Broadcasting over Internet-II

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PIM-SM (protocol independent multicast – sparse mode)

- As per RFC4601
- Single shortest path spanning tree
- Rooted at some agreed node – Rendezvous point (RP)
  - The shared tree – called RPT
- To be used for all the group communications

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- Independent of routing protocol
- Use unicast routing information base created by the routing protocol
- Altenatively can use multicast routing information base
  - created using unicast routing tables and mBGP.

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Multicast states

- Forwarding states in routers
  - (*,*) - for all groups, from any source
  - (*,G) – for group G, from any source
  - (S,G) – for group G, from source S
  - (S,G,rpt) – for group G, from Source S, on rendezvous point tree
    - Usually this means that for child nodes specified for this entry, the packets from S for this group G are not forwarded

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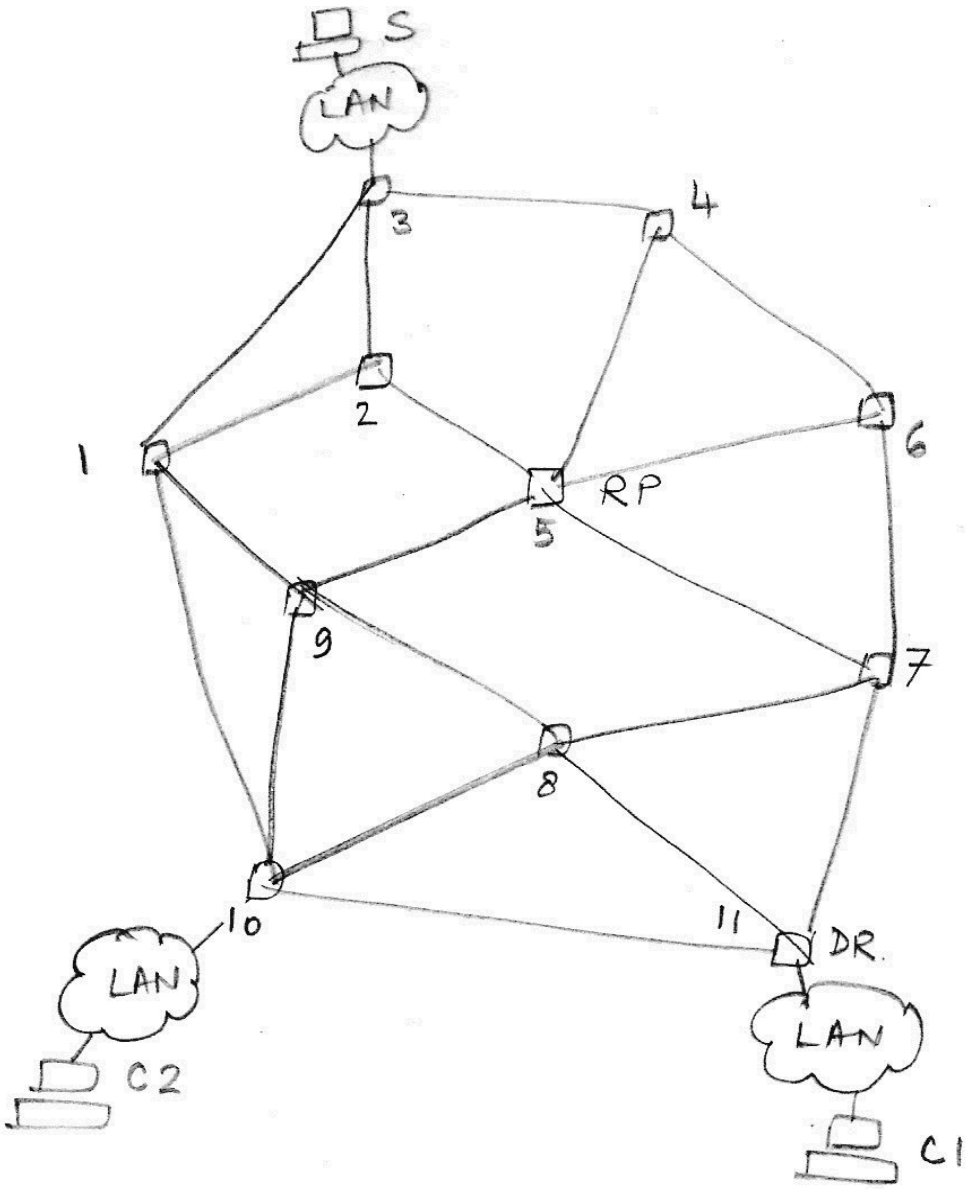

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Phase-I: RP Tree

- Receiving endpoint request DR (designated router) – for subscription to G.
- DR creates state for (*,G) join
- DR send (*,G) to the router in direction of RP

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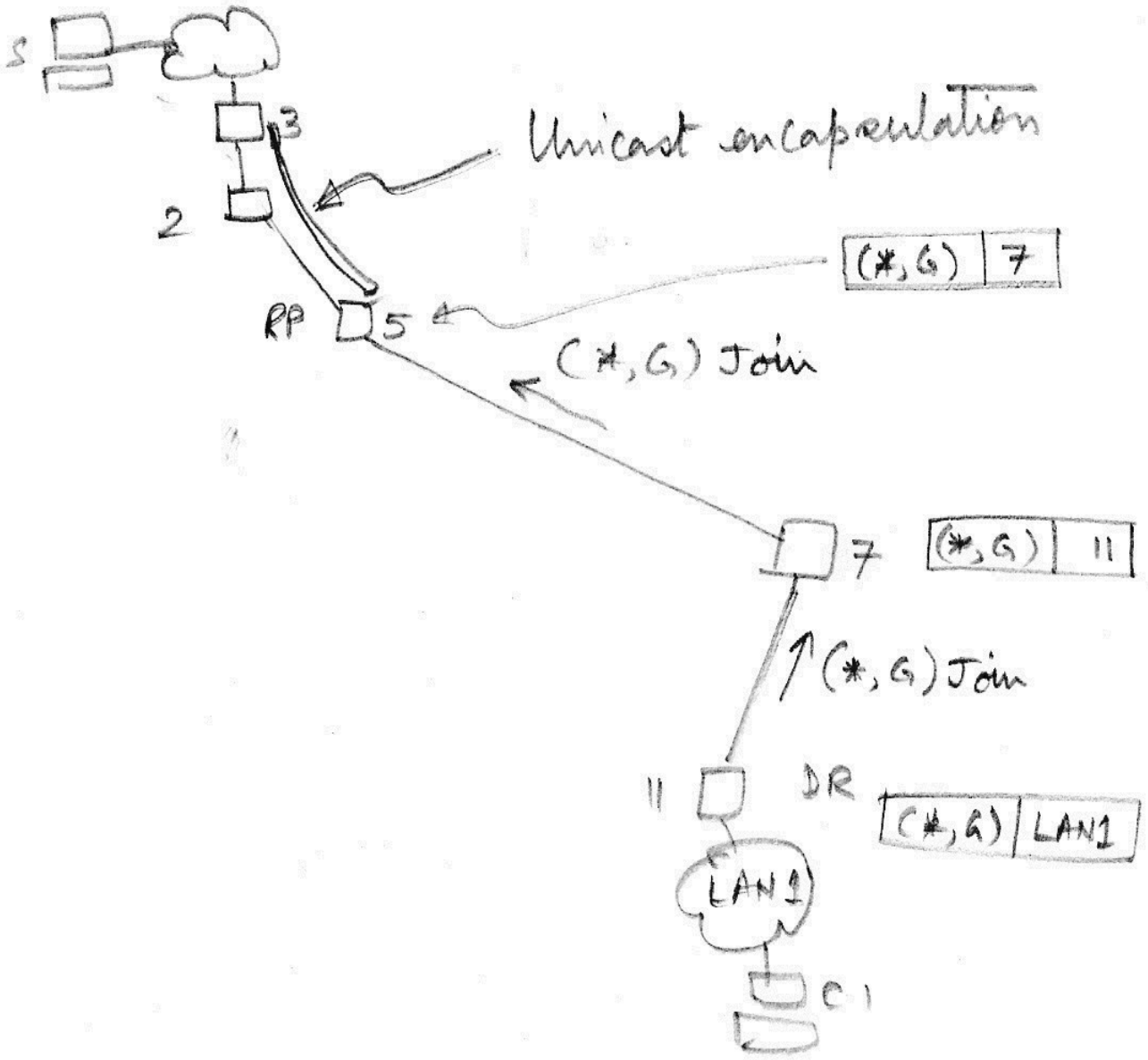

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- For G in SSM multicast range (232.0.0.0-232.255.255.255)
  - Any (*,G) join will be dropped
  - Only (S,G) join is permitted
- For any source multicast (ASM) (all multicast addresses other than SSM)
  - (*,G) and (S,G) joins permitted

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Register packets

- The source for multicast packets gives packets to its designated router
- The DR encapsulates the multicast packets in unicast packets
  - Protocol field for unicast IP packets is set to IP (IP in IP tunneling)
- The encapsulated packets sent to RP

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What RP does?

- RP de-encapsulates the packets.
- Forwards them to nodes as per multicast forwarding table
- RP initiates (S,G) join towards S (Phase-II: Register Stop)

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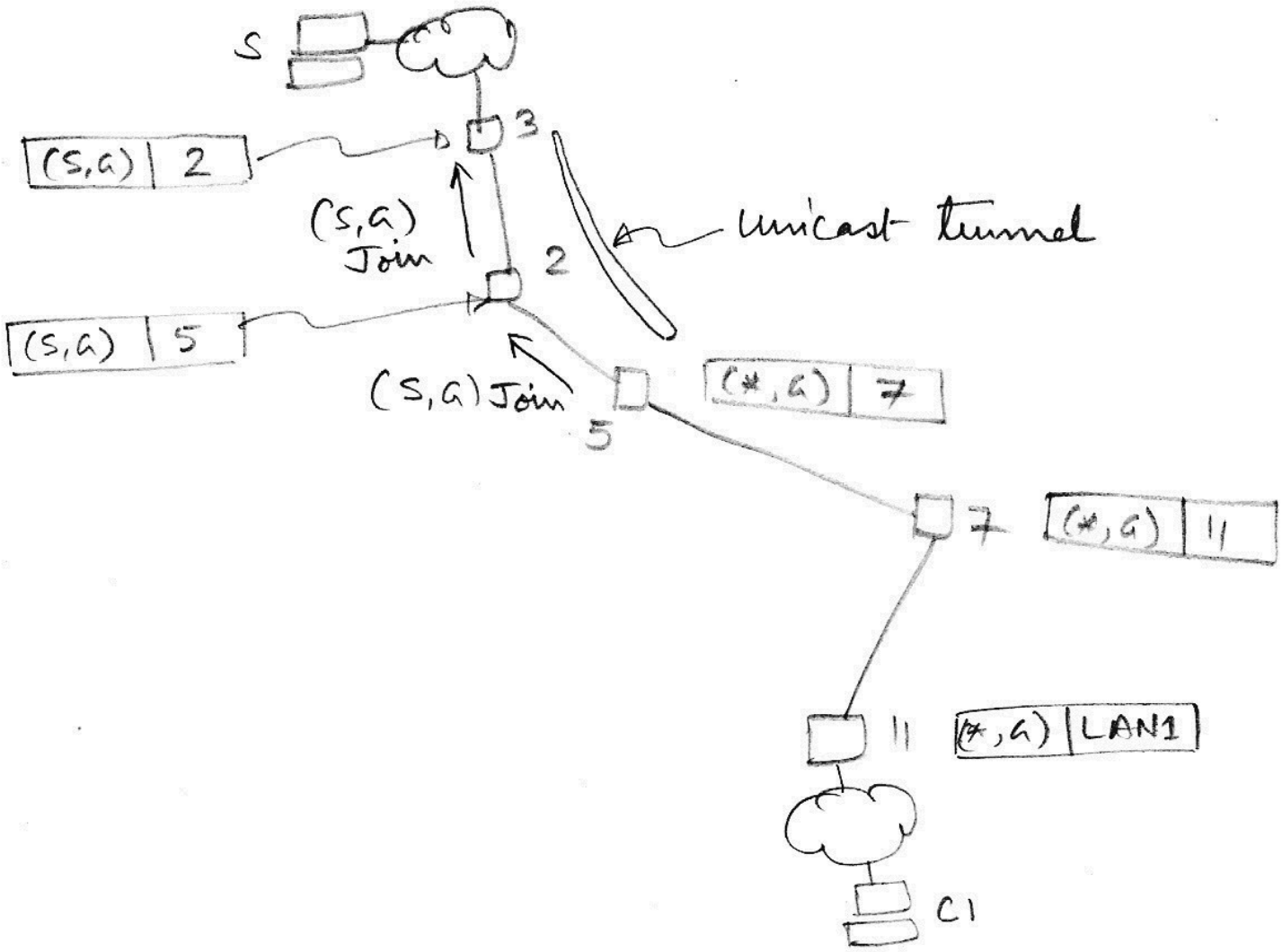

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- When RP starts getting two copies of multicast packets
  - Discards the encapsulated packets
  - Send register stop message to DR of S

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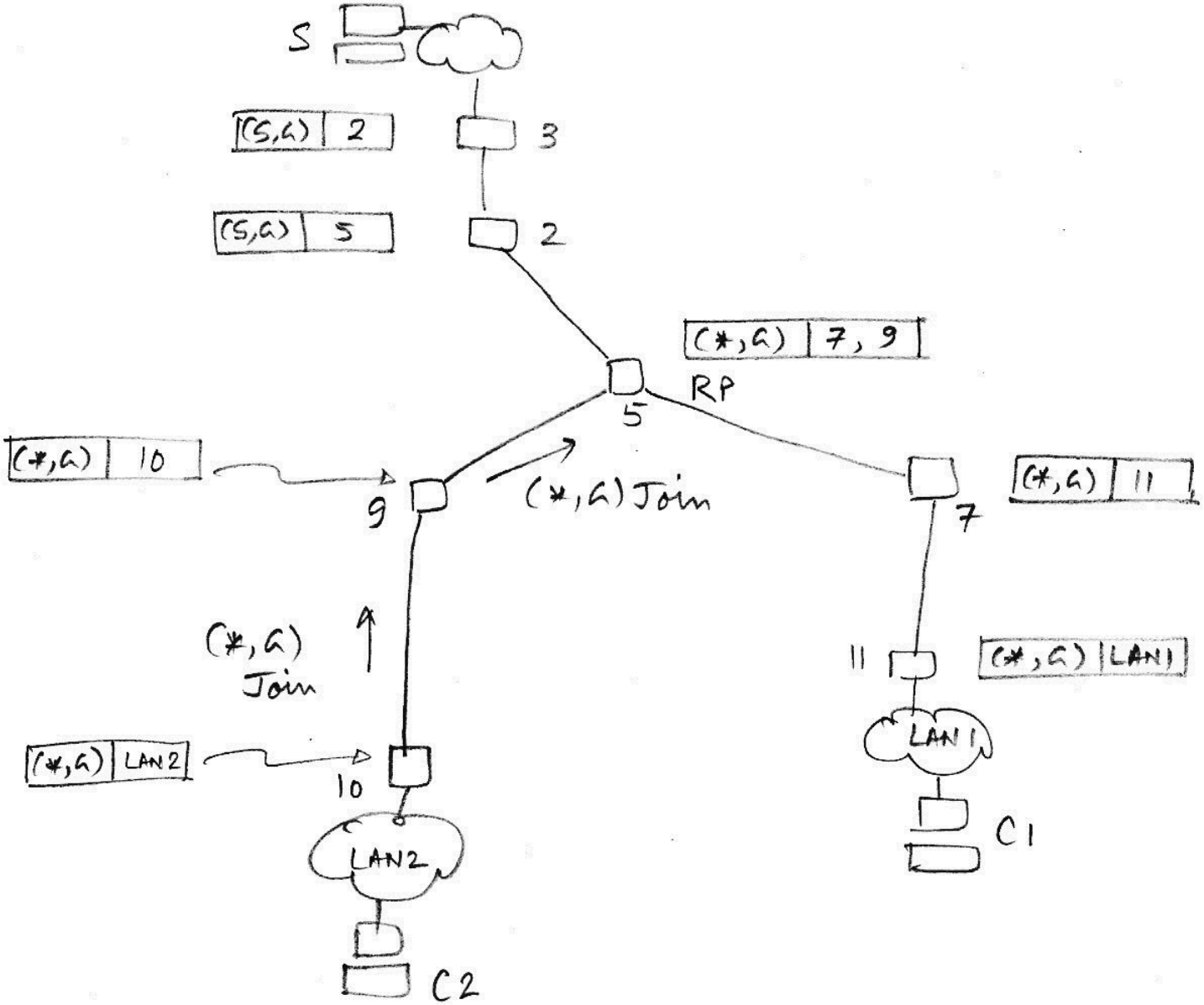

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Routing rules

- Node have (S,G) children C1={A, B, C}
- Node also have (*,G) children as C2= {B, D, E, S}, (S,G,rpt) children as C3
- If a packet received from shortest path to S
  - Packet forwarded to $((C1 \cup C2) - \{S\}) - C3$

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- If packet received from shortest path to RP, but not from shortest path to S
  - Forwarded to $C2-C3$

Phase -III : Shorest path tree

- Any router can optionally decide to send (S,G) join towards S
- (S,G) join reaches to some router already having (S,G) state, or to S
- The router receives two copies of each packet

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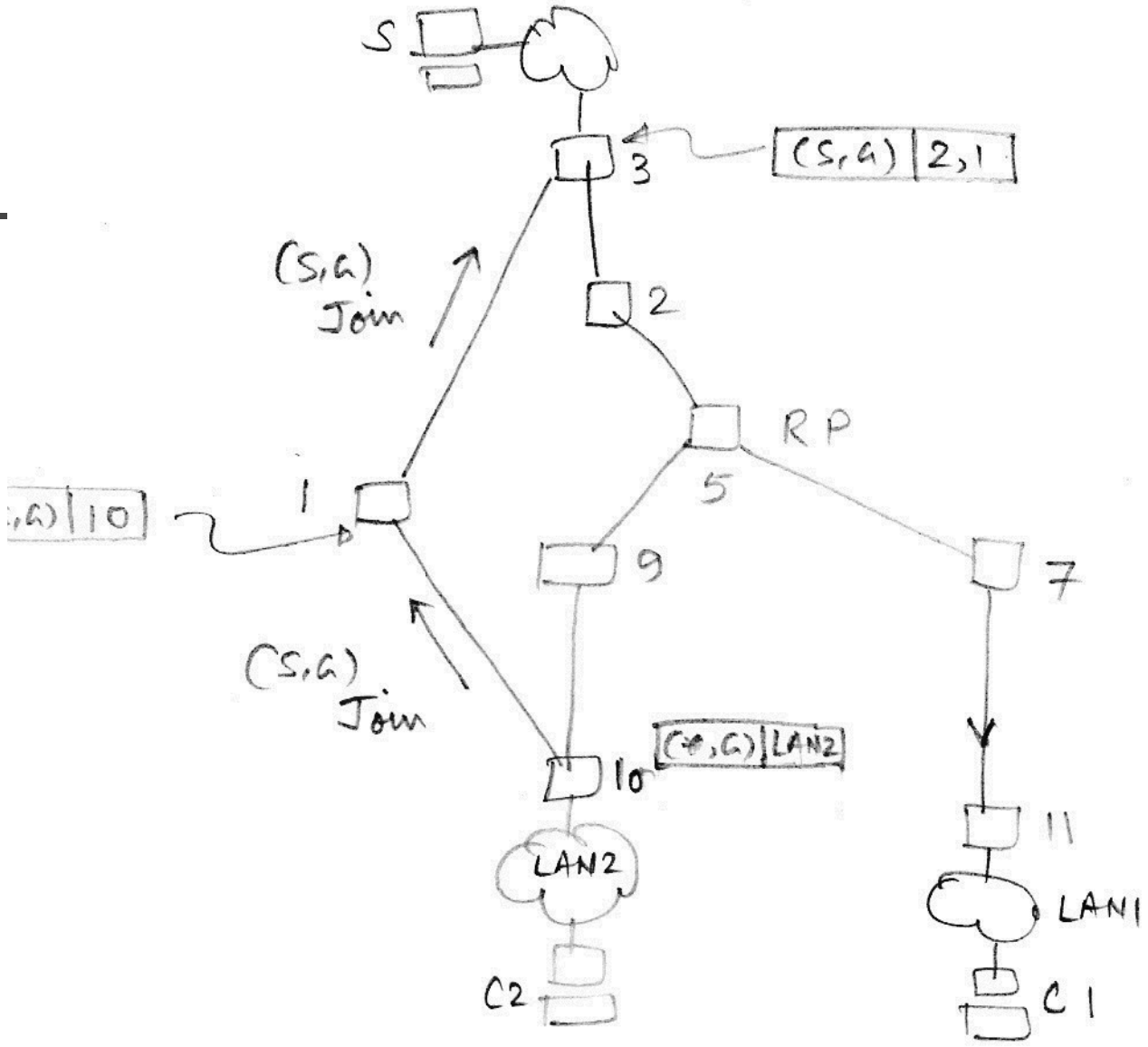

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- Router sends (S,G,rpt) prune towards RP
- The prune forwarded till it reaches a router which have at least one child having (*,G) but no (S,G,rpt) state

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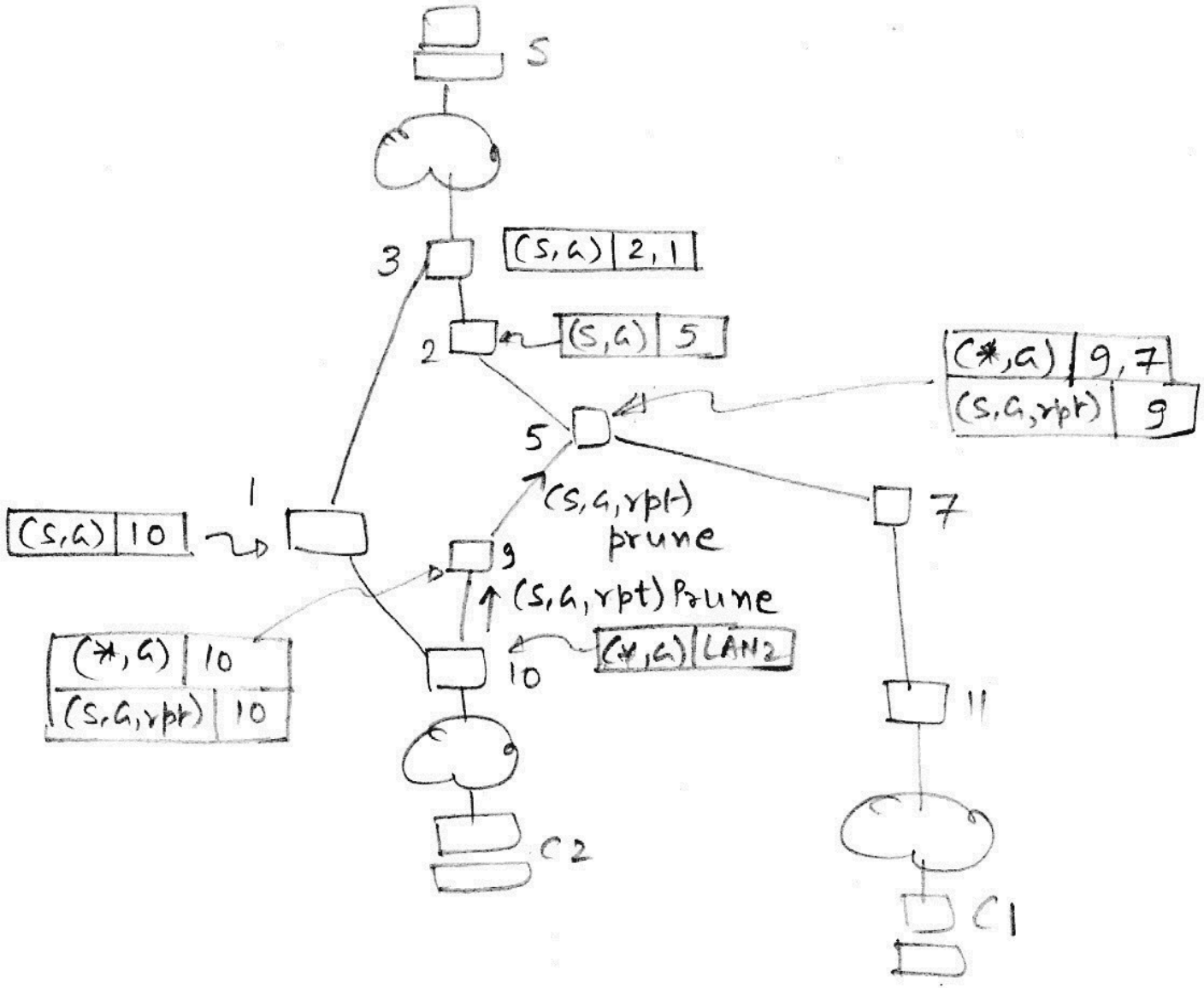

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How RP is selected?

- Some of the routers in the network - configured to be candidates for being RP
- A Boot Strap Router through a simple election process
- Each candidate tells the BSR of its willingness to be RP
- BSR builds a RP-set and broadcast it periodically to all the nodes in network

- Every node uses hashing on group address to determine the RP for that group from the RP-set.
- There can be more than one RP
- Each group will have only one RP

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