

three area ospf test lab configs:

```
L-A-B--aa#
L-A-B--aa#
L-A-B--aa#
L-A-B--aa#
L-A-B--aa#sh run
Building configuration...

Current configuration : 2365 bytes
!
version 12.4
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname L-A-B--aa
!
boot-start-marker
boot-end-marker
!
!
no aaa new-model
memory-size iomem 5
!
!
ip cef
!
!
no ip domain lookup
!
username lab privilege 15 password 0 lab
!
!
!
!
interface Loopback0
 ip address 19.19.19.1 255.255.255.255
!
interface FastEthernet0/0
 ip address 19.1.0.1 255.255.255.0
 duplex auto
 speed auto
!
interface FastEthernet1/0
 no ip address
```

```
shutdown
duplex auto
speed auto
!
interface FastEthernet2/0
no ip address
shutdown
duplex auto
speed auto
!
interface FastEthernet3/0
no ip address
shutdown
duplex auto
speed auto
!
router ospf 65525
router-id 19.19.19.1
log-adjacency-changes
network 19.1.0.0 0.0.0.255 area 19
network 19.19.19.1 0.0.0.0 area 19
!
ip http server
ip forward-protocol nd
!
!
!
!
!
control-plane
!
alias exec crs copy run start
alias exec aaa sh run | i alias
alias exec c config t
alias exec siib show ip int brie
alias exec sir show ip route
alias exec sire show ip route eigrp
alias exec srso show run | section ospf
alias exec srsb show run | section bgp
alias exec srse show run | section eigrp
alias exec scn show cdp nei
alias exec scnd show cdp nei det
alias exec srs show run | sec
alias exec sri show run | i
alias exec sip show ip protocol
alias exec pv ping vrf
alias exec tv trace vrf
```

```

alias exec sion show ip ospf nei
alias exec siro show ip route ospf
alias exec siobr show ip ospf border-routers
alias exec siod show ip ospf database
alias exec siode show ip ospf database external
alias exec siodei show ip ospf database external | i
alias exec siodr show ip ospf database router
alias exec siodri show ip ospf database router | i
alias exec siodd show ip ospf database database
alias exec siodn show ip ospf database network
alias exec siodns show ip ospf database network self
alias exec siods show ip ospf database summary
alias exec siodsi show ip ospf database summary | i
alias exec sioda show ip ospf database asbr-sumary
alias exec sioib show ip ospf interface brief
alias exec sios show ip ospf stat
alias exec siot show ip ospf traffic

```

```

!
line con 0
  exec-timeout 0 0
  logging synchronous
line aux 0
line vty 0 4
  exec-timeout 120 0
  logging synchronous
  login local
line vty 5 15
  exec-timeout 120 0
  logging synchronous
  login local
!
end

```

```

L-A-B--aa#siib
Interface                IP-Address      OK? Method Status          Protocol
FastEthernet0/0         19.1.0.1        YES manual up              up
FastEthernet1/0         unassigned      YES unset  administratively down down
FastEthernet2/0         unassigned      YES unset  administratively down down
FastEthernet3/0         unassigned      YES unset  administratively down down
Loopback0                19.19.19.1     YES manual up              up
L-A-B--aa#sion

```

```

Neighbor ID      Pri   State           Dead Time   Address        Interface
19.19.19.19     1     FULL/DR         00:00:37   19.1.0.2       FastEthernet0/0

```

```

L-A-B--aa#sioib
Interface  PID  Area          IP Address/Mask  Cost  State  Nbrs  F/C
Lo0        65525 19            19.19.19.1/32   1     LOOP  0/0

```

```
Fa0/0      65525 19          19.1.0.1/24      1      BDR    1/1
L-A-B--aa#sh ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route
```

Gateway of last resort is not set

```
      19.0.0.0/8 is variably subnetted, 6 subnets, 2 masks
O      19.19.19.19/32 [110/2] via 19.1.0.2, 01:11:20, FastEthernet0/0
O      19.3.0.0/24 [110/3] via 19.1.0.2, 01:11:20, FastEthernet0/0
O      19.19.19.2/32 [110/3] via 19.1.0.2, 01:11:20, FastEthernet0/0
O      19.2.0.0/24 [110/2] via 19.1.0.2, 01:11:20, FastEthernet0/0
C      19.19.19.1/32 is directly connected, Loopback0
C      19.1.0.0/24 is directly connected, FastEthernet0/0
      100.0.0.0/8 is variably subnetted, 3 subnets, 2 masks
O IA   100.0.0.100/32 [110/4] via 19.1.0.2, 01:11:21, FastEthernet0/0
O IA   100.1.0.0/24 [110/4] via 19.1.0.2, 01:11:21, FastEthernet0/0
O IA   100.0.0.1/32 [110/5] via 19.1.0.2, 01:11:21, FastEthernet0/0
      52.0.0.0/8 is variably subnetted, 3 subnets, 2 masks
O IA   52.52.52.52/32 [110/5] via 19.1.0.2, 01:11:21, FastEthernet0/0
O IA   52.1.0.0/24 [110/5] via 19.1.0.2, 00:30:55, FastEthernet0/0
O IA   52.2.0.0/24 [110/4] via 19.1.0.2, 01:11:34, FastEthernet0/0
L-A-B--aa#
```

```
L-A-B--A#
L-A-B--A#
L-A-B--A#
L-A-B--A#
L-A-B--A#
L-A-B--A#
L-A-B--A#
L-A-B--A#
L-A-B--A#sh run
```

Building configuration...

Current configuration : 2459 bytes

!

version 12.4

service timestamps debug datetime msec

service timestamps log datetime msec

no service password-encryption

```
!  
hostname L-A-B--A  
!  
boot-start-marker  
boot-end-marker  
!  
!  
no aaa new-model  
memory-size iomem 5  
!  
!  
ip cef  
!  
!  
no ip domain lookup  
!  
username lab privilege 15 password 0 lab  
!  
!  
!  
interface Loopback0  
 ip address 19.19.19.19 255.255.255.255  
!  
interface FastEthernet0/0  
 ip address 19.1.0.2 255.255.255.0  
 duplex auto  
 speed auto  
!  
interface FastEthernet1/0  
 ip address 52.1.0.2 255.255.255.0  
 duplex auto  
 speed auto  
!  
interface FastEthernet2/0  
 ip address 19.2.0.2 255.255.255.0  
 duplex auto  
 speed auto  
!  
interface FastEthernet3/0  
 no ip address  
 shutdown  
 duplex auto  
 speed auto  
!  
router ospf 65525  
 router-id 19.19.19.19
```

```
log-adjacency-changes
network 19.1.0.0 0.0.0.255 area 19
network 19.2.0.0 0.0.0.255 area 19
network 19.19.19.19 0.0.0.0 area 19
network 52.1.0.0 0.0.0.255 area 52
!
ip http server
ip forward-protocol nd
!
!
!
!
!
control-plane
!
alias exec crs copy run start
alias exec aaa sh run | i alias
alias exec c config t
alias exec siib show ip int brie
alias exec sir show ip route
alias exec sire show ip route eigrp
alias exec srso show run | section ospf
alias exec srsb show run | section bgp
alias exec srse show run | section eigrp
alias exec scn show cdp nei
alias exec scnd show cdp nei det
alias exec srs show run | sec
alias exec sri show run | i
alias exec sip show ip protocol
alias exec pv ping vrf
alias exec tv trace vrf
alias exec sion show ip ospf nei
alias exec siro show ip route ospf
alias exec siobr show ip ospf border-routers
alias exec siod show ip ospf database
alias exec siode show ip ospf database external
alias exec siodei show ip ospf database external | i
alias exec siodr show ip ospf database router
alias exec siodri show ip ospf database router | i
alias exec siodd show ip ospf database database
alias exec siodn show ip ospf database network
alias exec siodns show ip ospf database network self
alias exec siods show ip ospf database summary
alias exec siodsi show ip ospf database summary | i
alias exec sioda show ip ospf database asbr-summary
alias exec sioib show ip ospf interface brief
alias exec sios show ip ospf stat
```

```

alias exec siot show ip ospf traffic
!
line con 0
  exec-timeout 0 0
  logging synchronous
line aux 0
line vty 0 4
  exec-timeout 120 0
  logging synchronous
  login local
line vty 5 15
  exec-timeout 120 0
  logging synchronous
  login local
!
end

```

L-A-B--A#siib

Interface	IP-Address	OK?	Method	Status	Protocol
FastEthernet0/0	19.1.0.2	YES	manual	up	up
FastEthernet1/0	52.1.0.2	YES	manual	up	up
FastEthernet2/0	19.2.0.2	YES	manual	up	up
FastEthernet3/0	unassigned	YES	unset	administratively down	down
Loopback0	19.19.19.19	YES	manual	up	up

L-A-B--A#sion

Neighbor ID	Pri	State	Dead Time	Address	Interface
19.19.19.1	1	FULL/BDR	00:00:34	19.1.0.1	FastEthernet0/0
19.19.19.2	1	FULL/DR	00:00:36	19.2.0.1	FastEthernet2/0
52.52.52.52	1	FULL/DR	00:00:39	52.1.0.1	FastEthernet1/0

L-A-B--A#sioib

Interface	PID	Area	IP Address/Mask	Cost	State	Nbrs	F/C
Lo0	65525	19	19.19.19.19/32	1	LOOP	0/0	
Fa0/0	65525	19	19.1.0.2/24	1	DR	1/1	
Fa2/0	65525	19	19.2.0.2/24	1	BDR	1/1	
Fa1/0	65525	52	52.1.0.2/24	1	BDR	1/1	

L-A-B--A#show ip route

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

Gateway of last resort is not set

```
19.0.0.0/8 is variably subnetted, 6 subnets, 2 masks
C    19.19.19.19/32 is directly connected, Loopback0
O    19.3.0.0/24 [110/2] via 19.2.0.1, 01:12:44, FastEthernet2/0
O    19.19.19.2/32 [110/2] via 19.2.0.1, 01:12:44, FastEthernet2/0
C    19.2.0.0/24 is directly connected, FastEthernet2/0
O    19.19.19.1/32 [110/2] via 19.1.0.1, 01:12:44, FastEthernet0/0
C    19.1.0.0/24 is directly connected, FastEthernet0/0
100.0.0.0/8 is variably subnetted, 3 subnets, 2 masks
O IA 100.0.0.100/32 [110/3] via 52.1.0.1, 00:32:07, FastEthernet1/0
      [110/3] via 19.2.0.1, 00:32:07, FastEthernet2/0
O IA 100.1.0.0/24 [110/3] via 52.1.0.1, 00:32:07, FastEthernet1/0
      [110/3] via 19.2.0.1, 00:32:07, FastEthernet2/0
O IA 100.0.0.1/32 [110/4] via 52.1.0.1, 00:32:07, FastEthernet1/0
      [110/4] via 19.2.0.1, 00:32:07, FastEthernet2/0
52.0.0.0/8 is variably subnetted, 3 subnets, 2 masks
O    52.52.52.52/32 [110/2] via 52.1.0.1, 00:32:08, FastEthernet1/0
C    52.1.0.0/24 is directly connected, FastEthernet1/0
O    52.2.0.0/24 [110/2] via 52.1.0.1, 00:32:08, FastEthernet1/0
L-A-B--A#
L-A-B--A#
L-A-B--A#
L-A-B--A#sh ip ospf
Routing Process "ospf 65525" with ID 19.19.19.19
Start time: 00:26:47.028, Time elapsed: 01:26:00.416
Supports only single TOS(TOS0) routes
Supports opaque LSA
Supports Link-local Signaling (LLS)
Supports area transit capability
Router is not originating router-LSAs with maximum metric
Initial SPF schedule delay 5000 msecs
Minimum hold time between two consecutive SPF's 10000 msecs
Maximum wait time between two consecutive SPF's 10000 msecs
Incremental-SPF disabled
Minimum LSA interval 5 secs
Minimum LSA arrival 1000 msecs
LSA group pacing timer 240 secs
Interface flood pacing timer 33 msecs
Retransmission pacing timer 66 msecs
Number of external LSA 0. Checksum Sum 0x000000
Number of opaque AS LSA 0. Checksum Sum 0x000000
Number of DCbitless external and opaque AS LSA 0
Number of DoNotAge external and opaque AS LSA 0
Number of areas in this router is 2. 2 normal 0 stub 0 nssa
Number of areas transit capable is 0
External flood list length 0
Area 19
Number of interfaces in this area is 3 (1 loopback)
```



```
Area has no authentication
SPF algorithm last executed 01:15:38.028 ago
SPF algorithm executed 6 times
Area ranges are
Number of LSA 13. Checksum Sum 0x064FFC
Number of opaque link LSA 0. Checksum Sum 0x000000
Number of DCbitless LSA 0
Number of indication LSA 0
Number of DoNotAge LSA 0
Flood list length 0
```

Area 52

```
Number of interfaces in this area is 1
Area has no authentication
SPF algorithm last executed 00:34:59.712 ago
SPF algorithm executed 5 times
Area ranges are
Number of LSA 14. Checksum Sum 0x0718FC
Number of opaque link LSA 0. Checksum Sum 0x000000
Number of DCbitless LSA 0
Number of indication LSA 0
Number of DoNotAge LSA 0
Flood list length 0
```

```
L-A-B--A#
L-A-B--A#
L-A-B--A#
```

```
L-A-B--1#
L-A-B--1#
L-A-B--1#
L-A-B--1#
L-A-B--1#
L-A-B--1#
L-A-B--1#
L-A-B--1#sh run
```

Building configuration...

Current configuration : 2335 bytes

!

version 12.4

service timestamps debug datetime msec

service timestamps log datetime msec

no service password-encryption

!

```
hostname L-A-B--1
!
boot-start-marker
boot-end-marker
!
!
no aaa new-model
memory-size iomem 5
!
!
ip cef
!
!
no ip domain lookup
!
username lab privilege 15 password 0 lab
!
!
!
!
interface Loopback0
 ip address 52.52.52.52 255.255.255.255
!
interface FastEthernet0/0
 ip address 52.2.0.1 255.255.255.0
 duplex auto
 speed auto
!
interface FastEthernet1/0
 ip address 52.1.0.1 255.255.255.0
 duplex auto
 speed auto
!
interface FastEthernet2/0
 no ip address
 shutdown
 duplex auto
 speed auto
!
router ospf 65525
 router-id 52.52.52.52
 log-adjacency-changes
 network 52.1.0.0 0.0.0.255 area 52
 network 52.2.0.0 0.0.0.255 area 52
 network 52.52.52.52 0.0.0.0 area 52
!
ip http server
```

```
ip forward-protocol nd
!
!
!
!
!
control-plane
!
alias exec crs copy run start
alias exec aaa sh run | i alias
alias exec c config t
alias exec siib show ip int brie
alias exec sir show ip route
alias exec sire show ip route eigrp
alias exec srso show run | section ospf
alias exec srsb show run | section bgp
alias exec srse show run | section eigrp
alias exec scn show cdp nei
alias exec scnd show cdp nei det
alias exec srs show run | sec
alias exec sri show run | i
alias exec sip show ip protocol
alias exec pv ping vrf
alias exec tv trace vrf
alias exec sion show ip ospf nei
alias exec siro show ip route ospf
alias exec siobr show ip ospf border-routers
alias exec siod show ip ospf database
alias exec siode show ip ospf database external
alias exec siodei show ip ospf database external | i
alias exec siodr show ip ospf database router
alias exec siodri show ip ospf database router | i
alias exec siodd show ip ospf database database
alias exec siodn show ip ospf database network
alias exec siodns show ip ospf database network self
alias exec siods show ip ospf database summary
alias exec siodsi show ip ospf database summary | i
alias exec sioda show ip ospf database asbr-summary
alias exec sioib show ip ospf interface brief
alias exec sios show ip ospf stat
alias exec siot show ip ospf traffic
!
line con 0
  exec-timeout 0 0
  logging synchronous
line aux 0
line vty 0 4
```

```
exec-timeout 120 0
logging synchronous
login local
line vty 5 15
exec-timeout 120 0
logging synchronous
login local
!
end
```

```
L-A-B--1#
```

```
L-A-B--1#
```

```
L-A-B--1#siib
```

Interface	IP-Address	OK?	Method	Status	Protocol
FastEthernet0/0	52.2.0.1	YES	manual	up	up
FastEthernet1/0	52.1.0.1	YES	manual	up	up
FastEthernet2/0	unassigned	YES	unset	administratively down	down
Loopback0	52.52.52.52	YES	manual	up	up

```
L-A-B--1#sion
```

Neighbor ID	Pri	State	Dead Time	Address	Interface
19.19.19.19	1	FULL/BDR	00:00:39	52.1.0.2	FastEthernet1/0
100.0.0.100	1	FULL/DR	00:00:32	52.2.0.2	FastEthernet0/0

```
L-A-B--1#sioib
```

Interface	PID	Area	IP Address/Mask	Cost	State	Nbrs	F/C
Lo0	65525	52	52.52.52.52/32	1	LOOP	0/0	
Fa1/0	65525	52	52.1.0.1/24	1	DR	1/1	
Fa0/0	65525	52	52.2.0.1/24	1	BDR	1/1	

```
L-A-B--1#sh ip route
```

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

```
Gateway of last resort is not set
```

```
19.0.0.0/8 is variably subnetted, 6 subnets, 2 masks
```

```
O IA 19.19.19.19/32 [110/4] via 52.2.0.2, 00:34:08, FastEthernet0/0
O IA 19.3.0.0/24 [110/2] via 52.2.0.2, 00:34:08, FastEthernet0/0
O IA 19.19.19.2/32 [110/3] via 52.2.0.2, 00:34:08, FastEthernet0/0
O IA 19.2.0.0/24 [110/3] via 52.2.0.2, 00:34:08, FastEthernet0/0
O IA 19.19.19.1/32 [110/5] via 52.2.0.2, 00:34:08, FastEthernet0/0
O IA 19.1.0.0/24 [110/4] via 52.2.0.2, 00:34:08, FastEthernet0/0
```

```
100.0.0.0/8 is variably subnetted, 3 subnets, 2 masks
```

```
O IA 100.0.0.100/32 [110/2] via 52.2.0.2, 00:34:09, FastEthernet0/0
O IA 100.1.0.0/24 [110/2] via 52.2.0.2, 00:34:09, FastEthernet0/0
O IA 100.0.0.1/32 [110/3] via 52.2.0.2, 00:34:09, FastEthernet0/0
    52.0.0.0/8 is variably subnetted, 3 subnets, 2 masks
C    52.52.52.52/32 is directly connected, Loopback0
C    52.1.0.0/24 is directly connected, FastEthernet1/0
C    52.2.0.0/24 is directly connected, FastEthernet0/0
L-A-B--1#
L-A-B--1#
L-A-B--1#
L-A-B--1#
```

```
L-A-B--2#
L-A-B--2#
L-A-B--2#
L-A-B--2#
L-A-B--2#
L-A-B--2#sh run
Building configuration...
```

```
Current configuration : 2410 bytes
!
version 12.4
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname L-A-B--2
!
boot-start-marker
boot-end-marker
!
!
no aaa new-model
memory-size iomem 5
!
!
ip cef
!
!
no ip domain lookup
!
username lab privilege 15 password 0 lab
!
!
!
```

```
!  
interface Loopback0  
 ip address 19.19.19.2 255.255.255.255  
!  
interface FastEthernet0/0  
 ip address 19.3.0.1 255.255.255.0  
 duplex auto  
 speed auto  
!  
interface FastEthernet1/0  
 no ip address  
 shutdown  
 duplex auto  
 speed auto  
!  
interface FastEthernet2/0  
 ip address 19.2.0.1 255.255.255.0  
 duplex auto  
 speed auto  
!  
interface FastEthernet3/0  
 no ip address  
 shutdown  
 duplex auto  
 speed auto  
!  
router ospf 65525  
 router-id 19.19.19.2  
 log-adjacency-changes  
 network 19.2.0.0 0.0.0.255 area 19  
 network 19.3.0.0 0.0.0.255 area 19  
 network 19.19.19.2 0.0.0.0 area 19  
!  
ip http server  
ip forward-protocol nd  
!  
!  
!  
!  
control-plane  
!  
alias exec crs copy run start  
alias exec aaa sh run | i alias  
alias exec c config t  
alias exec siib show ip int brie  
alias exec sir show ip route
```

```

alias exec sire show ip route eigrp
alias exec srso show run | section ospf
alias exec srsb show run | section bgp
alias exec srse show run | section eigrp
alias exec scn show cdp nei
alias exec scnd show cdp nei det
alias exec srs show run | sec
alias exec sri show run | i
alias exec sip show ip protocol
alias exec pv ping vrf
alias exec tv trace vrf
alias exec sion show ip ospf nei
alias exec siro show ip route ospf
alias exec siobr show ip ospf border-routers
alias exec siod show ip ospf database
alias exec siode show ip ospf database external
alias exec siodei show ip ospf database external | i
alias exec siodr show ip ospf database router
alias exec siodri show ip ospf database router | i
alias exec siodd show ip ospf database database
alias exec siodn show ip ospf database network
alias exec siodns show ip ospf database network self
alias exec siods show ip ospf database summary
alias exec siodsi show ip ospf database summary | i
alias exec sioda show ip ospf database asbr-summary
alias exec sioib show ip ospf interface brief
alias exec sios show ip ospf stat
alias exec siot show ip ospf traffic
!
line con 0
  exec-timeout 0 0
  logging synchronous
line aux 0
line vty 0 4
  exec-timeout 120 0
  logging synchronous
  login local
line vty 5 15
  exec-timeout 120 0
  logging synchronous
  login local
!
end

```

L-A-B--2#siib

Interface	IP-Address	OK? Method Status	Protocol
FastEthernet0/0	19.3.0.1	YES manual up	up

```

FastEthernet1/0      unassigned      YES unset      administratively down down
FastEthernet2/0      19.2.0.1        YES manual    up              up
FastEthernet3/0      unassigned      YES unset      administratively down down
Loopback0            19.19.19.2      YES manual    up              up
L-A-B--2#sion

```

```

Neighbor ID      Pri   State           Dead Time   Address      Interface
19.19.19.19      1     FULL/BDR        00:00:33   19.2.0.2    FastEthernet2/0
100.0.0.100     1     FULL/DR         00:00:33   19.3.0.2    FastEthernet0/0

```

L-A-B--2#sioib

```

Interface      PID   Area           IP Address/Mask   Cost   State  Nbrs F/C
Lo0             65525 19              19.19.19.2/32     1      LOOP  0/0
Fa2/0           65525 19              19.2.0.1/24       1      DR    1/1
Fa0/0           65525 19              19.3.0.1/24       1      BDR   1/1

```

L-A-B--2#sh ip route

```

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

```

Gateway of last resort is not set

```

      19.0.0.0/8 is variably subnetted, 6 subnets, 2 masks
O      19.19.19.19/32 [110/2] via 19.2.0.2, 01:13:56, FastEthernet2/0
C      19.3.0.0/24 is directly connected, FastEthernet0/0
C      19.19.19.2/32 is directly connected, Loopback0
C      19.2.0.0/24 is directly connected, FastEthernet2/0
O      19.19.19.1/32 [110/3] via 19.2.0.2, 01:13:56, FastEthernet2/0
O      19.1.0.0/24 [110/2] via 19.2.0.2, 01:13:56, FastEthernet2/0
      100.0.0.0/8 is variably subnetted, 3 subnets, 2 masks
O IA   100.0.0.100/32 [110/2] via 19.3.0.2, 01:13:58, FastEthernet0/0
O IA   100.1.0.0/24 [110/2] via 19.3.0.2, 01:13:58, FastEthernet0/0
O IA   100.0.0.1/32 [110/3] via 19.3.0.2, 01:13:58, FastEthernet0/0
      52.0.0.0/8 is variably subnetted, 3 subnets, 2 masks
O IA   52.52.52.52/32 [110/3] via 19.3.0.2, 01:13:58, FastEthernet0/0
O IA   52.1.0.0/24 [110/3] via 19.3.0.2, 00:33:15, FastEthernet0/0
O IA   52.2.0.0/24 [110/2] via 19.3.0.2, 01:13:58, FastEthernet0/0

```

L-A-B--2#

L-A-B--2#

L-A-B--B#



```
L-A-B--B#
L-A-B--B#
L-A-B--B#
L-A-B--B#
L-A-B--B#sh run
Building configuration...

Current configuration : 2459 bytes
!
version 12.4
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname L-A-B--B
!
boot-start-marker
boot-end-marker
!
!
no aaa new-model
memory-size iomem 5
!
!
ip cef
!
!
no ip domain lookup
!
username lab privilege 15 password 0 lab
!
!
!
!
interface Loopback0
 ip address 100.0.0.100 255.255.255.255
!
interface FastEthernet0/0
 ip address 100.1.0.2 255.255.255.0
 duplex auto
 speed auto
!
interface FastEthernet1/0
 ip address 52.2.0.2 255.255.255.0
 duplex auto
 speed auto
!
```

```
interface FastEthernet2/0
 ip address 19.3.0.2 255.255.255.0
 duplex auto
 speed auto
!
interface FastEthernet3/0
 no ip address
 shutdown
 duplex auto
 speed auto
!
router ospf 65525
 router-id 100.0.0.100
 log-adjacency-changes
 network 19.3.0.0 0.0.0.255 area 19
 network 52.2.0.0 0.0.0.255 area 52
 network 100.0.0.100 0.0.0.0 area 0
 network 100.1.0.0 0.0.0.255 area 0
!
ip http server
ip forward-protocol nd
!
!
!
!
!
control-plane
!
alias exec crs copy run start
alias exec aaa sh run | i alias
alias exec c config t
alias exec siib show ip int brie
alias exec sir show ip route
alias exec sire show ip route eigrp
alias exec srso show run | section ospf
alias exec srsb show run | section bgp
alias exec srse show run | section eigrp
alias exec scn show cdp nei
alias exec scnd show cdp nei det
alias exec srs show run | sec
alias exec sri show run | i
alias exec sip show ip protocol
alias exec pv ping vrf
alias exec tv trace vrf
alias exec sion show ip ospf nei
alias exec siro show ip route ospf
alias exec siobr show ip ospf border-routers
```

```

alias exec siod show ip ospf database
alias exec siode show ip ospf database external
alias exec siodei show ip ospf database external | i
alias exec siodr show ip ospf database router
alias exec siodri show ip ospf database router | i
alias exec siodd show ip ospf database database
alias exec siodn show ip ospf database network
alias exec siodns show ip ospf database network self
alias exec siods show ip ospf database summary
alias exec siodsi show ip ospf database summary | i
alias exec sioda show ip ospf database asbr-sumary
alias exec sioib show ip ospf interface brief
alias exec sios show ip ospf stat
alias exec siot show ip ospf traffic

```

```

!
line con 0
  exec-timeout 0 0
  logging synchronous
line aux 0
line vty 0 4
  exec-timeout 120 0
  logging synchronous
  login local
line vty 5 15
  exec-timeout 120 0
  logging synchronous
  login local
!
end

```

L-A-B--B#siib

Interface	IP-Address	OK?	Method	Status	Protocol
FastEthernet0/0	100.1.0.2	YES	manual	up	up
FastEthernet1/0	52.2.0.2	YES	manual	up	up
FastEthernet2/0	19.3.0.2	YES	manual	up	up
FastEthernet3/0	unassigned	YES	unset	administratively down	down
Loopback0	100.0.0.100	YES	manual	up	up

L-A-B--B#sion

Neighbor ID	Pri	State	Dead Time	Address	Interface
100.0.0.1	1	FULL/BDR	00:00:36	100.1.0.1	FastEthernet0/0
19.19.19.2	1	FULL/BDR	00:00:34	19.3.0.1	FastEthernet2/0
52.52.52.52	1	FULL/BDR	00:00:36	52.2.0.1	FastEthernet1/0

L-A-B--B#sioib

Interface	PID	Area	IP Address/Mask	Cost	State	Nbrs	F/C
Lo0	65525	0	100.0.0.100/32	1	LOOP	0/0	
Fa0/0	65525	0	100.1.0.2/24	1	DR	1/1	

```
Fa2/0      65525 19      19.3.0.2/24      1      DR      1/1
Fa1/0      65525 52      52.2.0.2/24      1      DR      1/1
```

```
L-A-B--B#sh ip route
```

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

```
Gateway of last resort is not set
```

```
      19.0.0.0/8 is variably subnetted, 6 subnets, 2 masks
O      19.19.19.19/32 [110/3] via 19.3.0.1, 01:18:18, FastEthernet2/0
C      19.3.0.0/24 is directly connected, FastEthernet2/0
O      19.19.19.2/32 [110/2] via 19.3.0.1, 01:18:18, FastEthernet2/0
O      19.2.0.0/24 [110/2] via 19.3.0.1, 01:18:18, FastEthernet2/0
O      19.19.19.1/32 [110/4] via 19.3.0.1, 01:18:18, FastEthernet2/0
O      19.1.0.0/24 [110/3] via 19.3.0.1, 01:18:18, FastEthernet2/0
      100.0.0.0/8 is variably subnetted, 3 subnets, 2 masks
C      100.0.0.100/32 is directly connected, Loopback0
C      100.1.0.0/24 is directly connected, FastEthernet0/0
O      100.0.0.1/32 [110/2] via 100.1.0.1, 01:35:56, FastEthernet0/0
      52.0.0.0/8 is variably subnetted, 3 subnets, 2 masks
O      52.52.52.52/32 [110/2] via 52.2.0.1, 00:37:36, FastEthernet1/0
O      52.1.0.0/24 [110/2] via 52.2.0.1, 00:37:38, FastEthernet1/0
C      52.2.0.0/24 is directly connected, FastEthernet1/0
```

```
L-A-B--B#sh ip ospf
```

```
Routing Process "ospf 65525" with ID 100.0.0.100
Start time: 00:13:23.760, Time elapsed: 01:41:16.548
Supports only single TOS(TOS0) routes
Supports opaque LSA
Supports Link-local Signaling (LLS)
Supports area transit capability
It is an area border router
Router is not originating router-LSAs with maximum metric
Initial SPF schedule delay 5000 msec
Minimum hold time between two consecutive SPF's 10000 msec
Maximum wait time between two consecutive SPF's 10000 msec
Incremental-SPF disabled
Minimum LSA interval 5 secs
Minimum LSA arrival 1000 msec
LSA group pacing timer 240 secs
Interface flood pacing timer 33 msec
Retransmission pacing timer 66 msec
Number of external LSA 0. Checksum Sum 0x000000
```

```
Number of opaque AS LSA 0. Checksum Sum 0x000000
Number of DCbitless external and opaque AS LSA 0
Number of DoNotAge external and opaque AS LSA 0
Number of areas in this router is 3. 3 normal 0 stub 0 nssa
Number of areas transit capable is 0
External flood list length 0
  Area BACKBONE(0)
    Number of interfaces in this area is 2 (1 loopback)
    Area has no authentication
    SPF algorithm last executed 01:36:31.836 ago
    SPF algorithm executed 6 times
    Area ranges are
    Number of LSA 12. Checksum Sum 0x05B6E1
    Number of opaque link LSA 0. Checksum Sum 0x000000
    Number of DCbitless LSA 0
    Number of indication LSA 0
    Number of DoNotAge LSA 0
    Flood list length 0
  Area 19
    Number of interfaces in this area is 1
    Area has no authentication
    SPF algorithm last executed 01:18:54.912 ago
    SPF algorithm executed 9 times
    Area ranges are
    Number of LSA 13. Checksum Sum 0x064900
    Number of opaque link LSA 0. Checksum Sum 0x000000
    Number of DCbitless LSA 0
    Number of indication LSA 0
    Number of DoNotAge LSA 0
    Flood list length 0
  Area 52
    Number of interfaces in this area is 1
    Area has no authentication
    SPF algorithm last executed 00:38:13.544 ago
    SPF algorithm executed 10 times
    Area ranges are
    Number of LSA 14. Checksum Sum 0x071200
    Number of opaque link LSA 0. Checksum Sum 0x000000
    Number of DCbitless LSA 0
    Number of indication LSA 0
    Number of DoNotAge LSA 0
    Flood list length 0
```

L-A-B--B#

```
L-A-B--Z#
L-A-B--Z#
L-A-B--Z#
L-A-B--Z#
L-A-B--Z#
L-A-B--Z#sh run
Building configuration...

Current configuration : 2361 bytes
!
version 12.4
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname L-A-B--Z
!
boot-start-marker
boot-end-marker
!
!
no aaa new-model
memory-size iomem 5
!
!
ip cef
!
!
no ip domain lookup
!
username lab privilege 15 password 0 lab
!
!
!
!
interface Loopback0
 ip address 100.0.0.1 255.255.255.255
!
interface FastEthernet0/0
 ip address 100.1.0.1 255.255.255.0
 duplex auto
 speed auto
!
interface FastEthernet1/0
 no ip address
```

```
shutdown
duplex auto
speed auto
!
interface FastEthernet2/0
no ip address
shutdown
duplex auto
speed auto
!
interface FastEthernet3/0
no ip address
shutdown
duplex auto
speed auto
!
router ospf 65525
router-id 100.0.0.1
log-adjacency-changes
network 100.0.0.1 0.0.0.0 area 0
network 100.1.0.0 0.0.0.255 area 0
!
ip http server
ip forward-protocol nd
!
!
!
!
!
control-plane
!
alias exec crs copy run start
alias exec aaa sh run | i alias
alias exec c config t
alias exec siib show ip int brie
alias exec sir show ip route
alias exec sire show ip route eigrp
alias exec srso show run | section ospf
alias exec srsb show run | section bgp
alias exec srse show run | section eigrp
alias exec scn show cdp nei
alias exec scnd show cdp nei det
alias exec srs show run | sec
alias exec sri show run | i
alias exec sip show ip protocol
alias exec pv ping vrf
alias exec tv trace vrf
```

```

alias exec sion show ip ospf nei
alias exec siro show ip route ospf
alias exec siobr show ip ospf border-routers
alias exec siod show ip ospf database
alias exec siode show ip ospf database external
alias exec siodei show ip ospf database external | i
alias exec siodr show ip ospf database router
alias exec siodri show ip ospf database router | i
alias exec siodd show ip ospf database database
alias exec siodn show ip ospf database network
alias exec siodns show ip ospf database network self
alias exec siods show ip ospf database summary
alias exec siodsi show ip ospf database summary | i
alias exec sioda show ip ospf database asbr-sumary
alias exec sioib show ip ospf interface brief
alias exec sios show ip ospf stat
alias exec siot show ip ospf traffic

```

```

!
line con 0
  exec-timeout 0 0
  logging synchronous
line aux 0
line vty 0 4
  exec-timeout 120 0
  logging synchronous
  login local
line vty 5 15
  exec-timeout 120 0
  logging synchronous
  login local
!
end

```

```

L-A-B--Z#
L-A-B--Z#
L-A-B--Z#siib

```

Interface	IP-Address	OK?	Method	Status	Protocol
FastEthernet0/0	100.1.0.1	YES	manual	up	up
FastEthernet1/0	unassigned	YES	unset	administratively down	down
FastEthernet2/0	unassigned	YES	manual	administratively down	down
FastEthernet3/0	unassigned	YES	unset	administratively down	down
Loopback0	100.0.0.1	YES	manual	up	up

```
L-A-B--Z#sion
```

Neighbor ID	Pri	State	Dead Time	Address	Interface
100.0.0.100	1	FULL/DR	00:00:34	100.1.0.2	FastEthernet0/0

```
L-A-B--Z#sioib
```



Interface	PID	Area	IP Address/Mask	Cost	State	Nbrs	F/C
Lo0	65525	0	100.0.0.1/32	1	LOOP	0/0	
Fa0/0	65525	0	100.1.0.1/24	1	BDR	1/1	

L-A-B--Z#sh ip route

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

Gateway of last resort is not set

19.0.0.0/8 is variably subnetted, 6 subnets, 2 masks

- O IA 19.19.19.19/32 [110/4] via 100.1.0.2, 01:29:05, FastEthernet0/0
- O IA 19.3.0.0/24 [110/2] via 100.1.0.2, 01:37:52, FastEthernet0/0
- O IA 19.19.19.2/32 [110/3] via 100.1.0.2, 01:31:17, FastEthernet0/0
- O IA 19.2.0.0/24 [110/3] via 100.1.0.2, 01:31:07, FastEthernet0/0
- O IA 19.19.19.1/32 [110/5] via 100.1.0.2, 01:20:18, FastEthernet0/0
- O IA 19.1.0.0/24 [110/4] via 100.1.0.2, 01:28:47, FastEthernet0/0

100.0.0.0/8 is variably subnetted, 3 subnets, 2 masks

- O 100.0.0.100/32 [110/2] via 100.1.0.2, 01:37:53, FastEthernet0/0
- C 100.1.0.0/24 is directly connected, FastEthernet0/0
- C 100.0.0.1/32 is directly connected, Loopback0

52.0.0.0/8 is variably subnetted, 3 subnets, 2 masks

- O IA 52.52.52.52/32 [110/3] via 100.1.0.2, 01:35:08, FastEthernet0/0
- O IA 52.1.0.0/24 [110/3] via 100.1.0.2, 00:39:38, FastEthernet0/0
- O IA 52.2.0.0/24 [110/2] via 100.1.0.2, 01:37:55, FastEthernet0/0

L-A-B--Z#  
 L-A-B--Z#  
 L-A-B--Z#  
 L-A-B--Z#