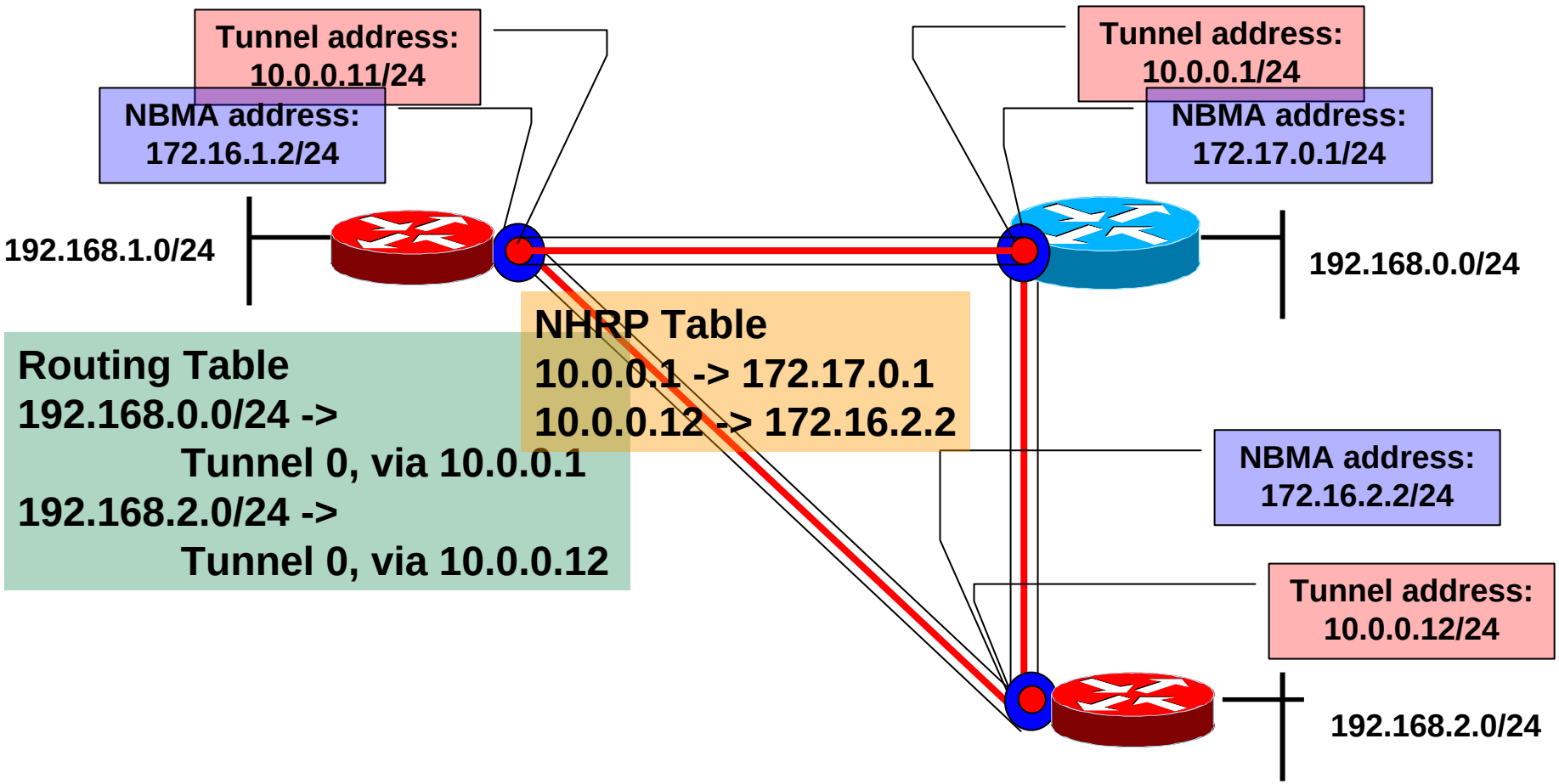
DYNAMIC MULTIPOINT VPN SPOKE TO SPOKE DIRECT TUNNELING

NOVEMBER 2004

Direct Spoke To Spoke Tunnels

- **Initially, spoke to spoke traffic can only travel via the hub**
- **In DMVPN, spokes can send packets directly to another spoke, if the routing table and NHRP table are available**
- **This does not change the principle so far**

Routes and NHRP Between Two Spokes



Learning process

- **In order to create a spoke to spoke tunnel, a spoke must**
  - **Learn a routing entry to the destination network**
  - **The next hop must be the remote spoke tunnel IP address**
  - **The spoke must learn the NBMA address of this next hop**
- **The IPsec tunnel is only built after that**

Route Learning

- The routing protocol is only between the hub and the spokes
- In order for spoke to spoke to work, the hub must preserve and advertise the private networks next hop as advertised by the spokes themselves

Route Learning (cont'd.)

- RIP keeps the next-hop information by default
  - This can not be disabled
- The next-hop preservation in EIGRP is not a default
  - It is turned on with the interface command
  - no ip next-hop-self eigrp <as>
- Next hop preservation in BGP is a default
  - It can be disabled with the BGP command
  - neighbor <n> next-hop-self
- In OSPF, next-hop preservation happens naturally except in point-to-multipoint mode

NHRP Learning

- A spoke will send an NHRP resolution request to its NHS to learn an NBMA address
- The queried address can be a network address
- Ideally, the queried address should be a next-hop address
- The NHS will respond with an NBMA address from its cache
  - The spoke will populate its cache with the answer

NHRP Learning (cont.)

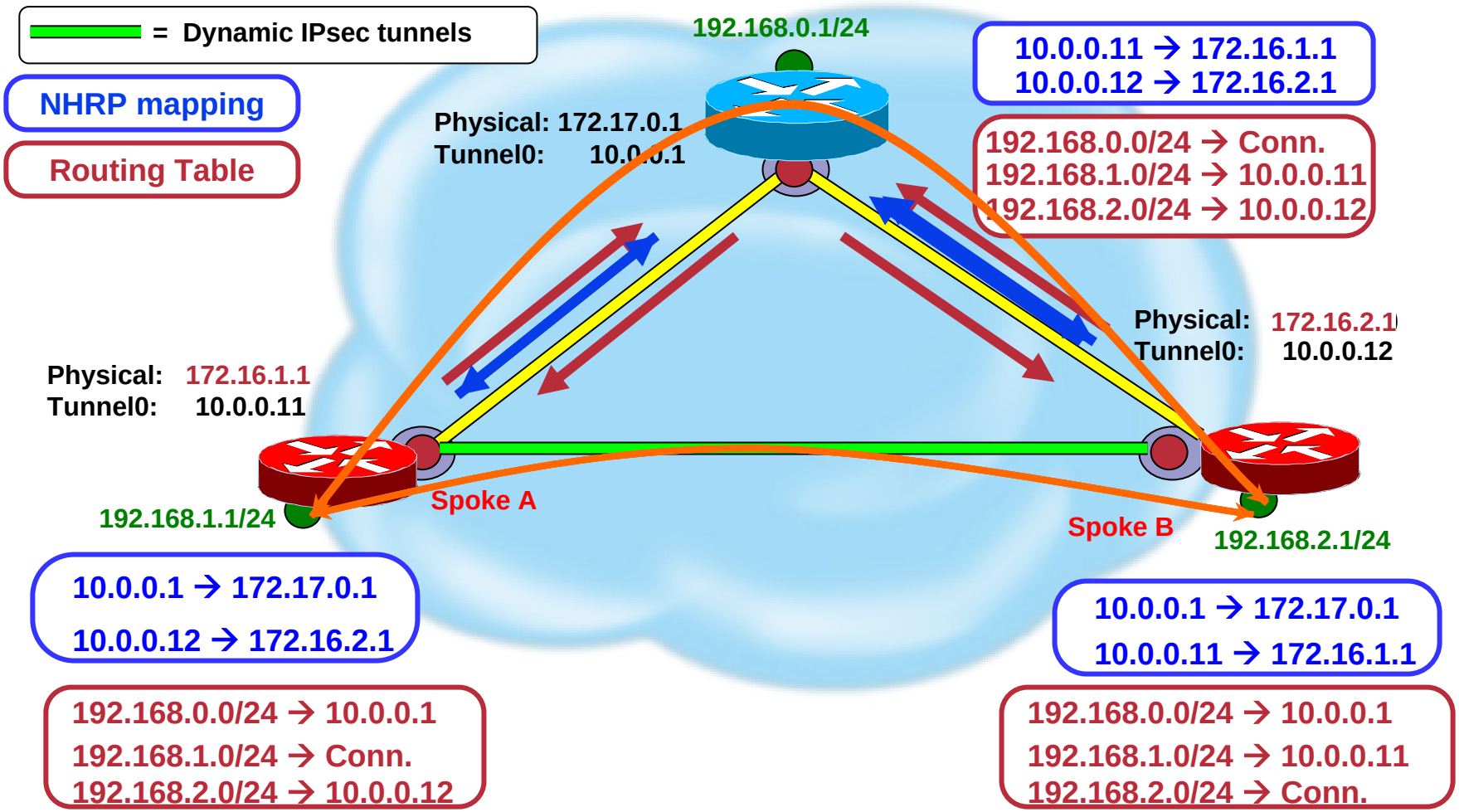
- The resolution reply will have a lifetime set to the remaining lifetime in the hub cache
- If the NHS does not have the entry in its cache, it returns an error and the spoke will install an incomplete entry and forward packets to the NHS
- During the learning process, the spoke will forward all the packets to its NHS

  This occurs in process switching

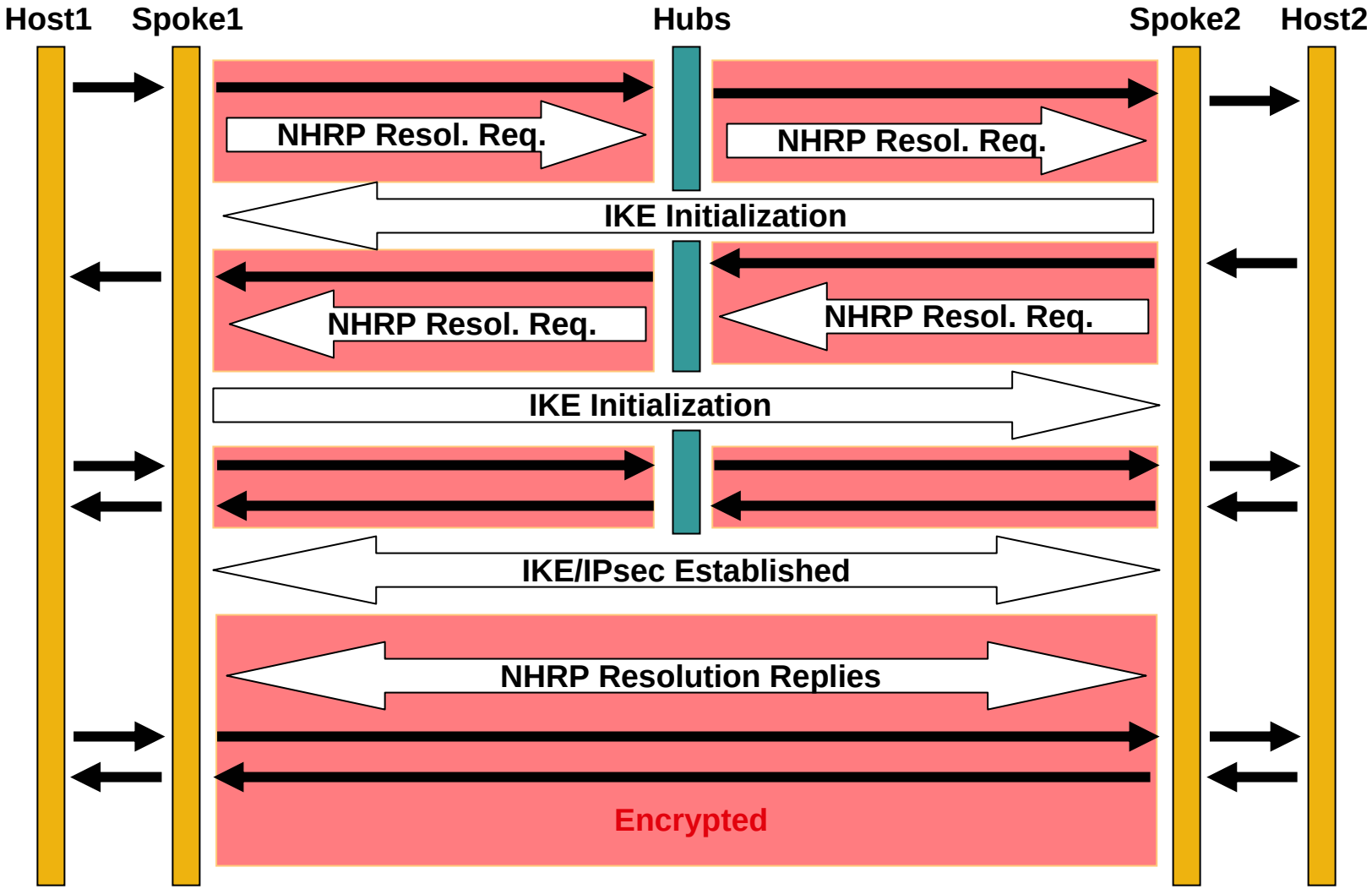
Tunnel Buildup

- As soon as the NHRP entry is created but NOT inserted in the cache, an IPsec tunnel will be initiated
- The NHRP entry will be inserted in the cache and used when the IPsec tunnel is actually ready
- The IPsec tunnel will disappear when the NHRP entry times out

NHRP Registration
Dynamically Addressed Spokes



Building Spoke-Spoke Tunnels



IKE Call Access Control

- IKE Call Access Control (CAC) was introduced in Release 12.3(8)T
- This feature allows Cisco IOS® Software to limit the number of IKE/IPsec connections
- It prevents small platforms from opening dozens of spoke to spoke tunnels (e.g. worm attack)

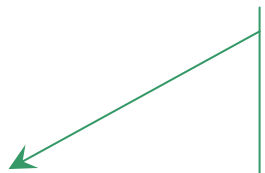
```
crypto call admission limit ike sa <number>
```

DMVPN Hub Configuration


```
crypto ca trustpoint CA
   enrollment terminal
   crl optional
   rsakeypair hub1
crypto ca certificate chain CA
   certificate 2368DB55000000000B4E
   certificate ca 1244325DE0369880465F977A18F61CA8
!
crypto isakmp policy 1
   encryption 3des
!
crypto ipsec transform-set ts esp-3des esp-sha-hmac
!
crypto ipsec profile prof
   set transform-set ts
!
interface Ethernet0/0
   ip address 192.168.0.1 255.255.255.0
!
interface Serial1/0
   ip address 172.17.0.1 255.255.255.252
```

DMVPN Hub Configuration (Cont'd.)


```
interface Tunnel0
   bandwidth 1000
   ip address 10.0.0.1 255.255.255.0
   ip mtu 1416
   ip nhrp map multicast dynamic
   ip nhrp network-id 100000
   ip nhrp holdtime 3600
   no ip split-horizon eigrp 1
   no ip next-hop-self eigrp 1
   delay 1000
   tunnel source Serial1/0
   tunnel mode gre multipoint
   tunnel key 100000
   tunnel protection ipsec profile prof
!
router eigrp 1
   network 10.0.0.0 0.0.0.255
   network 192.168.0.0
   no auto-summary
```



For spoke to spoke configs

DMVPN Spoke Configuration


```
crypto ca trustpoint CA
   enrollment terminal
   crl optional
   rsakeypair spoke1
crypto ca certificate chain CA
   certificate 236FD380000000000B4F
   certificate ca 1244325DE0369880465F977A18F61CA8
!
crypto isakmp policy 1
   encryption 3des
!
crypto ipsec transform-set ts esp-3des esp-sha-hmac
!
crypto ipsec profile prof
   set transform-set ts
!
interface Ethernet0/0
   ip address 192.168.1.1 255.255.255.0
!
interface Serial1/0
   ip address 172.16.1.1 255.255.255.252
```

DMVPN Spoke Configuration (Cont'd.)


```
interface Tunnel0
   bandwidth 1000
   ip address 10.0.0.11 255.255.255.0
   ip mtu 1416
   ip nhrp map multicast 172.17.0.1
   ip nhrp map 10.0.0.1 172.17.0.1
   ip nhrp network-id 100000
   ip nhrp holdtime 3600
   ip nhrp nhs 10.0.0.1
   ip nhrp server-only
   delay 1000
   tunnel source Serial1/0
   tunnel mode gre multipoint
   tunnel key 100000
   tunnel protection ipsec profile prof
!
router eigrp 1
   network 10.0.0.0 0.0.0.255
   network 192.168.1.0
   no auto-summary
```

Recommendation

- The use of wildcard pre-shared keys is strongly discouraged
- With such topologies, it is recommended to use a Public Key Infrastructure (PKI) to authenticate nodes