



Code-Division Multiple Access (CDMA)

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Interface Circuits Design



Wireless Networks – Challenges

01. Decreasing signal strength

02. Interference with other sources

03. Multipath propagation

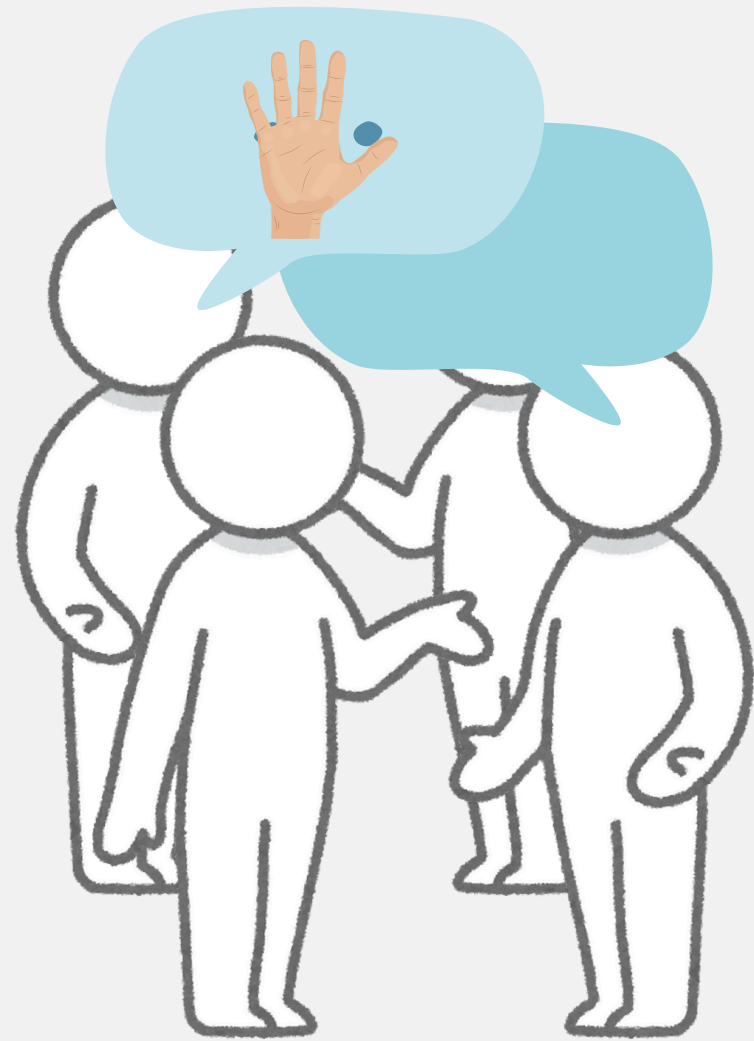


CDMA – Introduction

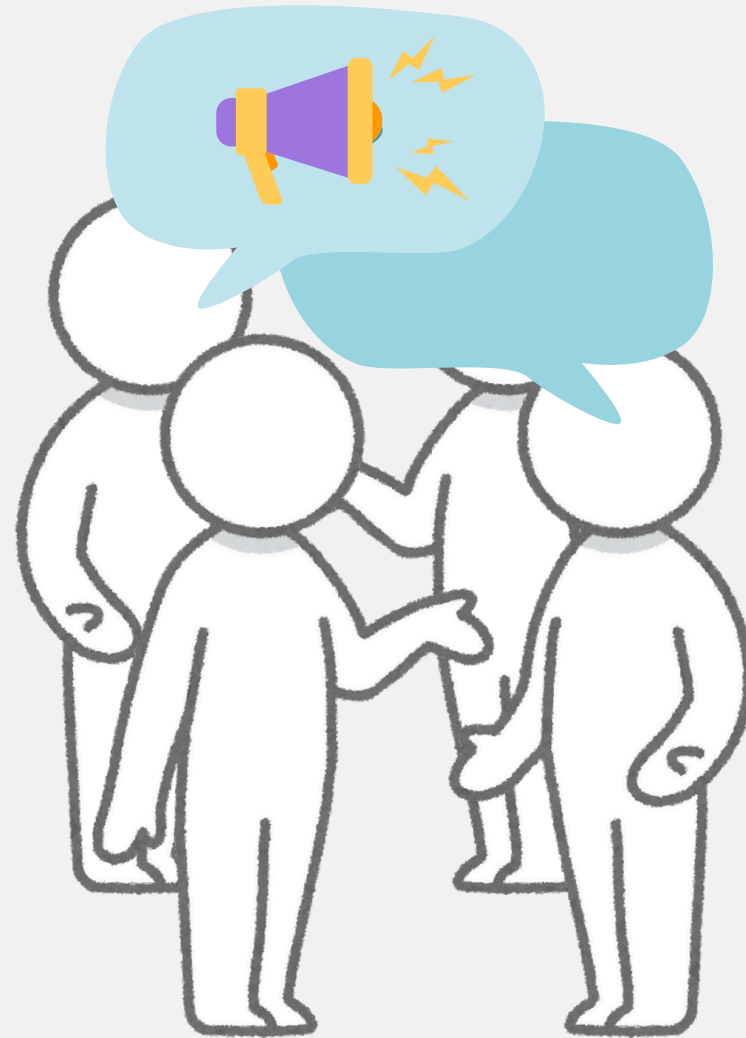


- ✦ A multiple access channel (MAC) method
- ✦ Several transmitter can send simultaneously
- ✦ Optimizing the use of available bandwidth
- ✦ Used in: GPS, Mobile phones, 3G

MAC Methods



Taking turns
Time Division



Different pitches
Frequency Division



Different languages
Code Division



CDMA – Variations

Synchronous CDMA

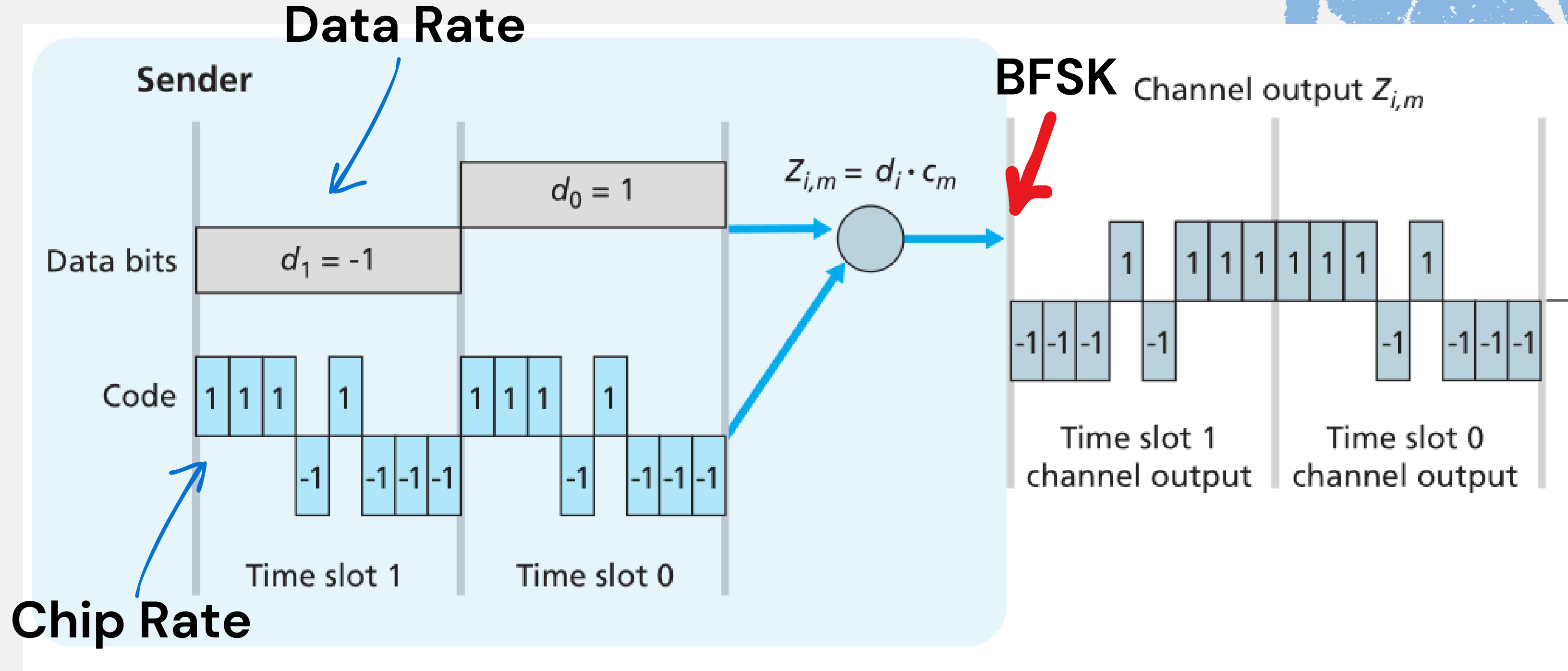
- ✦ Orthogonal codes
- ✦ Optimizing the use of available bandwidth

Asynchronous CDMA

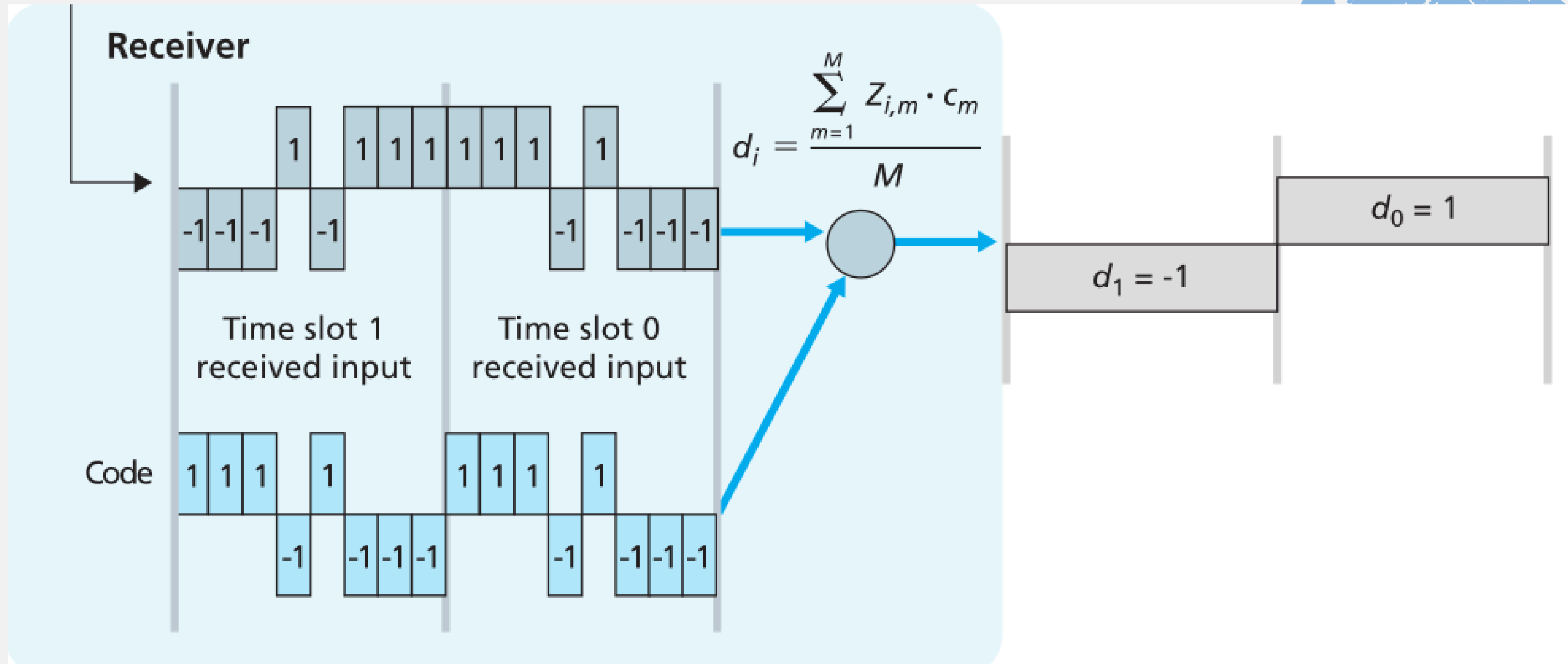
- ✦ Pseudorandom Codes
- ✦ Interference Management



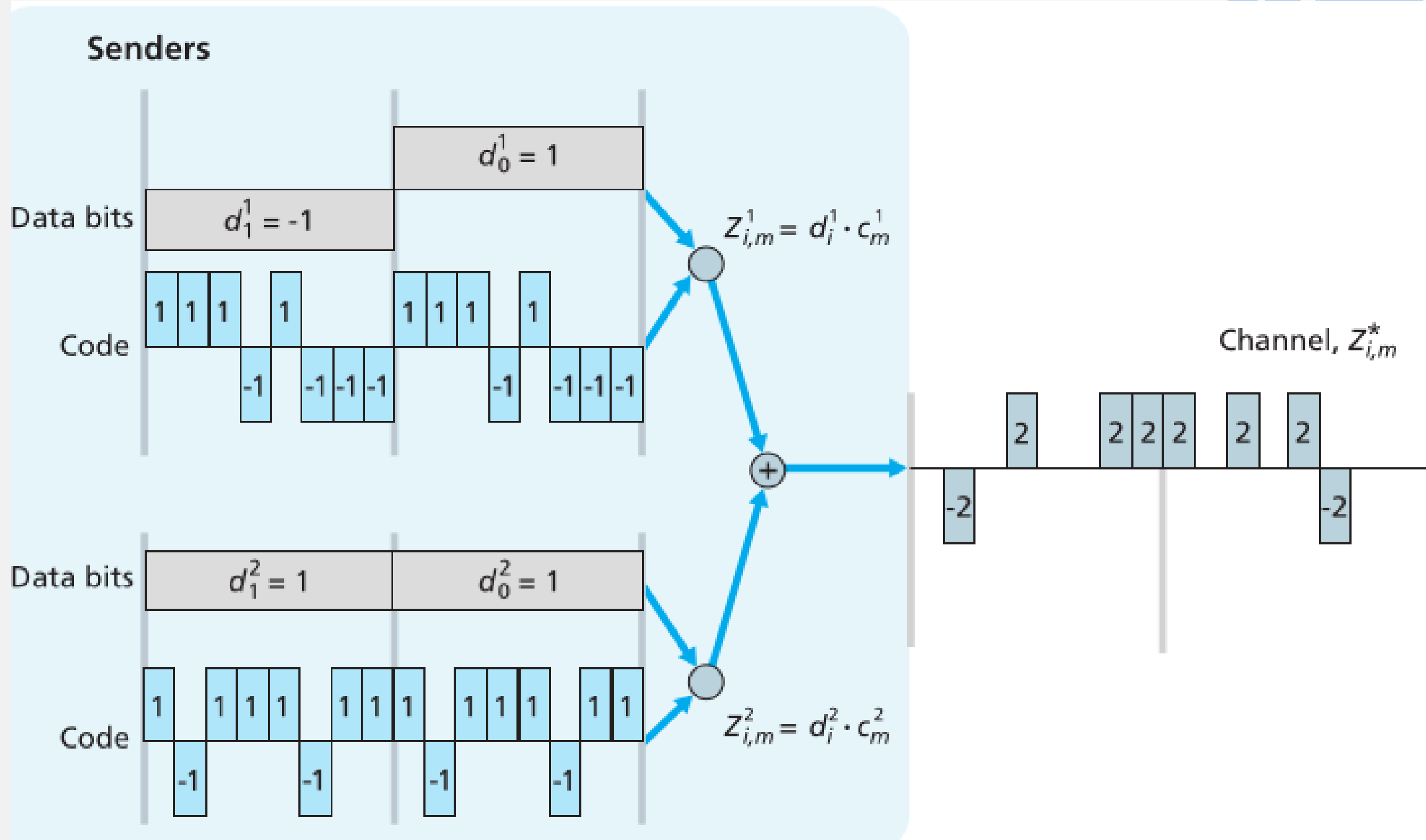
CDMA – Sender



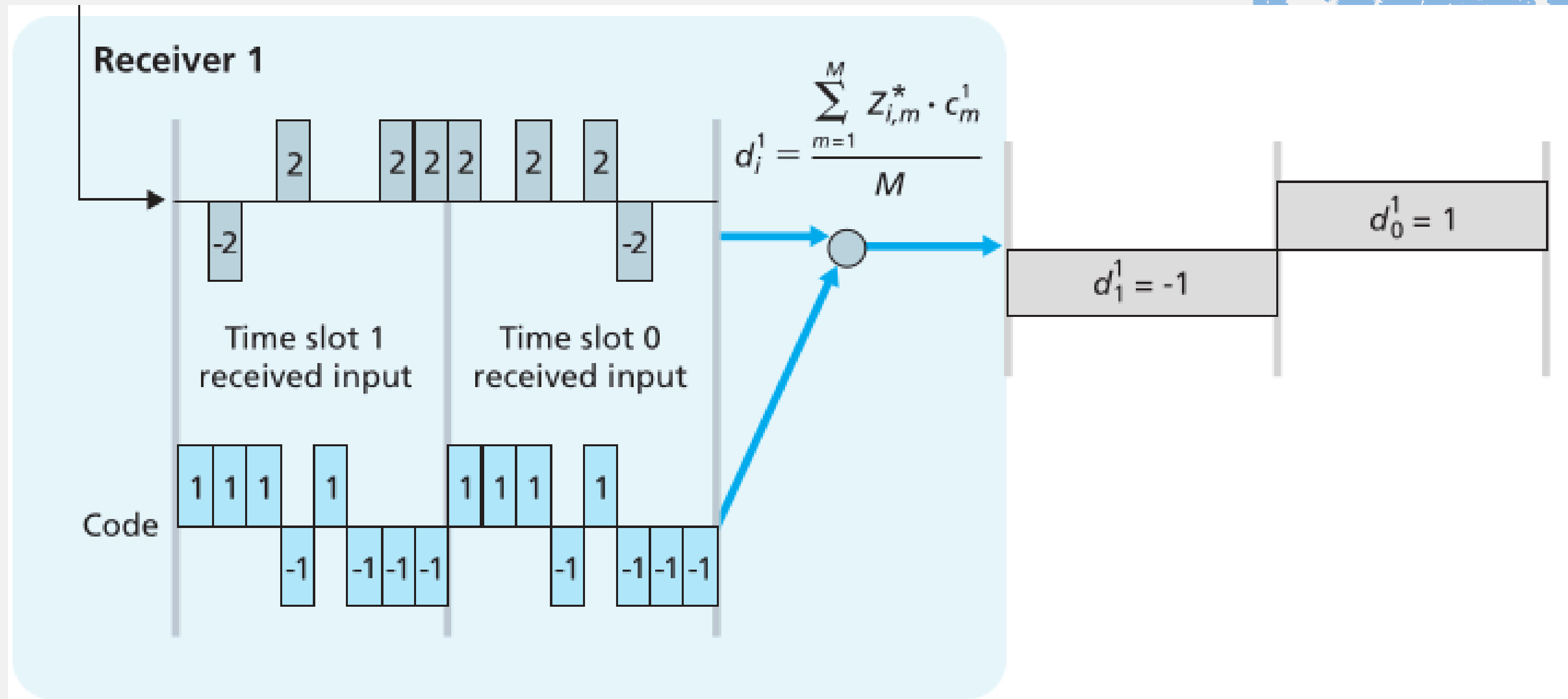
CDMA – Receiver



CDMA – Multiple Senders



CDMA – Multiple Receivers



CDMA – Requirements



Code assignment

Code notification

Time synchronization

Code Assignment Methods

Centralized – Base Station Control

When a mobile device (user equipment) initiates a connection, it communicates with the base station, which allocates an appropriate code based on the current network conditions and the user's requirements.

Distributed – Autonomous Selection

Devices may autonomously select codes based on predefined algorithms or local information. This method can be more flexible but may require mechanisms to handle potential code conflicts and interference.



Code Notification Methods

Dedicate Signaling

The mobile device transmits a message over a control channel, indicating the assigned code. This message is received by the base station, allowing it to recognize and correctly process the incoming signal.

Code Assignment Messages

These messages contain information about the assigned code and are essential for establishing a communication link between the mobile device and the base station.



Time Synchronization Methods

Base Station Synchronization

Base stations are synchronized to a common time reference, often using GPS signals or other precise timing sources. This ensures that all base stations operate on the same time scale, facilitating coordinated communication.

User Equipment Synchronization

Mobile devices adjust their transmission timing to align with the base station's timing. This adjustment is achieved through signaling messages exchanged between the base station and the mobile device, allowing the device to synchronize its transmission with the base station.



Error Detection/Correction



- ✦ Not mentioned in CDMA specification
- ✦ Each enterprise implementation have its own method
- ✦ **CDMA2000:**
 - CRC for error detection
 - Convolutional methods for error correction

Supplementary content



- ✦ Code assignment algorithms
- ✦ Detailed error detection/correction in CDMA2000
- ✦ Asynchronous CDMA

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Thank You!