同济大学计算机网络实验

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题目：实验八 快速生成树

一. 实验目的

理解快速生成树协议 RSTP 的配置及原理

二. 实验原理

生成树协议作用是在交换网络中提供冗余备份链路，并解决交换网络中的环路问题

生成树协议是利用 SPA 算法（生成树算法），在存在交换环路的网络中生成一个没有环路的树形网络。运用该算法将交换网络冗余的备份链路逻辑上断开，当主要链路出现故障时，能够自动的切换到备份链路，保证数据的正常转发。生成树协议目前常见的版本有 ST(生成树协议 IEEE 802．1d ）、 RSTP（快速生成树协议 IEEE802．1w ）、 MSTP （多生成树协议 IEEE 802.1s）。

生成树协议的特点是收敛时间长。当主要链路出现故障以后，到切换到备份链路需要 50 秒的时间。快速生成树协议（RSTP）在生成树协议的墓础上增加了两种端口角色：替换端口（ alternate port ）和备份端口（ backup Port ），分别做为根端口（root Port ）和指定端口（ designated Port ）的冗余端口。当根端口或指定端口出现故障时，冗余端口不需要经过 50 秒的收敛时间，可以直接切换到替换端口或备份端口。从而实现 RSTP 协议小于 1 秒的快速收敛。

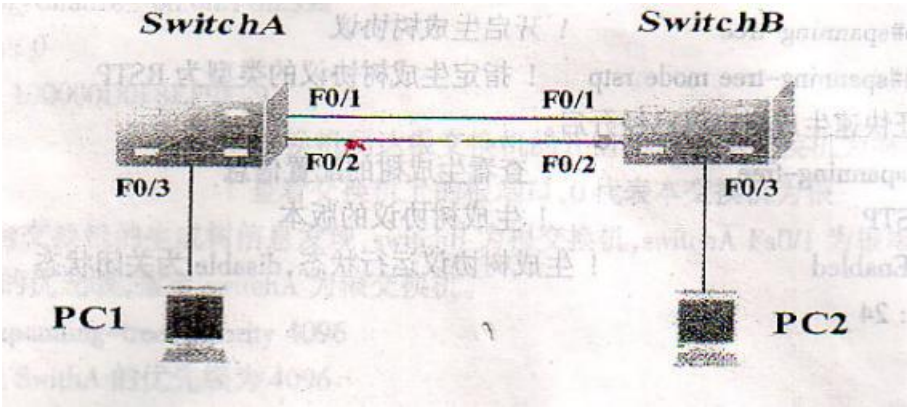
三. 实现功能

使网络在有冗余链路的情况下避免环路的产生，避免广播风暴等.

四.实验设备

S2126 两台，主机两台，直连线 4 条

五.实验拓扑图



六.实验步骤

1 交换机 A 的基本配置:

```
SwitchA(config)#vlan 10
SwitchA(config-vlan)#name sales
SwitchA(config-vlan)#exit
SwitchA(config)#inter fast 0/3
SwitchA(config-if)#switch access vlan 10
SwitchA(config-if)#exit
SwitchA(config)#inter range fast 0/1-2
SwitchA(config-if-range)#switch mode trunk
```

2.交换机 B 的基本配置：

```
SwitchB#conf
SwitchB(config)#vlan 10
SwitchB(config-vlan)#name sales
SwitchB(config-vlan)#exit
SwitchB(config)#inter fast 0/3
SwitchB(config-if)#switch access vlan 10
SwitchB(config-if)#exit
SwitchB(config)#inter range fast 0/1-2
SwitchB(config-if-range)#switch mode trunk
```

3. 配置快速生成树协议：

```
SwitchA#conf
SwitchA(config)#spanning-tree
SwitchA(config)#spanning-tree mode rstp
switchB#conf
SwitchB#conf
SwitchB(config)#spanning-tree
SwitchB(config)#spanning-tree mode rstp
```

4. 设置交换机的优先级，指定 switchA 为根交换机：

```
SwitchA(config)#spanning-tree priority 4096
```

5.具体配置步骤：

```
S2126G-2#enable 14
S2126G-2#enable 14
S2126G-2#config
Enter configuration commands, one per line.  End with CNTL/Z.
S2126G-2(config)#vlan 10
2018-10-24 19:41:08  @5-CONFIG:Configured from outband
S2126G-2(config-vlan)#name sales
2018-10-24 19:41:14  @5-CONFIG:Configured from outband
S2126G-2(config-vlan)#exit
2018-10-24 19:41:19  @5-CONFIG:Configured from outband
S2126G-2(config)#interface fastEthernet 0/5
2018-10-24 19:41:29  @5-CONFIG:Configured from outband
S2126G-2(config-if)#switchport  access vlan 10
2018-10-24 19:41:43  @5-CONFIG:Configured from outband
S2126G-2(config-if)#exit
```

```
2018-10-24 19:42:11  @5-CONFIG:Configured from outband
S2126G-2(config)#exit
2018-10-24 19:42:14  @5-CONFIG:Configured from outband
S2126G-2#show vlan id 10

VLAN Name                             Status    Ports
---- -------------------------------- --------- ---------------------
10   sales                            active    Fa0/5
                                                Ag1

S2126G-2#conf
Enter configuration commands, one per line.  End with CNTL/Z.
S2126G-2(config)#vlan 10
2018-10-24 19:43:00  @5-CONFIG:Configured from outband
S2126G-2(config-vlan)#name sales
2018-10-24 19:43:05  @5-CONFIG:Configured from outband
S2126G-2(config-vlan)#exit
2018-10-24 19:43:08  @5-CONFIG:Configured from outband
S2126G-2(config)#interface  fastEthernet 0/5
2018-10-24 19:43:15  @5-CONFIG:Configured from outband
S2126G-2(config-if)#switchport access vlan 10
2018-10-24 19:43:26  @5-CONFIG:Configured from outband
S2126G-2(config-if)#exit
2018-10-24 19:43:32  @5-CONFIG:Configured from outband
S2126G-2(config)#exit
2018-10-24 19:43:34  @5-CONFIG:Configured from outband
S2126G-2#show vlan id 10

VLAN Name                             Status    Ports
---- -------------------------------- --------- ---------------------
10   sales                            active    Fa0/5
                                                Ag1

S2126G-2#conf
Enter configuration commands, one per line.  End with CNTL/Z.
S2126G-2(config)#interface aggregatePort 1
2018-10-24 19:44:16  @5-CONFIG:Configured from outband
S2126G-2(config-if)#switchport  mode trunk
2018-10-24 19:44:23  @5-CONFIG:Configured from outband
S2126G-2(config-if)#exit
2018-10-24 19:44:26  @5-CONFIG:Configured from outband
S2126G-2(config)#interface  range fastEthernet 0/1-2
2018-10-24 19:44:48  @5-CONFIG:Configured from outband
S2126G-2(config-if-range)#port-group 1
```

```
2018-10-24 19:44:59  @5-CONFIG:Configured from outband
S2126G-2(config-if-range)#exit
2018-10-24 19:45:03  @5-CONFIG:Configured from outband
S2126G-2(config)#exit
2018-10-24 19:45:07  @5-CONFIG:Configured from outband
S2126G-2#show aggregatePort 1 summary
AggregatePort MaxPorts SwitchPort Mode   Ports
------------- -------- ---------- ------ ----------------------
Ag1           8        Enabled    Trunk  Fa0/1 , Fa0/2


switchA#show run

System software version : 1.66(3) Build Sep  7 2006 Rel

Building configuration...
Current configuration : 485 bytes

!
version 1.0
!
hostname switchA
vlan 1
!
vlan 10
 name sales
!
vlan 30
!
vlan 40
!
vlan 50
!
enable secret level 14 5 'T,1u_;C3U-8U0<D4^.tj9=G54/7R:>H
enable secret level 15 5 'SH.Y*T74X,tZ[V/UU+S(\W&Q21X)sv'
!
spanning-tree mode rstp
spanning-tree
spanning-tree mst 0 priority 4096
interface fastEthernet 0/1
 switchport mode trunk
!
interface fastEthernet 0/2
 switchport mode trunk
```

```
!
interface fastEthernet 0/5
 switchport access vlan 10
!
end

switchA#
switchA#
switchA#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
switchA(config)#interface fastEthernet 0/3
2018-10-24 19:11:52  @5-CONFIG:Configured from outband
switchA(config-if)#switchport access vlan 10
2018-10-24 19:12:49  @5-CONFIG:Configured from outband
switchA(config-if)#eixt
                   ^
% Invalid input detected at '^' marker.

switchA(config-if)#exit
2018-10-24 19:12:58  @5-CONFIG:Configured from outband
switchA(config)#exit
2018-10-24 19:13:00  @5-CONFIG:Configured from outband
switchA#show run

System software version : 1.66(3) Build Sep  7 2006 Rel

Building configuration...
Current configuration : 544 bytes

!
version 1.0
!
hostname switchA
vlan 1
!
vlan 10
 name sales
!
vlan 30
!
vlan 40
!
vlan 50
!
```

```
enable secret level 14 5 'T,1u_;C3U-8UO<D4^.tj9=G54/7R:>H
enable secret level 15 5 'S-aeh`@4X'dfimLUU{bcknAQ2zyglow
!
spanning-tree mode rstp
spanning-tree
spanning-tree mst 0 priority 4096
interface fastEthernet 0/1
 switchport mode trunk
!
interface fastEthernet 0/2
 switchport mode trunk
!
interface fastEthernet 0/3
 switchport access vlan 10
!
interface fastEthernet 0/5
 switchport access vlan 10
!
end

switchA#
switchA#
switchA#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
switchA(config)#interface fastEthernet 0/5
2018-10-24 19:13:17  @5-CONFIG:Configured from outband
switchA(config-if)#no switchport access vlan
2018-10-24 19:13:29  @5-CONFIG:Configured from outband
switchA(config-if)#exit
2018-10-24 19:13:32  @5-CONFIG:Configured from outband
switchA(config)#exit
2018-10-24 19:13:33  @5-CONFIG:Configured from outband
switchA#show run

System software version : 1.66(3) Build Sep  7 2006 Rel

Building configuration...
Current configuration : 485 bytes

!
version 1.0
!
hostname switchA
vlan 1
```

```
!
vlan 10
 name sales
!
vlan 30
!
vlan 40
!
vlan 50
!
enable secret level 14 5 'T.Y*T7+3UtZ[V/,4^S(\W&-54X)sv'~
enable secret level 15 5 'S)sv'~14X*T7+.tUU[V/,|7Q2\W&-/-
!
spanning-tree mode rstp
spanning-tree
spanning-tree mst 0 priority 4096
interface fastEthernet 0/1
 switchport mode trunk
!
interface fastEthernet 0/2
 switchport mode trunk
!
interface fastEthernet 0/3
 switchport access vlan 10
!
end

switchA#
switchA#
switchA#
switchA#show spanning-tree

StpVersion : RSTP
SysStpStatus : Enabled
BaseNumPorts : 25
MaxAge : 20
HelloTime : 2
ForwardDelay : 15
BridgeMaxAge : 20
BridgeHelloTime : 2
BridgeForwardDelay : 15
MaxHops : 20
TxHoldCount : 3
PathCostMethod : Long
```

```
BPDUGuard : Disabled
BPDUFilter : Disabled
BridgeAddr : 00d0.f8d4.79c0
Priority : 4096
TimeSinceTopologyChange : 0d:0h:13m:21s
TopologyChanges : 0
DesignatedRoot : 100000D0F8D479C0
RootCost : 0
RootPort : 0

switchA#show run

System software version : 1.66(3) Build Sep  7 2006 Rel

Building configuration...
Current configuration : 485 bytes

!
version 1.0
!
hostname switchA
vlan 1
!
vlan 10
 name sales
!
vlan 30
!
vlan 40
!
vlan 50
!
enable secret level 14 5 'TNq&#Z13UOrJ%(84^p]K*.t54B^"[/7
enable secret level 15 5 'Sdhl&-84Xein'.tUUfjo+/7Q2gkE,lu
!
spanning-tree mode rstp
spanning-tree
spanning-tree mst 0 priority 4096
interface fastEthernet 0/1
 switchport mode trunk
!
interface fastEthernet 0/2
 switchport mode trunk
!
```

```
interface fastEthernet 0/3
 switchport access vlan 10
!
end

switchA#
switchA#
switchA#
switchA#show spanning-tree

StpVersion : RSTP
SysStpStatus : Enabled
BaseNumPorts : 25
MaxAge : 20
HelloTime : 2
ForwardDelay : 15
BridgeMaxAge : 20
BridgeHelloTime : 2
BridgeForwardDelay : 15
MaxHops : 20
TxHoldCount : 3
PathCostMethod : Long
BPDUGuard : Disabled
BPDUFilter : Disabled
BridgeAddr : 00d0.f8d4.79c0
Priority : 4096
TimeSinceTopologyChange : 0d:0h:13m:51s
TopologyChanges : 0
DesignatedRoot : 100000D0F8D479C0
RootCost : 0
RootPort : 0

switchA#
2018-10-24 19:19:57  @4-TOPOCHANGE:Topology is changed
2018-10-24 19:20:26  @4-TOPOCHANGE:Topology is changed
switchA#show run

System software version : 1.66(3) Build Sep  7 2006 Rel

Building configuration...
Current configuration : 485 bytes

!
version 1.0
```

```
!
hostname switchA
vlan 1
!
vlan 10
 name sales
!
vlan 30
!
vlan 40
!
vlan 50
!
enable secret level 14 5 'T-/-aeh3U~1'dfi4^.t{bck54|7zygl
enable secret level 15 5 'S1'dfim4Xt{bcknUU7zygloQ2-aeh`@
!
spanning-tree mode rstp
spanning-tree
 --More--
2018-10-24 19:21:34  @4-TOPOCHANGE:Topology ispanning-tree mst 0 priority 4096

interface fastEthernet 0/1
 switchport mode trunk
!
interface fastEthernet 0/2
```

七.实验结果

switchA：

```
S2126G-2#
2018-10-24 19:48:15  @5-LINKUPDOWN:Fa0/5 changed state to down

shiyan8:showrun:
switchB#show run

System software version : 1.66(3) Build Sep  7 2006 Rel

Building configuration...
Current configuration : 448 bytes

!
version 1.0
!
hostname switchB
vlan 1
```

```
!
vlan 10
 name sales
!
vlan 30
!
vlan 40
!
vlan 50
!
enable secret level 14 5 'TNq&#Z13UOrJ%(84^p]K*.t54B^"[/7
enable secret level 15 5 'Sdhl&-84Xein'.tUUfjo+/7Q2gkE,1u
!
spanning-tree mode rstp
spanning-tree
interface fastEthernet 0/1
 switchport mode trunk
!
interface fastEthernet 0/2
 switchport mode trunk
!
interface fastEthernet 0/3
 switchport access vlan 10
!
end
```

SwitchB:

```
switchB#show run

System software version : 1.66(3) Build Sep  7 2006 Rel

Building configuration...
Current configuration : 448 bytes

!
version 1.0
!
hostname switchB
vlan 1
!
vlan 10
 name sales
!
```

```
vlan 30
!
vlan 40
!
vlan 50
!
enable secret level 14 5 'TNq&#Z13UOrJ%(84^p]K*.t54B^"[/7
enable secret level 15 5 'Sdhl&-84Xein'.tUUfjo+/7Q2gkE,1u
!
spanning-tree mode rstp
spanning-tree
interface fastEthernet 0/1
 switchport mode trunk
!
interface fastEthernet 0/2
 switchport mode trunk
!
interface fastEthernet 0/3
 switchport access vlan 10
!
```

Ping 192.168.10.30:

```
C:\Documents and Settings\Administrator>ping 192.168.10.30 -t

Pinging 192.168.10.30 with 32 bytes of data:
Reply from 192.168.10.30: bytes=32 time<1ms TTL=128
Reply from 192.168.10.30: bytes=32 time<1ms TTL=128
Reply from 192.168.10.30: bytes=32 time<1ms TTL=128
Reply from 192.168.10.30: bytes=32 time<1ms TTL=128
Reply from 192.168.10.30: bytes=32 time<1ms TTL=128
Reply from 192.168.10.30: bytes=32 time<1ms TTL=128
Request timed out.
Reply from 192.168.10.30: bytes=32 time<1ms TTL=128
Reply from 192.168.10.30: bytes=32 time<1ms TTL=128
Reply from 192.168.10.30: bytes=32 time<1ms TTL=128
Reply from 192.168.10.30: bytes=32 time<1ms TTL=128
Reply from 192.168.10.30: bytes=32 time<1ms TTL=128
Reply from 192.168.10.30: bytes=32 time<1ms TTL=128
Reply from 192.168.10.30: bytes=32 time<1ms TTL=128
Reply from 192.168.10.30: bytes=32 time<1ms TTL=128
Reply from 192.168.10.30: bytes=32 time<1ms TTL=128
Reply from 192.168.10.30: bytes=32 time<1ms TTL=128
Reply from 192.168.10.30: bytes=32 time<1ms TTL=128
```

```
Reply from 192.168.10.30: bytes=32 time<1ms TTL=128
Reply from 192.168.10.30: bytes=32 time<1ms TTL=128
Reply from 192.168.10.30: bytes=32 time<1ms TTL=128
Reply from 192.168.10.30: bytes=32 time<1ms TTL=128
Reply from 192.168.10.30: bytes=32 time<1ms TTL=128
Reply from 192.168.10.30: bytes=32 time<1ms TTL=128
Reply from 192.168.10.30: bytes=32 time<1ms TTL=128
Reply from 192.168.10.30: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.10.30:
    Packets: Sent = 26, Received = 25, Lost = 1 (3% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

显示丢一个包，结果正确.

八.实验心得体会

通过配置路由实验学习到了 RIP 路由信息协议配置的相关原理，通过三层交换机以及两个路由器进行转发构造了一个互联互通的网络，对计算机网络的认识更深入了一步。