

1

VLAN配置

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单交换机的VLAN配置

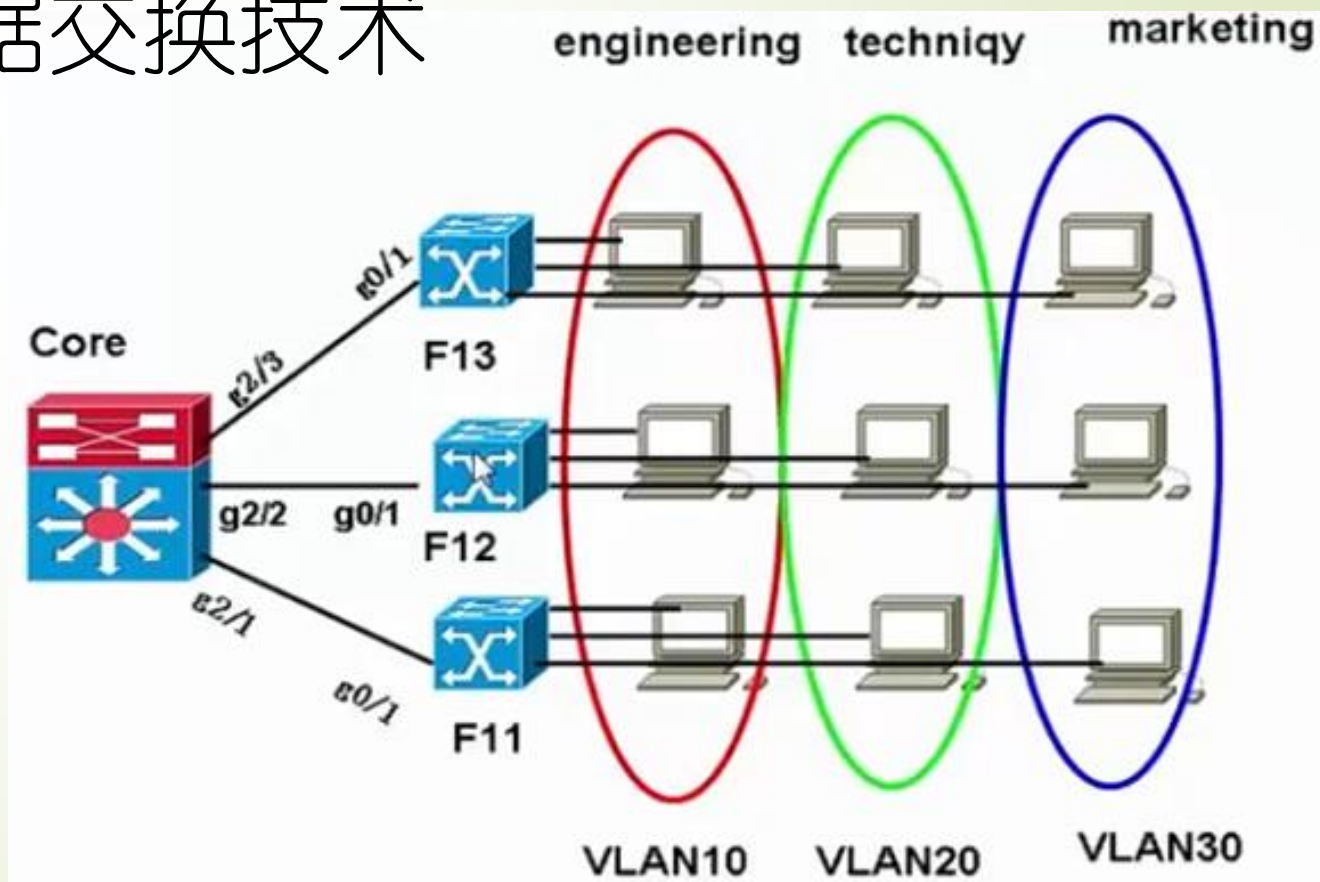
- 实验目的
- 实验原理
- 关键命令
- 实验内容
- 实验步骤

实验目的

- 掌握以太网交换机上VLAN划分过程
- 验证每个VLAN为独立的广播域
- 验证属于同一VLAN的终端之间的通信过程
- 验证属于不同VLAN的两个终端之间不能通信

VLAN原理

➡ VLAN (Virtual Local Area Network) 中文名为“虚拟局域网”，是一种将物理上的局域网从逻辑上划分为多个广播域，从而实现虚拟工作组的数据交换技术



VLAN原理

- ➡ VLAN是通过软件把网络按逻辑分组，对物理上交换机端口分割，把不同地理位置的主机分割到相同VLAN内，每个VLAN等同于独立的以太网。每个VLAN有独立的转发表。
- ➡ 同一VLAN内终端间相互传输MAC帧，不同VLAN内终端之间不允许相互传输MAC帧
- ➡ 默认情况下，交换机所有端口属于默认的VLAN1，交换机的所有端口属于同一个广播域

VLAN的功能

- ➡ 有效控制网络广播风暴
- ➡ 提高网络的安全性，如限制网络中的计算机访问权限、防病毒、防止信息被监听等
- ➡ 有效的网络监控
- ➡ 流量管理
- ➡ 实现不同地域部门内的局域网通信

思科 2960 交换机

- 24个以太网10/100Mbps PoE端口，2个两用上行端口
- 没有被划分VLAN时，交换机默认只有VLAN1，所有端口在VLAN 1



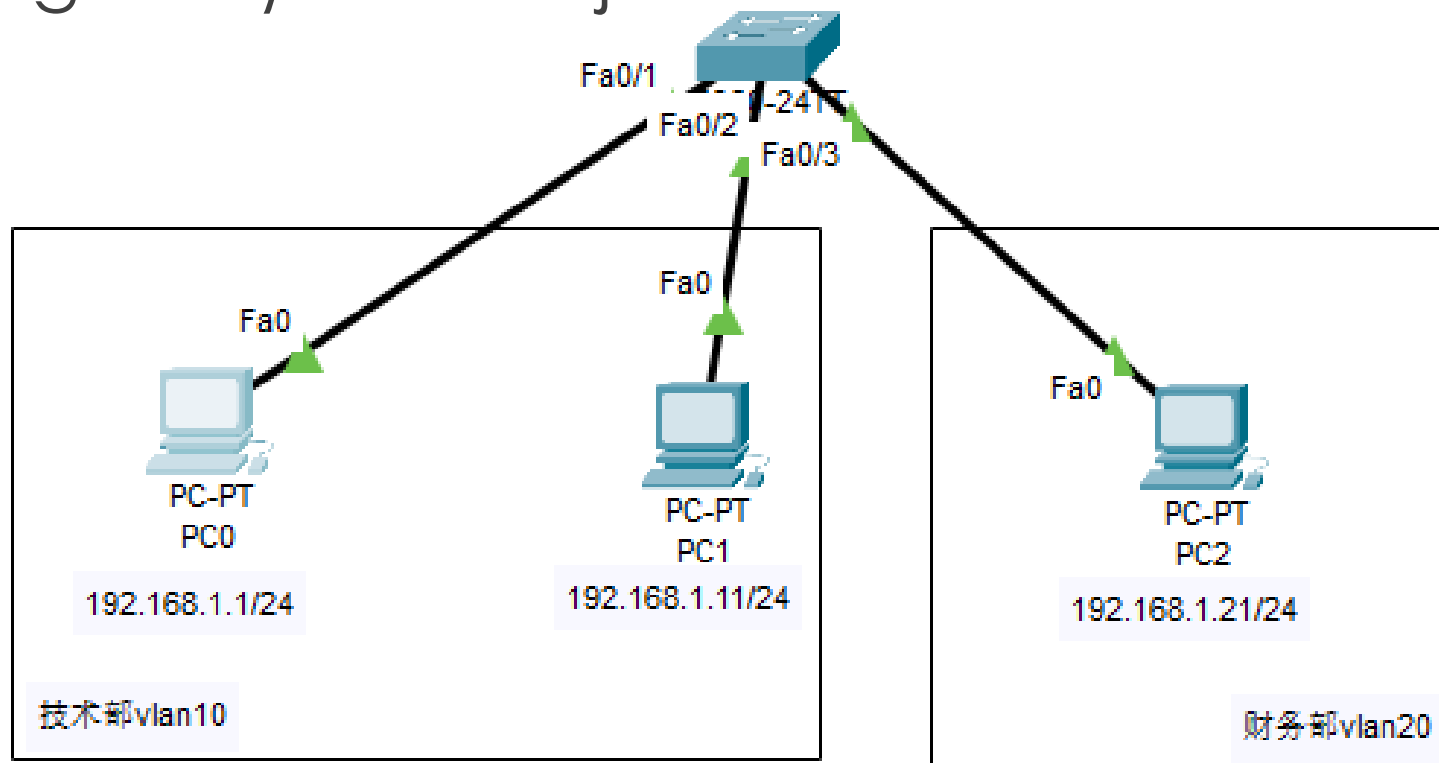
硬件连接

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创建VLAN

- 第一条命令：创建VLAN
Switch(config)#vlan 10
- 第二条命令：VLAN命名
Switch(config-vlan)#name jishubu



端口划入VLAN

- 第一条命令：全局配置模式下进入接口fastethernet 0/1的配置

```
Switch(config)#interface fastethernet0/1
```

- 第二条:把fa0/1输入端口划分给VLAN 10

```
Switch(config-if)#switchport access vlan 10
```

端口从VLAN删除

- 第一条命令：全局配置模式下进入接口fa0/2

```
Switch(config)#interface fa0/2
```

- 第二条命令:把fa0/2端口从VLAN 10中删除

```
Switch(config-if)#no switchport access vlan 10
```

查看VLAN

- 查看所有VLAN信息
Switch#show vlan
- 查看所有VLAN10信息
Switch#show vlan 10

查看MAC表

- Switch#show mac-address table

清除MAC表中存在的转发项

- Switch#clear mac-address table

删除VLAN

Switch(vlan)#no vlan 10

- ➡ 删除VLAN 10后，所有分配给VLAN10的端口都变回非活动状态
- ➡ 所以删除vlan前，先将vlan使用的接口先释放,才能被再使用

Switch>en

Switch#configure terminal

Enter configuration commands, one per line. End with CNTL/Z.

Switch(config)#interface f0/1

Switch(config-if)#no switchport access vlan 10

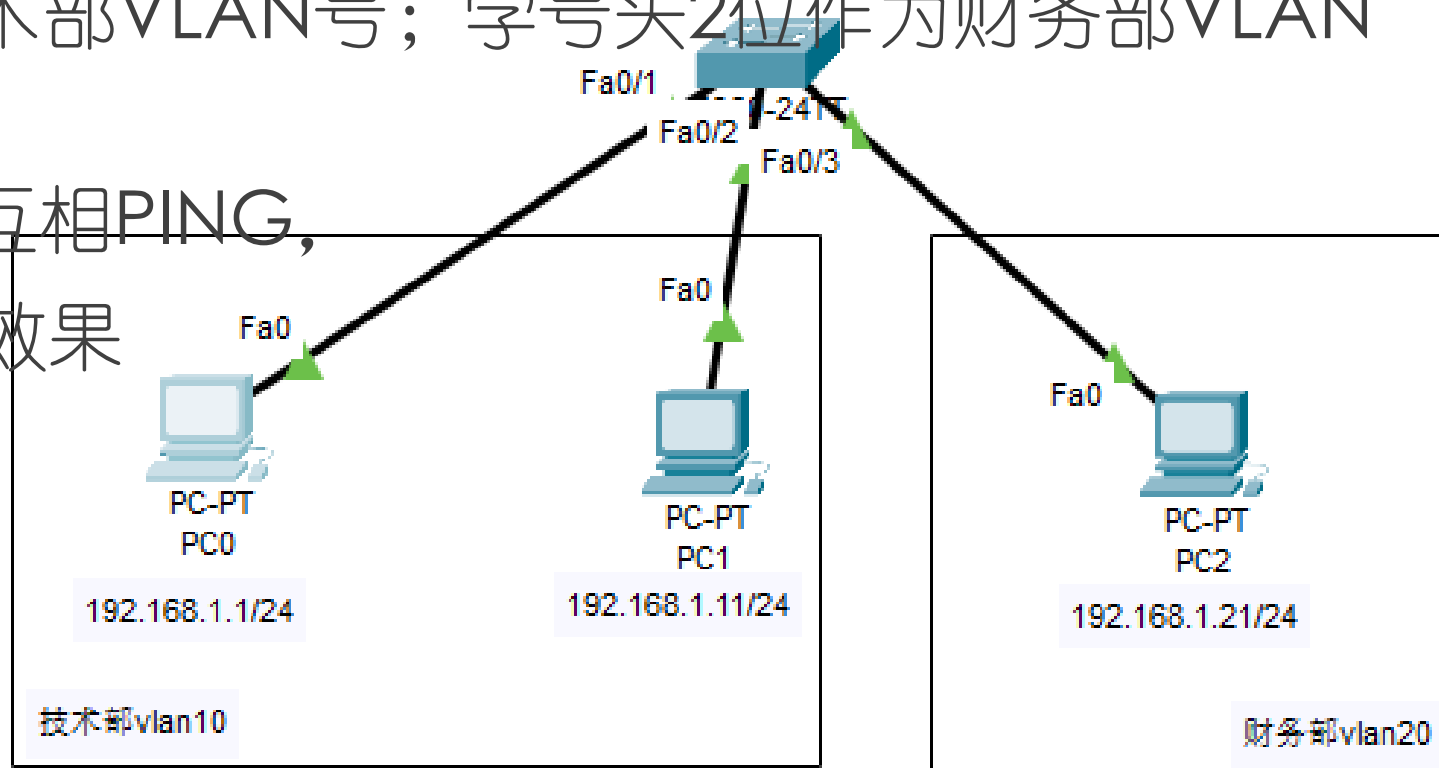
Switch(config-if)#exit

Switch(config)#no vlan 10

Switch(config)#end

实验内容(单交换机)

- 1, 创建具有如图拓扑结构的网络,要求PC2的IP地址最后一段为学号1-2位
- 2, 3台PC互相PING, 验证连通性
- 3, 创建2个VLAN, 分别命名技术部和财务部, 以自己学号最后2位作为技术部VLAN号; 学号头2位作为财务部VLAN号
- 4, 再次3台PC互相PING, 验证VLAN创建效果

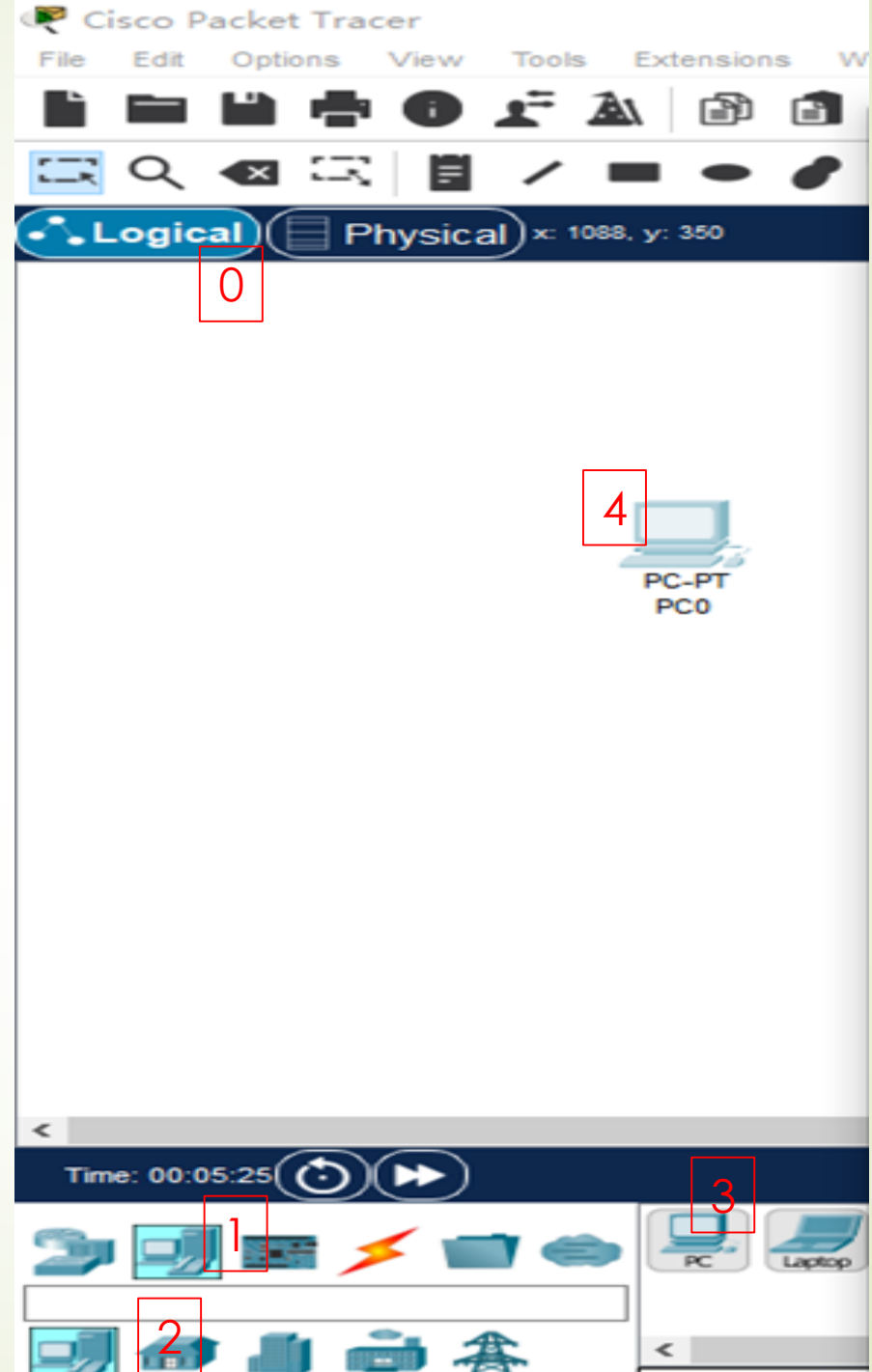


实验步骤

- 1, 构建网络拓扑
- 2, 标注IP地址和子网掩码
- 3, 查看并标注交换机接口名称
- 4, 配置IP地址和子网掩码
- 5, 选择要监视的网络协议
- 6, 网络连通性测试
- 7, 查看交换机接口（端口）状态汇总表
- 8, 测试广播域
- 9, 交换机上创建 V L A N
- 1 0, 交换机上划分 V L A N
- 1 1, 验证同一VLAN中的计算机之间可以直接通信, 不同VLAN中的计算机之间不能直接通信。
- 12, 验证划分VLAN可将庞大的广播域分割成若干个独立的广播域
- 13, 查看交换机MAC表

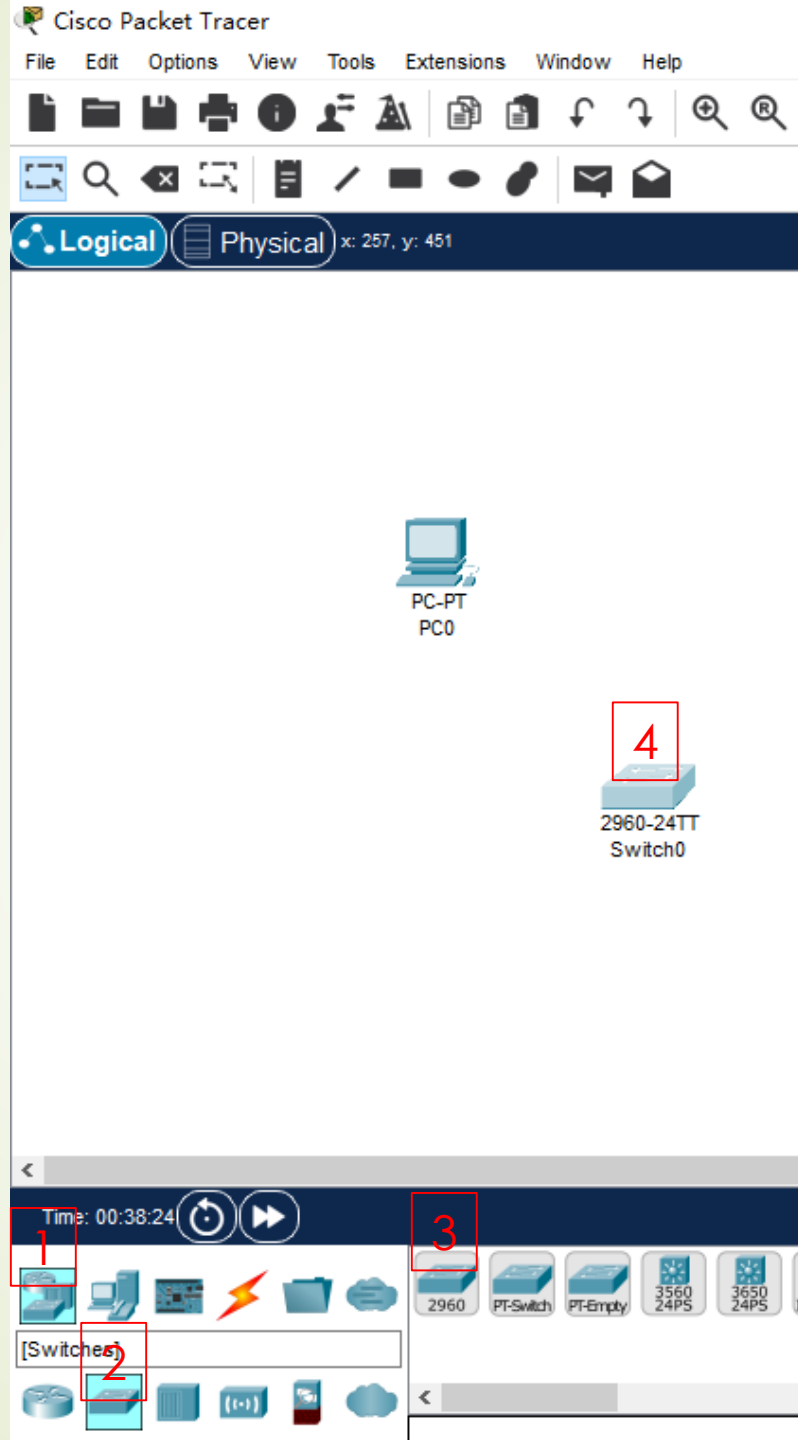
添加PC

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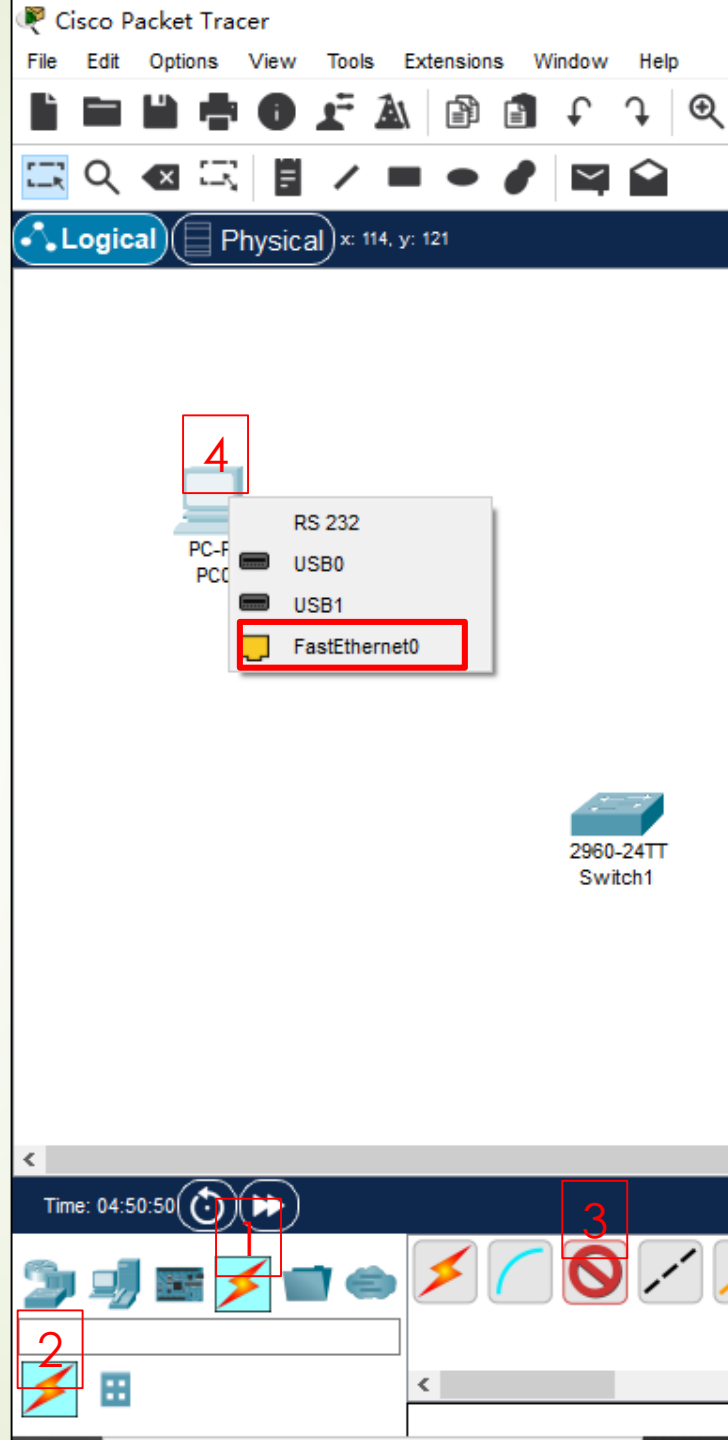


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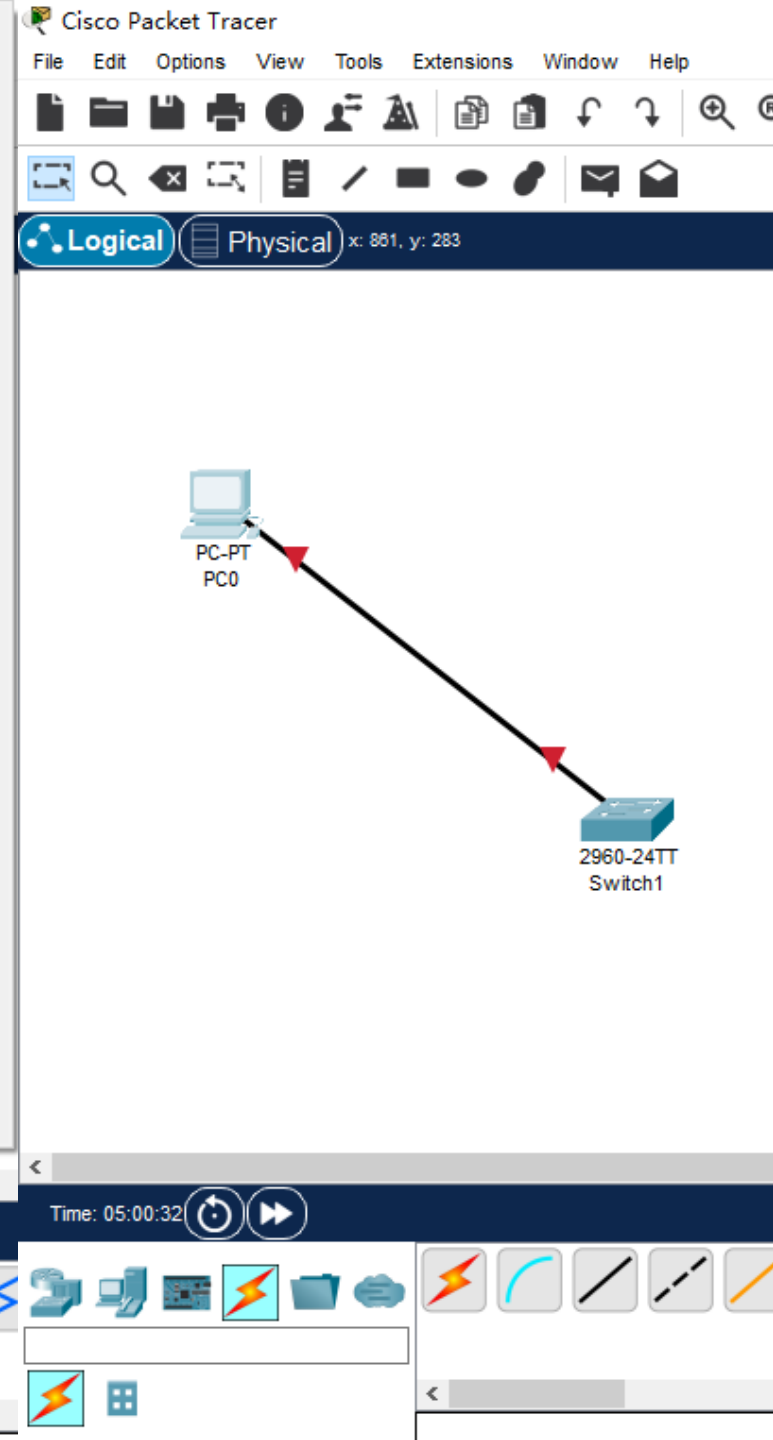
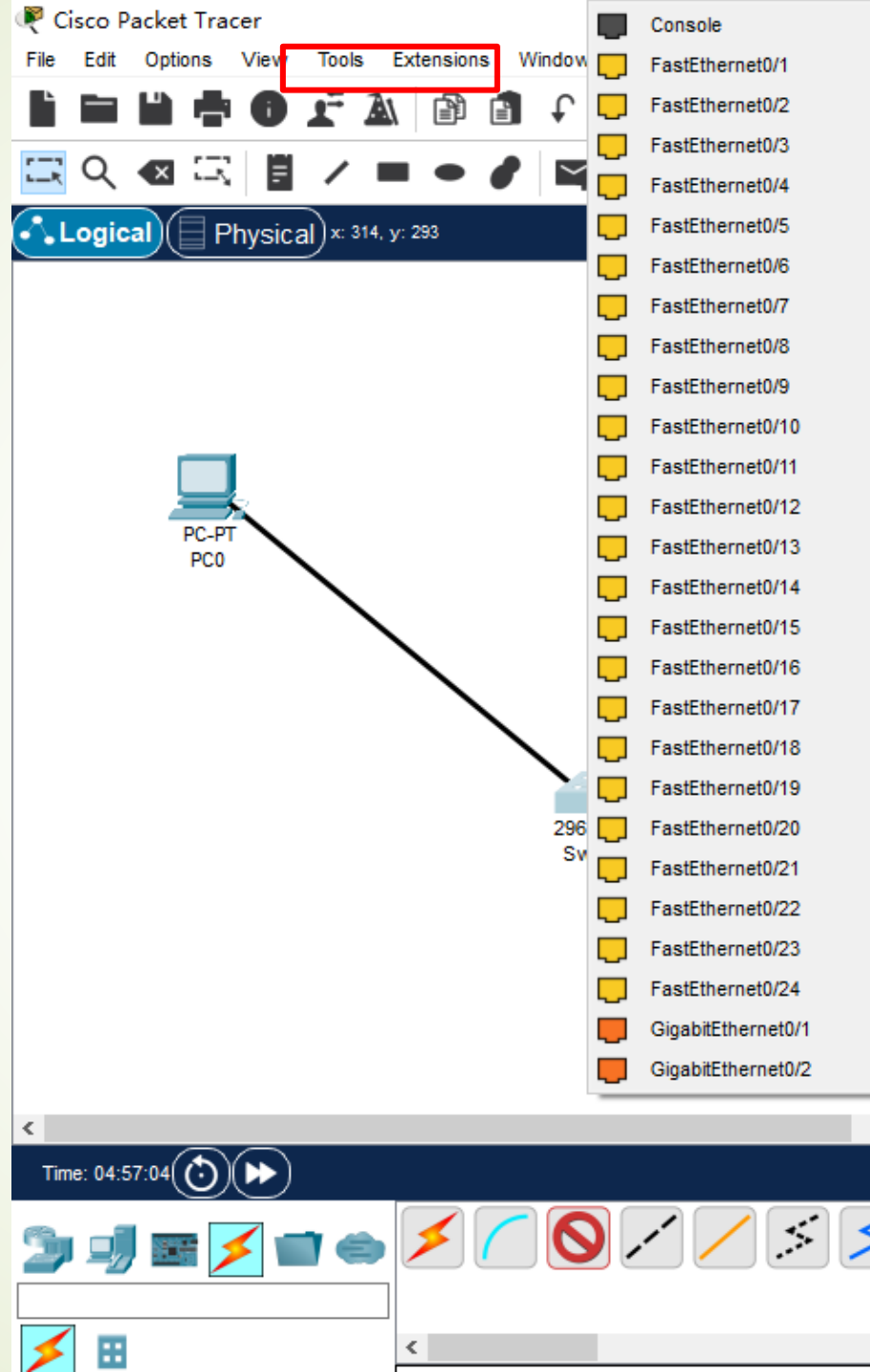
添加
交换机

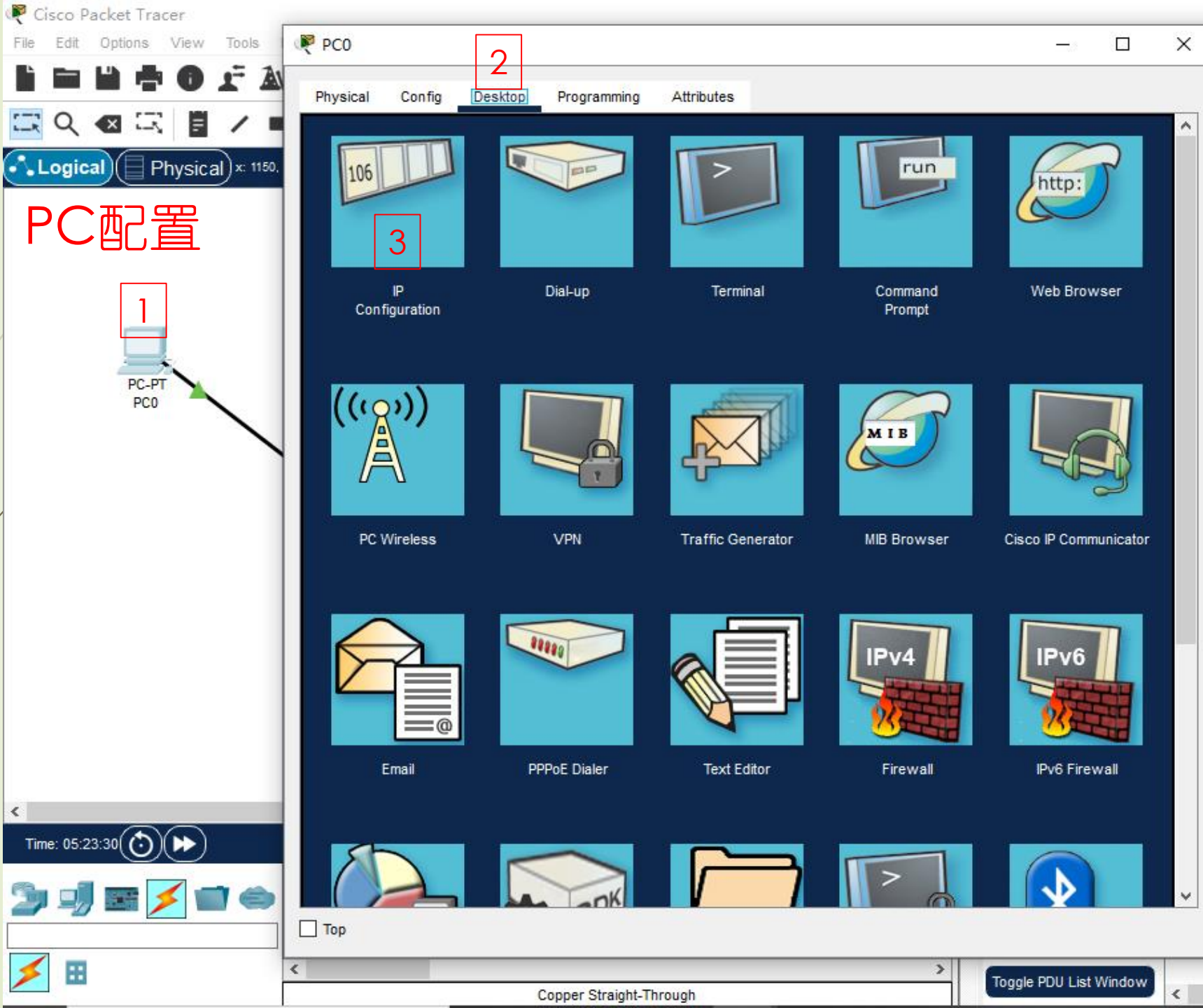


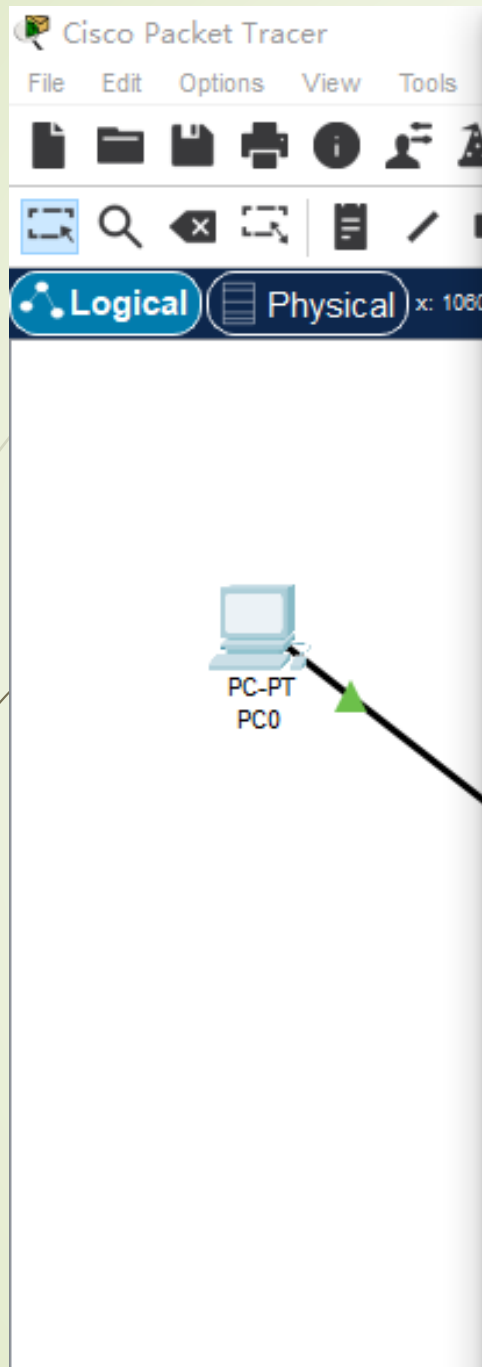
连接
直通线



设置连接 端口







PC0

Physical Config **Desktop** Programming Attributes

IP Configuration

Interface: FastEthernet0

IP Configuration

☐ DHCP ☒ Static

IPv4 Address: 192.168.1.1

Subnet Mask: 255.255.255.0

Default Gateway: 0.0.0.0

DNS Server: 0.0.0.0

IPv6 Configuration

☐ Automatic ☒ Static

IPv6 Address: /

Link Local Address: FE80::2D0:BCFF:FE60:E696

Default Gateway:

DNS Server:

802.1X

☐ Use 802.1X Security

Authentication: MD5

Username:

Password:

Cisco Packet Tracer

File Edit Options View Tools Extensions Window Help

Logical Physical x: 101, y: 124

检查IP设置成功

PC0 Device Name: PC0
PC0 Device Model: PC-PT

Port	Link	IP Address	IPv6 Address	MAC Address
FastEthernet0	Up	192.168.1.1/24	<not set>	00D0.BC60.E696
Bluetooth	Down	<not set>	<not set>	00D0.BAED.8EED

Gateway: <not set>
DNS Server: <not set>
Line Number: <not set>

Physical Location: Intercity > Home City > Corporate Office > PC0

Switch1

Time: 05:30:28

Scenario 0

New Delete

Toggle PDU List Window

建立VLAN之前，测试网络互通性

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Packet Tracer

Options View Tools Extensions Window Help

Physical x: 780, y: 444

```
graph TD
    Switch[Switch] ---|Fa0/1| PC0[PC-PT PC0]
    Switch ---|Fa0/2| PC1[PC-PT PC1]
    Switch ---|Fa0/3| PC2[PC-PT PC2]
    subgraph "技术部vlan10"
        PC0
        PC1
    end
    subgraph "财务部vlan20"
        PC2
    end
    PC0 --- IP0[192.168.1.1/24]
    PC1 --- IP1[192.168.1.11/24]
    PC2 --- IP2[192.168.1.21/24]
```

PC0

Physical Config Desktop Programming Attributes

Command Prompt

```
C:\>ping 192.168.1.11

Pinging 192.168.1.11 with 32 bytes of data:

Reply from 192.168.1.11: bytes=32 time=4ms TTL=128
Reply from 192.168.1.11: bytes=32 time<1ms TTL=128
Reply from 192.168.1.11: bytes=32 time<1ms TTL=128
Reply from 192.168.1.11: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.1.11:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 4ms, Average = 1ms

C:\>ping 192.168.1.21

Pinging 192.168.1.21 with 32 bytes of data:

Reply from 192.168.1.21: bytes=32 time=16ms TTL=128
Reply from 192.168.1.21: bytes=32 time<1ms TTL=128
Reply from 192.168.1.21: bytes=32 time<1ms TTL=128
Reply from 192.168.1.21: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.1.21:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 16ms, Average = 4ms

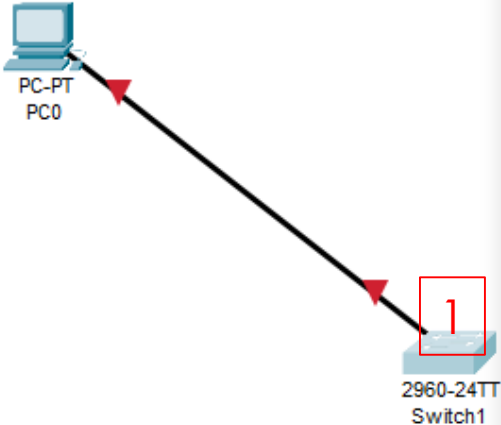
C:\>
```

Cisco Packet Tracer

File Edit Options View Tools Extensions Window Help

Logical Physical x: 1280, y: 289

交换机配置VLAN



PC-PT PC0

2960-24TT Switch1

Time: 05:10:42

Switch1

Physical Config **CLI** Attributes

IOS Command Line Interface

```
Processor board ID FOC1010X104
Last reset from power-on
1 Virtual Ethernet interface
24 FastEthernet interfaces
2 Gigabit Ethernet interfaces
The password-recovery mechanism is enabled.
64K bytes of flash-simulated non-volatile configuration memory.
Base ethernet MAC Address       : 00:D0:58:22:E6:AE
Motherboard assembly number     : 73-10390-03
Power supply part number        : 341-0097-02
Motherboard serial number       : FOC10093R12
Power supply serial number      : AZS1007032H
Model revision number           : B0
Motherboard revision number     : B0
Model number                    : WS-C2960-24TT-L
System serial number            : FOC1010X104
Top Assembly Part Number        : 800-27221-02
Top Assembly Revision Number    : A0
Version ID                      : V02
CLEI Code Number                : COM3L00BRA
Hardware Board Revision Number  : 0x01

Switch Ports Model          SW Version  SW Image
-----
*   1 26    WS-C2960-24TT-L    15.0(2)SE4  C2960-LANBASEK9-M

Cisco IOS Software, C2960 Software (C2960-LANBASEK9-M), Version 15.0(2)SE4, RELEASE
SOFTWARE (fcl)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2013 by Cisco Systems, Inc.
Compiled Wed 26-Jun-13 02:49 by mnguyen

Press RETURN to get started!
```

Copy Paste

Top

交换机配置命令

Switch>enable

Switch#configure terminal

Enter configuration commands, one per line. End with CNTL/Z.

Switch(config)#vlan 10

Switch(config-vlan)#name jishubu

Switch(config-vlan)#exit

Switch(config)#类似的配置其他vlan

Switch(config)#interface range f0/1-2

Switch(config-if-range)#switchport access vlan 10

Switch(config-if-range)#exit

Switch(config)#类似的配置别的端口

配置完查看 vlan

```
Switch#show vlan
```

VLAN Name	Status	Ports
1 default	active	Fa0/4, Fa0/5, Fa0/6, Fa0/7 Fa0/8, Fa0/9, Fa0/10, Fa0/11 Fa0/12, Fa0/13, Fa0/14, Fa0/15 Fa0/16, Fa0/17, Fa0/18, Fa0/19 Fa0/20, Fa0/21, Fa0/22, Fa0/23 Fa0/24, Gig0/1, Gig0/2
10 jishubu	active	Fa0/1, Fa0/2
20 caiwubu	active	Fa0/3
1002 fddi-default	active	
1003 token-ring-default	active	
1004 fddinet-default	active	
1005 trnet-default	active	

VLAN	Type	SAID	MTU	Parent	RingNo	BridgeNo	Stp	BrdgMode	Trans1	Trans2
1	enet	100001	1500	-	-	-	-	-	0	0
10	enet	100010	1500	-	-	-	-	-	0	0
20	enet	100020	1500	-	-	-	-	-	0	0
1002	fddi	101002	1500	-	-	-	-	-	0	0
1003	tr	101003	1500	-	-	-	-	-	0	0
1004	fdnet	101004	1500	-	-	-	ieee	-	0	0
1005	trnet	101005	1500	-	-	-	ibm	-	0	0

VLAN	Type	SAID	MTU	Parent	RingNo	BridgeNo	Stp	BrdgMode	Trans1	Trans2
------	------	------	-----	--------	--------	----------	-----	----------	--------	--------

```
Remote SPAN VLANs
```

```
Primary Secondary Type Ports
```

```
Switch#
```

建立VLAN之后，再测试网络互通性

PC0

Physical Config Desktop Programming Attributes

Command Prompt

```
C:\>ping 192.168.1.11

Pinging 192.168.1.11 with 32 bytes of data:

Reply from 192.168.1.11: bytes=32 time=0ms
Reply from 192.168.1.11: bytes=32 time=0ms
Reply from 192.168.1.11: bytes=32 time=0ms
Reply from 192.168.1.11: bytes=32 time=0ms

Ping statistics for 192.168.1.11:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milliseconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>ping 192.168.1.21

Pinging 192.168.1.21 with 32 bytes of data:

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

Ping statistics for 192.168.1.21:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
    Approximate round trip times in milliseconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>
```

PC1

Physical Config Desktop Programming Attributes

Command Prompt

```
C:\>ping 192.168.1.1

Pinging 192.168.1.1 with 32 bytes of data:

Reply from 192.168.1.1: bytes=32 time=0ms
Reply from 192.168.1.1: bytes=32 time=0ms
Reply from 192.168.1.1: bytes=32 time=0ms
Reply from 192.168.1.1: bytes=32 time=0ms

Ping statistics for 192.168.1.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milliseconds:
        Minimum = 0ms, Maximum = 7ms, Average = 2ms

C:\>ping 192.168.1.21

Pinging 192.168.1.21 with 32 bytes of data:

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

Ping statistics for 192.168.1.21:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
    Approximate round trip times in milliseconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>
```

PC2

Physical Config Desktop Programming Attributes

Command Prompt

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.1.1

Pinging 192.168.1.1 with 32 bytes of data:

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

Ping statistics for 192.168.1.1:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
    Approximate round trip times in milliseconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>ping 192.168.1.11

Pinging 192.168.1.11 with 32 bytes of data:

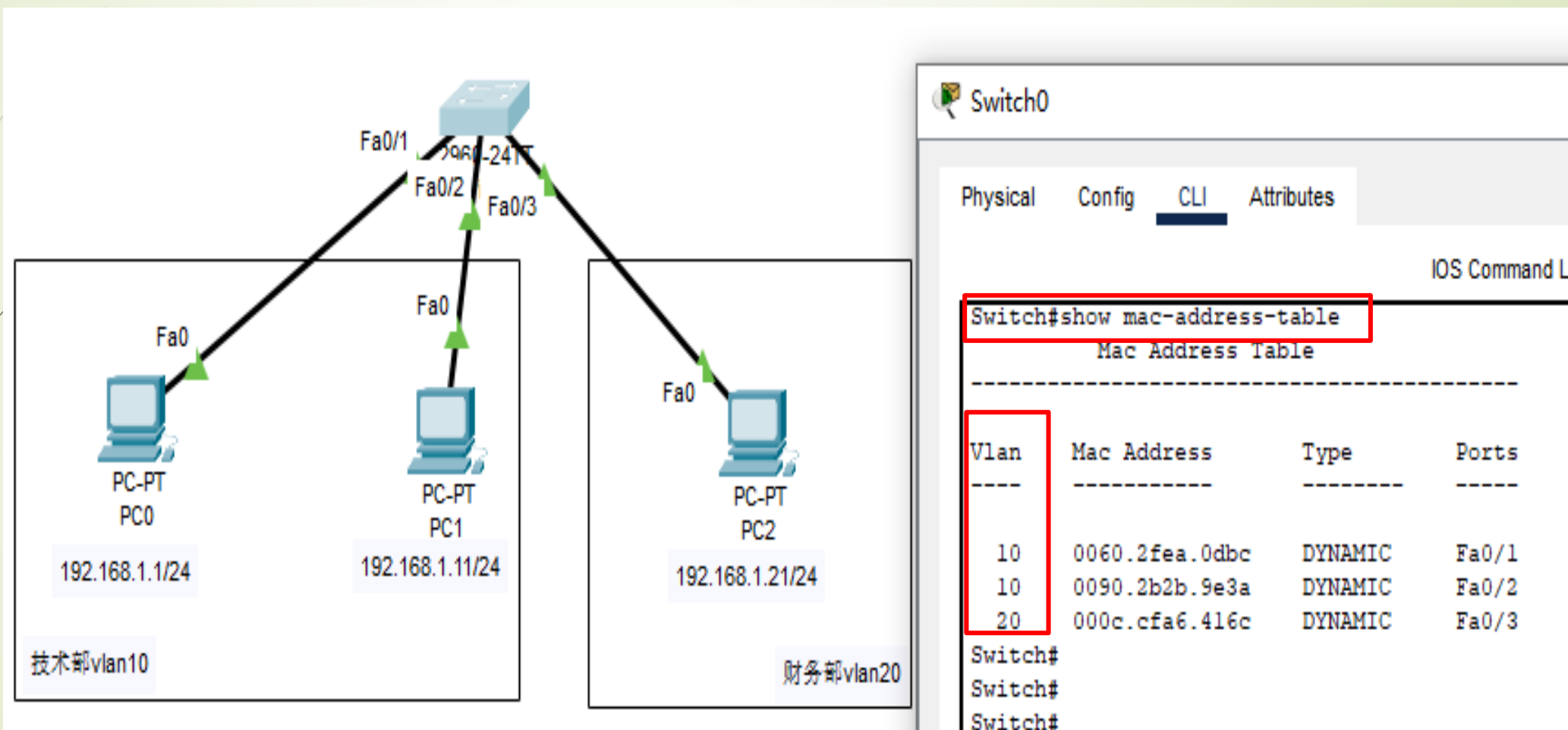
Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 192.168.1.11:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
    Approximate round trip times in milliseconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>
```

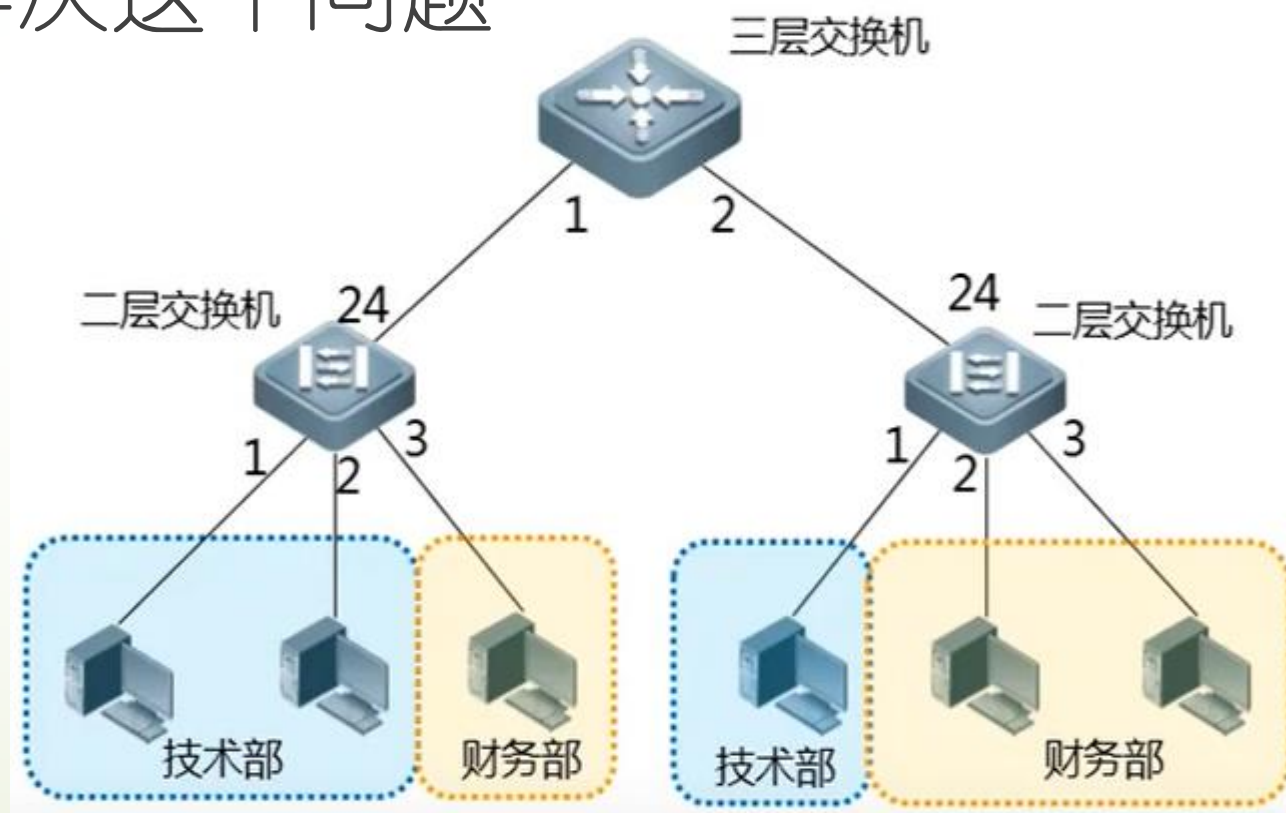

交换机MAC表里有VLAN信息

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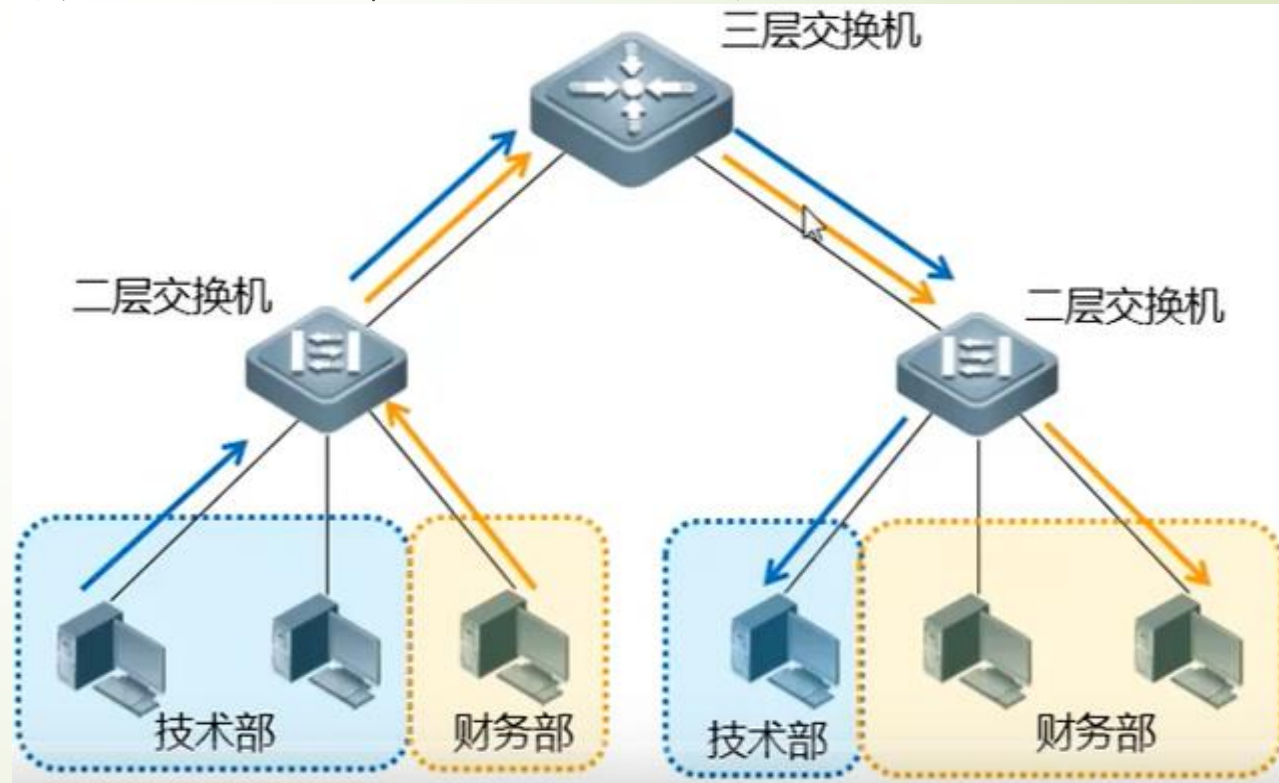
多交换机的VLAN配置 (Trunk)

- 还需要解决不同交换机上同一个部门的互通，不同部门之间的隔离需求。
- 使用Trunk来解决这个问题



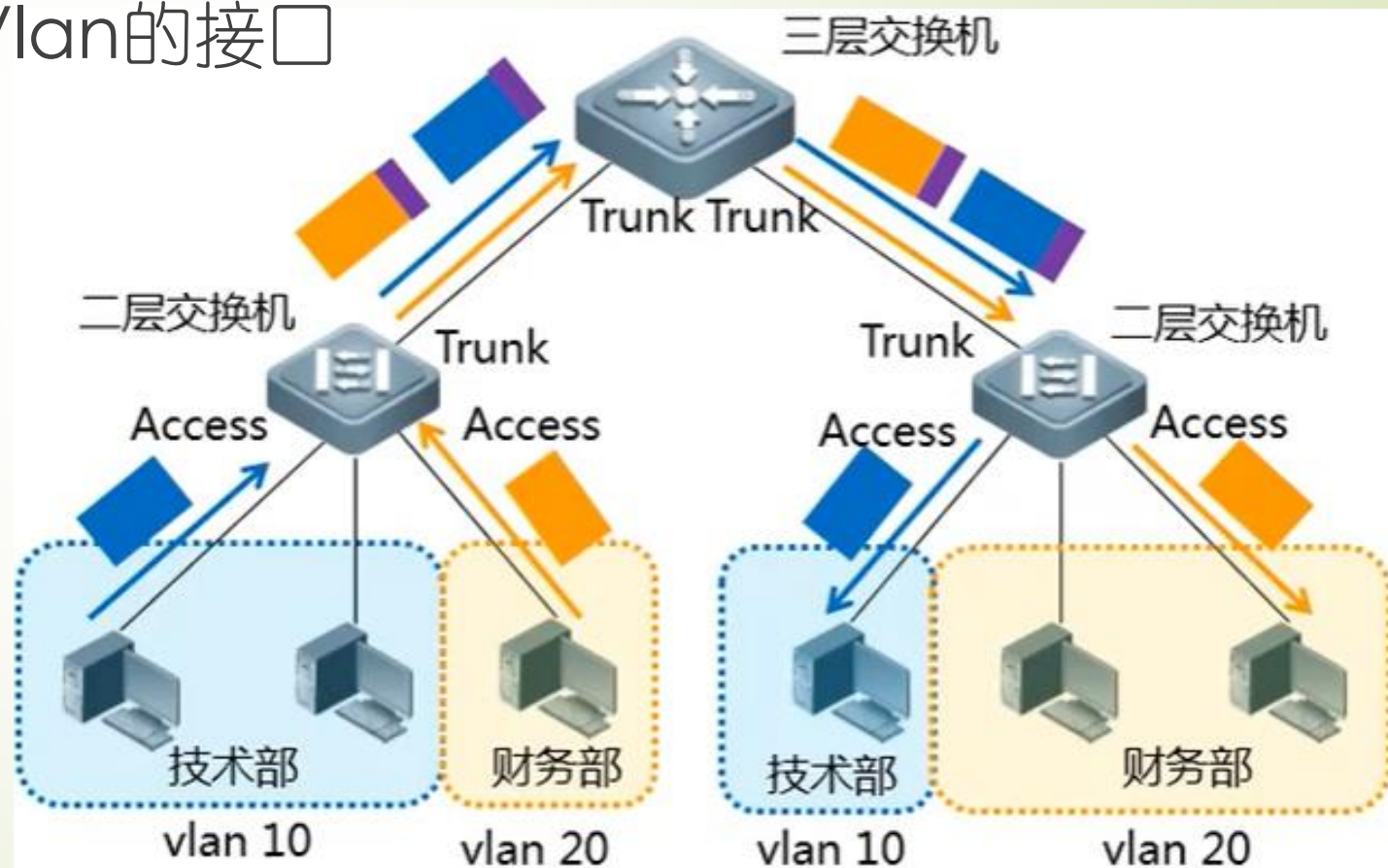
多交换机的VLAN配置 (Trunk)

- 需求1：不同交换机之间的同一部门需要互通
 - 解决1：交换机之间可以传递不同部门的数据
- 需求2：不同部门之间仍隔离需求。
 - 解决2：交换机之间传递不同部门的数据要区分开



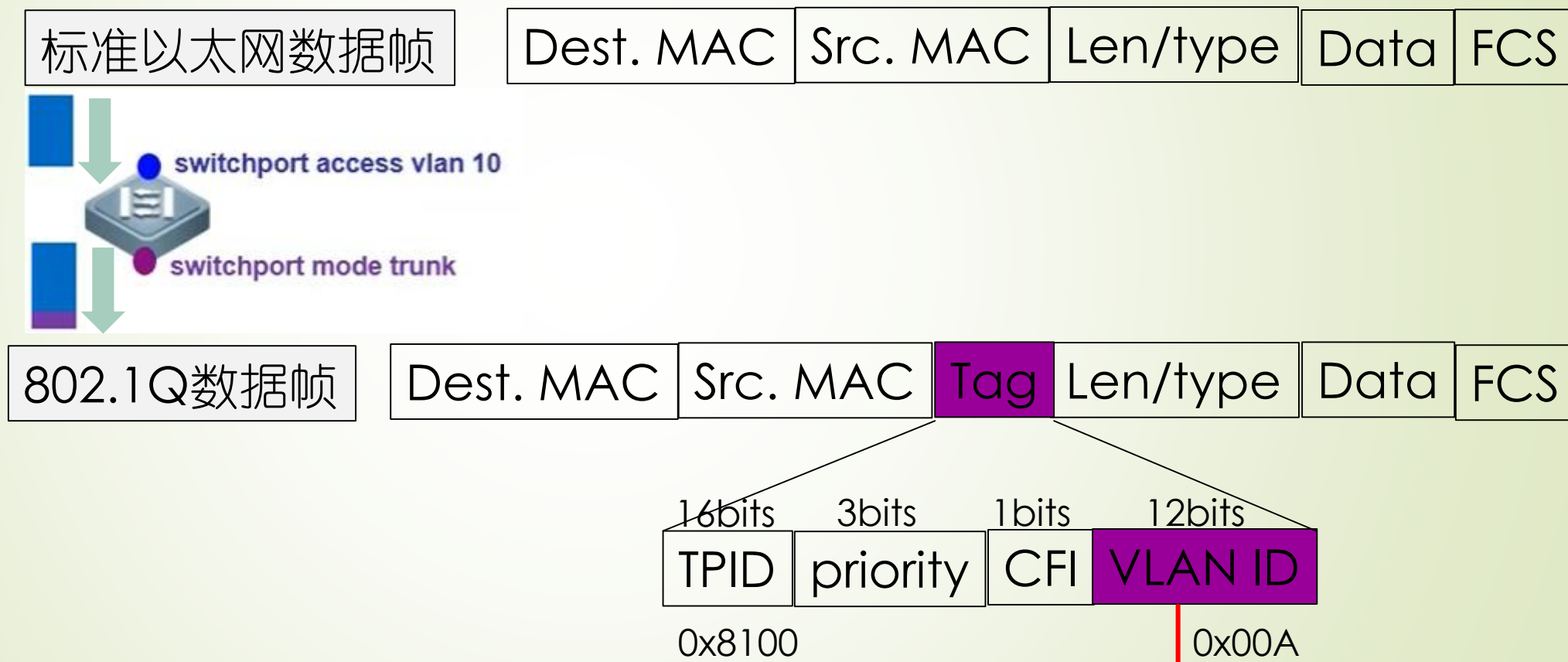
一条线路上同时传输多个VLAN数据

- 交换机之间互连的接口配置为Trunk属性，交换机之间传递数据时自动添加一个Tag，里面含有该数据原始的vlan
- 数据传递到终点时，交换机去掉Tag标记，同时将数据传输给属于这个Vlan的接口



一条线路上同时传输多个VLAN数据

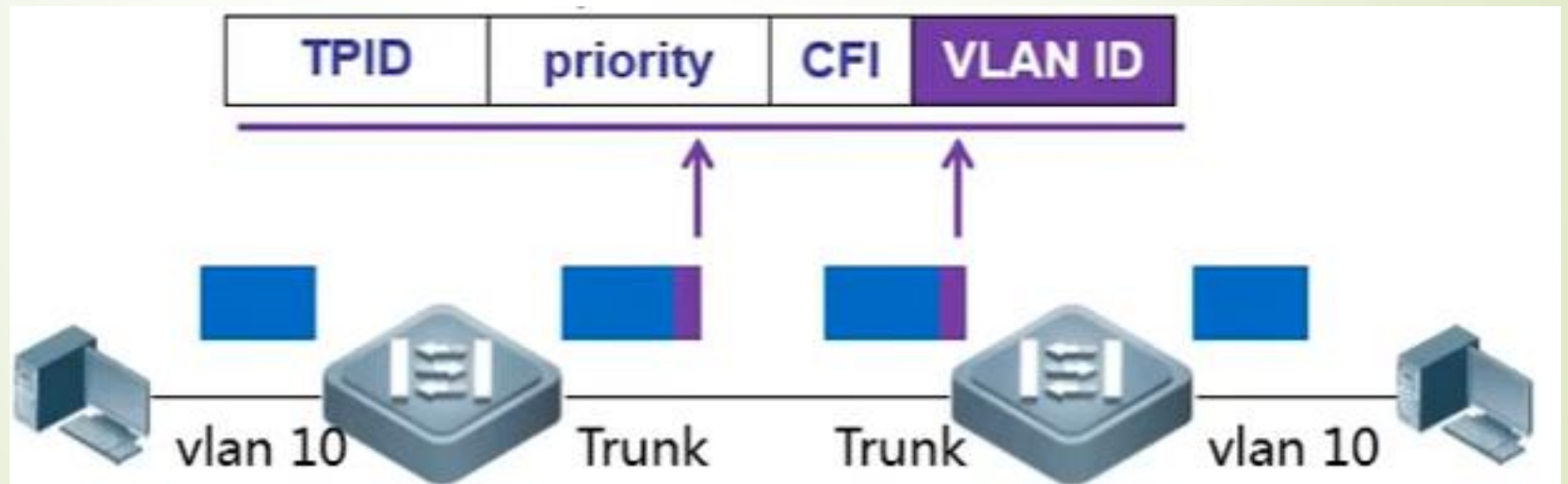
- 数据在从Trunk接口转发出去后，添加Tag标记，里面含有该数据原始的vlan



为接收标准以太网数据帧的接口所属VLAN，即access命令指定的VLAN ID

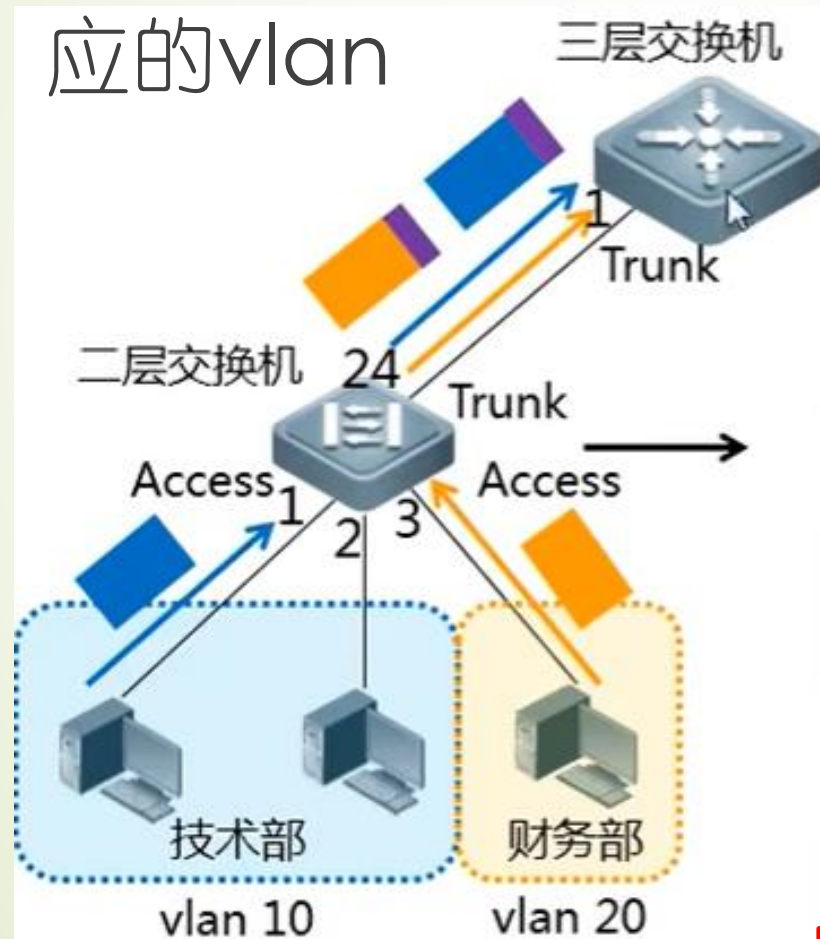
添加和去除Tag标记

- 数据从交换机的Trunk口转发出去时，添加含有vlan ID的Tag标记；
- 数据从交换机的Access口转发出去时，去掉Tag标记。同时数据只能转发给原始vlan端口



Trunk的配置和查看

- 交换机的Trunk默认只转发当前设备上已经建立的vlan数据。因此，在“三层交换机”上必须创建相应的vlan



```
Switch(config)# vlan 10
Switch(config-vlan)# name JiShuBu
Switch(config)# vlan 20
Switch(config-vlan)# name CaiWuBu

Switch(config)# interface fastethernet 0/1
Switch(config-if)# switchport mode trunk
```

```
Switch(config)# vlan 10
Switch(config-vlan)# name JiShuBu

Switch(config)# vlan 20
Switch(config-vlan)# name CaiWuBu

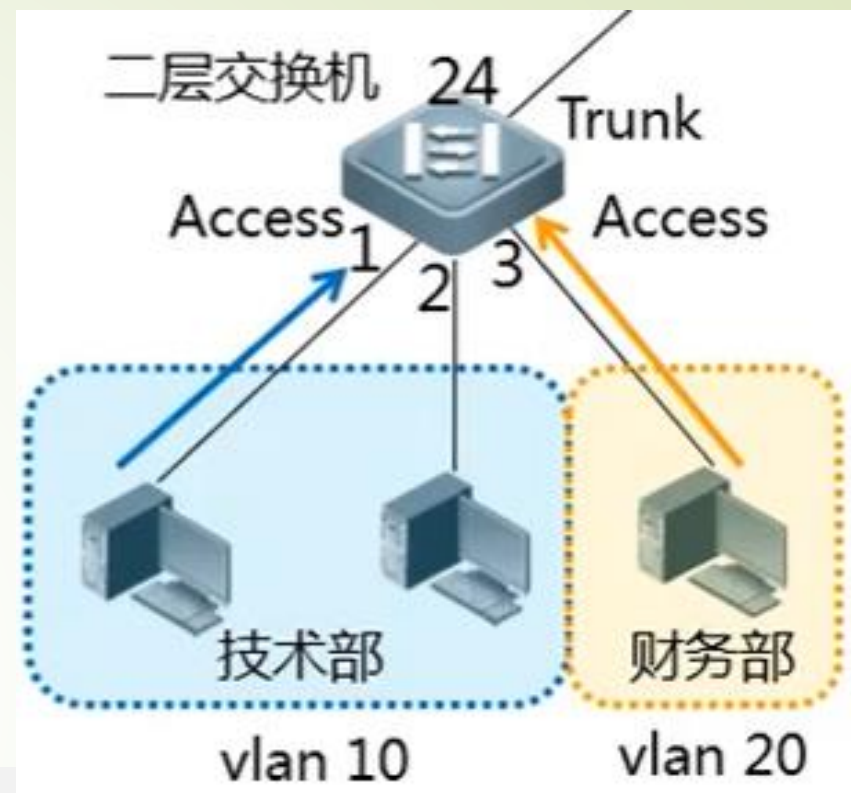
Switch(config)# interface range fastethernet 0/1-2
Switch(config-if)# switchport access vlan 10

Switch(config)# interface fastethernet 0/3
Switch(config-if)# switchport access vlan 20

Switch(config)# interface fastethernet 0/24
Switch(config-if)# switchport mode trunk
```


二层交换机配置结果查看

- 默认所有的端口属于vlan 1
- 配置为Trunk的接口属于所有vlan



```
Router#sh vlan
```

VLAN Name	Status	Ports
1 VLAN0001	STATIC	Fa0/4, Fa0/5, Fa0/6, Fa0/7 Fa0/8, Fa0/9, Fa0/10, Fa0/11 Fa0/12, Fa0/13, Fa0/14, Fa0/15 Fa0/16, Fa0/17, Fa0/18, Fa0/19 Fa0/20, Fa0/21, Fa0/22, Fa0/23 Fa0/24, Gi0/25, Gi0/26
10 VLAN0010	STATIC	Fa0/1, Fa0/2, Fa0/24
20 VLAN0020	STATIC	Fa0/3, Fa0/24

SWITCH0的配置

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```
Switch>enable
```

```
Switch#configure terminal
```

```
Enter configuration commands, one per line. End with CNTL/Z.
```

```
Switch(config)#vlan 10
```

```
Switch(config-vlan)#name jishubu
```

创建vlan 10,并命名

```
Switch(config-vlan)#exit
```

```
Switch(config)#vlan 20
```

```
Switch(config-vlan)#name caiwubu
```

创建vlan 20,并命名

```
Switch(config-vlan)#exit
```

```
Switch(config)#interface range f 0/1-2
```

```
Switch(config-if-range)#switchport access vlan 10
```

分配f0/1和f/2给vlan 10

```
Switch(config-if-range)#exit
```

```
Switch(config)#interface f 0/3
```

```
Switch(config-if)#switchport access vlan 20
```

分配f0/3给vlan 20

```
Switch(config-if)#exit
```

```
Switch(config)#interface f 0/4
```

```
Switch(config-if)#switchport mode trunk
```

分配f0/4用trunk

```
Switch(config-if)#switchport trunk allowed vlan all
```

```
Switch(config-if)#end
```

SWITCH0配置完检查

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Switch0

Physical Config **CLI** Attributes

IOS Command Line Interface

```
Switch#show vlan
```

VLAN Name	Status	Ports
1 default	active	Fa0/5, Fa0/6, Fa0/7, Fa0/8 Fa0/9, Fa0/10, Fa0/11, Fa0/12 Fa0/13, Fa0/14, Fa0/15, Fa0/16 Fa0/17, Fa0/18, Fa0/19, Fa0/20 Fa0/21, Fa0/22, Fa0/23, Fa0/24 Gig0/1, Gig0/2
10 jishubu	active	Fa0/1, Fa0/2
20 caiwubu	active	Fa0/3
1002 fddi-default	active	
1003 token-ring-default	active	
1004 fddinet-default	active	
1005 trnet-default	active	

VLAN	Type	SAID	MTU	Parent	RingNo	BridgeNo	Stp	BrdgMode	Trans1	Trans2
1	enet	100001	1500	-	-	-	-	-	0	0
10	enet	100010	1500	-	-	-	-	-	0	0
20	enet	100020	1500	-	-	-	-	-	0	0
1002	fddi	101002	1500	-	-	-	-	-	0	0
1003	tr	101003	1500	-	-	-	-	-	0	0
1004	fdnet	101004	1500	-	-	-	ieee	-	0	0
1005	trnet	101005	1500	-	-	-	ibm	-	0	0

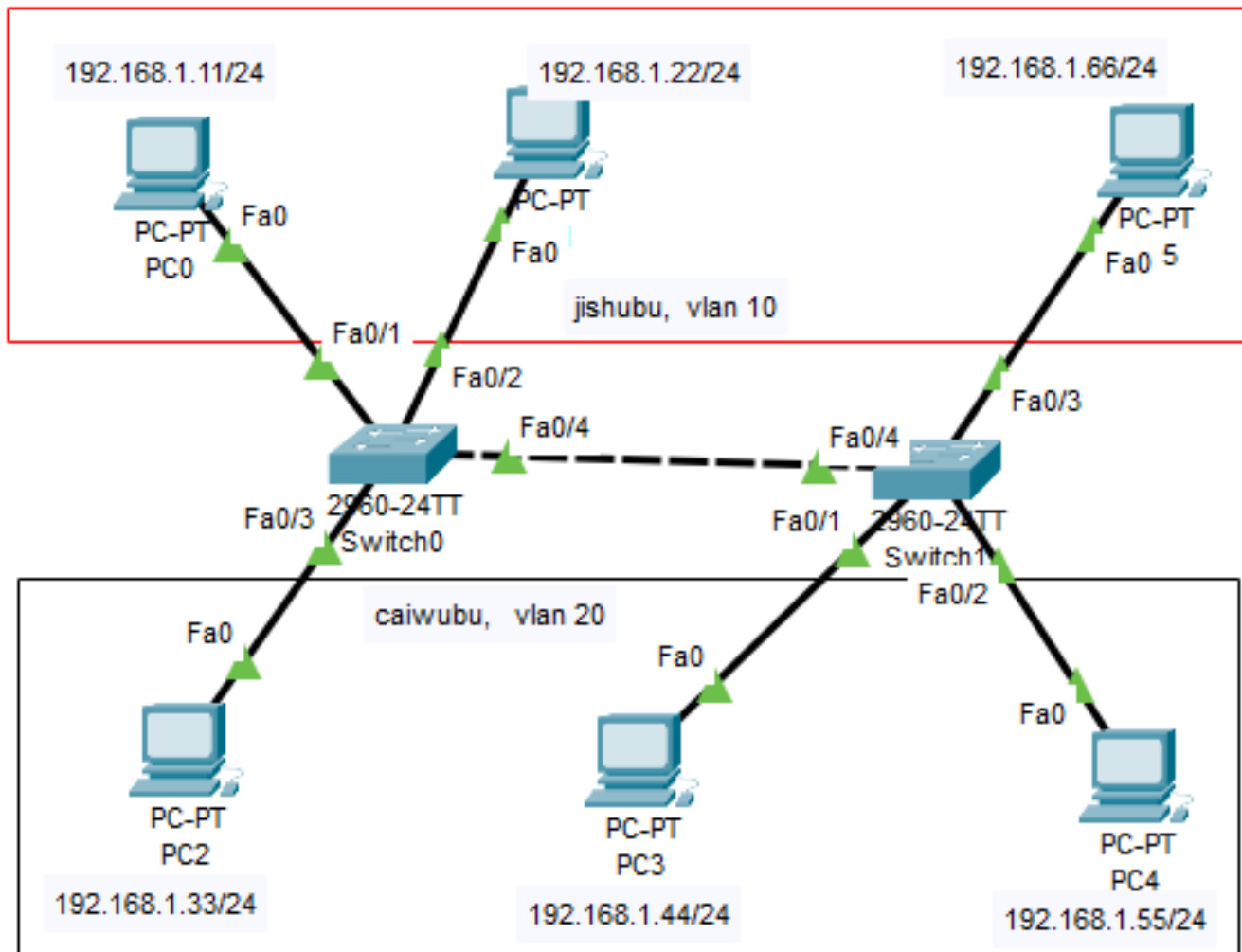
VLAN	Type	SAID	MTU	Parent	RingNo	BridgeNo	Stp	BrdgMode	Trans1	Trans2
1	enet	100001	1500	-	-	-	-	-	0	0
10	enet	100010	1500	-	-	-	-	-	0	0
20	enet	100020	1500	-	-	-	-	-	0	0
1002	fddi	101002	1500	-	-	-	-	-	0	0
1003	tr	101003	1500	-	-	-	-	-	0	0
1004	fdnet	101004	1500	-	-	-	ieee	-	0	0
1005	trnet	101005	1500	-	-	-	ibm	-	0	0

Remote SPAN VLANs

Primary	Secondary	Type	Ports

Switch#

实验内容 (多交换机)



1. 创建如图拓扑网络
2. 6台PC互相PING，先验证连通性
3. 创建2个VLAN，分别命名技术部和财务部，以自己学号最后2位作为技术部VLAN号；学号1-2位作为财务部VLAN号
4. 6台PC再互相PING，验证VLAN效果