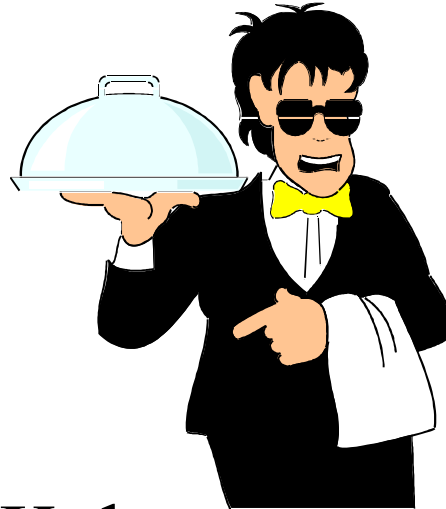# Ordered BECN
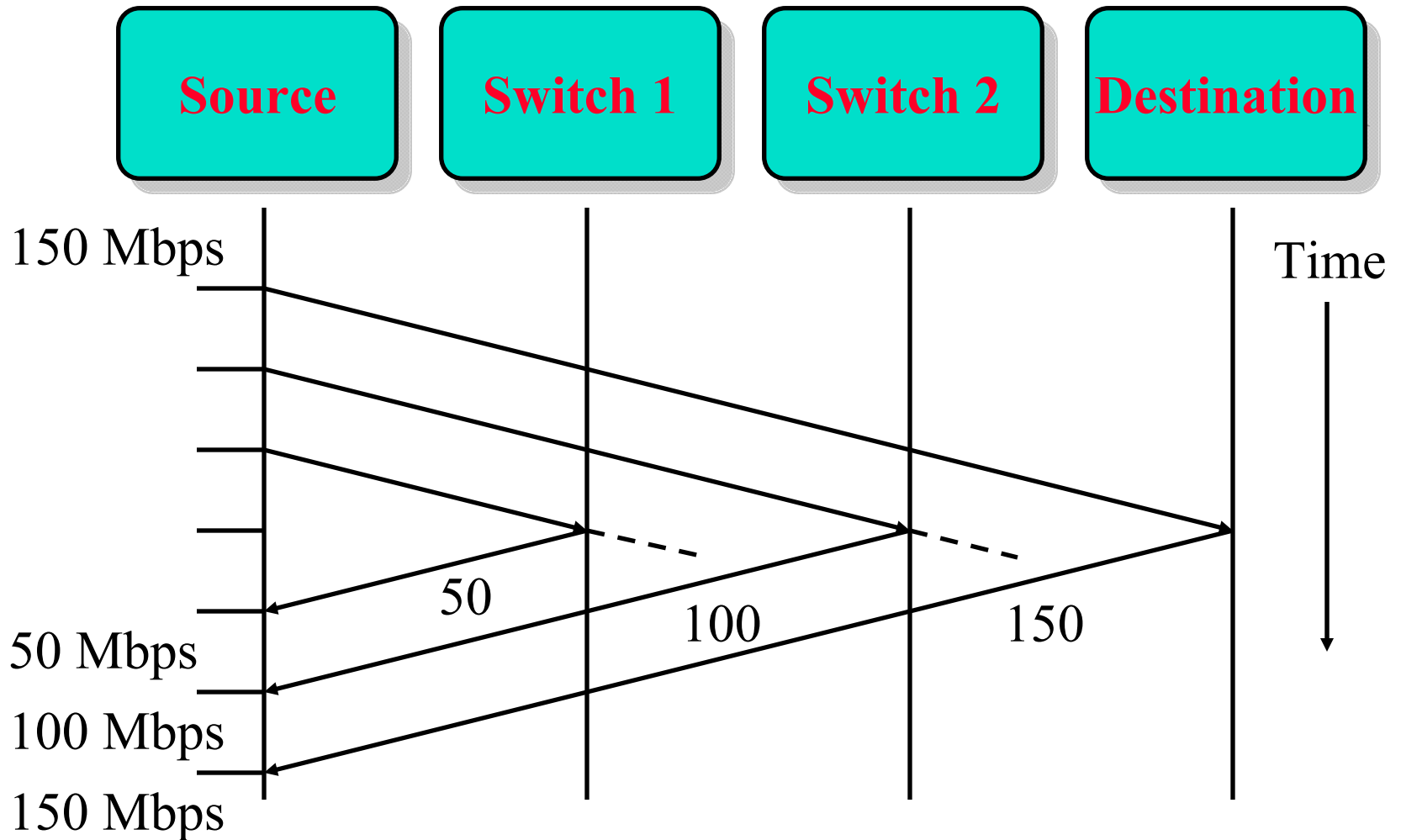
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Raj Jain is now at
Washington University in Saint Louis
Jain@cse.wustl.edu
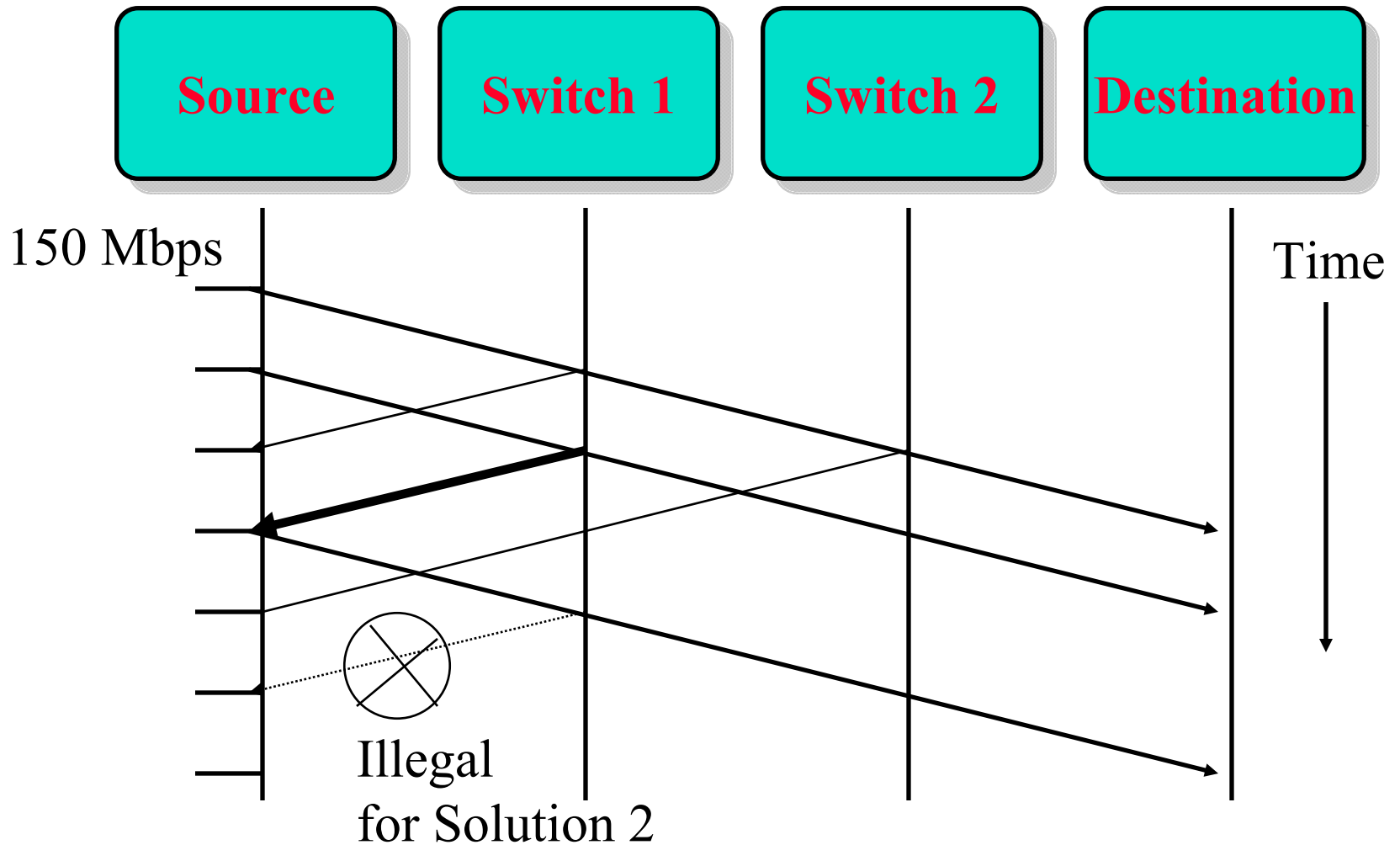http://www.cse.wustl.edu/~jain/

Overview

□ Why BECN's cause confusion

□ How to Fix it

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Backward Explicit Congestion Notification

150 Mbps

Source   Switch 1   Switch 2   Destination

Time

50

100

150

50 Mbps

100 Mbps

150 Mbps

Backward Explicit Congestion Notification
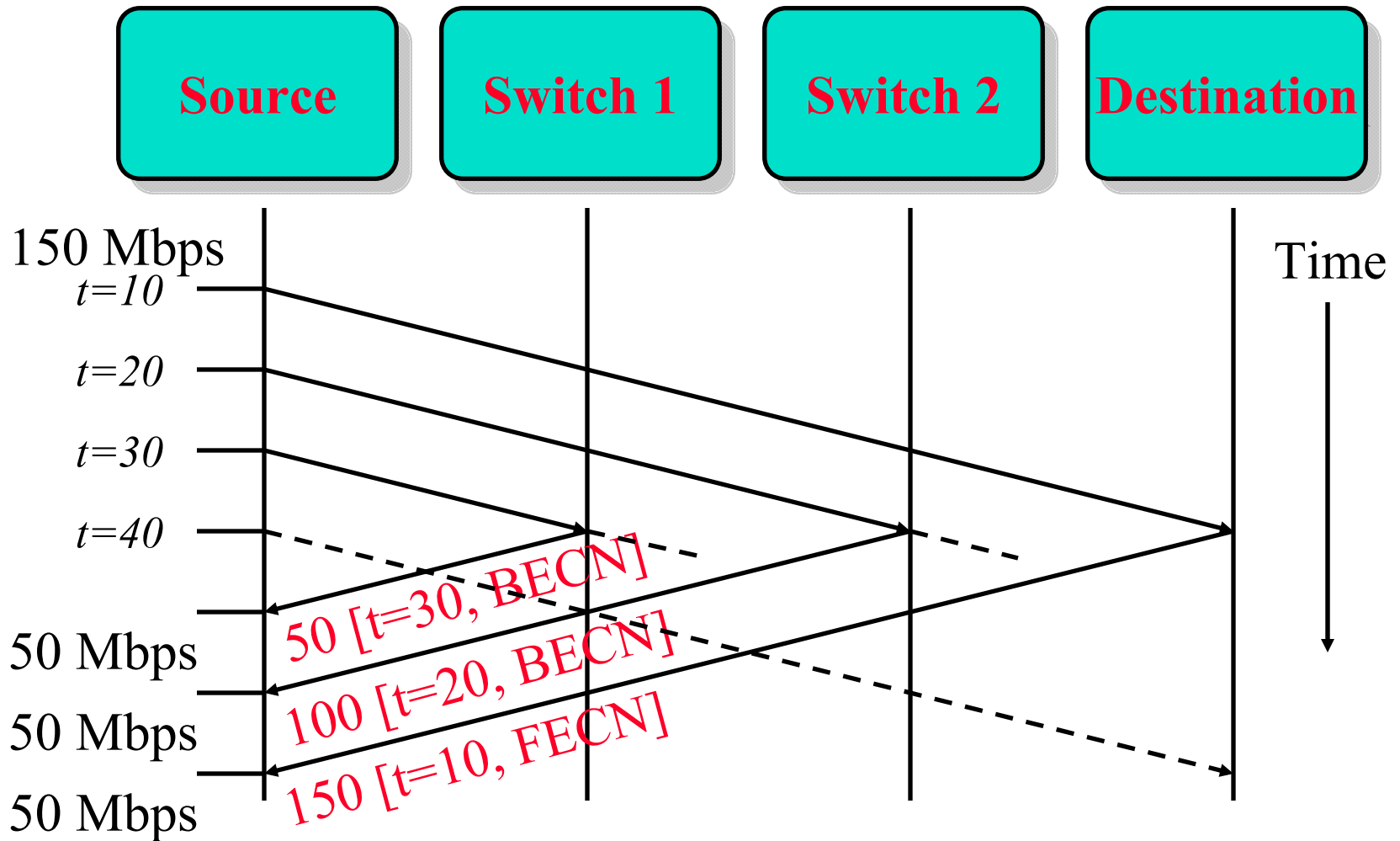

The Ohio State University

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BECN: Problems

❑ BECN's from multiple switches can come out of order

❑ One BECN can overrule the effect of other

❑ BECN can actually increase the rate

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Ordered BECN

❑ Each RM Cell contains a timestamp from the source

❑ Source ignores out-of-date information. Remembers the time up to which it has already acted

❑ BECN can not increase
FECN can increase/decrease

❑ RM Cell contains BECN/FECN bit

❑ Out-of-date FECN's are also ignored

Ordered BECN: Example

Source   Switch 1   Switch 2   Destination

150 Mbps

Time

t=10

t=20

t=30

t=40

50 [t=30, BECN]

50 Mbps

100 [t=20, BECN]

50 Mbps

150 [t=10, FECN]

50 Mbps

OSU Ordered BECN Rules

❑ BECN is optional for switches

❑ BECN should be sent only if overloaded

❑ Source includes a timestamp in each RM cell
The timestamp field is ignored by other nodes

❑ RM cells include BECN/FECN bit initialized to FECN

❑ The original RM cell is forwarded towards the destination.

❑ A copy of the RM cell with BECN/FECN bit changed to
BECN is returned to the source

❑ The source remembers the timestamp of the last BECN/FECN
RM cell received

❑ All BECN/FECNs with earlier timestamp are ignored

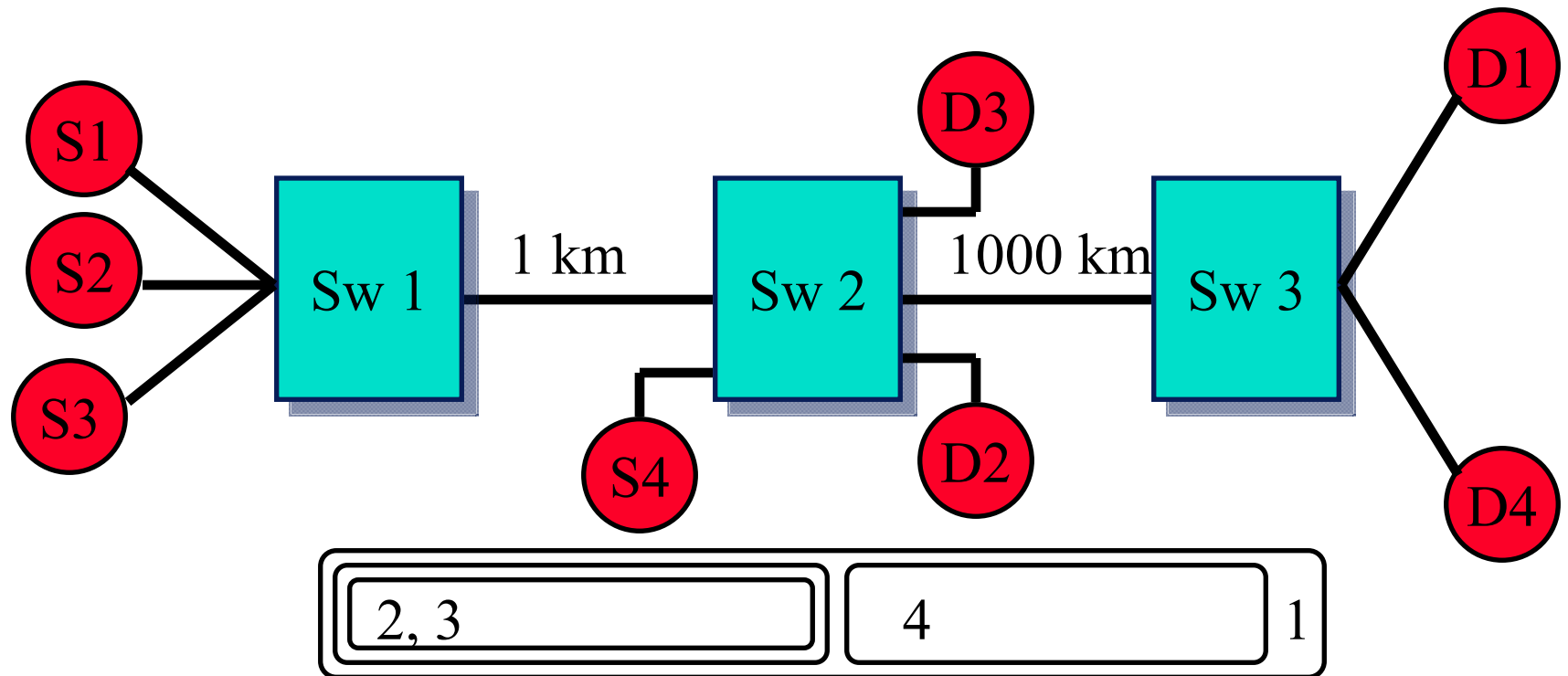❑ All BECN that would result in rate increase are ignored

BECN Rules

❑ BECN :When a switch generates an RM cell destined for the source when the switch is not acting as a virtual destination

❑ RM cells include BECN/FECN bit initialized to FECN

❑ All BECN that would result in rate increase are ignored

❑ BECN is optional for switches

❑ BECN should be sent only if overloaded

❑ The original RM cell is forwarded towards the destination.

❑ A copy of the RM cell with BECN/FECN bit changed to BECN is returned to the source

❑ BECN can be sent on the "First RM" cell

❑ If the source has received an RM cell from the destination, then no switch should generate a BECN

❑ => Need "Not yet heard from destination" bit in RM cells

Subsequent BECN Solutions

❑ Source ignores all BECNs that result in rate increase.

❑ Switch does not generate a subsquent BECN if it has seen other reverse RM cells for this VC.
=> Need bit per active VC in the switch

❑ The source includes a timestamp in each RM Cell and remembers the timestamp of the last BECN/FECN RM cell acted. Ignores BECN/FECNs with earlier timestamps are ignored.

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Upstream Configuration

□ All links 155 Mbps. Link 1: 1 km, Link 2: 1000 km

□ Max-min optimal: 51.3, 51.3, 51.3, 103.6 Mbps

□ Goal: To check that all unused capacity is allocated to S4

Summary

❑ Without a timestamp field,
BECN's can cause confusion

❑ Need a timestamp field and
BECN/FECN bit in the RM Cell

❑ Need to specify rules for BECN/FECN usage

❑ Sequence number can be used in place of timestamps.
But, timestamp can also be used for round-trip delay
estimate