

REGNECENTRALEN - A DYNAMIC WORKSHOP IN DATAMATICS

Regnecentralen was established in 1955 by Denmark's Academy of the Applied Sciences as a non-profit institution, from which, it was envisaged, an independent Danish contribution to information processing could emerge. Later, this idea won the support of Denmark's leading business, industrial, and financial organizations, when Regnecentralen was re-established as a limited company in 1964 in order to create the economic basis needed for its further realization.

Since producing the country's first computer in 1957, Regnecentralen has become not only the undisputed locus of Denmark's computer industry, but also one of the most versatile and experienced information processing firms in Europe.

Since its inception, Regnecentralen has been active in four major areas of information processing:

Systems Development

- hardware systems for information processing and control applications of many kinds
- software systems for effective utilization of hardware systems (Algol, Cobol, Fortran, monitors)

Manufacturing

- computer systems: Dask, Gier, RC 4000
- special equipment: RC 1100 Scanlog System, RC 1600 Graphic Converter, RC 2000 Paper Tape Reader, RC 3000 Converter System

Service

- at seven bureaux in Denmark, Norway, Sweden, and Germany
- with a total of eleven computer systems and four off-line RC 3000 converter systems

Education

- open courses: orientation, basic, advanced
- closed courses for special groups.

Hardware Experience

The RC 4000 is the third computer system developed by Regnecentralen. Originally instituted "to acquire or construct and operate computing machinery," Regnecentralen gained first-generation experience by building a vacuum tube machine, called Dask, and using it for scientific computation and administrative data processing. Dask, Denmark's sole computer until 1960, was in operation as late as 1967. Parts of it are displayed today at the Museum of Technology in Elsinore.

In 1962 Regnecentralen began the manufacture of the Gier computer, a second-generation machine, based on transistor technology, the first of which had been developed as a special project for the Royal Geodetic Institute. Regnecentralen developed software as well as peripheral devices for both of its computers, but whereas Dask remained unique, some forty Gier computer systems — equipped with a large array of input/output devices, an extensive software library, and one of the most effective Algol compilers in existence — are now installed in Scandinavia, Germany, France, Australia, Poland, Hungary, Czechoslovakia, and Bulgaria.

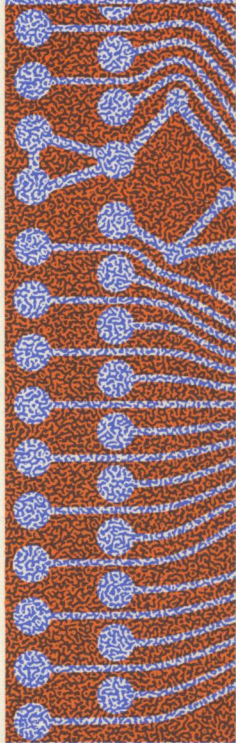
Many of Regnecentralen's products — software as well as hardware — have originated as special projects, or have been developed as solutions to particular problems. The RC 2000 paper tape reader is a case in point.

The typical mechanical tape reader must be activated by the computer each time it is to read a character, after which it must stop the tape before the next character and wait for the computer to activate it again. This technique requires a system of mechanical clutches and pinch rollers, results in a series of abrupt starts and stops, and limits the reading speed to about 1000 characters/second.

The RC 2000, developed as a solution to these problems, employs few mechanical parts, its chief component being a solid-state buffer store of 256 characters. The tape is advanced by a servo mechanism, which regulates the tape speed according to the number of characters in the buffer: if the buffer is empty, the tape is advanced at full speed; as the buffer is filled, the speed is reduced. Thus it is possible to start and stop the tape gradually, as subsequent characters are stored in the buffer till the computer is ready for them.

This electronic solution, which enables tapes to be read at 2000 characters/second, has resulted in considerable sales of Regnecentralen's tape reader. The RC 2000 is available with interface for all major computer systems, and some 500 are now installed throughout Europe and in South America, in part through original equipment manufacturer agreements with Univac, Olivetti, Saab, Honeywell, and others.

```
length:= 3
end
end KOP proc;
open (master,
open (new_master
open (transact
comment
inrec (master,
inrec (transac
next;
if master (1)
begin comment
newrec (new
new_master (
new_master (
new_master (
inrec (transa
go to next
and 5;
if master (1)
begin comment
newrec (new
```



Software Experience

Recognizing at the outset that the effectiveness of information processing systems depends on an integration of hardware and software, Regnecentralen assumed a leading role in the development of the Algol language, and following the publication of "Report on the Algorithmic Language ALGOL 60," produced an Algol compiler for Dask in 1961.

Regnecentralen's subsequent software development has been varied and extensive. Apart from its first compiler, for Dask, and its most recent one, for the RC 4000, Regnecentralen has written compilers for American, German, and Swedish manufacturers, while developing no less than four versions of the Gier Algol compiler. A Fortran 4 compiler is currently being written for the RC 4000.

Related development includes: symbolic assemblers, utility programs, general file maintenance and sorting programs, process control systems, time-sharing monitors, and software libraries. The Gier system library has grown continually, since the computer was introduced, and now includes over 400 items covering scientific, technical, and administrative applications. As for the RC 4000, a sizeable software development is anticipated in connection with the installation of these machines in Regnecentralen's service bureaux in replacement of the Gier systems now in use.

The development of application programs for the service bureaux also constitutes a major area of activity. The bureaux, incidentally, are an indispensable proving ground, where new methods are tried out and new problems formulated as a basis for further development. Programs developed include both scientific computation and administrative data processing, often taking the form of standard systems that can be used by many customers. The programs now employed are among the most advanced and flexible found anywhere, being based on methods devised by Regnecentralen in close collaboration with highly qualified users.

Regnecentralen's standard systems cover such areas as payrolls, banking, housing administration, sales analysis, auditing, network planning (Pert), information retrieval, road building, surveying, and mathematical statistics. In addition to standard systems, Regnecentralen has developed numerous programs for individual customers, among the more advanced of which are production planning programs and integrated management information systems.

The Third Generation

Having evolved two generations of hardware and software, Regnecentralen undertook in 1965 to develop a hardware configuration and time-sharing system for a chemical plant being built by the Danish engineering firm Haldor Topsøe at Pulawy in Poland. The result of this combined hardware-software project was a new computer, implemented in monolithic integrated circuits and oriented toward real-time operation in industrial

control systems. Since the summer of 1967, this first RC 4000 has continuously supervised the Pulawy plant, the largest ammonium nitrate factory in Europe, in the following ways:

Every five minutes the computer performs alarm monitoring by scanning and checking some 250 process variables against prescribed alarm limits. Every hour the computer prints two log reports on all process variables in the plant (about 600); at any time the operator can call for trend logging of a single variable. Every eight hours the computer prints a process evaluation report on 135 material balances as well as production and consumption figures for the period. In idle intervals the computer performs self-checking of basic hardware functions to detect and report possible malfunctions.

A flexible time-sharing system permits independent task programs for alarm monitoring, data logging, and production of reports to be executed on a regular schedule. One of the task programs keeps the control typewriter operative continuously so that the operator can type an instruction to the system at any time. Major operator options are: selection of start time and frequency of each task; exclusion of analog and digital inputs from one or more production lines; change of scale factors and alarm limits of analog inputs; and selection of alternative output devices for printing of log and balance reports.

A Dynamic Workshop in Datamatics

From the very beginning, when a staff of seven undertook the building of Dask, Regnecentralen has had the character of a workshop, a dynamic workshop in datamatics. Here, individual freedom to experiment and to create has top priority. Here, too, a lively interplay between theory and practice in major areas of datamatics has taken place continuously for three computer generations.

This roomy environment has enabled Regnecentralen to tackle many special problems, often in a pioneering way, producing a kind of experience that gives Regnecentralen a decided advantage over large-scale manufacturers who are forced to deal in general-purpose solutions.

Regnecentralen's workshop environment has also enabled it to engage in a diversity of activities — systems development, manufacturing, service, and educational programs for Danish business, industry, and science. With everything under one roof, so to say, Regnecentralen is able to offer — as few others can — truly integrated solutions to problems of information processing and control, solutions that match the integration of hardware and software essential in modern applications.

RC 4000[®]
COMPUTER