Bluetooth® Seminar Series

Tools, Techniques, and Trends

What's New in Bluetooth 5.2

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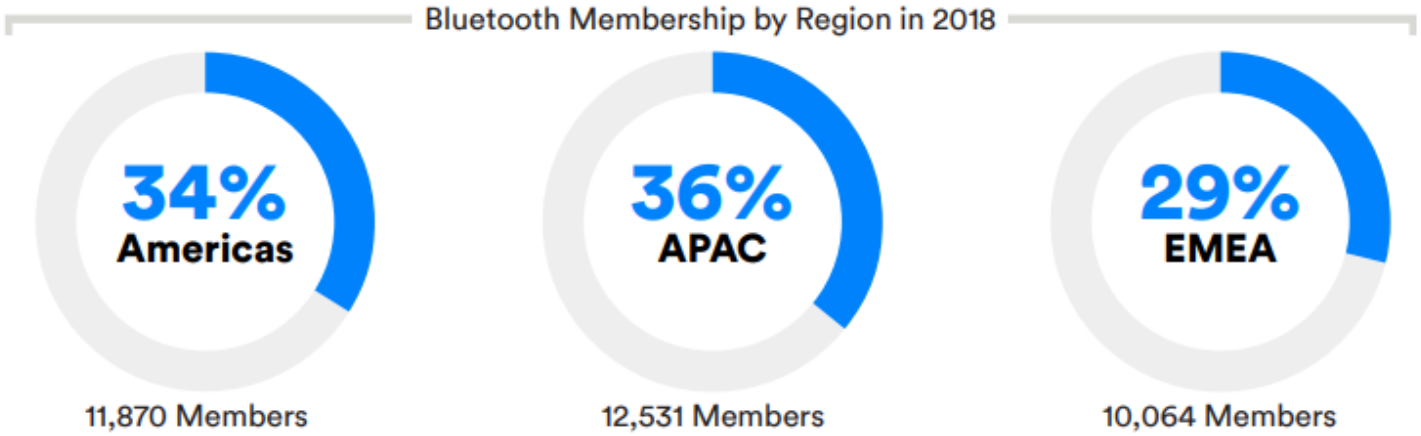
Agenda

- Quick overview of key pre-5.2 Bluetooth features
- New features introduced in Specification 5.2
- Where to go for more information

True Worldwide Multi-Vendor Interoperability



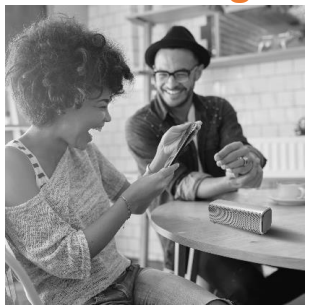
Worldwide adoption
Worldwide interoperability
Single Standard Worldwide

Bluetooth waves of innovation and standardization

solution

topology

audio streaming



wireless headsets
wireless speakers
in-car infotainment

data transfer

sports & fitness devices
health & wellness devices
peripherals & accessories

location services

point of interest
navigation & wayfinding
item & asset tracking

device networks

control systems
monitoring systems
automation systems

point-to-point

broadcast

mesh

Bluetooth continues to meet the expanding needs

audio streaming

data transfer

location services

device networks

New Features

LE Audio

Advert Enhancements

Higher Speed 2M PHY

Long Range Coded PHY

GATT Caching Enhancements

Direction Finding

Bigger Broadcasts (Advertising Extensions)

Mesh Networking

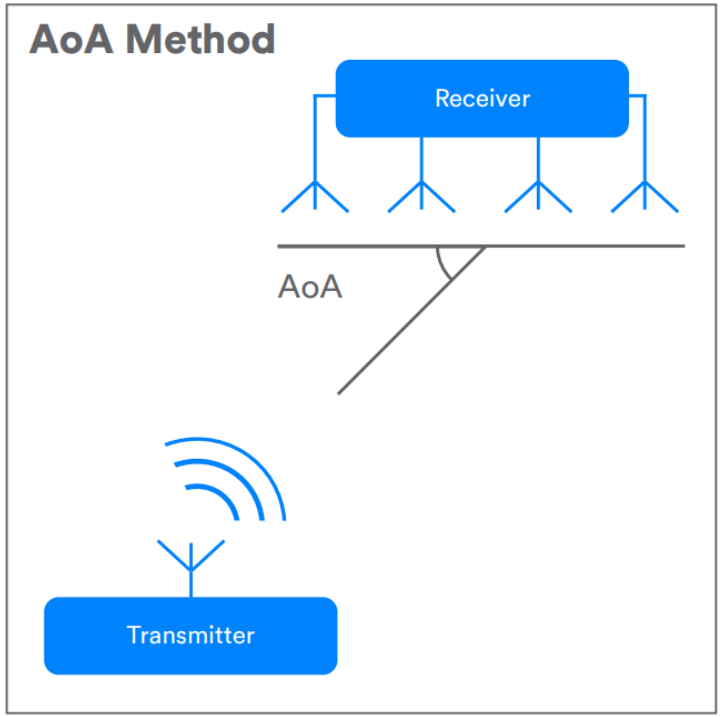
Advertising Enhancements

Direction Finding

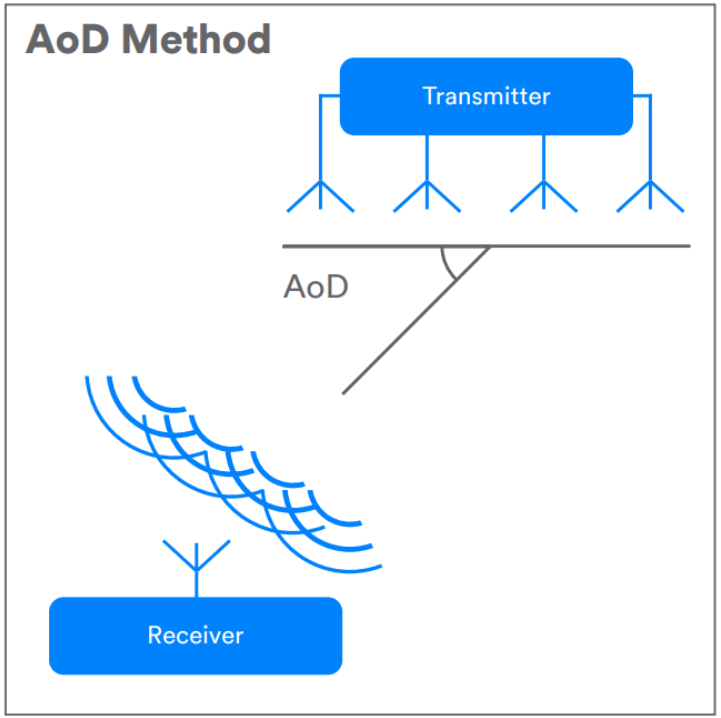
Introducing Bluetooth Direction Finding

- New optional 5.1 Core Spec feature enables determining the direction of a Bluetooth signal
- Enables development of Bluetooth proximity solutions that can understand device direction
- Enables development of Bluetooth positioning systems that can achieve down to centimeter-level accuracy

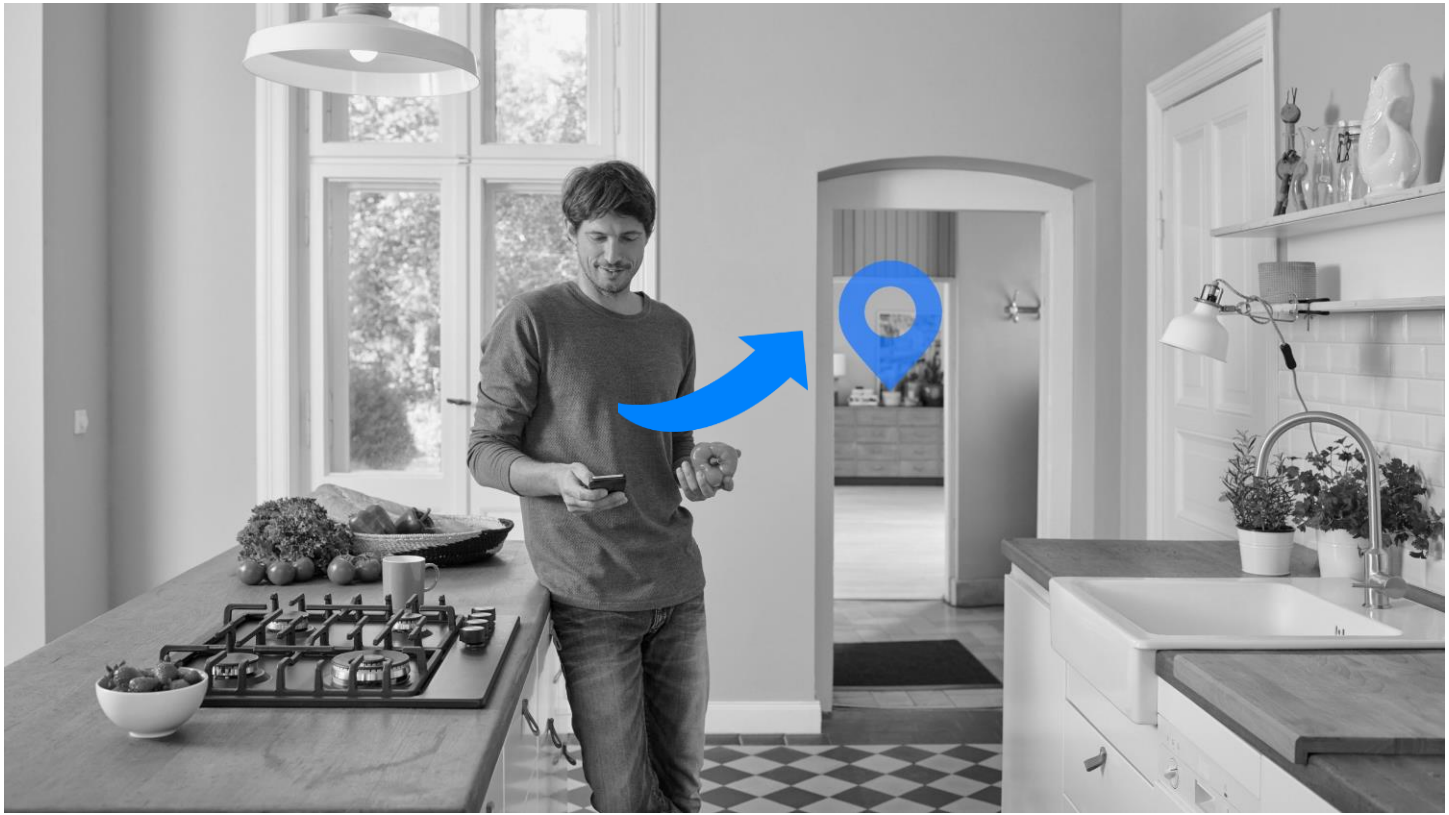
Bluetooth Direction Finding

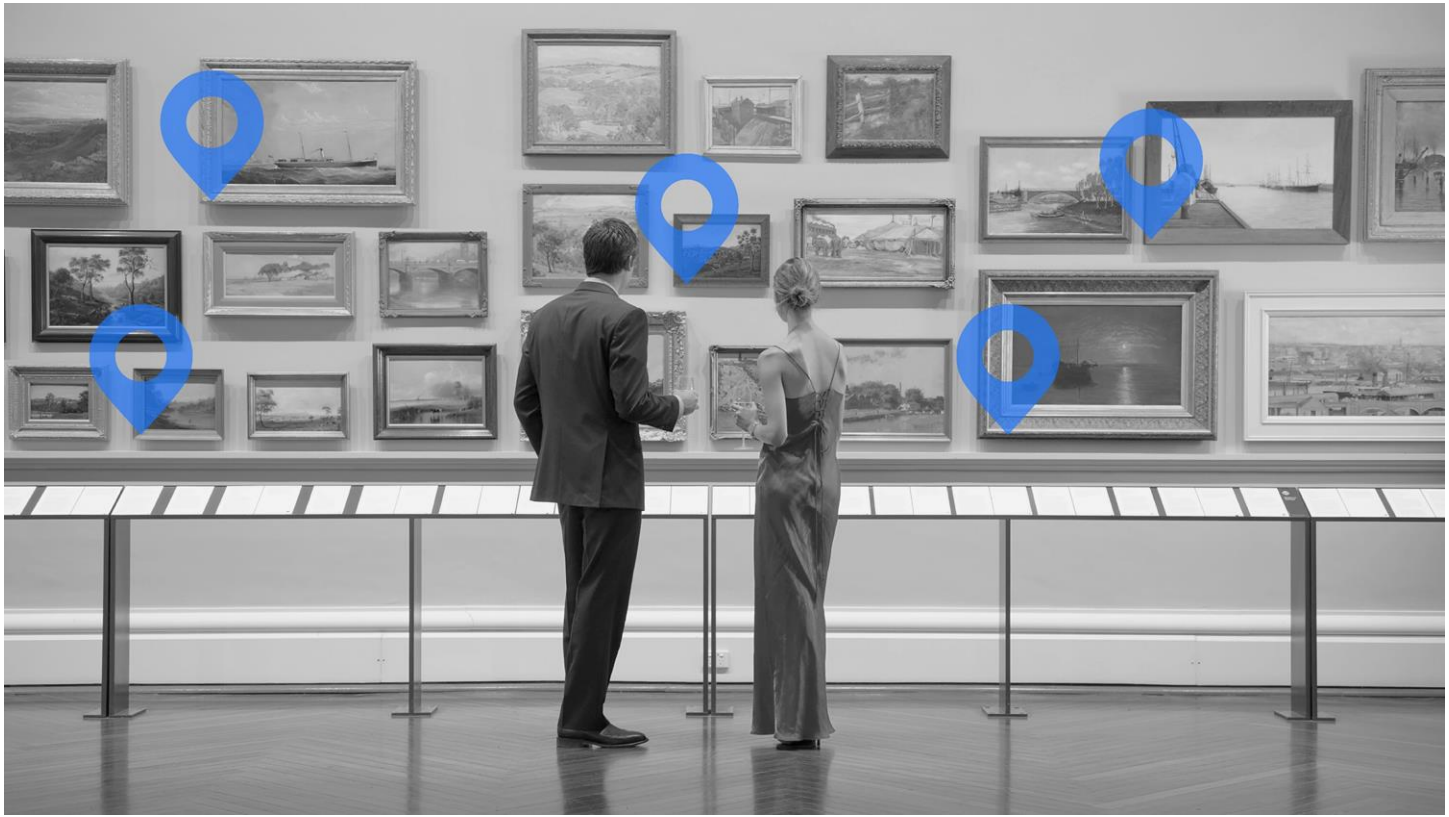


Bluetooth direction finding using angle of arrival (AoA)



Bluetooth direction finding using angle of departure (AoD)





Item Finding — A growing number of consumers are attaching Bluetooth tags to keys, wallets, purses, and other personal property to help them locate lost items.

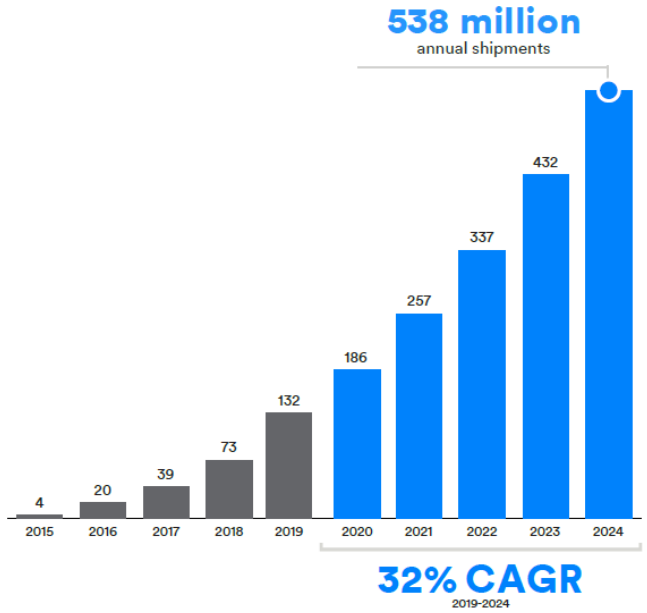
Asset Tracking — Bluetooth technology is powering rapid growth in real-time location system (RTLS) solutions used for tracking assets and inventory to increase productivity and reduce costs.

Wayfinding — Bluetooth indoor positioning systems (IPS) have quickly become the solution for indoor GPS, helping visitors navigate their way through complex facilities.

Access Control — Whether used to unlock cars or enhance workplace safety by controlling access to hazardous and critical industrial spaces, Bluetooth technology is replacing key fobs and key cards.

Bluetooth® Location Services Device Shipments

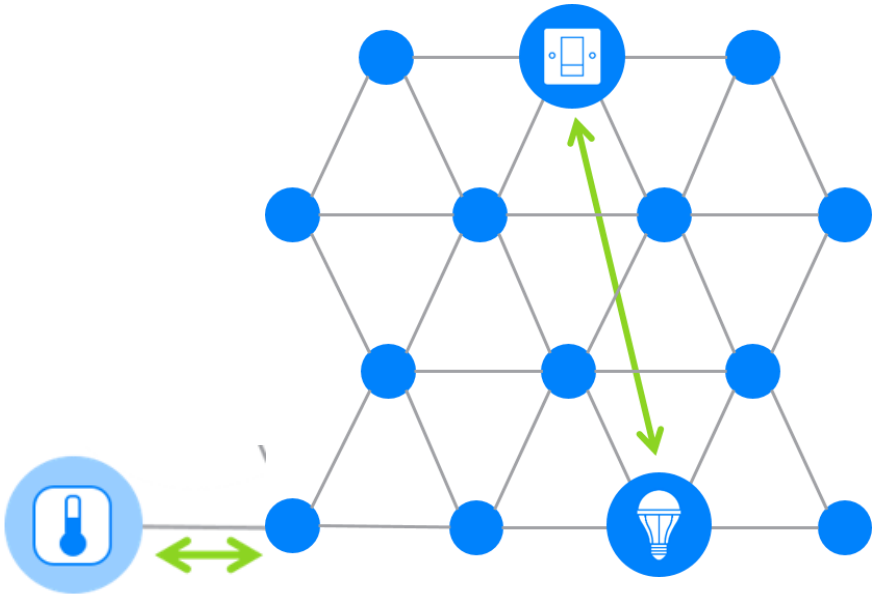
numbers in millions



Source: ABI Research, 2020

Bluetooth mesh

Bluetooth mesh is a **Commercial** and **Industrial** grade solution



Peer-to-peer communications

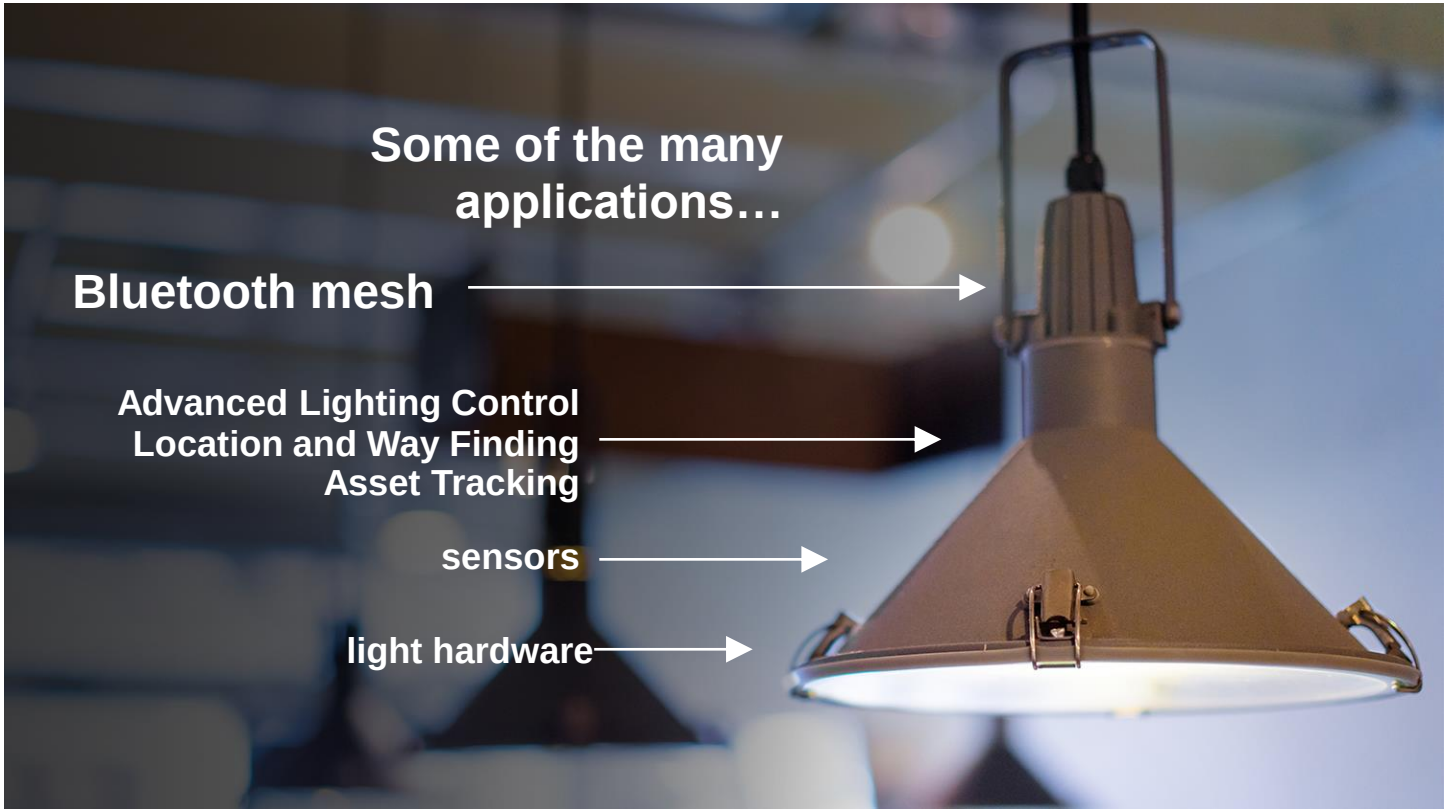
- Nodes communicate directly
- No hubs or routers
- No single points of failure
- Connection to IT networks is optional

Multipath and Multi-Hop

- Source node broadcasts message
- Nodes relay (optional) messages to destination
- Node failures do not impact delivery

Low Power Nodes

- Low power nodes find friend nodes
- Friend nodes cache LP node messages
- Wake up based on schedule or threshold


Some of the many applications…
Bluetooth mesh
Advanced Lighting Control
Location and Way Finding
Asset Tracking
sensors
light hardware


Lighting
Lighting
Air Conditioner
Station Occupancy
Ambient light sensor
Beacon
Curtain
Lighting
Lock & Access

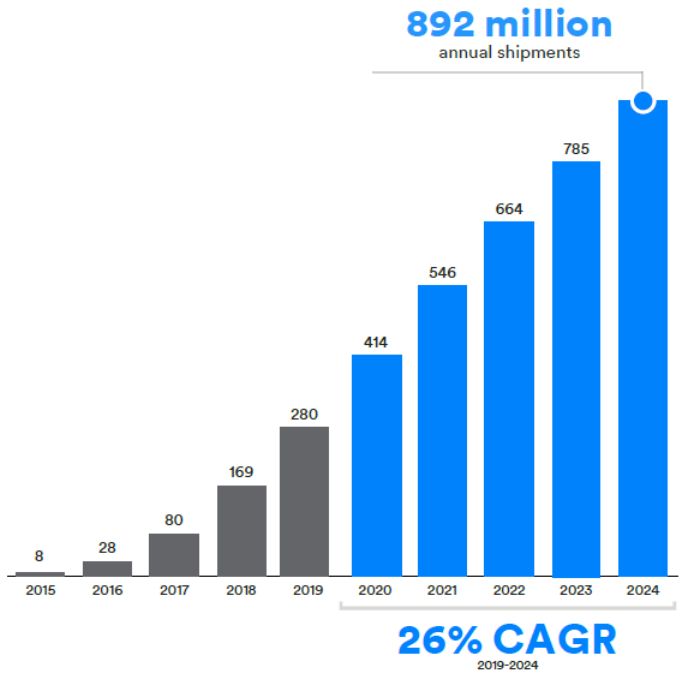
Automation Systems —Bluetooth technology enables the automation of a building's essential systems, including HVAC (heating, ventilation, and air conditioning), lighting, and security to harness energy savings, lower operating costs, and improve the life span of a building's core systems.

Control Systems — Bluetooth mesh networking is quickly being adopted as the wireless communications platform of choice in a number of control systems, including advanced lighting solutions for smart building and smart industry markets.

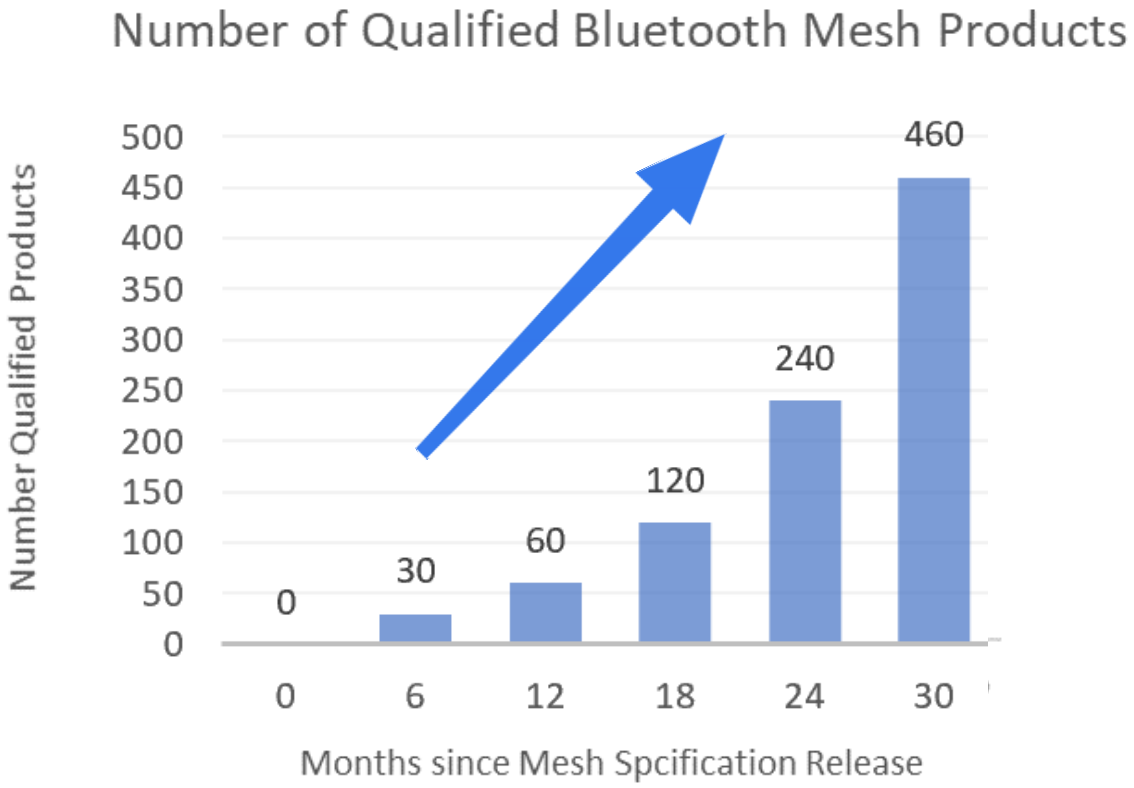
Monitoring Systems — Bluetooth wireless sensor networks (WSN) monitor environmental factors to improve employee productivity, lower operating costs, or reduce unplanned downtime of production equipment.

Bluetooth® Device Networks Device Shipments

numbers in millions



Source: ABI Research, 2020



New Smart Home Subgroup

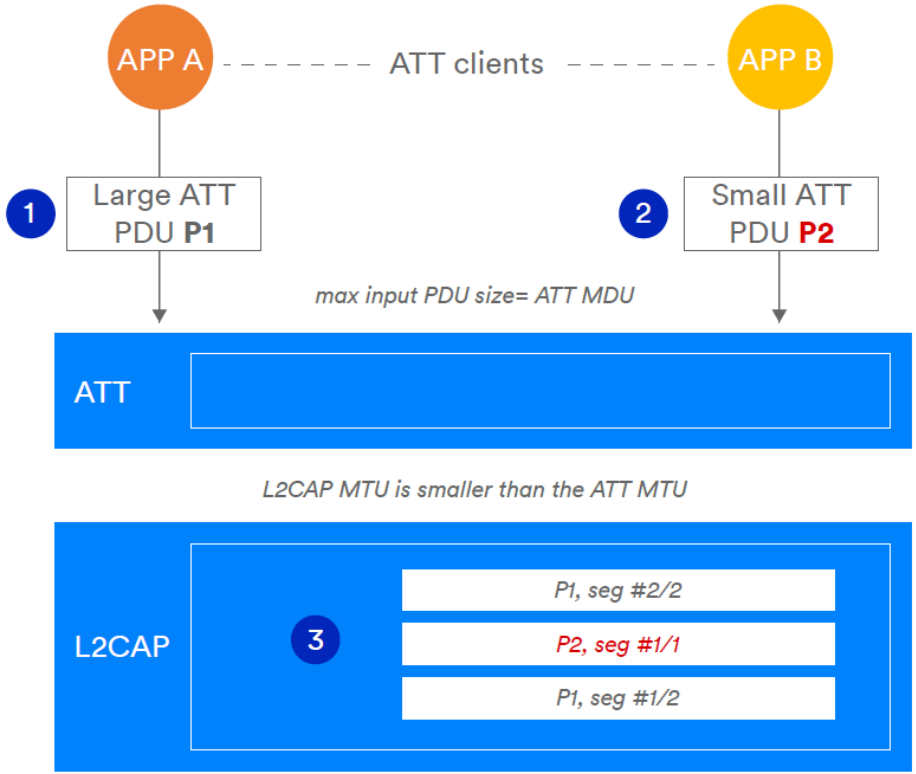
Chair: Dapeng (Max) Liu, Alibaba

New features introduced in Core Spec 5.2

- Enhanced Attribute Protocol (EATT)
- LE Power Control (LEPC)
- Isochronous Channels (ISOC)

Enhanced Attribute Protocol (EATT)

- Improved version of the Attribute protocol (ATT)
  - supports concurrent transactions
  - allows the interleaving of L2CAP packets relating to ATT packets from different applications.
  - ATT and L2CAP MTUs are independently configurable and may be reconfigured during a connection.



Enhanced Attribute Protocol (EATT)

Benefits

- Reduces instances where one application's use of the stack temporarily blocks that of another.
- Can reduce the end-to-end latency of one or more of the applications
- Improves the user's experience of responsiveness.

LE Power Control (LEPC)

- Provides Bluetooth LE devices with the ability to exercise power management by optimizing transmit power levels dynamically.
- Receivers can request a change in Tx power
- Transmitters may optionally change Tx power
- Power Control is not new in Bluetooth
  - used in the Bluetooth BR/EDR Controller to negotiate and adjust the transmission power level with each other.

LE Power Control (LEPC)

Benefits

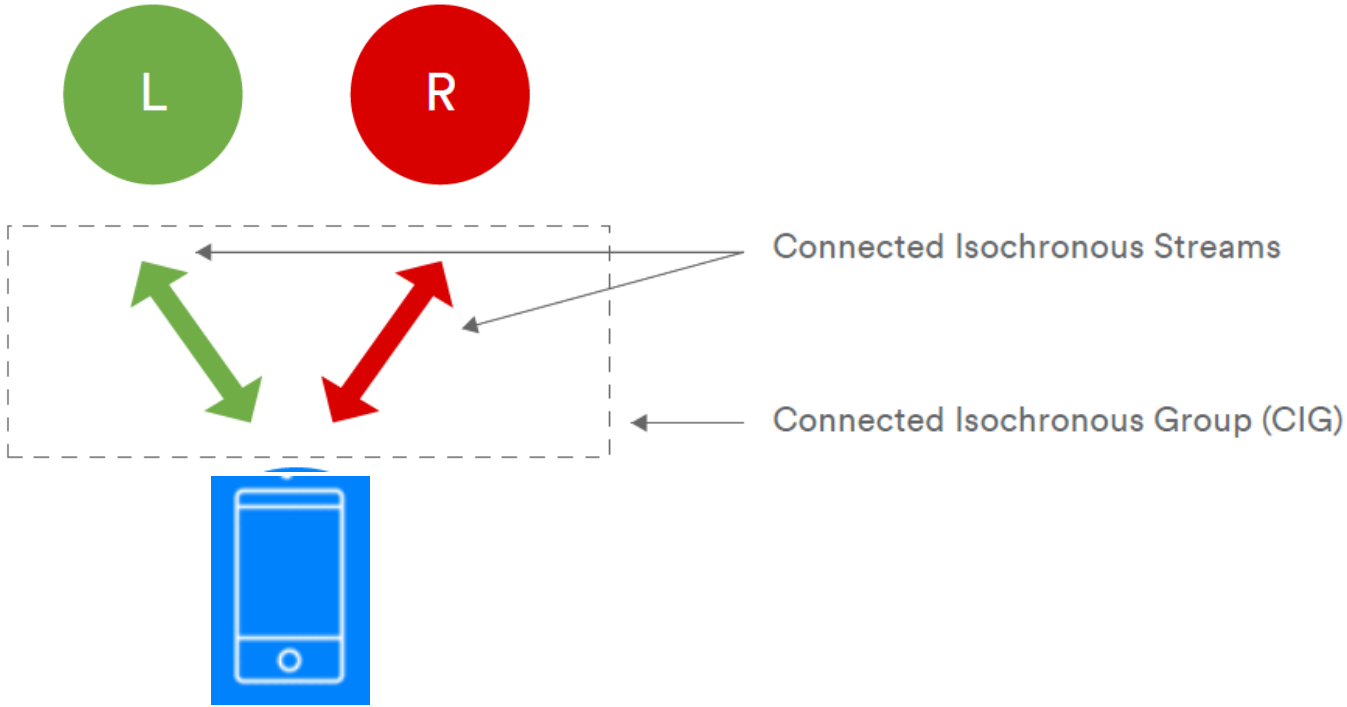
- Reduction of overall power consumption by transmitter
- Improves reliability through the active maintenance of receiver signal strength
  - stays within the optimal range supported by the receiver.
- Improved coexistence with other 2.4 GHz devices (e.g. WiFi)

Isochronous Channels (ISOC)

- Allows the communication of time-bound data to one or more devices for time-synchronized processing.
- Primarily designed to support LE Audio, the next generation of Bluetooth audio
- New physical channel (LE ISOC)
  - Works with existing LE PHYs (2M, 1M, Coded)
- Supports connection or connectionless (allowing broadcast to an unlimited number of devices) use cases

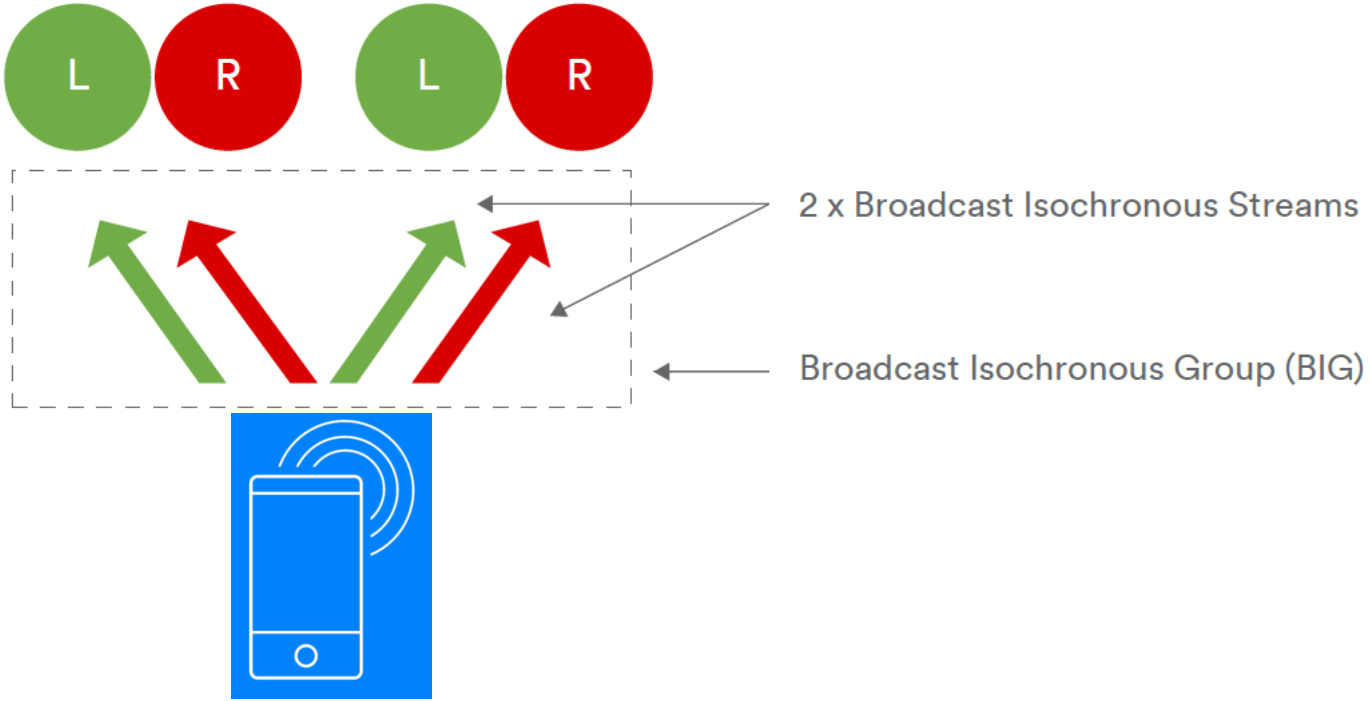
Isochronous Channels (ISOC)

Connection oriented *isoch streams and groups servicing Left and Right earbuds*



Isochronous Channels (ISOC)

Broadcast oriented *isoch streams and groups servicing Left and Right earbuds*



Isochronous Channels (ISOC)

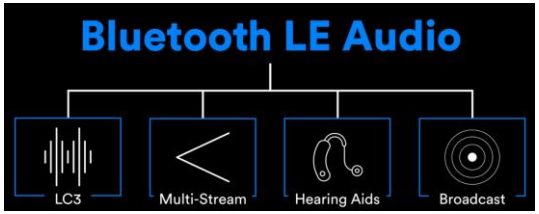
- **Benefits**
- Enables ***personal audio sharing***
  - transmit audio for synchronized playback by small, private groups of devices
- Enables ***public broadcast***
  - transmit audio to a large collections of devices of unlimited sizes in public spaces, such as cinemas.
- Offers a new standard for hearing aids and support assisted hearing systems in diverse locations, such as theaters, conferences, lecture halls, and airports.
  - multilanguage audio systems will become possible

LE Audio

LE Audio

The next generation of Bluetooth

- Bluetooth Low energy Radio
- Includes a new high quality, low-power audio codec (LC3)
- Multi-Stream
  - Multi-Stream Audio will enable the transmission of multiple, independent, synchronized audio streams
- Hearing Aids
  - Enables development that brings all the benefits of Bluetooth audio to people with hearing loss
- Broadcast Audio
  - New use case: Audio Sharing (personal or location based (public venues)



AUDIO SHARING

To learn more:

www.bluetooth.com/leaudio

Where to get more information on 5.2

- Exhibitors here at this seminar (experts and here in person)
- Ellisys staff
- Bluetooth.com “Resource” section
  - *Bluetooth Core Specification Version 5.2 Feature Overview*
  - *Bluetooth Core Specification Version 5.2*
  - *Bluetooth Market Update*
- Silicon vendors
- 35,000+ Bluetooth member companies (list available on bluetooth.com)

topology solution

Audio streaming

data transfer

location services

device networks

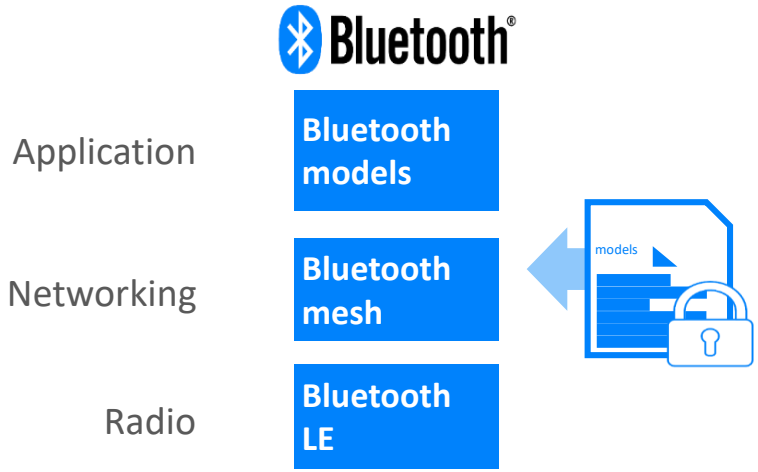
Applications and Solutions

point-to-point

broadcast

mesh

Bluetooth controls its future



Bluetooth controls the entire technology stack

Immutable models specifications

- Models define device behavior
- New definitions can be added, but NEVER eliminated

- **A light switch purchased today will be able to turn on a lamp purchased 30 years from now**
- **If your company and products are going to last 20-30 or more years, you want to pick a technology that will still be a around and innovating.**

Thank you!

Questions?

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