Routing Foundations

Network Layer Functions

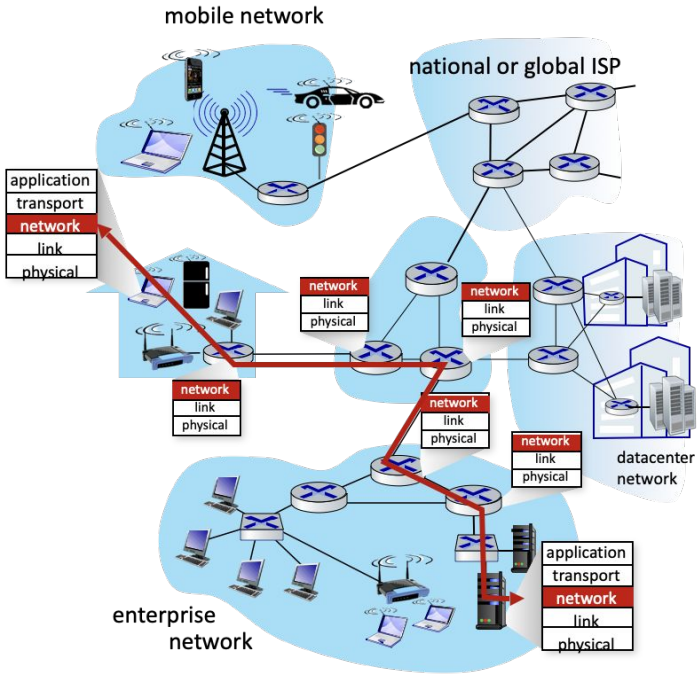
- Forwarding: move packet from router input interface to correct output interface (data plane)

- Routing: determine route taken by packets from source to destination (control plane)

- There are two approaches to structuring the control plane:
  - Local view
  - Global view

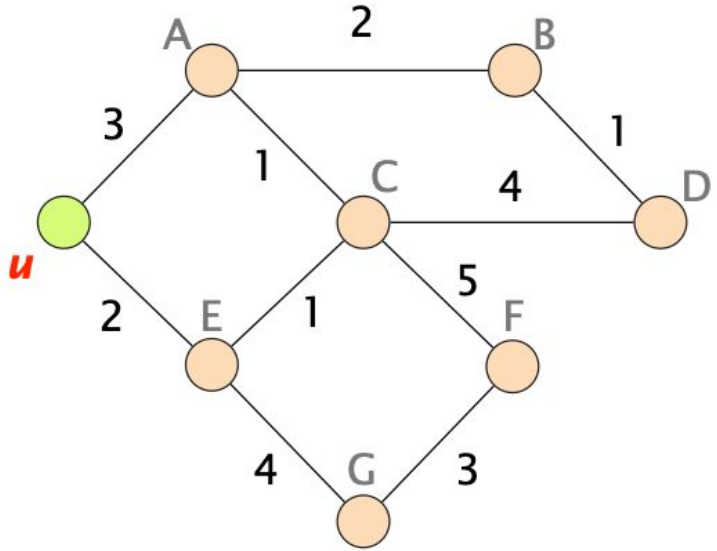
Routing Protocols

- Routing protocol goal: determine “good” paths (i.e., routes), from sending hosts to receiving host, through network of routers
- path: sequence of routers packets traverse from given initial source host to final destination host
- “good”: least “cost”, “fastest”, “least congested”



We Use Graph Abstractions to Solve Path Selection

- Nodes are routers
- Edges are links
- Weights are costs

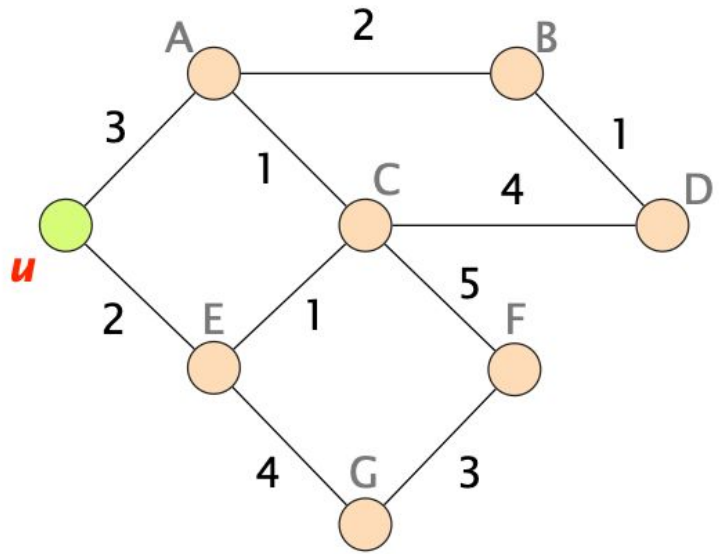


Dijkstra's Algorithm for Shortest Path Search

S = {*u*} — set of nodes for which we know the shortest-path

D(*v*) — the smallest distance currently known by *u* to reach *v*

c(*u*,*v*) — the weight of the link connecting *u* and *v*



Dijkstra's Algorithm for Shortest Path Search

Initialization

$S = \{u\}$

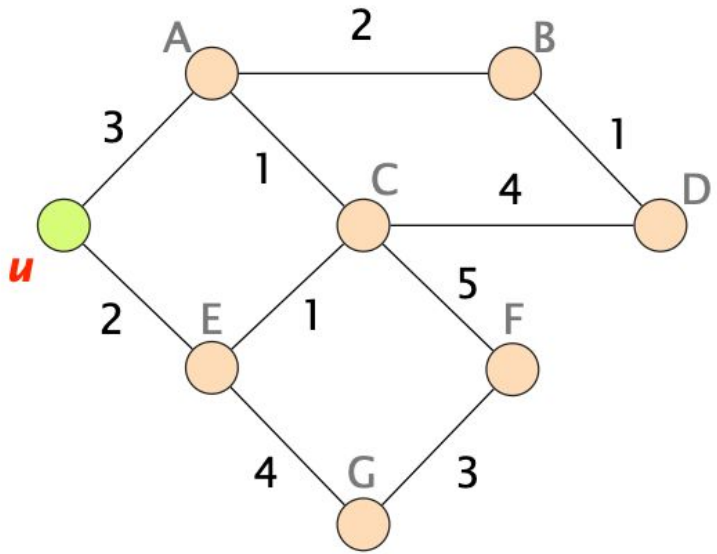
for all nodes v:

    if (v is adjacent to u):

        $D(v) = c(u,v)$

    else:

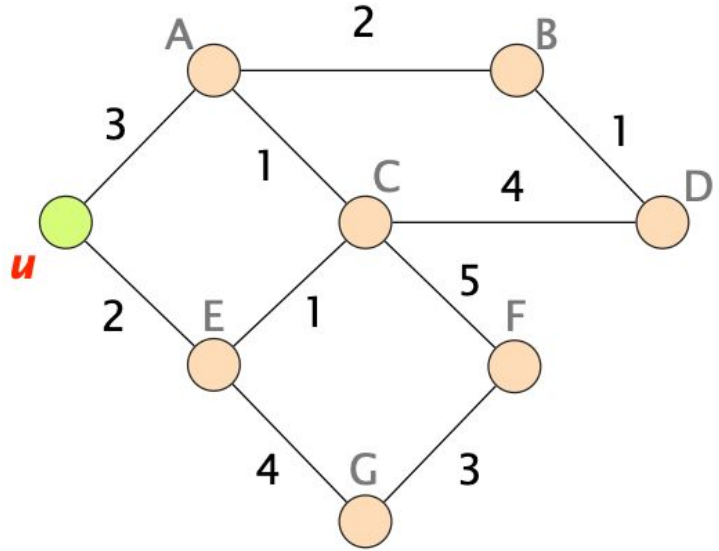
        $D(v) = \infty$



Dijkstra's Algorithm for Shortest Path Search

D(.) = S = {u}

A	3
B	∞
C	∞
D	∞
E	2
F	∞
G	∞



Dijkstra's Algorithm for Shortest Path Search

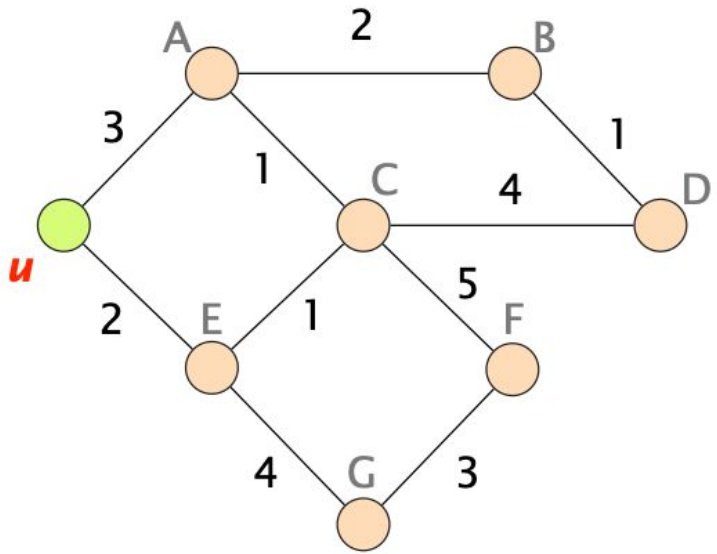
Loop

while *not* all nodes in S:

add *w* with the smallest D(w) to S

update D(*v*) for all adjacent *v* not in S:

$D(v) = \min\{D(v), D(w) + c(w,v)\}$



Dijkstra's Algorithm for Shortest Path Search