



Interview of Hubert Zimmerman

Interviewed by:
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Hubert Zimmerman: As far as I'm concerned, this international data communications scene started in 1972 with an R&D project in France that had as a goal to do something similar to what ARPA had been doing in the US. This was the CYCLADES Project, which was headed by Louis Pouzin. I think you met Louis.

James Pelkey: I'm going to meet him in Ft. Lauderdale in a few weeks time.

Zimmerman: So, one of the basics in our approach was to just try not to make the same mistakes that other people had done, but start from where they were. This is how we approached the people who were working on Arpanet. We just explained to them, and Louis had pretty good contacts with American people, the approach we had and more or less what turned out is that they found their place with things they would have liked to have done, and places where things could be done the way they would do them now. That was very positive, both for us, for them, because they had a place to throw their ideas. Also it was very good for international cooperation. That was in 1972, 1973.

Pelkey: Did you go to ICCG, the public demonstration of Arpanet in Washington, D.C. in October 1972?

Zimmerman: Louis was there.

Pelkey: CYCLADES is C-Y-C-L-A-D-E-S?

Zimmerman: Yeah, and there is a book on CYCLADES that Louis can show you.

Pelkey: Was it to be a research network or a military network or --

Zimmerman: No, this was a research network among universities, the idea being that this would by some means influence the industry and the computer sciences and data communications. One of the orientations, in terms of data communications within CYCLADES, was to have a pure datagram network, and that was one of the ideas that people who had been working on Arpanet, they said: "We should do it simpler," and Louis was very enthusiastic about this, so we developed this pure datagram network. It turned out that -- and we had, again, very good cooperation within IFIP, trying to define common specifications and develop standards proposals within IFIP.

Pelkey: Now, when did IFIP start up?

Zimmerman: IFIP started working in 1974, 1975 probably, and after we had had some experience in France. Yeah, it was probably around 1974, 1975. The idea was -- you mentioned this idea of internetworking, which Vint was also very conscious of the requirement of this -- and discussing this, the idea came that IFIP was the proper place for letting such ideas mature at the international level, and that IFIP could be a place where standards could be prepared, be passed to official standardization bodies. That's what was done, and --

Pelkey: Was IFIP then supported by the PTTs?

Zimmerman: No, IFIP was more or less the scientific community -- basically the Arpanet people, CYCLADES people, and a few guys in Europe that were starting to meet together to prepare a European academic network. IFIP came out with an early proposal for a standard for network interconnection, something like IP, or TCP/IP, with the Internet header and things like that. IFIP collectively decided that they should contribute this to CCITT, and this was a time when packet switching was just discussed within CCITT. I remember going there, in Geneva, as a young engineer and scientist, with lots of enthusiasm for what we had defined. We had agreed at an international level with people who had lots of good experience with this, and we banged into the PTTs that from a contrary point-of-view were not ready to accept us. One of the explanations was that the approach was a datagram way of managing communication resources is very much data processing oriented, and this was something that was not common to the PTTs' culture, a computer data communications culture, so they were going their way on virtual circuits --

Pelkey: Do you remember when this first meeting you went to at CCITT was?

Zimmerman: The first X.25 standard was defined in 1976, probably, so it was probably in 1974. IFIP, maybe started in 1973, then discussions were going on in CCITT and there was a first level of X.25 standard then in 1976. The pressure for this datagram orientation of the way of managing communication resources, there was enough pressure for CCITT leaving minimum room for having datagrams in addition to virtual circuits, but it was very short circuits¹ were the things which were fully defined, and it was -- I don't remember exactly what, but some sort of annex, that there was another kind of data communications standard which was to be developed, and that this was a datagram kind of thing. Later on, on this low-level kind of communications standards, for public networks there was, in the following years, between '76 and '80, there were following discussions about datagrams and finally they disappeared from the X.25 standard. I think it is just recognition of the fact that the PTT's culture was not ready to accept this. The thing which went on its way was the development which was done in the -- let's say the continuation of Arpanet and CYCLADES and the IFIP work, and in particular this was taken over by Xerox on their Ethernet, and the people who had not been able to push this within CCITT were happy to find this used on local area networks, so there was a continuation of the definition of 'pseudo-standards' for local area networks, which were also in good harmony with the Arpanet protocols and packet radio, that kind of thing. This gave birth to the Ethernet technology, to TCP/IP, which were roughly in the same family. Now, when we discussed, within IFIP, when we discussed internetworking, we were concerned not only with the interconnection of networks, but also with the interconnection of hosts, so we also had, in parallel with the work on datagrams, we also worked together in the preparation of standards for the upper layers. IFIP prepared a proposal for a transport protocol, for a virtual terminal protocol, and started off with a file transfer protocol. That was probably in 1976.

Pelkey: What working group, was this 6.1?

Zimmerman: Yeah, that was 6.1; everything was happening in 6.1 at that time, and later on there was the group on local area network and messaging.

Pelkey: Who attend these 6.1 sessions?

Zimmerman: Vint Cerf; another guy from BBN, a tall guy [Alex McKenzie]; Louis Pouzin; myself; Andre Dentin; and at that time, there was also the European Academic Network; EIN, the European Informatics Network had also been started, so we had a forum there. We were assembling; Europeans were discussing this, and everybody was meeting in IFIP.

Pelkey: How frequently were these 6.1 meetings happening?

Zimmerman: Say every three months, but that was a very good technical cooperation. For instance, for the work within IFIP, I remember that at some point in time, we decided we had enough elements for writing down a proposal for a transport protocol. I remember meeting with Vint Cerf, this other guy, and myself, in London for three days, writing down the thing, copying this -- each going away with a separate copy of the document, just to make sure that it did not get lost, and this was the first version of the IFIP transport protocol.

Pelkey: Do you recall when that meeting was?

Zimmerman: No, but the protocol was published in the ECM-CCOM papers. So we were discussing this within the scientific community, if you wish, within IFIP. At the same time we were conscious that, if we wanted to have standards, and really believed that standards were necessary, we had to go through an official standards organizations. As far as the upper layers were concerned, it was clear they were not to

¹ He is describing a PTT counter-proposal to datagrams called Fast Select. -- Ed.

be defined within CCITT, but rather within ISO. So we started, I'll say the initiative was taken from here, from France. We went to SC6, Subcommittee 6 within TC97 of ISO. Are you familiar with this?

Pelkey: No.

Zimmerman: There is a technical committee. ISO is divided into technical committees. There is one technical committee on data processing and data communications, which is TC97, Technical Committee. There are many committees. Now, within this there are subcommittees, each one covering a specific topic, and, at that time, Subcommittee 6 was covering data communications. So, we went there and we explained what we were doing, and their requirement for going further, in terms of communications standards for having host-to-host communication or data processing oriented communications standards. There was a low level of acceptance of the message at that time. We were accepted as people, but the ideas did not really get through.

Pelkey: Do you recall when that was?

Zimmerman: That started in 1975 and --

Pelkey: So you first approached them in 1975?

Zimmerman: Yeah, and we worked with them on the definition of the HDLC. That was the time when HDLC was just getting out of the oven after ten years of hard work. Now, there was a fair amount of politics in this, and HDLC had been blocked for some time, until IBM got SDLC through, HDLC couldn't go through, so there was a lot of politics, and we were probably not good enough politicians at that time. We had made a proposal for starting an activity on upper-layer protocols, that's what we call them now, within SC6, and the decision was made -- there was a plenary of SC6 and a decision was that: "No, this is not the kind of thing to do. It's not mature enough." It turns out that the UK people were much better politicians and had not really been participating in SC6, but had probably worked their way through BSI, made a proposal at the next high level, at the TC97 level, for starting one full subcommittee on this upper-layer protocol thing, and, being good politicians, they succeeded. So the week after -- that happened in Sydney in probably the spring of '77 -- one week, SC6 said: "No, it's not mature enough," just to start something in the corner, and the week after, the next level up, they decided it was. It's mature, it's time to start something, and we'll start it big, and it started in parallel with SC6. The subcommittee was created on open systems interconnection, so that was the beginning of the SC16, a subcommittee at the same level as SC6.

Pelkey: Now isn't that something. Now, who were the Englishmen?

Zimmerman: I think one of the guys who were lobbying around at this meeting was Frank Taylor.

Pelkey: Was he at the National Physical Laboratory?

Zimmerman: He was not at the National Physical Laboratory. I don't remember where he was, but he was part of the gang with Donald Davies and Derek Barber. There's another guy who was pretty active in standards. Louis Pouzin will remember his name. So the committee was created and we had a first meeting. It was -- let's see, officially I think the first meeting was in September 1977 or 1978² in Washington, and that was the -- you can probably find the dates. At that meeting, you had probably the key players of the first years of OSI within ISO.

Pelkey: And who were those people?

Zimmerman: Charles Bachman, he was a database guy --

² First SC16 meeting in Washington, DC was March 1978 – Ed.

Pelkey: Where?

Zimmerman: He was working with Honeywell at that time. Now he has his own company, Charles Bachman. I think Richard des Jardins was still chairman of the OSI subcommittee within ISO; Paul Bartoli from AT&T; I think John Day³ was one also of the guys from Arpanet who was also very active in this field. There were people from the UK. In general I have a problem with names, as you can see.

Pelkey: Are these meetings documented anywhere, where I can go back and find out who attended them and what the dates were?

Zimmerman: If you go to, the Secretariat of SC16 was in ANSI, so if you go to ANSI and if you ask the secretariat, they will open their files and find the reports of the meetings, so you will have the dates, you will have the people, and you can call Lisa Rajchel at ANSI in New York. So you had, at that time, it was SC16, which later on was transferred for some obscure reasons into SC21. So currently she is secretary of subcommittee 21, which at that time was number 16. So, we had this first meeting, and I think it was in September of 1977, and at that time, several countries came with contributions. Two things happened at this meeting. One was putting on the table the basis that each country had to be the starting point for discussing the standards. There were contributions from the US, from Japan, from the UK, from Germany, from France. Those were probably the main contributors. When the contributions were put on the table it was clear that everybody had the same idea in mind; everybody was doing about the same thing at several layers of functions and protocols to handle those functions. Charles Bachman was the chairman of SC16. He had been nominated chairman at this meeting, and he said: "Well, that's nice. Everybody agrees. Let's go out for dinner. We have had a fruitful meeting, and we can tomorrow just pass the conclusions of the meeting that everything is fine and we can work together because we have about the same ideas." Having, myself, worked in standards within CCITT and in the pseudo- standards within IFIP, I had a clear -- and within ISO within SC6 -- I had a clear perception that the only way to make sure that things would stick was just to write this down and have people sign those. So I said that I thought that if we all agree, why not put this on paper? I volunteered to do the job with whoever would like to help me, but I thought it was essential. Charles Bachman said: "Well, probably its premature, but if you want to make a miracle -- if Zim wants to make a miracle, let him do it." I said: "Ok, I'm going to do a miracle," and we remained there in the evening with a few guys -- the others went to dinner -- with a few guys, probably five or six, I don't remember -- and we started to cut and paste and write down the things - - and this was the first version of the OSI reference model. It was probably a 12-page document in which you had all the basic ingredients of the final version of the reference model. We picked seven layers -- there were, in some cases some people had organized their stuff in five and six and seven and -- I think it was the US contribution which turned out to have just seven, it put the composition into seven layers. We picked this one because it was not worse than the others, and the others would fit also within this, and we wrote down the basic principals of the reference model. We probably finished around 3:00 in the morning, and we had this ready for the meeting the next morning, and passed this around. Everybody was happy and said: "Well, so we have a document." That was the first version of the reference model, and from there on, what had been there remained.⁴ The other thing -- I'm backtracking a little bit -- the other thing that happened at this meeting was some sort of organizing work, and we decided to establish several working groups and distribute responsibilities among the major actors, the major countries that were participating. We had Working Group 1 on architecture, and I was made responsible for this; we had Working Group 2 was probably on transport; Working Group 3 on upper layers; and Working Group 4 on management. Yeah, Working Group 3 was on virtual terminal, file transfer and the like; and the secretariat for Working Group 1, so it was passed to France, with myself in chair; Working Group 2 was past the US, with George White from National Communication Service -- something in the federal government, NCS -- Working Group 3 was Alwin Langsford from the UK. Working Group 4 was Japan, with Kenji Naemura⁵ from NTT. That was a fair distribution of responsibilities among --

³ No, Day was not there, but Gary Grossman from the same organization did attend. -- Ed.

⁴ He is describing the production of the document, TC97/SC16/N46. -- Ed.

⁵ Naemura had done his PhD on the ILLIAC IV project at UIUC and Day and he knew each other from that project. Both were surprised to find the other involved in this. -- Ed.

Pelkey: And who was in the meeting that night, when you stayed until 3:00 in the morning, these gentlemen?

Zimmerman: No, Paul Bartoli, John Day⁶, maybe Jon Becker from Burroughs -- no not from Burroughs --

Pelkey: Was that ever documented, that meeting, at any time?

Zimmerman: The people who were there?

Pelkey: That's an important meeting in the history.

Zimmerman: I remember a few names. If you ask other people you may cross -- you may find other names. I'm sure that Paul Bartoli was there. He's with AT&T. He is still very active within ANSI, and within SC21. I remember Michel Elie from Bull.

Pelkey: John Day?

Zimmerman: John Day was probably there, not 100% sure.⁷

Pelkey: You thought he was with Honeywell?

Zimmerman: No, at that time John Day was with DTI, which was a small company in Champaign-Urbana. I think if you meet John Day, he has a very good memory.⁸

Pelkey: Do you know where he is today?

Zimmerman: Yeah, he is with Codex near Boston. You can probably find the address, and again, if you go to ANSI, she probably has most of the information, and she can direct you to the other people. I was made responsible for the working group on architecture. I had a feeling --

Pelkey: Let me ask you another question. You had this group. When did the working groups get established?

Zimmerman: At this first meeting.

Pelkey: In the morning, you came back, gave everybody the document, and they said it was great --

Zimmerman: Well, just before this. Somehow I had some -- I'm not quite sure, but it probably happened like this; we had decided to form the working groups, we had small meetings. Then it was the end, everyone was happy. I said: "Well, now let's just write this down."

Pelkey: Gotcha.

Zimmerman: From there on, I think it was clear to everybody that the key thing in the process of developing standards was first to establish the OSI reference model. Protocols would fit into it, but if the structure were not consolidated, then the other thing would not stick. I think there was a general agreement that this had to be done. There were probably different perceptions on how to do it, but the way I managed to get it done was twofold: one was to really convince people that this was the key thing, that it had to become a standard and if it did not become a standard, the whole thing would fall apart, and

⁶ Should be Gary Grossman -- Ed.

⁷ See previous footnotes. --Ed.

⁸ Zimmermann called Day sometime later and asked if he would chair the formal description work in WG1 and then attended the first WG1 meeting in Paris in October 1978. -- Ed.

in particular, something which helped was that there was more or less some competition with CCITT, who were starting to try to define their own protocols for teletext at that time, and that they had in mind that they should define some sort of structure for hosting this. Having CCITT moving their way and preparing recommendations, it was pretty convincing for people within ISO that they should go fast and have something solid, a standard, so that's one thing, convincing people that this had to be done, to be done fast, and to be done solid. The other trick that was used was to have people agree that we should only work in constructive. In particular, one thing that I made was to define forms for contributions. So we had a reference text, we had it from the very first meeting. The thing that was agreed was that we should all approve this text, so that we had a first version, another version, another version, and each version should be an improvement from the preceding one. The forms had, as a name, "Proposed Improvement to the OSI Reference Model," something that identified that this is the place where we want to improve, and this is the improvement we propose, and this is rational proposing it. This was used at each meeting. Those contributions were used and discussed, or discussed and used to improve and produce the next version. So we always -- and I think it's very important when you have that kind of collective creation, or the process of building consensus, is to have something which is THE common thing on which -- which is there and belongs to everybody, but is outside of anybody, so that it can be common. If it has no concrete existence out of the minds, there will be lots of misunderstanding. At some point in time, it was -

Pelkey: Did you put that online?

Zimmerman: No, at that time we just used scissors and paper and scotch tape. It was ok. There was also lots of enthusiasm in this. People were conscious that they were doing something that would have some influence in the overall data processing and communications world.

Pelkey: This is 1978, '79?

Zimmerman: This is between 1978 and 1982, basically. It took about four years to have the thing completely agreed and --

Pelkey: Specified.

Zimmerman: -- and stabilized. One thing, which also was clear, I think to a number of people but particularly to me, was that in that kind of process, you cannot have something, which, from a technical point of view, is perfect. It's much nicer if you have one guy doing one thing, that would probably be, from a pure technical point of view, that would be better. Now, from the point of view of having something which is to be useful in the real world, it was important to have something which was accepted by everybody, and something in which, despite it's technical weaknesses, would really satisfy the requirements of a variety of people who were going to use it. At that time, somehow, we had to admit, and I was convinced pretty early, that we shouldn't have something which was far from being perfect from a technical point of view, in abstract, but had to be accepted and endorsed by the major players. We put a fair amount of pressure for, at some point in time, just freezing things, and saying: "Unless there's a very good reason to change something, we won't change it." We had, for instance, a proposal from the UK, saying: "This is nice. We have done a good job. Now, this is not English. We are going to re-write it," and it was clear that the nuances, which were there and had been written by Japanese, by Germans, by English, by French -- there were things in different places that were important to some people, and the others did not even know, just because they had the view of how they would use it. This thing was important to them. To others, it was just a mistake in the usage of the language. We had a few discussions of that sort, and it was clear to me that the text as it was, was good enough to serve its purpose, and if we tried to improve it, it would destroy it's --

Pelkey: Organic-ness.

Zimmerman: We suggested to the UK that, if they were not happy with the English, they could translate it just as we translated in French, so as to have a pure Oxford English version. Anyway, one of the most intense decision making moments was in Berlin in -- when was that, 1981? You can probably find this

back in the files from ANSI. We had a vote for moving us to the DIS, Draft International Standards stage,⁹ which is the time where it's more or less frozen. At that time there were -- everybody was admitting that the standard, or the text was good enough, the reference model was good enough, to have it as a standard; it could serve its purpose, except the US, which was not convinced that it should be a standard. They said: "That would probably be just a technical report which does not have the weight of a standard." There were good reasons for this, from the stance that it's not something you can apply to real things. It's just a frame for putting standards. They said: "Well, a frame need not be a standard," but the reason for making it a standard is to freeze it, and the standard is much more difficult to change than a technical report. So, the US was not convinced that it should be a standard. The UK had the position that it was not in good shape, and it had to be rewritten to make it good English and to make it conform to the ISO rules for publishing standards. So, we had this big meeting where there were proposals for voting to make this at DIS, or a DP, I don't remember. It's probably a DP because the decision of making a DIS can only be done by writing. It's a vote by writing, so it's moving to the DP.¹⁰ DP is Draft Proposal, but it's the first time where it becomes the beginning of a standard. Before this, it's just a working document. So the proposal was put on the table, to have it as a standard, and the US made their point, that they felt it was not necessary to have it as a standard, and the UK just started to explain that they had passed this document to their experts -- the guy who was explaining this had not really participated in it. He was a guy from BSI, a professional standards guy, but had not participated in this. It was not what had happened. He started to explain that they had given this document to their experts, and they had said unanimously, more or less, that this document should be put in the basket." That was the end of it, because telling this to a bunch of people who had been working hard like hell to produce something, who know that it's not really perfect but it has some value, telling them that it's just good for the paper basket, that was the end of it. Everybody agreed. The US said: "We'll just abstain. We'll not oppose," and that is the way the OSI reference model moved to the DP stage.

Pelkey: Who argued for the United States?

Zimmerman: John Aschenbrenner from IBM, who was head of the US delegation at SC16.

Pelkey: So then, you think this was 1981 in Berlin. From there, that was the first --

Zimmerman: I think that was the time where the reference model --

Pelkey: That was really a turning event -- a meeting with substance.

Zimmerman: Before this it was going and moving well, but this was probably a key --

Pelkey: Now, during this period of time, what kind of contact did you have with what was happening with TCP/IP and the publication of XNS.

Zimmerman: There are two things that are interesting to also analyze. One is the relationship with the Arpanet community, and IFIP and all this. The other is the relationship with CCITT. Surprisingly, the Arpanet gang, bunch of people, did not join ISO, except just a few, like John Day. Most of them just stayed out of the process.

Pelkey: Why, do you think?

Zimmerman: One thing is that just before the work started within ISO, Vint Cerf and Bob Kahn had published their TCP protocol. Being responsible for contracts within ARPA, they had passed contracts to various people here and there to implement it, and probably they were reluctant to see people going to

⁹ He corrects it further down, but this was the 1980 meeting in Berlin and it was the vote to progress to DP, Draft Proposed standard. -- Ed.

¹⁰ Here he corrects himself. It was the DP vote. -- Ed.

another place and discuss things that might well be different from their stuff. The result is that the Arpanet community missed what was happening within ISO.

Pelkey: It sure did.

Zimmerman: Within ISO, what they missed is that probably the American academic community was not represented within ISO, but all major computer manufacturers, all the major industry players, were there within ISO. So one thing is that it was clear, at the end, if they agreed on something, that was the thing that would probably have the most weight. They just turned out not to join. If they had participated, I think there probably would have been a merge between TCP/IP and things defined within ISO. It turned out that, within ISO, what was taken as a basis, was the IFIP proposal for the transport protocol, virtual terminal protocol and file transfer protocol. This, of course, had some influence from Arpanet, but there was no further input from the Arpanet community on this. So, it went on its way, and the outcome is something, which is equivalent. For instance, if you take the OSI transport protocol, something which is equivalent to TCP, but its just different, and its not better, its not worse, its just different. So that's one thing that happened.

Pelkey: Were they ever specifically invited to become part of this process and declined?

Zimmerman: I don't know. John Day would probably know better than I do, because he was part of both communities. The other thing is CCITT. So CCITT had been, up to 1980, I think the work between ISO and CCITT had been done pretty much in isolation. The thing that was done in 1980 within CCITT was teletext; teletext had some similarity with work done within OSI. It was based on X.25, but they were doing their stuff on their side, and there was no real contact between ISO and CCITT. It's from 1980 that several things happened. One thing is that CCITT started to work on MHS, Message Handling System. One of the key players on MHS was the Canadians from BNR, Bell Northern; the people from Xerox, who had a data processing culture. They were keen not to be on their own. They had also participated in another working group within IFIP, on messaging, so they were not isolated within the data communications community, within the communications community.

Tape Side Ends

Zimmerman: So that's one thing. The other things were that the OSI reference model was getting pretty solid at that time. One thing, among others -- there are probably other things worth mentioning -- but one thing is that I moved from INRIA, the data processing research institute in France, I moved to CNET, which is the telecommunications technical establishment. At that time --

Pelkey: When did you move?

Zimmerman: In 1980, and one of the reasons for moving -- there were several reason for moving there - - but one of the reasons was the will of the French PTT's to put together, or to get more, of the data processing culture. It was agreed that I would keep participating in standards, as I had done before, and from that time was in a much better position to act as a go-between between ISO and CCITT. So I was, within ISO, still in charge of the OSI reference model group, and people knew that I had moved to the PTT's. They could see that it did not change my way of managing and pushing things, and it was clear that I was being supported by the French PTT's. Also, towards CCITT, I could go there with the support of the French PTT's, and that it was something they wanted to help, and I was going back and forth between ISO and CCITT. For instance, the thing that the French PTT's did was to submit to CCITT contributions under their name, the contributions that had been prepared within AFNOR, the name of the whole French community. Passing problems back and forth, and trying to help solve problems. So, between 1980 and 1984, the end of the next study period within CCITT, this was part of a time where there was a --

Pelkey: Coming together?

Zimmerman: Yeah. The CCITT and ISO went together as much as possible on, say, the usage of the OSI reference model for distributed data processing and telematic services, as they call theirs. In particular, the thing which was the most successful was the message handling, and X.400 was developed with the main initiative being taken within CCITT, but in pretty good coordination within ISO, so that at the end, the standards defined within CCITT was more or less acceptable to ISO, and we now have a common standard between ISO and CCITT on this. At the same time, there was also an agreement between ISO and CCITT which was developed on the lower layers, so the whole thing, the reference model -- well, lower layers, as far as X.25 is concerned, which is the only thing they currently use on the CCITT side, were the transport protocol, with a number of various classes but that's better than nothing, the session protocol presentation and the X.400 application oriented protocol, that was agreed in common between ISO and CCITT, and I think this is something which has some value, in terms of inter-communication between those services. It has also some effect on the potential development or evolution of the data processing and telecommunications industry. That's about when I left ISO. I kept helping things to go on, but more or less, after 1985, I started to prepare this company, and I started the company at the end of 1986, so I'm in a different business now.¹¹ There is another thing that you had not covered, which is the story of local area networks, which were more or less not part of the initial development of the OSI reference model. They had their room left, just because people developing the reference model had the culture of the Arpanet and all this, and knew about Ethernet and all this, so there was room for this. Never the less, in terms of networks, there are two different types of networks: the connection oriented and connection-less oriented networks, which have less intercommunication capability within each of them among networks of the same style. That's the way it is. It's probably better to have two than five, but it would have been better if there had just been one. It is probably not the end of the story, in the sense that there are some standards for local area networks. I've not directly participated in the development of those standards, say on Ethernet. I think the kind of analysis that you are --

Pelkey: Is ISO connection oriented?

Zimmerman: If you discuss with people on local area network standards, I think the rationale for the development is different from the one for the reference model in general, and those standards developed in --

Pelkey: This is the IEEE, 802?

Zimmerman: Yeah, it's the IEEE, 802. It's different actors, different environment. There was no PTT. There were no major actors; some taking the initiative, some others coming saying: "Our stuff is as good as yours," and that gave something which is more varied than what got out of CCITT, but its not the same context either. I think the environment was different, and it's also worth analyzing how things happen, and for that you should discuss with people who had participated in this.

Pelkey: But now the fact is that 802 is really becoming the lower layers of the ISO, in terms of how --

Zimmerman: It's one of the bases. There are two bases. One is on the local area networks, 802, and its ISO equivalent. The other one is on X.25 or circuit switching type of networks, and the two are reconciled at the transport service boundary, so that the same applications can run on top of both networks. The only thing, which is a bit tricky, is when you want to interconnect those two kinds of networks. Another thing, which is probably interesting to see in the future, is what happens with ISDN, and what was the influence of ISDN. ISDN is, apart from any technical analysis, ISDN is pure telecommunications stuff. What they do with this, how it connects with the computers, who takes the lead in terms of beyond the basic telephony -- pure replacing a leased line by switched ISDN circuits -- beyond

¹¹ Zim and long time friend, Michel Gien who was also part of CYCLADES and was at the Oct 78 WG1 meeting, founded a company, a microkernel company, called Chorus Systems. This was a spin-off from one of the Pilot Projects called for in the Nora-Minc Report. -- Ed

this, the services which will develop there, with which protocol, how they will merge or keep separate from the traditionally data processing, that's something which I think is worth looking at.

Pelkey: Yes. I hold the view that channelized ISDN is a joke, that 64 kilobits at the desktop is archaic.

Zimmerman: What I'm saying is that it's probably something worth looking at in the coming years.

Pelkey: I agree with you completely. I'm respectful of your time. I thank you very, very much, and I appreciate the time to sit together.

Zimmerman: You should ask Louis Pouzin, and if you have dates or names or things missing, you may just send me a note saying: "Could you find -- "

Pelkey: I'm going to send you a transcription of this, and I'll mark in the columns.

Zimmerman: If there are things that you would like, I will look in my files at home, and if I can provide more details, I will do it.

Pelkey: Thank you very much.

END OF THE INTERVIEW