

An Interview with

LOUIS POUZIN

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Conducted by Andrew L. Russell

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### Abstract

Louis Pouzin reflects upon his career in computing, and particularly his experience as the director of the Cyclades datagram packet-switching research project in the 1970s. Pouzin describes his experiences working in French companies such as Bull and Simca, the French weather bureau, and his time at MIT in the early 1960s. He explains the origins of the Cyclades project, the creation of a harmonious team of workers, their interactions with French, British, and American counterparts, and the political factors behind the eventual demise of Cyclades in the late 1970s. Finally, he reflects on his career after Cyclades, including standardization projects at CNET and the awards that he has received for his contributions to computer networking.

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**Russell:** This is Andy Russell, and I'm here with Louis Pouzin. Thank you. I want to start simply with your education and your first involvement with computers.

**Pouzin:** Yes, it was more like computers were involved with me. <laughter> I started my professional life in 1953, and there was no computer at that time. I sort of became a little bit involved in the company I was working with punch cards. Well, it was a little bit cryptic, but I thought it was perhaps a good way of making statistics or sorting things out and so on. But then I was working in a company – *Compagnie industrielle de téléphone*, meaning industrial telephone company, which was a subsidiary of *Compagnie générale d'électricité*, CGE. Now this company has become Alcatel. I had been exposed to various activities in that company. Since I was a beginner engineer, I was no better than the usual middle-level technicians, and I had to learn a lot. But after a few years, I thought I had learned enough. <laughter> I wanted to change. I was not interested in really *téléphonie*. I discovered an article about computers, and it stirred something in me – woke something in me – that I would like, something exciting intellectually. So I joined Bull. And I was in a technical department which was interfacing between the salespeople and the technical people. Usually the salespeople were always inventing things that didn't exist to be able to sell them, and the technical people didn't want to do anything like that. They'd say, "Well, there's no market." So we had to mediate, you know, as a way to perhaps satisfy the client but not necessarily do a new development technically. It was interesting. But then Bull got into a big venture building Gamma 60, a big computer. You heard of it, I suppose. And the company grew in a bit wild way because they had to hire a lot of people who just were not necessarily very under control. So they developed a machine. They sold a number of them. They were even a club within IBM. A club of IBM vendors which had failed to sell it, an IBM machine, against the Gamma 60. <laughter> But then they had trouble with how to make the machine work because they didn't have much experience with it, with the various circuits and so on. So it took a hard time to get the machine up and running. They had a lot of down time. But finally they got them running after a long, long effort. But of course that took a lot of blood from the company in terms of people being used and so on. And they finally had need for a financial partner, and they got General Electric. Well, actually, initially they had some time with RCA. It was

just a technical partner. They were buying. Because IBM had put on the market the IBM 1401, and there was no such machine in Bull. They were so much in the spirit of punch card machines that they had forgotten that IBM was going to produce something like that. So they needed some, you know, more modern computers. So they got an RCA 301, which they marketed in Europe under a different name. But that didn't last. That didn't bring them the financial support they needed. So finally they got to General Electric, and of course the, the new masters of General Electric started to control, control the cost, control the planning, product planning and so on. And they had introduced in the European market – well, at least more than the European because Bull had quite a large market worldwide – but I would say mostly European because it was closer to the headquarter of the company. So they had the GE 600. Something similar to an IBM 7090. They were on par with IBM for computing power. But then again, they didn't have perhaps the appropriate maintenance expertise. There were downtimes and so on. The clients were not satisfied, and General Electric decided they would stop the marketing of that machine in Europe. And I was at that time on a project with the French weather bureau. Because the people at the weather bureau in France were extremely peculiar, they wanted the machine almost built customized for their needs. So they thought I was the guy for handling that situation <laughter> because I had studied time-sharing, and I was supposed to be the guy who knew how to handle that. And I had started to study their problem. And when GE stopped the marketing of the GE 600, the French weather bureau had to pick another machine. After a few months, they picked Control Data 6400. The bureau wanted me to stay on the project, but since it was not a Bull machine, I had to go someplace else. So I had various software houses which wanted to hire me to get the bureau contract. Finally, I chose one of them because I knew the guy who was heading the company... He was a former Bull client. When he was at the EDF, French electricity, he had bought a Gamma 60. <laughter> So he was a guy I knew quite well, and I thought he was a good guy. I joined his company who rented me to the weather bureau, and I developed a system there on the 6400. I got some good people. The people from the weather bureau who were not really good programmers, but there was a special procedure in France at the time where, whereby people who had to go to military service could request a special assignment either for education, for scientific development, and so on.

So I had collared the few people whom I'd known in giving courses in the, in Paris University. They were training for, you know, getting a Master in computing. So I got them hired by the French *Météo*. <laughter>

**Russell:** How did you end up teaching those courses in Paris at the university?

**Pouzin:** You'll remember perhaps that we had a revolution in '68. And intellectually I was in favor of the insurrection. <laughter> Beside that I was already known in the academic circles because after I had been at MIT, I was particularly the guy in France who knew English, computing systems, time-sharing, and so on, so I had opportunities to be at a number of conferences at various universities. And, therefore, the students asked me to join their meetings to discuss how to teach computing. And, thereafter, one of the professors at the *École supérieure d'électricité*, he was attending one of those meetings, and he asked me whether I would give courses. So I said, "Yeah, why not?" <laughter> I started giving courses. And then at Paris 6, and then at *Centre national des arts et métiers* and so on, gradually I had a little bit of places where I was teaching something, not a full year, full-year course, but teaching essentially operating systems.

**Russell:** A lot of what you've just described flowed in part from your experience at MIT. I wonder if you could explain how you arrived at MIT and the content of your work there.

**Pouzin:** When Bull was in the throes of problems with Gamma 60 and relationship with General Electric, I didn't know English at that time. I said, "If I don't know English, if I don't know any computers, I have no career in computing." <laughter> So I asked my boss whether perhaps there could be an opportunity to spend some time in United States. They introduced me to [Fernando J.] Corbató, who was the vice head of the computing department at MIT. I met him in Munich at the time of an IFIP Congress. So we had a little bit of a chat. I didn't chat much in English, but he said, "Well, I'll make you a proposal." And he did. And I joined his team to build CTSS.

**Russell:** And you were there for a year?

**Pouzin:** Two and a half years.

**Russell:** Long enough to learn English certainly.

**Pouzin:** Learn English and also learn how to live, how to behave a bit more like an American. <laughter>

**Russell:** Is that good or bad? <laughter>

**Pouzin:** I was there at the time they started to work on Multics. I had programmed a lot of commands on CTSS. Most people were working in assembly code at the time. My way of working was always to try to save time and sometimes spend a lot of time to find out how to save time. <laughter> So I [was] using micro instructions, which nobody was using at MIT. And, well, that gives you idea how to write things faster a little bit. Then I used MAD which was sort of pre-ALGOL. So I could fix commands on mainly logic. There was not much interaction with operating systems. I had a battery of small programs, small – let’s say – steps, which would interface between the MAD calls and the operating systems primitives. So I could write quickly things by using a library. So I developed a lot of commands in MAD, but then when I started working on Multics on the design, which was done by combining the cooperation with Bell Labs, I thought now, “What do I do? Do I stay with the Multics things or not?” I didn’t want to stay in the U.S. with my family. I had two children, and I’d prefer they would be educated in France rather than in the U.S. So I decided I would go back to France. I told my people at MIT that I intended to go back. And they said, “Well, you shouldn’t. You have a big interesting place and so on.” So I said, “Yes, you’re right, but...” <laughter> But I had told them sufficiently in advance so that they would not give me important things to do within Multics. I still did something in CTSS because they had nobody else to do it. But since I had learned how to write commands and save time, I developed the idea of the shell. I wrote a specification of a shell program with a flow chart, etc., but because I was

going back to France I didn't have time to write it. So one of my colleagues, a woman, took up that charge. She developed it with a guy from GE because GE also was involved in MIT because of the [GE] 645, which was used in Multics. So the woman is Glenda, her name was Glenda Schroeder at the time. But she divorced, and now she's Glenda Hughes. But she's also retired now. <laughter> I'm just going, you know. So she wrote the shell with a colleague, and then the shell was adopted by Unix and so on. So that's the process of how I learned computers, how I joined MIT, and how I became involved in networking.

**Russell:** I'm curious – when you said learn to act a little bit more like an American, what did you mean? Acting more entrepreneurial? The French system, from what I've learned, especially the educational system and business systems, are quite different from the American system, right? There's more competition in America at universities and in industry.

**Pouzin:** When I was in my first month at MIT, sometimes there was a technical point to discuss. And like the French, I was criticizing things based on this and that. And they said, "Well, if you have another idea, do it." Okay. So I started doing things without criticizing. <laughter>

**Russell:** Interesting.

**Pouzin:** That's the American way. <laughter> Using MAD was quite exotic at the time for writing commands. But, you know, I didn't even discuss that. I just started doing it. And the shell also was considered a little bit... funny. <laughter> It was quite useful for people because they could write commands with parameters, like [freeware?] and so on. Also, we were invited sometimes with friends. When I was invited with someone in the office where most of the people were men. Sometimes the men were inviting me, and if we wanted to have them at home, I always invited my colleagues. But after one year, I found out that it was not the way of doing it. The women – the men are not in charge of them. <laughter> What else? I also found out, for example, when I the U.S., I found out

that I had American friends, and I was their older friend. All the other friends that they had known had vanished some place. So they had a rotation of friends on very high frequency rotation. They keep in touch. I mean, I'm not at all in a dispute. They just keep their addresses. They sent Christmas cards, but they don't see them anymore. They changed very often from that relationship, at least the young people. They were in their 20s, in their 30s, you know. It may change later on in their life. But it turned out that I had been friends with them for two and a half years, and I was the older friend in their circle. <laughter>

**Russell:** Did you keep in touch with them?

**Pouzin:** Some of them, yes. I have Glenda Hughes in California. Margaret Child. Corbató and Jacques Vallée. Not all of them, but let's say half a dozen of them.

**Russell:** So then when you returned to France, you worked with Bull and then the weather bureau and then eventually moved.

**Pouzin:** Bull had become Bull General Electric. And then there was one Italian American. He had a terrible Italian accent. <laughter> But he was a very active man, and very, very friendly. He picked me as a sort of – let's see – monkey and... *singe savant*, meaning to go visit the people who were prospect or client of GE 600 to make lectures about time-sharing. So I traveled to different places in Europe with him to give lectures. But after six months or so, I said, "Well, perhaps lecturing is fine, but then perhaps there is something more interesting to do." That's why they put me on the contract with the weather bureau.

**Russell:** How long were you with the weather bureau?

**Pouzin:** I left Bull in '68 probably. No, even before that. I came back from the States in '65. I was there between early '63 and mid '65. So I was probably lecturing for the rest of '65 and part of '66. That's where Bull started to get a little bit disorganized. And I was



using my time to study different operating systems, giving internal lectures within Bull, participating in summer school, and things like that. So they put me on the *Météo* contract in '67 or '68. And after that, the *Météo* didn't want to pay me anymore. They thought the system was running, so there was no need for me. So I looked for another job. And I picked an ad in the newspaper looking for some engineering computing. It was a recruiting house. I talked to them. It turned out that the real employer was Simca, a car manufacturer. So I met them, and they already had a relationship with Chrysler. Later on they became Chrysler France, but at that time they were still Simca. But there were some Chrysler people within the company, like the financial director. The guy who was running the computing operation. All these guys were from Detroit, you know... <laughter> And he saw on my CV that I had been at MIT. So necessarily I was their guy. So he hired me, and it was... Car manufacturing is a lot of routine. The computing system center was mainly considered as a paper mill, producing huge stacks of paper for the various workshops. So you just had to keep up with the production. Well, it was a little bit boring, but I'd never been in such a company, so I was learning the sociology of the company. Most people in most places were long-time people. They just tried to get up in the hierarchy. And they are not very intellectually interested in computing. They are interested in salary and power. <laughter> And fighting each other. <laughing> In that company, since it had been created over the years, initially was Ford. And then it became an Italian company. I'm not sure which one. And they also had bought some more. There were various clients which were originally from different companies. It was a little bit funny. But I also understood that I wouldn't make old bones in that company. So after – let's say – two years, I had phone calls coming from my previous colleagues. One who had been in Bull, but he had switched to CII. Another was an academic whom I knew very well. So they called me the same day because they had a meeting the day before of the committee set up by *La délégation à l'informatique*. It was a special team set up by the government to push the evolution of France to computing. And they were supervising CII and also supervising any investment in computing made by the administration. So they were trying to get the administration to buy CII machines. So they had heard of Arpanet, and they had sent a mission visiting various places in the States. They came back with the conclusion that it was a technology which would have a lot of future and

that, if CII wanted to compete worldwide, they had to have a network technology. So they decided that they had to build something like Arpanet. And they needed someone to lead the project. And of course they wanted Louis Pouzin. <laughter> So I said, “Okay, we’ll meet.” And in a few weeks, we decided that I would leave Simca, and I would leave Chrysler France, and go to the *délégation à l’informatique* in order to lead the project. It took a number of months because they had difficulty finding enough money to pay me. Finally, they found a solution. So I joined the *délégation à l’informatique*, and I started to recruit people.

**Russell:** How did you pick the people to recruit?

**Pouzin:** I recruited one guy who was a French civil servant, but he was not happy where he was. He was in *Polytechnique*, same school as I. And he was within the engineering part of the army. Or he was in a bureaucracy, and my boss who also in that sector of the army, was also – let’s say – on lease, if we can say that, but he was detached to *délégation à l’informatique*. So he was supervising me for the project. And he said, “Well, there is Hubert Zimmerman, you know. You should meet him.” Okay. He was just the guy I wanted. I took one person from Simca, where I had been. I had one person from CII. One person from CERN, a French guy who was at CERN. So I had a small team like that. And then when I needed more people... Initially that was enough to write a report to explain to the administration what we were going to do. That was strong advice I had received from someone in the Ministry of Finance. He said, “In France, if you don’t have a book on a project, you don’t exist.” So we had to write a book, that thick...

**Russell:** What year was that?

**Pouzin:** I was hired at the end of ’71, so it was probably between end of ’71 and April or May ’72. So at the time I had Jean-Louis Grangé and Hubert Zimmerman; Gérard Le Lann, he came a little bit later. So we were three or four writing that book. And I was not sure when we did that whether it would be useful for us, except that I accepted the idea that it was needed in the bureaucracy. But the thing I discovered in the next two years,

whenever I needed to show the government, or someone in administration would make a speech about network or write an article, they were taking extracts from that report without mentioning the author of it. <laughter> So it was a way to, you know, to spread our ideas without really making effort to do it except writing the book in the first place.

**Russell:** Then others took the ideas as their own.

**Pouzin:** Exactly. <laughter> So it's better than let them talk silly things, you know. After the report, we started really working on the protocols. I knew the Arpanet protocols, but I also knew their weaknesses. One thing I did is spend three weeks in the States to visit BBN in Boston, Larry Roberts in Washington, Barry Wessler in Salt Lake City, Len Kleinrock and so on, you know – the major guys who were developing Arpanet.

**Russell:** And they were all pretty cooperative?

**Pouzin:** Very cooperative. Very open. At first when I told them I was going to build their network, they didn't believe it. <laughter>

**Russell:** Did you know any of them from your time earlier at MIT? Did those connections help?

**Pouzin:** I knew of course Corbató. I should have known Bob Metcalfe except that, when he was at MIT, he was a student, so I didn't know him. I think I knew Len Kleinrock, perhaps in a meeting someplace. I knew also [Michel] Melkanoff, who was a professor at UCLA. I had met him in France because he was sort of cosmopolitan. He was Russian. He immigrated to France. He had worked in France. He was speaking French perfectly well. And ended up as head of the computing department at UCLA. So he was quite useful in creating contacts for me when I visited California. And in Washington, I had the French embassy to arrange meetings with Larry Roberts. They were very, very open, very cooperative. BBN, I just gave them phone calls. Well, they were interested to know what we were doing. So it was sort of a give and take, you know.

**Russell:** And the same with the British?

**Pouzin:** At that time, I had not yet got in touch with the British. I knew some people from the British post office who worked in standardization. ISO and so on. But those were not involved in networking. They were involved in PTT things. *Téléphonie*. The British post office. But the people I knew later on were NPL, National Physical Labs. So, you know, the first thing we did was compare protocols and design our protocols, which were different. And produce descriptions and specification of those protocols. So as soon as we had some material ready, I organized a workshop at the end of '72 with the people I knew in Europe which I had heard of or sent them letters explaining what we were doing. I had a workshop in Paris, just one day. Maybe two. I'm not sure. But there were Donald Davies from NPL and Peter Kirstein from UCL. Someone in Germany I'd also known through TC6. At the end of '71, one of my colleagues in France who was secretary of IFIP. IFIP had just created a new TC, telecommunication, and he asked me to represent France in that TC. So we already had a TC meeting in early '72, and we already had a list of people interested in networking in Europe and in other places. And then later on, after that workshop, we had discussions. There was already in the U.S. something called the Network Working Group. And I had met Donald Davies who had participated in some meeting in the U.S. I'm not sure who was the American delegate at that time. I think it was Keith Uncapher perhaps. He was at that time in a research place. Perhaps it was RAND. And so we discussed that. We said, "Well, you're a networking group, but it's probably more effective if you want to propagate ideas, to get people, and so on, to be part of an institution like IFIP." So I arranged for them to get in touch. IFIP was quite open to the idea. So we wrote one page of paper stating that we were affiliated to IFIP. And then we started to populate TC 6.1. And I suggested Derek Barber be the chairman because we had also at the same time a European project called COST 11 initially and later on we named EIN [European Informatics Network]. And I was also immediately proposed by France to be the French delegate within that project. But I didn't want to have too many hats, you know, to be a TC member, EIN member, and so on. So I suggested Derek Barber because he was already the British delegate within EIN. It was

also, you know, politically interesting to have a number of people to not polarize things too much. That's the way INWG [International Network Working Group] became in existence as a part of TC 6.

**Russell:** What's interesting is that none of this sounds like basic research. It's not like you were hiding out in a lab somewhere trying to figure out network protocols; you were collaborating internationally across institutions.

**Pouzin:** Yeah. It was based on relationships. Now no longer.

**Russell:** Right.

**Pouzin:** We had no Chinese yet, but we had someone from South Africa. And we had Russian, Polish. The TC 6 base was people who had come from the various IFIP members. They were not all active in the field, but they could contribute to conferences. Indeed, yes, the idea was not to have a lab of people but to have a bunch of people who would cooperate and not through e-mail. That didn't exist yet. But at least through a document we could exchange and we would use conferences, which were organized in different places, to meet each other and to have some occasional TC 6.1 meeting.

**Russell:** I had a chance to look at the early records of what was circulated within INWG [IFIP TC 6.1]. What struck me was that the most active people in that committee were the French (the Cyclades team), the Americans (Cerf and Arpanet people), and the British. And then at some point in 1975 or so – two or three years after it was created – it seemed to become more of a rivalry. Right? IFIP/ INWG was trying to create one consensus transport protocol. And then I don't know if things got less friendly or less collaborative or what. Can you help me understand what happened?

**Pouzin:** Yeah, I think it's, it's mainly Vint Cerf and Bob Kahn who for some reasons which probably are not strictly personal. They probably had some political reasons in the U.S. But they did not join the consensus. The consensus was built essentially by Alex

McKenzie in BBN. So we had agreed among all of us into a sort of common way of operating protocols. We had to make changes in our protocol. Other people were prepared to make changes in theirs so it could be compatible. But Bob Kahn decided that he was already too far into the development, which was not true. <laughter> It took him three years to finish it. So that introduced some split. But I don't really... I'm not really sure about all the intricacies of that policy. I'm not sure. You'll have to ask them really.

**Russell:** Okay.

**Pouzin:** But we were not so concerned of that because at that time, everybody had ideas and protocols that were not supposed to be lifelong. We thought that they would be changing and so on. We were in a mentality of experimenting. So you could say, "Well, we'll do that, but in two or three years, maybe we'll change." So, we're not too concerned, especially since we've got work to do. We had to develop a network. We had to be part of EIN at the European level, made a lot of lecturing, write papers, and so on. We said, "Well, when the time will come, we'll interconnect." But we never interconnected with ARPA. We interconnected with EIN, with the European Space Agency, with some university, I think it was in Roma. I'm not sure. So we had ad hoc interconnections at the terminal level. People could log into a computer, but there was no really computer-to-computer communication. It was essentially terminal-to-computer through the Net. So we had interconnected the Net with black boxes, ad hoc things.

**Russell:** At the same time, you more than anyone talked about pressure from the outside, from IBM and the PTTs, and their drive to dominate or monopolize or the market, which was yet to be defined. Right? IBM was maybe not a monopoly but powerful.

**Pouzin:** Dominant, yeah.

**Russell:** Dominant. And so amidst these exciting-sounding collaborations, experimentation, the competitive world and the big money were also important factors. Did that trouble you or spur you on?

**Pouzin:** It spurred me on. Everybody was very motivated to invent things. I was telling my people that, “Make sure that people steal your ideas. Because if they steal your ideas, they’re at least six months late.” <laughter> The best way to sell ideas is when [someone] can think they’ve invented part of it.

**Russell:** Right. Your team seemed to function unusually well, and you’re all still in touch and seem to get along. That must have been important as well.

**Pouzin:** Oh sure. First, if you don’t work in a mentality of trust, then people are not effective. They need trust. They need interesting, challenging objectives. And they need competition. But they also need cooperative competition. We had no secret among the various places. We were telling each other what we were doing and vice versa. So the competition was trying to advance faster. And we were quite fast. So that was my philosophy. If things take too long, they die. I say, every year when the leaves fall, you have to have something new to announce. We were usually organizing some kind of workshop with demonstrations and so on.

**Russell:** Was the Cyclades team all in one place? Were you all at INRIA, all in one building?

**Pouzin:** No. We had one guy – Jean-Louis Grangé – who went to work at the PTT for about six months. We had much more difficulty with the PTT. Without telling the *délégation à l’informatique*, they had a separate packet net based on the PTT computers, which not *persona grata* in France because there was CII. And second, they were only interested in terminal to computer but not computer to computer. And of course there was a “virtual circuits” mentality. I had started initially, when I designed the packet net, with pure datagrams: no end-to-end control within the net, control only in the host level. It was totally unacceptable for the PTT. But on the other hand, it was politically necessary that we worked officially hand in hand because the different lines were much too expensive to be part of our budget. So they had to be provided free to the project. And on the other hand, we also had to somehow pretend that what we were doing could be used by the

PTT. But they had this little project going on. We had our first Yalta with them; you know what Yalta is? Okay.

**Russell:** Yalta, as in the summit after the war? Okay. Yeah. <laughter>

**Pouzin:** So we had a Yalta with the French PTT, where they would build a packet net according to my specification, and we would put someone in our team into the PTT.

**Russell:** What year was that?

**Pouzin:** It must have been end of '72 or early '73 or something like that. Of course I had absolutely no trust in the PTT. First, I had a small team. They had a mentality – a monopoly mentality – you know, “We do things. People have to accept it.” And I knew they would be late in the project. And I said, “If we are one year late, we will have trouble continuing the project.” When Jean-Louis Grangé started to work with them, he understood quite quickly that, first, they would not build the packet net according to my specs. They would continue doing their own because they thought that PTT don't have to do anything else that they don't want. And second, they would be late. There was no efficiency in the PTT. So I convinced my boss that it was necessary to develop our own packet net to make sure our project would go on as scheduled. And I said, “When they will be ready, we'll use our network.” <laughter> Of course when they were ready. <laughter> And in the meantime, we had a demonstration of the network being in operation. We demonstrated not to the Minister himself, but someone from the Ministry of Industry and the head of the telecom PTT. We had a meeting where we demonstrated Cyclades operating, with people putting a job in a machine in INRIA and the job being executed in Grenoble and sending back the output to INRIA. It was a demonstration that the network was working. At this point, it was clear even for the head of the PTT that we were enough advanced to be more convincing than the guy in their labs. So we never discussed again using their network. It was finished. Of course we had CII because it was their machines. And we had some sort of, not hostility but – let's say – distant interest



from IBM because IBM was mainly in line with the PTT. They didn't want to have any fight with them.

**Russell:** IBM France?

**Pouzin:** Yes, IBM France. What they wanted really was to have some way of interconnecting their 360s. Their 360 network SNA was designed to use these lines. These lines were quite acceptable in terms of cost in a country like the States but not in Europe. They were interested in having some kind of communication system which was much less expensive than these lines. So they were prepared to interconnect anything that PTT would do but no more, you know. They didn't want to make any particular change in their SNA system. So they were in a way looking at what we were doing. They were also developing an experimental network, a scientific network, using their 360/67. So we knew everyone in there. We were on very good terms with the people who were working on that project. At the same time we were developing Cyclades, there was a group of French bankers who were tired of hearing of projects building communication systems which never happened. So they had started a project which intended to build a data network for the bankers. Of course we immediately got in touch with them. We became very good friends. They were interested in what we were doing. <laughter> So finally pushed by the events, the PTT announced at the end of '73 perhaps or maybe later on. You have to check with Rémi Després, for example or maybe someone else. Maybe with Hubert [Zimmerman]. So at some point the PTT finally announced officially that they would build a data network. And one of the political consequences is that the attempt by the bankers to build their own system, would stop. "Go to hell." So we were left with the PTTs in front of us. And we had a number of companies which were interested. For example, CERN at some point wanted us to build a packet net for the CERN. We said, "Well, okay, that's fine. But we're not really a software house. We are willing to provide the software we've developed. All documentation, including engineering advice. But we don't have the resources to put people into building the system." And we had other companies also which wanted to build systems based on our engineering. The French highways, the Credit Agricole, the Marine, the Navy network. All those administrations

and larger places were looking at what we were doing and thinking that perhaps, if CII would incorporate that into their products, they would have something ready in a shorter time than what the PTT were doing. So that increased, of course, the hostility with the PTT because they didn't like that. But on the other hand, the French *délégation à l'informatique* were powerful. Fortunately for them, President Pompidou died. And then we had a new president called Giscard d'Estaing. And Giscard d'Estaing was not in the same mentality; Pompidou was still a follower of De Gaulle's policy. De Gaulle's policy was to be independent from the American. And CII in building a network was in a way a continuation of the same policy – become independent. But Giscard absolutely had no technology vision. He was interested in politics, but not in technical things. He had advisors who had no technical training. They were people from *Ecole nationale d'administration*, and people who make rectangles, and put arrows between rectangles, and they think it's going to work. <laughter> So they dissolved the *délégation à l'informatique*. Finished. Disbanded. <laughter> And as a result, our funding was cut. And they also joined together CII and Honeywell-Bull and made CII-Honeywell-Bull, a new company. And this new company which had not much experience in networking, they said they would take our technology and develop it in their own system. The guy who was at that time heading Bull was an engineer. He had been at IBM before, and he was a guy who understood very well strategy and technology. So I think he was pretty convinced that it was a good deal to get what we had developed. But he had been put in place by the technical group, which was also a partner in CII, and this group was Thomson. Thomson was typically a company that was making electro-mechanical devices, but also working for the army, for the military, for the aerospace and so on. And here you had CG, which was a huge group – all kinds of electrical things – and *téléphonie*. CG had apparently put a lot of money into supporting Giscard's election everywhere. You know, the lobbyists finance the elections. And why did they finance the elections? It's because they didn't like the government policy with Thomson, because Thomson had decided to go into *téléphonie*. And that was extremely displeasing for General Electric, for CG, because they were not the monopoly but the dominant provider in France. There were other ones, but they were the big one. And to them, introducing another competitor in *téléphonie* was not very attractive. In addition to that, the

*délégation à l'informatique* had put up an industrial group called Unidata. And Unidata was CII, Siemens, Plessey in the U.K., Olivetti in Italy, and Phillips in the Netherlands. So this Unidata group had a strategy to develop a product series by sharing engineering, sharing development, and having each one a particular specialty. And they had decided, for example, that Siemens... Siemens also was in computing, but they were not very dominant. And so they had decided that Siemens would close down the computing subsidiary they had in France. And on the other hand, the French would close their computing subsidiary in Germany. So each one would have its own clean territory. And that means that for *Compagnie générale d'électricité* in France that Siemens was becoming a partner of a big French company and, therefore, it certainly would be detrimental to their market for the *téléphonie*. The delegate from the *informatique* told me that. They wanted to scatter Thomson's enterprises in *téléphonie*, and financing Giscard was probably a way to push them to that direction. And once Giscard was elected, so they disbanded Unidata. Siemens was furious about that because it was really treason for them. <laughter>

**Russell:** So then even though you had all of these allies – the banks, the railways, COST 11, CERN – that wasn't enough?

**Pouzin:** That wasn't enough because once the government decided that they would go another way... All those companies are so much in relationship with the government. If they want to have, for example, privilege in taxes or dominant people... Very often the government provided for some high-level people to go into these companies. So there is a lot of interference. They can't afford to go their own way. They have to somehow deal with the government. So they switched their side.

**Russell:** Is there something that you can think of that you might have done differently to avoid this outcome?

**Pouzin:** In France?

**Russell:** Yes. Because the way the politics lined up, your funding was cut...

**Pouzin:** I doubt it. I doubt because the PTT was still very much entrenched in building their virtual circuit system. They managed to have allied with the German and the British. They got X.25. Well, X.25 was actually designed by Larry Roberts. You know that. But he was a good salesman, and he sold the idea to the Europeans. So they banded together in CCITT. At the time it was called ITU-T. They banded together because they had also created this sort of werewolf. They masqueraded. You know, they considered IBM as the big monster which was about to swallow telecom. It was not true. But they convinced various PTTs that if they did not come to an agreement on a packet net standard, IBM would become the dominant. So they got ahold of CCITT to agree on X.25, and therefore, it was quite difficult politically to do it any other way. Which means that any research project which didn't use X.25 was guaranteed not to have any funding.  
<laughter>

**Russell:** This must have been quite a deflating series of events, to watch and feel the momentum and partners building behind good ideas; and then decisions taken by non-technical people for non-technical reasons...

**Pouzin:** For political reasons.

**Russell:** For political reasons.

**Pouzin:** Perhaps technical but... <simultaneous talking and laughter> But a different field.

**Russell:** How long did it take for things to unravel? You must have been quite disappointed.

**Pouzin:** Giscard probably was elected in '74 or the year before that. And it took about one year to unravel things. And another thing also is that we were located and paid by

INRIA. And they decided to create a new agency because they said, “Well, you know, research is okay. You’ve done very good research. But now let the industry take the lead.” Well, they didn’t say, “Go home,” but almost, you know. <laughter> And therefore, there was no need for more research. And so the group I had at INRIA was no longer useful. These agencies, they wanted to develop the use of computing in France. I mean, network kind of training, propaganda, exploring new fields and so on to get the French much more involved in using computing. But the Ministry of Finance didn’t want to put any additional civil servants into the agency. They said, “Well, you want to go into your agency. Fine, but you have to find yourself it’s hard to populate that agency.” So the way they found is by taking people from my group, which they sent to this agency. They wanted also to split INRIA to have one part of it doing mainly strict research, mainly based on mathematics, because there was a French professor who also was a member of the Academy of Science who was strictly a mathematician. He didn’t understand anything but mathematics. And he was very – let’s say – uncomfortable with us because we were engineers of software operating systems. He didn’t understand those things. He was also quite jealous about his territory, so he wanted us to be put out. So part of us went to CNET (the French PTT), including myself, Hubert Zimmerman, Michel Gien. Part went to the agency, and part were someplace else. Some stayed in INRIA. Some of them created their own company or went to different places. Najah Naffah went to CII. So our group was disbanded, but since the network was already installed, the PTT didn’t cut the line immediately. They were in a way, you know, postponing those things. So it continued to work without any funding for a few years because it was used in the various universities of research where it had been already installed. They were using it for developing network applications. So it probably gradually disappeared, but it probably took something like four years to disappear by pieces.

**Russell:** The three of you who went to CNET, did you work in the same group together, or were you also put in different places?

**Pouzin:** We were in the same departments, yeah. Same departments.

**Russell:** But you didn't stay in networking? You more or less dropped out from OSI and subsequent projects where Hubert took the lead.

**Pouzin:** Me, I dropped out. Hubert was the main thrust. <simultaneous talking>

**Russell:** Hubert was in the middle of it, yes, so he continued. During that time did you maintain an interest in OSI or what he was doing? Or was Hubert doing his own thing?

**Pouzin:** I maintained interest in SC 6. It was not OSI strictly. It was still the sequel of HDLC and so on. And on the other hand, I was producing articles and papers so I could go to conferences and meet those people in various places. But I was not involved directly in OSI. I was taking a lot of time and also a lot of funds because you had to travel to meetings and so on. And I was not in a position to get that from the CNET management. Perhaps I could have tried, but I knew that if I tried it probably would have backfired onto me. I preferred to keep a low profile. <laughter>

**Russell:** I want to go back just to clarify something. The term "pure datagram" is used a lot as a distinction between other types of networking. Can you help me understand that concept a little bit better?

**Pouzin:** Okay, datagram has been actually renamed in the ISO world. They call that connectionless communication, and that's the real word for that. Basically the way to shift packet in the network is like taxis, like Arpanet was doing in those times and also something that Paul Baran had designed. But that's not the essence of datagram. The essence of datagram is connectionless. That means you have no relationship established between sender and receiver. Just things go separately. One by one. Like photons. And they can come into different ports and go out of different ports. Putting together things that are interrelated are the business of the higher-level sender and receiver. So we recreate a lot of circuits at the higher level. But the network ignores those relationships. That's essentially the datagram. And on the other hand, for example, if you take Internet. Internet has no... It's just one packet at a time. But it's also called datagram because

there is no relationship established between the entrance of the Net and the output of the Net.

**Russell:** So then Internet today is what you would call pure datagram?

**Pouzin:** Yes.

**Russell:** But Arpanet was...

**Pouzin:** Arpanet was virtual circuit. To the point that there was no host-to-host control. BBN built a network saying that, "We never lost a packet." <laughter> Well, that's no good. <laughter> First, they were inputting into the Net long, what were they, was a block or something. So the network got these blocking pieces, sent those through the Net using adaptive routing, but putting things back together at the other end of the Net, and delivering that with end-to-end control, within the net. So it was reasonably well controlled. But it was not end-to-end from the host viewpoint. And that was essentially a virtual circuit service using internal datagram, but that's not for the user.

**Russell:** Okay.

**Pouzin:** So what we did is datagram for users. Then, they don't have to worry about opening a circuit, how long it's going to last, how much does it cost, and so on. In a virtual circuit system, the virtual circuit is a resource that requires management and optimization and all kind of things. But packets... Of course you have to optimize the traffic but not at the packet level. Not at the circuit level. It's just a matter of traffic engineering.

**Russell:** So it's simplicity that you're after; that makes for a simpler network or fewer things to manage in the network.

**Pouzin:** The company that built a network in France, they had built both datagrams and circuits net. They said that a virtual circuit net would cost four to five times as much as a datagram did.

**Russell:** Can I ask you also about the [1978] Nora-Minc Report? The political context in France was different from the United States, in terms of strategic objectives and regulation. I know you described some French electoral politics of the mid-1970s, but I think that Nora-Minc came out later. Can you tell me a little bit about that and what its consequences were for you?

**Pouzin:** At the time, there was no deregulation yet. It came later. Probably at the end of the 70s or beginning of the 80s. It came only gradually. First, the PTT accepted that foreign operators could have POPs – point of access points – in France. And then at this time, a number of companies started to use foreign operators to go to the U.S. because it was cheaper. A little competition started between the various operators, essentially over long-distance circuits, especially transatlantic circuits. But it was the first step. And the second step was to introduce the ability to have *téléphonie* or something. I'm not sure about the sequence of things because I didn't follow that very carefully. But they accepted that only on public networks, and then they came to private networks. It went step by step. It was probably spread over something like five years. And one thing they had to do was to write... In order to deregulate, you have to have regulations. And there were no regulations. There was a book called the PTT Code. The PTT Code was essentially saying users are not allowed to do that. It was actually a list of what people were not allowed to do. <laughter> So they had to write something that said that what the PTT could do and what they weren't allowed to do. It was new. <laughter> Because they could do anything they wanted before. So it took some time to do that. Gradually it opened, and then the French PTT became also a competitor at the international level, which they were not initially. But that did happen not like in the U.S. They didn't have AT&T to break up in pieces. But the PTT there was also to create subsidiaries, which were fake private companies which... <laughter> which they could control.



**Russell:** They probably didn't compete with one another very well, did they? <laughter>  
Okay. Let's see. You then moved on to be a dean at a business school?

**Pouzin:** Yes.

**Russell:** Can you tell me a little bit about that?

**Pouzin:** At the end of the 80s. Yes, I was at CNET. Since I was no longer involved in networking, I was involved in standardization.

**Russell:** Maybe we should talk about that first and then the business school. What sorts of standardization projects did you work on at CNET?

**Pouzin:** It turned out that at the European level, the European Commission wanted to have something institutional opposed to United States. They wanted to have a big block of European industry which would compete with the U.S., or at least to agree in the U.S. about common standards. They didn't want the U.S. to be completely open and completely free to do anything they wanted, because the U.S. were not so much sold on standards. They were mainly "let the best one win" and so on. So the European way was to follow CCITT, but CCITT was worldwide, and therefore, very slow to make big decisions. Decisions were not necessarily consistent with each other and so on. Well, they said they needed something European, so they created ETSI, European Telecommunication Standards Institute. ETSI was supposed to make a telecommunications center for Europe. But then they said, "We also need a counterpart in computing," because all computers, standards were all proprietary. They're IBM standards. Or if they are not IBM, they are Burroughs, or UNIVAC, or whatever – there was no standard. That means a lot of interfacing problems. People are captive. So we needed European standards in computing. Now, an institution which was completely dormant called CENELEC. It was actually two institutions. One was called CEN; the other one was CENELEC. One was supposedly a standard organization which was dormant. It wasn't doing anything. It was mainly on electrical things. The other one was

electronic things. They put the two things together and said, “Now you have to make standards. Okay, but don’t reinvent the wheel.” There are a number of standards which come from PTT and from various manufacturers. The idea is to take standards that exist and to find out the particular parameters, the particular arrangement which could make those standards interpretable without reinventing those standards. In other words, we would take a subset of their capacities to hook them together. They call that functional standards. So it was mainly an activity of comparing various designs, arguing about what is essential, what is not essential, is it possible to do away with that, and produce a new kind of paper which said functional standards. For example, the terminals used in one country to be able to connect to a host in another country by using the PTT standard called X3, standards for interfacing terminals to computers. Another example would be the mail systems badly needed some kind of formats which could be used by the various mail handling system without imposing details about the way they would build internally. So at CNET, since I was relatively deprived of a big project, they said, “Well, go make standards.” <laughter> I met a number of people from PTTs, from IBM. It was a very interesting place, but again, after a certain time, it becomes a little bit boring because nothing goes very fast, it becomes politics at some point. After a few years in that job, one of my colleagues at CNET... There was an education department, and this department was headed by a man who was extremely expansive. He was creating places, creating things everywhere. He liked to create new schools. And by talking to the various big companies in France, they came to the conclusion that selling network services to those big companies was difficult because there was no one trained to be both managers (for all the services the companies were producing) on the one hand and, on the other hand, to be sufficiently expert in networking. So they didn’t know how to introduce networks in the company. They were used to having separate computers. Every department was more or less in charge of its own computing systems. So they had big systems, big computing centers which nobody was satisfied with. And they said, “Well, why don’t we educate people in networking technology so that they could then disseminate that within their own companies.” So they created an MBA training in Sophia Antipolis, which is near Antibes, not far from Nice. One of the guys at CNET had somehow become quite friendly with the director of the education department. And he

was given the job being director of that new MBA place. And since I knew him well, he offered me to go there to develop the technical training. There were basically three teams in that MBA place. One was management. He was an American coming from MIT. The other one was more organization, communication, and so on. He was Italian who was also at the London School of Economics. He was not there when we started to come to the U.S., but he was nominated later on to LSE, which is a business school in London. And the third one was me for technical matters. So I started to develop a program and find people. We didn't hire new people for that. We were just asking them to teach a number of sessions in different parts. And so it went for some time. It didn't work very smoothly because, first, the guy from MIT wanted to have the power. He wanted to be the chief of the place, so he was pushing everybody. He was asking some of the students to be spies as to how the other teachers would do. He was very asocial guy. The Italian was very good. And since I was a technical guy, I had no training teaching MBA classes. So I was criticized by the American for not knowing how to do the teaching. On the other hand, the class was something like 25, 30 people. About half of them had engineering training. They were very satisfied with my teaching. The other part was not with the commercial or (instructing or industry) or whatever; we even had someone who had been a priest before. They were interesting people, but they were not interested in technical matters. <laughter> So, see, it didn't matter anyway. And then, as a sequel of deregulation, the PTT were saying, "Well, we are spending a lot of money in training engineers who go work with our competitors. We don't want to pay anymore for that." So they decided to split the PTT, to take the education department out of the PTT except the research part. Anything they had created in the other field, they said, "Well, it's no longer a PTT job to do that" because they don't want to pay for it. And therefore, the funding for teachers became difficult too, because they are the major funders. <laughter> So I thought it was a good time to find another place. First, a young guy who was director of this place, he was basically an apparatchik. His strategy in his career is to spend a few years here, a few years there, and so on, you know. Climb the scale. So I wasn't sure what was going to happen afterwards. And I was at that time 62. I said, "Well, I have three more years before retirement. I have all the credits. So it's a good time to take my retirement." <laughter> So I left Theseus. And the next six or seven years, I went back to

Theseus, just to teach momentarily to one week or two at a time. I was again hired, but I was no longer in charge of the technical education. There had other people to do it. And finally Theseus was sold to the Chamber of Commerce, Nice Chamber of Commerce, and joined another institution, and they were sold again to another institution in the north of France. I'm not sure what's happening. I'm not sure it still exists, by the way. <laughter>

**Russell:** We spoke earlier about ACM, and in your ACM SIGCOMM prize citation there is a mention of your work as a popular ACM lecturer. Was that much earlier in your career?

**Pouzin:** Oh, much earlier. Much earlier. It was... I guess it was before I started with Cyclades. I'm not sure. I would have to retrieve that out of my memory books. It's very old.

**Russell:** You went to a few different cities to lecture?

**Pouzin:** Yeah. <simultaneous talking> One in Washington, one in Chicago, one in Montana. And I think another one. I forget. Maybe it was at least three places, maybe four. The procedure is the chapter invites you. It's not organized from the top. So I had probably at that time I had some reputation in operating systems because I had developed the one for the French *Météo*, and so I was invited probably to give a lecture on operating systems. And then I was involved in Cyclades. I was completely immersed in the Arpanet and so on, so it stopped there.

**Russell:** Did you maintain a membership in ACM or other professional societies throughout the 70s and 80s?

**Pouzin:** I maintained membership probably mid-70s or more. After that, no, I didn't have any more time to read the articles, and they didn't have much interest in networking at the time. Their population of authors were mainly oriented towards simulation and modeling and all kind of things, too mathematical for me. And I didn't see any interest in

articles related to networks. The network, network articles were mainly in NJCC, AFIPS, and so on. Most of the major publications initially in networking were in those books.

**Russell:** You've won several awards in your retirement, one of them was the ACM SIGCOMM award.

**Pouzin:** Yeah.

**Russell:** There were many other awards as well. How did it feel to win all these awards for a whole career of things, many years after the fact of doing those things?

**Pouzin:** Well, it's... I really don't care. <laughter> I was not after those things. They came without my initiatives. And on the other hand, we have a saying in France. They say, "You're never a prophet in your own country." The French don't like the French. <laughter> Well, I got the awards... A reason also is because I started late. I started my career working for industrial companies in which you don't do research there. You're just working for the company. So I started writing articles at MIT. My first article in a scientific journal was on time-sharing. What was called? It was a British paper, I'm not sure about the name of the magazine. And then of course, I was proposing papers either for conferences or just publications. So that was probably the way I started to be known internationally, but I didn't push very much for big awards. It came because people knew me, and they said, "Well, he hasn't got that yet, so let's give him one." <laughter>

**Russell:** Some seem ironic. The Legion of Honor, for example, seems ironic in a sense...

**Pouzin:** The 21<sup>st</sup> of April, I have been nominated in ISO for the Hall of Fame. I don't know what that is. It's kind of a medal. <laughter> That's why I'm going to Geneva two or three weeks from now to receive it. Indeed, it's very odd. <laughter>

**Russell:** You're still active in founding companies and putting out products, do you want to say a little bit about that?

**Pouzin:** I sort of did that a little bit when I went to the *Météo*, the French weather bureau. I was observing that we were able to put up quite sophisticated software with very few people. Just get the right people. So it came to me the idea that perhaps we could get software contracts. But then I said, “Well, very few people get big contracts with that, and second, you don’t have all the connections with political people.” Because, you know, anything that’s important in France has a political side. I said, “That’s not what I want to do.” I would prefer to design and build and disseminate and teach, and so on but without too much concern about the financial side. And we had a group of people, every month you have to pay their salary. <laughter> It’s a nightmare.

**Russell:** What about your view of the Internet as it is today? The IETF, the Internet standards body has grown and some of its critics and friends say it’s a little too bureaucratic now, or it doesn’t do much, or it’s got problems with its committee structure, with intellectual property, and so on. Do you follow those debates much?

**Pouzin:** A bit. But following it, in a very serious way, it’s a full-time job. So I don’t want to spend my whole time doing that. It’s like IBM in the past, you know. It’s full-time. So I think IETF for all networking has become what the PTTs were in the past. <laughter> It’s a very static place where things are moving with a lot of difficulty, and it’s not very optimized. It’s mainly compromises between people who have different viewpoints, for one thing, and also people who want to keep their job. So it’s better not to shake, not to make too many waves. So they are not going to – how do I say – make a revolution of new concepts. The Internet has been stuck into old concepts for the past 15 years or 20 years. So it’s obsolete. It works, but it’s obsolete. <laughter> And it requires a lot of patches, you know. Whenever I see new RFCs [Request for Comments], it’s something that introduces one more exception, one more restriction, one more... It’s really a nightmare to know all the RFCs needed to build something. It’s not clear. It’s not even reliable because when you have so many things to take into account, it’s impossible to make things right. You always make mistakes.

**Russell:** Do you see any way to fix that at all?

**Pouzin:** It's like having leaks, you block a leak, ok, but if your pipeline is rotten, then you'll be getting a leak someplace else. <laughter>

**Russell:** I think that's about all my questions. Is there anything more you want to say?

**Pouzin:** Well, put a little help in getting John Day<sup>1</sup> recognized in Europe, you know. He's quite good at getting recognition by himself. But sometimes you need a little push initially. I had a number of people I knew, so that helped. It picked things up. I don't have any more potential for pushing things, you know, but I think that sometimes I'm used as a – let's see, how you say – as a statue. If I go into a meeting and the other guys are younger there, they say, "Let's be serious." <laughter> But that's okay. So I hope they will get some funding in Europe. That will mean great things. Because then there would be people ready to invent new concepts. I don't think it will come from the U.S. It's too... There is a corporation of people who are so tied into what exists. I'll call them the techno-guardians. It's just keeping things, you know, protected from the outside. Where the Europeans are probably a bit more open to that because most of them, as opposed to the U.S. people, most of the people who are on the networking today didn't know the beginning of the network. They all became involved in it much later on, and they had a lot of pressure internally, you know, to do things new. Which is not quite the case in the U.S., because a lot of people started much earlier in networking, and now they have the power. They are now 50, 60, and they still keep things the way they are. They control things. GE, for example, wouldn't get anywhere because there's too much involved in... too much old people involved in it. Too many. <laughter>

**Russell:** Okay, thank you very much.

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<sup>1</sup> John Day, Arpanet and OSI veteran and author of *Patterns in Network Architecture: A Return to Fundamentals* (Prentice-Hall, 2008), proposes a new network architecture. He has created the Pouzin Society, named in honor of Louis Pouzin, to "provide a forum for developing viable solutions to the current Internet architecture crisis." See <http://www.pouzinsociety.org/>.