

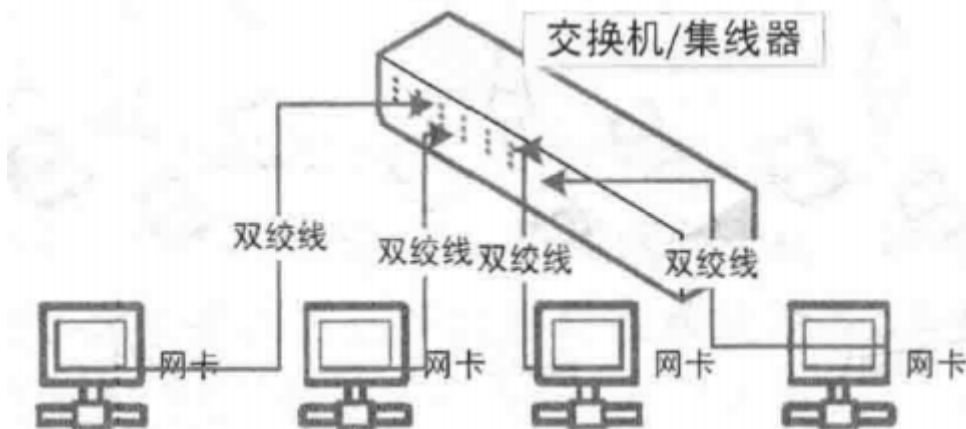
实验(十)：以太网组网实验

一.实验目的

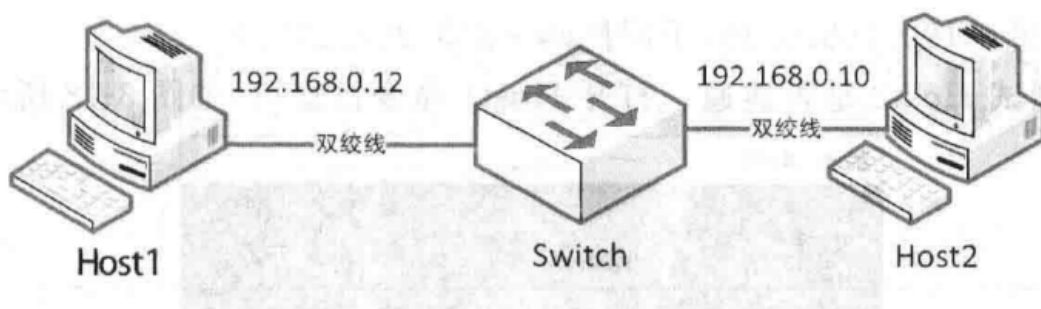
- 物理网络是计算机网络的基本组织单元，其各个节点之间可以进行数据通信。物理网络是互联网的基础架构，无论对于理解网络基本原理还是网际互联原理都非常关键。实验利用以太网交换机组成一个独立的双绞线以太网物理网络，实现网络节点之间的互通。
 - 理解局域网组网原理。
 - 理解掌握以太网组网步骤。
 - 了解以太网网络地址格式。

二.实验原理

- 以太网是当下主流的有线局域网技术，广泛应用于家庭和企业的网络建设中。即便在采用无线网络的场景中，最终的互联网接入也离不开以太网的支持。以太网的构建基础包括网络设备、以太网卡和双绞线。在构建双绞线的以太网网络时，每个加入网络的设备都需要装配一块以太网卡，而在当前的计算机中，以太网卡通常已被集成于主板之上。网络中的集线器和交换机，都是以双绞线为基础的以太网设备，它们提供多个网络端口以便连接。通过双绞线，主机的网络卡可以与这些设备的端口相连，形成独立的物理网络环境，允许网络中的节点之间进行通信。



- 就网络拓扑结构而言，典型的以太网组网示例包括两台计算机和一台交换机，它们通过双绞线相互连接。在这样的设置中，一台计算机（Host1）充当操作和测试平台，而另一台（Host2）则作为被测测试平台。同样，家用无线路由器也可以在此类实验中替代交换机的角色。



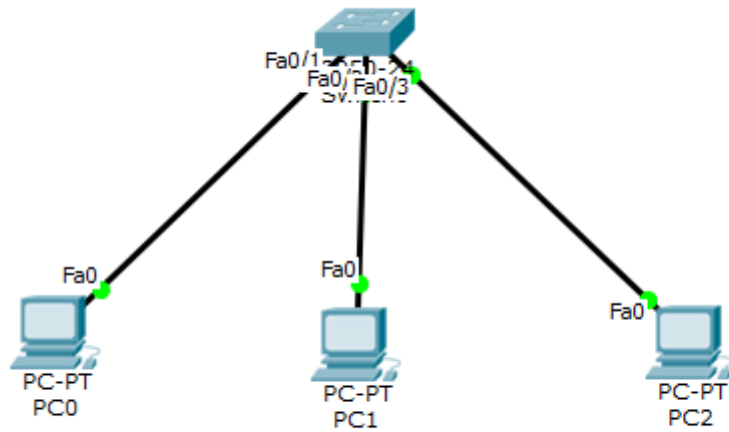
三.实验环境

- 操作系统：Windows 10

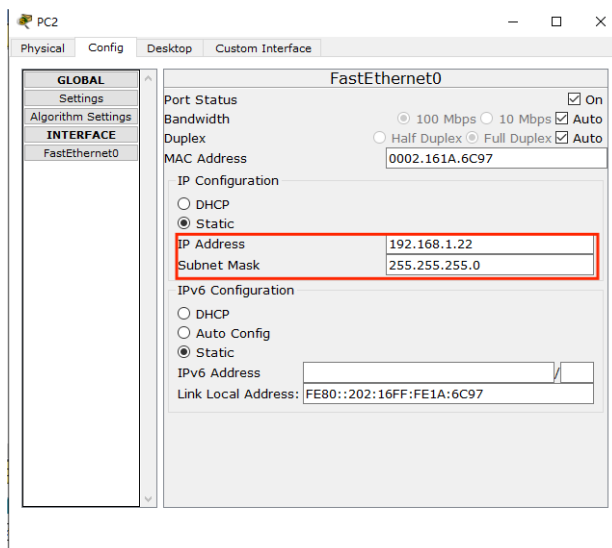
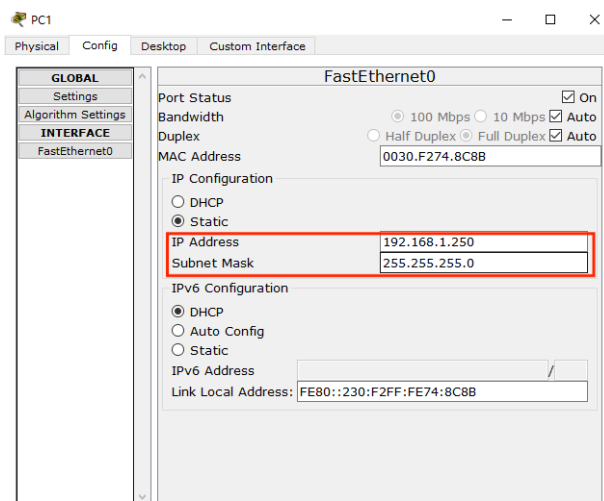
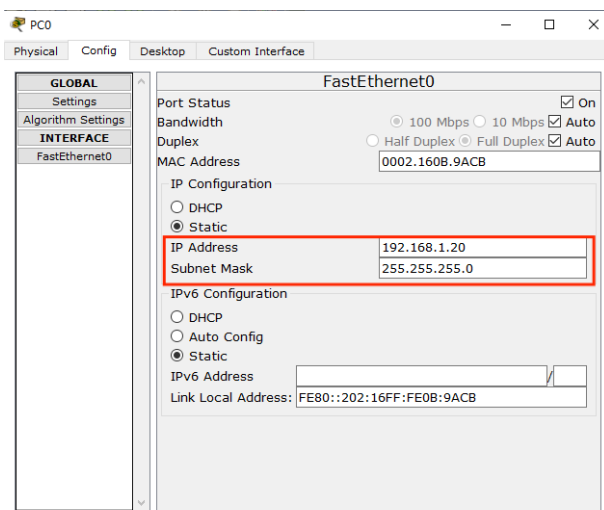
- 网络环境：局域网
- 软件：Cisco Packet Tracer 虚拟实验环境

四.实验步骤

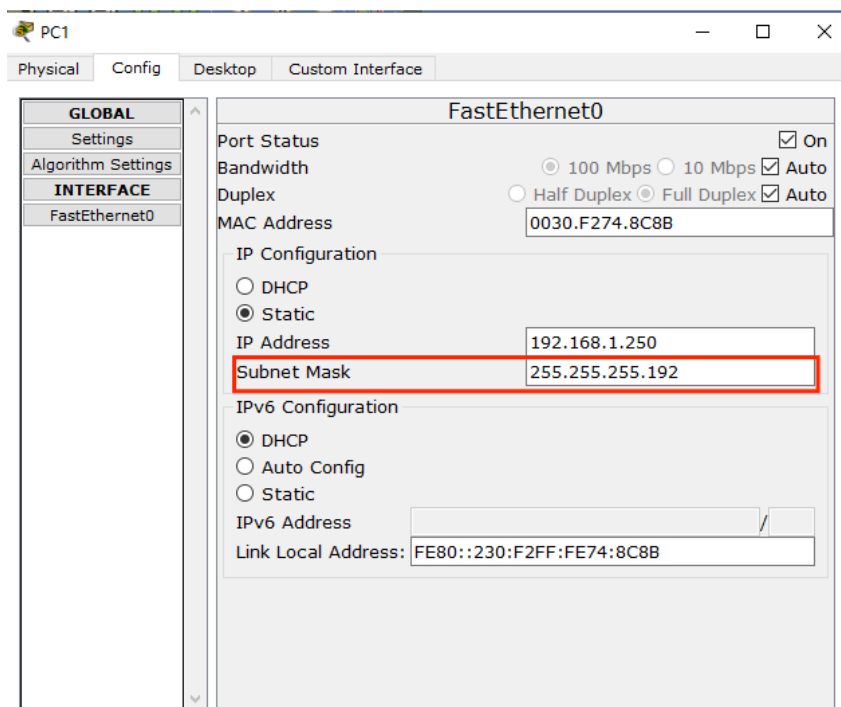
- 按下图所示方式构建网络拓扑结构



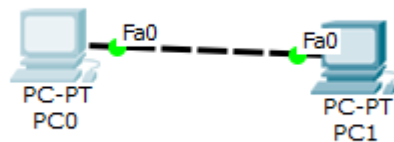
- 为 PC0 PC1 PC2 分别配置 ip 地址和子网掩码



- 使用 ping 命令测试 PC0、PC1、PC2 之间的网络连通性，观察和记录 ping 命令的结果。
- 修改 PC1 的子网掩码为 255.255.255.192，再使用 ping 命令观察



- 两台终端连接，观察 ping 的结果



五、实验现象

- PC0、PC1、PC2 两两之间 ping 通信成功

```
Command Prompt

PC>ping 192.168.1.250

Pinging 192.168.1.250 with 32 bytes of data:

Reply from 192.168.1.250: bytes=32 time=0ms TTL=128
Reply from 192.168.1.250: bytes=32 time=0ms TTL=128
Reply from 192.168.1.250: bytes=32 time=0ms TTL=128
Reply from 192.168.1.250: bytes=32 time=0ms TTL=128

Ping statistics for 192.168.1.250:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

PC>ping 192.168.1.22

Pinging 192.168.1.22 with 32 bytes of data:

Reply from 192.168.1.22: bytes=32 time=0ms TTL=128
Reply from 192.168.1.22: bytes=32 time=0ms TTL=128
Reply from 192.168.1.22: bytes=32 time=0ms TTL=128
Reply from 192.168.1.22: bytes=32 time=1ms TTL=128

Ping statistics for 192.168.1.22:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

```
Command Prompt

PC>ping 192.168.1.20

Pinging 192.168.1.20 with 32 bytes of data:

Reply from 192.168.1.20: bytes=32 time=0ms TTL=128
Reply from 192.168.1.20: bytes=32 time=1ms TTL=128
Reply from 192.168.1.20: bytes=32 time=1ms TTL=128
Reply from 192.168.1.20: bytes=32 time=0ms TTL=128

Ping statistics for 192.168.1.20:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

PC>ping 192.168.1.22

Pinging 192.168.1.22 with 32 bytes of data:

Reply from 192.168.1.22: bytes=32 time=6ms TTL=128
Reply from 192.168.1.22: bytes=32 time=0ms TTL=128
Reply from 192.168.1.22: bytes=32 time=0ms TTL=128
Reply from 192.168.1.22: bytes=32 time=0ms TTL=128

Ping statistics for 192.168.1.22:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 6ms, Average = 1ms
```

```
Command Prompt

PC>ping 192.168.1.20

Pinging 192.168.1.20 with 32 bytes of data:

Reply from 192.168.1.20: bytes=32 time=1ms TTL=128
Reply from 192.168.1.20: bytes=32 time=0ms TTL=128
Reply from 192.168.1.20: bytes=32 time=0ms TTL=128
Reply from 192.168.1.20: bytes=32 time=1ms TTL=128

Ping statistics for 192.168.1.20:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

PC>ping 192.168.1.250

Pinging 192.168.1.250 with 32 bytes of data:

Reply from 192.168.1.250: bytes=32 time=0ms TTL=128
Reply from 192.168.1.250: bytes=32 time=0ms TTL=128
Reply from 192.168.1.250: bytes=32 time=0ms TTL=128
Reply from 192.168.1.250: bytes=32 time=0ms TTL=128

Ping statistics for 192.168.1.250:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

- 修改 PC1 的子网掩码为 255.255.255.192，通信失败

```
PC0

Physical Config Desktop Custom Interface

Command Prompt

Packet Tracer PC Command Line 1.0
PC>ping 192.168.1.250

Pinging 192.168.1.250 with 32 bytes of data:

Reply from 192.168.1.250: bytes=32 time=1ms TTL=128
Reply from 192.168.1.250: bytes=32 time=0ms TTL=128
Reply from 192.168.1.250: bytes=32 time=0ms TTL=128
Reply from 192.168.1.250: bytes=32 time=0ms TTL=128

Ping statistics for 192.168.1.250:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

PC>ping 192.168.1.250

Pinging 192.168.1.250 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 192.168.1.250:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

- 两台终端连接 ping 通信成功

Command Prompt

```
Packet Tracer PC Command Line 1.0
PC>ping 192.168.1.250

Pinging 192.168.1.250 with 32 bytes of data:

Reply from 192.168.1.250: bytes=32 time=1ms TTL=128
Reply from 192.168.1.250: bytes=32 time=0ms TTL=128
Reply from 192.168.1.250: bytes=32 time=0ms TTL=128
Reply from 192.168.1.250: bytes=32 time=0ms TTL=128

Ping statistics for 192.168.1.250:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

六、实验结论

- 在进行以太网组网的实验中，我深入了解到以太网作为当下最广泛应用的有线局域网技术的核心组成部分，包括网络设备、网络接口卡和双绞线等。实验强调了子网技术在以太网设计中的重要性，这一技术允许网络管理员将庞大的网络划分为更小、更便于管理的子网络单元。我观察到，仅当设备处于相同子网内时，它们才能直接通信；位于不同子网的设备之间的通信则依赖于路由器等中介设备，因为路由器具备将数据从一个子网路由到另一个子网的能力。
- 通过这次实验，子网的概念和作用被进一步明确。子网通过在网络地址和主机地址之间引入一个中间层来实现网络的细分，这不仅优化了网络的性能和安全性，还简化了网络的管理流程。子网掩码的作用在实验中被特别强调，作为一个32位的数字标识，它定义了IP地址中的哪些位代表网络（包括子网）部分，哪些位代表主机部分，从而帮助确定任何特定IP地址的子网归属，并指导路由器正确地进行数据包的转发。通过本次以太网组网实验，我不仅掌握了以太网技术的基本操作和配置方法，也深刻理解了子网技术在现代网络设计中的重要性和实用价值。