CSE3151

COMPUTER NETWORKS

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NETWORK LAYER

Medium Access Sublayer: Pure and slotted ALOHA, Persistent and Non persistent CSMA, CSMA with collision detection and collision free protocols, IEEE standard 802.3 and Ethernet.

Data Link Layer: Types of errors, framing, error detection & correction methods; Flow control, Stop & wait ARQ, Go-Back- N ARQ, Selective repeat ARQ, HDLC.

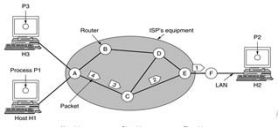
Network Layer: Internet address, classful address, subnetting, static vs. dynamic routing, shortest path algorithm, flooding, distance vector routing, link state routing, ARP, RARP, IP, ICMP.

Transport Layer: UDP, TCP, Connection management, Addressing, Establishing and Releasing Connection, Congestion control algorithm, Flow control and Buffering, Multiplexing.

Presentation Layer: Data Compression techniques, Frequency Dependent Coding, Context Dependent Encoding.

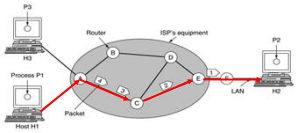
ROUTING

- The main function of the network layer is **ROUTING PACKETS** from the source machine to the destination machine.
- In most networks, packets will require multiple hops to make the journey.
  - The routing algorithm is that part of the network layer software responsible for deciding which output line an incoming packet should be transmitted on.
- **ROUTING ALGORITHMS** can be grouped into two major classes:
  - NONADAPTIVE AND
  - ADAPTIVE.



NONADAPTIVE ROUTING

- NONADAPTIVE algorithms do not base their routing decisions on any measurements or estimates of the current topology and traffic.
- Instead, the choice of the route to use to get from **I to J** (for all I and J) is computed in advance, offline, and downloaded to the routers when the network is booted.
- This procedure is sometimes called **static routing**

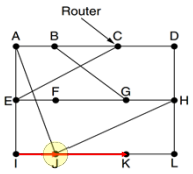


ADAPTIVE ROUTING

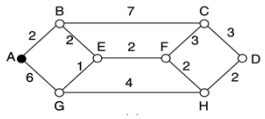
- ADAPTIVE algorithms, in contrast, change their routing decisions to reflect changes in the topology, and sometimes changes in the traffic as well.
- These dynamic routing algorithms differ in :
  - **where they get** their information (e.g., **locally**, from adjacent routers, or from all routers),
  - **when** they change the routes (e.g., when the topology changes, or every ΔT seconds as the load changes), and
  - **what metric** is used for optimization (e.g., distance, number of hops, or estimated transit time

OPTIMALITY PRINCIPLE

- It states that if router J is on the optimal path from router I to router K then the optimal path from J to K also falls along the same route



THE SHORTEST PATH ALGORITHM



- One way of measuring path length is the number of hops. Using this metric, the paths ABC and ABE in Fig. 5-7 are equally long.
- Another metric is the geographic distance in kilometers, in which case ABC is clearly much longer than ABE.
- Dijkstra

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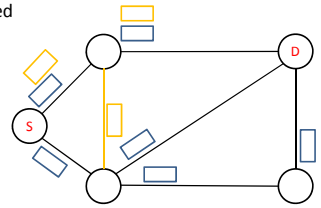
FLOODING

- When a routing algorithm is implemented, each router must make decisions based on local knowledge, not the complete picture of the network.
- A simple local technique is flooding, in which every incoming packet is sent out on every outgoing line except the one it arrived



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DISTANCE VECTOR ROUTING

- A distance vector routing algorithm operates by having each router maintain a table (i.e., a vector) giving the best known distance to each destination and which link to use to get there.
- These tables are updated by exchanging information with the neighbors. Eventually, every router knows the best link to reach each destination
- As an example, assume that delay is used as a metric and that the router knows the delay to each of its neighbors

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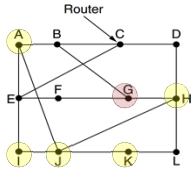

To	A	I	H	K
A	0	24	20	21
B	12	36	31	28
C	25	18	19	36
D	40	27	8	24
E	14	7	30	22
F	23	20	19	40
G	18	31	6	31
H	17	20	0	19
I	21	0	14	22
J	9	11	7	10
K	24	22	22	0
L	29	33	9	9
	JA delay is 8	JI delay is 10	JH delay is 12	JK delay is 6

Vectors received from J's four neighbors

$8 + 18 = 26$
$10 + 31 = 41$
$12 + 06 = 18$
$06 + 31 = 37$

G: Send via A -18ms

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LINK STATE ROUTING

1. Discover its neighbors and learn their network addresses.
2. Set the distance or cost metric to each of its neighbors.
3. Construct a packet telling all it has just learned.
4. Send this packet to and receive packets from all other routers.
5. Compute the shortest path to every other router.

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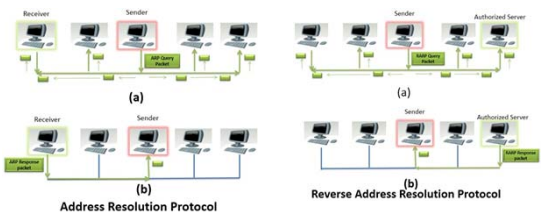
ARP and RARP

- Address Resolution Protocol
- Reverse Address Resolution Protocol



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