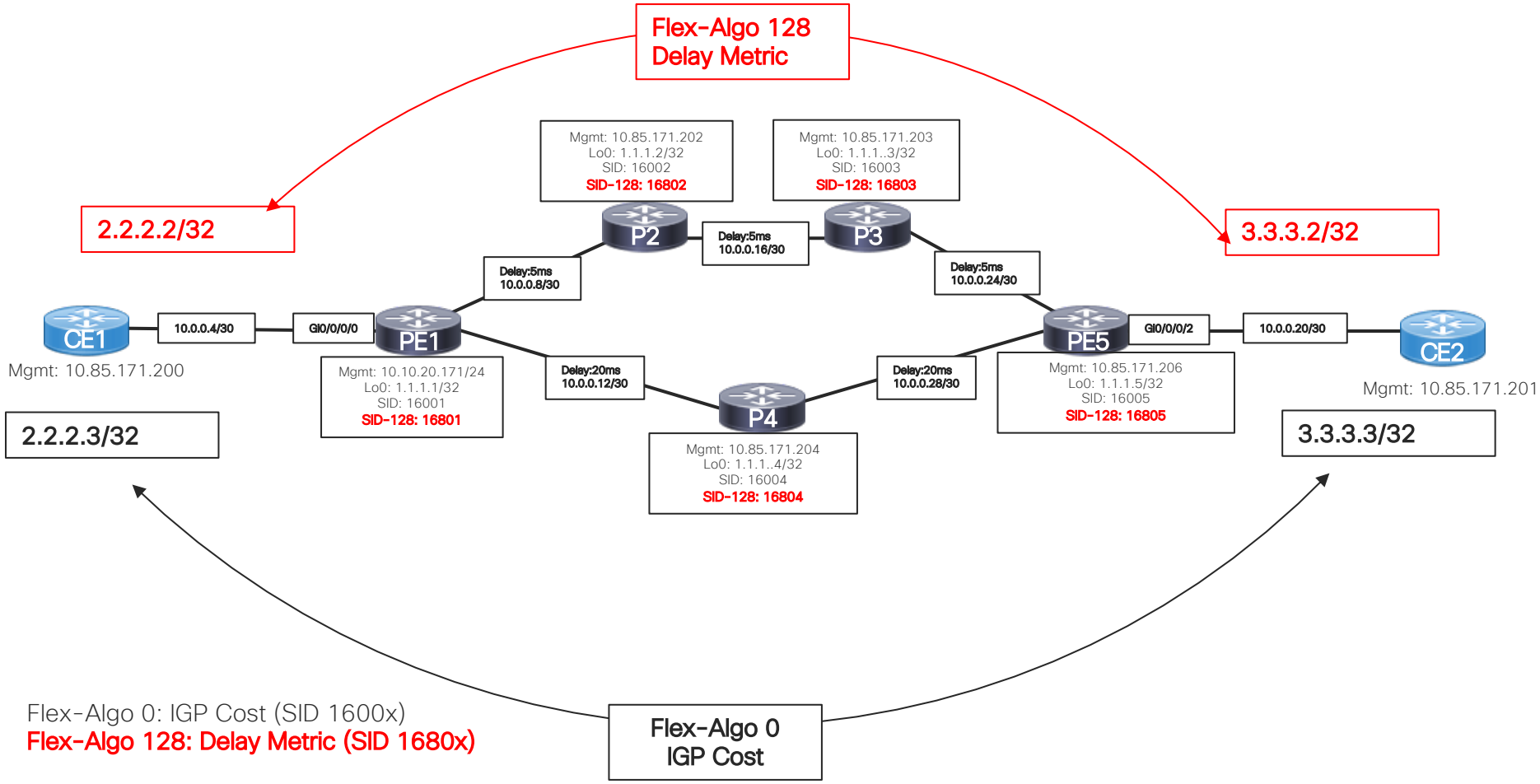


Flex-Algo 0: IGP Cost (SID 1600x)

Flex-Algo 128: Delay Metric (SID 1680x)

Configure Performance-Measurement on All Routers

```
RP/0/RP0/CPU0:pe1#sh run performance-
measurement
Mon Sep  7 17:59:07.402 UTC
performance-measurement
 interface GigabitEthernet0/0/0/2
  delay-measurement
   advertise-delay 5000
  !
 !
 interface GigabitEthernet0/0/0/3
  delay-measurement
   advertise-delay 20000
  !
 !
!
```

```
RP/0/RP0/CPU0:pe5#sh run performance-
measurement
Mon Sep  7 18:00:07.658 UTC
performance-measurement
 interface GigabitEthernet0/0/0/0
  delay-measurement
   advertise-delay 5000
  !
 !
 interface GigabitEthernet0/0/0/1
  delay-measurement
   advertise-delay 20000
  !
 !
!
```

Configure Flex-Algo (OSPF) on All Routers

```
RP/0/RP0/CPU0:pe1#sh run router ospf 1
Mon Sep  7 18:02:05.131 UTC
router ospf 1
 distribute link-state
 log adjacency changes
 segment-routing mpls
 area 0
  interface Loopback0
   passive enable
   prefix-sid absolute 16001
   prefix-sid algorithm 128 absolute 16801
  !
  interface GigabitEthernet0/0/0/2
   cost 1
  !
  interface GigabitEthernet0/0/0/3
   cost 1
  !
 !
 flex-algo 128
  metric-type delay
  advertise-definition
 !
!
```

Assign Flex-Algo 128 Prefix-SID to Looopback0

Create Flex-Algo 128 with delay as metric

Flex-Algo Validation

Flex-Algo 128

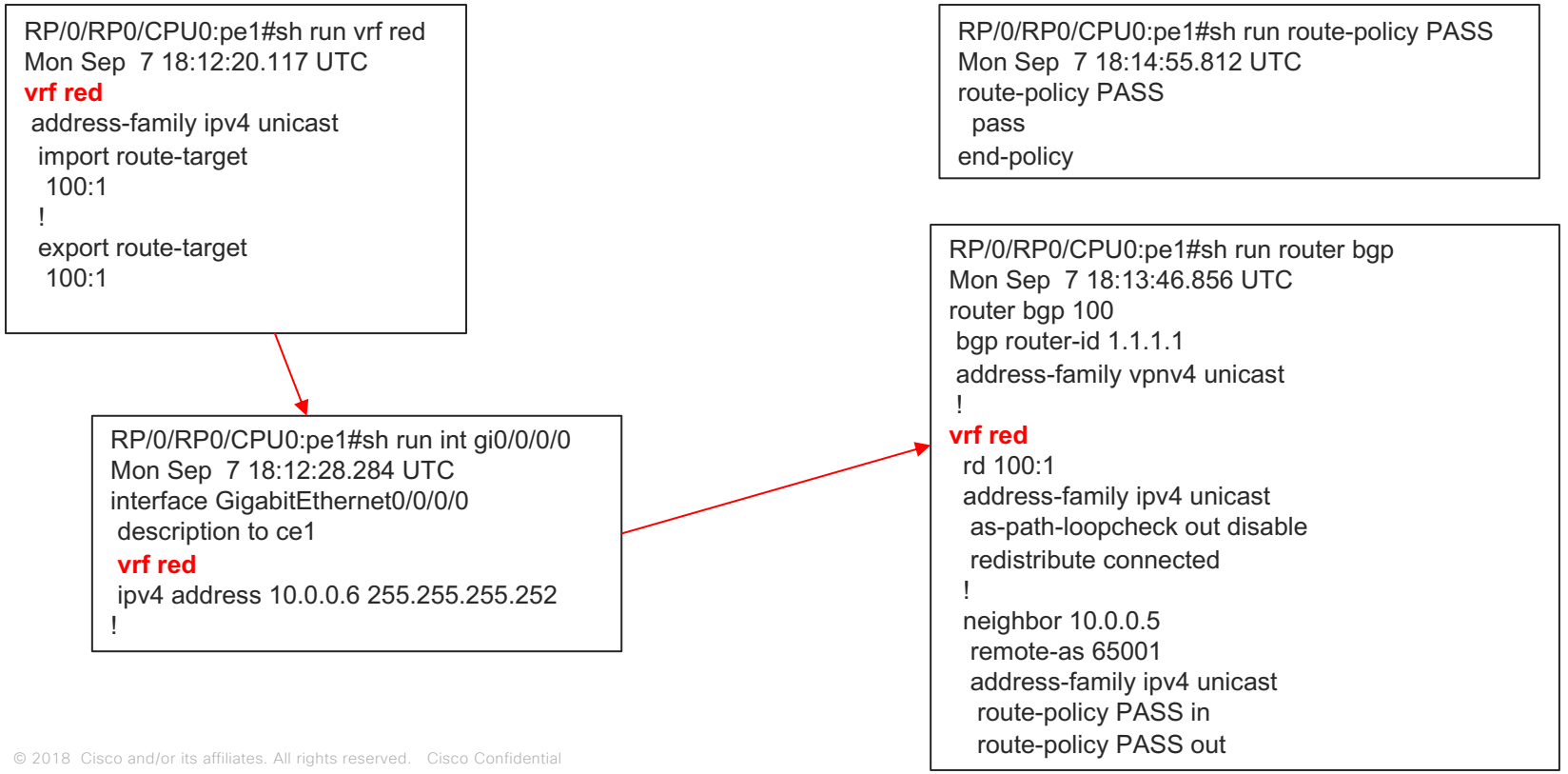
```
RP/0/RP0/CPU0:pe1#sh ospf routes flex-algo 128
Mon Sep  7 18:05:10.708 UTC

 Route Table of ospf-1 with router ID 10.0.0.6 (VRF default)

  Algorithm 128

 1.1.1.2/32, Metric 5001, SID 802, Label 16802
    10.0.0.9, from 10.0.0.9, via GigabitEthernet0/0/0/2
 1.1.1.3/32, Metric 10001, SID 803, Label 16803
    10.0.0.9, from 10.0.0.9, via GigabitEthernet0/0/0/2
 1.1.1.4/32, Metric 20001, SID 804, Label 16804
    10.0.0.13, from 10.0.0.13, via GigabitEthernet0/0/0/3
 1.1.1.5/32, Metric 15001, SID 805, Label 16805
    10.0.0.9, from 10.0.0.9, via GigabitEthernet0/0/0/2
```

Flex-Algo 0

```
RP/0/RP0/CPU0:pe1#sh ospf routes
Mon Sep  7 18:06:47.409 UTC

Topology Table for ospf 1 with ID 10.0.0.6

Codes: O - Intra area, O IA - Inter area
       O E1 - External type 1, O E2 - External type 2
       O N1 - NSSA external type 1, O N2 - NSSA external type 2

O    1.1.1.1/32, metric 1
     1.1.1.1, directly connected, via Loopback0, ifIndex 10
O    1.1.1.2/32, metric 2
     10.0.0.9, from 10.0.0.9, via GigabitEthernet0/0/0/2, ifIndex 8, path-id 1
O    1.1.1.3/32, metric 3
     10.0.0.9, from 10.0.0.18, via GigabitEthernet0/0/0/2, ifIndex 8, path-id 1
O    1.1.1.4/32, metric 2
     10.0.0.13, from 10.0.0.13, via GigabitEthernet0/0/0/3, ifIndex 9, path-id 1
O    1.1.1.5/32, metric 3
     10.0.0.13, from 10.0.0.26, via GigabitEthernet0/0/0/3, ifIndex 9, path-id 1
```

*** Notice that route to 1.1.1.5/32 takes different paths in each of the algorithms.

Create VPN red on PE towards CE



Color BGP Routes in VRF red on PE5

```
RP/0/RP0/CPU0:pe5#sh run | begin extcommunity
Mon Sep  7 18:16:54.976 UTC
Building configuration...
extcommunity-set opaque RED
  5001
end-set
```

```
RP/0/RP0/CPU0:pe5#sh run route-policy vpnv4
Mon Sep  7 18:17:36.950 UTC
route-policy vpnv4
  if destination in (3.3.3.2/32) then
    set extcommunity color RED
  else
    pass
  endif
end-policy
!
```

```
RP/0/RP0/CPU0:pe5#sh run router bgp
Mon Sep  7 18:18:26.854 UTC
router bgp 100
 bgp router-id 1.1.1.5
 address-family vpnv4 unicast
 !
 neighbor-group RR
  remote-as 100
  update-source Loopback0
  address-family vpnv4 unicast
   route-policy vpnv4 out
  !
 !
 neighbor 1.1.1.2
  use neighbor-group RR
 !
```

**Route 3.3.3.2/32 received on PE5 sent from CE2 will be colored with community 5001 when advertised to BGP peer 1.1.1.2.

Route Color Validation on PE1

```
RP/0/RP0/CPU0:pe1#sh bgp vrf red
Mon Sep  7 18:25:55.527 UTC
BGP VRF red, state: Active
BGP Route Distinguisher: 100:1

Status codes: s suppressed, d damped, h history, * valid, > best
              i - internal, r RIB-failure, S stale, N Nexthop-discard
Origin codes: i - IGP, e - EGP, ? - incomplete
   Network          Next Hop            Metric LocPrf Weight Path
Route Distinguisher: 100:1 (default for vrf red)
*> 2.2.2.2/32       10.0.0.5                 0             0 65001 i
*> 2.2.2.3/32       10.0.0.5                 0             0 65001 i
*>i3.3.3.2/32       1.1.1.5 C:5001           0    100      0 65001 i
*>i3.3.3.3/32       1.1.1.5                  0    100      0 65001 i
*> 10.0.0.4/30      0.0.0.0                  0         32768 ?
*>i10.0.0.20/30     1.1.1.5                  0    100      0 ?
*> 192.168.0.1/32   10.0.0.5                 0             0 65001 i
*>i192.168.0.2/32   1.1.1.5                  0    100      0 65001 i

Processed 8 prefixes, 8 paths
```

Assign BGP routes with Color 5001 to Flex-Algo 128 (SR ODN)

```
RP/0/RP0/CPU0:pe1#sh run segment-routing
Mon Sep  7 18:27:15.038 UTC
segment-routing
 traffic-eng
  on-demand color 5001
   dynamic
    sid-algorithm 128
   !
```

Validate SR-TE policy for prefix 3.3.3.2/32 on PE1

```
RP/0/RP0/CPU0:pe1#sh segment-routing traffic-eng policy
Mon Sep  7 18:29:52.742 UTC

SR-TE policy database
---------------------

Color: 5001, End-point: 1.1.1.5
  Name: srte_c_5001_ep_1.1.1.5
  Status:
    Admin: up  Operational: up for 01:25:22 (since Sep  7 17:04:30.792)
  Candidate-paths:
    Preference: 200 (BGP ODN) (active)
      Requested BSID: dynamic
      Constraints:
        Prefix-SID Algorithm: 128
        Maximum SID Depth: 10
      Dynamic (valid)
        Metric Type: TE,   Path Accumulated Metric: 0
          16805 [Prefix-SID: 1.1.1.5, Algorithm: 128]
```

Validate Paths on CE1

```
ce1#sh ip route bgp
Codes: L - local, 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, H - NHRP, l - LISP
       a - application route
       + - replicated route, % - next hop override, p - overrides from PfR

Gateway of last resort is 10.85.171.1 to network 0.0.0.0

      3.0.0.0/32 is subnetted, 2 subnets
B        3.3.3.2 [20/0] via 10.0.0.6, 2d20h
B        3.3.3.3 [20/0] via 10.0.0.6, 01:38:16
      10.0.0.0/8 is variably subnetted, 5 subnets, 3 masks
B        10.0.0.20/30 [20/0] via 10.0.0.6, 2d20h
      192.168.0.0/32 is subnetted, 2 subnets
B        192.168.0.2 [20/0] via 10.0.0.6, 2d20h
```

Path to 3.3.3.2 from CE1 using shortest delay path (Flex-Algo 128)

```
ce1#traceroute 3.3.3.2
Type escape sequence to abort.
Tracing the route to 3.3.3.2
VRF info: (vrf in name/id, vrf out name/id)
  1 10.0.0.6 [AS 100] 14 msec 5 msec 3 msec
  2 10.0.0.9 [MPLS: Labels 16805/24003 Exp 0] 208 msec 186 msec 190 msec
  3 10.0.0.18 [MPLS: Labels 16805/24003 Exp 0] 154 msec 5 msec 7 msec
  4 10.0.0.26 [MPLS: Label 24003 Exp 0] 10 msec 4 msec 7 msec
  5 10.0.0.21 [AS 100] 7 msec *  7 msec
```

Path to 3.3.3.3 from CE1 using shortest IGP path (Flex-Algo 0)

```
ce1#traceroute 3.3.3.3
Type escape sequence to abort.
Tracing the route to 3.3.3.3
VRF info: (vrf in name/id, vrf out name/id)
  1 10.0.0.6 [AS 100] 8 msec 6 msec 4 msec
  2 10.0.0.13 [MPLS: Labels 16005/24005 Exp 0] 192 msec 189 msec 194 msec
  3 10.0.0.30 [MPLS: Label 24005 Exp 0] 194 msec 193 msec 197 msec
  4 10.0.0.21 [AS 100] 195 msec *  204 msec
```