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# Fast Convergence and Load Splitting



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# Benefits of Sub-second Convergence

- The scalability components improve on the efficiency of handling increases (or decreases) in service users (receivers) and service load (sources or content).
- New algorithms and processes (such as aggregated join messages, which deliver up to 1000 individual messages in a single packet) reduce the time to reach convergence by a factor of 10.
- Multicast subsecond convergence improves service availability for large multicast networks.
- Multicast users such as financial services firms and brokerages receive better quality of service (QoS), because multicast functionality is restored in a fraction of the time previously required.

# Multicast Convergence IOS Infrastructure

- PIM Router Query Messages

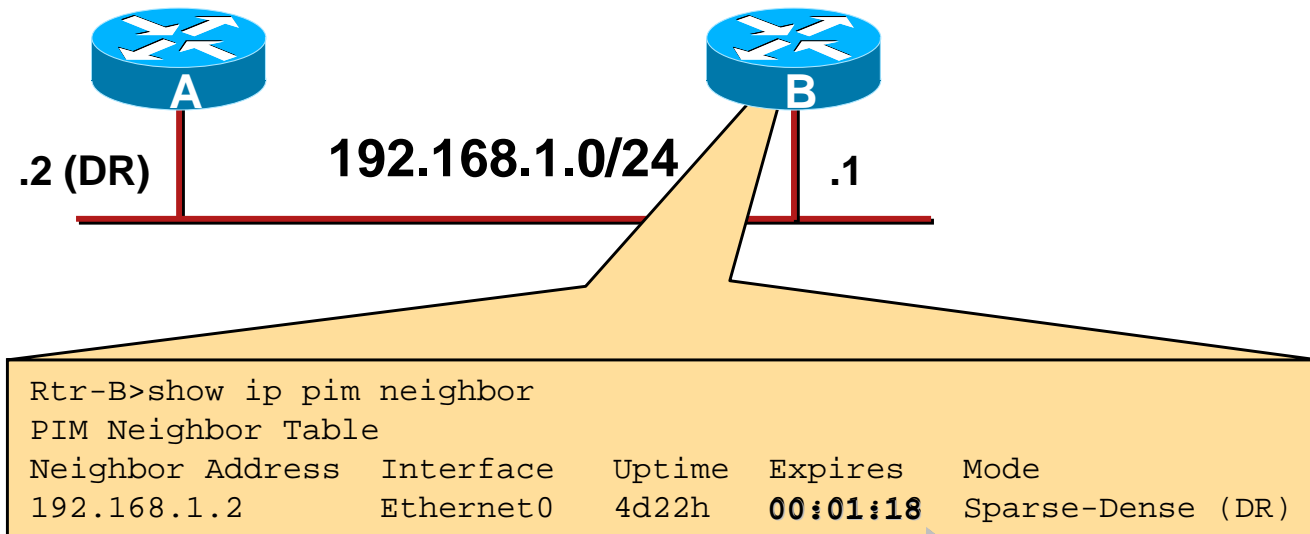
PIM router query messages (PIM hellos) even every few milliseconds

- Triggered RPF Check

RPF check triggered by changes in unicast topology. Periodic RPF check can be set to relatively high values (~ sec) w/o impact on convergence.

- Topology Changes and Multicast Routing Recovery

# DR Failover



- **Depends on neighbor expiration time**
- **Expiration Time sent in PIM query messages**  
Expiration time = 3 x <query-interval>  
Default <query-interval> = 30 seconds  
DR Failover ~ 90 seconds (worst case) by default

# Tuning DR Failover

- Tune PIM query interval

Use interface configuration command

```
ip pim query-interval <period> [msec]
```

Default <period> = seconds

“msec” keyword available beginning with 12.1(11b)E

Permits DR failover to be adjusted

Sub-second DR failover possible

Smaller intervals increase PIM query traffic

Increase is usually insignificant

# RPF Check Interval and Backoff

- Tuning periodic RPF check interval

```
ip multicast rpf interval seconds [list access-  
list | route-map route-map]
```

Default interval 10 seconds

- Back-off mechanism can be adjusted in unstable topologies

```
ip multicast rpf backoff minimum maximum [disable]
```

Default values 500 msec (min) and 5 seconds (max)

# Summary

- IP multicast

All failures / topology changes are corrected by re-converging the trees

Re-convergence time is sum of:

- Failure detection time (only for failure cases)

- Unicast routing re-convergence time

- ~ #Multicast-trees PIM re-convergence time

Possible

- ~ minimum of 200 msec initial

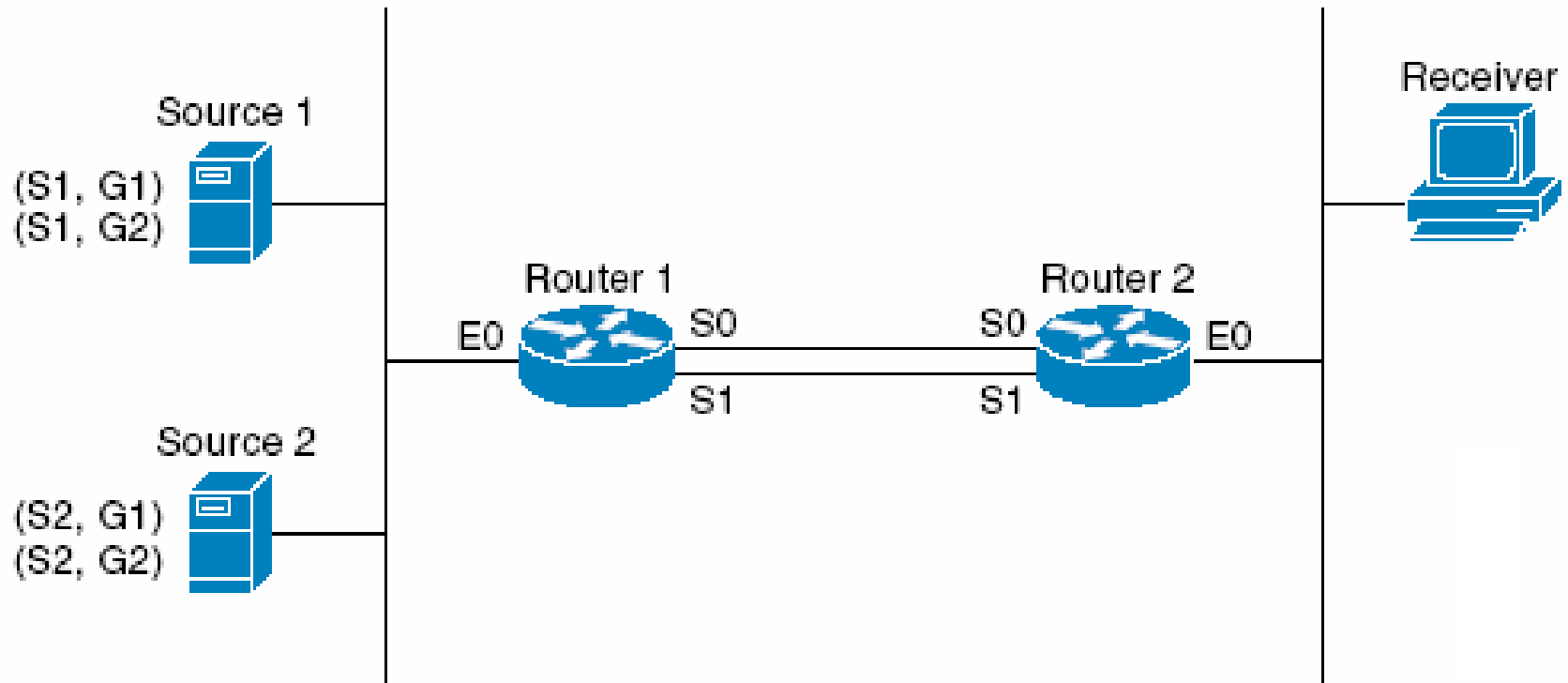
- ~ 500 ... 4000 trees convergence/sec

- Same behavior with mLDP

# Multicast Load-Splitting over ECMP

- multicast traffic can be split with pseudorandom distribution over ECMP towards RP for (\*,G) or source for (S,G) based on hash algorithm
- disabled by default, highest IP address PIM neighbor (RPF next-hop) is used
- load-splitting efficiency depends on number of multicast states
- can be affected by PIM Assert process for dense mode and bi-dir
- can be affected by PIM Assert process in SM and SSM if not configured consistently

# Default PIM Behavior



# ECMP Load-Splitting Algorithms

- highest PIM neighbor
- ECMP multicast load splitting method based on source address (S-hash)

```
ip multicast multipath
```

- ECMP Multicast Load Splitting Based on Source and Group Address (S,G-hash)

```
ip multicast multipath s-g-hash basic
```

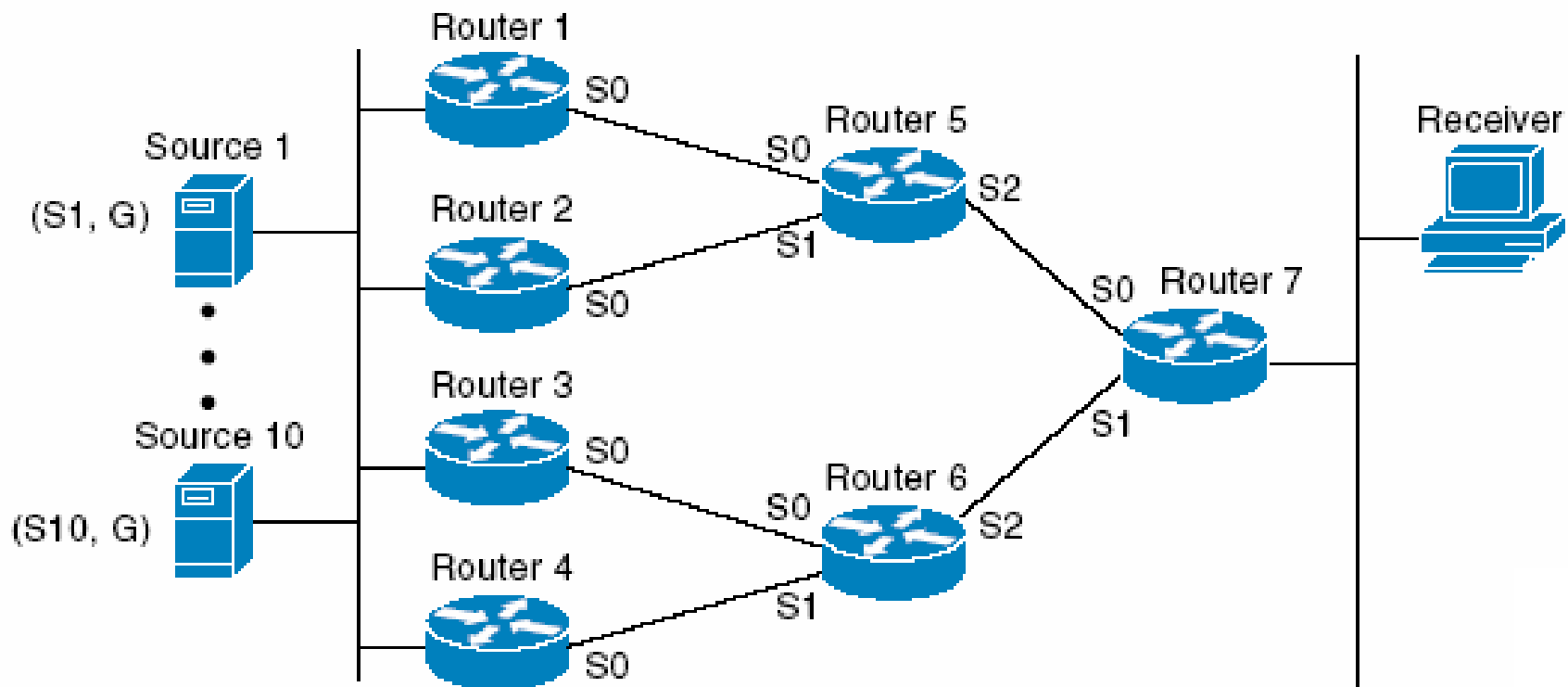
available in 12.2(33)SRB and subsequent releases

- ECMP Multicast Load Splitting Based on Source, Group, and Next-Hop Address (S,G,NHT-hash)

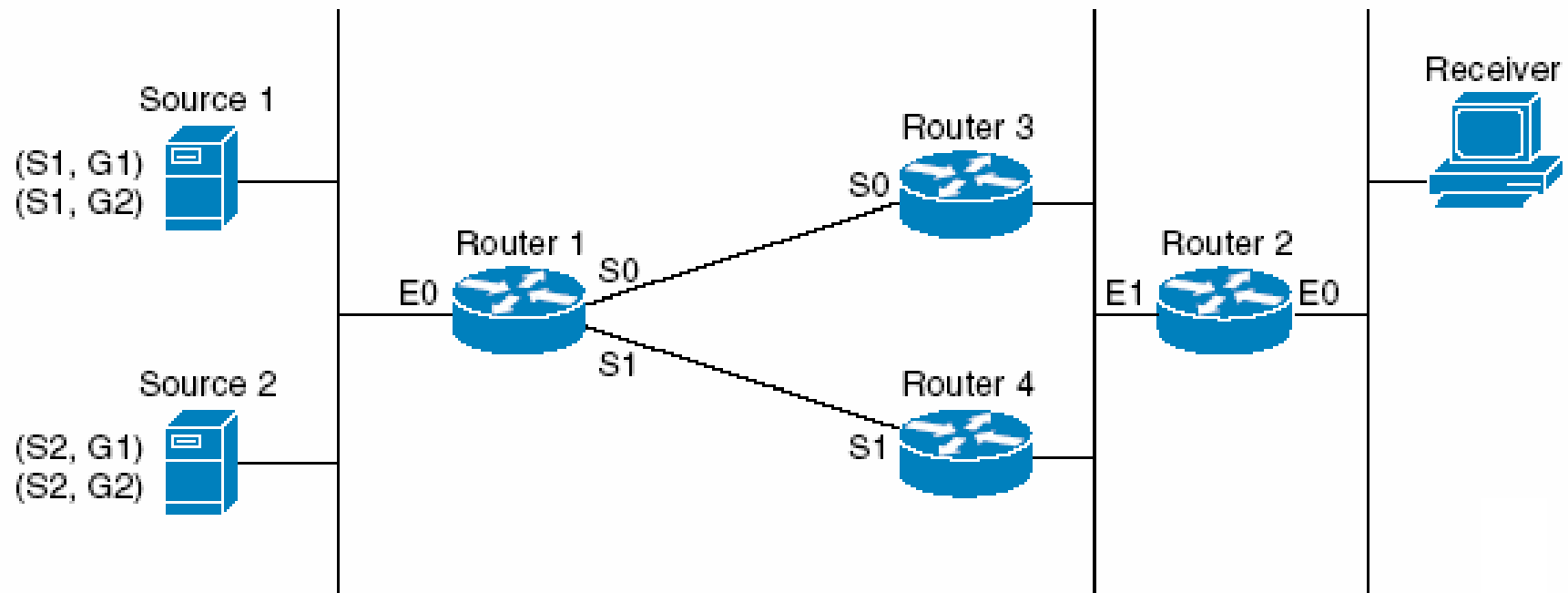
```
ip multicast multipath s-g-hash next-hop-based
```

available in 12.2(33)SRB and subsequent releases

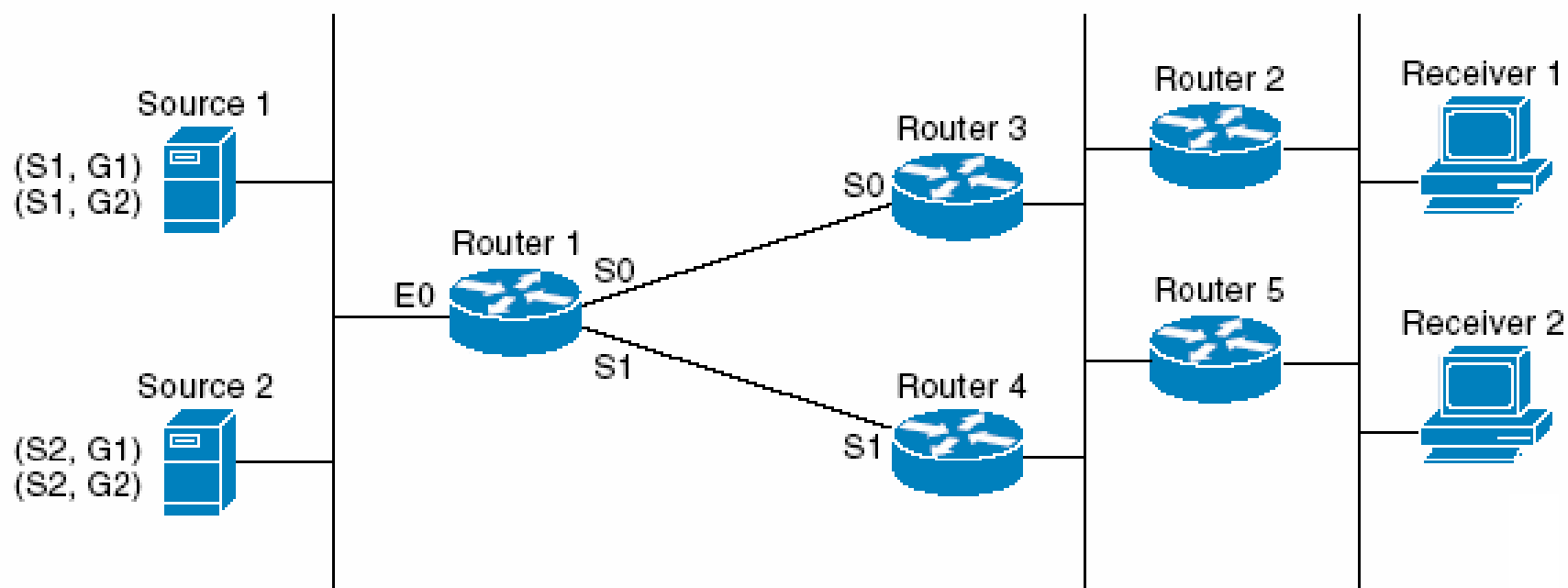
# Polarization Topology



# Load Splitting and Assert Process



# Load Splitting and Assert Process



# Useful Documents

- Multicast Sub-second Convergence

[http://www.cisco.com/en/US/docs/ios/ipmulti/configuration/guide/imc\\_sub2nd\\_conv\\_g\\_ps6441\\_TSD\\_Products\\_Configuration\\_Guide\\_Chapter.html](http://www.cisco.com/en/US/docs/ios/ipmulti/configuration/guide/imc_sub2nd_conv_g_ps6441_TSD_Products_Configuration_Guide_Chapter.html)

- Multicast Load-Splitting

[http://www.cisco.com/en/US/docs/ios/ipmulti/configuration/guide/imc\\_load\\_splt\\_ecmp\\_ps6441\\_TSD\\_Products\\_Configuration\\_Guide\\_Chapter.html](http://www.cisco.com/en/US/docs/ios/ipmulti/configuration/guide/imc_load_splt_ecmp_ps6441_TSD_Products_Configuration_Guide_Chapter.html)

# Q & A



