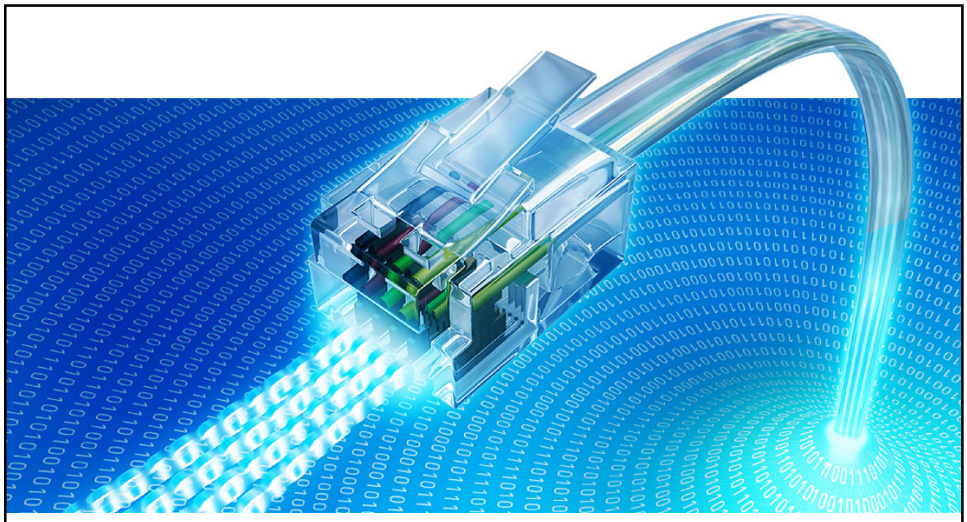
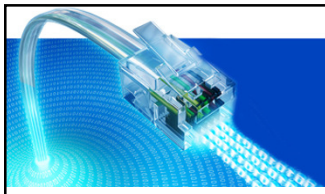


Nivel de Red

Profesor: Juan Carlos Cuéllar Q.

1



Temas a tratar en el Nivel 3

Responsabilidades del Nivel 3

El enrutador – configuración básica

Switches de Nivel 3

Enrutamiento Estático

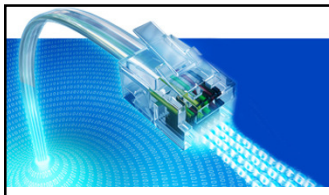
Algoritmos de Enrutamiento → Vector Distancia, Estado de Enlace, Enrutamiento Jerárquico → RIP OSPF IGRP (configuración)

IPv4 - subnetting

Diseño Lógico de redes a nivel 3

IPv6

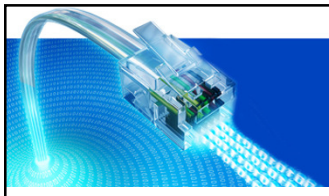
2



Agenda de hoy

- Responsabilidades del nivel de red.
- Enrutador, configuración Básica.
- Switches de nivel 3.
- Tema de investigación para la próxima clase.

3



Nivel de Red

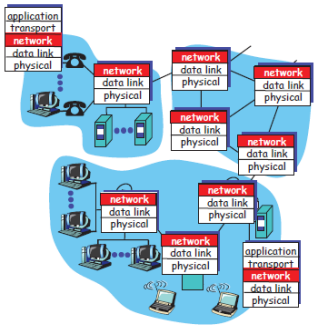
Responsabilidades

- Proporciona conectividad y selección de la ruta entre dos sistemas con ubicación geográfica distinta.
- La unidad de información se llama PAQUETE (**Datagrama**).
- Envía paquetes/datagramas nodo a nodo.
- Permite identificar nodos (Dirección IP).
- Controla congestión en la red.

4

Responsabilidades del Nivel de Red

1. Transportar segmentos entre hosts.
2. Encapsular los segmentos en **datagramas**.
3. El protocolo de red interviene en cada host y enrutador.
4. El protocolo de enrutamiento interviene entre enrutadores.
5. El enrutador analiza la cabecera IP de todos los datagramas que pasan a través de él.



5

Nivel de Red

- Equipos de interconectividad que trabajan en este nivel:
  - Switches de Nivel 3
  - **Enrutador/Encaminador/Router**

- Protocolos característicos de este nivel:
  - Internet Protocol (IP)
  - Internet Control Message Protocol (ICMP)
  - Address Resolution Protocol (ARP)
  - Protocolos de Enrutamiento

6

Funciones básicas del nivel de Red

1- **Retransmisión** *(«forwarding»)*

Mover paquetes desde un puerto de entrada del enrutador a un puerto de salida del mismo.

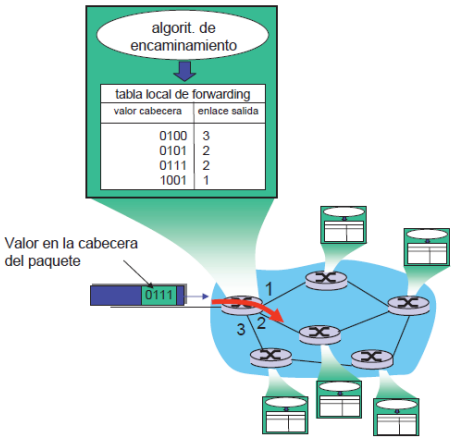
2- **Enrutamiento** *(«routing»)*

Determina la ruta que deben seguir los paquetes desde el origen hasta el destino.
(Protocolo de Enrutamiento).

7

Funciones básicas del nivel de Red

Interacción entre ENVÍO y ENRUTAMIENTO:



8

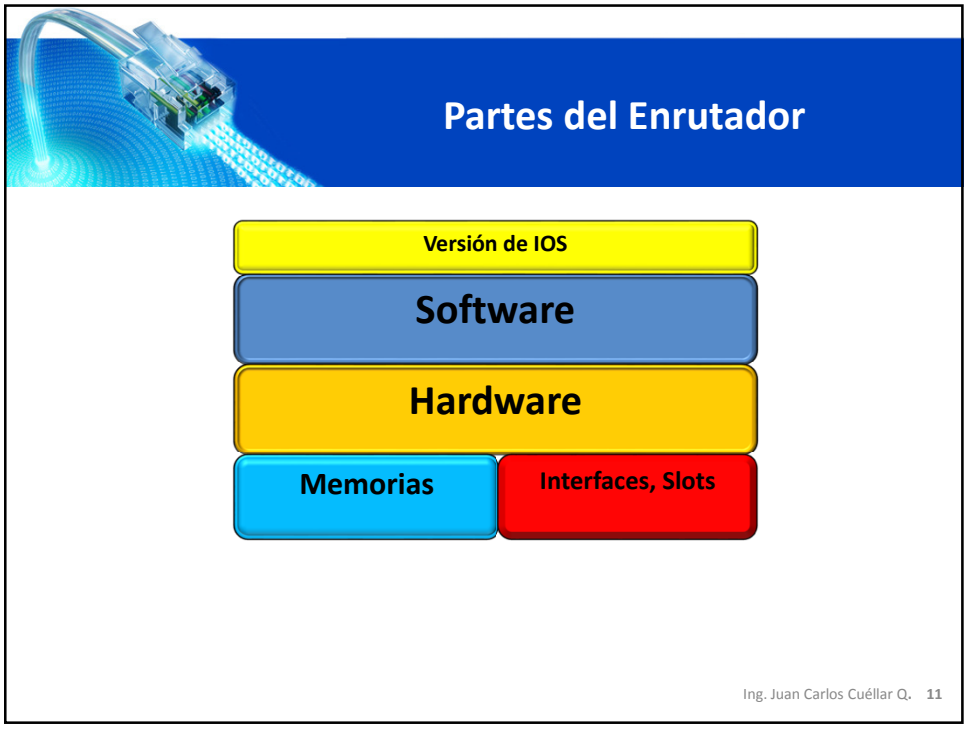
- Mentimeter.com
- Menti.com

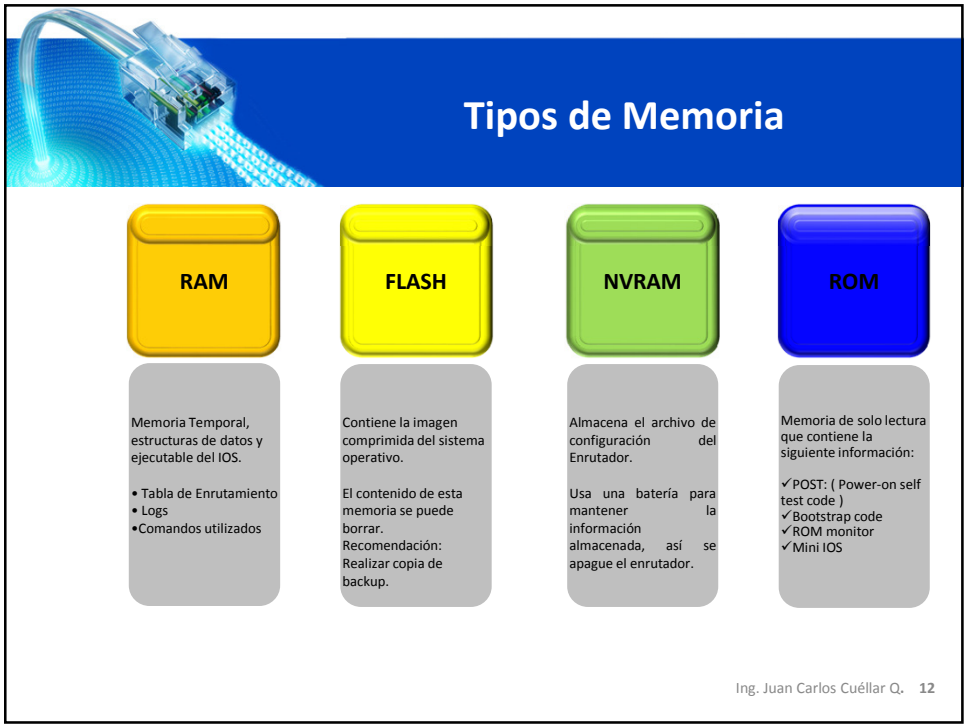
9

¿ Definición de enrutador ?

- Dispositivo de red que se encarga de enrutar/enviar tráfico (paquetes IP) de una red a otra.

10


Partes del Enrutador
Versión de IOS
Software
Hardware
Memorias
Interfaces, Slots
Ing. Juan Carlos Cuéllar Q. 11

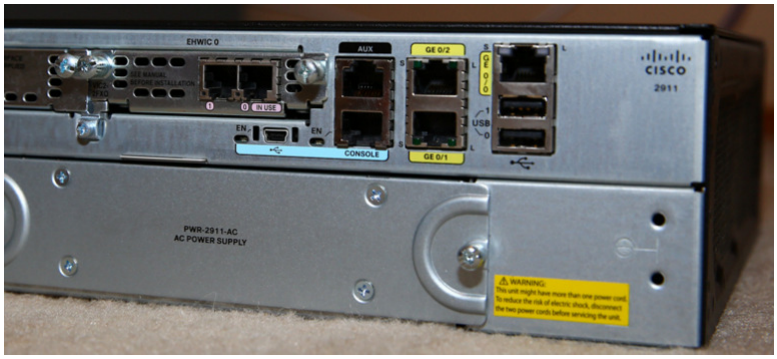

Tipos de Memoria
RAM
Memoria Temporal, estructuras de datos y ejecutable del IOS.
• Tabla de Enrutamiento
• Logs
•Comandos utilizados
FLASH
Contiene la imagen comprimida del sistema operativo.
El contenido de esta memoria se puede borrar.
Recomendación: Realizar copia de backup.
NVRAM
Almacena el archivo de configuración del Enrutador.
Usa una batería para mantener la información almacenada, así se apague el enrutador.
ROM
Memoria de solo lectura que contiene la siguiente información:
✓POST: (Power-on self test code)
✓Bootstrap code
✓ROM monitor
✓Mini IOS
Ing. Juan Carlos Cuéllar Q. 12

Partes de un enrutador ...

- Interfaces

- ❑ Interfaces LAN
- ❑ Interfaces WAN
- ❑ Puerto de Consola
- ❑ Puerto Auxiliar

Interfaces en el en



Partes de un enrutador ...

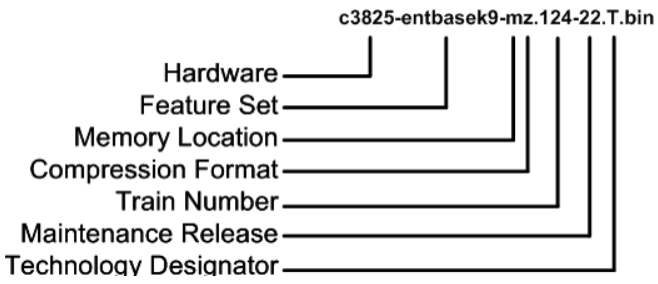
CISCO IOS - Internetwork Operating System

El sistema operativo de las máquinas cisco viene por versiones dependiendo del equipo y funcionalidades que se deseen.

Características:
1. Escalabilidad
2. Enrutamiento confiable y adaptativo.
3. Optimización de las WAN´s.
4. Capacidades de administración y seguridad.
5. Protocolos

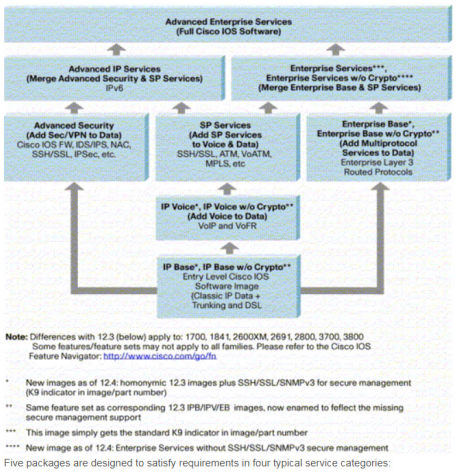
Versión de IOS

```
c1600-y-mz.112-16.p
```



Versión IOS

Figure 8. Cisco IOS Software Packaging for Cisco Routers and Switches



Five packages are designed to satisfy requirements in four typical service categories:

https://www.cisco.com/c/en/us/about/security-center/ios-nx-os-reference-guide.html

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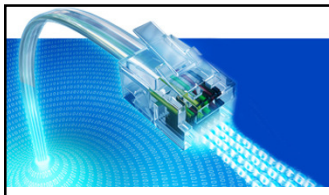
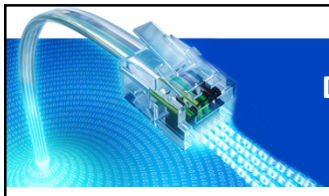
Secuencia de Arranque del Enrutador

- ❑Rutina POST
- ❑Cargar y ejecutar el bootstrap code
- ❑Encontrar la imagen de IOS
- ❑Cargar la imagen de IOS
- ❑Encontrar el archivo de configuración
- ❑Cargar el archivo de configuración
- ❑Prompt de modo usuario



Encontrando la imagen de IOS

- Análisis del registro de configuración.
- Análisis del archivo de configuración
- Cargar la imagen de IOS
- Intentar arrancar vía red (net boot)
- Mini IOS (RXBOOT)
- ROMMON



Determinando el Valor del Registro de Configuración

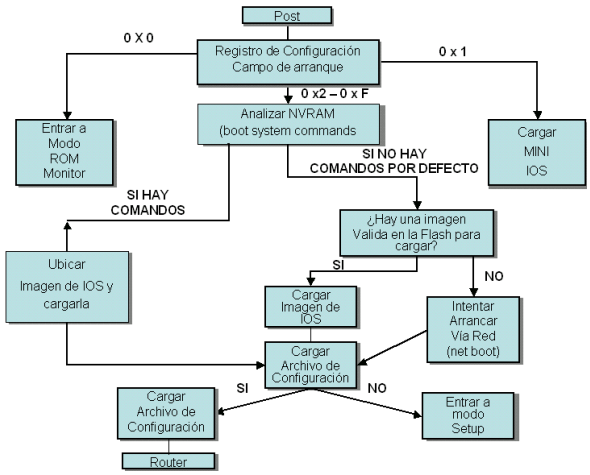
```
Router#show version
Cisco Internetwork Operating System Software
IOS (tm) 1600 Software (C1600-Y-M), Version 11.2(16)P,  RELEASE SOFTWARE (fc1)
Copyright (c) 1986-1998 by cisco Systems, Inc.
Compiled Tue 20-Oct-98 04:23 by dschwart
Image text-base: 0x02005000, data-base: 0x02329324

ROM: System Bootstrap, Version 12.0(3)T, RELEASE SOFTWARE (fc1)
ROM: 1600 Software (C1600-RBOOT-R), Version 12.0(3)T,  RELEASE SOFTWARE (fc1)

Router uptime is 31 minutes
System restarted by power-on
System image file is "c1600-y-mz.112-16.p", booted via flash

cisco 1601 (68360) processor (revision C) with 7680K/512K bytes of memory.
Processor board ID 14720326, with hardware revision 00000001
Bridging software.
X.25 software, Version 2.0, NET2, BFE and GOSIP compliant.
1 Ethernet/IEEE 802.3 interface(s)
2  serial(sync/async) network interface(s)
System/IO memory with parity disabled
8192K bytes of DRAM onboard
System running from RAM
8K bytes of non-volatile configuration memory.
4096K bytes of processor board PCMCIA flash (Read/Write)

Configuration register is 0x2102

Router#
```

Valor del Registro de Configuración

Valor	Descripción
0x0	Usar modo ROM monitor (Iniciar Manualmente mediante el comando **b**)
0x1	Iniciar automáticamente desde la ROM (Opción por defecto si no existe FLASH)
0x2 to 0xF	Examinar la NVRAM en busca de comandos de inicio (boot system), 0x2 es la opción por defecto si el enrutador tiene FLASH

```
Router(config)#config-register  0x2102
[Ctrl-z]
Router#copy run start
Router#reload
```


Proceso de Arranque Detallado

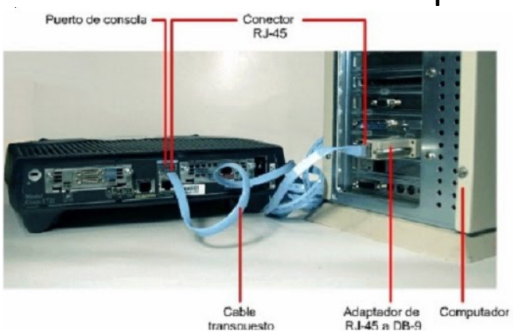


Línea de Comandos

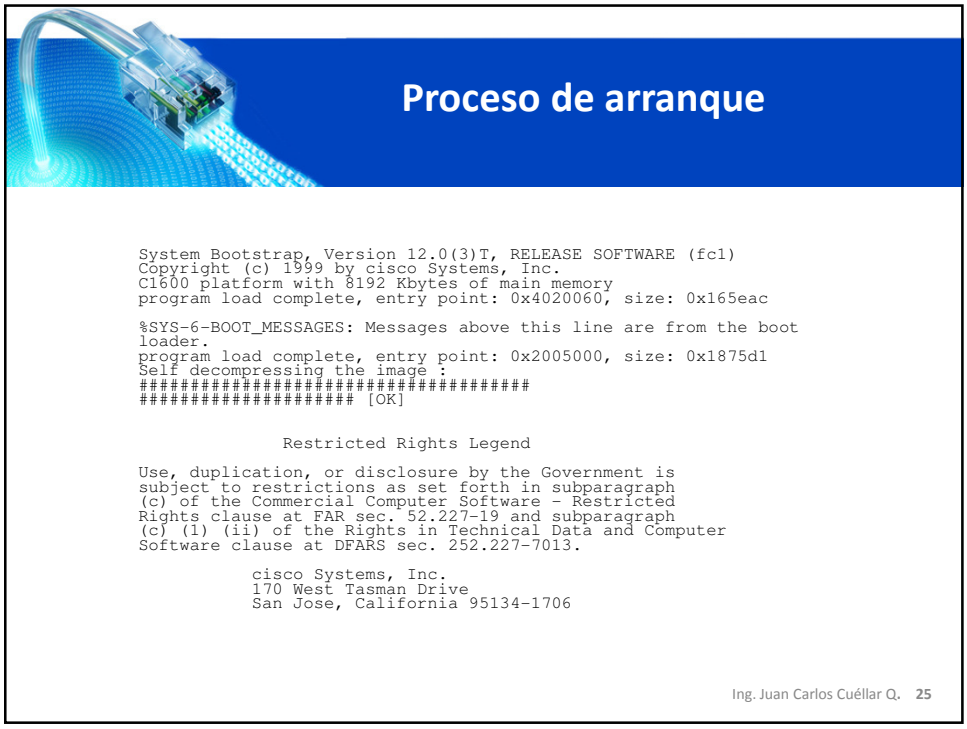
- Utiliza línea de comandos (CLI-Command line interface) para el proceso de configuración y resolución de problemas.
- Los comandos varían de acuerdo al modelo e interfaces de cada dispositivo.
- Permite utilizar Ctrl-C y Ctrl-V. (Copiar y pegar).
- Posee ayuda en línea para verificar sintaxis y argumentos asociados a cada comando.
- Posee diferentes modos de operación.

Proceso de Instalación y Configuración

- Conexión al puerto de consola



Bits por segundo :	9600
Bits de datos :	8
Paridad :	Ninguna
Bits de parada :	1
Control de Flujo :	Hardware

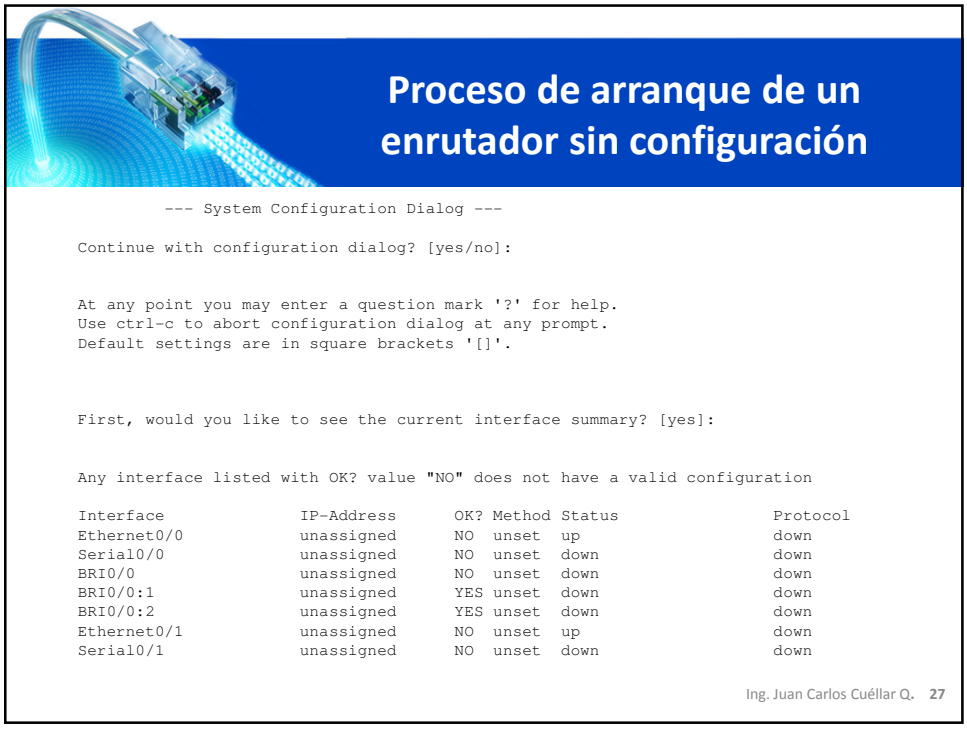


Proceso de arranque

```
System Bootstrap, Version 12.0(3)T, RELEASE SOFTWARE (fc1)
Copyright (c) 1999 by cisco Systems, Inc.
C1600 platform with 8192 Kbytes of main memory
program load complete, entry point: 0x4020060, size: 0x165eac

%SYS-6-BOOT_MESSAGES: Messages above this line are from the boot
loader.
program load complete, entry point: 0x2005000, size: 0x1875d1
Self decompressing the image :
########################################
#################### [OK]


             Restricted Rights Legend

Use, duplication, or disclosure by the Government is
subject to restrictions as set forth in subparagraph
(c) of the Commercial Computer Software - Restricted
Rights clause at FAR sec. 52.227-19 and subparagraph
(c) (1) (ii) of the Rights in Technical Data and Computer
Software clause at DFARS sec. 252.227-7013.

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

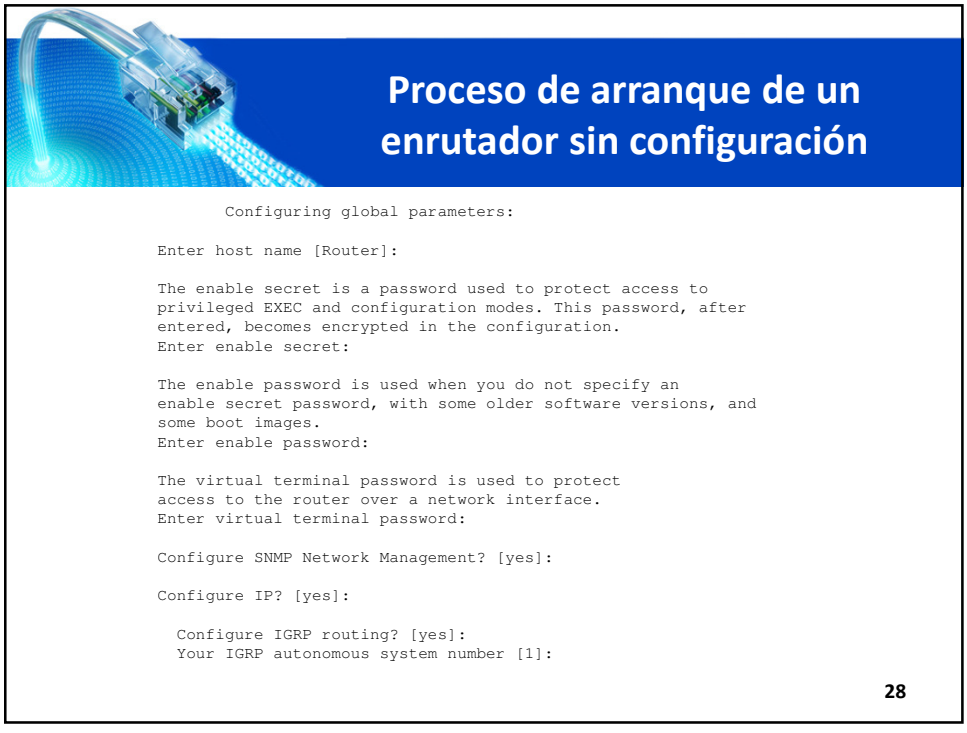

Proceso de arranque

```
Cisco Internetwork Operating System Software
IOS (tm) 1600 Software (C1600-Y-M), Version 11.2(16)P,  RELEASE SOFTWARE
(fc1)
Copyright (c) 1986-1998 by cisco Systems, Inc.
Compiled Tue 20-Oct-98 04:23 by dschwart
Image text-base: 0x02005000, data-base: 0x02329324

cisco 1601 (68360) processor (revision C) with 7680K/512K bytes of memory.
Processor board ID 14720326, with hardware revision 00000001
Bridging software.
X.25 software, Version 2.0, NET2, BFE and GOSIP compliant.
1 Ethernet/IEEE 802.3 interface(s)
2  serial(sync/async) network interface(s)
System/IO memory with parity disabled
8192K bytes of DRAM onboard
System running from RAM
8K bytes of non-volatile configuration memory.
4096K bytes of processor board PCMCIA flash (Read/Write)


Press RETURN to get started!


Router>
```



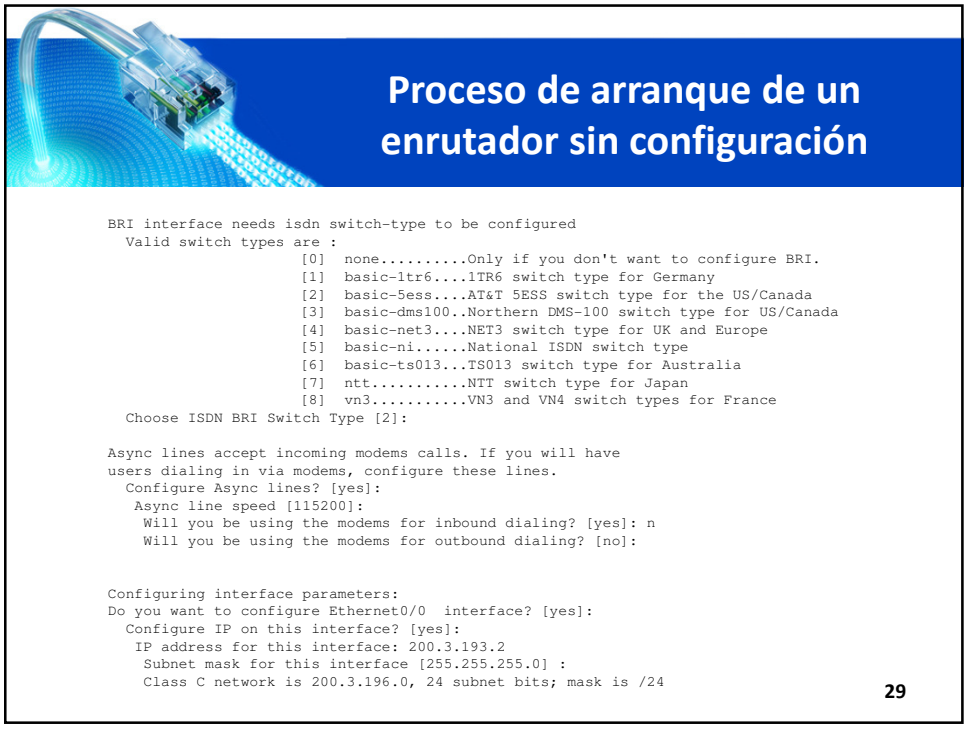
Proceso de arranque de un enrutador sin configuración

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

Continue with configuration dialog? [yes/no]:


At any point you may enter a question mark '?' for help.
Use ctrl-c to abort configuration dialog at any prompt.
Default settings are in square brackets '[]'.


First, would you like to see the current interface summary? [yes]:


Any interface listed with OK? value "NO" does not have a valid configuration

Interface              IP-Address      OK? Method Status                Protocol
Ethernet0/0            unassigned      NO  unset  up                    down
Serial0/0              unassigned      NO  unset  down                  down
BRI0/0                 unassigned      NO  unset  down                  down
BRI0/0:1               unassigned      YES unset  down                  down
BRI0/0:2               unassigned      YES unset  down                  down
Ethernet0/1            unassigned      NO  unset  up                    down
Serial0/1              unassigned      NO  unset  down                  down
```

Proceso de arranque de un enrutador sin configuración

```
        Configuring global parameters:

Enter host name [Router]:

The enable secret is a password used to protect access to
privileged EXEC and configuration modes. This password, after
entered, becomes encrypted in the configuration.
Enter enable secret:

The enable password is used when you do not specify an
enable secret password, with some older software versions, and
some boot images.
Enter enable password:

The virtual terminal password is used to protect
access to the router over a network interface.
Enter virtual terminal password:

Configure SNMP Network Management? [yes]:

Configure IP? [yes]:

  Configure IGRP routing? [yes]:
  Your IGRP autonomous system number [1]:
```



Proceso de arranque de un enrutador sin configuración

```
BRI interface needs isdn switch-type to be configured
  Valid switch types are :
                      [0]  none.....Only if you don't want to configure BRI.
                      [1]  basic-1tr6....1TR6 switch type for Germany
                      [2]  basic-5ess....AT&T 5ESS switch type for the US/Canada
                      [3]  basic-dms100..Northern DMS-100 switch type for US/Canada
                      [4]  basic-net3....NET3 switch type for UK and Europe
                      [5]  basic-ni......National ISDN switch type
                      [6]  basic-ts013...TS013 switch type for Australia
                      [7]  ntt...........NTT switch type for Japan
                      [8]  vn3...........VN3 and VN4 switch types for France
  Choose ISDN BRI Switch Type [2]:

Async lines accept incoming modems calls. If you will have
users dialing in via modems, configure these lines.
  Configure Async lines? [yes]:
   Async line speed [115200]:
    Will you be using the modems for inbound dialing? [yes]: n
    Will you be using the modems for outbound dialing? [no]:


Configuring interface parameters:
Do you want to configure Ethernet0/0  interface? [yes]:
  Configure IP on this interface? [yes]:
   IP address for this interface: 200.3.193.2
    Subnet mask for this interface [255.255.255.0] :
    Class C network is 200.3.196.0, 24 subnet bits; mask is /24
```

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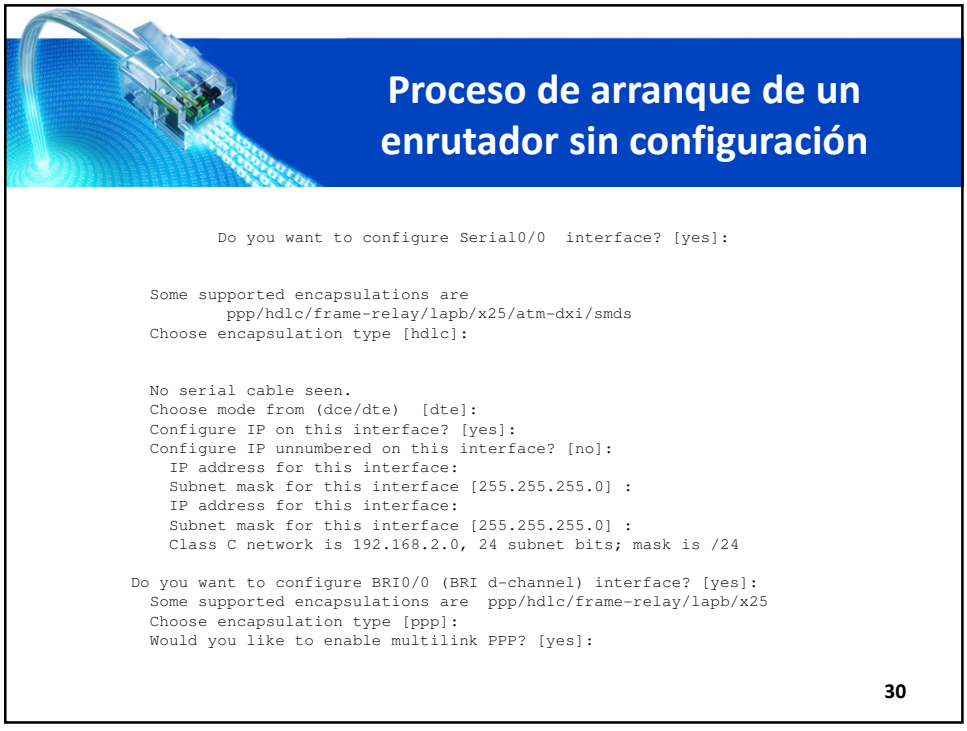
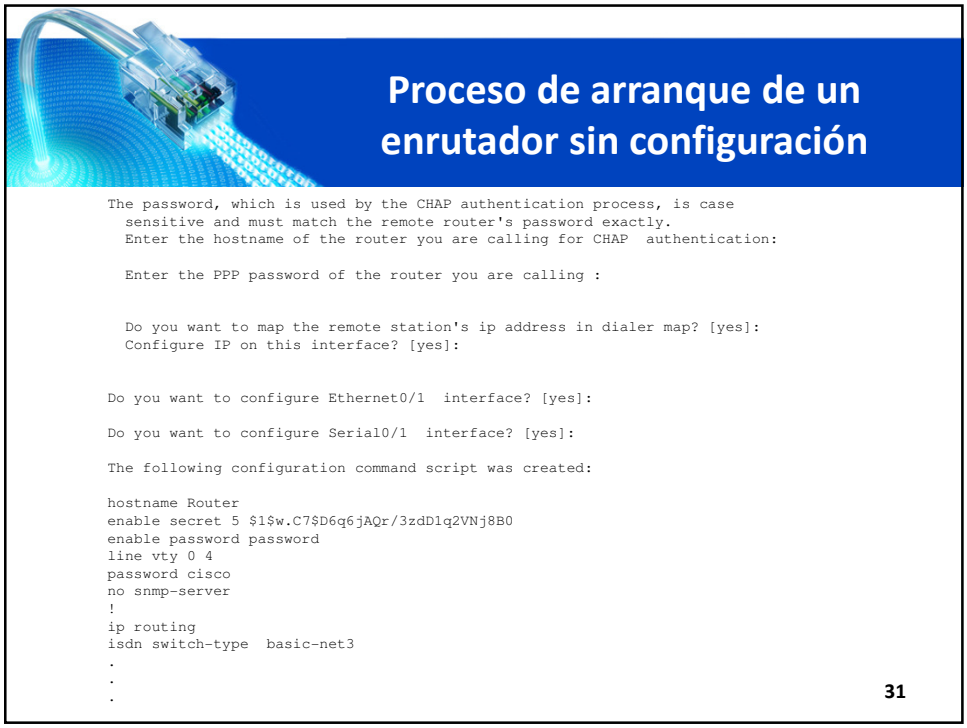
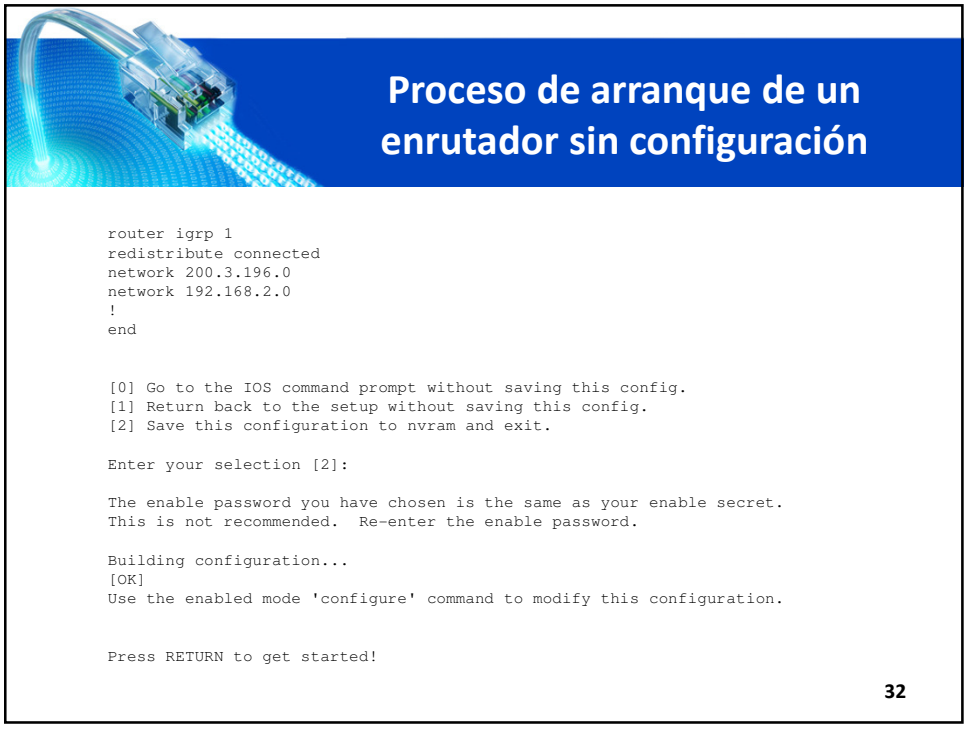


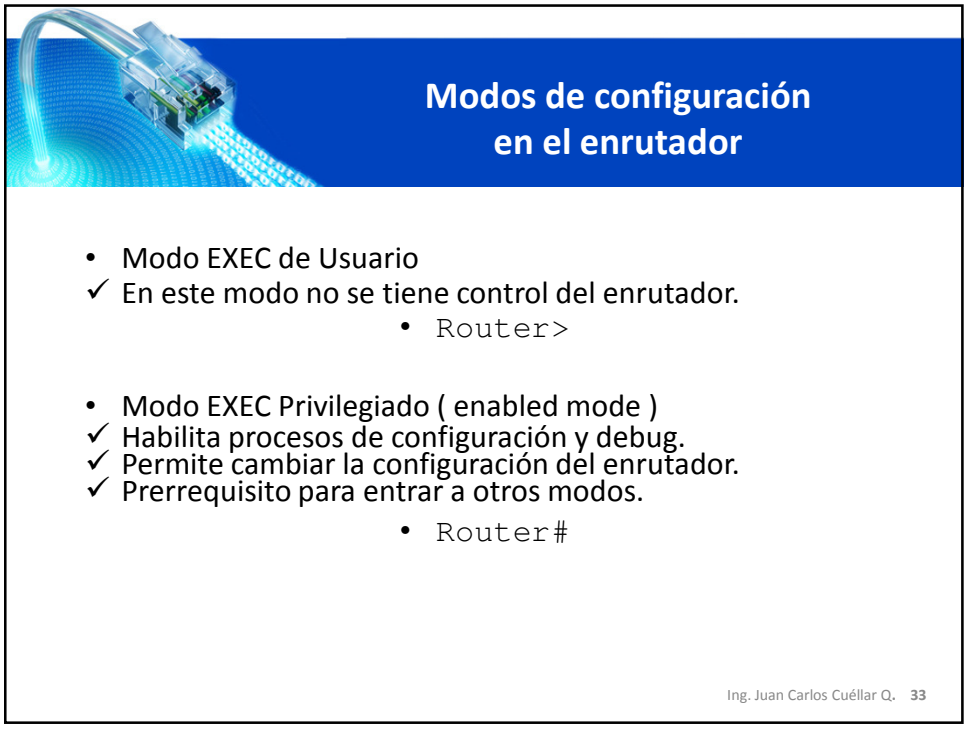
Proceso de arranque de un enrutador sin configuración

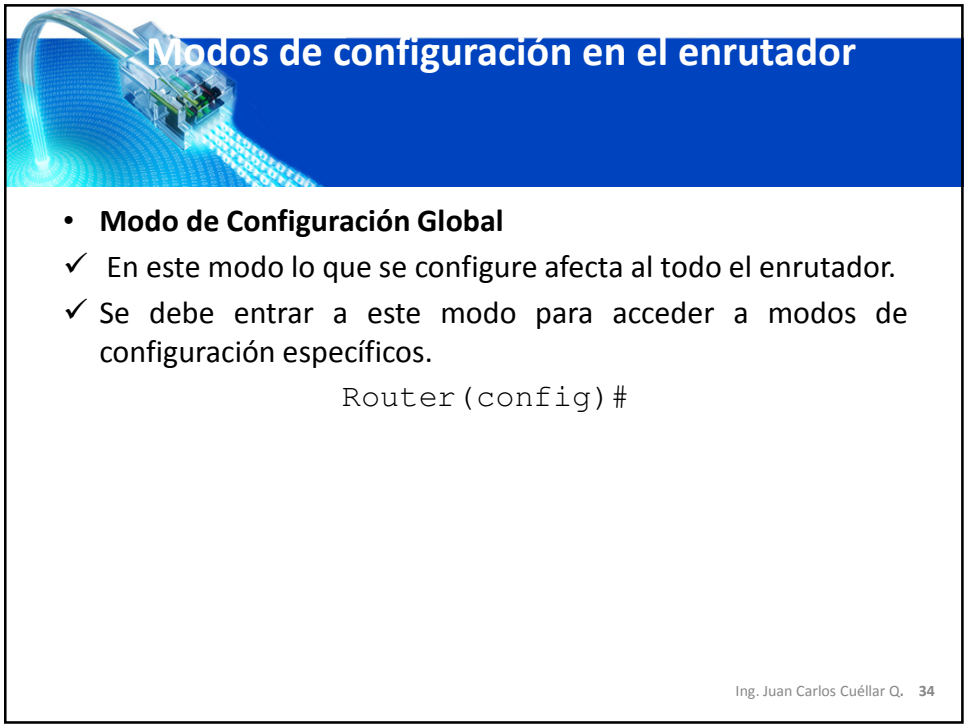
```
          Do you want to configure Serial0/0  interface? [yes]:


    Some supported encapsulations are
           ppp/hdlc/frame-relay/lapb/x25/atm-dxi/smds
    Choose encapsulation type [hdlc]:


    No serial cable seen.
    Choose mode from (dce/dte)  [dte]:
    Configure IP on this interface? [yes]:
    Configure IP unnumbered on this interface? [no]:
      IP address for this interface:
      Subnet mask for this interface [255.255.255.0] :
      IP address for this interface:
      Subnet mask for this interface [255.255.255.0] :
      Class C network is 192.168.2.0, 24 subnet bits; mask is /24

  Do you want to configure BRI0/0 (BRI d-channel) interface? [yes]:
    Some supported encapsulations are  ppp/hdlc/frame-relay/lapb/x25
    Choose encapsulation type [ppp]:
    Would you like to enable multilink PPP? [yes]:
```

30


Proceso de arranque de un enrutador sin configuración
The password, which is used by the CHAP authentication process, is case
sensitive and must match the remote router's password exactly.
Enter the hostname of the router you are calling for CHAP authentication:
Enter the PPP password of the router you are calling :
Do you want to map the remote station's ip address in dialer map? [yes]:
Configure IP on this interface? [yes]:
Do you want to configure Ethernet0/1 interface? [yes]:
Do you want to configure Serial0/1 interface? [yes]:
The following configuration command script was created:
hostname Router
enable secret 5 1w.C7$D6q6jAQr/3zdD1q2VNj8B0
enable password password
line vty 0 4
password cisco
no snmp-server
!
ip routing
isdn switch-type basic-net3
.
.
.
31


Proceso de arranque de un enrutador sin configuración
router igrp 1
redistribute connected
network 200.3.196.0
network 192.168.2.0
!
end
[0] Go to the IOS command prompt without saving this config.
[1] Return back to the setup without saving this config.
[2] Save this configuration to nvram and exit.
Enter your selection [2]:
The enable password you have chosen is the same as your enable secret.
This is not recommended. Re-enter the enable password.
Building configuration...
[OK]
Use the enabled mode 'configure' command to modify this configuration.
Press RETURN to get started!
32


Modos de configuración
en el enrutador
• Modo EXEC de Usuario
✓ En este modo no se tiene control del enrutador.
• Router>
• Modo EXEC Privilegiado (enabled mode)
✓ Habilita procesos de configuración y debug.
✓ Permite cambiar la configuración del enrutador.
✓ Prerrequisito para entrar a otros modos.
• Router#
Ing. Juan Carlos Cuéllar Q. 33


Modos de configuración en el enrutador
• Modo de Configuración Global
✓ En este modo lo que se configure afecta al todo el enrutador.
✓ Se debe entrar a este modo para acceder a modos de configuración específicos.
Router(config)#
Ing. Juan Carlos Cuéllar Q. 34

Modos de configuración en el enrutador...

```
Router con0 is now available
Press RETURN to get started.

Router>
Router>enable
Router#
Router#config terminal
Router(config)#exit
Router#
```


Modos de configuración en el enrutador...

Modo Usuario ---> **Router>enable**

Modo Privilegiado ---> **Router# config term**

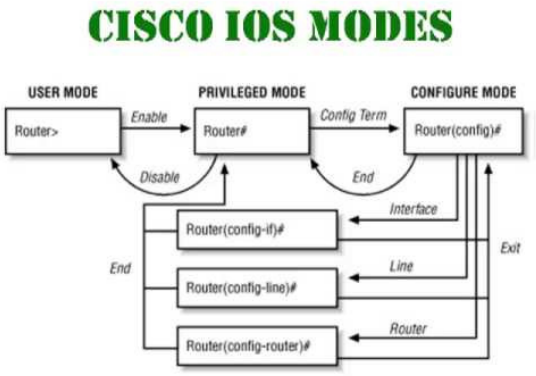
Modo de Configuración Global ---> **Router(config)#**

Ctrl-Z (end)

Exit

Modo de Config.	Prompt
Interface	**Router(config-if)#**
Subinterface	**Router(config-subif)#**
Line	**Router(config-line)#**
Router	**Router(config-router)#**

Modos de Configuración



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Línea de Comandos
Edición y ayuda en línea

- ✓ **Ayuda en Línea**

  El sistema operativo entrega una lista de comandos que se pueden ejecutar por modo, como también los argumentos asociados con cada comando.

- ✓ **Mensajes de Error**

  En la línea de comandos se puede identificar problemas de sintaxis al ejecutar algún comando.

- ✓ **Buffer comandos recién ejecutados**

  Permite ejecutar, editar o reorganizar los últimos comandos ejecutados.

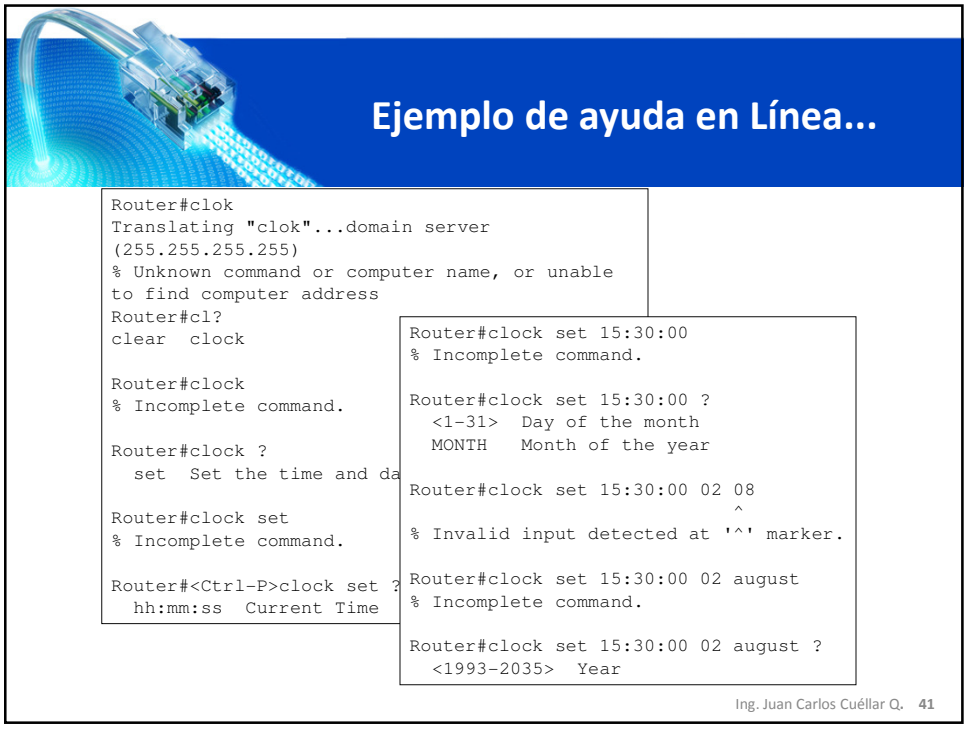
Comando de ayuda en línea

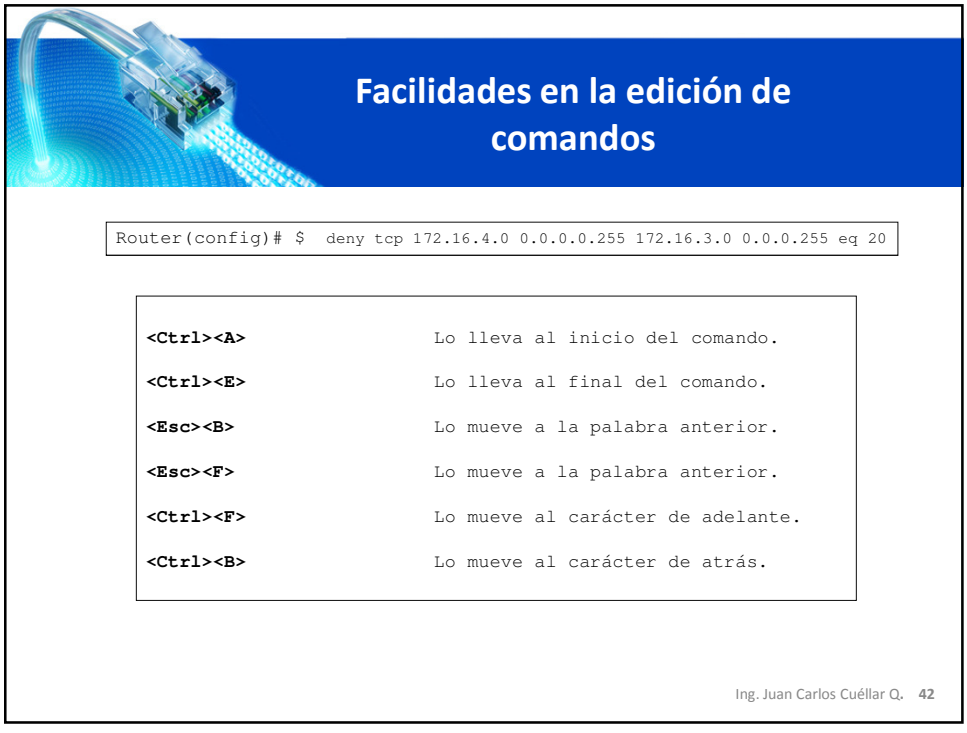
```
Router#?
Exec commands:
  access-enable     Create a temporary Access-List entry
  access-template   Create a temporary Access-List entry
  bfe               For manual emergency modes setting
  clear             Reset functions
  clock             Manage the system clock
  configure         Enter configuration mode
  connect           Open a terminal connection
  copy              Copy configuration or image data
  debug             Debugging functions (see also 'undebug')
  disable           Turn off privileged commands
  disconnect        Disconnect an existing network connection
  enable            Turn on privileged commands
  erase             Erase flash or configuration memory
  exit              Exit from the EXEC
  help              Description of the interactive help system
  lock              Lock the terminal
  login             Log in as a particular user
  logout            Exit from the EXEC
  name-connection   Name an existing network connection
  no                Disable debugging functions
  pad               Open a X.29 PAD connection
 --More--
```

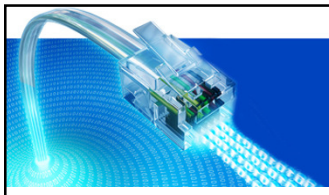

Ejemplo de ayuda en Línea

```
Router#clok
Translating "clok"...domain server (255.255.255.255)
% Unknown command or computer name, or unable to find computer address
Router#cl?
clear  clock

Router#clock
% Incomplete command.

Router#clock ?
  set  Set the time and date

Router#clock set
% Incomplete command.

Router#<Ctrl-P>clock set ?
  hh:mm:ss  Current Time
```

- **Traslación de nombre a IP**
- **Solicitud de ayuda**
- **Recuperando el último comando digitado.**

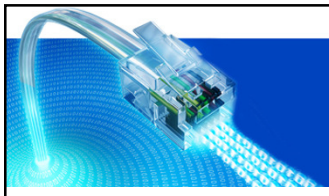

Ejemplo de ayuda en Línea...
Router#clok
Translating "clok"...domain server
(255.255.255.255)
% Unknown command or computer name, or unable
to find computer address
Router#cl?
clear clock
Router#clock
% Incomplete command.
Router#clock ?
set Set the time and da
Router#clock set
% Incomplete command.
Router#<Ctrl-P>clock set ?
hh:mm:ss Current Time
Router#clock set 15:30:00
% Incomplete command.
Router#clock set 15:30:00 ?
<1-31> Day of the month
MONTH Month of the year
Router#clock set 15:30:00 02 08
^
% Invalid input detected at '^' marker.
Router#clock set 15:30:00 02 august
% Incomplete command.
Router#clock set 15:30:00 02 august ?
<1993-2035> Year
Ing. Juan Carlos Cuéllar Q. 41


Facilidades en la edición de comandos
Router(config)# $ deny tcp 172.16.4.0 0.0.0.0.255 172.16.3.0 0.0.0.255 eq 20
<Ctrl><A> Lo lleva al inicio del comando.
<Ctrl><E> Lo lleva al final del comando.
<Esc><B> Lo mueve a la palabra anterior.
<Esc><F> Lo mueve a la palabra anterior.
<Ctrl><F> Lo mueve al carácter de adelante.
<Ctrl><B> Lo mueve al carácter de atrás.
Ing. Juan Carlos Cuéllar Q. 42



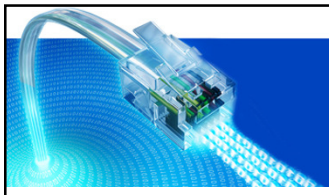
Revisando los comando ejecutados...

<Tab>	Completa el comando
<Ctrl><P> or Up arrow	Llama el ultimo comando ejecutado
<Ctrl><N> or Down arrow	Se mueve al siguiente comando ejecutado
Router> **show history**	Muestra los comandos ejecutados
Router# **terminal history number-of-lines**	Configura la cantidad de comandos a almacenar en el buffer de comandos
Router# **no terminal editing**	Deshabilita las funciones de edición de comandos
Router# **terminal editing**	Habilita las funciones de edición de comandos



Comando *show version*

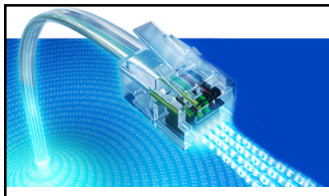
```
Router#show version
Cisco Internetwork Operating System Software
IOS (tm) 1600 Software (C1600-Y-M), Version 11.2(16)P,  RELEASE SOFTWARE (fc1)
Copyright (c) 1986-1998 by cisco Systems, Inc.
Compiled Tue 20-Oct-98 04:23 by dschwart
Image text-base: 0x02005000, data-base: 0x02329324

ROM: System Bootstrap, Version 12.0(3)T, RELEASE SOFTWARE (fc1)
ROM: 1600 Software (C1600-RBOOT-R), Version 12.0(3)T,  RELEASE SOFTWARE (fc1)

Router uptime is 31 minutes
System restarted by power-on
System image file is "c1600-y-mz.112-16.p", booted via flash

cisco 1601 (68360) processor (revision C) with 7680K/512K bytes of memory.
Processor board ID 14720326, with hardware revision 00000001
Bridging software.
X.25 software, Version 2.0, NET2, BFE and GOSIP compliant.
1 Ethernet/IEEE 802.3 interface(s)
2  serial(sync/async) network interface(s)
System/IO memory with parity disabled
8192K bytes of DRAM onboard
System running from RAM
8K bytes of non-volatile configuration memory.
4096K bytes of processor board PCMCIA flash (Read/Write)

Configuration register is 0x2102

Router#
```



Configuración Básica

Para empezar el proceso de configuración de un enrutador se deben realizar siempre los siguientes pasos:

- ✓ Configurar la interfaz LAN del enrutador
- ✓ Configurar el password para pasar a modo privilegiado.
- ✓ Configurar el password de las terminales virtuales (vty´s).



Configurando la interfaz LAN

```
Router(config)#interface type number
Router(config-if)#
```

```
Router(config)#interface type slot/port
Router(config-if)#
```

```
Router(config)# interface ethernet 2
Router(config-if)# media-type 10baset
```

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

Configurando la interfaz LAN (Ethernet) ...

Se debe entrar a modo de configuración global

```
Router#config term
Router(config)#
```

Elegir la interfaz a configurar

```
Router(config)#interface ethernet 0
Router(config-if)#
```

Asignar dirección IP y descripción

```
Router(config-if)#ip address 200.3.192.249 255.255.255.0
Router(config-if)#description Laboratory Interface
Router(config-if)#
```

Habilitar la interfaz ("subirla")

```
Router(config-if)#no shutdown
Router(config-if)#
Router(config-if)#exit
Router(config)#
```


Configurando passwords...

Password para pasar a modo privilegiado

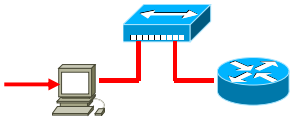
```
Router(config)#enable password password
```

Secret Password

```
Router(config)#enable secret password
```

Virtual Terminal Password

```
Router(config)#line vty 0 4
Router(config-line)#login
Router(config-line)#password password
```



Console Password

```
Router(config)#line console 0
Router(config-line)#login
Router(config-line)#password password
```

Comandos útiles para la consola...

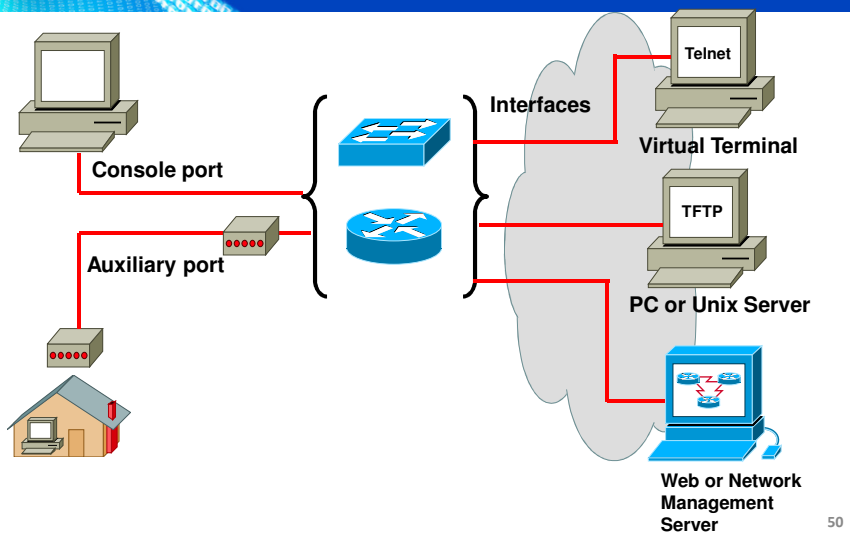
```
Router(config)#line console 0
Router(config-line)#exec-timeout 0 0
```

Configura el time-out para la consola

```
Router(config)#line console 0
Router(config-line)#logging synchronous
```

Permite que los mensajes de consola no interrumpan la digitación de comandos.

Configuración del enrutador



Configurando el nombre del Router

Nombre del enrutador

```
Router_prueba>enable
Router_prueba#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router_prueba(config)#hostaname Router
Router(config)#
```

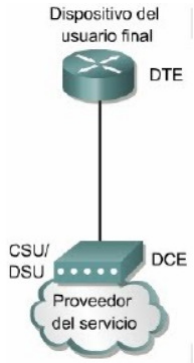
Mensaje de Bienvenida

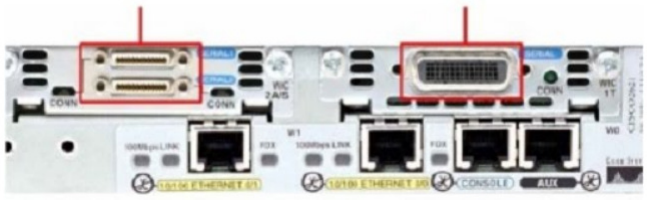
```
Router(config)#banner motd #
Enter TEXT message.  End with the character '#'.
Bienvenido al Router
Laboratorio de Redes #
Router(config)#
```


Puertos Seriales en un enrutador

Conector SMART serial

Conector DB-60





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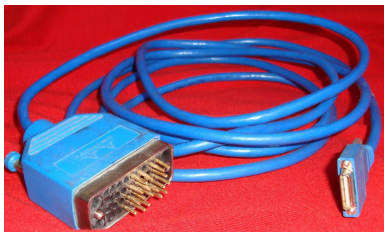
Puerto Serial DB-60

Cable DTE con conector V.35 macho

Cable DCE con conector V.35 hembra

53

Puerto Smart Serial



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Cables seriales Cisco

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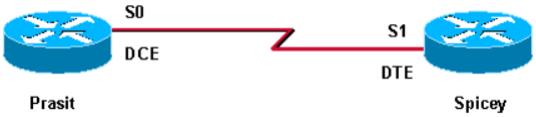
Concexión Back-to-Back



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Configurando una interfaz serial

Se debe iniciar el proceso desde configuración global

```
Router#config term
Router(config)#
```

Elegir la interfaz

```
Router(config)#interface serial 0
Router(config-if)#
```

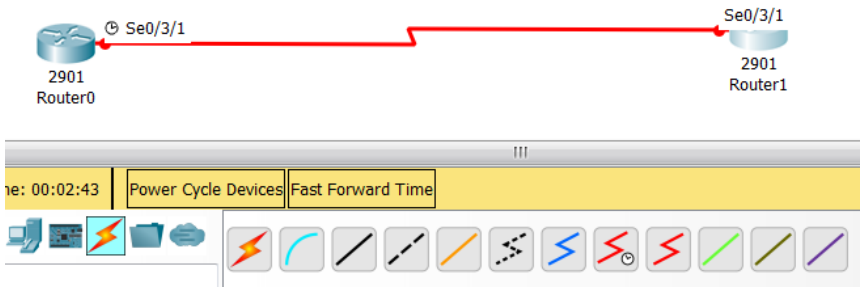
Configurar el clock rate solo en interfaces con cables DCE

```
Router(config-if)#clock rate 64000
Router(config-if)#
```

Configurar el Bandwith

```
Router(config-if)#bandwith 64
Router(config-if)#
Router(config-if)#exit
Router(config)#
```


Conexión serial en el Packet Tracer



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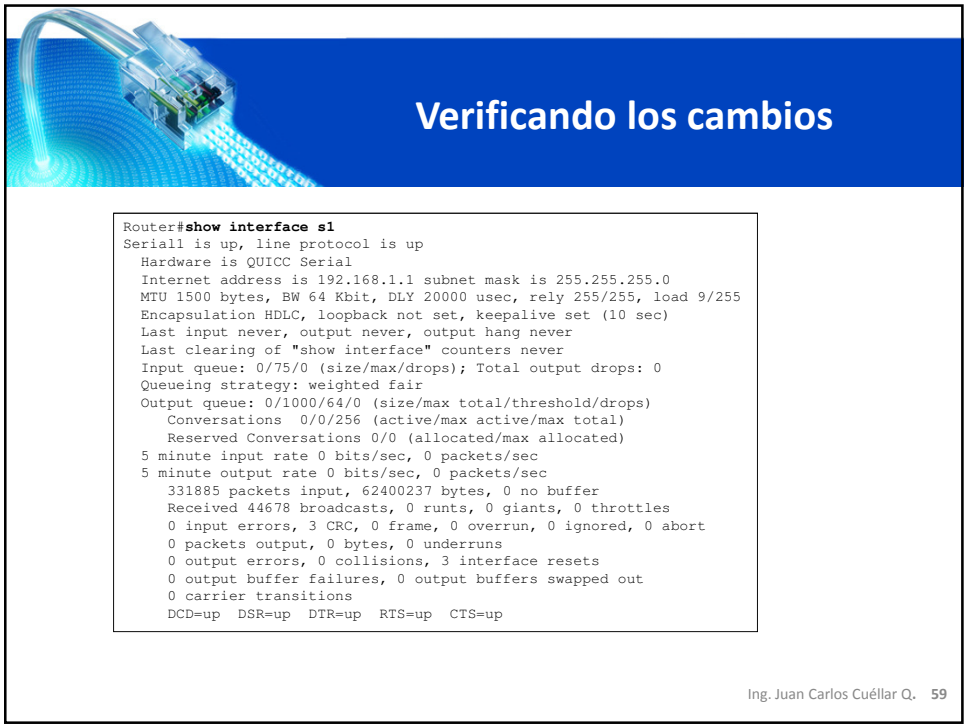
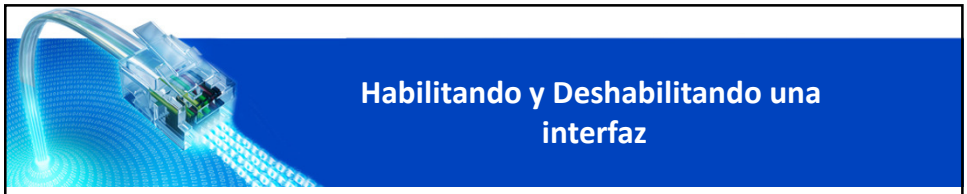


Verificando los cambios

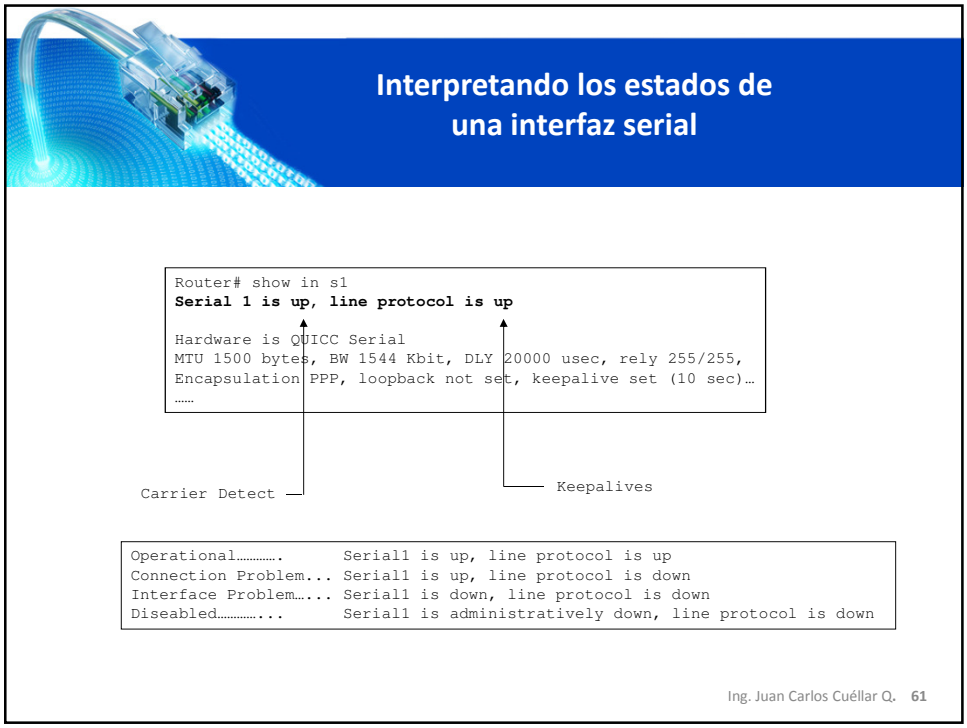
```
Router#show interface s1
Serial1 is up, line protocol is up
  Hardware is QUICC Serial
  Internet address is 192.168.1.1 subnet mask is 255.255.255.0
  MTU 1500 bytes, BW 64 Kbit, DLY 20000 usec, rely 255/255, load 9/255
  Encapsulation HDLC, loopback not set, keepalive set (10 sec)
  Last input never, output never, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0 (size/max/drops); Total output drops: 0
  Queueing strategy: weighted fair
  Output queue: 0/1000/64/0 (size/max total/threshold/drops)
     Conversations  0/0/256 (active/max active/max total)
     Reserved Conversations 0/0 (allocated/max allocated)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     331885 packets input, 62400237 bytes, 0 no buffer
     Received 44678 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 3 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     0 packets output, 0 bytes, 0 underruns
     0 output errors, 0 collisions, 3 interface resets
     0 output buffer failures, 0 output buffers swapped out
     0 carrier transitions
     DCD=up  DSR=up  DTR=up  RTS=up  CTS=up
```

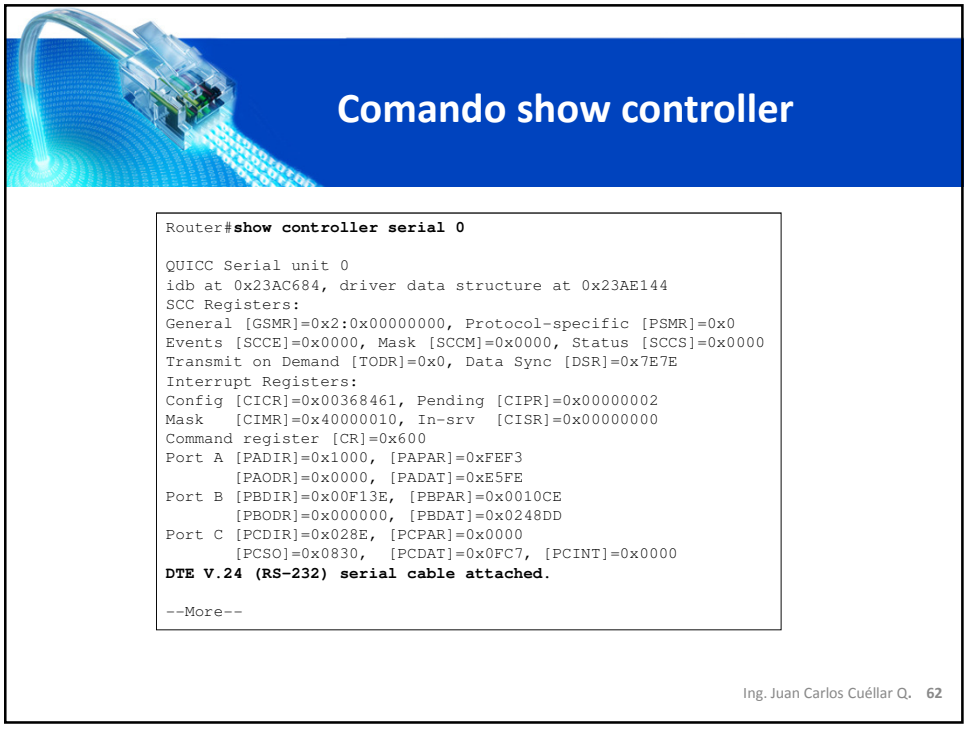



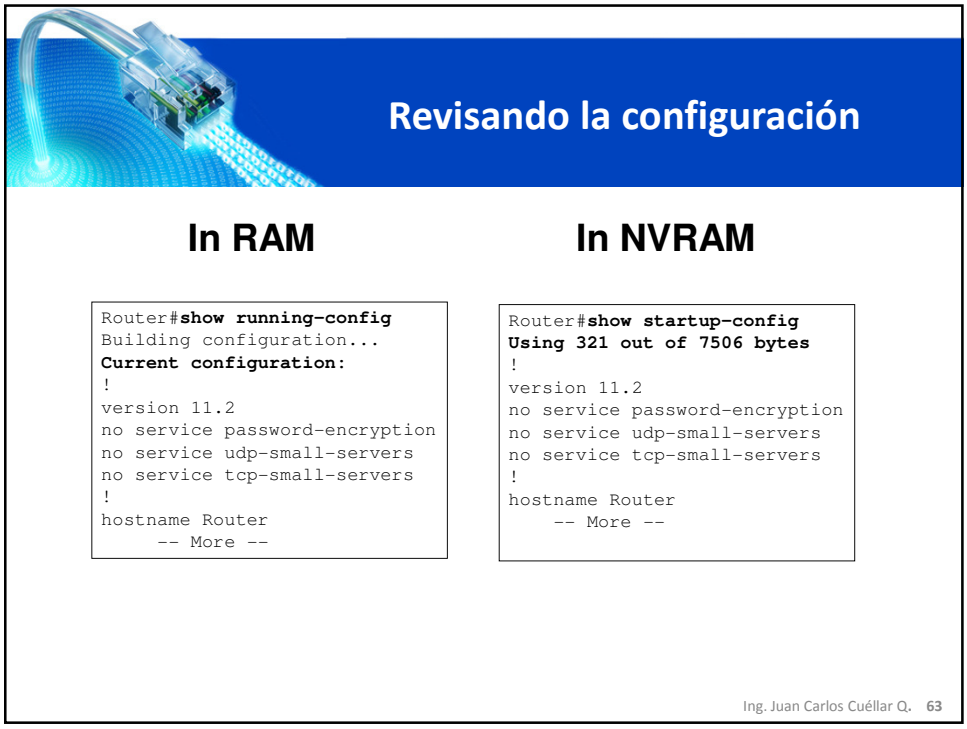
Habilitando y Deshabilitando una interfaz

```
Router#config term
Router(config)#
Router(config)#interface serial 0
Router(config-if)#shutdown
%LINK-5-CHANGED: Interface Serial0, changed state to administratively down
%LINKPROTO-5-UPDOWN: line protocol on Interface Serial0, changed state to  down
```

```
Router#config term
Router(config)#
Router(config)#interface serial 0
Router(config-if)#no shutdown
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0, changed state to up
%LINK-3-UPDOWN: Interface Serial0, changed state to up
```


Interpretando los estados de una interfaz serial
Router# show in s1
Serial 1 is up, line protocol is up
Hardware is QUICC Serial
MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255,
Encapsulation PPP, loopback not set, keepalive set (10 sec)…
……
Carrier Detect
Keepalives
Operational……. Serial1 is up, line protocol is up
Connection Problem... Serial1 is up, line protocol is down
Interface Problem…... Serial1 is down, line protocol is down
Diseabled……... Serial1 is administratively down, line protocol is down
Ing. Juan Carlos Cuéllar Q. 61


Comando show controller
Router#show controller serial 0
QUICC Serial unit 0
idb at 0x23AC684, driver data structure at 0x23AE144
SCC Registers:
General [GSMR]=0x2:0x00000000, Protocol-specific [PSMR]=0x0
Events [SCCE]=0x0000, Mask [SCCM]=0x0000, Status [SCCS]=0x0000
Transmit on Demand [TODR]=0x0, Data Sync [DSR]=0x7E7E
Interrupt Registers:
Config [CICR]=0x00368461, Pending [CIPR]=0x00000002
Mask [CIMR]=0x40000010, In-srv [CISR]=0x00000000
Command register [CR]=0x600
Port A [PADIR]=0x1000, [PAPAR]=0xFEF3
[PAODR]=0x0000, [PADAT]=0xE5FE
Port B [PBDIR]=0x00F13E, [PBPAR]=0x0010CE
[PBODR]=0x000000, [PBDAT]=0x0248DD
Port C [PCDIR]=0x028E, [PCPAR]=0x0000
[PCSO]=0x0830, [PCDAT]=0x0FC7, [PCINT]=0x0000
DTE V.24 (RS-232) serial cable attached.
--More--
Ing. Juan Carlos Cuéllar Q. 62


Revisando la configuración
In RAM
In NVRAM
Router#show running-config
Building configuration...
Current configuration:
!
version 11.2
no service password-encryption
no service udp-small-servers
no service tcp-small-servers
!
hostname Router
-- More --
Router#show startup-config
Using 321 out of 7506 bytes
!
version 11.2
no service password-encryption
no service udp-small-servers
no service tcp-small-servers
!
hostname Router
-- More --
Ing. Juan Carlos Cuéllar Q. 63


Salvando la configuración
Router#copy running-config startup-config
Destination filename [starup-config]?
Building configuration...
[OK]
Router# copy run start
Ing. Juan Carlos Cuéllar Q. 64

Ejemplo

- Concepto de puerta de enlace/ Default Gateway.
- Análisis Switch L2 intervlan-router.

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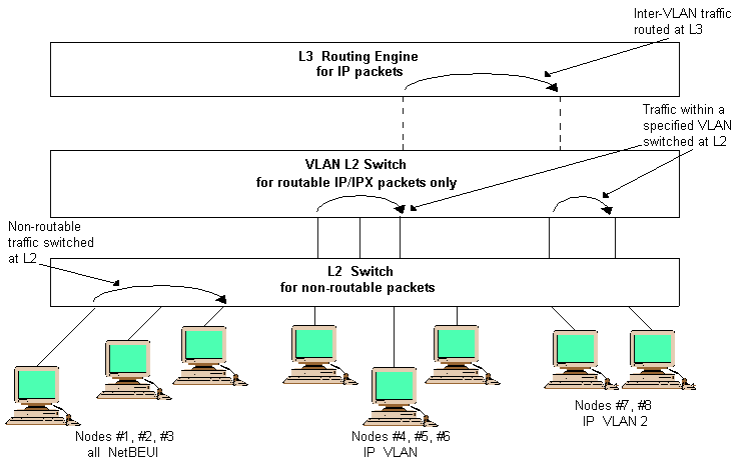
Switch de Nivel 3



Ejemplo

Mentimeter.com

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Diferencias entre un enrutador y un switch de nivel 3

- Los switches no poseen interfaces WAN.
- No soportan algunas características de QoS.
- El reenvío de paquetes en los switches se realiza mediante ASIC (Applicarion Specific Integrated Circuits).
- No soportan NAT.

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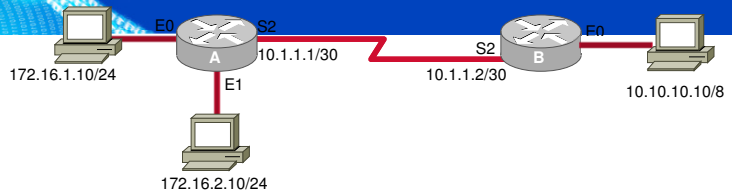
Tabla de Enrutamiento




```
RouterA#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 -  OSP external type 1, E2 - OSPF external type 2, E-EGP
        i - IS-IS, LI - IS-IS  level-1, L2 - IS-IS level-2, * candidate default
        U- per-user static route, 0 - ODR
        T- traffic engineered route

Gateway of last resort is not set
        172.16.0.0/24 is subnetted,  1 subnets
C         172.16.1.0 is directly connected, Ethernet0
C         172.16.2.0 is directly connected, Ethernet1
C       10.1.1.0 is directly connected, Serial2
```

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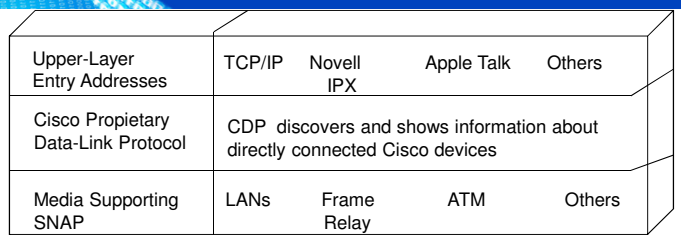
Cisco Discovery Protocol



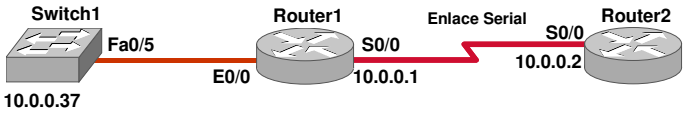
Protocolo propietario Cisco que permite obtener información de los dispositivos Cisco directamente conectados.

Cisco Discovery Protocol...

- La información que se obtiene con el protocolo es la siguiente:

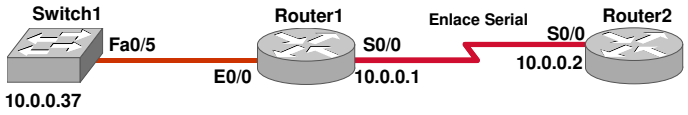
- Nombre del dispositivo
- Dirección IP de su interfaz LAN o WAN
- Plataforma
- Tipo de dispositivo
- Puertos de conexión

Cisco Discovery Protocol...



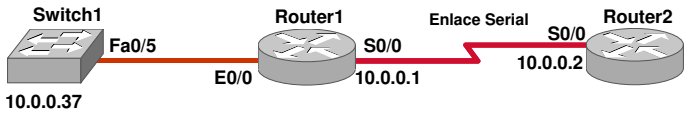

```
Router1#show cdp ?
  entry       Information for specific neighbor entry
  interface   CDP interface status and configuration
  neighbors   CDP neighbor entries
  traffic     CDP statistics
  <cr>

Router1(config)#no cdp run
Router1(config)#interface serial0
Router1(config-if)#no cdp enable
```


Cisco Discovery Protocol...



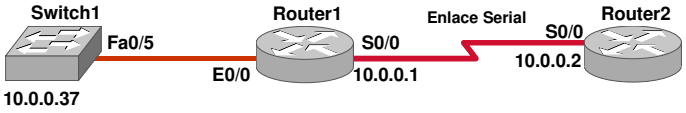

```
Router1#show cdp neighbors
Capability Codes: R - Router, T - Trans Bridge, B - Source Route Bridge
                  S - Switch, H - Host, I - IGMP, r - Repeater
Device ID        Local Intrfce     Holdtme    Capability  Platform   Port ID
Switch1             Eth 0/0         154           T S       WS-C2912-X Fas0/5
Router2             Ser 0/0         128             R       2611       Ser 0/0
```

Cisco Discovery Protocol...



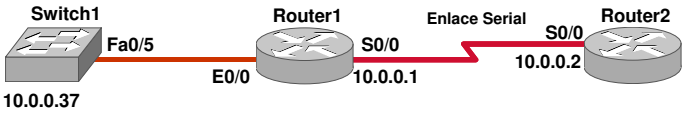

```
Router1#show cdp neighbors  detail
-------------------------
Device ID: Switch1
Entry address(es):
  IP address: 10.0.0.37
Platform: cisco WS-C2912-XL,  Capabilities: Trans-Bridge Switch
Interface: Ethernet0/0,  Port ID (outgoing port): FastEthernet0/5
Holdtime : 145 sec

Version :
Cisco Internetwork Operating System Software
IOS (tm) C2900XL Software (C2900XL-H2S-M), Version 12.0(5.1)XP, MAINTENANCE INTERIM SOFTWARE
Copyright (c) 1986-1999 by cisco Systems, Inc.
Compiled Fri 10-Dec-99 10:57 by cchang
```


Cisco Discovery Protocol...



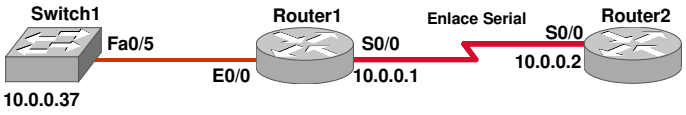

```
---------------------------
Device ID: Router2
Entry address(es):
  IP address: 10.0.0.2
Platform: cisco 2611,  Capabilities: Router
Interface: Serial0/0,  Port ID (outgoing port): Serial0/0
Holdtime : 179 sec

Version :
Cisco Internetwork Operating System Software
IOS (tm) C2600 Software (C2600-I-M), Version 11.3(2)XA1, PLATFORM SPECIFIC RELEASE SOFTWARE (fc2)
TAC:Home:SW:IOS:Specials for info
Copyright (c) 1986-1998 by cisco Systems, Inc.
Compiled Fri 03-Apr-98 07:00 by rnapier
```

Cisco Discovery Protocol...




```
RouterA#sh cdp traffic
CDP counters  :
          Packets output:  56, Input: 38
          Hdr syntax: 0, Chksum error:  0, Encaps failed:  3
          No memory: 0, Invalid packet:  0, Fragmented: 0

RouterA#sh  cdp  interface
S0/1   is administratively down, line protocol is down
          Encapsulation HDLC
          Sending CDP packets every 60 seconds
          Holdtime is 180 seconds
```

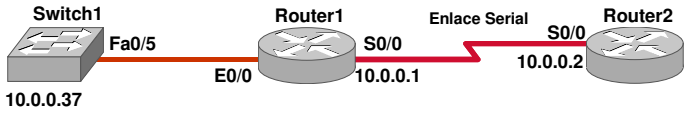

Conexiones vía Telnet




```
Router1#telnet 10.0.0.37
Trying 10.0.0.37 ... Open
Bienvenido al Switch1
User Access Verification
Password:
Switch1>en
Password:
Switch1#exit
[Connection to 10.0.0.37 closed by foreign host]
Router1#
```

```
Router1#telnet 10.0.0.2
Trying 10.0.0.2 ... Open
Bienvenido al Router2
User Access Verification
Password:
Router2>en
Password:
Router2#exit
[Connection to 10.0.0.2 closed by foreign host]
Router1#
```

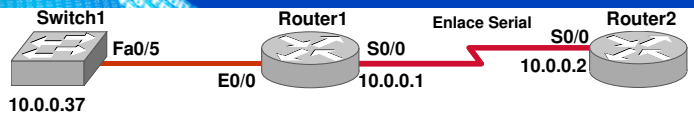
Suspendiendo una conexión telnet




```
Router1#telnet 10.0.0.37
Trying 10.0.0.37 ... Open

Bienvenido al Switch1

User Access Verification

Password:
Switch1>en
Password:
Switch1#<Ctrl><Shift><6> x
Router1#
```

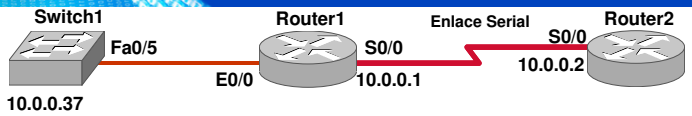
```
Router1#telnet 10.0.0.2
Trying 10.0.0.2 ... Open

Bienvenido al Router2

User Access Verification

Password:
Router2>en
Password:
Router2# #<Ctrl><Shift><6> x
Router1#
```


Revisando las conexiones abiertas…




```
Router1#show sessions
Conn Host               Address            Byte  Idle Conn Name
   1 10.0.0.37          10.0.0.37             0     0 10.0.0.37
*  2 10.0.0.2           10.0.0.2              0     0 10.0.0.2

Router1#<Enter>+<Enter>
[Resuming connection 2 to 10.0.0.2 ... ]

Router2#<Ctrl><Shift><6> x

Router1#1<Enter>+<Enter>

[Resuming connection 1 to 10.0.0.37 ... ]

Switch1#<Ctrl><Shift><6> x

Router1#sh sessions
Conn Host               Address            Byte  Idle Conn Name
*  1 10.0.0.37          10.0.0.37             0     0 10.0.0.37
   2 10.0.0.2           10.0.0.2              0     0 10.0.0.2
```

Cerrando una sesión telnet




```
Router1#show sessions
Conn Host                Address             Byte  Idle Conn Name
*  1 10.0.0.37           10.0.0.37              0     0 10.0.0.37
   2 10.0.0.2            10.0.0.2               0     0 10.0.0.2

Router1#disconnect 2
Closing connection to 10.0.0.2 [confirm]
Router1#sh sessions
Conn Host                Address             Byte  Idle Conn Name
*  1 10.0.0.37           10.0.0.37              0     0 10.0.0.37

Router1#disconnect
Closing connection to 10.0.0.37 [confirm]
Router1#sh sessions
% No connections open
Router1#
```


Comando *ip host name*

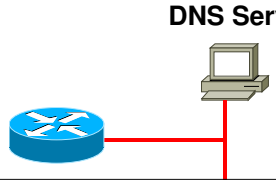
```
Router(config)#ip host name [alias] address [IP address]
```

- Define un alias para mapear una dirección IP.

```
Router(config)#ip host Central 200.3.192.249
Router(config)#ip host Ciencias 200.3.192.250
```

Se pueden asignar alias a equipos o interfaces.

Configuración de un name server




```
Router(config)#ip name-server server-address1
[[ server-address2]... [ server-address6]
```

Permite especificar uno o varios servidores DNS.

Solo pueden especificarse un máximo de 6 servidores.

Sistema de nombres en el enrutador

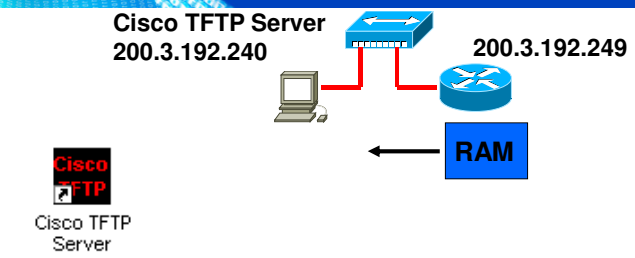
```
Router(config)# ip domain-lookup
Router(config)#end
Router#pat
Translating "pat"…domain server (255.255.255.255)
%Unknown command or computer name, or unable to find computer
address

Router#config t
Router(config)#no ip domain-lookup
Router(config)#end
Router#pat
%Unknown command or computer name, or unable to find computer
address
Router#
```

Viene activo por defecto.

Revisando la lista de ip hosts

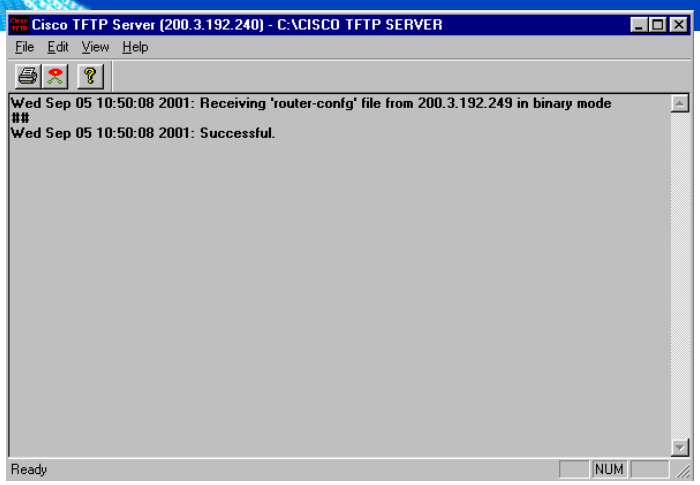
```
Router#show hosts
Default domain is not set
Name/address lookup uses domain service
Name servers are 255.255.255.255

Host                      Flags       Age Type    Address(es)
Central                   (perm, OK)  0   IP      200.3.192.249
Ciencias                  (perm, OK)  0   IP      200.3.192.250
Router#
```


Utilizando TFTP Server

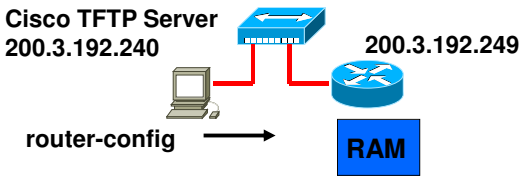



```
Router#copy running-config tftp
Remote host []? 200.3.192.240
Name of configuration file to write [router-confg]?
Write file router-confg on host 200.3.192.240? [confirm]
Building configuration...

Writing router-confg !! [OK]
Router#
```

Utilizando TFTP Server...

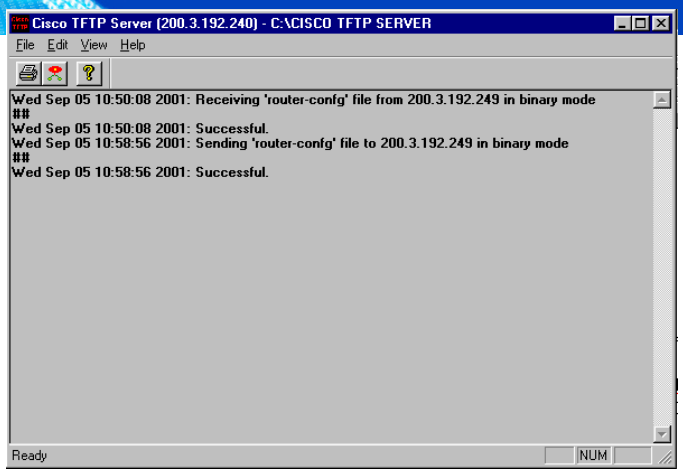


Utilizando TFTP Server...

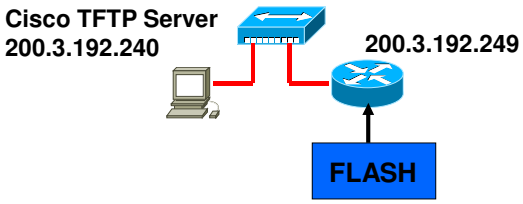



```
Router#copy tftp running-config
Host or network configuration file [host]?
Address of remote host [255.255.255.255]? 200.3.192.240
Name of configuration file [router-confg]?
Configure using router-confg from 200.3.192.240? [confirm]
Loading router-confg from 200.3.192.240 (via Ethernet0): !
[OK - 607/7467 bytes]

Router#
```

Utilizando TFTP Server..

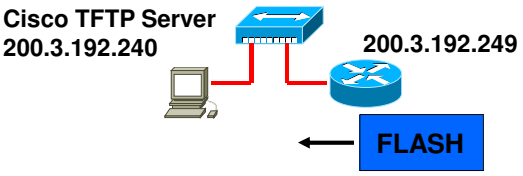


Haciendo Backup del IOS



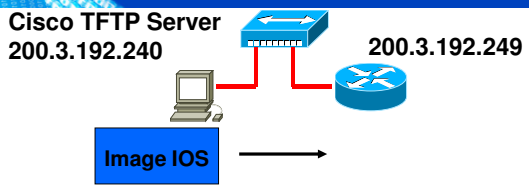

```
Router#show flash

System file directory:
File Length Name/status
  1  10084696 c1600-y-mz.112-16.p

[10084760 bytes used, 6692456 available, 16777216  total]
16384k bytes of processor board System flash (Read ONLY)
```

Haciendo Backup del IOS

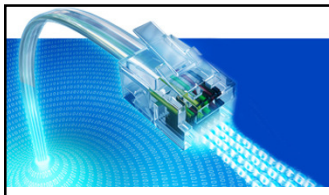



```
Router#copy flash tftp
Source filename []? c1600-y-mz.112-16.p
Address or name of remote host [255.255.255.255]? 200.3.192.240
Destination filename [c1600-y-mz.112-16.p]?
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
<output omitted>
10084696 bytes copied in 709.228 secs ( 14223 bytes/sec)
Router#
```


Haciendo Backup del IOS




```
Router#copy tftp flash
Address or name of remote host [200.3.192.240]?
Source filename []? c1600-y-mz.112-16.p
Destination filename [c1600-y-mz.112-16.p]?
Accessing tftp://200.3.192.240/ c1600-y-mz.112-16.p...
Erase flash:before copying? [confirm]
Erasing the flash filesystem will remove all files! Continue? [confirm]
Erasing device ....eeee(output omitted) ...erased
Erase of flash: complete
Loading c1600-y-mz.112-16.p from 200.3.193.240 (via Ethernet0):
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
<output omitted>
[OK - 10084696/20168704 bytes ]
Verifying checksum...OK (0x9AA0)
10084696 bytes copied in 309.108 secs ( 32636 bytes/sec)
Router#
```



Temas para revisar en la próxima clase

- Ventajas y desventajas de utilizar enrutamiento estático en su red.
- Como se configura enrutamiento estático en enrutadores Cisco.

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