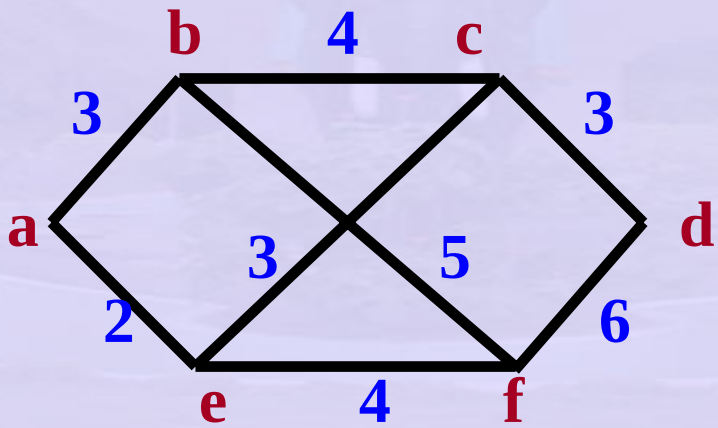
Link State Routing



Link State Routing

- Discover its neighbour and learn network addresses
  - Measure cost to each of its neighbours
  - Construct a packet telling what it has learnt
  - Send packet to all other routers
  - With link state packets from all router construct shortest path to every other router

Links State Packets from Different Routers

a	
seqno	
age	
b	3
c	2

b	
seqno	
age	
d	3
c	4
f	5

c	
seqno	
age	
b	4
d	3
e	3

d	
seqno	
age	
c	3
f	6

e	
seqno	
age	
a	2
c	3
f	4

f	
seqno	
age	
b	5
d	6
e	4

Link State Routing

- Flags
  - Send flags
    - On which lines should the packets be sent
  - Ack flags
    - On which lines should the packets be acked
  - Seqno
    - Sequence number of packet
      - Useful to distinguish between new and old packets
  - Age
    - Remove packets that are circulating that are aged

Link State Routing

- Distribution of link state packets:
  - Periodically flood
  - dam the flood
  - seqno –
    - new forward
    - old discard
    - lower discard
- What if seqno corrupted
  - Packet discarded after it has aged
  - decrementing age by route
  - Decrement age also on time
- All link state packet acked echo reply/ echo request with timestamp

Link state packet information (router b)

src	seqno	age	ack a c f	send a c f	Data
a	21	60	1 0 0	0 1 1	
f	21	60	0 0 1	1 1 0	
e	21	51	1 0 1	0 1 0	
c	20	60	0 1 0	1 0 1	
d	21	59	0 1 1	1 0 0	

Once all link state packets available – compute SSSP on all possible destination

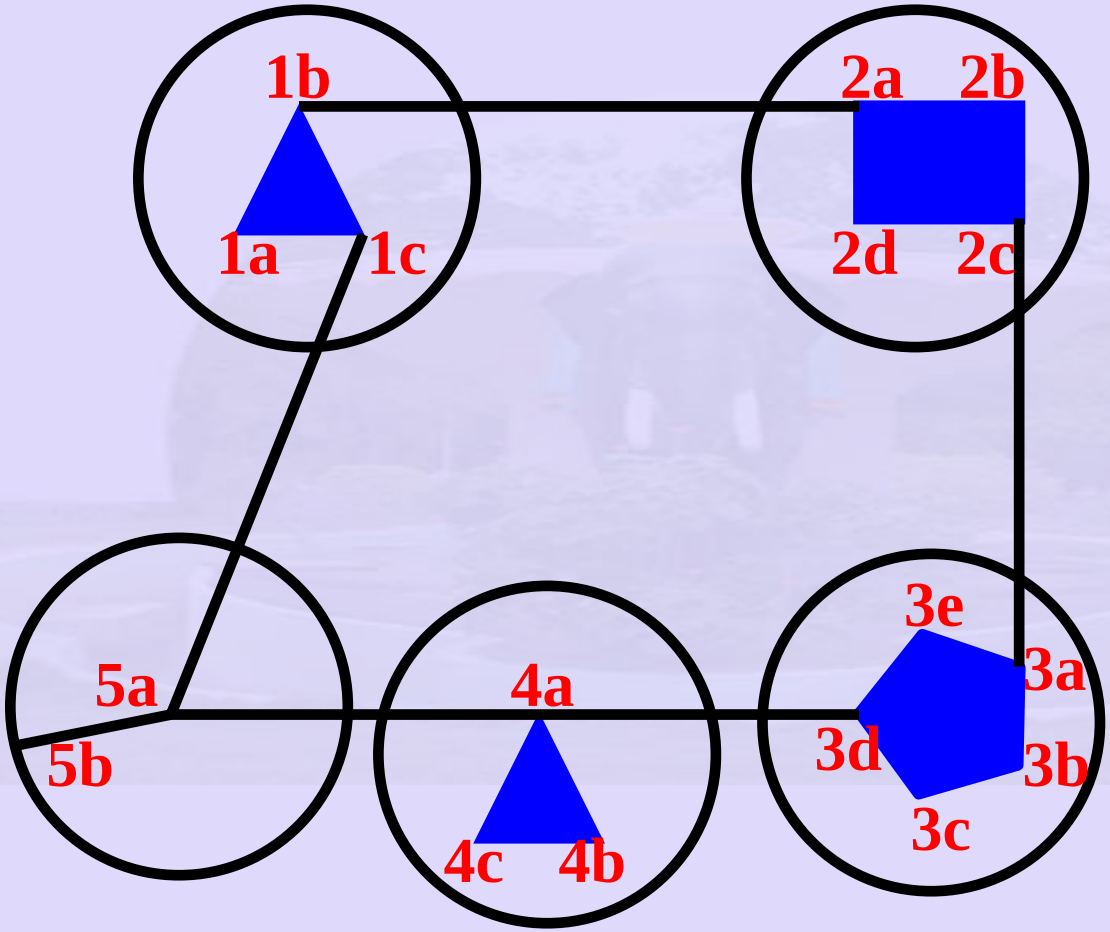
Distributed Routing

- Too many routers:
  - Hierarchical routing
  - Backbone routers
  - Regional routers (Points of Presence)
  - Subnetting

Distributed Routing

- Flooding (Broadcast routing)
  - Send distinct packet to every host (wasteful of network bw)
  - Every incoming packet sent on every out going line except the line on which it arrived.
  - Generates large number of packets
    - Use hop count
      - Seqno to prevent reflooding
  - Selective flooding
    - East west need not be sent south north
    - Flooding in military
      - When master dies

Hierarchical routing



Full table 1a

	Line	Hop
1a	0	0
1b	1b	1
1c	1c	1
5a	5a	1
	5b	1

Hierarchical routing table 1a

	Line	Hop
1a	-	-
1b	1b	1
1c	1a	1
2	1b	2
3	1c	4
4	1c	3
5	1c	2

Path 1a to 3a via 1c = 6

1a to 3a via 2a = 5

Therefore not always the best.

Distributed Routing (Miscellaneous)

- Multi destination routing:
  - Each packet contains a list of destinations
  - Router check destinations for choosing output lines
  - Copy of packet made and forwarded only line where destination exists
  - Partitioning of destination into the output lines
  - After sufficient number of hops – each packet only one destination

Distributed Routing (Miscellaneous)

- Multidestination Routing
  - Sending a message to a group of hosts
  - Routers must know about hosts that belong to the same group
  - Prune spanning tree to include only the edges of hosts in the group
  - Forward packets in that group
    - Link state / distance vector
    - Node not in group tells host not to send
  - n groups – m members

Distributed Routing (Miscellaneous)

- Sink tree router / spanning tree
  - Each router copies packets on to output lines on spanning tree except line it arrived.
- Reverse Path Forwarding:
  - Broadcast packet at router forwarded on all lines other line it arrived
  - Provided packet arrived on preferred
  - Otherwise discarded
  - No need to know spanning tree

Distributed Routing (Miscellaneous)

- When a router receives a multicast packet
  - Examines spanning tree
  - Prune tree to lead to hosts only on the group
  - Forward packets only on pruned tree
- Link state pruning:
  - Each router aware of the complete subnet topolo
  - Prune spanning tree
    - Start from end of each path and work toward the root
      - Distance vector approach
    - Reverse path forwarding
      - Send message back to host to prune its tree

Distributed Routing (Miscellaneous)

- Core base tree
  - Single spanning tree / group
  - Root near middle of the group
  - Host sends multicast packet send to the root
  - Multicast along spanning tree