IEEE P802.11  
Wireless LANs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 802.11 Style Guide | | | | |
| Date: 2012-11-26 | | | | |
| Author(s): | | | | |
| Name | Company | Address | Phone | email |
| Adrian Stephens | Intel Corporation |  |  | Adrian.p.stephens@intel.com |
| Peter Ecclesine | Cisco Systems | 170 W. Tasman Dr., San Jose, CA 95134-1706 | +1-408-527-0815 | petere@cisco.com |
| William Marshall | AT & T |  |  | wtm@research.att.com |

Abstract

This document contains a description of certain elements of style to be used in 802.11 Standards and Amendments, starting with REVmb (IEEE STD 802.11-2011) and its amendments.

R1: updated reflecting additional changes in REVmb. Numbering consistent with REVmb\_D8.0.

R2: added comments about word usage from experience gained during 802.11aa 11MEC

R3: updated to include items from 11-11-0844r0. Added section on “ensures”.

R4: updated following Std 802.11-2012 publication.

R5: typos fixed. Added “changes in IEEE-SA style guide” section

R6: reviewed prior to 802.11ac MDR.33

# Introduction

## Purpose

The purpose of this document is to describe certain elements of style to be used in IEEE 802.11 Standards and Amendments starting with IEEE Std 802.11-2012, and including its amendments.

There are two benefits from using this style:

* Uniformity/consistency between different documents. Don’t forget that amendments eventually are edited into the baseline in the next revision standard. If the amendment uses styles that are inconsistent with the baseline, we either have to tolerate an inconsistent revision, or the editor/comment resolution committee have to resolve those inconsistencies.
* To reduce the amount of work in committee – i.e., these decisions have already been taken, and there is no need for the editor/comment resolution committee of a new document to have to re-invent the wheel.

In addition, it is expected that this document may be cited in comment resolutions where a standard/amendment does not comply to this style.

The presence of this guide also goes some way to address the complaint which has been made that “802.11 has undocumented rules” about what goes in a standard.

## WG802.11 style vs IEEE-SA style

What right do we have to define an 802.11 Style? Surely the IEEE-SA Style guide is all we need?

There are many elements of convention that are not addressed in the IEEE-SA Style guide where we benefit from consistency in 802.11.

There are also elements of style in 802.11 that fail to comply with the IEEE-SA Style guide. The fact that this material has been through IEEE-SA publication editing and approved multiple times shows that slavish consistency to the IEEE-SA Style Guide is not a requirement of the IEEE-SA standards development process.

However, gratuitous deviation from the IEEE-SA Style Guide is not a good idea.

These principles are embodied in the following requirement:

* An 802.11 Revision or Amendment shall comply with this document. An 802.11 Revision or Amendment shall comply with the IEEE-SA Style Guide.
  + Where there is a conflict between these two documents, this document takes precedence.
  + Where there is a clear and consistent conflict between the IEEE-SA Style Guide and the 802.11 baseline standard, this should be discussed (e.g., in the Editors’ meeting or TGm<letter>) and this document updated.

This document should also be updated by the Editors’ or TGm<letter> when new editorial conventions are decided.

## WG 802.11 MDR

802.11 will conduct a mandatory draft review (MDR) between the document editor and the WG802.11 technical editor(s).

One purpose of this MDR is to ensure compliance with the requirements of this document.

The MDR is described in 11-11/0615.

## ANA Process

Documents that need numbers from namespaces administered by the ANA should insert <ANA> into their document in place of a number rather than choosing a number.

The editor will then ask the ANA for numbers to be assigned (see 802.11 Operations Manual for full procedure), and when numbers have been assigned, the editor should replace the <ANA> flags with the allocated values.

All <ANA> flags must have been replaced before entry to sponsor ballot.

## Why can’t I leave all this to the publication editor?

The argument goes that seeing that the IEEE-SA pays for a professional editor to clean-up the document prior to publication, we (i.e., contributors to drafts and their TG editors) don’t need to worry about elements of “style” in the draft, particularly as we are engineers and not professional editors, and can’t be expected to understand or care about obscure rules of grammar.

But if you do this:

1. The WG MDR will be a painful experience (for all concerned)
2. You may continually get lots of editorial comments, which take more effort to deal with than getting things right earlier in the process
3. Publication editing will be a painful and slow experience (for the TG editor, who bears the burden of review)
4. Publication editors vary in the degree of diligence they apply to the task, particularly related to uniformity of style with the baseline.
5. Adopting a uniform style creates “least surprise” amongst your readers.
6. Poor and broken English creates the wrong impression for your voters related to completeness or technical accuracy.
7. Rules about, punctuation and. syntax matter – they can modify the meaning of the text;

# General 802.11 Style

## Frame Format Figures

See 11-09-0714-02-000m-big-ed-issues.doc for more detail and background.

Generally frame format figures should be either an “octet aligned” or a “bit aligned” structure. If a mixture of the two is required, it is recommended to break the figure into two or more parts. Arrows should not be used, except where labelling parts of the structure (e.g., MAC Header).

Figures should be drawn using tables with each part of the figure in its own cell, along with custom ruling.

An example of the octet-aligned figure follows:



Another used format is those figures where the “octets” row goes above the structure boxes to allow for arrows and labelling below the structure boxes. Such uses should be minimized in new material.

An example of the bit-aligned figure follows:



## Case of true/false

All “true” and “false” should be lower case, except where they are part of pseudo-code or code.

Note that MIB variables take “true” and “false” even in pseudo-code.

## “Is set to”

The verb “set” should only be used when describing how a field obtains a value, e.g. “The Measurement Duration field is set to the preferred or mandatory duration of the requested measurement, expressed in units of TUs.”

Where the value of the field is read or referenced, (e.g., in the context of a condition), “is set to” shall not be used.

## Information Elements

Elements should be called the “<Purpose> element”, where <Purpose> does not include the word “information” (e.g. the “QoS Capability element”). References to the structure from the text should include the word “element” at the end.

The phrase “information element” shall not appear, except in the headings of 8.4.2.

The same convention exists for “subelements”.

## Naming of MIB Variables

MIB Variables shall be named and described according to the conventions in 11-09-0533-01-0arc-recomendation-re-mib-types-and-usage.ppt.

## Removal of functions and features

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.

## Capitalization

Capital letters are often over-used.

Capital letters should be reserved for:

* Abbreviations
* Proper names of entities outside 802.11. Generally follow whatever appears to be the prevailing custom.
* Initial letters of headings
* Initial letters of proper names
  + Frame names – e.g. the “Beacon frame”, but “transmits a beacon” where it is used to represent the concept of a beacon (no caps).
  + Element names – e.g. “the Capabilties element”, but “the capabilities of the STA”
  + Field names – e.g. “the More Data subfield of the Frame Control field”, but “shall set it to 1 if it has more data to send”.

## Use of verbs & problematic words

Normative verbs shall not appear in informative text. The usual culprit is verbs like “may” or “should” in NOTEs. This is also true for equivalent phrases such as “is required/recommended to”.

Verbs deprecated by the IEEE (e.g., “must”, “will”) should not be used, except:

* “will” can be used when stating future fact, and using any other tense dilutes the intended meaning. This case should be rare.
* “must” is used in some boilerplate reproduced from the IEEE-SA style guide. Do not edit the boilerplate text ;0).

The use of “can” should be considered carefully. It should be interpreted as meaning “is allowed to” or “is able to”, when interpreted in the context of normative statements made elsewhere in the standard, or referenced from the standard, or that are generally well known or self-obvious. When those conditions do not exist, use the word “might” as this expresses the possibility of something happening without use understding how it can happen.

“May not” should be replaced by “shall not”.

“Only” is often misused. “Only” is a constraint, which should apply to a condition, not to a verb (unless that verb is part of expressing a condition).

So: “A STA shall only transmit an Ack when it receives a packet” is wrong, and “A STA shall transmit an Ack only when it receives a packet” is right.

Also “shall … only” often doesn’t go far enough. “A STA shall transmit an Ack only when it receives a packet” can be interpreted as “A STA shall not transmit an Ack when does not receive a packet” – i.e. expressing only the constraint. A better unambiguous rule is: “A STA shall transmit an Ack when it receives a packet; it shall not transmit an ACK otherwise.” – which makes both the positive (do this) and negative (don’t do this) conditions explicit.

*Bottom line:* minimize use of “only” in normative text.

“Ensures” should be avoided, and although the IEEE-SA style guide has nothing to say on this topic, the IEEE-SA editors reword to avoid its use, as it may be construed as providing a guarantee. Can be reworded as “verify that <condition> is true, and take remedial action if not.”

Note that these rules do not apply in material that is a direct quote from another source. However note also that the IEEE-SA will require copyright letters from any copyright owers whose material is directly quoted.

### Which / that

Note that the use of which and that as described in the IEEE-SA style guide.

E.g. use of “which” should generally be preceded by a comma or preposition.

### Missing & use of articles (indexicals)

A common error in non-English native speakers is improper use of articles: “a, an, the”.

These are important, because they identify they identify which entity or under what conditions behaviour is being described. An improper article can create ambiguity about specification, so this should not be considered something to “leave to the publication editor”.

The errors are:

* Missing article
* Improper article (“a” vs “an”)
* Missing antecedent (“the” without a preceding identification).

The following example is typical:

* A STA that receives an abc frame shall transmit an xyz response frame.
* The xyz response frame shall have the def field set to 1.
* The STA shall wait for another abc frame for up to aWaitTime, and if no such frame arrives, explode in a puff of logic.

### Missing noun in noun phrase

Many of the things we define take part in a noun phrase. For example,

A Beacon frame

The HT Capabilities element

The HT Capabilities Info field [of the HT Capabilities element]

The HT-Greenfield subfield [The HT Capabilities Info field [of the HT Capabilities element]]

The PHY-TXSTART.confirm primitive.

The Length field.

Do not miss out the “noun” part of the noun phrase. i.e., “The Length field is set to 1” is correct, but “The Length is 1” is incorrect.

### Unicast and Multicast

The terms “unicast” (or “directed”) and “multicast” are deprecated in favour of “individually addressed” and “group addressed”.

## Numbers

Values are shown as digits when representing the value of fields, and follows the IEEE Style Guide otherwise. e.g. “set to 1” and “two packets”.

Also, specific usages:

* twos complement
* “1-octet field” and “field of length one octet” are both correct

Note that there is always a space between a number and its units (e.g., “20 MHz”). Long numbers have embedded spaces to group digits into threes (e.g., “65 635 octets”).

## Hyphenation

Most words created from a prefix and a word should not include a hyphen.

The editor closed up the following compound words in Std 802.11-2012:

* nonauthorized
* nonbasic
* nonbufferable
* noncountry
* nondecreasing
* nonempty
* nonexcluded
* nonextended
* nonglobal
* nonidentity
* noninfrastructure
* noninteger
* noninvasive
* nonmember
* nonmesh
* nonmobile
* nonoperating
* nonoverlapping
* nonpeer
* nonperiodic
* nonpowersaving
* nonprotected
* nonreceipt
* nonreserved
* nonrobust
* nonstandard
* nontransmitted
* nontriggered
* nonvoice
* nonzero
* deaggregation
* deencapsulated
* descrambler
* dewhiten
* multiframe
* omnidirectional
* preassociat...
* preauthenticat...
* preexist...
* premodifier
* preplanning
* preprocess...
* preset
* preshared
* reactivation
* reassociat...
* redirect
* reestablish...
* rehabilitation
* remap
* resent
* resubmit
* reused
* unadmitted

There are exceptions. The following are OK:

* non-initial
* non-monotonic
* non-negative
* non-null
* pre-robust
* fixed-length (hyphenated when before a noun)
* follow-up
* signal-to-noise
* STA-to-STA
* third-party
* variable-length (hyphenated when before a noun)
* vendor-specific

Note that IETF RFC xxx references do not use a hyphen in IEEE 802.11.

## References to SAP primitives

The name of a primitive should be viewed as an adjective. Add the word “primitive” to turn it into a noun phrase. So say: “The SME generated an MLME-NEIGHBORREPREQ.request primitive”.

## References to MIB variables/attributes

There is no need to indicate that a cited variable is a MIB variable. It is obvious from its name.

So: “The STA sets the Event field to 1 when ~~the MIB attribute~~ dot11MgmtOptionEventsActivated is true, and sets it to 0 otherwise.” – i.e., delete any superfluous “the [MIB] (attribute|variable)”.

## Hanging Paragraphs

A paragraph that occurs between a heading and children of that heading is called a hanging paragraph. It is not allowed because the scope of a reference to the heading is unclear – is it only the text that follows, or does it include all the children too?

Therefore, a subclause shall include either text, or child subclauses, but not both.

If even one sentence of “introduction” is necessary before child subclauses, this must go in its own child subclause. Such subclauses are typically headed “General” or “Introduction”. Don’t use “Introduction” if it contains any normative statements.

## Abbreviations

Abbreviations may be defined for terms that are used frequently throughout the document. When an abbreviation has been defined, use it. (If you don’t the publication editor will probably replace most occurances in the text of the full term with the abbreviation).

But don’t create abbreviations for:

* Terms used only a handful of times
* Names of fields, structures, elements or frames

# Style applicable to specific Clauses

Clause numbering relates to IEEE Std 802.11-2012.

## Definitions (Clause 3)

Subclause 3.1 contains definitions that are consolidated by IEEE into a single publication of general definitions for terms used in IEEE standards. Any definition that is considered “generally applicable in the industry” should be included in 3.1.

However, many definitions that appear in 802.11 are more local, and have no meaning or significance outside of this particular document. Such definitions should be included in 3.2.

For example, the term “cipher suite” (a set of one or more algorithms designed to provide data confidentiality, date authenticity or integrity, and/or replay protection) is applicable outside of the 802.11 standard, and is included in 3.1. The term “Michael” (The message integrity code for the Temporal Key Integrity Protocol) is included in 3.2.

Abbreviations used in definitions should be spelled out in full on their first use in each definition. Example: “**access point (AP) path:** Path between two tunneled direct-link setup (TDLS) peer stations (STAs) via the AP with which the STAs are currently associated.”.

## General Description (Clause 4)

Clause 4 provides a general description of the wireless system. It should be written in declarative, not normative, language.

## Frame formats (Clause 8)

Clause 8 is reserved for describing structure (apart from statements in 8.1).

Statements that describe the actions of a STA in order to determine a value for a field and any other behavioural specification should not be present in Clause 8.

This requires a bit of interpretation.

For example: “the Length field is set to the logarithm of the number of octets in the remainder of the frame” is acceptable. The act of calculating a logarithm is not considered to be behaviour.

But: “The Legacy Devices Present field is set to 1 when the STA receives a beacon that does not include an HT Operation element” is clearly a description of behaviour, and therefore not acceptable.

### Use of normative language in structure/field definitions

See 11-09-0433-01-000m-clause-7-normative-language.doc.

Normative language shall not be used to describe structure. I.e., you can say: “the structure consists of an 3-octet Length field followed by an Amplitude field” – although it is more typical to use tables and figures to define structure.

Normative language shall not be used for describing the encodings of fields. I.e., you can say: “the value 1 represents Measurement Enabled”, but cannot say: “the field shall be set to 1 to represent Measurement Enabled”.

## SAP Interfaces (Clause 6)

### Presence statements

Normative language shall not be used in “Presence” statements, such as occur in primitive parameter tables. These statements should, wherever possible, follow this template:

***The <name> <type of structure> is [optionally] present [only] if <some condition>.***

Note – TGmc is probably going to change this to replace “only” with “; otherwise not present”.

### Consistency Requirements

The SAP interfaces should be reviewed for consistency. Unfortunately, most participants pay little attention to these interfaces, and they often become inconsistent with changes made elsewhere in the document.

The following consistencies should exist:

* The parameters in the .request should match (in some sense) the contents of a request frame.
* The parameters of a .indication should match the .request
* The parameters in the .response should match (in some sense) the contents of a response frame.
* The parameters of a .confirm should match the .response
* Any Reason Code values enumerated in a .request/.indication should
  + match, and
  + the names of these values should be present in the Reason Code table of the Frame Formats clause.
* Any Status Code values enumerated in a .response/.confirm should:
  + match, in the sense that the .confirm contains all the values of the .response, plus any locally-generated Status Code values,
  + the names of the values from the .response should be present in the Status Code table of the Frame Formats clause.

### Primitive Patterns

A service’s primitives should fit one of the following patterns:

|  |  |
| --- | --- |
| **Type** | **Primitives** |
| 1 – Unconfirmed, local | .request |
| 2 – Confirmed, local | .request / .confirm |
| 3 – Unconfirmed, remote | .request / .indication |
| 4 – Confirmed, remove | .request / .indication / .response / .confirm |
| 5 – Event | .indication |

### Locally generated Status Codes

A .confirm primitive should not generally include locally generated status codes that represent:

* “You asked me to do too much”[[1]](#footnote-1)
* “You asked me to do something invalid”[[2]](#footnote-2)
* Transmission failure / success[[3]](#footnote-3)
* Response timeout (i.e., “did not receive an xyz response action frame in time”).

Transmission failure/success and response timeout may be present when specific protocol is defined for the SME that is dependent on these values.

## Annexes

Annexes in a revision standard should be ordered (at some point during the balloting process) starting with Bibliography, then all normative Annexes, then all informative.

Annexes in an amendment should be added after all existing Annexes. An amendment should not attempt to modify the ordering of annexes in the baseline. If any reordering is required, it will be performed during a revision.

## Annex A – Bibliography

Annex A shall contain the bibliography. All references appearing in this bibliography shall be cited in the normative or informative text.

## Annex B – PICS

The 802.11 Standard shall include a PICS (Protocol Implementation Conformance Statement) proforma.

The level of detail to be included in the PICS is left to the discretion of the voters. Historically the PICS has identifies major components of the wireless system, identified whether their implementation is mandatory or optional, and indicated any interaction between implementation requirements. Historically the PICS has not included an entry corresponding to each and every “shall” in the normative text.

Note that the PICS does not create requirements for conformance, it merely reflects what is stated in the body of the standard.

## Annex C – MIB

The 802.11 Standard shall include a MIB (Management Information Base).

Each MIB variable shall be classified as capability, control, or status, as described in 11-09-0533-01-0arc-recomendation-re-mib-types-and-usage.ppt.

MIB authors should follow the recommendations in C.2. Each amendment should ensure that its MIB compiles, as described in C.1. This is a non-trivial task, as it requires rolling in the MIB from previous amendments to discover numbering and naming collisions. (This is a requirement of a WG802.11 MDR prior to sponsor ballot).

### Naming of MIB Variables

MIB Variables shall be named and described according to the conventions in 11-09-0533-01-0arc-recomendation-re-mib-types-and-usage.ppt.

### Description of MIB Variables

The DESCRIPTION of each MIB variable follows a standardized format:

Line #1: "This is a <type> variable" (either control, status, or capability)

Line #2: "It is written by <writer>[ when <condition>]"

Line #3: (optionally) "The change takes effect <when>"

Follow these two/three lines with a blank line, then any further descriptive text

### Compliance requirements

This is a work in progress. However, it appears that we have repeatedly broken the IETF rules relating to modifying existing groups and compliance statements.

See document 11-11/0544, which states:

1. An amendment may not modify any existing group
2. An amendment must include each new variable in a new group
3. An amendment should not replace an existing group, e.g., no “dot11smtBase<n>” increments.
   1. Note it will be the job of the revision to sweep up any changes to these “fundamental” groups.
4. An amendment must provide a new module-compliance statement for each module it introduces new objects/groupt into.
   1. Each new group must be cited in at least one module-compliance statement.

It may be that the best way to procede is a middle-ground:

1. Allow the Amendments to break the IETF rules by editing existing groups and compliance statements
2. In a revision, define new groups and compliance statements for any that were modified by amendments to the previous revision, and deprecate the superseded ones.

### Lexical requirements

The MIB needs to be compilable. The smtools compiler (see reference in C.2) requires 7-bit ASCII, or compilation will be aborted. Note the following:

* Greek or Unicode characters are not allowed. Spell out the units in full.
* Font effects, such as superscript, will be lost if the MIB is read in .txt format. For exponentiation, use “\*\*” (e.g., 2\*\*32).

# Changes in the IEEE-SA Style Guide

This section summarises changes in the style guide.

## 2009 to 2012

* Scope and purpose statements no longer have to match exactly the PAR, they merely need to be within the scope of the statements in the PAR, **as determined by the (sponsor) balloting group**.
* The Standards Dictionary (IEEE 100) is now available as an online database:
  + <http://dictionary.ieee.org/dictionary_welcome.html>
  + Access is granted to WG officers and editors, and requires approval by our staff liaison.
  + The CD ROM can be ordered from Techstreet (<http://www.techstreet.com/cgi-bin/detail?product_id=1588912>, $213.00)
* Do not use words that imply any properties regarding safety (this shouldn’t be an issue for us).
* Example of “Hanging paragraph” added.
* New material describing use of italics in equations.
* Standards cited in a Bibliography can be either dated or undated, as appropriate.
* Chicago Manual of Style cited for various aspects of style.
* New guidelines and best practices for the creation and maintenance of IEEE standards terms and definitions.

1. Resource limits that are purely local are not relevant to the protocol and should not appear. This is different from resource limits that are negotiated on-the-air. These can be a proper subject of status codes. [↑](#footnote-ref-1)
2. See 11-11/0284 for a detailed rationale. But in brief, the reason is that both SME and MLME are in equal possession of knowledge about what is valid, from the point of view of operation of the protocol. The SME should not ask the MLME to do something that is invalid, and the MLME shouldn’t need to report such errors. [↑](#footnote-ref-2)
3. These may appear when there is an MLME protocol described that generates such a timeout, or an SME protocol described that makes use of such an event. [↑](#footnote-ref-3)