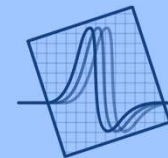


Wearables, Hearables and Hearing Health

Alexander Goldin, Ph.D.

Alango Technologies, Ltd. - Founder and CEO

Haifa Digital Health 16 Jan 2017



A L A N G O

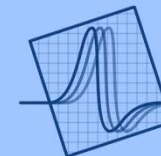
Technologies and solutions

About Alango

- DSP software technologies for voice, audio and hearing enhancement
- Offices
 - 35 people
 - HQ, R&D: Haifa (Israel), R&D: St. Petersburg (Russia)
 - Representatives: China, Korea, Singapore, Taiwan, Japan
- Over 30 million product licenses and growing fast
- Automotive, mobile and accessories, conferencing, assistive listening



Since 2002





Hearing health facts

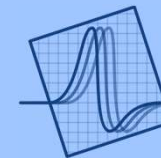
About hearing loss

- 14-17% (more than 700M) people worldwide have hearing loss (2015)
- The number of hearing impaired people is growing twice as fast as the general population

About hearing aids

- 95% of hard of hearing people can be helped by hearing aids
- In developed countries only 15-20% of people with hearing loss use hearing aids
- In developing countries only 1 in 40 of those who need it have access to hearing aids
- Hearing aids sales are stagnating for the past several years

Q: Why ?



4 Reasons ... (at least)

1. Extremely high cost due marketing & distribution

- Hearing aid makers spend (per device):
- \$250 on manufacturing + \$250(!) on marketing + \$75 on R&D = \$575
- Top-of-the-line devices are sold by audiologists for \$3000-\$5000

2. Hearing aid is a medical device

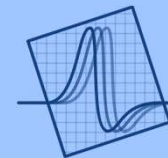
- Associated with elderly or handicapped people (hearing aids stigma)
- About half of people with hearing loss avoid seeking help

3. Limited functionality

- Mainly hearing amplification
- Limited connectivity
- Limited frequency range (300-7000Hz)

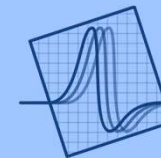
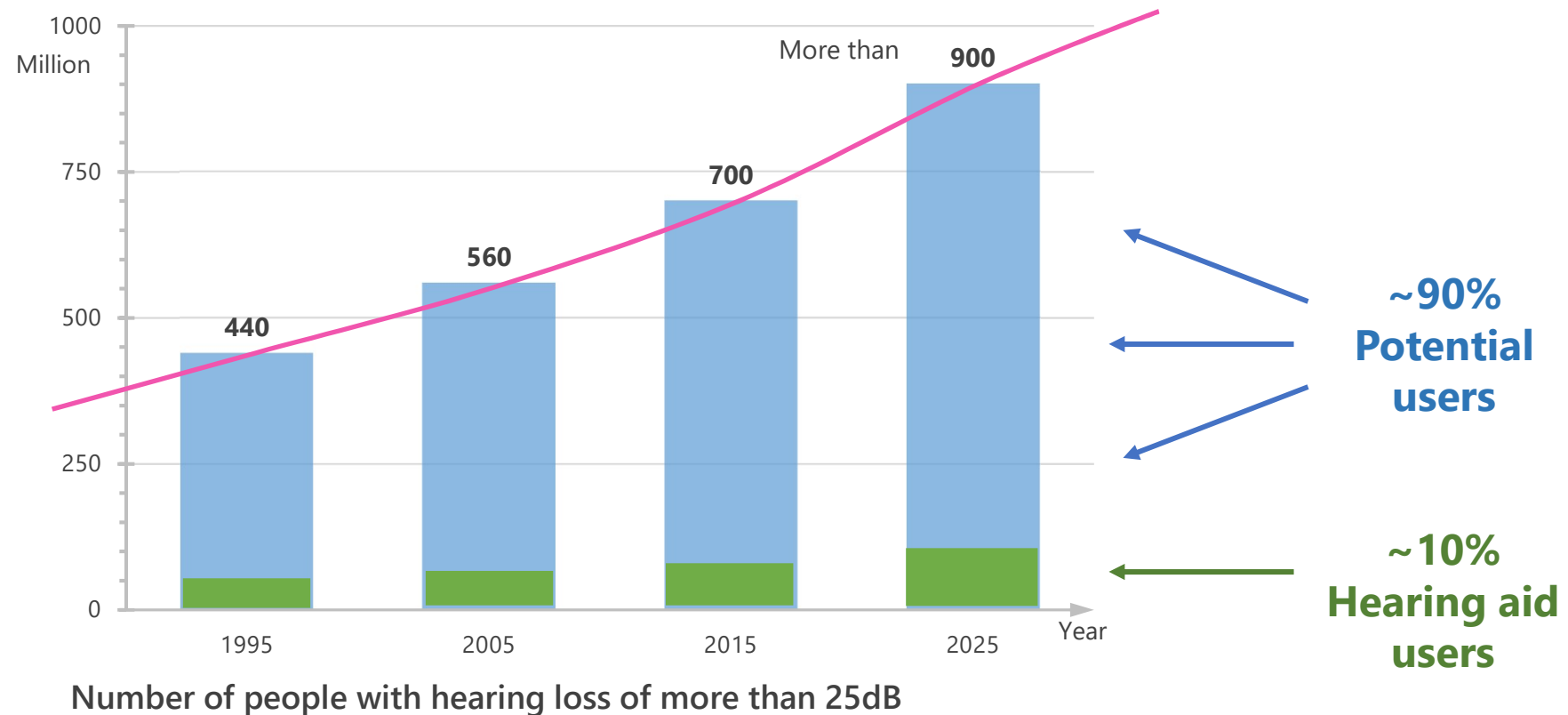
4. Technology (satisfaction is not guaranteed)

- 20% of people who bought hearing aids return them
- 17% users are dissatisfied, 7% keep them in the drawer



Hearing Enhancement Devices - The Most Needed Wearables

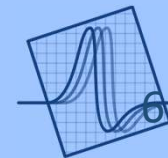
In 2015 more than 700M people worldwide reported hearing loss



Can we do something?

“No problem can be solved by the same kind of thinking that created it”

“The measure of intelligence is the ability to change”



“Think different” (Apple advertising slogan, 1997)

Traditional hearing aid	→	Bluetooth™ headset or earbud with hearing enhancement
Medical device	→	Consumer Electronics device
As small as possible, better invisible, but making you look older.	→	Stylish, fashionable device of different types making you look ...
High cost of manufacturing and precision components	→	Low cost of manufacturing due to using high-volume, CE components
High cost of marketing & distribution	→	Distributed via Internet or consumer electronics channels
Limited performance due to size and power consumption limitations	→	Larger form factor allows using better components, rechargeable batteries and powerful DSP
Limited connectivity	→	May connect to everything via a Bluetooth® protocol and smartphone

Hearables Prior Art ... SoundID 2006

Dr. Rodney Perkins,

Founder and Chief Medical Officer of SoundID

(Dr.Perkins also founded ReSound, one of top 6 hearing aid companies)



“At Sound ID, our mission is to break the sound barrier and provide cutting edge acoustic technology to those who have difficulty listening in noise. With our technology, sleek, high tech design, and superior ergonomics, we enable our consumers to enjoy mainstream listening and communication activities with greater ease, efficiency, and effectiveness.”

- Ambient Mode - Enhances listening by amplifying sounds around you.
- Mobile Phone Mode - Improves the sound clarity of on-the-go phone conversations
- CompanionLink™ Mode :
 - Conversations in noisy environments are enhanced by transmitting the sound of a conversation partner directly to the user's ear via the CompanionLink™ microphone
 - Improved sound intensity and quality from television without raising the TV volume
 - Meeting and conference room listening is improved by placing the CompanionLink™ and table top holder in front of the target speaker
 - Lectures and sermons are more easily understood by placing the CompanionLink™ on the lectern

Hearables Prior Art ... Followers:

SoundHawk

(out of business)



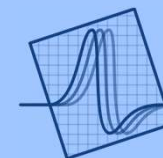
SoundWorld CS50

(still around but not very successful)



SK telecom Smart [Hearing Aid]

(not actually launched)



Hearables Prior Art ... Newcomers:

2016: Nuheara IQbuds

- amplification <20dB
- do not have ear fitting options
- price \$299



2017: BOSE “HearPhones”

- amplification ???
- active noise cancellation
- price ~\$600 (as per rumors from CES)

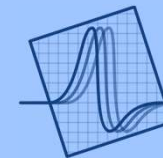


The Time is Right to Change the World with Better Hearing

Low-cost, high-quality hearing enhancement is NOW possible!

All components are available:

- ✓ Bluetooth chips integrating audio DSP
- ✓ Low-cost, powerful DSP with ultra-low power consumption
- ✓ MEMS microphones with high SNR and excellent matching
- ✓ Wireless charging solutions
- ✓ Smartphone applications
- ✓ **Green light from FDA !**



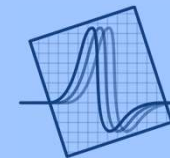
The green light from



**U.S. FOOD & DRUG
ADMINISTRATION**

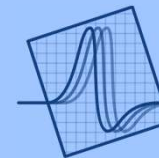
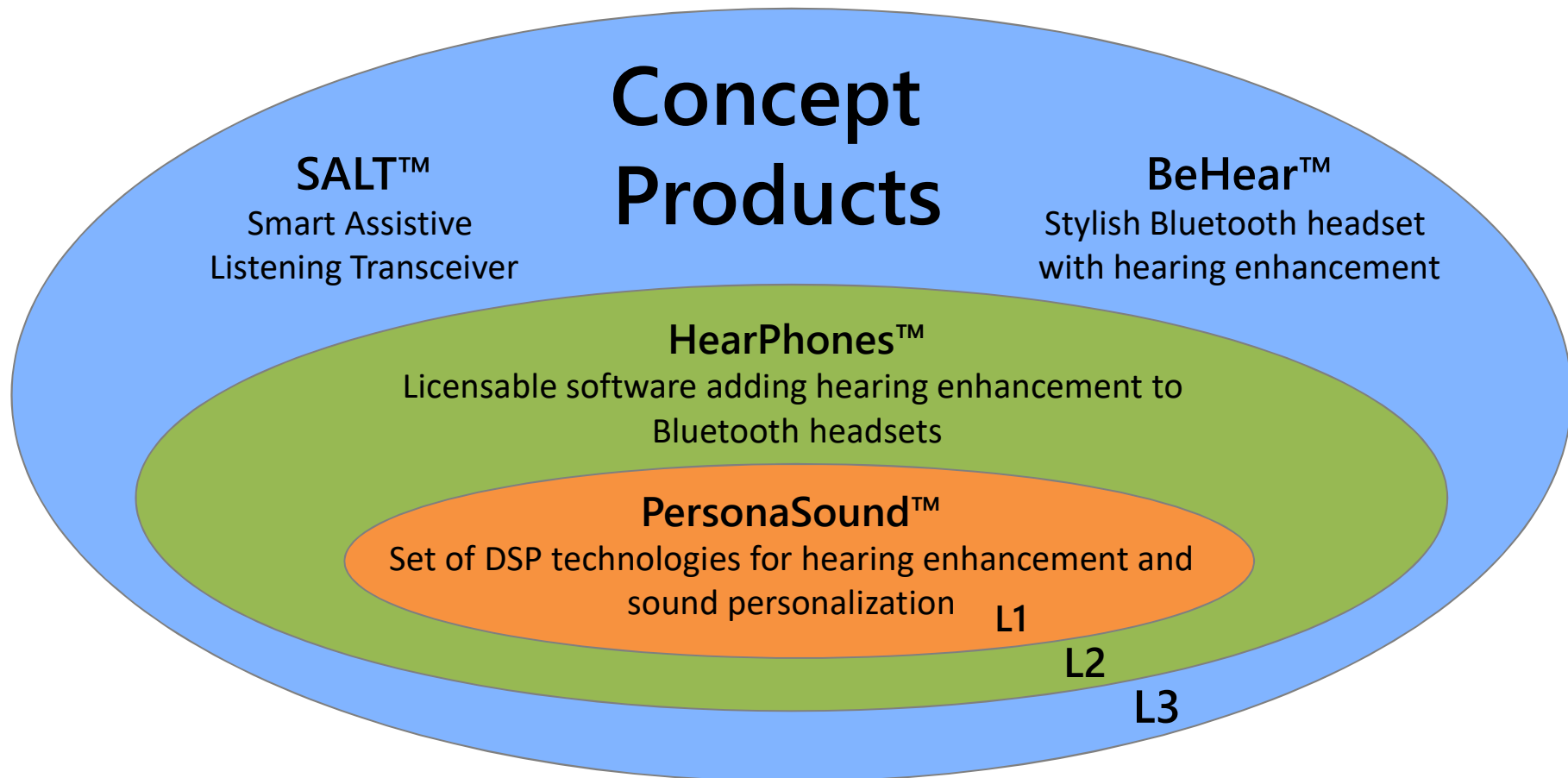
Dec. 2016:

- FDA announced
it does not intend to enforce the requirement for adults to obtain a medical evaluation before obtaining most hearing aids.
- FDA noted
its continued commitment to the possible creation of a category of over-the-counter (OTC) hearing aids.
- FDA suggests
that lower cost products are needed which will create more consumer choice and foster greater competition and innovation among manufacturers.

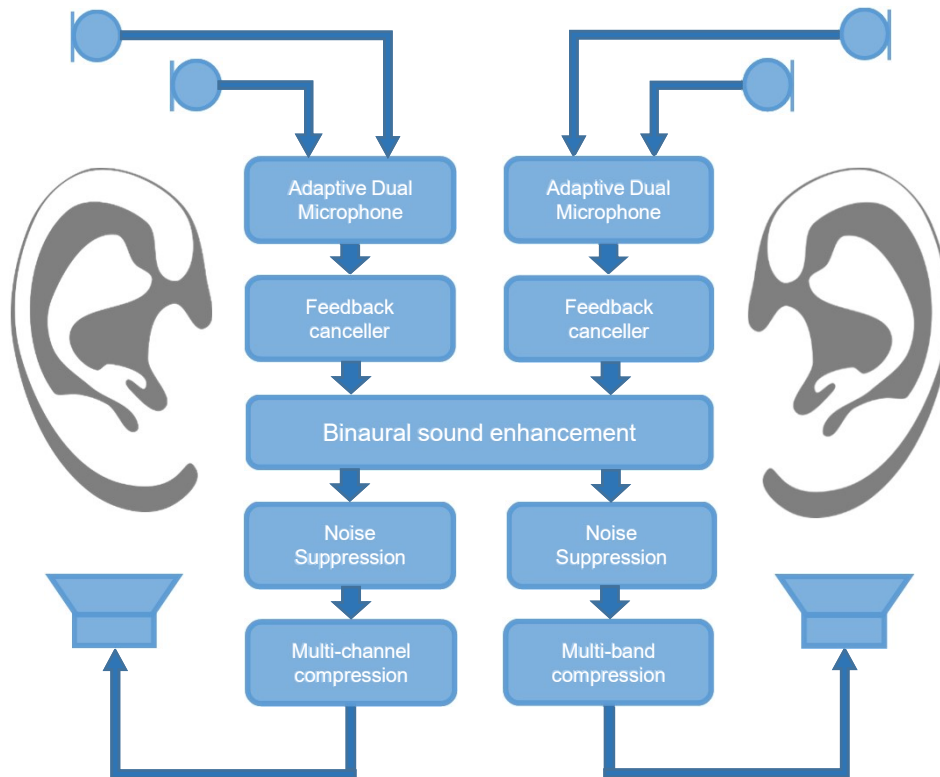


3 Layers of Alango Solutions

L1: Technology → L2: Reference Design → L3: Product



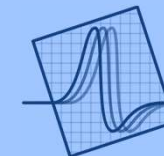
L1: PersonaSound™ - DSP for Hearing Enhancement



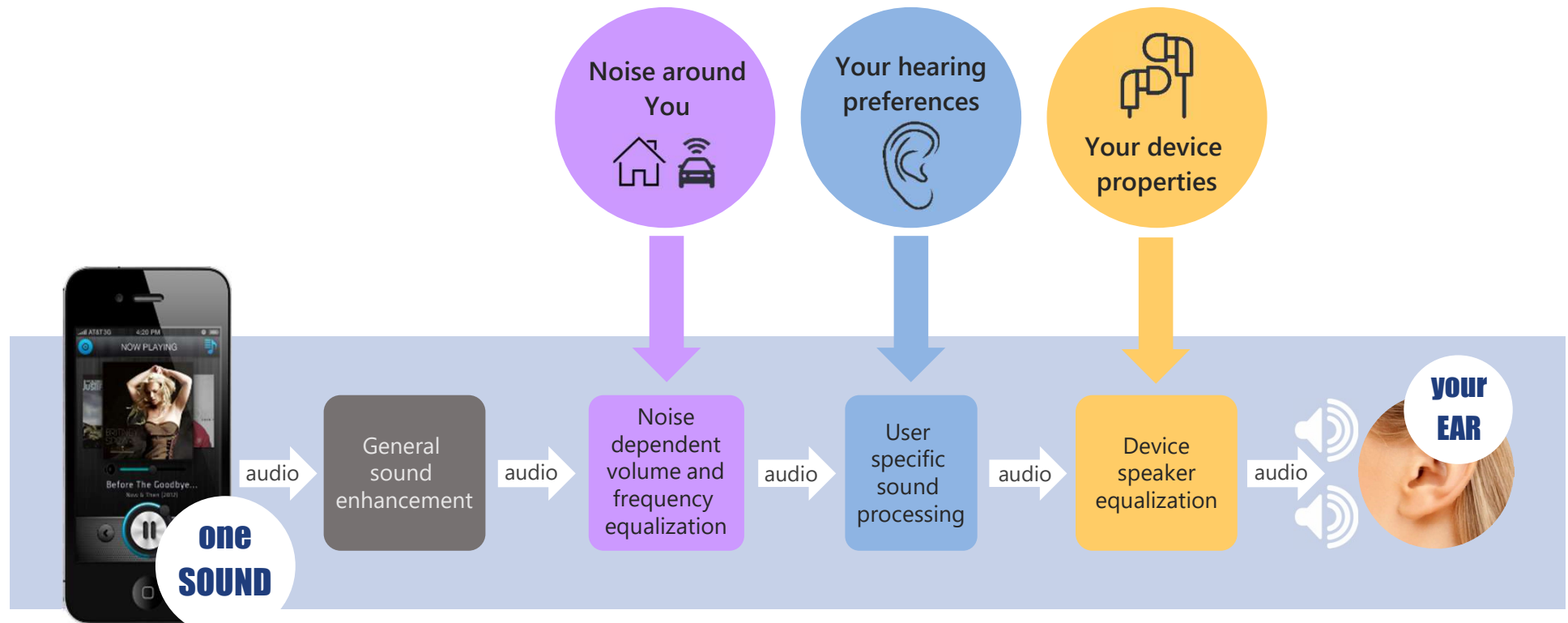
Everything you can find in the most expensive hearing aids:

- Adaptive, binaural beamforming
- Advanced feedback canceller
- Stationary, transient and wind noise suppression
- Multi-channel sound compression, tunable for specific hearing loss and environments
- And more ...

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L1: PersonaSound™ - Let's make the music personal



L2: HearPhones™ - Software Reference Design

Licensable software solution powered by PersonaSound™ set of DSP technologies that transforms a Bluetooth headset into a personal sound amplifier



Choose or change your style

4 microphone, sport style



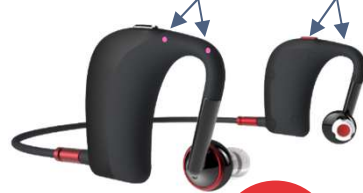
2 microphone, binaural, stylish



2 microphone, Binaural, stylish



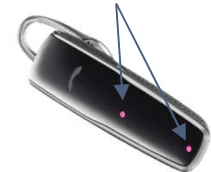
4 microphone, sport-style



1-2 microphone, Monaural, compact

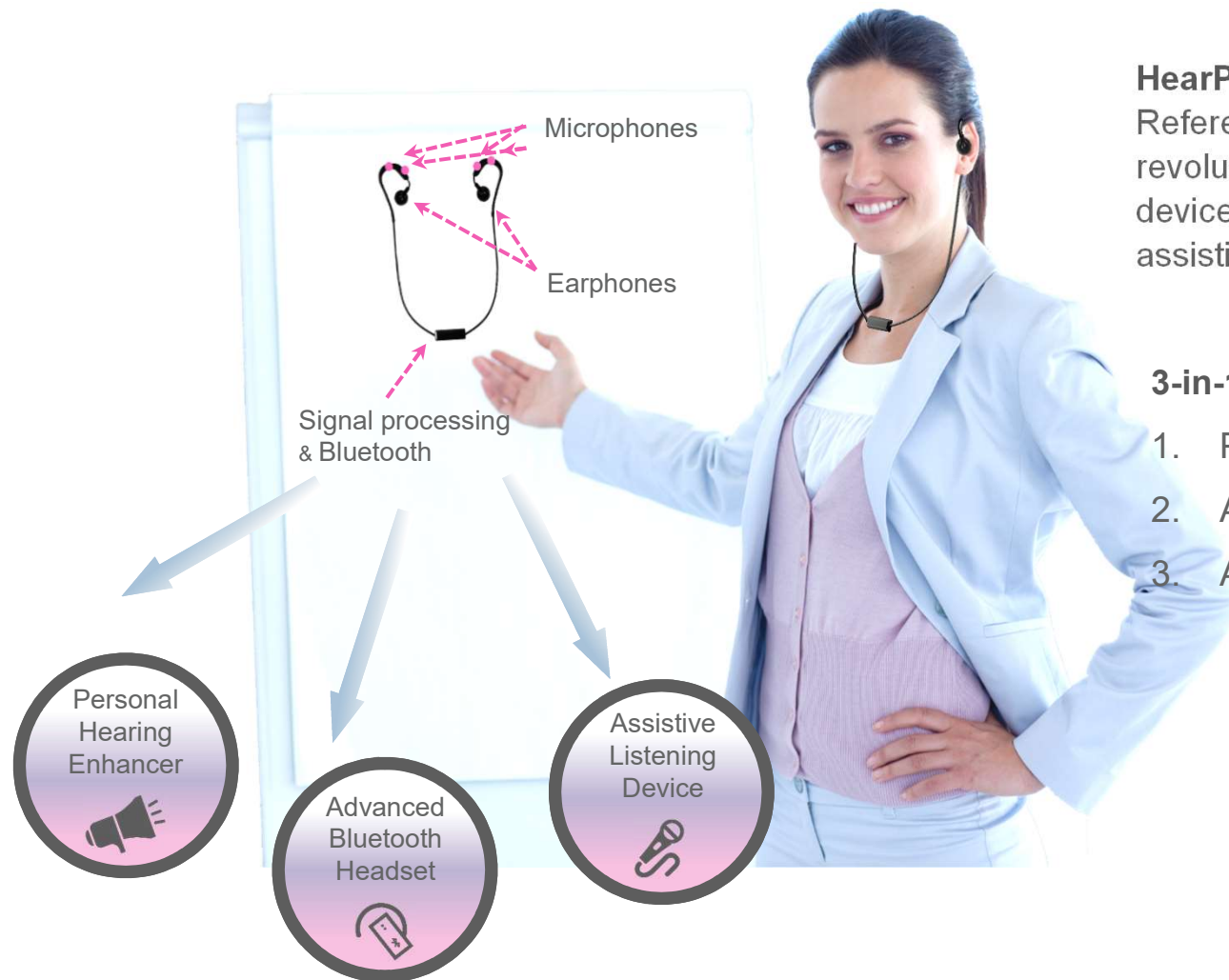


2 microphone, monaural



Includes PersonaSound™ technology

L2: HearPhones™ - Smart Hearing Solution



HearPhones™:

Reference software design for revolutionary consumer electronics device with hearing enhancement and assistive listening capabilities.

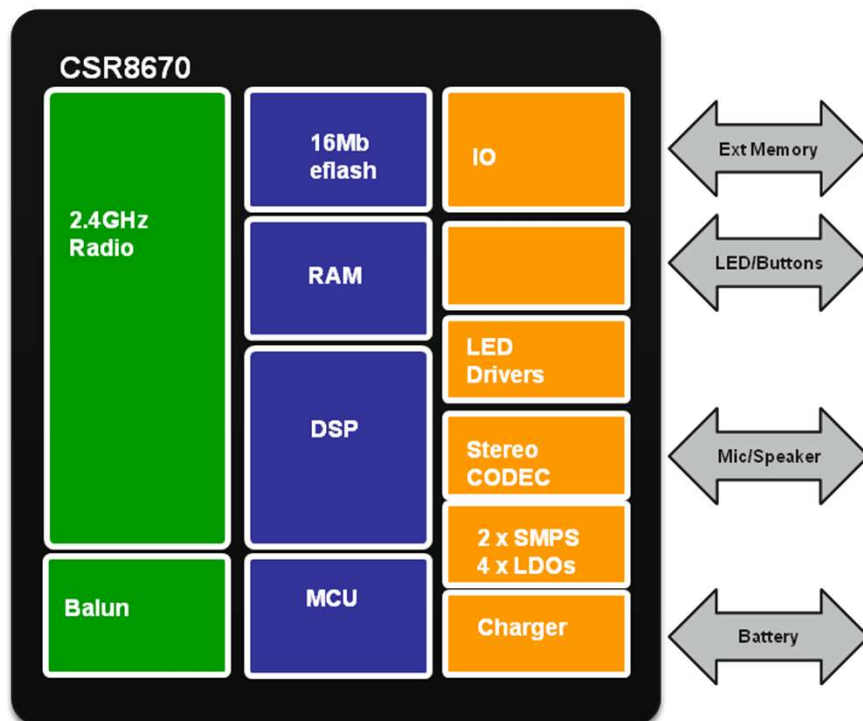
3-in-1:

1. Personal Hearing Enhancer (PHE)
2. Assistive Listening Device (ALD)
3. Advanced Bluetooth Headset (BH)

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L2: HearPhones™ - What Alango Provides

Make your own HearPhones™ type of product based on
CSR 8670/75 – the leading SoC solution for high-end Bluetooth headsets



You will receive:

- Digital signal processing libraries for all modes: hearing enhancement, music enhancement, phone calls, assistive listening
- Example source code for CSR 8670/75 MCU demonstrating all functionality
- Software configuration tools
- Hearing API (HAPI) libraries for Android, iOS and Windows allowing to build custom applications to control HearPhones
- Example applications for Android, iOS and Windows illustrating Hearing API libraries

ALANGO vs. BOSE

- Alango HearPhones™ has nothing to do with the BOSE HearPhones product
- Alango introduced the HearPhones name and the licensable solution in 2015
- Alango popularized this name via its promotional materials, videos and industry presentations
- Alango's semiconductor partner presented the HearPhones name to its customers
- Many liked this name, apparently BOSE as well, since they started using it last month for their new wireless earphones...

Bet who is going to win

L3: Concept Products – www.WearAndHear.com

BeHear™ - Bluetooth® headset with ambient hearing enhancement and personalized listening capabilities

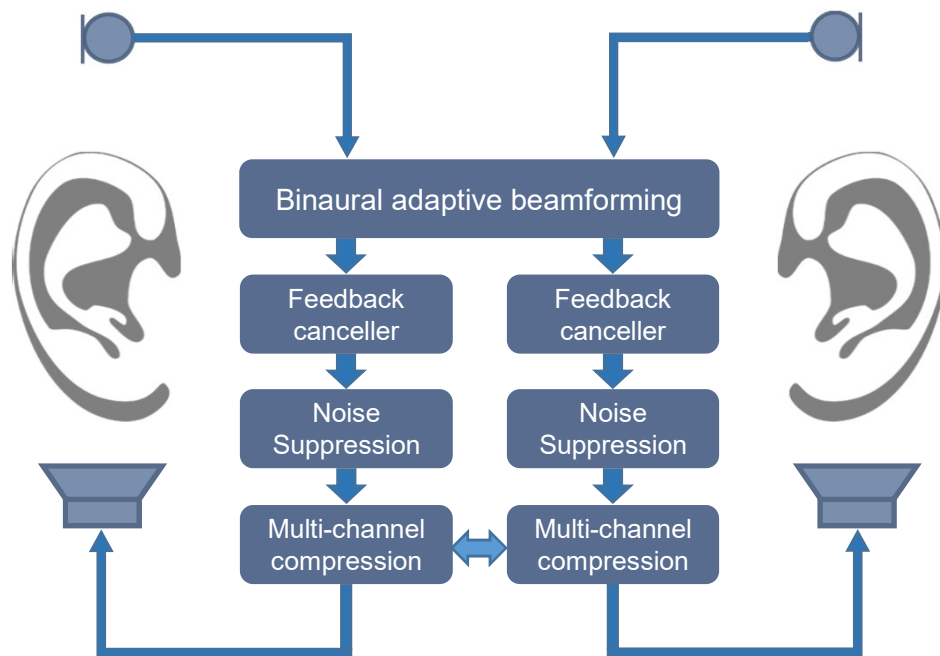


SALT™ (Smart Assistive Listening Transceiver) - Personal Sound Amplifier, Bluetooth® stereo headset and Assistive Listening Device



L3: BeHear and SALT - the power of hearing enhancement

120MHz of DSP power running advanced, field proven, fully customizable voice enhancement and hearing enhancement technologies



- Adaptive, binaural beamforming
- Advanced feedback canceller
- Stationary, transient and wind noise suppression
- Multi-channel compression tunable for specific environments

L3: BeHear and SALT: Hearing Preferences Assessment

Using your mobile device screen...

Indicate your hearing preferences with a simple built-in assessment for multiple frequencies.
Choose **two** levels for each frequency:



Most Comfortable Level
(sound is most pleasant and clear around this level)



Hearing Threshold
(sound becomes audible above this level)



L3: BeHear and SALT: Personalization at Your Fingertips

“Best hearing point” – Just find it!



User can intuitively modify the default hearing enhancement by touching different parts of the screen.

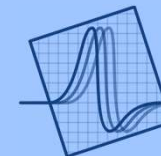
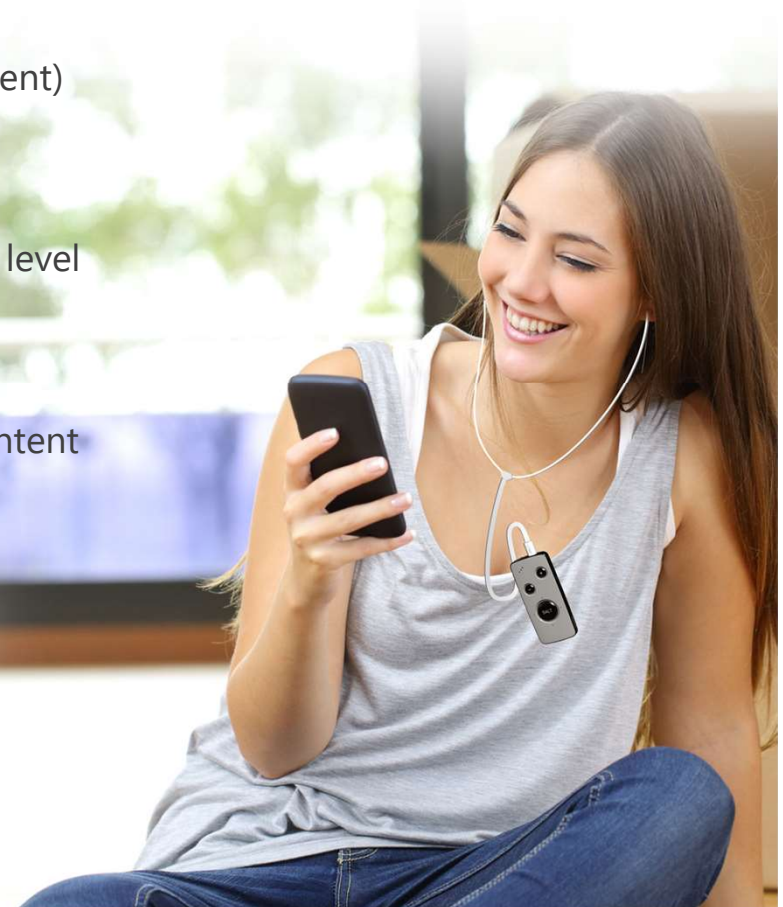
Default hearing enhancement is done automatically, based on the hearing preferences assessment.

L3: BeHear and SALT: Advanced Bluetooth Stereo Headset

Understand voice, enjoy music

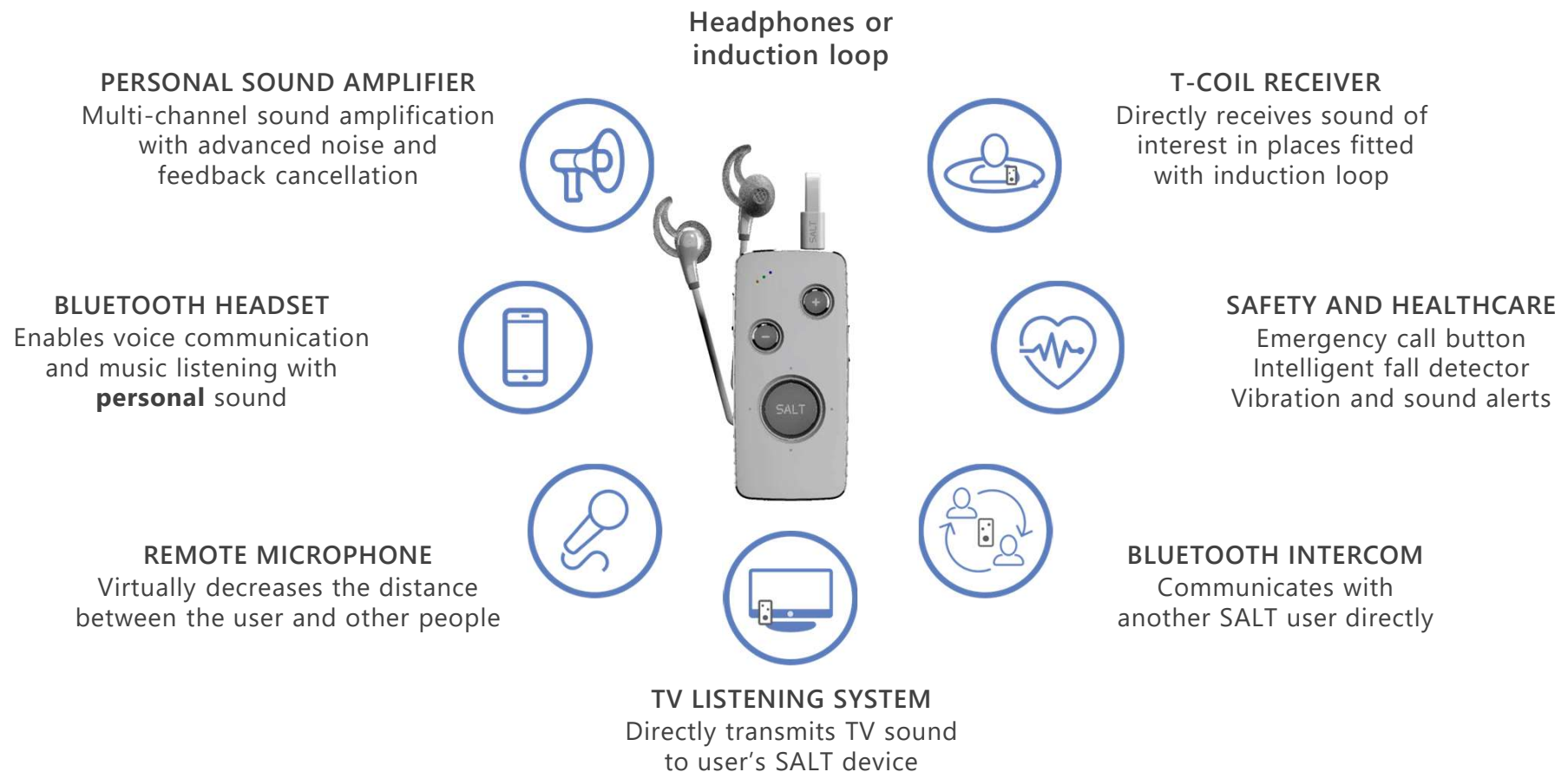
*Powered by
HearPhones™ technology*

- ✓ **Personalized voice call and music sound according to:**
 - User hearing (based on user's hearing preferences assessment)
 - User preferences (based on real time sound customization)
- ✓ **Noise dependent volume & equalization control**
Sound is additionally amplified according to ambient noise level and spectrum
- ✓ **ListenThrough™**
Stay aware of ambient sound while enjoying your music content
- ✓ **EasyListen™**
Slows down the incoming, far end speech for better understanding
- ✓ **Advanced noise cancellation**
 - Beamforming (Binaural case)
 - Static and transient noise reduction
 - Wind noise reduction



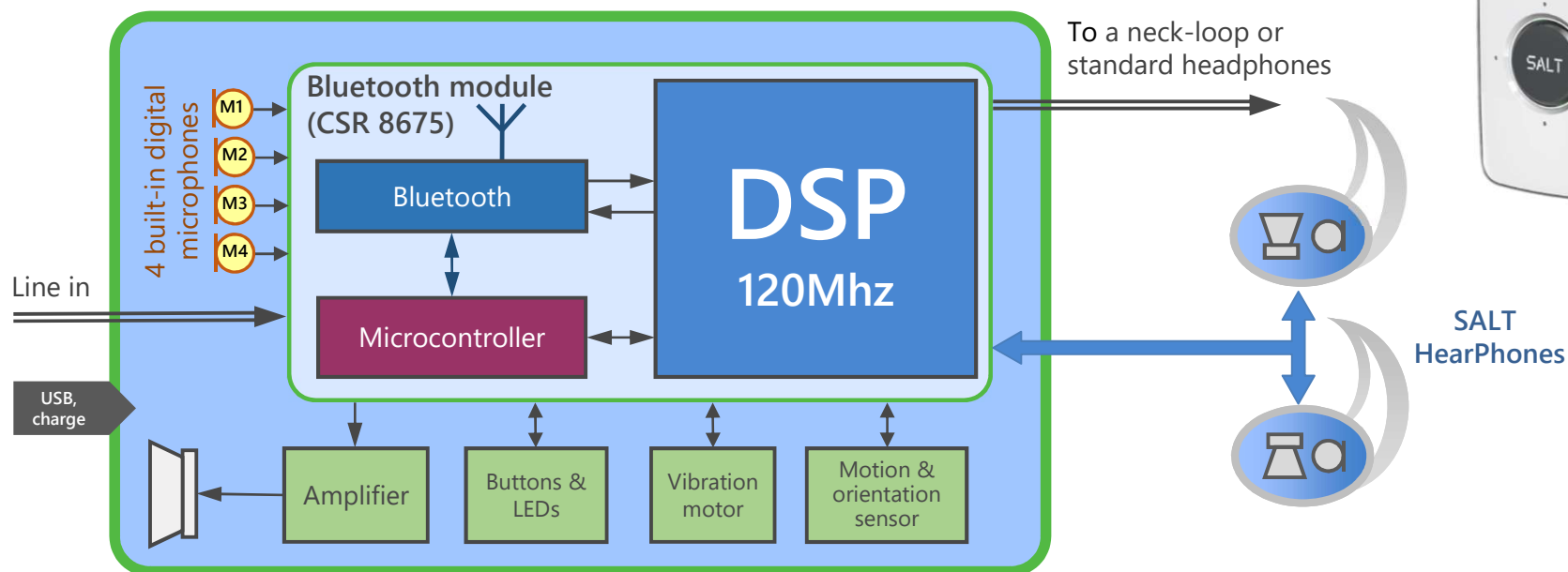
L3: SALT - “Swiss army knife” for the Hearing Impaired

PersonaSound™, HearPhones™ and much more...



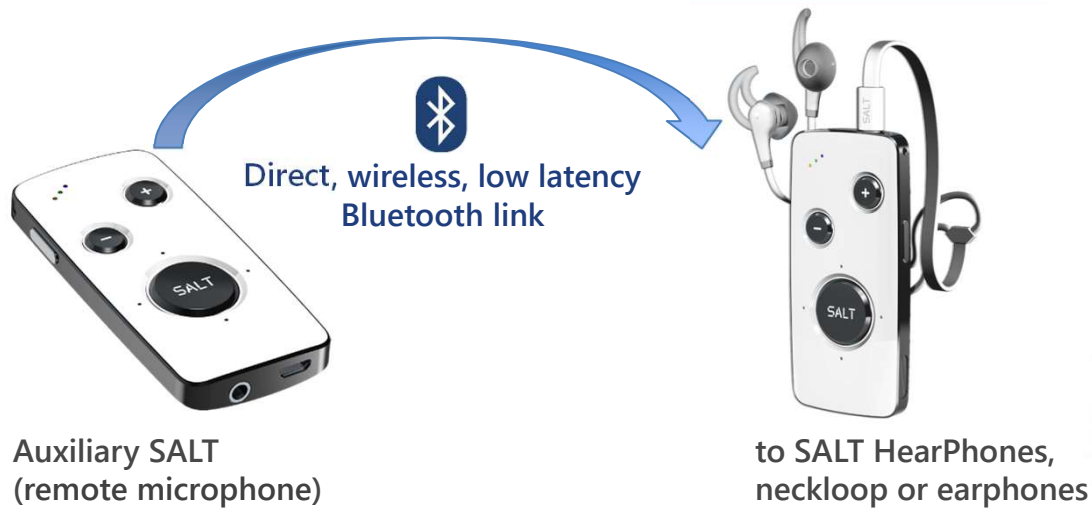
L3: SALT Teardown

A powerful hardware platform for hearing enhancement and assistive listening applications



L3: SALT: Remote Microphone

SALT can be switched into transmitter (auxiliary) mode and used as a remote microphone

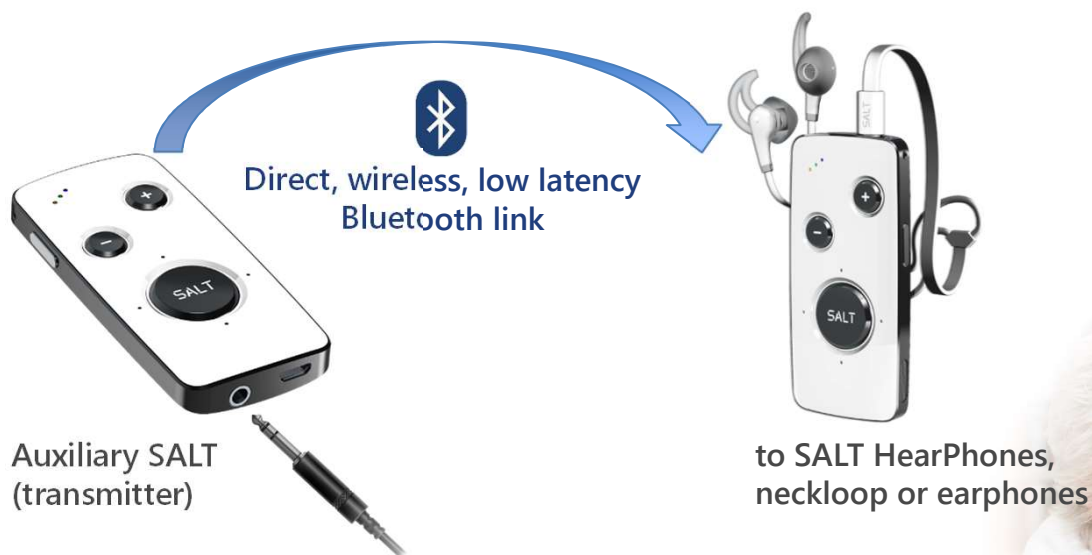


Sound before transmission is enhanced by 4 microphone adaptive beamforming and noise suppression technologies



L3: SALT: TV Listening System

Personalized TV stereo sound directly to your ears

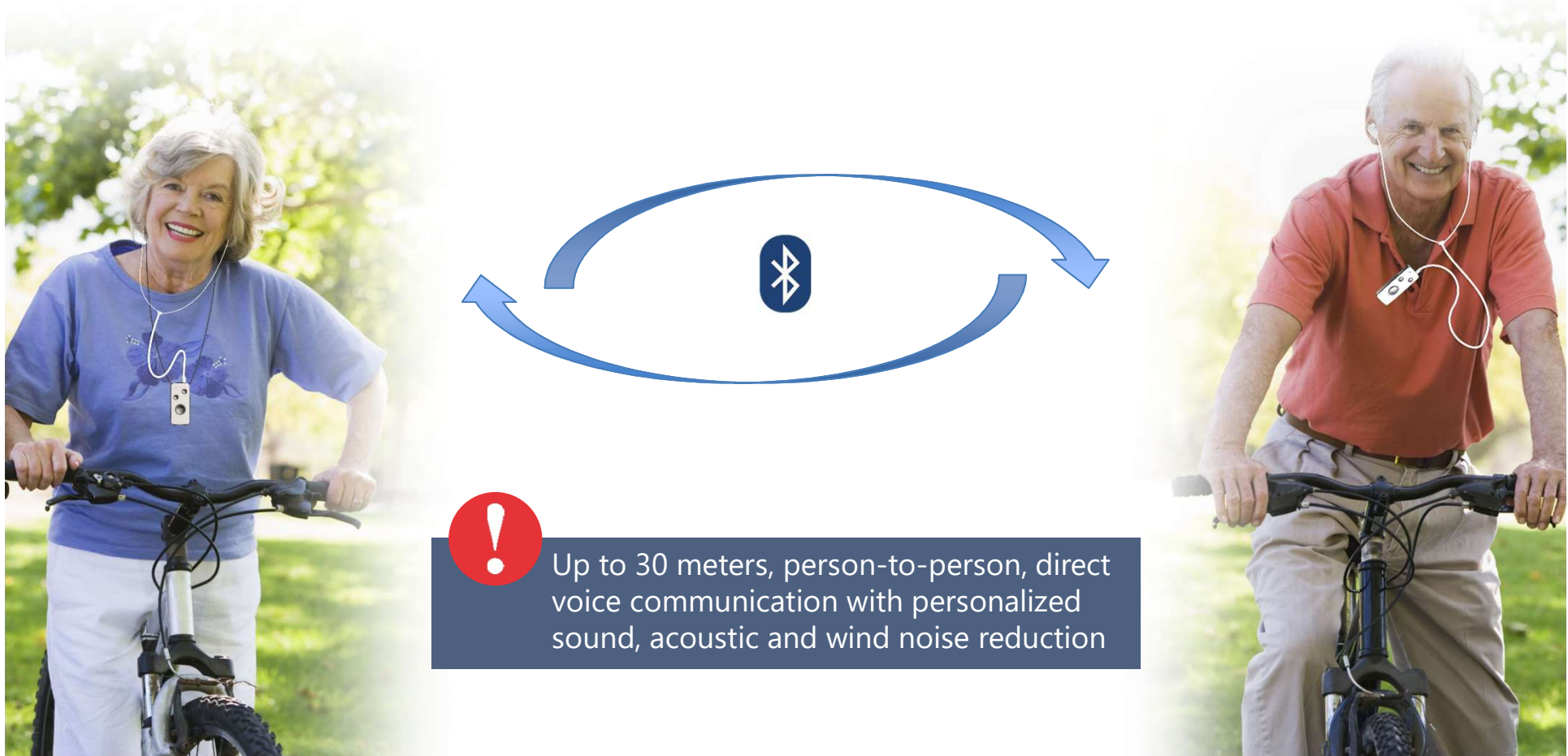


SALT can be switched into transmitter (auxiliary) mode and connected to TV audio output



L3: SALT: Two-way Wireless Intercom

Direct, wireless communication wherever necessary



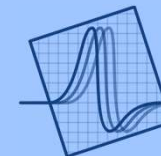
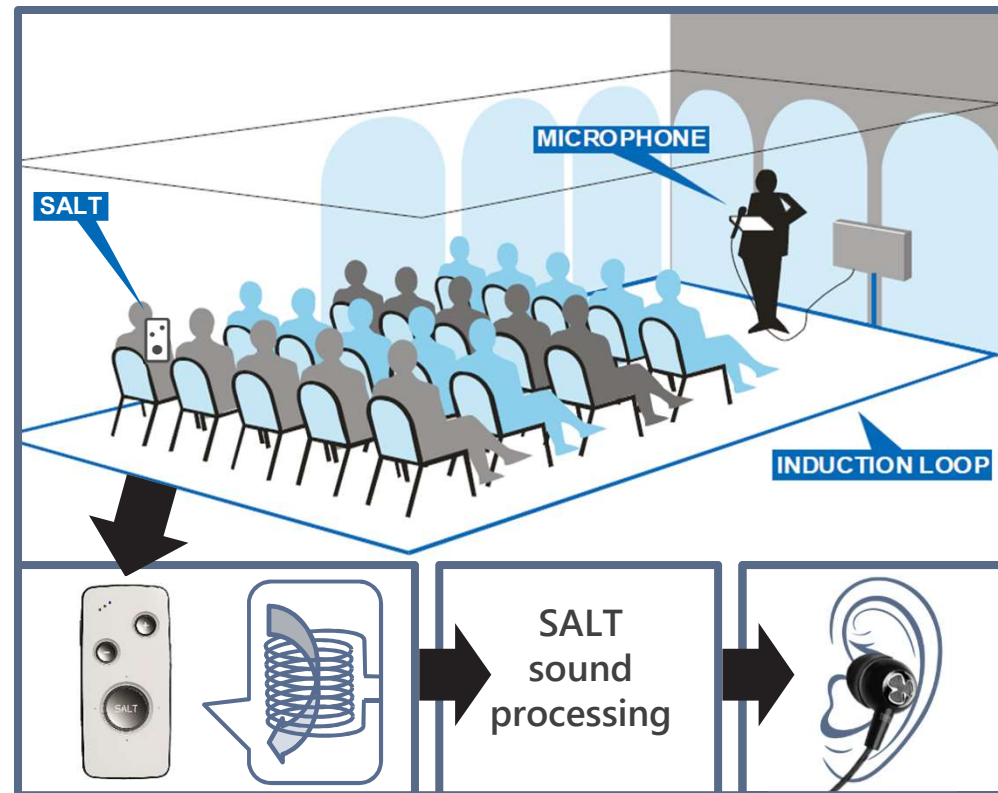
L3: SALT: Telecoil Receiver

When you need help occasionally and it is at hand...

Built-in telecoil, amplifier and sound personalization



Can be used with SALT HearPhones™ or any high quality earphones



L3: SALT: Even More...



✓ Intelligent fall detector:

- Automatic fall detection
- User response inquiry with vibration and loudspeaker
- Automatic call to preprogrammed numbers(s)

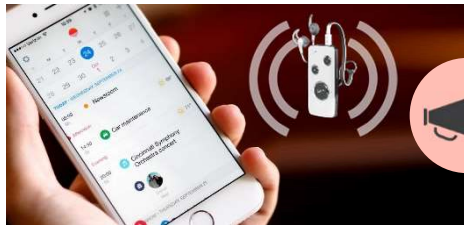


✓ Emergency call button for help request



✓ Wireless leash for you smartphone

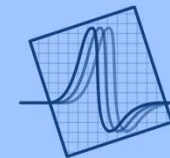
With vibration and loudspeaker alert



✓ Talking organizer with vibration alarm

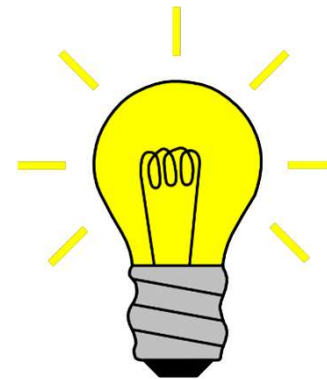


More... You name it



Future Thoughts: Personal Hearing Assistant

- Incorporate voice recognition capability for spoken commands to the system
- Interface with cloud-based voice recognition services, such as:
 - Siri
 - Google Now
 - Cortana
 - Amazon Echo
 - Blackberry Assistant
 - ...
- Enable social sharing via users groups for additional support



Future Thoughts: Cooperation with Audiologists

- Establish tele-audiology network
- Limit deep personalization to “professionals only”
- Provide audiologists with tools to perform customization and support services:
 - Face-to-face
 - Remote



Thank You

For more info, visit:

www.WearAndHear.com

