Oral History of Leonardo Del Castillo

Interviewed by **Michael J. Halvorson** for the Microsoft Alumni Network

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Preface

The following oral history is the result of a recorded interview with Leonardo Del Castillo as conducted by Michael J. Halvorson on August 9, 2023, at Microsoft Studios in Redmond, Washington. This interview is part of the Microsoft Alumni Network's Microsoft Alumni Voices initiative. The goal of this project is to record the institutional history of Microsoft through the recollections of its former employees, so that the information may inform and inspire future generations.

Readers are asked to bear in mind that they are reading a transcript of the spoken word captured through video rather than written prose. The content reflects the recollections of the interviewee. The following transcript was edited by the Microsoft Alumni Network, which holds the copyright to this work.

Interview

Michael Halvorson: Today I am interviewing Leonardo del Castillo for the Microsoft Alumni Network Oral Histories project. It is Wednesday, August 9, 2023. My name is Mike Halvorson. We'll be exploring Leo's entire career at Microsoft with an emphasis on his work in the Xbox group. Thanks for being here with me this morning, Leo!

Leo Del Castillo: Pleasure to be here, Mike.

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Michael Halvorson: Great. So why don't we just begin by having you tell us a little bit about your background as we get started? Where were you born? When were you born? Where did you grow up?

Leo Del Castillo: I was born and raised in Southern California. Born in 1965 and lived most of my life [there] until basically coming to Seattle to work for Microsoft. [I lived] in and around the LA Basin. I went to school at Cal Poly Pomona. I studied electrical engineering there and went to work almost right away. I'll tell you a little bit more about my background there.

Michael Halvorson: Go ahead. Tell me about your background.

Leo Del Castillo: Growing up as a kid, I was always fascinated by science. I was fascinated by electronics, in particular. Even as a child, I loved taking things apart, [and] putting them back together again. It was natural that I would learn about electronics and hardware. Back then, there was no software development when I was growing up. But I got into electronics. I self-taught myself [and] learned a little bit in high school. This kind of led to going to college to become… well, to get an electrical engineering degree.

I was very fortunate that I was introduced to [an] engineer that was running a one-man engineering business in the same town where I was growing up, and he hired me to help him out doing

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electrical assembly. He actually turned into a mentor of mine and I was able to not just do electrical suddenly but actually start to exercise a lot of other engineering disciplines. I had… you know, when I was in high school, RadioShack TRS-80 computers had just come out in the market; the first real personal computers long before the IBM PC was introduced.

I was fascinated by computer programming and learning… [I] eventually was able to buy one and learned how to program. So, here I am designing electrical circuits and writing computer programs on my home computer, while I'm working my way through college under the mentorship of my boss, Bill. His name has to be Bill! [laughs]

But that kind of gave me a lot of opportunity to kind of really learn how to do things on my own. And [I] kind of like learning by doing, and it also took a very pragmatic approach to how I designed things.

As I said, I worked my way through college and I found myself after college, working mostly in the entertainment industry in Southern California. I did systems for mass duplicating videotape cassettes, right back when we used to rent video cassettes. I used to write the control software for factories that did mass recording. I worked for a company that built a TV editing equipment and film editing equipment. I basically replaced their retiring engineering staff--that had started this

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little business--and I was their sole engineer, redesigning their equipment using more modern digital technologies.

And as part of that, we were working with a company that had an idea for animatronic, robotic type of devices that can be used for point-of-sale and they had pitched to Microsoft. We were at the time... the company I was working for, consulting with this company, to help them develop the control software and things. And, interestingly enough in their pitch to Microsoft, they met Rick Thompson who was running the PC Hardware group. He decided that this technology might actually be applicable to building products and particularly building toys. So, he purchased and acquired this company, and I wasn't working for the company, I was consulting for them. But as part of the purchasing process, as Microsoft was considering [purchasing] this company, they asked me to present the work that we had been doing, the technical materials, what we developed for, for control of the robots and most importantly, coordinating the control of the robots with video content.

We were encoding control information and video signals so that it could be synchronized. And by the end of that presentation, representatives of this group from Microsoft ended up purchasing the company, and then offering me and one of my coworkers a job, as well. So, while I never interviewed for Microsoft, that was my interview, I guess, and I ended up being offered the job right away. I was able to make the move, and I joined Microsoft in 1995.

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Michael Halvorson: Can I just step back for one second about your past? You became interested in computers and electronics at an early age, but you also needed to study that in college. You had to take mathematics [and] physics. Was that kind of a disconnect with the things that you'd been learning, or did that really support your journey through school? Did [electrical engineering] still seem like a thing you wanted to do, academically?

Leo Del Castillo: Yes, I would say that I was a self-driven learner. All through high school I took all the math classes, science classes, physics classes that I could take. I always enjoyed science. I had [the] privilege to have really good math teachers and really good science teachers. I really got a grasp for basic science and physics in high school, such that it all came naturally. You know, I really liked to connect dots. I liked to see how I can apply concepts. So, when I went to college, I started college at Cal Poly Pomona, and got my degree there, and I actually took as many classes as I could take. I took well more credits than I really needed to get my Bachelors of Science in electrical engineering.

I really enjoyed how the mix of mathematics and physics works together into engineering disciplines where you actually make practical use. That's how I always thought about engineering, [it's] really the practical application of the things you learn in science and math. As I said, I worked my way through college, so I was constantly applying the things that I learned in what I was doing.

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Michael Halvorson: Great! Yeah, that's a really interesting story. I appreciate that so much. So, when you started at Microsoft [back] then, you didn't have a formal interview, [and] weren't being recruited in that way. But then you moved up to Redmond, is that right? Did you come up?

Leo Del Castillo: That's correct. In 1995, after I was offered the job, we moved up in August. It was right before the Windows 95 launch. Bought a house in Redmond, actually, not that far away from campus. My wife and my two children. I was just about 30 years old with two sons. We moved the whole family up and started working right away.

Michael Halvorson: What building did you work in?

Leo Del Castillo: My first building [and] first office, I shared with my coworker that had been hired with me and it was in Building 19. The room was so small, I could practically touch both walls with my outstretched arms. And we sat back-to-back with our desks facing opposite walls, but so close together that our backs were practically touching most of the time. Luckily, we were only in that office for a couple of months. They moved us into the same building, Building 19. We got moved into an outside corner that actually was so large that we could put a ping pong table inside the middle of the room. So yeah, Building 19 was my first building.

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Michael Halvorson: Did you begin to work on this ActiMates product? Describe what your work was like. Was that in the Microsoft Kids group or something?

Leo Del Castillo: This was part of PC Hardware. The company that was purchased was called Dare to Dream and Rick Thompson [was] running it at the time. At the time when I joined, the Mouse business was the foundational business for PC Hardware. The Keyboard business was just getting off the ground. So that was a new product. Rick Thompson was kind of looking for different markets to get into hardware development, and he kind of had this idea about building kids toys that would be Microsoft branded.

He [Rick] bought this company, and we came, and the product line we ultimately designed was called ActiMates. We started with the first character, Barney, the purple dinosaur. We launched that product in 1996. The whole concept [of this] toy was kind of an interesting thing because it was actually supposed to be an educational toy. Part of building that team out, we hired a child psychologist that used to work on Sesame Street programs. He understood how kids learned and how they interacted through playing, and he developed some really interesting interactive games and features that we built into these toys. The toy was semi-robotic. It would move around its head, it could move its arms. [It was] simple. But it was enough to kind of give it a personality. One of the features that we built [was that it could] also play peekaboo.

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Even though it looked like just a stuffed animal, if you covered his eyes [then] he played peekaboo. There were different types of things that you could play standalone with Barney, but we also had a transmitter that could control his actions. We could synchronize to a game that was written for the PC, but [that] the children played along with you. It wasn't like you plugged them in or anything wireless. [Recording error; content omitted]

We also had video content. So, with the Barney show, we created the script cues of things for Barney to say and motions to make in the show. It was as if Barney was watching the show with the child. Now the beauty of how this product worked, though, was that it was very seamless, in that while he's watching TV, and interacting with the TV, [he could also] play peekaboo. [He could] seamlessly go into peekaboo with no disruption. [There wasn't] a mode, you didn't have to go in and configure him into peekaboo mode. It was just, you start playing peekaboo! And when you stop playing, [he would] go back to interacting with the TV show. It was a very magical thing.

It was never a market success. But anybody I've ever talked to that ever personally interacted with the toy or had it with their children was very happy with it, and we had lots of happy people. But it was a little [too] expensive for toys. It was something maybe a little bit ahead of its time. [But its] something I'm pretty proud [that] we did.

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Michael Halvorson: Then once you had [the] set up for Barney, you were able to do… What was it? Arthur [from PBS Kids]? And some of the other characters using the same base model, but maybe customizing it to different character actions?

Leo Del Castillo: Yes. That's correct. Barney was our first character and then we had a relationship with PBS and we were able to secure the rights to do Arthur and his sister, DW. [Recording error; content omitted]

Michael Halvorson: Leo, I had two boys [who were] also [children] during the late 90s. You know, one of them was [interested] in Arthur and DW, and Buster, and all the characters on PBS. I understand the market there and the popularity of that brand! Can you talk a little bit [about the] engineering, though? For example, [the technology] wasn't Bluetooth or something like that. How was the wireless connection managed and what kind of engineering challenges did you have with a product like this?

Leo Del Castillo: This was the interesting thing about this, [it] was very low cost, right? We had a very low cost for very simple mechanical movements, but they also had to be very safe. You know that a child is going to interact with something… they're going to hug it, they're going to bend it, and they're going to pull on it. Everything had to be kind of flexible and compliant. The motors had to be able to move, but if there was too much resistance,

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obviously [they would] want to try to overcome it. So there had to be logic in there… [There was] a spring-loaded mechanism in there so that you could override it without damaging the mechanism. And the motors were limited in how much torque they could apply. So that if it was being constrained, it would stop trying to move [in order to] conserve battery, because it just wouldn't make any sense [otherwise].

The head tilted very simply left to right. And again, everything was kind of spring loaded in compliance. So, you can override the action. One of the reliability tests that we came up with was a reliability engineer… He basically… bought a [dryer and] used to tumble the toys for hours and hours and hours to see if they would break, and they were very, very robust.

The controls were controlled by a very simple microcontroller, and the voice was all compressed. This is before the high-tech pressure systems that we have today. [There] was a TI-based compression engine that we were able to purchase as a standalone chip, and we could record [the] talent's voice and compress it offline… [It was] a lot of fun.

Michael Halvorson: Can I… ask about the communication to the computer, also that part?

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Leo Del Castillo: Yeah, absolutely. The wireless was basically a very simple AM-modulated 49-megahertz system that used the same basic rules as like a cordless [device] calibrating the same band… It was very low cost to implement and we could implement this microcontroller. The device that we created that connected to it, had two different types. One you connected to a PC through… back then there was the joystick port that had a MIDI interface. We used that MIDI interface to communicate with this puck who had a microcontroller that would then create commands and strip them out wirelessly to the device. It was one-way. You couldn't do status back, [you] just broadcast out and then were targeted. So, we had codes for Barney, Arthur, DW, and so forth…

The TV one was similar. It had controllers doing all the transmitting, but we used a means of recording bits of information in the horizontal over scan of the video signal. Back in analog television days, we used to have additional parts of the signal that kind of overlapped outside the visible spectrum or visible frame of the television. We could modulate white and black on each of those lines, and one of the things that I discovered… because it had to be able to be recorded on videotape and played back, was that videotape recorders sometimes drop lines. So, you can't count all the line there, sometimes it had to be repeated, and so we had to build in error correction into the coding scheme, so that we could take line dropouts and still be able to decode the information. That was a lot of it.

Michael Halvorson: This is fascinating. Did you feel like you were able to use components that were sort of readily available maybe in other

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settings? Was your team like, "Oh, you know what, let's use this from this, this from this, this from this, and we're gonna kind of make this."

Leo Del Castillo: Yeah, actually all the parts that we used were off the shelf parts. So, we either used discrete components, or off the shelf microcontrollers, or hook firmware. We used the same microcontroller for all three things. The two pucks and the device itself, [the] ActiMates device--all using a microchip-based pig controller.

We should be getting to Xbox—we're spending a lot of time on ActiMates. [laughs]

Michael Halvorson: Understood! So, let's talk about how you transitioned to this new group that was forming related to the Xbox. How'd you get pulled into that project concept?

Leo Del Castillo: So, I'd worked on ActiMates, and that was continuing to go, and they asked me to look at incubating some new projects. I got put on with a small team. We're looking at what are other off-market opportunities [that] we could potentially build products in, and we came up with a few different concepts that never actually saw the light of day. (But [were] very interesting.) [The] first one was a device for kids with a keyboard and a camera, where you typed messages and you sent them to each

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other. Now at the time, nobody thought kids would ever want to type messages and take pictures and send them to each other. And so that product never saw the light of day. It was called Maxwell. [laughs]

We then looked at digital music players. And again, it was one it was one of these things where… well [we weren't] really sure. [The] music industry [really] wants to control rights to music, they're never going to let us license music and distribute it digitally. So, we're not gonna built that product. So that never saw the light of day.

The third one was, how do you take the Office suite of applications, so you can read your email, your contacts, and so forth, and have it with you all the time? [It was] called Wyatt. That was the third thing that we were incubating. While I was doing that in 1999, this team was starting called Xbox. And they had just gotten the go ahead to form the team and actually build the product. I was one of the people that were asked to join the team. So, we put away [the] incubation projects [that] we had been working on, and I joined the team in 1999, as we started [that project].

Michael Halvorson: When the team first started, it's my understanding that they were hoping someone else would build this box, right? Microsoft maybe gets another vendor, another hardware maker, and Microsoft comes in, and does software--but that

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didn't pan out. So, did that kind of create panic suddenly when it's like, “Hey, we have to make this ourselves?”

Leo Del Castillo: No, I think there were definitely two perspectives on how Microsoft could enter the video game design/video game business. While I wasn't involved in those early conversations, there were basically two schools of thought. One was, “We need to build our own device because we need to control everything, [and] it needs to be secure. It's going to be a loss-leader if somebody isn’t gonna want to build it.” The other was, “No, we need to replicate the success of the PC industry, where Microsoft stays in the software business and we let the hardware business commoditize, and they'll just create platforms, and we'll just write software to go on that.”

Those two [schools of thought] were debated… Ultimately, the decision was made to go build our own home-built console, and own the design top to bottom. So that's when I was asked to join. So by that point, we had already made the decision that we were going to build our own console now. How we were going to go build it, in terms of how much existing hardware we leveraged, versus, doing things [on] our own, was going to change over time.

The reality for that very first Xbox was [that] we didn't have a lot of time. We needed to get it into market as soon as possible. So, it wasn't time [enough] to develop a lot of complex custom silicon. But what we did do, we were able to get Nvidia to

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customize the next generation of GPU and make a [version that] was targeted for our architecture. But we were leveraging very much a PC architecture for that first class.

We had an Intel Coppermine-based CPU and we were using some of the fastest memory that was available at the time. That was pretty cutting edge. Then this special Nvidia processor that was customized for video games, and that basically formed the basis for our box. But it was so similar to Windows, that we could have run Windows on it at some point. [It] didn't necessarily have every single thing to be Windows PC compliant. But it had all the same basic architecture. We evolved from there after that original Xbox design, but that got us up and running much more quickly than we would have if we just started from scratch with bare silicon.

Michael Halvorson: Leo, how long did it take them to go from this challenge and specification that you're talking about to actually producing this?

Leo Del Castillo: Yeah, so… wow. I'm gonna struggle a bit with the timeline but I will tell you this: the longest poles in the tent for that development was the custom video processor, and it was both the processor and the southbridge, which were a two-chip chipset. Those were being developed. That generation for them was already in development. But they still needed to tape out a whole chip and bring it up.

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Our early designs in the CPU were almost off the shelf. It was a Coppermine Intel processor, so it wasn't that far afield from what was already in market. We already had a CPU, we just needed the GPU and the southbridge stitching all together. So, we were able to get early work done on system integration and initial software development using off the shelf PC components, because a lot of that looked and smelled the same. Silicon development always seems to come in a little bit later than you really want it to. There were issues found that had to be fixed. We were turning the motherboard and were having to adapt to changes.

One of the issues that we found was, we used the USB signaling for our original game controllers even though it wasn't an actual USB port. The interface for the initial southbridge had an error which didn't allow it to actually drive a long cable. So, we had to put in a hub chip inside of the console, so that we could drive the long cables with the hub instead of coming directly out of the southbridge chip.

We had to do a lot of those changes at the last minute. Going into production, holiday season is very important for entertainment devices. You know, it only comes once a year. You only have one opportunity, really, so we had real hard goals of when we needed to get into market in November. We were really rushed trying to get the design ready in manufacturing. But our manufacturing team did a really smart thing in order to kind of be ready for everything. As we were finalizing the

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design, they were practice-building the [Xbox] iteratively, so they were building products that weren't something we would sell to customers. When it got to the end of the manufacturing line, they basically took them apart so they could constantly exercise the line, so we would learn how to build stuff. When the design was done, we could release, and we could actually ramp up into production as fast as possible.

Michael Halvorson: Leo, when you say, "the design is done," do you mean when the actual box unit itself was done, where you knew how big [the final Xbox case] was going to be? Talk about that.

Leo Del Castillo: Yeah, I mean, we actually had the design for what the chassis looked like, what the motherboard looked like, the optical drive, the power supply, and all that. There were lots of last-minute motherboard changes or software that was coming together. It's a little hard for me to remember from that long ago all the different things that were, like, the last things to come in. But we had to design at like 90% complete. It was… that last 10%, the hard part…

Michael Halvorson: Understood. How many people were working on this? You described your early time in Microsoft, just in small rooms. How big are these teams getting?

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Leo Del Castillo: The initial Xbox team was definitely a skeleton crew. We only had about... I think we had maybe fortyish people in the hardware team? And that included everything from sourcing and manufacturing-- engineering program management is just for the hardware part--and that was to put together the mechanical design, the motherboard, power supply, everything. So, we had to leverage our supply base. We had to leverage our technology partners. Intel, we worked with them.

They had a motherboard development team that they basically contracted out to us... They did a lot of electrical work on the board. [They] also helped us with the thermal solution that had designed the heatsink and all that stuff. We got a lot of help from our development partners and our suppliers. It wasn't until after we shipped that first box that we really started to be able to grow the team and then start to take on more and more of that design ourselves.

[With] the first box, I was basically responsible for writing a lot of specs and doing integration, making sure all the parts hooked up together. We had to work with the optical drive team to get an optical drive, which was a challenge in and of itself, because we knew, going in, we needed some kind of secure media, right? We couldn't just sell discs, games on DVDs, and not have them get copied, even though this was before DVD writers, we knew that was going to be an eventual issue.

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We had to find a way to make the media secure. We worked with a company that had worked with other game console companies, like Nintendo and Sony, to develop similar technology that had an IP base that they had licensed to us. They could develop our own custom-based concepts utilizing their patent portfolio, and that relationship worked out really well. As far as I know, Microsoft still uses that same technology, or variations of that technology, through all the Xbox generations that use optical media.

Michael Halvorson: Yeah, that's fascinating. We know that third-party software developers were going to try to create things for the Xbox, right? They probably wanted systems to test. Were you asked to create these test systems and send them around? How did that work?

Leo Del Castillo: Initial game development, before the silicon was ready for us, [required] us to leverage existing components, and we put together PCs that had a similar processor [and] a similar graphics processor from Nvidia (it was like the generation before). The processor had the memory, the speed (kind of equivalent), similar to what was going to be in the console. [It] wasn't cycle for cycle accurate, but it basically was a high-performance PC at the time. It was a really nice PC. And it was hard… I remember going for some talks with some of the game developers and they didn't accept it as a console. They said, "It's a nice PC. I don't know how we're gonna develop console games for it, but-" So, we had to kind of win them over, and say, "This is just to get started. We will eventually get there with our own hardware." And we did.

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Michael Halvorson: Give me a sense for how the project like this was managed. Were you you in a hardware group that was pretty isolated, in a different place? Or did you interact with people in the other teams?

Leo Del Castillo: We interacted often, I mean, Seamus Blackley was a big personality. Jay Allard was part of getting all [of] that started, [and] we interacted a lot. We were in pretty tight quarters. At that time, we had moved from Redwest campus over to Millennium, which was [a] highly-condensed [space]. There was hardly any space for everybody. We were kind of in a pressure cooker--everybody having to work together. But yeah, Xbox felt like a team within the larger company. [It] felt like its own culture and our own personality; our own identity inside the company for a long time.

Michael Halvorson: Yeah, that's a pretty legendary move [to the Millennium buildings in Redmond]. But how many people went over to that new place? Do you recall?

Leo Del Castillo: I will say that it was probably on the order of 1000. It might be closer to 2500. Again, it's kind of hard for me to remember all the different teams that we had there. We also had some of the Bungie team. [They] were there for some time writing *Halo*. We had a lot of the software operating system being put together there, [and] Xbox Live started there, and all that development.

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We had all of our operations [there], and running our factory, [and] holding people responsible for sourcing components, and closing business deals with all of our suppliers—[we] were all in those buildings. That was quite a few people. It definitely grew over time.

Michael Halvorson: Leo, are you a gamer? Were some of your colleagues, engineering colleagues, gamers or was this sort of a physics experiment for you? I mean, what was [the video game part] like?

Leo Del Castillo: It's funny. My wife would say that she felt like she had successfully kind of quieted down the video gaming in the house until I came home and said, "Hey, guess what? I got a new job and I'm going to be building a game console!" [laughs] That kind of brought video games back into our house. I played video games quite a bit, but I would say I wasn't necessarily like, you know, the avid gamer.

I like a certain set of games, and I would play kind of casually more than anything else, but it was definitely hard to not be, you know, a video game player and part of that organization. We definitely had our *Halo* matches once a week, [and] I was never very good at it. It was kind of… I was always the one that people were shooting at. But, I liked the driving games, and so I

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played a lot of that as well, too. As my kids grew up, I played games with them, as well.

Michael Halvorson: Can you talk a little bit about the controllers? Was there a separate engineering effort for the controllers?

Leo Del Castillo: When we started the organization, we started a team that was focused on the console, and we [also] had a separate team that was focused on all the accessories. Keep in mind [that] most of us came from the PC hardware team, which was very focused on human interactive devices, like mice and keyboards. We actually have quite a bit of industry knowledge of how to build things that people interacted with. So, the team that built the original game controller was seeded out of that organization, [which] had some of that knowledge.

The interesting thing is that the original game controller for Xbox ended up being very large and kind of a little counter-intuitive [for] ergonomics and things like that. I would say it's one of those very polarizing designs. There are people who love it, and then there are people who really hated it. And we really took a more global perspective in looking more broadly at what the demographic was and realized, you know, not all gamers have very large hands. Maybe we have to look more broadly at the full breadth of gamers across the world, across genders, body types, and things [like that], and then broaden that perspective. [In the end, we came] up with a much more compact, more universal fit controller.

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Michael Halvorson: This is the Duke controller?

Leo Del Castillo: The Duke was the original. Then Akebono was the slimmed down one that actually became the prototype. I would say everything traces back to that Akebono design. If you look at all the current controllers, there definitely have been shifts, and there's been some significant shifts. But [the] basic ergonomics are very, very similar. I think, actually, fairly well done, as well.

Michael Halvorson: This first Xbox project was so successful, it just seems legendary [now] for Microsoft and for the industry. Although [we know] it was actually difficult to get it to the finish line. [This has] been described in some of the documentaries that you've been in. [But all told,] it seems like the launch was very successful. Was that the way it felt internally, too, as part of the team?

Leo Del Castillo: I would say no. Keep in mind when we launched the original Xbox, it was not an easy thing. The result was a lot of long days, long nights, long weekends, getting everything done across the whole team, right? There were challenges in hardware design, there's targeted challenges of bringing production up and running. There was challenges in getting all the software games finished and have them show up well. So, it was when we got to production, that's [when it felt like] a great accomplishment.

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It was [ultimately] energizing because, I think, the original launch was fairly-well received. And as challenging as it was, it really established that credibility that we had, you know. Up until that point, everybody thought, "There's no way Microsoft can get to do video games." It's like, "They write Office. It's like beige pants you know?" [laughs] It's not gaming, right?

But that first box gave us that credibility. The company also stood behind us, and really invested, and said, "Okay, you can start growing the team now." In fact, there was a decision made to close down a satellite TV business called Ultimate TV, and merge all those resources that have been working on complex digital design (motherboards and TV things), into the Xbox hardware team. Now, suddenly, we went from this little team that got started to this much larger team, that included silicon development, which was fantastic.

That influx did two things: a huge influx of talent and skill sets that we didn't have before. Now we had full teams that knew how to develop motherboards and how to develop silicon and all that, but it also created a cultural challenge because we had that team located in Silicon Valley. So it was geographically located in different places. They had come from their own culture, so they had created their own culture. We spent quite a bit of time learning how to work together as one team. I think we did it very successfully.

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So, we have this group [that has] their own culture in Silicon Valley. Now we're merged together and while we successfully integrated and became one team, it was a process that took some time and there was a lot of flying back and forth. But it really helped. It really helped strengthen the team and build that skill set. I mean, there's great silicon folks that joined the team, and [they] allowed us to build the complex silicon that we really needed to really take ownership [of the system]. So, when we finished, the original Xbox generation started working on the new generation, the Xbox 360.

That was when our engineers became very involved in the development of the graphics processor and the IOs, and the silicon architecture, which was super important. We had shifted over to using an IBM PowerPC-based processor instead of an Intel-based processor. We shipped our graphics architecture from Nvidia over to ATI which ultimately became AMD. Our silicon architects were part of that, and we actually developed part of that silicon as well. That went into the chipset, and it allowed us to build a much more powerful, much more integrated system in Xbox 360.

Michael Halvorson: Did you personally take on new roles when the Xbox 360 [project] started up? Did you do something different?

Leo Del Castillo: The evolution of my role in Xbox: when I started, I was half of the electrical engineering team (one way to think of it). As we grew, I took on leadership roles, so I was managing the

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Redmond-based electrical engineering team, and then I started taking on more and more responsibility. I led all of development for a while, by time we got to Xbox 360 and launched in the market. Soon thereafter, I was Engineering General Manager, and then took over development test responsibilities for all of the console part of the business. Then over time, eventually all the hardware became my responsibility (by the time I ended my career there).

Michael Halvorson: Yeah, that's really interesting. So how many people did you manage during the time of the 360 (or getting into the Xbox One)?

Leo Del Castillo: I think for Xbox 360 was probably around 50 or 60. I had electrical engineering, mechanical engineering, and test [groups], at both [the] system and hardware levels. I [also] had a program management team. So yeah, that sounds about right. Maybe closer to 40. It's hard for me to remember.

Michael Halvorson: In what ways did your duties change? Were you involved with hiring a bunch of people?

Leo Del Castillo: Oh, yes. When I started [on] Xbox, being really only half of the Microsoft electrical engineering team, I wrote a lot of specs. I did some with design, but very little design that went into that. I did some design, as I did more and more leadership. I spent

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more time kind of leading and really focusing on system integration. Making sure that we knew what we were building and kind of driving some clarity around what the specifications are, how interfaces would work, and things like that, for Xbox 360.

I own the product specification, right? I kind of made sure that we were clear on what we needed to have, what the product would do, and how to do it. I was… no longer doing any of the design work. I didn't really contribute much at all to design other than when there were issues. Sometimes I would lend my hand where I could, to help solve issues we had (thermal issues or manufacturing issues). I personally spent time in the factories when we were ramping production, trying to solve manufacturing issues. Same thing through export, you know, through all of the Xboxes--same thing. I was going back and forth to the factories all the time to do troubleshooting on the line and figure out what was going on.

Michael Halvorson: Did you feel that Microsoft's relatively recent entry into this market made it harder for the company to consider those issues or plan for them? Or do you feel like Microsoft was just like a lot of other companies, that were going to have engineering challenges and have to deal with them?

Leo Del Castillo: I would say a couple of things. One, I really appreciated the fact that Microsoft as a company provided quite a bit of latitude to the team. I think, year over year, we always spent more money

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than we thought we were going to. We had more issues come up than we had ever thought were possible. But they stood by us. It didn't [feel] like [they would] lose faith, in that we will eventually learn how to do things the right way.

Microsoft [is mostly] a software company, right? Even though they had to building mice for, by that point, probably 15 or 20 years. [They still] had to really learn what it meant to be a true hardware company. It's really that integration of hardware and software, where we are today, where there isn't such a thing as a “hardware product” anymore. Because it's all hardware.

Microsoft had to learn all the things that come along with that. The capital investments in tooling, the lead times to order components. Sometimes we had to make commitments on silicon that were six to nine months, sometimes 12 months, ahead of when we actually were going to take possession of those materials--all those realities of running a business of that scale.

There are a lot of parts that we have to buy, and [then] we sell them, and we ended up getting that money back in terms of revenue, but it's still a lot of money, and it turned into billions of dollars pretty quickly. That's something that Microsoft had to learn how to do, which I think now Microsoft has a pretty good handle on what it means to be an integrated hardware and software company. But it was a learning challenge.

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Michael Halvorson: I've heard that. This video series that several of us have watched--the six-part video series about the creation of the Xbox--one of the strategies [the producers] take in that series is to kind of say, "Hey, there were some challenges here, right? This was hard." Then they have an episode about some of the challenges with the Xbox 360. (I'm thinking of the Rings of Death thing or whatever?) Does that [issue] seem like a good example of one of the challenges that could creep in? Can you talk about that a little bit?

Leo Del Castillo: If I had one thing to learn from in my entire career that I would point at, it would be the extra challenge with Xbox 360, and the three red lights otherwise known as the Ring of Death or the Red Ring of Death. I will say that it is the one thing in my career that I can point back to say I absolutely hated every minute of that, but I value everything that I learned from it.

And that was an experience—again… the fact that the company supported us through the whole thing, even though it was quite a large challenge--it cost a lot of money to go fix. It had the danger of really tarnishing our reputation. I think we handled it the right way. And I think we came out of it, knowing that we needed to do better, and we knew where we needed to go to do better, and we had the latitude to go do that. They had to get the trust from the company. That, "Yes we believe that you can turn this around and fix it." Personally, for me, I was leading development at the time that we launched the Xbox 360. I was not yet in charge of all of the hardware, but I

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was very key in leading electrical mechanical design for the product. When we saw issues coming in and customer returns coming in, I was right there on the front line with the engineers trying to figure out what this meant like, “Where's it coming from?

After we launched Xbox 360 (after the holiday season), we ramped as fast as we could, and we were building products as fast as we could, because the demand for Xbox 360 was so high at the beginning. We were making it as fast as we possibly could. [But] right after the holiday season, we started to see units come back with this three-red-lights symptom. We marshaled forces--our silicon engineers, our mechanical engineers, [and] electrical engineers--to figure out what was failing. Our Silicon partners also were part of that.

It took some time to figure out exactly what was failing, because it was one of those problems that was exceedingly difficult to find. We weren't sure if it was at the motherboard level or at the silicon level, [if] it was a component level problem or assembly problem or a process problem. And it required temperature to get there. [But] we didn't understand the failure mechanism. It took us a few months before we could finally actually zero in on what the issue was, and figure out what was causing it. It was one of those things that--you know, we owned enough of the design, but we didn't do *all* the design ourselves.

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In a lot of places, we were trusting our suppliers to fill in the blanks for us. In this particular case, that caused a problem. We had specified the conditions under which our silicon would operate. And [the] package design… even though [it] was informed by all of our requirements, didn't meet our requirements, and we lacked the sophistication and technical understanding of how to double check the performance. So ultimately, what we learned from that… we learned a lot about reliability engineering and the science of physics of failure. That filled in some blanks for us.

While we had been really exercising and trying to make sure the design was robust, we weren't stimulating it in the right way. We were running it at a high temperature for long times and it was working great, and we felt really good about that. [But] it turned out [that] running hot for a long time wasn't a problem. The problem was going hot and going cold, going hot and going cold. So, every time we got hot and cooled down, and [got] hot and [cooled] down, [it] caused stress and fatigue, and that's what was failing. [But] we never saw that, because we never exercised in that way. That wasn't a failure mode that we had anticipated.

Michael Halvorson: It seems extremely difficult to track down and find.

Leo Del Castillo: When we created [the condition], it still would fail reliably, [but] when we had a fresh console in hand, [it would] take weeks to be able to synthesize that failure mode in the lab. It wasn't

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something you can just do overnight. That's why it took us a very long time to identify the issue, and then come up with the fix. We knew we came up with the fix and then validated [it]- In the end, I think it was close to a year. In the meantime, customer units are failing and we're figuring out how to fix them and send them back. And the most painful part was that, with the original fixes, unfortunately, we weren't really fixing them. We were replacing the part that was broken, that was going to break the same way, because we hadn't yet fixed the problem.

So, customers were lost. A lot of customers got very angry with us. There was a time when we had jackets [with] Xbox 360 on [them]. We were proud to be part of the team. [But] for a while it was very dark. I had several times [where] I was wearing my jacket in public, and [I] was talked to by a customer who had had a bad experience with an Xbox. But I continued to wear my jacket--I thought that was super important. I knew a lot of my team [had the same issue] at the time.

I don't know anybody who left the team because of that issue. They weren't happy about it but they were all invested in fixing it. And we did and we got through it: [we] fixed the problem. The [repaired] product looked the same as the product that failed. So, one of the things that we launched, with the new generation of Xbox 360, [was a] version that we called Trinity, which was a whole new visual design. It looked different than the original Xbox 360. It was quiet. It was reliable. That was the beginning of [things] getting better.

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Michael Halvorson: I'm so appreciative of that challenge and [your solution]. How was that problem described internally? [This was] a cultural thing [outside of Microsoft], as many people know, because the Xbox was so popular. But it wasn't the only hardware failure in the PC industry or in the gaming industry. I think of the Tony Hawk wireless skateboard, a peripheral that my kids were always trying to attach, and it wouldn't work. There were many [gaming peripherals] like that. But did this problem have a legacy internally?

Leo Del Castillo: Well, we recognize that as a problem… that we were responsible for. One of the key learnings that you have is regardless of whose components you use or who does the assembly, even if you're paying them to do it, it's your name that goes on the product. It's your product. If it has a problem, it's your problem. It's not your supplier's problem. They're not the ones that are going to get the heat for it. You are. At the end of the day, you have to be responsible for everything that goes on [in] your product, and you have to know what's going in there. You have to trust your suppliers but you have to verify them as well. And you just cannot be relaxed about it. You have to always be vigilant to make sure that everything is clearly communicated, that they're doing their due diligence, and that you're backfilling that as best you can.

The more layers of defense you put together, the better your product will be. And that is the discipline that we built in that team. So that, design over design, over design, this has gotten

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better. Our designs got better. It [came] to the point where we were fixing problems long before we ever got to production. Production stopped being an event. It used to be a big, you know… people at the factory, you're going to spend time, they're going to fix a lot of problems. It became less than less of an event. Fewer and fewer issues were popping up. We were solving the problems that were getting smaller and smaller and smaller. It got to the point where we had lots of little tiny problems, but no single problem was worth working on, anymore. That's kind of where you want to get to, so that way, [when] one weird one comes up, [it is] because something went wrong somewhere else. You can put resources on that, [and] get it fixed right away, and it's not covered up by a bunch of stuff that you created yourself.

Michael Halvorson: Leo, were some people already starting to work on the next system? Did you have some kind of sequential development for these consoles? Or were you working on new console technologies at the same time?

Leo Del Castillo: Absolutely. We always have multiple programs going on in parallel, because you start at the beginning of a console generation, you'd have an initial design, and you'd have to regenerate already [with] next year's cost reduction plans in place. Because you had everything that went into the first design, you would ultimately always learn things that you want to do a little bit differently. We had to be very cost optimized, and we'd find things that would then [go] on the list of things that go into the next iteration. We would have initial release, [and] we have cost-reduction [releases].

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Sometimes, its cost reduction involving silicon. Sometimes, we would launch with silicon at one level of geometry, and then be able to do a die-shrink to make it less expensive, and that would be planned out a couple of years in advance. So, you'd have that work kind of going in parallel. Then you'd have the next generation program come out, [and] some of them overlap. We did a cost reduction for the cost reduced version of Xbox 360 that launched in parallel with the new Xbox One when it came out. The original Xbox One was the first time that we actually launched ahead of schedule, from what we had planned. We were well on top of that design and we were in production building consoles long before we needed to but at a very relaxed pace. I would say it was one of the best ones. [The] same thing [happened] with Xbox One X, which was the last one that I was involved with. That was the first 4k UHD console. It was the highest performance, smallest package, and fastest timeline that we've ever done. It launched right on schedule in parallel with the cost-reduced Xbox One, the Xbox One S.

Michael Halvorson: Oh, that's fantastic. Were your teams very aware of what your competitors were doing in the console wars that were out there? There was certainly a lot of comparison. Was that something that you looked at carefully, and tried to study, or anticipate, what your competitors would do?

Leo Del Castillo: Oh, yes. I think anybody who is in a competitive environment [does that], particularly when you're in a competition with just

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one or two key competitors. This was not a big industry. So really, it's Xbox, PlayStation, [and] Nintendo. Those were the key players, and so there are not a lot of players you have to keep tabs on. Do we look at each other's products? I'm sure that Sony was tearing apart Xboxes and Nintendo game consoles, like Nintendo was tearing theirs apart, just like we were tearing theirs apart. It was interesting to see the differences and philosophies and design strategies, though, that each company uses independently of each other.

I would say that there are things we probably learned from looking at each other's designs, but there's still, you know, our own twist on how to do things… I would say the biggest uncertainty you always had is when you're getting ready for that next generation. There's the [question] of, "Which direction are they going to go?" More performance? What performance? You're worried about coming out and looking like you're at a performance deficit or a feature deficit. There is the uncertainty about what is [the main feature]: Kinect, virtual worlds and AR, VR… Is that going to be the thing that drives new console experiences?

There are all these things- you have to kind of play the field right and see what's forming and see how the game is being played. Then plan your moves out, because nothing moves instantaneously. You have to be very thoughtful because you have to put your piece down and knowing that they're going to be… you can't just move them at the last minute.

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Leo Del Castillo: You're going to decide on a processor. You're going to find out how much memory is going to go. You're going to decide on whether you're going to have an optical drive, [or] write [to] a hard drive, [or] what kind of performance levels [in] flash drives--all those things have to be figured out ahead of time. I would say... I'm proud of the team, being able to pull this off--in the original Xbox One generation, the console was supposed to be always connected. It was going to be a generation in which we didn't have to do media-based anti-piracy, because we would use an online authorization scheme that would be more secure, to take the place of having to build secure media.

Our customers let us know that that was probably not the right decision. [laughs] If I remember right, it wasn't much more than about two months before the design was supposed to be final (so they could start production). We had to figure out how to turn the security features back on in our media, in order to be able to launch Xbox One with secure media.

Thankfully, we've been working with the same suppliers on optical drives, [the] same firmware base, and a lot of the features that we needed were already in there. We just didn't turn them on. I personally got on an airplane with my counterpart from Xbox security, and [we] visited our chief suppliers and told them our situation. [I] told them what we had to do, and got their commitment that we would be able to get that done, and we were able to get the software going. The software team--everything they do to implement a game anti-piracy checks--all got rolled in so close to the very last minute, [but] it enabled anti-piracy on Xbox One.

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Michael Halvorson: Yeah, that's fascinating. I mean, there are some companies in which you could not change hardware specifications that quickly before shipping. So that's really interesting. Microsoft was continuing to try to change and pivot as they were going.

Leo Del Castillo: I think the Xbox team is a great example of really integrated parallel development across hardware and software at all levels--all the way through the games experiences. We had hardware designs [and] operating systems. We had games that we would use to actually test the hardware, because try as hard as we might, sometimes we thought we would [be] stressing the hardware as hard as we could. [But] somebody would write a game engine that would make our voltage regulators drop out, because they were hitting them in some strange way. So, we would have to learn from [what people] actually did. Top to bottom integration [is] a lot of our work, and [we made] sure we had the greatest possible designs.

Michael Halvorson: Did things change in these years, Leo? In relation to testing, you said that you had responsibility for testing, and I'm [wondering] the ways that you did that? How did that change into the Xbox One era and beyond?

Leo Del Castillo: We evolved our approach to design and test quite a bit. We learned as we went [and] learned from our mistakes. I think it's really… it's kind of building those competencies, and doing our

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design work, testing at the lowest levels possible, and building up to that integrated design. Testing along the way became very much a part of the culture of how it was done. Our motherboard teams would generally have all of the IOs, all the power delivery, clocking, memory buses, all that stuff would be figured out long before silicon showed up. And validated like we knew the power supplies were going to work. We knew that we could simulate the step stresses and power dissipation we had integrated.

We integrated our design work between mechanical chassis of thermal solution, the motherboard layout, the footprint of the silicon, like where each of the signals are going to come out, for saying the memory busses that were highly critical. It was all done concurrently, to the point where sometimes the mechanical team needed to move a bus or a screw location, [even] a few millimeters might impact the motherboard design. They'd have to talk about what components they could move, and the silicon ball out. I mean, it's like all those people were working hand in hand to make sure all those things worked together. The Xbox One X... everything is so streamlined in there, that the location of even the wiring harnesses, to go from the hard drive down to the motherboard, [is thought through]. It's all based on where the air needs to flow, how the signals need to ride, the acoustic noise of the fans... all of that.

Michael Halvorson: Leo, it sounds like a really interesting work environment. Multidisciplinary, I would say, in your approach. Can you say something about how you hired new people into these groups? What the interview process was like? I guess I'm thinking of my own experience of Microsoft with these whiteboard interviews

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and these challenging [questions]. Were you similar? Or... gentler? In what ways did you interview new people for your teams?

I would say that our style of assessing talent and bringing talent on board... I don't know that it was particularly stressful. I would like to hope that it wasn't. One of the things that I think I enjoyed while I was working there was we didn't have a lot of turnover. We had a very stable core team. Not a lot of people came and went... But there's definitely people who left and we would hire people. It wasn't a revolving door, so we weren't burning people out and chucking them out the door.

When I left the team in 2018, I had been working with a large number of people for 10 years or more... I enjoyed that stability a lot. What we looked for when we did hire new people was engineers that had the design discipline to know how to--not just kind of design off the cuff, but really kind of plan [and] think through requirements. [People that] had the competency to understand how to do it iteratively through analysis and simulation, so that we weren't guessing at whether it was going to work. We had [built] higher and higher confidence as we went. You know, being able to push through adversity, and when issues show up, [that] you don't kind of shrink away from them... you should put your energy towards resolving them... One of the things that I valued in my team was really focusing on solutions.

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I never felt that team members were blaming each other for issues when there was an issue. It didn't really matter whose fault it was. Let's go figure out how to fix it. That was the culture that we really took [up], because it's our product. We need to go fix it, regardless of how and then we tried to figure [it] out. Okay, now [its] out, [and] we fixed that problem. Let's make sure we don't have that same problem again. I always like to ask my team to be inventive and find new ways to mess up, instead of messing up the same old way over and over again.

Michael Halvorson: Does Microsoft participate in ongoing research in the field, or [did you] connect through professional groups or societies? Or would you say that these [gaming] companies [like Microsoft] do a lot of their work internally and don't necessarily interact with outside groups?

Leo Del Castillo: I'm not sure I understand what you mean.

Michael Halvorson: Some firms connect with [industry] professionals and are involved with ongoing standards or research. And Microsoft has its own research area too. But I'm not aware of how that works in the Hardware side of things [at Microsoft].

Leo Del Castillo: That's a good question. Many of my engineers on the electrical side, I had engineers that were active in IEEE, for instance. We had engineers that were participating in some of the standards

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bodies around the memory bus, for instance. The JEDEC committee for developing memory buses was one of them. I had one engineer that was really involved in power delivery and power regulation circuitry, and was working with industry on design… of, you know, a specification for FETs for high performance voltage regulators, things like that. So, there was some participation, absolutely. I don't know that I had a significant seat at any of those tables. But you know, when you're building high performance, consumer products that have to be reliable, you kind of have to be involved to some degree.

Michael Halvorson: That makes sense. I'm going to ask you one more question about the tech side of these Xbox units, if that's okay. It just has to do with internet connectivity and broadband. One of the important things [in the] very first Xbox was broadband connectivity, at a time when that wasn't very popular. But that became a really good investment, a good bet. Over time, Xbox Live and other things sort of came out of that. Was that important? Were there any interesting engineering issues there [around] internet conductivity? Or broadband connectivity through the [various] consoles?

Leo Del Castillo: The choice to put broadband connectivity in the original Xbox, I think, was a great vision that panned out… really panned out. From an engineering perspective, and a manufacturing perspective, it also turned out to be quite an advantage, because it gave us a high bandwidth interface that we can easily connect, to drag throughout the test and development process with the manufacturing process. We utilize that port for collecting data on the manufacturing process, to do software installation, download data, run tests, and all that sort of stuff. If

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we hadn't had that kind of a connection, it would have been a lot more challenging.

So, there were the benefits that we had on that side. But in terms of the engineering challenges, I would say, really, the only real challenges I think that technically would come up is when we started doing WiFi, because we would have to ask, “How do you combine the WiFi interface with our game controller?” Then later, Bluetooth as well. That sometimes presented challenges in, you know, where do you put the RF module? Where is the antenna is located? And so forth. I'd say that was probably the biggest challenge, but honestly, it wasn't [too bad]. It wasn't the thing that kept us up at night. It may [have] caused some interesting problems to solve. But generally, those weren't the [main] issues that we had.

Michael Halvorson: Let's talk a little bit about some of the later parts of your career. Didn't you get involved in cryogenic computing and some of that work?

Leo Del Castillo: Yes. So, after Xbox One X (the last console I worked on), I left the Xbox team for a short time to go work on PCs. That was on the Surface. I left the Xbox team to help with the laptop and book product line in [the] Surface [group]. At that time, Surface was doing their improvements on that product line and [had] some issues to solve around the original laptop, which I think is a great product and I still use one today. That was a lot of fun.

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It gave me an opportunity to look at a completely different type of product, with a different customer base, and different [engineering] things to care about. I learned a lot more about mechanical engineering, since Xbox was probably 75% electrical and 25% mechanical [engineering]. Whereas, laptops are more [like] 75% mechanical and 25% electrical. So, I learned a lot about that, and optics and design for this, [and about] the displays and print. It was a great challenge. It was a great time. But about a year into that this opportunity came up as part of the quantum engineering team, where they needed somebody to help to basically lead the team that was creating part of the technology that was going to be needed for quantum support technology interface to the qubits. Then be able to translate from the qubit domain into a classical domain.

I was asked [if I] wanted to drive that. It was an opportunity to take on a completely different type of challenge. So, I went from consumer products based on silicon to this technology called cryogenic computing. It required superconducting electronics that operated on magnetic flux, instead of moving electrons that were based on niobium (instead of silicon), This operates at cryogenic temperatures down to four degrees Kelvin, and it [was] completely out of my experience base, but very, very fun. Very challenging. I got to work with some fantastic people.

Being part of the quantum team for that time and working on that- The brilliant physicists that were working on qubits, that

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are still working on those, really stretched me in ways that I hadn't been stretched in a long time. That was a great experience. We did develop the technologies that we needed. We did some assessments across different types of technologies. We ultimately landed on what was the right path going forward. And at that point, we were able to pare down the effort to focus on just the one-to-one technology direction, that part became part of the quantum team. And the rest of our resources then got redistributed across Azure as a part of Azure.

Michael Halvorson: May I ask you what the overall goals of that project were?

Leo Del Castillo: The goals of the cryogenic computing work were to develop circuitry that could ultimately [provide] high-performance, high-speed interfaces that could work at cryogenic temperatures, and that were very low energy. That was super important, because qubits are exquisitely sensitive. So, the interface to them is also very, very sensitive. This circuitry that we were developing for this technology was based on superconducting electronics, and intended to be able to provide high speed but low energy interfacing to the qubits. We had a couple of different ways to go about that. We were selecting between different types and deciding which was the right path to go forward.

Michael Halvorson: Fantastic! When you look at all the different things you did, can you pull out a few moments of real pride or a sense of

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accomplishment about some of the things that you did that you might want to highlight, just so we can think about them?

Leo Del Castillo: Yes. The last Xbox console that I worked on was for me, personally, a great achievement across the team because we… it was a generation where we knew we had to go do something. We spent the right amount of time figuring it out. We threw away the wrong design a couple of times before we landed on what we needed to go do. Then we just executed on it [in] a very, very excellent way. And that's something I was super proud of. You know, you always have little problems that show up here and there, but it was a program that as challenging as it was, we kind of like pointed at where we're going to land, and you know, we got there. And we got there by doing it, by hitting our marks along the way, every single time. It wasn't because it was easy. It wasn't because we padded everything. It was because by that time the team had achieved a level of excellence that is just magic to watch. That was one of the reasons why it was a little bit easier for me to leave the team. I really felt like that team had gotten to [where] it was gonna be hard to make [it] that much better.

Michael Halvorson: That's fantastic. You seem like you were really successful as a manager and really cared for your teams, and yet, you studied engineering in school and worked on electronics for so many years. How did you develop in that [leadership] role? How did you learn how to do those things?

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Leo Del Castillo: When I started at Microsoft, I was 30 years old. I had two children, a toddler and an eight-year-old at the time. I will say that as I grew my career at Microsoft, and as I grew into management roles, I learned [to] use skills I learned as a parent that I can apply to management. I've learned skills, I learned management and applied it to my family. I think hopefully in the appropriate ways. I never did performance reviews for my family [laughs] but I think that that kind of maturation process goes hand in hand.

I think that the environment that Microsoft had and the culture that I worked in was kind of conducive to that. I would say, I was not necessarily… I never aspired to be a manager. I always wanted to be a hands-on engineer. I wanted to design things and I still do. I still like making and designing things. I like solving problems. I never really focused on things like management, but management… leadership became one of those things that if you look around and nobody's doing it, you better do it yourself, right? Because otherwise it's not going to get done. And you know, I find myself kind of like looking around and feeling like, I think I can lead through this. That's, I think, is why I gravitated towards taking the leadership roles, ultimately, and it wasn't like I aspired to someday lead all of that. It was because I felt like it was the right thing to do, and that maybe I could be the one to do that… and help everyone be successful. And that's… I think having the opportunity to do that at Microsoft was a great experience for me, and something I carry on my current career as well.

Michael Halvorson: I appreciate that very much. How do you think Microsoft changed in the years that you were there?

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Leo Del Castillo: The corporate culture did go through shifts. It was easy to see. When I joined, Bill was still the president and the CEO and chairman of the board. We went through Steve Ballmer's leadership, and then Satya [Nadella] taking over, and I'd say each of those phases have their own characteristics--not only how we act as a company, but also how we were perceived by the outside world. I would say that it's been nothing but positive, I think, in terms of what the trajectory is looking like. I think we have… you know, Microsoft enjoys a very positive view from outside looking in. I think there's been a lot of… when Microsoft announced their goal to become carbon neutral, in 2030, and erase the carbon footprint that we had accumulated up to that point, that was setting an example for the rest of the industry. Its leadership in AI, leadership in the cloud, and more generally, doing the right thing [more often] than not, I think…

Michael Halvorson: I wanted to ask you a little bit about what you're doing now. And basically what you've done after Microsoft.

Leo Del Castillo: After I was on cryogenic computing, I did a few other incubation projects within Azure. But at that point, I starting to think, "Hey, maybe I should do one more thing different from Microsoft before I retire." So, I started looking at other opportunities. And this opportunity showed up to go work for a startup. It was kind of homegrown here in the Pacific Northwest, a company called Echodyne, and we build commercial radar systems based on technology that was incubated out of intellectual ventures. It's a great opportunity

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to kind of go back to a small group, a small number of engineers working on yet another thing that I knew nothing about. Going into radar, after having done all the other things that I've done, was a whole new twist for me. This is an opportunity now for me to try to leverage all the learnings that I've accumulated in my career to date, and now apply them in a startup environment, and help this company meet its goals on its way to do a full-blown organization.

Michael Halvorson: That's great. It sounds like you're still having fun, which is really good.

Leo Del Castillo: Absolutely.

Michael Halvorson: Is there anything else that you wanted to talk about or mention today? As we kind of think about your career at Microsoft, and [for] people maybe reading this or seeing this in the future?

Leo Del Castillo: I think one thing that I've taken away from my career to date is that, we spent a lot of time working, and we spent a lot of time with our coworkers--sometimes more than our families. And I think that we have to remember that... we build all these relationships, and [they are] part of our extended family. No matter where we go, no matter where we leave, one company goes to another, and it seems like all those relationships are still out there, and [we should] try to keep them alive. That's one of

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the things that, when I left Microsoft, it was kind of a change for me. You know, 26 years in the same company, the change of scenery, all new people. But I try to keep my relationships open, in my lines of communication, with my old folks and old friends.

Michael Halvorson: Well, I can see that they would all enjoy spending time with you. I certainly have, and I think at this point, we can go ahead and bring our conversation to a close. So, I want to thank you so much for being here, and say "thank you" for taking the time to talk with us.

Leo Del Castillo: Oh, thank you. My pleasure.

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