Prof. Edwin Candy

Interviewed by

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Welcome to the Archives of Information Technology, where we capture the past and inspire the future. It is Friday the 6th of March 2020, and we are in the City of London, at the headquarters of the British Computer Society. I am Richard Sharpe, and I have been researching and writing about the IT industry since the early 1970s.
[00:25]
The man who makes his contribution today to the Archives has been involved in IT a lot longer than that, and on both sides of IT as well, on the computing side and on the communications side. He is Professor Edwin Candy, and he was born on the 23rd of February 1944, just before the end of the Second World War, in Melbourne, Australia.

Correct.

When did your family get to Australia?

Oh, in the 1850s.

1850s.

1850s. Four, four strings. One side from Glasgow, Portland Street, Pettigrew's another side Willis's from just south of Cambridge. Travelled to Australia with eleven kids, lost one on the way. Set up a, a road building business, construction business, in Melbourne, built all the, all the main arteries to and from Melbourne in the early days. Another one, Candy family, came out, one of them travelled on Brunel's *SS Great Britain*.

Oh yeah.

And they set up a stonemasonry business in Melbourne. So…

Now your father and grandfather were both solicitors.

Yes.

You decided not to take that route. Why was that?

Well, when you sit in a lawyer's office as a young child and see this enormous pile of paper, all tied with pink ribbons, you think, [laughs] think well actually, I'd much rather be *doing* stuff rather than thinking about… So, always really interested in science, built electronic equipment.

[02:01]
You went into school in 1950, in Melbourne.

Yes.

Did you enjoy school?

Not really, [laughs] to be honest. I guess… A private school. So, if you were a grand sportsman, and ultimate academic, life was easy. But if you were a sort of, an average student, with a scientific bent, capable of building things and doing things, and didn't want to join the Society of the Jocks, not so interesting.

Right.

But nevertheless, I had a lot of fun there, did, did the, a lot of the electronics, the, built the PA system, did all the stuff for the shows, built PS systems, and all that sort of stuff, which was about the height of electronics in those days. So it was a good grounding. I used to spend hours in the evening building stuff for them, and making it work. Sound systems for fairground concert, fairs, you know, so…

[03:06]
And by the time you left, when you were sixteen, left school when you were sixteen, in 1960, there were, just for the record, 5,500 computers in the world.

Oh absolutely.

That's all. That's all.

Mm.

There's a gap of two years between that and you going to Melbourne Institute of Technology. Was that National Service, or what?

No, actually I missed National Service, but, the school I went to, Trinity Grammar School, was very much producing students for the stockbrokers and for the administrators. And I got the leaving certificate, and I was pretty clear I was going to go down, down the scientific, electronics route. And all the subjects I had lined up were totally inappropriate. [laughs] So, you had to do things like strength of materials, and, and… Anyway, so I went off down to the, down to Swinburne Technical College for a couple of years, and also Taylors College, which is a sort of, coaching group. And so I did the, part of my matriculation, and the technical subjects that I needed to enter Royal Melbourne Institute of Technology. Because in those days there was the technical route, which are primarily designed to produce technicians and tradespeople, which went that way, and there was the academic route, which was very academic, and required, you know, I think in my day only about three per cent of students could get to university. There was only one in Melbourne. But it wouldn't have helped me if I had gone there, because having, if I had finished and got a science degree, I was totally useless. [laughs] I'd have to go and do ten years of industry.

Right.

So, you know, I decided to… And as it turned out, opportunities came faster, faster than my qualifications would have done.

Right.

So, my, my academic education is actually quite splintered. And so I can't sit down and say, well I've got a degree in this and a degree in that, because, I ended up doing stuff which was ahead of what I could learn. So I know it sounds a bit arrogant, but it

just happened to be that the industry was going so fast that the industrial experience, if you got the right stuff, was probably well ahead of what you could get.

[05:20]

And you were, while at the institute, you were also working for Pye?

Yes.

Pye. Now that's a very old name, from…

Yes.

It was an English company.

Absolutely.

Cambridge-based I think.

Yes. Yeah, and my first boss was a chap called Gwen Court, a Welshman, who came out, who was with the, did a lot of radar research during the war, and then moved to Australia as the Technical Director of Pye Proprietary Limited. And that's, and that was a, a subsidiary company of the Pye Group. So yes. And the reason I did that is that, doing this part-time stuff, I said to my father, 'Look, you know, I don't really want to waste time.' 'Oh,' he said, 'I know somebody who might know somebody,' being a solicitor. So I got marched into, into Melbourne, and, Gwen Court the chap's name was, and, I just can't remember the other name for the moment. No. Anyway. Sitting round the table, and, they said, 'Oh yes, and, let's talk about the economy,' and, and, [laughs] the law. And, Gwen Court said, 'Well, what have you done?' And I said, 'Well I've built a few things in the workshop. I rather like the idea of a satellite dish, and, I'm trying to build an oscilloscope, and I've got a TV underway.' 'Oh,' he said, 'that's, now that's really interesting. Yeah. Why do you, why do you want to come here?' And I said, 'Well, you know, I really enjoy all that.' 'Oh, yeah,' he said, 'that's very interesting.' Anyway, they went back to talking about the law and the world. And at the end, they said, we all shook hands and said, 'Oh what

about, what about me?' [laughs] And they said, 'Oh. Oh yeah, you just, come up, come in on the 10th of January, and, you'll be fine.'

And you were a cadet engineer, was the term, was it?

Well what happened is that they, they said… Gwen Court didn't understand the Australian education system. He said, 'Oh we'd better put you on as an apprentice.' So I waited to do the apprentice stuff, and, I don't want to belittle the apprenticeship, but, it was fairly basic, you know. I went into a machine shop and I spent two and a half weeks filing a piece of brass block flat. And then I went up to the maths class, and they said, 'Oh, now, we've got really difficult questions today. What's the square root of nine?' And I said to them, 'I thought you were going to ask me what the square root of minus nine was.' [both laugh] So I went back to Gwen Court and said, 'Look, you know, I, I don't want to waste your time. You've given me this time off, but, my education already is ahead of that. And I don't think it's good value.' And he said, 'Well, how about you see if you can get yourself into part-time institute early?' I said, 'Well yes.' So I trotted down there and they said, 'Well you haven't got this, and you have got that. But, yeah, well we'll, we'll give you a go. If you do that, those exams at the end of the year, you can start with us.' And that was for a diploma of communication engineering. So he, he then caught me in the next day and said, 'Oh good move Candy. We'll… I've got you down for cadet engineer now.' And that was fantastic, because it meant I went, went into the labs, started doing systems designing products for…

Of radio systems.

Yes.

Pye was big in radio.

Yes. Absolutely.

[08:24]

And what was it doing… What was it doing in Australia? It was obviously providing kit for people in Australia, but was it doing any fundamental research in Australia, or was it instead implementing the products that were coming out from the UK?

No. Well, they obviously were based on UK products, but they were doing a lot of their own R&D. One of the early projects I was involved with was the design for UHF ground-to-air transmitters in the 200 megacycle range. And they were 200-watt UHF transmitters actually. Funnily enough, to talk to Mirage jet fighters. But they had been bought by the Department of Civil Aviation, because they didn't want these fighters flying over and not being able to talk to them. And then, ultimately that contract went on. But I was, I was involved in the design and development of that from an early stage.

Right.

And we did a lot of antenna matching equipment, filters, which were not used in the UK at all. In fact subsequently I came over and did a whole series of lectures for Pye about how to implement um, multiplexing.

One of the…

So, yes, it was doing fundamental stuff. An early project was involved in the, in part of the design of sections of equipment for a telephone system, mobile telephone system, for the New South Wales Government Railways. They had built a lot of it, but they hadn't got it all right. So they said, 'Oh, here you are Candy, try and sort this lot out.' So, we took bits out and put new bits in. And it was pretty fundamental stuff, because, it was, it was new.

[09:53]
One of the attributes of Australia is that it's very big.

It is.

And there aren't a lot of people there. So the communication issues are, presumably different.

Vast.

Given…

Absolutely

…[inaud] on this little island here…

Yeah.

…of the United Kingdom, we've got, we've got a lot of people packed into a small amount of space. Can you contrast the two please, and give us a view of them?

Absolutely. Well, firstly, most of the mobile, most of the radio systems, telephone or normal sort of, two-way mobiles, you know, taxi phones, in England, were based on a two-frequency system, one for each of you to talk and one to listen. And you could actually have a duplex conversation But really, in Australia it was all single frequency. But in England, the transmitters were limited in the cars to five watts or very low power, and the reason is, the density of society meant you could poke a little aerial up, you cover the local village and the environment, and there was enough people in business to satisfy it. But Australia, even in suburban Australia, it was much more different. If you wanted to run a successful taxi company, you had to cover the greater metropolitan Melbourne, which in those days was probably, I suppose a radius of ten to fifteen miles. And so, to get the, get the coverage, you had to put the antennas up on the highest possible spot to get the cell as large as possible. Whereas in England the problem was more… So coverage is the issue in Australia.

Right.

Whereas in England, the question was about capacity. So, the Government limited the size of the power, so that you could have lots of transmitters, and you could have

lots of businesses. So, actually, quite different. So, here you would find 5-watt transmitters; in Australia you would find 25-watt.

Right.

So, quite… And…

That's good.

It also meant that, you had the opportunity to travel all over the place, because you were forever putting radio systems up on the highest mountains you possibly could, to get 30-, 40-, 50-mile radius.

Yes.

And ultimately I ended up doing a project in, in Malaysia, where we put a base station on top of Mount Kota Kinabalu, which was the ground-to-air station for the South China Sea. So that's a mighty big cell. [laughs] So…

It is.

Yes.

[12:17]
And during this period, in 1968, while, in your career, you were seconded to Digital Equipment Corporation…

Yes.

…in Maynard, Massachusetts, USA, called DEC.

Mm.

In 1967, the year before you went, when you were 24, DEC had launched the PDP-10.

Yes.

A minicomputer. And was knocking out these minicomputers like nobody's business, and they were becoming very popular. What a tremendous opportunity for a 24-year-old.

Oh, absolutely. Well, I mean that's a, that's, that whole project was a determining point in my career.

Right.

And so much of what went on after that came from that moment. In fact the computers we were using was the PDP-8/S and the PDP-8/I. And, they were, the DEC people were, were, what do you call it, an outflow, a spin-off from IBM. Because they felt that there was a good opportunity to build small computers in the industrial control. What led to that is that we and my boss won a project, massive project, to automate the offshore platforms which were going into Bass Strait. So it was a big radio communication part, because we had to get communication links onshore right out to the offshore platforms in the middle of the Strait, 200 feet deep. The platforms were obviously in very harsh conditions. So the…

Where is Bass Strait?

South of Melbourne. It's a piece of water that runs in the Southern Ocean between Melbourne and Tasmania.

OK.

It is one of the most roughest, violent, treacherous spaces of the sea.

And they were digging for oil there?

They, they found oil, offshore, somewhere between ten, fifteen miles, in 200 metres. [laughs] So, very deep. I think it was 200 metres, I… But… So, what happened, we won this contract to do that, and we won it by bringing in a number… We, we bought the Pye Association in because we could get relay equipment, and representative of that was knowledge, although I did all the propagation stuff, we signed up with a company called ICC TRW. ICC first. And that, that company was supplying Esso oil all of the onshore command and control for the oil wells in Houston and Dallas in Texas. So we put it together. And then of course, they said, 'Well look, we are, we are generally using a computer system. It's a drum-based system, own-build, and, that's what we will use to do the programming and that stuff.' From the time we got the contract to when we actually started the implementation phase, the company was bought by TRW. Now TRW were the main contractor for the space, for the Apollo space mission. They were developing, they were looking at TTL integrated circuits, and how they could be coordinated with communication systems, control systems. So TRW bought ICC as one of the ways of spinning off the technology that they had developed. So they said, 'Sorry, all of that stuff that you were going to buy, it's all out, and we're going to do something different. We're going to put in DEC PDP-8/I, or 8… Yeah, they were parallel, 8/I – parallel computing systems. So we're going to get rid of all this drum technology, we're going to go to, all TTL. So throw out all the boards you've made. And by the way, you'd better make sure that, you know, that the people who are going to build and design these systems, know what they're doing.' So my boss got a phone call and said, 'Ed,' he said, 'do you mind going to the US for six months?' [laughs] And I said, 'Well, what about this contract?' 'Oh,' he said, 'well, we're going to have to do it now.' [laughs] So, so they sent me a questionnaire, and they said, 'Well what do you know about digital electronics?' And they asked me some very simple questions, what does a flip-flop look like? What…

What's a…?

A flip-flop.

Flip-flop. Yup.

Yeah. What does an OR gate look like? What does a serial register look like? Can you draw a circuit of one? And, you know, because I had been fiddling around in the garage, I, yeah, that's, I understand that. So, off we went. And it was fabulous, because DEC were in this old woollen mill in Maynard, on the river, and it was a state, you know, water-driven mill, old, 1800s, and these old floors, with beams, and, all painted whitewash over the brick. And there they had all this stuff they were doing. And we, we did classes, we did work, we got projects to build systems, we got projects to build bits of a computer. At the end they gave us a little certificate saying, you know, 'Thank you very much, you've done this and you've done that.'

[17:15]
So, Digital Equipment was actually formed by the Olsen brothers, particularly Ken Olsen was leading it.

Yes. Yeah.

Became very successful, but lost its way in the age of the PC after 1981.

Yes.

And the workstation. And then was, was eaten up by Compaq, and then Compaq was eaten up by Hewlett-Packard.

Packard. Mm.

But, it was very famous at the time for being an engineers' company.

Oh, yes. Yeah. Yeah, it was.

Did you enjoy that, being an engineer?

Oh, absolutely.

It was run by engineers, not by businessmen, really.

Well, you see we… They were the days when you were solving problems. So, I mean, later in my career it became very commercial, you know, but, but in those days, it was like trying, it wasn't a mousetrap, so you used to have to think about, how in the hell are going to do it? So, you were in that wonderful position of, when you did something, it, it was, it was the *only* solution. There wasn't another one. So, so the costs and the prices were determined by, generally, the costs of doing it. And there was no such thing as scaling in those days, so, some of these things were very very expensive. But you were solving a problem. And the second part of this phase was, was actually going down to the Manned Space Center in Houston. Because… So we did, we did the computer. And then went down to Houston, and, where they did all the supervisory control logic and systems, so there's a computer, but then the rest of it's another level. And, TRW of course were based, or had operations, at the Manned Space Center in Houston. So they said, 'Well come on, you'd better come down here for a week or so.' So we went down to, to the Apollo Manned Space Center in Houston. And, and things there that I learnt and saw which became fundamental to my career. Like for example, we were using contra-phase modulation for getting the maximum capacity we could on the carrier out, out into space, to the Moon. And, you know, when we did 3G, the four-phase modulation was a component part of the early, early piece. And they said, 'How do you know about this?' I said, 'Well, I picked that up in 1968.' [laughs] So, it's very fortuitous. Yes.

[19:34]
1968 was a very interesting time.

Mm.

Given the Vietnam War.

Yes.

Given sex, drugs, rock 'n' roll.

Absolutely.

Given the student movement. Were you affected at all by that?

I was very very lucky. I was too… They, they stopped… What do you call it? What's the name for, for, putting people into the forces?

National Service.

National Service. They stopped that just before I finished my last year at school.

Oh right.

And then, two years later they started conscripting, they started conscripting for the Vietnam War. But I was just a bit too old for it. So I missed out, because my birthday…

Lucky…

Well absolutely

Lucky guy.

Some of my colleagues weren't so lucky.

Yeah, because, Australia did go in with the Americans into Vietnam.

They did, yeah.

And they lost quite a few troops as well.

Oh abs-

[20:36]

So, you went back then to Melbourne.

Yup. There's another piece about that sort of freedom, and that…

Yeah.

Because what it did is that, it, it gave you, the sort of flower power movement gave you a sense of, actually, you can change things, you can, you can do things, you can contribute. So I wasn't involved in the sort of, rock 'n' roll music scene or something like that, but, you know, the enthusiasm that existed at that stage was, was absolutely fabulous. Because we were doing stuff that, you know, even this little Pye company in Melbourne, here we were, doing things which perhaps our, people immediately behind us had never thought possible.

[21:15]
You are also in Oz, the land of Oz, Australia.

Mm.

A young nation, which was beginning to feel itself, and get its own identity wasn't it?

Yeah, and that, that played a big part in what I was doing. You said earlier, oh yes, it's a big country, not many people. So, what, what really happened in Australia is that you, you suddenly found yourself with a job to do, and nobody to do it, no expertise. And it could, it could cover any aspect of a project. It could go from selling, representation, quoting, system design, and then, actually, helping to design it, build it, appoint the engineers, or design it. Go into the factory and build the blooming stuff. Then go out to site, switch it on, and call them in, and commission it. And then go round three days later and give them the bill, [laughs] so, the invoice. So you were, you were involved in, not only the, the narrow technology. So… And what I found when I came to Britain, that was really really valuable stuff. Because most of my colleagues in Britain, I'm not speaking ill of them, but it's just the way we work in a place where there's lots of resources and lots of technologies, people were very very narrow, and absolutely, unbelievably skilled, but in a very narrow piece.

Some often,which prevented them, because of the knowledge they were acquiring there, from actually having the breadth.

Yes.

And in Australia it forced you to do the deep dive, and it forced you to go horizontally. So it was easier to take on executive positions, because you had a feel for all of the parts of the picture.

[23:01]
So Pye in Australia was not a reproduction of culture from Pye UK?

No.

It was an Australian company, with an Australian culture…

Yes.

…which was, we can do this.

Yes.

And we can do any, anybody can do anything.

Yeah.

And you've got to do the whole business.

Mm. I mean the Pye… I was reading a book, *Radio Man*, which was about the founder of Pye, C O Stanley. And, very interesting. He, he didn't necessarily believe he had to have academics or fundamental research. He employed just clever people who had a… And if they felt that they could make something out of this, then, he let them go and do it. So there was, it was, in the engineering part, it was very free. There was no sort of, policy saying what you could do and what you couldn't do.

You found an opportunity, somebody would buy something from you, and if you could build it, well you set about doing it. And if there was some equipment in England you should bring out, you bring it out. But the cells were often different. So you either had to modify or build your own. So all the mobile phones which were used in my time were all, without exception, came out of the laboratory in Australia and built in the Australian factory.

So to that extent, Pye Australia was very like Digital Equipment, Maynard?

Yes. Yeah. Yes, yeah. I mean for example, later on we, we built one of the world's first microprocessor-controlled radios, a thing called the FM 900, and that was a radio which you could program to do anything. Anyway, we got a call from British Telecom at the time saying, 'We desperately need a radio phone for our service here. Do you think your 900 would do it?' So we went down to the lab, got, the engineers were doing software, said, 'Yeah, we can… No problem at all, we'll, we'll have a version, we'll have it in the, [laughs] air-freighted next week.' And off it went. And the first British radio phone service used a large number, I think there were other suppliers as well, but they used these FM 900s. And we actually produced a computer-controlled intelligent mobile phone in Australia before they ever produced it in England.

[25:08]
Pye was taken over in August 1969 by Philips.

Yes.

The Dutch company.

Yup.

Was there a change of culture as a result of the takeover?

Yeah, definitely. Yes, quite… So, I mean, no one way is right. So I've talked to you about the entrepreneurial flair of Pye. And there were risks with that, because they

got themselves ultimately into a, into other places where they thought they could make, they could create a market for televisions, made them, and then, they didn't have a market, you know? And they produced, quite a number of projects which, products which actually didn't have an answer. Philips, much more administrative, much more engineering control, much more discipline. So, it was actually, good in terms of my career, because I had benefited a lot from the maturity and the, the discipline of the Dutch, and I have great respect for, for that company.

[26:10]
Do you regret the passing of companies like Pye, like Ferranti?

[hesitates] Yes. I mean, one of the reasons for coming over here in 1986, it was very clear that, that Pye was starting to, you know, it… England particularly was losing a lot of its grip on its leadership in electronics, and that included people like Ferranti. And I thought, well if I, at least I can come over and contribute. And we could perhaps try and re-energise parts of that sector of British industry so that we could perhaps take a place in the, in the new world. But, you know, there are lots of issues. Government policy, and, lack of financing, and… And, you know, also, I have to say, you know, quite a, inflexible way of going ahead, which I'm afraid ultimately meant that, many parts of British industry no longer exist in the electronics field. And I find, I really regret that.

The type of work you were doing at that time was, computerised command and control centre for the Melbourne Metropolitan Fire Brigade for example.

Yes.

Which was, quite adventurous.

It was. [laughs] It was. Yeah.

[27:30]
In 1971 you become Systems Product Manager/Business Manager. Now this is quite interesting because, the word manager now comes into your title, Ed.

Yeah.

How are you as a manager?

Oh. [laughs] Well others have to judge that, don't they. [laughs] But, I think probably what… If, if you are subjected to the personnel interviews which try and fit you into a Belbin psychometric analysis, what usually comes out is that, I am very socially responsible for my employees; I lead by respect, and by engagement; and, I have always had a, an ability to look to the future and make judgements beyond where we are, and can take those people with me and, and they generally enjoy, from what I hear, working in an area that's probably at the front, and has challenges, but great enthusiasm and experience and opportunity.

Can you sack people?

Well you have to along the way. I generally have avoided wholesale clear-outs and sackings. I have done an awful lot of, you know, re, restructuring, reorganising. But usually, if you look at people, you can find a place where they belong, and, if you find you have to sack somebody, it's because you've made a very bad decision in the first place.

Or someone else has.

Yeah.

Right.

So, I had a project in Malaysia which, it was a bit of a basket case, and Philips said, 'Can you come and sort it out?' And, you know, multiple ethnic groups, and people with different skills, people with poor eyesight working on miniature equipment, and people with good eyesight [laughs] working on stuff which was full of, you know, plumbing. So, you know, you switch them around immediately. [laughs] So, yeah,

horses for courses. Try and, try and get the guy, help the people to work in what they're best at.

[29:43]

You, now, in the 1970s, the world has 79,000 computers, as opposed to 5,500 in 1960.

Yes. Yeah.

So it's really, really leapt up. And of course, 1971 we have a bit of a breakthrough. Intel produces its first microprocessor for a Japanese calculator company, and we have the advent of the, of the microprocessor. Were you playing about with them, with microprocessors, in the early Seventies?

Yeah, absolutely. Well, at that stage, in the Seventies, I was sort of, responsible for radio systems, and that was Product Manager. But, the way the company was organised is that you had a sort of, like a business responsibility, and then you had a, engineering group, which generally was responsible to the, to the chief engineer rather… But, but you, also, there was dual… Philips was very much multiple responsibilities. And, we, we employed a number of graduates who, who had been studying microprocessors, microprocessor architecture. So we produced a range of radio system products, all which were microprocessor controlled, switching systems, command and control systems, all with… And we used to use, we used Intel processors, and we also used the Fairchild 8-bit machines. And they were, they were really quite sophisticated. And we learnt some big lessons in the early days, you know, about documentation of software, and, beware of the guy who can do this software in his head, and, codes it to the machine, and then, then decides he's going to travel the world and you're left with the machine and a customer and nothing works, because you haven't coded it. So, there was sort of, the, the… It was a bit like the Wild West. So, we, we very much learnt how to build microprocessors on, on shared, shared microprocessing common buses. We developed ways of sharing assembled software between the same machines so that they could take over the responsibility for a task if one dropped out. And, we probably didn't sell a lot of them, but, but there was a lot of fundamental microprocessor design.

[31:55]

Communications is, to an extent remains different from computing. Of course the mean time between failure has gone down and down on the computing side.

Mm.

But in some computing systems, failure is OK, because you can reboot the thing.

Mm.

Whereas in communications…

Yes, absolutely, 99.99% on everything. And that's pretty much fundamental in a mobile phone network. But it's also fundamental in a police command-and-control system. You cannot have failures. So, a lot of our work was designed to make things more reliable, or realise where, you know, rebooting wasn't an option. And, I worked for an Austrian company that, well not work, we had a partnership with an Austrian company, and that was, you know, in sort of, late Nineties, '96 onwards, just in that spot. And, Frequentis it was called. And they used to make air traffic control systems, process control, and, you know, that's one place where you cannot have a failure. So, you know… And, you know, the supervisory control systems we did in the early days, it actually didn't matter if it stopped for a while, because you would clamp the data and when you had got it all running again you'd just download it and it would all be hunky-dory. But when you were actually controlling real-time machines, industrial applications, if something goes wrong, you know, it's, you know, really difficult. And that in some respects limited some of the work we did. But of course we realised that actually we couldn't afford to have that reliability till we found other reasons. So, part of that parallel processing microprocessor stuff was designed to address that, so that you could build standby systems. You know, all the base stations, stuff for police finance, they all had hot standbys, you know, they'd switch over immediately.

[33:50]

The discipline that Philips brings to it means that the company is relatively successful, gaining market share, and they ship you out in 1981 to New Zealand.

Oh, yes. [laughs] Yes.

Which is, was 1,000 miles away from Australia. We think of them next to each other, but, it's 1,000 miles isn't it or something? What were you doing, then, in New Zealand?

Well I had been quite successful in Australia. The work I did with… When Philips came, we had quite a vibrant systems group, you know, with those big contracts. Philips was not so well placed. And, when I came back into it, there were significant losses, and, you know, it really wasn't well organised. So I, I was fortunate enough to restructure it, produce our own product portfolio, a mix of stuff that we designed ourselves and others, and, by the end of that we were, we were looking at nearly 70 per cent market share in, in systems in Australia. And we had some big overseas competitors, Motorola, Hitachi, and some very good Australian competitors. So that was quite a success, and that really was about thinking ahead and identifying use, and all the standard, you know, product stuff. But then the company said, 'Well, we really aren't doing very well in New Zealand. New Zealand, a company called Tait has got it all. Would you mind going over there and, sort of, [laughs] putting them straight?' That would be a bit unfair, but… They, New Zealand said, 'Yes, we could do much better. Much better to do a fast track. Could we borrow him for a while?' And so, we've, we've got, we're manufacturing PABX equipment in New Zealand; we could use those as logical elements to drive some of the more complicated systems. So, yeah, I went over there for twelve months, helped them set up, won some business. And then, went back home, and of course left them to complete the business and, do what they could with it. And so, yeah, so, it was really a start-up job. Very engaging.

[36:01]
And when you came back into Australia, you weren't in Melbourne, you were in Sydney.

I went back to Melbourne and no sooner had I got back, they knocked on the door and said, 'We… You obviously can put things together. In Australia Philips has got a number of product divisions which are operating completely separately. Data systems, radio systems, medical electronics, telephone communications systems, are all separate. And, you know, surprise surprise, they're often the same customers and the same payment, you know, New South Wales government or this, so… And so we really want to think about it, and what we are going to do is to take four people from each of the disciplines, with a business and technical understanding of each, and see if we can create Philips Communications Systems, or Philips Professional Systems, for Australia.' So we took about twelve months, and we went through all of the business plans, the organisation structure. You know, here is a new way of doing it. Which means that Philips can benefit from scale. And so, we got that project pretty much up, and at the last minute we had selected each of the state managers who essentially would lead this. Because Australia is such a big country, you have to run it from the State; you can't afford to sit back in the other side, because communications in those days was still pretty lame. Anyway, the guy who was appointed to do Sydney was head of data systems in Sydney, suddenly said, 'Well I'm going to work for a Japanese company.' So they said, 'Oh. Oh, oh, yeah, well, Ed…' [laughs] And so… And so, so I ended up with the job of State Manager in New South Wales. So, that was, that was quite formative, because, we've done all this deep technical stuff and this vision stuff, and the strategic plan was about, you know, future vision and what it should look like as a combined enterprise, and now you've got to do it. [laughs] So… So anyway, so I spent, three or four years, I can't remember exactly how long it was, as State Manager. And that meant actually melding it together. And it took, you know, looking after, you know, let's, let's have one credit system, let's have a composite sales force with, with skills in different parts. Let's have a high level representation team to talk to, to the big customers, the government authorities, and the Commonwealth authorities. And let's get our product range into a way that people can recognise it, and the people who write tender specifications and write procurement can understand what we've got. And we did really well there as well actually.

[38:36]

I did a lot of coverage of Philips, because I found it quite a fascinating company.

Mm.

It had a computer side to it.

Yes.

But the computer people in the marketplace thought that Philips was a telecommunications company.

Oh absolutely.

And the telecommunications people in the marketplace thought that Philips was a shaver company.

Yes.

And they all thought that it was something else than it really was. And indeed the, the national managing director, if he was down on his numbers, would just sell some more Philishaves.

Yeah, exactly. Yes.

It was a bit chaotic in that way.

Well, yeah. And it, Philips in those days was a, was a very complicated organisation, almost a three-dimensional matrix. And they used to say, oh, you know, the strength of this company is, we have a matrix organisation, so it means you've got three bosses. So you report to the local chairman for the wholesale success of your business. You have a horizontal line to Holland, which will report to the product group, and you have another line out at 90 degrees who talk to the regional guys, who would concentrate on different product centres. So, it did slow things down. In some respects you, you ended up with autonomy simply because the process of going through each of the approvals was so long that you never get anything done. But, on

the other hand, they were, they weren't aggressive, arrogant, alpha managers, and they weren't looking for massive increase in, in turnover, or, and fundamental major attacks on the marketplace. They were just saying, 'Look, if we get ten per cent per growth over everything each year, that's pretty good.' Now that means that sometimes you get more in one bit and less on another, but you know, once you started to move into the very aggressive Asian-dominated, US-dominated, you know, we're going to be successful under any way, and we're going to control our destiny, a completely different, different proposition, and, hard to, hard to go into… I mean Philips were global, because they used to do bespoke designs in Holland and their other places, and then they would then, that television set would then be implemented or modified with, for the Indonesian market. So, it wasn't that they weren't a global company, just that structure I think was too inflexible for fast-moving, a high-tech expanding world that, that we were getting into.

And eventually they lost it, didn't they.

Yes. Yeah. Yeah, and I mean I had a bit of experience with that as well, because, later on, perhaps I'll tell you the story later on, but I was involved in a strategic process which, we looked at all the professional divisions and what they were doing.

[41:30]
Then, after being, for three years, up until 1986, the State Manager for the state of New South Wales…

Yes.

…the most prosperous state in the whole of Australia…

Yes.

…and presumably you think it's the best as well…

Well I was Victorian, so, [laughs] nowhere other than New South Wales would get away with it.

No.

It was, it was the largest population. Sydney was the centre of, of most large corporations that came to Australia. In fact Sydney's fortunes used to go up and down with world economy, because the Americans, when things got tough, would sell up all their buildings and their, or shut down their operations and retreat back to San Francisco, and the housing prices would fall, and then things would get better and they'd all come back up again, and the house prices would rise. So, yeah. But it was a… And Sydney's a very dynamic, cosmopolitan, you know, we often say, you know, Australia, I mean, Adelaide's what Churchill went to; in Melbourne it's what school you went to; in Sydney it's, how much money you've got; and Brisbane, 'Come in and have a beer.' [laughs] So… But, yeah, Sydney, very dynamic, very dynamic.

[42:36]
So '86 to '87. You then move to Cambridge, UK…

Yes.

…where Philips Radio Communication Systems is based, as International Systems Manager. Why the move, Ed?

Well, they were… We… I had gone through that strategic review, implemented many of the policies, and made a successful operation, and brought a lot of people alongside, because you knew you were turning their lives upside-down, quite a challenge. And then there was a change in the chairman, and he said, 'Well actually, I want to do things a little differently. So it means that probably there's another level of restructuring to go.' And I said to them, 'Look, I, probably I'm not the right person to do this.' And they said, 'Oh well, you know, we like you, you can go back to Melbourne.' And I said, 'Well, I don't necessarily want to go back to Melbourne.' But, they said, 'Well have a think about it.' And then somebody rang up and said, 'You know, they like you in England. Why don't you… We'll buy you a ticket, and you can go and have a talk to Roger Crabtree,' who was the HR director at Philips.

At that stage they were trying to concentrate all the radio businesses' control from, from national bodies back to Cambridge in Philips' Radio Communication Systems, PRCS. So I went and saw Roger Crabtree, and he said, 'Oh…' And we knew each other, because, you know, I'd been backwards and forwards. And he said, 'Well,' said, 'there's four, we've got four opportunities which you might like to think about.' 'Oh, so that's pretty kind of you.' That was in July. So he said, 'Well yes, one of them is, we've got an antenna factory in Ireland, we really need somebody to go and manage that. We're in a bit of difficulty with radio systems. We've got a whole radio systems separate division in Cambridge with about 450 people. We could really do with some serious leadership.' He said, 'We've also got an issue with R&D throughout the world. Every national organisation is trying to design the same stuff, and no longer is it practical.' And one other, which to this day I cannot remember. Anyway, I thought about it, and said, 'Well actually, I, I've had quite a lot of time managing people. I would much rather perhaps get back and look at long-term strategy and, and try and help build a company which is really powerful and is getting the best value for its technical and its innovation.' So I said, 'Well I'll take the International Systems Manager job.' I wasn't there [laughs] very long with that, as, as you can see, but… So…

Two years.

Mm?

Two years.

Yeah. So, so the first thing that happened is that, we had some, made a look at the applied research rather than product research, and thought, right well we've got to get digital stuff really into this company. There was lack of it in Cambridge. So, I set up a programme to do digital PMR as it's called, and we employed a couple of guys, and I employed a fellow called Murthy Renduchintala. He was a graduate, went into that. Ultimately became a senior executive in Qualcomm. And they set about doing digital PMR, which eventually became TETRA, a bit later, and I'll come back to that story. [46:05]

Next thing is that, a guy from Eindhoven knocked on the door and said, 'Oh, well,' he said, 'we're not really getting enough of this EU research funding.' 'Oh, yes, well, I know about the Framework programme; it's primarily telecommunications and, you know, fibre-based.' Yes,' he said, 'nevertheless, we expect you to see if you can get some.' So I took this call line, like a, like a set of bibles, and hunted through it, and I found a paragraph in it with something about… It wasn't called tenderers, but, but… Respondents. So, invited to provide projects which provide the mobility of telephone numbers between instruments. Essentially what they're saying is that they wanted to have a telephone which had a unique number, and no matter where you plug it into the network, in any place, it had the same number. And I thought, well, OK, a mobile phone is really one of those. [laughs] So I thought, right, well, let's, let's get together and maybe we'll put something on the basis of mobile communications. I was also very much aware at that stage, because I had been pretty much involved in the edges of, of early stages of mobile telephony, that Philips thought they were a PMR company, and they should really be a mobile phone company, because that's, otherwise, you know, the world, you know, the days of state agents and electricians and government people walking around with, with a box screwed in their car, and an aerial poking out the top, were over. And even though you could make it a hand-held, it still was not a, it was a point-to-point communication system. So, you know, things were going to change. So I thought, well, let's see.

[47:57]

So, I got together with a research chap in, down in Crawley, Rod Gibson, and he had been doing some work as well. And we sat down and said, 'Look, now let's, let's try and project what's likely to happen in technology terms.' So, now, could we really get a large amount of computing into, into a product, which would allow it to do a lot more than just basic… Yeah, and we could see, with a, with a, you know, Moore's law, that that could be feasible with a, phone. Could we miniaturise it? Yeah? Could we make it small enough? Could we build a network, or could you design a network which had the capacity to provide service to everybody? Not just business users, not just a narrow group, or a different one in each country, which would be universal. And then we thought, well, and what sort of services are really… You know, it's got to… If it's going to be sort of, have this impact, it's got to do more than basic voice calls. It's got to actually link people with their lives, you know, on the basis that people want to talk to people and not places. That's the argument for mobile. I've

always said that. Also, people want to be able to manage their lives from a mobile position, rather than a fixed position. And that's not to say you don't do business computing control systems, but in terms of managing your lives, that's, being able to do it instantaneous is far more fundamental. So on the basis of that, we thought about a proposition called Universal Mobile Telecommunications, UMTS.

UMTS.

UMTS. Universal Mobile Telecommunications System. And so, having got that, we said, look, no good doing it on our own, because this, the challenge here is enormous. We are being invited to do collaborative programmes. Let's see who we can call. So, so we went round. We ran up every man and his dog. And the end result is that we set up a meeting in April, which was, must have been 1987, down in Philips research laboratories, and, I think we had about 30 companies represented. And it was, it was really, a moment of, you know, appreciation, we had people like Matra, and, and Ericsson, and Nokia, and, and some of the German companies, Bosch, and, and our own companies, Philips Communications Systems. All of these people were there. BT were there. And, some of the universities, Strathclyde University, there right from the beginning. So. And essentially we said to them, 'Look, we think that, that there is an opportunity in the longer term to build this, and, would you, would you be prepared to share some of that research? So, you make the research that you're doing available to the others, and they'll make their research, and then we will organise extra work projects to do the bits which nobody has covered.' And they said, 'Well we think that's a pretty good idea. We like the idea of that.' You know, Europe's very much collaborative at the research phase, and, rather than America which is, you know, one person builds a standard and then they, they kill everybody and hope that their de facto standard will be the winner. You can't afford to do that in this country, in Europe, at that stage, because the market's not big enough.
[51:25]
So anyway, they all showed appreciation. So he said, 'All right, well then, we're going into workshops this afternoon, and we want you to just summarise the key points of your R&D on these forms, and, and between tonight and tomorrow morning we will have a look to see whether this constitutes a programme.' Now we had done a bit of work at the beginning, trying to work out what it was like. So, it was a bit like

playing patience, you know, oh that one goes there, that one goes on there. Oh we've got too much of that, not enough of that. By the next morning, at ten o'clock, we said, 'Look, we think we've got a programme. These are, these are the companies, if you says yes. These are the work packages we'd like to take. These are the bits which we are missing, so, would you do a bit of that, for instance .' There was a real absence of spectrum management. And BT put their hand up for that. And we said, 'Well that's fantastic, but could we take some of yours off and give it to somebody…' Anyway, so we had this package, and they all said, 'Actually, we think it's a good idea.' So over the lunchtime we put it all together in a package and gave it to them, and given that research is really expensive for all corporations, and it has to get board approval, you can't go off and do collaboration, give away your IPR, without agreement. So, we said, 'Look, here's the thing. Go back and see if your, your executives and your boards would, would go with it.' And the majority of them did. So they came back, and then, then…

[52:52]

So then there was a real fearsome amount of effort to produce all the work packages, build a, a programme, which was RACE 2043 I think was the ultimate name when it was awarded. But, well it wasn't that easy. Because we, we put the bid in, and, the guys in Philips, who were well into the EU as part of the group, they came back and said, 'Well done guys. Best technical proposal. Fantastic. Really, you know, lots of innovation. Good one on that.' And then they came back and said, 'Wow, you've done really really well.' Strategic imperatives, societal, all these EU words, you know, which they use. So we thought, oh, we're doing all right. The next phone call said, 'Mm, you'd better sit down.' And I thought, oh what's this about?' They said, 'Don't think it's going to go Ed. We were only allocated five million ECU and you've asked for 43.' And I said, 'Well it ain't going to go anywhere with Five. No chance.' So, I really thought about it. Well I'm not going to… Being an Aussie, I'm not going to… [laughs] I'm not going to let them beat me. So I got hold of the key influencers, I said, 'Look, you've got to go round to your national governments, who will influence the committee, and try and see if we can get this reversed.' And what was happening, is, at that stage, this is '88, GSM was at its infancy, and, and it was, the EU regarded it as a really, as a major win; even though it wasn't their win, it was SET who put together the, the Council of European BTTs. That was where the innovation came. But they, they put it into ANSI European standard. And the EU

were sort of claiming ownership of the innovation, a pan-European mobile system. And they were saying, 'No, no no no no no. We're not going to have anything disrupt the glorious GSM.'

[54:51]

Now I'm, I'm not arguing against GSM, because, it was fundamental in the, in the direction. But we had to change that. We had to say, 'Look, actually, this is not about tomorrow. This is a programme which is going to be in fifteen years it's going to take to get this stuff. It really is. But if you don't start now, it won't happen.' Well of course, this is, the, the solutions have got to go at the same pace as the technological innovations have to be brought to market, you know. So, anyway, still wasn't looking good. So… And that's the] bit that was mentioned in the GSM .com thing is that, I said to my secretary, 'Look, we've only got one last shot at this. I need to talk to Huber,' who was head of the research project group, I think DG, DG13? Anyway, so I need to talk to him, because, we're lost. And, so I got Rod Gibson, and we jumped on a plane and went over there. But, before that, I said, 'I'm not quite sure how we're going to get to him, because he's a very busy man, and they probably won't talk to us.' 'Oh,' she said, 'I'll fix it.' This is my administrator. So she got on the phone. [laughs] And she rang up and said, 'Oh, I need to talk to Mr Huber.' And they said, 'Well he's not available. What's it about?' She said, 'Oh well, Mr Candy needs to talk to Mr Huber immediately, preferably tomorrow morning at nine o'clock.' And the secretary comes back and said, 'Well who's Mr Candy?' And she says, 'Well I suggest you spend the next eight hours finding out who he is.' [both laugh] So… So… [laughing] So, it was a very bold step. So, we fronted up next morning. And he said, 'What's all this about?' And, I can't remember actually, the details of the conversation, but essentially, we said, 'Look, you know, this going to be a disaster. Because we believe that by 2000 more than 50 per cent of all telephony communications will be made on mobile. And here you are, spending 250 million on fixed telephone systems. And we can show you the projections, and what this is showing you, that, that actually, because it is possible to do it, somebody will do it. Unless you're there…'

And if it's not you, it'll be someone else.

Somebody else. And I used that argument several times. Anyway, he listened to us, I give him his due, and he said, 'Look,' he said, 'I've got a problem.' He said, 'All the money has been allocated. We have to spread it around the member countries. We have to spread it between small to medium enterprises. We have to spend it on major industrial things.' He said, 'It's, it's all run out.' And I said, 'Well, now the programme we've put in there has got a wide range of educational institutions, it's got industrials in it, it's got small to medium enterprises. So it meets that criteria.' He said, 'Well I still have a problem, because, I am getting pressure from a number of nation states to say, they don't want it.' And I said, 'Well that's a different issue.' But he said, 'Leave it with me.' He said, 'I don't know how we're going to change it, but I hear you've been rattling the runes,' which I have. 'Because, I don't want to be a fool, and, I don't think you want to be one either.'

[58:26]

So he came back the next morning. So he said, 'Look, the issue is,' he said, 'I know you've got five. I think there's seven.' I said, 'Well forget seven. I mean you can't put 25 gummies together with seven million.' I said, 'You can't even get them to the first meeting.' [laughs] you know. But, you know. So the 43 could be 39. I said, 'We can't do that.' He said, 'But look, I, looking at it last night, I believe…' So this is what he said, 'I believe that, actually, I can see another seven million becoming available, because some of the people who are there will not meet their objectives in the first year. I'll guarantee you can have that seven million. So that means you will get fourteen million for the first year.' And he said, 'If you're prepared to go on that basis, we'll then spend a year making sure that there's funding in the subsequent years which will fill the…' And at the end of the day I think they spent 250 million ECU on the project by the time they got to the end of it. So he was… And, and so the thing went to, into vote. And we won by two votes.

The man had vision.

Mm. Yeah. Roland Huber. So, you know, full marks to him. So that was, that was one of those battles. And, you know, these are, these are very determining moments in your career, you… You know, I wasn't prepared to, to drop it. And I'm absolutely convinced that we had to, it had to happen.

That's why I want to hear, that's why I wanted to hear it in detail.

Yeah.

Because it's a, a seminal time. And therefore, Europe has some of the best mobile communications in the world, and leads the world in many issues of mobile communications.

Mm. Yeah.

[1:00:09]
You then moved, '89 to '91, as Technical Director of a Philips-Shell-Barclays Bank consortium.

Yes.

And you were involved in, a bit of a failure, the embryonic personal communication network called Rabbit.

Rabbit, yes. [laughs]

Rabbit Rabbit.

Rabbit Rabbit. So, now, firstly, I mean I had got the 3G programme under operation. And, you know, once you've got these things going, all the work packages, so, it is possible to leave and appoint people to follow. And Philips were good, they, they got some extra administrators to, to follow through. And then say said, 'Well look, we, we've got this personal communications licence.' So, I thought, well it's, that's fairly risky stuff. What we're, what we're looking at is sort of, cellular at one end, and personal communications at the other end. But it's worth a try. And, we did get personal, personal phones, which would make and receive calls eventually, with a low power network all round the world. It was probably too early for its time. But, at the same time, well within a couple of months of setting it up, the Government announced personal communication network, PCNs. Essentially they were… And it was the

right thing to do. They were taking the GSM initiative and trying to drive it into personalisation, which is meeting some of the objectives which I was trying to get in the UMTS project. And we telegraphed that, saying there was a big understanding that that's where we had to go.

[1:01:50]

So, having, having got Rabbit going, and having talked to many people about it, I said, well was it an abject failure? Well, it was in that we only got a small number of customers in the midst of a recession. That year we actually got more customers than Vodafone got. [laughs] So… And I think they, they lost a significant proportion of customers at that stage, whilst we were gaining them. But nevertheless, it wasn't enough to really submit the extra stages.

[1:02:31]

And then, at the same time, Hutchison were also putting in telepoint networks. So, Philips decided… And it wasn't part, it wasn't about the, the initiative. They said, 'Look we, we are in some difficulty. We are now going to concentrate, so, we are going to concentrate on manufacture. We are not going to do peripheral businesses, we're not going to be an operator. So, sorry guys, we're out.' And, so, in a sort of, moment of, not despair, but, what are going to do next, we thought we might talk to Hutchison, because we already, I was Chairman of the international Telepoint Operators Association at the time. And so, we thought, well, you know, maybe they'd be interested, and they had been unsuccessful in getting a PCN licence at the time. So we had this phone call, and they said, 'Well how much do you need?' And we said, 'Well, you know, we need this amount to finish it off.' And they said, 'Well yeah, we'll… Yeah, we'll buy it for £1.' And the other two shareholders said, 'Yeah, well that's all right, that means that, you know, we don't have to follow through.' And, so we got it up and running, got the customer care centre.

[1:03:29]

But what was really important about that is that, this was a consumer project from the beginning, and so perhaps more importantly, Rabbit sorted out how you could go into a shop, take your phone off the shelf, and make two phone calls, and you could start using it.

Yes.

And, and we had agreements with people like Boots and Comet to have them sitting on the stands at the end of the aisles; you know, for 200 quid you could buy a phone, and one to go in the house. So, what we had really said… And then, [laughs] I remember, we had a, there was an event at the NEC, and the marketing director at the time, Mike Bowland, said, 'We're going to make a splash Ed.' And I drove round the corner and got all this technical stuff going, and we said, 'How are we going to make all this work? And this enormous orange balloon up in the sky with Rabbit on, and I thought, oh God. [laughs] We're away now whether you like it or not. So. Anyway, but I think the, the… So, we rolled that innovation into Orange. Because Hutchison at that stage were Microtel…

Yes.

And then they became Orange. And so, we… And that was quite help… So we already had the customer care centre running.

[1:04:39]
So 1992 to 1996 you became Technology Director of Orange which was initially Microtel.

Yes.

And, basically, Orange became this super-duper worldwide mobile network provider.

Yes.

Making huge amounts of money. And you were the technical director. And you basically moved into mobile services, but you moved into mobile services as technical director, not only for voice. You had a longer-term perspective than that, didn't you?

Oh absolutely. Definitely.

It was voice and data.

Yes. Well now, just to correct… It was Technology Director, not technical director.

Sorry.

Yeah, no, it's quite an important distinction, because the technical director was really responsible for the basic roll-out and engineering, the implementation of what's there. My role as Tech- And I, I had the opportunity, because Colin Tucker, who was my boss, was the supplier into Rabbit. And, I got on very well with Colin. And then, ultimately he was headhunted for the job of Technical Director of Microtel. And he rang me up and he said, 'Oh Ed,' he said, 'I'm being interviewed. [laughs] Would you mind giving me a reference?' I said, 'Well, I, I think you're an excellent candidate.' So, I assisted his appointment. Not wholly. And then, of course, when the table, chairs turned, so when we decided to dismantle BUIPS, I said to Colin, 'Look, I'm, I'm now looking to, on the next phase,' 'Oh,' he said, 'would you, would you come… What do you think, what's the best computer?' And I said, 'Well, this is, this part of taking us through would be ideal.' Because the, the DCS 1800 was just, GSM at a different frequency.

Right.

So…

DCS 1800.

Yes.

Yup.

So… And, again, the GSM society were always very protective, they wouldn't allow extra bits. And they, they, you know, they tried to stop UMTS in a number of occasions on the way through. And this was another example of their fear, of, that something else would bypass. So, so first, you're absolutely right, as Technology Director, what I'm looking at is, actually how do we take part of the original vision with UMTS, and deliver it with, with the basic 2G services? And I was appointed at

one stage as Chairman of the PCS interest group in the GSMA group. And that was to amalgamate DCS 1800 into GSM, which we got done, and to standard. But then, and I was looking at some slides this morning, and, we started, as part of that technology group, looking at actually how to do video over narrow band, even with what was there. We looked at how to do data systems and, and GPRS data, had kids working on data component, and how we would, the platforms that we would put in. We did a project with Nokia for multimedia, under the RACE, under the EU framework programme. So that's what I was trying to do, is set the, set the scene, so that both at the board level and at a, at an engineering level, the guys always knew where they were going, and it wasn't just basic mobile services, it was…

[1:08:08]
Then, you went to Simoco Limited…

Mm.

…Philips buyout, in Cambridge, in 1996 to 2000. You were Board Group Development Director.

Mm.

And you had a 400-strong digital R&D team.

Yes.

That was pretty big.

Yeah, well it was finishing off the, the TETRA development. And that was a big project, you know, you… These digital systems are a very significant number of people involved. Yeah, absolutely.

[1:08:37]
Back to Hutchison, in the year 2000.

Mm. Well that's an interesting story as well. Because when I, when I… I went… I went to Cambridge because they offered me a main board position, and actually I had been spending my life going from Cambridge to, to Bristol, so, it was pretty tough personally. So… And they said, 'Well, we don't really want you to go, but, if you, if you want to come back, we'll have you back.' So, I started doing, I started putting the, doing the final stages of the TETRA job, and, if you recall, I said I helped start up this digital PMR. Well that was like, part of the forerunner… I mean, a lot of this was done with industry, so it's not all in one person. But those techniques, those, that development line, ultimately fed into the TETRA programme, which, you had to build digital handsets for PMR, rather than, you know, cellular radio. Quite different. So… And that's… So then, then the Hutchison bit, is that, there was a, there was a change of management, potentially, and they said, 'Well, you know, look and see where you can get some extra money to support your own, own salary.' Because… I said, 'Well that's OK.' And then, a day after the chairman said that, the phone rang, and Hutchison said, 'Would you help us get the licence?' [laughs] 'Absolutely delighted.' So, so I, I spent a month or so working to get, help get the licence, which we got. And then they said, 'Well you'd better join us again, hadn't you?' So, that's how, that's how we got, got to that point, yeah.

[1:10:19]

And you remained with Hutchison to 2009, as Technology Director, and then Group Technology Director.

Yes.

Was it a very bad time, in 2000, the dotcom bubble, boom, and then bust?

Actually… Well there were, there were are a few things. What bit that didn't mention along the way is the formation of the UMTS project. And it's quite material. Because after the RACE programme finished, and this was about 1995, in a lift following a consultation meeting which, you gave all the research results and where it was going, I was buttonholed in the lift by four people, Jo da Silva, Robert Swain, Bosco Fernandes, and they said, 'Well now Ed, you've got all this online. Where we go now?' And I said, 'Well, you, you've got to, you've got to form an industry group

of the actors, not just the operational manufacturers, it's got to get everybody. How about you set up a taskforce, the standards regulators, government, and we try and work out how to go?' And as a result of that UMTS forum, a taskforce, one of the, one of the recommendations was that a forum would be formed. And so, I'm doing 2G Orange, but I've got a 3G programme going in parallel. And, so, I then set, agreed to set up the UMTS Forum, which is nm amalgamation of the actors I suppose, a good way of saying, industry actors. And that set an industry body, which wasn't biased. It had operators, manufacturers, regulators.

Right.

[1:12:06]
And that was quite important in getting the spectrums allocated and starting to build that energy which would keep that project going. So, going from research to implementation is a fairly hairy business, and many things fail. So that was, that was quite an important, important initiative. So now, now of course Hutchison ring up and say, 'Well you were Mr 3G, you set the forum up. You've set the policy. You've done this, you've done that. We'd really like you to help us.' And so, we now, we now find that we're at the beginning of 3G. Standards had been halted, again by a bit of GSM resistance, we'll have UMTS as an air interface, rather than a system. I had been saying, look, what we need to do is, evolve the GSM core network, so that it can manage the information and the data revolution, so that GSM can migrate the early data rates in the first specification with only 384 kilobits, not really enough, but nevertheless worth, worth going. Because that was roughly where the handsets were sitting, in terms of internal capacity on power and battery consumption.
[1:13:16]
So, we then, we then start to, we get the licence, then we've got to do the job. And the Release 99 did not suit us all at all, because it was a long way away from the vision that I felt on the place which we were going. I felt all we would be doing is a slightly faster 2G with a bit of video. Wrong. We had to do much better than that. And it was pretty clear as part of my technology team in Orange, and I had some very good IT guys in there, they were saying, 'Look, you know, we should be doing this free flow, we should be doing all the communications via the Internet. You know, that's what we should be doing. And I really agree with you.' We can't get the

flexibility to speed up on the 2G system, but we'll start implementing that, and we'll do this multimedia programme with Nokia and a few others to get that, that emphasis going. So then, along comes a licence, and we've got to build it. Now, right back in the start of the UMTS taskforce, they said we, I got up one day and said, 'Look, you've got to do a timetable.' So I produced a timetable, you know, research, validation, standardisation, development, rollout, all this stuff. I said, you know, 'This is the work you've got to do if we're going to launch in 2003.' So that programme, set up 2003, was when the industry was aiming to launch, and what I am really pleased about is that, that target date was actually achieved. Because Three launched on the 3rd of March 2003. [laughs]

[1:14:49]

So, so that, that sort of transition meant, what was, what was our architecture? What was the basic fundamental implementation of Three? Was it just going to be, a very fast interface and essentially 2G stuff? No, we're not going to do that.

No.

We are going to produce a… And that's what we worked really hard at, is an IP infrastructure, something that emulated the sorts of infrastructures you saw inside an ISP, and, and a data, you know, an internet provider. And so, we set out, and that's where I did have the opportunity of influencing that. And we ultimately jumped ahead, and we, my standards team, you know, they went and did all the video stuff, they did all the, they influenced the high speed data standards to try and make sure that we could do it in time.

[1:15:44]
And, it was 3G that really led to the great explosion of mobile telephony.

Well I always say that, you know, we talk about generations. First generation was really just trying to get coverage, yeah? Very expansive, no capacity, but at least you could do it. 2G was really the, the arrival of consumer. It meant that you could multiplex multiple channels onto single carrier, so you could get the volume of transactions and the capacity, and you could use digital, which meant you could replicate equipment at a lower cost, and therefore you get to the point where you can

start to get the prices of equipment down to where it's affordable for everybody. But my view, right from the very start in UMTS, is that, actually we were going for a different world. And it was a long time ago. And, you know, when you look back through the papers, as I did in preparation for the interview, I saw, you know, really, that, that was a really special moment. And so what we were doing is saying, look, actually, I want to get to the place where we are mobilising the Internet. And, Apple did us a favour, even though, [laughs] you know, because they came along with the product eventually, to do it. We, funnily enough I came across a piece of paper the other day, which was, I wrote in about 2001, which specified the handset. And, it had, information, [laughs] you know, all, round the outside. And in the middle, an iPhone. And I had spelt mine f-o-n-e. [both laugh] And my handset group actually visited Apple, and gave them that, that job specification, not technical specification. Apple weren't interested in talking to us actually. They didn't get past the reception. Intel were, and, Nokia were. Nokia weren't that interested either, funnily enough, so Nokia participated in the multimedia projects, but… They were very much convinced that the managing interface was fundamental to their success. It was very good for 2G, was irrelevant for actually going into the…

[1:17:52]

So, in 2006 we, we had this network all ready, so layered architecture, big TIBCO interface, so, everything was IP, so, you know, you didn't have all of the sort of, the situation where you put the new platform on, you had to redevelop everything. And it took eighteen months to put fax into Orange, because of the silo telecommunications architectures. We already had, shortly after the launch was complete, a content management system, and a content control. We actually did a project with the BBC to develop that stuff, which ultimately underpinned their iPlayer project.

OK.

So…

[1:18:35]
We are now 2020.

Right.

We're now in 2020.

Yeah.

And, there is another G coming along, 5G.

Mm.

Some people have been rather critical of it, not necessarily of it but of the expectations around it. Are you?

[hesitates] I… It's, it's a good question. And it's a good question because, I think, you know, you, you've got such a lot tied up in what's been done, that it's very easy to say, well the next one won't be better. And on the other hand, with the technology, you can say, well what can you do better? So, that's how. But then you also have to ask, well, what do people need, how is it going to meet their needs? I'm, I have to say, I'm not so convinced about the business cases. I think that the, there will be extra capacity, and there will be extra capability. Some of that is going to have to be met by a drastic increase in the density of sites in order to deliver the 5G. So I don't think it's all plain sailing yet. Now somebody once said, is that the odd generations have the most difficulty, and the even ones are the ones that clean up the mess after the previous ones [laughs], you know.

[1:20:00]

I was about to talk about this generation. So you had analogue, then then you had digital, then you had 3G, and I think, you know, we went from business to consumer voice, and then, all of a sudden we change what the mobile phone does. So I always feel that 3G, I don't want to be arrogant about it all, I will always feel 3G is such a fundamental change in what we were, what we *could* bring, and then, you know, the IT industry did the rest. It, it, you know, it provided the applications, the infrastructure. The IT network is now the world's largest interconnection machine. Only just recently the telephone network was the biggest machine in the world. So there has been this massive transition. And…

[1:20:48]
So you are a bit sceptical about 5G.

Well.

Are you sceptical about, about the role of a Chinese vendor in the 5G network, Huawei?

Well, I, I have my own view on that. I think that's more about competition and protection rather than security.

Can you explain that?

Have to remember that the, that the social media companies have an enormous knowledge about all of your activities and your personal data. That is a far greater security risk, in my mind, than, than a Chinese vendor. Because nowadays, all equipment is very complex, it all has to be managed from a central control vendor system. So, every piece, everybody makes a piece of PlayStation, computer server, you know, whatever it is, piece of cloud, they are connected back, and they, people sit in rooms doing patches, looking at faults, looking at skips and runs, and putting patches in, all the time. That's, that's where we are. And the Chinese are no different. The Chinese are to be congratulated actually, in taking the next phase development ahead, and putting the technical excellence and the energy into, into the project. So I would, I don't feel that the criticism is really justified.

[1:22:19]
Are we entering a phase of a digital dystopia? Tim Berners-Lee thinks we are, and is very concerned about it.

What would you, what would you say a digital dystopia would be?

It probably looks like where we are at the moment.

Well, perhaps, put it another way, is that, you know, regulation and laws always follow the event. And, it's, governments do not react to future visions; they react to what they find. So in some respects, where we are at the moment is a bit of the Wild West. And so there is opportunity for malfeasance, and there is opportunity for, you know, causing a lot of trouble. And, it's, it's, you know, it's… With every benefit there's always a, a limitation. And, one has to be careful not to, not to remove the opportunity through fear. So, you know, and it goes back to the red flag in front of the motorcar, you know, it was dangerous, run people over, and it has killed a lot of people, the motorcar. But think of the opportunities created. So, that's why I think we are, we are in a place where governments need to change and work much harder in regulation control, but don't necessarily, don't take away the freedom.

[1:23:45]

What are the mistakes that you have made in your career, Ed Candy?

Ah. [pause] I think that, I have always felt that, perhaps it was best to get the job done, rather than get the recognition. And so, a lot of what has happened in this journey has been, don't take the recognition; just try and influence. Say to Ericsson at the right time, 'Look, you know, if you don't follow 3G, if you don't follow this, you know, the guys on the other side of the world will.' So… And yet to be a leader you have to bang the spear on the ground and say, 'Follow me.' Maybe we would have got a bit faster, and some of the routes which were taken may not have had, we wouldn't have had had to go through them, if I had been a bit more forthright. But then on the other hand, I'm not sure, if I had forthright, whether it would have, you know, those Machiavellian, those who stand to benefit by the old order, would be very effective in removing him. But I think, I'm happy with that; less, you know, with that more collaborative approach.

[1:25:11]

You don't sound to me like a man who is not forthright.

[laughs] Well, it depends what, what you mean by forthright, you know.

Do you think, I mean, that you are steeped in and were grown up in an Australian culture, gives you an edge of being able to say things more directly to people than perhaps people in the UK would do?

Oh absolutely. Yeah, that was, that was a, that was a fantastic [laughs] benefit of being an Aussie. Firstly, as you, you could say something and you wouldn't necessarily be logged into the, into the particular socioeconomic group; but secondly, a big country, lots to do, big problems, taught you to be very direct, you know. If a tower's going to fall down, you don't form a committee and say, 'Let's consider what appropriate strategic solutions we will put in, and do we need ballistic holes in the ground or what?' You know, so you grab, you know, vernacular, grab the bloody rope mate and don't let go of it. And in the meantime I'll think what we're going to do next. And that's a bit, that's, that is … And that is a characteristic about Aussies, they are direct. But, I think on balance they, their directness is, is not directed at you personally. And, you know, you can get abused by a guy, by an Aussie, in a set of words which, over here you, you would take him to court. But you say, 'Oh, come on you silly old b, let's have a beer.' [laughs] So… And I guess it's grown up because you, you had no choice, you had to get on with people, because, if you had a row with somebody, he might be the only guy who is within 250 miles who can help you get your car going again. Mm.

[1:26:56]
I've done many of these interviews, Professor Edwin Candy, and I have never come across anybody so far in the interviewing process who said, grab the rope mate and let's make it work. Thank you very much for your entertaining and important and insightful contribution to the Archives of Information Technology. Thank you Professor Edwin Candy.

Oh thank you very much, great fun.

[End of Interview]