Communication Networks

Spring 2022

Coralie Busse-Grawitz

http://comm-net.ethz.ch/

ETH Zürich

10. March 2022

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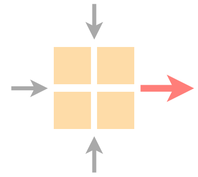


last week's exercise

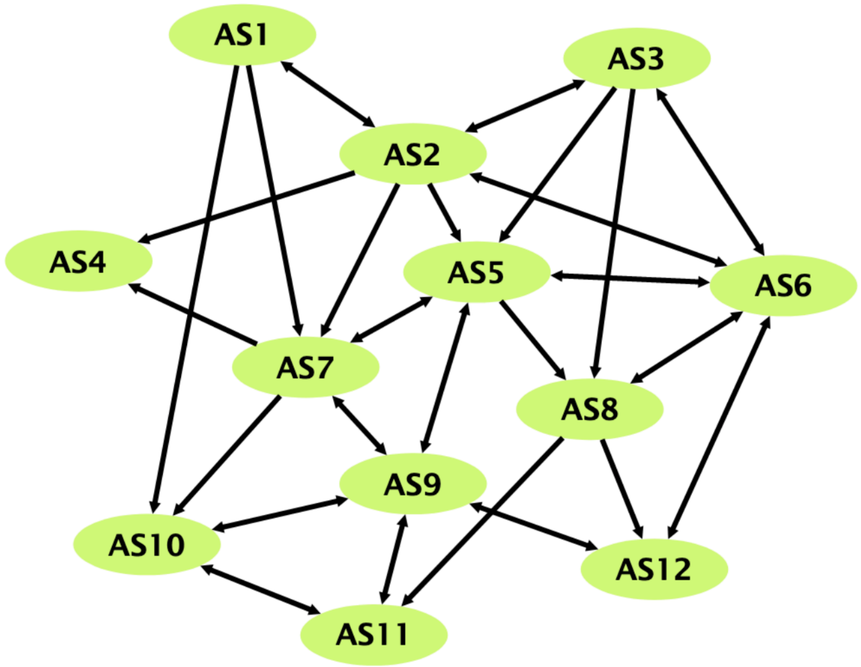
interactive questions

this week's exercise

time to solve the exercise

Task 1.2

Internet Organization



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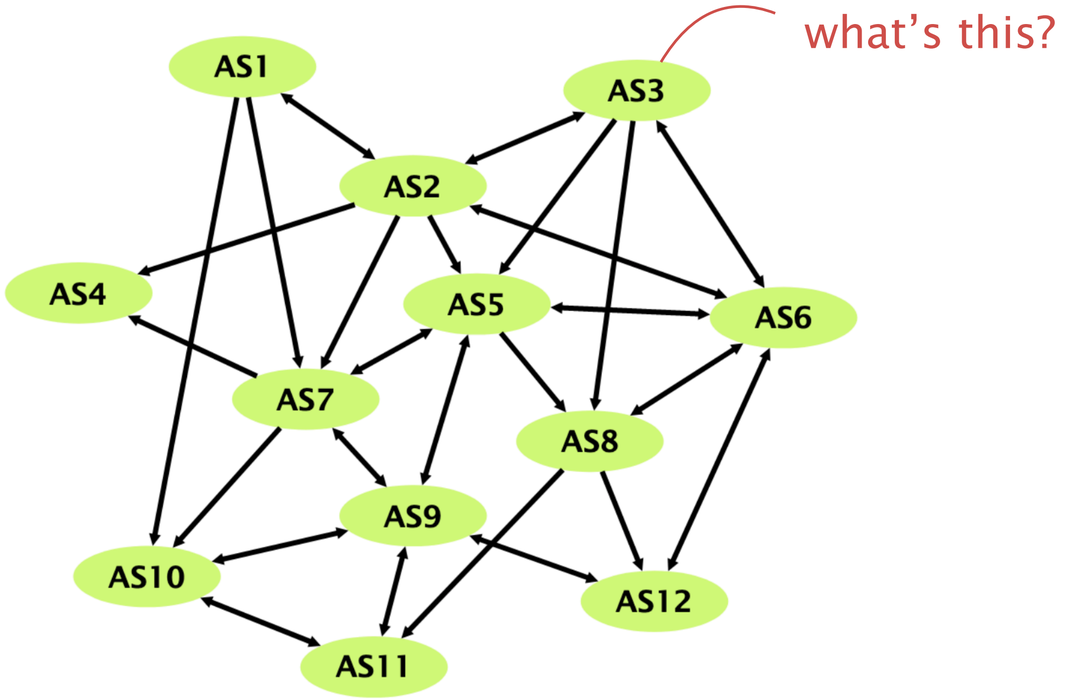
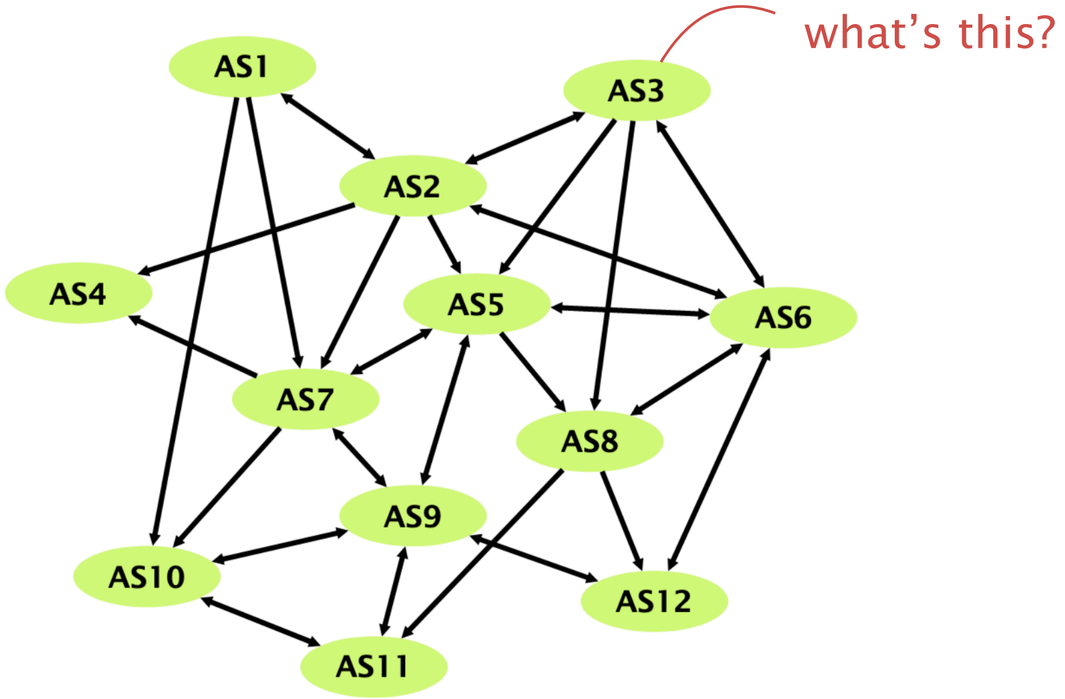
Internet Organization



An Autonomous System is
a “managed network entity”



You will get a more in-depth picture in a few weeks :)

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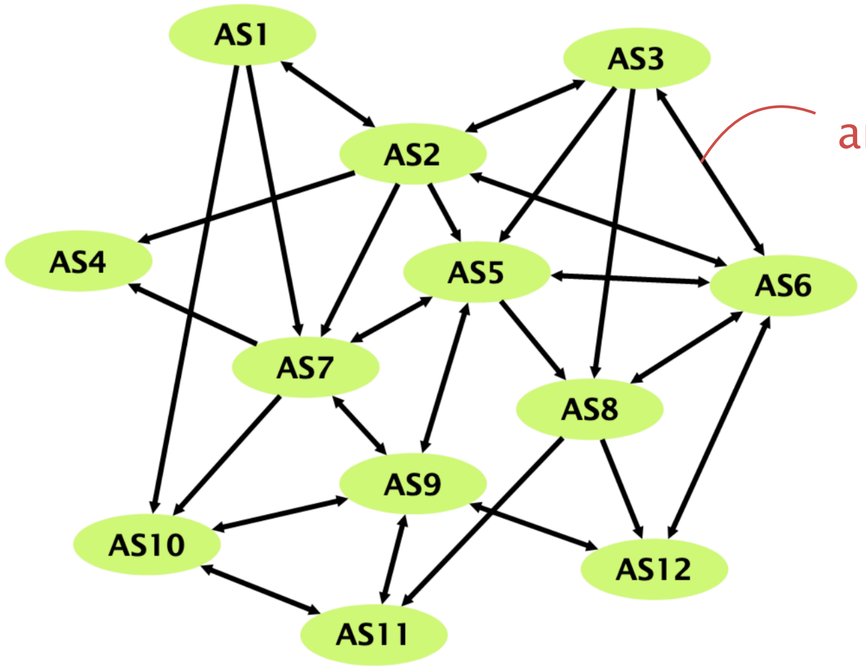
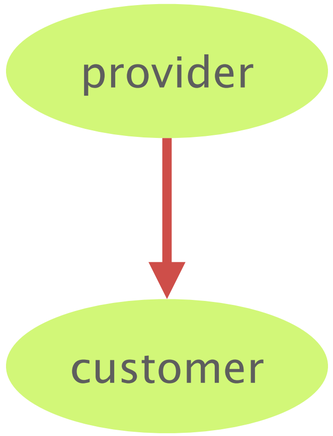
Internet Organization



and what's this?

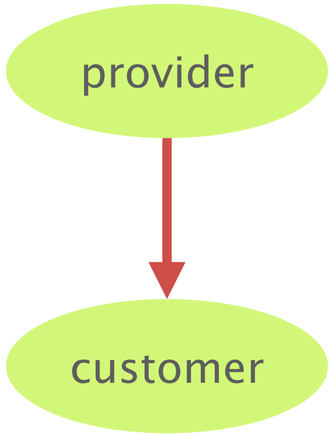
The arrows represent the

ASes' business relations

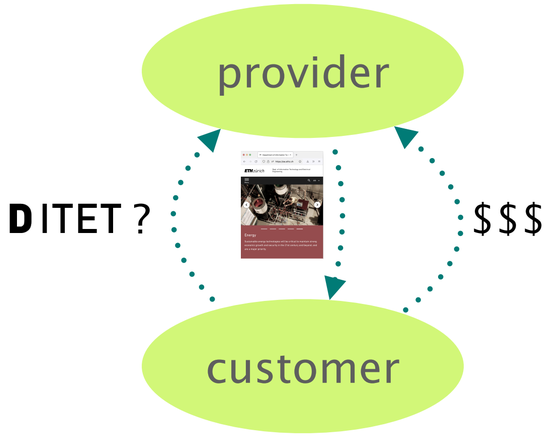


The arrows represent the ASes' business relations

notation



service example



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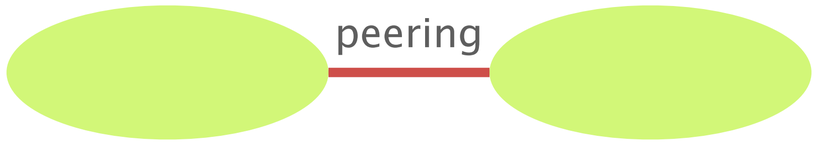

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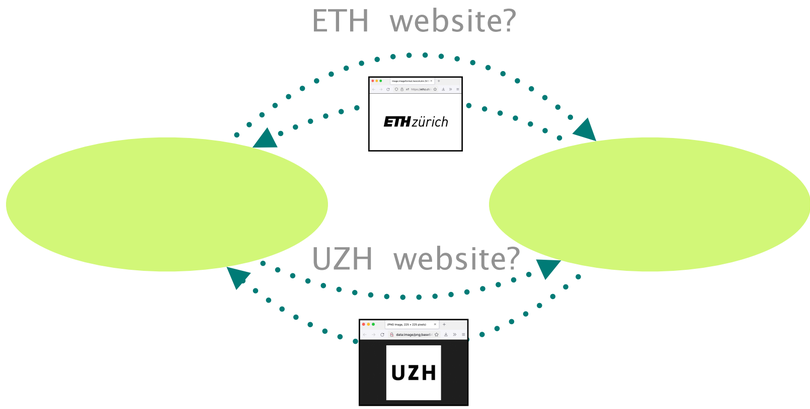


no cost

from the lecture...

The Internet has a hierarchical structure

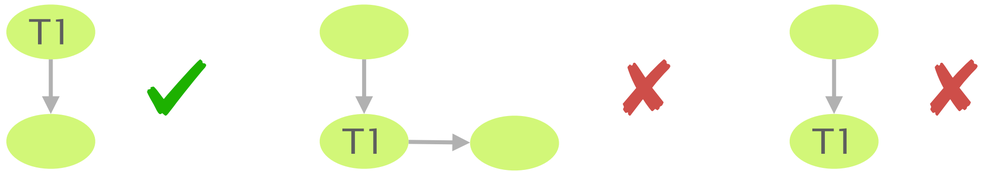
Tier-1	have no provider
international	
Tier-2	provide transit to Tier-3s
national	have at least one provider
Tier-3	do not provide any transit
local	have at least one provider

from the lecture...

The Internet has a hierarchical structure

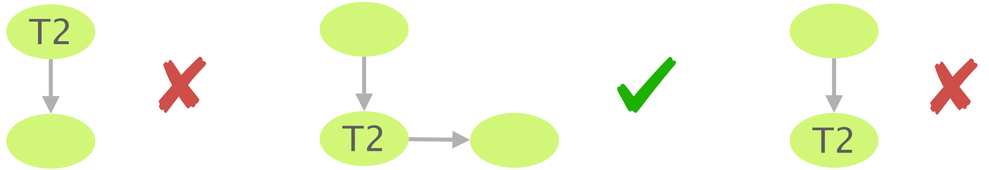
Tier-1
international

have no provider



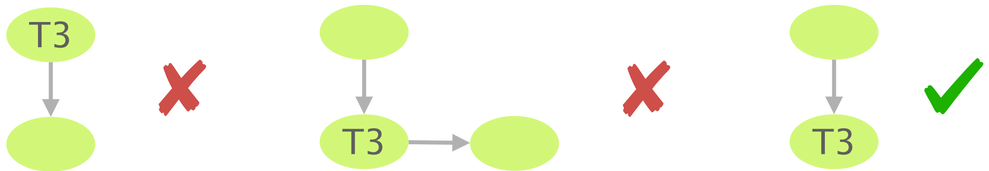
Tier-2
national

provide transit to Tier-3s
have at least one provider



Tier-3
local

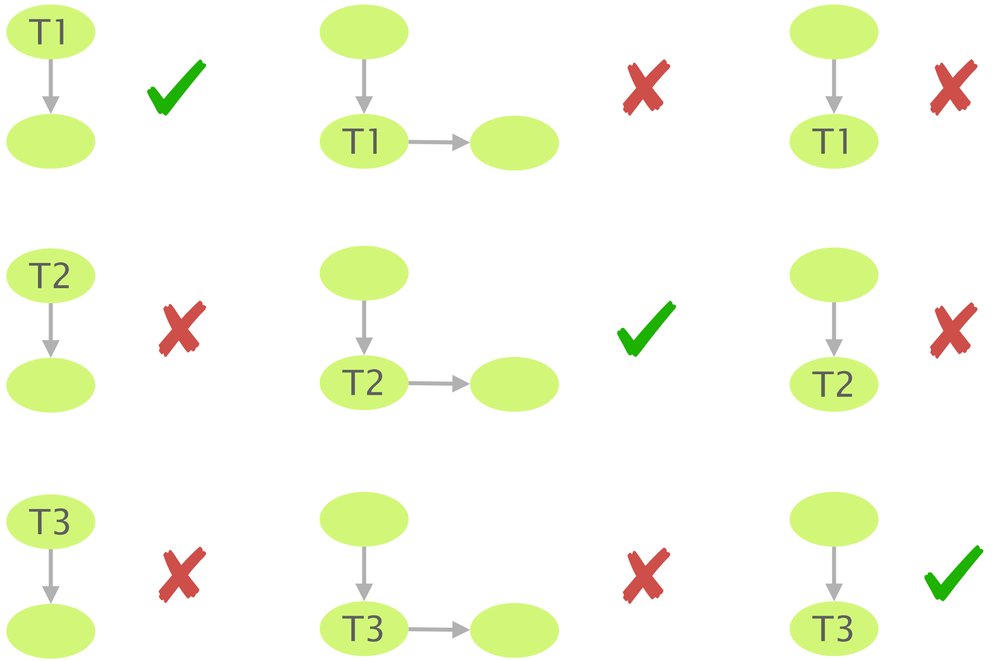
do not provide any transit
have at least one provider



from the lecture…

The Internet has a hierarchical structure

Tier-1 international	have no provider
Tier-2 national	provide transit to Tier-3s have at least one provider
Tier-3 local	do not provide any transit have at least one provider
+ IXPs	only peer



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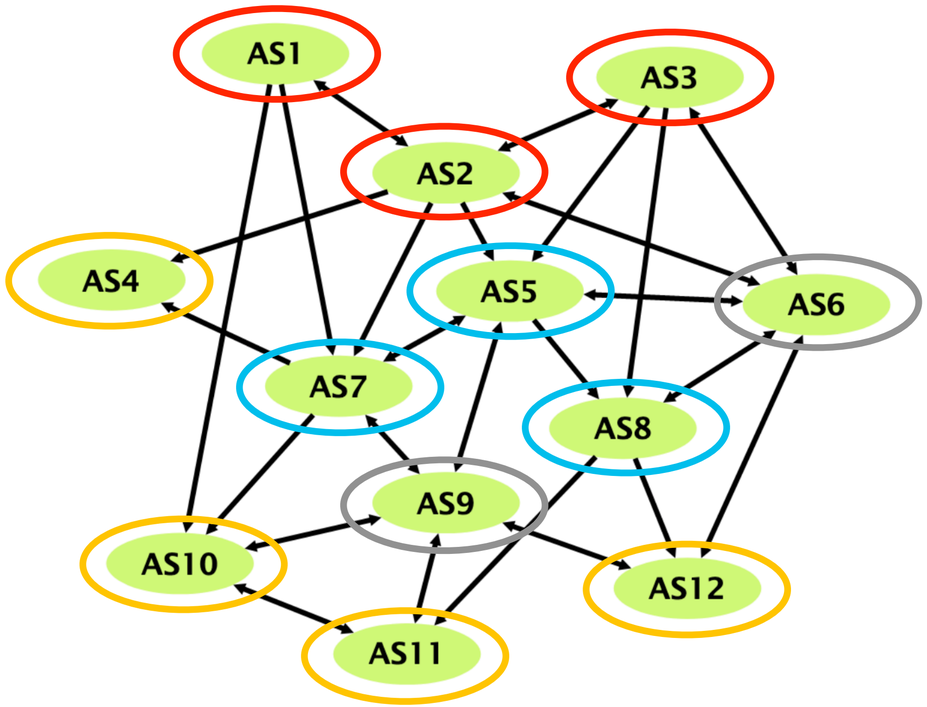
Internet Organization



Tier 1

Tier 2

Tier 3

IXP

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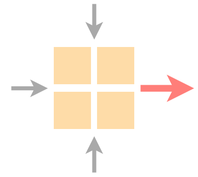

last week’s exercise

interactive questions

this week’s exercise

time to solve the exercise

If one adds 1 to all link weights,
the shortest paths stay the same

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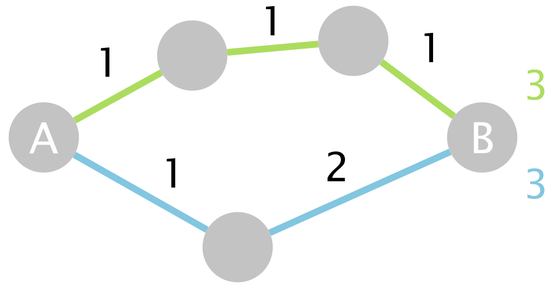
the shortest paths stay the same



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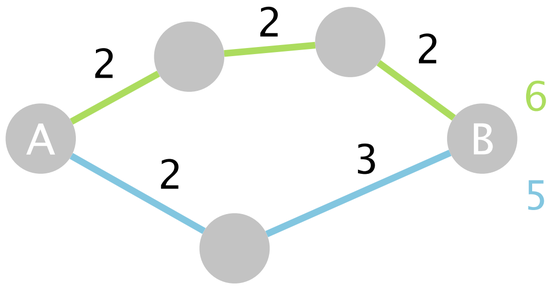

When routing by flooding on a spanning tree,
all switches learn the location of all endpoints

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Link-State protocols rely on a global network view

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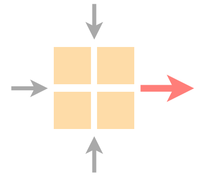

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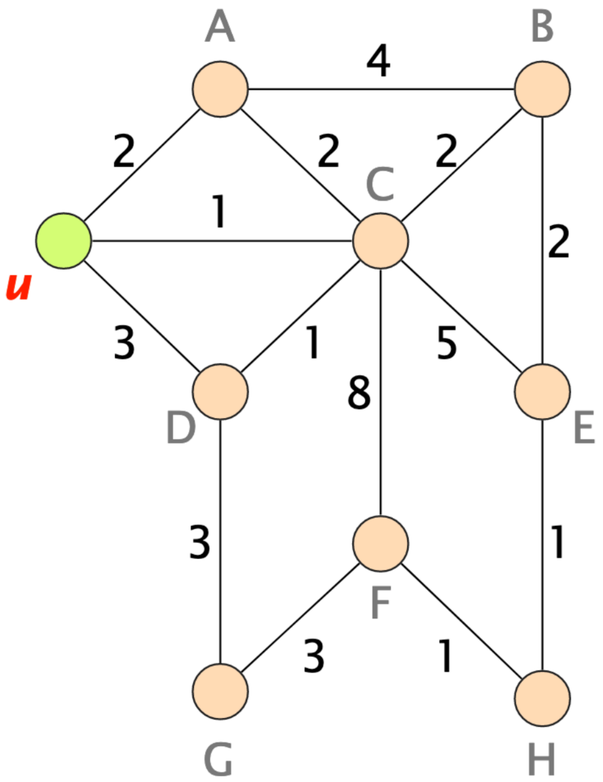
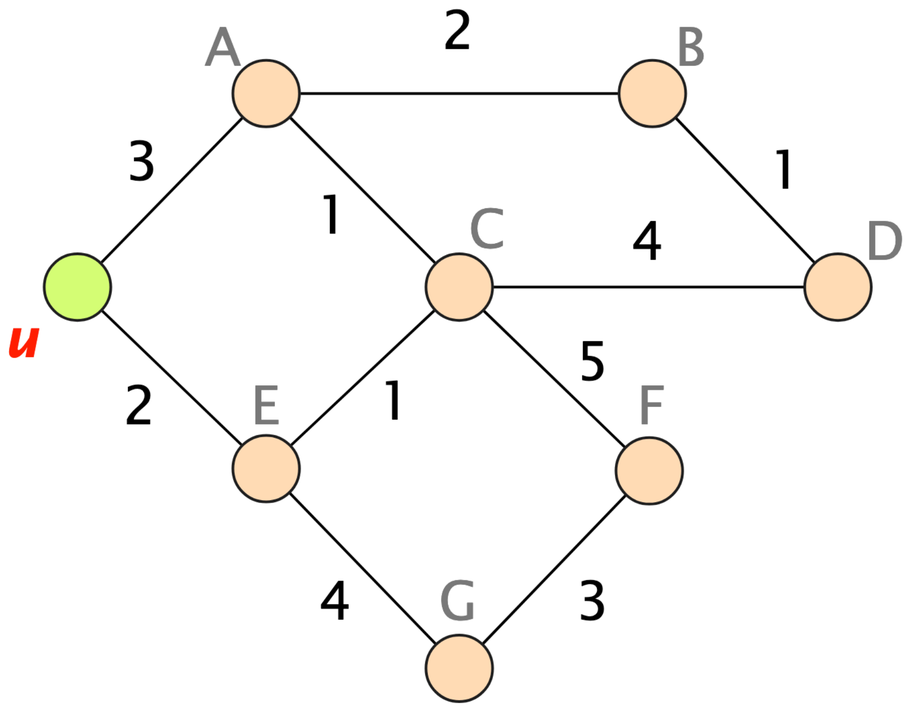
Task 1

Dijkstra's Algorithm



Let's compute the shortest paths from *u* using Dijkstra's algorithm

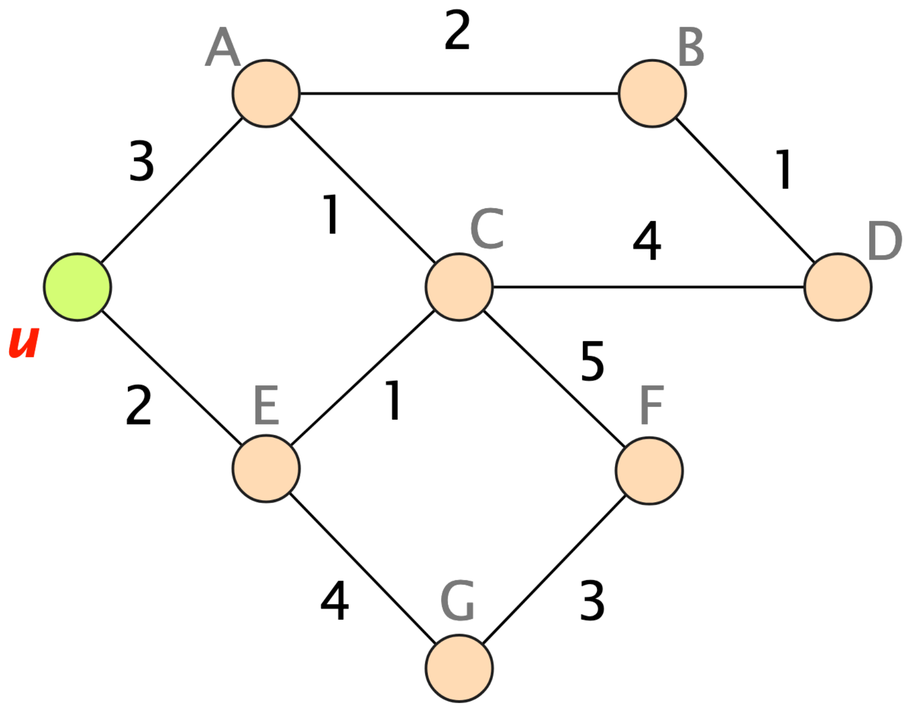


S = {*u*} — set of nodes for which we know the shortest-path

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

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

Let's compute the shortest paths from *u* using Dijkstra's algorithm



Initialization

S = {*u*}

for all nodes *v*:

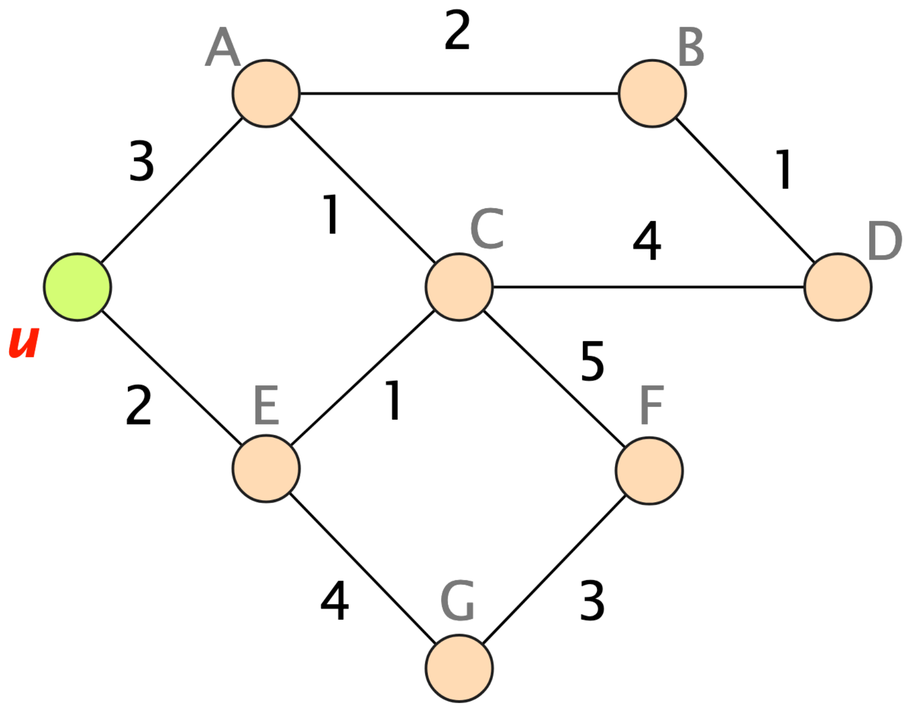
    if (*v* is adjacent to *u*):

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

    else:

        D(*v*) = ∞

Let's compute the shortest paths from *u* using Dijkstra's algorithm

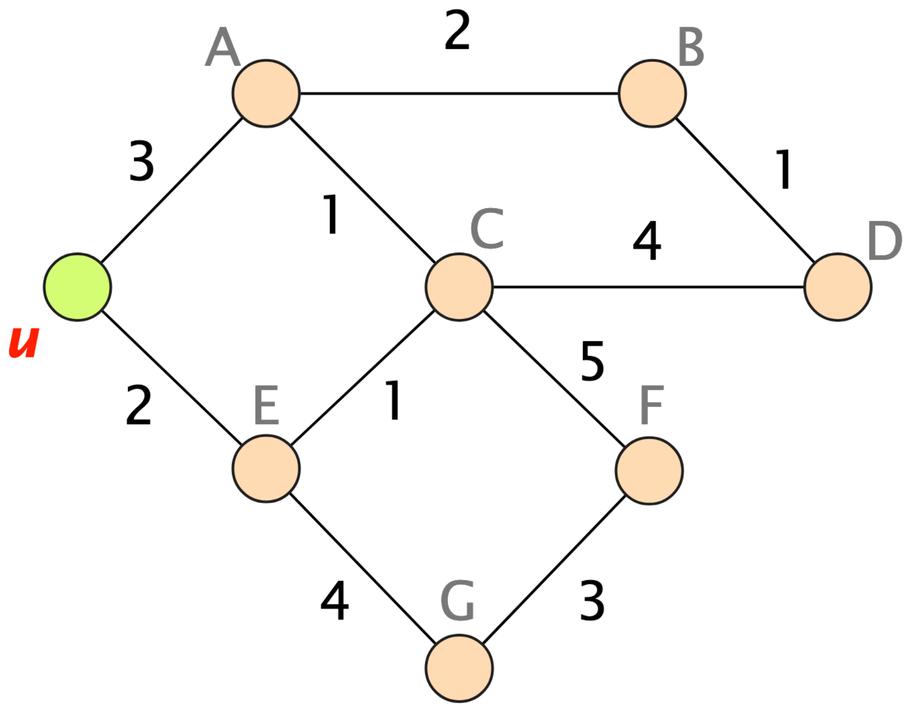


D(.) =

S = {u}

A	3
B	∞
C	∞
D	∞
E	2
F	∞
G	∞

Let's compute the shortest paths from *u* using Dijkstra's algorithm



Loop

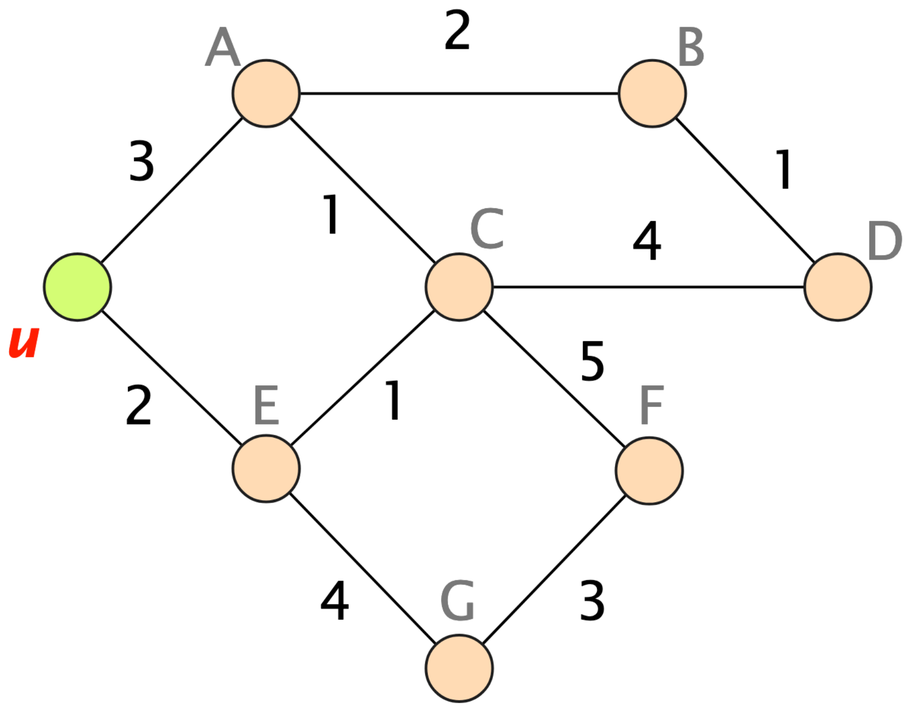
while *not* all nodes in S:

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*)}

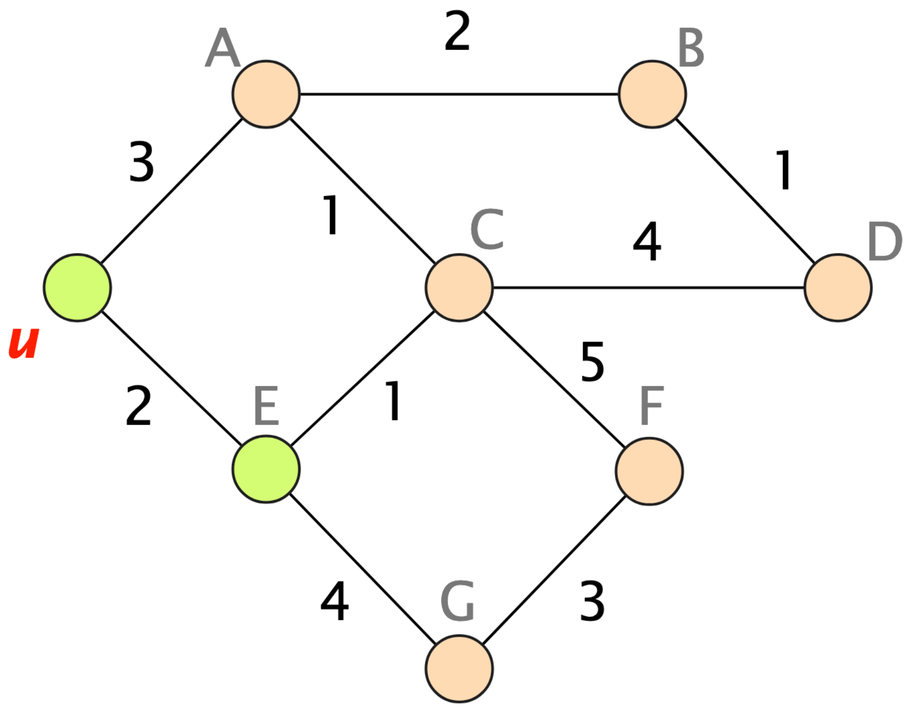
Let's compute the shortest paths from *u* using Dijkstra's algorithm



D(.) = S = {u}

A	3
B	∞
C	∞
D	∞
E	2 — smallest D(*w*)
F	∞
G	∞

Let's compute the shortest paths from *u* using Dijkstra's algorithm



add E to S

S = {u, E}

D(.) =

A	3
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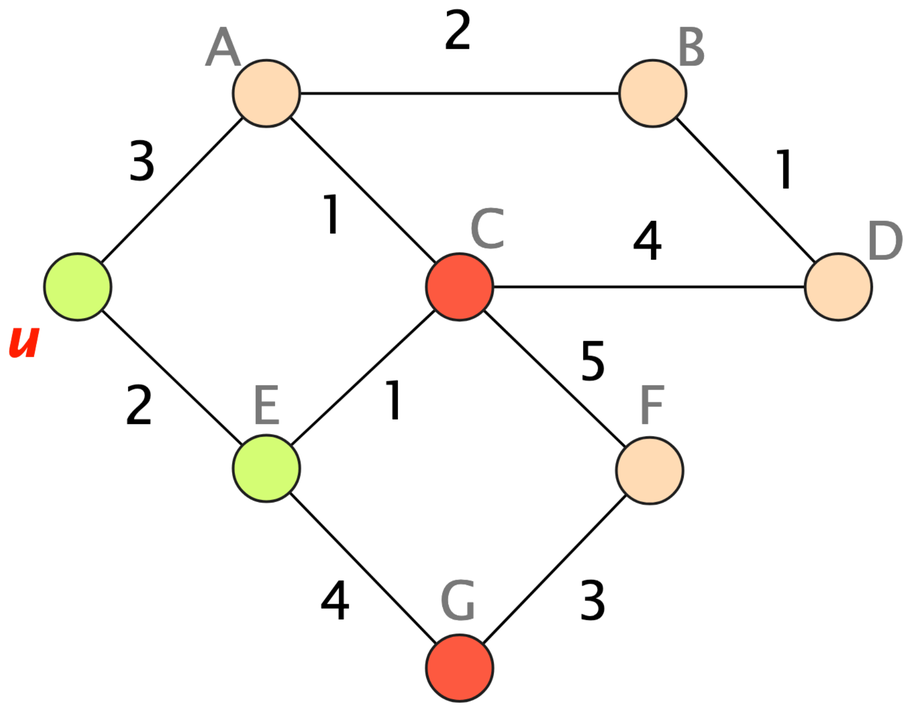
F	∞
G	∞

Let's compute the shortest paths from *u* using Dijkstra's algorithm

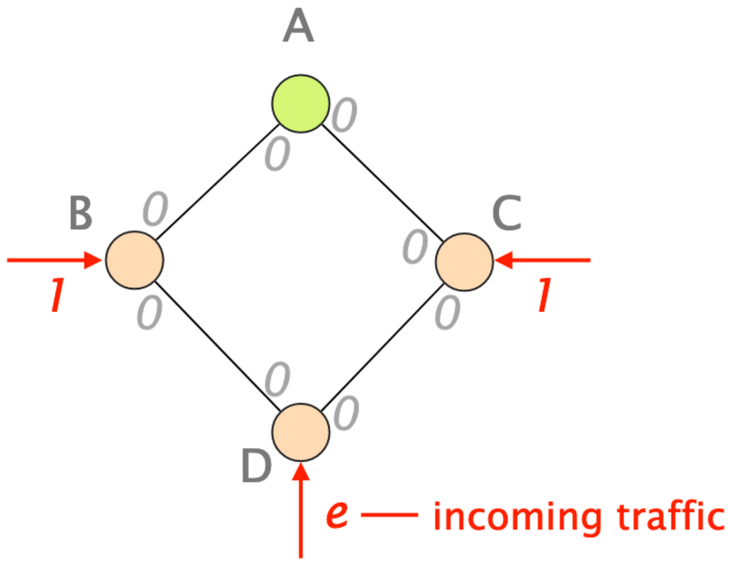


D(.) = S = {u, E}

A	3	
B	∞	
C	3	D(*v*) = min{∞, 2 + 1}
D	∞	
E	2	
F	∞	
G	6	D(*v*) = min{∞, 2 + 4}

Task 2

Changing weights



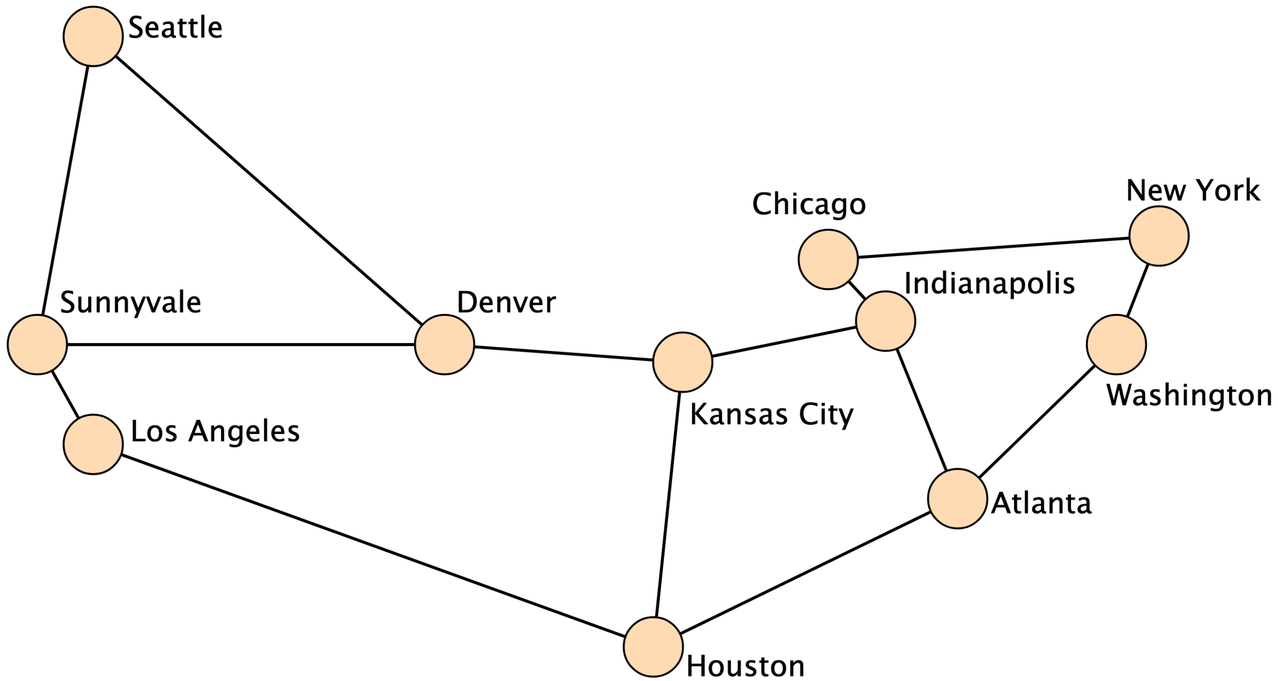
Consider dynamic weights

Weights can be asymmetric

Next-hop as tie-break value

Task 3

Link Weight Configuration



The Abilene network in the US

Task 4

Source-and-Destination-Based Routing

possible to route based on
the source, not destination?

compare dst-based routing
to src-and-dst-based routing

Task 5

Reverse Dijkstra (Exam 2020)

#	**U**	A	B	C	D	E	F	G	H	I
1	0	2	3	1	-	-	-	10	-	11

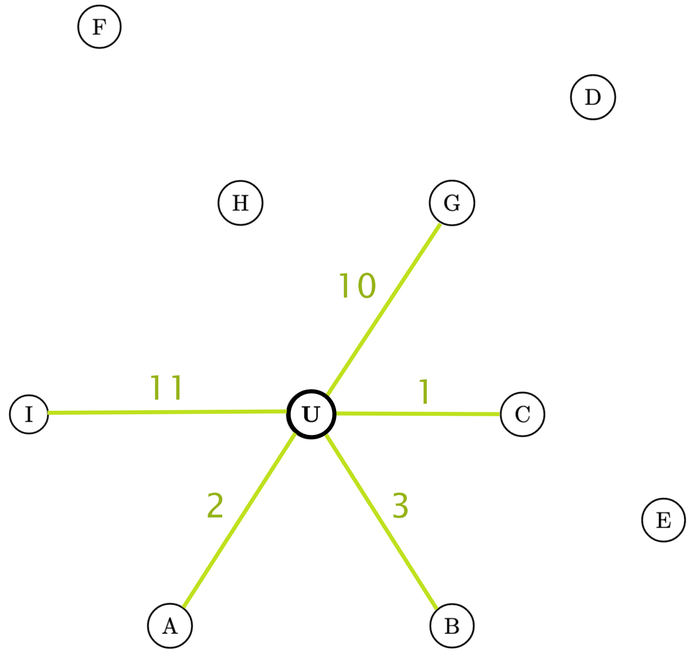
no parallel edges

only positive weights

tie-break: alphabet

Task 5

Reverse Dijkstra (Exam 2020)



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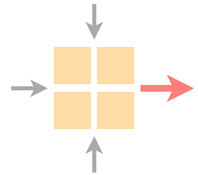

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