

Attached is the supporting material for the P802.1AS D6.2 comment against clause 14, submitted by Geoff Garner on (row 76 in the submitted Excel spreadsheet P802.1AS-d6-2-garner-comments.xls. The date of this document is November 6, 2009.

## 14. Timing and Synchronization management

### 14.1 General

This clause defines the set of managed objects, and their functionality, that allow administrative configuration of clock parameters and timing and synchronization protocols.

The objects that comprise this management resources are

- a) The Default Parameter Data Set (Table 14-1).
- b) The Current Parameter Data Set (Table 14-2)
- c) The Parent Parameter Data Set (Table 14-3)
- d) The Time Properties Parameter Data Set (Table 14-4)
- e) The Port Parameter Data Set (Table 14-6)
- f) The Acceptable Master Table Parameter Data Set (Table 14-7)

### 14.2 The Default Parameter Data Set

#### 14.2.1 Clock Identity

The value is the clockIdentity, see 8.5.2.2, of the local clock.

#### 14.2.2 Number Ports

The value is the number of ports of the time-aware system. For an end station the value is 1.

#### 14.2.3 Clock class

The value is the clockClass of the time-aware system that implements the clock class specifications of 8.6.2.2.

The initialization value is selected as follows:

- a) If the Default Parameter Data Set member gmCapable is TRUE, then
  - 1) clock class is initialized 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, clock class is initialized to 248;
- b) If the Default Parameter Data Set member gmCapable is FALSE, clock class is initialized to 255.

NOTE - The time-aware system has a LocalClock entity, which may be the free-running quartz crystal that just meets the 802.3 Std requirements, but could also be better. There can be a ClockSource entity, e.g., timing taken from GPS, available in the local system that provides timing to the ClockSource entity. The time provided by the time-aware system, if it is the grandmaster, is reflected by the combination of these two entities, and the various attributes should reflect this combination as specified in 7.6.2.5 of IEEE Std 1588<sup>TM</sup>-2008. For example, when the LocalClock entity uses a quartz oscillator that meets the requirements of IEEE 802.3 Std 802.3<sup>TM</sup>-2008 and B.1 of this standard, clockClass may be set to the initial value of 248. But, if a GPS receiver is present and synchronizes the time-aware system, then the clockClass may be initialized to the value 6, indicating traceability to a primary reference time source.

#### 14.2.4 Clock accuracy

The value is the clockAccuracy of the time-aware system that implements the clock class specifications of 8.6.2.3.

The initialization value is selected as follows:

- a) clock accuracy is initialized 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, clock accuracy is set to 254 ( $FE_{16}$ ).

#### 14.2.5 Offset scaled log variance

The value is the offsetScaledLogVariance of the time-aware system that implements the clock class specifications of 8.6.2.4

The initialization value is selected as follows:

- a) offset scaled log variance is initialized 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, offset scaled log variance is set to 16640 ( $4100_{16}$ ).

#### 14.2.6 Priority1

The value is the priority1 attribute of the time-aware system, see 8.6.2.1.

#### 14.2.7 Priority2

The value is the priority2 attribute of the time-aware system, see 8.6.2.5.

#### 14.2.8 GM Capable

The value is TRUE if the time-aware system is capable of being a grandmaster, and FALSE if the time-aware system is not capable of being a grandmaster.

#### 14.2.9 Current UTC Offset

The value is the offset between TAI and UTC, relative to the ClockMaster entity of this time-aware system. It is equal to the global variable sysCurrentUtcOffset (see 10.3.8.16). The value is in units of seconds.

The initialization value is selected as follows:

- a) the value is the value obtained from a primary reference if the value is known at the at the time of initialization, else
- b) the value is the current number of leap seconds, see 8.2.3, when the time-aware system is designed.

NOTE - A clock that is designed to be clock class 6 can include implementation-specific measures to ensure it meets the specifications of 8.6.2.2 for clock class 6 and therefore has access to the UTC offset value before initializing the currentUtcOffset member. For example, the clock can synchronize to the GPS system, which provides the UTC offset value, as part of initialization.

#### 14.2.10 Current UTC Offset Valid

The value is TRUE if the currentUtcOffset, relative to the ClockMaster entity of this time-aware system, is known to be correct. It is equal to the global variable sysCurrentUtcOffsetValid (see 10.3.8.13).

The initialization value is set to TRUE if the value of currentUtcOffset is known to be correct, otherwise it is set to FALSE.

#### 14.2.11 Leap59

A TRUE value indicates that the last minute of the current UTC day, relative to the ClockMaster entity of this time-aware system, will contain 59 seconds. It is equal to the global variable sysLeap59 (see 10.3.8.12).

The initialization value is selected as follows:

- a) The value is obtained from a primary reference if known at the at the time of initialization, else
- b) The value is set to FALSE.

#### 14.2.12 Leap61

A TRUE value indicates that the last minute of the current UTC day, relative to the ClockMaster entity of this time-aware system, will contain 61 seconds. It is equal to the global variable sysLeap59 (see 10.3.8.11).

The initialization value is selected as follows:

- a) The value is obtained from a primary reference if known at the at the time of initialization, else
- b) The value is set to FALSE.

#### 14.2.13 Time Traceable

The value is set to TRUE if the timescale and the value of currentUtcOffset, relative to the ClockMaster entity of this time-aware system, are traceable to a primary reference standard; otherwise the value is set to FALSE. It is equal to the global variable sysTimeTraceable (see 10.3.8.14).

The initialization value is selected as follows:

- a) If the time and the value of currentUtcOffset are traceable to a primary reference standard at the time of initialization, the value is set to TRUE, else
- b) The value is set to FALSE.

#### 14.2.14 Frequency Traceable

The value is set to TRUE if the frequency determining the timescale of the ClockMaster Entity of this time-aware system is traceable to a primary standard; otherwise the value is set to FALSE. It is equal to the global variable sysFrequencyTraceable (see 10.3.8.15).

The initialization value is selected as follows:

- a) If the frequency is traceable to a primary reference standard at the time of initialization the value is set to TRUE, else
- b) The value is set to FALSE.

1       **14.2.15 Time Source**  
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3       The value is the source of time used by the grandmaster clock.  
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5       The initialization value is selected as follows:  
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- 7       a)   If the time source (8.6.2.7 and Table 8-3), is known at the time of initialization, the value is derived  
8           from the table, else
- 9       b)   The value is set to  $A0_{16}$  (INTERNAL\_OSCILLATOR.)  
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## 14.2.16 Default Parameter Data Set Table

Table 14-1—Default Parameter Data Set Table

Name	Data type	Operations supported*	Conformance+	References
Clock Identity	Octet8	R	T	14.2.1
Number Ports	Integer8	R	T	14.2.2
Clock Class	Enumeration8	RW	T	14.2.3 IEEE Std 1588-2008 7.6.2.4
Clock Accuracy	Enumeration8	RW	T	14.2.4 IEEE Std 1588-2008 7.6.2.5
Offset Scaled Log Variance	Integer16	RW	T	14.2.5
Priority1	UInteger8	RW	T	14.2.6
Priority2	UInteger8	RW	T	14.2.7
GM Capable	Boolean	RW	T	14.2.8
Current UTC Offset	Integer16	RW	T	14.2.9
Current UTC Offset Valid	Boolean	RW	T	14.2.10
Leap59	Boolean	RW	T	14.2.11
Leap61	Boolean	RW	T	14.2.12
Time Traceable	Boolean	RW	T	14.2.13
Frequency Traceable	Boolean	RW	T	14.2.14
Time Source	Enumeration8	RW	T	14.2.15 and Table 8-3
		*R= Read only access ; RW - Read/Write access	+T= Required for Time-aware port	

There is one Default Parameter Table per time-aware system. Each table row contains a set of parameters for the time-synchronization capability as detailed in Table 14-1.

## 14.3 The Current Parameter Data Set

### 14.3.1 Steps Removed

The value is the number of gPTP communication paths traversed between the local clock and the grandmaster clock, as specified in 10.3.3.

The initialization value is 0.

NOTE - For example, steps\_removed for a slave clock on the same PTP communication path as the grandmaster clock will have a value of 1, indicating that a single path was traversed

### 14.3.2 Offset From Master

The value is an implementation-specific representation of the current value of the time difference between a slave and the grandmaster, as computed by the slave, and as specified in 10.2.12. It is recommended that the data type be scaledNs. The initialization value is implementation specific.

### 14.3.3 Current Parameter Data Set Table

There is one Current Parameter Data Set Table per time-aware system. Each table row contains a set of parameters for each port that supports the time-synchronization capability as detailed in Table 14-2.

**Table 14-2—Current Parameter Data Set Table**

Name	Data type	Operations supported*	Conformance+	References
Steps Removed	Integer16	R	T	14.3.1
Offset From Master	scaledNs (recommended)	R	T	14.3.2

## 14.4 Parent Parameter Data Set

### 14.4.1 Parent Port Identity

If this time-aware system is the grandmaster, the value is a portIdentity whose clockIdentity is the clockIdentity of this time-aware system, and whose portNumber is 0.

If this time-aware system is not the grandmaster, the value is the portIdentity of the master port of the gPTP communication path attached to the single slave port of this time-aware system.

The value is the sourcePortIdentity of the port on the master that issues the Sync messages used in synchronizing this clock.

The initialization value is a portIdentity for which:

- a) the clockIdentity member is the value of the clock identity member of the default data set, and
- b) the portNumber member is 0.

#### 14.4.2 Cumulative Rate Ratio

An estimate of the ratio of the frequency of the grandmaster to the frequency of the LocalClock entity of this time-aware system. Cumulative rate ratio is expressed as the fractional frequency offset multiplied by  $2^{41}$ , i.e., the quantity  $(\text{rateRatio} - 1.0)(2^{41})$ , where  $\text{rateRatio}$  is computed by the PortSyncSyncReceive state machine (see 10.2.10.1.4).

#### 14.4.3 Grandmaster Identity

The value is the `clockIdentity` attribute, see 8.5.2.2, of the grandmaster clock.

The initialization value is the `clock identity` member of the default data set (14.2.1)

#### 14.4.4 Grandmaster Clock Class

The value is the `clockClass`, see 8.6.2.2, of the grandmaster clock.

The initialization value is the `clock class` member of the default data set.

#### 14.4.5 Grandmaster Clock Accuracy

The value is the `clockAccuracy`, see 8.6.2.3, of the grandmaster clock.

The initialization value is the `clock accuracy` member of the default data set.

#### 14.4.6 Grandmaster Offset Scaled Log Variance

The value is the `offsetScaledLogVariance`, see 8.6.2.4, of the grandmaster clock.

The initialization value is the `offset scaled log variance` member of the default data set.

#### 14.4.7 Grandmaster Priority1

The value is the `priority1` attribute, see 8.6.2.1, of the grandmaster clock.

The initialization value is the `priority1` value of the default data set.

#### 14.4.8 Grandmaster Priority2

The value is the `priority2` attribute, see 8.6.2.5, of the grandmaster clock.

The initialization value is the `priority2` value of the default data set.

#### 14.4.9 Parent Data Set Table

There is one Parent Parameter Data Set Table per time-aware system. Each table row contains a set of parameters for each port that supports the time-synchronization capability as detailed in Table 14-3.



**Table 14-3—Parent Parameter Data Set Table**

Name	Data type	Operations supported*	Conformance+	References
Parent Port Identity	Octet10	R	T	14.4.1
Cumulative Rate Ratio	Integer32	R	T	14.4.2
Grand Master Identity	Octet8	R	T	14.4.3
Clock Class	UInteger8	R	T	14.4.4 IEEE Std 1588-2008 7.6.2.4
Clock Accuracy	Enumeration8	R	T	14.4.5 IEEE Std 1588-2008 7.6.2.5
Offset Scaled Log Variance	Integer16	R	T	14.4.6
Priority1	Integer8	R	T	14.4.7
Priority2	Integer8	R	T	14.4.8
		*R= Read only access ; RW - Read/Write access	+T= Required for Time-aware port	

## 14.5 Time Properties Parameter Data Set

### 14.5.1 Current UTC Offset

The value is currentUtcOffset for the current grandmaster (see 14.2.9). It is equal to the value of the global variable currentUtcOffset (see 10.3.8.9). The value is in units of seconds.

### 14.5.2 Current UTC Offset Valid

The value is currentUtcOffsetValid for the current grandmaster (see 14.2.10). It is equal to the global variable currentUtcOffsetValid (see 10.3.8.6).

### 14.5.3 Leap59

The value is leap59 for the current grandmaster (see 14.2.11). It is equal to the global variable leap59 (see 10.3.8.5).

### 14.5.4 Leap61

The value is leap59 for the current grandmaster (see 14.2.12). It is equal to the global variable leap61 (see 10.3.8.4).

### 14.5.5 Time Traceable

The value is timeTraceable for the current grandmaster (see 14.2.13). It is equal to the global variable timeTraceable (see 10.3.8.7).

### 14.5.6 Frequency Traceable

The value is frequencyTraceable for the current grandmaster (see 14.2.14). It is equal to the global variable frequencyTraceable (see 10.3.8.8).

### 14.5.7 Time Source

The value is timeSource for the current grandmaster (see 14.2.15). It is equal to the global variable timeSource (see 10.3.8.10).

### 14.5.8 Time Properties Parameter Data Set Table

There is one Time Properties Parameter Data Set Table per time-aware system. Each table row contains a set of parameters for each port that supports the time-synchronization capability as detailed in Table 14-4.

**Table 14-4—Time Properties Parameter Data Set Table**

Name	Data type	Operations supported*	Conformance+	References
Current UTC Offset	Integer16	R	T	14.5.1
Current UTC Offset Valid	Boolean	R	T	14.5.2
Leap59	Boolean	R	T	14.5.3
Leap61	Boolean	R	T	14.5.4
Time Traceable	Boolean	R	T	14.5.5
Frequency Traceable	Boolean	R	T	14.5.6
Time Source	Enumeration8	R	T	14.5.7 and Table 8-3
		*R= Read only access ; RW - Read/Write access	+T= Required for Time-aware port	

## 14.6 Port Parameter Data Set

### 14.6.1 General

For the single port of a time-aware end station and for each port of a time-aware bridge, the following port parameter data set is maintained as the basis for protocol decisions and providing values for message fields. The number of such data sets is the same as the number ports value of the default parameter data set.

### 14.6.2 Port Identity

The value is the portIdentity attribute of the local port, see 8.5.2.

### 14.6.3 Port Role

The value is the value of the port role of this port (see Table 10-1), and is taken from the enumeration in Table 14-5.

**Table 14-5—port\_state enumeration**

State	Value
DisabledPort	3
MasterPort	6
PassivePort	7
SlavePort	9
	All other values reserved

NOTE - The enumeration values are consistent with IEEE Std 1588<sup>TM</sup>-2008, Table 8.

The initialization value is 3 (DisabledPort.)

### 14.6.4 Peer Mean Path Delay

The value is an estimate of the current one-way propagation time on the link attached to this port, measured as specified for the respective medium (see 11.2.15, 12.5, and E.4). The value is zero for ports attached to IEEE 802.3 EPON links and for the master port of an IEEE 802.11 link, because one-way propagation delay is not measured on the latter and not directly measured on the former. It is recommended that the data type be scaledNs. The initialization value is zero.

### 14.6.5 Delay Asymmetry

For ports attached to full-duplex, IEEE 802.3 media, the value is the propagation delay asymmetry (see 8.3), which is equal to delayAsymmetry (see 10.2.7.7). It is recommended that the data type be scaledNs. The initialization value is the measured propagation delay asymmetry, if known, or 0 otherwise. For ports attached to other media, the value is 0.

### 14.6.6 Neighbor Rate Ratio

An estimate of the ratio of the frequency of the LocalClock entity of the time-aware system at the other end of the link attached to this port, to the frequency of the LocalClock entity of this time-aware system (see 10.2.7.5). Neighbor rate ratio is expressed as the fractional frequency offset multiplied by  $2^{41}$ , i.e., the quantity  $(neighborRateRatio - 1.0)(2^{41})$ .

#### 14.6.7 Log Mean Announce Interval

The value is the logarithm to the base 2 of the of the Announce message transmission interval, see 10.6.2.2. The initialization value is 0.

#### 14.6.8 Announce Receipt Timeout

The value is the number of Announce message transmission intervals that a slave port waits without receiving an Announce message, before assuming that the master is no longer transmitting Announce messages and the BMCA needs to be run, if appropriate. The initialization value is 2.

#### 14.6.9 Log Mean Sync Interval

The value is the logarithm to the base 2 of the time synchronization transmission interval, see 10.6.2.3. The initialization value is -3.

#### 14.6.10 Sync Receipt Timeout

The value is the number of time synchronization transmission intervals that a slave port waits without receiving synchronization information, before assuming that the master is no longer transmitting synchronization information and that the BMCA needs to be run, if appropriate. The initialization value is 3.

#### 14.6.11 Log Mean Pdelay\_Req Interval

For full-duplex, IEEE 802.3 media and CSN media that use the peer delay mechanism to measure path delay (see E.4.3.1), the value is the logarithm to the base 2 of the Pdelay\_Req message transmission interval, see 11.5.2.2. For these media, the initialization value is 0. For all other media, the value is 127.

#### 14.6.12 Version Number

This value is set to versionPTP as specified in 10.5.2.2.3

#### 14.6.13 Nup

For an OLT port of an IEEE 802.3 EPON link, the value is the effective index of refraction for the EPON upstream wavelength light of the optical path (see 13.1.4 and 13.7.1.2.2). The initialization value is 1.0. For all other ports, the value is 0.

#### 14.6.14 Ndown

For an OLT port of an IEEE 802.3 EPON link, the value is the effective index of refraction for the EPON downstream wavelength light of the optical path (see 13.1.4 and 13.7.1.2.1). The initialization value is 1.0. For all other ports, the value is 0.

#### 14.6.15 Acceptable Master Table Enabled

The value is equal to the Boolean acceptableMasterTableEnabled (see 13.1.3). If the time-aware system contains an ONU port attached to an IEEE 802.3 EPON link, the default value is TRUE. If the time-aware system does not contain an ONU port attached to an IEEE 802.3 EPON link, the default value is FALSE.

### 14.6.16 Port Parameter Data Set Table

There is one Port Parameter Data Set Table per port of a time-aware system. Each table row contains a set of parameters for each port that supports the time-synchronization capability as detailed in Table 14-6. Rows in the table can be created or removed dynamically in implementations that support dynamic configuration of ports and components.

**Table 14-6—Port Parameter Data Set Table**

Name	Data type	Operations supported*	Conformance+	References
Port Identity	Octet10	R	T	14.6.2
Port Role	Enumeration8	R	T	14.6.3, Table 14-5
Peer Mean Path Delay	scaledNs (recommended)	R	T	14.6.4
Delay Asymmetry	scaledNs (recommended)	RW	T (full-duplex IEEE 802.3 media only)	14.6.5
Neighbor Rate Ratio	Integer32	R	T	14.6.6

**Table 14-6—Port Parameter Data Set Table**

Name	Data type	Operations supported*	Conformance+	References
Log Mean Announce Interval	Integer8	RW	T	14.6.7
Announce Receipt Timeout	UInteger8	RW	T	14.6.8
Log Mean Sync Interval	Integer8	RW	T	14.6.9
Sync Receipt Timeout	UInteger8	RW	T	14.6.10
Log Mean Pdelay_Req Interval	Integer8	RW	T	14.6.11
Version Number	UInteger4	R	T	14.6.12
Nup	Double	RW	T (only for OLT ports attached to IEEE 802.3 EPON media)	14.6.13
Ndown	Double	RW	T (only for OLT ports attached to IEEE 802.3 EPON media)	14.6.14
Acceptable Master Table Enabled	Boolean	RW	T (only for ports of time-aware systems that contain an IEEE 802.3 EPON ONU port)	14.6.15
		*R= Read only access ; RW - Read/Write access	+T= Required for Time-aware port	

## 14.7 The Acceptable Master Table Parameter Data Set

### 14.7.1 Max Table Size

The value is the maximum size of the AcceptableMasterTable. It is equal to the maxTableSize member of the AcceptableMasterTable structure (see 13.1.3.2).

### 14.7.2 Actual Table Size

The value is the actual size of the AcceptableMasterTable. It is equal to the actualTableSize member of the AcceptableMasterTable structure (see 13.1.3.2), i.e., the current number of elements in the acceptable master array. The actual table size is less than or equal to the max table size. For a time-aware system that contains an ONU attached to an IEEE 802.3 EPON link, the initialization value is 1. For a time-aware system that does not contain an ONU attached to an IEEE 802.3 EPON link, the initialization value is 0.

### 14.7.3 Acceptable Master Array

Each element of this array is an AcceptableMaster structure. For a time-aware system that contains an ONU attached to an IEEE 802.3 EPON link, the array is initialized to contain a single entry. The acceptablePortIdentity member of the single entry is the portIdentity of the OLT port of the link that the ONU port is attached to. The alternatePriority1 member of the single entry is 246. For a time-aware system

**Table 14-7—Acceptable Master Table Parameter Data Set Table**

Name	Data type	Operations supported*	Conformance+	References
Max Table Size	implementation-specific	R	T (only for ports of time-aware systems that contain an IEEE 802.3 EPON ONU port)	14.7.1
Actual Table Size	implementation-specific	RW	T (only for ports of time-aware systems that contain an IEEE 802.3 EPON ONU port)	14.7.2
Acceptable Master Array	AcceptableMaster[ActualTableSize]	RW	T (only for ports of time-aware systems that contain an IEEE 802.3 EPON ONU port)	14.7.3

that does not contain an ONU attached to an IEEE 802.3 EPON link, the array is initialized to an empty array.