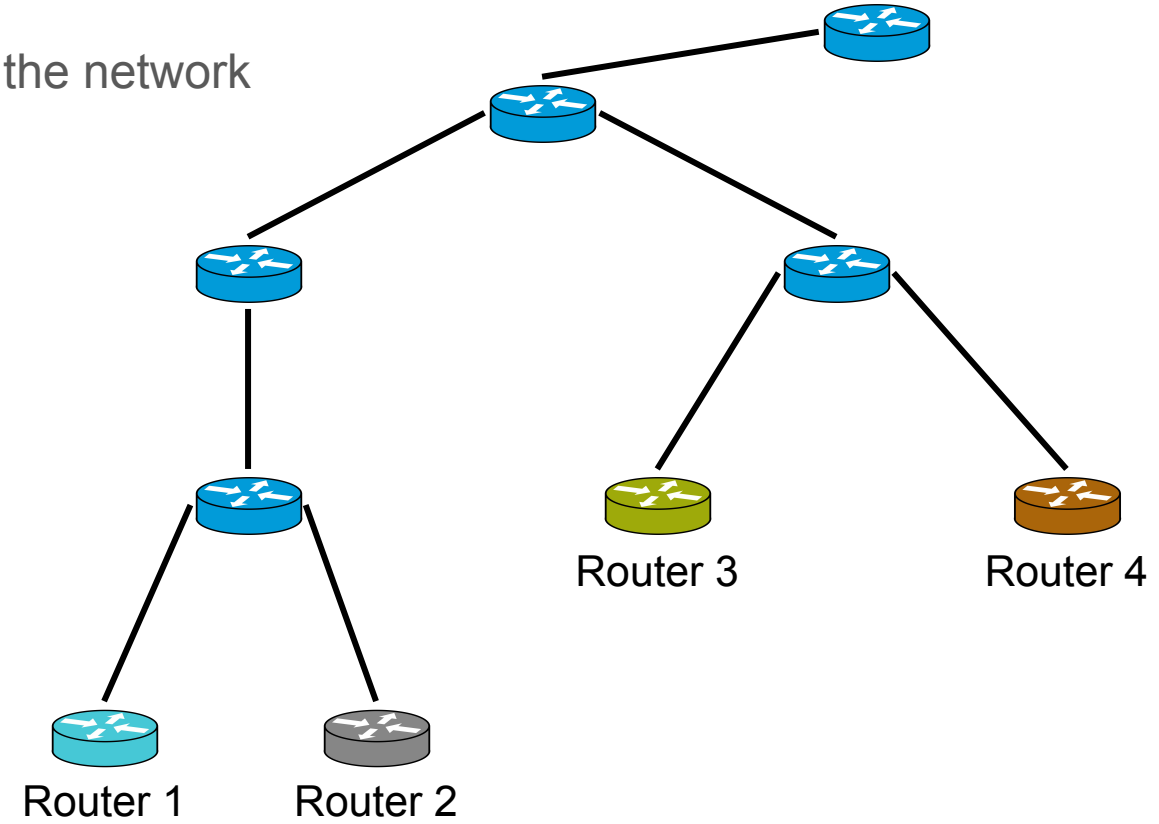
It Is Time to Reconsider Multicast

Louis Navarre, François Michel, Olivier Bonaventure

Multicast enables efficient one-to-many communications

- Avoid multiple copies in the network



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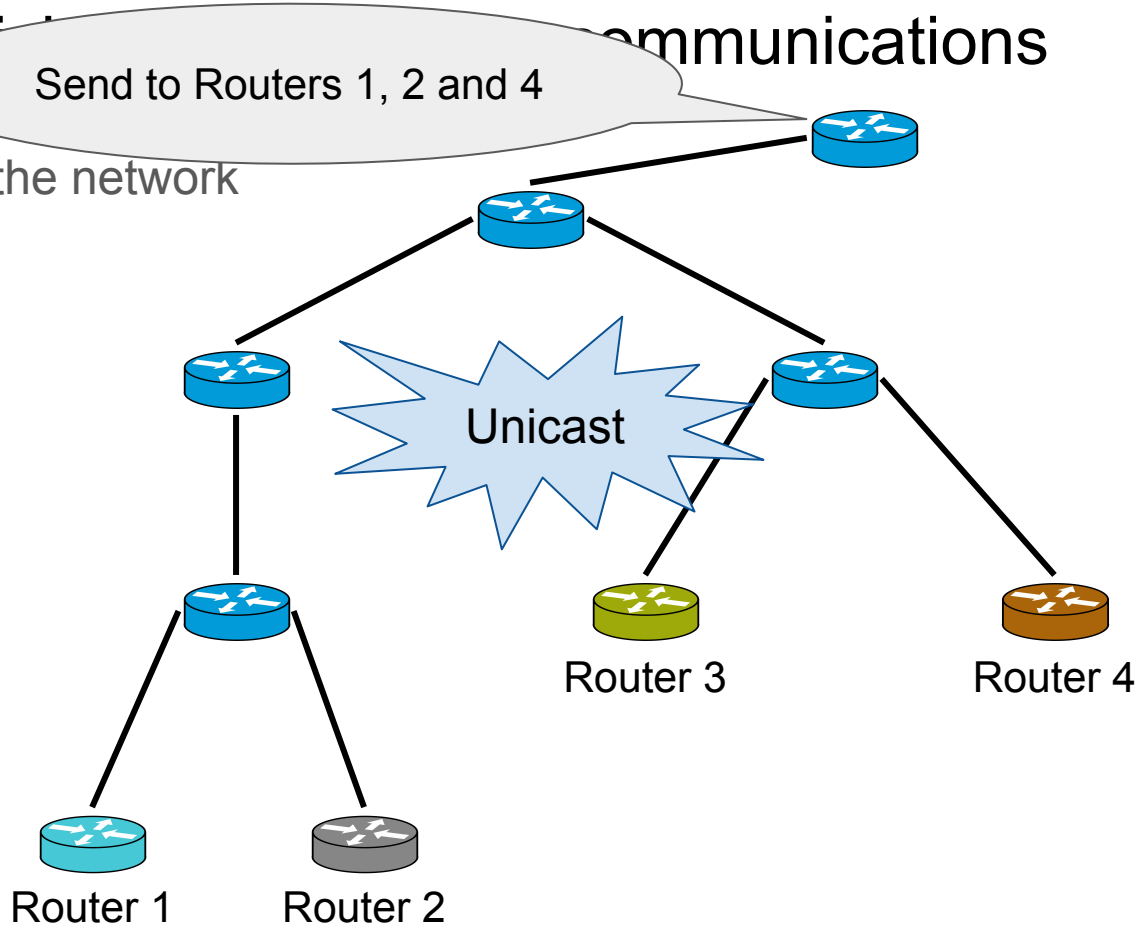

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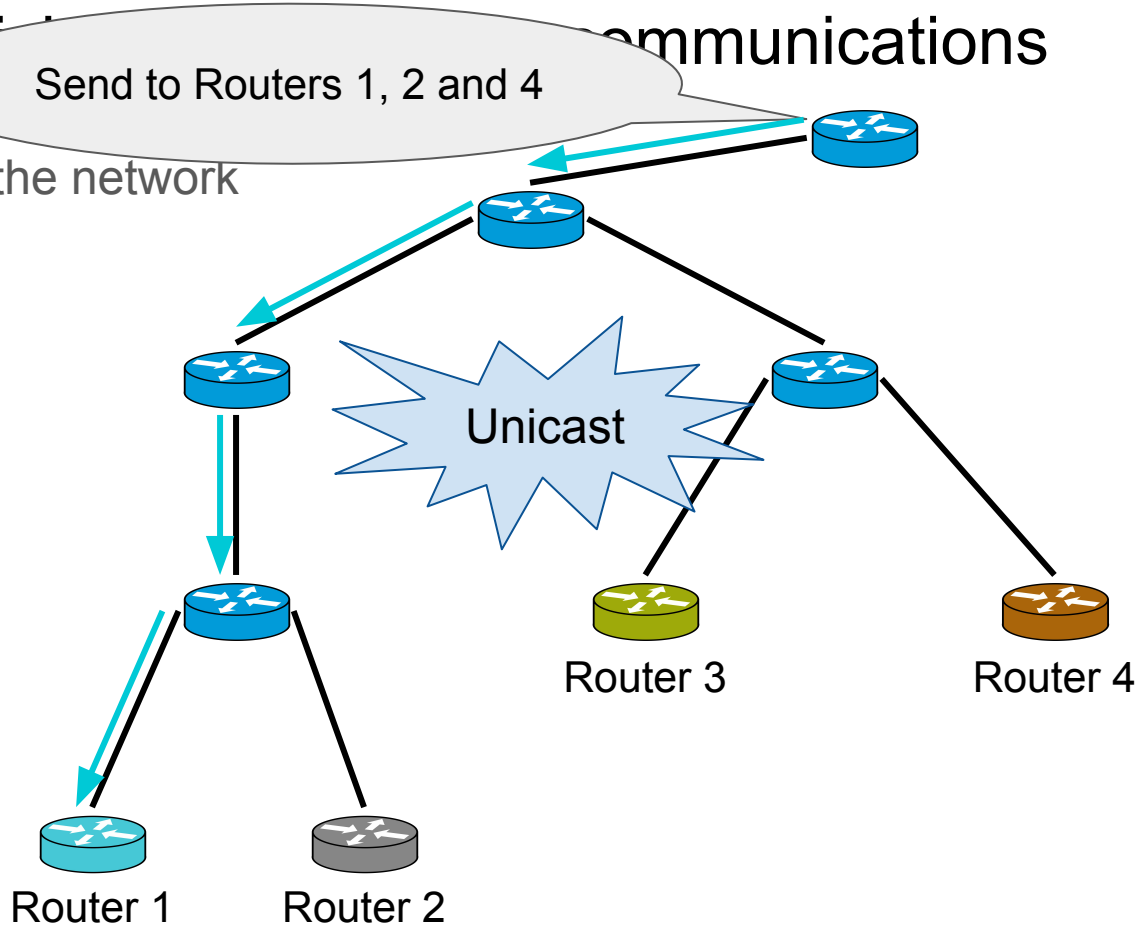

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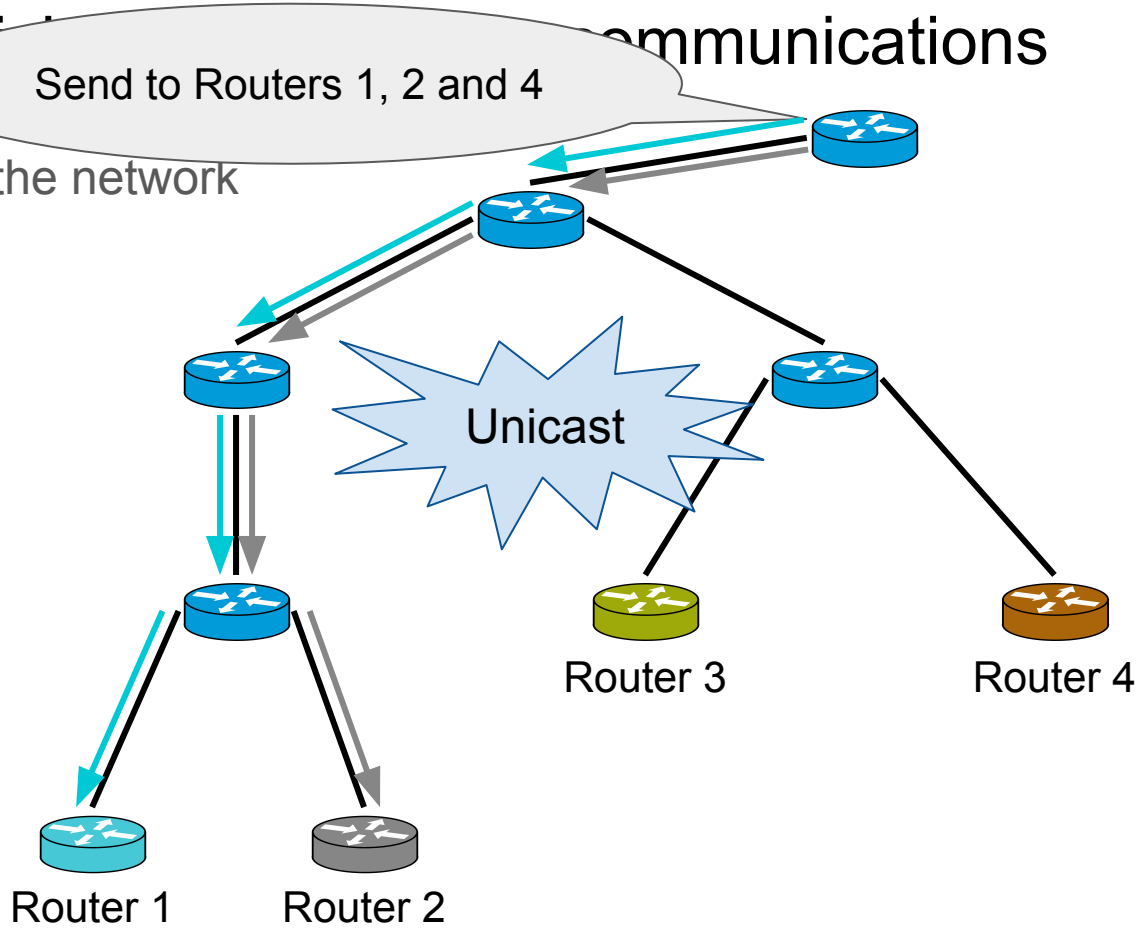

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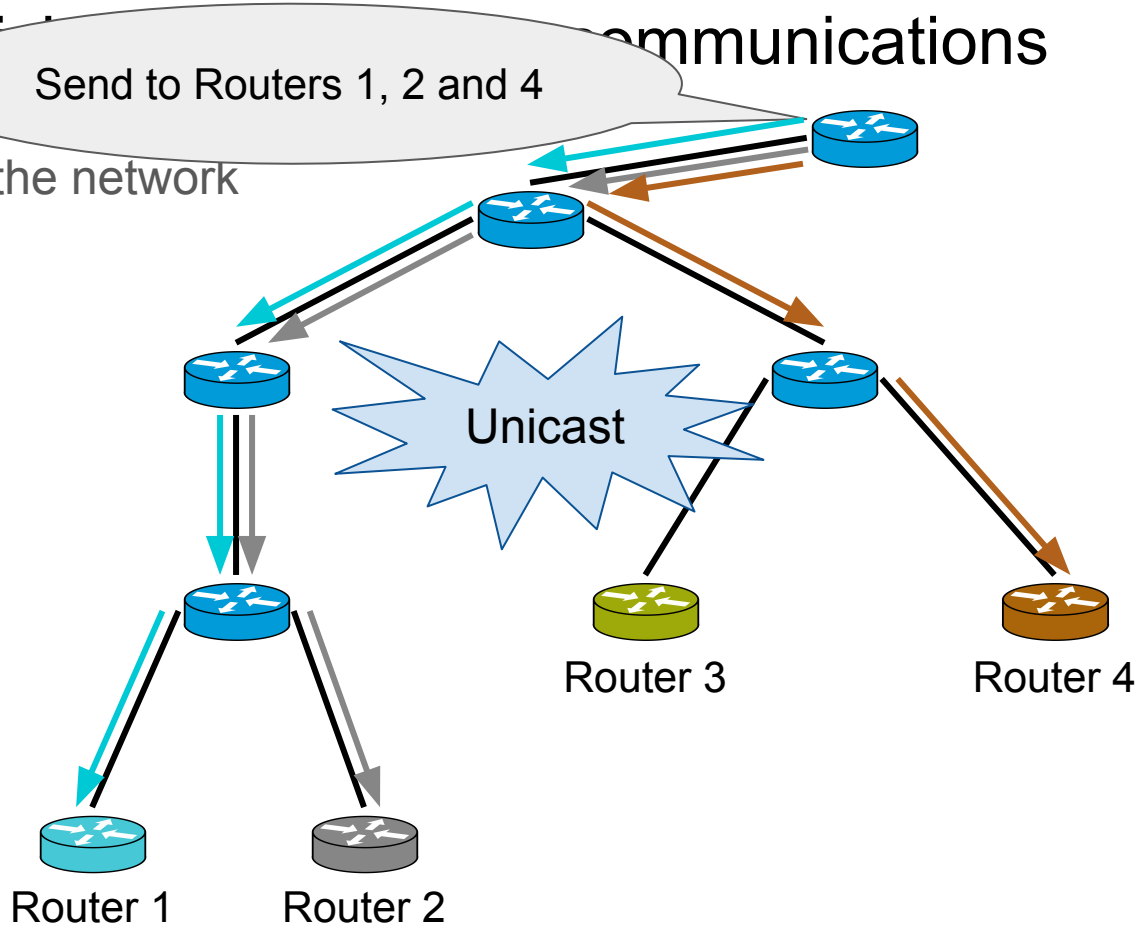

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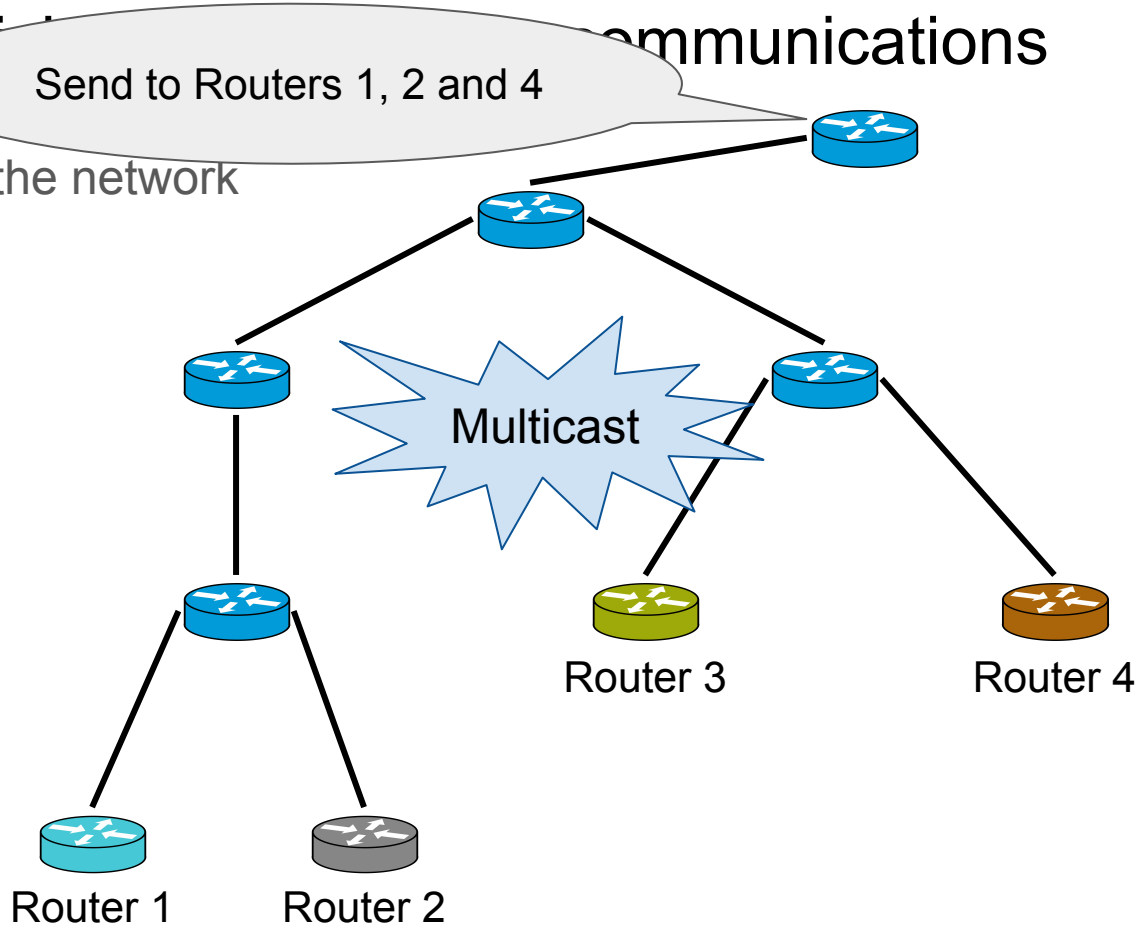

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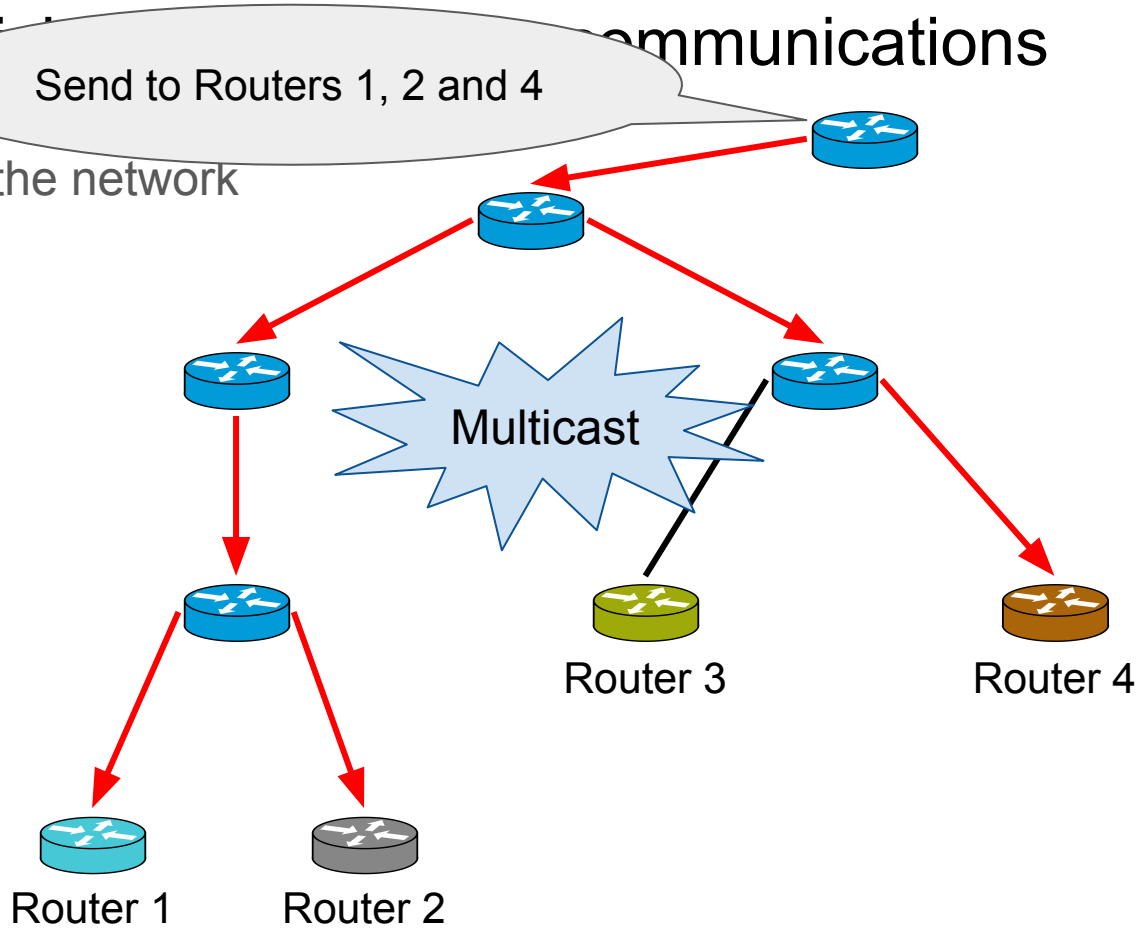
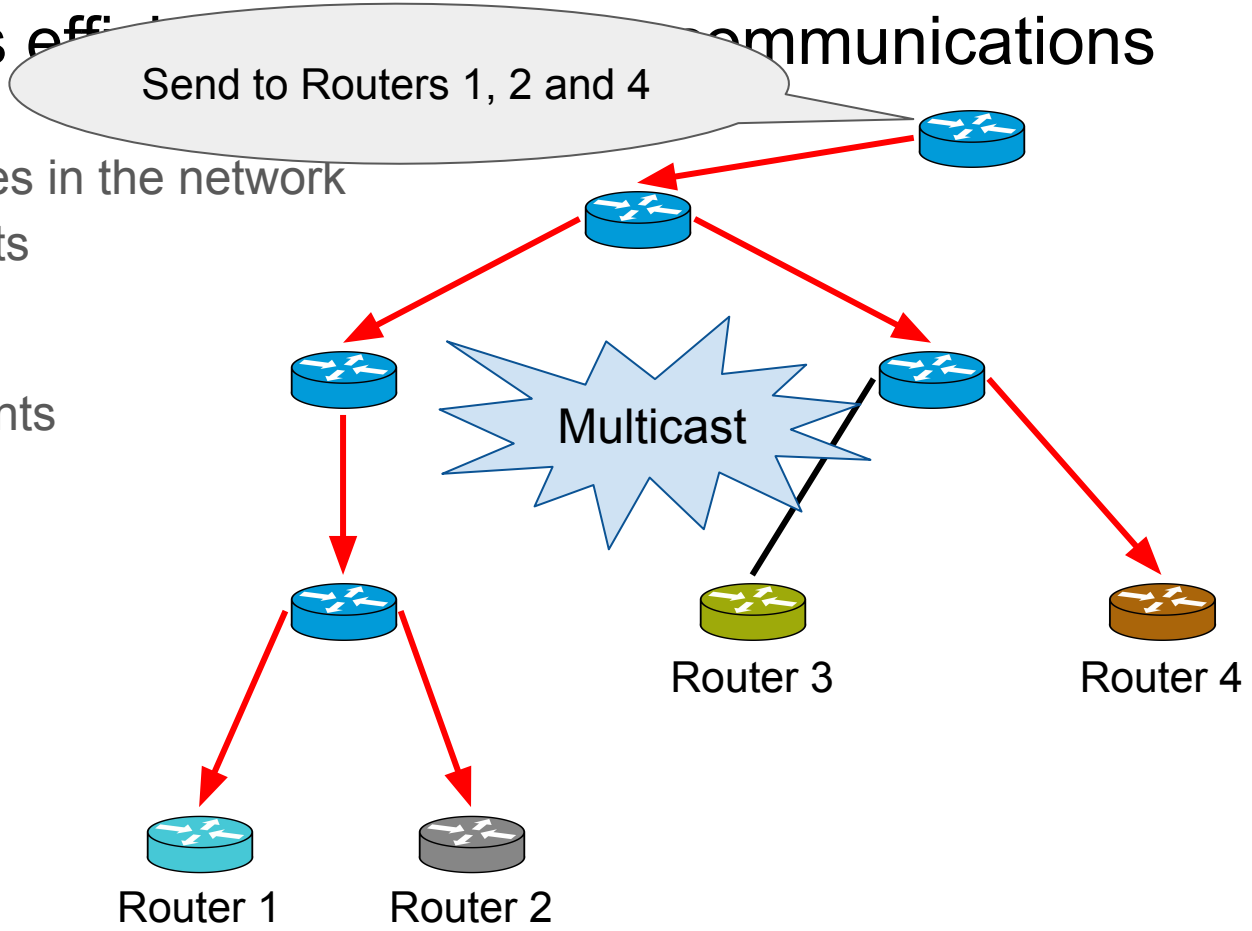


Multicast enables effi[illegible]ommunications

- Avoid multiple copies in the network
- Current deployments
  - IPTV
  - Stock exchange
- Potential deployments
  - Videoconferences
  - Live streaming
  - …



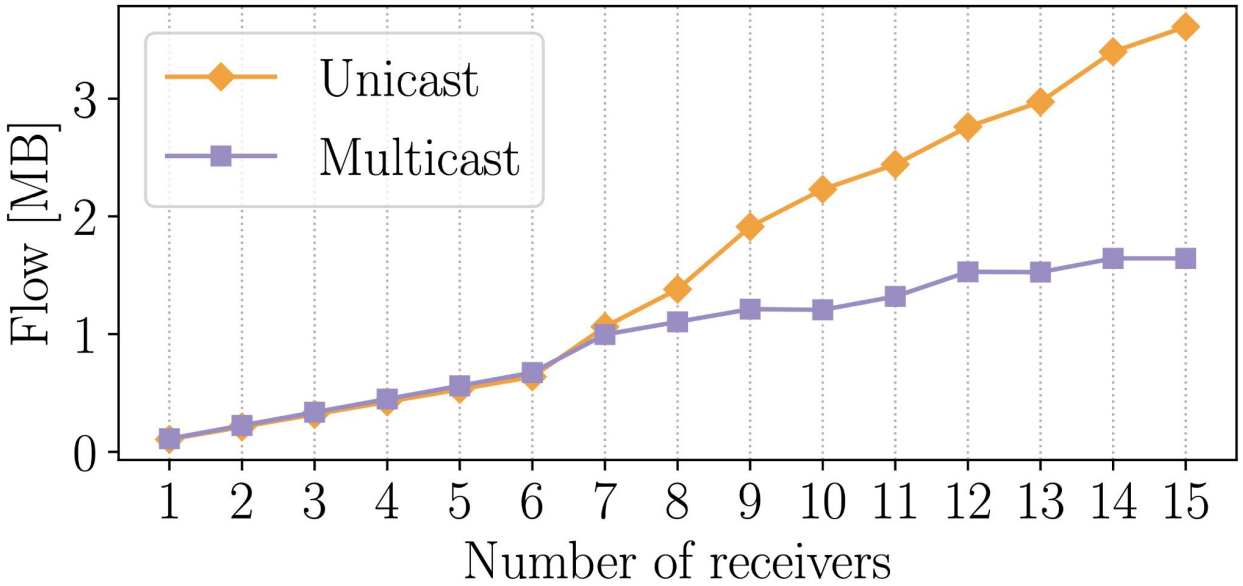
From theory to practice

- Mininet emulation of GEANT (22 routers, 36 links)
- 100 UDP packets of 1000 bytes payload
- Multicast mechanism: Bit Index Explicit Replication
- We ignore communication setup

- Measurements
  - CPU cycles at the sender
  - Bytes flowing in the network

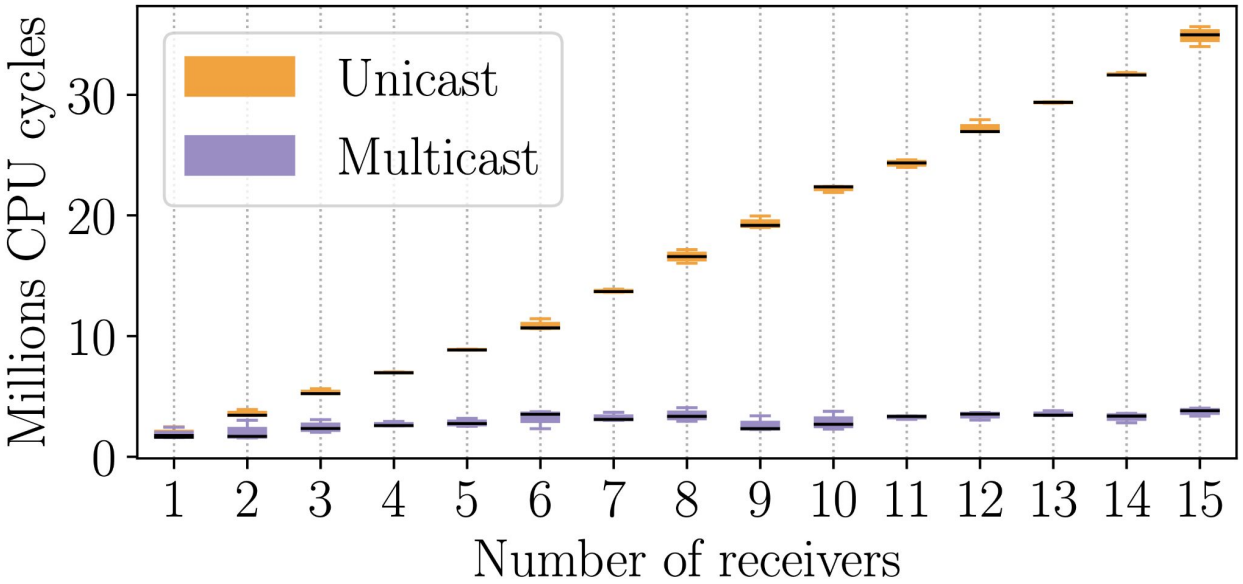
Multicast reduces the bytes footprint

We avoid sending multiple times the same packet on the same link



CPU cycles remain constant in multicast

- Linear increase with unicast
- CPU cycles of the routers increase due to duplication…
- … but less packets to forward/duplicate



So, why don’t we use (more) multicast?

Well… this paper…

Deployment Issues for the IP Multicast Service and Architecture

Christophe Diot, Sprint Advanced Technology Labs
Brian Neil Levine, University of Massachusetts
Bryan Lyles, Sprint Advanced Technology Labs
Hassan Kassem, SprintLink
Doug Balensiefen, Sprint

Well… this paper…

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The issues… and possible solutions?

- Scalability: IP Multicast state on routers
- New protocols implementation in the kernel
- Inter-domain policies

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  QUIC is a great example

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The issues… and possible solutions?

- Scalability: IP Multicast state on routers
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  ⇒ Performance gap with user-space and increased
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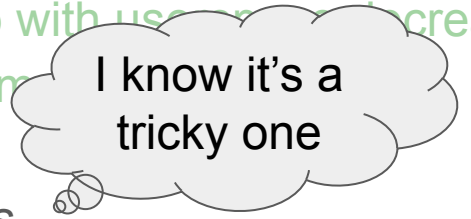
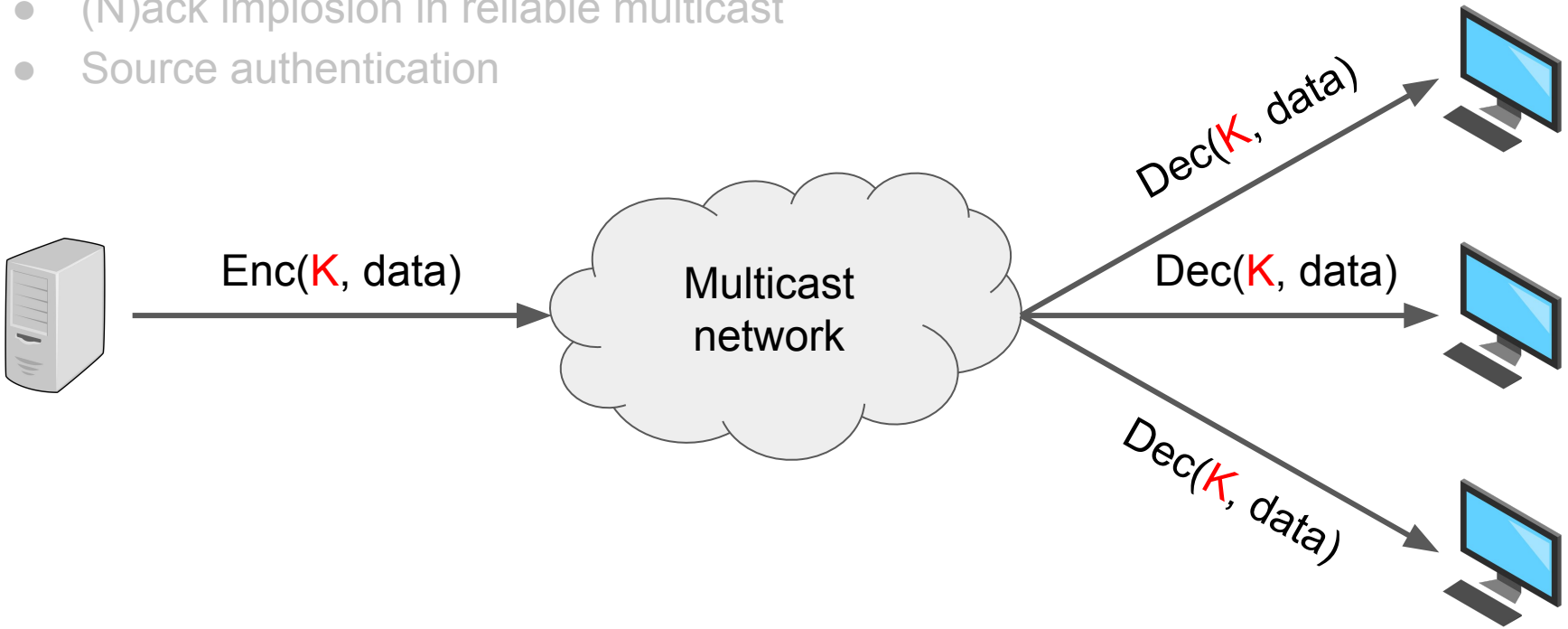


- Inter-domain policies
  ⇒ Multicast overlay networks (with CDNs)
  CDNs could act as multicast relays

Other issues

- Data encryption in dynamic groups
- (N)ack implosion in reliable multicast
- Source authentication



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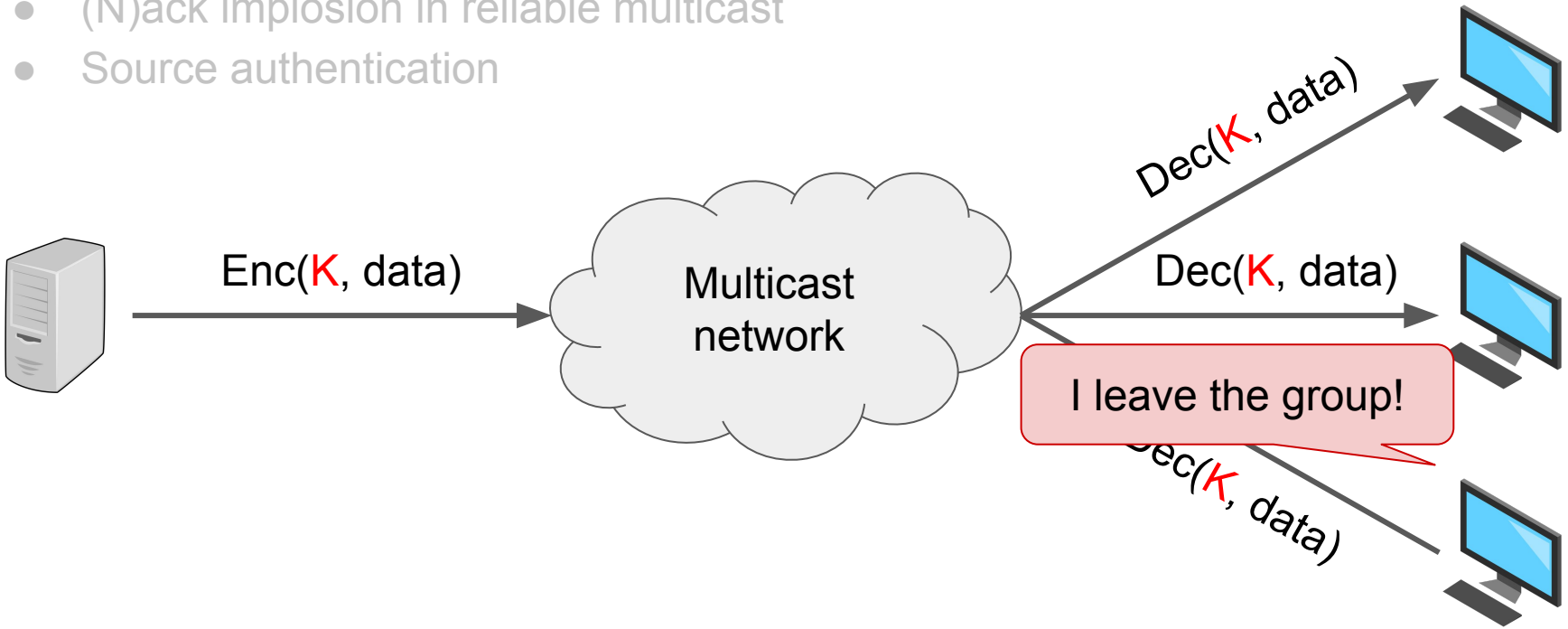

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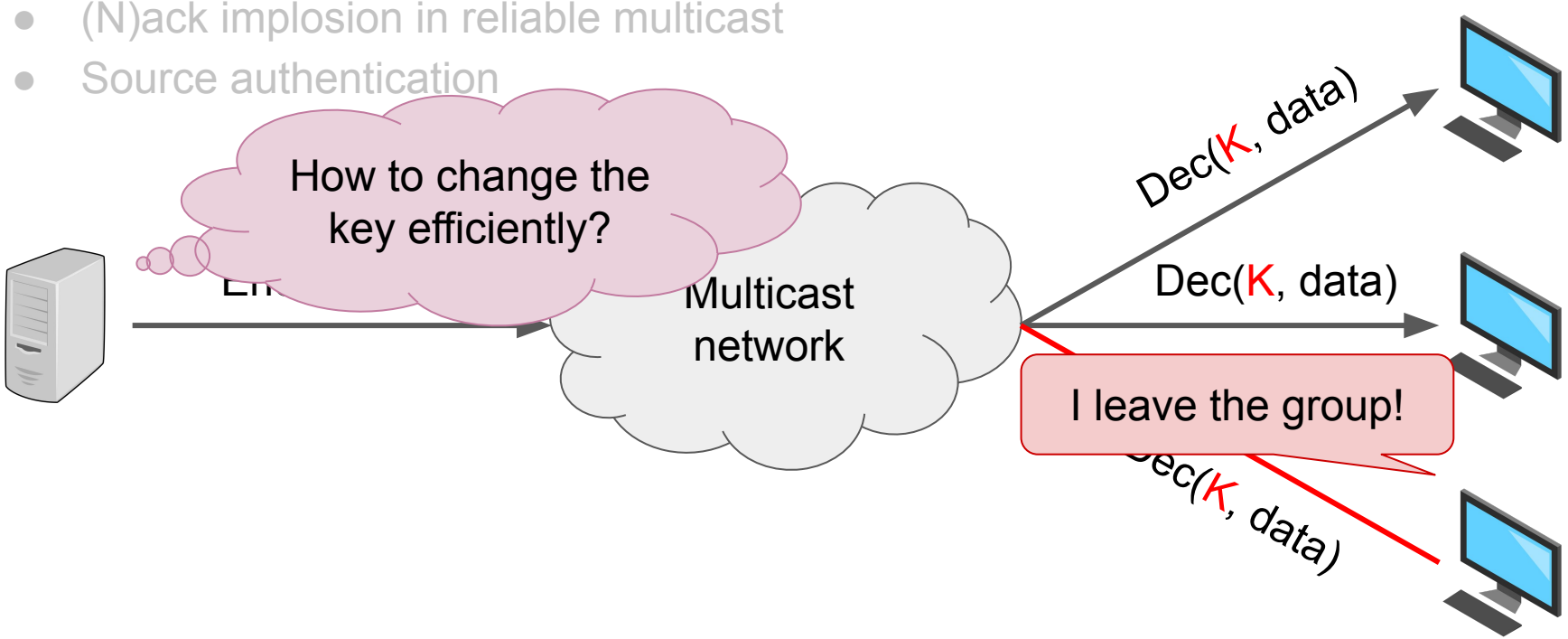

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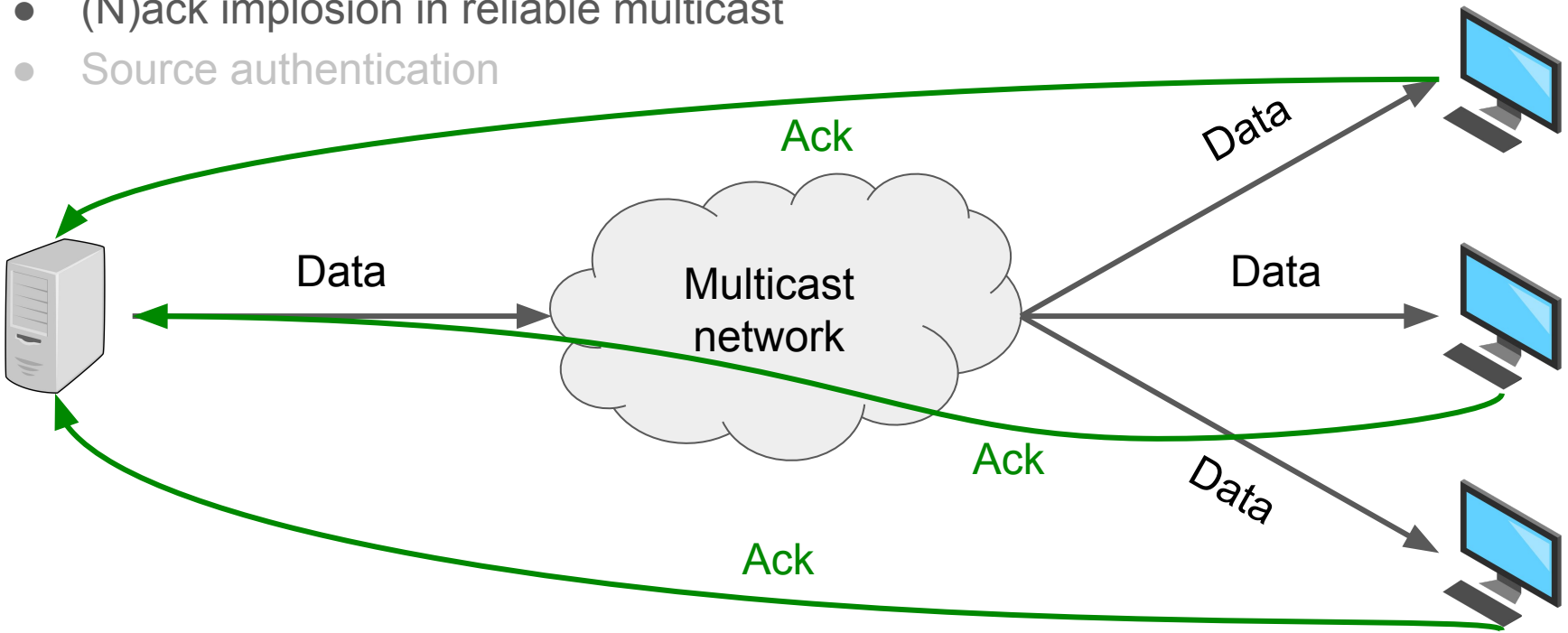

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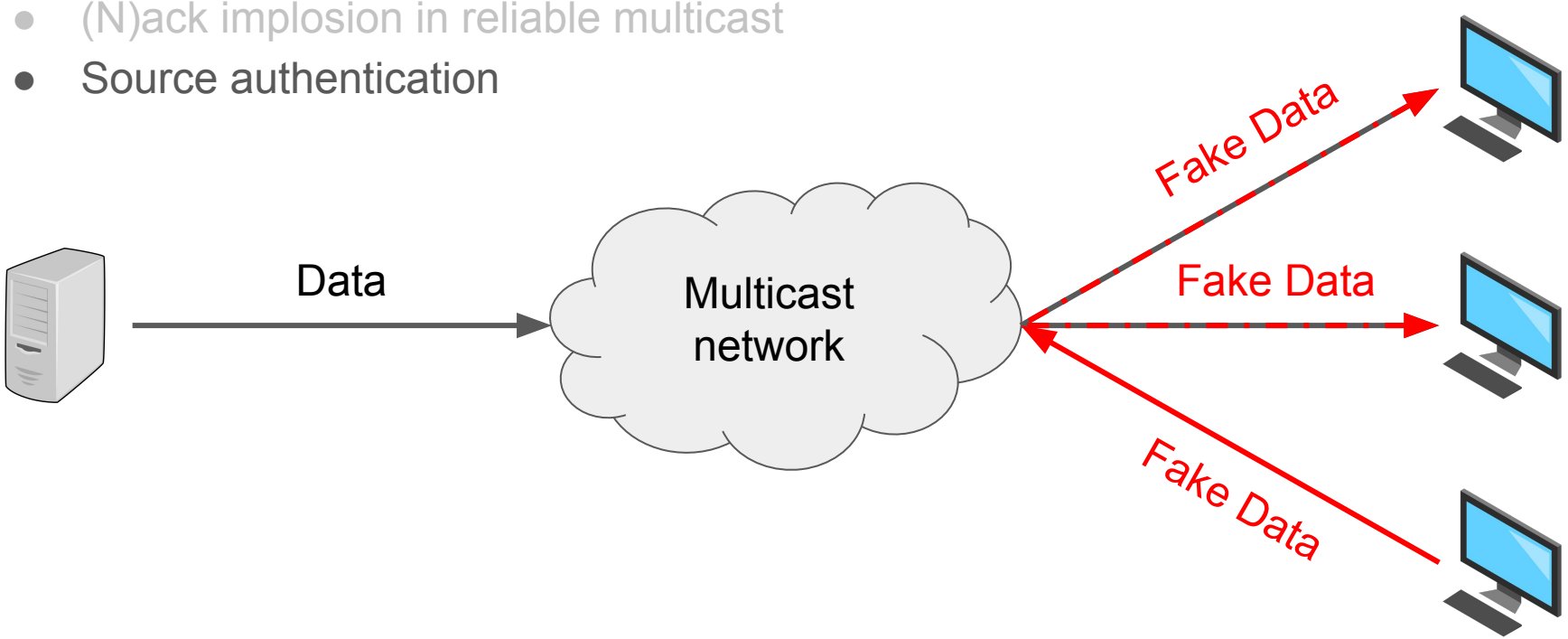

Multicast is complex, but worth the effort!

- Trade-off: Simplicity vs efficiency
- Previously: focus on simplicity
- Now: efficiency

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Resource utilization **IS** (or at least, can be) an issue today!

Netflix, YouTube cut video quality in Europe after pressure from EU official

Netflix reduces bit rates while YouTube makes standard definition the default.

JON BRODKIN - 3/20/2020, 4:41 PM

Do not hesitate to reach out: louis.navarre@uclouvain.be

Other issues not covered here

Summarized in this paper (16th November, 2022)

If Multicast is the Answer - What was the Question?

Dirk Trossen
Huawei Research
Munich, Germany
dirk.trossen@huawei.com

Jon Crowcroft
University of Cambridge
Cambridge, UK
Jon.Crowcroft@cl.cam.ac.uk