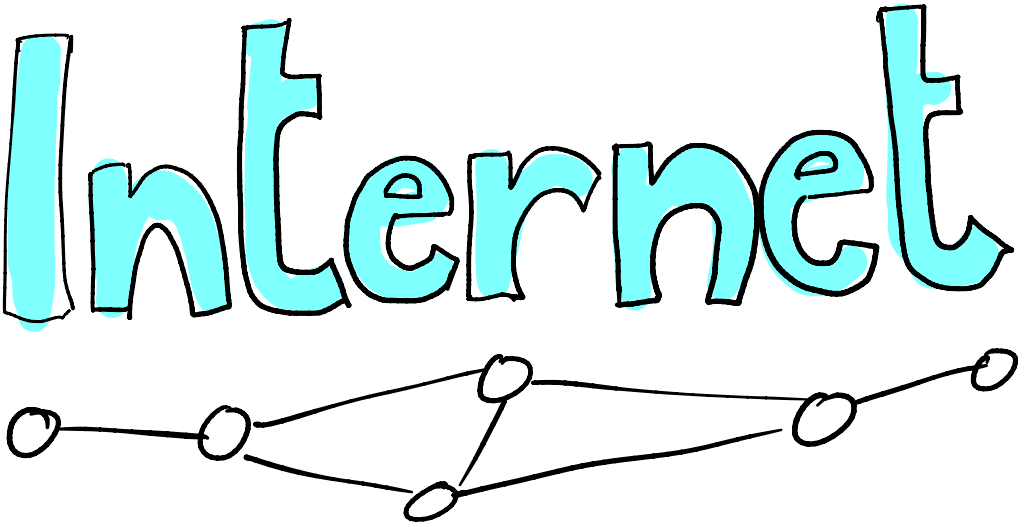
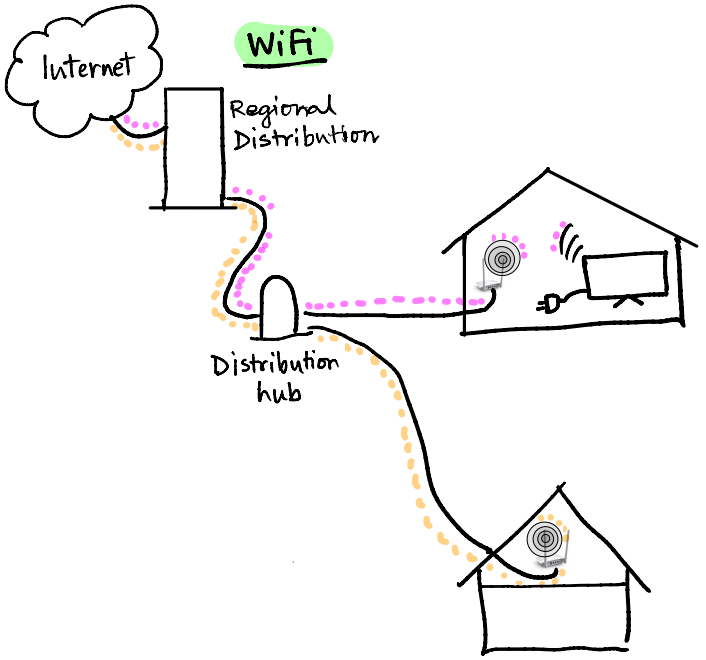
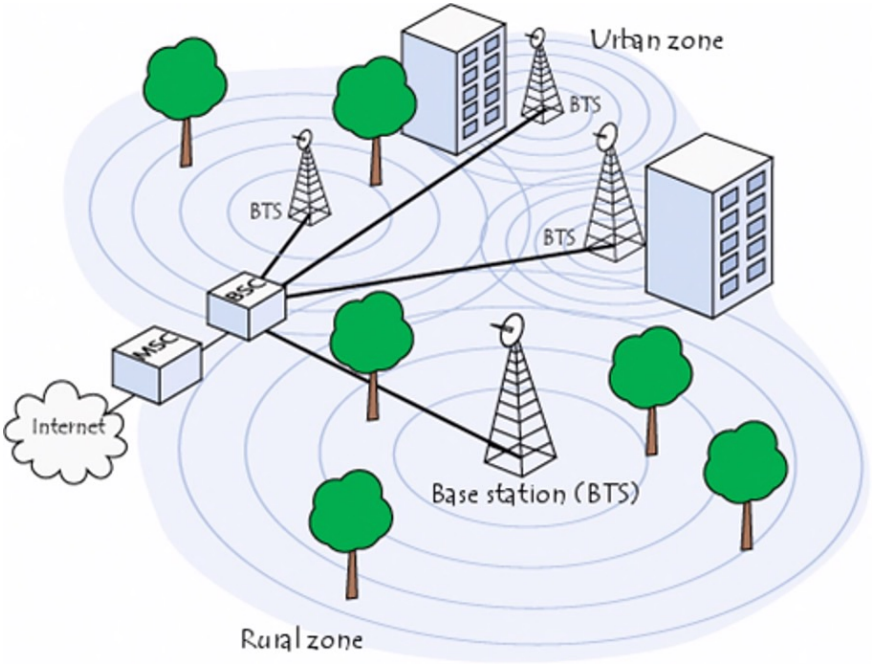
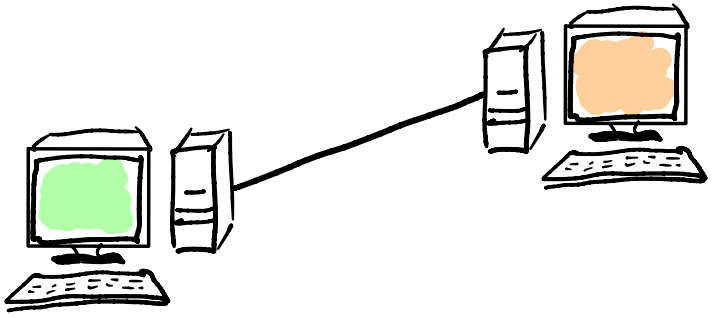

Internet

Thus far


Internet
WiFi
Regional Distribution
Distribution hub

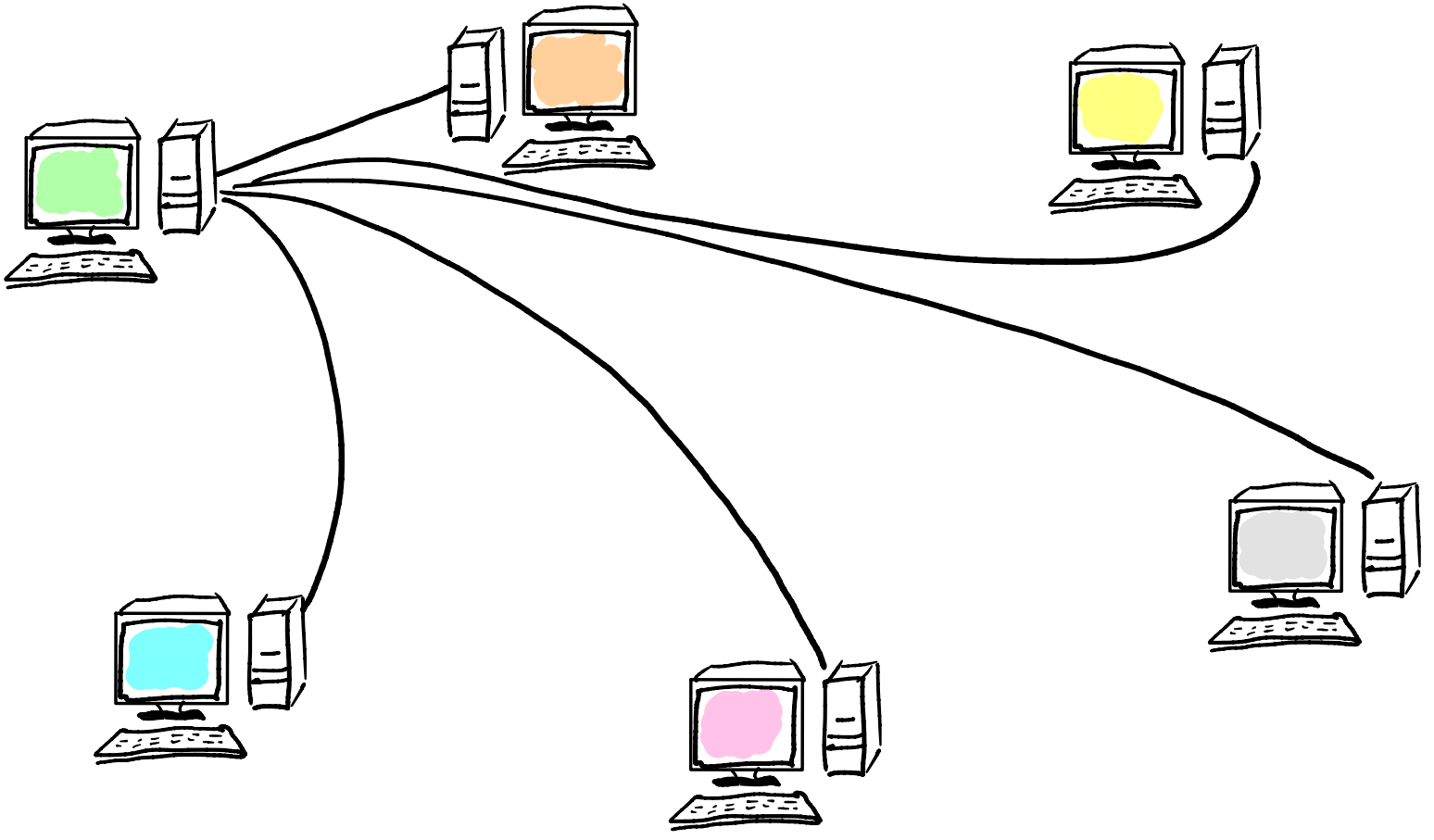

Urban zone
BTS
BTS
BTS
BSC
MSC
Internet
Base station (BTS)
Rural zone

From computing to communication (connecting you and me)



But connecting everyone → how many connections ?

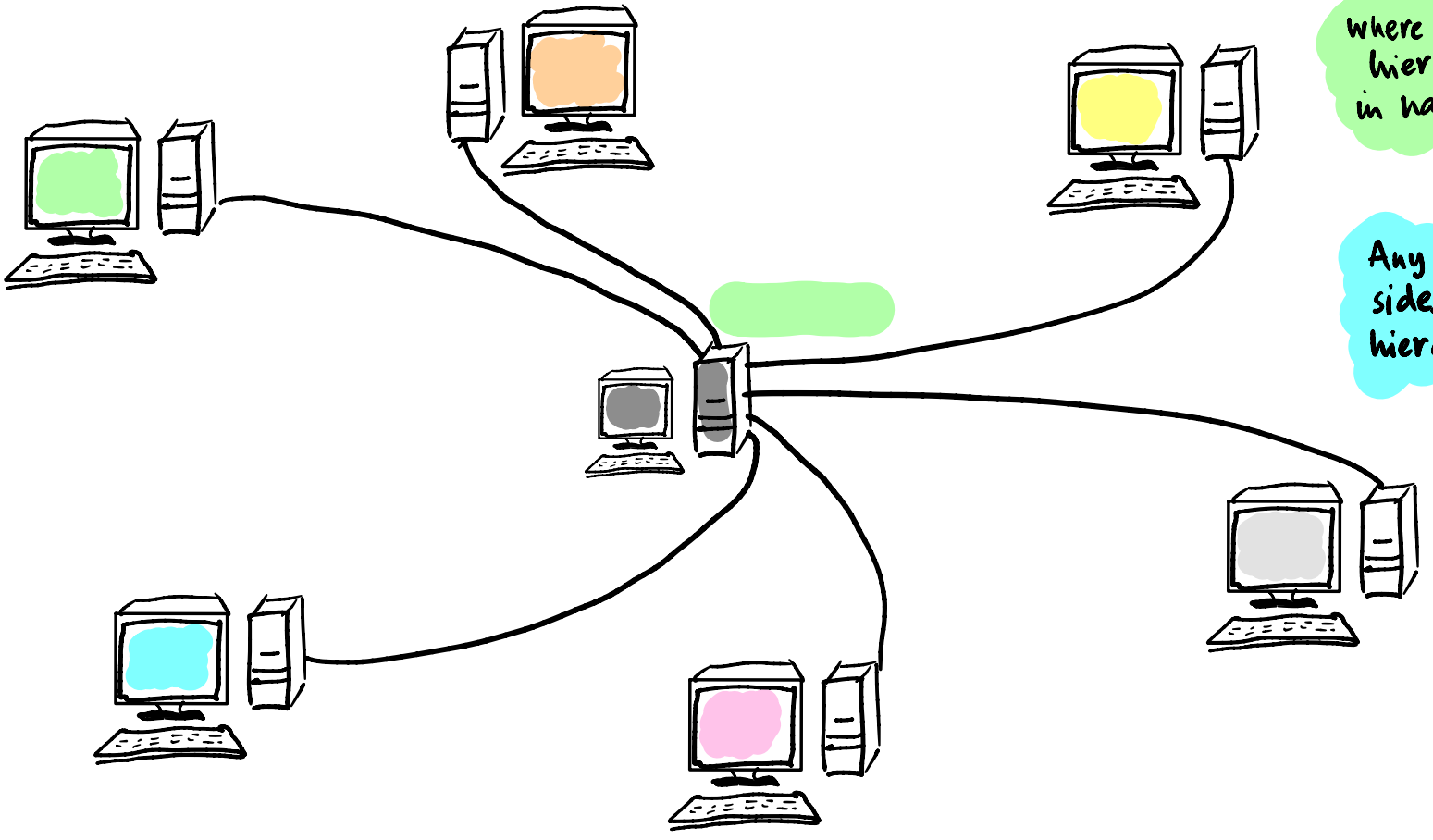
- Clique
- $N C_2$
- Ports
- cost



Similar Problems in other walks of life ?

What's the solution?

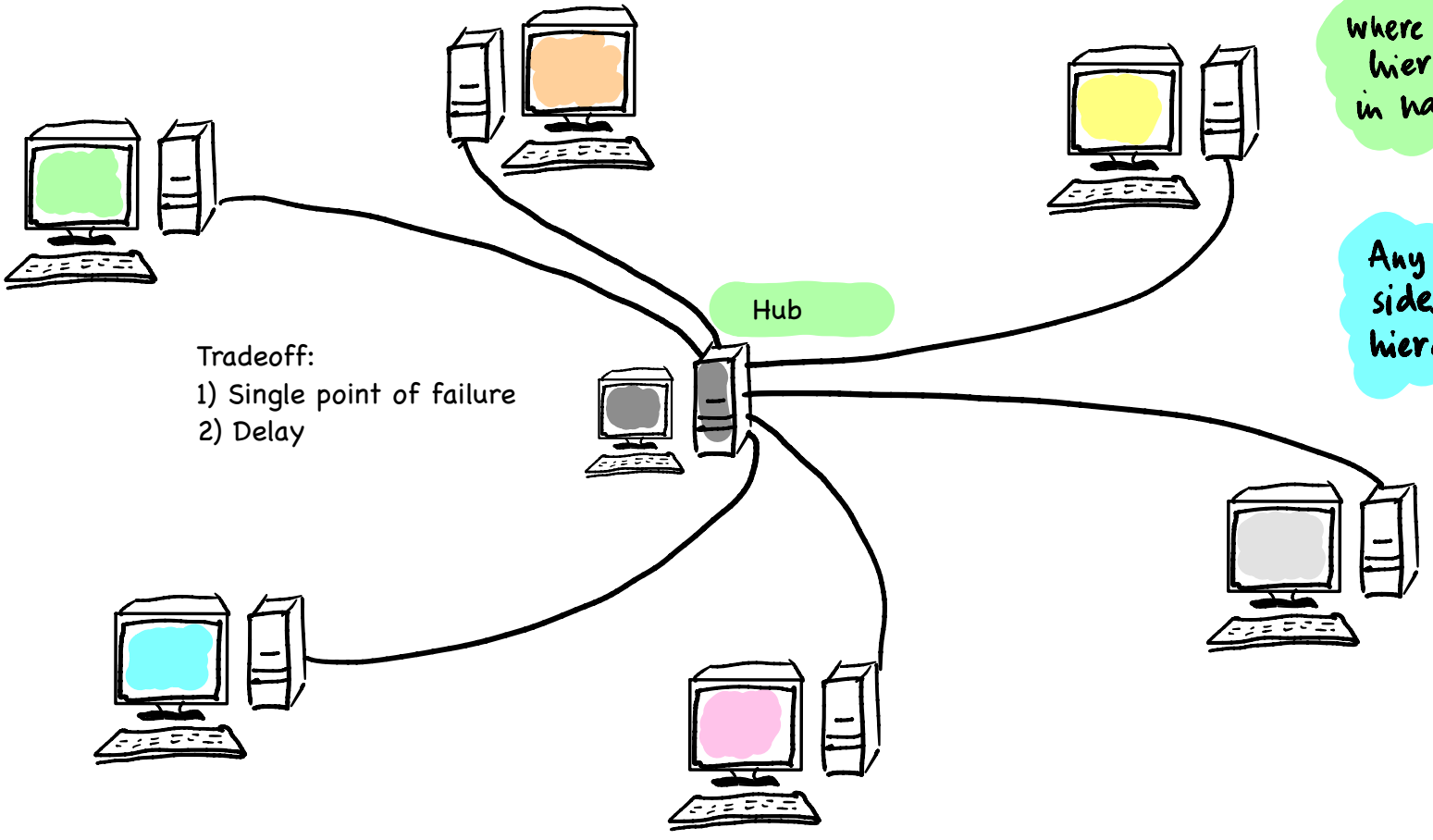
Hierarchy → Permeates natural & man-made efficiency



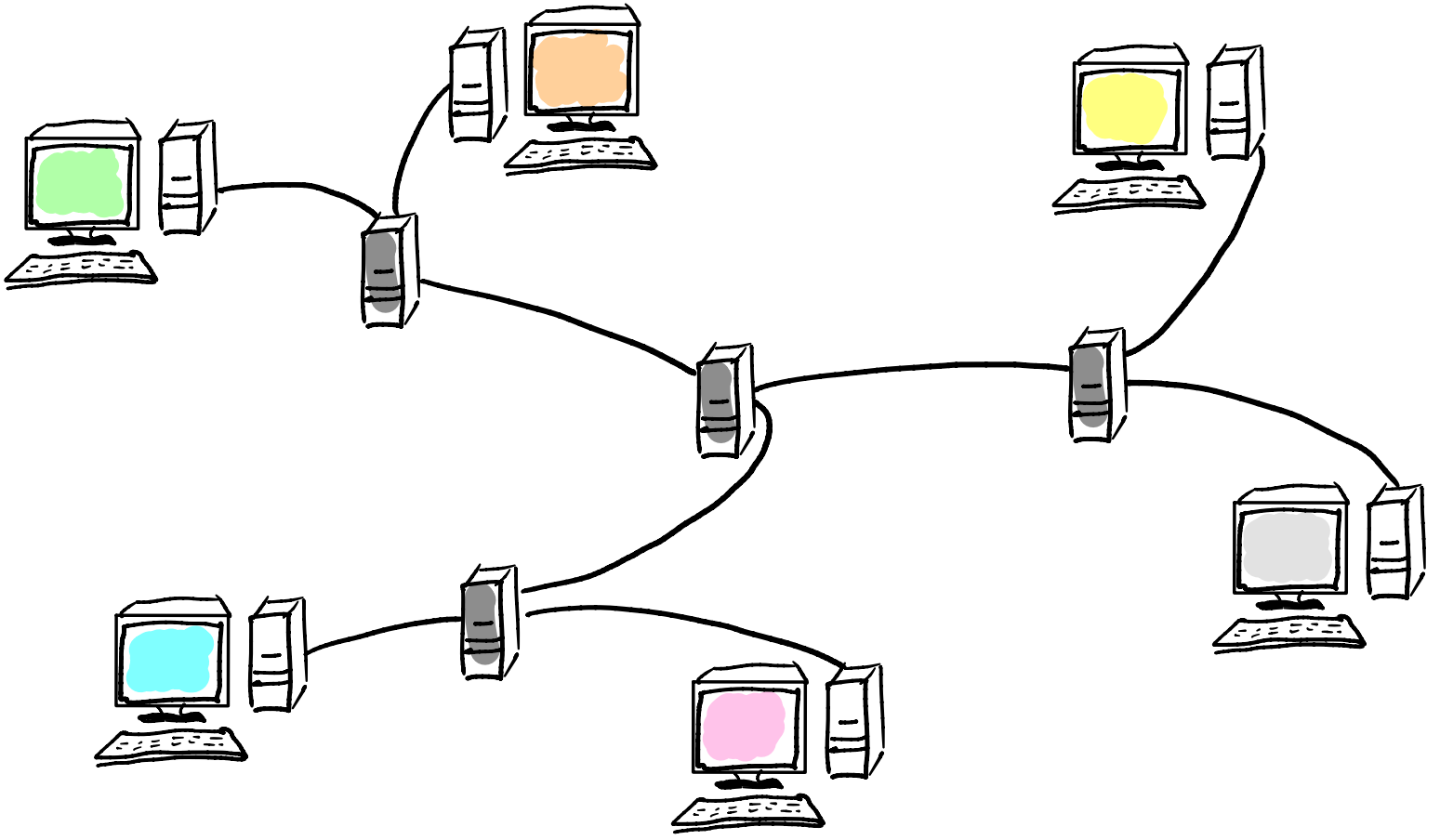
where is hierarchy in nature?

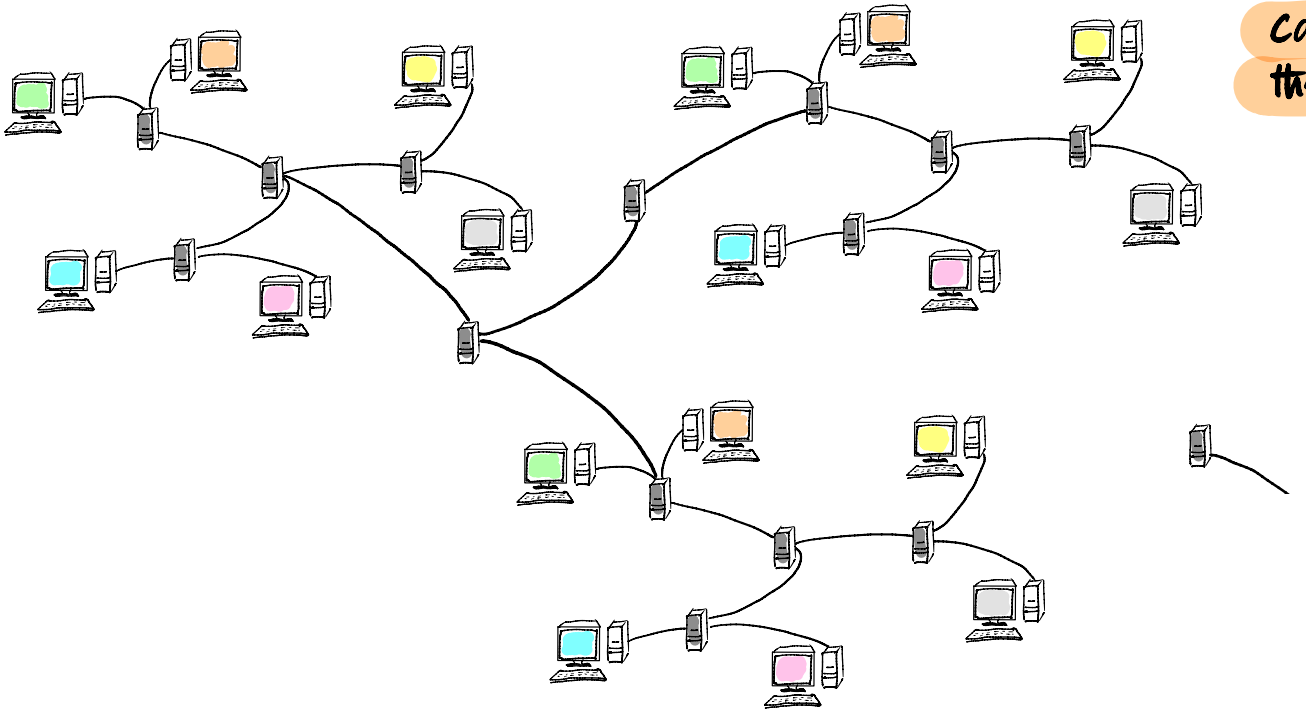
Any down sides of hierarchy?

Hierarchy → Permeates natural & man-made efficiency

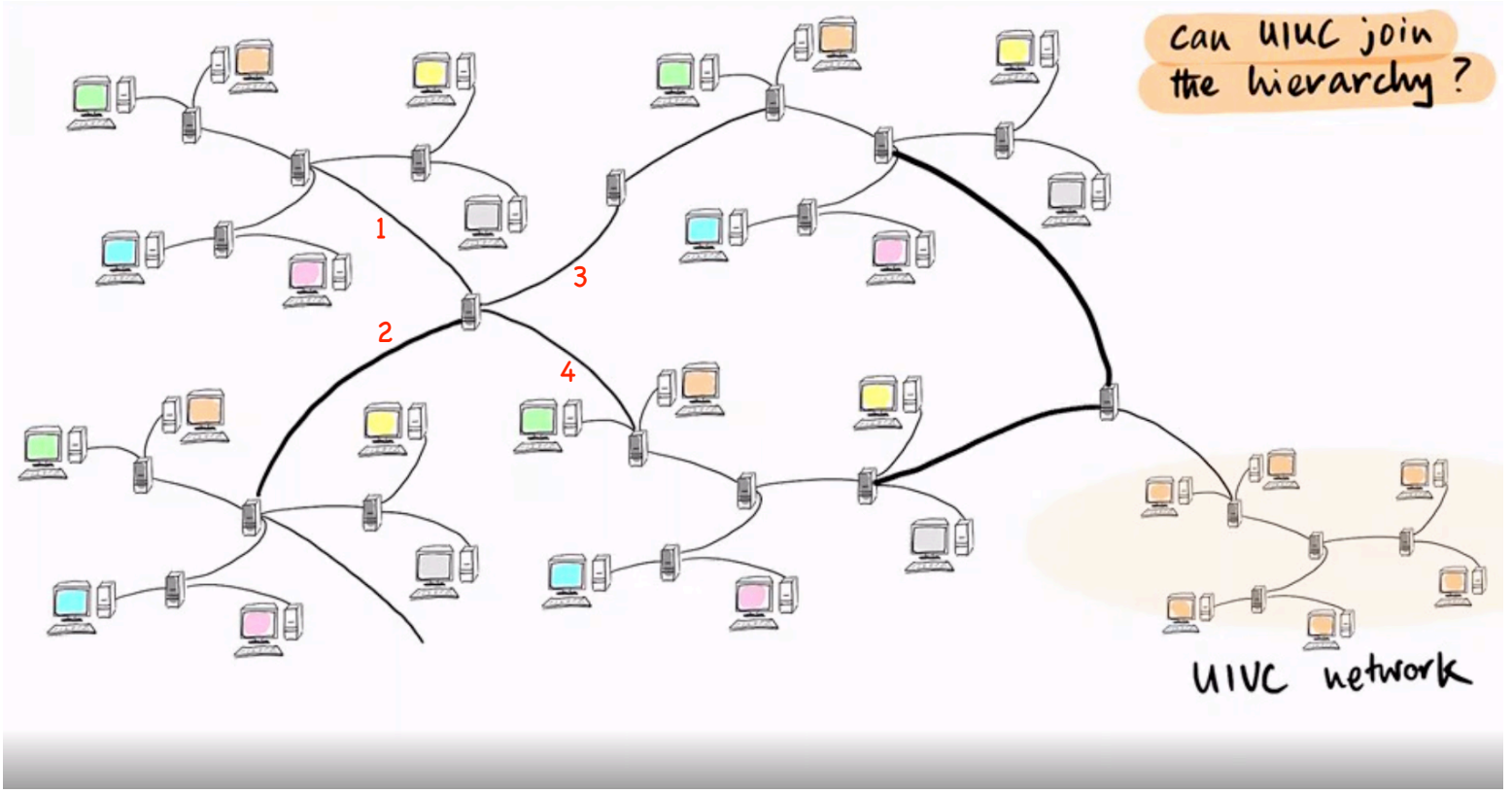


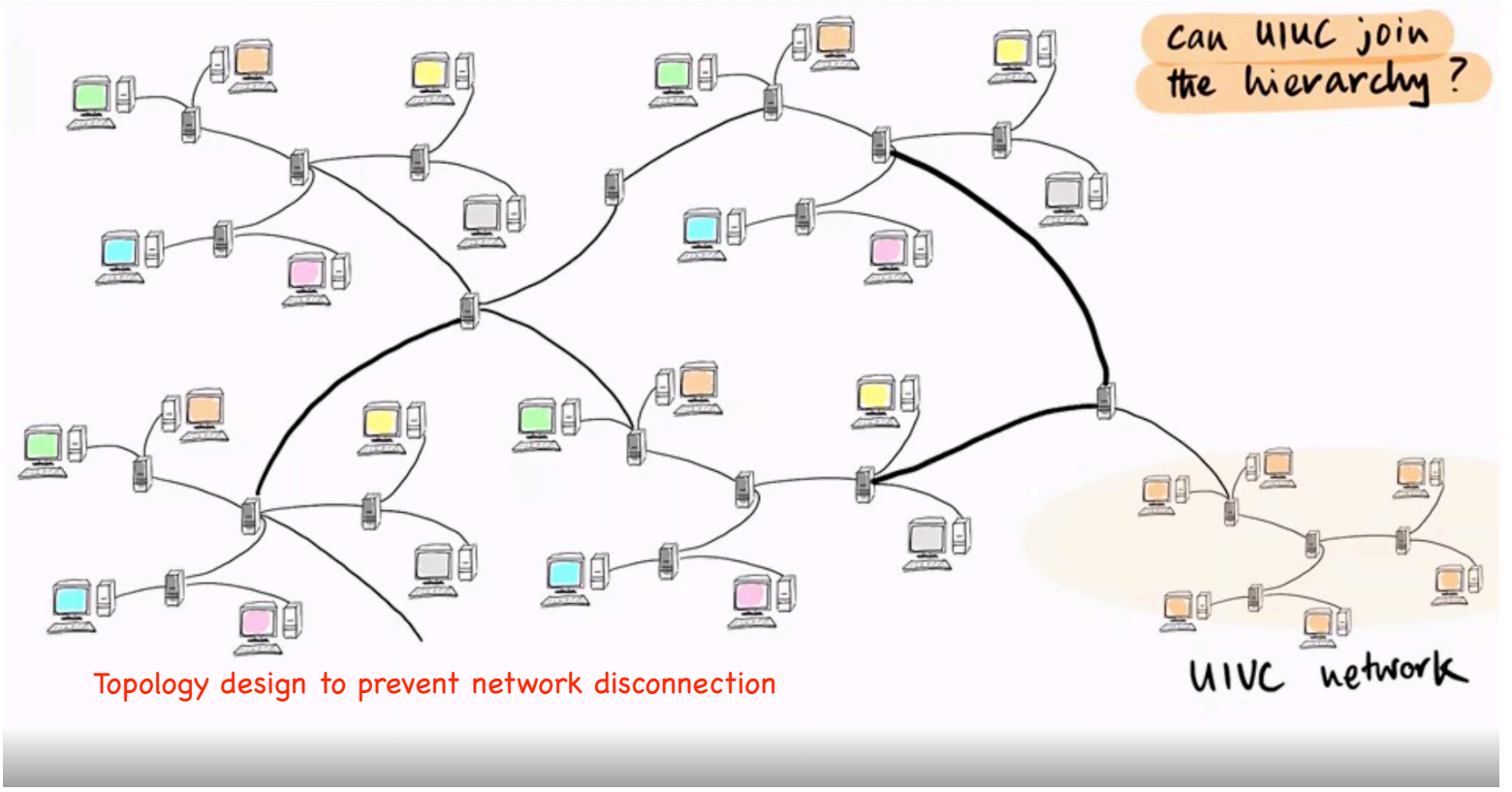
Hierarchy of Hierarchy → Why not Keep going?



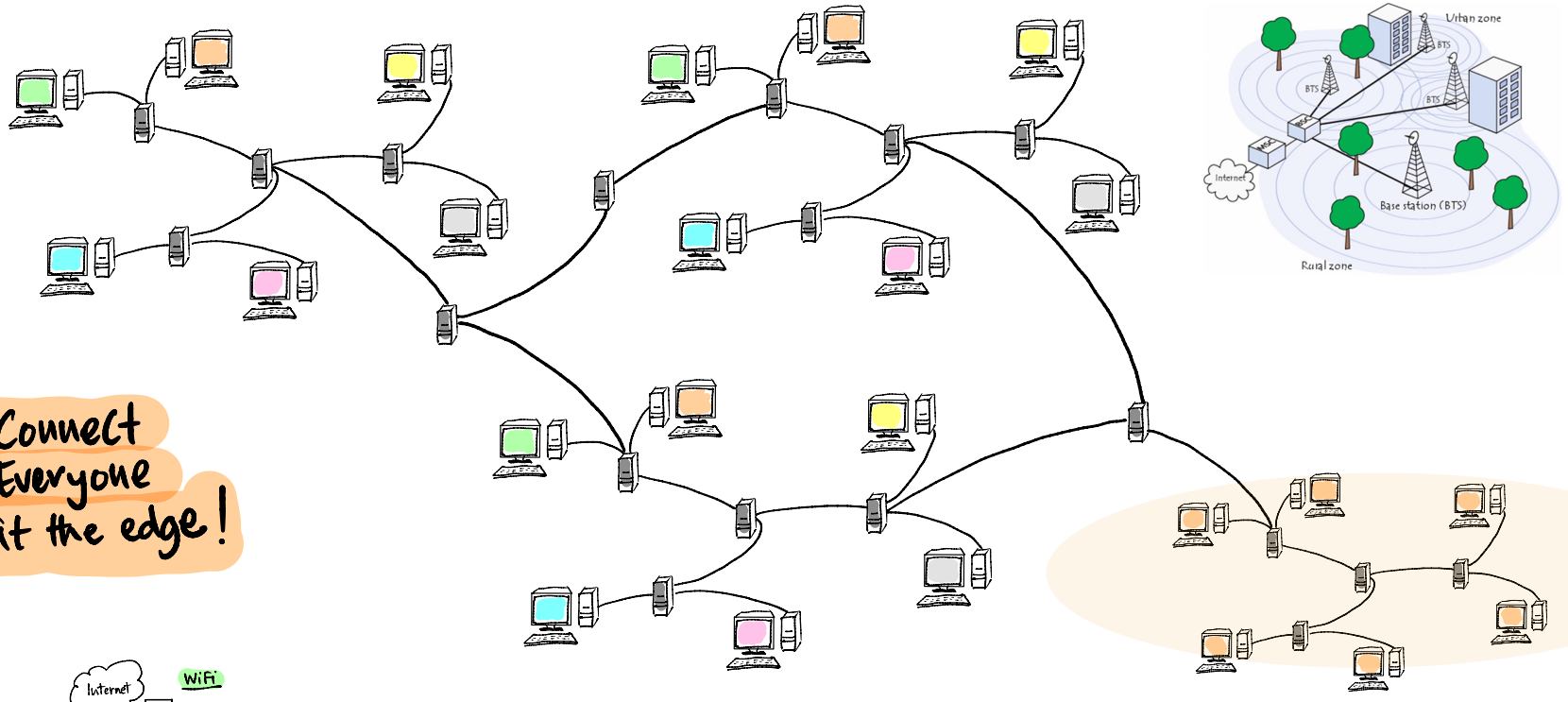


what about failure, disconnection?


can UIUC join the hierarchy?
1
2
3
4
UIUC network

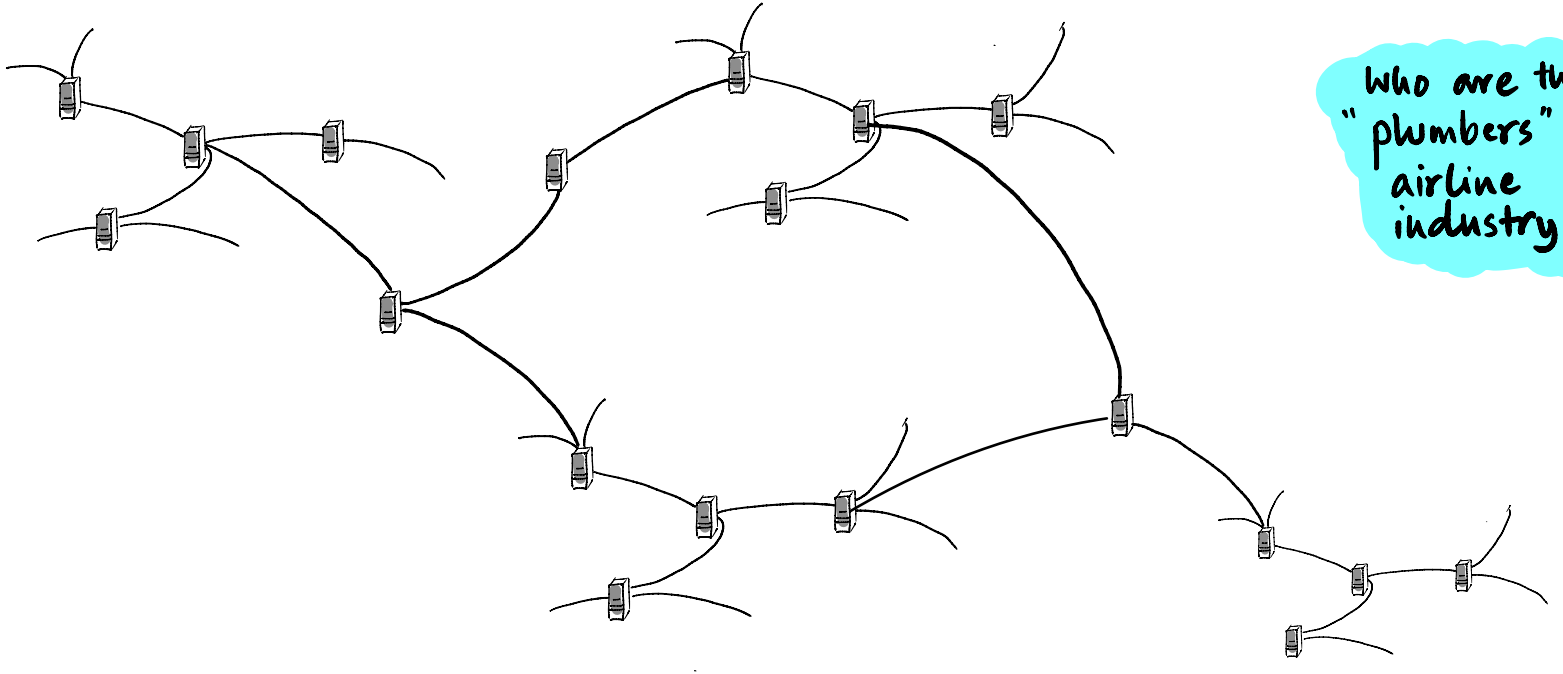


Topology design to prevent network disconnection


Connect
Everyone
At the edge!
Internet
WiFi
Regional Distribution
Distribution hub
Urban zone
BTS
BTS
BTS
Internet
Base station (BTS)
Rural zone

Who is doing the "plumbing", maintaining, managing? ISPs

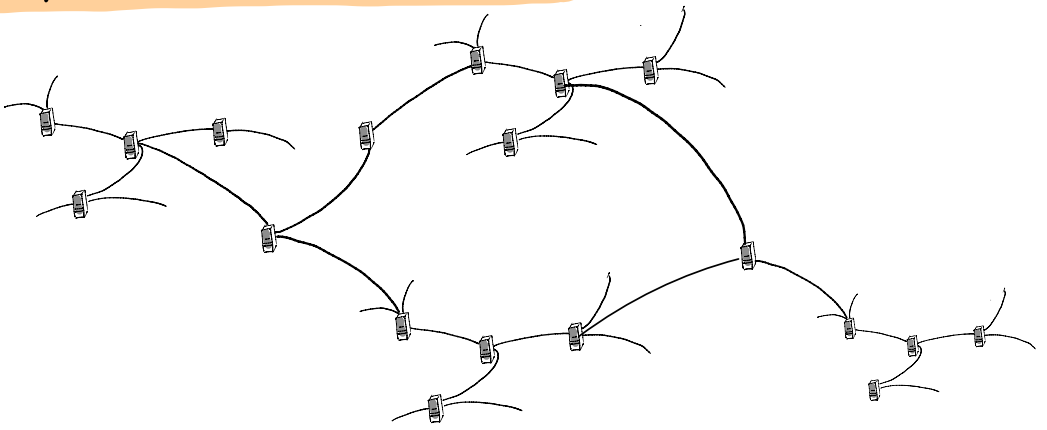
Who owns routers?

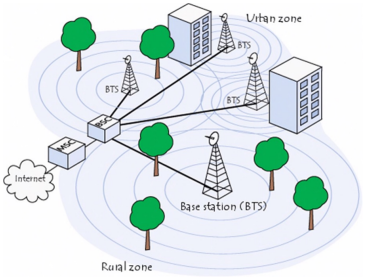


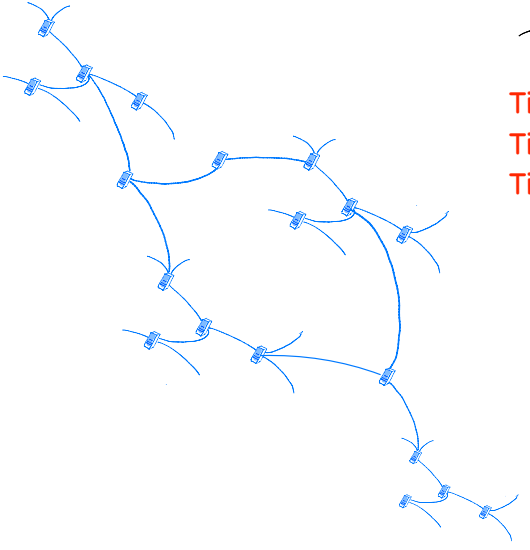
Who are the "plumbers" in airline industry?

Can 1 ISP cover the whole world?

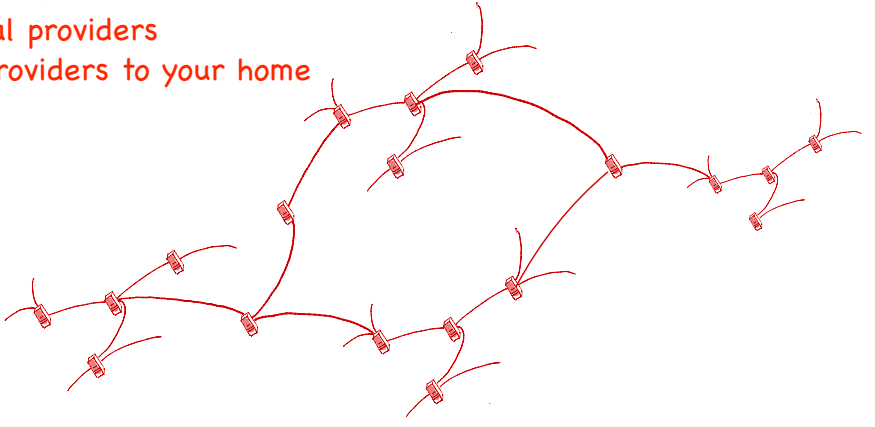
Tier 1, 2, 3 Service Providers





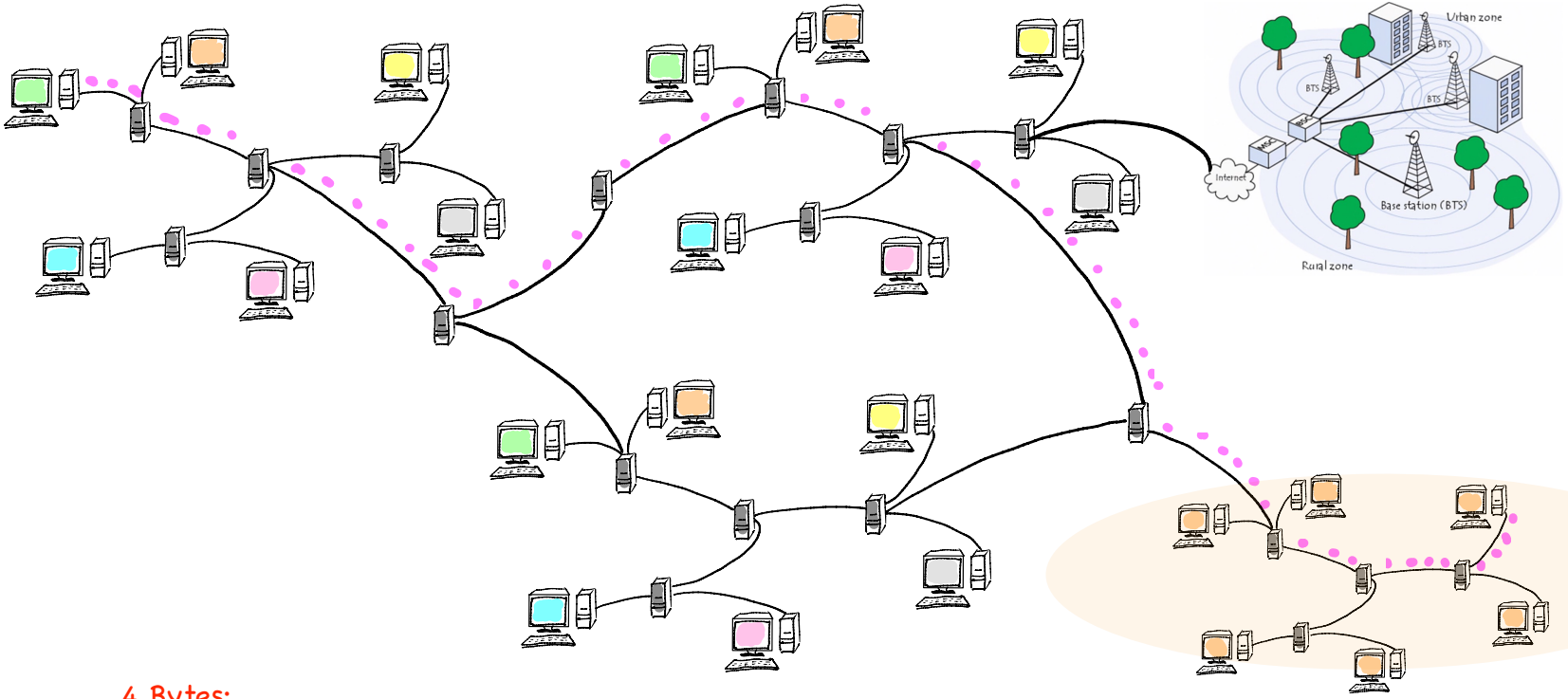


Tier 1: backbone of the internet
Tier 2: regional providers
Tier 3: local providers to your home



Infrastructure Ready !! Now communicate . . . but wait !

To whom ? which address ?

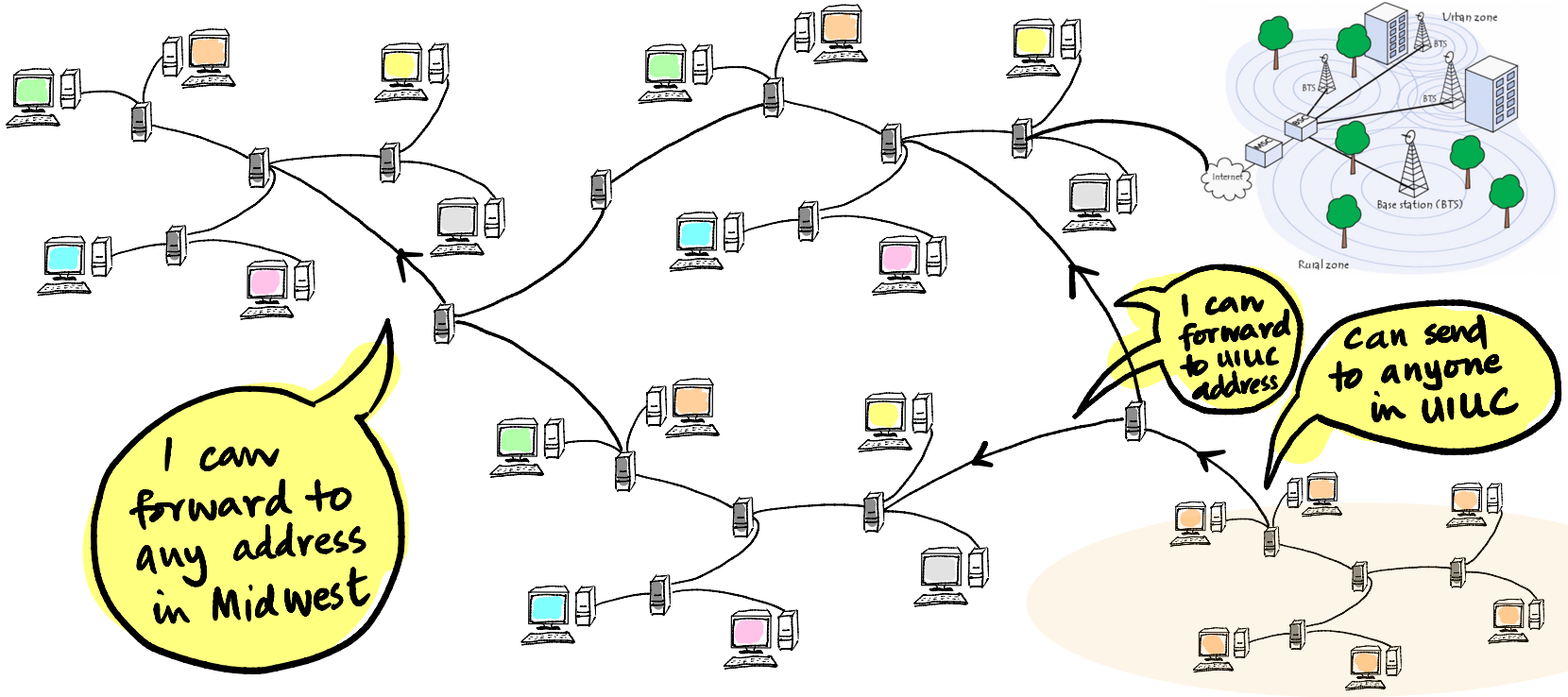


4 Bytes: ____. ____.____.____

IP address : ece.illinois

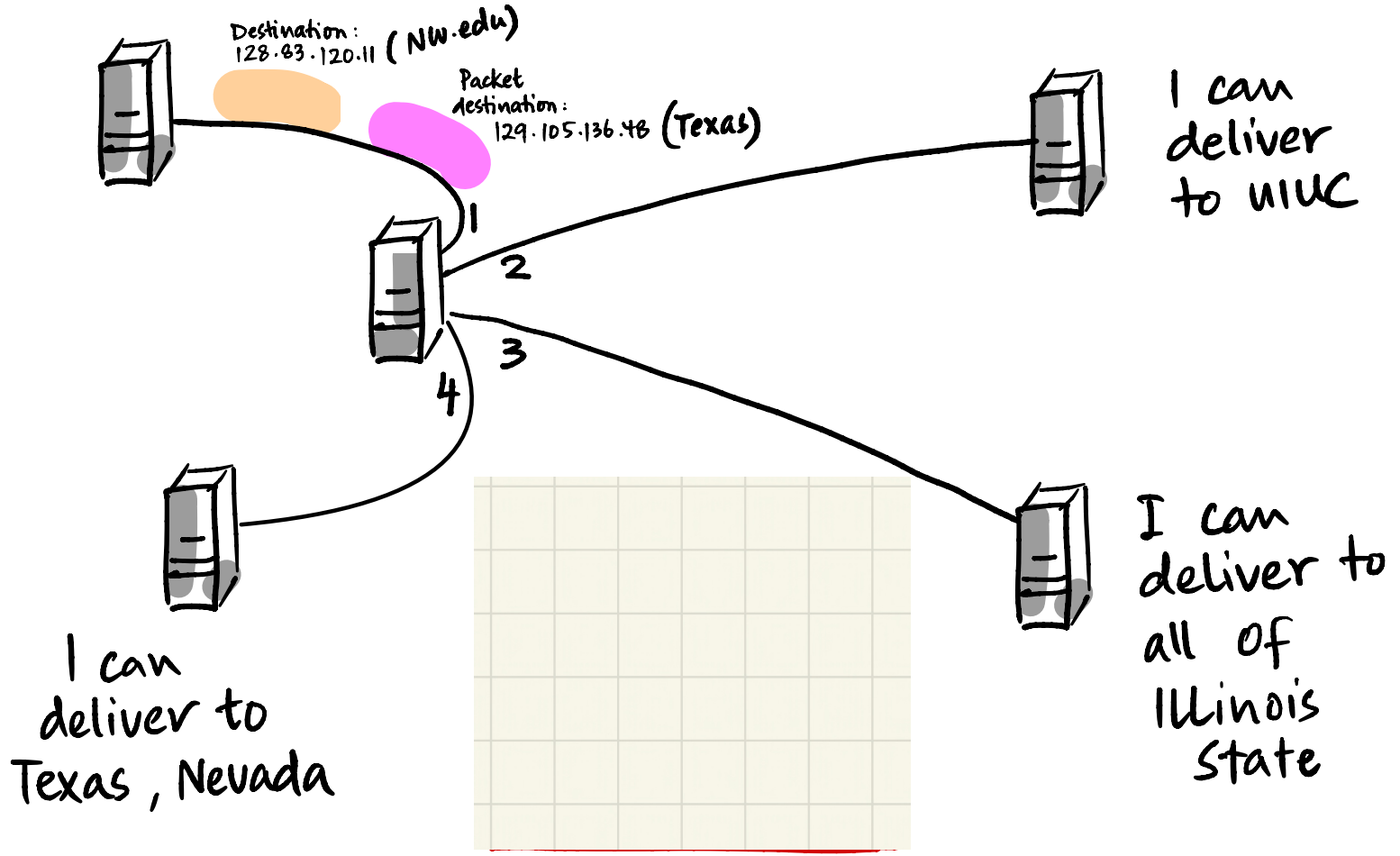
130.126.151.38

Advertising : Who can deliver to which address

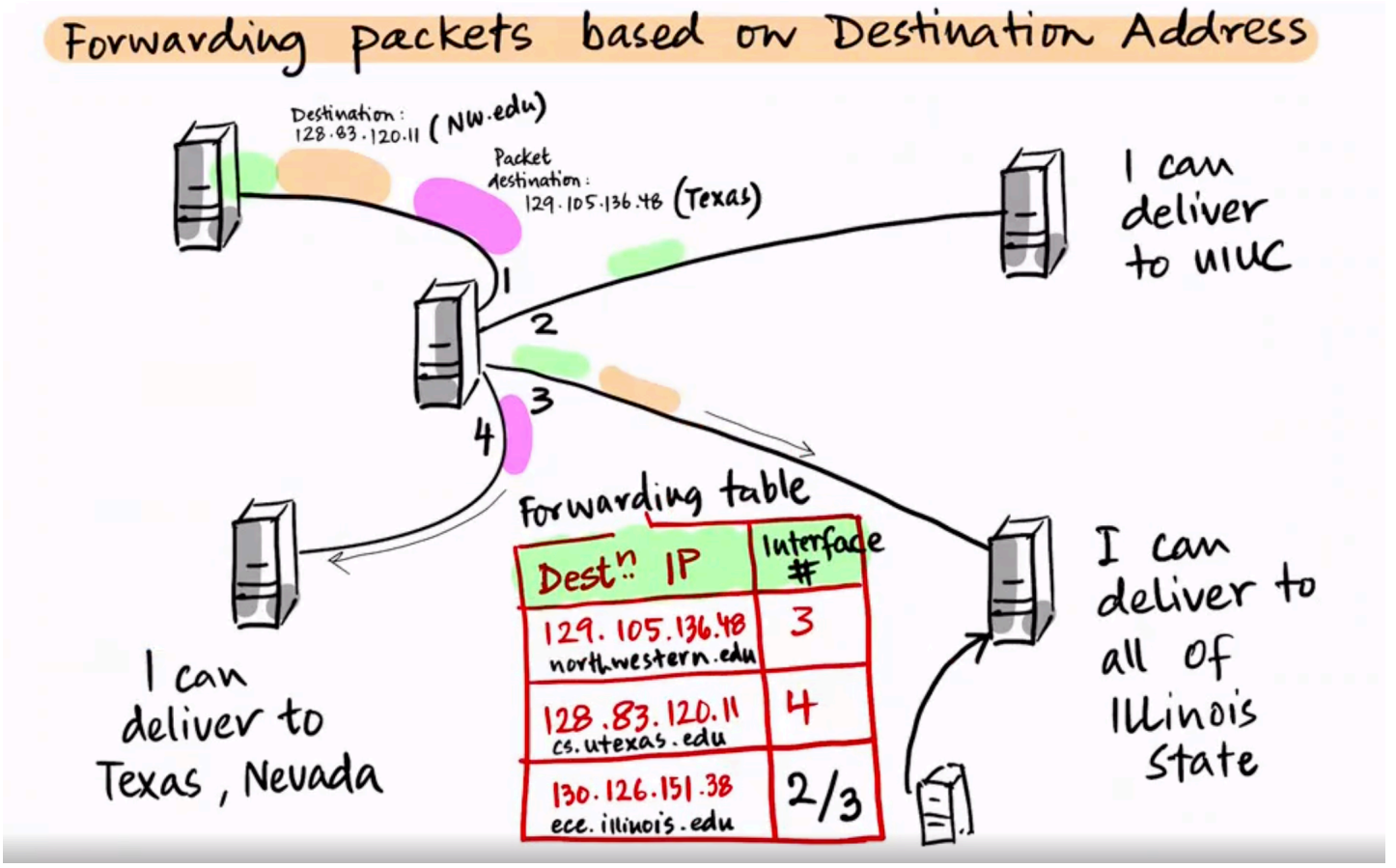


As if Routers are gossiping to figure out who can forward to whom.

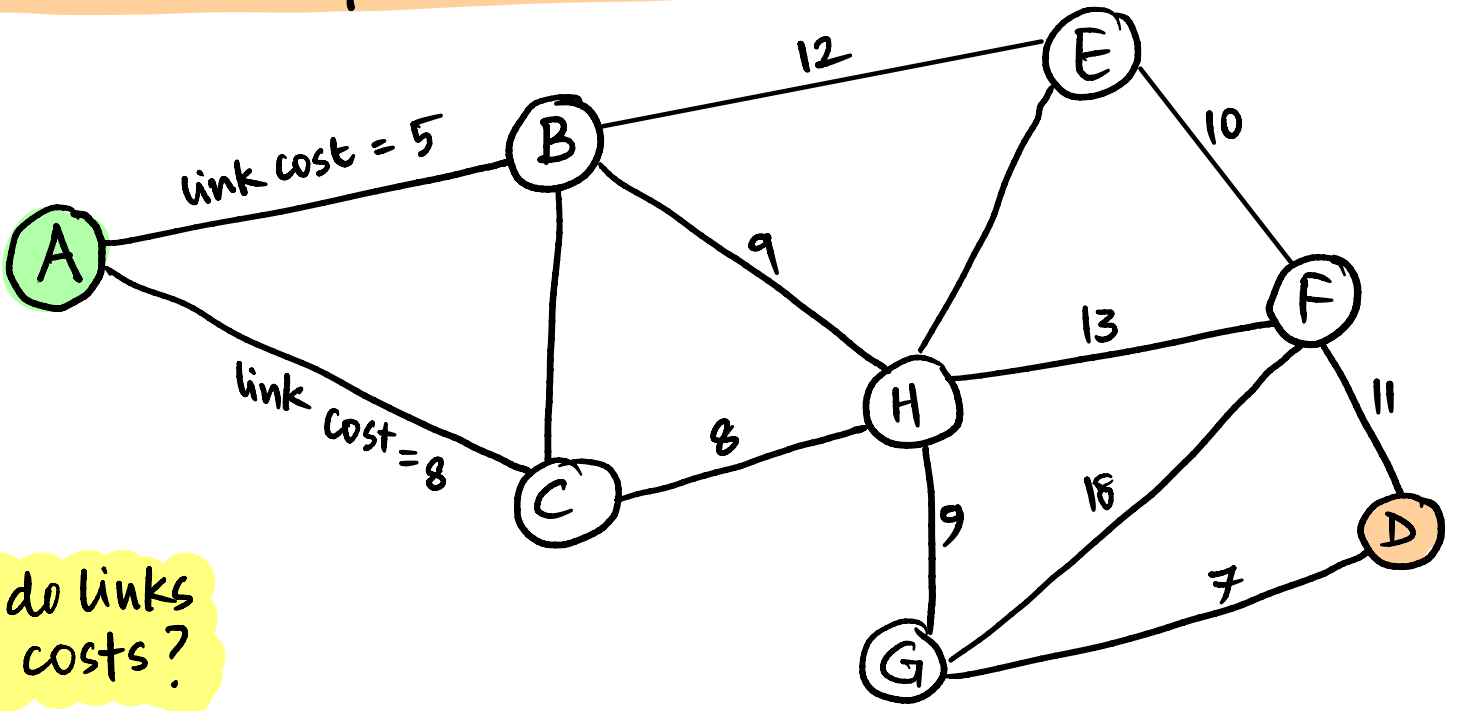
Forwarding packets based on Destination Address



Forwarding packets based on Destination Address

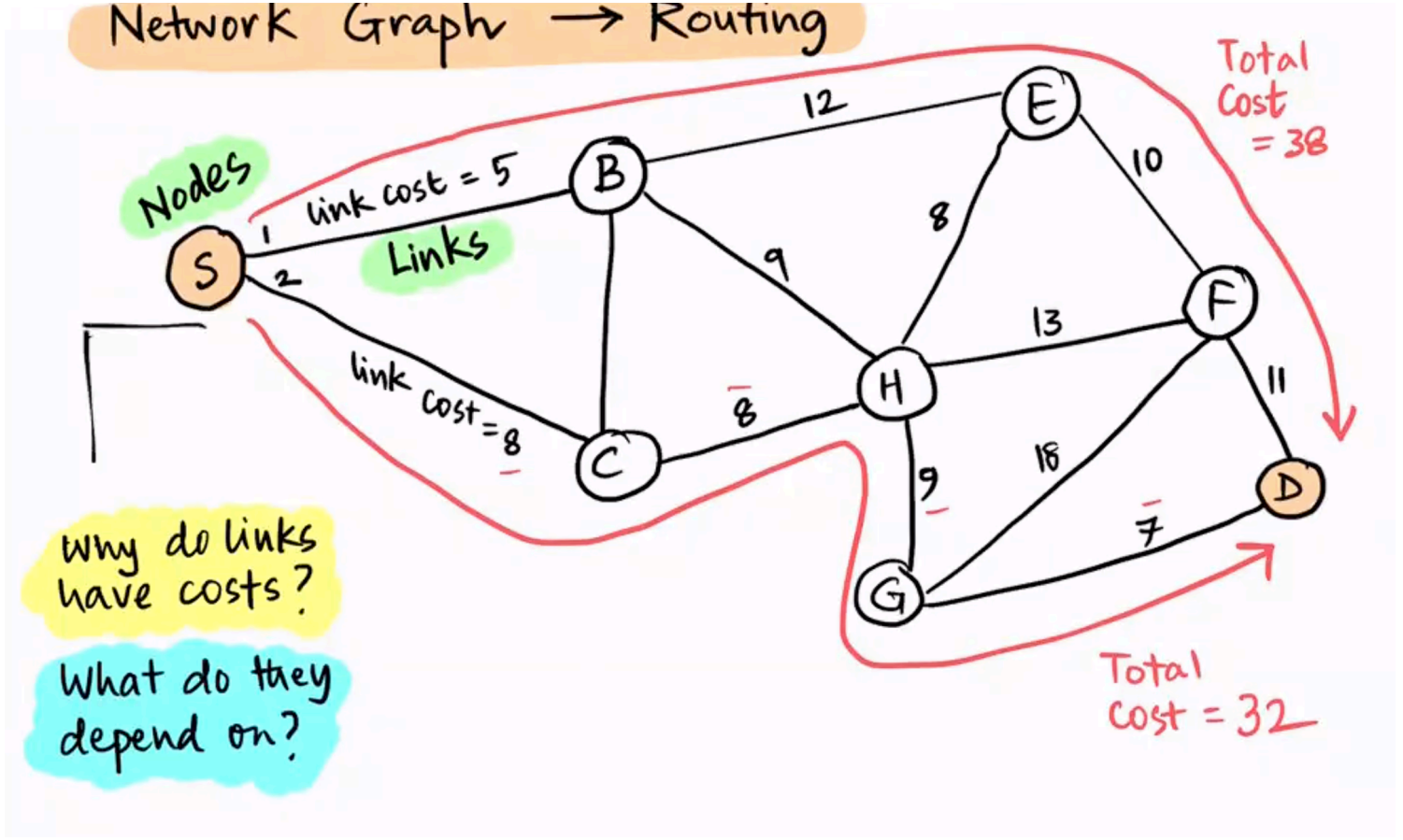


Network Graph → Routing

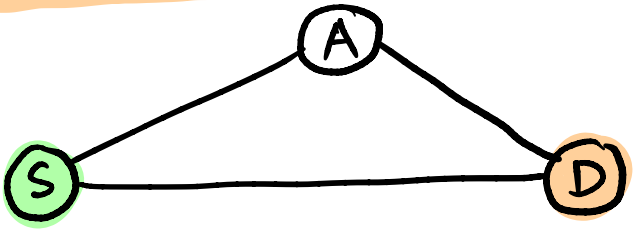


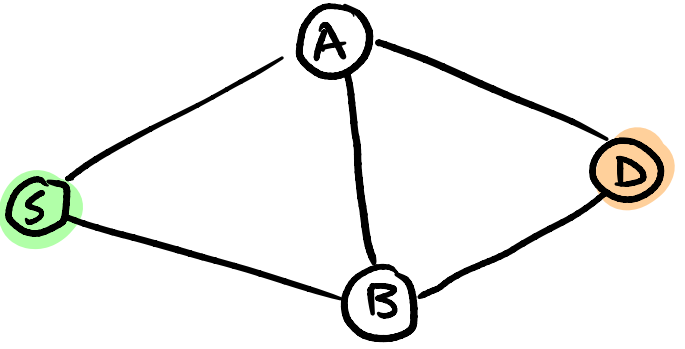
Why do links have costs?

What do they depend on?

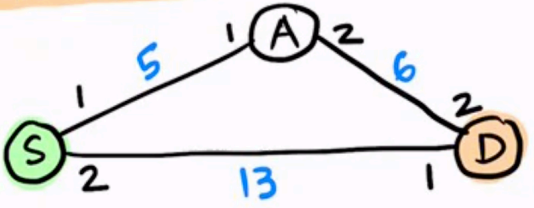

Network Graph → Routing
Nodes
Links
link cost = 5
link cost = 8
S
B
C
E
F
G
H
D
1
2
12
10
8
9
13
11
8
9
18
7
Total Cost = 38
Total Cost = 32
Why do links have costs?
What do they depend on?

Let's Route

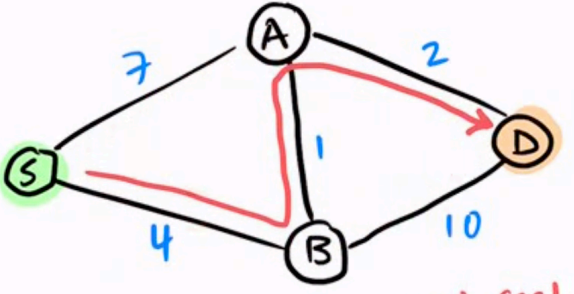




Let's Route

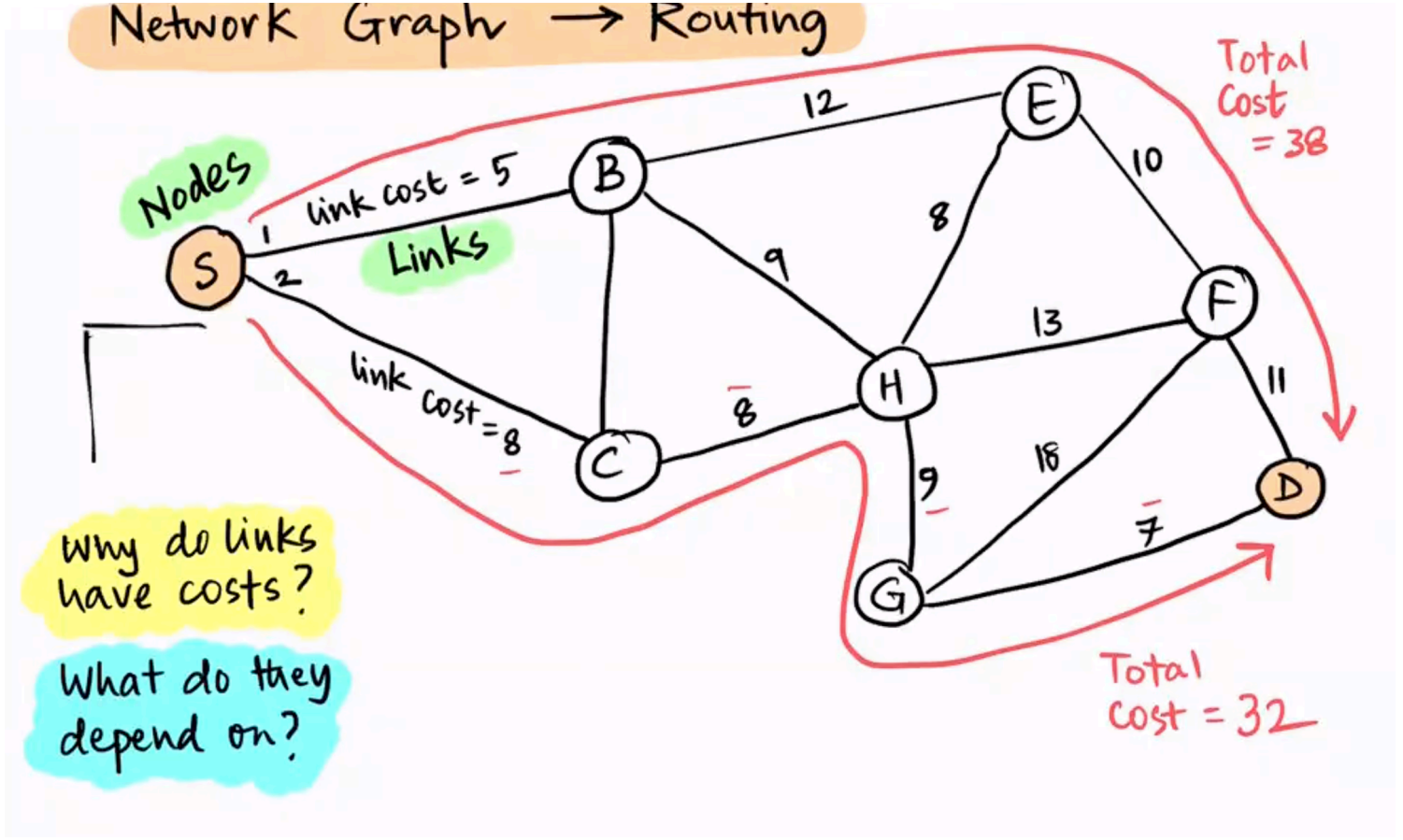


Least cost path ⇒ S → A → D



Least cost path

S → B → A → D


Network Graph → Routing
Nodes
Links
link cost = 5
link cost = 8
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18
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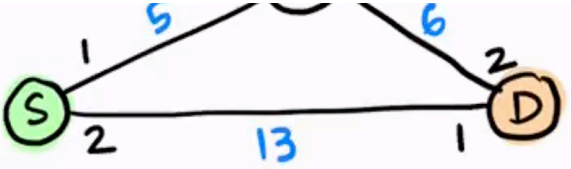
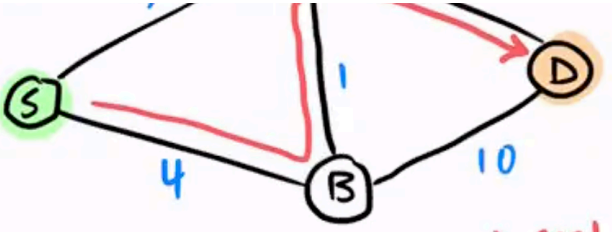
Total Cost = 38
Total Cost = 32
Why do links have costs?
What do they depend on?



Least cost path ⇒ S → A → D



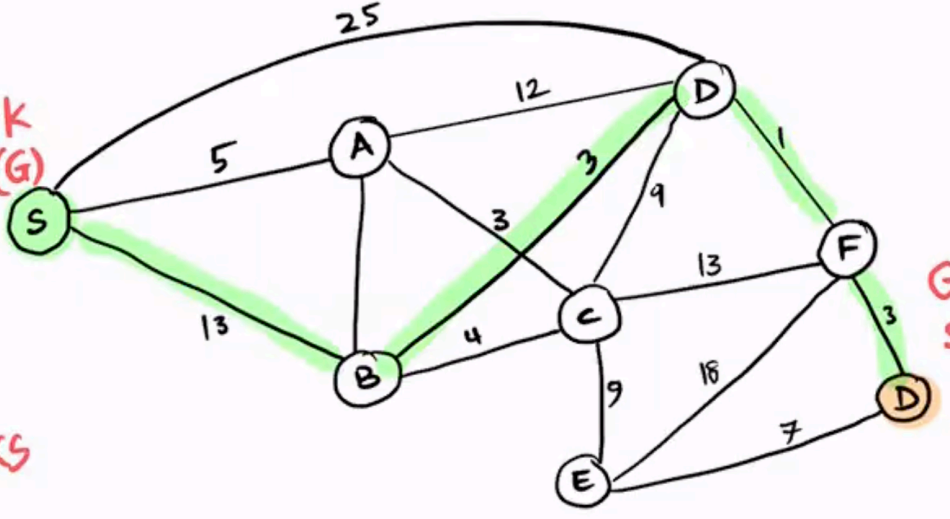
Least cost path

S → B → A → D

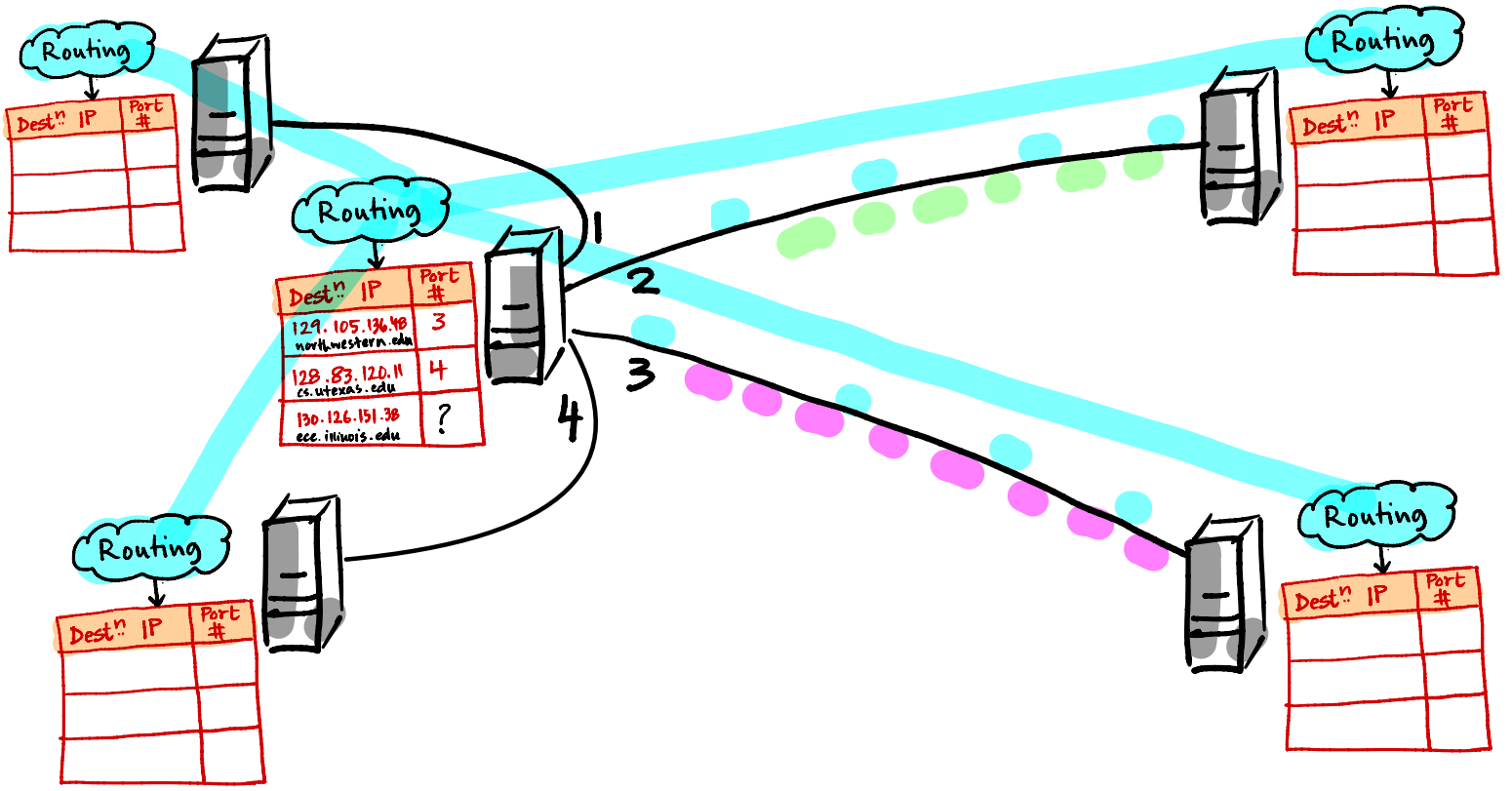
Network Graph (G)

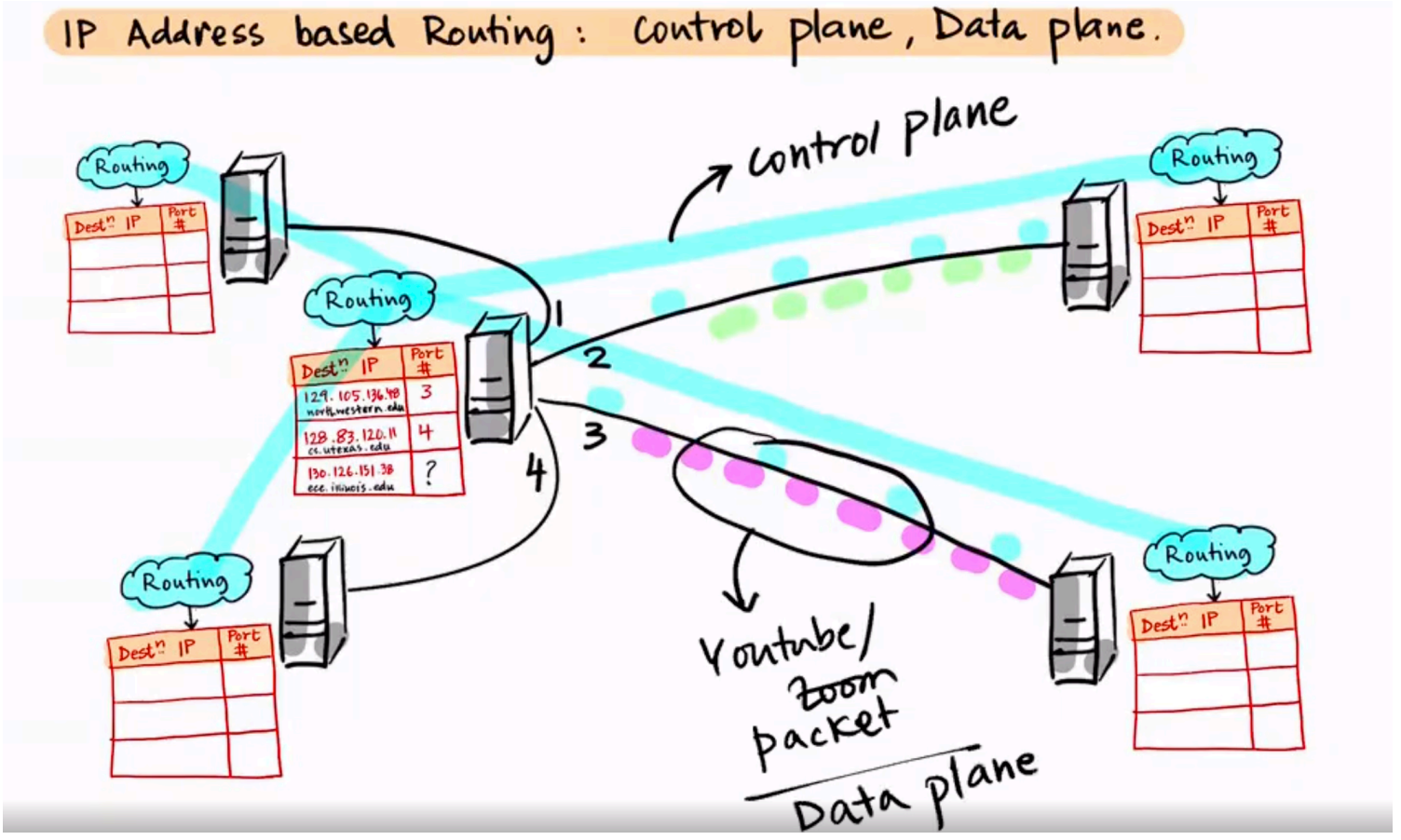
↓

Node + Links

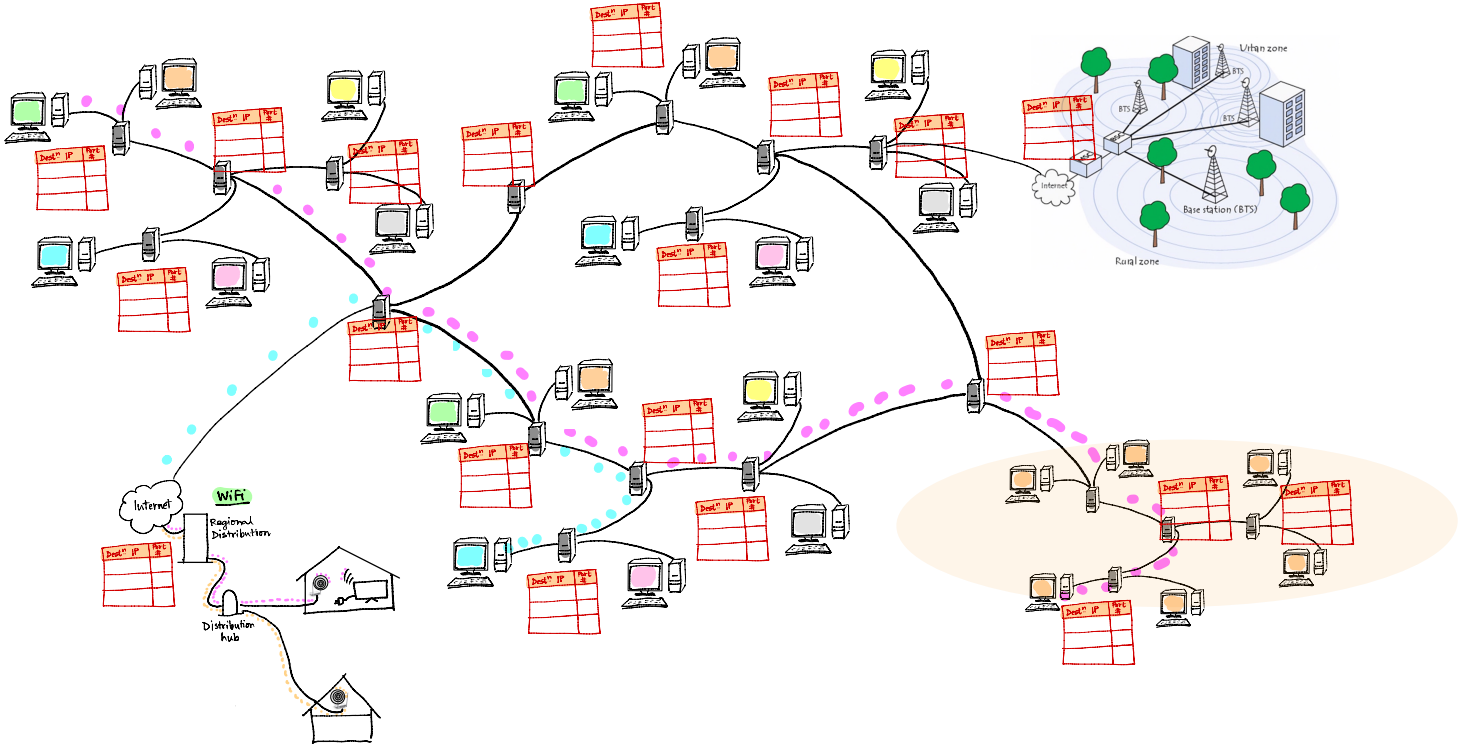


IP Address based Routing : Control plane, Data plane.



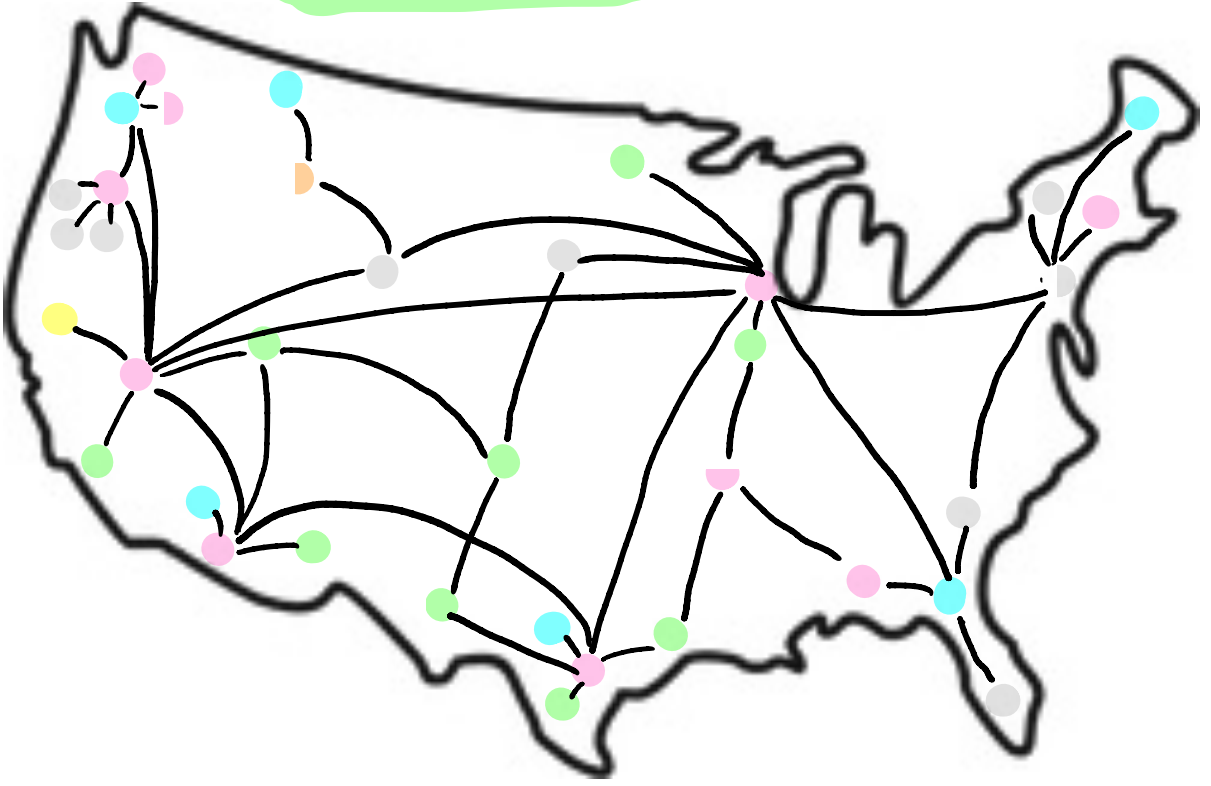

IP Address based Routing : Control plane, Data plane.
Routing
Dest^n IP
Port #
Routing
Dest^n IP
Port #
129.105.136.98 northwestern.edu
3
128.83.120.11 cs.utexas.edu
4
130.126.151.38 ece.illinois.edu
?
1
2
3
4
control plane
Routing
Dest^n IP
Port #
Routing
Dest^n IP
Port #
Routing
Dest^n IP
Port #
Youtube/ Zoom packet
Data plane

Zoom Out


Urban zone
BTS
BTS
BTS
Base station (BTS)
Internet
Rural zone
Internet
Wifi
Regional Distribution
Distribution hub

The airports are ready, and flights can link them

Now what?



Coming up next lecture:

Internet 2/2