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BT-101

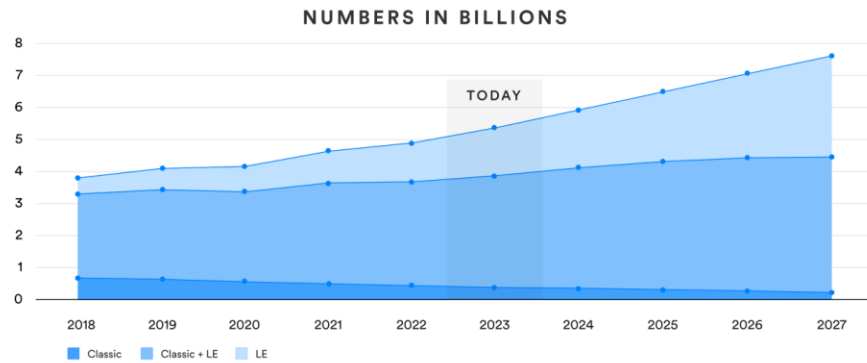
Emerging Bluetooth LE Use Cases and Applications

Jayanth Krishna | August 2023



The Market by Radio Versions and Device Types

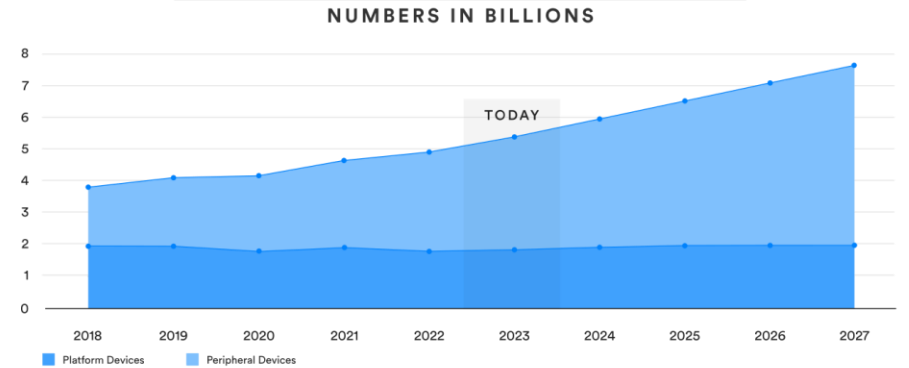
Bluetooth® Enabled Device Shipments by Radio Version



Bluetooth LE – Fastest Growing Radio Version

Annual shipments of single-mode Bluetooth® LE devices will nearly match those of dual-mode annual device shipments by 2027.

Bluetooth® Platform & Peripheral Device Shipments



Peripherals Drive Growth

- 1.5B Bluetooth LE Single Mode devices to ship in 2023
- 97% of all Bluetooth devices will include LE by 2027

The Solution Areas



Audio Streaming



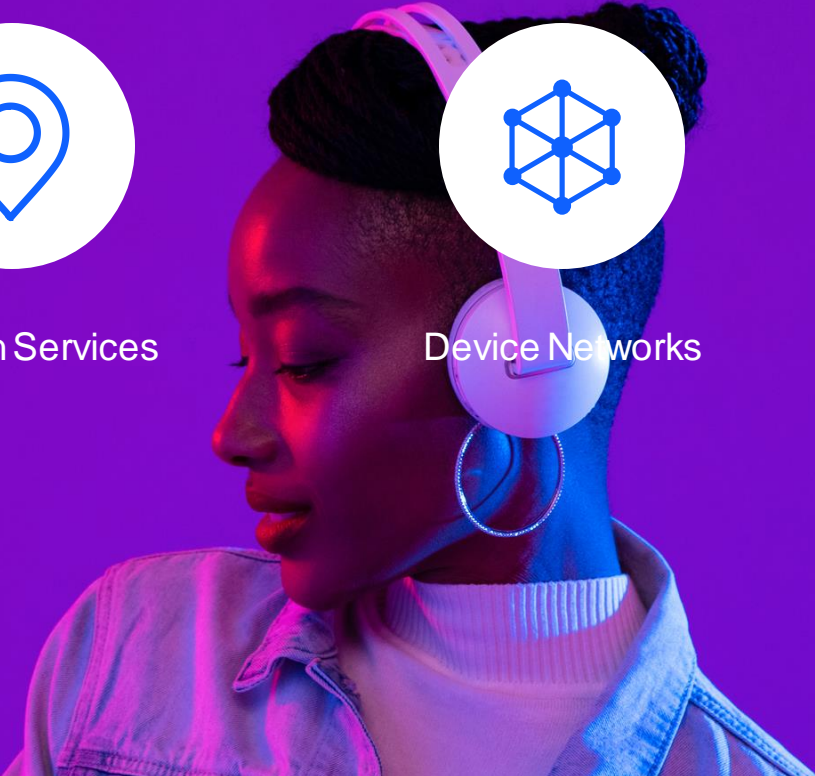
Data Transfer

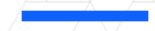


Location Services



Device Networks

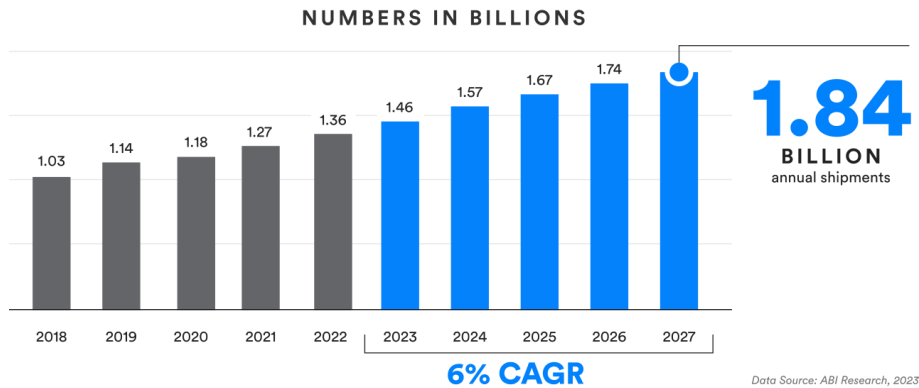




Audio Streaming

Audio Streaming — Market and Applications

Annual Bluetooth® Audio Streaming Device Shipments



- Enabled by Classic Audio today
- LE Audio enables new use cases

Primary Devices



Speakers



Headphones



Car Infotainment

Sample Emerging Devices



TVs



Hospital Beds



Wearables

Parts to consider

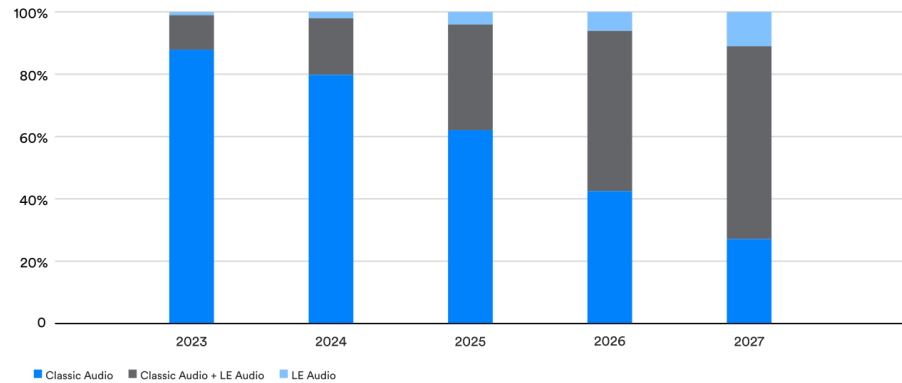
RS9116

RS9116W

LE Audio – Exploring new paradigms

Bluetooth® Audio Streaming Devices

BY PERCENTAGE



Data Source: ABI Research, 2023

- Both classic and LE Audio will be supported for foreseeable future
- Driven by need to work with installed base



Audio Sharing | Unmute your world | Hear your best

Sample Devices for LE Audio



Smart Watches



Headphones



Hearing Aids



TVs

Auracast for Public Locations



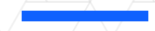
Airports



Conferences



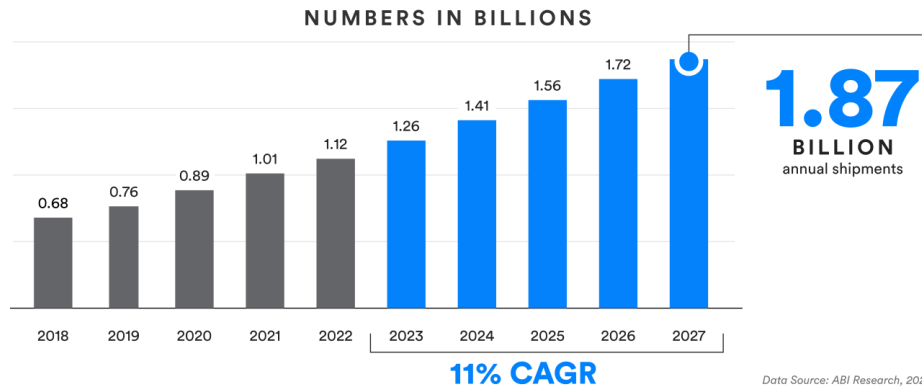
Bars / Gyms



Data Transfer

Data Transfer – Market and Applications

Annual Bluetooth® Data Transfer Device Shipments



- Bluetooth® AR/VR devices are set for significant growth
- Factory automation seeing higher adoption with emergence of predictive maintenance

Primary Devices



Smart Watches /
Fitness Devices



Portable Medical
Devices



PC Peripherals

Sample Emerging Devices



Factory Automation



AR / VR



Power Tools

Parts to consider

RS9116

RS9116W

xG24

xGM240S

xGM240P

xG21

xGM210P

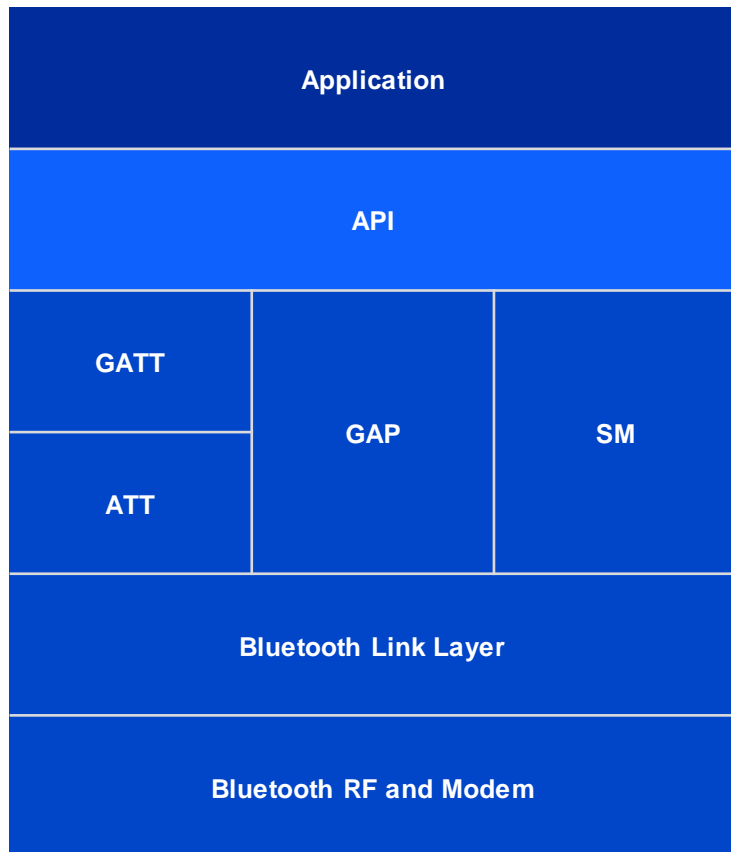
xG27

xG22

xGM220P

xGM220S

Data Transfer Technology Stack & What's Next



Improvements in v5.4

- LE GATT Security Levels Characteristic
 - Enables pre-check of GATT server conditions, enables better user experience
- Advertising Coding Selection
 - Allows the host to select the value of the coding parameter for extended advertising.

Future Features

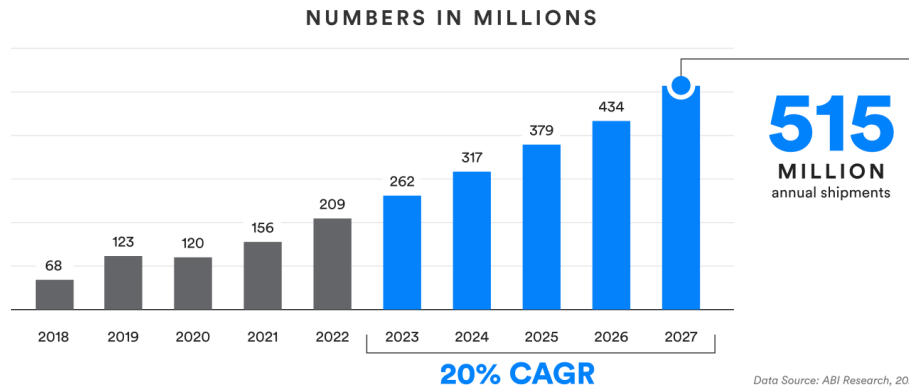
- High Data Throughput
 - Different PHY (RF and Modem) being considered
 - Will change Link Layer and Host stack.
 - Expected to support up to 8Mbps
 - Enables faster firmware updates, streaming larger media
- Higher Frequency Bands
 - Supporting Bluetooth on other unlicensed bands (5 & 6 GHz)
 - Higher data throughput, lower latency, greater positioning accuracy.
 - Decongest 2.4 GHz band



Location Services

Location Services - Market and Applications

Annual Bluetooth® Location Services Device Shipments



- Key enabler for real-time time location services across multiple use cases
 - Indoor navigation, asset tracking, digital key, item finding

Primary Devices



Asset Tags



Beacons



Locators

Sample Emerging Devices



Building Access



Automotive Access



Power Tools

Parts to consider

xG24

xGM240S

xGM240P

xG27

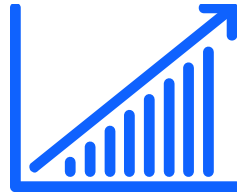
xG22

xGM220P

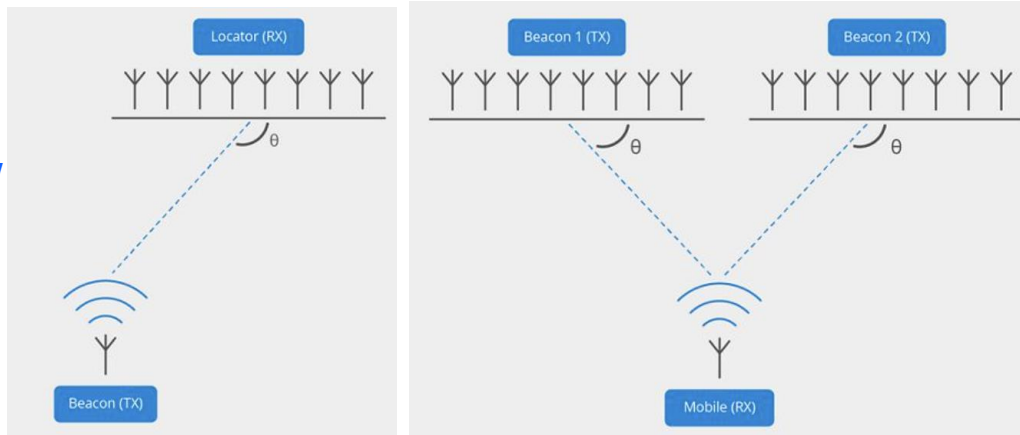
xGM220S

Positioning Services Technology & Future Features

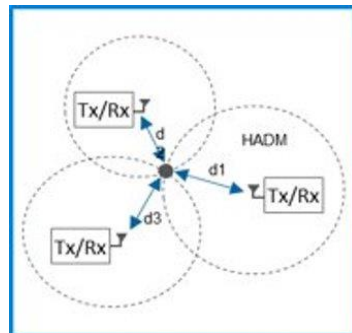
Received Signal Strength Indication



Angle of Arrival/Departure

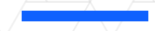


High Accuracy Distance Measurement



- High Accuracy Distance Measurement
 - Being worked on in the SIG work groups
 - More accurate, secure and reliable
 - Much Simpler deployment & hence better user experience
 - Ecosystem support building
- Channel Sounding
 - Core Specifications Feature
 - Multiple techniques for distance estimation
 - Phase based (PBR) and Round trip time (RTT)
 - Security in built in the specification

Attend “BT-202 Bluetooth HADM: Perfecting Location Services”

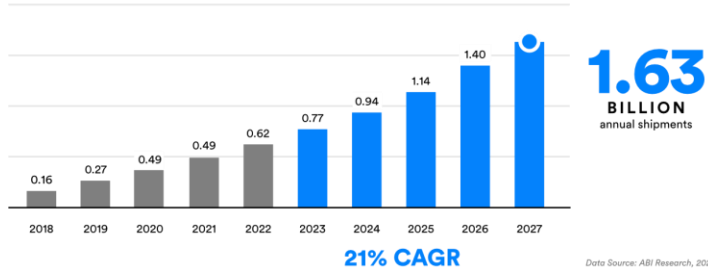


Device Networks

Device Networks - Market and Applications

Annual Bluetooth® Device Networks Device Shipments

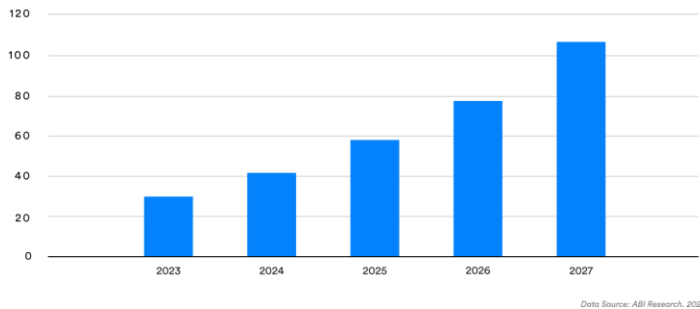
NUMBERS IN BILLIONS



- Fast growing solution area
- 2.63x growth from 2023-2027

Annual Bluetooth® ESL Shipments

NUMBERS IN MILLIONS



- ESLs drive a more gratifying & cohesive omnichannel experience

Primary Devices

Networked Lighting Control



Light Sources



Light / Occupancy Sensors



Control Devices

Sample Emerging Devices



ESLs



HVAC Systems



Temp / Humidity Sensors

Parts to consider

xG24

xGM240S

xGM240P

xG21

xGM210P

xGM27

xG22

xGM220P

xGM220S

Device Networks Technology

Key Enhancements to Bluetooth Mesh

- Mesh Protocol with multiple new features (v1.1)
 - Remote Provisioning
 - Certificate Based Provisioning
 - Subnet bridging
 - Directed Forwarding
- New Models
 - Mesh binary large object transfer model
 - Device Firmware Update
- Networked Lighting Control Profiles
 - 6 specifications for different devices

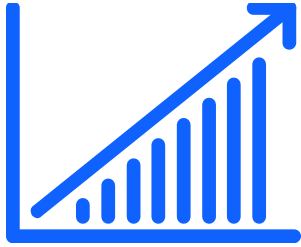
Attend “BT-201 Features and Benefits of the New Bluetooth Mesh Standard”

New Features Enabling ESL

- Periodic Advertisement with Responses
 - Bidirectional mode with sub-events
 - Enabling “Synchronized” mode network
 - Upto 32K peripherals in the network
- Encrypted Advertisement
 - Standardized way of communicating encrypted data in adv, scan response and EIR
 - Key exchange through encrypted & authenticated ACL
 - CCM algorithm used for encryption and authentication
- ESL Profile
 - Defines characteristics and commands for ESL
 - Defines the different states and state transitions

Attend “BT-203 Bluetooth 5.4: Everything You Need to Know”

Conclusions



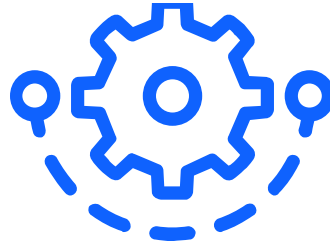
Bluetooth growing significantly across all four solution areas

Device networks (21% CAGR)

Location Services (20% CAGR)

Data Transfer (11% CAGR)

Audio (6% CAGR)



Significant new developments enabling newer use cases and devices

Mesh Protocol

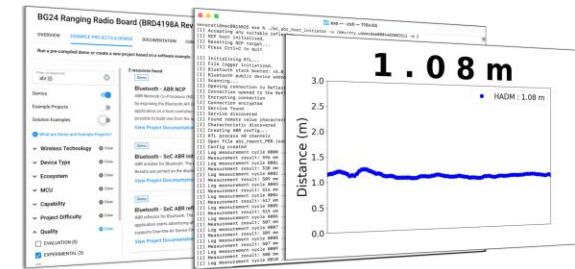
ESL

HADM

High Throughput

Higher Bands

LE Audio



GSDK 4.3.0 supports mesh protocol, ESL & HADM

Silicon Labs has a rich portfolio of ICs, Modules, Software and Tools to support all the Bluetooth needs of our customers

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BT-101

Thank you!



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Q&A

