CS2105 Lecture 7

Routing

4 March, 2013

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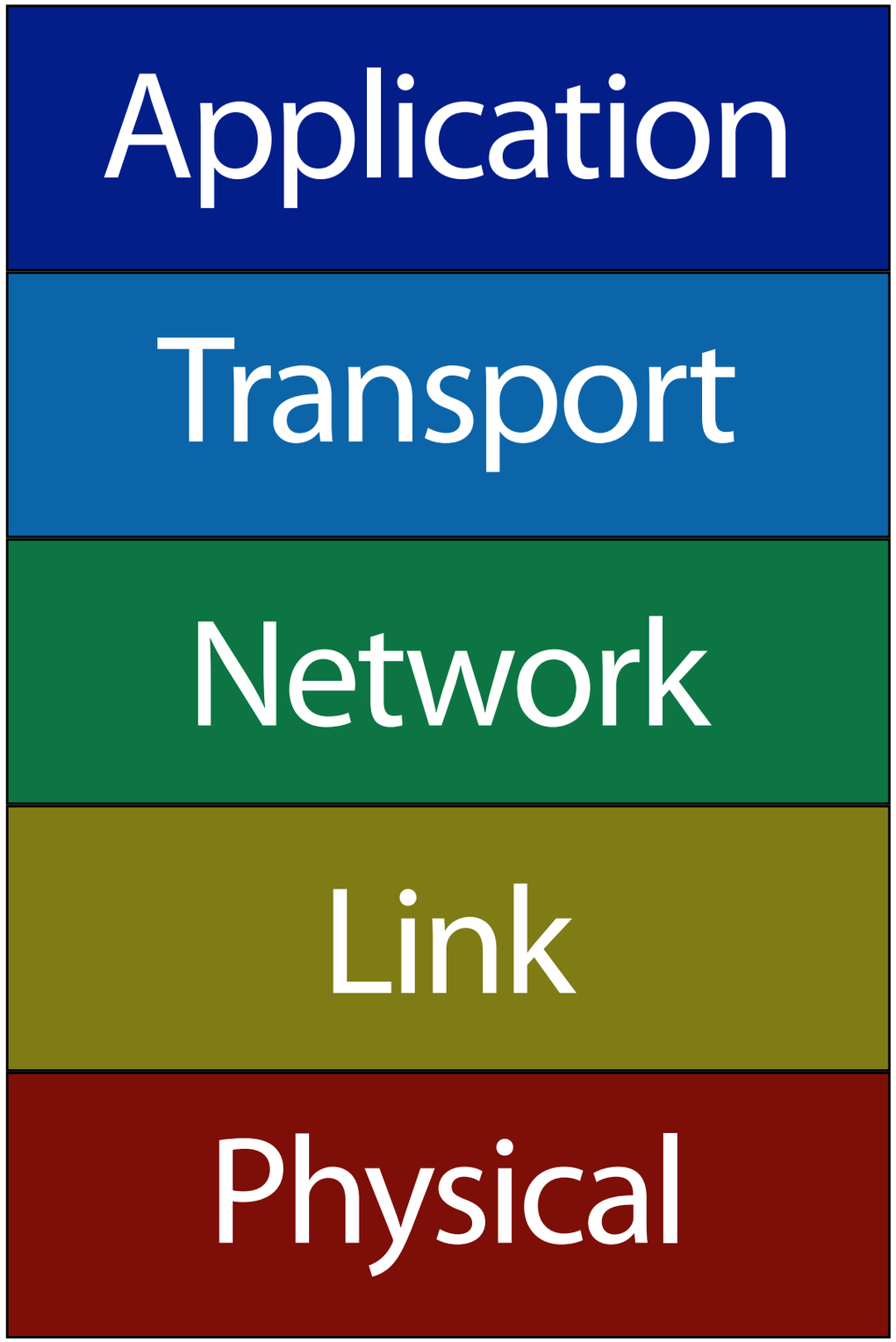
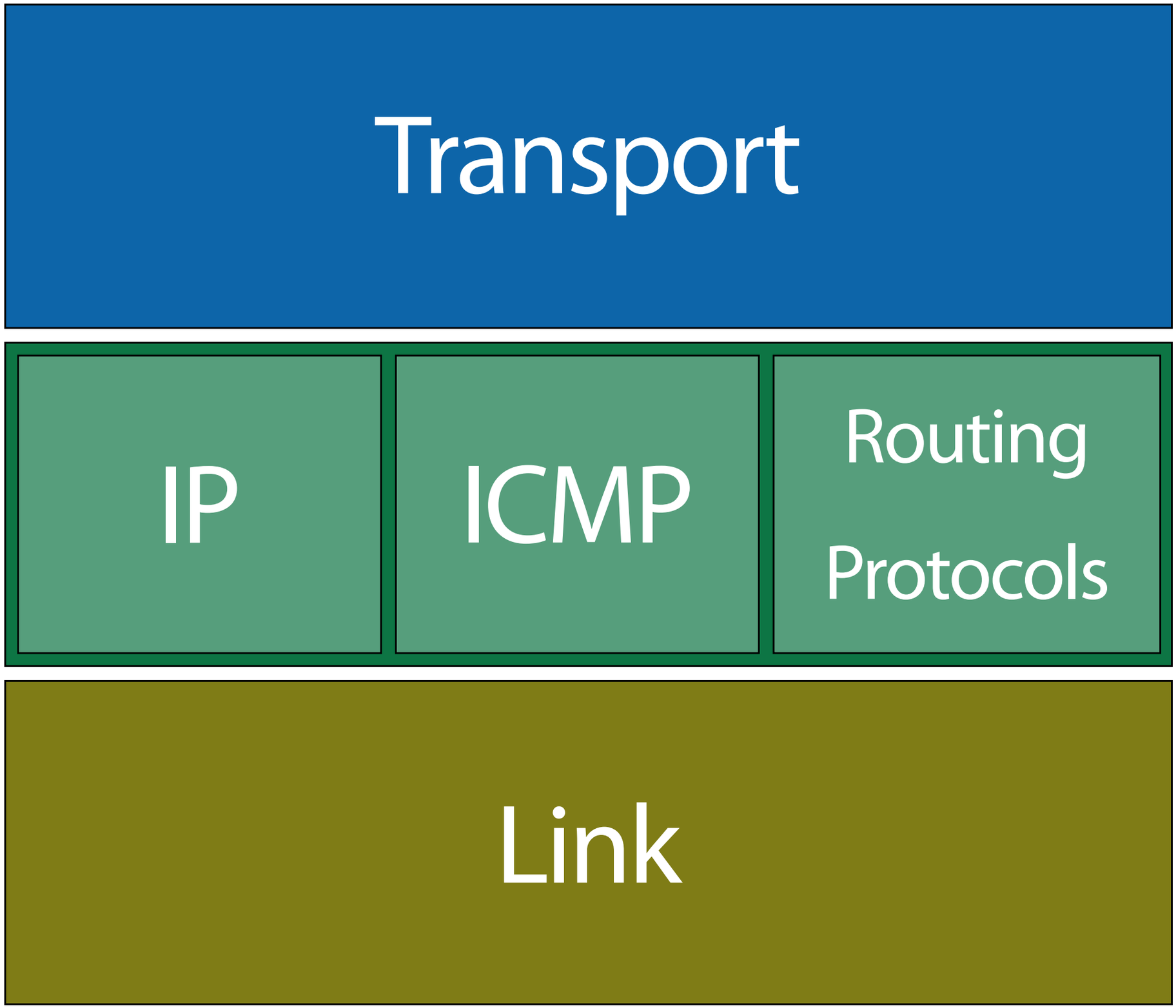
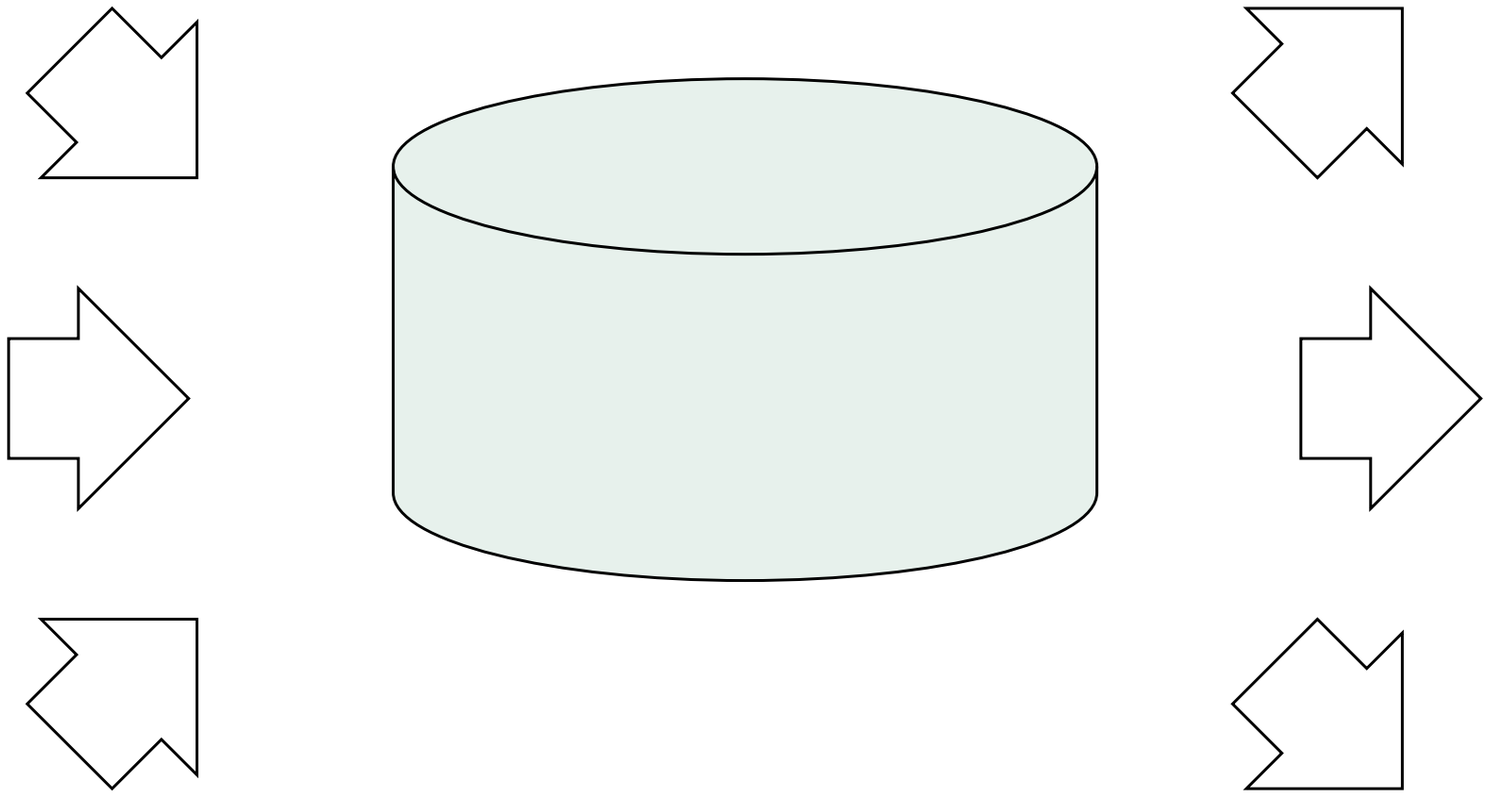
After this class, you are expected to understand

- the purpose of routing protocols on the Internet
- the differences between inter-domain and intra-domain routing.
- the workings of link-state and distance vector routing
- the principle of Bellman-Ford equation
- how RIP works


Application
Transport
Network
Link
Physical


Transport
IP
ICMP
Routing Protocols
Link



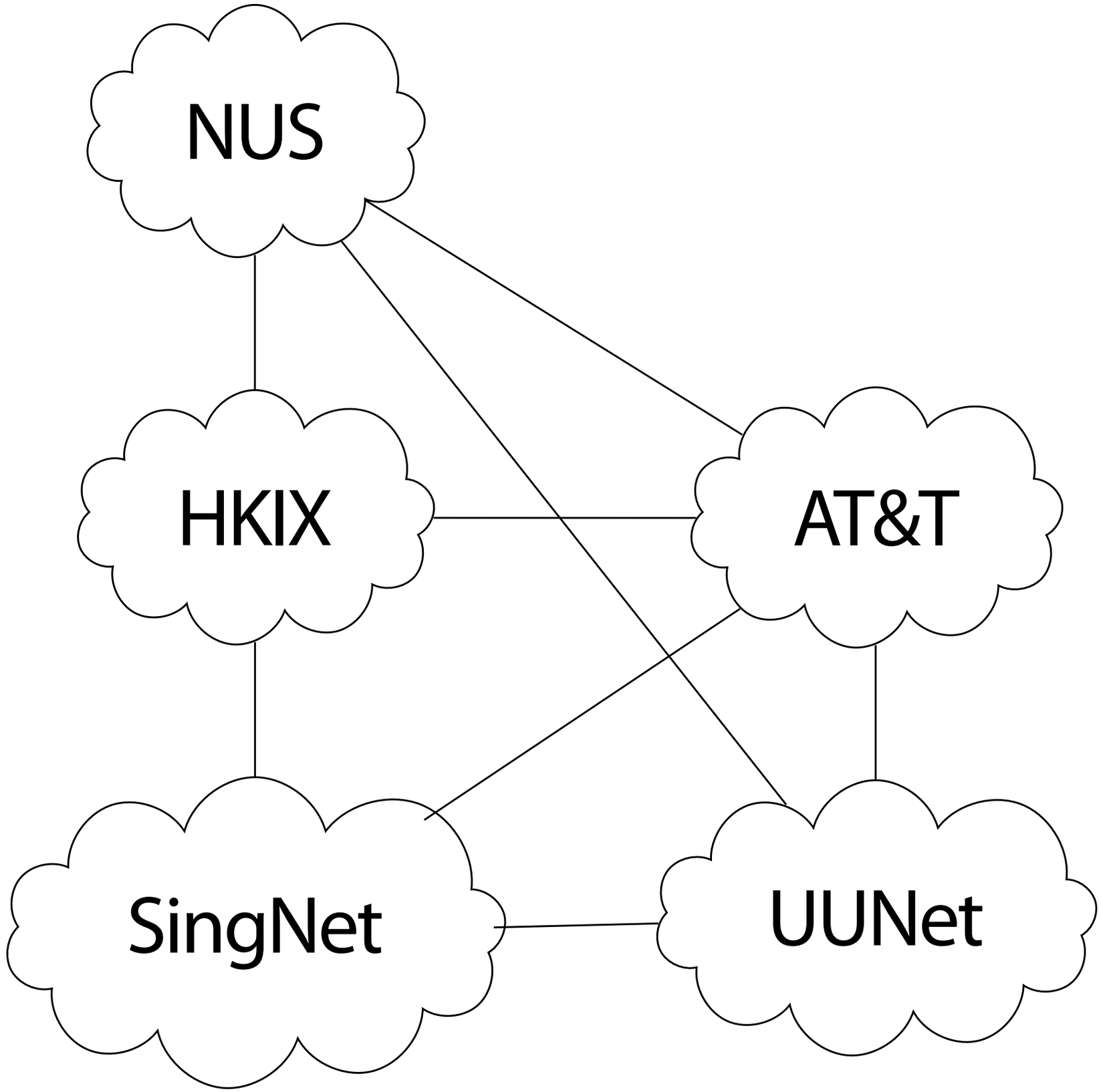
forwarding table

longest prefix matching

The Internet is a ``network-of-networks'', organized into autonomous systems (AS), each own by an organization.

Inter-*AS* routing

Intra-*AS* routing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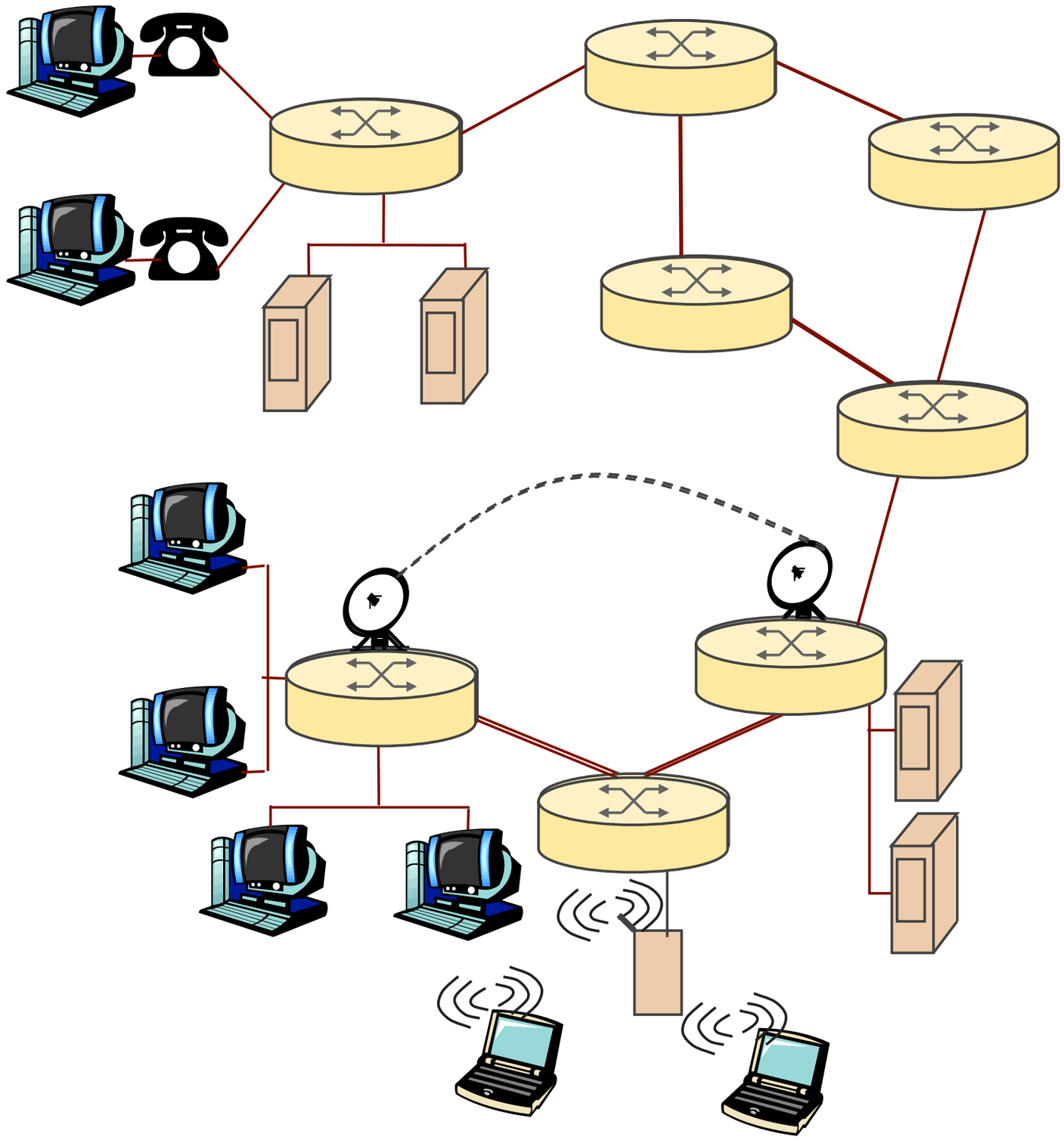
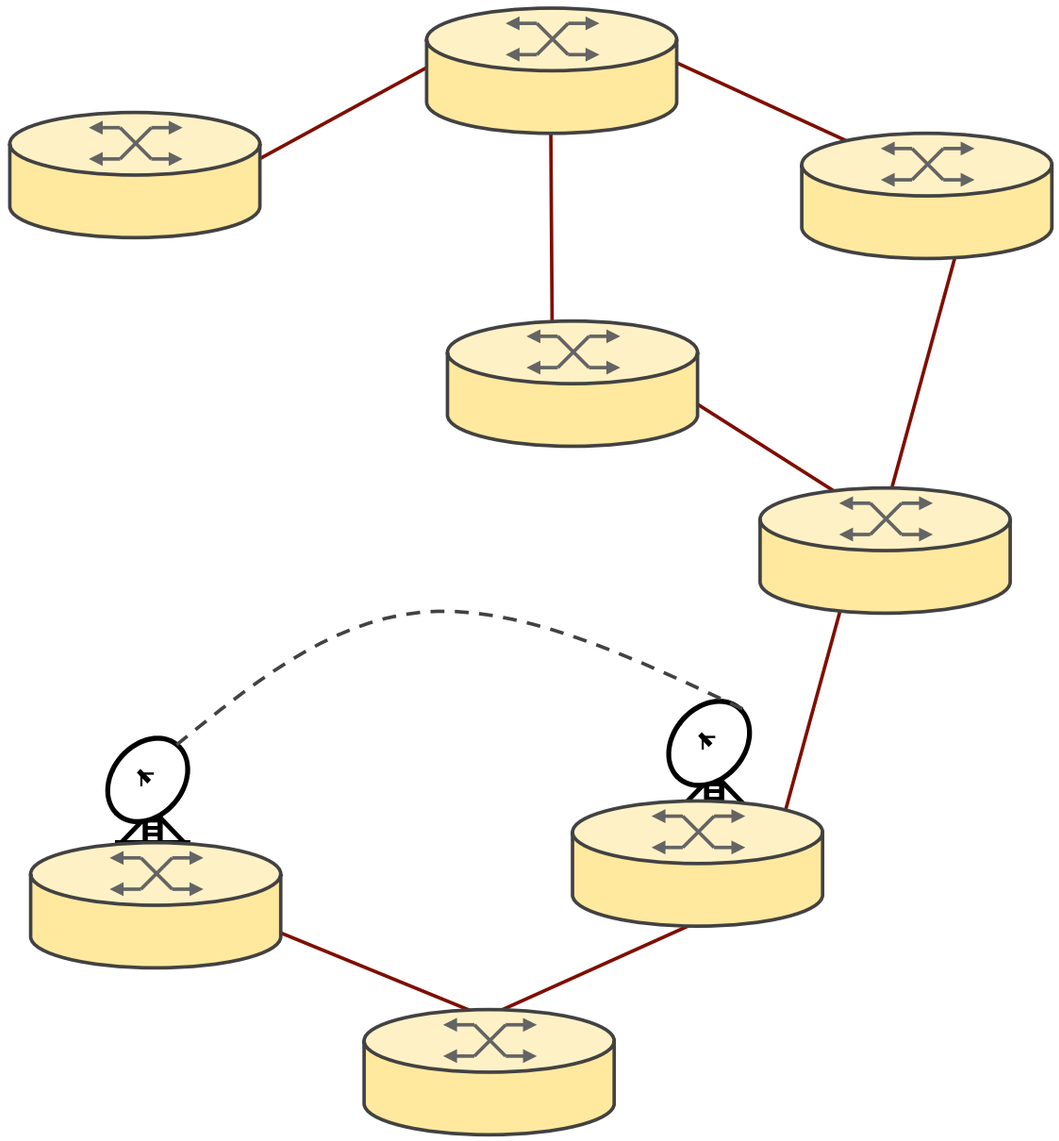
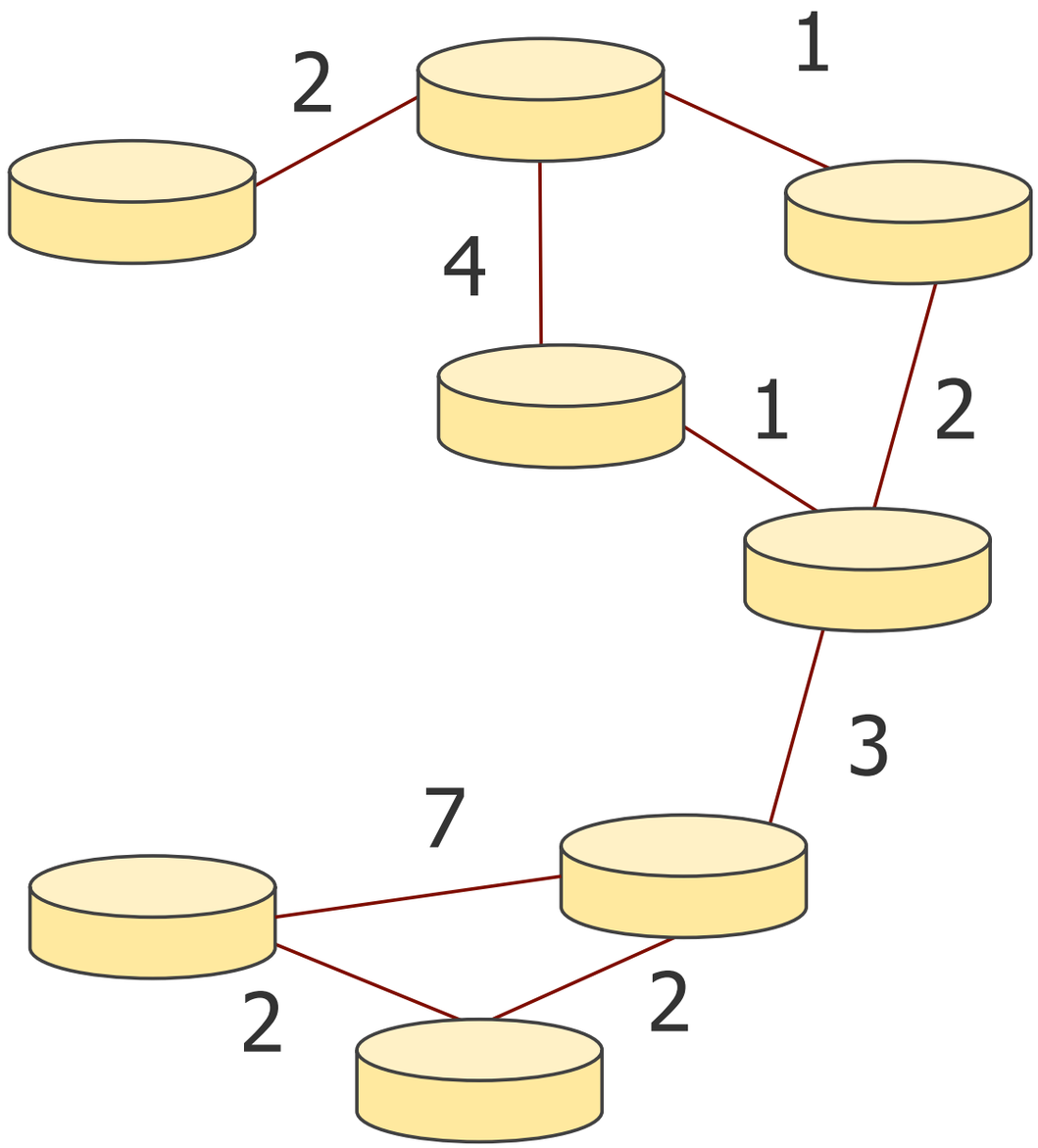
Abstract view of intra-domain routing






2
1
4
1
2
3
7
2
2

Routing: finding the **least cost path** in a graph.

Link-State Routing

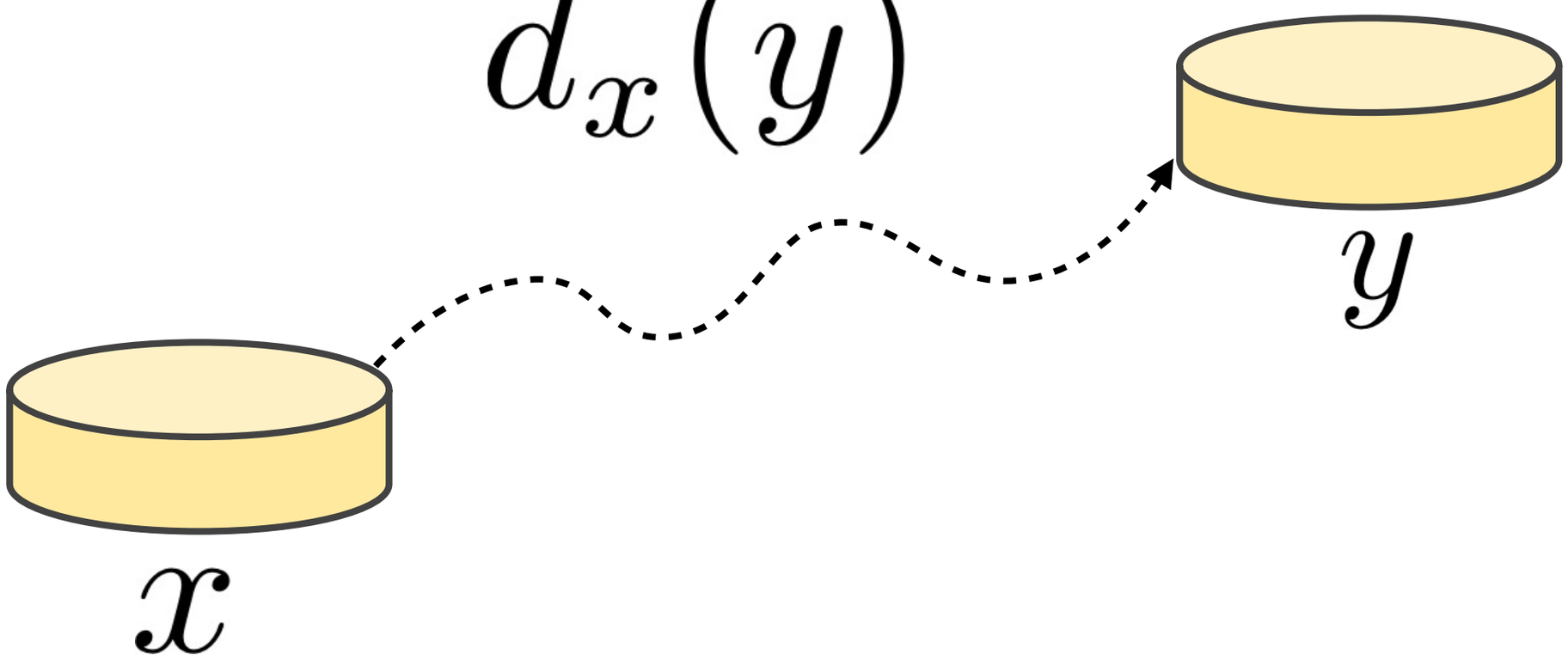
1. Broadcast link cost to each other

2. Compute least cost path locally

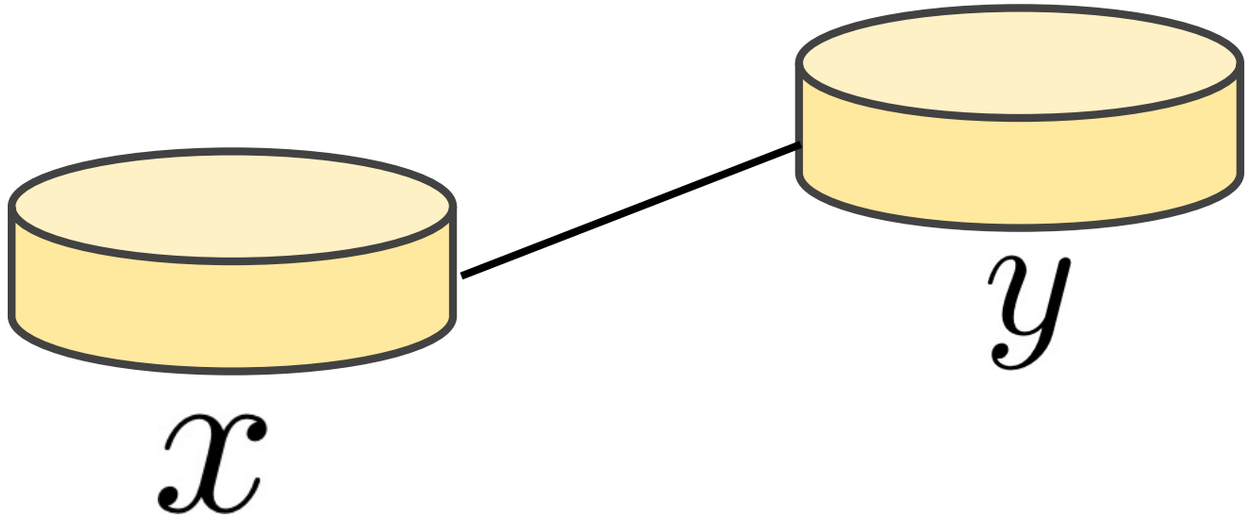
Distance Vector Routing

1. Swap local view with neighbors
2. Update own's local view
3. Repeat

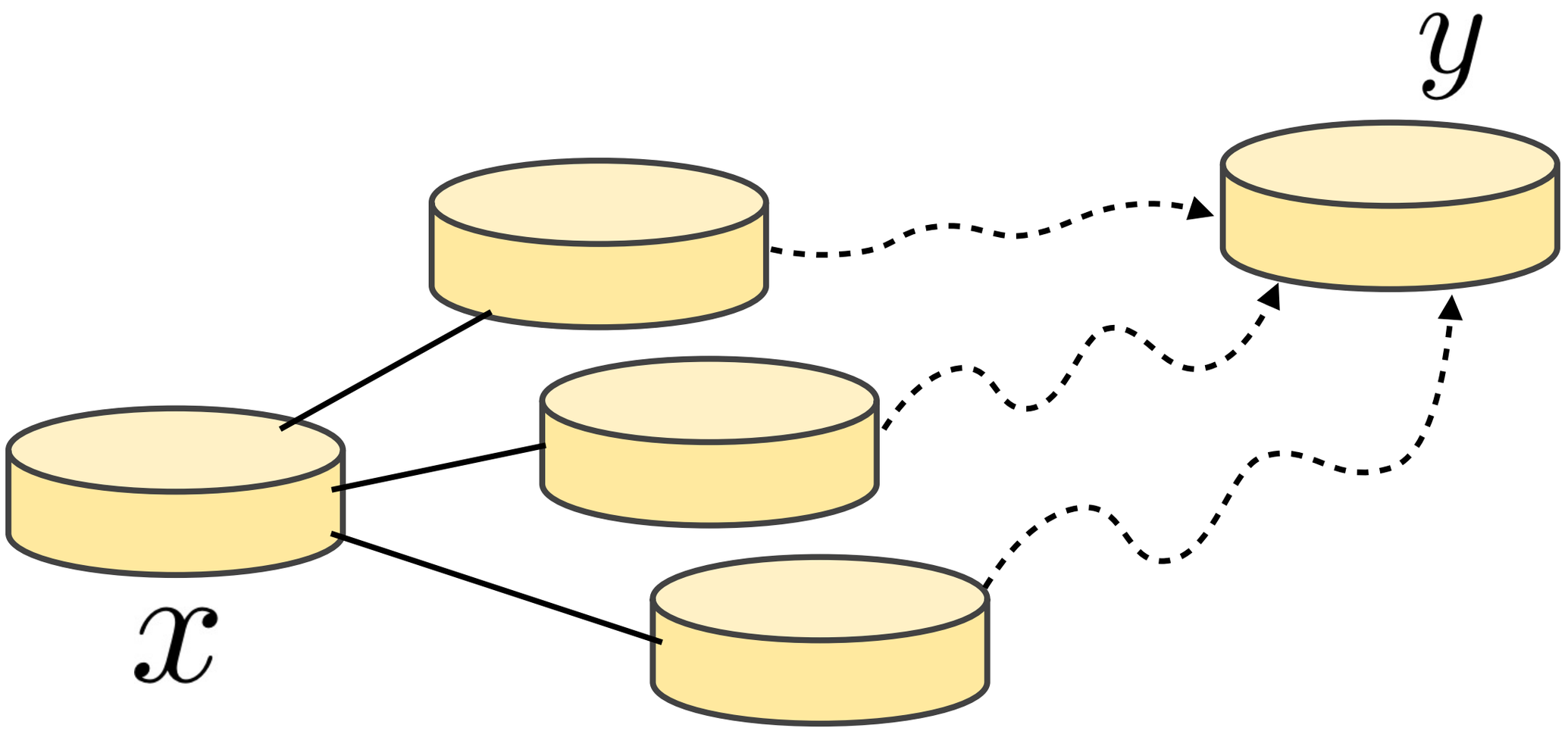
$d_x(y)$



$$c(x, y)$$



$$d_x(y) = min_v\{c(x,v) + d_v(y)\}$$



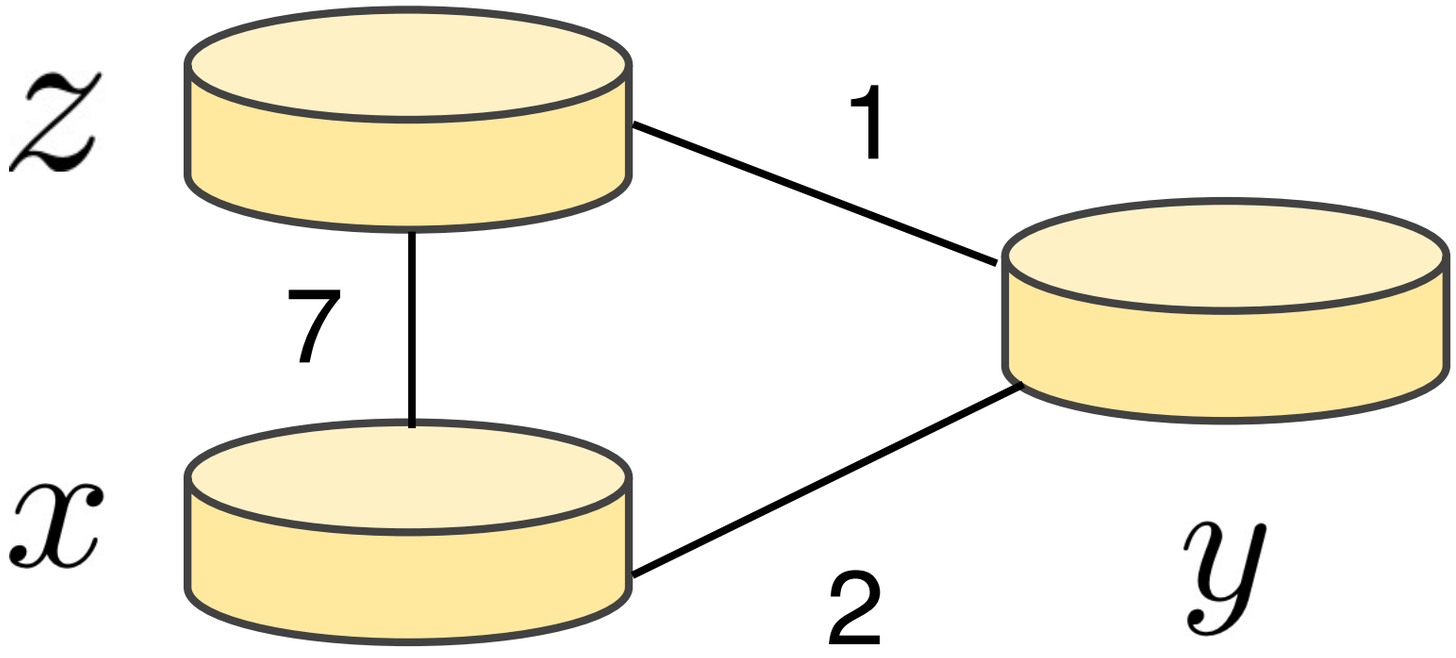
Bellman Ford Equation

$$d_x(y) = min_v\{c(x,v) + d_v(y)\}$$

dest	next hop	cost
v	z	10
w	z	23
x	x	21
y	x	17
z	z	12

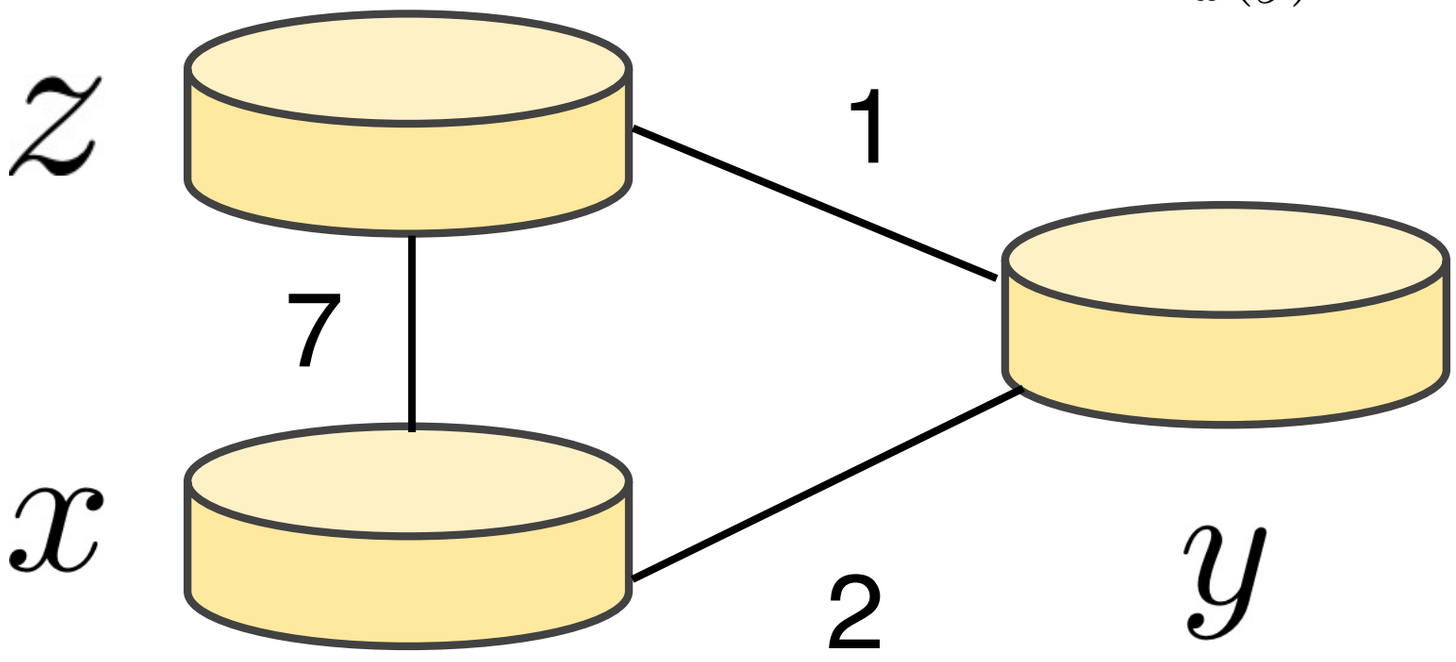
Distance Vector: the "local view" exchanged between neighbors.

dest		cost
v		10
w		23
x		21
y		17
z		12



	x	y	z
x			
y			
z			

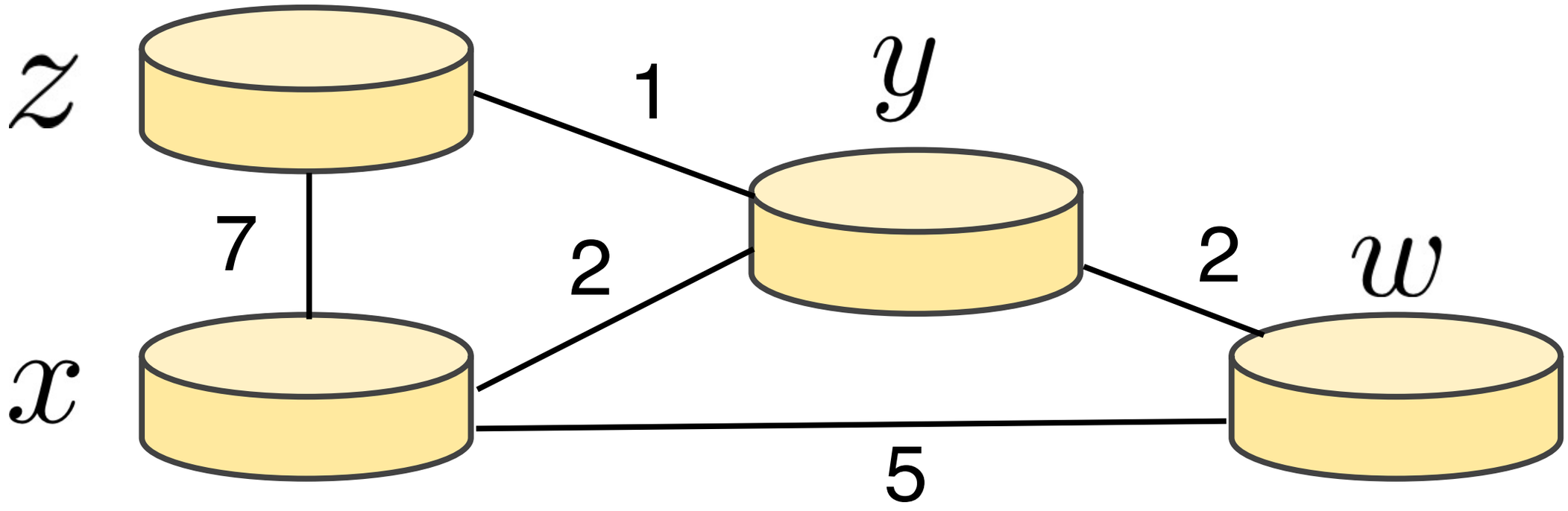
$$d_x(y) = min_v\{c(x,v) + d_v(y)\}$$



	x	y	z
x			
y			
z			

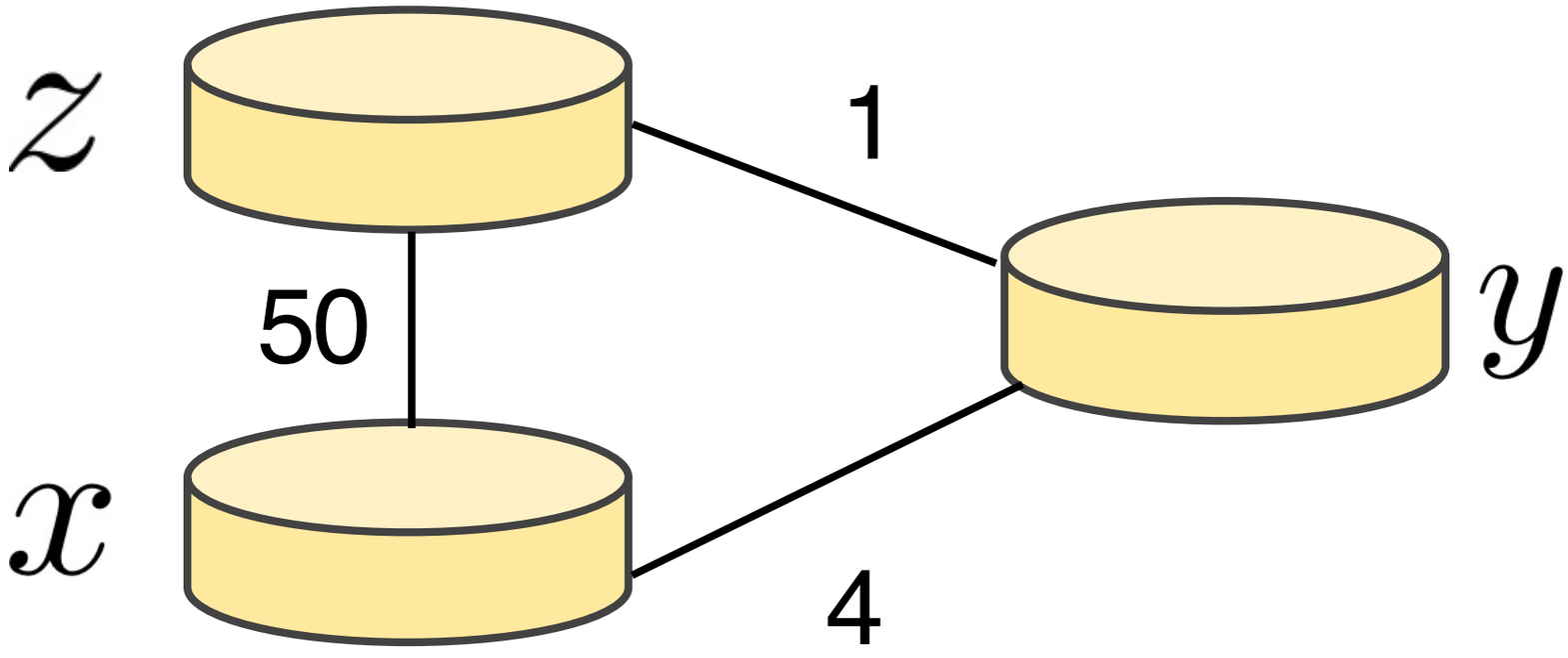
	x	y	z
x			
y			
z			

	x	y	z
x			
y			
z			



	x	y	z	w
x				
y				
z				
w				

	x	y	z	w
x				
y				
w				



	x	y	z
x			
y			
z			

	x	y	z
x			
y			
z			

decentralized
self-terminating
iterative
asynchronous

``count-to-infinity"

``poisoned reverse"

link state vs. distance vector

message complexity

convergence speed

robustness (error)

RIP: Routing Information Protocol

Routing Table

dest	next hop	hop count
v	z	3
w	z	7
x	x	1
y	z	5

Route is **static** and **load insensitive.**

Exchange routing table every 30 seconds over UDP port 520

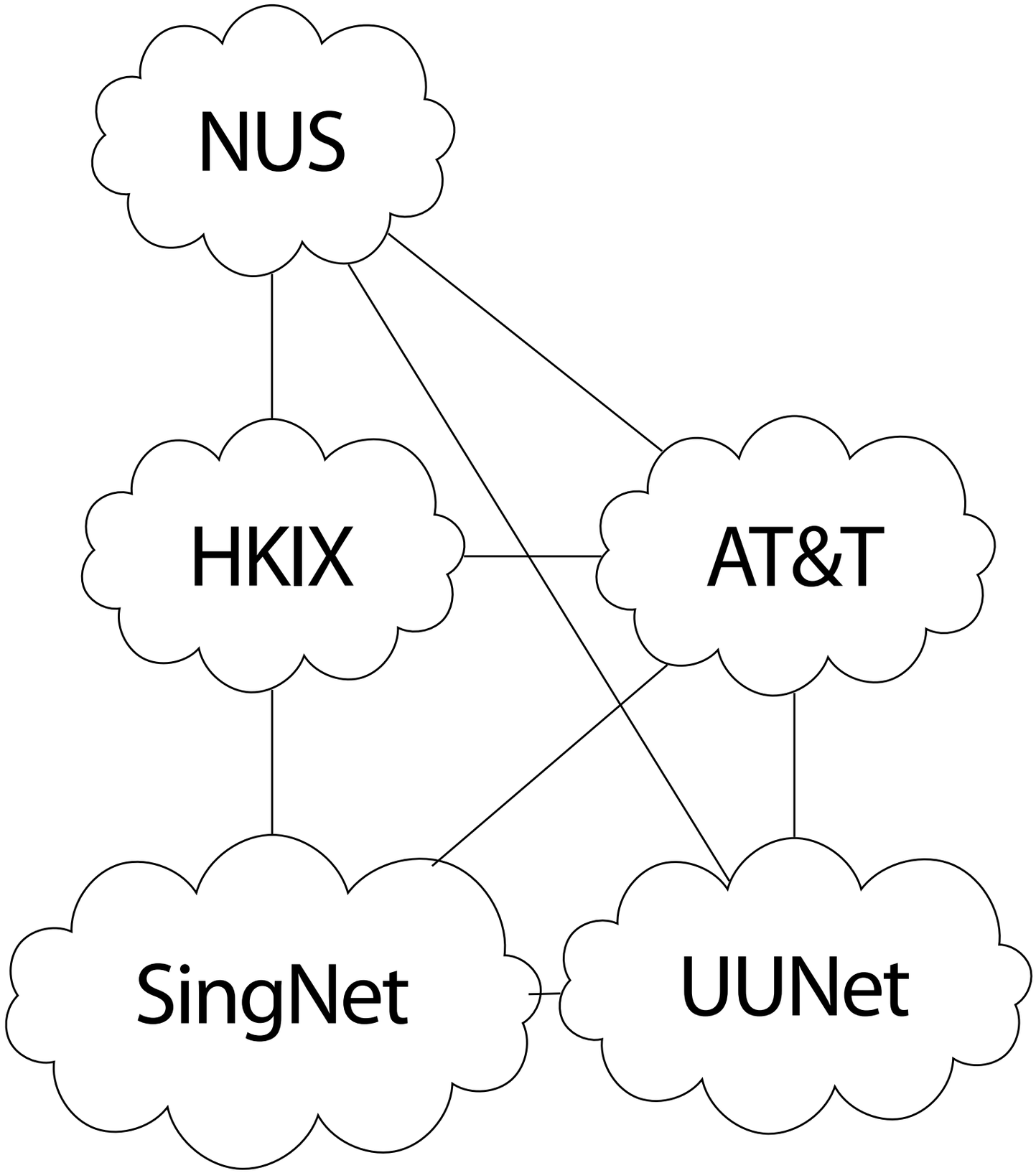
``Self-repair'': if no update from a neighbor for 3 minutes, assume neighbor has failed

Inter-*AS* routing

Intra-*AS* routing

BGP: Border Gateway Protocol

Hot Potato Routing: route to AS whose gateway has the least cost.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Admin Matters

TA Office Hours

Venue change:

DR5, AS6 02-08

Date: **11 March** 2013

Time: 2:00 - 3:30pm

Venue: **MPSH 1 Section A**

MCQs + short questions (practice questions will be posted)

Lecture 1-5

Problem Set 1-4

DIY Exercises 1-2

One
A4-size
double-sided
crib sheet
allowed