Interview of John Day

Interviewed by:
James L. Pelkey

Recorded July 11, 1988
Canton, MA

CHM Reference number: X5671.2010

John Day: We were discussing the organization, and dealing with high uncertainty environments. I think that the way we've done the architecture, first doing an architecture as a general framework to coordinate the work and allow it to go forward in parallel, and then refining that to service definitions to protocols, and then for people to go off and do implementations is a nice way of 'concretization' of abstract concepts, so that you can actually manage a high uncertainty project with some idea that -- of essentially rat-hole recognition early on -- you have a framework, you can see where the critical areas are, you have a way of measuring when you've run down a rat-hole and it's time to back out, you have a way of [knowing] how it's all supposed to fit together, rather than, when you're always dealing with the bottom level of implementation, implementation, implementation. It seems that humans, to some extent, deal better with abstract problems when they can objectify them -- make them look real. In a sense, what you do with an architecture -- at least my concept of it -- is that you provide that concretization, i.e. in abstract terms. You talk about entities and layers and SAPs [Service Access Points] and all the other garbage, and that allows you some things to manipulate while you are thinking about things at this abstract level, before you start refining them down. It also keeps you from making this mistake we were talking about, with respect to the garbage can model, that you don't start trying to make too detailed decisions at too high a level, and it gives you a way of managing that whole process all the way down.

James Pelkey: In the case of OSI, where do you think that concept came from, of managing the project that way, or looking at the world that way, and leading to this model concept, which I understand was relatively unique?

Day: It is relatively unique, and it has remained unique, which is kind of peculiar. Different people may have different ideas. A lot of it came out of the fact that Charlie brought in the seven-layer model from the database world.

Pelkey: Charlie?

Day: Bachman. He was the first chair of SC16. Charlie was very much --

Pelkey: First chair of the?

Day: SC16, which is the original OSI committee. Charlie was --

Pelkey: What year was this?

Day: 1978, March. Now Charlie was a big proponent of the conceptual schema approach to doing databases, which required -- essentially, that the conceptual schema is an abstract model of the enterprise. That led to the modeling, although I don't think, at the time, any of us really realized how that worked as a management tool. It was a technical description tool. It allowed you to do some, essentially, prototyping stuff. I know Charlie, at the time, was doing some prototyping through a language that he had implemented -- his conceptual schema of stuff, or a variation thereof. It probably wasn't a truly conceptual schema as they would think of it, but at least there were some tools being played with there. I didn't really understand the management aspect of it until I ran into the garbage can model [Cohen and March, 1972], and it all sort of began to gel. Of course, I had already run into Kuhn and Fleck and other things, and that approach to science as encompassing a model had gelled fairly well. It's always been something I've been digging into, and as I said, in the early days of OSI, it was real apparent that we had the wire-stringer telephone types, versus the networking types, and there was a real difference of approach, and of perspective on the problem, which really led to a lot of the arguments and a lot of the debate over the network transport boundary and all of that.

Pelkey: Could you go back in the course of our conversation and bring me current.

Day: Yeah, let's go back to the original question about how the ARPANET sort of diverged off from --

Pelkey: First, why don't you briefly discuss your background?

Day: My background was with the ARPANET. I was at the University of Illinois as a grad student, had been involved in the ILIAC IV project, and when ILIAC IV was going to go to California --

Pelkey: What year was this?

Day: 1970, '71, somewhere in there. One of the things going on at the research facility was that we were going to be on the ARPANET, and we chose not to use a TIP, because it really constrained how you could attach devices, the kinds of devices you could attach and everything, so we built our own little terminal access facility. It was a small host, based on a PDP-11/20, and we started getting involved, and being part of the Network Working Group and the design of the protocols and all that sort of stuff.

Pelkey: And you personally got involved in this?

Day: Yeah. There were basically three or four of us in a core group there, and others later. Two of us were primarily involved with the ARPANET at large and protocol design and that sort of thing.

Pelkey: Who was the other gentleman?

Day: Gary Grossman, who is still in Champaign. Along about '73, '74, somewhere in there, we had this Network Working Group, we had the RFC's coming out, circulating through the network and all this sort of stuff --

Pelkey: This is when Jon Postel, was he the custodian of them at that point or was Crocker still doing it?

Day: No, the RFC's were being handled by the Network Information Center, and anyone could write one an send it out, and it just got deposited at SRI, and you could retrieve them from there, or whatever, and they performed -- there was no central person in charge of it just yet. Postel was very much active and doing a lot of good stuff, and we were all working on figuring out how to do these protocols. Basically, the ARPANET protocols, the upper layer protocols, got frozen in about 1973 when ARPA decided that the ARPANET was "finished," and they weren't going to sponsor that anymore. At that point, we had sort of decided, at least within the Network Working Group -- and I know several conversation with people I had -- that while we sort of had gotten the first cut and we were much better on our way to understanding the problem of virtual terminal, file transfer, virtual file system sort of problems, and now we should sort of go back and think about how we wanted it to really look. At that point, ARPA cut off funding for all of the upper layer stuff, so basically we still had the same upper layer protocols in the ARPANET that existed in 1973. There have been no major changes to any of them.

Pelkey: Well, if I understand, Vint Cerf, at Stanford, picked up what was the host-to-host protocol --

Day: We're getting to that. We're getting to that. Upper layers are not transport.

Pelkey: Oh, ok, right. One specific question; did you go to the scenarios in '72, in Washington, D.C., where they demonstrated the ARPANET?

Day: No. Of that was the ICCC meeting?

Pelkey: Right.

Day: No, I remember that. Anyway, at about this time, all this stuff is going on. There's a lot of activity. They started trying to include some international stuff, because by this time, the NPL-NET was up and running and doing things; CYCLADES as coming along and being very active, and informally, there was this international Network Working Group formed --

Pelkey: By Vint Cerf?

Day: By Vint, and that was -- and I'm not sure if it was first formed as sort of an ARPA thing and then became IFIPS 6.1, or exactly what the order of that was, but it eventually started meeting as IFIPS 6.1.

Pelkey: IFIPS is part of what body.

Day: As far as I know, it's an independent body. It's the International Federation of Information Processing Societies, and as far as I know, it's a stand-alone international body. So the International Network Working Group was set us as IFIPS Working Group 6.1, and we would meet primarily at conferences like ICCC, or IFIPS Congress, some congress where we knew we'd all end up, and as I remember it, the three major things that, by '75, '76 that were really being worked on were a transport protocol -- an internetworking transport protocol --

Pelkey: Are those two issues?

Day: No, the international transport protocol for internetworking, a virtual terminal protocol, and formal description techniques.

Pelkey: There was TCP, and at one point there was no IP.

Day: Right. Now, in '74, Cerf and Kahn proposed the original TCP, which contained no IP, and I think it was about '76, '77 that they made the split, when they realized that they needed to separate it for security reasons and various other reasons -- to make the split -- but at this time, TCP was still very much a research project, and sort of coming along. People were playing with it and finding bugs in it and deadlocks, and figuring things out. Meanwhile, there was this debate going on within IFIPS 6.1 on this transport protocol. Now, at the same time, the whole X.25 debate had surfaced, and in essence, this group found out about the X.25 thing late. Of course, Louis was one of the big opponents of X.25 and warning the world of the problems of X.25.

Pelkey: This is the connection versus connectionless debate?

Day: Not so much that. I think the real concern with respect to X.25 was -- the real fear was that the PTTs were going to try to take over the computer industry in Europe. Without a Carterphone decision in Europe, the argument was going to be made that the only terminals you could connect to their network were their terminals, i.e. their host computers, and no one was really hot for that idea. Yeah, the connectionless-connection oriented debate gets brought into that, and primarily that was generated to some extent by the political problems between INRIA and the PTT, and that CYCLADES was, to some extent, a big embarrassment for the PTT, because they had built a packet switch network, and the PTT had failed, to that point.

Pelkey: And INRIA -- what kind of a body was that?

Day: And this time it's IRIA, not INRIA, but IRIA went through a -- and you'll have to check with the French on this -- it's essentially a research arm of the government, not associated with the PTT. I don't know where it reports into -- like Commerce or where -- so it's more of a separated -- more doing just computer science research --

Pelkey: And then how does CNet --

Day: As I understand, CNet is the Bell Labs of the French PTT. So, in a sense, the way that the PTTs ended up responding to that was by, at the end of the project, hiring most of the key people from CYCLADES to work on it. Still, they had gone and -- really, the virtual circuit thing is really a problem of paradigm shift. I mean, the phone companies had to see everything as a circuit.

Pelkey: Now going back to this period of time of '74, '75, where you were noting that the X.25 debate was going on --

Day: The X.25 debate was going on in one corner --

Pelkey: And IFIPS was going on --

Day: IFIPS was going on, and then TCP was developing, but you also had the European networks; NPL, EIN, CYCLADES were being built, and the French and, to some extent the Europeans in general, were proposing a somewhat different transport protocol, and they were pushing for the idea that whatever transport protocol you had, had to operate equally well over both a connectionless and a connection-oriented environment. They were being much more pragmatic than the US was in saying: "Look, we've tried to stop X.25, we've tried to make some modifications. We haven't had a whole lot of success" because, at this point, none of the people were connected with the PTTs, and the CCITT was not -- it was a heck of a lot more closed than it is now, and not at all susceptible to those sorts of things. If you weren't from one of the operating -- from a PTT -- nothing you said made any difference. That's changed. While CCITT is still a lot more closed and structured than ISO is, it's a lot less structured than it was ten years ago. So anyway, that debate was going on the side. Meanwhile, there was this debate within IFIPS on what the transport protocol should look like, and that came to fruition in about 1977, with the publication of INWG 96, which is the document number. INWG 96 was this proposed internet protocol, internet transport protocol, that --

Pelkey: Which came out of which body?

Day: This was out of IFIPS 6.1, and was published in a conference on protocols held in Liege, and put together by Danthine, Andre Danthine. If you haven't talked to Andre Danthine, you should. Andre is a --

Pelkey: Where is he?

Day: The University of Liege.

Pelkey: That must be in France.

Day: Belgium. Eastern Belgium.

Pelkey: Was he charged with a subcommittee?

Day: No, Andre, Louis, Donald, Derek, Vint were all the sort of kingpins -- the older generation that was involved in all of this. It was really funny; at the early OSI meetings there were two sets of people, right. There was one group that was like 45 and older, and there was another group that was like 25 to 30, and there was really nothing in between. Actually, it was more like 30 to 35. I was, at that time, one of the youngest people involved, and I was like 29 at the time -- 28, 29 -- and there was nothing in between, and essentially it was just like the old software/hardware distinction ten years before that, right? Well, in a sense, you had the same thing. There were a few guys who were the movers and shakers of the older group -- Charlie and Donald and Derek and Andre and Vint and those guys were around -- so this transport protocol -- there were a lot of very hard debates about how to do it and everything. Cerf was not at all enthralled with the idea of accommodating X.25 in any way, shape or form, and it was a complete anathema to him, and he didn't want to have anything to do with it. The Europeans, taking a much more pragmatic view, said: "You're right. Technically it's a pile of garbage -- "

Pelkey: This is because it really was a connection-oriented --

Day: Well, it's not so much that. It was poorly layered. You see, the problem was -- if you go back and read the papers at the time -- it is not an end-to-end protocol. Strictly speaking, as it was being touted in 1974, it was a DTE to DCE protocol. It only got you from there to the network, but it had these funny end-to-end side effects, and when you said: "Well, my acknowledgment tells me that it got to the network.

How do I know that it got to the other end?" The phone company's answer was: "Trust me, we never lose anything." Of course, users sort of looked at that and said: "You've got to be kidding me. You're going to expect me to believe this shit?" So that was the problem.

Pelkey: And that came about because of the fact -- from a Larry Roberts side -- (unintelligible) and the PTTs couldn't agree about the internal --

Day: Well yeah, to some extent, but you see at this time, the CCITT believed that the only thing they standardized was interfaces to networks, not how the network worked internally, so they felt constrained to only do it that way. They were also trying to expand the domain -- I mean, Louis was right. They were trying to expand the control of the networks to take in more things. In fact, if you read the ISDN stuff now they're still trying to do that, because they keep talking about internal network services, which are nothing more than end-systems that do database services or anything else, and how those differ from database services that are connected to the network, versus ones that are owned by the PTT, your guess is as good as mine. In fact, the way they ended up defining the pad actually shows this too, because -- everybody else who built small minicomputers to act as terminal concentrators to networks had viewed them as small, low-functionality hosts connected to the network. The PTTs defined the PAD [Packet Assembler/Disassembler] as being part of the network, as an interface between start/stop terminals and packet-mode terminals, and of course by doing that, they said that the PAD was part of the network and was only sold by them. Unfortunately, doing that requires that you introduce an asymmetry into your architecture. Essentially, you've got network switches, hosts talking to something that's in the network, terminal, and nothing. It doesn't balance out. In fact, I used to draw a picture which showed switches, PAD device -- like host, terminals out here, and would label the bottom half according to the ARPANET, CYCLADES view of the world, and the top half by the CCITT view of the world, and you could see how it just doesn't match up, and in fact, one view is asymmetrical, because it includes more stuff.

Pelkey: Could you reconstruct that?

Day: Sure. Well, it's actually pretty simple.

Pelkey: This is my notebook. I have everybody write in my notebook.

Day: Basically what you're doing is [drawing in notebook] switch, switch, host, host, pad, and terminal. There may be terminals here too. In the ARPANET, this is the network. In the CCITT, this is the network.[1]

Pelkey: Oh, I see, because they want to connect it up here where the terminal --

Day: Yeah, yeah, right! In that, transport runs from here to here. The host-IMP protocol is there. IP is essentially like this. It's all nice, ok. Here, X.25 goes -- well X.29 goes like this. X.25 goes like this, except it has these funny side effects. If you do it the official way -- but remember, Datapac said that it actually went to here and Telenet said they actually took it out to there, so it just gets skewed, and once you start doing that, it starts making everything else go funny.

Pelkey: You don't have compatibilities.

Day: Right, now you can't just pile things on top of each other and muck things around in a nice building block fashion. So anyway, you had this battle going on.

Pelkey: It wasn't very elegant, the X.25.

Day: The X.25 was not elegant at all, and it had --

---

[1] This picture is in Patterns in Network Architecture, and in the Lost Layer talks at www.pouzinsociety.org -JD

Pelkey: And a lot of you just didn't want to be constrained, in terms of what you were going, by --

Day: The addressing was obviously inadequate. They had allocated something like space for 100 networks in the US, you know, and everyone said: "Give me a break. This is not going to work," and the flow control was very constrained and not very flexible as you would have in TCP or any of the other ARPA things, and we had already proven that that took more buffer space, at the time, but it was this typical fixed-window flow control that they had used in HDLC, and they were just reusing the same things they had used before and hadn't really taken in to account the new world. In any case, there was this debate, and so there were multiple debates going on, and there was no unified front. You had Cerf and the Europeans having fights over the right way to do it right. You had the whole IFIPS group arguing with the PTTs over X.25 and that that wasn't the right way to do it, as well as connectionless/connection-oriented going on. In essence, Cerf lost the IFIPS Working Group 6.1 debates. The protocol came out looking very much like the CYCLADES TS protocol, and very much like what TP4 looks like today. In fact, to some extent -- actually, to a large extent -- I think that Cerf lost those debates for good reasons. TCP is not that good a protocol. We can go into all the technical reasons why that is, but it has built in inefficiencies. At that point --

Pelkey: And this INWG 96 was the old guard putting forth --

Day: The original -- no, no, it's not the old guard. It's the young Turks in Europe.

Pelkey: Ok, the young Turks in Europe.

Day: You had three different groups here. You had young Turks in the US, young Turks in Europe, and then the old guard of both places, and there were debates between the young Turks -- the young Turks were not of a single mind by any stretch of the imagination. Now some of us -- the ARPANET had one major problem. It was, and still is, exceedingly parochial.

Pelkey: In what way?

Day: If it isn't done in the ARPANET, it isn't done. You don't look at any work that wasn't done on the ARPANET.

Pelkey: In terms of intellectual contributions --

Day: An intellectual contribution to what is happening. There were just tons of people running around, arguing about things, who had never looked at the experiences of, or the requirements, that people in Europe were trying to put together. What they're users -- either the old guard or the new guard -- they had no idea of what that really --

Pelkey: In other words, it became an elitist view, where if you were part of the ARPA experience, then --

Day: Whether they were -- there was some elitism to it, but basically it was very much a closed, parochial view of the world. Now, from '70 to '72 or '73, that wasn't such a bad deal, because there really wasn't anybody else around. The trouble was after that, there was a lot of good work being done elsewhere, and you should be taking that into account. I started -- in fact; one of my reasons for getting involved in IFIPS to begin with was to get access to that work.

Pelkey: You were still at the University of Illinois.

Day: I was still at the University of Illinois, and to get a broader view of what was happening. So that's how I ended up getting connected with the Europeans, and found that a lot of their arguments made a lot of sense, that from a real world point of view, they had a lot of things that they were really concerned about legitimately. So we saw eye to eye on a lot of stuff, and that's where Zimmerman and I started building up our friendship.

Pelkey: And you say 96 came out in 1977? Do you know what month?

Day: The original paper may have been summer of '76, and was published in the conference proceedings in February of '77 I believe the document was INWG96.1 –and that's I think what the sequence of events was.

Pelkey: It sounds like that was an important document.

Day: Yeah, it was. In fact, I remember going back and looking at it a year or two ago --

Pelkey: Do you have a copy of it?

Day: Someplace.

Pelkey: I'd love a copy of it.

Day: I don't have it here. It would be at home. Somewhere, it is -- it was something like that; a meeting in London in the summer, and then that was the next February that we actually had the document published as part of this conference proceedings. It seems to me it would have had to have been '77 because it wasn't the same -- it might have been. It might have been summer of '77, winter of '78. It's hard to say. I can't remember right now. I've got a bibliography upstairs that can probably confirm that.

Pelkey: So the young Turks in Europe, and all these debates going on, all these background debates --

Day: Right.

Pelkey: -- and the young Turks of Europe put forth this concept of transport.

Day: Well, it had been going on, back and forth, for quite some time. We had all been reading TCP, and we had all been reading CYCLADES TS, and we had been debating things back and forth, and we started building this document in much the same way that standards get built anywhere, and that led to working out the debates, to this document getting put together. Like I said, that document got published; I think Cerf's name is on it, Scantlebury from the UK, and a bunch of other people. At that point, Cerf effectively dropped out. It was very, very apparent that he just quit showing up, and sort of pulled back from it. He had sort of -- it became reasonably apparent that he had lost the argument, so he was going to take his ball and go home.

Pelkey: Right.

Day: In '78, when OSI was established, March of '78 when we had that first meeting and Charlie walked in with the seven layer model, we had all been realizing that, if all this stuff was going to work, it had to be done at an international level; that communications protocols for the ARPANET, or for EIN, wasn't sufficient. Everybody had to do it the same way or it wasn't going to be worth anything, so that's what we had been pushing for in out own little way. I wasn't aware of the ISO stuff all that much. I was still . . .

Tape Side Ends

Day: I've heard stories about that, and they're somewhat conflicting. There had been a project to do a general model of communications that had been assigned to SC6, and SC6 didn't like the idea of being the old guard, and it was just allowed to languish, assuming that nobody worked on it, you'd just drive it all away. For some reason, which I've never really gotten, and at this point it's hard to find out because no one wants to admit to having been against OSI, TC97 decided to take that project out of SC6 and form a new Study Committee 16 to do it. Now, if I had to guess, the impetus for this came from Europe, but I don't know. If you've seen the Nora-Minc Report --

Pelkey: No.

Day: Computerization of Society that was done in '78, for Giscard d'Estang, it outlines what the impact of computerization is going to be on French society, what the French have to do to deal with it, what the major technical areas are that the French should try to exploit, and there are essentially five projects that they outline, as well as this idea of an overall set of standard protocols for communications. It doesn't in so many words say 'an OSI reference model' or 'and OSI architecture' or anything like that, but the words are such, and in fact they think it would end up being done in CCITT and it turned out it didn't, but you can read that that's what they were talking about. In fact, those five projects ended up being run by the people from CYCLADES.

Pelkey: Do you have a copy of that report?

Day: That's actually a book that was published by MIT Press here in the States.

Pelkey: Computerization of Society?

Day: Computerization of Society by Simon Nora and Alain Minc. I've met both of those guys. So anyway, for some reason, and I wasn't privy to all the political machinations that -- this is before my career as an electro-political engineer -- this all got set up, and they had the first meeting in March, '78, and at that meeting --

Pelkey: Where was that meeting held?

Day: In Washington. Charlie brought in the seven-layer model. Now, the whole layering idea was very much agreed to within the ARPANET and the CYCLADES and NPL; all of the young Turks, that was a fundamental thing that everyone was working from. Basically, it came out of what was, at that time, the going thing -- really coming out of Dijkstra's work with THE Operating Systems and a layered approached to operating systems.[2] Multics had been layered. It was this whole idea of building up these layers of functionality and treating the layers below as a black box, and that's what we applied to networking, and that's sort of the legacy of having come out of operating systems. The committee was formed. In the early days, there was a lot of back and forth, and a lot of hold over from this INWG 96 crowd, and Postel and all these things, through most of '78.

Pelkey: The 96 crowd?

Day: That crowd that had been involved with the IFIPS 6.1 -- there was a lot of crossover, but basically as soon as it sort of became apparent that 16 was really going to run with the ball, almost everybody from IFIPS 6.1 came over to SC16, and 6.1 sort of dwindles off, and IFIPS 6 went into other things like messaging and other things that people hadn't gotten into yet, but for the most part, that whole group of people picked up and moved into 16.

Pelkey: Over the course of the '78 --

Day: -- '79 time frame. In fact for a while, they were going to both sets of meetings, and then it became apparent that there was really no sense.

Pelkey: Why does it?

Day: Why bother? IFIPS 6.1 had served its purpose. The meeting was held in Washington. I didn't go to that meeting. This is the period when I was living in Houston and working in Illinois and commuting electronically through the network. I was living - - '76 to '79, my wife was post-doctoring at Baylor College of Medicine, so I was living down there and working in Illinois.

---

[2] E. Dijkstra, "The Structure of THE Operating System Multiprogramming System." Comm. ACM, vol. 11, no. 5, 1968, pp. 341–346.

Pelkey: A truly modern man.

Day: That was 12 years ago, and there are people who don't think that's possible today. So I didn't go to that first meeting, but we had one of the other guys -- Grossman -- had gone to it, and we were all involved in talking about it.

Pelkey: Now who was chairing that?

Day: Charlie Bachman.

Pelkey: Had he been part of SC6?

Day: I think so. You'll have to talk to Charlie about that.

Pelkey: Where can I reach him?

Day: He runs Bachman Information Systems in Cambridge, Kendall Square. What is it, Cambridge Place? Is that the name of that, over there by Kendall Square? Charlie was running the show as chair of SC16. They formed, at this first meeting, three working groups: architecture, upper layers and lower layers. Zimmerman was put in charge of architecture. By some quirk, which I still don't understand, at that first meeting, the young Turks ended up basically in control of all the key places.

Pelkey: So one was architecture.

Day: Two was upper layers.

Pelkey: Who was --?

Day: Alan Langsford from the UK, and three was lower layers. I think the original chair was George White. Everyone realized that speed was of the essence, and it's really kind of amusing these days to listen to everybody complain about how long the standards process takes, because, until we came along, it took even longer.

Pelkey: Now, you had a deadline, because of how the --

Day: I don't know that we had a real deadline, but we realized we had to get things done fast. We took the first two years to basically firm up the architecture, so that you had --

Pelkey: Did you serve on the architecture --?

Day: Yeah. What happened was, in October of '78 or summer of '78, Zim called me and said -- I've been active in the virtual terminal and formal description technique stuff in the IFIPS group -- he said: "Would you come and set up the FDT effort for OSI?" I said: "Sure." It sounded like a good idea, so I went to the October '78 meeting with the intent of doing --

Pelkey: Which was held in?

Day: Paris. So I went over and spent some time setting up FDT, but primarily started getting involved in doing the architecture as a whole.

Pelkey: FDT is?

Day: Formal Description Techniques. So I was doing all of that. The FDT stuff didn't take all of my time, and at that time, the document looked like -- it was just a hodge-podge of stuff thrown in, so we started working through the document at that meeting. Then, by the next meeting, I came up with a complete

reorganization of the document, made it a lot more functional, and did essentially a cut and paste of all the information that was there into the structure, and that is essentially the structure of the document today, and we started working it through. I ended up doing FDT as sort of a sidelight, and really mainly participation in the development of the architecture as a whole. Now, to go back to what was happening here in Paris, there had been a couple of conferences held during '78, '79, and there were discussions of the OSI stuff at those meetings with a lot of the IFIPS 6.1 -- still a lot of crossover. Like I said, Cerf sort of pulled back, and at this point, actually beginning actively discouraging ARPANET people from participating. I know we were getting our funding, and by this time I was still in Illinois, but we had spun out of the university and formed a small company by about '79 or so. Maybe '77, '78, something like that, and we were getting our funding from DCA, Defense Communications Agency, so they were a little bit removed from ARPA, but still very much pressure related, and they were getting a lot of pressure about me being sent to OSI meetings, but they kept making arguments that they ought to be keeping track of it and all this stuff, but for the most part, Cerf actively discourages and prevented people who were at MIT or ISI or any of those places from actually attending or participating in any of the US meetings or international meetings on OSI.

Pelkey: Do you have any views as to why, other than the fact that he lost the debate and that things were going differently?

Day: Yeah, and I think he felt that if he kept away from it, it was going to fail, and they were just doing an architecture, and it was nice definitional stuff, but it would never do anything.

Pelkey: Gotcha.

Day: Now, we knew that what we were doing was an architecture first, and at this point I remember doing a lot of stuff -- there was a lot of kidding that the ARPANET architecture was a Carnak architecture -- you know, Johnny Carson, Carnak the Magnificent. "Given these protocols, what was the architecture that generated it?" It's unfair, in the sense that really, the ARPANET got more things right than any experiment of that type deserved to.

Pelkey: And it was just an experiment.

Day: Right. In fact, probably its biggest failure, its biggest problem, is that it got too much right the first time.

Pelkey: It became too successful --

Day: Well, you never had the chance to go back and actually do it the way you thought you really -- the way it ought to be done, because it all sort of worked, and so the younger ones coming along just sort of picked it up and said: "Well, this is the way you do it." So there was a lot of that going on. I think Cerf really felt that OSI would never amount to anything, but it was really apparent to anyone who looked at the business side of things that the way it was going with CCITT, who was backing OSI and the need for it, the way the European governments were really behind this as a way of creating a level playing field. The game plan here was to secure market share for European computer companies, which this was going to go and no one was going to let it fail. I don't think Cerf realized any of that.

Pelkey: 'Cause at this point in time, the TCPIP process was being driven by the Defense Department, to try to create a protocol.

Day: Right, but again, remember, it took eight years. From '74 to '82, when they finally actually made it "the standard protocol" -- and they really only made it the standard protocol in '82 because of the pressure from OSI, right, because in 1980 we finished -- we started battling the reference model and spun out the protocol projects, and now Cerf had been doing this thing for six, seven years, and they still didn't have good implementations, and it was still a lot of experimentation, and it was: "Why does it take six years to do a transport protocol?" Well, there's no good reason, and to some extent, calling it experimentation, from a good researcher's point of view, it wasn't. It was a lot of people building things.

There was no concerted test plans, there was no concerted experiments. It was sort of: "Try it. See what happens." As a research project, it was not good science. People used to say: "TCP is one of the most tested protocols around," and I used to say: "No, it's one of the most run protocols around." There's a big difference between stress-testing, and just putting it on the network and having a lot of people run it. It was a lot of sloppy procedure in that case. I think this -- to a large extent, Cerf did not think it would actually ever amount to something. He had missed the whole political/economic rationale for doing it, and things like the Nora-Minc Report and corresponding reports that were being done in Japan and England and other places. It was clear to me from the beginning that this was going to be it, and it was really just a question of the CCITT and IBM, as far as who the competition was. In '82, '83, we finally co-opted the CCITT and we all adopted the same text for standards, and we started this collaborative thing with CCITT and ISO where, on set protocols, we actually produced common text for everything.

Pelkey: What caused that to happen? That was a significant event.

Day: That was a significant event. There was a just a lot of pressure from all the member bodies to make it happen. Luckily the guy who is in charge of the reference model, Tom Steele in CCITT, was in a very good position to force it to happen, and he very carefully went through the two documents, and they worked out -- there must have been maybe a half a dozen major technical points where there was material in the CCITT document that needed to be included in the OSI document, but they were major in the sense of they didn't change the structure or anything, but they were topics that needed to be covered in one or the other, so we made those changes in '83 -- '82, I guess -- and finalized them in '83, and then that was the document. Really, the speed with which we were moving was absolutely incredible. We actually went through one secretariat because she couldn't handle the level of activity of these meetings.

Pelkey: How long did these meetings last?

Day: Two weeks, and at this time they were small. There was only maybe 150 to 200 people involved, and --

Pelkey: Were you aware of what was happening at 802?

Day: 802 hadn't started yet, not in '78, '79. Yeah, we all knew about 802.

Pelkey: Excuse me; you said there were 50 or 150 people involved in this process.

Day: I'd say it was more like 150 at that time.

Pelkey: That's not very many people. It's a lot, but it's --

Day: Well, remember, prior to 1978 --

Pelkey: How many countries?

Day: Probably 20, 25 countries. Prior to 1978, an SC in ISO was generally about 20 people. A working group was six to ten.

Pelkey: So 150 was tremendous.

Day: Ok? HDLC took like seven years to do. We produced the reference model in two, and that put us on this parallel track, where we were producing five to ten standards a year. Two years for that --

Pelkey: How did this happen? Why did it happen? Who asserted the pressure?

Day: First of all, the young Turks ended up in control. We all came out of development crews. We were not standards goers per se, so basically we only used rules that we needed, and basically, to this day, we only instituted as many rules as we need to keep things under control and to keep everybody from getting

-- feeling that they're getting cut out or something. The bigger it gets and the larger it gets the more rules we've had to institute, but we were producing documents very, very quickly; turning them over. Discussions -- if you had a point you wanted to hold things up: "Well, we should consider this point -- " and you could bring up a technical argument, fine. If you said: "Well, I just think we ought to let it percolate a while," forget it! We kept going.

Pelkey: Hubert Zimmerman who was, in this period, I have the sense, more formal, more overt, but you couldn't say anything negative. All you could say was positive.

Day: To some extent, yeah.

Pelkey: In other words, it was a real way of managing that. If you came in and said: "We shouldn't be doing it this way -- "

Day: Tell me a way to do it or don't bother with it. Right. Either come in with a proposal to solve it or I don't want to hear it.

Pelkey: And it really speeded the process up.

Day: Right, because you were basically saying: "No, we're not going to just discuss this for the sake of discussion. If you've got an actual proposal to make, make it."

Pelkey: If not, let's go on.

Day: Right, and basically I do the same thing when I'm running meetings. Now, to some extent -- and I've run meetings a lot and I think I've become very good at driving consensus -- there is something to be said for -- and I remember there was one of the first meetings naming and addressing of documents we started working on an addenda. We walked into a meeting in Washington with no paper at all, no working document; a lot of contributions. We spent the first day and a half just sitting in a room, about 20 of us, going around the room, people discussing naming and addressing. Basically what we were doing, I was letting everyone get their concerns out on the table. By the middle of the second day, someone came in and said: "Are we going to get anything out of this meeting?" "Just, don't worry. It'll be there." Middle of the second day, I divided them up into areas that had come up, and sent them -- we outlined the topics (unintelligible) -- and sent them off to write it. By Friday I had 90 handwritten pages, but had we tried to do that initially without people -- that way, when everyone was writing it up, they knew what the complaints were going to be if they did something, so they could write to take care of those complaints ahead of time. Now, it took another three years of debate, or four years of debate, to get that all taken care of and worked out, but --

Pelkey: There was a structure for it to be --

Day: I've found that, almost every meeting I've been to, you start off with these discussions. They sort of mash around. It looks very chaotic, that nothing is going to gel. About 48 hours, or half way through the meeting, you start seeing a structure, you throw everybody into it, and you go, and by the end of the meeting you've got something. It works almost like clockwork. It's chaotic, but it works. These meetings became exceedingly chaotic. I'd spent two weeks, and probably some of the most frenetic time I've ever had. Being the head of the US delegation for architecture was actually worse than probably the other places, because you had to be -- or I had to be -- somewhat knowledgeable on everything, whereas if I had to work in one of the protocols, I'd have been a lot more focused; one protocol, get that, that's all I had to worry about.

Pelkey: How many people in the US delegation at this point?

Day: In '79 -- I wasn't head of the delegation in '79. I was still sort of a renegade, coming as an IFIPS representative.

Pelkey: When did you become head of the delegation?

Day: Whenever we formed X3T51, which must have been 1980.

Pelkey: X3?

Day: T51. It would have been spring of '80, because it was after the London meeting and before Berlin.

Pelkey: When was the Berlin meeting?

Day: November '80.

Pelkey: That was an important meeting.

Day: That's where we ok'd the reference model.

Pelkey: Now, before that, how did it become seven layers?

Day: Charlie walked in with a model that was seven layers. It's basically the Honeywell model, and there were some other proposals on the table. His was the most complete, and in the interest of -- we knew we had to get something done and done quickly, it was just grab one and go with it, and for, I'd say, up through '80, '81, there were still debates about whether we should get rid of a layer or so, and Zim was very, very good at holding the line that: "No, we're not going to do that. We're not going to second guess it. It'll set us back too far. We're going to go through."

Pelkey: Now, if I understand it. In November of '80, the Berlin meeting, there was some kind of a vote that was taken or –

Day: There was a vote to pass the document to DP ballot -- Draft Proposed International Standard -- and that marked, essentially, the base document on which what is now the basic reference model.

Pelkey: Do you remember anything about that process?

Day: It took forever. It was a long meeting. We didn't get out of there until 8:30, 9:00 that night. They locked us in the building. Germans don't -- see, we started this thing starting in October of '78, we started doing things that standards committees had never done before. We worked late. In fact, in '78, Michele Gien and Grossman and a couple of other people stayed up all night getting N46 put together and written up so that they could vote on it the next day as the base model.

Pelkey: N46?

Day: It was the first version of the reference model.

Pelkey: When was that done?

Day: March '78. In October, we were putting together the second version of the model, and we didn't finish doing that until 4:00 in the morning. In fact, we sent the -- entire well, I was dying of a cold. Michele Gien and I went upstairs and typed on the word processor -- we had lines going out to a machine at INRIA to do the typing. We typed up the document until about midnight and we realized that nothing we typed from here on could be Xeroxed and put in place, so we just said: "That's it. We quit." I was dying of a cold, so he and I went home and went to bed. Others stayed up all night, until 4:00 in the morning, Xeroxing and collating. We sent the entire secretarial staff home. The girls didn't need to be there. We were crazy enough to stay until 4:00 in the morning, that was fine, but they didn't need to. So we sent them home, and they were there 'til 4:00 in the morning. There's a great story of Zimmerman taking seven people in a Deux Cheveaux through this -- well, it was 4:00 in the morning and there's no public transportation in Paris, right. So they cram seven people -- and not small people. Charlie

Bachman stands about 6'6". Don Shepard is not small by any means. Kenji Naemura, the Japanese delegate, was sitting on Charlie's lap. (I believe the other occupants were Tilly Bayard (WG1 Secretariat), Shepard, John Aschenbrenner, and Mike Purton.) We had seven people in a Deux Cheveaux, cruising through the streets of Paris, dropping people off at their hotels, and we were back at 8:30 the next morning to do the voting. We didn't look too good that morning. I had -- in fact, when I crawled on the plane that afternoon, I was dying of this cold I had picked up, and I hadn't eaten since noon the previous day -- it was like 2:00 in the afternoon. Well, we had worked straight through. We hadn't been able to get any dinner. We didn't stop to go out for dinner. Got up the next morning, came right back into the meeting, finished the meeting by a little after 12:00, went to the airport -- but that was normal. That was the pace we were maintaining. All of the meetings were like that. This was not the kind of things that standards people did. Standards people met from 9:00 to 4:00 and took their leisurely time, and talked the issues; it was an old-boys club, but at those times, while the standards were important, they didn't have the economic impact, potential economic impact, that this was going to have. So the rules had changed substantially. There was big money involved, and everybody knew it. That's where the 'electro-political engineering' term comes from. Everybody realized that where we drew the lines for the layers, and how we did the technical solutions, determined market lines, determined economics, determined money in somebody's pocket, so everybody was out of blood. It was no longer this nice old-boys club.

Pelkey: Isn't that something. So there was incremental -- now, were the companies exerting pressure on this?

Day: Well, companies were exerting pressure always through their individual representatives. The trouble is that nationally, you're supposed to have formed national body positions, and have one national body position going in. It doesn't always work that way. Over the years, we've gotten much, much better at that. In the early days, in '78 and '79, it was really everyone talking for himself.

Pelkey: Whoever was interested went.

Day: And it was much more fluid.

Pelkey: You went as John Day.

Day: Yeah, I was John Day, and I did the technical --

Pelkey: Representing the United States was just --

Day: Well, I was for the right technical solution. Now, some people -- and it's really funny, even today you can see it in standards -- you see new people coming thinking that all the arguments here are technical, and it's really funny to watch their education, just like it was very funny in '78, '79 to watch the fact -- I recognized the datacom/networking dichotomy quite early. A lot of people never did. Seeing that is a real change.

Pelkey: Datacom meaning the CCITT traditional --

Day: The telephony -- what I call the 'beads of a string model' Beads on a string. If you look at the old pictures, the way CCITT always drew things, you have essentially this symmetrical view of these boxes, all on a string, and there's never any recognition that there's common functionality across these boxes. In fact, the whole -- if you look at the architectural mistakes they tend to make, it derives directly from that point of view. You don't recognize that there's this layered functionality going up.

Pelkey: That this is a channel, and how much can you get through it?

Day: Right, and you do all these things to it. There's no partitioning of the functionality at the various places. You had those debates going on all the time. So, yeah, there was a lot more at stake here.

Pelkey: Come back with me again to this Berlin meeting. When you went to the DP ballot. You said it was a long meeting and you got locked into the meeting that night.

Day: Right.

Pelkey: Do you remember anything else about the balloting?

Day: Well, we had to go through the document page by page. There was a rather impassioned speech by a member of the UK delegation, deriding everything we were doing.

Pelkey: Someone who was attending for the first time --

Day: Well, it was his first time attending, I think maybe attending SC16 -- probably second time -- but he – Mike [Purton] was an employee of BSI, and in classic British tradition, was really right on the money, very formal, 'this is the way we do standards,' right? We were very much a lose, 'fly by the seat of our pants, get the thing out and get on with it' sort of organization at the time, and it was a real culture shock to this person.

Pelkey: What is BSI?

Day: British Standards Institute. They're the ISO member body.

Pelkey: It's been described to me that he stood up and he said it wasn't worth the paper it was written on, that his engineers had reviewed it and this is just not the way to do it, and that we ought to start all over.

Day: Right, right, right. Well, you know, clearly --

Pelkey: What happened when he sat down?

Day: I don't remember. I think everyone just sort of ignored him and went along. It was, to some extent, a bit of an embarrassment for the UK.

Pelkey: Hubert's recollection was that that really consolidated the vote.

Day: Well, it could very well have . . .

<div align="center">

Tape Side Ends

</div>

Day: Well, it does, but on the other hand, that same kind of thing --

Pelkey: My visualization, if you will, is that he sits down. Here are all these delegations. All of you had spent years, all these late nights, all this effort, and this person just kind of stands up and says: "What you guys have been doing for years is just a waste of time," and while there might have been -- everybody might have had their pros and cons as to whether or not it should work, that really consolidated the voting behind --

Day: Well, yeah, but there's also a phenomena that you see quite often in science. The knowledge of what the reference model said was not entirely in the document. It was in the minds of the people who had written it. All those words, to us, elicited ideas that weren't necessarily there that we hadn't written down. For various reasons they either weren't appropriate or we couldn't, but the point is that the whole layer concept -- like I said, accepted from '72, '73 -- this whole group had been working -- there was a real -- in fact, Derek and I were talking about this in January. There was a real commonality of approach. Details were different, but there was a real commonality of general approach amongst that whole group, so we knew we were right. We built stuff, and we were a paradigm shift. We had constituted a revolution, from the beads on a string model to the layered model, and we knew it. We knew we were right. Mike, being much more of an old guard standards person, entirely too formal for a document like

this. This was not an implementation document, this was a document that was going to provide the framework for work to go on -- it was completely outside his realm. He was the one who was always going through telling us to eliminate all the tutorial material. You were supposed to just state the requirements, and of course I contended that this was not the case; that much as we started saying earlier, that the whole purpose of this, of any kind of document like this, was to take the reader from what he knows to what you want him to know, because I know there's no common external reality. I can't, in this case, write that down as just a thing. I've got to take him from things he knows to how I want him to see it. So anyway, that debate went on and on, and there was a real, total lack of - - if you believe in external reality, it's really hard to see that there isn't one.

Pelkey: So the tutorials were this process that you went through consciously, saying: "We have to educate -- "

Day: We've changed things around. Somebody said that a lot of that stuff did get taken out, and the document, I think, has suffered. It makes it much more difficult to read. In any case, to some extent, Mike's speech probably did consolidate the vote in that sense.

Pelkey: This wasn't Mike Barber?

Day: No, it's -- oh God, I'm real bad on names this morning. I don't know why. He was an employee of BSI, and really not a technical type at all, so he didn't have a whole lot of credibility in the group, but on the same token, be careful about generalizations, because I pulled the same stunt two years later and stopped the vote on transport. Two years later, when we were ready to make the first DP ballot on transport, everyone was -- the document was in really sad shape. It was really a lousy specification, and you'll still hear remarks around -- kidding remarks in US meetings about: "Day, is there any more Culinane stationery around?" I was working for Culinane at the time, working with Charlie, and I wrote a two and a half page contribution that said: "Guys, this document is crap. There's nothing in here. You can't implement from this document." When you level those arguments at the reference model, it's not so bad, because the reference model wasn't meant to be implemented in the first place, but if the first protocol that OSI brings out is a specification that can't be implemented, we're going to take it on the chin, and we deserve every bit of it. I went through a lot of things and said: " . . . And there's not even a bloody state diagram in this document." I went into a US meeting; they were all ready to vote 17 to one in favor. I passed out the document. Everyone read it. There was this -- you could just feel this tense silence, right?

Pelkey: This is only in the US delegation.

Day: Only the US delegation. I remember the IBM representative nudging the DG representative and saying: "Well, he's right." The vote went one to 17 against.

Pelkey: Now how about that.

Day: Ok? It caused major rework on the specification, not to change the protocol, but just to get it a lot more solid. So, you've got to be careful about these generalizations that standing up and saying: "Guys, you're all wet," will cause the group to solidify, because it doesn't always work that way.

Pelkey: Yeah, it's just that you have to be right. At least it helps.

Day: It helps. So that does tend to happen.

Pelkey: So the Berlin meeting, after Mike spoke, your recollection is that a lot of people got up and stood --

Day: Yeah people got up and said --

Pelkey: The vote went along pretty quickly.

Day: Well, we still had to go through the document. Also, I think this came pretty late. We had been going through the document. We had, I think, probably finished the document at that point. Mike stood up and made his impassioned plea. Its 7:30, 8:00. Nobody has had dinner. Nobody had -- most of them didn't have lunch, and it was sort of: "What in the hell is this guy doing?" He had already been causing a lot of trouble in the meetings, and getting -- trying to get people to do things that they didn't think were necessary or against what we were trying to do, so he really didn't have any support whatsoever. At that point, the Germans, I think, got up and said: "We support this," etc., and he called the vote, and that was it.

Pelkey: That's the other story that I've gotten. It was almost like [probably some visual gesture] --

Day: Right, exactly.

Pelkey: So, after the Berlin meeting, the group of you must have felt a great deal of satisfaction?

Day: Yeah.

Pelkey: Other than the fact that you were all tired.

Day: We were tired and -- well, to some extent there was some satisfaction, but in a real sense, it was -- there was not real elation, I think, in the sense that: "Well, we got the document out, it's time to get on with the other documents," and there were a lot of things going on, and we just had to keep it moving.

Pelkey: So then, what happened after '80? You indicated that -- at that point in time, TCP realized it had to get its act together, as a separate event.

Day: Well, not really. I think it wasn't until we got close to publishing a transport protocol that TCP began to realize that they had to get their act together.

Pelkey: When did you do that?

Day: I think TCP went to DP -- if I was at Culinane -- it would had to have been '81, '82, somewhere in there, but in a sense -- and it's not so clear that the pressure for TCP to get its act together was being precipitated by OSI as much as it was being precipitated by the fact that the project had been going on since '74, and had yet to produce the replacement for the NCP. I think on both counts, Cerf was under a lot of pressure to put up or shut up. The protocol was out being used and everything, and there were a lot of people playing with it on the network, but nobody was -- actually, I'd say that the realization that OSI had made it -- well, there were two realizations. One was: Cerf's leaving ARPA was a real watershed. That was '83?

Pelkey: I think it was '83.

Day: '82, '83 -- late '82 or early '83. I think that was, to some extent, a watershed. Actually, one of the more fun ones that I remember -- it was about the same period -- was picking up Scientific American one month and seeing a three-page ad for SNA with seven layers. Up 'til that time, SNA had five layers. If you go back and look at any SNA document previous to '82, you'll see five layers of SNA. I knew we'd made it when SNA suddenly had seven layers.

Pelkey: So transport protocol -- now when, was NBS -- were you aware of what was --

Day: NBS had started up their effort along about the same time. In fact, at first, they started to go with TCP, and some people came down on Heafner pretty hard. In fact, the first -- one of the first things that Estelle, the formal description technique they were developing, was applied to was TCP, and then someone came down -- they came down and gave them a lot of pressure about being OSI, and they

switched over to OSI, and started pushing OSI very heavily. They started pushing to get implementations going and things like that.

Pelkey: So then the transport protocol came out in '81, '82. Then what happened?

Day: It's a blur. Basically, from then on, there was basically a standard a year, and then there started getting to be two or three standards, or five standards a year, and you could really see the snowball effect taking -- a snowball effect going in, just because we had done --

Pelkey: All this happening within each of the seven layers?

Day: Because we had done the reference model first, and because we also had done it as the basic part first and then we started extending the reference model, we were able to just send off all these efforts in parallel and let them start peeling stuff off.

Pelkey: When you started this process, did you have any idea what this thing that became known, as Profiles would become?

Day: No, and it's still not clear to me that you need them.

Pelkey: Isn't one of the arguments this raises is the issues of testability and conformance?

Day: No. There may be an argument, but it's not a valid argument. One of the things that we have consistently tried to do from the beginning of OSI is say as little about the implementation as possible, because it was readily apparent from the beginning that how you implemented the protocol for a very simple device that only did one thing, versus a general purpose implementation for a big mainframe, would be significantly different. For example, if I'm doing a file server, I never have to initiate a connection. People always connect to it, so why test for it? Why require it? So there was a lot of discussion: "Say as little about it as possible so that you can have as much freedom of implementation." As long as you can get the bits on the line the right way, who cares? In a sense, I really think that the Profiles thing is one more attempt by IBM to slow down the work, and if you look at the way they've organized it --

Pelkey: Why do you say IBM, when it's Boeing and GM that appear to be driving the process?

Day: No, not really. Not really at all. Now, Boeing and GM I think are legitimate places to try and drive what you want to do, which things you want to select. Having internationally published Profiles -- it's not clear to me that it's absolutely necessary, and it certainly isn't necessary the way they're going about it.

Pelkey: And that's where you see IBM exerting --

Day: Right, exactly. In fact, most of the Profiles are being pushed by things like COS and SPAG, right? Those are not user groups; those are manufacturers.

Pelkey: Right.

Day: Being pushed by things like MAP and TOP, now that's a users' group, and actually they're in a position to say: "For the 'X industry,' we're going to use X and Y." When you really get down to it, the only thing they really should be talking about is the Upper Layers.

Pelkey: Right, six and seven.

Day: Five, six and seven, because what you're going to need to support your application is --

Pelkey: For example, as defined in Token Bus, as an example.

Day: Right. That's irrelevant. Any technology you want to use is ok. Now, I can see a company saying: "Our factory is going to be Token Bus." Fine. "Our manufacturing protocol is going to be MAP." Fine. The big debate over choice of transport class is really bogus, because you can't a priori choose a class of transport. Class of transport -- you know, the idea of the classes of transport -- they all provide the same service interface -- the idea is they make assumptions about the reliability of the underlying network. You don't know that ahead of time, right? So what the purpose of the transport layer is: the application asks for a quality of service, the network provides a quality of service, and once you know what those two are, transport can then choose the appropriate class of service to provide, but until he knows what role, or even what the characteristics are today -- because, it can be storming outside, it can be different than it was yesterday. You can't choose transport class. Now, as far as the organizational thing goes, notice what they've done. By creating this whole functional standards area directly under TC97 -- and this is where a particular person at IBM has a lot of influence, at the TC97 JTC1 level; he's got it going off to the side there -- you've essentially completely divorced the implementers from the designers. The designers are down in SC21, SC16. They're pushing all of the implementation issues into this functional standards area, and keeping the two completely separate. One of the biggest debates -- and it's not even clear it's been completely resolved at this point -- is whether or not there's going to be any way for the study committees to say: "Wait a minute guys, this is in conflict with the base standard. Your Profile violates the base standard." In fact, Profiles that COS has been providing do not conform to OSI.

Pelkey: Holy shit. Is that true?

Day: Yes, absolutely.

Pelkey: COS shouldn't be providing Profiles, they should just be providing this conformance testing mechanism, right?

Day: Well, COS -- it's really funny. I've now come to watch the creation of many standards groups, and they all go through the same -- what many groups associated with this stuff -- they all go through the same set of development phenomena. Remember when IEEE started? "Hey guys, LANs. We got it sacked. Six months from now, we're going to have IEEE standards for LANs. No problem: Get in, get out quick! We're not going to take all this time like those guys in ISO take, man. We can do it fast." Three years later, we were still waiting for IEEE standards. Complete lack of recognition of what it takes to build a consensus. I've seen people come in and try to push things through OSI fast, and in fact we've had it happen in network management where the Japanese convener has tried to take a lot of short cuts. He's ended up taking longer to produce a standard than virtually anybody else. The thing I've learned is that you follow the rules, and basically what you're doing is trying to get everyone comfortable with the consensus, make sure that they feel like they've gotten their piece in, that their problems have been taken care of, they understand why it's done one way or another, whatever, and just keep that process going through. Don't make any major changes. Don't make any major shifts. If you make a major change, make sure everybody knows what it is and it's all -- everyone gets a chance to look at it, and if you keep that going like that, very methodically, you actually get done faster than you do the other way, because what you'll end up doing is getting very far into the balloting process, and then having your whole consensus blow up in your face, and now you're back to square one.

Pelkey: That was described to me, by someone else, as a process of defining objectives up front.

Day: To some extent. It's not always clear what the objectives are. It's not clear that you can know the objectives that strongly. I think it's more a question of keeping everyone feeling conformed and involved and making sure that they feel that --

Pelkey: They matter --

Day: -- well, and that their considerations are being taken into account and that we're responding to them, and they know why it's being done. Once in a while you get somebody like the Germans who are just completely out to lunch. Well, the Germans came in and were against having multi-peer broadcast, because they said that multi-peer should be only in the application layer and should be simulated by

having n-1 pair-wise connections in the bottom six layers, and we said: "You're crazy. Just get out of here." I mean, just totally illogical.

Pelkey: Now, help me understand something. When I look at let's say an ISO model, and I see the bubble chart of standards, they always kind of put the transport as X.25.

Day: No, X.25 is a network layer protocol.

Pelkey: I meant network, but they put in X.25. Now, going back to the earlier comments about X.25 being seen as this confusing things that doesn't make any sense -- how does it become such a critical part of it all now?

Day: Well, it becomes a critical part because the CCITT has got all these -- and everybody else -- has got all these networks based on X.25. It's just something we've got to live with. In fact, there are grandfather clauses in the reference model for certain things in X.25 that you just had to take into account. It doesn't fit. The longer it goes on as we go through the X.25 '84, '88, it starts moving in that direction, but there are fundamental things about X.25 that will never fit well in the model. Originally, the PTTs were proposing it as the reliable transfer mechanism, and if you go back to papers written in the '75 to '77 time frame, there's a real debate going on between whether or not X.25 is reliable or not; the PTTs saying: "We never lose a packet," and the users saying: "Look, I don't care what you say. I don't trust you anyway." Come on give me a break here. And then, of course, people actually coming out with performance papers with packet switched networks showing that it wasn't reliable enough, that you couldn't guarantee delivery and that you actually needed a transport protocol, so that was what the whole debate -- that was part of the whole connectionless/connection-oriented debate. The whole premise of CYCLADES was that you couldn't guarantee end-to-end reliability; the network cannot guarantee end-to-end reliability, therefore don't try. Let the end systems give you end-to-end reliability, and you do just enough to make that cost effective, and thereby be able to make your switches a lot cheaper because you're not spending all this time trying to make things more reliable than you really can.

Pelkey: Right.

Day: You're up with 90%, and it's going to cost you a mint to do the other 10%. Don't bother.

Pelkey: Sounds like a very wise perspective on it all.

Day: Right, but remember, data communications people had always been very anal about making sure that everything got there, even though you couldn't. In fact, there's still this debate in the lower layers about -- you'll hear about the hop-by-hop harmonization, versus the internetworking approach, and it's still very much unsettled as to what the solution is.

Pelkey: This connection versus connectionless is something that is still --

Day: Yeah, but it's not even connectionless versus connection- oriented, it's hop-by-hop harmonization versus internetworking. Now, the hop-by-hop stuff tends to be connection-oriented, but we've been talking about -- and it's merely a matter of time before someone finally proposes it -- a connection-oriented internetwork protocol. We've seen the need for it; we've just never gotten around to doing it.

Pelkey: Which would be an interesting situation for the PTT's to have to deal with.

Day: In fact there is a way of seeing the connectionless/connection-oriented as not being diametrically opposed; however it requires a somewhat -- you can't do it with X.25 and IP. It requires different protocol structures, and it requires a somewhat different way of looking at the lower layers. Apparently, I'm about the only person who thinks he knows how to do it, but I haven't had time to write it up.

Pelkey: But that would be a real breakthrough. We've come from having started off with this analog/digital view of the world, this more refined data communications versus networking view of the

world, and there really is a need to reconcile them at some point in time. That's an important step to be taken, to bring these two events together. They've kind of coexisting now, but it's not integrated.

Day: Right, it's not an integrated view of the world.

Pelkey: And until it is -- there's an awful lot of power and an awful lot of money --

Day: The thing is that both sides have to fundamentally give up some things, and neither side, at this point, is really willing to do that. It requires a different perspective in order to see how you make the two work together.

Pelkey: How do you see this issue being resolved?

Day: Well, probably the first thing is I have to sit down and actually write up how it all works, with the right way of looking at it, and then we start letting people get used to the idea, and eventually it probably leads to some different network layer protocols.

Pelkey: Well, good luck with that effort.

Day: When I get time, yeah.

Pelkey: We were talking about something of a larger nature earlier. You, by having lived in Houston and commuted electronically to Illinois, currently have some idea of the power of networks, in terms of how one does work and the flexibility and freedom it gives one, and yet organizations, even as sophisticated as Codex is today, don't use networks anywhere near as much as they could, in terms of computer conferencing or just as a rudimentary tool of managing themselves through networks, as opposed to people-to-people, face-to-face. Do you see that process changing? Do you see that businesses will come to be able to manage themselves through networks, as opposed to the traditional way?

Day: It's going to require some major changes in the way things are done. I don't see that American management style is - American management style seems to be based on maintaining a certain level of incompetency. I don't think they're as -- there are very few managers I've found who actually think about managing; think about thinking about managing -- move one level removed and look at what they're doing. It's the same thing with the technology. I've put together a series of notes at one time, which I've never turned into a paper, on capitalizing on innovation, and frankly I don't think we're very good at it. In fact, what I used as my departure point was that at the time I moved to Houston, if you looked at what we had, in terms of what was going on in the ARPANET, and the ability, yeah we've improved it, we've refined the ideas a bit, but the basic functionality was there. I was getting 80% of my mail electronically, I was living on the network, we built real -- basically all we've done in the intervening ten years is refine some stuff. In the mean time, we've gotten some international standards, but that's almost irrelevant, to the point of view of getting it into corporations, and the hardware it's implemented on has become smaller and cheaper. As far as our intellectual understanding and the amount of strides we've made in actually doing it, nothing has changed. This isn't good. This isn't good at all.

Pelkey: Do you see Japanese or the Europeans --?

Day: No, I don't see anybody as being really good at pushing it. The only thing that the Japanese and the Europeans have going for them that we don't is that they're smaller. You can make things happen in a smaller environment much faster than you can here. The problem, I think, comes down to two things. One is that we're not very good at taking new ideas to product, in the sense that generally, what you end up doing as research has to be totally reimplemented before it can be product, whether it's academic research or whether it's corporate research, and I think a lot of that has to do with not applying an architectural view at the beginning, to both guide the research and also bring in the pragmatics of what you need in the marketplace -- the billing stuff and all the other trappings that have to go onto something to make it a product-izable thing -- early enough so that you actually can avoid having this working prototype in the lab that the engineers can actually use every day, and think it's product, and having to

reimplement it as product. That's one half of it. The other thing that we're not doing is what I'd call strategic marketing. We're not getting companies to take on the new technologies, to understand how they insert into their businesses ahead of time. We're not working with them to say -- I always thought that one of the biggest failures of office automation was that people -- we were providing the things that programmers found useful. I hate to tell you, but programmers aren't the majority of white-collar office workers in this country, not even close. Nobody was really looking at what does the paper flow in this business look like, and what are the tools that you need to expedite it? What are the social problems that you have to work through with respect to that? At the same time, I was looking at the impact of technology on organizations, and the literature is very funny, in the sense that the literature comes up with all these conflicting remarks, that it has no effect, it has great effect. There doesn't seem to be any consistent thing, and blah, blah, blah. What's really funny is the organization theorists seem to have totally missed the point that they treat technology as a monolith; that the technology of production is different from . . .

Tape Side Ends

Day: . . . and said: "Here is a technology that is totally counter to the flow of material," the impact was bad. "Here's something that was an administrative technology -- had nothing to do with production -- it had no effect whatsoever." Well, no surprise.

Pelkey: Let me ask you a couple of pertinent questions. One is, given this issue of strategic marketing, think of it in terms of the SC, the standards committee work, and the implementation -- that is, where you start to bring users into it. How does this process of creating standards -- at some level, there's a strategic marketing issue there, of bringing in the marketplace - - i.e., the users -- together with the technology?

Day: Right. In the OSI case, the users, frankly, are not that impacted. Their requirements are not that important. That's a bad thing to say, but in the sense that -- just like an operating system, when it's done well, you never see it, good communications should never get in the way. User requirements --

Pelkey: The X.25 compromise is an example of a user --

Day: -- getting in the way badly. Basically, communications should be set up, torn down, and send stuff. How can you blow it? One of the things I lecture about around here all the time, and is a real hard concept for a lot of people to get through, is 'what are the applications this network is for?' I say: "No! Networks don't serve applications." Applications require operating regions. Networking technologies serve certain operating regions.

Pelkey: 'Operating region' being?

Day: Some multi-dimensional thing consisting of response time, delay, bandwidth, etc -- all those things.

Pelkey: The service environment.

Day: Right. My argument is that if I build a packet switch that has the same cost as a circuit switch, should it matter to the customer what label I put on the box? Banking is going to require some high bandwidth backbone networking capability, some ATM type low-end things with certain characteristics. Factory automation is going to require certain operating regions for their equipment. What you want to do in developing your product line is realize what are the spaces -- what are the clusters that fall out of those operating regions -- and you build technologies to service those operating regions, and you build technologies to service those operating regions. It's not that CAD/CAM uses LANs, it's CAD/CAM needs high response time/high bandwidth, whatever it is. That seems to be a hard concept to get across. Basically, what you're trying to do is disconnect --

Pelkey: How do those parameters get into this standards making process, other than just on the competence of the people participating in the process?

Day: In a sense, when the architecture is set up, it's not relevant to the standards process, because what you've got is the old wine glass view of the model, that there are technologies below. You get a technology independent view at the network layer, and then you get the applications above. There are lots of communication technologies you can have. Which ones are -- it's sort of a competitive thing.

Pelkey: The delicatessen.

Day: Right. It's a competitive thing.

Pelkey: The user should be concerned about having the flexibility to mix and match --

Day: Who is going to give me the operating region I need at the best cost, and whatever fits that, he should use.

Pelkey: Question of a different kind: given that the group of you are progressive and innovative and competent, could you run these committee processes over electronic mail loops as opposed to doing it in person?

Day: Not really.

Pelkey: Why not.

Day: You could run the document distribution, and this is one of the things of "how to speed up the process," and one of the obvious things is -- the biggest delay is in getting documents out. That you could do electronically, but it's real hard -- and you might be able to have preliminary debates over a computer conference. There's not real substitute for sitting in a room at a blackboard hashing the thing out.

Pelkey: Because of everybody being in the same time domain and everybody --

Day: There's that, and there's also the thing of just making sure you've got -- and also, as you get into -- in a small group, it's probably more do-able. In larger groups, where you've got national body positions to recognize, and the process becomes a tad more formal --

Pelkey: But why wouldn't it lend itself more to computer conferencing? Someone doesn't have to show their position, other than when they formally count them?

Day: Yeah, but you end up having to work out compromises and stuff, and unless you have -- well, with voice conferencing and electronic blackboards, you might be able to do something with it.

Pelkey: Have a group of you ever talked about doing it?

Day: Oh, yeah, we've talked about it, but who is going to pay for it.

Pelkey: Well, it's got to be cheaper than everybody being paid to go two weeks --

Day: Somebody has to pay for it.

Pelkey: ISO.

Day: ISO doesn't have that kind of funds. Remember, our individual companies pay for our travel, so it's real hard to get any real central thing like that going. In Europe it's probably easier, because, in fact, I think the way BSI works is that they pay the travel of the corporate people going, whereas in the US it's not that way at all. So it's real hard to put that together, organizationally. I think, also, back in the early days, when we first started talking about teleconferencing, I think people also began to recognize that

changing networking actually -- it works better -- I think it works much better after the people get to know each other. The personal interaction helps a lot, and to a large extent --

Pelkey: Only because you're more forgiving --

Day: Well, you also have a better sense of what kinds of arguments the person is going to respond to. The other problem is that a lot of this stuff just takes the time for people to come to grips with what the proposal is, what it's implications are, and to sell it at home.

Pelkey: We've learned to think as groups. We've learned to think -- concentration span requires time generally, and with other people, in order to be able to think issues through. Most people don't know how to think abstractly.

Day: That's also a major problem, but the other thing is -- and you've seen it before -- you throw something out in a meeting and everybody goes: "No way." Then, two days later you throw it out again, and people go: "Well -- " It just needs time to sink in. Well, it's true with international groups, especially when you have all the cultural differences and stuff. You also need time for people to go back and sell it at home, and all of that.

Pelkey: But all those arguments lend themselves to computer conferencing.

Day: They could if a lot of the stuff was there. Frankly, again, I can derive a lot about the political sensitivities of a meeting by watching body language, facial expressions, and all of that, and until we have all of that, it's much less do-able. Also, it still comes down to the fact that the best deals are made in the bar at night.

Pelkey: I have thoroughly enjoyed this conversation, and I greatly appreciate your time. It's been very, very enlightening, and you've been very helpful. I appreciate your time.

END OF THE INTERVIEW