3. Definitions

For the purposes of this standard, the following terms and definitions apply. The *IEEE Standards Dictionary Online* should be consulted for terms not defined in this clause.[8]

3.1 accuracy: The mean of the time or frequency error between the clock under test and a reference clock over an ensemble of measurements (see IEEE Std 1588-2019).

3.2 Bridge: Either a MAC Bridge or a VLAN-aware Bridge, as specified in Clause 5 of IEEE Std 802.1Q-2018.

3.3 clock: A physical device that is capable of providing a measurement of the passage of time since a defined epoch.

3.4 device: An entity implementing some functionality, e.g., a clock, a time-aware system, a port.

3.5 direct communication: A communication of IEEE 802.1AS information between two PTP Instances with no intervening PTP Instance.

3.6 end station: A device attached to a local area network (LAN) or metropolitan area network (MAN) that acts as a source of, and/or destination for, traffic carried on the LAN or MAN.

3.7 event message: A message that is timestamped on egress from a PTP Instance and ingress to a PTP Instance.

NOTE—See 8.4.3.[9]

3.8 fractional frequency offset: The fractional offset, y, between a measured clock and a reference clock as defined by the following:

$$y = \frac{f_m - f_r}{f_r}$$

where f_m is the frequency of the measured clock and f_r is the frequency of the reference clock. The measurement units of f_m and f_r are the same.

3.9 frequency offset: The offset between a measured frequency and a reference frequency as defined by $f_m - f_r$, where f_m is the frequency of the measured clock and f_r is the frequency of the reference clock. The measurement units of f_m and f_r are the same.

3.10 general message: A message that is not timestamped.

3.11 gPTP communication path: A segment of a generalized precision time protocol (gPTP) domain that enables direct communication between two PTP Instances.

NOTE—See 8.1.

3.12 grandmaster-capable PTP Instance: A PTP Instance that is capable of being a Grandmaster PTP Instance.

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[8] *IEEE Standards Dictionary Online* is available at https://dictionary.ieee.org/.

[9] Notes in text, tables, and figures of a standard are given for information only and do not contain requirements needed to implement the standard.

3.13 Grandmaster Clock: In the context of a single PTP domain, the synchronized time of a PTP Instance that is the source of time to which all other PTP Instances in the domain are synchronized.

3.14 Grandmaster PTP Instance: A PTP Instance containing the Grandmaster Clock.

3.15 local area network (LAN): A network of devices, whether indoors or outdoors, covering a limited geographic area, e.g., a building or campus.

3.16 local clock: A free-running clock, embedded in a respective entity (e.g., PTP Instance, CSN node), that provides a common time to that entity relative to an arbitrary epoch.

3.17 message timestamp point: A point within an event message serving as a reference point for when a timestamp is taken.

3.18 message type: The message type of a message is the name of the respective message, e.g., Sync, Announce, Timing Measurement Frame.

3.19 precision: A measure of the deviation from the mean of the time or frequency error between the clock under test and a reference clock (see IEEE Std 1588-2019).

3.20 primary reference: A source of time and/or frequency that is traceable to international standards. *See also:* **traceability.**

3.21 PTP End Instance: A PTP Instance that has exactly one PTP Port.

3.22 PTP Instance: An instance of the IEEE 802.1AS protocol, operating in a single time-aware system within exactly one domain. A PTP Instance implements the portions of IEEE Std 802.1AS indicated as applicable to either a PTP Relay Instance or a PTP End Instance.

NOTE—As used in IEEE Std 802.1AS, the term *PTP Instance* refers to an IEEE 1588 PTP Instance that conforms to the requirements of IEEE Std 802.1AS.

3.23 PTP Link: Within a domain, a network segment between two PTP Ports using the peer-to-peer delay mechanism of IEEE Std 802.1AS. The peer-to-peer delay mechanism is designed to measure the propagation time over such a link.

NOTE—A PTP Link between PTP Ports of PTP Instances is also a gPTP Communication Path (see 3.11).

3.24 PTP Relay Instance: A PTP Instance that is capable of communicating synchronized time received on one PTP Port to other PTP Ports, using the IEEE 802.1AS protocol.

NOTE—A PTP Relay Instance could, for example, be contained in a bridge, a router, or a multi-port end station.

3.25 recognized timing standard: A recognized standard time source that is a source external to IEEE 1588 precision time protocol (PTP) and provides time that is traceable to the international standards laboratories maintaining clocks that form the basis for the International Atomic Time (TAI) and Coordinated Universal Time (UTC) timescales. Examples of these sources are National Institute of Standards and Technology (NIST) timeservers and global navigation satellite systems (GNSSs).

3.26 reference plane: The boundary between a PTP Port of a PTP Instance and the network physical medium. Timestamp events occur as frames cross this interface.

3.27 residence time: The duration of the time interval between the receipt of a time-synchronization event message by a PTP Instance and the sending of the next subsequent time-synchronization event message on another PTP Port of that PTP Instance. Residence time can be different for different PTP Ports. The term *residence time* applies only to the case where syncLocked is TRUE.

NOTE 1—See 10.2.5.15 for the definition of the variable syncLocked.

NOTE 2—If a PTP Port of a PTP Instance sends a time-synchronization event message without having received a time-synchronization event message, e.g., if syncLocked is FALSE or if sync receipt timeout occurs (see 10.7.3.1), the duration of the interval between the most recently received time-synchronization event message and the sent time-synchronization event message is mathematically equivalent to residence time; however, this interval is not normally called a *residence time*.

3.28 stability (of a clock or clock signal): A measure of the variations over time of the frequency error (of the clock or clock signal). The frequency error typically varies with time due to aging and various environmental effects, e.g., temperature.

3.29 synchronized time: The time of an event relative to the Grandmaster Clock.

NOTE—If there is a change in the Grandmaster PTP Instance or its time base, the *synchronized time* can experience a phase and/or frequency step.

3.30 synchronized clocks: Absent relativistic effects, two clocks are synchronized to a specified uncertainty if they have the same epoch and their measurements of the time of a single event at an arbitrary time differ by no more than that uncertainty.

NOTE—See 8.2.2.

3.31 syntonized clocks: Absent relativistic effects, two clocks are syntonized to a specified uncertainty if the duration of a second is the same on both, which means the time as measured by each advances at the same rate within the specified uncertainty. The two clocks might or might not share the same epoch.

3.32 time-aware system: A device that contains one or more PTP Instances and/or PTP services (e.g., Common Mean Link Delay Service).

NOTE 1—See 11.2.17 for a description of the Common Mean Link Delay Service.

NOTE 2—A time-aware system can contain more than one PTP Instance in the same domain and/or different domains.

3.33 timestamp measurement plane: The plane at which timestamps are captured. If the timestamp measurement plane is different from the reference plane, the timestamp is corrected for ingressLatency and/or egressLatency. *See:* **reference plane**.

NOTE—For timestamping on egress and ingress, see 8.4.3.

3.34 traceability: See 3.1.81 in IEEE Std 1588-2019.