Ethernet Ring Protection Solution

The Ethernet technology was invented by Bob Metcalfe, the founder of 3Com in 1973. Since then, the technology has gained sustainable development due to its simplicity, openness, and low cost, and has gradually gained a leading position in the LAN field. Today, almost all the LANs newly constructed are based on the Ethernet technology. For this reason, MANs start to draw close to the Ethernet. The members of the Metro Ethernet Forum (MEF) cover almost all mainstream vendors in the industry.

The Ethernet technology (IEEE 802.3), however, still does not support fast convergence. When any link is interrupted, the network will be unavailable for up to tens of seconds. This can hardly be tolerated by real-time services borne on the network.

To support fast convergence, the IEEE workgroup came up with the IEEE802.17 RPR technology, which provides self-healing through switching within 50 ms. Compared with the Ethernet technology that involves a low cost, the RPR technology, however, brings higher investment. In general, the RPR technology is used only when users pose very strict reliability requirements. More users ask for a technology that combines the low cost of the Ethernet technology and the high reliability of the RPR technology, so as to largely shorten the network self-healing convergence time without bringing additional investment.

For this purpose, H3C launched an innovative Ethernet technology called the Rapid Ring Protection Protocol (RRPP). The RRPP technology is a link layer protocol specially designed for Ethernet rings. It can prevent broadcast storm caused by data loops in Ethernet ring networks. When a link or device on an Ethernet ring fails, the RRPP technology enables quick switchover to the backup link to ensure that the services are quickly restored. Compared with the STP, the RRPP has obvious advantages: simple algorithm, fast topology convergence, and convergence time independent of the number of nodes on the ring.

I. Overview

The Ethernet ring solution is a high-reliability ring network solution that combines the RRPP technology and the Ethernet technology. The RRPP technology well simplifies the Ethernet ring computation process and provides high reliability during the fast switchover to the backup link. The Ethernet ring solution provides high reliability with high cost performance for enterprise users and meets carriers' network reliability requirements.

u Principles of the RRPP Technology

The RRPP consists of one master node, multiple transmission nodes, and the control VLAN. The master node is configured with a master port and a slave port. Normally, the master node periodically sends Hello packets via the master port. Once receiving any Hello packet sent by itself, the slave port is immediately blocked. The control VLAN transits RRPP control packets and effectively protects control packets.
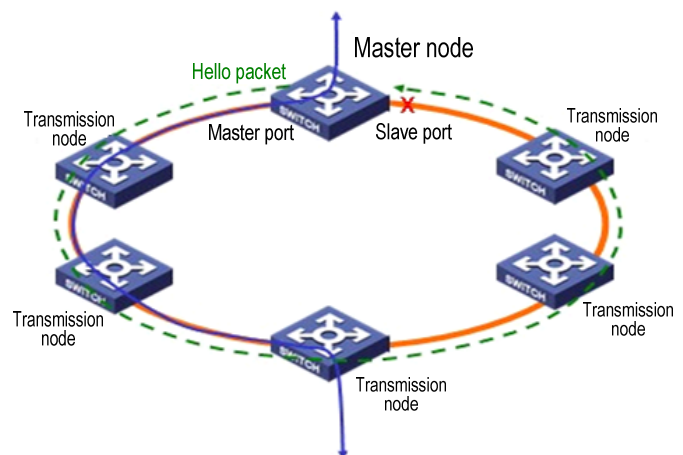
Once a failure occurs (e.g. a link is interrupted), the adjacent node or port will immediately detect the failure and immediately send a link failure notification packet to the master node. Upon receipt of the link failure notification packet, the master node considers that the ring is faulty and thus immediately enables the slave port link and at the same time sends a packet to all the other transmission nodes to notify the link failure and tell the other nodes to change the transmission direction. After the transmission nodes update the forwarding table, the data flow is switched over to the normal link.
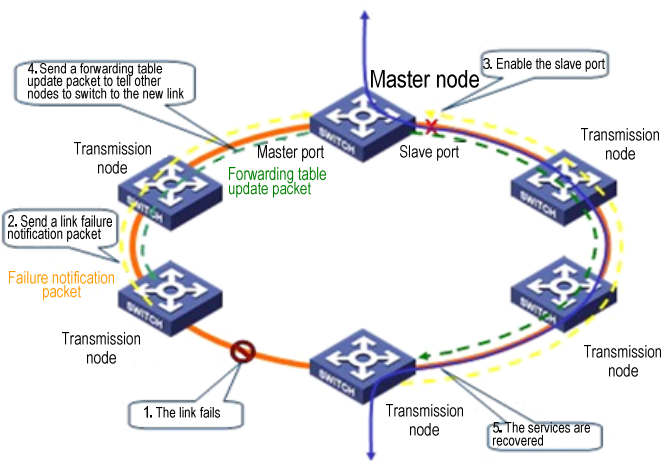
When the failure is recovered, the faulty node or port will be up again and then the faulty node will temporarily block this port but the port can still transparently transmit RRPP packets. The Hello packets from the master node can pass the port temporarily blocked. Once the slave port of the master node receives any Hello packet sent by itself, the master node considers that the ring network has already been restored and thus will immediately block the slave port and send a packet to all the other nodes, so as to tell the other nodes to enable the port temporarily blocked and refresh the port status. Finally, the traffic is switched over to the normal link.

II. Technical Advantages and Features

ʊ High Reliability
When any link or node on the Ethernet ring fails, the Ethernet ring solution ensures that the link switchover is completed within 50 ms and the service switchover is completed within 50 to 200 ms.

ʊ Low Cost
H3C RRPP technology does not change the traditional Ethernet hardware. All the medium-range and high-end switches in the existing network can support the GE port RRPP feature through software upgrade. Moreover, H3C will keep increasing the type of ports supporting the RRPP technology, so as to extend the application scope of the low-low protection technology.

Security Guarantee

A dedicated VLAN is used to transmit control packets. Control packets are isolated from other data packets. This ensures that control packets are not affected by the user network and thus guarantees the security of control packets. In addition, a priority is set for this VLAN to ensure that control packets are transmitted at a higher priority than other packets.

ʊ Wide Application
In H3C Ethernet ring solution, the service protection time has nothing to do with factors such as the number of nodes on the ring, the device load, the services borne on the network, and the network traffic.

Independent of the number of nodes on the ring: When used to construct a large-scale ring, the RRPP technology can still ensure that service switchover is completed within 50 to 200 ms.

Independent of the device load: When a complex protocol runs on the device (e.g. when multiple ACL rules are configured or the device serves as the MPLS PE), the network convergence time is not affected at all.

Independent of the services borne on the network: Whatever services (e.g. voice and video) are running in the upper layer, the RRPP technology can ensure a very short switchover time.

Independent of the network traffic: Even when the network traffic is high, the network is able to self-heal within milliseconds. As services keep growing and the data volume keeps increasing, the Ethernet ring technology can still guarantee fast service switchover.

III. Applications

The Ethernet ring solution can be applied in the following environments:

ʊ Campus networks

ʊ Small-scale or medium-scale MANs

ʊ LANs with very high reliability requirements

ʊ Convergence layer and access layer of large-scale MANs