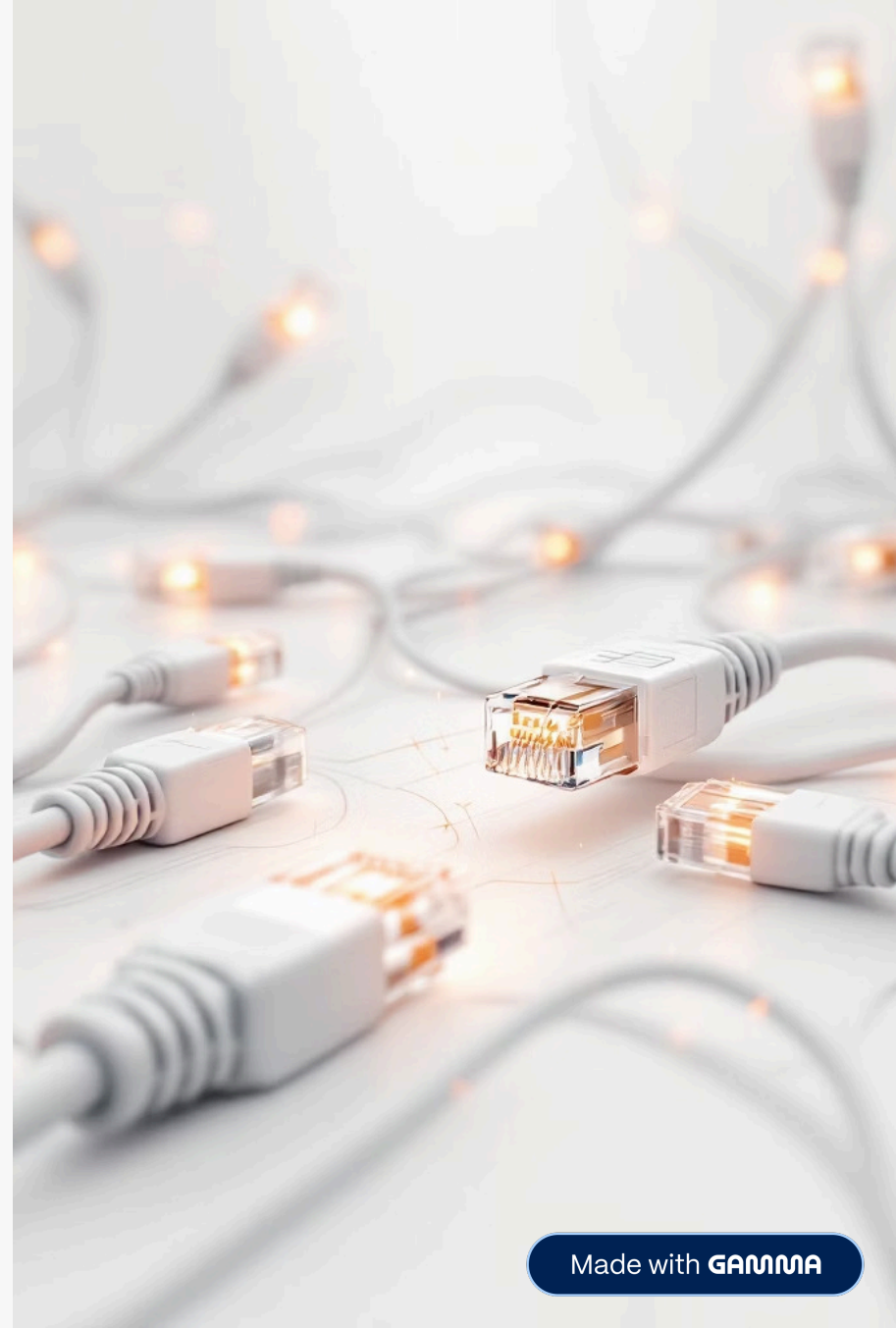


# CSMA/CD: The Rules of the Early Ethernet Road

Understanding how devices learned to share a network without chaos



# The Challenge: A Busy Network Party



## Imagine the Scene

A room full of people all trying to talk at once, raising their voices to be heard



## The Question

How do you ensure everyone gets heard without descending into complete chaos?



## The Reality

Early Ethernet faced this exact problem: multiple devices sharing one network cable

# The Solution: Carrier-Sense Multiple Access

## How It Works

**Carrier-Sense:** Listen before you speak. Devices "listen" to the network cable, checking if it's currently in use.

If the cable is silent (idle), a device can begin transmitting its data. If it's busy, the device waits patiently.

**Multiple Access:** Any device can attempt to transmit when the line is clear, following the same listening protocol.



# The Problem: Simultaneous Speaking



## The Perfect Storm

Two devices listen simultaneously, both hear silence, and start transmitting at exactly the same moment

## The Result

Their messages collide, garbling the data and making it unreadable for both parties

## The Term

This is called a **collision**—a fundamental challenge in shared communication channels

# The Fix: Collision Detection

01

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## Detect

Devices continuously monitor the network while transmitting. If they detect a collision, they stop immediately.

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## Signal

A "jam signal" is sent to alert all other devices that a collision has occurred and the network needs to clear.

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## Wait

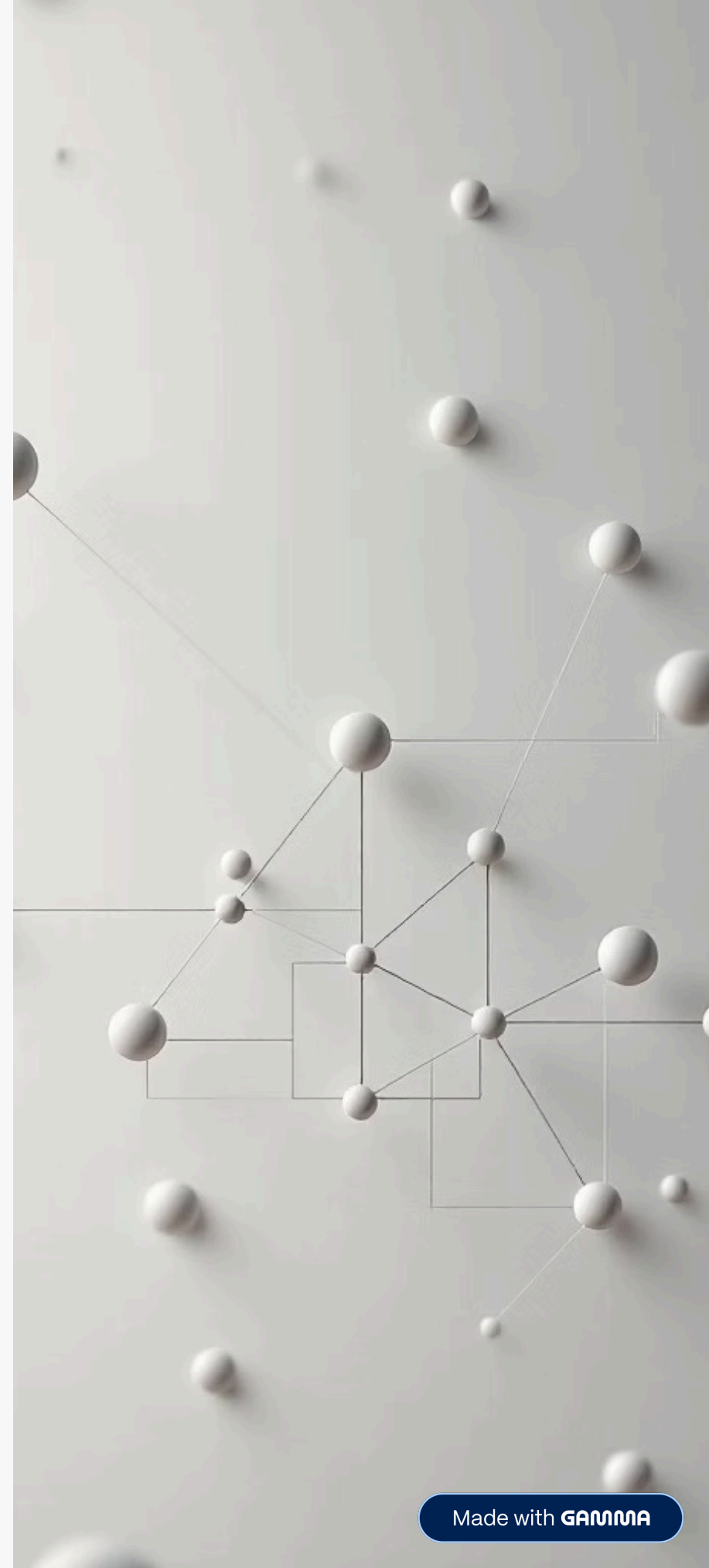
Each device waits a **random** amount of time before attempting to transmit again. This randomness prevents repeat collisions.

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## Retry

After the random delay, devices listen again and attempt to transmit when the line is clear.



# The Evolution: From Hubs to Switches

## The Old Way

CSMA/CD was crucial for early Ethernet networks using hubs, where all devices shared a single communication medium.

Devices had to contend for access, leading to potential collisions and reduced efficiency.

## The Modern Way

Ethernet switches emerged in the 1990s, providing dedicated connections and enabling full-duplex communication.

This eliminated collisions entirely, making CSMA/CD largely obsolete and paving the way for faster, more efficient networks.

