

ouees-202306 topic 02:

Packet switching

Routing basics

Kenji Rikitake

20-JUN-2023

School of Engineering Science, Osaka University

On the internet

@jj1bdx

Copyright ©2018-2023 Kenji Rikitake.

This work is licensed under a [Creative Commons Attribution 4.0 International License](#).

CAUTION

Osaka University School of Engineering Science prohibits copying/redistribution of the lecture series video/audio files used in this lecture series.

大阪大学基礎工学部からの要請により、本講義で使用するビデオ/音声ファイルの複製や再配布は禁止されています。

Lecture notes and reporting

- <https://github.com/jj1bdx/oueees-202306-public/>
- Check out the README.md file and the issues!
- Keyword at the end of the talk
- URL for submitting the report at the end of the talk

Packet Switching

Packet switching

What if you can split a stream into the *packets* and let them be delivered through *different links* for each packet?

How to form a packet (1/2)

- Split a stream into multiple pieces of data

ABCDEFHIJ -> ABC DEF HIJ

- Put a header on each piece

ABC DEF HIJ -> P1-ABC P2-DEF P3-HIJ

How to form a packet (2/2)

- Add source and destination addresses to each packet

P1-ABC P2-DEF P3-HIJ

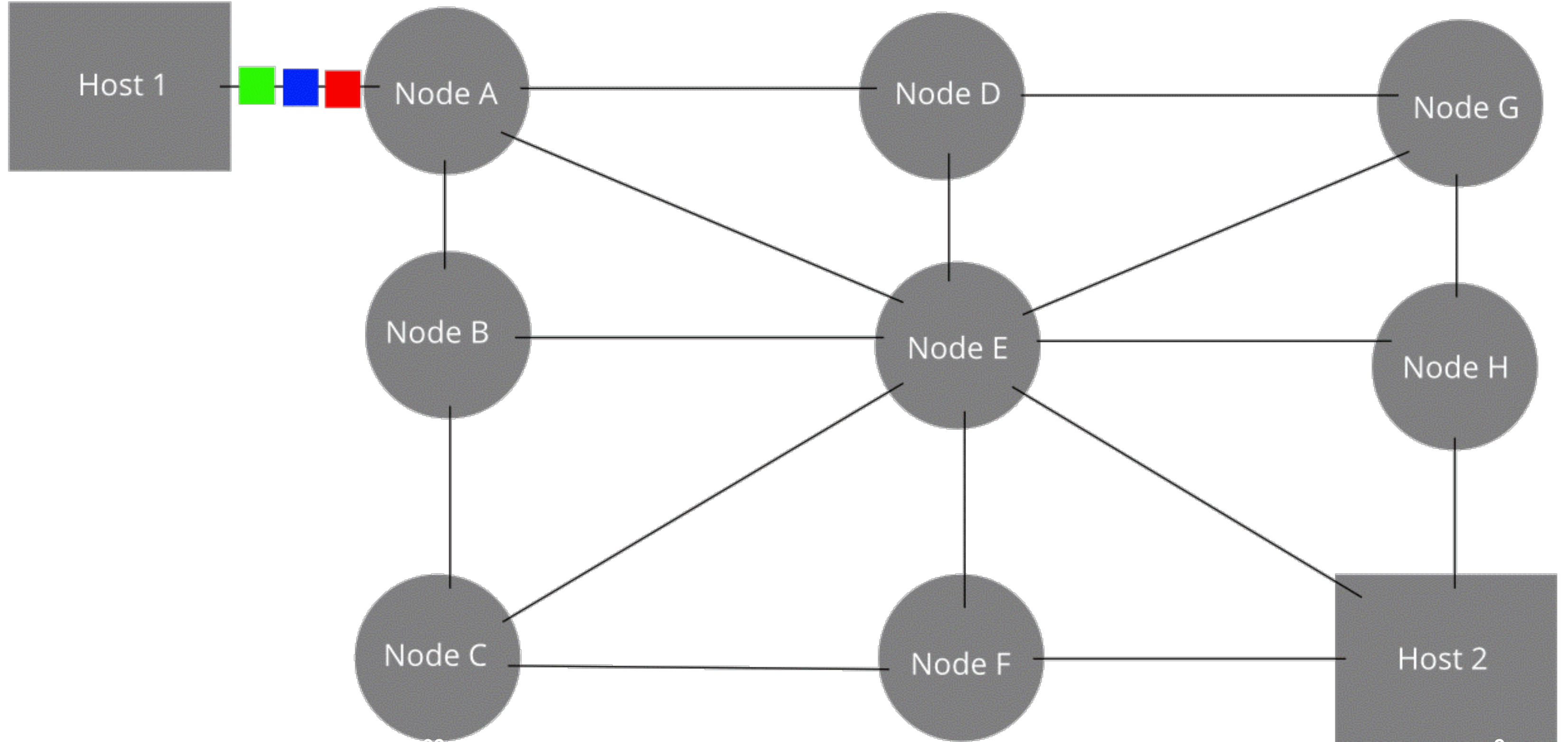
-> FromXtoY-P1-ABC

FromXtoY-P2-DEF

FromXtoY-P3-HIJ

- Then send them on the network!

The original message is **Green**, **Blue**, **Red**.

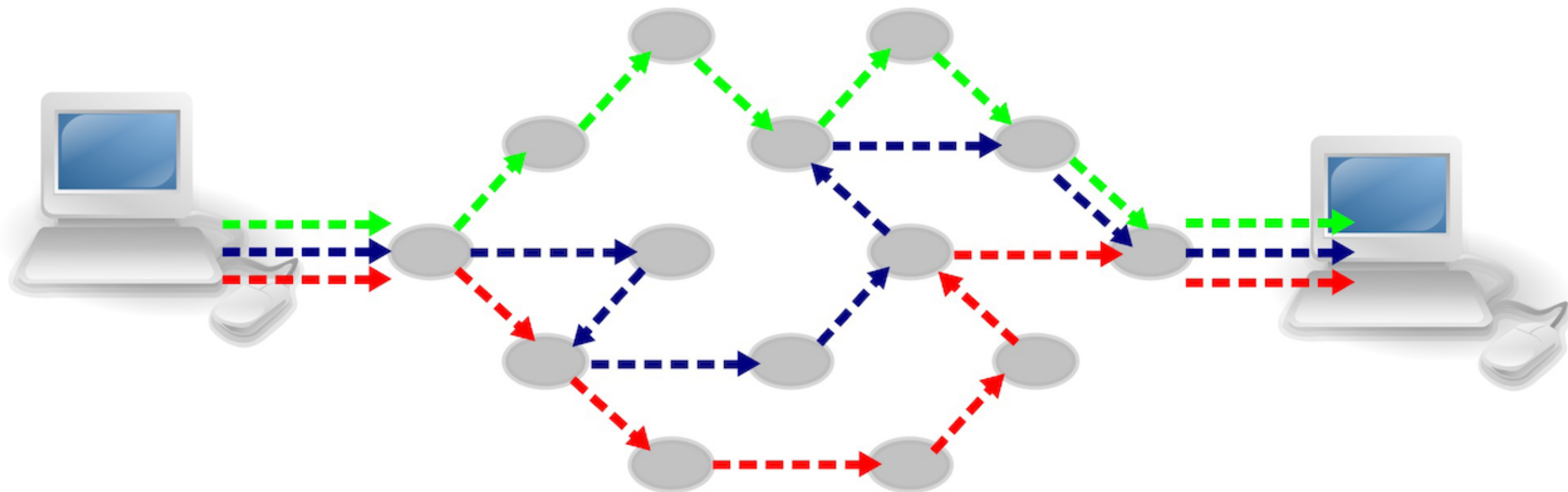


Packet switching and the nodes

- Each communication node must know how to assemble/disassemble information to/from the packets
- Each communication node must know which link should be used to send a packet for the given destination
- Packets can be lost; relaying nodes cannot detect a lost packet

Packet (dis)assembly issues

- The sequence of delivered packets may differ from that of the sender intents; holding the out-of-sequence packets are required
- Retransmission is required to recover a lost packet for a reliable communication

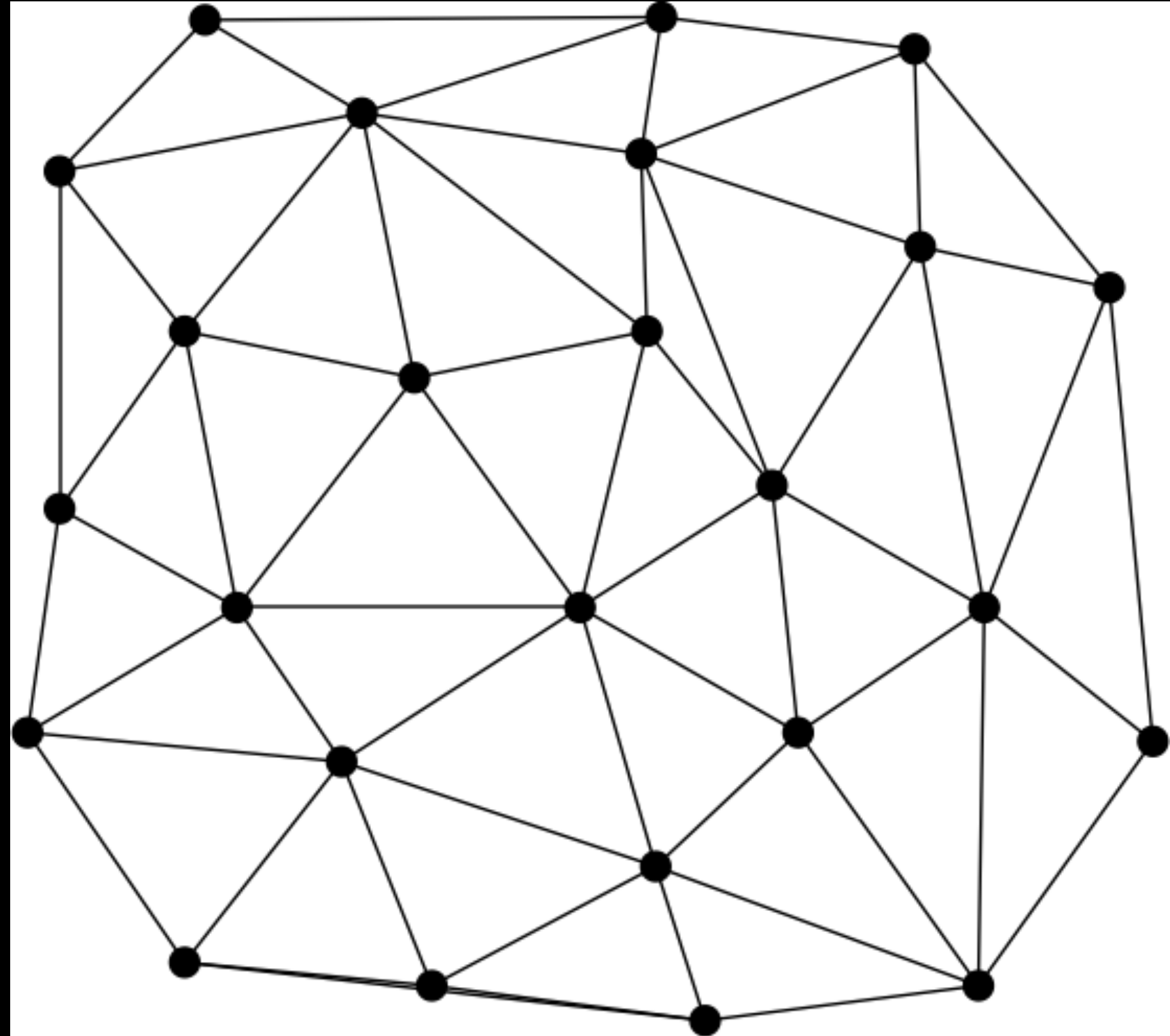


Packet switching enables

- Changing the packet relay routes *during* the communication
- Using multiple routes for a single communication link
- Aggregating multiple communication links into a physical link
- Connectionless *and* connection-oriented communication simultaneously

Truly distributed networks are feasible by packet switching

- No centralized nodes
- Each link can be utilized by all nodes
- A disconnection of the link will not be fatal so long as one link is connected to a node



Disadvantages of packet switching

- Each node must be able to form/generate and decode/interpret a packet
- Forming and decoding a packet takes time and the computing resources
- Reliability and latency can be a trade-off
- Relay nodes can be neutralized by denial-of-service attacks
- Difficult to manage

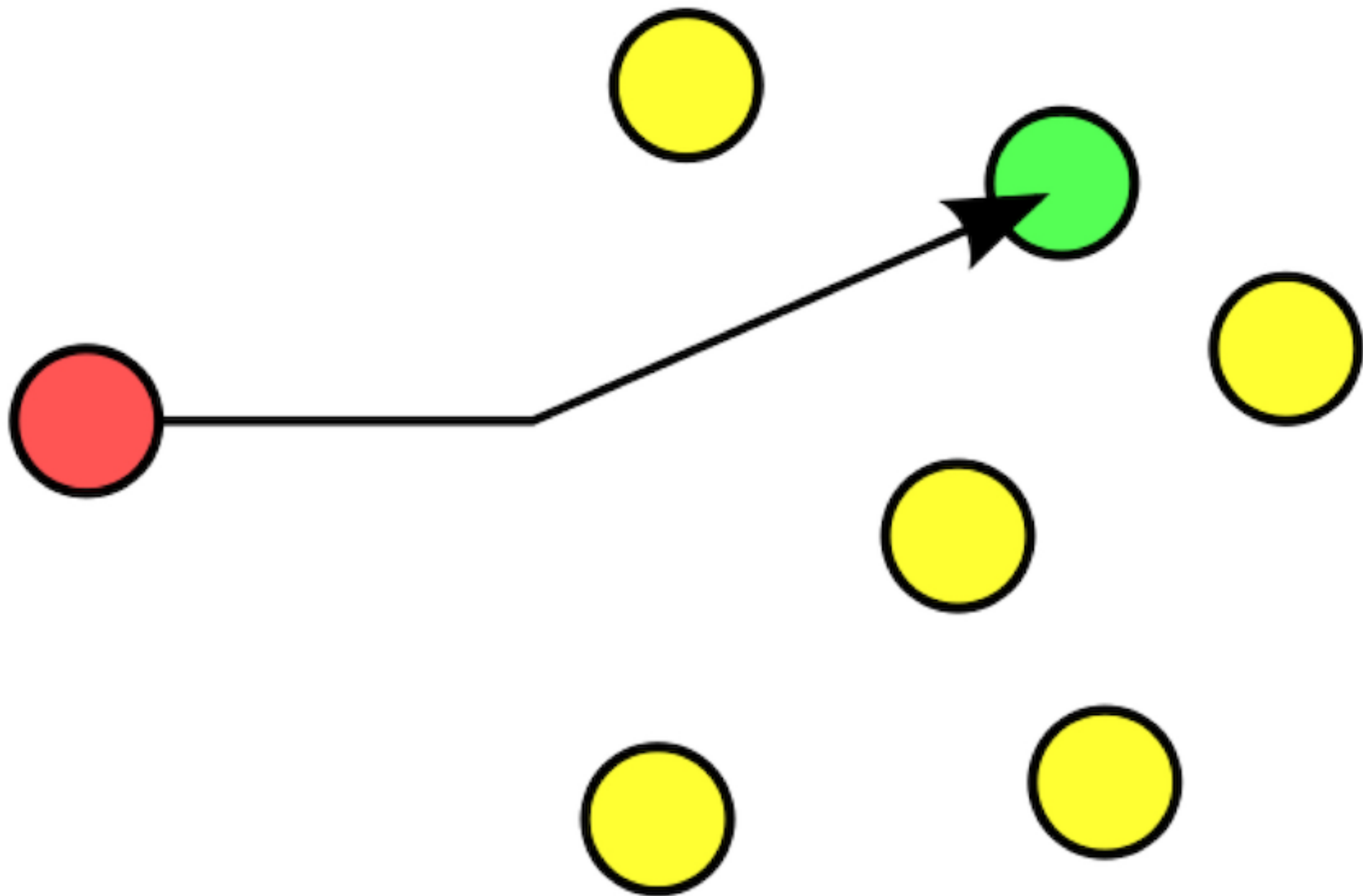
Routing basics

Various aspects of routing

- Delivery
- Addresses
- Static or dynamic
- Route aggregation
- Security

Delivery schemes

- Unicast
- Broadcast/Multicast/Anycast



Unicast

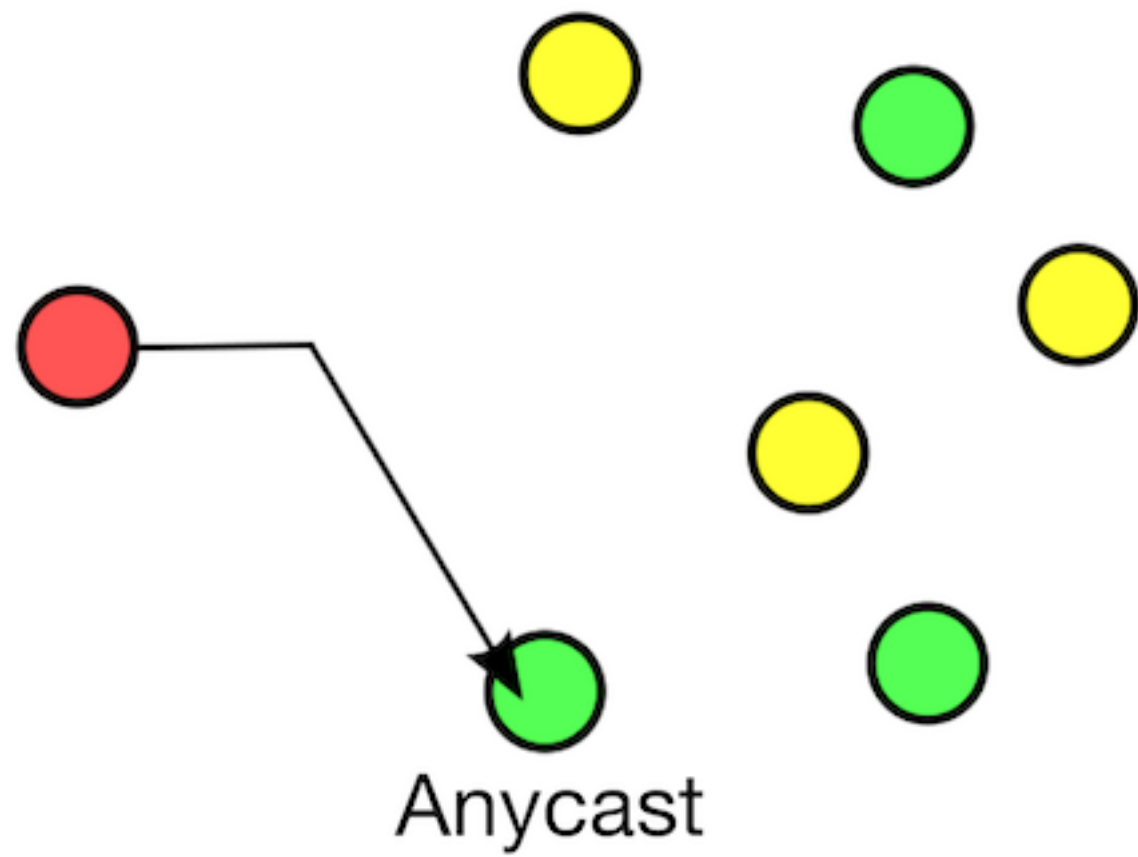
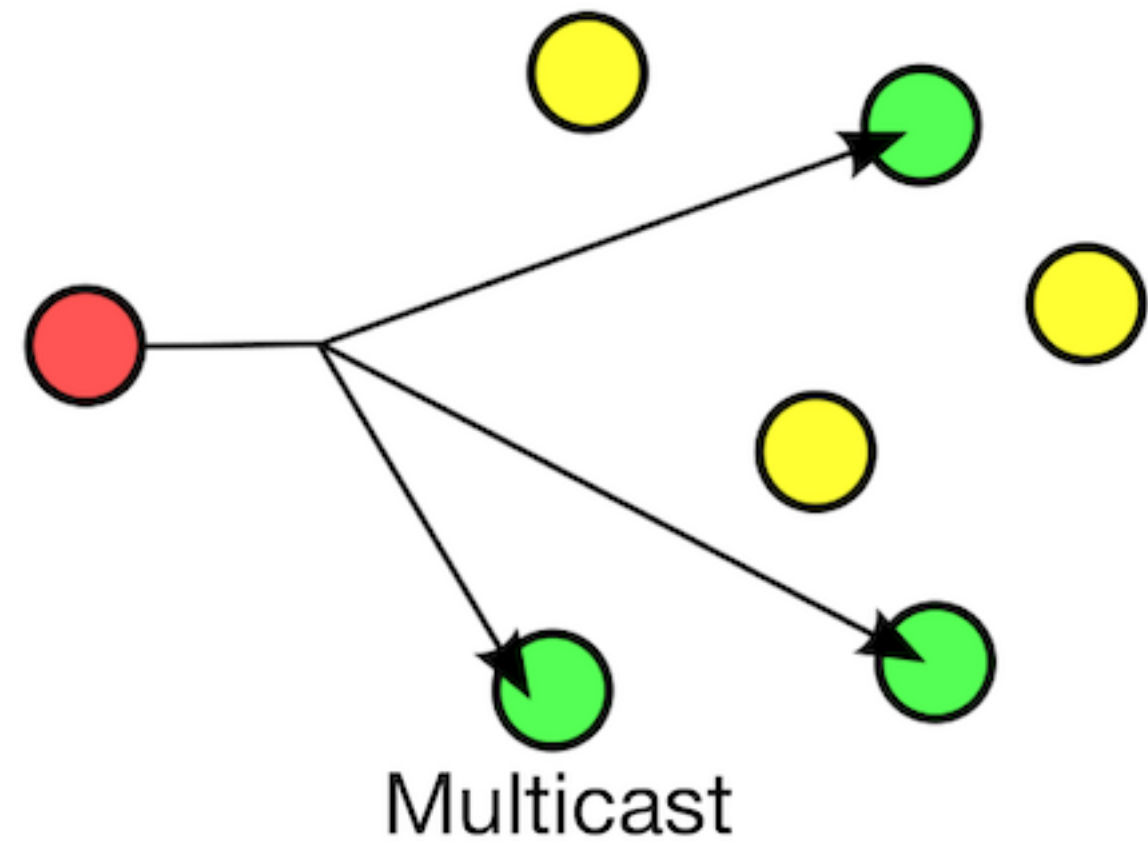
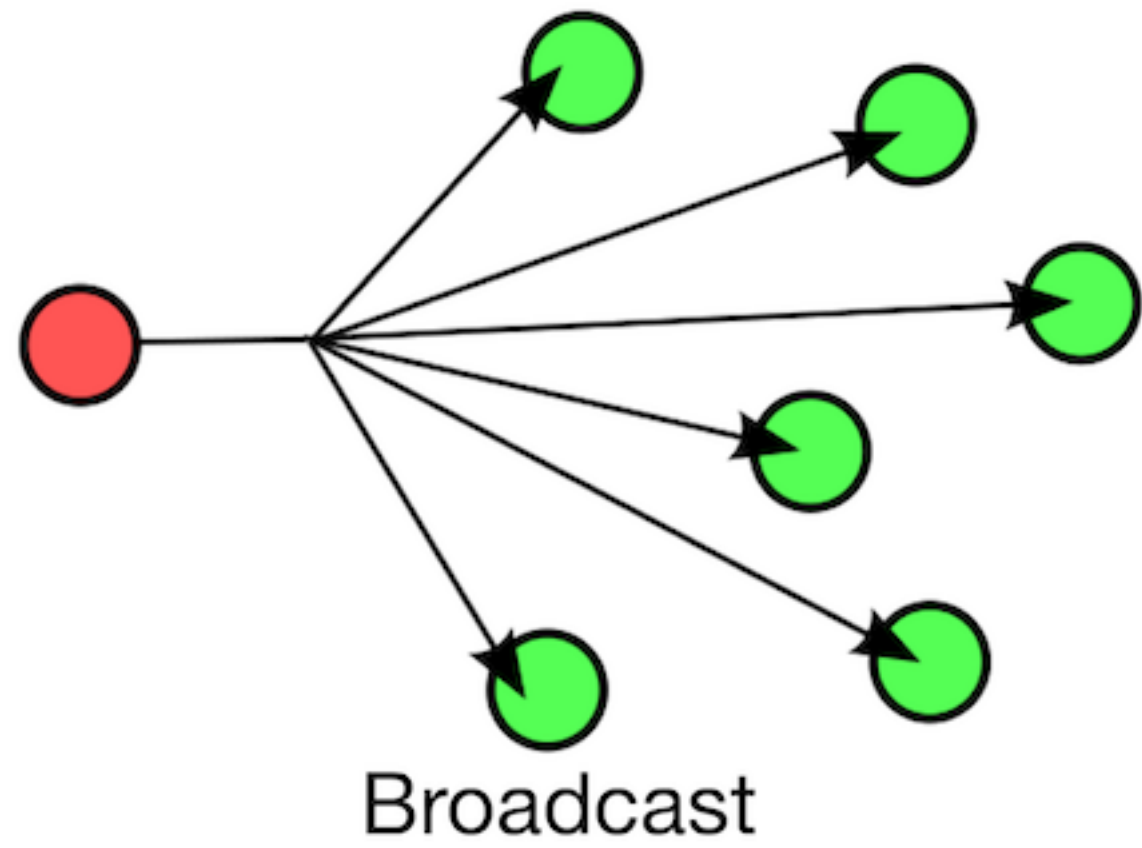


Photo and image credits

- All photos and images are modified and edited by Kenji Rikitake
- Photos are from Unsplash.com unless otherwise noted
- Packet Switching animated GIF: [By Oddbodz from Wikimedia Commons](#), CC BY-SA 3.0
- Internet packet switching: [By Computer-blue.svg: OpenClipartderivative work: Pluke \(Computer-blue.svg\)](#), via Wikimedia Commons, CC0 (Public Domain)
- Unicast/broadcast/multicast/anycast diagrams: [By Easyas12c~commonswiki / Perhelion](#), via Wikimedia Commons, CC0 (Public Domain)