The Ultra-wide Possibilities of Ultra-Wideband

Nitin Dahad (00:05):

This is a Smarter World podcast, focusing on the technology current issues behind today's connected world. I'm host Nitin Dahad, editor at EE Times and embedded.com. In this episode, we'll discuss ultra-wideband and how it promises to bring change to the connected world. Ultra-wideband has received a lot of interests lately as handset makers, like Apple and Samsung have begun to roll it out while the big players in the automotive industry are making serious moves in secure car access. What makes these use cases possible is ultra-wideband's ability to provide special awareness to smart edge devices. What does this mean for access control for the consumer and for the ultra-wideband ecosystem?

(00:44):

Today, I'm joined by Charles Dachs, SVP and General Manager for Secure Embedded Transactions at NXP Semiconductors and Ramesh Songukrishnasamy, SVP and CTO at HID Global. Charles, let's start with you. I know from talking to you before that the very name of ultra-wideband has met with some pre-conceived ideas and misconceptions based on its utilization, say 10 years ago. For people who are coming new into this topic, or for the first time, or they might be carrying some baggage of their past understanding of ultra-wideband. Once and for all, can you explain what it is and what it makes possible?

Charles Dachs (01:21):

Indeed, I think the biggest misconception out there is ultra-wideband is just an hour connectivity technology. And it is true that many, many years ago it started as a data transfer technology and as such, and at that time it was competing with technologies like Wi-Fi and Bluetooth. But since then, ultra-wideband has gone through several transformations. It has evolved from an OFDM-based data transfer communication technology to an impulse radio technology, which is specified in IEEE. And more recently, it's been enhanced with security extensions and a number of things that guarantee of an integrity and accuracy of arranging measurements are going to deliver on the user experience. Today, it truly is actually a sensing technology. It provides the unique ability to provide secure location capabilities of devices with respect to each other.

Nitin Dahad (02:14):

And maybe just explain why it was reinvented, why didn't it just continue being wireless HTMI improved or something like that?

Charles Dachs (02:22):

All for a simple that there were other technologies that dealt with data transfer technology like Wi-Fi, Bluetooth. And the reason it was re-invented is really that it provides capability that none of these others connectivity technologies could provide. And that is that ability to provide special awareness and secure location capabilities to devices that equipable to wideband. That's

why it came to a forefront again. We had a debate even within NXP, within FiRa on whether we should rename this and call it differently because ultra-wideband has this connotation of things that were very different 10, 20 years ago. But at the same time, the past few years, it was used by many industry players in its new capability as a sensing technology so we just selected to continue calling it ultra-wideband.

Nitin Dahad (03:16):

And I guess, within your customers, now, people now accept what it is now and they don't really necessarily have a preconceived idea because obviously they're working with you on this.

Charles Dachs (03:25):

That's correct. I think there was maybe a bit more in a year ago, some confusion, we don't see the confusion in the market anymore.

Nitin Dahad (03:32):

Good. Good. And what does it make possible?

Charles Dachs (03:34):

What it makes possible is for it sensing capability that makes it possible for devices to understand their respective location with respect to each other and that in a very accurate way. And when you provide that capability to devices, they now can act in an intelligent manner based on their understanding of that relative location. Many other use cases that are now attracting interest are really relying on that capability.

Nitin Dahad (04:05):

Okay. And we'll talk about the use cases later. Ramesh would you like to add something?

Ramesh Songukrishnasamy (04:08):

Yeah. I think what Charles said is correct. Things like accurate ability to allocate relative position as well as doing it in a very secured manner, make it more robust out of interference. And those are some of the things would make the applications, or use cases much more robust and enable consistent, seamless user experience.

Nitin Dahad (04:36):

That's interesting because people for many years have been trying to do this single user digital ID without much success, because there are too many different systems. I guess that's part of where this might help. Is that right?

Ramesh Songukrishnasamy (04:52):

I think so, yeah.

Nitin Dahad (04:53):

What drives innovation in this area? I know you talked about security, is it the secure access that's driving innovation or are there other things as well?

Ramesh Songukrishnasamy (05:00):

Actually, I see the evolution is happening in all the three dimensions that we talked about, maybe a different pace, a different time. For example, for a long period access control has been mainly based on low-frequency out of technology-based, right? But in the past six, seven years, you see significant increase in adoption of BLE and NFC based solutions. Thanks to Mobile Access Solutions. That option of mobile has really helped to adapt these BLE, NFC based solutions. As I mentioned earlier, by and large, even in mobile access solutions, the main user interaction has been to emulate the physical card in some form or other, right? Also, the usage of mobile, you're able to store multiple digital credentials in a single device and use them across multiple applications and use cases. I think that Australia now is enabling seamless hands-free access control. More importantly, how can you provide a consistent, seamless experience when you unlock the smart lock into your home or unlock your car or access your workspace, or when you checking into a hotel, right? That I think is where the innovation is happening a lot as we speak.

Nitin Dahad (06:24):

What are the key characteristics of ultra-wideband on the specific example of access? Pin down what is it exactly that it's giving you that significant advantage?

Ramesh Songukrishnasamy (06:34):

Okay. Maybe I will start with what Charles mentioned earlier, right? To add to what he said, I think UWB in my view enables higher level of accuracy in positioning capabilities, right along with increased security compared to other out of technologies. And UWB is also more immune to our interference so it works much better in high traffic settings. I think these capabilities will enable a much better seamless user experience in a variety of use cases like hands-free access control in your workplace, hospitals, hotels, homes. That, I think to me is one of the key differentiation.

Nitin Dahad (07:18):

I suppose. Yes. But why is that accuracy important? I think it gets to the crux of that secure access, isn't it? Yeah. That accuracy.

Ramesh Songukrishnasamy (07:26):

That's true. Yeah. I think it plays two important role within. One, to be able to provide a secure access, making sure that okay, it's you and it's only you and not somebody else tailgating and things like that. And second and most important aspect is the user experience. With ability to

pinpoint where you are precisely in a location, you can then enable more advanced capabilities like intent detection, whether somebody is walking towards the door and then looking at the trajectory, you can unlock and you can verify the credential and lock the door so it becomes very seamless. And if that's an automatic door, as you approach, the door automatically opens and then as soon as you exit certain space outside of the door, it automatically closes. At the same time if you're just passing by the door and again, looking at the angle of arrival and the trajectory, it can say that, okay, now this individual, even though he or she has the valid digital credential is not intending to open the door so I'm not going to unlock this door. Those kind of higher level capabilities would be possible with these type of technologies.

Nitin Dahad (08:48):

Excellent. You've explained it very well. I think that's what I was trying to get to. Well done. Thank you. Let's go to connectivity and again, it's for both of you but I think there are a few connectivity technologies out there. Are they mutually exclusive or complimentary and what does ultra-wideband add to the wireless tech landscape? And you did talk about interoperability and just tell us a little bit about how everything fits in together here.

Charles Dachs (09:14):

I think to your question, are they mutually exclusive or complimentary? I think it's probably both. They will be implementations where they will be complimentary. I think access, a home access or car access is a good example of that where Bluetooth would be used for blue valley would be used for the discovery part of the interaction with their user. And then as soon as you come in proximity of a door of a car or your home an ultra-wideband would take over. And in other cases, I might use cases where they might be completely mutually exclusive, meaning only ultra-wideband might be used for another specific use case or only Wi-Fi and Bluetooth will be used. What ultra-wideband brings to the table as we, Nitin already discussed earlier is truly visibility to precisely locate in space and do that in an extremely robust way and an extreme secure way. That radius what's ultra-wideband is bringing to a table that compliments what other connectivity solutions are able to provide today.

Nitin Dahad (10:17):

Ramesh, did you want to add anything to that in terms of the overall landscape?

Ramesh Songukrishnasamy (10:21):

Yeah. I agree with what Charles mentioned there, right? It's mainly use case driven, right? For example, with the broad portfolio of products that we have in HID. We enable trusted identities of walls, places, people, things and many of our products are packed with multiple RFID technologies like low-frequency NFC, BLE, Wi-Fi to address various needs of the customers in different use cases. In some use cases, it's sufficient to have one or two combination of these technologies but in some cases you end up in having support multiple RFID technologies, especially in case where we are in the transition mode. Ideally speaking, one don't want to have

the low frequency out of technology, but then let a huge customer base install base, which still predominantly uses lot of low frequency cars.

We end up in offering low-frequency in even our latest products, right? That's just to maintain the continuity of it but I'm sure at some point the convenience and the security and the versatility of the mobile phones would overtake and help the customers to transition or to this new mobile access based ecosystem. Then we don't need to no longer support certain RF technologies but then definitely UWB has its unique capability when it comes to location sensing because that's the key aspect of UWB. I think again, time has to say but I personally think UWB would play a very key role in many of the future offerings moving forward.

Nitin Dahad ([12:10](#)):

How do the technologies actually work together if you have those multiple technologies working together. I guess there's something you have to consider in terms of how you make sure everything hands off to each other well.

Charles Dachs ([12:22](#)):

Yeah, that's correct and this is also where standards come in. For instance, at FiRa [inaudible 00:12:27] consortium, one of the first use case which has been specified is the access use case and how do we deliver a consistent experience across different ecosystem, different verticals for access. That's one of the key thing that FiRa has been focusing on the same is true for car access, where the car connectivity consortium has looked into how to make sure that this combination of Bluetooth Valley and ultra-wideband is done in such a way that it delivers on the experience promise.

Nitin Dahad ([13:02](#)):

That sounds like it's very similar to how, when Bluetooth was initially set up here, it was set up with profiles, which were standardized.

Charles Dachs ([13:11](#)):

It is, yes.

Nitin Dahad ([13:12](#)):

Okay. There's one question I wanted to ask related to how ultra-wideband compares and overcomes hurdles at say Bluetooth. I think you answered it earlier but because we're talking about this connectivity right now, how does ultra-wideband overcome the hurdles that Bluetooth low energy has in terms of precise inside, outside detection for hands-free access?

Charles Dachs ([13:34](#)):

Yeah, I think fundamentally the physics are different Wi-Fi and Bluetooth really rely on a moderated sign wave carried over an hour frequency where ultra-wideband really has a unique pale signal, very short pulse signal, which is operating over 500 megahertz or frequency. And that fundamental difference in physics means that Bluetooth Valley Wi-Fi are just by nature, more susceptible to environmental factors. They use RSSI, right? Which includes structures and interferences from other radios and results in reduced also accuracy. Whereas ultra-wideband just benefits from the fact that this pale signal maintains its accuracy, even as the distance between the device is increasing. If you really have devices that move away from each other tens of meters away from each other, it's still very resilient in a non-line of sight operations.

Ramesh Songukrishnasamy (14:30):

Yeah. Maybe Nitin, I would like to add on that a dimension to what Charles has mentioned. I think Charles feel free to correct me if I'm wrong. I was not part of the Bluetooth special interest group or NFC forum at the beginning but now I'm part of FiRa. One of the thing I see happening in UWB is specifically for hands-free access is we are starting UWB adoption with a very focused use case in mind. And one of the first use cases that as a consortium that we have taken ease access, right? That means we are able to define certain standards, that and performance requirements that are interoperability requirements exclusively for the physical access control or hands-free access.

(15:19):

That I think sets apart UWB and the adoption of UWB to enable a more seamless, secure access compared to other RF technologies with which Gar originated in a different context, but then got adapted into physic and the physical access world. But as I see that UWB is taking a completely different approach in terms of driven by the use case specifically for access control to start with. And of course, we have many other use cases in the pipeline, Charles, I don't know if you agree with this, please feel free to come in.

Charles Dachs (15:57):

Yeah. In the case specifically of NFC, I think one of the big benefit of NFC when it started was that there was a legacy infrastructure. There were already many contactless cards out there used for access and our use cases. One of the difficulty related to that is it's 20 years of legacy that you need to deal with including solutions that are completely non-standard compliant, depending on where you're trying to enable visa use cases, now NFC has dealt with this by over years, just making sure that the solutions that were being deployed enable to deal with that additional complexity of a legacy infrastructure. The advantage, as Ramesh said, for ultra-wideband, it's a clean playing field for ultra-wideband. And we starting from the gecko in defining the use case and the implementations in such a way that every device door lock out there is going to be interoperable from the gecko so I think that's one of the key differences here.

Nitin Dahad (16:59):

One last point on this topic before we move on to consumer adoption and I think it relates as well. How are biometrics complimentary to ultra-wideband? And I think part of this was covered earlier but, can you just tell us the connection between biometrics and ultra-wideband here?

Charles Dachs (17:15):

Yeah. I can say that the biometrics has been complimentary to any of the RFID based technologies all along. I think that we continue in specific use cases where you need multi-factor authentication. RFIDB is one of the factors then use biometrics say that or a facial or fingerprint or some other form as a second factor authentication. I think that aspect will continue even though they enhanced the security that comes with the UWB might make it much more robust, much more stronger, the overall solution.

Nitin Dahad (17:55):

Let's talk a little bit about consumer adoption and what would it take for new users to get used to a new technology? You talked about interoperability earlier but let's just dwell on what is it going to take for users to get used to this?

Ramesh Songukrishnasamy (18:08):

I think interoperability and a robust ecosystem are really key for adoption of any new technologies, especially if that is not much legacy so that's true for ultra-wideband as well. Without interoperability, we cannot achieve first of all, consistent user experience across different devices, manufactured by different manufacturers and we cannot scale. And that's why we set up FiRa consortium with the help of industry leaders and technology providers to promote UWB and ensure interoperability. That really guarantees or at least gives assurance that the device that you buy can work with multiple mobile phones or other end point devices as technology evolves.

Charles Dachs (18:57):

And If I would add to this so indeed, making sure that you provide this unique and consistent experience is going to be key for the consumer. The other one of course, is that across a broad ecosystem leaders in their industries start deploying and manufacturing devices that have that capability, right? And that's very important. And that's what we see right now happening in mobile and automotive. And also starting an IOT, you have some very big names out there that are essentially understanding knowledging and acting on that unique capability that ultra-wideband delivers and are pushing consumer devices out there. It's going to be more and more visible to consumers as more devices, phones, cars, et cetera, are going to be equipped with this technology.

Nitin Dahad (19:47):

And I think part of it is going to be the large smartphone manufacturers supporting it. I know, for example, there was a big talk about this when, was it last year when Apple introduced

quietly, the ultra-wideband, the latest iPhone last year, what's the importance of some of these smartphone manufacturers picking up on this? And I think Ramesh should probably have something to say on that.

Ramesh Songukrishnasamy (20:09):

Yeah. Definitely now, compared to in the past, the mobile phones, the variables are becoming the primary holders of digital credentials so they play a key role in adoption of technologies like this and especially ensuring the interoperability of it. And that's why we are happy to have some of the big players in the consortium. And we are quite excited about the fact that many of the key players have joined this consortium to drive the interoperability and adoption.

Nitin Dahad (20:40):

In terms of consumer adoption again, I think one of the other things which probably is necessary is yes, it's good to have it in say the smart phones or the access devices, but then it needs it on the other side as well in the locks and everything else. I guess you need to have the producers of the access systems as well, adopting it. Is that right?

Ramesh Songukrishnasamy (21:04):

That's true. Yeah. That's redrawing. That's why you see a number of key players in the access industry, meaning the access control reader manufacturers, lock manufacturers are in the consortium.

Nitin Dahad (21:17):

And are there any, maybe there aren't. But are there any examples of people who are already adopting it, who you can name, or you can give examples without names?

Ramesh Songukrishnasamy (21:25):

The CS 2020 at the beginning of this year, it looks like a very long time ago from it. We did do a technology demonstration along with the NXP and Samsung to showcase both UWB enabled readers and smart residential locks. I think, I'm not saying we are the only one, but I see many key players are quite interested in this and that's why they are part of the FiRa consortium as well.

Charles Dachs (21:53):

But if you look at the members, for instance of FiRa with some really big names out there, [inaudible 00:21:58] HID being one of them, which obviously are active in this space.

Charles Dachs (22:04):

I'd like to add if I can one more point about the mobile William's role is in here. It's not just providing phones that are equipped with ultra-wideband, some of these big names and the ones that haven't been vocal about it. Apple, Samsung and Xiaomi are active in driving a broad range

of use cases, right? It's public that Apple and some car manufacturers are working together. As Ramesh said, as public Samsung is working with some access companies. They also do this because they want to deliver that ultimate experience for end users and because they also acknowledged the fact that a lot of work has to be done in the background to create that interoperability promise. And they're very active doing that.

Nitin Dahad ([22:49](#)):

Okay, let's talk about standardization. Where do we stand in terms of ... I think you did address it very briefly, but what are the next steps and what will be the critical milestones towards achieving interoperability?

Charles Dachs ([23:00](#)):

I can quickly give three branches to standardization. IEEE is one. Where in particular, the last two years, there were a lot of activities and extending the original IEEE ultrawideband standard with security and also enhancements that allow better integrity and accuracy arranging measurements. So far in MAC level implementations have been specified in the IEEE at the car connectivity consortium specifically for this hands-free access use case. As we just discussed, the standards are now in place with digital key release, free.au specification is there, right? And that will enable passive location aware keyless access and then FiRa. And this is why together with HID [inaudible 00:23:44] and Samsung, we jointly initiated the FiRa initiative last year is now making sure that beyond the car access or car ecosystem we deliver on this interoperability promise.

([23:57](#)):

FiRa was created more than a year ago, has now more than 50 members. And it focused immediately on essentially building upon what was defining IEEE and providing the FI and MAC technical requirements and specifications so that use cases could be built on top of the standards defined in IEEE that was actually already finalized. And then it moved into really also starting developing specifications for use cases and access was one of a key focus area there, but it's now being extended to many other. So test specifications are going to be following up for FI and MAC and specific use cases and more working groups are being put together now to address variety of use cases beyond access.

Nitin Dahad ([24:51](#)):

One of the other areas I think in studying ultra-wideband is there's HRP and there's LRP. I don't know if there are two camps or it has different applications. Could you tell us maybe a little bit about those, because that is part of the standardization.

Charles Dachs ([25:06](#)):

I think there is not much of a debate anymore. There were a number of few closed ecosystems, primarily in automotive, which we're looking into LRP. But if you look for instance at FiRa and

the car connectivity consortia today by mandating HRP for ecosystems, and a reason for that is simply the fact that it offers lower power consumption. It has much higher data rates than LRP and also has a better radio link budget, which means that it's, for instance, less effected by human body at innovations. And last but not least, it also has an operational range, which is much larger so that RP typically is going to work around until 10 meters. HRP allows you to go to up to 100 meters and out of sight. So it's quite a difference. Yeah. My personal perspective to this, I don't think there is so much of a debate anymore on what the main trend will be in terms of ultra-wideband option.

Nitin Dahad ([26:05](#)):

Once we have ultra-wideband in the phone and in our door lock, it basically becomes part of our home but then what's next, you talked about seamless user experiences, but how is that going to be enabled?

Ramesh Songukrishnasamy ([26:17](#)):

I think it mainly goes back to the fundamental benefits of UWB, right? Because of its fine ranging capability. We believe it'll enable many new location-based services, whether it is access or a device to device communication and IOT applications, both in the consumer electronics space, as well as in the industrial applications. And that's something we're quite excited about because the potential of UWB technology in managing access to physical and digital places, things and identities are something fundamental to many of our offerings. And we believe this will change a lot. And in many of our offerings in different use cases.

Charles Dachs ([27:04](#)):

Two activists. I mean, give you specific examples of where we see your interest in indoor navigation, a real-time location of services in industrial environments, ticket validation for public transport services, top free, complete hands-free mobile payment experiences, where essentially you walk in a pay area to check out from your shopping experience, social distancing, virtual reality, gaming applications. There really is a very broad range of interesting use cases out there. Yes, in the home, for instance, in faxes, we discussed the thing quite extensively, but then many other things in how audio experiences can be improved by essentially having music, following you from one room to the other, same for lighting robots that had the duty to go to our charging stations in the very simple way that a lot of things that could be dominant in the home environments beyond access.

Nitin Dahad ([28:02](#)):

Okay. I mean, you've really addressed the point that access can be a catalyst for many more different use cases.

Charles Dachs ([28:08](#)):

Yes, and it can in the sense of that from a consumer experience, to give you an example, for instance, for NFC one of the catalysts for users to really be exposed to that technology and that user experience was transit. And in China, in particular, for instance, tons of people today are using their mobile phones to access their bus, their subway with NFC. And because it's a simple way to create that gesture not that experience. The consumers understand that they were doing it with a card before now they do it with a phone. It has a better UI. We do it for access, we do it for payment. In particular for payment, they should look now in the last year, the adoption of mobile pays that payment has increased substantially and it's a simple act. And they understand that experience of being accessible to wide-band will be also catalysts from that perspective.

Nitin Dahad (29:01):

Am I right in imagining that where they're using NFC at the moment, it'll be more secure using ultra-wideband.

Charles Dachs (29:07):

I think it will be a combination of like Ramesh was saying earlier, they will be use cases where you're going to have combinations of both just to take car access, for instance. NFC is going to stay because you do want to have a solution which operates with no battery. If your battery is completely low, you still want to have the ability to provide that access digital key experience. That's going to be a combination of both.

Nitin Dahad (29:30):

What about the road ahead for both of you now? Why should we have confidence in ultra-wideband to become a widespread reality and why should companies jump on the bandwagon as soon as possible?

Ramesh Songukrishnasamy (29:42):

Sure. Maybe I'll start first. I think as we discussed many key points here, I think UWB starting from almost a clean sheet has less of a legacy issues to deal with, right? It's more of how well we can define the standards, how well we can enable interoperability, how broadly we can build this ecosystem and that's really the key and that we are seeing the work in progress when starting to happen as we speak. And that gives very high confidence for key players in this industry to join force in creating much more delightful user experience in their products, or offerings.

(30:29):

That really one of the main factors and second is, as we briefly talked about some of the enhanced security aspects, I think there is an increasing awareness and also demand about security and data privacy. And this technology is going to enable some of those aspects or overcome some of the shortcomings in the other RF technologies so that is the second factor. The third one is ability to have versatile applications going from one place to other place in

different devices and different endpoints. If we could create consistent user interactions, user experience, I think that would make the adoption much wider, much faster.

Charles Dachs (31:19):

To add to this, I think what makes me very confident that this is not just an experiment out there in addition to what Ramesh just said, it's just a sheer interest we get across different industry verticals on what ultra-wideband can bring to them. It's quite impressive of a number of companies that reach out to understand every technology and also see what they can do with it as an analogy. But this is bringing a really unique proposition to them and their end users. And the second item is really the endorsement it's getting from some really big companies out there and at the end technologies, don't reach scale unless some very big players invest. And if you look at the brands out there in the automotive space, the ones that have been vocal about it, like Continental BMW, Volkswagen, Bosch, the Mobile Space, Apple, Samsung, Xiaomi in the access space has Alloy, HID and many others. These are not small players, they're leaders in their industries. And the fact that they are working with other players in the industry to create this broader ecosystem is what gives me a lot of confidence here.

Nitin Dahad (32:32):

That sounds exciting. Charles and Ramesh thank you very much.

Charles Dachs (32:36):

Thanks a lot, Nitin.

Ramesh Songukrishnasamy (32:37):

Thank you, Nitin.

Nitin Dahad (32:38):

This has been the Smarter World podcast with me, Nitin Dahad. Thanks for listening and see you next time.