

Danny Cohen  
Oral History  
Interviewer: Leonard Kleinrock  
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Now. My. Why. Well yeah well I know. Physically. I was a graduate student there to meet the form sixty five to sixty seven and then I moved to have on and go to live in Southern and from sixty seven to sixty nine. And no I were to meet medium computer graphics. And I was interested in fast computing and the end of the many compute the computing that was required for graphics. Faster and sort of Paul Bremer likes three dimensional leaping that were it was a big probably the Anytime thing in necessary for think it acts light simulation. Venue. When you see see them mention an environment and sixty nine I see is my beach the. In a state is a is in season two of a self. Of computer science. However when I think that my faculty appointment was a fierce appointment that voted. Of computer science. The bizarre science and the after of it I moved into. Why a sigh. Which is information scientists inside to the fewest see your son shit is now in style. Well again gone. Or on computer all. On fast computer graphics and then I moved to where the voice. The time voice communication. Because a lie. Demonstrated in some visit. People. My wife and my other real time. Flight Simulator. Involved gun. Made the observation that this is the problem is I had to sort of always dime. A graphic. Earlier Similar to the problem that are in the meantime voice communication. And he suggested that I move to Eisai. To wear on voice. So the. So the. This is obviously a pin before you move. And the went all moved to I.S.I. start working and we done. VOICE. And the voice. Required a telephone conversation was usually sixty four in a big game which was more than the OP an it lined bet on a fifty K. to be fakim. For one. So one. Going to fall in line. Good the oval over frills and this the resources and the very rich. And if you have two telephone lines. That was then tighter network. So we had to compress the game with speech. And we can greatly do two point four Q. to beat a second. In the in the saws. There's a challenging to get voice is compressed so far without losing. Intelligibility in speech a speech or go be NATION. In several other properties of speech. Tell the. Our main main Paul Bremer was at the time the speech compression. Today. Speech from the speech from question is down by singing cheap. Game can play several conversations with dying in the communication ride. Gindi. Particularly thousand of of conversations. But then the poem. The main problem of compassion. And the poor in that we saw orders for that this environment. Became much simpler time. And we in today. We don't lose such compassion because of the quality of the of the speech that we will do believe it. The. Now. We in a speech in this speech was a few years after that when referring it when we sold or finished. This speech. Going to cation. So it dance between occasion. And I think that we did was video communication and video communication thank you for sixty four. You know beat. To few megabits per second after completion. In the of to visit. And you're going the same time we also did some graphics communication. And after the started the Moses. Poor ject. It is running about forty years now. You know forty years of the five years ago and this is the and after that we did. Speed. Computerize which was me. Before. I'm a zone and or the other. He seems it you probably do. Do of of of the neighborhood. Today and all the older that

is are above funding. So I start mental think I start getting out of funding. While I was still a student. It is hard on this night of it is that not all because Ivan came from heart of all the love of fallen out of power and it was made the whole eighty city could not get money. Got originally for our parking ticket. So the spot of visual aid. No point going. So again. I started getting getting out of funding of my own. After Ivan left left. Howard which was in sixty eight or sixty eight. Until about ten years ago when it dies. A move to do son. But then I got up a funding or so it around. So most of my academic life. Was up a fund. With under our funding. And I think about it you could go to a pop into I have is the say India. And if they found it interesting. They found you. I like the standard way that their way outta the way the government buys names for example. They specify what names are on in exactly what's in it should look like the other property of the name. And then the issue of ingress local pose in live or in control after all. Paul poses an i Pod shoes. Cheapest. The cheapest is going to propose on. And except it is release or gee it's different because the government doesn't know what research the government did not say we need to convert and Medicare to energy. And I son came in today OK I can do that. The grid MC square in our power accepted it because it was a base proposal with this is different because we have. We are contract on in the idea. He made a convincing government that it is good a deal. And it would be used and reasonable. Price. With our plate was easy because the poker managers it up are very good in two respects and I mean I get Iranian Jews it I recognised it. Since I started working for our power which was sixty a weasel now y'all bill. And I have all the the notice you. I freeze. As a matter of fact the before the opening it. But it was. It will note. Out if it was in it was a lot of discussions with the contractors in about what would you want in Laurie was. It was a clean coal. We're talking or networking problems. Before so he knew all about it as a matter of law and came to our part because he has a great ideas. In our Political be nice be it a little falls a convinced him to join them. And unlike any say it is you are if big or something similar to I've been out of bar was vague in foregone titles. To be good a good eighty years. In the system to change. This time it's in their hands and it is the board. A.G.C. announcement or something. So our party. Now they think we are in the. It's a minute it in Vienna sorry. Please pop or something about release I and our pal. Poor Billy. Against orders over those of of a good relationship or. If a out. Does not go saw in form on R.S.B.. And then look at a bosoms. Instead Arpaio is looking who are the best people in the country. That you that can do. That's getting no. There were only this on the subject. The interested in this is a choice of subject. Sometimes come form of our. But most of the time comes a little from the contrast of. For example. I thought it. The aircraft could be metal is a would be some computers in the cockpit head being that the pilot. So we convinced our power to issue a pogrom called by with the so she ate. It was computer I was able to zip I lowered it being the pad of not only fly the plane but understand. Then Vitamin D. is a situation in situation awareness and and. We came to a pub is it. Now but I don't eat it out and make your pocket so that the industry is in a city that before the need. Here. Yes. I. Much. It was even in seven or seven ways. Some of the ballgown unlikely gain to be children acacia for example. There were great. Bob Bob can head of doing it. And then he thought or do I need to do it safer for I need speech compilation. Who can do spiritual boyish

vigil Persian or done best. By by people is thunder. Bob Barr boys at U.C. Santa Barbara and speech comparison. Cling sense. I see their name or something seemingly out of it. And also told the stalker. At least growing up. The people noted that the other group in legal knob. Deal forty two bed post people don't live with us and you know. They were good in it working. We were good in it will get over to spec. Speech that wig. Sri. Or was interested enough in that other aspect. So are popular to get her go up of about eight contractual invited them to a meeting. Bob please ended. Is banned you of support from. What should be done. And then in the invited they were going to you guys are going to back up and that. You got it. You in you have to interface to each other and you figure out how you are of it and we need to get it. So Bob. And I'm sure. It was in violation of the Fed are it really holds. If a are bald. Divided their will and. B.. Pogrom to give him. There was it. Before that are by the another. Another mode which was down to lick and speech compression. They have like five contractors that were there five conduct over the chosen out of stain that post. And they say for two years we will with all you. Five after two years. We see the best. Two. And we down to licked from sleep too. And we'll continue. What they built their whale. So the media make all the five me. Enemies of each other here. Is a. The not cooperating the not tell everything about where this was before. Paula blaring seventy's and. It was the way Bob can put it all come it boy. GOD us to to stand on each other's shoulder. To cooperate. To head. Each other it was obvious that we even when all of us to give him all those together with the success of a. But we be old together and you will not competitors will. Participant. Here teach us. The down to leg. Mode with the government was very proud of. Does it out to the lead in to it of stand it when each other so that we still don't each other those which was not very helpful. It was. It was that I pitty of. Like the idea of whining in a speech compression. The speech and of saying think. Pogrom with. Lound elect. Was it done it it up or. I pity you. I faded it was either the love I owe it was before I. Which meaning book will but they do. That's why. Well he was. You know you. I I had dinner in a Dia. That was that we can do corners. But with computers. And if I want to buy something I didn't like computer of what I want to buy. And my computer will go in find all in provided and. For example like electronic parts in Moses. We usually find your the product that you want by defining the chip. In August. And I felt that in addition to making your own cheap you need to make a board with to make a fish them. So you have to buy lots of things. And you can get a computer and one day I was it are by and I was waiting for was a live a toe and Craig feed. That was in another of our fees came. Game by we were waiting for the elevator and grey is typical started say the New Order great idea did you have lately. And I say. Let me read to you about. Call that are actually going to have a nice into it and said This is the best idea. You. The steel got to come with me to go forward into these office. Is it type something and showed me. It was a minimal two before Llano which was the that we did our act of always hear it. And he said only Cohen has the same dia. I think it's a great idea I think we should do it. Danniella to need to do it. I say. Million dollar and by the time it was ill Jose did it was easily one of the two million dollars I forgot. I forgo is exactly what it was but it was something like that because that I cycle is about a quarter million dollar you. And I thought for people. And then and. Revealed a week. It told me it was. It was opposed to a million dollars bill for you. And

then he say to me. The only I know your good friend. And you will get all three Bob would you rather get the money from Bob. Oh oh. I can give you the victory. And I suppose. It was all right. And it it's all books and. Any go and we go it is money it took a while because it wasn't stoic the for Bob and Bob is another will live for the money. It took a while but we got it in this program was the part of the system that we be that you thought it would we need any wind. TO IT TO DO list of contact database of corn titles. Look for that. If we didn't find it difficult our tools it know how to ask those can talk to those going to find a new wing. Days in a storm. One that was a problem that hour to hour. After Bush routing our thanks. And there was not no way in the US to make them. Distinguish easy. And someone came with that idea was it ethical after every system called I have. If identify for info is these are mute your days at that other aircraft is friends and you don't shoot it. Because you should go from the distance. You know. And so they do put I.F.'s on tanks. And they could not be in the I.F.'s because there was a part that was out of production. And they looked over political and find it as ask our system. To find it in our see sense in which in founding new up some oil. So chain of conductor is a good part and a God I have and they saved. Done that and we go to an isolated before the bombing of defense. THANK YOU THANK YOU us for our help. And this it was older and happened because Greg. Thought it was a great idea to have organized it. Today. Don't think about Congress is done without computers. You go to Amazon if they don't find it they know that of the rope and they tell you it will find. What. Question or. Action. Why. By that. But before they let me let me add something to the previous another example. Well it was the pub before the Internet. But it was of. That I notice that it I.S.I. We head. About eight posts. Three or four. When. When do computers. That Isiah head. And then there was one that went to U.C.L.A.. One when we went away in one rental can take one into U.S.C.. So we have about it and they cost about eighty thousand dollars a month. Charge by the two arpa. And I say you know it's take one import connected to a computer to the computer or have them. Several he said in a good Nixon. And they connect them to do you want connection. And we have a local area near the local as it were a recorded. I forgot the board they were there with my family. Until we came to replace one. One bought it cost you eighty. Of the lot of money meant to put it is ahead of some other thing. We think we think about you know you do one of mine. I called a boat. Mark ported. We we talked about it. And I say you say you know like six or six or seven hundred thousand dollars a month. And the US military discourse. I gave you the generic number of million dollars. And he say. You get it. You get it I can do that and we start doing it and it is became the. What did we called it The Last Night us last night. This became last night or so that our son Janice area. And then in the Strand Diego. They build another one called the call itself laid. In in. Any cause. Indeed note. Mark you did not take it to a committee. We are that you spend. Million dollars on by the equipment. A lot of you are in the we bought the the the sale of the scope boxes. We need. Cisco boxes for that. And I think we go to something I see is going on the five. We have little fiend gains. Is a use for. Number one in the most. Number two and easy. We started doing it any different with fast. And I favor generic Million Dollar is Bob Taylor. When he weighed to our part of the rectal it was present in that very few are much of the news a million dollars. It seems as if upper did not know about smaller the changes in the. So those are examples of ideas

it came from the contract will last to our power. And after I did not a great idea but we don't give out any speed. They didn't of say this is so it was a good idea. Therefore let's do it is easy very different than it was. We any safe. For example at N.S.A. if the ideas came from any safe. To Zyklon to hard to say really. We want to welcome such and such. There. Most of the times ideas whether or not it's good this. They could be all there were good but and they save as two new Intel nine in discussion is in. Risk us and in and out of humans and the Green made out with Divide the little budget. And it was a long time before you go to answer for the calling out of power and getting until we've seen. Online. Oh we've seen a week. Was on things that was unique to our power. I'm sure because our nation of if a out of. But that's why they go to do to get to. Follow. That fun. Yeah. So he. This thing is there are persist in Will. Because Arthur had a very good project Paga majors. And a Pogo managers. Well. Scientifically technically very good. And we're really do. We see today Cleese Apple has already scored. Are the least Kiper. But an imperial. But it but in in reality most the most forgotten Angela do not want to to have failures. The those vehicles will always talk about it if you don't have a look you don't. Don't take enough Leask which. What I told make you do you tell people who listen to ski. If you don't for. We denote. Extend try how you could do better. But you join me in most places they square not people did not like to take a risk that I could talk about it. ARPA was willing to take this hour by very very few failures. Speech understanding in my opinion was not a great success it was. It was expected to be with her it was a failure not I don't want to argue about it. Another again another example. Was that I used to get the other P I of our power. Used to get one three months later it was on papers from all other our power can talk to us. Release of technically people who published this month in a to go to of them and put him in in the hallway or. And then later when I saw something that I thought could relate to eat. Help in these. The oil and look for it and it was difficult to find. So I thought if I if I could get a computer to look for it. It would be easy. Easier. But the. But the least came on paper. So my idea was to make it come in in the email. Because we knew how to do certain image. Good lives religion. Subject which was browsing. Which was but I think your browser. So I still it'd be easier to find. If we have some standard for much for that and this led to the idea of electronic libraries. So I came to Bob. With this idea. Bob thought it was a good idea. And he gave it to by and Bess and Brian Bishan ball. Decided it was the best people to do it right here with a PM working for Bill and they sought the MIT was in stand forward and seen you in Cornell and I For go to it's. I came from U.S.C. they did not think that U.S.C. was the right people to to do it properly. I was part of this school because it was my idea. And fast. The fares. For much propose for much was one that I suggested. And this became a pope apologetics that. They just developed by Philip Hill by cause and there in some other universities and anything was open to no one of the participants. And in again. It came it came for the community to a power. But many of the air earlier that. When I was still it. It helpful. Before I moved to Eisai there was an amendment. Therefore go to which for which sell a dog. A Disney Cruise a defense budget. And that all of the research done by I hope our must be. Defense oriented. When fill them in. Yes and. And we try to say that if you do graphics the OK news it is off things are blah blah blah. And I called the lottery. And in and asked him about it and Laurie. You know Don you don't understand.

I will add this stuff to your pa poser you tell me what you do. And why it is good. You know. And I will add the boiler plate for the forget about this one to them and. It's not your problem it's mine. Back in. Any here. I know. All. No no there were no dimple. Just or louder minds or will project like the simulation. In the seen it. Which was practically a computer video game between tense and it was used for training in it was the use of this use for training. Think Amanda has for over working together with each other here and now to attack. It was not the mechanics of that I mean is it thanks. But it was not raining to drive a tank but it. The need to operate. That X. is about us and it was very successful program that Craig's feed. Forms are other of is the in this was meter The oriented. But it was not imposing. It was be to solve this militantly public. Yeah. You know. Right. It was him it was was the would be Zionism. To fold. To address this problem and allow the first computer game. The kind of computer games. That most popular. All over there were plenty plenty. It is really came to see. Oh. First. Oh. No. Yeah. This one was done. I think would be been an Essene better thousand and was involved in it. But unlike my seeing. That was the lead time flying. This was else Africans or. We even though it is a dime is not all. It is not. Will Die much. Divinities said a second though to make a difference. That which makes in the fight. A second of two. He's no longer time in the IT IS. We leave the. It's fast real time. This was the. Slope with dime and. The real note in the picture that you sells the images you sell. What a two dimensional on it midges of a map and daughter. Moving on it with Labor's. Will the thing that I did was to our flying in your hand on a stick and started. And you lose a gust in is the speed of. Now. One. You know. I will I was loosing recently. Dimitry least scribe. This guy my mode of operation is to get other people to do. Any say this is not only that I make every work for me. Doing where I made him. Was my boss. The LOT of where for example. Because of me. He changed from being the director of sun lab to be the director of the OP war Jack that we were running. I think that I very good in the. Then again thing for getting other people to do to do. The only power minute we have to define who does what he or she would get into Usually we start. Start Porgie it by thinking what I want to protect to do in order of the main the main component of it when for example when we started Moses. I thought would be the user interface with the use of should define what it would be our interface with for political change and I was the mask. Making out of this. Oh no this was the Poles the ballroom that we did a size four vocal occasion of we listen I cheat. Use those in various universities that are sending a detailed design of that of a cheap. And we did what it. What it really was is required to make it into real cheap what is required is to make masks and must not ask for any religious I used to be something like eight. Masks. To date can be twenty or forty. Because there are many many more layers. And in those masks are given to fabrication How's that use them to make it cheaper. To make way for others and their way they have to be diced and they die and then needle dies they have to be mounted on some carrier and wired such that the contacts are available outside. To the roots of Legion. It is states that have to be done in order to get even produce produce chips. So when. When we started Moses assessing was the scene with of the big part of it in the middle parts are getting ready dying checking it it is reasonable. Which is illegal. And they comply with all the old city. Jews then convert it into mosques are to check the quality of the masks. They

decided to call act in the very small sizes like Michael. To make sure that the lines out of the right size. In then. That the accepted. And meeting with the requirement for the shipment. Me now to cut out to die for their way fail in out to bind it to carriers in how to check that everything is OK. You know. And then the evil in the back to the user. They will do the use a design during the project in isolation. With no relation to other it was an hour or two weeks out to two goopy them. And wayfarers. We invent. We invented. Way fails with chips of different sizes. Going in the same or the change of the same size on every film. And this was just shot. Challenging until you found very signature Russian do it. Yeah. So the feel thing was many. Me plus one or two people that I thought understand. The Jews and us to understand. The the detail in the component of Alias I know better than I do. Because I was very limited in my understanding. My Elvis is alive doesn't everything was about in the entire system. What of the Met major component. Sort of the interface between them and then look into each its state its components in our interact. So we will be particularly top down. We started the top and then new in the Daily look into it and you will hear what we need to buy from the outside what we can lower sales and earnings and eventually we'll get to the point that people can start doing. Doing their will on February the. And then test it with each other and issue. My idea I do find to find people found and I found the middle class I sometime we have to bring in from outside. Oh. We think why have very early reporting. I required reporting or if I had to submit a report. Then I would ask my people to like their part and I had to give up at the No two really I don't think old complaining about our passing me seeing it in need of need and usually the ripple the support was in. When I was talking with Bob. Or the other program managers all night long welcome but Internet was is bogus. Mainly with Bob living. We really saw it was. We thought of our program ages. The main of them was born or slipping. About whom I owned something. And most of the poting was down by talking in very neat. You use this you. Forward. Now and it is between aware and in the garbage. The about as. Verily verbalise was needed. Because I was lucky it will restore the managers that scared of the Nor was it the right things will happen. I was out of then. I think it bodes. You know about borders of unreal like to tell you that. It came it came to a at last fall and from an N.S.A. poorer mostly been. It was a were a he came to our power phone Many say to one village Siple because he was in New York about really size this was is area. Very technical in the detail. And much more than either unusual. Manager. And one time. I follow I join the visits in this group it in a say in then tile globe of about twenty people came around. And he was telling them a little about our life in our Up there any. It told him. The funny or interesting thing about our power to get operatives or contract or do you want. And they argue. Don't accept what you say. As a hurry the is. This is unlike any say when they were in the program manager then you can try to or to do with them not to say yes. I don't know. Yeah I say knew better listen to the those contract it was up and drive to ALL BECAUSE OF AND dozen other than you and have better ideas in your job is that Apple is no to argue with them. But to get the best best out of it. The HIMYM main difference between ARPA and most other. The only going to the shops that are going to arrive those of are is still to to. If you want to be smart in no in no or to do in how to do it. And you choose it. The best people for forcible bridges. If every the best example. Then a safe way of working. Opened. Exactly

even end of requests for proposals is the time it was be able or the agency announcement later and used to be our R.F.P. aggress hope was an N.S.A. N.S.A. if told. Told the community what they won't. And the community send in both poses. The proposer will peer reviewed the playfield by competitors. For the same. Because if you're not good if you'll note. If your appeal. Then you were looking the same area and then you are a competitor will. So the oil bubble idea of peer reviewing for we said in their ideas could not be paid and Dean. The idea is defined bit. So then to make things we have a blog a Pogo is with more to give like fifty thousand dollars. Or like one main to do something. And if you want something really done you need to find several Go bother doing a say in the if was involved. When they went into Centive the full go to the good with the excellent scent of accidentals on something like that but it was. It was built for the small pieces because N.S.A. A safe was not designed to use big overwhelmed but we saw pogroms up over his big fall. Ball. At. Oh. Yeah. Voisin heard it all but speech pogrom. About eight eight different contrive to like you this speech for them. Every three months that we had a meeting or saw the son of a serial six months ahead meetings. The important thing about those meetings with in the winter we had meetings it youth or even after they go to what was or do about of the program with event a uniter. And it is something to the ballgame was called N.S.C. for needed secure communication. When Edward spiritual portion or network. Ski was clubbed. In is these meeting. We will vary call the rating because we were working with the same project in the same god. So we are trying to help each other and when people in the sky board they do a lot of the conductor saying I'll bite if you will didn't intend on doing they did this will it will be easier for us all begin three billion little bit a day to give you. If we do it this way. And we will go up with a game with a not competing will or will this in goal of getting this is into. When we did Moses. Reveal. We have meeting vividly. Again. So lead to six months. And you were trying to help each other there were some competition for example or. Was I still stand for the meat course it's all in your own Nic. Leading in Berkeley. We. They've been of so indeed Leask and CMU the P S E C store league. That. But the Patterson. In badly and H. stick on the D.S. is the Sony. You a whatever he scored the slides competing by the very high. I live in but most in Jim Clark indeed. The geometry engine and. In there was a god and all of them talk with me to make sure that weekend weekend. Would use a cheap new we have to tell them about design a little bit later to change or some of those out of information exchange is a meetings that are not management meeting but devotee very technical. But. It's a little technical the the real the the I live in. The caves as in phone. In on time to time you told other people that maybe there is something that you do that you know about us all. We we do that can help you. But the different a degree going to exchange was much smaller little compared to is poor Jack's to watch of meetings. The technique and the technical meeting. Book he told more than twenty. Be a meeting the general be I'm eating in the world maybe fifty people. It places places like MIT or saying Ford or I.S.I. or CMU or of or of these places have at least ten different up apologist. Were able to send it by a line or two people in the really high level be that. Little not necessarily up to date on or is in the days. So that an orthogonal of a lot. System design is. Where as is a technical meetings a little Pogo mills. He was. You know I signed started by Keith and given or left with you I'm going to assign sickle.



Because it could not get things done it went. So we're running against the PL is the ceiling. And this is such that in order to make the computer science GO BIG it. Rand. You had you had to cut some other pieces of land which was a big war. And no no one was interested in it so he said the great idea I'll stay he's a girl and start. In start a book called girl dies at insitu the other smart thing that gives the was to make it part of the of university. And he chose a private university. As out of hand is a state university. Take most like U.C.L.A. a lot of badly. Is easily out in the sway you could get us about development index and expansion. Within our was always seen days out of a new vien month. So I say started as a very independent. But I'm sure of you a see in the seventeen miles between downtown Ville U.S.C. was in there knowing how their eyes I will is was really helpful to separate us all. Or is a. Or this reaches university you have like into the pot main arguments who does lot in would would be dong still hold me. So he would. Yeah. Keith or the very nature. Very well Nate weird in the was one of the people who started a fix them American Federation of invalid imposing system or something like that and he was going to meet technical I'm sure listing he got it one stage but he noted like Paul Graham's or design. So Lucian. Technical problems for a long time. But he know where to find follow me everywhere and to find people who can. Well concealed weapons. And. We were getting in and save it. If you is a thing Neal behind time saving selling technologies are generally will twenty years behind time so he said their vote is the Air Force move forward is computing. Without team but I to be writing programs or designing systems. But know how to connect to connect to home which was necessary to stuff pogroms in in to get in to get him working in all. We've diamond in the US. How many years ago. Ed do it a few more years and he left I assign moves enjoin Bob is C.N.N. I is in dealing bill here and there and appreciate knowing all the. The law is all of this. Oh yeah. It was is a via that the up up all. Office will be part of Zeiss Ikon puting center. And in the butt in a full duplex tell me not winnable gonna git it out by touch the lead to a wins a key set a way into the computer or it outta all those are open it to Eisai will simple gov Arnie. Echoing the lead there is a bogus manager with IP So Evan visqueen would sound crazy that time but it's very very aware. And our poll of is was part of the I.S.I. computing environment which was a great said. Boy still I.S.I. and his are both of us. Oh oh. Oh. While because when Bob can start in the village life or gone. If so what what was the first thing that you would need in order or do it in need lethal. Any Go to do the conclusion that he would need many contractors to welcome it. So therefore they should become better but he should use the same software. So you don't have to use to Paul Graham. Solution to the same problem differently in different. Sized So therefore. And then he chose. Unix. To be. This environment. You're an example of leo's so billygoat to be developed B.S.D. belly. What is what is the best this is what they have here. And it was done I think in order to support the ball VI environment for the release I community and others of it is like community use the same. Same programs in the same for much. In the or the files wherein. You know that he forgot. No one knows it was the graphic PAUL McGEOUGH It's vulgar me. I can very well for a full go to. And there was a lot of very easy. And any bells he did not of design tools. Isn't our community used. From time to time some people in the community. Like Chuck size. Developed a bit a little bit better ballgowns like Chuck develop programs that allow you to make lined. Be not only the

bling the to each other no always under Invertigo but also arcs. Which is it important to get used to induce the. With everything is the lesser properties. It would leave a will. The inductance. Inductance. But Jack was only one of using it and in the better this is then develops. Develop faster because many people use it used in many people he changed the law been involved it. So Chuck finally Joe and so is indeed. This was something that up understood that in order to get it to get some focus on the community. The first thing you need is in the Internet being able to interchange of them with ability because in the different instance. This is part of the motivation for the entire internet it is be able to Sheryl. Programs in data. You can. I apologize for being too egocentric and describe everything from my point of view it is if I was the only person will contribute abs. Which was not the case. But we we noticed. Very early that the the three heads in a voice with real time issues which were not. It's important for other programs. If US step in you send their side in this I live two seconds later. No one cares. You know I notice it. On the other hand if one beaches along. The site is where he will face a life or just a voice is everything we know is you know you the signal is OK. There is any out there is no is always in the signal because it dark passed by. So I want to close the door. Someone coughed into. So he's always knowing that you. But you don't like delays from interactive speed. So we were. We started complaining about it in vain. Invited me to an internet meeting. To explain our ballgames. So I came there in and explain our problems and. In this illusion that we suggested. I said I managed to convince the. Our poll is a different. That we have different. Well being but they are related and we have to solve them together. How to sew lead which was basically a separation of IP from D.C.P. talked about two years of arguments that. That I wanted to separate issues. Issues. Intervened in Vince or that maybe we don't have to begin doing lately of those ilks people in the MIT people joining them. Joined me. And also pushed to of the separation it took some time. Do good feel in the any changes. It changes the nature of the order of the Internet. The Internet was designed basically to do F.T.P. Internet. Both of them can take the Lays in timeliness is not that important. Would know what was important was perverse and I believe we did not need that of its reliability but we need. So was a triangle that was supposed to describe it too bad we don't have a piece of paper. I know. Vint suggested that I would join the internet go. Dilip a look at present this ball games because even though we didn't agree with nice solution is reduce the the problem that we have the problem. So we became part of the Internet. If effort and. Today most of the traffic on the Internet is is traffic that is real time. Note not necessarily I read I be too indifferent were to say. We separate the Our solution was to split the C.P. into D.C.P. and IP and everything which needed IP. But no to C.P. is done by U.D.P. you dippy means notice it. No reliability. And most of that Africans Internet today. Is U.D.P. notice it. Right. The filters in that line there I get it when I was a lawyer or built in I was very going for a consulting company that. Paul Graham for Laurie all billeted legal. And now you all belittle or go to a mammal. About about G.S. coordinates and the euro teach in a very there's style is no one is allowed all but styled. And particularly no one except love and goodness of standing. In the the other company that I joined in said You're much. Your other student. So you should be able to understand the things already. So I already. And it came back and say there are seven mistakes here and there

is a good job. Which is all. So there was a problem because they didn't know there that go to live in the daily with it. So they asked me if I will be willing to do that being math student me that if you post something it is that I know metal with a boat so I went to love His showed him to most of them little will try put it lightly already. Already know about. One of them with the mistakes and when we stick by the mistake. And the goods are shit was longer the dissembled counterexample. And we know he looked at the it didn't jump up and down. Made me sick finally someone to resist it when one of my FIL to ask it. It Howard late it was to explain to I. I've been teach that stuff. So this is Deepika and. Laurie and the big I'LL BUY had sex that I disagree with was not person on. It was I'll do we get it forward. APOLLODORUS it I remember I remember only the cases where I was a light. Many other cases but I am from my memory. Intentionally or note. When I came to win a game to have over the. I was it then went and made the student and the invention very rare Slater told me about Ivan's loss and I thought I was very interested in Gaza if you want to take it. So I went I went to Harvard which you could take a class. Them eighty. And I did not understand. Procedure that the whole is ill to be meted to the class by inferior because they wanted to keep it in a world class. I didn't understand that you have to be admitted. So I came to this house with a who that was supposed to be only to the people who admitted. In the with a very funny exchange between I've been in me because I did not understand the system it all. So I haven't said why don't you come to motor my office and we'll talk about it so I mean first question was What did you do in graphic when you know about it. To admit it's like simulation. Which is three D.. Three times leaping. I've managed to do it in sketch bit. So I was very interested to Album of the later. We had a designer to do it in How to hear any imposes software that I have. And I've been saying I'm going to be to build a system. Because I've been know that he can get money from Washington. It was not from our public and he just came from our part. But it was again the style. We started in conflict. I mean and I do all the data that was apologetic. To be done in the ball. It took a year or two to believe that Harvard and then they moved it to you the in the company and you would I continue. This was would have been Sutherland started with. So I am of the big arguments. We have been getting rid of with with bogus managers in there one of them was with The Last Airbender when he just came. And I was learning Moses. He told me that you want to know exactly. So some detail about something. And I said don't bother with do is lie to be tested. We know that it is right. And he say no I want exactly. So we are you ill obviously did not get what you wanted. But it was convinced it was not needed. I had some other big arguments and what they wanted a member I WARN I don't remember the other one of the ones but it was not their relationship that. That I was told by our about what to do and how to do it and who should do it. I had free them to I need both technically me technically the way I thought was right. Lets you do that with you but only don't remember them. Was it was really you do that already know do know would love doing and you really want to do it to executed as out in a cloud your outing rather than being at the server you go down than up and down and up just stating that living it and really don't remember much of it. Much of they did it and who did wrote in order will the challenge. Round. So let's keep this question. That was. Because of in again. Example of a sort of computer scientists in Orsha of university Kansas. It turns out that people who

don't leave uses in the state. Don't realize that ocean view. You know they pick and name two places in kinda. And seeing that. Or even under the name of a vessel when again. Usually some thirty regarding the some of the mother tongue in cheek and think it should never be taken too seriously. There was a paper about AI that I wrote that is it in about it or send it to an AI conference in this day and it passed peer to peer review and was accepted what was in the Asian. After the this convoy and that was fitting the published some Porthos away in England for Messick University. Shows. It shows this paper. To be included in the book that you wrote about a soft on ingenuity. Without noticing that it was all sudden. And without noticing that that. Can the US and ocean view. Well not exactly. Seeing this is expected to go to Israel. I was on the net with the will. When you do you do go overboard with a friendly game. You find several have a whole fairly good. And I'm expecting one day to get. So some of him to contact me. Well she went with the name forward. Little bit. You know in the musical signs in most go their way over to the to big star choose one Start Your easier for people who invented or a deal. According to the shins and the other the other Start your Which is big you. Is of chicle when Venter invented purple. I invented. Purveyors of meaning. You get me going. So yes. I was right. I write. Culch. Yeah book a book called You know that I see you about Apple did a lot. Is mostly the things that Lovey started. Bob continued in vain. Joined that or those silly technically the shop. People. There are the few people like that is a country. So government is a country are lucky to have Xin to have them in government service. Usually you don't get people like that into government is an example. In the end it. It was those akin to the usual Kentucky talk book you meant. Culture of the government. It is ideas are coming. Even home from Kentucky to which most of them are university or signed on to a scientist and sound of them come from our PA is the Internet and the the Internet and there is the best example of him. It started with a few. Maybe five to ten contract talks. So I can. Did a development. And then it explained to the point that everyone is on the Internet now and maybe don't remember that seas would be different. So you deny. V.L.S.I. changed is a country or to the Internet could not be as much. Now if you go isn't for the village sigh. Progress. The physical part of the various I was mainly down by contract so. Like entailed in the AIM The There are no no not in universities but with big university help. But if you paid in with his private companies. Yes. Of our head. In But if you paid in many many see in many other things for example in X. or an example. Baldly. In it is a corporation Russell then computation Council. Is to put it with great participation by the condemning. Organisation in the city than of the search. Organisations. So it was in the film and then even N.S.A. or in our in our home. Government research organisation and indeed succeeded. It with and luckily it isn't always in twenty years since often eat or seems so. Or the violations of that if we are was full of our vulnerability you. Before we should be forgiven by the. I was really wish we could lose someone or need to was done and then it does you know cheat. But that's but there's always be somewhere in the east of or the techno or give it up a bush in any doubts for through is a note. Not Stein shelling. Because damaging wind on the million by by B.B. and I am eighteen B.B. and then by people I mean ski and they make out the end. In the world as a tool. I forgot. But. But gruff is a God speaks to the done. Or this global mean if a. The graphics was done in pushed by Ivan. Some of them

land. It was not. Up of funding at the time it was MIT funding good it was the speech of the. In the budget was it was part of the up a community or these life any influence did it or people here really started to pull their IP deep or go. Yeah. Laney's is the same. Same class of the of inventing. But Baggett's imaging in the speech the them eighty. And then or of it went into Up up. Laurie. Laurie the same. The same thing to airlift found their of the article munity of the out of the council. And then. And then take it then timesharing it or for being developed by these movies got cut got you know. And then it or the AI. Is part of the feet in the main. It is. In somehow. And can thing about of in this program that if a case in for example was on he did not succeed. As expected simulations. With the with that it was a link to lead sixteen relation ship see Malaysian will cease and simulation. That even main designed Dural for an extra Monique's now and David Ridgen the cheaper we did in big system design to computer and he didn't design. And more were no way for family that it will come to a country called the mike now which is statement about my men or women or them but the communities. Yes. In our vowed we had in the great gulf existed that I've been put to give it or it was a P.D.P. one with four displays around. Cabinet. Ridge which did what my first do nowadays when Tom Ridge was the already know. It was too expensive. And some other things. It was a fantastic. Graphics in charge assistance. It was the only place that I could fly in my life and my flight simulator. We should be Windows or forward into sideways and the. And in we in order student. To go to some time a location that we could. We when we could use this system. And it was easy to get time it night. Lady at night. Then in the evening or during the day. And it was used by over the student in mind old person that know no one knew we was. Yeah. Then turns out you name was. J.C. out leak ideal of a thought there might be. And enough to use our system so I've been told You can use it like any other student. So it was good safety Mike stalker look to for croquet him. Any hand. So this was my introduction. It's all the action to do legally deal. Even when I moved to. When I moved to Harvard which is sixty seven. And I. Lots of discussions. With He isn't just did. It suggested a million that I moved from all over the limit the be part of four ject Mark. Paul is marked with at the time running by second this is one of the. One of the names of the four people who need timesharing it was you know. They did not do the original time surely it was in error Force pilot. Ne Ne Ne was assigned to a mighty simple Gmail. He sat it to speak with I to sleep in I come to an E. major notes of money in the east a the MIT a kind of evil within. And it will it was it that I kill for Jack market design. So I So the idea was that I bring my flight simulation. To MIT and we knew some voters there around it. And he said yes said to me all about if we buy a big teen and put computers in each of them good or helping to be a good. Only seen it you could. It was small enough. And you read Paul Graham's a instruments or divil something. Some idea that the Havens I may get the aid. And he said yesterday I start a company think out annoying when I say Donny. You don't want to do it goes on to do it with him. Because it is it is like would be in bed. A way in the goldfish. He can tell and that are around and crush you without you understanding what happened on oil would. It was a multimillionaire admit I am. He could buy an able play and it was to all kind of sync for me by Hope it was beyond. With it. I did know that you know I do you know enjoying him in the I never this never decide if it was good obeyed. Choice. But Zoe legally do legally deal suggest it

is a joint project knock. And you think go and talk to me this was his name and he said don't talk about the opening. Because if you do if you talk about Elvis it. We never talk about any CA enjoy enough I mention that if you relate to any media jumped on it in two albums the deal. We decided to sell this company that we did not start. But legally there was a light I was the entire meeting was about able to fix it and I did a lot of action was with a legal aid you. Ordered this thing is the thing had come out of it. That out about well that we've either government. In a way that the government. As a government should know and we're not supposed to or the F.A.A. hours. And it took many years. It took many of to where it was a governmental We're live there. When I think government I don't mean the White House. I mean Congress so that. He said it's you you. But you buy the synergy different and different way than you buy needs and months and amendment was pushing it to side. In of the ash in the response. GAME OF THE be a thing which left. Which the government could do Boyd agency announced it is saying we are interested in a wholly know Jake. And if you have any idea why it is already or your invited to others and specify exactly what it is and. And I'm not it again if you live in a in a Dia. You have to sell it fails for a beer. The other thing is it. And I don't know how to do it politely. They kindly be able to people in it up are today. IS NO TO CLOSE TO DO is a DO is a lovely. Bulb. Been so was none other than his Sikhs made out of from different kings and queens as I see you in and those got is a Full of you have and. The fact you know the. Your made the news and your made that is collections in Ukraine. Sawin. If you will and he is a portable one in navies. No to do. But the be paid with condemn me here. Oh it is a war profession on standing. So that Arthur does notice today. Oh boy. Now does not he's all N.S.A. If that's not his N.S.A. fade. A God and been and this was. Don't continue. A billion dollars. But as it were in the scouting the holy. But maybe maybe was. I don't think. But all in are in any safe. Into these army signed. Borders housing exit which Same it. Said of a year was in touch with the invited me to Joey. But those not interesting in the. Science void. Always working on podium in the Army has our part will join technology. So it somehow me feel chill. Systems. And you know not looking. Is in the air field. But looking so Dick no duty. If our feet. I don't know what is going to be ocean of our poll was to the communication technology. Like you are you in England beat started. And doing in it do you know or overseer the world. One of those things. V.L.S.I. mentally new variable as memorably as up we're going to be in software was. And I'll buy the flooring and Reno. In the question is how do you make the either. To be like our positive in making up or be like. Indicators it is to good people and people who don't have necessarily to be to see it in life you don't fix it in to it in get useful when you know. And you don't have to get a paycheck from to government. They can do it. So some other arrangement. Like like you for example. Thank you very much. Well most welcome.