

TELEPROCESSING

A UNIVERSITY TELEPROCESSING SYSTEM BASED ON RIAD COMPONENTS

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A teleprocessing system connecting 4 RIAD-computers and a terminal network is working in the regional educational computing center at the József Attila University (JATE, Szeged, south-east Hungary) since 1978 providing services for other educational institutions as well. In the paper the application fields, the hardware and software components, the system architecture and experiences are presented. A special attention is paid to the communication control software developed by the Laboratory of Cybernetics of JATE.

Institutional training in computing techniques was started in 1957 at the József Attila University (JATE, Szeged), first in Hungarian high school education. The main task of the Laboratory of Cybernetics of the University, established in 1963, is to provide the technical basis for this education, besides research activity. For practices different computers have become available since 1963, following the increase of the requirements. The central computers ES-1040, ES-1010 of the present system were installed in 1975-76 and they were planned to be the core of a regional educational computing center. Our aim was to develop a teleprocessing system based upon this hardware, which can meet the users' needs for a longer period, i.e. the needs of the students and teachers at the JATE as well as at other educational institutions in south-east Hungary.

FIELDS OF APPLICATION

The main application fields are as follows:

In *education* a group of 250 students of the JATE, specialized in computing sciences use most intensively the system. The majority of their tasks is connected with the exercises of specific courses (programming, numerical mathematics etc.) and with their diploma work; preparing, debugging and running programs. The role of these exercises is to give experience in using and constructing operating systems, data and program structures, programming languages, algorithms, programming techniques. A further group comprises the students of the JATE and of other high schools participating in user-training.

As a second field the *research applications* have to be mentioned. University assistants, on the one hand, extensively use problem oriented program packages (statistics, numerical mathematics etc.) and on the other, develop special programs to solve computational problems related to research and development work.

The fields mentioned above have a cyclic effect on the system's

workload. *Conventional data processing* (and program development for this purpose) plays the role of the buffer. At the same time this activity of the university computing center ensures a connection with the real world as well.

The requirements coming out of the previous tasks are met by the hardware and software facilities outlined below.

HARDWARE

The *central resource* is the computer ES-1040, with a core memory of 1024 Kbytes capacity, one byte-multiplex and three selector channels, eight disk drives (7.25 Mbytes/disk), six tape drives (800 bpi), three card readers, two line printers, paper tape station and a console typewriter.

The computer ES-1010 is used first of all as a *communications processor*. It is connected with the multiplex channel of the ES-1040 by a channel-to-channel adapter CCA. Besides the basic peripheral units (operator's console, paper tape station) additional devices (disk drive of 800 Kbyte capacity, line printer, UCC incremental plotter, four-channel analogue input) were attached to it in order to enhance its capability in software development and special research tasks.

In the *set of terminals* the 11 VT-340 CRT terminals placed in the students' terminal room near the computer room play a specific role. Utilizing the short distance they are connected with the communications processor by high-speed parallel interfaces. Further four VDT type terminals are at the disposal of the fellows of the Laboratory. Four VDDS/AP-72 and two VTS-56100/AP-70 units and two ES-1010 computers at remote sites in other institutes and high schools are connected with the system by telecommunication lines (through the communications processor as well). The remote small computers in the teleprocessing system can be considered as concentrators, controlling 4 VT-340 terminals each. The control programs are running in a multiprogramming environment, therefore this function does not affect essentially the local processing. The teleprocessing system is displayed in Figure 1.

SOFTWARE

The ES-1040 is run under the OS 21.8F operating system in MVT. The teleprocessing services of the CRJE and TSO as well as the BTAM and TCAM macros are available. In addition to the usual operating system components the compilers of CDL2, PASCAL and PROLOG can be used. In education the PL/1, PASCAL, FORTRAN and ASSEMBLY languages are preferred.

For the computer ES-1010 a new program system was designed and developed in the Laboratory of Cybernetics for the control of the heterogeneous, continuously growing teleprocessing system allowing the parallel use of the ES-1010 central processor and peripheral units for other purposes as well. The critical point in this development was constructing and adding a CCA-handler to the ES-1010 operating system. This handler makes possible the parallel, many-to-many connections between programs in the two computers and it is available both from system and user programs. The new software components work under a standard RTDMFE monitor and the FMS-10 file management system. They provide the following *fundamental services*.

REMOTE DEVICES

COMPUTER ROOM

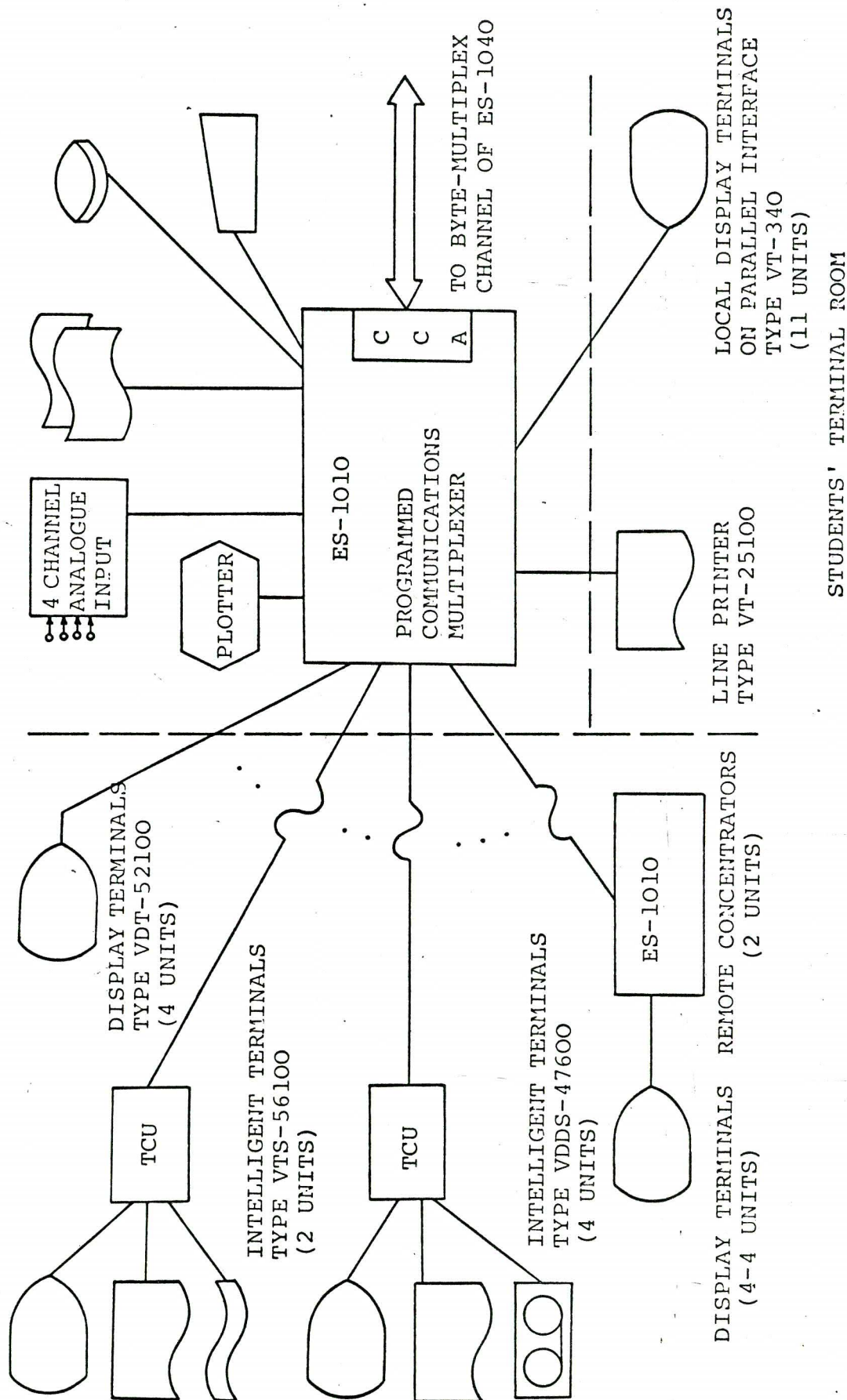


Figure 1

TERMINAL NETWORK OF THE JATE REGIONAL EDUCATIONAL COMPUTING CENTER

a) *Communication control*. The program CRTSO (Figure 2) controls the communication between the terminals and the ES-1040 when the services of the CRJE or TSO are in use. This program supports all types of terminals in the system (VT-340, VDT, VTS-56100, VDDS, ES-1010) admitting point-to-point or multipoint connection. A stand-alone section of it directly connects the line-printer of the ES-1010 (which is in the terminal room) with the writer-task of the ES-1040 allowing the users to get their printed output without the intervention of the computer room personnel. The control program CRTSO is run in a foreground partition of 9 Kbytes, supposing 26 terminals.

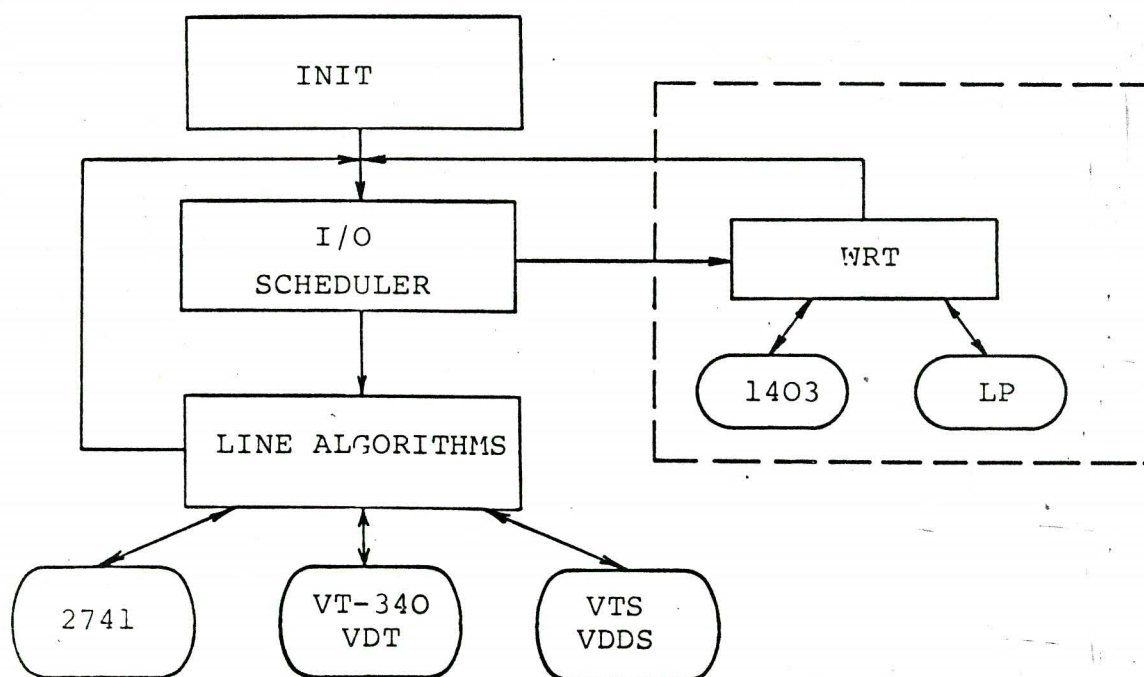


Figure 2
Control scheme of program CRTSO

The TCON programs on the remote concentrators support 4 communication lines with AP-70 algorithm. They concentrate (deconcentrate) the transfer from (to) their own local (or remote) terminals, running in a foreground partition of 1 Kbytes. (This program was developed by the Computing Center of the Medical Highschool, Szeged and the Laboratory of Cybernetics.)

b) *Using the ES-1010 as a satellite computer*. The EDITRJE subsystem developed for ES-1010 provides versatile text editing facilities on the terminals attached by parallel interfaces, with a job entry to the ES-1040 background processing. Its library is available direct from the compilers. This subsystem is a very useful means for writing and testing programs first of all on ES-1010.

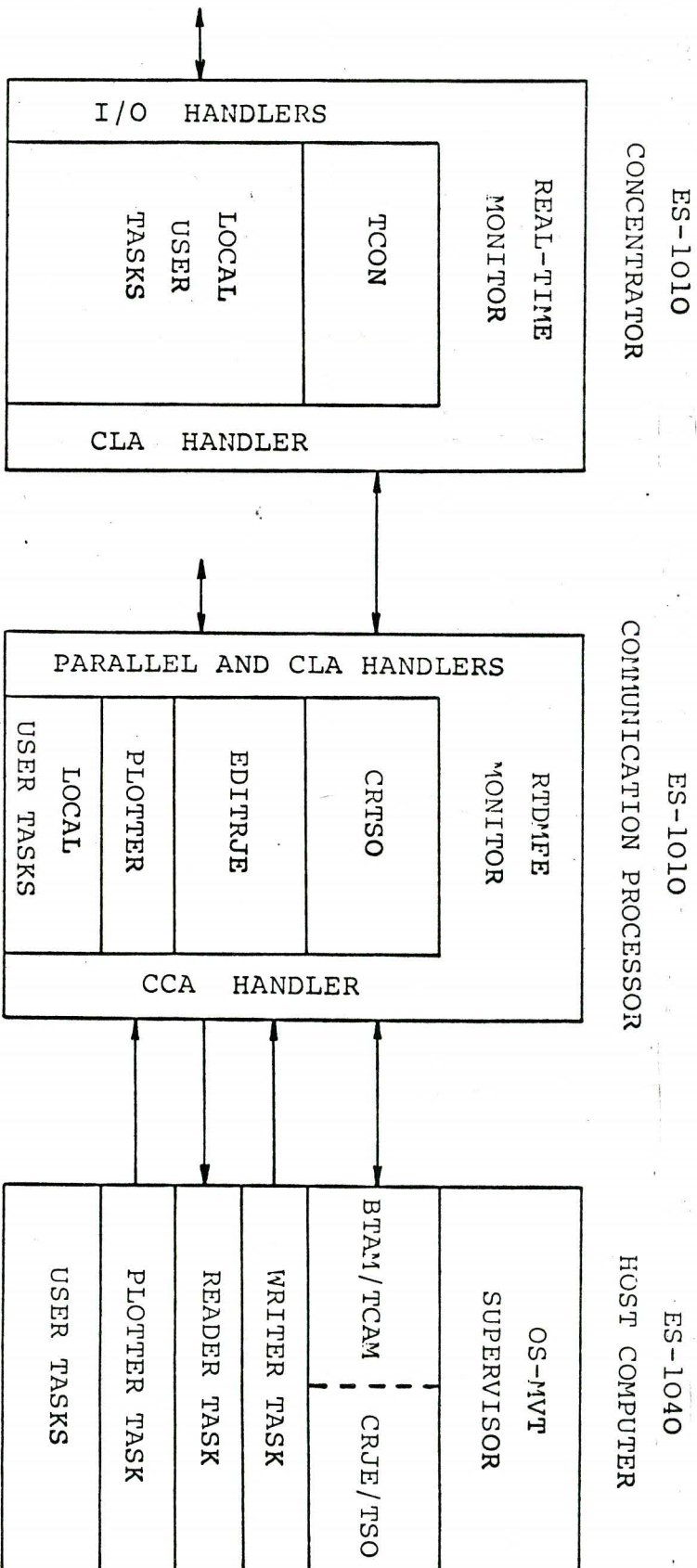


Figure 3

SOFTWARE COMPONENTS

RTDME - Real-time disk operating system
 CRTSO - Terminal control task
 EDITRJE - Text editor task
 PLOTTER - Graphic output interpreter

c) *Background processing.* The graphic output is mentioned just as an example. The on-line UCC plotter is controlled by an interpreter run on the ES-1010, interpreting and performing the statements of the graphic output, produced by FORTRAN subroutines.

Due to the design and architecture of the ES-1010 software developed in the Laboratory of Cybernetics (see Figure 3) all the above functions are available at the same time. Therefore the following facilities are at the disposal of the users:

on computers (ES-1040, ES-1010-s)
local background processing

on terminals connected by parallel interfaces
ES-1010 text-editor
remote job entry to ES-1040
CRJE/TSO (entry to background processing on ES-1040)

on all the terminals
CRJE/TSO (entry to background processing on ES-1040).

EXPERIENCES

The installation of the teleprocessing system had a significant influence on the students' work:

- the interactivity as compared to the batch processing is a fundamental change in the excess to the computer,
- the syntax checkers make easier and faster the solution of the programming exercises,
- as a result of this the number of the exercises solved has considerably increased, together with the number of students' jobs performed (10000-12000 per semester, 1000-1200 per week in the urgency periods),
- the students have the possibility to be acquainted with the up-to-date means of program development and computing,
- they can perform their work according to specific individual schedules, adjusted to their personal obligations, interest and tempo.

The existence of the terminals in the other supported (educational and research) institutions, the fact that the facilities of a large system became available on the spot, caused a favourable change in the role of the computing techniques in research and education. With the help of these terminals a great deal of future specialists and users is trained in real computational environment.

As far as the resources are concerned, for such a number of users the disk storage devices (ES-5052) proved to be critical. Besides the capacity problems even the reliability of the system is depending first of all on them. The components of the teleprocessing subsystem (VIDEOTON processors, modems and terminals) fairly meet the requirements.