8. IEEE 802.1AS concepts and terminology

8.1 gPTP domain

A gPTP domain, hereafter called simply a *domain,* consists of one or more PTP Instances and links that meet the requirements of this standard and communicate with each other as defined by the IEEE 802.1AS protocol. A gPTP domain defines the scope of gPTP message communication, state, operations, data sets, and timescale.

A domain is identified by two attributes: domain number and sdoId. The sdoId of a domain is a 12-bit unsigned integer. The sdoId is structured as a two-part attribute as follows:

— The most significant 4 bits are named the majorSdoId, and
— The least significant 8 bits are named the minorSdoId.

A time-aware system shall support one or more domains, each with a distinct domain number in the range 0 through 127. A time-aware system shall support the domain whose domain number is 0, and that domain number shall not be changed to a nonzero value. Unless otherwise specified in this standard, the operation of gPTP and the timescale in any given domain is independent of operation in any other domain.

The value of majorSdoId for a gPTP domain shall be 0x1. The value of minorSdoId for a gPTP domain shall be 0x00.

NOTE 1—The above requirements for majorSdoId and minorSdoId are for gPTP domains. The requirements for the Common Mean Link Delay Service (CMLDS) are given in 11.2.17.

Both the domainNumber and the sdoId are carried in the common header of all PTP messages (see 10.6.2.2).

NOTE 2—In the 2011 edition of this standard, the attribute majorSdoId was named transportSpecific, and its value was specified as 0x1 in 10.5.2.2.1 of Corrigendum 1. The attribute minorSdoId did not exist in the 2011 edition, but its location in the common header was a reserved field, which was specified to be transmitted as 0 and ignored on receipt.

Unless otherwise stated, information in the remainder of this document is per domain.

NOTE 3—In steady state, all PTP Instances in a gPTP domain are traceable to a single Grandmaster PTP Instance.

8.2 Timescale

8.2.1 Introduction

The timescale for a gPTP domain is established by the Grandmaster Clock. There are two types of timescales supported by gPTP:

— The timescale PTP: The epoch is the PTP epoch (see 8.2.2), and the timescale is continuous. The unit of measure of time is the second defined by International Atomic Time (TAI) (for the definition of TAI, see Service de la Rotation Terrestre [B28], with further amplification in IAU [B27]; and for more information on TAI, see Jekeli [B22], international system of units (SI) brochure [B14], and Petit and Luzum [B26]). The timescale of domain 0 shall be PTP. See IEEE Std 1588-2019 for more details.
— The timescale ARB (arbitrary): The epoch is the domain startup time and can be set by an administrative procedure. Between invocations of the administrative procedure, the timescale is continuous. Additional invocations of the administrative procedure can introduce discontinuities in

the overall timescale. The unit of measure of time is determined by the Grandmaster Clock. The second used in the operation of the protocol can differ from the SI second.

8.2.2 Epoch

The epoch is the origin of the timescale of a gPTP domain.

The PTP epoch (epoch of the timescale PTP) is 1 January 1970 00:00:00 TAI.

NOTE—The common portable operating system interface (POSIX) algorithms can be used for converting elapsed seconds since the PTP epoch to the ISO 8601:2004 [B15] printed representation of time of day on the TAI timescale (see also ISO/IEC 9945:2003 [B17]).

See Annex C for information on converting between common timescales.

8.2.3 UTC offset

When the timescale is PTP, it is possible to calculate Coordinated Universal Time (UTC) time using the value of currentUtcOffset. The value of currentUtcOffset is given by

currentUtcOffset = TAI – UTC

where the difference TAI – UTC is derived from UTC – TAI (the negative of currentUtcOffset) specified in IERS Bulletin C.

The value of currentUtcOffset for the current Grandmaster PTP Instance is maintained in the currentUtcOffset member of the time properties data set (see 14.5.2).

NOTE 1—As of 0 hours 1 January 2017 UTC, UTC was behind TAI by 37 s, i.e., TAI – UTC = +37 s. At that moment, the IEEE-802.1AS-defined value of currentUtcOffset was +37 s, as designated in the applicable IERS Bulletin C (see Clause 2; see also Service de la Rotation Terrestre [B28] and U.S. Naval Observatory [B29]).

NOTE 2—Leap second events and the value of UTC – TAI are posted well in advance in IERS Bulletin C. A list of all leap second events is maintained by the U.S. Naval Observatory [B29], which also offers an extensive discussion of timescales, leap seconds, and related time issues.

NOTE 3—The value of currentUtcOffset represents the difference between TAI and UTC. Since 1972, only integral values are permitted for this difference. Due to leap seconds, UTC cannot be correctly represented as a single integer but can be expressed in the ISO 8601:2004 [B15] print form. See also C.2 for an example of the use of the POSIX algorithm to compute the correct print form.

When the timescale is PTP, it is possible to calculate local time from the time provided by a gPTP domain using the currentUtcOffset, leap59, and leap61 member values of the time properties data set and knowledge of the local time zone and whether and when daylight savings time is observed.

When the timescale is ARB, the values of currentUtcOffset, leap59, and leap61 cannot be used to compute UTC.

The mechanism for computing UTC or any other time does not change the synchronized time (see 3.29), i.e., the PTP Instance time, of a PTP Instance.

8.2.4 Measurement of time within a gPTP domain

Time in a gPTP domain shall be measured as elapsed time since the epoch of the timescale of that domain.

8.3 Link asymmetry

This standard requires the measurement of the mean propagation time (also known as the *mean propagation delay*) between the time-aware systems that comprise the two endpoints of a link. The measurement is performed when one of the time-aware systems (the initiator time-aware system) sends a message to the other time-aware system (the responder time-aware system). The responder then sends a message back to the initiator at a later time. The departure of the message sent by the initiator time-aware system is timestamped, and the timestamp value is retained by that system. The arrival of this message at the responder time-aware system is timestamped, and the timestamp value is conveyed to the initiator time-aware system in a subsequent message. The departure of the response message sent by the responder time-aware system (in response to the message it receives from the initiator time-aware system) is timestamped, and the timestamp value is conveyed to the initiator time-aware system in a subsequent message. The arrival of this response message at the initiator time-aware system is timestamped, and the timestamp value is retained by that system. The mean propagation time is computed by the initiator time-aware system after receiving the response message, from the four timestamp values it has at this point.

Typically, the propagation time is not exactly the same in both directions, and the degree to which it differs in the two directions is characterized by the delay asymmetry. The relation between the individual propagation times in the two directions, the mean propagation time, and the delay asymmetry is as follows. Let t_{ir} be the propagation time from the initiator to the responder, t_{ri} be the propagation time from the responder to the initiator, meanLinkDelay be the mean propagation time (see 10.2.5.8), and delayAsymmetry be the delay asymmetry. The propagation times in the two directions are illustrated in Figure 8-1.

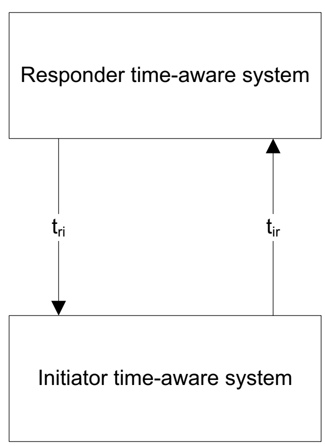

Figure 8-1—Propagation asymmetry

The meanLinkDelay is the mean value of t_{ir} and t_{ri}, i.e., meanLinkDelay = $(t_{ir} + t_{ri}) / 2$. The delayAsymmetry is defined as:

t_{ir} = meanLinkDelay – delayAsymmetry

t_{ri} = meanLinkDelay + delayAsymmetry

In other words, delayAsymmetry is defined to be positive when the responder to initiator propagation time is longer than the initiator to responder propagation time.

This standard does not explicitly require the measurement of delayAsymmetry; however, if delayAsymmetry is modeled, it shall be modeled as specified in this clause.

NOTE 1—A time-aware system can change the value of delayAsymmetry during operation (see 14.8.10, 14.16.8, and Annex G).

NOTE 2—A time-aware system PTP Port cannot measure the value of delayAsymmetry during live operation of the system (i.e., asymmetryMeasurementMode is FALSE; see 10.2.5.2); therefore, the value of delayAsymmetry must be defined separately using information from the supplier or additional testing before running the live system. The methods for measuring asymmetry are not specified in this standard. These values can be added to the system configuration to improve the accuracy of time synchronization. The inaccuracy caused by asymmetry is half the value of the difference between t_{ri} and t_{ir}, and these inaccuracies can either accumulate over successive hops or, if the successive asymmetries have different signs, cancel each other over the successive hops.

8.4 Messages

8.4.1 General

All communications occur via PTP messages and/or media-specific messages.

8.4.2 Message attributes

8.4.2.1 General

All messages used in this standard have the following attributes:

a) Message class
b) Message type

The message class attribute is defined in this clause. The message type attribute is defined in 3.18. Some messages have additional attributes; these are defined in the subclauses where the respective messages are defined.

8.4.2.2 Message class

There are two message classes, the event message class and the general message class. Event messages are timestamped on egress from a PTP Instance and ingress to a PTP Instance. General messages are not timestamped. Every message is either an event message or a general message.

8.4.3 Generation of event message timestamps

All event messages are timestamped on egress and ingress. The timestamp shall be the time, relative to the LocalClock entity (see 10.1) at which the message timestamp point passes the reference plane marking the boundary between the PTP Instance and the network media.

The definition of the timestamp measurement plane (see 3.33), along with the corrections defined as follows, allows transmission delays to be measured in such a way (at such a low layer) that they appear fixed and symmetrical to gPTP even though the MAC client might otherwise observe substantial asymmetry and transmission variation. For example, the timestamp measurement plane is located below any retransmission and queuing performed by the MAC.

NOTE 1—If an implementation generates event message timestamps using a point other than the message timestamp point, then the generated timestamps should be appropriately corrected by the time interval (fixed or otherwise) between the actual time of detection and the time the message timestamp point passed the reference plane. Failure to make these corrections results in a time offset between PTP Instances.

NOTE 2—In general, the timestamps can be generated at a timestamp measurement plane that is removed from the reference plane. Furthermore, the timestamp measurement plane, and therefore the time offset of this plane from the reference plane, is likely to be different for inbound and outbound event messages. To meet the requirement of this clause, the generated timestamps should be corrected for these offsets. Figure 8-2 illustrates these offsets. Based on this model the appropriate corrections are as follows:

egressTimestamp = egressMeasuredTimestamp + egressLatency

ingressTimestamp = ingressMeasuredTimestamp − ingressLatency

where the timestamps relative to the reference plane, egressTimestamp and ingressTimestamp, are computed from the timestamps relative to the timestamp measurement plane, egressMeasuredTimestamp and ingressMeasuredTimestamp, respectively, using their respective latencies, egressLatency and ingressLatency. Failure to make these corrections results in a time offset between the slave and master clocks.

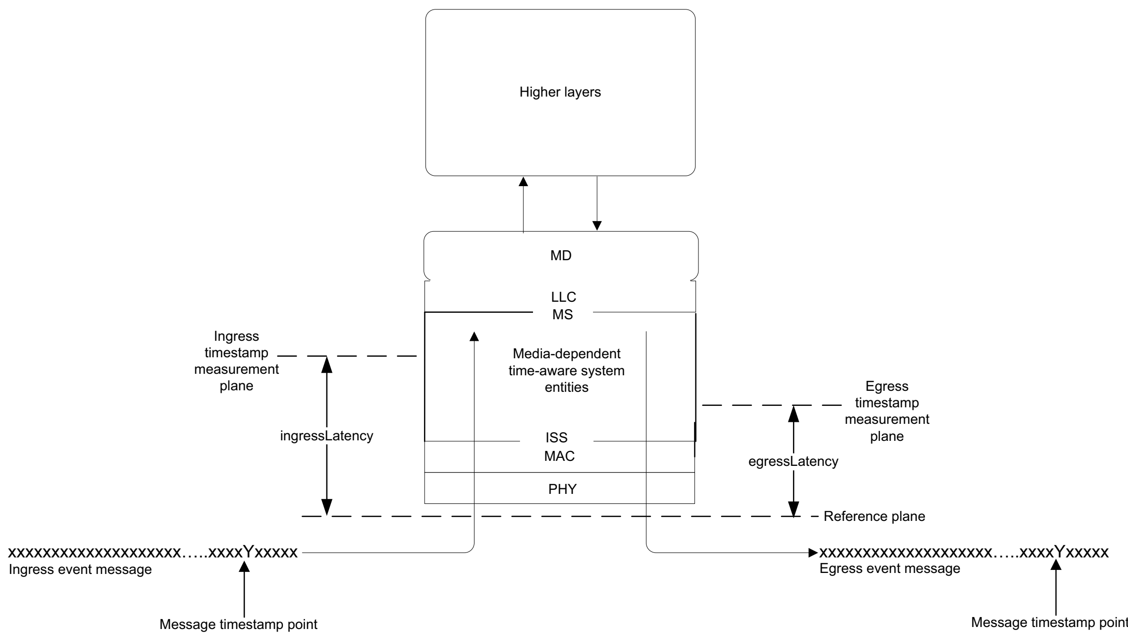

Figure 8-2—Definition of message timestamp point, reference plane, timestamp measurement plane, and latency constants

8.4.4 Priorities

IEEE Std 802.1AS messages shall be transmitted in expedited manner compared to other traffic (e.g., best effort).

NOTE 1—If IEEE Std 802.1AS messages are not expedited in the internal queueing, long bursts of other traffic can cause loss of synchronization due to timeouts.

NOTE 2—For example, two outbound queues can be supported: one outbound queue is used to transmit nonexpedited traffic (e.g., best-effort), and another outbound queue is used to transmit frames in an expedited manner, including IEEE 802.1AS messages. Outbound queues are often implemented in hardware, but software implementation is possible.

NOTE 3—When IEEE Std 802.1Q-2018 is supported, the outbound queue used for transmitting IEEE 802.1AS messages uses a traffic class (see 3.268 of IEEE Std 802.1Q-2018) greater than zero.

NOTE 4—Frames carrying IEEE 802.1AS messages are neither VLAN-tagged nor priority-tagged, i.e., they are untagged (see 11.3.3).

8.5 Ports

8.5.1 General

The PTP Instances in a gPTP domain interface with the network media via physical ports. gPTP defines a logical port, i.e., a PTP Port, in such a way that communication between PTP Instances is point-to-point even over physical ports that are attached to shared media. One logical port, consisting of one PortSync entity and one media-dependent (MD) entity, is instantiated for each PTP Instance with which the PTP Instance communicates. For shared media, multiple logical ports can be associated with a single physical port.

Unless otherwise qualified, each instance of the term *port* refers to a *logical port.*

8.5.2 Port identity

8.5.2.1 General

A PTP Port is identified by a port identity of type PortIdentity (see 6.4.3.7). The value is maintained in portDS.portIdentity (see 14.8.2). A port identity consists of the following two attributes:

a) portIdentity.clockIdentity
b) portIdentity.portNumber

8.5.2.2 clockIdentity

The clockIdentity attribute shall be as specified in 7.5.2.2 of IEEE Std 1588-2019.

8.5.2.3 Port number

The portNumber values for the PTP Ports on a time-aware system shall be distinct in the range 1, 2, …, 0xFFFE.

The portNumber value 0 is assigned to the interface between the ClockMaster and ClockSource entities (see 10.1 and Figure 10-1). The value 0xFFFF is reserved.

8.5.2.4 Ordering of clockIdentity and portIdentity values

Two clockIdentity values X and Y are compared as follows. Let x be the unsigned integer formed by concatenating octets 0 through 7 of X such that octet j+1 follows octet j (i.e., is less significant than octet j) in x (j = 0, 1, ..., 6). Let y be the unsigned integer formed by concatenating octets 0 through 7 of Y such that octet j+1 follows octet j (i.e., is less significant than octet j) in y (j = 0, 1, ..., 6). Then:

a) X = Y if and only if $x = y$,
b) X > Y if and only if $x > y$, and
c) X < Y if and only if $x < y$.

Two portIdentity values A and B with members clockIdentity and portNumber are compared as follows. Let a be the unsigned integer formed by concatenating octets 0 through 7 of A.clockIdentity, such that octet j+1 follows octet j (i.e., is less significant than octet j) in a (j = 0, 1, ..., 6), followed by octet 0 of A.portNumber, followed by octet 1 of A.portNumber. Let b be the unsigned integer formed by concatenating octets 0 through 7 of B.clockIdentity, such that octet j+1 follows octet j (i.e., is less significant than octet j) in b (j = 0, 1, ..., 6), followed by octet 0 of B.portNumber, followed by octet 1 of B.portNumber. Then:

d) A = B if and only if $a = b$,
e) A > B if and only if $a > b$, and
f) A < B if and only if $a < b$.

A portIdentity A with members clockIdentity and portNumber and a clockIdentity B are compared as follows. The unsigned integer a is formed from portIdentity A as described above. The unsigned integer b is formed by first forming a portIdentity B' whose clockIdentity is B and portNumber is 0. b is then formed from B' as described above. A and B are then compared as described in items d) through f) in this subclause.

8.6 PTP Instance characterization

8.6.1 PTP Instance type

There are two types of PTP Instances used in a gPTP domain, as follows:

a) PTP End Instance
b) PTP Relay Instance

All PTP Instances are identified by clockIdentity.

In addition, PTP Instances are characterized by the following attributes:

c) priority1
d) clockClass
e) clockAccuracy
f) offsetScaledLogVariance
g) priority2
h) clockIdentity
i) timeSource
j) numberPorts

NOTE—Attributes c) through i) can be considered to be associated with the ClockMaster entity of the PTP Instance.

8.6.2 PTP Instance attributes

8.6.2.1 priority1

priority1 is used in the execution of the BMCA (see 10.3). The value of priority1 is an integer selected from the range 0 through 255. The ordering of priority1 in the operation of the BMCA (see 10.3.4 and 10.3.5) is specified as follows. A ClockMaster A shall be deemed better than a ClockMaster B if the value of priority1 of A is numerically less than that of B.

The value of priority1 shall be 255 for a PTP Instance that is not grandmaster-capable. The value of priority1 shall be less than 255 for a PTP Instance that is grandmaster-capable. The value 0 shall be reserved for management use, i.e., the value of priority1 shall be set to 0 only via management action. The default value shall be set to one of the values listed in Table 8-1, and the choice of value from Table 8-1 is left to the implementer of the PTP Instance.

Table 8-1—Default values for priority1, for the respective media

PTP Instance type	Default value for priority1
PTP Instances that are a central/critical part of the network and are not expected to ever be turned off during normal network operation (e.g., Bridges, wireless access points, and grandmaster-capable end nodes that are intended by the manufacturer to be Grandmaster PTP Instances). (End node Grandmaster PTP Instances are not a 'central' part of the network, but they are "critical" to this gPTP operation.)	246
PTP Instances that (A) can be turned off at any time and therefore cannot be considered a central/critical part of the network; or (B) are a central/critical part of the network, are not expected to ever be turned off during normal network operation, and are grandmaster-capable, but are not intended by the manufacturer to be Grandmaster PTP Instances. PTP Instances that can be turned off and are turned off affect only the function(s) they support and do not affect any other functions of the network (e.g., desktop computers, fixed (heavy or otherwise) end nodes, speakers, receivers, amplifiers, and televisions).	248
PTP Instances that can go away (physically or otherwise) at any time (e.g., PTP Instances that are designed to be transient to the network such as laptop computers, cell phones, and battery-powered speakers).	250
PTP Instance that is not grandmaster-capable.	255

NOTE 1—Care must be applied to multi-function device design, specifically for an end station that also contains a Bridge. The Bridge function inside multi-function devices must not be powered down when the end station function is powered down, or else the data and controls (like gPTP) passing through the Bridge function to other network devices will cease. Example devices of this are a television and/or amplifier/receiver, each of which contains a Bridge.

NOTE 2—The BMCA (see 10.3) considers priority1 before other attributes; the priority1 attribute can therefore be used to force a desired ordering of PTP Instances for best master selection.

NOTE 3—The settings for priority1 in Table 8-1 guarantee that a PTP Instance that is grandmaster-capable is always preferred by the BMCA over a PTP Instance that is not grandmaster-capable.

NOTE 4—These values are assigned so that PTP Instances with priority1 value of 246 are selected as Grandmaster PTP Instances over PTP Instances with priority1 values of 248 or 250. (PTP Instances with priority1 value of 255 are never selected as Grandmaster PTP Instances.)

NOTE 5—These default values are suitable for applications in which the availability of the Grandmaster PTP Instance is the most important criterion for Grandmaster PTP Instance selection. A PTP Instance built for a specific application for which this is not the case can be capable of having priority1 changed via management.

8.6.2.2 clockClass

The clockClass attribute denotes the traceability of the synchronized time distributed by a ClockMaster when it is the Grandmaster PTP Instance.

The value shall be selected as follows:

a) If defaultDS.gmCapable is TRUE (see 14.2.7), then
   1) clockClass is set to the value that reflects the combination of the LocalClock and ClockSource entities; else
   2) If the value that reflects the LocalClock and ClockSource entities is not specified or not known, clockClass is set to 248;
b) If the defaultDS.gmCapable is FALSE, clockClass is set to 255 (see 8.6.2.1).

The ordering of clockClass in the operation of the best master clock algorithm (see 10.3.4 and 10.3.5) is specified as follows. When comparing clockClass values, PTP Instance A shall be deemed better than PTP Instance B if the value of the clockClass of A is lower than that of B.

See 7.6.2.5 of IEEE Std 1588-2019 for a more detailed description of clockClass.

NOTE—The PTP Instance has a LocalClock entity, which can be the free-running quartz crystal that just meets the IEEE 802.3 requirements, but could also be better. There can be a ClockSource entity, e.g., timing taken from a GNSS, available in the local system that provides timing to the ClockSource entity. The time provided by the PTP Instance, if it is the Grandmaster PTP Instance, is reflected by the combination of these two entities, and the clockClass reflects this combination as specified in 7.6.2.5 of IEEE Std 1588-2019. For example, when the LocalClock entity uses a quartz oscillator that meets the requirements of IEEE Std 802.3-2018 and B.1 of this standard, clockClass is set to 248. But, if a GNSS receiver is present and synchronizes the PTP Instance, then the clockClass is set to the value 6, indicating traceability to a primary reference time source (see 7.6.2.5 of IEEE Std 1588-2019).

8.6.2.3 clockAccuracy

The clockAccuracy attribute indicates the expected time accuracy of a ClockMaster.

The value shall be selected as follows:

a) clockAccuracy is set to the value that reflects the combination of the LocalClock and ClockSource entities; else
b) If the value that reflects the LocalClock and ClockSource entities is not specified or unknown, clockAccuracy is set to 254 (FE_{16}).

The ordering of clockAccuracy in the operation of the best master clock algorithm (see 10.3.4 and 10.3.5) is specified as follows. When comparing clockAccuracy values, PTP Instance A shall be deemed better than PTP Instance B if the value of the clockAccuracy of A is lower than that of B.

See 7.6.2.6 of IEEE Std 1588-2019 for more detailed description of clockAccuracy.

8.6.2.4 offsetScaledLogVariance

The offsetScaledLogVariance is a scaled, offset representation of an estimate of the PTP variance. The PTP variance characterizes the precision and frequency stability of the ClockMaster. The PTP variance is the square of PTP Deviation (PTPDEV) (see B.1.3.2).

The value shall be selected as follows:

a) offsetScaledLogVariance is set to the value that reflects the combination of the LocalClock and ClockSource entities; else
b) If the value that reflects these entities is not specified or not known, offsetScaledLogVariance is set to 17258 ($436A_{16}$). This value corresponds to the value of PTPDEV for observation interval equal to the default Sync message transmission interval (i.e., observation interval of 0.125 s; see 11.5.2.3 and B.1.3.2).

The ordering of offsetScaledLogVariance in the operation of the best master clock algorithm (see 10.3.4 and 10.3.5) is specified as follows. When comparing offsetScaledLogVariance values, PTP Instance A shall be deemed better than PTP Instance B if the value of the offsetScaledLogVariance of A is lower than that of B.

See 7.6.3 of IEEE Std 1588-2019 for more detailed description of PTP variance and offsetScaledLogVariance. (Subclause 7.6.3.3 of IEEE Std 1588-2019 provides a detailed description of the computation of offsetScaledLogVariance from PTP variance, along with an example.)

8.6.2.5 priority2

priority2 is used in the execution of the BMCA (see 10.3). The value of priority2 shall be an integer selected from the range 0 through 255. The ordering of priority2 in the operation of the BMCA is the same as the ordering of priority1 (see 8.6.2.1).

The default value of priority2 shall be 247 or 248. The default value for a PTP Relay Instance should be 247. The default value for a PTP End Instance should be 248. See 7.6.2.4 of IEEE Std 1588-2019 for a more detailed description of priority2.

NOTE—IEEE 802.1AS performance is improved when the number of hops between the Grandmaster PTP Instance and a slave PTP End Instance is reduced. When BMCA attributes are equal in a network, the preceding recommendations for priority2 select a PTP Relay Instance in order to reduce the number of hops (rather than use clockIdentity alone).

8.6.2.6 clockIdentity

The clockIdentity value for a PTP Instance shall be as specified in 8.5.2.2.

8.6.2.7 timeSource

The timeSource is an information only attribute indicating the type of source of time used by a ClockMaster. The value is not used in the selection of the Grandmaster PTP Instance. The data type of timeSource shall be TimeSource, which is an Enumeration8. The values of TimeSource are specified in Table 8-2. These represent categories. For example, the global positioning system (GPS) entry includes not only the GPS system of the U.S. Department of Defense but the European Galileo system and other present and future GNSSs.

Table 8-2—TimeSource enumeration

Value	Time source	Description
0x10	ATOMIC_CLOCK	Any PTP Instance, or PTP Instance directly connected to such a device, that is based on atomic resonance for frequency and that has been calibrated against international standards for frequency and time.
0x20	GPS (see NOTE 1)	Any PTP Instance synchronized to any of the satellite systems that distribute time and frequency tied to international standards.
0x30	TERRESTRIAL_RADIO	Any PTP Instance synchronized via any of the radio distribution systems that distribute time and frequency tied to international standards.
0x40	PTP	Any PTP Instance synchronized to an IEEE 1588 PTP-based source of time external to the gPTP domain (see NOTE 2).
0x50	NTP	Any PTP Instance synchronized via the network time protocol (NTP) to servers that distribute time and frequency tied to international standards.
0x60	HAND_SET	Used in all cases for any PTP Instance whose time has been set by means of a human interface based on observation of an international standards source of time to within the claimed clock accuracy.

Table 8-2—TimeSource enumeration *(continued)*

Value	Time source	Description
0x90	OTHER	Any source of time and/or frequency not covered by other values, or for which the source is not known.
0xA0	INTERNAL_OSCILLATOR	Any PTP Instance whose frequency is not based on atomic resonance nor calibrated against international standards for frequency, and whose time is based on a free-running oscillator with epoch determined in an arbitrary or unknown manner.
NOTE 1—In this standard, this value refers to any GNSS or Regional Navigation Satellite System (i.e., not only GPS). NOTE 2—For example, a clock that implements both a gPTP domain and a separate IEEE 1588 (i.e., PTP) domain, and is synchronized by the separate IEEE 1588 domain, would have time source of PTP in the gPTP domain.		

All unused values are reserved.

See 7.6.2.8 of IEEE Std 1588-2019 for a more detailed description of timeSource.

The initialization value is selected as follows:

a) If the timeSource (8.6.2.7 and Table 8-2) is known at the time of initialization, the value is derived from the table, else
b) The value is set to $A0_{16}$ (INTERNAL_OSCILLATOR).

8.6.2.8 numberPorts

The numberPorts indicates the number of PTP Ports of the PTP Instance.