
The history of the development and operation of
Information Technology at the Potchefstroom Campus of
the PU for CHE from approximately 1967 to 2003

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PREFACE

Historical writing is, by nature, selective and cannot convey all information in detail. The same applies to this document. There is an abundance of meeting minutes and reports available from which only single core decisions could be conveyed. There are also many photos available on certain topics, but only a limited number of them could be used. On the contrary, some topics under discussion have very few or no photographs available at all. Contributions in this regard will be much appreciated and valued, as will photos of staff members who do not appear on any of the photos in this document. In addition, any comments on factual inaccuracies and missing core information will be valued.

The documents referred to in this document, together with any other related documents, have been saved on a CD titled "IT history PU for CHE 1967-2003" that is kept in the NWU archive. The documents in Winword format that are referred to can be found on the same CD in the IT history\Winword\ directory.

CHAPTER

1

Introduction

Today, it is difficult to imagine a world without the variety of computers, including desktops, laptops, tablets, smartphones and the unseen computers in most of our household appliances (and much more) that we take for granted. Computers have an immense impact on our daily lives and have changed the nature of scientific

research completely. This has, however, not always been the case and many of us grew up with only a vague notion that somewhere out there existed something called computers that had basically no visible impact on our daily lives.



Schematic representation of the main hardware components used for calculations at the PU for CHE from the 1950s to the present time, from the slide rule to mechanical calculators,, to electrical calculators, to printing calculators, to the IBM 1130 and the mainframe era, to the first powerful servers like the IBM RS/6000, and presently the modern compact servers with multiple hard drives

Although numerical calculations have always been part of most research in disciplines like Statistics and Physics, the execution thereof was often laborious and time-consuming. For calculations that did not require extreme accuracy, the slide rule was a solution, but for more accurate work, manual and electric calculators had to be used. This process was quite tedious and required thorough checks to prevent input errors. As such, there was an early demand for fast, accurate electronic computers. In some instances, calculations were complex, e.g. differential equations, which often required ingenious solutions. Prof PH Stoker mentioned that, on suggestion of Pierre Haarhoff, a post-graduate student, integrals of intricate functions were calculated by drawing the graphs on paper, cutting it out accurately and then weighing it¹.

A serious demand developed for electronic computing facilities at the University. It thus comes as no surprise that the purchase of the first computer was strongly advocated for.

¹ Transcription of the Author's interview with Prof PH Stoker, 7 September 2009

CHAPTER

2

The Beginning

EARLY HISTORY²

The University was, early on, aware of the possible advantages of a computer for mathematical sciences research in particular. Contact was established with the important computer companies in South Africa at the time, like IBM South Africa and ICT. In approximately 1959, IBM South Africa invited the University to inspect a new computer that Massey-Ferguson had installed in Vereeniging. A large delegation of staff members paid a visit to this new computer, but nothing further transpired¹⁷.

In about 1961, Dr FJ du Plessis from Economic Sciences commissioned the Department of Instrument Making to build what turned out to be an interesting example of, in essence, an analogue computer. This computer could simulate the effect of external factors on the economy. Money was represented by a coloured liquid, the flow of which was regulated by control valves, pumps and feedback channels.

²Based, for the most part, on transcriptions of interviews the Author conducted with Prof. JF de Beer, Prof. T Steyn and Mrs K Benadie on 19 November 2008 and Mrs A Oosthuizen on 20 November 2017.

In the 1960s, a Johannesburg company demonstrated a commercial analogue computer on campus. The problems that could be solved with this computer were limited and the demonstration generated very little interest.

During this time, Mr (later Dr) JAM de Villiers, who was studying towards his PhD in Physics (on the scattering of muons), had to perform complex calculations for the theoretical curves that he had to compare with his experimental values. These calculations were performed for him by Mr CE Harding on the ZEBRA computer in STC's computer department³. STC later wanted to donate the ZEBRA computer to the University, but the donation was impractical and, subsequently, rejected. The reason for this rejection was that ZEBRA computers used vacuum tubes, which took up a lot of space and required a lot of maintenance. All programming on the ZEBRA was done in Assembler and not a high-level language, which did not make it very user-friendly. In addition, the arrival of more modern and compact computers that made use of semiconductors, made the ZEBRA a less attractive option.

Dr (later Prof) JF de Beer, in partnership with Dr (later Prof) JH Venter from Statistics, manually calculated simulations of the penetrability of the atmosphere by cosmic rays. It was an exceptionally time-consuming exercise, which emphasised the necessity of

the University obtaining a computer. With the (possible) help of Prof AJE Sorgdrager from Economic Sciences, the matter was taken up with the rector at the time, Prof HJJ Bingle. In the early 1960s, during his doctoral studies at the University of Chicago, Dr Venter gained experience working with Fortran on the IBM 7090 of the University in question⁴. In 1965/66, during a research visit to the University of Durham, England, Dr de Beer, on his part, gained extensive experience in solving physics calculation problems with a computer. Both Dr Venter and Dr de Beer were eager to use a computer. They were supported by Prof WP Robbertse, the Dean of Natural Sciences at the time⁵.

In approximately 1966, the University of the Witwatersrand wanted to sell their IBM 1620 computer and the PU for CHE sent a delegation there to investigate the matter. At the time, the PU staff were already aware of the IBM 1130, the IBM 1620's successor, and decided against the purchase. The process was then started to obtain approval for the purchase of a new IBM 1130 computer.

THE PURCHASE OF THE FIRST COMPUTER

Prof JM de Wet from Statistics presented a formal proposal to encourage the purchase of an IBM 1130 computer (a matter which he referred to as exceptionally urgent) to the Faculty Board of Natural Sciences

on 31 August 1966⁶. Prof De Wet was supported by Prof WP Robbertse from Mathematics and Applied Mathematics, who also served as the Dean of Natural Sciences at the time, and Prof PH Stoker from Physics. Prof De Wet's thorough and well-argued proposal was accepted by the Finance Committee on 27 September 1966⁷ and confirmed by the University Council on 28 September 1966⁸.

The IBM 1130 was ordered and expected to be delivered in about one year. The total purchase price of the computer was R37 500⁹, approximately R2.6 million in 2017 Rand (ZAR) value. In the interim, a card punch was purchased to capture data and programmes on punch cards for use on computers in the vicinity.

PROGRAMMING LANGUAGE TRAINING

During October 1966, Dr JF de Beer presented a course in Fortran programming for interested parties. Several scientists from Physics, Statistics and Mathematics attended the course. At the end of the course, the attendees' programming attempts were tested on the IBM 360 computer of the Atomic Energy Board at Pelindaba. For the researchers, this

visit and their subsequent expertise in Fortran programming emphasised the power of the computer in solving calculation problems, and thus the arrival of the University's first computer was awaited with great anticipation. From time to time, Physics researchers in particular had to use computers in the vicinity, like those at the Atomic Energy Board and the Universities of Pretoria and the Witwatersrand. This further emphasised the urgent need for the IBM 1130.

Before the arrival of the IBM 1130, IBM South Africa presented a week-long course in Assembler for University staff. This training was attended by Dr JF de Beer, Dr JH Venter and Dr DJ van Wyk¹⁰.

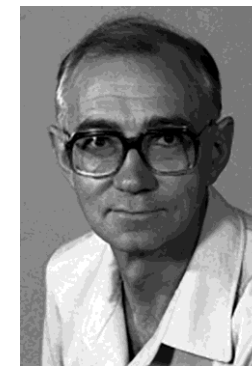


Figure 1 Prof JF (Hannes) de Beer

³ JAM de Villiers, D.Sc. thesis, PU for CHE, 1961

⁴ Transcription of Author's interview with Prof. JH Venter on 2 September 2009

⁵ Personal conversation between the Author and Prof WP Robbertse in 1996.

⁶ Faculty Board of Natural Sciences, minutes, 31 August 1966, Art 33

⁷ Finance Committee, minutes, 27 September 1966, Art 21

⁸ University Council, minutes, 28 September 1966, Art 9 XIX

⁹ According to Prof JH Venter's recollection, the IBM 1130 was made available to the University at a special price, through the mediation of Mr JF Clarke, the Sales Manager of IBM South Africa.

¹⁰ Giel Hattingh, *Rekenaarwetenskap en Inligtingstelsels*, Chapter 4.6 in 'n *Bekroonde Nalatenskap: Die Fakulteit Natuurwetenskappe oor 100 jaar*, Editor: Elize S van Eden, 2017

PUTTING THE IBM 1130 INTO OPERATION

It was decided that Dr JF de Beer, at the time a member of the Department of Physics, would take the lead in the computer centre that would be established. In 1967, Ms Klaasje Moraal (later Mrs Klaasje Benadie) was the first full-time employee appointed at the centre.

The IBM 1130 was delivered in July 1967 (earlier than anticipated) when Dr De Beer was abroad. The University did not own a forklift to move the heavy computer. Mr MGL Bosman from the Department of Maintenance and his team moved the computer, which was still in its packaging, from the sidewalk to the Physics building's elevator by rolling it on pipes. It was then moved to the second floor (via the elevator), where it was, again, rolled on pipes to the computer room.



Figure 2 The University's IBM 1130 computer in 1971. The computer is in the foreground and the card reader/punch is in the background. The mechanical paper tape reader is on the far right of the photo. The identities of the two persons at the card reader are unknown. (Source: Photo collection, NWU archive)

This computer room was previously used by Statistics students and third-year Physics students for practical sessions. A few changes were made to the rooms to make them fit for use as a computer centre. A false floor was, however, not installed and the cables rested on the floor.

The computer was set up by one of IBM South Africa's computer experts, Mr Fred Macaskill, who was a PU for CHE alumnus.

The IBM 1130 computer had a memory of 32 kilobytes and a removable disk drive of 1 megabyte¹. Programmes were uploaded to the computer with a punch card reader, which also functioned as a card punch. The punch card reader or mechanical paper tape reader was used for data input. The IBM 1130's operating system was stored on punched cards; a large pack of cards had to be read into the machine whenever the operating system had to be reloaded. Output was generated with a typewriter or a card punch machine. In practice, it appeared that the typewriter was unable to handle



Figure 3 The IBM 1130's IBM 2310 hard drive. It had a capacity of 1 megabyte and a diameter of approximately 38 cm. (Source: Author's photo collection)

the workload, resulting in numerous problems. The problem was only solved when, after quite some time, a line printer was purchased.

To demonstrate the computer's capability to interested parties, two post-graduate Physics students, Mr JP Maree and Mr DJ Joubert, respectively, developed a programme that could calculate the day of the week of any date in history and one that could play noughts and crosses with the computer.

The computer was officially handed over to the University's rector, Prof HJJ Bingle, on 14 September 1967 by Mr JF Clarke, IBM South Africa's CEO. During the ceremony, the photo in Figure 4 was taken. Reports on the event appeared in *Die Wapad* of 20 September 1967¹¹ and *Die Veteraan* of Sept/Nov 1967¹².



Figure 5 The people who were involved in the initial acquisition of the IBM 1130 computer, were present at the 25-year commemoration of the partnership between IBM/ISM and the University on 24 August 1992. They are (from left to right), Prof WP Robbertse, former Dean of Natural Sciences; Mr Wiid du Toit, former IBM South Africa salesperson; Mrs Klaasje Benadie, formerly Ms Klaasje Moraal, the computer centre's first full-time staff member; Prof JF de Beer, the first Head of the Computer Centre; and Mr JF Clarke, former IBM South Africa CEO.

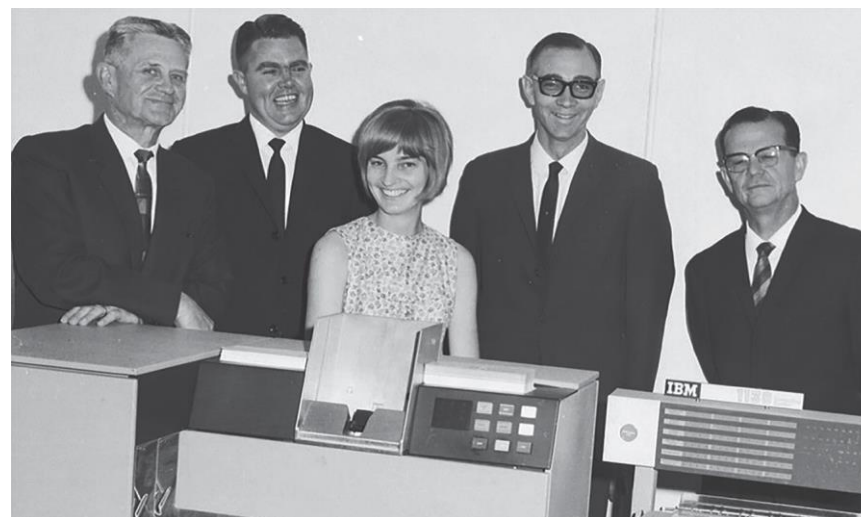


Figure 4 The official handover of the IBM 1130 to the Rector of the PU for CHE, Prof HJJ Bingle, (left) by the CEO of IBM South Africa, Mr JF Clarke (second from the left). Also present on the photo are (from left to right) Ms Klaasje Moraal, Dr JF de Beer and Prof WP Robbertse.

¹¹ *Die Wapad*: Vol 23 Nr 1, p5, 20 September 1967, accessed at http://dspace.nwu.ac.za/bitstream/handle/10394/14016/Wapad_d23_n01_1967.pdf?sequence=1

¹² *Die Veteraan*, p47, September/November 1967

THE OPERATION OF THE IBM 1130

The IBM 1130 was a user-friendly computer that could be operated by users and did not require operating staff. As such, initially, there were no operating staff. The departmental typists were responsible for completing the scientists' punch work.

The IBM 1130 was, almost since its arrival, in full-time use, especially by Statistics and Physics. Very soon, it was also used continuously (including after hours), especially by Mr (later Dr) WF Coetzee, who conducted calculation-intensive research into

the trajectories of cosmic ray particles in the complex geomagnetic field. Thereafter, similar work was conducted from approximately 1969 to 1972 by Mr (later Dr) PJ König's for his doctoral research project in Physics.

The IBM 1130 was later expanded to include an IBM 1132 line printer to replace the overworked typewriter, and also two disk drives and two magnetic tape drives. The memory was also increased to 32 kilobytes. Between 1970 and 1971, a second IBM 1130 was purchased to help with the increasing workload. In August 1971, a small graphic plotter was added¹³. Before the plotter was obtained, rough

graphs could only be printed with the line printer. This was done by changing the position of a character in different rows. This technique was developed by Prof JH (Hennie) Venter.

The Department of Physics used punched paper tape to process cosmic ray data received from Antarctica via telex transmission. The neutron monitor results from Hermanus were also stored on punched tape¹⁴. The IBM 1130's mechanical paper tape reader was very slow at 15 characters per second. This resulted in bottlenecks, since the IBM 1130 could only work on one task at a time. In approximately

1971/1972, Prof de Beer purchased a Facit optical paper tape reader, which operated much faster at 500 characters per second. There was no standard interface for connecting the Facit paper tape reader to the IBM 1130. Prof de Beer approached Mr (later Dr) AJ van der Walt of Electronic Services to design and build a suitable interface. This interface was designed with TTL-integrated circuits. The programming was done in Assembler by Prof de Beer and Mr van der Walt, and the Facit tape reader was successfully commissioned. This was the University's first successful attempt to connect non-IBM equipment to an IBM computer.



Figure 6 The IBM 1132 line printer that was later purchased.
(Source: Photo collection of Mr L Smuts)



Figure 7 Mr (later Dr) JJ (Johan) van Loggerenberg (Source: Photo collection of JJ van Loggerenberg)

STAFF

As mentioned earlier, Dr JF de Beer was the first head of the Computer Centre. He was assisted by Ms Klaasje Moraal, who was appointed in July 1967 as the centre's first full-time staff member.

The staff complement was later extended and in 1969, Ms Dicky Otten (later Mrs Dicky Venter) was appointed as Scientific Programmer. During the same time, Mrs Bettie Venter was appointed as Punch Operator. She did, however, quite soon take over the operation of the salary system (see below), as it took up a lot of time. Mr (later Prof) Piet Bruwer joined the team in 1971 or 1972; he was

¹³ Die Wapad, Vol 26, Nr 6, p9, 7 May 1971, accessed at http://dspace.nwu.ac.za/bitstream/handle/10394/14430/Wapad_d26_n06_1971.pdf?sequence=1&isAllowed=y

¹⁴ The telex signals were transmitted via high-frequency radio from Antarctica to South Africa and contained an abundance of errors. It was common practice to transfer the data twice and then compare the two tapes' data to identify and correct transmission errors.



Figure 8 Mr (later Prof) T (Tjaart) Steyn (Source: Photo collection of T Steyn)

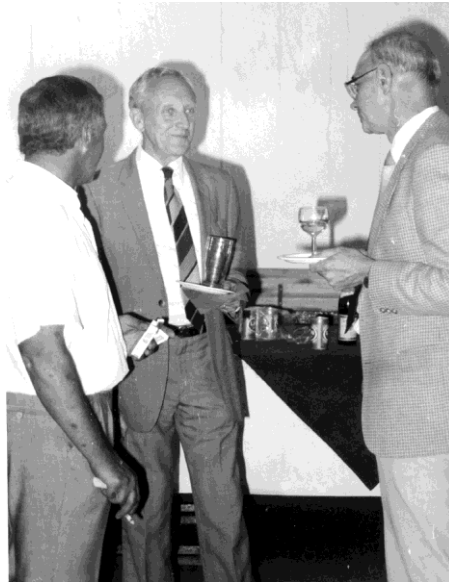


Figure 9 Prof PJS Bruwer (left), Prof JF de Beer (right) and Prof PH Stoker (middle) were pioneers in the early years of the Computer Centre. (Source: Photo collection of Mrs A Mans)

mainly involved in Computer Science lecturing. Mr Johan van Loggerenberg was appointed in about 1973, also as Scientific Programmer. Before this appointment, he performed programming and operating work for the Department of Physics²².

In 1973, Ms Engela Wilson was appointed as Punch Operator. Mr (later Prof) T (Tjaart) Steyn started working at the Computer Centre in January 1974. In the 1970s, he played an important role at the Computer Centre. Later on, he moved to the Department of Computer Science when it separated from the Computer Centre.

Until 1970, Prof De Beer was only involved with the Computer Centre in a part-time capacity, since he still had obligations at the Department of Physics. From 1970 onwards, he was transferred to the Computer Centre in full-time capacity. Prof WP Robbertse, the Dean of Natural Sciences, advocated for the implementation of Computer Science as a subject in the Faculty of Natural Sciences,¹⁵ and from 1971 Computer Science was offered as a two-year major subject in the Faculty of Natural Sciences.¹⁶ Prof de Beer headed both departments until 1978. While the two departments functioned as a unit, the staff members were allocated to one of the two departments.

DEVELOPMENT OF ADMINISTRATIVE SYSTEMS

The most successful early administrative application that was developed for the University, was the salary system that Ms Klaasje Benadie developed in Fortran in 1968/69. The system was so successful that it functioned until 1996, with necessary upgrades and adjustments for the later computer platforms performed as required¹⁷. On the IBM 1130, the salary system was mainly operated using punched cards. Staff members' personal information, their salaries and bonuses were kept on punched cards, which was updated, as required, by Mrs Bettie Venter. Approximately 300 staff members' salary payments were initially handled by the system. This number increased to about 1600 in 1996.

Later on, a system was developed to store and extract student alumni's contact information¹⁸.

Another administrative system that was developed for the University was the student assessment system, which was developed by 1969. In Die Wapad of 26 June 1970, a report appeared on the

¹⁵ Transcription of a conversation between the Author and Prof JF de Beer, 15 January 2013

¹⁶ Faculty Board of Natural Sciences, minutes, Art 26, 18 February 1970

¹⁷ Transcription of the Author's interview with Prof JF de Beer, Prof T Steyn and Mrs K Benadie, 19 November 2008

¹⁸ ITB News, p 3, July 1992

statistical analysis that was done on the 1969 exam results using the computer¹⁹. From 1971 onwards, exam results were printed and released using the computer²⁰.

The increased core memory of the IBM 1130 allowed for the use of Cobol as a programming language, which enabled Mr Johan van Loggerenberg to expand the student assessment system into a basic student system²¹. The extent of the programming for administrative systems led to Mr Johan van Loggerenberg and the two Punch Operators being moved to the Administrative Building where they reported to the Registrar, Prof HC van Rooy²². The Administrative Development Group, that was based in the Administrative Building until 1977 (when Mr van Loggerenberg left the University's employ), moved back to Computer Services, from where they operated from the beginning of January 1980²².

The Computer Centre also accepted projects from the Potchefstroom Municipality. In approximately 1973, the Computer Centre was approached to process water and electricity bills for the Potchefstroom residents. The

system, which was large for the time, was successfully developed by Prof De Beer and his team. This system processed municipal bills for eleven years and generated useful income for the Computer Centre. In 1978, a budget of R23 400 (approximately R700 000 in 2017 ZAR value) was forecast for this work. This ongoing project benefitted staff members by exposing them to commercial systems and was later on a very useful experience for the Computer Science lecturers²³.

IBM SOUTH AFRICA'S PARTNERSHIP WITH THE UNIVERSITY

IBM South Africa was involved with the University's Computer Centre in various ways. In 1968, IBM presented a seminar at the University²⁴.

IBM South Africa made several donations to the University in the early years of the partnership. There are photos of two such events in 1972.



Figure 10 Mr JF Clarke, IBM South Africa CEO, discusses some IBM equipment with Prof JF de Beer during a seminar in 1968.



Figure 11 A donation from IBM South Africa is handed over to Prof JF de Beer (left) in 1972. (Source: Photo collection, NWU Archive)



Figure 12 Another donation is made by IBM South Africa to the University in 1972. In this photo, Mr HM Robinson, Head of Public Relations (second from the right) receives the donation in the presence of Prof JF de Beer (right). (Source: Photo collection, NWU archive.)

¹⁹ Die Wapad, Vol 25, No 9, p1, 2 June 1970 accessed at http://dspace.nwu.ac.za/bitstream/handle/10394/14348/Wapad_d25_n09_1970.pdf?sequence=1&isAllowed=y

²⁰ Die Wapad, Vol 26, No 14, p6, 10 September 1971, accessed at http://dspace.nwu.ac.za/bitstream/handle/10394/14440/Wapad_d26_n14_1971.pdf?sequence=1&isAllowed=y

²¹ Transcription of the Author's conversation with Dr J van Loggerenberg, 14 October 2009

²² Transcription of the Author's interview with Mr EH van Niekerk, 15 September 2009

²³ Transcription of the Author's interview with Prof JF de Beer, Prof T Steyn and Mrs K Benadie, 19 November 2008

²⁴ The photos in Figures 10, 11 and 12 with their captions obtained from the NWU archive, is the only information available on the respective topics.

NEW LOCATION FOR COMPUTER SERVICES

The Computer Centre and computers were moved from the old location in the Physics building to a newly designed, fit-for-purpose location in the Mathematics wing of the Natural Sciences building at the beginning of 1974.

The two IBM 1130 computers were in use until August 1974, when they were replaced with an IBM 370/125 computer. Although the IBM 1130s had limited calculation power and memory, a lot of useful work was done on them. The computer users had to learn how to programme effectively, which is an important skill - even when working with modern computers with large memories and powerful processors.



Figure 13 The wing of the Natural Sciences building where the Computer Centre was housed on the ground floor from 1974. The Department of Mathematics and Applied Mathematics occupied the top two floors.

CHAPTER

3

The IBM 370/125 computer, from 1974 to 1980

THE PURCHASE OF THE IBM 370/125

On 18 September 1973, the Finance Committee of the University Board, on recommendation of the Computer Committee, decided to obtain an IBM 370/115 computer at an annual rental fee of R84 000¹ (approximately R4,3 million per year in 2017 ZAR value). At the time, the IBM 1130 had already been in service for more than five years (since 1967). This decision was upheld by the University Council on 1973-09-19 and an IBM 370/125 computer was ordered.

The IBM 370/125 was installed during August 1974. It had a memory of 128 kilobytes and removable disk drives with a capacity of 75 megabytes each. When it was found that the operating system used almost all the memory, it was upgraded to 256 kilobytes². While the IBM 370/125 was a substantial improvement on the IBM 1130, it still could not handle the demand for computer capacity and interactive programme development.

¹ Finance Committee, Minutes, 18 September 1973, Art 16.

² Conversation between the Author and Prof T Steyn, 8 March 2017

This problem was highlighted in a memorandum dated 5 April 1976³, by Dr (later Prof) H Moraal from the Department of Physics, who emphasised the importance of the research method of using numerical techniques in the natural sciences. The use of these techniques created a lot of opportunities for researchers, but had high demands in terms of calculation ability. It also required interactive programming, which the IBM 370/125 was incapable of.

THE UNISA INVESTIGATION

In 1976, the University requested that the Institute for Computer Systems from the University of South Africa



Figure 1 Mr AJ (Johan) Smith

(UNISA) investigate the PU for CHE's computer infrastructure and make recommendations⁴. (It is interesting to note that four of the six members of this task team were former students of the PU for CHE's Department of Physics, namely Prof CH Bornman, Prof N Coetzee, Prof NF du Plooy and Prof JP Maree.) This institute presented their report on 1 November 1976⁵ and made thorough recommendations on the necessary business systems, Computer Centre staff structure and physical computer needs for the next ten years. It was found that the demand for computer capacity in 1976 was 1.8 times the existing capacity. The report interestingly recommended that there be a reasonable extent of integration between the Computer Centre and the Department of Computer Science, with specialists being appointed jointly in both departments. Shortly thereafter, this was no longer applicable to the PU for CHE, because the two departments were separated in 1978.

On 1 April 1978⁶, Mr AJ Smith was appointed Head of the Computer Centre, while Prof JF de Beer continued working in full-time capacity as Head of the Department of Computer Science.

After the two departments were separated, the staff complement for each department was as follows⁷:

Computer Science: JF de Beer, P Bruwer, A Meyer, P Kotze and A Mans

Computer Centre: AJ Smith, K Benadie, M Dent, T Steyn, J van Rooy, C Blume, E Venter and E Wilson

Other recommendations made in the UNISA report were partially implemented:

- The recommendations regarding the governance of the Computer Centre were implemented. At the end of 1977, the decision was made to appoint a new Steering Committee for the Computer Centre with a sub-committee for Administrative Systems and Library and a sub-committee for Scientific Users⁸. These committees were appointed at the beginning of 1978⁹. The Steering Committee was constituted during its first meeting on 10 April 1978. The Vice Rector, Prof JS du Plessis, was the Chairperson of the Committee, which consisted of the Head of the University's Vaal Triangle Campus, the two registrars, the heads of the Computer Centre and the Department of Computer Science,

as well as the chairpersons of the sub-committees for Administration and Library, and of Scientific Users.

- The IBM 370/125 was upgraded at the end of 1977 with a central processor that was 30% faster and the memory was increased to 512 kilobytes. A remote job entry terminal was installed at the Administration Building and five computer terminals were supplied to the Computer Centre¹⁰.
- A Data General Eclipse S230 minicomputer and several computer terminals were purchased to address the demand for interactive programme development and for increased processing speed for scientific users and Computer Science students. This computer was delivered¹¹ at the beginning of 1978 at a cost of R185 000¹², approximately R4,8 million in 2017 ZAR value.
- An IBM Series/1 minicomputer was installed at the Vaal Triangle Campus at the beginning of 1979¹³. It was connected to the mainframe computer at the Potchefstroom campus by means of a telephone data line.

³ H Moraal, Memorandum regarding computer facilities, 5 April 1976

⁴ Policy and Development Council, Minutes, 1976-09-14, Art 3.7

⁵ University of South Africa, Institute for Computer Systems, Report regarding computer utilisation at the PU for CHE, 1 November 1976

⁶ Computer Users Meeting, Minutes, 24 April 1978, Art 1

⁷ Giel Hattingh, *Rekenaarwetenskap en Inligtingstelsels*, Chapter 4.6 in 'n *Bekroonde Nalatenskap: Die Fakulteit Natuurwetenskappe oor 100 jaar*, Editor: Elize S van Eeden, 2017

⁸ Computer Users Meeting, Minutes, Art 3.1, 9 November 1977

⁹ Letter from the Vice Rector addressed to the Author regarding his nomination as a member of the Committee for Scientific Computer Users, 20 February 1978

¹⁰ Computer Users Meeting, Minutes, Art 3.1, 9 November 1977

¹¹ Steering Committee, Computer Services, Minutes, Art 3, 25 January 1978

¹² Computer Centre, Report, Art 2, July 1978, Appendix to Minutes, Steering Committee, Computer Services, 7 August 1978

¹³ Computer Users Meeting, Minutes, Art 5, 31 January 1979



Figure 2 Prof JS du Plessis, Vice Rector of the University and Chairperson of the Steering Committee (right) receives the Data General Eclipse S230 minicomputer. (Source: Photo collection, NWU archive)

At the time of the UNISA investigation in 1976, the staff complement was as follows: The Group for Administrative Systems separated from the rest and Mr JJ van Loggerenberg and three card punch operators reported to the Academic Registrar and were located in the Administrative Building. The rest of the staff reported to Prof JF de Beer and consisted of (i) the Group for Scientific Systems and the Library with Mr M Dent, Mr J Leonard and one card punch operator, (ii) the Group for Remuneration and Departmental Development, which consisted of Mrs K Benadie and (iii) the Group for Computer Operation and External Work that was manned by Mr T Steyn and a computer operator. Thus, apart from the two managers, there were five computer specialists, four card punch operators and one computer operator. A second computer operator was appointed at the beginning of 1978, which allowed the daily operating service time to be extended to 06:00 – 20:15¹⁴.

THE ECLIPSE MINI COMPUTER

As mentioned earlier, the Eclipse S/230 minicomputer was purchased at the beginning of 1978. While it was very useful for calculation-intensive tasks, it could only service a limited number of users simultaneously. The Eclipse was updated early in 1980 with an extra hard drive and its core memory was increased from 192 to 320 kilobytes to enable it to service more users. By the middle of 1980, terminals for the Eclipse were also placed at the Departments of Physics and Statistics¹⁵. Later in the year, this facility was expanded and it was possible to communicate with the Eclipse from any location on campus through acoustic modems¹⁶. The limited number of simultaneous users the Eclipse could serve did, however, remain a problem. In 1981, the Eclipse was no longer available for general use and was reserved for experimental work at Computer Science¹⁷.

In 1983, the Eclipse was donated to the CSIR¹⁸. At this event, the Steering Committee of Computer Services decided to award a bonus of R1 000 to Andries de Beer, a computer science student who did his best to optimally manage and maintain the Eclipse¹⁹.

¹⁴ Computer Users Report, Minutes, Art 7, 22 February 1978

¹⁵ Computer Services, Newsletter, August 1980

¹⁶ Computer Services, Newsletter, October 1980

¹⁷ Steering Committee Computer Services, Minutes, Art 5.3, 14 August 1981

¹⁸ Steering Committee, Computer Services, Minutes, Art 16.1, 27 June 1983

¹⁹ Steering Committee, Computer Services, Minutes, Art 17.1, 27 June 1983

THE MEDIA CONVERTER

After upgrading the IBM 370/125, there were still problems with CPU overload. One of the culprits was the load placed on the central processor by relatively slow peripherals, like the graphic plotter, paper tape reader and other equipment. In 1976, Electronic Services started to develop small independent microcomputer systems with Intel 8080 and 8085 microprocessors²⁰ for use in sophisticated research equipment. Electronic Services was commissioned to develop a microcomputer system which could serve as media converter for the IBM 370/125. This would serve as an interface between the slow peripherals and an IBM-compatible digital magnetic tape recorder. Mr EP Blignaut developed and programmed this microcomputer system that was commissioned at the end of January 1978²¹. The IBM 370/125's central processor wrote the data for the graphic plotter and other peripherals to the (relatively fast) IBM magnetic tape recorder. That eased the burden on the IBM's central processor by allocating the slow mechanical plotting process to the media converter and freeing the IBM's CPU from the slow peripherals. Vice versa, the data from the punched tape reader was transferred to magnetic tape, which could be read at high speed to the central processor of the IBM 370/125 by one of the IBM digital tape drives. The system

was expanded to enable the transfer of data from the data cassette tapes that, e.g. the Library used to capture the book catalogue data to an IBM-compatible digital tape recorder.



Figure 3 *The media converter. On the photo, Mrs Renée Smit from the Department of Physics is transferring data from the punched paper tape to the IBM-compatible tape machine. The graph plotter is not visible on the photo. (Source: Photo collection, Mrs AD Mans)*

THE CAFETERIA SYSTEM

In the 1970s, a facility was developed for computer users where they could, for the first time, read punch cards into the computer to run small computer tasks. This facility included card punch machines, a card reader and a printer. It is not clear when this facility was established, but it was first mentioned in the minutes of the Computer Users Meeting on 28 September 1977²² when it was announced that a third card punch would be installed in the cafeteria. Through the cafeteria, Computer Science students and researchers could punch and test short programmes by themselves. The Author used this system and found it very useful for short tasks, unlike the batch processing system that required that all computer tasks be queued at Task Reception.

COMPUTER USERS

By mid-1978, there were approximately 200 computer users at the University. The Committee for Scientific Users remarked that this number was much lower than that of the University of the Witwatersrand²³. According to the Computer Centre's report dated 6 June 1978, scientific calculation took up 42% of computer time and administrative applications 10%. At that stage, there were six specialists and four operators on the staff²⁴.

The Computer Users Meetings started on 8 June 1977 and meetings were held monthly. These meetings were useful networking opportunities for Computer Centre staff and computer users.

The last minutes that could be found of such a meeting was dated 2 June 1981. It is not known whether these meetings still took place thereafter.

²⁰ Committee for Scientific Users, Minutes, 19 November 1979, Appendix: 'n Samevatting van die huidige verspreiding en standaard van plaaslik ontwikkelde mikroverwerkingstelsels, compiled by Electronic Services, 19 November 1979

²¹ Computer Users Meeting, Minutes, Art 8, 25 January 1978

²² Computer Users Meeting, Minutes, Art 4, 8 June 1977

²³ Committee for Scientific Users, Minutes, Appendix: Document detailing the planning of the Computer Centre from September 1978 to September 1979, Art IV-3, 23 August 1978

²⁴ Steering Committee, Computer Services, Minutes, Appendix, 6 June 1978

THE COMPUTER CENTRE BECOMES COMPUTER SERVICES

By mid-1979, the name of the Computer Centre was changed to the Department of Computer Services and Mr AJ Smith's job title changed to Director of Computer Services. At this stage, the department's most popular service was the processing and marking of multiple-choice question papers²⁵.

In time the IBM 370/125's age and annual maintenance costs increased

significantly. The bigger problem, however, was its inability to meet the demand for computing power. Computer Services had a very limited budget in the late 1970s, making it impossible to buy a new computer. The fact that all programmes and data had to be uploaded to the computer with punched cards, remained a problem. Smaller programmes could, as mentioned earlier, be uploaded by

users at the cafeteria. Big tasks had to, however, be submitted on punch cards at Task Reception, where there was often a waiting period.

Prof Tjaart Steyn preserved some historical computer components from the earlier years, including the black board depicted in Figure 5 that was

used to indicate the waiting time for the different task streams. The task stream for the cafeteria had the highest priority, but was available only for very short programmes. BG was the next priority and was used for programmes requiring up to 10 minutes for calculation. F3 was used for longer programmes²⁶.



Figure 4 The management of the University visited the machine room in April 1979. From left to right, Prof T van der Walt (Rector), Prof JS du Plessis (Vice Rector), Prof WP Robbertse (Dean of Natural Science), Mr J Smith (Director of Computer Services) and Prof JF de Beer (Head, Department of Computer Science). (Source: Photo collection, NWU archive)

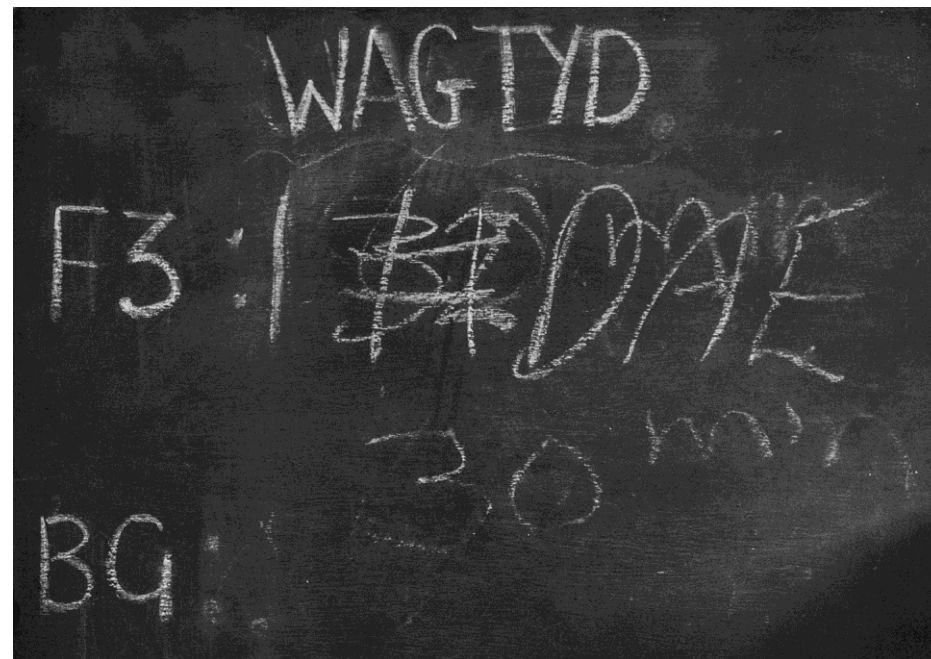


Figure 5 The blackboard that indicated the expected waiting times for the different task streams during the IBM 370/125 era. As can be seen, a user indicated frustration by exaggerating the values.

²⁵ Computer Services, Newsletter, Vol 2, Nr 3, November 1979

²⁶ Computer Centre, Report, Art 2, 6 June 1978, Appendix to the Minutes of the Computer Services Steering Committee, 6 June 1978

Figure 6 The west wing of the computer room in May 1979. The disk drives are visible on the left. Mrs Anne Mans is in the background and Mrs Klaasje Benadie stands with her back to the camera. (Source: Photo collection, NWU archive)



Figure 7 The east wing of the computer room in May 1979. Mrs Anne Mans is standing by the punched card reader. (Source: Photo collection, NWU archive)



NEWSLETTER

In the 1970s, a newsletter for computer users was published for the first time. It is unknown when the first edition was published, but the second edition was published in 1978. This newsletter was published several times a year. The first few editions consisted of a single page, while later editions consisted of several A4 pages that were stapled together. From 1979, the newsletter had its own front cover, which was later a stylised PU for CHE emblem printed with a line printer (see Figure 8).

The Computer Services newsletter contained valuable information, as well as new developments in computer science. Later on, it also contained news from other universities' newsletters. The last available edition of this newsletter is the August 1980 edition. Although an edition was prepared for October 1980, it was, according to a note attached thereto, never published. The newsletter was succeeded in 1984 by RKD Nuus that was published and bound in A5 format.

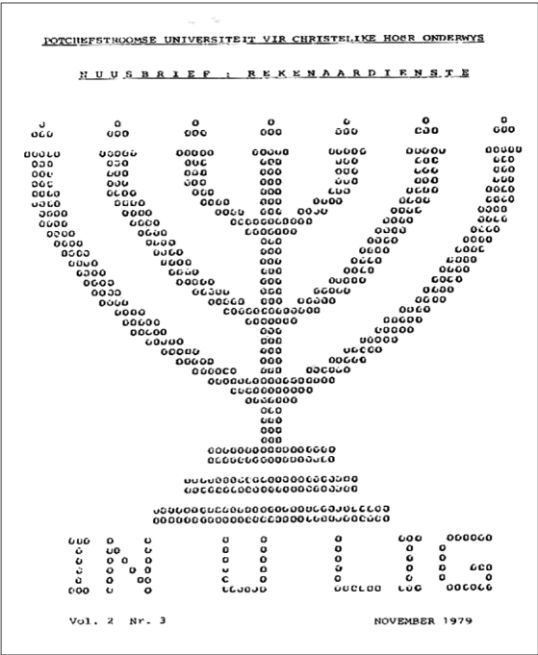


Figure 8 Example of Computer Services' newsletter front page in November 1979.

OPEN DAYS

On 27 June 1979²⁷ and 10 September 1980²⁸ Computer Services hosted open days to present modern technology and developments to users. At the second such open day, the following developments were presented:

- Small Hewlett-Packard calculators, like the HP-35, HP-45, HP-65, etc.
- Apple II home computer, which was released in South Africa at

about that time

- DEC, ICL and IBM commercial computers
- IBM and CDS word processors
- Tektronix graphics screens
- Electronic Services showcased some of their locally-developed microcomputers

The Computer Services Meeting considered the open days very successful²⁹.



Figure 9 In this photo from the June 1979 open day, equipment is being demonstrated to Prof J Spoelstra from the Department of Mathematics (sitting) and Prof PH Stoker from the Department of Physics (middle back).

FURTHER DEVELOPMENTS

At the beginning of 1980, the highly-regarded mathematical/statistical set of IMSL subroutines were purchased for mathematical and statistical analyses. The WATFIV Fortran translator was also made available and it streamlined programme development and corrections³⁰. Further expansion included a graphic plotter with a 36-inch drum by the end of 1980³¹ and a digitiser, which had been purchased in 1979³².

At the Vaal River Branch (later the Vaal Triangle Campus), a demand developed for computer facilities, especially after the appointment of Prof JM Hatting who lectured Operational Research, Mathematics and Computer Science at that campus of the University. Initially, in 1978, a computer terminal was provided, but in the beginning of 1979 an IBM Series/1 minicomputer³³ was provided to the Goodyear Street Campus and was connected to the IBM 370/125 with a post office data line. This computer was especially used by the Computer Science students.

A lack of space was a continuous problem for Computer Services and was often discussed by the Computer Services Steering Committee. At the

Committee's meeting on 22 November 1979, Prof WP Robbertse mentioned that the space used for the old nuclear accelerator could possibly be used for Computer Services³⁴, something which was only realised ten years later to solve a very pressing space problem.

Mr AJ Smith, Director of Computer Services, left the employ of the University at the end of November 1980³⁵. He was the first director who had previously worked in the professional computer environment. Further expansion of Computer Services during his term was prevented by an extremely tight budget. He was succeeded by Prof JM (Giel) Hattingh, who was appointed at the beginning of 1981³⁶.

The 1970s were trying years for Computer Services with the IBM 370/125 that had limited computing power and could not address the growing demands of the computer users. The IBM 370/125 was in service from August 1974 to July 1981; a long time to struggle with a computer with inadequate computing power. Prof Hatting prioritised addressing this problem in the 1980s.

²⁷ Computer Users Meeting, Minutes, Art 5, 26 July 1979

²⁸ Computer Services, Newsletter, August 1980

²⁹ Computer Users Meeting, Minutes, Art 6, 1 August 1979

³⁰ Computer Users Meeting, Minutes, Art 4a, 5 March 1980

³¹ Computer Users Meeting, Minutes, Appendix 1, 8 October 1980

³² Computer Services, Newsletter, November 1979

³³ Computer Users Meeting, Minutes, Art 5, 31 January 1979

³⁴ Steering Committee, Computer Services, Minutes, Art 4.2c, 22 November 1979

³⁵ Letter from Mr AJ Smith to the Author regarding farewell event, 10 November 1980

³⁶ Computer Users Meeting, Minutes, Art 4, 3 March 1981

CHAPTER

4

The 1980s (1981-1990)

INTRODUCTION

During the 1980s, the mainframe computer environment expanded quite significantly. Batch processing with punched cards as the general input source for external data was slowly phased out. The new approach would be to use interactive computer terminals that could be distributed across the University's campuses. This was also the beginning of inter-university networks, with connections being established between the mainframe computers of all South African universities. This would later on be expanded to include international universities.

With the expansion of interactive computer facilities, computer use became common in many academic and administrative departments, especially as a result of real-time administrative systems, the more widespread use of scientific calculations and the increasing use of word processing on the mainframe. This further increased the demand for computing power, and this necessitated frequent upgrading of the mainframe computers. This had to happen despite budget pressure caused by the strong decline in the value of the South African Rand (ZAR) in the 1980s that caused severe pressure

on university budgets. Between 1981 and 1985, the ZAR value declined by approximately 150%, with the biggest decline taking place between 1984 and 1985 (see Figure 1). Most computer equipment was imported from the USA and any decline in ZAR value had a proportional impact on the University's dollar-based computer capital and maintenance costs. The 1980s was thus a time of restricted budgets and a growing demand for faster computers

At the end of the 1980s, there was a strong drive to develop local area networks (LANs) on the two campuses. This would later lighten the load on the expensive mainframe environment by transferring the computing load to personal computers (PCs) and servers on the LANs.

An important development in this decade was the rise of microcomputers, from a humble beginning to a dominating movement that would later replace the mainframe computer almost entirely. The development of LANs, which connected microcomputers, servers, powerful departmental computers and mainframe computers with one another, ushered in the 1990s. Sometime later, the mainframe environment became redundant at most universities.

At the end of 1990, the University's computer-related departments were reorganised to develop an all-encompassing department of Information Technology and Management (ITM). This chapter describes the history from 1981 to just before the formation of the new department of Information Technology and Management.

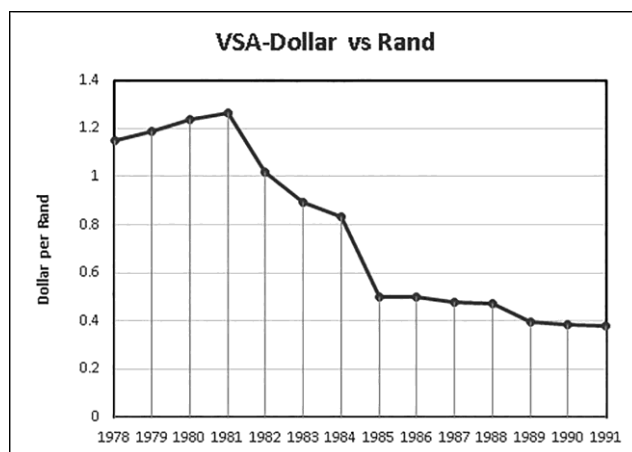


Figure 1 The ZAR-USD exchange rate in the 1980s¹. The significant decline in ZAR value from 1981 is evident and had a significant impact on the finances of Computer Services, since the bulk of their capital and equipment maintenance costs was US Dollar-based.

GOVERNANCE, MANAGEMENT AND STAFF

Council and Management Committee

The Management Committee of the University had to approve all important decisions regarding computer services. All decisions with a significant financial or organisational impact had also to be approved by the University Council.

Empowering the Management Committee by providing information on computer science, was important. IBM², for example, presented an overview of computer technology to the Management Committee on 5 and 6 May 1981.

Steering Committee

The Director of Computer Services reported to the chairperson of the Steering Committee of Computer Services, the Vice Rector of Finance and Management.

It is unclear when the first Steering Committee for Computer Services was established, but on 18 September 1973, during a meeting of the Committee on Finance of the University Board, mention was made of the Computer Committee. At that time there was, therefore, already a

type of committee that advised the Computer Centre. It also appears that, even before obtaining the first IBM 1130, there was already a committee that had managed the procurement process. As mentioned in a previous chapter, the UNISA investigation team of 1976 recommended that a Steering Committee for Computer Services be instated with relevant subcommittees. The first documented minutes of the Computer Services Steering Committee that could be obtained was that of 10 April 1978, which was chaired by the Vice Rector, Prof JS du Plessis. During the meeting, it was mentioned that the committee was established by the Rector on the grounds of an unknown memorandum addressed to him. Two subcommittees, namely a committee for Scientific Users and for Administrative and Library systems were also established. At the following

¹ Numerical values obtained from <https://businesstech.co.za/news/finance/116372/rand-vs-the-dollar-1978-2016/>

² ISM – n Terugblik, deur P du B Wehman Beheer Komitee Rekenaardienste, Appendix to Minutes, Art 6, 5 July 1984

meeting of the Executive Committee of the Steering Committee, the Head of the Computer Centre, Mr AJ Smith, was instructed to compile a set of rules and regulations³. for Computer Services. His proposed rules and regulations were approved by the Steering Committee of Computer Services on 3 September 1979⁴. The University Council approved the rules and regulations on 13 September 1979⁵, which appeared as an Appendix to the minutes of the Steering Committee of Computer Services meeting held on 22 November 1979.

The rules and regulations, as well as the composition of the Steering Committee of Computer Services were later amended, amongst others, in 1981⁶.

In 1984, a new Steering Committee was appointed, and new rules and regulations were accepted⁷. Provision was made for two subcommittees, namely Research and Education.

In the late 1980s, the Steering Committee included a large group of senior staff members. From the last available minutes of the Committee (7 November 1988), it seems as if the Committee consisted of 29 members.

The Steering Committee of Computer Services was an important forum, where the planning, budget and functioning

of Computer Services were discussed at a high level by interested parties and specialists.

Management

In the previous chapters, it was indicated that Prof JF (Hannes) de Beer was the first Head of the Computer Centre which, together with the Department of Computer Science, functioned as a unit. In 1978, the two departments were separated and Mr AJ (Johan) Smith was appointed as Head of the Computer Centre. The name "Computer Centre" was changed to Computer Services in 1979 and Mr Smith's title was changed to Director. Mr Smith left the employ of the University at the end of November 1980.

At the beginning of 1981, Prof JM (Giel) Hattingh was appointed as Director of Computer Services. Prof Hattingh brought the problem of limited computing power to the attention of University Management. He ascribed it to the fact that Computer Services was financially neglected in the 1970s⁸. From the Vice Rector of Finance and Management's communication to Prof Hattingh (at that time the Director of Finance and Planning) dated 20 October 1986, it appears that Prof Hattingh's continuous representations were successful, as it is noted that the University allocated double the amount

provided for in the subsidy formula to Computer Services in 1986⁹ (although it still was not nearly enough to ensure a quick response on the mainframe computer). Prof Hattingh is known for the role he played in the expansion of the mainframe computer environment. In 1985, he was promoted to Director of Finances and Planning, but remained involved in computer matters. From 24 June 1986, he was the Chairperson for the Steering Committee of Computer Services¹⁰.



Figure 2 Prof JM (Giel) Hattingh

Prof Hattingh was succeeded as Director by Dr P du B (Philip) Welman. Dr Welman was familiar with the data network environment and played a key role in establishing local area networks at the University and in developing a national academic data network in South Africa. He also championed the process of diversifying the University's computer platforms, adding departmental and microcomputers. He was in the University's employ until October 1990.

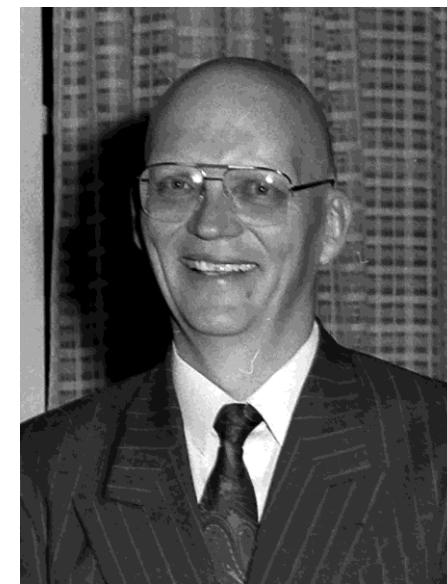


Figure 3 Dr P du B (Philip) Welman, Prof JM Hattingh's successor as Director of Computer Services

³ Steering Committee of Computer Services Steering, Minutes, Art 4.1, 8 September 1978

⁴ Steering Committee of Computer Services, Minutes, Art 4.1, 3 July 1979

⁵ Steering Committee of Computer Services, Minutes, Art 4.1, 22 November 1979 ⁶ Steering Committee of Computer Services, Minutes, Art 2, 14 August 1981

⁷ Steering Committee of Computer Services, Minutes, Art 7.3, 13 February 1984

⁸ Computer Services, Strategic Plan, Art 2, August 1982

⁹ Letter, NJ Swart to JM Hattingh, 20 October 1986

¹⁰ Executive of Steering Committee of Computer Services, Minutes, 24 June 1986

Computer Services sub-departments

In the early 1980s, Computer Services consisted of two divisions, namely the division of Academic Systems and that of Administrative Systems, each of which had a Deputy Director in charge¹¹. In 1984, these divisions were reorganised and another division was added. Thereafter the three divisions were Facilities, Support Service and Administrative Information Systems. This structure was maintained until 1988 when the division of Administrative Information Systems was moved from Computer Services to the Department of Management and Information Services. For the remainder of the 1980s, Computer Services consisted of only the Facilities and Support Services departments.

Staff

By mid-1981, the staff complement of Computer Services increased to 25, 10 of which were specialists. It was, however, far less than Universities like the University of the Orange Free State (UOFS), which had 41 staff members in their computer services department. This was brought to the attention of the Vice Rector of Finance and Management by Prof Hattingh in a letter dated 27 July 1981¹². The staff shortage and insufficient remuneration for computer staff remained a problem at Computer Services for a long time. This resulted in the delay of the redevelopment of interactive administrative systems, which were intended to replace the batch processing systems.

In the Computer Services newsletter, RDK Nuus, which was published regularly from 1984 onwards, staff members were listed, making it easier to keep track of the staff complement growth. In 1984, the number of positions increased to 38, 21 of whom were specialists¹³. In 1985, there were 41 positions, with 23 specialists; in 1986 there were, respectively, 42 and 23 positions; in 1987, these numbers were 40 and 23; and in 1988, this number changed to 26 and 1 after the division of Administrative Information Services moved to the Department of Management and Information Services. In 1989, the Department of Computer Services had 25 staff members, 18 of whom were specialists.

In the late 1980s, an interesting staff matter presented itself in the form of Dr Philip Welman who went out of his way to create a position for Mr GB (Gabriel) Makhonxa at Computer Services. Initially, Mr Makhonxa worked as a messenger at the Bureau of University Education. Several staff members, including Prof Peter van Eldik (the Dean of Natural Sciences at that time) and Dr Welman noticed Mr Makhonxa's aptitude. Prof van Eldik helped him to complete Grade 12 by mentoring him in Mathematics, and Dr Welman appointed him as contact person at Task Reception on 1 February 1996. It became clear quite early on that he did

very well in this working environment and was trained and moved to the Operations Division where he worked as computer operator. Dr Welman had a lot of difficulty appointing him as a technical staff member, since he originally worked as a messenger. With the help of the Rector at the time, Prof CJ Reinecke, the appointment was finally made¹⁴. (Mr Makhonxa was the first black person who was appointed as a regular non-academic staff member and not a service worker at the University.) Mr Makhonxa continued with his studies and obtained a BCom Degree and a Diploma in Higher Education. Although he had a bright future in the computer world, he chose to become a teacher, as he felt this was the best way to help his people. He left the employ of the University at the end of 1992¹⁵.

There are not many photos available of the staff members from the 1980s. The following are some of the rare photos available:

Figure 4 Mr Gabriel Makhonxa (left) conducting operating work in the machine room at Computer Services. (Source: Photo collection of Mrs AD Mans)



¹¹ Steering Committee of Computer Services, Minutes, Appendix regarding staff needs, 14 August 1981

¹² Letter from JM Hattingh to NJ Swart, 27 July 1981

¹³ RDK Nuus, p 9 and 10, November 1984

¹⁴ Transcription of the Author's interview with Dr P du B Welman on 15 October 200

¹⁵ ITM, Annual Report, Art 2.4.4, 1992



Figure 5 Mrs Elsie Buys was a central figure in Computer Services and ITM for a long time. She was the secretary for the Director of Computer Services from approximately 1979 to July 1993. (Source: Photo collection of Mrs AD Mans)

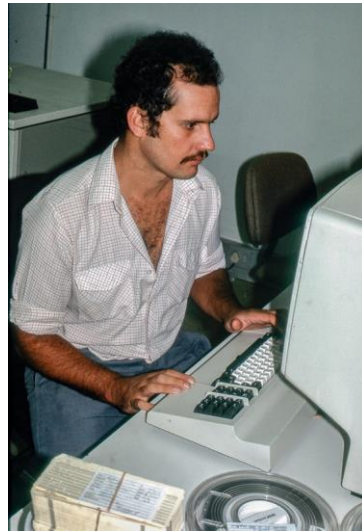


Figure 7 Mr CML (Krap) Steinmann was a well-known operator in the 1980s. (Source: Photo collection of Mrs AD Mans)



Figure 6 Mrs Chrissie Blume, Mrs Anne Mans and Mrs Klaasje Benadie were all central figures in Computer Services and, later, ITM. (Source: Photo collection of Mrs AD Mans)

MAINFRAME COMPUTER EQUIPMENT AND SOFTWARE

The IBM 4331 computer

Prof JM Hattingh quickly made a strong case for the purchase of a computer that would be capable of supporting interactive processing through terminals. He indicated that the batch processing method, which, at that stage was done with the IBM 370/125, was a very ineffective way to use staff members in the User Departments and in Computer Services. At the Steering Committee of Computer Services meeting of 6 March 1981, it was recommended that an IBM 4331 computer be purchased¹⁶. This recommendation was approved by the University Council on 2 April 1981¹⁷. In July 1981, the IBM 370/125 was replaced with the IBM 4331 mainframe computer

which was much more powerful. It had a 3-megabyte memory and 2 gigabytes of disk space¹⁸.

One of the biggest advantages of the IBM 4331 computer was its ability to run the VM/SP operating system, which meant that the computer could, with the help of interactive terminals, be operated from outside of the computer room. This eliminated the hassle of punch cards that were punched, handed in at Task Reception, where it had to be collected once the data was processed and the results were available. Now, users could upload programmes directly from a computer terminal and see the results fairly soon,



Figure 8 One of the early computer terminals that display the University emblem. (Source: Photo collection of Mrs AD Mans)

¹⁶ Steering Committee of Computer Services, Minutes, Art 5, 6 March 1981

¹⁷ University Council, Minutes, Art 16, 2 April 1981

¹⁸ ITB Nuus, Memoires, p 4, July 1992



Figure 10 The photo of Computer Services staff members in the machine room, which appeared in *IBM Inform*. From left to right: Mrs Klaasje Benadie, Mr Johan Nel, Mr Jan van Rooy, Mrs Anne Mans and Mr Richard Drevin. (Photo, with acknowledgement, from *IBM Inform*, April/May 1983)

unless the programme was particularly long. Interactive terminals were made available to users from April 1982¹⁹. A total of 35 terminals were originally purchased, four of which had colour graphics screens. Initially, there were 20 terminals available to users.

Further computing facilities was made available to scientific users when a CDC terminal was connected to the CSIR computer in July 1981 by means of a data line²⁰.

The VM/SP operating systems enabled the University's administrative systems that, at the time, had to rely on batch processing, to be converted to interactive systems. This resulted in the large-scale redevelopment of the administrative systems, which put a lot of pressure on the development staff of Computer Services.

The interactive use of the computer by many users put the central processor under a lot of stress. As such, the processor was upgraded to an IBM 4331-K2, which increased processing speed by approximately 80%. This resulted in several improvements and allowed Computer Services to start planning interactive administrative systems.

The University's computer set-up at the beginning of 1983 is described in detail in an article that was published in

¹⁹ Computer Services, Report, Junie 1982

²⁰ Computer Users Meeting, Report, 2 June 1981

Figure 9 Mrs Anne Mans at the workstation that was connected to the CSIR's powerful computer. To her left is the punch card reader. This station also had a printer that is not visible on this photo. (Source: Photo collection of Mrs AD Mans)



IBM Inform's April/May edition²¹. (IBM Inform was IBM South Africa's magazine that reported on new developments and gave details of clients' computer installations.) According to this article, the University's IBM 4331 computer had a 3-megabyte memory and 2 gigabytes of disk space.

The use of terminals by end users resulted in the availability of applications like word processing, stimulated more general use of the computer, also by clerical staff.

In April 1983, the Focus database and development software for business

systems was purchased. In July of the same year, the development of an interactive student system in Focus commenced. This added more stress to the computer, but enabled the elimination of the clumsy batch processing systems.

One of the most important facilities of the Computer Centre was Task Reception, especially when batch processing was still commonly used for big tasks and printers were not widely available. The photo in Figure 11 depicts Task Reception in the early 1980s. Mrs Elise van Dijken worked there for quite some time.

The IBM 4341

The demand for computing power continued to increase and in July 1983, the University upgraded to an IBM 4341 Model 10 with a 4-megabyte memory, which, in turn, was upgraded to an IBM 4341 Model L2 with an 8-megabyte memory in January 1984. This IBM 4341 had an IBM 3080 disk controller and an IBM 3705 communication controller, which lessened the load of peripheral equipment on the CPU quite considerably.

The highly recommended and extensive set of subroutines for mathematical and statistical work, IMSL, was installed in 1984²². This addressed a big need in scientific programming and remained a very popular resource. Another useful programme that was released during this time was IBM's Professional Office System (PROFS), which was used for office automation²³.

A notable improvement was the installation of two IBM 6670 laser printers in 1983, one at Computer Services and one in the Administration building. These were the first high-volume laser printers at the University, which had the added benefit of being able to print Afrikaans text with diacritical characters, which was imperative in letter writing in Afrikaans.



Figure 12 The IBM 1403 printer was a vital component at Task Reception. It was a fast line printer that could print approximately 1 000 lines per minute. (Source: Photo collection of Mrs AD Mans)



Figure 11 Task Reception, with Mrs Elise van Dijken on the left of the photo. (Source: Photo collection of Mrs AD Mans)

²¹ IBM Inform, "PU hou tred met rekenaartegnologie", April/May 1983, p14-15

²² RKD Nuus, p16, November 1984

²³ RKD Nuus, p11, November 1984

The IBM 4381 and later computer platform diversification

The number of mainframe computer users continued to increase and in August 1984 there were 800 active users, which again created response-time problems. As a result, the IBM 4341 was replaced with an IBM 4381, which was much more powerful²⁴. This computer's physical size required that the computer room be extended, which, in turn, required that the two adjacent offices be incorporated into the computer room. The walls to these offices were broken down and a false floor was installed.

The IBM 4381, with its accompanying tape and disk drives, was commissioned on 22 January 1985. This was a long,

complicated process that started on 7 January 1985 and necessitated the total reorganisation and expansion of the computer room²⁵. The new computer had a 16-megabyte memory (double that of the IBM 4341) and the processing speed more than doubled.

After the new computer was installed, IBM South Africa hosted a social reception for the staff members of Computer Services at the University's farm, Nooitgedacht. IBM South Africa's Berthol Theiland, who served as IBM's sales representative at the University for quite some time, played a key role in the computer installation and social reception.



Figure 13 The computer room in April 1985. (Source: NWU archive)



Figure 14 Mr Berthol Theiland served as a sales representative of IBM South Africa at the University for a long time. In this photo, he is working at the social reception that IBM South Africa hosted for the Computer Services staff after the IBM 4381 installation. (Source: Photo collection of Mrs AD Mans)



Figure 15 Computer Services staff members enjoying the reception at Nooitgedacht. (Source: Photo collection of Mrs AD Mans)



Figure 16 Mrs Wilna Oosthuizen and Mrs Klaasje Benadie in a relaxed mood at the Nooitgedacht reception. (Source: Photo collection of Mrs AD Mans)

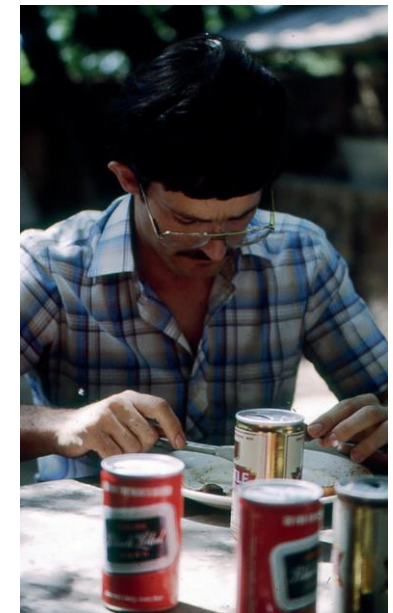


Figure 17 Mr Jan van Rooy at the Nooitgedacht reception. (Source: Photo collection of Mrs AD Mans)

²⁴ Executive Meeting of Steering Committee of Computer Services, Minutes, 12 March 1986, in Steering Committee of Computer Services, Agenda, 21 October 1986

²⁵ RKD Nuus, p1, March 1985

From the 1982 implementation of the IBM 4300 series of mainframe computers until 1985, there was a dramatic increase in computing power (see Figure 18).

Increasing computer power became a necessity when the number of computer terminals increased as a result of an increase in user numbers. Figure 19 depicts the increase in the number of terminals between 1982 and 1985.

The popularity of the mainframe computer continued to increase and in August 1985, the number of active users totalled 1 000²⁶.

In August 1985, Computer Services was visited by Prof Heinrich Herbstreith from the University of Karlsruhe in Germany. Prof Hattingh invited him to advise Computer Services on the planning of the University's computer infrastructure. His recommendations were summarised in Dr Philip Welman's presentation, Strategy for the use of computers, which was presented on 21 November 1986²⁷ at the Steering Committee of Computer Services meeting.

Prof Herbstreith recommended that the University diversify its computer set-up and, apart from the mainframe environment, also provide for

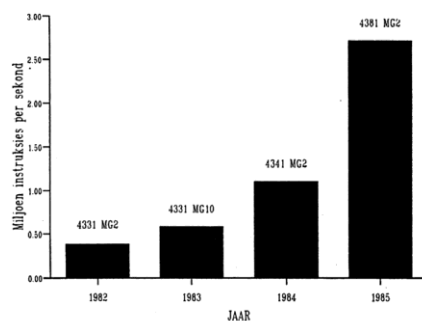


Figure 18 The increase in processing power of the University's IBM 4300 range of computers between 1982 and 1985 (Source: Computer Services, Annual Report, July 1984 to June 1985, p12, annexe to Management Committee of Computer Services, meeting minutes, 25 November 1985)

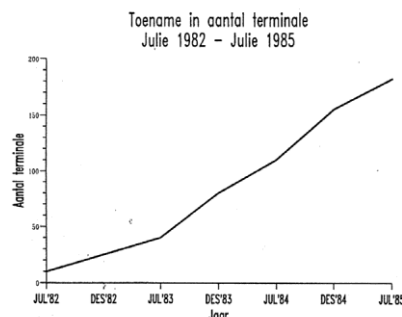


Figure 19 The increase in the number of computer terminals at the University between 1982 and 1985. (Source: Computer Services, Annual Report, July 1984 to June 1985, p15, annexe to the Management Committee of Computer Services, meeting minutes, 25 October 1985)

departmental computers and for a microcomputer on every desk. All these systems had to be connected to national and international networks. Independent computers had to be avoided entirely, and good training equipment had to be prioritised for Computer Science. These recommendations were accepted by the Steering Committee²⁸ and had a significant impact on the future planning of the University's computer infrastructure.

In 1985 the first step was made in the direction of data communication with other universities when a connection was made to the University of Pretoria's mainframe computer. This was very useful for the Ferdinand Postma library that could start exploring the Dobis/Libis library system on the UP computer. (See Chapter 6 for more information on the library's computerisation.)

In February 1986, the number of active computer users increased to 1 200. The continuously growing computer use resulted in serious problems regarding computer response time in 1986. This happened even though the University upgraded to the IBM 4381 in 1985 and from the VM/SP operating system to VM/HPO in April 1986. One of the biggest reasons for this problem was the real-time student system that took up approximately one fifth of the

computer capacity²⁹. The impact of the long computer response time was so significant, that it was discussed at the University's Management Committee on more than one occasion³⁰. The University's budget was, however, under severe pressure and the Vice Rector of Finance and Operations, Prof NJ Swart, wrote a letter to Prof Hattingh on 20 October 1986, in which he informed him that Computer Services was allocated a budget of R2,5 million for both 1987 and 1988³¹. In addition, the Steering Committee of Computer Services decided in October 1986 that the installation of a PC laboratory at the Potchefstroom campus and one at the Vaal Triangle Campus should be prioritised and that the mainframe computer upgrading had to wait³².

In future, more emphasis would be placed on distributing the computing load to other platforms, rather than upgrading the mainframe computer. This necessitated the implementation of good data networks, which would, in future, receive a lot of attention.

An important expansion in the mainframe computer software was the implementation of Graphics Data Display Manager (GDDM), SAS in 1985 and Storage and Information Retrieval System (STAIRS) in 1986³³. GDDM could be used to display data graphically on a computer terminal with graphics

²⁶ RKD Nuus, p1, November 1985

²⁷ Steering Committee of Computer Services, agenda, 21 October 1986

²⁸ Steering Committee of Computer Services, Minutes, Art 5.4, 21 October 1986

²⁹ Computer Services, Annual Report, Art 2, 1986

³⁰ Steering Committee of Computer Services, Minutes, Art 16.2, 27 February 1986 and Art 9, 18 March 1986

³¹ A letter from NJ Swart to JM Hattingh, 20 October 1986

³² Steering Committee of Computer Services, Minutes, Art 5.9, 21 November 1986

³³ RKD Nuus, Chapter 3.1, April 1986

capabilities. SAS provided extensive support to, amongst others, statistical analysis and extended graphic abilities. STAIRS could store unformatted information, like regular documents, in a database. It had a powerful search function.

In 1987 the Mohawk data capture system³⁴, that functioned with diskettes instead of punched cards, was implemented. The diskettes thus replaced the punched cards as the most important data input medium for batch processing systems.

In mid-1987 it was reported that the number of active computer users declined by 200, which was ascribed to the fact that the two PC laboratories were taken into use the previous year by Computer Science students who were, previously, dependent on the mainframe computer. The problem with response time was, however, not addressed and in June 1987, the IBM 4381 P02 was upgraded to an IBM 4381-Q14. This computer had

two processors and a 24-megabyte memory. The total disk space was now 7.5 gigabytes, and there were 345 terminals³⁵ at the University. The computer's response time improved significantly with the upgrade and the real-time student registration in 1988, which included the issue of receipts for the first time³⁶, was completed without incident. For this upgrade, the machine room had to be increased in size by taking up two more offices, which exacerbated the office space problem for Computer Services. Some relief came from the two new computer labs for students that were installed in the accelerator building and that served as microcomputer lab, graphics lab and terminal lab on the first floor and a training room and demonstration centre on the second floor³⁷.

In 1988, a lot of damage was caused by a fire in the student terminal room, possibly as a result of a cigarette butt that was disposed of in a scrap paper container³⁸. The damage was estimated at R100 000 for equipment

and approximately R90 000 for the building. A total of 24 terminals and a printer was destroyed.

In April 1988, Afrikaans document proofreading was introduced³⁹. This could be done on the mainframe computer by using a combination of Script and Displaywrite/370. Interesting to note is that the work on this started when IBM South Africa commissioned Prof Hertzog Venter, a retired Professor in Afrikaans/Dutch at the PU for CHE, to compile an Afrikaans wordlist with hyphenation. He completed this wordlist, but passed away on 17 May 1988 before he could complete the synonym list⁴⁰.

The stress on the mainframe computer was further decreased with the installation of two departmental

computers; one was installed in the last term of 1988 and one in the beginning of 1989. The first computer was an IBM 9375 Model 40 with a 16-megabyte memory and 1.7 gigabyte disk space for the Departments of Physics and Statistics⁴¹. It was installed at the Department of Physics and was intended to function as a powerful processor for the computer-intensive research work conducted in the aforementioned departments. This computer did, however, not meet expectations and was soon updated to a model 60⁴², which more than doubled the speed. The users needed even more computing speed and the IBM 9375 was replaced with an RS/6000 RISC processor late in 1990 (more on this later in this chapter).

Figure 20 Damage caused in early 1988 by a fire in the student terminal room (Source: Photo collection of Mrs AD Mans)

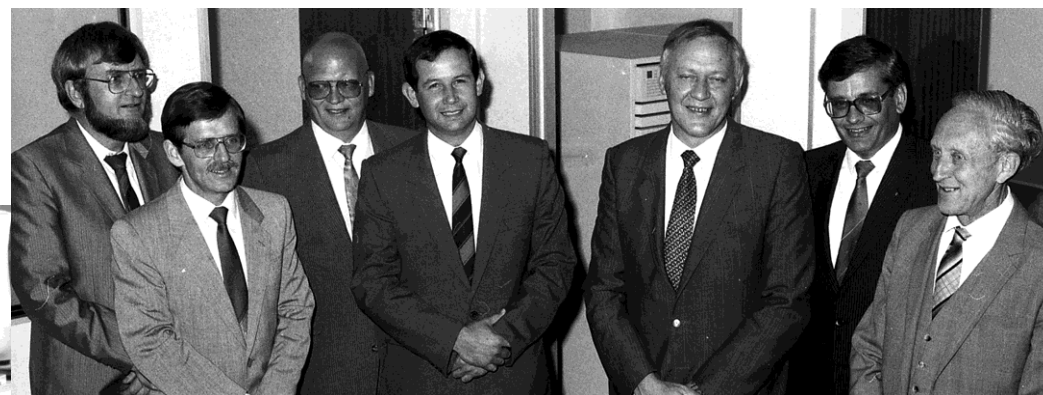


Figure 21 The hand-over of the IBM 9375 computer to the Departments of Physics and Statistics. From left to right, Prof Harm Moraal, Prof Peter van Eldik, Dr Philip Welman, an ISM representative, Prof Giel Hattingh, another ISM representative and Prof Pieter Stoker. (Source: Photo collection, NWU archive)

³⁴ RKD Nuus, p18, Julie 1987

³⁵ RKD Nuus, p31, July 1987

³⁶ RKD Nuus, p30, April 1988

³⁷ RKD Nuus, p2-8, October 1987

³⁸ RKD Nuus, p34, April 1988

³⁹ RKD Nuus, p20, April 1988

⁴⁰ Private communication with Ms Mariet Venter, daughter of prof Hertzog Venter, 5 May 2017

⁴¹ RKD Nuus, p10, March 1989

⁴² RKD Nuus, p6, July 1989

The second departmental computer was an IBM 4361 Model 3 with a 4-megabyte memory and 1 040 megabyte disk space. This computer (donated by Volkskas Aksepsbank⁴³) was installed at the Vaal Triangle Campus in Vanderbijlpark. This large

piece of equipment had to be hoisted three storeys high and moved into the building from the outside with a crane. This installation was completed on 13 January 1989. The computer was mainly used by the students of the Computer Science and Engineering departments⁴⁴.

Figure 22 The installation of the IBM 4361 at the Vaal Triangle Campus. The computer had to be hoisted three storeys high and moved into the building with a crane. (Source: Photo collection of Mrs AD Mans)



REKENAARGEbruik VANAF 1982 TOT 1988

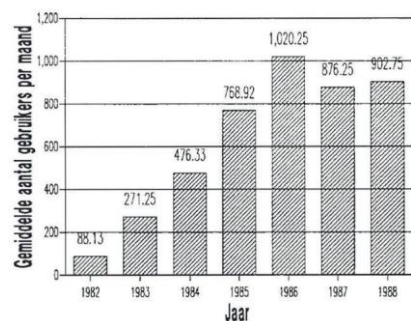


Figure 23 Levelling out of the number of users from 1986 (Source: RKD News March 1988, p2)

Unfortunately, it was realised that this computer's computing power was insufficient. As a result, it was used seldom and thus the IBM 4361 was decommissioned on 1 November 1990.

The increasing use of PCs and departmental computers resulted in the average of the number of active users levelling out and declining after 1986 (see Figure 23). Despite this decline, the computer's response time decreased during 1989, causing much discontent amongst users⁴⁵.

In late 1988, an IBM 7171 protocol converter was purchased⁴⁶, making it easier for users to work from home and, therefore, during quieter times. This converter provided access to the mainframe computer through dial-up modems. This allowed users to access the mainframe from their home PCs through a terminal emulation programme and a suitable modem. Initially, four dial-up modems were provided⁴⁷.

Electronic mail on the mainframe computer was announced in the RKD Nuus of November 1989⁴⁸. This was made available to all other mainframe users at the University, South-African universities and organisations that were connected to Uninet, the national academic network. Connections to universities abroad were, in principle, possible, but had not yet been made available for general use. This was the beginning of the communication revolution created by electronic mail, especially when it could later be used from PCs connected to the LAN. In

the RKD Nuus of March 1990, André de Waal from Computer Sciences motivated users to use electronic mail, because "it could change their lives". Prophetic words!

The space problem in the Computer Services machine room, was finally solved when the ground floor of the old accelerator centre in the last half of 1989 was allocated for use as the machine and control room. This room had a surface area of 400 m² and could comfortably house a big mainframe computer. Provision was made for uninterrupted power supply by installing big batteries and a converter, which addressed the negative effects of unexpected power outages on mainframe computer equipment. Provision was also made for good security and for firefighting equipment. The relocation of the mainframe computer and the accompanying equipment could, as a result of good planning, be completed in four days' time during January 1990⁴⁹.



Figure 24 The spacious new machine room before the installation of the computer equipment. (Source: Photo collection of Mrs AD Mans)

⁴³ Steering Committee of Computer Services, Minutes, Art 5, 7 November 1988

⁴⁴ RKD Nuus, p11, March 1989

⁴⁵ RKD Nuus, p6, July 1989

⁴⁶ Steering Committee of Computer Services, Minutes, Art 2.2.4, 27 November 1987

⁴⁷ RKD Nuus, p15, March 1989

⁴⁸ RKD Nuus, p3, November 1989

⁴⁹ RKD News, p1, March 1990

Figure 25 The new machine room in operation. Some of the disk drives can be seen on the foreground. The person in the background is Mrs Rika Nieuwoudt. (Source: NWU archive)



Figure 26 The batteries for emergency power in the new machine room. (Source: Photo collection of Mrs AD Mans)



Figure 27 Two examples of the IBM RS/6000 computers. (Source: Author's photo collection)



The total disk space of the mainframe computer was increased to 20 gigabytes in 1990⁵⁰. The Department of Mechanical Engineering obtained external funding for a powerful Convex computer with a vector processor, which was suitable for computing-intensive projects. In late 1989, this computer was installed at the Vaal Triangle Campus' Goodyear Building⁵¹.

In February 1990, IBM announced the powerful RS/6000 RISC computers. Dr Welman saw enormous potential in these computers, and the University was the first South African university that ordered and received them. Seven of these computers that were optimised for numerical intensive computing and required by, inter alia, the Departments of Physics and Statistics, were purchased⁵². Two of these computers were swapped for the IBM 9375 computer that did not have enough computing power for their processing needs. The IBM 9375 was then used for all mainframe-based word processing.

The RS/6000 met the expectations of the Department of Physics, who used it very fruitfully⁵³. An RS/6000 was also made available to the Faculty of Engineering for their computing-intensive projects, one was used for experimental work with administrative

systems, one served as a network server and the others were allocated to general computer work. This resulted in the mainframe computers from 1991 being mainly used for administrative systems⁵⁴. The large capital purchases of 1990 unfortunately resulted in overspending of R1.5 million, which negatively influenced the IT budgets for 1991 and 1992, when the shortage had to be addressed⁵⁵.

The arrival of powerful, affordable processors like the IBM RS/6000 and other Unix-based systems, together with the growing number of PCs and the development of reliable LANs, was the beginning of the move away from the mainframe environment. As a result, the pressure on the IBM 4381 could be decreased and, eventually, the University's mainframe computer could be phased out.

The 1980s was a time during which the mainframe environment developed from an environment with limited and clumsy access to the general interactive computer platform for the entire University. Developments in the late 1980s resulted in the diversification of the computer environment with mainframe computers remaining the most important computer platform, but with a variety of smaller decentralised platforms distributing the computing load.

⁵⁰ Department of Operating Systems, Annual Report, Annexe 4, ITM, 1990.

⁵¹ Computer Services, Annual Report 1989, Art 4, in Management Committee of Computer Services agenda, 23 November 1989

⁵² ITB Nuus, p12, November 1990

⁵³ Transcription of the Author's interview with Prof MS Potgieter, 8 September 2010

⁵⁴ ITB Nuus, p25, 26, November 1991

⁵⁵ ITM, Annual Report, Art 4.1.1, 1991

COMPUTER GRAPHICS

The graphical presentation of variable values is an indispensable technique in mathematical sciences, just as it is a valuable resource in the geo and commercial sciences. Thus it was important for computer users from these disciplines to have access to effective equipment for the graphical presentation of their results.

As indicated in a previous chapter, the first graphics plotter was obtained in 1971⁵⁶ and the first digitiser in 1979⁵⁷. A graphics plotter with a 36-inch drum was obtained in 1979⁵⁸. A graphics plotter with a 36-inch drum was obtained in 1979. It is not clear whether this equipment was incompatible with the IBM 4300 series of computers, but in the Computer Services report dated March 1981, Prof Hattingh complains that the graphics equipment was inadequate and that no graphics equipment was connected to any of their computers. In addition, Prof Hattingh notes that the Department also does not own a graphics terminal, flatbed plotter or digitiser⁵⁹.

Prof Hattingh, probably as a result of his background in statistics and a clear understanding of the importance of

graphic presentations in disciplines like Statistics, Physics and Mathematics, emphasised the importance of interactive graphics capabilities in several presentations. The increased pressure on the Computer Services budget for upgrading the mainframe computer did, however, delay the process.

A crucial step in the direction of interactive graphics was obtaining the GDDM software in 1984⁶⁰. This enabled graphics presentation on any computer terminal with graphics capabilities, something that was used far and wide. A further step was implementing a graphics workstation early in 1985. It included a computer terminal, a graphics screen and accompanying copy unit (both from Tektronix), as well as a plotter and digitiser (both from Calcomp). This allowed graphics to be presented, printed or plotted. The graphics workstation was augmented with an IBM 7372 6 pen plotter⁶².

The SAS programme suite was obtained in 1985⁶³. It included a module SAS Graph with powerful graphic capabilities like three-dimensional and other sophisticated graphics.

In the late 1980s, during one of his visits abroad, Dr Philip Welman came across the IBM 7350 image processor with advanced graphics capabilities. He contacted ISM, the local IBM representatives about this equipment. In the interim, ISM imported a 7350 with the hope to develop a market for it in South Africa. This did not prove successful, and Dr Welman managed to convince ISM to place the IBM 7350 at the University⁶⁴. The matter was approved by the Steering Committee of Computer Services on 14 February 1989⁶⁵. Early in 1989, the processor was installed⁶⁶ and on 5 June

1989 Mr Dave Pegg from ISM officially handed it over to Prof CJ Reinecke, the Rector⁶⁷. This garnered a lot of interest in image processing at the University's Potchefstroom Campus and a successful symposium on image processing applications was held on 13 November 1989⁶⁸.

At the end of the 1980s, the University was well-placed regarding mainframe computer graphics capability. In the interim, the microcomputers' graphics capabilities improved significantly, especially with the arrival of the higher resolution screens, like VGA in 1987. Spreadsheet programmes like Lotus 123 and Quattro Pro, which had good graphics capabilities, were quite user-friendly. Harvard Graphics combined high-quality graphics with easy user interfaces. All three these programmes were supported by Computer Services.

At the end of the 1980s, the University's computer graphics facilities were well-developed.



Figure 28 The graphics workstation. A part of the digitiser is visible on the left of the photo and a part of the plotter can be seen on the right. (Source: Photo collection of Mrs AD Mans)

⁵⁶ Die Wapad, Vol 26, Nr 6, p9, 1971-05-07 accessed at http://dspace.nwu.ac.za/bitstream/handle/10394/14430/Wapad_d26_n06_1971.pdf?sequence=1&isAllowed=y

⁵⁷ Newsletter, Computer Services, Art 10, November 1979

⁵⁸ Computer Users Meeting, Minutes, Appendix 1, 8 October 1980

⁵⁹ Computer Services Report, Art 2.1.3, April 1981, Appendix to Minutes, Steering Committee of Computer Services, 6 March 1981

⁶⁰ RKD Nuus, p15, August 1984

⁶¹ RKD Nuus, p13, March 1985

⁶² RDK Nuus: p23, July 1987

⁶³ RDK Nuus, p14, March 1985

⁶⁴ Transcription of Author's interview with dr P du B Welman, 15 October 2009

⁶⁵ Steering Committee of Computer Services, Minutes, Art 6, 14 February 1989

⁶⁶ RKD Nuus, p17, March 1989

⁶⁷ RKD Nuus, p1, July 1989

⁶⁸ RKD Nuus, p24, November 1989

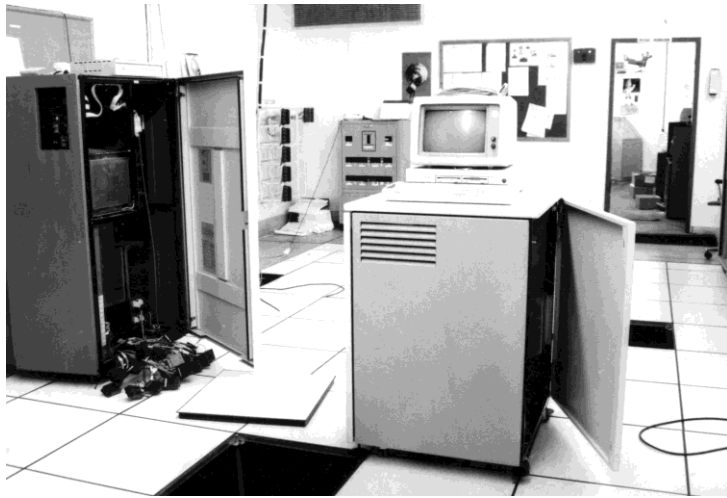


Figure 29 The installation of the IBM 7350 image processor in the machine room (Source: Photo collection of Mrs AD Mans)



Figure 30 Mr Dave Pegg (right) from ISM hands over the IBM 7350 image processor to the Rector, Prof Carols Reinecke. (Source: Photo collection of Mrs AD Mans)

MICRO OR PERSONAL COMPUTERS

A lot of confusion exists around the terms microcomputer and personal computer referring to small single-user computers. The term personal computer or PC is used internationally. As such, the term PC, in this document, refers to the commercial multi-purpose personal computer that is in common use. Microcomputer refers to single-purpose computers used for controlling complex equipment.

The integrated microprocessor of the mid-1970s was the predecessor of the computer and telecommunication revolution that entirely changed the work and communication patterns, e.g. the PC and cell phone that is currently part of almost any developed household and business. The first commercial microprocessor was the Intel 4004, which was introduced in 1971. This was followed by the 8008 (1972), the 8080 (1974), the 8085 (1976) and the 8088 (1979), which formed the basis of the IBM PC. Later, the 80186, the 80286 used in the IBM PC/AT, the 80386, the 80486 and the Pentium followed. The IBM PS/2's arrival in 1987 resulted in an improvement in the PC environment⁶⁹, with faster processing, larger memory, physically smaller disks and better integration with other IBM environment.

The first commercially successful PC for the consumer market was the Apple 2 which was released in 1977. It proved very popular and was produced until 1993⁷⁰. Lower-priced Taiwanese clones of the Apple 2 became available in South Africa in 1981 and immediately attracted buyers, because it included an elementary word processor, Wordstar, and spreadsheet program, VisiCalc. It was the first home computer for many academics and did a lot to improve the computer skills of University staff members. The arrival of dot matrix printers, like the Epson TX-80 in 1978⁷¹, contributed to the increasing popularity of the Apple clones.

An Apple 2 PC was purchased from the Computer Services budget in 1981⁷². This computer was mainly used by Computer Science students, but was later made available to the Department of Education Practice to determine if it could be of use to Education students⁷³. Although several Apple 2 clones were used informally by departments, large-scale use thereof never took off at the University. One of the reasons for this is that Apple instituted sanctions against South Africa in the 1980s.

⁶⁹ RKD Nuus, p24, July 1987

⁷⁰ https://en.wikipedia.org/wiki/Apple_II

⁷¹ Information from <http://lowendmac.com/2014/personal-computer-history-the-first-25-years/>

⁷² Steering Committee of Computer Services, Minutes, Art 6.1, 14 August 1981

⁷³ Steering Committee of Computer Services, Minutes, Art 2.4(d), 29 January 1982

Figure 31 Mr Johan Nel, Head of Operations at Computer Services at the Apple 2 microcomputer. (Source: Photo collection of Mrs AD Mans)



In 1981, the IBM Personal Computer (later known as the IBM PC) was released. The fact that a big and trusted computer company's name was linked to the PC, inspired confidence in consumers and, came into common use. This computer was succeeded by the IBM XT, which was more powerful and included a hard drive. PCs were, however, still expensive and the price of the IBM XT was almost the same of that of a medium-sized car. The PC first made a real impact on the University when clones of the IBM PC and XT became available, especially the cheaper ones from Taiwan. Initially, sales were slow, both as a result of a lack in computer skills and in funds. The availability of attractive applications like word processors did, however, motivate people to develop the necessary computer skills. When prices and computer power slowly became more attractive, a lot of people started viewing the PC as a problem solver worth the time and effort. As a result, the number of PCs on campus increased significantly in the 1980s. There were several attempts by the Steering Committee of Computer Services to standardise PCs, but it was an impossible task since there were so many suppliers that sales could not be controlled. Unfortunately, no central

records were kept of PC purchases and, as such, no information on the number of PCs on campus at the time is available.

The only available documented information is on the PC laboratories that was used for student training, which will be discussed in the following paragraphs.

The Steering Committee of Computer Services realised in 1986 that PC laboratories were urgent necessities and decided that the installation of a PC laboratory on both campuses is more urgent than upgrading the overloaded mainframe computer⁷⁴. At the beginning of 1987, a PC laboratory

(with 30 Olivetti PCs) was installed on both the Potchefstroom and Vaal Triangle campuses.

In the beginning of 1989, two additional PC laboratories were installed at the Potchefstroom campus (one in the Natural Sciences building and one in the Library), each with 20 TSM PCs⁷⁵.

The old accelerator building was repurposed in 1990 to make provision for the mainframe computer and several PC laboratories. The then existing PC laboratory was moved to the new location. The building consisted of laboratories with respectively 24 mainframe terminals, the 20 TSM PCs

(connected to a Novell network), 36 Olivetti PCs and 6 IBM PCs⁷⁶.

The 1980s was a period during which the PC became a commonly used and popular resource that mainly functioned independently. At the end of this era, the University's LAN, PUKNET, was developed. This was the first step to a totally integrated computer environment with national and international links between the PCs and mainframes of academic institutions. The installation of network-connected PC laboratories for learning was the next priority, since there was a big demand for it.

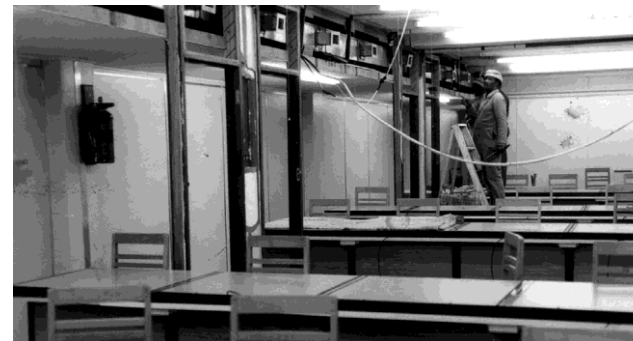


Figure 32 The installation of a PC laboratory in the Ferdinand Postma library. (Source: Photo collection of Mrs AD Mans)



Figure 33 The new terminal room was one of the new spaces that were made available after the old accelerator was repurposed. (Source: Photo collection of Mrs AD Mans)

⁷⁴ Steering Committee of Computer Services, Minutes, Art 5.9, 21 October 1986

⁷⁵ RKD Nuus, p12, March 1989

⁷⁶ RKD Nuus, p1-2, July 1990

Figure 34 One of the PC laboratories that were installed in the old accelerator. (Source: Photo collection of Mrs AD Mans)



ADMINISTRATIVE SYSTEMS

The Director of Computer Services, Mr AJ Smith, requested in May 1980 that a new department, Information Services, be established in Computer Services⁷⁷. Mr Faan Koekemoer was the first Head of this department, which included Mr RH Drevin as Systems Analyst and Mr EH van Niekerk as Programmer. The student system was developed from 1979. Other systems that were developed during this era included the ledger and leave systems. All the systems of this era were, for the most part, batch systems developed in RPG2.

Considerable progress was made in system development with the arrival of the IBM 4331 with its VM/

SP operating system that enabled interactive programme development. This progress was further enhanced by the purchase of the Focus fourth generation language for administrative system development. Mr A (Attie) Juyn was appointed in 1982 as the second programmer and he took the lead in Focus development. In 1985, he was appointed as Database Administrator.

The new real-time student system was the first big system developed in Focus. In 1984 development commenced, and by March 1985 the heart of the system was in use⁷⁸. The first real-time student registration was done in 1986. The system was quite sophisticated and could print letters to clients with

capital and lower-case characters, as well as diacritical characters. In 1988, the student debit system was developed and commissioned. This system managed all aspects of students' financial transactions and, as of the student registration of 1989⁷⁹, all relevant functions could be performed in real time on computer⁸⁰.

The real-time telephone system was developed in 1985, with which extensions and user information of the Siemens POTS was managed⁸¹. Data from the telephone costing system was transferred to this system to debit departments and individuals for telephone costs incurred.

The SANSO system that was used to report to the government on the University's functioning, was developed between 1985 and 1989 by Mr A Juyn, Mr I Larney and Mr K Vosloo. This system was extremely important, since state subsidies were largely determined by it.

In 1988, it was decided to move the Department of Administrative Information Systems from Computer Services to the Department of Management Information⁸². Mr EH van Niekerk was appointed as Director of this department and reported to Prof Hattingh, who was then the Executive Director of Finance and Operation. At the time of the relocation, the systems

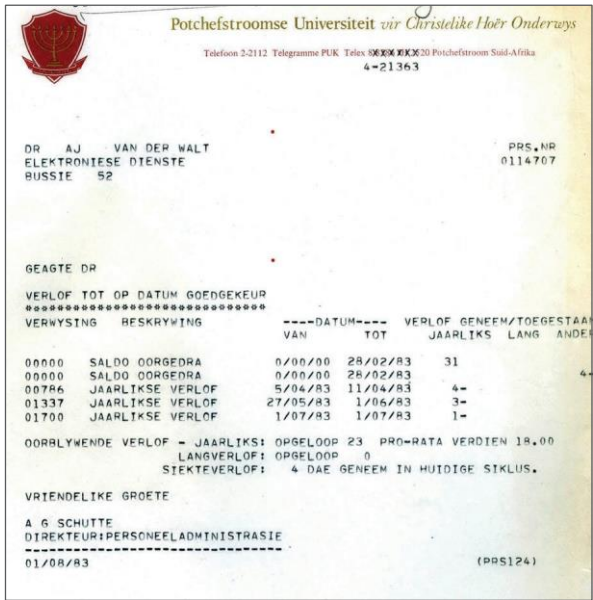


Figure 35 Example of a leave report from 1983. (Source: Author's archive)

⁷⁷ Steering Committee of Computer Services, Minutes, Art 4, 5 May 1980

⁷⁸ Steering Committee of Computer Services, Report RKD 1st semester 1985, Appendix to Minutes, 1 April 1985

⁷⁹ Computer Services, Annual Report, Art 4, 1989 in Steering Committee of Computer Services, Agenda, Art 5, 23 November 1989

⁸⁰ RKD Nuus, p7, March 1989

⁸¹ Computer Services, Annual Report, July 1984 to July 1985

⁸² Steering Committee of Computer Services, Minutes Art 3.1, 29 March 1988

UNINET, THE SOUTH AFRICAN ACADEMIC WIDE AREA NETWORK

development staff consisted of Mr EH van Niekerk, Mr RH Drevin, Mr A Juyn, Mr R Coertzen, Mr J Greylingh, Mr A Allen, Mr K Pretorius, Mrs A Bell, Mrs E Conradie, Mrs M Janse van Vuuren and Mrs C du Plessis, together with seven data processors and card punch operators.

A central students assessment system was developed and commissioned in 1989⁸³, together with a meal payment system. This was the first system that made use of the client/server configuration⁸⁴.

Initially, the Focus developers promised the inclusion of a fully-fledged database. By the late 1980s, however, it became clear that the promise would not be honoured soon and a task team was appointed to make recommendations on a suitable database. This did, however, only become a reality in the 1990s.

During the 1990s, the clumsy batch processing systems were replaced with mainly real-time systems for the management of the most important business aspects of the University. This resulted in the streamlining of many University functions.

Dr Welman was a pioneer in connecting the University to local, national and international data networks. By 1982/1983, he was appointed Chair of the Subcommittee for inter-university networks, which was a subcommittee of the Committee of IT Directors appointed by the Committee of University Heads. Other members of the subcommittee were Mr Wille Fryer and Mr Mike Lawrie, respectively the Directors of Computer Services at the Universities of Pretoria and Rhodes⁸⁵.

As mentioned previously, a need developed (independent of the work of the abovementioned committee) for a link between the mainframe computers of the PU for CHE and that of the University of Pretoria (UP). This was driven by the Ferdinand Postma Library's need to make use of the UP's Dobis/Libis library system. This link was established in December 1984 by using a post office data line⁸⁶. Since both universities had IBM mainframe computers, IBM's protocols and software could be used to establish the connection between the computers. This connection was one of the first inter-university links in the country.

The first step of the subcommittee for Interuniversity Networks was connecting all South African universities with IBM mainframe computers to one another in 1987. The first institutions that were connected were the PU for CHE, the CSIR, UP and the University of the Witwatersrand^{88 89}.

In the same year, Uninet, the South African academic network was established with the help of what is now known as the National Research Foundation (NRF), which also served as patron of the network. Most of the groundwork was laid by the University of Rhodes, the University of Cape Town and the PU for CHE. The manager of Uninet was Mr Vic Shaw, former IT Director at the CSIR. The operational work was mainly contracted to the CSIR. Dr Philip Welman from the PU for CHE was appointed the first chair of the Uninet Council and played a significant role in the further development of Uninet. Most South African Universities quickly joined Uninet, but it took quite some time to establish the necessary technology for intercampus connections.

One of Uninet's biggest problems was reconciling the different network

environments of the participating universities. As such, TCP/IP, a relatively unknown protocol at the stage, was selected as network protocol to connect the different networks. In 1990 an experimental TCP/IP network connection was established between the PU for CHE and Rhodes University⁹⁰. It functioned very well, and TCP/IP was used as the general intercampus protocol.

At the time, Uninet was a South African national connection with no international links. Mr Mike Lawrie, the Director of Computer Services at Rhodes University, had links with Randy Bush, an early internet pioneer in the USA, who helped him to establish a telephonic data connection with the USA in February 1988. This connection allowed Uninet users to send emails to Rhodes University, from where, with the intervention of Randy Bush in Portland, Oregon, it was sent to Fidonet in the USA. From here it was further distributed internationally⁹¹. In 1991, the telephonic link was replaced with a dedicated 9600 bps connection that would later make international connection much easier. In time, the bandwidth was increased according to demand and the financing available.

⁸³ RKD Nuus, p17, July 1989

⁸⁴ Computer Services, Annual Report, Art 4 1989, in agenda, Management Committee of Computer Services, Art 5, 23 November 1989

⁸⁵ Dr P du B Welman, The history of the development and operation of Information Technology at the Potchefstroom Campus of the PU for CHE from approximately 1967 to 2003, contributions to Cobus van der Walt, Art 3, approximately 2009

⁸⁶ RKD Nuus, p7, March 1985

⁸⁷ RKD Nuus, p9, October 1988

⁸⁹ P du B Welman, Report, Investigation into an academic network, Report presented to the Inter-University Computer Committee of the Committee for University Heads, May 1987

⁹⁰ Management Committee of Computer Services, meeting minutes, Art 5, 6 September 1990

⁹¹ The history of internet in South Africa, How it began, by Mike Lawrie, 1979, accessed by www2.frd.ac.za/uninet/history/ on 13 July 2017

LOCAL AREA NETWORKS

As mentioned earlier, Prof Heinrich Herbstreith from the Karlsruhe Technical University in Germany visited the PU for CHE during August 1985. He was invited by Prof JM Hattingh to advise the University on the development of its computer environment. As a result of the visit, Dr P du B Welman compiled a document that contained the recommendations of Prof Herbstreith, titled A Strategy for the Use of Computers. This strategy was approved at a meeting of the Steering Committee of Computer Services on 21 October 1986⁹². This strategy recommended that the University develop an integrated computer environment that made provision for a LAN which could connect all computers and the mainframe computer. It further recommended that provision be made for national and international connections.

This strategy was purposefully followed by Dr Welman and resulted in investigations on how LANs could be established and managed effectively at the University. Mr Henry van der

Walt and Mr Ludwig Myburgh from Computer Services did ground-breaking work in this regard.

First, experiments were conducted with Arcnet and, by mid-1989, the following buildings were connected: Administration, Law, Economic Sciences, the Library, Frans du Toit, JS van der Merwe and Education⁹³. The server resided at Computer Services. While the network functioned well, it was quite slow.

In 1989, experiments were also conducted with Token Ring. This was a network protocol that IBM developed, and which fit in well with the environment in which there was an emphasis on IBM equipment. An experimental Token Ring network was successfully established between Electronic Services and Computer Services. The Library was also equipped with a relatively large Token Ring network⁹⁴.

The Token Ring network functioned very well and was fast. It was, however, quite expensive and the installation

COMPUTER-AIDED LEARNING (CAL)

In this section, Computer-Aided Learning at the University is not discussed in-depth, but only where it is mentioned in documents or discussions about the role of Computer Services therein.

CAL is mentioned for the first time in the University's documentation on the computer environment by Prof JM Hattingh in a report on the state of the computing environment. This report was compiled shortly after his appointment as Director of Computer Services in 1981. In this report, he emphasises the importance of CAL and, prophetically, states that CAL would play an increasingly vital role in the University, which would necessitate considering and researching ways in which it can be addressed effectively⁹⁶.

At a meeting of the Steering Committee of Computer Services on 29 January 1982⁹⁷, CAL was discussed. This was a special meeting that only addressed CAL in connection with a recommendation by the Senate Committee on CAL, that a computer terminal and an Apple microcomputer be placed at the Faculty of Education

costs were high. In the interim, Ethernet developed very well and proved to be much cheaper. The decision was made to migrate to Ethernet subnetworks in the buildings.

The University's LAN was named PUKNET⁹⁵. At the core of the LAN was a 10 Mbps optic fibre ring with Proteon routers in each of the following buildings: Computer Services, Physiology, Economic Sciences, the Library and Administration. The router at Computer Services provided access to the mainframe computers. On the Vaal Triangle Campus, an Ethernet-based network was installed with telephone data lines to connect to PUKNET. Novell Netware was selected as the network operating system and PUKNET was taken into use in the second half of 1990.

These were the first steps in the establishment of PUKNET. During the 1990s it would expand to the most general form of connection on the University's campuses, and having national and international links.

⁹² Steering Committee of Computer Services, Minutes, Art 5.4, 21 October 1986

⁹³ RKD Nuus, p13, July 1989

⁹⁴ RKD Nuus, p13, July 1989

⁹⁵ Committee for Telecommunication Networks, Minutes, Art 5.1.6, 10 September 1990

⁹⁶ Computer Services, Report, Art 1.2 (i), April 1981, Appendix to Minutes, Steering Committee of Computer Services, 6 March 1981

⁹⁷ Steering Committee of Computer Services, Minutes 29 January 1982

for research purposes. The matter was carefully approached and it was decided to place an Apple microcomputer at the Faculty for a semester to determine its success. No further references to this matter could be found.

Dr P du B Welman notes, in retrospect on his time as Director of Computer Services⁹⁸, that the Computer Data Corporation (CDC) Plato system for CAL was investigated from 1982-83. Plato terminals, which were connected to the CDC computer in Johannesburg, were installed at the University to establish a test environment. There was, however, limited interest in the system.

In the following years, Computer Services reported only that the lack of computer facilities for CAL left a big gap. In 1987, Prof C de Beer from the Faculty of Law reported a donation of R180 000 from Trust Bank for the purchase of the WICAT system for CAL⁹⁹. Prof F Venter elaborates on this in the RKD Nuus of October 1988. This system was quite comprehensive and included a central computer with storage facilities, six terminals and a printer. The development of learning material did, however, prove to be very time-consuming.

From the beginning of 1987, a PC laboratory was installed that was available for CAL. In 1990 Dr Welman reported that the following PC laboratories were available at the University¹⁰¹:

• Computer Science 1	30
• Computer Science 2	14
• Computer Services 1	21
• Library	21
• Economic Sciences	11
• Vaal Triangle 1	31
• Vaal Triangle 2	11

There were not sufficient PC laboratories available, but budget pressure was a limiting factor. During the 1980s, facilities for CAL at the University were slowly made available. The reason for this slow progress was probably, in part, a result of academic staff's limited access to equipment because of the financial pressures of the 1980s. While the installation of PC laboratories in the late 1980s improved the situation, it was still not sufficient.

RKD NUUS

Information provision to computer users is an important way to promote efficient computer use. As mentioned, in the late 1970s regular computer user meetings were held to address this need. These meetings were supplemented with several short newsletters that were published from 1978 to 1980. Thereafter, it appears that communication with computer users was interrupted for some time.

Dr P du B Welman was appointed as Deputy Director of Computer Services in October 1981. He was requested to have a newsletter published on a regular basis. As a result, the first edition of the RKD Nuus was published in August 1984. This newsletter was a neatly printed and bound publication, usually in A5 format with about twenty or thirty pages. The newsletter addressed developments at Computer Services and communicated information regarding computer facilities. For the rest of the 1980s, the newsletter was published two or three times per year. The author attests to the usefulness and thoroughness of the RKD Nuus as a valuable resource in the compilation of this chapter on the 1980s.

CONCLUSION

The 1980s was a period of great development for Computer Services. It started with a mainframe computer with limited capabilities and that could only handle batch processing. The decade ends with mainframe computers that could support campus-wide interactive computing that was enhanced by powerful departmental computers and many PCs, an increasing number of which were already campus-wide interlinked and linked to servers and the mainframe computers by means of PUKNET. All these computer facilities were also connected to other national academic institutions. International interactive connections would soon become available.

Prof Hattingh and Dr Welman established a solid foundation in the 1980s which could be further expanded in the 1990s.

⁹⁸ Dr P du B Welman, The history of the development and operation of Information Technology at the Potchefstroom Campus of the PU for CHE from approximately 1967 to 2003, contributions to Cobus van der Walt, Art 3, approximately 2010

⁹⁹ Steering Committee of Computer Services, Minutes, Art 10.5, 27 November 1987

¹⁰⁰ RKD Nuus, p25, October 1988

¹⁰¹ Executive of Steering Committee of Computer Services, Appendix to Minutes, 6 August 1990

CHAPTER

5

The Coordinating Role of the Committee for Telecommunication Networks

INTRODUCTION

The first telecommunication network at the University was the telephone network. Initially, a manual private branch exchange was used, but in the 1960s this was replaced with an electromagnetic private automatic branch exchange (PABX) for internal and external telephone communication. This became outdated in the 1980s and parts became difficult to obtain. Mr TF (Theuns) Schutte from the Telephone Division launched an investigation into replacement possibilities in 1983. He approached Dr AJ (Cobus) van der Walt from Electronic Services for

assistance. This was the beginning of Electronic Services' involvement in the telephone network and, in general, in the University's telecommunication networks.

Electronic PABXs were already available and ISDN (Integrated Services Digital Network) gained popularity. ISDN was a technique by means of which telephone exchanges could handle voice and data simultaneously. This implied that Computer Services should also be involved in deciding on a new PABX. Coordination between the

different departments involved proved cumbersome. These departments included Telephone Administration, which managed switchboard and telephone accounts (reporting to the Registrar); Electronic Services, which managed technical aspects; Computer Services, which managed data networks; and Technical Services that managed the earlier load shedding system and the civil work related to the cable connections on campus.

ESTABLISHMENT OF THE COMMITTEE FOR TELECOMMUNICATION NETWORKS

As a result of the involvement of various departments in the University's telecommunication networks, coordination of the various aspects became a necessity. Prof JM (Giel) Hattingh, Director of Computer Services, and Dr AJ (Cobus) van der Walt, Head of Electronic Services, approached Prof NJ (Nic) Swart, the Vice Rector of Finance and Operations, and requested the establishment of a committee for telecommunications networks. The request was granted and the Committee for Telecommunications Networks (CTN) was established with Prof Hattingh at the helm, Dr van der Walt as secretary, and Mr A (Andries) Engelbrecht, the Registrar of Finance and Operations, as an additional member. The committee's first meeting was held on 7 June 1984.

The CTN filled a big gap and membership eventually expanded to include nine members, namely the Executive Director of Finance, the Head of Electronic Services, the Executive Director of Operations, the Director of Finance, the Director of Computer Services, the Director of Information Services, the Deputy Registrar and the Senior Electronic Technician responsible for telephone networks. The Committee disbanded at the end of 1990, when the establishment of the Department of Information Technology and Management (ITM) took over most of its coordinating functions. The last meeting of this committee was held on 4 March 1991.



Figure 1 Mr JJM (Jaap) Verhoef, Deputy-Registrar and manager of the telephone division. (Source: Photo collection of the NWU archive)

It is noted, with gratitude, that the Deputy Registrar, Mr JJM (Jaap) Verhoef, played an instrumental role over an extended period of time to ensure the smooth functioning and record keeping of all the CTN's meetings.

LARGE PROJECTS COORDINATED BY THE CTN

IMPLEMENTATION OF THE ELECTRONIC TELEPHONE NETWORK¹

Purchase of the Siemens PABX

In the early 1980s, electronic exchanges had already been available for quite some time, and was in successful operation at many universities. It was, therefore, logical for the University to plan for an electronic private automatic telephone exchange (PABX). During this time, one of the emerging technologies was ISDN (Integrated services digital network) that could manage both voice and data. The feasibility of these technologies was investigated.

Dr AJ van der Walt and Mr PPH Schön from Electronic Services investigated potential service providers and identified the following: Siemens, AEI Henley, Philips, Plessey and

STC. Supplier information, as well as background information from the SA Post Office's telephone department was collected. There were many discussions to determine the University's needs. From all the identified needs, a product specification was compiled and a tender document was prepared in Afrikaans (quite unusual for the time).

Tenders were requested for PABXs for both the Potchefstroom and Vaal Triangle campuses. The presentations were analysed by Dr van der Walt, who advised that the Siemens tender be accepted. (This happened before the CTN was established.) This recommendation was supported by the Management Committee² and the

¹Transcription of conversation between Jaap Verhoef, Pieter Schön and the Author, 10 February 2017

²Executive Committee, Minutes, Art 7.2.2.6, 12 June 1984

Assets Committee³ and approved by the University Council on 22 June 1984⁴. For the Potchefstroom campus, Siemens offered two Siemens 601 exchanges to provide the requested 1 500 extensions. The two sub exchanges were interconnected and, to a great extent, functioned as a unit. This was especially the case from 23 May 1988 when pulse code modulation (PCM) interconnections were used between the exchanges. One Siemens 601 PABX was also provided to the Vaal Triangle Campus.

An unusual characteristic of the tender document was that it made provision for a Versabaille unit to be connected to the call registration system, to make provision for a blind person, Mr TF (Theuns) Schutte, to operate the system.



Figure 2 Mr TF (Theuns) Schutte (Source: Photo collection, NWU archive)

Renewal of the telephone cable network

There was a big demand for more extensions on the Potchefstroom campus. The new PABX made provision for many more extensions than the old PABX could handle, and this required the implementation of a new telephone cable network. The old cables were mostly installed without ducting, a practice that was no longer acceptable. Plans were, therefore, made for the installation of an entirely new telephone cable network between buildings, which had to be ducted before installation. The Post Office was responsible for the cables and casings, but the University was responsible for digging the necessary trenches for the ducting. It was attempted to dig the trenches in a very short time, which disrupted gardens and pedestrian traffic for quite some time. The ducting that was installed played a key role in the development of comprehensive data and management networks at the University.

Planning the new telephone network

With more extensions than ever before, the redesign of the telephone network and awarding of additional extensions was necessary. Almost all the existing telephones would have to be replaced with DTMF telephones for faster dialling.

Dr van der Walt developed a new telephone database in Focus, which could manage the applications of departments for extensions, the awarding thereof and the submission of the applications for the new extensions to the Post Office. This system could also print the internal telephone guide. The Post Office pushed for the timeous submission of installation applications, since it would require a lot of work from their side. The database was, therefore, completed in a short time.

Special mention must be made of the excellent support provided by Mr AL (Bert) Venter, Head Technician of External Works of the Post Office in Potchefstroom. He was especially accommodating to the University during the renewal of the telephone and cable network of the Potchefstroom campus.

Exchange connections

One of the limitations that had to be managed was the limited number of exchange connections that the Post Office could provide between the PABX and the public exchange. This was a problem at both campuses, but was more relevant to the Potchefstroom campus with its much higher telephone traffic. A partial solution was to integrate in the new PABX most of the existing exchange connections to private departmental numbers. The problem was only solved when, in April 1985, the Post Office upgraded the public exchange and provided sufficient exchange connections. The final solution was presented in 1986, when an electronic public exchange for Potchefstroom was installed and z-screen cables were used to provide PCM connections to the campus.

At the Vaal Triangle Campus, the number of exchange connections was also a limiting factor until a new public exchange was installed at Bedworth Park in 1988, and the campus could be connected with a z-screen cable.

³ Asset Committee (Finance sub-committee), Minutes, Art 4.10, 22 May 1984

⁴ University Council, Minutes, Art 9.2, 22 June 1984

The commissioning of the new telephone exchanges

Everything went more or less according to plan with the commissioning of the new PABXs. The exchange at the Vaal Triangle Campus was commissioned on 26 October 1984, followed by that at the Potchefstroom campus on 24 November 1984. Both exchanges functioned very well.

Improvements to the PABX happened systematically. Direct dialling to the extensions was implemented at the beginning of 1987 at the Potchefstroom campus, and on 13 July 1990 at the Vaal Triangle campus.

The Siemens 601 PABXs remained in operation for 20 years, until 2004. This attests to Siemens' technical expertise to remain competitive with an exchange that used an Intel 8086 processor (the same as used by the Olivetti PCs) and 2-megabyte memory. It is interesting to note that most of the Siemens 601 development was done by Siemens engineers in South Africa.

The University entered into an agreement with Siemens South Africa to allow the University to themselves maintain the PABXs, which saved a lot of money in terms of maintenance.



Figure 3 Mr PPH (Peter) Schön

This required that a new position be created, namely that of Senior Electrical Technician in the Department of Electronic Services. Mr PPH Schön was appointed in this position, where he served in related positions for more than twenty years. He was responsible for maintaining the Siemens exchanges and was recognised as an expert by Siemens South Africa, who often consulted him.

Telephone cost management

The rental of telephone extensions and cost of telephone calls were initially covered by the central budget. Limiting these costs became increasingly difficult until the budget was distributed amongst the departments in 1986 and they had to manage their own telephone budgets. This led to a significant cost saving and a reduction in the number of extensions used.

Connection of hostel telephones to the PABX on the Potchefstroom campus

For a long time, telephone traffic to on-campus student residences was handled by small manual exchanges in the hostels. Incoming telephone traffic was very high, especially during the evenings, making it rather difficult to make telephone calls to students in a residence. The problem was solved from 1988 on by connecting the telephones for incoming traffic to the student residences, to the PABX. The incoming exchange connections to the PABX were underutilised after office hours and therefore available for student residences.. This successfully solved the communication bottlenecks to the student residences and resulted in great user satisfaction.

Connecting the hostel telephones to the central PABX had an interesting and beneficial additional advantage. During a visit by the Postmaster General, Mr S du Toit Venter, to the University, he was requested to assist the University regarding the high cost of rental of external telephone extensions. Connecting the student residence telephones led to a significant increase in calls and thus in income to Post and Telecommunications, due to the substantial higher number of exchange connections that were available in the evenings for calls to residences. Mr Venter agreed that the cost of rental for the external extensions would be the same as that for internal extensions⁵. As a result, the rental cost of departmental extensions decreased by approximately a third from April 1995, campus-wide. This resulted in a big annual saving.

⁵ ITB Inligting, p1, April 1995

IMPLEMENTATION OF THE LOCAL AREA NETWORK

The growing number of PCs on the campuses made interconnections between them necessary. In addition, management systems like the meal payment system required network connections for the relevant PCs. PC networks were managed by Computer Services, while technical side of the meal payment system was managed by Electronic Services. Although the planning and implementation of PUKNET was mostly done by Computer Services, the CTN coordinated and partially financed the process. The implementation of PUKNET is discussed in detail in Chapter 4.

DIGITAL UNIVERSITY ACCESS CARDS

Requests were made by several parties for the implementation of digital university access cards. The motivators were especially Security Services for access control and Student Residence Administration for implementing a meal payment system. An important requirement was that card readers had to be weather proof and capable of functioning at campus access gates. An investigation indicated that Wiegand access cards were the best solution⁶. The advantage of the Wiegand access cards is that they are difficult to forge

and that there were waterproof card readers available for them. Electronic Services designed the coding of the access cards and provided a check character to minimise reading errors.

A local supplier, who had the access cards manufactured in Germany, was identified. When the access cards were delivered early in 1988, it appeared that they were erroneously coded. The urgency to release the access cards at the beginning of the academic year did not allow for the access cards to be returned to the supplier. Electronic Services could address the erroneous coding by decoding the access cards using a very complex algorithm. This had the unexpected advantage of the access cards being even more difficult to forge.

The first large-scale access control system was developed for the Ferdinand Postma Library and was commissioned during the July holidays of 1988. The next project was the basement door of the Administration building and the access gates at the western entrance of the campus. Thereafter, several access control systems were implemented.

The digital University access cards enabled the development of a meal payment system for hostels, which

had to be put into commission at the beginning of 1998. Hostel administration compiled specifications for the system, requested tenders and appointed a contractor. A week before the students arrived for the new academic year, the contractor admitted that he was incapable of delivering the system. Then Mr EP Blignaut of Electronic Services designed and implemented an emergency system within 10 days⁷. This system, with its updates, formed the foundation of the meal payment systems for the next ten years.

LOAD SHEDDING SYSTEM

The costs of electrical energy at a big organisation is determined by energy use in kilowatt hour (kWh) and the maximum demand in kilovolt ampere (kVA). To decrease energy costs for the University, it became necessary to control both components. The maximum demand could be controlled by switching off large loads, like big geysers in hostels, during periods of high demand.

Technical Services managed a Honeywell load shedding system from 1985. This could switch off a number of geysers in student residences

during peak times. The system was, however, limited in its capabilities. The increasing energy costs required a more comprehensive load control system. Electronic Services planned the system and purchased a commercial load control management software system. This enabled the University to monitor and intelligently control all the large geysers to minimise the maximum kVA demand. In February 1990, the system was commissioned and resulted in significant electricity cost savings. This system was coordinated and financed by the CTN.

The load management system was later on, when the new department, ITM, was instituted, the responsibility of the networks division of ITM.

CONCLUSION

Before the formation of the department of Information Technology and Management, the Commission for Telecommunication Networks successfully coordinated the development and management of the important communication networks of the university. From 1991, this coordination could, to a large extent, be managed by ITM.

⁶ Committee for Telecommunication Networks, Minutes, Art 5.1, 12 November 1987

⁷ Electronic Services, Annual Report, 1989

CHAPTER

6

Library computerisation

INTRODUCTION¹

As the guardian and retriever of a large amount of academic information, it goes without saying that the Ferdinand Postma Library as a university library, would have to utilise information technology. Appropriate affordable IT resources were not available in the early years. However, the University Librarian since 1976, Mr (later Prof) CJH (Casper) Lessing, was aware of the possible applications of information technology in libraries, and already started using it in the 1970s. Later, it was exploited

and used more intensively, to such an extent that the Ferdinand Postma Library became a leader in certain fields in South Africa and abroad. From 1980, Prof Lessing was supported in this venture by Mr (later Dr) T (Tom) Larney, who later became the Assistant Director (Research and Development) at the library. He was computer literate and could develop computer software.

¹ This chapter is mainly based on information from transcriptions of interviews conducted by the Author with 1) Prof CJH Lessing and Dr T Larney on 3 March 2010, 2) Dr T Larney and Mrs C Breytenbach on 16 February 2010 and 3) later private correspondence with Dr T Larney.



Figure 1 Prof Casper Lessing



Figure 2 Dr Tom Larney

INTEGRATED LIBRARY SYSTEMS

Integrated library systems are used to computerise the important operational functions of a library, such as purchase, cataloguing, lending, information supply, etc. Early on, the library was already aware of the possibility of using the German/Belgian Dobis/Libis system for integrated library management. This was a powerful system that, in principle, could run on the University's IBM mainframe computer, but demanded much processing power and storage capacity. In the financially-difficult 1980s, there were insufficient resources available for the University's computer to run the Dobis/Libis system. A module was, however, purchased for capturing bibliographic records. This allowed the capturing of bibliographic data to continue. From 1985 onwards, the link between the PU for CHE's mainframe computer and that of the University of Pretoria, which already used the Dobis/Libis system, was used. This enabled the Ferdinand Postma Library to extract information from the UP's Dobis/Libis system and explore the system. By 1988, a number of modules from the Dobis/Libis system was implemented on the local mainframe computer³. The system was, however, never completely implemented. By the end of the 1980s,

FIRST APPLICATIONS

The Ferdinand Postma Library purchased several programs from the British Library in the mid-1970s, with which information on new bibliographic records, which were distributed by British Library on magnetic tape, could be selected and printed. This was very useful in bringing new publications to the attention of the academic personnel.

By the late 1970s, the digital bibliographic records of library resources were captured in the internationally-recognised MARC format. Electronic Services designed customised digital equipment for this procedure. Capturing digital bibliographic records using computerised equipment was in general use until such time that the library would have an integrated computerised library system. Some of the information that was selectively extracted from the abovementioned British Library tapes, was also used² for this purpose.

² Computer Services, Annual Report, Art 8, 1986, Appendix to minutes, Executive Committee Computer Services, 21 October 1986

³ Steering Committee, Computer Services, Minutes, Art 9, 1987-11-27

it became clear that the Dobis/Libis system reached the end of its useful lifetime and was terminated in 1991. This necessitated the selection of a new integrated library system.

After a thorough study of several relatively unsatisfactory systems, it was decided to purchase the Data Trek system from Data Trek Inc in the USA. This was a DOS-based system that could run on a computer network. It was successfully commissioned by 1993 and was of great advantage to the Ferdinand Postma Library, since it was a completely integrated system that could manage most library functions. Amongst other advantages, this meant that the massive card catalogue could be removed from the library to make space for modern computerised resources.

Although Data Trek provided excellent service, a more attractive option became available when the GAELIC consortium of South African universities and Technikons north of the Vaal River was formed. This consortium successfully negotiated financing for a comprehensive and integrated library system for all tertiary institutions within the GAELIC consortium, with the Mellon Foundation in the USA. In 1997, GAELIC decided to purchase the Innopac system from Innovative Interfaces Inc in the USA. All cooperating tertiary institutions' bibliographic records had

to be adapted to the new system. The Ferdinand Postma Library's continuous and consistent use of the international Marc format for bibliographic records proved very beneficial, since they could import their bibliographic records into the new system without the assistance of external contractors. The Innopac system was implemented and successfully used. Innopac was upgraded in 2001 to include a graphic interface, and was known as the Millennium system. It rendered a valuable service to the Library.

ELECTRONIC MAGAZINE INDICES AND INFORMATION DATABASES

Quite early on, Prof Lessing and his colleagues became aware of the importance of bibliographic indices of academic journals to academic users. Apart from printed bibliographic records that they had already made available in the 1970s, they subscribed to the DIALOG digital information service in the USA in 1981. Initially, this service was connected to by means of a telephonic connection using an acoustic modem. Later, the cheaper and faster packet-switching network of the SA Post Office, Saponet, was used. DIALOG was an extremely useful service, something which the author could attest to.

DIALOG was the predecessor of the computerised magazine indices which the university acquired and which made it a pioneer amongst South African universities. This started with the purchase of their first CD-ROM, the Grolier Encyclopaedia, in 1986. This was very successfully used and resulted in more CD-ROMs with magazine indexes and other databases being purchased. Pioneering work was done to extract this information in an as yet technologically unstable environment. Soon CD ROM readers were interconnected by means of the CD-Net network, which simplified access to information. Further development enabled the CD ROM readers to be connected to PUKNET from approximately 1990. This technology was further developed, in particular with the HP SureStore multi-CD ROM drivers, which could connect a large number of CD ROM drives to the network. There were approximately 200 CD ROM drives in this system, making it one of the biggest CD ROM networks in the world at that time. Although this was a very important and useful facility, it was only an interim phase before all magazine indices and full text databases would be made available on the World Wide Web by the mid-1990s. These information sources were later made available at a reasonable price by consortiums like GAELIC. Commercial companies, like EBSCO and SWETS, also made many

information databases available at an affordable price through the Internet.

The Ferdinand Postma Library developed a website for the library in 1996, which made information sources accessible via the web. This system was expanded from 2000 onwards to provide access to many information databases and the Innopac library system, on-campus and also for off-campus students.

It is clear that the Ferdinand Postma Library was successful in providing excellent service in computerised access to academic journals and information databases for academic users.

CONCLUSION

At the end of 1998, Prof Lessing retired after a very fruitful service of four decades, during which a lot was accomplished to make academic information available in an effective, computerised manner to academics and students. His innovative work methods were continued by his successors, Mr PE (Paul) Buys and Mr (later Dr) T (Tom) Larney. They continued and enhanced the excellent service to both academics and students through computerised methods.

CHAPTER

7

Information Technology and Management, 1991 to 2003

INTRODUCTION

In the 1980s, information technology was characterised by the domination of the mainframe computer. This changed in the 1990s when servers and networks dethroned the mainframe computer as the king of the computer world. In fact, as part of this movement, the University's mainframe computers were decommissioned in 1996. From then on, specialised servers and networked PCs with ever-improving national and international networks, would take the lead.

The management of information technology at the University also changed at the start of the 1990s. This chapter covers the time period from the formation of the new Department of Information Technology and Management (ITM) in October 1990 until the PU for CHE's end as an independent entity in 2003.

Important factors determining the strategy of ITM included the need for effective University business systems,

the change-over to the new millennium, the broad expansion of the data communication network and, later on the need for student support systems, learning management systems and support for distance education.

THE ESTABLISHMENT OF THE DEPARTMENT OF INFORMATION TECHNOLOGY AND MANAGEMENT

The University's Management Committee established a commission on 23 January 1990, which comprised Prof CJ van der Watt, Chief Director of Staff; Prof P van Eldik, Executive Director of Technology and Development; and Prof JH Venter, professor in Statistics and a demanding computer user, to advise about the optimal structure within which the computer-related departments at the PU for CHE could be organised to form an effective information technology support structure. Because the University had become strongly dependent on this technology¹, this new entity had to provide effective advice, planning and operational functions in information technology².

The commission consulted far and wide and took note of the Committee for Telecommunications Networks' recurring requests for the establishment of a division of Telecommunication Services in the

same structure as that of Computer Services. The first report presented to the Management Committee on 8 May 1990³ was accepted, and the final report was presented to the University Council on 5 September 1990. The University Council accepted the commission's recommendations on 28 September 1990. It was decided that the departments of Computer Services and of Operational and Information Services, as well as the Telephone Division that formed part of Meeting Administration, be combined to form a new department, namely the Department of Information Technology and Management (ITM). This Department would report to the Executive Director of Technology and Development, Prof P van Eldik. Dr AJ (Cobus) van der Walt, previously the Head of Electronic Services, was appointed as Director of the new Department, effective 1 October 1990⁴. His first task was to structure the new department.

ITM initially consisted of five divisions: Operations, Operating Systems, User Training, Information Systems and Networks. The Department of Electronic Services was soon added as an additional department, and



Figure 1 T1 The Vice Rector, Prof Albert Viljoen (left) to whom the Director of ITM, Dr Cobus van der Walt (right) reported to from 1992 to 2000. This photo was taken in June 1998, during the welcoming of Dr Michael Zastrocky, Vice President of the Gartner Group, which were leading IT advisors to ITM.

advertised and successful applicants were appointed. Divisional managers were appointed, effective 1 November 1990. Thereafter, positions within the divisions were structured and the necessary appointments were made, effective 1 December 1990.

GOVERNANCE, MANAGEMENT AND STAFF

Governance

All important decisions regarding ITM and the computer environment had to be approved by the Executive Committee. Especially important decisions also had to be approved by the University Council. An attempt was made to provide the Management Committee with core information regarding the strategic importance of information technology during the annual visits of the Management Committee to ITM. Later in the decade, an effort was made by the Director of ITM to conduct regular visits to members of the Management Committee. This created a better understanding of the possibilities and problems of information technology.

Administrative Support operated as a staff function. ITM Vaal Triangle Campus was initially incorporated into User Training, but was later added as a seventh ITM division. The structuring of ITM had to be managed within the limited human resources budget of 1991. There was, however, latitude to correct a few historical deficits, and small salary increases were given to most employees.

The first step was to finalise the job descriptions of the managers of the divisions, and to do job grading according to the Peromnes system. Clearly vacant and new positions were

¹ CJ van der Watt, Report regarding restructuring and development of Information Technology at the PU for CHE, 5 September 1990

² Management Committee, Minutes, Art 3.2, 1990-09-11

³ Management Committee, Minutes, Art 33, 1990-05-08

⁴ Management Committee, Minutes, Art 3.2, 11 September 1990

The ITM Director initially reported to the Executive Director of Technology and Development, Prof Peter van Eldik. After the latter left the employ of the University in 1991, ITM reported to the Vice Rector, Prof AJ (Albert) Viljoen. The position of Vice Rector of Technology was established at the beginning of 2001; ITM then had to report to this position.

The Management Committee's annual visits to ITM

The Management Committee conducted annual visits to ITM from 1992. These visits of a couple of hours allowed ITM to inform the Management Committee of strategic developments in information technology. The topics that were discussed over the years give an overview of the change in the strategic vision of the ITM Director and managers. (Unfortunately, not every year's programme of the Management Committee's visits to ITM are available.)

During the first visit in 1992, an overview was given of the structure and functioning of the ITM department, including a strategic vision of expected developments in information and communication technologies. The significant impact

of the telecommunications revolution was pointed out as well. The old paradigm where a user was linked to a centralised mainframe computer was being replaced by the experience that the user was in the centre of an information universe. This user is served by a local area, wide area and international networks. All of this would create a multitude of new possibilities in distance education⁵.

In 1993, emphasis was placed on the technology vision for 1997-2000 and the planning for the decommissioning of the mainframe computer⁶.

In 1995, the focus was, amongst others, on the fact that effective management and operation of information technology had become a critical success factor for universities. Emphasis was also placed on the fact that the world of information technology was becoming increasingly complex. During this year, the way was also paved for the appointment of a permanent Deputy Director of ITM⁷.

In 1998, the transition to the new millennium was prioritised. The increasingly strategic role that IT-empowered organisations would play in the future, which would require a transformation in the way universities were considered by the corporate world⁸, was also accentuated.

In 1999, it was pointed out that information technology had become a part of our way of living. In the commercial sector, it has already become a differentiator between successful and unsuccessful organisations, which also increasingly applied to universities. The importance thereof had to be considered in the University's strategic, operational and staff planning. The global availability of IT staff was a growing problem that also affected South Africa. The deployment of information technology had to be done in such a way that it did not unnecessarily increase complexity so that staff requirements remained within reasonable limits. One of the most important ways to limit complexity was the standardisation of software and equipment. Focus was also increasingly being shifted to the nearing transition to the new millennium⁹.

In the year 2000 (commonly referred to as Y2K), focus was shifted to the impact of the coming tsunami of electronic business (e-business) and mobile business (m-business) on organisations and how the University should prepare itself for the future. The Rector, Prof Carools Reinecke, requested that Dr Cobus van der Walt gather a team of experts from the University to compile a strategy and business plan

on the implementation of the virtual aspects of flexible learning at the PU for CHE. An agreement was reached on a deadline of three weeks after the meeting. This resulted in a strategy document titled Strategy and business plan for implementing the virtual aspects of flexible learning at PU for CHE¹⁰, referred to later on as the Three Weeks Document.

Coordination and advisory committees

With the establishment of ITM, the old Steering Committee of Computer Services ceased to exist. In its place the Coordination Committee ITM and the Advisory Committee ITM were formed. The Coordination Committee served as a forum for the large users of ITM facilities and services to state needs and exchange information. The Advisory Committee was a very useful forum in which several experts and equals from other universities and the private sector could comment on the strategy and facilities of ITM.

⁵ IT-geskiedenis\Winword\1992 BKbesoek.doc

⁶ IT-geskiedenis\Winword\1993 BKBESK_2.doc

⁷ IT-geskiedenis\Winword\1995 BKBSK ITB gesprek met Bestuurskomitee 24 Okt 1995.doc

⁸ IT-geskiedenis\Winword\1998 BK98CW.ppt

⁹ IT-geskiedenis\Winword\1999 BK besk beklemtoude sake.doc

¹⁰ van der Walt, editor, Strategy and business plan for implementing the virtual aspects of flexible learning at PU for CHE, 2000, IT-geskiedenis\Winword\DriewekedokumentRektorDinsdag.doc, Maart 2000

ITM directors

(This subsection was written by Mr Boeta Pretorius, the current (2017) Executive Director of the North-West University's IT Department.)

In October 1990, Dr Cobus van der Walt took over the reins and served as the ITM Director for just over ten years. During these years it became increasingly important to focus on the client and, as such, the Customer Service Department was established. For the first time, requests and problems were managed by a system.

One of the biggest challenges of the late 1990s was planning the transition to the new millennium. Dr van der Walt, however, guided the Department to a problem-free transition.

One of the sustainable successes of this era was the establishment

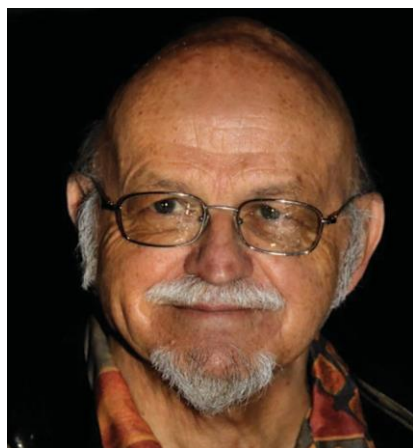


Figure 2 Dr AJ (Cobus) van der Walt, ITM's first Director (Source: Author's photo collection)

of the company IT3-Educational Services, which was and still is, in 2017 (OpenCollab) responsible for administrative system development for the University. The Forte development system for administrative systems was purchased and successfully used for many years.

One of the highlights of Dr van der Walt's tenure and something that most remember him for, was the beginning of ITM's direct involvement in virtual learning. The Rector requested that he develop a document on the use of technology in education at the University; he was given three weeks to complete this document, which became known as the Three Weeks Document and is still referenced today.

Dr van der Walt handed over the Directorship to his Deputy Director, Mr Attie Juyn, at the end of 2000.



Figure 3 Mr A (Attie) Juyn was ITM Director from 2001 to 2003 and Executive Director of Information Technology from 2004 to 2014.



Figure 4 ITM management in 1996. From left to right in front: Mr Ernst Blignaut, Manager of Electronic Services; Dr Cobus van der Walt, Director of ITM; and Mr Richard Drevin, Operations Manager. Back: Mr Ernest van Niekerk, Manager of Information Systems; Mr Jan van Rooy, Manager of Operation Systems; Mr Attie Juyn, Information Technologist; Mr Wilhelm van Belkum, Network Manager; and Mr Boeta Pretorius, User Training Manager. (Absent: Mrs Aldine Oosthuyzen, Manager of ITB Vaal Triangle campus)

Mr Attie Juyn took over as Director in 2001, where he served until the end of 2014 when he accepted a position at the University of Stellenbosch. Although he had a major influence on the expansion of the ITM department, this section will only mention a few highlights between 2000 and 2003. Mr Juyn had a background in business systems and played a significant role in the planning and building of a new student system. He firmly believed in cooperation with other national and international universities and played a significant role in South Africa's involvement in two international projects, namely Quali and, to a lesser extent, Sakai. This period was marked by preparation for the merging of the three campuses to form the North-

West University. The extent of IT's centralisation or decentralisation was not technically demanding, but emotionally challenging.

ITM management

ITM management consisted of all the managers of the different ITM divisions. The members of the ITM management of 1996 are depicted in Figure 4.

The divisional managers had more or less full authority over their divisions. The authority, responsibility and accountability of the Director and Managers were defined by a management matrix that was agreed upon between them¹¹.

¹¹ IT-geskiedenis\Winword\Bestur13 Bestuursmatriks van ITB.doc, 2000-10-30

Subdivisions and staff members of ITM

As previously mentioned, there were seven divisions in ITM in 1991. The following table depicts these divisions and their initial staff complements:

Department	Number of staff members
Administrative Support	4
Operations	7
Operational Systems	3
Electronic Services	4
Information Services	8
User Training	8
Networks	10
Vaal Triangle Campus	4
Total	48

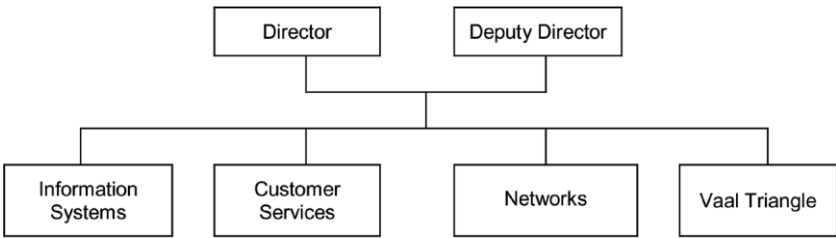
Initially, there were 49 staff members in ITM (Director included).

One of the problems at the start of ITM was the physical location of the department's divisions of Information Systems and of Networks being in other buildings than the rest of ITM. Information Systems was located in the Administration building, and Networks was located in the Physics wing of the Natural Sciences complex. Electronic Services was also located in the Physics wing but due to the special building requirements for Electronic Services, it was not economically justifiable

to move them. By the end of 1995, Computer Sciences moved to other floors in the same building, which made more space available for the divisions Information Systems and Networks to move to the same wing as the rest of ITM. This helped to create a better sense of unity amongst the ITM staff.

In time, the staff members and needs changed, which resulted in restructuring the divisions and decreasing the number of them. The department of User Training and a section of Operations (Helpline and PC-storage) was merged in 1997 to form the division of Customer Services, which was headed by Mr Boeta Pretorius. The establishment of this division illustrated the growing emphasis being placed on the customer. Prof EJ Smit, retired University Registrar, was appointed the first Head of the Helpline in Customer Services. The Remedy Action Request System was commissioned in 1997 to keep track with user requests. The machine room responsibilities were transferred to Networks¹². With the resignation of Mr Jan van Rooy in 1997, the Operating Systems' functions were divided between Customer Services (applications) and Networks (UNIX environment operating systems). From 1 March 1999, Electronic Services were separated from ITM to form part of Specialist Academic Services.

ITM was structured as follows as of 1 March 1999¹³:



The ITM structure was adapted again in 2001 when the Customer Services team's expansion required that it be divided into two divisions, namely End-user Technology with Boeta Pretorius as Manager, and Helpline, with Daleen Botha as Manager¹⁴.

In October 2004, a set of photos were taken of the IT staff complement, which is similar to the staff complement of ITM at the end of 2003, the last year included in this history.



Figure 5 The new department, Customer Service, in 1998 after a restructuring of divisions in ITM in 1997. Boeta Pretorius, the Customer Services Manager, stands at the right of the second row and Prof Rassie Smit, Helpline Manager, is second from the left in the first row. (The ITM Director and Deputy Director are also present on the photo, but were not members of the division.) (Source: Photo collection of the NWU archive)

¹² A Juyn, Customer Service, Proposal for restructuring, 24 January 1997, IT-gekiedenis\Winword\KlienteDiensVoors.doc

¹³ ITM, Annual Report, Art 2.4.2, 1998

¹⁴ ITM Annual Report, Art 2.2, 2001



Figure 6 All the staff members of ITM.



Figure 8 ITM Information Systems: Front row, from left to right: Phillip du Plooy, Ida Richter, Marinda Riekert, Mari Prinsloo, Anna-Marie Bell, Ernest van Niekerk (Manager). Back row: Jan-Louw du Preez, George Gericke, Johan Badenhorst, Johan Greyling, Le Roux Kruger

Figure 7 ITM Management: From left to right: Rika Nieuwoudt (Customer Services Manager), Wilhelm van Belkum (Networks Manager), Aldine Oosthuyzen (Manager of ITB Vaal Triangle campus), Ernest van Niekerk (Manager of Information Systems), Attie Juyn (Director), Boeta Pretorius (Manager User Support)

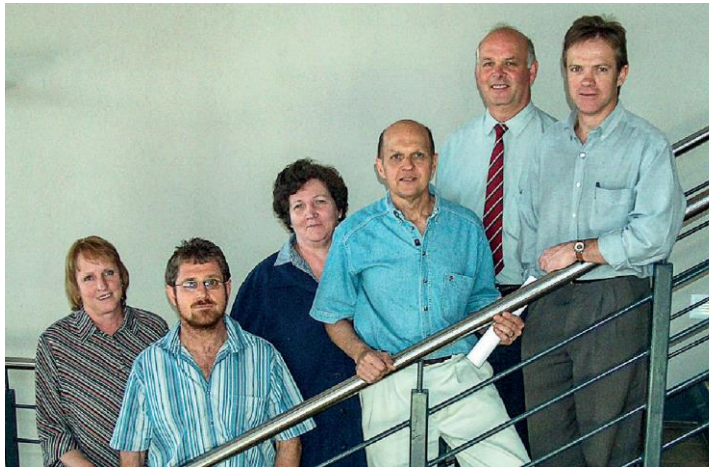


Figure 9 ITM User Support Front, from left to right: Chrissie Blume, Adelle Lotter, Géna Nel. Middle, from left to right: Paul Buys, Wilna Oosthuizen, Gerda Schilling. Back, from left to right: Boeta Pretorius (Manager), Petra Riedel

Figure 10 *ITM Customer Services Front, from left to right: Ivano van Rooyen, Philna Barnard, Hettie Jonker, Koos Brits, Geraldine Gerhardt, Alta van Zyl, Thabo Molambo. Middle, from left to right: Ria van Deventer, Rika Nieuwoudt (Manager), Dirk Venter, Barend Cilliers. Back, from left to right: Heinrich Bekker, Christoff Welthagen, Gawie le Roux, Johan Swanevelder, Thys Snyman, Flip van Schalkwyk, Riaan van der Walt*



Figure 11 *ITM Networks Front, from left to right: Wilhelm van Belkum (Manager), Stef Bezuidenhout, Engela Wilson, Hannes Kriel, Peter Schön, Lappies Labuschagne, Mathews Seroalo. Back, from left to right: Dawie van den Berg, Wim Rankin, Riaan Marx, Jopie Dulhardt, Leslie Muller, Pieter Enslin, Sias Makgale*



BUDGET APPROACH

One of the biggest influences on the functioning of ITM in its early years was the shortage of funds as a result of the amount of R1,44 million overspent on the capital account of Computer Services by the end of 1990. This, together with the last payment of R380 000 on a loan by Senbank to Computer Services and R300 000 worth of unpaid invoices at the end of 1990, resulted in very limited funds for capital purchases during 1991 and 1992.

The current account was also under a lot of pressure as a result of the high annual software and maintenance costs of the mainframe computers (approximately R1 million per year). In addition, the mainframe computer's printing expenses amounted to about R220 000 annually. The running costs of the mainframe computer in addition to the mainframe printing expenses and data line costs took up about 75% of the ITM's operational cost allocation. A further problem was that the mainframe computer costs were USD-based and, with the ZAR continually declining in value, annual operational costs continually increased. (The ZAR value versus the USD declined by about 33% from 1991 to 1996.)

Several approaches were followed to find a solution to the budget pressure. A decision was taken to

phase out mainframe computers in the long run, but this required that alternative solutions be found for the University's business systems. Finding good alternatives for these business systems was a time-consuming and arduous process that took up a lot of time during the 1990s (this will be discussed in more detail later in the chapter).

Another problem with financing was the earlier practice that the Computer Services budget had also to provide for computer equipment in the academic departments. This resulted in a stressed relationship between Computer Services and the academic departments. For this reason, ITM requested approval for a different budget approach that allocated a part of the ITM budget to deans, only to be used for computer equipment. Every dean then had to distribute that budget between the academic departments in the faculty of the relevant dean. This also applied to printing costs and disk space, for which cost recovery was instituted from September 1991. These arrangements resulted in a smaller budget for ITM, which only had to provide central facilities.

THE UNIVERSITY'S BUSINESS SYSTEMS

Migration from the mainframe computer

As mentioned earlier, real-time systems for the University was developed with the Focus fourth-generation development environment during the 1980s. By 1989, the student system and the central students assessment system was already developed as real-time systems and development of systems that would be of strategic importance to the University was continued. The mainframe computer's slow response time did, however, delay system development.

As a result of the decision to phase out the mainframe computers over the long-term, an alternative computer platform had to be found for business systems. One of the possibilities under investigation was migrating to a package environment. Here, the ITS package of the South African company, Integrated Tertiary Software (Pty) Ltd, was investigated in-depth, as per a decision made during a meeting of the ITM Coordination Committee on 1991-07-03¹⁵. The user departments reported at the following meeting on 1991-08-22¹⁶ that the ITS systems did not in general address their stated needs. At the meeting held on 1991-12-02¹⁷, it was decided to abandon this avenue of investigation.

The other possibility that was investigated was migrating the Focus systems to a Unix platform, like the IBM RS/6000, the operational costs of which was approximately a third that of the mainframe environment. Benchmark tests were performed on RS/6000 computers at IBM in München, Germany, which showed positive results. In a test run, the warehouse system was successfully migrated to the RS/6000 environment in 1992.

It was decided that the client/server environment was a better architecture to use. In 1993, the human resources system was migrated to the client/server architecture using the IBM RS/6000 as a server. This proved successful, but several problems were experienced with the Focus database, which could only be solved after a visit abroad by Mr Attie Juyn, ITM's information technologist. There was a vague discomfort over the long-term use of Focus as a data base environment, since it became clear that the Focus developers paid relatively little attention to the actual database part of their development environment¹⁸.

A problem with migration to the client/server environment, was the amount of time it would take to redevelop the financial systems. A lot of discomfort was experienced with the present system as a result of the lack of commitment accounting and the long waiting period for ledger reports, and a quick solution of this problem was desired.

All of this this resulted in a penetrating investigation of the strategy for the University's administrative information systems.

Inter-university cooperation in business system development

The possibility of interuniversity cooperation for system development was investigated. This matter was presented by Prof JT Meij from the University of Stellenbosch (US) at a meeting of Directors of the Information Technology Departments of the South African Universities in 1994. Such a strategy was investigated and it was found that cooperation between the US and PU for CHE was possible¹⁹. The principle of cooperation was accepted by the PU for CHE on 1995-01-31.

The principle of interuniversity cooperation was also attractive to the University of Pretoria, who joined the consortium.

The mechanism of cooperation between the three different universities required a lot of negotiations. Initially, it was considered to conduct the cooperation in the form of a business trust, Unitrust. It was, however, realised that the VAT implications of a business trust would make such an arrangement not financially rewarding. It was decided to use an Interuniversity Information Technology Committee (Unikom) as entity that would coordinate systems development between the universities. Unitrust served as its marketing wing. The PU for CHE donated R500 000 to the University of Stellenbosch in recognition of the development costs that the latter made to the systems that would, in future, be shared by the institutions²⁰.

A project plan was developed for the implementation of the Unikom systems at the PU for CHE. The ITM Director was asked to act as Project Manager and it was decided to relieve him of some of his regular responsibilities by having the managers of the ITM divisions rotate as acting deputy directors of ITM for periods of approximately three months each²¹.

Initially, both the student systems and the financial core systems were scheduled for implementation at the beginning of 1996. By October 1995, it became clear that the Unikom

¹⁵ ITM Coordination Committee, Minutes, Art 4.1.2, 3 July 1991

¹⁶ ITM Coordination Committee, Minutes, Art 3, 22 August 1991

¹⁷ ITM Coordination Committee, Minutes, Art 3.3.1, 2 December 1991

¹⁸ ITM Annual Report, Art 3.1.2.1, 1994

¹⁹ ITM Annual Report, Art 3.1.2.3, 1994

²⁰ Letter from Dr Cobus van der Walt to Prof Kobus Meij, 16 September 1996

²¹ ITM Annual Report, Art 3.1, 1995

development team was behind schedule and that it would not be possible to implement the student system in January 1996. Consequently, the implementation was delayed to July 1996. The rest of the systems, excluding the manpower system, were all implemented during 1996. The manpower system was successfully implemented in 1998.

The Unikom systems were developed for the Adabas database system that could run on a variety of computer platforms. With the advent of powerful processors in a smaller format, it was no longer necessary for a university the size of the PU for CHE to use mainframe equipment. It was decided to use a cluster of two DEC Alpha computers for the Unikom systems. This had the advantage that it was the same generation of computers that was in use at the US, who had expertise in this field. Using the same computer platforms had the benefit of complete

interchangeability of software, sharing of equipment, etc. The DEC Alpha computers were installed in July 1995 and commissioned in October 1995. The computers were stable and rendered good service²².

The University's large business systems that formed part of the Unikom systems were no longer dependent on the mainframe computer and the smaller business systems were migrated to the client/server environment. Word processing and SAS was earlier migrated to PCs and scientific processing had already been migrated to the RS/6000s in 1990/1991. It was, therefore, possible to phase out the mainframe computers of the University and decommission them in November 1996. Historical data was moved to the University of Pretoria's mainframe computer beforehand to ensure safe backup²³, if ever needed.



Figure 12 Mr Ernest van Niekerk with one of the DEC Alpha computers on which the Unikom systems operated. Mr Van Niekerk was the ITM Information Systems manager for a long time. (Source: NWU archive)

²² ITM Annual Report, 1996

²³ ITM Annual Report, Art 2.6, 1996

In January 1997, the Unikom system was used for the first time during student registration. The system was first tested with the smaller number of students at the Vaal Triangle campus, and problems were addressed. Thereafter it was successfully implemented at the Potchefstroom campus²⁴.

In 1998, Version 2 of the Unikom systems was implemented after a new Compaq Alphaserwer 4100 was commissioned to handle the increased load. This made the old DEC Alpha computers available as the testing platform for system development and to run adaptability tests for millennium compatibility.

The new Compaq computer had adequate computing power to easily handle the peak time during the 2008 student registration period and, for the first time, it was possible for other computer users to continue with

their tasks while registration was in progress²⁵.

The University of Stellenbosch unexpectedly announced in May 1999 that they wanted to terminate the four-year-old Unikom cooperation agreement. Although the PU for CHE was unsatisfied with many aspects of the cooperation, especially the management by the US of the development group and quality control, the termination came as a surprise and required an urgent alternative. The University did, however, continue to have the right of using and expanding the Unikom systems, and also obtained its source code.

In the preceding years, the PU for CHE rationed its staff complement in ITM Information Systems division, with the result that there was no longer sufficient human resources to support systems of this extent.



Figure 13 Mr Johan Greyling with one of the IBM 3380 disk drives during the dismantling of the mainframe computer in 1997. The IBM 3380 disk drives was an important component of the mainframe environment and had a capacity of 2.5 gigabytes. Mr Greyling was a key figure in ITM Information Systems for a long time. (Source: NWU archive)

²⁴ ITM Annual Report, 1997

²⁵ ITM Annual Report, Art 3.2, 1998

Business system support in cooperation with IT3 Educational Systems

The University's dilemma with the termination of the Unikom agreement was used as an opportunity to significantly improve the development and support of the University's business systems. In this regard, further system development and maintenance was contracted to a new company, IT3 Educational Systems.

IT3 was a group of IT companies mainly based in the Western Cape. The Managing Director of IT3, Mr Don Hobson, also functioned as a consultant in the system development group of both Unikom and the US. With the dismantling of the Unikom agreement, several of the Unikom contractors indicated that they were willing to provide further support services to the PU for CHE, albeit in a different capacity. A new company was established in the IT3 group in August 1999, namely IT3 Educational Systems (IT3:ES), in which the PU held a minority share and could nominate two directors on the board of five. The first board meeting of IT3:ES took place on 1999-11-18 in Durbanville²⁶. The PU for CHE's directors on the board were the Rector, Prof CJ Reinecke and the ITM Director, Dr AJ van der Walt. By the end of 1999, the company employed

approximately 18 contractors to support and further develop the University's Unikom systems. Almost all the contractors were experienced in the Unikom systems and previously functioned as contractors to Unikom²⁷.

The PU for CHE was impressed by the dramatic improvement in the Unikom system's management and the resulting quality improvement. The end-users were also happy with IT3 ES's service.

A lot of work was conducted in the Unikom ranks to ensure that the Unikom Version 3 release of the business systems would be millennium compatible. It was therefore imperative that Version 3 be implemented before the end of 1999. The sudden termination of the Unikom cooperation agreement at the end of July 1999, as previously described, put the PU for CHE under immense pressure. The newly-formed IT3:ES did, however, through close cooperation with the ITM's Information Systems division, ensure that Version 3 could be implemented in 1999. It was testified by the personnel of the University that this was the easiest implementation of any of the Unikom versions²⁸, a testimony to the high-quality service that the

University consistently received from IT3 ES.

IT3 ES's development of new functionality in the University's business systems was done efficiently. Version 4 made provision for the altered requirements of reporting to the Government. Version 5 was implemented in July 2000 because the University's academic structure had changed and provision had to be made for the establishment of academic schools and focus areas²⁹. In 2000, three new versions of the business systems were developed and implemented to address changing needs.

By the year 2000, it was evident that business systems were not being developed quickly enough to keep track with the University's business needs. This was, in particular, ascribed to the ineffective Natural development environment of the Adabas database system. In cooperation with the Gartner Group, an investigation was launched into alternative development environments and it was recommended to the Management Committee that the Forté development environment be purchased. This recommendation was,

eventually, approved by the Rector. The change required that the IT3 ES and University's development staff be trained in the use of Forté. This process was completed by October 2000.

The implementation of the Forté development environment enabled the University to think differently about system development. In 2001, it was decided to replace the business systems with a new development, Epuk. This was an extensive and comprehensive project that would take a few years and provide the University with high-quality business systems.

In 2001, the University established a company, Glob-Ed Systems (Pty) Ltd, wherein ownership of the new business systems would reside³⁰. This company would also handle the marketing of these systems. A decision was made to refer to the business and education training systems as the Varsité systems for marketing purposes.

By the time that the PU for CHE became part of the multi-campus North-West University, it had a good set of business systems that would be further developed according to leading standards.

²⁶ IT3 Educational Systems, Board Meeting, Minutes, 18 November 1999

²⁷ ITM Annual Report, Art 3.4, 1999

²⁸ ITM, Annual Report, Art 3.5, 1999

²⁹ ITM, Report to Audit Committee, Art 3.1.1, Mei 2000

³⁰ Glob-Ed Systems (Edms) Bpk, Minutes of first board meeting, 2001-07-17

TEACHING AND LEARNING MANAGEMENT SYSTEMS

In the 1990s, ITM promoted the implementation of electronic learning methods (e-learning) by the University. ITM tried to motivate the Management Committee to implement e-learning as a general teaching and learning method. ITM conducted extensive background research in this regard and often discussed the matter during the Management Committee's visits to the ITM.

In 1996, the University decided to offer a B-degree in Business Administration (BBA) telematically for distant students³¹. For this purpose the department of Telematic Learning Systems (TLS) was established with Prof Lou van Wyk as Director. These

developments departed from the practice of using only contact sessions as a teaching and learning method. TLS initially used Lotus Notes as a teaching-learning management system, but it had defects and was later replaced with a product developed internally.

One of the basic needs for the implementation of e-learning was the availability of a teaching and learning management system. This system is used to grant local and distance students telematic access to learning material, communication with lecturers and fellow students, and access to relevant library and administrative systems. Attempts were made from 1996 onwards to develop such a system.

Figure 14 The task team for network-based learning and teaching platforms during a visit to the University of Michigan. From left to right: Prof Paul du Plessis, an IBM representative that travelled with the group, Dr Cobus van der Walt and Prof Albert Viljoen. (Source: Author's photo collection)



The first project was PUKWESS (PUK Web Student Support). Mrs Bessie van der Walt from the Ferdinand Postma Library, was seconded (through the Vice Rector's mediation) to ITM User Training for a period of eight months to help with the system's development because she was experienced in web-based systems development. This proved very successful and she managed to complete the first web-based registration of a prospective student³².

A task team that consisted of the Vice Rector, Prof AJ Viljoen; Prof SJP du Plessis, Director of the Bureau for Academic Support Services; and Dr AJ van der Walt, Director of ITM, conducted visits to the USA and Canada from 26 May 1997 to 11 June 1997 to study network-based learning and student support systems³³. It became clear to them that the University urgently had to develop a strategy to initiate and implement network-based learning.

In response to the aforementioned, the development of a teaching and learning platform garnered more attention and, subsequently, a study group on student support platforms was established. This group decided on the name FLIP (Flexi-learn Internet Platform) on 28 October 1997 for

the system of the PU for CHE³⁴. It was decided to use a development package, SERF, from the University of Delaware to further develop FLIP³⁵. SERF was used by both the PU for CHE and the University of Stellenbosch as development package.

In 1998, the members of Unikom nominated a task team to make a recommendation on a teaching and learning system. This group, under the leadership of Ms Karen Lazenby from the University of Pretoria, recommended on 13 November 1998 that WebCT be selected by the Unikom partners as teaching and learning management system³⁶. The FLIP task team, under the leadership of Attie Juyn, the Deputy Director of ITM, recommended on 16 July 1999, however, that the PU for CHE rather continue with the development of its own FLIP, since many shortcomings of WebCT had come to light in the interim.

In 1999, as explained above, the development and support of the University's business systems moved from Unikom to IT3:ES. IT3:ES announced that they wanted to develop a new and comprehensive teaching and learning platform, Alexander. This platform would

³¹ CJ Reinecke, Presentation to University Board: Vestiging van 'n Telematiese Leersisteem by die PU vir CHO, 1996-04-12

³² Transcription of Author's interview with mnr Ernest van Niekerk, 15 September 2009

³³ AJ Viljoen, SJP du Plessis and AJ van der Walt, Report on the visit to the USA and Canada to determine the implications of the changing learning environment for the PU for CHE, IT-geskiedenis\Winword\Verslag oor besoek aan VSA en Kanada.doc, 20 June 1997

³⁴ Study group on the student support platform, Agenda, Art 5, 28 October 1997

³⁵ KTask team on Technology and Flexible Learning, Report, Art 4, 25 February 199

³⁶ Karen Lazenby, Report On The Evaluation Of Web-Based Teaching\Learning Management Systems By The Universities Of Stellenbosch, Potchefstroom and Pretoria, Art 6, 13 November 1998

completely integrate with the University's business systems. The suggestion was accepted by the University after concepts thereof were also evaluated by Prof Casper Schutte, the former Chief Executive Director of Science, Technology and Informatics at the University of South Africa³⁷.

The first version of Alexander was implemented in the second semester of 2000 and successfully used for the presentation of the Pharmacology Honours programme³⁸.

Alexander was based on the Microsoft development environment, and there was positive interaction with Ms Leanne Steer from Microsoft South Africa regarding Alexander. She indicated that Microsoft was in the process of

developing their own teaching and learning platform, Microsoft Learning Technology (MLT). This information was very important for Alexander's further development, since it would be meaningless to compete with Microsoft. It would be preferable to rather enrich MLT.

On 23 June 2000, Leanne Steer facilitated a meeting in Cape Town between the PU for CHE IT Director, IT3:ES and prof Steve Molyneux from the Learning Lab at the University of Wolverhampton in England. The Learning Lab was in the process of developing a teaching and learning management programme named Wolf. Several similarities were identified between Alexander and Wolf and it was decided in principle that

Figure 15 *The signing of the Memorandum of Understanding between the PU for CHE and the Learning Lab of the University of Wolverhampton on 15 November 2000 by Dr Cobus van der Walt and Prof Steve Molyneux, respectively from the two institutions. (Source: Author's photo collection)*



representatives of IT3 ES and the PU for CHE would conduct a visit to the Learning Lab shortly thereafter. This visit took place from 24-28 July 2000³⁹. Molyneux and his staff's approach appealed to the representatives, and was similar to their approach to Microsoft's MLT. The Rector, Prof Carools Reinecke, conducted his own visit to Molyneux and his team in August 2000⁴⁰ with the intent to foster greater cooperation. It was decided to attempt the establishment of Learning Lab at the PU for CHE, like that of Molyneux. As a result, a Memorandum of Understanding was signed on 2000-11-15 by Prof Steve Molyneux and Dr Cobus van der Walt at the University of Wolverhampton⁴¹.

The plans for Alexander's linking to Microsoft's MLT was foiled when Microsoft announced in December 2000 that they would be abandoning MLT's development⁴². The development of Alexander did, however, continue.

Alexander version 2.1 was ready by the

end of 2001 and was used to present the compulsory module, RINL 111 (Computer and Information Skills) to all (approximately 3 000) first-year students in 2002. In their evaluation of Alexander, the Bureau for Academic Support Services reacted positively to the characteristics of Alexander and stated that it was the best teaching and learning system available at the time⁴³.

With the transfer of the marketing of the University's business systems to Glob-Ed Systems (Pty) Ltd, the name Alexander was changed to Varsité Learning Management System in 2002⁴⁴.

Varsité Learning Management System was further developed and extensively utilised by the University. The development of an in-house teaching and learning management system proved to be a wise and cost-effective decision, since its cost was much less than that of a good commercial system.

³⁷ CJH Schutte, Report on the Alexander project, 29 April 2000

³⁸ ITM Information systems, Annual Report, Art 2.6.2, 2000

³⁹ Cobus vd Walt, Internal Report, Important impressions of visit to England, 24-28 July 2000, 1 August 2000

⁴⁰ ITM, Management Meeting, Minutes, Art 11.5, 2 August 2000

⁴¹ Cobus van der Walt, Report, Visit to the University of Wolverhampton, Art 3.1, 15 November 2000

⁴² Telephone conversation between Leanne Steer and Cobus van der Walt, December 2000

⁴³ Bureau for Academic Support Services, Progress Report: Alexander development project, 26 November 2001

⁴⁴ Glob-Ed Systems (Pty) Ltd, Board Meeting, Minutes, Art 6.2, 27 February 2002

THE Y2K PROJECT

Towards the end of the twentieth century, the IT industry became aware of potential problems in many computer systems, since only two numbers were used to store the year number instead of the entire year comprising four numbers. This detrimental practice originated from an era when computer memories and disc space was very expensive and this practice could save space by just using two characters for the year number. As a result, a lot of computer and management systems could experience problems at the turn of the millennium at the end of 1999. Many institutions took the necessary precautions to overcome this problem, which necessitating editing of the relevant programs. These programming updates, in turn, had an impact on equipment requirements and, in many cases, required the purchase of new equipment. The risk also existed of interruptions to the national power grid and, as such, provision had to be made for emergency electricity supplies. At many organisations, including the PU for CHE, projects that had to include senior management, were launched for the year 2000 transition.

The first mention of the Y2K problem was made in a newsletter to the ITM personnel after a Management

meeting on 29 November 1995. It was mentioned that Cobus van der Walt, the ITM Director, attended a symposium of the Gartner Group, a well-known advisory organisation in the field of information technology held in France. At this symposium, he became aware of the attention at a high-level was being given to the Y2K problem. ITM prepared itself to compile a technology vision for Y2K, which would allow it to plan for the year 2000 from the correct framework. This vision was completed in 1996⁴⁵.

One of the management goals of ITM in 1997 was determining the impact of the year 2000 and planning for it accordingly. Mrs A Oosthuyzen, Manager of ITM Vaal Triangle Campus, was nominated to lead a study group in this regard and make the necessary recommendations. The ITM Advisory Committee meeting of 1997 warned that the year 2000 should be given high priority⁴⁶. During the Management Committee's annual visit to ITM in 1997, the Y2K problem was brought to their attention⁴⁷. This discussion was repeated during the 1998 and 1999 meetings. At a joint meeting of the ITM Coordination Committee and the Monitor Committee of Administrative Computer Systems on 30 October 1997,

it was decided to recommend that a University Committee be nominated to plan for the implications of the millennium transition⁴⁸. The biggest risks that the aforementioned meeting identified included the following::

- Problems with the official University systems
- Important research and other academic systems that were not centrally managed
- Individual work stations that were not adequately tested or replaced in time
- Hidden microprocessors, e.g. in laboratory equipment, elevators, etc., which were not Y2K compatible
- University service providers that were not Y2K compatible
- A large demand could develop for IT experts, especially closer to the turn of the millennium. This could put the University in a difficult position regarding retaining ITM expert staff.

A warning was issued that the Y2K could have significant cost implications for the University.

In 1998, a University-wide Y2K project was launched under a high-level steering committee. Mrs A Oosthuyzen was appointed project leader.

In the interim, Unikom thoroughly investigated the Y2K compatibility of their systems, an action that would continue until the dissolution of the partnership in 1999. A computer programme, Insight 2000, was purchased by Unikom to identify risks, and a new Y2K-compatible Version (Version 3) of the Unikom system was developed.

All ITM's systems were reviewed for possible Y2K problems that had to be corrected.

The increased equipment demands of the Y2K-compatible network and anti-virus programmes, necessitated the replacement of incompatible computers connected to PUKNET. A total of 345 workstations had to be replaced and the memory of 400 workstations had to be upgraded. A cost of R2,4 million was budgeted for⁴⁹. Funds were also made available

⁴⁵ Cobus van der Walt, Technological vision for 2000, 5 September 1996

⁴⁶ ITM Advisory Committee, Minutes, Art 6.6, 2 April 1997

⁴⁷ Visit from Management Committee to ITM, agenda, Art 5.2.3, 12 August 1997

⁴⁸ ITM, Overview Report to the Audit Committee, Art 3.1, 6 November 1997

⁴⁹ Steering Committee Year 2000, Minutes, Art 5.4, 26 August 1999

for the purchase of a motor generator for ITM's machine room.

As a precaution, the Y2K Steering Committee decided that no ITM staff member would be allowed to take leave during January and the first half of February 2000⁵⁰.

The Y2K Steering Committee did thorough work and ensured that most people at the University were aware of the potential Y2K problems and their precautions.

On 2000-01-01, a special ITM management meeting was scheduled to determine whether the millennium transition was progressing smoothly⁵¹.

The meeting was also attended by the Vice Rector, Prof AJ Viljoen; the Registrar, Prof CFC van der Walt; and the Registrar of Finance, Prof IJ Rost. It was gratefully noted that no big problems had been observed and that all business systems that could be tested at that stage, functioned correctly. No serious problems were detected later either. At the end of the meeting, Prof Viljoen thanked ITM for managing a smooth millennium transition at the University.

The planning for the millennium transition under the leadership of Mrs Aldine Oosthuyzen was, therefore, very successful.

THE EXPANSION OF THE PC LABORATORIES

Software legalisation

One of ITM's inherited problems was the fact that very little of the software in use in the PC laboratories were legal. With the end of sanctions against South Africa in the early 1990s and intensified copyright legislation, it became necessary to control the legality of software. Unfortunately, the lack of control during the sanction years resulted in many illegal copies of software being used at the University and that staff members often engaged in unethical and illegal behaviour in this regard. It could have been a big embarrassment for the University if any legal action was taken against it as a result of this. The legalisation of software had a big cost-implication for the University, which is why it was not easy to rectify the problem during the early budget-restricted years.

In 1992, a two-year plan was launched to legalise the software in use in the central training labs. Half of the cost of approximately R200 000 (about R900 000 in 2017 ZAR value) was obtained from the 1992 budget and the rest was purchased early in 1993 from that year's budget. This legalised the standard software that ran on PUKNET, the local area network of the University, and the central PC labs under ITM control⁵².

University personnel were informed of the requirement to only use legalised software.

From 1993, provisions were made to ensure that ITM had the necessary software licenses to ensure that simultaneous users of the central IT facilities were within legal bounds. This system worked well until 1997, when Microsoft no longer sold simultaneous licenses for their software, and ITM had to buy individual packages. This resulted in negotiations with Microsoft South Africa's Leanne Steer, the Microsoft representative at the University, with whom the University had a good relationship. ITM obtained campus licenses from Microsoft for their products and operating systems that were in use. The annual costs amounted to R200 000 (about R550 000 in 2017 ZAR value)⁵³. This included departmental computer use and home use for staff members which were on the payroll of the University. Although it was substantial expenditure, this ensured that the University kept its staff members and students within legal bounds regarding Microsoft software use. This arrangement was still in effect by the time that this document was published.

⁵⁰ Steering Committee Year 2000, Progress with high-risk areas, Art 1.15, 28 April 1999

⁵¹ ITM, Management Meeting, Minutes, 2000-01-01

⁵² ITM, Annual Report, Art 3.6, 1992

⁵³ ITM, Management Meeting, Minutes, Art 7.2, 24 February 1989

The expansion and upgrading of the PC laboratories

The continuous demand for more and bigger PC laboratories was a result of the intense use of the laboratories by certain courses. As a result of the pressure on ITM's capital budget in the first few years (pressure that resulted from overspending in 1990 that had to be paid back over three years), no significant PC room expansion could be undertaken. Thereafter, there was consistent expansion and upgrading of the PC labs. The PC labs

benefitted greatly from the upgrading of computers to prevent Y2K problems. Many of the labs were upgraded to Pentium processors during this period. This resulted in a significant improvement (Figure 16).

In 2001, the PC laboratories in the Library were expanded and 144 new Pentium 4 PCs were provided. At that time, the total number of PCs in laboratories under ITM's management was 409. In addition, 286 more PCs were distributed across 10 laboratories in different Departments or Faculties

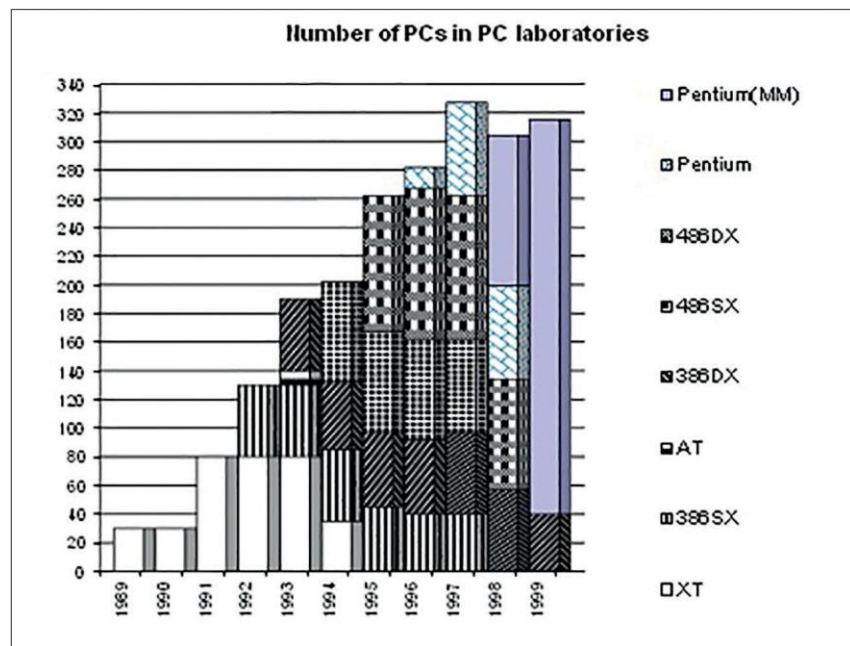


Figure 16 The growth in the number and quality of workstations in the PC laboratories. After the upgrading in 1999 to prevent Y2K problems, the increase in computing power is evident. (Source: ITB Annual Report, 1999)

THE DEVELOPMENT OF PUKNET

Initial implementation of PUKNET

The coordinated development of PUKNET commenced in 1990, as described in Chapter 4. The Potchefstroom campus network was initially developed with a back-bone connection in ring form between the most important buildings, with network servers located at key points on campus. Interior cabling was initially based on the token ring standard, but was later done according to the 10 Base-T standard. On the Vaal Triangle Campus, the network initially started as a small network between the earlier engineering buildings. The interior cabling there was based on the Ethernet Thinnet standard.

PUKNET quickly developed into a key element of the University's infrastructure and many people depended on it for daily tasks. The further expansion and stabilisation thereof was, therefore, a high priority.

Further development of PUKNET

With time, PUKNET expanded almost exponentially. By 1994, the Potchefstroom campus had 1600 microcomputers that were connected to the network. In 1995, PUKNET was also expanded to buildings that previously belonged to the Potchefstroom Education College.

The Vaal Triangle Campus network also developed rapidly. All the important buildings were connected by 1994 and at that time most staff members had network connected microcomputers.

All main frame terminals at the Vaal Triangle Campus were phased out during 1994.

By 2001, there were 2 989 network ports at the Potchefstroom campus and 272 at the Vaal Triangle campus. The increase in the number of network ports during the 1990s is depicted in the following figure (Figure 17).

From a relatively small network in 1991, PUKNET expanded into a large, comprehensive network by the end of the 1990s.

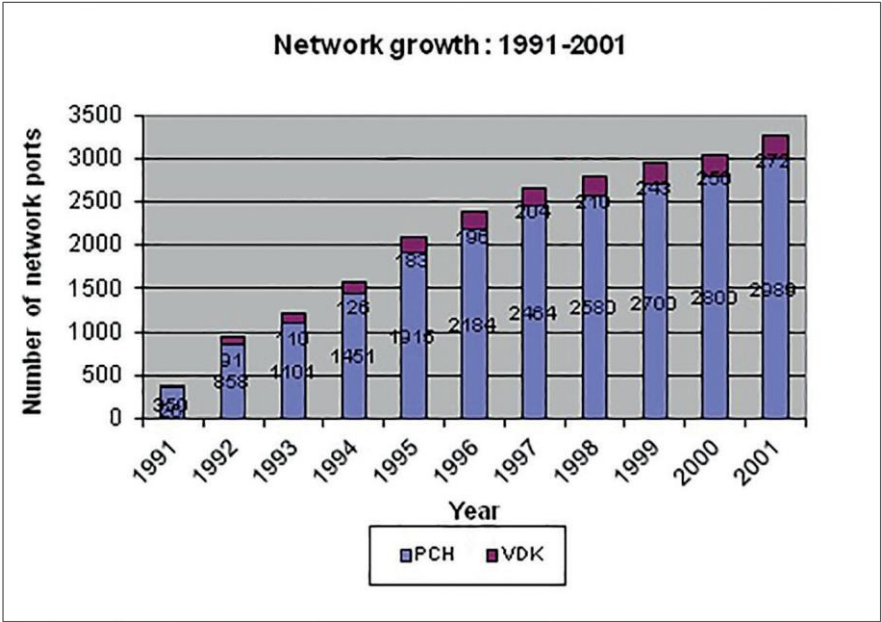


Figure 17 The growth in the number of network points at the Potchefstroom and Vaal Triangle campuses in the 1990s. (Source: ITM Annual Report, 2001)

Cabling standard

The mixed cabling standards undermined the network’s reliability and made maintenance difficult. A programme was quickly launched to do all cabling according to the 10 Base-T standard. By 1995, both campuses adhered to this standard.

The rationalisation of the connection standards resulted in the networking being more manageable, new connections being easier to install and problem identification being easier.

Topology and technology

The increase in network traffic at the Potchefstroom campus made the backbone topology that was initially installed ineffective. A comprehensive investigation was launched into network topology and related equipment was installed. In 1994 it was decided to make use of a so-called collapsed backbone. This implied that all connections to network servers were combined at a central point at a fast router, a Wellfleet BCN. As part of this project, all network servers were moved to the machine room where maintenance, a stable power supply and environment were available.

Later on, ITM Networks developed a strategy for further upgrading of PUKNET through very fast ATM technology. This strategy was approved

by the Management Committee in June 1998 and the cost was approximately R4,6 million over a period of three years. For this purpose, Fore/Marconi equipment was used and implemented from 1999. This gave PUKNET a very fast backbone and ensured high-speed connectivity to the large number of network users.

Network operational system and application software

At the start of the PUKNET development, it was decided to use Novell Netware as network operating system. It appeared to be an excellent choice and during 1996, the system was upgraded to Netware 4.1.

Initially, the Da Vince email system was implemented, but the limitations thereof resulted in the implementation of Groupwise, also a Novell product, in 1996. This software delivered excellent service for a long time

Storage space

By 1995 the available storage space on the file servers of PUKNET was 48 gigabytes on magnetic drives and 20 gigabytes on optical drives. This increased in 1996 to almost 100 gigabytes in total. Later numbers are not known.

Internet access

Initially, internet access to the University was provided by the Uninet consortium of South Africa's public universities. During 1991 only a dial-up connection was available for international connectivity and it could only be used for email. From 1992, Uninet used a dedicated line of 4 800 bps for the internet connection. This was increased to 9 600 bps in 1993 and to 64 kbps in 1994. With time, the University started using an additional dedicated line to SAIX. In 2000 this was a 512 kbps connection⁵⁴.

The following figure depicts the significant increase in bandwidth from 1991 to 2002.

Student access to email and internet

During 1995 network connections were made to a computer in each student residence, and a trial run was conducted to install network connections in all the rooms of the Patria and Wag-'n-Bietjie student residences.

Access to facilities like email on the network for students was provided in cooperation with the student organisation, Sleutelbord, that was established in 1995. These services were significantly expanded from 1997 onwards, as additional financing was obtained from an additional R25 levy on student registration fees.

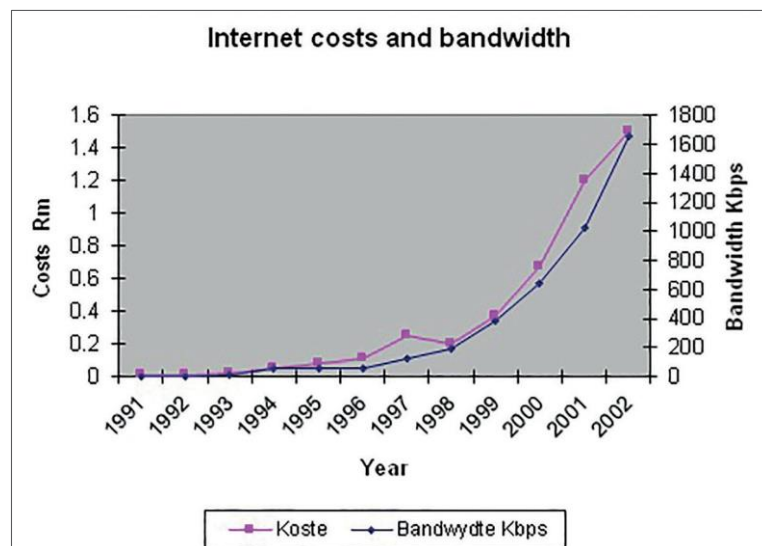


Figure 18 The increase in internet bandwidth and the associated costs from 1991 to 2002. (Source: Annual Report, ITM Networks 2001, Art 3.1.4)

LOAD SHEDDING SYSTEM

In large organisations, the electricity bill depends on both the amount of kWh used and the peak amount of electrical energy used in a period of 15 minutes in a given month, reported in kVA. It is therefore important to minimise the maximum KVA demand as far as possible. In 1990, at the Potchefstroom campus a system was installed which managed KVA demand by switching off geysers during peak time. This system was initially implemented by Electronic Services and from 1991 was the responsibility of ITM Networks.

The load control system resulted in a big saving on the University's electricity bill. In the next figure, for example,

the kVA demand from 1985 to 1996 is depicted in a column graph, with the solid lines indicating the electricity costs per year and the projected electricity costs without load shedding by a dotted line. It is clear that, when load control was implemented in 1990, the KVA demand was clearly lowered, as did the electricity costs. By 1996 the load shedding saved approximately R1,5 million per year.

After 1996, the actual electricity costs started increasing at the same gradient as before 1990, since all the loads that could be controlled was already part of the load shedding system.

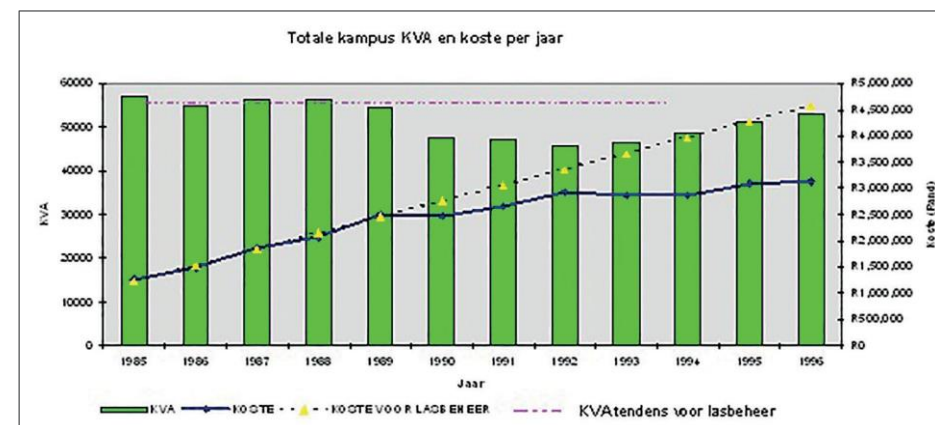


Figure 19 The trend of KVA demand (column graph), the actual electricity costs (solid line) and the projected electricity costs without load shedding (dotted line) between 1985 and 1996. (Source: Annual Report ITM Networks 1996, art 3.4)

⁵⁴ ITM networks, Annual Report, Art 3.1.6, 1996

THE IBM SP RESEARCH COMPUTER

There was a great need under certain researchers, especially in the Departments of Physics, Statistics and Computer Science and Information Technology for powerful computers for their very computing-intensive research. During 1996 an interest group of these researchers and staff from ITM negotiated with IBM about the provision of such a powerful research computer to the University. The negotiations were successful and the computer was ordered by the Vice Rector, Prof Albert Viljoen, on 1996-12-06⁵⁵.

The IBM RS/6000 SP computer with parallel processors was delivered in January 1997 and was made available for use in February 1997. The purchase of the computer was made possible by a grant from the SUR (Shared Universities Research) programme of IBM. The grant enabled the University to purchase a computer with a list price of R3 500 000 for R1 000 000⁵⁶.

The IBM SP was powerful enough to allow scientists at other universities to also evaluate the system. In doing so, the PU for CHE tried to influence other universities to join a partnership of universities by financially contributing to the upgrading of the SP. This would have allowed the development of a true national

academic research computer centre. The University of the Witwatersrand's Department of Chemistry was the first to test the SP, followed by the Centre for Water Resources Research (in Pietermaritzburg) and the University of Stellenbosch. At the PU for CHE, these facilities were mainly used by the departments of Physics, Statistics and Computer Sciences.

Unfortunately, additional funds for the upgrading of the IBM SP did not realise and, in time, other computer platforms overtook it. It did, however, provide very good service for quite some time to the researchers at the PU for CHE. Prof Marius Potgieter from the Department of Physics was an intensive user of the IBM SP and highly praised its ability to be used in advanced research⁵⁷ projects.

THE RELATIONSHIP BETWEEN THE PU FOR CHE AND IBM

The PU for CHE's first computer was provided by IBM South Africa and installed in July 1967. This was the beginning of a long partnership between the University and IBM South Africa, as well as its successor, ISM, after IBM's withdrawal from South Africa in 1986. For many years IBM dominated the mainframe environment and was a source of expertise in various fields. All the University's mainframe computers (the IBM 1130, 370/125, 4331, 4341 and 4380) were supplied by IBM. Later, when RISC processors were developed, the PU for CHE was the first South African University to purchase a RS/6000 computer. Later on, in the 1990s, IBM South Africa made a special offer to supply the IBM SP parallel processing computer to the University, as described above.

IBM South Africa and ISM made several donations to the University, the earliest of which are described in Chapter 2. In the late 1980s, an IBM 7350 image processor was loaned to the University (also as per a previous Chapter).

In the University and IBM South Africa/ISM partnership, the latter's university representatives played a significant role at Computer Services/ITM. Mention has already been made of Mr Berthol Theiland's role in the 1980s, and in the first half of the 1990s, Ms Mariet Venter provided excellent support. On 24 August 1992, both sides were delighted to commemorate the 25-year partnership during a festive occasion.

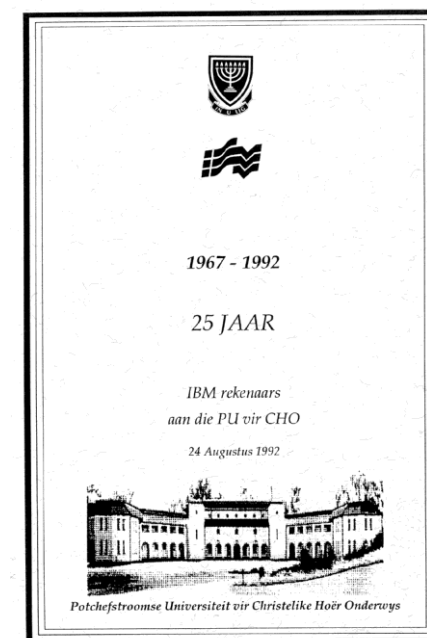


Figure 20 The cover page of the 25-year anniversary festivities of the IBM and PU for CHE partnership (Source: Author's document collection)

⁵⁵ Vice Rector of the PU for CHE's letter to IBM South Africa, 6 December 1996

⁵⁶ ITM, Annual Report, Art 3.1, 1997

⁵⁷ Transcription of the Author's interview with Prof Marius Potgieter, 20 October 2010

The celebration took the form of a dinner in the reception room of the synod hall of the Reformed Churches in Potchefstroom. At this event, Prof JF de Beer (the first head of Computer Services), was the master of ceremonies, and Mr JF Clarke (Post Office and Telkom CEO and former IBM South Africa CEO) was the guest speaker. The prayer before the meal was done by Prof WP Robbertse, the former Dean of Natural Sciences, who strongly advocated for the purchase of the first computer and for the establishment of Computer Science as a University subject. Mr Wiid du Toit, the IBM salesman of 1967, and Mrs Klaasje Benadie, the first full-time employee of the Computer Centre,

were also in attendance. At this event, Mr Malcolm Taylor, General Manager of Smaller Companies in ISM, presented a commemorative wall clock to the Director of Information Technology and Management.

For a long time, IBM was the leader in the computer world at the time when the mainframe computer was still king of computers in big organisations. With the general downsizing of computers, amongst others as a result of the budget pressures of the 1990s in the USA, IBM's role in the world of powerful processors and client-server processing diminished, resulting in IBM losing its leadership status. As a result, IBM's role at the PU for CHE became less important.



Figure 21 The commemorative clock that IBM South Africa handed presented to Information Technology and Management at the 25-year celebration of IBM computers at the PU for CHE on 24 Augustus 1992. (Source: Photo collection of Mr Boeta Pretorius)



Figure 22 At the commemoration of the 25-year IBM and PU for CHE partnership on 1992-08-24, a photo was taken of ITM management. From left to right: Mr Ernest van Niekerk, Manager of Information Services, Dr Cobus van der Walt, Director of ITM, Mr Jan van Rooy, Manager of Operating Systems, Mr Piet Vergeer, Head of Administrative Support, Mrs Aldine Oosthuyzen, Manager of ITM at the Vaal Triangle Campus, Mr Boeta Pretorius, Manager of User Training and Mr Ernst Blignaut, Manager of Electronic Services. (Source: Photo collection of Mr Ernest van Niekerk)



Figure 23 Some of the guests who attended the 25 - year commemoration of the IBM/ISM and University partnership. From left to right: Ms Mariet Venter, Sales Representative of ISM, Mr Malcolm Taylor, General Manager of Smaller Companies at ISM, Mrs and Mr JF Clarke, CEO of the Post Office and Telkom, Prof Carools Reinecke, Rector, Mrs Bessie van der Walt and Dr Cobus van der Walt, Director of ITM. (Source: Photo collection of the NWU Archive)



Figure 24 The IT-heads/directors who attended the 25-year commemoration: Prof Giel Hattingh (1981-1985), Dr Philip Welman (1986-1990), Prof Hannes de Beer (1967 - 1978) and Dr Cobus van der Walt (1990 - 2000). Mr Johan Smith (1978 - 1980) could unfortunately not attend the event. (Source: Photo collection of the NWU Archive)

AFRIKAANS SPELLCHECKER

As mentioned earlier, an Afrikaans spell checker that was developed by IBM SA was supplied to the University for word processing in the mainframe and DisplayWrite environments. With the general use of Microsoft Word on PUKNET and campus PCs, the need developed for an Afrikaans spell checker for MS Word.

ITM User Training identified this gap and in 1994 did the necessary development work for a Microsoft Word compatible spell checker, and they started by compiling an Afrikaans word list. This developed in a successful commercial product that sold 3 922 copies in 1995⁵⁸. The product was often updated for new versions of MS Word. It was later commercially marketed outside of the University and in 2001, 13 807 commercial licenses⁵⁹ were sold.

⁵⁸ ITM Annual Report, 1995, Art 32

⁵⁹ ITB Customer Services, Annual Report, 2001, Art 4.1

STYLE TEMPLATES

A stylesheet contains a series of instructions for a word processor, like Microsoft Word, to standardise document layout and ensure consistency. This is used in many large organisations and forms part of the corporate identity of the organisation. It also simplifies document assembling from subdocuments originating from different sources.

ITM emphasised the advantages of stylesheets early on to the Vice Rector, Prof Albert Viljoen. Prof Viljoen was supportive of the idea, since his office encountered many problems with the compilation of annual and other comprehensive reports that originated from different offices. The Vice Rector appointed a task team early in 1993 to compile a page layout standard for the University. The task team consisted of representatives from various university academic and service departments. Dr Cobus van der Walt, Director of ITM, served as the convener of the task team. The task team met seven times and, on 1994-12-02 provided feedback to the Vice Rector⁶⁰.

A set of standard stylesheets were compiled and approved by the Management Committee. The stylesheets were compiled in a way that would allow for easy implementation.

Some of the advantages of the stylesheets were:

- A uniform appearance for all University documents, which was especially important for documents compiled from different offices.
- Easy integration of the different documents from different authors to form one composite document.
- Time was saved by not having to experiment with different types of headings, fonts and font sizes.
- The minimum amount of training was necessary to enable staff members to compile neat, standardised documents.

The Vice Rector made the use of standard stylesheets compulsory for all annual reports that were submitted to him. This assisted greatly in making the use of the University's stylesheets standard practice at the University.

CONCLUSION

After the great developments in the field of Information Technology in the 1990s, the PU for CHE was, at the end of its existence as an independent university, well-placed in terms of its information technology resources. From humble beginnings in 1967, computer, network, knowledge and learning resources were developed that resulted in a well-developed information technology base for the newly unified North-West University at the end of 2003 after the merging of the different campuses of the PU for CHE.

⁶⁰ Task team to formulate page layout standard, Report, Convener: Cobus van der Walt, 2 December 1994

ACKNOWLEDGEMENTS

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My thanks to the following persons (in alphabetical order) who were willing to share their experience through interviews and otherwise: Mrs Corrie Breytenbach, Dr Willem Coetzee, Prof JF de Beer, Prof Giel Hattingh, Mr Attie Juyn, Dr Tom Larney, Prof Harm Moraal, Mrs Aldine Oosthuyzen, Prof Marius Potgieter, Mr Boeta Pretorius, Mr Peter Schön, Prof Tjaart Steyn, Prof PH Stoker, Prof Hennie Venter, Mr Jaap Verhoef, Dr Johan van Loggerenberg, Mr Ernest van Niekerk, Mrs Alta van Zyl, and Dr Philip Welman.

Mrs Heinie Venter transcribed the interviews with great care, something the author is very appreciative for.

To everyone who made old photographs available, especially Mrs Anne Mans who has a very valuable collection of old photos: thank you. My thanks are also conveyed to Prof Tjaart Steyn for the valuable historical items that he preserved and made available for photography, as well as the valuable information about the early years that he clearly remembers.

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Mrs Yvette Labuschagne, thank you very much for your organisational work during this long project.

To my wife, Petro, thank you for giving me the freedom to spend long hours working on this history.

This history and the entire computer development at the PU for CHE was only possible under the guiding hand of our Lord.

Cobus van der Walt

December 2017