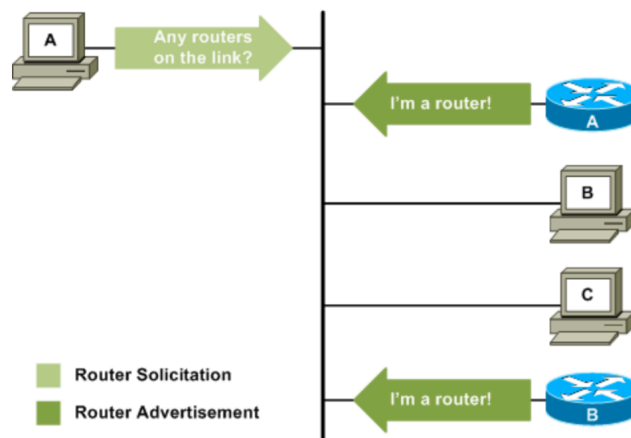


Network Layer (III)

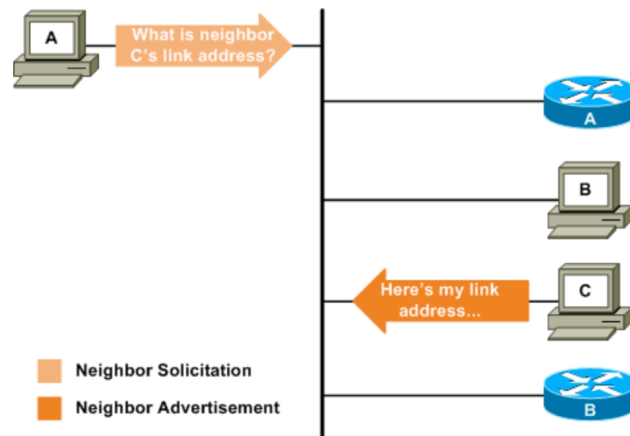
Neighbor Discovery Protocol

- **Replaces ARP in IPv6** (multicast vs broadcast)
- **Built into ICMPv6**, defines ICMPv6 message
 - **Router Solicitation** (Type 133)
 - Hosts inquire with Router Solicitation messages to locate routers on an attached link (all routers multicast ff02::2). Routers which forward packets not addressed to them generate Router Advertisements immediately upon receipt of this message rather than at their next scheduled time.
 - **Router Advertisement** (Type 134)
 - Routers advertise their presence together with various link and Internet parameters either periodically (all nodes multicast ff02::1), or in response to a Router Solicitation message sender. It includes information like available link prefixes, MTU, and etc.
 - **Neighbor Solicitation** (Type 135)
 - Neighbor solicitations are used by nodes to determine the link layer address of a neighbor, or to verify that a neighbor is still reachable via a cached link layer address.
 - **Neighbor Advertisement** (Type 136)
 - Neighbor advertisements are used by nodes to respond to a Neighbor Solicitation message.
 - **Redirect** (Type 137)
 - Router may inform hosts of a better first hop router for a destination.
 - REF: https://en.wikipedia.org/wiki/Neighbor_Discovery_Protocol
- Router Discovery
 - When first joining a link, an IPv6 host multicasts a router solicitation to the *all routers* multicast group, and each router active on the link responds by sending a router advertisement with its address to the *all nodes* group.



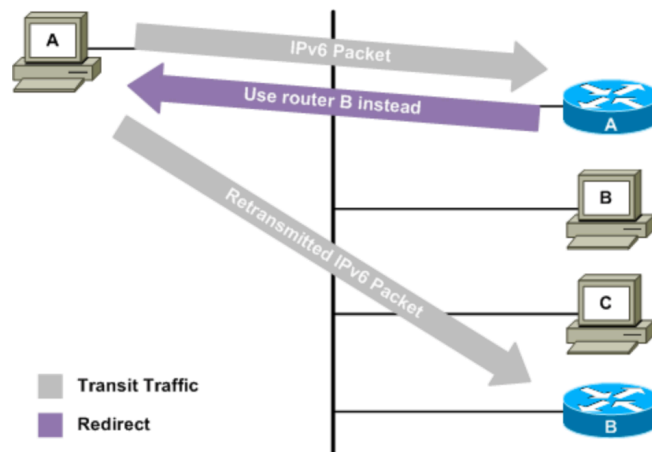
- Address Resolution

- A host seeking the MAC address of a neighbor multicasts a neighbor solicitation and the neighbor (if online) responds with its link layer address in a neighbor advertisement.



- Redirection

- Routers use redirect ICMPv6 message to either point hosts toward a more preferable router, or to indicate that the destination actually resides on link.



- Diagram REF: <https://packetlife.net/blog/2008/aug/28/ipv6-neighbor-discovery/>

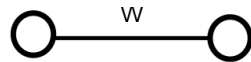
- RFC 4861

Routing

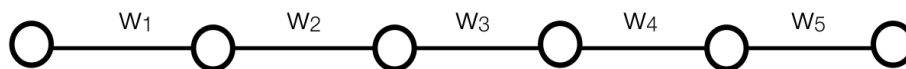
- Finding a good path from source to destination
 - topology discovery
 - route selection

Link Weights

- What is a good measure of “weight” of a link?



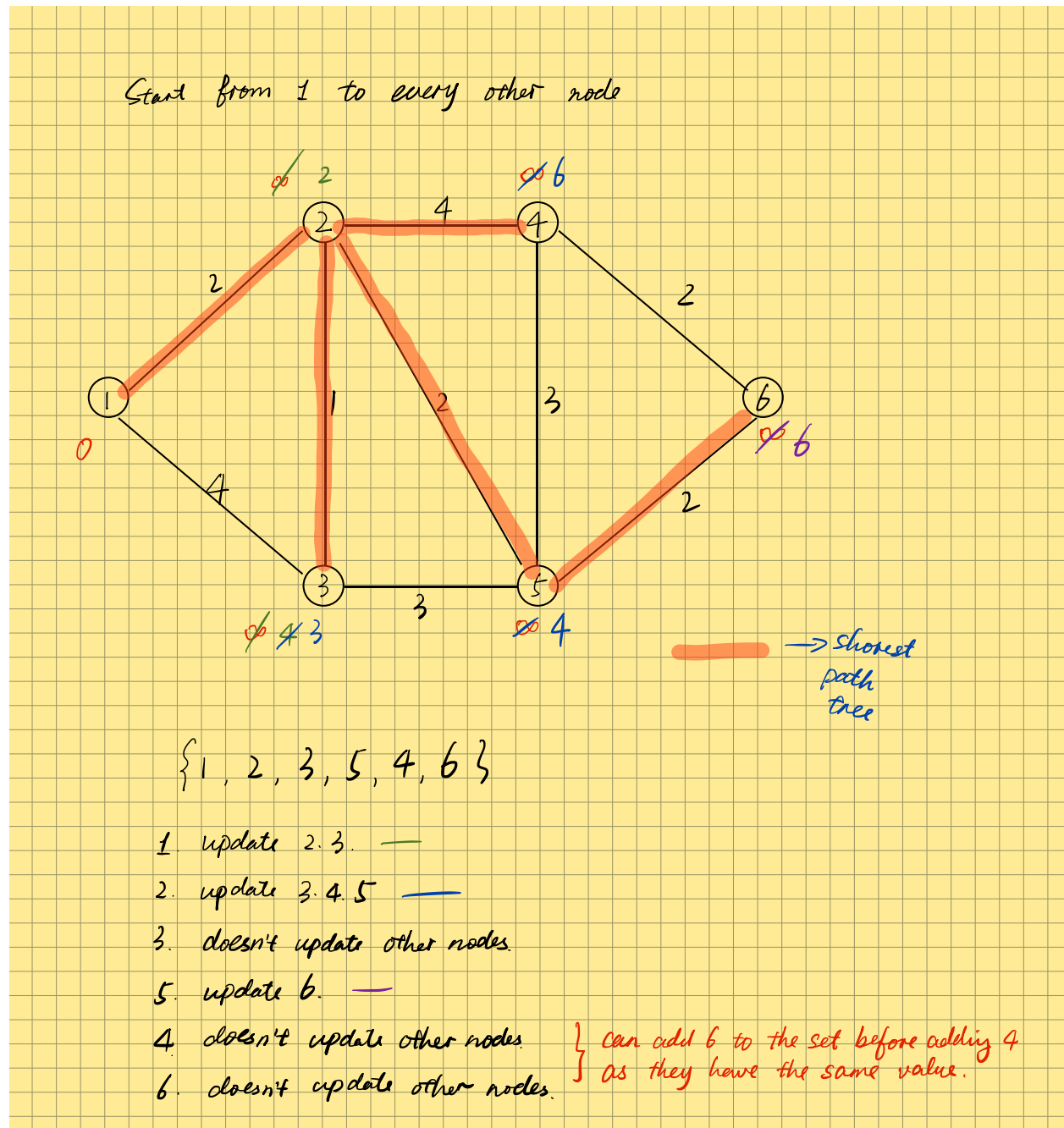
- Link measures:
 - Throughput / bit rate
 - Latency
 - Loss probability
- Weight of a path?



- Path measures:
 - Sum
 - Latency
 - Min/Max
 - Throughput / bit rate
 - Product
 - Loss probability

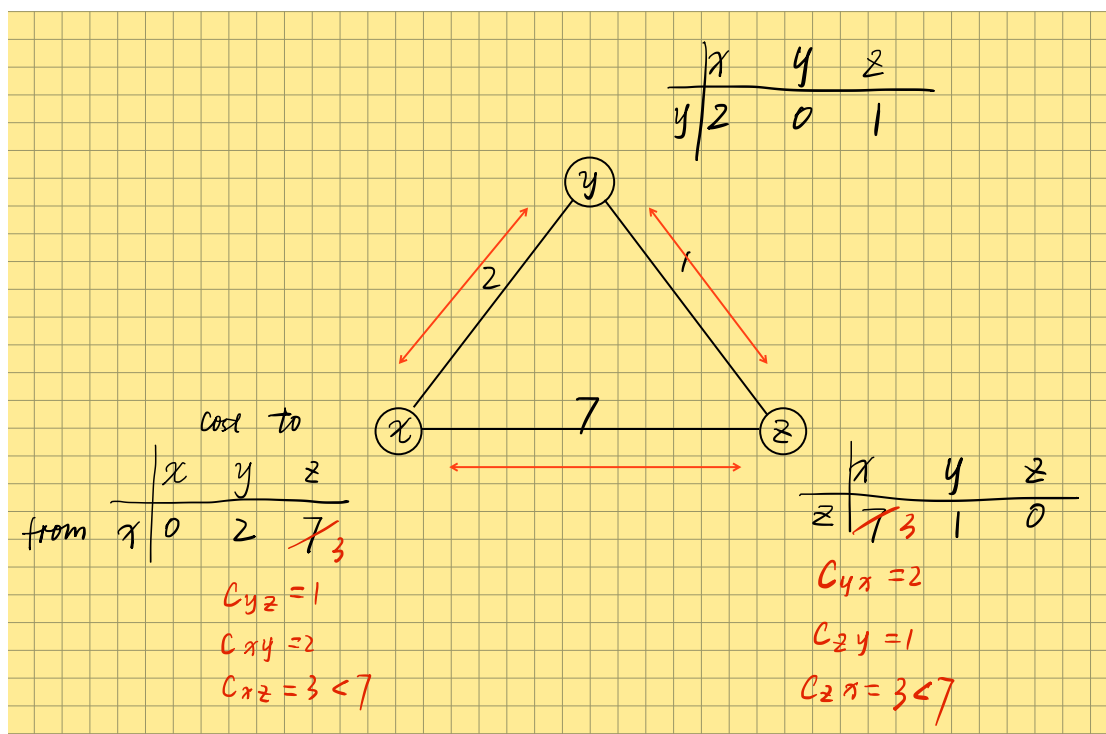
Routing Protocols - Categories

- Link State
 - net topology, link costs known to all nodes
 - accomplished via “link state broadcast”
 - all nodes have same info
 - shortest paths calculated and used to populate the routing tables
 - Dijkstra’s algorithm: compute the shortest path from one node to all other nodes
 - It picks the unvisited vertex with the lowest distance, calculates the distance through it to each unlisted neighbor, and updates the neighbor’s distance if smaller.



- Distance Vector: decentralized

- **estimates of distances** to all nodes in the network **sent to all neighbors**
- **estimates** are **improved** based on information from neighbors
- the process is repeated and routing tables are populated **based on the estimates**



Disclaimer: Notes adapted from the textbook and online resources.