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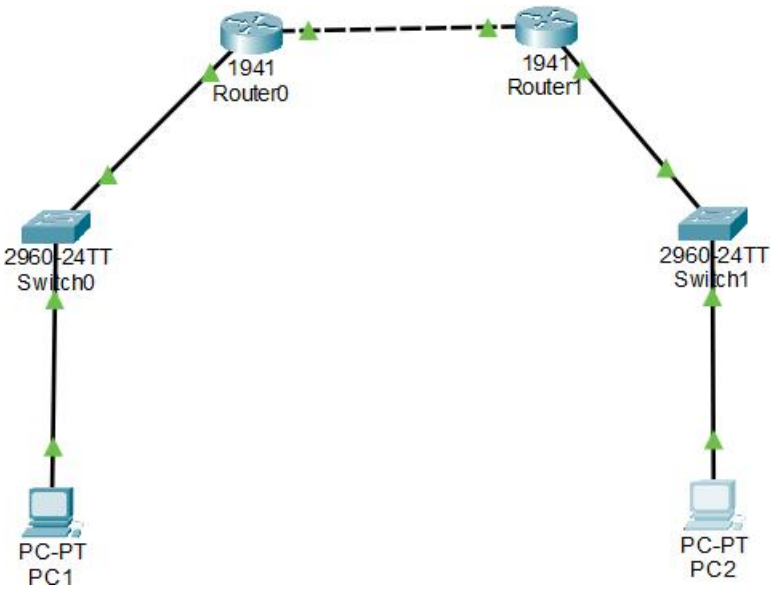
OSPF & BGP Dynamic Routing

OSPF




```
Router0_09010282327036>show ip route
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, 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

     10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       10.10.10.0/24 is directly connected, GigabitEthernet0/0
L       10.10.10.1/32 is directly connected, GigabitEthernet0/0
     192.168.10.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.10.0/24 is directly connected, GigabitEthernet0/1
L       192.168.10.1/32 is directly connected, GigabitEthernet0/1
O    192.168.20.0/24 [110/2] via 10.10.10.2, 00:49:57, GigabitEthernet0/0

Router0 09010282327025>
```

```
R1_090102823270 36>show ip route
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, 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

     10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       10.10.10.0/24 is directly connected, GigabitEthernet0/0
L       10.10.10.2/32 is directly connected, GigabitEthernet0/0
O    192.168.10.0/24 [110/2] via 10.10.10.1, 00:44:56, GigabitEthernet0/0
     192.168.20.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.20.0/24 is dire tly connected, GigabitEthernet0/1
L       192.168.20.1/32 is dire tly connected, GigabitEthernet0/1

R1_090102823270 25>
```

- PC1→PC2

```
C:\>ping 192.168.20.1

Pinging 192.168.20.1 with 32 bytes of data:

Reply from 192.168.20.1: bytes=32 time=10ms TTL=254
Reply from 192.168.20.1: bytes=32 time<1ms TTL=254
Reply from 192.168.20.1: bytes=32 time<1ms TTL=254
Reply from 192.168.20.1: bytes=32 time=10ms TTL=254

Ping statistics for 192.168.20.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 10ms, Average = 5ms

C:\>
```

- PC2→PC1

```
Ping statistics for 192.168.10.1:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\>ping 192.168.10.2

Pinging 192.168.10.2 with 32 bytes of data:

Reply from 192.168.10.2: bytes=32 time<1ms TTL=126
Reply from 192.168.10.2: bytes=32 time=11ms TTL=126
Reply from 192.168.10.2: bytes=32 time=11ms TTL=126
Reply from 192.168.10.2: bytes=32 time=13ms TTL=126

Ping statistics for 192.168.10.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 13ms, Average = 8ms

C:\>
```

Analisis Percobaan OSPF

Langkah-Langkah Percobaan

1. Membuat Topologi Jaringan
   - Menyusun jaringan dengan beberapa router yang saling terhubung untuk membentuk sebuah topologi tertentu.
2. Mengaktifkan OSPF
   - Mengonfigurasi protokol OSPF di masing-masing router dengan menggunakan perintah router ospf [process-id].
3. Mengatur Router ID
   - Setiap router diberikan Router ID yang unik sebagai identitas untuk membedakan router dalam jaringan OSPF.
4. Menambahkan Jaringan ke Protokol OSPF
   - Jaringan yang terhubung ke router dikonfigurasi ke dalam protokol OSPF menggunakan perintah network [IP address] [wildcard mask] area [area-id].
5. Melakukan Verifikasi Rute
   - Memastikan rute yang didapat melalui OSPF menggunakan perintah show ip route, untuk mengecek apakah konfigurasi sudah berjalan dengan benar.

Hasil dan Observasi

- OSPF mampu mempelajari rute secara otomatis dan mendistribusikannya ke seluruh router dalam jaringan.
- Protokol ini menunjukkan respon cepat dalam menangani perubahan topologi, seperti pemutusan atau pengaktifan kembali koneksi antar router.
- Konfigurasi area pada OSPF membantu mempercepat proses penghitungan jalur dan meningkatkan efisiensi komunikasi.

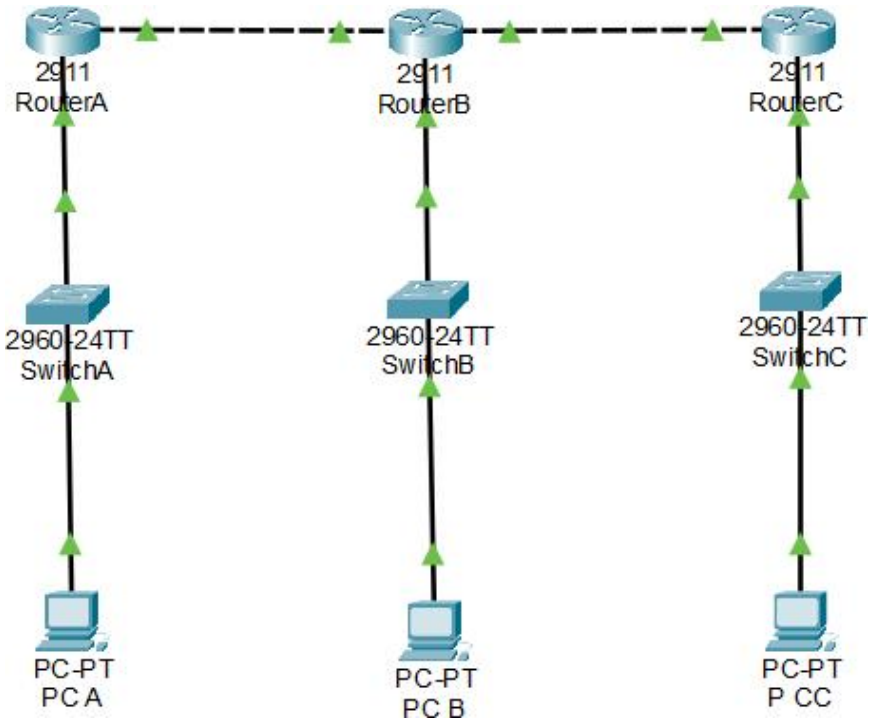
Kesimpulan

Protokol OSPF merupakan solusi yang handal untuk implementasi routing pada jaringan berskala besar dan kompleks. Beberapa keunggulan yang ditemukan meliputi:

1. Konvergensi Cepat
   - Kemampuan OSPF dalam merespon perubahan jaringan secara cepat menjaga stabilitas dan performa jaringan.
2. Manajemen Jaringan yang Efisien
   - Fitur pengelompokan jaringan ke dalam area mempermudah pengelolaan dan mengurangi beban sistem.
3. Pencegahan Masalah Looping
   - OSPF mengimplementasikan algoritma SPF (Shortest Path First) untuk memastikan jalur optimal sekaligus menghindari looping.
4. Kemampuan Skalabilitas Tinggi
   - Protokol ini cocok digunakan pada jaringan besar karena mampu menangani jumlah rute yang banyak tanpa mengorbankan kinerja.

Dengan keandalan dan fleksibilitasnya, OSPF menjadi pilihan yang sangat tepat untuk jaringan yang membutuhkan efisiensi, stabilitas, dan kemampuan adaptasi terhadap perubahan topologi.

BGP



- RouterA

```
RouterA_09010282327036>show ip route
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, 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

     10.0.0.0/8 is variably subnetted, 3 subnets, 2 masks
C       10.10.10.0/24 is directly connected, GigabitEthernet0/0
L       10.10.10.1/32 is directly connected, GigabitEthernet0/0
B       10.10.20.0/24 [20/0] via 10.10.10.2, 00:00:00
     192.168.10.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.10.0/24 is directly connected, GigabitEthernet0/1
L       192.168.10.1/32 is directly connected, GigabitEthernet0/1
B    192.168.20.0/24 [20/0] via 10.10.10.2, 00:00:00

RouterA_09010282327025>
```

- RouterB

```
RouterB_09010282327036>show ip route
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, 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

     10.0.0.0/8 is variably subnetted, 4 subnets, 2 masks
C       10.10.10.0/24 is directly connected, GigabitEthernet0/0
L       10.10.10.2/32 is directly connected, GigabitEthernet0/0
C       10.10.20.0/24 is directly connected, GigabitEthernet0/1
L       10.10.20.1/32 is directly connected, GigabitEthernet0/1
B    192.168.10.0/24 [20/0]  via 10.10.10.1, 00:00:00
     192.168.20.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.20.0/24 is directly connected, GigabitEthernet0/2
L       192.168.20.1/32 is directly connected, GigabitEthernet0/2

RouterB 09010282327025>
```

- Router3

```
Router3_09010282327036#show ip route
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, 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

     192.168.20.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.20.0/24 is directly connected, GigabitEthernet0/0
L       192.168.20.2/32 is directly connected, GigabitEthernet0/0
     192.168.30.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.30.0/24 is directly connected, GigabitEthernet0/1
L       192.168.30.1/32 is directly connected, GigabitEthernet0/1

Router3_09010282327025#
```

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.20.2

Pinging 192.168.20.2 with 32 bytes of data:

Request timed out.
Reply from 192.168.20.2: bytes=32 time<1ms TTL=126
Reply from 192.168.20.2: bytes=32 time=11ms TTL=126
Reply from 192.168.20.2: bytes=32 time=13ms TTL=126

Ping statistics for 192.168.20.2:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 13ms, Average = 8ms
```

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.10.2

Pinging 192.168.10.2 with 32 bytes of data:

Reply from 192.168.10.2: bytes=32 time=11ms TTL=126
Reply from 192.168.10.2: bytes=32 time=13ms TTL=126
Reply from 192.168.10.2: bytes=32 time=14ms TTL=126
Reply from 192.168.10.2: bytes=32 time=14ms TTL=126

Ping statistics for 192.168.10.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 11ms, Maximum = 14ms, Average = 13ms
```

```
C:\>ping 192.168.20.2

Pinging 192.168.20.2 with 32 bytes of data:

Reply from 192.168.20.2: bytes=32 time<1ms TTL=255
Reply from 192.168.20.2: bytes=32 time=1ms TTL=255
Reply from 192.168.20.2: bytes=32 time<1ms TTL=255
Reply from 192.168.20.2: bytes=32 time<1ms TTL=255

Ping statistics for 192.168.20.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>
```

Analisis Percobaan

Percobaan ini bertujuan untuk memahami konfigurasi dan mekanisme kerja BGP dalam menentukan jalur antar-Autonomous System (AS). BGP menggunakan atribut seperti AS Path, Local Preference, dan MED untuk menentukan rute terbaik. Setelah konfigurasi dilakukan, router bertukar informasi rute dengan tetangga (neighbor) dan memilih jalur optimal sesuai kebijakan yang telah ditetapkan.

Kesimpulan

BGP adalah protokol yang andal untuk routing antar-AS, dengan kemampuan skalabilitas yang tinggi dan fleksibilitas dalam pengelolaan kebijakan routing. Walaupun proses konvergensinya cenderung lebih lambat, BGP tetap menjadi pilihan utama untuk jaringan besar dan kompleks yang memerlukan kontrol penuh terhadap pemilihan jalur.