2/11

- HLP
- Multicast
  - PIM
- 11:20 - 11:50 Exam 1

BGP

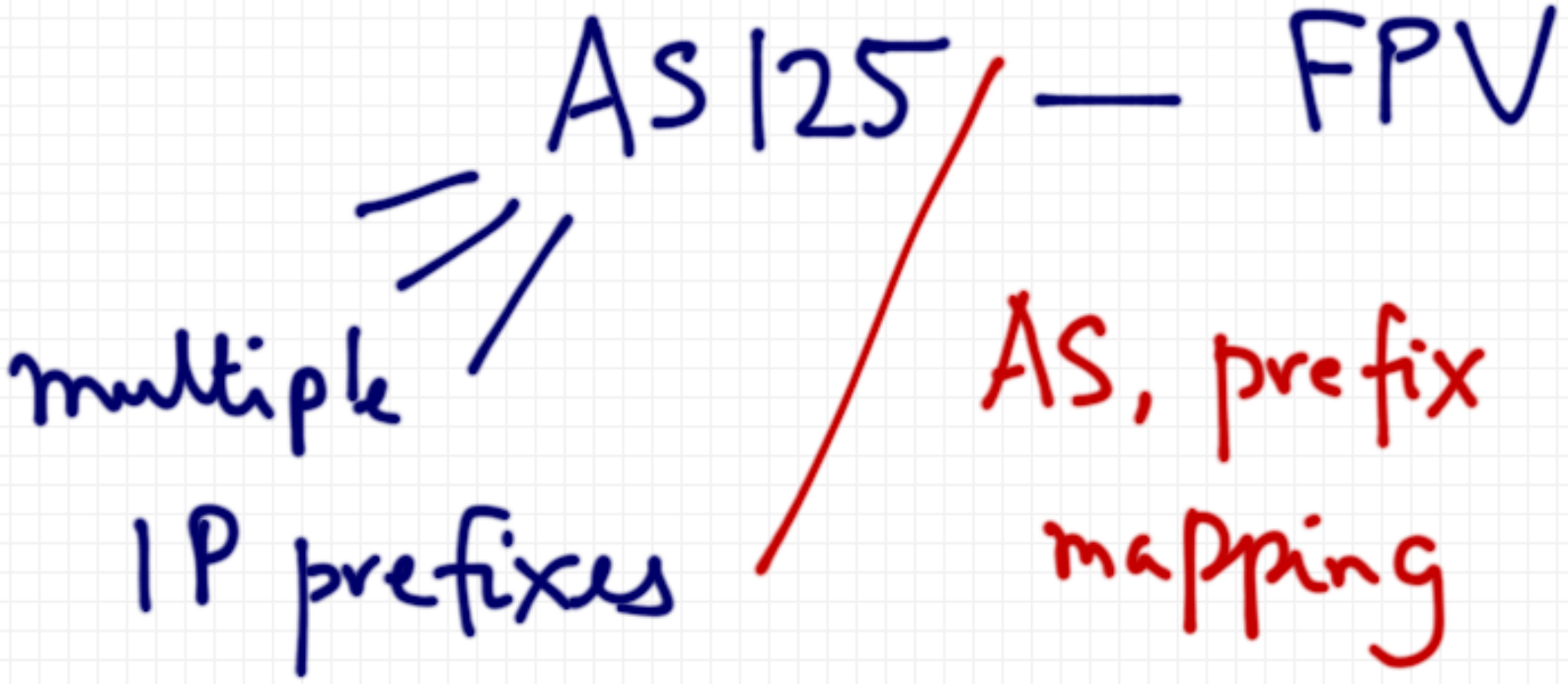
— routes are to

IP prefixes

128.125/16 — AS path

HLP

- routes are to ASs



Key Ideas HLP

- Fragmented path vector
- AS routes
- Cost Hiding - Isolation
- Optimizes for common case - exceptions

BGP

HLP

General Policies

Common-case but allows exceptions

BGP

HLP

HLP

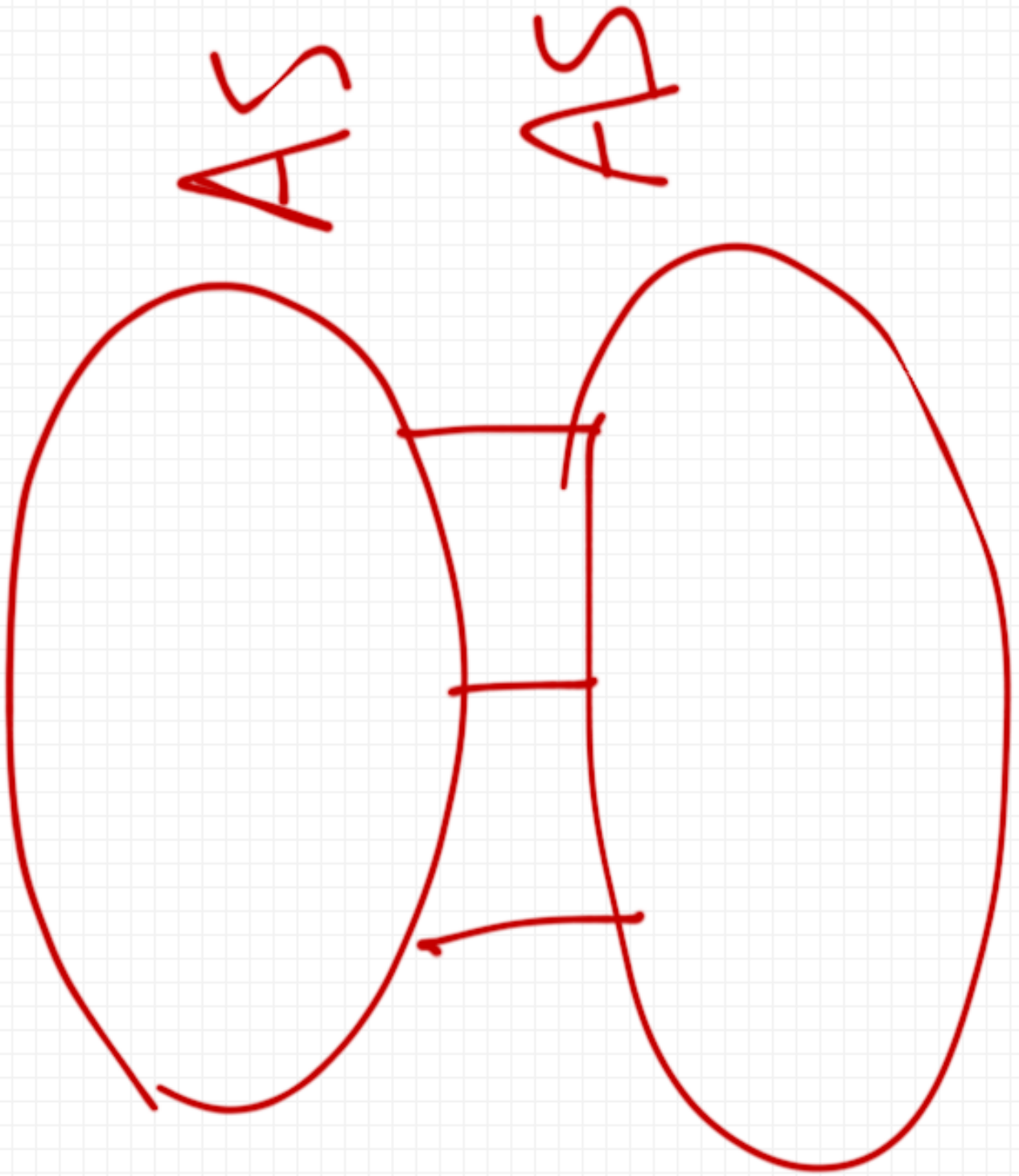
$n^{k(D)}$

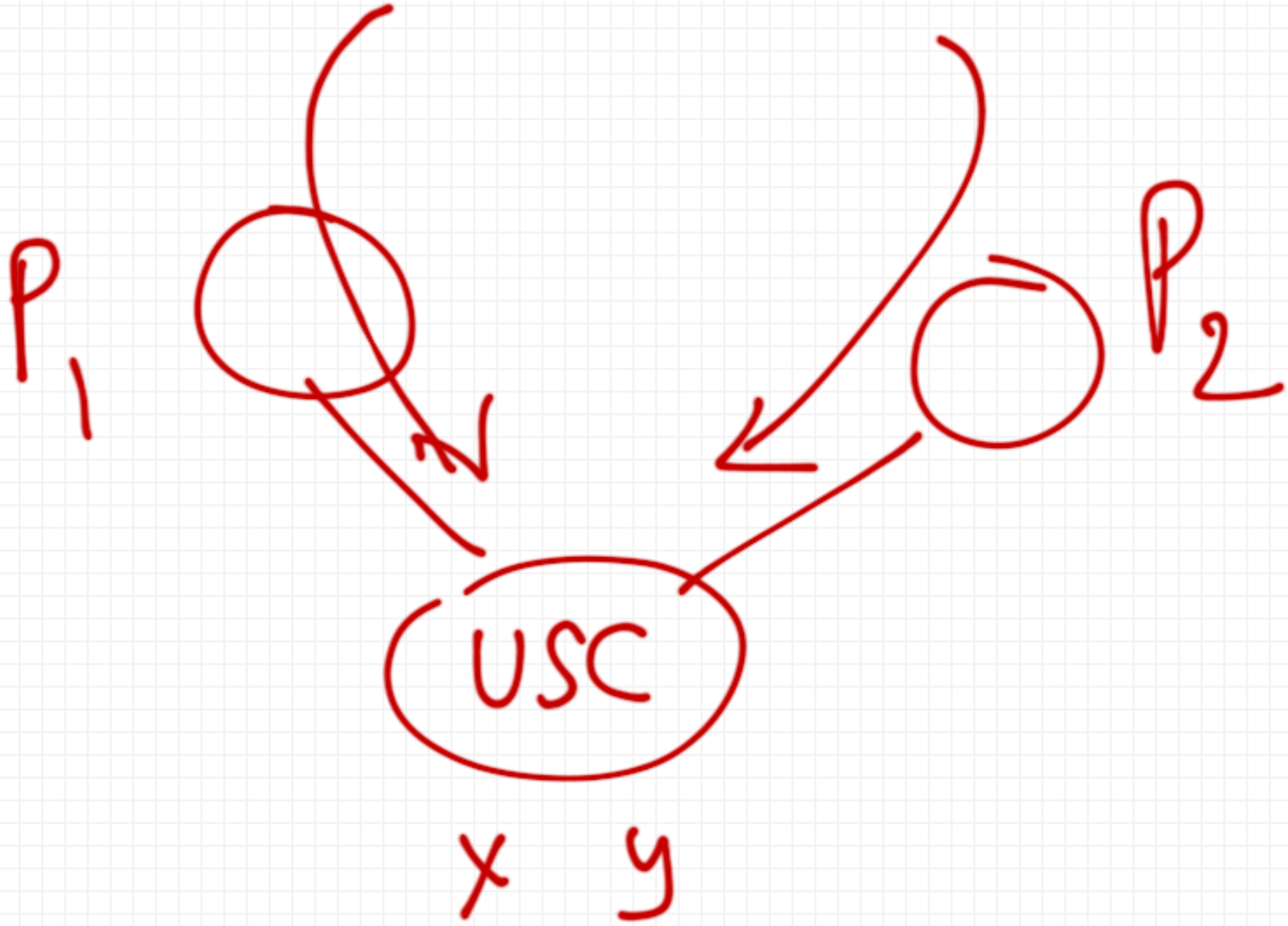
1..4

$n \sim n^4$

BGP

$O((n-1)!)$


AS
AS


P1
P2
USC
x
y

Multicast

IP Multicast

— Routing

— Reliable Transport

End System Multicast

Delivery

Unicast

Broadcast

↓

Multicast

IP Multicast

- Lectures, Videocasts
  - ↓
  - CDNs
- Collaboration
  - ↓
  - Servers

Service Model

Unicast

API network

send (d, pkt)

(pkt, s) = rcv()

IP address of host / routers

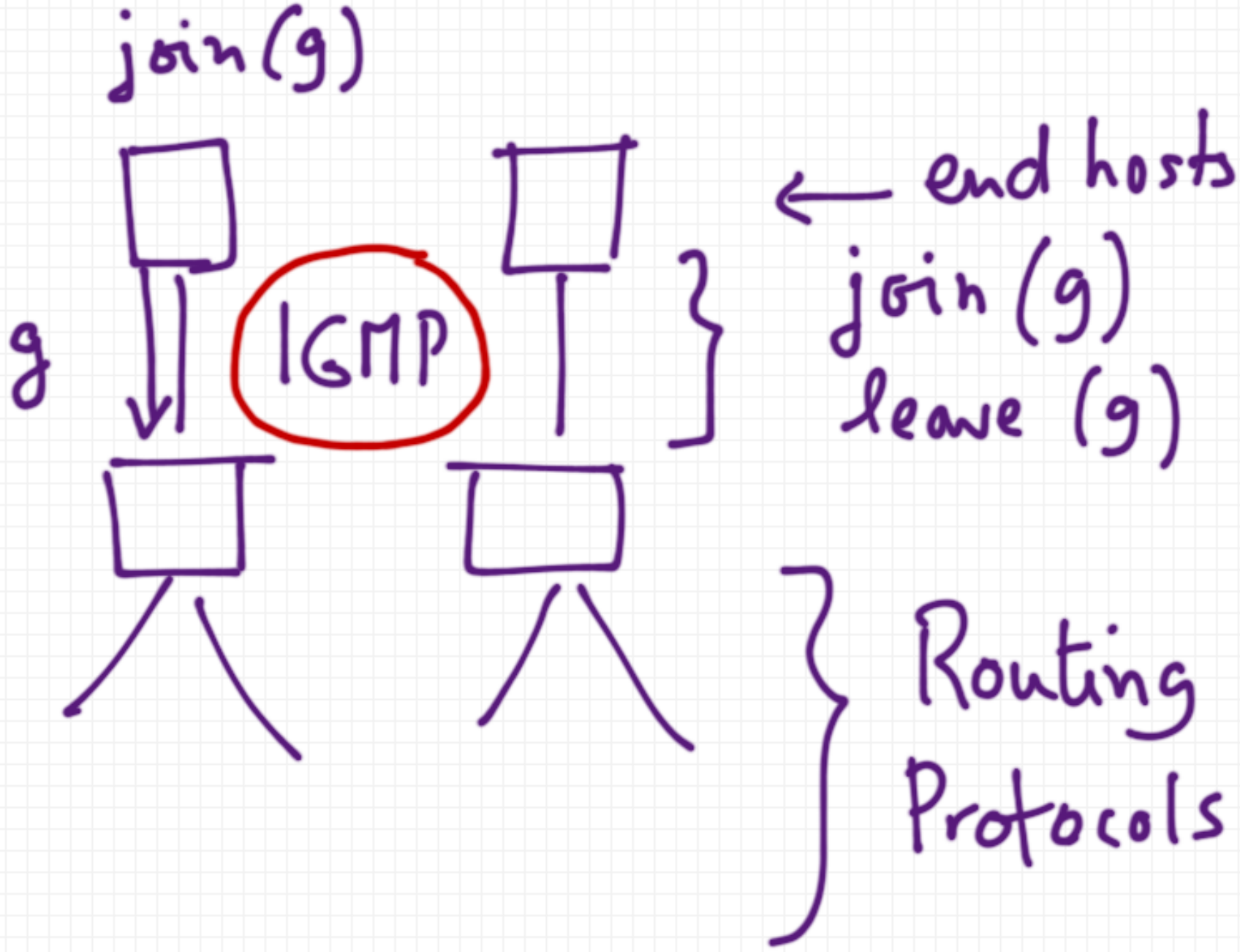
IP Multicast

- class D address
  224.0.0.0 –
- g ← identifier for members of a multicast group
- has no information abt group members

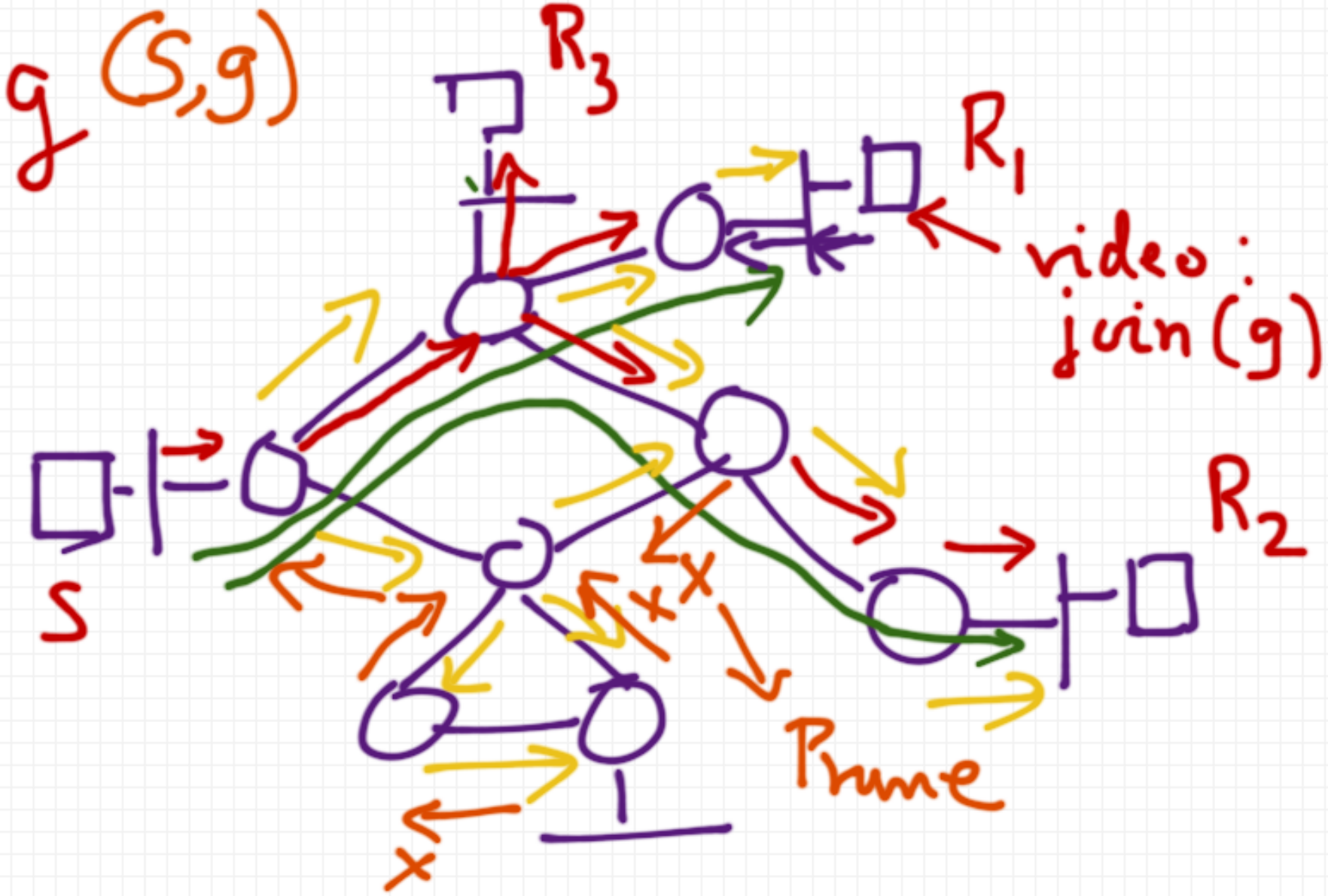
- anyone can be a member of a group g
- group members join/leave dynamically
- anyone can send to a group
  - ↑ non-members
- senders don't know who receivers are

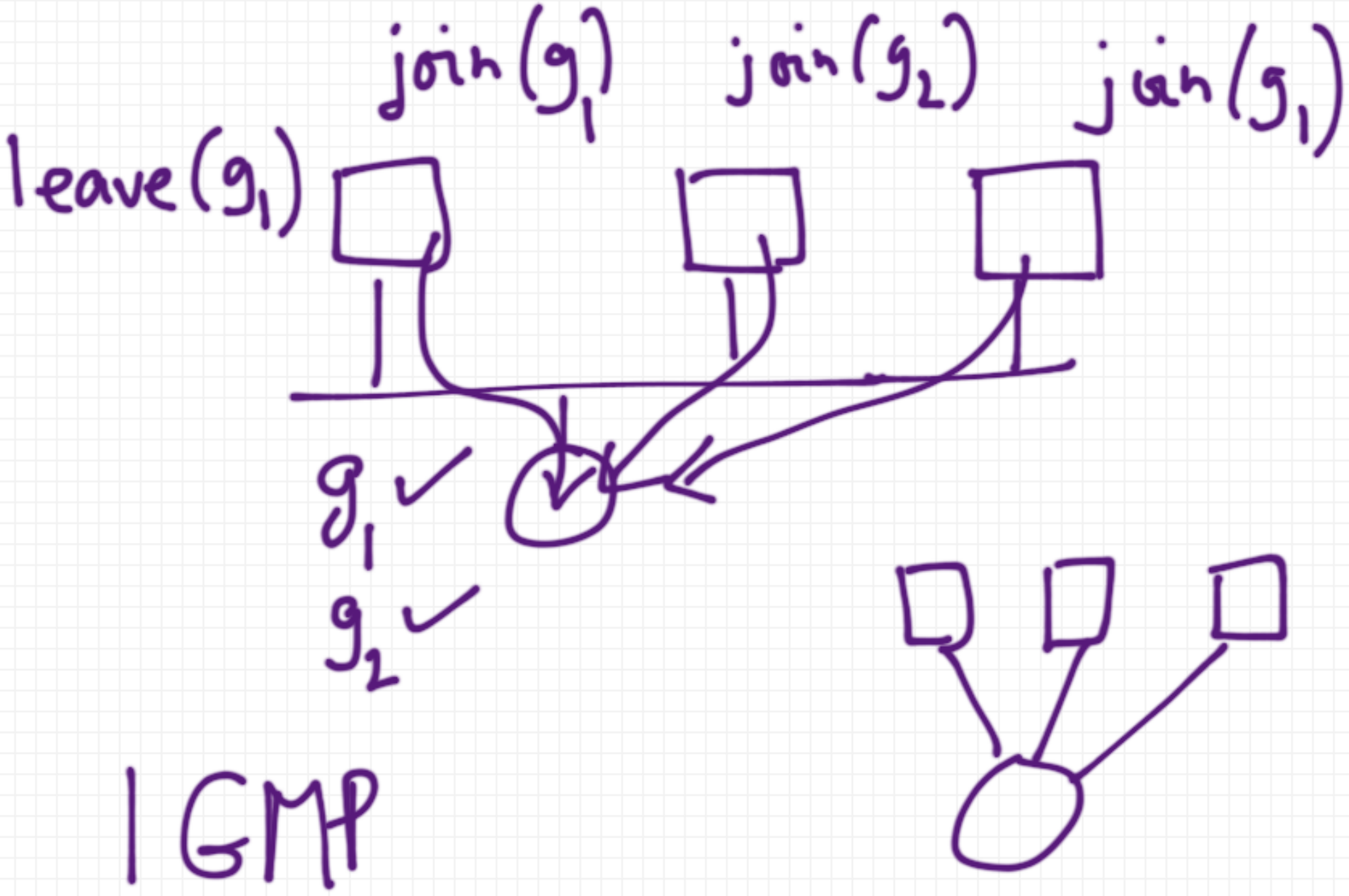
Service model

- Send (g, pkt)
- Join (g)
- Leave (g)
- (pkt, g) = receive ()

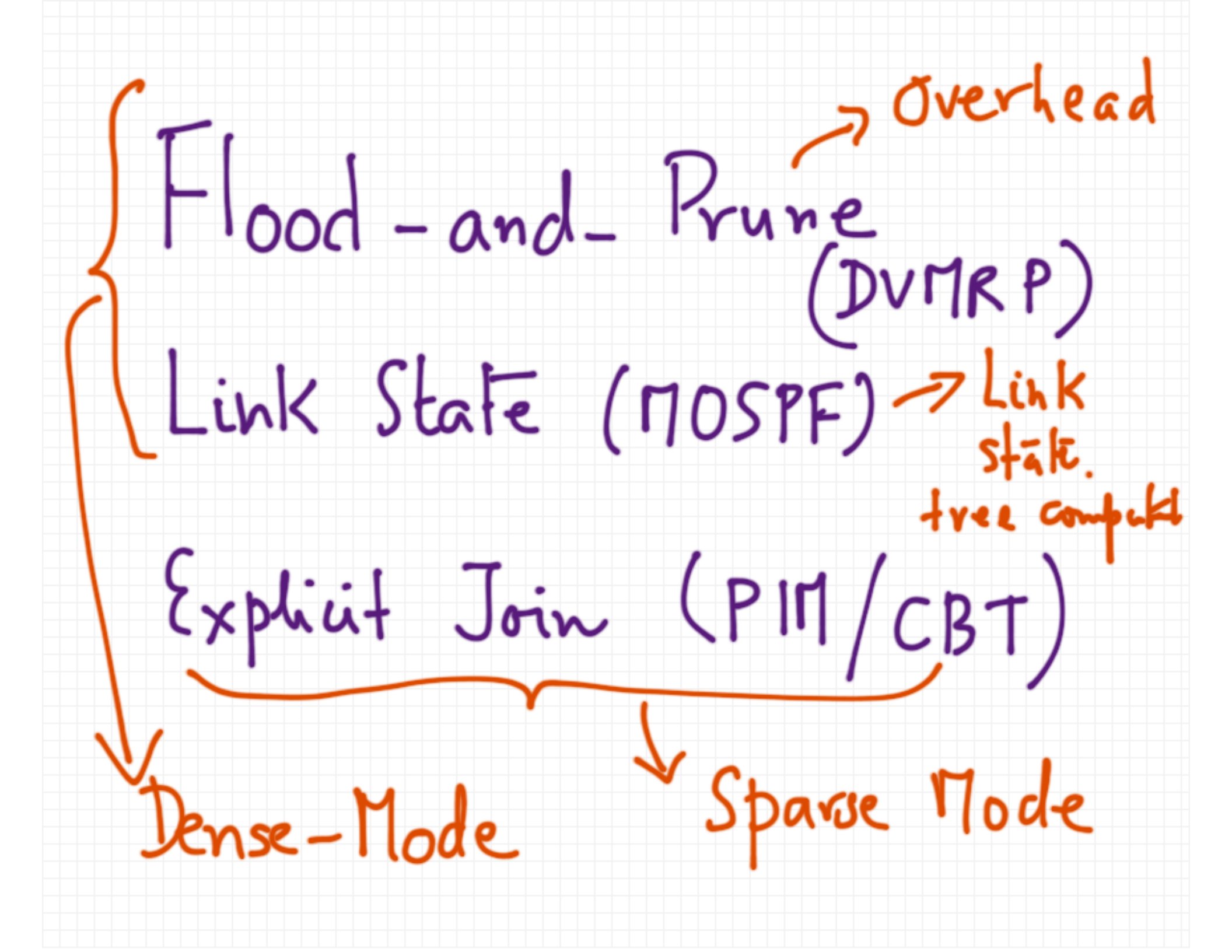

join(g)
g
IGMP
← end hosts
join (g)
leave (g)
Routing
Protocols

Benefits of IP Multicast

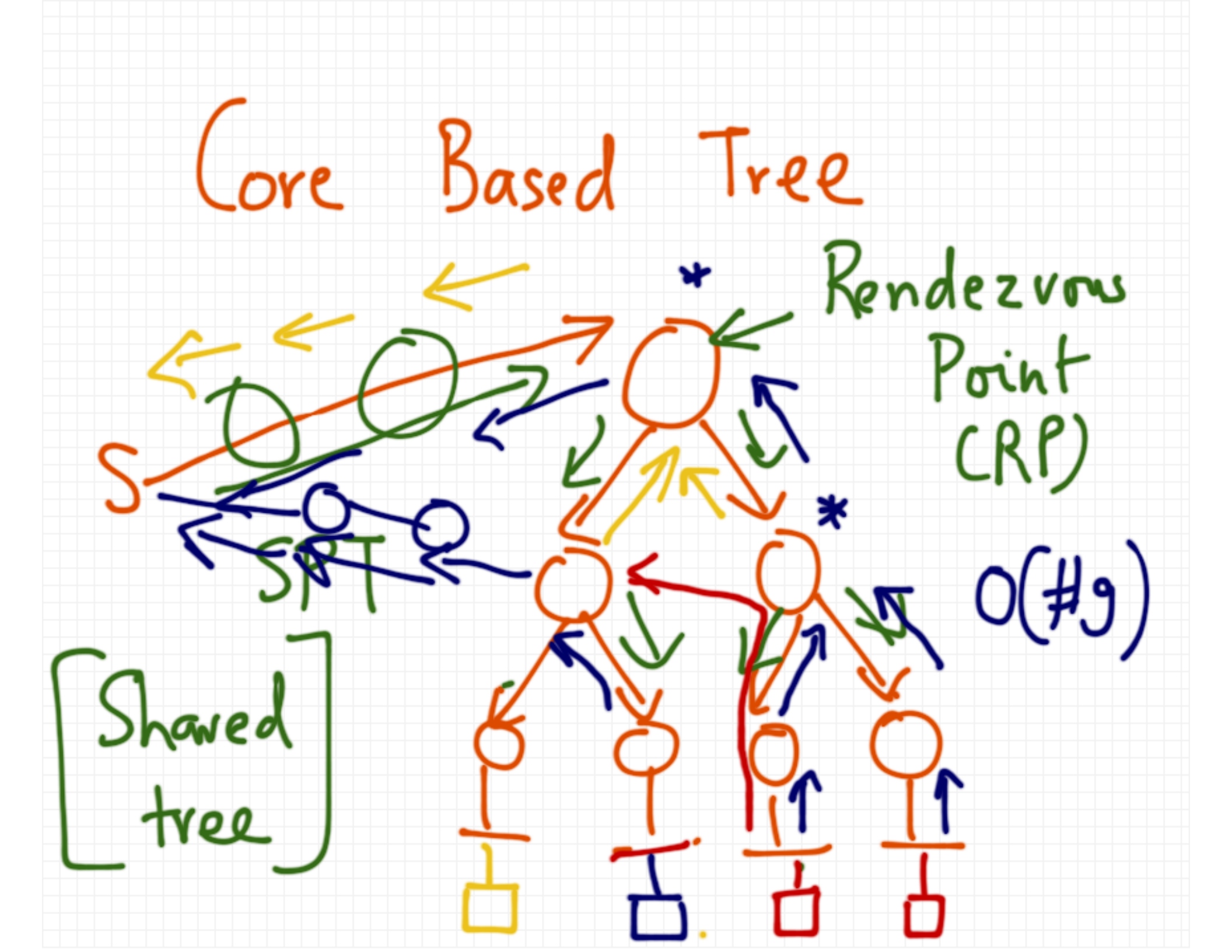


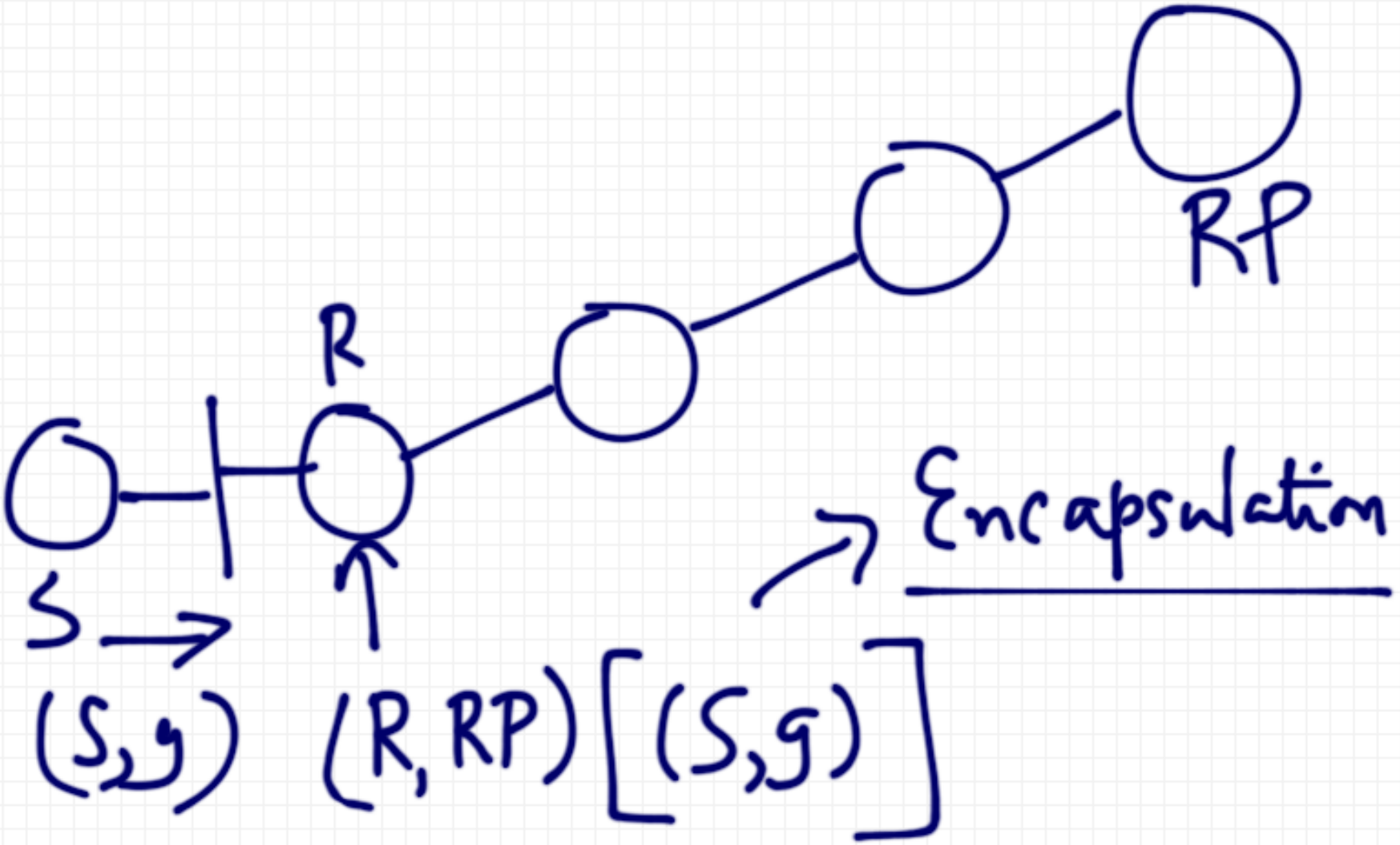


IGMP


Flood-and-Prune
Overhead
(DVMRP)
Link State (MOSPF)
Link state. tree computed
Explicit Join (PIM/CBT)
Dense-Mode
Sparse Mode

Reverse Path Forwarding


Core Based Tree
Rendezvous Point (RP)
S
SPT
O(#g)
[Shared tree]


RP
R
S
(S,G)
(R, RP)
[(S,G)]
Encapsulation

(S, g) entries

— Source-Specific (SPT)

(*, g) — Shared Tree