5. Conformance

This clause specifies the mandatory and optional capabilities provided by conformant implementations of this standard.

5.1 Requirements terminology

For consistency with existing IEEE and IEEE 802.1 standards, requirements placed upon conformant implementations of this standard are expressed using the following terminology:

a) ***shall*** is used for mandatory requirements.
b) ***may*** is used to describe implementation or administrative choices ("may" means "is permitted to," and hence, "may" and "may not" mean precisely the same thing).
c) ***should*** is used for recommended choices (the behaviors described by "should" and "should not" are both permissible but not equally desirable choices).

The Protocol Implementation Conformance Statement (PICS) proforma (see Annex A) reflects the occurrences of the words shall, may, and should within the standard. The words shall, may, and should, as used in Annex A itself, reflect the use of the PICs and not conformance to the standard.

The standard avoids needless repetition and apparent duplication of its formal requirements by using ***is***, ***is not***, ***are***, and ***are not*** for definitions and the logical consequences of conformant behavior. Behavior that is permitted but is neither always required nor directly controlled by an implementer or administrator, or whose conformance requirement is detailed elsewhere, is described by ***can***. Behavior that never occurs in a conformant implementation or system of conformant implementations is described by ***cannot***. The word ***allow*** is used as a replacement for the phrase "support the ability for," and the word ***capability*** means "can be configured to."

5.2 Protocol Implementation Conformance Statement (PICS)

The supplier of an implementation that is claimed to conform to this standard shall complete a copy of the PICS proforma provided in Annex A and shall provide the information necessary to identify both the supplier and the implementation.

5.3 Time-aware system requirements

An implementation of a time-aware system shall support at least one IEEE 1588 precision time protocol (PTP) Instance.

5.4 PTP Instance requirements and options

5.4.1 Summary of requirements

An implementation of a PTP Instance shall:

a) Implement the generalized precision time protocol (gPTP) requirements specified in Clause 8.
b) Support the requirements for time-synchronization state machines (10.1.2, 10.2.1, 10.2.2, 10.2.3, 10.2.4, 10.2.5, and 10.2.6).
c) Support at least one PTP Port.
d) On each supported PTP Port, implement the PortSyncSyncReceive state machine (10.2.8).

e) Implement the ClockSlaveSync state machine (10.2.13).

f) Support the following best master clock algorithm (BMCA) requirements:

   1) Implement the BMCA (10.3.2, 10.3.3, 10.3.4, 10.3.5, 10.3.6, 10.3.8, and 10.3.10).

   2) For domain 0, implement specifications for externalPortConfigurationEnabled value of FALSE (10.3.1).

   3) Implement the PortAnnounceReceive state machine (10.3.11).

   4) Implement the PortAnnounceInformation state machine (10.3.12).

   5) Implement the PortStateSelection state machine (10.3.13).

   6) Have the BMCA as the default mode of operation, with externalPortConfiguration FALSE, on domain 0.

   7) Implement at least one of the possibilities for externalPortConfigurationEnabled (i.e., FALSE, meaning the BMCA is used, and TRUE, meaning external port configuration is used) on domains other than domain 0.

g) Implement the SiteSyncSync state machine (10.2.7).

h) Implement the state machines related to signaling gPTP capability (10.4).

i) For receipt of all messages and for transmission of all messages except Announce (see 10.6.3) and Signaling (see 10.6.4), support the message requirements as specified in 10.5, 10.6, and 10.7.

j) Support the performance requirements in B.1 and B.2.4.

5.4.2 PTP Instance options

An implementation of a PTP Instance should:

a) Support the performance requirements in B.2.2 and B.2.3.

An implementation of a PTP Instance may:

b) Support the following media-independent master capability on at least one PTP Port:

   1) Implement the PortSyncSyncSend state machine (10.2.12).

   2) Implement the PortAnnounceTransmit state machine (10.3.16).

   3) Implement the AnnounceIntervalSetting state machine (10.3.17).

   4) For transmit of the Announce message, support the message requirements as specified in 10.5, 10.6, and 10.7.

c) Support the following for Grandmaster PTP Instance capability:

   1) Support the media-independent master capability specified in item b) of 5.4.2.

   2) Support the requirements for a grandmaster-capable PTP Instance (10.1.3).

   3) Implement the ClockMasterSyncSend state machine (10.2.9).

   4) Implement the ClockMasterSyncOffset state machine (10.2.10).

   5) Implement the ClockMasterReceive state machine (10.2.11).

d) Support more than one PTP Port as a PTP Relay Instance (5.4.3).

e) Support transmit of the Signaling message according to the message requirements as specified in 10.5 and 10.6.

f) Support more than one PTP Instance; such support allows for more than one domain (7.2.3).

g) Support the following external port configuration capability on at least one port:
   1) Implement specifications for externalPortConfigurationEnabled value of true (10.3.1).
   2) Implement the PortAnnounceInformationExt state machine (10.3.14).
   3) Implement the PortStateSettingExt state machine (10.3.15).

h) Implement the SyncIntervalSetting state machine (10.3.18).

i) Implement one or more of the application interfaces specified in Clause 9; A PTP Instance that claims to support application interfaces shall state which application interfaces are supported.

j) Support timing and synchronization management as specified in Clause 14.

k) Support the use of a remote management protocol. A PTP Instance that claims to support remote management shall:
   1) State which remote management protocol standard(s) or specification(s) are supported (see A.19).
   2) State which standard(s) or specification(s) for managed object definitions and encodings are supported for use by the remote management protocol (see A.19).
   3) If the Simple Network Management Protocol (SNMP) is supported as a remote management protocol, support the managed object definitions specified as Structure of Management Information version 2 (SMIv2) Management Information Base (MIB) modules in Clause 15.

l) Implement both BMCA and external port configuration on domains other than domain 0; if both possibilities are implemented on domains other than domain 0, the default value of externalPortConfigurationEnabled shall be FALSE.

5.4.3 PTP Relay Instance requirements

An implementation of a PTP Relay Instance shall:

a) Support more than one PTP Port.

b) Support the PTP Instance requirements specified in 5.4.

c) Support the media-independent master capability specified in item b) of 5.4.2.

5.5 MAC-specific timing and synchronization methods for full-duplex IEEE 802.3 links

An implementation of a time-aware system with IEEE 802.3 media access control (MAC) services to physical ports shall:

a) Support full-duplex operation, as specified in 4.2 and Annex 4A of IEEE Std 802.3-2018.

b) Support the requirements as specified in Clause 11.

c) Implement the SyncIntervalSetting state machine (10.3.18).

An implementation of a PTP Instance with IEEE 802.3 MAC services to physical ports may:

d) Support asymmetry measurement mode as specified in 10.3.12, 10.3.13, 10.3.16, 11.2.14, 11.2.15, 11.2.19, and 14.8.45.

e) Support one-step capability on receive as specified in 11.2.14.

f) Support one-step capability on transmit as specified in 11.2.15.

g) Support the OneStepTxOperSetting state machine specified in 11.2.16.

h) Support propagation delay averaging, as specified in 11.2.19.3.4.

5.6 MAC-specific timing and synchronization methods for IEEE Std 802.11-2016

An implementation of a time-aware system with IEEE 802.11 MAC services to physical ports shall:

a) Support the requirements as specified in Clause 12.
b) Support at least one of
    1) the media-dependent master state machines (12.5.1), or
    2) the media-dependent slave state machine (12.5.2).

An implementation of a PTP End Instance with IEEE 802.11 MAC services to physical ports shall:

c) Support at least one of TIMINGMSMT as specified in IEEE Std 802.11-2016 or FINETIMINGMSMT as specified in IEEE Std 802.11-2016.

An implementation of a PTP Relay Instance with IEEE 802.11 MAC services to physical ports shall:

d) Support the requirements of TIMINGMSMT as specified in IEEE Std 802.11-2016.

An implementation of a PTP Relay Instance with IEEE 802.11 MAC services to physical ports should:

e) Support FINETIMINGMSMT as specified in IEEE Std 802.11-2016.

NOTE—In order to maintain backward compatibility with existing TM-based PTP End Instances that support only Timing Measurement (TM), the PTP Relay Instance is required to support TM. PTP End Instances are allowed to support TM or Fine Timing Measurement (FTM), or both to permit PTP End Instances compliant with this standard to implement only the FTM standard, which requires a PTP Relay Instance that supports FTM.

5.7 MAC-specific timing and synchronization methods for IEEE 802.3 EPON

An implementation of a time-aware system with IEEE 802.3 Ethernet Passive Optical Network (EPON) MAC services to physical ports shall:

a) Support the requirements as specified in IEEE Std 802.3-2018 for multipoint MAC Control (64.2 and 64.3) and multipoint physical coding sublayer (PCS) and physical medium attachment (PMA) extensions (Clause 65).
b) Support the requirements as specified in Clause 13.

5.8 MAC-specific timing and synchronization methods for coordinated shared network (CSN)

An implementation of a time-aware system with CSN MAC services to physical ports shall:

a) Support the requirements as specified in Clause 16.
b) Support at least one MoCA port (16.6.2) or ITU-T G.hn port (16.6.3).