Ulisse: An Italian project for a multifunctional terminal system

R Cerretti - University of Camerino, Italy
D. Jasilli - CNUCE, CNR Institute, Pisa, Italy
D.R. Matteucci - CNUCE, CNR Institute, Pisa, Italy

T e paper has been prepared and printed on a Ulisse system.

Abstract

The paper describes a project conducted in collaboration between CNUCE, an Institute of the Italian National Research Council, and a private research center, concerning a multifunctional system (Ulisse) capable of operating both as a stand alone unit for office administration and automation (word processsing, file management and retrieval) and as an intelligent terminal with local facilities for text editing, text formatting and storage.

The first results of the application of Ulisse in the environment of the scientific users of CNUCE are illustrated.

1 Introduction to the Ulisse project

CNUCE is an Institute of the Italian National Research Council.

The National Research Council (CNR) is a Public Agency, having a corporate existence and autonomous administration, placed at the service of the Presidency of the Council of Ministers.

CNUCE began its life in July 1965 as "Centro Nazionale Universitario di Calcolo Elettronico" of the University of Pisa.

From November 1973 it has been the scientific computing center of the CNR.

In this new situation CNUCE is the largest computing center in Italy for automatic data processing in research activities.

The main objectives of CNUCE are the supplying of DP services for scientific and technological purposes and the support and performing of researches and studies in the sphere of applied computer science.

The Ulisse project is the result of a collaboration between CNUCE and a private research center.

The project which is known as the "Ulisse project", was started in June 1976 with the aim of designing and developing a "universal" terminal system which could meet the various needs of the average user of a big non-commercial computing center operating in a time-sharing environment.

The typical user of this kind of computing center has certain needs which are generally non-specific and very common; these needs are:

- documentation on programs
- writing of scientific and technical papers
- free accessing to proprietary files
- information retrieval in large, remote-accessible files (program library, bibliographic data bases etc.)
- availability of programs locally and on easily transportable medium (in place of punched cards)
- availability of a limited quantity of permanent disk space
- local printing of a limited quantity of information

The ideal terminal system to match most or all of these demands would have:

- very strong local data handling capabilities (for data preparation, text editing, file management)
- local capability for storing and easy retrieval of data and programs
- fair or good printing speed
- good quality of print
- cheap and interchangeable storage medium
- some text formatting functions
- batch and interactive mode of operation both easily available and user eligible

Ulisse is a system designed to satisfy most or all of these needs; it has a CPU, a writable storage, a magnetic auxiliary storage, a reasonable printing speed, a good printing quality (full-body), and a program library for off-line use which, from a limited original use, is progressing towards objectives which far exceed the initial scope of the first design.

Ulisse is a microprocessor based system, which can be used both stand-alone, as a terminal, and as a distributed system (a network of Ulisse).

Its architecture is based on a standardized control card containing the CPU, 4 kbyte RAM memory, 1 kbyte ROM memory. The use of RAM memory makes the system very flexible and inexpensive: the same control card is used in may very different ways according to the particular application, thus lowering the cost of the hardware and its production and giving the system maximum flexibility of employment.

Distributed system can be easily assembled by adding, to any new device, an individual control card which communicates with a central control card normally handling auxiliary storage and communication lines.

2 Ulisse's hardware

The block-diagram in fig.1 shows Ulisse's architecture and data links. The system is based on the following components:

- the CPU of the system is a model 8080A INTEL microprocessor

- 1 kbyte Read Only Memory (specifically EPROM) containing the system's programs: the Initial Monitor Loader, the physical input-output control programs (e.g. the disk driver) and some utility routines

- 4 kbytes Random Access Memory containing application programs

A Data Bus connects the CPU with the interface of various peripheral devices; these devices are:

- standard typewriter keyboard
- serial printer (daisy wheel printing element)
- magnetic disk storage (floppy disk)
- alphanumeric video display unit and keyboard
- paper tape reader
- serial interface to the telephone line (modem)

4 Functional characteristics

Ulisse is a multifunctional system capable of working under many different conditions; it acts as an intelligent terminal and-or as an independent system for office automation and administration management.

Typical application packages are:

Text editor
Text formatter
Interactive [terminal]
Batch [terminal]
Data Entry System
Administrator
File Handler

The Monitor is the supervisor of the system and is entered directly at power-on time through the Initial Monitor Loader, and during normal running whenever other programs are exited.

4.1 Monitor

In the Monitor environment the user can have the catalog of all files stored on disk memory; may erase one or all disk files; may have the length of a defined file; may copy one or more "source" file(s) onto a "destination" file; may type on the printer the content of a file; may cancel the entire disk file library.

Furthermore, the user can enter a different environment simply by typing the keyword of that environment e.g. "Ed" for editor and so on.

See Appendix A.1 for the complete list of Monitor commands.

4.2 Text-editor

In the Editor environment the user may write new files or modify existing files; the file-name of the file one wants to work with is specified as the operand of the Monitor command which allows the user to enter the editor environment; if the file is a new file, the file is generated automatically. Ulisse's editor is substantially a subset of the 370-CMS Edit system.

See Appendix A.2 for Text Editor commands.

4.3 Text-formatter

Files previously defined may be printed with various formats through commands of the Text Formatter environment. The user can easily modify the printing format, both by inserting special commands and control characters in the text of the file to be printed, and by specifying a command string before starting the print session.

It is also possible, at print time, to give the system text lines directly from the keyboard (e.g. a variable letter heading): this is a very useful feature rarely present in text-formatting systems; the string input from the keyboard is output only when the entire line is printed with its own specified format, defined at file editing time.

Ulisse's Text formatter is similar to the 370-CMS Script system.

See Appendix A.3 for the complete list of Text Formatter commands.

4.4 Interactive [terminal]

Ulisse acts as an interactive terminal (emulating 2741, TTY or many other similar terminals) when in the Interactive environment.

In this environment, however, Ulisse has the further capability of sending files previously stored directly on its disk memory to a central computer and can receive files from the remote computer directly onto the floppy disk; in both cases, it is possible to have, via the printer, a hard copy of the information transmitted or received. The user is aware of the transmission of files to or from the computer through an audible signal, in absence of the printed copy.

See Appendix A.4 for the interactive operation commands.

4.5 Batch [terminal]

Ulisse can be used also as a batch terminal (with 2780 or 3780 protocol); the user can select the mode of operation simply by typing the appropriate commands on the keyboard

entering the "Batch" environment

In this environment, Ulisse emulates 2780 operations (or those of similar devices): files from the floppy disk can be sent to and received from the main computer.

4.6 Commercial packages

A number of new packages are now being developed. These packages allow a very diversified use, and range from billing to general ledger, to stock handling and so on.

The commercial system is based on various modules: each of them makes use of a common Data Entry System (D.E.S) which permits writing under specified formats and controls the data files to be used locally or sent to the computer through the terminal functions.

A completely new language now being tested allows the user to build his own solution for each application, instead of using rigid procedures written by software makers: the user is not forced to learn any programming language, but only to familiarize with a new way of describing his work to Ulisse. The only limitation to Ulisse's use in a very big volume application is the auxiliary memory size, that is the limit of the floppy disk as a mass storage.

The D.E.S., Administrator and File Handler functions are being tested at the present time and cannot be further described in this paper.

5 Ulisse in the CNUCE computing system

The CNUCE computing system is made up by a 370-158 and a 370-168 system and by a vast data transmission network which is extended through Italy. The 370-168 system which is managed by the VM-370 has the task of managing all the terminals, both interactive and batch. The 370-158, managed by the VS2-HASP system, is responsible, in batch mode, for the heavy production load. The two systems are physically connected by a line at 40800 bps; logically the connection is made between a virtual machine of the 370-168 which controls a HASP Work Station simulating the BSC Adapter, and the HASP RJE on the 370-158. The two operating systems, central HASP and HASP Work Station, have been suitably modified in order to make possible the exchange of

information data and programs between the two computer systems.

The data transmission network is realised by means of a series of Time-Division Multiplexers working on leased lines at 9600 bps, capable of managing both interactive and batch terminals at speeds varying from 110 to 2400 bps according to the particular needs of the users in the geographical area where the TDM is installed.

5.1 Considerations on the interactive service

The interactive service is offered to the users from 8.00 a.m. to 12.00 p.m. from Tuesdays to Fridays and from 2.00 a.m. to 12.00 p.m. on Mondays. The service is therefore active for monthly average of about 300 hours. The number of virtual machines defined on the system is generally about 500.

In the diagrams in appendix 2, the trend of the average load of interactive terminals in a day, the average CPU time and the hours of connection debited monthly to the interactive users are all shown with the CPU time and connection time ratio relevant to the period January-September 1976.

5.2 The utilisation of Ulisse

What can be expected from a heavy utilisation of a terminal of the Ulisse type?

Although the period of time since the first prototypes of Ulisse were introduced is still too short to be able, at this point, to make a definite evaluation, a first consideration and analysis of the data so far obtained seems to demostrate the following:

a) the terminal load on the system during the day (and consequently also the average load) is reduced because all the editing and text formatting functions can be performed at the periphery.

b) the CPU load is also reduced, although, as the editing time is relatively small on the CPU, this reduction is not very evident. However, as far as the connection time is concerned, a total reduction can be expected as connection is only necessary when files and information are being exchanged between the central memories and the Ulisse floppy disk.

Thus we have a more rational utilisation of data transmission network, with requests for connection time which, although more frequent, are of much shorter lenght.

c) The most concrete advantage is represented by the saving of disk space. With the constitution of decentralised user archives, the central permanent archives are clearly greatly reduced and the user will have disk space at their disposition in the central system only for the time of actual connection.
If there are 500 virtual machine, each having an average disk space of 10 cylinders of 3340 disk unit and with a peak load of 80 users contemoraneously, the use of the CNUCE central system is of 5000 cylinders with a maximum contemporary use of 800 cylinders; in these conditions the ratio of effective use is 16%.
The constitution of peripheral archives on terminals of the Ulisse type can lead to the improvement of this utilisation ratio to values very close to 100%.

6 Use of Ulisse for non numeric application

Beyond the application of Ulisse as a computer terminal at CNUCE, and those in the business field e.g. word processing, office automation, etc. a system with the characteristics of ULISSE can be succesfully used as a data entry device for many non numeric computer applications in the field of the humanities.

An important role of CNUCE's research activity is in the field of computational linguistics, where great importance is given to devices which process non numeric data and texts.
The complete input cycle involves pre-editing, transcription and input, correction and editing, and is at the present expensive and time consuming. Until now the input has been

made through punched cards, and the verification and correction of data has been mainly executed using computers with a strong human interaction.
Consequently the time for data input and the related costs are high. The advent of new devices such as ULISSE, used as data entry system, means that it is possible to overcome these deficiences.
Single or multi-station key-to-disk system, with text editing and text formatting features, offer facilities far beyond those of card punchers and represent a very good solution.

In this respect, ULISSE is the first intelligent terminal to incorporate locally very strong text editing and formatting facilities previously available only on much bigger systems.
the validity of ULISSE is being, tested, at the moment, in the preparing of files of linguistic data.

APPENDIX A:

System commands

In the following sections the various environment commands are described: when is a given environment, the user activates the corresponding function by typing (or keying on the video console keyboard) the first characters of the command as presented between < > in the following functional description.

A.1 Monitor commands

Catalog	the disk file directory is printed
Erase filename	the file named is erased from disk memory
Length filename	the file length is printed: the number of tracks used and the byte occupation of last track used are given
Copy dest-file	one or more "source" file are copied onto a "destination" file
Copy *	the content of the diskl is copied on the disk2 (in the two disks configuration)
Type filename	the named file is printed with or without the row number
Clear	the complete disk library is cancelled
Free	the number of free disk trakcs is given
Edit filename	enters the Editor environment
Tf filename	enters the Text formatter environment
Interactive	enters the interactive environment
Batch	enters the Batch environment

A.2 Text-Editor Commands

Input	
Top	position the editing process to the first line of the text
Bottom	moves to the bottom line of the text
Delete n	removes the specified number of lines from the file
Next	prints the next line (moves forward in the text by a specified number of lines)
Change	locates any specified character string in the current line and replaces it with a new character string
Locate	finds a specified string of characters and established the first line in which it occurs as the current line
Go n	positions the editing process at a specified line number
Type n	prints the specified number of lines of the file (less then 256)
X	controls the function of the following Type command (the line number is printed before each line)
Y	annuls the previous command
Quit	exits from Edit without saving file on disk

A.3 Text Formatter commands

The following commands are inserted in the text at Text-Editing time.
A command line is preceded by a full stop (.).

Particular characters to be inserted in the text:

/ carriage return
$ carriage return with indentation
~ space between words is not to expand

ll	line length (number of characters per line)
pl	page length (number of lines per page)
tm	top margin (number of blank lines at the top of the page)
lm	left margin (number of blank characters on the left)
bm	bottom margin (number of blank lines at end of page)
fp	first page (first page of impagination)
pn	page number (number with which page numbering should begin)
pd	page number down (page number is not printed)
pu	page number up (annuls the previous command)
ii	input line (transfer new text from the terminal to the current location in the text)
in n	indent (gives a new value to indent character)
c	change indent character
c	change slash
sp	space number (changes the space between the lines)
np	new page (begin new page)

sd script down (not to be scripted)

su script up (annuls the previous command)

st stop (stops printing at end of each page)

co n column (moves printing to the right to the specified value)

A.4 Interactive environment commands

Baud 300	defines the transmission speed at 300 bauds (the default value is 134.5 bauds)
Echo on	the file transmitted or received is printed
Echo off	the file transmitted or received is not printed
Open	opens the transmitting or receiving session
Close	closes the transmitting or receiving session
Reset	restart the operation
Go	enables the line
Control G	starts the transmission
Control D	End of Transmission
Quit	leaves the interactive environment

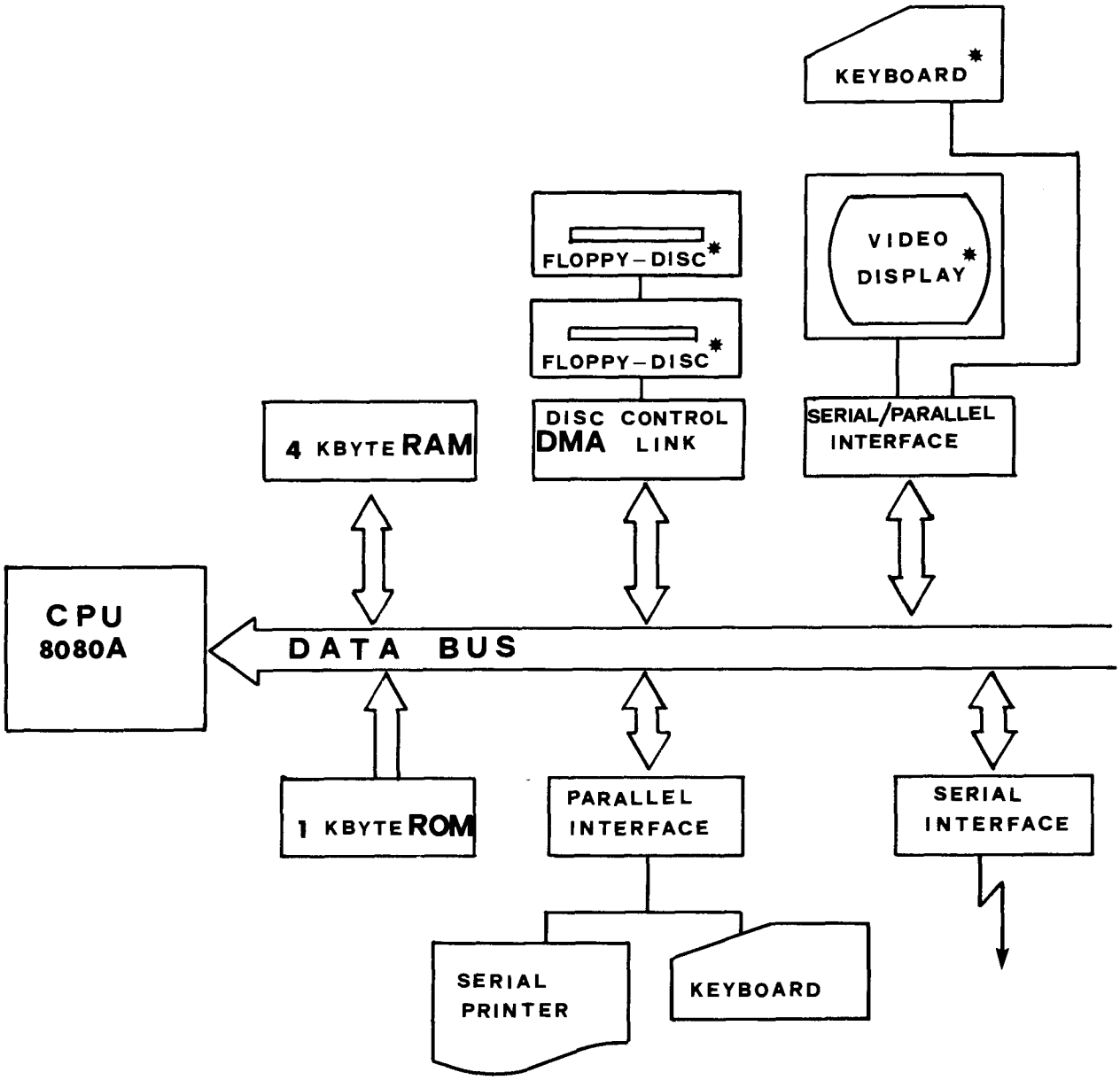

FIG. 1 ULISSE'S BLOCK DIAGRAM & ARCHITECTURE IN THE STANDARD CONFIGURATION

* FLOPPY DISC MAY BE 1 TO 6 UNITS

VIDEO AND KEYBOARD MAY BE 1 TO 8 UNITS

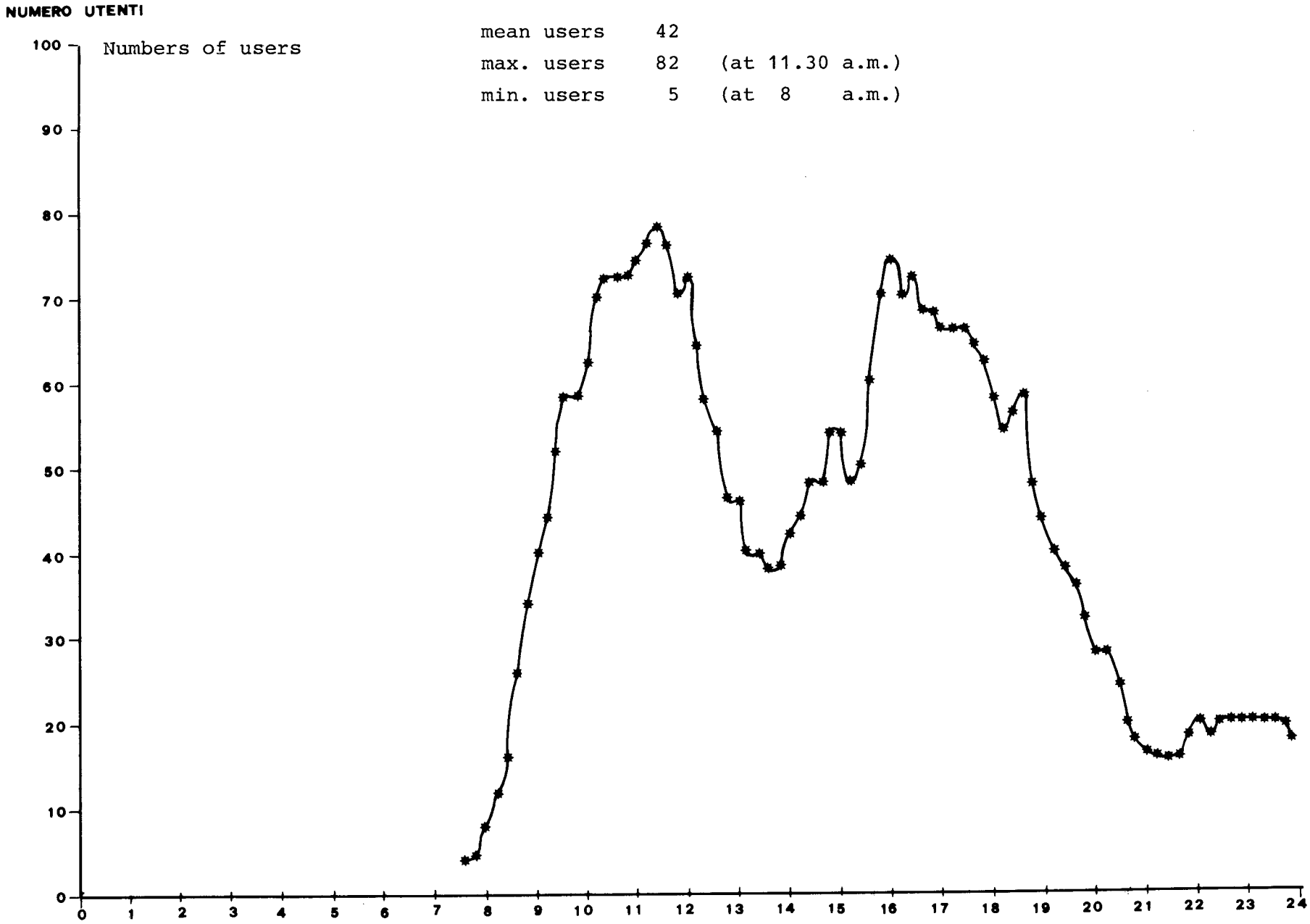
NUMERO UTENTI
Numbers of users
mean users 42
max. users 82 (at 11.30 a.m.)
min. users 5 (at 8 a.m.)
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

Fig.2

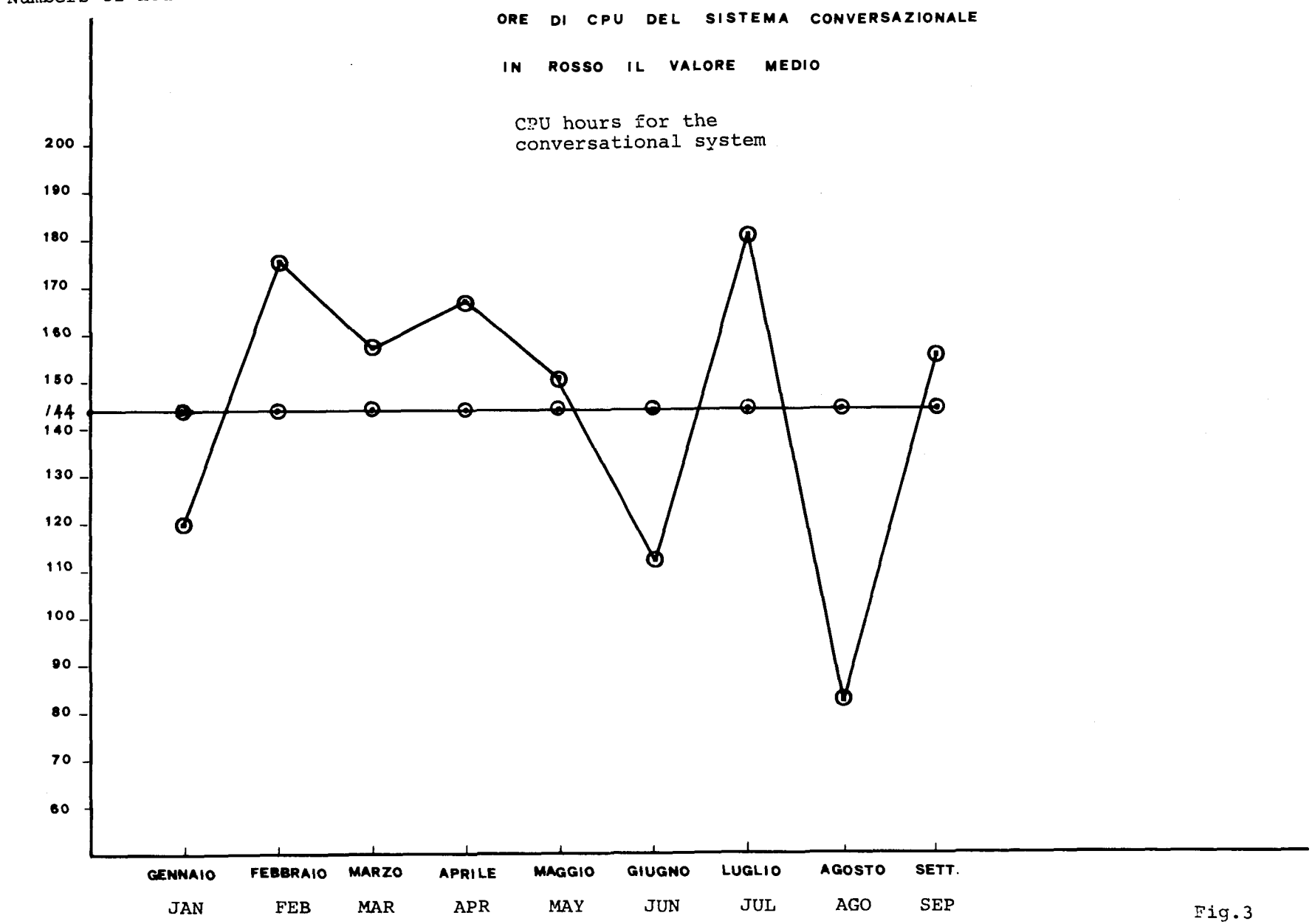
Numbers of hours
ORE DI CPU DEL SISTEMA CONVERSAZIONALE
IN ROSSO IL VALORE MEDIO
CPU hours for the conversational system
200
190
180
170
160
150
144
140
130
120
110
100
90
80
70
60
GENNAIO
FEBBRAIO
MARZO
APRILE
MAGGIO
GIUGNO
LUGLIO
AGOSTO
SETT.
JAN
FEB
MAR
APR
MAY
JUN
JUL
AGO
SEP

Fig.3

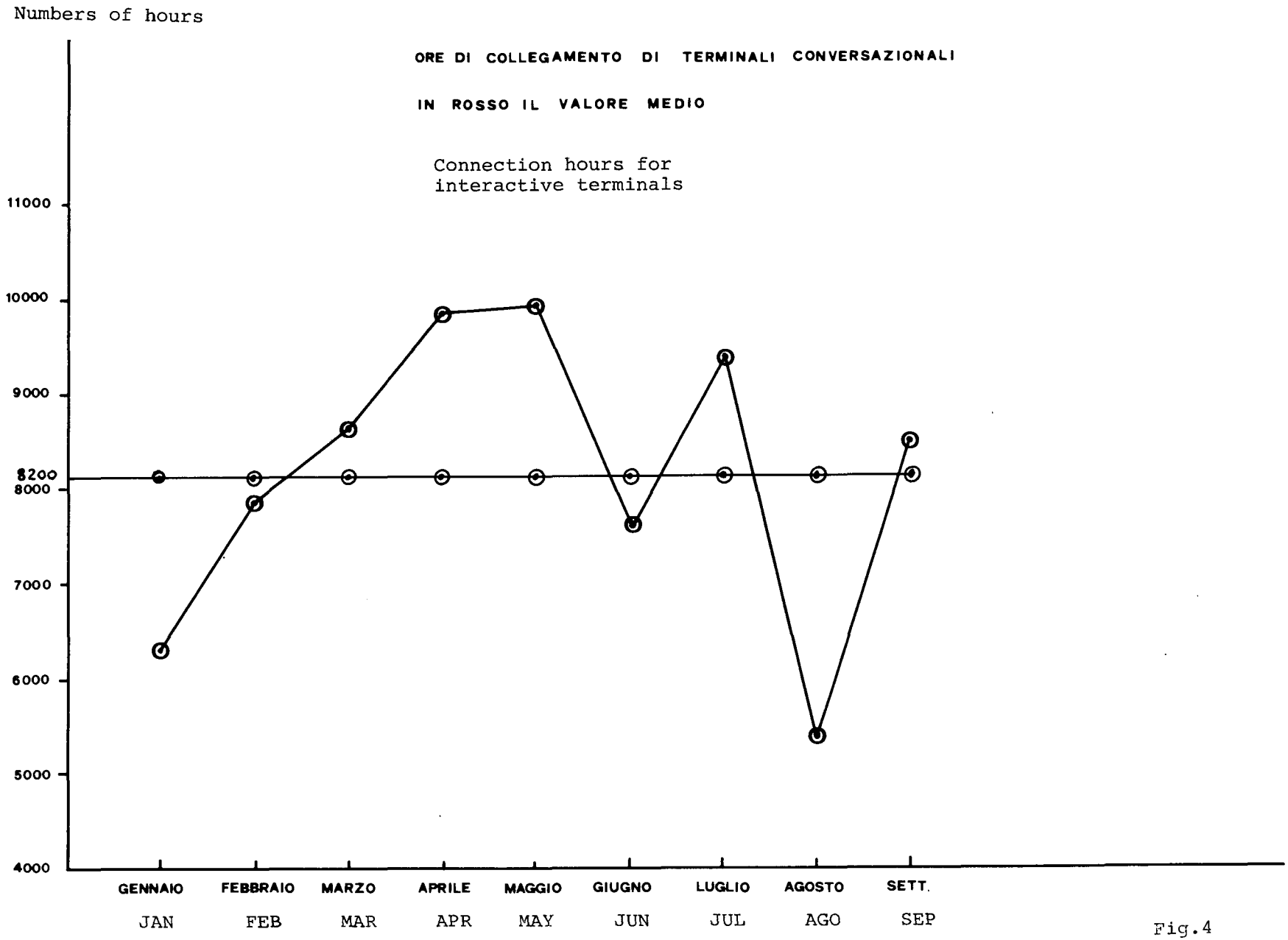
Numbers of hours
ORE DI COLLEGAMENTO DI TERMINALI CONVERSAZIONALI
IN ROSSO IL VALORE MEDIO
Connection hours for
interactive terminals
11000
10000
9000
8200
8000
7000
6000
5000
4000
GENNAIO
FEBBRAIO
MARZO
APRILE
MAGGIO
GIUGNO
LUGLIO
AGOSTO
SETT.
JAN
FEB
MAR
APR
MAY
JUN
JUL
AGO
SEP

Fig.4

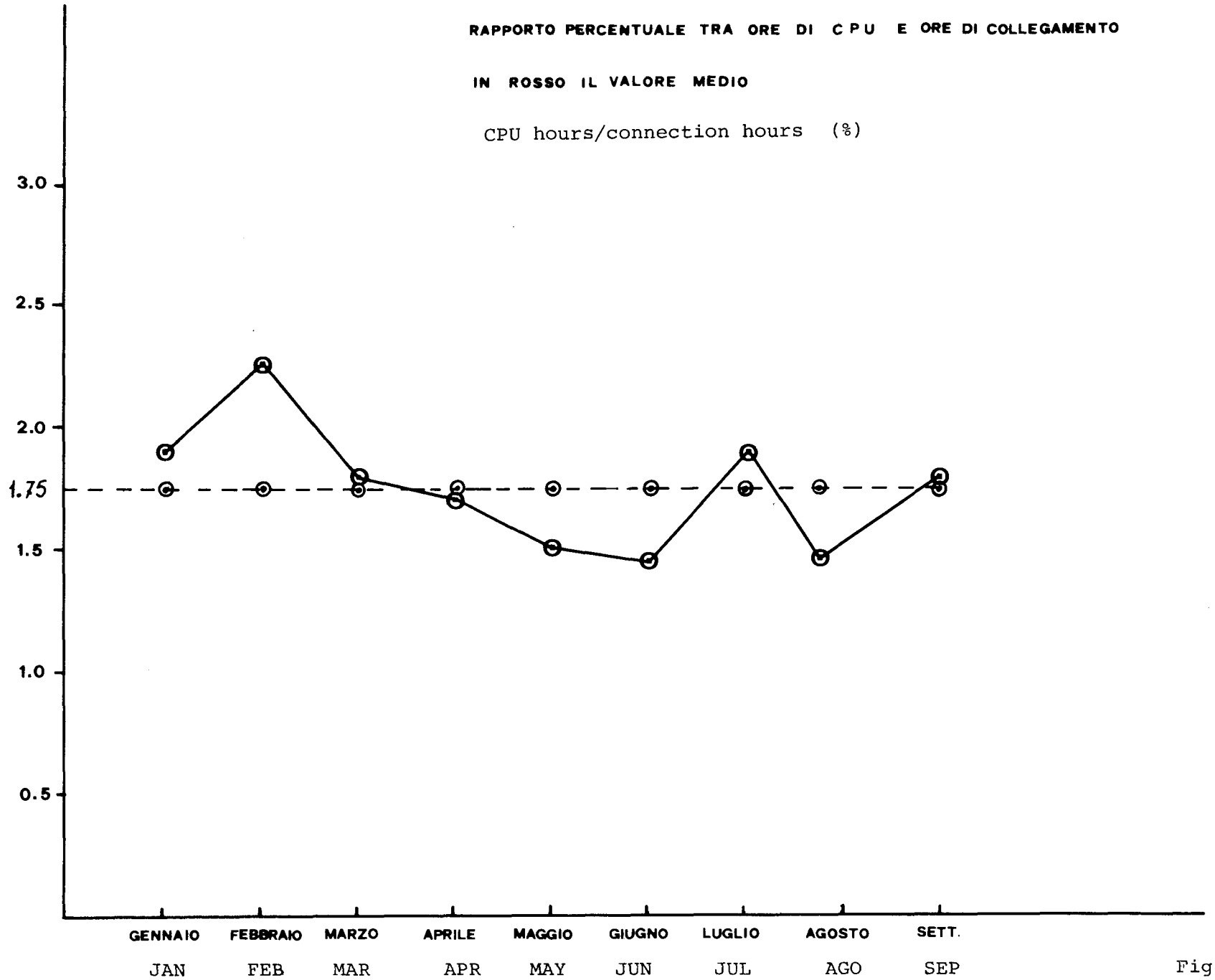
RAPPORTO PERCENTUALE TRA ORE DI C P U E ORE DI COLLEGAMENTO
IN ROSSO IL VALORE MEDIO
CPU hours/connection hours (%)
3.0
2.5
2.0
1.75
1.5
1.0
0.5
GENNAIO
FEBBRAIO
MARZO
APRILE
MAGGIO
GIUGNO
LUGLIO
AGOSTO
SETT.
JAN
FEB
MAR
APR
MAY
JUN
JUL
AGO
SEP

Fig.5