

METHOD AND DEVICE FOR TOPOLOGY DISCOVERY AND CONNECTIVITY VERIFICATION IN ROADM SYSTEM

TECHNICAL FIELD OF THE DISCLOSURE

[0001] The present disclosure relates to the technical field of optical communication, and in particular, relates to a method and a device for topology discovery and connectivity verification in a ROADM system.

BACKGROUND

[0002] A reconfigurable optical add-drop multiplexer (ROADM) performs the functions of routing and adding/dropping optical signal in an optical line system. The ROADM may switch the flow of a wavelength division multiplexing (WDM) system at a wavelength layer. For example, the ROADM may add, drop, or route individual or multiple wavelengths used for carrying data without converting an optical signal from an optical domain to an electronic domain and back again.

[0003] The ROADM may schedule services at an optical network wavelength level and is an important component of intelligent all-optical network. In an implementation mode of the ROADM, a wavelength selective switch (WSS) is mainly used currently, and both an up-wave function and a down-wave function are realized by using the WSS. However, the WSS is comparatively expensive, and it is not conducive to cost control if the WSS is used for both the up-wave function and the down-wave function. In addition, the ROADM card need to be interconnected through an optical fiber, and the conventional mode of the ROADM card-optical fiber interconnection in different direction inside the ROADM node is connected manually according to a pre-planned connection diagram. However, there are many optical fiber links interconnected between ROADM cards, and there is a possibility of errors caused by manual connection.

[0004] In view of the above situation, how to overcome the defects existing in the prior art to solve the problem of high cost and the problem that errors are prone to occur in manual connections of conventional optical fiber links, is a difficult problem to be solved in the present technical field.

SUMMARY

[0005] Aiming at the above-mentioned defects or improvement requirements of the prior art, the present disclosure provides a method and device for topology discovery and connectivity verification in a ROADM system, and the down-wave is realized by an optical splitter, saving the cost; for the optical fiber link connection between the ROADM cards, it can be automatic to discover the topology, connect the ROADM cards, and verify the connection thereof.

[0006] Embodiments of the present disclosure use the following technical solutions.

[0007] In a first aspect, the present disclosure provides a method for topology discovery and connectivity verification in a ROADM system, comprising:

[0008] sending, by any device for topology discovery and connectivity verification in the ROADM system after being powered on, its own first device information, in a broadcasting manner to other device(s) for topology discovery and connectivity verification in the ROADM system, wherein the first device information comprises one or more of an identifier of a source chassis, a single disk slot number of a source single disk, and a port number of a WSS of a source single disk where a test light signal on a single disk is located;

[0009] by any device for topology discovery and connectivity verification in the ROADM system, receiving test light information from a port of the WSS, saving the first device information, in the test light information, of other device(s) for topology discovery and connectivity verification in the ROADM system as second device information, and superposing the first device information and the second device information and then sending to other device(s) for topology discovery and connectivity verification in the ROADM system, wherein the second device information comprises one or more of a received identifier of the chassis, a received single disk slot number, and a port number of a WSS where the received test light signal on a single disk is located;

[0010] comparing, by any device for topology discovery and connectivity verification in the ROADM system, its own first device information with the second device information in the received information, and if the information is consistent with each other, this link pairing succeeding, and then performing pairing record to its own first device information and the first device information in the received information.

[0011] Further, after completing the link pairing, each device for topology discovery and connectivity verification in the ROADM system compares the pairing record with the pre-input corresponding relationship of each port so as to verify whether the

connection is correct or not.

[0012] Further, a distribution function of any device for topology discovery and connectivity verification in the ROADM system in a test light sending direction is realized through an optical splitter; and an up-wave function of the device for topology discovery and connectivity verification in the ROADM system in a test light receiving direction is realized through a WSS.

[0013] In a second aspect, the present disclosure provides another method for topology discovery and connectivity verification in a ROADM system, comprising:

[0014] sending, by any device for topology discovery and connectivity verification in the ROADM system after being powered on, test light information with its own fixed code in a broadcasting manner to other device(s) for topology discovery and connectivity verification in the ROADM system;

[0015] determining, by any device for topology discovery and connectivity verification in the ROADM system, the fixed code therein when receiving the test light information sent by other device(s) for topology discovery and connectivity verification in the ROADM system, and completing link pairing between the devices if a device represented by the fixed code is its own preset pairing device.

[0016] Further, when receiving the test light information sent by other device(s) for topology discovery and connectivity verification in the ROADM system, any device for topology discovery and connectivity verification in the ROADM system switches a port using a preset port switching rule, and records a time point of receiving the same fixed code in each port, and determines whether a corresponding port is a port matched with the device represented by the corresponding fixed code according to the received time point.

[0017] Further, that when receiving the test light information sent by other device(s) for topology discovery and connectivity verification in the ROADM system, any device for topology discovery and connectivity verification in the ROADM system switches a port using a preset port switching rule, and records a time point of receiving the same fixed code in each port, and determines whether a corresponding port is a port matched with the device represented by the corresponding fixed code according to the received time point, comprises:

[0018] presetting a port switching rule, and sequentially switching one port of a WSS in said any device for topology discovery and connectivity verification in the ROADM system every other time period;

[0019] obtaining a match relationship between a preset port and other device(s) for topology discovery and connectivity verification in the ROADM system, and converting the match relationship between the port and other device(s) for topology discovery and connectivity verification in the ROADM system into a match relationship between the time period and other device(s) for topology discovery and connectivity verification in the ROADM system;

[0020] for the fixed code sent by other device(s) for topology discovery and connectivity verification in the ROADM system, recording the time points thereof received in each port, and determining whether the time period where the time point received by the corresponding port is located is matched with the preset device or not, and then if it does, establishing link pairing between the corresponding port and the corresponding device.

[0021] In a third aspect, the present disclosure provides a device for topology discovery and connectivity verification in a ROADM system for achieving the methods in accordance with the first and second aspects, the device comprising a test light sending function module, a distribution function module, an up-wave function module, a test light reception function module and a control function module,

[0022] wherein the test light sending function module is used for sending a test light signal;

[0023] the distribution function module is used for multiplexing and then multiply distributing both the service light signal, and the test light signal which is sent from the test light sending function module;

[0024] the up-wave function module is used for separating the service light signal from the test light signal, and switching different ports for receiving the test light signal and sending the test light signal to the test light reception function module;

[0025] the test light reception function module is used for receiving the test light signal; and

[0026] the control function module is used for controlling work of each module.

[0027] Further, the distribution function module comprises an optical splitter which can be realized in a cascading mode or realized by a single device.

[0028] Further, the up-wave function module comprises a WSS.

[0029] Further, each of the distribution function module and the up-wave function module further comprise a WDM, wherein the WDM of the distribution function module is connected with the optical splitter so as to realize a multiplexing function of

the service light signal and the test light signal, and the WDM of the up-wave function module is connected with the WSS, in order to realize a demultiplexing function of the service light signal and the test light signal.

[0030] Compared with the prior art, the beneficial effects of the present disclosure are as follows: the down-wave is realized by an optical splitter, saving the cost; for the optical fiber link connection between the ROADMs, it can be automatic to discover the topology, perform the link connection, and verify the correctness of the connection thereof, thereby avoiding the problem that errors are prone to occur in manual connections of conventional optical fiber links.

BRIEF DESCRIPTION OF THE DRAWINGS

[0031] In order to more clearly explain the technical solutions of the embodiments of the present disclosure, the drawings required to be used in the embodiments of the present disclosure are briefly introduced in the followings. Obviously, the drawings in the following description are some embodiments of the present disclosure, and for those skilled in the art, other drawings may be obtained according to these drawings without any inventive labor.

[0032] FIG. 1 is a schematic diagram of module connection of a device for topology discovery and connectivity verification in a ROADM system according to Embodiment 1 of the present disclosure.

[0033] FIG. 2 is a schematic diagram of a first implementation mode of a distribution function module according to Embodiment 1 of the present disclosure.

[0034] FIG. 3 is a schematic diagram of a second implementation mode of a distribution function module according to Embodiment 1 of the present disclosure.

[0035] FIG. 4 is a schematic diagram of a first implementation mode of an up-wave function module according to Embodiment 1 of the present disclosure.

[0036] FIG. 5 is a schematic diagram of a second implementation mode of an up-wave function module according to Embodiment 1 of the present disclosure.

[0037] FIG. 6 is a flowchart of a method for topology discovery and connectivity verification in a ROADM system according to Embodiment 2 of the present disclosure.

[0038] FIG. 7 is a schematic diagram of a specific scenario according to Embodiment 2 of the present disclosure.

[0039] FIG. 8 is another flowchart of a method for topology discovery and

connectivity verification in a ROADM system according to Embodiment 3 of the present disclosure.

[0040] FIG. 9 is a schematic diagram of an extension process of Step 20 in Embodiment 3 of the present disclosure.

[0041] FIG. 10 is a schematic structural diagram of an apparatus for topology discovery and connectivity verification in a ROADM system according to Embodiment 4 of the present disclosure.

DETAILED DESCRIPTION

[0042] In order to make the objectives, technical solutions and advantages of the present disclosure clearer, the present disclosure will be further described in detail below with reference to the drawings and embodiments. It should be understood that the specific embodiments described herein are only used to explain the present disclosure and are not intended to limit the present disclosure.

[0043] In addition, the technical features involved in various embodiments of the present disclosure described below can be combined with each other as long as they do not conflict with each other. The present disclosure will be described in detail below with reference to the combination of the drawings and embodiments.

[0044] Embodiment 1

[0045] As shown in FIG. 1, Embodiment 1 of the present disclosure provides a device for topology discovery and connectivity verification in a ROADM system, comprising a distribution function (Distr func) module 110, an up-wave function (Up-wave func) module 120, a test light sending function module (TLSFM) 130, a test light reception function module (TLRFM) 140, and a control function (Con func) module 150, wherein the test light sending function module 130 is used for sending a test light signal; the distribution function module 110 is used for multiply distributing both a service light signal, and the test light signal which is sent from the test light sending function module 130 after the two are multiplexed; the up-wave function module 120 is used for separating the service light signal from the test light signal, and switching different ports so as to receive the test light signal and send the received test light signal to the test light reception function module 140; the test light reception function module 140 is used for receiving the test light signal; and the control function module 150 is used for controlling the work of each module.

[0046] The distribution function module 110 of the present embodiment comprises an

optical splitter, and the up-wave function module 120 comprises a WSS. In addition, each of the distribution function module 110 and the up-wave function module 120 may further comprise a WDM, wherein the WDM of the distribution function module 110 is connected with the optical splitter so as to realize the multiplexing function of the service light signal and the test light signal, and the WDM of the up-wave function module 120 is connected with the WSS, in order to realize the demultiplexing function of the service light signal and the test light signal.

[0047] Specifically, with reference to FIG. 1, the distribution function module 110 of the present embodiment realizes the multiplexing of both the test light signal sent by the test light sending function module 130 from a direction of 400a and the service light signal sent from a direction of 200a, and then sending the two light signals out from a direction of 300a.

[0048] In the present embodiment, in the distribution function module 110, the signal sent from the direction of 200a is a WDM signal, i.e. the wavelength of each signal is different, and the test optical signal sent from the direction of 400a is a signal with a different wavelength from that sent from the direction of 200a.

[0049] In the present embodiment, the distribution function module 110 comprises an optical splitter Splitter, and the attenuation of each path in the optical splitter Splitter may be the same or different. The Implementation mode of the Splitter can be realized in a cascading mode, and can also be realized by a single device.

[0050] In the present embodiment, in the distribution function module 110, the signal sent from the direction of 200a and the signal sent from the direction of 400a can be multiplexed by using a coupler, and can also be multiplexed by using a wavelength division multiplexing device (WDM). When a coupler is used for multiplexing, the implementation mode of the distribution function module 110 is as shown in FIG. 2 that the Splitter, through a conversion of 2:n, multiplexes the signals in two directions and then distributes the multiplexed signals through n path; and when a WDM is used for multiplexing, the implementation mode of the distribution function module 110 is as shown in FIG. 3, that firstly, the WDM multiplexes the signals in two directions, and then the Splitter, through a conversion of 1:n, distributes the signals in n paths.

[0051] In the present embodiment, in the direction of 300a, the signals sent out from a1, a2 to an are the same; that is, the signal in each port comprises both the test light signal sent by the test light sending function module 130 which is sent from the direction of 400a and the service light signal sent from the direction of 200a.

[0052] In the present embodiment, the up-wave function module 120 is realized by using the WSS, and the up-wave function module 120 will send the service light signal from a direction of 200b, and send the test light signal from the direction of 400b. The separation of the test light signal and the service light signal is realized.

[0053] In the present embodiment, the separation function between the test light signal and the service light signal in the up-wave function module 120 can be realized through the WSS per se, and can be realized through the WDM too. When being realized through the WSS per se, the implementation manner of the up-wave function module 120 is as shown in FIG. 4, and in this case, the WSS per se has a separation function; when being realized through the WDM, the implementation mode of the up-wave function module 120 is as shown in FIG. 5, that the signal passing through the WSS is separated into a service light signal and a test light signal after passing through the WDM, and then they are sent out respectively.

[0054] In the present embodiment, the wavelength range of the WSS of the up-wave function module 120 comprises a wavelength of the test light signal sent from the direction of 400a and a wavelength of the service light signal sent from the direction of 200a.

[0055] In the present embodiment, the WSS of the up-wave function module 120 continuously switches a wavelength channel of the test light signal at ports b1 to bn, and the sequence of switching is not limited. It may be switched sequentially or randomly. The residence time of the test light signal at ports b1 to bn may be the same, and can also be different.

[0056] In the present embodiment, only one pair of optical fibers is connected between each pair of ROADM single disks to realize the interconnection between the single disks, wherein each ROADM single disk is one of the above-mentioned devices, and each ROADM single disk comprises the distribution function module 110, the up-wave function module 120, the test light sending function module 130, the test light reception function module 140 and the control function module 150.

[0057] Through the above-mentioned devices, the optical splitter is used for realizing the up-wave function, thereby saving the cost.

[0058] Embodiment 2

[0059] Based on the device for topology discovery and connectivity verification in a ROADM system provided in the embodiment 1, the present embodiment 2 provides a method for topology discovery and connectivity verification in a ROADM system,

and as shown in FIG. 6, the method comprises the following steps:

[0060] Step 100: sending, by any device after being powered on, its own first device information in a broadcasting manner to other device(s), wherein the first device information comprises one or more of an identifier of a source chassis, a single disk slot number of a source single disk, and a port number of a WSS of a source single disk where a test light signal on a single disk is located.

[0061] Step 200: receiving, by any device, test light information sent by a port of the WSS, saving first device information of other device(s) in the test light information as second device information, and superposing the first device information and the second device information and then sending the superposed first device information and second device information to other device(s), wherein the second device information comprises one or more of a received identifier of the chassis, a received single disk slot number, and a port number of a WSS where the received test light signal on the single disk is located.

[0062] Step 300: comparing, by any device, its own first device information with the second device information in the received information, and this link pairing being successful if the information is consistent with each other, and then performing pairing record to its own first device information and the first device information in the received information. Through the above steps, the discovery of the topology among each device in the ROADM system can be realized.

[0063] In addition, the method may further comprise step 400: comparing, by each device after completing the link pairing, the pairing record with a pre-input corresponding relationship of each port so as to verify whether the connection is correct or not. Through this step, the correctness of link connection can be determined. In the present embodiment, the distribution function of any device in a test light sending direction is realized through an optical splitter; and the up-wave function of any device in the test light receiving direction is realized through the WSS.

[0064] The above is an overview for the method of the present embodiment, and the method of the present embodiment will be described in more detail below by taking a single disk as a device as an example.

[0065] Taking a single disk in the ROADM system as an example, the implementation mode of the topology discovery function of the embodiment is as follows. As soon as the single disk is powered on, the information sent by each service disk from the test light sending function module 130 comprises but is not limited to the following

information: an identifier of a source chassis + a single disk slot number of a source single disk + a port number of a WSS of a source single disk where a test light signal on a single disk is located. The identifier of the chassis only needs to be unique, which may be a name, a certain serial number, or an IP address. The sequence of the above-mentioned information is not limited either.

[0066] The test light reception function module 140 of the single disk receives the test light information sent from a certain port of the WSS ports b1 to bn. It is which port is known by the single disk per se, because from which port of b1 to bn the test light enters exactly is realized by the single disk through configuring a channel of the WSS.

[0067] When the received information comprises the information sent by other single disks: an identifier of a source chassis + a slot number of a source single disk + a port number of a WSS of a source single disk where a test light signal on a single disk is located, the information is saved as: a received identifier of a chassis + a received slot number of a single disk + a received port number of a WSS where a test light signal on a single disk is located. The sequence of the information is not limited. Then the information is sent out along with the information including the present single disk; that is, the information sent out comprises, but is not limited to, the following information: an identifier of a source chassis + a slot number of a source single disk + a port number of a WSS of a source single disk where a test light signal on a single disk is located + a received identifier of a chassis + a received slot number of a single disk + a received port number of a WSS where a test light signal on a single disk is located. The sequence of the information is not limited.

[0068] When receiving information next time, the single disk compares the information of the present single disk, i.e. an identifier of a source chassis + a single disk slot number of a source single disk + a port number of a WSS of a source single disk where a test light signal on a single disk, with the information, i.e. a received identifier of a chassis + a received slot number of a single disk + a received port number of a WSS where a test light signal on a single disk is located, in the received information (an identifier of a source chassis + a slot number of a source single disk + a port number of a WSS of a source single disk where a test light signal on a single disk is located + a received identifier of a chassis + a received slot number of a single disk + a received port number of a WSS where a test light signal on a single disk is located), and if the information is consistent with each other, this link pairing is successful, then it records both the information of the present single disk, i.e. the

current information of an identifier of a source chassis + a slot number of a source single disk + a port number of a WSS of a source single disk where a test light signal on a single disk is located, and the information in the received information of an identifier of a source chassis + a slot number of a source single disk + a port number of a WSS where a test light signal on a single disk of a source single disk is located, and then records both the information in pairing.

[0069] Each single disk continuously performs the above operation to complete topology discovery. Finally, each single disk can be compared with the input corresponding relationship of each port after topology discovery is completed, so as to realize the connectivity verification function. The input corresponding relationship of each port may be loaded from the network to each single disk, or may be manually input depending on the corresponding relationships advanced planned.

[0070] The topology discovery of the present embodiment will be described in more detail below by using a specific scene.

[0071] As shown in FIG. 7, in this scenario, three devices are provided, namely three single disks, wherein an upper device is referred to as E, assuming that the chassis identifier thereof is E, the slot number thereof is 1, and the port number of the WSS where the test light wavelength is located on the current single disk is b1, then the information sent by this single disk is E1b1 as soon as this single disk is powered on. A device on the left and blow side is referred to as F, assuming that the chassis identifier thereof is F, the slot number thereof is 1, and the port number of the WSS where the test light wavelength is located on the current single disk is b2, then the information sent by the single disk is F1b2 as soon as this single disk is powered on.

[0072] Since the port a1 of the upper single disk E is connected to the port b2 of the left single disk F, and the port b1 of the upper single disk E is connected to the port a2 of the left single disk F, there is a link connection between the two single disks, and the WSS test light signal of the upper single disk E is located at the port b1, and the test light signal of the WSS of the left single disk F is located at the port b2, whereby the intercommunication is realized between the two single disks.

[0073] When the information received by the receipt function module of the upper single disk E is F1b2, this received information is translated into the received information F1b2, and then is added after the originally sent information for sending; that is, the subsequently sent information is E1b1F1b2.

[0074] When the left single disk F receives the information E1b1F1b2 sent by the

upper single disk E, the current port of the left single disk F is represented as F1b2, and it is compared with the latter part information F1b2 in the received information E1b1F1b2. Then if the two are consistent with each other, it indicates the pairing is successful, and in a specific implementation, a pairing result can be determined by sending multiple times and receiving multiple times. For example, there is a limitation that the success of the pairing is more than 3 times continuously.

[0075] Similarly, the left single disk F will receives the information E1b1 sent by the upper single disk E, and translate this received information into the received information E1b1, and then add the received information after the originally sent information for sending; that is, the subsequently sent information is F1b2E1b1. After the upper single disk E receives the information F1b2E1b1 sent by the left single disk F, the latter part of information E1b1 is compared with the current port number, and if the current port number is just E1b1, the pairing between the two is successful.

[0076] Meanwhile, for the single disk on the right and below side, it is assumed that the current device number thereof is G, the slot number thereof is 1, and the port of the WSS where the test light is located is b1. Since the single disk E and the single disk F are in communication with each other at this time, and the port a2 of the single disk E and the port b1 of the single disk G are connected with each other, for the E, the information E1b1F1b2 sent at the moment is sent out through the distribution function module which is mainly realized through the optical splitter Splitter, and the information sent by each port is the same. Therefore, the information E1b1F1b2 is also sent from the port a2 of the single disk E. And it is assumed that the port of the test light of the single disk G is the port b1 at the moment, so that such information is also received by the port b1. However, the single disk G will compare the latter half part F1b2 in the received information E1b1F1b2 with the current port information G1b1 of the test light of the present single disk, and if the two are inconsistent, the pairing fails.

[0077] Only one of the formats of the above-mentioned information is listed, and the implementation format of the information is not limited in the real implementation.

[0078] In summary, the embodiment of the present disclosure uses the optical splitter to realize the down-wave function, thus saving the cost; for the optical fiber link connection between the ROADMs, the topology discovery can be automatically performed, the match connection can be automatically performed, and the correctness of the connection thereof can be automatically verified, thereby avoiding the problem

that errors are prone to occur in manual connections of conventional optical fiber links.

[0079] Embodiment 3

[0080] Based on the device for topology discovery and connectivity verification in a ROADM system provided in the embodiment 1, the present embodiment 3 provides another method for topology discovery and connectivity verification in a ROADM system. As shown in FIG. 8, the method comprises the following steps:

[0081] Step 10, sending, by any device after being powered on, test light information including its own fixed code in a broadcasting manner to other device(s). The fixed code described in this step is a code uniquely owned by each device, and the fixed code of each device is different so as to identify which device has sent the information through the fixed code. In addition, the broadcast of the information of this step is realized through an optical splitter.

[0082] Step 20, determining, by any device, the fixed code in test light information sent by other device(s) when receiving the test light information from other device(s), and if the device represented by the fixed code is its own preset pairing device, completing the link pairing between the devices. In this step, it is necessary to clarify firstly that the connection relationship between devices is generally set in advance before topology discovery and connectivity verification are performed; and in the present step, the received fixed code is used to determine whether the device currently connected with itself is a device which has been set a connection relationship in advance, and if it is, the link pairing relationship between the two devices is determined, or otherwise, the link pairing is not performed.

[0083] In the present preferred embodiment, for Step 20, any device may further use a preset port switching rule to perform port switching, record a time point received by the same fixed code in each port, and determine whether the corresponding port is a port matched with the device represented by the corresponding fixed code according to the received time point, when receiving the test light information sent by other device(s). In this step, the pairing relationship between this device and that device is further performed, thus realizing the pairing relationship between the port of the present device and other device(s). In addition, the switching of the port in this step is realized through the WSS.

[0084] Specifically, as shown in FIG. 9, the step 20 (determining, by any device, the fixed code in test light information sent by other device(s) when receiving the test

light information from other device(s), wherein if the device represented by the fixed code is its own preset pairing device, the link pairing between the devices is completed) can be expanded in detail as the following steps:

[0085] Step 21, presetting a port switching rule, and sequentially switching one port of the WSS in the device every other time period. For example, there are ten ports of the WSS, then ten time periods are preset to switch the ports of the WSS, in which the first time period, i.e., the first minute, is used for switching to the first port of the WSS, the second time period, i.e., the second minute, is used for switching to the second port of the WSS, and so on, until the tenth time period, i.e., the tenth minute, is used for switching to the tenth port of the WSS.

[0086] Step 22, obtaining a match relationship between a preset port and other device(s), and converting the match relationship between the port and other device(s) into a match relationship between a time period and other device(s). For example, originally, the first port of the current device WSS is set to be matched and connected with the device A, and the second port of the current device WSS is set to be matched and connected with the device B, then the match relationship between its own port and other device(s) is converted into a match relationship between a time period and other device(s); that is, the first minute is used for matching and connecting the device A, the second minute is used for matching and connecting with the device B, and so on.

[0087] Step 23, for the fixed code sent by other device(s), recording the time points of receiving it in each port, determining whether the time period in which the time point received by the corresponding port is located is matched with the preset device or not, and if it does, establishing a link pairing between the corresponding port and the corresponding device. For example, a fixed code of the device A will be comprised in the information sent to the present device by the device A, and if the information is received at a certain time point within the first minute when the present device switches a port of the WSS, it shows that the match connection with the device A is successful, and the link pairing between the first port of the current device WSS and the device A is established, however, if the information sent by the device A is received during other time period (for example, the second minute) when the present device switches the WSS port, it shows that the match connection with the device A is unsuccessful, and the port to which the information of the device A is sent is not the preset port, but is the other port. The determination of the other device(s) and the

other port is the same, and details are not described herein again.

[0088] In summary, the embodiment of the present disclosure uses the optical splitter to realize the down-wave function, thus saving the cost; and for the optical fiber link connection between the ROADM cards, the topology can be automatically discovered, the connection can be automatically performed, and the correctness of the connection thereof can be automatically verified, thereby avoiding the problem that errors are prone to occur in manual connections of conventional optical fiber links.

[0089] Embodiment 4

[0090] On the basis of the method and device for topology discovery and connectivity verification in a ROADM system provided by the above-mentioned embodiments 1 to 3, the present disclosure also provides an apparatus for topology discovery and connectivity verification in a ROADM system which can be used for realizing the above-mentioned method, and module function of the device. As shown in FIG. 10, it is a schematic diagram of an apparatus architecture of the present embodiment. The apparatus in the present embodiment comprises one or more processors 21 and a memory 22. One processor 21 is taken as an example in FIG. 10.

[0091] The processor 21 and the memory 22 may be connected by a bus or other means, and the connection by bus is taken as an example in FIG. 10.

[0092] The memory 22 is used as a non-volatile computer-readable storage medium, and can be used to store non-volatile software programs, non-volatile computer-executable programs and modules, such as the methods and modules in Embodiments 1-3. The processor 21 executes various functional applications and data processing of the apparatus through running non-volatile software programs, instructions and modules stored in the memory 22, i.e., realizing the method, module function for topology discovery and connectivity verification in a ROADM system in Embodiments 1 to 3.

[0093] The memory 22 may include a high-speed random access memory, and may also include a non-volatile memory, such as at least one magnetic disk storage device, a flash memory device, or other non-volatile solid state memory devices. In some embodiments, the memory 22 may optionally include memories remotely set relative to the processor 21, and these remote memories may be connected to the processor 21 through a network. Examples of the aforementioned networks include, but are not limited to, the Internet, an enterprise intranet, a local range network, a mobile communication network, and combinations thereof.

[0094] The program instructions/modules are stored in the memory 22, and when the program instructions/modules are executed by the one or more processors 21, the method, module function for topology discovery and connectivity verification in a ROADM system in embodiments 1 to 3 are executed, for example, executing the each step shown in FIG. 6, FIG. 8 and FIG. 9 as described above.

[0095] The ordinary skill in the art can understand that all or a portion of the steps in the various methods of the embodiments can be completed by a program to instruct relevant hardware, and the program can be stored in a computer readable storage medium, which can include: Read Only Memory (abbreviated as ROM), Random Access Memory (abbreviated as RAM), magnetic disk or optical disk, etc.

[0096] The above description is only the preferred embodiments of the present disclosure and is not intended to limit the present disclosure. Any modification, equivalent replacement, and improvement made within the spirit and principle of the present disclosure shall be included in the protection of the present disclosure.

WHAT IS CLAIMED IS:

1. A method for topology discovery and connectivity verification in a ROADM system, characterized in comprising:

sending, by any device for topology discovery and connectivity verification in the ROADM system after being powered on, its own first device information in a broadcasting manner to other device(s) for topology discovery and connectivity verification in the ROADM system, wherein the first device information comprises one or more of an identifier of a source chassis, a single disk slot number of a source single disk, and a port number of a WSS of a source single disk where a test light signal on the single disk is located;

receiving test light information sent from a port of the WSS by any device for topology discovery and connectivity verification in the ROADM system, saving first device information, in the test light information, of other device(s) for topology discovery and connectivity verification in the ROADM system as second device information, and superposing and then sending the first device information and the second device information to the other device(s) for topology discovery and connectivity verification in the ROADM system, wherein the second device information comprises one or more of a received identifier of the chassis, a received single disk slot number, and a received port number of a WSS where the test light signal on the single disk is located;

comparing, by any device for topology discovery and connectivity verification in the ROADM system, its own first device information with the second device information in the received information, and if the information is consistent with each other, this link pairing succeeding, and performing pairing record to its own first device information and the first device information in the received information.

2. The method for topology discovery and connectivity verification in a ROADM system of claim 1, characterized in that each device for topology discovery and connectivity verification in the ROADM system compares the pairing record with the pre-input corresponding relationship of each port after completing the link pairing, so as to verify whether the connection is correct or not.

3. The method for topology discovery and connectivity verification in a ROADM

system of claim 1, characterized in that a distribution function of any device for topology discovery and connectivity verification in the ROADM system in a test light sending direction is realized through an optical splitter; and an up-wave function of any device for topology discovery and connectivity verification in the ROADM system in the test light receiving direction is realized through the WSS.

4. A method for topology discovery and connectivity verification in a ROADM system, comprising:

sending, by any device for topology discovery and connectivity verification in the ROADM system after being powered on, test light information with its own fixed code in a broadcasting manner to other device(s) for topology discovery and connectivity verification in the ROADM system;

determining, by any device for topology discovery and connectivity verification in the ROADM system, the fixed code in the test light information sent by other device(s) for topology discovery and connectivity verification in the ROADM system when receiving the test light information from other device(s) for topology discovery and connectivity verification in the ROADM system, and the link pairing between the devices to be completed if the device represented by the fixed code is its own preset pairing device.

5. The method for topology discovery and connectivity verification in a ROADM system of claim 4, characterized in that when receiving the test light information sent by other device(s) for topology discovery and connectivity verification in the ROADM system, any device for topology discovery and connectivity verification in the ROADM system further uses a preset port switching rule to perform port switching, records the time point received by the same fixed code in each port, and determines whether the corresponding port is a port matched with the device represented by the corresponding fixed code according to the received time point.

6. The method for topology discovery and connectivity verification in a ROADM system of claim 5, characterized in that, that when receiving the test light information sent by other device(s) for topology discovery and connectivity verification in a ROADM system, any device for topology discovery and connectivity verification in the ROADM system further uses a preset port switching rule to perform port

switching, records the time point received by the same fixed code in each port, and determines whether the corresponding port is a port matched with the device represented by the corresponding fixed code according to the received time point specifically comprises:

presetting a port switching rule, and sequentially switching one port of a WSS in said any device for topology discovery and connectivity verification in the ROADM system every other time period;

obtaining a match relationship between a preset port and other device(s) for topology discovery and connectivity verification in the ROADM system, and converting the match relationship between the port and other device(s) for topology discovery and connectivity verification in the ROADM system into a match relationship between the time period and other device(s) for topology discovery and connectivity verification in the ROADM system;

for the fixed code sent by other device(s) for topology discovery and connectivity verification in the ROADM system, recording the time points of receiving the fixed code in each port, and determining whether the time period in which the time point of receiving the fixed code by the corresponding port is located is matched with the preset device for topology discovery and connectivity verification in the ROADM system or not, and if it does, establishing a link pairing between the corresponding port and the corresponding device for topology discovery and connectivity verification in the ROADM system.

7. A device for topology discovery and connectivity verification in a ROADM system, characterized in comprising a test light sending function module, a distribution function module, an up-wave function module, a test light reception function module and a control function module,

wherein the test light sending function module is used for sending a test light signal;

the distribution function module is used for multiplexing and then multiply distributing both a service light signal and the test light signal which is sent from the test light sending function module;

the up-wave function module is used for separating the service light signal from the test light signal, and switching different ports for receiving the test light signal and sending the test light signal to the test light reception function module;

the test light reception function module is used for receiving the test light signal;
and

the control function module is used for controlling work of each module.

8. The device for topology discovery and connectivity verification in a ROADM system of claim 7, characterized in that the distribution function module comprises an optical splitter, and the optical splitter is realized in a cascading mode, or realized by a single device.

9. The device for topology discovery and connectivity verification in a ROADM system of claim 8, characterized in that the up-wave function module comprises a WSS.

10. The device for topology discovery and connectivity verification in a ROADM system of claim 9, characterized in that each of the distribution function module and the up-wave function module further comprises a WDM, wherein the WDM of the distribution function module is connected with the optical splitter so as to realize a multiplexing function of the service light signal and the test light signal, and the WDM of the up-wave function module is connected with the WSS, in order to realize a demultiplexing function of the service light signal and the test light signal.