An Interview with

MARC E. LEVILION

OH 417

Conducted by Andrew L. Russell

on

2 April 2012

Paris, France

Charles Babbage Institute
Center for the History of Information Technology
University of Minnesota, Minneapolis

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2 April 2012

Oral History 417

Abstract

French computer engineer Marc Levilion reflects upon his career with computers and computer networking that spanned from the 1950s to the 1990s. Levilion describes his 33-year employment with IBM France, where he worked on projects at the intersection of computing and telecommunications including error-detection and correction codes, IBM digital Private Branch Exchanges, IBM's Systems Network Architecture (SNA), and IBM contributions to the X.21 and X.25 international standards. Levilion describes the relationship between IBM facilities in La Gaude, France and Raleigh, North Carolina; compares the networking concepts behind SNA, X.21, and X.25 to the concepts deployed in the Arpanet and by Louis Pouzin in Cyclades; and explains IBM's global standards strategy and IBM's involvement with French standards committees, the International Organization for Standardization (ISO), the European Computer Manufacturers' Association, and the Comité Consultatif International Téléphonique et Télégraphique. Levilion reflects on his participation in Open Systems Interconnection in various roles: as IBM France representative to committees in Association Française de Normalisation (AFNOR), as head of the AFNOR delegation to ISO, and as convenor of the OSI architecture Working Group.

This set of nine interviews conducted with Tilly Bayard-Richard, Najah Naffah, Louis Pouzin, Marc E. Levilion, Michel Gien, Jean-Louis Grangé, Gérard Le Lann, Rémi Després, and André Danthine was funded by the ACM History Committee with a fellowship on "European Contributions to Computer Networks: An Oral History Project."

Russell: This is Andy Russell, and it's the second of April 2012, and I'm here with Marc Levilion. I want to start at the beginning, with your education and introduction to computers. You graduated with electrical engineering and mechanical engineering degrees from college. How did you get into those fields?

Levilion: Well, it happened that my father was a lawyer, and his idea was that I would be a lawyer after him, but I was not interested in these kinds of activities. In the secondary studies, suddenly I decided I didn't want to continue learning ancient Greek, I turned into mathematics. Really, my father was very surprised to say a little. The normal education system in France is that – at the time you had very few choices – at the end of the secondary school, you could choose between purely literature or purely mathematics or what was called experimental sciences. We had no college at the time. We had primary school, secondary school, university. And so at the end of secondary school, you had three main branches – of course if you had gone that far. You could of course leave school earlier at the time, but if you wanted to take the *baccalauréat* exam, which was the opening to the university level, you had these three main choices. Experimental sciences was for medical studies or paramedical studies. Literature was for people who wanted to study philosophy, history, all these great things. And of course the mathematical/ scientific section was an opening towards pure science or techno-applied science at the university level. We still have the system in this country that existed at the time where there are two main branches for higher, or university level education: the university side and what we call *Grandes Ecoles*, technical schools which are devoted to studies like engineering essentially. Or management schools – you could study management in dedicated schools like HEC, *Hautes études commerciales*, or you could study engineering but mainly in schools, devoted schools. The best one, the highest ranking one was *L'Ecole polytechnique*, and all the best people in France have gone through these higher education schools. One of the key ones was *Ecole normale supérieure* – it's still called *Ecole normale supérieure* – which leads to very high professionals in education. Essentially, that's where university teachers are educated – *Ecole normale supérieure*. Admission to these schools at the time (and still now) was difficult – if you go through the secondary system and have succeeded in the exam, which is called *baccalauréat*, then you have a choice. Either you go to the university, which is open and not expensive. That's the easy path in terms of being accessible to everybody. Or you take the more difficult path towards the schools because these have a selective examination. They have so many places available, and you go through an examination, and those with the best ranking are selected and enter the schools. So, it's more difficult. It's not a very good system, but it works. <Laughter> It creates a kind of a system where the sons of the people who went through the system go through the system – and the sons of the sons of the sons, and it is a very elitist system, not very democratic. Because if you are in an environment where you have people who have been through these systems – who have better positions in the society – then the children get better education, and if they get better education, they have more chances in succeeding in entering these schools. So, that's the way it is in this country. And it's very hard work, actually – very, very, very hard work. It's still true, I've seen my grandchildren, my children and my grandchildren have gone through this system as well. And my grand daughter is now in *L'Ecole normale supérieure*, another one is in *L'Ecole polytechnique* – so, it's the same system continued. So after very hard work, I finally succeeded, having been accepted in one of these schools, which is called *Ecole centrale de Paris*. I stayed for three years studying mathematics and physics and engineering in general. Very generally. And we were about 220 people in that school each year. The first and second year were general teaching, and the third year had some opening into selections of what you wanted to do such as chemistry or electrical/ mechanical engineering or civil engineering and architecture or mining. At the time, mines were still something very significant in this country. Now it's completely disappeared, but at the time, we had a section of people who wanted to study how to dig coal <laughter> and things like that. So, it was a very hard time. I still remember it. It was not fun.

Russell: But when you finished, you moved to Harvard, for a year, right?

Levilion: Yes.

Russell: Did you know about computers then or had you encountered a computer before?

Levilion: No. We had teaching in physics on vacuum tubes. Transistors did not exist yet. And I had happened to see in one of the labs of the school a computation device able to sum up to 10 digits. I had the feeling that it was a very interesting field. At the time the fashion was something that was called servomechanisms, allowing to control the movement, distant movement of things. And the question for me was whether I wanted to study servomechanisms or computation systems. Nothing existed really in France. That was 1957. And when I asked for advice from some people I knew, they all said well that is no future so you should not study that <Russell laughter>, but I thought it was interesting and so on. And also, in order to be chosen to get the scholarship to the United States, you had to propose a field of study, and that was not a main interest for people, so it was an opportunity to be real different from the others, and it happened that I was selected and got the scholarship. But, I think – I'm not very sure about the dates – that was in 1957, in the beginning of the year in 1957, it was decided by the French Ministry of Foreign Affairs, which was the sponsor of these scholarships, that I would be awarded one. But classically France is in a poor financial situation, and under the 4th Republic, we had very difficult times, and so they found that they had no money after having decided that some people were awarded scholarships. So I couldn't apply to where I wanted to go, that was the MIT, and when finally sometime maybe in June 1957, they told me, yes, they had the money for me. I applied to MIT, and it was too late. So I had no idea about Harvard except that the advisor at the Ministry told me that I could apply, should apply to Harvard, and I did, and that was a very good idea because I went into the section directed – it was called the Computation Lab in Harvard – directed by Professor Aiken. Howard Aiken. Howard H. Aiken. Who was a very exceptional person, and I believe, I'm not sure, that he was the inventor of the first mechanical computer – Mark I in Harvard – which was used during the war for computing the first atomic bomb or some things like that. So he developed a theory, which he called switching theory based on Boolean algebra. And that's essentially what I learned in Harvard.

Russell: Did you have an easier time that year than in college?

Levilion: Yeah, it was a fantastic place to be, and it was a fantastic difference. In France – in the *Ecole centrale* – at least during the two first years, teaching was in a large, I mean, *amphithéâtre*, with 220 students, and at the bottom was the teacher explaining or at least saying what he had to say and when it was finished he would go away and that was all. I went to Harvard and there we were maybe 15 students, for these 15 students we had one professor and assistant professor, labs at our disposal, and we could walk in the professors' offices, where they were expected to be present and being in a position to answer questions from the students – that was unheard of for me! Such as the ability in the middle of the class, to say, "Well, Mr., you just said that 2+2=4, can you explain?" <laughter> which was something astounding for me. So it was a great time, and I enjoyed it very much. And discovering of course the United States was great. So, yes, I had a very, very interesting year, but I was too old, and at the end of that year, it was 1958, I graduated as a Master of Arts, Master of Science, whatever you want to call it, and Aiken asked me to stay for one more year or two years and get a PhD. And I said, "Well, I have no money because my scholarship was a one-year scholarship." He said, "No problem, we'll give you the money." But I was French citizen, and we were in the middle of the Algerian War, and I had to make a choice – either to give up my studies because I was too old, and go back to the country and go into the army and fight for my country. And I was not too sure about that war, but at least it was a duty. Or, take the offer, stay, and become an American citizen because I couldn't go back to France. So I made the real bad decision in my life, and I went back home. That's my first wrong decision I ever made, but really significant. I was French – *France uber alles*, as some say in French. <laughter> So I went back home. And I fought in the Navy for two years.

Russell: Then when you finished you took a job with IBM?

Levilion: I had to find a job – and at the time it was not difficult to find a job as an engineer anywhere in this country. I applied at Bull, I applied at IBM France, and I applied at – I don't remember the name of that company which wanted me to do radar research or things like that. And I chose IBM France – first I had met the IBM people in the U.S. And I had applied, well, asked if I could work with IBM, when I was in Harvard. They told me that I had to go to IBM Europe, but in France.

Russell: Can you explain the difference between IBM and IBM Europe?

Levilion: Oh, IBM is an American company created in 1924 – it started with Time Recording Company, and then it turned into IBM when they started making punched card machines for the U.S. administration, for the – how do you say …

Russell: Census.

Levilion: Census. Yes. But then they started doing worldwide business, and they started selling their machines across the world, and after awhile they decided to organize an entity in charge of managing the selling of machines in Europe, and that was called IBM Europe, but IBM Europe was a management organization covering national companies, national companies were in charge of the actual sales. There was a national company in the U.K., there was a national company in Germany, there was a national company in France, Italy. And of course during World War II these companies had to continue to survive more or less easily being isolated from the U.S. and in particular they had to – well, it started before the war – they had to adjust the machines so that they could work with 50 Hertz instead of 60 Hertz, so they had to have dedicated laboratories to study these kinds of things and adjust, adapt the machines to the European marketplace. So, they had created before the war a small lab in France to that effect. And this lab developed during the war because of the necessities of working in isolation. So, I'm sorry, I'm moving away from IBM Europe. IBM Europe was just a management organization distributing orders to the national companies under the supervision of IBM in Armonk. So there was IBM Europe, and there was IBM Asia Pacific, and so on.

Russell: So then to work for IBM…

Levilion: You had to go through either a national company or through IBM Europe, which was on top of the national companies. But I was not interested in sales. When I applied to IBM and Bull when I was still a sailor in the French Navy – officer – I knew people who had told me that they could help me being accepted by Bull, and when I saw some high-ranking people in Bull, they said, "Well, you are interested in engineering, but if you like to make money, you shouldn't do engineering, you should do management. So we'll take you – we'll offer you a job" as what was called *technico-commercial*.[1] It's just in between engineering and sales. So I didn't want that, so... IBM had decided at the time that it was going to move its lab which was in Paris – to expand the lab, make it something real, significant, and move it from Paris to the south of France because the first thing was to expand it and they needed more space. And second it was the policy of the French government at the time to move industry outside of Paris towards anywhere in the country just to give more energy outside of Paris. So it was the policy of the French government, and IBM France, being actually a kind of foreign body inside France, wanted to be a good citizen.. It took the idea of moving its lab to the south – or any other place outside of Paris, but the south of France was a good choice … Nice is the city on the Mediterranean Sea, very close to Italy, and it has the second-ranking airport in France after Paris as a whole. It was a very good location because it was in connection with the world – direct connection to the U.S. and of course connections to the main European cities. So because I wanted to do engineering and not business, not marketing, not things like that which I'm not interested in, I chose IBM. That's the way it went.

Russell: The lab had been up and running when you got there? Or was it just starting when you got there?

[1] A note from Levilion after the interview: "This is the French equivalent to a function called Sales Engineer in the U.S. Within IBM, there were Sales Representatives, whose job was to convince customers that nothing was better for them than an IBM machine. But they had little technical knowledge. They had to be supported by people who were able to understand the how these machines worked. Of course, the salesmen had a higher salary and better prestige!"

Levilion: When I joined IBM, the lab was still in Paris, and it was moved. It was under construction when I joined, and they told me it was in Nice, but it was not in Nice. It was 10 kilometers outside of Nice in a very remote and strange place, a strange decision.

Russell: Can you tell me a little bit about some of the work that you did there? Ten years or so you were there?

Levilion: Yes, something like that. I joined IBM at the end of 1960, and moved to Nice in the beginning of '61, in March or April '61, because they had a temporary lab. They were – what do I say – hiring so many new engineers because they had planned to expand the lab – that the location in Paris was becoming really too small, and the lab in La Gaude, close to Nice, was not finished so they moved a selection of people to a temporary location in Nice where I went. So I was in Nice from April '61. The lab opened in December '61. And I moved back to Paris in 1980, having spent in the meantime two years in Brussels on a special assignment. So it was actually 20 years. So I was very surprised when I went to IBM because I was interested in computers, and I discovered that I was going to work on telecommunications, which was not really what I was interested in. I wanted to do computers and not telecommunications. After all, why not? And the interest was that very early IBM became interested in the connection between computing and telecommunications. So, my real first activity was in Paris and it was how to establish a means of entering Telex messages into a computer. That was back in 1960, end of 1960, beginning of 1961. So I was given the problem. Here is a Telex. Telex was an old telecommunication system, which was point to point between two dedicated machines. And a line-switching system – how to enter that into computer? Very interesting. So, I had to start on that quite alone. But it expanded, and I had a team of two or three engineers at the end, but that was done in competition with similar work done in one of the U.S. labs. Because it was the policy of IBM for a very long time to maintain competition among its labs, usually competition between a lab in the U.S. and a lab somewhere else in the world. And in the end taking the best solution, our solution was not selected. <laughter>

Russell: So then what happened? In a market, if you lose to the competition, you lose! <laughter>

Levilion: It's the same thing. You lose. And you are not promoted. <laughter>

Russell: Oh, okay. I see. Okay. <laughter> But you don't lose your job?

Levilion: No, you don't lose your job. You lose the project. Okay? And you move to another project. And so that project didn't succeed. When we moved to La Gaude actually, that project died, well, it continued when we were in Nice in the temporary lab, we continued on that project, but then it died, and we moved into the new lab, and I started working on studies – technical and practical and theoretical studies on the telecommunication lines used for transmitting data. Telecommunication lines were made for telephones or Telex or telegraph. *Télégraphie*, or essentially telephone at the time. And the question was, how can one use these telephone lines with all their properties tailored to the transmission of voice? How can they be used to transmit bits of information? And in particular how these lines were subject to noise and that you could put information at one end and not get it correctly at the other end because of surges of transmission, of – how could I say – distortions and noise on the line, which resulted in loss of information. So I made theoretical studies based on the theory of information on these things, and we had a campaign of measurements on actual lines rented from the French PTT organization, which was *the* owner of all telecommunication means in the country. So, we had built a little machine that transmitted known information and another one which received that information and compared received information to the transmitted information, knowing what had been transmitted, and looked at the distribution of errors in these lines. And my job at the time was to make a model based on some aspects of information theory that were to replace the actual experiments by a model so we could make very short measurements using PTT lines, getting some key parameters on the lines, using these key parameters to, in the model, to have a distribution of errors and then apply that to the – how could I say – to mechanisms for detecting and correcting these errors. Not based on actual experiments but based on my model.

Russell: Were you going to conferences or were you aware of other work in the field on similar things? In IBM U.S. labs or elsewhere?

Levilion: We had access to documents but not conferences. We had a very good library so we could read what was being done outside. But we were very busy with our own work and not enough opened to the rest of the world. We didn't have time to read actually. One of my colleagues, by the name of Dr. Étienne P. Gorog was a very good scientist and at the time, the study of error detecting and correcting codes was critical and he made a very significant contribution to the theory of error detecting and correcting codes, and he delivered a conference in Munich, I guess, yes, and I attended his conference in Munich. It was my first international conference. Was it in '62? Something like that. I worked at the time with an American of Greek descent called C. M. Melas who also had done some useful work on error detecting and correcting codes. That was an interesting period.

Russell: Did IBM end up using your work in equipment that they built, or was this just for laboratory purposes?

Levilion: Well, then, the result of these studies was – I don't know if it's still in use. <laughter> In order to transmit digital information on analog transmission lines, you had to have a piece of equipment which was called a modem on each end of the line, and on top of that, you had a mechanism to distribute the bits of information and a set of rules for sending information, which was called line control protocol, or data link control protocol. Initially, this was a block transmission system. These line transmission protocols had to include a mechanism for error detection and/or correction and the early protocols applied very basic error detecting and correcting mechanism until the time when came SLC, single line control, which was a bit-oriented mechanism. And this includes an error detecting and correcting mechanism which is based on the distribution of errors. If you select a mechanism for error detecting, it has some theoretical properties which depend on the ratio of overhead bits to the actual number of information bits transmitted. But if you can make the error detection system such that it will detect not randomly but will actually detect the type of errors which is going to happen, then you have much better results. So what came out of our studies was a specification of an error detecting protocol which was tailored to the type of errors that was most likely to be encountered on the lines. So it was useful at the time. What I believe, I'm not sure, is that the same protocol, because it's easy to reproduce what has been created once, has been applied later on although the type of errors have changed. Now we have digital transmission lines. We don't have any more rotary switches in the telephone exchanges. At the time, the switching system was called rotary, that was an electro-mechanical switch, and these switches were creating noises in packets, in bursts, because of very technical reasons. That's no longer true with the digital switches we have now. But I guess that despite the fact that the source of noises has disappeared, the same mechanisms are still applied, which had sense at the time, which don't have sense anymore. But I'm not sure. So yes, it has been useful at the time and is probably still there because SDLC was turned into an international standard – which is called HDLC – high performance data link control – the same thing with some slight improvements. But it did incorporate these error-detecting mechanisms based on our studies. It was my first kind of useful work…

Russell: You mentioned that you went to IBM Belgium briefly…

Levilion: Yes, two years, because IBM had created a machine for message switching. There are two main means of transmitting information across the world. One is called line switching (or circuit switching, which is a more elaborated version). Line switching, was what you used in telephone, classical telephone. You are the source of information and you want to have connection with some people across the world, and you ask for establishing a physical link - it may be satellite but it's still physical – between source and destination and through a number of switches in the world, you establish a physical, real path which is dedicated to that single conversation. Or, you can use what was called at that time message switching where you send the whole message to one point, and then at that point the selection is made at the best route towards the destination to another intermediate point, and you send the whole message. That was used mainly in the United States for telegraphy; you sent a telegraph message, and it was received at one point where they took out the tape and planted the tape into another section/ transmission line to another point, where they received the whole tape, would cut out the tape and put it into another transmitter. Such was the system. And that was reproduced automatically with message switching systems. That creates long waiting queues at the intermediate switches, and this is why packet switching was invented – just to make that mechanism faster. With a message switching system, you have to wait until the whole message is received in the first switching point, before you decide on what to do with it. So you have a long time waiting for the whole message to be there before you decide on the way you transmit it. So it creates long delays. The invention of packet switching by Mr. Paul Baran was an extraordinary improvement on that mechanism. So packet switching is an evolution of message switching, but the two main modes of switching are line or circuit switching on one side and message or packet switching on the other side. So we had created in IBM France a message switching machine, which was the result of a market study, which had been done before, which showed there was a need for a machine of that typed. So there was a proposal for a machine built in La Gaude based on IBM 360 Model 40 and a group was created in Brussels because there was a marketing center in Brussels – telecommunications marketing center under IBM Belgium – and there was a group created there in order to support the marketing of that machine. It was a real failure. <laughter> I think we sold about half a dozen or something like that. I went to Brazil to build a proposal. We had a team of five or six – having to go all over the world where it was felt there would be a need for such an equipment – and build the proposal because the local IBM companies were not able to make a very specific proposal on a machine which was not a worldwide machine. IBM had its mainline products supported by world marketing efforts and education for the salespeople, technical support, and marketing support, and everything that was needed. So they knew how to sell these machines, but not the specific machine make for a little niche market called a special product, which was very, very parochial to some extent. It had to be supported by people specially trained to understand the machine and what it was able to do and how to put it to work, so we had to go wherever it was felt useful by the local company. When there was a potential to sell a machine in some country, one of us would be sent to that place in order to help the local people building that proposal. And that's why I went to Brazil, to Venezuela, to Peru, just to help the local people. I still have a real good friend in Brazil. He's coming next week or something. <laughter>

Russell: Something good came out of it then. <laughter>

Levilion: Yes. <laughter> But I think we did sell a half dozen of these machines**.** It was not a big success. But it was an interesting time for me – a very interesting machine. I had a hand in its design, a small hand in its design. But it was not a real success, not a marketing success. IBM 5910.

Russell: Then you returned to La Gaude for the development of the digital private branch exchange?

Levilion: Yes. The lab in IBM France had created products – digital branch exchanges – a few years before that and had been very successful in selling machines which were called IBM 1750, but only for the European market. The U.S. didn't want to enter in competition with the classical makers of branch exchanges in the U.S. And also it was not the main core of business for IBM. So they accepted that as a kind of an experiment, these kinds of machines would be tested on the European market. It was the beginning of digital switching for telephone. It was really, really new. So the 1750 existed, and I joined the group which was in charge of studying the future – the evolution – of what could be made afterwards and what new ideas we could be bring in that domain. Later on, IBM decided that it would become a worldwide project and decided that La Gaude was not the proper place for doing worldwide products and that it had to be brought back into the U.S. And then they decided that, no, IBM would not continue in that field but would work together with another company which was called Rolm and then it was a dismal failure.

Russell: I can see this causing problems in the United States, given AT&T's role at that time as the monopoly telephone provider.

Levilion: But we didn't… IBM did not attack the monopoly of the public switches.

Russell: Ah, OK.

Levilion: It was still worse in France, in Europe in general and in France in particular, than in the U.S. In the U.S., the competition was much more open. First you have two common carriers and not one. So there was competition among the common carriers, and they were much more open to buying other equipments from other firms. In France – in general in Europe and in France particularly – the telephone company was a state-owned, government-owned company, and its role in promoting the national economy was very strong, and it has closed links with its own suppliers. And it was more or less in charge of helping those suppliers doing good business, not only France but also exporting. So it was a closed market reserved to French suppliers, and of course, not to the enemy – IBM France was an enemy in this country. The idea of attacking the supply of products to the national telephone company was just unthinkable. But private branch exchanges, though, is another story because that is something that belongs to companies, even to an hotel – an hotel has a private branch exchange – small one but still… Companies had their own private branch exchanges so they could buy from anybody. And in particular, the invention of digital switched branch exchanges was a great, great, great improvement. In terms of flexibility, in terms of adaptability to the local requirements and really, really…

Russell: And politically it didn't cause a big problem?

Levilion: No, because it was not supplying the government owned telephone companies. True across the whole of Europe and also in the U.S., but to a less extent in the U.S., Canada, Japan, which had more open markets. But France was terrible, terrible. This activity didn't last for long for me because then I moved into a local group created in support of SNA, IBM's Systems Network Architecture. That was a great improvement on the organization of telecommunications with computers. The idea that – how could I explain that – that all the mechanisms for creating, managing, transmitting information between a computer and its slave equipments would be unified with the same mechanism, the same system. Indeed, you didn't need to have a different access method for each different terminal from each different computer because you had families of computers, which didn't have all the same operating systems and each family had its own little mechanism for speaking with such type of equipment. So the idea was to organize once and forever all these specific solutions. All types of operating systems would have the same mechanism for communicating with all types of outside equipments. This was the big idea of SNA. And, at the same time, before that actually, the PTTs of the world had decided that they would build on packet switching - circuit switching or packet switching – and in particular packet switching. And because we were so dependent on the capacity for us to convey information across PTT lines – PTT was French, standing for *Poste, Télégraphe* et *Téléphone.* It's from the old world of the 19th century. So the idea was essentially for us, IBM, that our customers who needed to distribute or concentrate information across their companies between terminals and the central computer had to hire telephone lines from the local suppliers which were the PTTs. And the lines in Europe were extremely expensive by comparison to what it was in the United States. And the PTTs thought that one way of making the lines less expensive would be to share them, and the sharing could be done either by circuit switching – you share the capacity from end-to-end – or packet-switching where you share the capacity on segments of the transmission path. And of course because of our dependency on the availability of communication support from the PTTs, we had to know what was going to happen in that field. So we were very interested in what was going to happen and that's why our lab became very quickly involved in understanding and then participating in the studies of the access to these things. We were not concerned with what was going to happen inside in the public networks, but we had to access the public networks from our machines in order to use the public networks and their new offerings. Their new offerings would be the interface X.21, or the interface X.25, depending on either circuit switching or packet switching. And our objective in that was to make sure that mechanisms work and that the interfaces would be effective and that they would be the same across the world because we didn't want to have to build specific equipments in order to use these interfaces in Japan, in the U.S., in France, in Germany, having different equipment each time. So our objective was to make sure that it would be a worldwide, really, accepted protocol.

Russell: This makes some sense, because to develop SNA you were users of and not a competitor to the PTT.

Levilion: Right, right, right.

Russell: In that sense, it also makes sense that SNA and the move to develop standards for X.21 and X.25 are two sides of the same coin, if I'm understanding correctly. That is, if you want to just facilitate communication and make sure it stays intact across different interfaces – across different networks – then SNA gets you within IBM networks; but then if you want to move across into a public network then you can use the X.21 or X.25 interface?

Levilion: Well, actually, maybe I'm not very clear, but the initial SNA was one computer and terminals. Then it became one computer and concentrators and terminals. Then it became computer to computer to concentrators to terminals. Between each piece there was – has to be – a telecommunication means. That telecommunication means to the IBM view initially and had been for a very long time: you, PTTs, provide us with a piece of copper between point A and point B, and we, IBM, know how to use that piece of copper to the best advantage of our customer. And we put our information on that piece of copper, so that your job, PTTs, is to provide us with the cheapest possible copper connection between point A and point B. Then the PTTs said, "Well, we are not interested then, not anymore, because we want to put value on that copper, and we want to share it among many users, because of course if you have a computer and a terminal, you use that piece of copper from time to time but not all the time, so it is a terrible waste. So we are going to make networks – switched networks – to allow sharing of the copper, and you will use a piece of copper between point A and point B on request." But still the idea of the PTTs was "we make the best use of that copper", and we IBM make the best use of the data we put on that copper. So there was, there was some interest in both sides for us to use the copper as provided by the PTTs and for them to put value on that copper and so that they would make more money than just by selling their copper. There was a joint interest. I'm not sure it answers your question.

Russell: Yes, because then X.21 and X.25 would help because, as you said, you could use the same equipment in different countries as well, because it was an international standard.

Levilion: Yes, it had to be an international standard and not a different solution in all of the countries of the world. So if it was the same interface, we could build one machine or one software in order to control that interface, and it would be the same across the world. So that was our mission in relation with the CCITT at the time, which became ITU-T afterwards – because CCITT is a French acronym it couldn't survive. <laughter> So our mission in La Gaude, in that group in La Gaude, with relation to the U.S. IBM people was to work with the PTTs in such a way that, given that we had to accept that we would no longer have their copper at our disposal – it had to work – and it had to be one. So that was my first discovery of – it was very difficult because the CCITT (that's *Comité Consultatif International Téléphonique et Télégraphique* – International Consultative Committees on Telegraphs and Telephones) was the property of the common carriers of the world. It was where the common carriers used to meet and make decisions on their own behalf. There was no – very little – there was actually no – how do I say – there was actually no opening to private companies, at least in countries like France, because of the strong government control on the telecommunication world. Very different in the United States because U.S. delegations to the CCITT usually included representatives of the industry. Not so for the French delegations.

Russell: So how did you manage to get into the French delegation?

Levilion: It happened that IBM Europe had very cleverly decided that it would have a director of telecommunications – and that they hired a former high-level ranking in the French PTTs. So IBM Europe was accepted to send a representative within the French delegation to the CCITT. But of course under control of the French delegations, so you couldn't say what you wanted, you had to be careful what you could say. So my first visit to Geneva and CCITT was because I had the mission to make a review of the proposals which were on the table on X.25.

Russell: What year was this?

Levilion: 1975, I guess, because the first version of X.25 was accepted in '76, so it probably was '75. So there were proposals on the table, slowly elaborating, so we had access to – I don't know how we had access to the papers, but we had access to the papers. So I had made a review of all the deficiencies of X.25 at the time of the proposal, and I came with a contribution from IBM Europe under the sponsorship of the French delegation to the CCITT. It was a rather thick contribution pointing out all the faults of X.25 at the time. So I moved into that meeting of the CCITT, which was extremely formal. You had to ask permission to speak, and you had to say, "Thank you, Mr. Chairman," and you had to say very politely what you had to say, and when you had finished you had to say, "Thank you, Mr. Chairman." It was very, very formal. And I was a little anxious because of what I had to say. And when it was finished, Remi Després, who was the CCITT convener for X.25… came to me and said, "Very interesting contribution, thank you very much, because it will help us very much in pulling X.25 square," – as they say, that's the French expression *au carré*, making it correct. It was a great relief for me because <laughter> I was a little anxious. So it helped and I got on very good terms with Després afterwards. We worked together. My idea – and the idea of IBM at the time behind really my contribution – was that it would show that X.25 was a real failure and couldn't work, had so many defects, it was an error, but actually it helped making it work correctly, so…

Russell: Did you know Louis Pouzin? He directed another computer network, Cyclades, and also made contributions to – or certainly critiques of – X.25 at the same time.

Levilion: Yes, but he didn't attend the X.25 meetings, he didn't go to the CCITT, he was doing his own research on Cyclades, and his view was that X.25 was a mistake, a fundamental mistake because his system was actually an evolution or maybe just a copy of ARPANET system. He's considered by many people as the inventor of packet switching; he's not. For the concept of packets was invented by Paul Baran, and the concept of isolated packets going their own way is coming from military requirements. So I believe that Pouzin and ARPANET kind of worked simultaneously on the same ideas, so I'm not sure he's really the inventor – he likes to be called the inventor of packet switching. He is a very exceptional man. So the idea of ARPANET and Louis Pouzin is that a packet is an isolated piece of information. It has its own life. It goes its own way through the network, which was a very interesting idea for military networks, which was the basis of ARPANET because if a switch is broken in the packet because it's bombed, then the packet finds a way around the faulty switch and there is always a path. The result is that you send packets in order and God knows what you get at the destination. But the PTTs, which had orderly lines, wanted to have a defined path between source and destination, so the X.25 system is very much like the telephone system. You say, "Mr. PTT, I want to go from A to B," and Mr. PTT organizes a path from A to B. Instead of being like in the telephone a piece of wire going from source to destination or a circuit chosen among pieces of wires from source to destination, which is assigned to one telephone conversation it is just – how can I say – the reservation of capacity in a selected series of switches along the path. So it has the advantage that once it's established, you know that everything you want to transmit from source will reach the destination, and it will reach the destination in the same order it was received initially by the packet switched network. Where in the Pouzin system and the ARPANET system, you send your message, break it into packets, you send the packets, and you pray. It's called send and pray. <laughter> And if everything goes nicely and you get all the packets – you may get them disorderly, and then you have to take the time to reassemble them in the correct sequence because this has significance. And, if things go really bad, you lose some packets in the transmission path. So that's the only difference between the PTT idea and the Pouzin/ARPANET idea. So we liked X.25. IBM liked it because that was very close to the philosophy of SNA. SNA is a packet-switching system. It's not known, but it is packet switching. But it is packet switched on fixed routes. SNA selects a map of the routes available and decides that each new communication between applications will be mapped on one particular physical route across a network. At least that was the initial SNA system to some extent. It was that way. Fixed routes. Packet-switched, but fixed routes. Very close to the philosophy of X.25.

Russell: At least two of the ARPANET people were involved with X.25 – Larry Roberts and Barry Wessler. Can you say much about their thinking and their influence on the design of X.25, or the role that they had at this meeting you were talking about?

Levilion: I'm not sure Larry Roberts himself was there. No, I don't think he was... But... There was in the X.25 group, there was a representative of AT&T who later on became the real manager of all OSI within CCITT. I'm trying to remember his name.

Russell: Was it [Paul] Bartoli?

Levilion: No, Bartoli was the chairman of SC.21 in ISO JTC1. He was also from AT&T, yes, but he was in ISO, not in CCITT. Bertine was his last name. He was very influential. I met Larry Roberts in conferences. In the X.25 group in the CCITT there were representatives from AT&T and somebody from Canada. I don't really remember the names. There was a guy from the U.K., from the Netherlands, but that's all. I'm not sure. Oh, and Japan. Japan. AT&T. Small group. That was very interesting. And Després is a good guy. Very interesting. I also looked at some of the X.21 activities because, as I said, IBM was more interested in – initially – X.21 and would have liked X.21 to win rather than X.25, so X.21 was very interesting. The essential property of X.21 was very fast switching – very fast establishment of connections allowing to open the line, send something, close the line, reopen the line when you have something to send… very, very interesting. And I made the architecture for managing or using X.21 within SNA, which has been applied to some extent so that you could retain within SNA the concept that you had a connection without having a connection. The property of X.21 was that you could release the line very quickly and reopen it very quickly when you needed it, but of course it was not the same line when you re-established it. But for SNA, it had to be considered as being the same line. So that was the organization. The architectural organization was interesting.

Russell: Was X.21 developed about the same time as X.25?

Levilion: Yes, it was.

Russell: At the same meeting?

Levilion: Yes, but in parallel. We didn't have the same people as on X.25 because we couldn't attend physically two meetings at the same time, so other people were devoted to X.21.

Russell: I want to get soon to your work with OSI in the 1980s, but I don't want to skip too quickly ahead onto that.

Levilion: No, no. It's up to your interests, not mine. I'm just remembering some of my old times. <laughter>

Russell: It sounds like a lot of important things happened between your meeting in Geneva in 1976 and when you started in OSI committees in 1980, but I'm not sure quite how to… How you would characterize that period in the late 1970s?

Levilion: For me, it was one of the most fascinating periods of my career... It was for me an opening outside of IBM because all that time I had been inside IBM. It was opening to the outside world, meeting other people having other points of view, having to defend IBM against these people and in close connection with the architects in Raleigh.

Russell: And who were the people you worked with in Raleigh?

Levilion: It was Jim Gray in Raleigh, who was responsible for the SNA architecture. And Dr. Ed Sussenguth, who liked me: he was a Harvard guy. <laughter> Ed Sussenguth. Very, very smart person. But also I was in close connection with the IBM research lab in Zurich. And they made very interesting theoretical studies on the properties of telecommunications, made studies on the mathematical evaluation of telecommunication protocols. And we made contributions to the CCITT on the properties of X.21 and X.25 based on the studies of Zurich, on the capabilities of the protocol to come to end and not be blocked or have infinite loops. And they made very theoretical studies on these aspects of protocols, telecommunication protocols. Very interesting. And the names of the guys, I don't remember. Very smart people. So I was navigating between La Gaude, Zurich, and Raleigh. So it was a very interesting time.

Russell: You talked about competition between your group and a group in the U.S. earlier in your career.

Levilion: Our group in La Gaude in relation with the architecture group in Raleigh was a delegation from Raleigh, because Raleigh was still on the idea that PTTs were to provide copper, their copper, and we were to put value on the bare copper. And of course these PTT guys created things, like X.21, X.25. That's good for the Europeans, okay? So you're Europeans, you manage with the PTTs, and we don't want to. So the group was in charge of essentially these aspects of dealing with the PTTs, looking at their strange ideas, trying to go against these strange ideas, and if not, then control that it would be usable and explain how to use that. So we had kind of a delegation of authority, and were no longer in competition. But of course you had to report very often to Raleigh, and… Oh, yes, I remember one of the guys in Zurich, Dr. Frank Corr. Very interesting person. He's dead now. Frank Corr was an American and he applied for a job in the French lab, not in an American lab, so he was in La Gaude. I think he was my first boss – my first manager in La Gaude. Yeah, he was. Not when I was in the French lab in Nice, the temporary lab, but when La Gaude lab was opened, I was under his responsibility. And then he moved to Zurich in the research lab. And he was in charge of telecommunication aspects in Zurich. Very, very, very smart person. And then he moved – when they closed – no, I think, I'm not sure – he went back to Raleigh afterwards and he became the manager of SNA architecture after Sussenguth for a period of time. In Raleigh there was a fantastic person – Bob (Robert) Donnan. He invented SDLC. Which later turned into HDLC. Fantastic man. He spent some time on assignment in La Gaude, and I worked with him. He had a very extraordinary creative mind. He could think a little too fast, so we had a very interesting time. We were assigned a problem at the time of how to use SDLC on satellite links. A property of satellite link is its very, very, very long delay. So the parameters of SDLC had been calculated for transmission on classical landlines. They were not tailored to the properties of satellite links – of satellite connections. <laughter> So, he would say, "Well, that's how it should be." I said, "Yes, you're a great man. Yes, good," and I would come back home and think about it and said, "No, there is a flaw in there." So I would come back the following morning and we were at a meeting and would say, "Bob, I'm a little worried. There's a problem here, how do you solve that?" So he would think and said, "Yes, you're right, yes, it doesn't work." So we would separate, and we would meet on the following morning, and he would have a solution. He'd say, "Yes, what I said the other morning was wrong. Okay, we'll do it that way." So I said, "Great, okay, it works. Fantastic." I will think of you and say, "Well maybe not." Each morning he would come back with a new grand, fantastic solution, inventing at an incredible speed? So yeah, he was fantastic guy. Bob Donnan. And of course in Raleigh there was the real, real, genius behind SNA, Jim Gray.

Russell: Did you know or work with John Aschenbrenner, Bud Emmons, and Joe De Blasi?

Levilion: Yes. Joe De Blasi was the top manager and the company director of standards in [IBM headquarters in] Armonk. So he was *the* man in charge of all standards, whether internal standards – because you had internal standards, too, in the company and use only such-and-such piece of equipment all across the company, boards of certain diameter and not otherwise, and that type of steel and not otherwise – so we had very specific internal standards. And we had also the activities of external standards relationship, where we had ISO and CCITT and all these standardization bodies. So he had on both hats. And we had an organization – he developed an organization with division standards directors. There was a standards director in IBM Europe. There was a division standard in IBM Asia Pacific. There was a division director in all the main branches of IBM. And then there was a standards manager in each IBM country. IBM standards manager for IBM France, for IBM U.K., for etc. And all that was in a hierarchy going up to De Blasi, who, of course had in Armonk a number of general managers under him and a staff, and he was the pope <laughter> of that structure.

Russell: So then when you went to CCITT or later to ISO, you would report to him?

Levilion: I would report not directly to him, but he had – in his structure, well, there was a management organization and a technical organization. And the technical organization was by technical subject matter, and it was a technical subject, OSI. And that technical subject was under the responsibility of John Aschenbrenner in Raleigh, and he had a counterpart in Europe – who was Cuong Ngo Mai. He was with IBM France in the French lab, and he was co-chairing with John Aschenbrenner. He was co-chairing the OSI activities, telecom activities in general, in OSI at the time, but all telecom activities. It started with the SDLC, HDLC, all these kinds of activities. All that was under John and Cuong. So they were theoretically sharing the responsibility on all telecommunication activities, which was more formal than real. But when we had an internal meeting they were co-chairing the internal meeting. Bud Emmons was under Aschenbrenner in charge of the technical aspects of some of the OSI layers, I don't remember which ones. I think it was transport layer. I'm not sure, but I believe so. Under John, there was a group of people, including Bob Donnan, including Bud Emmons, including Lloyd Hollis.

Russell: It's more of a vast structure than I had imagined. Or than it appears from the outside.

Levilion: It's an extremely vast structure. Extremely vast structure.

Russell: In the documents, a few of these names pop up here and there. But now that you explain it, it makes sense that it was organized in this hierarchy.

Levilion: It comes all the way from De Blasi all the way down with a branch which is more political and management and another which is more technical.

Russell: So then the strategic decisions came from De Blasi and then passed down through the management?

Levilion: Yes, and the technical decisions were in the hands of the specialists per subject, per domain. When I was in La Gaude working on X.25 and X.21, my reporting was in Raleigh. I had also organizational reporting and the technical reporting, so I had a manager in La Gaude who was giving me political directions. It was a little strange because we did have these two reportings – to my local hierarchy and to my technical hierarchy in Raleigh. Interesting. Difficult and interesting.

Russell: I can imagine that put you in some awkward positions or difficult positions. Can you tell me a little bit about your contributions to OSI? Eventually you were the chair of the AFNOR [*Association Française de Normalisation*] delegation to OSI.

Levilion: So, OSI was more or less an invention of Zimmerman, Hubert Zimmerman. I think he understood very quickly that X.25 was not *the* solution to digital computer-to-computer communications but only a tool. The idea of the PTTs was "we invented X.25 and, therefore, there is no need for SNA anymore," which was a big mistake. It's like saying once you have invented railways, you don't need to have people making goods to be transported in the railways. So, Hubert understood that and – I think it was in '79, '78, or '77… I'm not sure about dates – he understood that there was a need to build something on top of X.25 or X.21. A tool – how could I say – to organize the structure of information to be distributed across computers and to give significance to that information. So that moved from CCITT to ISO because it was no longer a pure transmission matter but a data processing matter. It was taken by ISO. I believe that the first meeting was in 1978 or '79 – I was not involved in that at all. I'm trying to remember the exact dates. I'm not sure. I was still working on X.25, X.21. In 1980, I decided that I didn't want to stay in La Gaude and had to move to more open activities. And at the time De Blasi's organization had decided that it had to create an OSI dedicated organization. And they created a job in IBM Europe in Paris as a local responsible for the OSI activities in Europe, and that's the job I took. And that was in 1980, end of 1980. And IBM was – how could I say – was very concerned about OSI, because OSI was much more dangerous for SNA than X.25. And before that, well, IBM had experience on computer communication architecture with SNA and knew how difficult it is. And when you are inside a company, you can give orders. You can say, "You shall do this that way, and if not you have to explain why." If you are in a committee with hundreds of people having different views and concerns, it's extremely, extremely, extremely difficult. So the first reaction of IBM was "They are crazy. They can't do it," and the second idea was "Okay, we know they can't do it. We have a solution. So, let's go and propose we give up our rights, our copyright on SNA, and we offer SNA to the world." And that was the proposal made – I believe, in '79 – I don't know exactly when – '79 or '80. To ECMA. ECMA was the European Computer Manufacturers' Association in Geneva, which was a kind of a standardization organization belonging to the European computer manufacturers. Most were there – well, there was Olivetti for Italy, Siemens for Germany, there were Swedish people, there was the English company ICL, IBM, and Digital Equipment was there, I think. The local, European branches of these companies. So the director of standards for IBM France – Francois Genuys[2] – went to ECMA with a big proposal made out of SNA and telling ECMA, "Here it is. Don't spend your time. Don't spend money. Don't waste money and time. That's all." And of course it was rejected <laughter> because, of course, it would have given too much power to IBM over

[2] Levilion added: "Genuys was an exceptional man, clever, learned, open minded, etc. under whose smart and able direction I worked part of my time in IBM Europe standards organization (1982-83). He was responsible for external standards under Willie Pfau, the Division Standards Director for IBM Europe and Middle East. Before, François had been Director of Standards for IBM France. He was a key player in the French data processing world and a founding member of several learned societies."

its competitors. But the initial move was that. We understand the need for a standard in that world. It's too difficult to be made by a committee, so we offer you the solution. Having been bluntly rejected, IBM had no other solution than to participate with the same ideas as what it had in X.25. If we can't stop it, we help it. We help it in such a way that it can work and in such a way that it works the same way all over the world. That's a real standard. And so this is why they created these positions, particularly in IBM Europe, which I took over, more as management activities than as a technical activity. So I had to make sure that the IBM companies of Europe would understand the significance of OSI in general and to IBM in particular. I would make sure that they would send representatives to the local ISO committees in Italy, in Germany, in Sweden, in Denmark, in the U.K., in France, and so on. And making sure that they would be – well, that they would know the strategies and the principles and make sure that we had united views on how to discuss and to defend IBM positions and so on. Making sure that they had knowledge of the IBM positions on these very technical subjects. So that was the principal of my responsibility and, of course, being in IBM Europe, I could not attend any of the local committees, nor participate in AFNOR, the French committee, so I could only participate in ECMA or CCITT, which I did because I'm not a manager, I'm a technician. <laughter> So I was a small person interested in attending the meetings and being sure that the IBM positions were expressed in these meetings and really coordinating the activities of the people. I did it at the time. I also attended ECMA meetings and CCITT meetings. My mission – at the time, both ISO and CCITT were developing models for OSI, and my view was that that was a big mistake and they had to come to one single model. And that was what I tried to do. My first work at OSI, my personal work at OSI, was to take the ISO draft and the CCITT draft and read them line-by-line and check/point out all the differences between the two and make a contribution to CCITT on that. I was very proud of it.

Russell: That sounds exhausting.

Levilion: Tom Steele, the AT&T delegate to CCITT on the OSI committee, told me that his objective was also to finally come to a single OSI model for both CCITT and ISO.

Anyway, that lasted for – what – two years? Three years. And then I was, of course, being more in the management/organizational side of standards, in closer relationship with Armonk. My manager was the IBM Director for Standards, well the Director of Standards for IBM Europe, a German – Willie Pfau. And of course Mr. Dick Holleman on De Blasi's staff in Armonk was the person in our domain in charge of the OSI side of activities. So I had links with Holleman, De Blasi, I had links with Aschenbrenner and his team. And of course with many people in France, but not too much because I was Europe, not France. <laughter> So we worked on the same principles, let it be, but let it be well. And in particular we had the position that OSI was a very good thing, but it was not a replacement for SNA. It was a means of communicating between SNA networks and non-SNA systems, like Bull's architecture. Bull had an architecture called DNA, if I'm right. Digital had an architecture, which was DECnet. Who else? The Germans had their own architecture as well. So our position was: we don't want to give up completely all the work which had been done on SNA. It works to the satisfaction of our customers. So OSI needs to be a means of communicating between closed IBM SNA networks and closed whoever else architecture networks there would be. So it's like a common language, like – how would say – Esperanto. You know what Esperanto is? I speak French. You speak American English. And in between us I don't need to learn English, you don't need to learn French, but we can both learn Esperanto, and we speak across Esperanto while keeping our language. You keep your language. I keep my own language. The Japanese keeps his own language, but Esperanto is there in the middle. So that's the way we understood OSI. Initially. We moved/evolved afterwards significantly. But, and also, we had the view that OSI is a set of communication protocols. What matters in the communication is *how* the information is exchanged, not how inside computers it is organized and ordered to be transported by the communication protocols. Therefore, what matters is what is in between, not how it is organized. And if you know OSI, OSI is three levels at least of international standards. One is the reference model, which gives the general organization. Second is the definition of the layers and how information is moved from layer to layer. And the third level is how the information is communicated between systems, between communicating systems. That's the protocols. And our view is that the only matter of significance to international standardization – to communication – is the set of protocols, and by obeying the rules of the protocols, how it is organized inside the computer is not something that is useful to the communication itself. Therefore, the concept of communication between what's called the services inside OSI is interesting in that it is the condition for defining the protocols, but it is not a condition for organizing the data inside the computers. So the services, what's called the services between the layers inside the communication system is not something to which conformance should apply. So you measure conformance to OSI by looking at what flows on the communication lines, but you don't measure conformance at the level of the internal structure, which makes it free for the protocol designer to organize things the way he wants inside the computer. Which prevents from competition at the layer level. You cannot bring a drawer and say "This is my session… And you put a drawer at the given level of OSI in the computer." So we wanted to be free to design our mechanisms the way we wanted and not be forced by standards inside… But only outside.

Russell: And I take it this view wasn't shared by everyone within OSI.

Levilion: No. No. No. And that was the heart of the discussion. And I think we – at least in the technical world – were understood. Even in the terminology, the protocols which flow between the communicating equipments are standards to which, conformance rules can apply. The definition – and these are protocol specifications – if you know OSI, you know that there are layers, levels. The exchange of information between layers inside the computer is called a service definition to which no conformance apply. And the first level, which is the Model, is just conceptual, and there is no conformance to the Model. So when people make comparisons by saying, "Well, OSI has seven layers, when SNA has only six layers; therefore, SNA does not comply with OSI," that's just nothing. It has no sense. No sense. So that's the battle we won. And also the concept of OSI out of an open system. The initial view of people – many people – was that OSI was to take the place of SNA in particular and of DNA and whatever, anything you can think of. Therefore, it is something that is to be implemented in all pieces of communicating equipment – let it be the main computer (at the time, the computing world was main central computing machine and some assistant large computers and a set of terminals and switches in between). So the idea was all these equipments would have to be OSI. That was one view. And our view was different. You take a whole set which is private, which has its own architecture, and somewhere within that, in one or many places distributed possibly, you have a conversion between the communication protocols of the private architecture and the communication protocols of OSI. So the system is not a single piece of hardware, it is a set of pieces of hardware. And that definition is in the OSI standard. And the definition of an open system as a set of computers and equipments of all sorts, which was in fact coined by Zimmerman, is very interesting because it allows all possible interpretations. If it is a set, it can be a set of one. Therefore, you can apply OSI to individual pieces of equipment or to a collection of things. So everybody was happy. And that's the genius of Zimmerman. <laughter>

Russell: From some of the things that I've read, from a certain point of view, OSI was initiated and developed exactly out of a fear of IBM.

Levilion: Yep. To a large extent, absolutely.

Russell: And then once these discussions in OSI started taking place, there's almost two games going on. One is a diplomatic, face-to-face, in committees, working things out, and you write definitions and they're formal and emotionless. But then there's behind-the scenes maneuvering, strategic moves, and maybe partnerships at all different levels between different companies or – IBM's a special case because it's so big – and then within national delegations as well. Within the American delegation there were some very tricky, subtle things going on.

Levilion: Sure. The American delegation has to have the general view of the United States. And what is the general view of the United States? It is some agreement between the companies which work in the U.S. on the subject. Same thing in France.

Russell: So were you in charge of trying to gauge or build that consensus within France?

Levilion: When – later on?

Russell: Later on.

Levilion: Later on. When I left IBM Europe to go back to IBM France after three years, I was in charge of OSI for IBM France. Which meant making IBM France understand OSI and its significance for the company, that is, establishing links with the SNA responsibles in France, the people who were in charge of selling or/and making SNA networks. Telling them what OSI was, how it was a danger or a plus. We had a very interesting study made by an external consultant which explained how IBM would increase its market share by adopting OSI because it would allow entering some of the IBM equipments inside the markets which were closed to IBM for political reasons, in particular in a country like France. All the administrative market was closed to IBM. As soon as there would be an opening to the competition through communication with the competition, then that would allow easier access to these closed markets. Thus there was a significant plus for IBM in adopting OSI. Hard to explain that to what we call the field, the salespeople and the higher-level marketing people in IBM France/management. I was in charge of that, and I was in charge of organizing the representation of IBM France to AFNOR, the French national member of ISO. And in charge of making sure that the French delegates to these committees would come with the official IBM positions and so on. So, at that time, I participated in the AFNOR mirror committee of SC16 and later on SC21. And that was chaired by Zimmerman at the time, Hubert Zimmerman. And Zimmerman changed, went to his own business. He left. He was with the French PTTs, and left the French PTTs, created his own company. And left and didn't continue with AFNOR, and they had to find somebody, and… The selection of the chairman of the committee is made by AFNOR. It is not a democratic process. They said, "Would you take that?" And so I had to go to my management at IBM and say, "Can I?" And they'd say, "Why not?" And so on. That's the way it went. So I became chairman of the French mirror committee on OSI. And then of course, by definition, head of delegation to the international meetings. And that's where it tends to really be difficult in standards because… Say, comes a technical problem – on some points in the standard. So you come in and say, "Well, that's how it should be done. That's the answer in my view. That's the answer." Well, then you go to an internal IBM meeting, and the problem is set on the table, and you say, "Well, that's my view," and the American guy says, "That's wrong," and the British guy says, "I've another point of view," and then Aschenbrenner says, "That's the decision. That's our IBM position." So the IBM position is not necessarily my initial position. So I go to AFNOR as the representative of IBM. And I defend the IBM position, which is not my position initially, but AFNOR is IBM, it's Bull, it's Digital in France, it's whoever you can think of – the French PTT in particular – and AFNOR comes with a position – it's not IBM position, it's not my position, it's AFNOR position. Then I go to the SC21 meeting or SC 16 meeting with the AFNOR position and I have to fight for the AFNOR position. It's really difficult. Very difficult. And each time you fail with respect to the mission you have been given, you come back to AFNOR and say, "Well, they did not accept our point of view, and this is what has been agreed, and do you accept that? And of course it's not exactly what you told me my mission was," and then you go to your own IBM and you say, "Well, you told me to say that to AFNOR, but AFNOR did not really take that position, and of course that is the agreement." It's terrible. Very, very difficult. It's schizophrenic. It's difficult, but it's very interesting. So at that time, I was extremely busy defending OSI, explaining it to the company, explaining it to customers, many, many meetings with customers. Explaining what OSI was, how we could understand it… what strategy we had with respect to OSI, why we had to take that position and not that position. Also with news people, interesting period…

Russell: At what point did you become aware or become concerned – especially talking to customers and news people – that Internet might be something that would just overtake everything that you had tried so hard to do?

Levilion: Okay, that happened in the beginning of the '90s. In '91, OSI had – how can I say – OSI had difficulties because there were so many strange political games around it. I take Bull, for instance. Bull, the main French computer manufacturer, had a very clear view that it wanted to use OSI because it was a means to fight against IBM. At the same time, they rather had a strategy – a local strategy – of saying, "We want to enter the IBM SNA products and install inside the IBM SNA products our own architecture. They had a product called Janus. Janus was the Roman god which had two faces – one behind and one in front. And that was very significant. They wanted to install their architecture inside our machines. And they used OSI more as a political game than a real technical game with respect to IBM. And several times we went to Bull and said "let's have an experiment with the IBM equipment, with the Bull equipment, and we try to communicate between these two equipments using OSI," and they always rejected our offer because their strategy was spoken OSI and actually invade IBM. At least with IBM. I don't know with all their competitors. So there was this kind of situation. There was the case also where people were always trying to make OSI more beautiful, more complete, more features, more possibilities – that's the bells and whistles syndrome. So we could never come to a conclusion because there was always something else to be added – something more beautiful to be added. And there was also a strange concept which was called the profiles. An idea came out that OSI was such a marvelous thing – it was so complex and so rich – but it was too rich. Therefore, some very smart people had to come together and to make subsets of OSI assigned to specific applications so that if you had a File Transfer Protocol, you would have a specific subset of the OSI protocols across all levels devoted to file transfers. If you wanted to do messaging, you would have another specific subset, which is a very crazy idea. Crazy! Mad! But in complete opposition with all the ideas which underlied OSI, which is a general uniform way of communicating across the world. But these concepts of profiles were discovered by entities like the European Commission Standards Committees, and people like that. They spent a lot of money on organizations like the European Workshops on Open Systems… and there was the counterpart in the U.S. and there was a counterpart in Japan, and they worked on making profiles, and they had international meetings to complete the standardized profiles across themselves. Waste of time, effort, money, and destroying the very concept of OSI. At the same time, inside IBM, the position was there is something in OSI, let's make it. Make it according to our views on how to use it. And, IBM made products – OSI products – in my view, they were not good products because the people who designed them had not understood OSI. So they just went the wrong way, and they implemented layer by layer and communication layer to layer inside their implementation. I had nothing to say but just thought it was crazy. And the result was a very expensive and inefficient solution. Expensive because there were few customers willing to take it. Expensive because of the way it was constructed. And not efficient because the way they decided to make it. And not really performing because it was… Well, we had had to make specific products inside IBM France for some of the levels of OSI, but which had been sold with success. That new offer was cumbersome, expensive, and not very efficient. And at the same time came Internet. Free! So on one side you have something that's free, available, you just have to load it. And on the other side, you have something which is much more architectured, much more complete, much more elaborate, but it is expensive. If you are any director of computation in a company, what do you choose? Of course you have a poor solution. Internet is just a mess. Internet should have never worked. Internet – if optical communications had not been invented just after, Internet would be dead. Internet has survived through the capacity – huge capacity – provided by optical communications. Internet had essentially transmission support and in there the application level of the Internet at the time was just nothing, just messaging… File Transfer, and Message Transfer.

Russell: John Day likes to say Moore's Law saved the Internet. Because computers had increased processing power, they could just power through the mistakes.

Levilion: Yes, yes, of course, yes. That's true. He's right. He's right. But Moore's law would have applied as well to the expansion of software needed to run OSI. I mean, I think so much capacity and memory space and so much poor competition. I mean, the protocols are a little heavier than those of Internet, so it makes a little difference… I'm not sure that was as significant as the cost. Free against expensive. And also terrible mistakes – there was a group in the French government which was in charge – I guess it still exists to some extent – of making buying decisions for the French government and establishing rules and giving structure for how you order this or that specific equipment. And they decided at the time to create a committee for establishing the rules for the French government on how to buy OSI products for the French government/French administration. And I was delegated by the Union of the French computer manufacturers – to represent that Union in the committee, being the OSI chairman of France. So I helped them draft the manual for the public buyers on how to order OSI equipment and, I mean, they created the book and everything went on very nicely. And then suddenly – great silence, nothing happened – it was in '92, '93, in '92 – it was ready to be published. And then I came back to the secretary of that commission and said, "What happens?" He gave a very strange answer which was, "We have created something on how to buy equipments for Open Systems Interconnection, yeah, but of course, before we interconnect open systems, we have to have open systems." At the time, open systems meant essentially standardized – no, not standardized, but non-proprietary operating systems. So they had not understood the meaning of open system in the sense of OSI – it's open provided it uses the standard communication protocols, but independently from the internal architecture of the computer. So, they stopped everything because of that misunderstanding on the meaning of open system. I was mad, but I couldn't do anything. So, there were all sorts of reasons that killed OSI at the time and made people decide to go to Internet. I paid the failure of OSI in 92-93 when IBM decided – IBM France was in the process of throwing people out because they were in bad financial condition, they considered that the failure of OSI was *my* failure. And I was asked to move away. Of course there was also the general plan that all people after 60 were to go. But I believe that if I had – if OSI had not been a failure, I could have stayed longer. But that's personal. Nothing to do with history. <laughter>

Russell: But, it's impossible to think that – given all that you've described – it's impossible to think one person could have made a difference either way.

Levilion: Of course. Of course, but if you are, if you are the messenger of bad news, you are responsible for the bad news. That's from Greek history; it's a fact. The messenger is killed if he brings bad news. Anyway. Which is – it's strange because I said initially the position of IBM was OSI is good, provided it's external to our closed SNA environment, and then IBM moved and said, "We shall offer to our customers the choice between SNA and OSI inside all pieces of equipment," which was a fantastic move ahead, and that was in ’92, more or less. And then it became, “We shall offer to our customers the choice between SNA and OSI and Internet,” <laughter> and then it became, “We shall offer the choice between SNA and Internet.”

Russell: I’ve seen this progression in textbook titles. It’s an interesting measure of, not necessarily the state of the art, but of trends. In early 1990s, the textbooks, I think there’s a couple, are on SNA and OSI. But within a few years – TCP/IP. It’s amazing.

Levilion: Yep, yep. But TCP/IP itself is nothing but the four first layers of OSI. So, TCP/IP by itself is nothing. TCP/IP goes with higher-layer protocols, which are never mentioned, but which exist, messaging protocols and the Web protocols. Had it not been for Web, I think also – I mean, I said something about optical communications, but the Web concepts over TCP/IP were key to the success of the Internet. It’s not – I mean everybody thinks about Internet, but the reality behind that is not Internet. The reality is Web. That’s information. Well, people say, “Well, I’m surfing on the Internet to get information on this and that,” which is crazy still. You get no information on Internet.

Russell: I’m continually surprised because even some computer science students don’t quite understand the difference between the Internet and the Web. They just get information from one…

Levilion: Absolutely. Absolutely. And they just – the people don’t really see anything – they just have local interfaces.

Russell: Well, I see by your watch it’s about noon. We’ve been talking for some time with no break. <Simultaneous talking> It’s fantastic.

Levilion: If it, if it helps you in some way, I’m glad.

Russell: Yes, and I think more than me, too. But it will certainly help me.

Levilion: And after that – after IBM, I worked for myself.

Russell: Consulting?

Levilion: Consulting and on EDI, electronic data interchange, for the European Commission and for AFNOR as well.

Russell: Sounds like it might have been a refreshing break from IBM…

Levilion: Yes.

Russell: I mean, 33 years with IBM.

Levilion: Yeah, long time. Long time.

Russell: Long time.

Levilion: So it was a different life.

Russell: Yes.

Levilion: And a different story because EDI is a very rudimentary type of communication. So that's my story. Okay.

Russell: Okay, well, thank you.

<Interview ends>