Zebra Your Edge Podcast

Hosts:

- **Tom Bianculi, CTO, Zebra**

Guest:

- **Jaap Haartsen, Inventor of Bluetooth technology**

Transcript

00:00:00:00 - 00:00:24:09
Tom
Hi, this is Tom Bianculli, the Chief Technology Officer here at Zebra Technologies. Today, I have the pleasure of being joined by Jaap Haartsen, who obtained his master of science and PhD degrees in electrical engineering, both with honors, from the Delft University of Technology in Holland. Since 1991, Jaap worked for Ericsson, first in the United States and later in Sweden.

00:00:24:11 - 00:00:50:25
Tom
Now, here's the famous part that we all know Jaap for: While working for Ericsson, he developed the specification for Bluetooth that all of us use every day in our lives. Between 2000 and 2008, he was a part time professor at University of Twente, teaching mobile radio communication systems. In 2015, he was inducted into the National Inventors Hall of Fame and currently is a partner of the Assen-based consumer electronics company Dopple.

00:00:50:27 - 00:00:53:24
Tom
Welcome, Jaap. Thanks for joining us.

00:00:53:26 - 00:00:56:10
Jaap
Yeah, thank you. It's a pleasure to talk to you.

00:00:56:13 - 00:01:16:16
Tom
Likewise. Yeah, we were you know, we've used the technology that you're the inventor of prolifically across our entire portfolio. Our customers use it every day in an enterprise context. And I know that everybody's familiar with it from a consumer perspective as well. So thanks for taking the time to sit down with me today and talk about the evolution and the impact of Bluetooth technology over the last 20 years.

00:01:16:18 - 00:01:35:01
Tom
I can remember at Zebra Technologies when we first started integrating Bluetooth technology and there was a lot of conversations around, well, should we... this is a new standard...is it something we should do or should we continue down the path of these kind of narrowband, 900 megahertz proprietary radios? Or should we make the leap to, you know, do something like the Bluetooth standard?

00:01:35:01 - 00:01:54:28
Tom
And how big is the standard going to become? You know, we weren't even sure of that, but we quickly realized that there was so much more benefit we would get by hopping on an emerging standard...doing it in a way that would allow for interoperation. And I think, you know, you just had the very early insight before many to realize that as well.

00:01:54:28 - 00:02:17:01
Tom

And we had the pleasure of incorporating that technology into our scanning equipment way back in 2001. And as I said, I knew, we knew, it was going to give us many more opportunities to support the frontline workers that we work with and that it was going to allow our devices in our portfolio, along with the ecosystem of other partners, to create much more interoperability and share information.

00:02:17:04 - 00:02:30:08
Tom
However, I know you've said before that you had no idea how big Bluetooth would become, how important it would become when you were first developing it and bringing it to the market as a mobile device feature. When did you realize its magnitude?

00:02:30:11 - 00:02:57:08
Jaap
Yeah, so Tom, I was working in the research environment and actually in 1992 I was in the U.S. and I was starting on indoor communications. Actually, I was working on a mobile phone to operate within the home base station, a personal station in your house. So we call it now maybe the femtocell. Yeah, But when I moved to Sweden in 1994, I was asked to come up with the solution to connect the mobile phone to its accessories.

00:02:57:10 - 00:03:24:08
Jaap
And it was not the idea to make money on the technology itself, but it was to add value to the phone to boost the sales of phones and the wireless connection to be low power, low cost and support both voice and data. Well, for me, it's as I said, I'm an engineer. I like to solve problems. I was in a research environment and I actually I was not concerned with commercial viability or commercial success.

00:03:24:11 - 00:03:46:20
Jaap
And even when the technology was already implemented in the phones and sold worldwide by famous brands, I still was not realizing, well, that was a big thing. And actually at one time I was reading an article, I think it was in 2006 of telecoms, and they said, well, you know, there are around 1 billion devices out there with Bluetooth inside.

00:03:46:23 - 00:04:00:05
Jaap
Yeah, But then it was I realized, okay, this is something big and this will not go away, that this quickly. This is something to stay. So that is when I realized the 1 billion mark in 2006 of the Bluetooth devices.

00:04:00:07 - 00:04:18:01
Tom
Yeah, that's... I mean that's amazing. And so it was an amazing journey. I think, you know, when I think back to that sort of, you know, mid to late 90s timeframe that, you know, you took the challenge on. It may seem obvious today, but the idea of combining voice and data together wasn't something that people were just, you know, were naturally thinking about.

00:04:18:07 - 00:04:37:23
Tom
And then the whole idea of profiles that got built into the standard where, well, for one type of device I want to make a certain packet structure a priority. And for another device, I may want to make another way of interacting a party with based on whether it's voice or data and the latency of the device, all those sorts of things.

00:04:37:23 - 00:05:07:22
Tom
So yeah, the early thinking that went into how to make it as flexible as possible, I'm sure is what led to a lot of the adoption that it did get. I know it did for us at Zebra. So was the initial goal to facilitate endless connections between mobile devices, kind of like I was just describing, and accessories and other types of devices? Or were you just trying to get Ericsson devices to talk to certain types of devices for specific purposes in support of, you know, consumers? Or is it more in support of enterprise applications?

00:05:07:22 - 00:05:09:16
Tom
Like how did you think about that?

00:05:09:18 - 00:05:30:27
Jaap
Well, when you asked the Ericsson management back in the 1994 for what would become important for the phone, they would say there are three things important for phone. One is voice. The second one is voice and the third one is voice. They had no idea that data should be important as well. But of course they thought, well, a little bit of data should be important.

00:05:30:27 - 00:05:57:24
Jaap
And one of the use scenarios we were thinking of, is what we call the briefcase trick. That means that in the plane you would answer all the emails on your laptop. Of course, you didn't have a connection at that time. But then you put it in your briefcase, you land on the airport, you turn on Bluetooth, it's connected to the phone and all your emails are forwarded to the internet to get to the to the end to the other side.

00:05:57:27 - 00:06:23:22
Jaap
So, but at that time, we didn't have very high data rates. So the phone could support up to 12 kilobits per second, that's about the maximum data rate it could do. So I was thinking, well, if I make it 10 times as much, that should be more than sufficient. So starting with that specification, which the data at 44 kilobits per second, but well quickly we realized, okay, this is going to become much bigger.

00:06:23:22 - 00:06:30:04
Jaap
So in the end, 144 megabits per second was the goal and that was the first specification of Bluetooth. Yeah.

00:06:30:06 - 00:06:50:00
Tom
Yeah. That's interesting. The evolution. Right. You can never get fast enough. You know, thinking back to I think the very first modem I had was probably 300 bits per second, 300 baud as it was called. And I love the application you describe there because, you know, it was a critical one in so many different markets.

00:06:50:00 - 00:07:07:11
Tom
But the idea that you could have it on your person or have it in your pocket, which is the notion of "store and forward" right, you know, the briefcase in the airplane example of storing the data. And then the second I've got the connectivity, I'm able to queue up the batched information and forward it along, which had applications in so many different places.

00:07:07:13 - 00:07:24:18
Tom
You know, all of that being said, though, and with all of that, I also if I could just comment real quickly on this idea of, hey, you know, 12 kilobits per second sort of thing, let me just add a zero to the end. You know, and I think sometimes we don't we don't make decisions that quickly anymore. Right.

00:07:24:19 - 00:07:39:27
Tom
You get committees together and you figure things out. And I think you cut and run and said, well, 12 kilobits per second is doing okay. I mean, sure it's going to go up. Let me just go to 140, which is going to blow people's doors off. And of course, it'll go up from there.

00:07:39:27 - 00:07:51:17
Tom
But it's something I can action and get moving, which must have been a mantra of yours because you came up with the solution pretty much like within a year's time. So how did that happen so fast?

00:07:51:17 - 00:07:55:04
Jaap
Well, a year's time is a little bit misleading.

00:07:55:06 - 00:07:55:21
Tom
Yeah. Yeah.

00:07:55:26 - 00:08:20:07
Jaap
As I said, I was working from it from the start in 1994, which was a kind of research project when the layout of the system was made. And it was not until 1997 that we realized, okay, we have to build an ecosystem around it. So we have to reach out to other companies. So that is what the Ericsson did and went to other companies and said,

00:08:20:09 - 00:08:47:08
Jaap
"You could also make devices that connected to the phone and yeah, to make this ecosystem." So in 1998, in February, we had approached four other companies which hooked up to this idea and we created the Bluetooth special interest group, right? And then, well, then within a year we had a specification, but of course 90% of that was already being done in this research area.

00:08:47:11 - 00:09:13:10
Jaap
So I had this input I had made and then the rest of that was created also by the other four companies. So most of it, what still had to be done in 1998 of 1997 when we started this cooperation with other companies, was the software layers on top of the radio layer. So we were quite good in radio layer, but softwarer layers on top of that still had to be developed quite a lot.

00:09:13:13 - 00:09:36:15
Jaap
And of course, with these five companies, everybody came together and made their effort to make this a specification. A July 1999, that was when the specification, the first version came out. So it was not within a year, the last 10%, the fine tuning was, but the 90% was already being done in that state. That made us also move quickly.

00:09:36:17 - 00:09:38:01
Jaap
to get products.

00:09:38:07 - 00:09:57:11
Tom
Yeah. So that was a great answer because it's a correction. And also the reason that describes how you were able to move so fast because I think looking from the outside in, well, it may have looked like it was a year because of the time from the formation of the special interest group and the standard and the four companies coming together at the time that it was actually launched.

00:09:57:14 - 00:10:21:08
Tom
But what you did the previous three years is move fast in the background without a lot of overhead, without a lot of red tape. Right. And you know, used your intuition and your technical knowledge and the team around you to go create. So that's probably a lesson for all of us, which is involve the masses at the right time and move fast with the smaller number of people when you're first getting started.

00:10:21:08 - 00:10:37:04
Tom
So love that. I know you had originally wanted to call Bluetooth "Piccolo" because of how music brings people together, but someone obviously had a different idea. How did you land on Bluetooth for this technology's name and you know, does it have a special meaning?

00:10:37:06 - 00:11:01:25
Jaap
Yeah. Okay. Well, when I started this in 1994, it was actually called MC Link and MC was an abbreviation for a multi communicator. It wasn't kind of a PDA. Maybe, you know Newton, this personal digital assistant. Well, the idea was that we would have a wireless link between the PDA and the phone, and then the phone would connect to the cellular system.

00:11:01:27 - 00:11:31:28
Jaap
And that, well, MC Link was just an actual name. And actually, MC never made it to the finish, but the Link remained later on. Yeah, when we approached the other companies, they were trying to get some kind of codename for this project and there was a discussion between my Swedish colleagues and American colleagues, and they talked about the history of the Scandinavian world.

00:11:32:00 - 00:12:11:06
Jaap
And there was this famous Danish king who was called a Bluetooth, and he made sure that the Scandinavian people were united. So he was a Viking king, but that was back in 950 or something. And actually that was a code name and there was never intended to make it into a commercial name. So we launched the technology in 1998 or actually in May 1999, when that was publicly announced, marketing people said, "Well, we've come up with another name," but well, they were thinking about PAN like personal area networks.

00:12:11:06 - 00:12:34:09
Jaap
But when you Google "pan", it was already there. So it was taken. Right. And well, I had considered Piccolo because I liked the flute, the music like that, the frequency hopping with Bluetooth does. It's like making music, but that was never considered seriously by them. So in the end they said, "Well, Bluetooth is temporary. We will come up with a new name."

00:12:34:09 - 00:12:47:11
Jaap
But they never came up with a new name. And the name stuck and everybody recognized it and was apparently easy to pronounce, no negative connotation with it all around the world. So it's a good name.

00:12:47:14 - 00:13:13:07
Tom
Yeah. Yeah. Well, it stuck for sure. And I think, you know, people probably rarely think about the origin of it, but, you know, use it pervasively in the way they talk about its use cases. So yeah that's awesome. I mean I think Piccolo would have been a fitting name as well, considering the way the technologies enabled this kind of special harmony between seemingly disparate devices and the people using them.

00:13:13:10 - 00:13:28:28
Tom
If it weren't for the technology, I'm not sure how easy it would be to create personal area networks. So even though the term was around for a long time, it was all a bit of a dream until you know, the likes of Bluetooth came along and we can now instantly share information across devices without having to make a physical connection.

00:13:29:00 - 00:13:55:23
Tom
We have this whole ecosystem of accessories. I mean, you know, it's phenomenal from rappers in the music industry endorsing earbuds, using Bluetooth to speakers to keyboards. It makes it easier to create, curate, share, interact with content. I mean, the impact of Bluetooth has been so significant. The technology has been so effective as a connectivity solution that no one's come up with something better in 20 years, which is astounding as well.

00:13:55:25 - 00:14:15:23
Tom
I would put one footnote on that though, which is, you know, and I gave you credit and compliment you and admire the insight in the early...I know you're getting the four companies together and building the standard. But really thinking about what are all the different ways this can be used, what are the profiles, how does the data rate evolve?

00:14:15:29 - 00:14:35:15
Tom
And so how do you create enough space in the standard such that it is a standard, but you almost take the cap off, right? What that standard could evolve to over time. And I think that must have been an early tenet of the architecture in the way you and the team were thinking about this.

00:14:35:15 - 00:14:54:15
Tom
But, you know, even cellular and Wi-Fi technology can't do what Bluetooth does in a lot of select applications. So you really hit the mark. You hit a homerun as an engineer and an innovator...inventor. How does that make you feel? And you know what? How did your realization of that come about?

00:14:54:17 - 00:15:16:03
Jaap
Well, as I said before, I didn't know that was becoming this big. But now it's if you walk in the street and you see Bluetooth all around you on advertisements, in shops, in cars, etc., it makes me very proud. And it's satisfying to see that technology that the way that you have been working on is embedded in all the devices that you see around you.

00:15:16:05 - 00:15:40:00
Jaap
So but I have to say that, well, I crossed my fingers because so many devices are operating at the same time in the same area and it's a radio. So there is all this kind of interference, mutual interference between the devices. And I simulated all those things back before we launched the technology. But simulations, you can only come that far with it.

00:15:40:03 - 00:15:53:25
Jaap
So, yeah, I'm still amazed by the fact that so many devices can operate without having a breakdown of the complete radio system when so many devices are operating simultaneously in the same area.

00:15:53:28 - 00:16:28:16
Tom
Yeah, yeah. And I can remember early days of our deployments of some of the Bluetooth technology, you know, whether it was the early days of frequency hopping spread spectrum, 2.4 gigahertz Wi-Fi before all the other 802.11 standards came out or it was a microwave oven in the break room of one of our customers, or it was a particular type of voice-based portable phone that they might have been using to communicate amongst peers within the environment.

00:16:28:18 - 00:16:46:15
Tom
There was lots of potential interference. Right. And ultimately, you know, through the flexibility of the standard, I can't think of a situation where we weren't able to work around those things. So but yeah, it is something to think about given everything that's floating out there from an RF perspective.

00:16:46:17 - 00:16:55:16
Jaap
But yeah, the frequency hopping concept has proved to be very robust against all these interference. Even amongst each other, so to say.

00:16:55:18 - 00:17:18:06
Tom
Yes. Yeah, yeah, certainly. And you know when we were looking at Bluetooth early on, we deployed it initially and I went back kind of into the archives, if you will. I took a little look back at what were some of the first FCC filings we had around Bluetooth. But the earliest one I came across was in that about that 2001 time frame, and it was for a wearable scanner.

00:17:18:06 - 00:17:39:25
Tom
So this was a scanner that would mount on your hand because if you're loading a vehicle, let's say as a parcel delivery person or, you know, a large carrier, transportation carrier, you might be loading hundreds of boxes into a long 53-foot trailer. You want to be able to keep your hands free, but you want to be able to also scan the barcode that's on that package.

00:17:40:02 - 00:18:10:19
Tom
So you can do a lot of scanning and moving almost simultaneously. So we came up with this sort of way of strapping, if you will, a barcode reader onto your hand with a power source, keep your hands free to manipulate the boxes, but also capture the data. And much like the other scenarios you described, which I'm sure you didn't envision this exact one at the time, but, you know, being able to get data from that scanner that's mounted on my wrist, maybe to a mobile computer that's on my hip or maybe to a computer that's mounted on a pole next to the dock door.

00:18:10:21 - 00:18:31:22
Tom
And whether it's the hip phone or it's the mobile computer mounted on the pole near the dock door, that second computer became the backhaul. And so it was processing and backhauling to the WiFi or the wide area network. And we could miniaturize what was actually on the worker's hand to keep it light flexible and allow them to move.

00:18:31:22 - 00:18:55:06
Tom
So it was a lot of innovation around industrial design, around user experience, around wearable computing. And you know what? What I'm pretty amazed about actually is we kind of invented that category around wearable computing. We initially built it around the Bluetooth standard to communicate with other more powerful computers. And to this day, it's still the way that we largely do that.

00:18:55:06 - 00:19:14:27
Tom
Now we've made it even smaller. We literally have what we call ring scanners. So the whole scanner with the Bluetooth radio mounts on your index finger and you can go and get the job done. So it's continued to evolve. But, you know, the Bluetooth has been the one constant around that evolution over time, even though many other technology transitions occurred along the way.

00:19:14:27 - 00:19:38:02
Tom
So, you know, one thing that I'm curious about in that regard is around differentiation, competitive differentiation. I mean, I think so many companies focus on how do they create competitive differentiation by building a moat around what they do and, you know, being very careful not to share and, you know, get competitive advantage over time by doing that.

00:19:38:09 - 00:20:09:04
Tom
But one of the things you did early on, I think, was look for continuous innovation by not thinking in a proprietary fashion, but rather thinking in an open innovation type of fashion. And that might be it's a little bit more of an accepted practice today in terms of open innovation. The terms become more common. But back in '94, '97, '98, that was not really the way people were thinking about innovation and creating differentiation.

00:20:09:04 - 00:20:13:09
Tom
So, yeah, what led you to that? How did you arrive there?

00:20:13:14 - 00:20:37:07
Jaap
You can say that with proprietary technology you can move faster, and we already mentioned that, also, when you talk to how could you do it within a year? We had done it first without any other companies involved because with an open technology you need to negotiate, agree, make compromises. But I have to say also that Ericsson was not after selling the technology itself, but boosting the phones.

00:20:37:13 - 00:21:05:09
Jaap
So they needed an ecosystem. And that made them take the step to open this technology for others as well. So in the end, with an open technology, the scope will be bigger, it will be larger, you will have more applications, diverse applications, you wouldn't have thought of in the beginning. And with open technology, in the end, it will be richer and then it will reach further than you would have with closed technology.

00:21:05:12 - 00:21:23:19
Jaap
And there is this famous African proverb which says, "If you want to go fast, you go alone. If you want to go far, you go together." And I think that's why Bluetooth is now this big...it's because we went together.

00:21:23:19 - 00:21:41:10
Tom

Yeah. Yeah. No, I love that. And I also like, correct me if I'm wrong on this, almost the two gears that it seems like you pursued, which is, "Hey, I'm going to go fast and maybe not quite alone, but more alone than together in the first couple of years." Let's say '94 to '97. And then said, "Okay, great, I got that baseline, that foundation.

00:21:41:16 - 00:21:48:14
Tom

Now I'm going to shift gears into, you know, let's go far together." And then went to the open innovation model and introduced this special interest.

00:21:48:14 - 00:22:09:03
Jaap

I can add a little bit about that. My manager was of the opinion that, okay, you put the task to a certain person to make a concept, make something, make a suggestion, make it as big as possible, and then others can shoot on it. So you start with something and not start with nothing and together have to come up with something.

00:22:09:09 - 00:22:10:21
Jaap

And I think that was a good idea.

00:22:10:27 - 00:22:32:24
Tom

Yeah. Yeah. It's always faster, easier to make progress when you start with something that people can start to kick around and add to. And so mixed makes a tremendous amount of sense. So yeah, I mean, we spoke about this, but I think to say most devices today come with Bluetooth is an understatement because just pretty much everything does.

00:22:33:01 - 00:22:59:12
Tom

We spoke about the history and you know, here we are in the milestone anniversary and it's continuing to evolve as I mentioned earlier, it's kept up with the times from supporting video to enabling wireless docking, which is, you know, phenomenal when you think about the amount of bandwidth that's required to do that. Do you think it ever gets replaced as the de facto personal area network or does the flexibility you envisioned from the beginning allow it to evolve for another 20 years?

00:22:59:12 - 00:23:25:05
Jaap

Yeah, well, there have been many efforts, of course, to replace that technology. Think about Wi-Fi direct. Think about ultra wideband. But you have to realize there are now about 30 billion-plus devices...an installed base around there. So if you want to introduce something, at least you have to have some backward compatibility towards all those devices out there.

00:23:25:07 - 00:23:48:24
Jaap

So my belief is it's better that we are still evolving things within the Bluetooth community to use the Bluetooth as a framework and build on top of that if you want to have new capabilities. And that's happening nowadays. And with that in mind, you can keep the backwards compatibility to all those 30 billion devices and still get new things out there.

00:23:48:27 - 00:24:10:26
Tom

Yeah, I think that's probably, you know, that's a pretty steep hill to climb to say, when you look at the risk-reward or the pros and cons ratio, even if you had something better, what are you letting go of in terms of compatibility? And I think that's always the silver lining. The advantage, I guess you might say, of a standard.

00:24:10:28 - 00:24:46:17
Tom

So, you know, I think when you zoom out overall in the conversation we've had, the bigger picture here is the whole wireless connectivity story. Right? You know, we have Bluetooth Wi-Fi, RFID - which Zebra's helped to pioneer and were leaders in - wireless charging, voice activation control devices, NFC/near-field communications, all of that...connecting everything from the IoT sensors that cost dimes and a couple of dollars all the way up to GPUs that costs tens of thousands of dollars.

00:24:46:24 - 00:25:16:23
Tom

Taking that back to the cloud, GPS, visible communications, etc. Each of these was driven more by technology standards and vision than the use cases. And I kind of find that interesting because it takes a pioneering mindset to say, okay, I may not envision the precise use case, but a truth that's going to be, you know, unquestionable in the future is that people are going to want more connectivity, they're going to want it faster, they're going to want it to work more effectively.

00:25:16:23 - 00:25:33:14
Tom
They're going to want to have more choice. They're going to want to have more access, accessories you can connect to. But it's not easy to navigate...to have that insight as you're trying to develop something to the market. So how did you manage that? How did you get people to believe in the standard in the tech when it was way ahead of the use case momentum in a lot of cases.

00:25:34:22 - 00:25:42:04
Tom
And, you know, how did that change people's behavior, the change management? What's your thoughts around that?

00:25:42:06 - 00:26:00:23
Jaap
Yeah, well, you're right that it was really technology driven when we brought out Bluetooth and we had to do a lot of what they call evangelizing to make the people aware what they could do with it. But in the end, as it is, I think the user is interested that it works. The interest is that it works.

00:26:00:25 - 00:26:20:19
Jaap
And for us engineers, you have to make it as smooth and automatic as possible so that the users don't have any hassle with it. So we said to each other, "Well, the biggest compliment would be that if the people are not even aware that Bluetooth is inside. And well, it's not easy, ad sometimes I think we are not there yet.

00:26:20:19 - 00:26:43:19
Jaap
People still have these out of the box experiences that they can pair it, or for security settings they need to have more interaction than you would like. But we are still working on that to make it into the system that really becomes that easy, automatic, and even invisible for the user.

00:26:43:19 - 00:26:48:07
Jaap
I think that is our main goal for all the technology we develop as engineers.

00:26:48:09 - 00:27:18:26
Tom
Yeah, that's, that's a great one for, I think the audience to take away. You know, it transcends Bluetooth, it transcends wireless. It's really saying, how do I make a user centered design approach the core of what I'm doing? I think that's another thing that's often underestimated is if you make it easy, frictionless, simple, and really about the user and not about the technology, then, you know, that's when the adoption goes off the hook.

00:27:18:26 - 00:27:41:29
Tom
And, you know, one of things I've always been amazed by throughout my career is very small reductions in friction, you know, meaning literally you look at almost how many clicks does it take to do something or have disproportionate impacts on people's adoption? And, you know, you could look at anything from an app store to, you know, you could look at the MP3 space in digital music.

00:27:42:01 - 00:28:04:05
Tom
I mean, what did iTunes in the Apple device do in that regard? And, you know, the ecosystem they built was really to just make it easy to put the whole experience together. There were plenty of other players out there that had all the pieces, but there was nobody that just made it seamless. And I think that idea of thinking through it, what's the experience as the means of driving mass adoption is often overlooked.

00:28:04:07 - 00:28:21:14
Tom
Unfortunately, it's often overlooked. So yeah, just a couple of other things and we'll close out what's been a great conversation. But what do you think Bluetooth will be 20 years from now? What impact will it have on our lives? What we will be able to do that we can't do today? What types of innovation might we expect to see in the next two decades?

00:28:21:14 - 00:28:34:05
Tom
Am I going to have a Bluetooth device implanted in me that's going to be communicating to the outside? I don't know. Or maybe a patch on my arm that's monitoring my vitals? I mean, where do you see it going?

00:28:34:07 - 00:29:00:04
Jaap
Yeah. All right. Well, I kind of look in the crystal ball, of course, but what I'm working on myself now. So, we are seeing that we are dealing with an aging population. You see that the costs of health, medical care, they exponentially rise. And how can we counteract that? So today I'm working on the systems that also use Bluetooth, that support wellbeing.

00:29:00:06 - 00:29:17:17
Jaap
For example, so that we stay healthy longer, we can see and hear and do things like we want to do even when we get older so, yeah, Bluetooth also in these devices can enrich and improve our standard of living.

00:29:17:19 - 00:29:18:07
Tom
Yeah.

00:29:18:07 - 00:29:28:19
Jaap
So, that's my main goal and what I'm seeing also, for example, with hearing aids is kind of where these kind of devices are now also getting Bluetooth enabled, and I see really a future in that.

00:29:28:21 - 00:29:48:13
Tom
Yeah that's inspiring, I guess I would say. And, you know from convenience to mission-critical livelihood and better quality of living, would be quite a lifecycle for a technology like Bluetooth. And it does seem like you and I both hit on the same area of health care and quality of life.

00:29:48:13 - 00:30:07:04
Tom
And it does seem very much where that will go when you look at the way the sensor ecosystem is evolving as well. So, hey, just two questions for you. Nothing thing to do with Bluetooth so much, but just to bulld off the you know, the the way you operate, the way you think, and maybe leave people with a couple of nuggets around that.

00:30:07:06 - 00:30:18:19
Tom
So when you think about the difference between innovation and invention, how should innovators, inventors think about that? What is you know, what do you think the depth is in a way of thinking about it?

00:30:18:22 - 00:30:38:26
Jaap
Well, I think that's a clever way of combining existing things that can come up that could kind of give you quite some innovation...you don't need invention for that. So for an invention, I think there has to be a problem and you have to solve that. And you can solve that in a unique new way that others have not done it.

00:30:38:26 - 00:30:50:29
Jaap
And that's really invention. But there are many ways to drive innovation. And therefore, as I said, it's not the same thing. You don't need inventions to do innovation, right?

00:30:51:04 - 00:31:07:19
Tom
Yeah. Very often you can, I guess, deliver innovations faster without the inventions. You'll build on the shoulders of others. So yeah, thanks for that. And I know this is a tough one. It's a big question. But, you know, over the course of your career, what's been your single biggest lesson learned along the way?

00:31:07:20 - 00:31:09:16
Tom
Just one of them.

00:31:09:18 - 00:31:34:16
Jaap
Yeah. Well, my lesson has been that you have to keep believing in your thing, what you're doing, even if people try to make you believe otherwise. So I met many people who are extrapolating technology, stretching technology, evolving it from existing things. But sometimes you have to make the jump. You have to come up with something completely new, look at it from a different way.

00:31:34:19 - 00:31:47:11
Jaap
And well, that's what inventors do. And inventors are stubborn and they are persistent. But yeah, keep your eye on the goal, what you want to achieve and believe in what you're doing.

00:31:47:13 - 00:32:07:17
Tom
Yeah, well, you heard it here from Jaap Haartsen: believe in what you're doing. Right? Have passion and persistence and change the world. AndI think Jaap, through the many things you've done, but certainly Bluetooth being one of the most popular, you've demonstrated that to all of us. Pretty much all of us use it every day.

00:32:07:24 - 00:32:32:13
Tom
And Zebra has gotten the pleasure of deploying that technology in an enterprise context for, you know, Fortune 100 companies, Fortune 500 companies around the world over over. 85% of the Fortune 500 are using Zebra products and pretty much all of those have Bluetooth. And then, of course, we're all familiar with it in our consumer life. And yeah, 20 years in and another who knows how many more decades to go, but it's not going anywhere anytime soon.

00:32:32:15 - 00:32:36:23
Tom
Jaap Haartsen, thanks for taking the time with me and look forward to collaborating in the future.

00:32:36:26 - 00:32:38:16
Jaap
It's nice talking to you, Tom.

00:32:38:19 - 00:32:45:02
Tom
Likewise. Thank you. All right.