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Wireless Technology in Hearing Aids

Eric Branda, AuD, PhD

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Risks/Benefits

- The applicability and accuracy of the course content may vary by the clinical, geographical, and cultural context; you should evaluate the course accordingly.
- As healthcare is rapidly evolving, new findings may change the validity of the information presented in this course. Providers should always consult the latest research and guidelines from professional associations.
- The interventions discussed in this course may be limited in generalizability, requiring practitioners to consider specific individual and population factors.
- The course may not cover all possible risk factors, diagnostic methods, or treatment options, and complex cases may require additional considerations.
- Healthcare providers should apply cultural competence and sensitivity to ensure effective and respectful care based on their patients' diverse needs.
- Providers should always evaluate the limitations of diagnostic and screening tools, considering their potential for false results as well as any ethical implications.
- It is the responsibility of course participants to critically evaluate the evidence from multiple sources to guide professional practice.



Learning Outcomes

After this course, participants will be able to:

1. identify different wireless technologies used in hearing aids.
2. describe the advantages of popular wireless technologies in hearing aids.
3. describe the limitations of some wireless technologies in hearing aids.



Wireless Technology in Hearing Aids



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Disclosure: I have the following relevant financial relationship in the products or services described, reviewed, evaluated or compared in this presentation.

I am the Director of Hearing Technology and Research for WS Audiology, for which I receive a salary. I have no relevant nonfinancial relationship(s) to disclose.



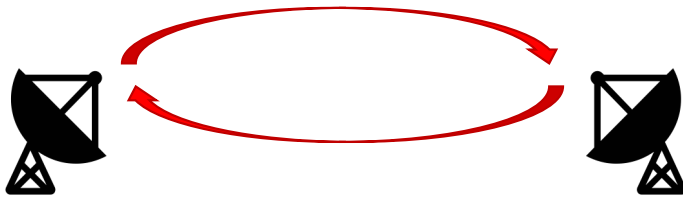
History of Wireless

- Attributed to Guglielmo Marconi in the 1890's
- British Patent number 12039 titled "Improvements in Transmitting Electrical impulses and Signals, and in Apparatus therefor"
- First message "Are you ready" sent over a distance of 3 miles



Basic Wireless Transmission

- Simplest transmission consists of two parts:
 - Transmitter
 - Receiver
- Typically sent along a particular frequency within a designated frequency band (i.e. 2.4 GHz)
- Information is sent along in the transmission frequency



Marshall Brain & Talon Homer "How Radio Works" 7 December 2000.
HowStuffWorks.com. <<https://electronics.howstuffworks.com/radio.htm>> 19 February 2025



ISM Radio Bands

- Industrial, scientific and medical (ISM) radio bands
- Regulated by the FCC
- Reserved internationally for the use of radio frequency (RF) energy for purposes other than telecommunications
- Frequency bands have specific designations



Wireless in Hearing Aids

- Two primary wireless approaches for hearing instruments
 - Near Field Magnetic Induction
 - 2.4 GHz Wireless Technology



Near Field Magnetic Induction

- Near-Field Magnetic Induction (NFMI) is a short range wireless physical layer that communicates by coupling a tight, low-power, non-propagating magnetic field between devices
- Introduced to hearing aids in 2004
- The concept is for a transmitter coil in one device to modulate a magnetic field which is measured by means of a receiver coil in another device
- Short range – less than 2 meters
- Commonly used carrier frequency of 13.56 Mhz

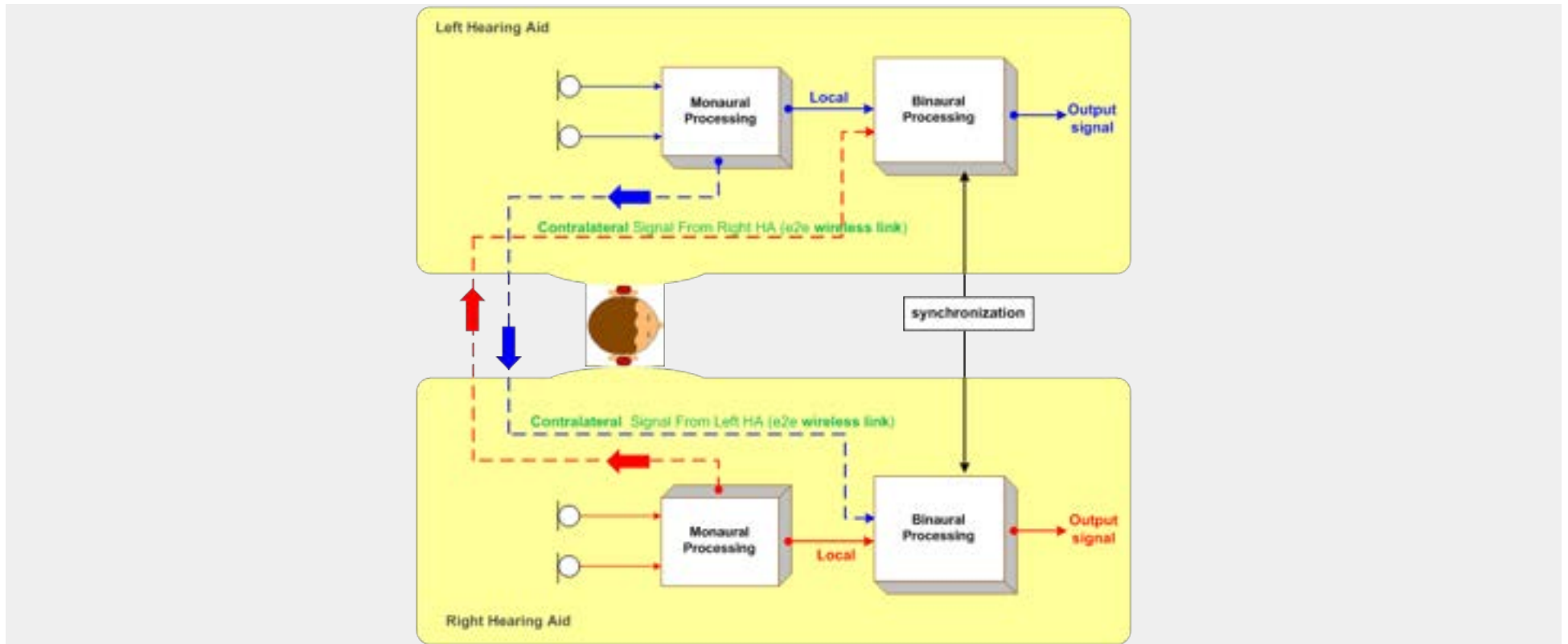


Near Field Magnetic Induction Applications

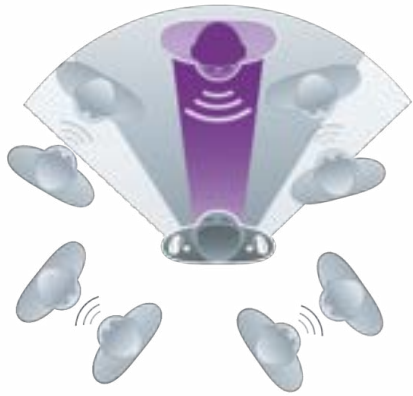
- Due to short transmission range, used mainly for instrument-to-instrument communication
- Drives bilateral synchronization between devices
- Provides high quality signal transfer between devices
- Each device can process data from both devices



Wireless Transmission Between Devices

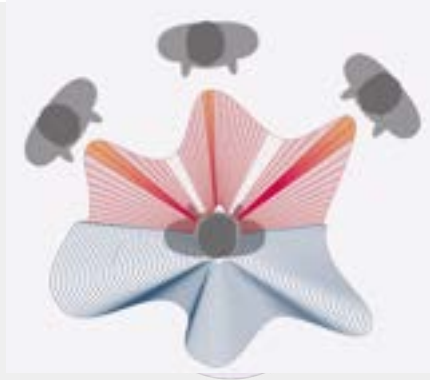


Near Field Magnetic Induction Examples



Narrow Directionality

- Wireless transfer between instruments for enhanced directionality
- Automatically adjusts based on environment
- Better than normal hearing in cocktail-party-like situations



RealTime Conversation Enhancement

- Analyzes, Augments and Adapts to multiple talkers
- Considers aspects such as talkers, communication dynamics, distance, and noise level



OneMic Directionality

- Directionality achieved with single microphone instruments
- Wireless transmission between ears for directional pattern



Near Field Magnetic Induction

- Benefits
 - Low cost
 - Energy efficient
 - Propagates through body and water
- Challenges
 - Short range for transmission





2.4 GHz
Wireless
technology

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2.4 GHz Wireless

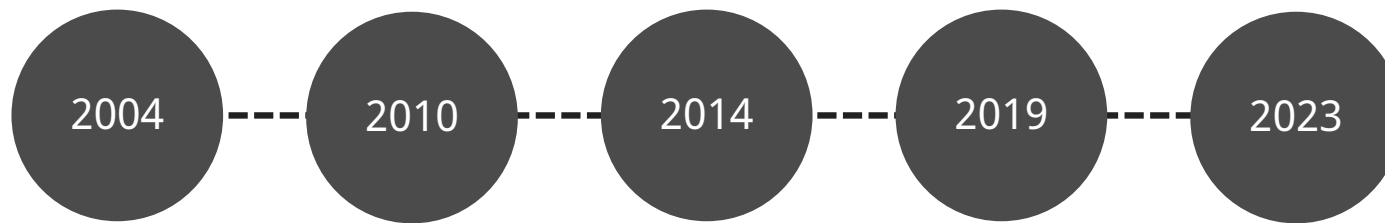
- 2.4 GHz is a commonly-used ISM band (2.4 to 2.4835)
- Transmission distances can vary based on power and obstacles
- Used for applications such as phones, WiFi, and microwave ovens
- Frequency hopping is often used to provide secure transmission



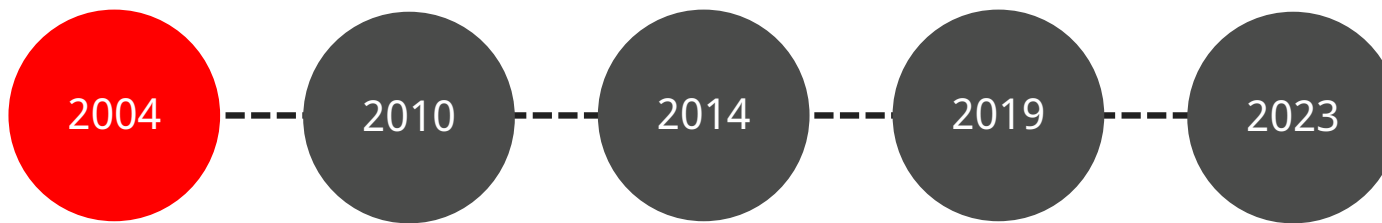
Bluetooth®



History of Bluetooth



History of Bluetooth



Bluetooth
Classic





2004

Bluetooth Classic

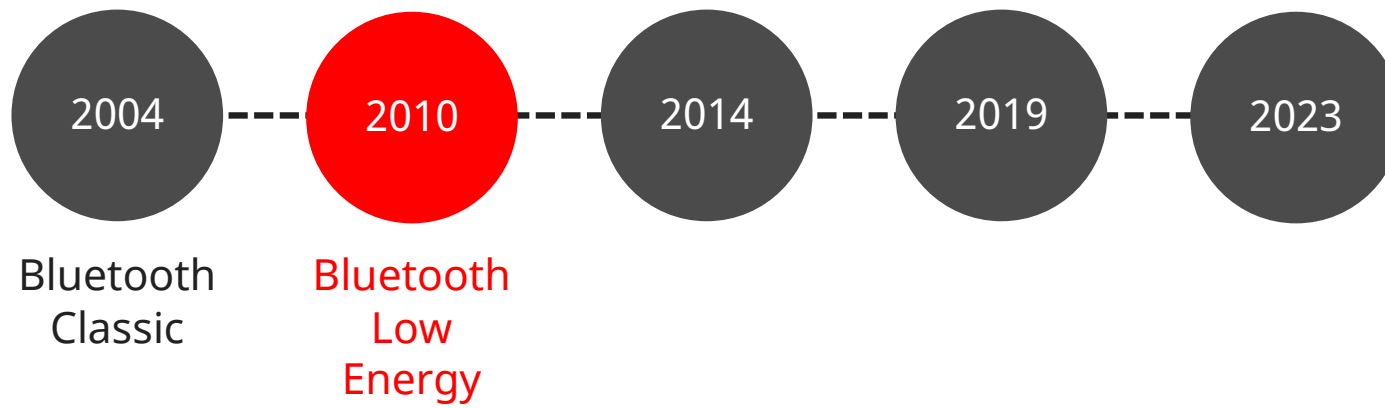
Official Bluetooth audio streaming protocol
Made for mobile calling with monaural headsets

- ✓ Streams to all Bluetooth devices (MFA)
- ✓ Most mobile phones support this protocol
- ✓ Hands free calling
- ✗ High power consumption
- ✗ No broadcasting possibility

Bluetooth Classic was not designed for hearing aids



History of Bluetooth



2010

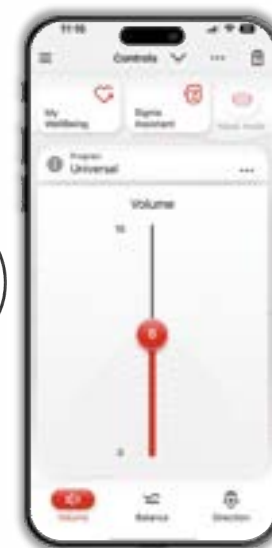
Bluetooth
Low Energy

Nx

X

AX

IX



2010: Bluetooth Low Energy

Bluetooth Specification 4.0 – Bluetooth Low Energy

- Also known as Bluetooth Smart, Bluetooth LE, BLE

Aimed at novel applications in the healthcare, fitness, security and home entertainment industries

- Short information packages and short time → reduce power consumption

- **NO audio streaming protocol available**



2013

Bluetooth SIG announced development of a Low Energy protocol for streaming Audio...



Bluetooth Low Energy

2013

The Bluetooth SIG announced development of an audio streaming standard for Bluetooth Low Energy

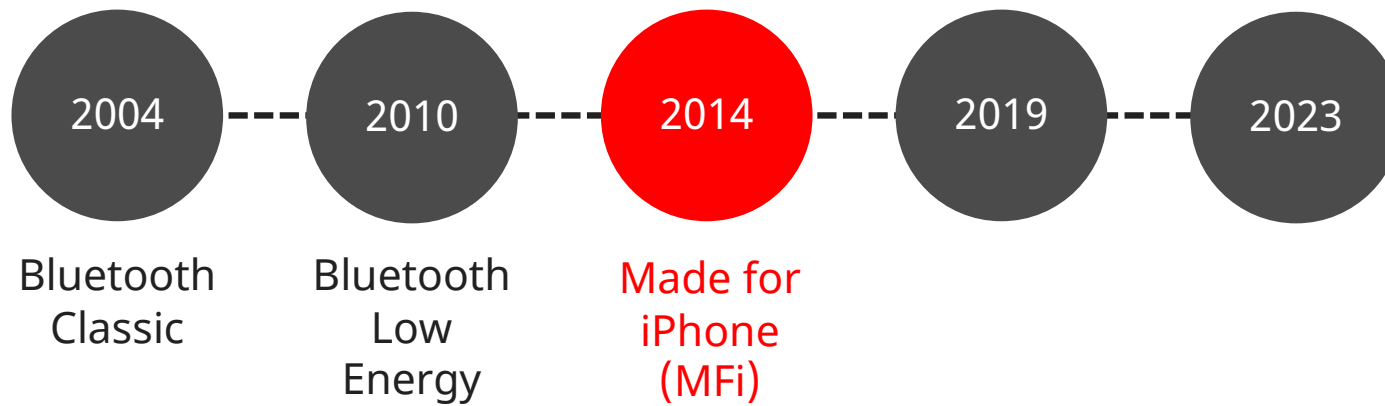


2023

LE Audio development is finished



History of Bluetooth





2014

Made for
iPhone
(MFi)

Nx

X

AX

IX

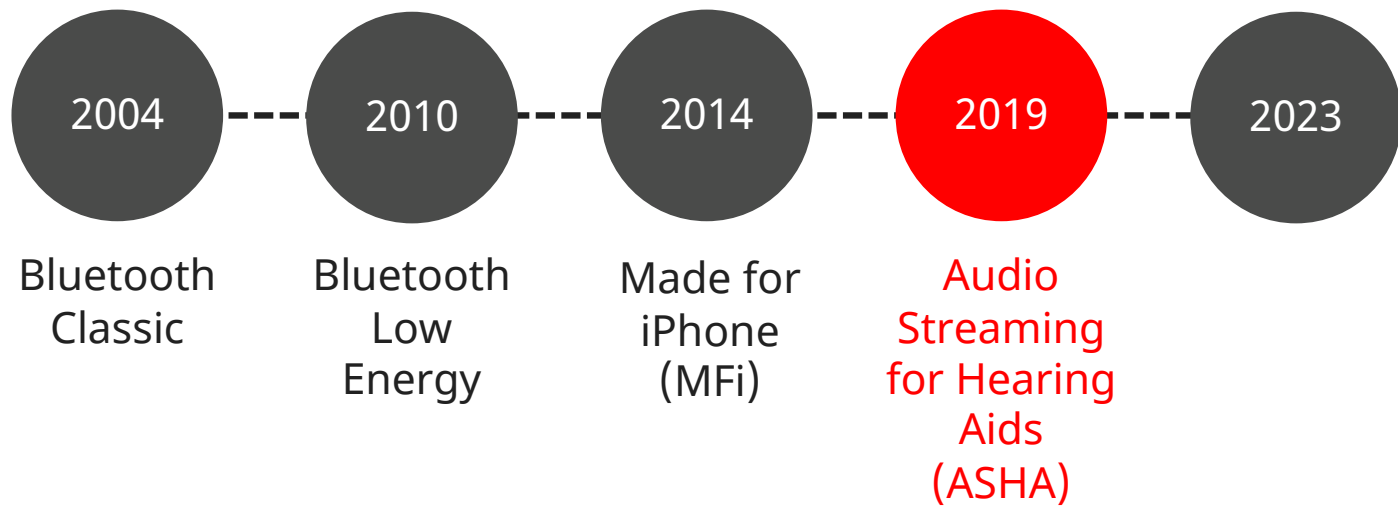


Bluetooth standard created by Apple

- ✓ Direct stereo streaming
- ✓ Significantly lower power consumption
- ✓ User-friendly integration into Apple ecosystem
- ✗ Only for Apple devices



History of Bluetooth





2019

Audio Streaming for Hearing Aids (ASHA)

Nx

X

AX

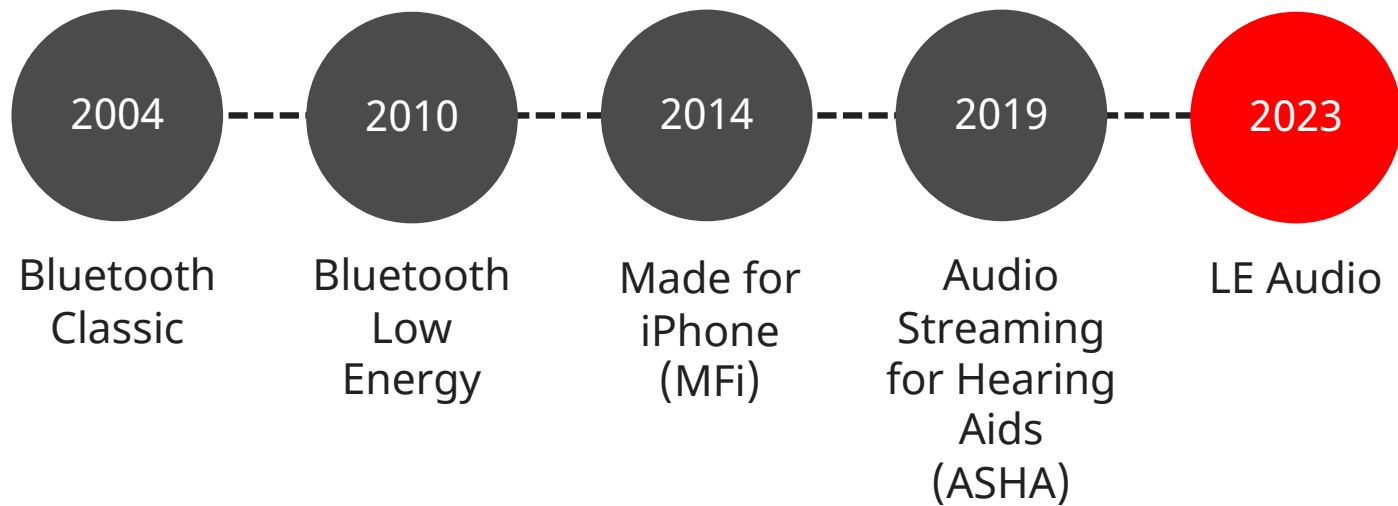
IX

Not an official protocol from Bluetooth SIG

- ✓ Low energy streaming of audio
- ✓ Low energy control of hearing aid
- ✗ No hands-free calling
- ✗ Limited availability in Android phones



History of Bluetooth





LE Audio



The official Bluetooth Low Energy protocol for audio transmission

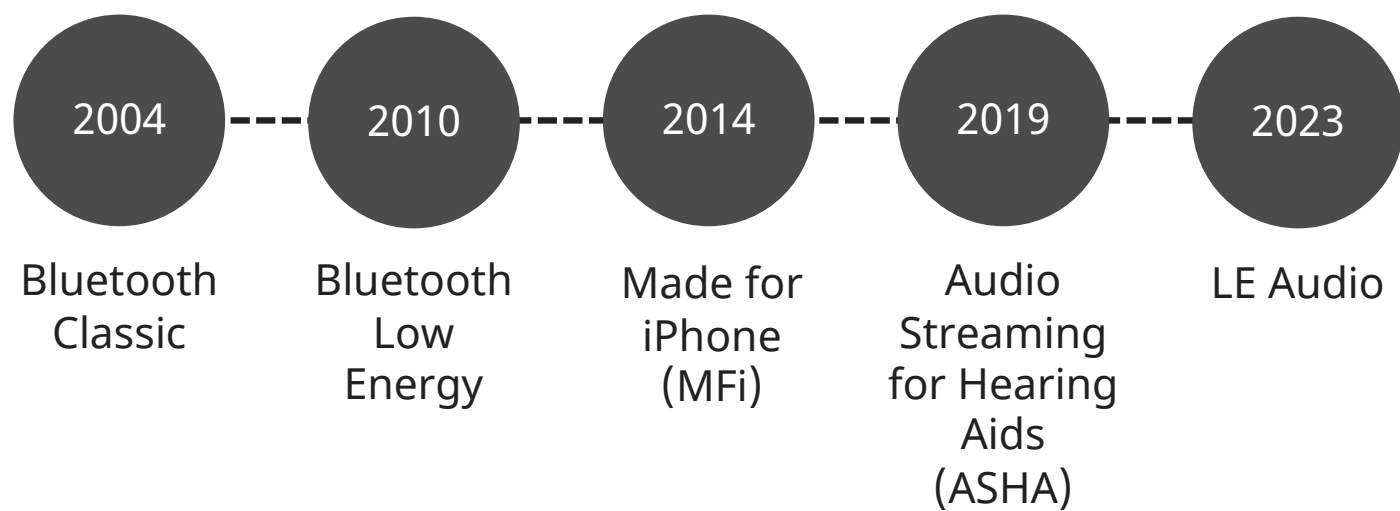


- ✓ Low energy audio streaming
- ✓ High quality, low latency audio
- ✓ Full support of hands-free calling
- ✓ Optimized for hearing aids
- ✓ Broadcasting possibility
- ✗ Still low market penetration

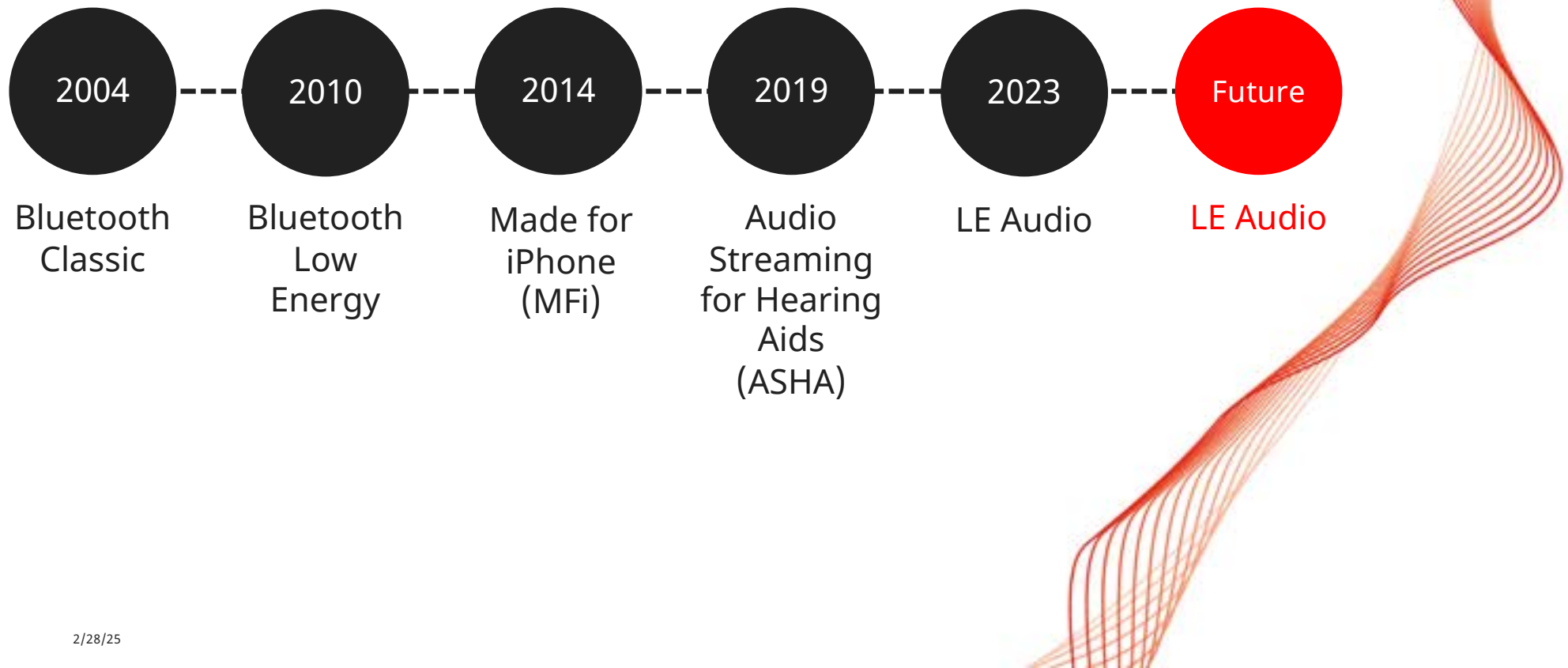
Will be implemented in consumer devices (phones, TVs, laptops, etc.)

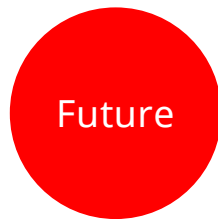


Where we are today



Future of Bluetooth





LE Audio

A series of thin, wavy, orange-red lines that flow from the bottom left towards the top right, creating a sense of movement and connecting the different elements of the slide.

3
BILLION

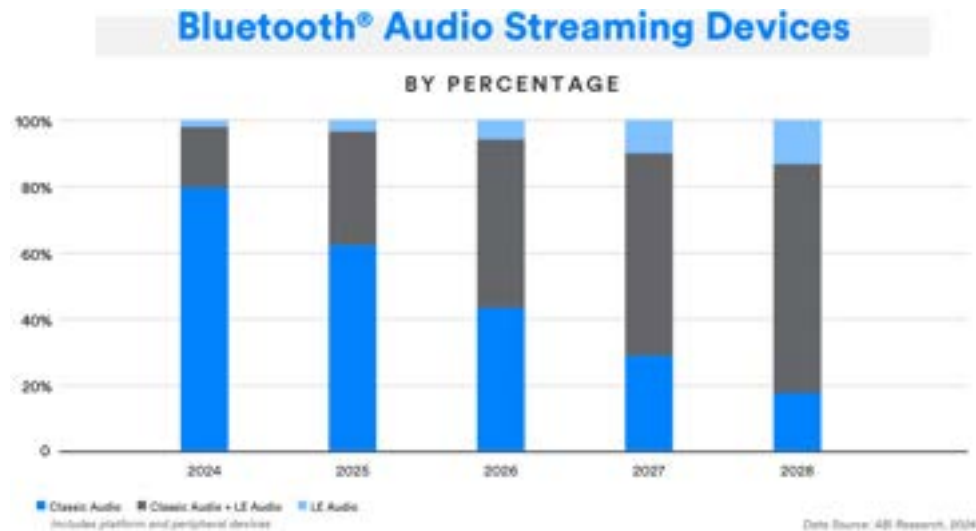
LE Audio-enabled devices
will ship annually by 2027



90%
of new smartphones will
support LE Audio by 2027



Future of LE Audio and Market Penetration



Forecast by Bluetooth SIG
([Bluetooth SIG 2024 Market Update](#), Section "Audio Streaming")

- Penetration of LE Audio will take time
- Penetrations dependence on different markets and regions
- Alternatives continue to be MFi and Classic, ASHA is predicted to decline



AURACAST™

A BLUETOOTH® TECHNOLOGY

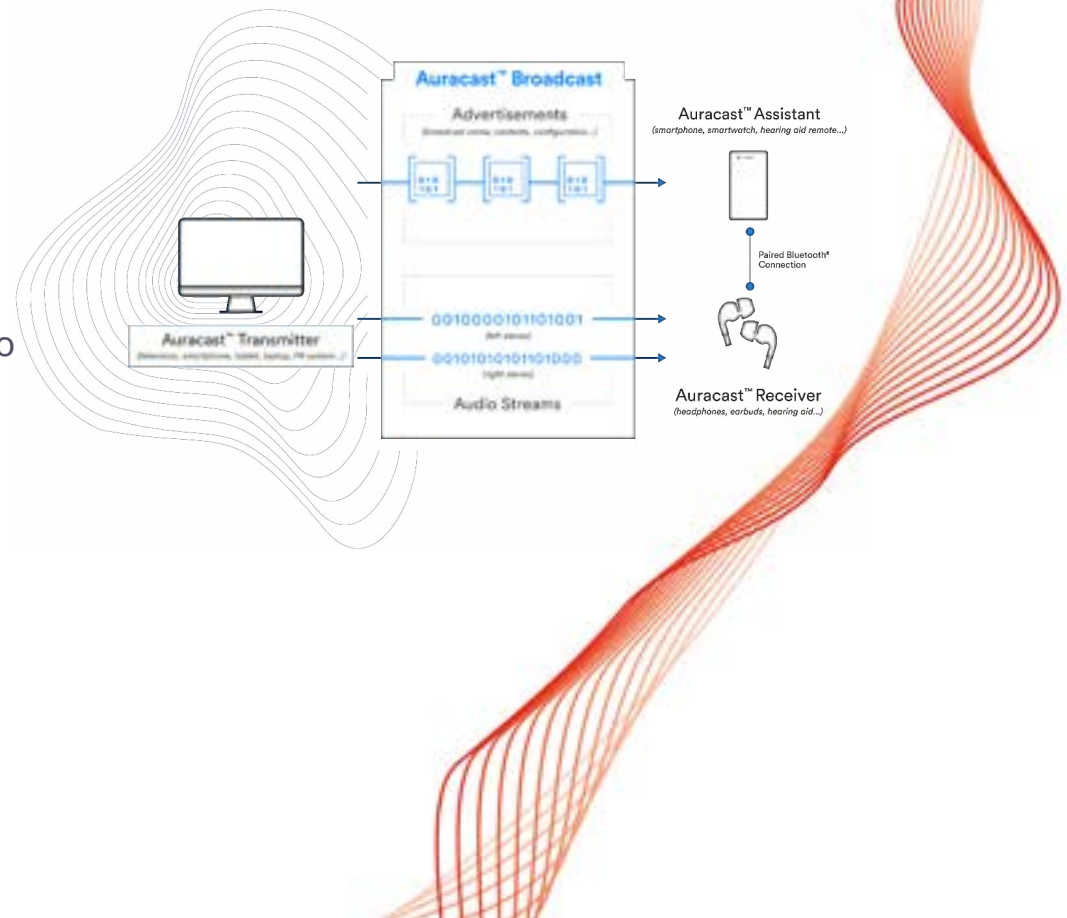


What is Auracast™?

Auracast is a brand – a logo

Auracast is built on top of LE Audio with additional functionality for **broadcasting**

An audio source device can broadcast one or more audio streams to an unlimited number of audio sync devices



Finding the Right Solution

- With so many wireless solutions, what is right for the patient?
- Identify patient needs for things such as phones, home entertainment and public venues
- The right solution meets those needs without compromising on performance



Signia BCT IX

- **Bluetooth® Classic** - provides universal connectivity
- **T-coil** – better hearing in challenging environments
- **Exceptional battery life** – All day wear time
- **LED** – confirms power on status
- **Serial number viewing window** – easy identification
- **Optional on-the-go charging case** – portability & convenience
- **Full audiological power of IX** – keeps you in the conversation



Signia Pure C&G T IX

- **BTLE & BTLE Audio** – Supports latest in connectivity
- **T-coil** – better hearing in challenging environments
- **Exceptional battery life** – All day wear time
- **Optional on-the-go charging case** – portability & convenience
- **Full audiological power of IX** – keeps you in the conversation



Conclusion

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Wireless Technology in Hearing Aids

- Wireless communication is now a standard part of most hearing aids
- Different wireless protocols achieve different goals for hearing aid performance
- Understanding the different types of wireless protocols as well as their strengths and weaknesses can help in better serving our patients





Thank you

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