Trung Tâm Tin Học Trí Việt

---✸---

CCNA 640-802

Giảng viên: Vòng Chấn Nguyên
CCNP, CCSI # 31419

Tp.Hồ Chí Minh, 10 tháng 9 năm 2007

LỜI MỞ ĐẦU

Toàn bộ bài giảng này đều được ghi chép lại theo giáo trình của Thầy Vòng Chấn Nguyên. Mọi sự sao chép xin làm ơn đề tên tác giả.

Chân thành cảm ơn !!!

MỤC LỤC

PHẦN 1: CCENT

CCENT

CẤU HÌNH CƠ BẢN CISCO ROUTER

1. Xóa và xem cấu hình :

```
R3#erase st  ---> xoa cau hinh khoi tao cua Router (erase start)
R3#erase startup-config
Erasing the nvram filesystem will remove all configuration files! Continue? [con
firm]
[OK]
Erase of nvram: complete
R3#
*Mar  1 00:06:53.942: %SYS-7-NV_BLOCK_INIT: Initialized the geometry of nvram

R3#reload
Proceed with reload? [confirm]            --> Reload Startup config

*Mar  1 00:06:59.812: %SYS-5-RELOAD: Reload requested by console.
System Bootstrap, Version 12.2(6r),  RELEASE SOFTWARE (fc1)
TAC Support: http://www.cisco.com/tac
Copyright (c) 2001 by cisco Sy
C2600 platform with 65536 Kbytes of main memory

program load complete, entry point: 0x80008000, size: 0xe7ab88
Self decompressing the image :
#################################################
########################################################################
#######
########################################################################
#######
############################################# [OK]

Smart Init is enabled

smart init is sizing iomem
  ID          MEMORY_REQ              TYPE
000091         0X0008B800 C2600 single Ethernet
               0X000F3BB0 public buffer pools
               0X00211000 public particle pools
TOTAL:         0X003903B0

If any of the above Memory Requirements are
"UNKNOWN", you may be using an unsupported
configuration or there is a software problem and
system operation may be compromised.
Rounded IOMEM up to: 4Mb.
Using 6 percent iomem. [4Mb/64Mb]

             Restricted Rights Legend

Use, duplication, or disclosure by the Government is
```

```
subject to restrictions as set forth in subparagraph
(c) of the Commercial Computer Software - Restricted
Rights clause at FAR sec. 52.227-19 and subparagraph
(c) (1) (ii) of the Rights in Technical Data and Computer
Software clause at DFARS sec. 252.227-7013.

           cisco Systems, Inc.
           170 West Tasman Drive
           San Jose, California 95134-1706



Cisco Internetwork Operating System Software
IOS (tm) C2600 Software (C2600-J1S3-M), Version 12.2(15)T13,  RELEASE SOFTWARE (
fc2)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2004 by cisco Systems, Inc.
Compiled Wed 16-Jun-04 01:38 by hqluong
Image text-base: 0x80008098, data-base: 0x819600C8

cisco 2610 (MPC860) processor (revision 0x00) with 61440K/4096K bytes of memory.

--->Dung luong Ram

Processor board ID JAD06240CD6 (191342702)
M860 processor: part number 0, mask 49
Bridging software.
X.25 software, Version 3.0.0.
TN3270 Emulation software.
1 Ethernet/IEEE 802.3 interface(s)
1 Serial network interface(s)
32K bytes of non-volatile configuration memory.                    -----> NVRam
16384K bytes of processor board System flash (Read/Write)       ---> Flash


         --- System Configuration Dialog ---

Would you like to enter the initial configuration dialog? [yes/no]: n


Press RETURN to get started!


*Mar  1 00:00:05.092: %LINEPROTO-5-UPDOWN: Line protocol on Interface VoIP-Null0
, changed state to up
*Mar  1 00:00:13.958: %LINK-3-UPDOWN: Interface Ethernet0/0, changed state to up

*Mar  1 00:00:13.958: %LINK-3-UPDOWN: Interface Serial0/0, changed state to do

*Mar  1 00:00:14.960: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet0/
0, changed state to down
*Mar  1 00:00:14.960: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0,
 changed state to down
*Mar  1 00:07:03.974: %IP-5-WEBINST_KILL: Terminating DNS process
```

```
*Mar  1 00:07:04.872: %LINK-5-CHANGED: Interface Ethernet0/0, changed state to a
dministratively down
*Mar  1 00:07:04.872: %LINK-5-CHANGED: Interface Serial0/0, changed state to adm
inistratively down
*Mar  1 00:07:15.658: %SYS-5-RESTART:
Cisco Internetwork Operating System Software
IOS (tm) C2600 Software (C2600-J1S3-M), Version 12.2(15)T13,  RELEASE SOFTWARE (
fc2)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2004 by cisco Systems, Inc.
Compiled Wed 16-Jun-04 01:38 by hqluong
*Mar  1 00:07:15.658: %SNMP-5-COLDSTART: SNMP agent on host Router is undergoing
 a cold start
*Mar  1 00:07:15.690: %LINK-3-UPDOWN: Interface Virtual-Access1, changed state t
o up
*Mar  1 00:07:16.691: %LINEPROTO-5-UPDOWN: Line protocol on Interf
cess1, changed state to up
Router>
Router>

Router con0 is now available





Press RETURN to get started.

Router>
Router>
Router>?
Exec commands:
  access-enable    Create a temporary Access-List entry
  access-profile   Apply user-pro
  clear            Reset functions
  connect          Open a terminal connection
  disable          Turn off privileged commands
  disconnect       Disconnect an existing network connection
  enable           Turn on privileged commands
  exit             Exit from the EXEC
  help             Description of the interactive help system
  lock             Lock the terminal
  login            Log in as a particular user
  logout           Exit from the EXEC
  modemui          Start a modem-like user interface

  mrinfo           Request neighbor and version information from a multicast
                   router
  mstat            Show statistics after multiple multicast traceroutes
  mtrace           Trace reverse multicast path from destination to source
  name-connection  Name an existing network connection
  pad              Open a X.29 PAD connection
  ping             Send echo messages
  ppp              Start IETF Point-to-Point Protocol (PPP)
  resume          Resume an active network connection
  rlogin         Open an rlogin connection
  show            Show running system information
  slip           Start Serial-line IP (SLIP)
  systat          Display information about terminal lines
  tclquit        Quit Tool Comand Language  shell
  telnet         Open a telnet connection
  terminal        Set terminal line parameters
  tn3270          Open a tn3270 connection
  traceroute      Trace route to destination
  tunnel          Open a tunnel connection
  udptn           Open an udptn con
  voice          Voice Commands
  where           List active connections
  x28            Become an X.28 PAD
  x3            Set X.3 parameters on PAD
```

Router>show version

```
Cisco Internetwork Operating System Software
IOS (tm) C2600 Software (C2600-J1S3-M), Version 12.2(15)T13,  RELEASE SOFTWARE (
fc2)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2004 by cisco Systems, Inc.
Compiled Wed 16-Jun-04 01:38 by hqluong
Image text-base: 0x80008098, data-base: 0x819600C8

ROM: System Bootstrap, Version 12.2(6r),  RELEASE SOFTWARE (fc1)
ROM: C2600 Software (C2600-J1S3-M), Version 12.2(15)T13,  RELEASE SOFTWARE
(fc2)


Router uptime is 23 minutes
System returned to ROM by reload
System image file is "flash:c2600-j1s3-mz.122-15.T13.bin"

cisco 2610 (MPC860) processor (revision 0x00) with 61440K/4096K bytes of memory.

Processor board ID JAD06240CD6 (191342702)
M860 processor: part number 0, mask 49
Bridging software.
X.25 software, Version 3.0.0.
TN3270 Emulation software.
1 Ethernet/IEEE 802.3 interface(s)
1 Serial network interface(s)
32K bytes of non-volatile configuration memory.
16384K bytes of processor board System flash (Read/Write)
Configuration register is 0x2102   ----> gia tri thanh ghi, gia trị nay la binh thuong.
--------------------------------------------------------------------------------
Router>show version ---> che do Auto Completion bang phim TAB
Cisco Internetwork Operating System Software
Cisco Internetwork Operating System Software
fc2)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2004 by cisco Systems, Inc.
```

```
Compiled Wed 16-Jun-04 01:38 by hqluong
Image text-base: 0x80008098, data-base: 0x819600C8

ROM: System Bootstrap, Version 12.2(6r),  RELEASE SOFTWARE (fc1)
ROM: C2600 Software (C2600-J1S3-M), Version 12.2(15)T13,  RELEASE SOFTWARE (fc2)


Router uptime is 37 minutes
System returned to ROM by reload
System image file is "flash:c2600-j1s3-mz.122-15.T13.bin"

cisco 2610 (MPC860) processor (revision 0x00) with 61440K/4096K bytes of memory.

Processor board ID JAD06240CD6 (191342702)
M860 processor: part number 0, mask 49
Bridging software.
X.25 software, Version 3.0.0.
TN3270 Emulation software.
1 Ethernet/IEEE 802.3 interface(s)  ---> Cac Interface hien co tren Router
1 Serial network interface(s)
 --More--
Router>sh flash: ----→ chi tiet bo nho flash

System flash directory:
File  Length   Name/status
  1   15182972  c2600-j1s3-mz.122-15.T13.bin
[15183036 bytes used, 1594180 available, 16777216 total]
16384K bytes of processor board System flash (Read/Write) ---> chi tiet Flash , chua Cisco IOS, chua SDM (voi Router 2800)

Router>
-------------
```

Router#sh ip interface brief ----> Trang thai cac Intreface

```
Interface              IP-Address      OK? Method Status                Protocol
Ethernet0/0            unassigned      YES unset  administratively down down

Serial0/0              unassigned      YES unset  administratively down down

Virtual-Access1            unassigned      YES unset  up                    up
```

*** **Chu y** : Ve mac dinh cac Inteface vat ly cua Cisco Router se co trang thai(Status) la administratively down (tu la shutdown).

2. Lam chu dau nhac lenh

Crtl + B --> ve truoc 1 ky tu
Crtl + F --> ve sau 1 ky tu
Crtl + A ----> dau dong
Crtl + E ---> cuoi dong
Crtl + D --> xoa ky tu tai vi tri con tro
Ctrl + P ----> ve cau lenh truoc do ---Previous
Ctrl + N ---> tien toi 1 cau lenh
Show history ---> Router nho bao nhieu cau lenh (default 10)

```
--------------------
```

Router>enable ---> Vao cap cao hon
Router#: la mode Privilege cap co tham dinh la cao nhat.
Tu cap nay ta co the chuyen vao mode cap cao hon (mode config) de cau hinh cho Router

Router#exit ---> ve cap thap hon (or Router# disable)

```
Router#run
Translating "run"...domain server (255.255.255.255)
```

→ **ko tat che do phan giai ten mien khi go sai lenh**

```
Translating "run"...domain server (255.255.255.255)
 (255.255.255.255)% Unknown command or computer name, or unable to find computer
 address
Router#sh startup-config
startup-config is not present
```

3. Sang che do Terminal:

Router#configure terminal

```
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#
```

---> dang dung o mode cau hinh toan cuc (global Configuration),tat ca cau lenh thuc hien mode nay se truc tiep anh huong den cau hinh dang chay cua Router (Running Cofigure)

Router(config)#hostname CiscoRouter2600 ------> cau hinh Host name thiet bi

4. Mot so thong so bao mat cua thiet bi:

a. Dat password cho cong Console cua thiet bi :

CiscoRouter2600(config)#line console 0 → vao line console 0

```
CiscoRouter2600(config-line)#password vnpro
CiscoRouter2600(config-line)#login
CiscoRouter2600(config-line)#exit
CiscoRouter2600(config)#
```

CiscoRouter2600(config)#end ---> ve muc Privilege (exit or ctrl + Z)

```
CiscoRouter2600#
*Mar  1 01:30:32.817: %SYS-5-CONFIG_I: Configured from console by console
CiscoRouter2600#
Rou
CiscoRouter2600(config-line)#log>
Router>
```

CiscoRouter2600(config-line)#login

```
Press RETURN to get started.
User Access Verification

Password:
CiscoRouter2600>
```

b. Dat Password cho user dang nhap tu User mode sang Privilege Mode

```
CiscoRouter2600#confeset functions
CiscoRouter2600#configure ter connect        Open a term
CiscoRouter2600#configure terminal
```

```
  disabl
Enter configuration commands, one per line.  End with CNTL/Z.
  disconnect       Disconnect an exi
CiscoRouter2600(config)#enable password cisco
  enab
CiscoRouter2600(config)#exited commands
CiscoRouter2600#
  e
*Mar  1 01:37:46.697: %SYS-5-CONFIG_I: Configured from console by consoleexit
Description of the interactive help system
CiscoRouter2600 con0 is now available

Press RETURN to get started.

User Access Verification

Password:
CiscoRouter2600>enable
Password:
CiscoRouter2600#
  e
*Mar  1 01:37:46.697: %SYS-5-CONFIG_I: Configured from console by consoleexit
Description of the interactive help system

CiscoRouter2600 con0 is now availableminal
Press RETURN to get started.a particular user
User Access Verification
  logout           Exit

Password:XEC
CiscoRouter2600>enable
  modemui
Password:t a modem

CiscoRouter2600#sh run

service timestamps log datetime msecast traceroutes
no service password-encryption
  mtrace
!
hostname CiscoRouter2600cast path from destinati
!
logging queue-limit 100
enable password cisco          → Password dang PlaintText(ko an toan )
  name
!o
ip subnet-zeroan existing ne
!o
!
!n
mpls ldp logging neighbor-changes
  pad
!
!
!
```

```
!
!O
!n
!
!2
!P
no voice hpi capture buffer
no voice hpi capture destinationmessages
!
!
mta receive maximum-recipients 0IETF Point-to-Point Protocol (PP
!
!
!
!
interface Ethernet0/0
 no ip address           Res
 shutdownive netwo
 half-duplex
!
interface Serial0/0
ip http server
ip classless
!
!
!
!
!
call rsvp-sync
!
!
mgcp profile default
!
dial-peer cor custom
!
!
!
!
line con 0
 password vnpro
 login
line aux 0
line vty 0 4
!
 --More--
---------------
CiscoRouter2600#copy run start   ---> tuong duong cau lenh #wr
Destination filename [startup-config]?
Building configuration...
[OK]
CiscoRouter2600#
-------------
```

*** **Chu y** :Khi ta dang dung o cap cao Privilege muon thuc hien cac lenh cua mode Privilege thi ta them tu khoa la “do”

```
CiscoRouter2600#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
CiscoRouter2600(config)#do show run
```

5. Tat co che phan giai ten mien cua Router (de Router ko phan giai ten mien khi ta go sai)

```
CiscoRouter2600(config)#no ip domain-lookup
CiscoRouter2600(config)#^Z
CiscoRouter2600#wr
*Mar  1 02:00:06.970: %SYS-5-CONFIG_I: Configured from console by console
Building configuration...
----------------
```

6. Bat co che ngan ngua ngat ngang cau lenh ma ta dang go

```
CiscoRouter2600(config)#line console 0
CiscoRouter2600(config-line)#logging synchronous
CiscoRouter2600(config-line)#exec-timeout  0 0 -→ (0 phut 0 giay)
CiscoRouter2600(config-line)#exit
CiscoRouter2600(config)#wr
              ^
% Invalid input detected at '^' marker.

CiscoRouter2600(config)#^Z
CiscoRouter2600#wr
*Mar  1 02:07:29.351: %SYS-5-CONFIG_I: Configured from console by console
CiscoRouter2600#wr
Building configuration...
```

e> Ma hoa tat cac passswod dang "cleartext" trong cau hinh cua cac thiet bi Cisco

```
CiscoRouter2600(config)#service password-encryption  --->> ma hoa MD7
Current configuration : 1214 bytes
!
version 12.3
service timestamps debug datetime msec
service timestamps log datetime msec
service password-encryption
!
hostname CCNA
!
boot-start-marker
boot-end-marker
!
enable password 7 110A1016141D
!
no aaa new-model
ip subnet-zero
!
!
no ip domain lookup
!
ip cef
ip audit po max-events 100
```

7. Cach dat password dang nhap tu User Mode -> Privilege ma hoa MD5

```
CiscoRouter2600(config)#enable secret vnpro
```

```
CiscoRouter2600(config)#^Z


Router uptime
CiscoRouter2600#

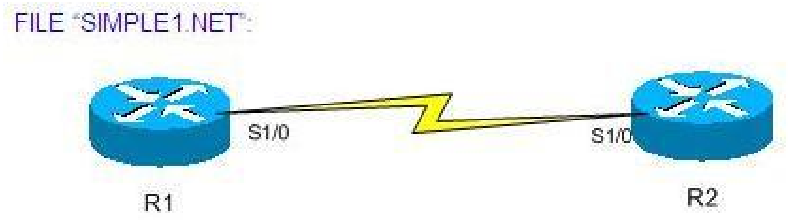
Current configuration : 800 bytes
!
version 12.2
service timestamps debug datetime msec
service timestamps log datetime msec
service password-encryption
!
hostname CiscoRouter2600
!
logging queue-limit 100
enable secret 5 $1$CWwB$mMIv5wVZKZrwpLvIGKIY81 --> co so 0 la plaint text, 5 MD5,7
MD7
enable password 7 0822455D0A16
!
ip subnet-zero
!
!
no ip domain lookup
!
mpls ldp logging neighbor-changes
!
!
!
 --More--
```

=====> neu enable secret (MD5) la password dc uu tien nhat de dang nhap tu User Mode sang Privilege Mode

Ma hoa: enable secret 5 $1$CWwB$mMIv5wVZKZrwpLvIGKIY81ry.
enable password 7 0822455D0A16board System flash (Read/Write

CAU HINH KET NOI ROUTER

1. Cau hinh cong Ethernet/Fastethernet



R1 (192.168.1.77/30) ----- R2 (192.168.1.78/30)

```
CCNA(config)#interface e0/0  ---> vao Mode Interface   (E0/0; Fa0/0)
CCNA(config-if)#hostname R1
------------------------------------
R1(config-if)#ip address 192.168.1.77 255.255.255.252
------------------------------------
R1(config-if)#no shutdown

------------------------------------
R1#ping 192.168.1.78

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.78, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms
R1#
------------------------------------
R1#sh run interface e0/0 -----> xem lai IP
Building configuration...

Current configuration : 83 bytes
!
interface Ethernet0/0
 ip address 192.168.1.77 255.255.255.252
 half-duplex
end

R1#
```

****** Chu y: : Neu da IP sai ta co the sua lai bang 2 cach sau :**
c1: Go de len IP cu
c2 : tra ve nguyen thuy cua IP

```
R1(config)#default interface e0/0
```

TELNET – SSH

Co the cau hinh bang cach truy xuat tu xa
- Telnet (23)
- SSH (22)

====> doi hoi Router fai cau hinh Line VTY

```
R1(config)#line vty 0 ?
  <1-4>  Last Line number  -----> ho tro tu 5 phien ket noi tu xa
  <cr>
-----------------
R1(config)#line vty 0 4 ---> cho phep chi su dung 5 phien ket noi
R1(config-line)#


R1(config)#line vty 0 4
R1(config-line)#pass
R1(config-line)#password vnpro  ---> pass cho VTY
R1(config-line)#login
R1(config-line)#exit
```

CISCO DISCOVERY PROTOCOL (CDP)

1. **Dinh nghia** :

- La giao thuc cho phep phat hien cac thiet bi Cisco khac dang ket noi "truc tiep" voi thiet bi cua minh
- Hoat dong Layer 2
- Chi co tren thiet bi cua Cisco

2. **Chuc nang**:

-Kiem tra trang thai hoat dong cua thiet bi lang gieng
-Lay duoc thong tin cua cac thiet bi lang gieng
-Ve so do mang

```
R1#sh CDP neighbors
Capability Codes: R - Router, T - Trans Bridge, B - Source Route Bridge
                  S - Switch, H - Host, I - IGMP, r - Repeater

Device ID       Local Intrfce   Holdtme     Capability   Platform  Port ID
R2              Eth 0/0          173                R        2620      Fas 0/0

R1#

R1#sh CDP neighbors  -> kiem tra cac thiet bi noi truc tiep toi Router
Capability Codes: R - Router, T - Trans Bridge, B - Source Route Bridge
                  S - Switch, H - Host, I - IGMP, r - Repeater

Device ID        Local Intrfce     Holdtme     Capability Platform Port ID
R2             Eth 0/0           150          R        2620      Fas 0/0

R1#sh CDP neighbors
Capability Codes: R - Router, T - Trans Bridge, B - Source Route Bridge
                  S - Switch, H - Host, I - IGMP, r - Repeater

Device ID        Local Intrfce     Holdtme     Capability  Platform  Port ID
R2             Eth 0/0           122          R        2620      Fas 0/0
R1#sh CDP neighbors
Capability Codes: R - Router, T - Trans Bridge, B - Source Route Bridge
```

```
                S - Switch, H - Host, I - IGMP, r - Repeater

Device ID        Local Intrfce     Holdtme    Capability  Platform  Port ID
R2               Eth 0/0            120          R        2620      Fas 0/0
R1#sh CDP neighbors
Capability Codes: R - Router, T - Trans Bridge, B - Source Route Bridge
                S - Switch, H - Host, I - IGMP, r - Repeater

Device ID        Local Intrfce     Holdtme    Capability  Platform  Port ID
R2               Eth 0/0            179          R        2620      Fas 0/0
```

*** **<u>Chu y</u> : Holdtime thoi gian luu thong tin cua Router khac**

****** CDP cho biet thong tin Layer3 cau hinh thiet bi Cisco dang ket noi truc tiep(biet duoc IP Address)**

```
R1#sh CDP neighbors detail

-------------------------
Device ID: R2
Entry address(es):
  IP address: 192.168.1.70
Platform: cisco 2620,  Capabilities: Router
Interface: Ethernet0/0,  Port ID (outgoing port): FastEthernet0/0
Holdtime : 133 sec

Version :
Cisco Internetwork Operating System Software
IOS (tm) C2600 Software (C2600-J1S3-M), Version 12.2(15)T14, RELEASE SOFTWARE (f
c4)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2004 by cisco Systems, Inc.
Compiled Sat 28-Aug-04 06:47 by cmong

advertisement version: 2
Duplex: half

R1#
---------------------------
Router(config)#no enable password  --> bo pass  enable
Router(config)#no enable secret --> bo pass secrect
Router(config)#line console 0
Router(config-line)#no password --> bo pass line console 0
```

3. Cau hinh cau thong bao khi gia nhap Router bang Telnet, SSH

```
Router(config)#banner motd # Xin chao#
```
motd: message of the day

4. **Tao co so du lieu tren Router**: luu thong tin ten thiet bi va IP tuong ung (ip host)

```
Router(config)#ip host Mr.Thanh 192.168.1.34
                    <luu Router co IP la 192.1681.34 co ten la Mr.Thanh>
Router(config)#Ctr + Z
```

```
Router#ping
00:40:36: %SYS-5-CONFIG_I: Configured from console by console

Router#ping Mr.Thanh

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.34, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms

Router#
Router#show host
Default domain is not set
Name/address lookup uses static mappings

Host                 Flags      Age Type   Address(es)
Mr.Thanh                (perm, OK)  0   IP    192.168.1.34  ----> kiem tao ip nao

Router#
```

CAU HINH KET NOI BANG CONG SERIAL

```
ROUTER#sh hosts
Default domain is not set
Name/address lookup uses static mappings

Codes: UN - unknown, EX - expired, OK - OK, ?? - revalidate
       temp - temporary, perm - permanent
       NA - Not Applicable None - Not defined

Host                      Port  Flags      Age Type   Address(es)
BA.THANH                  None  (perm, OK)  0   IP    192.168.1.2
HOANG                     None  (perm, OK)  0   IP    192.168.1.1
THAO                      None  (perm, OK)  0   IP    192.168.1.9
HUNG                      None  (perm, OK)  0   IP    192.168.1.4
LAN                       None  (perm, OK)  0   IP    192.168.1.3
HAU                       None  (perm, OK)  0   IP    192.168.1.10
M.TUAN                    None  (perm, OK)  0   IP    192.168.1.15

----------------

ROUTER(config)#do wr
Building configuration...
[OK]
ROUTER(config)#do sh arp -→ Xem bang ARP

Protocol  Address          Age (min)  Hardware Addr   Type   Interface
Internet  192.168.1.9             6   0004.c129.6360  ARPA   Ethernet0/0
Internet  192.168.1.11            -   0007.0e9a.0dc0  ARPA   Ethernet0/0
Internet  192.168.1.10            3   0007.ebfc.1d20  ARPA   Ethernet0/0
Internet  192.168.1.15            1   0009.e8c5.2d20  ARPA   Ethernet0/0
Internet  192.168.1.1             8   0009.4330.6100  ARPA   Ethernet0/0
Internet  192.168.1.3            8   0008.e31b.9d40  ARPA   Ethernet0/0
Internet  192.168.1.2            8   0005.3233.0960  ARPA   Ethernet0/0
Internet  192.168.1.4            8   000b.5f9a.d0e0  ARPA   Ethernet0/0
```

```
---------------

ROUTER(config)#do sh run

memory-size iomem 15
no aaa new-model
ip subnet-zero -----> Cisco co the dung subnet 0
ip cef

--------------
```

*** **Chu y** : Cac cach Telnet

1. # Telnet <ip>
2. # Telnet <host>
3. # ip
4. # host

```
--------------
```

ctrl + shift + 6 bo tay bam phim "x" van giu phien ket noi hien hanh

ROUTER#sh sessions ----> xem phien ket noi

```
Conn Host              Address           Byte  Idle Conn Name
*  1 m.tuan           192.168.1.15         0     2 m.tuan --> dau "*"vi tri phien ket noi cuoi cung
---------------------
ROUTER#resume 1  -> tra lai phien ket noi 1 (co dau "*") hoac co the Enter 2 lần
[Resuming connection 1 to m.tuan ...]
--------------------
ROUTER#sh users   -> ai Telnet minh
    Line       User       Host(s)              Idle       Location
*  0 con 0                m.tuan              00:07:50
                     hung                00:03:30
                     hau                00:02:22
                     ba.thanh              00:01:41
                     hoang               00:01:11
                     thao               00:00:55
  66 vty 0               idle                 00:05:52 LAN
  67 vty 1               idle                 00:05:08 HUNG
  68 vty 2               idle                 00:01:53 M.TUAN
  69 vty 3               idle                 00:00:59 THAO
  70 vty 4               idle                 00:00:53 HAU

  Interface    User               Mode         Idle     Peer Address
```

ROUTER#clear line 67 ------> ko cho nguoi khac ket noi toi(nguoi o line 67)

```
--------------------------

ROUTER#
[Resuming connection 3 to hau ... ]
```

```
[Connection to hau closed by foreign host]
ROUTER#
```

```
ROUTER#sh controllers s0/0
```

→ Kiem tra dau cap V35 loai nao dang ket noi toi cong serial cua minh (DTE- DCE)

Neu la DCE ----> thi cap xung

```
ROUTER(config)#int s0/0
ROUTER(config-if)#clock rate 64000
ROUTER(config-if)#shutdown
```

----> tat 10s roi no shut lai

```
ROUTER(config-if)# no shutdown
```

Xem chi tiet cong s0/0

```
Serial0/0 is down, line protocol is down
  Hardware is PowerQUICC Serial
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec,
     reliability 252/255, txload 1/255, rxload 1/255
  Encapsulation HDLC, loopback not set
  Keepalive set (10 sec) ---> 10s gui/nhan 1 lan
  Last input 00:01:38, output never, output hang never
  Last clearing of "show interface" counters 00:29:50
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: weighted fair
  Output queue: 0/1000/64/0 (size/max total/threshold/drops)
     Conversations  0/0/256 (active/max active/max total)
     Reserved Conversations 0/0 (allocated/max allocated)
     Available Bandwidth 1158 kilobits/sec
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     3 packets input, 568 bytes, 0 no buffer
     Received 3 broadcasts, 0 runts, 0 giants, 0 throttles
     3 input errors, 0 CRC, 2 frame, 0 overrun, 0 ignored, 0 abort
     0 packets output, 0 bytes, 0 underruns
     0 output errors, 0 collisions, 34 interface resets
     0 output buffer failures, 0 output buffers swapped out
     6 carrier transitions
```

Status (Layer 1)

    e.g : down
        1. Cong serial hu
        2. Cable hu
        3.Chua ket noi cable
        4.Ko nhan dc tin hieu song mang(CD)

Protocol(Layer2)

eg: down
1.dong goi chuan WAN ko tuong thich 2 dau ket noi
2.Ko nhan dc tin hieu KeepAlive
3.Chua cap clockrate

----
b1: Gan cap(V35)
b2: no shut 2 cong
b3: xac dinh loai V35 nao DCE-DTE

```
#sh controller <serial>
```

b4: Neu la DCE cap Clock rate

SSH (Secure Shell)

- De thuc hien bai LAB nay truoc tien ta disable het cac password enable password secret Va nho no login

----
- Dang nhap tu xa bang Telnet phai cung cap Username & password
Cach dag nhap cong Console bang user/pass

B1: Tao CSDL de chung thuc nguoi dung tren Router

```
CCNA(config)#username netadmin password vnpro ---> user name /pass
```

* Khi Telnet vao thi quyen Use mode : Privilege level 0
Privilege mode: Privilege level 15

```
CCNA(config)#username netadmin privilege 15 -----> cho phep user net admin dang nhap vao Router voi tham quyen cao nhat
```

B2: Cau hinh cong console va tai line vty de thay doi hinh thuc dang nhap

```
CCNA(config)#line vty 0 10 ---> tuy y
CCNA(config-line)#login local  -> cho phep dang nhap cong console bang user/pass voi use/pass lay tu CSDL cuc bo cua Router
CCNA(config-line)# exit
```

_--------------

***SSH** la cai tien cua ung dung Telnet (TCP,port 23); du lieu truyen thong trong SSH (TCP, port 22) duoc ma hoa an toan
- Ma hoa theo chuan (RSA: Risvest Shamir Aldeman) trong ung dung SSH (hay RSA,Diffie Helman)
- SSH hien dang co nhung phien ban : 1.0;1.5;1.99;2.0

Mot phien ket noi SSH dc dien ra giua 2 phia:
+Mot phia goi SSH Client
+ va SSH Server

*****Chu y**: phai su dung cung phien ban SSH su dung giua Clent va Server(nen dung phien

ban 2.0)
2.0 <----> 2.0
1.0 <-----> 1.5 <-----> 1.99

- SSH Client (Putty,Open SSH)
- Cac buoc trien khai tren thiet bi Cisco:

B1 : Tao User/Pass
B2: Thuat toan RSA doi hoi phai cau hinh 1 Khoa(key)
duoc sinh ra tu 2 thong so tren thiet bi cisco
    +Hostname (phai khac hostname Router)
    +IP domain-name

```
CCNA(config)#ip domain-name vnpro.org
```

B3: Tao khoa

```
CCNA(config)#crypto key generate rsa
The name for the keys will be: CCNA.vnpro.org
Choose the size of the key modulus in the range of 360 to 2048 for your
  General Purpose Keys. Choosing a key modulus greater than 512 may take
  a few minutes.

How many bits in the modulus [512]: 1024     -----> mac dinh la 512, lon nhat la 2048
% Generating 1024 bit RSA keys, keys will be non-exportable... [OK]

CCNA(config)#
*Oct 11 10:54:46.103: %SSH-5-ENABLED: SSH 1.99 has been enabled
CCNA(config)#
```

B4:
+ C2800: ver 1.99
+ C2600: ver 1.5 --> ko thay doi dc Ver

Cau hinh SSH Version2 voi tinh nang ma hoa manh nhat

```
CCNA(config)#ip ssh version ?
  <1-2> Protocol version

CCNA(config)#ip ssh version 2
```

B5: Cau hinh cac thong so mo rong cho SSH
    + So lan cho phep nhap thong tin chung thuc sai

```
        CCNA(config)#ip ssh authentication-retries ?
          <0-5>  Number of authentication retries
        CCNA(config)#ip ssh authentication-retries 3
```

    + Chinh thoi gian time Out cua 1 phien ket noi SSH (default 120)

```
        CCNA(config)#ip ssh time-out ?
          <1-120> SSH time-out interval (secs)

CCNA(config)#ip ssh time-out 60
```

B6: Cau hinh line VTY cua thiet bi Cisco chi chap nhan SSH hoac Telnet hoac Ca hai

VD1: chi su dung SSH

```
CCNA(config)#line vty 0 4
CCNA(config-line)#login local
CCNA(config-line)#transport input SSH
```

VD2: Dung ca hai

```
CCNA(config)#line vty 0 4
CCNA(config-line)#login local
CCNA(config-line)#transport input SSH Telnet
CCNA(config-line)#
--------------------------

CCNA#ssh -l <login name> <IP host>
```

`CCNA#ssh -l netadmin LAN` **-----→ hostname cua Router ket noi toi la LAN**

```
Password:

Password:
Chao mung ban den voi Router cua Lan
Lan#
CCNA#show ip ssh
SSH Enabled - version 2.0
Authentication timeout: 60 secs; Authentication retries: 3
CCNA#
```

QUA TRINH KHOI DONG CUA THIET BI CISCO

1. Rom monitor
rommon1>
hoac >
hoac $

**** Do Admin***

+ ~> Recovery password
+ ~> Thay doi gia tri thanh ghi (Configuration register)
Ex: Configuration register is 0x2102

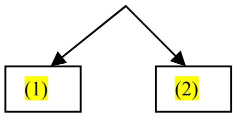
**** Khong do Admin***

+ Flash hu
+ Ko load duoc IOS

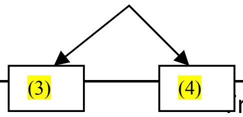
2. Boot ROM
Router (boot)>
~> Muc dich nang cap Flash

3. Boot Sequence

Router (PowerOn) ----> (Run IOS from ROM) POST ----> (Configuration Register) Read & Load cau hinh trong NVRAM ----> (run) NVRAM (load Startup-config)



(1) (ko co NVRAM) ----> Tim TFTP Server

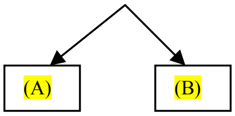


(3) co file *.confg(Start-config) - --> Load len RAM

(4) ko co file *.confg -----> SETUP MODE

(2) (Co NVRAM) ------> Load len RAM (Load len Running-config)

Cac gia tri thanh ghi :
+ ~> 0x2100 ---> ROM MONITOR (IOS promt cua ROM)
+ ~> 0x2101 ----> BOOT ROM (Cisco 2500 only)
+ ~> 0x2142 Boot binh thuong nhung bo qua cau hinh Startup-config trong NVRAM vao thang **SETUP MODE**
+~> 0x2102 (Default)-----> (normal Boot) Run Flash load Cisco IOS ------> RAM -----> (Ko co IOS) ----> Flash Hu --->Tim TFTPver



(A) co (IOS) load ve RAM
(B) ko co(IOS) ROM MONITOR

RECOVERY PASSWORD

**~~~~~> Tac dong Router, thay doi gia tri Configuration Register (Doi bit 6 =1) bo qua NVRAM**

1. **Ta cong tac nguon cua Router (30s)**

Nhan to hop phim (Ctrl + Break) Dung o he dieu hanh cua ROM

```
Rommon 1>
System Bootstrap, Version 12.2(10r)1, RELEASE SOFTWARE (fc1)
TAC Support: http://www.cisco.com/tac
Copyright (c) 2002 by cisco Systems, Inc.
C2600 platform with 65536 Kbytes of main memory


monitor: command "boot" aborted due to user interrupt
rommon 1 >
```

2. Doi gia tri thanh ghi (bo qua NVRAM)
   + 2500 : > o/r 0x42

   +2600 tro di : romon2> confreg 0x2142

3. Khoi dong lai Router bang cach
   +rommon2> i
   hoac +rommon2>reset

```
rommon 1 > confreg 0x2142


You must reset or power cycle for new config to take effect
rommon 2 > reset

System Bootstrap, Version 12.2(10r)1, RELEASE SOFTWARE (fc1)
TAC Support: http://www.cisco.com/tac
Copyright (c) 2002 by cisco Systems, Inc.
C2600 platform with 65536 Kbytes of main memory
```

4. Vao Privilege, kiem tra lai Strart-up config
   Copy tu Startup-config -> running-config -→ giu cau hinh nhung bo pass
   # copy start run

*** **Chu y** : Neu thuc hanh VNPro #erase st

5. Vao Mode Config, bo cac password cu dat password theo y muon

6. Thay doi lai gia tri thanh ghi ve gia tri mac dinh la 0x2102

7. Luu cau hinh vao NVRAM va Reload

BACKUP and RESTORE

1. BACKUP STARTUP CONFIG → TFTP SERVER

*** Chu y la: phai noi PC vao Router

Router (192.168.1.11) ----------------------- TFTP Server (192.168.1.111)

```
Saigon#copy startup-config tftp:
Address or name of remote host []?
Address or name of remote host []? 192.168.1.111 ---→ Dia chi cua TFTP SERVER
Destination filename [saigon-confg]?
!!!!!
1480 bytes copied in 0.272 secs (5441 bytes/sec)
Saigon#
```

2. BACKUP Flash → TFTP SERVER

```
SAIGON#copy flash: tftp:
Source filename []? c2600-ik8s-mz.122-11.T11.bin
Address or name of remote host []? 192.168.1.111  ---→ IP Address TFTP Server
Destination filename [c2600-ik8s-mz.122-11.T11.bin]?
.!!!!!!
```

3. RESTORE TFTPServer → RAM (Running Config)

```
#Erase st
 #Reload
```

--→ Muc dich xoa cau hinh cu de sau khi chep se co lai cau hinh truoc khi xoa cau

hinh

*** Cac buoc thuc hien**

Dat lai IP cho Router
Copy TFTP Start
Copy Start Run

```
Router#copy tftp: startup-config
Address or name of remote host []? 192.168.1.111
Source filename []? Saigon-confg
Destination filename [startup-config]?
```

4. RESTORE IOS FLASH

```
# erase flash
#reload
vao Romon1>
System Bootstrap, Version 11.3(2)XA4, RELEASE SOFTWARE (fc1)
Copyright (c) 1999 by cisco Systems, Inc.
TAC:Home:SW:IOS:Specials for info
C2600 platform with 65536 Kbytes of main memory

device does not contain a valid magic number
boot: cannot open "flash:"
boot: cannot determine first file name on device "flash:"

System Bootstrap, Version 11.3(2)XA4, RELEASE SOFTWARE (fc1)
Copyright (c) 1999 by cisco Systems, Inc.
TAC:Home:SW:IOS:Specials for info
C2600 platform with 65536 Kbytes of main memory

device does not contain a valid magic number
boot: cannot open "flash:"
boot: cannot determine first file name on device "flash:"

System Bootstrap, Version 11.3(2)XA4, RELEASE SOFTWARE (fc1)
Copyright (c) 1999 by cisco Systems, Inc.
TAC:Home:SW:IOS:Specials for info
C2600 platform with 65536 Kbytes of main memory
```

*** PHAN BIET HOA THUONG**

rommon 1 >set ----> hien ra nhung thong so da dc cau hinh cho Router de giao tiep voi Tftp Server

```
PS1=rommon ! >
ip_address=10.10.10.6
ip_dsubnet_mask=255.255.255.0
tftp_server=10.10.10.1
tftp_file=7.bin
DEFAULT_GETWAY=10.10.10.1
DEFAULT_GATWAY=10.10.10.2
DEJAULT_GATEWAY=10.10.3.200
RET_2_RCALTS=
RET_2_RUTC=0
?=0
```

```
IP_ADDRESS=192.168.1.5
IP_SUBNET_MASK=255.255.255.0
DEFAULT_GATEWAY=192.168.1.15
TFTP_SERVER=192.168.1.15
TFTP_FILE=c2600-ik8s-mz.122-11.T11.bin
BSI=0
RET_2_RTS=
rommon 2 >    ----> chi ket noi voi Ethernet dau tien(neu Router co nhieu Interface)
rommon 2 >
rommon 2 > IP_ADDRESS=192.168.1.11
rommon 3 > IP_SUBNET_MASK=255.255.255.0
rommon 4 > DEFAULT_GATEWAY=192.168.1.111
rommon 5 > TFTP_SERVER=192.168.1.111
rommon 6 > TFTP_FILE=c2600-ik8s-mz.122-11.T11.bin
rommon 7 > sync
rommon 8 > set
PS1=rommon ! >
ip_address=10.10.10.6
ip_dsubnet_mask=255.255.255.0
tftp_server=10.10.10.1
tftp_file=7.bin
DEFAULT_GETWAY=10.10.10.1
DEFAULT_GATWAY=10.10.10.2
DEJAULT_GATEWAY=10.10.3.200
RET_2_RCALTS=
RET_2_RUTC=0
BSI=0
RET_2_RTS=
IP_ADDRESS=192.168.1.11
IP_SUBNET_MASK=255.255.255.0
DEFAULT_GATEWAY=192.168.1.111
TFTP_SERVER=192.168.1.111
TFTP_FILE=c2600-ik8s-mz.122-11.T11.bin
?=0
rommon 9 >
rommon 9 > tftpdnld

          IP_ADDRESS: 192.168.1.11
      IP_SUBNET_MASK: 255.255.255.0
     DEFAULT_GATEWAY: 192.168.1.111
         TFTP_SERVER: 192.168.1.111
           TFTP_FILE: c2600-ik8s-mz.122-11.T11.bin

Invoke this command for disaster recovery only.
WARNING: all existing data in all partitions on flash will be lost!
Do you wish to continue? y/n:  [n]:  y

!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! -----------------→ Co cai nay moi chep thanh cong
```

5. Copy IOS tu Router sang Router

R1 ------------------------- R2 (TFTP SERVER)

R2: se dong vai tro lam Router chua IOS can chep

```
(config)#tftp-server flash: <tenIOS> alias IOSTRUNG  -→ Dat ten dai dien
```

R1: copy tfpt flash

```
SAIGON#copy tftp flash
Address or name of remote host []? 192.168.1.13  ---→ IP Address Router2
Source filename []? IOSTRUNG
Destination filename [IOSTRUNG]?
Accessing tftp://192.168.1.13/IOSTRUNG...
Erase flash: before copying? [confirm]
Erase flash: before copying? [confirm]
Erasing the flash filesystem will remove all files! Continue? [confirm]
Erasing device... eeeeeeee
```

BASIC SWITCHING

I. Tat ca cac port tren 1 Switch thuoc 1 Broadcast Domain ten la VLAN1

➔ Su dung 1 Network /1 Subnet

II. Xay dung 1 co so du lieu goi la MAC Address Table = CAM (Content Address Memory)

➔ Truyen du lieu "thong minh" hon HUB

III. Co che Switch xu ly va truyen Frame

1. Store and Forward: Default tren tat ca cac Switch 29xx tro di
- Switch nhan frame tu 1 port sau do kiem tra noi dung data cua Frame (CRC Cyclic Redundancy Check) kiem tra tinh toan ven Frame dam bao Frame khong loi thi moi truyen den dich tiep
Sau do dua vao dia chi Destination MAC de Forward Frame den port thich hop
- Uu Diem:
    + Co che tin cay (Most reliable)
- Nhuoc Diem:
    + Tang do tre trong tien trinh xu ly Frame (Increase Latency)
    + Do tre phu thuoc vao kich co cua Frame (Latency Fluctuate; bien thien).

2. Cut - Through

Switch nhan Frame tu 1 port va se Forward Frame den dich ngay sau khi doc duoc dia chi Destination MAC
- Uu Diem:
    + Fastest
- Nhuoc Diem:
    + Nguy co bi loi va Frame dung do den dich la cao nhat. (Fragment Frame Collision Frame: < 64 bytes) Anh huong den performance cua he thong mang.

3. Fragment- Free

Switch nhan Frame tu 1 port va se Forward frame den dich voi dieu kien Frame do it nhat bang 64 Bytes (> = 64 Bytes).
- Uu Diem:
    + Loc bot Colision

-Khuyet Diem:
  + Van con nguy co truyen Frame loi den dich

****** Tom lai: dung nhieu nhat van la co che Store and Forward va ko can thiep vao trong duoc.

IV. MAC ADDRESS TABLE

-Khi Swich nhan Frame co Destination MAC
  + Broadcast
  + Multicast 0100.5Exx.xxxx
  + Unknow Unicast (Khi Destination MAC ko co trong MAC Address Table)

-Forward Frame tren tat ca cac Port con lai cua Switch ngoai tru port ma no da nhan
-Switch xay dung MAC Address Table dua vao dia chi Source MAC cua Frame mà Switch nhận được từ các port tương ứng co ket noi cua Switch
-Dua vao bang MAC Address Table, Switch se Forward Frame theo Entry cua DESTINATION MAC va Port (Entry ton tai 300 giay)
******* Chu y:
  + MAC khong duoc Broadcast vi 1 Interface phai co MAC Address (MAC 1 thiet bi ko the la FFFF.FFFF.FFFF)
  + 1 port co the nhieu MAC khac nhau (trong truong hop noi voi Switch khac)

V. Redundancy Topology

- So do thiet ke mang dua ra bao gom nhieu Switch ket noi voi nhau thanh 1 mach nham han che rui ro

+ Access Layer
+ Destination Layer
+ Core Layer

Tranh hien tuong "One point of Failure" -------> so do mang mang tinh du phong

Khi thuc hien Topology nay se bi cac hien tuong sau:

1.* Broadcast Storm

- Tin hieu Broadcast se bi gui lien tuc khong ngung tren toan bo cac Switch
- Luu thong Broadcast se chiem het toan bo bang thong cua cac luu thong binh thuong khac trong mang

2.* Multiple Frame Copies

Xuat hien nhieu phien ban giong nhau cua Frame duoc lan truyen trong mang
- Mot thiet bi se nhan rat nhieu Frame giong nhau tu cac thiet bi khac gui den

3. Mac Database Instability

Su mat on dinh cua CSDL MAC cua Switch: 1 port tren SW co nhieu MAC, nguoc lai 1 MAC ko the co tren nhieu port, chi xuat hien 1 port nay ko dc xuat hien port khac

VI DU: port 1 co MAC A, MACB
  Nguoc lai MACA, khong the co the co port 1, port2

Khac phuc hien tuong ========> Giao thuc Spanning Tree Protocol (CCNA)

VI. Configure and Catalyst Switch:

- Hoat dong Layer 2
- Su dung Cisco IOS
- Directly Configure: Console Port
- Remotely Configure: Line vty

*** Cach thuc cau hinh Switch co ban trong qua trinh lam LAB VNpro.

Xoa cau hinh cu
*Cach 1:
#erase start
#delete vlan.dat
#reload
*Cach 2: Bam nut Mode giu den khi 4 den sang len va chop lien tuc cho den khi 4 den het chop thi ngung --> xoa cau hinh xong

SWITCH CONFIGURE

*Cau hinh IP cho VLAN1

```
SW(config)#int vlan1
SW(config-if)#ip address 192.168.1.11 255.255.255.0
SW(config-if)#no shut
```

----

*Tat ca cac port cua SW thuoc ve 1 Broadcast domain ten la VLAN1

SW(192.168.1.x/24)---------------------------(Router)--------------------------SW(192.168.2.y/24)

Ta co the cau hinh Default Gateway cho SW nham muc dich cho phep SW co the dc cau hinh tu cac thiet bi khac lop mang

```
SW(config)#ip default-gateway 192.168.1.254
-------------
```

```
SW#sh mac-address-table
        Mac Address Table
------------------------------------------

Vlan    Mac Address       Type        Ports
----    -----------       --------    -----
 All    000b.5f26.ad80    STATIC      CPU
 All    0100.0ccc.cccc    STATIC      CPU
 All    0100.0ccc.cccd    STATIC      CPU
 All    0100.0cdd.dddd    STATIC      CPU
   1    00e0.4c21.65cd    DYNAMIC     Fa0/8 --> MAC cua PC gan vao cong Fa0/8 cua SW
Total Mac Addresses for this criterion: 5
SW#
```

```
SW#sh mac-address-table dynamic -----> cac MAC Address tu hoc duoc
          Mac Address Table
-------------------------------------------

Vlan    Mac Address       Type        Ports
----    -----------       --------    -----
   1    00e0.4c21.65cd (NIC PC)    DYNAMIC     Fa0/8
Total Mac Addresses for this criterion: 1
SW#
```

----

* Cau hinh dia chi MAC cua 1 thiet bi la 1 "Static Entry" trong bang MAC Address Table cua SW de tranh dia chi MAC tren bi xoa ra khoi bang MAC

VD: hay cau hinh cai dia chi MAC cua PC la 1 Static Entry tai port 8 cua SW

```
SW#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
SW(config)#mac-address-table static 00e0.4c21.65cd vlan 1 interface fa0/8
SW#sh mac-address-table
          Mac Address Table
-------------------------------------------

Vlan    Mac Address       Type        Ports
----    -----------       --------    -----
 All    000b.5f26.ad80    STATIC      CPU
 All    0100.0ccc.cccc    STATIC      CPU
 All    0100.0ccc.cccd    STATIC      CPU
 All    0100.0cdd.dddd    STATIC      CPU
   1    00e0.4c21.65cd    STATIC      Fa0/8 -----> ton Ram cua SW
Total Mac Addresses for this criterion: 5
SW#
```

```
ROUTER(config)#no mac-address-table static 0000.1111.2222 vlan 1 interface fa0/20
 ---> Xoa 1 Entry Static
```

PORT SECURITY

Y nghia: Cau hinh port SW chi chap nhan 1 hoac 1 so dia chi MAC nao do do nguoi quan tri qui dinh ma thoi. Neu vi pham port tren se bi chuyen sang trang thai loi hoac bi Shutdown

Vi du : Cau hinh port Fa0/8 cua SW chi chap nhan "DUY NHAT" 1 dia chi MAC cua may tinh cua ban ma thoi. Neu vi pham thi port se bi Shutdown

**** Chu y: phai lam lien tuc cac command duoi

```
Sw(config)#int fa0/8
Sw(config-if)#switchport mode access
ROUTER(config-if)#switchport port-security mac-address ?
  H.H.H   48 bit mac address
  sticky  Configure dynamic secure addresses as sticky -----------> cau hinh port se chap
nhan dia chi MAC dau tien su dung port nay sau nay cac port khac gan vao se xem la vi
pham
Sw(config-if)#switchport port-security mac-address 00e0.4c21.65cd

Sw(config-if)#switchport port-security maximum ?
  <1-132>  Maximum addresses ----> so lan toi da cho phep vi pham khi gan vao port ko hop
le
Sw(config-if)#switchport port-security maximum 1

Sw(config-if)#switchport port-security violation ? ----> vi pham se xu ly theo cac truong hop
ben duoi
  protect   Security violation protect mode     ----> port chuyen sang trang thai loi va xuat hien
cac cau thong bao tren man hinh
            35xx: khong hoat dong
            29xx: port van hoat dong
  restrict  Security violation restrict mode
  shutdown  Security violation shutdown mode
Sw(config-if)#switchport port-security violation shutdown

Sw#sh mac-address-table
          Mac Address Table
-------------------------------------------

Vlan    Mac Address       Type        Ports
----    -----------       --------    -----
 All    000b.5f26.ad80    STATIC      CPU
 All    0100.0ccc.cccc    STATIC      CPU
 All    0100.0ccc.cccd    STATIC      CPU
 All    0100.0cdd.dddd    STATIC      CPU
   1    00e0.4c21.65cd    STATIC      Fa0/8 -----> khi thanh cong Entry nay se tro thanh
EntryStatic
Total Mac Addresses for this criterion: 5

Sw#sh port-security interface fa0/8
Port Security              : Enabled
Port Status                : Secure-up
Violation Mode             : Shutdown
Aging Time                 : 0 mins
Aging Type                 : Absolute
SecureStatic Address Aging: Disabled
Maximum MAC Addresses      : 1
Total MAC Addresses        : 1
Configured MAC Addresses   : 1
Sticky MAC Addresses       : 0
Last Source Address        : 0000.0000.0000
Security Violation Count   : 0


Sw#sh port-security int fa0/8
Port Security              : Enabled
Port Status                : Secure-shutdown
```

```
Violation Mode            : Shutdown
Aging Time                : 0 mins
Aging Type                : Absolute
SecureStatic Address Aging: Disabled
Maximum MAC Addresses      : 1
Total MAC Addresses        : 1
Configured MAC Addresses   : 1
Sticky MAC Addresses       : 0
Last Source Address        : 00e0.4c15.0ea1 ----->MAC PC gay ra shutdown
Security Violation Count   : 1 -----> tang len 1 lan
```

******** Sau do gan dung MAC nhung hien tuong port van ko hoat dong duoc

```
Sw#sh port-security
Secure Port MaxSecureAddr CurrentAddr SecurityViolation Security Action
              (Count)       (Count)         (Count)
---------------------------------------------------------------------------
      Fa0/8            1           1                 1        Shutdown
---------------------------------------------------------------------------
Total Addresses in System (excluding one mac per port)     : 0
Max Addresses limit in System (excluding one mac per port) : 1024

FastEthernet0/8 is down, line protocol is down (err-disabled)
  Hardware is Fast Ethernet, address is 000b.5f26.ad88 (bia 000b.5f26.ad88)
  MTU 1500 bytes, BW 100000 Kbit, DLY 100 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  Auto-duplex, Auto-speed, media type is 100BaseTX
  input flow-control is unsupported output flow-control is unsupported
  ARP type: ARPA, ARP Timeout 04:00:00
  Last input 00:07:24, output 00:07:24, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue: 0/40 (size/max)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     107 packets input, 14275 bytes, 0 no buffer
     Received 98 broadcasts (0 multicast)
     0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
     0 watchdog, 10 multicast, 0 pause input
     0 input packets with dribble condition detected
     240 packets output, 20502 bytes, 0 underruns
```

----->>>>>>>>>>>>>> Cach phuc hoi lai port da shutdown

Mac dinh tat ca cac Intreface vat ly cua SW o trang thai "down" vi vay khi ket noi voi PC nguoi dung port se hoat dong
De nang cao tinh bao mat ta nen Shutdown nhung port khong su dung tren SW tranh truong hop truy xuat trai phep.

```
Sw(config)#int fa0/8
Sw(config-if)#shutdown
Sw(config-if)#no shut
Sw(config-if)#
00:32:00: %LINK-5-CHANGED: Interface FastEthernet0/8, changed state to administr
atively down
Sw(config-if)#
00:32:03: %LINK-3-UPDOWN: Interface FastEthernet0/8, changed state to up
00:32:04: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/8, chang
ed state to up
Sw(config-if)#
```

CAU HINH TAC DONG LEN NHIEU INTERFACE CUA SWITCH

Vidu1: hay shutdown port Fa0/1 den Fa0/5

```
SW(config)#int range Fa0/1 -5
Sw(config-if-range)#shutdown
```

Vidu2: hay shutdown port Fa0/6 den Fa0/8 , F0/10 , Fa0/12

```
Swconfig)#int range Fa0/6-8 , Fa0/10 ,  Fa0/12
Swconfig-if-range)#shutdown
```

Vidu3: hay shutdown port Fa0/9, Fa0/11, Fa0/13 -19

```
Sw(config)#int range Fa0/9 , Fa0/11 , Fa0/13 -19
Sw(config-if-range)#shutdown
```

DEN HIEU CUA SWITCH

BIA: Burned-in address

MTU: Maximum Tranfer Units

Mot interface cua Switch mac dinh hoat dinh o co che:

+ Duplex: Auto (ca 2 Auto thi Full)
+ Speed: Auto (ca 2 Auto thi Max)
Duplex Missmatch --> Nguy co mach khong hoat dong
Speed Missmatch --> Mach bi ngat

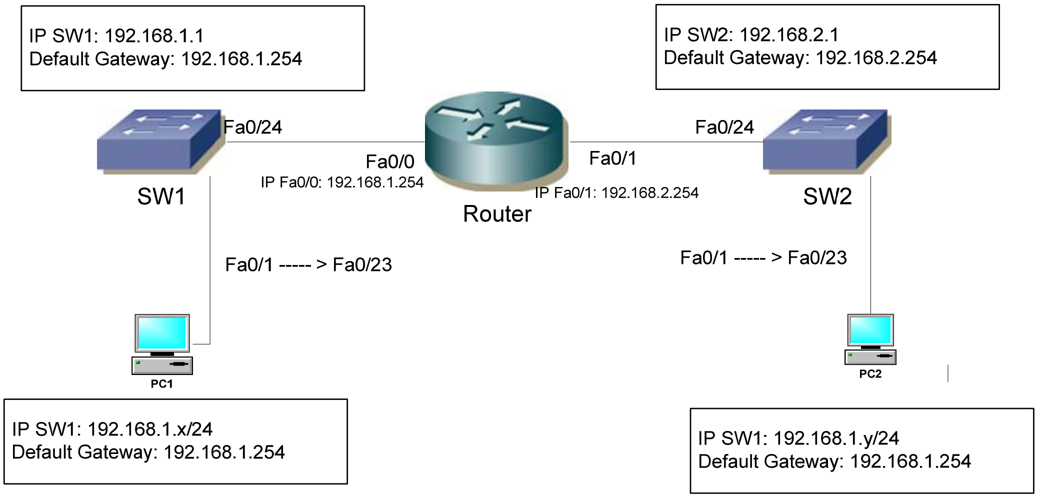
Mot so tin hieu ve den Led

SYST (System Led):
- Green: Operational
- Green & Flash: Lost IOS
- Amber (Ho phach, Cam) : System Malfunction (he thong ben trong bi hong), POST Fail

Port Led:
- Amber --> Green : Operational
- Green --> Amber : Port Faulty (Port bi hu)

CAU HINH ROUTER 2800 LAM DHCP SERVER BANG SDM

Mo hinh: Mo hinh nay se xay dung duoc trong noi bo Cong Ty gom 2 phong ban.



Buoc 1: Khoi dong dich vu HTTPS tren Router

```
(config)#ip http secure-server
```

Buuoc2: Tao User Account de cho phep cau hinh Router bang SDM

***** Luu y: Account nay phai co privilege 15 moi co quyen su dung SDM

```
CCNA(config)#username netadmin password vnpro
CCNA(config)#username netadmin privilege 15
```

Buoc 3:

```
(config)#ip http authentication local
```

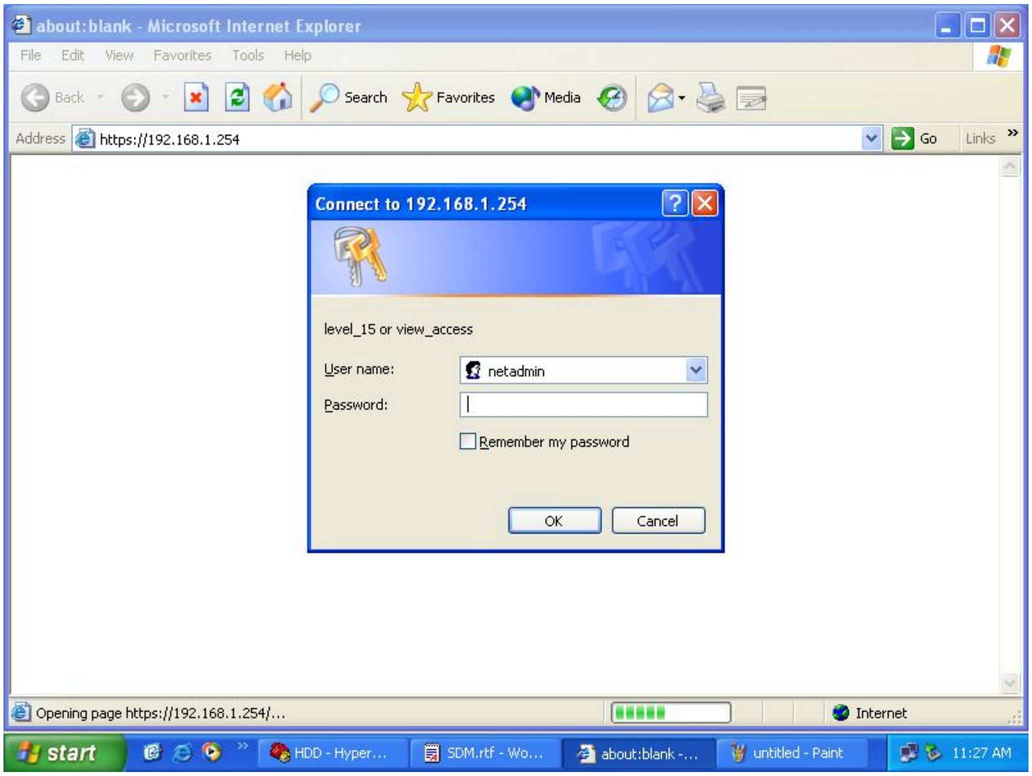
~~~~~> cho phep nguoi dung cau hinh Router bang giao dien Web. Khi dang nhap Router se chung thuc nguoi dung bang CSDL cuc bo tren **Rsouter**

Cach thuc hien:

*** **Chu y** : SDM

Cau hinh Router 2800 bang SDM doi hoi:
+ Router da co cai SDM
+ PC co cai JavaRuntimeEnviroment

1. Qua trinh dang nhap :
~~~~~



Connect to 192.168.1.254

level_15 or view_access

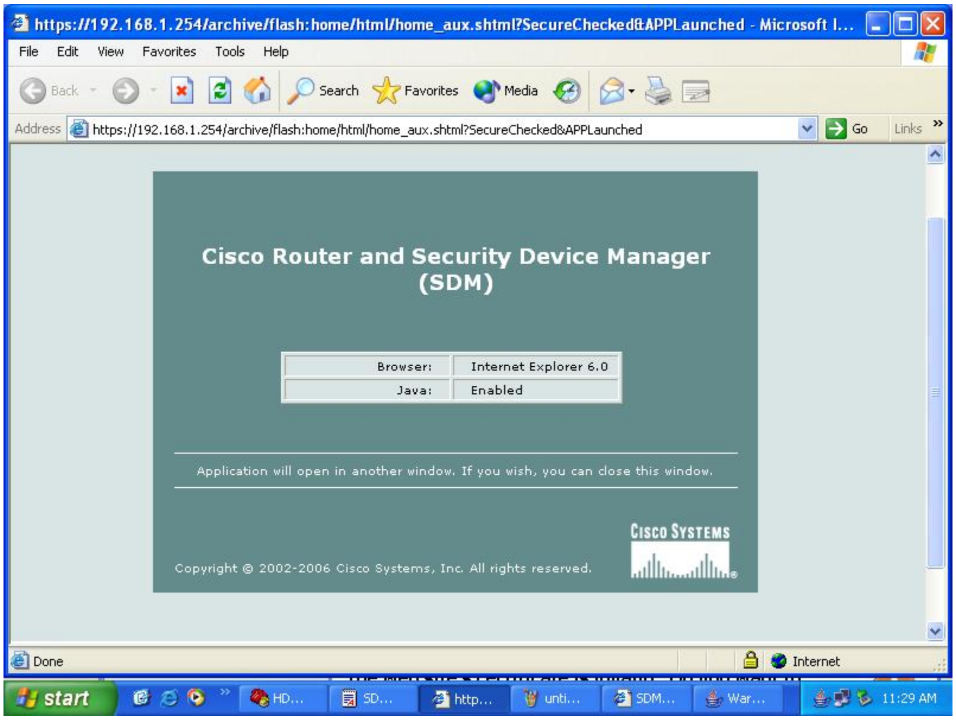
User name: netadmin

Password:

☐ Remember my password

about:blank - Microsoft Internet Explorer
Address https://192.168.1.254
OK
Cancel
Opening page https://192.168.1.254/...
Internet
11:27 AM

2. Nhap username: netadmin; pass: vnpro tao o buoc tren



Address https://192.168.1.254/archive/flash:home/html/home_aux.shtml?SecureChecked&APPLaunched

Cisco Router and Security Device Manager (SDM)

Browser:	Internet Explorer 6.0
Java:	Enabled

Application will open in another window. If you wish, you can close this window.

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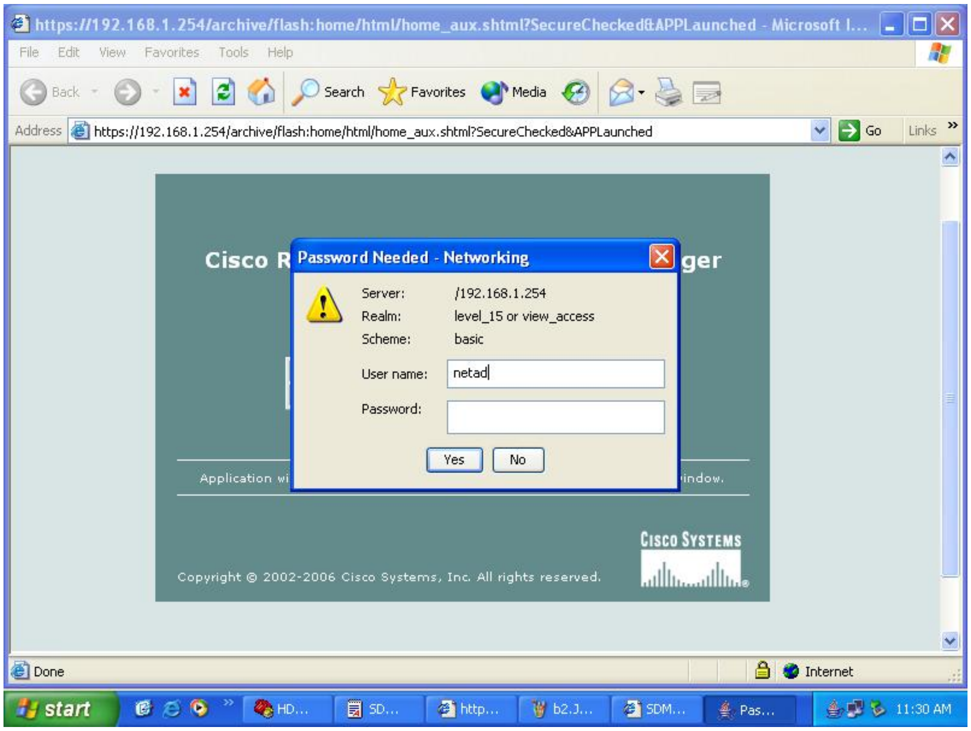
3. Tiep

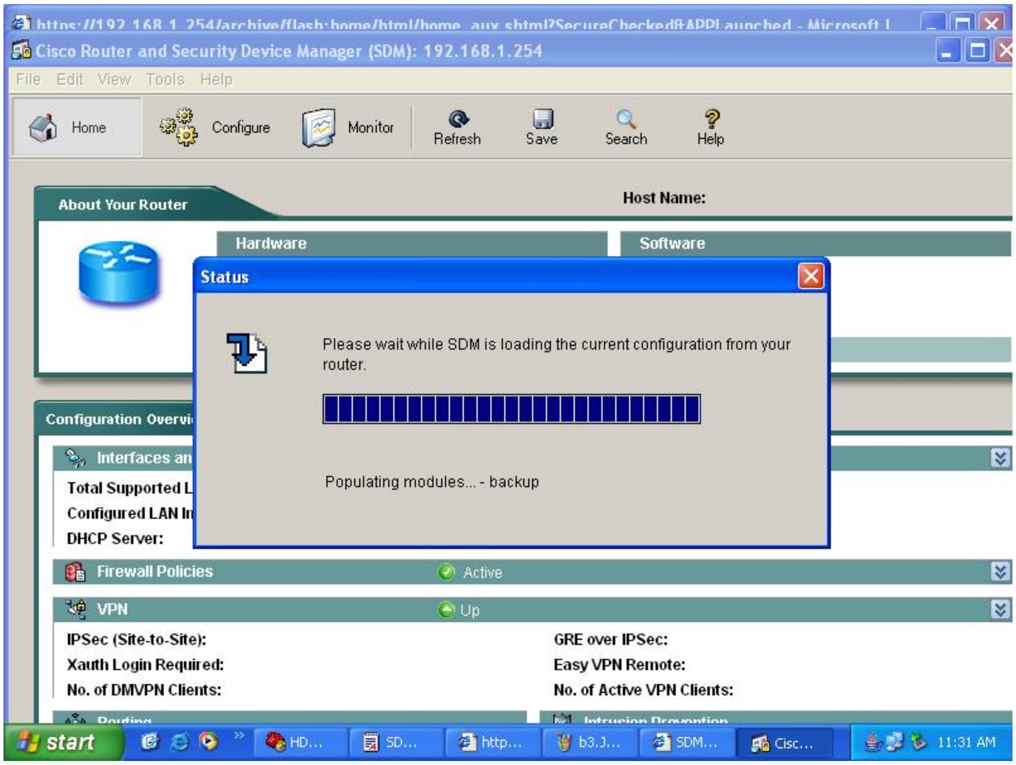

https://192.168.1.254/archive/flash:home/html/home_aux.shtml?SecureChecked&APPLaunched - Microsoft I...
File Edit View Favorites Tools Help
Back Search Favorites Media
Address https://192.168.1.254/archive/flash:home/html/home_aux.shtml?SecureChecked&APPLaunched
Go Links
Cisco R
ger
Application wi
indow.
Copyright © 2002-2006 Cisco Systems, Inc. All rights reserved.
Cisco Systems
Done
Internet
start
HD...
SD...
http...
b2.J...
SDM...
Pas...
11:30 AM

Password Needed - Networking

Server: /192.168.1.254
Realm: level_15 or view_access
Scheme: basic
User name: netad
Password:

Yes No

4. Khoi tao ket noi

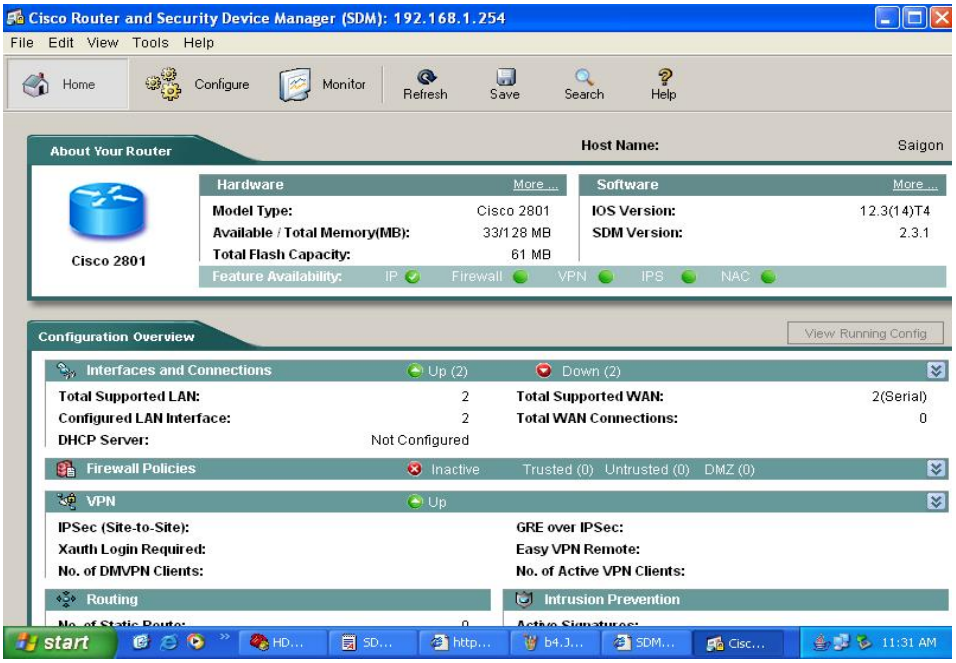


Status

Please wait while SDM is loading the current configuration from your router.

Populating modules... - backup

5. Tiep



Host Name: Saigon

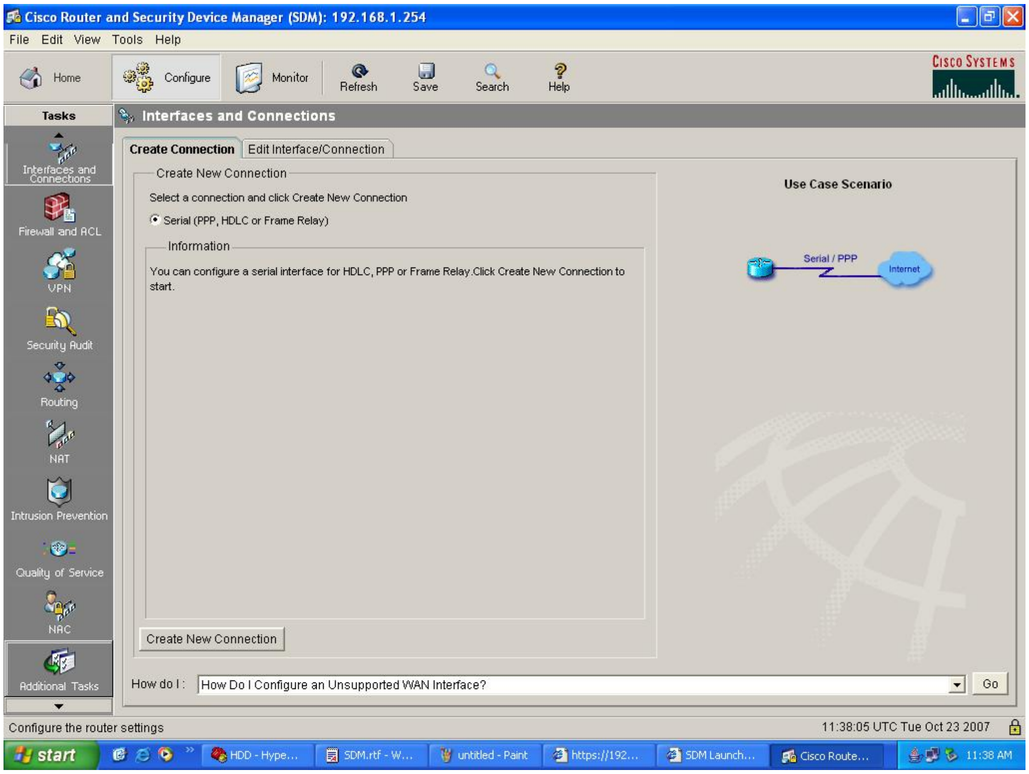
Model Type: Cisco 2801
Available / Total Memory(MB): 33/128 MB
Total Flash Capacity: 61 MB

IOS Version: 12.3(14)T4
SDM Version: 2.3.1

Total Supported LAN: 2
Configured LAN Interface: 2
DHCP Server: Not Configured
Total Supported WAN: 2(Serial)
Total WAN Connections: 0

IPSec (Site-to-Site):
Xauth Login Required:
No. of DMVPN Clients:
GRE over IPSec:
Easy VPN Remote:
No. of Active VPN Clients:

6. Tiep



Select a connection and click Create New Connection

● Serial (PPP, HDLC or Frame Relay)

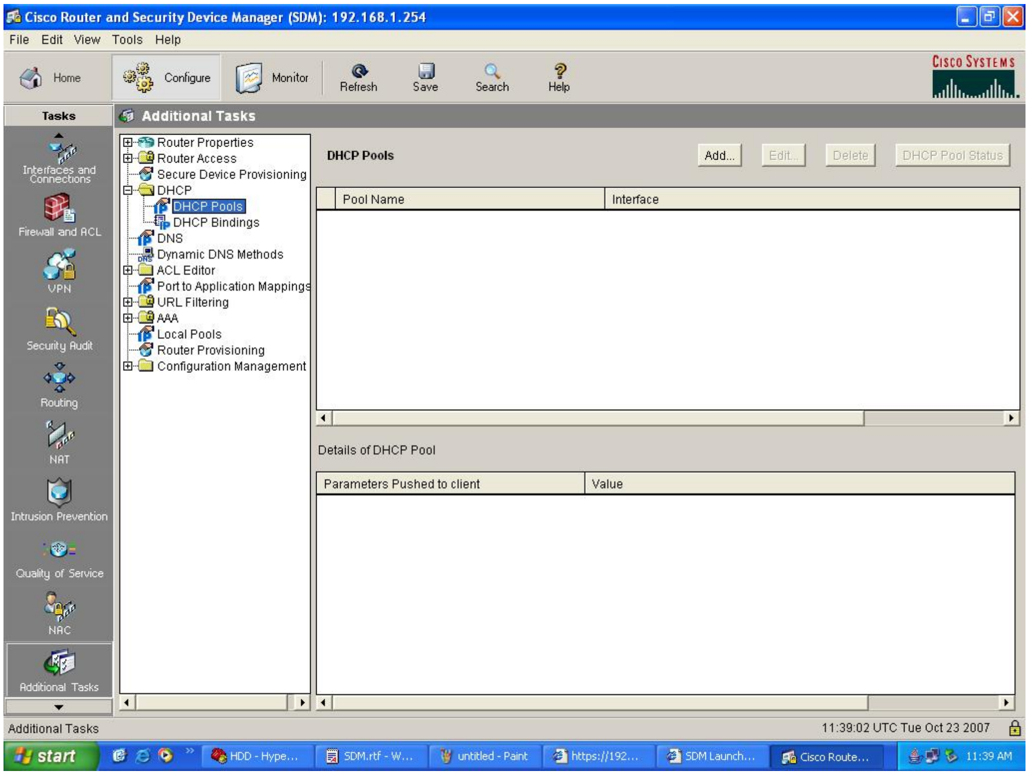
You can configure a serial interface for HDLC, PPP or Frame Relay.Click Create New Connection to start.

How do I: How Do I Configure an Unsupported WAN Interface?

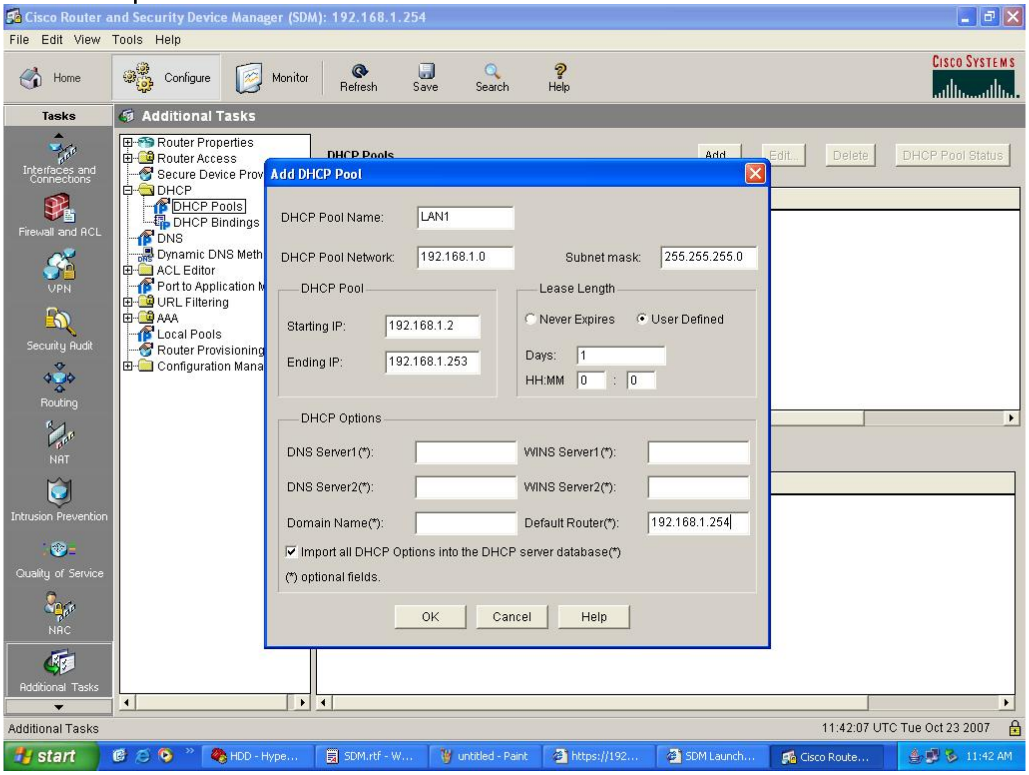
Configure the router settings

11:38:05 UTC Tue Oct 23 2007

7. Nhap vao **Additional Tabs**

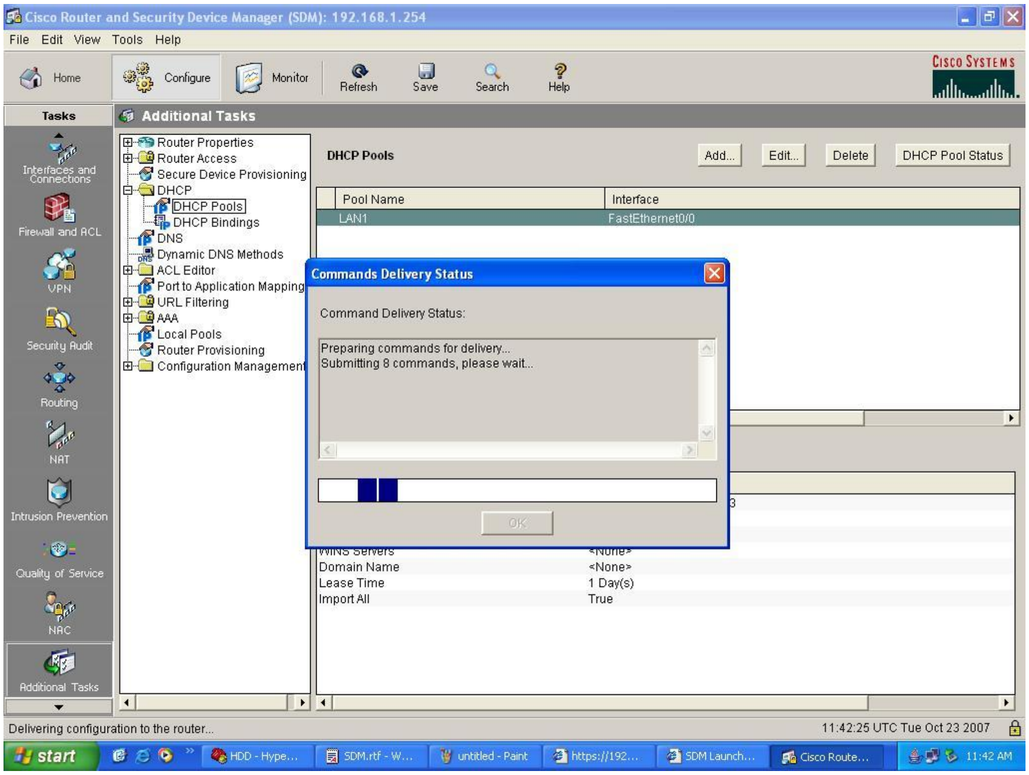


8. Tiep



DHCP Pool Name: LAN1
DHCP Pool Network: 192.168.1.0
Subnet mask: 255.255.255.0
Starting IP: 192.168.1.2
Ending IP: 192.168.1.253
○ Never Expires ● User Defined
Days: 1
HH:MM 0 : 0
DNS Server1(*):
WINS Server1(*):
DNS Server2(*):
WINS Server2(*):
Domain Name(*):
Default Router(*): 192.168.1.254
☑ Import all DHCP Options into the DHCP server database(*)
(*) optional fields.

9. Dang tao IP sunnet cho LAN 1



DHCP Pools

Pool Name	Interface
LAN1	FastEthernet0/0

Command Delivery Status:

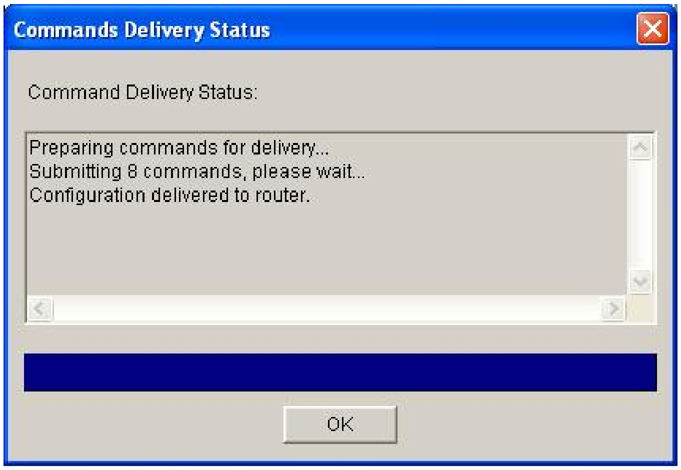
Preparing commands for delivery...
Submitting 8 commands, please wait...

Domain Name	<None>
Lease Time	1 Day(s)
Import All	True

Delivering configuration to the router...

11:42:25 UTC Tue Oct 23 2007

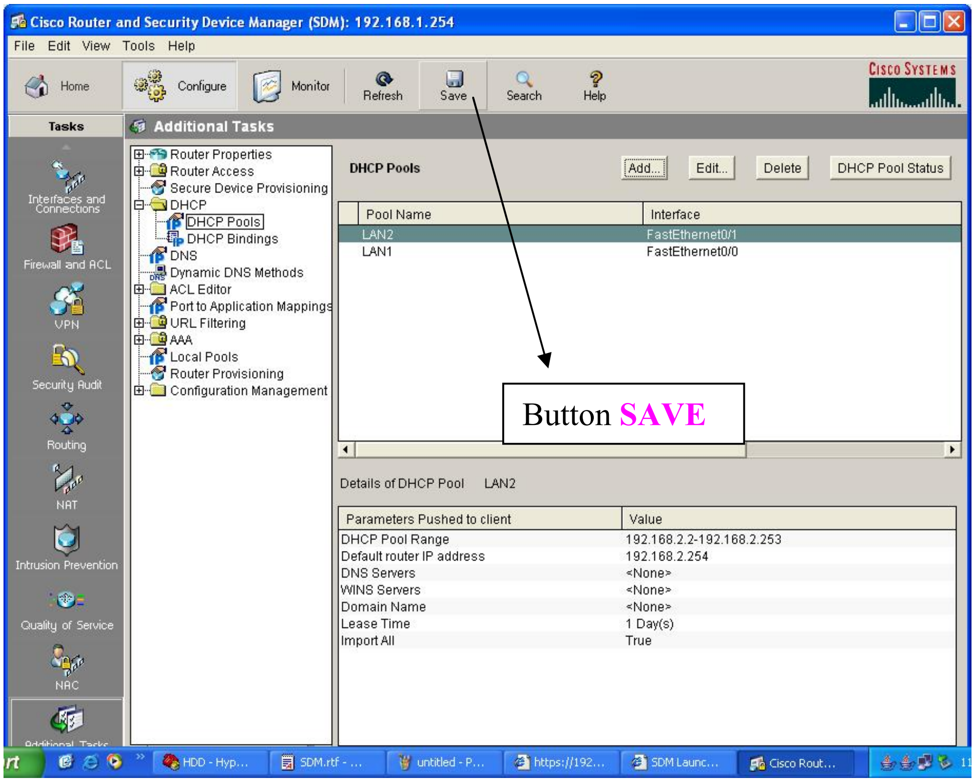
10. Tao thanh cong



Command Delivery Status:

Preparing commands for delivery...
Submitting 8 commands, please wait...
Configuration delivered to router.

11. LAN 2 tao tuong tu



Pool Name	Interface
LAN2	FastEthernet0/1
LAN1	FastEthernet0/0

Details of DHCP Pool LAN2

Parameters Pushed to client	Value
DHCP Pool Range	192.168.2.2-192.168.2.253
Default router IP address	192.168.2.254
DNS Servers	<None>
WINS Servers	<None>
Domain Name	<None>
Lease Time	1 Day(s)
Import All	True

12. Nhap vao **Save** Button de ket thuc
13. Kiem tra bang cach gam PC1 vao SW1, PC2 vao SW2

- Router se cap IP cho PC1 : 192.168.1.x/24
- Router se cap IP cho PC2 : 192.168.2.x/24
- Tien hanh ping tu PC2 --→ PC1 va nguoc lai

*** Luu y: trong truong hop nay Routing Table se duoc xay dung san cho cac Broad Cast Domain no thuoc ve.

TAO CAC MANG LOOPBACK

*** Tao interface Loopback: ----> interface Loopback khong bi down

Router R1

```
(config)#int lo0
(config)#ip add 192.168.1.94 255.255.255.224  -------------→ Chon dia chi cuoi cung la
192.168.1.94 (Magic Number la 32, SM : 255.255.255.224)
---------------→ ko no shut vi la card Loopback

(config)#int lo1
(config)#ip add 192.168.2.62 255.255.255.240 ---------------→ ko no shut

R1#sh ip int bri
Router#sh ip int bri
Interface              IP-Address      OK? Method Status                Prot
ocol
FastEthernet0/0          unassigned      YES unset  administratively down down

Serial1/0              200.100.100.25  YES manual up                    up

Serial1/1              unassigned      YES unset  administratively down down

Serial1/2              unassigned      YES unset  administratively down down

Serial1/3              unassigned      YES unset  administratively down down

Serial1/4              unassigned      YES unset  administratively down down

Serial1/5              unassigned      YES unset  administratively down down

Serial1/6              unassigned      YES unset  administratively down down

Serial1/7              unassigned      YES unset  administratively down down

FastEthernet2/0          unassigned      YES unset  administratively down down

FastEthernet2/1          unassigned      YES unset  administratively down down

Loopback0                192.168.1.94    YES manual up                    up

Loopback1                192.168.2.62    YES manual up                    up --→ card Loop back
trang thai luon UP/UP


R1#
```

```
R1s#sh ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

     200.100.100.0/30 is subnetted, 1 subnets
C       200.100.100.24 is directly connected, Serial1/0
     192.168.1.0/27 is subnetted, 1 subnets
C       192.168.1.64 is directly connected, Loopback0
     192.168.2.0/28 is subnetted, 1 subnets
C       192.168.2.48 is directly connected, Loopback1
Router#
```

Router R2

```
R2(config)#int lo0
R2(config-if)#ip address 192.168.30.176 255.255.255.240
R2(config-if)#exit
R2(config)#int lo1
R2(config-if)#ip add 192.168.40.254 255.255.255.192
R2(config-if)#

Interface                  IP-Address      OK? Method Status                Prot
ocol
FastEthernet0/0            unassigned      YES unset  administratively down down

Serial1/0                  200.100.100.26  YES manual up                    up

Serial1/1                  unassigned      YES unset  administratively down down

Serial1/2                  unassigned      YES unset  administratively down down

Serial1/3                  unassigned      YES unset  administratively down down

Serial1/4                  unassigned      YES unset  administratively down down

Serial1/5                  unassigned      YES unset  administratively down down

Serial1/6                  unassigned      YES unset  administratively down down

Serial1/7                  unassigned      YES unset  administratively down down

FastEthernet2/0            unassigned      YES unset  administratively down down

FastEthernet2/1            unassigned      YES unset  administratively down down

Loopback0                  192.168.30.174  YES manual up                    up
```

```
Loopback1              192.168.40.254  YES manual up                  up

R2#sh ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

     192.168.30.0/28 is subnetted, 1 subnets
C       192.168.30.160 is directly connected, Loopback0
     192.168.40.0/26 is subnetted, 1 subnets
C       192.168.40.192 is directly connected, Loopback1
     200.100.100.0/30 is subnetted, 1 subnets
C       200.100.100.24 is directly connected, Serial1/0
R2#
```

CAC LOAI GIAO THUC DINH TUYEN

1. **Static Router :** La cach thuc chinh nha quan tri cau hinh thong tin cac Network trong he thong ma Router chua biet (Bang tay: Manual Configure)

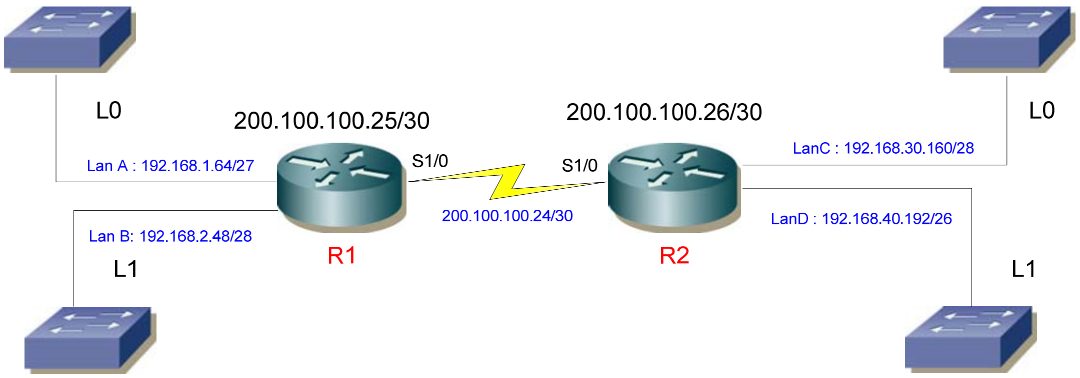
AS (Autonomous System): Tap hop tat ca cac thiet bi mang hoat dong duoi su quan tri chung cua 1 to chuc nao do.

- Uu Diem:
  + Phu hop cho AS nho
  + Thong tin dinh tuyen trong Router la tin cay
- Nhuoc Diem:
  + Ton cong quan tri neu AS co nhieu Network
  + Ko co kha nang cap nhat su thay doi cua cac Network dang xa trong he thong trong bang dinh tuyen cua tung Router

2. **Dynamic Router:** la cach thuc cac Router tu dong trao doi thong tin dinh tuyen voi nhau nham muc dich xay dung bang dinh tuyen hoan hao

- Uu Diem: + Cac Router co kha nang cap nhat bang dinh tuyen cua no khi co su thay doi trong he thong
- Nhuoc Diem:
  + Nhung co che trao doi thong tin dinh tuyen tu dong lam tieu ton bang thong cua mang tai 1 so thoi diem (sometime) ----> Routing Overhead.
  + Mot so giao thuc dinh tuyen dong co co che hoi tu cham do do co nguy co gay Routing Loop
  + Mot so giao thuc dinh tuyen dong doi hoi va gay ton nhieu bang thong (RAM&CPU) cua Router

STATIC ROUTER



*****R1 cau hinh Static Router, ta phai day cho no LAN C va LAN D

R1(config)#ip route 192.168.30.160 255.255.255.240 * ------------> di den duong mang co Subnet :192.168.30.160

Tai * co 2 tuy chon : <Out interface> va <Nexthop IP Address>

- **Out Interface**:
  R1(config)#ip route 192.168.30.160 255.255.255.240 S0/0 -------> cong ra truc tiep tren Router cua minh(R1)

****ip route khi router nhan duoc packet co Destination Network la 192.168.30.160
AD=0

- **Nexthop ip address**:
  R1(config)#ip route 192.168.30.160 255.255.255.240 200.100.100.26 -----> dia chi cua IP ke can noi toi Router minh --------→ dia chi cong serial cua R2 trong truong hop nay

AD=1

+**AD (Administrative Distance)**: la thong so ma dua vao no Router se danh gia thong tin dinh tuyen ve 1 Network nao do dang tin cay hon.

+AD cang nho cang dang tin cay.

Router chi dua vao bang dinh tuyen cua no nhung thong tin duong mang tin cay va tot nhat

~~~~> Trong cau hinh Static Router ta nen cau hinh theo cach Nexthop IP address

~~~~> Dung cho mo hinh da truy cap (Multile Access)

```
R1#sh ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set
```

```
     192.168.30.0/28 is subnetted, 1 subnets
S       192.168.30.160 [1/0] via 200.100.100.26 ----------------→ Duong mang cua R2
     192.168.40.0/28 is subnetted, 1 subnets  -------------→ Dung NextHop ip address
S       192.168.40.192 is directly connected, Serial1/0 ---------------→ Duong mang cua R2
                  ------------→ Dung Out Interface(S1/0)
     200.100.100.0/30 is subnetted, 1 subnets
C       200.100.100.24 is directly connected, Serial1/0
     192.168.1.0/27 is subnetted, 1 subnets
C       192.168.1.64 is directly connected, Loopback0
     192.168.2.0/28 is subnetted, 1 subnets
C       192.168.2.48 is directly connected, Loopback1
R1#
```

*****R2 cau hinh Static Router, ta phai day cho no LAN A va LAN B

```
R2(config)#ip route 192.168.1.64 255.255.255.224 200.100.100.25
R2(config)#ip route 192.168.2.48 255.255.255.240 S1/0
```

```
R2#sh ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

     192.168.30.0/28 is subnetted, 1 subnets
C       192.168.30.160 is directly connected, Loopback0
     192.168.40.0/26 is subnetted, 1 subnets
C       192.168.40.192 is directly connected, Loopback1
     200.100.100.0/30 is subnetted, 1 subnets
C       200.100.100.24 is directly connected, Serial1/0
     192.168.1.0/27 is subnetted, 1 subnets
S       192.168.1.64 [1/0] via 200.100.100.25
     192.168.2.0/28 is subnetted, 1 subnets
S       192.168.2.48 is directly connected, Serial1/0
```

**************====➔ Kiem tra R1

```
R1#ping 192.168.1.94

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.94, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 4/4/4 ms
R1#
```

**************====➔ Kiem tra R1 ping toi duong mang 192.168.40.192 cua R2 Ko noi truc tiep

```
R1#ping 192.168.40.192
```

```
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.40.192, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 16/64/212 ms
R1#
```

************* Kiem tra tuong hop khi R2 tat Loopback0 thi thong tinh dinh tuyen con trong R1 ko ???

```
R2#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
R2(config)#int lo0
R2(config-if)#shu
R2(config-if)#shutdown
R2(config-if)#
```

```
Serial1/1              unassigned      YES unset  administratively down down

Serial1/2              unassigned      YES unset  administratively down down

Serial1/3              unassigned      YES unset  administratively down down

Serial1/4              unassigned      YES unset  administratively down down

Serial1/5              unassigned      YES unset  administratively down down

Serial1/6              unassigned      YES unset  administratively down down

Serial1/7              unassigned      YES unset  administratively down down

FastEthernet2/0        unassigned      YES unset  administratively down down

FastEthernet2/1        unassigned      YES unset  administratively down down

Loopback0              192.168.30.174  YES manual administratively down down → da bi tat

Loopback1              192.168.40.254  YES manual up                    up
```

===→ thong tin dinh tuyen o R2: khong con duong mang 192.168.30.160

```
Gateway of last resort is not set

     192.168.40.0/26 is subnetted, 1 subnets
C       192.168.40.192 is directly connected, Loopback1
     200.100.100.0/30 is subnetted, 1 subnets
C       200.100.100.24 is directly connected, Serial1/0
     192.168.1.0/27 is subnetted, 1 subnets
S       192.168.1.64 [1/0] via 200.100.100.25
     192.168.2.0/28 is subnetted, 1 subnets
S       192.168.2.48 is directly connected, Serial1/0
R2#
```

===→ thong tin dinh tuyen o R1

```
R1#sh ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

     192.168.30.0/28 is subnetted, 1 subnets
S       192.168.30.160 [1/0] via 200.100.100.26 ----------→ Neu khong mat thi sau 3 phut se
mat (Trong bang dinh tuyen R1 van con duong mang Loopback0)
     192.168.40.0/28 is subnetted, 1 subnets
S       192.168.40.192 [1/0] via 200.100.100.26
                       is directly connected, Serial1/0
     200.100.100.0/30 is subnetted, 1 subnets
C       200.100.100.24 is directly connected, Serial1/0
     192.168.1.0/27 is subnetted, 1 subnets
C       192.168.1.64 is directly connected, Loopback0
     192.168.2.0/28 is subnetted, 1 subnets
C       192.168.2.48 is directly connected, Loopback1
R1#
```

******** Chu y :

+Thong tin cua Route cua cac inteface ket noi truc tiep voi Router chi hien thi trong bang dinh tuyen khi Inteface do la o trang thai UP/UP

+ Thong tin dinh tuyen Static Router chi mat khi mach noi giua 2 Router bi gian doan (Khong con o trang thai UP/UP)

```
R1#sh ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

     192.168.1.0/27 is subnetted, 1 subnets
C       192.168.1.64 is directly connected, Loopback0 -------→ Mat het cac duong mang thuoc
Rouer 2.
     192.168.2.0/28 is subnetted, 1 subnets
C       192.168.2.48 is directly connected, Loopback1
R1#
```

*********Cap nhat lai bang dinh tuyen:

```
R2#clear ip router *
```

STATIC ROUTER (Backup Line)

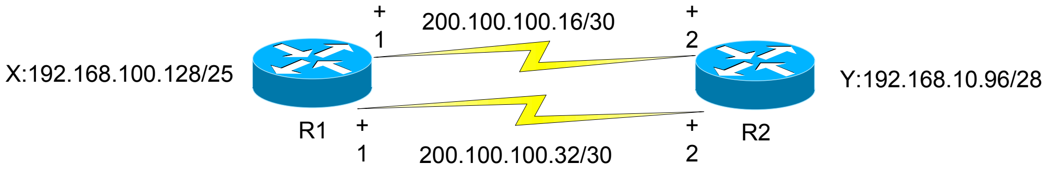
I. Lý thuyết :

1. Floating Static Route :

-La cach thuc cau hinh Static Router thay doi thong so AD mac dinh
-Cau hinh Floating Static Route thi ta phai cau hinh "Nexthop IP Address"

* Muc dich : Cau hinh Floating Static Route nham muc dich cau hinh 1 line Backup cho duong truyen chinh(Thong thuong su dung Dynamic Routing Protocol)

Vidu :



====> Cau hinh R1

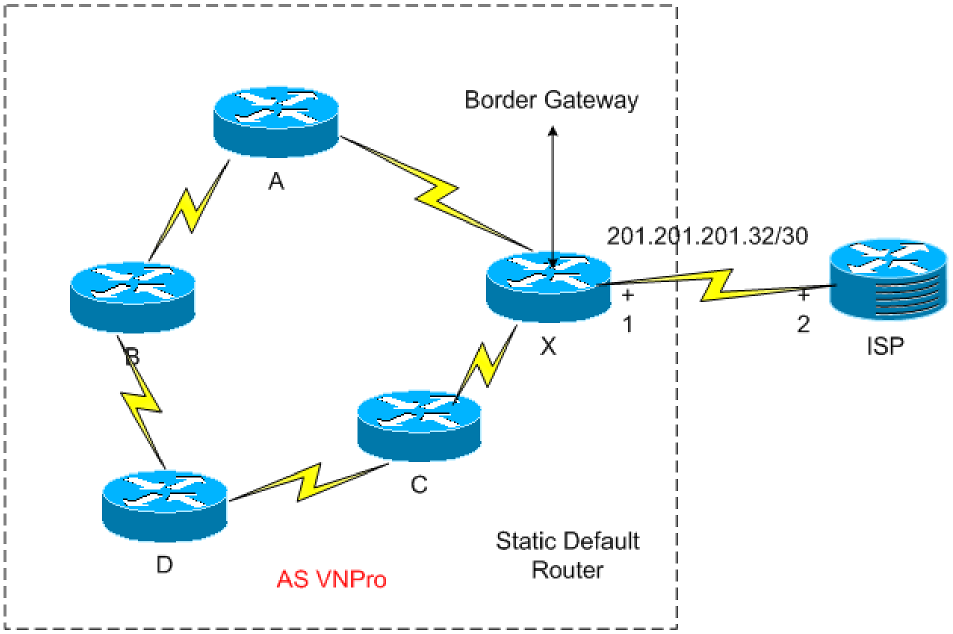
```
(config)#ip route 192.168.10.96 255.255.255.240 200.100.100.18
-----> (Default NetxHop Ip Route: AD=1)
(config)#ip route 192.168.10.96 255.255.255.240 200.100.100.34 8
--> (Khai bao NetxHop Ip Route: AD=8 nham giam do uu tien)
                                                            AD= {1-255}
```

====> R2: cau hinh Static Route phai cau hinh hai chieu

```
(config)#ip route 192.168.100.128 255.255.255.128 200.100.100.17
-> (Default NetxHop Ip Route: AD=1)
(config)#ip route 192.168.100.128 255.255.255.128 200.100.100.33 8 ------------------->(Khai bao NetxHop IP Route: AD=8 nham giam do uu tien)
```

2. Tu khoa "Pemanent" trong cau lenh Static Route:

La 1 loai Static Route dac biet thuong dung cau hinh tren Border Gateway Router con co ten goi Gateway of Last Resort (Router vua giao tiep voi cac Router khac tren cung AS va vua giao tiep voi Router cua nha cung cap dich vu Internet (ISP))



* Muc dich: Nham muc dich de Router trong AS se Forward cac goi tin (packet) co Destination Network Address khong nam trong bang dinh tuyen cua Router

```
X(config)#ip route 0.0.0.0 0.0.0.0 201.201.201.34 permanent ---------> IP cua ISP
```

Trong bang Routing Table se co

```
S* 0.0.0.0/0
```

Tu khoa Permanent thuong duoc cau hinh trong cau lenh cau hinh Static Default Route tren Border Gateway nham muc dich bao toan thong tin Static Default Route trong bang dinh tuyen cua Router Border Gateway trong truong hop duong ket noi giua Border Gateway Router va Router cua ISP bi chap chon (Flapping), nham on dinh thong tin bang dinh tuyen cua cac router khac trong cung AS su dung Routing Protocol

Trong truong hop link ket noi giua Border Gateway Router trong va Router ISP that su hong, tu khoa Permanent se giu thong tin Static Default Route 3 phut trong Routing Table cua no.

3. **Theo doi cong viec ben duoi cua Router:**

```
#debug ip packet-------->Bat Debug
#u all--------> tat ket noi
```

******Xem Debug router khi ta Telnet toi thiet bi khac:
#terminal monitor (neu R2 telnet toi R1)

*** Khi ta dung tren Router ping kiem tra cac ket noi den mang dang xa thi Router se lay IP of Out Inteface cua no lam IP Source

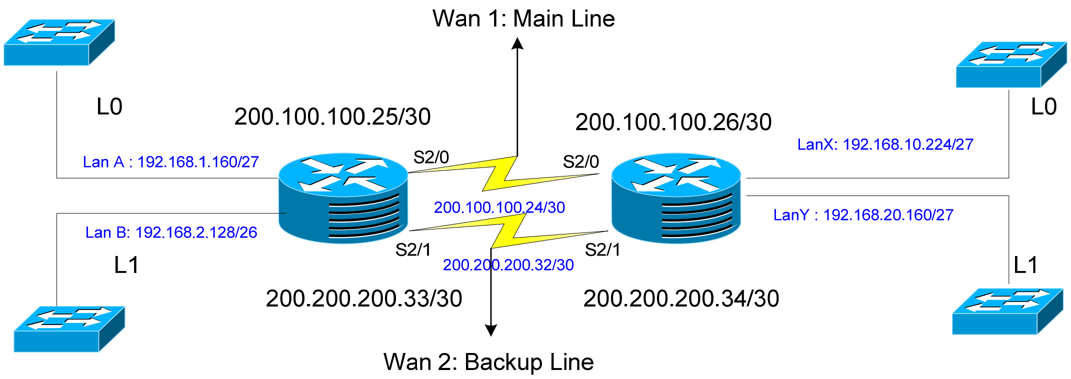
SU DUNG PING MO RONG(Extended Ping)

De doi Source IP cua goi tin Ping tren Router nham muc dich tang tinh uyen chuyen cho Admin trong viec kiem tra ket noi trong co so ha tang mang tu LAN nay sang LAN kia.

```
R1#ping
```

```
Protocol [ip]:
Target IP address: 192.168.10.254
Repeat count [5]: 10 -----> Mot lan goi 10 goi tin
Datagram size [100]:
Timeout in seconds [2]:
Extended commands [n]: y -----------> su dung lenh mo rong khong? tra loi Y
Source address or interface: 192.168.1.94 --------------> Lo0
Type of service [0]:
Set DF bit in IP header? [no]:
Validate reply data? [no]:
Data pattern [0xABCD]:
Loose, Strict, Record, Timestamp, Verbose[none]:
Sweep range of sizes [n]:
Type escape sequence to abort.
Sending 10, 100-byte ICMP Echos to 192.168.10.254, timeout is 2 seconds:
Packet sent with a source address of 192.168.1.94
!!!!!!!!!! --------------> 10 dau "!" la 10 goi tin den dich
Success rate is 100 percent (10/10), round-trip min/avg/max = 1/3/4 ms
```

II. Thực hành:



1. Cấu hình kết nối giữa 2 Router :

* **Router Saigon**:

```
SaiGon#sh ip int bri
Interface              IP-Address      OK? Method Status                Prot
ocol
FastEthernet0/0          unassigned      YES unset administratively down down

FastEthernet1/0          unassigned      YES unset administratively down down

FastEthernet1/1          unassigned      YES unset administratively down down

Serial2/0              200.100.100.25 YES manual up                    up

Serial2/1              200.200.200.33 YES manual up                    up

Serial2/2              unassigned      YES unset administratively down down

Serial2/3              unassigned      YES unset administratively down dow
```

* **Router HANOI**:

```
HaNoi#sh ip int bri
Interface              IP-Address      OK? Method Status               Prot
ocol
FastEthernet0/0          unassigned      YES unset administratively down down

FastEthernet1/0          unassigned      YES unset administratively down down

FastEthernet1/1          unassigned      YES unset administratively down down

Serial2/0              200.100.100.26 YES manual up                  up

Serial2/1              200.200.200.34 YES manual up                  up

Serial2/2              unassigned      YES unset administratively down down

Serial2/3              unassigned      YES unset administratively down dow
```

==➔ Kiểm tra kết nối giữa hai router

- Router HaNoi voi dia chi 200.100.100.26

```
SaiGon#ping 200.100.100.26

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.100.100.26, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 32/52/84 ms
```

- Router HaNoi voi dia chi 200.200.200.34

```
SaiGon#ping 200.200.200.34

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.200.200.34, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 32/48/76 ms

SaiGon#sh cdp nei
Capability Codes: R - Router, T - Trans Bridge, B - Source Route Bridge
                  S - Switch, H - Host, I - IGMP, r - Repeater

Device ID        Local Intrfce     Holdtme    Capability  Platform  Port ID
HaNoi            Ser 2/1           135          R        7206VXR   Ser 2/1
HaNoi            Ser 2/0           135          R        7206VXR   Ser 2/0
```

➔ Kết nối đến router HaNoi bằng 2 line.

2. Cấu hình các card Loopback

* **Router Saigon**:

-LAN A (Loopback 0):

```
SaiGon(config)#int lo0
SaiGon(config-if)#ip address 192.168.1.190 255.255.255.224
```

```
-LAN B (Loopback 1):
SaiGon(config)#int lo1
SaiGon(config-if)#ip address
SaiGon(config-if)#ip address 192.168.2.190 255.255.255.192

SaiGon#sh ip int bri
Interface              IP-Address      OK? Method Status                Prot
ocol
FastEthernet0/0          unassigned      YES unset  administratively down down

FastEthernet1/0          unassigned      YES unset  administratively down down

FastEthernet1/1          unassigned      YES unset  administratively down down

Serial2/0              200.100.100.25  YES manual up                    up

Serial2/1              200.200.200.33  YES manual up                    up

Serial2/2              unassigned      YES unset  administratively down down

Serial2/3              unassigned      YES unset  administratively down down

Loopback0                192.168.1.190   YES manual up                    up

Loopback1                192.168.2.190   YES manual up                    up
```

* **Router HaNoi**:

```
-LAN X (Loopback 0):
HaNoi(config)#int lo0
HaNoi(config-if)#ip address
HaNoi(config-if)#ip address 192.168.10.254 255.255.255.224

-LAN Y (Loopback 0):
HaNoi(config)#int lo1
HaNoi(config-if)#ip add
HaNoi(config-if)#ip address 192.168.20.190 255.255.255.224

aNoi#sh ip
*Oct 31 09:30:15.231: %SYS-5-CONFIG_I: Configured from console by console
HaNoi#sh ip int bri
Interface              IP-Address      OK? Method Status                Prot
ocol
FastEthernet0/0          unassigned      YES unset  administratively down down

FastEthernet1/0          unassigned      YES unset  administratively down down

FastEthernet1/1          unassigned      YES unset  administratively down down

Serial2/0              200.100.100.26  YES manual up                    up

Serial2/1              200.200.200.34  YES manual up                    up

Serial2/2              unassigned      YES unset  administratively down down
```

```
Serial2/3              unassigned      YES unset  administratively down down
```

```
Loopback0              192.168.10.254  YES manual up                 up
```

```
Loopback1              192.168.20.190  YES manual up                 up
```

3. **Taọ Static Router :**

```
SaiGon#ping 192.168.10.254

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.10.254, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)
```

Kiểm tra kết nối giữa Router SaiGon và mạng LAN X bên trong Router HaNoi không thành công mặc dù 2 Router này đã tạo kết nối

===➔ Cách giải quyết là tạo kết nốt bằng Static Router (Manually Configure)

* **Router Saigon**:

- Line chính :

```
SaiGon(config)#ip route 192.168.10.224 255.255.255.224 200.100.100.26
```
=➔ dong nay se cho ket noi toi LAN X voi AD default (AD=1)

```
SaiGon(config)#ip route 192.168.20.160 255.255.255.224 200.100.100.26
```

=➔ dong nay se cho ket noi toi LAN Y voi AD default (AD=1)

- Line Backup

```
SaiGon(config)#ip route 192.168.10.224 255.255.255.224 200.200.200.34 10
```
=➔ dong nay se cho ket noi toi LAN X voi AD = 10

```
SaiGon(config)#ip route 192.168.20.160 255.255.255.224 200.200.200.34 10
```
=➔ dong nay se cho ket noi toi LAN Y voi AD =10

```
SaiGon(config)#do sh ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

     200.200.200.0/30 is subnetted, 1 subnets
C       200.200.200.32 is directly connected, Serial2/1
     192.168.10.0/27 is subnetted, 1 subnets
S       192.168.10.224 [1/0] via 200.100.100.26
```

```
     200.100.100.0/30 is subnetted, 1 subnets
C       200.100.100.24 is directly connected, Serial2/0
     192.168.20.0/27 is subnetted, 1 subnets
S       192.168.20.160 [1/0] via 200.100.100.26
     192.168.1.0/27 is subnetted, 1 subnets
C       192.168.1.160 is directly connected, Loopback0
     192.168.2.0/26 is subnetted, 1 subnets
C       192.168.2.128 is directly connected, Loopback1
```

* **Router Hanoi**:

```
HaNoi(config)#ip route 192.168.1.160 255.255.255.224 200.100.100.25
HaNoi(config)#ip route 192.168.2.128 255.255.255.192 200.100.100.25
```

=➔ dong nay se cho ket noi toi LAN A,B voi AD default (AD=1)

```
HaNoi(config)#ip route 192.168.1.160 255.255.255.224 200.200.200.33 10
HaNoi(config)#ip route 192.168.2.128 255.255.255.192 200.200.200.33 10
```

=➔ dong nay se cho ket noi toi LAN A,B voi AD=10

```
HaNoi#sh ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

     200.200.200.0/30 is subnetted, 1 subnets
C       200.200.200.32 is directly connected, Serial2/1
     192.168.10.0/27 is subnetted, 1 subnets
C       192.168.10.224 is directly connected, Loopback0
     200.100.100.0/30 is subnetted, 1 subnets
C       200.100.100.24 is directly connected, Serial2/0
     192.168.20.0/27 is subnetted, 1 subnets
C       192.168.20.160 is directly connected, Loopback1
     192.168.1.0/27 is subnetted, 1 subnets
S       192.168.1.160 [1/0] via 200.100.100.25
     192.168.2.0/26 is subnetted, 1 subnets
S       192.168.2.128 [1/0] via 200.100.100.25
```

===➔ Kiểm tra kết nối giữa Router SaiGon và mạng LAN X bên trong Router HaNoi

```
SaiGon#ping 192.168.10.254

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.10.254, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 24/47/76 ms
```

4. **Shutdown:**

➔ Trong bảng định tuyến ta không thấy giá trị của line 200.200.200.200.32/30

Tien hanh ngat ket noi giua Router Saigon va Hanoi trên line 200.100.100.24/30
Xem thử Saigon va Hanoi có xây dựng bảng định tuyến cho các Lan A,B,X,Y và trao đổi thông tin trên line 200.200.200.32/30(line Backup) không ???

- Trạng thái trước khi Shutdown :

```
SaiGon#sh ip int bri
Interface                  IP-Address      OK? Method Status                Prot
ocol
FastEthernet0/0            unassigned      YES unset  administratively down down

FastEthernet1/0            unassigned      YES unset  administratively down down

FastEthernet1/1            unassigned      YES unset  administratively down down

Serial2/0                  200.100.100.25  YES manual up                    up

Serial2/1                  200.200.200.33  YES manual up                    up
```

* **Routing Table:**

```
SaiGon(config)#do sh ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

     200.200.200.0/30 is subnetted, 1 subnets
C       200.200.200.32 is directly connected, Serial2/1
     192.168.10.0/27 is subnetted, 1 subnets
S       192.168.10.224 [1/0] via 200.100.100.26
     200.100.100.0/30 is subnetted, 1 subnets
C       200.100.100.24 is directly connected, Serial2/0
     192.168.20.0/27 is subnetted, 1 subnets
S       192.168.20.160 [1/0] via 200.100.100.26
     192.168.1.0/27 is subnetted, 1 subnets
C       192.168.1.160 is directly connected, Loopback0
     192.168.2.0/26 is subnetted, 1 subnets
C       192.168.2.128 is directly connected, Loopback1
```

- Sau khi Shutdown :

```
SaiGon#sh ip int bri
Interface                  IP-Address      OK? Method Status                Prot
ocol
FastEthernet0/0            unassigned      YES unset  administratively down down
```

```
FastEthernet1/0        unassigned     YES unset  administratively down down

FastEthernet1/1        unassigned     YES unset  administratively down down

Serial2/0              200.100.100.25 YES manual administratively down down

Serial2/1              200.200.200.33 YES manual up                    up
```

*** <u>Routing Table</u>:**

```
SaiGon#sh ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

     200.200.200.0/30 is subnetted, 1 subnets
C       200.200.200.32 is directly connected, Serial2/1
     192.168.10.0/27 is subnetted, 1 subnets
S       192.168.10.224 [10/0] via 200.200.200.34
     192.168.20.0/27 is subnetted, 1 subnets
S       192.168.20.160 [10/0] via 200.200.200.34
     192.168.1.0/27 is subnetted, 1 subnets
C       192.168.1.160 is directly connected, Loopback0
     192.168.2.0/26 is subnetted, 1 subnets
C       192.168.2.128 is directly connected, Loopback1
```

5. Theo doi xu ly ben duoi cua Router:

1. *<u>Chưa thay đổi Source IP :</u>*

```
SaiGon#debug ip packet
IP packet debugging is on
SaiGon#ping 192.168.10.254

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.10.254, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 20/41/88 ms
SaiGon#
*Oct 31 10:25:09.835: IP: tableid=0, s=200.200.200.33 (local), d=192.168.10.254 (Serial2/1),
routed via FIB
*Oct 31 10:25:09.839: IP: s=200.200.200.33 (local), d=192.168.10.254 (Serial2/1), len 100,
sending
*Oct 31 10:25:09.915: IP: tableid=0, s=192.168.10.254 (Serial2/1), d=200.200.200.33 (Serial2/1),
routed via RIB
*Oct 31 10:25:09.919: IP: s=192.168.10.254 (Serial2/1), d=200.200.200.33 (Serial2/1), len 100,
rcvd 3
*Oct 31 10:25:09.927: IP: tableid=0, s=200.200.200.33 (local), d=192.168.10.254 (Serial2/1),
routed via FIB
```

```
*Oct 31 10:25:09.931: IP: s=200.200.200.33 (local), d=192.168.10.254 (Serial2/1), len 100,
sending
*Oct 31 10:25:09.951: IP: tableid=0, s=192.168.10.254 (Serial2/1), d=200.200.200.33 (Serial2/1),
routed via RIB
*Oct 31 10:25:09.955: IP: s=192.168.10.254 (Serial2/1), d=200.200.200.33 (Serial2/1), len 100,
rcvd 3
*Oct 31 10:25:09.963: IP: tableid=0, s=200.200.200.33 (local), d=192.168.10.254 (Serial2/1),
routed via FIB
*Oct 31 10:25:09.967: IP: s=200.200.20
SaiGon#0.33 (local), d=192.168.10.254 (Serial2/1), len 100, sending
*Oct 31 10:25:09.983: IP: tableid=0, s=192.168.10.254 (Serial2/1), d=200.200.200.33 (Serial2/1),
routed via RIB
*Oct 31 10:25:09.987: IP: s=192.168.10.254 (Serial2/1), d=200.200.200.33 (Serial2/1), len 100,
rcvd 3
*Oct 31 10:25:09.991: IP: tableid=0, s=200.200.200.33 (local), d=192.168.10.254 (Serial2/1),
routed via FIB
*Oct 31 10:25:09.991: IP: s=200.200.200.33 (local), d=192.168.10.254 (Serial2/1), len 100,
sending
*Oct 31 10:25:10.011: IP: tableid=0, s=192.168.10.254 (Serial2/1), d=200.200.200.33 (Serial2/1),
routed via RIB
*Oct 31 10:25:10.011: IP: s=192.168.10.254 (Serial2/1), d=200.200.200.33 (Serial2/1), len 100,
rcvd 3
*Oct 31 10:25:10.011: IP: tableid=0, s=200.200.200.33 (local), d=192.168.10.254 (Serial2/1),
routed via FIB
*Oct 31 10:25:10.011: IP: s=200.200.200.33 (local), d=192.168.10.254 (Serial2/1), len 100,
sending
*Oct 31 10:25:10.043: IP: tableid=0, s=192.168.10.254 (Serial2/1), d=200.200.200.33 (Se
SaiGon#rial2/1), routed via RIB
*Oct 31 10:25:10.047: IP: s=192.168.10.254 (Serial2/1), d=200.200.200.33 (Serial2/1), len 100,
rcvd 3
SaiGon#u all
Port Statistics for unclassified packets is not turned on.

All possible debugging has been turned off
```

2. *Thay đổi Source :*

```
SaiGon#debug ip packet
IP packet debugging is on
    SaiGon#ping
    Protocol [ip]:
    Target IP address: 192.168.10.254
    Repeat count [5]: 10
    Datagram size [100]:
    Timeout in seconds [2]:
    Extended commands [n]: y
    Source address or interface: 192.168.1.190
    Type of service [0]:
    Set DF bit in IP header? [no]:
    Validate reply data? [no]:
    Data pattern [0xABCD]:
    Loose, Strict, Record, Timestamp, Verbose[none]:
    Sweep range of sizes [n]:
    Type escape sequence to abort.
    Sending 10, 100-byte ICMP Echos to 192.168.10.254, timeout is 2 seconds:
```

```
Packet sent with a source address of 192.168.1.190

*Oct 31 10:30:55.435: IP: tableid=0, s=192.168.1.190 (local), d=192.168.10.254 (Serial2/1),
routed via FIB
*Oct 31 10:30:55.435: IP: s=192.168.1.190 (local), d=192.168.10.254 (Serial2/1), len 100,
sending.
*Oct 31 10:30:57.435: IP: tableid=0, s=192.168.1.190 (local), d=192.168.10.254 (Serial2/1),
routed via FIB
*Oct 31 10:30:57.435: IP: s=192.168.1.190 (local), d=192.168.10.254 (Serial2/1), len 100,
sending.
*Oct 31 10:30:59.435: IP: tableid=0, s=192.168.1.190 (local), d=192.168.10.254 (Serial2/1),
routed via FIB
*Oct 31 10:30:59.435: IP: s=192.168.1.190 (local), d=192.168.10.254 (Serial2/1), len 100,
sending.
*Oct 31 10:31:01.435: IP: tableid=0, s=192.168.1.190 (local), d=192.168.10.254 (Serial2/1),
routed via FIB
*Oct 31 10:31:01.439: IP: s=192.168.1.190 (local), d=192.168.10.254 (Serial2/1), len 100,
sending.
*Oct 31 10:31:03.435: IP: tableid=0, s=192.168.1.190 (local), d=192.168.10.254 (Serial2/1),
routed via FIB
*Oct 31 10:31:03.439: IP: s=192.168.1.190 (local), d=192.168.10.254 (Serial2/1), len 100,
sending.
*Oct 31 10:31:05.435: IP: tableid=0, s=192.168.1.190 (local), d=192.168.10.254 (Serial2/1),
routed via FIB
*Oct 31 10:31:05.435: IP: s=192.168.1.190 (local), d=192.168.10.254 (Serial2/1), len 100,
sending.
*Oct 31 10:31:07.435: IP: tableid=0, s=192.168.1.190 (local), d=192.168.10.254 (Serial2/1),
routed via FIB
*Oct 31 10:31:07.439: IP: s=192.168.1.190 (local), d=192.168.10.254 (Serial2/1), len 100,
sending.
*Oct 31 10:31:09.435: IP: tableid=0, s=192.168.1.190 (local), d=192.168.10.254 (Serial2/1),
routed via FIB
*Oct 31 10:31:09.435: IP: s=192.168.1.190 (local), d=192.168.10.254 (Serial2/1), len 100,
sending.
*Oct 31 10:31:11.435: IP: tableid=0, s=192.168.1.190 (local), d=192.168.10.254 (Serial2/1),
routed via FIB
*Oct 31 10:31:11.435: IP: s=192.168.1.190 (local), d=192.168.10.254 (Serial2/1), len 100,
sending.
*Oct 31 10:31:13.435: IP: tableid=0, s=192.168.1.190 (local), d=192.168.10.254 (Serial2/1),
routed via FIB
*Oct 31 10:31:13.435: IP: s=192.168.1.190 (local), d=192.168.10.254 (Serial2/1), len 100,
sending.
Success rate is 0 percent (0/10)
SaiGon#ping 192.168.10.254

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.10.254, timeout is 2 seconds:
!!!
*Oct 31 10:31:26.611: IP: tableid=0, s=200.200.200.33 (local), d=192.168.10.254 (Serial2/1),
routed via FIB
*Oct 31 10:31:26.615: IP: s=200.200.200.33 (local), d=192.168.10.254 (Serial2/1), len 100,
sending
*Oct 31 10:31:26.675: IP: tableid=0, s=192.168.10.254 (Serial2/1), d=200.200.200.33
(Serial2/1), routed via RIB
```

```
*Oct 31 10:31:26.679: IP: s=192.168.10.254 (Serial2/1), d=200.200.200.33 (Serial2/1), len
100, rcvd 3
*Oct 31 10:31:26.687: IP: tableid=0, s=200.200.200.33 (local), d=192.168.10.254 (Serial2/1),
routed via FIB
*Oct 31 10:31:26.691: IP: s=200.200.200.33 (local), d=192.168.10.254 (Serial2/1), len 100,
sending
*Oct 31 10:31:26.735: IP: tableid=0, s=192.168.10.254 (Serial2/1), d=200.200.200.33
(Serial2/1), routed via RIB
*Oct 31 10:31:26.739: IP: s=192.168.10.254 (Serial2/1), d=200.200.200.33 (Serial2/1), len
100, rcvd 3
*Oct 31 10:31:26.747: IP: tableid=0, s=200.200.200.33 (local), d=192.168.10.254 (Serial2/1),
routed via FIB
*Oct 31 10:31:26.747: IP: s=200.200.20!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 24/41/72 ms
SaiGon#0.33 (local), d=192.168.10.254 (Serial2/1), len 100, sending
*Oct 31 10:31:26.767: IP: tableid=0, s=192.168.10.254 (Serial2/1), d=200.200.200.33
(Serial2/1), routed via RIB
*Oct 31 10:31:26.771: IP: s=192.168.10.254 (Serial2/1), d=200.200.200.33 (Serial2/1), len
100, rcvd 3
*Oct 31 10:31:26.779: IP: tableid=0, s=200.200.200.33 (local), d=192.168.10.254 (Serial2/1),
routed via FIB
*Oct 31 10:31:26.783: IP: s=200.200.200.33 (local), d=192.168.10.254 (Serial2/1), len 100,
sending
*Oct 31 10:31:26.795: IP: tableid=0, s=192.168.10.254 (Serial2/1), d=200.200.200.33
(Serial2/1), routed via RIB
*Oct 31 10:31:26.799: IP: s=192.168.10.254 (Serial2/1), d=200.200.200.33 (Serial2/1), len
100, rcvd 3
*Oct 31 10:31:26.827: IP: tableid=0, s=200.200.200.33 (local), d=192.168.10.254 (Serial2/1),
routed via FIB
*Oct 31 10:31:26.831: IP: s=200.200.200.33 (local), d=192.168.10.254 (Serial2/1), len 100,
sending
SaiGon#
*Oct 31 10:31:26.855: IP: tableid=0, s=192.168.10.254 (Serial2/1), d=200.200.200.33
(Serial2/1), routed via RIB
*Oct 31 10:31:26.855: IP: s=192.168.10.254 (Serial2/1), d=200.200.200.33 (Serial2/1), len
100, rcvd 3
SaiGon#u all
Port Statistics for unclassified packets is not turned on.

All possible debugging has been turned off
```

GIOI THIEU CAC LOAI ROUTING PROTOCOL

-Interior Gateway Protocol (IGP): nhung giao thuc dinh tuyen dong ma cac Router su dung de trao doi thong tin dinh tuyen voi nhau trong cung 1 AS (Autonomous System): RIP, EIGRP, OSPF

-Exterior Gateway Protocol (EGP): la giao thuc dinh tuyen dung de trao doi giua ISP, AS tam co Quoc Gia voi nhau.

1. Classful Routing Overview

- Doi hoi toan bo he thong phai co gia tri Subnetmask cua cac Network la dong nhat. Các Router trao đổi thông tin định tuyến với nhau nhưng không gửi kèm giá trị **Subnet Mask** trong thông tin định tuyến. (Khong ho tro VLSM)
-Thong tin dinh tuyen trao doi giua cac Router khong bao gom SM
-Thong tin dinh tuyen khi duoc quang ba tu 1 Router qua 1 Router khac thong qua 1 network khac MAJORNETWORK thi se bi "Auto-Summary"
    + Ta khong the can thiep vao co che Auto Summary nay.

2. Classless Routing Overview

- Cho phep nhieu gia tri SM khac nhau cua cac Network trong he thong (ho tro VLSM)
-Thong tin dinh tuyen trao doi giua cac Router co bao gom gia tri SM
- Van con hien tuong Auto Summary tuy nhien o giao thuc nay ta co the khong che va dieu khien duoc.
- Doi voi Cisco IOS tu 11.0 tro ve truoc cac Router su dung giao thuc dang "Classful", nghia la Router tin rang no so huu tat ca cac Subnetwork co cung Major Network voi cac Subnetwork cua cac Interface ma no dang co, Do do khi Router nhan duoc Packet co Destination Network Address khong nam trong bang dinh tuyen nhung co cung Major Network voi nhung Major Network ma no dang co thi Router se "Drop" ngay ca khi tren Router co cau hinh "Static Default Route"
    + De tranh hien tuong tren nguoi ta phai cau hinh them cau lenh IP Classless tren cac IP Router chay IOS tu 11.0 tro ve truoc.
- Tren cac dong IOS tu 11.X tro ve sau thi thi cau lenh:"IP Classless" duoc Enable by Default
(config)# ip classless

Câu lệnh **ip classless** đã được **enable by default** trên các IOS từ **11.x** trở về sau.

- -

3. Distance Vector Routing Protocols

- Các Router trao đổi thông tin định tuyến theo chu kỳ (**Rip: 30s**)
- Thông tin định tuyến trao đổi giữa các Router là nội dung của toàn bộ bảng định tuyến.
- Chu kỳ trao đổi thông tin định tuyến xảy ra là bắt buộc ngay cả khi không có sự thay đổi nào trong hệ thống, dễ dẫn tới hiện tượng **Routing Overhead**
- Các Router hoàn toàn không biết được sơ đồ tổng quan mạng của toàn bộ hệ thống, Router chỉ có thể biết thông tin của các đường mạng khác trong hệ thống thông qua các Router láng giềng (**neighbor**) mà thôi.

-Đối với **RIP V.2:** hoat dong theo kieu **Distance Vector**, cac Router su dung Router Protocol RIP trao doi thong tin dinh tuyen theo thoi gian 30 giay/lan.

RIP có **Metric** la so Hop **Count** (số Router mà nó đi qua).

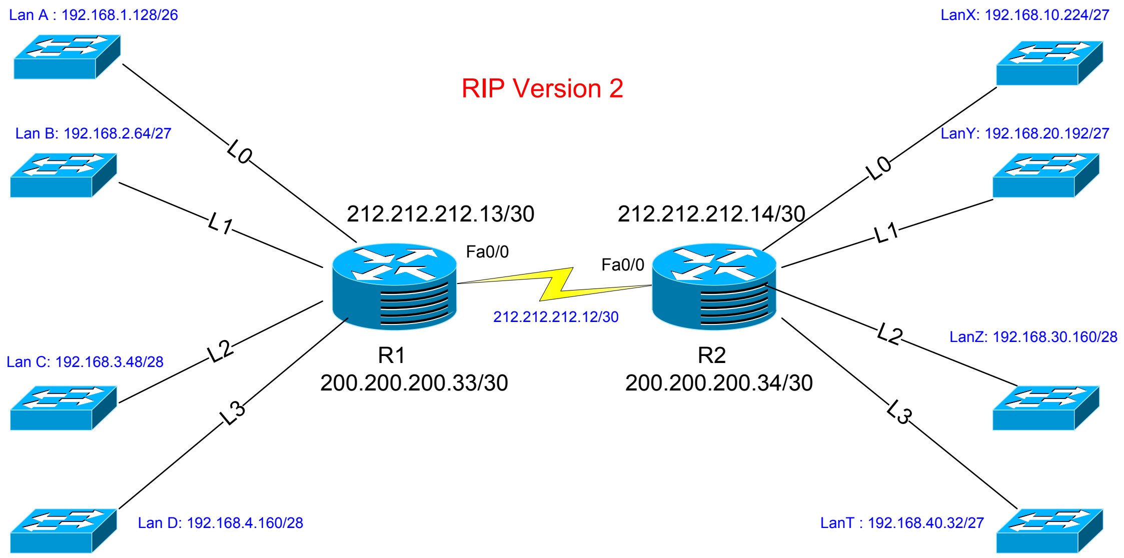
Metric là tiêu chí đánh giá độ tốt tùy thuộc giao thức định tuyến về thông tin của 1 đường mạng nao do cua Router.Doi voi Dynamic Routing Protocol khac nhau se co Matric khac nhau

+ Hop Count cang nho thi duong di cang tot (Hop Count <= 15, Infinite (so vo cuc), AD=120)

Khi Router biết được thông tin 1 Network thông qua nhiều Router khác với **Metric** bằng nhau thì dữ liệu gửi đến đường mạng trên sẽ được gửi theo cách **Load Balance** (cân bằng tải - Minimum: 4 (Default); Maximum: 16)

- Router sẽ tăng **Metric** của một đường mạng mà nó có lên 1 trước khi gởi cho láng giềng của nó
- Các Router sử dụng RIPv2 để trao đổi thông tin định tuyến sẽ giao tiếp với nhau bằng địa chỉ **Multicast 224.0.0.9**

************** **THUC HANH**********************



1. **<u>Buoc 1</u> :** Cau hinh muc co ban(IP …..)
2. **<u>Cau hinh RIP V2 :</u>**

<u>a. Cau hinh R1</u>

```
R1(config)#router rip
R1(config-router)#version 2
R1(config-router)#network 192.168.1.0
R1(config-router)#network 192.168.2.0
R1(config-router)#network 192.168.3.0
R1(config-router)#network 192.168.4.0
R1(config-router)#network 212.212.212.0
```

=➔ Router se quang ba cac mang ma no dang co

***** Muon lam lai (truong hop lam sai):**

```
R1(config)#no router rip
```

b. <u>Cau hinh R2</u>:

=====> Telnet sang R2 xem Routing Table

<u>aa>></u>

```
RR2#sh ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP:50:46.895: %LINEPROTO-5-
UPDOWN: Line protocol on Interface Lo
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter areacs for unclassifie
 changed state to uped on.
Saigon(co
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

     212.212.212.0/30 is subnetted, 1 subnets
C       212.212.212.12 is directly connected, FastEthernet0/0
     192.168.30.0/28 is subnetted, 1 subnets
C       192.168.30.160 is directly connected, Loopback2
     192.168.10.0/27 is subnetted, 1 subnets
C       192.168.10.224 is directly connected, Loopback0
     192.168.40.0/27 is subnetted, 1 subnets
C       192.168.40.32 is directly connected, Loopback3
R    192.168.4.0/24 [120/1] via 212.212.212.13, 00:00:00, FastEthernet0/0
     192.168.20.0/27 is subnetted, 1 subnets
C       192.168.20.192 is directly connected, Loopback1
R    192.168.1.0/24 [120/1] via 212.212.212.13, 00:00:00, FastEthernet0/0
R    192.168.2.0/24 [120/1] via 212.212.212.13, 00:00:00, FastEthernet0/0
R    192.168.3.0/24 [120/1] via 212.212.212.13, 00:00:04, FastEthernet0/0
```

<u>bb>></u>

```
RR2#sh ip route RIP
R    192.168.4.0/24 [120/1] via 212.212.212.13, 00:00:16, FastEthernet0/0
R    192.168.1.0/24 [120/1] via 212.212.212.13, 00:00:16, FastEthernet0/0
R    192.168.2.0/24 [120/1] via 212.212.212.13, 00:00:16, FastEthernet0/0
R    192.168.3.0/24 [120/1] via 212.212.212.13, 00:00:16, FastEthernet0/0
```

- **<u>Giai thich</u> :**

AD = 120
Matric = 1 ---> qua 1 Router
/24 --> Bi Auto Sumary

<u>cc>></u>

Neu Router la RIPv2 thi:

```
R1(config)#router rip
R1(config-router)#no auto-summary
R1(config-router)#
R1#clear ip route *
```

```
R1#sh ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP:50:46.895: %LINEPROTO-5-
UPDOWN: Line protocol on Interface Lo
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter areacs for unclassifie
 changed state to uped on.
Saigon(co
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

     212.212.212.0/30 is subnetted, 1 subnets
C       212.212.212.12 is directly connected, FastEthernet0/0
     192.168.30.0/28 is subnetted, 1 subnets
R       192.168.30.160 [120/1] via 212.212.212.14, 00:00:03, FastEthernet0/0
     192.168.10.0/27 is subnetted, 1 subnets
R       192.168.10.224 [120/1] via 212.212.212.14, 00:00:03, FastEthernet0/0
     192.168.40.0/27 is subnetted, 1 subnets
R       192.168.40.32 [120/1] via 212.212.212.14, 00:00:03, FastEthernet0/0
     192.168.4.0/28 is subnetted, 1 subnets
C       192.168.4.160 is directly connected, Loopback3
     192.168.20.0/27 is subnetted, 1 subnets
R       192.168.20.192 [120/1] via 212.212.212.14, 00:00:03, FastEthernet0/0
     192.168.1.0/26 is subnetted, 1 subnets
C       192.168.1.128 is directly connected, Loopback0
     192.168.2.0/27 is subnetted, 1 subnets
C       192.168.2.64 is directly connected, Loopback1
     192.168.3.0/28 is subnetted, 1 subnets
C       192.168.3.48 is directly connected, Loopback2
```

```
R1#sh ip route rip
     192.168.30.0/28 is subnetted, 1 subnets
R       192.168.30.160 [120/1] via 212.212.212.14, 00:00:04, FastEthernet0/0
     192.168.10.0/27 is subnetted, 1 subnets
R       192.168.10.224 [120/1] via 212.212.212.14, 00:00:04, FastEthernet0/0
     192.168.40.0/27 is subnetted, 1 subnets
R       192.168.40.32 [120/1] via 212.212.212.14, 00:00:04, FastEthernet0/0
     192.168.20.0/27 is subnetted, 1 subnets
R       192.168.20.192 [120/1] via 212.212.212.14, 00:00:04, FastEthernet0/0 ---> thoi gian
Router cap nhat bang dinh tuyen
R1#
```

===> ko bi Auto Sumamry

dd>> Xem protocol su dung

```
R1(config-router)#do sh ip protocol

Incoming update filter list for all interfaces is not set
  Redistributing: rip
  Default version control: send version 2, receive version 2
    Interface             Send  Recv  Triggered RIP  Key-chain
    FastEthernet0/0       2     2
    Loopback0             2     2
    Loopback1             2     2
    Loopback2             2     2
    Loopback3             2     2
  Automatic network summarization is not in effect
  Maximum path: 4 ---> Load Balance 4
  Routing for Networks:
    192.168.1.0
    192.168.2.0
    192.168.3.0
    192.168.4.0
    212.212.212.0
  Routing Information Sources:
    Gateway         Distance      Last Update
    Gateway         Distance      Last Update
    212.212.212.14       120       00:00:25
  Distance: (default is 120) ----> AD =120
```

<u>ee>></u> Thay doi Load Balance

```
R1(config)#router rip
R1(config-router)#maximum-paths ?
  <1-16>  Number of paths
R1(config-router)#maximum-paths 6

R1(config-router)#do sh ip protocol
  Incoming update filter list for all interfaces is not set
  Redistributing: rip
  Default version control: send version 2, receive version 2
    Interface             Send  Recv  Triggered RIP  Key-chain
    FastEthernet0/0       2     2
    Loopback0             2     2
    Loopback1             2     2
    Loopback2             2     2
    Loopback3             2     2
  Automatic network summarization is not in effect
  Maximum path: 6 ----------> chinh Load Blance 6
  Routing for Networks:
    192.168.1.0
    192.168.2.0
    192.168.3.0
    192.168.4.0
    212.212.212.0
  Routing Information Sources:
    Gateway         Distance      Last Update
    Gateway         Distance      Last Update
    212.212.212.14       120       00:00:04
  Distance: (default is 120)

R1(config-router)#
===========
```

<u>3. Buoc 3:</u> Capure RIP:

```
R1#debug ip rip
RIP protocol debugging is on
R1#
```

```
R1#u all

de
R1(config-router)#default_ __ __ __ __ _b
R1(config-router)#deb^Z                  ^
% Invalid input detected at '^' marker.

R1#d
*Nov  3 04:40:51.451: %SYS-5-CONFIG_I: Configured from console by console
R1#de
R1#deb
R1#debug ip r
R1#debug ip rip
RIP protocol debugging is on
R1#
*Nov  3 04:41:07.247: RIP: sending v2 update to 224.0.0.9 via Loopback1 (192.168.2.94)
*Nov  3 04:41:07.247: RIP: build update entries
*Nov  3 04:41:07.247:           192.168.1.128/26 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:41:07.247:           192.168.3.48/28 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:41:07.247:           192.168.4.160/28 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:41:07.247:           192.168.10.224/27 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:41:07.247:           192.168.20.192/27 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:41:07.247:           192.168.30.160/28 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:41:07.247:           192.168.40.32/27 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:41:07.247:           212.212.212.12/30 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:41:07.247: RIP: ignored v2 packet from 192.168.2.94 (sourced from one of our
addresses)
*Nov  3 04:41:07.791: RIP: sending v2 update to 224.0.0.9 via Loopback2 (192.168.3.62)
*Nov  3 04:41:07.791: RIP: build update entries
*Nov  3 04:41:07.791:           192.168.1.128/26 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:41:07.791:           192.168.2.64/27 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:41:07.791:           192.168.4.160/28 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:41:07.791:           192.168.10.224/27 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:41:07.791:           192.168.20.192/27 via 0.0.0.0, metric 2, tag 0
R1#
*Nov  3 04:41:07.791:           192.168.30.160/28 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:41:07.791:           192.168.40.32/27 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:41:07.791:           212.212.212.12/30 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:41:07.791: RIP: ignored v2 packet from 192.168.3.62 (sourced from one of our
addresses)
*Nov  3 04:41:08.003: RIP: sending v2 update to 224.0.0.9 via Loopback3 (192.168.4.174)
*Nov  3 04:41:08.003: RIP: build update entries
*Nov  3 04:41:08.003:           192.168.1.128/26 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:41:08.003:           192.168.2.64/27 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:41:08.003:           192.168.3.48/28 via 0.0.0.0, metric 1, tag 0
R1#
*Nov  3 04:41:08.003:           192.168.10.224/27 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:41:08.003:           192.168.20.192/27 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:41:08.003:           192.168.30.160/28 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:41:08.003:           192.168.40.32/27 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:41:08.003:           212.212.212.12/30 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:41:08.003: RIP: ignored v2 packet from 192.168.4.174 (sourced from one of our
addresses)
R1#
*Nov  3 04:41:09.315: RIP: received v2 update from 212.212.212.14 on FastEthernet0/0
```

```
*Nov  3 04:41:09.315:      192.168.10.224/27 via 0.0.0.0 in 1 hops
*Nov  3 04:41:09.315:      192.168.20.192/27 via 0.0.0.0 in 1 hops
*Nov  3 04:41:09.315:      192.168.30.160/28 via 0.0.0.0 in 1 hops
*Nov  3 04:41:09.315:      192.168.40.32/27 via 0.0.0.0 in 1 hops
R1#
*Nov  3 04:41:13.143: RIP: sending v2 update to 224.0.0.9 via Loopback0 (192.168.1.190)
*Nov  3 04:41:13.143: RIP: build update entries
*Nov  3 04:41:13.143:           192.168.2.64/27 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:41:13.143:           192.168.3.48/28 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:41:13.143:           192.168.4.160/28 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:41:13.143:           192.168.10.224/27 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:41:13.143:           192.168.20.192/27 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:41:13.143:           192.168.30.160/28 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:41:13.143:           192.168.40.32/27 via 0.0.0.0, metric 2, tag 0
R1#
*Nov  3 04:41:13.143:           212.212.212.12/30 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:41:13.143: RIP: ignored v2 packet from 192.168.1.190 (sourced from one of our
addresses)
R1#
*Nov  3 04:41:14.963: RIP: sending v2 update to 224.0.0.9 via FastEthernet0/0
(212.212.212.13)
*Nov  3 04:41:14.963: RIP: build update entries
*Nov  3 04:41:14.963:           192.168.1.128/26 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:41:14.963:           192.168.2.64/27 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:41:14.963:           192.168.3.48/28 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:41:14.963:           192.168.4.160/28 via 0.0.0.0, metric 1, tag 0
R1#
*Nov  3 04:41:35.367: RIP: sending v2 update to 224.0.0.9 via Loopback1 (192.168.2.94)
*Nov  3 04:41:35.367: RIP: build update entries
*Nov  3 04:41:35.367:           192.168.1.128/26 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:41:35.367:           192.168.3.48/28 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:41:35.367:           192.168.4.160/28 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:41:35.367:           192.168.10.224/27 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:41:35.367:           192.168.20.192/27 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:41:35.367:           192.168.30.160/28 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:41:35.367:           192.168.40.32/27 via 0.0.0.0, metric 2, tag 0
R1#
*Nov  3 04:41:35.367:           212.212.212.12/30 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:41:35.367: RIP: ignored v2 packet from 192.168.2.94 (sourced from one of our
addresses)
*Nov  3 04:41:36.375: RIP: sending v2 update to 224.0.0.9 via Loopback2 (192.168.3.62)
*Nov  3 04:41:36.375: RIP: build update entries
*Nov  3 04:41:36.375:           192.168.1.128/26 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:41:36.375:           192.168.2.64/27 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:41:36.375:           192.168.4.160/28 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:41:36.375:           192.168.10.224/27 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:41:36.375:           192.168.20.192/27 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:41:36.375:           192.168.30.160/28 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:41:36.375:           192.168.40.32/27 via 0.0.0.0, metric 2, tag 0
R1#
*Nov  3 04:41:36.375:           212.212.212.12/30 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:41:36.375: RIP: ignored v2 packet from 192.168.3.62 (sourced from one of our
addresses)
*Nov  3 04:41:37.759: RIP: received v2 update from 212.212.212.14 on FastEthernet0/0
*Nov  3 04:41:37.759:      192.168.10.224/27 via 0.0.0.0 in 1 hops
```

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*Nov  3 04:41:37.759:      192.168.20.192/27 via 0.0.0.0 in 1 hops
*Nov  3 04:41:37.759:      192.168.30.160/28 via 0.0.0.0 in 1 hops
*Nov  3 04:41:37.759:      192.168.40.32/27 via 0.0.0.0 in 1 hops
*Nov  3 04:41:37.791: RIP: sending v2 update to 224.0.0.9 via Loopback3 (192.168.4.174)
*Nov  3 04:41:37.791: RIP: build update entries
*Nov  3 04:41:37.791:           192.168.1.128/26 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:41:37.791:           192.168.2.64/27 via 0.0.0.0, metric 1, tag 0
R1#
*Nov  3 04:41:37.791:           192.168.3.48/28 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:41:37.791:           192.168.10.224/27 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:41:37.791:           192.168.20.192/27 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:41:37.791:           192.168.30.160/28 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:41:37.791:           192.168.40.32/27 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:41:37.791:           212.212.212.12/30 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:41:37.791: RIP: ignored v2 packet from 192.168.4.174 (sourced from one of our
addresses)
R1#
*Nov  3 04:41:41.367: RIP: sending v2 update to 224.0.0.9 via Loopback0 (192.168.1.190)
*Nov  3 04:41:41.367: RIP: build update entries
*Nov  3 04:41:41.367:           192.168.2.64/27 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:41:41.367:           192.168.3.48/28 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:41:41.367:           192.168.4.160/28 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:41:41.367:           192.168.10.224/27 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:41:41.367:           192.168.20.192/27 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:41:41.367:           192.168.30.160/28 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:41:41.367:           192.168.40.32/27 via 0.0.0.0, metric 2, tag 0
R1#
*Nov  3 04:41:41.367:           212.212.212.12/30 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:41:41.367: RIP: ignored v2 packet from 192.168.1.190 (sourced from one of our
addresses)
R1#
*Nov  3 04:41:44.675: RIP: sending v2 update to 224.0.0.9 via FastEthernet0/0
(212.212.212.13)
*Nov  3 04:41:44.675: RIP: build update entries
*Nov  3 04:41:44.675:           192.168.1.128/26 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:41:44.675:           192.168.2.64/27 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:41:44.675:           192.168.3.48/28 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:41:44.675:           192.168.4.160/28 via 0.0.0.0, metric 1, tag 0
R1#
*Nov  3 04:42:03.087: RIP: sending v2 update to 224.0.0.9 via Loopback1 (192.168.2.94)
*Nov  3 04:42:03.087: RIP: build update entries
*Nov  3 04:42:03.087:           192.168.1.128/26 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:42:03.087:           192.168.3.48/28 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:42:03.087:           192.168.4.160/28 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:42:03.087:           192.168.10.224/27 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:42:03.087:           192.168.20.192/27 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:42:03.087:           192.168.30.160/28 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:42:03.087:           192.168.40.32/27 via 0.0.0.0, metric 2, tag 0
R1#
*Nov  3 04:42:03.087:           212.212.212.12/30 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:42:03.087: RIP: ignored v2 packet from 192.168.2.94 (sourced from one of our
addresses)
*Nov  3 04:42:04.307: RIP: sending v2 update to 224.0.0.9 via Loopback2 (192.168.3.62)
*Nov  3 04:42:04.307: RIP: build update entries
*Nov  3 04:42:04.307:           192.168.1.128/26 via 0.0.0.0, metric 1, tag 0
```

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*Nov  3 04:42:04.307:           192.168.2.64/27 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:42:04.307:           192.168.4.160/28 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:42:04.307:           192.168.10.224/27 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:42:04.307:           192.168.20.192/27 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:42:04.307:           192.168.30.160/28 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:42:04.307:           192.168.40.32/27 via 0.0.0.0, metric 2, tag 0
R1#
*Nov  3 04:42:04.307:           212.212.212.12/30 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:42:04.307: RIP: ignored v2 packet from 192.168.3.62 (sourced from one of our
addresses)
R1#
*Nov  3 04:42:06.051: RIP: received v2 update from 212.212.212.14 on FastEthernet0/0
*Nov  3 04:42:06.051:     192.168.10.224/27 via 0.0.0.0 in 1 hops
*Nov  3 04:42:06.051:     192.168.20.192/27 via 0.0.0.0 in 1 hops
*Nov  3 04:42:06.051:     192.168.30.160/28 via 0.0.0.0 in 1 hops
*Nov  3 04:42:06.051:     192.168.40.32/27 via 0.0.0.0 in 1 hops
*Nov  3 04:42:06.823: RIP: sending v2 update to 224.0.0.9 via Loopback3 (192.168.4.174)
*Nov  3 04:42:06.823: RIP: build update entries
*Nov  3 04:42:06.823:           192.168.1.128/26 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:42:06.823:           192.168.2.64/27 via 0.0.0.0, metric 1, tag 0
R1#
*Nov  3 04:42:06.823:           192.168.3.48/28 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:42:06.823:           192.168.10.224/27 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:42:06.823:           192.168.20.192/27 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:42:06.823:           192.168.30.160/28 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:42:06.823:           192.168.40.32/27 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:42:06.823:           212.212.212.12/30 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:42:06.823: RIP: ignored v2 packet from 192.168.4.174 (sourced from one of our
addresses)
R1#
*Nov  3 04:42:07.955: RIP: sending v2 update to 224.0.0.9 via Loopback0 (192.168.1.190)
*Nov  3 04:42:07.955: RIP: build update entries
*Nov  3 04:42:07.955:           192.168.2.64/27 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:42:07.955:           192.168.3.48/28 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:42:07.955:           192.168.4.160/28 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:42:07.955:           192.168.10.224/27 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:42:07.955:           192.168.20.192/27 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:42:07.955:           192.168.30.160/28 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:42:07.955:           192.168.40.32/27 via 0.0.0.0, metric 2, tag 0
R1#
*Nov  3 04:42:07.955:           212.212.212.12/30 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:42:07.955: RIP: ignored v2 packet from 192.168.1.190 (sourced from one of our
addresses)
R1#
*Nov  3 04:42:12.387: RIP: sending v2 update to 224.0.0.9 via FastEthernet0/0
(212.212.212.13)
*Nov  3 04:42:12.387: RIP: build update entries
*Nov  3 04:42:12.387:           192.168.1.128/26 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:42:12.387:           192.168.2.64/27 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:42:12.387:           192.168.3.48/28 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:42:12.387:           192.168.4.160/28 via 0.0.0.0, metric 1, tag 0
R1#
*Nov  3 04:42:30.011: RIP: sending v2 update to 224.0.0.9 via Loopback1 (192.168.2.94)
*Nov  3 04:42:30.011: RIP: build update entries
*Nov  3 04:42:30.011:           192.168.1.128/26 via 0.0.0.0, metric 1, tag 0
```

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*Nov  3 04:42:30.011:           192.168.3.48/28 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:42:30.011:           192.168.4.160/28 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:42:30.011:           192.168.10.224/27 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:42:30.011:           192.168.20.192/27 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:42:30.011:           192.168.30.160/28 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:42:30.011:           192.168.40.32/27 via 0.0.0.0, metric 2, tag 0
R1#
*Nov  3 04:42:30.011:           212.212.212.12/30 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:42:30.011: RIP: ignored v2 packet from 192.168.2.94 (sourced from one of our
addresses)
*Nov  3 04:42:31.215: RIP: sending v2 update to 224.0.0.9 via Loopback2 (192.168.3.62)
*Nov  3 04:42:31.215: RIP: build update entries
*Nov  3 04:42:31.215:           192.168.1.128/26 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:42:31.215:           192.168.2.64/27 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:42:31.215:           192.168.4.160/28 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:42:31.215:           192.168.10.224/27 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:42:31.215:           192.168.20.192/27 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:42:31.215:           192.168.30.160/28 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:42:31.215:           192.168.40.32/27 via 0.0.0.0, metric 2, tag 0
R1#
*Nov  3 04:42:31.215:           212.212.212.12/30 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:42:31.215: RIP: ignored v2 packet from 192.168.3.62 (sourced from one of our
addresses)
R1#
*Nov  3 04:42:33.431: RIP: received v2 update from 212.212.212.14 on FastEthernet0/0
*Nov  3 04:42:33.431:      192.168.10.224/27 via 0.0.0.0 in 1 hops
*Nov  3 04:42:33.431:      192.168.20.192/27 via 0.0.0.0 in 1 hops
*Nov  3 04:42:33.431:      192.168.30.160/28 via 0.0.0.0 in 1 hops
*Nov  3 04:42:33.431:      192.168.40.32/27 via 0.0.0.0 in 1 hops
*Nov  3 04:42:33.607: RIP: sending v2 update to 224.0.0.9 via Loopback0 (192.168.1.190)
*Nov  3 04:42:33.607: RIP: build update entries
*Nov  3 04:42:33.607:           192.168.2.64/27 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:42:33.607:           192.168.3.48/28 via 0.0.0.0, metric 1, tag 0
R1#
*Nov  3 04:42:33.607:           192.168.4.160/28 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:42:33.607:           192.168.10.224/27 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:42:33.607:           192.168.20.192/27 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:42:33.607:           192.168.30.160/28 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:42:33.607:           192.168.40.32/27 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:42:33.607:           212.212.212.12/30 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:42:33.607: RIP: ignored v2 packet from 192.168.1.190 (sourced from one of our
addresses)
*Nov  3 04:42:34.359: RIP: sending v2 update to 224.0.0.9 via Loopback3 (192.168.4.174)
*Nov  3 04:42:34.359: RIP: build update entries
R1#
*Nov  3 04:42:34.359:           192.168.1.128/26 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:42:34.359:           192.168.2.64/27 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:42:34.359:           192.168.3.48/28 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:42:34.359:           192.168.10.224/27 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:42:34.359:           192.168.20.192/27 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:42:34.359:           192.168.30.160/28 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:42:34.359:           192.168.40.32/27 via 0.0.0.0, metric 2, tag 0
*Nov  3 04:42:34.359:           212.212.212.12/30 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:42:34.359: RIP: ignored v2 packet from 192.168.4.174 (sourced from one of our
addresses)
```

```
R1#
*Nov  3 04:42:38.343: RIP: sending v2 update to 224.0.0.9 via FastEthernet0/0
(212.212.212.13)
*Nov  3 04:42:38.343: RIP: build update entries
*Nov  3 04:42:38.343:          192.168.1.128/26 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:42:38.343:          192.168.2.64/27 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:42:38.343:          192.168.3.48/28 via 0.0.0.0, metric 1, tag 0
*Nov  3 04:42:38.343:          192.168.4.160/28 via 0.0.0.0, metric 1, tag 0
R1#
```

==========

4.Buoc 4:

- Mac dinh Router Rip V2 se cap nhat bang dinh tuyen cho cac Interface ket noi truc tiep cua no moi 30s

- Khi Router chay RIPv2 ta muon khong gui cap nhat bang dinh tuyen vao cac Interface ket noi vao LAN cu moi 30s

```
R1(config)#router rip
R1(config-router)#passive-interface lo0
R1(config-router)#passive-interface lo1
R1(config-router)#passive-interface lo2
R1(config-router)#passive-interface lo3
R1(config-router)#passive-interface lo4
```

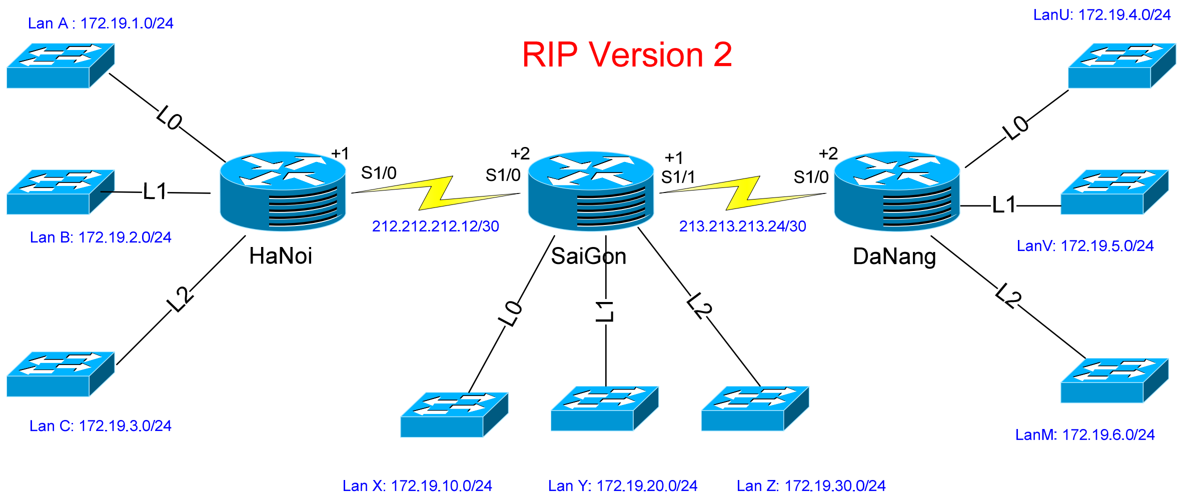
```
R1#debug ip rip
RIP protocol debugging is on
R1#
*Nov  3 04:54:42.791: RIP: received v2 update from 212.212.212.14 on FastEtherne
t0/0
*Nov  3 04:54:42.791:      192.168.10.224/27 via 0.0.0.0 in 1 hops
*Nov  3 04:54:42.791:      192.168.20.192/27 via 0.0.0.0 in 1 hops
*Nov  3 04:54:42.791:      192.168.30.160/28 via 0.0.0.0 in 1 hops
*Nov  3 04:54:42.791:      192.168.40.32/27 via 0.0.0.0 in 1 hops
R1#u all
Port Statistics for unclassified packets is not turned on.

All possible debugging has been turned off
R1#
```

ROUTING LOOP

Để ngăn chặn Routing Loop trong giao thức định tuyến Distance Vector. Người ta quy định ra 5 nguyên tắc sau:
- Split Horizon: thông tin định tuyến của Router A mà nó học được từ Router B khác sẽ không được quảng bá ngược lại trong thông tin cập nhật bảng định tuyến gởi cho B.
- Route Poisoning: Khi một thông tin Network nào đó trên Router bị mất đi, thì nó sẽ gởi cập nhật cho các Router láng giềng của nó về thông tin đường mạng đã chết trên với Metric là Infinity 16
- Poison Reverse: khi Router nhận được thông tin của láng giềng của nó báo về một đường mạng đã chết => Router sẽ gởi gói Poison Reverse (giống như 1 thông tin Ack) khẳng định là Router đã biết về việc đó.
- Holddown Timers: khi Router B nhận được thông tin từ Router A báo về một Network X đã mất thì Router B vẫn giữ thông tin về đường mạng X trong bảng định tuyến trong khoảng thời gian Holddown Timers là 180s. Trong khoảng thời gian trên nếu như Router B nhận được thông tin về đường mạng X từ các Router khác Router A với Metric = hoặc kém tốt hơn Metric từ Router A thì Router B sẽ không học thông tin về đường mạng X từ các Router trên. Nhưng nếu tốt hơn thì học ngay. Sau thời gian Holddown Timers, nếu như có 1 Router nào đó báo cho Router B thông tin về đường mạng X với bất kỳ Metric nào thì Router B sẽ học thông tin về đường mạng X qua Router trên, tuy nhiên vẫn giữ thông tin về đường mạng X qua Router A thêm 60s.
- Trigger Update: khi Router có sự thay đổi thông tin về 1 Network nào đó thì ngay lập tức nó sẽ gửi cập nhật về sự thay đổi đó cho các láng giềng của nó mà không cần phải đợi đến đúng chu kỳ

BÀI TẬP:



Nhận xét : Đây là mạng gián đoạn (Discontinuous Network)

- Một hệ thống gồm nhiều Router có các Subnet khác nhau, có cùng Major Network và bị ngăn cách bởi các mạng khác Major Network
- Đối với mạng gián đoạn thì không thể nào hoạt động được khi sử dụng giao thức định tuyến động Classful.

= = = = = = = = == = == = == = == = === == == = == = == == = == == = == = == ==

6. Cấu hình kết nối giữa 3 Router :

* **Router HaNoi**:

```
FastEthernet0/0        unassigned      YES unset  administratively down down
Serial1/0              212.212.212.13  YES manual up                    up
Serial1/1              unassigned      YES unset  administratively down down
Serial1/2              unassigned      YES unset  administratively down down
Serial1/3              unassigned      YES unset  administratively down down
Serial1/4              unassigned      YES unset  administratively down down
Serial1/5              unassigned      YES unset  administratively down down
Serial1/6              unassigned      YES unset  administratively down down
Serial1/7              unassigned      YES unset  administratively down down
Loopback0                172.19.1.254    YES manual up                    up
Loopback1                172.19.2.254    YES manual up                    up
Loopback2                172.19.3.254    YES manual up                    up
```

* **Router SaiGon**:

```
FastEthernet0/0        unassigned      YES unset  administratively down down
Serial1/0              212.212.212.14  YES SLARP  up                    up
Serial1/1              213.213.213.25  YES manual up                    up
Serial1/2              unassigned      YES unset  administratively down down
Serial1/3              unassigned      YES unset  administratively down down
Serial1/4              unassigned      YES unset  administratively down down
Serial1/5              unassigned      YES unset  administratively down down
Serial1/6              unassigned      YES unset  administratively down down
Serial1/7              unassigned      YES unset  administratively down down
Loopback0                172.19.10.254   YES manual up                    up
Loopback1                172.19.20.254   YES manual up                    up
Loopback2                172.19.30.254   YES manual up                    up
```

*** Router DaNang**:

```
Interface              IP-Address      OK? Method Status              Protocol

FastEthernet0/0          unassigned      YES unset  administratively down down

Serial1/0              213.213.213.26  YES manual up                  up

Serial1/1              unassigned      YES unset  administratively down down

Serial1/2              unassigned      YES unset  administratively down down

Serial1/3              unassigned      YES unset  administratively down down

Serial1/4              unassigned      YES unset  administratively down down

Serial1/5              unassigned      YES unset  administratively down down

Serial1/6              unassigned      YES unset  administratively down down

Serial1/7              unassigned      YES unset  administratively down down

Loopback0                172.19.4.254    YES manual up                up

Loopback1                172.19.5.254    YES manual up                up

Loopback2                172.19.6.254    YES manual up                up
```

7. Cấu hình Dynamic Routing Protocol:

*** Ha Noi :**

```
 HaNoi(config)#router rip
HaNoi(config-router)#ver
HaNoi(config-router)#version ? -------→ RIP Version 2
  <1-2>  version
HaNoi(config-router)#network 172.19.0.0
HaNoi(config-router)#network 212.212.212.0
```

==➔ Xem Routing Table :

```
HaNoi#sh ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

R    213.213.213.0/24 [120/1] via 212.212.212.14, 00:00:05, Serial1/0
     212.212.212.0/30 is subnetted, 1 subnets
```

```
C       212.212.212.12 is directly connected, Serial1/0
     172.19.0.0/16 is variably subnetted, 4 subnets, 2 masks
C       172.19.3.0/24 is directly connected, Loopback2
C       172.19.2.0/24 is directly connected, Loopback1
C       172.19.1.0/24 is directly connected, Loopback0
R       172.19.0.0/16 [120/1] via 212.212.212.14, 00:00:05, Serial1/0
```

* SaiGon :

```
SaiGon(config)#router
SaiGon(config)#router rip
SaiGon(config-router)#version 2
SaiGon(config-router)#network 172.19.0.0
SaiGon(config-router)#network 212.212.212.0
SaiGon(config-router)#network 213.213.213.0

SaiGon#sh ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

C    213.213.213.0/24 is directly connected, Serial1/1
     212.212.212.0/30 is subnetted, 1 subnets
C       212.212.212.12 is directly connected, Serial1/0
     172.19.0.0/16 is variably subnetted, 4 subnets, 2 masks
C       172.19.30.0/24 is directly connected, Loopback2
C       172.19.20.0/24 is directly connected, Loopback1
C       172.19.10.0/24 is directly connected, Loopback0
R       172.19.0.0/16 [120/1] via 213.213.213.26, 00:00:21, Serial1/1
                      [120/1] via 212.212.212.13, 00:00:00, Serial1/0
```

* DaNang:

```
DaNang(config)#router rip
DaNang(config-router)#version 2
DaNang(config-router)#network 172.19.0.0
DaNang(config-router)#network 213.213.213.0

DaNang#sh ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set
```

```
     213.213.213.0/30 is subnetted, 1 subnets
C       213.213.213.24 is directly connected, Serial1/0
R    212.212.212.0/24 [120/1] via 213.213.213.25, 00:00:25, Serial1/0
     172.19.0.0/16 is variably subnetted, 4 subnets, 2 masks
C       172.19.6.0/24 is directly connected, Loopback2
C       172.19.5.0/24 is directly connected, Loopback1
C       172.19.4.0/24 is directly connected, Loopback0
R       172.19.0.0/16 [120/1] via 213.213.213.25, 00:00:25, Serial1/0
```

AD= 120
1= Matric---> qua 1 Router
24--> Bi Auto Sumary

HaNoi(config-router)#no auto-summary --→ tắt Summary
SaiGon(config-router)#no auto-summary --→ tắt Summary
DaNang(config-router)#no auto-summary --→ tắt Summary

===➔ Se không bi Auto-Sumary

- **Ha Noi :**

```
HaNoi#sh ip route rip
     213.213.213.0/30 is subnetted, 1 subnets
R       213.213.213.24 [120/1] via 212.212.212.14, 00:00:14, Serial1/0
     172.19.0.0/24 is subnetted, 9 subnets
R       172.19.30.0 [120/1] via 212.212.212.14, 00:00:14, Serial1/0
R       172.19.20.0 [120/1] via 212.212.212.14, 00:00:14, Serial1/0
R       172.19.10.0 [120/1] via 212.212.212.14, 00:00:14, Serial1/0
R       172.19.6.0 [120/2] via 212.212.212.14, 00:00:14, Serial1/0
R       172.19.5.0 [120/2] via 212.212.212.14, 00:00:14, Serial1/0
R       172.19.4.0 [120/2] via 212.212.212.14, 00:00:14, Serial1/0
```

- **SaiGon :**

```
SaiGon#sh ip route rip
     172.19.0.0/24 is subnetted, 9 subnets
R       172.19.6.0 [120/1] via 213.213.213.26, 00:00:24, Serial1/1
R       172.19.5.0 [120/1] via 213.213.213.26, 00:00:24, Serial1/1
R       172.19.4.0 [120/1] via 213.213.213.26, 00:00:24, Serial1/1
R       172.19.3.0 [120/1] via 212.212.212.13, 00:00:25, Serial1/0
R       172.19.2.0 [120/1] via 212.212.212.13, 00:00:25, Serial1/0
R       172.19.1.0 [120/1] via 212.212.212.13, 00:00:25, Serial1/0
```

- **DaNang:**

```
DaNang#sh ip route rip
     212.212.212.0/30 is subnetted, 1 subnets
R       212.212.212.12 [120/1] via 213.213.213.25, 00:00:13, Serial1/0
     172.19.0.0/24 is subnetted, 9 subnets
R       172.19.30.0 [120/1] via 213.213.213.25, 00:00:13, Serial1/0
R       172.19.20.0 [120/1] via 213.213.213.25, 00:00:13, Serial1/0
R       172.19.10.0 [120/1] via 213.213.213.25, 00:00:13, Serial1/0
R       172.19.3.0 [120/2] via 213.213.213.25, 00:00:13, Serial1/0
R       172.19.2.0 [120/2] via 213.213.213.25, 00:00:13, Serial1/0
```

```
R       172.19.1.0 [120/2] via 213.213.213.25, 00:00:13, Serial1/0

HaNoi#sh ip protocols -------→ kiem tra Load Balance va AD

Routing Protocol is "rip"
  Sending updates every 30 seconds, next due in 26 seconds
  Invalid after 180 seconds, hold down 180, flushed after 240
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Redistributing: rip
  Default version control: send version 2, receive version 2
    Interface             Send  Recv  Triggered RIP  Key-chain
    Serial1/0             2     2
    Loopback0               2     2
    Loopback1               2     2
    Loopback2               2     2
  Automatic network summarization is not in effect
Maximum path: 4  ---> Load Balance 4

  Routing for Networks:
    172.19.0.0
    212.212.212.0
    213.213.213.0
  Routing Information Sources:
    Gateway         Distance      Last Update
    212.212.212.14       120      00:00:25     ------→ Lan Update Routing table cach day 25s
  Distance: (default is 120) -→ AD
```

=========> Thay doi Load Balance

```
HaNoi(config)#router rip
HaNoi(config-router)#maximum-paths 10 ---→ Doi Load Balance bang 10

HaNoi#sh ip protocols
Routing Protocol is "rip"
  Sending updates every 30 seconds, next due in 21 seconds
  Invalid after 180 seconds, hold down 180, flushed after 240 → theo nguyen tac Holddown
Timers
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Redistributing: rip
  Default version control: send version 2, receive version 2
    Interface             Send  Recv  Triggered RIP  Key-chain
    Serial1/0             2     2
    Loopback0               2     2
    Loopback1               2     2
    Loopback2               2     2
  Automatic network summarization is not in effect
  Maximum path: 10 ---> Load Balance 4
  Routing for Networks:
    172.19.0.0
    212.212.212.0
    213.213.213.0
  Routing Information Sources:
    Gateway         Distance      Last Update
  212.212.212.14       120      00:00:05
 Distance: (default is 120)
```

8. Capture RIP version 2

```
HaNoi#debug ip rip
RIP protocol debugging is on
HaNoi#
*Nov  6 18:02:51.463: RIP: sending v2 update to 224.0.0.9 via Serial1/0 (212.212.212.13)
*Nov  6 18:02:51.467: RIP: build update entries
*Nov  6 18:02:51.467:         172.19.1.0/24 via 0.0.0.0, metric 1, tag 0
*Nov  6 18:02:51.471:         172.19.2.0/24 via 0.0.0.0, metric 1, tag 0
*Nov  6 18:02:51.475:         172.19.3.0/24 via 0.0.0.0, metric 1, tag 0
HaNoi#
*Nov  6 18:02:58.883: RIP: sending v2 update to 224.0.0.9 via Loopback2 (172.19.3.254) -→
Thoa man 5 nguyen tac ngan chan routing Loop (Split Horizon) không goi tro lai cho Network
172.19.3.0/24
*Nov  6 18:02:58.887: RIP: build update entries
*Nov  6 18:02:58.887:         172.19.1.0/24 via 0.0.0.0, metric 1, tag 0
*Nov  6 18:02:58.891:         172.19.2.0/24 via 0.0.0.0, metric 1, tag 0
*Nov  6 18:02:58.891:         172.19.4.0/24 via 0.0.0.0, metric 3, tag 0
*Nov  6 18:02:58.895:         172.19.5.0/24 via 0.0.0.0, metric 3, tag 0
*Nov  6 18:02:58.899:         172.19.6.0/24 via 0.0.0.0, metric 3, tag 0
*Nov  6 18:02:58.903:         172.19.10.0/24 via 0.0.0.0, metric 2, tag 0
*Nov  6 18:02:58.903:         172.19.20.0/24 via 0.0.0.0, metric 2, tag 0
*Nov  6 18:02:58.907:         172.19.30.0/24 via 0.0.0.0, metric 2, tag 0
HaNoi#
*Nov  6 18:02:58.907:         212.212.212.12/30 via 0.0.0.0, metric 1, tag 0
*Nov  6 18:02:58.907:         213.213.213.24/30 via 0.0.0.0, metric 2, tag 0
*Nov  6 18:02:58.927: RIP: ignored v2 packet from 172.19.3.254 (sourced from one of our
addresses)
HaNoi#
*Nov  6 18:03:03.103: RIP: received v2 update from 212.212.212.14 on Serial1/0
*Nov  6 18:03:03.103:      172.19.4.0/24 via 0.0.0.0 in 2 hops
*Nov  6 18:03:03.107:      172.19.5.0/24 via 0.0.0.0 in 2 hops
*Nov  6 18:03:03.111:      172.19.6.0/24 via 0.0.0.0 in 2 hops
*Nov  6 18:03:03.115:      172.19.10.0/24 via 0.0.0.0 in 1 hops
*Nov  6 18:03:03.119:      172.19.20.0/24 via 0.0.0.0 in 1 hops
*Nov  6 18:03:03.119:      172.19.30.0/24 via 0.0.0.0 in 1 hops
*Nov  6 18:03:03.123:      213.213.213.24/30 via 0.0.0.0 in 1 hops
HaNoi#
*Nov  6 18:03:06.131: RIP: sending v2 update to 224.0.0.9 via Loopback0 (172.19.1.254)
*Nov  6 18:03:06.135: RIP: build update entries
*Nov  6 18:03:06.139:         172.19.2.0/24 via 0.0.0.0, metric 1, tag 0
*Nov  6 18:03:06.139:         172.19.3.0/24 via 0.0.0.0, metric 1, tag 0
*Nov  6 18:03:06.139:         172.19.4.0/24 via 0.0.0.0, metric 3, tag 0
*Nov  6 18:03:06.139:         172.19.5.0/24 via 0.0.0.0, metric 3, tag 0
*Nov  6 18:03:06.139:         172.19.6.0/24 via 0.0.0.0, metric 3, tag 0
*Nov  6 18:03:06.139:         172.19.10.0/24 via 0.0.0.0, metric 2, tag 0
*Nov  6 18:03:06.139:         172.19.20.0/24 via 0.0.0.0, metric 2, tag 0
*Nov  6 18:03:06.139:         172.19.30.0/24 via 0.0.0.0, metric 2, tag 0
HaNoi#
*Nov  6 18:03:06.139:         212.212.212.12/30 via 0.0.0.0, metric 1, tag 0
```

```
*Nov  6 18:03:06.139:         213.213.213.24/30 via 0.0.0.0, metric 2, tag 0
*Nov  6 18:03:06.147: RIP: ignored v2 packet from 172.19.1.254 (sourced from one of our
addresses)
HaNoi#
*Nov  6 18:03:13.907: RIP: sending v2 update to 224.0.0.9 via Loopback1 (172.19.2.254)
*Nov  6 18:03:13.911: RIP: build update entries
*Nov  6 18:03:13.915:         172.19.1.0/24 via 0.0.0.0, metric 1, tag 0
*Nov  6 18:03:13.915:         172.19.3.0/24 via 0.0.0.0, metric 1, tag 0
*Nov  6 18:03:13.919:         172.19.4.0/24 via 0.0.0.0, metric 3, tag 0
*Nov  6 18:03:13.923:         172.19.5.0/24 via 0.0.0.0, metric 3, tag 0
*Nov  6 18:03:13.923:         172.19.6.0/24 via 0.0.0.0, metric 3, tag 0
*Nov  6 18:03:13.923:         172.19.10.0/24 via 0.0.0.0, metric 2, tag 0
*Nov  6 18:03:13.923:         172.19.20.0/24 via 0.0.0.0, metric 2, tag 0
*Nov  6 18:03:13.923:         172.19.30.0/24 via 0.0.0.0, metric 2, tag 0
HaNoi#
*Nov  6 18:03:13.923:         212.212.212.12/30 via 0.0.0.0, metric 1, tag 0
*Nov  6 18:03:13.923:         213.213.213.24/30 via 0.0.0.0, metric 2, tag 0
*Nov  6 18:03:13.927: RIP: ignored v2 packet from 172.19.2.254 (sourced from one of our
addresses)
HaNoi#
*Nov  6 18:03:19.895: RIP: sending v2 update to 224.0.0.9 via Serial1/0 (212.212.212.13)
*Nov  6 18:03:19.899: RIP: build update entries
*Nov  6 18:03:19.899:         172.19.1.0/24 via 0.0.0.0, metric 1, tag 0
*Nov  6 18:03:19.903:         172.19.2.0/24 via 0.0.0.0, metric 1, tag 0
*Nov  6 18:03:19.907:         172.19.3.0/24 via 0.0.0.0, metric 1, tag 0
HaNoi#
*Nov  6 18:03:26.879: RIP: sending v2 update to 224.0.0.9 via Loopback2 (172.19.3.254)
*Nov  6 18:03:26.883: RIP: build update entries
*Nov  6 18:03:26.883:         172.19.1.0/24 via 0.0.0.0, metric 1, tag 0
*Nov  6 18:03:26.887:         172.19.2.0/24 via 0.0.0.0, metric 1, tag 0
*Nov  6 18:03:26.887:         172.19.4.0/24 via 0.0.0.0, metric 3, tag 0
*Nov  6 18:03:26.887:         172.19.5.0/24 via 0.0.0.0, metric 3, tag 0
*Nov  6 18:03:26.887:         172.19.6.0/24 via 0.0.0.0, metric 3, tag 0
*Nov  6 18:03:26.887:         172.19.10.0/24 via 0.0.0.0, metric 2, tag 0
*Nov  6 18:03:26.887:         172.19.20.0/24 via 0.0.0.0, metric 2, tag 0
*Nov  6 18:03:26.887:         172.19.30.0/24 via 0.0.0.0, metric 2, tag 0
HaNoi#
*Nov  6 18:03:26.887:         212.212.212.12/30 via 0.0.0.0, metric 1, tag 0
*Nov  6 18:03:26.887:         213.213.213.24/30 via 0.0.0.0, metric 2, tag 0
*Nov  6 18:03:26.895: RIP: ignored v2 packet from 172.19.3.254 (sourced from one of our
addresses)
HaNoi#
*Nov  6 18:03:29.555: RIP: received v2 update from 212.212.212.14 on Serial1/0
*Nov  6 18:03:29.559:      172.19.4.0/24 via 0.0.0.0 in 2 hops
*Nov  6 18:03:29.563:      172.19.5.0/24 via 0.0.0.0 in 2 hops
*Nov  6 18:03:29.563:      172.19.6.0/24 via 0.0.0.0 in 2 hops
*Nov  6 18:03:29.567:      172.19.10.0/24 via 0.0.0.0 in 1 hops
*Nov  6 18:03:29.571:      172.19.20.0/24 via 0.0.0.0 in 1 hops
*Nov  6 18:03:29.575:      172.19.30.0/24 via 0.0.0.0 in 1 hops
*Nov  6 18:03:29.579:      213.213.213.24/30 via 0.0.0.0 in 1 hops
HaNoi#
*Nov  6 18:03:34.199: RIP: sending v2 update to 224.0.0.9 via Loopback0 (172.19.1.254)
*Nov  6 18:03:34.199: RIP: build update entries
*Nov  6 18:03:34.199:         172.19.2.0/24 via 0.0.0.0, metric 1, tag 0
*Nov  6 18:03:34.203:         172.19.3.0/24 via 0.0.0.0, metric 1, tag 0
```

```
*Nov  6 18:03:34.207:        172.19.4.0/24 via 0.0.0.0, metric 3, tag 0
*Nov  6 18:03:34.211:        172.19.5.0/24 via 0.0.0.0, metric 3, tag 0
*Nov  6 18:03:34.211:        172.19.6.0/24 via 0.0.0.0, metric 3, tag 0
*Nov  6 18:03:34.211:        172.19.10.0/24 via 0.0.0.0, metric 2, tag 0
*Nov  6 18:03:34.211:        172.19.20.0/24 via 0.0.0.0, metric 2, tag 0
*Nov  6 18:03:34.211:        172.19.30.0/24 via 0.0.0.0, metric 2, tag 0
*Nov  6 18:03:34.211:        212.212.212.12/30 via 0.0.0.0, metric 1, tag 0
*Nov  6 18:03:34.211:        213.213.213.24/30 via 0.0.0.0, metric 2, tag 0
*Nov  6 18:03:34.227: RIP: ignored v2 packet from 172.19.1.254 (sourced from one of our
addresses)
HaNoi#u all
Port Statistics for unclassified packets is not turned on.

All possible debugging has been turned off
```

======> Mac dinh Router Rip V2 se cap nhat bang dinh tuyen cho cac Interface ket noi truc tiep cua no moi 30s

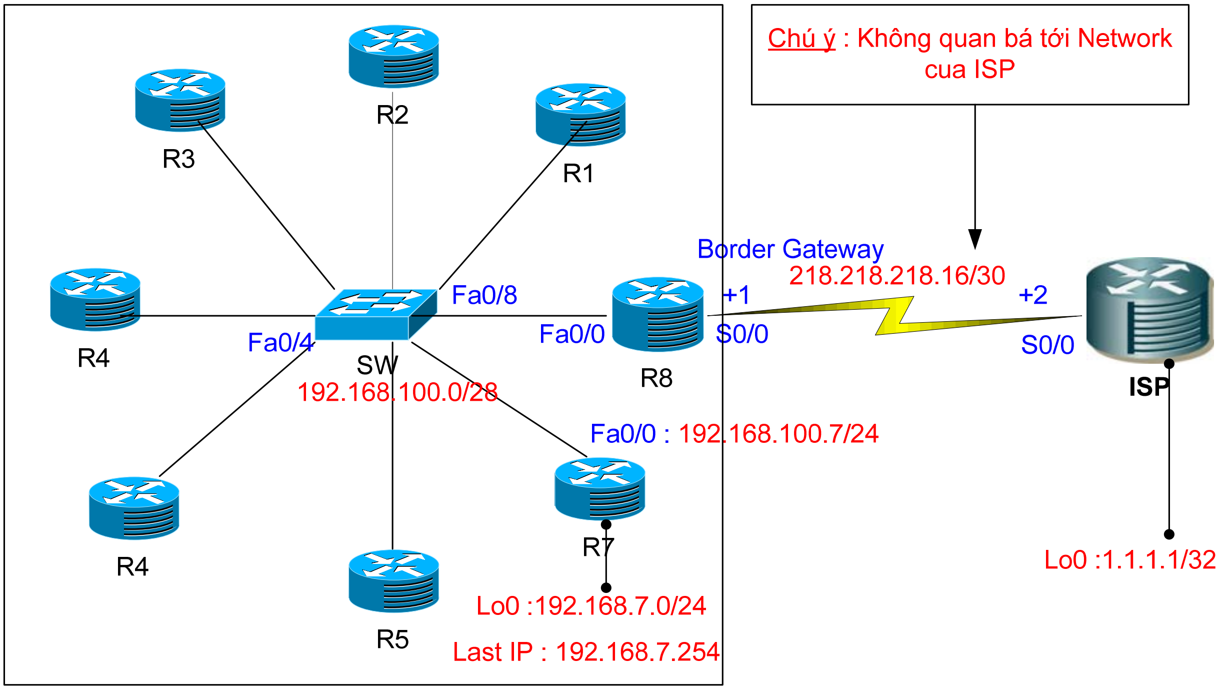
Khi Router chay RIPv2:

+ Khong gui cap nhat bang dinh tuyen vao cac Interface ket noi vao LAN

```
HaNoi(config-router)#passive-interface lo0
HaNoi(config-router)#passive-interface lo1
HaNoi(config-router)#passive-interface lo2
=======
HaNoi#debug ip rip
RIP protocol debugging is on
HaNoi#
*Nov  6 18:08:33.519: RIP: received v2 update from 212.212.212.14 on Serial1/0
*Nov  6 18:08:33.519:      172.19.4.0/24 via 0.0.0.0 in 2 hops
*Nov  6 18:08:33.523:      172.19.5.0/24 via 0.0.0.0 in 2 hops
*Nov  6 18:08:33.527:      172.19.6.0/24 via 0.0.0.0 in 2 hops
*Nov  6 18:08:33.531:      172.19.10.0/24 via 0.0.0.0 in 1 hops
*Nov  6 18:08:33.535:      172.19.20.0/24 via 0.0.0.0 in 1 hops
*Nov  6 18:08:33.535:      172.19.30.0/24 via 0.0.0.0 in 1 hops
*Nov  6 18:08:33.539:      213.213.213.24/30 via 0.0.0.0 in 1 hops
HaNoi#
*Nov  6 18:08:49.499: RIP: sending v2 update to 224.0.0.9 via Serial1/0 (212.212.212.13)
*Nov  6 18:08:49.503: RIP: build update entries
*Nov  6 18:08:49.503:   172.19.1.0/24 via 0.0.0.0, metric 1, tag 0
*Nov  6 18:08:49.507:   172.19.2.0/24 via 0.0.0.0, metric 1, tag 0
*Nov  6 18:08:49.511:   172.19.3.0/24 via 0.0.0.0, metric 1, tag 0
HaNoi#
*Nov  6 18:09:00.339: RIP: received v2 update from 212.212.212.14 on Serial1/0
*Nov  6 18:09:00.343:      172.19.4.0/24 via 0.0.0.0 in 2 hops
*Nov  6 18:09:00.347:      172.19.5.0/24 via 0.0.0.0 in 2 hops
*Nov  6 18:09:00.351:      172.19.6.0/24 via 0.0.0.0 in 2 hops
*Nov  6 18:09:00.355:      172.19.10.0/24 via 0.0.0.0 in 1 hops
*Nov  6 18:09:00.359:      172.19.20.0/24 via 0.0.0.0 in 1 hops
*Nov  6 18:09:00.359:      172.19.30.0/24 via 0.0.0.0 in 1 hops
*Nov  6 18:09:00.363:      213.213.213.24/30 via 0.0.0.0 in 1 hops
HaNoi#u all
Port Statistics for unclassified packets is not turned on.
```

```
All possible debugging has been turned off
HaNoi#
```

Thực hành :



1 . **Bước 1** : Cau hinh co ban cho Route R7 va Loopback0

2. **Bước 2** : Cau hinh Default Route

Router Border gateway khong tu dong quang ba Default Route ma no co cho cac Router ben trong cung AS voi no.Muon cho Router Border Gateway quang ba default Router cho cac Router ben trong cung AS ta phai thuc hien cau lenh

```
(config-router)#router rip
(config-router)#default-information originate
```

```
sh run
Building configuration...

Current configuration: 1360 bytes
!
version 12.3
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname R8
```

```
!
boot-start-marker
boot-end-marker
!
!
no aaa new-model
!
resource policy
!
mmi polling-interval 60
no mmi auto-configure
no mmi pvc
mmi snmp-timeout 180
ip subnet-zero
 --More-- _________        _________ip cef
!
!
no ip dhcp use vrf connected
!
!
no ip domain lookup
no ip ips deny-action ips-interface
!
no ftp-server write-enable
!
!
!
!
!
!
!
!
!
!
!
!
!
 --More-- _________        _________!
!
!
no crypto isakmp ccm
!
!
!
!
interface Loopback0
 ip address 192.168.8.254 255.255.255.0
!
interface FastEthernet0/0
 ip address 192.168.100.8 255.255.255.240
 duplex auto
 speed auto
!
interface FastEthernet0/1
 ip address 218.218.218.17 255.255.255.252
 duplex auto
 speed auto
!
interface Serial0/1/0
 no ip address
 --More-- _________       _________ shutdown
 no fair-queue
 clockrate 2000000
!
interface Serial0/2/0
 no ip address
 shutdown
 clockrate 2000000
!
router rip
 version 2
 network 192.168.8.0
 network 192.168.100.0
 default-information originate
 no auto-summary
!
ip classless
ip route 0.0.0.0 0.0.0.0 218.218.218.18 permanent
!
!
ip http server
no ip http secure-server
!
 --More-- _________       _s________!
!
!
!
control-plane
!
!
!
!
!
!
!
!
banner motd ^CBORDER GATEWAY^C
!
line con 0
 exec-timeout 0 0
 password vnpro
 logging synchronous
 login
line aux 0
line vty 0 4
 password vnpro
 --More-- _________       _________ login
line vty 5 807
 password vnpro
 login
```

```
!
end

R8#
```

******Thong tin dinh tuyen cua Route R7**

```
R7#sh ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is 192.168.100.8 to network 0.0.0.0

R    192.168.8.0/24 [120/1] via 192.168.100.8, 00:00:08, FastEthernet0/0
R    192.168.4.0/24 [120/1] via 192.168.100.4, 00:00:02, FastEthernet0/0
R    192.168.5.0/24 [120/1] via 192.168.100.5, 00:00:11, FastEthernet0/0
R    192.168.6.0/24 [120/1] via 192.168.100.6, 00:00:11, FastEthernet0/0
C    192.168.7.0/24 is directly connected, Loopback0
C    192.168.100.0/24 is directly connected, FastEthernet0/0
R    192.168.3.0/24 [120/1] via 192.168.100.3, 00:00:03, FastEthernet0/0
R*   0.0.0.0/0 [120/1] via 192.168.100.8, 00:00:08, FastEthernet0/0
R7#
----------------------------------------------
```

******Thong tin dinh tuyen cua Route R8**

```
R8#sh ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is 218.218.218.18 to network 0.0.0.0

     218.218.218.0/30 is subnetted, 1 subnets
C       218.218.218.16 is directly connected, FastEthernet0/1
C    192.168.8.0/24 is directly connected, Loopback0
R    192.168.4.0/24 [120/1] via 192.168.100.4, 00:00:10, FastEthernet0/0
R    192.168.5.0/24 [120/1] via 192.168.100.5, 00:00:00, FastEthernet0/0
R    192.168.6.0/24 [120/1] via 192.168.100.6, 00:00:00, FastEthernet0/0
R    192.168.7.0/24 [120/1] via 192.168.100.7, 00:00:17, FastEthernet0/0
     192.168.100.0/28 is subnetted, 1 subnets
C       192.168.100.0 is directly connected, FastEthernet0/0
R    192.168.3.0/24 [120/1] via 192.168.100.3, 00:00:13, FastEthernet0/0
S*   0.0.0.0/0 [1/0] via 218.218.218.18
```

3. **Bước 3** : Cau hinh ISP Route

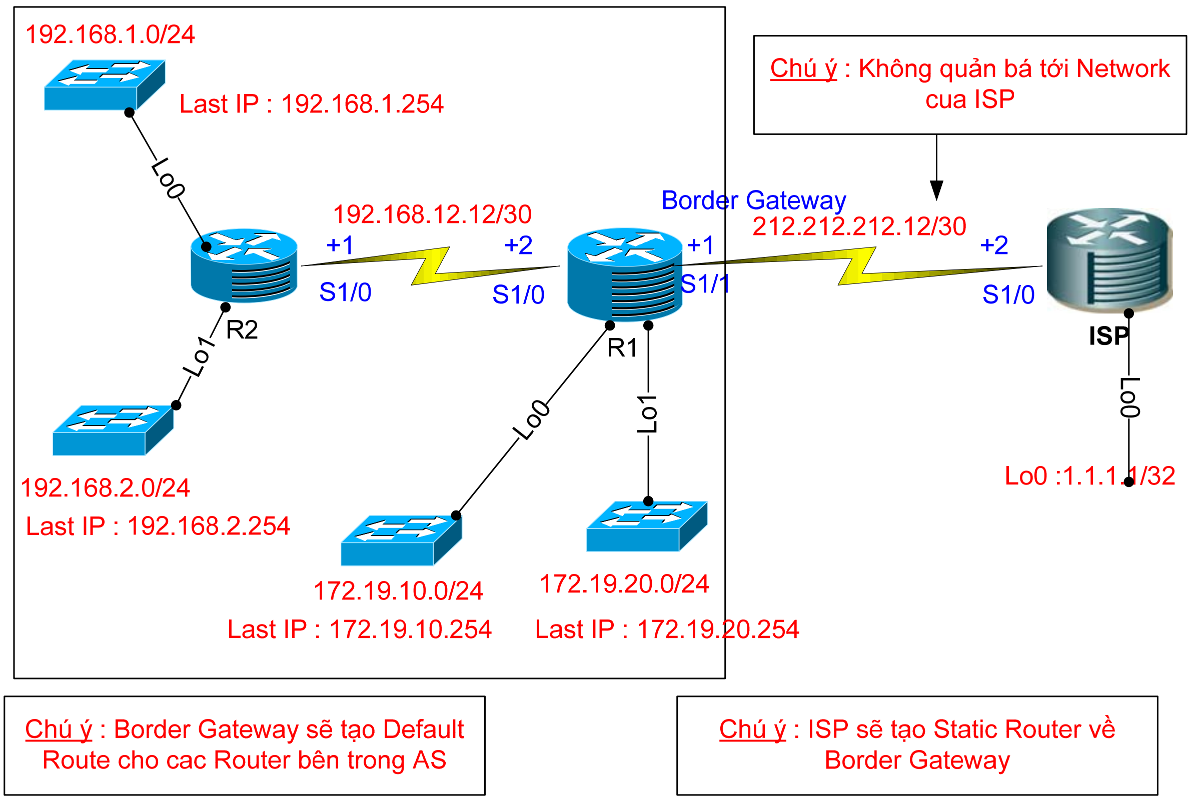
cau hinh static route la 0.0.0.0 0.0.0.0 218.218.218.17

```
sh run
Building configuration...

Current configuration : 822 bytes
!
version 12.3
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname ISP
!
boot-start-marker
boot-end-marker
!
!
no aaa new-model
ip subnet-zero
ip cef
!
!
no ip domain lookup
!
ip audit po max-events 100
!
 --More-- _________       _________!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
interface Loopback0
 ip address 1.1.1.1 255.255.255.255
!
interface FastEthernet0/0
 ip address 218.218.218.18 255.255.255.252
 --More-- _________       _________ duplex auto
 speed auto
!
interface Serial0/0
 no ip address
 shutdown
```

```
!
interface Serial0/1
 no ip address
 shutdown
!
ip http server
no ip http secure-server
ip classless
ip route 0.0.0.0 0.0.0.0 218.218.218.17
!
!
!
!
!
!
!
!
 --More-- __________        __________line con 0
 exec-timeout 0 0
 logging synchronous
line aux 0
line vty 0 4
 privilege level 15
 no login
line vty 5 15
 privilege level 15
 no login
!
!
end

ISP#
```



Chú ý : Không quản bá tới Network cua ISP

Chú ý : Border Gateway sẽ tạo Default Route cho cac Router bên trong AS

Chú ý : ISP sẽ tạo Static Router về Border Gateway

1 . **Bước 1** : Cau hinh co ban cho Route R2 va Loopback0

```
R1#sh ip int bri
ocol
FastEthernet0/0         unassigned      YES unset  administratively down down

Serial1/0            192.168.12.13   YES manual up                    up

Serial1/1            unassigned      YES unset  administratively down down

Serial1/2            unassigned      YES unset  administratively down down

Serial1/3            unassigned      YES unset  administratively down down

Serial1/4            unassigned      YES unset  administratively down down

Serial1/5            unassigned      YES unset  administratively down down

Serial1/6            unassigned      YES unset  administratively down down

Serial1/7            unassigned      YES unset  administratively down down

Loopback0              192.168.1.254   YES manual up                    up

Loopback1              192.168.2.254   YES manual up                    up
```

```
sh run
Building configuration...

Current configuration : 1553 bytes
!
version 12.4
service timestamps debug datetime msec
service timestamps log datetime msec
service password-encryption
!
hostname R1
!
boot-start-marker
boot-end-marker
!
enable secret 5 $1$/VWZ$FdtFgUqc.JjKrsZ1f.EZq0
enable password 7 045802150C2E
!
no aaa new-model
!
resource policy
!
ip subnet-zero
!
!
 --More-- ◘◘◘◘◘◘◘◘◘         ◘◘◘◘◘◘◘◘◘ip cef
no ip domain lookup
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
 --More-- ◘◘◘◘◘◘◘◘◘         ◘◘◘◘◘◘◘◘◘!
!
interface Loopback0
```

```
 ip address 192.168.1.254 255.255.255.0
!
interface Loopback1
 ip address 192.168.2.254 255.255.255.0
!
interface FastEthernet0/0
 no ip address
 shutdown
 duplex half
!
interface Serial1/0
 ip address 192.168.12.13 255.255.255.252
 serial restart-delay 0
!
interface Serial1/1
 no ip address
 shutdown
 serial restart-delay 0
!
interface Serial1/2
 --More-- ◘◘◘◘◘◘◘◘◘        ◘◘◘◘◘◘◘◘◘ no ip address
 shutdown
 serial restart-delay 0
!
interface Serial1/3
 no ip address
 shutdown
 serial restart-delay 0
!
interface Serial1/4
 no ip address
 shutdown
 serial restart-delay 0
!
interface Serial1/5
 no ip address
 shutdown
 serial restart-delay 0
!
interface Serial1/6
 no ip address
 shutdown
 serial restart-delay 0
 --More-- ◘◘◘◘◘◘◘◘◘        ◘◘◘◘◘◘◘◘◘!
interface Serial1/7
 no ip address
 shutdown
 serial restart-delay 0
!
router rip
 version 2
 network 192.168.1.0
 network 192.168.2.0
 network 192.168.12.0
 no auto-summary
```

```
!
ip classless
!
no ip http server
no ip http secure-server
!
!
!
!
!
!
 --More-- ◘◘◘◘◘◘◘◘◘        ◘◘◘◘◘◘◘◘◘control-plane
!
!
!
!
!
!
gatekeeper
 shutdown
!
!
line con 0
 exec-timeout 0 0
 password 7 02100A4B1909
 logging synchronous
 login
 stopbits 1
line aux 0
 stopbits 1
line vty 0 4
 password 7 095A40190B0A
 login
!
 --More-- ◘◘◘◘◘◘◘◘◘        ◘◘◘◘◘◘◘◘◘!
end

R1#
```

```
R1#sh ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

     192.168.12.0/30 is subnetted, 1 subnets
C       192.168.12.12 is directly connected, Serial1/0
R    192.168.10.0/24 [120/1] via 192.168.12.14, 00:00:11, Serial1/0
```

```
R    192.168.20.0/24 [120/1] via 192.168.12.14, 00:00:11, Serial1/0
C    192.168.1.0/24 is directly connected, Loopback0
C    192.168.2.0/24 is directly connected, Loopback1
R1#
```

2. **<u>Bước 2</u>** : Cau hinh Default Route

Router Border gateway khong tu dong quang ba Default Route ma no co cho cac Router ben trong cung AS voi no.Muon cho Router Border Gateway quang ba default Router cho cac Router ben trong cung AS ta phai thuc hien cau lenh

```
Border(config)#router rip
Border(config-router)#default-information originate
```

```
Border#sh run
Building configuration...

Current configuration : 1660 bytes
!
version 12.4
service timestamps debug datetime msec
service timestamps log datetime msec
service password-encryption
!
hostname Border
!
boot-start-marker
boot-end-marker
!
enable secret 5 $1$rti0$HIqR1cvjzNYhBreaUY9ko1
enable password 7 02050D480809
!
no aaa new-model
!
resource policy
!
ip subnet-zero
!
!
 --More-- ◘◘◘◘◘◘◘◘◘        ◘◘◘◘◘◘◘◘◘ip cef
no ip domain lookup
!
!
!
!
!
!
!
!
!
!
!
!
!
```

```
!
!
!
!
!
!
!
!
 --More-- ◘◘◘◘◘◘◘◘◘         ◘◘◘◘◘◘◘◘◘!
!
interface Loopback0
 ip address 192.168.10.254 255.255.255.0
!
interface Loopback1
 ip address 192.168.20.254 255.255.255.0
!
interface FastEthernet0/0
 no ip address
 shutdown
 duplex half
!
interface Serial1/0
 ip address 192.168.12.14 255.255.255.252
 serial restart-delay 0
!
interface Serial1/1
 ip address 212.212.212.13 255.255.255.252
 serial restart-delay 0
!
interface Serial1/2
 no ip address
 --More-- ◘◘◘◘◘◘◘◘◘         ◘◘◘◘◘◘◘◘◘ shutdown
 serial restart-delay 0
!
interface Serial1/3
 no ip address
 shutdown
 serial restart-delay 0
!
interface Serial1/4
 no ip address
 shutdown
 serial restart-delay 0
!
interface Serial1/5
 no ip address
 shutdown
 serial restart-delay 0
!
interface Serial1/6
 no ip address
 shutdown
 serial restart-delay 0
!
 --More-- ◘◘◘◘◘◘◘◘◘         ◘◘◘◘◘◘◘◘◘interface Serial1/7
 no ip address
 shutdown
 serial restart-delay 0
!
router rip
 version 2
 network 192.168.10.0
 network 192.168.12.0
 network 192.168.20.0
 default-information originate
 no auto-summary
!
ip classless
ip route 0.0.0.0 0.0.0.0 212.212.212.14 permanent
!
no ip http server
no ip http secure-server
!
!
!
!
!
 --More-- ◘◘◘◘◘◘◘◘◘        ◘◘◘◘◘◘◘◘◘!
control-plane
!
!
!
!
!
!
gatekeeper
 shutdown
!
!
line con 0
 exec-timeout 0 0
 password 7 111F1715051D
 logging synchronous
 login
 stopbits 1
line aux 0
 stopbits 1
line vty 0 4
 password 7 051D081F3343
 login
 --More-- ◘◘◘◘◘◘◘◘◘        ◘◘◘◘◘◘◘◘◘!
!
end

Border#
```

******Thong tin dinh tuyen cua Route R1**

```
R1#sh ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
```

```
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is 192.168.12.14 to network 0.0.0.0

     192.168.12.0/30 is subnetted, 1 subnets
C       192.168.12.12 is directly connected, Serial1/0
R    192.168.10.0/24 [120/1] via 192.168.12.14, 00:00:19, Serial1/0
R    192.168.20.0/24 [120/1] via 192.168.12.14, 00:00:19, Serial1/0
C    192.168.1.0/24 is directly connected, Loopback0
C    192.168.2.0/24 is directly connected, Loopback1
R*   0.0.0.0/0 [120/1] via 192.168.12.14, 00:00:19, Serial1/0

-----------------------------------------------
```

******Thong tin dinh tuyen cua Route R2 (Border Gateway)**

```
Border#sh ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is 212.212.212.14 to network 0.0.0.0

     192.168.12.0/30 is subnetted, 1 subnets
C       192.168.12.12 is directly connected, Serial1/0
     212.212.212.0/30 is subnetted, 1 subnets
C       212.212.212.12 is directly connected, Serial1/1
C    192.168.10.0/24 is directly connected, Loopback0
C    192.168.20.0/24 is directly connected, Loopback1
R    192.168.1.0/24 [120/1] via 192.168.12.13, 00:00:25, Serial1/0
R    192.168.2.0/24 [120/1] via 192.168.12.13, 00:00:25, Serial1/0
S*   0.0.0.0/0 [1/0] via 212.212.212.14
```

3. **Bước 3** : Cau hinh ISP Route

```
sh run
Building configuration...

Current configuration : 1424 bytes
!
version 12.4
service timestamps debug datetime msec
service timestamps log datetime msec
service password-encryption
!
hostname ISP
!
boot-start-marker
```

```
boot-end-marker
!
enable secret 5 $1$Nu1f$.vauVHqu4Fj5QKtNiY0sV0
enable password 7 110A1016141D
!
no aaa new-model
!
resource policy
!
ip subnet-zero
!
!
 --More-- ◘◘◘◘◘◘◘◘◘         ◘◘◘◘◘◘◘◘◘ip cef
no ip domain lookup
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
 --More-- ◘◘◘◘◘◘◘◘◘         ◘◘◘◘◘◘◘◘◘!
!
interface Loopback0
 ip address 1.1.1.1 255.255.255.255
!
interface FastEthernet0/0
 no ip address
 shutdown
 duplex half
!
interface Serial1/0
 ip address 212.212.212.14 255.255.255.252
 serial restart-delay 0
!
interface Serial1/1
 no ip address
 shutdown
 serial restart-delay 0
!
interface Serial1/2
```

```
 no ip address
 shutdown
 serial restart-delay 0
 --More-- ◘◘◘◘◘◘◘◘◘        ◘◘◘◘◘◘◘◘◘!
interface Serial1/3
 no ip address
 shutdown
 serial restart-delay 0
!
interface Serial1/4
 no ip address
 shutdown
 serial restart-delay 0
!
interface Serial1/5
 no ip address
 shutdown
 serial restart-delay 0
!
interface Serial1/6
 no ip address
 shutdown
 serial restart-delay 0
!
interface Serial1/7
 no ip address
 --More-- ◘◘◘◘◘◘◘◘◘        ◘◘◘◘◘◘◘◘◘ shutdown
 serial restart-delay 0
!
ip classless
ip route 0.0.0.0 0.0.0.0 212.212.212.13
!
no ip http server
no ip http secure-server
!
!
!
!
!
!
control-plane
!
!
!
!
!
!
gatekeeper
 shutdown
 --More-- ◘◘◘◘◘◘◘◘◘        ◘◘◘◘◘◘◘◘◘!
!
line con 0
 exec-timeout 0 0
 password 7 00121D161654
 logging synchronous
 login
 stopbits 1
line aux 0
 stopbits 1
line vty 0 4
 password 7 07192F5C5C06
 login
!
!
end

ISP#
```

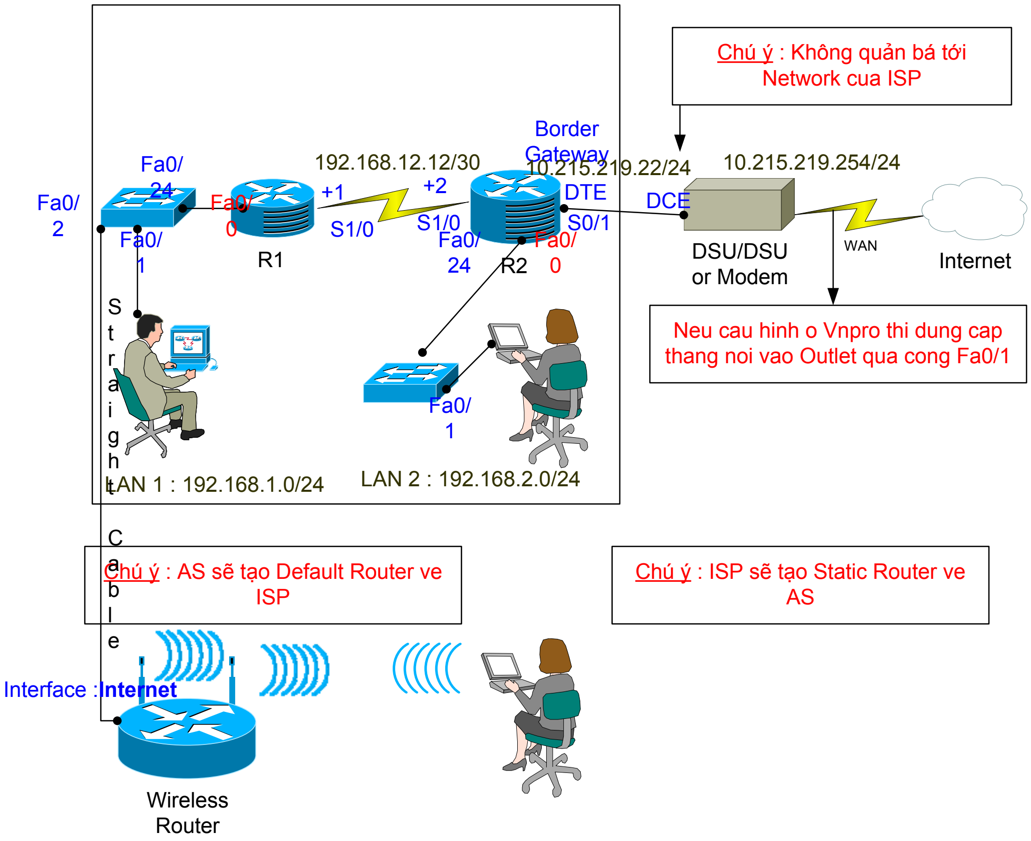
```
R1#telnet 1.1.1.1
Trying 1.1.1.1 ... Open


User Access Verification

Password:
ISP>
```

==➔ Qua trinh ket noi da thanh cong !!!

CAU HINH MOT HE THONG THUC TE



-Buoc 1: kiem tra DTE hay DCE

+Gan Cap Serial vao 2 cong Serial cua Router,kiem tra trang thai xem co UP-UP chua

+Neu UP-UP thi kiem tra

```
R1#sh controllers s1/0
```

→Kiem tra dau cap V35 loai nao dang ket noi toi cong serial cua minh (DTE- DCE)

+Neu la DCE ----> thi cap xung

Trong truong hop nay R2 la DCE

```
R2(config)#int s1/0
R2(config-if)#clock rate 64000
```

----> tat 10s roi no shut lai

-Buoc 2 : Dat IP cho cong Serial cho 2 Router
+ R1: 192.168.12.13 255.255.255.252
+ R2: 192.168.12.14 255.255.252.252
Ping kiem tra ket noi giua 2 Router bang cong Serial
-Buoc 3 : Cau hinh SDM cua R1
+ DHCP : Ca 2 pool 192.168.1.0/24 va 192.168.2.0/24
+ DNS1: 210.245.31.130
DNS2: 203.113.188.1

*****Chu y : R2 ko can cau hinh vi R1 se cau hinh 2 Pool cap dia chi IP cho ca 2 LAN

-Buoc 4 : Cau hinh RIP

```
        + R1
                R1(config-router)#network 192.168.1.0
                R1(config-router)#network 192.168.12.0
        +R2 Default Route toi Internet (ISP)
                R2(config-router)#network 192.168.12.0
                R2(config-router)#netwok 192.168.2.0
                Dat IP cho cong Fa0/1 cua Router R2
                        #10.215.219.22 255.255.255.0
                R2(config)#ip route 0.0.0.0 0.0.0.0 10.215.219.254
        =====➔ Kiem tra ket noi tu LAN1 sang LAN2: ping 10.215.219.22

                ping 10.215.219.254 khong the duoc vi ta chua NAT(o buoc sau)
```

- Buoc 5 : Muon ben LAN2(Router R2) nhan IP Dynamic cho ca Client trong LAN2 (binh thuong ko cap duoc vi khac Subnet)

```
R2(config)# int fa0/0 --------> Vao Interface tren Router R2 noi voi Switch.
R2(config-if)# ip helper-address <IP cua Router lam DHCP server> ---> Bat ki IP nao ket noi truc tiep tren Router dong vai tro lam DHCP.
```

Example: (config-if)# ip helper-address 192.168.12.13

- Buoc 6:

Router Border gateway khong tu dong quang ba Default Route ma no co cho cac Router ben trong cung AS voi no.Muon cho Router Border Gateway quang ba default Router cho cac Router ben trong cung AS ta phai thuc hien cau lenh

```
R2(config)#router rip
R2(config-router)#default-information originate
```

- Buoc 7 : Kiem tra co dong bo thoi gian giua 2 ben thoi gian ko????

```
R1#sh clock detail
*11:41:02.623 UTC Thu Nov 8 2007
Time source is hardware calendar
```

Nguyen ly dong bo thoi gian :

```
R1#conf ter
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#hostname R1 --→ nham kiem tra qua trinh dong bo thoi gian
R1(config)#^Z ----> Bam Ctr + Z
R1#
*Nov  8 11:44:12.387: %SYS-5-CONFIG_I: Configured from console by console -----> Log Message (chua dong bo voi R2)
R1#
```

` -Buoc 1: xac dinh 1 thiet bi lam NTP Master(Network Time Protocol) trong he thong la thiet bi dong vai tro lam moc thoi gian chuan

+Trong vi du nay ta chon R2

+Cau hinh thoi gian chuan trong thiet bi

```
        R2#clock set <hh:mm:ss>  <Month:3 ky tu>  <Day:2 so>  <Year: 4 so>
        exp:    R2#clock set 11:49:20 Nov 08 2007
        + xac dinh vai tro NTP Master
        R2(config)#NTP master
```

-<u>Buoc 2</u>: Cac thiet bi con lai trong he thong se cau hinh dong bo thoi gian voi NTP master

+ Chi dinh dia chi Ip cua NTP Master

```
R1(config)#ntp server 192.168.12.14
```

+ cap nhat lai dong ho thiet bi cua minh

```
R1(config)#ntp update-calendar
```

Kiem tra giong nhau chua

```
R1#sh clock detail
12:06:19.617 UTC Thu Nov 8 2007
Time source is NTP
```

-----> Da dong bo thoi gian.

- Buoc 8 : NAT(Network Address Translation)

-Chuyen doi nhung IP cua nguoi dung trong LAN thanh ra nhung dia chi IP Public de giup cho nguoi dung co the giao tiep Internet
+ Inside Local: La nhung day dia chi cua nguoi dung trong mang LAN
+ Inside Global: La 1 hoac nhieu dia chi Ip(no thuong la Public) cho cac day dia chi Inside Local giao tiep voi Internet.
-Khi nguoi dung trong LAN giao tiep voi Internet. Source IP cua nguoi dung se duoc chuyen doi Inside Global (10.215.219.22)

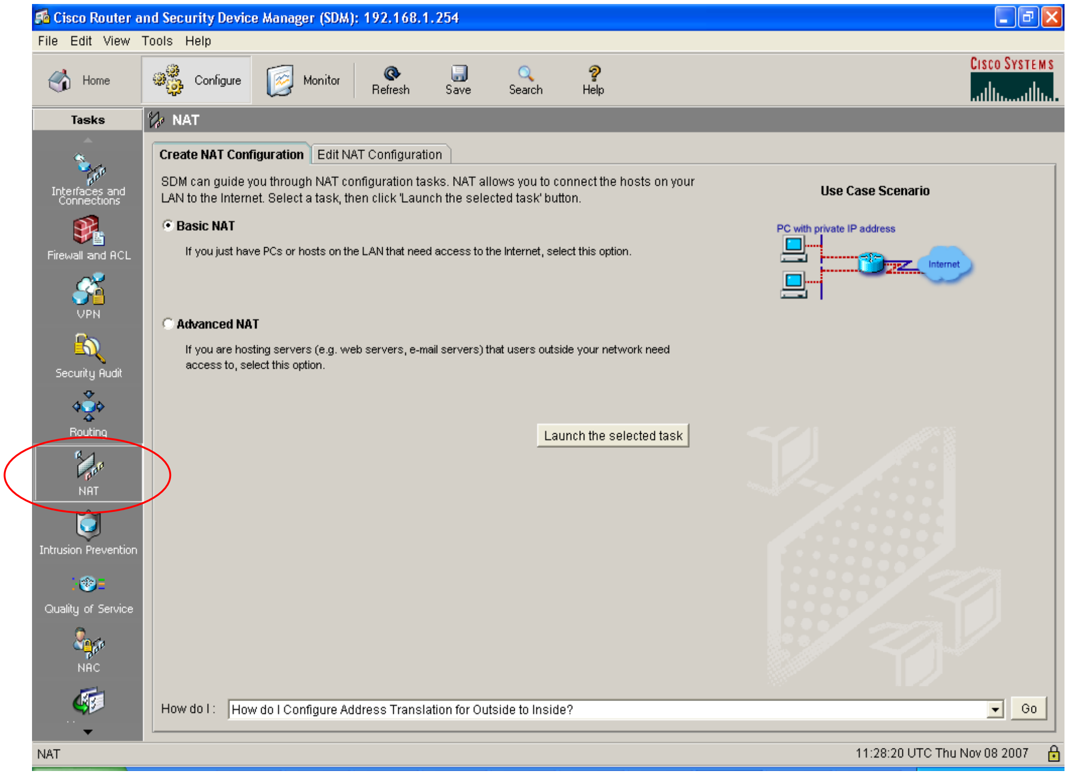
-Co che anh xa nhieu Inside Local sang 1 Inside Global thi phai kem theo gia tri Source Port (> 1024) goi la Port Address Translation (PAT) hay NAT Overloading

<u>*** Chu y:</u> nhieu Inside Local sang nhieu Inside Global goi la Dynamic NAT

<u>Cach lam:</u> Cac buoc trien khai PAT tren Router Border Gateway (R2) bang SDM

*** Vao giao dien SDM

-Buoc 1: a>Chon NAT



SDM can guide you through NAT configuration tasks. NAT allows you to connect the hosts on your LAN to the Internet. Select a task, then click 'Launch the selected task' button.

● Basic NAT

If you just have PCs or hosts on the LAN that need access to the Internet, select this option.

○ Advanced NAT

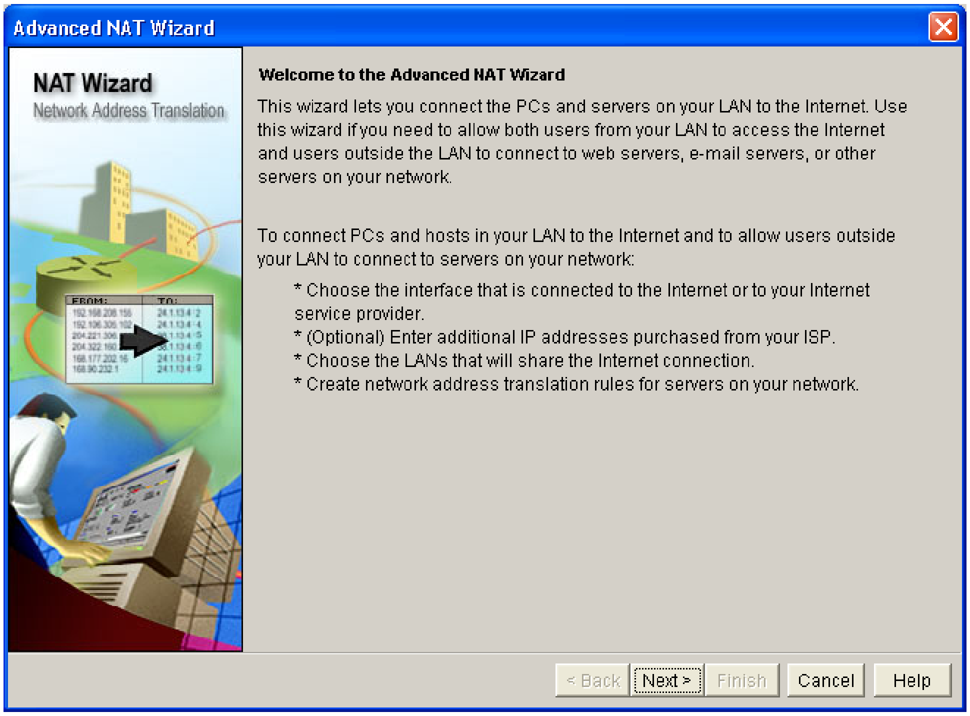
If you are hosting servers (e.g. web servers, e-mail servers) that users outside your network need access to, select this option.

How do I : How do I Configure Address Translation for Outside to Inside?

11:28:20 UTC Thu Nov 08 2007

+Basic NAT chi NAT tren 1 LAN ket noi truc tiep
+Chon Advanced NAT(theo yeu cau de bai ta co 2 Inside Local: 2 LAN)

b>Tiep theo chon Button Launch the selected task



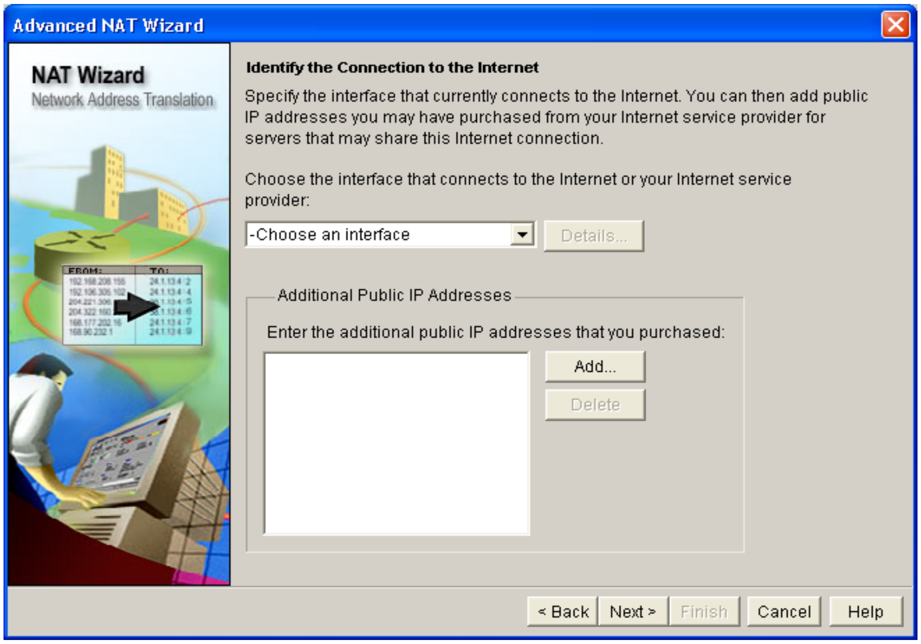
Welcome to the Advanced NAT Wizard

This wizard lets you connect the PCs and servers on your LAN to the Internet. Use this wizard if you need to allow both users from your LAN to access the Internet and users outside the LAN to connect to web servers, e-mail servers, or other servers on your network.

To connect PCs and hosts in your LAN to the Internet and to allow users outside your LAN to connect to servers on your network:

* Choose the interface that is connected to the Internet or to your Internet service provider.
* (Optional) Enter additional IP addresses purchased from your ISP.
* Choose the LANs that will share the Internet connection.
* Create network address translation rules for servers on your network.

C> Bam Next



Identify the Connection to the Internet

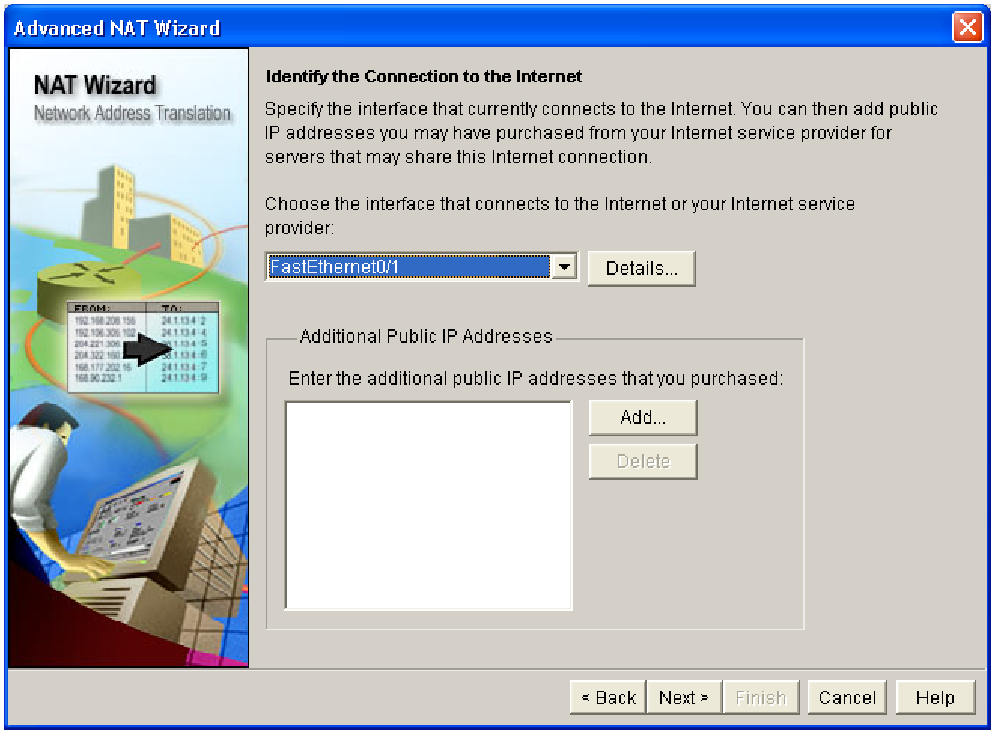
Specify the interface that currently connects to the Internet. You can then add public IP addresses you may have purchased from your Internet service provider for servers that may share this Internet connection.

Choose the interface that connects to the Internet or your Internet service provider:

-Choose an interface

Enter the additional public IP addresses that you purchased:

d> Chon Interface ra Internet, trong truong hop nay la Fa0/1(xem tren hinh ve) Day la Interface giao tiep voi Internet (trong truong hop o Vnpro la Interface giao tiep voi Outlet)



Identify the Connection to the Internet

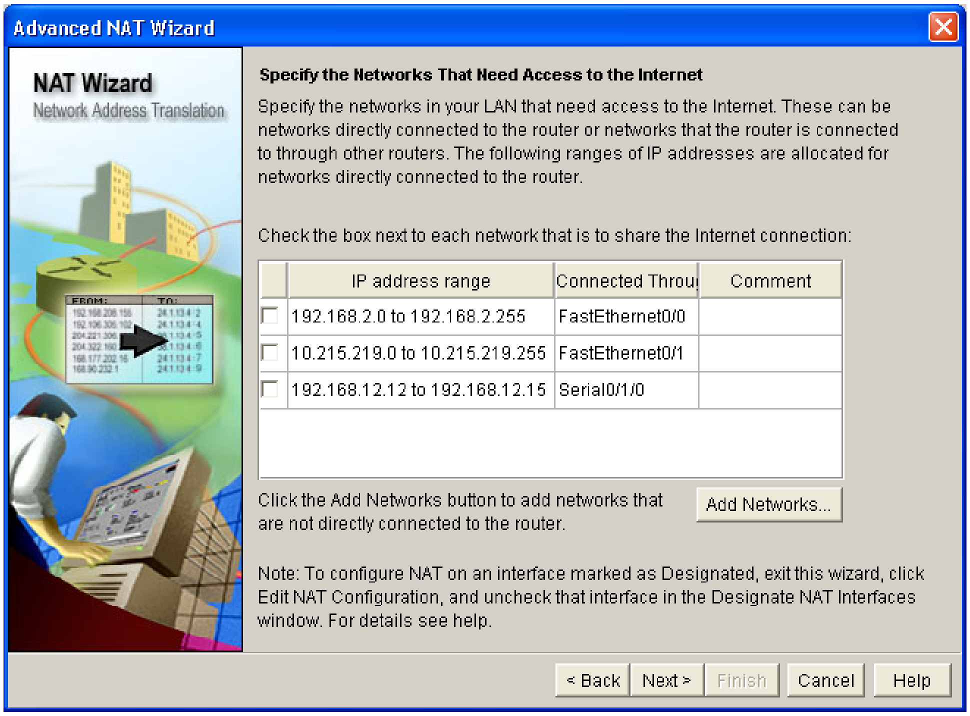
Specify the interface that currently connects to the Internet. You can then add public IP addresses you may have purchased from your Internet service provider for servers that may share this Internet connection.

Choose the interface that connects to the Internet or your Internet service provider:

FastEthernet0/1

Enter the additional public IP addresses that you purchased:

e > Bam Next



Advanced NAT Wizard

NAT Wizard
Network Address Translation

Specify the Networks That Need Access to the Internet

Specify the networks in your LAN that need access to the Internet. These can be networks directly connected to the router or networks that the router is connected to through other routers. The following ranges of IP addresses are allocated for networks directly connected to the router.

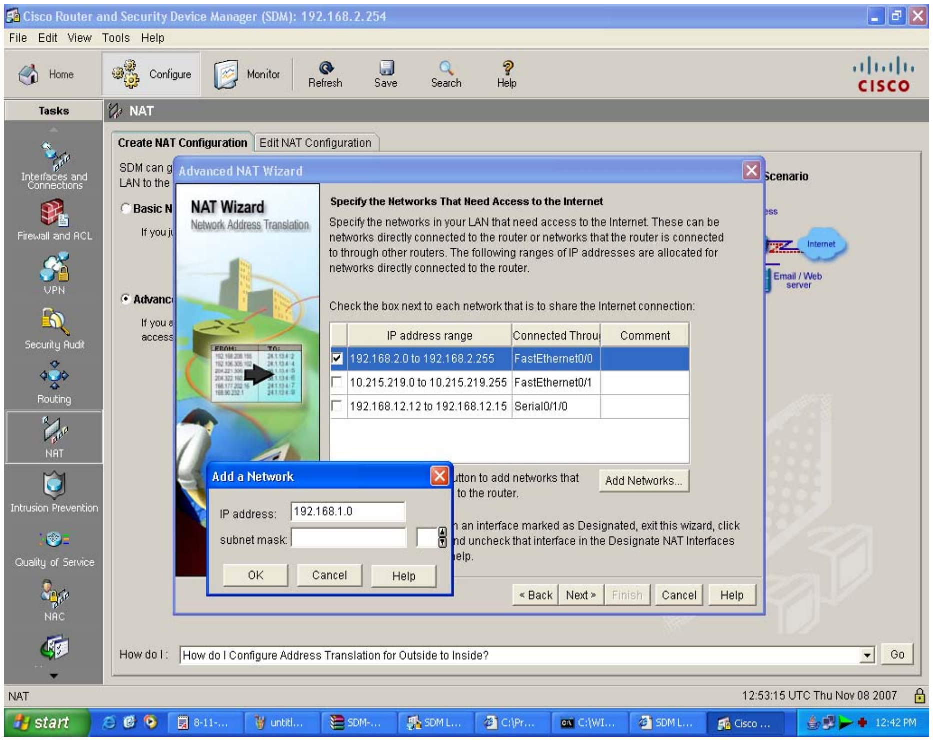
Check the box next to each network that is to share the Internet connection:

	IP address range	Connected Throu	Comment
☐	192.168.2.0 to 192.168.2.255	FastEthernet0/0	
☐	10.215.219.0 to 10.215.219.255	FastEthernet0/1	
☐	192.168.12.12 to 192.168.12.15	Serial0/1/0	

Click the Add Networks button to add networks that are not directly connected to the router.

Note: To configure NAT on an interface marked as Designated, exit this wizard, click Edit NAT Configuration, and uncheck that interface in the Designate NAT Interfaces window. For details see help.

f> <u>Xac dinh day Inside Local</u>
Chon cac dia chi ra Internet (192.168.2.0)
Vi ta con cac dia chi LAN 1 cung can ra Internet nen ta fai Add them 1 Network nua
Bam vao Add Networks…



Cisco Router and Security Device Manager (SDM): 192.168.2.254

NAT

Advanced NAT Wizard

Specify the Networks That Need Access to the Internet

Specify the networks in your LAN that need access to the Internet. These can be networks directly connected to the router or networks that the router is connected to through other routers. The following ranges of IP addresses are allocated for networks directly connected to the router.

Check the box next to each network that is to share the Internet connection:

	IP address range	Connected Throu	Comment
☑	192.168.2.0 to 192.168.2.255	FastEthernet0/0	
☐	10.215.219.0 to 10.215.219.255	FastEthernet0/1	
☐	192.168.12.12 to 192.168.12.15	Serial0/1/0	

Add a Network

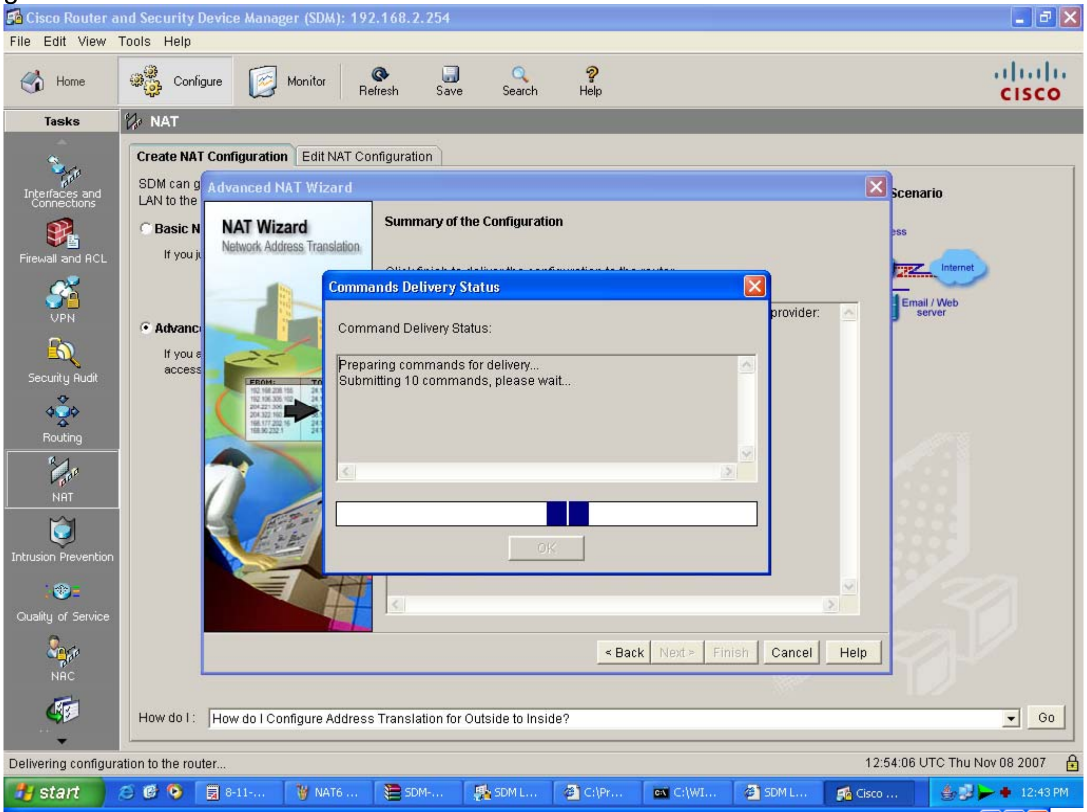
IP address: 192.168.1.0
subnet mask:

How do I: How do I Configure Address Translation for Outside to Inside?

NAT 12:53:15 UTC Thu Nov 08 2007

Nhap IP: 192.168.1.0 va Subnet Mask: 255.255.255.0

g> Bam Next



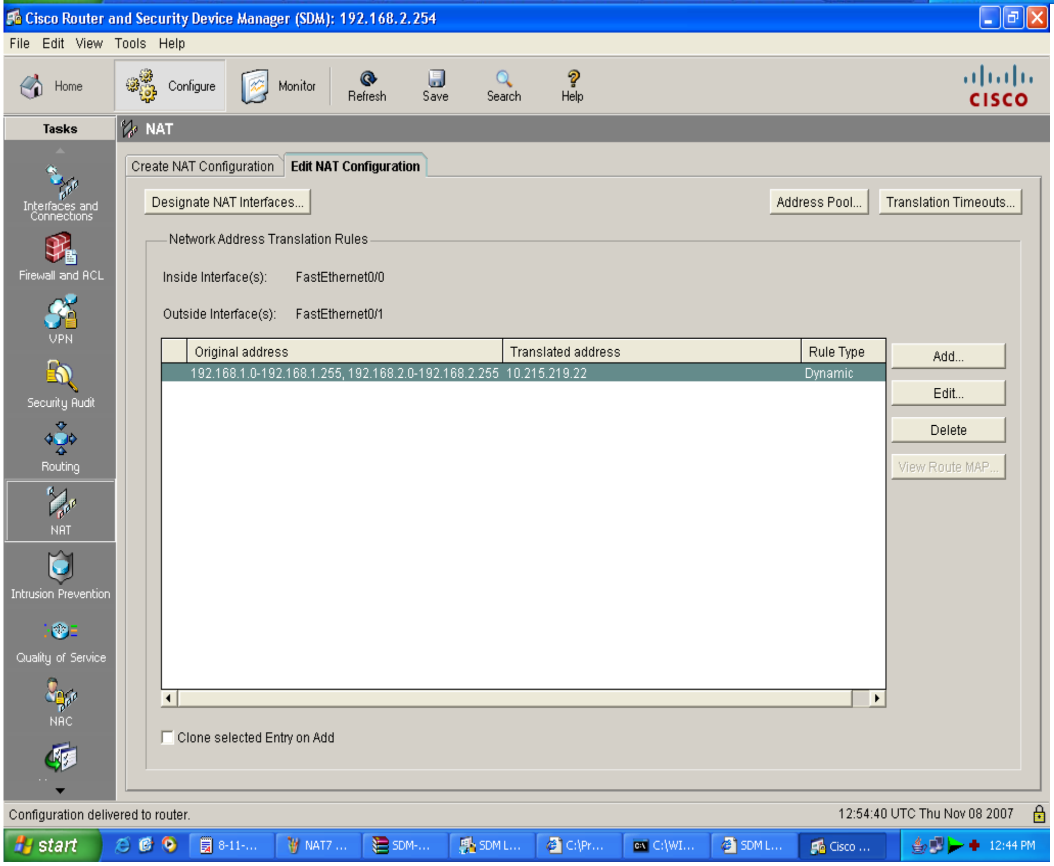
Command Delivery Status:

Preparing commands for delivery...
Submitting 10 commands, please wait...

How do I : How do I Configure Address Translation for Outside to Inside?

Delivering configuration to the router...

12:54:06 UTC Thu Nov 08 2007



Network Address Translation Rules

Inside Interface(s): FastEthernet0/0

Outside Interface(s): FastEthernet0/1

Original address	Translated address	Rule Type
192.168.1.0-192.168.1.255, 192.168.2.0-192.168.2.255	10.215.219.22	Dynamic

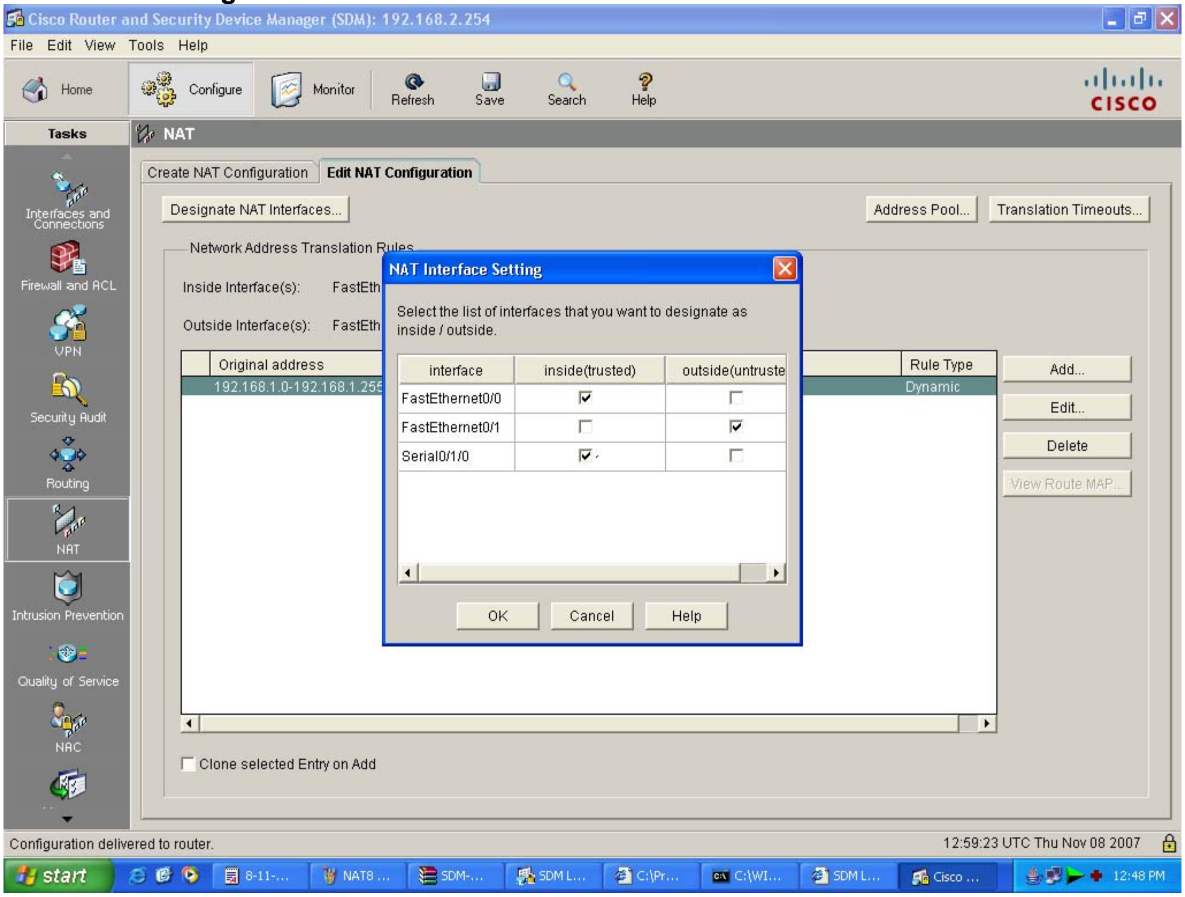
☐ Clone selected Entry on Add

Configuration delivered to router.

12:54:40 UTC Thu Nov 08 2007

h> Xac dinh cac Interface Inside va OutSide

Chon button **Designate NAT Interfaces …**



NAT

Network Address Translation Rules

Inside Interface(s): FastEth

Outside Interface(s): FastEth

Original address	Rule Type
192.168.1.0-192.168.1.255	Dynamic

☐ Clone selected Entry on Add

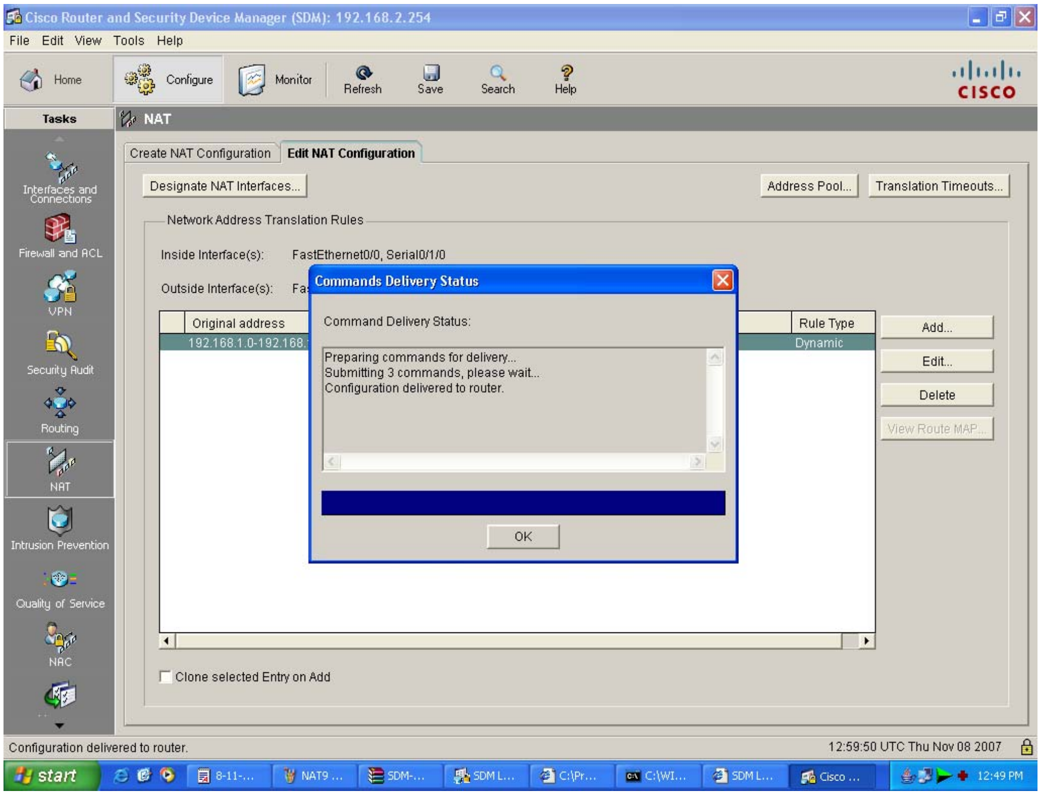
NAT Interface Setting

Select the list of interfaces that you want to designate as inside / outside.

interface	inside(trusted)	outside(untruste
FastEthernet0/0	☑	☐
FastEthernet0/1	☐	☑
Serial0/1/0	☑	☐

Configuration delivered to router.

12:59:23 UTC Thu Nov 08 2007



Inside Interface(s): FastEthernet0/0, Serial0/1/0

Outside Interface(s): Fa

Original address	Rule Type
192.168.1.0-192.168.	Dynamic

☐ Clone selected Entry on Add

Command Delivery Status:

```
Preparing commands for delivery...
Submitting 3 commands, please wait...
Configuration delivered to router.
```

Configuration delivered to router.

12:59:50 UTC Thu Nov 08 2007

i> Nhan Ok de ket thuc
j> Nhan Button Save de luu lai cau hinh

- Buoc 9:

```
R1#ping 66.94.234.13 (YAHOO)

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 66.94.234.13, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 668/685/724 ms
R1#
```

- Buoc 10 : Xem Bang NAT :

```
R2#sh ip NAT translations

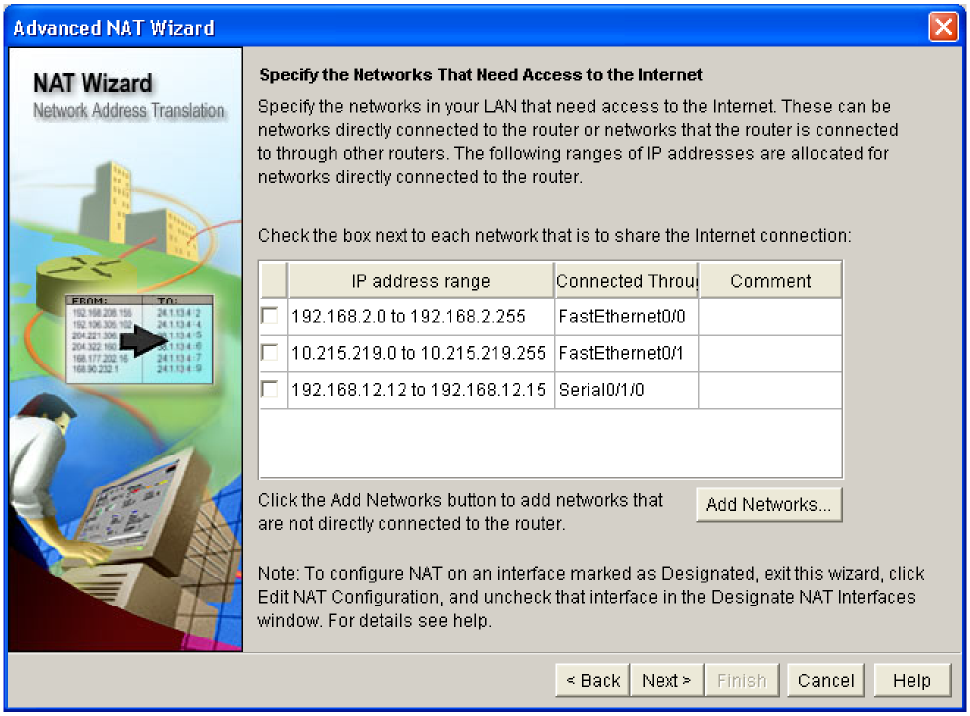
Pro Inside global      Inside local       Outside local      Outside global

udp 10.215.219.22:1031 192.168.1.100:1031 210.245.31.130:53  210.245.31.130:53
tcp 10.215.219.22:1156 192.168.1.100:1156 207.46.193.254:80  207.46.193.254:80
tcp 10.215.219.22:1157 192.168.1.100:1157 211.206.123.219:80 211.206.123.219:80
tcp 10.215.219.22:1158 192.168.1.100:1158 210.245.31.22:80   210.245.31.22:80
tcp 10.215.219.22:1159 192.168.1.100:1159 210.245.31.22:80   210.245.31.22:80
udp 10.215.219.22:1041 192.168.2.2:1041   210.245.31.130:53  210.245.31.130:53
tcp 10.215.219.22:1186 192.168.2.2:1186   64.233.189.104:80  64.233.189.104:80
tcp 10.215.219.22:1187 192.168.2.2:1187   209.191.93.150:443 209.191.93.150:443
tcp 10.215.219.22:1188 192.168.2.2:1188   68.180.207.182:80  68.180.207.182:80
```

```
R2#debug ip NAT
IP NAT debugging is on
R2#terminal monitor (Vi dang o Router 1 Telnet toi R2)

Nov 8 13:10:49.739: NAT: s=192.168.1.100->10.215.219.22, d=210.245.31.130 [4195]
-> 192.168.1.100: (Inside Local), 10.215.219.22(Inside Global), 210. 245.31.130: Out Global
Nov  8 13:10:49.759: NAT: s=210.245.31.130, d=10.215.219.22->192.168.1.100 [16417]
Nov  8 13:10:49.795: NAT*: s=192.168.1.100->10.215.219.22, d=207.46.19.254 [4196]
Nov  8 13:10:49.803: NAT*: s=207.46.19.254, d=10.215.219.22->192.168.1.100 [0]
Nov  8 13:10:49.815: NAT*: s=192.168.1.100->10.215.219.22, d=207.46.19.254 [4198]
Nov  8 13:10:49.851: NAT*: s=192.168.1.100->10.215.219.22, d=207.46.19.254 [4199]
Nov  8 13:10:49.859: NAT*: s=207.46.19.254, d=10.215.219.22->192.168.1.100 [34337]
Nov  8 13:10:50.279: NAT*: s=207.46.19.254, d=10.215.219.22->192.168.1.100 [34338]
Nov  8 13:10:50.383: NAT: s=192.168.1.100->10.215.219.22, d=210.245.31.130 [4201]
Nov  8 13:10:50.399: NAT: s=210.245.31.130, d=10.215.219.22->192.168.1.100 [17653]
Nov  8 13:10:50.431: NAT*: s=192.168.1.100->10.215.219.22, d=211.206.123.219 [4202]
Nov  8 13:10:50.531: NAT*: s=192.168.1.100->10.215.219.22, d=207.46.19.254 [4204]
Nov  8 13:10:59.035: NAT: expiring 10.215.219.22 (192.168.2.2) tcp 1196 (1196)
Nov  8 13:11:01.683: NAT*: s=192.168.2.2->10.215.219.22, d=60.254.131.177 [2851]
Nov  8 13:11:01.683: NAT*: s=192.168.2.2->10.215.219.22, d=60.254.131.177 [2853]
Nov  8 13:11:04.667: NAT: expiring 10.215.219.22 (192.168.2.2) tcp 1199 (1199)
Nov  8 13:11:04.667: NAT: expiring 10.215.219.22 (192.168.2.2) tcp 1198 (1198)
Nov  8 13:11:04.687: NAT*: s=192.168.2.2->10.215.219.22, d=60.254.131.177 [2855]
Nov  8 13:11:04.687: NAT*: s=192.168.2.2->10.215.219.22, d=60.254.131.177 [2856]
Nov  8 13:11:07.707: NAT*: s=60.254.131.177, d=10.215.219.22->192.168.2.2 [0]
Nov  8 13:11:07.707: NAT*: s=60.254.131.177, d=10.215.219.22->192.168.2.2 [0]
All possible debugging has been turned off
R2#u all
All possible debugging has been turned off
```

- Buoc 11: Trong truong hop gan them thiet bi phat song Wireless thi khi lam NAT phai them Interface Wireless tai buoc nay.



Specify the Networks That Need Access to the Internet

Specify the networks in your LAN that need access to the Internet. These can be networks directly connected to the router or networks that the router is connected to through other routers. The following ranges of IP addresses are allocated for networks directly connected to the router.

Check the box next to each network that is to share the Internet connection:

	IP address range	Connected Throu	Comment
☐	192.168.2.0 to 192.168.2.255	FastEthernet0/0	
☐	10.215.219.0 to 10.215.219.255	FastEthernet0/1	
☐	192.168.12.12 to 192.168.12.15	Serial0/1/0	

Click the Add Networks button to add networks that are not directly connected to the router.

Note: To configure NAT on an interface marked as Designated, exit this wizard, click Edit NAT Configuration, and uncheck that interface in the Designate NAT Interfaces window. For details see help.

INTERSITE WAN LINK

Mo hinh ket noi:

R1 (s0/1/0) (+1) ------------- 212.212.212.12/30-------------R2 (+2) (Serial0/2/0)

- **Cau hinh Router R1**:

+B1: Cam cap V35 (chua cau hinh IP Address)
+B2: Kiem tra DTE-DCE

```
R1#sh control s0/1/0
```

+B3: Neu la DCE Cap xung

```
R1(config)# clock rate 64000
------
R1(config)#
R1#sh ip int bri
Interface              IP-Address      OK? Method Status              Prot
ocol
FastEthernet0/0        unassigned      YES unset  administratively down down

FastEthernet0/1        unassigned      YES unset  administratively down down

Serial0/1/0            212.212.212.13 YES manual up                   up

Serial0/3/0            unassigned      YES unset  down                dow
```

```
R1#ping 212.212.212.14

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 212.212.212.14, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 28/28/28 ms
```

- **Cau hinh Router R2** :

```
R2#sh ip int bri
Interface              IP-Address      OK? Method Status                Prot
ocol
FastEthernet0/0          192.168.2.254   YES manual up                    down

FastEthernet0/1          unassigned      YES unset  administratively down down

Serial0/1/0            unassigned      YES unset  administratively down down

Serial0/2/0            212.212.212.14  YES manual up                    up

Serial0/3/0            unassigned      YES unset  administratively down dow
```

**** Cac ky thuat Internet WAN ****

- DSL
- Cable Modem

1. **Point To Point**: Lease Line

-Ket noi dang Full Mess, Cong Thuc tinh so ket noi
n la so Route : n.(n-1)/2
-Chuan dong goi Layer 2 trong ket noi Inter Site WAN Link dang Point-To-Point:
+ HDLC (Hight Lever Datalink Control) la chuan dong goi Layer 2 mac dinh tren tat ca cac thiet bi Cisco
+ PPP (Point to Point Protocol)

Kiem tra:

```
R1#sh int s0/1/0
Serial0/1/0 is up, line protocol is up
  Hardware is GT96K Serial
  Internet address is 212.212.212.13/30
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec,
     Reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation HDLC, loopback not set
  Keepalive set (10 sec)
  Last input 00:00:07, output 00:00:00, output hang never
  Last clearing of "show interface" counters 00:39:07
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: weighted fair
  Output queue: 0/1000/64/0 (size/max total/threshold/drops)
     Conversations  0/1/256 (active/max active/max total)
     Reserved Conversations 0/0 (allocated/max allocated)
     Available Bandwidth 1158 kilobits/sec
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     295 packets input, 20119 bytes, 0 no buffer
     Received 231 broadcasts, 0 runts, 0 giants, 0 throttles
     1 input errors, 1 CRC, 1 frame, 1 overrun, 0 ignored, 0 abort
     317 packets output, 20251 bytes, 0 underruns
     0 output errors, 0 collisions, 9 interface resets
     0 output buffer failures, 0 output buffers swapped out
     4 carrier transitions
     DCD=up  DSR=up  DTR=up  RTS=up  CTS=up
```

2. Point to Multi Point

-Cong nghe Frame Relay, X25(cong nghe lau doi).....
-Cong nghe khac chuan dong goi se khac
+ Trong LAN la 802.3
+ Ngoai WAN
====> Doi hoi phai co su tuong thich ve chuan dong goi Layer 2 giua 2 dau ket noi thi mach moi hoat dong **(UP - UP)**
R1 (HDLC) -------------Internet-------------R2 (HDLC)
R1 (PPP) -------------Internet-------------R2 (PPP)
-----> UP UP

R1 (HDLC) Cisco -------------Internet-------------R2 (PPP) Juniper
-----> UP DOWN

Kiem tra:

R1 (HDLC) Cisco -------------Internet-------------R2 (PPP) Juniper

vi du :
-B1:

```
R1(config)#int s0/1/0
R1(config-if)#encapsulation ppp
R1(config-if)#
```

-B2:

```
R1(config-if)#do sh ip int bri
Interface                  IP-Address      OK? Method Status                Prot
ocol
FastEthernet0/0            unassigned      YES unset administratively down down

FastEthernet0/1            unassigned      YES unset administratively down down

Serial0/1/0                212.212.212.13 YES manual up                    down
```

--> Chuan dong goi khac nhau nen se bi UP-DOWN

```
Serial0/3/0                unassigned      YES unset down                  down
```

-B3:

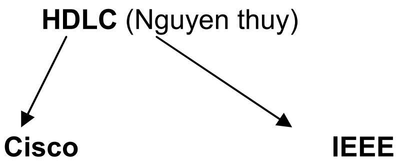
```
R1(config-if)#do sh int s0/1/0
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec,
    reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation PPP, LCP Open
  Open: CDPCP, IPCP, loopback not set
  Keepalive set (10 sec)
  Last input 00:00:01, output 00:00:00, output hang never
  Last clearing of "show interface" counters 00:02:48
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: weighted fair
  Output queue: 0/1000/64/0 (size/max total/threshold/drops)
    Conversations  0/1/256 (active/max active/max total)
    Reserved Conversations 0/0 (allocated/max allocated)
    Available Bandwidth 1158 kilobits/sec
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
    25 packets input, 502 bytes, 0 no buffer
    Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
    0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
    46 packets output, 636 bytes, 0 underruns
    0 output errors, 0 collisions, 8 interface resets
 --More--
*Nov 10 03:55:21.303: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1/
0, changed state to up
```

----------> Luc nay mach dang hoat dong

R1 (PPP) -------------Internet-------------R2 (PPP)

HDLC (NGUYEN THUY)

- Truyen cham
- Tin hieu Analog
- Co che phat trien va khac phuc loi kem
- Chi ho tro truyen data theo kieu Asynchronous (bat dong bo)



HDLC (cua Cisco)	PPP
+ Truyen nhanh + Truyen tin hieu Analog, Digital + Co che phat trien va khac phuc loi manh me + Ho tro truyen data vua theo kieu	+ Cung co tinh nang tuong tu HDLC + Ho tro nhieu Layer 3 hon khac nhau: IP, IPX, Apple + Ho tro tinh nang tuy chon mo rong bao gom:

Asynchronous, Synchronous + Ho tro chuan Layer 3 la IP	.Authentication .Multilink .Compress .Call Back

1. FRAMING

La co che (hoac luat) trong WAN: qui dinh giua 2 dau ket noi de thong nhat ve co che dong goi Frame, dieu khien qua trinh truyen nhan Frame.

2. SYNCHRONOUS

-Doi hoi phai co su dong bo ve xung nhip giua 2 thiet bi CSU/DSU giua 2 dau cua mach ket noi
-Tin hieu truyen la Digital
-Data truyen duoi dang la 1 Block cac Byte nen toc do nhanh hon.

3. ASYNCHRONOUS

-Khong doi hoi su ap dat su dong bo xung nhip giua 2 thiet bi dieu che giua 2 dau cua mach ket noi.
-Tin hieu truyen di la dang Analog
-Du lieu goi tung Byte

4. PPP (Layer 2)

1> Nhung thanh phan cua PPP:

- HDLC: La thanh phan giao tiep voi Layer 1, se qui dinh ra hinh thuc dong goi Frame phu hop tuy thuoc vao co che truyen thong (Asyn, Syn).

- LCP (Link Control Protocol):
+Co nhiem vu thiet lap, duy tri va ket thuc kenh truyen
+Kiem tra chat luong duong truyen
+Phat hien va khac phuc loi cua du lieu
+Thuc hien nhien vu thuong luong cac tuy chon trong qua trinh thiet lap kenh truyen
    + Authentication
    + Multilink
    + Compress
    + Call Back
-NCP (Network Control Protocol): co nhiem vu quy dinh hinh thuc dong goi Frame khac nhau tuy thuoc vao giao thuc Layer 3 khac nhau.

Kiem tra :

```
R2(config-if)#no encapsulation ppp

R1(config-if)# shut
R1(config-if)# no shut

Serial0/1/0 is up, line protocol is down
  Hardware is GT96K Serial
  Internet address is 212.212.212.13/30
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation PPP, LCP REQsent, loopback not set
  Keepalive set (10 sec)
  Last input 00:00:02, output 00:00:00, output hang never
  Last clearing of "show interface" counters 00:00:12
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: weighted fair
  Output queue: 0/1000/64/0 (size/max total/threshold/drops)
     Conversations 0/1/256 (active/max active/max total)
     Reserved Conversations 0/0 (allocated/max allocated)
     Available Bandwidth 1158 kilobits/sec
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     1 packets input, 24 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     7 packets output, 98 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets
     0 output buffer failures, 0 output buffers swapped out
```

```
R1#sh int s0/1/0

Serial0/1/0 is up, line protocol is down
  Hardware is GT96K Serial
  Internet address is 212.212.212.13/30
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation PPP, LCP Listen, loopback not set
  Keepalive set (10 sec)
  Last input 00:00:05, output 00:00:18, output hang never
  Last clearing of "show interface" counters 00:00:36
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: weighted fair
  Output queue: 0/1000/64/0 (size/max total/threshold/drops)
     Conversations 0/1/256 (active/max active/max total)
     Reserved Conversations 0/0 (allocated/max allocated)
     Available Bandwidth 1158 kilobits/sec
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     4 packets input, 86 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     10 packets output, 140 bytes, 0 underruns
     0 output errors, 0 collisions, 2 interface resets
     0 output buffer failures, 0 output buffers swapped out
 --More--
```

Kiem tra:

```
R1#sh int s0/1/0gured from conso
Serial0/1/0 is up, line protocol is up
  Hardware is GT96K Serial
  Internet address is 212.212.212.13/30
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
 Encapsulation PPP, LCP Open   -----> LCP Open thi NCP moi Open (CDPCP, IPCP
```

thanh phan cua NCP)

```
  Open: CDPCP, IPCP, loopback not set
  Keepalive set (10 sec)
  Last input 00:00:39, output 00:00:07, output hang never
  Last clearing of "show interface" counters 00:05:35
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: weighted fair
  Output queue: 0/1000/64/0 (size/max total/threshold/drops)
     Conversations  0/2/256 (active/max active/max total)
     Reserved Conversations 0/0 (allocated/max allocated)
     Available Bandwidth 1158 kilobits/sec
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     70 packets input, 3698 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     72 packets output, 3176 bytes, 0 underruns
     0 output errors, 0 collisions, 4 interface resets
```

5. PPP FRAME FORMAT

-Flag: goi 1 truong co **01111110** bao bat dau gui Frame va ket thuc Frame
-Address:
-Control:
-Protocol:
  0021(Hex): Internet Pro
  0029(Hex): AppleTalk
  002B (Hex): Novell IPX
  8021: Internet Protocol Control Protocol
  8029: Appletalk Control Protocol
  802B: Novell IPX Control Protocol
  C021: Link Control Protocol
  C023: Authencation Protocol
-Data:
-FCS:
Khi mach khong co trao doi du lieu trong 1 khoang thoi gian thi mach se trao doi voi nhau nhung Idle Frames (La nhung bit 0, 1 roi rac)
De tranh truong hop nham voi Data nguoi ta se them mot bit 0 vao sau bit thu 5 tinh tu ben phai qua

011111100.11011110.01111110

WIRELESS LAN

1. **Gioi thieu**:

-Cung cap tinh co dong (Flexibility) uyen chuyen cho nguoi dung.
- Mo rong cua LAN
-Moi truong truy xuat CSMA/CA (Carrier Sense Multiple Access/Collision Avoidance)

2. **Service Set Area**: WLAN (giong Broadcast Domain trong LAN) :la tap trung tat ca cac

thiet bi khong day cung hoat dong chung duoi 1 su quan tri nao do. Su dung chung 1 Network

3.**Cac thiet bi Wireless**:
- Wireless NIC
- Acess Point(giong HUB LAN): la thiet bi phat song radio va no taio ra 1 vung hoat dong Service Set Area cho cac may tinh su dung Wireless ket noi.
  + Mot Access Point thuong co 2 Interface chinh.
    * Interface Ethernet : de ket noi voi LAN de tro thanh 1 phan mo rong cua LAN
    * Interface Radio (Anten): phat song radio de tao moi truong truy xuat cho nguoi dung ko day.
  + Doi voi Access Point cac Interface su dung cung Network (Subnetwork)
  + Dong goi va chuyen dinh dang Frame

4. **Wireless Router** :
- Chuc nang giong nhu AP
- Hai Interface Radio va Ethernet thuoc 2 Network/Subnetwork khac nhau
- Cung cap kha nang dinh tuyen.

***Luu y: Giao tiep giua cac thiet khong day trong cung 1 Service Set Area doi hoi ve su tuong thich giua cac chuan ko day

5. **Cac chuan WLAN**:

- **802.11b** :
+La chuan Wireles phat ra song radio duoc dieu che theo ki thuat DSSS(Direct Sequence Spread Spectrum: trai pho chuoi truc tiep)
+Tan so 2,4 Ghz, phat ra 11 kenh khac nhau (1-> 11) voi toc do toi da 11Mbps
+ Hai thiet bi phat song 802.11b neu cung phat ra 2 kenh giong nhau hoac gan nhau thi tin hieu se nhieu va triet tieu lan nhau.
Do do neu ta thiet lap 1 Service Set Area co nhieu hon 1 thiet bi phat song chuan 802.11b thi cac thiet bi phai dam bao cung phat ra song Radio voi kenh truyen cach nhau la 5.Ta co the tao 1 Service Set Area su dung chuan 802.11b voi toi da 3 thiet bi phat song.(Thiet bi co kenh 1,Thiet bi co kenh 6,Thiet bi co kenh 11)

- **802.11a:**
+La chuan Wireles phat ra song radio duoc dieu che theo ki thuat OFDM(Orthogonal Fregency Division Multiplexing Ghep kenh phan chia tang so truc giao):
+ Tan so 5Ghz
+ Phat ra 23 kenh(1-23) voi toc do toi da la 54 Mbps
Do do ta co the tao toi da 1 Service Set Area su dung chuan 802.11a thi cac thiet bi phai dam bao cung phat ra song Radio voi kenh truyen cach nhau la 2 voi tan so la 12 thiet bi phat song.

-802.11g:
+La chuan Wireles phat ra song radio duoc dieu che theo ki thuat
  . DSSS: 11Mbps
  . OFDM: 54Mbps

6. Mot so mo hinh mang ko day co ban:
- **Adhoc (Independent Basic Service Set IBSS)**:
Mot mo hinh Wireless LAN co ban bao gom 2 may tinh co card mang Wireless giao tiep voi nhau.
- **Basic Service Set (BSS)** :la 1 mo hinh Wireless LAN bao gom co 1 thiet bi phat song

Radio(AP,WR) va cac PC co card Wireless
Truyen thong giao tiep giua cac PC trong Service Set Area se gui den AP, WR
Sau do AP,WR moi goi data den dich

7.**Extensible Service Set (ESS):**
-La 1 mo hinh Wireless LAN bao gom nhieu hon 1 thiet bi phat song Radio(Cac thiet bi phat song nay phai phat ra kenh dam bao khong bi nhieu va triet tieu nhau)
-Nguoi dung khi o gan thiet bi phat song nao thi se ket noi voi thiet bi phat song do, khi nguoi dung di chuyen ra khoi tam phu song cua 1 thiet bi phat song nao do thi may tinh nguoi dung se ket noi voi thiet bi phat song khac
-De cho su chuyen vung cua nguoi dung ko bi mat ket noi thi ta duoc khuyen nen tao ra 1 vung chong chap giua 2 thiet bi phat song voi do lon khoang 10-15%

8. **Mot so tinh chat cua Wireles LAN:**

- Truyen thong Half Dupleft
- Tin hieu song Radio phat di ra ngoai ko khi se bi anh huong boi nhieu yeu to
  + Radio bi hap thu vat can ---> suy yeu tin hieu
  + Phan xa,nhieu xa ---> Song bi lech pha,triet tieu lan nhau.
  + Bi anh huong cua cac thiet bi phat song khac: Cord less Phone, Viba, TV.....

*** Mot so yeu to can nhac khi thiet ke mang ko day:
- Thiet bi phat song su dung Anten loai nao, Cong suat ra sao.
  + Dang huong
  + Don huong
  + Voi Anten co cong suat cao,phat ra tan so cao,tam cao phai cang hep

**** Thuc hien cong viec : Site Survey(Router:Aironet AP phat song 300m)
9. Bao mat:
- Chung thuc
-Ho tro ma hoa du lieu
- bang phuong thuc
 + PSK(Preshared Key)
   . Key tinh
   . co nguy co bi Crack de dang
+ WPA
   . Hinh thuc chung thuc la bat buoc
   . Thuat toan ma hoa phuc tap
   . Key dong, thay doi lien tuc
   Gom 2 loai:
    * Personal :CSDL chung thuc nguoi dung duoc luu cuc bo tren thiet bi phat song
    * Enterprise:CSDL chung thuc User duoc luu tren 1 may chu chung thuc rieng.

Khi User muon ket noi voi AP thi User se duoc yeu cau chung thuc. Thong tin chung thuc User duoc gui tu User se duoc AP chuyen den Server de chung thuc.
Thong tin chung thuc trao doi giua Server va AP duoc ma hoa manh me

CACH THUC TRIEN KHAI MOT WIRELESS LAN

1.Thuc hien cong viec Site Survey
2. Lua chon cac thiet bi phat song phu hop
 - Tam phu song
- Mat do bao phu
- So luong nguoi dung -→ Mot thiet bi phat song ho tro tot khoang 30 User Wireless.
- Loai Anten
- Cong suat Anten

- Cac chuan Wireless phu hop
3. Cau hinh co ban cho 1 thiet bi phat song
- Cau hinh Static IP
- Cau hinh dich vu DHCP de cap IP dong cho gnuoi su dung Wireless
- Thong so : SSID (Service Set Indentification): ten cua Service Set Area.Phai dong nhat tren tat ca cac thiet bi phat song trong cung 1 Service Set Area.
4.Cau hinh kieu chung thuc.
5. Cau hinh kieu ma hoa.

BT:

TIEN TRINH THIET LAP KET NOI

1.Cac thiet bi phat song Radio (AP,WR)
AP sau khi cau hinh mac dinh no se Broadcast ra Service Set Area cua no bao gom cac thong tin.
+ SSID
+ Tan so
+ Kenh
+ Authentication
+ Encryption
+ DHCP
2. Wireless User: PC, Laptop su dung Windows mac dinh se phat hien thong tin Broadcast tu AP voi cong cu: Zero Configuration Utility (ZCF) duoc tinh hop ben trong he dieu hanh Windows se giup cho cac Wireless User se tu dong ket noi AP.
Neu Access Point ko cau hinh chung thuc hoac no se dua 1 Wizard de giup user nhap password neu nhu Access Point yeu cau chung thuc.
3. Mot so cach khac phuc diem yeu cua Web:
-Diable tinh nang cua AP(SSID Cloaking)
- Loc ra MAC Filter: dinh nghia ra cac MAC cho phep ket noi toi AP

WR LINKSYS

Cac Interface:
1. Internet
2. Radio (Wireless)

PHẦN 2: CCNA

CCNA

Virtual Lan (Vlan)

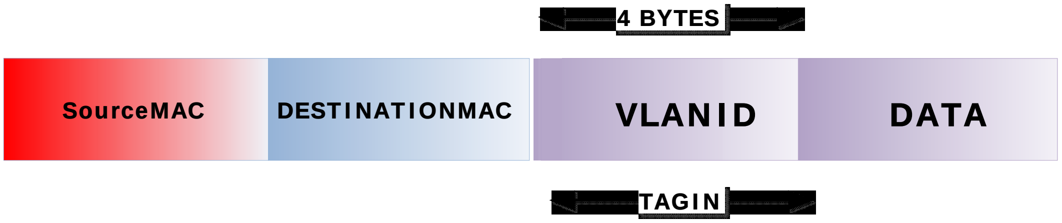
1. Khai niem:

-La ki thuat chia nho broadcast domain vat ly thanh nhieu Virtual Broadcast Domain
-Moi VLAN se su dung 1 Network hoac 1 Subnetwork

2. Loi ich:

-Tang hieu suat mang
-De dang trien khai cac tinh nang bao mat
-Tiet kiem chi phi
-Tang tinh uyen chuyen trong viec thiet ke he thong.
-Cho phep nhom nguoi dung co cung chuc nang trong mot to chuc vao chung 1 Broadcast Domain ma khong phu thuoc vao vi tri dia ly.
-Cac user trong cung VLAN co the giao tiep voi nhau de dang, cac User thuoc ve cac VLAN khac nhau muon giao tiep voi nhau thi doi hoi phai co su xuat hien cua thiet bi Layer 3(Router).
- Thong tin VLAN duoc tao tren Switch va co the lan truyen sang cac Switch khac ket noi trong cung 1 he thong thong qua duong ket noi Trunk va Interface VLAN1(thong tin VLAN ko dua qua duong mang khac)

*** Trunk Link: la ket noi giua cac Switch voi Switch hoac Switch voi Router trong co so ha tang co trien khai VLAN. Ket noi nay cho phep luu thong cua tat ca VLAN di qua no
- Data cua nguoi dung thuoc VLAN nao khi len duong Trunk se duoc Switch dong goi(encapsulation) thong tin VLANID vao Frame de danh dau DATA tren thuoc ve VLAN nao.
- Co 2 hinh thuc dong goi VLANID:
  + 802.1q(dot1q): La hinh thuc dong goi thong tin ve VLAN cho cac Frame thuoc ve cac VLAN khac nhau voi do lon la 4bytes.
Thong tin VLANID se duoc dong goi sau truong Destination MAC (Tagin). Tinh toan (CRC)kiem tra tinh toan ven cua Frame.

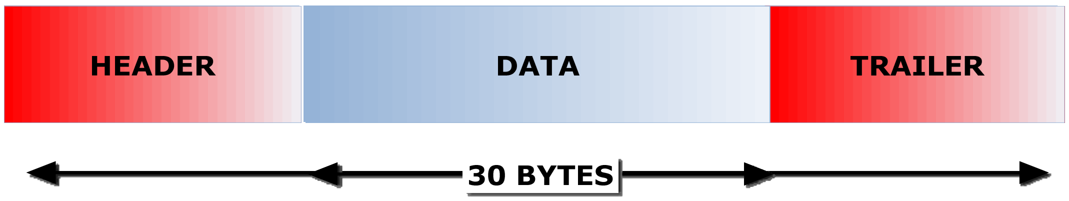


Hinh 1: Cau truc 802.1q (dot1q)

  + ISL (Inter Switch Link): chi co tren cac SW Cisco
La hinh thuc dong goi VLANID vao cac Frame thuoc VLAN khac nhau

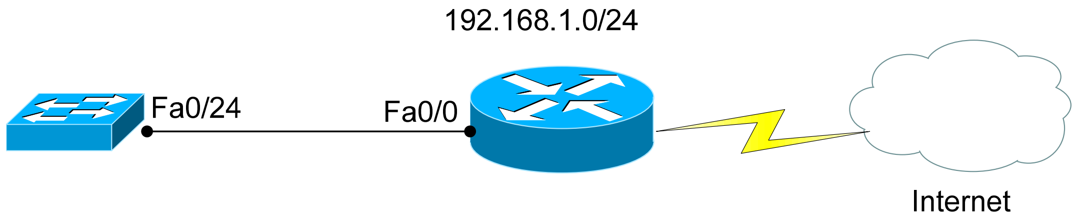
Thong tin ve VLANID se duoc dong goi duoi dang
  26bytes: Header

4bytes: Trailer
vao Frame nguyen thuy



Hinh 2: Cau truc ISL

CACH TAO THONG TIN VLAN TREN CISCO CATALYST SWITCH



1. Buoc 1 : Tao thong tin VLAN, dat ten cho VLAN(Optional)

Co duong mang 192.168.1.0/24 -> can 4 VLAN

VLAN10: Giam Doc: port 1-5
VLAN20: Nhanvien : port 6-16
VLAN30: TapVu : port 17,19.21
VLAN1: =➔ port 18, 20,22,23,24(nối với Router).Cac port nay de danh cho cac quan tri.

Subnet 0 : 192.168.1.0/26(VLAN1) DG: 192.168.1.62
Subnet 1 : 192.168.1.64/26(VLAN10) DG: 192.168.1.126
Subnet 2 : 192.168.1.128/26(VLAN20) DG: 192.168.1.190
Subnet 3 : 192.168.1.192/26(VLAN30) DG: 192.168.1.254

```
SWHDD(config)#vlan 10
SWHDD(config-vlan)#name GIAMDOC
SWHDD(config-vlan)#exit
SWHDD(config)#vlan 20
SWHDD(config-vlan)#name NHANVIEN
SWHDD(config-vlan)#exit
SWHDD(config)#vlan 30
SWHDD(config-vlan)#name TAPVU
```

SWHDD#sh vlan
hoac SWHDD#sh vlan brief

```
SWHDD#sh vlan

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Fa0/1, Fa0/2, Fa0/3, 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
10   GIAMDOC                     active
20   NHANVIEN                    active
30   TAPVU                      active
1002 fddi-default               act/unsup
1003 token-ring-default            act/unsup
1004 fddinet-default             act/unsup
1005 trnet-default              act/unsup

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
30   enet  100030     1500  -      -      -        -    -        0      0

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

=================================================================
```

```
SWHDD#sh vlan bri

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Fa0/1, Fa0/2, Fa0/3, 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
10   GIAMDOC                          active
20   NHANVIEN                         active
30   TAPVU                            active
1002 fddi-default                     act/unsup
1003 token-ring-default               act/unsup
1004 fddinet-default                  act/unsup
1005 trnet-default                    act/unsup
```

====> duoc luu trong File VLAN.dat

2. Buoc 2 : Mac dinh tat ca cac port cua SW thuoc ve Broadcast Domain la VLAN1
Do do sau khi tao thong tin ve VLAN ta phai thuc hien viec gan port tren SW vao cac VLAN vua tao ra theo y muon

***** Luu y :** Viec gan port tren SW vao VLAN duoc thuc hien ko nhat thiet phai giong nhau tren tat ca cac SW trong he thong.

```
- VLAN 10:
SWHDD(config)#int range fa0/1 -5
SWHDD(config-if-range)#switchport mode access
SWHDD(config-if-range)#switchport access vlan 10
- VLAN 20:
SWHDD(config)#int range fa0/6 -16
SWHDD(config-if-range)#switchport mode access
SWHDD(config-if-range)#switchport access vlan 20

- VLAN 30:
SWHDD(config)#int range fa0/17 , fa0/19 , fa0/21
SWHDD(config-if-range)#switchport mode access
SWHDD(config-if-range)#switchport access vlan 30
```

***** Kiem tra:**

```
SWHDD#sh vlan brief

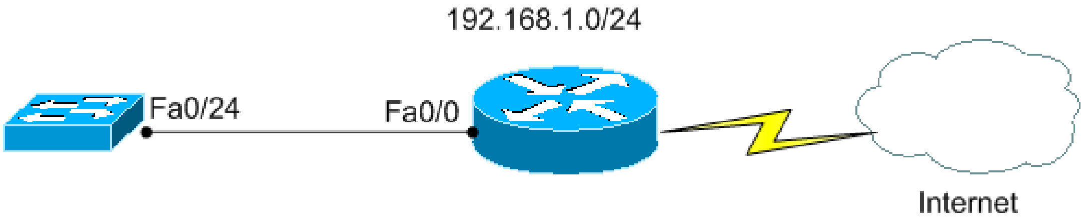
VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Fa0/18, Fa0/20, Fa0/22, Fa0/23
                                                Fa0/24
10   GIAMDOC                    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

***** Ket luan:** ta da tao ra tren Switch 4 Broadcast domain khac nhau, 1 broadcast domain su dung 1 Network/Subnet

ROUTING INTER-VLAN (Router on a Stick Network)

1. Ly thuyet:

Mo hinh LAB:



- De cau hinh dinh tuyen cho VLAN ta can phai co thiet bi Layer 3 ket noi toi SW
- Duong ket noi nay phai co toc do >=100Mbps (Router phai co cong Fast Ethernet tro len) va phai duoc cau hinh la duong Trunk de cho phep luu thong cua tat ca cac VLAN di qua.
- Thiet bi router cau hinh de dinh tuyen cho cac VLAN de dung mot cong vat ly Fast Ethernet tro len ket noi toi SW co chia VLAN. Cong vat ly nay cua Router se duoc chia thanh nhieu Interface luan ly co ten goi la Subinterface. Moi Subinterface se phu trach dinh tuyen cho tung VLAN.

2. Thuc hanh:

-Buoc 3 : Cau hinh port ket noi tu SW len Router la Port Trunk

> Doi voi SW2950: chi ho tro dong goi VLANID theo chuan 802.1q ma thoi.

```
SWHDD(config)#int fa0/24
SWHDD(config-if)#switchport mode trunk
```

> Doi voi SW 3xxx: Ho tro ca 2 kieu dong goi la dot1q, ISL

```
SWHDD(config-if)#switchport mode trunk encapsulation dot1q
```

-Buoc 4 :

Cau hinh chia Subinterface tren cong FastEthernet cua Router ket noi voi SW (ko duoc phep dat IP)

```
RouterHDD(config)#int fa0/0
RouterHDD(config-if)#no shut
```

Tao 4 subinterface, moi subinterface cau hinh dong goi VLANID tuong thich voi SW.
Moi Subinterface se duoc dat IP Address.IP address tren moi subinteface se la Default Gateway cua nhung may tinh noi den cac port thuoc ve cac VLAN tuong ung.

```
RouterHDD(config)#int fa0/0.?  <0-4294967295>  FastEthernet interface number
RouterHDD(config-subif)#encapsulation dot1Q 1 --------> Subinterface se dinh tuyen cho VLAN1
```

```
If the interface doesn't support baby giant frames
maximum mtu of the interface has to be reduced by 4
bytes on both sides of the connection to properly
transmit or receive large packets. Please refer to
documentation on configuring IEEE 802.1Q vLANs.
```

```
===================================
RouterHDD(config)#int fa0/0.1  -----> tao ra 1 Subinterface co ten la Fa0/0.1
RouterHDD(config-subif)#encapsulation dot1Q 1
RouterHDD(config)#ip add 192.168.1.62 255.255.255.192   → Default Gateway
```

```
int fa0/0.10
encapsulation dot1Q 10
ip add 192.168.1.126 255.255.255.192
```

```
int fa0/0.20
encapsulation dot1Q 20

ip add 192.168.1.190 255.255.255.192

int fa0/0.30
encapsulation dot1Q 30
ip add 192.168.1.254 255.255.255.192
==============================
#sh run
!
interface FastEthernet0/0.1
 encapsulation dot1Q 1 native
 ip address 192.168.1.62 255.255.255.192
 no snmp trap link-status
!
interface FastEthernet0/0.10
 encapsulation dot1Q 10
 ip address 192.168.1.126 255.255.255.192
 no snmp trap link-status
!
interface FastEthernet0/0.20
 encapsulation dot1Q 20
 ip address 192.168.1.190 255.255.255.192
 no snmp trap link-status
!
interface FastEthernet0/0.30
 encapsulation dot1Q 30
 ip address 192.168.1.254 255.255.255.192
 no snmp trap link-status
!
RouterHDD#sh ip int bri
Interface              IP-Address      OK? Method Status                Protocol
FastEthernet0/0          unassigned      YES unset  up                    up

FastEthernet0/0.1         192.168.1.62    YES manual up                    up

FastEthernet0/0.10        192.168.1.126   YES manual up                    up

FastEthernet0/0.20        192.168.1.190   YES manual up                    up

FastEthernet0/0.30        192.168.1.254   YES manual up                    up

FastEthernet0/1          unassigned      YES unset  administratively down down

Serial0/1/0             unassigned      YES unset  administratively down dow
```

*** Chu y :

- Doi voi kieu dong goi 802.1q co 1 khai niem goi la Native VLAN (nghia la data xuat phat tu VLAN nay khi len duong Trunk se ko dong goi VLANID).Mac dinh Native VLAN la Vlan1

- Interface VLAN1 gan cho SW se duoc dat IP thuoc Subnet/Network duoc gan cho nguoi dung thuoc VLAN1

```
SWHDD(config)#int vlan 1
SWHDD(config-if)#ip add 192.168.1.1 255.255.255.192
SWHDD(config-if)#no shut
```

Default Gateway cua SW co chia VLAN se la dia chi IP thuoc Subinterface tren Router ma Subinterface nay duoc cau hinh dinh tuyen cho VLAN 1

```
SWHDD(config)#ip default-gateway 192.168.1.62

SWHDD#ping 192.168.1.62   ----→ VLAN 10

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.162, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/203/1004 ms

SWHDD#ping 192.168.1.126 ----→ VLAN 20

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.126, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/203/1004 ms

SWHDD#ping 192.168.1.190 ----→ VLAN 30

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.190, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/203/1004 ms
```

CO CHE THIET LAP KET NOI TRUNK GIUA CAC SWITCH

I - Duoc quan ly boi giao thuc DTP(Dynamic Trunk Protocol)

SW1 (Fa0/24) -------------------------SW2 (Fa0/24)

```
SW1#sh int trunk

Port       Mode         Encapsulation  Status        Native vlan
Fa0/24     desirable    802.1q         trunking      1

Port       Vlans allowed on trunk
Fa0/24     1-4094

Port       Vlans allowed and active in management domain
Fa0/24     1

Port       Vlans in spanning tree forwarding state and not pruned
```

```
Fa0/24      1
```

----> SW noi SW tu dong Trunking , con noi Router va SW thi phai tao Trunking

```
SW1#sh int fa0/24 switchport
Name: Fa0/24
Switchport: Enabled
```

Administrative Mode: dynamic desirable --> Mac dinh Port SW hoat dong o Mode **dynamic desirable** (ham muon)

<1>.*** Dynamic Desirable: port hoat dong o trang thai trunk va chu dong thuong luong 'ru re' dau kia ket noi thiet lap duong trunk

Desirable - Desirable -----> Trunk

```
Operational Mode: trunk
Administrative Trunking Encapsulation: dot1q
Operational Trunking Encapsulation: dot1q
Negotiation of Trunking: On
Access Mode VLAN: 1 (default)
Trunking Native Mode VLAN: 1 (default)
Voice VLAN: none
Administrative private-vlan host-association: none
Administrative private-vlan mapping: none
Administrative private-vlan trunk native VLAN: none
Administrative private-vlan trunk encapsulation: dot1q
Administrative private-vlan trunk normal VLANs: none
Administrative private-vlan trunk private VLANs: none
Operational private-vlan: none
Trunking VLANs Enabled: ALL
Pruning VLANs Enabled: 2-1001
Capture Mode Disabled
Capture VLANs Allowed: ALL
Protected: false
Appliance trust: none
```

- Buoc 1: Vao interface fa0/24

```
SW1(config)#int fa0/24
SW1(config-if)#sw mode trunk
SW1#sh int trunk

Port      Mode       Encapsulation  Status      Native vlan
Fa0/24      on         802.1q         trunking     1

Port     Vlans allowed on trunk
Fa0/24      1-4094

Port      Vlans allowed and active in management domain
Fa0/24      1

Port      Vlans in spanning tree forwarding state and not pruned
Fa0/24      1
```

<2>*** Trunk (ON): port hoat dong o trang thai trunk va chu dong thuong luong 'ru re' dau kia

ket noi thiet lap duong trunk

Trunk - Desirable -----> Trunk

<3>***Auto : port hoat dong o trang thai trunk, tuy nhien no bi dong va chi thiet lap ket noi thiet lap duong trunk khi duoc 'ru re'

Auto - Desirable -----> Trunk

```
SW1(config)#int fa0/24
SW1(config-if)#switchport mode dynamic ?
  auto       Set trunking mode dynamic negotiation parameter to AUTO
  desirable  Set trunking mode dynamic negotiation parameter to DESIRABLE
SW1(config-if)#switchport mode dynamic auto

SW1#sh int trunk

Port       Mode         Encapsulation  Status        Native vlan
Fa0/24     auto         802.1q         trunking      1

Port     Vlans allowed on trunk
Fa0/24     1-4094

Port       Vlans allowed and active in management domain
Fa0/24     1

Port       Vlans in spanning tree forwarding state and not pruned
Fa0/24     1
```

<4> Desirable - Access -----> Ket noi bi pha huy

```
SW1#sh int trunk        ----> ko thay gi
```

<5>*** Auto - Auto -----> Ket noi bi pha huy

```
SW1(config-if)#switchport mode dynamic auto ----> lam ben SW1
SW2(config-if)#switchport mode dynamic auto ----> lam ben SW2

SW1#sh int trunk        ----> ko thay gi



SW1#sh int fa0/24 switchport
Name: Fa0/24
Switchport: Enabled
Administrative Mode: dynamic auto
Operational Mode: static access
Administrative Trunking Encapsulation: dot1q
Operational Trunking Encapsulation: native
Negotiation of Trunking: On
Access Mode VLAN: 1 (default)
Trunking Native Mode VLAN: 1 (default)
Voice VLAN: none
Administrative private-vlan host-association: none
Administrative private-vlan mapping: none
Administrative private-vlan trunk native VLAN: none
Administrative private-vlan trunk encapsulation: dot1q
Administrative private-vlan trunk normal VLANs: none
Administrative private-vlan trunk private VLANs: none
Operational private-vlan: none
Trunking VLANs Enabled: ALL
Pruning VLANs Enabled: 2-1001
Capture Mode Disabled
Capture VLANs Allowed: ALL
Protected: false
Appliance trust: none
```

***** Chu y :   +**Mode Access ko Trunk voi moi hinh thuc**

+Nen cau hinh port Trunk bang tay.

Tom tat:

```
Auto - Desirable
Auto - Trunk
====> Trunk
------------------
Auto - Auto
Auto - Access
====> khong trunk
-------------------

Trunk - Trunk
Trunk - Desirable
====> Trunk
------------------

Trunk - Auto
Trunk - Access
====> khong trunk
---------------------

Desirable - Desirable
Desirable - Trunk
====> trunk
------------------

Desirable - Auto
Desirable - Access
====> Khong trunk
```

II – Thay doi Native VLAN :

Mac dinh Native VLAN la VLAN1

Ta co the cau hinh thay doi Native VLAN. Luu y khi thay doi Native VLAN, ta phai cau hinh thay doi dong nhat tren TAT CA cac port ket noi giua SW va SW, giua SW va Router va cau hinh tren Subinterface cua Router dinh tuyen cho VLAN ma ta chi dinh lam Native VLAN

1/ Cau hinh thay doi Native VLAN tren cac port ket noi cua SW

```
SW1(config)#int fa0/24
SW1(config-if)#switchport trunk native vlan 10 ----> Native VLAN 10
SW1(config-if)#shut
SW1(config-if)#no shut
00:41:36: %LINK-3-UPDOWN: Interface FastEthernet0/24, changed state to down
00:41:37: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/24, chan
ged state to down
00:41:39: %LINK-3-UPDOWN: Interface FastEthernet0/24, changed state to up
00:41:41: %CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on
FastEt
hernet0/24 (10), with SW2 FastEthernet0/24 (1).
00:41:41: %CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on
FastEt
hernet0/24 (10), with SW2 FastEthernet0/24 (1).
00:41:41: %CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on
FastEt
hernet0/24 (10), with SW2 FastEthernet0/24 (1).
00:41:41: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/24, chan
ged state to up
00:41:42: %CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on
FastEt
hernet0/24 (10), with SW2 FastEthernet0/24 (1).

SW2(config-if)#switchport trunk native vlan 10 ----> Native VLAN 10
SW2(config-if)#shut
SW2(config-if)#no shut


SW1(config-if)#do sh int trunk

Port      Mode        Encapsulation  Status       Native vlan
Fa0/24     on         802.1q        trunking      10

Port     Vlans allowed on trunk
Fa0/24     1-4094

Port      Vlans allowed and active in management domain
Fa0/24     1

Port      Vlans in spanning tree forwarding state and not pruned
Fa0/24     1
```

2/ Cau hinh thay doi Native VLAN tren Router

Vao SubInterface duoc cau hinh dinh tuyen cho VLAN ma ta se chi dinh la Native VLAN

```
Router(config)#int fa0/0.10
Router(config-subif)#encapsulation dot1q 10 native
```

DHCP BANG COMMAND LINE

Subnet 0 : 192.168.1.0/26(VLAN1)   DG: 192.168.1.62
Subnet 1 : 192.168.1.64/26(VLAN10)   DG: 192.168.1.126
Subnet 2 : 192.168.1.128/26(VLAN20)   DG: 192.168.1.190
Subnet 3 : 192.168.1.192/26(VLAN30)   DG: 192.168.1.254

-Buoc 1 : Bat dich vu DHCP tren Router
(config)#service dhcp
-Buoc 2: Tao ra cac pool dia chi de cap dong cho nguoi dung chi tiet cua cac pool nay bao gom

- + Ten Pool
- + Day IP se cap cho User(IP/SM)
- + DG
- + DNS
- + Lease Time (neu can)

Vi du : Tao 1 pool co ten **VLAN1** de cap cho user thuoc VLAN1

```
Router(config)#ip dhcp pool VLAN1        ---> Phan biet hoa thuong, ko co khoang trang
Router(DHCP-config)#network 192.168.1.0 255.255.255.192       ---> Qui dinh IP va SM
Router (DHCP-config)#default-router 192.168.1.62
Router (DHCP-config)#dns-server 210.245.31.130 203.113.188.1 210.245.31.10
Router (DHCP-config)#lease 5    -----> Thoi gian song cua IP la 5 ngay
```

```
ip dhcp pool VLAN1
network 192.168.1.0 255.255.255.192
default-router 192.168.1.62
dns-server 210.245.31.130 203.113.188.1 210.245.31.10
lease 5

ip dhcp pool VLAN10 network 192.168.1.64 255.255.255.192
default-router 192.168.1.126
dns-server 210.245.31.130 203.113.188.1 210.245.31.10
lease 5

ip dhcp pool VLAN20
network 192.168.1.128 255.255.255.192
default-router 192.168.1.190
dns-server 210.245.31.130 203.113.188.1 210.245.31.10
lease 5

ip dhcp pool VLAN30
network 192.168.1.192 255.255.255.192
default-router 192.168.1.254
dns-server 210.245.31.130 203.113.188.1 210.245.31.10
lease 5
```

* Mo rong :

```
Router(config)#ip dhcp pool VLAN1
Router(dhcp-config)#?
DHCP pool configuration commands:
  accounting         Send Accounting Start/Stop messages
  bootfile           Boot file name
  class              Specify a DHCP class
  client-identifier  Client identifier
  client-name        Client name
  default-router     Default routers
  dns-server         DNS servers
  domain-name        Domain name
  exit                Exit from DHCP pool configuration mode
  hardware-address    Client hardware address
  host                Client IP address and mask
  import              Programatically importing DHCP option parameters
  lease               Address lease time
  netbios-name-server  NetBIOS (WINS) name servers
  netbios-node-type   NetBIOS node type
  network             Network number and mask
  next-server         Next server in boot process
  no                  Negate a command or set its defaults
  option              Raw DHCP options
  origin              Configure the origin of the pool
  relay               Function as a DHCP relay
  subnet              Subnet allocation commands
  update              Dynamic updates
  utilization         Configure various utilization parameters
  vrf                 Associate this pool with a VRF

Router(dhcp-config)#
```

-Buoc3: Xac dinh cac IP loai tru
Cac IP nay da duoc gan lam DG hoac Int Vlan1 hoac da duoc gan tinh cho cac may chu trong he thong
VD : Loai tru IP 192.168.1.1 khong cap cho User cua VLAN1

```
(config)#ip dhcp excluded-address 192.168.1.1
```

VD: Loai tru day IP tu 192.168.1.66 - 192.168.1.76 khong cap cho user VLAN10

```
(config)#ip dhcp excluded-address 192.168.1.66 192.168.1.76
```

```
ip dhcp excluded-address 192.168.1.1
ip dhcp excluded-address 192.168.1.62
ip dhcp excluded-address 192.168.1.126
ip dhcp excluded-address 192.168.1.190
ip dhcp excluded-address 192.168.1.254
```

#sh ip dhcp binding -----> xem IP cap cho cac may trong mang

```
Router#sh ip dhcp binding
Bindings from all pools not associated with VRF:
IP address          Client-ID/              Lease expiration        Type
                    Hardware address/
                    User name

192.168.1.65        0100.15f2.7b0b.25       Dec 02 2007 10:53 AM    Automatic
192.168.1.129       0100.e04d.0129.78       Dec 02 2007 10:27 AM    Automatic

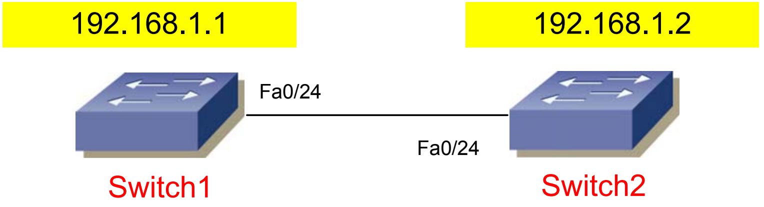


Router#sh run
Building configuration...

Current configuration : 2448 bytes
!
version 12.3
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname Router
!
```

```
boot-start-marker
boot-end-marker
!
enable secret 5 $1$J2.5$pnICzDtCVIcGxpYNba7YR0
enable password cisco
!
no aaa new-model
!
resource policy
!
mmi polling-interval 60
no mmi auto-configure
no mmi pvc
mmi snmp-timeout 180
ip subnet-zero
ip cef
!
!
no ip dhcp use vrf connected
ip dhcp excluded-address 192.168.1.1
ip dhcp excluded-address 192.168.1.126
ip dhcp excluded-address 192.168.1.190
ip dhcp excluded-address 192.168.1.254
ip dhcp excluded-address 192.168.1.62
!
ip dhcp pool VLAN1
  network 192.168.1.0 255.255.255.192
  default-router 192.168.1.62
  dns-server 210.245.31.130 203.113.188.1 210.245.31.10
  lease 5
!
ip dhcp pool VLAN10
  network 192.168.1.64 255.255.255.192
  default-router 192.168.1.126
  dns-server 210.245.31.130 203.113.188.1 210.245.31.10
  lease 5
!
ip dhcp pool VLAN20
  network 192.168.1.128 255.255.255.192
  default-router 192.168.1.190
  dns-server 210.245.31.130 203.113.188.1 210.245.31.10
  lease 5
!
ip dhcp pool VLAN30
  network 192.168.1.192 255.255.255.192
  default-router 192.168.1.254
  dns-server 210.245.31.130 203.113.188.1 210.245.31.10
  lease 5
!
!
no ip domain lookup
no ip ips deny-action ips-interface
!
no ftp-server write-enable
!
!
!
!
!
```

VTP (VLAN TRUNKING PROTOCOL)



1-Xay dung he thong cac SW ket noi voi nhau thong qua duong Trunk
2- Cac SW nay duoc cau hinh hoat dong trong cung 1 VTP Domain
 + Mac dinh, SW thuoc VTP Domain la NULL
 + SW dong vai tro mac dinh la : VTP mode Server
3- Cac SW trong cung 1 VTP Domain se chia se thong tin VLAN dong nhat

```
SW1#sh VTP Status
VTP Version                     : 2
Configuration Revision          : 0
Maximum VLANs supported locally: 128 ---> so VLAN co the ho tro
Number of existing VLANs        : 5        ---> so VLAN hien co
VTP Operating Mode              : Server
VTP Domain Name                 :
VTP Pruning Mode                : Disabled
VTP V2 Mode                     : Disabled
VTP Traps Generation            : Disabled
MD5 digest                      : 0x57 0xCD 0x40 0x65 0x63 0x59 0x47 0xBD
Configuration last modified by 0.0.0.0 at 0-0-00 00:00:00
Local updater ID is 192.168.1.2 on interface Vl1 (lowest numbered VLAN interface
 found)

SW1#sh vlan

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Fa0/1, Fa0/2, Fa0/3, Fa0/4   ---> VLAN mac dinh
                                                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
1002 fddi-default                     act/unsup         ---> VLAN he thong
1003 token-ring-default               act/unsup         ---> VLAN he thong
1004 fddinet-default                  act/unsup         ---> VLAN he thong
1005 trnet-default                    act/unsup         ---> VLAN he thong

VLAN Type  SAID       MTU   Parent RingNo BridgeNo Stp  BrdgMode Trans1 Trans2
---- ----- ---------- ----- ------ ------ -------- ---- -------- ------ ------
1    enet  100001     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
------- --------- ----------------- ------------------------------------------

SW1(config)#no vlan 1002
Default VLAN 1002 may not be deleted. -----> VLAN he thong ko xoa duoc
```

4- Thong tin VLAN lan truyen qua cac SW thong qua ket noi Trunk va Int VLAN 1

```
SW1(config)#vtp domain vnpro              ---> Phan biet hoa thuong,ko khoang trang
Domain name already set to vnpro.

SW1#sh vtp status
VTP Version                     : 2
Configuration Revision          : 0
Maximum VLANs supported locally: 128
Number of existing VLANs        : 5
VTP Operating Mode              : Server
VTP Domain Name                 : vnpro
VTP Pruning Mode                : Disabled
VTP V2 Mode                     : Disabled
VTP Traps Generation            : Disabled
MD5 digest                      : 0x57 0xCD 0x40 0x65 0x63 0x59 0x47 0xBD
Configuration last modified by 0.0.0.0 at 0-0-00 00:00:00
Local updater ID is 192.168.1.1 on interface Vl1 (lowest numbered VLAN interface
 found)
```

5- Cau hinh Mode Trunk

```
SW1(config)#int fa0/24
SW1(config-if)#switchport mode trunk

SW1#sh int trunk

Port      Mode         Encapsulation  Status        Native vlan
Fa0/24    on           802.1q         trunking      1

Port      Vlans allowed on trunk
Fa0/24    1-4094

Port      Vlans allowed and active in management domain
Fa0/24    1

Port      Vlans in spanning tree forwarding state and not pruned
Fa0/24    1
```

1.> VTP MODE SERVER: la mode mac dinh tren tat cac SW. SW hoat dong o Mode Server co kha nang :

+Tao,xoa, sua thong tin ve VLAN

- Luu thong tin ve VLAN trong Flash: VLAN.dat

+ Cap nhat dong bo thong tin ve VLAN tu SW khac trong he thong neu nhu thong tin ve VLAN do co so Revision Number cao hon

+ Lan truyen, quang ba thong tin cho ca SW khac trong cung VTP Domain

* Revision Number = Configuration

La thong so the hien su cap nhat cua thong ve VLAN trong VTP Domain
Khi SW o VTP Mode Server thay doi thong tin ve VLAN thi thong so nay se tang dan 1
So Revision Number cang lon thi thong tin VLAN cang update

Exp: Tao VLAN tren SW1, SW2 ko tao

VLAN10: GIAM DOC
VLAN20: BAOVE
VLAN30: NHANVIEN

```
SW1#sh vtp status
VTP Version                     : 2
Configuration Revision          : 3
Maximum VLANs supported locally: 128
Number of existing VLANs        : 8
VTP Operating Mode              : Server
VTP Domain Name                 : vnpro
VTP Pruning Mode                : Disabled
VTP V2 Mode                     : Disabled
VTP Traps Generation            : Disabled
MD5 digest                      : 0x57 0x51 0x5F 0xBB 0xE2 0xBF 0x49 0x2F
Configuration last modified by 192.168.1.1 at 3-1-93 00:44:31
Local updater ID is 192.168.1.1 on interface Vl1 (lowest numbered VLAN interface
 found)
```

--------------> SW2 se hoc duoc VLAN tu SW1

```
SW2#sh vtp status
VTP Version                     : 2
Configuration Revision          : 3
Maximum VLANs supported locally: 128
Number of existing VLANs        : 8
VTP Operating Mode              : Server
VTP Domain Name                 : vnpro
VTP Pruning Mode                : Disabled
VTP V2 Mode                     : Disabled
VTP Traps Generation            : Disabled
MD5 digest                      : 0x57 0x51 0x5F 0xBB 0xE2 0xBF 0x49 0x2F
Configuration last modified by 192.168.1.1 at 3-1-93 00:44:31
Local updater ID is 192.168.1.2 on interface Vl1 (lowest numbered VLAN interface
 found)
```

- Tao VLAN4 tren SW2

--------------> SW1 se hoc duoc VLAN4 tu SW1; do do so Revison tang len la 4

```
SW1#sh vtp status
VTP Version                     : 2
Configuration Revision          : 4
Maximum VLANs supported locally : 128
Number of existing VLANs        : 9
VTP Operating Mode              : Server
VTP Domain Name                 : vnpro
VTP Pruning Mode                : Disabled
VTP V2 Mode                     : Disabled
VTP Traps Generation            : Disabled
MD5 digest                      : 0xDB 0x5A 0xD4 0x83 0xAB 0x48 0x28 0x08
Configuration last modified by 192.168.1.2 at 3-1-93 00:46:38
Local updater ID is 192.168.1.1 on interface Vl1 (lowest numbered VLAN interface
 found)
```

Ket luan :

-Khi co su thay doi thong tin ve VLAN thi ngay lap tuc SW se quang ba cho cac SW con lai trong cung VTP Domain

-Neu nhu ko co su thay doi nao ca thi giua cac SW se co co che Refresh.Trao doi thong VLAN lan nhau sau moi 300s.

-Viec dong bo thong tin tren VLAN tren tat ca SW trong cung 1 VTP Domain nham muc dich :

+ Giup cho SW co CSDL ve VLAN dong nhat de co thong tin dong goi VLANID cho cac du lieu thuoc ve cac VLAN khac nhau khi gui len duong Trunk

+ Giup cho SW nhan dien va hieu duoc thong tin data tu VLAN gui den tu SW khac thong qua duong Trunk la can thiet.Viec gan port tren cac SW khac nhau la tuy y ngau nhien ko nhat thiet phai giong nhau tren tat ca cac SW

2> VTP Mode Client :

-SW hoat dong o Mode nay se ko co quyen tao xoa sua thong tin ve VLAN trong he thong
- Chi hoc thong tin VLAN tu SW khac gui den va luu o Flash: VLAN.DAT
- Forward thong tin ve VLAN cho cac SW khac trong cung VTP Domain

VIDU : SW2 lam Client.

```
(config)#VTP mode client
SW2#sh vtp status
VTP Version                    : 2
Configuration Revision         : 4
Maximum VLANs supported locally : 128
Number of existing VLANs       : 9
VTP Operating Mode             : Client
VTP Domain Name                : vnpro
VTP Pruning Mode               : Disabled
VTP V2 Mode                    : Disabled
VTP Traps Generation           : Disabled
MD5 digest                     : 0xDB 0x5A 0xD4 0x83 0xAB 0x48 0x28 0x08
Configuration last modified by 192.168.1.2 at 3-1-93 00:46:38 ---> Mat dong Local Update

SW2(config)#VLAN 50   ---> Client ko tao duoc VLAN
VTP VLAN configuration not allowed when device is in CLIENT mode.
```

3> VTP Mode Transparent :

La Mode dac biet, Switch o mode nay se:

* Co quyen tao xoa, sua thong tin ve vlan.Tuy nhien cac thong tin vlan nay chi luu cuc bo (local) tren Switch do ma thoi ma khong anh huong hay lan truyen sang Switch khac trong cung VTP Domain.
* Switch o Mode nay khong cap nhat thong tin ve vlan cua cac Switch trong cung VTP DOMAIN gui cho no ngay ca khi thong tin do co so Revision Number cao hon.
* Forward thong tin ve vlan nhan duoc tu mot Switch den Switch khac trong cung vtp domain.
* La mot hinh thuc thiet ke nham xay dung mot so vlan rieng biet lam tang tinh bao mat.

Luu y:

Nen dat Switch Mode Transparent o node cuoi cung cua he thong Switch,

Nen cau hinh chuyen Transparent sau khi da o mode server hoac client da hoc day du thong tin ve VLAN trong he thong.

4> VTP Password :

La thong tin duoc dinh kem trong thong tin quang ba (advertise) ve VLAN lan truyen giua cac Switch trong cung mot vtp Domain.

+Neu nhu Switch co cau hinh vtp password no se kiem tra thong tin quang cao ve VLAN nhan duoc tu Switch khac.

+Neu thong tin do co kem them password dung, so trung, thi Switch se cho la thong tin do hop le ve se cap nhat hoac forward den thong tin do den cac Switch khac.

```
SW2(config)#vtp password cisco
```

Vidu: SW2 tao pass VTP

tao VLAN 70 TAOLAO
SW1 --> Sh vlan ko hoc duoc
SW1 dat pass VTP la cisco
tao VLAN 60
Vi SW2 co dat password la cisco nen
se hoc duoc

```
SW1#sh vtp password ---> xem pass VTP
VTP Password: cisco
```

5> VTP Pruning :

```
SW1#sh vtp status
VTP Version                     : 2
Configuration Revision          : 6
Maximum VLANs supported locally: 128
Number of existing VLANs        : 11
VTP Operating Mode              : Server
VTP Domain Name                 : vnpro
VTP Pruning Mode                : Disabled
VTP V2 Mode                     : Disabled
VTP Traps Generation            : Disabled
MD5 digest                      : 0x45 0x4A 0xDD 0x9E 0x32 0x81 0x36 0xF1
Configuration last modified by 192.168.1.1 at 3-1-93 01:45:14
Local updater ID is 192.168.1.1 on interface Vl1 (lowest numbered VLAN interface
 found)
```

*Muc dich_ Ngan ngua Sw Forward cac Frame ko can thiet(broadcast) tu VLAN nay sang VLAN khac
Muon cau hinh VTP Pruning ta phai cau hinh o SW dong vai tro VTP Mode Server ma thoi.

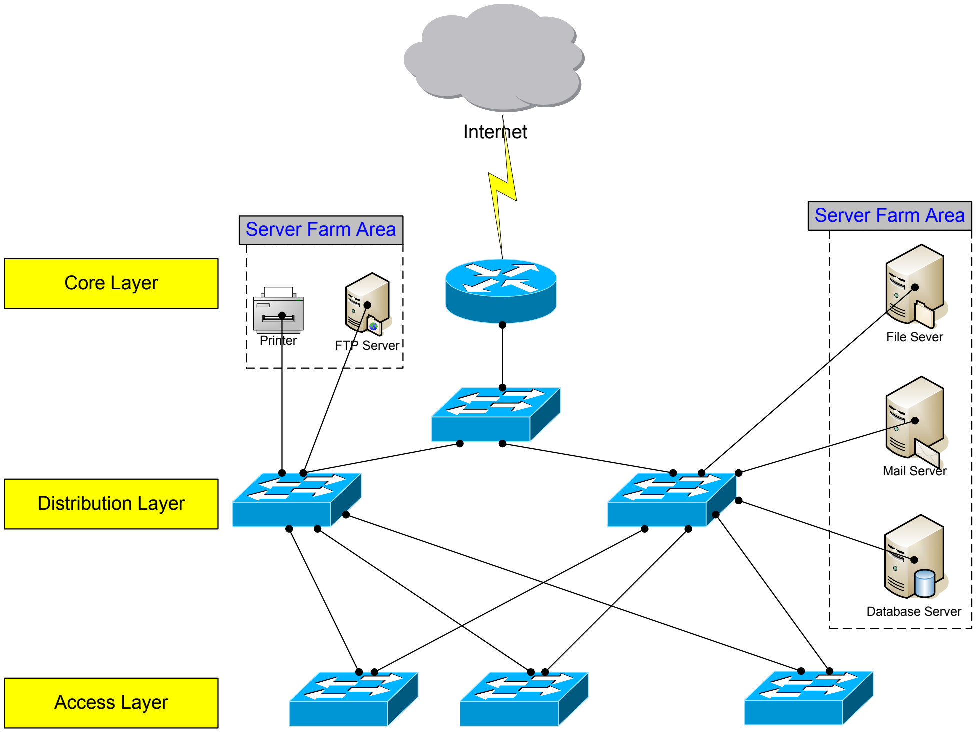
```
SW1(config)#vtp pruning
Pruning switched on
```

```
SW2#sh vtp status
VTP Version                     : 2
Configuration Revision          : 7
Maximum VLANs supported locally : 128
Number of existing VLANs        : 11
VTP Operating Mode              : Client
VTP Domain Name                 : vnpro
VTP Pruning Mode                : Enabled
VTP V2 Mode                     : Disabled
VTP Traps Generation            : Disabled
MD5 digest                      : 0xE5 0xFE 0xA3 0x2D 0x76 0xC2 0x27 0x94
Configuration last modified by 192.168.1.1 at 3-1-93 01:54:09
```

LAN CAMPUS

I> Lý thuyết :

1. Tổng quan ;



-Cisco đưa ra 1 mô hình mạng tiêu chuẩn:

+Core Layer: Giao tiếp với bên ngoài LAN (Internet hay với Site khác).

+Distribution Layer: Là nơi tập trung các tài nguyên chia sẻ (printer, server…). Có một cụm Server kết nối với Switch gọi là Sever farm.

*** **Chú ý** : Nên dành các Port 1 Gb để uplink kết nối với SW khác hay các layer khác.

+AccessLayer: bao gồm những Switch kết nối với người dùng đầu cuối.(End user)

➔ Mô hình trên gọi là One Point of Failure. Vì nếu SW tại Distribution Layer chết thì cả mạng cũng chết.

-Có sơ đồ mạng mang tính dự phòng (Redundancy):

+Các SW kết nối với nhau tạo thành một mạch khép kín.

+Sơ đồ thiết kế LAN mang tính dự phòng là 1 sơ đồ đảm bảo tính sống còn của LAN bằng cách thiết lập những đường đi dự phòng hỗ trợ việc giao tiếp xuyên suốt giữa các Layer với nhau.

+Sơ đồ này thiết lập ra mạch kết nối giữa các SW là khép kín.

+Nó giải quyết được hiện tượng One Point of Failure

Tuy nhiên sơ đồ này cũng có những vấn đề cần quan tâm nếu ta sử dụng các SW "Low end".

2. Hien tuong:

- Broadcast Storm (Switching Loop, Bridging Loop):

Có một máy tính trong mạng, muốn truy suất đến server của hệ thống, ở gói tin đầu tiên đảm bảo Source IP và Destination IP chính xác, gửi ARP request: có Destination MAC là 12 chữ F, SW sẽ đưa tín hiệu đó ra các port, và tín hịêu Broadcast đó sẽ chạy vòng trong mạng, lưu thông Broadcast đó chiếm tất cả các lưu thông trong mạng.

- Multiple Frame Copy:

Là hiện tượng có nhiều phiên bản của frame được gửi đi trong hệ thống.
ARP request: gửi đến server, server nhận 1 lần qua 1 đường đi. Sẽ có nhiều frame đến server, server phải ARP Response liên tục.

- MAC Database Instability:

Sự mất ổn định của các địa chỉ MAC trong bảng MAC table.

*** Lưu ý một port của SW được quyền có nhiều MAC Address, nhưng một MAC chỉ xuất hiện tại một port duy nhất mà thôi, nên SW sẽ xoá MAC cũ và cập nhật Entry mới.

GIAO THỨC SPANNING TREE (STP)

1. Khái niệm :

- Được quy định trong chuẩn 802.1d

- Là một giao thức hoạt động trong suốt ngay sau khi các SW có kết nối với nhau.

-Mục đích của Spanning Tree sẽ tìm cách phá vỡ (break) mạch khép kín kết nối giữa các SW trong thiết kế mang tính dự phòng nhằm tránh các hiện tượng xấu (3 hiện tượng trên). Nhưng vẫn đảm bảo tính dự phòng trong hệ thống.

2. Tiến trình Spanning Tree: trải qua 3 bước:

- Bước 1: Bầu chọn **Root Bridge**

+ Ngay sau khi các SW kết nối với nhau, chúng sẽ gửi ra các gói **BPDU (Bridge Protocol Data Unit)** mạng thông tin:

*BridgeID bao gồm thông số:

- Priority: 32768 gồm 16 bit (default),
- MAC address của SW gồm 48 bit (không bao giờ thay đổi).

* Root ID:

Bridge ID của SW đóng vai trò làm Root Bridge sẽ gửi ra và trao đổi lẫn nhau để bầu chọn SW đóng vai trò làm Root Bridge. Lúc ban đầu SW tự cho mình làm Root Bridge.

+ Sau khi trao đổi BPDU hoàn tất thì SW đóng vai trò làm **Root Brigde** là SW có Bridge ID nhỏ nhất.

- Các SW còn lại sẽ đóng vai trò là **Non Root Brigde,** lúc này chỉ có Root Brigde mới được quyền gửi BPDU mà thôi.
- Các Non Root Bridge khi nhận được BPDU từ Root Brigde tại các port có kết nối của nó, sẽ thay đổi thông số **Sender Bridge ID** và Forward đến các SW khác trong hệ thống.

Lúc này chỉ có RootBridge được gửi BPDU với chu kỳ là **2s**.

- Bước 2 : Bầu chọn **Root Port**

+ Từ những **non Root Bridge** tìm đường đi xuất phát từ port nào đến Root Bridge mà có chi phí (**path cost**) thấp nhất.

Pathcost là một thông số dựa vào băng thông của đường truyền và giá trị path cost sẽ được cộng dồn khi qua mỗi kết nối.

BANDWIDTH	**PATH COST**
10Mbps	100
100Mbps	19
1Gbps	4
10Gbps	2

+ Trong trường hợp từ non Root Bridge có nhiều hơn một port đến Root Bridge mà có path cost thấp nhất và path cost bằng nhau thì port được chọn là Root Port là port có Port ID (fa0/0 – fa0/24) thấp nhất.

- Bước 3: Bầu chọn **Designated port**

+Trên mỗi Segment liên kết giữa các SW sẽ bầu chọn ra port nào đóng vai trò Designated port là port có path cost đến Root Bridge thấp nhất. Port nằm trên Root Bridge luôn đóng vai trò là Designated port (path cost = 0)

+ Trong trường hợp tại một segment có 2 port có pathcost đến RootBridge bằng nhau thì việc bầu chọn Designated Port dựa vào

- Sender Bridge ID
- Nếu Sender Bridge ID bằng thì sẽ dựa vào Bridge ID mà port thuộc về.

3. Vai trò (Port Role) và trạng thái hoạt động (Status):

ROLE	**STATUS**
Designated	Forwarding
Non Designated	Blocking

4. Tóm lại :

- Tiến trình Spanning tree sau khi hội tụ sẽ có 2 đặc điểm:

+ Từ những **non RootBridge** ta chỉ có một đường đi duy nhất với cost thấp nhất đến **RootBridge** mà thôi.

+Trạng thái hoạt động của các port kết nối giữa các SW chỉ có thể là Forwarding hay là Blocking.

- Tiến trình Spanning tree được tính toán khi các port của SW có kết nối và các port này sẽ có cơ chế chuyển đổi trạng thái như sau:

+ Listening (15s) : lắng nghe và gửi BPDU.
Nhưng tại trạng thái này nó không học địa chỉ MAC nhận được từ port mà cũng không Forward data.

+ Learning (15s) : Forward delay cũng gửi nhận BPDU và bắt đầu học địa chỉ MAC nhận được từ port nhưng vẫn không Forward dữ liệu.

+ Fowarding: gửi và nhận BPDU, học MAC và forward dữ liệu.

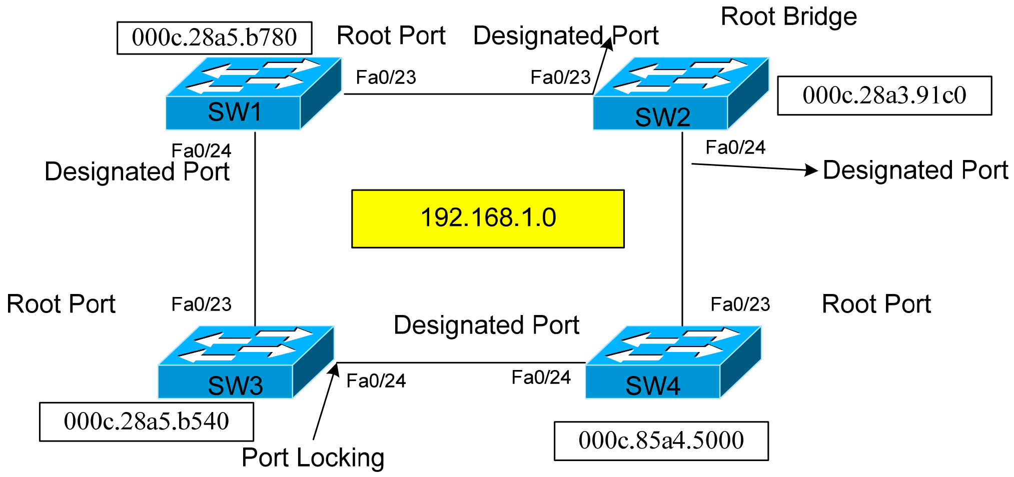
+ Blocking: sau khi tiến trình Spanning tree hoàn tất thì port này xuất hiện: port chỉ lắng nghe và nhận BPDU không học MAC và cũng không forward dữ liệu.

*** Nếu như port blocking không nhận được BPDU sau 10 chu kỳ (Maxage = 20s) thì lập tức port sẽ chuyển sang listening, learning và forwarding để đảm bảo thay thế đường đi chính đã bị hỏng

➔ đảm bảo tính dự phòng. (nhưng phải mất 50s để hội tụ).

II> Thực hành:

Mô hình :



- SW2#sh spanning-tree vlan 1

```
VLAN0001
  Spanning tree enabled protocol ieee
  Root ID    Priority    32769
             Address     000c.28a3.91c0
             This bridge is the root ---> Root bridge
             Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
  Bridge ID  Priority    32769  (priority 32768 sys-id-ext 1)
             Address     000c.28a3.91c0
             Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
             Aging Time 300

Interface        Role Sts Cost      Prio.Nbr Type
---------------- ---- --- --------- -------- --------------------------------
Fa0/1            Desg FWD 19        128.1    P2p
Fa0/23           Desg FWD 19        128.23   P2p
Fa0/24           Desg FWD 19        128.24   P2p
```

- SW1#sh spanning-tree vlan 1

```
VLAN0001
  Spanning tree enabled protocol ieee
  Root ID    Priority    32769
             Address     000c.28a3.91c0
             Cost        19
             Port        23 (FastEthernet0/23)
             Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID  Priority    32769  (priority 32768 sys-id-ext 1)
             Address     000c.28a5.b780
             Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
             Aging Time 300

Interface        Role Sts Cost      Prio.Nbr Type
---------------- ---- --- --------- -------- --------------------------------
Fa0/23           Root FWD 19        128.23   P2p
Fa0/24           Desg FWD 19        128.24   P2p
```

- SW3#sh spanning-tree vlan 1

```
VLAN0001
  Spanning tree enabled protocol ieee
  Root ID    Priority    32769
             Address     000c.28a3.91c0
             Cost        38
             Port        23 (FastEthernet0/23)
             Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID  Priority    32769  (priority 32768 sys-id-ext 1)
             Address     000c.28a5.b540
             Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
             Aging Time 300
```

```
Interface        Role Sts Cost      Prio.Nbr Type
---------------- ---- --- --------- -------- --------------------------------
Fa0/23           Root FWD 19        128.23   P2p
Fa0/24           Altn BLK 19        128.24   P2p
```

- SW4#sh spanning-tree vlan 1

```
VLAN0001
  Spanning tree enabled protocol ieee
  Root ID
             Cost       19
             Port       23 (FastEthernet0/23)
             Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID  Priority    32769  (priority 32768 sys-id-ext 1)
             Address     000c.85a4.5000
             Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
             Aging Time 15

Interface        Role Sts Cost      Prio.Nbr Type
---------------- ---- --- --------- -------- --------------------------------
Fa0/1            Desg FWD 19        128.1    P2p
Fa0/23           Root FWD 19        128.23   P2p
Fa0/24           Desg FWD 19        128.24   P2p
```

SPANNING TREE PORT FAST

-Cau hinh cac port ket noi voi "End User" tiet kiem thoi gian 30s de chuyen sang trang thai Forwarding (bo qua Listening , Learning).

**** Luu y ko duoc cau hinh tinh nang nay tren cac Port ket noi giua cac SW va SW

```
SW2(config)#int range Fa0/1 -22
SW2(config-if-range)#switchport mode access
SW2(config-if-range)#spanning-tree portfast

%Warning: portfast should only be enabled on ports connected to a single
 host. Connecting hubs, concentrators, switches, bridges, etc... to this
 interface  when portfast is enabled, can cause temporary bridging loops.
 Use with CAUTION

%Portfast will be configured in 5 interfaces due to the range command
 but will only have effect when the interfaces are in a non-trunking mode.
```

SPANNING TREE (cont.)

1. Cach thuc can thiep vao qua trinh bau chon ROOT BRIDGE

- Nham muc dich chi dinh ra SW dong vai tro lam Root Bridge
+ Chu dong trong viec thiet ke
+ Toi uu duong di trong he thong
+ Dam bao hieu suat he thong

- Co 2 cach lam:

* Cach 1 : Chi dinh SW dong vai tro lam Root Bridge. Ngoai ra ta con co the chi dinh SW dong vai tro lam Root Bridge du phong nham muc dich

+ Chu dong trong viec bau chon Root Bridge
+ Tiet kiem thoi gian bau chon Root Bridge

VD: Cau hinh SW1 lam Rootbridge cua VLAN1 va SW2 lam Root Bridge du phong cho VLAN1

```
SW1(config)#spanning-tree vlan 1 root primary

SW1#sh spanning-tree vlan 1

VLAN0001
  Spanning tree enabled protocol ieee
  Root ID    Priority    24577 --> priority trong BridgeID SW1 se la nho nhat so voi cac SW khac trong
VLAN 1
             Address     000c.85a4.1100
             This bridge is the root
             Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID  Priority    24577  (priority 24576 sys-id-ext 1)
             Address     000c.85a4.1100
             Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
             Aging Time 300

Interface        Role Sts Cost      Prio.Nbr Type
---------------- ---- --- --------- -------- --------------------------------
Fa0/22           Desg FWD 19        128.22   P2p
Fa0/23           Desg FWD 19        128.23   P2p
Fa0/24           Desg FWD 19        128.24   P2p

SW2(config)#spanning-tree vlan 1 root secondary

SW2#sh spanning-tree vlan 1

VLAN0001
  Spanning tree enabled protocol ieee
  Root ID    Priority    24577
             Address     000c.85a4.1100
             Cost        19
             Port        23 (FastEthernet0/23)
             Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID  Priority    28673  (priority 28672 sys-id-ext 1) --> priority trong Bridge ID SW1 se la nho
thu 2 so voi ca SW khac trong VLAN 1
             Address     000c.28a3.91c0
             Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
```

```
      Aging Time 300

Interface        Role Sts Cost      Prio.Nbr Type
---------------- ---- --- --------- -------- --------------------------------
Fa0/23           Root FWD 19        128.23   P2p
Fa0/24           Desg FWD 19        128.24   P2p]
```

*** Cach 2: can thiep thang vao Priority viec cau hinh thay doi thong so Priority trong Bridge ID cua SW ma ta muon chi dinh lam Root Bridge hoac Secondary Root Bridge cua VLAN nao do

VD: Cau hinh SW1 lam Root Bridge cua VLAN 1 va SW2 lam Secondary du phong

```
SW1(config)#spanning-tree vlan 1 priority ?
  <0-61440> bridge priority in increments of 4096 --> Priority phai la boi so cua 4096
```

++++ Truong hop nhap sai priority se co thong bao

```
SW1(config)#spanning-tree vlan 1 priority 656
% Bridge Priority must be in increments of 4096.
% Allowed values are:
  0     4096  8192  12288 16384 20480 24576 28672
  32768 36864 40960 45056 49152 53248 57344 61440
```

```
SW2(config)#spanning-tree vlan 1 priority 8192
```

```
SW2#sh spanning-tree vlan 1

VLAN0001
  Spanning tree enabled protocol ieee
  Root ID    Priority    1
             Address     000c.85a4.1100
             Cost        19
             Port        23 (FastEthernet0/23)
             Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID  Priority    4097   (priority 4096 sys-id-ext 1) --> Cong them 1 voi sys-id-ext 1
             Address     000c.28a3.91c0
             Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
             Aging Time 300

Interface        Role Sts Cost      Prio.Nbr Type
---------------- ---- --- --------- -------- --------------------------------
Fa0/23           Root FWD 19        128.23   P2p
Fa0/24           Desg FWD 19        128.24   P2p
```

2. STP: 802.1d

Cay STP khi hoi tu ma su thay doi xay ra o duong di chinh thi se mat :
    20s(Maxage)
    30s(Lis + Lean)
    Mat tat ca 50s de cay STP hoi tu.

3. RAPID STP: 802.1w IEEE

- La 1 tien trinh STP chay tren 1 Broadcast Domain duy nhat
- Tien trinh bau chon Root bridge , Root Port, Designated Port cua RSTP ko co gi khac so voi STP
- Muc dich:
    + Cai thien thoi gian hoi tu lai khi cay STP bi thay doi
        MAXAGE: 6s (3 chu ki goi BPDU)
        Bo qua 30s Listening + Learning

4. Switch cua Cisco ket hop

-STP: 802.1d va giao thuc PVST + (Per VLAN STP) cua Cisco qui dinh

PVST+ qui dinh ra tung tien trinh STP khac nhau cho moi VLAN duoc trien khai trong he thong SW

```
Current configuration : 2800 bytes
!
version 12.1
no service pad
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname SW2
!
!
ip subnet-zero
!
no ip domain-lookup
ip ssh time-out 120
ip ssh authentication-retries 3
!
!
spanning-tree mode pvst
no spanning-tree optimize bpdu transmission
spanning-tree extend system-id
spanning-tree vlan 1 priority 4096
 --More—
```

**** Muc dich :

- Ngan ngua truong hop khi chi co 1 tien trinh STP cua VLAN 1 block 1port nao do ma port do lai la port co duong di tot nhat thuoc ve 1 VLAN nao do khi he thong trien khai VLAN

-Ta co the qui dinh ra cac SW dong vai tro lam Root Bridge cho 1 va nhieu VLAN, tang tinh uyen chuyen trong viec thiet ke VLAN, toi uu hoa duong di cua cac VLAN ho tro kha nang can bang tai tren cac SW, tang hieu suat he thong.

-

VD : Cau hinh SW1 lam Root Bridge cua VLAN 1 va VLAN 10
Cau hinh SW2 lam Root Bridge cua VLAN 20 va VLAN 30

```
SW1(config)#int range VLAN1 , VLAN10
SW1(config)#spanning-tree vlan 1 root primary


SW2(config)#int range VLAN20 , VLAN30
SW2(config)#spanning-tree vlan 1 root secondary
```

5. TINH NANG SPANNING TREE BPDU GUARD

BPDU Guard là hai phương pháp nhằm ngăn chặn gói BPDU lạ đi vào mạng. Nói rõ hơn khi có Switch lạ cắm vào mạng thì Switch này không thể trao đổi với các Switch khác trong mạng nếu như có bật tính năng này lên. Các tính năng này chỉ có tác dụng trên cổng, có nghĩa là bạn phải cấu hình trên từng cổng. Nếu bạn cấu hình trên cổng f0/1 mà lại đi cắm Switch lạ vào cổng f0/2 thì Switch mới này vẫn có thể trao đổi thông tin với mạng một cách bình thường.

-Cau hinh tren cac Port ket noi voi End User

-Khi cac port nay nhan duoc bat ky goi BPDU nao do do 1 SW nao do goi den ngay lap tuc port se bi "SHUT DOW"
--> la 1 co che bao ve cay Spanning Tree

VD : Cau hinh tinh nang BPDUGuard tren port 1 –> port 5 cua SW

```
SW1(config)#int range fa0/1 -5
SW1(config-if-range)#switchport mode access
SW1(config-if-range)#spanning-tree bpduguard enable
```

6. RAPID - PVST:

- Mode PVST hoi tu nhanh.

```
SW1(config)#spanning-tree mode rapid-pvst
```

```
SW1#sh spanning-tree

VLAN0001
  Spanning tree enabled protocol rstp
  Root ID    Priority    1
             Address     000c.85a4.1100
             This bridge is the root
             Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID  Priority    1      (priority 0 sys-id-ext 1)
             Address     000c.85a4.1100
             Hello Time   2 sec  Max Age 20 sec  Forward Delay 15 sec
             Aging Time 300

Interface        Role Sts Cost      Prio.Nbr Type
---------------- ---- --- --------- -------- --------------------------------
Fa0/22           Desg FWD 19        128.22   P2p Peer(STP)
Fa0/23           Desg FWD 19        128.23   P2p Peer(STP)
Fa0/24           Desg FWD 19        128.24   P2p
```

OPEN SHORTEST PATH FIRST (OSPF-RFC 2382)

RIP v2	OSPF
- Distance Vector : thuat toan Bellman - Cac Router trao doi thong tin dinh tuyen theo chu ky(30s) - Cac Router ko biet so do tong quan he thong.(Network Topology) - Ko mang tinh mo rong, bi gioi han ve so Router su dung trong AS(Max15) -Metric : Hop count (so router ma no di qua) - De cau hinh - Co nguy co xay ra Routing Loop - Hoi tu cham, it tieu ton tai nguyen Router - Tieu ton nhieu Bandwidth cua ket noi WAN phuc vu cho viec trao doi thong tin dinh tuyen giua cac Router.	-Link State : thuat toan Dijsktra - Khong trao doi thong tin dinh tuyen theo chu ki. Cac Router chi cap nhat thong tin dinh tuyen theo co che Trigger Update - Biet hoan toan Network Topology - Mang tinh mo rong cao, khong gioi han so Router su dung trong 1 AS - Metric = 10^8/ BW (bps) - Kho cau hinh - Khong bao gio xay ra Routing Loop - Hoi tu nhanh, tieu ton rat nhieu tai nguyen cua Router (RAM, CPU) - It tieu ton Bandwidth cua ket noi WAN phuc vu cho viec trao doi thong tin dinh tuyen giua cac Router.

CACH THUC HOAT DONG CUA ROUTER SU DUNG OSPF

I. Ly thiet :

Router su dung OSPF la giao thuc dinh tuyen de xay dung bang dinh tuyen thanh cong .
Trai qua 3 buoc :

- Buoc 1 : Khi Router duoc cau hinh OSPF, dau tien no se gui ra cac goi tin "Hello" tai dia chi Multicast 224.0.0.5 (doi voi RIP thi dia chi Multicast : 224.0.0.9) de bat dau qua trinh thiet lap quan he Neighbor voi cac Router ket noi truc tiep hoac hoat dong trong cung 1 Area

- Area: la khai niem ve pham vi trao doi thong tin dinh tuyen cua cac Router chay OSPF. Cac Router hoat dong trong cung 1 Area se co cung CSDL Network.

  OSPF cho phep thiet ke phan cap 1 AS bao gom nhieu Area khac nhau. Moi Area co 1 hoac nhieu Router. Tuy nhien phai dam bao viec cac Area phai co it nhat 1 ket noi tap trung ve Backbone Area chinh la Area 0.

- Mot so thong tin trong goi tin 'Hello':

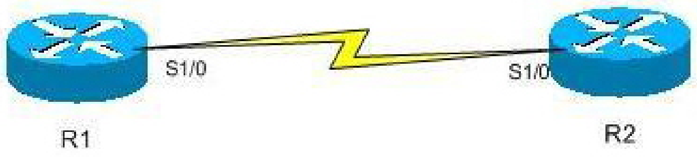
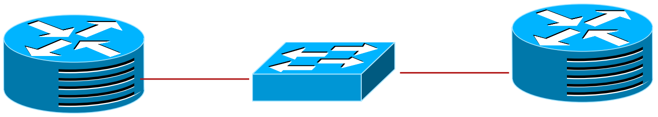
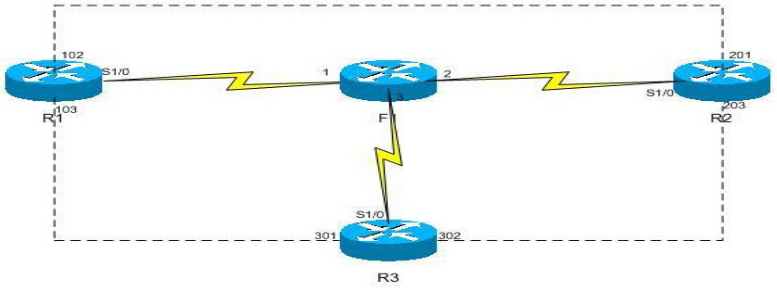
- AreaID : chi ra vung hoat dong cua Router
- RouterID : mac dinh la dia chi IP ‘cao nhat’ cua bat ky Interface vat ly nao ket noi truc tiep tren Router. Trong truong hop co cau hinh Loopback (Logical Interface) thi Router se uu tien chon IP cua Interface Loopback lam Router ID.

Trong truong hop Router duoc cau hinh nhieu Interface Loopback, thi no se chon Interface Loopback co IP cao nhat lam Router ID

******* Luu y** : RouterID ta co the gan tinh cho Router.

- Hello/ Dead Interval:
  - + Chu ky trao doi goi tin Hello giua cac Router
  - + Thoi gian toi da ma Router doi de nhan goi tin Hello tu Neighbor cua no Default = x 4 Hello Interval

Qua trinh trao doi Hello giua cac Router chay OSPF ngoai viec phuc vu cho qua trinh nham muc dich duy tri moi quan he Neighbor giua chung.Cac goi tin Hello duoc trao doi theo chu ky giua cac Router nhu sau:

NETWORK TYPE	**FIGURE**	**HELLO INTERVAL**	**DEAD INTERVAL**
Point to Point (Serial connection)		10s	40s
Broadcast Multi Access (Ethernet/ FastEthernet connection)		10s	40s
Non Broadcast Multi-Access (Frame Relay)	**Router --------- Frame Relay--------------Router**  102 S1/0 1 2 201 103 R1 3 F S1/0 203 R2 S1/0 301 302 R3	30s	120s

- Authentication : Default = Null

- Stub Area Flag : (Course BSCI - CCNP)

De 2 Router chay OSPF co the thiet lap duoc quan he Neighbor thanh cong khi va chi khi cac thong so sau trong goi tin Hello trao doi giua chung la tuong thich Area ID (0), Hello/Dead Interval, thong so sau trong goi tin Hello trao doi giua chung la tuong thich

+ Area ID
+ Hello/Dead Interval
+ Authentication
+ Stub Area Flag

Sau khi thiet lap duoc quan he Neighbor thanh cong thi Router se luu thong tin cac Neighbor cua no vao 1 CSDL goi la Neighbor Table tren RAM cua Router.

-Buoc 2: Router bat dau trao doi cac goi tin LSA(Link State Advertisement) mang thong tin trang thai cac Network ma no dang co voi cac Neighbor hop le cua no. Qua trinh nay duoc goi la qua trinh thiet lap "Adjacency"

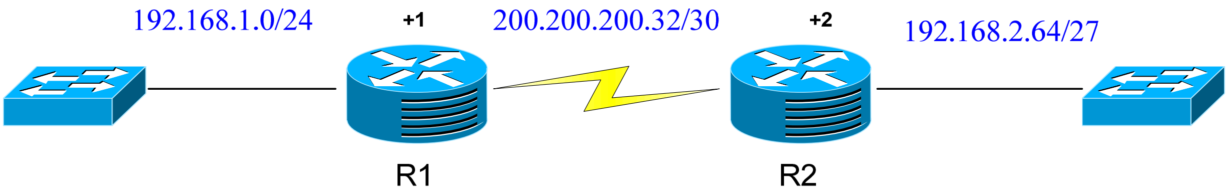
Sau khi Router hoan tat viec trao doi cac thong tin dinh tuyen voi cac Neighbor cua no, Router se luu thong tin tat ca cac trang thai duong link co so ha tang vao 1 CSDL goi la : "Topology Database " trong RAM (Router).
→ Router se co trang thai "Adjacency" la "Full" nghia la no da hoan tat viec trao doi thong tin dinh tuyen voi Neighbor cua no.

-Buoc 3 : Router su dung thuat toan Dijkstra(Shortest Path First) de tinh toan duong di tot nhat den tat ca cac Network trong he thong. Cac thong tin tot nhat se duoc luu vao Routing Table luu trong (RAM cua Router).

*** Luu y : Thuat toan Dijktra cung ton nhieu cong suat CPU cua Router.

==== > OSPF ton nhieu tai nguyen cua he thong cau Router : RAM + CPU

II. Thuc hanh :



R1(config)#router ospf 1

*Process ID : chi ra tien trinh OSPF dang hoat dong tren Router. Co gia tri 1- 65535 va chi co y nghia local tren moi Router.

-Moi Router co the co nhieu tien trinh OSPF.
-Moi tien trinh OSPF thuoc 1 Area khac nhau
-Moi tien trinh OSPF tao ra 1 CSDL OSPF rieng biet.

```
R1(config)#router ospf 1
R1(config-router)#network 192.168.1.0 0.0.0.255 area 0
R1(config-router)#network 200.200.200.32  0.0.0.0.3  area 0
```

*Wildcard Mask: la day nhi phan gom 32bit, duoc chia lam 4 octet, voi moi bit 0 cua Wildcard Mask se dai dien cho phan bit ma ta can quan tam cua dia chi IP/Network

Vi du:

***** Meo tinh nhanh :

Ta lay local Broadcast 255.255.255.255 tru di cho Subnetmask cua IP/Network ma ta quan tam ➔ Wildcard Mask

- Router R1

192.168.1.0/24 SM: 255.255.255.0
Wildcard bit : 00000000.00000000.00000000.11111111
------------→ 0.0.0.255

200.200.200.32/30
Wildcard bit: 00000000.00000000.00000000.00000011
-----------→ 0.0.0.3

- Router R2

192.168.2.64/27 SM: 255.255.255.224
Wildcard Mask: 255.255.255.255
255.255.255.224
0.0.0.31

R1:

```
router ospf 1
network 192.168.1.0 0.0.0.255 area 0
network 200.200.200.32  0.0.0.3  area 0
```

R2:

```
router ospf 1
network 192.168.2.64 0.0.0.31 area 0
network 200.200.200.32  0.0.0.0.3  area 0
```

```
R1#sh ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

     200.200.200.0/30 is subnetted, 1 subnets
C       200.200.200.32 is directly connected, Serial0/2/0
C    192.168.1.0/24 is directly connected, FastEthernet0/0
     192.168.2.0/27 is subnetted, 1 subnets
O       192.168.2.64 [110/65] via 200.200.200.34, 00:00:26, Serial0/2/0

R1#sh ip ospf neighbor

Neighbor ID     Pri   State           Dead Time   Address         Interface
200.200.200.34    0   FULL/  -        00:00:36    200.200.200.34  Serial0/2/0
```

Router lang gieng (IP cao nhat cua cong vat ly)

```
R1#sh ip ospf interface

FastEthernet0/0 is up, line protocol is up
  Internet Address 192.168.1.254/24, Area 0
  Process ID 1, Router ID 200.200.200.33, Network Type BROADCAST, Cost: 1
  Transmit Delay is 1 sec, State DR, Priority 1
  Designated Router (ID) 200.200.200.33, Interface address 192.168.1.254
  No backup designated router on this network
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    oob-resync timeout 40
    Hello due in 00:00:03
  Supports Link-local Signaling (LLS)
  Index 2/2, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 0, maximum is 0
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 0, Adjacent neighbor count is 0
  Suppress hello for 0 neighbor(s)
Serial0/2/0 is up, line protocol is up
  Internet Address 200.200.200.33/30, Area 0
  Process ID 1, Router ID 200.200.200.33, Network Type POINT_TO_POINT, Cost:
64
```

```
  Transmit Delay is 1 sec, State POINT_TO_POINT,
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    oob-resync timeout 40
    Hello due in 00:00:00

Supports Link-local Signaling (LLS)
  Index 1/1, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1, Adjacent neighbor count is 1
    Adjacent with neighbor 200.200.200.34
  Suppress hello for 0 neighbor(s)
```

=====➔ Chu y : Cong serial BW la 1,544 x 10^6 bps

COST : 10^8 / 1.544 x 10^6 = 64

```
R1#sh ip protocols
Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 200.200.200.33
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    192.168.1.0 0.0.0.255 area 0
    200.200.200.32 0.0.0.3 area 0
  Routing Information Sources:
    Gateway         Distance      Last Update
    200.200.200.33       110      00:08:52
    200.200.200.34       110      00:08:52
  Distance: (default is 110)

R1#sh ip ospf int s0/2/0
serial0/2/0 is up, line protocol is up
  internet address 200.200.200.33/30, area 0
  process id 1, router id 200.200.200.33, network type point_to_point, cost: 64
  transmit delay is 1 sec, state point_to_point,
  timer intervals configured, hello 10, dead 40, wait 40, retransmit 5
    oob-resync timeout 40
    hello due in 00:00:07
  supports link-local signaling (lls)
  index 1/1, flood queue length 0
  next 0x0(0)/0x0(0)
  last flood scan length is 1, maximum is 1
  last flood scan time is 0 msec, maximum is 0 msec
  neighbor count is 1, adjacent neighbor count is 1
    adjacent with neighbor 200.200.200.34
  suppress hello for 0 neighbor(s)

R1#sh ip ospf database

            OSPF Router with ID (200.200.200.33) (Process ID 1)

                Router Link States (Area 0)

Link ID         ADV Router      Age         Seq#       Checksum Link count
200.200.200.33  200.200.200.33  762         0x80000003 0x003987 3
200.200.200.34  200.200.200.34  678         0x80000006 0x001D7C 3
```

=➔ thong tin trang thai duong Link

```
R1#sh ip route ospf
     192.168.2.0/27 is subnetted, 1 subnets
O       192.168.2.64 [110/65] via 200.200.200.34, 00:12:09, Serial0/2/0
```

Cost(Metric) qua Seria 64 + cong Fast la 1

AD

III. Bai tap :

Border Gateway trong Router trong OSPF

- Cau hinh Default Router
- Khong duoc quang ba Network ket noi voi ISP vao OSPF
- Quang ba Default Router tu dong cho cac Router khac trong cung AS nhu sau:

```
(config)#router ospf 1
(config-router)#default-information originate
```

- Vao tien trinh OSPF tren Router thuc hien cau lenh nhu tren
- NAT

CAU HINH THAY DOI ROUTER ID

- Viec thay doi cach thuc chon RouterID mac dinh yeu cau Router chay OSPF la chon cong vat ly co IP cao nhat nham muc dich duy tri tinh on dinh cua tien trinh OSPF tren Router.

R1 (212.212.212.13/30) ---------------------------- R2 (212.212.212.14/30)

Co 2 cach :

- Cach 1 : Cau hinh int Loopback tren Router

VD : cau hinh int Loopback tren moi Router nhu sau
R1:L1 222.222.222.222/32
R2:L1 223.223.223.223/32

```
R2(config)#int Lo1
R2(config-If)#ip add 223.223.223.223 255.255.255.252
R2#reload
```

**** Luu cau hinh va Reload de Router ID co tac dung.

```
R2#sh ip ospf int

Enter configura
  Internet Address 212.212.212.14/30, Area 0
  Process ID 1, Router ID 223.223.223.223, Network Type POINT_TO_POINT, Cost: 64

  Transmit Delay is 1 sec, State POINT_TO_POINT,
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    oob-resync timeout 40
    Hello due in 00:00:04
  Supports Link-local Signaling (LLS)
  Index 3/3, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1, Adjacent neighbor count is 1
    Adjacent with neighbor 222.222.222.222
  Suppress hello for 0 neighbor(s)
FastEthernet0/1 is up, line protocol is up
  Internet Address 192.168.20.222/27, Area 0
  Process ID 1, Router ID 223.223.223.223, Network Type BROADCAST, Cost: 1
  Transmit Delay is 1 sec, State DR, Priority 1
  Designated Router (ID) 223.223.223.223, Interface address 192.168.20.222
  No backup designated router on this network
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    oob-resync timeout 40
```

- Cach 2 : Gan RouterID tinh vao tien trinh OSPF tren RouterID. Neu ta su dung cach nay thi se co muc uu tien cao nhat trong viec Router chon thong so RouterID

VD : Ta cau hinh

R1: 1.1.1.1

R2: 2.2.2.2
================

B1: Vao dung tien trinh OSPF tren Router

```
R2(config)#router ospf 1
```

B2 : cau hinh Router ID bang cau lenh

```
R2(config-Router)#router-id 1.1.1.1
```

B3 : Cho Router khoi dong lai tien trinh OSPF bang cach

```
R2#clear ip ospf process
```

---> chon Yes.

```
R2#clear ip ospf process
Reset ALL OSPF processes? [no]:Yes

R2#sh ip ospf interface    E1 - OSPF external
Serial0/1/0 is up, line protocol is up
  Internet Address 212.212.212.14/30, Area 0
  Process ID 1, Router ID 2.2.2.2, Network Type POINT_TO_POINT, Cost: 64
  Transmit Delay is 1 sec, State POINT_TO_POINT,
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    oob-resync timeout 40
    Hello due in 00:00:03
  Supports Link-local Signaling (LLS)
  Index 3/3, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1, Adjacent neighbor count is 1
    Adjacent with neighbor 1.1.1.1
  Suppress hello for 0 neighbor(s)
FastEthernet0/1 is up, line protocol is up
  Internet Address 192.168.20.222/27, Area 0
  Process ID 1, Router ID 2.2.2.2, Network Type BROADCAST, Cost: 1
  Transmit Delay is 1 sec, State WAITING, Priority 1
  No designated router on this network
  No backup designated router on this network
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    oob-resync timeout 40
```

```
R2#debug ip ospf events
OSPF events debugging is on
R2#
*Dec 15 10:21:00.303: OSPF: Rcv hello from 1.1.1.1 area 0 from Serial0/1/0 212.212.212.13
*Dec 15 10:21:00.303: OSPF: End of hello processing
*Dec 15 10:21:01.083: OSPF: Send hello to 224.0.0.5 area 0 on FastEthernet0/1 from
192.168.20.222
*Dec 15 10:21:01.083: OSPF: Send hello to 224.0.0.5 area 0 on FastEthernet0/0 from 192.168.2.142
*Dec 15 10:21:01.083: OSPF: Send hello to 224.0.0.5 area 0 on Serial0/1/0 from 212.212.212.14
R2#
*Dec 15 10:21:10.303: OSPF: Rcv hello from 1.1.1.1 area 0 from Serial0/1/0 212.212.212.13
*Dec 15 10:21:10.303: OSPF: End of hello processing
*Dec 15 10:21:11.083: OSPF: Send hello to 224.0.0.5 area 0 on FastEthernet0/1 from
192.168.20.222
*Dec 15 10:21:11.083: OSPF: Send hello to 224.0.0.5 area 0 on FastEthernet0
```

CAU HINH THAY DOI THONG SO HELLO/DEAD INTERVAL

Nham kiem tra qua trinh thiet lap Neighbor giua cac Router

+ Area ID
+ Hello/Dead Interval
+ Authentication
+ Stub Area Flag

VD:

-- Thay doi Hello-Interval cua R2 la 15 giay.

```
R2(config)#int s0/1/0
R2(config-if)#ip ospf hello-interval 15
```

```
R2#sh ip ospf neighbor ---> Mat Neighbor/Mat Ip router
```

```
R2#
*Dec 15 10:29:20.263: OSPF: Rcv hello from 1.1.1.1 area 0 from Serial0/1/0 212.2
12.212.13
*Dec 15 10:29:20.263: OSPF: Mismatched hello parameters from 212.212.212.13
*Dec 15 10:29:20.263: OSPF: Dead R 40 C 60, Hello R 10 C 15
*Dec 15 10:29:21.083: OSPF: Send hello to 224.0.0.5 area 0 on FastEthernet0/1 fr
om 192.168.20.222
*Dec 15 10:29:21.083: OSPF: Send hello to 224.0.0.5 area 0 on FastEthernet0/0 fr
om 192.168.2.142
```

-- Thay doi Hello-interval cua R1 la 15s. Thay doi DeadInterval 40 giay

```
R1(config)#int s0/2/0
R1(config-if)#ip ospf hello-interval 15

R1(config-if)#ip ospf dead-interval 40
```

```
R1#
*Dec 15 23:39:47.507: OSPF: Rcv hello from 2.2.2.2 area 0 from Serial0/2/0 212.212.212.14
*Dec 15 23:39:47.507: OSPF: Mismatched hello parameters from 212.212.212.14
*Dec 15 23:39:47.507: OSPF: Dead R 60 C 40, Hello R 15 C 15
*Dec 15 23:39:52.815: OSPF: Send hello to 224.0.0.5 area 0 on FastEthernet0/1 from
192.168.10.174
*Dec 15 23:39:52.815: OSPF: Send hello to 224.0.0.5 area 0 on FastEthernet0/0 from 192.168.1.78
*Dec 15 23:39:54.019: OSPF: Send hello to 224.0.0.5 area 0 on Serial0/2/0 from 212.212.212.13
*Dec 15 23:40:02.507: OSPF: Rcv hello from 2.2.2.2 area 0 from Serial0/2/0 212.212.212.14
*Dec 15 23:40:02.507: OSPF: Mismatched hello parameters from 212.212.212.14
*Dec 15 23:40:02.507: OSPF: Dead R 60 C 40, Hello R 15 C 15
*Dec 15 23:40:02.815: OSPF: Send hello to 224.0.0.5 area 0 on FastEthernet0/1 from
192.168.10.174
```

OSPF AUTHENTICATION

La 1 tuy chon duoc cau hinh tren cac Router chay OSPF .Thong tin chung thuc duoc cau hinh tren Router mac dinh la "NULL".Sau khi duoc cau hinh thi thong so chung thuc thi Router se dua vao thong so nay de kiem tra tinh dung dang cua cac thong tin trao doi voi cac Router khac trong cung Area.Neu router nhan duoc bat ki goi tin nao cua Router khac trong cung Area goi den no se kiem tra thong so chung thuc. Neu thong so chung thuc duoc dinh kem trong goi tin gui den trung khop voi thong so chung thuc duoc cau hinh tren Router thi no se xem do la goi tin hop le va nguoc lai.

Co 2 cach cau hinh chung thuc trong OSPF
+ Plain Text (CCNA - 640-802)
+ MD5 (MSCI - CCNP)

CAU HINH OSPF PLAINTEXT AUTHENTICATION

Co 2 buoc :

- B1: Cau hinh mat ma (authentication): la thong so chung thuc tren tung Interface cua Router chay OSPF. Khi Interface duoc cau hinh mat ma, no se su dung mat ma nay de lam thong tin kiem chung cho cac goi tin trao doi voi cac Neighbor cua no

Ta co the cau hinh nhieu mat ma khac nhau tren cac Interface khac nhau cua Router tuy nhien phai dam bao su dong nhat ve mat ma giua cac Router Neighbor voi nhau tren tung Network. Ta vao Interface tren router cau hinh nhu sau:

```
R2(config)#int s0/1/0
R2(config-if)#ip ospf authentication-key cisco
```

---> key phan biet hoa thuong, ko khoan trang, nhieu nhat la 8 ki tu. Neu nhieu hon 8 ki tu thi chi co 8 ki tu dau ma thoi.

- B2 : Co 2 cach :
  - +Cach 1: Dung tai Interface da cau hinh mat ma o tren thuc hien cau lenh.

```
(config-if)#ip ospf authentication
```

  - +Cach 2: Vao tien trinh OSPF tren Router thuc hien cau lenh.

```
(config)#router ospf 1
(config-router)#area 0 authentication
```

VD : Doi key sang Cisco1 se co thong bao nhu sau;

```
R2#
*Dec 15 11:39:51.231: %OSPF-5-ADJCHG: Process 1, Nbr 1.1.1.1 on Serial0/1/0 from
 FULL to DOWN, Neighbor Down: Dead timer expired
```

TRANG THAI THIET LAP NEIGHBOR GIUA CAC ROUTER CHAY OSPF

****** TIP :**

Khi ta cau hinh quang ba cac Network, hoac la Subnetwork thuoc ve Interface nao tren Router cua minh bang cau lenh :
(config-router)#network **...** trong OSPF thi co nghia la da "enable" tien trinh OSPF chay tren Int do.

- **DOWN** : Khi Int cua Router chua duoc Enable tien trinh OSPF
- **INIT (initial)**: Router bat dau goi goi tin "hello" ra Int da duoc kich hoat OSPF va bat dau tien trinh thiet lap quan he Neighbor
- **2WAY**: Router da nhan duoc goi tin Hello tu lang gieng nao do thong qua cac Interface cua no.Router thuc hien viec kiem tra thong tin chua trong goi hello nhan duoc de xet dieu kien thiet lap quan he neighbor.

Neu nhu cac dieu kien trong goi tin hello nhan duoc thoa dieu kien thi Router se xay dung Neighbor Table chua danh sach Neighbor hop le.
- **Exstart**: Router bat dau trao doi cac goi LSA mang thong tin trang thai cac duong Link ma no so huu voi cac Neighbor hop le cua no.(nham thiet lap Adjacency).
- **FULL** : Router da hoan tat tien trinh trao doi LSA voi cac Neighbor cua no. Tien trinh thiet lap Adjacency da hoan tat.

TIEN TRINH BAU CHON DESIGNATED ROUTER (DR) & BACKUP DESIGNATED ROUTER (BDR).

TRONG MO HINH MANG Broadcast, Non Broadcast Multi-access.

- Trong mo hinh dang Broadcast hoac Non Broadcast Multi Access nham han che viec Router phai thiet lap Adjacency lan nhau theo co che Full Mesh. Khien cho luu thong cua he thong mang bi chiem rat nhieu tai thoi diem phuc vu cho viec trao doi thong tin dinh tuyen cua cac Router.

- Nham han che van de tren OSPF qui dinh ra viec bau chon Router dong vai tro lam DR va router dong vai tro lam BDR trong network nay ma thoi.Cac Router con lai dong vai tro lam DROTHER .Trong Network dang Broadcast hoac Non Broadcast Multiaccess cac DROTHER chi thiet lap Adjacency voi DR va BDR ma thoi.Cac DROTHER con lai giao tiep voi DR o dia chi **224.0.0.6**, DBR voi **224.0.0.5**. Router DR se giao tiep voi cac Router con lai thong qua dia chi 224.0.0.5

- Cac DROHER se nhan duoc CSDL tap trung tat ca cac trang thai duong link tu DR gui xuong va khi co su thay doi ve Network tren DROTHER nao, no se bao cho DR ma thoi thong qua co che Trigger Update va sau do DR se cap nhat su thay doi va thong bao cho cac Router con lai.

- Tieu chi bau chon Router dong vai tro lam DR va BDR trong Network Broadcast/Non Broadcast Multi Access.

+ Router dong vai tro lam DR la Router co 'Priority' cua Int ket noi vao Network Broadcast/Non Broadcast Multi Access CAONHAT so voi cac Router con lai. Router co Priority cua Int ket noi vao Broadcast/Non Broadcast Multi Access cao thu 2 se bau chon lam BDR (la du phong cua DR trong truong hop DR bi Fail).

+ Trong truong hop Priority bang nhau (default = 1) thi Router duoc bau chon lam DR la Router co RouterID CAO NHAT, Router co RouterID cao thu 2 se duoc bau la BDR.

```
R1#sh ip ospf neighbor

Neighbor ID     Pri   State           Dead Time   Address         Interface
2.2.2.2           1   FULL/BDR        00:00:30    192.168.100.2   FastEthernet0/
0
3.3.3.3           1   2WAY/DROTHER    00:00:36    192.168.100.3   FastEthernet0/
0
5.5.5.5           1   FULL/DR         00:00:31    192.168.100.5   FastEthernet0/
0

R5#sh ip ospf neighbor

Neighbor ID     Pri   State           Dead Time   Address         Interface
1.1.1.1           1   FULL/DROTHER    00:00:37    192.168.100.1   FastEthernet0/
```

```
0
2.2.2.2          1   INIT/DROTHER    00:00:34    192.168.100.2   FastEthernet0/
0
3.3.3.3          1   FULL/BDR        00:00:37    192.168.100.3   FastEthernet0/
0

R5#sh ip ospf int fa0/0
FastEthernet0/0 is up, line protocol is up
  Internet Address 192.168.100.5/29, Area 0
  Process ID 1, Router ID 5.5.5.5, Network Type BROADCAST, Cost: 1
  Transmit Delay is 1 sec, State DR, Priority 1
  Designated Router (ID) 5.5.5.5, Interface address 192.168.100.5
  Backup Designated router (ID) 3.3.3.3, Interface address 192.168.100.3
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    oob-resync timeout 40
    Hello due in 00:00:06
  Supports Link-local Signaling (LLS)
  Index 1/1, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 2
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 3, Adjacent neighbor count is 3
    Adjacent with neighbor 1.1.1.1
    Adjacent with neighbor 2.2.2.2
    Adjacent with neighbor 3.3.3.3  (Backup Designated Router)
  Suppress hello for 0 neighbor(s)
  Simple password authentication enabled

R3#sh ip ospf int fa0/0
FastEthernet0/0 is up, line protocol is up
  Internet Address 192.168.100.3/29, Area 0
  Process ID 1, Router ID 3.3.3.3, Network Type BROADCAST, Cost: 1
  Transmit Delay is 1 sec, State BDR, Priority 1
  Designated Router (ID) 5.5.5.5, Interface address 192.168.100.5
  Backup Designated router (ID) 3.3.3.3, Interface address 192.168.100.3
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    oob-resync timeout 40
    Hello due in 00:00:01
  Supports Link-local Signaling (LLS)
  Index 3/3, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 0, maximum is 1
  Last flood scan time is 0 msec, maximum is 4 msec
  Neighbor Count is 3, Adjacent neighbor count is 3
    Adjacent with neighbor 1.1.1.1
    Adjacent with neighbor 2.2.2.2
    Adjacent with neighbor 5.5.5.5  (Designated Router)
  Suppress hello for 0 neighbor(s)
  Simple password authentication enabled

R1#sh ip ospf int fa0/0
FastEthernet0/0 is up, line protocol is up
  Internet Address 192.168.100.1/29, Area 0
  Process ID 1, Router ID 1.1.1.1, Network Type BROADCAST, Cost: 1
  Transmit Delay is 1 sec, State DROTHER, Priority 1
  Designated Router (ID) 5.5.5.5, Interface address 192.168.100.5
  Backup Designated router (ID) 3.3.3.3, Interface address 192.168.100.3
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    oob-resync timeout 40
    Hello due in 00:00:09
  Supports Link-local Signaling (LLS)
  Index 2/2, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 0, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 3, Adjacent neighbor count is 2
    Adjacent with neighbor 3.3.3.3  (Backup Designated Router)
    Adjacent with neighbor 5.5.5.5  (Designated Router)
  Suppress hello for 0 neighbor(s)
  Simple password authentication enabled
```

```
R1#sh ip ospf neighbor

Neighbor ID     Pri   State           Dead Time   Address         Interface
2.2.2.2           1   2WAY/DROTHER    00:00:32    192.168.100.2   FastEthernet0/
0
3.3.3.3           1   FULL/BDR        00:00:39    192.168.100.3   FastEthernet0/
0
5.5.5.5           1   FULL/DR         00:00:34    192.168.100.5   FastEthernet0/
0
```

```
R3#sh ip ospf neighbor

Neighbor ID     Pri   State           Dead Time   Address         Interface
1.1.1.1           1   FULL/DROTHER    00:00:31    192.168.100.1   FastEthernet0/
0
2.2.2.2           1   FULL/DROTHER    00:00:30    192.168.100.2   FastEthernet0/
0
5.5.5.5           1   FULL/DR         00:00:32    192.168.100.5   FastEthernet0/
0
4.4.4.4           0   FULL/  -        00:00:31    192.168.34.34   Serial0/2/0
```

CAU HINH CAN THIEP VAO QUA TRINH BAU CHON DR/BDR

Co 3 cach :

- Cach 1 : chinh thong so Priority tren Int ket noi vao Network Broadcast hoac la Non Broadcast Multi Access cua Router muon chi dinh lam DR sao cho no co Priority CAO NHAT so voi Router con lai.(Priority 1-255). Muon BDR thi chinh Priority cao thu 2

VD : Cau hinh R2 dong vai tro lam DR

```
R2(config)#int fa0/0
R2(config-if)#ip ospf priority ?
  <0-255>  Priority
R2(config-if)#ip ospf priority 10
```

```
R2#sh ip ospf int fa0/0
FastEthernet0/0 is up, line protocol is up
  Internet Address 192.168.100.2/29, Area 0
  Process ID 1, Router ID 2.2.2.2, Network Type BROADCAST, Cost: 1
  Transmit Delay is 1 sec, State DR, Priority 10
  Designated Router (ID) 2.2.2.2, Interface address 192.168.100.2
  Backup Designated router (ID) 5.5.5.5, Interface address 192.168.100.5
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    oob-resync timeout 40
    Hello due in 00:00:05
  Supports Link-local Signaling (LLS)
  Index 1/1, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 2
  Last flood scan time is 0 msec, maximum is 4 msec
  Neighbor Count is 3, Adjacent neighbor count is 3
    Adjacent with neighbor 1.1.1.1
    Adjacent with neighbor 3.3.3.3
    Adjacent with neighbor 5.5.5.5  (Backup Designated Router)
  Suppress hello for 0 neighbor(s)
  Simple password authentication enabled
```

- Cach 2 : Chinh RouterID

Chinh RouterID cua Router muon lam DR la cao nhat.

- Cach 3 :

+Ta giu nguyen Priority cua Router duoc chi dinh lam DR
+ Cau hinh thay doi Priority cua cac Router con lai bang 0

- ⇨ Khi do Router se khong tham gia vao qua trinh bau chon DR va BDR. Khi do cac Router do chi dong vai tro lam DROTHER ma thoi
- ⇨

VD : Cau hinh thay doi Priority cua R5, R3 , R2 bang 0

```
R2#sh ip ospf neighbor

Neighbor ID     Pri   State           Dead Time   Address         Interface
1.1.1.1           1   FULL/DR         00:00:33    192.168.100.1   FastEthernet0/
0
3.3.3.3           0   2WAY/DROTHER    00:00:36    192.168.100.3   FastEthernet0/
0
5.5.5.5           0   2WAY/DROTHER    00:00:32    192.168.100.5   FastEthernet0/
0
```

ENHANCED INTERRIOR GATEWAY ROUTING PROTOCOL(EIGRP)

I. Ly Thiet :

1. Tong quan :

- EIGRP la 1 phien ban nang cao nham thay the giao thuc dinh tuyen IGRP cu ky
- Chi hoat dong tren thiet bi Cisco Router.
- Hoat dong chu yeu dua tren nguyen tac Distance Vector cong them 1 so tinh nang Link State goi la Hybrid Routing Protocol
- Ho tro nhieu giao thuc Layer 3 khac nhau : IP, IPX, Apple Talk
- Cac Router chay EIGRP hoat dong trong cung 1 AS (qui mo nho hon AS dinh tuyen co ban: tap hop cac thiet bi chiu su quan tri chung cua 1 nha quan tri) .
    + Autonomous System (AS): 1- 65535; chi ra pham vi hoat dong trao doi dinh tuyen cua cac Router chay EIGRP. Cac Router hoat dong trong cung 1 AS thi CSDL dinh tuyen dong nhat
- Classless Routing Protocol
- De cau hinh hon OSPF
- Hoi tu nhanh nhat

*** Chu y : neu la he thong toan thiet bi Cisco nen dung giao thuc nay vi mang se hoi tu nhanh nhat.

2.Cach thuc hoat dong ; xay dung bang dinh tuyen.

- **Buoc 1** : Dau tien Router chay EIGRP se gui ra cac goi tin Hello ra khoi interface cua no nham muc dich thiet lap quan he Neighbor voi cac Router hoat dong trong cung 1 AS.

+ Chu ky cua goi tin Hello trong EIGRP nhu sau

BW	**HELLO INTERVAL**	**HOLD TIME**
> T2 (1544 Mbps)	5S	Hello Interval x 3
< = T1	60s	Hello Interval x 3

+ Trao doi thong tin dinh tuyen tai dia chi : **224.0.0.10**
+ Hai Router chay EIGRP thiet lap Neighbor thanh cong khi va chi khi cac thong so trong goi tin Hello la tuong thich
    * AS Number
    * Hello Interval / Holdtime
    * Authentication
    * Thong so K (K value) trong cong thuc tinh Metric cua EIGRP (BCSI - CCNP) trao doi giua cac Router la thuong thich .

$$EIGRPMetric = \left(k1 * \frac{10^7}{BW} + \frac{\left(k2 * \frac{10^7}{BW}\right)}{56 - Load} + k3 * \frac{Delay}{10} + \frac{k5}{Reliability + k4} \right) * 256$$

Default: K1 va K3 = 1
K2, K4, K5 = 0

Default Metric $$EIGRP = \left(k1 * \frac{10^7}{BW} + k3 * \frac{Delay}{10} \right) * 256$$

Voi : BW : bps
Load: tai cho phep tren duong truyen (1- 255)
Delay: do tre tren duong truyen (Ms)
Reliability: do tin cay cua duong truyen (1-255)

+ Router se luu thong tin cac Neighbor hop le cua no vao CSDL goi la Neighbor Table (tren RAM cua Router)

- **Buoc 2** : Cac Router se trao doi thong tin dinh tuyen ma no co voi cac Neighbor hop le cua no. Sau khi viec trao doi nay hoan tat Router se luu thong tin tat cac cac Network trong he thong vao CSDL goi la: **Topology Database** (RAM cua Router)

- **Buoc 3** : Router su dung thuat toan DUAL (Diffusing Updated Algorithm) : ket hop thong tin cua hai bang Neighbor Table va Topology Database de tinh toan ra duong di co Metric "Tot nhat" den tung network trong he thong. Sau do, Router luu thong tin cac duong di tot nhat vao Routing Table (RAM cua Router)

*** Luu y : doi voi moi giao thuc Layer 3 khac nhau moi Router se xay dung moi CSDL dinh tuyen EIGRP khac nhau.

3. Nhung thuat ngu EIGRP (EIGRP Terminology):

- **FD (Feasible Distance)**: la Metric do router tinh toan duoc de di den 1 Network nao do voi Metric la tot nhat
- **Successor**: la 1 Router ma thong qua no Router cua ta co the di den 1 Network nao do
- **Successor Router :** la thong tin dinh tuyen ve 1 network nao do voi Metric la FD va duoc luu tai 2 CSDL :
  + Topology Database
  + Routing Table

* **Feasible Successor**: la Router ma thong qua no Router cua ta co the di den 1 duong mang nao do trong he thong voi Metric kem tot hon (lon hon) Metric cua Successor nhung phai thoa dieu kien la :

RD cua Feasible Successor < FD

RD: Reported Distance = Advertised Distance (AD)

RD: la Matric bao lai cua Router Neighbor cho Router minh biet duoc Metric tu Router Neighbor di den 1 Network nao do trong he thong.

***** **Ket luan:**

- Router chay EIGRP co toi thieu 1 Successor cua tat cac network trong he thong.
- No co the la 1 hoac nhieu FS
- No cung co the khong co FS nao

* **Feasible Successor Router:** la Backup Route. Mac dinh duoc luu trong Topology Database ma thoi. Trong truong hop Successor Router bi mat ngay lap tuc Feasible Seccessor Router se duoc su dung ngay de thay the Successor Router ma khong can phai tinh toan lai CSDL dinh tuyen ======> hoi tu nhanh.

+ Trong truong hop Router ko co Feasible Successor cua Network X nao do trong he thong thi ngay lap tuc no se **SET** trang thai cua network do trong bang Topology Database thanh **ACTIVE** va **SET FD** cua network do thanh **gia tri am (-).**
Sau do Router se gui ra goi tin **QUERY** den tat ca cac Neighbor con lai cua no nham truy van thong tin ve Network tren.

+ Goi tin Query trao doi giua cac Router chay EIGRP la dang goi tin duoc truyen theo co che **Connection Oriented** nghia la khi Router nhan duoc goi tin Query thi bat ky Neighbor nao cua no hoi ve 1 thong tin Network nao do thi Router se phai thuc hien co che phan hoi tuong minh de tra loi goi Query tren.

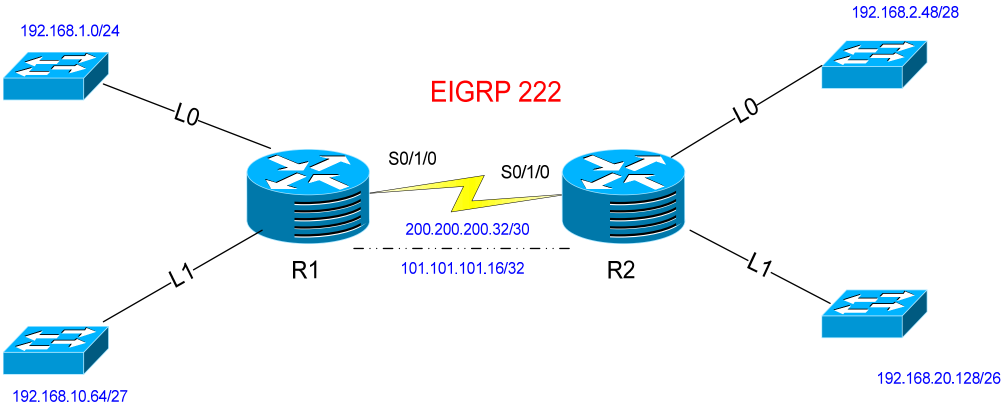
RTP (Reliable Transport Protocol)

- La 1 giao thuc Layer 4 dac biet su dung de quan ly truyen thong giua cac Router chay EIGRP
- Quy dinh ra 2 co che truyen thong
    + Connection Oriented (truyen co yeu cau ACK)
    + Connectionless (truyen khong co yeu cau ACK)

* Mot so goi tin EIGRP truyen thong theo kieu Connection Oriented
    + Update : cap nhat thong tin dinh tuyen
    + Query
    + Reply cua Query

* Mot so goi tin EIGRP truyen thong theo kieu Connectionless
    + Hello
    + ACK cua ACK

II. THUC HANH:



Co 2 cach cau hinh EIGRP:

- **Cach 1** : Cau hinh giong RIPv2 chi quang ba Major Network ma thoi

```
R1(config)#router eigrp 222
R1(config-router)#network 200.200.200.0
R1(config-router)#network 192.168.1.0
R1(config-router)#network 192.168.10.0
R1(config-router)#no auto-summary -----> vi giong voi RIPv2
```

- **Cach 2** : Cau hinh theo kieu OSPF

Quang ba Network chinh xac + Wildcard Mask

```
R2(config)#router eigrp 222
R2(config-router)#network 200.200.200.32 0.0.0.3
R2(config-router)#network 192.168.2.48 0.0.0.15
R2(config-router)#network 192.168.20.128 0.0.0.63
R2(config-router)#no auto-summary
```

```
R1#wr
Building configuration...

*Dec 22 12:07:59.047: %SYS-5-CONFIG_I: Configured from console by console
```

```
*Dec 22 12:07:59.859: %DUAL-5-NBRCHANGE: IP-EIGRP (0) 222: Neighbor 200.200.200.3
4 (Serial0/1/0) is up: new adjacency [OK]

R1#sh ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

     200.200.200.0/30 is subnetted, 1 subnets
C       200.200.200.32 is directly connected, Serial0/1/0
     192.168.10.0/27 is subnetted, 1 subnets
C       192.168.10.64 is directly connected, Loopback1
     192.168.20.0/26 is subnetted, 1 subnets
D       192.168.20.128 [90/2297856] via 200.200.200.34, 00:00:41, Serial0/1/0
C    192.168.1.0/24 is directly connected, Loopback0
     192.168.2.0/28 is subnetted, 1 subnets
D       192.168.2.48 [90/2297856] via 200.200.200.34, 00:00:41, Serial0/1/0

R1#sh ip route eigrp
     192.168.20.0/26 is subnetted, 1 subnets
D       192.168.20.128 [90/2297856] via 200.200.200.34, 00:17:33, Serial0/1/0
     192.168.2.0/28 is subnetted, 1 subnets
D       192.168.2.48 [90/2297856] via 200.200.200.34, 00:17:33, Serial0/1/0

R1#sh ip eigrp neighbors
IP-EIGRP neighbors for process 222
H   Address                 Interface       Hold Uptime   SRTT   RTO  Q  Seq
                                            (sec)         (ms)       Cnt Num
0   200.200.200.34          Se0/1/0           10 00:18:34  870  5000  0  3
```

#debug ip packet ---> de xem dia chi giao tiep thong tin dinh tuyen 224.0.0.10

```
Routing Protocol is "eigrp 222"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Default networks flagged in outgoing updates
  Default networks accepted from incoming updates
  EIGRP metric weight K1=1, K2=0, K3=1, K4=0, K5=0
  EIGRP maximum hopcount 100                ---> ho tro 100 Router
  EIGRP maximum metric variance 1 -> ve mac dinh Router chi dua thong tin Successor Route vao
bang dinh tuyen ma thoi
  Redistributing: eigrp 222
  EIGRP NSF-aware route hold timer is 240s
  Automatic network summarization is not in effect
  Maximum path: 4        ---> Can bang tai la 4 duong (default)
  Routing for Networks:
    192.168.1.0
    192.168.10.0
    192.168.100.0
    200.200.200.0
  Routing Information Sources:
    Gateway         Distance      Last Update
    (this router)         90      00:21:58
    200.200.200.34        90      00:11:36
  Distance: internal 90 external 170

Routing Protocol is "ospf 222"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 192.168.10.94
  Number of areas in this router is 0. 0 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
  Routing Information Sources:
    Gateway         Distance      Last Update
  Distance: (default is 110)

R1#sh ip route eigrp
     192.168.20.0/26 is subnetted, 1 subnets
D       192.168.20.128 [90/2297856] via 200.200.200.34, 00:24:44, Serial0/1/0
     192.168.2.0/28 is subnetted, 1 subnets
D       192.168.2.48 [90/2297856] via 200.200.200.34, 00:24:44, Serial0/1/0

#sh int s0/1/0

Serial0/1/0 is up, line protocol is up
  Hardware is GT96K Serial
  Description: KET NOI VOI R2
  Internet address is 200.200.200.33/30
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation HDLC, loopback not set
  Keepalive set (10 sec)
  Last input 00:00:04, output 00:00:02, output hang never
  Last clearing of "show interface" counters 01:06:16
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue: 0/40 (size/max)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     1309 packets input, 79793 bytes, 0 no buffer
     Received 390 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     1293 packets output, 78584 bytes, 0 underruns
     0 output errors, 0 collisions, 19 interface resets
     0 output buffer failures, 0 output buffers swapped out
     30 carrier transitions
     DCD=up  DSR=up  DTR=up  RTS=up  CTS=up

R1#sh ip eigrp topology
IP-EIGRP Topology Table for AS(222)/ID(192.168.10.94)

Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
       r - reply Status, s - sia Status

P 192.168.100.0/24, 1 successors, FD is 28160
        via Connected, FastEthernet0/0
P 192.168.10.64/27, 1 successors, FD is 128256
        via Connected, Loopback1
P 192.168.2.48/28, 1 successors, FD is 2297856
        via 200.200.200.34 (2297856/128256), Serial0/1/0
P 192.168.1.0/24, 1 successors, FD is 128256
        via Connected, Loopback0
P 200.200.200.32/30, 1 successors, FD is 2169856
```

```
        via Connected, Serial0/1/0
P 192.168.20.128/26, 1 successors, FD is 2297856
        via 200.200.200.34 (2297856/128256), Serial0/1/0
```

(2297856/128256)

++++> 2297856: Successor
128256 : FD

Them vao duong mang 101.101.101.16/30 (qua cong fa0/1--fa0/0) noi 2 Router lai.

```
R1#sh ip eigrp neighbors
IP-EIGRP neighbors for process 222
H   Address                 Interface       Hold Uptime   SRTT   RTO  Q  Seq
                                            (sec)         (ms)       Cnt Num
1   101.101.101.18          Fa0/1             10 00:00:13    1   200  0  8
0   200.200.200.34          Se0/1/0           13 00:37:41  455  2730  0  9

R1#sh ip eigrp topology
IP-EIGRP Topology Table for AS(222)/ID(192.168.10.94)

Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
       r - reply Status, s - sia Status

P 192.168.100.0/24, 1 successors, FD is 28160
        via Connected, FastEthernet0/0
P 192.168.10.64/27, 1 successors, FD is 128256
        via Connected, Loopback1
P 192.168.2.48/28, 1 successors, FD is 156160
        via 101.101.101.18 (156160/128256), FastEthernet0/1
        via 200.200.200.34 (2297856/128256), Serial0/1/0
P 192.168.1.0/24, 1 successors, FD is 128256
        via Connected, Loopback0
P 101.101.101.16/30, 1 successors, FD is 28160
        via Connected, FastEthernet0/1
P 200.200.200.32/30, 1 successors, FD is 2169856
        via Connected, Serial0/1/0
P 192.168.20.128/26, 1 successors, FD is 156160
        via 101.101.101.18 (156160/128256), FastEthernet0/1
        via 200.200.200.34 (2297856/128256), Serial0/1/0

Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

#sh ip route

Gateway of last resort is not set

     200.200.200.0/30 is subnetted, 1 subnets
C       200.200.200.32 is directly connected, Serial0/1/0
     101.0.0.0/30 is subnetted, 1 subnets
C       101.101.101.16 is directly connected, FastEthernet0/1
     192.168.10.0/27 is subnetted, 1 subnets
C       192.168.10.64 is directly connected, Loopback1
     192.168.20.0/26 is subnetted, 1 subnets
```

```
D       192.168.20.128
         [90/156160] via 101.101.101.18, 00:04:25, FastEthernet0/1
C    192.168.1.0/24 is directly connected, Loopback0
     192.168.2.0/28 is subnetted, 1 subnets
D       192.168.2.48 [90/156160] via 101.101.101.18, 00:04:25, FastEthernet0/1
C    192.168.100.0/24 is directly connected, FastEthernet0/0
```

Ta nhan thay voi ket noi cong FastEthernet thi FD la nho hon so voi cong Serial vi vay ket noi se su dung FD nay

************ Shut down fa0/1(bo duong mang 101.101.101.16/30)
Vi dang su dung duong mang nay la duong chinh.
Nen duong mang   200.200.200.0/30   hoat dong tro lai..

```
R1(config)#do sh ip rou
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

     200.200.200.0/30 is subnetted, 1 subnets
C       200.200.200.32 is directly connected, Serial0/1/0
     192.168.10.0/27 is subnetted, 1 subnets
C       192.168.10.64 is directly connected, Loopback1
     192.168.20.0/26 is subnetted, 1 subnets
D       192.168.20.128 [90/2297856] via 200.200.200.34, 00:00:23, Serial0/1/0
C    192.168.1.0/24 is directly connected, Loopback0
     192.168.2.0/28 is subnetted, 1 subnets
D       192.168.2.48 [90/2297856] via 200.200.200.34, 00:00:23, Serial0/1/0
C    192.168.100.0/24 is directly connected, FastEthernet0/0
```

CAU HINH THAY DOI HELLO INTERVAL/ HOLDTIME TREN ROUTER CHAY EIGRP

* **Luu y** : Thay doi Hello Interval trong EIGRP thi HoldTime van giu nguyen khong he thay doi(gap 3 lan) lan tuong ung(khac voi OSPF).

VD1 : Thay doi Hello Interval la 5s HoldTime 10s

```
R1(config)#int s0/1/0
R1(config-if)#ip hello-interval  eigrp 222 5
R1(config-if)#ip hold-time eigrp 222 10

R1#clear ip eigrp neighbors
*Dec 23 09:48:51.663: %DUAL-5-NBRCHANGE: IP-EIGRP(0) 222: Neighbor 200.200.200.3
4 (Serial0/1/0) is down: Interface Goodbye received
R1#clear ip eigrp neighbors
*Dec 23 09:48:52.963: %DUAL-5-NBRCHANGE: IP-EIGRP(0) 222: Neighbor 200.200.200.3
4 (Serial0/1/0) is up: new adjacency

R1#sh ip eigrp neighbors
```

```
IP-EIGRP neighbors for process 222
H   Address                 Interface       Hold Uptime   SRTT   RTO  Q  Seq
                                            (sec)         (ms)       Cnt Num
0   200.200.200.34          Se0/1/0           1 00:00:36    2   200  0  16
```

VD2 : Thay doi Hello Interval la 15s

```
R1(config-if)#
*Dec 23 09:53:39.271: %DUAL-5-NBRCHANGE: IP-EIGRP(0) 222: Neighbor 200.200.200.3
4 (Serial0/1/0) is down: Interface Goodbye received
R1(config-if)#
*Dec 23 09:53:42.579: %DUAL-5-NBRCHANGE: IP-EIGRP(0) 222: Neighbor 200.200.200.3
4 (Serial0/1/0) is up: new adjacency

R1#clear ip eigrp neighbors
*Dec 23 09:55:44.791: %DUAL-5-NBRCHANGE: IP-EIGRP(0) 222: Neighbor 200.200.200.3
4 (Serial0/1/0) is down: holding time expired
R1#
*Dec 23 09:55:53.651: %DUAL-5-NBRCHANGE: IP-EIGRP(0) 222: Neighbor 200.200.200.3
4 (Serial0/1/0) is up: new adjacency
*Dec 23 09:55:53.715: %DUAL-5-NBRCHANGE: IP-EIGRP(0) 222: Neighbor 200.200.200.3
4 (Serial0/1/0) is down: manually cleared
R1#
*Dec 23 09:56:07.651: %DUAL-5-NBRCHANGE: IP-EIGRP(0) 222: Neighbor 200.200.200.3
4 (Serial0/1/0) is up: new adjacency
R1#
*Dec 23 09:56:12.699: %DUAL-5-NBRCHANGE: IP-EIGRP(0) 222: Neighbor 200.200.200.3
4 (Serial0/1/0) is down: holding time expired
R1#
*Dec 23 09:56:21.327: %DUAL-5-NBRCHANGE: IP-EIGRP(0) 222: Neighbor 200.200.200.3
4 (Serial0/1/0) is up: new adjacency
R1#
*Dec 23 09:56:26.383: %DUAL-5-NBRCHANGE: IP-EIGRP(0) 222: Neighbor 200.200.200.3
4 (Serial0/1/0) is down: holding time expired
*Dec 23 09:54:06.527: %DUAL-5-NBRCHANGE: IP-EIGRP(0) 222: Neighbor 200.200.200.3
4 (Serial0/1/0) is down: holding time expired -----> song 10s, chet 5s
```

*** Khi ta dieu chinh HelloInterval thi phai nho dieu chinh HoldTime tuong ung sao cho dam bao HoldTime tuong ung lon hon Hello Interval

VD2 : Thay doi R1 Hello Interval la 20s R2 Hello la 25s
R1 Hello Interval la 20s R2 Hello la 20s

EIGRP MD5 AUTHENTICATION

-.La hinh thuc cau hinh thong so chung thuc ma hoa MD5 de dinh kem vao cac goi tin trao doi giua cac Router chay EIGRP.
Khi Router duoc cau hinh chung thuc thi no se dinh kem thong tin nay vao cac data dinh tuyen trao doi voi cac Router khac trong cung AS.
- Ngoai ra, khi no nhan bat ky thong so dinh tuyen tu cac Router khac thi no cung se kiem tra thong tin chung thuc trong cac data dinh tuyen nhan duoc.
- Cac data dinh tuyen nhan duoc Router cho la hop le khi va chi khi thong so chung thuc la trung khop.

1. Chung tuc MD5 trong EIGRP su dung ky thuat Moc Khoa (Key Chain):

- Ky thuat Key Chain qui dinh ra noi Router se su dung 1 hoac nhieu key chain de chung thuc thong

tin trao doi lan nhau.
Tuy nhien ta phai dam bao cac Router ke can nhau su dung cac Key Chain tuong thich voi nhau tren tung Network ket noi giua chung.
-Trong moi Keychain ta phai cau hinh cac thong tin sau
+ Ten keychain : phan biet hoa thuong, no blank, chi co y nghia cuc bo tren tung Router
+ So luong Key co trong tung Keychain: So luong Key phai tuong thich tren tung keychain chung thuc cua cac Router.

```
                    (R1)-----------------MD5-------------------- (R2)
               Keychain: mockhoaR1             Keychain: mockhoaR2
             Key: 1 --> Key ID               key: 1 --> Key ID
```

+ Doi voi cac Key tao ra, phai dam bao su trung khop cac thong tin tren tung key Chain chung thuc cua cac Router:
* KeyID : ten cac khoa
* Key-string: mat ma cua khoa
* Thoi gian chap nhan khoa : accept-lifetime (default = Infinite)
* Thoi gian bat dau su dung khoa de tao ma khoa ; send-lifetime (default = Infinite)

2. Cau hinh chung thuc MD5 trong EIGRP su dung Keychain co 1 key

- **Buoc 1** : Tao keychain tren tung Router dat ten cho cac Key chain vua tao ra :

```
R1(config)#key chain mockhoaR1
R2(config)#key chain mockhoaR2
```

- Buoc 2 : tao Key tren tung moc khoa

```
R1(config-keychain)#key 10      ---> key ID
R2(config-keychain)#key 10      ---> key ID
```

- Buoc 3 : Cau hinh thong so cho Key vua tao

```
R1(config-keychain-key)#key string cisco            ---> giong nhu la password
R2(config-keychain-key)#key string cisco            ---> giong nhu la password
```

- Buoc 4 : Kich hoat chung thuc MD5 tren Interface chay EIGRP ket noi voi Neighbor cua no va chi dinh Keychain su dung de chung thuc o interface tren.

```
R1(config)#int s0/1/0
R1(config-if)#ip authentication mode eigp 222 md5
R1(config-if)#ip authentication key-chain eigrp 222 mockhoaR1   ---> ten Keychain su dung
```

```
R1#debug eigrp packets
EIGRP Packets debugging is on
   (UPDATE, REQUEST, QUERY, REPLY, HELLO, IPXSAP, PROBE, ACK, STUB, SIAQUERY, S
IAREPLY)

R1#
*Dec 23 11:05:25.171: EIGRP: Sending HELLO on Serial0/1/0
*Dec 23 11:05:25.171:   AS 222, Flags 0x0, Seq 0/0 idbQ 0/0 iidbQ un/rely 0/0
R1#
*Dec 23 11:05:26.331: EIGRP: received packet with MD5 authentication, key id = 1
0
*Dec 23 11:05:26.331: EIGRP: Received HELLO on Serial0/1/0 nbr 200.200.200.34
*Dec 23 11:05:26.331:   AS 222, Flags 0x0, Seq 0/0 idbQ 0/0 iidbQ un/rely 0/0 pe
erQ un/rely 0/0
```

VD : Thay doi Key string R2 : vnpro

```
R1#debug
*Dec 23 11:06:25.523: %DUAL-5-NBRCHANGE: IP-EIGRP(0) 222: Neighbor 200.200.200.34
(Serial0/1/0) is down: Auth failure
R1#debug eigrp packets
EIGRP Packets debugging is on
    (UPDATE, REQUEST, QUERY, REPLY, HELLO, IPXSAP, PROBE, ACK, STUB, SIAQUERY,
SIAREPLY)
R1#
*Dec 23 11:06:39.055: EIGRP: pkt key id = 10, authentication mismatch
*Dec 23 11:06:39.055: EIGRP: Serial0/1/0: ignored packet from 200.200.200.34, opcode = 5 (invalid
authentication)
*Dec 23 11:06:39.675: EIGRP: Sending HELLO on Serial0/1/0
*Dec 23 11:06:39.675:   AS 222, Flags 0x0, Seq 0/0 idbQ 0/0 iidbQ un/rely 0/0
R1#
*Dec 23 11:06:40.363: EIGRP: Sending HELLO on Loopback0
*Dec 23 11:06:40.363:   AS 222, Flags 0x0, Seq 0/0 idbQ 0/0 iidbQ un/rely 0/0
*Dec 23 11:06:40.363: EIGRP: Received HELLO on Loopback0 nbr 192.168.1.254
*Dec 23 11:06:40.363:   AS 222, Flags 0x0, Seq 0/0 idbQ 0/0
*Dec 23 11:06:40.363: EIGRP: Packet from ourselves ignored
R1#
*Dec 23 11:06:41.379: EIGRP: Sending HELLO on Loopback1
*Dec 23 11:06:41.379:   AS 222, Flags 0x0, Seq 0/0 idbQ 0/0 iidbQ un/rely 0/0
*Dec 23 11:06:41.379: EIGRP: Received HELLO on Loopback1 nbr 192.168.10.94
*Dec 23 11:06:41.379:   AS 222, Flags 0x0, Seq 0/0 idbQ 0/0
*Dec 23 11:06:41.379: EIGRP: Packet from ourselves ignored
R1#
*Dec 23 11:06:43.483: EIGRP: pkt key id = 10, authentication mismatch
*Dec 23 11:06:43.483: EIGRP: Serial0/1/0: ignored packet from 200.200.200.34, opcode = 5 (invalid
authentication)
*Dec 23 11:06:43.947: EIGRP: Sending HELLO on Serial0/1/0
*Dec 23 11:06:43.947:   AS 222, Flags 0x0, Seq 0/0 idbQ 0/0 iidbQ un/rely 0/0
R1#
*Dec 23 11:06:45.231: EIGRP: Sending HELLO on Loopback0
*Dec 23 11:06:45.231:   AS 222, Flags 0x0, Seq 0/0 idbQ 0/0 iidbQ un/rely 0/0
*Dec 23 11:06:45.231: EIGRP: Received HELLO on Loopback0 nbr 192.168.1.254
*Dec 23 11:06:45.231:   AS 222, Flags 0x0, Seq 0/0 idbQ 0/0
*Dec 23 11:06:45.231: EIGRP: Packet from ourselves ignored
*Dec 23 11:06:45.831: EIGRP: Sending HELLO on Loopback1
*Dec 23 11:06:45.831:   AS 222, Flags 0x0, Seq 0/0 idbQ 0/0 iidbQ un/rely 0/0
*Dec 23 11:06:45.831: EIGRP: Received HELLO on Loopback1 nbr 192.168.10.94
*Dec 23 11:06:45.831:   AS 222, Flags 0x0, Seq 0/0 idbQ 0/0
*Dec 23 11:06:45.831: EIGRP: Packet from ourselves ignored
R1#
*Dec 23 11:06:47.891: EIGRP: pkt key id = 10, authentication mismatch
*Dec 23 11:06:47.891: EIGRP: Serial0/1/0: ignored packet from 200.200.200.34, opcode = 5 (invalid
authentication)
*Dec 23 11:06:48.311: EIGRP: Sending HELLO on Serial0/1/0
*Dec 23 11:06:48.311:   AS 222, Flags 0x0, Seq 0/0 idbQ 0/0 iidbQ un/rely 0/0
R1#u all
*Dec 23 11:06:49.943: EIGRP: Sending HELLO on Loopback0
*Dec 23 11:06:49.943:   AS 222, Flags 0x0, Seq 0/0 idbQ 0/0 iidbQ un/rely 0/0
*Dec 23 11:06:49.943: EIGRP: Received HELLO on Loopback0 nbr 192.168.1.254
*Dec 23 11:06:49.943:   AS 222, Flags 0x0, Seq 0/0 idbQ 0/0
*Dec 23 11:06:49.943: EIGRP: Packet from ourselves ignored
*Dec 23 11:06:50.519: EIGRP: Sending HELLO on Loopback1
*Dec 23 11:06:50.519:   AS 222, Flags 0x0, Seq 0/0 idbQ 0/0 iidbQ un/rely 0/0
*Dec 23 11:06:50.519: EIGRP: Received HELLO on Loopback1 nbr 192.168.10.94
*Dec 23 11:06:50.519:   AS 222, Flags 0x0, Seq 0/0 idbQ 0/0
*Dec 23 11:06:50.519: EIGRP: Packet from ourselves ignored
R1#u all
```

```
Port Statistics for unclassified packets is not turned on.

All possible debugging has been turned off
R1#
```

3 . Cua hinh chung thuc MD5 trong EIGRP su dung KEYCHAIN co nhieu hon 1 khoa :

Trong moi keychain su dung de chung thuc MD5 trong EIGRP ta co the quy dinh ra nhieu khoa khac nhau de dung chung thuc tai tung thoi diem khac nhau giua cac Router.. Vi vay can co su dong bo thoi gian tren Router phai co cac thong so chi tiet la dong nhat.

- Buoc 1 :

```
R1 : Key chain R1chain
+       key 5
        key-string vnpro
        send-lifetime 11:35:00 DEC 23 2007 duration 120
                       <start time>
        accept-lifetime 11:35:00 DEC 23 2007 11:37:00  DEC 23 2007
                                               <stop time>
+       key 6
        key-string abc
        send-life 11:37:01 DEC 23 2007 Infinite
                       <start time>
        accept-lifetime 11:37:01 DEC 23 2007 Infinite
                                               <stop time>


R2 : Key chain R2chain
+       key 5
        key-string vnpro
        send-life 11:35:00 DEC 23 2007 duration 120
                       <start time>
        accept-lifetime 11:35:00 DEC 23 2007 11:37:00  DEC 23 2007
                                               <stop time>
+       key 6
        key-string abc
        send-life 11:37:01 DEC 23 2007 Infinite
                       <start time>
        accept-lifetime 11:37:01 DEC 23 2007 Infinite
                                               <stop time>
```

```
R1(config)#key chain R1chain
R1(config-keychain)#key 5
R1(config-keychain-key)#key-string vnpro
R1(config-keychain-key)#send-lifetime 12:05:00 DEC 23 2007 duration 120
R1(config-keychain-key accept-lifetime 12:05:00 DEC 23 2007 12:07:00 DEC 23 2007
R1(config-keychain-key)#
R1(config-keychain-key)#key 6
R1(config-keychain-key)#key-string abc
R1(config-keychain-key)#send-lifetime 12:07:01 DEC 23 2007 Infinite
R1(config-keychain-key)#accept-lifetime 12:07:01 DEC 23 2007 Infinite
R1(config-keychain-key)#
```

- Buoc 3 : Chi dinh key chain su dung interface tren Router

```
R1(config)#int s0/1/0
R1(config-if)#ip authentication mode eigp 222 md5
R1(config-if)#ip authentication key-chain eigrp 222 R1chain
```

====> mat neighbor

```
          #debug eigrp packets
```

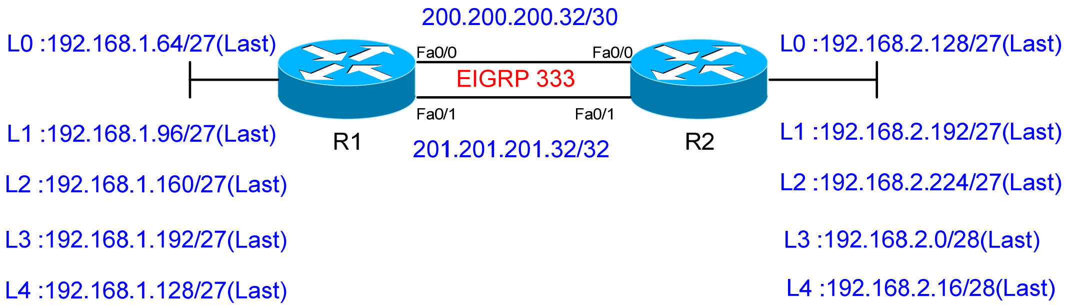
- Buoc4 :

```
#clear ip eigrp neighbor

1(config-if)#
Dec 23 11:57:08.468: %DUAL-5-NBRCHANGE: IP-EIGRP(0) 222: Neighbor 200.200.200.34
 (Serial0/1/0) is up: new adjacency
Dec 23 11:57:08.800: %DUAL-5-NBRCHANGE: IP-EIGRP(0) 222: Neighbor 200.200.200.34
 (Serial0/1/0) is down: keychain changed

1#
Dec 23 11:58:03.532: %DUAL-5-NBRCHANGE: IP-EIGRP(0) 222: Neighbor 200.200.200.34
 (Serial0/1/0) is down: manually cleared
Dec 23 11:58:04.356: %DUAL-5-NBRCHANGE: IP-EIGRP(0) 222: Neighbor 200.200.200.34
 (Serial0/1/0) is up: new adjacency
```

LOAD BALANCING


200.200.200.32/30
L0 :192.168.1.64/27(Last)
Fa0/0
Fa0/0
L0 :192.168.2.128/27(Last)
EIGRP 333
Fa0/1
Fa0/1
L1 :192.168.1.96/27(Last)
R1
201.201.201.32/32
R2
L1 :192.168.2.192/27(Last)
L2 :192.168.1.160/27(Last)
L2 :192.168.2.224/27(Last)
L3 :192.168.1.192/27(Last)
L3 :192.168.2.0/28(Last)
L4 :192.168.1.128/27(Last)
L4 :192.168.2.16/28(Last)

1. Can bang tai dong deu:

```
R1#sh ip eigrp neighbors
IP-EIGRP neighbors for process 333
H   Address              Interface       Hold Uptime   SRTT   RTO  Q  Seq
                                         (sec)         (ms)       Cnt Num
1   201.201.201.34         Fa0/1            13 00:28:47   68   408  0  39
0   200.200.200.34         Fa0/0            13 00:29:02    1   200  0  38

R1#sh ip route eigrp
     192.168.2.0/24 is variably subnetted, 5 subnets, 3 masks
D       192.168.2.0/28
          [90/156160] via 201.201.201.34, 00:04:32, FastEthernet0/1
          [90/156160] via 200.200.200.34, 00:04:32, FastEthernet0/0
D       192.168.2.16/28
          [90/156160] via 201.201.201.34, 00:04:32, FastEthernet0/1
          [90/156160] via 200.200.200.34, 00:04:32, FastEthernet0/0
D       192.168.2.224/27
          [90/156160] via 201.201.201.34, 00:04:32, FastEthernet0/1
          [90/156160] via 200.200.200.34, 00:04:32, FastEthernet0/0
D       192.168.2.192/27
          [90/156160] via 201.201.201.34, 00:04:32, FastEthernet0/1
          [90/156160] via 200.200.200.34, 00:04:32, FastEthernet0/0
D       192.168.2.128/26
          [90/156160] via 201.201.201.34, 00:04:32, FastEthernet0/1
```

```
        [90/156160] via 200.200.200.34, 00:04:32, FastEthernet0/0

R1#sh ip route 192.168.2.0 255.255.255.240
Routing entry for 192.168.2.0/28
  Known via "eigrp 333", distance 90, metric 156160, type internal
  Redistributing via eigrp 333
  Last update from 200.200.200.34 on FastEthernet0/0, 00:06:22 ago
  Routing Descriptor Blocks:
  * 201.201.201.34, from 201.201.201.34, 00:06:22 ago, via FastEthernet0/1
      Route metric is 156160, traffic share count is 1          -----> goi can bang tai
      Total delay is 5100 microseconds, minimum bandwidth is 100000 Kbit
      Reliability 255/255, minimum MTU 1500 bytes
      Loading 1/255, Hops 1
    200.200.200.34, from 200.200.200.34, 00:06:22 ago, via FastEthernet0/0
      Route metric is 156160, traffic share count is 1
      Total delay is 5100 microseconds, minimum bandwidth is 100000 Kbit
      Reliability 255/255, minimum MTU 1500 bytes
      Loading 1/255, Hops 1

R1(config)#router eigrp 333
R1(config-router)#maximum-paths ?
  <1-16>  Number of paths         --> toi da 16 duong can bang tai
R1(config-router)#maximum-paths 1

#sh ip eigrp protocols

IP-EIGRP Topology Table for AS(333)/ID(192.168.1.94)

Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
       r - reply Status, s - sia Status

P 192.168.1.96/27, 1 successors, FD is 128256
        via Connected, Loopback1
P 192.168.1.64/27, 1 successors, FD is 128256
        via Connected, Loopback0
P 192.168.2.0/28, 1 successors, FD is 156160
        via 200.200.200.34 (156160/128256), FastEthernet0/0
        via 201.201.201.34 (156160/128256), FastEthernet0/1
P 192.168.2.16/28, 1 successors, FD is 156160
        via 201.201.201.34 (156160/128256), FastEthernet0/1
        via 200.200.200.34 (156160/128256), FastEthernet0/0
P 192.168.2.224/27, 1 successors, FD is 156160
        via 201.201.201.34 (156160/128256), FastEthernet0/1
        via 200.200.200.34 (156160/128256), FastEthernet0/0
P 192.168.1.192/27, 1 successors, FD is 128256
        via Connected, Loopback3
P 192.168.2.192/27, 1 successors, FD is 156160
        via 200.200.200.34 (156160/128256), FastEthernet0/0
        via 201.201.201.34 (156160/128256), FastEthernet0/1
```

* Khi ta chinh maximum-paths=1 tuc la ta da disable tinh nang Loadbalancing
======> con dung chi co 1 duong mang.

```
R1#sh ip route  eigrp
     192.168.2.0/24 is variably subnetted, 5 subnets, 3 masks
D       192.168.2.0/28
        [90/156160] via 200.200.200.34, 00:02:17, FastEthernet0/0
D       192.168.2.16/28
        [90/156160] via 201.201.201.34, 00:02:17, FastEthernet0/1
D       192.168.2.224/27
```

```
         [90/156160] via 201.201.201.34, 00:02:17, FastEthernet0/1
D       192.168.2.192/27
         [90/156160] via 200.200.200.34, 00:02:17, FastEthernet0/0
D       192.168.2.128/26
         [90/156160] via 200.200.200.34, 00:02:17, FastEthernet0/0
```

*** Chinh maximum-paths lai la 4**

```
R1#sh ip route eigrp
     192.168.2.0/24 is variably subnetted, 5 subnets, 3 masks
D       192.168.2.0/28
         [90/156160] via 201.201.201.34, 00:00:17, FastEthernet0/1
         [90/156160] via 200.200.200.34, 00:00:17, FastEthernet0/0
D       192.168.2.16/28
         [90/156160] via 201.201.201.34, 00:00:17, FastEthernet0/1
         [90/156160] via 200.200.200.34, 00:00:17, FastEthernet0/0
D       192.168.2.224/27
         [90/156160] via 201.201.201.34, 00:00:17, FastEthernet0/1
         [90/156160] via 200.200.200.34, 00:00:17, FastEthernet0/0
D       192.168.2.192/27
         [90/156160] via 201.201.201.34, 00:00:17, FastEthernet0/1
         [90/156160] via 200.200.200.34, 00:00:17, FastEthernet0/0
D       192.168.2.128/26
         [90/156160] via 201.201.201.34, 00:00:17, FastEthernet0/1
         [90/156160] via 200.200.200.34, 00:00:17, FastEthernet0/0


R1#sh ip eigrp topology
IP-EIGRP Topology Table for AS(333)/ID(192.168.1.94)

Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
       r - reply Status, s - sia Status

P 192.168.1.96/27, 1 successors, FD is 128256
        via Connected, Loopback1
P 192.168.1.64/27, 1 successors, FD is 128256
        via Connected, Loopback0
P 192.168.2.0/28, 2 successors, FD is 156160
        via 201.201.201.34 (156160/128256), FastEthernet0/1
        via 200.200.200.34 (156160/128256), FastEthernet0/0
P 192.168.2.16/28, 2 successors, FD is 156160
        via 200.200.200.34 (156160/128256), FastEthernet0/0
        via 201.201.201.34 (156160/128256), FastEthernet0/1
P 192.168.2.224/27, 2 successors, FD is 156160
        via 200.200.200.34 (156160/128256), FastEthernet0/0
        via 201.201.201.34 (156160/128256), FastEthernet0/1
P 192.168.1.192/27, 1 successors, FD is 128256
        via Connected, Loopback3
P 192.168.2.192/27, 2 successors, FD is 156160
        via 201.201.201.34 (156160/128256), FastEthernet0/1
        via 200.200.200.34 (156160/128256), FastEthernet0/0

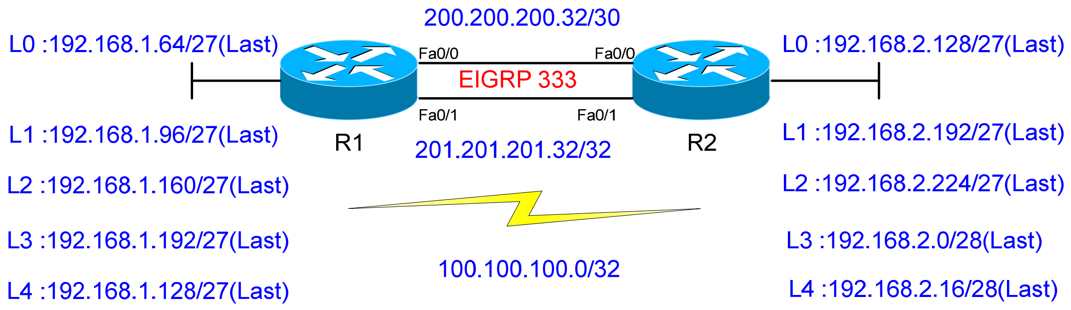
Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
       r - reply Status, s - sia Status

P 192.168.1.160/27, 1 successors, FD is 128256
        via Connected, Loopback2
P 200.200.200.32/30, 1 successors, FD is 28160
        via Connected, FastEthernet0/0
```

```
P 192.168.1.128/27, 1 successors, FD is 128256
        via Connected, Loopback4
P 201.201.201.32/30, 1 successors, FD is 28160
        via Connected, FastEthernet0/1
P 192.168.2.128/26, 2 successors, FD is 156160
        via 201.201.201.34 (156160/128256), FastEthernet0/1
        via 200.200.200.34 (156160/128256), FastEthernet0/0
IP-EIGRP Topology Table for AS(33)/ID(192.168.1.222)
```

2. Can bang tai khong dong deu:

Ket noi them 1 cong Serial IP: 100.100.100.0/30



200.200.200.32/30
L0 :192.168.1.64/27(Last)
Fa0/0
Fa0/0
L0 :192.168.2.128/27(Last)
EIGRP 333
Fa0/1
Fa0/1
L1 :192.168.1.96/27(Last)
R1
201.201.201.32/32
R2
L1 :192.168.2.192/27(Last)
L2 :192.168.1.160/27(Last)
L2 :192.168.2.224/27(Last)
L3 :192.168.1.192/27(Last)
L3 :192.168.2.0/28(Last)
100.100.100.0/32
L4 :192.168.1.128/27(Last)
L4 :192.168.2.16/28(Last)

```
R1#sh ip eigrp neighbors
IP-EIGRP neighbors for process 333
H   Address             Interface       Hold Uptime   SRTT   RTO  Q  Seq
                                        (sec)         (ms)       Cnt Num
0   201.201.201.34          Fa0/1           14 00:02:46    3   200  0  147
1   200.200.200.34          Fa0/0           13 00:03:24  334  2004  0  149
2   100.100.100.2           Se0/3/0         11 00:08:07    1   200  0  148

R1#sh ip eigrp topology
IP-EIGRP Topology Table for AS(333)/ID(192.168.1.94)

Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
       r - reply Status, s - sia Status

P 192.168.1.96/27, 1 successors, FD is 128256
        via Connected, Loopback1
P 192.168.1.64/27, 1 successors, FD is 128256
        via Connected, Loopback0
P 100.100.100.0/30, 1 successors, FD is 2169856
        via Connected, Serial0/3/0
P 192.168.2.0/28, 2 successors, FD is 156160
        via 201.201.201.34 (156160/128256), FastEthernet0/1
        via 200.200.200.34 (156160/128256), FastEthernet0/0
        via 100.100.100.2 (2297856/128256), Serial0/3/0
P 192.168.2.16/28, 2 successors, FD is 156160
        via 201.201.201.34 (156160/128256), FastEthernet0/1
        via 200.200.200.34 (156160/128256), FastEthernet0/0
        via 100.100.100.2 (2297856/128256), Serial0/3/0
P 192.168.2.224/27, 2 successors, FD is 156160
        via 201.201.201.34 (156160/128256), FastEthernet0/1
        via 200.200.200.34 (156160/128256), FastEthernet0/0
        via 100.100.100.2 (2297856/128256), Serial0/3/0
P 192.168.1.192/27, 1 successors, FD is 128256
 --More--
```

```
R1#sh ip route  eigrp
     192.168.2.0/24 is variably subnetted, 5 subnets, 3 masks
D       192.168.2.0/28
           [90/156160] via 201.201.201.34, 00:05:43, FastEthernet0/1
           [90/156160] via 200.200.200.34, 00:05:43, FastEthernet0/0
D       192.168.2.16/28
           [90/156160] via 201.201.201.34, 00:05:43, FastEthernet0/1
           [90/156160] via 200.200.200.34, 00:05:43, FastEthernet0/0
D       192.168.2.224/27
           [90/156160] via 201.201.201.34, 00:05:43, FastEthernet0/1
           [90/156160] via 200.200.200.34, 00:05:43, FastEthernet0/0
D       192.168.2.192/27
           [90/156160] via 201.201.201.34, 00:05:43, FastEthernet0/1
           [90/156160] via 200.200.200.34, 00:05:43, FastEthernet0/0
D       192.168.2.128/26
           [90/156160] via 201.201.201.34, 00:05:43, FastEthernet0/1
           [90/156160] via 200.200.200.34, 00:05:43, FastEthernet0/0
```

```
R1#sh ip route  eigrp
     192.168.2.0/24 is variably subnetted, 5 subnets, 3 masks
D       192.168.2.0/28
           [90/156160] via 201.201.201.34, 00:05:43, FastEthernet0/1
           [90/156160] via 200.200.200.34, 00:05:43, FastEthernet0/0
D       192.168.2.16/28
           [90/156160] via 201.201.201.34, 00:05:43, FastEthernet0/1
           [90/156160] via 200.200.200.34, 00:05:43, FastEthernet0/0
D       192.168.2.224/27
           [90/156160] via 201.201.201.34, 00:05:43, FastEthernet0/1
           [90/156160] via 200.200.200.34, 00:05:43, FastEthernet0/0
D       192.168.2.192/27
           [90/156160] via 201.201.201.34, 00:05:43, FastEthernet0/1
           [90/156160] via 200.200.200.34, 00:05:43, FastEthernet0/0
D       192.168.2.128/26
           [90/156160] via 201.201.201.34, 00:05:43, FastEthernet0/1
           [90/156160] via 200.200.200.34, 00:05:43, FastEthernet0/0
```

```
R1#sh ip protocols
Routing Protocol is "eigrp 333"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Default networks flagged in outgoing updates
  Default networks accepted from incoming updates
  EIGRP metric weight K1=1, K2=0, K3=1, K4=0, K5=0
  EIGRP maximum hopcount 100
  EIGRP maximum metric variance 1
  Redistributing: eigrp 333
  EIGRP NSF-aware route hold timer is 240s
  Automatic network summarization is not in effect
  Maximum path: 4
  Routing for Networks:
    100.0.0.0
    192.168.1.0
    200.200.200.0
    201.201.201.0
  Routing Information Sources:
    Gateway         Distance      Last Update
    (this router)         90      02:11:59
    100.100.100.2         90      00:05:56
    200.200.200.34        90      00:05:56
    201.201.201.34        90      00:05:56
  Distance: internal 90 external 170
```

********* Mong muon dua Feasible Successor vao bang dinh tuyen de ho tro can bang tai khong dong deu.

- Cau hinh thay doi thong so EIGRP maximum metric variance, co mien gia tri (1 - 128).

+ EIGRP maximum metric variance = 1 chi dua Successor Router vao bang dinh tuyen ma thoi.

$$Variance > \frac{MetricFeasibleSuccessor}{FD}$$

```
R1#sh ip eigrp topology
IP-EIGRP Topology Table for AS(333)/ID(192.168.1.94)

Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
       r - reply Status, s - sia Status

P 192.168.1.96/27, 1 successors, FD is 128256
        via Connected, Loopback1
P 192.168.1.64/27, 1 successors, FD is 128256
        via Connected, Loopback0
P 100.100.100.0/30, 1 successors, FD is 2169856
        via Connected, Serial0/3/0
P 192.168.2.0/28, 2 successors, FD is 156160
        via 201.201.201.34 (156160/128256), FastEthernet0/1
        via 200.200.200.34 (156160/128256), FastEthernet0/0
        via 100.100.100.2 (2297856/128256), Serial0/3/0
P 192.168.2.16/28, 2 successors, FD is 156160
        via 201.201.201.34 (156160/128256), FastEthernet0/1
        via 200.200.200.34 (156160/128256), FastEthernet0/0
        via 100.100.100.2 (2297856/128256), Serial0/3/0
P 192.168.2.224/27, 2 successors, FD is 156160
        via 201.201.201.34 (156160/128256), FastEthernet0/1
        via 200.200.200.34 (156160/128256), FastEthernet0/0
        via 100.100.100.2 (2297856/128256), Serial0/3/0
P 192.168.1.192/27, 1 successors, FD is 128256
        via Connected, Loopback4
P 192.168.2.192/27, 2 successors, FD is 156160
        via 201.201.201.34 (156160/128256), FastEthernet0/1
        via 200.200.200.34 (156160/128256), FastEthernet0/0
        via 100.100.100.2 (2297856/128256), Serial0/3/0
P 200.200.200.0/24, 1 successors, FD is 28160
        via Connected, FastEthernet0/0
P 192.168.1.160/27, 1 successors, FD is 128256
        via Connected, Loopback3
P 201.201.201.32/30, 1 successors, FD is 28160
        via Connected, FastEthernet0/1
P 192.168.1.128/27, 1 successors, FD is 128256
        via Connected, Loopback2
P 192.168.2.128/26, 2 successors, FD is 156160
        via 201.201.201.34 (156160/128256), FastEthernet0/1
        via 200.200.200.34 (156160/128256), FastEthernet0/0
        via 100.100.100.2 (2297856/128256), Serial0/3/0
```

ex: Variance > 2297856/ 156160 = 14,7147540…….

Chinh Variance = 14 --> 2 duong

Chinh Variance = 15 --> 3 duong

```
R1(config)#router eigrp 333
R1(config-router)#variance 15
```

```
R1#sh ip route eigrp
     192.168.2.0/24 is variably subnetted, 5 subnets, 3 masks
D       192.168.2.0/28
          [90/156160] via 201.201.201.34, 00:01:19, FastEthernet0/1
          [90/156160] via 200.200.200.34, 00:01:19, FastEthernet0/0
          [90/2297856] via 100.100.100.2, 00:01:19, Serial0/3/0
D       192.168.2.16/28
          [90/156160] via 201.201.201.34, 00:01:19, FastEthernet0/1
          [90/156160] via 200.200.200.34, 00:01:19, FastEthernet0/0
          [90/2297856] via 100.100.100.2, 00:01:19, Serial0/3/0
D       192.168.2.224/27
          [90/156160] via 201.201.201.34, 00:01:19, FastEthernet0/1
          [90/156160] via 200.200.200.34, 00:01:19, FastEthernet0/0
          [90/2297856] via 100.100.100.2, 00:01:19, Serial0/3/0
D       192.168.2.192/27
          [90/156160] via 201.201.201.34, 00:01:19, FastEthernet0/1
          [90/156160] via 200.200.200.34, 00:01:19, FastEthernet0/0
          [90/2297856] via 100.100.100.2, 00:01:19, Serial0/3/0
D       192.168.2.128/26
          [90/156160] via 201.201.201.34, 00:01:19, FastEthernet0/1
          [90/156160] via 200.200.200.34, 00:01:19, FastEthernet0/0
          [90/2297856] via 100.100.100.2, 00:01:19, Serial0/3/0
```

```
R1#sh ip route 192.168.2.128 255.255.255.192
Routing entry for 192.168.2.128/26
  Known via "eigrp 333", distance 90, metric 156160, type internal
  Redistributing via eigrp 333
  Last update from 100.100.100.2 on Serial0/3/0, 00:02:15 ago
  Routing Descriptor Blocks:
    201.201.201.34, from 201.201.201.34, 00:02:15 ago, via FastEthernet0/1
      Route metric is 156160, traffic share count is 15
      Total delay is 5100 microseconds, minimum bandwidth is 100000 Kbit
      Reliability 255/255, minimum MTU 1500 bytes
      Loading 1/255, Hops 1
  * 200.200.200.34, from 200.200.200.34, 00:02:15 ago, via FastEthernet0/0 ---> goi tin tiep theo xac dinh cong nao de ra ngoai
      Route metric is 156160, traffic share count is 15
      Total delay is 5100 microseconds, minimum bandwidth is 100000 Kbit
      Reliability 255/255, minimum MTU 1500 bytes
      Loading 1/255, Hops 1
    100.100.100.2, from 100.100.100.2, 00:02:15 ago, via Serial0/3/0
      Route metric is 2297856, traffic share count is 1
      Total delay is 25000 microseconds, minimum bandwidth is 1544 Kbit
      Reliability 255/255, minimum MTU 1500 bytes
      Loading 1/255, Hops 1
```

Variance * FD > Feasible Successor

3. Route Summarization :

Tom tat thong tin dinh tuyen tu 1 Router quang ba sang Router khac voi muc dich chinh la la "thu hep kich co bang dinh tuyen cua cac Router".

-Buoc 1 : Liet ke ca Network muon Summary

192.168.1.64/27
192.168.1.96/27
192.168.1.12827
192.168.1.168/27
192.168.1.192/27
Liet ke Bit giong nhau nhieu nhat cua cac Network muon Summary tu trai qua phai.

====> cac network tren giong nhau 24 bit

summary route : 192.168.1.0/24

ex1 : 192.168.128.0/24
192.168.159.0/24

summary route : 192.168.128.0/19

ex2 : 200.200.64.0/24
....

200.200.79.0/24

summary route : 200.200.64.0/20

- Buoc 2 : Vao tung Interface cua Router ket noi voi lang gieng cua no quang ba Summary Route

```
R1(config)#int fa0/0
R1(config-if)#ip summary-address eigrp 333 192.168.1.0 255.255.255.0
R1(config-if)#
R1(config-if)#exit
R1(config)#
R1(config)#int fa0/1
R1(config-if)#ip summary-address eigrp 333 192.168.1.0 255.255.255.0
R1(config-if)#
R1(config-if)#exit
R1(config)#
R1(config)#int s0/3/0
R1(config-if)#ip summary-address eigrp 333 192.168.1.0 255.255.255.0
```

```
R1#sh ip route eigrp
    192.168.1.0/24 is variably subnetted, 6 subnets, 2 masks
D      192.168.1.0/24 is a summary, 00:00:05, Null0

----> Tu tao

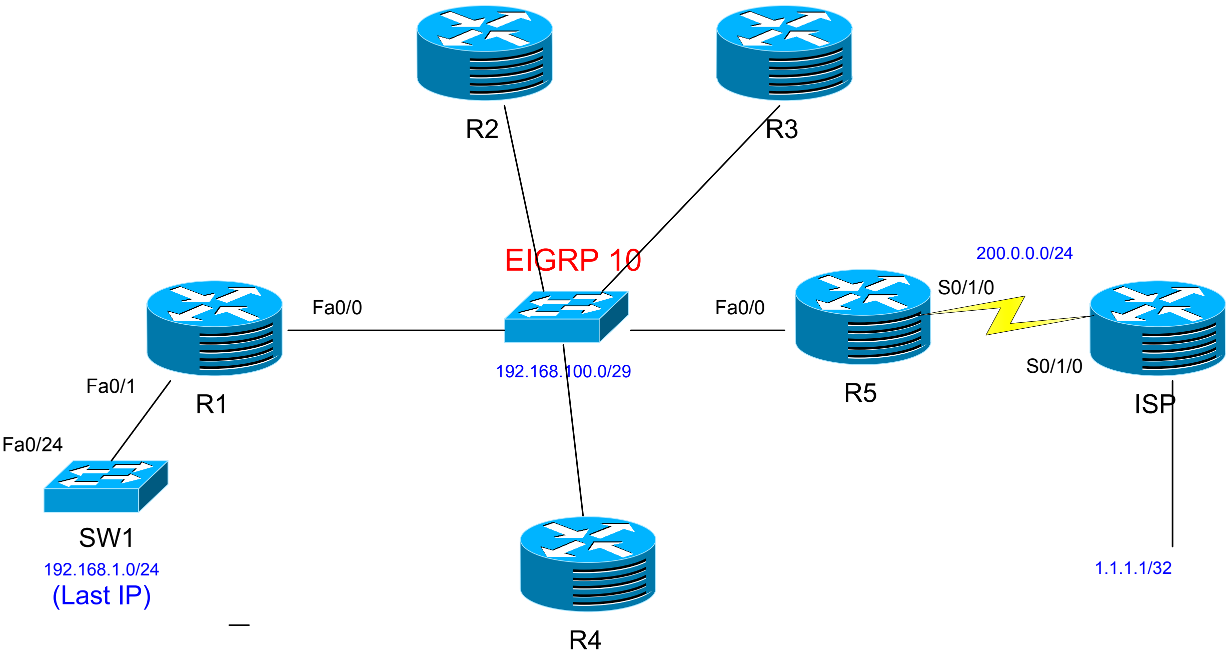
D   192.168.2.0/24 [90/156160] via 201.201.201.34, 00:00:05, FastEthernet0/1
----> Tao cho Neighbor
                  [90/156160] via 200.200.200.34, 00:00:05, FastEthernet0/0
                  [90/2297856] via 100.100.100.2, 00:00:05, Serial0/3/0
```

<u>******** **Chu y** </u>: Router hoc duoc Summary Route tu Neigbor cua no
Router tu tao ra Summary Router da quang ba cho Neighbor va chi ve **NULL 0**

4. KY THUAT NULL 0 : la ky thuat chong Routing Loop khi Router cau hinh Summary Route thi mac dinh Router tao ra Summary Route chi ve NULL 0

- Cau Router tra cuu trong Routing Table theo luat Longest Math First

5. BORDERGATEWAY EIGRP:



* Static Default Route :

De quang ba Default Route tu Border Gateway nguoc ve cac Router khac trong cung AS 1 cach tu dong thi ta co 2 cach

- Cach 1 : su dung trong truong hop network ket noi giua Border Gateway va ISP la 1 network khac MajorNet

B1 : Cau hinh Default Route (khong quang ba Network ket noi giua Border Gateway va ISP vao EIGRP)

B2 : Vao dung tien trinh EIGRP tren Router Border Gateway thuc hien cau lenh

```
R5(conf ig)#router eigrp 222
R2(config-router)#redistribute static
```

+ ==> quang ba Static Default Router tu Router Border Gateway cho cac Router khac trong cung AS)

*** Cac Router khac

```
#clear ip route *
```

VI DU: External Route: nhung thong tin dinh tuyen ma Router chay EIGRP co duoc tu giao thuc dinh tuyen khac
AD = 170 (default).

```
R1#sh ip protocols
 EIGRP NSF-aware route hold timer is 240s
  Automatic network summarization is not in effect
  Address Summarization:
    192.168.1.0/24 for FastEthernet0/1, Serial0/1/0
    Summarizing with metric 28160
  Maximum path: 4
  Routing for Networks:
    192.168.1.0/26
    192.168.1.64/26
    192.168.1.128/26
    192.168.1.0
    192.168.14.16/30
    192.168.100.0/29
  Routing Information Sources:
    Gateway         Distance      Last Update
    (this router)        90      00:01:17
    192.168.100.4        90      00:01:17
    192.168.100.5        90      00:32:51
    192.168.100.2        90      00:01:17
    192.168.100.3        90      00:01:17
    192.168.14.18        90      00:01:17
  Distance: internal 90 external 170
```

```
#sh ip route
Gateway of last resort is 192.168.100.5 to network 0.0.0.0

     192.168.14.0/30 is subnetted, 1 subnets
C       192.168.14.16 is directly connected, Serial0/1/0
     192.168.4.0/26 is subnetted, 1 subnets
D       192.168.4.128 [90/2297856] via 192.168.14.18, 00:01:19, Serial0/1/0
     192.168.1.0/24 is variably subnetted, 4 subnets, 2 masks
C       192.168.1.64/26 is directly connected, FastEthernet0/0.10
C       192.168.1.0/26 is directly connected, FastEthernet0/0.1
D       192.168.1.0/24 is a summary, 00:01:19, Null0
C       192.168.1.128/26 is directly connected, FastEthernet0/0.20
     192.168.2.0/28 is subnetted, 1 subnets
D       192.168.2.64 [90/156160] via 192.168.100.2, 00:04:11, FastEthernet0/1
     192.168.100.0/29 is subnetted, 1 subnets
C       192.168.100.0 is directly connected, FastEthernet0/1
     192.168.3.0/28 is subnetted, 1 subnets
D       192.168.3.160 [90/30720] via 192.168.100.3, 00:04:13, FastEthernet0/1
D*EX 0.0.0.0/0 [170/30720] via 192.168.100.5, 00:01:14, FastEthernet0/1
```

- Cach 2:

Trong truong hop ket noi giua BorderGateway Router va ISP la 1 Network cung MajorNet(A: /8; B: /16; C: /24)

- Buoc 1 : Van cau hinh Static Default Route
- Buoc 2 : Quang ba Network ket noi voi ISP vao EIGRP

```
R5(conf ig)#router eirgp 10
(config-router)#net 200.0.0.0
```

- Buoc 3 : Quang ba Default Route cho cac Router cung chay Eigrp trong cung AS bang cach :

```
R5(config)#ip default-network 200.0.0.0
                              <network ket noi voi ISP>
```

Cac Router khac :

```
        #clear ip route *
        #sh ip route
                D* <network ket noi voi ISP>
R1#sh ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
    D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
    N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
```

```
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is 192.168.100.5 to network 200.0.0.0

D*   200.0.0.0/24 [90/30720] via 192.168.100.5, 00:04:48, FastEthernet0/0
     192.168.4.0/27 is subnetted, 1 subnets
D       192.168.4.64 [90/156160] via 192.168.100.4, 00:12:18, FastEthernet0/0
     192.168.5.0/26 is subnetted, 1 subnets
D       192.168.5.128 [90/156160] via 192.168.100.5, 00:12:18, FastEthernet0/0
C    192.168.1.0/24 is directly connected, FastEthernet0/1
     192.168.2.0/28 is subnetted, 1 subnets
D       192.168.2.160 [90/156160] via 192.168.100.2, 00:12:18, FastEthernet0/0
     192.168.100.0/29 is subnetted, 1 subnets
C       192.168.100.0 is directly connected, FastEthernet0/0
     192.168.3.0/28 is subnetted, 1 subnets
D       192.168.3.48 [90/30720] via 192.168.100.3, 00:12:18, FastEthernet0/0
```

```
R5#sh ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is 200.0.0.2 to network 0.0.0.0

C*   200.0.0.0/24 is directly connected, FastEthernet0/1 ---> qui dinh duong nay la Default Route cua
nhung Router ben trong
     192.168.4.0/27 is subnetted, 1 subnets
D       192.168.4.64 [90/156160] via 192.168.100.4, 00:41:47, FastEthernet0/0
     192.168.5.0/26 is subnetted, 1 subnets
C       192.168.5.128 is directly connected, Loopback0
D    192.168.1.0/24 [90/30720] via 192.168.100.1, 00:00:18, FastEthernet0/0
     192.168.2.0/28 is subnetted, 1 subnets
D       192.168.2.160 [90/156160] via 192.168.100.2, 00:23:09, FastEthernet0/0
     192.168.100.0/29 is subnetted, 1 subnets
C       192.168.100.0 is directly connected, FastEthernet0/0
     192.168.3.0/28 is subnetted, 1 subnets
D       192.168.3.48 [90/30720] via 192.168.100.3, 00:44:30, FastEthernet0/0
S*   0.0.0.0/0 [1/0] via 200.0.0.2
```

************* Mo rong :**

Router Gateway chạy EIGRP quảng bá Default Route cho các Router khác chạy EIGRP trong cùng AS bằng cách nó sẽ: "***đánh dấu***" một Network X kết nối trực tiếp với nó bằng câu lệnh: "***ip default-network***"

- Network X này phải là 1 Network có Address thuộc Major Network.
- Network X này phải được Router Gateway trong EIGRP quảng bá cho các Router khác bằng EIGRP
- Câu lệnh "***ip default-network***" giúp Router Gateway hướng dẫn cho các Router khác Forward Packet với Destination Address không nằm trong bảng định tuyến của chúng đến Router Gateway thông qua Network được đánh dấu.

ACCESS CONTROL LIST (ACLs)

I. LY THUYET :

1. Khai niem :

- ACLs la ung dung duoc tich hop trong Cisco IOS
- Nham muc dich :

+ Filtering Traffic trong he thong. Router chi co the loc cac Traffic di qua no (Pass through it) nhung khong the loc duoc cac Traffic xuat phat tu tren chinh Router (Originate from It).

*** Thuc hien viec loc Traffic dua vao :

> Source IP va Destination IP

> Source Port va Destination Port

2. Ung dung:

- Trien khai Security trong he thong vi the duoc xem nhu Firewall
- Qui dinh ra cac day dia chi IP can NAT
- Filter cac thong tin dinh tuyen gui tu Router nay sang Router khac (BSCI)
- Chat luong dich vu - Quality Of Service (QoS): BCMSI, ONT, QoS (CCNP), CCIP

3. Tinh nang ung dung Firewall :

*** Cac hinh thuc Router xu ly goi tin khi duoc trien khai ACLs :

- ACLs duoc viet ra duoi dang 1 scrip (van ban) co trinh tu
- ACLs chi co tac dung khi va chi khi no duoc Apply vao cac Interface va cac Line tren Router.
- Mot Access List duoc viet ra bao gom cac cau lenh cam hoac la cho phep (Permit/Deny).

ACLs no co the duoc Apply tren cac Interface cua Router theo chieu **IN/OUT**

+ **IN**: loc va xu ly cac Packet cua cac Traffic di vao Interface tren Router. Khi Router nhan duoc Packet no se xu ly ACLs so sanh cac dieu kien cua ACLs sau do moi thuc hien cong viec dinh tuyen.

+ **OUT**: Router se loc va xu ly cac Packet cua Traffic di ra khoi Interface tren Router. Khi Router nhan duoc Packet no se xu ly dinh tuyen truoc sau do moi xet dieu kien ACLs.

- Router do dieu ACLs theo trinh tu Top - Down, neu Packet dung o bat ki dong nao cua ACLs thi ngay lap tuc Router se thoat ra khoi ACLs va xu ly Packet tren ung theo qui dinh cua ACLs la Permit/Deny

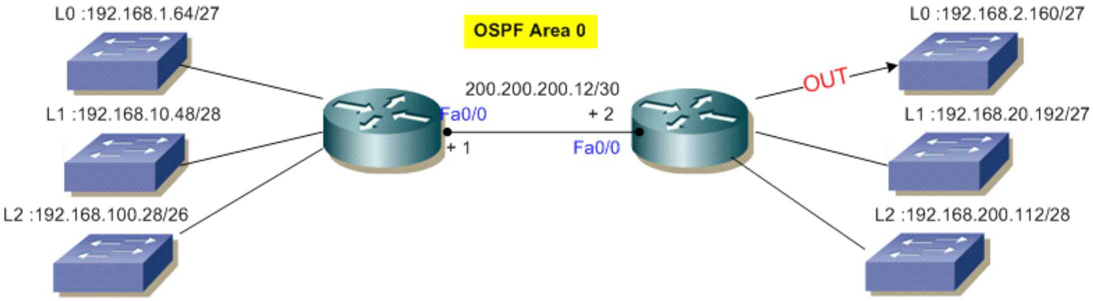
*** Neu nhu Packet khong dung voi ACLs tren thi Packet tren se bi Drop.

4. Phan loai ACLs :

a> Standard ACLs :

+ Co so hieu la 1 - 99, doi voi IOS 12.3 tro ve sau ho tro tren 1300 – 1999 ACLs

+ La loai ACLs loc Traffic chi dua vao SourceIP cua Packet



+ Khi ta qui dinh

* **Permit:** Cho phep tat ca cac nguon luu thong thoa dieu kien hoat dong tren toan bo ACLs

* **Deny:** Cam tat ca cac nguon luu thong thoa dieu kien hoat dong tren toan bo ACLs

Khi Apply Standard ACLs ta nen viet no o gan dich cua luong luu thong.

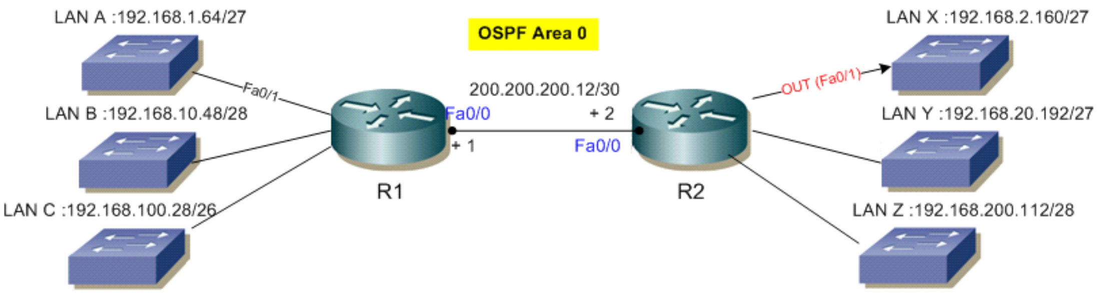
VIDU: Viet Standard ACLs sao cho:

+ Cam User thuoc LAN A va LAN B tren Router 1 truy xuat LAN X

```
Access-list 1 deny 192.168.1.64 0.0.0.31
Access-list 1 deny 192.168.10.48 0.0.0.31
```

+ Chi cho phep LAN C tren R1 truy xuat LAN X

```
Access-list 1 permit 192.168.100.28 0.0.0.63
```



```
R2(config)#access-list 1 deny 192.168.1.64 0.0.0.31
                <so hieu> <Source IP Address> <WildCard>
R2(config)#access-list 1 deny 192.168.10.48 0.0.0.15
R2(config)#access-list 1 permit 192.168.100.128 0.0.0.63
R2(config)#access-list 1 permit 0.0.0.0 255.255.255.255
```

hoac

```
R2(config)#access-list 1 permit any
```

-------> nham cho Traffic cua LAN Y, Z co the vao LAN X, LANC co the vao LAN Y,Z

******** **Chu y** : + dieu kien nao cua ACLs co the duoc viet truoc thi se duoc Router xu ly truoc

+ Khi ta dung lenh "NO" bat ky dong nao cua ACLs thi mac dinh ta xoa han luon ACLs do

+ Nen viet ACLs ngoai nhap truoc va phai tinh toan chinh sach hop ly.

+ Mac dinh o cuoi ACLs co 1 cau lenh an la "DENY ANY"

```
R2(config)#int fa0/0
R2(config-if)#ip access-group 1 out
                         <so hieu> <Chieu>
```

****** WILDCARD MASK :(Challenge)**

VD 1: Loc Traffic 192.168.1.0/24
Nguyen Net: 192.168.1.0 0.0.0.255
+ IP Chan tren Net: (Bit cuoi cung cua Ip luon la 0)
192.168.1.00000000
Wildcard Bit: 0.0.11111110
===> 192.168.1.0 0.0.0.254
+ IP le tren Net: (Bit cuoi cung la so 1)
192.168.1.00000001
0.0.0.11111110
===> 192.168.1.0 0.0.0.254
+ IP cua 1 host cu the:
192.168.1.100 0.0.0.0

Hoac host 192.168.1.100
I
VD2: Loc traffic 192.168.100.32/27

+ Nguyen Net 192.168.100.32 0.0.0.31
+ IP Chan 192.168.100.0010000**0**
Wildcard Bit 0.0.0.11011110 ==> .30
+ IP le 192.168.100.0010000**1**
WC 0.0.0.11011110 ==> .30

VD3: Loc traffic 192.168.20.112/28
+ Nguyen Net 192.168.20.112 0.0.0.15
+ IP Chan 192.168.20.0111000**0**
Wildcard Bit 0.0.0.10001110
==> 192.168.20.128.14
+ IP le 192.168.100.0111000**1**
WC 0.0.0.10001110
==> 192.168.20.129 0.0.0.14

VD4: Loc traffic 192.168.1.128/26
+ Nguyen Net 192.168.1.128 0.0.0.63
+ IP Chan 192.168.1.1000000**0**
Wildcard Bit 0.0.0.01111110 ==> .62
==> 192.168.1.128 0.0.0.62
+ IP le 192.168.100.1000000**1**
WC 0.0.0.01111110 ==> .62
==> 192.168.1.129 0.0.0.62

VD5: 192.168.1.128- 192.168.1.159

192.168.1.**10**000000
192.168.1.**10**111111

➔ 192.168.1.128 0.0.0.31

VD6: Day IP
192.168.1.0
....
192.168.7.0

192.168.**00000**001.0
192.168.**00000**111.0

== > 192.168.1.0 0.0.7.255

VD7:

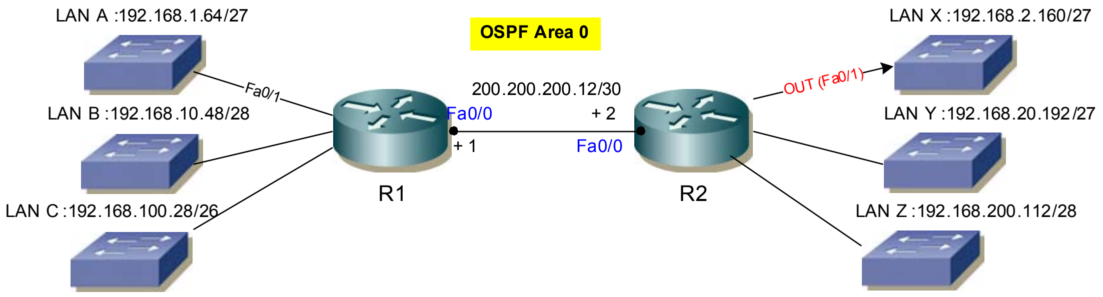
Day 192.168.1.1 192.168.3.254
192.168.1.1 0.0.3.255

VD8: Loc Le, Chan 192.168.128.1
....
192.168.192.154

IP Chan 192.168.10000000.00000001
IP Le 192.168.11000000.00000001
KQ: 0.0.01111111.11111110

192.168.128.1 0.0.127.254

II. THUC HANH :



VD ACLs1 : Apply tren R2

Viet 1 Standard ACL tren R2 thoa dieu kien:

- Chi cho phep host 192.168.1.66 o LAN A truy xuat LAN X.

Cam cac host con lai o LAN A truy xuat X

- Cho phepLAN B truy xuat LAN X
- Cam LAN C truy xuat LAN X
- Cho phep cac LAN con lai truy xuat LAN X(chi ro noi ap ACLs)

```
R2(config)#access-list 1 permit 192.168.1.66 0.0.0.0
R2(config)#access-list 1 deny 192.168.1.64 0.0.0.31
R2(config)#access-list 1 permit 192.168.10.48 0.0.0.15
R2(config)#access-list 1 deny 192.168.100.128 0.0.0.63
R2(config)#access-list 1 permit any
```

VD ACLs2: Apply tren R1

Viet 1 Standard ACLs thoa dieu kien

- Chi cho phep Ip chan LAN X truy xuat LAN A. Cam cac IP le truy xuat LAN A
- Cam cac IP le tu LAN Y va Z truy xuat LAN A
- Cho phep cac LAN con lai truy xuat LAN A (Chi ro noi ap ACLs)

```
access-list 1 permit 192.168.2.160 0.0.0.14
access-list 1 deny 192.168.2.161 0.0.0.14
access-list 1 permit 192.168.20.193 0.0.0.30
access-list 1 permit 192.168.200.113 0.0.0.30
access-list 1 permit any
```

VD3:

Viet 1 Standard ACL tren R2 thoa dieu kien:

- Chi cho phep host 192.168.1.66 o LAN A truy xuat LAN X.

Cho phep cac IP chan truy xuat LAN X

Cho phep cac IP le truy xuat LAN X

```
access-list permit 192.168.1.66 0.0.0.0
access-list permit 192.168.1.64 0.0.0.30
access-list permit 192.168.1.65 0.0.0.30
```

```
R2#sh access-lists
Standard IP access list 1
    10 deny   192.168.1.66 (3 matches)
    20 permit 192.168.1.64, wildcard bits 0.0.0.30 (13 matches)
    30 deny   192.168.1.65, wildcard bits 0.0.0.30 (3 matches)
```

```
40 permit any
```

***** Bo Access List:**

Khi ta muon bo Access List ta nen :
+ > Den Int da Apply va bo Apply
+ > Bo ACLs bang cach
(config)#no access-group 1

VD4 : Viet 1 Standard thoa dieu kien :
- Cam User 192.168.2.165 Telnet den R1 va IP le Telnet den R1
- Chi cho phep cac User co IP Chan tu LAN X truy xuat den R1

```
access-list 1 deny host 192.168.2.165
access-list 1 permit 192.168.2.160 0.0.0.14
access-list 1 deny 192.168.2.161 0.0.0.14
access-list 1 permit  any

line vty 0 15
access-class 1 in
exit
```

===> Ngan Telnet bang Standard ACLs

```
int fa0/1
ip access-group 1 out
```

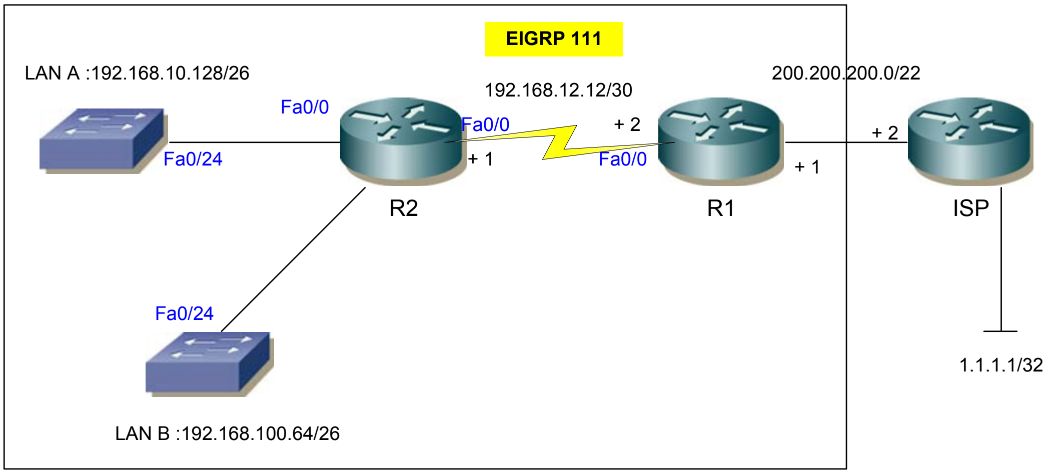
b> <u>Extended ACLs:</u>

```
R2#sh run int fa0/1 -----> Thay ACLs
Building configuration...

Current configuration : 123 bytes
!
interface FastEthernet0/1
 ip address 192.168.2.174 255.255.255.240
 ip access-group 1 out
 duplex auto
 speed auto
end

R2#sh ip int fa0/1
FastEthernet0/1 is up, line protocol is up
  Internet address is 192.168.2.174/28
  Broadcast address is 255.255.255.255
  Address determined by setup command
  MTU is 1500 bytes
  Helper address is not set
  Directed broadcast forwarding is disabled
  Multicast reserved groups joined: 224.0.0.5 224.0.0.6
  Outgoing access list is 1
  Inbound  access list is not set
  Proxy ARP is enabled
  Local Proxy ARP is disabled
  Security level is default
  Split horizon is enabled
  ICMP redirects are always sent
  ICMP unreachables are always sent
  ICMP mask replies are never sent
  IP fast switching is enabled
  IP fast switching on the same interface is disabled
  IP Flow switching is disabled
  IP CEF switching is enabled
  IP CEF Feature Fast switching turbo vector
  IP multicast fast switching is enabled
  IP multicast distributed fast switching is disabled
  IP route-cache flags are Fast, CEF
  Router Discovery is disabled
  IP output packet accounting is disabled
  IP access violation accounting is disabled
  TCP/IP header compression is disabled
  RTP/IP header compression is disabled
  Policy routing is disabled
  Network address translation is disabled
  BGP Policy Mapping is disabled
```

- Extended ACL co so hieu tu 100-199, doi voi IOS 12.3 ho tho them 2000-2699
- Ho tro them viec loc Traffic dua vao
    - + Source IP/ Destination IP
    - + Source Port/Destination Port
    - + Protocol
- Tang tinh uyen chuyen trong viec Traffic vi vay tang tinh uyen chuyen trong viec truyen khai Security.
- Nen viet va apply gan Source cua luong Traffic, nham de toi uu hoa luu thong trong he thong.



VD1: Viet Extended ACL tren R2 thoa dieu kien ;

- Chi cho phep nguoi dung co IP chan o LAN A truy xuat Internet

```
access-list permit 100 tcp 192.168.10.128 0.0.0.62 any eq www
```

- Cam nguoi dung co IP le o LAN A truy xuat Internet

```
access-list deny 100 tcp 192.168.19.129 0.0.0.62 any eq 80
```

- Chi cho phep nguoi dung co IP le o LAN A ping

```
access-list permit 100 icmp 192.168.10.129 0.0.0.62 any echo
```

- Cam nguoi dung co IP chan o LAN A ping
- Cac luu thong khac o LAN A cho phep di binh thuong

```
access-list 100 permit tcp 192.168.10.128 0.0.0.62 any eq 80
          <Source Port>   <Source IP>     <Des IP> <Des Port>
```

```
access-list 100 deny tcp 192.168.10.129 0.0.0.62 any eq www
                                                 <equal> <application>
```

```
access-list 100 permit icmp 192.168.10.129 0.0.0.62 any echo

access-list 100 deny icmp 192.168.10.129 0.0.0.62 any echo
                                               <Des IP> <Ping>
access-list 100 permit ip any any
                <Protocol TCP/IP>      <Source IP> <Destination IP>

int fa0/1
ip access-group 100 in
```

VD 2 : Viet Extended ACLs
Tai R2 viet 1 Extended ACL thoa dieu kien :

+ Chi cho phep user co IP 192.168.10.130 ping den 1.1.1.1 ma thoi
+ Cam tat ca cac User con lai ping 1.1.1.1
+ Cam User co IP 192.168.10.130 truy xuat WEB den 1.1.1.1
+ Cho phep tat ca cac User con lai truy xuat WEB den 1.1.1.1
+ Chi cho phep user co IP chan o LAN A TELNET ma thoi
+ Cam tat ca cac user con lai cua LAN A TELNET
+ Cac luu thong khac cho phep di binh thuong.

```
access-list 100 permit icmp host 192.168.10.130 host 1.1.1.1 echo
access-list 100 deny icmp 192.168.10.128 0.0.0.63 host 1.1.1.1 echo
access-list 100 deny tcp host 192.168.10.130 host 1.1.1.1 eq www
access-list 100 permit tcp 192.168.10.128 0.0.0.63 host 1.1.1.1 eq 80
access-list 100 permit tcp 192.168.10.128 0.0.0.62 any eq 23
access-list 100 deny tcp 192.168.10.129 0.0.0.62 any eq 23
access-list 100 permit ip any any

int fa0/0
ip access-group 100 in
```

VD 3 : Viet Extended ACLs tren LAN B

+ Chi cho phep User co IP la 192.168.100.68 truy xuat WEB ma thoi.
+ Cam User co IP chan truy xuat lan A va Truy xuat WEB
+ Cam User o LAN B ping den LAN A nhung co the ping den bat ki noi khac
+ Chi cho phep User IP le truy xuat LAN A ma thoi
+ Cac luu thong khac di binh thuong
+ Hay ghi chu Access-list nay la ACLs danh cho linh (cap duoi)

5. Chu Y :
a>***** **Cach dat ghi chu cho ACL** :

```
R2(config)#access-list 101 remark Chinh sach danh cho cap duoi.

access-list 101 remark CHO LINH XAI ACLs
access-list 101 permit tcp host 192.168.100.68 any eq 80

access-list 101 deny ip 192.168.100.64 0.0.0.62 192.168.10.128 0.0.0.63
access-list 101 deny tcp 192.168.100.64 0.0.0.62 any eq www

access-list 101 deny icmp 192.168.100.64 0.0.0.63 192.168.10.128 0.0.0.63 echo

access-list 101 permit ip 192.168.100.65 0.0.0.62 192.168.10.128 0.0.0.63
access-list 101 permit ip any any
```

b>Xoa ACLs:

Khi ta "NO" bat ki dong nao cua Standard va Extended ACLs thi mac dinh ta xoa han luon ca ACLs

c> Truong hop co nhieu ACL
Tai moi interface cua Router o moi chieu, ta co the Apply nhieu hon 1 ACLs thoa dieu kien :

- Chi su dung 1 ACLs cho moi chong giao thuc ma thoi.
- Neu nhu moi chieu IN hoac OUT cua Traffic tai 1 Interface cua Router co duoc Apply nhieu hon 1 ACLs danh cho 1 chong giao thuc thi Router se uu tien xu ly ACL nao co so hieu cao hon.

NAME ACCESS LIST

1. **Khai niem** :

- La loai ACL duoc dinh nghia bang Name (Case Sensitive, No Blank)
- Phai duoc dinh ro la Standard hay Extended
- Co the su dung lenh "NO" tung dong trong ACL ma khong bi xoa han ca ACL
- Cho phep hoan doi vi tri cac dong lenh, them bot, chinh sua , de dang.

VD 1 tai R1: Viet 1 name ACL Standard thoa dieu kien

+ Cam User tu LAN A Telnet den R1
+ Chi cho phep User tu LAN B co IP le Telnet den R1

```
R1(config)#ip access-list standard Telnetcontrol
                        <ACL Type> <name ACL>
R1(config-std-nacl)#remark DIEU KHIEN TELNET DEN R1
     <standard>
R1(config-std-nacl)#deny 192.168.10.128 0.0.0.63
R1(config-std-nacl)#permit 192.168.100.65 0.0.0.62
R1(config-std-nacl)#permit any
```

```
ip access-list standard Telnetcontrol
remark DIEU KHIEN TELNET DEN R1
deny 192.168.10.128 0.0.0.63
permit 192.168.100.65 0.0.0.62
permit any
```

```
int line vty 0 15
access-class Telnetcontrol in
                <ACL name>
R1#sh access-list
Standard IP access list telnetcontrol
   10 deny   192.168.10.128, wildcard bits 0.0.0.63
   20 permit 192.168.100.65, wildcard bits 0.0.0.62  --> thieu cam IP chan LAN B
   30 permit any
```

```
ip access-list standard telnetcontrol
permit host 192.168.10.130
deny 192.168.100.64 0.0.0.62
```

```
R1#sh access-list
Standard IP access list telnetcontrol
   40 permit 192.168.10.130
   10 deny   192.168.10.128, wildcard bits 0.0.0.63
   20 permit 192.168.100.65, wildcard bits 0.0.0.62
   30 permit any
   50 deny   192.168.100.64, wildcard bits 0.0.0.62
```

===> Thu tu ACL khong chinh xac

2. Chinh sua Name Access List :

Ta muon bo dong nao cua Name ACL thi ta vao cai Mode cua ACL do va dung lenh no <sequence number>

```
(config-std-nacl)#no 10
```

3. Them 1 dong truoc 1 dong lenh trong name ACL : nham de Router xu ly truoc.

*** Them 1 Rule:

+ Chi cho phep host 192.168.10.130 tu LAN A Telnet den R1

- Vao Mode config cua name ACL
- Thuc hien cau lenh :

```
R1(config-std-nacl)#9 permit host 192.168.10.130
```

```
R1(config-std-nacl)#9 permit host 192.168.10.130
R1(config-std-nacl)#do sh access-list
Standard IP access list Telnetcontrol
    9 permit 192.168.10.130
    10 deny   192.168.10.128, wildcard bits 0.0.0.63
    20 permit 192.168.100.65, wildcard bits 0.0.0.62
    30 permit any
Standard IP access list telnetcontrol
```

+ Cam IP chan LAN B Telnet den R1

```
29 deny 192.168.100.64 0.0.0.62
```

```
R1(config-std-nacl)#do sh access-list
Standard IP access list Telnetcontrol
    9 permit 192.168.10.130
    10 deny   192.168.10.128, wildcard bits 0.0.0.63
    20 permit 192.168.100.65, wildcard bits 0.0.0.62
    29 deny   192.168.100.64, wildcard bits 0.0.0.62
    30 permit any
Standard IP access list tel
```

+ Viet 1 Name Extended ACL cam User co IP le cua 2 LAN A va B ping va truy xuat WEB
+ Cac Traffic khac cho di binh thuong

```
ip access-list Extended Policy
remark CHINH SACH CAM LINH

deny icmp 192.168.10.129 0.0.0.62 any eq echo
deny tcp 192.168.10.129 0.0.0.62 any eq www

deny icmp 192.168.100.65 0.0.0.62 any eq echo
deny icmp 192.168.100.65 0.0.0.62 any eq 80
permit ip any any

int s0/2/0
ip access-group Policy Out
```

VD1: Tai Router Ha Noi viet 1 name ACL dang Extended thoa dieu kien :

+ Ghi chu la VLAN Policy

+ Cam User thuoc VLAN 11 va 33 truy xuat LAN Hue
+ Cam User thuoc VLAN 1 va 22 truy xuat LAN Nha Trang
+ Chi co user co IP chan cua 2 VLAN 11 va 22 duoc quyen truy xuat WEB
+ Chi co User thuoc VLAN 1 co quyen Ping
+ Chi co User co IP le cua VLAN 33 duoc quyen Telnet
+ Cac luu thong khac di binh thuong
Viet ACL va chi ro noi Apply va Chieu

```
ip access-list Extended VLANPolicy
remark VLAN Policy

deny ip 192.168.11.0 0.0.0.255 192.168.40.0 0.0.0.255
deny ip 192.168.33.0 0.0.0.255 192.168.40.0 0.0.0.255
deny ip 192.168.1.0 0.0.0.255 192.168.20.0 0.0.0.255
deny ip 192.168.22.0 0.0.0.255 192.168.20.0 0.0.0.255

permit tcp 192.168.11.0 0.0.0.255 any eq 80
permit tcp 192.168.22.0 0.0.0.255 any eq www
deny tcp any any eq 80

permit icmp 192.168.1.0 0.0.0.255 any eq echo
deny icmp any any eq 23

permit tcp 192.168.33.1 0.0.0.254 any eq 23
permit tcp any any eq 23

permit ip any any
```

Apply tren tung SubInterface.

*** **Luu y** :

- ACL tang do tre trong qua trinh xu ly Packet cua Router
- Nen soan thao ACL can than va chi tiet o Notpad truoc khi trien khai tren Router

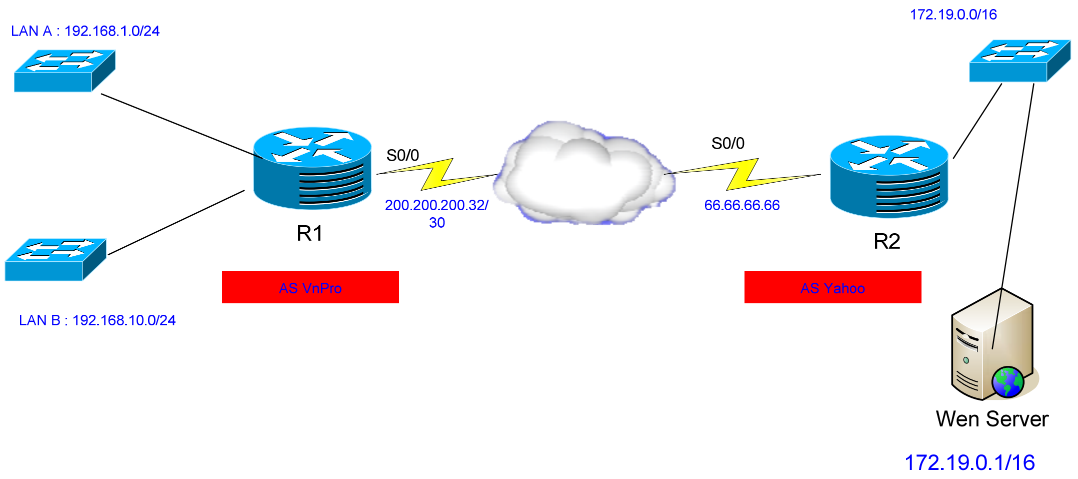
NAT (Command Line)

I . Ly Thuyet :

1. Khai niem :

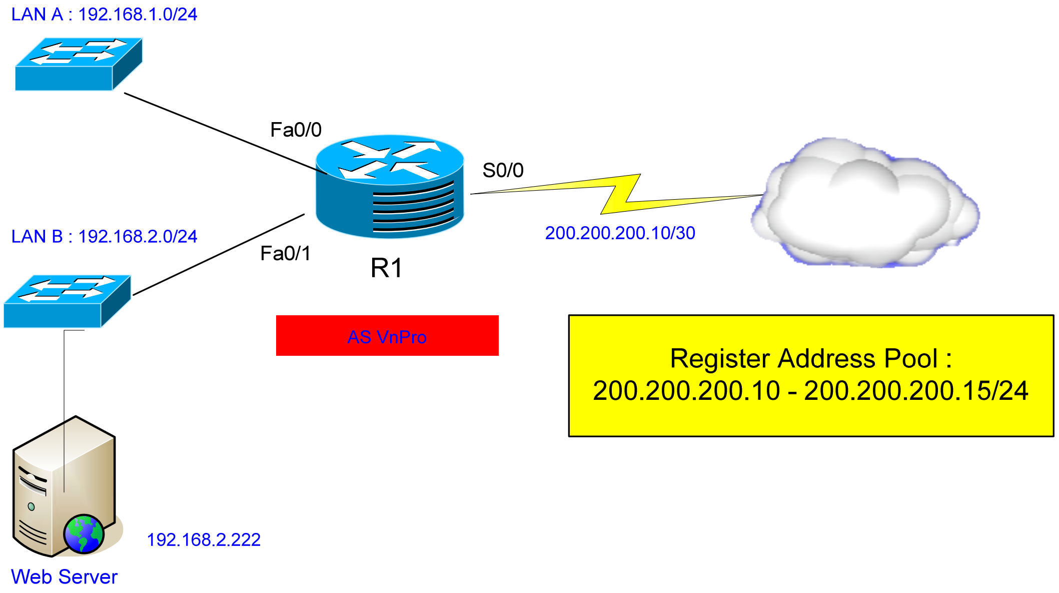
- La hinh thuc chuyen doi Source IP cua cac luong luu thong ben trong mang noi bo voi Internet
- Giam su can kiet tai nguyen IPv4 (RFC 1918 IP Private: A: 10.x.x.x; B: 172.16 - 172.31, C: 192.168)

Router thuc hien viec chuyen doi dia chi bang cach xay dung 1 CSDL goi la NAT Table bao gom cac truong anh xa tu Inside Local - Inside Global (#show ip NAT Translation)



* **Inside Local**: la nhung day dia chi (thuong la Private) duoc su dung de gan cho user thuoc cac LAN noi bo. La day dia chi can duoc NAT de giao tiep voi Internet
* **Inside Global**: la 1 hoac nhieu IP Public/Registration se dai dien cho cac day Inside Local giao tiep voi Internet
* **Outside Local**: la nhung day dia chi IP duoc su dung gan cho cac User trong LAN noi bo cua cac AS khac cac AS cua minh. Cung can duoc NAT de giao tiep voi Internet
* **Outsde Global**: duoc dang ki de dai dien cho day Outside Loal truy xuat Internet.

2. Mot so hinh thuc NAT:



a> **Static NAT** la hinh thuc xay dung 1 truong anh xa tinh tu
<1> Inside Local -------------> <1> Inside Global

+ la anh xa cho phep cac may chu ben trong LAN co the duoc truy xuat boi User ngoai Internet

VD: Static NAT anh xa IP cua Web Server thanh 200.200.200.15

- Buoc 1: Cau hinh xay dung truong anh xa tinh (Static NAT Entry)

```
 R1(config)#ip NAT inside source static 192.168.2.222 200.200.200.15
                                        <Inside Local> <Inside Global>
```

Xay dung 1 truong anh xa tinh trong bang NAT cua R1. Router se chuyen doi data xuat phat tu may tinh co Source IP la 192.168.2.222 thanh 200.200.200.15 de giao tiep voi Internet

- Buoc 2: Apply cau lenh IP NAT Inside va IP NAT Outside phu hop.

+ Doi Interface ket noi voi ISP

```
R1(config)#int s0/0
R1(config-if)#ip nat outside
```

+ Doi voi Interface ket noi voi LAN

```
R1(config)#int fa0/1
R1(config-if)#ip nat inside
```

b> **Dynamic NAT**: la cach thuc xay dung cac truong anh xa tu dong
<n> Inside Local ----- <n> Inside Global.

VD : Cau hinh Dynamic NAT de anh xa tu dong 3 IP 192.168.1.68, 192.168.1.99, 192.168.1.88 thuoc LAN nguoi dung ra 3 Registed IP : 200.200.200.12; 200.200.200.13; 200.200.200.14

- Buoc 1: Dung ACL de quy dinh ra cac IP can duoc NAT (Qui dinh ra cac ip Inside Local)

```
R1(config)#access-list 1 permit host 192.168.1.68
R1(config)#access-list 1 permit host 192.168.1.99
R1(config)#access-list 1 permit host 192.168.1.88
```

- Buoc 2: Quy dinh ra NAT Pool co nghia la day IP Inside Global

```
R1(config)#ip NAT pool GIAMDOC 200.200.200.12 200.200.200.14 netmask 255.255.255.0
<Pool Name: case sensitive>    <Star>              <End>
```

- Buoc 3: Viet cau lenh NAT

```
R1(config)#ip NAT Inside Source list 1 pool GIAMDOC
```

Anh xa tu dong 3 IP qui dinh trong access-list 1 tra 3 IP trong Pool GIAMDOC

- Buoc 4: Apply 2 cu lenh NAT Inside va NAT Outside hop ly.

+ Doi Interface ket noi voi ISP

```
R1(config)#int s0/0
R1(config-if)#ip nat outside
```

+ Doi voi Interface ket noi voi LAN

```
R1(config)#int fa0/0
R1(config-if)#ip nat inside
```

c> Dynamic NAT with Overloading (Port Address Translation):

- La hinh thuc anh xa tu dong <n> Inside Loal ----- <m> Inside Global (n > m)

Su dung kem gia tri Source Port (> 1024).

- Cau hinh Dynamic NAT with Overloading.

VD : Cau hinh tat cac IP con lai cua LAN A truy xuat Internet bang dia chi 200.200.200.10

- B1 : Cau hinh Inside Local

```
R1(config)#access-list 2 permit 192.168.1.0 0.0.0.255
```

- Buoc 2: Dinh nghia NAT Pool

Trong truong hop Inside Global IP la 1 dia chi cua Interface tren Router Gateway ket noi voi ISP thi ta co the "khong can" viet NAT Pool hoac cung co the viet nhung voi Start IP = End IP

```
R1(config)#ip nat pool NGUOIDUNG 200.200.200.10 200.200.200.10 netmask 255.255.2550
```

- Buoc 3: Viet cau lenh NAT

+ Truong hop co viet NAT Pool:

```
R1(config)#ip NAT inside source list 2 pool NGUOIDUNG overload
```

===> **Chu y**: neu ko co tu khoa Overload thi so User truy xuat Internet bang so IP NAT Pool

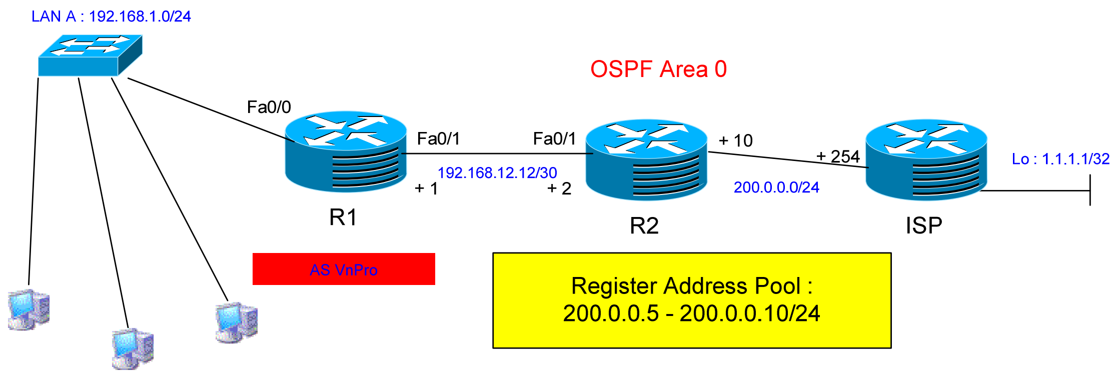
+ Truong hop ko viet NAT Pool

Do interface cua Inside Global ket noi truc tiep voi ISP

```
R1(config)#ip nat inside source list 2 interface s0/0 overload
```

- Buoc 4: Apply 2 cau lenh IP Nat Inside va IP Nat Outside hop le

II. Thuc hanh :



VD 1: Cau hinh Static NAT tren R2

192.168.1.111 200.0.0.9
192.168.1.222 200.0.0.8
192.168.1.108 200.0.0.7

```
ip nat inside source static 192.168.1.111 200.0.0.9
ip nat inside source static 192.168.1.222 200.0.0.8
ip nat inside source static 192.168.1.108 200.0.0.7

int fa0/1
ip nat outside

int fa0/0
ip nat inside

R2#sh ip nat translation
Pro Inside global      Inside local       Outside local      Outside global
icmp 200.0.0.7:512     192.168.1.108:512  1.1.1.1:512        1.1.1.1:512
--- 200.0.0.7          192.168.1.108      ---                ---
--- 200.0.0.9          192.168.1.111      ---                ---
icmp 200.0.0.8:512     192.168.1.222:512  1.1.1.1:512        1.1.1.1:512
--- 200.0.0.8          192.168.1.222      ---                ---
R2#

debug ip nat
IP NAT debugging is on
R2#
*Jan 10 12:05:26.955: NAT*: s=192.168.1.222->200.0.0.8, d=1.1.1.1 [21931]
*Jan 10 12:05:26.959: NAT*: s=1.1.1.1, d=200.0.0.8->192.168.1.222 [21931]
*Jan 10 12:05:27.615: NAT*: s=192.168.1.111->200.0.0.9, d=1.1.1.1 [5356]
*Jan 10 12:05:27.615: NAT*: s=1.1.1.1, d=200.0.0.9->192.168.1.111 [5356]
*Jan 10 12:05:27.691: NAT*: s=192.168.1.108->200.0.0.7, d=1.1.1.1 [496]
*Jan 10 12:05:27.691: NAT*: s=1.1.1.1, d=200.0.0.7->192.168.1.108 [496]
*Jan 10 12:05:27.959: NAT*: s=192.168.1.222->200.0.0.8, d=1.1.1.1 [21932]
*Jan 10 12:05:27.959: NAT*: s=1.1.1.1, d=200.0.0.8->192.168.1.222 [21932]
*Jan 10 12:05:28.615: NAT*: s=192.168.1.111->200.0.0.9, d=1.1.1.1 [5357]
```

```
*Jan 10 12:05:28.615: NAT*: s=1.1.1.1, d=200.0.0.9->192.168.1.111 [5357]
*Jan 10 12:05:28.691: NAT*: s=192.168.1.108->200.0.0.7, d=1.1.1.1 [497]
*Jan 10 12:05:28.691: NAT*: s=1.1.1.1, d=200.0.0.7->192.168.1.108 [497]
*Jan 10 12:05:28.959: NAT*: s=192.168.1.222->200.0.0.8, d=1.1.1.1 [21933]
*Jan 10 12:05:28.959: NAT*: s=1.1.1.1, d=200.0.0.8->192.168.1.222 [21933]
*Jan 10 12:05:29.691: NAT*: s=192.168.1.108->200.0.0.7, d=1.1.1.1 [498]
*Jan 10 12:05:29.691: NAT*: s=1.1.1.1, d=200.0.0.7->192.168.1.108 [498]
```

```
R2#clear ip NAT translation * ---> Xoa Static NAT van con.
R2#sh ip nat translations
Pro Inside global     Inside local       Outside local     Outside global
icmp 200.0.0.7:512    192.168.1.108:512  1.1.1.1:512       1.1.1.1:512
--- 200.0.0.7         192.168.1.108      ---               ---
--- 200.0.0.9         192.168.1.111      ---               ---
icmp 200.0.0.8:512    192.168.1.222:512  1.1.1.1:512       1.1.1.1:512
--- 200.0.0.8         192.168.1.222      ---               ---
```

VD 2: Cau hinh Dynamic NAT tren R2

* Inside Local:
    192.168.1.100
    192.168.1.200
* NAT Pool 200.0.0.5 200.0.0.6 /24

```
access-list 1 permit host 192.168.1.100
access-list 1 permit host 192.168.1.1200

ip nat pool GIAMDOC 200.0.0.5 200.0.0.6 netmask 255.255.255.0

ip nat inside source list 1 pool GIAMDOC

int fa0/0
ip nat inside


int s0/0
ip nat outside
```

```
debug ip nat
IP NAT debugging is on
R2#
*Jan 10 12:31:53.715: NAT*: s=192.168.1.100->200.0.0.5, d=1.1.1.1 [23586]
*Jan 10 12:31:53.715: NAT*: s=1.1.1.1, d=200.0.0.5->192.168.1.100 [23586]
*Jan 10 12:31:54.623: NAT*: s=192.168.1.200->200.0.0.6, d=1.1.1.1 [5705]
*Jan 10 12:31:54.623: NAT*: s=1.1.1.1, d=200.0.0.6->192.168.1.200 [5705]
```

`*** R1#no ip nat inside` -→ khi viet sai

`R1#clear ip nat` → mat het cac thong tin trong NAT Table

VD3 : Cau hinh Dynamic NAT wit Overload
+ Inside Local : Tat ca cac User con lai cua LANA
+ Inside Global 200.0.0.10

```
access-list 2 permit 192.168.1.0 0.0.0.255

ip nat pool NHANVIEN 200.0.0.10 200.0.0.10 netmask 255.255.255.0

ip nat inside source list 2 pool NHANVIEN overload
```

(hoac ip nat inside source list 2 int s0/0 overload)