

# MARC ANDREESSEN

## ORAL HISTORY

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### COMPUTERWORLD HONORS PROGRAM INTERNATIONAL ARCHIVES

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Transcript of a Video History Interview with  
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Founder & Chief Operating Officer, Netscape Communications

Recipient of the 1995 Science Applications International  
Corporation (SAIC) Information Technology Leadership Award for  
Global Integration

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Interviewer: David K. Allison (DKA)  
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Smithsonian Institution

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DKA: Let's start with your academic background and your work in Mosaic and how you got into interactive computing.

MA: One of the first things I did when I went to the University of Illinois was start working in a research lab, at the university's physics research facility. This was really an educational experience because it introduced me to both the world of high-end computing and networking. The Internet was already there; everybody used it because it was there.

DKA: Did you know that you were interested in computer science?

MA: Oh yes, sure. I was studying computer science at the University of Illinois and working on the side. I was considerably more interested in applied programming--in actually doing things that people found useful--as opposed to just studying theory. During that time I also worked at IBM.

DKA: Whom did you work for at IBM?

MA: No actually, in Austin, Texas. I spent part of 1990 and part of 1991 in a co-op program. It was a great experience for me, to be both at IBM and in the industry.

DKA: Were you involved with networking applications at IBM as well?

MA: That was when IBM was trying to crack the 3D Workstation market. I came back from IBM and joined NCSA largely because they were doing a lot of 3D work. I thought that would provide an interesting continuation.

DKA: What year of college was that?

MA: That was 1992, but I'm not exactly sure. I didn't have a traditional schedule of courses.

DKA: Did they basically let you do what you wanted to with computing there?

MA: Pretty much, yes. I was in a degree program but it wasn't highly structured. I just tried to keep up. I basically never studied. I attended classes, but that's about it. I haven't checked my GPA since I've left. Someday someone will look it up and my cover will be blown. After that I just started working at NCSA.

DKA: What was that like? Tell me about the environment at NCSA.

MA: Working at NCSA was fascinating. The super-computing program in the mid-1980's originated because the government thought it was crucial that a powerful computing infrastructure be provided for scientists.

An interesting thing happened around 1990: all the supercomputing centers essentially stopped running supercomputers. They shut down the Crays. They could no longer afford to keep them running, especially with the advent of more cost efficient microprocessors. They can't even afford to take them out of the buildings: it costs \$500,000 just to remove them from the third floor. These machines are now just sitting there dead because the scientists would much rather have a DEC Alpha Workstation on their desk, which is as fast or faster than a supercomputer and available at a fraction of the cost.

Because it was a Federal undertaking, the supercomputing program had a life of its own. When Mosaic was started, NCSA was really trying to figure out what it was going to do and what its role would be. It's interesting to look back now at Mosaic. It's only been ten years since the program began, but this was a hectic decade in the computer industry. When I was there, we had a large team of people on board. There was considerable opportunity to explore ideas simply because there were many facilities, a lot of networking, and a lot of money.

DKA: Were these people mainly undergraduates, graduate students, or professors?

MA: All of the above. We had about two hundred folks, running the full spectrum from high school students on up. It was a great experience as far as people were concerned.

DKA: And was networking was the big topic of discussion there?

MA: Networking was a very big deal. The backbone developed by the National Science Foundation was originally built for the supercomputer centers, and eventually became the foundation for the Internet. Networking was always the big thing. Since it no longer made sense to run a supercomputer, what do you do? And so networking quickly became a very big part of NCSA, the theory being that the next stage would be to link together everything--especially scientists and educators who up until that point had been using the Crays.

DKA: So tell me about the set of ideas that lead you and your friends to develop applications for the Internet.

MA: The whole Internet phenomenon had been gaining momentum for the past decade, but it was still very much limited to a small audience of people. It was limited to people who were skilled programmers, for example, and its full potential was not being tapped. At the time the Internet worked fine as infrastructural device, but wasn't friendly enough for people who wanted to do interesting things. So it was primed for someone to come along and try to take all this information and this great networking and pull it together with a graphical interface for the desktop PC.

Networking had arrived so fast, and everything was happening so rapidly, that people just hadn't yet gotten around to making it accessible. They finally got to it.

DKA: People were using gopher servers; they were using e-mail. What was the critical set of new ideas that you brought in?

MA: One idea was that multi-media should be a key part of the Internet. Everyone knew desktop computers and the network were perfectly capable of handling images. The new part was simply combining this idea with the ability to link together resources across the globe. You could just connect a piece of information in Texas with a piece of information in Switzerland and isolate it back. People had also been talking about hypertext for a long time, and it finally happened at NCSA. We had worked out most of the hard problems at NCSA. In the beginning the Internet was plagued by many difficult networking problems. It isn't a perfect system, but it works beautifully.

DKA: So, many people had talked about networking computers, but here was a simple solution. It didn't expect things to happen perfectly every time, but was effective nonetheless.

MA: Correct. Right.

DKA: Now you're saying a similar idea was involved in Mosaic. How did this idea develop? Did your team just sit around the table talking about it, or is this something you conceived on your own? How did you move from the basic notion of network interactivity to developing a real program that people could use?

MA: I figured out that this was something that we should do and it was the right time and place to do it, and then it was a fairly simple application of just pulling the two halves together. The networking works great. The desktop user interface works great. All we really tried to do was to pull them together. And then we sat down and began writing code.

DKA: Who was "we"?

MA: Initially this included another gentleman who is still at Champaign and myself. We spent about three months hammering it out.

DKA: You'd stay up nights working late. What did you write this in? Was this a C application?

MA: Yes, All C. It is ironic that the only way to develop an application like this in C--which is only one step up from some other languages but with twenty or thirty years programmer experience behind it--is to sit down and write in C.

DKA: You haven't said much about hypertext mark-up language. Was this something that was widely known and used? Was it something that was unusual for you in this application?

MA: On the Internet there were a lot of activities taking place, a lot of different ideas in a lot of different places; there were a lot of ideas in progress, and many efforts underway, and all we really had to do was create a means of pulling those activities together. So we literally stole from as many sources as we could find, and made sure we supported them all. At that time there were twenty or thirty servers supporting hypertext markup language. We made sure that we supported all of those because we thought they would be important and we just tried to pull that together and make sure we could display images and cover all the bases. The great thing about the Internet--the thing that catalyzed it in the first place and renews it every day--is that there are so many people able to use it, able to do a million different things. It's an open platform that anybody can develop and create applications for. A lot of people are able to apply their energy, and see it bear fruit.

DKA: It sounds like your goal was to integrate as much as possible because so many new applications come out and they're very targeted. But from the outset you tried to be broad in terms of your grasp.

MA: We targeted the users. We wanted to make Mosaic friendly for people to use. One of the great things to see is that, in fact, people have always enjoyed using the application, as they now enjoy using Netscape. They really get into it. At first many don't understand it; but after spending ten minutes or so playing around with the interface, something clicks and they're off. Focusing on that process was really important to us.

DKA: When you and Eric began writing this application, what did you think was going to happen? Was it something that you thought only a few people would use? Did you ever expect it to become a really big deal?

MA: We expected that quite a few people would use it. We just tried to hurry and get it out there--initially to a limited group of ten or twelve alpha and beta testers. Of course, the Internet is a great way to distribute viruses too; put a virus out and then it propagates. The funny thing now is that the same technique is being used by mainstream software companies for distribution, like Oracle for example. These companies are basically giving out their database for Windows by putting it out on the Net. It's an interesting approach, and one that will have some pretty major repercussions. And that's essentially what we tried to do. This was actually a model that had been used a lot in the past, sort of based on the shareware model of free distribution, except now using the Internet. Get it out there and into people's hands.

DKA: Did you talk about starting a company when you originally developed Mosaic? Or did you think "This is a great tool, let's give it to everybody"? What was your position?

MA: I wondered if there was business there. Interesting thing, I grew up in Wisconsin and went to school in Illinois, and they just don't start companies out there. You just don't do it. You won't go anywhere. The environment is all wrong. The culture is all wrong. I didn't realize the potential until I came out here. The people and the culture is just so dramatically different. Had we been at Stanford, of course we would have started a company; in the Midwest, no way. Not a chance.

DKA: And yet do you think that, had you started a company before distributing a huge number of free copies, that maybe it wouldn't have been so successful?

MA: If we had started a company and then done the free distribution thing--which is to seed the market and invest resources in development to capture the potential as it emerges--I think we could have done fairly well. I was a little bit worried when we started this company that we were starting too late, and we certainly have to continue to work very hard to stay ahead. I think we timed it well. We were just within the limit. Had we started a year earlier, there's the chance that the commercial market just wouldn't have been there. We would have simply run out of cash before the market arrived.

DKA: You introduced Mosaic in March of 1993, as I recall, and it started growing very rapidly. You were completing your education at the same time, is that correct?

MA: Yes. I think they gave me the grade.

DKA: So that must have been a heady period. What was that like?

MA: It was just something else. The surprising thing was that every time you expected it to calm down and level off it just kept increasing. If anything, the rate of change just keeps escalating. It's reflective of what happens with data in general. It's a struggle in all cases just to keep up. We try to stay abreast of all the users, all the requests, all the things that they want to do. A lot of companies just started coming to us, wanting to commercialize the product. It was pretty amazing.

DKA: So here you are, a couple of students and you have companies knocking on your door saying "Gee, we'd like to commercialize this software." What would you say to them?

MA: Well, we'd say "Okay" and then we'd try to figure out how to charge them. Research funding in general and funding for these types of efforts in particular dropped off in the early '90's. It became increasingly important at NCSA, for example, that projects be self-funding, or to have commercial revenue behind them. Arguably, if you've got money you can concentrate on research; but if you are really worried about funding and are struggling to secure revenue, then you're spending a lot of time and effort on things other than the research. You're starting to run the research project like a business, but it's not a business; it does not have any of the required people, skills or foundation. It was actually fairly stressful because it wasn't clear what to do, how to carry it forward, or how to keep it going. It was not clear that, past a certain point, a research center should let go of a product and let it take its natural course. We tried to figure that out and we ended up with a licensing approach.

DKA: So was this something that you worked out with university officials? What was the environment at the university when the private sector started to knock on the door?

MA: By that time the people at NCSA started to realize what was going on. They began to understand a couple of things. First of all they realized that this was going to be significant, and that this potentially allowed the supercomputing center to not only continue but to flourish; and they also realized that there was money in it. They started taking a keen interest in it all. So after a while it was sort of taken out of our hands. After a certain point it made sense to leave.

DKA: In some ways this reminds me of the story of Pres Eckert and John Mauchley and how they developed the ENIAC at the University of Pennsylvania. They left because they couldn't come to terms with the university. It's interesting that it comes up again. You decided that you'd finish your degree and also enter a commercial agreement with the university; and then you realized that wasn't going to work out. What happened?

MA: There were many companies that came to the university and said "We would like to take this, we would like to commercialize this." It was interesting to watch the university try to deal with that. Things were following their natural course, and when I graduated I decided to leave. There was no reason to stay there. The environment was falling to pieces compared to what it had been, simply because there was this influx of money. The project grew from two people to twenty. It was completely different. I left and a number of other people on the project left at about the same time.

DKA: And had you and Eric been managing the project, or did somebody else manage it as a group?

MA: There never really was a manager.

DKA: A loose confederation of people?

MA: Yeah, a loose confederation of people, simply because there was really no structure. There was really no management. It really doesn't make sense for there to be management. It's was so different from a company. It's supposed to be. Conversely, being in an academic environment was also highly political.

DKA: So you decided that there was nothing in it for you. What did you do with your life at that point?

MA: I tried to sift through and figure out where to go, what to do. I talked to a lot of companies about different things, definitely out here. I came out here to visit in October and really liked the area a lot.

DKA: Was this your first time?

MA: Yeah. I liked the fact that there were all these high tech companies out here. It's sort of funny that in the rest of the country people have started to put down Silicon Valley, and say things aren't happening there anymore. It's really incredible how much there is out here, how many things are going on and how it's still so central.

DKA: You interviewed with a number of companies and eventually accepted an offer?

MA: Yes. A small company in Palo Alto called Enterprise Integration Technologies--an impressive name. I lasted about three months.

DKA: And then what happened?

MA: And then I met Jim Clark. He was leaving Silicon Graphics and was interested in starting another company. He really enjoyed starting Silicon Graphics and watching evolve.

DKA: Did he come looking for you or did you just run into him at a party?

MA: Well, he was looking for technical people. He wanted to do a software company. He had spent twelve years, I believe, at Silicon Graphics. There were alot of people he knew at Silicon Graphics but he couldn't take them with him so he was looking for outside people; it started as simply as that.

Somebody told him about Mosaic and he got in touch with me down here and we started talking about American television and I decided that this might be a good opportunity to talk.

DKA: Did that mean negotiations with the Supercomputer Center or did you have rights or did you even know what the status of the material was?

MA: Yes. Essentially what happened was, the licensing program hadn't really started yet, or it had started but wasn't really active. I knew for a fact that we didn't want to use any of the code that we had written at the university. It wasn't going to stand up as commercial software. I knew that we had to completely re-write it. We had to do cross-platform support. We needed to make it a lot faster and add security, and I knew at that time that we basically wanted to give away the web browser side. So we knew that we couldn't count on per-copy royalties. We basically declined to take a license fee because at that point we didn't see any potential property issues. There were no trade secrets, patent issues, copyright issues. So we basically just struck out on our own.

DKA: Now you say you knew that you wanted to give away the software. This is not a normal approach in business to start giving away your product.

MA: Absolutely not.

DKA: What did you think when you said "Gee, Jim let's start a company and give away what we're making."?

MA: He thought I was a little bit crazy. But we would give it away under specific terms, and to educational and for evaluation use. A lot of companies who are going to use it are going to pay for it, because among other things they want to pay for it. Free software is usually more expensive in the long run for companies to use. It's not a major thing if you have a useful piece of software. It's not too dramatic to make it available to people who are going to pay for it anyway. In addition, we knew that we were going to be doing development in a number of areas anyway, and have a range of products. The web browser was going to be one of these, so in a sense we gave away one so that people could see the others. The third aspect of it--again an aspect that's pretty unique to the Internet--is we wanted to repeat what happens when you put tools into people's hands on a very broad scale because then they pick them up and do all kinds of great things with them that you would never have thought of.

DKA: What ideas did Jim bring to this? How did he look at this networking opportunity?

MA: He had an interesting perspective. It was an especially interesting perspective for me because this was when discussion about the information superhighway was reaching a fevered pitch. He had been very involved in the Time-Warner project, which envisioned interactive television delivered over a broadband network, where you have very powerful \$200.00 boxes sitting on every TV set. He brought the viewpoint that you should have broadband data going into everyone's home and you should have computing devices everywhere doing interesting things.

And when that happened there could be a very large new part of the software industry to address that. What we realized today is that the PC is essentially a platform for data on the Internet. We went ahead and hired most of the original team doing Mosaic who I think were happy to have an opportunity to make a go of starting a new company and also the opportunity to do something significant again.

DKA: So you had a team of about how many people?

MA: About six or seven.

DKA: They sat around and wrote the original Netscape Navigator?

MA: Yes. Basically we all sat in a room, this was in May, June, July of last year (1994). The company was between ten and twenty people last year.

DKA: So the first thing was to get Navigator done and then begin developing new commercial packages? Tell me a little bit about your products beyond Navigator. What other applications did you see then to support that?

MA: What we really did was run a number of things in parallel. There's a couple of different approaches you can take when you start a company. One is to be very conservative and not overextend yourself. Another approach is to undertake a major development effort with a lot of work in engineering up front that's going to take three, four or five years to get a first product out.

We're in an environment where heavy investment makes a lot of sense--provided it's put into the right areas--and we need to have products that will materialize within a year because we think the market will support that. So from the beginning we put as much development as we could onto both the client and server sides. We expanded the development with another team that took those core pieces and started building applications on top of them. We talked about that quite a bit. We basically cranked that out as fast as we could.



We cranked out the first clients and servers in the first two months or so. We tried to just blow this out the door. If you took two years to get it out the product would be far more technically advanced. But its more important to get it out there fast so people begin using it and begin to integrate the technology as rapidly as possible. That's when they begin building on top of it. If it's out there it just starts to pick up momentum on its own. So that's the approach that we decided to take.

The other point is that this approach compensates for the fact that we were invested in very heavily. So, by shipping product in December our revenues went from zero to a point where we're quite happy and pretty much able to fund the bulk of the company's work and development. Expansion and growth is a lot more comfortable than going out and raising capital.

DKA: Already Mosaic had been picked up by just about everybody. Did you think the same would happen to Netscape? Or were you surprised by how rapidly Netscape grew and was embraced by the community?

MA: I think we were a bit surprised again; we were certainly hoping something like this would happen again. It actually happened much faster than we expected. It really illustrates not only broad interest in the Internet, but also the sheer number of people using it. Its really significant when you look at the numbers. I think we have about six million Navigator users now, and those are the ones on the public network. That's not counting people behind firewalls who we can't see. The interesting thing is that those numbers are far in excess of many of the figures you hear in the computer industry. The subscriber rates right now, for example, are approximately that. There are not a lot of software applications able to have that many users, and it just happened so *quickly*. The downside is that it could vanish overnight. You have to keep up.

DKA: You mentioned that you completely re-wrote the code when you came out here, adding a couple of features. What, specifically, were these innovations?

MA: When we originally wrote Mosaic we had the NSF backbone, which was T3 at the time--45 megabits per second, which is really fast. We basically wrote the software without bandwidth considerations in mind. We just designed it for a really fast network, and a really fast workstation for that matter. What we wanted to do, and what we are doing with Netscape, is try to make it very broad in terms of who could use it. We wanted it to be useable over average modems and ordinary phone lines. We did a lot of work there to make it very efficient. We also needed to build in security. And, again, security is a very fundamental issue; it makes it possible to have private applications over a shared network. We wanted to build security in, and make sure that it ran very well across platforms.

Windows is dominant, but we wanted it very broad based for other platforms that companies were running. There's a presence of Mac's in almost every company and a lot of workstations in research and development, so we wanted to make sure that our software ran across all of those. We spent most of '94 basically creating the product, making it commercial and taking all these things into account. What's really fun about this year (1995) is that now we have the opportunity to do things that we've never done before.

DKA: Let me ask you a little bit about the look and feel of Netscape, because you mentioned earlier that even when you were in college you were quite concerned about ease of use. And it seems to me that the ease of use and the ability to cross platforms the core of what makes Netscape so popular. What was it like to develop the Netscape interface? Did you have long discussions about the look and feel? Or was it just another Windows application? How did you treat those issues in your development group?

MA: Basically we took the minimalist approach, as we did with Mosaic. With the interface we tried to make sure there was a minimal amount of stuff other than the Net-based information itself. It would draw out that information, make it possible for people to focus on that information, and get rid of all the crap that usually clutters applications.

DKA: Was that your aesthetic approach? Did you say to the team "That's too complicated. Let's not put that in."? Was that your discipline?

MA: I feel very strongly about that, and I think a lot of other people on the team did too. The people on the team share a number of things. One of them is that general approach. The other thing is something that I think is really great, and rare in the university environment: I always wanted to produce software people would use and get it out there. One of the really exciting things happening in this company is that there's a very strong ethic, a very strong philosophy towards producing products and shipping them and getting them out and empowering customers. I think that really helps us a lot. It not only keeps our energies up by working towards that goal but it also helps the software to be better by just getting it out in front of users. Because we have the network available to us for distribution we are able to do that very quickly and very effectively. We get hundreds, thousands . . . piles and piles of incoming messages every day. We've got them all archived and all sorted. We can just wander through and look at everything in terms of comments and feedback on the program. I think that's really exciting. I think a lot of companies are going to start taking advantage of that.

DKA: I'd like to take a break right now and have you, just for the record, give us a brief description of what Navigator is and how it looks.

MA: I'm going to keep the description real simple because the great thing about Netscape is it really *is* simple. Essentially what we're trying to do is present information in as simple a form as possible for the user to read and deal with. Images are a fundamental part of that information, as is a user interface that's very easy to use. Today the interface uses a document approach which people are very comfortable with and very familiar with. Standard throughout documents are hypertext links to other pieces of information on the network. I'll go into one of the links. It goes out over the network to some post, some server that contains some piece of information, make a request and sends some data back. There's broad range of things that happen within those parameters, truly where the magic occurs. And particularly a lot of interesting things can really happen. Where should we go? There's a number of efforts to index the entire Internet. And one of the fun things that's happening is that a number of them are starting to become companies in their own right. This is an index called Yahoo that's been on the Net for about a year. The guys who started it are Ph.D. students at Stanford. Just a week ago they got a significant amount of venture capital backing. And now they're striking out on their own. The catalog of resources on the Internet will be supported by advertising in the future.

[demonstration]

Let's see what we did want to do. This is an index of just about everything that's out there and they spend a lot of time trying to keep this up to date. This is a company that spends all their time cruising the net, trying to organize everything. So here we are in sort of the government area. Let's do a search. We got a whole bunch of responses. Newt Gingrich rolled this out a couple of months ago. This is just piles and piles of information, every piece of information ever produced by the Congress. All kinds of stuff. Its good if you're out here. Everything that shows up in blue is a link to something else. One of the things that we tried to do was make sure to keep the concepts of client and server very separate and the client deals with the human being sitting in front of the PC. The server deals with the application, whatever it is doing. The backend has the database with the information.

DKA: As you mentioned, your corporate strategy is to stay on both sides of that equation.

MA: Yes. Because they're both very important. The future's on both sides because the client needs to have the capability to display information and to make it useful. Increasing capabilities of either one means that both benefit. In terms of its capabilities as a system, its value increases also.

DKA: Do you find that you spend a lot of time surfing the Net?

MA: I spend quite a bit of time on the Net because I try to keep up with what's happening. And also, what I'm finding increasingly now--especially in the last three or four months--is that there's a lot of video sources coming on line, and news feeds and computer related publications and so on. I spend half an hour every morning reading the news, in addition to newspapers. It's actually becoming very useful for that purpose. We have a fairly fast link here. A lot of people are using Netscape these days over a modem; a lot of people are using a number of very fast lines. There is a question about when we are going to get real bandwidth into the home. In the meantime most of the real networking power is at companies.

DKA: What has astonished you most about the kinds of things that are coming up on the Net?

MA: The generic answer would be "the variety", the sheer number of people who are able to apply creativity to this is just so much greater than I expected. I don't think you could find another media which has precipitated such a volume of creative content. Video is great but it has limitations, as does audio. Not many people can write books, or publish magazine articles. All these are very restricted mediums.

But the Internet is a medium where anyone with a basic level of technical competence can create content. One of the things that we are going to try to do over the next few years is to try to create more and more tools to make it even easier for people to do that. We think that some day it should be possible for *everyone* to publish on the Net. As easily as people approach word processing today. And that should be a huge market opportunity for a lot of companies. Everybody has something to say.

DKA: The idea that your personal home page, to the Wall Street Journal to Wired Magazine, are all at the same level is really interesting.

MA: It's going to make a whole different world in terms of the leverage that large companies typically have, the distribution channels that companies typically have, because their size won't matter much anymore.

DKA: Let's talk about some of the strategies your company is pursuing now. One of them is partnerships. You're making a lot of partnerships with a variety of different companies. Maybe you could talk about some of those you think are important.

MA: Somebody once said that the best type of strategic partnership is a purchase order. One of the things that we're really happy about is that we have a great set of partners. A lot of them are also customers; that's really significant. We really try to develop products that they really like to use.

The Internet is such a global phenomenon; it touches the fields of publishing, media, advertising, distribution; it involves the folks who write computer software and even other platforms themselves. It touches all of that. There's no way we can develop for all those things on our own. We just can't.

At the same time, the platform vendors--Digital, for example--are very interested in working with us to enhance their offerings for their customers. One of the exciting things that's happened in the last year is MCI and then Pacific Bell stepped up to the plate. MCI is the first major American communications company that really understands networking and the idea that they can offer data services effectively. We're really excited about that. We have investment in DCS technology, which is really great people at PCI who are really taking the stuff and working out the detail. Anything in particular?

DKA: Well I'm curious about the MCI business and of course the new relationship you just announced with Sun. What was your thinking behind those two in particular?

MA: Sure. In MCI's case it goes back almost a year when we started talking to them. MCI was thinking about data services and is an incredible company largely due to the incredible people there. A good example is Vint Cerf who really was the father of the Internet and is still very active and much involved in many aspects of the Internet--and also with MCI with their data services. It was a matter of basically putting together a plan by which they could make a run at this market. A year ago the big question was: "Is there an Internet market?" and if so what does that mean? We thought we had a pretty good grip on what we were going to do and then MCI developed very rapidly a plan, a set of specifications, and then we basically got to work on developing software for it, making sure that the client-server software was going to meet their needs.

MCI was our really significant early customer and major supporter. Last month they brought on MCI On Line and they'll get into that service through MCI. I think unlimited access is not as ubiquitous as it should be, and this is the year that it is really changing with the arrival of MCI, the arrival of Pacific Bell and the other regional Bell's. With all of the consumer on-line services already provided, they want to provide access to the Internet as rapidly as they can. They are going to provide national wide coverage at extremely competitive rates. It's going to be really revolutionary in terms of the number of people who will be going online. The introduction of Windows 95 is going to be another shot in the arm for the whole environment.

The access to the marketplace via MCI is built on Netscape software and we just think that's great for the infrastructure and environment. Sun almost single-handedly made the Internet happen in the '80's simply because it was involved with pushing and making predominant the protocols, the set of standards and building the platforms that allow universities, a lot of researchers, a lot of educators, a lot of businesses to do heaving internetworking to be able to run servers. And of course the client-server really began to pick-up in the '80's. This stuff really all comes out of Sun. They've been very fundamental, in fact, for a very long time. I'm really excited about being able to work with them. Their customers are very eager. They have a 50% market share in Internet servers for example--the hardware platform stuff. Their customers and our customers are in many cases the same, so we sell our software and they'll make heavy use of Sun hardware. It just makes a lot of sense for us to get together and make sure that the customers are happy.

DKA: I think you have an agreement as well with Master Card. You've talked about the provider side, the hardware side; what about how money flows across the Internet, electronic commerce? How do you see that developing?

MA: One way to describe the universe is users, merchants and financial institutions--the three fundamental pillars to making electronic commerce happen. A lot of commerce is electronic today. Arguably it's all electronic, but its not electronic in the way that we're thinking about simply because electronic commerce means that there is a global network being used as the marketplace. We need to get the global network working on the marketplace part. So a big part of that is making it possible to actually do transactions on the network. And again, the new concept we're really trying to apply here--and a lot of other companies are really trying to apply--is that you can't trust the network. You assume that there are people out there to get you, and you take that as a limitation; then you build your software anyway.

We're working with Master Card, Bank of America and First Data Corporation, which does a lot of credit clearing, to bridge the gap between this completely untrusted global network on the one hand and this backend clearing system that's been built up over time to support transactions--credit cards and debit cards and other forms of transactions. We are trying to tie all that together and then build that into the software. We've got a really good start already because we've got security built into both the clients and servers we sell and distribute, so people are able to connect, for example, to Marketplace MCI.

[demonstration]

This is the starting place: let's dive into Marketplace MCI. What happens when you connect with Marketplace MCI is that this bar up here goes blue, this little icon down here turns a different shade and the key icon becomes whole, and now communication is secure. All the communication that goes back and forth between the client and server is now encrypted so that people aren't going to be able to read it. In fact, if we are really paranoid, we can actually go and we can actually look at the digital signature of the information that came across and we can verify that it really is MCI. We can step through, go to different shops--and again this is secure so people can't even tell what we're looking at if they're watching us on the Net. Let's go to the 'special occasions' section for example. New arrivals. There's a whole bunch of different products in this case. We can carry this all the way through, we're going to do 'anonymous' because we don't want to type in all the information about home address. We can actually go through and fulfill the purchase on line, the credit authorization, and the transaction takes place on line and its completely secure so if somebody's watching or snipping packets out of the network, they can't tell what's going on.

That's the really exciting part, and then the work that we're doing for the financial institutions reinforces that. I think over time this environment has the potential to make transactions considerably more efficient than they have been in the past. The day when people can do one set, two set, three set transactions spontaneously over the net is the day when people can start offering information services. They can charge for them. There are many implications which flow from that scenario.

DKA: So you see this as liberating for small business?

MA: Oh yes, I think it's a huge small business opportunity. It's a useful opportunity for a number of reasons. For one, you can go global just like that, you are by default. Another implication is that you can have a presence that is equal to or superior to any major company; in fact you see that quite often on the Net. Some of the small companies on the Net have much more impressive content, much more impressive services available than many of the large companies. Many big companies aren't even there yet. For a lot of small companies it should be considerably cheaper and easier to bring up a small business than it ever has been before. We're starting to see that now especially in the Valley. It's going to become a lot easier for people to bring up services that are *exclusively* electronic. For example, the cost of setting up a server--if you set up a server yourself, you buy all the hardware, you buy all the telecommunications--you're only talking about a start-up fee of maybe \$15,000, and a couple of thousand dollars a month. That is not very much money to run a business. If you're an established business and you want to distribute marketing material on the Net, that amount is far less than you would pay for most activities involve paper, color brochures and things like that. I think it's going to be a tremendous innovation and lower the barrier for a lot of businesses.

DKA: Let me turn the discussion a little bit. As we see the commerce side of the Internet developing rapidly, what's going to happen to its educational value, the ability to share information freely and openly amongst institutions? How do you see the educational side of the Internet evolving? Will it get crowded out by the commercial side? Will the educational coexist peaceably with the commercial?

MA: This is what's different about the Internet medium compared to other mediums. We're still constrained, I think, by considering distribution as a limited thing, that there are only thirteen channels on the TV set, or only so many magazines in print. The good thing about the Net environment is that the more content that appears, the more that happens; the richer the environment gets, the more powerful it becomes for everyone. Particularly the impact of commercialization of the Net is going to mean that investment is going to flow into it to expand the infrastructure, far in excess of what would have been possible otherwise.

Because all these activities can take place in parallel, and because they enrich one another, the presence of the educational activities enhances the availability of the commercial services and vice versa. The whole thing should just spiral upward. Basically that's how the environment should work and how I think it will work. The infrastructure does take a lot of funding. It doesn't just appear by itself. Among other things the commercialization is absolutely going to guarantee that the Net will be there. The educational opportunities will be far greater than they would be in the absence of commercialization.

DKA: So you don't see commercialization as a pivotal issue. In many places people are now looking to charge for connect time; before, they didn't. You don't see those issues coming out?

MA: I always hate to accuse people of not understanding the situation, but people really don't understand the situation. I think in particular there's been a number of longstanding assumptions that are just not true anymore. One is that access was free. It was never free. This stuff always cost money. The question is "Who does it cost?" Well, for access at colleges and universities and educational institutions it has always cost the government money. It still costs the government money. The difference is it should cost the government *less* now because there's other money that should help pay for it. It has always cost businesses money to hook up to the Internet. We're still talking about a T1 line for \$500 to a \$1000 a month--really nothing for most businesses. Again, there's no limit to the number of things that can be done, the number of applications that can be out there, the number of uses they can be put to, or the number of users that are on the network.

The entire infrastructure continues to grow. If there's economic justification for that to happen, then all these activities can take place. None of these crowd out the others because nobody is saying that you have to tune into them, that you have to take part in it. It's just all there. It's just all accessible to you. Educational use of the Net today is just blooming incredibly; and something to look at is the number of elementary schools today whose students have home pages online. This is something that wasn't happening two years ago. It's happening completely in parallel with Marketplace MCI. In fact the investment that MCI is making in infrastructure is *directly* helping the educational use to continue to expand.

A network in general behaves in such a way that the more nodes that are added to it, the whole thing gets more valuable for everyone on it because all of a sudden there's all this new stuff that there wasn't before. You saw it with the phone system. The more phones that are on the network, the more valuable it is to everyone because then you can call these people. Federal Express, in order to grow their business, would add a node in Topeka and business in New York would spike. You see it on the Internet all the time. Every new node, every new server, every new user expands the possibilities for everyone else who's already there.

DKA: As long as it can handle the traffic.

MA: As long as it can handle the traffic. In general the value of the network to everyone expands in proportion to the square of the number of the nodes, which explains the exponential curve you see wherever there is a measure of it. As far as handling the traffic, [Metcalf] also has a lot to say about that. The other thing that he says about the traffic is that fiber optic cable is theoretically capable of handling far in excess of anything we're seeing today. 35 Megabits is a trickle compared to what a single strand of fiber can do over time. As far as bandwidth, it is mostly the local loop to the home that is really the blockage point. It's because of the installed base for the regional Bell operating companies. This is something that they have to work through or somebody's going to bypass them--the cable companies or wireless or somebody like that. Except for that fundamental limiter--access into the home--the general bandwidth is increasing in price performance or dropping in price faster even than microprocessors are. It's by a factor of four or so every year. George Gilder's answer to this sort of question is that over time--let's say five to ten years--the Internet will essentially be free. Everybody gets connected to it and it just gets correspondingly much more powerful.

DKA: What is the role of the government here? Clearly that first networking environment you spoke of was a government-supported environment, one which could not have existed otherwise. Much of the early Internet work was government supported.

MA: Sure.

DKA: Is it time for the government to get out? Does the government have a continuing role? What is your perspective sitting here in Netscape about what the government should be doing?

MA: There are a couple of different things the government should be doing. The government should be continuing to fund access for educational research. They should continue to be hooking up as many schools, universities, and libraries as possible. They should do all of that. I think that's very crucial; and the great thing is it doesn't cost them that much money. One of the little known facts about the Internet is that the NSF backbone up to a couple of years ago (when it ceased to exist) cost only \$11 million a year for the whole thing. That's just not very much money. So the government can and should, I think, be very involved in providing access to all the different domains in which it falls. The government should be--and is being to an extent--very aggressive about using the Net as a means of communicating with the public as well as to increase its own internal efficiency. Government, if anything, has been more aggressive than the private sector in adopting this technology. That's about it. In everything else, I think it makes more sense for the government to not be involved at this point. I think that the market is just taking off on its own. I think too much government involvement at this point would be very bad.

DKA: You don't think that government needs to set standards?

MA: No. No use in government setting standards. It would be one of the worst things that could happen because the pace of the technology and its innovation is happening so fast. If the government were actually able to deal with that, which in fact it is not, it would completely stall innovation. Government sets standards that don't work. Actually, the Internet is a great example of that. The government set a networking standard, OSI; nobody uses it. They finally just had to get rid of it. They all use TCP/IP which was not a government standard. Imagine if the government tried to make standards in software. The computer industry would have been stalled.

DKA: You remember ADA, the government language standard?

MA: Absolutely. There you go. I think government should do exactly what industry does, which is be as aggressive as possible. The problem is that the technology changes so fast that it's a challenge just to try and keep up, but that's a great problem to have because that means that the potential just keeps increasing.

DKA: Your concern was with global integration. We've not talked specifically about global issues but more about American issues *per se* and yet all the companies you're dealing with have a global presence. What is your strategy from a corporate perspective on the spread of this throughout the whole world?

MA: First of all we are trying very much to have that happen, and are doing everything possible to have that happen. We are still a very small company at this point. We are definitely limited. We do not have a major sales force in Europe at this point. The global sales force consists of six people right now. We are certainly partnered with companies. For example in Japan there is now a Netscape Japanese subsidiary with a country manager and a set of partners including some of the Japanese computer software companies. I think we'll have a very active involvement in Europe from a sales and distribution standpoint. We put a lot of time and effort into all our programs to make sure that they can be used internationally.

There are two aspects to that: internationalization of the software--for example, there are Japanese texts and character sets and so on. We're doing all of that. The other thing is cryptography. We build cryptography into most of our products. Cryptography is export-controlled by the government as a munition so we do make sure that we have versions of our software that can be exported, in fact those are the ones in use on the Internet predominantly. We're under certain limitations as a result as export controls to restrict the strength of the cryptography. But we do try to make sure that the software can be used overseas.

DKA: From a social and cultural perspective, how do you see the relationships between countries, if at all.

MA: Originally I didn't bring that up because, as you're spending time on the Internet, you start to take all that for granted because it's just there. The funny thing about this environment is that everybody just assumes that it's 'global everybody'. You're just as likely to be dealing with someone in France or in Yugoslavia or wherever as you are to be dealing with someone in the United States. I think it is really compelling and really different. A lot of people, especially a lot of young kids, are going to be growing up now in this environment, it being a part of how they're educated. It's just natural to be communicating with people in other cultures and other countries. It just happens. It's not something that anybody particularly even notices at this point, because it is so natural a part of the Internet.

DKA: And yet this represents a truly fundamental change?

MA: Yes. It is really something else. In a sense we're all in favor of it from an abstract point of view. From a practical standpoint, there's not a whole lot we have to do simply because it's there, it exists at this moment.

DKA: Marc, as you stop and dream and look toward the future, what does the world look like online in this integrated future for you in ten years?

MA: Optimistically in ten years? Let's see. Ten years out is almost too far at this point. Just too far. Ten years from now I would like to think . . . there are a number of practical things that I would like to think would be true, such as multi-megabit data access just about everywhere, including wireless; the price of multiprocessors should have plummeted by a lot, they should be running multiple parallel processors at that point or something like that--given that all of these things are going to happen and the technology is going to continue to go forward. I don't know of anything particular relevant to say about it other than the change is going to be so huge that I don't feel comfortable speculating about any of the results because it's just going to be a fact of life. It's just going to be there. You're going to get megabits of data while you're eating and you are not even going to think twice about it. I don't think we even have the slightest idea of what that's going to mean.

DKA: Do you see a downside?

MA: Well, there are lots of potential negatives for individuals. It's going to mean wrenching changes, I think. The technology itself: no negatives. The impact on people: it depends. It's going to continue to change the way the work force is put together, the activities that people undertake, the amount of change people have to be undergoing to stay current. It's going to challenge the education system in order to keep up. It's going to have a whole series of impacts like that. The sheer rate of change, assuming it continues to increase, is going to start to get pretty severe.

DKA: It would seem to me that, for consumers in particular, the overhead of maintaining the physical facilities where you view goods is going to be too costly to maintain because people can actually do this kind of commerce over the Internet.

MA: Right; and actually five or ten years is about the right timeframe to be thinking about that issue because that's about the right amount of time for consumer habits to change on a broad scale. It comes down to the user experience fundamentally. If the mechanisms and the technology are compelling enough, consumer behaviour will change over time. We've seen that happen in the last 3 or 4 years with PCs. They went from an esoteric hobbyist's toy to the point where if you don't use one today you're not one of the 40 to 50,000,000 who are pretty much shaping the way we all do everything. I think its going to be that kind of time period for that kind of shift to occur, and after that we're probably not going to look back. Everything will be completely different.

DKA: Can you think of anything we should talk about that we haven't already?

MA: We probably don't want to talk about my dietary habits. Not a whole lot.

DKA: Did you ever dream that this was what you would do with your life?

MA: No.

DKA: What did you think you were going to do?

MA: No idea. Pretty sure I wasn't going to be a farmer.

DKA: So you might not be doing this in ten years from now?

MA: Who knows? I might be bagging groceries in Safeway. It's hard to tell.

DKA: That's it. Thank you.