

# Prácticas de laboratorio de Redes de Ordenadores

## Práctica 4 Solución: Routers RIP-OSPF

Written by

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## ***Práctica 4: Routers***

### 3. GUIÓN DE LA PRACTICA

#### 3.1 Configuración IOS

##### 3.1.1 Toma de contacto con el IOS

- ✓ Incluir un diagrama de modos por los que pasa un router.

Inicialmente el router arranca y se configura, después notifica una tabla de encaminamiento a los nodos conectados directamente, tras recibir notificaciones idénticas de los otros nodos conectados a él, actualiza su tabla y la notifica a los demás. Finalmente llega a un estado estable con tabla de encaminamiento invariable.

- ✓ Probar los comandos básicos que se encuentran en el apéndice e incluir en la memoria el resultado de la ejecución de cada uno de ellos.

```
Router#terminal history size 20
```

```
No se obtienen resultados porque no hay historial
```

```
Router#?
```

```
ROUTER2#?
```

```
Exec commands:
```

access-enable	Create a temporary Access-List entry
access-profile	Apply user-profile to interface
access-template	Create a temporary Access-List entry
archive	manage archive files
bfe	For manual emergency modes setting
cd	Change current directory
clear	Reset functions
clock	Manage the system clock
cns	CNS subsystem
configure	Enter configuration mode
connect	Open a terminal connection
copy	Copy from one file to another
debug	Debugging functions (see also
'undebug')	
delete	Delete a file
dir	List files on a filesystem
disable	Turn off privileged commands
disconnect	Disconnect an existing network
connection	
enable	Turn on privileged commands

erase	Erase a filesystem
exit	Exit from the EXEC
help	Description of the interactive help
system	
isdn	Run an ISDN EXEC command on a BRI
interface	
lock	Lock the terminal
login	Log in as a particular user
logout	Exit from the EXEC
modemui	Start a modem-like user interface
monitor	Monitoring different system events
more	Display the contents of a file
mrinfo	Request neighbor and version
information from a multicast	
router	
mrm	IP Multicast Routing Monitor Test
mstat	Show statistics after multiple
multicast traceroutes	
mtrace	Trace reverse multicast path from
destination to source	
name-connection	Name an existing network connection
no	Disable debugging functions
pad	Open a X.29 PAD connection
ping	Send echo messages
ppp	Start IETF Point-to-Point Protocol
(PPP)	
pwd	Display current working directory
reload	Halt and perform a cold restart
rename	Rename a file
restart	Restart Connection
resume	Resume an active network connection
rlogin	Open an rlogin connection
rsh	Execute a remote command
send	Send a message to other tty lines
setup	Run the SETUP command facility
show	Show running system information
slip	Start Serial-line IP (SLIP)
squeeze	Squeeze a filesystem
start-chat	Start a chat-script on a line
systat	Display information about terminal
lines	
telnet	Open a telnet connection
terminal	Set terminal line parameters
test	Test subsystems, memory, and
interfaces	
traceroute	Trace route to destination
tunnel	Open a tunnel connection
udptn	Open an udptn connection
undebug	Disable debugging functions (see also
'debug')	
verify	Verify a file

where	List active connections
write	Write running configuration to memory, network, or terminal
x28	Become an X.28 PAD
x3	Set X.3 parameters on PAD

```

Router#show ?

ROUTER2#show ?
  aaa                Show AAA values
  access-expression  List access expression
  access-lists       List access lists
  accounting          Accounting data for active
sessions
  adjacency           Adjacent nodes
  aliases             Display alias commands
  arp                 ARP table
  async              Information on terminal lines used
as router interfaces
  backup             Backup status
  bgp                BGP information
  bridge             Bridge Forwarding/Filtering
Database [verbose]
  buffers            Buffer pool statistics
  c1700              Show c1700 information
  caller             Display information about dialup
connections
  cca                CCA information
  cdapi              CDAPI information
  cdp                CDP information
  cef                Cisco Express Forwarding
  class-map          Show QoS Class Map
  clock              Display the system clock
  cns                CNS subsystem
  compress           Show compression statistics
  configuration       Contents of Non-Volatile memory
  connection         Show Connection
  context            Show context information
  controllers        Interface controller status
  cops               COPS information
  crm                Carrier Resource Manager info
  debugging           State of each debugging option
  derived-config      Derived operating configuration
  dhcp              Dynamic Host Configuration
Protocol status
  diag               Show diagnostic information for
port adapters/modules
  dialer             Dialer parameters and statistics
  dnsix              Shows Dnsix/DMDP information

```

dxl	atm-dxl information
entry	Queued terminal entries
exception	exception informations
file	Show filesystem information
flash:	display information about flash:
file system	
frame-relay	Frame-Relay information
history	Display the session command
history	
hosts	IP domain-name, lookup style,
nameservers, and host	table
html	HTML helper commands
idb	List of Hardware Interface
Descriptor Blocks	
interfaces	Interface status and configuration
ip	IP information
ipv6	IPv6 information
key	Key information
line	TTY line information
llc2	IBM LLC2 circuit information
location	Display the system location
logging	Show the contents of logging
buffers	
memory	Memory statistics
modemcap	Show Modem Capabilities database
ntp	Network time protocol
parser	Display parser information
policy-map	Show QoS Policy Map
ppp	PPP parameters and statistics
pppoe	PPPoE information
privilege	Show current privilege level
processes	Active process statistics
protocols	Active network routing protocols
qdm	Show information about QoS Device
Manager	
queue	Show queue contents
queueing	Show queueing configuration
radius	Shows radius information
random-detect-group	display random-detect group
registry	Function registry information
reload	Scheduled reload information
rhosts	Remote-host+user equivalences
rif	RIF cache entries
rmon	rmon statistics
route-map	route-map information
rtr	Service Assurance Agent (SAA)
running-config	Current operating configuration
sessions	Information about Telnet
connections	
smpls	SMDS information

smf	Software MAC filter
snapshot	Snapshot parameters and statistics
snmp	snmp statistics
sntp	Simple network time protocol
spanning-tree	Spanning tree topology
sss	SSS Information
stacks	Process stack utilization
standby	Hot Standby Router Protocol (HSRP)
information	
startup-config	Contents of startup configuration
subscriber-policy	Subscriber policy
subsys	Show subsystem information
tacacs	Shows tacacs+ server statistics
tcp	Status of TCP connections
tech-support	Show system information for Tech-
Support	
template	Template information
terminal	Display terminal configuration
parameters	
time-range	Time range
track	Tracking information
traffic-shape	traffic rate shaping configuration
trunk	Trunk info
users	Display information about terminal
lines	
version	System hardware and software
status	
vlans	Virtual LANs Information
vpdn	VPDN information
vrrp	VRRP information
vtemplate	Virtual Template interface
information	
whoami	Info on current tty line
x25	X.25 information
x29	X.29 information

```
Router#hostname
```

```
ROUTER2#hostname
```

```
Translating "hostname"...domain server (255.255.255.255)
```

```
Translating "hostname"...domain server (255.255.255.255)
(255.255.255.255)
```

```
Translating "hostname"...domain server (255.255.255.255)
```

```
% Unknown command or computer name, or unable to find
computer address
```

- ✓ Ejecutar el comando `show running-config` y analizar e inferir el significado de cada una de las líneas obtenidas como resultado.

```
Router#show running-config

ROUTER2#show running-config
Building configuration...

Current configuration : 756 bytes
!
version 12.2
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname ROUTER2
!
enable secret 5 $1$6HVO$1pja.5YopEYJNwIL1NO/h.
enable password cisco
!
ip subnet-zero
no ip routing
!
!
!
!
!
!
!
interface Ethernet0
 ip address 172.0.0.1 255.255.0.0
 no ip route-cache
 shutdown
 half-duplex
!
interface FastEthernet0
 ip address 172.10.0.1 255.255.0.0
 no ip route-cache
 speed auto
!
interface Serial0
 ip address 172.40.0.2 255.255.0.0
 no ip route-cache
 clockrate 9600
!
ip classless
ip route profile
no ip http server
no ip pim bidir-enable
!
```



```
!  
dialer-list 1 protocol ip permit  
dialer-list 1 protocol ipx permit  
!  
!  
line con 0  
line aux 0  
line vty 0 4  
    password cisco  
    login  
!  
no scheduler allocate  
end
```

### 3.1.2 Configuración de las interfaces ethernet y serie

- ✓ Configurar las interfaces Ethernet y Serie de cada uno de los routers con la direcciones IP y máscaras indicadas en la Figura 1. Incluir en la memoria, la información sobre el estado de configuración de cada router después de las modificaciones (Comando *show running-config*).

```
Router#show running-config  
  
Router1#show running-config  
Building configuration...  
  
Current configuration : 616 bytes  
!  
version 12.2  
service timestamps debug uptime  
service timestamps log uptime  
no service password-encryption  
!  
hostname Router1  
!  
enable secret 5 $1$XSwM$mDLAF16dAWgFAar9YBBcc.  
enable password teLec0m  
!  
ip subnet-zero  
!  
!  
!  
!  
!  
!  
!  
interface Ethernet0
```

```
ip address 172.44.0.2 255.255.0.0
half-duplex
!
interface FastEthernet0
ip address 172.14.0.1 255.255.0.0
speed auto
!
interface Serial0
no ip address
shutdown
no fair-queue
clockrate 9600
invert txclock
!
ip classless
no ip http server
ip pim bidir-enable
!
!
!
!
line con 0
line aux 0
line vty 0 4
password cocoverde
login
!
no scheduler allocate
end
```

```
ROUTER2#show running-config
Building configuration...
```

```
Current configuration : 756 bytes
```

```
!
version 12.2
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname ROUTER2
!
enable secret 5 $1$6HVO$1pja.5YopEYJNwIL1NO/h.
enable password cisco
!
```

```
ip subnet-zero
no ip routing
!
!
!
!
!
!
interface Ethernet0
 ip address 172.0.0.1 255.255.0.0
 no ip route-cache
 shutdown
 half-duplex
!
interface FastEthernet0
 ip address 172.14.0.2 255.255.0.0
 no ip route-cache
 speed auto
!
interface Serial0
 ip address 172.34.0.1 255.255.0.0
 no ip route-cache
 clockrate 9600
!
ip classless
ip route profile
no ip http server
no ip pim bidir-enable
!
!
dialer-list 1 protocol ip permit
dialer-list 1 protocol ipx permit
!
!
line con 0
line aux 0
line vty 0 4
 password cisco
 login
!
no scheduler allocate
end
```

```
Router3#show running-config
Building configuration...
```

```
Current configuration : 664 bytes
!
version 12.2
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname Router3
!
enable secret 5 $1$e7QL$0Byz6slaEOpC65EUwzSPW/
enable password cisco
!
ip subnet-zero
!
!
!
!
!
!
interface Ethernet0
 ip address 172.44.0.1 255.255.0.0
 half-duplex
!
interface FastEthernet0
 no ip address
 shutdown
 speed auto
!
interface Serial0
 ip address 172.34.0.2 255.255.0.0
 no fair-queue
 invert txclock
!
ip classless
no ip http server
no ip pim bidir-enable
!
!
dialer-list 1 protocol ip permit
dialer-list 1 protocol ipx permit
!
!
line con 0
line aux 0
line vty 0 4
 password cisco
 login
!
```

```
no scheduler allocate
end
```

### 3.1.3 Configuración de RIP

- ✓ Comprobar la tabla de encaminamiento del Router 3 (*“show ip route”*) con los otros apagados.

```
Router3#show ip route

Router3>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
```

- ✓ Activar RIP V.1 en cada router, incluir en la memoria la tabla de encaminamiento del Router 3 explicando las rutas añadidas por RIP.

```
Router3#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
```

```

R    172.14.0.0/16 [120/1] via 172.44.0.2, 00:00:15,
Ethernet0
                                [120/1] via 172.34.0.1, 00:00:08,
Serial0
C    172.34.0.0/16 is directly connected, Serial0
C    172.44.0.0/16 is directly connected, Ethernet0

```

## 3.2 Protocolo RIP

### 3.2.1 Operación de RIP

- ✓ Identificar todos los routers de los cuales capturamos mensajes RIP e incluir un mensaje de cada uno de ellos.

```

Router1:
Frame      Time          Src MAC Addr      Dst MAC Addr
Protocol   Description
Src Other Addr      Dst Other Addr      Type Other Addr
10          242.548000      0009E84D0581      *BROADCAST
RIP        Response, 2 Entries (ver. 1)
172.14.0.1          255.255.255.255

+ Frame: Base frame properties
+ ETHERNET: ETYPE = 0x0800 : Protocol = IP: DOD Internet Protocol
+ IP: ID = 0x0; Proto = UDP; Len: 72
+ UDP: IP Multicast: Src Port: RIP, (520); Dst Port: RIP (520); Length = 52 (0x34)
+ RIP: Response, 2 Entries (ver. 1)

00000:  FF FF FF FF FF FF 00 09 E8 4D 08 0D 08 00 45 C0
ÿÿÿÿÿÿ..èM....EÀ
00010:  00 48 00 00 00 00 02 11 0B D9 AC 0C 00 01 FF FF
.H.....Û~...ÿÿ
00020:  FF FF 02 08 02 08 00 34 F5 15 02 01 00 00 00 02
ÿÿ.....4ö.....
00030:  00 00 AC 20 00 00 00 00 00 00 00 00 00 00 00 00
..~ .....
00040:  00 02 00 02 00 00 AC 2A 00 00 00 00 00 00 00 00
.....~*.....

Router2:
Frame      Time          Src MAC Addr      Dst MAC Addr
Protocol   Description
Src Other Addr      Dst Other Addr      Type Other Addr
12          276.558000      0009E84D0581      *BROADCAST
RIP        Response, 2 Entries (ver. 1)

```

```

172.14.0.2          255.255.255.255

+ Frame: Base frame properties
+ ETHERNET: ETYPE = 0x0800 : Protocol = IP: DOD Internet
Protocol
+ IP: ID = 0x0; Proto = UDP; Len: 72
+ UDP: IP Multicast: Src Port: RIP, (520); Dst Port: RIP
(520); Length = 52 (0x34)
+ RIP: Response, 2 Entries (ver. 1)

00000:  FF FF FF FF FF FF 00 09 E8 4D 05 25 08 00 45 C0
ÿÿÿÿÿÿ..èM.%..EÀ
00010:  00 48 00 00 00 00 02 11 0B D8 AC 0C 00 02 FF FF
.H.....Ø~...ÿÿ
00020:  FF FF 02 08 02 08 00 34 F5 14 02 01 00 00 00 02
ÿÿ.....4ö.....
00030:  00 00 AC 20 00 00 00 00 00 00 00 00 00 00 00 00
..~.....
00040:  00 01 00 02 00 00 AC 2A 00 00 00 00 00 00 00 00
.....~*.....

```

- ✓ Completar el esquema de la práctica indicando toda la información que puedas averiguar acerca de las redes a las que están conectados los routers (router 1, ...), sus interfaces, métrica etc.

Red Router 1-2-PC: 172.14.0.0 /16, el router 1 tiene interfaz Fastethernet0 172.14.0.2, el router 2 Fastethernet 0 con IP 172.14.0.1 y el PC se conecta mediante un hub, todos los equipos están unidos al hub. Métrica 1.

Red Router 2-3: 172.44.0.0 /16, router 2 interfaz Ethernet0 172.14.0.2, router 3 interfaz Ethernet0 172.14.0.1. Métrica 1.

Red Router 1-3: 172.34.0.0/16, router 1 interfaz serial0 172.34.0.1, router 3 interfaz serial0 172.34.0.2, Métrica 1

### 3.2.2 Operación de Split Horizon

- ✓ ¿Son iguales los mensajes RIP enviados? Explicar las diferencias.

No, al activar el split horizon en uno de los routers, se envían mayor número de datagramas debido a que el router 2 tiene desactivado el split horizon e informa a los routers 1 y 3 de las redes a las que sabe llegar a través de ellos, mientras que el que tiene activado el split horizon no informa hacia atrás.

- ✓ ¿Se mantiene invariable la tabla de encaminamiento de la estación en ambos casos?

Si, en la tabla de encaminamiento no se producen cambios, ya que el split horizon es un sistema para evitar errores de generación de bucles en caso de cambio de la topología de la red, en este caso no se producen cambios, así que el hecho de activar el split horizon no afecta.

✓ ¿Crees que el Router 1 tiene activado Split Horizon? ¿Por qué?

Si tiene activado el split horizon, esto se puede deducir, debido a que en los datagramas que envía el router 1 al 2 no le informa que sabe llegar a la red 172.44.0.0, ya que a esa red llega a través del router 2, tal y como se ha visto en teoría, no informa a un router de la ruta que sabe llegar a través de dicho router.

### 3.2.3 Operación de RIP v2

✓ Indicar los campos nuevos que aparecen en los mensajes RIP V2 respecto de los anteriores.

RIP: Routing Domain = 0 (0x0)

---

RIP: Route Tag = 0 (0x0)

---

RIP: Subnet Mask = 0.0.0.0

---

RIP: Next Hop = 0.0.0.0

---

✓ ¿Cuál es la dirección de destino de los mensajes RIP V2?

IP: Destination Address = 224.0.0.9

---

## 3.3 Configuración IOS

### 3.3.1 Configuración de OSPF

✓ Ejecutar el comando `show ip-route` en el Router 2 con los demás apagados.

```
C 172.14.0.0/16 is directly connected, FastEthernet0
C 172.44.0.0/16 is directly connected, Ethernet0
```



- ✓ Tabla de encaminamiento del Router 3 teniendo activado OSPF en cada router con métrica 1 en cada interface.

```
O IA 172.14.0.0/16 [110/2] via 172.34.0.1, 00:00:04, Serial0
O IA 172.24.0.0/16 [110/2] via 172.34.0.1, 00:00:04, Serial0
C 172.34.0.0/16 is directly connected, Serial0
C 172.44.0.0/16 is directly connected, Ethernet0
```

### 3.3.2 Operación de OSPF

- ✓ Comprobar mediante qué protocolos de capas inferiores es transferido OSPF y a qué direcciones IP se envían los mensajes OSPF

Emplea el protocolo IP. Los mensajes se envían de 172.14.0.2, 172.14.0.1 y 172.24.0.1 a 224.0.0.5

- ✓ Estudiar cronológicamente la secuencia de mensajes en la red 172.14.0.0

94.872000 OSPF Message = Hello 172.14.0.1 → 224.0.0.5

```
+ Frame: Base frame properties
+ ETHERNET: ETYPE = 0x0800 : Protocol = IP: DOD Internet Protocol
+ IP: ID = 0x1; Proto = OSPF IGP; Len: 64
+ OSPF: Message = Hello
```

95.875000 OSPF Message = Hello 172.14.0.2 → 224.0.0.5

```
+ Frame: Base frame properties
+ ETHERNET: ETYPE = 0x0800 : Protocol = IP: DOD Internet Protocol
+ IP: ID = 0xD; Proto = OSPF IGP; Len: 64
+ OSPF: Message = Hello
```

104.874000 OSPF Message = Hello 172.14.0.1 → 224.0.0.5

```
+ Frame: Base frame properties
+ ETHERNET: ETYPE = 0x0800 : Protocol = IP: DOD Internet Protocol
+ IP: ID = 0x2; Proto = OSPF IGP; Len: 68
+ OSPF: Message = Hello
```

105.876000 OSPF Message = Hello 172.14.0.2 → 224.0.0.5

---

- + Frame: Base frame properties
- + ETHERNET: ETYPE = 0x0800 : Protocol = IP: DOD Internet Protocol
- + IP: ID = 0x14; Proto = OSPF IGP; Len: 68
- + OSPF: Message = Hello

114.876000 OSPF      Message = Hello                      172.14.0.1    →  
224.0.0.5

- + Frame: Base frame properties
- + ETHERNET: ETYPE = 0x0800 : Protocol = IP: DOD Internet Protocol
- + IP: ID = 0x3; Proto = OSPF IGP; Len: 68
- + OSPF: Message = Hello

115.878000 OSPF      Message = Hello                      172.14.0.2    → 224.0.0.5

- + Frame: Base frame properties
- + ETHERNET: ETYPE = 0x0800 : Protocol = IP: DOD Internet Protocol
- + IP: ID = 0x17; Proto = OSPF IGP; Len: 68
- + OSPF: Message = Hello

Los dos primeros mensajes que se envían no tienen neighbor, lo que nos indica que aún no ha detectado la presencia de ningún router vecino, posteriormente si tienen activado este bit y tal y como se puede ver envían un volumen de datos mayor, lo que refleja el hecho de que cada router notifica al otro como su vecino. También se puede observar que el intervalo de envío de los mensajes hello es de 10 segundos.

### 3.3.3 Estudio de los mensajes OSPF

- ✓ Incluir una trama Hello

Frame	Time	Src MAC Addr	Dst MAC Addr	Protocol	Description	Src Oth...	Dst Ot...	T...
16	85.534000	0004DD0CC179	USC IN000005	OSPF	Message = Hello	172.24.0.1	224.0.0.5	IP
19	94.872000	0009E84D0581	USC IN000005	OSPF	Message = Hello	172.14.0.1	224.0.0.5	IP
21	95.534000	0004DD0CC179	USC IN000005	OSPF	Message = Hello	172.24.0.1	224.0.0.5	IP
26	95.875000	0009E84D07F3	USC IN000005	OSPF	Message = Hello	172.14.0.2	224.0.0.5	IP
32	104.87...	0009E84D0581	USC IN000005	OSPF	Message = Hello	172.14.0.1	224.0.0.5	IP
34	105.53...	0004DD0CC179	USC IN000005	OSPF	Message = Hello	172.24.0.1	224.0.0.5	IP
36	105.87...	0009E84D07F3	USC IN000005	OSPF	Message = Hello	172.14.0.2	224.0.0.5	IP
39	114.87...	0009E84D0581	USC IN000005	OSPF	Message = Hello	172.14.0.1	224.0.0.5	IP
41	115.53...	0004DD0CC179	USC IN000005	OSPF	Message = Hello	172.24.0.1	224.0.0.5	IP
43	115.87...	0009E84D07F3	USC IN000005	OSPF	Message = Hello	172.14.0.2	224.0.0.5	IP

```

+IP: ID = 0x14; Proto = OSPF IGP; Len: 68
-OSPF: Message = Hello
  OSPF: Version = 2 (0x2)
  OSPF: OSPF Packet Type = Hello
  OSPF: Packet Length = 48 (0x30)
  OSPF: Source Router ID = 172.34.0.1
  OSPF: Area ID = 0.0.0.1
  OSPF: Checksum = 0xA348
  OSPF: Authentication Type = None
  OSPF: Authentication = 0x0000000000000000
  OSPF: Netmask = 255.255.0.0
  OSPF: Hello Interval = 10 (0xA) seconds
  +OSPF: Hello Options = 2
    OSPF: Router Priority = 1 (0x1)
    OSPF: Dead Interval = 40 (0x28) seconds
    OSPF: Designated Router = 0.0.0.0
    OSPF: Backup Designated Router = 0.0.0.0
    OSPF: Neighbor = 172.44.0.2
  
```

En la trama se observan entre otros datos, el intervalo de mensajes Hello, el tiempo de espera antes de dar por desaparecido a un router, el campo de autenticación, el código de área, el router designado, y el router con el que ha establecido vecindad.

- ✓ Incluir una trama de cada tipo de mensaje OSPF

## DESCRIPCIÓN DE BASE DE DATOS

Frame	Time	Src MAC Addr	Dst MAC Addr	Protocol	Description
318	300.860000	0009E84D07F3	0009E84D0581	OSPF	Message = Database

Src Other Addr	Dst Other Addr	Type Other Addr
172.14.0.2	172.14.0.1	

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Frame: Base frame properties
  Frame: Time of capture = 12/11/02 10:27:40.714
  Frame: Time delta from previous physical frame: 2000
microseconds
  Frame: Frame number: 318
  
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Frame: Total frame length: 146 bytes
Frame: Capture frame length: 146 bytes
Frame: Frame data: Number of data bytes remaining = 146 (0x0092)
ETHERNET: ETYPE = 0x0800 : Protocol = IP: DOD Internet Protocol
ETHERNET: Destination address : 0009E84D0581
    ETHERNET: .....0 = Individual address
    ETHERNET: .....0. = Universally administered address
ETHERNET: Source address : 0009E84D07F3
    ETHERNET: .....0 = No routing information present
    ETHERNET: .....0. = Universally administered address
ETHERNET: Frame Length : 146 (0x0092)
ETHERNET: Ethernet Type : 0x0800 (IP: DOD Internet Protocol)
ETHERNET: Ethernet Data: Number of data bytes remaining = 132
(0x0084)
IP: ID = 0x3E; Proto = OSPF IGP; Len: 132
IP: Version = 4 (0x4)
IP: Header Length = 20 (0x14)
IP: Precedence = Internetwork Control
IP: Type of Service = Normal Service
IP: Total Length = 132 (0x84)
IP: Identification = 62 (0x3E)
IP: Flags Summary = 0 (0x0)
    IP: .....0 = Last fragment in datagram
    IP: .....0. = May fragment datagram if necessary
IP: Fragment Offset = 0 (0x0) bytes
IP: Time to Live = 1 (0x1)
IP: Protocol = Open Shortest Path First IGP
IP: Checksum = 0x6006
IP: Source Address = 172.14.0.2
IP: Destination Address = 172.14.0.1
IP: Data: Number of data bytes remaining = 112 (0x0070)
OSPF: Message = Database Description
OSPF: Version = 2 (0x2)
OSPF: OSPF Packet Type = Database Description
OSPF: Packet Length = 112 (0x70)
OSPF: Source Router ID = 172.34.0.1
OSPF: Area ID = 0.0.0.1
OSPF: Checksum = 0x3F78
OSPF: Authentication Type = None
OSPF: Authentication = 0x0000000000000000
OSPF: Options = 66 (0x42)
    OSPF: .....1. = Processes AS External routes
    OSPF: .....0.. = Does not support MOSPF
    OSPF: ....0... = Does not process Not-So-Stubby-Area
advertisements
    OSPF: ...0.... = Does not process external attributes LSAs
    OSPF: ..0..... = Does not support demand circuit extensions
OSPF: Flag Summary = 2 (0x2)
    OSPF: .....0 = Slave
    OSPF: .....1. = More database descriptions will follow
    OSPF: .....0.. = Not the first Packet of database
descriptions
    OSPF: Database Sequence Number = 6883 (0x1AE3)
    OSPF: Age = 40 (0x28)
    OSPF: Options = 34 (0x22)
    OSPF: .....1. = Processes AS External routes
    OSPF: .....0.. = Does not support MOSPF
    OSPF: ....0... = Does not process Not-So-Stubby-Area
advertisements
    OSPF: ...0.... = Does not process external attributes LSAs
    OSPF: ..1..... = Supports demand circuit extensions
OSPF: Link State Advertisement Type = Router Links

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OSPF: Router ID = 172.34.0.1
OSPF: Router ID = 172.34.0.1
OSPF: Sequence Number = 2147483649 (0x80000001)
OSPF: Link State Checksum = 0x55AF
OSPF: Length = 48 (0x30)
OSPF: Age = 20 (0x14)
OSPF: Options = 34 (0x22)
    OSPF: .....1. = Processes AS External routes
    OSPF: .....0.. = Does not support MOSPF
    OSPF: ....0... = Does not process Not-So-Stubby-Area
advertisements
    OSPF: ...0.... = Does not process external attributes LSAs
    OSPF: ..1..... = Supports demand circuit extensions
OSPF: Link State Advertisement Type = Summary Link (IP Network)
OSPF: Network Address = 172.4.0.0
OSPF: Router ID = 172.34.0.1
OSPF: Sequence Number = 2147483649 (0x80000001)
OSPF: Link State Checksum = 0x9D1E
OSPF: Length = 28 (0x1C)
OSPF: Age = 30 (0x1E)
OSPF: Options = 34 (0x22)
    OSPF: .....1. = Processes AS External routes
    OSPF: .....0.. = Does not support MOSPF
    OSPF: ....0... = Does not process Not-So-Stubby-Area
advertisements
    OSPF: ...0.... = Does not process external attributes LSAs
    OSPF: ..1..... = Supports demand circuit extensions
OSPF: Link State Advertisement Type = Summary Link (IP Network)

OSPF: Network Address = 172.34.0.0
OSPF: Router ID = 172.34.0.1
OSPF: Sequence Number = 2147483649 (0x80000001)
OSPF: Link State Checksum = 0x207F
OSPF: Length = 28 (0x1C)
OSPF: Age = 20 (0x14)
OSPF: Options = 34 (0x22)
    OSPF: .....1. = Processes AS External routes
    OSPF: .....0.. = Does not support MOSPF
    OSPF: ....0... = Does not process Not-So-Stubby-Area
advertisements
    OSPF: ...0.... = Does not process external attributes LSAs
    OSPF: ..1..... = Supports demand circuit extensions
OSPF: Link State Advertisement Type = Summary Link (IP Network)
OSPF: Network Address = 172.44.0.0
OSPF: Router ID = 172.34.0.1
OSPF: Sequence Number = 2147483649 (0x80000001)
OSPF: Link State Checksum = 0xB1E2
OSPF: Length = 28 (0x1C)

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## PETICIÓN DE ESTADO DE ENLACE

Frame	Time	Src MAC Addr	Dst MAC Addr	Protocol	Description
320	300.862000	0009E84D0581	0009E84D07F3	OSPF	Message = Link State
		Src Other Addr	Dst Other Addr	Type Other Addr	
		172.14.0.1	172.14.0.2		

Frame: Base frame properties

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Frame: Time of capture = 12/11/02 10:27:40.716
Frame: Time delta from previous physical frame: 1000
microseconds
Frame: Frame number: 314
Frame: Total frame length: 106 bytes
Frame: Capture frame length: 106 bytes
Frame: Frame data: Number of data bytes remaining = 106 (0x006A)
ETHERNET: ETYPE = 0x0800 : Protocol = IP: DOD Internet Protocol
ETHERNET: Destination address : 0009E84D07F3
ETHERNET: .....0 = Individual address
ETHERNET: .....0. = Universally administered address
ETHERNET: Source address : 0009E84D0581
ETHERNET: .....0 = No routing information present

ETHERNET: .....0. = Universally administered address
ETHERNET: Frame Length : 106 (0x006A)
ETHERNET: Ethernet Type : 0x0800 (IP: DOD Internet Protocol)
ETHERNET: Ethernet Data: Number of data bytes remaining = 92
(0x005C)
IP: ID = 0x3D; Proto = OSPF IGP; Len: 92
IP: Version = 4 (0x4)
IP: Header Length = 20 (0x14)
IP: Precedence = Internetwork Control
IP: Type of Service = Normal Service
IP: Total Length = 92 (0x5C)
IP: Identification = 61 (0x3D)
IP: Flags Summary = 0 (0x0)
IP: .....0 = Last fragment in datagram
IP: .....0. = May fragment datagram if necessary
IP: Fragment Offset = 0 (0x0) bytes
IP: Time to Live = 1 (0x1)
IP: Protocol = Open Shortest Path First IGP
IP: Checksum = 0x602F
IP: Source Address = 172.14.0.1
IP: Destination Address = 172.14.0.2
IP: Data: Number of data bytes remaining = 72 (0x0048)
OSPF: Message = Link State Request
OSPF: Version = 2 (0x2)
OSPF: OSPF Packet Type = Link State Request
OSPF: Packet Length = 72 (0x48)
OSPF: Source Router ID = 172.44.0.2
OSPF: Area ID = 0.0.0.1
OSPF: Checksum = 0xF07D
OSPF: Authentication Type = None
OSPF: Authentication = 0x0000000000000000
OSPF: Link State Type = 0x0000
OSPF: External Network Address = 172.34.0.1
OSPF: Router ID = 172.34.0.1
OSPF: Link State Type = 0x0000
OSPF: External Network Address = 172.44.0.0
OSPF: Router ID = 172.34.0.1
OSPF: Link State Type = 0x0000
OSPF: External Network Address = 172.34.0.0
OSPF: Router ID = 172.34.0.1
OSPF: Link State Type = 0x0000
OSPF: External Network Address = 172.4.0.0
OSPF: Router ID = 172.34.0.1

```

ACTUALIZACIÓN DE ESTADO DE ENLACE

Frame	Time	Src MAC Addr	Dst MAC Addr	Protocol	Description
323	300.864000	0009E84D07F3	0009E84D0581	OSPF	Message = Link State
		Src Other Addr	Dst Other Addr	Type Other Addr	
		172.14.0.2	172.14.0.1		

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Frame: Base frame properties
  Frame: Time of capture = 12/11/02 10:27:40.718
  Frame: Time delta from previous physical frame: 1000
microseconds
  Frame: Frame number: 317
  Frame: Total frame length: 194 bytes
  Frame: Capture frame length: 194 bytes
  Frame: Frame data: Number of data bytes remaining = 194 (0x00C2)
ETHERNET: ETYPE = 0x0800 : Protocol = IP: DOD Internet Protocol
ETHERNET: Destination address : 0009E84D0581
  ETHERNET: .....0 = Individual address
  ETHERNET: .....0. = Universally administered address
ETHERNET: Source address : 0009E84D07F3
  ETHERNET: .....0 = No routing information present
  ETHERNET: .....0. = Universally administered address
ETHERNET: Frame Length : 194 (0x00C2)
ETHERNET: Ethernet Type : 0x0800 (IP: DOD Internet Protocol)
ETHERNET: Ethernet Data: Number of data bytes remaining = 180
(0x00B4)
IP: ID = 0x41; Proto = OSPF IGP; Len: 180
IP: Version = 4 (0x4)
IP: Header Length = 20 (0x14)
IP: Precedence = Internetwork Control
IP: Type of Service = Normal Service
IP: Total Length = 180 (0xB4)
IP: Identification = 65 (0x41)
IP: Flags Summary = 0 (0x0)
  IP: .....0 = Last fragment in datagram
  IP: .....0. = May fragment datagram if necessary
IP: Fragment Offset = 0 (0x0) bytes
IP: Time to Live = 1 (0x1)
IP: Protocol = Open Shortest Path First IGP
IP: Checksum = 0x5FD3
IP: Source Address = 172.14.0.2
IP: Destination Address = 172.14.0.1
IP: Data: Number of data bytes remaining = 160 (0x00A0)
OSPF: Message = Link State Update
OSPF: Version = 2 (0x2)
OSPF: OSPF Packet Type = Link State Update
OSPF: Packet Length = 160 (0xA0)
OSPF: Source Router ID = 172.34.0.1
OSPF: Area ID = 0.0.0.1
OSPF: Checksum = 0x42D0
OSPF: Authentication Type = None
OSPF: Authentication = 0x0000000000000000
OSPF: Number of Ads = 4 (0x4)
OSPF: Age = 41 (0x29)
OSPF: Options = 34 (0x22)
  OSPF: .....1. = Processes AS External routes
  OSPF: .....0.. = Does not support MOSPF
  OSPF: ....0... = Does not process Not-So-Stubby-Area
advertisements
  OSPF: ...0.... = Does not process external attributes LSAs

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    OSPF: ..1..... = Supports demand circuit extensions
OSPF: Link State Advertisement Type = Router Links
OSPF: Router ID = 172.34.0.1
OSPF: Router ID = 172.34.0.1
OSPF: Sequence Number = 2147483649 (0x80000001)
OSPF: Link State Checksum = 0x55AF
OSPF: Length = 48 (0x30)
OSPF: ..0..... = Not a virtual link endpoint
OSPF: .0..... = Not an AS Boundary Router
OSPF: 0..... = Not an area border Router
OSPF: Number of Links = 2 (0x2)
OSPF: IP network/Subnet number = 172.24.0.0
OSPF: Stub Network mask = 255.255.0.0
OSPF: Link Type = Connects to Stub Network
OSPF: Number of Metrics = 0 (0x0)
OSPF: TOS0 Metric = 1 (0x1)
OSPF: IP network/Subnet number = 172.14.0.0
OSPF: Stub Network mask = 255.255.0.0
OSPF: Link Type = Connects to Stub Network
OSPF: Number of Metrics = 0 (0x0)
OSPF: TOS0 Metric = 1 (0x1)
OSPF: Age = 21 (0x15)
OSPF: Options = 34 (0x22)
    OSPF: .....1. = Processes AS External routes
    OSPF: .....0.. = Does not support MOSPF
    OSPF: ....0... = Does not process Not-So-Stubby-Area
advertisements
    OSPF: ...0.... = Does not process external attributes LSAs
    OSPF: ..1..... = Supports demand circuit extensions
OSPF: Link State Advertisement Type = Summary Link (IP Network)
OSPF: Network Address = 172.44.0.0
OSPF: Router ID = 172.34.0.1
OSPF: Sequence Number = 2147483649 (0x80000001)
OSPF: Link State Checksum = 0xB1E2
OSPF: Length = 28 (0x1C)
OSPF: Destination Netmask = 255.255.0.0
OSPF: SLA Type of Service = 1
OSPF: Metric = 2
OSPF: Age = 31 (0x1F)
OSPF: Options = 34 (0x22)
    OSPF: .....1. = Processes AS External routes
    OSPF: .....0.. = Does not support MOSPF
    OSPF: ....0... = Does not process Not-So-Stubby-Area
advertisements
    OSPF: ...0.... = Does not process external attributes LSAs
    OSPF: ..1..... = Supports demand circuit extensions
OSPF: Link State Advertisement Type = Summary Link (IP Network)
OSPF: Network Address = 172.34.0.0
OSPF: Router ID = 172.34.0.1
OSPF: Sequence Number = 2147483649 (0x80000001)
OSPF: Link State Checksum = 0x207F
OSPF: Length = 28 (0x1C)
OSPF: Destination Netmask = 255.255.0.0
OSPF: SLA Type of Service = 1
OSPF: Metric = 1
OSPF: Age = 21 (0x15)
OSPF: Options = 34 (0x22)
    OSPF: .....1. = Processes AS External routes
    OSPF: .....0.. = Does not support MOSPF
    OSPF: ....0... = Does not process Not-So-Stubby-Area
advertisements

```



```

    OSPF: ...0.... = Does not process external attributes LSAs
    OSPF: ..1..... = Supports demand circuit extensions
OSPF: Link State Advertisement Type = Summary Link (IP Network)
    OSPF: Network Address = 172.3.0.0
    OSPF: Router ID = 172.33.0.1
    OSPF: Sequence Number = 2147483649 (0x80000001)
    OSPF: Link State Checksum = 0x9D1E
    OSPF: Length = 28 (0x1C)
    OSPF: Destination Netmask = 255.255.0.0
    OSPF: SLA Type of Service = 1
    OSPF: Metric = 3

```

## RECONOCIMIENTO ACTUALIZACIÓN

Frame	Time	Src MAC Addr	Dst MAC Addr	Protocol	Description
340	308.858000	0009E84D07F3	USC IN000005	OSPF	Message = Link State
		Src Other Addr	Dst Other Addr	Type Other Addr	
		172.14.0.2	224.0.0.5		

```

Frame: Base frame properties
  Frame: Time of capture = 12/11/02 10:27:48.612
  Frame: Time delta from previous physical frame: 144000
microseconds
  Frame: Frame number: 334
  Frame: Total frame length: 78 bytes
  Frame: Capture frame length: 78 bytes
  Frame: Frame data: Number of data bytes remaining = 78 (0x004E)
ETHERNET: ETYPE = 0x0800 : Protocol = IP:  DOD Internet Protocol
ETHERNET: Destination address : 01005E000005
  ETHERNET: .....1 = Group address
  ETHERNET: .....0. = Universally administered address
ETHERNET: Source address : 0009E84D07F3
  ETHERNET: .....0 = No routing information present
  ETHERNET: .....0. = Universally administered address
ETHERNET: Frame Length : 78 (0x004E)
ETHERNET: Ethernet Type : 0x0800 (IP:  DOD Internet Protocol)
ETHERNET: Ethernet Data: Number of data bytes remaining = 64
(0x0040)
  IP: ID = 0x49; Proto = OSPF IGP; Len: 64
  IP: Version = 4 (0x4)
  IP: Header Length = 20 (0x14)
  IP: Precedence = Internetwork Control
  IP: Type of Service = Normal Service
  IP: Total Length = 64 (0x40)
IP: Identification = 73 (0x49)
  IP: Flags Summary = 0 (0x0)
    IP: .....0 = Last fragment in datagram
    IP: .....0. = May fragment datagram if necessary
  IP: Fragment Offset = 0 (0x0) bytes
  IP: Time to Live = 1 (0x1)
  IP: Protocol = Open Shortest Path First IGP
  IP: Checksum = 0x2C48
  IP: Source Address = 172.14.0.2
  IP: Destination Address = 224.0.0.5

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```
IP: Data: Number of data bytes remaining = 44 (0x002C)
OSPF: Message = Link State Ack
OSPF: Version = 2 (0x2)
OSPF: OSPF Packet Type = Link State Ack
OSPF: Packet Length = 44 (0x2C)
OSPF: Source Router ID = 172.34.0.1
OSPF: Area ID = 0.0.0.1
OSPF: Checksum = 0xE442
OSPF: Authentication Type = None
OSPF: Authentication = 0x0000000000000000
OSPF: Age = 5 (0x5)
OSPF: Options = 34 (0x22)
    OSPF: .....1. = Processes AS External routes
    OSPF: .....0.. = Does not support MOSPF
    OSPF: ....0... = Does not process Not-So-Stubby-Area
advertisements
    OSPF: ...0.... = Does not process external attributes LSAs
    OSPF: ..1..... = Supports demand circuit extensions
OSPF: Link State Advertisement Type = Router Links
OSPF: Router ID = 172.44.0.2
OSPF: Router ID = 172.44.0.2
OSPF: Sequence Number = 2147483650 (0x80000002)
OSPF: Link State Checksum = 0x72D4
OSPF: Length = 48 (0x30)
```