



Oral History of Chuck House

Interviewed by:
Dag Spicer

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Spicer: Okay, we're here today at the Computer History Museum in Mountain View, California with Chuck House. It's October 18th, 2018. Chuck, why don't you-- first of all, welcome to CHM. We're delighted to have you here.

House: Thank you.

Spicer: You've been a longtime supporter of the museum and have done a lot of interesting things on your own, which is largely why we have you here. We want to hear about your interesting career prior to CHM, but also afterwards as well. Why don't you start with telling us a little bit about where you were born, where you grew up, what your folks did, that kind of thing?

House: Sure, I'm native Californian born here before World War II down in Southern California in Huntington Park in 1940, if you can imagine. So, there are less than half of one percent of Californians can claim that today. We're a rarity these days. My mom and dad took me to Phoenix at age one. Dad was a traveling salesman, actually a welding equipment salesman. And World War II was just breaking out. And he had invented several welding tips that became important for the Phoenix area and also for the Southern California area for aircraft manufacture.

Spicer: By tips, you mean the piece that goes on the end of the welding--

House: Yeah, yeah, actual tip design.

Spicer: Right.

House: And for some of the special alloys they had, they needed very precise kinds of tools. And he designed some of those things. Not college educated at all but a resourceful man. Stayed in sales his whole life, although he retired at age forty-six to go live in the gold rush country. Mom was the daughter of a schoolteacher who came from Texas. And her great, great, great grandfather-- no, let's see, her great, great grandfather, my great, great, great grandfather, was in the gold rush coming across from Indiana to Hangtown, which is today Placerville. And so, we have some early history in California. I went to-- so, we moved from Phoenix to Des Moines when dad was called into the service finally in '44, came back to Southern California in '48. I graduated high school in La Habra. I just went to our sixtieth reunion, if you can imagine. And I couldn't believe how old those people looked. It was stunning. Thank god I don't, but it was quite an experience. I went to college in Southern California at Caltech and then hired in to Hewlett Packard in 1962. I was the ninety-eighth engineer. They said I was ninety-eighth. I think I was the ninety-eighth on the payroll, and they had had like nine had left the company in the first twenty-three years. So, it retained most of its people. But the point was I was there early enough to know Dave and Bill pretty well. And in fact, at one point, my office was next door to the pair of them.

Spicer: Wonderful. Well, that's great. Thanks for taking us up to your HP days. I want to go back just a little bit and talk about your youth, your high school. Were you into sports, into math, into humanities? Kind of where did you fall on that spectrum?

House: Great questions. I was really sick as a youngster. I missed a hundred days of school in fourth grade, asthma problems. So, I was not into sports whatsoever. And that had been a problem basically since birth. But that's one disease you can often outgrow even though I grew up in smoggy L.A. And smog was identified there the year I was born. So, we had plenty of it. But I got interested in science in ninth grade. My science teacher wanted us to do a science experiment. And in particular, the science fair idea that Intel, until recently, sponsored, Westinghouse did it earlier, the first one had been held the year before. And I built a color television kit that explained two different ways of doing color television. This is 1954. So, it's pretty early compared to when they commercially became available. I won third place at the L.A. County fair. And that kind of hooked me. And then we moved to La Habra, kind of a small backwater town in Orange County at the time, seven thousand people and very low educational attainment kind of thing. But they had a program at Caltech that, if a teacher would bring two students, he could get in free for a Wednesday night lecture series. And I heard John Lilly talk about porpoises. I heard Fred Hoyle talk about astronomy. I decided that's where I want to go. That's what I want to do.

Spicer: Sorry, can you just explain a teacher brought you and another student to these lectures?

House: Yeah.

Spicer: How did that work?

House: Well, our physics teacher asked if anybody wanted to go to these-- I mean it's a drive of twenty miles to go to this.

Spicer: Okay.

House: And he picked up four of us in an old Plymouth, drove us over, and we sat through these lectures. So, I probably went to four of those along the way.

Spicer: Wow.

House: You know my sophomore-- probably freshman and sophomore years of high school. And I just thought-- I mean this was so exciting to hear these guys talking about unimaginable things. And one thing, when I was sick, the way I handled school, I guess I was home tutored in a way. And what it was was the girl across the street, her dad was a doctor, and they had Britannicas. And she would loan me one volume at a time. So, I'd read the N volume. And you'd read about navies, and Norway, and things like that. And then if you got the S volume, you could read about Sweden, and the Scharnhorst. So, when television came in, I think I was eleven when we got a television set. And the "War of the Pacific" was one of the first movies. And the problem I had was I had read all this stuff, I mean I'm reading the encyclopedia, if you can imagine, and imagined what it would be like. And then here's these pictures, and it's not like what I had imagined at all. So, there was this-- ever since, I've been fascinated by the notion that a picture is a thousand words. But you have to have the right picture.

Spicer: Exactly. Well, that's amazing. Now, tell us a bit about your high school years. You got into Caltech. So, clearly you were a good student.

House: Well, I-- so, we had moved to a new high school that had just started. So, it was pretty small. I think our class was a hundred and eighty, something like that. I was a good student. I became valedictorian. But I also had joined the track team. I felt good enough to go out for track. I wasn't particularly good as a runner. But by senior year, I set the high school half mile record.

Spicer: Now, hold on, that's pretty amazing because earlier you just said you had asthma, and you were not an athlete. And so, that's great that you were-- you got a little healthier I guess later on.

House: I did get healthier. I kind of outgrew it, became a Boy Scout, became an Eagle Scout, wound up hiking the Sierra. I've probably hiked the length of the John Muir Trail.

Spicer: Oh, my gosh.

House: Three times. Later worked in the forestry and ran a pack station.

Spicer: Sorry, what is a pack station?

House: What's a pack station?

Spicer: Yeah.

House: That's a collection of horses, where people want to go in the back country. And you pack up mules and take their tents and their cooking gear and all that stuff in.

Spicer: Got it.

House: So, I was the wrangler. Now, that was-- I was up for Memorial Day weekend fishing with my parents. And I think I was a senior in high school. And the packer quit on these people that owned this place. They went through the camp. I was the only kid around basically. I think I was a hundred and thirty pounds and six foot tall. I had to be a total string bean, never been on a horse in my life. And they said, "Would you like to be our wrangler for the summer?" And I said, "Sure." I came back two weeks later, and they handed me a saddle and a bridle. And I'm looking at these things. They said, "You do ride, don't you?" "Well no, never have." That was a big learning experience that day.

Spicer: Yeah, you definitely feel it for several weeks after when you're first getting used to--

House: So, five dollars a day, all the food you could eat, all the gas you could use. But since you had to work seven days a week, you never got to use any gas.

Spicer: And sorry, what town was this again?

House: That was in Bridgeport, California up near-- just on this side of the Nevada border and south of Reno.

Spicer: Okay.

House: And great experience. And then I later was in the forest service there and did a stint with the fish and game.

Spicer: Now, what were you doing with the forest service and fish and game?

House: Oh, I was just a summer student, summer intern.

Spicer: Okay.

House: Kind of thing. GS3, I think they called me.

Spicer: So, you would be like clearing trails and that kind of thing?

House: We cleared trails. We fought fire. We cleaned campgrounds. It was grunt work.

Spicer: Right.

House: But you're out in the outdoors. And the forestry was five days a week not seven. So, you could go hiking on the two intermediate days. So, I've climbed, I don't know, forty mountains, something like that, including several first ascents. So, there was a long time I debated the outdoor life versus a technology life. And what I've basically-- and as we walked over here, I mentioned that we have a horse ranch today up near the Sierra. I'm still playing that both ends of the candle if you will.

Spicer: Right, now when they had these pack stations, were they about thirty to fifty miles apart because that was about as far as a horse could drive in a-- or could drive, could ride in a day?

House: These were commercial enterprises. So, anybody that wanted to set one up did. So, we had-- there were two in our valley, which was the Bridgeport Valley. You may know-- you may or may not. You know where Bishop is?

Spicer: I don't, no.

House: So, if you go up 395, which is the east side of the Sierra there's a-- Lone Pine is the first town. That's where Mount Whitney is, the access point. Several different towns, the big town is Bishop. It has about two thousand people. Our town was three hundred. But every major valley-- every major river coming off the mountains would have a little valley. Probably, each would have a pack station. And interestingly, we were working with packers today for the horses that we have. They'll have horses that retire. And we take them and use them for kids for training.

Spicer: Now, just to-- one more question about the pack stations. Were these-- what kind of customers were they? Were they kind of well-off people or just regular folk?

House: Well, this was the late '50s. And there was a kind of a back to nature movement. A lot of people were doing, I'd call it either car camping, or had small trailers, or they'd stay in these little campgrounds. So, we had fourteen cabins at our place, ten acres, twenty horses, something like that. And you could pitch a tent, or you could kind of rent a-- there was a little platform thing that had a tent on top of it. And I don't know, three dollars a night kind of thing for one of those back then. So, the clientele was by and large kind of a-- I don't know that I'd have a descriptor for it, middle class kind of folk for the most part. What I focused on were the sixteen-year-old girls. <laughs> This was-- you know, you're the kingpin, right, on your horse. And you put them on the horse, and you ride off into the back country. It was a great summer.

Spicer: All right, let's go from high school to Caltech.

House: Okay.

Spicer: So, describe me just for a little--

House: Hardest thing I've ever done.

Spicer: Public interest here. What was it like to get that letter from Caltech saying you had been accepted?

House: So, first of all, I'd gotten accepted to-- I applied to seven schools, got accepted to all of them. And Caltech was the last letter. And so, I had these six. I had honors at entrance at Berkeley and Stanford and Harvey Mudd. And my mother loved Harvey Mudd. It was ten miles away, brand new. This is on the Pomona campus, beautiful school. But Caltech waited to send the letter. Okay, I get the letter, and I was basically, I wouldn't say at risk, but I was provisional. So, it's the only one that no scholarship, no recognition, nothing. And we're not sure you're going to make it. And at our fiftieth reunion of our class, an old professor sidled up to me. He said, "You did all right."

Spicer: That's nice.

House: But it was incredibly tough because our high school, being new enough, didn't have much of the grounding that many of the other students had had. And then to boot, I got married sophomore year, middle of the sophomore year, and wound up having-- and Caltech would only allow full-time registration. So, you had to do eighteen units a term. And I needed a job. My dad was not pleased that I got married. So, he sawed off the college money. That was that. And I got a job as a draftsman in aerospace. Again, like never riding a horse, I'd never done any drafting. But I kind of faked my way in and got this job and held it for two and a half years thirty-five hours a week while taking eighteen units.

Spicer: Oh, my gosh. Okay, that's impressive.

House: And when-- I mean I'm interviewing-- getting out of school, I'm interviewing a guy from Boeing. He says, "How come your grades are so crappy?" And they were basically a 3.0, you know, B average, top third of the class. I said, "Crappy? Let me tell you what I'm doing. I think they're terrific. I'm graduating." It didn't cut any ice with him. But that was-- Caltech was an interesting place. I had I think four Nobel prize winners were my teachers. So, Nobelists teach freshmen. So, I had George Beadle for biology. I had Linus Pauling for chemistry. We had Richard Feynman for physics. I mean these are world class people, and you're seventeen years old.

Spicer: That's incredible.

House: I'll tell you one story on that if you like. I'm sitting next to a kid named Kip Thorne.

Spicer: Wow.

House: And I knew him pretty well.

Spicer: Was he in your class?

House: Yeah, he was in my class.

Spicer: Is he in your cohort, yeah?

House: So, we're sitting next to each other, and we're taking our chemistry final. Every test was open book, take it home, do it for a week because nobody could do any of this stuff. Except chemistry was a memory test. So, closed book, three hours, that's it. So, we're sitting there. And after about an hour, kids start leaving, handing their books in and going.

Spicer: That's not a good sign.

House: At the end of two hours, yeah, more have left. At the end of three hours, he and I are maybe one of twenty people still in the room. And this is that whole class of a hundred and eighty. And we walk out, and I said, "God, your dad was a chem prof at Utah. You know, you're obviously brighter than sin. What's the problem?" He said, "Well, that question about Boltzmann's constant." And I said, "Yeah, god, I couldn't remember if it was ten to the minus twenty-three or ten to the minus thirty-one." He says, "You're confusing that with Avogadro. I got to wondering why Boltzmann thought there was a constant. And I tried to derive it from first principles, and it took two hours. So, I didn't finish the test."

Spicer: Oh, my gosh.

House: It's his only C in four years at Caltech. He would have been valedictorian if he hadn't muffed that over that question. But the sequel is we're pushing out the double doors to leave Bridge auditorium, and he says, "You know, Boltzmann committed suicide in Basel in 1903. And Einstein did the special theory there in 1905. Do you believe in transmutation of soul?" I'm seventeen years old. But all I could think to

say was, "I'm Methodist." And when I see Kip these days, he still laughs about you know, boy that was-- so, here's a kid seventeen years old. He's worried about the origin of the universe. And of course, he just won the Nobel prize this year, which none of us thought an astrophysics award would ever be made. But it was. So, that's kind of-- the other thing about Caltech, I had four classes over the years that I was one of two or the only student in the class. They would teach the-- if you signed up, they'd teach it.

Spicer: Now, were these-- did you choose unusual courses or why was that?

House: No, no. Well, one was-- for Caltech, was unusual. I chose a project management course. They actually were teaching something like that. I was the only one that signed up. The problem was, since I'm working all the time and never on campus, I never went to class. But I couldn't find anybody with the class notes. And I finally-- the sixth week of a ten-week course, I went to the class. And this guy, one guy is sitting there. And he says, "I've been waiting to meet you."

Spicer: The teacher?

House: I got a-- yeah, that was the professor. I got a pretty average grade in that class. That didn't work out so well.

Spicer: Yeah, he noticed.

House: The other thing I had to do, and you couldn't do this today, I signed up for two eight o'clocks, two nine o'clocks, and two ten o'clocks. And then I could be on the road by eleven to get to my job in San Gabriel by twelve. And then I'd work twelve to six and then come home and do homework or whatever. But the problem was if you never went to class, so I had to alternate which class you go to. So, I was a spotty student you might say.

Spicer: Well, a spotty student at Caltech is still pretty-- better than most of us.

<laughter>

Spicer: So, that's great. What a fun story. So, what degree did you end up with?

House: Kind of an odd one. It was a bachelor's degree in engineering physics. And what had happened there was semiconductors were just being basically described. Shockley had been on campus in '55. I got there in '58. And then in '57, he came up here to Palo Alto because his mother was sick. But he was working with Arnold Beckman of Beckman Instruments. And Caltech hired a guy named Middlebrook and kept a student named Carver Mead. And those two had this semiconductor course. So, again, a bit of a funny story. Junior year, I'd switched out of geology to go into engineering because geology was forever. And you needed a PhD. And with a wife and now a kid on the way, I thought I better have a job, so how about electronics. And they introduced transistors on the final. Here's an essay about how the Ebers-Moll model works, which Middlebrook had worked with Ebers at Stanford and John Moll. And Moll later worked with me at HP. So, I mean it's a small world, right? But they introduced this on the

final, five problems on the final. At the end of two and a half hours of a three-hour test, I had nothing in my blue book, nothing. And then I--

Spicer: Sorry, what's your blue book?

House: A blue book is your test book you hand in.

Spicer: Oh, your answer book.

House: Yeah.

Spicer: Okay.

House: And I guess they had a blue cover is why they called them blue books. But the-- all of a sudden, I thought I so-- so, I solved the first problem and nailed it. Then I started on the second, and the time was up. And I handed it in. I thought, "I am dead." I went back a week later and got-- and emblazoned on it was twenty-one out of a hundred. And I thought, "I am dead." Second highest grade in the class.

Spicer: Oh.

House: <laughs> There was a twenty-two and then me. And because of that, Carver admitted me to a senior class. That was junior year.

Spicer: So, now you mentioned that they introduced transistors in this test. Is that to say you had never heard or seen--

House: We had never heard of transistors, never looked at them in a circuit kind of structure. Just read about it, and solve these problems as though RLC circuits are going to be good enough. And it's like you have got to be kidding. But that was a Caltech experience.

Spicer: Yeah, that's tough. It reminds me almost of the-- you know the senior wrangler exams that they have at Cambridge?

House: Yeah.

Spicer: The best mathematician, and there's only like one person every few years-- yeah, yeah. So, that's amazing. Thank you for explaining that. Okay so, you're out of Caltech. What year is it right now?

House: '62.

Spicer: Okay, and you've got a BA-- S?

House: I've got a BS in engineering physics, which-- so, semiconductors were thought of as physics devices, chemical physics processes, and not electronics at the time. So, vacuum tubes were electronic, but transistors were not. And I didn't know until one of these oral histories that I picked up, it happened to be the Chemical Heritage Foundation, did a hundred- and sixty-page transcript with Carver Mead. And Gordon Moore, who he didn't know, walked into his office one day the year before I was his lab student.

Spicer: So, you were Gordon Moore's--

House: I was Carver Mead's lab student at Caltech.

Spicer: Okay, thank you.

House: And the year before I became that, which was my senior year, he meets Gordon Moore. A friend of Carver's who worked at Fairchild sent Gordon back to Caltech, where Gordon had graduated. And he says, "I've got some transistors. They're reject transistors. But if you could use them in your lab, I'd let you because that will let students get excited." So, I got to use essentially the first batch of reject transistors that Carver ever had and maybe anybody had for all I know.

Spicer: And when you say reject, did they--

House: Oh, they worked.

Spicer: They worked.

House: Yeah, they didn't have the high gain--

Spicer: Not up to spec.

House: And they might be-- the markings on them might have been-- so, it was cosmetic in many cases. So, I get to HP-- oh so, then the question is where do you want to go. And Carver said-- he says, "You're really good in a lab. You're not much good in class." Well, I never was in class. <laughs> But he said, "There's this company called Hewlett Packard that-- they've got-- they build instrumentation. And the thing about instrumentation," and I never forgot this, "Is you've got to be three times the state of the art to build a tool that other people can use to work on state of the art stuff." Right? So, you're always on the forefront. He said, "So, the way you think," he says, "I think you'd be great for Hewlett Packard." So, that's why I interviewed them, and as it turned out, ninety-eighth engineer, but the first one to ever build a transistorized anything for them.

Spicer: Wow, now yeah, let's get into your HP years. So, this is '62, '63?

House: '62.

Spicer: Right.

House: July 2nd, 1962.

Spicer: So, tell us who did you interview with? And what was the position you were going for?

House: Oh, my god, are you serious? You want to know that?

Spicer: I thought it might have been either Bill or-- but if it's--

House: Well, it was actually a confluence of odd deals. So, Carver said, "You ought to go interview." And they sent a guy named Marco Negrete on campus, who later ran all of our desktop computer line. The 9100 we have down in the timeline, he was the division manager that built that. So, he came on campus. And then a bunch of guys get reject letters. And a few people got invites to come up to see HP. I didn't get either one. So, I called him and said, "I really liked interviewing with you guys. And I've got an interview trip with Sylvania. Can I double up and come by your place if you'll pick up half the tab?" He said, "Oh, my god, we didn't send you a letter. I'm really sorry. Sure, come on by." So, I come by, and I interviewed with a bunch of people. And a key guy, the first guy was a guy named Blair Harrison, whose name is hardly recorded anywhere. But he ran our frequency and time division. And he said brightly in this quiz, he said, "Well, you've worked with semiconductors already," at this company I was working with plus Carver. He said, "What happens to the voltage across the diode when you apply heat to it?" I said, "Well, it goes up." <laughs> And I could tell from his face that was the wrong answer. And so, I said, "Well, here, I'll derive it for you." So, I write down the equation, derive it. And he looked at it. He-- "Well, god, it looks like it does go up." He said, "But they don't." At the end of the day, he comes back by, and he says, "I found the flaw in the equation."

Spicer: I think what you bring up, just let me intercede for a second here, is a really important theme in the history of technology, which is that these devices are not quite black boxed yet. We're still dealing with-- certainly, on the application side, no one knows really how to design these things just yet. Would you agree with that?

House: Oh, absolutely. For Carver, in our senior lab, I built a mono stable multi-vibrator at his request. Wound up, I built probably one of the first storage cells.

Spicer: In like a transistor-based storage--

House: Yeah, transistor-based storage cell. So, it's a one or a zero. But we didn't know to call it that. And he was excited, and I was excited. And my lab partner was excited. And then a year later, I'm at Stanford in a course. And some guy comes running in from Fairchild, and he says, "We've just built a storage cell." And it's basically the same circuit.

Spicer: Amazing.

House: So, yeah it was-- that was-- so, that's-- so, I go home from that trip. Now, this is a bit of a protracted story, but I think you'll like it. And several people who have gone on the visit got reject letters. Thanks for coming, but sorry. A couple got invites, or what do I want to say--

Spicer: Offers.

House: Offers. I didn't get a letter. Well, I had met another guy named Al Bagley, who we've got his oral history on file here, who sort of did the first atomic clocks and a whole bunch of wonderful things for HP, and a Caltech grad. And I called him. I said, "I didn't get a letter." He says, "Oh, my god," you know, "I'll take care of that." So, directly, I get a letter, and it's addressed to another classmate. But it's sent to my address.

Spicer: They're not having much luck with you, are they?

House: No, I was off campus. But it is to my address, his name. And I looked at that awhile, and I thought the hell with it. I'm going to accept. So, I show up at HP July 2nd. My wife and my second baby was actually born the week before. So, they stayed in Pasadena while I got housing up here. And they said, "Well, we didn't hire you." Well, here's the letter. Years later, when I had my exit interview with Lew Platt, who was CEO at the time, he says, "We never wanted you in the first place, did we?" After thirty years, so I got in. And then because of that circumstance, they said, "Well, you didn't interview with Bill or Dave or with Barney Oliver," who ran our labs. Okay, "We're going to have you go talk to Barney right now." Bingo, we go to see Barney. We walk in. I said, "You gave a talk at Caltech when I was a sophomore in high school. And you talked-- you were with John Lilly talking about porpoises. He said, "That's right." So, bingo, off we go.

Spicer: Connection, yeah.

House: And then he said-- well, he said, "What excites you?" And I said basically, I worked with these oscilloscopes doing this stuff for these AND gates or this multi-vibrator. He said, "Great, we're moving our oscilloscope division to Colorado. I see on your form that your mother was born in Colorado. You're a Colorado kid. Just do it-- finish a master's degree at Stanford here, and then you're on your way." I said, "Well, tell me about that division." He says, "It's the only doormat division we have. Everybody else, we're number one in the world. Tektronix just clubs us," he says, "So, you can help make them number one."

Spicer: Now, explain what you mean by doormat division.

House: Lowest profit, lowest sales, basically, the kick them around the-- I mean HP at the time was a very proud place, kind of the best instrumentation around.

Spicer: Oh, yeah, absolutely.

House: Except in scopes.

Spicer: Really? So, they were always chasing Tektronix?

House: Oh, yeah. I mean they had-- when I joined the scope division, I think we had six percent, and they had ninety-one percent of the market.

Spicer: I never knew that.

House: Iwatsu in Japan had the other-- oh, Fairchild actually had two percent, and Iwatsu had one percent. So, I want to do-- again, I want to do transistorized scopes. And you could buy a vacuum tube for the frontend, 6AU6, for eighty-eight cents. And a Fairchild 2N709 was eight bucks. And I'm going to need like twelve or fifteen of these devices, right? And they're all, "You can't do that." And I said, "Well, you know, we've got to if we're going to--"

Spicer: So, tell me. What did you do there? Did they make the calculation that the price would drop eventually and that it would be a good design choice to use those? Or did they just not-- was it not price sensitive really?

House: We weren't price sensitive. And the other thing, it wasn't like my bosses told me much of what to do. You were basically hired in, given a workbench and a lot of freedom. It was an incredible exercise.

Spicer: And again, you're only-- there's only ninety or a hundred engineers in the whole company, right?

House: Yeah, and I was down in an outlying division. We were like a mile from headquarters. We were in the old headquarters. So, we only had--

Spicer: Is that one Page Mill?

House: Yeah, it was 395 Page Mill. Headquarters was 1501. Now, the Hanover Place is halfway in between. So, we were-- ours was built to a Safeway spec, so if the company went broke, Packard could sell the building.

Spicer: A Safeway spec, now you're full of these interesting aphorisms. You've got to explain what this means <laughs>. What's a Safeway spec?

House: Well, if you go broke with your first building, Safeway grocery store would buy it.

Spicer: Because it's--

House: Because it's designed to their footprint.

Spicer: It's like a big empty space that can be-- yeah, okay got it. Thank you.

House: He never had to sell it to Safeway.

Spicer: Right. That's good design principle. Okay so, you're at HP now. Tell us about your first assignment there and then maybe the next five or-- sorry, how long were you at HP, quite a long time?

House: Twenty-nine years.

Spicer: Twenty-nine years. So, why don't we just start with-- we could make this product-driven if you like, or if there are personal milestones you want to talk about.

House: Sure, let me just hit a few of the-- so, the first project was the 1402 twenty-megahertz vertical amplifier, dual-channel vertical amplifier for the 140 oscilloscope. It stayed in the product line for like eighteen years, one of the-- it had two vacuum tubes on the frontend, two on the backend. But all the rest was transistorized.

Spicer: Why did you use vacuum tube frontend? Was that for--

House: High impedance.

Spicer: High impedance.

House: Yeah, very-- you needed at least a 40-meg impedance frontend for the probe connection. And then backend, in order to swing a cathode ray tube voltage of a hundred and twenty volts, when Motorola brought the 2N2218s out, we could finally do it in transistors, but until then-- so, I used these big Amperex-- I mean they were 10-watt bottles. They would burn your hand easy every time you pulled the plug-in out.

Spicer: Right, so that was to drive the horizontal scan?

House: Right. Yeah, horizontal and vertical. Actually, to drive the vertical scan, the horizontal sweep was another guy's plugin. Interesting project in that it got adopted by Sylvania Air Support, which meant actually, at the time, a lot of installations around the world. So, it was one of HP's bigger placements of scopes.

Spicer: So, this was a military market?

House: Yeah.

Spicer: Yeah.

House: And it turned out the units burned up. They had like thirty of these things in big racks. And I got a trip to Sylvania Buffalo, New York in January to find out why these things were burning up. And it turned out, we had a fan blowing air out. And they had a fan blowing air in. And so, they just created a stalemate. So, they just burned these things to a crisp. But they wouldn't let me work on this because it was a union shop. We were in the old Pierce-Arrow auto plant. I don't think it'd been swept out since they'd built the

last Pierce-Arrow over there. Oh, it was so scum-ball. And so, they'd let me come in at five thirty at night and work until midnight. So, I could work around the union.

Spicer: On the QT.

House: Yeah, yeah. And I did that for four days. And my questions were, "Why did you buy ours and not Tektronix?" And they said, "Well, the contract was for like four million dollars for all this HP gear. And to throw thirty oscilloscopes in added a dollar to the whole contract." So, it was obviously a bundled thing that we snuck in. So, that was my education. My second project was a programmable scope. And it was a zero baseline stabilize. Back then scopes, the trace would drift around with warm up. So, you never knew where ground really was. So, you always had to be recalibrating your system. So, we built an automatic calibrator. And it was wonderful. But we could only figure out how to do it on one channel. And the problem with a comparative scope with one channel is how do you compare anything?

Spicer: Right.

House: And I was the engineer not the manager and not the marketing guy. And when they came back and said, "God," you know I'm like, "You could have thought about that." So, I never again let someone else do my market research. I always did my own.

Spicer: Even as an engineer? As an engineer--

House: Yeah.

Spicer: You would do market research?

House: Which was-- which sort of broke the mold at HP.

Spicer: Yeah, I would think so.

House: So, the next project was-- I'll never forget it. So, we had moved, meanwhile, to Colorado. And I worked for the same guy for both of those projects. And he sat me down. He says, "I've got a list of eighteen projects here. And you're my best designer. Pick the three you want to work on." Okay? And I'm just, "Oh man, this is really cool." And I picked these three. He says, "Well, two of those I've already awarded to Chuck Gustafson." Well, you dumb son of a bitch. Why would you give me a list that's already circumscribed? That's not fair. When I put that in a book one time I said my grandmother would call that a fine kettle of fish.

Spicer: Yes.

House: As opposed to the profane statement. But I wrote that up years later. And this guy just got a real chuckle out of that. He says, "Yeah, I kind of remember that." Anyway, what was left on the list was a FAA control tower display request. And I said, "What's that?" And he said, "Well, it's some cockamamie thing

where they want to have-- they've got these big CRTs that have a four-foot throw. And they sit in these-- and GE builds them. They're four hundred pound deals. And this is how they track airplanes."

Spicer: They're like SAGE consoles, basically.

House: Yeah, and he said, "And we've hired a guy from GE who thinks he knows how to build a shortened version that would actually be something you could put in a standard electronic box. Why don't you go talk to him?" So, I go talk to this guy, and he was serious. He had an expansion mesh lens idea, kind of a spherical dome thing that would deflect the beam widely. So, we took a TV bottle and got rid of the electromagnetic gun, put an electrostatic gun in it. Now, transistors could drive the plates. Everything about it was beautiful. And it was a TV-sized display. This is 1965. And it had a problem because when you went through this expansion mesh, it also expanded the spot size. So, sort of the dot was not a dot. It was kind of a smear. And what the FAA wanted was they wanted to be able to write the name of the airplane, the number of the airplane.

Spicer: Oh, of course, the designator, yeah.

House: It couldn't do that.

Spicer: Right.

House: So, what should have happened is we should have cancelled the project because it didn't qualify for their bid. And where else would you sell it? And I got excited. Here's this picture is worth a thousand words. So, I persuaded-- and they were going to cancel it. And I said, "Well, if you're going to cancel it, I ought to be able to take it to potential customers because we're not going to be giving anything away to our competition, right?" And the guy says, "Well, you've got to go with an HP salesperson. No engineer is ever allowed in a shop alone." It's Christmas week though. I'm driving from Colorado to my home in Southern California for Christmas. And no one wanted-- so, the sales guys are all willing to set it up, but, "Why don't you do it. I don't need to be there." So, I took it to Sandia Labs. I took it to Kitt Peak. I took it to-- there was a big recording-- Burr-Brown was a military recording outfit in Phoenix. In L.A., I took it to a bunch of places including Triple-I.

Spicer: Now, with this-- sorry to interrupt. Would this have been like an XY display?

House: It was an XY display.

Spicer: Right.

House: XYZ display, twenty megahertz XYZ.

Spicer: Oh, the Z is the-- to modulate them.

House: Yeah.

Spicer: Yeah.

House: So, twenty megahertz on all three axes. It's a-- you've got one here somewhere.

Spicer: And didn't you use-- have you ever heard of a Charactron?

House: Yeah.

Spicer: Yeah where there's like a little mask with the characters in--

House: Yeah, we didn't have any characters. I mean you had to write the character as a pixel set.

Spicer: As a vector?

House: Yeah, well as a vector display. But if you fooled around, you could either do it pixelated, or you could do stroke. Anyway, I find a bunch of people excited about this thing. We can tie it to a computer. And in particular, Triple-I, which was-- what the hell was Triple-I called? Integrated-- anyway, it was the group that later did Tron.

Spicer: Oh, the graphics shop.

House: Yeah, big-- but they weren't a graphics shop yet. They were doing big system computing. I walk into this place. It was like North Hollywood or somewhere. I don't remember where, Orange County maybe. Just a room full of equipment, and they said, "We believe you could make animated graphics for movies." And I'm, "You've got to be kidding." Well, they just fell all over this box. So, I get back, and I report this. And my-- the marketing manager, Bill Terry-- did you ever know Bill Terry at HP?

Spicer: No.

House: He was the HP-- he was the engineering group vice president for years, ran the computer group actually for years. He ran it when the pocket calculator came out.

Spicer: Oh, yes.

House: He did a marketing study. And he came back, and he said, "The world needs thirty-one of these things." And he tells that to Packard at a division review. And Packard said-- I wasn't in the room at this time. And said, "Well, when I come back next year, I don't want to see this in the lab." Right? So, I hear this story the next day and I said, "Well, Bill didn't call my dad. He wants two. That's six percent of the world market right there," which was complete bullshit. But he (Packard) won't be back for a year. I'll bet we could have it in production. And they bet sixty grand to let me continue. And we put it out. That became the box that Denton Cooley used for the first artificial heart transplant display in his surgery room. It's the moon monitor. It's why we saw Neil Armstrong's foot hit the moon. Not the full box, but the Z-- I

built an eighty-megahertz Z axis. So, that supported space video. Until four months before, they were going to do a radio broadcast.

Spicer: Now, how did you go around-- in some ways, you went around-- was it Packard or Hewlett? I don't remember.

House: Well, kind of both.

Spicer: Who said I don't want to see this in the lab anymore. (Packard)

House: So, they're in Palo Alto. I'm in Colorado Springs. And they only came once a year.

Spicer: Oh, okay.

House: And so, you could get away with a lot. In fact, at that particular review, when I was showing the box, Hewlett-- I was not allowed to show the programmable box. So, we had a programmable box, and then mine was displaying it. I was allowed to show my display but not to make anything happen. So, I poke the programmable thing, and the screen starts lighting up. And Hewlett just came across the table, and he says, "Oh, my god, what?" I said, "We'll I'm not--" He said, "Do that again." I said, "I'm not allowed actually to do that. I just accidentally hit it." Well, you know that--

Spicer: Did you?

House: And then he got up--

Spicer: Was it an accident?

House: Then he got up to go to the bathroom, and we had locked the front door. He had to go out the back door. And he couldn't get out. And I said, "You're not allowed to leave yet. I'm not finished." So, he remembers me. And then the punchline was I said, "This market will be larger than the entire Hewlett Packard company within five years." And he just exploded, "Bullshit, bullshit."

Spicer: And you meant the computer monitor--

House: I meant computer displays.

Spicer: Displays, yeah.

House: And five years later, they were. And I sent him a note from Colorado. And he sent back a note, "Yep," one word, "Yep."

Spicer: Now, by the way, was this in monochrome? This was monochrome, right?

House: This was monochrome. We talked about color. But we had green phosphor, or orange phosphor, or-- you know, but no, it was all monochrome.

Spicer: So, you could order the phosphor color. Yeah?

House: So, the story when they came back the second year is it was in production. Packard just blew a head gasket. And he said, "I thought I said to kill this son of a bitch." He was-- and he's a big guy, wagging, "I thought I said to kill this." And I said, "No sir, what you said was you didn't want to see it in the lab. It's in production." "Well, where is it selling?" And I said, "And you were told the market was thirty-one. We've already sold forty." We sold one to Doug Engelbart. Alan Kay uses it for the FLEX machine at Utah. It made some noteworthy kinds of things.

Spicer: Yes.

House: But it was the first commercial XYZ box of vector graphics around.

Spicer: That's amazing you got away with it.

House: Well so, then-- yeah so, years later-- that was '67, yeah probably '67, January '67. April of-- April 1st '82-- so, what would that be, fifteen years? I become the chief engineer of Hewlett Packard. And my office is going to be next to David Packard on 1501 Page Mill Road.

Spicer: Is this David-- Barney Oliver's former role?

House: Yeah, I took Barney's engineering role. So, we split Barney's job when he retired. I got the engineering side, and Joel Birnbaum got the research side. And Joel, of course, was famous. And I just worked for a living. But anyway, Packard, for my going away party from Colorado Springs, sends out a Medal of Defiance. Then that became the Medal of-- so, you've probably seen that plaque.

Spicer: I have indeed. So, that's the story.

House: That's why I got it. And so, I come to Palo Alto, set up shop. We had a wall between us. It wasn't like I could see Dave at his desk. But I'm like eighteen feet from his desk. I'm the closest person to his desk beside his secretary, closer than Hewlett was. And so, I've got this plaque laying on a-- just there by my desk. And a guy named Gifford Pinchot walks in. Actually, do you know that name?

Spicer: He's familiar, but I don't recall how.

House: So, Gifford Pinchot the first founded the forestry with Teddy Roosevelt.

Spicer: Okay.

House: And Gifford Pinchot III wrote a book called "Intrapreneuring." But he hadn't yet done it. And my secretary gets a call. And she was Bob Marshall's daughter, who was co-chairman of Tandem at the time. And she says, "There's this guy named Pinchot on the line who wants to interview you. And I said, "Well, ask him if he founded the forest service. And if he did," because I was in the forestry, right, famous name. I said, "If he did, I'll take the call."

Spicer: It's an unusual name, too.

House: And he says, "Well, I'm not him, but I'm his grandson." So, okay-- so, he comes in. Here's this damn plaque. He whips out a Polaroid camera and says, "What's this about?" And I told him. And he said, "Can I take a picture?" Click, he does. Two years later, I get-- HP PR guy wanders into my office and says, "We've got this manuscript. And you're chapter one. And you're taking Dave Packard's name in vain. And it's just really-- you know, we can't have this in print."

Spicer: Was this your big book that you worked on?

House: No, this is Gifford's book. It came out in '85 called "Intrapreneuring," coined the word.

Spicer: Right.

House: And I'm chapter one. And I'm looking at that, and I thought--

Spicer: And he put that picture in there?

House: This is the greatest job I've ever had. I don't want it to end. But I'm going to have to talk to Packard about this. And it's got a picture of this stupid plaque. So, I walk next door and Dave-- and I hand him that. I said, "We've got a little problem here, and PR is kind of excited." He reads about a paragraph and he's-- and I said, "This happened years ago. I doubt if you remember." He reads about a paragraph, and he says, "Young man, I do remember. And listen, you're in a job now where you can stop a lot of good things from happening. I want you to remember that." Hands the sheet to them and said, "Print it."

Spicer: Wow.

House: So, that is--

Spicer: So, he's kind of giving you permission to continue being--

House: Yeah.

Spicer: Thinking outside the box.

House: But until I did my book, I still thought it had been a gag gift, and he just went along with it. But what I found out is he was concerned about creativity in the company sort of eroding. And he wanted to

set an example that it's okay to challenge people. So, he had used that opportunity. So, circumstance makes your career. These little-- so, that was a stunning kind of thing.

Spicer: You know Thomas Watson of IBM, Sr., used to have this thing called the Wild Ducks painting.

House: Yeah.

Spicer: And he would say, "We need a few wild ducks here." But of course, within the context of IBM, a wild duck is someone who doesn't iron their shoelaces that morning or something.

House: So, I knew a wild duck. I'll tell you the wild duck story. So, Bill Johnson, BJ he went by. Did you ever know that name out of DEC?

Spicer: I don't think so, no.

House: He ran the networking group for Digital, and then later he was adopted by Gerstner: "Let's reinstate wild ducks. So, he got profiled in *Forbes* or somewhere as a wild duck. Well, earlier, he and I had been cohorts in a get smart MBA program down in San Diego. And I'm running HP engineering. And we both decided coming out of it, we want to take this thing that wasn't yet called the Internet, but we want to connect our companies. And we're going to do it with what became WAIS, W-A-I-S, if you remember that system.

Spicer: Yes.

House: But earlier than that, we were doing CompuVision, Compuware and just anything we could do. We had Hayes modems. We had--

Spicer: CompuServe?

House: Yes, on K-Pro portables. And it was great. And the WELL came out of this project with Stewart Brand. But I invited-- BJ says, "I'll set one up for DEC. You set one up for HP. And then we'll compare notes on what happens when people are connected." I brought him out to give a talk to our Cupertino group. And I should back up. Along the way, and I told you some highlights, but I didn't mention logic analyzers. But logic analyzers became sort of the capstone of what I did for HP.

Spicer: Right.

House: So, I was about to mention logic analyzers. And I'll come back to that because it's a full story. But the issue around logic analyzers that led me to DEC was, well first of all, I had interviewed DEC in 1966, '65, in Maynard.

Spicer: That's early.

House: They were smaller than our HP division was. They were twenty million dollars. And a graduate friend from Stanford had gone out there and wanted me to come interview. And I thought they're not going anywhere. So, so much for foresight. That would be '66.

Spicer: Hard to tell in the early days with different companies.

House: Later, in '76, they're trying to debug the VAX 780.

Spicer: Right.

House: And they couldn't do it. And my tools would enable it, but HP was in the computer business by then. And so, I got together with Gordon Bell and several people at DEC. And we agreed that if we could get both boards of directors to agree that we were an instrument division, and we wouldn't share what we learned with our computer divisions, that we could do it. Both boards agreed. So, I put five people in the DEC headquarters. And the reason it's called VAX 780 is because it came out in '78. It took us a year to debug it. And what they couldn't do, they couldn't handle the virtual addressing without our logic analyzers.

Spicer: Which is what that whole--

House: Yeah.

Spicer: Project is about.

House: Right.

Spicer: Virtual addressing.

House: So, I knew DEC from those experiences.

Spicer: Can I just ask, sorry-- you didn't-- it seems like because this required a board to board level approval, what was the intended market for the logic analyzer if you weren't going to just sell it to anyone who wanted it?

House: Well, the only market it had value-- it worked for anybody using microprocessors or computers.

Spicer: Yeah.

House: So, our major-- probably eighty percent of our sales the first few years were to computer companies.

Spicer: Okay.

House: But I'm a computer company. So, I look like I'm sneaking under the tent. So, I had to build this shell that said we're a black box deal. We'll never talk to the computer guys. And the computer guys got really-- they tried to stop us. My point was we have to be measuring the best computers in the world in order to give you the best tools in the world because there's a lot of people ahead of you.

Spicer: Yeah, and they felt it was a competitive advantage to keep it in-house.

House: Exactly so, that was a fairly big battle. And I was in front of the board several times on that deal.

Spicer: Wow.

House: I could come back to the Luis Alvarez story at some point if you want because that would be a fun one. But the point I want to say here is in '84, I'd been a buddy with this guy from DEC running the network group.

Spicer: Okay.

House: Okay, who became the wild duck at IBM.

Spicer: Do you remember his name? Are you--

House: Yeah, Bill Johnson.

Spicer: Bill Johnson?

House: He goes by BJ. He wound up later-- I think he was vice chairman of Rensselaer Polytechnic, or one of those back east. He's still alive, or at least he was a year ago. And he came out to visit. And he stayed in our master bedroom. And it turns out the following week, HP had its first ever executive committee meeting, management council meeting, which was about twenty of us, that we analyzed DEC. And we brought in some outside clown, and he brings annual reports from their last year. And we're sitting at this table, big old U-shaped thing up in some fancy place in Napa Valley. And he says, "I want you to take that back page, and we're going to go around the room. And I want to know from each of you who you know personally on that page. In other words, do you know any of the DEC people?"

Spicer: So, what's on the back page? Tell us.

House: The list of their officers, their board of directors. So, it's like thirty names.

Spicer: Okay.

House: Well, he gets all-- the first eighteen people, not one of them has ever met a single person or talked to them that they would admit to at least. They get to me, and I said, "Well, this guy BJ, who runs our engineering team, slept in my master bedroom last Saturday night." Oh god, the thing blows up. "And

Bob Glorioso, I know him because I built this stuff for him. And Gordon Bell, I know him." Now, Gordon was no longer there, but I said-- and they're just apoplectic. And then Joel's the last guy. Joel's sitting next to me. And he says, "Well, and actually, I know--" <laughs> And then he gives them, the whole team, a sermon. He says, "Well, if you don't know who the hell you're competing with, how do you know what they think? How do you know how to--" you know he said, "Chuck is the only one here that's awake." And I-- thank god, you know, but so, that was kind of-- so, that's what the wild duck triggered.

Spicer: Can I just ask what the blend between engineering and sales was over the course of your career? Did that-- did those proportions change over the course of your career, engineering versus--

House: For my work?

Spicer: For your work, engineering versus sales, marketing, these kind of high-level relationships that you're talking about.

House: Well, I never was technically in sales. I was always in engineering. But I did the whole thing.

Spicer: But it sounds like you had a marketing sort of world view, which a lot of engineers don't have. And I don't want to put words in your mouth, but do you-- it sounds like you were always looking-- maybe this is something that HP promotes, that you have to have a market for your--

House: Well, my dad was a salesman. And we used to say he could sell ice cubes to Eskimos and just the gift of gab. And I would travel with him as a kid and watch him in action. And he'd just . . . he'd befriend people. He'd get to know them. He had the Hughes Culver City account, sold them like millions of dollars of thin-wall tubing for their liquid missile game and stuff like this. So, I think I kind of probably learned a lot from him in an osmotic way. And then when this single channel machine, you go oh, how could you be so damned dumb. And so, then the display box worked out really-- we sold seventeen thousand of these boxes at two grand a piece. So, it was a thirty-five million dollar business.

Spicer: And this was the one that--

House: That Packard wanted stopped.

Spicer: There was a world market of thirty-one for it.

House: Yeah, and then when logic analyzers came out, and that's a story worth telling I believe. So, coming off the display box, I did a couple of pedestrian things. And then Tektronix was about to introduce their big do-all machine. If you don't know the Tektronix line, they did a lot of plugin scopes. But in 1970, they introduced the 7000 scope, which had four plugins. And it was just-- it was a giant-- it was like a Shopsmith. It could do anything. And I was given the assignment to build the competing box for HP. And we're starting two years late. They've already got this thing on the market. What are you going to do? So, I went to IEEE in New York March of 1970 with another designer. And we managed to stand in their booth and tout their machine to customers. If you can imagine, we're wearing HP badges. And the Tektronix

guys not only let us in but asked us to give the demos. And I asked them why. And they said, "Well, you guys know these products a lot better than we do." They'd just seen them. They're all sales guys. We're engineers and we're playing with them and trying to figure out the linearity of the sweep and trying to . . . I mean we're essentially debugging these instruments.

Spicer: Just tell me, did HP go out and buy this scope, for example, or competing products and--

House: No.

Spicer: Take them apart?

House: No.

Spicer: To see how they worked and--

House: No, never did that.

Spicer: You never did any--

House: No.

Spicer: Okay.

House: But I'm in their booth.

Spicer: That's funny.

House: And everybody that would come by, I'd ask, "Are you interested in this?" And they said, "Well, it's really interesting, but it costs a lot more. It does the same thing as my scopes today. It doesn't do anything new other than print characters on screen. And I don't need a spectrum analyzer sitting alongside a scope. I use one or the other, but I don't use them concurrently." And then you say, "Well, what do you need?" And they kept saying, "Well, we're having trouble with these little chips coming out. And we think we need an eight-channel scope not a four channel," or, "We think we-- we're really struggling with how to handle microcomputers." Okay so, I come home, and we're about six weeks from having a design review of our prototype. And we had eight plugins not four. We really had gone off the deep end, and I had character printing.

Spicer: The mainframe could accept up to eight modules?

House: Yeah.

Spicer: Wow.

House: Yeah, and it used liquid crystal displays. I mean it was sexy. It had every piece of hot technology.

Spicer: What was the model number?

House: Huh?

Spicer: The model number?

House: We never put a model number on it.

Spicer: It didn't ship or--

House: No, so, I-- the point is we're getting ready for this prototype review.

Spicer: Okay.

House: Breadboard review, and we couldn't make the sucker work. And we had-- I look at the backplane, and we've got like-- it's like that Cray downstairs. It's just this wiring harness that goes on forever. And then my team is trying to explain least significant bit, most significant, first in/first out, and saying we're just having a bitch of a time understanding how to have all these plugin nacelles talk to each other and wire it correctly. And it's just driving us mad.

Spicer: Very difficult, yeah.

House: So, the division review, Packard, and Hewlett, and Barney are all there. And they said-- and I say, "You know, I think we ought to cancel this," in the meeting. I said, "I just stood six weeks ago in the booth of Tektronix. They don't do anything new. The customers weren't that excited. But the customers have these digital problems. And we can't even figure out how to wire this sucker. And we're two years behind. And they spent seven million dollars already on R and D. And I've got a budget of two. I'll never get home. So, I think this is a lost cause." And they were, "Fine, okay, done. What would you like to do? And you've got twelve minutes left on your--" And I said, "Well, there's this digital problem, see." Then I said, "The reason they want an eight-channel scope is they want to find out on each channel whether it's high or low."

Spicer: Right.

House: I said, "Scopes are good at looking at the transition. They're not good at the steady state. We need to have something that looks at steady state one, then two, then three. We need a synchronous logic determinator." And Barney just went absolutely nuts. And--

Spicer: In a good way?

House: Huh?

Spicer: In a good way?

House: In a good way.

Spicer: Yes.

House: And that-- and Hewlett, I'll never forget it. He stands up. He says, "You know I've been hearing stuff like this at a couple of the divisions." And it's the computer divisions. And he said, "Why don't you put a plan together." And that became the logic analyzer line.

Spicer: And your expected customer was microprocessor designers, computer designers?

House: We just thought it was an interesting problem to solve at first. And then--

Spicer: Now, that had a model number.

House: Oh, yeah. The first one was the 1601L. The L stood for lab because it was a twelve channel-- we could only get twelve bat-handles across the width of a 180 plugin, 180 oscilloscope plugin. But you needed a sixteen-bit. So, what we said this is for eight-bit micros and four flag lines.

Spicer: Right.

House: And we'll build a sixteen-bit for our second if it works.

Spicer: What is the state of storage scopes at this time?

House: Do what?

Spicer: What is the state of storage scopes at this time?

House: We had a variable persistence storage scope in the 140 line, the 141. Tek had the 564, which was not variable persistence. It was kind of a capture and hold. And you could change the dwell time, but it wasn't-- I've forgotten exactly. It was a static charge deal. And you had to discharge it in order to rewrite it. Ours, you actually could dial the length of the persistence kind of just with the knob.

Spicer: Right. It must be very difficult just as a general engineering problem to keep-- because to use-- to adopt a modular architecture, the problem is that the signal path keeps getting interrupted every time you plug in a new module. So, the interfaces between those--

House: Well, yeah. I mean this was all the analog world. So, you're spending time cutting delay lines to length. It's asynchronous design. And you're worried about race conditions. And yeah, I cut my teeth on that for a long, long time. And the rate of interference problems between modules is huge. So, the RFI studies were-- and even our-- the display box I built, I had a big mu-metal shield around this whole TV

tube. But we still-- if you set it on top of a chassis with a big power supply, our zeros looked like Lissajous patterns. And it was fascinating.

Spicer: Well, to me, Hewlett Packard has always represented the extreme bleeding edge. Like you have said, to be on the leading edge, you have to-- the test equipment you use in your lab has to be at three times the leading edge or whatever. And it seems like, I was watching a recent show-- this is just an aside, but on the latest HP scopes that are about a hundred and forty thousand dollars.

House: They are expensive, aren't they?

Spicer: Are just stunning zero--

House: Well, but they're major computers--

Spicer: Zero to sixty gigahertz, eight channels, the probes alone are eight thousand dollars <laughs>.

House: Oh, yeah.

Spicer: So, that, to me, is HP. So, I'm not all that surprised that they would build equipment for relatively small markets. Is that an accurate thing?

House: Well, we didn't--

Spicer: Because they're very high margin instruments usually.

House: So, let me wrestle with that thought for a moment because driving up here, I got to-- I was trying to think about what are a couple of the significant points. And so, we built this thing pretty sure it would have value but not quite sure who for. And in particular, I had gotten to know-- well, we had already built-- let's see is that true? We had in the lab our HP 35, the handheld calculator. And it was a one-bit serial micro. But we were using several of the Intel 4004s around the company. And so, this little box was great for that. We had plenty of leads for that, and you could play around. And we're a ten-megahertz box. We weren't a very fast box. So, it had to be some toy micro to work. Well, then it turns out a company called MSI Data-- you ever heard of them?

Spicer: Possibly.

House: MSI Data, at one point, was the leading purchaser of 4004s in the world. And the issue was some guy who worked for Xerox El Segundo, about the time Xerox got bought-- well, about the time-- what do I want to say? SDS. He worked for SDS. Xerox bought him. He deplaned or something. And he lived next door to a guy that ran an Alpha Beta supermarket. And he goes to him, and he says, "What could you use in the way of electronic devices?" And the guy-- "Come down and look at our store." So, he comes down. And he watches all these grocery clerks running around trying to restock shelves. And he says, "Well, if you had something that you could just write down, type in, how much you need of this and that and the

other, and then take it to the backroom, that'd be good. Wouldn't it?" So, he builds a cart with two car batteries and a little keyboard thing with a 4004 micro and starts a company called MSI Data, which stood for medium-scale integration data, in Costa Mesa. And I find out-- he decided to become friends with Dave House at Intel, who's no relation, but we traded on the name. And I'm building gear for them, of course. And so, I chase down there. Well, they offered me a job. And I thought this could be-- so, I actually got pretty steeped in what they were doing and then brought that back to our tools group. And so, we had a couple of ready-made customers. The other one was Linkabit that Paul-- the Qualcomm guy¹. You know who I mean. We did his interviews here [at CHM]. We'll both think of it. But anyway, he said Linkabit-- so, my first seven customers for a logic analyzer, one was Linkabit. One was-- which was going to become Qualcomm, but we didn't know it. One was MSI Data. One was Raytheon. And it was Raytheon Data Systems out of Norwalk, Massachusetts. They bought seventeen. So, we had one salesman that sold eighteen, seventeen to this one company. And I went back to find out what he knew. He says, "I don't even know how to turn the damn thing on. But I've got this guy who's digital. And I said, 'Try this.' And he's ordered seventeen of them." I love it. So, but we had another guy who had sold eleven. And so, what I was doing, I was tracking all of this. By now, I'm general manager of the R and D lab, the product marketing guys, and the manufacturing team. And it was a hoodlum group basically. But I wanted to know where we're selling these things. We sold fifty to MIT, forty-nine of them for twenty percent of list price. And I just went nuts.

Spicer: Oh, that's a big discount.

House: Yeah. And I went back there. And I met a guy named Danny Hillis who was using these on the Thinking Computer. And I canceled the order. It was our top end machines, a ten-thousand-dollar box. And I said, "I'm not going to give these things away for nothing. This is crazy." And the salesman was all pissed. And Danny didn't care. He had a contract to pay anything he wanted. And then I had another-- he sold twelve to the Indian Institute of Science, IIS, not IIT, but IIS, which was the Tsinghua of India, or the Princeton of India, major science school. They were teaching Lyapunov state variables, probably the only university in the world teaching it at the time. Maybe some Russian ones were. So, they went nuts for these machines. And I flew over there to find out why. And--

Spicer: That's used in filtering, I think, right?

House: Huh?

Spicer: That's used in filtering?

House: Yeah. And well, basically, the whole thing logic analyzers do is the state variable table. You're just building ones and zero tables and then decoding them for what they might mean.

Spicer: So, this is the 1601 now?

¹ [Interviewee's note] Actually Irwin Jacobs, Pauls' father.

House: So, well by the time I got to India or to MIT, these were our third round. These were 1610's in particular was what those were.

Spicer: And they're roughly ten thousand dollars?

House: And that one was ten thousand, yeah. So, the line went from about two thousand to ten thousand at that time. And then we got into the development system business, and that was about thirty thousand. And then so, your question about me being sales, no. I was always doing market research. I was-- I gave multiple seminars, a two-day seminar on how to use logic, probably taught twenty-five thousand people that stuff. So--

Spicer: No. I want to ask you a little bit about that because I did notice that on your resume that you had personally taught twenty-five thousand engineers how to use your logic analyzer. So why don't you tell us just a bit about that, and how important was it to HP to educate its engineers in this _____?

House: Well, nobody knew what these tools were. I mean, micros were pretty new. And--

Spicer: Sorry, what year is this again?

House: We're talking, for the-- when would that be? Late '75. So the 8008 and the 8080 were out. The 8132 and the 8086 were-- hadn't even been sourced. I think Motorola was about to introduce the 6800. So we hired a guy from Motorola, who-- we were debugging the 6800, and they called to ask-- well, we called to ask about a question we were having, and they said, "How can you tell?" And we, "Well, here's how we can tell." And it was the look-ahead feature they had built in, that nobody was supposed to know about.

Spicer: It was some internal, yeah.

House: And their point-- and this was Carmen-- what the hell was Carmen's last name? (Santoro). It doesn't matter. But their management was just saying, "We can't sell this stuff, because nobody understands it." And this was before the Orange Crush that Bill Davidow did, and all that. So it was on the front end of, you know, the early adopters. And they're all learning coding sheets, and, I mean, it's just a bizarre--

Spicer: It was really a whole generation of engineers had to be taught--

House: Yeah, you had to take analog engineers and turn them into--

Spicer: Microprocessor.

House: Yeah, this is what synchronous design is about, instead of asynchronous. And they just fought it tooth and nail. I mean, a lot of people were good with, you know, with TI, you know, TTL logic and ECL logic, and all the letter logic families were out there, but they were all doing asynchronous design, you

know? They were doing all that Quine-McCluskey stuff, and, you know, and acting as though they knew what they were doing. And none of it made any sense, unless you did it in a synchronous way, so you always had-- you knew when to sample--

Spicer: A master clock.

House: Yeah. And of course IBM had built their computers that way for years.

Spicer: Now, in the same vein, how hard was it for engineers to move from vacuum-tube orient-based design to transistor-based design?

House: Oh, that was-- well, the company I worked for, when I was going through Caltech, very hard. You know, we were an aerospace outfit, and we were-- you know, the cookbook engineers, we used to call them, just never made the transition. And I was just sort of a fly on the wall, but I watched probably 20 of these guys just die and get replaced. At HP, it was an evolution, but it didn't seem that hard to me there.

Spicer: Did HP have any in-house training, like they did for--

House: Oh, yeah.

Spicer: On transistors?

House: Yeah, we did a lot of stuff. And they had a great program to go back to Stanford. You know, the Honors Co-op program was--

Spicer: Tell us about that, because you went through that, right?

House: I went through it, and I ran it for a while.

Spicer: Oh my gosh, okay, well, let's wrap up--

House: I know something about it.

Spicer: Let's wrap up the logic analyzer, and then we'll go on to Stanford, or whatever is the next step. What products, after that, did you work on? If any?

House: Well, what I was really going to say is, so I kind of did everything, but I really was never in sales. I was either engineering or sort of-- I'll call it general management. But I had this hands-on approach, you know, throughout. So that was-- I did that through '82. '62 to '82, I was a designer, you know, I mean, filed a few patents here and there. HP didn't believe in patents. We just outran people. And then '82, I was appointed corporate engineering director, moved to Palo Alto, and from then on, I was totally in management, either staff management, which is what that job was, or I later set up the first software

division for HP. Again, I couldn't write a line of software, but I'm running a software division. Kind of like the horses and the drafting.

Spicer: Oh, well, you know, Lou Gerstner ran IBM, he didn't know anything about computers. But so let's start with '82.

House: So '82, I'm back out here, and the question I was brought out for was, we're now in the computer business, and we're getting our head handed to us. We'd hired Joel from IBM, superb guy, and the company has kind of become two cultures. There's kind of-- we're hiring computer group guys out of either Chico State, because they're great coders, or out of old computer companies, and they bring all their habits. So it's not the HP of the lore and the HP way and all that, it's just-- and they're alien. And my job was to, A, make that homogenous, or at least have some coherence, but, more importantly, we had this divisional model everywhere. So the way we ran the computer business, you had a CPU division, you had a peripherals division, you had a disk drive division. And nobody understood interfaces. So kind of the problem of the plug-ins you were talking about? And now we've got, you know, a division in Vancouver, Washington, building something for a Cupertino division, building something for a German operation, and the stuff doesn't plug together and work. So the whole question was, how do you put, you know, bus standards in, and APIs, and how do you design a scaffold that can run a systems company, but still hold this semi-autonomous divisional model for how to run P&L's (Profit and Loss centers). And it was just frightful. It was kind of like going and standing in that Tek booth. I'd go around and ask all these people, and they all told me what was wrong with the other guy. But they had no conversational mechanism. They didn't have joint meetings, they didn't have joint projects, they didn't have a way of--

Spicer: Integrating.

House: Yeah. And so that's why we started looking at how do you stitch this company together, this wildly-- I had 91 divisions reporting to me. 91 R&D labs, plus 26 research labs reported to Joel, and reported to me dotted line.

Spicer: And this is a global--

House: Yeah. And this is like 40,000 engineers, development engineers. We were the fourth largest engineering firm in the world, for R&D. And Ford Motor, IBM, Boeing and us, I think, were the-- was the list. So I'm desperate for-- and we were, by far, the most geographically dispersed. These were in 26 states and nations. And Packard said, "Your job is to be at every one of them, every year." I said, "Well, what am I going to say?" He says, "Just tell them what you learned at the last one." This is nuts.

Spicer: You're going to be doing a lot of flying in this job.

House: So that's what led to finding the Cisco router. So I signed the first contract Cisco ever had for a commercial company, 27 months before their second contract.

Spicer: Okay, now you better tell us about that. That sounds pretty important.

House: Well--

Spicer: Is this HP buying a router from Cisco?

House: So, the question was, how do you build something that can connect these people together? So I brought Doug Engelbart in as a consultant. I hired Bert Raphael, who ran the ARPANET node for SRI, and we hired-- who was the kid? Mark-- oh god. Time flies when you're having fun. (Mark Laubach). One of Dave Farber's top students out of Delaware, or Maryland, wherever he was. So I had a little team that was just-- I mean, right on the cutting edge of what was happening with the BBN stuff. And Bert says, "Well, you know," he said, "I know this couple who's got this little company, and it's not going anywhere, but I think it's really cool." "Okay, and how do you know?" And he told me this in the computer history museum, downstairs, for that Engelbart thing we had. He said, "Well, I ran a travel service. My wife had a travel agency, and they bought their tickets from us." And he says-- this is kind of-- this is not-- we don't have to be off-camera, but it's a little off-color. He said, "The question always was, did they want one room or two, because they were into open marriage." He said. So I thought that was pretty interesting. And then, of course, I was an AI guy, and I looked at this router stuff. So he brings them in, and HP labs, with Joel, put a project together. And then I put together a project, and we built, quote, the HP Internet. We called it that in May of '86, when we introduced it to the world. Actually, to-- we introduced it through some scientific conferences.

Spicer: And is this an intranet for company use only?

House: Yeah. We didn't call it Intranet, we called it Internet, for us. But yeah, we connected five divisions first, and then we connected, essentially, all the divisions. So we were running on top of an early version of the CalREN stuff, and all-- well, we had to pull T5's into everybody, you know, to do it. And so, when I wrote the HP book-- I mean, when I signed the contract, Sandy Lerner, and, you know, Len Bosack are in the room, right? Plus, I think, they had Bill Graves. I don't think it was-- it was long before Morgridge had shown up. This is like May of '85, I think, or '86. And they didn't jump up and down and say, "We got one," right? They just acted very matter of fact, and walked out. So I write the history book. Cisco invites me down to give a talk about the book, to a bunch of their people. Joel Bion, at the time, executive vice president for engineering, stands up and introduces me as the guy that founded Cisco. What are you talking about? He says, "Well, you bought the first, I don't know, four dozen routers that we ever sold."

Spicer: That's amazing. What a great story.

House: But I didn't know it. I mean, you know, 'til he told me. So I think there's a lot of circumstantial stuff in the valley like that, that we-- that's one of the beauties, to me, of these oral interviews that we do, is, you collect, you know, one person will give you-- here's my story. Bing bing bing bing. Another person-- you know? And if somebody can ever cross-thread those and say, "Oh my god, he was, huh?" You know, it's just this-- I mean, we are sitting on a treasure trove with these. I wish we could do five times as many, in a hurry.

Spicer: I know. Well, that's the idea, you know? And these connections that-- I mean, just in this interview alone, I've discovered probably 20 things I didn't know that you were, you know, you watched the-- what was that, the lecture on porpoises at Caltech with--

House: With Barney.

Spicer: With Barney Oliver. Just-- it's a very small community, is what I find, you know? That when you look at the-- I've often thought that--

House: That's why SETI exists, is because they did that work with porpoises.

Spicer: Oh, really?

House: Yeah, and Barney was-- he says, if you can talk to porpoises, there's got to be alien life everywhere, so he was one of the founders of SETI.

Spicer: Oh, how interesting.

House: Barney was interesting. He was the sixth person ever to be elected to both the National Academy of Science and Engineering. And his name's hardly known today, you know? It's--

Spicer: Yeah, he really is not well-known. That's something we should change.

House: But he was sure phenomenal.

Spicer: Okay, so tell us, what are you doing now? I mean, not today, but at this point in our narrative. It's about '85.

House: Okay, so I ran corporate engineering for a while. We built that structure. We did a lot of other great things, including Motif, the 3D look and feel. Again, I was told, by Joel, "Don't you, by god, show that to anybody." And we sent it in, we were the last entrant- the day before the thing closed for the Unix selection committee. The OSF. And it was by acclamation, they picked it. And then, of course, that became, later, the basis of, you know, what Microsoft stole from-- Apple thought they stole it from them. They stole it from us, actually. In fact, they didn't steal it. Bob Frankenberg gave it to them.

Spicer: Right, the windowing.

House: Yeah. But so-- it was the fact that the icons could actually be done in three dimensions. So they had a look and feel to them.

Spicer: Right, like a drop shadow, or something.

House: Yeah. So that-- we won two IDSA gold medals for that. First software gold medals they'd ever awarded. So lots of stuff. And I, you know, along the way, I got notoriety. So I got awards here and there, and, you know, you get to go traffic with interesting people, and all that. But the thing I was reflecting on, coming up-- and I did this in a talk about five years ago. I had-- I always felt it was a disadvantage. I was not in a place to run a company that became a unicorn, you know? I was never looking to run a company like that. I didn't-- I wasn't-- I didn't think of myself as a CEO kind of guy. And I was always in the backwater, it felt like. You know, you weren't at a name that was a household name, you were at HP, which was kind of undercover. In retrospect, what a privilege I had. It's almost like Peggy Burke. Peggy got to work with every VC and every start-up in the Valley. Huh? On branding. Well, the point was, she got to work on it all. I got to work with leading-edge tools, in leading-edge labs, everywhere around the world. And see what was going on. And get to know the people. I mean, what-- how could you design a job like that? If you set out and said, "What spec sheet would you want to write for your life?" I mean, it was the greatest privilege, and I was virtually unaware of how magical that would turn out to be. But, thinking back on it, that was so fortuitous, it's just incredible.

Spicer: Now, what were some of the strengths of HP, when you look back at the company?

House: Well, I'm going to presume the old HP, is what you're implying in that.

Spicer: I suppose you're right, yeah. Management by walking around, and that--

House: Management by walking around was huge. Well, these division reviews. So Dave and Bill, every year, went to every division around the globe. And that's what I would up doing, too, and you'd hold a review when you got there. And Hewlett would say, he says, "It's not important, what we know going in, and it's not even important what we do while we're there." He says, "What's important is that we arrive."

Spicer: At a common understanding?

House: No, that we just show up.

Spicer: Oh, just shot up.

House: He says, "By showing up, they have spent a month in a lather, trying to figure out what they've got that makes sense." He says, "So I'm a galvanizing function for the company." He says, "That's what keeps this company together, as much as anything." And then I can cross-fertilize. I saw something today that should be at CE, and things like that. So that was a magical piece. And they-- when they did it, because they're in a remote location, and they couldn't get back for a year, or, you know, I mean, they could, but-- they could give you suggestions, and you didn't have to follow it. You could chase it a little while and then say, "Well, they're full of shit." You know? And do your own thing. And they would let you. And so there was this quasi autonomous feel to these places. And Hewlett's point, always, was, if you have a group of 500 to 1000, you'll know everybody by first name. Marketing won't be an alien force, because the lab will have to work with them, you know? And if that team doesn't work together, they don't get any new money, you know? It's a self-driven funding operation. And so you learn-- so it's 91 small

companies, is what it is. And the motivational factor that that provides, they felt, way outweighed the lack of, you know, the idea that the left hand doesn't know what the right does, and that you might duplicate effort. We didn't worry so much about duplicate effort, but we became concerned about the systemizing. That had to be solved.

Spicer: How parts come together.

House: Yeah. And so-- but that was able to be codified.

Spicer: So, if you had-- I think you said 26 labs?

House: 91 labs in 26 states and nations.

Spicer: 26 states, 91 labs. So, I mean, were you just flying constantly?

House: Yeah, pretty much.

Spicer: For several years?

House: Yeah, like five years.

Spicer: Five years.

House: Yeah. At the start-- actually, I-- the story predates that. I did a lot of travel for Logic, trying to sell that around the world, which took a lot of-- the 25,000 engineers, and--

Spicer: The analyzer.

House: Yeah. And we-- ultimately, we brought a bunch of faculty people, young faculty in, trained them. In fact, like seven of them became IEEE presidents later. It's amazing, looking at the list. But the-- my wife, at the time, and I'd been married 20 years to her, gives me a Christmas present, and it's a calendar, marked up with how many dinners I had missed. And it was over 200. And we had four kids, and you know-- and we owned a business on the side, and we ran a plant nursery on the side, and it was her swan song. She just, you know, see you later. And so that was that. I never kept track with-- but I was a million-mile traveler, you know, most years, for those years.

Spicer: I want to touch on that a little bit, but not too much, because it's deeply personal. But one thing you see all the time in this valley, with people who are driven-- highly driven, motivated people, and on demanding projects, is this-- the suffering of relationships in their lives. The personal relationships in their lives suffer, because they're just pounding the work, constantly, you know? 80, 100-hour weeks. And do you have any comment on that?

House: I do. First of all, I've been married three times. The second two from HP people, or with HP people. But there's two problems. I mean, the pressure is immense. It is 60, 80, 100-hour weeks, especially in start-ups and things like that. The second is, engineers, by kind of nature, are not what I'd call the most warm, fuzzy, empathetic, you know-- I'm sure there's these personality charts, and they're off in some corner, that wouldn't be, necessarily, great fathers, husbands, in the classic sense, anyway. And then there's a third factor. I believe that the language separates you pretty quickly. You just-- you're in a vernacular, and a technical world, that, unless your spouse has some reason to track that, you're just-- you're aliens, in terms of common discovery. And that third, actually became a bigger factor, I think, in at least one of my situations. Now, I-- second marriage, great gal, didn't last very long, kind of a rebound thing for both of us. Third one, it's on her third marriage. She's a PhD computer science gal out of Berkeley, you know? She is a hard-charging technology gal-- she's won several national awards for her field. She was the Cupertino curriculum director, when Woz walked across the street with an Apple II and said, "Can you use one of these in a school?" And she said, "Nope." And he prevailed, and she was one of the first ten PhDs out of Berkeley in computer education, which had both a computer science, an engineering, and an education sign-off by all three departments. So we-- I mean, we're best friends. We're spouses in the classic sense. But we also share a lot of technology understanding, and vicarious thrill. And I think that's important for a lot of people.

Spicer: Yes, I think so.

House: But, it's tough. Now, our-- my first wife, we might have made it work, but we had a very sick youngster, for five years. And a lot of families, where you have a situation like that, fracture anyway, never mind if you're in high tech, or-- I mean, it's just-- there's all sorts of complications that can happen.

Spicer: Right, well, thank you for touching on that. I know it's very personal, and I really appreciate you talking about it, because I think it's a widespread problem in the Valley.

House: Oh, I will tell you, one day-- so I'm at HP. My wife, one day, calls and says, "I got the job at Apple." And I called Lew Platt, my boss, and-- you know who Lew was, right?

Spicer: Oh, yeah.

House: And he says, "She can't do it." I didn't actually call him. I went up to his office. I'm sitting across-- "She can't go to Apple, Chuck." I said, "You call her and tell her." He called like at six in the morning, and he says--

Spicer: Oh, he did call her?

House: Huh?

Spicer: He did call her?

House: No, he didn't call her. He called me at six in the morning, to say, "A, the board has met, and it's okay. She can go, and you can stay in your job. There is a change with your job, though. We're going to move it off the management council, so that you don't have access to some of the really secret documents." Right? And I thought, wow, you know? She's only going to do education for K12. This isn't something HP does. And but boy, they went nuts, okay? So that was--

Spicer: To think you'd need board sign-off for the spouse of a manager-- that's pretty impressive. Different times.

House: But I was sort of in the inner circle of the place, too. So, you know. But it was kind of surprising. And I thought I'll get out of the penalty box, you know, a year, two years-- four years go by, and I'm not out of the penalty box. That's when I left.

Spicer: You know, I noticed something really interesting on your resume, which was this nursery that you ran, or perhaps are still running, in Colorado, I think?

House: Yeah.

Spicer: A rose--

House: Well, it was-- Los Robles was the name of it, which was The Oaks. That's the fraternity house at Stanford.

Spicer: Yes, I know, that's right.

House: Which I was never in, but I loved the name. Yeah, I went to work for Monrovia Nursery before I went to the Pack Station. So through high school, I worked at a little plant nursery. Retail side of their plant nursery at the time, called Rosedales. And my brother worked across the street at the Japanese nursery. And years-- so then I'm in Colorado, you can't grow anything in Colorado if you're a California, because it's the cold winters. So I had the-- and I'm self-taught, completely, at gardening. But I wound up buying a little nursery. And I had two other couples at HP-- one other couple at HP and one from our church, and my wife and I at the time, and we bought this thing, and eventually it was just the two of us, and eventually just her. But, you know. Yeah. And we had 20 people at peak season. We had the largest rose franchise between St. Louis and California.

Spicer: See, this is what I mean. You have done so many interesting things.

House: Well, it was a kick, you know? Now, that was hard at HP, because I would take a leave of absence every spring.

Spicer: To go work in the nursery?

House: Yeah, for six weeks.

Spicer: Oh my goodness.

House: And I remember my boss just, "You know, you can't be general manager of the Logic analyzer division and take six weeks off every year." And I said, "Well, okay, then I have to quit." "Oh, well, maybe we can find a way." You know, I mean I was available on-call if they needed me. But, yeah. And my view was-- and my view about a lot of people who take these jobs, they rent your service. You don't-- the company doesn't own you. The company-- it's wrong to think of-- that you dedicate your life to your company. Because you dedicate your life to yourself and your family and your learning, and you know? And the company is a major part of that, sure. But basically, they rent your service. That's the way to think of it.

Spicer: That's very good. And, you know, with HP, I find people--

House: And we could do that there.

Spicer: People had-- especially people my age, or a little older, and, you know, 50, 60, who worked there, have a deep loyalty, that I've never seen with any other company, even IBM or--

House: Apple has a fair touch of it. It's the only other one I can think of.

Spicer: But HP just, you know, people worked-- like you said, they-- almost no one almost ever left.

House: So let me tell you how I got trapped by circumstance, as a result. So I go do the HP book. We did probably 150 decent interviews, probably 550, you know, short snippet things. Basically got turned down like once, okay? And it was Bob Wayman, who was acting-CEO at the time when-- must have been between Carly and--

Spicer: Apotheker?

House: Huh?

Spicer: Léo--

House: Yeah, Léo Apotheker, yeah. So-- but Bob had been, you know, he'd been the CFO in Fort Collins when I was-- ran a Fort Collins division. I knew him well. And I said, "Bob, I'd really love to get the backstory on--" He says, "Charlie, it's got to be all off the record." And then he told me a ton. But he wouldn't be on the record. But I never had another problem, and I never had a problem going back later and getting signatures. And I didn't get them all, but fundamentally we had to get them all, because we worked through the U of Illinois privacy act at the time, which is where Ray [Price, co-author] was faculty. And then I take the Cisco thing. And I argued with CHM staff, and I argued with several others about, you know, it's much better to get the signature later than before, because you'll get a lot more candid interview, okay?

Spicer: Yeah, as long as you don't forget. Yeah.

House: Well, or as long as they'll sign it, okay? So the candid interviews, guess what people don't want to do? Chambers is still alive, they're still in the industry, or they went to Juniper, or--

Spicer: What we often notice, too, is actually the-- in the run-up to before the camera starts, a lot of good stuff gets said.

House: Oh, right. Or after.

Spicer: Or afterwards. But, you know, we can't record that.

House: I did Ed Leonard, you know, for Cisco, in a coffee shop. Beautiful. I do him on stage, wooden. Camera turns off and he's just a mountain of information. Ed, Jesus.

Spicer: That's too bad he does that, yeah.

House: But the point I wanted to make is, the difference in the loyalty and affection for HP people, and Cisco people, was dramatic, is what I found in those two sets of roughly the same size populations. Which I did not expect.

Spicer: Can you tell us a bit more about that?

House: Well, a lot of people at Cisco are proud of what they did, and of what the company accomplished. They aren't particularly proud of how the company operated. So there's an awful lot of them left with bitterness, and they-- one guy named Stu, I won't give you his last name, but he said, "I've turned that chapter, Chuck. I just don't revisit that." I mean, like five or six vice presidents. "I'm just not going to talk about it." That would be unthinkable for HP people.

Spicer: I think, too, the, you know, Cisco is an acquisition engine, as you know.

House: Well, that's the other thing, yeah.

Spicer: That must create a lot of turmoil.

House: Oh, the angst over the spin in, spin out deals, for the core engineering teams, was-- is still fractured. Probably never able to be healed.

Spicer: Now, just because you are the perfect HP person, I want to ask you this. What is the HP way?

House: Packard had 11 rules, and I published them. In fact, that just came up the other day. Somebody sent me, "Is this the right list?" And I looked at it. "Yeah, it's the right list, except for here's one addition that was throw in later that wasn't true." They said they borrowed money from Fred Terman,], which they

did not. But he had 11 rules, and basically it's, start by thinking of every employee as a person with dignity. And then he just goes through these points, one by one, about, you know, treat them as you would like to be treated, you know? Give them the respect that, you know, on and on. We're striving for perfection here, but, you know, we're also-- we're open to failure if you learn from it. I mean, just a lot of wordy precepts that, to me, that's the closest thing to something written down that we've got. And that-- I don't know that that survived in any strong way. It's in the appendix to my book, but it's-- they don't-- I don't think they teach it at HP these days.

Spicer: Right. And the one thing about HP, I noticed, is-- or at least the old HP, perhaps, was the premium placed on technical competence. If you were-- I mean, the engineers were the highest lifeform at the company, I believe. Is that true?

House: They were, they were. Which had its issues, as you can imagine, for some other groups.

Spicer: Can you tell us a bit about--

House: Second-class citizens, you know, mechanical engineer is a second-class citizen, you know? The legal guys aren't even worth letting in the room, you know, et cetera. Marketing is-- sales are third-class. But the divisions worked against that. I mean, trying to build this cohesive, small unit worked against that. But when Joel came to HP, he said, over and over, and I think he even put this in the interviews I did here with him. He said the watchword everywhere was, what's the contribution. What is it that makes this different than what anybody else is offering. And it can't be a 10% improvement. It's got to be, you know, something that makes a difference. And that was-- it was ruthless. So a story on that vein-- this book, "Intrapreneuring" came out, from Gifford Pinchot, and it talks about how you want to reward the kids with stock options. This is '85, okay? Who create the HP-35s and stuff like that, right? And this is sort of the incentive to have these innovators be really on the cutting edge of innovation. And Hewlett-- I was talking to Bill. We had a plane ride together, somewhere in the HP jet. And we were in an argument over Colorado. He's telling me what the town is, and "That's not that town, for Christ's sake. You know, I live here. I've been on the air pollution commission. I've been to every county in the state, four times. Come on. You know, you never lived here, Bill." But I asked him about this point, and he said, "Well, let me tell you what would-- why that's a flawed thesis." He said, "If I gave a big stock option for the guys that did the HP-35," he says, "And not to the rest of HP labs, where their colleagues are," he says, "I've done a real disservice. What I've done is said I'm voting on commercial success, rather than on your research quality." Okay? He says, "So what the HP-35 success ought to generate is enough stock options that I can then give it on merit to the research results in this lab. Otherwise I debase it." And he said, "As soon as you debase it, what they'll start doing is going for low-hanging fruit." He said, "So I would resist that altogether." So, of course, he dies, you know, Carly's running it, Joel's gone, guess what they did? Start giving stock options for the-- and there hasn't been anything significant, to my knowledge, come out of HP labs in the last decade. So I don't know that it's cause and effect, but certainly it's an interesting way to look at it.

Spicer: Tell us about your post-HP life. You've started a bunch of companies, you taught at Stanford, you've done-- you were at Cogswell-- you've done some interesting things.

House: So when I left HP, it was pretty clear software was becoming the driver. And HP just struggled mightily. So I'm on my way to a computer history museum function, the second annual computer bowl, as HP's rep, right? With Bill Gates on my team, and Stewart Alsop and a couple of others-- oh, the great kid out of Apple, Larry--

Spicer: Wozniak?

House: No, no, Larry--

Spicer: Tesler?

House: Tesler. The guy from Xerox PARC< that showed the stuff to--

Spicer: The demo--

House: Steve Jobs, yeah. So it was a great little panel. And we won on the last question. But just prior, I gave a talk to the executive committee, and the board, about what we need to do with Software Divisions at HP. And the issue was, I was building essentially a software engineering platform for tools, and Sun had just given theirs away. And I'm being held to a profit standard. And I said, you know, "We can't run our Software Divisions the way we run other divisions. We got to run it based on the pull-through we have of the total package that we sell. Because people are bundling and giving this stuff away, and our autonomy model doesn't fit that, but it can't work." So Lew (Platt) walks me to the door and he said, "That was a great talk, Charlie." He says, "I've often seen you give talks where two or three people in the room are pissed off, and other people agree. He says, you scored 100 percent on this one." He said, "There isn't a person in there that liked what you had to say." <laughter> And I thought, "It might be time to be thinking about something else." So I had licensed my Soft Bench, was what we called it, to Informix, among others. And I went over to Informix to run their R&D and product Marketing Team.

Spicer: What year would this be?

House: '91, May of '91. February or March of '93, and we were-- we had pulled this out of a turnaround. It was a turnaround situation. We'd run the stock from like six to eighty or something. And really had a good run with Phil White running it. And I was in the Schiphol Airport-- or I'd gone over to London, 10 Downing Street, to talk about our secure database for the Navy, and they had a bomb go off outside. Oh, that was exciting! <laughs> And so I've had a bunch of those along the way. I had one where my seatmate in Paris was blown up six weeks later by the German Red Army, and my mother, who had been on the other side of him freaked! This is-- remember the guy from Siemens that got destroyed? This would have been in '80--(Karl Heinz Beckurts)

Spicer: The Red Army faction got him?

House: Yeah.

Spicer: Oh, no. Oh, I do remember now, yes. Yes.

House: Blew his BMW 50 feet in the air.

Spicer: Yes, how awful.

House: Well, they had 32 people on the list. They had the sixteen-- two people from each of the sixteen top computer companies were on their list. And seven of the thirty-two had dinner that night in Paris. It was the IEEE Annual European meeting. And I was giving the keynote. And so when I found out I was on that list, I got out of Corporate Engineering, and put Marv Patterson's name on it, and printed 100,000. You know, we had all these printers. I thought, "Well, shit, let's just print brochures and get my name off of that." But--

Spicer: That is so funny! <laughs> I mean, it's not funny, it's terrifying. But what you did was kind of funny.

House: I launched into that from some other piece. What was I telling you about?

Spicer: Oh, well, we were just talking about post HP life. So I'm at Informix. I'm at this Schiphol thing, and the guy I'd met in London walks up and he said, "God!" He said-- oh, and meanwhile I come home and my boss, the CEO says, "Did you get the order?" And I said, "Get the order? We are a hundred light years from having that product in a deliverable State. No, I didn't get the order!" You know, but they're excited. And so four months later, I went over for the Tulip Festival in Amsterdam, at Keukenhof. And I meet the guy in the Schiphol Airport, who I'd met at 10 Downing Street. And he said, "We could be interested in that software sometime, what's going to be the schedule?" Well, I knew that at the quarterly review, we had told the analysts that we had sold it. And I didn't know that we hadn't. Right? So here I am like I said, "Wait a minute," you know? So I came home and asked about it, and I deplaned the next day. I just decided, "This is not an ethical place. And it turned out, the guy who replaced me and the rest of the staff and the CEO all went to jail.

Spicer: Oh, my gosh! Of Informix?

House: They were kiting-- kited a billion dollars' worth of stuff.

Spicer: Oh, my gosh.

House: It's very lightly reported in a book about Informix by one of the staff people there. But yeah, so I was-- that was an interesting two years. Learned a lot about two-phase commit. In fact, I had an airline ticket not work the other day, because their two-phase commit for Delta Airlines didn't work.

Spicer: Can you explain what that means?

House: Two-phase commit means that if you look at a bunch of-- so let's say you're a travel agent, and somebody asks you about a trip from Fresno to Salt Lake. And it's got connections here. You know, you got two or three different ways of doing it. And you put a tentative on one until you check the time of another. When you go back to say, "Yes," if that's been held, that's a two-phase commit. So you commit first, and then you commit the second time. And not until the second time is that seat released to anybody else to have.

Spicer: Right, so it's a term of art in databases.

House: Yeah.

Spicer: Right.

House: Right, so Sybase pioneered that, Oracle and Informix did not have that. And we had to scurry. So I had to learn a lot of database stuff. But again, I went over as the tools guy. I'm an HP tools guy, and I must have held 20 conferences, you know, executive sessions with potential customers. Not one ever asked about tools. They all wanted to know about the database. And I'm telling Phil, "Hey, you know, the action's in the database!" <laughs> And that wasn't how he wanted to view the problem. So anyway, so I was there a couple years, I left there. We had an interesting day one day. I had a call at 6:04 in the morning, in Palo Alto on a Saturday. And it was my wife's best friend, and she says, "I'm in New York. You must have deployed!" "What do you mean deployed? Jane, what are you t--," she says, "I'm at Macy's and their cash registers aren't working." <laughter> "You must have deployed your database." 6:06 a.m., Informix gets the hotline call. And we shut-- we and IBM, and it was actually an IBM problem, shut Macy's down for 31 hours the Saturday after Thanksgiving.

Spicer: Oh, my gosh!

House: Bankrupted Macy's.

Spicer: I was going to say!

House: Yeah, bankrupted Macy's. They declared bankruptcy 45 days later. They lost 20 percent of the Christmas sales.

Spicer: That was the one store?

House: Huh?

Spicer: The one store declared bankruptcy.

House: No, the national chain.

Spicer: The whole chain?!

House: Yeah, we took every cash register across the nation down.

Spicer: Aren't they still in business, though?

House: Well, they restructured it.

Spicer: Oh, okay, so they went into Chapter 11 or whatever and came out again.

House: Yeah. Years later I was giving a talk in Park City--

Spicer: Wow!

House: -- to some group that was based on AS-400s, and I mentioned this story, and a guy raises his hand in the back and says, "I was part of that team!"

Spicer: Ouch. Is that what they were using, AS-400s?

House: Yeah. <laughs> Oh, god, that was funny! So anyway, in my office at Informix the next Monday comes a guy named Joe Schoendorf. You know that name?

Spicer: No.

House: I'm going to insist that we do an interview here for Joe at some point (which we did for CHM). And, through Excel partners, he was the first Apple Marketing Director when they did the Apple 3 and then the Lisa. And then he deplaned because he made too much money. And his wife, Nancy, was at Mohr-Davidow for a lot of years. And she was-- anyway, I mean, the whole Valley is like, you know? So he walks into my office and he says, "Did you have something to do with that Macy's thing?" And I said, "Well, I, you know, I kind of-- he said, "Well, I'll tell you what," he says, "I know what you know about software from HP," because he had been at HP, "And I want you to go down and meet this Veritas team." So I went down and met a guy named Mark Leslie, who put me on his board for a little tiny company, like 20 people. And I listened to what they're doing, and they had two products. One is a test tool, and one was a fault tolerant rollover kernel. And at the end of the board meeting, I walked out and I said, "You know, what you got to do, shoot one. You know, I don't care which one. They both sound very interesting, but you got to shoot one, because 20 guys can't chase two things going like this." So he said, "Well, I really don't need that kind of advice, thank you very much," pfft, gone! <laughs> Lasted on the board one day, right? About nine months later I get a call-- so after I left Informix, I just took six months off. I had a good friend dying of a brain tumor and I took care of him for a while, and I got a call from a headhunter who described the situation. And I said, "It sounds a lot like Veritas," he says, "Well, it is!" <laughs> And I said, "Then we don't need to talk further!" He says, "*Ah, contraire*, Mark wants you. He wants you to come run the Tools Division--"

Spicer: Oh, wow.

House: "-- until they can do an IPO and sell it." So that's how I got to Veritas. The story there was hysterical. I walk in for the-- after I'd been hired, and forgot to ask what he'd pay. Okay. I get home and my wife says, "Well, what's he going to pay?" I said, "Well, you know, I'm sure he'll pay a going rate." Which was not true. But I had this interview and he said, I said, "Why'd you-- what did you bet on?" And he said, and this goes to a point you raised earlier. He said, "You got a great resume. The stuff at HP forever, and the stuff at Informix and the awards you've won." He said, "But the thing that caught my eye was when you bankrupted the nursery and how you handled that." He said, "I thought that's a lot more like who we are."

Spicer: Wow! That's great.

House: Okay? And then he says, "Betty Sue here will get whatever you need to outfit your office." And Betty Sue hands me an Office Max catalog. I circled a few things and gave it to her at the end of the day and she looked at it, and she says, "We have a three-hole punch."

Spicer: Oh, it's going to be that kind of company. <laughs>

House: Yeah! And I went back to Mark and I said, "It's a lot more like the nursery." <laughter> So that was Veritas. And I ran the Tools Division. Oh, we knocked them dead. It was incredible, including some important work at Boeing that you need to thank us for some day when you think about how to take those--

Spicer: Can you speak about that?

House: I probably can. Basically it was the question of how do you do the test suites that run against the software for Mission Critical stuff. And what we had built was a set of tools called code coverage tools. Dominico Ferrari over at Berkeley was big on this for years. But we built probably the best suite out there. Pure Software and Rational and people like that couldn't solve the problems.

Spicer: Was this to test avionics?

House: Huh?

Spicer: Was this to test out the avionics or-- yeah, avionics.

House: Yeah, yeah, it's all avionics.

Spicer: Right.

House: And I had very rigorous testing kind of stuff. Well, the net was we wound up selling-- we nailed nine out of ten big deal. We had the Bhopal, India deal with Honeywell. We got all of Honeywell's plants after that. I mean, just--

Spicer: Union Carbide you mean? Or Bhopal.

House: No, it was-- was it-- it was Union Carbide, that's right.

Spicer: In Bhopal. Yeah, yeah.

House: What was the Honeywell thing? There was something Honeywell had, too, that was a disaster. Anyway, great stuff. And I'm so flushed with excitement-- my division is now working. We're really selling, you know, "Mark, it's just great!" He said, "Great! Let's go to the board," he says, "Now, we can sell it." He says, "Now, it's worth something! We can sell it!" Ahh! So I thought about buying it, and did not. But we wound up selling it to Centerline in Boston. So I went back for a year as a loaned executive for that. And then--

Spicer: Were they a private equity firm?

House: No, they-- well, yeah, they were-- no, that was actually a company.

Spicer: A VC?

House: It was a VC-backed private company, and they ultimately died. And then I didn't know what to do, but I had been teaching a course at Stanford on what digital communication was going to be about. And I thought there's computing and communication are just crashing together, but we don't teach it-- we teach it was very isolated ideas. And there's just got to be something in that that we could do. So I was looking for a job that might have components of that. And I found a company that was looking for a Consulting Engineer-- Consulting Executive to take a division they had in Santa Barbara, it's an East Coast company, and figure out how to extract the important stuff. You know, so it was a three-month gig basically. Uh, okay. So I went down there, I'm in Santa Barbara about an hour and you go, "I don't know what they've got here, but we better figure out how to make this work! <laughs> This is a very nice town!" I had never spent any time there. Even though I'm a Southern California kid, as an adult I'd never, you know, it's like, "Holy shit! You know, I could bring a convertible down <laughs>-- this could be!" <laughs> Well, the company was a little company called Spectron Microsystems.

Spicer: Oh, yeah, yeah!

House: And so I persuaded them to leave it as a business. We had the kernel of the Microsoft. We went to Ring Zero, and that's why Sound Blaster and all that stuff worked. And that led to the demise of the company, because Microsoft sued Intel, who had given us the contract. And--

Spicer: And what did you guys make down there? Was it emulators? In-circuit emulators?

House: We made in-circuit emulators, and we also made a digital signal processing kernel, operating system. SPOX we called it.

Spicer: Oh, yeah, right! I remember that.

House: And that ultimately, that was the linchpin for the lawsuit that the Feds brought against Microsoft. Because if Gates could tell Grove to get out of the software business on our piece of software, then it clearly was Restraint of Trade. So I got to know some of those principals. Intel gave me seven million dollars in hush money to not ever talk about it.

Spicer: Oh, my god.

House: We got a contract with Palm for the Palm 7. Remember when they had that push technology? We had the OS for that. And again, getting through Microsoft, because Microsoft had to approve that to run so that the Palm could interface with Microsoft. And Donna (Dubinski)-- so I walked into a meeting some years ago, CNN wanted to give an award for portable software, and they named two things. They named the HP 35 and the Palm Pilot. And I walk into this TV studio up in San Francisco, and she says, "What are you doing here?!" And I said, "Well, actually, I built your operating system!" <laughs> She had no idea!

Spicer: Oh, wow.

House: You know, for Trip Hawkins. And as well as I had built the tools for the HP 35. So you know, touchpoints are kind of fun in there. Well, we ran that for-- I guess I ran that a couple years. Kind of half on the staff of New Jersey and then running the division in Santa Barbara.

Spicer: So sorry, just quickly. They did R&D down in Santa Barbara, or production? Or--

House: No, we did everything. We were just a little tiny-- we built this little digital-- so we were working a lot with the TI. Remember when TI had all those little flipping mirrors?

Spicer: Oh, the DLP.

House: Yeah, and so we did all the DLP OS's. We did all sorts of-- so all the video-conferencing software that was out there. All the IPV-6. We were building kernels for all this esoteric crap. And you know, we were just basically a G-job, and we'd take contracts and so we were doing consulting engineering, and then once in a while, we'll spin a product out of it. And the company we worked for was Dialogic, who was building basically PBX's in a PC. And they didn't know why they had us, but they had bought us, and so that was that. But we wound up-- TI got concerned that if the-- if we got a corner on the OS market for their chips, it'd be sort of like Microsoft did to Intel. So they built that analogy. So they came after us in a hostile takeover, and bought the company out from under us. So then I went to Dialogic to run their R&D program in New Jersey, which was a lot of fun, and pretty educational, especially educational for how the East Coast works compared to the West.

Spicer: Can you tell us a bit about that? That sounds interesting.

House: So I'll give you a good one. So Mary -- who's the VC gal that was so big in networking for a while that wound up over at Kleiner-Perkins? Mary-- six letters.

Spicer: Gibson?

House: Huh?

Spicer: Gibson?

House: No. It may come to me. Well, we can do it post-edit. Anyway, she and several of these people are out writing the books, you know, and about how this is the-- remember the one book where they said, "This is the greatest license to do stealing legally"? <laughs>

Spicer: Yeah, yeah.

House: So she was the VC arm for him. So we had the first Annual Silicon Parkway meeting. You know, we had several Bell Labs Divisions, we had us, we had about 20 little startups doing networking stuff, or whatever. Mostly communication-based. And-- Mary Meeker!

Spicer: Oh, yeah.

House: So Mary, and there's like 300 people in the audience. And she walks up and she says, "Question." And they were all, you know, "We are innovators like you can't believe!" and she said, "Well, question. How many of you-- show of hands-- have been with more than three companies in the last decade?" And like six hands. <laughs> And she said, "You're not risk-takers. <laughs> You don't have any idea." <laughs> You know, and then goes on with her talk. And then I was next, and I said, "Well, let me describe Veritas." I said, "We went five months without salary for anybody. But we issued stock." And I said, "And nobody left." And they all, "Oh, well, you know it was gonna--," and I said, "No," I went around and I sampled, and I said, "Of the 22 people something like 17 had gotten stock at four other companies previously that all failed. They were there because they believed in the product and they believed in the guy running it. Okay? And as long as they could find a way to get by, they're there." And the room was just incredulous, you know? So the difference between East Coast and West Coast had more to do with confidence and risk-taking than anything else. They're, I mean, incredibly smart people back there. And for systems engineering, I think they were better. In fact, I'll just say without question they were better, in general. These are people building the big military systems. A lot of the infrastructure systems for business. You know, IBM is but one of many that you could describe in that panoply. But they just-- they were more procedural, they were more organized. They were more attentive to the kinds of things that you would have to have for failsafe backbone. Despite a Tandem claim and stuff like that. But my god, they would not put a toe over the line <laughs> if risk was involved.

Spicer: Right, so this mantra that people use now about, "Fail often and break things," was completely the opposite of--

House: Oh, yeah, that just wouldn't fly. And the notion of using stock as an incentive is pretty light on the East Coast. That's a West Coast phenomenon.

Spicer: Is that because-- did HP set the tone for this kind of casual West Coast--

House: Oh, I think they set the tone for the casualness. They didn't set the tone for stock options. I mean, we had some, but no one got rich out of HP except the two owners. I mean, some people made good money, but it wasn't a Google or-- we didn't create a thousand millionaires kind of thing. Or even a thousand ten-thousand-aires <laughs>, I doubt. So that was the-- so the Dialogic. Then Intel bought Dialogic, and it turned out I had been injured. So I set a nursery up there. The nursery I had in Colorado, we ran for ten years together. My wife kept it. She sold it later, and she still goes back and works it in the spring. It's amazing, and she's my age. So it's-- but she just loves-- I mean, we both love the outside. And so I bought a place in New Jersey. I love the Garden State license plate. I didn't know they had 25 million deer, and that you couldn't keep them out of your garden. So it wasn't as satisfying as it might have been from a gardening standpoint. But I, nonetheless, started a nursery back there, and my wife started a horse farm deal back there. And the horse thing we've kept. And my deal at the ranch today is I said, "I'll be your landscaper, but I'm not going to go in the business at this age." But the sequel to that is my brother thought I was making money with the Colorado thing, and he wound up taking over a defunct nursery. And today it has just become the largest plant nursery on the globe. And they've had a couple of acquisitions to do that in recent years, but his son still runs the piece that he built.

Spicer: What's the name of the nursery?

House: Village Nurseries. So everything you see at the Lowe's or Target.

Spicer: At the gas station.

House: Yeah, is theirs.

Spicer: Wow!

House: They just bought Color Spot, which is all the perennials and annuals. So Monrovia which is where I started is the biggest employer in our hometown where I live now. So I tell people, "I started there 61-years-ago," and they can't even, "Really?! What did you do?" "Well, I watered cans pretty much." So, Dialogic got bought by Intel. I'd been injured, spent a year in bed. Didn't think I'd walk again. When they said, "Do you--," well, when I was-- when I did recover to where I could, I thought I hadn't skied enough.

Spicer: Was this a skiing accident, then?

House: Huh?

Spicer: How did you injure yourself, or can you--

House: Just on a tennis court. Severed my Achilles tendon.

Spicer: Oh, dear.

House: And then coming out for a Computer History Museum annual meeting, I severed it a second time. That was fascinating. I tried to travel too early.

Spicer: Did you have a big cast on your leg?

House: Oh, yeah.

Spicer: I remember that, yeah.

House: Yeah, that was the night we gave Doug Engelbart his award, and he objected when he learned that I had a patent on his pull-down stack software. And it was HP's most important patent. And we did it for logic analyzers, not for computing.

Spicer: Right.

House: But anyway, I bought a ski house in Park City, Utah. And consulted from there for Intel around the globe for a while. Ran their Societal Impact of Technology program, which was made-- because I'd been ACM President. And but the other thing, toward the end, I ran their Collaboratory Research program. And this was a question of, "Can it be better than being there using electronic tools?" And we did some fairly interesting work.

Spicer: Chuck, tell us a little bit about your efforts to link with the STS program, the Science Technology and Society program at Stanford, and your other efforts to kind of be an advisor or an *eminence grise* as far as advising people about technology and its history and its-- how to manage technology, as well.

House: *Eminence grise*? Is that what you said? Holy smokes! I never thought of that! Yeah, I think the-- well, the origins for my interest in history go back to Caltech. Caltech was-- had one course taught in my senior year by a fellow named Ned Munger, who was a Fulbright, actually a Ford Foundation Scholar. And he was interested in emerging nations. And the significance of this was he would have the meetings at his house in the evening. And have wine and cheese, weekly.

Spicer: How lovely.

House: And I'm married, and I've got the evenings only <laughs>, and we thought-- this-- and we go and kind of gorge ourselves, you know? And but it wasn't history. What it was was some guy coming through L.A. who was like the Police Chief of Istanbul, or the Foreign Minister for Brasilia, or you know-- it was current events, completely. So you see the guy on TV the night before, and you're in a room with 12 students and him, you know, in this small living room over wine. And this isn't history the way I did it in high school. This is actionable stuff. And then as I'm traveling, I wound up in 50 countries for HP. When

you said, "How much travel did you do?" A lot. And probably 40 of those were business. You know, the others would be travel we've done since for ourselves. And you wind up having to find ways to connect. And one way I would always take a list of what I wanted to say. "My name is Charles House. I'm from Colorado Springs. I'm with Hewlett Packard. We build instrumentation. We also build computing. It's a real pleasure to be here in your--," 'brrrr,' you know, whatever, "And I really hope to see blah-blah-blah." Three or four points of interest. And then I would ask them to write that out for me phonetically, so that I could say it in their language.

Spicer: Oh, nice!

House: And so that would be my opening. And of course, it's halting and mispronounced and all that kind of stuff. But the fact that you go on for more than two sentences is-- was enough to win their hearts.

Spicer: Absolutely!

House: Many, many times.

Spicer: Oh, yeah!

House: And so then you get invited home, and you stay over the weekend if you could, or you know, all sorts of things. And I could arrange travel pretty easily at the time. And so I just wound up becoming a student of the world. And one of the things that kept standing out was this dichotomy between the tools we were building for people to build computers on the one hand, and to build digital communications on the other, and they just never crossed. And so when I took the (HP) job at Palo Alto, I went over to Stanford to ask if they had a course doing that. And the answer was, "No." I said, "Well, are you guys concerned about that?" "No." "Would you let me build a course?" And so I found a guy named Jim Adams who was a great old Caltech guy in the Industrial Design department. And he got me to file for an NSF grant, and we put together a program we called ISIS, which is not the right term today, but it was Information Systems and their Impact on Society. Subtitle was, "Carrier pigeons to satellite dishes."

Spicer: Nice.

House: And I taught it in my home once a week with wine and cheese.

Spicer: Oh, my gosh!

House: And we did that for four years. Actually, the last two years we were up to like 80 or 90 kids and so I didn't do it at my home anymore. But I had a satellite dish at home, and Jimmy Treybig had installed it for me, and stuff like that. And so it was great fun. But it just kept nagging at me that we're misunderstanding. We're not even reflecting at all on what this is going to mean. So I wound up doing some papers, and then presentations as well as the course that I put together. I wound up teaching the course through National Technological University for several years.

Spicer: That's in Singapore, right?

House: Huh?

Spicer: In Singapore?

House: No, they were actually based in Fort Collins, Colorado.

Spicer: Oh, I'm sorry, okay. And Sylvan Systems bought them along the way. But we were an analog satellite-based distribution system for like 20 companies. IBM, Motorola, HP and one other were the founding companies. I was on the board of that. So I had this program at Stanford, and when the NSF money ran out, and a hundred students, I thought, "Well, they'll make it part of the curriculum." Stanford, in its infinite wisdom, cancelled the whole thing. Just said, "Well, the money's gone, sorry." But then Bob McKim and Jim figured out a way to nest it into what became Science Technology and Society that Fred Turner runs today. So that became that program at Stanford. They just recently got to where they can give a PhD in it. For years, they didn't. I had one to do. So I tried studying with Tom Kuhn at Princeton.

Spicer: Oh, my goodness.

House: And Tom told me I was too old to be considered one of his students. I was 29 at the time. He said, "You know, you're too old to invest in you."

Spicer: He was harsh. Wow.

House: And I asked him if he'd ever thought about, you know, he might curl up at the chalkboard, and his students are going to be all upset. Pissed him off. <laughs> So I've crossed paths with some interesting people. But anyway, then I'm in Santa Barbara with this little outfit, and over lunch one day somebody said, "Have you ever met Glen Culler?" And I, "Well, I think so, but I can't place it." Well, Glen, of course, had been at the big conference we had at Ricky's around the history of personal workstations. There's an ACM book on that.

Spicer: Oh, I didn't know that was at Ricky's.

House: Yeah, we held it at Ricky's. And John White was the organizer, and Glen was a big participant.

Spicer: John R. White?

House: John R. White.

Spicer: John R. White, right.

House: Who I hired later to be the ACM Director. And he did a great job for like 15 years. Anyway, this guy says, "You know, Glen did all this stuff for the internet." "Really?! You know, he's not in the books."

"Well, he did it." But he left, he gave up a tenured position to go run a company. He started like 20 companies.

Spicer: Wow.

House: And pretty much all of them went bankrupt, but that's a different issue. But the things he founded were incredible. And I got-- I was able to get him nominated and he won the National Medal of Technology. But he had been a-- he'd a stroke and he hadn't spoken in a decade. But we were able to converse somewhat. In fact, interesting story, when he-- when the President Clinton called him, his nursemaid was out shopping. His wife had passed away earlier. And he calls his son (Dave Culler) at Berkeley and I happened to be in Dave's office, and he's trying to tell him the President called. And Dave is going, "The President of the Church? The President of Rotary? The President of the school? What President?!" "The President of the United States called!" This guy went out and in six weeks got a speech therapist and he gave a four sentence acceptance speech at the National Academy.

Spicer: Aw, that's lovely.

House: Vint Cerf comes over in tears and hands me a check for a hundred thousand bucks, and says, "Start a chair for him at Santa Barbara."

Spicer: Oh, my gosh!

House: It would have been better if hadn't been a MCI stock certificate, but <laughs> yeah, true story. And none of his kids, four PhD kids, none of him knew he had done this until he stood up there and talked. They were just sobbing.

Spicer: Oh, my gosh! What a story!

House: So awards can mean something. Yeah, awards can mean something.

Spicer: Yeah. Wow.

House: So the point was, I'm in Santa Barbara, I've talked to him, and I thought, "You know, that thing we did at Stanford, we could do that here." And so a fellow that had worked for me at HP, Bruce Bimber, by now had done the book on OTA and its history back in Washington. And he arrived as a Political Science professor at Santa Barbara. We got together over lunch and said, "Why don't we do that thing we were doing at Stanford?" That became the Center for Information Technology and Society, CITS, still runs. John Seely Brown is on the board; Mark Bertelsen, the back-up to Larry Sonsini at Wilson Sonsini, is on the board; Dave Toole, and myself and we just added somebody, I can't remember who. So that's run 20 years. We've published like 50 monographs about digital impact on society around the globe, mostly in third-world countries.

Spicer: Oh, that's amazing.

House: It's a very successful little program. And then when I was ACM president, I tried to get that baked into, but that's a tough organization, it takes a while to move a battleship kind of deal. But I gave enough talks that that's why Intel was willing to recognize me and give me that title, so that enabled me to sort of be freelance. And then that, when I retired from Intel, they sort of had a, you get to a certain age they invite you pretty strongly to, which is, I mean I got a great-- I was at HP 29 years. I was at Intel 5 years, but I got credit for 11 because of the acquisitions along the way. So my health benefits are Intel, not HP, and they're spectacular.

Spicer: Oh, awesome.

House: Thank God for that.

Spicer: Good. That's good.

House: The-- anyway, then I'm kind of casting about and I got a call. I was going to leave Intel on a Thursday or Friday. It was on a Friday night. I got a call like on Tuesday night at ten o'clock from somebody I (Eleanor Wynn), that never called after hours, and she said, "I just heard about this job at Stanford, and you would have been perfect for it." I said, "Would have been?" She said, "Yeah, they've got somebody." "What job is it?" "Well, it's Media X," and which was the knockoff of the Media Lab at MIT and I said, "Yeah, I'd-- I mean I helped start that thing when I was at Intel." But, and I'm still-- she was at Intel up in Portland. I was at Intel. I was in Vegas at the time, and I said, "What do you mean? What's the deal?" She says, "Well, I applied for-- I should have had you nominated for it. I applied for it and I didn't get it and I just found that out because they've picked the person." So I sent an email like five minutes later to the two guys running it and said, "Hey, if that job is still open, I'd at least, I'll be in your office tomorrow at nine," and I was. I flew over from Vegas on the early flight, walked in. I get a high-five from one of them and the other one says-- this is Roy Pea and Byron Reeves and Terry Winograd and I said, "They're going to interview me," and I said, "No, no. You know me. I mean you've all known me. I want to interview you about this job. First of all, are you looking for something short-term, or are you looking for something that goes a while? Because I'm not interested in a three-month or a six-month thing." Well, they're looking for something long-term. I said, "And does age matter?" and "Well, Stig (Hagström) upstairs is still teaching at 83." "Okay, that answers that. And do you need a Ph.D.? I don't have one," and I went back to Santa Barbara to run that program and that's when I ran into the rule that if you don't have a Ph.D. you're *persona non grata*. They said, "No, this is Stanford. We go on merit. We don't-- you don't have to have a Ph.D." and so all of that checks out great. And then I said, "Well, what do you pay?" and there's a little country Western song, "Two out of Three Ain't Bad." So then yeah, it turned out, fortuitously, the guy they had already given the job offer to, declined it because it didn't pay enough and I was essentially retiring and I thought, hell, I could do it. So then I had a platform. Now you've got, I ran that for five years and you could just go anywhere, do anything. We worked, we probably had 40 or 50 projects. We worked with like 28 departments across the campus. To do any project you had to have three departments involved, but you could have law, medicine, and business involved. You could have electrical engineering and bio and environmental involved, just beautiful stuff. Zoom, we sponsored the Zoom kid. Then, he went to Cisco and then Cisco ignored him and so the Cisco legal counsel quit Cisco after 20 years and bankrolled him.

Spicer: Now, sorry. Who is the Zoom? You mean the company Zoom?

House: Yeah.

Spicer: That makes those recorders, digital?

House: They have the video teleconferencing. Do you use Zoom? You don't use Zoom teleconferencing. I can tell.

Spicer: Yeah, we don't have it here.

House: Okay. It is phenomenal. It's H.264, around the globe so it doesn't matter what your sign-in bandwidth is. You don't load the system, so everybody, lip sync happens so we use this routinely where we are.

Spicer: Wow.

House: And we're talking to people around the globe from our home in...

Spicer: I wonder what their secret sauce is.

House: Well, they do an H.264 multicast. They use the Intel multicast chips, the multiplatform so they detect what bandwidth you're coming in on and then you get the OS that ties to that. So you don't load the system for fast stuff. It is beautiful. I mean that's, I ran the ACM history committee that way for the last several years.

Spicer: Oh, I'll check it out.

House: So I did that for a while, loved it. The problem with that is I got bored. You just-- I mean there's a certain amount of, even as eclectic as it was, the job was to try and find funding, so you're always out there tin-cupping, not unlike a computer museum in that respect. And companies have a very different instinct than academia. They think there's a deliverable tied to money and that's just not the way the universities work and I got tired of that and a chance to run Cogswell came along and they turned me down in the first interview because I didn't have the Ph.D. and I wasn't this and that and the other. And then after six months, they couldn't find anybody. They called and kind of like the Veritas thing, "I'm not sure you want to talk to me," and "Oh yeah, *contraire*, we do." They take me through it. I don't know if you ever went through their shop.

Spicer: No, no, no.

House: But it was an absolute playground to play in.

Spicer: Wow.

House: Every animated film that's ever come out of Hollywood through when I was there had a Cogswell animator on it.

Spicer: Really? So that's what they train is animators?

House: Yeah, trained animators, digital sound, probably had one of the best three or four sound studios in California, and we'd lease that out for groups to use. And we had, one year I was there, a student film that was entered in I don't know how many film festivals we entered, but we won 57 international awards. We won the Best Film from the Philadelphia Film Festival for a decade out of 680 films that they had filmed, and this is up against film peeps. I mean this is up against Hollywood studio types.

Spicer: UCLA Film School and all those places.

House: And so we were knocking 'em dead and it was just, I mean I told the interviewer that day, I said, "If there'd been a school like this when I was 17, this is what I'd have done. I wouldn't have gone to Caltech. I'd have gone to this," and, because I grew up next to Hollywood and my grandad worked there and I knew a lot of...

Spicer: Now, they're a private institution, right?

House: Yeah.

Spicer: Cogswell?

House: Yeah, and the difficulty they had gotten into and the reason they wanted me was they were doing a turnaround of a bankrupted, they got caught in the 2009-10 down. They owned their property and they leased or they took big loans on it and then it went underwater and the bank called the note. And so a VC picked them up and he and I didn't agree necessarily over time and then I had a stroke and decided maybe this isn't the thing I ought to-- it was a pretty stressful job. And fortunately, the stroke wasn't debilitating but it was certainly a wake-up call and so I deplaned. And I'd been doing InnovaScapes for a long time, just kind of as a partial thing, write a few papers once in a while and give a talk here and there and just kind of a fun sidebar, if you will. And I got-- well, and then through the museum we had a chance at that Cisco thing. Oh no, I'm sorry. I'm leaving one piece out. I wrote the HP book. I did. That took from 2001 to 2009.

Spicer: Wow.

House: Long time in gestation.

Spicer: Amazing. It's a big book, too.

House: Yeah. I didn't have time to make it small. But the-- when Don Proctor joined the board here, Len took him to dinner, as the story goes, and said, "What has Cisco done to preserve their heritage?" and he said, "I don't know, but I'll go find out."

Spicer: Oh, nice.

House: Came back and said they've tried twice to collect artifacts and both times the guy doing it got laid off and the guy was sore enough he shot a bunch of stuff with a .45. I mean not-- he says, "We can't go back to the employee base."

Spicer: That's interesting.

House: And John Hollar and I thought we ought to be able to work out a way that we could do something and you know what we did. And so I did the, through InnovaScapes I did the interviews on a separate contract and then we did the artifact collecting here. And I'd done a few oral histories here but not many prior to that, and I'd done a lot of interviews for the HP thing but didn't codify them in a way to put them in our files. I should have, but I guess late in life you just start-- I mean Paul Allen died this week. I had a book proposal in front of him about six months ago just as a, but he was too ill to consider it and I don't know that he would've, anyway. I've got one in front of Morgridge, and he's kind of dancing around it. Well, I don't know if he'll do it but I just look at these and so I had Freddy Gibbons sitting in this seat not long ago. Then I...

Spicer: I like how you call him Freddy.

House: Huh?

Spicer: I like how you call him Freddy.

House: Well, he was Freddy. He is Freddy. I'm an old-timer around here. But what's the-- Janelle Bedke, do you know Janelle or know of her?

Spicer: No.

House: So three people cofounded Software Publishing and they founded it on Janelle's dining room table and she quit to run the company and Fred and a guy named John Page stayed at HP because they needed the salary and her husband also worked at HP, Ken Fox. He later went over and was R and D manager at ASK. But the point is, I had Janelle in the seat, went through this thing, and among other things said, "My God, your entire staff was women, and they were powerful women." I mean Scott Cook's wife, that's how Scott funded Intuit was through Software Publishing money from Signe. They had Diane Wheeler. They had Nancy Schoendorf. They had, anyway, a host of people, and I said, "My God, this is-- this isn't in the history books that we had a major, the third-largest software company in the world is being run by women." She said, "Well, that's because of Fred." She said, "Ask him," so I have him in the chair and I said, "Tell me about that." He says, "Simple." He said, "My dad was a ship captain." I said, "What's

that got to do with it?" He said, "Do you know anything about ship captains?" "No." He said, "They're gone 11 months of the year." He said, "I'd just assume anything that gets done is done by women."

Spicer: Nice. That's great.

House: I mean isn't that-- that's a pearl you wouldn't get.

Spicer: That's a nice philosophy. Yeah.

House: And then I said, "Here's the main artifact we have about Software Publishing," and it's that cover, the Macworld cover with Jobs, Kapor-- not Jobs. Gates, Kapor, and Fred. Can you image that?

Spicer: A little bit.

House: Do you remember that one?

Spicer: Little bit, yeah.

House: He says, and Janelle, who gave it to us said, "Oh yeah, here's"-- I mean we were semi-famous and all that and Fred was 29 and Bill was 23. And I haul it up for Fred, and he just blew up. Remember? Were you taping that one? He just blew up, and he said, "That goddamn cover," he says, "that killed my company." I said, "That's not-- Janelle didn't say that," and that's not on record. He says, "Oh." He says, "Let me tell you, Steve Jobs trapped us in Hawaii on the launch of the Macintosh and took that picture," and he said, "and IBM saw that picture when the magazine came out and they cancelled my contract and that was 90 percent of my revenue." I mean, I said, "Have you ever told that story?" He says, "Oh," he said, "a few friends know it." But I mean...

Spicer: Wow. Well, now everyone knows it.

House: Talk about an object lesson.

Spicer: That's good.

House: Yeah. So that's what I mean, Sandy talking about her mother, abandoned her.

Spicer: Sandy?

House: Did you read that? Sandy Lerner.

Spicer: Lerner? Yeah.

House: Her mother abandons her and two aunts vie for her and one says, "You'll be in Beverly Hills. It's really nice, and you'll have a car when you're 16," and dah, dah, dah. And the other one says, "I live in the

foothills of California. It's kind of a hardscrabble ranch, but you can have a pony Friday." She said, "Guess what I picked?"

Spicer: The pony. They always pick the pony.

House: Yeah, but I mean, so these are wonderful.

Spicer: That's great.

House: So anyway, the point was for me, the more I got involved, the more excited I got and the corollary was I read a bunch of the interviews and I thought I could add something that many of them don't. I know some back stories and I can tease some things out of people they might not otherwise share and in that respect, maybe I could be a useful adjunct to this program. So that's kind of what I've been up to.

Spicer: Just before we wrap up, I want to ask you about your ACM presidency because that seems important and we just sort of brushed on it a little bit.

House: Oh by the way, I was ACM President. Oh, that was hysterical.

Spicer: Anything you want to say about that?

House: Sure. So I joined-- I must have joined ACM and what was IRE, maybe IEEE when I was in college and I promptly dropped all three as soon as you're out of college because I had a job and they didn't care. But along the way, I rejoined what became IEEE, so I think I've been a member of IEEE for today probably close to 50 years. Wound up being the vice president of publications, an elected office along the way in the '80s when I was at HP. We built the digital library, the first digital library that they had, which was all photos, essentially a page of proof photos as opposed to word-search stuff, but it was a big deal at the time. And then-- but I never rejoined ACM, and I didn't think of myself as a computer scientist even though I was running the software divisions by now. And I'm on a plane going to New York one time from San Francisco, and Gwen, and I'm seated on the aisle, midway through the plane and Gwen Bell is walking past to the restroom. "Chuck, what are you doing here?" And I'd been on the Computer Bowl and I'd been on the board ever since, on the trustee board but kind of, I mean lackadaisical. I wouldn't say I was a very useful member but two-thirds of the members don't do much and I was one, certainly one of those. And Len was just getting, we were just in process of moving it from the Boston to-- '95, so it was '95 and she said, "You ought to run for ACM president." "Well, what do you...?" I said, "I'm not even a member." She says. "What's that got to do with it?" She says, "The problem they have is they're a bunch of academics. They need somebody from industry. You'd be perfect. Think about it, okay?" Toddles on back to the restroom. On the way back, she stops again and says, "Okay, I've thought about it. You'd be great." So...

Spicer: And now what-- had she just been president, as well?

House: She was in her term on the board after being president.

Spicer: Right, so the...

House: So she had stepped down. A guy named Stu Zweben.

Spicer: ...past president was...

House: Yeah, past, so she's immediate past president and Stu Zweben, who is an academic's academic, was the current president and I think she was just jabbering to herself. So I said, "Sure, and I, but I got to go read up on it," and so I read up that everybody's pissed off about it's losing its touch. It doesn't have anything creative, isn't modern, and they were trying to figure out whether human factors, the SIGCHI and things like that ought be part of it or not, like they blew off the Internet Society. I mean talk about dumb. And so I write up this lengthy thing that they're going to publish about why I would be a great president. I haven't been a member, but looking in from the outside, this thing is all fouled up from start to finish, right? And I handed it to Joel Birnbaum, and he says, "You want the job?" I said, "Yeah. It might be kind of fun." He said, "Well, tear this up, and write something positive."

Spicer: Yeah, it does sound a little negative.

House: So I wrote something positive, and I won. And the first meeting we had of all the SIGs, you know the structure. They've got all these Special Interest Groups, like 45 of them or so. So we have a meeting in San Jose of, the annual meeting of all the SIG directors and all this and so I'm introduced. And this is before I hired John White, so Joe DeBlasi was the CEO or whatever they called him. I was president and they introduced me and I go about two sentences and some guy yells out from the back, doesn't raise his hand or anything, "What qualifies you to be president of this organization?" I just stopped and I hear myself say-- one of those out-of-body experiences. You look down. The mouth is moving. What's going to come out? And I said, "That's not the question. The question is out of 64,000 members, why couldn't you find someone qualified?" So I launched it with a salvo.

Spicer: That's funny.

House: But it-- talk about a great experience.

Spicer: Was it?

House: Oh, I mean it was better than being an HP instrument guy. You talk about a way to meet everybody in every field, and we wound up publishing a book that was very telling. You may know the book, "The 200 Wizards." Know that book?

Spicer: Yeah. Oh, "Wizards and Their Wonders"?

House: Yeah, "Wizards and Their Wonders."

Spicer: Yeah, yeah, yeah.

House: Lou Bachrach did all the photography.

Spicer: I worked-- I did a bit of work on that.

House: Oh, did you?

Spicer: Yeah.

House: So we had the big whoop-de-do, and were you there at the National Academy?

Spicer: I was not. No, I was not at the Washington thing. No.

House: Oh man, so they've got the walls lined with double life-size pictures of each of us, okay? And 162 of the 200 people are there, I think was the number.

Spicer: That's cool.

House: I mean, oh yeah.

Spicer: Wow.

House: And you could bring, so I brought my wife and my three daughters and they're all, I mean it was a black-tie deal. It was a whoop-de-do deal, and because I'm still ACM president I can give, I can be one of the speakers, right? I wasn't emcee, but I could be a part-time emcee. And I-- we chose that to give the Newell Award that night to Carver Mead.

Spicer: Nice.

House: And so let me set the stage for you, so we've got the dais. We're in the small anteroom off to the side but really crammed in. We had probably 500 people in the room and, which is a pretty big anteroom, and Carver's going to give the after-dinner talk. This was before dinner and I said, "Show of hands, how many here have known Carver more than 50 years?" or it might have been 40 years at the time because he's our honoree. And the answer was no one. I had met him earlier than anybody in the room because he was my professor when I'm a senior and he was a first-year teacher and so I said, "Well, we know him for Moore's law. Some of you know him from Moore's law. He wrote Moore's law and Gordon gave the talk at Ted (actually much earlier) and so, and he's the Moore Professor at Caltech," and yada yada. "But you may not know about the cochlear implant for hearing and he did that, also, and in fact, Vint Cerf's wife here, the first words she ever heard Vint speak, he called from the (White House) Rose Garden to tell her he'd just won the National Medal of Technology." Well, she starts sobbing. Vint starts sobbing. The whole room, I mean one of those deals, right? So we get through that and I give him the award and we talk about Allen Newell, who I think was still alive but not at the meeting but it was in the book. And then we go off and Carver had given a talk for me earlier. We did the ACM1 down at San Jose, 2000-person conference.

Spicer: I remember that one. Yeah.

House: Lost a ton of money. That was right as the dot-com meltdown was starting. And so I...

Spicer: That's right. Yeah. We had a big display there actually, the museum.

House: You did. That's right. That's right. So I had-- the first speaker was Gordon. The second speaker was Carver. The third was Joel, and Carver stands up with no slides and he's just going to wing it and he just, and Gordon had had 100 slides in 30 minutes, one of those deals. Maybe it was Gordon and then Joel and then Carver. Yeah, that might have been it. Anyway, the point was Carver gave the worst speech I'd ever heard him give, two thousand people, and I had, of course, solicited him to give it. So here we are. We're going to be at the National Academy, and I thought, oh shit, here we go again. So this guy walks up after dinner, shuffles up. Everybody is perched on little chairs. It was a lot like one of our talks, and he says, "On the plane out," he says, "I didn't write anything for this speech," and I thought, oh, here we go again. "But on the way out, I got to thinking, what does it mean, best computer science professor in America?" He said, "That's quite an honor," and he said, "And I got to thinking about how silly that is." He says, "In a lifetime, if you're lucky, you have 400 students." Ten Ph.D. students for forty years, right? And he said, "And all I can remember were the best 10." He said, "And they were great. They knew the book. They knew how to solve the stuff. They could have given the lecture better than I could. They were a delight. He says, "And then I got to thinking about the worst 10," and he said, "And they were actually pretty memorable but," he said, "they challenge you. They were a pain in class. They were disruptive. They didn't think the, if they ever read the book they challenged it." And he said, "One of them just introduced me." My daughters go, "Dad!" and it seemed like five hours before he went on. It was-- and then he says, he said, "It's interesting." He said, "Six of my ten worst are on these walls and none of my best ten."

Spicer: Oh my gosh.

House: "Maybe we're grading the wrong thing." I thought that was incredible.

Spicer: Can you say what some of his best people were?

House: No, he didn't really get into that.

Spicer: He didn't say that. Yeah.

House: But the other thing I wanted to reflect on and I've thought about this a lot, so we have the books. We have 162 of these people. We have the books. We have plenty of milling-around time. People are going around like a high school annual getting other people to sign their books. What stunned me was that I probably knew two-thirds of the people. I didn't meet anybody else who knew more than a dozen. Everybody was in their domain and never went out of it.

Spicer: Exactly.

House: But because I'd been ACM president, because I was in the instrument world and not the domain world I had a breadth, not a depth kind of thing.

Spicer: And not only that, as a historian you get to see, you're looking at it in a deeper way than most practitioners do. Most engineers and computer scientists do not know the history of their own discipline. So the older ones do, but the current, the last couple generations, really they've, what they do is they take past historical accomplishments and then sort of put them in a sidebar in the textbook. So you get all of Claude Shannon's work, for example, his entire life, corpus of work is reduced to one, four sentences in a textbook or something, and that's it.

House: Yeah, a footnote at best.

Spicer: So that's what I mean is...

House: I was giving a talk for-- where was I? I was probably at MediaX. I don't remember where I was at. Maybe it was just an InnovaScapes talk but the point was I was over here at Carnegie Mellon at the NASA campus and we airlifted it to Cleveland or wherever they are.

Spicer: Oh, CMU is in Pittsburgh.

House: Pittsburgh. So I've got the Pittsburgh crowd and this crowd and I said, "God, it's a real pleasure to be here," and I mean this computer science program is unbelievable. This is Herb Simon and, "Huh?" And it was like, "Who?" I mean it stopped me cold, absolutely stopped me cold and so then I, of course, launched into the, "You guys, you're at one of the three most famous computer science institutions in the world, and you've got to honor the people." Yeah, I mean Allen Newell and Herb Simon are beyond giant.

Spicer: You know what we, Kirsten and I, call this? The history gene. Some people have it, and some people don't. They just don't care, or they just don't think about the past. And you have the history gene. I have the history gene. Max has the history gene. We get it. We're looking for a longer narrative, for reasons why things are, not just accepting-- Steve Jobs in his great Stanford speech says, "Everything you see around you was done by people, and that means you can change the things around you, too." I thought that was a great message, very simple. Don't just accept the world as it is. Make changes. Make it better.

House: Oh yeah. You should have heard them at HP when I went back for a history degree.

Spicer: You? Steve Jobs came to HP?

House: No, no. I was-- you should have heard my HP colleagues in Colorado Springs when I said, "I think I'm going to go get a degree in history." "You've already got a Master's in engineering. Why would-- what would you do with that?" And I said, "I don't know, but I just have this need to do it," and it was, I mean talk about phenomenal.

Spicer: It's a real...

House: Remember I said I went to, I wanted to work with Tom Kuhn, and-- but yeah, so I've got a Master's in the history of technology and urban studies and it probably has informed more of my engineering than my engineering studies have done just because you just, you have a different lens through which you observe things.

Spicer: Yeah, and also recreating-- I mean none of us, in a way, have the luxury of, let's say we wanted to, as engineers we use the Laplace transform, for example. If you want to study the history of that, there's a fantastic history behind that but it might take you a couple weeks and you'd have to read in French and so but that, all that is lost. It's just, it's kind of too bad, and I see the Computer History Museum's role in some ways as recovering that past.

House: We have such an awesome responsibility there and opportunity. So let me tell you what I'm doing right after today. So I'm going over to Stanford this afternoon to research three books on Zach Taylor and my conviction, and we'll see whether the books will bear me out, is that he was one of the most innovative presidents in American history. And he's written off completely as, I mean the words, the best words about him say he's a forgotten president, not a failed president, but he happened to be the guy when California found gold. Actually, Polk was the guy when they found gold but he's the guy that inherits the problem and his first basic set of Cabinet meetings are around California wants to become a state. And the slavery issue, the 1850 Compromise which happened after he died, he didn't last very long, is what's talked about when they talk about his tenure or the Clayton-Bulwer Treaty, which had to do with the Nicaragua Canal. Those are the only things that any of the standard search-the-web kind of stories give you, other than he had been this general and he fought Santa Ana or something and yada yada. Well, he has his Cabinet get together, and he says, "If we pass a law that affects California, how long before they know there's a law and if they ignore it, how long before we know they ignore it and how long before we can get back and say, 'Do it, damn it.'?" The answer is about a year and a half and he said, "That can't work. That can't work. Bring me plans that would make that different," and he got an appeal about clipper ships and they improved the speed of clipper ships by almost 50 percent in the next year.

Spicer: How did they do that?

House: They built a new design.

Spicer: Oh, new design. Okay.

House: Yeah, out of Boston.

Spicer: Wow.

House: The-- he did sign the treaty because going across the Isthmus was half the time it had been to go around the Cape. Well, it was half the time after the clipper ships so he signed that and Ulysses Grant had done the pioneering work for him for the time. He'd ridden horses and he knew you could move by

horseback but he couldn't find anybody to do the idea of a Pony Express. He wanted the telegraph, but they said, "Until we have railways, we can't do it." Then, everybody told him the railways was impractical except one guy in New York who kept lobbying, and he couldn't get his Secretary of Treasury because of the cost of the Mexican-American War said, "We can't afford it." But he's pushing on all these things and so I'm hopeful and there's three books, one written in 1933 and another one that Stanford has, and I'm hopeful I can find buttressing for this because I think it'd make a wonderful little anecdote. And here's this guy completely forgotten who actually was working pretty hard for this stuff.

Spicer: An interesting comment, too, on the importance of telecom to tie a nation together and the railroad, of course, but communications, yeah.

House: He thought you could get the-- so he said, "It took my Cabinet a half a day to get to D.C. from New York. It took me three days from New Orleans. It takes how long to get to California?" and his posit was that it you could do in less than two weeks. Turns out they completed the Golden Spike in '69. In 1876, they did it in three and a half days with a train.

Spicer: From, say New...

House: From D.C. to San Francisco.

Spicer: Wow, that's incredible. Wow.

House: Yeah, and so I mean the guy-- but my point would be he was a logician and a pragmatic guy. He wasn't a politician. He wasn't a theorist. He was just, "Hey, we got a problem here."

Spicer: Yeah. That sounds really interesting.

House: So hey, I've enjoyed this tremendously. I hope this is of some value for you guys.

Spicer: Oh, yeah. This is was wonderful, Chuck. Thanks so much, and we'll have to do a Part Two sometime. No, just kidding.

House: God, there's no more.

Spicer: Yeah. Well, thanks again, Chuck. It's been a real honor to have you here today, and we wish you all the best in your future endeavors.

House: Thank you. Appreciate it.

Spicer: Thank you. Okay.

END OF THE INTERVIEW