The study of router standby mechanism for smart and cooperation network

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Abstract. This paper is devoted to researching the routing reliability and router standby mechanism for smart and cooperation network. The method of updating and initiating the standby router has been also provided. With the aid of virtual interface, both the main router and standby router will be transparent to the network. Through Mini-Net simulated experiment, this paper has verified the mechanism. It is found that the mechanism of router standby can effectively cope with the network interruption caused by the failed router. It has the advantage of fast handoff and low latency.

Introduction

With the development of information technology, modern people have become increasingly more dependent on the network. Hence, it has become a popular topic as to how to effectively manage the resource allocation in the network and ensure the reliable transmission. The existing network is featured by big data, various types, complicated structure as well as wide source and application. Large amounts of data are seen as a precious asset to human. In the case of missing data or link failure in storage node, it will cause enormous loss to the network. After the routing or link in the network fails, the message reaching the node might be discarded or retransmitted constantly, leading to the transient traffic interruption or traffic loop until the network calculates the new topology and routing in convergence. In most cases, the interruption will last a few seconds.

Hence, many experts both at home and abroad have proposed the mechanism of standby routing so as to enhance the routing reliability and continuous communication. Meanwhile, CISCO has advanced the well-known hot standby routing protocol [1] (HSRP) that can offer a backup method to realize the transparent switching between main router and hot standby router. The fast switching can also ensure the high-quality user experience. To be more specific, a set of routers is specified as sharing a virtual IP address. These routers should follow a certain order of precedence. The main router will take the highest precedence while standby servers function as other routers. Once the main router fails, the router with a high precedence will switch to the main router.

The virtual router redundancy protocol [2] (VRRP) is proposed by IETF to deal with the single-point failure in the static gateway configured in the LAN. In 1997, the workgroup drew up the RFC2338[2] that had contained the basic framework of the protocol. The host computer is allowed to use the single router for backup. In the case of failed routing, it can still maintain the connectivity between different routers. The RFC3768[3] proposed in 2004 has included a new safety verification method for VRRP. The RFC5798[4] proposed in 2010 has offered a method to improve the utilization rate of standby routing through load sharing. The support for IPv6 is also realized. The IP standby protocol [5] (IPSTB), which is advanced by some experts including Higginson, can offer a fast way to recover the failed node. IP fast reroute [6,7] (IPFRR) has emerged to deal with network failure. The network redundant route is provided to improve some failed nodes in the main route. Some experts from South Korea have studied the use of fast rerouting [8] to handle link failure under the framework of CCN.

On the basis of deeply researching the router standby mechanism in the world, this paper has realized the transparent switching between main router and standby router to ensure the normal

operation of the network. In the context of link failure, the standby link has been used for routing and thus ensured the route accessibility.

Router standby mechanism

We design the mechanism in Smart and cooperation network [13,14,15]. In router standby mechanism, the router will carry out the standby operation on its own hardware, software and content stored. If a failed node results in network break down and interrupted data transmission, the standby router will function to recover the network.

This mechanism has defined two routers. The first is the main router, which is involved in the actual routing in the network. There are also several routers of the same type. It is called standby router. The standby router will back up the resource, FSIB（Forwarding Status Information Base）, interface and PGT（Pending Get Table） in the main router. The standby technology aims to resolve a certain failure existing in the hardware or software system. It is specified that there is at least one standby router that can replace the main router functionally. When the main router breaks down, the standby router will rise to provide routing service for the user. This chapter will elaborate on the standby node routing in three stages, namely the establishment of standby router, the update of standby router and the initiation of standby router.

The specific mechanism processes is presented in the Fig.1, specific description as follows

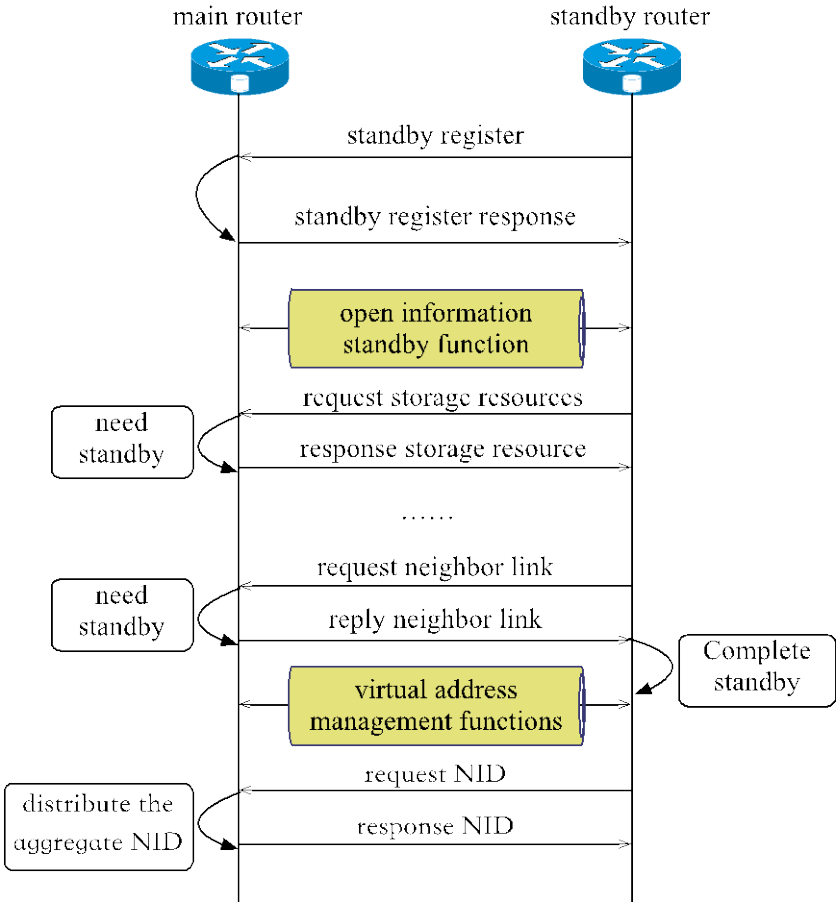

Fig. 1 Router standby processes

(1)The standby router will send the information regarding standby registry to the main router.

(2)The main router will determine whether it is the main router or not. If so, it will respond to the standby router. If not, the information will be discarded.

(3)The standby router will make a request for storage resource to the main router.

(4)The main router will determine whether the storage resource should be backed up or not. If so, it will respond to the request. If not, it will discard the data packet directly.

(5)The standby router will request other information such as neighbor link and forwarding table, as seen above.

(6)After backing up the information, the standby router will request the virtual component identifier.

(7)After receiving the request information, the main router will send an integrable virtual component identifier based on its own identifier space to the standby router.

The update and initiation of standby router

Contrary to the pull-typed establishment of standby router, the update of standby router takes the form of push. During the course of backing up the information, the main router has adopted the pending standby table (PBT) to record the standby. The update timer is initiated to check the update of standby resource before forwarding it to the standby router. The data structure of PBT can be seen in the fig. 2.

After the timer expires, the main router will check whether the resource (including service and routing) has been updated or not. If so, the standby router will send the message for update.

backu2 c1 ntent u2 date time32 e31 d

Inte3face numbe3	T0
SID1	T1
31 ute	T
SID	T3

Fig. 2 Data structure of Pending Base Table

The standby router has adopted the initiation timer to send the message to the main router regularly. If the main router responds, the standby router will not be initiated. If not, the standby router will be put into operation.

Virtual interface setting

In general, the component-layer interface in the smart and cooperation network will be connected with the bottom-layer physical interface to receive and transmit the data. There is a type of virtual interface [10,11] that can function in the form of logical interface. Without the function of receiving and transmitting the data packet, it has to rely on other interfaces to achieve it. The logic interface is referred to as virtual interface.

The technique of virtual interface introduced in this chapter can realize the integration of network component identifier routing, thus making the standby router transparent to the network. The typical hierarchy of virtual interface between main router and standby router can be seen in the Fig. 3.

Smart Service Layer
Resource Adaption Layer
Network Module Layer
Virtual interface layer

Fig. 3 The virtual interface structure of router standby

Experiment and result analysis

The experiment on the router standby mechanism has been conducted, as seen in the Fig. 4. To be more specific, NID1 is /iplab/bjtu/chain. NID1 is /iplab/bjtu/standby. NID2 is /sever/bjtu/chain.

NID2 is /sever/bjtu/chain. Virtual integration NID1 is /iplab/bjtu. Virtual integration NID2 is /server/bjtu.

The RTT of the main router is set as 20 ms while that of the standby router is 100 ms. The service demander will carry out ping operation on the service supplier to check the link connectivity. The time gap of ping packet is 0.1 second. But in this experiment, it is set as 100 s. The main router will conduct the down (router failure) or up (router initiation) operation every 10 seconds. The round-trip latency has been presented in the Fig. 5, whether the router standby is adopted or not.

When the router standby is adopted, the early stage of down and up operation is accompanied by switching interruption.

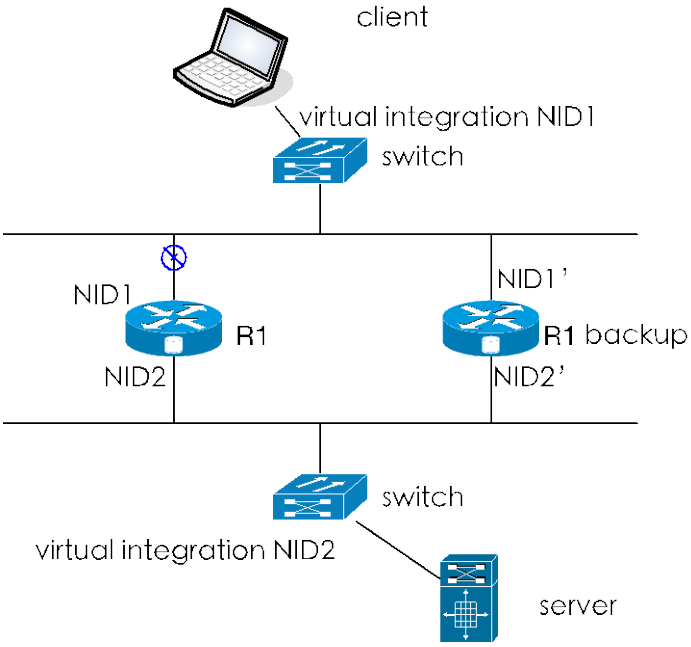

Fig. 4 Topology of router standby

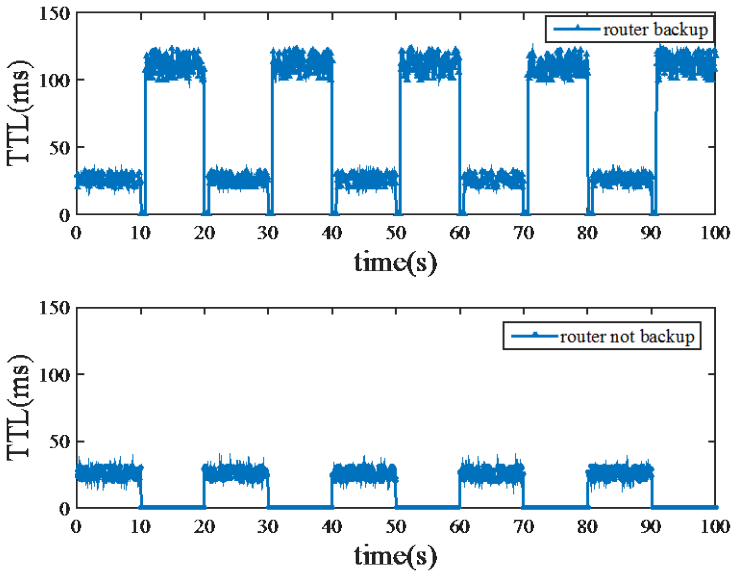

Fig. 5 TTL

Summary

This paper is concerned with the routing reliability of smart and cooperation network. In order to solve the problem of failed router, this paper has researched a router standby mechanism. The method of updating and initiating the standby router is also given. The virtual interface has been adopted to

make the main router and standby router transparent to the network. The Mini-Net simulated experiment is conducted to verify the mechanisms. It is found that the router standby mechanism can effectively solve the problem of interrupted network caused by failed router. It also has the advantage of fast switching and low latency.

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