

Q Project - Techequation.org

LoRa Data Packets

Week 3 - Part 3

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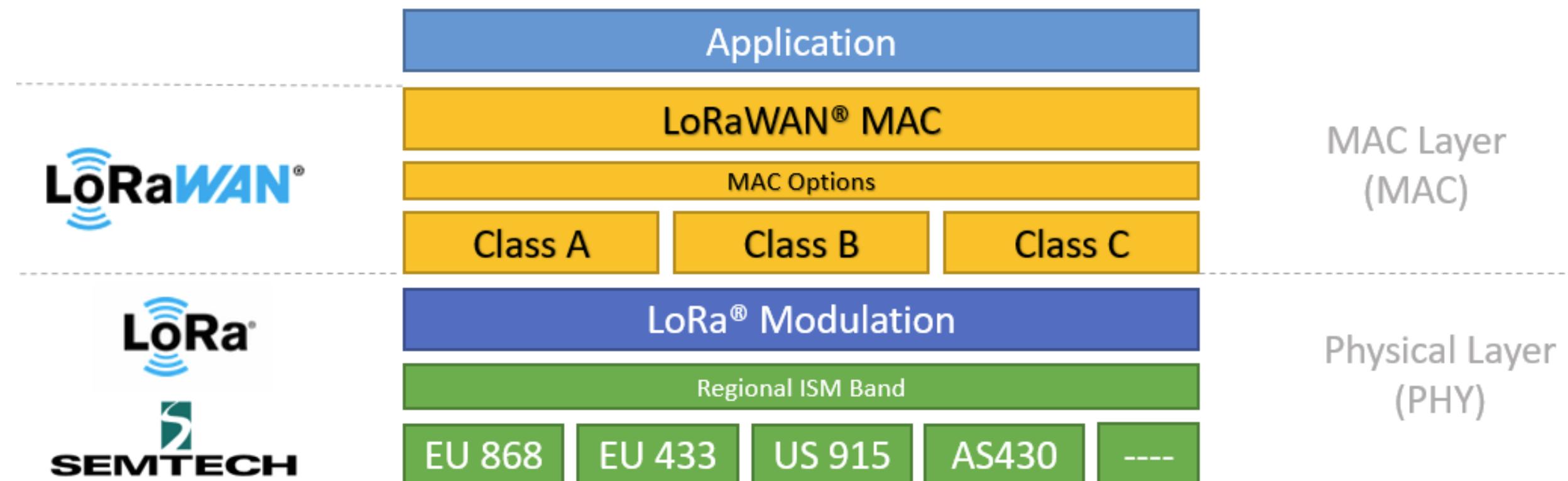




Technical Lesson

Today we will go in-depth on how LoRa data packets are sent through the air. Afterwards, we will review a website with an in-depth LoRa tutorial.

Recall: LoRaWAN Stack



STACK

A stack is a layering of multiple protocols.

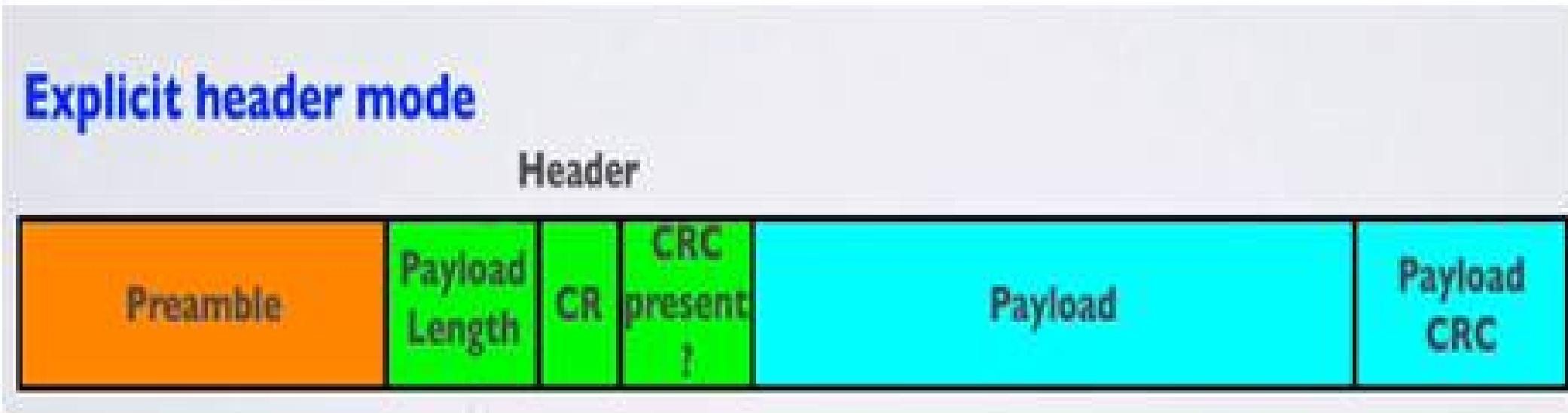
SPLIT

The diagram shows the split between hardware and software layers.

SENDING

This stack allows LoRa data packets to be sent properly.

LoRa Data Packet

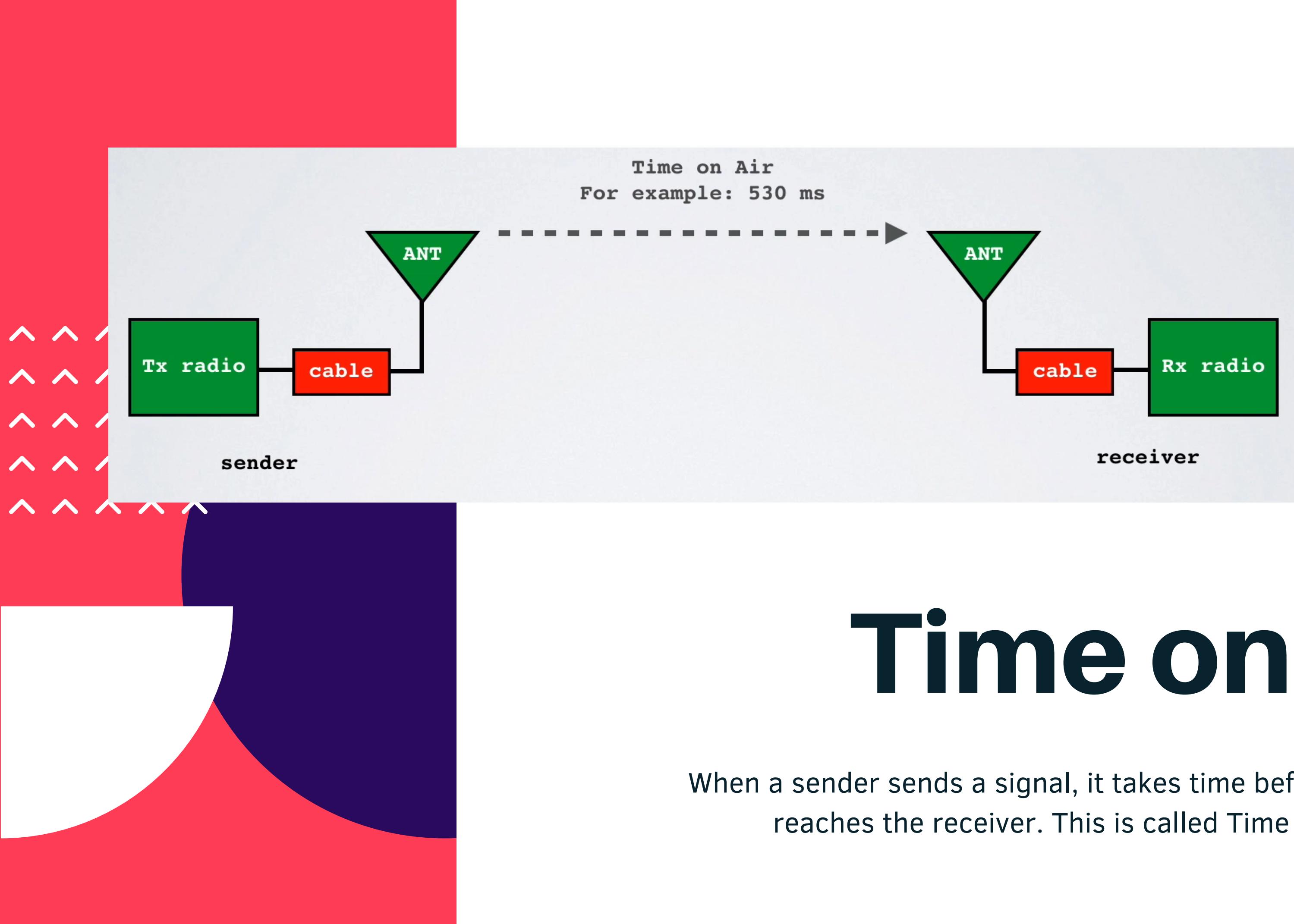


A LoRa packet has three parts: preamble, header (optional), and payload.



CRC: Cycle Redundancy Check
CR: Coding Rate

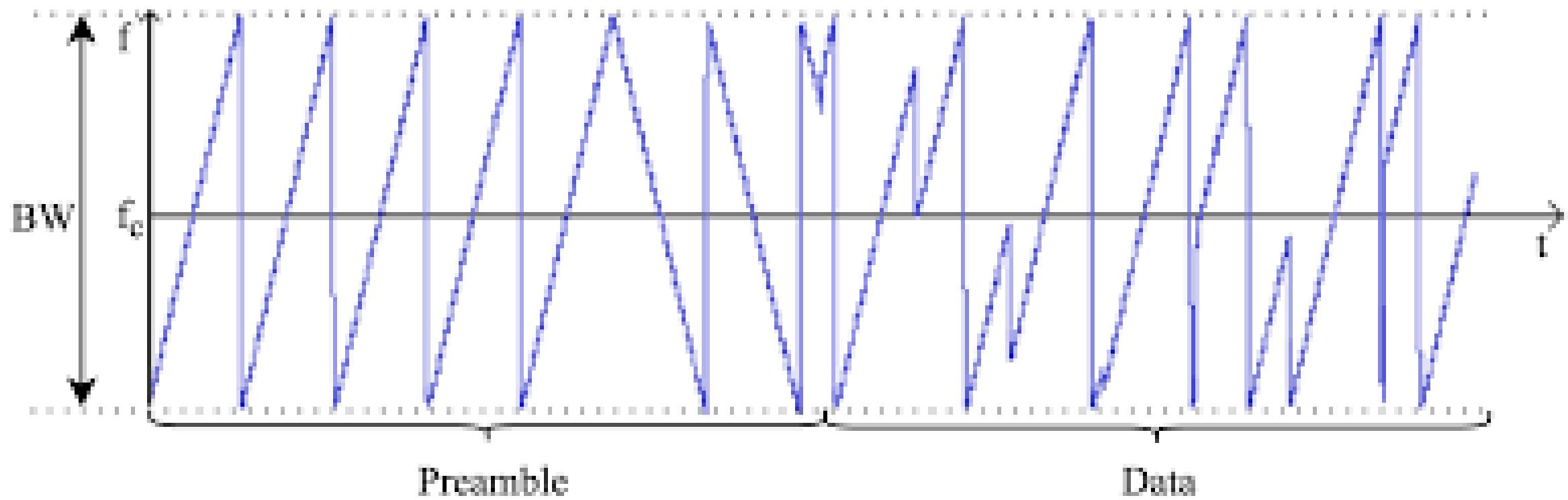




Time on Air

When a sender sends a signal, it takes time before the signal reaches the receiver. This is called Time on Air (ToA).

Radio Waves



$$\text{ToA} = \text{Tpacket} = \text{Tpreamble} + \text{Tpayload}$$

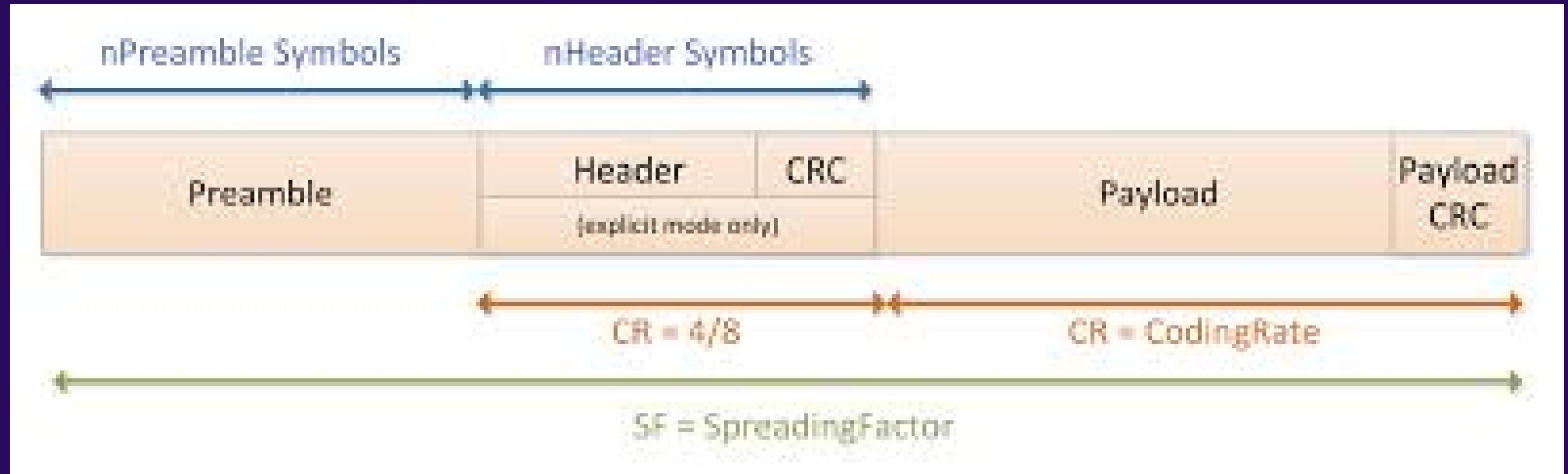
$$\text{Tpreamble} = (\text{npreamble} + 4.25) \text{ Ts}$$

npreamble = 9 for US915 (8 for EU868)

Ts = symbol duration in sec



Distance and ToA



Increasing the SF increases the chirp rate. The distance the signal can reach increases, and so does the ToA.

LoRa devices are optimized to reduce power used when sending through shorter distances.

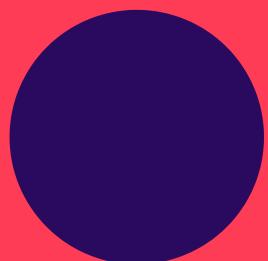
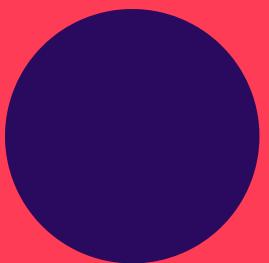
Data Rate (Spreading Factor)	Sensitivity	Time On Air
SF7	-123.0 dBm	41 ms
SF8	-126.0 dBm	72 ms
SF9	-129.0 dBm	144 ms
SF10	-132.0 dBm	288 ms
SF11	-134.5 dBm	577 ms
SF12	-137.0 dBm	991 ms



Viewing a Tutorial

We will now tour a website that gives a well-put together tutorial.

Questions





Sources

https://www.youtube.com/watch?v=C_Rh5GSENA4

<https://randomnerdtutorials.com/esp32-lora-rfm95-transceiver-arduino-ide/>

<https://learn.adafruit.com/lora-and-lorawan-radio-for-raspberry-pi/sending-data-using-a-lora-radio>