

# 14. Wrong default route propagation in OSPF enabled network

Default route introduce ultimate outgoing interface for L3 PDU from our network. Most common use is in stub-networks where is only one interface pointing to outside network (in this case is no need for load balancing between two or among ISPs interfaces). Instead of routers having to store routes for all of the networks in the internet, they can share a single default route to represent any network that is not in the routing table.

In small office networks is static routing and manual default route settings in use but in large network or in much more flexible network scenarios are dynamic routing protocol introduced.

**Static default route can be propagated** from router where command ***ip route 0.0.0.0 0.0.0.0 interface/IP\_of\_next\_hop*** to all other routers in network.

How to enable default route distribution to network with most common IPv4 routing protocols?

1) *Configure static default route on router that act as network boundary to ISP network with command:*

```
ip route 0.0.0.0 0.0.0.0 interface/IP_of_next_hop
```

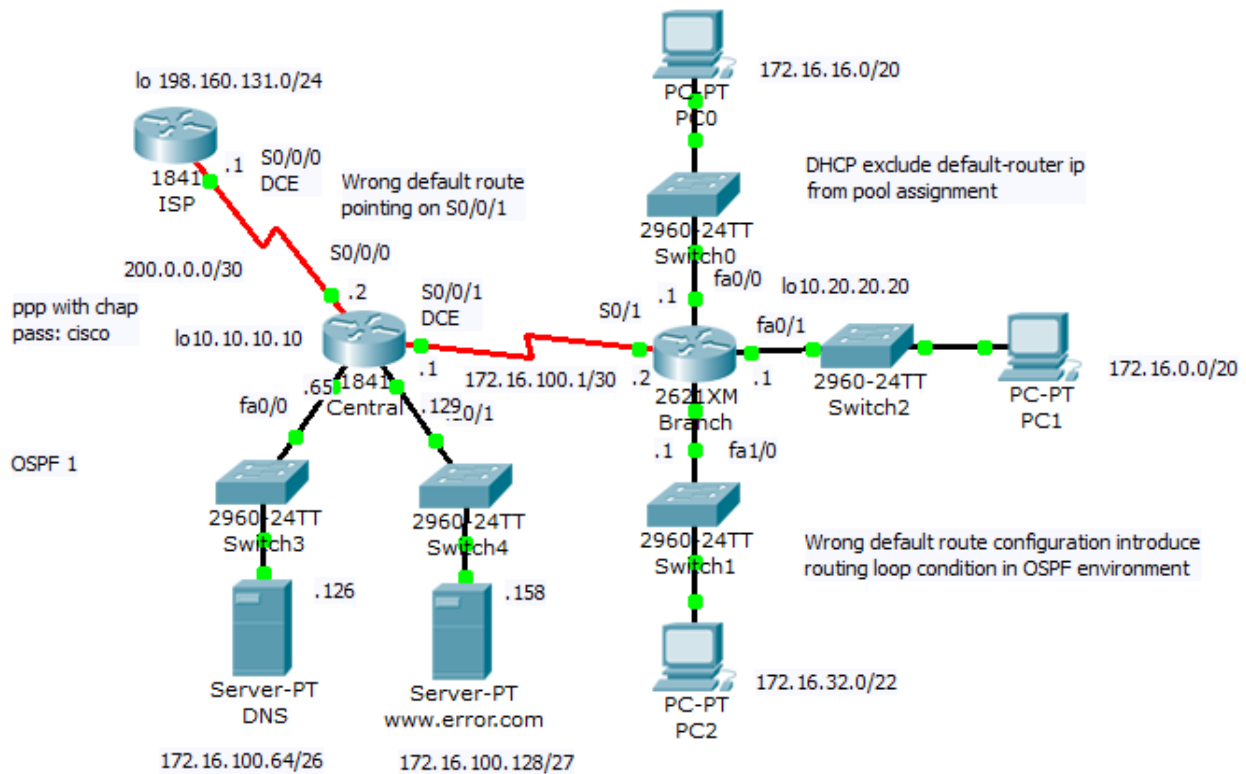
2) *Default static route needs to be advertised to all others routers that use dynamic routing protocols*

- for RIP1/2 use router command: default-information originate
- for EIGRP use router command: redistribute static
- for OSPF use router command: default-information originate

But what is happen when wrong default route is introduced in network topology? How troubleshoot problem with wrong default static route? We going to explore how this condition affect our production network and how to fix it.

Preconfigured scenario in cisco packet tracer 5.2 or [above can be obtained from here](#). Small office network in this scenario look like this

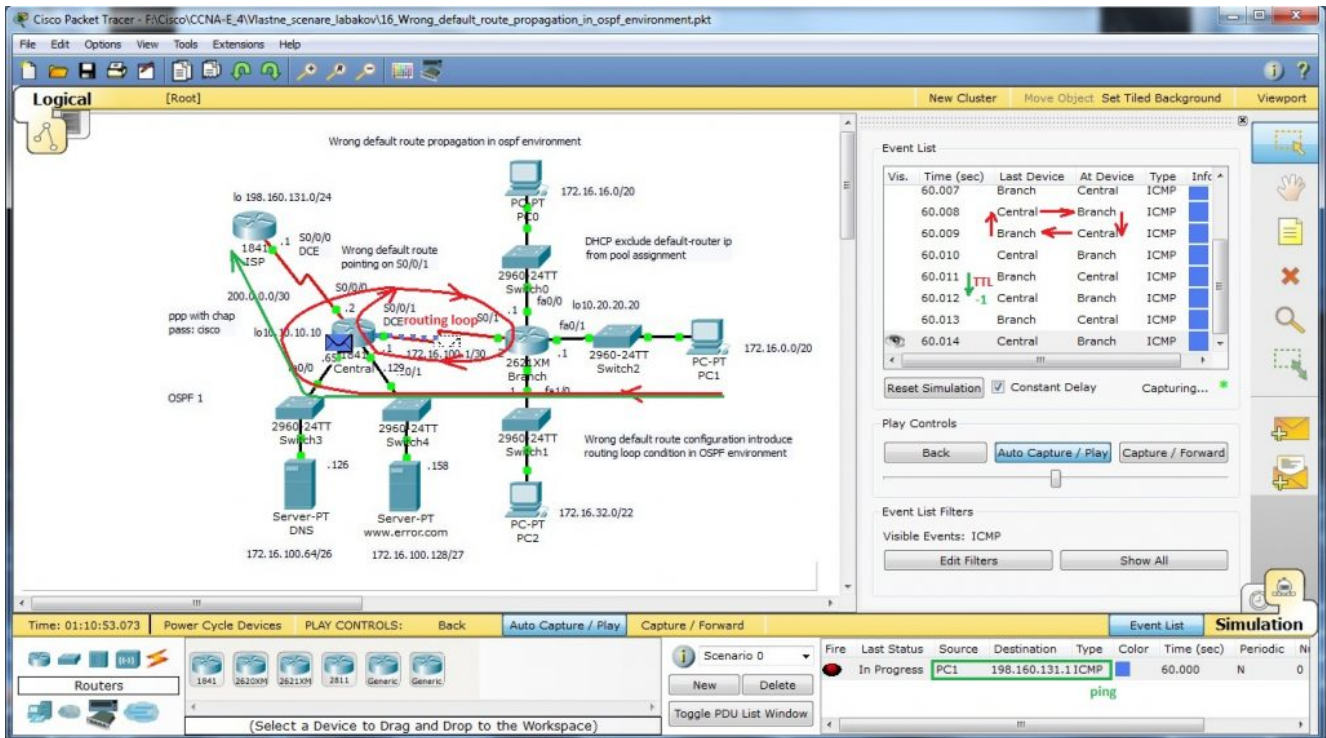
Wrong default route propagation in ospf environment



Network topology consist of central router (act as boundary between office network and WAN) and one branch router (for simplicity is there only one branch router). All end devices are on separate networks and private address space is in use in internal network. Wrong default route

**ip route 0.0.0.0 0.0.0.0 serial0/0/1** (correct it is **serial0/0/0**) introduce in network routing loop that we will examine.

Our lab include option for sending ping and follow what is happen. Toggle to simulation mode and Auto capture/play.



Wrong default route lead PDU to its origin and Branch router loop back to central router with default route. L3 PDU contain mechanism how to break endless looping of PDU – TTL in data packet header is decreased after L3 routing to appropriate interface as you can see on next picture (PDU examination in cisco packet tracer – simulation mode).

PDU Information at Device: Branch

OSI Model    Inbound PDU Details    **Outbound PDU Details**

PDU Formats

HDLC

0	8	16	32	32+x	48+x	56+x	Bi
FLG:	ADR:	CONTROL:	DATA: (VARIABLE LENGTH)	FCS:	FLG:		
0111 1110	0x8f	0x0		0x0	0111 1110		

IP

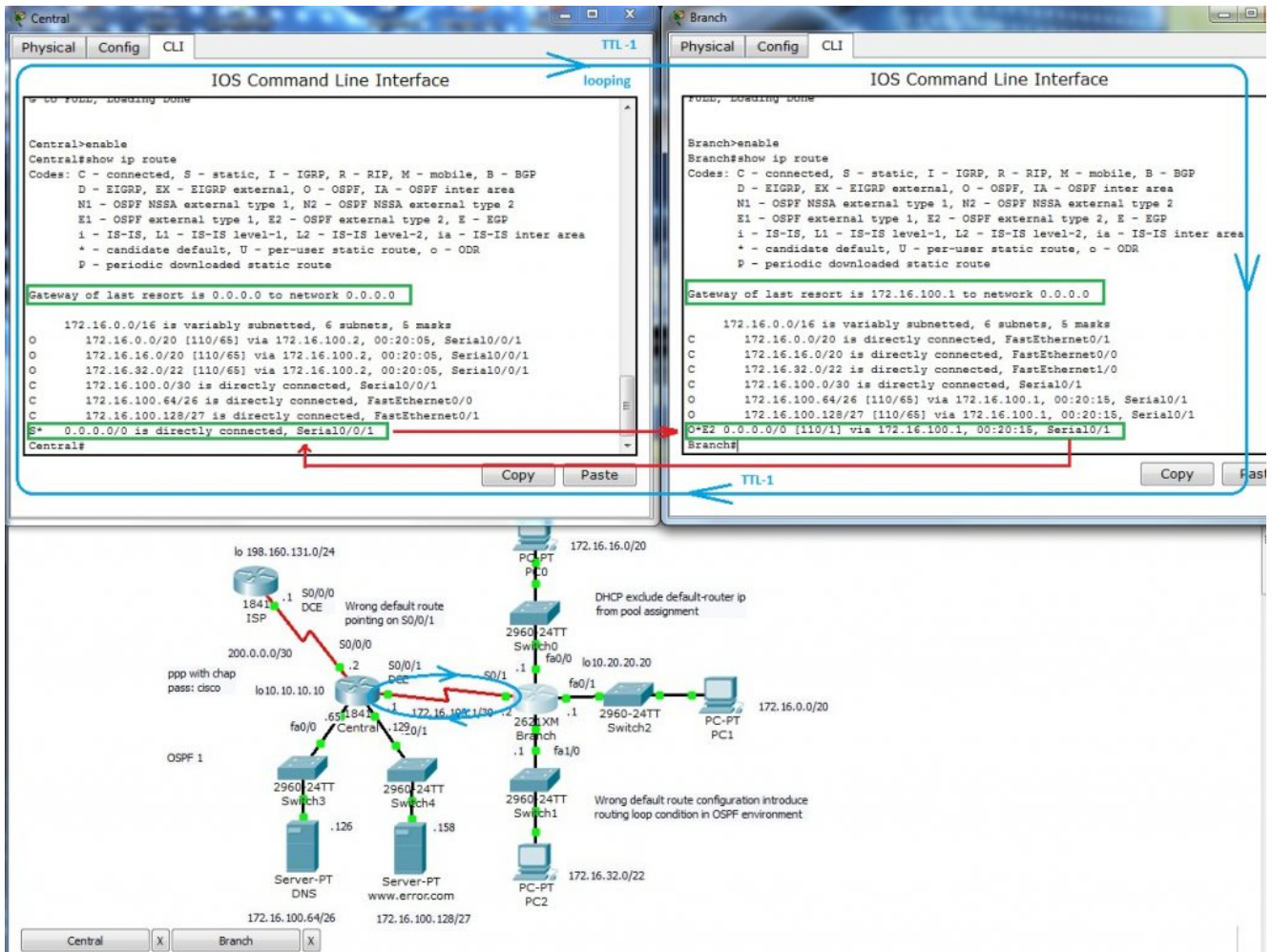
0	4	8	16	19	31	Bits
4	HL	DSCP: 0x0	TL: 28			
	ID: 0x4	0x0	0x0			
	<b>TTL: 2</b>	PRO: 0x1	CHKSUM			
SRC IP: 172.16.0.2						
DST IP: 198.160.131.1						
OPT: 0x0					0x0	
DATA (VARIABLE LENGTH)						

ICMP

0	8	16	31	Bits
TYPE: 0x8		CODE: 0x0	CHECKSUM	
ID: 0x2		SEQ NUMBER: 1		

TTL=1 decreased after routing to outgoing if -1 when 0 reached PDU will be drop

Output from most common troubleshooting command show ip route that output from routers routing table issued on both routers is:



Now is time correct our mistake. What we need to do? At first you must remove wrong default route. There is no way how to change existing static route. First remove wrong route with command

```
no ip route 0.0.0.0 0.0.0.0 serial0/0/1
```

that point not to ISP router but back to internal Branch router and cause routing loop. Next step is introduce appropriate (correct) default route this way:

```
ip route 0.0.0.0 0.0.0.0 serial0/0/0
```

and now we going to examine output from show ip route. But you will obtain problem that is cause of my mistake. In routing table is not default route introduced. Keep in mind that static route (but all routes) is in output only when appropriate outgoing interface is on. Then we will examine up state of s0/0/0 interface. As you can see physical layer is Up but protocol is down.

S0/0/0 interface on Central router is connected to ISP with PPP link that use chap as authentication protocol. We need examine clock command on DCE end of serial link and then authentication credential on bot end of link.

And there is the problem, ISP side is supplied wit incorrect name of Central router. there is a typo Cnetral and correct it may state Central.





The image displays a network simulation interface with two CLI windows and a network diagram.

**Central CLI:**

```

Central#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 0.0.0.0 to network 0.0.0.0

 172.16.0.0/16 is variably subnetted, 6 subnets, 5 masks
O   172.16.0.0/20 [110/65] via 172.16.100.2, 00:43:11, Serial0/0/1
O   172.16.16.0/20 [110/65] via 172.16.100.2, 00:43:11, Serial0/0/1
O   172.16.32.0/22 [110/65] via 172.16.100.2, 00:43:11, Serial0/0/1
C   172.16.100.0/30 is directly connected, Serial0/0/1
C   172.16.100.64/26 is directly connected, FastEthernet0/0
C   172.16.100.128/27 is directly connected, FastEthernet0/1
200.0.0.0/24 is variably subnetted, 2 subnets, 2 masks
C   200.0.0.0/30 is directly connected, Serial0/0/0
C   200.0.0.1/32 is directly connected, Serial0/0/0
S*  0.0.0.0/0 is directly connected, Serial0/0/0
Central#
  
```

**Branch CLI:**

```

Branch#enable
Branch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Branch(config)#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 172.16.100.1 to network 0.0.0.0

 172.16.0.0/16 is variably subnetted, 6 subnets, 5 masks
C   172.16.0.0/20 is directly connected, FastEthernet0/1
C   172.16.16.0/20 is directly connected, FastEthernet0/0
C   172.16.32.0/22 is directly connected, FastEthernet0/0
C   172.16.100.0/30 is directly connected, Serial0/1
O   172.16.100.64/26 [110/65] via 172.16.100.1, 00:43:11, Serial0/1
O   172.16.100.128/27 [110/65] via 172.16.100.1, 00:43:11, Serial0/1
O#E2 0.0.0.0/0 [110/1] via 172.16.100.1, 00:04:17, Serial0/1
Branch(config)#
  
```

**Network Diagram:** Shows a central router (Central) connected to an ISP (198.160.131.0/24) and a branch router (Branch). The central router has interfaces s0/0/0, s0/0/1, and s0/0/2. The branch router has interfaces s0/1, fa0/0, and fa0/1. There are several switches (Switch1, Switch2, Switch3, Switch4) and servers (Server-PT DNS, Server-PT www.error.com, PC-PT PC1, PC-PT PC2) connected to the network. A note indicates "Wrong default route pointing on S0/0/1" and "Wrong default route configuration introduce routing loop condition in OSPF environment".

**Event List Table:**

Vis.	Time (sec)	Last Device	At Device	Type	Infc
	0.002	Switch2	Branch	ICMP	
	0.003	Branch	Central	ICMP	
	0.004	Central	ISP	ICMP	
	60.000	--	PC1	ICMP	
	60.001	PC1	Switch2	ICMP	
	60.002	Switch2	Branch	ICMP	
	60.003	Branch	Central	ICMP	
	60.004	Central	ISP	ICMP	

For ISP (internet access – now without security configuration) connection in network with many clients I decided for NAT (network address translation) with PAT (port address translation) on interface s0/0/0.

At first we must create standard access list (i use named but also can be used numbered)

ip access-list standard NAT

permit 172.16.0.0 0.0.15.255

permit 172.16.16.0 0.0.15.255

permit 172.16.32.0 0.0.15.255

permit 172.16.100.0 0.0.0.3

and then enable nat translation with command

## ip nat inside source list NAT interface s0/0/0 overload

most common beginners (also me) mistake is forget mark appropriate interface as ip nat inside and outside. in our case it is:

interface s0/0/0

ip nat outside

interface s0/0/1

ip nat inside.

Now we can place simple PDU between appropriate ends.

The image contains three main parts:

- Top Left Screenshot:** Shows the 'show ip route' command output on the 'ISP' router, displaying routes for 198.160.131.0/24, 200.0.0.0/24, 200.0.0.0/30, and 200.0.0.2/32.
- Top Right Screenshot:** Shows the configuration of NAT on the 'Central' router. Key commands include:
 

```

            Central(config)#ip access-list standard NAT
            Central(config-std-nacl)#permit 172.16.0.0 0.0.15.255
            Central(config-std-nacl)#permit 172.16.16.0 0.0.15.255
            Central(config-std-nacl)#permit 172.16.32.0 0.0.15.255
            Central(config-std-nacl)#ip nat inside source list NAT interface s0/0/0 overload
            Central(config)#ip nat inside source static 172.16.100.64 interface s0/0/0
            Central(config)#ip nat inside source static 172.16.100.64 200.0.0.2
            Central(config)#no ip nat inside source static 172.16.100.64 200.0.0.2
            Central(config)#interface s0/0/0
            Central(config-if)#ip nat outside
            Central(config-if)#interface s0/0/1
            Central(config-if)#ip nat inside
            Central(config-if)#
            
```

 Annotations explain that 'overload' is used for servers with static NAT and that interfaces must be marked as 'inside' and 'outside'.
- Bottom Diagram:** A network topology diagram showing an ISP connected to a 'Central' router (S0/0/0, S0/0/1). The Central router is connected to two branch switches (Switch3 and Switch4) via S0/0/1. The diagram also shows PC1 and PC2 connected to the switches. OSPF is configured on all routers. A note mentions 'Wrong default route configuration introduce routing loop condition in OSPF environment'.
- Bottom Right Table:** A packet capture table showing ICMP traffic:
 

Vis.	Time (sec)	Last Device	At Device	Type	Infc
60.001		PC1	Switch2	ICMP	
60.002		Switch2	Branch	ICMP	
60.003		Branch	Central	ICMP	
60.004		Central	ISP	ICMP	
60.005		ISP	Central	ICMP	
60.006		Central	Branch	ICMP	
60.007		Branch	Switch2	ICMP	
60.008		Switch2	PC1	ICMP	

As „how to?“ training you can establish connection for inside servers and enable reach them from ISP side. There must be

used static nat and address range for inside global must increase from 200.0.0.0/30 to minimal 200.0.0.0/29 as it state previews picture.

Final and fixed packet tracer lab is on next picture and for your training [can be obtained from here \(PKT 5.2 or above\)](#).

The screenshot displays a Packet Tracer Logical view of a network topology. The network consists of several interconnected devices including routers (1841, 2620XM, 2621XM, 2811, Generic), switches (2960-24TT, 2960-24TT, 2960-24TT, 2960-24TT), and servers (Server-PT DNS, Server-PT www.error.com). Key configurations and annotations include:

- ISP:** Router 1841 with loopback address 198.160.131.0/24 and interface S0/0/0.
- Central:** Router 2620XM with loopback address 172.16.100.1/30 and interface S0/0/1.
- Branch:** Router 2621XM with loopback address 172.16.100.1/30 and interface S0/1.
- Switches:** Four 2960-24TT switches (Switch1, Switch2, Switch3, Switch4) connected to the routers.
- PCs:** Multiple PC-PT devices connected to the switches.
- Configurations:** NAT with PAT on interface S0/0/0, DHCP exclude default-router ip from pool assignment, and OSPF 1.
- Annotations:** "Wrong default route propagation in ospf environment", "Wrong default route pointing on S0/0/1", "Wrong default route configuration introduce routing loop condition in OSPF environment", "need public address for remote reachability and DNS records How to do it is for your personal training.", "DHCPC include default-router ip from pool assignment".

The Event List table shows the following data:

Vis.	Time (sec)	Last Device	At Device	Type	Infc
	60.001	PC1	Switch2	ICMP	
	60.002	Switch2	Branch	ICMP	
	60.003	Branch	Central	ICMP	
	60.004	Central	ISP	ICMP	
	60.005	ISP	Central	ICMP	
	60.006	Central	Branch	ICMP	
	60.007	Branch	Switch2	ICMP	
	60.008	Switch2	PC1	ICMP	

The simulation controls at the bottom show the time as 01:41:26.556 and the event list as follows:

Fire	Last Status	Source	Destination	Type	Color	Time (sec)	Periodic	N
	Successful	PC1	198.160.131.1	ICMP		60.000	N	0

The event list filter is set to Visible Events: ICMP. The simulation status is "Simulation" and the event list shows "That was our goal :-)".