

*a history of
academic computing
at indiana university
bloomington
1940-2000*

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This history is dedicated to the people whose commitment and diligence have made academic computing at Indiana University what it is today: IU faculty and administrators, the IU Board of Trustees, staff personnel of the RCC, WCC, SCSG, OIC, BACS, and OAC, and the thousands of students who have made our endeavors worthwhile.

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Compiled in summer 1986 upon the occasion of the opening of a
state-of-the-art facility for Bloomington Academic Computing Services
and the Marshal H. Wrubel Computing Center,
750 N. State Road 46 Bypass, Bloomington, IN 47405.

The Central Statistical Bureau

Computing at Indiana University has a rich and long history that began in 1940 with the establishment of an agency called the Central Statistical Bureau. It was directed by Dr. Francis McIntyre of the Economics Department (and later by Dr. James Moffat and still later by the future president of Indiana State University, Dr. Raleigh Holmstedt) and managed by Mr. Harold Bly. The Bureau was charged with providing statistical services for faculty research. It was located in the basement of the "B&E" (Business and Economics) building (Woodburn Hall), a Public Works Administration project that was completed in 1939.

The equipment was simple. It consisted of one keypunch, one electro-mechanical IBM 405 tabulator (which printed 80 lines per minute, compared to today's more common 1100 lines per minute), and one IBM 75 counting card sorter (which read and sorted 400 cards per minute). All of the equipment was run from direct current electricity that was provided by a generator in a nearby room.

The sorter was part of an IBM grant to the University. In exchange, the University agreed to teach courses about this equipment. However, the sorter was designed for an earlier generation of cards. Though the cards were the same size, the sorter handled 45-column cards with round holes rather than 80-column cards with rectangular holes. Because of the war effort, Harold Bly could not get the inexpensive part needed to upgrade to an 80-column sorter, so each time the sorter was used, he carefully wedged the read head in the proper place for the new generation of cards. Harold Bly taught courses about these machines for many years. The courses largely drew students from the School of Business and a number of townspeople who worked in industry. Today this generation of equipment is only marginally considered computing equipment.

During and after World War II, the equipment was increasingly used by the Registrar's Office for student records, course registration, and so on. In those days course registration took place in the fieldhouse (located just across Seventh Street from the B&E building). Master course registration cards were keypunched at the Central Statistical Bureau, taken to the IBM Service Bureau in Indianapolis for duplication, and then placed in pigeonholes in the fieldhouse. The pigeonholes were later replaced by tables staffed by faculty and graduate students who dispensed the orange class registration cards.



The Central Statistical Bureau during its first month of operation (September 1940) in the basement of the Business and Economics Building (now Woodburn Hall). The machine at left is an IBM 405 tabulator (80 lines per minute), in the center is an IBM 75 card sorter (400 cards per minute, 45-hole cards). At right is a keypunch. The machines were run from DC current provided by a generator in an adjoining room.

The Central Statistical Bureau was moved to the east side of the basement of the Administration Building (Bryan Hall) in 1943. In the late 1940s, the Central Statistical Bureau was dissolved and its functions absorbed by the Registrar's Office. Doctoral students from the School of Education continued to use the equipment for statistical research for many years.

The Beginning of Research Computing

In the fall of 1949 Dr. Lynne Merritt of the Chemistry Department was on sabbatical leave at the California Institute of Technology. Shortly before he returned to Bloomington, he began using a new IBM 604 calculating machine. Realizing that such a machine would greatly facilitate his research, he wrote to Chemistry Chairman Frank T. Gucker and asked if it would be possible to obtain one for Indiana University. He proposed it be shared with the Registrar's Office. However, the Registrar had no need for the more sophisticated features (multiplication and division!) that were of vital importance to Dr. Merritt's research, and thus could not justify sharing the additional cost. Moreover, the Registrar's Office could go to the IBM Service Bureau in Indianapolis if it needed multiplication and division. And multiplication, at least, could be performed on the existing equipment by progressive addition.

Fortunately, Dr. Merritt was able to obtain a grant from the Office of Naval Research fully funding the rental (\$3,072 per year) of an IBM 602A Calculating Punch. This machine was installed in the Administration Building in the same room as the equipment belonging to the Registrar's Office so that auxiliary equipment (e.g. keypunches) could be shared.

This machine was prone to the troubles of many electro-mechanical devices. Dr. Merritt explains that when it broke down, "We would get out the drawings, trace the wires, and find the [bad component]. Then we would call IBM in Indianapolis. They would ship the part by bus, and we would install it." This tends to remind us of slower-paced times in a bucolic college town. Today we imagine that when a machine "crashes," the engineers are roused from their beds no matter the hour to diagnose and correct the problem. While this is often appropriate, it is interesting that manufacturers of many computers and computer components today are returning to emergency service by telephone and express mail.



Harold Bly demonstrates the IBM 402 tabulator to local school teachers in Bryan Hall in the early 1950s.



Dale Hall with the IBM 650 in the basement of Bryan Hall, mid-1950s.



IU's first real computer, the IBM 650, was delivered in the fall of 1956. It rented for \$31,200 a year, included no software or operating system, had only 2,000 words of memory, occupied 1,000 square feet of floor space, and contained approximately 1,000 vacuum tubes, which generated a great deal of heat. In 1958 the University remodeled and air conditioned a special room for it in the basement of Swain Hall East, at a cost of \$72,000.

When the Korean War broke out, the Selective Service based student deferments in part upon grade point averages, which the Registrar's Office was required to calculate. Suddenly that office had a need for a machine that would divide numbers. While their own equipment did not provide it, Dr. Merritt's IBM 602A Calculating Punch did, and it came to be used by the Registrar's Office during the business day and by Drs. Merritt, Marshal Wrubel (Astronomy) and Gucker between 5 p.m. and 8 a.m. for their research. Dr. Merritt recalls that during their nighttime work, IU President Herman B Wells would often stop by to talk with them about the machines.

The Research Computing Center

In his Fall 1953 State of the University address, President Wells recognized the need for more advanced research computing equipment:

Many complicated problems in the physical, biological, and social sciences, in business, and in education require the employment of modern high-speed computing machines for practical solution. We should expand our facilities to supply an adequate research computing center coordinated with our present setup which serves primarily administrative and bookkeeping functions. Much of the expense of the necessary additional equipment can be reclaimed from contract research.

The following January (1954) Dean Herman T. Briscoe (College of Arts and Sciences) formed a committee chaired by Dr. Merritt to propose a "Scientific Computing Center." The efforts of this committee resulted in the establishment of the Research Computing Center (RCC) in the west side of the basement of the Administration Building across the hallway from the Registrar's computing equipment. Thus, Dr. Merritt became the first, but unofficial, director of research computing resources for the University.

"In those days," Merritt explains, "we did not go after official approval. We just did what needed to be done." In the fall of 1955, Dr. Merritt returned to the California Institute of Technology on another sabbatical (this time on a Guggenheim Fellowship) and Dr. Wrubel was appointed the first official director after, according to one story, Vice President and Dean of Faculties Ralph Collins became ill-at-ease with the informal and unofficial nature of Dr. Merritt's position and went to the Board of Trustees for a formal appointment.

Two of the committee's recommendations, in one form or another, have endured and form a repeatedly heard rallying cry among faculty computer users. The first was that research computing equipment should be available on an "open shop" basis; i.e., researchers should be able

to use the equipment themselves with support from staff. Because computers of the time offered no debugging facilities, because the machines could handle only one user at a time, and because there were no operating systems, this recommendation was almost a necessity at the time. In fact, it helps to explain why the programmers of the day were called "operators."

The second recommendation was that computing services should be available to all researchers, including those who could not personally fund their use. As Dr. E. Wainright Martin (School of Business) explains, "For years, this was one of the few universities where computing was free. That required a lot of support from campus administration!"

The Card Programmed Calculator

The committee also recommended the purchase of an IBM 650, but since the delivery time was expected to be 28 months, it also recommended the immediate rental, as a stopgap, of a device called a Card Programmed Calculator (CPC), which rented for \$14,000 per year. This was a very curious machine and, like its predecessor, not a computer as we think of them today. Its capabilities were very much like the \$15 calculators that now seem to hang on the racks of every checkout counter. While it was conceptually very simple, using it was extremely difficult.

The primary difference between the CPC and today's calculators is that the operator punched his commands on cards using a relatively inexpensive keypunch, waited his turn, and fed the cards into the CPC. Because the commands were executed as each card was read, the program was executed sequentially. In today's computers the entire program is usually stored in memory before execution begins, thus allowing commands to be repeatedly executed or skipped, as the program and data require. These features (looping and branching) are mainstays of today's computers that the CPC could not directly perform. Dr. Stan Hagstrom (Chemistry) remembers that looping was performed on this machine by simply running the appropriate part of the card deck back through the card reader as many times as necessary. He also remembers that his was the first program to be executed on this machine and that it worked correctly the first time. He explains that he was successful because the CPC was used very much like the mechanical calculator he had been using. He needed only to duplicate the things he had previously done by hand.



In the basement of Bryan Hall, probably in 1958, keypunch operator Dova Crow (left) and student employee Marta Petto punched and sorted cards in the Research Computing Center.



In 1958 students in the High School Science Institute used the IBM Card Punch equipment located in the basement of Swain Hall East.

For those with a technical bent, this machine used the same 80-column cards that are still (rarely) in use today, as well as a three-address true numeric machine language rather than an assembly language. Data were 7-digit floating point with exponential biasing (by 50) and a COBOL-like overstrike for negative numbers. It had 22 registers, but no memory. After data were stored in the registers, one or two instructions (i.e. cards) had to be executed before the contents of the register could be used. The instruction set consisted of addition, subtraction, multiplication, division, and, interestingly, transcendental functions. There were also three electro-mechanical storage devices that were called "ice boxes." Each of these contained 16 words of storage.

The IBM 650

In the fall of 1956 the IBM 650 was delivered. This was the University's first real computer, and it rented for \$31,200 per year. It did not contain an operating system (something that the purchasers of even microcomputers expect today) and had 2,000 words of magnetic drum memory. Each word could contain a 10-digit decimal number. One estimate says that this computer offered 40 times as much compute power as the CPC.

In 1958 Dr. Merritt succeeded Dr. Wrubel as director. This time it was official. In April 1958 the IBM 650 was upgraded to triple its compute power and was moved to the east side of the basement of Swain East in what had been an electronics repair facility. It was placed in a room especially remodeled and air conditioned for it at a cost of \$72,000 or \$72K (pronounced "72K" as the computer types would come to say). The expensive air conditioning was required because the machine contained approximately 1000 electronic vacuum tubes and generated a great deal of heat, which tended to destroy the vacuum tubes. Breakdowns of both the computer and the air conditioning equipment were common and expected.

The major feature of the IBM 650 was the rapidly spinning 2,000-word magnetic "drum" onto which a researcher's program was written prior to execution. This drum served to make the machine much faster than its predecessors.

Technically speaking, the assembler (SOAP, Symbolic Optimal Assembly Program) assembled each program so that the instructions could be magnetically loaded on the drum in optimal positions so that the next instruction could be immediately transferred to the computer upon



Dale Hall points out virtues of the IBM 650 to college students in the basement of Swain Hall East, 1960.

completion of the previous one. This tended to reduce the amount of computer time required to complete the job by a significant factor, because several instructions could be executed for each drum revolution rather than just one. However, because the drum was so small, programs had to be heavily "overlaid": i.e., loaded for execution onto the drum, one small piece after another.

This machine was later upgraded with the addition of 60 words of magnetic core memory. This was the University's first computer memory as we think of it today. This memory was intended to be used as a temporary storage device to transfer (buffer) data between the magnetic tape drives and the magnetic drum. However, sophisticated users soon found that they could store small parts of programs (fewer than 50 words) in this memory and execute them much faster than if they were stored on even the fast drum.

A Review of the 1950s

There is a belief among some that until well into the 1970s computing on this campus was the province of only the physical scientists. Records indicate that they played a central role in the use, management, and acquisition of computers. However, those records also indicate that by 1959, almost 30 departments (including the Schools of Business, HPER, Journalism, and Music, and the Departments of Linguistics, Spanish, and Speech and Theatre) were users of the IBM 650 computer for both research and instruction. It is interesting to note that also by 1959, 30% of the academic computing budget was recovered from grants and contracts.

A lot of today's press refers to the need for access to supercomputers. In 1959 faculty were using the supercomputers of the day because insufficient compute power was available on this campus. Faculty in Astronomy and Physics were using ILLIAC at the University of Illinois, faculty in Physics were using an IBM 701 at Los Alamos, and faculty in the Graduate Institute for Mathematics and Mechanics were using SWAC at UCLA.

Dr. Harrison Shull of the Chemistry Department became director in 1959 and was followed, in 1962, by Dr. Wain Martin.

The IBM 709/1401

In the mid- to late-1950s, two major, nationwide computing centers were formed in this country: one on the east coast and one on the west coast. (The



Stanley Henson of Spencer High School learns the complex operation of the IU Research Computing Center and the IBM 650 from Dale Hall, assistant director (right). Swain Hall East, 1960.



In April 1962 Dale Hall (foreground) designed this space in the basement of the HPER Building. Then the home of the Research Computing Center, it was to become the home of the Wrubel Computing Center. Hall, appointed director of the RCC in 1966, is pictured here with the IBM 709, one of IU's first computers to provide a compiler.

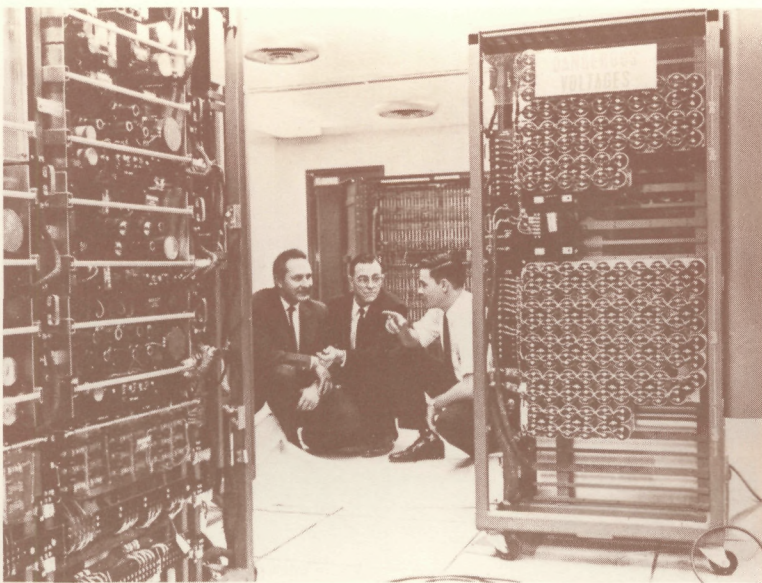
one on the west coast was called the Western Data Processing Center and was located at the Graduate School of Business, University of California, Los Angeles, and began with an interim IBM 650). Users at member institutions keypunched their programs and data on cards and mailed them to these centers for processing. The output was provided in the return mail. These computing centers provided services for both instruction and research. When asked how users handled such details as keypunch errors in such a time-consuming environment, Dr. John Castellan (Psychology) explains the obvious: users were "very careful." Such attention surely demonstrates how desperate was the need for computing at that time.

Indiana University, however, was headed in another direction. In late 1961 or early 1962 the RCC moved into a specially constructed basement of the HPER building. The facility was designed by Mr. Dale Hall (who was later to become director). In May 1962, Mr. Stephen Young (who would also become director) issued the RCC's first Newsletter. During the construction of the gymnasium addition to the HPER building, drillings had indicated that there were limestone deposits. Pilings were sunk, and part of the gymnasium addition was constructed atop them. The deposits were later discovered to be rubble from an older building, and the area was excavated to provide space for the computing center. An IBM 709 and three auxiliary machines were installed with grants from the National Science Foundation and the Indiana University Foundation.

The first auxiliary machine copied the user's programs and data from punched cards onto magnetic tape. The magnetic tape was then moved to the 709 where it was read. As the job ran, the 709 wrote the output onto two magnetic tapes. When the job was completed, the tapes were removed, and one of these tapes was mounted on the second auxiliary machine (which punched the results onto cards). The other tape was mounted on the third auxiliary machine (which printed the output). In 1963 these three machines were replaced with an IBM 1401 computer.

The RCC IBM 709 was not a new machine. It was a specially configured machine that had been used by the Air Force on a South Pacific island. Dr. Hagstrom estimates that this \$1 million machine had about the power of today's \$3000 IBM PC.

The 709 contained about 5,000 vacuum tubes. Thus, it was subject to even more serious vacuum tube problems than the IBM 650 with its 1,000 vacuum tubes. While Steve Young remembers that IBM would not disclose any measure of how



In April 1962 the Research Computing Center moved into the basement of the HPER Building. Shown here with a new IBM 709 are, from left, Harrison Shull, Dale Hall, and Bill Easterling (IBM field representative). Note the rack of large capacitors at right.

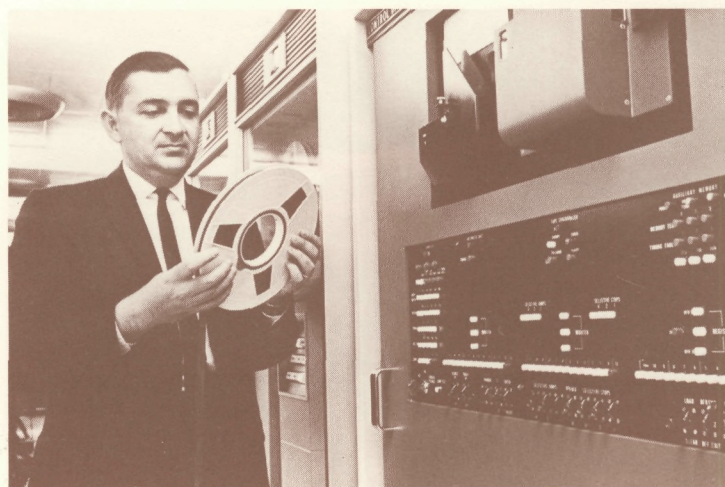
frequently they expected the 709 to fail, experience here was that one of the vacuum tubes would fail, on average, every 20 minutes, with a resulting machine crash. Dr. Hagstrom remembers that the 709 once ran for 17 hours without a known failure. He also remembers that one time all 5,000 vacuum tubes were replaced. Because the machine crashed so often, graduate students learned to locate and replace the bad tubes. Mr. Hank Moreland, the head IBM engineer, was more than a little unhappy about this, but accepted it once he found that letting someone else replace the tubes allowed him to sleep through the night without a telephone call.

On the technical side, the IBM 709 was the University's first machine to provide a compiler (FORTRAN). Thus, the computer became much easier to use. This was an excellent compiler for scientific purposes and was remarkably bug-free. However, it was slow. Dr. Hagstrom, Dr. Frank Prosser (Chemistry and RCC), and Steve Young developed another, extremely fast FORTRAN II compiler that they called FASTRAN. It was designed to be 100% IBM compatible, was designed for knowledgeable users, and was based on some early, but unfinished work (FLAT, FORTRAN Language Algebraic Translator) by Mr. David Kurn, one of the legendary RCC staff. Dr. Hagstrom describes David Kurn as the only person he ever knew who could write assembly language programs at a keypunch: a feat that old systems programmers will recognize as truly remarkable. FASTRAN was used at the University of Illinois because it was so fast that their 709 could execute in 16 hours what previously required 24 hours. Tests here showed that FASTRAN could compile a famous set of programs called the "BMDs" in only 45 minutes. IBM's compiler required nine hours. FASTRAN was eventually carried to the University of Waterloo and became the basis for a famous student compiler for IBM Machines called WATFOR.

For those who were having difficulty transferring their programs from the 650, a simulator was available. This allowed the 709 to pretend it was a 650 and thus execute the older programs. In fact, the process was a bit more complicated because the simulation program had been written to run on an IBM 704 (which was not available here) instead of the IBM 709 (which was available here), so another simulator was needed to make the 709 look like a 704. Thus, the 709 ran a program that made it act like a 704, which ran a program that made it act like a 650, which then ran the user's 650 program. Today conversion is recognized as one of the major costs of changing computers.



Stephen W. Young, later to become director of the Wrubel Computing Center, and Dale Hall (at IBM 709 console). HPER Building basement, 1962.



Wain Martin with the Control Data Corp. 8090 in the basement of the HPER Building, mid-1960s.



In the mid-1960s the Research Computing Center received a grant to install a Control Data Corp. 3400/3600 system. Dale Hall, the first full-time director of the RCC, demonstrates the computer to people on tour of the RCC in the basement of the HPER Building.



Stephen Young with the CDC 3600 in the background, printers and tapes in the foreground. HPER Building basement, 1960s.

The IU Department of Police Administration was to become the biggest user of the IBM 709/1401 machines for highway design and traffic flow analysis.

A number of faculty campaigned for, and won, the inclusion of an IBM 101 Electronic Statistical Machine as a separate device to handle statistical analysis in this new home. They believed that the 709 was far too much machine for their simple problems.

The CDC 3400/3600

When the University began looking for a new and bigger computer, IBM was in the midst of legal problems. The corporation was accused of being a monopoly, and thus it could not offer the University the large and important discounts that it commonly offered educational institutions. The University looked to acquire a new machine. But should it be a decimal machine or should it be a binary machine?

In 1965 the RCC received a National Science Foundation grant to install a Control Data Corporation (CDC) 3400/3600 computer system. This was a one-of-a-kind combination that CDC provided at the urging of Dr. Hagstrom. Because of budget cutbacks, the 3400 was replaced with a CDC 8090.

Also in 1965, the *Random Bits* newsletter was begun, and the Bloomington Campus Computer Use Committee was formed. This committee continues to be the Indiana University Bloomington faculty voice on academic computing policy. It is composed of faculty from various academic departments. In this way, many faculty members have provided invaluable service to academic computing, normally without praise or public visibility. It is clear that they have played significant roles. Unlike other universities, Indiana University did not permit the computing center to become the property of one academic department.

The following year saw the end of faculty serving in part-time roles as directors of RCC. Dr. Dale Hall became the first full-time director. In June 1966 the RCC received the CDC 3400 computer that had been requested earlier, and it was coupled with the CDC 3600 through the "shared memory" that Dr. Hagstrom had promoted.

Thus began the glory days of the programmers of the operating system. People like Steve Young, Dr. Prosser (who later was to start the Computer Science Department), Ms. Ann Bardin, Mr. Chuck Flowers, and Ms. Ruth Kobbe developed (as

computer owners were then expected to do) the operating system. This one was a very sophisticated and flexible operating system called SYSI1 (SYSstem Indiana version 1) and later SYSI2 that included a sophisticated technique developed by E.W. Dijkstra to keep the 3400 and the 3600 functioning smoothly without stepping on the toes of the other. Something called SAVEFILES (all computing was in upper-case letters in those days) were also available for the online storage of information. Previously, all information was stored on either magnetic tape or on punched cards. There were no such things as today's floppy disks. In fact, the 3400/3600 was the first Indiana University machine to have a disk at all.

Records show that these machines were "down," or inoperable, for 80 to 100 hours per month as a result of hardware maintenance and air conditioning problems alone. Today, BACS likes its machines to be "up" 99% of the time; i.e., we do not want them to be down for any reason for more than seven hours per machine per month.

Data Systems and Services

The need for improved computing facilities for administrative purposes continued to increase. The University needed systems to bill the federal government for student fees and books charged against the GI Bill, to calculate Social Security deductions and telephone charges for students in the dorms (five cents per call), and to issue 5,000 monthly payroll checks. At this time, too, student records were kept on large sheets of paper in the Registrar's Office. Harold Bly explains that at the end of each semester, student grades were keypunched and the cards assembled for each student. They were then printed on a multi-part form that contained carbon paper at the bottom. The carbon was removed, aligned with the student's permanent record, and then heated with a Transfer Posting Machine to transfer the grades from the carbon to the permanent record.

Clearly, better systems were needed, and sometime in the mid-1960s, the Registrar's Office got its first stored program computer, or what today we call a computer (as opposed to a calculator). This was an IBM 1401 (the same model that RCC had) with 12,000 bytes of memory (today's microcomputer usually has a minimum of 256,000 bytes), a disk, and four tape drives. The machine was the responsibility of Harold Bly of the former Central Statistical Bureau. He hired, among others, Mr. Richard Harrison (now a local attorney) as an operator, and Mr. Ron Terrell as a programmer.



Frank Prosser with a module of the CDC 3600. HPER Building basement, 1964.



Students analyzed output from the CDC 3600 in the HPER Building, 1964.

Ron Terrell was primarily responsible for producing the first telephone course registration system for colleges in the United States. It soon fell into disuse, however, because of the lack of support software.

Ron Terrell is also important to computing at Indiana University because his is one of the first and most respected names to be mentioned by academic computing programmers when they speak of administrative computing programmers. He was able to bridge that more or less (generally, less) good-natured warring between these professionals that seems to exist on many college campuses.

Dr. Bill Perkins (then a graduate student and now chairman of the Operations and Systems Management Department in the School of Business) wrote the major part of the 1401 payroll program.

The 1401 remained in Bryan Hall for only a short period of time. In 1966 or 1967 Data Systems and Services (DS&S) was formed under Mr. Bob Espie and the 1401 was moved to 17th Street. Harold Bly became an Assistant Registrar and served as liaison to DS&S. Bob Espie was soon followed by Mr. Ernie Jones and later by Dr. Ronald Jonas, the Director of what is now called Administrative Computing.

Coming of Age: The 1970s

The early 1970s were great years for academic computing at Indiana University.

In January of 1970 RCC entered the age of interactive computing. As many as five people could now sit at typewriter-like devices and submit jobs to the CDC 3600 for execution. These jobs could be typed in or could be submitted from files stored on disk. Mr. Bob Phillips and Steve Young provided the software to support this interactive computing, which immediately implied the need for an on-screen editor. As Steve Young explains, "If we could insert, delete, and replace, we had provided everything that was needed." While it was appropriate for the time, this "line editor" was a far cry from the full-screen editors and word processors that we take for granted today. Those terminals communicated with the computer at the then blinding speed of about 10 characters per second. Today, BACS terminals operate 24 times as fast and many think they should operate 100 times as fast.

June of 1970 brought a significant change in the mission of the Research Computing Center. It was now responsible for providing academic computing services to the regional campuses as well as to the Bloomington campus.

The CDC 6600

In November 1970 the CDC 3400/3600 was replaced by a CDC 6600, a computer so powerful that it could simultaneously process seven jobs and at the same time keep a supply of partially completed jobs ready for processing as soon as one of the seven finished using its fair share of the computer.

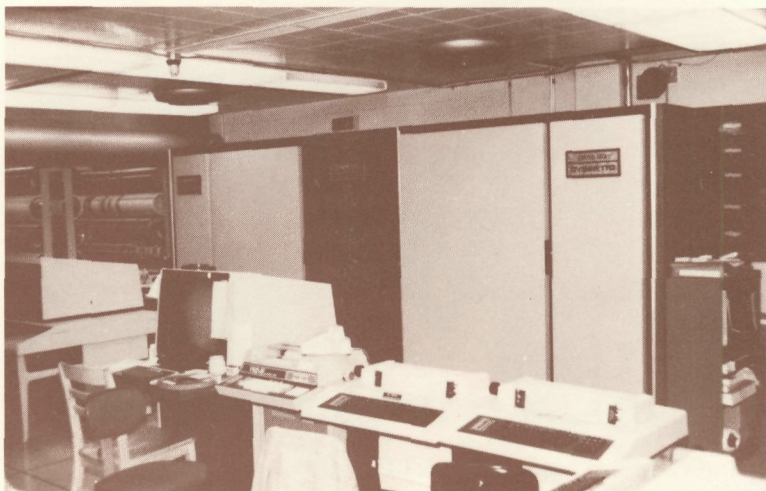
The early 1970s also brought the appointment of Mr. Al Towell (also now a local attorney). He had the responsibility of helping the nontraditional computer user become accustomed to computing.

Comparing today's software (SNOBOL, etc.) with what was then available for such users makes it appear that he accepted an impossible job. Mr. Ferris McCormick was already announcing the death of FORTRAN and espousing the use of ALGOL and other languages. Besides the BMD programs, the high-quality software packages we know today were almost nonexistent. Mr. Don Byrd and later Mr. Jim Hettmer began a long campaign to promote the use of plotting devices and software. Mr. Dave Forman was poking a finger into whatever he could.

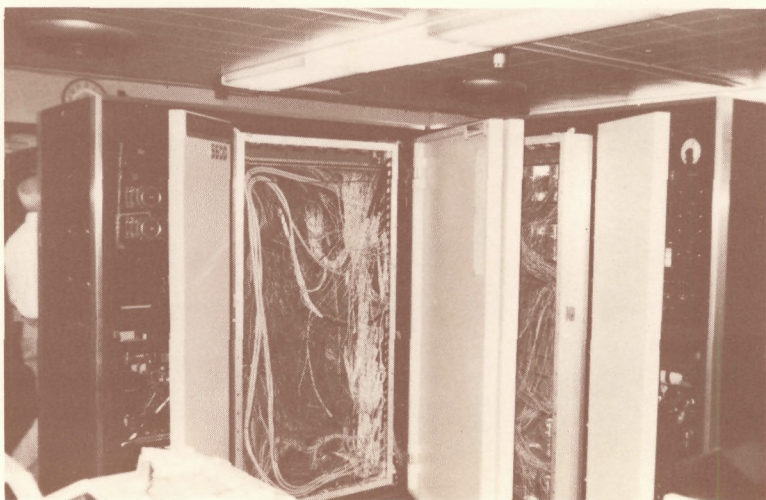
Remember that academic computing began with the Central Statistical Bureau? And remember that the statisticians wanted an IBM 101 because they thought an IBM 709 had too much compute power for their problems? They must have changed their minds. Ms. Martha Vandivort brought SPSS (Statistical Package for the Social Sciences) to RCC. Year after year this statistics program continues to be the most widely used software that BACS offers.

Finally, the early 1970s brought the RCC strongly into its first contact with "networking." Though the word had a different meaning then, the RCC began the installation of Remote Job Entry (RJE) stations through the work of Ann Bardin (who took care of the EXPORT/IMPORT software) and Mr. Dave DeLauter (who took care of the hardware). Over the next few years, the RCC would install a number of RJE's in Chemistry, Ballantine, Business, Memorial, and the remote campuses where users could put their own card decks through card readers and soon receive their print. In 1971 the RCC received a \$100,000 grant from Control Data to help in this and other expansions.

In February of 1973 the Research Computing Center was renamed the Marshal H. Wrubel Computing Center (WCC), in honor of its first official director, who died in 1968 at age 44 while on sabbatical in Colorado.



CDC 172 in the background, with (left to right) consoles for the CDC 6600, CDC 172, Prime, and Vax in the foreground. HPER Building basement, 1983.



The CDC 6600 with doors and bays open as it is being prepared to be removed from the HPER Building, 1983. Ralph Dudley, CDC district supervisor of customer engineers, is at left.



From left, Marvin Grubb (on telephone), CDC engineer Larry Crotser, and Research Computing Center operator John Gerth with the CDC 3600 in the HPER Building basement, mid-1960s.



Harrison Shull and Gary Cagle at a Plato terminal, 1970s.

Also in 1973, Steve Young, the second up-through-the-ranks Director, was named.

WCC also began its second contact with “networking,” this time in the guise of connecting terminals distributed throughout the campus to the computers in the basement of the HPER building through software called INTERCOM. It was not very sophisticated, and though many will remember it, few will remember it fondly. Dr. Hall, Ann Bardin, and later Mr. Ed Kubaitis played vital roles. And many of us still remember the “TRAN gear,” as some of the networking hardware was called. Eventually WCC would offer both batch and time-sharing services to all regional campuses.

In 1976 a Control Data Corporation CYBER 172 computer was added to WCC. The Center staff enhanced some software from the University of London to connect the 172 with the older CDC 6600 to form a very sophisticated “multi-mainframe” system. Ms. Jane Pataki is a name that many will remember for her fine work in this extremely complicated and unusual connection. She possessed a debugging style that served her well in this work. It was fascinating to watch her find the latest problem.

It was also in the 1970s that the author, Jim Haskett, likes to believe he made useful technical contributions to high-quality academic computing. His magnetic tape stager, the bulk memory (today’s microcomputer RAM-disk), and an operating system benchmark (which used some of Jane Pataki’s programs) that he and Ann Bardin developed with others, attracted national attention.

The Small Computer Support Group

In the 1970s there were two other academic computing organizations on the Bloomington campus: the Small Computer Support Group (SCSG) and the Office of Instructional Computing (PLATO).

The SCSG was formed in November of 1979 by Drs. Prosser and Homer Neal in Research and Graduate Development, with John Smith as the director. SCSG had two offices in Memorial Hall, and it later moved to Atwater Avenue. SCSG had a budget of \$80,000 (including salaries), three people, and was charged with helping researchers with small computers that were used mainly as real-time laboratory data collection devices.

At that time many saw microcomputers as “toy” computers. Obviously, anyone who wanted to do “real” computing would have to go to WCC! The quality, price, speed, and features of hardware and software that would soon be developed showed this view of microcomputers to be embarrassingly short sighted.

Office of Instructional Computing

Interest in PLATO (computer-aided instruction) at Indiana University was initiated by Dr. Shull when he was Dean of Research and Graduate Development. He brought PLATO terminals to the Bloomington campus. These terminals were connected through long-distance telephone lines to computers at the University of Illinois that ran software especially designed for this type of instruction.

In 1979 Dr. Neal created the Office of Instructional Computing with PLATO site director Dr. Bill Sanders (then a graduate student). The new office also had responsibility for the incorporation of microcomputers into the educational process and the design, testing, evaluation, and acquisition of educational software. It operated on a \$100,000 budget from a suite of offices in the School of Education.

Like SCSG, PLATO met resistance on campus. While some viewed it as an important instructional tool, others viewed it as draining money from “real” computing.

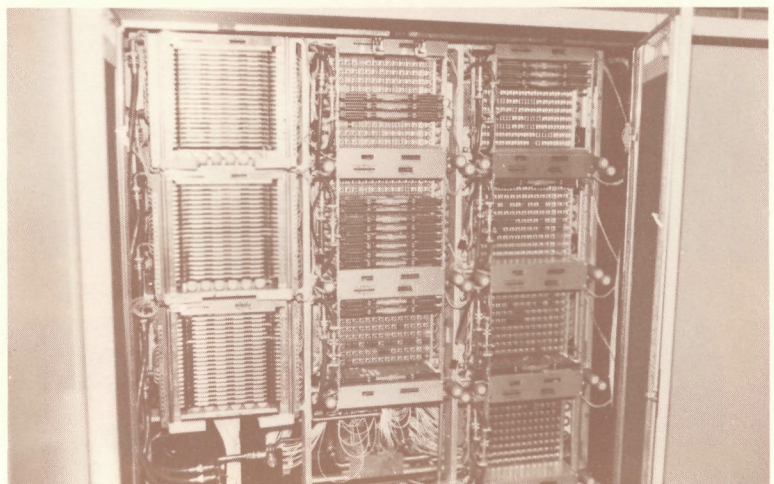
The 1980s: Bloomington Academic Computing Services (BACS)

Several events occurred in the early- to mid-1980s that were very significant to academic computing on the Bloomington campus. While a report of these years can probably be better provided in the future, the following provides a little history for the period from 1980 through 1986.

If parts of the 1960s and 1970s were the glory days of the operating system programmers, then the 1980s belong to our users. Those of us who have been involved in computing have reared our child, we think, well. The hardware is much more reliable, more powerful, and in many cases, cheaper. Partly because of the existence of the inexpensive microcomputer, software development has greatly matured and a whole new understanding about quality, “user-friendly” software has developed.



John Gerth (left) faces consoles for the CDC 855, CDC 172, Prime, and Vax, with CDC tape drives behind him. Jim Haskett is on the right. HPER Building, 1983.



The inside of the CDC 170/855 during installation, HPER Building, 1983.



Larry Jackowiak, Control Data Corp. engineer, stands by the CDC 170/855 when it was installed in the HPER Building basement, 1983.



LuAnn Sowder at the CDC 170/855 tape drives in the HPER Building basement, 1984. Consoles for the super-minis are in the foreground.

The first significant event occurred in 1981, when the Indiana State legislature granted the University \$6.5 million in bonding authority for the purchase of academic computing equipment. This resulted in the replacement of the CDC 6600 with a CDC 855 and the eventual addition of three Prime computers, eight Digital Vaxes, a campuswide network, and a statewide network allowing access from all regional campuses. (Dr. Prosser, a long-time participant in academic computing activities, played a major leadership role in obtaining this money.)

The second significant event was the appointment of Dr. Daniel W. DeHayes as Associate Dean (and later Dean) for Academic Computing, the first full-time, academic administrator for academic computing.

The third was the consolidation of the Marshal H. Wrubel Computing Center, the Small Computer Support Group, and the Office of Instructional Computing into Bloomington Academic Computing Services, under Dean DeHayes.

The fourth significant event was an explosive entry into the world of minicomputers and the almost totally interactive style of computing that their hardware and software is designed to support. Along with this came a decrease in the use of card equipment.

The fifth was the establishment of very strong programs for the ownership of mini- and microcomputers by academic departments, as well as the personal ownership of microcomputers for the University community.

The sixth significant event was the 1985 signing of an agreement with Digital Equipment Corporation granting the University a 45% discount on computing resources for the integration of (once again, but with a much broader definition) networking into academic computing throughout the Indiana University System.

The seventh is (again) an emphasis on the nontraditional computer user and the infusion of technology into the academic process.

The eighth is the integration of BACS services in one specially designed, state-of-the-art computing facility. Thanks to the untiring efforts of "move" coordinators John Gerth and Jennifer Bohmstedt, the office of the future has become the office of today. For the first time since the early 1970s, the academic computing staff is together under one roof. And for the first time EVER, Indiana University academic computing has moved out of the basement.

The Big Move: July 21-26, 1986

No one except computer center employees could have imagined what it takes to move a computer center 1.7 miles.

And many of those who did imagine it wish they hadn't.

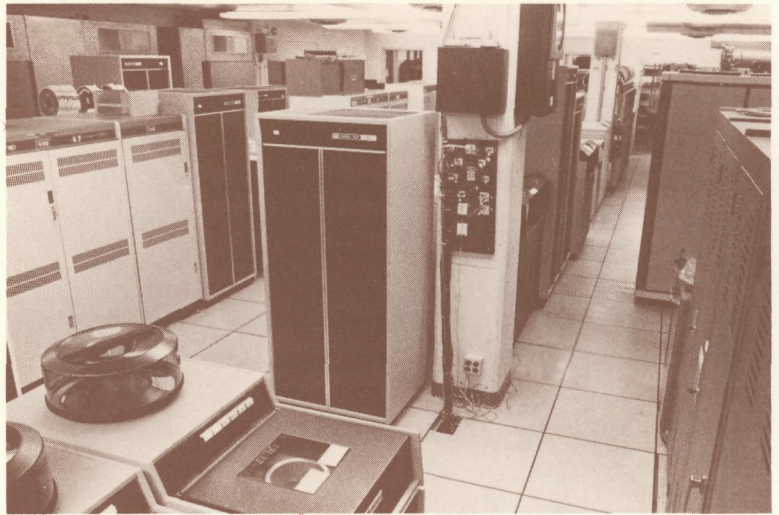
There really wasn't much time. In March 1986 the State legislature approved the \$4 million needed to remodel the old University Middle School Building, and Dean DeHayes announced that he planned to have the move of the Wrubel Computing Center from the HPER building take place in July 1986, the period of lightest usage of WCC facilities.

The Dean appointed Mr. John Gerth and Ms. Jennifer Bohmstedt to oversee the remodeling and the move. Their task was enormous. Working with architects and engineers, they designed a facility to house the fast-growing computer center and a BACS staff of some 85 full-time and 30 part-time employees.

Many other BACS personnel were also involved in this major move. Tasks like informing thousands of users of projected downtimes so they could plan their summer research and teaching, assigning special consultants to work with the "heavy" users, and developing contingency plans lest something disastrous occur during the move (How many nights of sleep did we lose over the possibility of a computer tipping or falling out of the moving van?)—all had to be planned and executed by staff who kept wondering how they themselves would react to the new "open office" concept.

Through the tremendous efforts of the WCC staff, and especially John Gerth, the move of the computing facility was carried out almost flawlessly. Detailed planning and commitment far beyond the call of duty paid off. The deinstallation, move, and reinstallation of twelve large computers, all peripheral equipment, and hundreds of miles of cable, were all completed in six days.

Unlike someone else who created something major in six days, John Gerth did not get to rest on the seventh day. He and many other WCC personnel continued to work their proverbial "26-hour days" until the job was done.



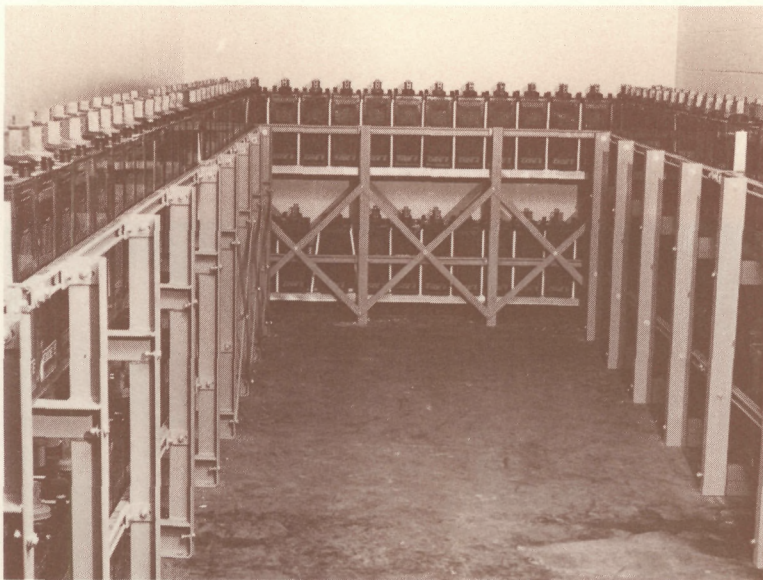
In the old Wrubel Computing Center in the basement of the HPER Building, computers and their peripheral equipment took up every available inch of floor space. By March 1986 when this photo was taken, engineers frequently had to move several pieces of equipment in order to make repairs or upgrades.



By May 1986 construction on the new Bloomington Academic Computing Services facility at Tenth Street and the Indiana 46 Bypass was well under way. New sidewalks were being poured while roofers, electricians, plumbers, and carpenters remodeled the building.



The raised computer floor for the new Wrubel Computing Center at Tenth Street and the Indiana 46 Bypass was built in June 1986. This special floor with removable panels shields the miles of heavy cables that connect and interconnect the large BACS computers, forming the academic computing network.



Over 170 high-powered batteries are used in the Uninterrupted Power Supply (UPS) for the new Wrubel Computing Center facility in the BACS Building at Tenth Street and the Indiana 46 Bypass. Electrical storms and power failures will no longer threaten critical data transmissions on BACS computers. (Photo taken at new BACS facility, May 1986.)



Easy does it! Loading the disk drives onto the moving van at the HPER loading dock, 21 July 1986. Avoiding excess vibration in the loading, unloading, and moving process was tricky.

Where Are We Going?— 1987-2000

If computing technology continues to change at its current pace, the remainder of this century holds possibilities limited only by our own imaginations. The phrase, "They said it couldn't be done," is disproven daily in the computing industry, where engineers, programmers, and manufacturers seem to be leaping over difficult, or even impossible, hurdles.

What will computing be like in the next decade? Let's look again, for a moment, at the past decade.

In the last ten years, the focus in computing has been upon the computer itself. BACS introductory courses teach programming techniques. Those who have acquired microcomputers have had to spend much of their time understanding operating systems and learning how to make their software work. Computer literacy—people understanding computers—has extended into all aspects of society.

The next decade will be very different. Computer literacy is a transient phase, to be replaced by people literacy—computers understanding people. Prices will drop while capabilities increase. Microprocessors already approach the power of our Vax and Prime supermini computers. By 1990 we should be able to purchase that power for the same money that currently pays for our personal computers.

In some cases, this power will be used for new applications, such as speech recognition and image analysis. In all cases, however, this power will be available for human interfacing. Thus, for example, when a novice user attempts to copy information upon a diskette that has been protected from overwriting, you might see this message: "To save your document on the diskette in the right-hand drive, the diskette must not be write protected. Remove the write lock tab (the silver paper next to the label) and try again"—instead of the type of "computerese" message you see today, "BDOS error xxxxx." Machines will tell you not only what is wrong, but also how to fix it.

Users who want direct access to an operating system will have that as an option, but menus, icons, and other visual aids will allow most users to deal directly with their applications.

Because computers will “understand” so much about people, people will be relieved of spending so much time *understanding* the computer. They can then focus upon applying the computer to their work.

Just as the telephone has brought the people of the world together through voice communication, the growing international computer network is making it possible to transmit data (and, thus, services) across geographic boundaries. In many countries of the world you can use your home computer to do banking and shopping, to order tickets to theatre and sports events, to read bulletin boards of upcoming community events, to communicate worldwide with friends and colleagues through electronic mail, to access databases and retrieve information about the latest stock prices, journal articles, chemical patents, doctoral dissertations, telephone numbers, or baseball scores.

The net effect of these changes is a significant broadening of the scope of computing. The IU community is no longer limited by resources available on the Bloomington or regional campuses; our computer network is being tied to an ever-increasing number of networks with hundreds of different services.

The People Behind the Computers

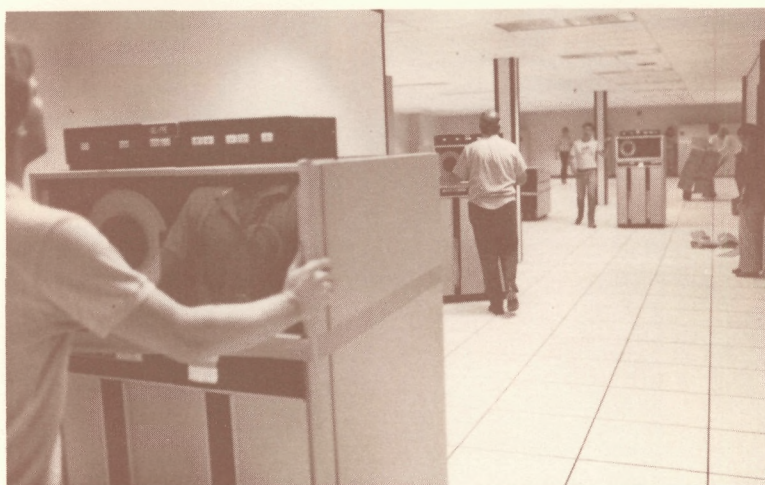
The history of academic computing at Indiana University may sound like a tale about machines, but it's really a story about people willing to take risks. Inventors, pioneers, explorers of unknown territory excited about possibilities, many of the people who brought computing to its current place were simply not content when things “couldn't” be done.

The contributions of the people mentioned in this history can be measured in terms of time saved, research dollars funded, and dollars spent on technology, but the intangible contributions—those of knowledge acquired, thought processes simplified, and pride of accomplishment—cannot be measured.

Indiana University has always focused its efforts on teaching, research, and service. The dedicated and brilliant people mentioned here have contributed to those efforts in a very special way. They have made an intricate and powerful technology available to the entire University community, and, lest we overlook the obvious, they have brought academic computing up from the basement.



Both heavy and delicate, computers required special care during the move from the old HPER facility to the new Wrubel Computing Center home at Tenth Street and the Indiana 46 Bypass, 21 July 1986.



The wide hallway into the machine room of the new Wrubel Computing Center facility made “moving in” on July 21 almost easy! Movers, engineers, and BACS staff worked quickly and efficiently to reinstall the CDC Cyber, Vaxes, and Primes.