Multicast geo-distribution control
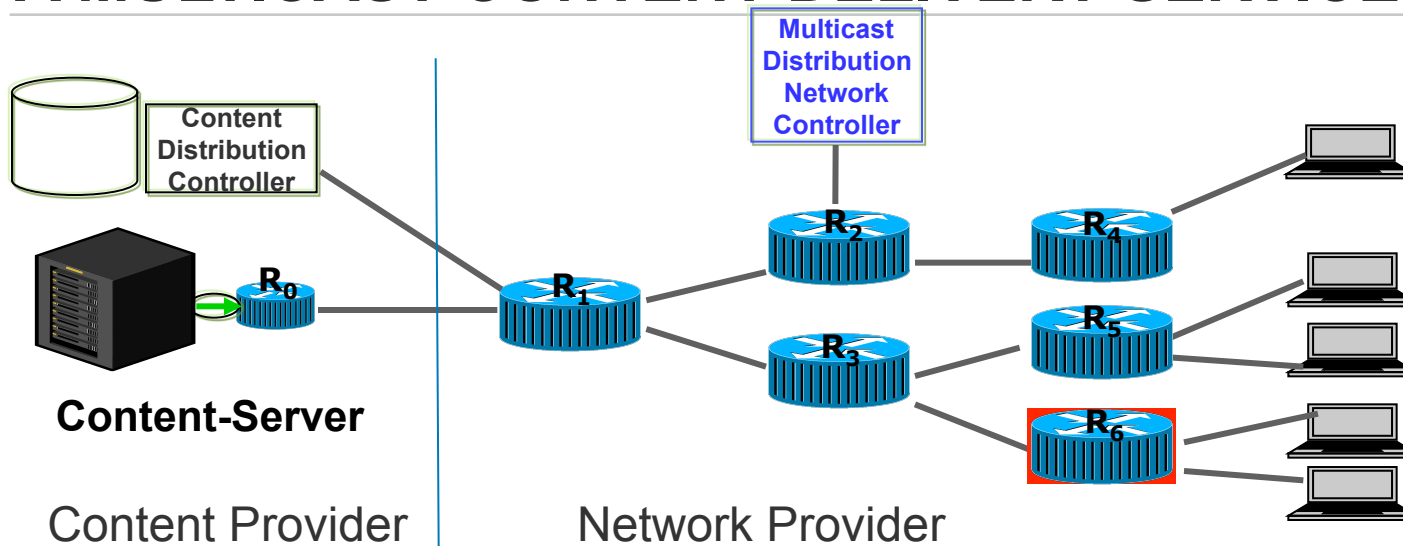## draft-rekhter-geo-distribution-control-03

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A MULTICAST CONTENT DELIVERY SERVICE MODEL

Content Distribution Controller (CDC)

- Apply content-access policy

- Determine content delivery method (e.g. multicast vs. unicast)
  Multicast Distribution Network Controller (MDNC)
- Determine, maintain, and communicate a global-view of multicast distribution access footprint
- Maintain and distribute multicast-distribution restriction policies (stipulated by CDCs) to Multicast Edge Routers
  Edge Routers (ERs)
- Network access routers of the IP Network infrastructure (R_4, R_5, R_6 in following diagrams)
- Multicast capable Ers are responsible for enforcing multicast-distribution restriction policies

TWO PROBLEMS TO BE SOLVED

Ability of content-provider to determine content-receiver network destination areas where multicast-delivery option is available at a given current time period.

Ability of content-provider to restrict multicast delivery of a given content on a designated multicast channel (S,G) to exclude a set of content-receiver network destination areas

- This is to support compliance with geo-restriction ("black-out") requirements that frequently exist for certain categories of live-event content distribution

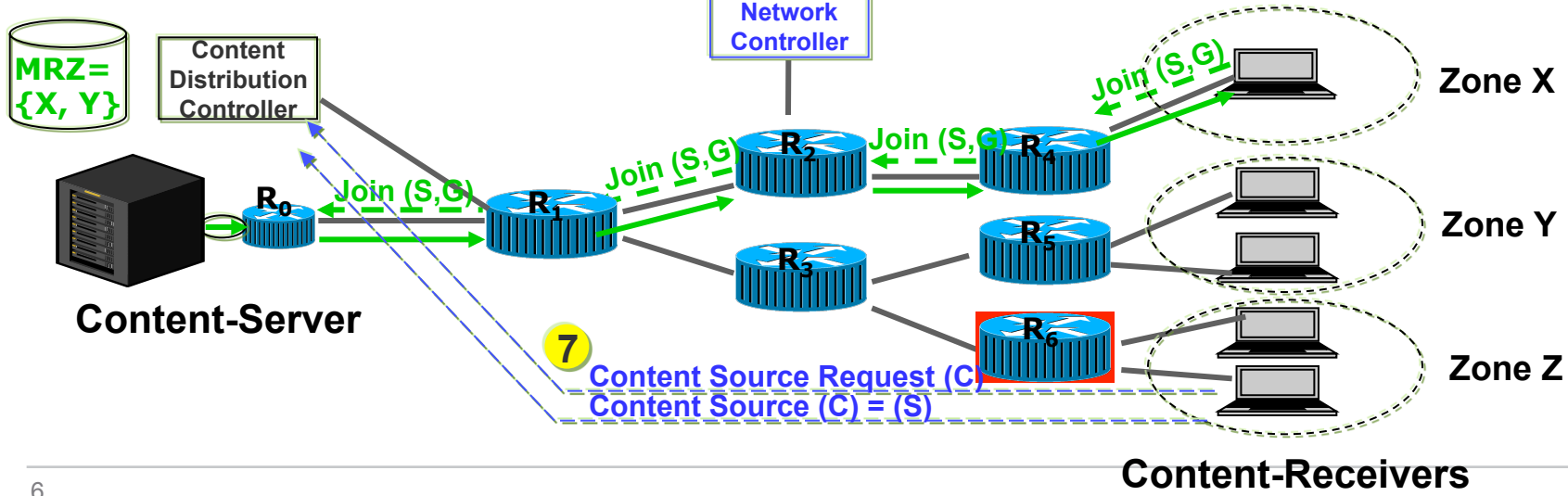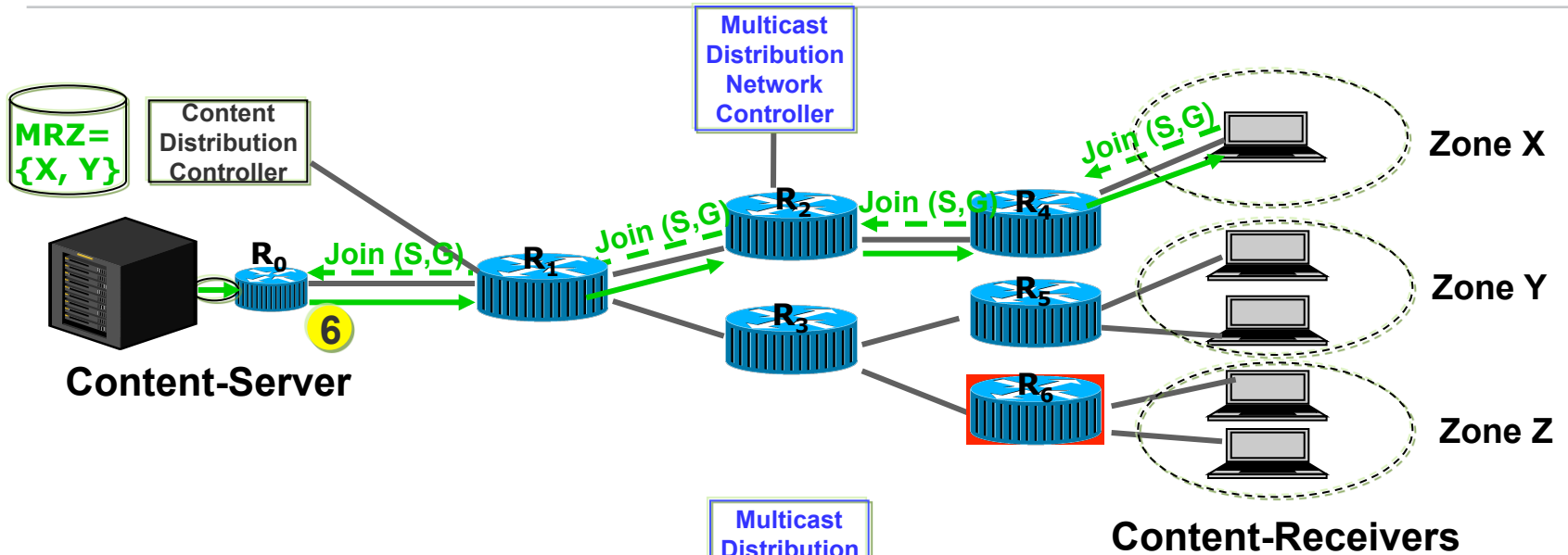# MULTICAST DISTRIBUTION REACHABILITY SIGNALING
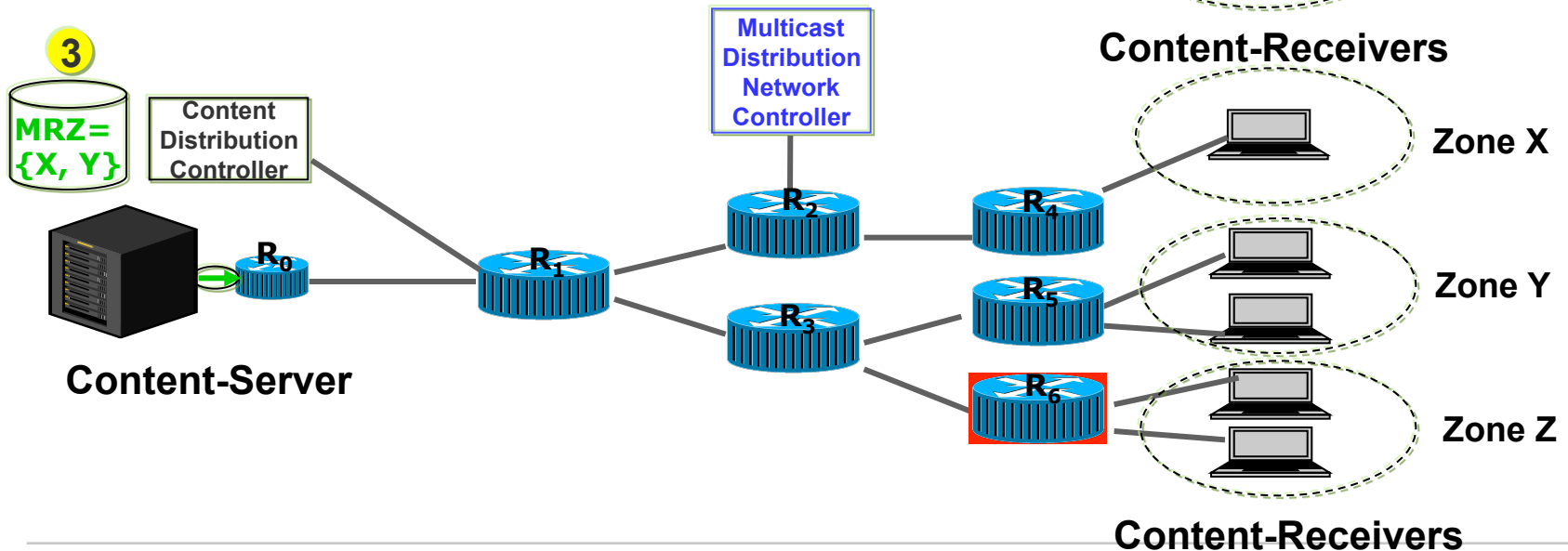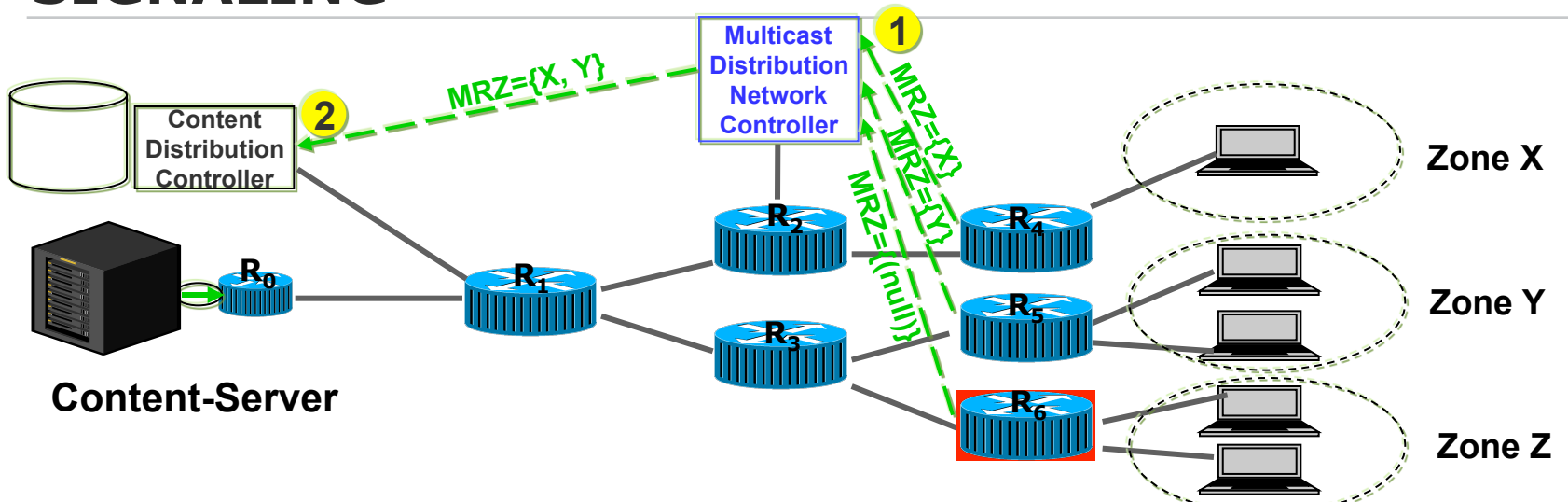
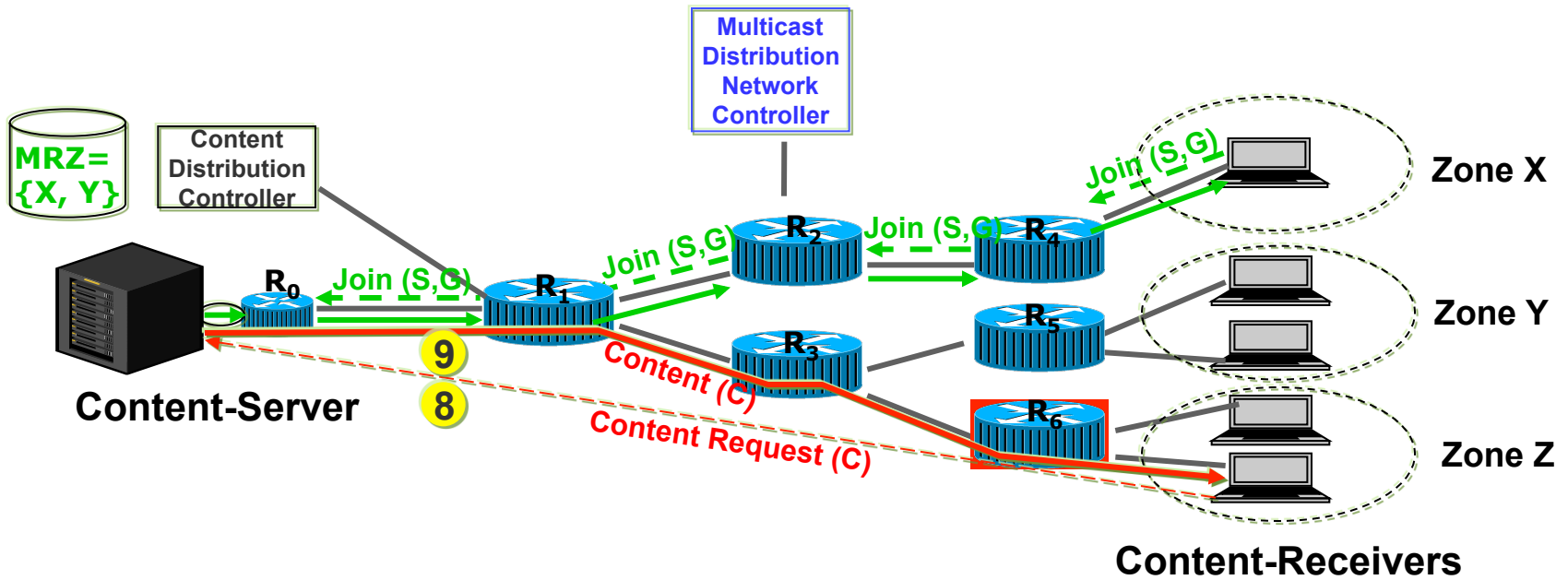# MULTICAST DISTRIBUTION REACHABILITY CONTROL
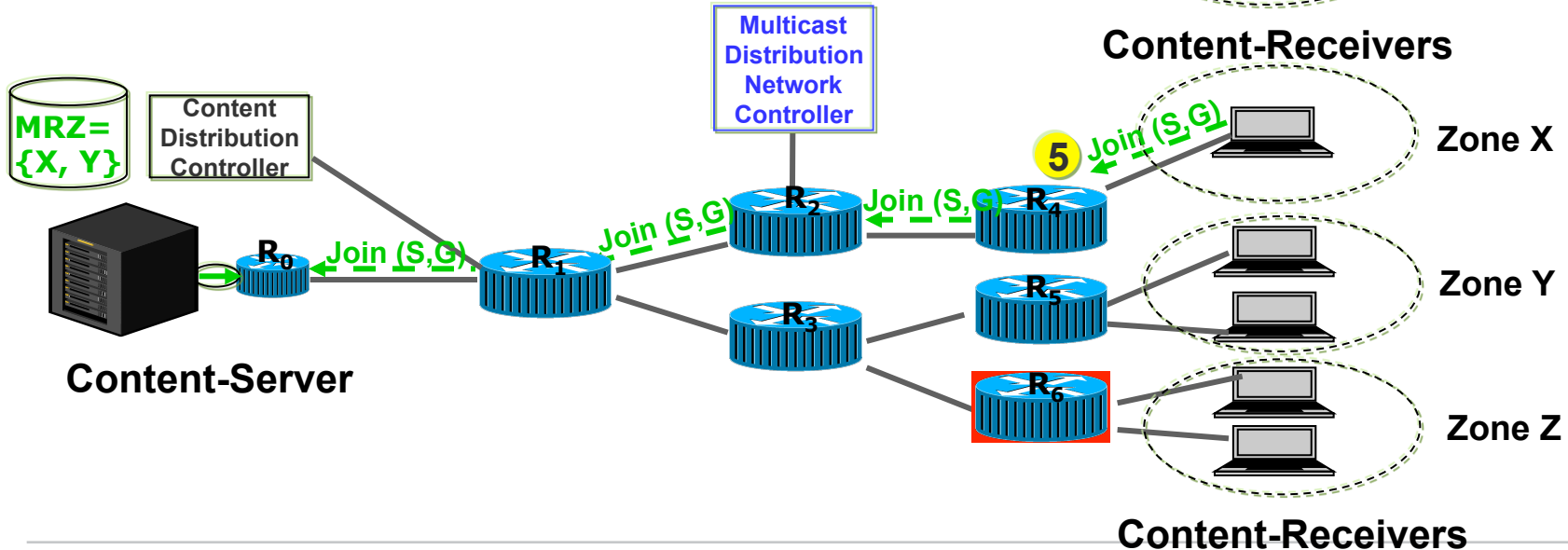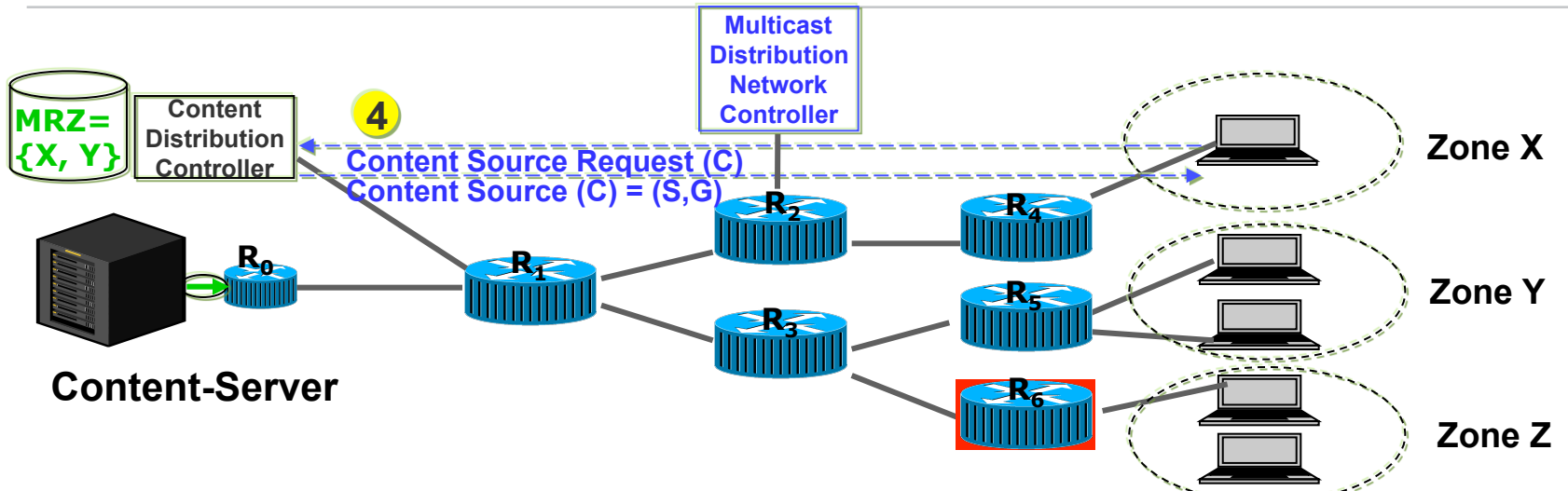
MULTICAST DISTRIBUTION REACHABILITY CONTROL

MULTICAST DISTRIBUTION REACHABILITY CONTROL

MULTICAST DISTRIBUTION REACHABILITY SIGNALING

(Refer to charts in slides #4~7)

- Each ER (R_4, R_5, R_6) is aware of the multicast reachability status for each subscriber ("content receiver") zone (IP destination prefix) that it serves
    - It's permissible that an ER might have a mixture of some multicast-enabled zones and some non multicast enabled

1 • Each ER announces ("signals") to the MDNC its list of multicast-enabled zones

2 • The MDNC maintains the list of all multicast-enabled zones in the network and announces the list to CDCs of CP/CDN customers who subscribe to content-multicast services

3 • The CDC keeps this list for use in selecting content distribution method in response to requests for content it manages

MULTICAST DISTRIBUTION REACHABILITY SIGNALING

(Refer to charts in slide #4~7)

4 ▪ The CDC selects an available multicast-channel (S,G) for multicast distribution of Content C

▪ In response to a request for Content C from a user in zone X which is multicast-enabled the CDC returns the multicast channel (S,G) as the "source address" for the content

5 ▪ The user issues a multicast Join (S,G) message to its serving ER R_1.
6 and receives a replicated multicasted copy of C from the network

▪ In response to a request for Content C from a user in zone Z which
7 is not multicast-enabled the CDC returns the unicast address S as the "source address" for the content

▪ The user issues a content request to source S.
8 and receives a replicated unicasted copy of C from server S
9

MULTICAST DISTRIBUTION EXCLUSION SIGNALING

Content-Server

Content-Receivers

Zone X

Zone Y

Zone Z
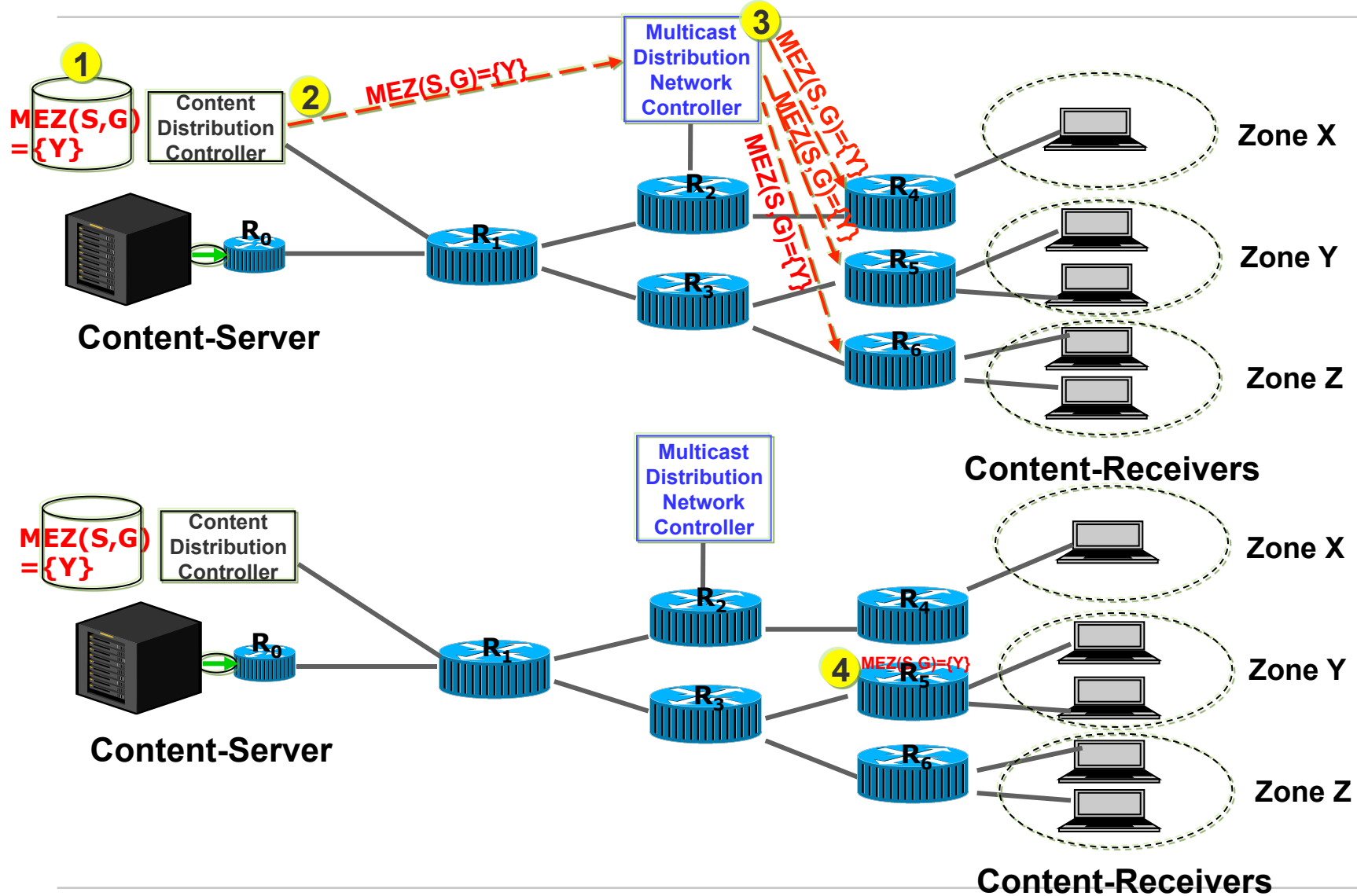
MULTICAST DISTRIBUTION EXCLUSION CONTROL

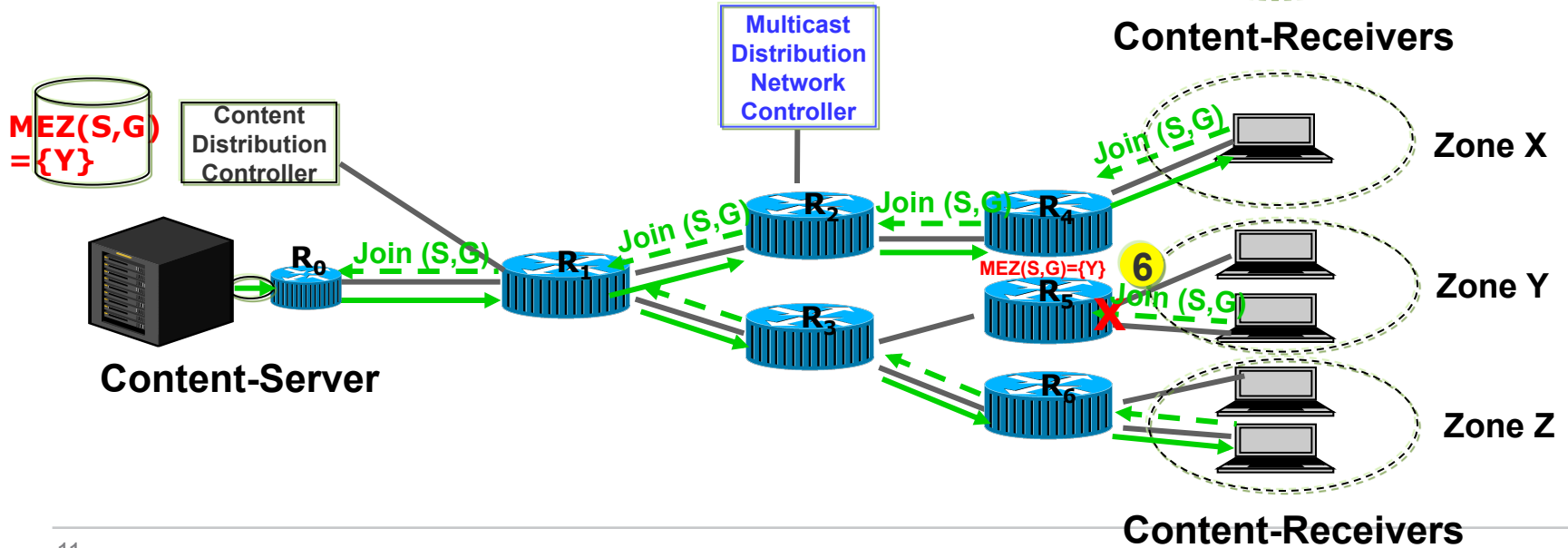# MULTICAST DISTRIBUTION EXCLUSION SIGNALING

MULTICAST DISTRIBUTION EXCLUSION SIGNALING
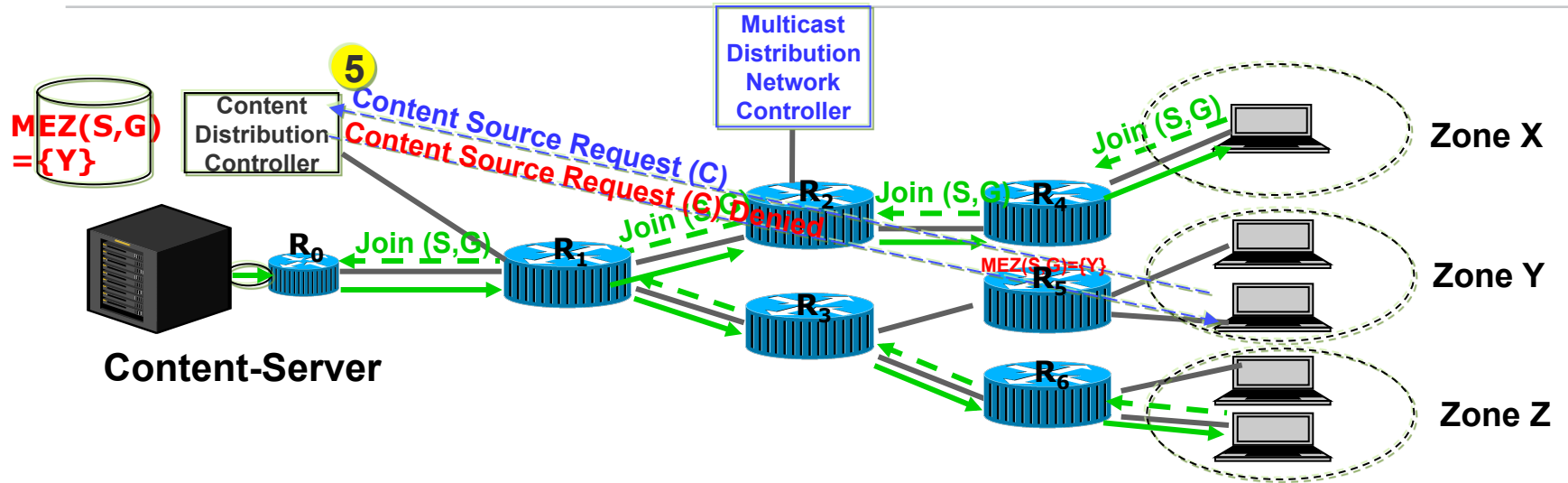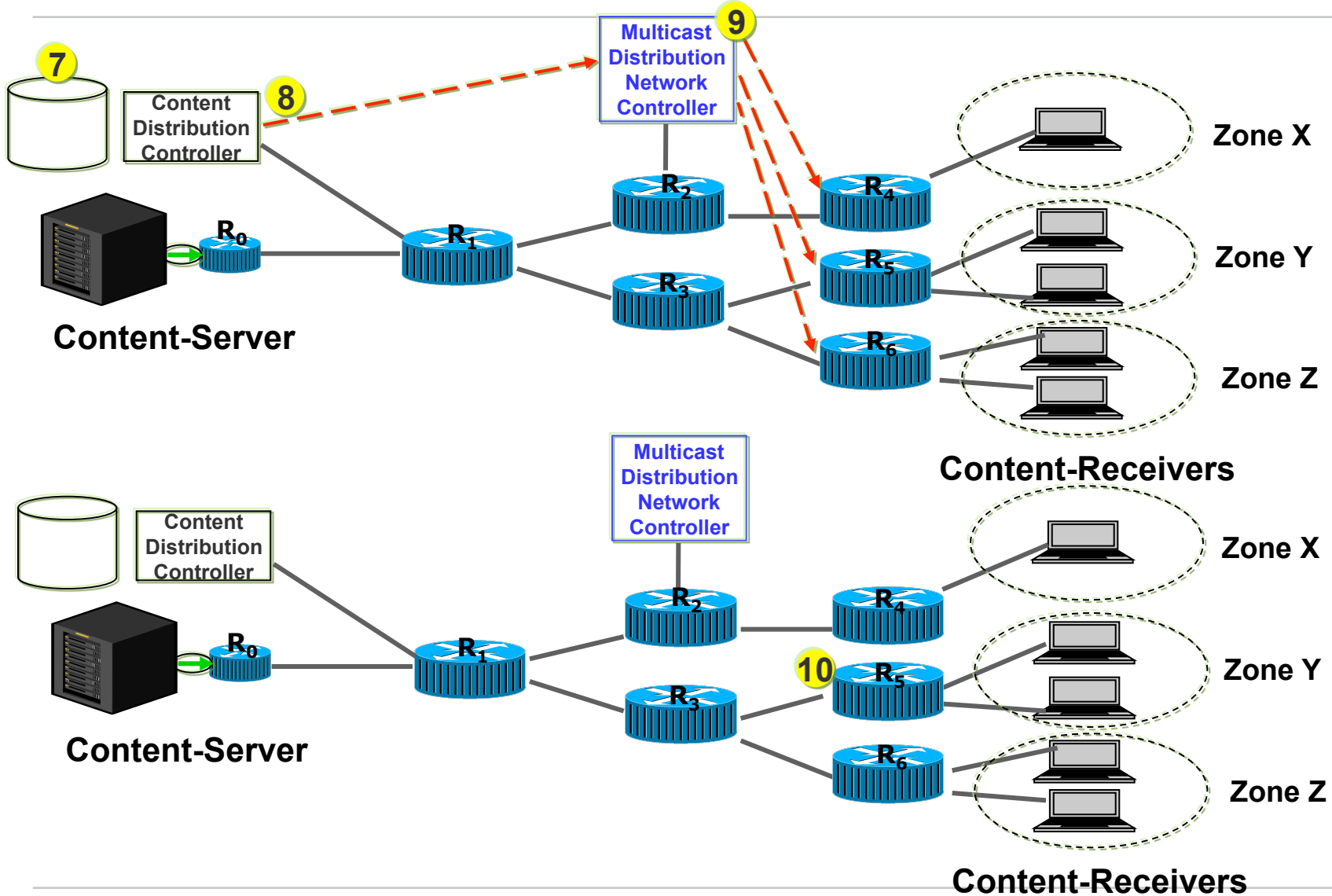
(Refer to charts in slides #10~12)

- The CDC selects an available multicast-channel (S,G) for multicast distribution of Content C

(1) - Assuming that Content C has geo-restriction rule that excludes zone Y from receiving the Content C, the CDC links this exclusion policy to multicast channel (S,G) as long as this channel is being used to distributes C

(2) - The CDC announces ("signals") the exclusion policy for (S,G) to the MDNC

(3) - The MDNC distributes the exclusion policy to the (multicast enabled) ERs

  - For signaling processing efficiency, the MDNC can limit the distribution of a given exclusion policy to those ERs serving the zones affected by that policy

(4) - ER R_5 which is the serving access router for zone Y records the exclusion rule for enforcement

MULTICAST DISTRIBUTION EXCLUSION SIGNALING

(Refer to charts in slides #10~12)

5 ▪ The CDC denies any request for Content C from any user in exclusion zone Y

6 ▪ ER R_5 will ignore Join (S,G) messages from any user in exclusion zone Y who attempts to access Content C by learning about (S,G) through illegitimate means and issuing an Join (S,G) message to the network

7 ▪ When multicast channel (S,G) is no longer used for C, the CDC removes the exclusion policy on (S,G),   and signals to the MDNC

8 ▪ The MDNC withdraws the exclusion policy in its signaling to the (multicast enabled) ERs

9 ▪ ER R_5 which is the serving access router for zone Y removes the exclusion rule from enforcement

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STATUS & REQUEST

draft-rekhter-geo-distribution-control-00 now split into the following three:

- draft-rekhter-geo-distribution-control-03
  - General problem & proposal description
  - Seeking Mboned review & adoption
- draft-rekhter-mdrs-00
  - BGP procedures with new SAFI for multicast reachability signaling
  - Seeking IDR review & adoption
- draft-rekhter-mdcs-00
  - BGP Flow-spec extensions for geo-restriction information signaling
  - Seeking IDR review & adoption

BACKUP SLIDES

SIGNALING MULTICAST DESTINATION REACHABILITY

What:

- Content receivers with multicast connectivity from the ER.

To Whom:

- Content Distribution Controllers (CDC)

How:

- The receivers are encoded as IP prefixes
- The prefixes are sent in BGP using the IPv4 or IPv6 AFI and a new MCAST-REACH SAFI (TBD)
- draft-rekhter-mdrs in IDR

LIMITING DISTRIBUTION OF MULTICAST REACHABILITY TO INTERESTED BGP SPEAKERS

- Only the CDCs are interested in the new MCAST-REACH reachability.

- Provisioning AFI/MCAST-REACH only sessions from each ER to each CDC does not scale well.

- Constrained Route-Target distribution (RFC 4684) is used control distribution of MCAST-REACH destinations toward interested CDCs:

  - CDC is provisioned with a Route-Target for each AFI. The RT is not re-used elsewhere.

  - CDC distributes the RT into RTC.

  - ERs attach RT to MCAST-REACH reachability.

SIGNALING MULTICAST DISTRIBUTION CONTROL IN BGP

Why:
- While the CDC can block a particular content request, a receiver may obtain enough information through other means to join the relevant multicast channel – the ERs need to be able to block the multicast join request based on geo-restrict information

What:
- Particular multicast content as (S,G) and whether the content is included or excluded on a per-zone basis.

To Whom:
- Interested ERs

SIGNALING MULTICAST DISTRIBUTION CONTROL IN BGP

How:

- Using BGP Flow-spec (RFC 5575) encoding.
    - Source goes in source prefix, Group goes in destination prefix.
    - AFI is IPv4 or IPv6. New SAFI, MCAST-FLOWSPEC (TBD).
- Included/Excluded content for a zone is signaled with an Included Route-Target or an Excluded Route-Target for each zone.
    - Receiver ports are associated with zones.
- draft-rekhter-mdcs: IDR

SIGNALING MULTICAST DISTRIBUTION CONTROL IN BGP

How:

- MCAST-FLOWSPEC routes are compiled into applicable policy on the receiving router. For example, on an ER, only policy matching zones for attached ports is necessary.
- When a subscriber tries to access content from a given port (PIM or IGMP join), the MCAST-FLOWSPEC policy is. If the port's zone matches inclusive or exclusive Route-Targets, the appropriate policy is applied and the join is either permitted or ignored.
  - A default policy of accept or reject may limit the number of routes that must be distributed.

SIGNALING MULTICAST DISTRIBUTION CONTROL IN BGP

Example policy from draft:

- Consider an ER in Manhattan that has a port that is provisioned with the following import RTs: <include-manhattan, exclude-manhattan, include-nyc, exclude-nyc, include-east, exclude-east, include-usa, exclude-usa>

- When the ER receives a Flow Spec route with <exclude-nyc, include- manhattan, include-usa> RTs, the ER first try to match "include- manhattan" or "exclude-manhattan" (the first ones on the list) - and the result is "include-manhattan". Therefore, the (S, G) carried in the Flow Spec route is allowed on that port of the ER.

LIMITING DISTRIBUTION OF MULTICAST DISTRIBUTION CONTROL

- Only some ERs may be interested in specific MCAST-FLOWSPEC routes.

- A Route-Target could be assigned for interested ERs according to internal provisioning decisions.

- MCAST-FLOWSPEC routes will have these RTs added.

- Constrained Route-Target distribution is used to limit the flooding of the routes.
    - Static RTC can be used to provision the ER targets in RTC.
    - In some (most?) circumstances, the zone RTs could be used for RTC purposes