

Lab Course „RouterLab“

VLAN, Routing Information Protocol

Miscellaneous

- ❑ Your feedback on work sheet 1?
- ❑ Don't reserve more time than you need!
- ❑ Check that interfaces are „no shutdown“
- ❑ Lab -k if devices not accessible
 - Please terminate a session ...
- ❑ Router XXX-rj1 require password
 - Login: root
 - Password: router

Virtual LAN (VLAN)

Definitions

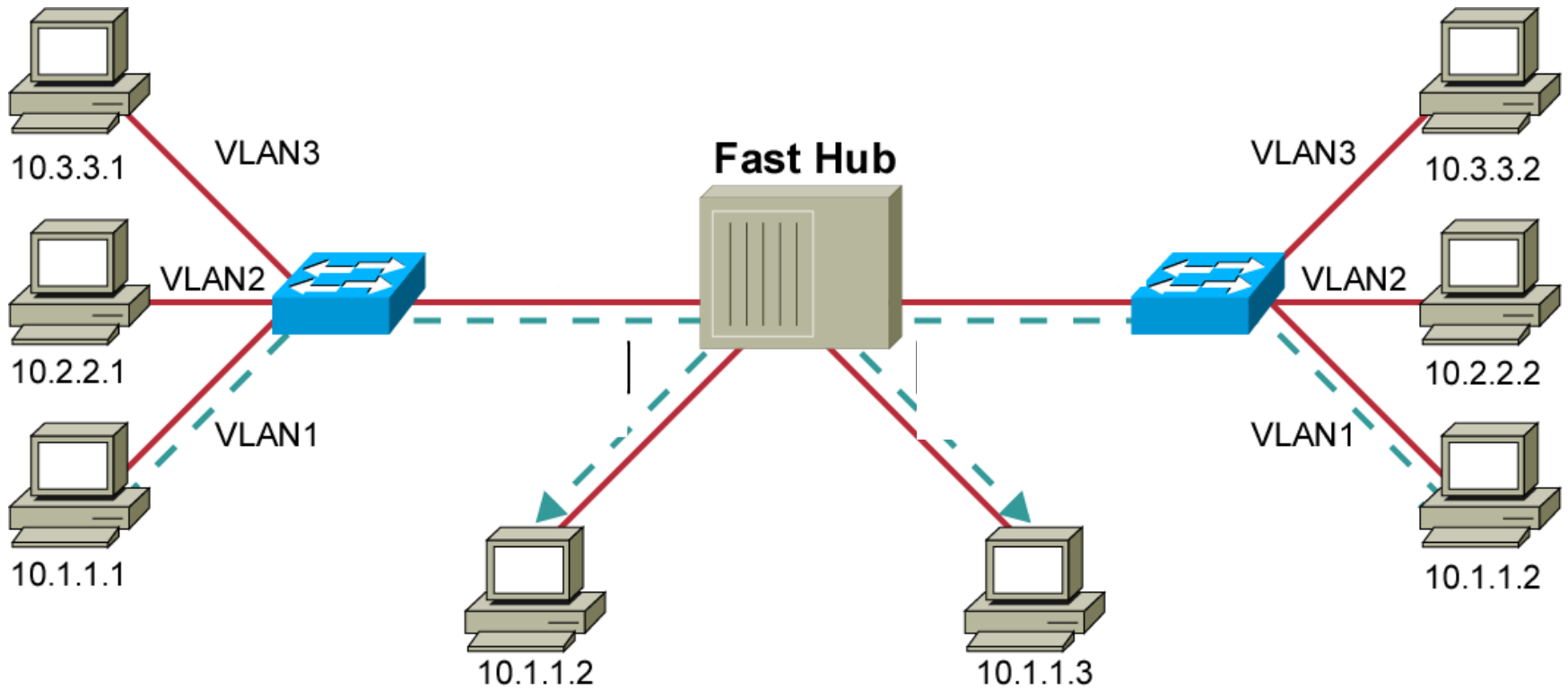
□ **LAN**

- broadcast domain
- Hubs or switches „connect“ different LAN segments
- Ethernet

□ **Virtual LAN (VLAN)**

- Group of devices can communicate with each other as if they were on the same LAN
- configured on switches (and routers)

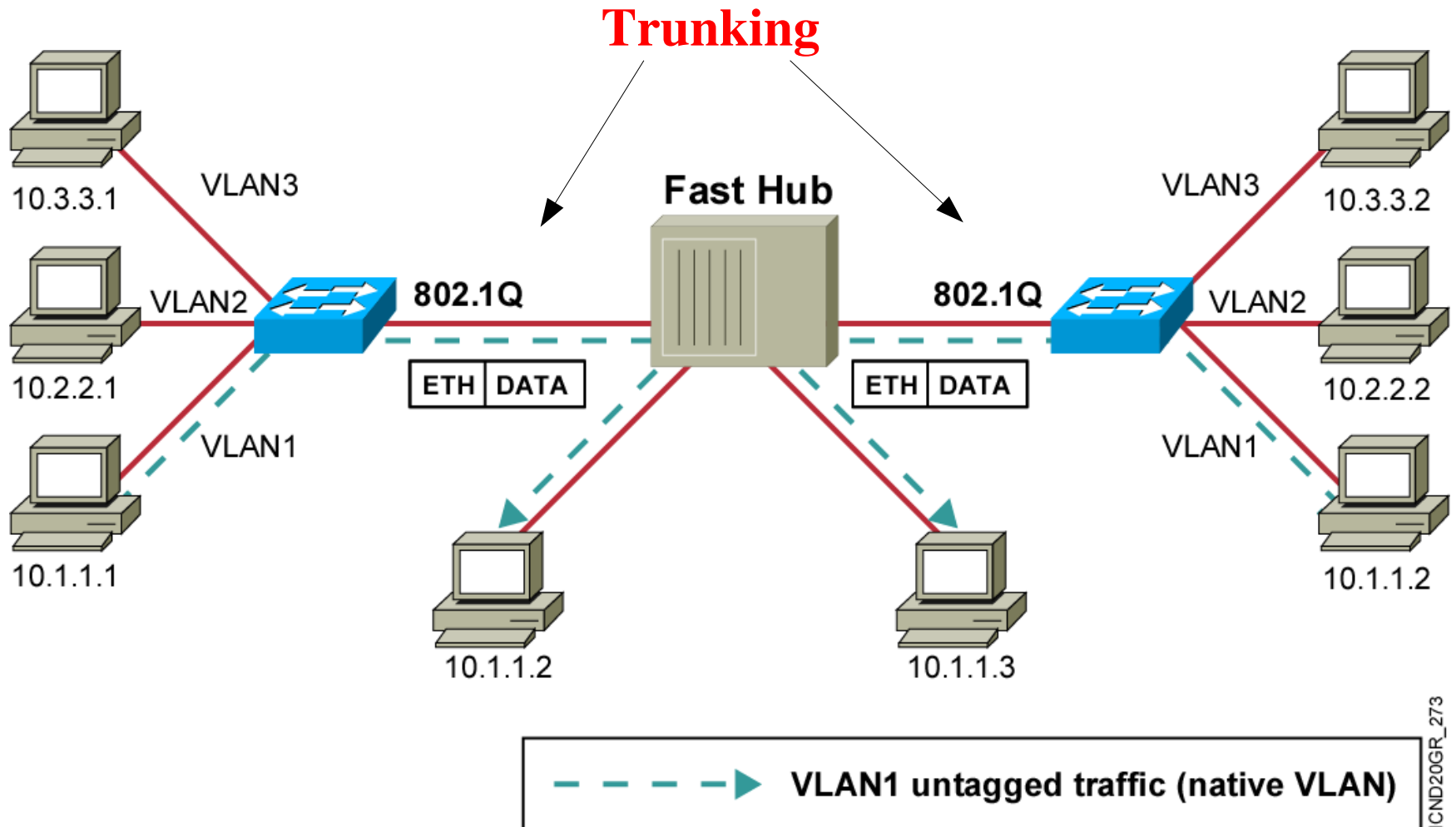
VLAN Example



Port-based VLANs

- ❑ Each switchport
 - can be assigned to a VLAN
 - accepts incoming traffic from a specific VLAN
 - forwards packets to ports that belong to same VLAN
- ❑ Configuration
 - (config-if) switchport access vlan <vlan-id>
 - (config-if) switchport mode access

Importance of Native VLANs



Trunking (802.1Q)

- ❑ Needed if multiple VLANs on same link
- ❑ Switch
 - (config-if) switchport trunk encapsulation dot1q
 - (config-if) switchport trunk allowed vlan 500,501
 - (config-if) switchport mode trunk
- ❑ Subinterface on Cisco, e.g., f0/0.100
 - (config-subif) encapsulation dot1Q <vlan_id>
- ❑ Extra unit on Juniper
 - vlan-tagging
 - unit 500 {vlan-id 500}

RIP

(Routing Information Protocol)

Routing Algorithm classification

Global or decentralized information?

Global:

- ❑ all routers have complete topology, link cost info
- ❑ “link state” algorithms

Decentralized:

- ❑ router knows physically-connected neighbors, link costs to neighbors
- ❑ iterative process of computation, exchange of info with neighbors
- ❑ “distance vector” algorithms

Static or dynamic?

Static:

- ❑ routes change slowly over time

Dynamic:

- ❑ routes change more quickly
 - periodic update
 - in response to link cost changes

RIP (Routing Information Protocol)

- ❑ Distance vector algorithm
- ❑ Included in BSD-UNIX Distribution in 1982
- ❑ Distance metric: # of hops (max = 15 hops)
- ❑ RFC 2453

Distance Vector Routing

Decentralized algorithm:

- ❑ router knows its neighbors and link costs to neighbors
- ❑ iterative computation, exchange of info with neighbors

Bellman-Ford Equation (dynamic programming)

Define $d_x(y) :=$ cost of least-cost path from x to y

Then

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

where min is taken over all neighbors v of x

Distance Vector Algorithm

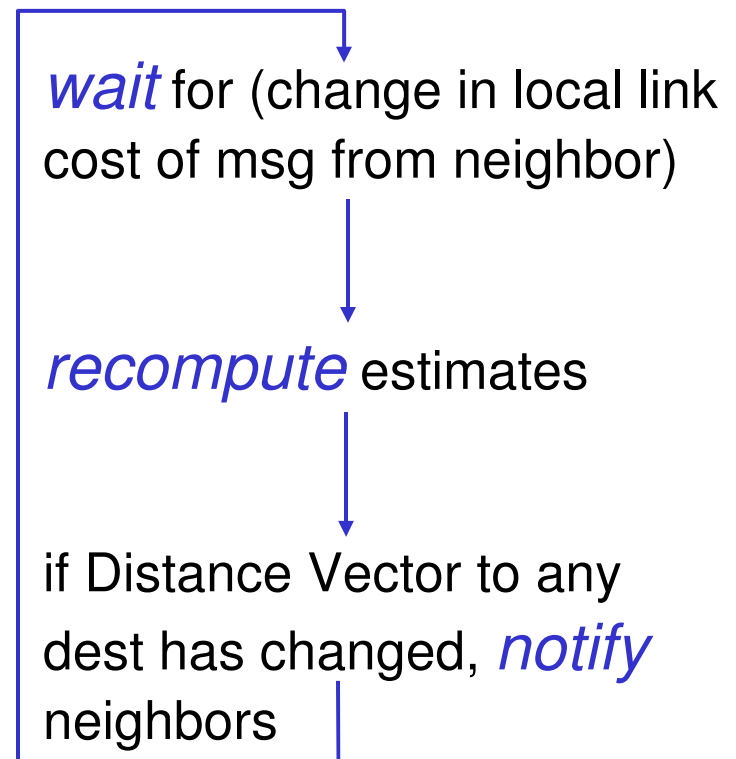
Iterative,
asynchronous:

- each local iteration caused by:
 - local link cost change
 - DV update message from neighbor

Distributed:

- each node notifies neighbors *only* when its Distance Vector changes
 - neighbors then notify their neighbors if necessary

Each node:

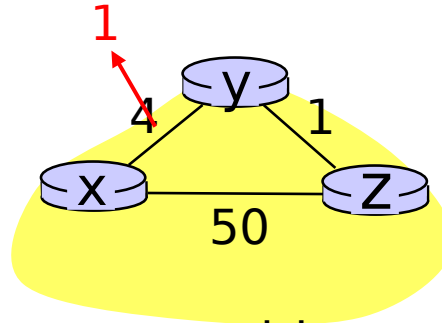


Distance Vector: link cost changes

Link cost changes:

- ❑ good news travels fast
- ❑ bad news travels slow

„Good news travel fast“



node y table

		cost to		
		x	y	z
from	x			
	y	4 1	0	1
	z	5	1	0

		cost to		
		x	y	z
from	x			
	y	1	0	1
	z	5	1	0

		cost to		
		x	y	z
from	x			
	y	1	0	1
	z	2	1	0

node z table

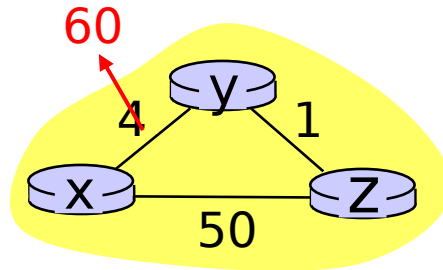
		cost to		
		x	y	z
from	x			
	y	4	0	1
	z	5	1	0

		cost to		
		x	y	z
from	x			
	y	1	0	1
	z	5 2	1	0

		cost to		
		x	y	z
from	x			
	y	1	0	1
	z	2	1	0

time →

Bad news: Count-to-Infinity



node y table

		cost to		
		x	y	z
from	x			
	y	4 6	0	1
	z	5	1	0

		cost to		
		x	y	z
from	x			
	y	6	0	1
	z	5	1	0

		cost to		
		x	y	z
from	x			
	y	6 8	0	1
	z	7	1	0

count
to
infinity
...

node z table

		cost to		
		x	y	z
from	x			
	y	4	0	1
	z	5	1	0

		cost to		
		x	y	z
from	x			
	y	6	0	1
	z	5 7	1	0

		cost to		
		x	y	z
from	x			
	y	6	0	1
	z	7	1	0

time →

RIP advertisements

- ❑ Distance vectors: exchanged among neighbors every 30 sec via Response Message (also called **advertisement**)
- ❑ Each advertisement: list of up to 25 destination nets within AS

How to avoid Count-to-Infinity

- ❑ Split Horizon
 - Don't announce route to neighbor from which route learned
- ❑ Split Horizon with Poisoned Reverse
 - in addition: say that a route is not reachable
- ❑ Triggered Updates
 - After metric change: send update immediately