



Bluetooth[®] Seminar Series

Tools, Techniques, and Trends



Audio – Classic vs Bluetooth LE

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About Mindtree

Mindtree at a Glance



\$1 bn

Annual revenue



20,000+

Mindtree Minds



Top 7

IT company in India

73%

US

20%

Europe

7%

APAC



43

offices

17

countries

Enabling connectivity for IoT

Bluetooth LE

BlueLitE

v5.2 Silicon IP for
Bluetooth low energy

Bluetooth Mesh

v1.0.1 Software Profile for
Bluetooth low energy

IPv6

IPv6 Stack for node devices

Dual Mode/Classic

EtherMind

v5.2 Software Stack for
Classic and Bluetooth LE

BlueWiz Classic

v2.1+EDR Silicon IP
Classic Bluetooth Controller

BlueWiz Dual Mode*

v5.2 Silicon IP
Dual Mode Controller

802.15.4/ IEEE 11073

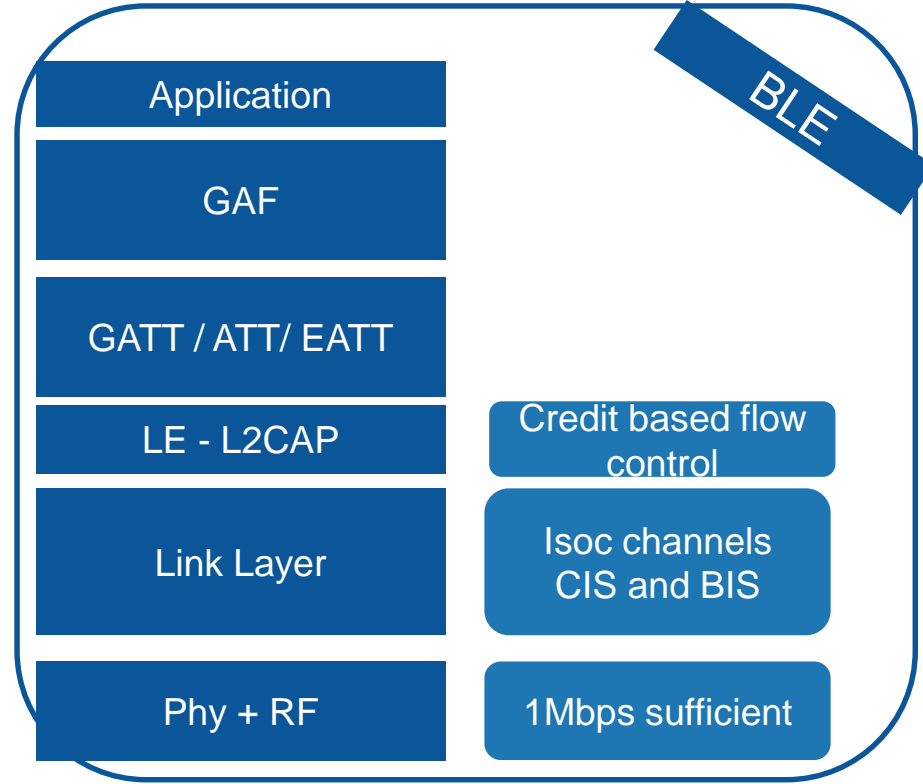
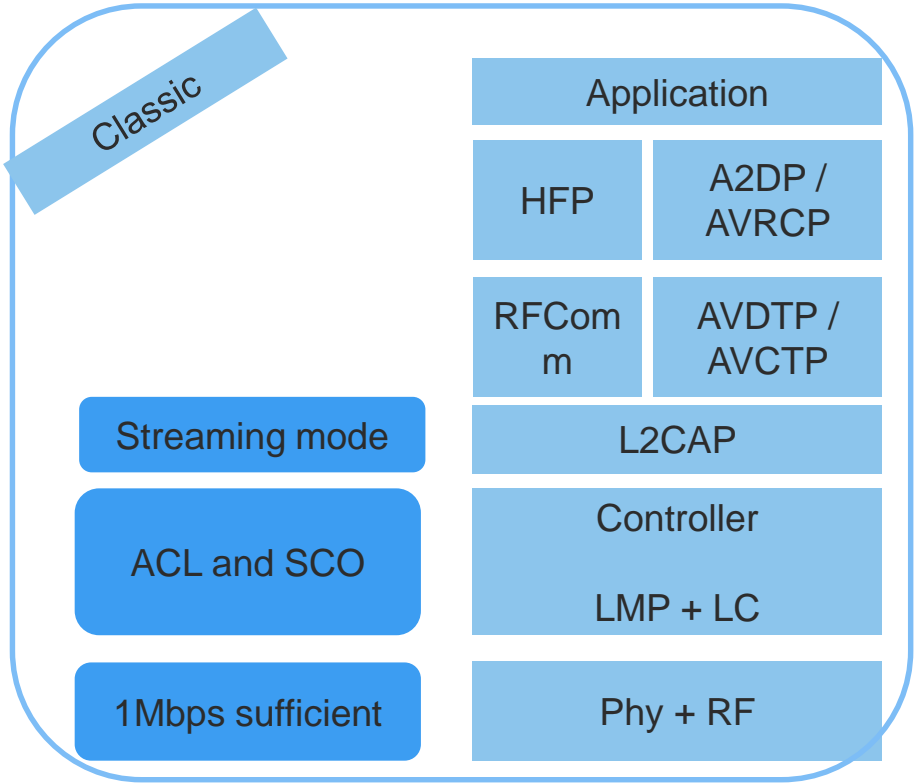
ThreadLitE

Silicon and Software IP for
802.15.4

**IEEE 11073 for medical
devices**

Professional Services: Engineering R&D, Testing, Cloud & Data

The Layers for Audio



A bit more about Classic

A2DP

Advanced Audio Distribution Profile

- Used to establish and manage audio stream for music streaming use cases. A2DP uses **AVDTP** (Audio Video Distribution Transport Protocol) as the underlying protocol layer.
- Negotiation of the choice of codec and codec parameters like sampling freq, block length.
- Has source and sink roles

AVRCP

Advanced Video Remote Control Profile

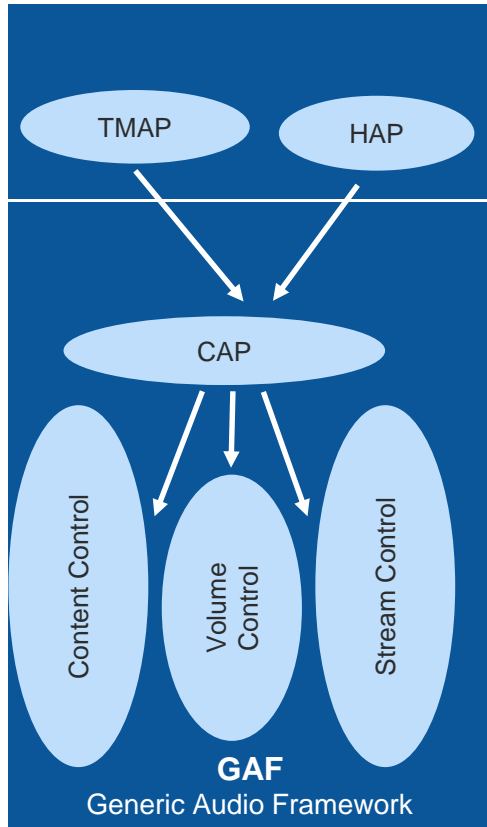
- Used to control media player. Uses **AVCTP** (Audio Video Control Transport Protocol) as the underlying protocol layer.
- Controls operations like play, pause, volume up / down, track change etc.
- Has controller and target roles

HFP

Hands Free Profile

- Used to realize Telephony related use cases. Uses **RFCOMM** (Radio Frequency communication) as the underlying protocol layer to provide reliable data stream.
- Used for call initiate / reject etc. Volume controls using AT cmds
- Has unit and gateway roles

A bit more about LE



- **Telephony and Media Audio Profile(TMAP):** This is top level profile for Telephony and Media Audio use case. It specifies configurations, settings of the parameters and procedures defined CAP.
- **Command Audio Profile(CAP):** Defines procedures that coordinates with Content Control & Stream Control profiles to realize a given use case.
 - CAP is the highest layer specification in the GAF, it references all the Content Control Profile & Stream Control Profiles to realize a given use case.
- **Content Control Profiles / Services:** *Main functionality is to control the content. Ex media player control*
 - Call Control Profile(CCP) & Telephone Bearer Service(TBS).
 - Media Control Profile(MCP) & Media Control Service(MCS).
 - MIC Control Profile(MICP) and MIC Control Service(MICS).
- **Stream Control Profile/Services:** Main functionality (i) Expose and Discover the Audio Capabilities (ii)Configure, Control and manage the LE isochronous channels for a given use case
 - Basic Audio Profile(BAP).
 - Audio Stream Control Service (ASCS).
 - Published Audio Capabilities Service(PACS).
 - Broadcast Audio Scan Service(BASS).
 - Coordinated Set Identification Service(CSIS) & Coordinated Set Identification Profile(CSIP)
- **Volume Control Profiles/Services:** Volume Control Profile(VCP) & Volume Control Service(VCS), Volume Offset Control Service(VOCS) and Audio Input Control Service(AICS).

Use Cases

Commonly Supported

Streaming Audio

SBC is the mandatory codec, other codec support can be negotiated using A2DP



LC3 is the only codec. Provision for Vendor codec

Handles both control and Data Path Signaling and Media Channels

A2DP

AVDTP

L2CAP

Asynchronous Connection Less (ACL) Connection

Controller
LMP + LC



GAF

GATT / ATT/
EATT

LE - L2CAP

Link Layer

Control path using BAP, ASCS, PACS, BASS

Data Path using Isoc channels - CIS

Streaming Audio – Media Player Control

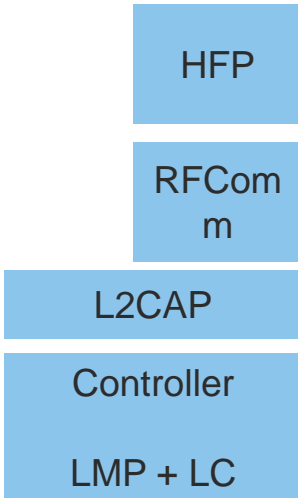


Telephone Audio

mSBC for wideband speech, CVSD for narrow band speech

- AT Commands for call control
- Volume control for mic and speaker through BT specific AT cmds

Synchronous Connection Oriented (SCO)



LC3 is the mandatory codec (Same as streaming audio) including super wideband speech

GAF

GATT / ATT / EATT

LE - L2CAP

Link Layer

- Call control using TBS/CCP
- Volume control using VCS/VCP, AICS, VOCS
- Integration with Skype, WhatsApp etc easier

Isoc channels - CIS

Use Cases

LE Specific

True WireLess (TWS)



- There no standardized methods for achieving this use case in Classic BT
- Proprietary methods are being used
 - Sniffing
 - Relay
 - Source side modifications

LC3 is the same codec for streaming

GAF

GATT / ATT/
EATT

LE - L2CAP

Link Layer

- Same profiles for Streaming Audio / Media Player / Telephony audio as detailed earlier

Isoc channels – 2x CIS
In the same CIG

Broadcast Audio



- There no standardized methods for achieving this use case using Classic BT
- Realization of the use case is non-trivial effort

LC3 is the same codec

GAM

GATT / ATT/
EATT

LE - L2CAP

Link Layer

- Selected set of the profiles are used
 - BAP, ASCS, BASS

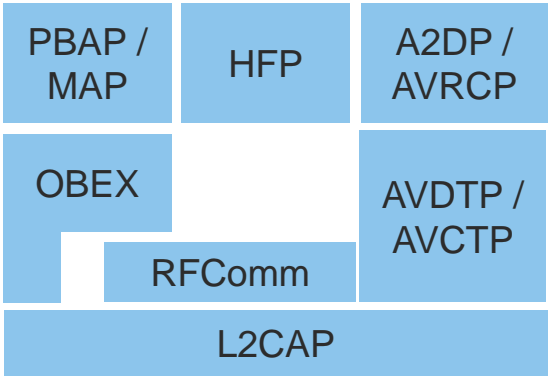
Isoc channels – BIS
Sync over Periodic Adv

Use Cases

Classic Specific

Phone Book Access

- Same set of profiles for streaming audio, telephone audio and media player control.
- OBEX (Object Exchange) over RFCOMM or L2CAP
- Phone Book and Message Access



No standard based support yet.

What does the future hold for us



- Audio over BLE addresses many popular use cases which are not possible in Classic.
- Audio over BLE needs to be proven in the market for large scale adoption.
- Since the specifications are still evolving, so more use cases (supported only by classic) can be addressed in due course.
- Automotive market will be the long pole in determining if and when Classic audio will sunset.



Thank you!

Questions?

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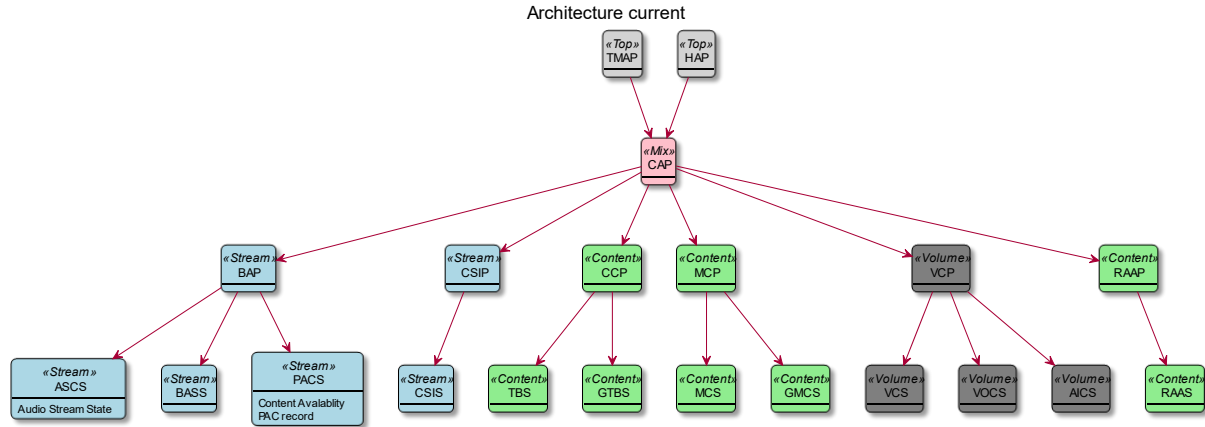
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Current Architecture



New Architecture

