

How MPLS OAM Works?

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MPLS OAM

Packet Format

Version Number		Must Be Zero	
Message Type	Reply Mode	Return Code	Return Subcode
Sender's Handle			
Sequence Number			
Timestamp Sent (seconds)			
Timestamp Sent (microseconds)			
Timestamp Received (seconds)			
Timestamp Received (microseconds)			
TLV ...			

MPLS OAM

Packet Format

- Version number: 1
- Message Type
 - MPLS Echo Request
 - MPLS Echo Reply
- Reply Mode
 - 1 Do not reply
 - 2 Reply via an IPv4/IPv6 UDP packet
 - 3 Reply via an IPv4/IPv6 UDP packet with Router Alert
 - 4 Reply via application level control channel
- Timestamp
 - Time-of-day in seconds and microseconds

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TTL Field in Labels

- Only the TTL field in the label at the top of the stack counts
- The outgoing TTL value is only a function of the incoming TTL value
- Outgoing TTL is one less than incoming TTL
- If outgoing TTL = 0, packet is not forwarded (not even stripped and forwarded as an IP packet)
- When an IP packet is first labelled, the TTL field is copied from the IP header to the MPLS header (after being decremented by 1)
- When the label stack is removed, the outgoing TTL value is copied to the TTL field in the IP header
 - Unless $\text{MPLS TTL} > \text{IP TTL}$

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MPLS Echo Request

```
R1#ping mpls ipv4 192.168.2.2/32 verbose
destination 127.0.0.2 repeat 1 exp 7 pad 0xFFFF
Sending 1, 100-byte MPLS Echos to 10.200.254.4/32,
    timeout is 2 seconds, send interval is 0 msec:
Codes: '!' - success, 'Q' - request not transmitted,
      '.' - timeout, 'U' - unreachable,
      'R' - downstream router but not target
Type escape sequence to abort.
!    Reply address 10.1.211.2, return code 3
```

Traceroute in MPLS VPN Network

LFIB (VRF 1)

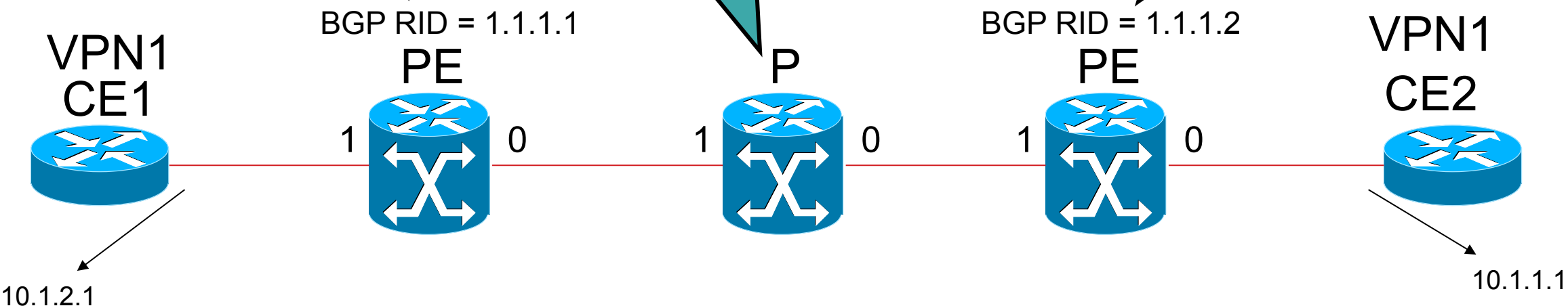
In label	prefix	Out interface	Out label
-	10.1.1.0/24	pos 0	26 32
31	10.1.2.0/24	pos 1	-

LFIB

In label	prefix	Out interface	Out label
26	1.1.1.1/32	pos 0	pop
29	1.1.1.2/32	pos 1	pop

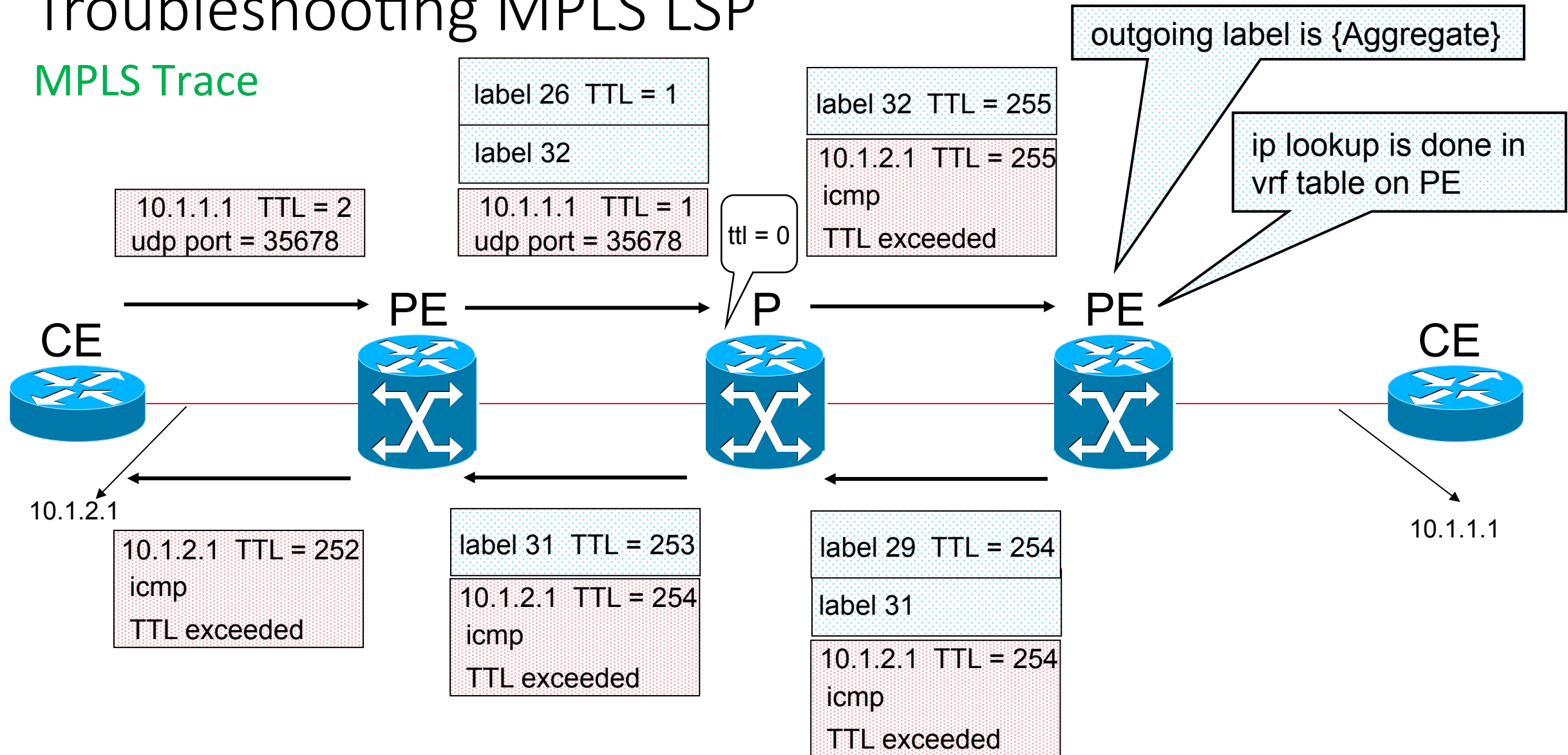
LFIB (VRF 1)

In label	prefix	Out interface	Out label
32	10.1.1.0/24	pos 0	-
-	10.1.2.0/24	pos 1	29 31



Troubleshooting MPLS LSP

MPLS Trace



MPLS OAM

MPLS Trace

- The ICMP messages “TTL exceeded” are forwarded along the LSP until the end of the LSP. So, the router does not lookup the source ip address in the global routing table to return the ICMP message.
- Reason : P routers do not have knowledge of VPN prefixes : all traceroutes initiated from within a VPN would fail
- ICMP messages are forwarded with EXP bits = 6

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MPLS Trace Hiding

- This command prohibits the copying of the TTL from the IP header to the MPLS shim header and vice versa (TTL is set to 255)
- It should be configured on the routers that do the label imposition (LSR edge routers), which is the PE routers.
- Providers like to use it so that the customers see the MPLS network as one hop when tracerouting

`no mpls ip propagate-ttl forwarded`

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MPLS Trace Hiding

```
CE1#traceroute 172.16.2.2 source 172.16.1.1
```

```
Type escape sequence to abort.
```

```
Tracing the route to 172.16.2.2
```

```
1 172.16.11.2 [AS 100] 3 msec 3 msec 3 msec —————→ local PE
2 10.1.111.11 [MPLS: Labels 19/24008 Exp 0] 122 msec 25 msec 19 msec —————→ P
3 10.1.211.2 [MPLS: Label 24008 Exp 0] 21 msec 16 msec 23 msec —————→ remote PE
4 172.16.12.1 [AS 100] 23 msec * 22 msec —————→ remote CE
```

(mpls ip propagate-ttl forwarded)

```
CE1#traceroute 172.16.2.2 source 172.16.1.1 (no mpls ip propagate-ttl forwarded)
```

```
Type escape sequence to abort.
```

```
Tracing the route to 172.16.2.2
```

```
VRF info: (vrf in name/id, vrf out name/id)
```

```
1 172.16.11.2 [AS 100] 4 msec 3 msec 3 msec —————→ local PE
2 10.1.211.2 [MPLS: Label 24008 Exp 0] 25 msec 25 msec 31 msec —————→ remote PE
3 172.16.12.1 [AS 100] 24 msec * 28 msec —————→ remote CE
```

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no mpls ip propagate-ttl on PE routers

