局域网（以太网）实验

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实验地点：济事楼 330 **实验时间：2020 年 10 月 22 日 78 节**

【实验目的】

1.通过实验再次熟悉主机 IP 地址和子网掩码的配置方法以及网络连通测试工具使用方法。

2.通过实验体会子网掩码在网络划分中的作用。

3.理解掌握以太网组网步骤以及局域网组网原理。

4.了解以太网网络地址格式等。

【实验原理】

1.物理网络

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，本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。

2.以太网

最初的以太网网络介质是一段同轴通信电缆，而这段同轴通信电缆产品名叫以太，以太网因此得名。以太网是总线型网络技术的杰出代表，其对网络层进行分层设计，可以适应不同介质，实现向后兼容，成为网络的“常青树”，是现代局域网事实标准，当前家庭和企业都使用以太网来构建物理网络。

以太网网络通信功能集成在以太网网卡内，其具有以太网物理地址（即 MAC 地址），采用 48 位二进制数据，比 IPV4 还要长，目的是为了防止地址冲突。以太网内所有节点必须先将数据接收下来然后才能判断自身是否是目标节点，选择是否接收。

3.局域网原理

局域网是指局部地区形成的一个区域性网络（即 LAN），即在一个较小物理

区域内将所有的计算机连接起来的低成本网络，其分布地区范围有限可大可小，大的如将两栋相邻建筑的计算机连接起来，小的如将办公室的计算机连接起来，其特点就是通信节点之间距离非常近而且密度大。

局域网相对其他网络传输速度快，性能稳定，框架简易且封闭，是许多机构构建物理网络的首选，其组成包括计算机设备、网络连接设备、网络传输介质三部分。

4.以太网组网原理

以太网是现今有线局域网的主体，即使是使用无线网络连接主机最终也都要借助以太网才能连接互联网，以太网主要由以太网网络设备（交换机）、以太网卡以及双绞线组成，交换机一般提供多个以太网端口，可以使用双绞线将主机网卡同交换机端口连接起来，从而构成一个独立的物理网络实现各节点之间的通信。

【实验设备】

1.一台运行 Windows 系统的计算机设备。

2.仿真终端软件 Cisco Packet Tracer。

【实验步骤】

1.使用双绞线直通线将三台计算机设备和一台 Cisco2950-24 交换机端口连接起来。

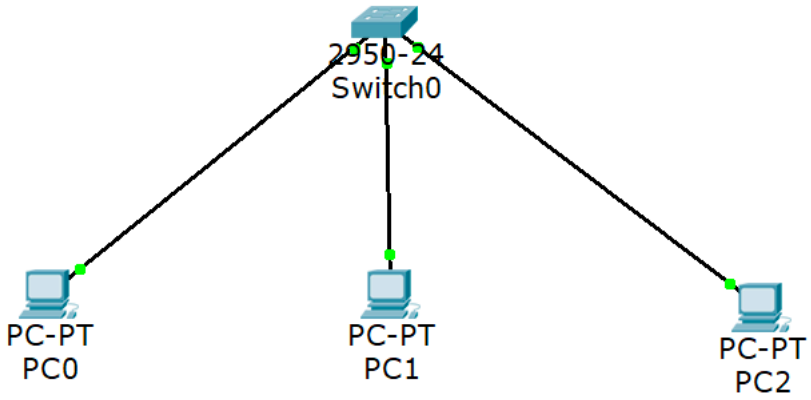
2.为三台计算机分别配置 IP 地址为 PC0:192.168.1.20 和 PC1:192.168.1.250 和 PC2: 192.168.1.22，并配置子网掩码为 255.255.255.0。使用 ipconfig 命令查看各台计算机的相关网络配置。

3.使用 ping 命令检测三台计算机设备之间是否连通。

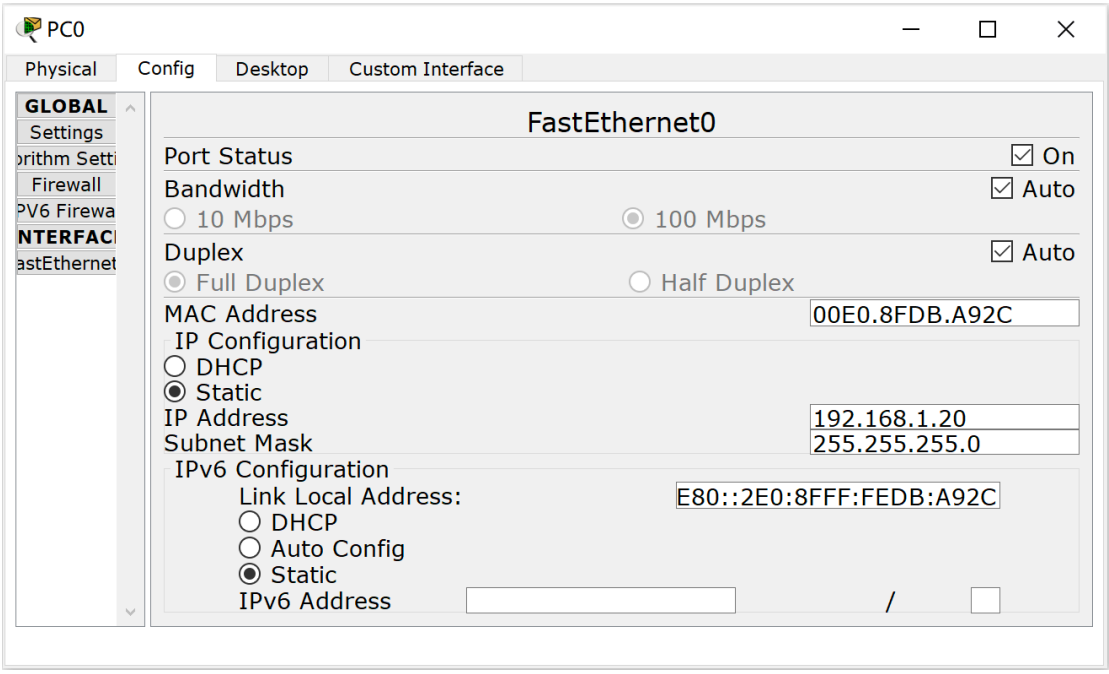
4.将 PC1 的子网掩码设置为 255.255.255.192，再重新检测三台设备之间的连通性（使用 ping 命令）。

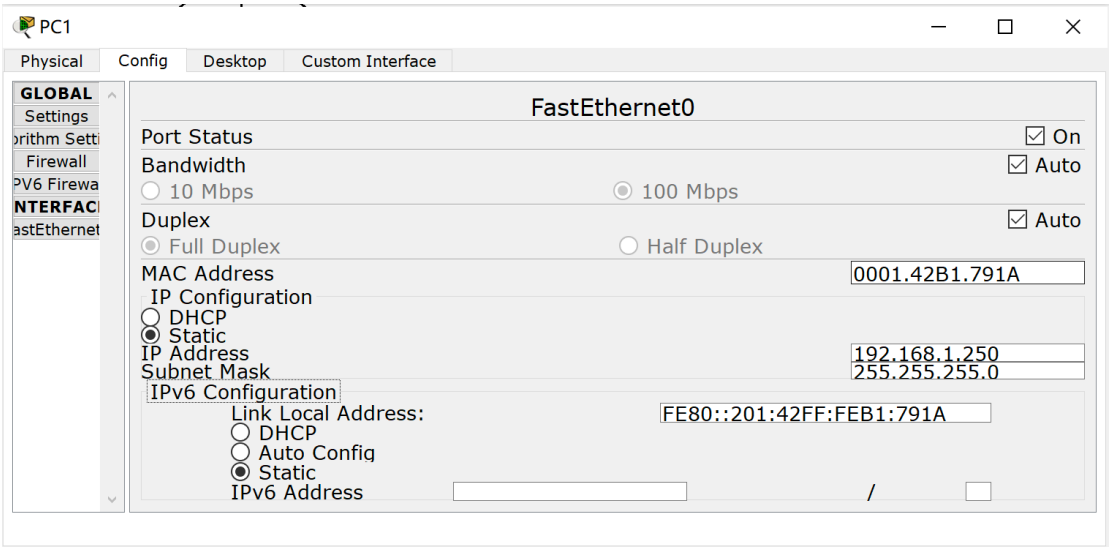
【实验现象】

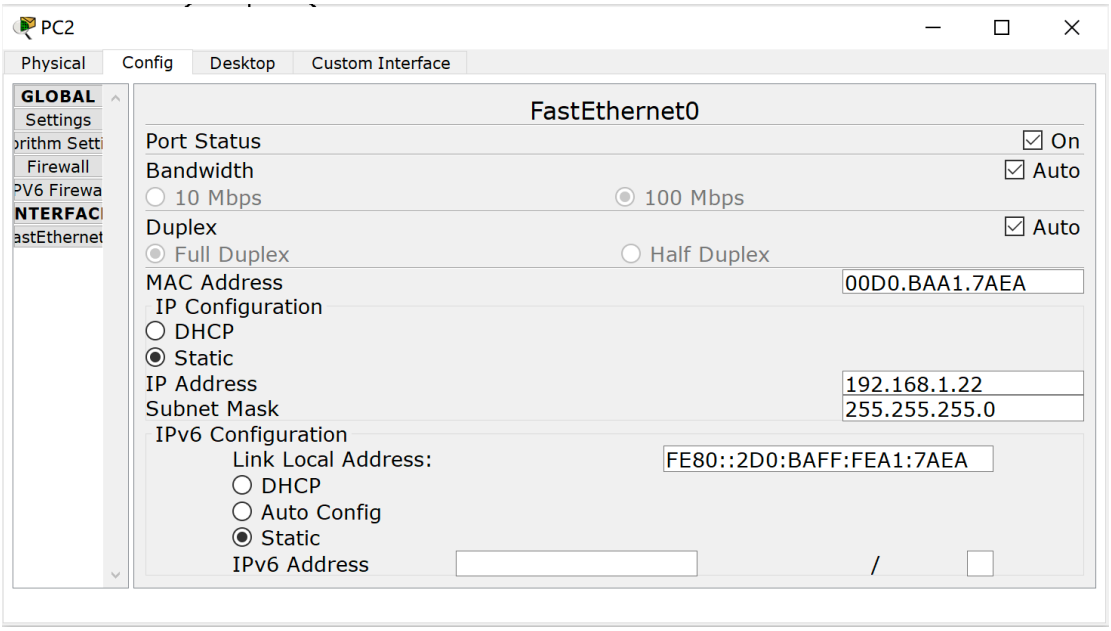
1.以太网组网拓扑结构如图。

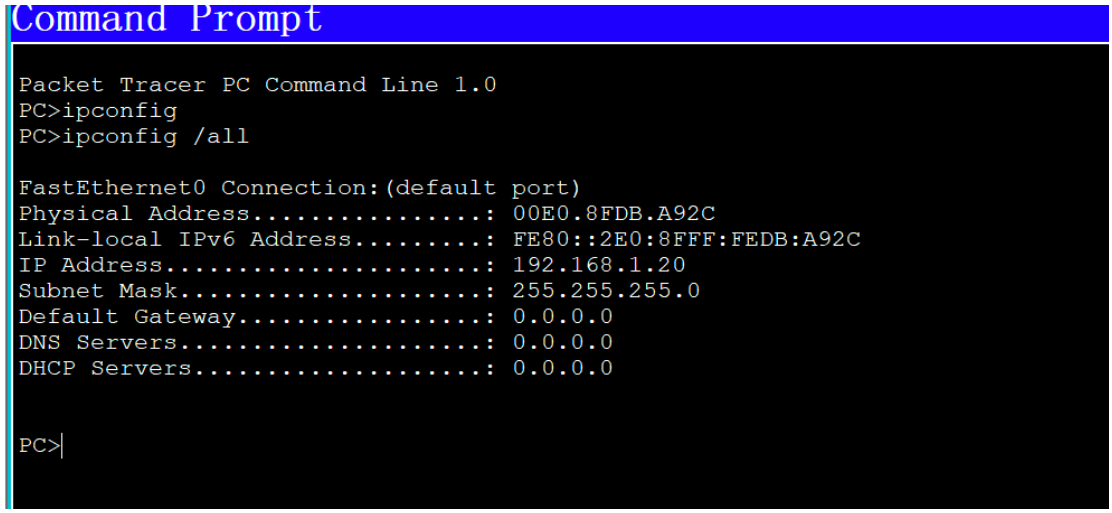


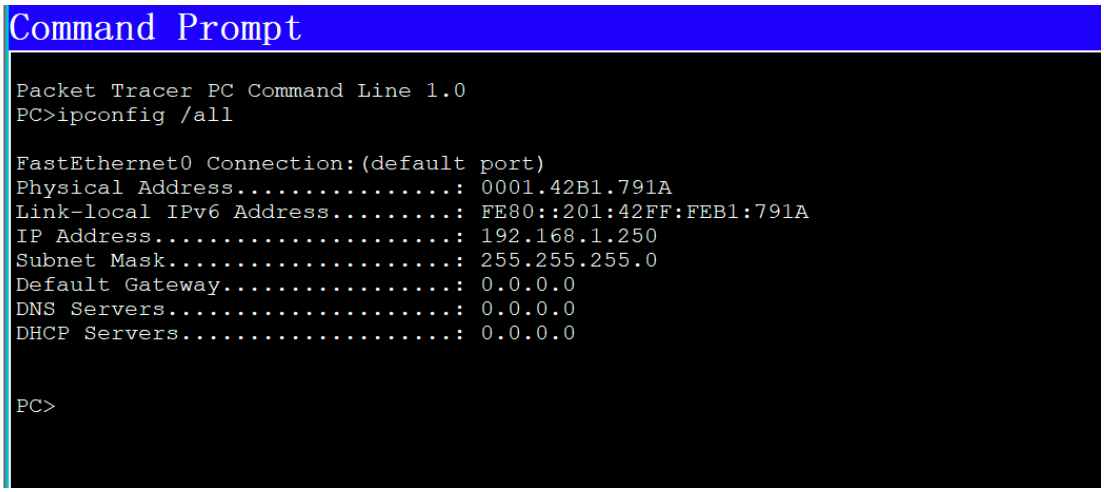
2.配置主机 IP 地址、子网掩码，以及查看各主机相关网络配置信息。

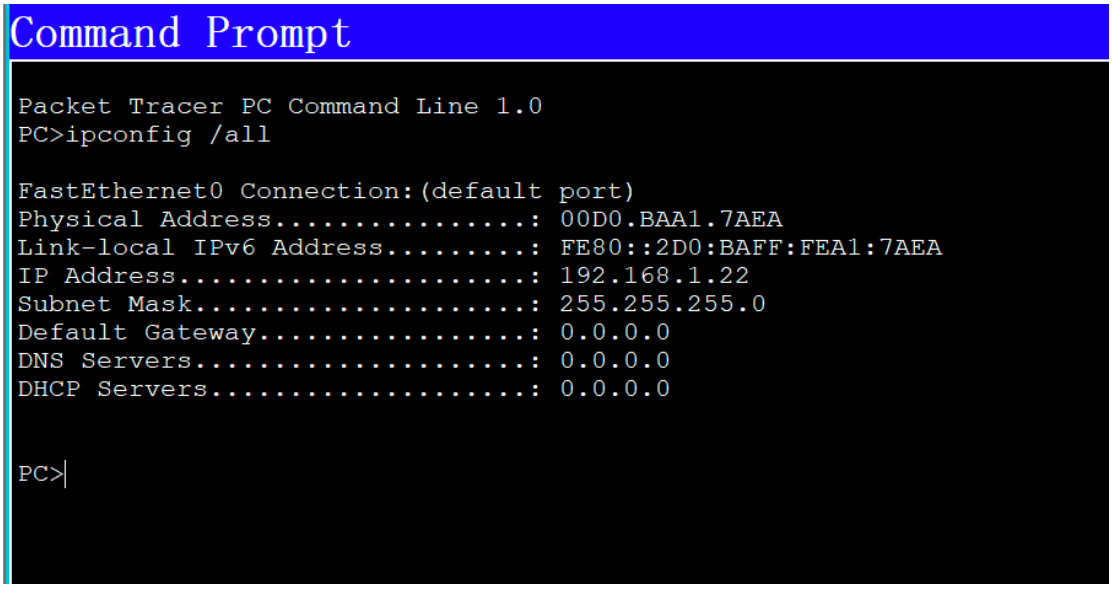



PC1
Physical
Config
Desktop
Custom Interface
GLOBAL
Settings
Firewall
FastEthernet0
Port Status
On
Bandwidth
Auto
10 Mbps
100 Mbps
Duplex
Auto
Full Duplex
Half Duplex
MAC Address
0001.42B1.791A
IP Configuration
DHCP
Static
IP Address
192.168.1.250
Subnet Mask
255.255.255.0
IPv6 Configuration
Link Local Address:
FE80::201:42FF:FEB1:791A
DHCP
Auto Config
Static
IPv6 Address


PC2
Physical
Config
Desktop
Custom Interface
GLOBAL
Settings
Firewall
FastEthernet0
Port Status
On
Bandwidth
Auto
10 Mbps
100 Mbps
Duplex
Auto
Full Duplex
Half Duplex
MAC Address
00D0.BAA1.7AEA
IP Configuration
DHCP
Static
IP Address
192.168.1.22
Subnet Mask
255.255.255.0
IPv6 Configuration
Link Local Address:
FE80::2D0:BAFF:FEA1:7AEA
DHCP
Auto Config
Static
IPv6 Address


Command Prompt
Packet Tracer PC Command Line 1.0
PC>ipconfig
PC>ipconfig /all
FastEthernet0 Connection:(default port)
Physical Address.....: 00E0.8FDB.A92C
Link-local IPv6 Address.....: FE80::2E0:8FFF:FEDB:A92C
IP Address.....: 192.168.1.20
Subnet Mask.....: 255.255.255.0
Default Gateway.....: 0.0.0.0
DNS Servers.....: 0.0.0.0
DHCP Servers.....: 0.0.0.0
PC>





3.使用 ping 命令检测三台计算机设备之间是否连通。

```
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 192.168.1.22

Pinging 192.168.1.22 with 32 bytes of data:

Reply from 192.168.1.22: bytes=32 time=1ms 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 = 1ms, Average = 0ms
```

```
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=0ms 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

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 = 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=1ms 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 = 1ms, Average = 0ms

PC>
```

4.将 PC1 的子网掩码设置为 255.255.255.192，再重新检测三台设备之间的连通性。

```
PC>ipconfig /all

FastEthernet0 Connection:(default port)
Physical Address.....: 0001.42B1.791A
Link-local IPv6 Address.....: FE80::201:42FF:FEB1:791A
IP Address.....: 192.168.1.250
Subnet Mask.....: 255.255.255.192
Default Gateway.....: 0.0.0.0
DNS Servers.....: 0.0.0.0
DHCP Servers.....: 0.0.0.0
```

```
PC>ping 192.168.1.20

Pinging 192.168.1.20 with 32 bytes of data:

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

Ping statistics for 192.168.1.20:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

PC>ping 192.168.1.22

Pinging 192.168.1.22 with 32 bytes of data:

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

Ping statistics for 192.168.1.22:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

```
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=12ms TTL=128
Reply from 192.168.1.22: bytes=32 time=0ms TTL=128
Reply from 192.168.1.22: bytes=32 time=5ms 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 = 12ms, Average = 4ms

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),
```

【分析讨论】