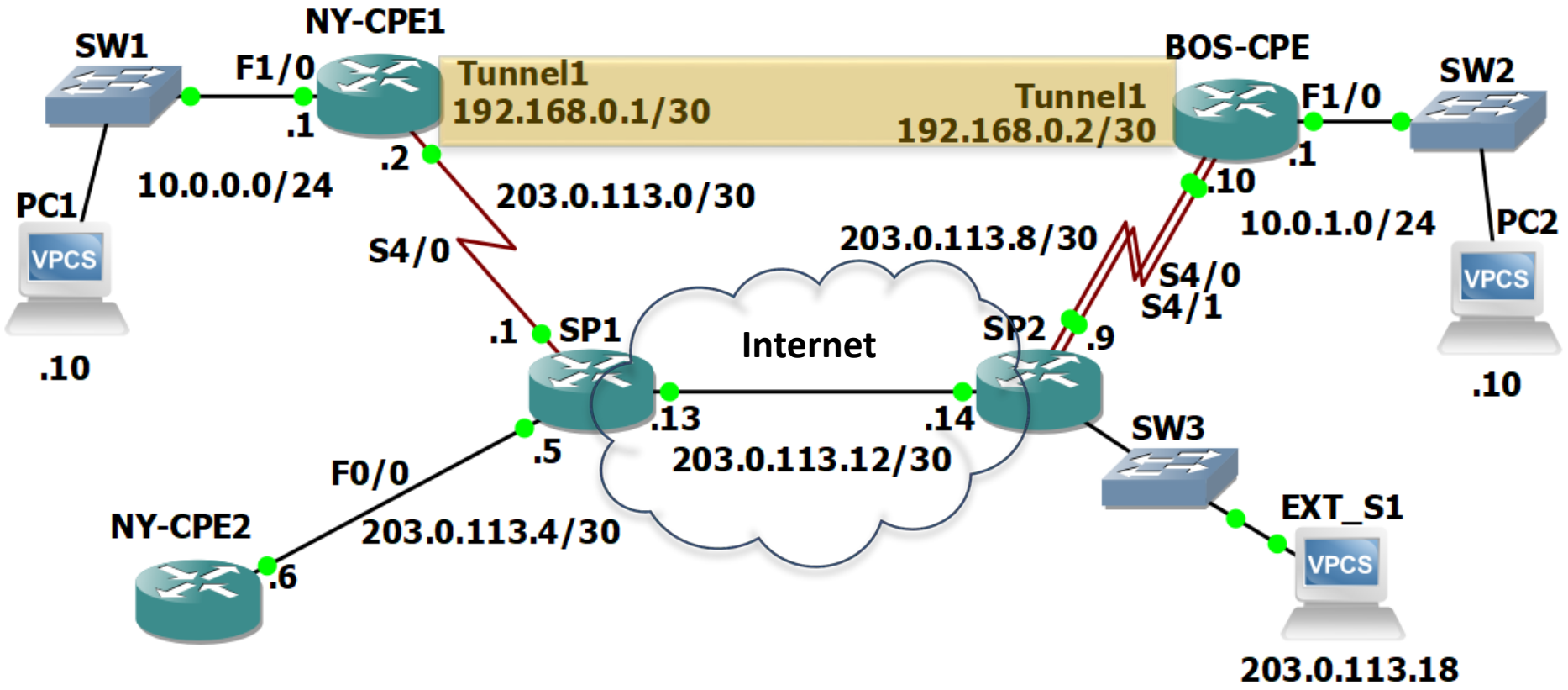
GRE Generic Routing Encapsulation

- With GRE, a virtual tunnel is created between two routers and packets are sent through the tunnel.
- GRE does not provide encryption natively.
- Open standard IPsec configuration does not support multicast (Cisco proprietary IPsec VTI does).
- GRE over IPsec provides multicast support over standard IPsec.

GRE Example


SW1
NY-CPE1
F1/0
.1
.2
Tunnel1
192.168.0.1/30
Tunnel1
192.168.0.2/30
BOS-CPE
F1/0
.1
SW2
10.0.0.0/24
203.0.113.0/30
.10
10.0.1.0/24
PC1
VPCS
.10
S4/0
203.0.113.8/30
S4/0
S4/1
.1
SP1
Internet
SP2
.9
PC2
VPCS
.10
.13
.14
.5
203.0.113.12/30
SW3
F0/0
NY-CPE2
203.0.113.4/30
.6
EXT_S1
VPCS
203.0.113.18

GRE Configuration

```
NY-CPE1(config)#interface Tunnel1
NY-CPE1(config-if)#ip address 192.168.0.1 255.255.255.252
NY-CPE1(config-if)#tunnel source 203.0.113.2
NY-CPE1(config-if)#tunnel destination 203.0.113.10

BOS-CPE(config)#interface Tunnel1
BOS-CPE(config-if)#ip address 192.168.0.2 255.255.255.252
BOS-CPE(config-if)#tunnel source 203.0.113.10
BOS-CPE(config-if)#tunnel destination 203.0.113.2
```

GRE Verification – show ip route

- The routers appear to be directly connected on their tunnel interfaces
- This is reflected in their routing tables

```
NY-CPE1#sh ip route

S*    0.0.0.0/0 [1/0] via 203.0.113.1
      10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C        10.0.0.0/24 is directly connected, FastEthernet1/0
L        10.0.0.1/32 is directly connected, FastEthernet1/0
      192.168.0.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.0.0/30 is directly connected, Tunnel1
L        192.168.0.1/32 is directly connected, Tunnel1
      203.0.113.0/24 is variably subnetted, 3 subnets, 2 masks
C        203.0.113.0/30 is directly connected, Serial4/0
C        203.0.113.1/32 is directly connected, Serial4/0
L        203.0.113.2/32 is directly connected, Serial4/0
```

GRE Verification – ping Tunnel Interface

- The tunnel interfaces can ping each other

```
NY-CPE1#ping 192.168.0.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.0.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 80/89/104
ms
```

GRE Verification – show ip route

- Routes need to be added for the internal networks behind the tunnel interfaces
- You can use static routes or a routing protocol

```
NY-CPE1#sh ip route

S*    0.0.0.0/0 [1/0] via 203.0.113.1
      10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C        10.0.0.0/24 is directly connected, FastEthernet1/0
L        10.0.0.1/32 is directly connected, FastEthernet1/0
      192.168.0.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.0.0/30 is directly connected, Tunnel1
L        192.168.0.1/32 is directly connected, Tunnel1
      203.0.113.0/24 is variably subnetted, 3 subnets, 2 masks
C        203.0.113.0/30 is directly connected, Serial4/0
C        203.0.113.1/32 is directly connected, Serial4/0
L        203.0.113.2/32 is directly connected, Serial4/0
```

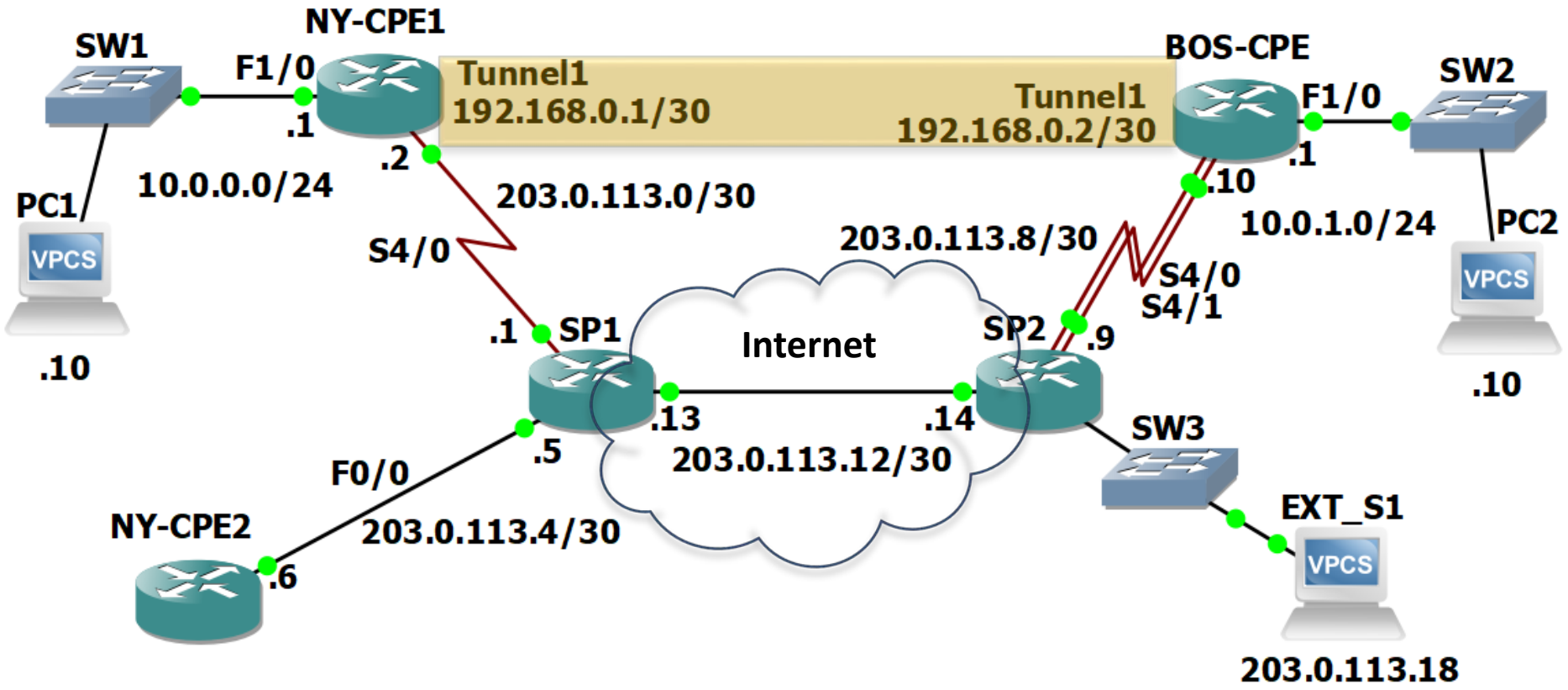
GRE Configuration – Routing

```
NY-CPE1(config)#ip route 10.0.1.0 255.255.255.0 192.168.0.2

BOS-CPE(config)#ip route 10.0.0.0 255.255.255.0 192.168.0.1
```

Or any IGP, for example OSPF:

```
NY-CPE1(config)#router ospf 1
NY-CPE1(config-router)#network 10.0.0.0 0.0.255.255 area 0
NY-CPE1(config-router)#network 192.168.0.0 0.0.0.3 area 0

BOS-CPE(config)#router ospf 1
BOS-CPE(config-router)#network 10.0.0.0 0.0.255.255 area 0
BOS-CPE(config-router)#network 192.168.0.0 0.0.0.3 area 0
```

Lab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S4/1
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.1
SP1
Internet
SP2
.9
.13
.14
.5
203.0.113.12/30
SW3
F0/0
NY-CPE2
203.0.113.4/30
.6
EXT_S1
VPCS
203.0.113.18