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Fast Forward: Bluetooth Low Energy Audio Past, Present and Future

Presenter: Jill Mecklenburger, AuD

- [Melissa] Welcome to today's course, Fast Forward: Bluetooth Low Energy Audio Past, present, and Future presented by Dr. Jill Mecklenburger from ReSound. This month on AudiologyOnline, we're celebrating innovation in the hearing industry with our fourth Industry Innovation Summit. Thank you for joining today, and we hope to see you in future courses. We'd like to thank our title sponsor, CareCredit, and all the companies that have joined us this year. It's now my great pleasure to turn the microphone over to our presenter today, Dr. Jill Mecklenburger.

- [Jill] Thank you, Melissa. Hi, everybody. I just wanted to hop on real quick with my video to say hello, but I'm going to turn it off because I am traveling and I don't have the best bandwidth. So just wanted to say hello as part of this introduction, and I'm really excited to present this course to you today. Okay, so as the title says, we're going to be talking about Bluetooth Low Energy Audio Past, Present, and Future. And why is this applicable to us? Well, how many people listening have actually gone a whole week without talking about connectivity with a patient or probably even a whole day? It's what began over a decade ago as wireless connectivity with more of a novelty being apps and streaming phone calls has now become a big part of everybody's lives in the hearing impaired world.

It's actually now one of the top three satisfaction drivers, connectivity and hearing aids. So I know often audiologists get very frustrated with the technology. It's easy for things to go wrong if patients don't have their phones updated, for example, or if they've lost pairing. But we do know that when patients are using their connectivity, they're very happy with it based on that satisfaction survey. But I'm here today to talk about a really exciting new version of Bluetooth that's going to kind of change the world and make everybody's lives more easier. So let's get started. Here are the learning objectives for the day, as you may have seen in the course description. But by the end of this course, you'll be able to explain the evolution of wireless technology, where it came from,

describe the recent changes to Bluetooth and hearing aids, and you'll also learn about how Bluetooth Low Energy Audio will improve daily outcomes for patients.

So really, going way back to the history of why do we even have wireless and hearing aids, it's the main reason originally that wireless hearing aids were developed were because people with hearing loss struggle in public places, as we know with, if there's a lot of reverberation and surrounding background noise. So the first systems were developed to address this, such as telecoil loops, FM systems, and infrared receivers. Telecoils were really the first wireless system, even though you might not think of them as wireless, they are. And they began in around 1938. And the way a telecoil works, as you can see here, is either a loop worn around a neck of a patient or around a room, such as an auditorium, and then the telecoil and the hearing aid, which is that little device with the copper wire around it that you can see there, is picked up by the hearing aid device.

So, you know, the example over on the right, you can have normal hearing listeners as well as any different type of telecoil receiver all sitting within the same loop. If you've been to New York City at all in the last 10 years, you've seen that all the taxi cabs are telecoil enabled, which is very cool. This was an initiative started, I think in 2012, so that people might not end up in the wrong location if they couldn't hear the driver. So what are the pros and cons of looping? Well, the great things about it are it's a mature technology, it's easy to use, many hearing aids have tele coils, and it's standardized, the international telecoil symbol, as we all know, is well established.

But the downsides of it are that the sound quality can be mediocre, it can be susceptible to interference, it's expensive to install, and depending on the position of the telecoil and the hearing aid, the sound level and quality can vary. So all wireless systems really work on the basis of radio transmission. And you can see an example here just of how a radio works, and this is so funny to me because I've been using this

slide for years talking about wireless. And, you know, I work for a Danish company, ReSound, and recently, in Denmark, I was on a team building exercise with some engineers, and we had to build a radio. So we actually did this and got it to work with very minimal materials.

So you can do it too. It's a fun thing to try at home. But the prior industry standard has been FM systems for many years. And as we know, this works with a transmitter for the radio, and then picked up with the FM receiver on the hearing aid, as you can see here. And these were very common still, in schools mostly, and places like the typical learning type institutions. So really, the first Bluetooth radio in hearing aids was near-field magnetic induction is, you can kind of see by the diagram here. The transmitter was plugged into a television set, for example, and then picked up by an intermediary device and sent to a near-field hearing aid.

That's why it was called NFMI, near-field magnetic induction. So the Bluetooth signal was sent between the receiver and the transmitter there. And the next advancement after that was proprietary radio frequency system, which ReSound first came out with back in 2010 with their 2.4 gigahertz. But you can see that the 900 megahertz system that came out right shortly after that was also proprietary. And basically, these were, did not involve a gateway device. So they were true wireless systems and hearing aids. The way 2.4 gigahertz works is it uses something called spread spectrum frequency hopping where the hearing aids, because you can see it, there might be many other types of devices operating on that same frequency, how do they not interfere with each other?

And the hearing aids will talk to the device that they're connected with and choose a different point within that frequency and hop around, you know, constantly. So they agree on this transmission that's sent between sending data packets between the two devices. So the original classic Bluetooth that we know of was always very power

hungry and not ideal for hearing aids. So back in 2011, Bluetooth developed something called Bluetooth Smart or Bluetooth Low Energy that required less battery power, and that enabled things like being able to use made for iPhone hearing aids as well as the ASHA or Android standard for hearing aids using less energy. So a fun fact here now, and you can enter in the chat if you know the answer, does anybody know the origin of the Bluetooth logo?

Give a moment here for anybody to type into the chat, should they know it. If not, I'll go ahead and give you the answer. It was actually named after King Harald Bluetooth Gormsson who was a Danish king, and he united the tribes of Denmark and Norway. And he was nicknamed Bluetooth because he had a front tooth which was dead, and it was a dark blue gray color. And the Bluetooth logo is actually his initials, H and B in the runic alphabet. So when Ericsson came out with Bluetooth in the nineties, they decided to name it after him. So fun fact to know the next time you see the Bluetooth logo. So the Bluetooth SIG is known as the Bluetooth Special Interest Group and they kind of own everything Bluetooth.

And in 2013, the European Hearing Instrument Manufacturer Association, which you can see are all these companies here, decided they wanted a better protocol for hearing aids because at this, at the time, you know, there weren't a lot of options in terms of Bluetooth with hearing aids. So they went to Bluetooth SIG asking for a new codec to have a lower or shorter latency, a dedicated hearing aid profile, and a broadcasting mode. These were all the requirements that were requested. And the Bluetooth SIG accepted this and began working on what we know now as Bluetooth Low Energy Audio. So Bluetooth Low Energy Audio, as I mentioned, is the latest version of Bluetooth, and it's available now, and it's really going to change everything.

It's going to allow basically anything to connect headphones, earbuds, cochlear implants, televisions, computers, smartphones, they will all be Bluetooth LE Audio

enabled. And not only will this make a big difference for the hearing impaired world, but people with normal hearing as well will be able to connect to all of these devices. It's estimated that by the year 2027, there'll be three billion Bluetooth LE Audio devices shipping annually, so that's pretty huge. So what are the benefits of Bluetooth LE Audio? Well, it's got a much better sound quality than previous versions of Bluetooth all while using much less power. So it's really kind of the best of all worlds. It's a very clear stream sound with a shorter latency and less battery consumption.

It has the ability for multi streaming, so you can connect to multiple devices simultaneously. You can connect between your phone and your computer and it's all very seamless. It also has this two-way communication that allows for hands-free calling with Android phones. But perhaps what I think is the most exciting component of Bluetooth LE Audio is a new system called Auracast, and this is basically broadcast and audio sharing. And you can do this from either your personal devices or public places will have Auracast broadcast sharing. And let's talk a little bit more about what that means. So part of this new Bluetooth LE Audio codec that was requested from the AHIMA group as mentioned before, is something called LC3 and it stands for Low Complexity Communications Codec.

So that's the new codec with Bluetooth LE Audio. And it has a much better sound quality, as I mentioned, and lower power than classic Bluetooth. And you can see comparison that was done here. And a codec is basically just how audio is sent, how it's compressed, and then decompressed when it's received at the receiving device. But the Bluetooth SIG group did this study when they developed LC3 and compared it to SBC, which is Standard Bluetooth Classic. And you can see the LC3 being the blue bars, and they asked listeners to rate the sound quality of streaming with zero being very poor and five being great. And you can see that the new codec way outperforms the Standard Bluetooth Codec as well.

And even at the lower bit rates, you can see it performs very well using less power. So it's a really kind of breakthrough new codec for Bluetooth. So now that we've discussed a little bit, kind of some of the different versions of Bluetooth, let's really see what the key distinctions are here. So Bluetooth Classic, which as we know, it's been around a long time and we've all used it, has good sound quality, it's very widely used, but some of the drawbacks are that it's battery hungry, it has a longer latency, it's not always optimal for developers to work with. Bluetooth Low Energy, which came out in 2011, as I mentioned, enabled the MFI and audio streaming that has good sound quality, low consumption, and low latency, but the drawbacks are that it's not really universal.

And finally, Bluetooth LE Audio, which is LE Audio, so that's a division of Bluetooth Low Energy, has enhanced sound quality, low battery consumption, and it's universal and future proof, so really easy to use. And really, the only drawback of it is that it's an emerging technology and it hasn't been broadly implemented yet, but we expect that to change really fast. I think it's going to be a huge explosion that you'll see soon of Bluetooth LE Audio being everywhere. So what is Auracast broadcast audio? We started to talk about that a little bit. To make a comparison, Think about classic Bluetooth, how that only allowed for one-to-one communication between devices, whereas with Auracast broadcast audio, it's going to connect simultaneously to an unlimited number of nearby devices.

So you can share, from a personal electronic device, to friends who are nearby who have, you know, earbuds or hearing aids or headphones that are Bluetooth LE Audio enabled. And you can make that a public broadcast to them, or you can select a passcode, for example, and keep it private so that only certain people can join. Whereas the Auracast that we'll see in public places, most likely will always be public for as many people to benefit from as possible. So there are three easy ways to join Auracast from your device. One would be with a smartphone, kind of like when you can

see the available wifi networks, same type of thing, you can see the available Auracast broadcast networks.

A QR code will be available so that you might see an Auracast logo at an airport, for example, and then you can just scan the QR code with your phone and you'll be in the broadcast streaming to your hearing aids. And then finally, they know that not everybody has a smartphone, not all of our patients have them, so there'll be a dedicated Auracast button that you can tap to start to begin the streaming as well. So here's an example of what that might look like in an auditorium, for example. You have this many people seated within the same place using different devices, earbuds, hearing aids, cochlear implants, and then an Auracast streamer will be streaming and it has the, the streamers are about the size of a wifi modem and they have the capability to, the range is 30,000, up to 30,000 feet.

So pretty good range for that Auracast stream for people to join in from anywhere in a large auditorium. So it's really going to make everything more friendly and hearing accessible for everybody. The sharing audio that I mentioned, I can think of an example, I was at sitting outside at a coffee shop not long ago, just enjoying a peaceful day, and these guys at a table next to me were watching on one of their phones a soccer game or some type of sporting event that was really loud and it was interfering. I just, I didn't care to hear it. So with Auracast broadcasting, they could have shared that with each other silently. So it's going to be a great benefit in that regard.

But really, I think one of the biggest advantages is public address systems. I've heard of a patient one time, a hearing aid user, who was at the airport reading a book, and even though they were sitting at the correct gate, they didn't hear the announcement that the gate had changed and they ended up missing their flight. So this will all be alleviated as well if you're able to tune into the gate agent via an Auracast stream, which will be possible. Really going to be a game changer there. And then finally, the

public TV watching, whether you're at a gym or a bar or even an airport, you can tune into all the different silent TVs and change the channel and listen to whatever you want with the Auracast stream.

So there are, the Bluetooth SIG has come out with very detailed requirements and specifications, but soon you're going to start seeing this Auracast logo all over the place letting you know that there's an Auracast stream available at this particular shop or venue or place of public transportation, all sorts of things. So it's really going to be, start becoming more and more common to see. The broadcasting for all, really it sends out this transmission similar to radio. And it's a breakthrough because we've never seen before where Bluetooth has allowed multiple users. The closest thing has really been a T-coil, which we kind of talked before about some of the disadvantages of T-coils. Telecoil and looping will still exist alongside Auracast for a long time, that's not going to go away, but this is just a newer, more modern, easier to use version of a similar type of technology.

So there are really endless possibilities here. There are silent screens, as I mentioned before, lecture halls. Think about museum tour, like a guided audio tour. I know I never feel comfortable putting on those headphones that other people have worn. Maybe it's just me. But in the future, you can listen with your own earbuds or hearing aids to a guided museum tour. There'll be multi language support. So for example, you can hear a movie in a different language if you need to while you're streaming. We talked about the theater auditorium concept of having the Auracast stream as well. So really endless possibilities here. I think it's going to normalize hearing loss because as we know, there's a strong stigma associated with hearing loss and people wearing their hearing aids, and this is going to kind of make everybody sort of equal.

When you're sitting in an auditorium listening to a broadcast, you could be receiving it as well as the person next to you wearing earbuds. So it's kind of, I feel like it's really

going to sort of level the playing field here and break down some of those isolation barriers that we've seen in the past. How is it going to affect your patients on a daily basis? Well, in terms of oral rehab and speech therapy for kids, this is really, this could potentially replace an FM system. It's going to make things so much easier for people in universities or schools and lecture halls, being able to hear clearly no matter where you're sitting in the auditorium. The workplace can make a huge impact difference there, conference rooms, and so forth.

And really, just in general, improve the quality of life for our patients. So ReSound Nexia, which we launched last fall, is the first Auracast enabled hearing aid or Bluetooth Low Audio, Low Energy Audio enabled hearing aid. And in the first launch, we provided these three receiver in-the-ear models, as you can see here, one rechargeable and two with batteries, 312 and 13. And then just this month, we also launched several new form factors including a CIC that is not wireless, just to keep it as small as possible, but an ITE/ITC type hearing aid for people who like an earbud looking kind of style, and that is wireless and Bluetooth Low Energy Audio enabled. And then finally, we also now have a BTE and a power BTE, which is really exciting.

So basically any patient, any hearing loss level that your patients have can be, have access to this exciting new technology. So we know that, you know, the previous generations of wireless are still around, and will still be around for a while, including looping and telecoil systems. So ReSound Nexia hearing aids have it all, they are available still, you know, to work with telecoils, FM systems, the proprietary technology that we have, whether you want to use made for iPhone or ASHA technology or bimodal with a cochlear implant. But now, the Bluetooth LE Audio technology available is really making this hearing aid future proof or ready for the future. So although as mentioned, the Auracast technology isn't appearing everywhere, you'll start to see it more and more.

And if somebody's wearing a Nexia hearing aid, they will be ready for that when it becomes available, as well as buying electronics that will interface with that as well, such as televisions, computers, tablets, and so forth. So let's look back at, really, the past, present, and future of this technology, as I mentioned, kind of summarizing everything we've talked about today and looking at the changes that have come about. We learned that telecoils have been around since the late 1930s, and they're still around today and they're great technology, but eventually, they will be replaced with newer things. FM systems have been around since the late sixties and have had their own place as well and advantages and lots of benefits to people with hearing aids.

Classic Bluetooth kind of laid the foundations for everything else that came after it, including the proprietary protocols that ReSound first came out with in 2010, which then led to later on the made for iPhone and Android streaming for hearing aids, all which fell in the Bluetooth Low Energy category. And then finally, this all set the stage for what we have now, which is the Bluetooth LE Audio really kind of opening up endless possibilities of ways that people can connect with their devices. And this Bluetooth LE Audio technology is expected to be the preferred audio standard for wireless communication in all electronic devices for the next 20 years. So it's really, it's here to stay and it's here to change the world.

So let's summarize what are the key takeaways that we've actually, we've learned about today? So, Auracast will be the future system for wireless transmission, as I just mentioned, in multiple locations for many different types of users. Whether you're wearing hearing aids or not, it's going to benefit everybody. It will exist in parallel with loop Systems for the next several years. So as I mentioned, they can both exist together. So it's not going to, it doesn't have to replace telecoil immediately. It will bring significant benefits to hearing aid users, as we talked about. All types of hearing aids over time will be Auracast enabled. So you're just, you're going to see this in every hearing aid on the market eventually.

And finally, the broad applicability beyond hearing aids to everyone else, and the modest cost of it, it's a very reasonable, reasonably priced to install Auracast system. So based on those two points, it's really going to ensure rapid development of this type of technology. So with that, I would like to say thank you and are there any questions?

- [Melissa] Thank you, Jill. We do have, let's see, any information that you can give us regarding Europe and Canada this time with Auracast and availability?

- [Jill] Well, it's going to be global so I would expect it to kind of develop in other parts of the world and Canada as well as the US kind of at a similar rate. So we'll start to see it more and more.

- [Melissa] Alright. And the only other thing I see is regarding Jabra products also having Auracast.

- [Jill] Yes, they will have Bluetooth Low Energy Audio as well. Jabra Earbuds, absolutely. Oh, and the Jabra hearing aids, was that the question? DTC Jabra, yeah. Hearing aids and earbuds, they will all have Bluetooth LE Audio. Good question.

- [Melissa] That's wonderful. Jill, thank you so much. This has been incredibly informative. I'd like to thank all of you also for joining us today. We are gonna go ahead and close down if there are no further questions. Again, thank you all for joining us.

- [Jill] Thanks, everyone.