

生成树机制实验报告

张磊 2017K8009922027

一、实验题目

生成树机制实验

二、实验内容

1. 基于已有代码，实现生成树运行机制，对于给定拓扑，计算输出相应状态下的最小生成树拓扑；
2. 自己构造一个不少于 7 个节点，冗余链路不少于 2 条的拓扑，节点和端口的计算的命名规则可参考 `four_node_ring.py`，使用 `stp` 程序计算输出最小生成树拓扑；

三、实验流程

1. 基于附件中的代码，完成 `stp.c` 中对 `stp_handle_cnfig_packet` 函数的编写；
2. 运行 `four_node_ring.py` 拓扑，4 个节点分别运行 `stp` 程序，将输出重定向到 `b*-output.txt` 文件；
3. 等待一段时间，执行 `pkill -SIGTERM stp` 命令强制所有 `stp` 程序输出最终状态并退出；
4. 执行 `dump_output.sh` 脚本，输出 4 个节点的状态；
5. 按照 `four_node_ring.py` 的规则，编写 `seven_node_ring.py` 文件，重复上述实验；

四、 实验结果

1. Four_node_ring:

```
"Node: b1"
root@zhanglei-VirtualBox:~/Workspace/share/06-stp/06-stp# kill -SIGTERM stp
root@zhanglei-VirtualBox:~/Workspace/share/06-stp/06-stp# ./dump_output.sh 4
NODE b1 dumps:
INFO: this switch is root.
INFO: port id: 01, role: DESIGNATED.
INFO:   designated ->root: 0101, ->switch: 0101, ->port: 01, ->cost: 0.
INFO: port id: 02, role: DESIGNATED.
INFO:   designated ->root: 0101, ->switch: 0101, ->port: 02, ->cost: 0.

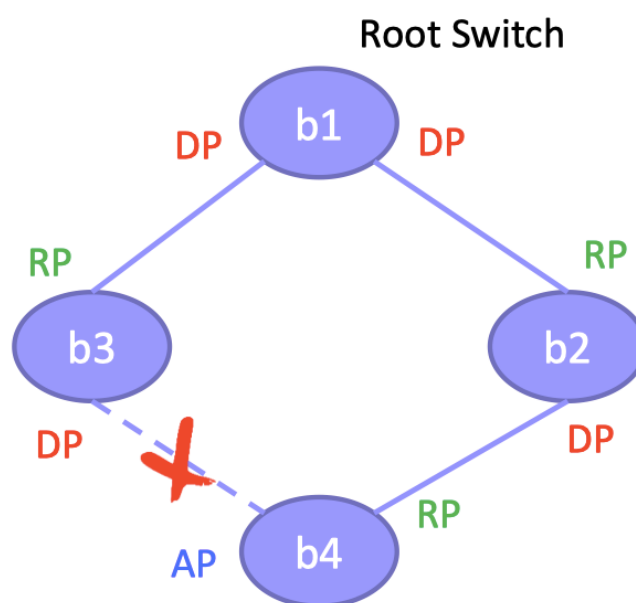
NODE b2 dumps:
INFO: non-root switch, designated root: 0101, root path cost: 1.
INFO: port id: 01, role: ROOT.
INFO:   designated ->root: 0101, ->switch: 0101, ->port: 01, ->cost: 0.
INFO: port id: 02, role: DESIGNATED.
INFO:   designated ->root: 0101, ->switch: 0201, ->port: 02, ->cost: 1.

NODE b3 dumps:
INFO: non-root switch, designated root: 0101, root path cost: 1.
INFO: port id: 01, role: ROOT.
INFO:   designated ->root: 0101, ->switch: 0101, ->port: 02, ->cost: 0.
INFO: port id: 02, role: DESIGNATED.
INFO:   designated ->root: 0101, ->switch: 0301, ->port: 02, ->cost: 1.

NODE b4 dumps:
INFO: non-root switch, designated root: 0101, root path cost: 2.
INFO: port id: 01, role: ROOT.
INFO:   designated ->root: 0101, ->switch: 0201, ->port: 02, ->cost: 1.
INFO: port id: 02, role: ALTERNATE.
INFO:   designated ->root: 0101, ->switch: 0301, ->port: 02, ->cost: 1.

root@zhanglei-VirtualBox:~/Workspace/share/06-stp/06-stp#
```

Dump results



最小生成树拓扑

2. Seven_node_ring:

```
root@zhanglei-VirtualBox:~/Workspace/share/06-stp/06-stp/seven_node_ring# ./dump_output.sh 7
NODE b1 dumps:
INFO: this switch is root.
INFO: port id: 01, role: DESIGNATED.
INFO:   designated ->root: 0101, ->switch: 0101, ->port: 01, ->cost: 0.
INFO: port id: 02, role: DESIGNATED.
INFO:   designated ->root: 0101, ->switch: 0101, ->port: 02, ->cost: 0.
INFO: port id: 03, role: DESIGNATED.
INFO:   designated ->root: 0101, ->switch: 0101, ->port: 03, ->cost: 0.

NODE b2 dumps:
INFO: non-root switch, designated root: 0101, root path cost: 1.
INFO: port id: 01, role: ROOT.
INFO:   designated ->root: 0101, ->switch: 0101, ->port: 01, ->cost: 0.
INFO: port id: 02, role: DESIGNATED.
INFO:   designated ->root: 0101, ->switch: 0201, ->port: 02, ->cost: 1.
INFO: port id: 03, role: DESIGNATED.
INFO:   designated ->root: 0101, ->switch: 0201, ->port: 03, ->cost: 1.

NODE b3 dumps:
INFO: non-root switch, designated root: 0101, root path cost: 1.
INFO: port id: 01, role: ROOT.
INFO:   designated ->root: 0101, ->switch: 0101, ->port: 02, ->cost: 0.
INFO: port id: 02, role: ALTERNATE.
INFO:   designated ->root: 0101, ->switch: 0201, ->port: 02, ->cost: 1.
INFO: port id: 03, role: DESIGNATED.
INFO:   designated ->root: 0101, ->switch: 0301, ->port: 03, ->cost: 1.
INFO: port id: 04, role: DESIGNATED.
INFO:   designated ->root: 0101, ->switch: 0301, ->port: 04, ->cost: 1.

NODE b4 dumps:
INFO: non-root switch, designated root: 0101, root path cost: 1.
INFO: port id: 01, role: ROOT.
INFO:   designated ->root: 0101, ->switch: 0101, ->port: 03, ->cost: 0.
INFO: port id: 02, role: ALTERNATE.
INFO:   designated ->root: 0101, ->switch: 0301, ->port: 03, ->cost: 1.
INFO: port id: 03, role: DESIGNATED.
INFO:   designated ->root: 0101, ->switch: 0401, ->port: 03, ->cost: 1.

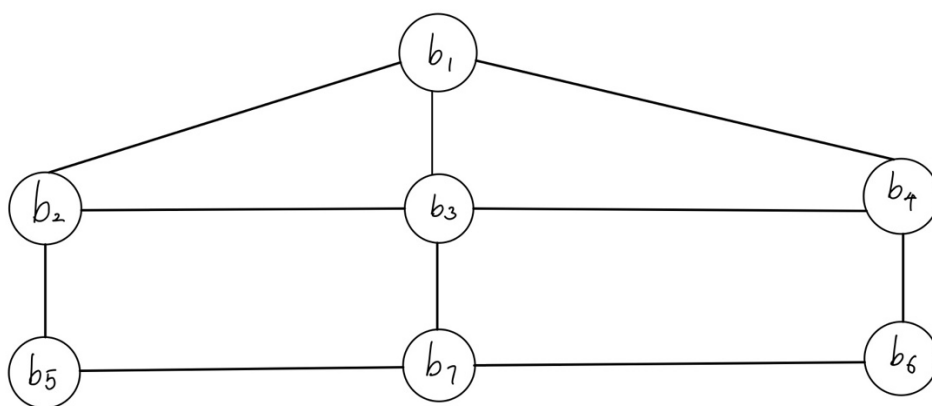
NODE b5 dumps:
INFO: non-root switch, designated root: 0101, root path cost: 2.
INFO: port id: 01, role: ROOT.
INFO:   designated ->root: 0101, ->switch: 0201, ->port: 03, ->cost: 1.
INFO: port id: 02, role: DESIGNATED.
INFO:   designated ->root: 0101, ->switch: 0501, ->port: 02, ->cost: 2.

NODE b6 dumps:
INFO: non-root switch, designated root: 0101, root path cost: 2.
INFO: port id: 01, role: ROOT.
INFO:   designated ->root: 0101, ->switch: 0401, ->port: 03, ->cost: 1.
INFO: port id: 02, role: DESIGNATED.
INFO:   designated ->root: 0101, ->switch: 0601, ->port: 02, ->cost: 2.

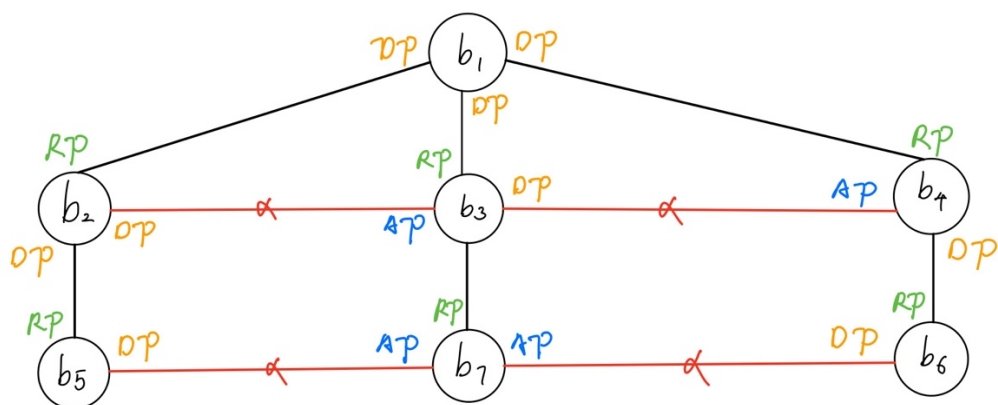
NODE b7 dumps:
INFO: non-root switch, designated root: 0101, root path cost: 2.
INFO: port id: 01, role: ROOT.
INFO:   designated ->root: 0101, ->switch: 0301, ->port: 04, ->cost: 1.
INFO: port id: 02, role: ALTERNATE.
INFO:   designated ->root: 0101, ->switch: 0501, ->port: 02, ->cost: 2.
INFO: port id: 03, role: ALTERNATE.
INFO:   designated ->root: 0101, ->switch: 0601, ->port: 02, ->cost: 2.

root@zhanglei-VirtualBox:~/Workspace/share/06-stp/06-stp/seven_node_ring#
```

Dump results



原始环状拓扑



最小生成树拓扑

五、 实验分析

1. Four_node_ring 的实验结果显示，stp 程序运行成功，成功去除原始环路中的冗余边，生成了最小生成树；
2. 在 seven_node_ring 实验中，我增加了链路的复杂度，构造了 7 个节点，4 条冗余边的环路，实验结果显示 stp 程序运行成功，成功构造出了这 7 个节点最小生成树；

六、 反思总结

1. 本次实验的原理与 zookeeper 这类分布式服务器的分布式一致性协议非常相似，由于上学期在面向对象编程课程中选择了阅读 zookeeper 的源码，所以对这次实验的生成树算法比较容易理解，并且通过这次实验，也让我复习了上学期阅读 zookeeper 源码的很多收获；
2. 通过这次实验，我对计算机网络协议中的生成树协议算法的运行机制又有了更进一步的理解，果然只有配合实验，才能更好的对理论课上学到的知识进行消化和吸收；

七、 参考文献

i

ii

ⁱ 中国科学院大学 2020 春计算机网络研讨课 06-生成树机制实验课件

ⁱⁱ 中国科学院大学 2020 春计算机网络研讨课 06-生成树机制实验附件代码