ASTRONET. THE NETWORK FOR ANALYSIS AND RETRIEVAL OF ASTRONOMICAL DATA IN ITALY

G. Sedmak
Osservatorio Astronomico di Trieste
Via G.B. Tiepolo 11
34131 Trieste - Italia

ABSTRACT

ASTRONET, the network for analysis and retrieval of astronomical data planned in Italy, is described with regard to the organization of the network, the hardware, and the standard software environment. ASTRONET starts with four VAX centers operating within 1981, to be expanded to six within 1983.

The network includes colour graphics and PDS plates digitization facilities. The software and graphics standards will be set as compatible as possible to major existing astronomical standards. ASTRONET is planned to be operative within 1983 as an open international astronomical facility.

1. INTRODUCTION

The increasing rate of large volumes of astronomical data from remote sources, like astronomical satellites and international ground-based facilities, generated a rapid growth of the number of data processing centers dedicated to astronomy as well as of astronomers pushing for access to further resources.

The analysis of the astronomical data processing scenario in Italy based upon the information contained in the plan of development for the years 1981-82-83 provided by the Group on Astronomy of Italy's Research Council, shows that about 70 % of the resources for national research programs were planned to implement astronomical data processing facilities.

After this analysis, the scientific council of the Group on Astronomy approved a development plan for a national-wide data analysis and retrieval facility for astronomy. Taking into account the geographical distribution of the astronomical research centers and the data processing resources already available, the recommendations of the commission

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of Italy's Research Council for the participation of Italian astrono-
mers in the Space Telescope program, and following the impact of UK
STARLINK, the structure of this facility was established with a network
of hardware compatible systems linking together selected astronomical
centers. This network is primarily intended to integrate astronomers
into a common standard software environment provided with data base fa-
cilities. The distributed processing of substantial amounts of data is
not presently considered even if technically possible.

The name of this network is ASTRONET.

2. ASTRONET

ASTRONET is the network for analysis and retrieval of astronomical data
planned in Italy to link together into a standard software environment
most existing astronomical data processing centers plus some new ones.
ASTRONET is also intended to enhance the circulation of information and
know-how relevant to astronomy and the integration of multi-center re-
search activities.

The ASTRONET program was started in 1981. The organization of the net-
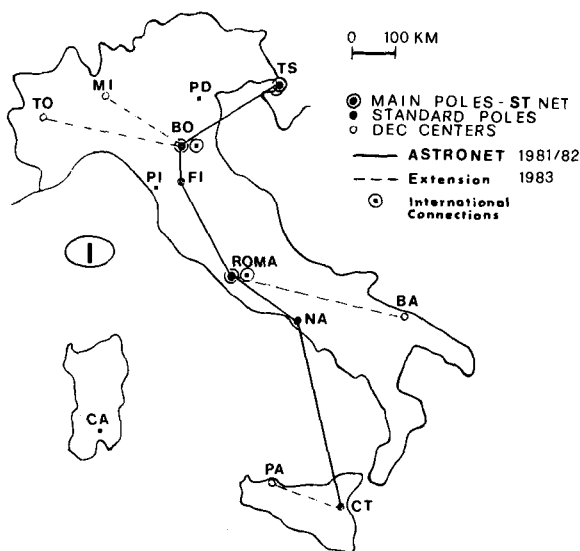work is shown in Fig. 1.

Fig. 1 ASTRONET architecture

The mainframe consists of the astronomical data processing centers of
Bologna, Firenze, Roma and Trieste, already equipped with DEC VAX

systems, plus the centers of Catania and Napoli, presently equipped with
DEC PDP11 computers but to be upgrated into VAX systems within the
ASTRONET development plan. Each pole should integrate all the astrono-
mical data processing centers operating in its area. Multi-center poles
are foreseen in Bologna and Roma. The mainframe will include special
graphics and plates digitization facilities in selected poles. Two
AYDIN 5000-series colour graphic sub-systems are already integrated in
 the Bologna and Trieste poles and two PDS 1010 A microdensitometers
in the Napoli and Trieste poles.

Some centers relevant to astronomical research that are not directly
included in the ASTRONET mainframe could be connected in the future
under an agreement of the parts involved, as well as centers dedicated
to research in computer data processing relevant to astronomy.

The network will be operated first by standard DECNET software through
switched telephone lines at low data rate. This approach should allow
to set up the network and start the standardization of user access to
available resources with a minimum expense of time and efforts. In the
future ASTRONET is planned to be operated through the commercial net-
work in packet-switching mode depending on the availability of this
facility in Italy.

International connections of ASTRONET to other astronomical networks
and/or data centers are planned to be implemented through the major
poles, including high data rate satellite connections.

3. CONFIGURATION OF POLES

The configuration of the poles of ASTRONET was defined so as to allow
effective processing of the large arrays of data corresponding to
rapid photometry, high resolution spectrometry, and two-dimensional
processing of astronomical images, with a typical array size figure
of 512 KB.

The configuration is based on the DEC VAX 32-bit computer under VMS
operating system. Two levels of throughput are provided using respecti-
vely the VAX 11/780 and VAX 11/750 CPU. Some poles include specific
hardware for special graphics and plates digitization. Array proces-
sors could be included if proven necessary.

The typical configuration of a full-service pole is shown in Fig. 2
The typical configuration supports a standard DEC VS 11 colour termi-
bal for low-end graphics at 512 x 512 x 3 format. Advanced graphics
sub-systems could be included according to the activity planned for
the concerned pole. The graphics hardware presently available consists
of 4000-series TEKTRONIX storage-type terminals, AYDIN 5000-series
colour display generators of 512 x 512 format, and PRINTRONIX and/or
VERSATEC printer/plotter hard-copy units.

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┌──────────────┐  ┌──────────────┐  ┌──────────────┐  ┌──────────────┐
│ MEMORY       │  │ DISC 1       │  │ DISC 2       │  │ MTU 1/2      │
│ 2/4 MB       │  │ 120 MB       │  │ 120 MB       │  │ 800/1600 BPI │
└──────────────┘  └──────────────┘  └──────────────┘  └──────────────┘
                                                   MASSBUS

┌──────────────┐  ┌──────────────┐  ┌──────────────┐  ┌──────────────┐
│ DEC VAX CPU  │  │ COLOUR TT    │  │ PRINTER/      │  │ PRINTER/      │
│ 11/750-11/780│  │ DEC VS11     │  │ PLOTTER 1    │  │ PLOTTER 2    │
└──────────────┘  └──────────────┘  └──────────────┘  └──────────────┘
                                                   UNIBUS

┌──────────────┐  ┌──────────────┐                  ┌──────────────┐
│              │  │ DEC PDP11    │                  │ DECNET       │
│ MULTIPLEXER  │  │ FRONT END    │                  │ INTERFACE    │
└──────────────┘  └──────────────┘                  └──────────────┘

┌──────────────┐  ┌──────────────┐  ┌──────────────┐
│ USER TTS 4/8 │  │ SPECIAL      │  │ PDS 1010A    │     ASTRONET
│ DEC VT100    │  │ GRAPHICS     │  │ MICRODENS    │
└──────────────┘  └──────────────┘  └──────────────┘
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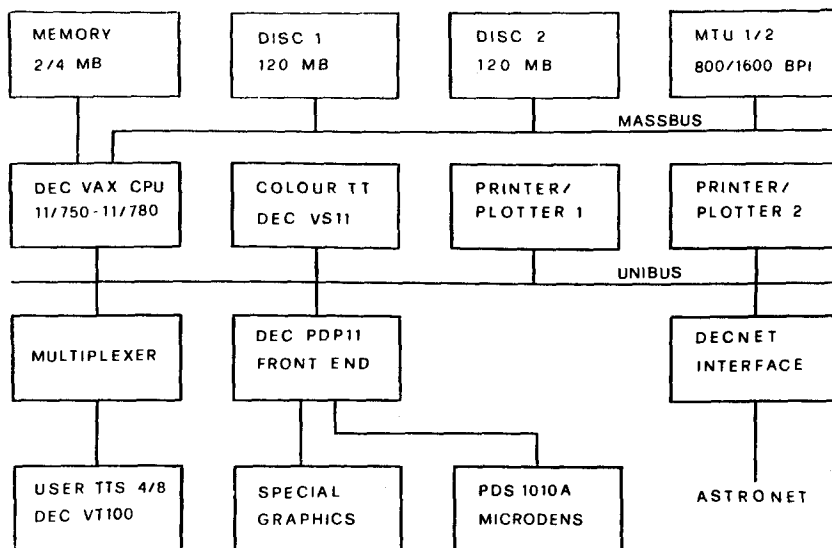
Fig. 2 Configuration of the typical ASTRONET pole with
special graphics and plates digitization facilities.

This hardware will be implemented/replaced by state-of-the-art compo-
nents within the ASTRONET development plan taking into account the in-
ternational trends and the working experience on astronomical applica-
tions.

The plate digitization is made by astronomy-standard Perkin Elmer
PDS 1010 A microdensitometers. Graphic tablets and/or TV digitizers
will be connected successively for specific applications.

The discs and tapes shown in Fig. 2 are the low-end standard. Large
512 MB discs and 6250 BPI tapes will be included in the configuration
within the ASTRONET development plan.

4. SOFTWARE STANDARDS AND GRAPHICS

One main goal of ASTRONET is to accomodate astronomical users into a
specific standard software environment for effective access to availa-
ble resources and integration of contributed software. This environment
will be made as compatible as possible to existing major astronomical
packages.

The software environment will be organized so as to interface the de-
dicated application modules to (a) user, (b) graphics, (c) data storage,
and, (d) documentation, through standard software interfaces. A speci-
fic interactive control language could be implemented within the user

interface if a suitable standard will be identified for this purpose.
Standard data structures will be in any case identified and imposed
to organize the data storage for processing purposes.

The implementation of a distributing data base compatible with and
possibly connected to existing major astronomical data bases is plan-
ned within the ASTRONET development.

The standardization of graphics will be implemented through a common
basic graphics software running on ASTRONET standard graphic terminal.
The basic software will be selected taking into account international
astronomical trends. A specific high-level graphic package is planned
to be introduced and integrated as one main part of the ASTRONET program.

The documentation on the software interfaces standards and the appli-
cation modules and/or packages available will be maintained in
ASTRONET together with the planned data base for on-line access by the
users.

5. CONCLUDING REMARKS

The ASTRONET program should be carried out within 1983. This program
should be parallel to the development and/or integration of specific
astronomical software to be run on ASTRONET.

The coordination of the network will be in charge of a management
group composed of one responsible/pole plus representatives of the users.
The management will be responsible to the scientific council of the
Group of Astronomy of Italy's Research Council, which will be repre-
sented in the management group.

The development of ASTRONET will be highly integrated to international
astronomical data processing programs. Consequently, recommendations
and/or proposals are welcomed.

After successful completion ASTRONET will be operated as an internatio-
nal facility open to all astronomers.

ACKNOWLEDGEMENTS

ASTRONET is based upon the contributions of several persons and insti-
tutions, acknowledged here as a whole.

I present ASTRONET in my quality of chairman of the commission for
astronomical technologies of the Group of Astronomy of Italy's Research
Council.