Telekomunikasi Dasar

Pert. 10 : Konsep Multiple Access
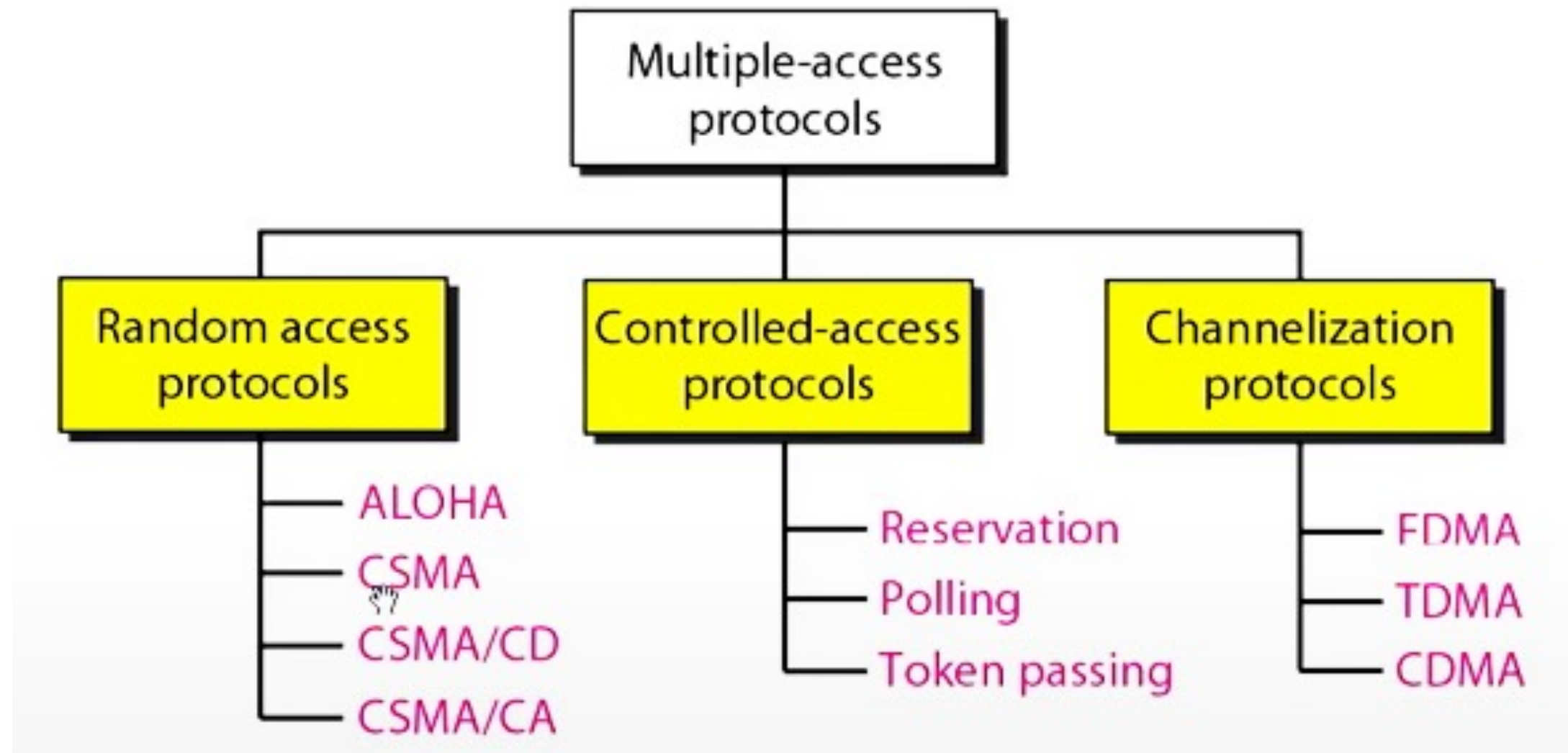
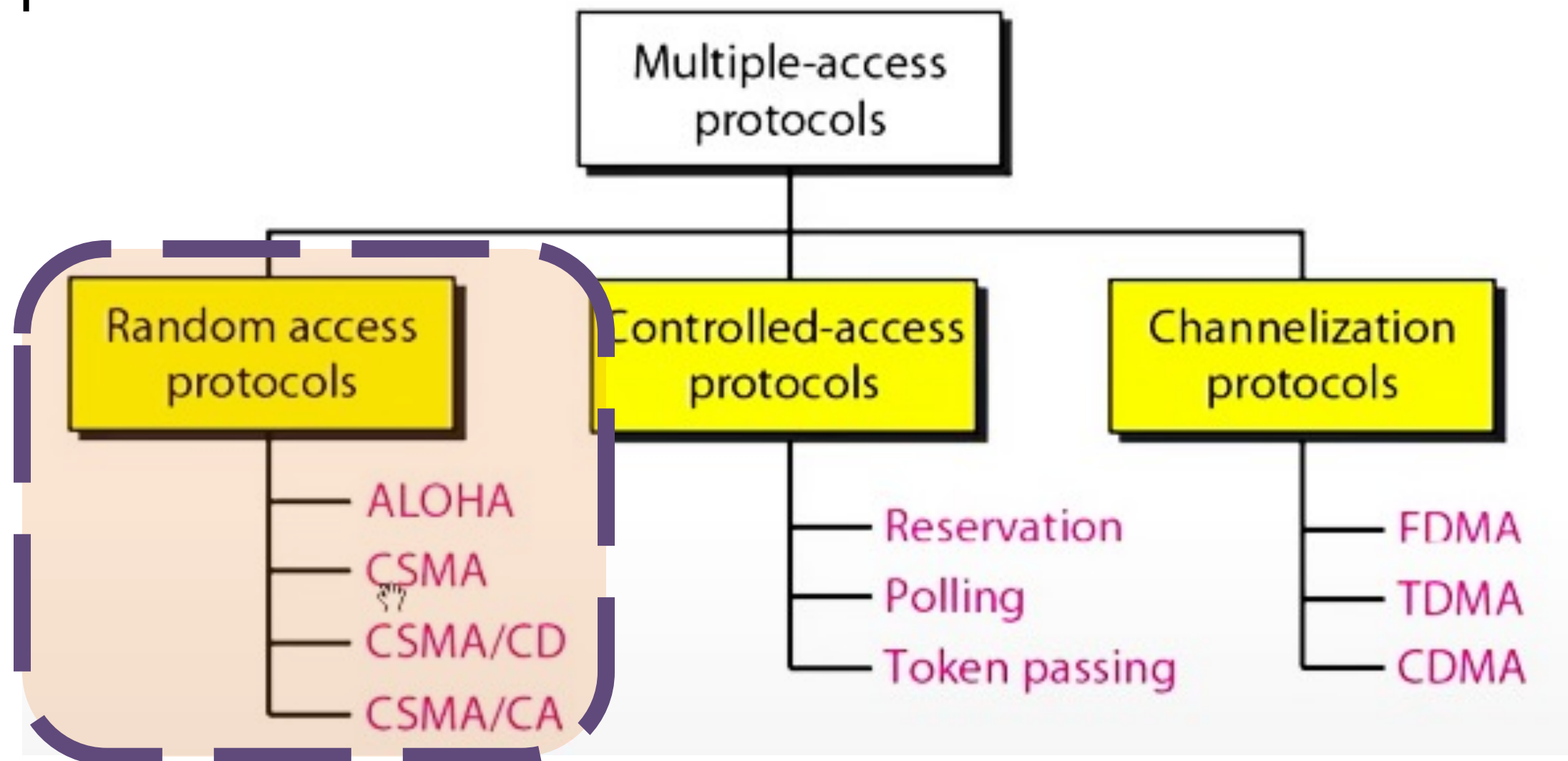Aqil Aqthobirrobbany, S.T., M. Eng.

Definisi

Multiple access adalah ketika beberapa pengguna atau *device* akan memanfaatkan satu *channel* /saluran data secara bersamaan secara efisien dan tanpa interferensi

Random Access

- Pada **Metode Random Access**, tidak ada *device* yang lebih superior dari pada *device* yang lain. Sehingga pada metode ini, semua *device* dianggap setara.

- Seperti halnya contoh **kasus WIFI**, semua *device* bisa mengakses dengan satu chanel frekuensi pada modem wifi (*access point*) tanpa ada salah satu *device* yang lebih prioritas
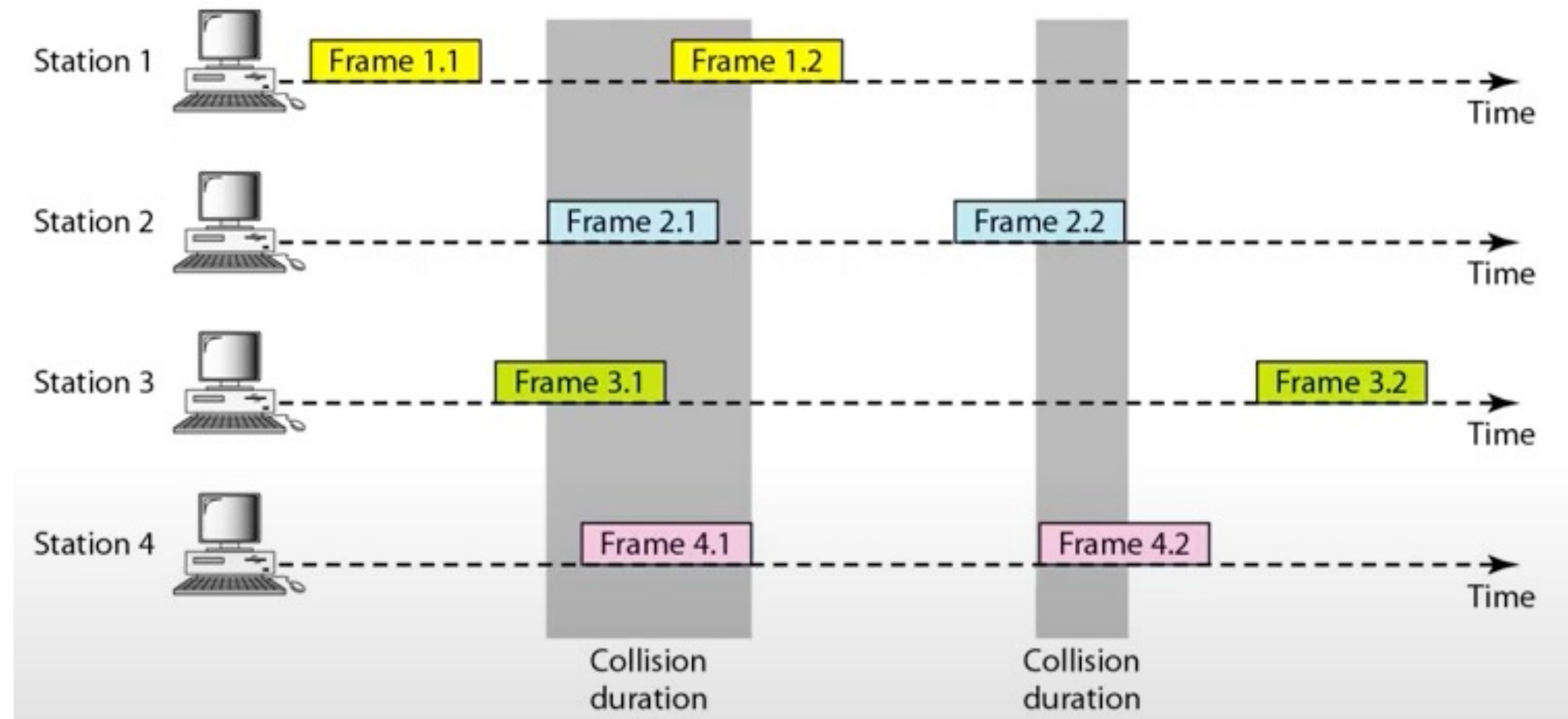
Random Access (ALOHA)

Sistem Kerja:

- Setiap perangkat bisa kapan saja mengirimkan data, tidak perlu menunggu giliran

- Kemungkinan terjadi *collision* tinggi

- Apabila terjadi *collision*, maka perangkat/*device* harus menunggu waktu acak untuk bisa mengirim data

Random Access (ALOHA)

Pure ALOHA Network :

- Tidak ada pengaturan waktu pengiriman data untuk setiap *station*. Sehingga akan memungkinkan terjadi *collision*, yaitu di mana beberapa station mengirimkan data secara bersamaan.

- *Collision* data akan mengakibatkan **data tidak valid terkirim** atau **data terkirim namun tidak diketahui** data pada *station* berapa yang berhasil terkirim.
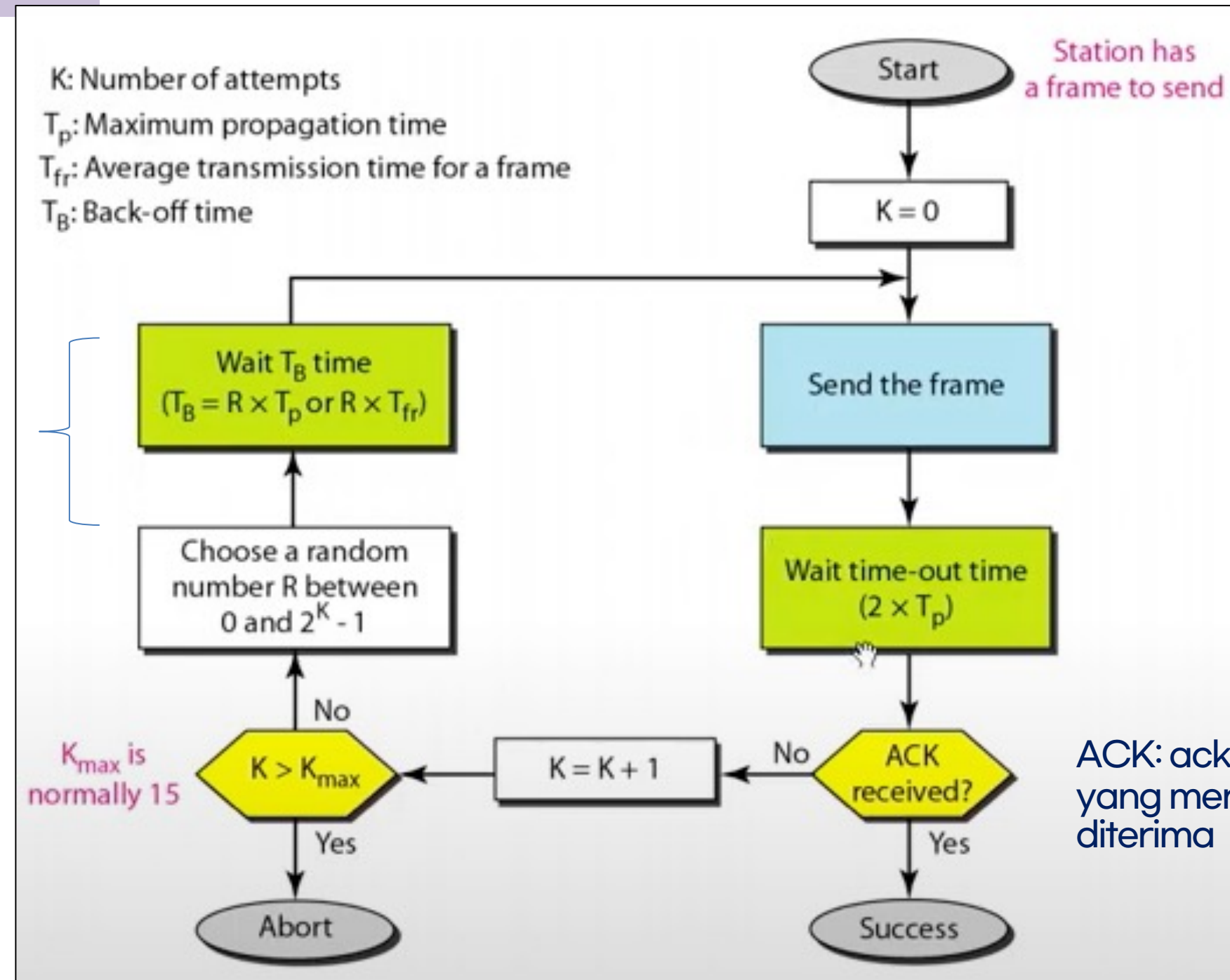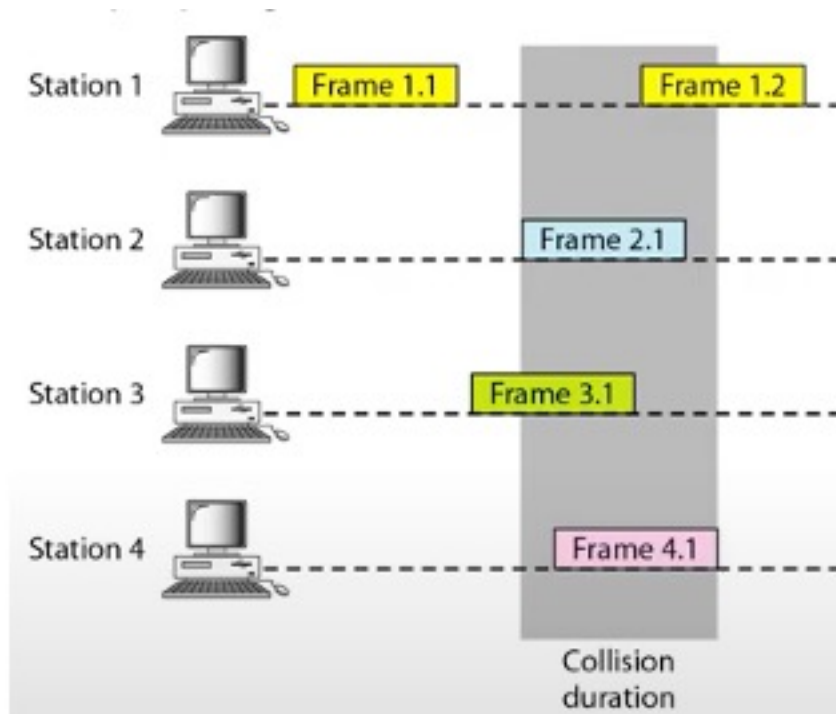

Gambar Ilustrasi Pure ALOHA Network

Random Access (ALOHA)

Pure ALOHA Network :

Why waiting for a random time?

K: Number of attempts

T_p: Maximum propagation time

T_{fr}: Average transmission time for a frame

T_B: Back-off time

Start — Station has a frame to send

K = 0

Send the frame

Wait T_B time ($T_B = R \times T_p$ or $R \times T_{fr}$)

Choose a random number R between 0 and $2^K - 1$

Wait time-out time ($2 \times T_p$)

K_{max} is normally 15

$K > K_{max}$ — No / Yes

K = K + 1

ACK received? — No / Yes

ACK: acknowledgment, sinyal/kode yang menandakan bahwa data telah diterima

Abort

Success

Station 1 — Frame 1.1 — Frame 1.2

Station 2 — Frame 2.1

Station 3 — Frame 3.1

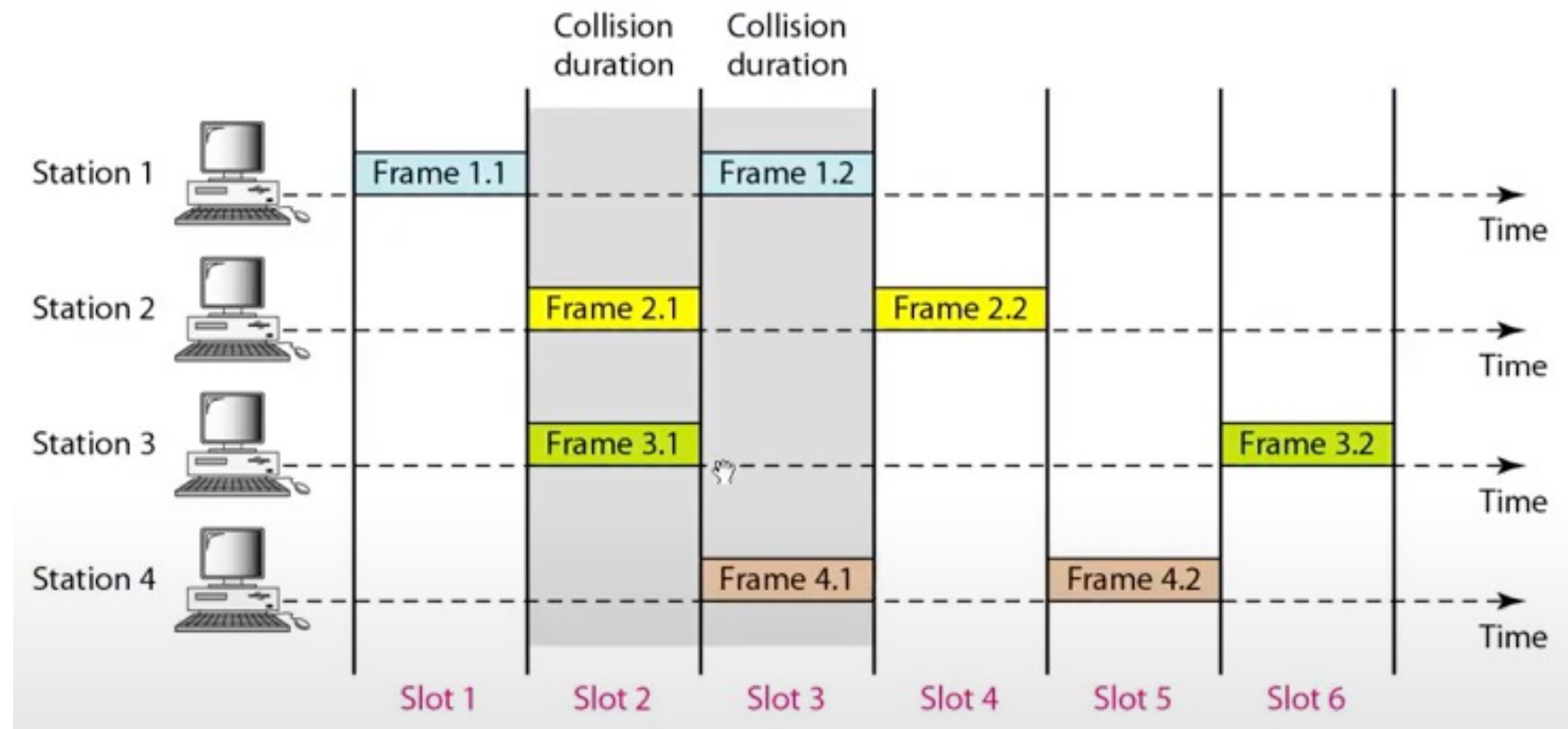Station 4 — Frame 4.1

Collision duration

Flowchart Pure ALOHA Network

Random Access (ALOHA)

Slotted ALOHA Network :

- Mulai ada pembagian waktu (slot) pengiriman untuk setiap *station*
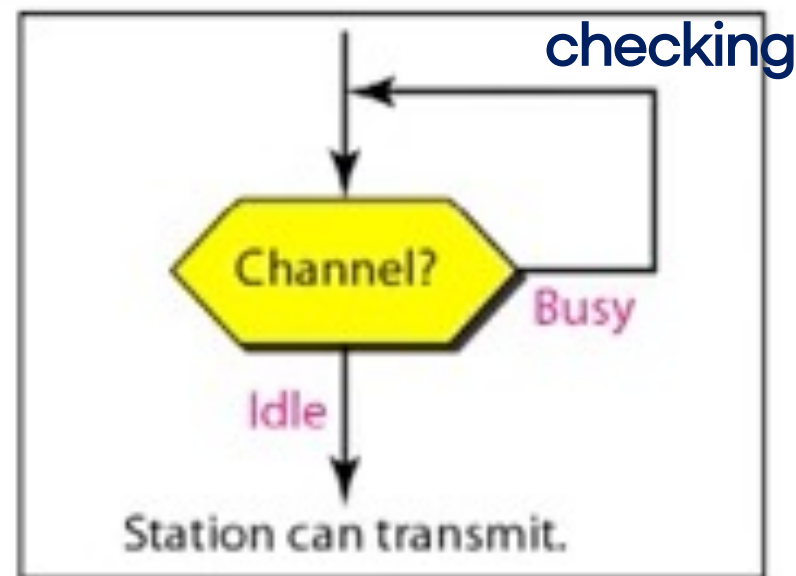- Setiap *station* hanya boleh mengirimkan data saat di awal slot

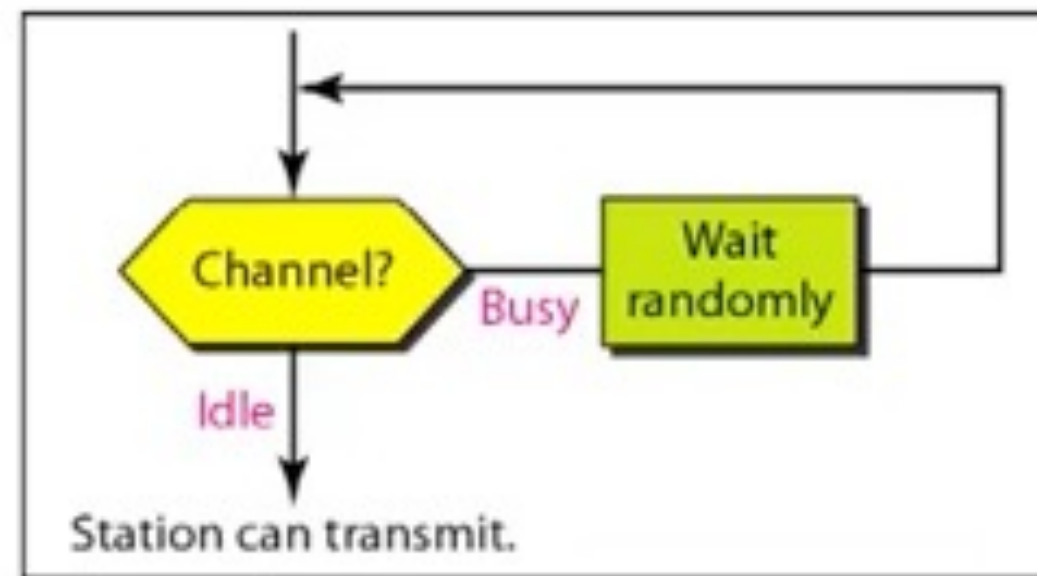Gambar Ilustrasi Slotted ALOHA Network

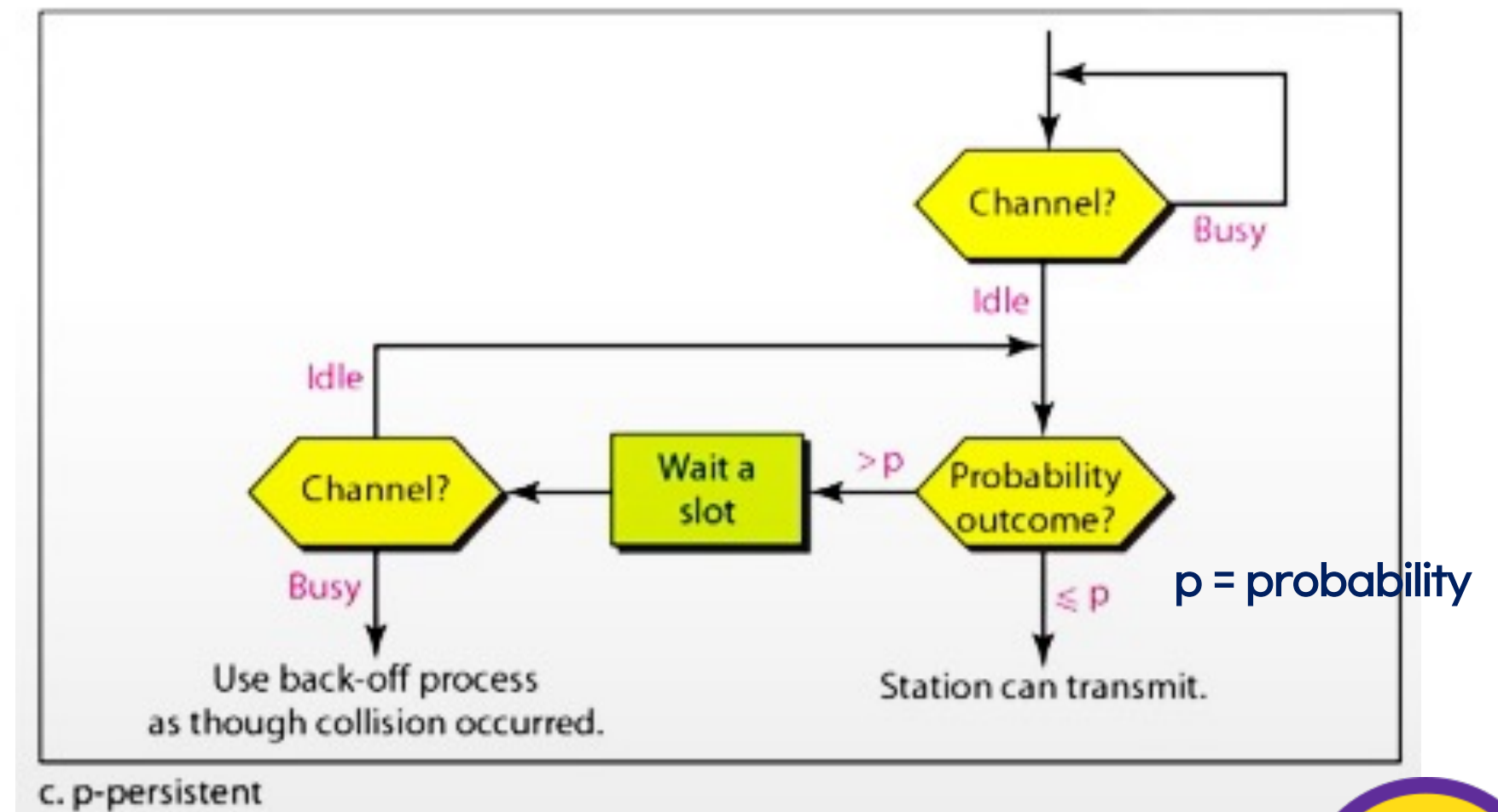# Random Access (CSMA)

Sistem Kerja:

- Carrier Sense Multiple Access (CSMA)

- Sebelum mengirim data, tipe ini akan "*sensing*" apakah saluran tersebut sibuk atau tidak

- Terdapat 3 cara "*sensing*", yaitu *1-persistent, non-persistent,* dan *p-persistent*
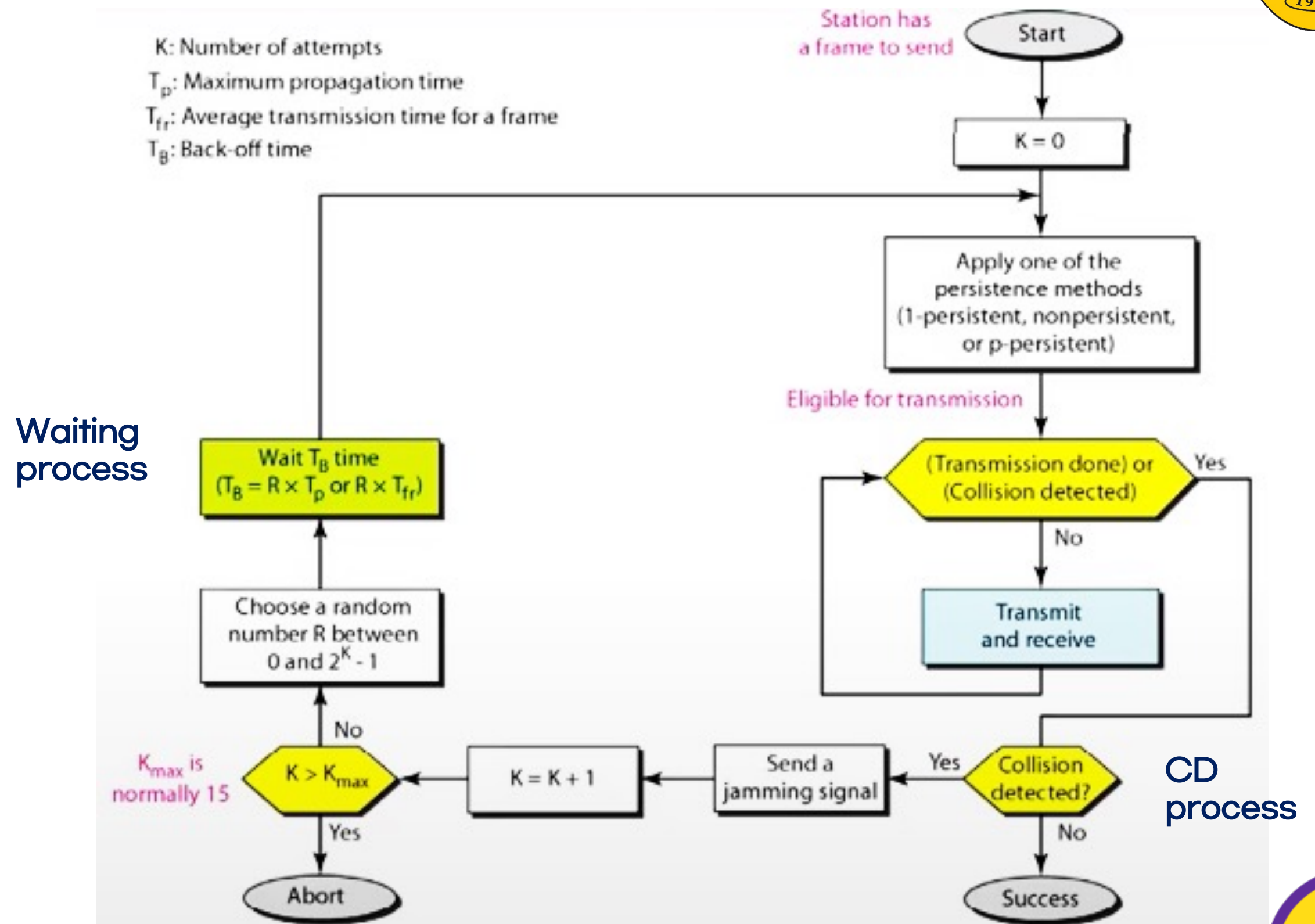

a. 1-persistent

b. Nonpersistent

c. p-persistent

Random Access (CSMA/CD)

Sistem Kerja:

- CSMA Collision Detection
- Ada tambahan proses pengecekan terjadinya tabrakan data (collision detection)

K: Number of attempts
T_p: Maximum propagation time
T_{fr}: Average transmission time for a frame
T_B: Back-off time

Station has a frame to send → Start

K = 0

Apply one of the persistence methods (1-persistent, nonpersistent, or p-persistent)

Eligible for transmission

(Transmission done) or (Collision detected) — Yes / No

Transmit and receive

Collision detected? — Yes / No

Success

Send a jamming signal

K = K + 1

$K > K_{max}$ — No / Yes

K_{max} is normally 15

Choose a random number R between 0 and $2^K - 1$

Wait T_B time ($T_B = R \times T_p$ or $R \times T_{fr}$)

Waiting process

CD process

Abort

Teknik Elektro
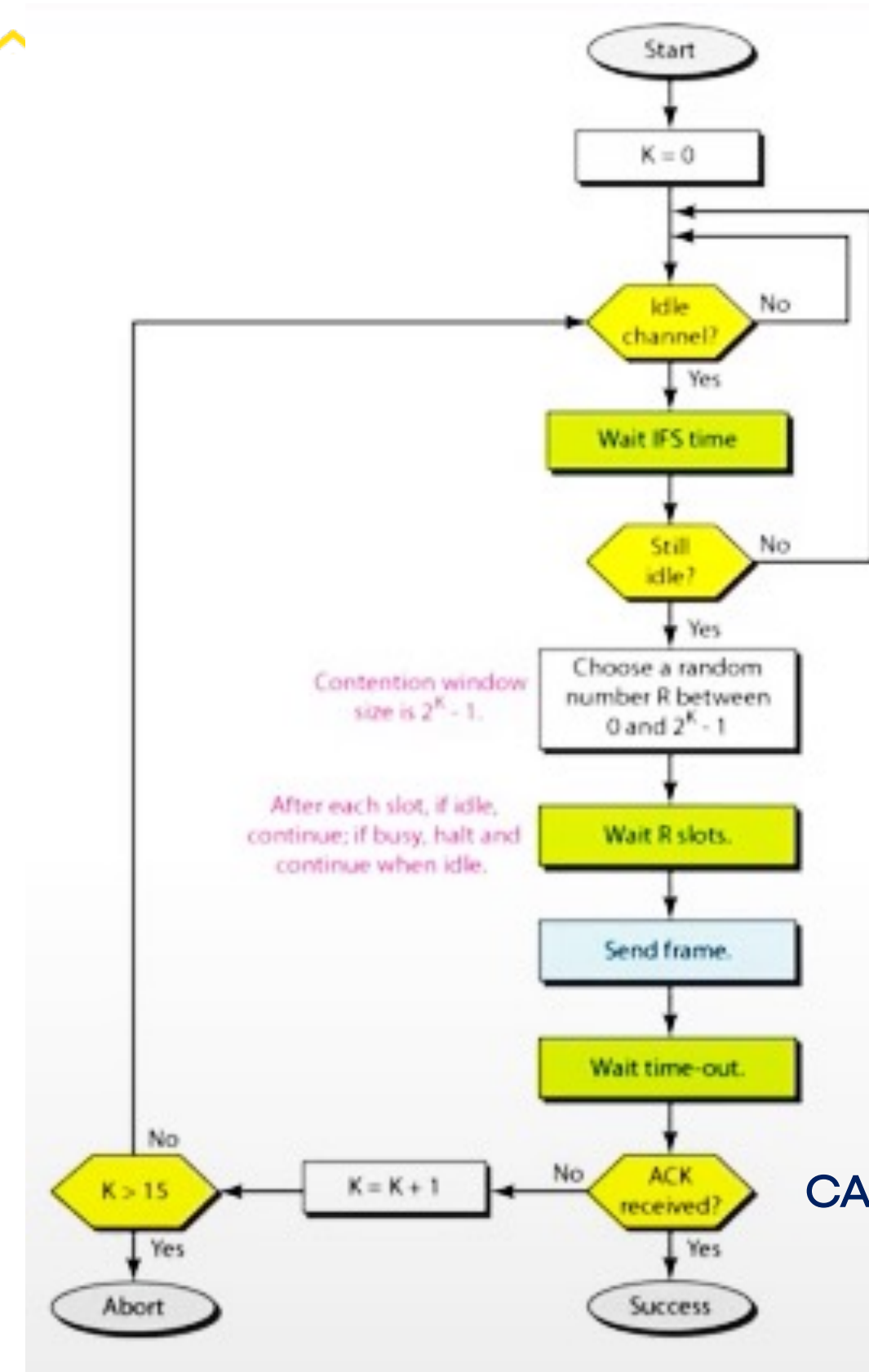**Fakultas Teknologi Industri**

Random Access (CSMA/CA)

Sistem Kerja:

- CSMA Collision Avoidance

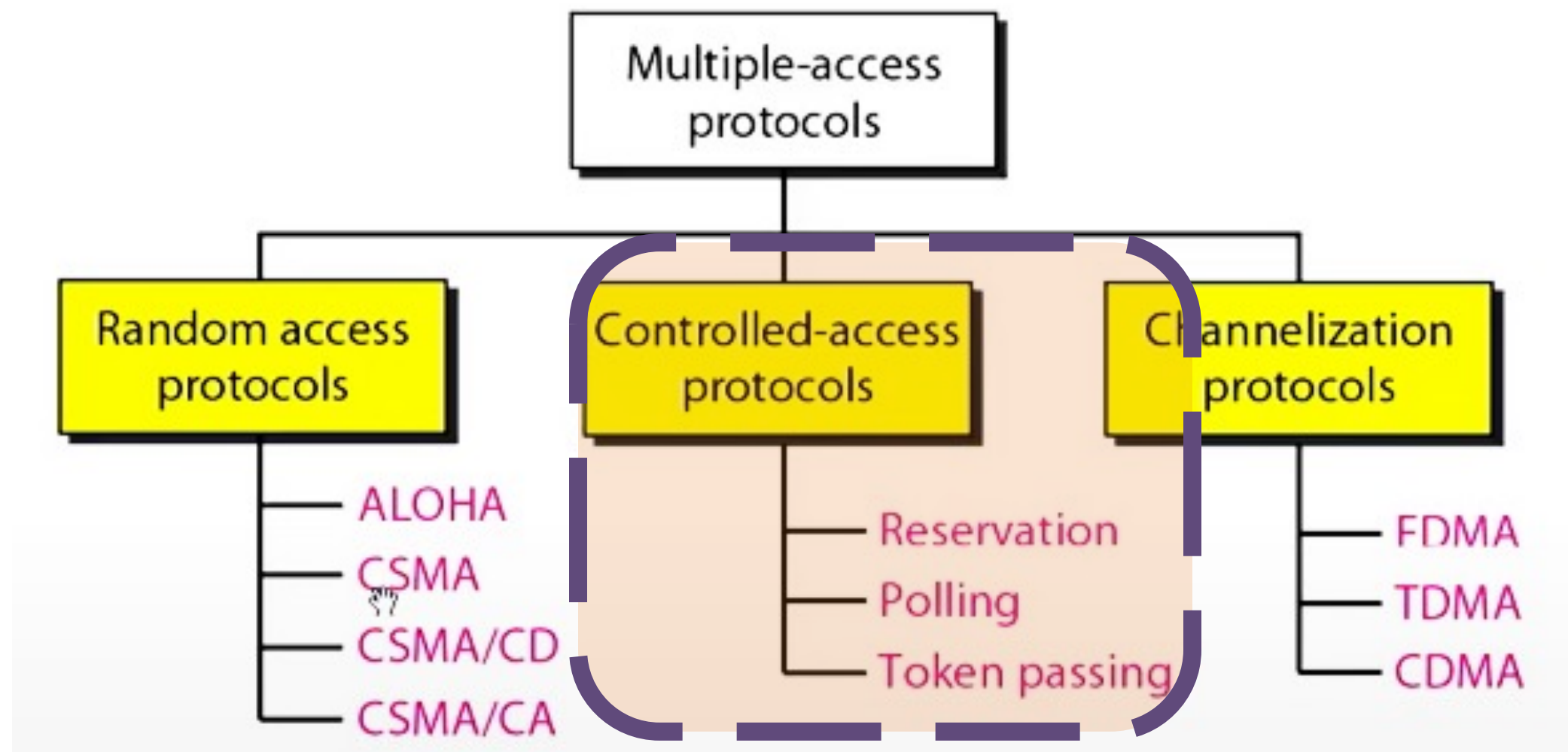- Ada tambahan proses pengecekan agar menghindari tabrakan (*collision avoidance*)

CA process

Controlled Access

- Pada **Controlled Access**, terjadi proses pemeriksaan kepada setiap pengguna saluran komunikasi sehingga dapat dipastikan hanya akan ada satu pengguna saja yang dapat mengirimkan data.

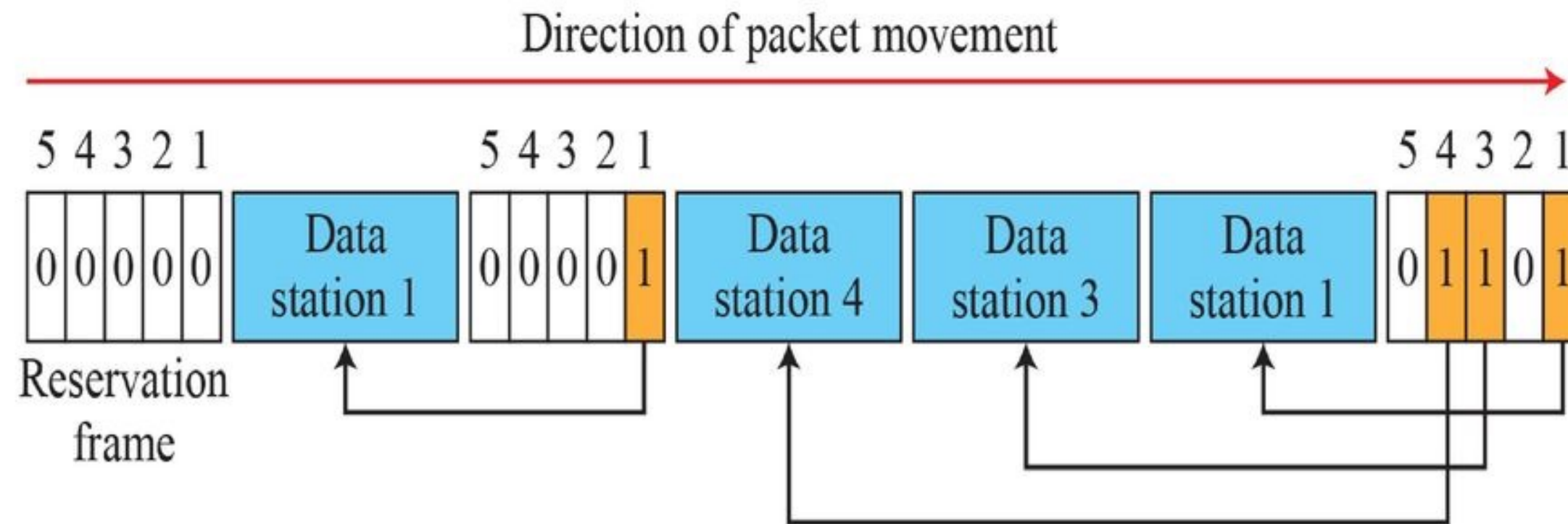- Teknik ini berfungsi agar menghindari terjadinya *collision* dan mengefisiensikan saluran komunikasi bersama

Controlled Access

Reservation

- In the reservation method, a station needs to make a reservation before sending data. Time is divided into intervals. In each interval, a reservation frame precedes the data frames sent in that interval.

- If there are N stations , there are N reservation minislots. Each minislot belongs to a station.
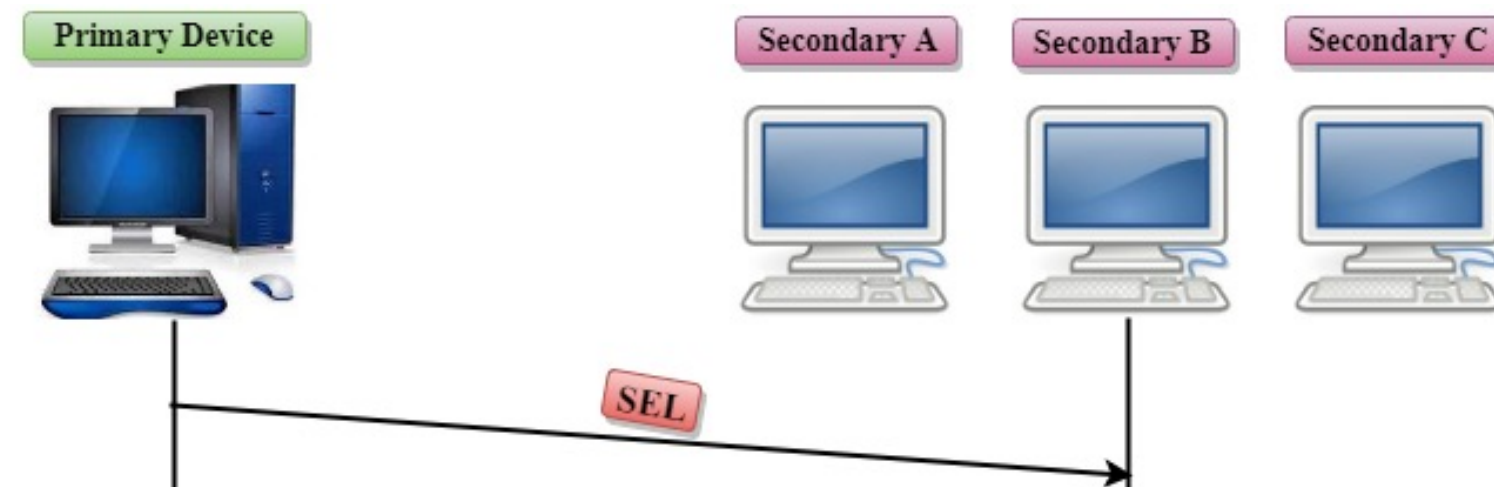

The Figure shows a situation with five stations and a five minislot reservation frame.

In the first interval, only stations 1, 3, and 4 have made reservations. In the second interval, only station 1 has made a reservation.

Controlled Access

Polling

- Polling works with topologies in which one device is designated as a **primary station** and the other devices are **secondary stations**.

- All data exchanges must be made through the primary device even when the ultimate destination is a secondary device.

- **The primary device controls the link; the secondary devices follow its instructions.** It is up to the primary device to determine which device is allowed to use the channel at a given time.
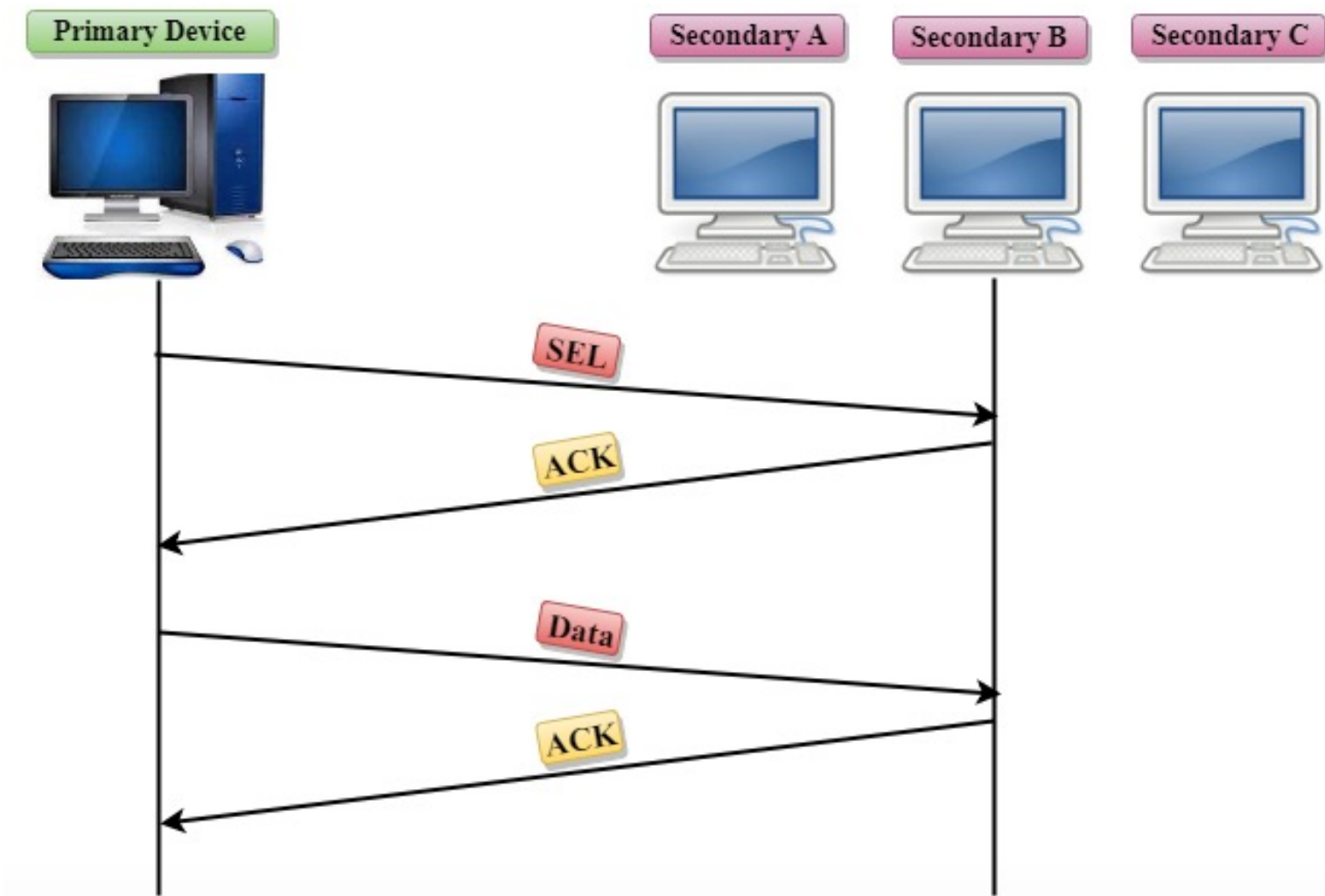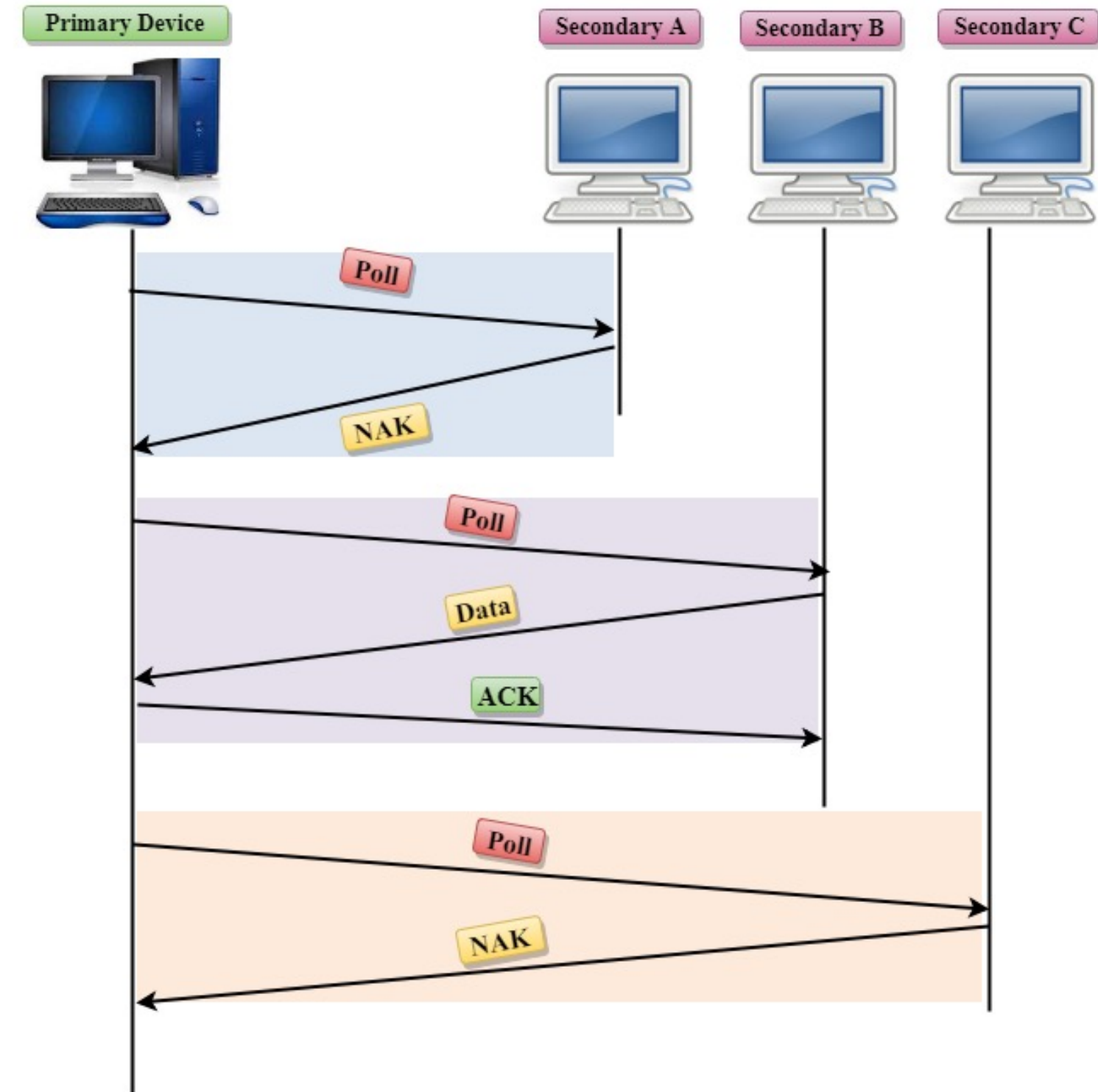
Controlled Access

Primary is ready to receive data

Primary device has something to send

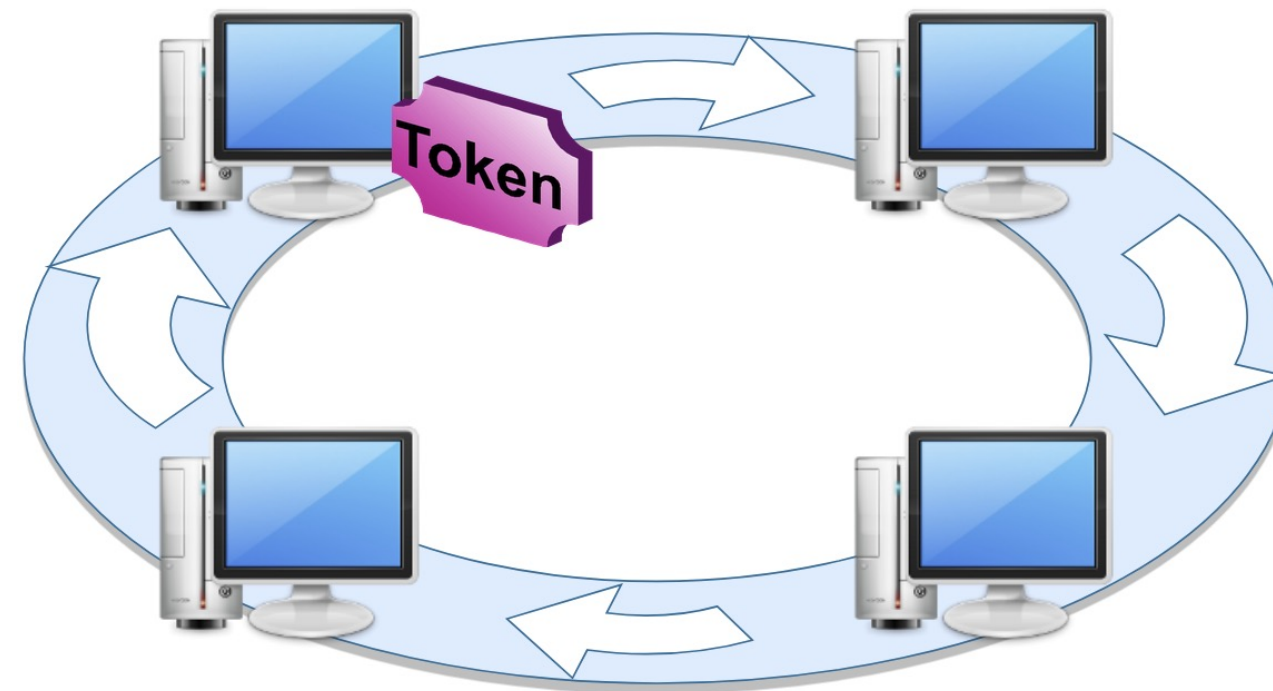# Controlled Access

In the token-passing method, the stations in a network are organized in a logical ring. In other words, for each station, there is a predecessor and a successor.

- **The predecessor** is the station which is logically before the station in the ring.

- **The successor** is the station which is after the station in the ring.

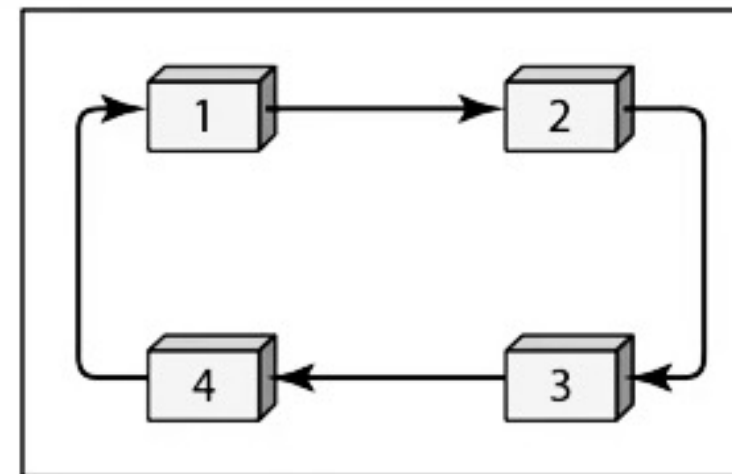- **The current station** is the one that is accessing the channel now.

The right has been passed from the predecessor to the current station, and will be passed to the successor when the current station has no more data to send.
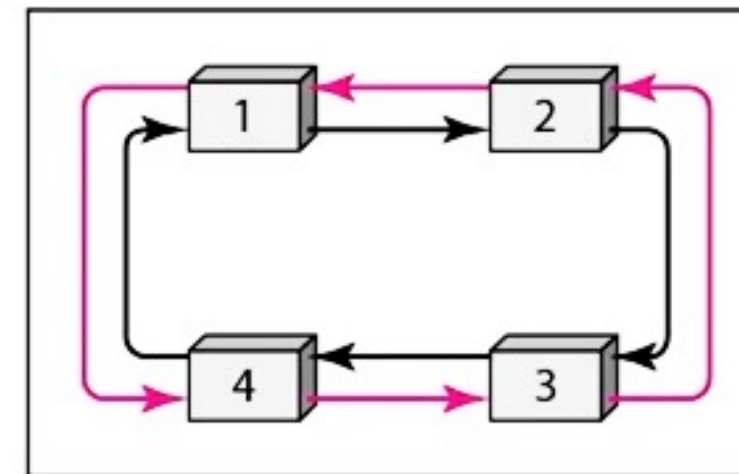
Controlled Access

A station sends the token to its successor (the next one in line). If one of the links fails, the whole system fails.

a. Physical ring
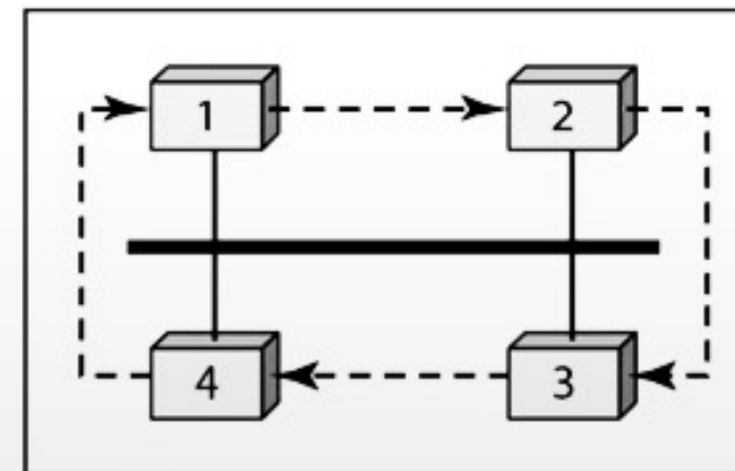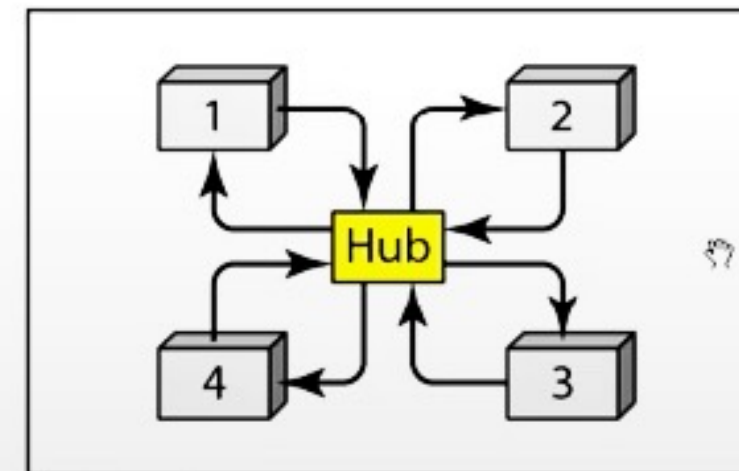
If one links in the main ring fails, the system automatically combines the two rings to form a temporary ring. Each station needs to have two transmitter ports and two receiver ports.

b. Dual ring

The stations are connected to a single cable called a bus. They, make a logical ring, because each station knows the address of its successor. When a station has finished sending its data, it releases the token that has the address of its successor.
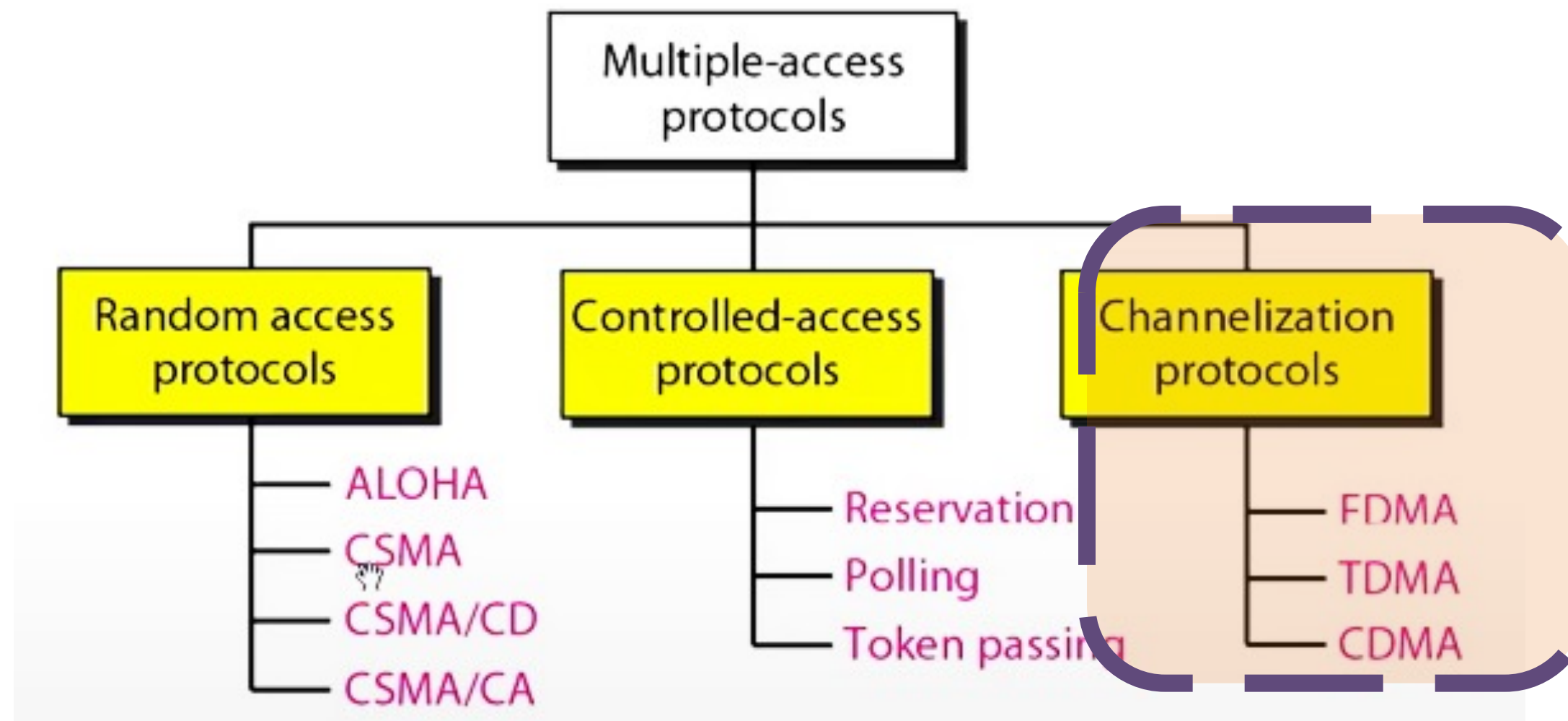

c. Bus ring

The physical topology is a star. There is a HUB that acts as the connector. The network is less prone to failure because if a link goes down, it will be bypassed by the hub.
Adding and removing stations from the ring is easier.

d. Star ring

Channelization

Channelization is a multiple-access method in which the available bandwidth of a link is shared in time, frequency, or through code, among different stations.
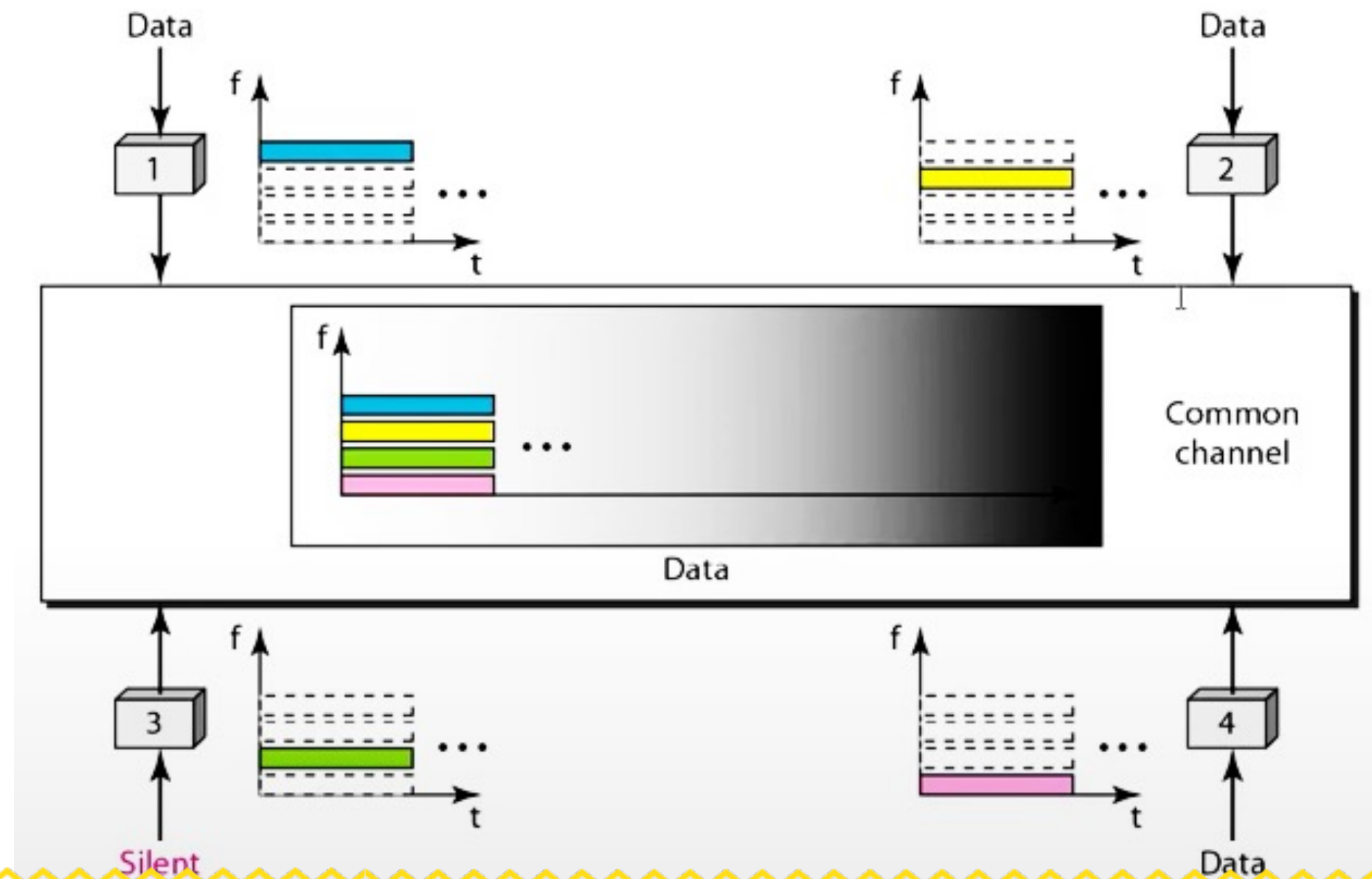
Channelization

- In Frequency-Division Multiple Access (FDMA), the available bandwidth is divided into frequency bands.

- Each band is reserved for a specific station, and it belongs to the station all the time.

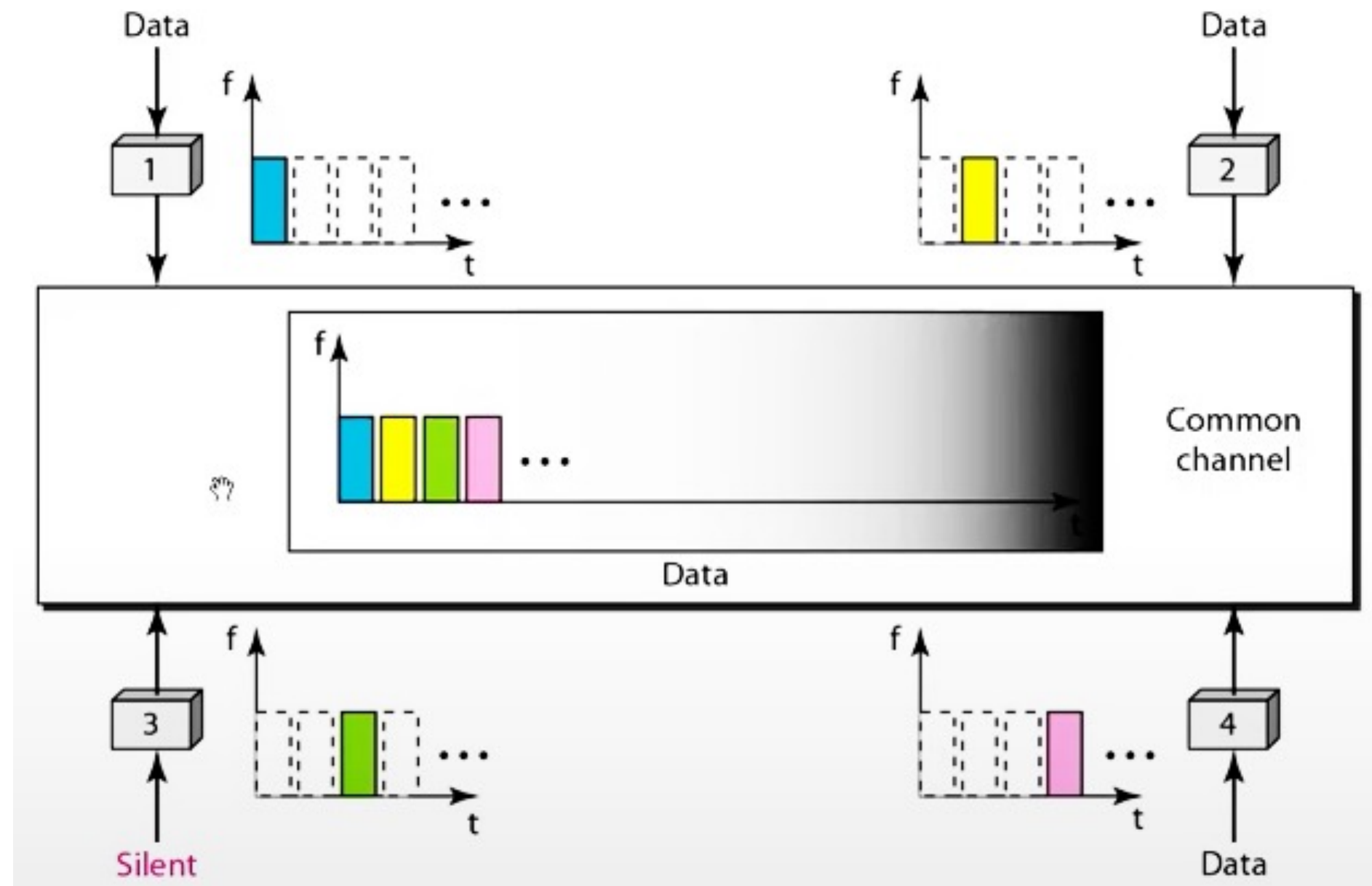- To prevent station interferences, the allocated bands are separated from one another by small guard bands.
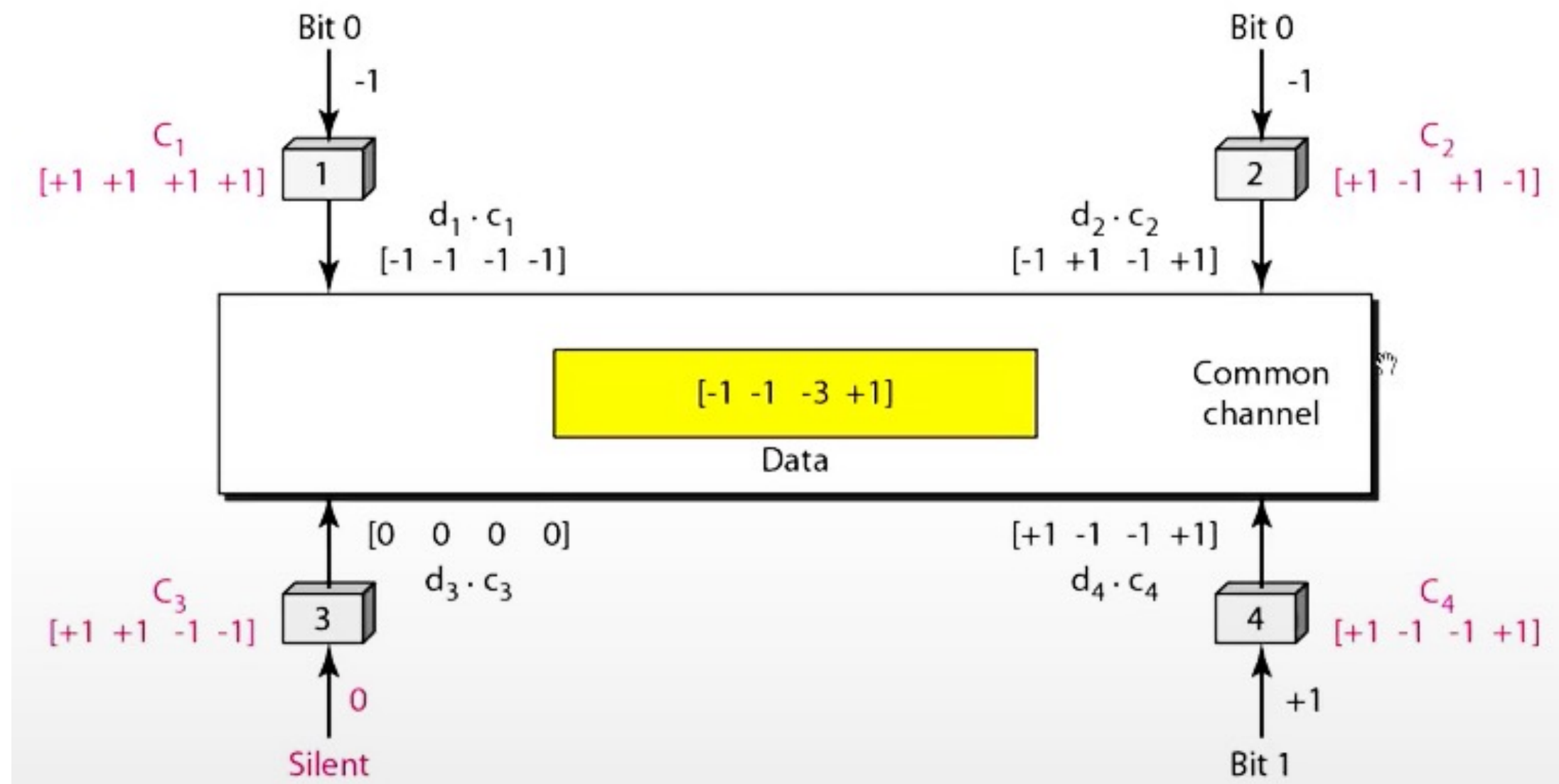
Channelization

- In Time-Division Multiple Access (TDMA), the stations share the bandwidth of the channel in time.

- Each station is allocated a time slot during which it can send data.Each station transmits its data in its assigned time slot.

Channelization

CDMA

- Each station is assigned a code.

- CDMA differs from FDMA in that only one channel occupies the entire bandwidth of the link.

- CDMA differs from TDMA in that all stations can send data simultaneously; there is no timesharing.

END