

Method, System and Device for Keeping Clock Synchronization of NTP Servers

Technical Field

The present document relates to the field of personality TV technologies, and in particular, to a method, system and apparatus for keeping clock synchronization of Network Time Protocol (NTP) servers.

Background of the Related Art

Most flows of business, for example, main businesses such as time shift businesses, TV of yesterday businesses, subscription businesses etc., of the Interactive Personality TV (IPTV) are dependent on the clock, with the rapid development of the IPTV, the pressure and responsibility of the NTP server are also growing greater and greater. The NTP server needs to provide NTP clock synchronization of various servers of the IPTV, and also provides NTP clock synchronization of the Set Top Box (STB). Since the time after the STB starts up is 1970 by default, the configuration of the NTP server does not limit the time difference and still provides the NTP clock synchronization service.

The NTP server of the IPTV (NTP-I server for short hereinafter) is configured to synchronize the clock from a telecommunication NTP server (NTP-T server for short hereinafter), and the NTP-T server is configured to not provide the NTP synchronization service if the time difference does not exceed 4S. The specific networking architecture is shown in Fig. 1, wherein, the NTP-T server provides the synchronization clock, and the NTP-I server synchronizes a clock signal from the NTP-T server to implement the clock synchronization, and synchronizes clocks of various business servers and STBs through an NTP synchronization (SYNC) signal.

If a clock jump for the NTP-I server exceeds 4S, due to the configuration of the NTP-T server, the operation of the NTP-I server synchronizing the clock from the NTP-T server will fail, and the error clock of the NTP-I server will be synchronized to all IPTV business servers

and STBs through the NTP service provided by itself, which results in clock disorder of the business servers and STBs, and generates abnormality of the business services.

Summary of the Invention

A method, system and apparatus for keeping clock synchronization of NTP servers are provided by the embodiments of the present document, which are used to solve problems such as clock disorder of the system and abnormality of the business service which may occurs when the clock synchronization of the NTP servers fails in the prior art.

In order to solve the above problem, the technical scheme of the present document is implemented as follows:

A method for keeping clock synchronization of Network Time Protocol NTP servers, comprising:

a first NTP-I server and a second NTP-I server synchronizing clocks from a telecommunication NTP-T server;

the first NTP-I server inquiring a first clock offset value between itself and the second NTP-I server according to a set time interval, inquiring a second clock offset value between itself and the NTP-T server when the first clock offset value exceeds a set time difference threshold, and correcting a local clock if the second clock offset value exceeds the set time difference threshold; and

the second NTP-I server inquiring a third clock offset value between itself and the first NTP-I server according to a set time interval, inquiring a fourth clock offset value between itself and the NTP-T server when the third clock offset value exceeds a set time difference threshold, and correcting a local clock if the fourth clock offset value exceeds the set time difference threshold.

Wherein, the first NTP-I server inquiring a first clock offset value between itself and the second NTP-I server according to a set time interval comprises:

the first NTP-I server transmitting a first clock offset inquiry request to the second NTP-I server according to the set inquiry time interval, and receiving the first clock offset value

between the second NTP-I server and itself returned by the second NTP-I server after receiving the first clock offset inquiry request.

Wherein, the second NTP-I server inquiring a third clock offset value between itself and the first NTP-I server according to a set time interval comprises:

the second NTP-I server transmitting a third clock offset inquiry request to the first NTP-I server according to the set inquiry time interval, and receiving the third clock offset value between the first NTP-I server and itself returned by first the NTP-I server after receiving the third clock offset inquiry request.

Wherein, the first NTP-I server inquiring a second clock offset value between itself and the NTP-T server, and correcting a local clock if the second clock offset value exceeds the set time difference threshold comprises:

the first NTP-I server transmitting a second clock offset inquiry request to the NTP-T server;

the first NTP-I server receiving the second clock offset value between the NTP-T server and itself and a standard clock of the NTP-T server returned by the NTP-T server after receiving the second clock offset inquiry request;

the first NTP-I server correcting the local clock according to the received standard clock when it is determined that the second clock offset value exceeds the set time difference threshold.

wherein, the second NTP-I server inquiring a fourth clock offset value between itself and the NTP-T server, and correcting a local clock if the fourth clock offset value exceeds the set time difference threshold comprises:

the first NTP-I server transmitting a second clock offset inquiry request to the NTP-T server;

the first NTP-I server receiving the second clock offset value between the NTP-T server and itself and a standard clock of the NTP-T server returned by the NTP-T server after receiving the second clock offset inquiry request;

the first NTP-I server correcting the local clock according to the received standard clock

when it is determined that the second clock offset value exceeds the set time difference threshold.

Wherein, the clock synchronization services are provided to business servers by the first NTP-I server and/or the second NTP-I server, and the clock synchronization services are provided to set top boxes by the first NTP-I server or the second NTP-I server.

A system for keeping clock synchronization of NTP servers, comprising:

a first NTP-I server, configured to synchronize a clock from a telecommunication NTP-T server; inquire a first clock offset value between itself and the second NTP-I server according to a set time interval, inquire a second clock offset value between itself and the NTP-T server when the first clock offset value exceeds a set time difference threshold, and correct a local clock if the second clock offset value exceeds the set time difference threshold; and

a second NTP-I server, configured to synchronize a clock from a telecommunication NTP-T server; inquire a third clock offset value between itself and the first NTP-I server according to a set time interval, inquire a fourth clock offset value between itself and the NTP-T server when the third clock offset value exceeds a set time difference threshold, and correct a local clock if the fourth clock offset value exceeds the set time difference threshold.

Wherein, the first NTP-I server is further configured to provide clock synchronization services to business servers and set top boxes; and the second NTP-I server is further configured to provide clock synchronization services to business servers and provide clock synchronization services to set top boxes.

An NTP server, comprising:

a clock synchronization module, configured to synchronize a clock from a telecommunication NTP-T server;

a first inquiry module, configured to inquire a first clock offset value between a first NTP-I server and a second NTP-I server according to a set time interval;

a second inquiry module, configured to inquire a second clock offset value between the first NTP-I server and the NTP-T server when the first clock offset value exceeds a set time difference threshold, and correct a local clock if the second clock offset value exceeds the set

time difference threshold.

Wherein, the first inquiry module is configured to:

transmit a first clock offset inquiry request to the second NTP-I server according to the set inquiry time interval, and

receive the first clock offset value between the second NTP-I server and the first NTP-I server returned by the second NTP-I server after receiving the first clock offset inquiry request.

Wherein, the second inquiry module is configured to:

transmit a second clock offset inquiry request to the NTP-T server when the first clock offset value exceeds the set time threshold;

receive the second clock offset value between the NTP-T server and the first NTP-I server and a standard clock of the NTP-T server returned by the NTP-T server after receiving the second clock offset inquiry request;

correct the local clock according to the received standard clock when it is determined that the second clock offset value exceeds the set time difference threshold.

The beneficial effects of the present document are as follows:

The method, system and apparatus for keeping clock synchronization of NTP servers provided by the embodiments of the present document are implemented by: a first NTP-I server and a second NTP-I server inquiring a clock offset value between itself and the opposite end, and when the first NTP-I server or the second NTP-I server finds that the clock offset value between itself and the opposite end exceeds a set time difference threshold, inquiring a clock offset value between itself and the NTP-T server; and correcting a local clock if the clock offset value between itself and the NTP-T server also exceeds the set time difference threshold. Thus, with the method, system and apparatus of the present document, problems such as clock synchronization failure of the NTP-I servers and disorder of clocks of the business servers and the STBs due to the synchronization failure are avoided, and normal synchronization of the NTP-I servers is ensured all the time, thus ensuring that the clock of the system is correct and enabling the system to operate normally.

Brief Description of Drawings

Fig. 1 is a diagram of networking architecture of an IPTV system in the prior art;

Fig. 2 is a diagram of a structure of a system for keeping clock synchronization of NTP servers according to an embodiment of the present document;

Fig. 3 is a flowchart of a method for keeping clock synchronization of NTP servers according to an embodiment of the present document; and

Fig. 4 is a diagram of a structure of an NTP server according to an embodiment of the present document.

Preferred Embodiments of the Invention

The embodiments of the present document provide a method for keeping clock synchronization of NTP servers, which is implemented by a system for keeping clock synchronization of NTP servers as shown in Fig. 2, wherein, the system comprises: a first NTP-I server, a second NTP-I server and a telecommunication NTP-T server.

The first NTP-I server is configured to synchronize a clock from a telecommunication NTP-T server; inquire a first clock offset value between itself and the second NTP-I server according to a set time interval, inquire a second clock offset value between itself and the NTP-T server when the first clock offset value exceeds a set time difference threshold, and correct a local clock if the second clock offset value exceeds the set time difference threshold.

The second NTP-I server is configured to synchronize a clock from the telecommunication NTP-T server; inquire a third clock offset value between itself and the first NTP-I server according to a set time interval, inquire a fourth clock offset value between itself and the NTP-T server when the third clock offset value exceeds a set time difference threshold, and corrects a local clock if the fourth clock offset value exceeds the set time difference threshold.

The above system further comprises a number of business servers and set top boxes. Wherein, the first NTP-I server is further configured to provide clock synchronization services to business servers and set top boxes; and the second NTP-I server is further configured to provide clock synchronization services to business servers and provide clock synchronization

services to set top boxes.

Specifically, the clock synchronization services are provided to business servers by the first NTP-I server and/or the second NTP-I server, and the clock synchronization services are provided to set top boxes by the first NTP-I server and/or the second NTP-I server.

The method for keeping clock synchronization of NTP servers provided by the embodiments of the present document, flowchart of which is shown in Fig. 3, comprises the following steps.

In step S11, a first NTP-I server and a second NTP-I server synchronize clocks from a telecommunication NTP-T server.

With respect to steps 0.1 and 0.2 shown in Fig. 2, the first NTP-I server and the second NTP-I server synchronize clocks from the NTP-T server, for example, transmitting an NTP synchronization (NTP SYNC) signal as shown in Fig. 2.

The services of the NTP synchronization system for the first NTP-I server and the second NTP-I server are configured, and the NTP server providing the standard clock is the telecommunication NTP-T server. The configuration files for configuring the first NTP-I server and the second NTP-I server are completely the same. The NTP process is started, to synchronize clocks from the NTP-T.

In addition, the first NTP-I server and the second NTP-I server provide clock synchronization to the business servers and set top boxes, for example, NTP SYNC as shown in the figure.

In step S12, the first NTP-I server inquires a first clock offset value between itself and the second NTP-I server according to a set time interval.

The first NTP-I server transmits a first clock offset inquiry request to the second NTP-I server according to the set inquiry time interval, and receives the first clock offset value between the second NTP-I server and itself returned by the second NTP-I server after receiving the first clock offset inquiry request.

With reference to Fig. 2, wherein, the first NTP-I server and the second NTP-I server install a clock Protection Program (NTP-PRO for short hereinafter) developed by themselves,

and configure an IP address of its own and an IP address of the opposite end, and configure a time difference threshold (LIMIT for short), for example, which can be 4S by default. The NTP-PRO process is started, which is a resident process, and is performed once every 10 seconds, and 10 seconds are the set time interval.

With reference to steps 1.1 and 1.2 in Fig. 2, they respectively are the first NTP-I server transmitting a clock offset inquiry request to the second NTP-I server and the second NTP-I server returning a clock offset value between itself and the first NTP-I server. In step S1.1, an “ntpdate -d {NTP-I-2}” command is used to perform clock offset inquiry, and what is returned in step S1.2 is a first clock offset value (OFFSET-REMOTE).

In step S13, whether the first clock offset value exceeds the set time difference threshold is determined. If so, step S14 is performed; otherwise, step S22 is performed.

The first clock offset value (OFFSET-REMOTE) is compared with the time difference threshold (LIMIT). When the first clock offset value (OFFSET-REMOTE) exceeds the time difference threshold (LIMIT), the subsequent inquiry operation is performed; otherwise, the clock is considered to be normal, and no operation is performed.

In step S14, the first NTP-I server inquiries a second clock offset value between itself and the NTP-T server.

When the first clock offset value exceeds the set time difference threshold, the first NTP-I server inquires a second clock offset value between itself and the NTP-T server.

The first NTP-I server transmits a second clock offset inquiry request to the NTP-T server; receives the second clock offset value between the NTP-T server and itself and a standard clock of the NTP-T server returned by the NTP-T server after receiving the second clock offset inquiry request; and the first NTP-I server corrects the local clock according to the received standard clock when it is determined that the second clock offset value exceeds the set time different threshold.

With reference to steps 1.3 and 1.4 shown in Fig. 2, they respectively are the first NTP-I server transmitting a clock offset inquiry request to the NTP-T server and the NTP-T server returning a clock offset value between itself and the first NTP-I server. In step S1.3, an “ntpdate

-d {NTP-T}" command is used to perform clock offset inquiry, and what is returned in step S1.4 is a second clock offset value (OFFSET-SERVER) and a standard clock (SERVER-TIME for short) of the NTP-T server, i.e., the current time of the NTP-T server.

In step S15, whether the second clock offset value exceeds the set time difference threshold is determined.

The second clock offset value (OFFSET-SERVER) is compared to determine whether the time difference threshold (LIMIT) is exceeded.

If so, step S16 is performed; otherwise, step S22 is performed.

In step S16, the local clock is corrected.

If the second clock offset value exceeds the set time difference threshold, the local clock is corrected.

If the second clock offset value (OFFSET-SERVER) exceeds the time difference threshold (LIMIT), the local clock is considered to be abnormal, and the local clock is corrected to be the same as the SERVER-TIME immediately; otherwise, the clock of the second NTP-I server is considered to be abnormal, and no operation is performed by the first NTP-I server.

In step S17, the second NTP-I server inquiries a third clock offset value between itself and the first NTP-I server according to a set time interval.

The second NTP-I server transmits a third clock offset inquiry request to the first NTP-I server according to the set inquiry time interval, and receives the third clock offset value between the first NTP-I server and itself returned by first the NTP-I server after receiving the third clock offset inquiry request.

With reference to Fig. 2, wherein, the first NTP-I server and the second NTP-I server install a clock Protection Program (NTP-PRO for short hereinafter) developed by themselves, configure an IP address of its own and an IP address of the opposite end, and configure a time difference threshold (LIMIT for short), for example, which can be 4S by default. The NTP-PRO process is started, which is a resident process, and is performed once every 10 seconds, and 10 seconds are the set time interval.

With reference to steps 2.1 and 2.2 in Fig. 2, they respectively are the second NTP-I server

transmitting a clock offset inquiry request to the first NTP-I server and the first NTP-I server returning a clock offset value between itself and the second NTP-I server. In step S2.1, an “ntpdate -d {NTP-I-1}” command is used to perform clock offset inquiry, and what is returned in step S2.2 is a first clock offset value (OFFSET-REMOTE).

In step S18, whether the third clock offset value exceeds the set time difference threshold is determined. If so, step S19 is performed; otherwise, step S22 is performed.

The third clock offset value (OFFSET-REMOTE) is compared with the time difference threshold (LIMIT). When the third clock offset value (OFFSET-REMOTE) exceeds the time difference threshold (LIMIT), the subsequent inquiry operation is performed; otherwise, the clock is considered to be normal, and no operation is performed.

In step S19, the second NTP-I server inquiries a fourth clock offset value between itself and the NTP-T server.

When the third clock offset value exceeds the set time difference threshold, the second NTP-I server inquiries a fourth clock offset value between itself and the NTP-T server.

The first NTP-I server transmits a second clock offset inquiry request to the NTP-T server; receives the second clock offset value between the NTP-T server and itself and a standard clock of the NTP-T server returned by the NTP-T server after receiving the second clock offset inquiry request; and the first NTP-I server corrects the local clock according to the received standard clock when it is determined that the second clock offset value exceeds the set time different threshold.

With reference to steps 2.3 and 2.4 shown in Fig. 2, they respectively are the second NTP-I server transmitting a clock offset inquiry request to the NTP-T server and the NTP-T server returning a clock offset value between itself and the second NTP-I server. In step S2.3, an “ntpdate -d {NTP-T}” command is used to perform clock offset inquiry, and what is returned in step S2.4 is a fourth clock offset value (OFFSET-SERVER) and a standard clock (SERVER-TIME for short) of the NTP-T server, i.e., the current time of the NTP-T server.

In step S20, whether the fourth clock offset value exceeds the set time difference threshold is determined.

The fourth clock offset value (OFFSET-SERVER) is compared to determine whether the time difference threshold (LIMIT) is exceeded.

If so, step S21 is performed; otherwise, step S22 is performed.

In step S21, the local clock is corrected.

If the fourth clock offset value exceeds the set time difference threshold, the local clock is corrected.

If the fourth clock offset value (OFFSET-SERVER) exceeds the time difference threshold (LIMIT), the local clock is considered to be abnormal, and the local clock is corrected to be the same as the SERVER-TIME immediately; otherwise, the clock of the first NTP-I server is considered to be abnormal, and no operation is performed by the second NTP-I server.

In step S22, the procedure ends.

In the above method, one NTP-I server is added in the IPTV system, to implement complementation between two NTP-I servers. The clock protection programs are started in both NTP-I servers, to implement protection and correction of the clocks with each other. For the business servers, one of two NTP-I servers can be the master NTP-I server and the other one can be the slave NTP-I server, and for the set top boxes, one of the NTP-I servers is selected as a server for providing the clock.

Based on the above method and system for keeping clock synchronization of NTP servers provided by the embodiments of the present document, the embodiments of the present document further provide an NTP server, of which the structure is shown in Fig. 4, comprises: a clock synchronization module 101, a first inquiry module 102, and a second inquiry module 103.

The clock synchronization module 101 is configured to synchronize a clock from a telecommunication NTP-T server.

The first inquiry module 102 is configured to inquire a first clock offset value between the first NTP-I server and the second NTP-I server according to a set time interval.

The second inquiry module 103 is configured to inquire a second clock offset value between the first NTP-I server and the NTP-T server when the first clock offset value exceeds a

set time difference threshold, and correct a local clock if the second clock offset value exceeds the set time difference threshold.

Preferably, the above first inquiry module 102 is specifically configured to transmit a first clock offset inquiry request to the second NTP-I server according to the set inquiry time interval; and receive the first clock offset value between the second NTP-I server and the first NTP-I server returned by the second NTP-I server after receiving the first clock offset inquiry request;

preferably, the above second inquiry module 103 is specifically configured to transmit a second clock offset inquiry request to the NTP-T server when the first clock offset value exceeds the set time threshold; receive the second clock offset value between the NTP-T server and the first NTP-I server and a standard clock of the NTP-T server returned by the NTP-T server after receiving the second clock offset inquiry request; correct the local clock according to the received standard clock when it is determined that the second clock offset value exceeds the set time difference threshold.

The above method and system for keeping clock synchronization of NTP servers provided by the embodiments of the present document are suitable for the protection when the NTP server is abnormal, and ensure that the business service will not be abnormal when the NTP server is abnormal, which effectively avoids the hidden danger of the clock being abnormal which exists when the NTP server is a single point device, and avoids the abnormality of the business service and clock disorder of the system due to the clock jump of the NTP.

The above description is only the preferred embodiments of the present document and is not intended to limit the protection scope of the present document.

What is claimed is:

1. A method for keeping clock synchronization of Network Time Protocol NTP servers, comprising:

a first NTP-I server and a second NTP-I server synchronizing clocks from a telecommunication NTP-T server;

the first NTP-I server inquiring a first clock offset value between the first NTP-I server and the second NTP-I server according to a set time interval, inquiring a second clock offset value between the first NTP-I server and the NTP-T server when the first clock offset value exceeds a set time difference threshold, and correcting a local clock if the second clock offset value exceeds the set time difference threshold; and

the second NTP-I server inquiring a third clock offset value between the second NTP-I server and the first NTP-I server according to a set time interval, inquiring a fourth clock offset value between the second NTP-I server and the NTP-T server when the third clock offset value exceeds a set time difference threshold, and correcting a local clock if the fourth clock offset value exceeds the set time difference threshold.

2. The method according to claim 1, wherein, the first NTP-I server inquiring a first clock offset value between the first NTP-I server and the second NTP-I server according to a set time interval comprises:

the first NTP-I server transmitting a first clock offset inquiry request to the second NTP-I server according to the set inquiry time interval, and receiving the first clock offset value between the second NTP-I server and the first NTP-I server returned by the second NTP-I server after receiving the first clock offset inquiry request.

3. The method according to claim 1, wherein, the second NTP-I server inquiring a third clock offset value between the second NTP-I server and the first NTP-I server according to a set time interval comprises:

the second NTP-I server transmitting a third clock offset inquiry request to the first NTP-I server according to the set inquiry time interval, and receiving the third clock offset value between the first NTP-I server and the second NTP-I server returned by first the NTP-I server

after receiving the third clock offset inquiry request.

4. The method according to claim 1, wherein, the first NTP-I server inquiring a second clock offset value between the first NTP-I server and the NTP-T server, and correcting a local clock if the second clock offset value exceeds the set time difference threshold comprises:

the first NTP-I server transmitting a second clock offset inquiry request to the NTP-T server;

the first NTP-I server receiving the second clock offset value between the NTP-T server and the first NTP-I server and a standard clock of the NTP-T server returned by the NTP-T server after receiving the second clock offset inquiry request;

the first NTP-I server correcting the local clock according to the received standard clock when it is determined that the second clock offset value exceeds the set time difference threshold.

5. The method according to claim 1, wherein, the second NTP-I server inquiring a fourth clock offset value between the second NTP-I server and the NTP-T server, and correcting a local clock if the fourth clock offset value exceeds the set time difference threshold comprises:

the first NTP-I server transmitting a second clock offset inquiry request to the NTP-T server;

the first NTP-I server receiving the second clock offset value between the NTP-T server and the first NTP-I server and a standard clock of the NTP-T server returned by the NTP-T server after receiving the second clock offset inquiry request;

the first NTP-I server correcting the local clock according to the received standard clock when it is determined that the second clock offset value exceeds the set time difference threshold.

6. The method according to any of claims 1-5, wherein, the clock synchronization services are provided to business servers by the first NTP-I server and/or the second NTP-I server, and the clock synchronization services are provided to set top boxes by the first NTP-I server or the second NTP-I server.

7. A system for keeping clock synchronization of NTP servers, comprising:

a first NTP-I server, configured to synchronize a clock from a telecommunication NTP-T server; inquire a first clock offset value between the first NTP-I server and the second NTP-I server according to a set time interval, inquire a second clock offset value between the first NTP-I server and the NTP-T server when the first clock offset value exceeds a set time difference threshold, and correct a local clock if the second clock offset value exceeds the set time difference threshold; and

a second NTP-I server, configured to synchronize a clock from a telecommunication NTP-T server; inquire a third clock offset value between the second NTP-I server and the first NTP-I server according to a set time interval, inquire a fourth clock offset value between the second NTP-I server and the NTP-T server when the third clock offset value exceeds a set time difference threshold, and correct a local clock if the fourth clock offset value exceeds the set time difference threshold.

8. The system according to claim 7, wherein, the first NTP-I server is further configured to provide clock synchronization services to business servers and set top boxes; and the second NTP-I server is further configured to provide clock synchronization services to business servers and provide clock synchronization services to set top boxes.

9. An NTP server, comprising:

a clock synchronization module, configured to synchronize a clock from a telecommunication NTP-T server;

a first inquiry module, configured to inquire a first clock offset value between a first NTP-I server and a second NTP-I server according to a set time interval;

a second inquiry module, configured to inquire a second clock offset value between the first NTP-I server and the NTP-T server when the first clock offset value exceeds a set time difference threshold, and correct a local clock if the second clock offset value exceeds the set time difference threshold.

10. The NTP server according to claim 9, wherein, the first inquiry module is configured to:

transmit a first clock offset inquiry request to the second NTP-I server according to the set

inquiry time interval, and

receive the first clock offset value between the second NTP-I server and the first NTP-I server returned by the second NTP-I server after receiving the first clock offset inquiry request.

5 11. The NTP server according to claim 9, wherein, the second inquiry module is configured to:

transmit a second clock offset inquiry request to the NTP-T server when the first clock offset value exceeds the set time threshold;

10 receive the second clock offset value between the NTP-T server and the first NTP-I server and a standard clock of the NTP-T server returned by the NTP-T server after receiving the second clock offset inquiry request;

correct the local clock according to the received standard clock when it is determined that the second clock offset value exceeds the set time difference threshold.

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