE Std 802.11ba™-2021: Wake-Up Radio Operation (Amendment 3)

— IEEE Std 802.11az™-2022: Enhancements for Positioning (Amendment 4)

— IEEE Std 802.11bd™-2022: Enhancements for Next Generation V2X (Amendment 5)

— IEEE Std 802.11bb™-2023: Light Communications (Amendment 6)

— IEEE Std 802.11bc™-2024: Enhanced Broadcast Services (Amendment 7)

Wording

- IEEE SA Standards Style Manual
- IEEE SA Standards Board Operations Manual
- 802.11 Style Guide

Wording (1)

Clause

➡️ top-level numbered chapter

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Wording (2)

Shall, should, may, and can

The word ***shall*** indicates mandatory requirements strictly to be followed in order to conform to the standard and from which no deviation is permitted (shall equals is required to).

The word ***should*** indicates that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others; or that a certain course of action is preferred but not necessarily required (should equals is recommended that).

The word ***may*** is used to indicate a course of action permissible within the limits of the standard (may equals is permitted to).

The word ***can*** is used for statements of possibility and capability, whether material, physical, or causal (can equals is able to).

Wording (3)

Obsolete, deprecated

➡️ Functions and features described in the published 802.11 standard shall not be removed unless they have been marked "obsolete and subject to removal in a subsequent revision of this standard." in a previous revision.

➡️ Functions and features might also be "deprecated", such as "The use of the dual CTS mechanism is deprecated."

- "Obsolete" is used as a route to remove unused and useless mechanisms.
- "Deprecated" is used as a method to indicate that implementations should stop using a feature, but acknowledges that the feature has been used and might still be used by existing implementations, and does not imply a feature's future removal from the standard.

The Help of AI

Use by artificial intelligence systems

In no event shall material in any IEEE Standards documents be used for the purpose of creating, training, enhancing, developing, maintaining, or contributing to any artificial intelligence systems without the express, written consent of IEEE SA in advance. "Artificial intelligence" refers to any software, application, or other system that uses artificial intelligence, machine learning, or similar technologies, to analyze, train, process, or generate content. Requests for consent can be submitted using the Contact Us form.

IEEE Std 802.11-2024

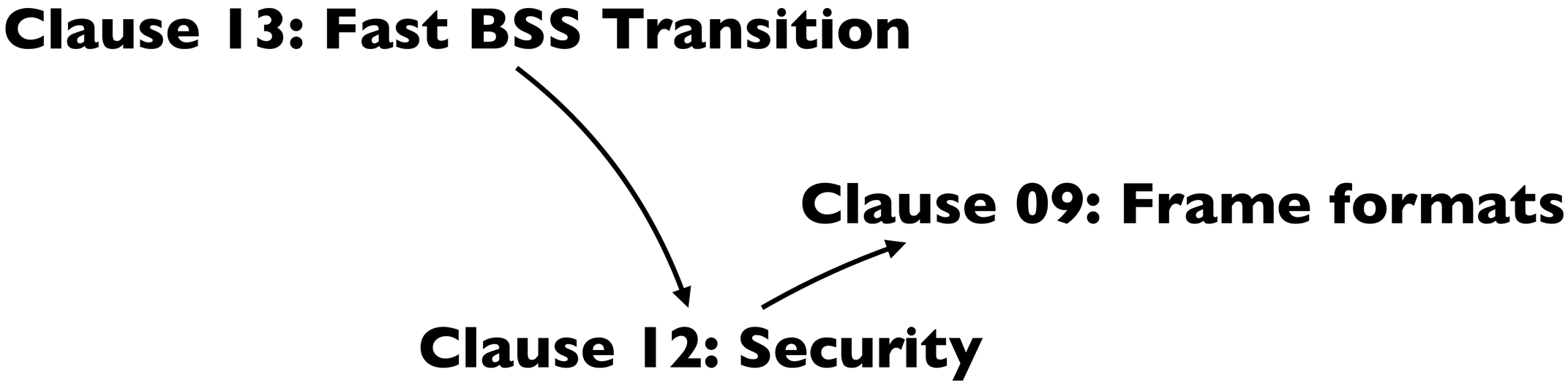
Just Skip It!

> A STA that receives a frame from its currently associated AP containing a ***Tetrapartial Timestamp*** or a ***Pentapartial Timestamp*** field may update its local TSF using the received portions of the AP's TSF timer contained in the received field, following the procedure described in 11.1.3.10.3.

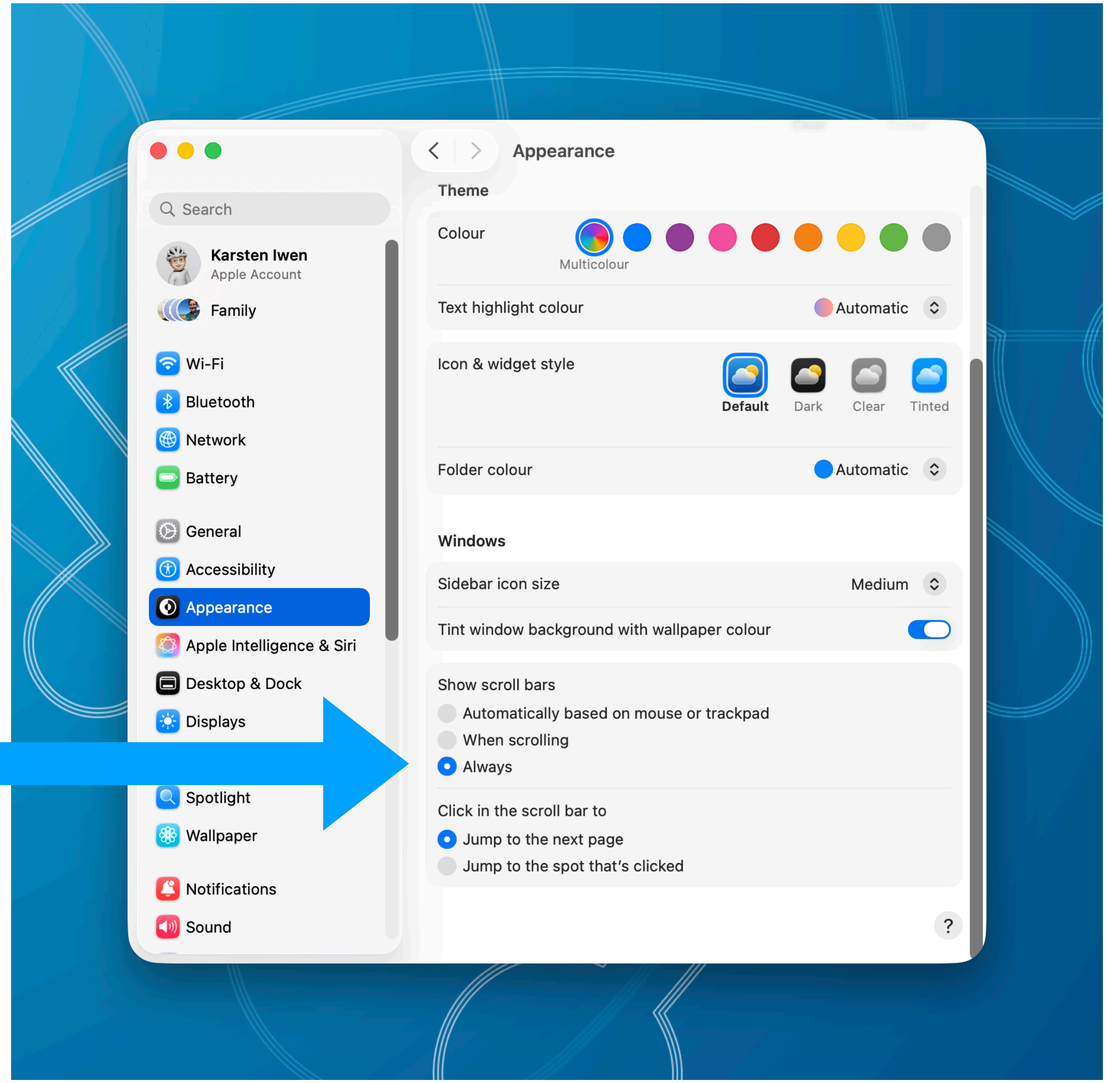
Split It!

Name	Size
00-Intro.pdf	10,4 MB
04-General description.pdf	3,8 MB
05-MAC service definition.pdf	2,2 MB
06-Layer management.pdf	3,9 MB
07-DS SAP specification.pdf	1,9 MB
08-PHY service specification.pdf	2,1 MB
09-Frame formats.pdf	15,5 MB
10-MAC sublayer fu...ional description.pdf	10,5 MB
11-MLME.pdf	9,2 MB
12-Security.pdf	4,7 MB
13-Fast BSS transition.pdf	2,7 MB
14-MLME mesh procedures.pdf	3 MB
15-DSSS PHY.pdf	2,3 MB
16-HR/DSSS PHY.pdf	2,3 MB
17-OFDM.pdf	2,6 MB
18-ERP PHY.pdf	2,1 MB
19-HT PHY.pdf	3,5 MB
20-DMG PHY.pdf	2,7 MB
21-VHT PHY.pdf	4 MB
22-TVHT PHY.pdf	2,6 MB
23-S1G PHY.pdf	4,2 MB
24-25-China DMG, MMG PHY.pdf	3,5 MB
26-HE MAC.pdf	4 MB
27-HE PHY.pdf	6,1 MB
28-EDMG PHY.pdf	5,7 MB
29-Wake-Up Radio (WUR) MAC.pdf	2,2 MB
31-32 NG V2X (NGV) MAC, PHY.pdf	3 MB
33 Light Comm MAC, PHY.pdf	2,2 MB
34-Enhanced broad...st services MAC.pdf	1,9 MB
Annex.pdf	12 MB

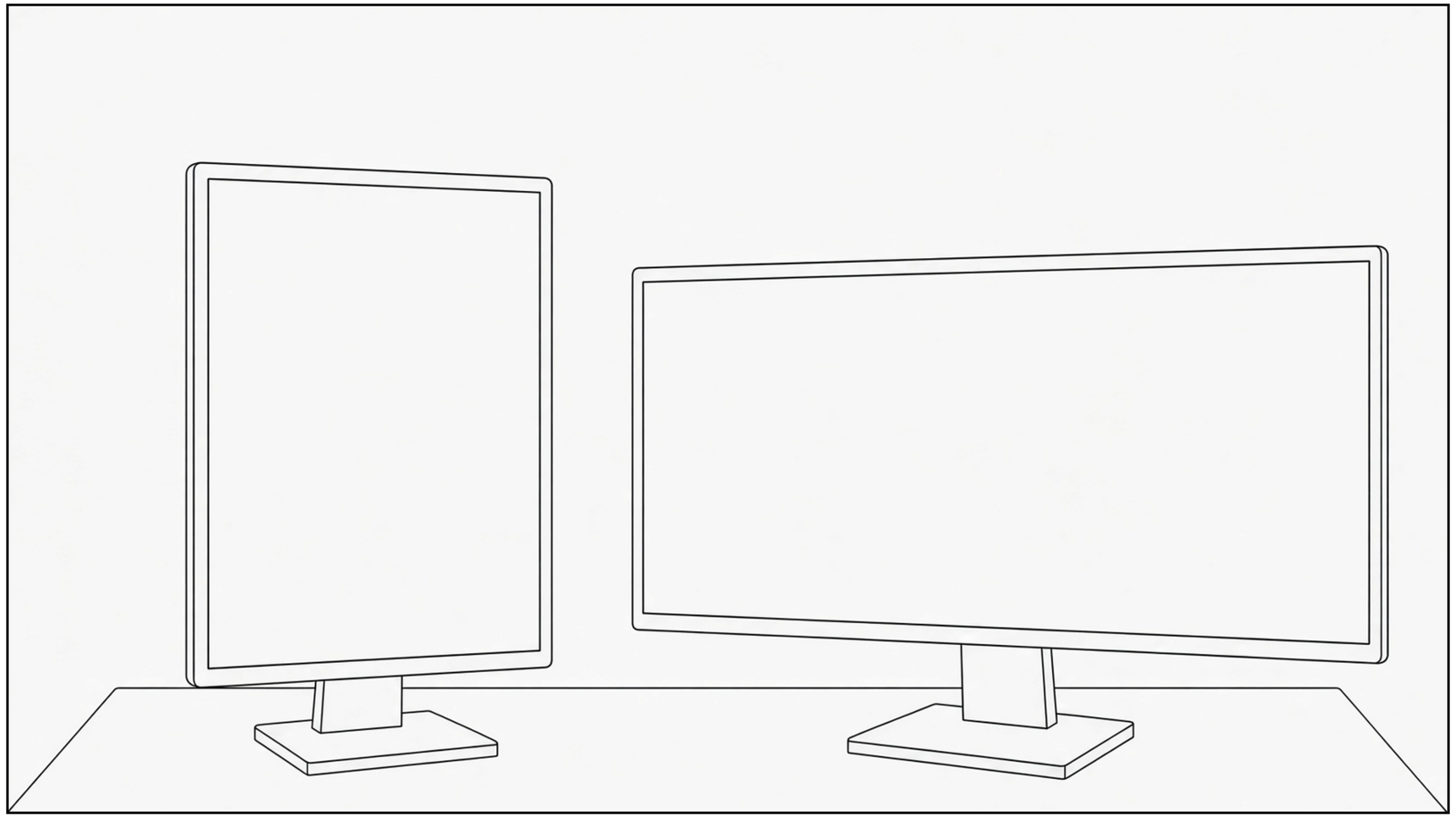
Don’t Jump!


Clause 13: Fast BSS Transition
Clause 09: Frame formats
Clause 12: Security

macOS


Search
Karsten Iwen
Apple Account
Family
Wi-Fi
Bluetooth
Network
Battery
General
Accessibility
Appearance
Apple Intelligence & Siri
Desktop & Dock
Displays
Spotlight
Wallpaper
Notifications
Sound
Appearance
Theme
Colour
Multicolour
Text highlight colour
Automatic
Icon & widget style
Default
Dark
Clear
Tinted
Folder colour
Automatic
Windows
Sidebar icon size
Medium
Tint window background with wallpaper colour
Show scroll bars
Automatically based on mouse or trackpad
When scrolling
Always
Click in the scroll bar to
Jump to the next page
Jump to the spot that's clicked

Monitor Setup

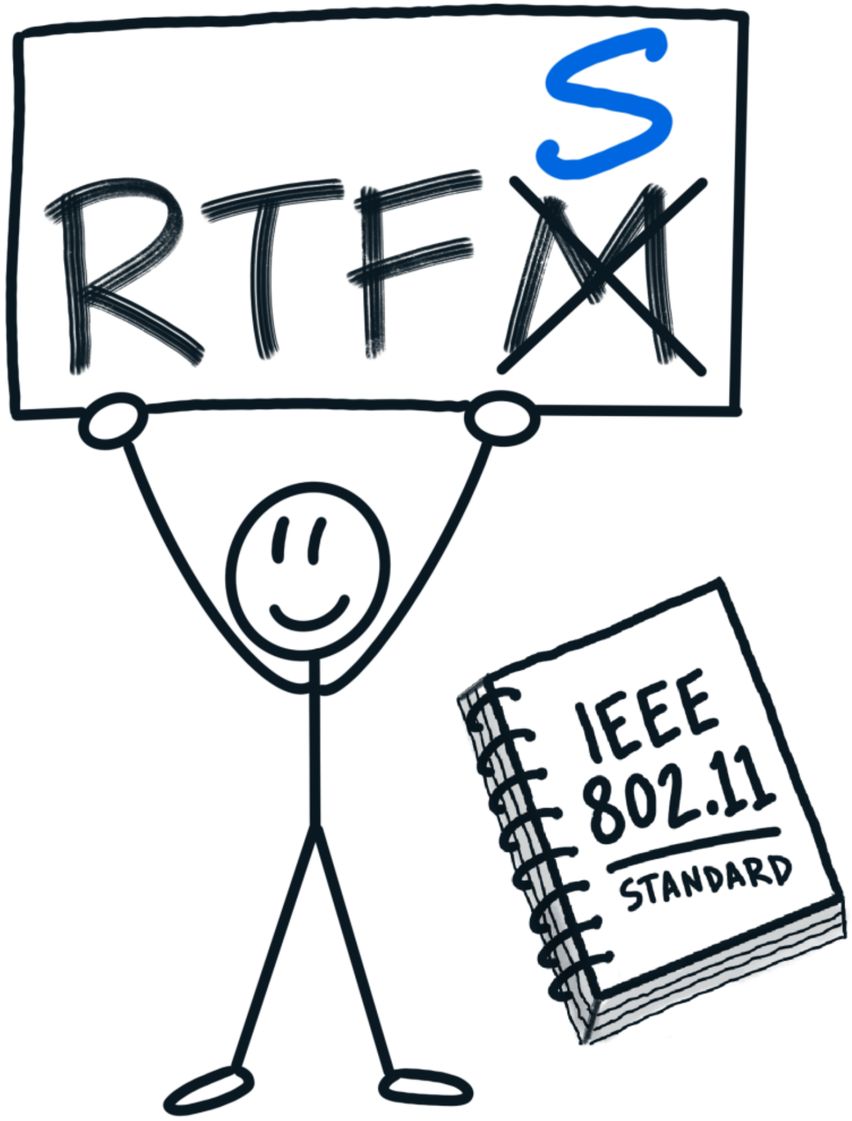


Getting Started

1. Clause 4: General description
   ➡️ Important to understand even more of the wording and general terms.
2. Clause 9: Frame formats
   ➡️ Open a capture and try to map fields to the definition in the standard.
3. Clause 12: Security
   ➡️ Look up the 4-Way-Handshake.
4. Clause 17: OFDM PHY
   ➡️ Briefly study a PHY header.

How to Read the 802.11 Standard

- **Yes, it's still hard!**
- **Stop whining!**



- The End -