9. Application interfaces

9.1 Overview of the interfaces

Unless otherwise stated, information in this clause is per domain.

The following subclauses define one application interface between the ClockSource entity and ClockMaster entity (see 10.1.2) and four application interfaces between the ClockTarget entity and ClockSlave entity (see 10.1.2). The ClockSource is an entity that can be used as an external timing source for the gPTP domain. The ClockSource entity either contains or has access to a clock (see 3.3). The ClockTarget entity represents any application that uses information provided by the ClockSlave entity via any of the application interfaces.

NOTE 1—The manner in which the ClockSource entity obtains time from a clock is outside the scope of this standard. The manner in which the ClockTarget uses the information provided by application interfaces is outside the scope of this standard.

The five interfaces are illustrated in Figure 9-1:

a) ClockSourceTime interface, which provides external timing to a PTP Instance,

b) ClockTargetEventCapture interface, which returns the synchronized time of an event signaled by a ClockTarget entity,

c) ClockTargetTriggerGenerate interface, which causes an event to be signaled at a synchronized time specified by a ClockTarget entity,

d) ClockTargetClockGenerator interface, which causes a periodic sequence of results to be generated, with a phase and rate specified by a ClockTarget entity, and

e) ClockTargetPhaseDiscontinuity interface, which supplies information that an application can use to determine if a discontinuity in Grandmaster Clock phase or frequency has occurred.

NOTE 2—The application interfaces described in this clause are models for behavior and not application program interfaces. Other application interfaces besides items a) through e) in this subclause are possible, but are not described here. In addition, there can be multiple instances of a particular interface.
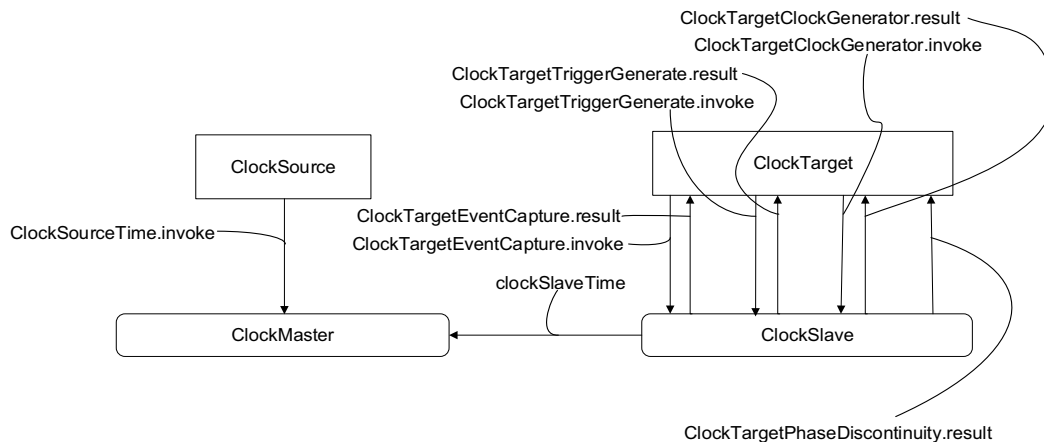

Figure 9-1—Application interfaces

9.2 ClockSourceTime interface

9.2.1 General

This interface is used by the ClockSource entity to provide time to the ClockMaster entity of a PTP Instance. The ClockSource entity invokes the ClockSourceTime.invoke function. The function provides the time, relative to the ClockSource, at which the function was invoked.

9.2.2 ClockSourceTime.invoke function parameters

```
ClockSourceTime.invoke {
        domainNumber,
        sourceTime,
        timeBaseIndicator,
        lastGmPhaseChange,
        lastGmFreqChange
}
```

9.2.2.1 domainNumber (UInteger8)

This parameter is the domain number of the gPTP domain to which this ClockSource entity is providing time.

9.2.2.2 sourceTime (ExtendedTimestamp)

The value of sourceTime is the time this function is invoked by the ClockSource entity.

9.2.2.3 timeBaseIndicator (UInteger16)

The timeBaseIndicator is a binary value that is set by the ClockSource entity. The ClockSource entity changes the value whenever its time base changes. The ClockSource entity shall change the value of timeBaseIndicator if and only if there is a phase or frequency change.

NOTE—While the clock that supplies time to the ClockSource entity can be lost, i.e., the PTP Instance can enter holdover, the ClockSource entity itself is not lost. The ClockSource entity ensures that timeBaseIndicator changes if the source of time is lost.

9.2.2.4 lastGmPhaseChange (ScaledNs)

The value of lastGmPhaseChange is the phase change (i.e., change in sourceTime) that occurred on the most recent change in timeBaseIndicator. The value is initialized to 0.

9.2.2.5 lastGmFreqChange (Float64)

The value of lastGmFreqChange is the fractional frequency change (i.e., frequency change expressed as a pure fraction) that occurred on the most recent change in timeBaseIndicator. The value is initialized to 0.

9.3 ClockTargetEventCapture interface

9.3.1 General

This interface is used by the ClockTarget entity to request the synchronized time of an event that it signals to the ClockSlave entity of a PTP Instance. The ClockTarget entity invokes the ClockTargetEventCapture.invoke function to signal an event to the ClockSlave entity. The ClockSlave entity

invokes the ClockTargetEventCapture.result function to return the time of the event relative to the current Grandmaster Clock or, if no PTP Instance is grandmaster-capable, the LocalClock. The ClockTargetEventCapture.result function also returns gmPresent, to indicate to the ClockTarget whether a Grandmaster PTP Instance is present.

9.3.2 ClockTargetEventCapture.invoke parameters

ClockTargetEventCapture.invoke {
    domainNumber
}

9.3.2.1 domainNumber (UInteger8)

This parameter is the domain number of the ClockSlave entity that is requested to provide the synchronized time of the signaled event.

9.3.3 ClockTargetEventCapture.result parameters

ClockTargetEventCapture.result {
    domainNumber,
    slaveTimeCallback,
    gmPresent
}

9.3.3.1 domainNumber (UInteger8)

This parameter is the domain number of the ClockSlave entity that is providing the synchronized time of the signaled event.

9.3.3.2 slaveTimeCallback (ExtendedTimestamp)

The value of slaveTimeCallback is the time, relative to the Grandmaster Clock, that the corresponding ClockTargetEventCapture.invoke function is invoked.

NOTE—The invocation of the ClockTargetEventCapture.invoke function and the detection of this invocation by the ClockSlave entity are simultaneous in this abstract interface.

9.3.3.3 gmPresent (Boolean)

The value of gmPresent is set equal to the value of the global variable gmPresent (see 10.2.4.13). This parameter indicates to the ClockTarget whether a Grandmaster PTP Instance is present.

9.4 ClockTargetTriggerGenerate interface

9.4.1 General

This interface is used by the ClockTarget entity to request that the ClockSlave entity send a result at a specified time relative to the Grandmaster Clock. The ClockTarget entity invokes the ClockTargetTriggerGenerate.invoke function to indicate the synchronized time of the event. The ClockSlave entity invokes the ClockTargetTriggerGenerate.result function to either signal the event at the requested synchronized time or indicate an error condition.

9.4.2 ClockTargetTriggerGenerate.invoke parameters

ClockTargetTriggerGenerate.invoke {
      domainNumber,
      slaveTimeCallback
}

9.4.2.1 domainNumber (UInteger8)

This parameter is the domain number of the ClockSlave entity that is requested to signal an event at the specified time.

9.4.2.2 slaveTimeCallback (ExtendedTimestamp)

If slaveTimeCallback is nonzero, its value is the synchronized time the corresponding ClockTargetTriggerGenerate.result function, i.e., the trigger, is to be invoked. If slaveTimeCallback is zero, any previous ClockTargetTriggerGenerate.invoke function for which a ClockTargetTriggerGenerate.result function has not yet been issued is canceled.

9.4.3 ClockTargetTriggerGenerate.result parameters

ClockTargetTriggerGenerate.result {
      domainNumber,
      errorCondition,
      gmPresent
}

9.4.3.1 domainNumber (UInteger8)

This parameter is the domain number of the ClockSlave entity that is triggering an event at the specified time.

9.4.3.2 errorCondition (Boolean)

A value of FALSE indicates that the ClockTargetTriggerGenerate.result function was invoked at the time, relative to the Grandmaster Clock, contained in the corresponding ClockTargetTriggerGenerate.invoke function. A value of TRUE indicates that the ClockTargetTriggerGenerate.result function could not be invoked at the synchronized time contained in the corresponding ClockTargetTriggerGenerate.invoke function.

NOTE—For example, the ClockTargetTriggerGenerate.result function is invoked with errorCondition = TRUE if the requested slaveTimeCallback is a time prior to the synchronized time when the corresponding ClockTargetTriggerGenerate.invoke function is invoked. As another example, the ClockTargetTriggerGenerate.result function is invoked with errorCondition = TRUE if a discontinuity in the synchronized time causes the requested slaveTimeCallback to be skipped over.

9.4.3.3 gmPresent (Boolean)

The value of gmPresent is set equal to the value of the global variable gmPresent (see 10.2.4.13). This parameter indicates to the ClockTarget whether a Grandmaster PTP Instance is present.

9.4.4 ClockTargetTriggerGenerate interface definition

The invocation of the ClockTargetTriggerGenerate.invoke function causes the ClockSlave entity to store the value of the slaveTimeCallback parameter in an internal variable (replacing any previous value of that

variable) until the synchronized time, or LocalClock time if gmPresent is FALSE, equals the value of that variable, at which time the ClockTargetTriggerGenerate.result function is invoked with errorCondition = FALSE. If it is not possible to invoke the ClockTargetTriggerGenerate.result function at slaveTimeCallback, e.g., if slaveTimeCallback is earlier than the synchronized time (or LocalClock time if gmPresent is FALSE) when the ClockTargetTriggerGenerate.invoke function is invoked, the ClockTargetTriggerGenerate.result function is invoked with errorCondition = TRUE. Invocation of the ClockTargetTriggerGenerate.invoke function with slaveTimeCallback = 0 (which is earlier than any synchronized time) is used to cancel a pending request.

9.5 ClockTargetClockGenerator interface

9.5.1 General

This interface is used by the ClockTarget entity to request that the ClockSlave entity deliver a periodic clock signal of specified period and phase. The ClockTarget entity invokes the ClockTargetClockGenerator.invoke function to request that the ClockSlave entity generate the periodic clock signal. The ClockSlave entity invokes the ClockTargetClockGenerator.result function at significant instants of the desired clock signal.

9.5.2 ClockTargetClockGenerator.invoke parameters

ClockTargetClockGenerator.invoke {
      domainNumber,
      clockPeriod,
      slaveTimeCallbackPhase
}

9.5.2.1 domainNumber (UInteger8)

This parameter is the domain number of the ClockSlave entity that is requested to deliver a periodic clock signal.

9.5.2.2 clockPeriod (TimeInterval)

The value of clockPeriod is the period between successive invocations of the ClockTargetClockGenerator.result function. A value that is zero or negative causes any existing periodic clock signal generated via this application interface to be terminated.

9.5.2.3 slaveTimeCallbackPhase (ExtendedTimestamp)

The value of slaveTimeCallbackPhase describes phase of the generated clock signal by specifying a point on the timescale in use such that ClockTargetClockGenerator.result invocations occur at synchronized times that differ from slaveTimeCallbackPhase by $n \times$ clockPeriod, where n is an integer.

NOTE—The value of slaveTimeCallbackPhase can be earlier or later than the synchronized time the ClockTargetClockGenerator.invoke function is invoked; use of a slaveTimeCallbackPhase value in the future does not imply that the initiation of the periodic clock signal is suppressed until that synchronized time.

9.5.3 ClockTargetClockGenerator.result parameters

ClockTargetClockGenerator.result {
      domainNumber,
      slaveTimeCallback,
}

9.5.3.1 domainNumber (UInteger8)

This parameter is the domain number of the ClockSlave entity that is delivering a periodic clock signal.

9.5.3.2 slaveTimeCallback (ExtendedTimestamp)

The value of slaveTimeCallback is the synchronized time of this event.

9.6 ClockTargetPhaseDiscontinuity interface

9.6.1 General

This interface provides discontinuity information, sent from the Grandmaster PTP Instance, to an application within an end station. It is used by the ClockSlave entity to supply sufficient information to the ClockTarget entity to enable the ClockTarget entity to determine whether a phase or frequency discontinuity has occurred. The ClockSlave invokes the ClockTargetPhaseDiscontinuity.result function in the SEND_SYNC_INDICATION block of the ClockSlaveSync state machine (see 10.2.13 and Figure 10-9). The invocation occurs when a PortSyncSync structure is received, after the needed information has been computed by the ClockSlaveSync state machine.

9.6.2 ClockTargetPhaseDiscontinuity.result parameters

```
ClockTargetPhaseDiscontinuity.result {
        domainNumber,
        gmIdentity,
        gmTimeBaseIndicator,
        lastGmPhaseChange,
        lastGmFreqChange
}
```

9.6.2.1 domainNumber (UInteger8)

This parameter is the domain number of the ClockSlave entity that is providing discontinuity information.

9.6.2.2 gmIdentity (ClockIdentity)

If gmPresent (see 10.2.4.13) is TRUE, the value of gmIdentity is the ClockIdentity of the current Grandmaster PTP Instance. If gmPresent is FALSE, the value of gmIdentity is 0x0.

9.6.2.3 gmTimeBaseIndicator (UInteger16)

The value of gmTimeBaseIndicator is the timeBaseIndicator of the current Grandmaster PTP Instance.

9.6.2.4 lastGmPhaseChange (ScaledNs)

The value of the global lastGmPhaseChange parameter (see 10.2.4.16) received from the Grandmaster PTP Instance.

9.6.2.5 lastGmFreqChange (Float64)

The value of lastGmFreqChange parameter (see 10.2.4.17) received from the Grandmaster PTP Instance.