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Technical requirements for high accuracy time synchronization

高精度时间同步技术要求

(English Translation)

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1 Scope

This standard specifies the networking requirements for high-precision time synchronization, the performance index requirements for high-precision time synchronization, the reliability requirements for high-precision time synchronization networks, the basic requirements for equipment related to high-precision time synchronization.

This standard applies to high-precision time synchronization networks, based on ground transmission using PTP technology.

2 Normative references

The following documents are essential to the application of this document. For the dated documents, only the versions with the dates indicated are applicable to this document;

for the undated documents, only the latest version (including all the amendments) is applicable to this standard.

YD/T 900-1997 Technical requirement for SDH equipment - Clock

YD/T 1012-1999 Node clock set of digital synchronization network and its timing feature

YD/T 1479-2006 Technical requirements and testing methods of primary reference clock equipment

YD/T 2879-2015 (OAM) technical requirements based on the synchronous network operation management and maintenance of a packet network

ITU-T G.8262 Timing characteristics of synchronous Ethernet equipment slave clock

3 Abbreviations

The following abbreviations apply to this document.

1PPS. 1 Pulse Per Second

4.1 Classification of time synchronization precision

Air interface synchronization of wireless technologies, such as cdma2000, TD-SCDMA, TD-LTE, LTE-A, as well as applications such as multimedia broadcast/multicast service MBMS, have different requirements for time synchronization and frequency synchronization, as follows.

4.2 Requirements for high-precision time synchronization

This standard mainly stipulates the realization of high-precision time transmission and high-precision time synchronization networking, based on PTP technology.

5.1 Hierarchical structure of high-precision time synchronization network

Considering the fact that the transmission network in China is divided into the inter-provincial backbone transmission network layer, the inner-provincial backbone transmission network layer, the local transmission network layer, THEN, the hierarchical structure of high-precision time synchronization transmission is at most three levels, as shown in Figure 1.

The master-slave synchronization method shall be used, for high-precision time

5.2 Composition and basic functions of time synchronization device

The level-1 time synchronization device shall be composed of two cesium clocks and two satellite timing receivers, etc., which can be traced to a higher-level domestic time-keeping reference (for example, the National Time Service Center), through a dedicated comparison method.

5.3.1 General principles of time synchronization networking

Under normal circumstances, the time synchronization device shall prefer the signal of the satellite timing receiver. When the satellite signal is unavailable, the low-level time synchronization device shall trace to the high-level time synchronization device,

5.3.2 Relationship between time synchronization network and frequency

synchronization network

5.3.3.1 The principle of setting the timing reference of the level-1 time

synchronization

The principle of setting the timing reference of level-1 time synchronization is as follows.

5.3.3.2 The principle of setting the timing reference of the level-2 time

synchronization

The principle of setting the level-2 time synchronization timing reference is as follows.

6.1 Overview

The working state of the satellite timing receiver will cause changes in the time transmission link of the time synchronization network.

6.2 Allocation of performance indicators of time synchronization

network when satellite timing is available

6.3 Allocation of performance indicators of time synchronization

network when satellite timing service is unavailable

When the satellite timing service is unavailable, the time synchronization network's networking model is as shown in Figure 4. In this networking mode, the time source part may be connected to multiple time synchronization devices, in series.

7.1 High-precision time synchronization technology

The realization technology of high-precision time synchronization involves inter-office transmission technology and intra-office distribution technology.

7.2 Inter-office transmission technology

Interoffice transmission technology includes the following two categories.

7.3 Intra-office distribution technology

Intra-office distribution techniques include the following two categories.

8.1 Overview

At present, the high-precision time synchronization interfaces mainly include PTP interfaces and 1PPS+ToD interfaces. The PTP interfaces can be used for both inter-office and intra-office time distribution, whilst the 1PPS+ToD interface is only used for intra-office time distribution.

8.2.1 Overview

PTP time interface requirements include packet encapsulation, packet transmission mode, packet type, packet transmission interval, delay mechanism, One-step/Two-step mode.

8.2.3 PTP message transmission mode

For PTP packets using Ethernet II encapsulation format, PTP multicast mode shall be supported; unicast mode can be optionally supported. For UDP over IPv4/IPv6 or other encapsulation formats, PTP multicast mode and unicast mode can be supported.

Requirements for PTP multicast and unicast are as shown in IEEE 1588-2008.

8.2.5 PTP packet sending interval

The PTP packet sending frequency can be configured. The configuration range of the sending frequency and the default sending frequency are as shown in Table 3.

8.2.6 PTP delay mechanism

The PTP interface shall support the E2E delay mechanism; optionally support the P2P delay mechanism.

8.2.7 PTP One-step and Two-step mode

It shall support One-step mode; optionally support Two-step mode.

8.3 1PPS+ToD time interface

9.1 Reliability requirements for time sources

The reliability requirements of the time source are as follows.

9.2 Requirements for time synchronization device and time link settings

The requirements for time synchronization device and time link settings are as follows.