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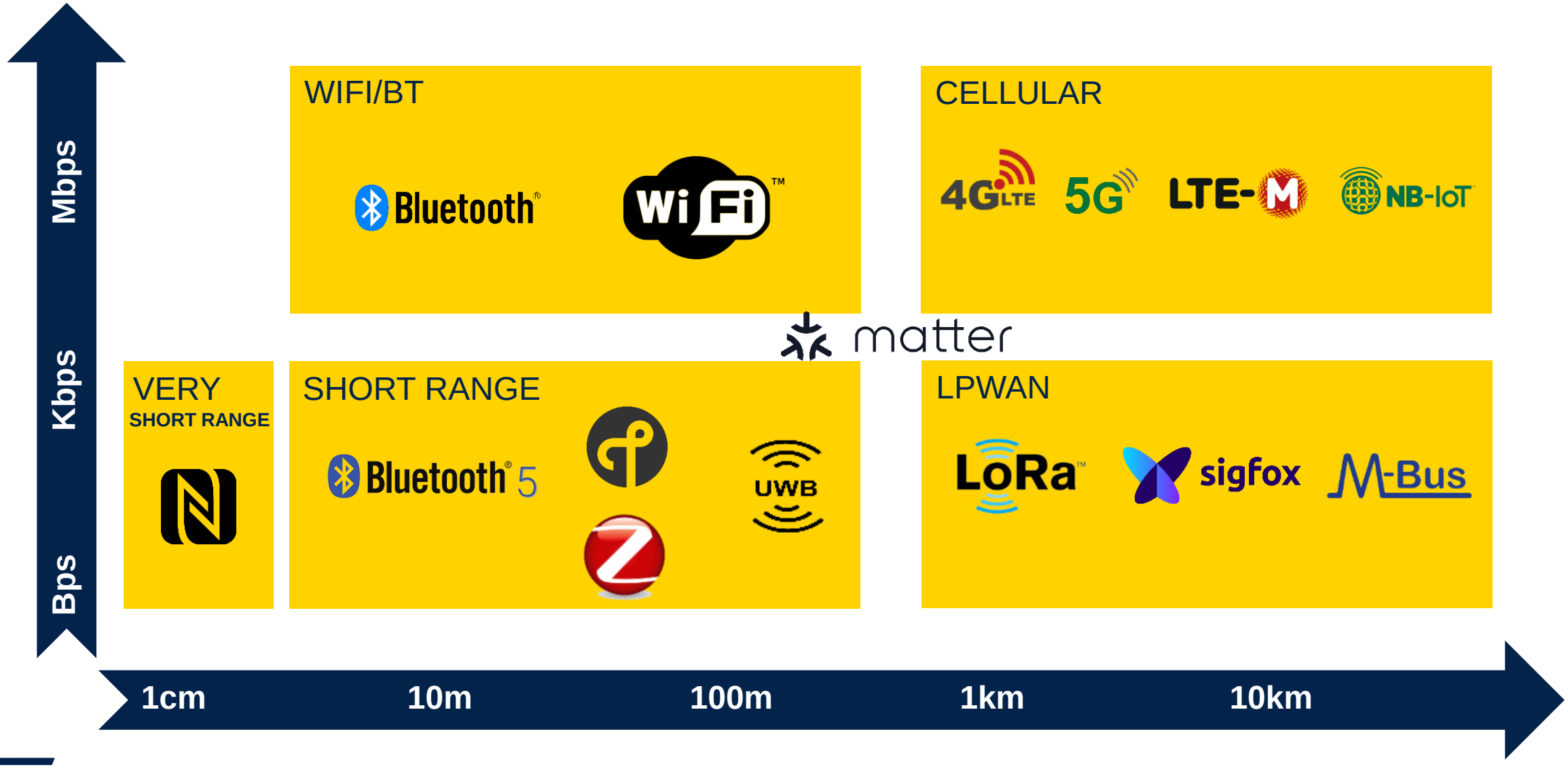
# Wireless connectivity

## Unlocking new opportunities for smart IoT solutions

Koh Kwang Meng

STMicroelectronics

# Communication Technologies - Overview



# Expanding STM32 portfolio


## MPU

**STM32MP1**
Up to 1 GHz Cortex-A7
209 MHz Cortex-M4

**STM32MP2**
Dual 1.5 GHz Cortex-A35
400 MHz Cortex-M33

## High-performance MCUs

**STM32F7**
1082 CoreMark
216 MHz Cortex-M7

**STM32H7**
Up to 3224 CoreMark
Up to 600 MHz Cortex -M7
240 MHz Cortex -M4

**STM32N6**
MCU with neural processing unit

**STM32F2**
Up to 398 CoreMark
120 MHz Cortex-M3

**STM32F4**
Up to 608 CoreMark
180 MHz Cortex-M4

**STM32H5**
Up to 1023 CoreMark
250 MHz Cortex-M33

## Mainstream MCUs

***Mixed-signal MCUs***

**STM32F3**
245 CoreMark
72 MHz Cortex-M4

**STM32G4**
569 CoreMark
170 MHz Cortex-M4

**STM32C0**
114 CoreMark
48 MHz Cortex M0+

**STM32F0**
106 CoreMark
48 MHz Cortex-M0

**STM32G0**
142 CoreMark
64 MHz Cortex-M0+

**STM32F1**
177 CoreMark
72 MHz Cortex-M3

## Ultra-low-power MCUs

**STM32L0**
75 CoreMark
32 MHz Cortex-M0+

**STM32U0**
140 CoreMark
48 MHz Cortex-M0+

**STM32L4**
273 CoreMark
80 MHz Cortex-M4

**STM32L4+**
409 CoreMark
120 MHz Cortex-M4

**STM32L5**
443 CoreMark
110 MHz Cortex-M33

**STM32U5**
651 CoreMark
160 MHz Cortex-M33

## Wireless MCUs

**STM32WL**
162 CoreMark
48 MHz Cortex-M4
48 MHz Cortex-M0+

**STM32WB0**
64 MHz Cortex-M0+

**STM32WB**
216 CoreMark
64 MHz Cortex-M4
32 MHz Cortex-M0+

**STM32WBA**
407 CoreMark
100 MHz Cortex-M33

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Latest product generation
Radio co-processor only
New series & lines introduced in 2024
Pre-announcement


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# Matter smart homes

matter

STM32 Cube

# Matter standard–What for?

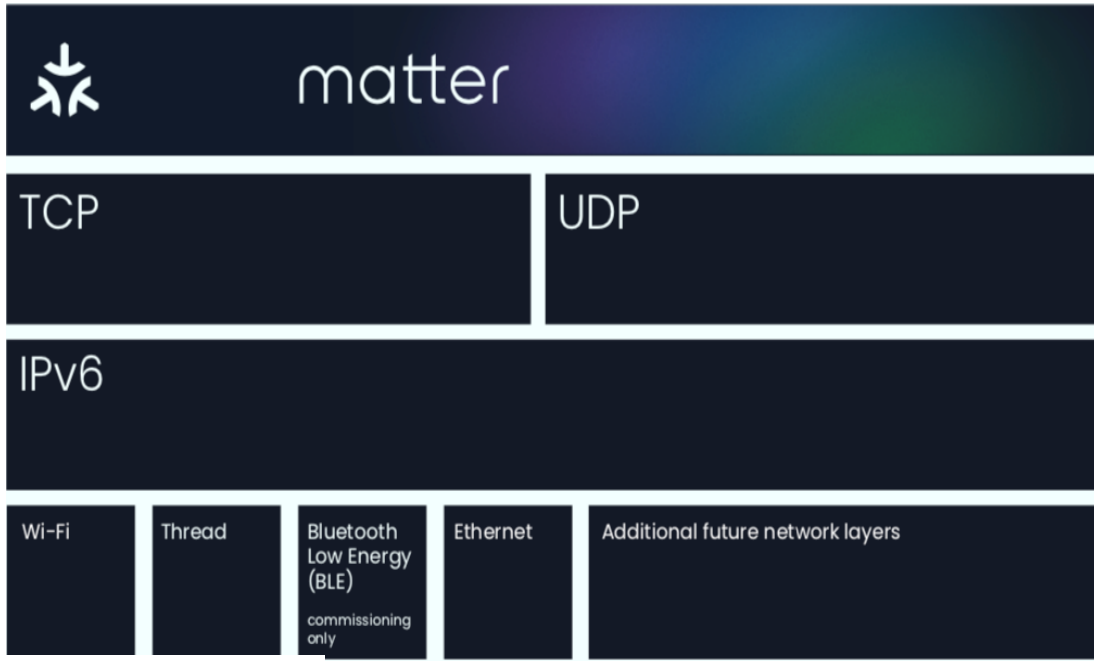
## Purpose of Matter

- Ensure interoperability for consumers with a unified connectivity protocol
- Enhance consumers' experience
- Ensure security and data privacy for consumers

## Motto:

*"Smart home devices should be **secure**, **reliable**, and **seamless** to use."*

By building upon Internet Protocol (IP), the project aims to enable communication across **smart home** devices, **mobile** apps, **cloud** services and to define a specific set of IP-based networking technologies for device **certification**.




csa connectivity standards alliance

ST is a promoter member of the connectivity standard alliance

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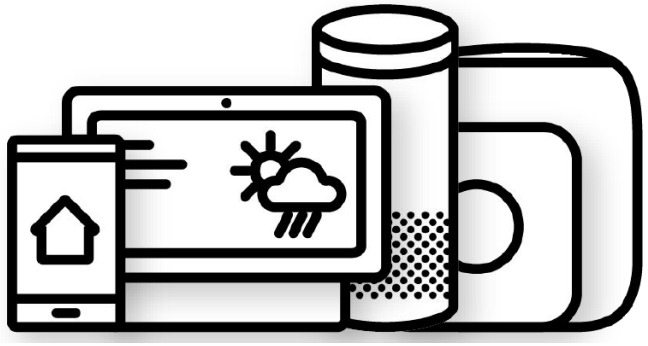
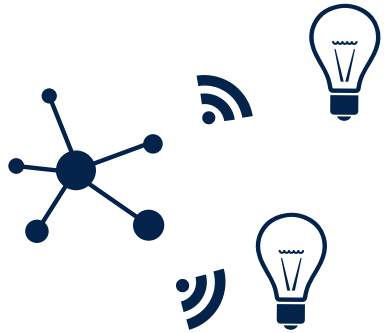
# Matter ecosystem

**CONTROLLERS**
Controllers can control and automate

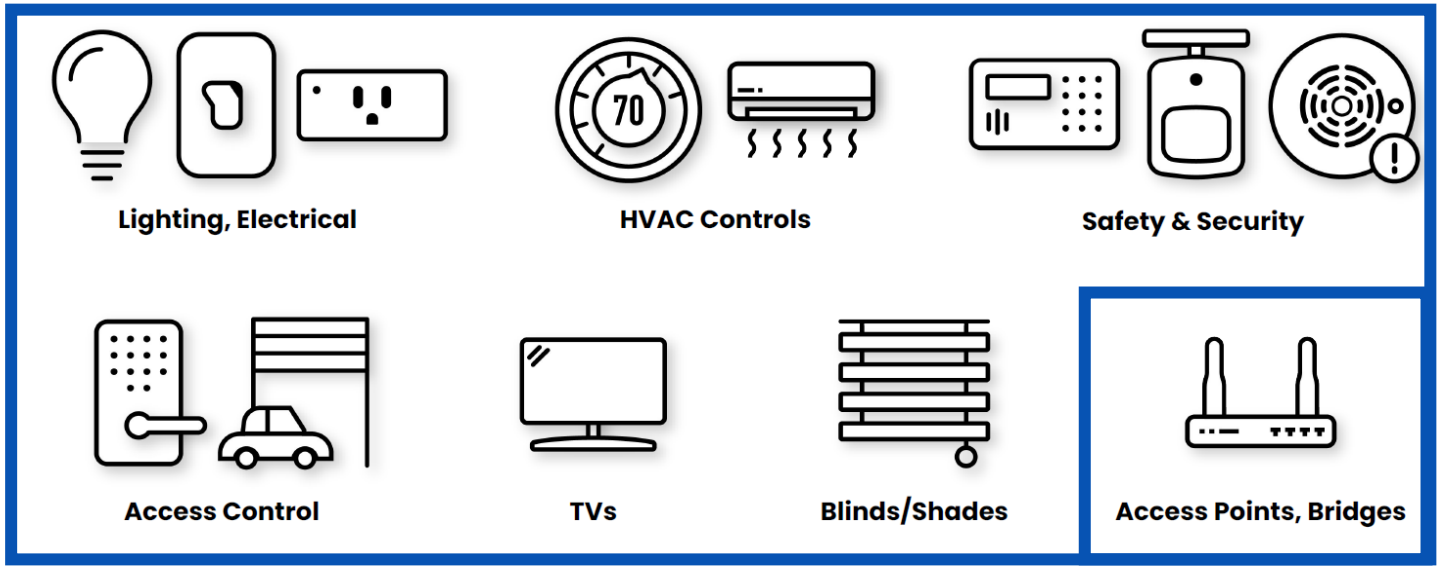


Bridged Node

zigbee
LoRaWAN
sigfox
Other networks



**TARGETS**
End Devices can connect using Wi-Fi, Thread and Ethernet protocols




Matter Bridged node can be used to control and automate non-Matter Devices using a Matter Controller

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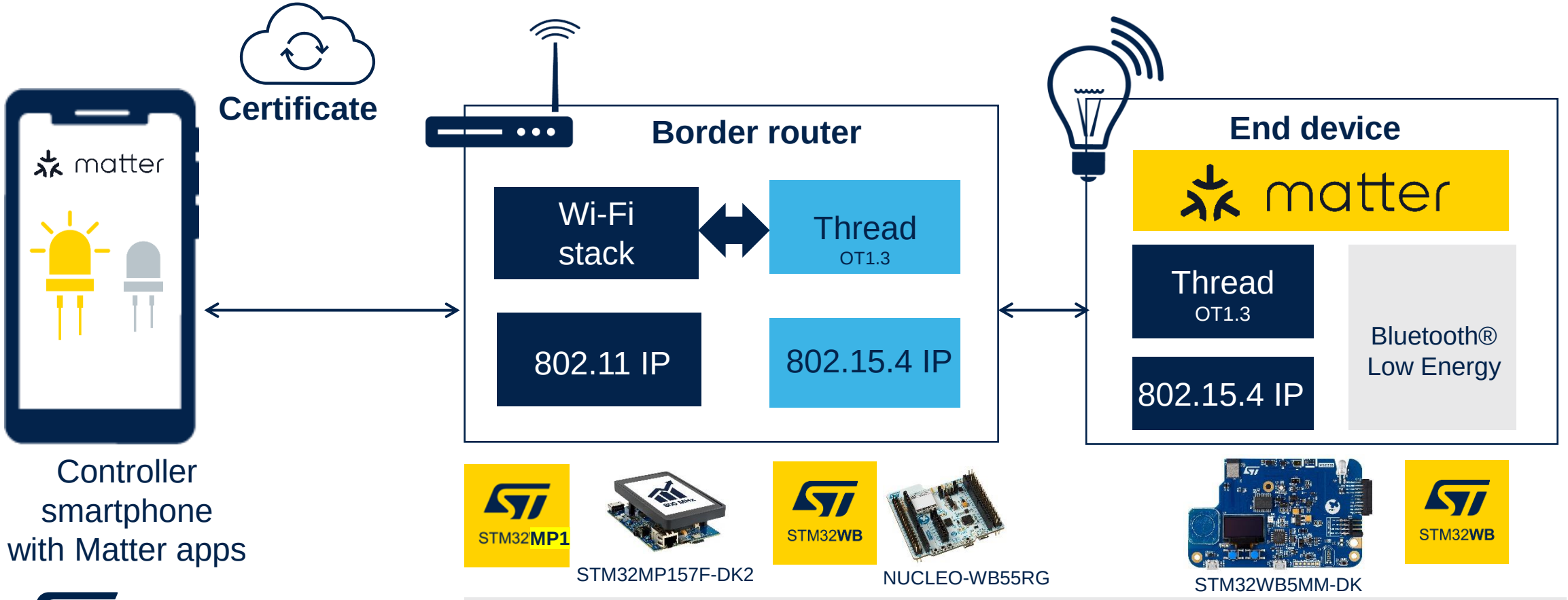
# Connected home with STM32 Matter

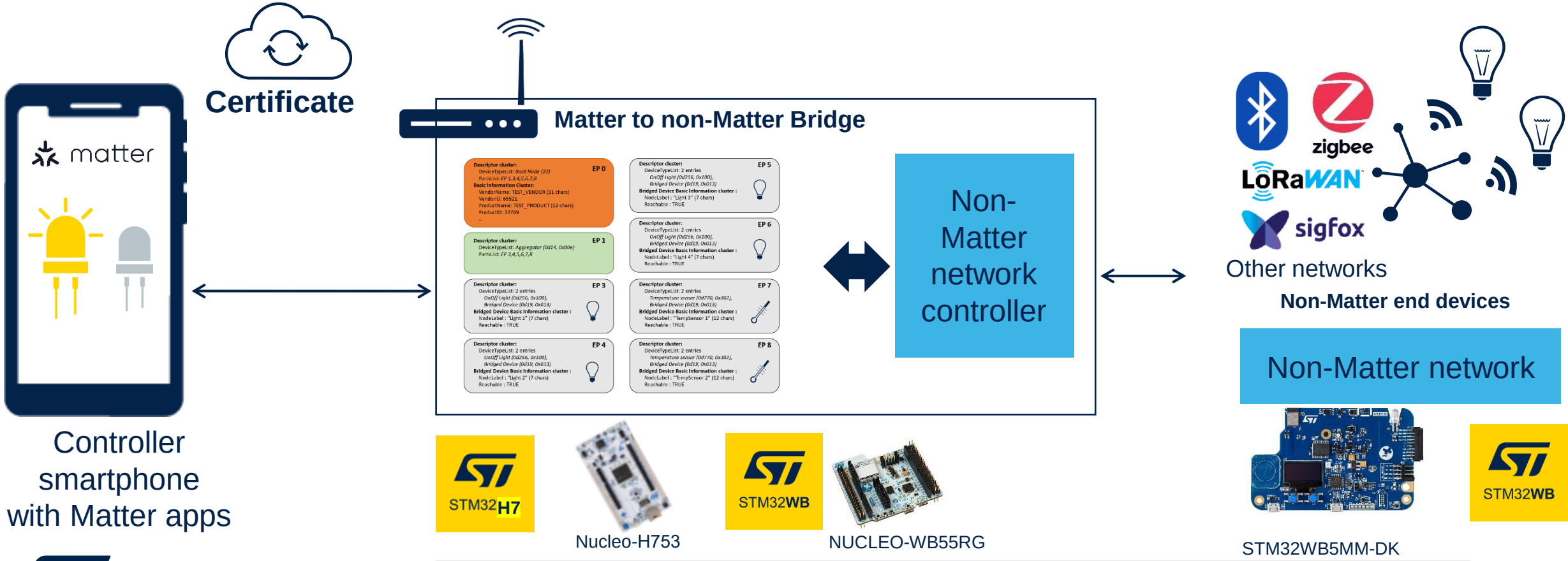
## Connect IoT devices with Matter technology




Matter end to end data transfer–Cloud connection

# Connected home with STM32 Matter

## Extend Matter reach to non-Matter devices using Bridge



# STM32Cube expansion package for Matter development

**X-CUBE-MATTER 1.0: the integration of the Matter SDK 1.1 provided by the CSA for running on the STM32WB55 MCU (using STM32CubeWB v1.18.0)**

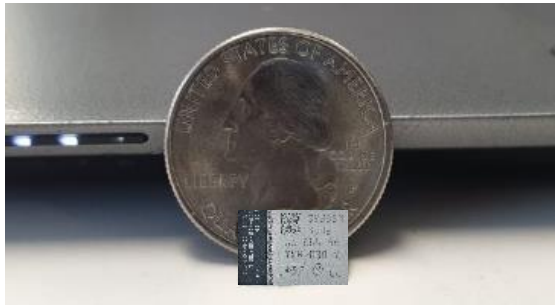
- Includes examples: Lighting app and window covering.
  Other device types examples can be delivered upon request
- Matter OTA: ability to update Arm® Cortex®-M0 (radio) and/or Arm® Cortex®-M4 (application) using the external flash
- Matter provisioning services:
  - CKS API to secure key pair generation and storage inside the device
  - Integration with CommScope PAI Services for DAC/PAI provisioning
- Subsequent Thread 1.3 and Bluetooth® Low Energy software also certified
- Pre-certified using certification tools from the Connectivity Standard Alliance
- Supported development board: STM32WB55-DK discovery kit
- Documentation based in Wiki pages (including OTBR, Matter to non-Matter Bridge example)
- ST Support (FAE) and ST Community

# STM32WB5M multi-protocol module

## Small form factor

7.3x11 mm

Full ref design up to antenna, crystals



## Reduce the cost

Down to 2 PCB layers

Everything inside (single cap outside)

Free of charge radio stack

Certified FCC, CE, NCC, JRF, KC, SRRC, ISED, GOST

## Multi-protocols

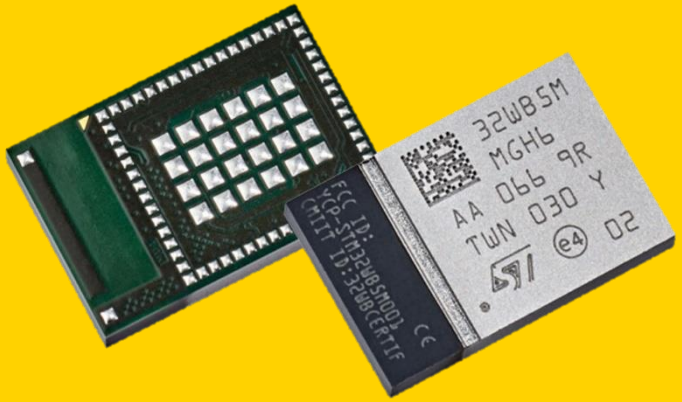
Bluetooth®

zigbee

OPENTHREAD

matter

+ Concurrent modes & Proprietary 2.4 GHz




RPN: STM32WB5MMGH6TR

## Strong feature set

Dual-core based

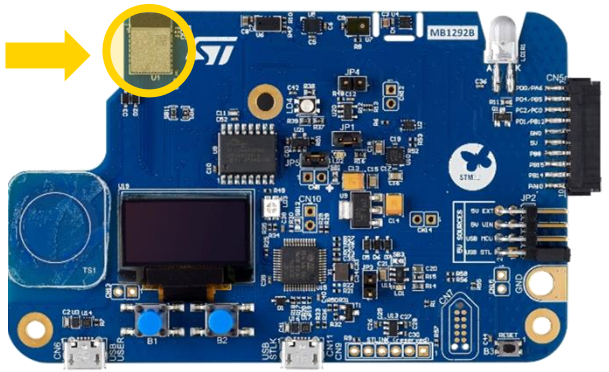
1 MB Flash/256 KB RAM

LCD, USB FS, ADC, COMP

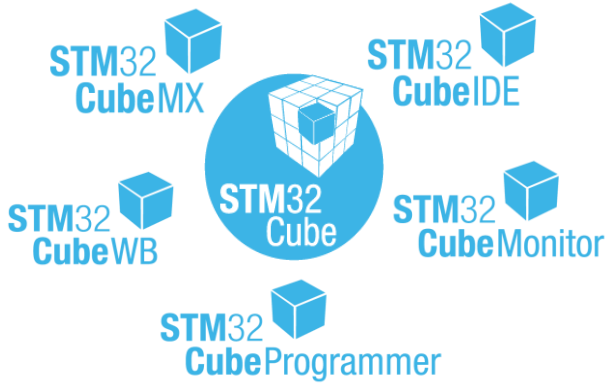
Security

OTA (application, radio)

## Discovery kit



## STM32 ecosystem

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# Takeaways

## Start developing Matter applications now

matter

1. Matter ensures interoperability, consumer experience, security and data privacy
2. STM32 family is fully adapted and boosted to support Matter
3. ST proposes all components you need for your Matter application: from sensors and actuators to secure elements
4. ST’s Matter support is extended to partnership with Matter provisioning players
5. Anticipate every step of your Matter development journey to ensure your Matter project results

# STM32 MCU 2.4 GHz portfolio

## STM32WB series

- **Dual core** & security (Arm® Cortex® -M4 / -M0+)
- Up to **1 Mbyte** of flash memory / **256 Kbytes** of RAM

MCUs: STM32WB55, STM32WB35, STM32WB15, STM32WB50, STM32WB30, STM32WB10

Modules: STM32WB5M, STM32WB1M

5.4 & mesh

matter

## STM32WBA series

STM32WBA54/55

STM32WBA52

5.4

- Arm® Cortex® -M33/TrustZone® 100 MHz
- **1 Mbyte of** flash memory / **128 Kbytes** of RAM
- Up to **+10 dBm** output power

## BlueNRG series

- Arm® Cortex® -M0/M0+
- Up to **256 Kbytes** of flash memory / **64 Kbytes** of RAM

System-on-chips: BlueNRG-1, BlueNRG-2/2N, BlueNRG-LP, BlueNRG-LPS

Module: BlueNRG-M2SP/SA

5.2 to 5.4 & mesh

EVOLUTION

## STM32WB0 series

STM32WB09

5.3

- Arm® Cortex® -M0+ at 64 MHz
- **512 Kbytes** of flash memory / **64K bytes** of RAM
- Bluetooth® Low Energy 5.3 (long range, 2 Mbps, Advertising ext, **AoA/AoD, Isochronous channel**)
- Up to **+8 dBm** of output power

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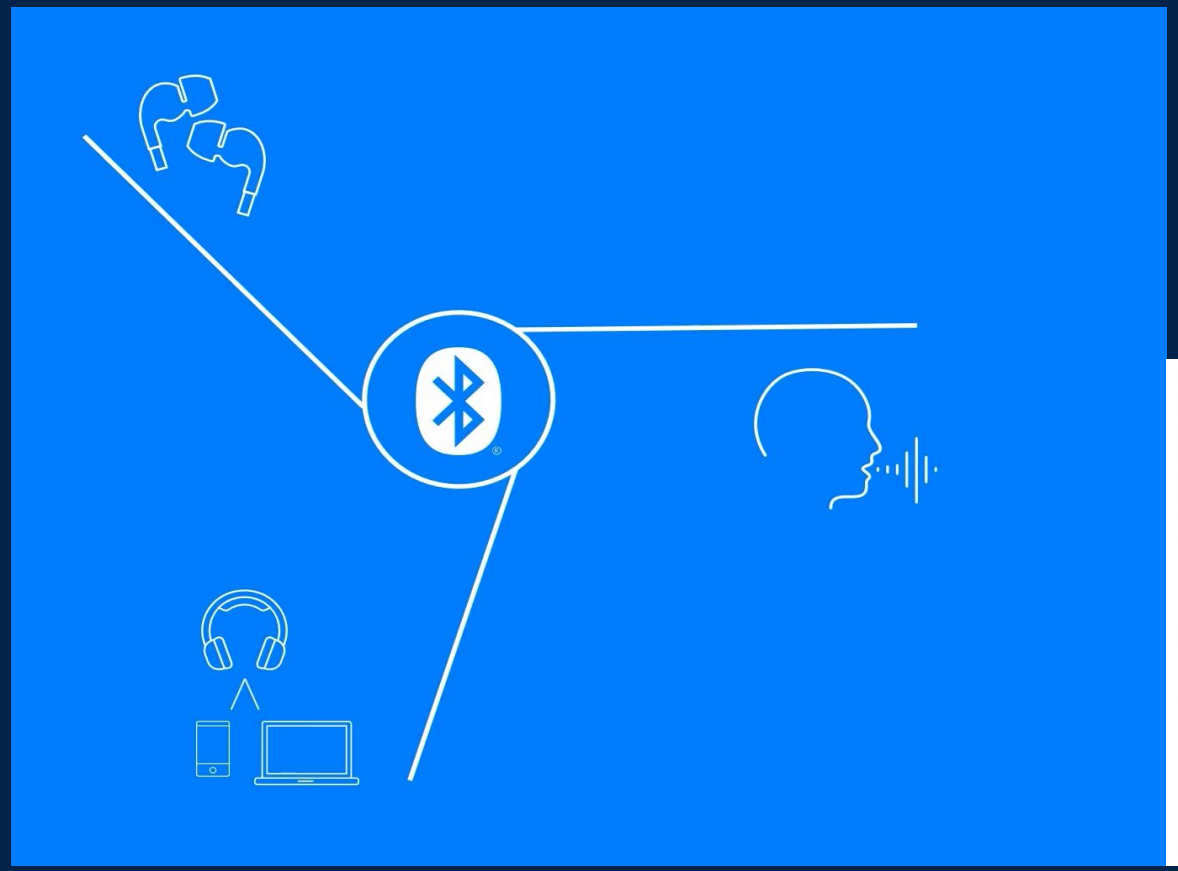
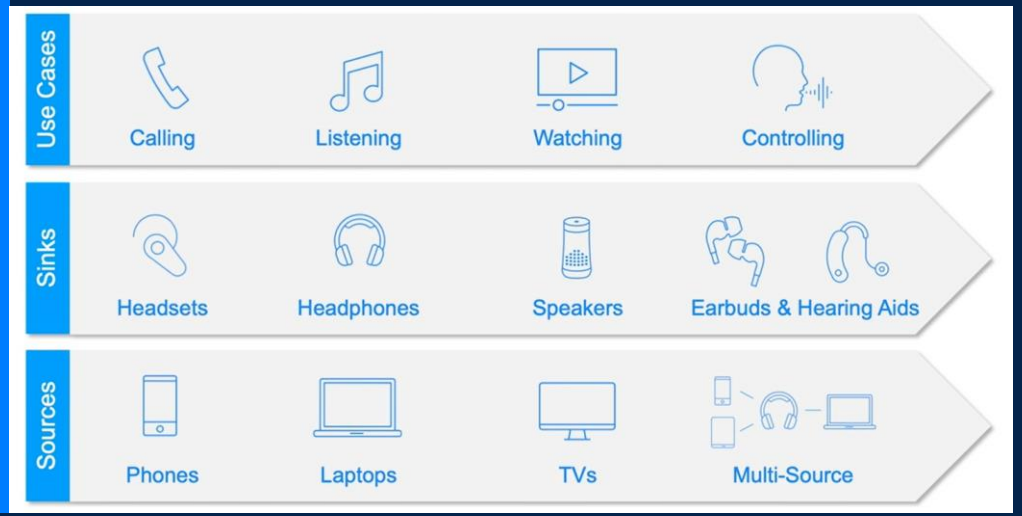
# Audio with Bluetooth® Low Energy 5.2



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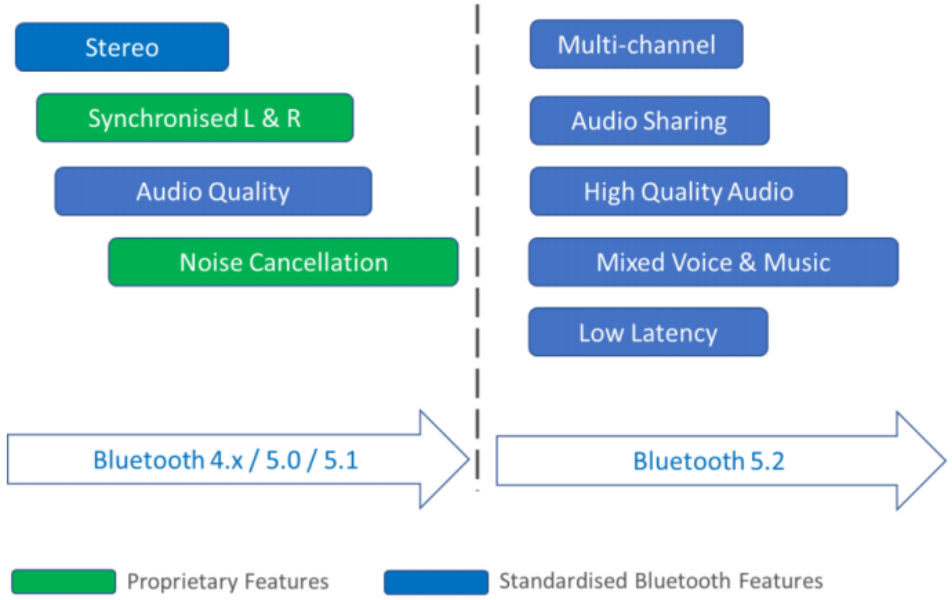
# Bluetooth® LE Audio evolution & applications




LC3

**Audio Quality**

Hearing Aids

**Audio Loss**

Low power,
High quality
Multi-stream

Multi Stream

**Audio streams**

Multiple
Independent
Synchronized

Broadcast

**Audio Sharing**

Unlimited Broadcast

Speaker

Car Radio

Earbuds

Headset

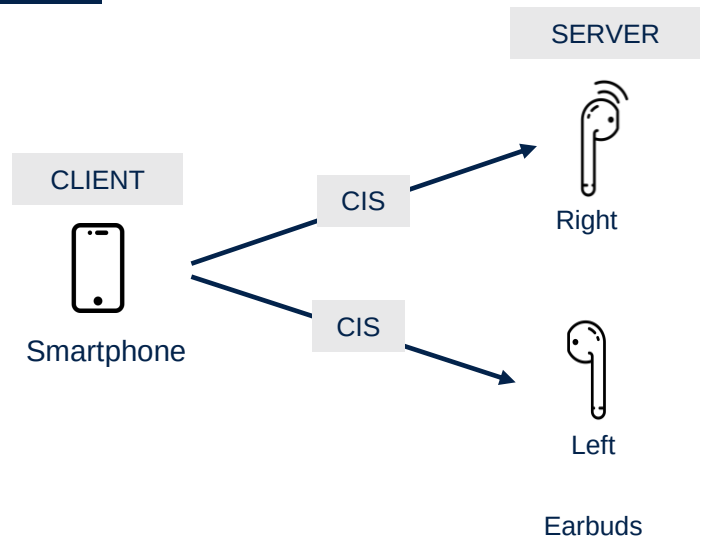
Hearing Aid

Headphone

# Unicast vs Broadcast roles
# Isochronous stream

## Unicast

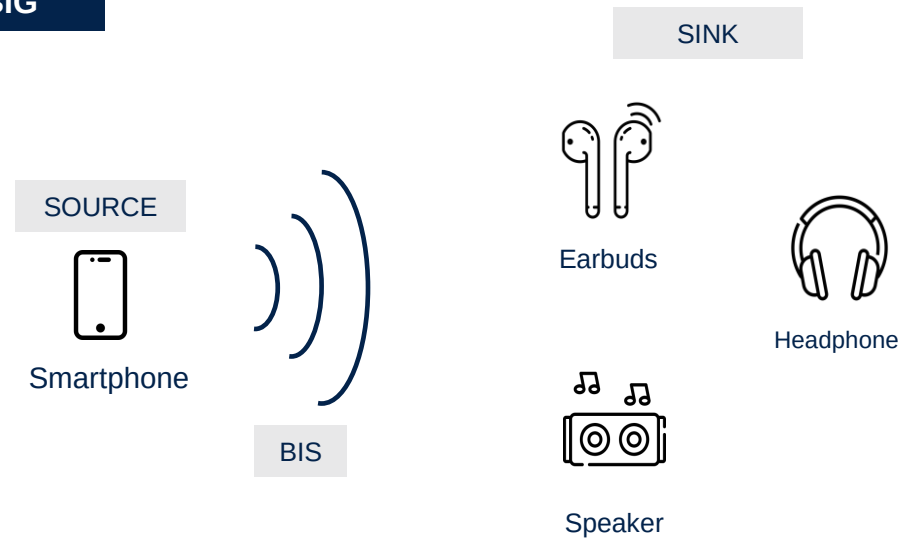
**CIG**




**CIG: Connected Isochronous Stream**

## Broadcast

**BIG**




**BIG: Broadcasted Isochronous Stream**

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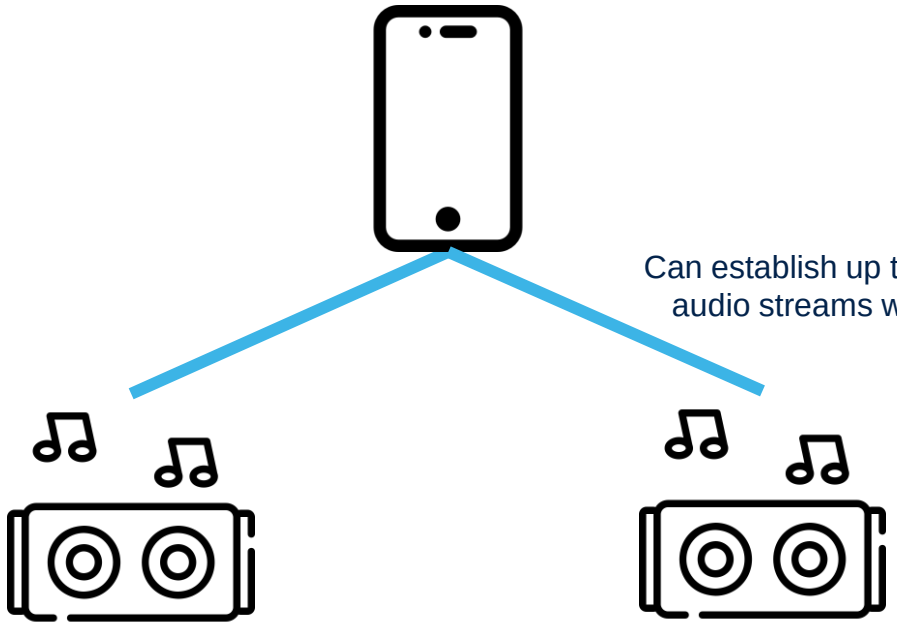
# STM32WBA5 links support

## 1 CIG supported
## Up to 2 CIS supported

1 Smartphone

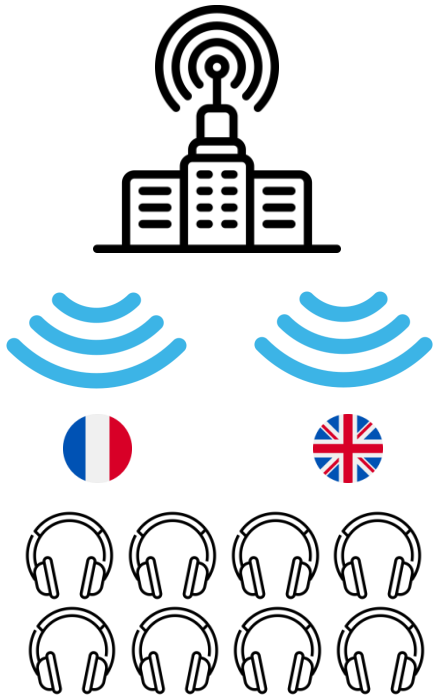


Can establish up to 2 unicast audio streams with 2 CIS

2 speakers

## 1 BIG supported
## Up to 2 BIS supported

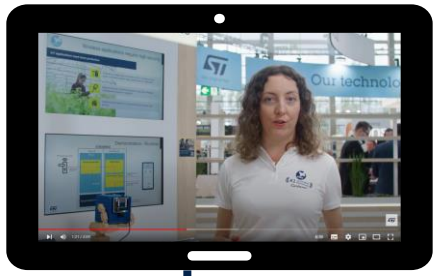
Train station announcements



Can establish up to 2 broadcast audio streams with 2 BIS

2 different languages

# Multi-language Auracast



Video source
speech

Public
Broadcast
Source

Jack 3.5mm

BIS #1
24 KHz Mono
English

BIS #2
24 KHz Mono
French

Jack 3.5mm

BIS #1
48 KHz Stereo
Music



Optional

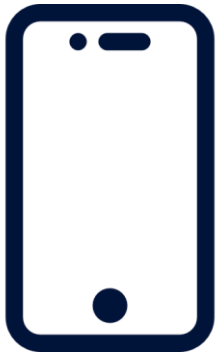
Jack 3.5mm

Public
Broadcast Sink

Select language with joystick

Jack 3.5mm

ACL
Broadcast Selection



Google Pixel

Public
Broadcast
Assistant

**Demonstrates:**

- Multi-Channel sources
- Auracast concept
- Low energy synchronization
- Low audio latency
- Great audio quality
- Available Cube WBA 1.3.0

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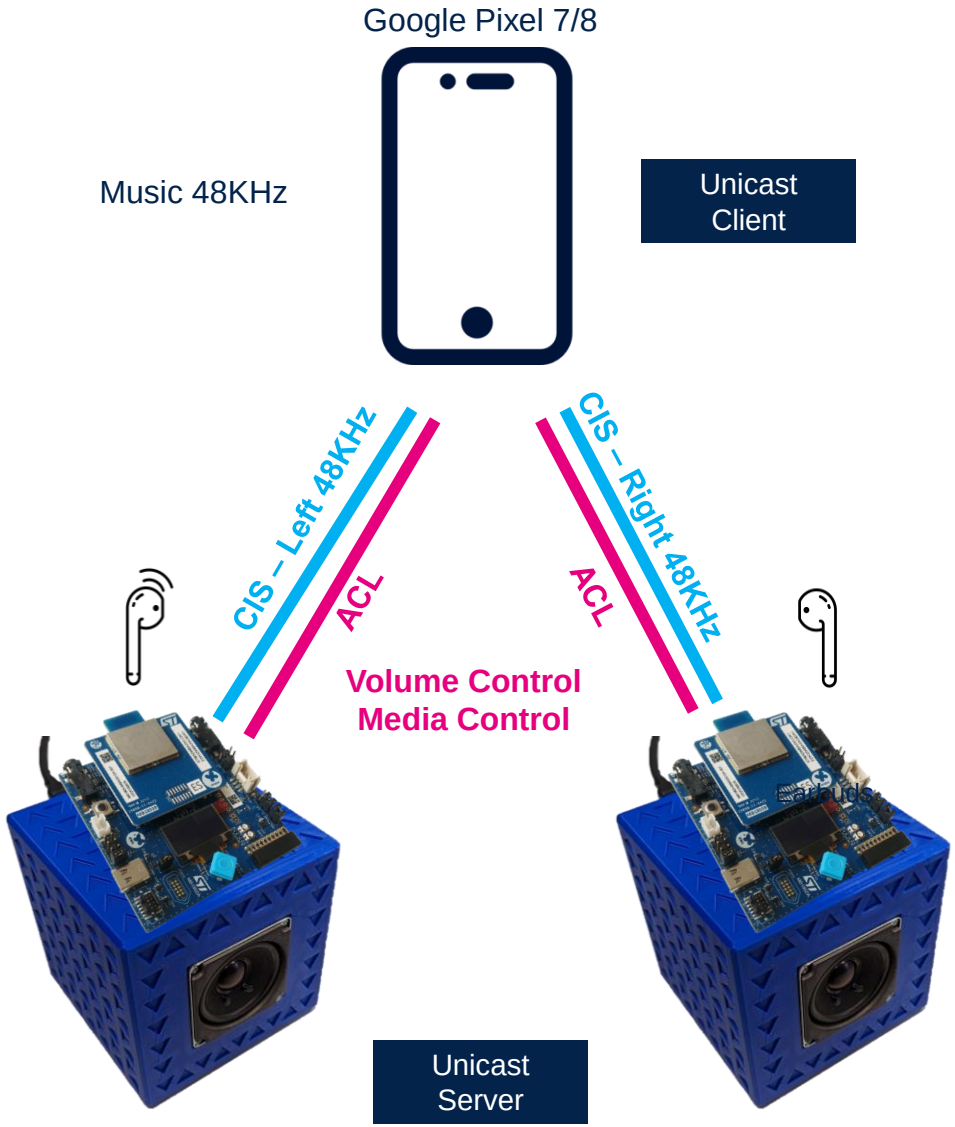
# Telephony & media audio profile unicast earbuds

**Demonstrates:**

- Smartphone compatibility
- Volume/media control
- Low Latency (from BLE Audio Spec)
- Best LC3 Config (48 KHz)
- Demo available Cube WBA 1.3.0

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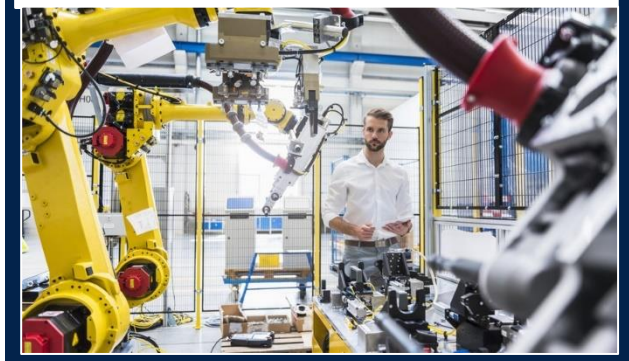
# Sub-1GHz product family


# sub-GHz connectivity is everywhere

## Smart industries



## Smart cities

## Smart agriculture

## Smart homes

## Asset tracking

## Metering

## Alarm systems

## Heat cost allocators

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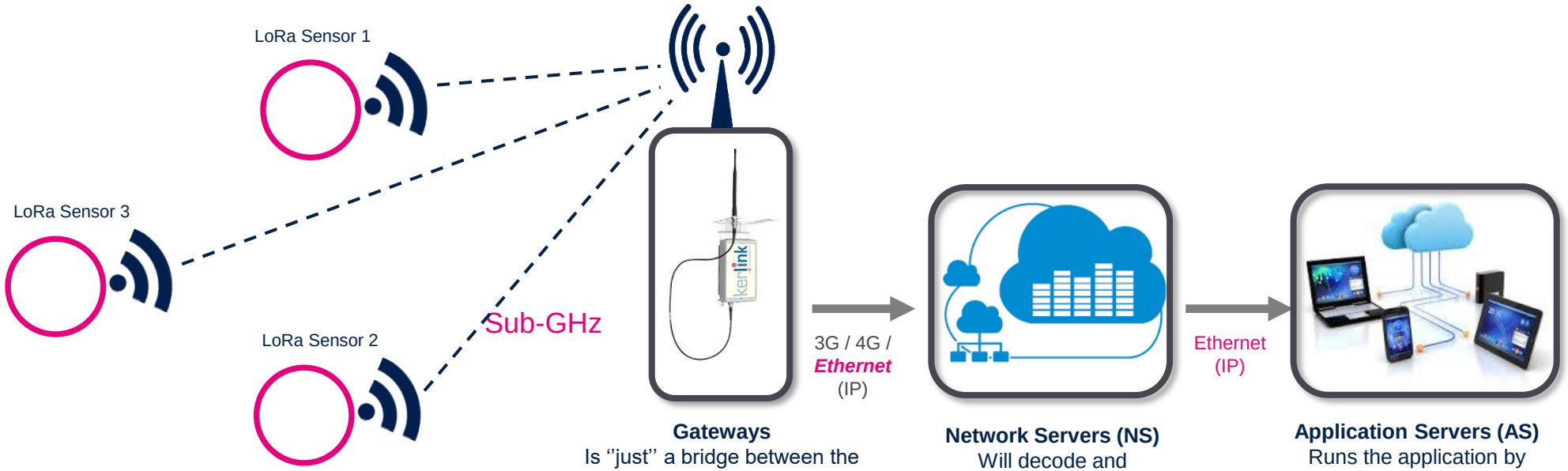
# LoRaWAN™ Network

## Network Topology Overview




**Devices**
The aim is to sense, track, record, monitor any activity. They could be connected to several Gateway and many devices could be connected to the same Gateway.

- **Each device has its own unique device address (DevAddr)**

**Gateways**
Is ‘‘just’’ a bridge between the devices and the Network Server.

**Network Servers (NS)**
Will decode and authenticates data from the device. If data is addressed to the NS then it will be forwarded to the right Application Server. Other players on top of Telco may offer Network Server services.

- **Each N.S has its own and unique Network Session Key (NwkSKey)**

**Application Servers (AS)**
Runs the application by decrypting the packets coming fro the NS. The App could run on a cloud server, PC, Phone … . Then the data are sent back to the right device via the N.S and the Gateway. Many AS can coexist in the same Network.

- **Each A.S has its own and unique Application Session Key (AppSKey)**

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# What is Amazon Sidewalk

**Seamless wide area network coverage for Sidewalk devices**

Sidewalk extends IoT node access by using Amazon Gateways

Standardizing on the Amazon sidewalk protocol unlocks Amazon Echo gateways in communication range of IoT devices

Asset tracking is achieved through multiple gateway access extending reach and increasing reliability

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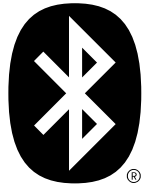
# How Amazon Sidewalk works

## Key aspects of Amazon Sidewalk solution

- Amazon Sidewalk utilizes both: Bluetooth LE and SubGHz RF technology
- Bluetooth LE is used to commission and setup gateway connections
- Amazon Gateways are Alexa enabled devices such as Amazon Echo
- IoT data can be transmitted through Bluetooth LE, LoRA or FSK
- Sidewalk data is routed to AWS servers through the Amazon Gateways
- The data is then accessed and visualized through AWS servers





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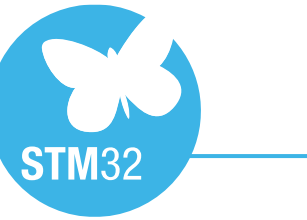
# Amazon Sidewalk – STM32WBA + STM32WL



NUCLEO-WBA52CG

NUCLEO-WL55JC1

LoRa®

amazon sidewalk

Amazon Echo 4th Gen



PC through AWS WiFi

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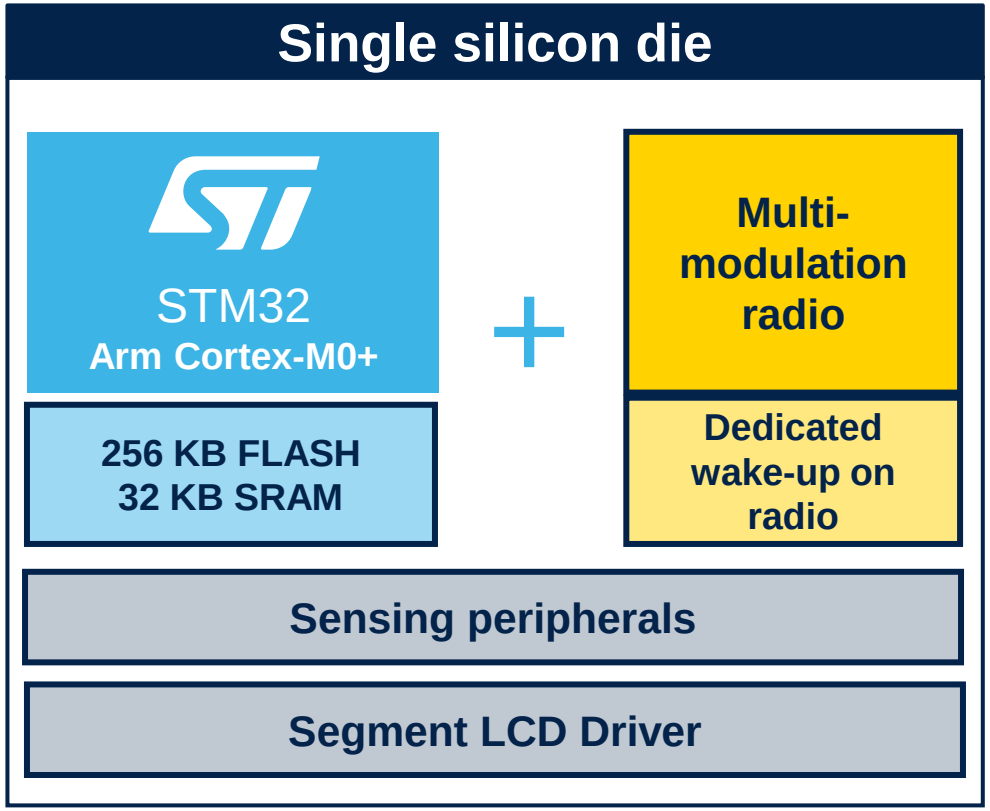
# Wireless MCU combining multiprotocol sub-GHz radio & application features


PACKAGES
- QFN48 6 x 6 mm
- QFN32 5 x 5 mm

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In high-volume production now. Contact us for samples or more information.

# What the STM32WL3 offers

**Highly integrated, low-power MCU for long-range connectivity**


Arm® Cortex® M0+ core up to 64 MHz
+ sub-GHz dual radio

LONGEVITY 10 YEARS COMMITMENT

## Lower design complexity

One single die in packages down to 5 x 5 mm integrating:

- 256 Kbytes of flash memory
- 2 radios: sub-GHz multimodulation radio & wide band wake-up radio
- Analog sensing peripherals
- LCD driver

## Flexibility

- Simple and ultra flexible platform with multiple modulation support: 4-(G)FSK up to 600 Kbps, 2-(G)FSK, (G)MSK, DBPSK, DSSS, OOK, ASK
- IQ interface to develop your own modulation for even more flexibility
- OOK always on wake-up radio

## Longer battery life for IoT devices

- Low power consumption radio down to 5.6 mA (Rx) and 8 mA (Tx at 10 dBm)
- Additional dedicated wake-up on radio with 4.2 µA always-on receiver for system wake-up

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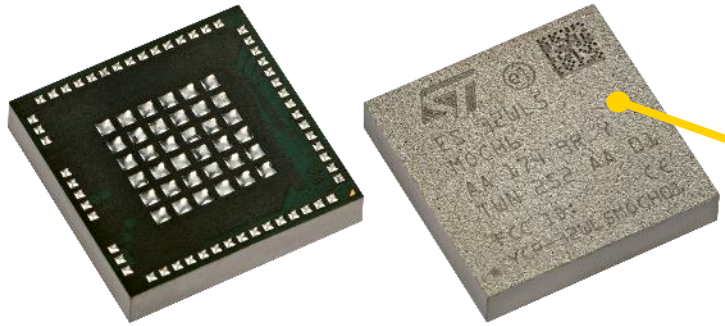
In high-volume production now. Contact us for samples or more information.

# What the STM32WL5M module line offers

**Faster development for power-efficient, long-range wireless devices**



Dual-core Arm® Cortex®-M0 and
Arm® Cortex®-M4 up to 48 MHz
+ sub-GHz radio transceiver

## High integration, small footprint

- Embedded dual-core STM32WL55JC MCU
- 256 Kbytes of flash memory, 64 Kbytes of SRAM with sub-GHz radio transceiver
- Integrated 32 MHz radio TCXO and 32 kHz RTC crystals
- All RF components for transmission and reception matching network, incl. default antenna filter
- STSAFE-A110 secure element (optional)

## Flexible wireless radio

- Certified for LoRaWAN® and Sigfox protocols
- Simple and ultra flexible platform with multiple modulation support: LoRa®, (G)FSK, (G)MSK and BPSK

## Expanding battery life for IoT devices

- Low power consumption radio down to 4.82 mA (Rx) and 15 mA (Tx at 10 dBm) (radio only)

LoRaWAN CERTIFIED

sigfox verified

LONGEVITY 10 YEARS COMMITMENT

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# STM32WL5M: one step further in integration

**All-in-one sub-Ghz SoC**

STM32**WL55JC**

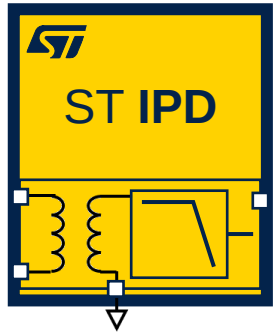
Dual-core MCU +
Multi-modulation RF

256KB FLASH
37 GPIOs

**Integrated Crystals**


32Mhz TCXO
32Khz XO

**Integrated Passive device**

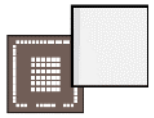



Matching network
Antenna filter

**Integrated RF Switch**

RX/TX
Switch

+ Optional STSAFE



Packed in a tiny
10 x 10 mm module

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# Our technology starts with You

Find out more at www.st.com



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