



Apple Computer Historical Information

# Interview with Apple Programmer Andy Hertzfeld

Source

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## NerdTV #1 : Andy Hertzfeld

**Bob:** Andy, it's great to see you. Welcome to NerdTV.

**Andy:** Thanks, good to see you.

**Bob:** What do you think NerdTV is?

**Andy:** Well you described it to me as *Charlie Rose* for nerds, an interview show focusing on technical issues of the day, maybe a little bit of history.

**Bob:** We couldn't afford the table, but otherwise it is the same.

**Bob:** You are best known for doing system software for the Macintosh. For the viewers who don't know you can you give us a short resume of where you came from and what you do?

**Andy:** I was a grad student at UC Berkeley when I bought my Apple II and it suddenly became a lot more interesting than school. I started focusing all my time on being an Apple II hobbyist, dropped out of grad school to go to work for Apple in August of '79. I did some products for the Apple II, most notably the first small low cost thermal printer, the Silent Type. I started on the Mac team in February of 1981, wrote a lot of the original system software for the Mac including the User Interface Toolbox, the Window Manager, Menu Manager, Control Manager. I left Apple in April of 1984, pretty soon after the introduction of the Mac. I helped my friend Burrell Smith who did the digital hardware for the Mac start a company called Radius in 1986 that made peripherals for the Mac. I did a lot of stuff as a third-party developer, sold system software back to Apple. In 1990, along with Bill Atkinson, who was sort of my mentor on the Mac project, we started a company called General Magic that made some of the first handheld computers - what they call a PDA, though I always thought that was not such a good name.

**Bob:** That was John Sculley's name.

**Andy:** That's right. I could go into lots of details about that, but we had a falling-out with Apple. Apple was our benefactor at starting General Magic, but about a year later decided they would rather BE General Magic and tried to make us blink out of existence... which we eventually did, but it took a few years. I left General Magic in 1996 to become an Internet hobbyist - got a T-1 line to my house. At one point I had all four food banks of the Bay Area hosted from this house here.

I got bitten by the free software bug in February of 1998 around the time of the Mozilla announcement. I was despairing of the structural problems in the software industry and suddenly, after reading Eric Raymond's book *The Cathedral and the Bazaar*, I realized that free software could be the path to an open and fair software industry.

So I decided to devote myself to making that happen sooner and ended up starting a company called Eazel in August of '99, trying to make free software easier to use. Eazel couldn't get its second round of funding so we had to shut down the company in May, 2001.

After that I started working with Mitch Kapor, who is a tremendous character - the guy who designed Lotus 1-2-3 - helping him get the Open Source Applications Foundation off the ground. We were developing an innovative Personal Information Manager called Chandler but a couple years ago I took off from that to do a project writing down my memoirs essentially, reminiscing about the

development of the Macintosh.

I developed some unique software to public it on the web that I call the Folklore Project. I established a web site called folklore.org devoted to what I call "collective historical storytelling" – allowing a group of people to cooperate telling their shared stories. I published on the web about 60 anecdotes about the development of the Mac in time for the Mac's 20th birthday in 2004. And that led to a book.

**Bob:** You have a book to plug!

**Andy:** I just got copies of this, it was printed in Italy.

**Bob:** "Revolution in the Valley: The insanely great story of how the Mac was made."

**Andy:** Yeah. It's not my title but I think the book turned out great.

**Bob:** And it's available wherever books are sold?

**Andy:** I hope so.

**Bob:** That's the plan.

**Andy:** You can buy it through Amazon today.

**Bob:** You've had an incredibly varied career. I want to cover whatever you want to cover, but also some old stuff, new stuff, philosophical stuff, perhaps.

**Andy:** Sure.

**Bob:** What was it that excited you about the Apple II?

**Andy:** Just owning my own computer. In those days I was a grad student in computer science and I liked to get to the bottom of all the systems I worked on, but you weren't allowed to. You didn't have root level permissions. I couldn't figure out some of the low-level I/O things. So I had a real drive to get my own computer. In fact when I first got my Apple II the first thing I did was turn it on and off, on and off, just because I had the power to do so, which I'd never had on a computer before.

I knew the Apple II was great when I bought it, but as I dug into the details it just

completely blew me away the creative artistic approach that the designers had taken. It was written by a sort of madman genius. Although I didn't know about it at the time, I could just see it in there. That design style was so intoxicating to me that I ended up being drawn to Apple as a moth to a flame. I started working at Apple about 18 months after I bought my Apple II.

**Bob:** Steve Wozniak was the primary designer of the Apple II. What could you see about his character in his product?

**Andy:** First thing was that he was a prankster. In some ways the Apple II was his greatest prank. Woz, his incredible sense of humor, his idealism, you could see it just in the code for the Apple II, his unique problem-solving approach. The Apple II was not designed like an ordinary product. It used crazy tricks everywhere.

I guess one of the first things was my realization of how the high-res screen worked. 280-by-192 by four colors - you do the math that requires a 12K frame buffer but it only had 8K in the frame buffer. I thought, "What's going on here?"

**Bob:** What was going on?

**Andy:** He used a very clever trick of clocking the basic machine synchronous with color microburst, so effectively you could micro-program the NTSC signal. It was really only one bit per pixel, but because it was synchronous with where you turned the pixels on, you could control the colors.

**Bob:** Wow! And what was it like when you finally met Woz?

**Andy:** I have a great story. I met him at the computer club. I was one of the founding members of the Apple Core, which first met April 1, 1978 - another April Fool's joke. I was told by John Draper, who'd I'd met, another legendary character....

**Bob:** Captain Crunch.

**Andy:** He was friends with Woz and that Woz would be coming to the July meeting in San Francisco of the Apple Core. So I positioned myself near the door, scrutinizing everyone who walked in, thinking I could tell Woz just by the glint in his eye. I had never seen a picture of him even. And I was able to pick him out.

**Bob:** By his glint?

**Andy:** By his smile and just the way he carried himself. Later that afternoon I ended up

going out to lunch with Draper and Woz to Larry Blake's in Berkeley where I remember being a little bit scared because they were talking about schemes for taking over communication satellites. This was 1978. I was wondering if I'd get arrested from just attending the lunch.

**Bob:** Of course they both came from the Blue Box era and Draper, with his Cap'n Crunch whistle, well I think he did some time, didn't he?

**Andy:** Yeah, on a couple occasions. The Apple II was entered in a trial in Stroudsburg, Pennsylvania as an "instrument of crime."  
(laughter)

**Bob:** When you were at UC Berkeley, was Bill Joy there? Did you know him?

**Andy:** Yeah, I knew him. He was TA for one of my classes. He spent more time than any other person at the terminal room. This was before he could get a terminal at his house. He was there almost 24 hours per day just re-writing UNIX a piece at a time.

**Bob:** I know the guy, but I didn't know him then. As a TA, did he devote himself at all to the teaching part of it, or was it just a way to make money? Did he care?

**Andy:** He cared about the technical stuff. I'm not sure about personally. He marked-up a few of my papers. I thought of him as a good TA.

**Bob:** Isn't it funny how you meet people at certain points in your life and then meet them again later. "You're that guy...."

**Andy:** He called me up shortly after the Macintosh introduction at Apple because he remembered me from Berkeley. I hadn't heard that he had founded Sun. He had heard about the laser printer that was under development and wanted to set up a meeting with Steve Jobs. I told Steve, "Hey, you ought to talk to this guy. He's one of the best programmers I ever met. Maybe you could hire him." I didn't know he had already founded Sun.

**Bob:** For those who don't know, there was a project called the Macintosh and Jef Raskin was the head of it. This was before Steve took it over....

**Andy:** That's right.

**Bob:** So it was another computer.

**Andy:** Well Jef deserves a lot of credit for putting together the vision of the Macintosh, which is the combination of extreme simplicity and ease of use and very high volume. I think that stuck with it from Jef's initial inception. Jef's other exemplary contribution was putting together an amazing team. Jef attracted Bill Atkinson to Apple, hired Bud Tribble, Burl Smith, Joanna Hoffman, Brian Howard. He put together the core team. Steve already had a prototype and a team before he took it over.

**Bob:** Jef later did the Canon Cat. Was that like his original version of the Mac?

**Andy:** Yeah. I would say that was very close to what he wanted to build with the Mac - essentially a text-based interface. Jef didn't want you to take your hands off the keyboard.

**Bob:** I remember he had the "jump" keys.

**Andy:** He called them the "leap" keys.

**Bob:** Leap keys, that's right. And he was very resistant to putting in arrow keys, so if you wanted to move only one character you still had to leap it.

**Andy:** He had a lot of foibles like that. His software insisted on having only one file per floppy disk, again tilting toward simplicity at all costs.

**Bob:** It was an information appliance.

When you came to the Macintosh team it was from the Apple II group. How did that transition take place?

**Andy:** I tell the story in my book called "Black Wednesday," which was a famous day in Apple history - February 26, 1981 - when Mike Scott, who was the CEO of Apple at the time. A lot of people thought Steve Jobs was a CEO of Apple but he never was until he came back to Apple in 1997. Mike Scott - I love Mike Scott - but he was sometimes cantankerous. I came into work one day and found that he had fired about half of the Apple II team. He felt they were getting fat and complacent and wanted to get us back to our old startup hustle. He fired three out of the four managers from the Apple II team. That kind of freed me up, but I was pretty disillusioned because they fired a friend of mine who I thought was one of the best programmers at the time at Apple, a guy named Rick Rickiev. I was ready to quit, myself.

Scotty heard that I was thinking about quitting Apple because of his actions, so he called me into his office and asked what it would take for me to stay? I said, maybe if I could work on the Mac project, which Steve had just taken over from Jef Raskin. In fact, when I finally started on the Mac, Steve put me in Jef's desk, which he hadn't moved out of yet. I started going through the drawers and I found model airplanes, cameras and stuff.

**Bob:** Did he ever get that stuff back?

**Andy:** I think so.

**Bob:** In doing a project like the Macintosh, is there an advantage to being young and strong?

**Andy:** Absolutely. Being idealistic really helps you overcome some of the many obstacles put in your path. Working long hours being single helps because your time is yours. Once you have a family your time isn't all yours anymore. Most of the Mac team, we were in our mid-20's, most of us were single, and we were able to essentially devote our lives to it.

**Bob:** We established that Jef put together the team and had a large part of the vision, what was it that Steve brought to the party?

**Andy:** Steve brought a ton to it. Foremost was just the space to do something. The politics in even a medium-sized company as Apple was at that time (from today's perspective I guess you'd still call it a small company) it sure seemed like a large company by then, having about a thousand people. The politics: the Mac could have run afoul of the Apple II – which it was priced like - and the Lisa - which it operated like. So just creating the space for a small team to do its thing could only have happened under the auspices of one of the founders.

But I think Steve's main contribution besides just the pure leadership is his passion for excellence. He's a perfectionist. Good enough isn't good enough. And also his creative spirit. You know he really, really wants to do something great. And he'll MAKE you do something great if you are not so inclined. He has incredible powers of persuasion. He can convince anyone of practically anything. It's really hard to do something like the Mac and it takes a character like Steve.

**Bob:** So if Steve hadn't stepped-in, would it have happened?

**Andy:** No way. It would have been just another little footnote. Another little research project that finally ran aground when one of the principals left to do something else. And Apple probably wouldn't be here.

**Bob:** The Mac was developed by a small team of people. Is there an ideal size of team?

**Andy:** Well it depends on the nature of the project, but I would say (to paraphrase Albert Einstein) that the ideal size of any project is as small as possible but no smaller.

**Bob:** And so the ideal size is one person?

**Andy:** One person if they can do it would be ideal, especially for a software project, because then you have no communication overhead. But typically for a project like the Mac, the size we had was pretty good. And it has different stages. The team grows as you have to write manuals and do testing... though the Mac had no formal testing. We used to say the final software for the Mac had six person-hours of testing, which was twelve people for a half hour. Literally the final release was ready at 5:30 and went off at 6 AM.

**Bob:** And the 12 people you found at Denny's?

**Andy:** No, they were the software team, plus a few hangers-on. At the time we were doing that testing, too, most of us had been awake for the previous 48 hours.

**Bob:** Now Burrell Smith is a great character in this. Some people think of him as a creation of Steve's, or perhaps of Jef - in the sense of coming out of the service department.

**Andy:** Right

**Bob:** And there are a lot of organizations where that wouldn't have happened. But also a brilliant designers and, well, kind of a wacky guy.

**Andy:** He's a character.

**Bob:** The stories of Burrell going to lunch in the truck.

**Andy:** I missed that in the book. I had it on my list, but I couldn't come up with a sharp enough way to write it. All it was, really, there were more people than could fit in the back seat and the front seat of the car so Burrell volunteered to go in the trunk. We used to sometimes communicate by Morse code. Once we played a joke and

left him in there for 10 or 15 minutes after we got back. That wasn't very nice.

**Bob:** There must have been something about this kind of womb-like experience that attracted him.

**Andy:** I think he was just trying to amuse his many fans.

**Bob:** His many fans....

**Bob:** Was the success of the Macintosh less or more than you expected? What expectation did anyone have?

**Andy:** We had high expectations. Part of Steve's job was to drum into us how important what we were doing actually would be to the world. We understood that if we pulled it off - obviously there was no guarantee that we would - if we pulled it off, Apple would be in a position to change the world. And I think we did to a large extent. Now it didn't have the commercial rewards necessarily that we thought we would for a variety of reasons. As you know, Microsoft eventually kind of grabbed the gold ring out of Apple's hands, I guess. We had artistic values more than commercial values. From the point of view of our artistic values I think we succeeded beyond our wildest dreams.

**Bob:** Why did you choose to leave Apple?

**Andy:** I had a bad manager, a manager who wanted me to salute to him. I didn't salute crisply enough.

**Bob:** Literally salute?

**Andy:** That's metaphor. I call the story in my book "to big for my britches." He took me for a walk to give me a verbal review. For the period of time I'd written most of the Macintosh system software he gave me a bad review because I was insubordinate to him. That disillusioned me. That took place in February 1983. I would have left then except I was too committed to the Mac. I had to stay to see it through. But as soon as it [shipped in] January 1984 [I] left.

I was still able to do system software. Did Switcher, the first multitasking environment for the Macintosh just as an outsider - I was able to sell it back to Apple. I wasn't going to work there because I loved the spirit of the Mac group but this guy came in - his name is Bob Belleville - the bad manager who made me quit, and wasn't able to compromise enough to stay there.

**Bob:** Why didn't Steve protect you?

**Andy:** Steve had promised to. When Bud Tribble, the former manager, had left, Burrell and I both almost quit. We were afraid we'd get a bad manager and Steve promised to protect me but at the time we had already essentially developed the Mac. The technical work was done and what Steve needed at that point were managers to take over the rest of Apple.

The Macintosh having shipped, his next agenda was to turn the rest of Apple into the Mac group. He had perceived the rest of Apple wasn't as creative or motivated as the Mac team, and what you need to take over the company are managers, not innovators or technical people.

**Bob:** So at that moment he needed Bob Belleville more than he needed you?

**Andy:** That was what I thought. A little later on I think he thought he needed me more, but during that time, yeah. And of course it all kind of backfired on him. He (Steve) got kicked out of Apple just shortly afterwards... much o the ill fate of Apple. I almost killed Apple.

**Bob:** When did you first meet Bill Gates?

**Andy:** I met him in July, 1981. I have a story in my book about that first meeting with Bill where he tried to guess how the Mac's cursor routines were working. He guessed wrong and I was about to tell him how they were software-based (he thought there was some hardware for them). We had even got it working on an Apple II. I was about to tell him that and Steve Jobs saw I was about to tell him that and tried to drown me out, saying SHUT UP!!

**Bob:** Didn't he later try to buy something from you?

**Andy:** Switcher. I also talk about that in the book.

**Bob:** He tried to low-ball you.

**Andy:** He tried to get me to brag about how fast I could write the program so then he could apply some dollar-per-hour value and come up with a low price for it.

**Bob:** He tried to trap you.

**Andy:** That was before I had written the program, we were just talking about it, so I didn't know how long it would take. I guess it was a common technique to use programmers' egos in order to get them to say they could do things quickly and therefore not have to pay that much.

**Bob:** It sounds kind of clumsy to me.

**Andy:** Well it didn't work. (laughter) I got to tell the story though. What's interesting is I ended-up selling that very same program to Apple and I also had to have a price negotiation with Steve Jobs. It really contrasts their two styles. Bill Gates was being extremely analytical, trying to figure out how many lines of code, how long that would take, how many dollars per hour you should get. Whereas Steve Jobs' approach was to just pull a number out of the air, insist it was right, and not even allow you to argue with him - just divine interpretation.

**Bob:** So if the number he pulled was high enough then you were happy.

**Andy:** And I wasn't THAT happy, but I was happy enough. I knew Switcher should be bundled with the Mac and I knew only he could do that, so I was willing to compromise more with him. If Bill Gates had owned Switcher, that would have caused a mess down the road.

**Bob:** Talking about egos of programmers, is there a programmer personality type?

**Andy:** There are a number of different programmer personality types. Any programmer is going to be rational, analytical - you need to because the computer is unsparing. But there are many different areas. People who work on the user interface side need to have empathy as a key characteristic. But if you are writing device drivers you don't really need to understand humans so well.

**Bob:** I remember always saying there were hippies and there were nerds and you kind of had to have a combination of them.

**Andy:** Or you can be a hippy nerd. I was a nerd but I was always more of a literary nerd, an artistic nerd.

**Bob:** I can see that.

**Bob:** But at the same time, with teams working closely together personality conflicts can be a problem.

**Andy:** You bet. Especially when people are idealistic and you are trying to do what you think is right. Sometimes people disagree. Some people's personalities are such that they can't really express themselves, so they just get bulldozed by whoever has the louder voice. But on the Mac team we were passionate and you have to stick to your guns some. Steve Jobs would confront you and try to challenge you to say why what you wanted to do was the right thing to do. And if you were a shrinking violet you probably couldn't get much done in an environment like that. In some ways it's self-selecting, a team's chemistry. And then good managers know how to make the most out of the different personality types that they could work with. Not that I've ever had a good manager.  
(laughter)

**Bob:** You've NEVER had a good manager?

**Andy:** I've had one or two. Bud Tribble, say.

**Bob:** I was just thinking about Bud Tribble.

**Andy:** He's back at Apple now.

**Bob:** It seems to me that there are like 25 people in the valley. That's it and you keep bumping into them. And five of them are Bud Tribble. If we look at Bud's path in parallel to yours it is an interesting one because Bill Tribble was hired by Apple to work on the Apple II...

**Andy:** Not on the Apple II. Bud was hired by Jef to be the first Mac programmer in September of 1980. He was in an MD/PhD program at the University of Washington, grinding-up cat brains for his PhD.

**Bob:** Well who wouldn't? We've all wanted to do that, but HE got a chance. So he took time off to come do the Mac?

**Andy:** Right, a one-year leave of absence, because it would only take about a year to do the Mac. So a year and a half later he quit the Mac to go back and finish. He didn't have to, he could have stayed with the Mac but then he would have flushed the four years he had already put into that program. So Bud went back, got his MD as well as his PhD and then decided to never practice medicine. He came back to Apple and took his old job back in the fall of '84.

**Bob:** Steve Jobs started another computer company after leaving Apple called NeXT.

**Andy:** And Bud was one of the five co-founders.

**Bob:** Right, but Bud eventually left NeXT under very dark circumstances as I recall, because he went to Sun. And Steve was very - I've never quite understood that - did Steve fire him or was Steve betrayed by Bud's departure?

**Andy:** Well NeXT was having a bit of a hard time. Bud advocated the position that should have taken earlier. Bud thought they should have dropped their hardware business.

**Bob:** The software guy wanted them to drop their hardware business?

**Andy:** Yes, not too surprising. Eventually they wouldn't, Bud sort of quit over that, or got enough at odds with them that it is hard to say whether he quit or was asked to leave. They also did a stock realignment in the company at the time that robbed him of a great deal of his stake in the company. They had a recapitalization and that's when he went off to Sun. Then about two months after he went to Sun they did drop their hardware business as he had suggested they do.

**Bob:** Well is that really surprising? So they diluted the heck out of him and then he left.

**Andy:** They diluted the heck out of everybody.

**Bob:** You were in Triumph of the Nerds and did a beautiful job I thought. And of course Steve Jobs was in the show, too. You have a story about that?

**Andy:** Yeah. Steve came over to my house shortly after it aired in 1996. I asked him what he thought of the documentary. He said he thought it was really good, but when he watched it on TV he thought his comment about Bill Gates having no taste might have been a little too harsh. So he called Bill Gates to apologize.

I don't know how you call Bill Gates, but if you are Steve Jobs you get right through. He said, "Bill I'm calling to apologize. I saw the documentary and I said that you had no taste. Well I shouldn't have said that publicly. It's true, but I shouldn't have said it publicly."

And Bill Gates replied, "I'm glad you called to apologize, Steve, because I thought that was really an inappropriate thing to say."

Steve couldn't help himself, he said, "You know it's true, it's true you have no taste."

And Bill Gates responded to him, saying "Steve, I may have no taste, but that doesn't mean my entire company has no taste."

So Bill admitted he had no taste, but thought it was an unfair slur to say that MICROSOFT had no taste.  
(laughter)

**Bob:** He hires people to have taste.

**Andy:** Exactly.  
(more laughter)

**Bob:** What is it that attracts you to Open Source software?

**Andy:** The chance for a healthy software industry. As should be apparent to everyone, sometime in the '90s the software industry kind of ran aground due to its structural problems. The Microsoft monopoly was choking off innovation. Essentially Microsoft, who owned the underlying platform, was at odds with both their users and developers. They didn't want innovation, they wanted to maintain the status quo. It's like playing a football game when one of the combatants owns the football field and the football and the helmets. I was really aware of the problem but I didn't know of any solution. It's good for the users and developers to have a common system software base. Its bad though if it has proprietary control.

So when the Mozilla announcement happened and I read Eric Raymond's The Cathedral and the Bazaar I had an epiphany, which obviously is a received epiphany, not an original idea. But I realized that if the common system software base could be owned by the community of users and developers under a free software license, you could have a healthy software industry where innovation can flourish. Once I got that, I thought it was incredibly important to help make that happen. I think the historical forces are going to make it happen. It's just a question of how long it will take. And I thought I could make a contribution toward making it happen sooner rather than later. Completely independent of anything I do I think it is progressing and eventually we'll get there. Free software has been incredibly good for the industry and will continue to be.

**Bob:** Some people wonder where's the business model in free software?

**Andy:** Well there are lots of different potential business models, but software is becoming a service. Software will go stale after awhile. What Eazel was going to do was to create a system management service. Eazel was dedicated toward making

computers easier to use, free software in particular. GUI-type usability is one type of usability, but system management is really one of the places where the systems let everyone else down.

You, as a computer expert, probably have to support a dozen other people in your life when their system collapses on them as it will every year or so if you are a computer user. So how can we fix that? Well the network can fix it, right? The expertise can be out there in the network. And people would be willing to pay, I believe, some modest rate, say, \$5 per month, \$10 per month to get access to a stream of updates and expertise. And I don't mean a person talking, but automated expertise. That's one potential business model, a kind of system management service. Perhaps it is even sold to you along with your ISP.

But there are other business models. I think O'Reilly, the publisher of my book, has a tremendous free software business model that they've been very successful with, which is publish books about it. Not many companies can do that, but there are traditional kinds of consultants. IBM, one of the largest and, as was growing up, one of the most avaricious companies is now firmly on the side of free software. They see it as being very advantageous for their consulting business, which gets them the lion's share of their revenue these days.

**Bob:** And helps them sell hardware that the free software runs on.

**Andy:** You bet. It's good for the customers. So I think we lived in feudal times when I was growing up, where the platform owner was the overlord and the users and developers were the serfs. But I think we are going to transition to a time of equality and a level playing field through the free software. I'm not saying every piece of software should be free, but the infrastructure-level pieces. The more people depend on it, the more reason there is for it to be free. Also the more it becomes a commodity for long-established technical standards.

If you look at the basis for the Microsoft monopoly, it's really old stuff that hasn't changed for a really long time, so that shouldn't be a place to get great commercial leverage.

**Bob:** And yet, it is and continues to be.

**Andy:** Yeah, yeah, although the world's moving away from it. You can definitely see the cracks in the dam.

**Bob:** Where are the cracks? Point to a crack. I agree with you, but I am trying to

illustrate it.

**Andy:** I would say low-cost PC's are an obvious example now. Moore's Law has taken us to the point where the hardware cost on a new PC could be under \$100. A PC could easily be sold for \$200, so a \$50 Windows license just doesn't play anymore. As hardware costs go down their model just doesn't work anymore. In the Third World, especially, you'll be seeing that. It just doesn't make sense if there is a free alternative.

You are also seeing it in the new range of devices. The network has now enabled lots of computing to move off the desktop into potentially thousands of different form factors like the Tivo, for example. You are not going to build your TiVO on top of Windows.

**Bob:** Are you familiar with the Eclipse 500 business jet?

**Andy:** No.

**Bob:** The Eclipse 500 is this new business jet that's coming out.

**Andy:** Vern Raburn's jet? Mike Boich, who was my partner at Eazel as well as my friend from the Mac days was thinking of getting one of those.

**Bob:** It's a million dollar jet, it's a cool idea, but...

**Andy:** they had some setbacks, right?

**Bob:** No, it's going great. Their engine builder failed them, so now they have a new engine builder and they had to raise the price a bit, but it's essentially a flying computer.

**Andy:** Yes.

**Bob:** It runs Windows NT. That kind of scares me.

**Andy:** Yeah. NT is no more, I imagine they're up to XP by these days.

**Bob:** Probably, they started with NT 4, but I'm nervous about an embedded Windows operating system that controls my pressurization.

**Andy:** Maybe Vern was around early enough that he gets a copy of the source code.

**Bob:** I think Bill Gates has a lot of money in Eclipse.

**Andy:** That's probably WHY it runs Windows NT.

**Bob:** Of course, that's exactly it. That's the deal.

**Andy:** They wouldn't have done that if they weren't incented to because it made no sense.  
(cell phone rings)

**Bob:** That's my phone, but we're not going to answer that. I wish I had turned that off...

**Bob:** So you did Eazel. From the outside Eazel was presented as a new graphical interface for Linux.

**Andy:** We were just building on top of Gnome. Our goal was to make Linux easier to use and part of that is work on the GUI side of things and part of that was work on system management. We evaluated the alternatives and ended up picking Gnome. We built something called Nautilus, a new file manager. I never thought of it as a file manager, I'd call it a graphical shell. We got about halfway done what we wanted to. It's just disappointing we never got to take it as far as we wanted.

**Bob:** How did it feel, to have to walk away from that?

**Andy:** Very disappointing. When you invest some fraction of your life working really hard, and ESPECIALLY when you put together a tremendous team like we did. And then to have to see all them scatter in the wind is very disappointing.

**Bob:** What became of the code you developed?

**Andy:** It is still used. If you install Gnome on your machine you'll be installing Nautilus. It has drifted away... it didn't live up to its potential. It still has some good stuff in it, but he people who took it over did not have much forward thinking vision. They ended up, "when all else fails just copy Windows." So it has kind of drifted into that modality.

**Bob:** Given that Windows has copied so many things in turn, that is ironic.

**Bob:** Can an independent software developer make a good living today.

**Andy:** Absolutely. I would think, in a variety of ways. It depends how independent you

want to be, but if you are a good programmer with a good track record you can consult for \$150,000 per year or more. I know lots of programmers who make that much just working for one company like Apple or Microsoft. If you are more entrepreneurial-minded you can try to se up a business. I don't know about single programmers doing all that well, although I do know a few, like a great guy I met working on the Gnome project, Rafe Levine. He lives in Berkeley, has been maintaining a free software project and making a fairly good living at it because they sell a commercial version. He's doing GhostScript and he sells non-GPL's versions, licenses them to printer companies, and he makes a decent living.

**Bob:** It's something to think, "I'm Rafe and my competitor is Adobe."

**Andy:** Well it's Rafe plus his cohorts - hundreds of volunteer programmers scattered over the world.

**Bob:** I wonder if John Warnock loses sleep over that? He might.

**Andy:** I think John Warnock is past the commercial wars these days. It would be Bruce Chizen, or whoever is the CEO, but Adobe is doing great as far as I can see.

**Bob:** They ARE. They seem to have found a path there, because it is so hard in this environment where Microsoft is so dominant. I attribute it to there being still room for companies that really have technical superiority. Adobe and Microsoft on a technology basis are just not comparable companies. Adobe could just clean Microsoft's clock any day. And people forget that because they think about a bigger company and more money, when in fact there is always room to be better.

**Andy:** Sure, Adobe is a tremendous company in the center of their expertise. They are almost untouchable because they really, really care about beautiful printing.

**Bob:** And there's Autodesk. Microsoft has a product, sure, but that doesn't mean Autodesk is threatened by that, because Autodesk is an 800 pound gorilla in CAD.

**Andy:** I don't know much about CAD. I know Intuit is another example of someone who resisted being devoured.

**Bob:** And fairly successfully. So you can do it, but it requires being so much better at your job and so much more nimble on your feet.

**Andy:** And of course what we don't know is the opportunity cost of the monopoly - what things would be like if there was a more level playing field today. Five times as

many great companies, maybe, would be flourishing.

**Bob:** One of your great outside interests is music. How have your interests in music and technology intersected?

**Andy:** Through the digital music revolution. In early 1998 I got into the MP3 thing. There was that site, mp3.com was actually how I learned about it, and I put all my music online. I built a custom server for myself. I started with 54 gigabytes on six nine-gig drives. Now I have over a terabyte on it, have about 7,000 works or so and it has been tremendous for me. Not only do I do all my music listening through it, when I travel it is still available to me as long as I have sufficient bandwidth. But I can also allow my friends to share some of it.

**Bob:** Where do you see this music revolution going?

**Andy:** Much along the same lines as now. Where I think the revolution that needs to take place but hasn't yet is in society's values in how to deal with it. Music wants to be heard. If I'm an artist, and I put a song out there, I want as many people to listen to it as possible. So it is not bad for me if people download it and hear it who otherwise would not. Though somehow the industry kind of thinks that's bad. I'm not saying everything should be free, but "the greatest good for the greatest number" is still a good prism for deciding what's right in this world. And suing your customers seems like a LOUSY business strategy any way you slice it. So I think there is a lot of evolution to come around in the current business models. Maybe the current record companies are toast. They certainly deserve to be.

Bandwidth is not decreasing, you know. It's an incredible lesson, when I first put my server together over six years ago it was a little bit of a strain. It could barely compress things in real time. Now I stick a CD in there and get it all ripped and compressed in under five minutes. It's just little corner of most people's hard disks. So the next things are the movies, which have an order of magnitude size of information, so I've started doing those as well. I put together a movie server for myself that now has over 500 works on it.

**Bob:** Really?

**Andy:** It's illegal, because one of the worst laws I'm aware of, the DMCA says that even though I buy the DVD I can't copy it onto my computer.

**Bob:** I forgot you are a criminal.

**Andy:** I'm a criminal in more ways than one.

**Bob:** Our new Attorney-General will be watching this.

**Andy:** The guy who writes memos about the Geneva Convention?

**Bob:** Yes, he'll determine that you are not covered by the Geneva Convention.

**Andy:** I'm afraid of that.

**Bob:** Where do you see yourself 10 years from now?

**Andy:** Jeeze, I'll be over 60 - I'm 51 now.

**Bob:** So am I. Don't we look good?

**Andy:** Born in 1953. Yeah, both of us, I think, look okay. I don't know, maybe I'll write a novel sometime in the next 10 years, but I also hope to be doing some interesting software projects. I see it as much the same. I used to think when I was 30 - I'd talk about this in interviews - would I still be able to program when I'm 40? I think in some ways I have lost some of my edge as a programmer, but I've gained a lot, too. So I would say I'm as effective a programmer as I have always been, but in different ways and for different reasons. And when I'm 60 even more so. I'll be able to have a lot better computers - better tools and stuff - but my short-term memory has been diminishing and will probably be mostly gone by then. I don't know.

**Bob:** You can sense it?

**Andy:** Definitely. I was - in my heyday anyway - a very fast programmer. I got things done quickly. The way that works is to have it all in your head so you never have to look anything up. And it is slipping away. I can already see it. I have to look things up. Now these days I have the greatest programming tool ever devised to help me, which is Google. It's really amazing how almost any situation you are in you can just take advantage of the collective wisdom to figure things out. Any problem you are stuck on, that you are looking for the right technique or whatever, you can just access the collective wisdom of the world. Tremendous!

**Bob:** You have been very successful, you have had an eclectic career, some of the companies you've worked for have not succeeded, but some of them have.

**Andy:** I co-founded three companies. Two of them went public and made money on both those. General Magic you'd have to say overall added up to a failure, it didn't come close to achieving its ambitions, but as a co-founder I made enough money to be set.

**Bob:** Do people do this for the money?

**Andy:** Yeah, sure. It varies. The best people don't do it for the money.

**Bob:** I guess that's where I am headed.

**Andy:** Money isn't a good enough reason. It's not related enough to its essence to be the right motivation. People who come into it for the money, maybe they'll make money, but they're not going to really shake things up. It takes something else - a passion for computing is the thing it takes more than anything else - a real love of what you are doing. I would say that's true of any endeavor.

**Bob:** The people who do it for the money, sometimes they make money, but typically they get out too soon. They don't carry through the dream as far as it could go.

**Andy:** Sure, because their dream is a dream of money. Ultimately you are at odds with your customers - the more money you make the less they have. The great thing about this industry is you can create value out of nothing, just out of bits. I used to say my software was made out of Diet Coke because that's what I consume a lot while writing it. But you can turn that into real value. And free software, better yet, because it is totally pure. It becomes more valuable when it is free because that freedom allows someone else to build on top of it.

**Bob:** Do you think the computing platforms we are used to are going to physically go away? As processors get cheaper we'll embed them in more things. Is it that our houses are going to come to life rather than that we'll have a big box under the desk?

**Andy:** The existing things don't go away as much as new venues will eventually take away some user time from them. But you'll still have something on your desk to make documents. There will still be desktop computers for that. You are not going to do that standing up or in your car, but yeah, eventually entire walls will become displays. We're seeing now for the first time computers make a real contribution toward home entertainment. The computer as a television and for music listening, we're already talking about that. It will be a big thing, if it isn't already it will be shortly. Communications - that was one of the things General Magic was into very

early, we were making a communicator when everyone else was just trying to make a handheld computer.

**Bob:** This change from computation to communication is a big one.

**Andy:** So your telephone is going to be a computer if it is not already.

**Bob:** Who are your heroes?

**Andy:** Bob Dylan is the first one I have to say. I'm a big Bob Dylan fan. But Steve Wozniak and Steve Jobs, I'll put them in there with Alan Kay. I have literary heroes, too.

**Bob:** Who are they?

**Andy:** Thomas Pynchon, Don DeLillo, Ian McEwan is my latest author who I just love. Neil Stephenson, I just read his trilogy. I finished that last 850 page book in just a week.

**Bob:** Who would you like most to have dinner with tonight?

**Andy:** My wife I guess, that's who I will have dinner with. Steve Jobs for years had promised me he'd arrange a meeting with Bob Dylan. He eventually did have a meeting with Bob Dylan and didn't include me in it. When I thought about it, its like "what am I really going to say to him?" Dylan has a tremendous first part of his biography out and when you read it you see, gee, you don't want to impinge on his time. I don't think I have anything unique to give to him so I'd rather just leave him alone. So I guess I'd want to have dinner with someone who would want to have dinner with me.

**Bob:** Do you know Linus Torvalds?

**Andy:** No, I've never really met him, though I came close a couple times. I think he's a tremendous guy, though, from everything I know about him.

**Bob:** Do you know his wife is the six-time Finnish woman's karate champion?

**Andy:** Yes.

**Bob:** We're living in interesting times now.

**Andy:** We always have.

**Bob:** Yes, but we are seeing an interaction between technology and society that is taking place on a global scale. The stuff that I do for PBS, we have a global audience, and often some of the most interesting comments come in from Australia. And I think we are getting a little behind the wave - we don't even understand what it is that we are doing. Do you have a sense of that?

**Andy:** In terms of the implications of our work we never really understand it. You are creating something to meet the need at hand. How people will use what you do you never can know, nor should you, because you like to be surprised. I used to say about the Mac that the best thing about it was the creativity of others being put into it. And it really was that way. If you knew everything that could be done with it that's limiting. Now in terms of the future of mankind and all that, I don't know.

**Bob:** You have a new iMac on your desk here. When you were doing the original Mac you had a vision of what that was and where it was going. Is this consistent with that?

**Andy:** Yeah. Your one thing it's an Apple and you just take a look at that thing and it has Steve Jobs's values right on the surface of it. You can clearly say it is something related to what we were doing. But even if we didn't. Let's say Steve hadn't come back to Apple and they were still making boring boxes. Its amazing to me how much of our original intent and values stayed with the machine long after most of the people who worked on it had left Apple. For years and years. Even Jef Raskin, who left before the rest of us, his contribution managed to hang around for much longer than you would think possible. It's just something about the formative stages.

**Bob:** I think it is a technology vector. And the early work has a great influence on determining the direction.

**Andy:** The Mac has a spirit. Even when the company was run by Sculley or Gil Amelio, that spirit of the original Macintoshes was in their machines in a very distinct way compared to, say, the Microsoft machines.

**Bob:** Now if we jumped back to 1984, we look at this machine today and say they are on a consistent evolutionary path, when did you think in 1984 that we'd have gotten to this machine. Are we late or are we early.

**Andy:** I would say the hardware exceeded my expectations. You just can't imagine what

a billion instructions per second is like back when we weren't even running a million. So the hardware has advanced tremendously, but the software is disappointing. I wouldn't have imagined that the paradigms we helped popularize with the Mac would last 10 years, much less 20 years. But today mainly it's still the same old stuff where I would have thought we could do a lot better. What I guess I didn't calculate into the formula was the stagnation of the monopoly. I think that's a big part of it. For a long while, innovative ideas couldn't really get off the ground because of the chokehold Microsoft had.

**Bob:** You describe a situation in which that's resolved through Open Source, but Open Source is in many ways an agrarian revolution. It's the farmers, it's the peasants, and that rarely works. It can establish an environment that is conducive to change, but there is usually some big hulking character who comes and bets up the old guy. That's certainly what Bill Gates fears - enemy he doesn't know, the one he hasn't seen, the company that's founded tomorrow.

**Andy:** Let's say Apple was able to get into the place Microsoft is in, they might do a better job of it, but we still haven't accomplished something. If you just have a different toll keeper, the King is dead, long live the King. I liken it more to the change from a monarchy to a democracy, where every man is king. That's where I'd like to see things go.

**Bob:** I'm the king of Charleston, South Carolina.

**Andy:** Congratulations.

**Andy:** I have another anecdote that has to do with Open Source and the Macintosh. In January, 2004, the Computer History Museum had a little presentation about the marketing of the Macintosh with all the original Macintosh marketing team up on the stage. And a large percentage of the rest of the Mac team in the audience. They had a Q&A toward the end and an older guy got up and said he thought MacPaint was probably the best program ever written. Was it possible for him to see the source code? It turns out the person asking the question was Don Knuth - another one of my heroes. He came up to me afterwards.

**Bob:** Bill Atkinson wasn't there?

**Andy:** Bill - who was the author of MacPaint - wasn't there. Don Knuth repeated his request to me and I thought, "Boy, that's Don Knuth asking me for a favor, I'd better do as much as I can to fulfill this. So as soon as I got home I called Bill and said, "You've got to have a copy of the MacPaint source lying around

somewhere." Nope. He had it on an old Profile hard drive that went up in smoke 10 years ago. I said, "Come on, Bill, it has got to be on a floppy somewhere." I twisted his arm hard enough, he called me back two days later he'd found this wooden box with floppies in it - he's got the MacPaint source, but no machine to read a floppy.

So I cobble together an old Mac. It turns out it is in an obsolete file format that had never shipped, because it was the Lisa Monitor file format that was just used for the development of the Lisa. So I had to write a utility to piece things together. It turns out the files weren't even encoded in text. In those days bytes were precious enough that it actually used a run length encoding to get the blanks at the beginning of scan lines and source code. All the indentation was wrong so I wrote another utility in perl and was able to get clean beautiful copies of the MacPaint source. Put them on a CD, sent them off to Don Knuth. He responded by inviting Bill and I over to his house, which was quite something.

**Bob:** He has the pipe organ there.

**Andy:** He has the organ and these amazing sculptures. He has a chest of academic awards. He showed us how he works standing up in two different offices. We went out to lunch with him and had a great time. He was grateful and really loved getting the source.

I was working on my folklore project and started thinking when I got back, "Why don't I put the MacPaint source code online?" I asked my friends and got some pretty negative feedback. Apple would have to sue me. Twenty year-old source code is a slippery slope; what if someone put three year-old source code up next? I'd be very foolish to do it. But I thought if it was useful to Don Knuth it would probably be useful to a lot of people for historical and academic purposes. So I was thinking of putting it on the site, Apple would send me a cease-and-desist, I'd take it down, but it would be out there then. But I was just a little too chicken. Finally Tim O'Reilly came up with the brilliant solution of donating it to the Computer History Museum as a historic artifact. Perhaps they could get permission from Apple. So that's what we did. It took a few months but in August Apple approved the donation of the MacPaint source code to the Computer History Museum. This was their first major software artifact in their collection so they made a big deal of it, made a video of us, and eventually the MacPaint source code will be available from their web site to anyone in the world.

**Bob:** And Apple can take a tax deduction.

**Andy:** Yeah, though it would be hard to value it.

**Bob:** It's beyond value.

**Andy:** Priceless.  
(laughter)

**Bob:** How are we doing for time? We're done?

**Andy:** Okay.

**Bob:** That was fun.

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