Multicasting
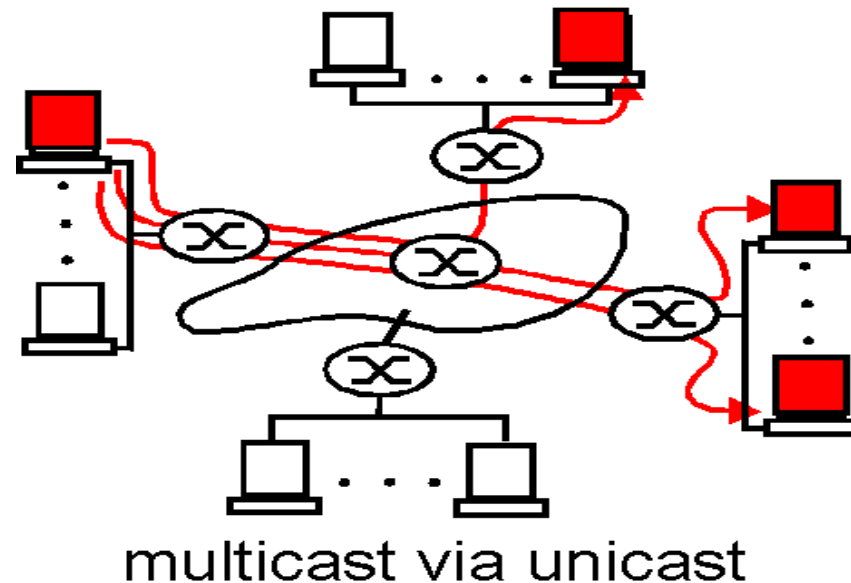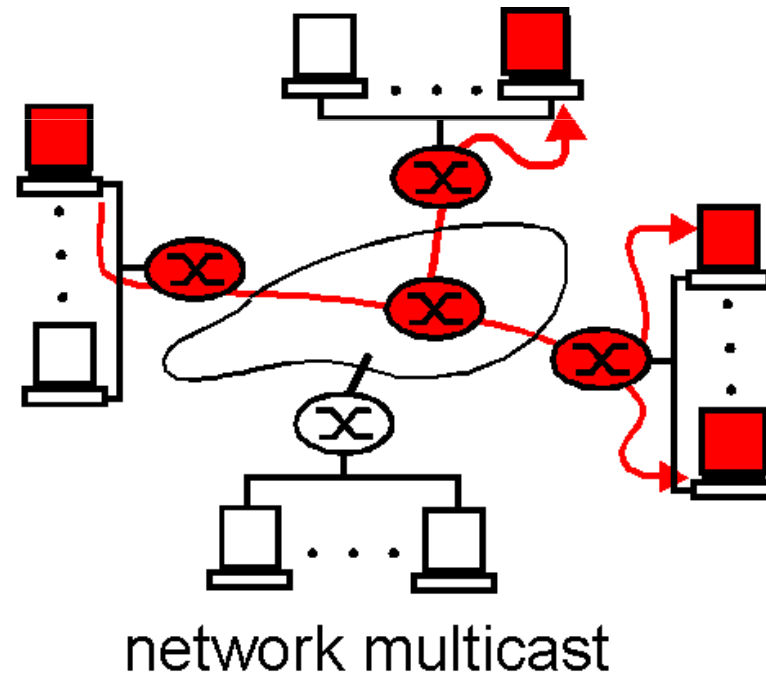
Multicasting

- [ ] Applications may require the use of point-to-multipoint connections
  - audio and video broadcast
  - Network games (Quake, etc.)

- [ ] multicasting can also be implemented by the source over a unicast network

multicast via unicast

Multicasting

- ☐ If the network supports multicasting 1 packet is enough
- ☐ Some nodes in the network must play an active role (red routers)

- ☐ Required Functionalities:
  - ■ Destinations groups definition
 - ■ addressing
  - ■ Routing definition

network multicast

Groups and Addresses

□ IP defines an addressing class for multicasting applications

11110	multicast addresses

from 224.0.0.0 to 239.255.255.255

□ Group addresses reduce overhead, but pose new problems:
  - How to build up a group
  - How to add members to a group
  - How to know the members' list

128.119.40.186

128.59.16.20

128.34.108.63

128.34.108.60

mcast group
226.17.30.197
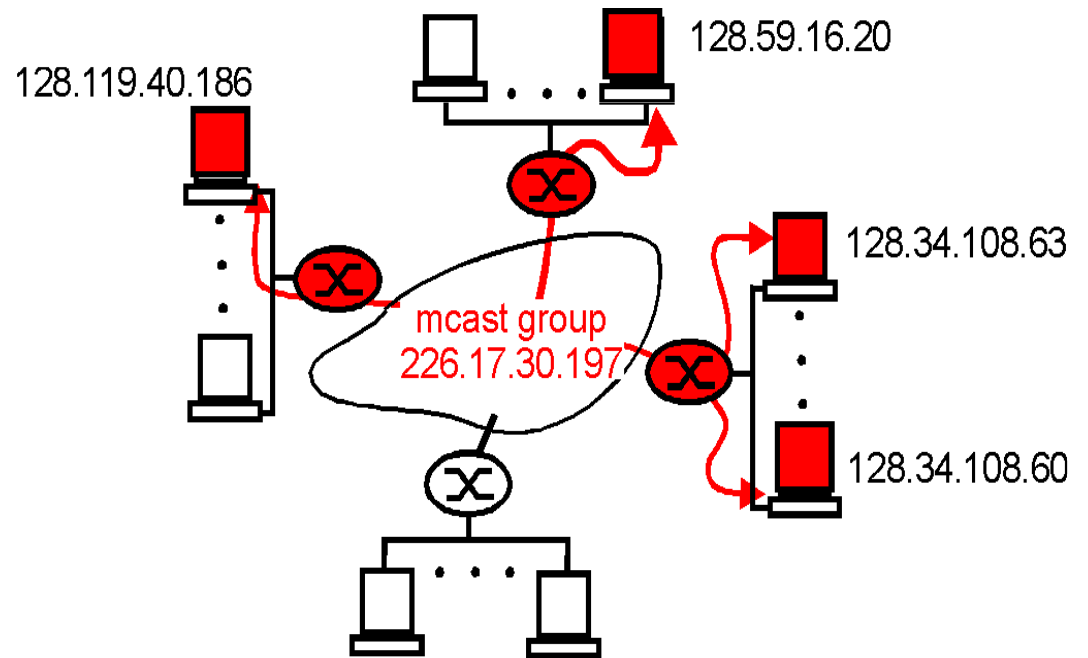
Internet Group Management Protocol (IGMP)

- Specific routers manage the multicasting
- IGMP is used in the communications between hosts and multicast routers
- Each host communicates with the multicast router within its own IP subnet
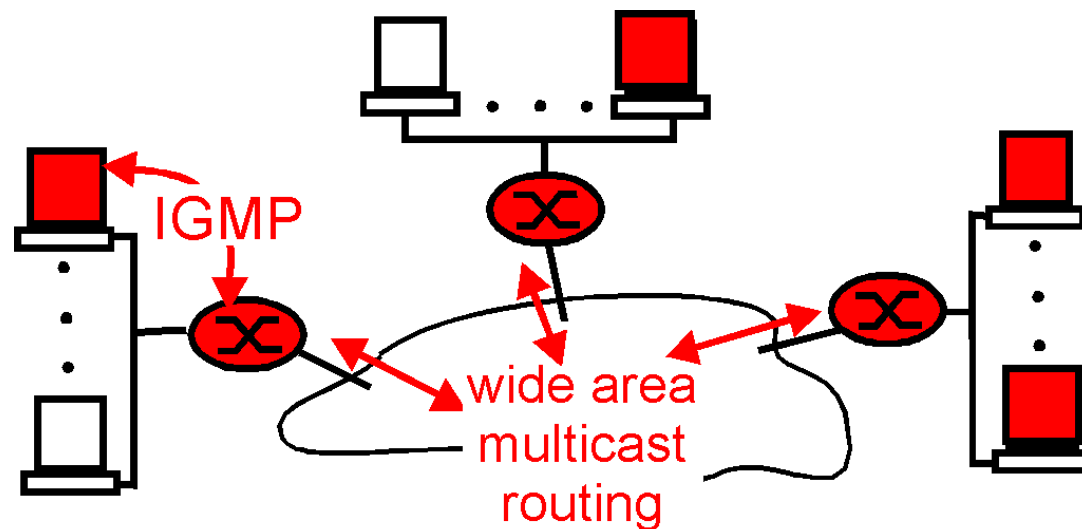
Group Management

- The multicast router periodically sends out multicast messages (224.0.0.1 to all the systems in the LAN)
- Hosts answer with the list of the multicast groups currently in use by some application
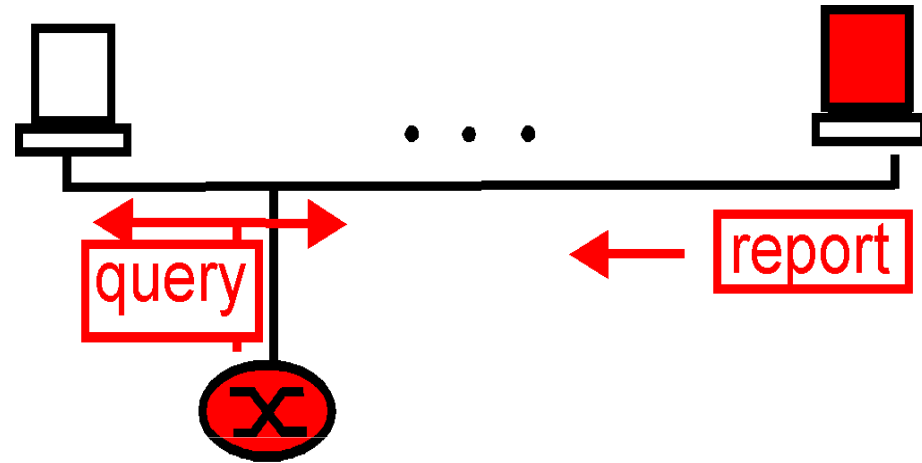
IGMP Message types	Sent by	Purpose
membership query: general	router	query multicast groups joined by attached hosts
membership query: specific	router	group joined by attached hosts
membership report	host	is joined to given multicast group
leave group	host	report leaving given multicast group

8	16	32
Type	Max. resp. time	Checksum
Multicast group address		
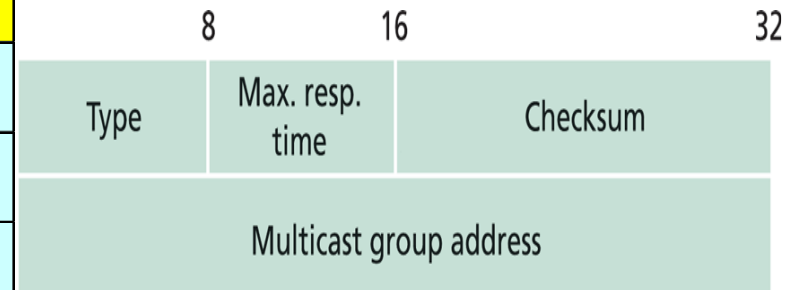
Source: Computer Networking, J. Kurose

Multicast routing
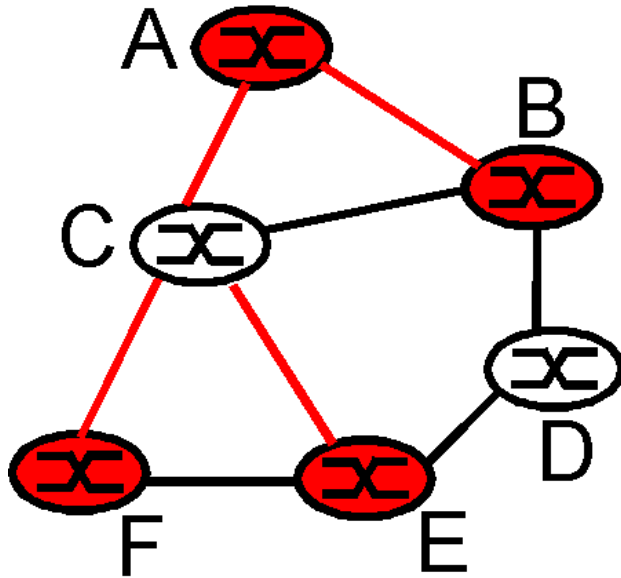
☐ How to forward multicast packets?

☐ Target: to set up a *spanning tree* without cycles

☐ The routers not connected to users of a given group may be excluded from the tree

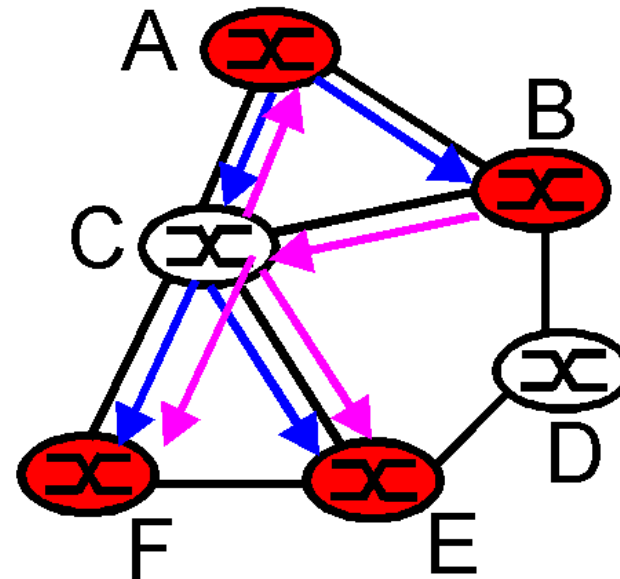☐ Similar problem to the transparent bridging
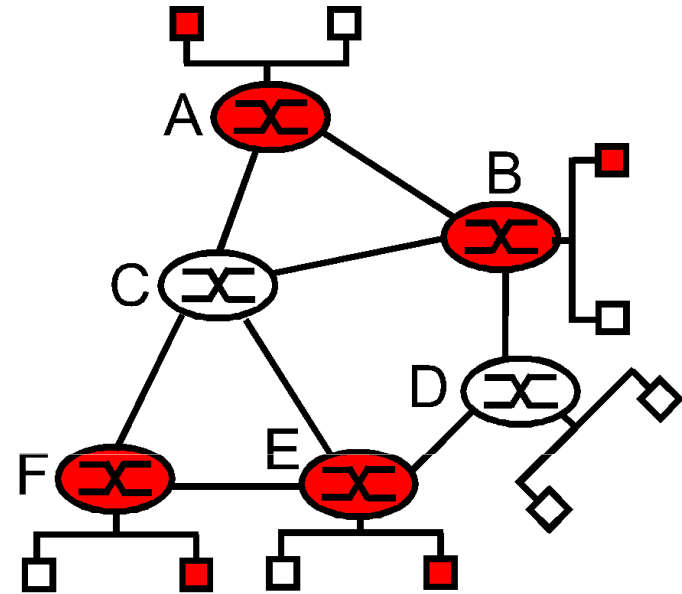
What Trees?

- ☐ One common tree FOR ALL the multicast traffic sources
- ☐ One tree FOR EACH of the multicast traffic sources

Group-shared tree

Source-based trees

Group-Shared Tree

- Theoretically the minimum cost tree can be found
- Practically sub-optimal approaches are used:
- *center-based approach:*
  - Central router election
  - Join (unicast) messages are sent to the central router
  - The messages trace the branches of the multicast tree and stop either at the central router or at a router already belonging to the tree
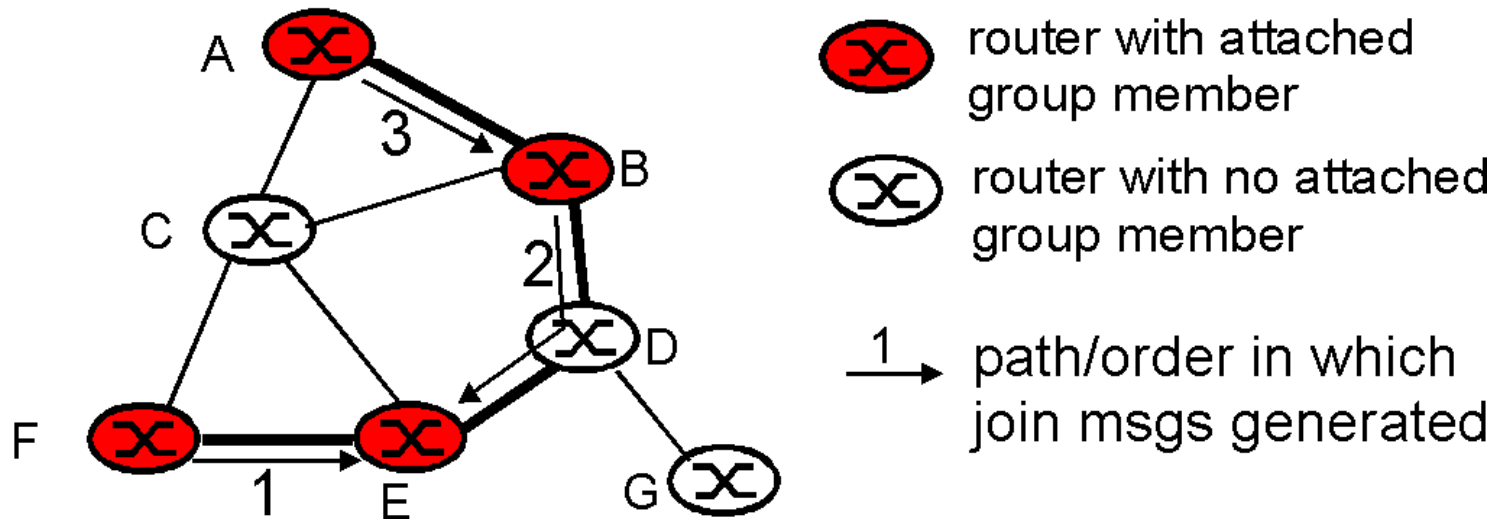
Source-based Trees

- ☐ It uses the shortest path tree
- ☐ Reverse Path Forwarding (RPF)

  - ☐ All the packets arriving from the shortest path to the source are forwarded
  - ☐ All the others are dropped
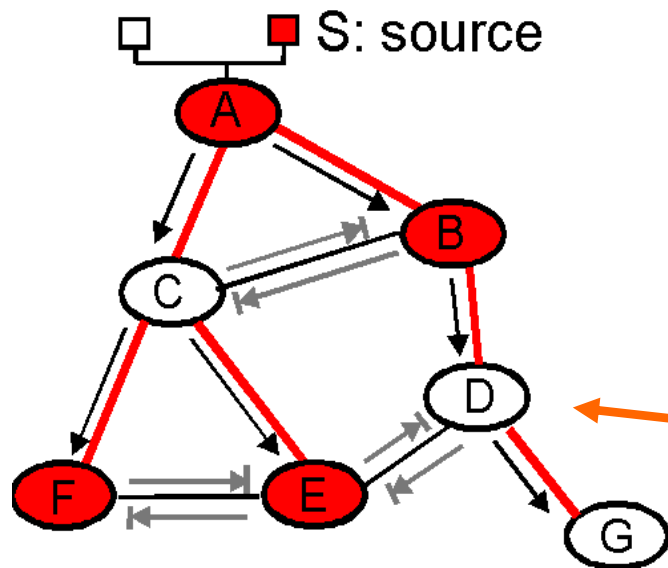
S: source

Non-multicast router may belong to the Multicast tree

Source-based Trees: pruning

☐ Pruning to eliminate nodes from the multicast tree

☐ Router can detach from the tree sending prune packet along the tree (in the opposite direction)

☐ Problems:

- Gather info on leaf routers (signalling needed)

- Let new router enter th tree (explicit unprune messages or pruninig timer)
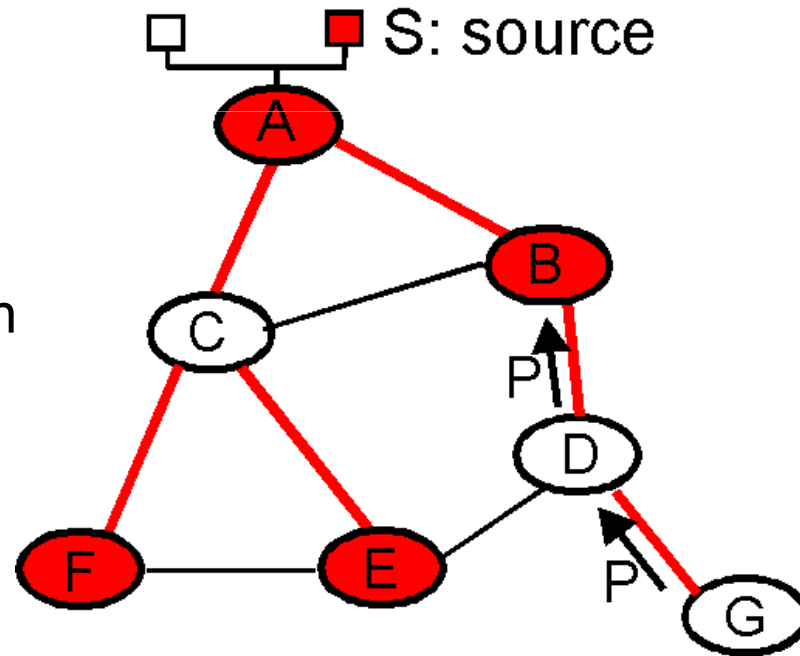
# Distance Vector Multicast Routing Protocol (DVMRP) – RFC 1075

- ☐ *distance vector* to set up the multicasting tree
- ☐ Each router owns a list of depending routers
- ☐ *pruning* messages are sent only if all the router of the list have already been pruned
- ☐ explicit *unprune messages (grafts)*
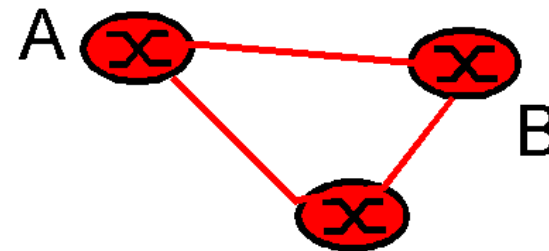- ☐ *pruning* info have a time-out

Multicasting in Internet

☐ Only a small fraction of Internet routers has *multicast functionalities*

☐ What happens if none of the neighboring routers supports multicast functionalities?

☐ MBone (*Multicast Backbone*) uses *tunneling*:
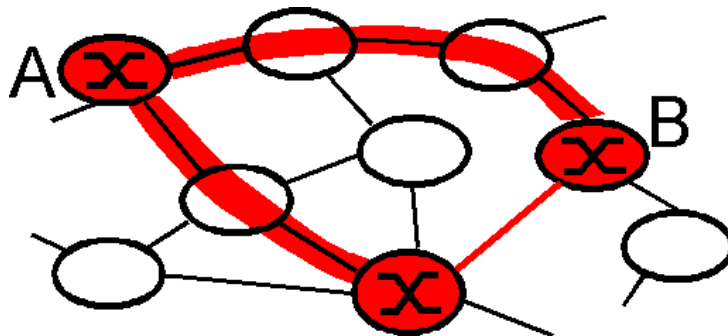
physical topology

logical mcast topology