3rd Edition

CCNA

Practical Lab 200-301

By : Basem Hamed

To

My Girl that always supports me, Loving You My Darling

Basem

About Author: -

Basem Hamed is a network and security engineer. He has been building his knowledge and experience for more than 11 years. He is interested in information security and data center fields. Basem worked at many companies in different positions, but he is passionate about instructing.

He has Authored books in Microsoft “Active Directory and Infrastructure 2008 “and in Cisco “CCNAx 200-120 Full and Practical Books”

Contacts: -

basem.cloud@gmail.com

/basemhamed.13

in/basemhamed

01001582348

CCNA Practical Book

This Book Focuses on Practical Training only but, you must know the whole theoretical terms related to this practical training to cover this training course.

This book is cover more than the CCNA explains.

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Printed in Egypt

1st Edition, 2015
2nd Edition, 2018
3rd Edition, 2021
4th Edition, 2022

ملاحظات :-

الكتاب دا صدقه جاريه علي روح والدي ووالدتي وحمايا – نسألكم الدعاء ليهم

الشرح اللي هنا مركز علي الجانب العملي فقط لا غير – مع بعض الملاحظات الخاصة بالتطبيق – في مواضيع نظري لم يتم ذكرها باللتفصيل في الكتاب

لو في اي حاجة مش واضحه مع اي حد وعايز يستفسر عن اي حاجه يتصل عليا او يبعتلي في اي وقت وان شاء الله انا هرد عليه

الشرح دا تم تجميعه من كتب وفيديوهات وخبره عمليه في كذا شركه وعلي كذا مشروع

بالتوفيق للجميع

باسم حامد

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Initial Configuration

ودي الإعدادات الأساسية اللي بتعملها علي الـ Router or Switch علشان تقدر بعد كدا تعمل عليهم Remote Connection

- Host Name بنغير فيها اسم الجهاز
- IP Address اللي هنعمل عليه Connect
- Remote Connection Service
- Password for Enable Mode
علشان يكون فيه Second Security Level علي الجهاز
- User Name - Password
- Securing Physical connections

التوصيل هنا بإستخدام Console Cable العادي

في نوع تاني من الـ console Cables بإستخدام الـ USB Console

هنبدا نتكلم علي الـ Initial for *Cisco Routers*

في الـ Real Life الـ Console Cable بيكون ليه Driver بيتعمل ليه Install وبنعرف رقم الـ Port من خلال الـ Device Manager بتاعه جهاز الكومبيوتر

نضغط علي جهاز الكومبيوتر D.Click :-

ونقوم بالخطوات التالية :-

أي حاجه مكتوب قبلها ! دي للتوضيح مش اكتر علشان توضح الـ Commands اللي بنكتبها

```
        --- System Configuration Dialog ---

Continue with configuration dialog? [yes/no]: no


Press RETURN to get started!



Router>! Here we are in User mode and we want to move to Enable mode
Router>! So , we will write enable
Router>enable
Router#
Router#! notice thet the #
Router#! in this mode you can test your configuration and using Show , debug commands
Router#! now moving to Configuration ( Global ) mode
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#
Router(config)#
```

```
Router(config)#! Change Host Name
Router(config)#hostname BUGs
BUGs(config)#
BUGs(config)#! Enable Remote Connection " telnet "
BUGs(config)#line vty 0 4
BUGs(config-line)#! this mean that 5 Clients are able to Connect remotely
BUGs(config-line)#password cisco123
BUGs(config-line)#login local
BUGs(config-line)#exit
BUGs(config)#
BUGs(config)#! Assign IP Address
BUGs(config)#interface fastethernet 0/0
BUGs(config-if)#no shutdown

BUGs(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

BUGs(config-if)#ip address 10.0.0.1 255.0.0.0
BUGs(config-if)#exit
BUGs(config)#! Enable Password
BUGs(config)#enable password cisco123
BUGs(config)#
BUGs(config)#! Username and Password
BUGs(config)#username Pasem password 123
BUGs(config)#exit
BUGs#
%SYS-5-CONFIG_I: Configured from console by console

BUGs#! save your configuration
BUGs#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
BUGs#
```

Line vty بحدد عدد ال Remote Sessions اللي مسموح بيها علي ال Device في نفس الوقت.

بعد كدا بنوصل الـ Router مع جهاز الكومبيوتر بكابل من نوع Cross Cable وبنديله IP , Subnet mask and Gateway الـ Gateway بيكون هو الـ IP بتاع الـ Router وتعمل Telnet علي الـ IP دا – الـ Gateway هو المخرج بتاع الجهاز للشبكات المختلفة

```
Packet Tracer PC Command Line 1.0
PC>telnet 10.0.0.1
Trying 10.0.0.1 ...Open


User Access Verification


Username:Pasem
Password:
BUGs>
```

في الـ Real Life هيتم استخدام برامج زي Putty or Secure CRT علشان نعمل Remote Connection علي الRouter

هتلاحظ هنا ان كان الاول PC وبعد ما عملية الـ Connection تمت بنجاح اتغيرت وبقت BUGs

---

نفس الخطوات علي الـ *Switch* بإختلاف ان الـ Interfaces بتاعه الـ Switch مش بتاخد IP وفي الحالة دي بنستخدم حاجة اسمها الـ VLAN اللي عن طريقها الـ Switch بياخد IP وبيكون اسمها الـ Management VLAN

لازم علشان نقدر نعمل Remote للـ Switch يكون الجهاز Member في الـ Management VLAN او يكون في Routing Enabled زي ما هنشوف مع بعض في باقي الـ Labs

```
Switch>enable
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#
Switch(config)#hostname BUGs-Lab1
BUGs-Lab1(config)#
BUGs-Lab1(config)#line vty 0 3
BUGs-Lab1(config-line)#password cisco123
BUGs-Lab1(config-line)#login local
BUGs-Lab1(config-line)#
BUGs-Lab1(config-line)#exit
BUGs-Lab1(config)#
BUGs-Lab1(config)#! Open VLAN Interface
BUGs-Lab1(config)#interface vlan 1
BUGs-Lab1(config-if)#no shutdown

BUGs-Lab1(config-if)#
%LINK-5-CHANGED: Interface Vlan1, changed state to up

BUGs-Lab1(config-if)#ip address 10.0.0.100 255.0.0.0
BUGs-Lab1(config-if)#exit
BUGs-Lab1(config)#
BUGs-Lab1(config)#username Hussein password cisco123
BUGs-Lab1(config)#
BUGs-Lab1(config)#enable password cisco
```

ومتنساش تعمل Save للـ Configuration بعد كدا نوصل الـ Switch بجهاز الكومبيوتر بـ Straight Cable ونعمل Telnet علي الـ Switch

```
PC>telnet 10.0.0.100
Trying 10.0.0.100 ...Open

User Access Verification
Username: Hussein
Password:
BUGs-Lab1>
BUGs-Lab1>enable
Password:
BUGs-Lab1#
BUGs-Lab1#
```

ممكن نعمل تشفير للـ Passwords اللي موجودة علي الـ Router or Switch وليها كذا طريقة :-

```
BUGs(config)#! useing Secret rather than password
BUGs(config)#enable secret cisco
BUGs(config)#username admin secret cisco123
BUGs(config)#
BUGs(config)#! Encryption command
BUGs(config)#Service password-encryption
BUGs(config)#
BUGs(config)#
```

Enable Secret اقوي في التشفير بتاعها من service password-encryption

اخر حاجة وهيا اننا بنعمل Password للـ Physical connection اللي هما Aux only on cisco Router والـ Console

```
HQ(config)#! Secure Physical connection
HQ(config)#
HQ(config)#line console 0
HQ(config-line)#!0 because there is only 1 console port
HQ(config-line)#password cisco123
HQ(config-line)#login local
HQ(config-line)#
HQ(config-line)#line aux 0
HQ(config-line)#!aux is an old physical connection method
HQ(config-line)#password cisco123
HQ(config-line)#login local
HQ(config-line)#
```

علشان نعمل Save للـ Configuration في عندنا Two Commands

```
Sw-Server#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
Sw-Server#write
Building configuration...
[OK]
Sw-Server#
```

Command History Buffer Commands

Command Syntax	Description
`switch# show history`	Displays the commands currently stored in the history buffer.
`switch# terminal history`	Enables terminal history. This command can be run from either user or privileged EXEC mode.
`switch# terminal history size 50`	Configures the terminal history size. The terminal history can maintain 0–256 command lines.
`switch# terminal no history size`	Resets the terminal history size to the default value of 20 command lines in Cisco IOS 15.
`switch# terminal no history`	Disables terminal history.

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Switching: -

- VLAN
- Voice VLAN
- VTP, Trunking
- Port Security
- STP
- Rapid – STP
- Ethernet Channel
- Switch Password Recovery
- Multi-layer Switch
- DHCP Snooping
- DAI
- SPAN
- PoE

VLAN

وظيفتها انها بتمنع الأجهزة المتصلة علي نفس الـ Switch To be Communicated تستخدم لغرض Security, Management

Interface VLAN علي الـ Switch = الـ Interface علي الـ Router

VLAN = Tunnel

الـ Design دا الاجهزة كلها في شبكة واحدة وكلهم بيقدروا انهم يعملوا Ping علي بعض -علشان هما علي نفس السوتش , في نفس الشبكة , كل الـ Interfaces موجودة في نفس الـ VLAN

الـ *MAC Address Table* اللي بيتعامل معاه الـ Switch

```
Switch#show mac-address-table
          Mac Address Table
-------------------------------------------

Vlan    Mac Address       Type        Ports
----    -----------       --------    -----

   1    0009.7c55.e9d5    DYNAMIC     Fa0/3
   1    000a.4176.a6ed    DYNAMIC     Fa0/4
   1    0030.a338.3ecd    DYNAMIC     Fa0/1
   1    00d0.ffbc.0ab8    DYNAMIC     Fa0/2
Switch#
```

علشان ازود المدة بتاعه الـ MAC Table - الـ Default بتاعها 5 دقائق

Switch(config)#mac address-table aging-time *seconds* [vlan *vlan-id*]

`Switch2960(config)# mac address-table static aaaa.aaaa.aaaa vlan 1 interface fastethernet 0/1`	Sets a permanent address to port fastethernet 0/1 in VLAN 1

```
Switch#show 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
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
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
```

To Create New VLAN: -

```
Switch(config)#! to Create new vlan
Switch(config)#! only from 2 to 1001 are availible
Switch(config)#vlan ?
  <1-1005>  ISL VLAN IDs 1-1005
Switch(config)#vlan 17
Switch(config-vlan)#name Development
Switch(config-vlan)#
Switch(config-vlan)#exit
Switch(config)#! to move the interfaces from vlan 1 to vlan 17
Switch(config)#interface fastethernet 0/2
Switch(config-if)#switchport access vlan 17
```

```
Switch#show vlan

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Fa0/1, 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
17   Development                      active    Fa0/2
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
17   enet  100017     1500  -      -      -        -    -        0      0
1002 fddi  101002     1500  -      -      -        -    -        0      0
1003 tr    101003     1500  -      -      -        -    -        0      0
1004 fdnet 101004     1500  -      -      -        ieee -        0      0
```

في طريقة تانية علشان نعمل Create VLAN ونضيف فيها الـ Interfaces في نفس الوقت

```
Switch(config)#! to move more that one interface to vlan
Switch(config)#
Switch(config)#interface range fastethernet 0/5-10
Switch(config-if-range)#switchport accress vlan 4
                                       ^
% Invalid input detected at '^' marker.

Switch(config-if-range)#switchport access vlan 4
% Access VLAN does not exist. Creating vlan 4
Switch(config-if-range)#! we don't have vlan 4 - but it created and interfaces moved
```

لو الـ Interfaces مش ورا بعضها

```
Switch(config)#interface range fast 0/11 , fast 0/14 , fast 0/20
Switch(config-if-range)#switchport access vlan 55
% Access VLAN does not exist. Creating vlan 55
Switch(config-if-range)#
```

```
Switch#show vlan

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Fa0/1, Fa0/3, Fa0/4, Fa0/12
                                                Fa0/13, Fa0/15, Fa0/16, Fa0/17
                                                Fa0/18, Fa0/19, Fa0/21, Fa0/22
                                                Fa0/23, Fa0/24
4    VLAN0004                         active    Fa0/5, Fa0/6, Fa0/7, Fa0/8
                                                Fa0/9, Fa0/10
17   Development                      active    Fa0/2
55   VLAN0055                         active    Fa0/11, Fa0/14, Fa0/20
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
4    enet  100004     1500  -      -      -        -    -        0      0
17   enet  100017     1500  -      -      -        -    -        0      0
55   enet  100055     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
```

في طريقة تالتة علشان اعمل VLAN عن طريق الـ VLAN Database

```
Switch#vlan database
% Warning: It is recommended to configure VLAN from config mode,
  as VLAN database mode is being deprecated. Please consult user
  documentation for configuring VTP/VLAN in config mode.

Switch(vlan)#vlan 11 name private
VLAN 11 added:
    Name: private
Switch(vlan)#
```

Voice VLAN

```
Switch(config)#interface fa 0/1
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 10
Switch(config-if)#switchport voice vlan 20
```

VLAN Troubleshoot

VLAN Troubleshooting Commands

EXEC Command	Description
`show vlan` `show vlan brief`	Lists each VLAN and all interfaces assigned to that VLAN (but does not include operational trunks)
`show vlan id` *num*	Lists both access and trunk ports in the VLAN
`show interfaces switchport` `show interfaces` *type number* `switchport`	Identifies the interface's access VLAN and voice VLAN, the configured and operational mode (access or trunk), and the state of the port (up or down)
`show mac address-table`	Lists MAC table entries, including the associated VLAN
`show interface status`	Summarizes the status listing for all interfaces (connected, notconnect, err-disabled), the VLAN, duplex, speed, and type of port

من الأوامر المهمة في التعامل مع الـ Interfaces وبتظهر كل التفاصيل الخاصة بيهم في شكل ملخص

```
SW1#show interfaces status

Port      Name               Status       Vlan       Duplex  Speed Type
Fa0/1                        notconnect   1            auto   auto 10/100BaseTX
Fa0/2                        notconnect   1            auto   auto 10/100BaseTX
Fa0/3                        notconnect   1            auto   auto 10/100BaseTX
Fa0/4                        connected    1          a-full  a-100 10/100BaseTX
Fa0/5                        connected    1          a-full  a-100 10/100BaseTX
Fa0/6                        notconnect   1            auto   auto 10/100BaseTX
Fa0/7                        notconnect   1            auto   auto 10/100BaseTX
Fa0/8                        notconnect   1            auto   auto 10/100BaseTX
Fa0/9                        notconnect   1            auto   auto 10/100BaseTX
Fa0/10                       notconnect   1            auto   auto 10/100BaseTX
Fa0/11                       connected    1          a-full     10 10/100BaseTX
Fa0/12                       connected    1            half    100 10/100BaseTX
Fa0/13                       connected    1          a-full  a-100 10/100BaseTX
Fa0/14                       disabled     1            auto   auto 10/100BaseTX
```

بالنسبة للـ Speed والـ Duplex الطبيعي بتاعهم انهم Auto علي حسب الـ Negotiation بتاع السوتشات بس تقدر تعدلهم انك تدخل علي الـ Interface وتغير الـ Speed و الـ Duplex

Interfaces Name and Type

Today's Most Common Types of Ethernet

Common Name	Speed	Alternative Name	Name of IEEE Standard	Cable Type, Maximum Length
Ethernet	10 Mbps	10BASE-T	802.3	Copper, 100 m
Fast Ethernet	100 Mbps	100BASE-TX	802.3u	Copper, 100 m
Gigabit Ethernet	1000 Mbps	1000BASE-LX	802.3z	Fiber, 550 m
Gigabit Ethernet	1000 Mbps	1000BASE-T	802.3ab	Copper, 100 m
10GigE (Gigabit Ethernet)	10 Gbps	10GBASE-T	802.3an	Copper, 100 m
10GigE (Gigabit Ethernet)	10 Gbps	10GBASE-S	802.3ae	Fiber, 400 m

Networking Media

Media	Physical Components	Frame Encoding Technique	Signaling Methods
Copper cable	UTP Coaxial Connectors NICs Ports Interfaces	Manchester encoding Nonreturn to zero (NRZ) techniques 4B/5B codes used with Multi-Level Transition Level 3 (MLT-3) signaling 8B/10B PAM5	Changes in the electromagnetic field. Intensity of the electromagnetic field. Phase of the electromagnetic wave.
Fiber-optic cable	Single-mode fiber Multimode fiber Connectors NICs Interfaces Lasers and LEDs Photoreceptors	Pulses of light Wavelength multiplexing using different colors	A pulse equals 1. No pulse is 0.
Wireless	Access points NICs Radio Antennas	Direct Sequence Spread Spectrum (DSSS) Orthogonal Frequency Division Multiplexing (OFDM)	Radio waves.

في خاصية في الـ Switches وهيا Auto-MDIX ومعناها إن أيا كان نوع الـ Cable المستخدم كدا كدا هيشتغل ودي By-Default معمول ليها Enable

`Switch2960(config)# interface fastethernet 0/1`	Enters interface configuration mode
`Switch2960(config-if)# mdix auto`	Enables Auto-MDIX on the interface
`Switch2960(config-if)# no mdix auto`	Disables Auto-MDIX on the interface

VTP

لو انا عايز انقل VLANs من Switch للتاني , او اني اسمح لـ VLANsمعينة انها تتكلم مع بعض والباقي لأ عن طريق الـ Trunking

الـ Trunk ليه استخدامات تانية مع الـ Access Points ومع الـ Servers خصوصا لو عليهم اكتر من Server او أكتر من SSID

الـ Trunk بيستخدم برضه لو انا عندي نفس الـ VLANS علي 2 Switches وعايزهم يكلموا بعض لازم يكون الـ Interface اللي رابط ما بين السوتشات Trunk

VTP Mode	Characteristics
Server	All VLAN and VTP configuration changes occur here. The server advertises settings and changes to all other servers and clients in a VTP domain. (This is the default mode for Catalyst switches.)
Client	Listens to all VTP advertisements from servers in a VTP domain. Advertisements are relayed out other trunk links. No VLAN or VTP configuration changes can be made on a client.
Transparent	VLAN configuration changes are made locally, independent of any VTP domain. VTP advertisements are not received but merely are relayed out other trunk links, if possible.
Off	VLAN configuration changes are made locally; incoming VTP advertisements are not processed locally, but simply relayed instead.

```
VTP-Server(config)#! configure vtp server
VTP-Server(config)#vtp mode server
Device mode already VTP SERVER.
VTP-Server(config)#vtp password cisco
 %The VTP password cannot be set for NULL domain
VTP-Server(config)#vtp version 2
VTP-Server(config)#vtp domain basem.com
Changing VTP domain name from NULL to basem.com
```

ممكن علي مستوي الـ Interface الواصل بين الـ Switches نعمل Allow/Deny للـ VLANs اللي عايزينها بس

```
VTP-Server(config-if)#switchport trunk allowed vlan ?
  WORD    VLAN IDs of the allowed VLANs when this port is in trunking mode
  add     add VLANs to the current list
  all     all VLANs
  except  all VLANs except the following
  none    no VLANs
  remove  remove VLANs from the current list
```

```
VTP-Client(config)#! configure VTP Client
VTP-Client(config)#vtp version 2
VTP mode already in V2.
VTP-Client(config)#vtp password cisco
Setting device VLAN database password to cisco
VTP-Client(config)#vtp domain basem.com
Domain name already set to basem.com.
VTP-Client(config)#! the same configuration as Server
VTP-Client(config)#vtp mode client
Setting device to VTP CLIENT mode.
VTP-Client(config)#
VTP-Client(config)#! let's try to create a new vlan
VTP-Client(config)#vlan 10
VTP VLAN configuration not allowed when device is in CLIENT mode.
VTP-Client(config)#! not allowed in client version
VTP-Client(config)#
```

مجرد ما تكتب الـ Command الخاص بـ *show vlan* هتلاقي اللي انت عامل ليه Create علي الـ Server اتنقل علي الـ Client ومش هتقدر تعمل Create لأي VLAN جديدة علي مستوي الـ Client Switch

```
Sw-Server#show vtp status
VTP Version capable             : 1 to 2
VTP version running             : 2
VTP Domain Name                 : basem.com
VTP Pruning Mode                : Disabled
VTP Traps Generation            : Disabled
Device ID                       : 0060.5C06.CE00
Configuration last modified by 0.0.0.0 at 3-1-93 00:16:13
Local updater ID is 0.0.0.0 (no valid interface found)

Feature VLAN :
--------------
VTP Operating Mode                : Server
Maximum VLANs supported locally   : 255
Number of existing VLANs          : 5
Configuration Revision            : 1
MD5 digest                        : 0xAA 0x9B 0xFA 0x83 0xD6 0xEB 0x37 0x1C
                                    0xA0 0x1B 0xA0 0x59 0x7F 0xEE 0x78 0x7F

Sw-Server#sh vtp password
VTP Password: 123
```

VTP Pruning is a feature in Cisco switches, which stops VLAN update information traffic from being sent down trunk links if the updates are not needed, helps in increasing the available bandwidth by reducing unnecessary flooded traffic.

Native VLAN

The native VLAN is the one into which untagged traffic will be put when it's received on a trunk port

لازم تكون واحدة علي كل السوتشات

```
Sw-Server(config-if)#int g 0/1
Sw-Server(config-if)#switchport mode trunk
Sw-Server(config-if)#switchport trunk native vlan ?
  <1-4094>  VLAN ID of the native VLAN when this port is in trunking mode
Sw-Server(config-if)#switchport trunk native vlan
```

Switch 1	Switch 2	Interface Status - Operation
Dynamic Desirable	Dynamic Desirable , Dynamic Auto , Trunk	*Trunk*
Dynamic Desirable	Access	*Access*
Dynamic Auto	Dynamic Desirable , Trunk	*Trunk*
Dynamic Auto	Dynamic Auto, Access	*Access*
Trunk	Dynamic Desirable , Dynamic Auto , Trunk	*Trunk*
Trunk	Access	*Down*
Access	Dynamic Desirable , Dynamic Auto , Trunk	*Access*
Access	Trunk	*Down*

في Old Modes في الـ Switches لما بنيجي نغير الـ Mode بتاع الـ Interface لـ Trunk لازم نختار الأول نوع الـ Encapsulation اللي دايما بنستخدم فيه dot1q ودا الخاص بـ Cisco

```
Switch(config-if)#int fa 0/1
Switch(config-if)#switchport trunk encapsulation dot1q
Switch(config-if)#switchport mode trunk
```

Port Security

علشان اربط الـ MAC Address بتاع الجهاز بالـ " Interface " Port بتاع الـ Switch – علشان امنع ان اي حد يجيب Personal PC ويوصله ويعمل اي حاجة هو مش مسموح بيها علي الشبكة

```
Switch#show mac-address-table
          Mac Address Table
-------------------------------------------

Vlan    Mac Address       Type        Ports
----    -----------       --------    -----

  1     0009.7c55.e9d5    DYNAMIC     Fa0/3
  1     0030.a338.3ecd    DYNAMIC     Fa0/1
  1     00d0.ffbc.0ab8    DYNAMIC     Fa0/2
```

هنربط الـ Interface fa0/3 بالـ MAC بتاع الجهاز المتوصل بيه – و Dynamic دي هتتغير وهتبقي Static

```
Switch(config)#interface fastethernet 0/3
Switch(config-if)#switchport mode access
Switch(config-if)#! this command mean that i will applying a Security command
Switch(config-if)#switchport port-security
Switch(config-if)#! enabling port security
Switch(config-if)#
Switch(config-if)#switchport port-security?
port-security
Switch(config-if)#switchport port-security ?
  mac-address  Secure mac address
  maximum      Max secure addresses
  violation    Security violation mode
  <cr>
Switch(config-if)#! mac-address that will assigned to the interface
Switch(config-if)#! maximum how many devices will connect through this interface
Switch(config-if)#! violation the switch action whin anther pc connected
Switch(config-if)#switchport port-security mac-address ?
  H.H.H   48 bit mac address
  sticky  Configure dynamic secure addresses as sticky
Switch(config-if)#! switchport port-security mac-address H.H.H will assign static " manual"
Switch(config-if)#! switchport port-security mac-address sticky will assigned "automatic"
Switch(config-if)#! switchport port-security mac-address  0009.7c55.e9d5
Switch(config-if)#switchport port-security maximum 1
Switch(config-if)#! only one pc will connect
Switch(config-if)#switchport port-security violation ?
  protect   Security violation protect mode
  restrict  Security violation restrict mode
  shutdown  Security violation shutdown mode
Switch(config-if)#switchport port-security violation shutdown
```

```
Switch#show mac-address-table
          Mac Address Table
-------------------------------------------

Vlan    Mac Address       Type        Ports
----    -----------       --------    -----

  1     0009.7c55.e9d5    STATIC      Fa0/3
  1     0030.a338.3ecd    DYNAMIC     Fa0/1
  1     00d0.ffbc.0ab8    DYNAMIC     Fa0/2
Switch#
```

```
Switch#
Switch#show port-security
Secure Port MaxSecureAddr CurrentAddr SecurityViolation Security Action
               (Count)       (Count)        (Count)
--------------------------------------------------------------------
        Fa0/3        1          1                 0         Shutdown
---------------------------------------------------------------------
Switch#show port-security inter fa 0/3
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   : 0
Sticky MAC Addresses       : 0
Last Source Address:Vlan   : 0009.7C55.E9D5:1
Security Violation Count   : 0

Switch#
```

Use the **switchport port-security aging** command to enable or disable static aging for the secure port or to set the aging time or type:

```
Switch(config-if)# switchport port-security aging { static | time time |
  type {absolute | inactivity}}
```

Parameters for the *port-security aging* Command

Parameter	Description
`static`	Enable aging for statically configured secure addresses on this port.
`time` *time*	Specify the aging time for this port. The range is 0 to 1440 minutes. If the time is 0, aging is disabled for this port.
`type absolute`	Set the absolute aging time. All the secure addresses on this port age out exactly after the time (in minutes) specified and are removed from the secure address list.
`type inactivity`	Set the inactivity aging type. The secure addresses on this port age out only if there is no data traffic from the secure source address for the specified time period.

ممكن تطبق Configuration الـ Port-Security علي كل الـ Interfaces عن طريق Range Command وفي الحالة دي هنخلي الـ MAC-Address Sticky

في حالة الـ Miss-Port Config الخاص الـ Configured MAC-Address هتظهر بالشكل دا في show interfaces status

```
Gi0/2                    err-disabled 1          auto   auto RJ45
Gi0/3                    err-disabled 1          auto   auto RJ45
```

```
Sw(config)# errdisable recovery cause link-flap
Sw(config)# errdisable recovery cause psecure-violation
Sw(config)# errdisable recovery interval 60
```

STP

بتشتغل By Default علي الـ Switch – وظيفتها بتمنع الـ Loop اللي ممكن يحصل في *Layer Two - Data Link* عن طريق ان عندي اكتر من طريق لنقل الداتا

علشان نغير الـ Root Switch بيتم تغييره عن طريق تعديل قيمة الـ Priority بتاعة الـ Switch – علشان مينفعش نغير في الـ MAC Address

```
Switch#show spanning-tree
VLAN0001
  Spanning tree enabled protocol ieee
  Root ID    Priority    32769
             Address     000B.BE8D.9B10
             This bridge is the root
             Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID  Priority    32769  (priority 32768 sys-id-ext 1)
             Address     000B.BE8D.9B10
             Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
             Aging Time  20

Interface        Role Sts Cost      Prio.Nbr Type
----------------- ---- --- --------- -------- --------------------------------
Fa0/1            Desg FWD 19        128.1    P2p
Fa0/2            Desg FWD 19        128.2    P2p
```

```
Switch(config)#spanning-tree vlan 1 ?
  priority  Set the bridge priority for the spanning tree
  root      Configure switch as root
  <cr>
Switch(config)#! spanning-tree vlan 1 priority " will modify the priority value "
Switch(config)#! spanning-tree vlan 1 root " primary or Secondry "
Switch(config)#! priority value is more interesting
Switch(config)#! spanning-tree vlan 1 priority ?
% Unrecognized command
Switch(config)#spanning-tree vlan 1 priority  ?
  <0-61440>  bridge priority in increments of 4096
Switch(config)#spanning-tree vlan 1 priority  4096
```

هنلاحظ تغيير في شكل الـ Design

علي الـ Root Switch هنكتب Command :- show spanning-tree

```
Switch#show spanning-tree
VLAN0001
  Spanning tree enabled protocol ieee
  Root ID    Priority    4097
             Address     00E0.F71D.25C8
             This bridge is the root
             Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID  Priority    4097  (priority 4096 sys-id-ext 1)
             Address     00E0.F71D.25C8
             Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
             Aging Time  20

Interface        Role Sts Cost      Prio.Nbr Type
---------------- ---- --- --------- -------- --------------------------------
Fa0/1            Desg FWD 19        128.1    P2p
Fa0/2            Desg FWD 19        128.2    P2p
```

قيمة الـ Priority بتزيد برقم الـ VLAN اللي موجودة علي الـ Switch

```
Switch(config)#spanning-tree vlan 5 root primary diameter 7
```

The **diameter** keyword defines the maximum number of switches between any two end stations. The range is from 2 to 7 switches

`Switch(config)# spanning-tree vlan 5 hello-time 4`	Changes the hello-delay timer to 4 seconds on VLAN 5
`Switch(config)# spanning-tree vlan 5 forward-time 20`	Changes the forward-delay timer to 20 seconds on VLAN 5
`Switch(config)# spanning-tree vlan 5 max-age 25`	Changes the maximum-aging timer to 25 seconds on VLAN 5

Port Fast and BPDU Guard

علي الـ Interfaces اللي بتتوصل بين End Devices and Switch بنعمل تفعيل لـ portfast and bpdu guard لمنع الـ Switch انه يبعت او يستقبل bpdu msg من علي الـ Clients Interfaces

By Default, الـ Switch بيتعامل مع اي Connected Device انه Switch فبالتالي بيبعت ليه الـ BDPU Message

```
Switch(config)#interface range fast 0/3-5
Switch(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 3 interfaces due to the range command
 but will only have effect when the interfaces are in a non-trunking mode.
Switch(config-if-range)#! don't send any bpdu msg on these interfaces
Switch(config-if-range)#spanning-tree bpduguard enable
Switch(config-if-range)#! if you recieved and bpdu msg on these interfaces shutdown them
Switch(config-if-range)#
```

STP Verification Commands

Description	Command
Displays STP information	`Switch# show spanning-tree`
Displays STP information for active interfaces only	`Switch# show spanning-tree active`
Displays abbreviated information for all STP instances	`Switch# show spanning-tree bridge`
Displays detailed information for all STP instances	`Switch# show spanning-tree detail`
Displays STP information for the specified interface	`Switch# show spanning-tree interface` *interface-id*
Displays STP information for the specified VLAN	`Switch# show spanning-tree vlan` *vlan-id*
Displays a summary of STP port states	`Switch# show spanning-tree summary`

Rapid STP

لتقليل الوقت اللي كانت بتستغرقه الـ Switches و هيا بتبعت الـ .BPDU msg بينهم في عملية الـ Election

```
BUGs(config)#spanning-tree mode rapid-pvst
BUGs(config)#! pvst ---> per vlan Spanning Tree
BUGs(config)#
```

```
BUGs#show spanning-tree
VLAN0001
  Spanning tree enabled protocol rstp
  Root ID    Priority    32769
             Address     0002.4AC7.5AC6
             This bridge is the root
             Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID  Priority    32769  (priority 32768 sys-id-ext 1)
             Address     0002.4AC7.5AC6
             Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
             Aging Time  20
```

STP vs. RSTP

- RSTP IEEE 802.1W & STP IEEE 802.1D
- RSTP IEEE 802.1W assumes the three STP ports states
  - Listening
  - Blocking
  - Disabled
- These states do not forward Ethernet frames and they do not learn MAC addresses
- RSTP IEEE 802.1W places them all into a new called Discarding state.

Features of STP Varieties

Protocol	Standard	Resources Needed	Convergence	Tree Calculation
STP	802.1D	Low	Slow	All VLANs
PVST+	Cisco	High	Slow	Per VLAN
RSTP	802.1w	Medium	Fast	All VLANs
Rapid PVST+	Cisco	Very high	Fast	Per VLAN
MSTP	802.1s, Cisco	Medium or high	Fast	Per instance

Ethernet Channel

بستخدمها في حالة لو عندي أكتر من Interface متوصلين بين الـ Switches وعايز اخليهم يشتغلوا كلهم مع بعض
علشان في الطبيعي ان Cable واحد بس اللي هيشتغل والباقي هيكون معمول ليهم Disable علشان الـ STP هتكون شغاله
الـ Channel بتعمل دمج للـ Interfaces وكمان بتعمل دمج للسرعة بتاعتهم
وممكن يطلق عليها Layer Two High Availability

الـ Ethernet Channel ليها 3 طرق في الـ Configuration بتاعتها

- *On* : Just Enable It

```
BUGs1(config)#interface range fastethernet 0/1-3
BUGs1(config-if-range)#channel-group 1 mode on
BUGs1(config-if-range)#
Creating a port-channel interface Port-channel 1

%LINK-5-CHANGED: Interface Port-channel 1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Port-channel 1, changed state to up
```

نفس الكلام علي الـ Switch التاني – بتعمل دمج للـ Interfaces بس – هتلاخظ ان الـ Interfaces حصل ليها Restart طبعا لازم يكون الرقم ثابت علي الاتنين

- *PAGP:* Cisco Only

```
BUDs2(config)#interface  range fastethernet 0/1-3
BUDs2(config-if-range)#channel-protocol pagp
BUDs2(config-if-range)#channel-group 3 mode ?
  active     Enable LACP unconditionally
  auto       Enable PAgP only if a PAgP device is detected
  desirable  Enable PAgP unconditionally
  on         Enable Etherchannel only
  passive    Enable LACP only if a LACP device is detected
BUDs2(config-if-range)#! channel-group 3 mode ( in pagp there are two modes auto and desirable )
BUDs2(config-if-range)#! channel-group 3 mode auto
BUDs2(config-if-range)#channel-group 3 mode auto
BUDs2(config-if-range)#
Creating a port-channel interface Port-channel 3
```

في حاجه اسمها Mode في البروتوكول دا - مينفعش يتكرر علي الـ Switches يعني واحد Auto والتاني يكون Desirable
بتعمل دمج للـ Interfaces – وكمان بتعمل دمج للسرعة

- *LACP*: Standard for All Vendors

```
Switch(config)#interface range fastethernet 0/1-3
Switch(config-if-range)#channel-protocol lacp
Switch(config-if-range)#channel-group 2 mode passive
Switch(config-if-range)#
Creating a port-channel interface Port-channel 2
```

في حاجة اسمها mode في البروتوكول دا - مينفعش يتكرر علي الـ Switches يعني واحد Active والتاني يكون Passive بتعمل دمج للـ Interfaces – وكمان بتعمل دمج للسرعة

وبتكون بالشكل دا

ولو جينا نشوف الـ STP هنلاقيه عامل دمج ليهم في Po وضايف ليها الرقم

```
BUGs#show spanning-tree
VLAN0001
  Spanning tree enabled protocol ieee
  Root ID    Priority    32769
             Address     0030.F257.7653
             This bridge is the root
             Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID  Priority    32769  (priority 32768 sys-id-ext 1)
             Address     0030.F257.7653
             Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
             Aging Time  20

Interface        Role Sts Cost      Prio.Nbr Type
---------------- ---- --- --------- -------- -------------------------------
Po2              Desg FWD 8         128.25   Shr

BUGs#
```

```
BUGs#show etherchannel
                Channel-group listing:
                ----------------------

Group: 2
----------
Group state = L2
Ports: 3 Maxports = 16
Port-channels: 1 Max Port-channels = 16
Protocol:   LACP
```

Mode	Protocol	Description
Auto	PAgP	Sets the interface to respond to PAgP negotiation packets, but the interface will start negotiations on its own.
Desirable	PAgP	Sets the interface to actively attempt to negotiate a PAgP connection.
On	EtherChannel	Forces the connection to bring all links up without using a protocol to negotiate connections. This mode can only connect to another device that is also set to on. When using this mode, the switch does not negotiate the link using either PAgP or LACP.
Active	LACP	Sets the interface to actively attempt to negotiate connections with other LACP devices.
Passive	LACP	Sets the interface to respond to LACP data if it receives negotiation requests from other systems.

Switch Password Recovery

الموضوع مختلف عن الـ Router | الـ Switch مش بيعمل Save للـ Configuration في الـ NVRAM إنما في config.text file

علشان نعمل Reset للـ Password بنضغط علي Mode Button اللي موضح في الصورة , علشان يدخلنا علي اعدادات الـ Flash

لازم دا يتم علي Real Device علشان برامج الـ Simulation مش بتدعم | وطبعا لازم تكون موصل Console

بعد كدا بنكتب الـ Commands التالية

- switch: **flash _init** → **to Prepare Flash**
- switch: **load_helper**
- switch: **dir flash:** → **list all Flash Files**

```
-    13  drwx      192   Mar 01 1993 22:30:48  c2960-mz-124-0.0.53
-    11  -rwx     5825   Mar 01 1993 22:31:59  config.text
-    18  -rwx      720   Mar 01 1993 02:21:30  vlan.da
```

هنعمل دلوقت Rename للملف اللي متخزن فيه الـ Configuration علشان يعمل ليه Ignore وهو بيعمل Boot

- switch: **rename flash:config.text flash:config.text.old**
- switch: **boot**
- Switch>**enable**
- Switch#**rename flash:config.text.old flash:config.text**
- Switch#**copy flash:config.text system:running-config**

بعد كدا هنعمل Rename تاني ونرجع الفايل لإسمه القديم علشان نعرف ننقل للـ Running-config ونعدل فيه
أو نعمل show ونشوف الـ Password اللي كنا مستخدمينه لو مش معمول ليه تشفير
أو نعمل New Configuration ونعمل ليها Save من اول وجديد

Multi-Layer Switch

```
Layer-3(config)#int fa 0/1
Layer-3(config-if)#no switchport
Layer-3(config-if)#ip address 10.0.0.1 255.0.0.0
Layer-3(config-if)#
Layer-3(config-if)#exit
Layer-3(config)#ip routing
Layer-3(config)#router ?
  bgp     Border Gateway Protocol (BGP)
  eigrp   Enhanced Interior Gateway Routing Protocol (EIGRP)
  ospf    Open Shortest Path First (OSPF)
  rip     Routing Information Protocol (RIP)
```

من المميزات اللي في الـ Layer-Three Switches انك تقدر تعطي الـ Interfaces بتاعتها IP زي ما هو موضح وكمان هتلاقي انها تدعم كل أنواع الـ Routing

في الـ Models القديمة لازم تعمل Enable لخاصية الـ Routing عن طريق الأمر بتاع IP Routing عشان الخدمة تشتغل معاك

ممكن تجرب في الـ Lab دا تعمل Enable لـ Static، Default Routing عشان تخلي الـ Internal Network تقدر تطلع انترنت وكمان تقدر تتواصل مع الـ Remote Networks

DHCP Snooping

بتمنع الـ DHCP Spoofing and Starvation عن طريق انه بيكون في Trust Interface بس والباقي بيكون Un-Trust بتعمل Drop للـ DHCP Server Packets من انها توصل اللي هما الـ Offer , Ack

```
SW-Snoop(config)#ip dhcp snooping
SW-Snoop(config-if)#interface fa 0/2
SW-Snoop(config-if)#ip dhcp snooping trust
SW-Snoop(config-if)#ip dhcp snooping limit rate ?
  <1-2048>  DHCP snooping rate limit
SW-Snoop(config-if)#ip dhcp snooping limit rate 6
SW-Snoop(config)#ip dhcp snooping vlan ?
  WORD  DHCP Snooping vlan first number or vlan range, example: 1,3-5,7,9-11
SW-Snoop(config)#ip dhcp snooping vlan 1
```

هنلاحظ ان في اخر Command اننا ممكن كمان نعمل Enable للـ Feature دي علي مستوي الـ VLAN

DAI

Dynamic ARP Inspection بتمنع هجمات الـ ARP Spoofing وان مش أي جهاز يبعت ARP Request

```
S1(config)# ip arp inspection vlan 10
S1(config)# interface fa0/24
S1(config-if)# ip arp inspection trust
```

```
S1(config)# ip dhcp snooping
S1(config)# ip dhcp snooping vlan 10
S1(config)# ip arp inspection vlan 10
S1(config)# interface fa0/24
S1(config-if)# ip dhcp snooping trust
S1(config-if)# ip arp inspection trust
```

```
S1(config)# ip arp inspection validate ?
  dst-mac  Validate destination MAC address
  ip       Validate IP addresses
  src-mac  Validate source MAC address
S1(config)# ip arp inspection validate src-mac
S1(config)# ip arp inspection validate dst-mac
S1(config)# ip arp inspection validate ip
S1(config)# do show run | include validate
ip arp inspection validate ip
S1(config)# ip arp inspection validate src-mac dst-mac ip
S1(config)# do show run | include validate
ip arp inspection validate src-mac dst-mac ip
S1(config)#
```

SPAN

Switch Port Analyzer بتستخدم لو احنا عايزين نعمل Mirror للـ Traffic اللي بيعدي من علي Interface or VLAN وناخد منه نسخة علي Interface تاني

بيستخدم في حالة Recording VOIP Calls او اننا عايزين نعمل Test لـ New Firewall Performance او انك عايز تعمل Analysis للـ Traffic علي الـ Wireshark

ممكن يكون الـ Destination علي نفس الـ Switch وممكن يكون Remote Switch

يفضل انك تعمله علي الـ Core Switch مش علي Edge

```
SPAN-SW(config)#!Configure SPAN Session Numner
SPAN-SW(config)#monitor session ?
  <1-66>  SPAN session ID
SPAN-SW(config)#monitor session 2 ?
  destination  SPAN destination configuration
  source       SPAN source configuration
SPAN-SW(config)#monitor session 2 source ?
  interface  SPAN source or destination interface
  remote     RSPAN
  vlan       SPAN source or destination VLAN
SPAN-SW(config)#monitor session 2 source vlan 5 , ?
  <1-1005>  SPAN VLAN ID
SPAN-SW(config)#monitor session 2 source vlan 5 , ?
  <1-1005>  SPAN VLAN ID
SPAN-SW(config)#monitor session 2 source vlan 5
SPAN-SW(config)#monitor session 2 destination inter
SPAN-SW(config)#monitor session 2 destination interface fa 0/10
```

PoE

Power Over Ethernet توصيل الـ Power من خلال الـ 4 Pin بتوع الـ Twisted Pair Cables ولازم تكون الـ Switches بتدعم الخاصية دي – By-Default الخاصية دي معمول ليها Enable

تستخدم مع أجهزة زي Access Points, Camera, Finger Machines

RJ-45			
	Nr. de pin	Identif.	Color
	1	Tx+	
	2	Tx –	
	3	Rx+	
	4	PoE –	
	5	PoE –	
	6	Rx –	
	7	PoE +	
	8	PoE +	

```
PoE-SW(config-if)#interface fa 0/1
PoE-SW(config-if)#power inline auto
```

بتظهر الـ Interfaces بالشكل دا – لو في حاجة متوصله بيقدر يعمل Detect للـ Model بتاعها لو compatible مع Cisco وكمان بيجيب الـ Maximum and Used Power Watts

```
Mar 30 06:59:50.028: %SYS-5-CONFIG_I: Configured from console by console
Switch>
Switch>show power inline
Available:124.0(w)  Used:46.2(w)  Remaining:77.8(w)

Interface Admin  Oper       Power   Device              Class Max
                            (Watts)
--------- ------ ---------- ------- ------------------- ----- ----
Fa0/1     auto   off        0.0     n/a                 n/a   30.0
Fa0/2     auto   off        0.0     n/a                 n/a   30.0
Fa0/3     auto   off        0.0     n/a                 n/a   30.0
Fa0/4     auto   off        0.0     n/a                 n/a   30.0
Fa0/5     auto   on         15.4    Ieee PD             4     30.0
Fa0/6     auto   off        0.0     n/a                 n/a   30.0
Fa0/7     auto   on         15.4    Ieee PD             4     30.0
Fa0/8     auto   on         15.4    Ieee PD             4     30.0
```

من الحاجات المهمة فيها انك تاخد بالك الأجهزة اللي هتوصلها محتاجة Power قد ايه علشان تشتغل – الأجهزة القديمه في سيسكو بتدعم لحد 15.4 وات والجديدة ممكن توصل معاك لحد 30 زي ما موضح في الصورة

لو عايز تغير في الاعدادات تقدر تدخل على الـ Interface وتكتب

SW (config-if) # Power inline auto → Enable POE on the Interface
SW (config-if) # Power inline never → Disable POE on the Interface

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Routing: -

- Direct Connect
- Static Route
- Show Version
- EIGRP - OSPF
- Inter – VLAN
- Router Password Recovery
- ACL
- NAT
- Router Service
  DHCP, Syslog, NTP
  CDP, SNMP, NetFlow
- High Availability
- IOS Value Explain
- Automatic Save
- VPN
- IPv6
- BGP
- GNS3
- SSH

Routing

وظيفته انه بيربط الـ Routers مع بعض – يعني الشبكات المختلفة مع بعض – يعني الفروع المختلفة مع بعض

كل Interface علي الـ Router بياخد IP من شبكة مختلفة عن الـ Interface التاني

Direct Connect

```
BUGs-HQ(config)#interface fastethernet 0/0
BUGs-HQ(config-if)#no shutdown

BUGs-HQ(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up

BUGs-HQ(config-if)#ip address 172.16.0.1 255.255.0.0
BUGs-HQ(config-if)#
BUGs-HQ(config-if)#interface fastethernet 0/1
BUGs-HQ(config-if)#no shutdown

BUGs-HQ(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up

BUGs-HQ(config-if)#ip address 10.0.0.1 255.0.0.0
BUGs-HQ(config-if)#
```

```
BUGs-HQ#show ip route
Codes: C - connected, S - static, I - IGRP, 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, E - EGP
       i - IS-IS, 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    10.0.0.0/8 is directly connected, FastEthernet0/1
C    172.16.0.0/16 is directly connected, FastEthernet0/0
BUGs-HQ#! routing table
BUGs-HQ#! C mean Direct Connect
```

Static Route

ودا معناه ان بيكون في شبكة الراوتر مش عارفها وعايز يوصل ليها

الـ Static هو اني بعرف الـ Router ايه هو الطريق المحدد اللي هيبعت عليه الـ Packet بتاعته

- Static Route Types- :
  - Standard static route
  - Summary static route
  - Default static route
  - Floating static route

```
BUGs-HQ1(config)#interface fastethernet 0/0
BUGs-HQ1(config-if)#no shutdown

BUGs-HQ1(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up
ipi
BUGs-HQ1(config-if)#ip address 17.0.0.1 255.255.255.252
BUGs-HQ1(config-if)#
BUGs-HQ1(config-if)#interface fastethernet 0/1
BUGs-HQ1(config-if)#no shutdown

BUGs-HQ1(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up

BUGs-HQ1(config-if)#ip address 192.168.1.1 255.255.255.0
BUGs-HQ1(config-if)#
BUGs-HQ1(config-if)#exit
```

```
BUGs-HQ2#show ip route
Codes: C - connected, S - static, I - IGRP, 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, E - EGP
       i - IS-IS, 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    10.0.0.0/8 is directly connected, FastEthernet0/1
     17.0.0.0/30 is subnetted, 1 subnets
C       17.0.0.0 is directly connected, FastEthernet0/0
BUGs-HQ2#! only two networks | but on Desigh we have three
```

```
BUGs-HQ1(config)#! now configure Static route
BUGs-HQ1(config)#! the network that routerdoesn't know then how to reach it ( nest Hop )
BUGs-HQ1(config)#ip route 10.0.0.0 255.0.0.0 17.0.0.2
BUGs-HQ1(config)#!command    Missed Network  the next hop
BUGs-HQ1(config)#
```

```
BUGs-HQ2(config)#! configure Static Route
BUGs-HQ2(config)#ip route 192.168.1.0 255.255.255.0 17.0.0.1
BUGs-HQ2(config)#
```

في الـ Static Route ممكن الـ Next Hop تكون الـ IP او Interface .

```
BUGs-HQ2#show ip route
Codes: C - connected, S - static  I - IGRP, 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, E - EGP
       i - IS-IS, 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    10.0.0.0/8 is directly connected, FastEthernet0/1
     17.0.0.0/30 is subnetted, 1 subnets
C       17.0.0.0 is directly connected, FastEthernet0/0
S    192.168.1.0/24 [1/0] via 17.0.0.1
BUGs-HQ2#! 1 Mean Metric
```

Metric → How Routing Protocol Calculate Best Path

- RIP: Hop count
- IGRP - EIGRP: Bandwidth (used by default), Delay (used by default), Load, Reliability, MTU
- IS-IS - OSPF: Cost (Bandwidth (Cisco's implementation))
- BGP : Path Attributes

Admin Distance → Routing Protocols Default Value

Route Source	Default Distance
Connected interface	0
Static route	1
EIGRP summary route	5
External BGP	20
Internal EIGRP	90
IGRP	100
OSPF	110
IS-IS	115
RIPv1, RIPv2	120
External EIGRP	170
Internal BGP	200
Unknown	255

Default Route

يعتبر مشتق من الـ Static بس الفكرة بتاعته اننا مش بنعرف اي شبكة
احنا بنعوض عنها بـ *0.0.0.0 0.0.0.0* يعني أي شبكة بأي mask Subnet تقدر توصل ليها من الـ Next Hop بتاعتك

ملحوظة

ممكن تستخدم الـ Exit Interface كمخرج للـ Traffic بدل الـ Next-Hop وهتلاقيها مستخدمة بكثرة مع IPv6

Show Version

```
Router#show version
Cisco IOS Software, C1900 Software (C1900-UNIVERSALK9-M), Version 15.1(4)M4, RELEASE
SOFTWARE (fc2)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2007 by Cisco Systems, Inc.Compiled Wed 23-Feb-11 14:19 by pt_team

ROM: System Bootstrap, Version 15.1(4)M4, RELEASE SOFTWARE (fc1)
cisco1941 uptime is 22 minutes, 53 seconds
System returned to ROM by power-on
System image file is "flash0:c1900-universalk9-mz.SPA.151-1.M4.bin"
Last reload type: Normal Reload


Cisco CISCO1941/K9 (revision 1.0) with 491520K/32768K bytes of memory.
Processor board ID FTX152400KS
2 Gigabit Ethernet interfaces
DRAM configuration is 64 bits wide with parity disabled.
255K bytes of non-volatile configuration memory.
249856K bytes of ATA System CompactFlash 0 (Read/Write)


Configuration register is 0x2102
```

من الأوامر المهمة الخاصة بسيسكو وبتعرفك معلومات كتير عن الـ Device هتلاقيني في الجدول اللي فوق في خط تحت الحاجات المهمة اللي لازم تكون واخد بالك منها كويس

كمان يتجيبلك معلومات عن الـ License اللي موجودة على الجهاز وكمان هل Enabled – In-use ولا لأ

```
License Info:

License UDI:

-------------------------------------------------
Device#   PID                   SN
-------------------------------------------------
*0        CISCO1941/K9          FTX1524WVWO-


Technology Package License Information for Module:'c1900'

-----------------------------------------------------------------
Technology    Technology-package          Technology-package
              Current       Type          Next reboot
-----------------------------------------------------------------
ipbase        ipbasek9      Permanent     ipbasek9
security      None          None          None
data          None          None          None
```

Dynamic Route

كل Router بيعلن عن الشبكات بتاعته وعن طريق الـ Database بتاعه الـ Protocol اللي شغال بيتم توصيل الشبكات المختلفة ببعضها - كل Protocol ليه طريقة عمل سواء في الـ Implementation اللي في الاول وكمان في الـ Update بتاعه

EIGRP Bonus

اول حاجة نضبط الـ Interfaces والـ IP's

```
BUGs-1(config)#interface fastethernet 0/0
BUGs-1(config-if)#no shutdown

BUGs-1(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

BUGs-1(config-if)#ip address 17.0.0.1 255.255.255.252
BUGs-1(config-if)#interface fastethernet 0/1
BUGs-1(config-if)#no shutdown

BUGs-1(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up

BUGs-1(config-if)#ip address 172.16.0.1 255.255.0.0
```

```
BUGs-2(config)#interface fastethernet 0/0
BUGs-2(config-if)#no shutdown

BUGs-2(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up

BUGs-2(config-if)#ip address 17.0.0.2 255.255.255.252
BUGs-2(config-if)#interface fastethernet 0/1
BUGs-2(config-if)#no shutdown

BUGs-2(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up

BUGs-2(config-if)#ip address 192.168.1.1 255.255.255.0
```

في حاجه في الـ EIGRP اسمها AS ودا رقم لازم يكون ثابت علي كل الـ Routers اللي متصلة مع بعض

```
BUGs-1(config)#! let's Configure EIGRP with AS 11
BUGs-1(config)#router eigrp 11
BUGs-1(config-router)#network 17.0.0.0
BUGs-1(config-router)#network 172.16.0.0
BUGs-1(config-router)#
BUGs-1(config-router)#no auto-summary
BUGs-1(config-router)#
```

```
BUGs-2(config)#! let's configure EIGRP with AS 11
BUGs-2(config)#router eigrp 11
BUGs-2(config-router)#network 17.0.0.0
BUGs-2(config-router)#
%DUAL-5-NBRCHANGE: IP-EIGRP 11: Neighbor 17.0.0.1 (FastEthernet0/0) is up: new adjacency

BUGs-2(config-router)#! automatic update
BUGs-2(config-router)#network 192.168.1.0
BUGs-2(config-router)#no auto-summary
BUGs-2(config-router)#
%DUAL-5-NBRCHANGE: IP-EIGRP 11: Neighbor 17.0.0.1 (FastEthernet0/0) resync: summary configured
```

بالنسبة للـ Auto-summary سواء عملنا ليه Enable او Disable ليها Cases معينة

```
BUGs-1#show ip route
Codes: C - connected, S - static, I - IGRP, 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, E - EGP
       i - IS-IS, 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

     17.0.0.0/30 is subnetted, 1 subnets
C       17.0.0.0 is directly connected, FastEthernet0/0
C    172.16.0.0/16 is directly connected, FastEthernet0/1
D    192.168.1.0/24 [90/30720] via 17.0.0.2, 00:04:10, FastEthernet0/0
BUGs-1#            Metric/ Admin Distance
```

EIGRP Different AS – How can Communicate?

هنعمل خطوات الـ Interfaces IP's وكمان الـ EIGRP Configuration زي ما شرحنا فيما سبق دي الـ Configuration
اللي في النص اللي هو HQ Router

```
BUGs-HQ(config)#router eigrp 17
BUGs-HQ(config-router)#network 100.0.0.0
BUGs-HQ(config-router)#
%DUAL-5-NBRCHANGE: IP-EIGRP 17: Neighbor 100.0.0.1 (FastEthernet0/0) is up: new adjacency

BUGs-HQ(config-router)#no auto-summary
BUGs-HQ(config-router)#
%DUAL-5-NBRCHANGE: IP-EIGRP 17: Neighbor 100.0.0.1 (FastEthernet0/0) resync: summary configured

BUGs-HQ(config-router)#router eigrp 11
BUGs-HQ(config-router)#network 17.0.0.0
BUGs-HQ(config-router)#
%DUAL-5-NBRCHANGE: IP-EIGRP 11: Neighbor 17.0.0.1 (FastEthernet0/1) is up: new adjacency

BUGs-HQ(config-router)#no auto-summary
BUGs-HQ(config-router)#
%DUAL-5-NBRCHANGE: IP-EIGRP 11: Neighbor 17.0.0.1 (FastEthernet0/1) resync: summary configured
```

```
BUGs-HQ(config)#! Now Configure Redistribution
BUGs-HQ(config)#! AS 11 redistribute in 17 and 17 will redistribute in 11
BUGs-HQ(config)#router eigrp 11
BUGs-HQ(config-router)#redistribute eigrp 17
BUGs-HQ(config-router)#router eigrp 17
BUGs-HQ(config-router)#redistribute eigrp 11
BUGs-HQ(config-router)#
BUGs-HQ(config-router)#
```

علي اي Branch

```
BUGs-BR2#show ip route
Codes: C - connected, S - static, I - IGRP, 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, E - EGP
       i - IS-IS, 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

D EX 10.0.0.0/8 [170/79360] via 100.0.0.2, 00:00:58, FastEthernet0/0
     17.0.0.0/30 is subnetted, 1 subnets
D EX    17.0.0.0 [170/53760] via 100.0.0.2, 00:00:58, FastEthernet0/0
     100.0.0.0/30 is subnetted, 1 subnets
C       100.0.0.0 is directly connected, FastEthernet0/0
C    192.168.1.0/24 is directly connected, FastEthernet0/1
BUGs-BR2#
```

OSPF

هنعمل Configuration للـ Interfaces عادي جدا وبعد كدا Configure الـ OSPF

```
BUGs-BR1(config)#router ospf 1
BUGs-BR1(config-router)#! process IP
BUGs-BR1(config-router)#router ospf 1
BUGs-BR1(config-router)#! process ID
BUGs-BR1(config-router)#network 192.168.1.0 0.0.0.255 area 0
BUGs-BR1(config-router)#!                    Wild Card
BUGs-BR1(config-router)#bnetwork 40.0.0.0 0.0.0.3
% Incomplete command.
BUGs-BR1(config-router)#network 40.0.0.0 0.0.0.3 area 0
BUGs-BR1(config-router)#
```

في حاجة اسمها Process ID وحاجة كمان اسمها Wildcard ودول

```
BUGs-HQ(config)#router ospf 2
BUGs-HQ(config-router)#network 40.0.0.0 0.0.0.3 area 0
BUGs-HQ(config-router)#network 100.0.0.0 0.0.0.3 area 0
BUGs-HQ(config-router)#
BUGs-HQ(config-router)#
00:20:26: %OSPF-5-ADJCHG: Process 2, Nbr 100.0.0.1 on FastEthernet0/0 from LOADING to FULL, Loading Done
```

```
BUGs-BR2(config)#router ospf 5
BUGs-BR2(config-router)#net 100.0.0.0 0.0.0.3 area 0
BUGs-BR2(config-router)#net 10.0.0.0 0.
00:20:22: %OSPF-5-ADJCHG: Process 5, Nbr 100.0.0.2 on FastEthernet0/0 from LOADING to FULL, Loading Done
255.255.255 area 0
```

```
BUGs-BR2#show ip route
Codes: C - connected, S - static, I - IGRP, 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, E - EGP
       i - IS-IS, 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    10.0.0.0/8 is directly connected, FastEthernet0/1
     40.0.0.0/30 is subnetted, 1 subnets
O       40.0.0.0 [110/2] via 100.0.0.2, 00:05:21, FastEthernet0/0
     100.0.0.0/30 is subnetted, 1 subnets
C       100.0.0.0 is directly connected, FastEthernet0/0
O    192.168.1.0/24 [110/3] via 100.0.0.2, 00:05:21, FastEthernet0/0
BUGs-BR2#
```

في *Command* اسمه *Show ip protocols*
بيجيبلي كل الـ Routing Protocols اللي موجودين علي الـ Router عشان الـ Routing Table مش هيجيب الا الأقل في الـ Admin Distance بس اللي هو Best Routing Protocol

```
BUGs-BR2#show ip protocols

Routing Protocol is "ospf 5"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 100.0.0.1
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    100.0.0.0 0.0.0.3 area 0
    10.0.0.0 0.255.255.255 area 0
  Routing Information Sources:
    Gateway         Distance      Last Update
    100.0.0.1            110      00:07:38
    100.0.0.2            110      00:07:44
    192.168.1.1          110      00:08:03
  Distance: (default is 110)
```

```
BUGs-BR2#show ip ospf ?
  <1-65535>       Process ID number
  border-routers  Border and Boundary Router Information
  database        Database summary
  interface       Interface information
  neighbor        Neighbor list
  virtual-links   Virtual link information
  <cr>
```

OSPF Multi Area

بمجرد ما نعمل الـ Configuration زي ما اتعلمنا – الشبكات هتشوف بعضها علشان في بينهم *Area 0 " back bone area* "

```
BUGs-1(config)#router ospf 2
BUGs-1(config-router)#network 40.0.0.0 0.0.0.3 area 0
BUGs-1(config-router)#network 10.0.0.0 0.255.255.255 area 2
BUGs-1(config-router)#
BUGs-1(config-router)#
```

ونفس الفكرة علي الـ Router التاني

```
BUGs-1#show ip rou
Codes: C - connected, S - static, I - IGRP, 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, E - EGP
       i - IS-IS, 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    10.0.0.0/8 is directly connected, FastEthernet0/1
     40.0.0.0/30 is subnetted, 1 subnets
C       40.0.0.0 is directly connected, FastEthernet0/0
O IA 172.16.0.0/16 [110/2] via 40.0.0.2, 00:00:42, FastEthernet0/0
```

من الحاجات المهمة اللي لازم تاخد بالك منها وهيا الـ Hello والـ Dead والأخيرة بتكون 4 أضعاف الأولي ولازم تكون ثابتة علي الـ Neighbors

```
R1(config)# interface serial 0/0/0
R1(config-if)# ip ospf hello-interval 5
R1(config-if)# ip ospf dead-interval 20
R1(config-if)# end
```

من خلالها بنحدد مين هو الـ DR بتاع الـ Topology

```
R1(config)# interface gigabitethernet 0/0
R1(config-if)# ip ospf priority 200
```

```
R2(config)# interface gigabitethernet 0/0
R2(config-if)# ip ospf priority 100
```

LSUs Contain LSAs

Type	Packet Name	Description
1	Hello	Discovers neighbors and builds adjacencies between them.
2	DBD	Checks for database synchronization between routers.
3	LSR	Requests specific link-state records from router to router.
4	LSU	Sends specifically requested link-state records.
5	LSAck	Acknowledges the other packet types.

The acronyms LSA and LSU are often used interchangeably.

An LSU contains one or more LSAs.

LSAs contain route information for destination networks.

LSA specifics are discussed in CCNP.

LSA Type	Description
1	Router LSAs
2	Network LSAs
3 or 4	Summary LSAs
5	Autonomous System External LSAs
6	Multicast OSPF LSAs
7	Defined for Not-So-Stubby Areas
8	External Attributes LSA for Border Gateway Protocol (BGP)
9, 10, 11	Opaque LSAs

Multicast Routing Protocols IP Addresses

Protocol	IPv4	IPv6
EIGRP	224.0.0.10	FF02::A/16
OSPF	224.0.0.5	FF02::5/16
OSPF DR	224.0.0.6	FF02::6/16

Inter VLAN

معناها ان عندي كذا VLAN وعايزهم بتكلمو مع بعض

علي الـ Router هنعمل *Sub-Interface* اني هقسم الـ Physical لكذا (Virtual) - Sub وكل واحد هربطه بـ VLAN مختلفة

```
Router(config)#interface fastethernet 0/0
Router(config-if)#no shutdown
Router(config-if)#exit
Router(config)#! Configure Sub Interface
Router(config)#interface fastethernet 0/0.10
Router(config-subif)#
%LINK-5-CHANGED: Interface FastEthernet0/0.10, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0.10, changed state to up

Router(config-subif)#no shutdown
Router(config-subif)#! Configure Encapsulation mode
Router(config-subif)#encapsulation dot1q 10
Router(config-subif)#ip address 192.168.1.2 255.255.255.224
Router(config-subif)#
Router(config-subif)#interface fastethernet 0/0.20
Router(config-subif)#
%LINK-5-CHANGED: Interface FastEthernet0/0.20, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0.20, changed state to up

Router(config-subif)#no shutdown
Router(config-subif)#encapsulation dot1q 20
Router(config-subif)#ip address 192.168.1.34 255.255.255.224
Router(config-subif)#interface fastethernet 0/0.30
Router(config-subif)#
%LINK-5-CHANGED: Interface FastEthernet0/0.30, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0.30, changed state to up

Router(config-subif)#no shutdown
Router(config-subif)#encapsulation dot1q 30
Router(config-subif)#ip address 192.168.1.66 255.255.255.224
Router(config-subif)#
Router(config-subif)#interface fastethernet 0/0.40
Router(config-subif)#
%LINK-5-CHANGED: Interface FastEthernet0/0.40, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0.40, changed state to up

Router(config-subif)#no shutdown
Router(config-subif)#encapsulation dot1q 40
Router(config-subif)#ip address 192.168.1.98 255.255.255.224
```

```
Router#show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol

FastEthernet0/0        unassigned      YES unset  up                    up

FastEthernet0/0.10     192.168.1.2     YES manual up                    up

FastEthernet0/0.20     192.168.1.34    YES manual up                    up

FastEthernet0/0.30     192.168.1.66    YES manual up                    up

FastEthernet0/0.40     192.168.1.98    YES manual up                    up

FastEthernet0/1        unassigned      YES unset  administratively down down

Vlan1                  unassigned      YES unset  administratively down down
```

الـ IP دا هيكون هو الـ Gateway بتاع أجهزة الـ Clients

علي الـ Switch لازم الـ Interface اللي واصل بينه وبين الـ Router يكون Trunk

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

Switch(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to down

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up
```

لو عملنا Ping بين الأجهزة

```
PC>ping 192.168.1.3

Pinging 192.168.1.3 with 32 bytes of data:

Request timed out.
Reply from 192.168.1.3: bytes=32 time=0ms TTL=127
Reply from 192.168.1.3: bytes=32 time=1ms TTL=127
Reply from 192.168.1.3: bytes=32 time=0ms TTL=127

Ping statistics for 192.168.1.3:
    Packets: Sent = 4, Received = 3, Lost = 1 (25%
loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

Router Password Recovery

- **0x2102**=load IOS from flash and then the configuration from NVRAM. The router looks in NVRAM for the boot sequence
- **0x2100**=Load ROM Monitor Mode
- **0x2101**=load Mini-IOS from ROM
- **0x2142**=Load IOS from Flash and do not load startup-config

Modifying the Configuration-Register

Router#config t

Router(config)#config-register 0x2102

بنعدل في قيمة الـ Configuration Register علشان نعمل Ignore للـ NVRAM

لازم تكون موصل Console Cable وتعمل Reboot للـ Router وهو بيعمل Load بتضغط علي Ctrl+C علشان نعمل Interrupt لعملية الـ Boot

```
Self decompressing the image :
###############
monitor: command "boot" aborted due to user interrupt
rommon 1 > CONFREG 0x2142
rommon 2 > reset
System Bootstrap, Version 12.3(8r)T8, RELEASE SOFTWARE (fc1)
Initializing memory for ECC
..
c2811 processor with 524288 Kbytes of main memory
Main memory is configured to 64 bit mode with ECC enabled

Readonly ROMMON initialized
```

في الحالة دي ممكن نعمل Show startup-config ونشوف ايه الـ Password للي ناسيينه

طب في حاله اننا عاملين تشفير للـ Password -- لازم نعمل الأول copy startup-config running-config وبعدها نعمل Password من الأول وبعد كدا نعمل Save عادي جدا

متعملش Save او اي تعديل من غير ما نتقل الـ Configuration من الـ Startup للـ Running

بعد كدا بنغير قيمة الـ Configuration Register ونرجعها للقيمه الطبيعية بتاعتها علشان يعمل Load للـ NVRAM نفس الخطوات اللي في الصورة بس هنغير لـ confreg 0x2102 أو ممكن نغير القيمه عن طريق الـ Command

```
Router(config)# configuration-register 0x2102
```

Access Control List

تعتبر كمثال مصغر من الـ Firewall اللي من خلاله بتحكم في اي حاجة في الشبكة

Standard	ودي بستخدمها في حالة اني عايز امنع شبكة كامله من انها تخرج من الـ Router-- بتتطبق علي الـ Interface الأقرب للـ Source-- من " 1 : 99 "
Extend	ودي لو عايز امنع جهاز عن جهاز عن Service معينة واسمح بباقي الـ Serviceانها تشتغل – بتتطبق علي الـ Interfaceالأقرب للـ Destination-- من " 100 – 199 "

هنبدأ نتكلم عن الـ Standard :-

```
BUGs-1#show ip route
Codes: C - connected, S - static, I - IGRP, 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, E - EGP
       i - IS-IS, 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

D    10.0.0.0/8 [90/33280] via 100.0.0.2, 00:06:06, FastEthernet0/0
     40.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
D       40.0.0.0/8 is a summary, 00:06:16, Null0
D       40.0.0.0/30 [90/30720] via 100.0.0.2, 00:06:06, FastEthernet0/0
     100.0.0.0/30 is subnetted, 1 subnets
C       100.0.0.0 is directly connected, FastEthernet0/0
C    172.16.0.0/16 is directly connected, FastEthernet0/1
C    192.168.1.0/24 is directly connected, Ethernet0/1/0
BUGs-1#
```

عايز امنع الشبكة 172.16.0.0 بس في نفس الوقت اسمح للتانيه انها تخرج من الـ Router

علي الـ Router اللي اسمه BUGs-1 علشان دا الأقرب للـ Source

```
BUGs-1(config)#! Create Standard ACL
BUGs-1(config)#access-list 17 deny 172.16.0.0 0.0.255.255
BUGs-1(config)#! Allow Other Networks
BUGs-1(config)#Access-list 17 permit any
BUGs-1(config)#
BUGs-1(config)#! go to the interface that connect to Denied Network
BUGs-1(config)#interface fastethernet 0/1
BUGs-1(config-if)#ip access-group 17 in
BUGs-1(config-if)#! in --> mean that this network ia an Internal network on this router
```

لو جينا نجرب :-

اللي رد هنا الـ Gateway وبعت Unreachable دي معناها انه مش عارف يبعت الـ Packet بتاعته فين

```
PC>ping 10.0.0.100

Pinging 10.0.0.100 with 32 bytes of data:

Reply from 172.16.0.1: Destination host unreachable.
Reply from 172.16.0.1: Destination host unreachable.
Reply from 172.16.0.1: Destination host unreachable.
Reply from 172.16.0.1: Destination host unreachable.

Ping statistics for 10.0.0.100:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

هنا هنلاقي الدنيا مظبوطة

```
PC>ping 10.0.0.100

Pinging 10.0.0.100 with 32 bytes of data:

Reply from 10.0.0.100: bytes=32 time=1ms TTL=125
Reply from 10.0.0.100: bytes=32 time=1ms TTL=125
Reply from 10.0.0.100: bytes=32 time=1ms TTL=125
Reply from 10.0.0.100: bytes=32 time=0ms TTL=125
```

لو جينا نشوف الـ Extend ACL

فيها بنحدد احنا عايزين نمنع ايه بالضبط علي الـ Router علي المثال اللي هنطبقه اننا هنمنع جهاز من الشبكة192.168.1.0/24 انه يوصل للـ Server

هنطبقها علي BUGs-3 علي الـ Interface External علشان دا الأقرب للـ Destination

علشان نعمل Test هنجرب ندخل علي الـ Server من علي الجهازين اللي في نفس الشبكة هنلاقي الآتي

```
BUGs-3(config)#
BUGs-3(config)#! Create Extend ACL 100-199
BUGs-3(config)#! Detect the Source and Destination IP and the Service that i wand do disabled it
BUGs-3(config)#access-list 117 deny tcp host 192.168.1.10 host 10.0.0.100 eq www
BUGs-3(config)#!
BUGs-3(config)#! Allow onter service
BUGs-3(config)#access-list 117 permit tcp host 192.168.1.10 any
BUGs-3(config)#access-list 117 permit tcp any any
BUGs-3(config)#! to Allow all Diff Traffics
BUGs-3(config)#
BUGs-3(config)#! Then go to interface that connectod to Destination Host
BUGs-3(config)#interface fast 0/1
BUGs-3(config-if)#ip access-group 117 out
BUGs-3(config-if)#! this mean that , its External Network
```

ملحوظة

لازم تكون فاهم طبيعة الـ Service اللي عايز امنعها عاملة ازاي , وهل ليها Port Number ولا لأ – ودا بيتحدد علي حسب الـ Layer اللي هيا شغاله فيه , وهل هي TCP or UDP

في نوع تالت اسمه Named Access List مجرب بس انك بتضيف ليها اسم وبتعمل الـ Configuration ليها عادي

ممكن نستخدم ACL في اننا نعمل Enable لـ Subnets معينة انها نعمل Telnet Connection

```
router (config)#ip access-list standard Telnet_Connection
router (config-std-nacl)#permit 10.11.0.0 0.0.0.255
router (config-std-nacl)#permit 10.12.0.0 0.0.0.255
router (config-std-nacl)#permit 10.13.0.0 0.0.0.255

router (config)#line vty 0 4
router (config-line)#access-class Telnet_Connection in
router (config-line)#! Name Case Sensitive
router (config-line)#password cisco
router (config-line)#transport input all
```

NAT - Network Address Translation

وظيفته انه بيحول من الـ Private IP للـ Public IP

Public IP Address Classes range

Class	1st Octet DEC range	1st Octet BIN	Start address	Finish address	1st Octet High order Bits	Network/ Host	Default Subnet Mask
A	1-126	00000001-01111110	0.0.0.0	126.255.255.255	0	N.H.H.H	255.0.0.0
B	128-191	10000000-10111111	128.0.0.0	191.255.255.255	10	N.N.H.H	255.255.0.0
C	192-223	11000000-11011111	192.0.0.0	223.255.255.255	110	N.N.N.H	255.255.255.0
D	224-239	11100000-11101111	224.0.0.0	239.255.255.255	1110		
E	240-255	11110000-11111111	240.0.0.0	254.255.255.255	11110		

Note: Class A address **127.0.0.0 - 127.255.255.255** cannot be used and is for **LOOPBACK** and diagnostic

Private IP Address Classes range

Class	1st Octet DEC range	1st Octet BIN	Start address	Finish address	1st Octet High order Bits	Network/ Host	Default Subnet Mask
A	10	00001010	10.0.0.0	10.255.255.255	0	N.H.H.H	255.0.0.0
B	172	10101100	172.16.0.0	172.31.255.255	10	N.N.H.H	255.255.0.0
C	192	11000000	192.168.0.0	192.168.255.255	110	N.N.N.H	255.255.255.0

ليه بنحول ؟ علشان في Policy في كل الـ ISP بتقول Deny any Request from any Private IP

في حالات في الـ NAT اننا ممكن نحول من Private لـ Private زي الـ VPN Site to Site أو لو عاملين MPLS Connection مع Client وهو عامل Allow لـ Subnets معينة

الـ NAT ليه 3 أنواع :-

Static → One Privato to One Public
Dymanic → Many to Many
PAT → One to All " The Difference in Port Number "

Static NAT

عايز PC 1 لما ييجي يعمل Ping علي PC0 يعمل عن طريق Public IP

```
BUGs-1(config)#! Assign your private and Public Networks
BUGs-1(config)#interface fast 0/1
BUGs-1(config-if)#ip nat inside
BUGs-1(config-if)#interface fast 0/0
BUGs-1(config-if)#ip nat outside
BUGs-1(config-if)#
BUGs-1(config-if)#exit
BUGs-1(config)#! Crete your NAT Role
BUGs-1(config)#ip nat inside source static 172.16.0.10 100.0.0.4
BUGs-1(config)#
```

علشان نتأكد من اللي عملناه هنكتب Command اسمه

BUGs-1#debug ip nat

```
BUGs-1#debug ip nat
IP NAT debugging is on
```

```
NAT: s=172.16.0.11->100.0.0.4, d=10.0.0.10 [1]

NAT: s=172.16.1.100->100.0.0.5, d=10.0.0.10 [24]

NAT: s=172.16.0.11->100.0.0.4, d=10.0.0.10 [2]

NAT*: s=10.0.0.10, d=100.0.0.4->172.16.0.11 [4]

NAT: s=172.16.0.11->100.0.0.4, d=10.0.0.10 [3]

NAT*: s=10.0.0.10, d=100.0.0.4->172.16.0.11 [5]

NAT: s=172.16.0.11->100.0.0.4, d=10.0.0.10 [4]

NAT*: s=10.0.0.10, d=100.0.0.4->172.16.0.11 [6]

NAT: s=172.16.1.100->100.0.0.5, d=10.0.0.10 [25]

NAT*: s=10.0.0.10, d=100.0.0.5->172.16.1.100 [7]

NAT: s=172.16.1.100->100.0.0.5, d=10.0.0.10 [26]

NAT*: s=10.0.0.10, d=100.0.0.5->172.16.1.100 [8]

NAT: s=172.16.1.100->100.0.0.5, d=10.0.0.10 [27]

NAT*: s=10.0.0.10, d=100.0.0.5->172.16.1.100 [9]
```

```
NAT*: s=10.0.0.10, d=100.0.0.4->172.16.0.11 [4]

NAT: s=172.16.0.11->100.0.0.4, d=10.0.0.10 [3]

NAT*: s=10.0.0.10, d=100.0.0.4->172.16.0.11 [5]

NAT: s=172.16.0.11->100.0.0.4, d=10.0.0.10 [4]

NAT*: s=10.0.0.10, d=100.0.0.4->172.16.0.11 [6]

NAT: s=172.16.1.100->100.0.0.5, d=10.0.0.10 [25]

NAT*: s=10.0.0.10, d=100.0.0.5->172.16.1.100 [7]

NAT: s=172.16.1.100->100.0.0.5, d=10.0.0.10 [26]

NAT*: s=10.0.0.10, d=100.0.0.5->172.16.1.100 [8]

NAT: s=172.16.1.100->100.0.0.5, d=10.0.0.10 [27]

NAT*: s=10.0.0.10, d=100.0.0.5->172.16.1.100 [9]
```

Dynamic NAT

لازم نحدد فيها الـ Range بتاع الـ Private وكمان الـ Pool بتاعه الـ Public طبعا مع تحديد الـ Inside and Outside

```
BUGs-1(config)#
BUGs-1(config)#! Create Private Range
BUGs-1(config)#access-list 4 permit 172.16.0.0 0.0.255.255
BUGs-1(config)#! Create Public IP's Pool
BUGs-1(config)#ip nat pool BUGs 100.0.0.4 100.0.0.10 netmask 255.255.255.240
BUGs-1(config)#! Confige NAT
BUGs-1(config)#ip nat inside source list 4 pool BUGs
BUGs-1(config)#
```

PAT Port Address Translation

نفس الـ Command بس بنزود عليه Overload

```
BUGs-1(config)#ip nat inside source list 4 pool BUGs overload
```

```
NAT: s=172.16.1.100->100.0.0.5, d=10.0.0.10 [28]

NAT*: s=10.0.0.10, d=100.0.0.5->172.16.1.100 [10]

NAT: s=172.16.1.100->100.0.0.5, d=10.0.0.10 [29]

NAT*: s=10.0.0.10, d=100.0.0.5->172.16.1.100 [11]

NAT: s=172.16.1.100->100.0.0.5, d=10.0.0.10 [30]

NAT*: s=10.0.0.10, d=100.0.0.5->172.16.1.100 [12]

NAT: s=172.16.1.100->100.0.0.5, d=10.0.0.10 [31]

NAT*: s=10.0.0.10, d=100.0.0.5->172.16.1.100 [13]

NAT: s=172.16.0.11->100.0.0.5, d=10.0.0.10 [5]

NAT*: s=10.0.0.10, d=100.0.0.5->172.16.0.11 [14]

NAT: s=172.16.0.11->100.0.0.5, d=10.0.0.10 [6]

NAT*: s=10.0.0.10, d=100.0.0.5->172.16.0.11 [15]

NAT: s=172.16.0.11->100.0.0.5, d=10.0.0.10 [7]

NAT*: s=10.0.0.10, d=100.0.0.5->172.16.0.11 [16]

NAT: s=172.16.0.11->100.0.0.5, d=10.0.0.10 [8]

NAT*: s=10.0.0.10, d=100.0.0.5->172.16.0.11 [17]
```

ممكن نستخدم الـ NAT برضه لو عايزين نحول من Private لـ Private في حالات معينه زي الـ VPN او ان في شركه محتاجة انك لما تعمل Access للـ Resources بتاعتها تبقي واخد Specific IP Range

Router Service

DHCP

وظيفته انه بيوزع Configuration بطريقة Automatic علي كل الأجهزة

```
Router(config)#ip dhcp pool BUGs-Network
Router(dhcp-config)#?
  default-router  Default routers
  dns-server      Set name server
  exit            Exit from DHCP pool configuration mode
  network         Network number and mask
  no              Negate a command or set its defaults
  option          Raw DHCP options
Router(dhcp-config)#default-router 192.168.1.1
Router(dhcp-config)#network 192.168.1.0 255.255.255.0
Router(dhcp-config)#exit
```

لو عايز استثني IP معين انه ميتوزعش – او مجموعة IP's

```
Router(config)#ip dhcp excluded-address 192.168.1.10
Router(config)#ip dhcp excluded-address 192.168.1.20 192.168.1.30
```

Router(dhcp-config)# **option 66 ip 10.1.1.250**	Provides the IP address of a TFTP server for option 66
Router(dhcp-config)# **option 150 ip 10.1.1.250**	Provides the name of a TFTP server for option 150
Router(dhcp-config)# **option 150 ip 10.1.1.250 10.1.1.251**	Provides the names of two TFTP servers for option 150
Router(dhcp-config)# **option 3 ip 10.1.1.1**	Sets the default route

في حالة إن الـ DHCP موجود علي سيرفر في شبكة والـ Client موجود في شبكة تانية كالموضح

لازم على الـ Interface الواصل في ناحية الـ Client نعمل Commandاسمه الـ Helper او الـ Relay Agent

```
Router(config)#int g0/0/1
Router(config-if)#ip helper-address 192.168.1.250
```

Syslog

```
Router(config)#logging 10.0.0.10
Router(config)#logging host 10.0.0.10
Router(config)#logging trap debugging
Router(config)#interface fast 0/1
Router(config-if)#no shutdown
```

R#Show Logging

بتجيب كل التفاصيل والأحداث اللي حصلت علي الـ Device في فترة معينة – او لحد ما يحصل ليه Reload كل الـ logs بتتمسح
ممكن تستخدم الـ Two Commands دول علشان تخلي الـ logs تظهر بتفصيل الـ Data – Time

```
Router(config)#service timestamps debug datetime msec
Router(config)#service timestamps log datetime msec
```

Code	Severity	Description	General Description
0	Emergency	System is unusable.	A "panic" condition usually affecting multiple apps/servers/sites. At this level it would usually notify all tech staff on call.
1	Alert	Action must be taken immediately.	Should be corrected immediately, therefore notify staff who can fix the problem. An example would be the loss of a primary ISP connection.
2	Critical	Critical conditions.	Should be corrected immediately, but indicates failure in a secondary system, an example is a loss of a backup ISP connection.
3	Error	Error conditions.	Non-urgent failures, these should be relayed to developers or admins; each item must be resolved within a given time.
4	Warning	Warning conditions.	Warning messages, not an error, but indication that an error will occur if action is not taken, e.g. file system 85% full - each item must be resolved within a given time.
5	Notice	Normal but significant condition.	Events that are unusual but not error conditions - might be summarized in an email to developers or admins to spot potential problems - no immediate action required.
6	Informational	Informational messages.	Normal operational messages - may be harvested for reporting, measuring throughput, etc. - no action required.
7	Debug	Debug-level messages.	Info useful to developers for debugging the application, not useful during operations.

في الـ Real Life بنستخدم برامج علشان تعرض لينا ملفات الـ Logs دي واشهرهم برنامج اسمه :-

Kiwi syslog

Orion

NTP Network Time Protocol

R#Show Clock
**0:19:27.445 UTC Mon Mar 1 1993*

```
Router(config)#ntp server 10.0.0.10
Router(config)#ntp authentication-key 1 md5 basem
Router(config)#ntp update-calendar
Router(config)#ntp trusted-key 1
Router(config)#do sh cloock
*5:27:33.262 UTC Sun Nov 16 2014
```

```
Router#show ntp status
Router#debug ntp packets
```

Cisco Discovery Protocol

من اهم الخدمات اللي موجودة على أجهزة Cisco ووظيفته انه يعمل Discover – Map لأجهزة Cisco اللي متصلين مع بعض – بيكون معمول ليه Enable تلقائيا

```
Router#sh cdp neighbor
Capability Codes: R - Router, T - Trans Bridge, B - Source Route Bridge
                  S - Switch, H - Host, I - IGMP, r - Repeater, P - Phone
Device ID     Local Intrfce    Holdtme    Capability   Platform    Port ID
Switch        Gig 0/0/0         164           S        2960        Fas 0/1
Switch        Gig 0/0/1         167           S        2960        Fas 0/1
```

هنلاحظ في الـ Output اللي طالع انه جايب الـ Local – Remote Interfaces and Platforms

في بروتوكول تاني اسمه LLDP ودا بيشتغل مع الـ Non-Cisco ولازم تعمل ليه Enable علي كل الأجهزه

```
Router(config)#lldp run
Router(config)#do sh lldp neighbor
Capability codes:
    (R) Router, (B) Bridge, (T) Telephone, (C) DOCSIS Cable Device
    (W) WLAN Access Point, (P) Repeater, (S) Station, (O) Other
Device ID           Local Intf     Hold-time  Capability      Port ID
Switch              Gig0/0/1       120        B               Fa0/1

Total entries displayed: 1
```

	CDP	LLDP
Cisco Priority	Yes	Yes
Run in Layer 2	Yes	Yes
Hold Time	180 Seconds	120 Secons
Global config	Cdp run no cdp run	Lldp run No lldp run
Interface-Level Command	Cdp enable No cdp enable	Lldp receive No llde receive Lldp transmit No lldp transmit

MOTD Message of the Day

```
Router(config)#banner motd ?
LINE c banner-text c, where 'c' is a delimiting character
Router(config)#banner motd #wlecome in CCNAx Book#
Router(config)#do wr
Building configuration...
[OK]
Router(config)#do reload
```

بعد ما نعمل Reload هنلاقي المسج كلآتي :-

```
Press RETURN to get started!

%SYS-6-LOGGINGHOST_STARTSTOP: Logging to host 10.0.0.10 port 514 started - CLI
initiated
wlecome in CCNAx Book
```

IOS Values Explain

High Availability

مهم اوي تكون فاهم النظري بتاع الـ Chapter دا – بتشتغل علي الـ Routers والـ Multi-Layer Switches

Characteristic	HSRP	VRRP	GLBP
Cisco proprietary.	Yes	No	Yes
Interface IP address can act as virtual IP address.	No	Yes	No
More than one router in a group can simultaneously forward traffic for that group.	No	No	Yes
Hello timer default value.	3 seconds	1 second	3 seconds
Hold timer default value.	10 seconds	3 seconds	10 seconds
Preemption enabled by default.	No	Yes	No for AVG, Yes for AVFs
Default priority.	100	100	100
Default weight.	—	—	100
Authentication supported.	Yes	Yes	Yes
Multicast address.	224.0.0.2	224.0.0.18	224.0.0.102
Virtual MAC address. (xx = group number)(yy = AVF)	V1: 0000.0c07.acxx V2: 0000.0c9f.fxxx	0000.5e00.01xx	0007.b400.xxyy

هنعمل دمج للـ 2 Physical IP's لـ واحد Virtual IP ودا هيكون هو لـ Gateway بتاع الأجهزة

قيمه الـ Priority الثابتة بتكون 100 وتقدر تغيرها في الـ Configuration ومن خلالها بتحدد مين هو الـ Router اللي ليه أولوية في انه يبعت الـ Packet

HSRP

```
Router(config)#
Router(config)#! Configure HSRP
Router(config)#interface fast 0/0
Router(config-if)#standby 1 ip 192.168.1.100
Router(config-if)#standby 1 priority 100
Router(config-if)#standby 1 preem
%HSRP-6-STATECHANGE: FastEthernet0/0 Grp 1 state Speak -> Standby
p
%HSRP-6-STATECHANGE: FastEthernet0/0 Grp 1 state Standby -> Active
Router(config-if)#standby 1 preempt
Router(config-if)#
Router(config-if)#interface fast 0/1
Router(config-if)#standby 1 ip 10.0.0.100
Router(config-if)#standby 1 priority 100
Router(config-if)#standby 1 preempt
```

```
R2(config)#! Configure HSRP
R2(config)#interface fa 0/0
R2(config-if)#standby 17 ip 192.168.1.100
R2(config-if)#standby 17 priority 150
R2(config-if)#interface fa 0/1
R2(config-if)#standby 17 ip 10.0.0.100
R2(config-if)#standby 17 priority 150
R2(config-if)#
R2(config-if)#
R2(config-if)#
%HSRP-6-STATECHANGE: FastEthernet0/0 Grp 17 state Speak -> Standby

%HSRP-6-STATECHANGE: FastEthernet0/0 Grp 17 state Standby -> Active
```

الـ IP اللي معرفينه بعد الـ Standby هيكون هو الـ Gateway بتاعه اجهزة الـ Client

```
Packet Tracer PC Command Line 1.0
PC>ping 10.0.0.11

Pinging 10.0.0.11 with 32 bytes of data:

Request timed out.
Reply from 10.0.0.11: bytes=32 time=0ms TTL=127
Reply from 10.0.0.11: bytes=32 time=0ms TTL=127
Reply from 10.0.0.11: bytes=32 time=0ms TTL=127

Ping statistics for 10.0.0.11:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

PC>tracert 10.0.0.11

Tracing route to 10.0.0.11 over a maximum of 30 hops:

  1   1 ms      0 ms      0 ms      192.168.1.1
  2   0 ms      0 ms      0 ms      10.0.0.11

Trace complete.
```

VRRP

```
Router(config)#! Configure VRRP
Router(config)#interface fast 0/0
Router(config-if)#vrrp 1 ip 192.168.1.100
Router(config-if)#vrrp 1 priority 100
Router(config-if)#vrrp 1 preempt
Router(config-if)#interface fast 0/1
Router(config-if)#vrrp 1 ip 10.0.0.100
Router(config-if)#vrrp 1 priority 100
Router(config-if)#vrrp 1 preempt
```

نفس الخطوات علي الـ Router التاني مع تجاهل الـ Priority and Preempt

بالنسبة للـ GLBP – حاول تعمله لوحدك

الـ VRRP – GIBP هيشتغلوا معاك علي الـ GNS3 بس مش علي الـ Packet Tracer

	HSRP	VRRP	GLBP
Packet	UDP encapsulation using 1985 port	IP encapsulation, 112	UDP encapsultion using 3222 port
Multicast	224.0.0.2	224.0.0.18	224.0.0.102
Standard	Cisco Proprietary	IEEE standard	Cisco Proprietary
Group Range	0 to 255	0 to 255	0 to 1023
Priority Range	1 to 255, Default 100	1 to 255, Default 100	1 to 255, Default 100
MAC Address	Virtual router MAC address 0000.0C07.ACXX	Virtual router MAC address 0000.5e00.01XX	allows up to four virtual MAC addresses per group
Timers	Hello = 3 Sec Default	Advertisement Interval = 1 Default	Hello = 3 Sec Default
	Hold = 10 Sec Default	Skew timer = (256-Priority)/ 256	Hold = 10 Sec Default
	Can Manually Change	Mster_Down_Interval =(3*Advertisement_Interval)+ Skew_time	Can Manually Change
Hello Messages	Active and Standby sends Hello messages	only Master router send advertisement packet	Hello messages all routers in group
Preempt	If a router has a higher priority than the active router and preemption is configured. It may take over as the active router using a COUP message Without preemption functio	By default VRRP routers are configured to pre-empt	GLBP allow a router to pre-empt and become AVG, if it has higher priority than the current AVG.
Active Router	Numerically higher priority wins, in case of routers with equal priority higher IP address wins.	Numerically higher priority wins, in case of routers with equal priority higher IP address wins.	AVG –Active Virtual Gateway, Primary gateway; Numerically higher priority wins, in case of routers with equal priority higher IP address wins.
Backup Router	another is elected as the standby HSRP router; and all the others remain in the listen HSRP state	May backup one or more virtual routers	AVF –Active Virtual Forwarder, secondary gateway, max 4 AVF can be configured.
Tracking	By default HSRP algorithm decreases the priority by 10, when tracked interface goes down	NO TRACKING OPTION	AVG assigns th necessary virtual MAC address to each of the routers participating in GLBP group. Up to 4 virtual MAC address can be used in any group.

Automatic Save

ممكن نعمل Save Configuration علي External Server بطريقة Automatic
ليها كذا فكرة :-

Kron Job

```
1-  Create Kron Job
    Router(config)#archive
      path tftp://tftp/Backup/SW-run/$h-config
      write-memory
```

دا معناه ان اي Save هيتعمل هيتاخد منه Backup علي الـ TFTP سيرفر في الـ Path اللي ضفناه
وطبعا لازم نكون معرفين الـ TFTP للـ Router او الـ Switch

```
Router(config)# ip host tftp 10.10.1.19
2-  Create schedule Time
      Router(config)#kron occurrence backup at 4:00 recurring
        policy-list autowrite
      Router(config)#  kron policy-list autowrite
        cli write
```

دا معناه ان كل يوم الساعة 4 هيتعمل Automatic Save للاعدادات وبالتالي الـ kroon هيشتغل و هياخد
نسخة على الـ TFTP

Scripting

Working with 9200 Series Switches

```
Switch(config)#event manager applet backup-config authorization bypass
      event timer cron cron-entry "0 4 * * *"
     action 1.0 syslog msg “Copy backup configuration to the Server”
     action 1.1 cli command “enable”
     action 3.0 cli command “copy run tftp://10.100.1.49/Backup/SWrun/SW1_1_$_event_pub_sec.txt”
pattern “Address”
    action 4.0 cli command “" pattern "Destination"
   action 5.0 cli command ""
```

معناه ان الساعة 4 هيبعت Log Message انه هياخد Backup وبعدها هيروح علي الـ Enable Mode ويكتب الأمر اللي في Action
3 و هياخد اسم الـ Device من الـ Host Name

VPN Bonus

Protocol	Speed	Encryption & Secure browsing	Stability	Media streaming	Torrent downloading	Available in CactusVPN software	Compatible with
PPTP	Fast	Poor	Medium	Good	Good	Windows and MacOS	Most OS and devices
L2TP/IPSec	Fast	Medium	Good	Good	Good	Windows and MacOS	Most OS and devices
OpenVPN	Slow	Good	Poor	Bad	Bad	Windows and MacOS	Most OS and devices
SSTP	Medium	Good	Medium	Medium	Good	Windows	Windows
SoftEther	Fast	Good	Good	Good	Good	No	Windows

Configure VPN with OSPF

Figure 15-16 *Summary Diagram for Upcoming GRE Examples*

Example 15-1 *Tunnel Configuration on R1*

```
R1# show running-config
! Only the related configuration is listed
interface serial 0/0/0
 ip address 1.1.1.1 255.255.255.0
!
interface tunnel0
 ip address 10.1.3.1 255.255.255.0
 tunnel mode gre ip
 tunnel source serial0/0/0
 tunnel destination 2.2.2.2

! The OSPF configuration enables OSPF on the tunnel interface as well.
router ospf 1
 network 10.0.0.0 0.255.255.255 area 0
```

The Same thing in the Router 2, don't Forget to Change the IP Address

Cisco Site to Site VPN Technology

	Cisco GET-VPN	Cisco DMVPN	Cisco GRE-Based VPN	Cisco Easy VPN	Standard IPsec VPN
	Tunnel-less VPN	Tunnel-based VPN			
Customer Benefits	• Simplifies encryption integration on IP and Multiprotocol Label Switching (MPLS) WANs • Simplifies encryption management through use of "group keying" instead of point-to-point key pairs • Enables scalable and manageable any-to-any connectivity between sites • Supports quality of service (QoS), multicast, and routing	• Simplifies encryption configuration and management for point-to-point GRE tunnels • Provides on-demand spoke-to-spoke tunnels • Supports QoS, multicast, and routing	• Enables transport of multicast and routing traffic across an IPsec VPN • Supports non-IP protocols • Supports QoS	• Simplifies IPsec and remote-site device management through dynamic configuration policy-push • Supports QoS	• Provides encryption between sites • Supports QoS
When to use	• Adds encryption to MPLS or IP WANs while preserving any-to-any connectivity and • networking features • Offers scalable, full-time meshing for IPsec VPNs • Enables participation of smaller routers in meshed networks • Simplifies encryption key management while supporting routing, QoS, and multicast	• Simplifies configuration for hub-and-spoke VPNs while supporting routing, QoS, and multicast • Provides low-scale, on-demand meshing	• Use when routing must be supported across the VPN • Use for same functions as hub-and-spoke DMVPN, but it requires more detailed configuration	• Use when simplifying overall VPN • configuration and management is • the primary goal, but only limited networking features are required • Use to provide simple, unified configuration framework for mix of Cisco VPN products	• Use when multivendor interoperability is required
Product interoperability	Cisco routers only	Cisco routers only	Cisco routers only	Cisco, ASA 5500 Series, Cisco VPN 3000 Series, and Cisco PIX® Firewall	Multivendor
Scale	Thousands	Thousands hub and spoke; hundreds partially meshed spoke-to-spoke connections	Thousands	Thousands	Thousands
Provisioning and management	CLI, Cisco Security Manager	Cisco Security Manager and Cisco Router and Security Device Manager	Cisco Security Manager and Cisco Router and Security Device Manager	Configuration automatically pushed to remote sites from headend; headend policies defined in Cisco Security Manager or Cisco Router and Security Device Manager	Cisco Security Manager and Cisco Router and Security Device Manager
Topology	Hub and spoke; any-to-any	Hub and spoke; on-demand spoke-to-spoke partial mesh; spoke-to-spoke connections automatically terminated when no traffic present	Hub and spoke; small-scale meshing as manageability allows	Hub and spoke	Hub and spoke; small-scale meshing as manageability allows
Routing	Supported; Cisco GET-VPN any-to-any connectivity capability can also be used to provide secure routing across an entire router backbone	Supported	Supported	Not supported	Not supported
QoS	Supported	Supported	Supported	Supported, but QoS policy is not dynamically pushed to the remote sites	Supported
Multicast	Natively supported across MPLS and private IP networks; tunneled across Internet-based WANs	Tunneled	Tunneled	Not supported	Not supported
Non-IP Protocols	Not supported	Not supported	Supported	Not supported	Not supported
Private IP addressing	Requires use of GRE or DMVPN with Cisco GET-VPN to support private addressesacross public Internet backbones	Supported	Supported	Supported	Supported
High availability	Routing	Routing	Routing	Stateless failover	Stateless failover

Acronym	Name	Type	Use
DES	Data Encryption Standard	Block cipher	General
3DES	Triple DES	Block cipher	General
AES	Advanced Encryption Standard	Block cipher	General
RC4	Rivest Cipher 4	Stream cipher	SSL, WEP
MD5	Message-Digest algorithm 5	Hash function	SASL, PKI, Kerberos, IKE
SHA-1	Secure Hash Algorithm	Hash function	TLS and SSL, PGP, SSH, S/MIME, and IPsec
Diffie-Hillman	Diffie-Hillman	Key exchange	General
RSA	RSA	Public key	General
PGP	Pretty Good Privacy	Public key	General

IPv6

IPv6 Address Types

في IPv6 لازم نفعل الـ Routing حتي مع الشبكات الـ Direct Connect عن طريق Command - *Ipv6 unicast-routing*

```
Router(config)#interface fast 0/0
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up

Router(config-if)#
Router(config-if)#ipv6 address a::1/64
Router(config-if)#interface fast 0/1
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up

Router(config-if)#ipv6 address b::1/64
Router(config-if)#exit
Router(config)#! we should allow routing when using ipv6
Router(config)#ipv6 unicast-routing
```

```
Router#show ipv6 route
IPv6 Routing Table - 5 entries
Codes: C - Connected, L - Local, S - Static, R - RIP, B - BGP
       U - Per-user Static route, M - MIPv6
       I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary
       O - OSPF intra, OI - OSPF inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2
       ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2
       D - EIGRP, EX - EIGRP external
C   A::/64 [0/0]
     via ::, FastEthernet0/0
L   A::1/128 [0/0]
     via ::, FastEthernet0/0
C   B::/64 [0/0]
     via ::, FastEthernet0/1
L   B::1/128 [0/0]
     via ::, FastEthernet0/1
L   FF00::/8 [0/0]
     via ::, Null0
```

بالنسبه للـ Routing Protocols بإستخدام IPv6

Static

```
BUGs-BR-1(config)#! configure Static route
BUGs-BR-1(config)#ipv6 route 100::0/64 ab::2
BUGs-BR-1(config)#
```

```
BUGs-BR-2(config)#! configure Static Route
BUGs-BR-2(config)#ipv6 route 10::0/64 ab::1
```

```
BUGs-BR-1#show ipv6 route
IPv6 Routing Table - 6 entries
Codes: C - Connected, L - Local, S - Static, R - RIP, B - BGP
       U - Per-user Static route, M - MIPv6
       I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary
       O - OSPF intra, OI - OSPF inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2
       ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2
       D - EIGRP, EX - EIGRP external
C   10::/64 [0/0]
     via ::, FastEthernet0/1
L   10::1/128 [0/0]
     via ::, FastEthernet0/1
C   AB::/64 [0/0]
     via ::, FastEthernet0/0
L   AB::1/128 [0/0]
     via ::, FastEthernet0/0
S   100::/64 [1/0]
     via AB::2
L   FF00::/8 [0/0]
     via ::, Null0
BUGs-BR-1#
```

RIPng

```
BUGs-BR-1(config)#
BUGs-BR-1(config)#! configure RIP
BUGs-BR-1(config)#ipv6 unicast-routing
BUGs-BR-1(config)#ipv6 router rip LAB
BUGs-BR-1(config-rtr)#exit
BUGs-BR-1(config)#
BUGs-BR-1(config)#interface fast 0/0
BUGs-BR-1(config-if)#ipv6 router rip LAB enable

BUGs-BR-1(config-if)#ipv6 rip LAB enable
BUGs-BR-1(config-if)#interface fast 0/1
BUGs-BR-1(config-if)#ipv6 rip LAB enable
```

```
BUGs-BR-2(config)#! Configure RIPng
BUGs-BR-2(config)#ipv6 unicast-routing
BUGs-BR-2(config)#
BUGs-BR-2(config)#ipv6 router rip LAB
BUGs-BR-2(config-rtr)#exit
BUGs-BR-2(config)#interface fastethernet 0/0
BUGs-BR-2(config-if)#ipv6 rip LAB enable
BUGs-BR-2(config-if)#interface fastethernet 0/1
BUGs-BR-2(config-if)#ipv6 rip LAB enable
BUGs-BR-2(config-if)#
```

```
BUGs-BR-1#show ipv6 route
IPv6 Routing Table - 6 entries
Codes: C - Connected, L - Local, S - Static, R - RIP, B - BGP
       U - Per-user Static route, M - MIPv6
       I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary
       O - OSPF intra, OI - OSPF inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2
       ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2
       D - EIGRP, EX - EIGRP external
C   10::/64 [0/0]
     via ::, FastEthernet0/1
L   10::1/128 [0/0]
     via ::, FastEthernet0/1
C   AB::/64 [0/0]
     via ::, FastEthernet0/0
L   AB::1/128 [0/0]
     via ::, FastEthernet0/0
R   100::/64 [120/2]
     via FE80::210:11FF:FE75:3201, FastEthernet0/0
L   FF00::/8 [0/0]
     via ::, Null0
BUGs-BR-1#
```

EIGRP

```
BUGs-BR-2(config)#! Configure EIGRP
BUGs-BR-2(config)#ipv6 router eigrp 17
BUGs-BR-2(config-rtr)#no shutdown
BUGs-BR-2(config-rtr)#exit
BUGs-BR-2(config)#interface fastethernet 0/0
BUGs-BR-2(config-if)#ipv6 eigrp 17
BUGs-BR-2(config-if)#interface fastethernet 0/1
BUGs-BR-2(config-if)#ipv6 eigrp 17
BUGs-BR-2(config-if)#
```

```
BUGs-BR-1(config)#! Configure EIGRP
BUGs-BR-1(config)#ipv6 router eigrp 17
BUGs-BR-1(config-rtr)#no shutdown
BUGs-BR-1(config-rtr)#exit
BUGs-BR-1(config)#interface fast 0/1
BUGs-BR-1(config-if)#ipv6 eigrp 17
BUGs-BR-1(config-if)#interface fast 0/0
BUGs-BR-1(config-if)#ipv6 eigrp 17
BUGs-BR-1(config-if)#
```

OSPF

BR-1

```
Router(config)#! Configure OSPF
Router(config)#ipv6 router ospf 1
%OSPFv3-4-NORTRID: OSPFv3 process 1 could not pick a router-id,please configure manually
Router(config-rtr)#! Asking for Router ID
Router(config-rtr)#router-id 100.100.100.100
Router(config-rtr)#exit
Router(config)#int fa 0/1
Router(config-if)#ipv6 ospf 1 area 0
Router(config-if)#int fa 0/0
Router(config-if)#ipv6 ospf 1 area 0
Router(config-if)#
```

BR-2

```
Router(config)#ipv6 router ospf 10
%OSPFv3-4-NORTRID: OSPFv3 process 10 could not pick a router-id,please configure manually
Router(config-rtr)#router-id 200.200.200.200
Router(config-rtr)#exit
Router(config)#interface fa 0/0
Router(config-if)#ipv6 ospf 10 area 0
Router(config-if)#interface fa 0/1
Router(config-if)#ipv6 ospf 10 area 0
Router(config-if)#
00:13:55: %OSPFv3-5-ADJCHG: Process 10, Nbr 100.100.100.100 on FastEthernet0/0 from LOADING to FULL, Loading Done
```

```
BUGs-BR-2#sh ipv6 route
IPv6 Routing Table - 6 entries
Codes: C - Connected, L - Local, S - Static, R - RIP, B - BGP
       U - Per-user Static route, M - MIPv6
       I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary
       O - OSPF intra, OI - OSPF inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2
       ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2
       D - EIGRP, EX - EIGRP external
C   10::/64 [0/0]
     via ::, FastEthernet0/1
L   10::1/128 [0/0]
     via ::, FastEthernet0/1
C   AB::/64 [0/0]
     via ::, FastEthernet0/0
L   AB::2/128 [0/0]
     via ::, FastEthernet0/0
O   100::/64 [110/2]
     via FE80::230:A3FF:FECC:8601, FastEthernet0/0
L   FF00::/8 [0/0]
     via ::, Null0
```

IPv6 ACL

مش بيدعم الا بس Named ACL

```
HQ(config)#! To prevent telnet
HQ(config)#ipv6 access-list NO_TELNET
HQ(config-ipv6-acl)#permit tcp host 2001:db8:cc1e:1::1 any eq 23
HQ(config-ipv6-acl)#exit
HQ(config)#line vty 0 15
HQ(config-line)#ipv6 access-class NO_TELNET in
```

```
HQ-1(config)#! Deny http and ftp traffics
HQ-1(config)#ipv6 access-list DENY_WWW_FTP
HQ-1(config-ipv6-acl)#remark Deny WWW and FTP access from R1 LANs to Web Server
HQ-1(config-ipv6-acl)#deny tcp 2001:db8:cc1e:1::/64 2001:db8:cc1e:a::/64 eq www
HQ-1(config-ipv6-acl)#deny tcp 2001:db8:cc1e:1::/64 2001:db8:cc1e:a::/64 eq ftp
HQ-1(config-ipv6-acl)#deny tcp 2001:db8:cc1e:2::/64 2001:db8:cc1e:a::/64 eq www
HQ-1(config-ipv6-acl)#deny tcp 2001:db8:cc1e:2::/64 2001:db8:cc1e:a::/64 eq ftp
HQ-1(config-ipv6-acl)#permit ipv6 any any
HQ-1(config-ipv6-acl)#exit
HQ-1(config)#! Assign to the interface
HQ-1(config)# int s0/0/0
HQ-1(config-if)# ipv6 traffic-filter DENY_WWW_FTP out
```

BGP Bonus

```
R1(config)#! Basic BGP Configuration
R1(config)#router bgp 200
R1(config-router)#neigh
R1(config-router)#neighbor 40.0.0.2 re
R1(config-router)#neighbor 40.0.0.2 remote-as 100
R1(config-router)#network 192.168.1.0
R1(config-router)#network 40.0.0.0
R1(config-router)#
```

```
R2(config)#router bgp 100
R2(config-router)#neighbor 40.0.0.1 remot
R2(config-router)#neighbor 40.0.0.1 remote-as 200
R2(config-router)#%BGP-5-ADJCHANGE: neighbor 40.0.0.1 Up

R2(config-router)#! adjancy changed to up
R2(config-router)#network 40.0.0.0
R2(config-router)#network 10.0.0.0
```

```
R2(config-router)#do sh ip route
Codes: C - connected, S - static, I - IGRP, 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, E - EGP
       i - IS-IS, 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    10.0.0.0/8 is directly connected, FastEthernet0/1
     40.0.0.0/30 is subnetted, 1 subnets
C       40.0.0.0 is directly connected, FastEthernet0/0
B    192.168.1.0/24 [20/0] via 40.0.0.1, 00:07:15
R2(config-router)#
```

Parameter	eBGP	iBGP
Abbreviation for	External BGP	Internal BGP
Neighborship	Both the Routers forming eBGP neighborship need to be in separate AS (Autonomous Systems)	Both the Routers forming iBGP neighborship need to be in same AS (Autonomous Systems)
Route advertisement	A route learnt from an eBGP peer will be advertised back to another IBGP or eBGP neighbor by default.	A route learnt from an IBGP peer will not be advertised back to another iBGP neighbor by default.
As Path addition	AS path is prepended to route when advertised to eBGP peer	AS path is not prepended to the route when advertised to an IBGP peer.
Attributes	Attributes like local preference are not sent to the eBGP peers but are sent to iBGP peer.	Attributes like local preference are sent to the IBGP peers but not to an EBGP peer.
Scope	Used Between organization or between organization and Internet Service provider	Used within the same organization
TTL	By default, EBGP peers are set with TTL = 1, which means neighbors are assumed to be directly connected	By default, EBGP peers are set with TTL = 255
AD (Administrative Distance)	EBGP routes have administrative distance of 20	IBGP routes have administrative distance of 200
Next Hop attribute	Next hop is changed to local router when it is advertised to EBGP peer by default	Next hop remains unchanged when route is advertised to iBGP peer
Topology	Doesn't require full mesh neighborship	Requires full mesh or else either of Route reflectors or Confederation
Loop prevention mechanism	Utilizes As Path for loop prevention	Uses BGP Split horizon i.e. non advertisement from iBGP to iBGP neighbor.

SNMP

```
R2(config)#! Access-list is an option
R2(config)# ip access-list standard ACL_SNMP
R2(config-std-nacl)# permit host 10.20.20.201
R2(config-std-nacl)# exit
R2(config)#! Configure SNMP
R2(config)# snmp-server community Test RW ACL_SNMP
R2(config)#! Community Name , Type , link it with the ACL
R2(config)# snmp-server location New York
R2(config)# snmp-server  enable traps ?
```

ونختار منها نوع الـ Traps اللي احنا عايزين نعمل ليها Monitor

بعد ما بنتخلص الـ Configuration بنستخدم Application علشان نقدر نتابع الـ Status بتاعه الأجهزة زي :-

Zenoss , PRTG

الـ PRTG بيستخدم حاجة اسمها Sensors من خلالها بنعمل Monitor للأجهزة

Net Flow Bonus

- Use to Monitor :-
  - ✓ Source and Destination IP Address
  - ✓ Source and Destination port Number
  - ✓ Layer 3 Protocol type and TOS
  - ✓ Input logical interface and Throughput

```
R1(config)# interface GigabitEthernet0/0
R1(config-if)# ip flow ingress
R1(config-if)# ip flow egress
R1(config-if)# ! for Source and Destination
R1(config)# ip flow-export destination 10.1.10.100 9996
R1(config)# ! Collector IP , Port Number
R1(config)# ip flow-export version 9
R1(config)# ! Version
R1(config)# ! Traffic sent on UDP ports 2055, 2056, 4432, 4739, 9995, 9996, and 6343.
```

```
R1# show ip flow interface
GigabitEthernet0/0
  ip flow ingress
  ip flow egress
```

```
R1# show ip flow export
Flow export v9 is enabled for main cache
Export source and destination details :
VRF ID : Default
Destination(1) 10.1.10.100 (9996)
Version 9 flow records
43 flows exported in 15 udp datagrams
```

ممكن نستخدم Application علشان تعمل Collect للـ Data زي مثلا :-

GNS3 Bonus

Analysis and Monitor the Traffic

```
R1(config)#enable password cisco
R1(config)#username basem password cisco
R1(config)#line vty 0 3
R1(config-line)#login local
R1(config-line)#password 123
R1(config)#interface fastEthernet 0/0
R1(config-if)#no shut
R1(config-if)#ip add 40.40.40.1 255.255.255.252
```

هنعمل R.Click علي الـ Link اللي واصل بين الـ Two Routers ونختار Start Capturing

وبعد كدا نختار Start Wireshark علشان يعمل Monitor for Traffic

ونعمل *Telnet* من *R1* لـــــ *R2* كالآتي :-

```
R1#telnet 40.40.40.2
Trying 40.40.40.2 ... Open
Username: basem
:Password
<R2
R2>en
:Password
R2#
```

هنلاقي برنامج الــ Wireshark اشتغل و عمل Analysis للـ Traffic اللي شغال و اتبعت

هنختار الـ Telnet Packet ونعمل R.Click عليها ونختار -- > Follow TCP Stream

هتظهر كالآتي :-

البروتوكول المستخدم في عملية التشفير هو الـ (Secure Shell) SSH

```
R1(config)#crypto key generate rsa
.Please define a domain-name first %
R1(config)#ip domain-name cisco.com
R1(config)#crypto key generate rsa
```

```
The name for the keys will be: R1.cisco.com
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
[Generating 1024 bit RSA keys ...[OK %

R1(config)#line vty 0 4
R1(config-line)#login local
R1(config-line)#password cisco
R1(config-line)#transport input ssh
```

```
R1#ssh

        c    Select encryption algorithm-
        l    Log in using this user name-
        o    Specify options-
        p    Connect to this port-
        WORD  IP address or hostname of a remote system

R1#ssh -l basem 40.40.40.2
Password:
```

```
SSH Bonus Commands

Router(config)#ip ssh version 2
Router(config)#ip ssh server algorithm encryption aes256-cbc aes192-cbc aes128-cbc
```

نعمل نفس الخطوات بإستخدام الــ Wireshark وفي الحاله دي هنستخدم Analysis for SSH Packets

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WAN

تستخدم لتوصيل الفروع المختلفة مع بعضها

Leased Line Types and Capacities

Line Type	Bit-Rate Capacity	Line Type	Bit-Rate Capacity
56k	56 kbps	OC-9	466.56 Mbps
64k	64 kbps	OC-12	622.08 Mbps
T1	1.544 Mbps	OC-18	933.12 Mbps
E1	2.048 Mbps	OC-24	1244.16 Mbps
J1	2.048 Mbps	OC-36	1866.24 Mbps
E3	34.064 Mbps	OC-48	2488.32 Mbps
T3	44.736 Mbps	OC-96	4976.64 Mbps
OC-1	51.84 Mbps	OC-192	9953.28 Mbps
OC-3	155.54 Mbps	OC-768	39,813.12 Mbps

```
Router(config)#! Cofigure Serial Interface
Router(config)#interface Serial 0/1/0
Router(config-if)#no shutdown

%LINK-5-CHANGED: Interface Serial0/1/0, changed state to down
Router(config-if)#
Router(config-if)#ip address 40.0.0.1 255.255.255.252
Router(config-if)#! Configure Clock Rate
Router(config-if)#clock rate 64000
Router(config-if)#
Router(config-if)#
```

علي الـ Router التاني

```
BR-2(config)#interface serial 0/1/0
BR-2(config-if)#no shutdown

BR-2(config-if)#
%LINK-5-CHANGED: Interface Serial0/1/0, changed state to up

BR-2(config-if)#ip
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1/0, changed state to up
BR-2(config-if)#ip address 40.0.0.2 255.255.255.252
```

Configure PPP Encapsulation on Serial Cables

```
BR-2(config-if)#encapsulation ppp
BR-2(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1/0, changed state to down

BR-2(config-if)#ppp authentication chap
BR-2(config-if)#
```

```
Router(config-if)#
Router(config-if)#encapsulation ppp
Router(config-if)#ppp authentication chap
Router(config-if)#
```

هنلاحظ ان الـ Interface بقي Down

لازم نضيف كل *Router* عن التاني كـ *Username* ونثبت الـ Password بتاع الاتنين

```
BR-2(config)#username Router password cisco
BR-2(config)#
BR-2(config)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1/0, changed state to up
```

```
Router(config)#username BR-2 password cisco
Router(config)#
Router(config)#
Router(config)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1/0, changed state to up
```

Wireless

الـ Wireless Ranges

الـ Wifi Channels

Automation

Scripts Type

Anisble, Puppet, and Chef Comparison

Feature	Ansible	Puppet	Chef
Term for the file that lists actions	Playbook	Manifest	Recipe, runlist
Protocol used to communicate with network devices	SSH, NETCONF	HTTP (REST)	HTTP (REST)
Uses agent or agentless model?	Agentless	Agent*	Agent
Uses a push or pull model?	Push	Pull	Pull

* Puppet can use an in-device agent or an external proxy agent for network devices.

Data Format Types

Data Format Comparison

Data Format	Origin/Definition	Central Purpose	Common Use
JSON	JavaScript (JS) language; RFC 8259	General data modeling and serialization	REST APIs
XML	World Wide Web Consortium (W3C.org)	Data-focused text markup, which allows data modeling	REST APIs, web pages
YAML	YAML.org	General data modeling	Ansible

Traditional Interface Output VS. JSON

IOS Router Output

```
GigabitEthernet0/0/0 is up, line protocol is up (connected)
  Description: Wide Area Network
  Internet address is 172.16.0.2/24
```

JSON Output

```
{
    "ietf-interfaces:interface": {
          "name": "GigabitEthernet0/0/0",
          "description": "Wide Area Network",
          "enabled": true,
          "ietf-ip:ipv4": {
              "address": [
                  {
                      "ip": "172.16.0.2",
                      "netmask": "255.255.255.0"
                  }
              ]
          }
    }
}
```