

Report on the fifth meeting of  
Member States Computing  
Representatives,  
11-14 April 1989

P. Prior

Operations Department

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European Centre for Medium-Range Weather Forecasts  
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Centre européen pour les prévisions météorologiques à moyen

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## P R E F A C E

The fifth meeting of Member State Computing Representatives took place from 11-14 April 1989 at ECMWF. Fourteen Member State (MS) personnel from thirteen Member States took part, the list of attendees is given in the Annex.

The meeting itself was a mixture of discussions on the Centre's current/future service, and technical presentations about particular aspects of the Centre's computer facilities. In addition, each Member State Computing Representative gave a short presentation about their particular service's connection to ECMWF and the use they make of the Centre's facilities. The programme is also given in the Annex.

This report gives a summary of each session of the meeting, in particular concentrating on the discussions that took place.

Part 1 gives all the contributions from Centre staff, the order following that of the sessions themselves. Part 2 gives the Member State Computing Representatives contributions, each report having been provided by the Representative concerned.

**PART 1**

***ECMWF Staff Contributions***

## ECMWF'S COMPUTER DIVISION STATUS AND PLANS

Geerd-R. Hoffmann

### 1. PERSONNEL

A major organizational change took place in September 1988. The number of Sections in the Computer Division has been reduced to 3:

- a. Computer Operations Section (Head: P. Gray)
- b. Systems Software Section (Head: C. Hilberg)
- c. User Support Section (Head: A. Lea)

and project groups were introduced for most of the sections. These project groups which usually consist of two persons are responsible under their leader for their specific task, and do their own work scheduling, but still report to their Section Head.

In addition to this, a Principal Analyst post was created reporting to the Head of Division. His main task is to assist the Head of Division, to look at special projects and then come up with proposals.

The Computer Division has assigned two staff members, J. Daabeck (Project Leader) and A. Jørgensen, to the interdivisional Graphics Group. P. O'Sullivan from the Meteorological Division also works in this group.

The number of posts in the Computer Division has not increased since the beginning of the 80's despite the substantial increase in the number of supported machines. Staff are, therefore, stretched to their limit, and this is why we urge the MS to always give us advance notice of any system changes they make, or requests they have, so that we can plan our resources in a reasonable way. It is very difficult for the Centre, despite our best efforts, to fulfill requests made at short notice.

### 2. THE CONFIGURATION

The Cray X-MP/48 is the number crunching machine used to run the analysis, the model, Research experiments, and also the MS batch jobs.

An IBM 3090 150E with vector facility is used for Data Handling. All permanent data are stored here, and - since July 1985 - also all new operational data.

Of the two Cybers (835 and 855) the 835 will be replaced by a second-hand 855 in the next few weeks. This will enable us to run only one operating system (BE or VE) on each machine and should result in an increased throughput (performance) on the VE machine. NOS/BE will be phased out at the end of 1989.

Four VAX 11-750 form a cluster and connect the Centre to the MS. A VAX 8350 is used as a 'graphics machine' (i.e. as an intelligent controller for graphical devices), whereas a VAX 6210 is used for the new data acquisition and pre-processing system which is currently being developed at the Centre. This new VAX based system is a major part of the planned move away from the NOS/BE system. More details will be given in the relevant presentations later at this meeting.

Such a complex configuration does not run permanently without errors. We say that a "major delay" has occurred if the forecast is delayed for more than one

hour. The "major delays" per year were decreasing continuously until 1987 (55 h), but went up to 97 h in 1988. This was mainly due to two occasions with very long delays (one of them for 16 h caused by an Install on Cray and subsequent loss of all data).

## 2.1 Cray X-MP/48

The Cray system has remained more or less unchanged since the last meeting. Three DD-29 disk units from the University of Manchester have been added bringing the number of disk units to 22 with a total capacity of 13.2 Gbytes. But there is still a lack of disk space, so that the retention time of a Cray file still is very short.

The reliability of the system has improved in 1988. There were only 31 incidents (56 in 1987), and the mean time between failures was 260 hours (145 h). The mean repair time was ca. one hour (0.7 h).

There was a steep increase in the number of jobs in 1987 which was mainly due to the way MARS was implemented. This continued until August 1988 when a new file handling method was introduced in MARS. So, the number of jobs is now at the normal level of 12000-13000 per week.

The statistics on total CPU utilization, however, show an alarming trend. The fact that user's utilization went down from about 60% in 1988 to 50% in the first months of 1989, while the blocked I/O went up to 31.20% (after 27.76 %) are an indication that the memory of the present system is not big enough for the applications we run, or in other words, that the jobs we are running have increased memory requirements and are heavily I/O bound. The improvements in the compilers while producing better/faster code (CFT77 saved about 10% CPU time on the model) do little to improve the I/O situation as well.

Another indication for the heavy workload on the Cray is the decreased number of delivered units (37 Mio in 1988 after 44 Mio in 1987).

These developments are being carefully monitored, but we have not yet reached any final conclusion.

## 2.2 ECFILE

A major software development in the last year was ECFILE. It is intended to eventually provide a means of storing and accessing permanent files from all of the Centre's machines. It is already operational on the Cray, will soon be tested on NOS/VE, and a VAX version will also become available at a later time.

The usage of ECFILE to date has shown that it can cope with large amounts of data transfers, and provides far better service than we ever had under NOS/BE. MS users are urged to make use of this facility to store their files before NOS/BE is phased out at the end of this year.

## 3. THE CYBER SYSTEMS

Both machines have been very reliable, with the 855 having 41 incidents in 1988, 203 hours of mean time between failures, and approx. 1 hour mean time for repairs. The figures for the 835 were 44 incidents / 191 h / 0.6 h respectively. 56% of the NOS/BE CPU time is used by Meteorological Operations (decoding, quality control etc.). This will steadily decrease until the end of the year when the new VAX based system will become operational and NOS/BE is discontinued. However, there are still great numbers of tapes written using NOS/BE and even now almost 250 tapes are mounted daily. So, data have to be moved to ECFILE if they are to be kept. Migration to NOS/VE continues, and we hope that the service will improve substantially when BE goes.

#### 4. THE DATA HANDLING SYSTEM

The major enhancement since the last meeting was the replacement of the IBM 4341 by an IBM 3090 150E with vector facility. The system now has 30 Gbytes on line disk storage, tape units (used for exchange of data and operational purposes), cartridge units (for data storage), and the mass storage device MSS for the automatic mounting of cartridges. The reliability of the IBM system is good with only 17 incidents per year and a mean time between failures of 483 hours. The number of tape mounts is continuously increasing (approx. 400 per day currently) and the peak link traffic to/from IBM has reached 12 Gbytes per day.

There is a heavy data transfer at the beginning of each month due to a series of statistical jobs run by the Center. It is, therefore, recommended that MS users submit jobs with high data requirements at the middle of the month for best performance.

#### 5. THE VAX CONFIGURATION

Little has changed in the VAX configuration since the last meeting: a new VAX 6210 was given on free lease to ECMWF to develop and run the data acquisition and preprocessing, and some more X25 routers have been bought, due to the increasing number of MS switching over to DECnet. The cluster of the four 11-750s remains the backbone of the communications with the MS.

The graphics load on the VAX 8300 has increased substantially. So, the data transfer to QMS more than doubled in the last two years (from 4 Gbytes to almost 10 Gbytes). This reflects the increased production of graphical output on the three A3 and four A4 QMS laser printers currently available. The plot queue times can be quite long sometimes.

#### 6. NETWORKS

##### 6.1 External Network (WAN)

The majority of the MS are now connected to ECMWF by 9600 bps lines. France is on a 14400 bps line, the Finnish line is split into two 4800 bps lines, and the speed of the Turkish line was reduced to 4800 bps because of the line quality. Norway is due to be connected shortly.

Dissemination statistics produced daily provide us with a comprehensive picture of what is going on, the amount of data transferred in each direction, and helps us locate problems.

##### 6.2 Internal Network (LAN)

The backbone of our internal network is LCN running at 50 Mbit/s connecting all machines at a high speed. In addition to this, there is a token ring network to the IBM with connections to PCs for manager services, and Ethernet connections for other users in each office. Thus, PCs will be connected to CDC, VAX and IBM using TCP/IP protocol. This upgrade is in process now, we run Novell Netware on PCs and have MICOM gateway to TCP/IP. The two SUN Workstations which were bought recently for the development of software are also connected to Ethernet.

## 7. PLANS

1989: Conclusion of the ITT for the replacement of the Cray, and start of the preparations in machine hall.

Cray RHF will become operational and TCP/IP support will be introduced in preparation for the Cray replacement.

Novell Network for PCs will be introduced in the coming weeks.

The new Data Acquisition, Preprocessing and Supervisor Monitor System (SMS) will become operational.

1990: Installation and acceptance of the new High Speed Computer Facility (HCF). Migration of operational suite and user jobs.

1991 onwards: The IBM 3850 MSS will be replaced.

Planned activities as contained in the 4 years' plan. These include the enhancement of the data handling system; introduction of high speed network (100 Mbyte/s) for internal communications, and evaluation of using LAN bridges for speeds beyond 64 kbit/s for external communications; replacement of the Cybers 855; and migration to OSI standards.

### QUESTIONS:

Juega: Is interactive access to ECFILE possible only for MS having Decnet?

Hoffmann: ECFILE can be used from all MS with no restrictions at all.

Orrhagen: LAN bridges are already used in Sweden to connect regional Centers. Why do you put their introduction here that far in the future?

Hoffmann: We intend to present a paper on this subject to TAC this autumn. We do believe, however, that LAN bridges would become useful to us only when speeds beyond 64 kbit/s will be needed for data transmission.



## USER SUPPORT SERVICES

Andrew Lea

### 1. STAFF

There were no staff changes since the last Meeting. Bert Kesseboom has come back to the section, after having been seconded to work on various projects in other sections for 18 months. The following table gives the names of the User Support staff, along with telephone numbers, IDs and Member State contact points.

<u>NAME</u>	<u>EXTENSION</u>	<u>ID</u>	<u>MS CONTACT POINT</u>
Lea, Andrew	2380	USA	
Greenaway, John	2385	USJ	DK, GB, FI, SE
Kesseboom, Bert	2379	USH	NL, N, TR, YU
Kreitz, Norbert	2381	USN	AT, DE, IE, CH
Maretis, Dimitris	2383	USD	GR, IT
Prior, Pam (Mrs.)	2384	USP	BE, FR, ES, PT

### 2. COMMUNICATING WITH USER SUPPORT

The new telephone number of the Centre introduced recently is: international (+44 734) 499 000 (operator). User Support staff can now be directly contacted by dialing first 499 and then the 3 last digits of their respective extension (as given above), for example (+44)734 499380 reaches Andrew Lea direct.

A. Lea and the advisor on duty also carry beepers. So, in case of urgent problems, the operator can be asked to contact either of them using this facility. The main means of written communication over the years was the COMFILE facility under NOS/BE. This service will be discontinued when BE is phased out at the end of this year. There is no replacement for it under NOS/VE. Therefore, Member States connected to Decnet should use the VAX mail facility to send messages, those not on Decnet could use the operator interface.

In response to suggestions at the previous meeting a Daily News facility was created on VAX, and is accessible under the command NEWS. It contains the latest operational information, and other items of interest. User Support would like to have feed-back on whether this facility is used by the Member States and whether it should be maintained.

When the Centre makes changes to its systems, it informs the MS well in advance. It would be very helpful, if the MS would also inform the Centre in advance when changes are made to their systems which could have an impact on the Centre. This could be done in an informal way (e.g. VAX Mail).

### 3. DOCUMENTATION

In addition to the known documentation provided in the form of Computer Bulletins, News Sheets, and bulletin boxes containing actual operational information, full interactive help facilities are now available for both VAX/VMS

and NOS/VE. The question, therefore, arises whether these interactive help facilities reduce the need for written documentation.

The News Sheet is used to convey information of an urgent nature. It is very important that News Sheets get wide distribution in the MS and reach all users interested and affected by such matters. It is not clear whether this is achieved at the moment. Extra copies could be sent on request, if they are needed.

The source of the Computer Bulletins has been transferred to NOS/VE.

It is clear that when NOS/BE is phased out, and when the present Cray is replaced, the respective manuals will go as well.

#### 4. TUITION

A computer training course was held at the beginning of this year. The program was slightly different from previous years, offering both an introduction to the Centre's computer systems (especially the Cray) and their usage, as well as presentations on heavily used software developed at the Centre (e.g. MARS, MAGICS). The course was well attended again.

Due to the planned replacement of the present Cray, it is the last time that we will offer a Cray COS course. It can be taken for granted that the operating system of the next supercomputer will be a new one. As already mentioned, if everything goes according to plan, the new supercomputer will be delivered in the middle of next year, and will run for six months in parallel with the existing Cray. Preparations for the migration will start at the Centre as soon as it is known which will be the successor machine.

It is, however, not possible for User Support to provide courses on the operating system and features of the successor machine before its installation, and before having some time to gain some experience. The question, therefore, arises whether there is a need for a computer course at the same time of year (February/March) covering MARS, MAGICS and ECFILE, or whether a full computer course covering both the new supercomputer and meteorological software should be organized for the autumn of 1990. [Note: those present at the meeting tended to prefer a course in autumn 1990.]

#### 5. LIBRARIES

There have been no great demand for library material recently, the reason being that there have been no major software developments in the last years.

ECLIB has been frozen, many of its functions have been taken over by Cray libraries. However, we could consider including new software from else where if this is needed, but due to the heavy workload, we cannot undertake extensive software developments ourselves.

Users are also advised that the BE licences for both NAG and IMSL libraries were terminated recently.

#### 6. SECURITY

With the spread of networks the Centre was forced to increase its level of security. So, it now asks all users to sign for their identifiers as a recognition of their responsibility that they have to look after their own ID. Also, only one user per ID is now allowed. Furthermore, users logged-on interactively to the VAX/VMS, and (later) NOS/VE systems will have to change

their passwords once per month. Also, the default of "private" files will be introduced on both systems.

Security will remain a very active point of discussion, and the Centre expects that MS will cooperate to reduce risks as much as possible.

QUESTIONS:

Juega: We received a letter recently complaining about not informing the Centre when changes are undertaken. We did not, however, make any changes. Was this letter only a circular?

Hoffmann: This letter was circulated to all MS because we have had some problems in the past. We would like to be informed about anticipated changes, and hope that the letter was understood in this way.

Orrhagen: Which IDs can be used to send VAX Mail giving information on changes in a MS?

Hoffmann: You can use my name or HCD to contact me. You can also send messages to the advisory. The advisory message box is "emptied" several times a day, and the messages are passed onto the recipients.

Pasquini: Can I use the Centre as a switch in order to contact users in other MS via VAX Mail from Italy.

Hoffmann: We are aware that links between countries can be via the Centre, without us even knowing. However, the Centre had a contractual obligation not to act as a circuit switch. Therefore, such a feature will not be implemented in the ECNET although it is a Decnet facility. Non-Decnet sites could use PSS as a terminal interface to get into the Centre, and then use the available VAX mail facilities. The Council has agreed with X29 connections.

Orrhagen: Documentation on paper should continue to be provided at least for the "number cruncher" at the Centre, even when interactive help facilities are available, because many users in the MS still use the machines only in batch mode.

v. d. Plank: Some MS are introducing now the use of such packages like MAGICS. A "short" computer course on the Centre's software rather than on the computing facilities could, therefore, be a great help to those countries.

Orrhagen: When will you know what machine will replace the Cray?

Hoffmann: We will know the make and type in autumn. The decision by the Council will be taken in November. The new machine will run in parallel with the Cray X-MP for 6 months. Users in the MS will have 6 months to migrate to the new machine. The Invitation to Tender (ITT) also requests access to a functionally similar machine before the installation. This would enable us to gain migration experience, and we will then decide what courses on migration to offer the MS.

Orrhagen: A "minor" course in connection with some migration help would be very useful to MS users.

Juega: Cray DISPOSE with a text field is used to send files to MS. How will this be done in future?

Kreitz: Utilities to do this are presently under development. Procedures have been written to transfer files from Cray to MS. They are currently using BE, but it is planned to provide similar facilities avoiding BE, when Cray RHF is working. Tests with Ireland and Austria have shown that this transfer is possible for VE and VAX remote sites. We have not yet succeeded to transfer files in this way to France (NOS site). More details will be presented during the talk on "Data transfer to MS via the telecommunications link" later during this meeting.

Hoffmann: In the past the Centre's policy was a very open one because misuse seemed very unlikely. But with the spread of networks in the MS and the possible interactive use of the Centre's systems from MS, MS are urged to step up their security. Security at the MS end is their own responsibility and the Centre, not being able to check any more than whether the account is a valid one, bona fide accepts jobs submitted from MS. It will, however, introduce passwords for accounts on new systems.

In addition to this, the Centre has taken expert advice on security, and believes that an expert meeting on security with MS participation would be one way of agreeing on a common policy and reducing the possible risks. It is, therefore, likely that such a meeting will be called for later this year which will discuss our exposure to such risks.

## NOS/VE AT ECMWF

Norbert Kreitz

### 1. NOS/VE FEATURES

The Network Operating System/Virtual Environment, better known as NOS/VE, is an operating system developed by CDC for its 180 series machines. It is a modern operating system providing a virtual memory environment, a consistent user interface and a block structured procedural command language. It supports standard 8-bit ASCII code, provides rings of security and it runs and produces reentrant code.

The files are organized in an hierarchical file system and are private by default, i.e. they can be accessed only by the owner. At the Centre users usually have a so-called PUBLIC subcatalog which can be accessed by all users to exchange files between each other. User activities are not visible to other users.

On-line access to manuals greatly facilitates system usage. All manuals are accessible on-line, and CDC system changes as well. It is clear that ECMWF also makes use of this feature and provides information on the commands developed in-house in the same way.

### 2. NOS/VE AT ECMWF

At ECMWF it is used on the Cyber front-end to provide interactive services including preparation, submission and monitoring of Cray jobs, as well as for short-term file storage.

Access to NOS/VE is through CDCNET. At ECMWF the VE prolog file contains the terminal definition and accesses the ECMWF procedures library which contains, for example, all the Centre specific commands for submitting and monitoring Cray jobs. It is advisable to ask User Support for assistance in setting up the prolog file.

### 3. SCL COMMAND FORMAT

The System Command Language (SCL) is the command language for the NOS/VE operating system. All NOS/VE commands follow SCL conventions. SCL commands have a verb-object structure: they begin with a verb that indicates the action followed by the object and/or modifiers. The convention for abbreviating commands is to use the three first characters of the verb and the first character of each additional word. In addition, aliases can also be chosen.

Parameters may also be abbreviated by often using the first character only.

### 4. UTILITIES

NOS/VE provides various utilities for editing, source and object code management etc. It is not necessary to get out of one utility to use services provided by another.

### 5. RUNNING A CRAY JOB

Commands have been developed at the Centre for submission and monitoring of Cray jobs, as well as inspection of outputs.

## THE NTS SYSTEM - MEMBER STATES' SOFTWARE FOR LINKING TO ECMWF

Tony Bakker

### 1. INTRODUCTION

The decision to develop a telecommunications system for Member States with VAXes was taken back in January 1986. Originally five countries joined (Germany, Ireland, Sweden, U.K., and Turkey). The software development started in August 1986. Sweden was the first country to be connected (December 1986) followed by Turkey (March 1987). Italy later joined the project and was connected in December 1987.

At the beginning of 1988 major enhancements to NTC software were introduced, and in May Yugoslavia joined the project and was connected. This year, U.K. and Ireland have already been connected, Finland and Norway are scheduled for connection in the next few weeks, and three more countries (Denmark, Germany and Netherlands) should be also connected in the next few months.

### 2. NTS FACILITIES

The NTS was designed to provide all the facilities provided by the NTC but uses standard DECnet file transfer and protocols. The whole network and protocol software is invisible to the user.

It provides:

1. File transfer facilities for the following file types: DD (Data Dissemination), DA (Data Acquisition), RJ (Remote Job), BO, PF (Permanent File), and GX (Graphics File),
2. Interactive access to the NTC systems,
3. Operator monitoring and control,
4. Electronic Mail and VMS PHONE utilities, and
5. Flexible usage of the NTS symbionts.

The user interface is provided by the NETQUEUE command which puts an entry into a queue and copies it to a transfer directory, whereas the NTCLOG command enables the system manager to monitor the actions of the symbionts. Control of whether the link is up, however, is still done in DECnet. MS can also use the operator account on the NTC system to check the status of remote jobs, dissemination file queues, or send a message to the operators.

Both the NETQUEUE and the NTCLOG commands have a programmable interface so that they can be called from Pascal and Fortran programs.

A set of DCL command procedures has also been developed and is available to MS together with the source and documentation.

The NTS is installable as a VMS layered product.

### 3. NTC PREREQUISITES

For a MS to run NTS a VAX processor running VMS is required as well as DECnet. Direct connection to VAX needs special PSI software. The other option is to use X25 routers. This is a new VAX development, it has got embedded PSI (so there is no need for special licence) and has the additional advantage that it can take workload away from the main VAX. (It is connected to Ethernet, so the VAX system has also to be connected to Ethernet.)

### 4. HARDWARE INVOLVED

The hardware at the Centre consists of a VAX cluster (6 VAXes), and a X25 switch (needed for the X25L3/L2 connections). They are connected via Ethernet using a Microserver.

Two of the VAXes are connected to the high speed LCN (thus being able to communicate with the mainframes), but all have connections to Ethernet.

Of the two X25 routers also connected to Ethernet one is in production use, the other is acting as a stand-by.

All X25L3 lines to the MS are connected to the CAMTEC X25 switch which is fully configured with no more free ports available. In future, when we introduce high speed connections to MS (especially to those where we receive Data Acquisition files from) they will be connected directly to ports in the X25 router, because it can handle up to 64 kbits.

As already mentioned above, the hardware needed at the MS end is an interface to X25L2 connected directly to the VAX or via an X25 router. The latter provides a more flexible solution.

The CAMTEC X25 switch proved to be quite reliable, but has some limitations. So, it supports only the 1980 protocols of X25, the packet size is limited to 256 Bytes, it supports only a limited number of ports (currently 8) and can run at speeds up to 9.6 kbps.

In contrast a Microserver/X25 router can support both 1980 and 1984 X25 protocols (i.e packet sizes greater than 256 bytes and windowing up to 128 packets), and either 2 ports at 256 Kbps or 4 ports at 64 Kbps. It is Digital's product for OSI connectivity, and has both PSI and DECnet routing embedded in it.

### 5. REMOTE JOB ENTRY

As an example of how the system works the actions involved when submitting a job from a MS and receiving the batch output will be briefly discussed.

A MS user can submit a job to one of the Centre's machines (e.g. Cray) by interactively issuing the NETQUEUE command and specifying the file to be sent, the three character identifier of the output recipient ('ECM' when the recipient is ECMWF), and the file type ('RJ' if the file is a remote job). The file is copied to the MS transfer directory, where it waits until a symbiont is notified and transfers the file to an ECMWF VAX queue. Then a sweeper process running on the Center's VAX picks up the RJ file and passes it on to RHF which transfers the file to the mainframe (e.g. Cray, if it is a Cray job). RHF has the in-built intelligence to remember what should happen with the output, and so, when the job has completed, it puts the batch output in a transfer directory on the ECMWF VAX, from where a symbiont copies it to the MS VAX queue. A sweeper process on the MS node picks up the file and copies it to the user directory.

## 6. FUTURE PLANS

We will introduce 64 kbps links in the next few years, with the MS sending us Data Acquisition files probably being the first to be connected.

Enhancements to symbionts will be introduced, as well as improved NETQUEUE command and operator interface. Known problems will be eliminated.

Migration to OSI is envisaged, as well as introduction of FTAM and DECnet Phase V. The latter, which is fully OSI compliant, is expected some time next year. Its introduction, however, will mean major changes in the network topology, and therefore it will take some time before it is fully implemented.

In this context we would like to urge MS to always install the latest version of DEC software available. This is because failure to do so could create major system problems in the future for all Member States.

### QUESTIONS:

Juega: What are the functions available in DECnet which have not been available in ECNET?

Bakker: There are no major differences in functionality concerning what can be sent to the MS, but, again, the software is more reliable and faster.

ECNET allows only one interactive access per session, whereas DECnet allows (in principle at least) an unlimited number of sessions.

DECnet provides substantial improvement in communications (electronic Mail, Phone facility, etc.).

Juega: Can you kill a running Cray job via the NTC?

Bakker: There are still problems concerning job status information and control. But we are working on them to improve visibility and control.

Juega: Are MS users allocated a certain amount of disk space for interactive use on DECnet as well as ECNET?

Bakker: Yes. MS states which can establish interactive access get their own disk space.

Gray: It is probably important for MS to know the costs of going to NTS. A basic system providing all facilities Tony talked about, and a reasonable performance would cost 20000 - 25000 pounds. In addition to this, joining the 'NTS Club' will cost an extra 10000 pounds. Maintenance for the DECnet hardware and software is about 2000 pounds, whereas there are no maintenance costs for our software.

Rudsar: From the discussions I got the impression that security is a problem with DECnet.

Bakker: There are some known problems arising in the way DECnet areas and nodes are defined. Certain schemes for node/area allocation as well as node filtering techniques can solve some of the problems, but sometimes additional hardware is required.



Our problems started when the first MS connected to other DECnet networks belonging to more than one "area" was connected to us. But these problems should disappear when DECnet Phase V is implemented in 2-3 years time.

Orrhagen: What are the costs of Microserver plus licences compared with MicroVAX plus licences?

Bakker: An X25 router, albeit more expensive when you buy it (approx. 14000 pounds), has embedded PSI, and it can help you reduce the workload on the main VAX. So, if you have one VAX then it is best to buy a L2 interface and PSI, whereas if you have Ethernet, an X25 router provides the more flexible solution with possibilities for expansion.

Gray: ECMWF switched from MicroVAX to Microserver because

- a. they are easier to support (no VAX VMS running on them),
- b. Microserver runs at 64 Kbits, which was not possible on the MicroVAX at that time, and
- c. it also provided us with 2 MicroVAXes cheaply (e.g. one to improve operator facilities and the other for driving peripherals along a long distance).

Dickinson: What are the security limitations, if any, when we grant interactive access to the Center to users outside the Met Office.

Bakker: In principle there are no limitations for interactive access. We have introduced some additional security measures on the VAX, and we are considering more. Great numbers of interactive users on the VAXes would, however, put a heavy workload on our 750's and would result in slowing down the system. Therefore, MS should use the possibility of interactive access as little as necessary, and as sensibly as possible.

## PLANNING A SUPERCOMPUTER INSTALLATION

Peter Gray

### 1. INTRODUCTION

The preparations for the installation of the new supercomputer have started in December 1988, i.e. some 18 months before the event. The main problems to be tackled were

- a. to find the space needed for the installation of the new supercomputer, and
- b. to provide the required electrical supply and cooling,

whilst retaining the existing functions of the computers and with a minimum interruption to services. Some of the major difficulties arise from the fact that the type of the machine which will eventually be purchased is not known during the greatest part of the planning period.

### 2. SPACE PLANNING

When the new supercomputer is installed it will run for six months in parallel with the existing Cray. This means that additional space has to be found for this period both in the Computer Hall and the Plant Room.

In the Computer Hall additional space will be created by reducing as well as moving closer Cyber equipment, and by temporarily moving the VAXes.

We have already completed the changes in the Cyber area, but we still have to start moving the VAXes. This job is complicated by the fact that the equipment involved plays a central role in the Centre's telecommunications, but is also connected to the LCN as well as the local terminal network. This means that in addition to the move of all VAX wiring under the floor, the telecommunications Centre has also to be moved. This has to be service interruption. Small interruptions cannot be avoided, but the Centre will try to minimize the impact of the moves on users as far as possible, and will always inform MS well in advance.

Space must also be made available in the plant room to accommodate the necessary cooling and power conditioning equipment in such a way that if refrigerant lines are needed we should be able to bring them directly up and keep them short.

The moves of equipment in the Computer Hall will also be used to seal cracks in the floor, and replace some jacks of the false floor, so that we can eventually support the load put on the floor by the new machine.

### 3. SUPPLIES NEEDED

The eventual needs in cooling and electrical power will be known only when it is decided which machine we will purchase. Our present cooling system is at its limits, during prolonged hot periods even beyond them. For the new supercomputer we anticipate an additional need of approx. 300 kW. We will get this by using all 4 chillers and installing a fifth as a stand-by.

The air conditioning units in the Computer Hall show corrosion problems, which results in rust dust in the air, and the units become increasingly difficult to maintain. In addition to this, the existing air flow is the wrong way round and is inadequate for modern machines. So, we will replace the air conditioning units and at the same time reverse the air flow in the Computer Hall.

#### 4. PLANS

We have already started with the preparations for the installation of the new supercomputer by moving around computer equipment and by issuing an ITT for the air conditioning system.

Detailed planning will start in the summer when the make and type of the new supercomputer will be known. Work on the air conditioning will start in September, the new chiller will be installed in winter. The final stage of the preparations will start in March 1990, so that everything is ready to accommodate the new machine by June 1990.

#### QUESTIONS:

Dickinson: What happens to the machines in the case of interruption of power supply?

Gray: Whenever a machine goes down, it always takes some time to bring equipment up again. The Cybers can go through power dips without major problems, the VAXes are on uninterruptable supply and are usually not affected, the IBM needs an engineer, the Cray as well, but he is on site.

## OPERATIONAL SERVICES

Graham Holt

### 1. MAINFRAME AVAILABILITY

The mainframes are not available at the following times due to preventive maintenance (all times are local):

CRAY	Saturdays	0800 - 1400
	Wednesdays	0700 - 0900
CDC	Alternate Saturdays	0800 - 1400
DEC	Each VAX once in 6 months	
	Wednesdays	0800 - 1000
IBM	Once in 6 months	
	Saturdays	0800 - 1200

DEC and IBM are practically available all year apart from some short periods.

The mainframes, however, are not available to users more frequently due to systems development work, most frequently the IBM system on Wednesdays from 0700-1000. Work on a VAX rarely impacts the whole system because of the cluster structure. We always try to inform users about periods of non-availability of the mainframes well in advance.

Machines may also be unavailable during storms due to problems with electricity supply. Recent improvements on the diesels should allow us to maintain power supply throughout critical periods.

### 2. SYSTEMS PERFORMANCE

User services depend on Operating Systems, applications programs and our ability to get the operational suite finished in time. Delays during the night, have impact on the user services during the following day if operational work is still outstanding. The operators work according to set principles, with analysts as a backup. Internal procedures and good communication and co-operation with other sections improve effectiveness.

### 3. TELECOMMUNICATIONS AND NETWORKS

Internal and external networks are becoming increasingly complex, with many processes being started automatically, communicating with each other and asking for operator action only when a machine is down. Under these circumstances, it has become increasingly difficult to keep the operators informed about the complexity of the system and reoccurring problems. Therefore, the analysts are usually called when complex problems occur.

The communication with operational staff in MS is usually good, but language problems, differences in working practices during night hours, and lack of knowledge about who is responsible for what in some MS occasionally create problems.

#### 4. ON SHIFT ACTIVITIES

Monitoring the activities of the four mainframes is an essential part of the shift responsibilities. The information displayed on screen automatically is of great help to operators, but some operating systems are more informative than others. The OMEGAMON software we use to monitor the IBM is a third party development. The log keeping and the problem reports as well as the analyst's replies provide the basis for the status meetings to discuss problems and progress, but also enable better hand-over from shift to shift.

The daily logs are entered in a database. Statistics on mainframe availability are produced from these entries. The work of the operators is controlled by the shift leader. The operators on each shift are split in two skill groups: one responsible for CDC and VAX, and another responsible for Cray and IBM. The reason for the introduction of skill groups was to enable operators to learn in depth certain machines so that their knowledge, confidence and problem solving skills are enhanced. The tasks of tape mounting and output splitting have been taken over by contract staff, leaving the operators with more time to concentrate on their main task, the running of the mainframes. The introduction of a new supercomputer next year will certainly increase the workload on the operators, as they will have to learn to operate a new mainframe fairly quickly. There is also a need for operators to learn more on Telecommunications and the VAXes, if they are to operate the systems effectively.

#### 5. RECENT ENHANCEMENTS

The installation of the new telephone exchange providing direct dial-in facilities will certainly improve communications with MS.

On the hardware side, the increase of Cray disk drives by two, has some effect on the retention period of Cray files. IBM disk capacity has also been increased by replacing two 3350 by 3380 disks. Additionally, two extra IBM 3480 tape drives were purchased. Our long-term plan is to go to a fully automated IBM storage subsystem.

We have now more NAD memory. CDCNET provides sufficient modules to support all terminals. The Centre is now wired with Ethernet to be used for PC connections. DEC Microservers were purchased to support DECnet connections and higher data transfer rates to MS. Peripherals are being moved away from BE in preparation for its phasing out.

NOS/VE 1.4.1 has been introduced, and after improvements in Cray - IBM Superlink the service is now more reliable.

#### 6. PLANNED CHANGES

Replacing the Cyber 825/835 by a second hand 855 should make more resources available to NOS/VE. Since NOS/BE will be phased out, all BE workload has to be moved to other machines.

#### QUESTIONS:

Kaindl: Does an operator stay in one skill group, or does he move around?

Holt: The policy is to move them around, but new people will be first assigned to one group for a certain time and concentrate on a certain system.

Juega: Are there examples of MS jobs running under operator responsibility?

Holt: If a MS wants a job to be monitored closely, then usually the MS contact point in User Support is informed and passes instructions/information to the operators on a "red card".

Orrhagen: Do you think that you could introduce unattended operation?

Holt: I do not think that this is feasible in our case.

Pasquini: Does the split in 3 sections have impact on the operational work?

Holt: Specialization is very important in our environment, and the existence of certain channels of communication for MS does have a positive effect on our work. The good communication and co-operation between the sections at the Centre is of great benefit for our work.

Pasquini: How do meteorological problems get dealt with?

Holt: Analysts in Meteorological Applications specialize in one area but also have basic knowledge of the operational suite so that they can at least start to investigate if not solve most problems when they are called in.

## THE DATA ACQUISITION PROJECT

Richard Dixon

### 1. INTRODUCTION

The data acquisition project is concerned with receiving incoming observations, sorting them into streams for preprocessing, and filing all the messages into a message database for future access. The development of a new system became necessary because of the termination of BE services later this year.

The new DEC VAX 6210 with 16 megabytes of memory and two 600 megabyte disks provides the power for the new data acquisition and preprocessing systems, and integrates better with our systems which handle the incoming data.

### 2. REQUIREMENTS

In reimplementing the system we introduced some new features such as a separate message database for the recording and extraction of data at a later time, the ability to handle the new system on a distributed basis, and the possibility of introducing additional sources of data as well as test databases.

The final system has to be reliable and recoverable, so that faults in the system or restarts should not result in loss of data; it should be also flexible enough to make possible the easy introduction of new data types, and efficient in making use of the available hardware. The system we are working on, which is approaching its completion, seems to fulfill all these requirements.

### 3. THE SYSTEM DESIGN

The origin of all data in the system is a group of input queues, which are normally built and filled by the telecommunications system (NTC/NTS). The data acquisition scans the queues and when it sees unprocessed data, it takes the oldest unprocessed file from the queue and unpacks the messages contained in it. Each time a message is removed from the queue, a time stamp is created from the VAX system clock and attached to the message. This timestamp will stay with the message throughout its life in the data acquisition system, and serves to identify it uniquely.

The message database consists of a number of separate files, each of which feeds a single preprocessing stream. To form these separate stream files into a single logical database, an additional index file which includes an entry for every message handled by the data acquisition, is also kept. For each incoming message the first task is to create a new index entry.

While the index entry is being created, it is a simple matter to check whether an identical message has already been received. Duplicate messages (i.e. messages with the same WMO header that are not longer than the earlier version) are regarded as 'second class data', and are written to a set of files which will not be archived or passed to preprocessing. New messages ('first class data') are written to the main database files. The index to the message database contains all information about each incoming message except for the actual message contents, and may be used to monitor the receipt of data.

The preprocessing streams read their data from the message database files at the same time as the data acquisition is writing them. In order not to use up too much time in checking the files for new data when the preprocessing is waiting, the files are read through an access library which includes a signal mechanism. When a preprocessing stream has read all the data available, it will become inactive until data acquisition re-activates it.

To allow the automatic restarting of a preprocessing stream from the same point at which it stopped, the access library also keeps a journal file for each preprocessing stream. Into the journal file are written records indicating the start and finish of each file received from the queues. This information is very important for recovering after unscheduled stops without a loss of data.

Some time after the message files have all been handled by preprocessing and their contents entered onto the reports database, the stream files and the index file are archived. The 'second class data' files which received the duplicated messages are simply deleted from disk: they are kept initially so that a human operator can select an alternative copy of a message, if one exists.

The new system provides also the possibility for selecting data to be forwarded to Member States.

#### 4. CURRENT STATUS

The developed new data acquisition system has now be routinely running since the beginning of the year, and has shown that it can handle what the existing sytem does. Mechanisms to handle new data types (messages in binary form) are in place.

The recoverabilty of the system is very good. However, the VAX interface to CFS, needed for file archiving is not yet working. It is planned for the system to become operational by the end of this year.



## THE NEW PREPROCESSING SYSTEM

Rex Gibson

### 1. FUNCTIONAL DESIGN

The basic functional design of ECMWF's Meteorological Operational System (EMOS), and especially of the preprocessing subsystem, is described in Meteorological Bulletin M1.4/1.

### 2. PROJECT STATUS

The decoding software has now been completely written and tested, though not within a full operational environment. The quality control code has been written for most data types; integration has begun, and extended testing began with one particular data type (AIREP) in order to test fully the interface to the message data base, and the delivery of data to the reports data base.

It is intended to extend the testing to the remaining data types, one by one; the complete set of preprocessing streams will then be run in real-time for an extended period. During this period of extended testing, the interfaces to the data assimilation system, the data coverage, and the manual correction will be developed. Data from the test running of the preprocessing streams will be used to assist in this development.

During the second half of this year work will be concentrated on the system integration, optimisation, and implementation. It is envisaged that full scale tests of the complete system, with subsequent data assimilation will be achieved by the end of September, and that operational implementation will be achieved during October and November.

### QUESTIONS:

Henning: Is GRID converted to GRIB, and then added to the data base?

Gibson: GRID data are converted into GRIB, then inserted into the fields data base; all reports are decoded to BUFR for the reports data base.

Dietzer: Who does the manual correction of the reports?

Gibson: The Meteorological Analysts in the Met. Ops. room. Since this is a time consuming process, and there may not always be sufficient time, the error files are split according to whether or not stations are considered to be "important" stations.

v.d.Plank: Is the software only for ECMWF use, or would it be available for Member States' Meteorological Services?

Gibson: All meteorological support software is available to the ECMWF Member States when tested. With regards to suitability, there are elements in this system which are of potential interest to a national weather service as well as to ECMWF; there also may well be some areas where that is required at ECMWF is only a subset of the requirements of a national weather service.

- Juega: What are the differences between the old and the new system?
- Gibson: The principle difference is the near real-time aspect of the new system, and the proximity of the preprocessing to the telecommunications source and subsequent data acquisition process. The objective has been to retain what was good in the old system while attempting improvements. We have taken the opportunity to use the standard agree international exchange formats, BUFR and GRIB, and we have designed to new system such that it will be possible to extend the validation and quality control in the future to introduce time continuity checks, and perhaps limited checks against first-guess data.
- Rudsar: Is the structure of the GRIB data base purely sequential?
- Gibson: The fields data base uses Cray unblocked data sets which are word addressable. Data are split, by timestep, into files within the data base, and several data bases (for operational and research purposes) are maintained. All data bases within the fields data base concept are maintained through a common software package, and linked by means of a master index which points to the data base index of each known data base.
- Henning: Is the preprocessing performed in real-time, or in batch?
- Gibson: The old system, still currently in use, is batch. The new system is meant to be as near real-time as possible, and is data driven.

## SYSTEM PLANS

Claus Hilberg

### 1. INTRODUCTION

There are 13 staff working in the Systems Software Section. They are responsible for the basic software for all machines as well as for the Local Area Network, CFS and the new Supervisor (SMS).

### 2. CRAY

The Cray will be replaced in Summer 1990. It now runs COS 1.16, but we plan to introduce the recently released COS 1.17 because we hope that it could solve the present scheduling and stability problems (COS 1.16 does not make good use of SSD, and manual scheduling is required).

ECFILE on the Cray is now operational, and MS users are urged to use it for storage and retrieval of files. CFT77 is also operational. Users are advised to adapt their applications to CFT77 because of the better performance it offers, and - in anticipation of the new supercomputer to come next year - to make their programs as ANSI standard as possible.

### 3. THE CYBERS

BE will be phased out at the end of 1989. Therefore, no more updates will be introduced. Users have to transfer their applications, and files away from BE as soon as possible. We expect that the announced replacement of the 835 by a second-hand 855 will not affect MS users.

VE will be in use at the Centre for some years and we intend to always upgrade it to the most recent version. After the decision taken by the Council at its last meeting, MS users may also have access to it. There are, however, still few NOS/VE MS users.

It is planned to implement ECFILE on VE. A VE version is already available, but some raw edges have still to be polished before it becomes operational. It will provide the same facilities as on the Cray and have the same Fortran callable interface, but each command itself will be a little different because of the nature of the VE command syntax.

### 4. THE VAXES

The VAXes will also continue to be used at the Centre for some years. We are currently upgrading VMS from 4.7 to 5.0, which is quite a major exercise. The changes have not been noticed by the external users but internally we had to verify (and sometimes modify) VAX software developed at the Centre because it makes substantial use of VAX system services. We will, however, continue to follow DEC upgrades as closely as possible, albeit with small delays because of the possible impact of the changes on our in-house software.

There is no operational version of ECFILE on the VAX yet, although we started its development on a VAX. The urgent need to have a Cray version because of the phasing out of NOS/BE made us concentrate our efforts on the Cray ECFILE

development. It is, however, planned to introduce a VAX version as soon as it is possible.

#### 4. CRAY RHF

When BE is phased out, Cray RHF should provide the link between Cray and the VAXes. We have the code on site but there are still problems to be solved before it becomes operational.

We believe that its introduction will cause no problems to MS users, and we will try to find a way of doing the job card editing provided by the BE station at the moment in such a way that users will not be affected.

#### 5. CFS

The Common File System (CFS) which was originally developed by Los Alamos National Laboratories is now marketed by a commercial company. It is a big package of great operational importance for the Centre. Therefore, we will introduce enhancements and some new facilities that are needed, but this will not be visible for MS users.

We also plan to introduce a "Universal Text Format" which will make it possible to move text files from one system to another via CFS.

#### QUESTIONS:

Greenaway: Will the planned conversion of job cards also handle the known upper/lower case problems on the Cray?

Hilberg: There have been some problems in this context (e.g. with Update) and we are investigating possible solutions after the experiences gained with NOS/VE.

Roger: The connection between the French VE and the Centre's VE is very slow. Do you intend to improve the situation?

Hilberg: This is mainly a problem of the PSS connection, and it is advisable to use the normal line and make an X29 call. We will start experimenting with X25 link to CDCNET when BT approves the Cyber X25 service.

## DATA TRANSFER TO MEMBER STATES VIA THE TELECOMMUNICATIONS LINK

Norbert Kreitz

### 1. INTRODUCTION

The transfer of data from the Centre to Member States is an integral part of the services provided by the Center. Batch output and data dissemination files are transferred automatically. All other data transfer has to be done under user control. Transfer of data originating on the Cray is of paramount importance to Member States not only because its number-crunching facilities are widely used but also because it is currently the only machine with access to the MARS archives. Some procedures developed at the Centre to facilitate this task are described below.

### 2. TRANSFER OF DATA

Until Cray RHF is operational, data originating from the Cray destined for a Member State are transferred to the telecommunication VAXes through the Cyber NOS/BE system. If the data are in coded format the transfer can be initiated by calling the NOS/BE procedure SENDTM in the TEXT field of the DISPOSE command, thus initiating all necessary steps in the transfer chain.

If the data are in binary format, however, problems may arise if the Cray records are bigger than 32 kbytes, the maximum record length that VAXes can handle. In this case the Cray records have to be split up into pieces, less than 32 kbytes long, before they can be transmitted. This can be done with the new utility CHOPPER, whose output file can then be transmitted in the same way as before, using SENDTM in the DISPOSE command. At the receiving end, the records can be reassembled again using the program JOICR (JOIVR on the VAX).

### 3. CONCLUDING REMARKS

The software presented here is a temporary solution, as it involves NOS/BE and will be replaced by a Cray RHF version later. It has not been extensively tested, therefore some care when using it is appropriate.

#### QUESTIONS:

- Juega: Can it work to a non VMS or VE Member State? We would like to try it out.
- Kreitz: You have to get JOICR (the program to join Cray records) working, and this might involve some work.
- Pasquini: Will JOICR be officially distributed, or Member States have to ask for it?
- Kreitz: We would like to get it out when the PF file type is implemented.
- Orrhagen: We would like to test it ASAP.

## ECFILE - ECMWF'S CENTRAL FILESTORE MANAGER

Neil Storer

### 1. INTRODUCTION

ECFILE is the new central filestore manager at ECMWF. It was developed for use on the Centre's mainframes and is based on CFS for the underlying storage system. The files reside in CFS on the IBM MVS system with the user not knowing on which device his data are.

ECFILE has been in use on the Cray for almost a year, it will shortly be available on the Cyber under NOS/VE, and on the VAX under VMS later.

### 2. ECFILE

The running version of ECFILE consists of two parts: one running on the Cray and the other on the IBM, communicating with each other using the Application-to-Application communication interface of Superlink.

The IBM part consists of a multi-tasked PL/1 program also called ECFILE. However, the user need only be concerned with the Cray part of ECFILE as the IBM part is more or less transparent to him.

The Cray part consists of a single-task Fortran program and a subroutine interface called ECFILE. So, ECFILE may be called either via the ECFILE control statement in JCL, or via the ECFILE subroutine from within a Fortran program. The parameters are the same in both cases with the function parameter FN specifying the required service: ADD (new directory), AUDIT, COPY (file), DELETE (file), GET (file from CFS and send it to the worker machine, equivalent to Cray ACQUIRE), LIST (directory node information), MERGE (two subdirectories), MODIFY (information in the directory or file-descriptor node), MOVE (file-descriptor or directory to another path), REMOVE (directory node), SAVE (i.e. store a file from worker machine in CFS, equivalent to Cray DISPOSE).

### 3. COMMON FILE SYSTEM (CFS)

As mentioned above, ECFILE uses the Common File System (CFS) to store files on the IBM. CFS was developed by Los Alamos National Laboratory in the USA, but has been extensively modified at ECMWF.

CFS is used to handle the storage media on which files are kept, so that the user (and ECFILE) need not worry about where his files reside. It will migrate files from disk to MSS and then to cartridge tape, depending upon such factors as file size and frequency of access. So, small, frequently accessed files usually reside on disk, medium sized files reside on MSS, whereas large and rarely used files usually reside on tape. However, the initial placement of a file can be affected by parameters specified by the owner, such as how frequently it will be accessed.

The storage devices used by CFS are very reliable, but they can still fail and data could be lost due to software bugs and user errors too. Since data in CFS is not backed up automatically, the owner himself is responsible for backing up his critical data!

CFS uses a hierarchical directory structure consisting of directories, sub-directories and file-descriptors, in a tree-like structure. Pathnames identify file-descriptor and directory nodes. The maximum length of a node name is 14 characters, whereas the maximum length of a complete pathname is 94 characters. Security is implemented by a system of access rights and passwords. By default only the owner of a file may access it, no-one else. The owner, however, may grant access rights/privileges to other users choosing what restrictions he wishes.

#### 4. MISCELLANEOUS

The maximum size of a file in CFS is 195 MBytes, i.e. approx. 24 Mwords. Cray datasets bigger than this must be split before SAVED.

There is no such concept as file cycles or editions in CFS. It is left to the user to name his CFS files in such a way that the name of the file incorporates such information.

Once a file is DELETED it is gone for ever. There is no mechanism to retrieve it. FN=DELETE is final, but it is possible instead to use FN=MODIFY,NNAME=.,REL=3 to act similar to DELETE but gives the user 3 days in grace.

Critical files in CFS must be backed up via COPY by the user. This is not done automatically by the system.

#### 5. CONCLUSIONS

ECFILE has been running satisfactorily on the Cray for some time now transferring approx. 9 GBytes of data between Cray and IBM on a typical day. Member States users are urged to use it for storage and retrieval of files, taking into consideration that files stored on NOS/BE will not be accessible any more after the end of this year.

A NOS/VE version will be introduced after all problems have been solved, and a VAX version will follow.

## MARS - ECMWF'S METEOROLOGICAL ARCHIVE

John Hennessy

### 1. INTRODUCTION

The Meteorological Archival and Retrieval System (MARS) was designed to address the problems encountered when using the GETDATA archive strategy, and provide an efficient, machine independent system based on a dedicated data handling machine connected to the other computers at the Centre via the local area network. Storing data in machine independent format ensures long-term compatibility and ease of support for the archives, enabling retrieved data to be used easily on any computer system.

### 2. SYSTEM OVERVIEW

The files of MARS archive data are managed by the Common File System (CFS), developed by Los Alamos National Laboratory. CFS is responsible for handling the storage, retrieval and backup of files in an integrated system covering all the various storage media available to the IBM 3090 150E with Vector facility (32 MBytes of memory, 32.5 GBytes 3380 disk storage, 169 GBytes mass storage, 6 tape drives 3420, and 8 tape drives 3480). These devices are used in an hierarchical manner by CFS, which moves files between the different media, with the aim of having the files most frequently accessed immediately available from disk or mass storage and those least frequently used stored on tape. Related files are kept together when written to tape.

Facilities to archive and retrieve data and to manage the database are provided by the MARS application software package which consists of a central component resident on the IBM server machine and a component on each of the other, worker machines. When a user invokes the system on a worker machine, a network connection is made with the central MARS component of the IBM.

### 3. ARCHIVE CONTENTS

The archived data includes (or will include)

- a Daily Archive, containing data at model resolution,
- a Time Series Archive, containing data at a lower resolution,
- an Archive of Monthly Means of model variables at model resolution,
- an Observational Archive, containing raw data, decoded and substituted values, quality control and analysis flags,
- Research Department Archives of results of numerical experiments,
- other datasets, to support a general data service, e.g. TOGA.

### 4. DATA STORAGE

All data is stored as series of CFS files, grouped into families to comprise archive streams. Some files are copied, or modified and copied, into more than



one family, to improve the efficiency of different retrieval combinations. This will, in particular enable access to time series data across a more suitable combination of files than that suited for retrieving daily data.

Surface data kept on model grid refer to model levels as well as pressure levels.

Observational data are stored in data structures, representing a number of observations within a specific geographical area.

Users need only specify requests in terms of data, with MARS doing the necessary mapping to CFS files and to the location of observations or fields within files.

## 5. DATA FORMATS

The obvious advantages to be gained by having one, machine independent and universally accepted standard for representing data in field form, encouraged ECMWF to give substantial support to WMO in defining the GRIB code for binary representation of field data. All MARS field data is stored in GRIB format.

What has been done in standardising binary representation for binary data in field form has been done for observations as well and has resulted in the BUFR (Binary Universal Form for Records) code. Previous archives will be converted to the standard formats.

## 6. MARS SUBSYSTEMS

MARS has three major sub-systems:

- MANAGE for archive information and management,
- ARCHIVE for storing data in an existing archive, and
- RETRIEVE which provides the necessary facilities to retrieve archived data.

MS users are mainly interested in the services provided by the RETRIEVE subsystem. Using the available directives they can specify

- which archive to access,
- which data to extract
- what processing to be done on the data,
- which file retrieved data is returned in,

Data is retrieved to the machine from which the request was issued.

The basic additional processes which may be performed on retrieved data are:

- spherical harmonic to grid-point conversion,
- sub-area extraction,
- grid mesh selection/conversion,
- production of U and V wind components from archived values of vorticity and divergence,

- unpacking (decoding) of retrieved data to one floating point value per word.

New facilities to add, difference and mean fields will also be provided.

## 7. USER INTERFACE

The MARS user interface consists of a simple language which enables users to communicate their requirements to the system in syntax is

```
VERB,Parameter1=Value1,....,ParameterN=ValueN
```

The following is an example of a retrieval request, resulting in the specified data being retrieved to the file MYFILE:

```
RETRIEVE, CLASS=OPERATIONS,  
TYPE=FORECAST,  
STREAM=DAILY ARCHIVE,  
LEVTYPE=PRESSURE LEVELS,  
LEVELIST=850/700/500,  
REPRES=SPHERICAL HARMONICS,  
PARAM=GEOPOTENTIAL,  
DATE=850930,  
TIME=12,  
STEP=24/TO/240/BY/12,  
TARGET="MYFILE",  
  
FORMAT=UNPACKED,  
RESOLUTION=T106,  
AREA=GLOBAL
```

## 8. BATCH INTERFACE

The batch interface always requires that a file of MARS directives be available. The format of the control card is

```
MARS, INPUT=lfm[Param1=Value1].....[ParamN=ValueN].
```

If INPUT=lfm is not present the default directive file is the job input stream. Other parameter=value pairs (which are optional) specified in the call will override values already in the file of directives.

The user is provided with one file of data for each retrieval request. Depending on the request these files may be merged and be local or catalogued.

## CFT77: CRAY'S NEW OPTIMISING COMPILER

Richard Fisker

### 1. INTRODUCTION

CFT77 is a completely new Cray compiler. It is written in Pascal and this should improve maintainability, portability on different machines, and make developments much easier to implement than for CFT. It is supported on COS and UNICOS on all Cray systems and it will be also available on all future machines as well.

### 2. CFT77 TRADE-OFFS

CFT77 will be available on all Cray systems, Fortran codes thus being portable from one Cray machine to another. Due to improved vectorization and optimization, it produces faster object code than CFT did. So, running our Spectral Model under CFT77 reduced the CPU time by 10%, while the Analysis became 20% faster after having overcome some initial problems. Syntax checking has been improved, and some features of Fortran 8X implemented.

The availability of Autotasking is of particular interest to us. But since it is currently available only with UNICOS, we have not gained any experience with it yet. It requires, however, significantly more compile time (typically 4 times slower than CFT), and code changes due to some incompatibilities with CFT (e.g. INTEGER rounding).

### 3. FORTRAN 8X EXTENSIONS

Some useful Fortran 8X extensions have been incorporated in CFT77. They help to write more readable code, make it easier for the compiler to vectorize (and possibly autotask), and facilitate memory management. So, for example, long identifier names are now possible (up to 31 characters), a subset of the ARRAY syntax is implemented, and automatic arrays are provided with their size determined at runtime. Recursive functions and subroutines are also possible but require the prefix RECURSIVE.

### 4. VARIOUS CFT77 FEATURES

The current default CFT77 is version 2.0. Some of its features are

- possibility for external source code files to be inserted (INCLUDE statement),
- LOOPMARK feature to indicate whether loops vectorized,
- allocated memory may be preset to undefined values using the INDEF option (for ALLOC=STACK only),
- compiler directives available to control bottom loading of loops.

An unpleasant feature of this version is that when users want to get DEBUG output, they have to switch off optimization i.e., they do not debug the same

problem. The next version of CFT77 (3.0) corrects this, and introduces apart from other improvements Autotasking (only for UNICOS at the moment).

## 5. AUTOTASKING

Autotasking is a new Cray product which automatically identifies the parts of a program that can run in parallel. It is done in three phases. First code dependencies are analysed and the Fortran code restructured with autotasking directives added to show found parallelism. This code is then used during the following translation phase to produce modified Fortran source code with embedded calls to library routines and intrinsic functions, which is finally compiled by CFT77.

We have not yet been able to assess autotasking because it works only with UNICOS; however, one problem is that the code seen by the compiler is not the same as the code provided by the user. This may create difficulties when debugging programs.

## 6. PORTING CFT PROGRAMS TO CFT77

Porting is facilitated by the fact that all CFT extensions and most compiler directives are implemented in CFT77 as well. However, optimization is significantly different in CFT77, and code changes may be required. For example, CFT77 does not force strong rounding, and this caused minor problems to the spectral model, but more serious ones with the analysis code.

It should be also born in mind that CFT77 requires the use of the segmented loader SEGLDR. SEGLDR has a completely different syntax as well as parameters than LDR. However, conversion from LDR is easily done by using LD2, a preprocessor that haves the same syntax as LDR, but converts to, and invokes SEGLDR.

## 7. CONCLUSIONS

Use of CFT77 and SEGLDR is strongly recommended as they offer new features and Cray support for them is much stronger.

### QUESTIONS:

Greenaway: When will CFT77 3.0 become operational?

Fisker: We have not tested the Suite yet, and there are some problems with ECFILE. Therefore, no date for the transition has been set.

## NEW SUPERVISOR SYSTEM

Claus Hilberg

### 1. INTRODUCTION

The daily production of our forecast is a complex operation with approx. 850 jobs running on 9 different mainframes from 4 different vendors connected together by 5 different link media using for these interconnections 6 different software packages. It is clear from this that there is a strong requirement for an automatic tool to help operators manage this workload. The Supervisor Monitor System (SMS) originally developed in 1979 and rewritten in 1982 has hitherto provided a very good service. It runs on NOS/BE and is written in SYMPL. With NOS/BE due to be phased out at the end of the year a new SMS had to be developed written in a language which is used on all machines to increase portability.

### 2. THE OBJECTIVES

The new Supervisor should allow a distributed process control, so that, for example, rescheduling of work is possible if a machine goes down. It should also provide centralized operator control, so that only one terminal is needed for the operators to find out the current status. All messages should be written into a central log file, and not only on paper as is the case now. Finally, distributed access to status information should be provided. The present Supervisor provides good and useful services, so the new one should provide the same functionality enhanced by those features that were found missing in the old one. The requirements, therefore, were that the new SMS should provide the functionality of the present one but better control of distributed processing, improved portability and reduced machine dependence, be able to run under VAX/VMS, satisfy operational as well as research requirements, and - what is totally new - be able to change the suite on the fly.

### 3. HOW THE SMS WORKS

The basic work unit presented to the SMS is a task, which performs a well defined piece of work. The SMS allows the user to define a number of tasks to be carried out on a configuration of computers and to declare dependencies between the tasks and conditions to be met before initiating tasks. The tasks which together perform a certain (major) job are considered as a unit and are collected into groups called families. Families are collected into groups called suites. One such example is our operational suite, but others can also be defined.

Tasks have the ability to send signals to the Supervisor (events). Timers can be used to control jobs by time, and triggers may be used to define complex dependencies between starting a task or a family and the state of a previously defined event, task, family or even suite. In case that a job fails, SMS restarts it once more issuing a message in case of new failure.

When SMS starts operating on a computer, it remains active until it is instructed to stop operation. The operator can at any time inspect SMS and either override the situation, or instruct SMS to schedule additional work for processing on the computers in the network by use of the command and display

program (CDP). CDP is not part of the processing of the SMS program. Its function is to provide the operator interface to the SMS system.

#### 4. SMS STATUS

The implementation has been completed, and documentation was sent out to all MS. It runs on VMS on VAX and under COS on the Cray, but there are no plans to implement it on the IBM. There is a need for some kind of networking mechanism, and a DECnet interface is now being coded.

SMS is available to MS on an as is basis, and some countries have already started (or consider starting) implementing it on their systems (e.g., The Netherlands, Finland, France).

The new Supervisor is now running at the Centre but not for operational work. It will become operational after some more tests have been done, before the end of this year.

#### QUESTIONS:

Fisker: What happens when jobs fail without issuing a message?

Hilberg: SMS would normally not notice it. A possible solution to this problem is to supply an estimate about how long a job will need to complete, so that SMS starts complaining if this time has been exceeded.

Fisker: What happens when the machine on which SMS runs fails?

Hilberg: There is a recovery problem when SMS is transferred to another machine. Our intention is to make running tasks send a message telling the system where recovery could start. Because of this problem, it is tempting to keep SMS on the VAX cluster. However, a great part of the jobs will run on the Cray, so it would make sense to have SMS there. A final decision has not been taken yet.

Roger: SMS assumes that only one network is available. But this is not the case either at the Centre or in France.

Hilberg: Some enhancements in this area are indeed needed.

Overend: Could it be possible to run SMS on a PC?

Hilberg: To do this you need a Pascal compiler as well as a mechanism that allows a PC to connect to other machines. It is still very difficult indeed to establish a connection between a PC and a Cray.

Orrhagen: What kind of time resolution does it have?

Hilberg: SMS looks at mailboxes every 100 ms. But all parameters will be tuned before the system becomes operational on the basis of the experience gained during the testing phase.

## MAGICS STATUS AND SUPPORT

Patrick O'Sullivan

### 1. MAGICS STATUS

The Meteorological Applications Graphics Integrated Colour System (MAGICS) is a subroutine library for general meteorological graphics applications written in Fortran 77 and developed at ECMWF. Its development started in 1984, it became operational in December 1985 providing mapping, contouring, wind and text plotting. Development continues and new enhancements, e.g. contour shading, observations plotting, faster contouring, axis drawing, have been introduced.

It was designed to conform to and use the new meteorological and graphics standards (e.g. GKS, GRIB and BUFR), makes use of modern contouring methods (CONICON) and provides a flexible and user friendly interface.

It performs a major portion of the general meteorological graphics applications at ECMWF, and has also been made available to 12 Member States.

### 2. MAGICS SUPPORT

The MAGICS support provided by the Centre for participants in the Joint MAGICS/GKS project is guided by the following proposals:

- a. ECMWF will investigate and solve problems, if they are demonstrable by the participants on the Centre's computers.
- b. Corrective code will be incorporated into new MAGICS releases.
- c. Major MAGICS releases will be made available from time to time, when such releases are made available for internal use at the Centre.
- d. ECMWF will inform about the availability of new releases. However, releases will only be sent on request. Updates to the MAGICS manual set will be included, and the usual tape handling charges will apply.

### 3. PARTICIPATION BY OTHER MEMBER STATES

Member States asking to join the joint MAGICS/GKS project will be subject to the same conditions as the current participants, i.e.

- a. pay a contribution of 2000 pounds,
- b. buy a CONICON option from the University of Bath (2600 pounds), and
- c. make their own provisions for a GKS implementation.

The contributions will be used to finance further enhancements of MAGICS.

## MAGICS/GKS OVERVIEW AND ENHANCEMENTS

Patrick O'Sullivan

### 1. INTRODUCTION

The Meteorological Applications Graphics Integrated Colour System (MAGICS) is a subroutine library which was developed by ECMWF to cater for all its graphical needs, but has also been made available to 12 Member States. It was designed to conform to and use new meteorological and graphics standards, e.g. GKS, GRIB, BUFR. It makes use of modern contouring methods (CONICON) and enables users to take advantage of colour graphics and device independence. It provides a flexible and user friendly interface.

### 2. MAGICS

#### 2.1 Elements of the design

MAGICS consists of a small number of subroutines and contains a comprehensive list of keywords which enable users to have full control over all graphical aspects in a very flexible way. This method allows easy-to-remember, plain-language keywords and the list of keywords can be easily extended.

A feature of MAGICS, which helps to reduce tedious and repetitious work, is the grouping of MAGICS parameter values. A group can be stored either internally in MAGICS or on a user-supplied file. These sets of parameter values can be used in later programs. This feature facilitates modular programming and makes programs more readable.

#### 2.2 Data input

MAGICS has been specifically designed to reduce the problems normally associated with passing data for fields to graphics packages. It has greatly simplified the extraction of areas to be contoured and conversion of data to polar stereographic projection.

Data for contouring and wind plots may be passed to MAGICS in matrix form or, in the case of data in GRIB code format, in the form of an input file. Data for observation plotting must be in the ECMWF Reports Data Base (RDB) format, but a future release will also permit data to be presented as WMO standard BUFR code.

#### 2.3 Mapping

Mapping is the placing or projecting of coastlines, grids and data onto the user's plotting area. Two types of projections are catered for, cylindrical and polar stereographic. It is not necessary for users to extract the required area before passing data as MAGICS can perform this function and the conversion to polar stereographic, if required.

#### 2.4. Contouring

MAGICS contouring is based on CONICON, which is designed to draw the contours of continuously differentiable fields. The contours are calculated in the user's input field and then projected onto the required area, for both cylindrical and



polar stereographic. A faster but coarser method of contouring, based on linear interpolation, is also available.

### 2.5 Contour shading

Contour shading allows users to shade the areas between contour levels with varying intensities, dot sizes and colours, and enables more information to be plotted on a map without causing confusion. Shading may be achieved with or without contour lines.

### 2.6 Wind field plotting

Wind fields may be presented to MAGICS as u and v velocity components, as speed and direction, or as GRIB code data. They may be plotted as wind arrows, WMO standard wind flags, streamlines, or isotachs. The use of colour enables the plotting of coloured wind arrows where the colour of the arrow can represent the relevant temperature, humidity etc.

### 2.7 Axis plotting

MAGICS axis facilities allow users to plot vertical and horizontal axes and include axis labelling, axis title plotting and subdivision of axes with ticks. Axes may be regular, logarithmic or user-defined.

### 2.8 Observation plotting

Observation plotting allows for the plotting of all observation types. At present, observational data for plotting must be in the ECMWF Reports Database (RDB) format, but a future release will permit observations to be presented as WMO standard BUFR code.

### 2.9 Text and legend plotting

MAGICS allows users to plot a block of text anywhere within the user's page, positioned automatically by MAGICS or specifically by the user.

Legend facilities are also provided with legend entries plotted into an area known as the legend box. Each legend entry consists of three distinct parts: symbol, automatic text and user text. The user has full control over the positioning of the legend box, the number of legend entries and the way entries are plotted within the box.

## 3. RECOMMENDATIONS AND SUGGESTIONS FOR ENHANCEMENTS

A series of recommendations and suggestions for enhancements of MAGICS have been made by users from the Member States as well as from the Centre. These include proposals for

- a. land/sea shading as well as masking for surface parameters, blanking of text/legend, and the provision of thicker contour highs/lows and labels,
- b. implementation of the rotated lat/long as well as of the transverse mercator projection,
- c. data representation for projected field plotted on polar stereographic with true map scale,

- d. plotting of observations in BUFR code, ship observations should be plotted on the side of the map to prevent overplotting, rotation of observations with longitude,
- e. implementation of some new features such as thermodynamic diagrams, X/Y graph drawing, plotting of gridpoint markers, plotting of digits/letters/ markers at selected positions and imaging,
- f. finally, the provision of documentation to enable substitution of other methods for contouring/coastline plotting by MAGICS, as well as support for GKS Level 2B and CGM Addendum 1.

## MICROMAGICS OVERVIEW

Jens Daabeck

### 1. INTRODUCTION

MicromAGICS is an adaptation of our MAGICS/GKS software to a microcomputer environment. It includes a user-friendly interface and an animation module, and it is expected to find a large user community because it is based on a very common and cheap environment, but offers at the same time a fairly large functionality. The transfer of MAGICS to a standard microcomputer environment was done by CPTEC (Centre for Weather Prediction and Climate Studies) in Brazil with ECMWF providing technical assistance.

### 2. MAGICS AND ITS RELATION TO MICROMAGICS

The MAGICS software was designed to support the needs of an operational NWP centre, and includes a list of facilities for 2-D plotting of fields and observations. It is based on new meteorological and graphics standards: GRIB, BUFR, CGM and GKS. It consists of a small set of Fortran callable subroutines which allow for plotting of contours, observations, wind fields (flags, arrows, streamlines and isotachs), text and legends.

MicromAGICS maintains the essential functionality of MAGICS, and provides a user friendly interface due to an interactive layer built on top of the MAGICS software.

### 3. CHARACTERISTICS OF MICROMAGICS

#### 3.1 Design goals

MicromAGICS was designed for the meteorological user doing research or operational work on an IBM (or IBM compatible) PC running MS-DOS and having a standard EGA graphics board. The data (observations, fields, or graphical plots) are already residing on the PC.

The basic assumption is that the typical user is interested in a sequence of plots, produced for some previously defined set of conditions (parameters). He would select a sequence of fields (and/or observations) for examination establishing what graphical function and geographical area is desired for each field.

As each plot is generated on the screen, the user may save it for creating an animation sequence, and for plotting on other graphical devices. In the first case, a slide is created, whereas in the second, a chart is generated. When a sequence of slides has been created, the user is able to view them in a carousel-like manner.

#### 3.2 Input and output

MicromAGICS accepts as input meteorological fields and observations in the standard GRIB format. If the data is not in an accepted format, the system will enable the conversion from a rectangular array of grid point values to GRIB format.

The output is either charts displayed on the screen, or metafiles for transfer to another system. MicromAGICS also allows for plotting of meteorological charts stored as metafiles.

### 3.3 User control

The parameters for executing actions are under complete control of the user. Default parameters can be generated for each action, and stored for later usage.

## 4. MICROMAGICS ORGANISATION

The general format of MicromAGICS is a set of 3 layers on top of the operating system. The first layer is the interactive layer which provides a menu-driven interface that enables the user

- to choose the data (DATASEL menu),
- to control graphical output (VIEW menu),
- to inspect and modify the parameter values of the specification groups currently in use (PARAMETER menu), and
- provides general book-keeping and maintenance functions (UTILITIES screen).

### QUESTIONS:

Orrhagen: When will MicromAGICS become available?

Daabeck: It should be here at the end of April, and depending on our experience, it could be made available to MS soon after that.

Juega: Will the source be available?

Daabeck: Yes, including the menu system which is part of it. It requires (MICROSOFT) Fortran77, and a C compiler for screen manipulation.

Rudsar: Could MS have MicromAGICS without having MAGICS?

Daabeck: I don't see why not, however, the meteorological service would have to join the "MAGICS Club" first.

## GKS, GKS AND MAGICS, CGM

Arne Jørgensen

### 1. GKS

GKS provides a set of basic functions for computer graphics programming. An application program calls GKS subroutines to generate graphical images on one or more graphics display devices.

The reasons for introducing a standard for basic computer graphics are:

- portability: An application program should be easily portable between different installations.
- device independence: An application program should produce similar - perhaps identical - images on quite different devices without program modifications.
- device longevity: The whole array of graphical devices including vector and raster hard copiers, frame buffers, storage tubes, refresh displays, microfilm recorders etc. should be controllable in a uniform manner.

GKS is device independent at such a level of abstraction that hardware peculiarities are shielded from the application program. Different levels of device intelligence are hidden from the application program by simulating missing facilities in software.

### 2. MAGICS/GKS

MAGICS is an application on top of GKS which uses it to achieve various enhancements.

Multiple workstations within a single program are available. A workstation in the GKS context can be a screen display, a plotter or a metafile. This can be used to produce a picture on a screen, send a hard copy to a plotter and store the picture in a metafile for long time archiving, all in the same run.

MAGICS uses the GKS output primitives Polyline, Fill Area, Text and Polymarker but not Cell Array. Polymarkers are used in one way only to provide the smallest available dot, e.g. in shading between contour lines. All other marker symbols in MAGICS are implemented by Polylines because the polymarker size is workstation dependent and therefore difficult to control consistently.

Instruction string commands have been introduced to enhance the control of text in order to support plotting of formulae, special symbols like the degree symbol and general control of font, quality colour, elevation (sub and superscript), height etc.

General blanking is not available in GKS, but blanking of grid labels in polar stereographic mapping is implemented in MAGICS.

Because GKS is the functional interface between MAGICS and the graphical devices, MAGICS is easily portable. All a site has to provide are a Fortran-77 compiler and a complete GKS installation. MAGICS can then start using all devices connected to GKS when a few well defined system dependent routines have been adjusted to the local environment.

### 3. COMPUTER GRAPHICS METAFILE (CGM)

The Computer Graphics Metafile is an ISO Standard for the storage of graphical information. Metafiles can be used for picture transfer between computers, graphical devices and software systems and also for archiving purposes or to support a picture library.

However, there are various barriers to CGM interchange as its implementations may differ in the elements they place in CGM as well as the elements they can successfully interpret from CGM. Blind interchange of CGMs is not possible but supplementary agreements, e.g. for font and attribute support as well as physical file formats, must be established. In spite of the present vendor specific difficulties, CGM is indeed widely adopted by graphics software and hardware vendors as well as industrial manufacturers as the major standard for interchange of information. CGM is closely related to the other standards GKS and CGI (Computer Graphics Interface). CGM generation and interpretation by GKS is well defined in the CGM Standard document.

CGI is anticipated to become a Standard in 1990, but based on the draft documents, CGI already sets the trend for graphics software and hardware vendors. GKS implementations are expected to be able to use CGI as their sole interface between the device-independent and the device-dependent code. It will also be possible to generate CGM from CGI and to interpret a CGM through CGI in a straightforward way.

ECMWF plans to produce a catalogue of metafiles in CGM operationally, and Member States will be informed about it in due course.

#### QUESTIONS:

Juega: Could you give us advice on what GKS implementation to use given that this is my first experience of GKS?

Jørgensen: We do not do that, except to say that it must be of level 2b.

Daabeck: Member States can, of course, discuss the matter with us separately if they wish to.

## FINAL DISCUSSION

Hoffmann: Concerning the problems with the DECnet area numbers, the policy we decided to implement is that the Centre itself - taking note of your wishes - will allocate you an area number for the DECnet connection. If needed, up to a total of 3 area numbers could be allocated to a MS, but area No. 1 is excluded.

You should also note that when you want to introduce new equipment and want to discuss the implications with the Centre, technical staff from the MS should visit the Centre for advice and in depth discussions, rather than trying to get information via VAX Mail or telephone calls.

v.d.Plank: The turn around times of jobs vary substantially. Therefore, some sort of guarantee of turn around times would be much appreciated.

Hoffmann: It is not possible to guarantee turn around times, because the elapsed time is unpredictable. We produce daily statistics, and try to understand what is happening and improve the service. However, small changes in workload sometimes result in great differences of turn around times. If necessary, users should use higher priority on the job card.

MS should also note that during parallel runs of the operational suite the time available to users will be restricted.

Pasquini: Do you think that it is possible to find a way of exchanging technical information between MS?

Hoffmann: It would be very useful and we are currently investigating the possible ways of doing it. So, e.g., we will be evaluating shortly the VAX Notes package.

Juega: Up to which degree is this meeting independent and can take its own decisions? Because regular meetings of this kind, the exchange of technical information during visits and by setting up an Installations Database are very useful. Do we need Council permission for this?

Also, is there a possibility to embed MS operational jobs doing some kind of postprocessing in the Supervisor so that they are submitted at the right time?

Hoffmann: The TAC wanted to be informed about this meeting, but it is the Centre that organizes it. We do, however, take note of the views of the MS as presented in the various official groups.

Concerning the embedding of MS operational jobs in our Supervisor, it is the Centre's view that our operations are independent from yours, because of the possible problems concerning responsibilities for, as well as testing and maintenance of such jobs. Furthermore, upgrades of our systems could affect those jobs, or MS jobs could

clash with parts of our suite. Therefore, MS should regard their operational jobs as their own responsibility.

The set-up of a technical database is a very good idea, but databases should be also maintained regularly!

We try to visit regularly MS. This year visits to The Netherlands and Norway are planned, possibly followed by visits to Germany and Spain.

Orrhagen: I agree that the triggering of MS jobs could create problems, but it were a great help to MS if a message could be issued informing MS to submit their jobs.

Henning: We use the arrival of some products to trigger jobs.

Is the transfer of metafiles a heavy load on the line? How big are they?

Daabeck: The CGM file size depends on the complexity of the plot. As an example, four test programs from MAGICS User's Guide have been used to generate CGM metafiles in Character encoding:

<u>EXAMPLE</u>	<u>TYPE</u>	<u>FILE SIZE (Kbytes)</u>
CONT01	contour	138
STRM01 (subroutine ONE)	streamlines	278
WIND04 (subroutine ONE)	wind arrows	411
CONT07	contour shading	187

There are copies of the programs and the plotted output in the MAGICS User's Guide.

Pasquini: We are planning to allow national users to access the Centre. Could we get any help on security issues from the Centre?

Hoffmann: A meeting on security later this year would be very useful because we all have similar problems. In the meantime we rely upon the accounts checking done by the MS.

(4 countries expressed interest in a meeting on security.)

Orrhagen: Is it possible for us to get software developed at the Centre to check accounts and improve security?

Hoffmann: All software produced at the Centre is available to MS, so is also the code developed to verify users.

The Computer Representative meetings are very useful to us. Therefore, I think that we should have an other one once the new supercomputer has been installed and is working. Taking into consideration the workload involved, the best date for the next meeting would probably be in Spring 1991.



## **PART 2**

### ***Member State Computing Representatives' contributions***

Note that although no-one from Greece was able to attend the meeting, a written report was submitted. It has been included here.

METEOROLOGICAL INSTITUTE OF BELGIUMComputer equipment

The main frame situated at the Belgian Meteorological Office is shared by 3 scientific governmental institutions :

- Royal Institute of Meteorology,
- Royal Observatory,
- Institute of Space Aeronomy.

The main frame is a Unisys 1100/82 :

Processors

- 1 CPU with SAM (Scientific Accelerator Module) -  
Power : 1.8 Mips
- 1 CPU without SAM
- CM : 2 x 1048 kw
- SIU (Storage Interface Unit): 8 kw
- 1 IOU (I/O Unit)
- 1 SMU (System Maintenance Unit)

Mass memory

- 2 x 5046 disk controllers ----> dual access
- 12 x 8450 disks (3.6 G bytes)

Other peripherals

- tape drivers : 4 Uniservo's
  - 1 x U30 : 800 - 1600 bpi
  - 3 x U36 : 1600 - 6250 bpi
- 1 printer
- 1 GCS (General Communication Subsystem)

Network

The network is connected to the Unisys through the GCS :

- 2 heavy terminals (UTS 700) are situated in the 2 other institutes sharing the main computer.
- 6 multidrop synchronous lines connecting terminals or PC's with SVT emulators (UTS20, UTS400, SVT, PC Unisys, Commodore, Olivetti, Tulip, Zeus) : ~ 53 terminals.
- 5 asynchronous terminals (tektronix graphical terminals or televideo 910).
- 1 IBM serie I connected via a direct line to the UNISYS is used for data acquisition and as backup for GTS data.
- 2 lines reserved for GTS data (WMO protocol).
- 1 X25 line connected to ECMWF.
- 1 asynchronous line connected to the VIDEOTEX system.
- 1 asynchronous line connected to HP X25-PAD multiplexer allowing a connection to the DCS (Belgian public network)

Several other minicomputers or PC's exist on our site but are not connected to the UNISYS.

- HP9000/320, HP9000/330 and HP9000/825
- VAX 11/730
- HP1000
- IBM PS/2 and IBM compatible PC's
- Olivetti M380T

Planned Configuration

The contract for the current main frame expires on the 31th of March 1990. The specifications for a new configuration were sent last February. The proposals were received end of March. The study of the proposals and the benchmarks will now be performed.

In short, the specifications contained the following features :

- one number cruncher.
- three departmental computers or a set of work stations having the same power as the departmental computers.
- a LAN allowing the connection of all the computers, PC's, plotters and printers on the site.

For the softwares, the migration to UNIX was decided.

Projects run at ECMWF

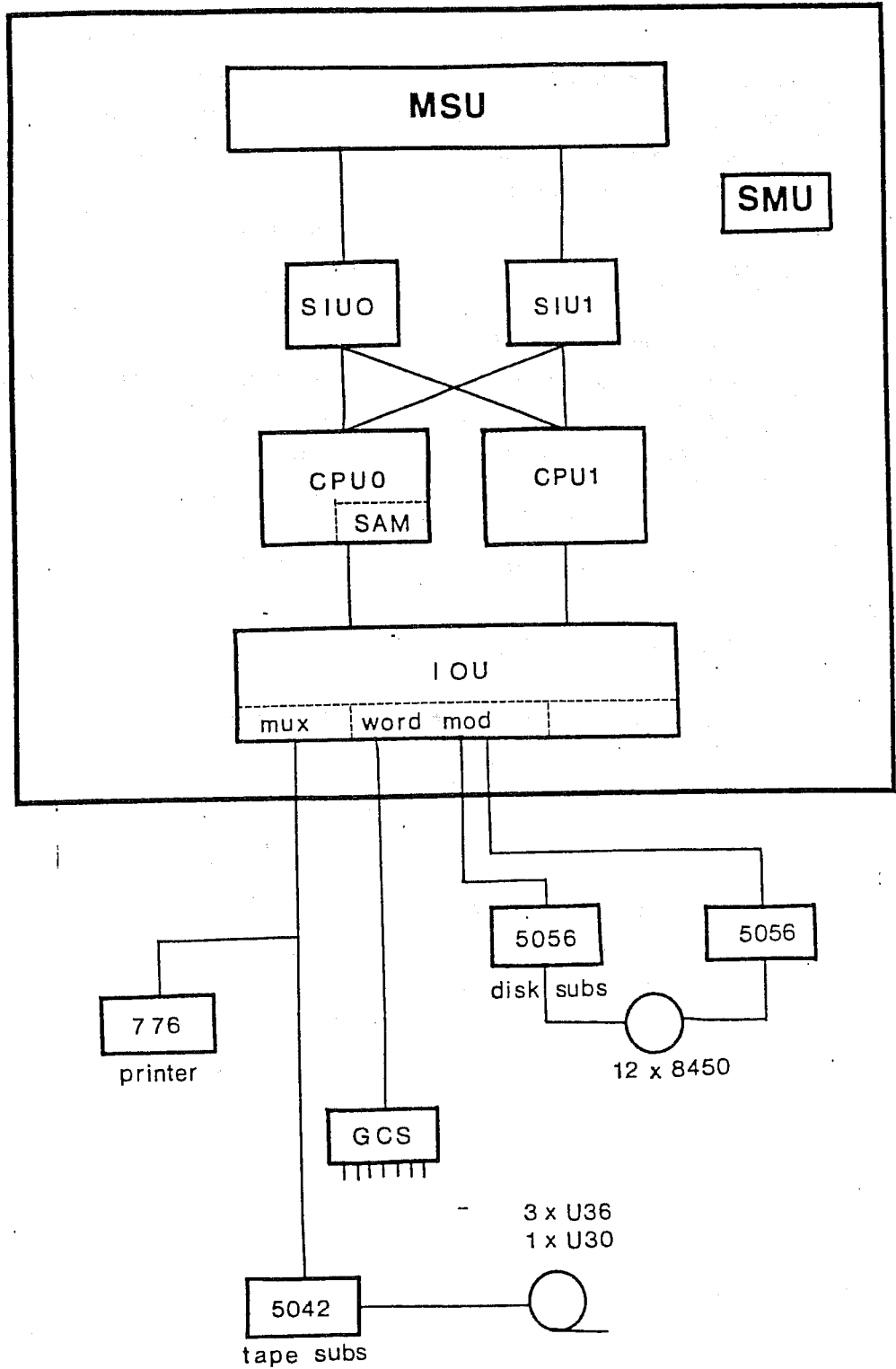
- programmes for the study of 2d turbulence are currently running. This project will go on probably until the end of this year.
- data retrieval.

Plans for next couple of years

Because of computer change, we do not expect an important usage of ECMWF computer except for data retrieval.

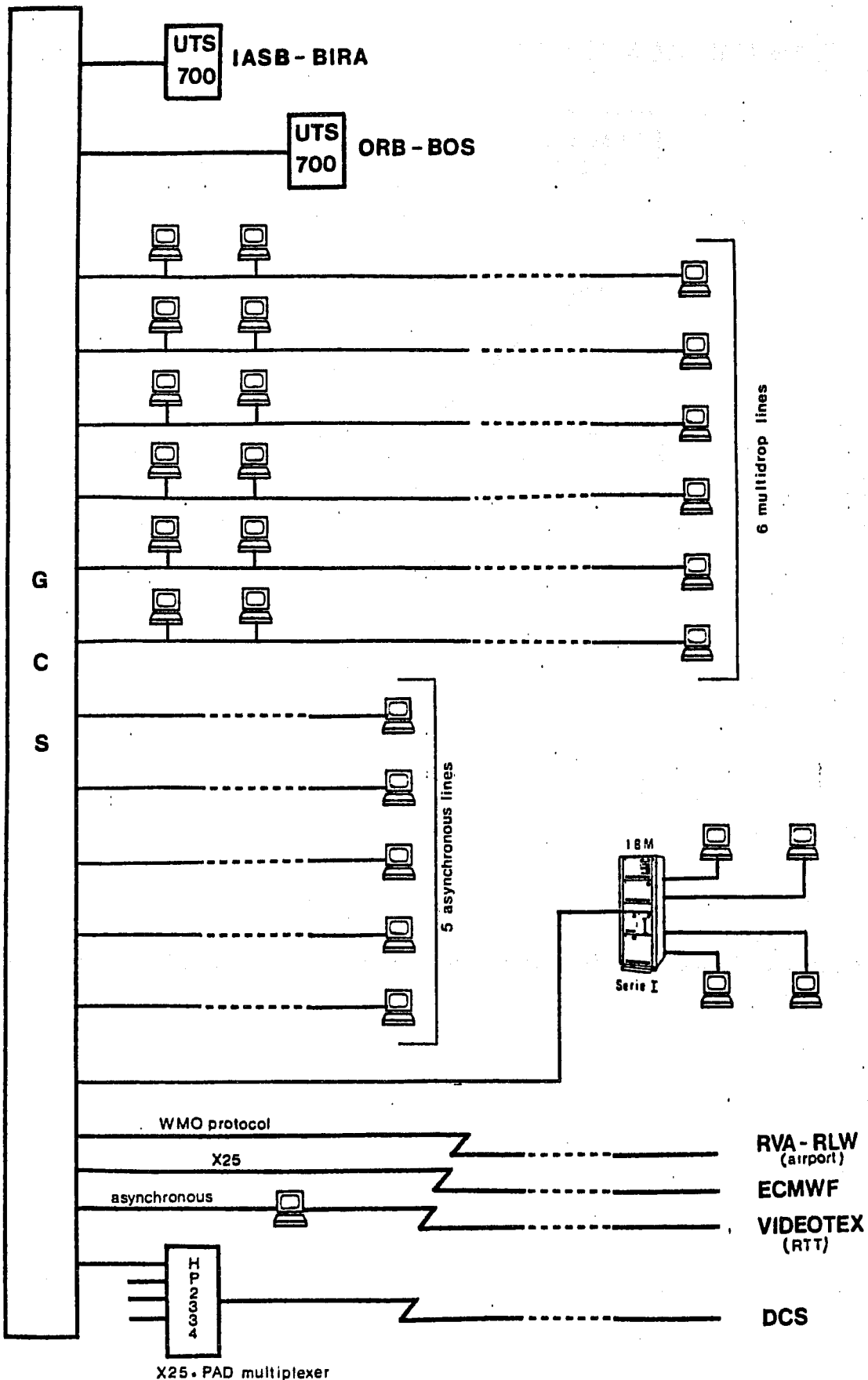
Unisys 1100/82

IRM - KMI



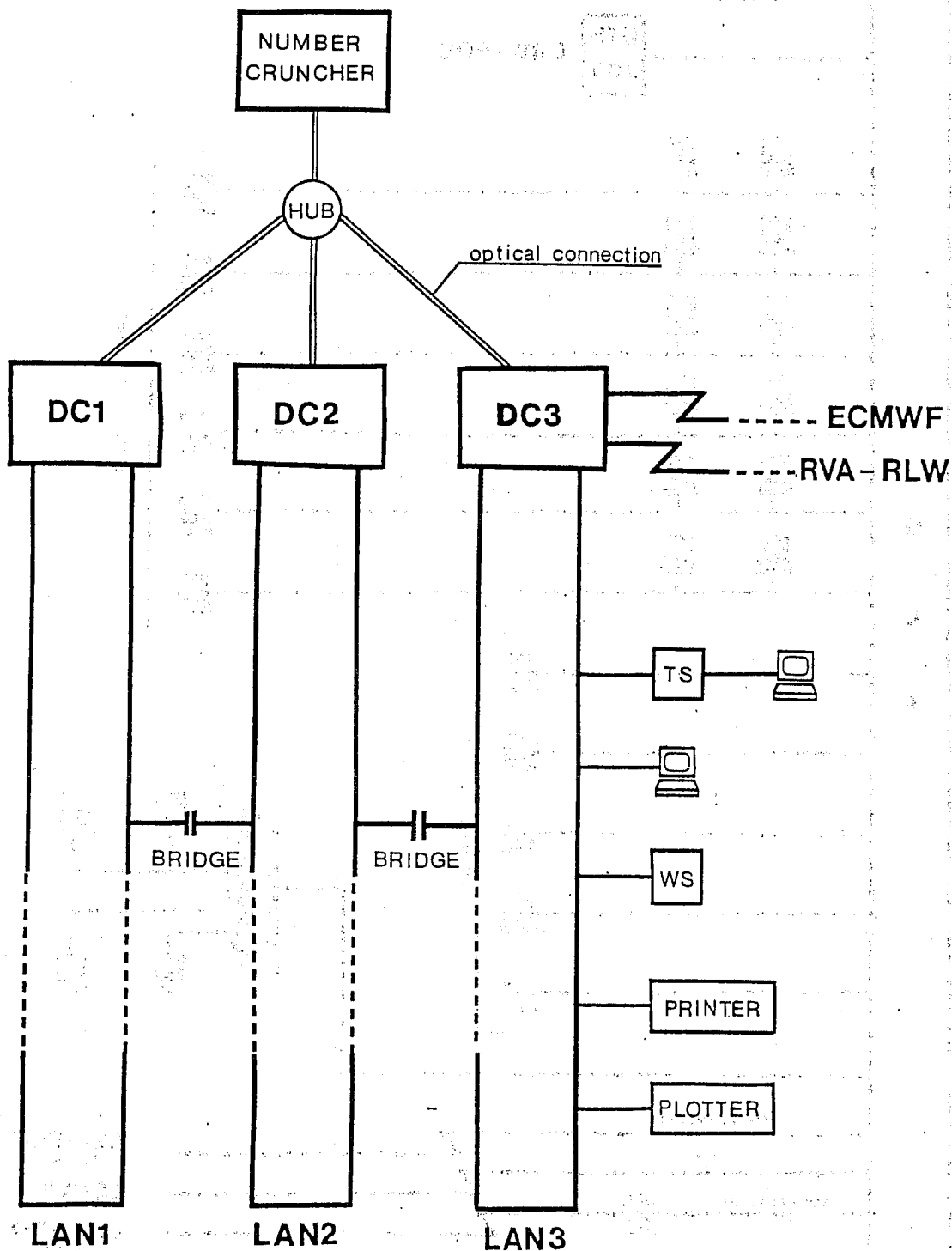
NETWORK

IRM - KMI

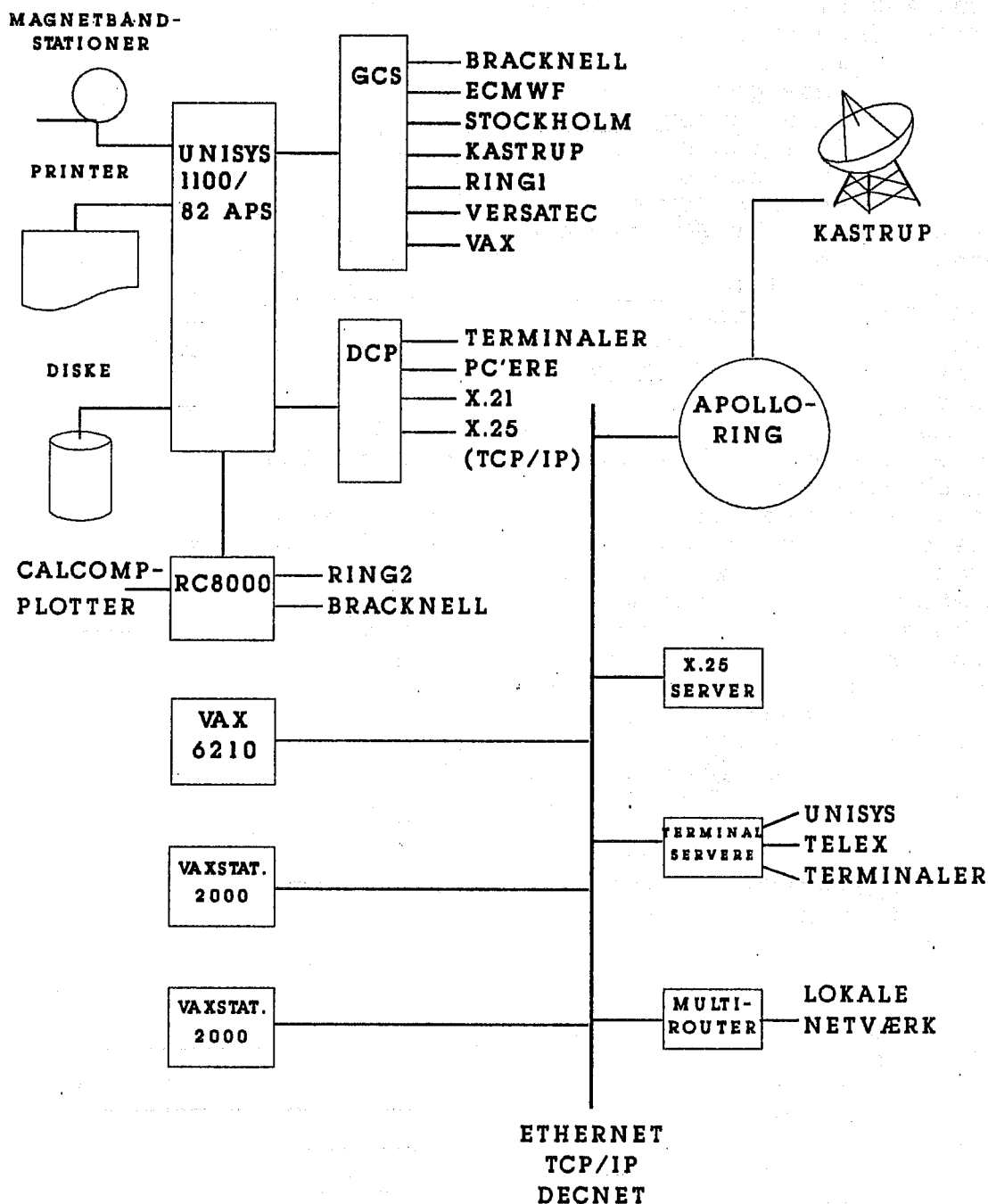


PLANNED CONFIGURATION

IRM-KMI



# DANMARKS METEOROLOGISKE INSTITUT EDB-SYSTEM 1988 (SKEMATISK)





The system at Denmarks Meteorological Institute(DMI).

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The kernel in our system is the Unisys 1100/82 APS computer.

This computer has a memory of 8 M words of 36 bits each.

The APS is an attached array - processor.

The 1100 has got 12 disks with a total of 8 G bytes, 3 tape stations and a Versatec electrostatic plotter.

The GCS is a communication unit which cannot be programmed.

All incoming lines - including the connection to ECMWF - has now been transferred to the Unisys.

The DCP is a programmable communication unit, which serves local terminals and PC's as well as X21 and X25 connections to local authorities etc.

RC8000 still exists and is connected to the 1100.

In routine it is used for plotting of some weather maps with preprinted contours. This plotting is done on two Calcomp pen plotters.

Some outgoing communications is still made on the RC8000.

One of them is Ring2, which is a communication line to danish airfields.

Also a system for dissemination of forecasts and other messages to our clients are running at the RC8000.

You may wonder why the line with GTS - data from Bracknell is shown on RC8000 as well as on the Unisys.

The explanation is that it is only there as a backup.

In case of a break-down of the Unisys 1100 the Bracknell line can be switched to RC8000 where the bulletins are queued for later transfer to the Unisys.

However the RC8000 is on its way out and we have got a VAX-system which shall gradually take over the tasks running at the RC8000 and some of those running at the Unisys.

The telex-system (a rather advanced one if we may say so ourselves) will be moved to the VAX in a very near future.

The preparations are almost finished and we are in the latest testing phase.

Some plotting will be moved.

An HP pen plotter has been purchased for that purpose.

The VAX-system is organised as a local area network connected through an Ethernet.

The system consists of a VAX 6210 with a memory on 32<sup>M</sup> bytes and two VAX-stations 2000 with 6 M bytes, terminal servers and an X25 server with 4 entrances, one for the Bracknell GTS-line, one for the ECMWF-line and 2 for domestic communication.

As you see we intend to move the connection to the center onto the VAX.

This is planned to be implemented this fall.

The VAX (of course) is connected to ~~to~~ the Unisys (via TCP/IP) as we have to transfer information in either direction.

As is well known we receive a rather large amount of disseminated products from ECMWF.

In the operational service some analyses and prognoses are plotted on the Versatec, partly as contour lines for pressure, geopotential height and temperature and partly what we call pseudosynops, that is prognostic values plotted as synops in gridpoints.

Also cloud amount and precipitation is plotted on maps.

More specialised forecasts are made on basis of the disseminated prognoses through statistical treatment (MOS etc.).

We also run our own limited area prognosis model four times a day. As boundary values we use values taken from the ECMWF disseminated fields.

A project is run which is investigating probabilities for precipitation based on the disseminated prognoses.

Another project uses the disseminated prognoses for forecasting of wind and temperature on a MOS basis.

A test of dataassimilation of a polar low based on an example from 1982 is run on the Cray.

The HIRLAM-group is planning to implement the total HIRLAM-level1 data assimilation and prognoses system on an AMDAHL VP 1100 vector processor.

To do this GTS-data are decoded at the Unisys, and ECMWF disseminated fields are used as boundary values.

The data is sent on a link to the AMDAHL computer situated at an institution called UNIC, the prognoses are run and the results are returned to DMI via the link.

At 0z an analysis and prognoses up to 36 hours are run.

At 6z,12z,18z an analysis and a 6 hour prognosis are run. The results of the prognosis are used as first guess fields for the next analysis.

The making of this system has involved testing on the Cray.

The MARS system has been used for data retrieval by several persons.

For the present we can only receive disseminated fields in the ECBIT code.

To be able to use the system to its full extend we plan to make a program which is able to decode GRIB.

This is planned do be done during the fall.

1) COMPUTER CONFIGURATION AT THE MET. COMPUTER CENTER DWD OFFENBACH  
 =====

A) Main computers  
 =====

1. ETA 10 E (Operating system EOS 1.2)  
 -----

- 4 CPU's, each with 128 MB memory, cycle speed 10.5 ns.
- 1 GB shared memory
- single processor speed 200 Mflops (benchmark program)
- 10 x 1.2 GB disk storage
- 2 tape units with 1600/6240 bpi (in summer 1989)

In summer 1989 the current ETA 10 model will be replaced by the  
 ETA 10 G model, CPU cycle speed 7 ns.

At the moment, the ETA 10 is used for the development of new  
 forecast models.

CY 180-990 E (Operating system NOS/BE and NOS/VE 1.4.1 dual state)  
 -----

- 1 CPU with 32 MB memory, vector facility, can be used with  
 NOS/VE VFTN-Compiler
- speed scalar 7.4 Mflops
- VFTN 36.0 Mflops
- NOS/BE part :
  - 2 MB CM, 2 MB ECM
  - 4 x 516 MB disk storage
  - 2 tape units 800/1600 bpi
  - 2 tape units 1600/6250 bpi
  - 16 NOS/BE - terminals
- NOS/VE part :
  - 28 MB memory
  - 8 x 611 MB disk storage
  - 3 tape units 1600/6250 bpi

On this machine runs the operational work.

CY 180-860 A (Operation system NOS/VE 1.4.1)

- 1 CPU with 64 MB memory, speed 2.6 Mflops
- 20 x 611 MB disk storage
- 3 tape units 1600/6250 bpi

This machine is used for the development of new programmes and not operational work.

B) Network and peripheral equipment

- The computers are connected via LCN Loosely Coupled Network ( 50 MBIT/s )
- 130 user terminals
- 10 printer 400 lines/min
- 2 printer 2000 lines/min
- 2 laser printer 24 pages/min
- connected via CDCNET ( 10 MBIT/s ) to CY 860 or CY 990

C) Graphic hardware

- 3 pen-plotter Calcomp 925/960 off-line
- 1 pen-plotter Calcomp 1077 on-line NOS/VE
- 1 electrostatic plotter Calcomp 953/5300 off-line and on-line NOS/VE
- 1 coloured electr. plotter Calcomp 1077 on-line NOS/VE
- 30 graphic terminals Graph-On 250

IGS ( interactive graphic system ) :

- 4 work-stations CY 910-400 - 12 MB RAM 0.8 Mflops
- 360 MB disk storage
- 60 MB cartridge
- 19 inch colour monitor

D) Satellite receiving system  
=====

Meteosat :

PDP 11/70 will be replaced by MICRO-VAX II 16 MB memory

NOAA :

MICRO-VAX II 16 MB memory ( in acceptance test )

E) RJE equipment connected to ECMWF  
=====

stand alone system :

RC 3600 computer connected to ECMWF

- RJE terminal
- printer
- card reader
- tape unit

2) PROJECTS RUNNING AT ECMWF  
=====

- development of a high-resolution limited area model
- test of own analysis programs against ECMWF analysis
- comparison of forecast models running on the ETA 10 with ECMWF forecast models
- timing tests of programs running on the ETA 10 and on the CRAY

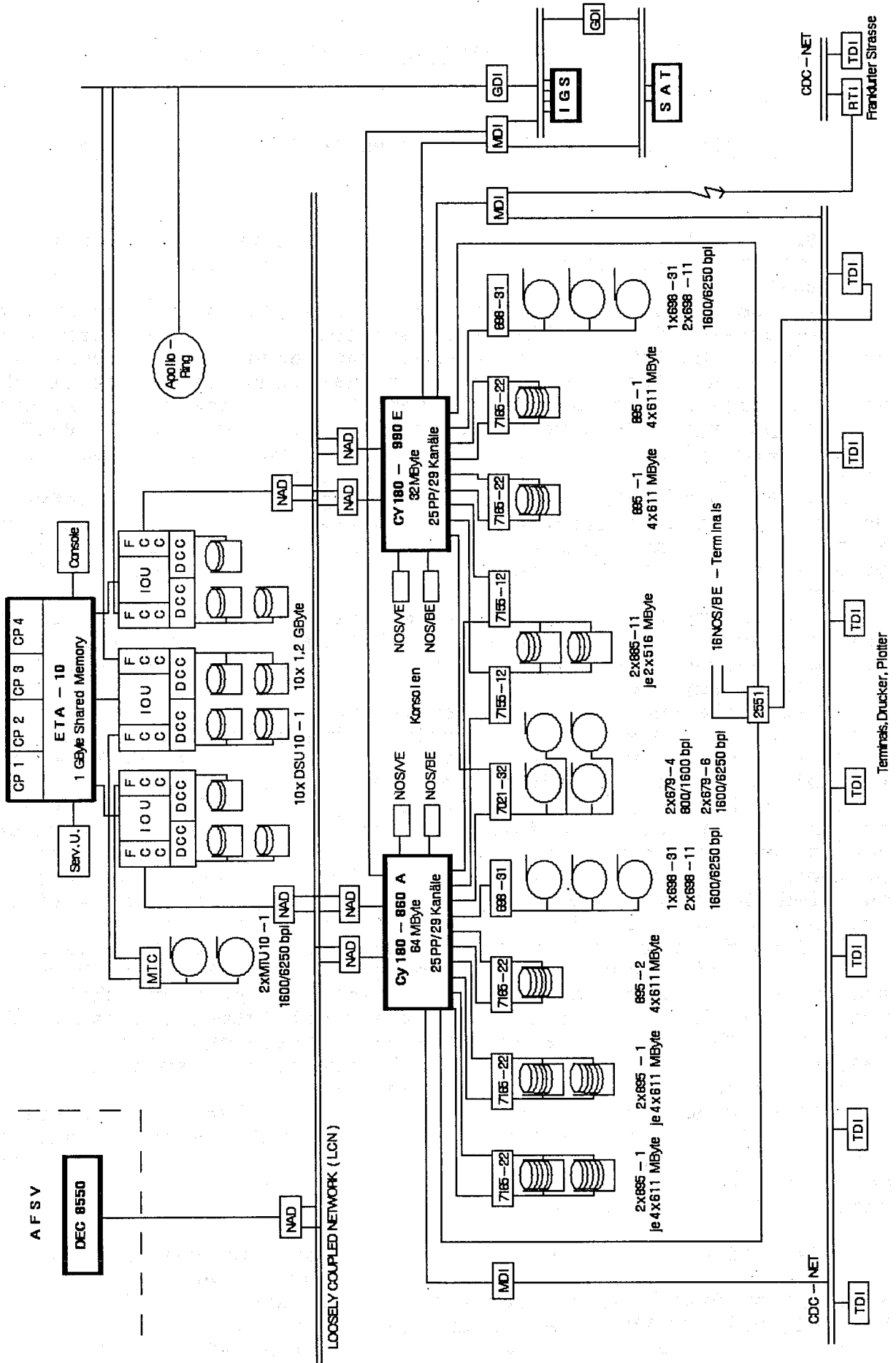
3) FUTURE PLANS  
=====

- make use of the ETA 10 as operational computer with a new family of forecast models ( winter 1989/90 )

ECMWF usage :

- direct connection between the CYBER's and ECMWF
- migration of programs, files and tapes from NOS/BE to NOS/VE
- test of modifications of own forecast models with ECMWF forecasts and vice versa

METEOROLOGISCHES RECHENZENTRUM



MEMBER STATE COMPUTING REPRESENTATIVES MEETING 11-14 APRIL 1989Actual and planned involvement in ECMWF's Computer Service (SPAIN)

Spain links to ECMWF through an ECNET connection running at 4.8 Kbps which is handled by our Host processor, a M-382 from Fujitsu-España S.A. (FESA)

Access to the link facilities is possible through an application program developed initially by a FESA team. Registered users can send Jobs, use the Interactive channel and have free access to Data Dissemination, Job Output and miscellaneous files received. This whole application is securely protected by means of an original Fujitsu package (Resource Access Control Facility - RACF), that checks permission grants to files, disk space ect. based on a user profile definition.

As the application program runs completely on the Mainframe CPU, we envisage no adaptation problems in the future to allow changes for a theoretically new operating system or Job card format. In fact, the generation of a RFT depends solely on input from the standard text editor.

The Interactive facilities are not shareable in the sense that only one user can be allowed at the time to have control of the session, however all users have access to the interactive window contents at any time.

From the two groups of registered users in Spain, the staff members of our Numerical Forecasting Service are the main spenders of ECMWF's Computer resources. The main projects run at ECMWF include the initialization procedures for our Limited Area Model (LAM) that follow the boundary derivative method originated by the Netherlands, and that is run at our Mainframe after the necessary comparisons and corrections were finalized. The adaptation relied on the substitution of operational NAG routines by similar routines from our Fujitsu supplied Library. Another project now running is the verification process for the inclusion of experimental soil fields as boundary conditions for our LAM. These procedures are fed by MARS on-line soil fields requested once a month today, but will soon become daily scheduled to increase accuracy. Another project that has been running for the last two years is the Model Output Statistics for our stations. The acces to ECMWF data was carried out using the CYBER's IMSLIB and ECLIB routines, and will have to be adapted also for CRAY usage, or to be run at our Mainframe.

Other minor usage of ECMWF computers is also carried out by our Computing Service at INM that mainly deals with special requests for archival data from MARS, occasional runs of the air parcel trajectory model from Sweden using ECMWF's specific Data Base, electronic Mail, shift daily operations ect.

Regarding the present service, our main interest now is to allow all our local users a unique interface that would solve all application data needs. Our Fields Data Base (FDB) follows closely the original ECMWF concept, and holds data from different sources like our LAM output, ECMWF's, Bracknell's Fine mesh and Global

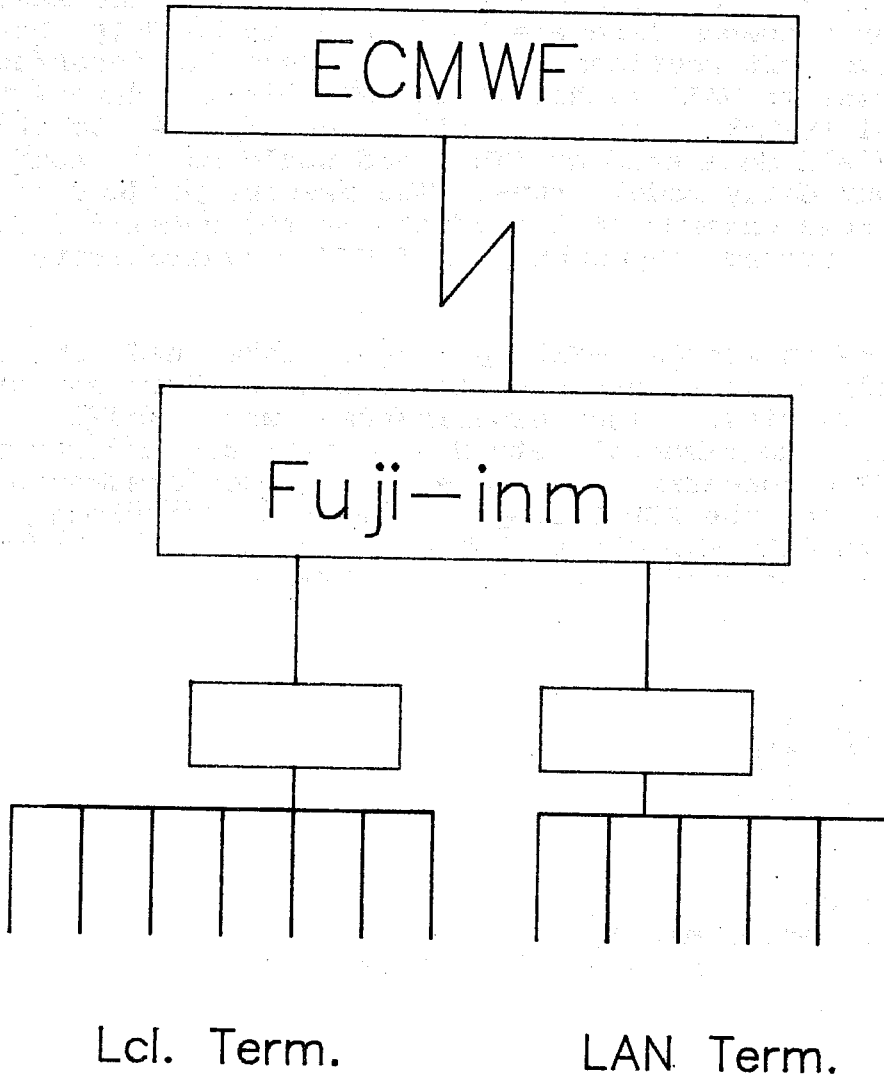
models, and NWS's coming from Washington (GTS). This will be our common interface for field data to be used generally. Feeding this Data Base from such different sources as GTS and MARS rises the necessity of a common language that seems to be GRIB, but at present we only have GRID routines that solve specific interfaces. A more flexible access to MARS either at the VAX level (Interactive) or at the IBM level (Batch) would alleviate our efforts to standarize the formats of field data used at INM, and would solve some operational aspects of our daily model runs. The present product catalogue does not include some experimental products or the model's full resolution which rise a strong dependency on ECMWF's availability of computer services.

Other INM interests will probably make use of the computer system or related Data Bases in the following years as has been noted in recent queries. The experimental wave model, air parcel trajectories, experimental Data Bases are such candidates. A special use of ECMWF's computer facilities is also foreseen prior to the celebration of the XXV Ollimpic Games at Barcelona in order to aquire archive data for Climatological surveys and the fine tuning of our local stations predictability using MOS.



Jose Juega.  
Computer Representative.  
Instituto Nacional de Meteorologia (INM)  
Spain





FRENCH METEOROLOGICAL OFFICE  
-----

Computing representative : J.M Quinto

1. Computer equipment  
-----

The last year were a significant year for le computer centre of the French meteorological administration. The decision to change the two old computer CDC (Cyber 175 and Cyber 835) was taken, so that le local network.

So from may to december we have replaced the Cyber 175 (1977/1988. R.I.P) by a Cyber 860 (32Mo, 12Mips), plugged the new network CDCNET with 7 devices interfaces, 2 Ethernet coax (for security), installed the cdcnet software on a new Cyber 930 (8Mo, 2Mips), then added a X25 internal network for connection with Transpac which permit to be connected with all the met centres such as Toulouse, Lannion, Grenoble and the Stations Meteorologiques Inter Regionales.

Today more than 200 terminals are connected to CDCNET and one of the 3 machines CDC.

At least a Cyber 960 (the first in Europe, 64Mo, 18Mips) replace the 835. It is in Dual State under NOS/NOS/ve since March 1989.

The whole disks were changed also, and the on-line mass storage for the 960 batch machine under Nos is 10GO (16\*895) and 4,4GO for NOS/VE (4\*XMD drives)

Idem for the 860 which is the real-time machine for meteorological data processing and have 2,6GO. 4\*885 disks drives of 480 MO each are security drives and mass storage for the analysis and forecast data base of Emeraude and Peridot models.

Four news printers, four news tape readers, and two Versatec colors plotters take the place of the old.

In a few word all of the centre were substitute during this year and this explain ours worries.

But the x25 trunk Paris/Reading is ready at 14.4kb since october 1988 and it will permit the transfer of the north atlantic radiance data (5 MO per day in 4 batches) more than the actual stream of data dissemination.

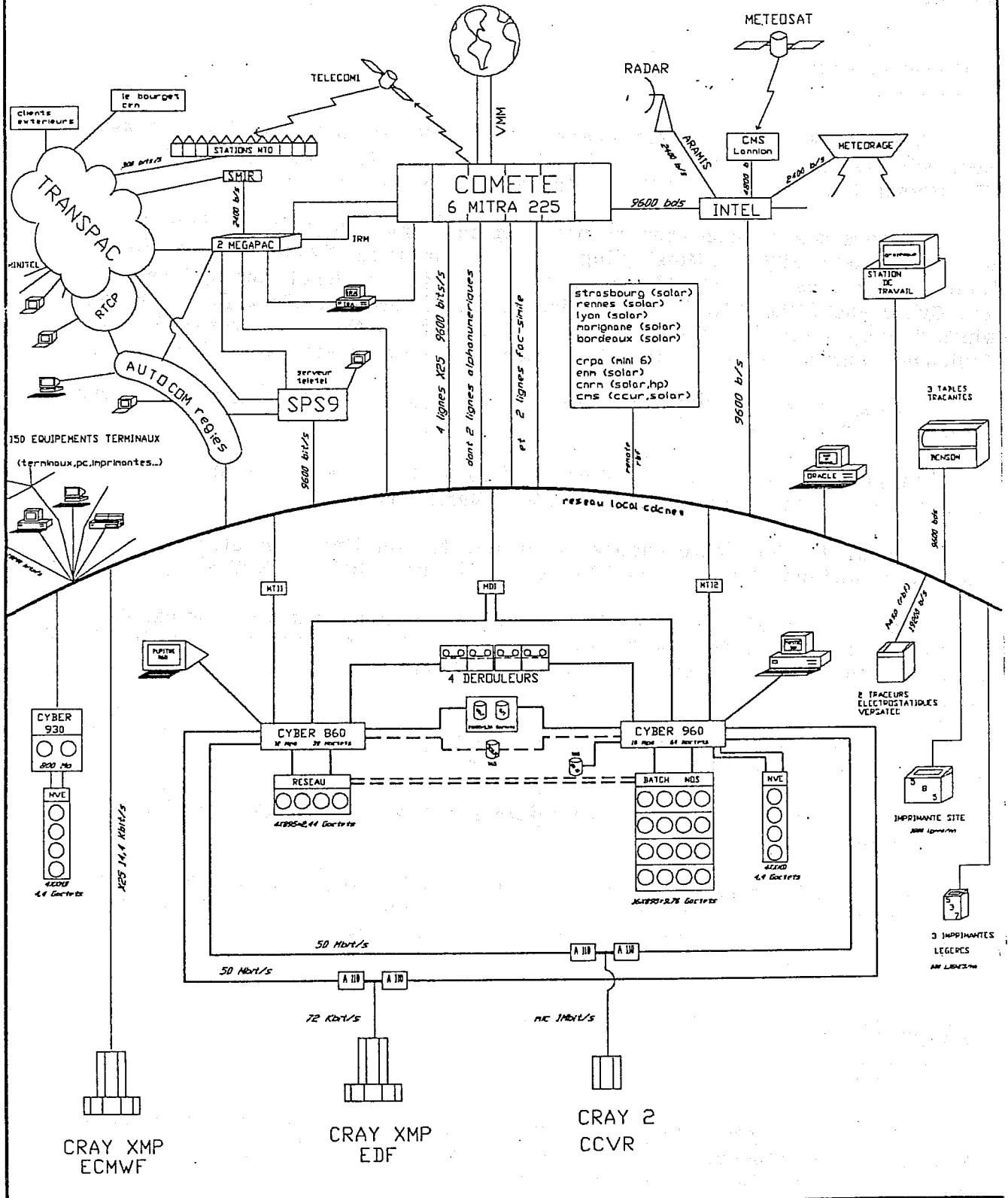
2.SOFTWARE  
-----

If te most of the projects have no problem, some of them as analysis and forecast for Emeraude and Peridot needs so much memory than it is almost impossible to run their except the week-end.

Janvier 1989

METEO FRANCE  
SERVICE CENTRAL D'EXPLOITATION DE LA METEOROLOGIE  
TTI/EX/TR

SCHEMA GENERAL DU TRAITEMENT DE L'INFORMATION



HELLENIC NATIONAL METEOROLOGICAL SERVICE (HNMS)  
COMPUTER CONFIGURATION

MAINFRAME

The HNMS uses as mainframe a Cyber 170/825 computer of 262 KWORDS main memory. In total, the available on-line diskstorage is 2.1.GB. There are also connected 2 magnetic tape units (800/1600, 1600/6250 BPI), a central printer, a calcomp plotter 1070 on-line and 13 terminals.

Operating system : NOS 2.1

Compilers : FORTRAN , COBOL

Data base : C R M

The ECMWF line is connected to the mainframe computer system.

The ECMWF products are directly processed in the mainframe and the prognostic charts are plotted either by the on line calcop plotter 1070 or by a graphical display tektro-nics 4010 and a serial graphical printer connected to it.

DEDICATED MINIS

Two Cyber systems 18/20

OPERATING SYSTEM MSOS 5.0

COMPILERS : FORTRAN

TELECOMMUNICATION PACKAGE : MSS (ODSI)

One cyber 18/20 computer system is used for the telecommunication needs with the software package MSS and the other cyber is used as back up system of the first one and also for plotting meteorological charts.

22 meteorological stations are connected to the cyber 18/20 telecommunication computer for sending and receiving meteorological observations. At the meteorological stations there are teletypes. This system is connected to GTS via ROME and SOFIA.

MAIN PROJECTS USING THE ECMWF COMPUTERS

- a. Statistical programs using the ECMWF archives for local forecasting purposes and
- b. Programs for studying Atmospheric Energetics.

PLANS

In the end of 1989 the HNMS plans to change the two cyber 18/20 computer system with a new system which will be used mainly for telecommunication purposes.

It is desirable to connect the ECMWF line on this new telecommunication system (either as main connection or as a back up connection).

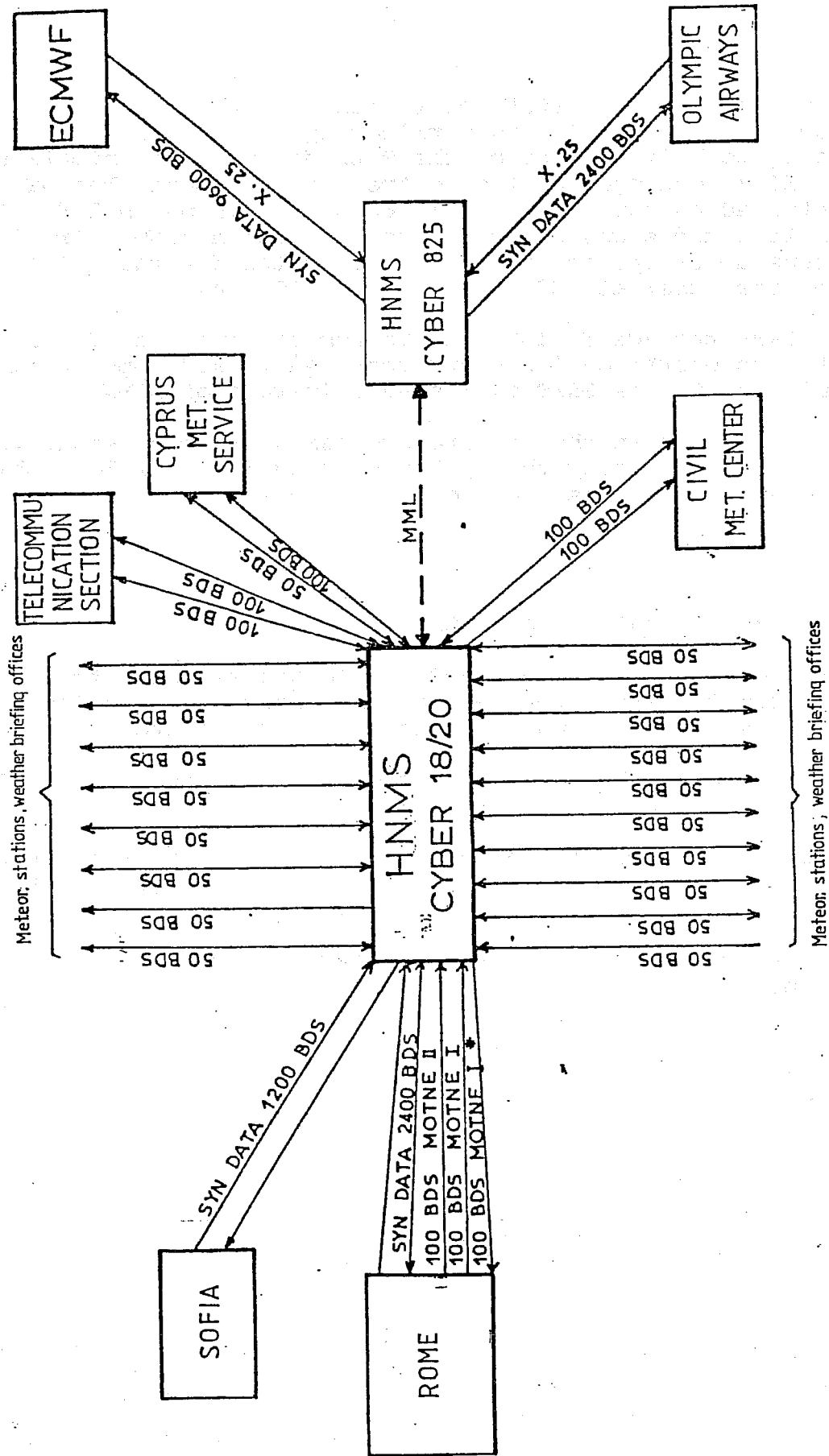


FIG. 3 HNMS TELECOMMUNICATION COMPUTER

ECMWF Link

We are at present in a state of transition from our original link based on ECNET protocols and terminating on our side on DEC PDP 11/40 equipment, to a link based on the National Telecommunications System (NTS) developed by the Centre, using DECnet. The NTS link was installed on our dual VAX 11/780 system in March 1989. A V29 multiplexing modem was connected to the Dublin/ECMWF circuit, and two channels set up, one at 2400bps to cater for the existing ECNET link and the other at 7200 bps for the NTS link.

In June 1989 the ECNET link will be removed and the NTS link brought into operational use and upgraded to 9600 bps. From that time it is planned to use GRIB exclusively instead of ECMWF bit code.

However our plans in that regard are being reviewed since we realised quite recently that polar stereographic fields, which are essential to our key applications, will not be available in GRIB.

Uses of ECMWF Computing Facilities.

Present uses are mainly confined to the occasional extraction of reports from the MARS archive, and the occasional running of a trajectory model which was developed by our research staff.

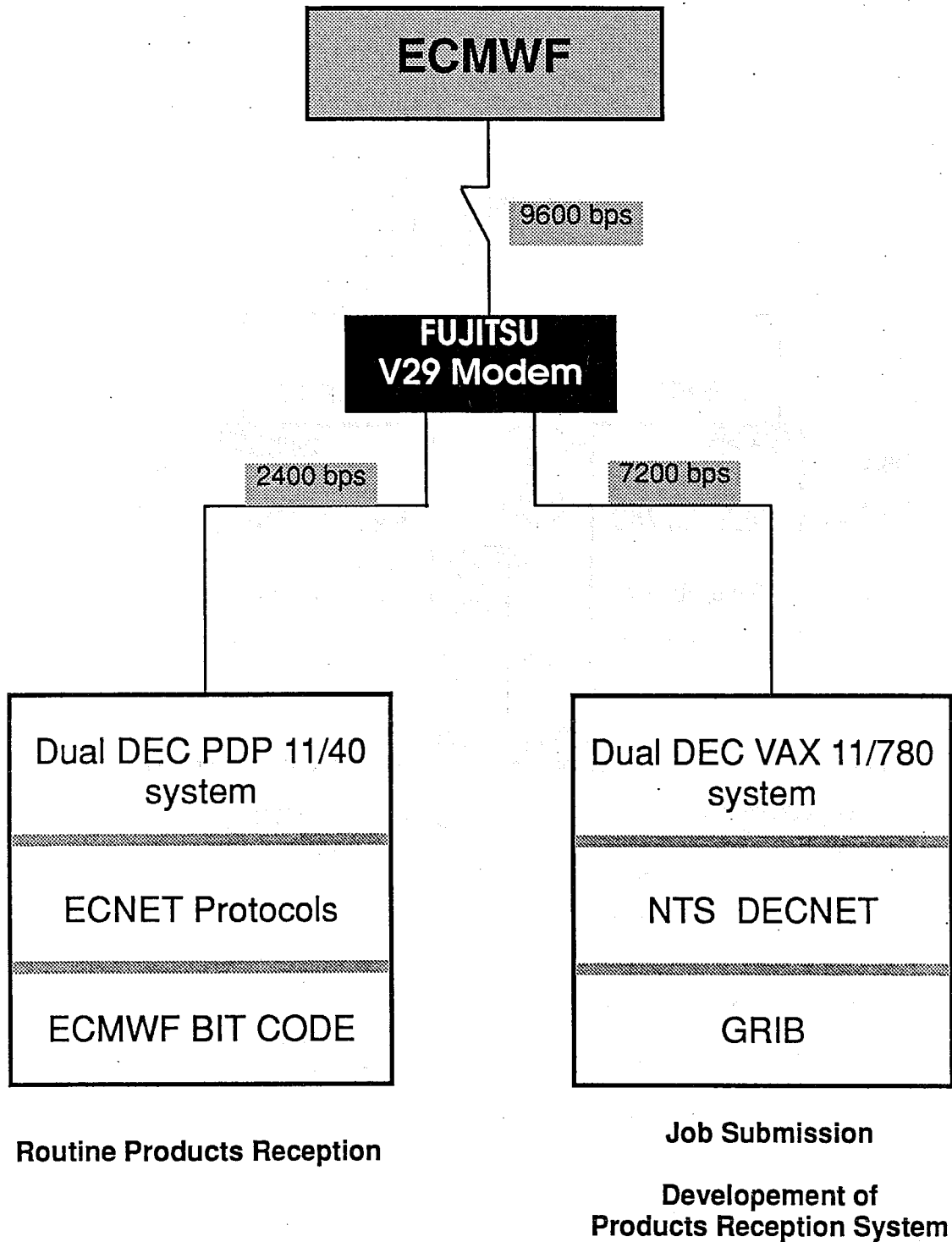
Future involvement by Ireland in the HIRLAM project is likely to mean greater use of the facilities.

In general our users are happy with the present arrangements, and the recent introduction of the DECNet link has improved the job submission procedures at the Irish end.

We are also very happy with the support provided by the ECMWF User Support unit!

# Irish Meteorological Service

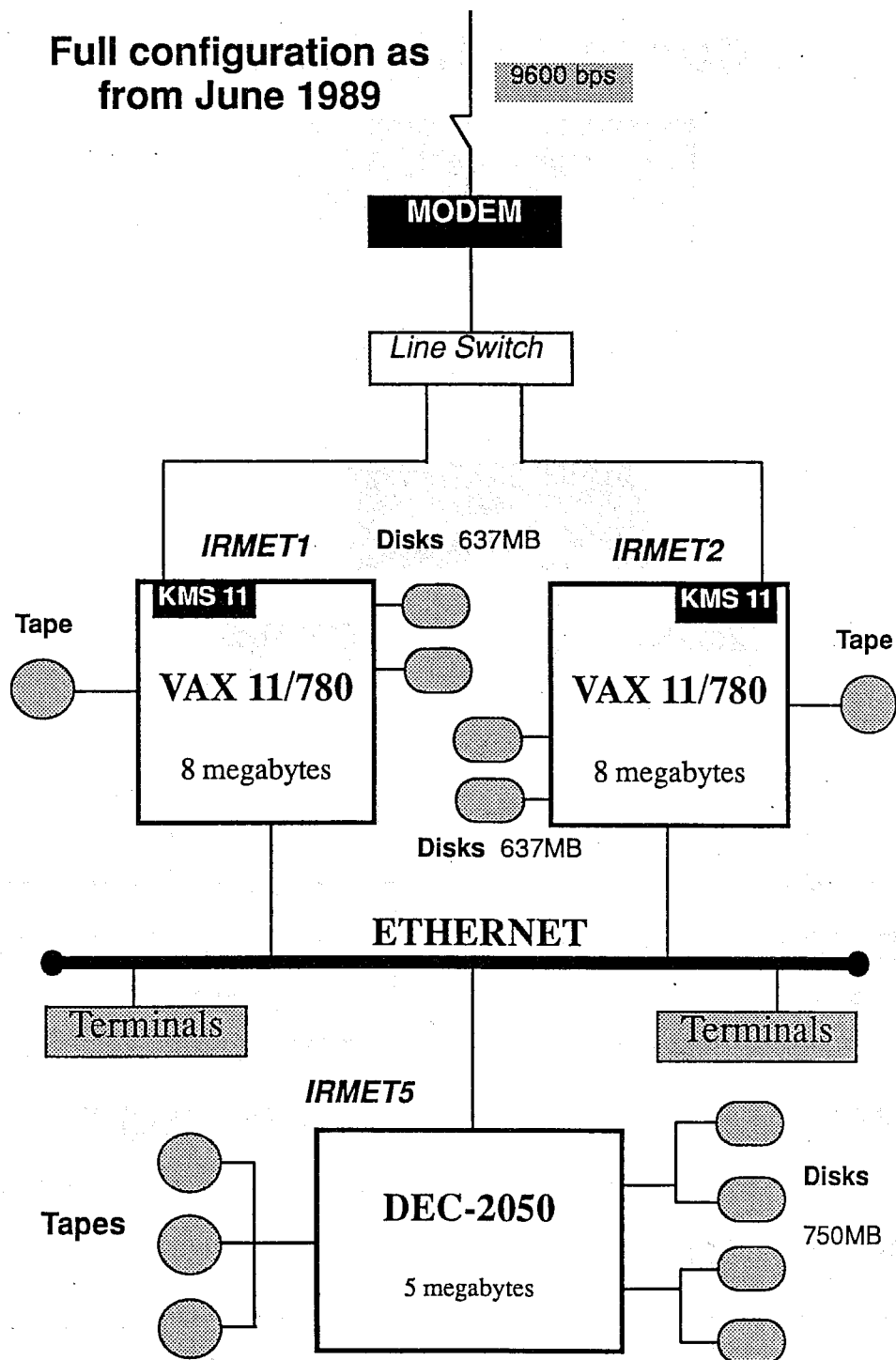
## Current ECMWF Link





# Irish Meteorological Service

Full configuration as from June 1989



**Present Use of ECMWF Computer Facilities**  
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[ 5 Registered Users ]

\* **Extraction of Reports via MARS**

\* **Running Trajectory Model**

**Future Plans**  
-----

\* **Involvement in HIRLAM Project will mean increased use of CRAY.**

ITALIAN METEOROLOGICAL SERVICE

Computing representative: S. Pasquini

### 1. Computer equipment

In fig. 1 is illustrated the main computing centre, located in Rome, it includes:

- IBM 3090 120E (32 Mbytes of memory, 8 Mips), that deals with analysis and forecast model, pre- and post-processing of data and interactive graphics;
- IBM 4381 P13 (8 Mbytes of memory, 4 Mips), that handles the real time access to the data bank, the national data dissemination and the data plotting.

The meteorological application software (mostly written in Fortran, APL and Cobol) is running under the following IBM basic software:

- MVS/XA operating system;
- GDDM for interactive graphics;
- CICS as DB/DC subsystem.

The telecommunications system is based on two IBM S/1 minicomputers (one active and the other in stand-by) performing message switching, handling international links based on WMO and X.25 protocols. There is an automatic switch over to the stand-by system in case of failure of the active minicomputer.

The graphics hardware is based:

- two electrostatic Benson plotters connected via channel to the IBM system;
- IBM graphic display terminals (3192 G20) and IBM PS/2.

### 2. RJE equipment

Italy is participating to the NTS project so the link (9600 bps) is based on DECNET/ISO software.

The RJE facilities illustrated in fig. 2 are:

- one Microvax II (5 Mbytes of memory) handling the ECMWF link and connected via Ethernet (Local Area Vax Cluster) to the system;
- a cluster of two 8250 Vax's (eachone of 16 Mbytes of memory) to support future developments (graphics, international

telecommunications);

The system is connected with the IBM machines in two ways:

- via channel (200 Mbytes per second) emulating an IBM tape to the IBM VM (CMS) operating system;
- via link using the IBM 3780 file transfer protocol.

### **3. Projects run at ECMWF**

At present the main areas covered by users, coming both from universities and the met service) are:

- development of a high-resolution limited area model;
- data retrieval from ECMWF archives for diagnostic studies;
- development of a numerical mesoscale model;
- model output statistics;
- transport and trajectory calculations.

### **4. Experience using ECMWF computer**

Italian users are very satisfied of the support of the Centre.

### **5. Plans**

The main improvements will be in the following areas:

- upgrading the IBM mainframe to a multiprocessors system with vector facilities;
- moving the international telecommunications to the Vax system;
- handling of binary data (grib, bufr) and coded digital fax in both IBM and DEC environment.

FINAL CONFIGURATION

ibm 3090 120E

ibm 4381

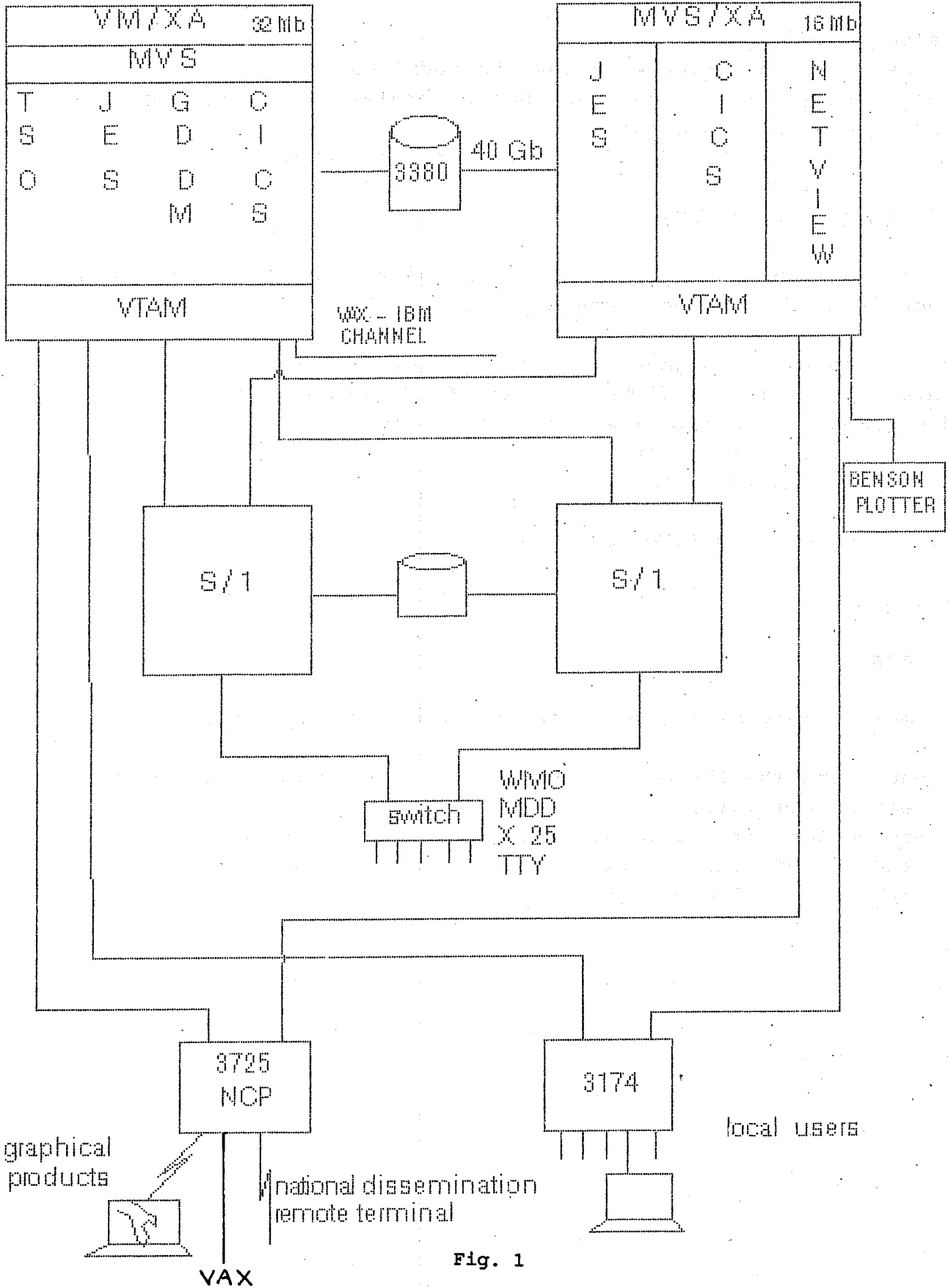


Fig. 1

\*\*\*\*\*  
 \*\* NEW VAXES CONFIGURATION \*\*\*  
 \*\*\*\*\*

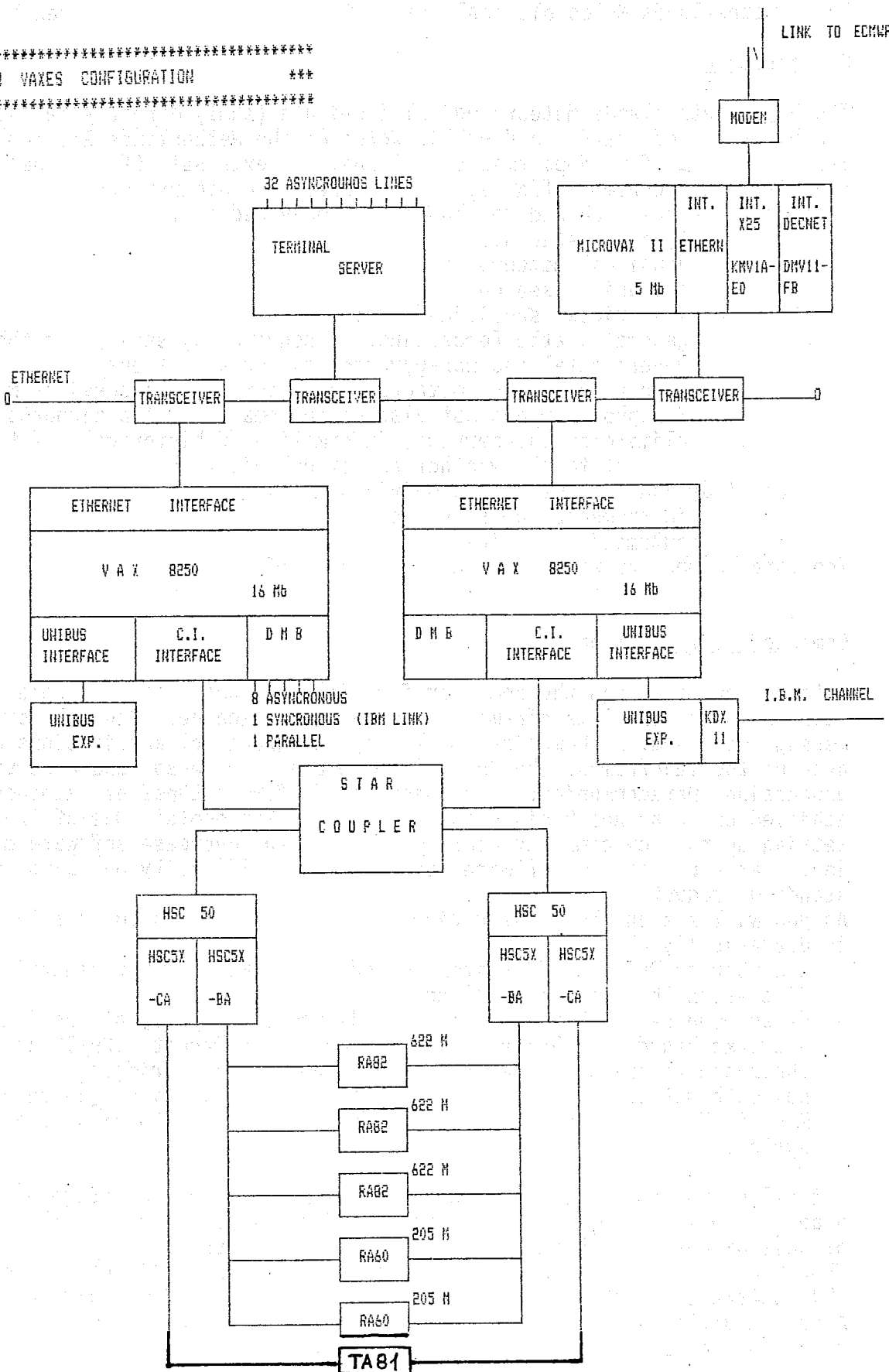


Fig. 2

Royal Netherlands Meteorological Institute

N.J. van der Plank

Organisation

The Royal Netherlands Meteorological Institute (KNMI) directly resides under the Ministry of Traffic and Public Works of the Netherlands Government. Besides the staffing departments (internal and external affairs, personnel and organisation, economic affairs) it has three main departments :

- scientific research and development, subdivided in :
  - . physical meteorology
  - . dynamical meteorology
  - . oceanic research
- operational services, subdivided in :
  - . general weatherforecasting, 24 hours a day service to the public, governmental and non-governmental organisations
  - . airport services, meteorological information services mainly on Schiphol airport but also on the smaller dutch airports
  - . climatological service, information of historical events with respect to the weather on netherlands territory
- technology and information, subdivided in :
  - . instrumentation services
  - . automation services

The total number of workers at KNMI is about 550.

Computer configuration

Until a few years ago the computer facilities of the institute were Unisys (Burroughs-branch) mainframes and DEC-PDP/11 machines. General computing like message handling, mathematical modelling and graphical applications were the area of the mainframes. The PDP/11's were used for sensor and observation processing. Datacommunication between the different types of machines was achieved on an ad hoc basis : our 'Home Grown Protocols'. One of the goals in setting up the new computer configuration is to decrease software maintenance in the area of 'system software' and increase reliability by using industry standard products.

As you will see in the illustration the situation, compared to a few years ago, is dramatically changed :

- a number of DEC/VAX-VMS systems moved in, as well on the central site in de Bilt as on the main airport Schiphol
- datacommunication between computers is now done by way of local area networks based on Ethernet; used protocols are Decnet, TCP/IP and BNA-II (Unisys environment). The LAN's are connected with bridges.
- new mathematical models as well as graphical applications (based on ECMWF's MAGIC/GKS) are planned to use a CONVEX supermini with UNIX as operating system.

Not all of the software on the new systems has reached the stage of operational usage : the software for interpretation of satellite data is still in the stage of development (though parts of it are already in use).

The 'heart' of the system still resides on the Unisys-mainframes. Conversion of this software to other systems is very difficult : it is mainly written in Algol. Migration in this area to other system means total renewal and that will take some years.

The illustration sketches the situation we will reach in some months. At the end of this year we expect new solution of the connection with the ECMWF, based

on a VAX-Decnet solution. Main area of interest here will be to solve the end user facilities of our research department; we plan to bypass the Unisys A-systems so we have to give them network facilities (i.e. file server functions) and PC-connectivity.

### Information infrastructure

The production process on the A-series mainframes is a result of 15 years of 'organical growth' of software. Due to the entangled software it is difficult to distinguish separate formal systems. To rebuild the central systems we are in the process of defining an information plan. Major components of this plan are :

- the definition of a series of databases for different kinds of usage, these has to form the skeleton of a new structure as well as for internal use as for external clients
- a standardized and controlled way of communicating with these databases
- within certain limits wedging out the the data-driven aspects in the production system

At this moment the definition of a database for radar and satellite images and its environment is studied. This will be a kind of pilot project to examine the implications of the information plan.



KNMI Climate Modelling Group

Regular projects      Computer projects at ECMWF in 1989

ID.: NLDMWGAC      "Circulation Modelling"

This project is an ongoing activity in the Dynamical Meteorology department of KNMI. In 1988 and the first months of 1989 instability mechanisms in a barotropic atmosphere were investigated on this account. The program is completed with the appearance of Rein Haarsma's thesis on the subject in march 1989. A new program, to develop and test a simple oceanwave model, which will be used to assess the influence of wave-induced stress on the atmospheric boundary layer and on a climatological atmospheric GCM has started now on this account.

ID.: NLDMWGCM      "General Circulation Model"

Application and development work on the linear steady state atmosphere model (made by Opsteegh and van den Dool) is performed on this account. Presently the emphasis is on preparation for coupled ocean atmosphere runs for the tropical Pacific (ENSO), for which a moisture convergence feedback mechanism was developed.

ID.: NLOOCEAN      "El-Nino Ocean Modelling"

A primitive equation equatorial betaplane ocean model was developed and tested on this account. Presently the model is spun up with observed wind and SST fields for the period '70-'83. In the near future the model will be coupled to the linear steady state atmospheric anomaly model to study the influence of air sea interaction on large scale instabilities in the coupled system.

Special projects:

ID.: SPNLOONA      "North Atlantic Ocean Modelling"

The dynamics, heat transport and air-sea interaction of the North-Atlantic ocean is studied, using a layered ocean general circulation model. Presently a 1 deg. by 1 deg. version of the model is initialized using the "Levitus" data and spun up with various idealised North Atlantic forcing fields, to investigate how sensitively the modelequilibrium depends on variations in the forcing.

ID.: SPNLCOTO      "CO2 transient atmosphere"

Analysis of Mockette's new radiation scheme in the context of long integrations for climate simulation. The radiation scheme will be redeveloped to incorporate changes in CO2 and other trace gas concentrations. Impact studies in the ECMWF model and comparison with Raschke's scheme, that is further developed by Roeckner in Hamburg, are planned later in the year.

## THE COMPUTING ENVIRONMENT AT DNMI

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Rebecca Rudsar  
DNMI, Oslo, Norway

### Computer Resources

The computer resources at the Norwegian Meteorological Institute consist of nine Norsk Data (NORD) computers, three MicroVax computers, an IBM 9370 model 90 and an Floating Point Systems Attached Processor (FPS164). There are also NORD computers at the forecasting departments in Bergen and Tromsø.

The NORD computers have, totally, approximately 70 terminals and a storage capacity of 2 GByte. Several of the disks are interchangeable and are changed at certain periods during the day so the storage capacity is in reality larger than 2 GB. The NORD computers are connected to each other via the NORD communication system COSMOS.

The IBM/FPS system has 33 terminals/PCs and a storage capacity of 3.2 GByte.

The Local Area Network is Network System's Hyperchannel which has a maximum transfer rate of 10 Mbit/sec. At present three computers are connected to Hyperchannel - one NORD computer, one MicroVax computer and the IBM 9370.

The NORD computers are the oldest part of the system and will gradually be replaced. A Tandem ext10 computer has already been installed and it is planned that this will replace the two NORD computers used for GTS communication in autumn 1989. The Tandem has an inbuilt backup system in that it has two CPUs and a common disk system. A new Microvax has just been installed and will gradually replace the Satellite Reception and Image Processing part of the system. Both of these new computers will be connected to Hyperchannel such that the transfer of data within the total system will be more flexible. It is also planned, at a later date, that the Online and Historical Databases be replaced by a larger computer, possibly with some form of backup such as dual CPUs, thus providing easier and more reliable access to these data (fig. 1).

The MicroVax which will be used for communication with ECMWF was installed in autumn 1988 and has, until now, been used for accessing a CRAY X-MP/28 at Trondheim University (SINTEF). However, a problem has occurred in connection with the communication to both Trondheim and ECMWF. This is due to an area number conflict in Decnet. If necessary the interface to Trondheim will be moved to another MicroVax (fig. 2).

The communication line between Oslo and ECMWF is to be established mid April 1989. It will be a 9600 bps line. The installation of the necessary software will occur at the end of April.

NWP Models

The Limited Area Models for Numerical Weather Prediction are run on the IBM/FPS computers. The IBM is used for pre- and post processing and numerical models are run on the FPS164 Attached Processor.

There are two limited area models, one with a grid net of 150 kilometers (LAM150) covering Europe and the North Atlantic and one with a grid net of 50 kilometers (LAM50) covering Scandinavia and the Norwegian Sea. Due to limited computer capacity the models are run according to the following scheme.

For 06/18 UTC observation time the LAM150 model is run giving prognoses for +48 hours. Data received from the UK Met. Office, or a combination of UK and US data, are used as boundary values. Afterwards the LAM50 model is run giving prognoses for +6 hours.

For 00/12 UTC observation time the LAM50 model is run using the previous LAM50 6hr prognosis as background data for the analysis and the results from the LAM150 model as boundary values. The prognoses are for +42 hours. Afterwards the LAM150 model is run giving prognoses for +6 hours.

Obs. time	00/12 -----	06/18 -----
	LAM50 (+42hrs)	LAM150 (+48hrs)
	LAM150 (+ 6hrs)	LAM50 (+ 6hrs)

Background data for analysis for LAM50/LAM150 - 6hr prognosis from previous run.

Boundary values for LAM150 - UK/US data.

Boundary values for LAM50 - LAM150 prognoses

For 00/12 UTC observation time maritime prediction models for ocean waves and storm surge are run using LAM50/LAM150 results as input.

File Structure

For each of the four observation times per day i.e. 00/06/12/18 GMT, there are three direct access data files. One for all the observation data, one for the results from the LAM150 model and one for the results from the LAM50 model. For observation times 06/18 GMT there are files for UK/US data. All of these files have the same structure.

They have 16-bit word, fixed length records and consist of three parts - information records, field index records and field data records.

The first two records contain information about the file such as date, time, no. of records containing field index, no. of data fields in the file, no. of records in the file.

The next records contain the field index records. Each data field is described by 16 parameters. These are - producer, grid number, year, month and day, time, record number, field length,

data type, time parameter, vertical coordinate type, parameter, vertical coordinate, relative vertical coordinate, grid type and flags.

After these records are the field data records. Each field contains a 20 word header giving a more detailed description of the data. Field data can span over several records.

To access a particular data field, the field index records are first scanned until the correct description is found and the appropriate record is then read directly. This form for data storage has been found to be very efficient and is now used for storing the results from the maritime models.

### Graphical Presentation

The graphics package which is used at DNMI has been written by a member of the research department. It uses IBM's graphics software GDDM. GKS/GDDM is now also available on the system and conversion to GKS is being considered. The package has been developed to meet the typical requirements in operational and experimental atmospheric and oceanographic modelling. It can be used from colour terminals and PCs. Graphical output is of the following types: horizontal fields, meteograms, soundings, cross sections, trajectories, observations.

Input to the graphics package is from the data storage files described previously. Operationally, after each prediction run, some meteograms and horizontal fields of model output are made available as metafiles. A cursor oriented menu is used to select graphical output from these metafiles. A time series presentation of four layers of clouds, precipitation together with MSLP and wind is included in this system.

### ECMWF Products

Data received from ECMWF will be used:

- 1) for general forecasting by the forecasting department.
- 2) as boundary values for Norwegian limited area models.
- 3) as backup for Norwegian limited area models.
- 4) as input for maritime models.

The data will be converted from GRIB format and stored in a direct access file of the same structure as previously described. As soon as the data has been converted and stored in this format it will be immediately available for use in the NWP system and for the graphics package.

It has not been finally decided whether the data conversion will take place on the MicroVax or the IBM computer. It is most probable that there will be parallel systems on both machines such that data can be transferred directly from the MicroVax to the NORD system in the event of the IBM computer being unavailable.

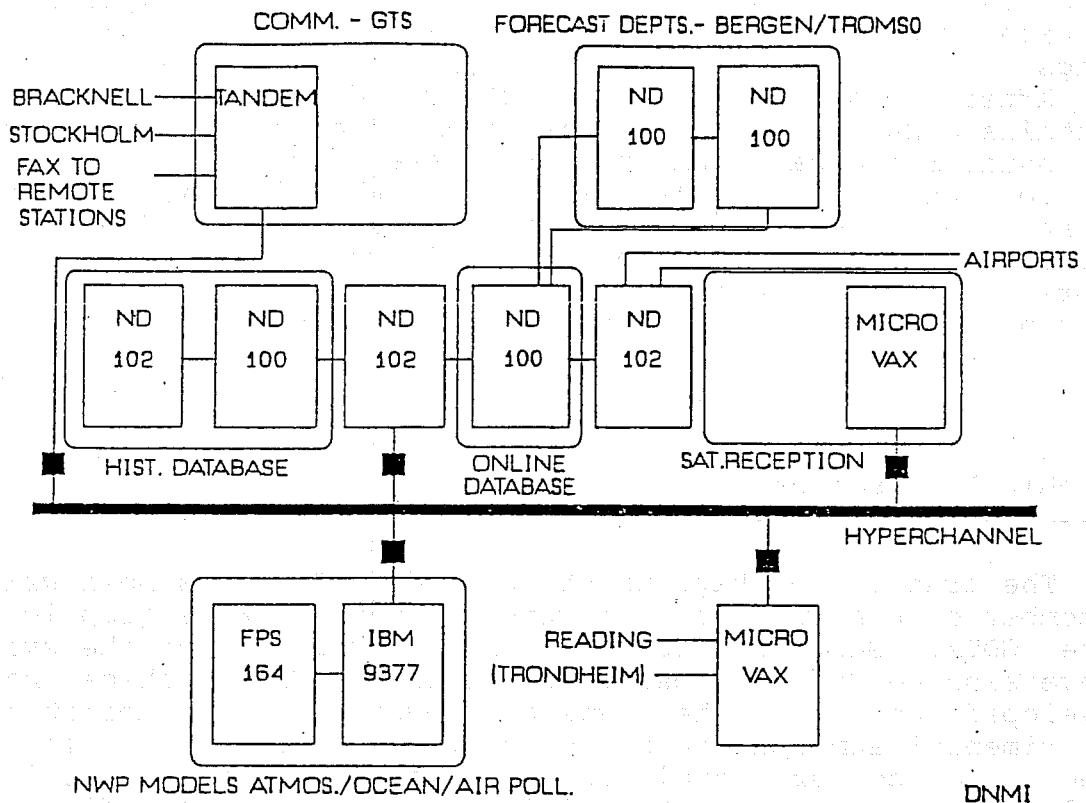


Fig. 1: Computer Configuration at DNMI

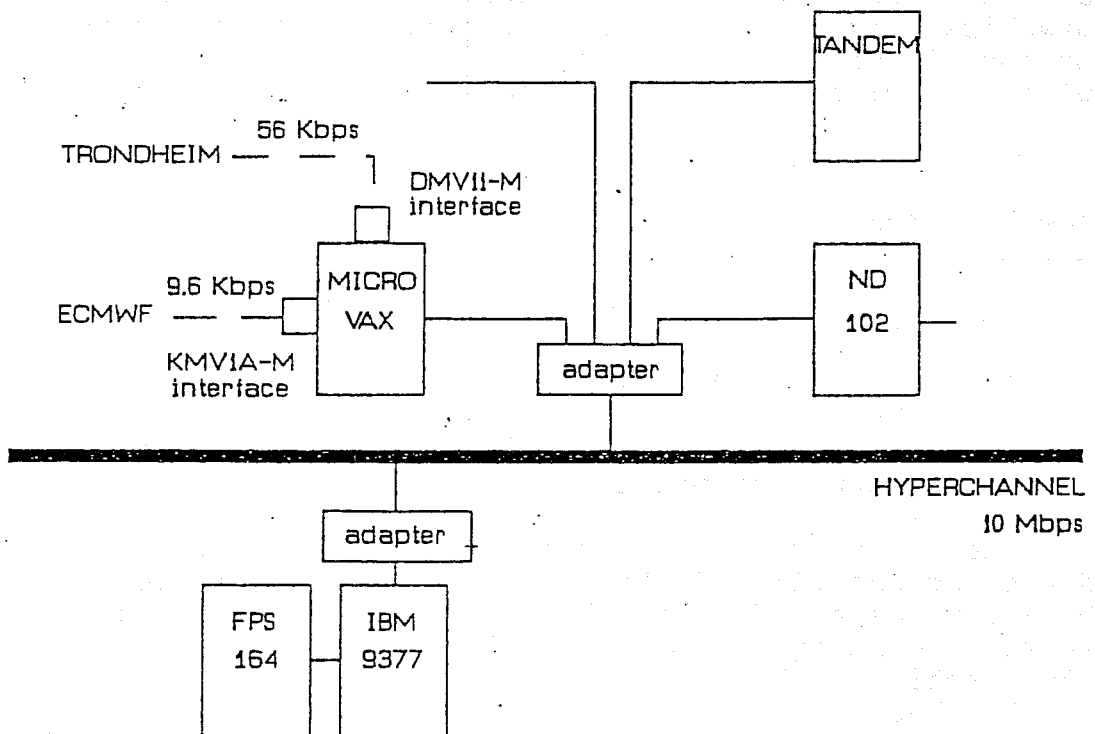
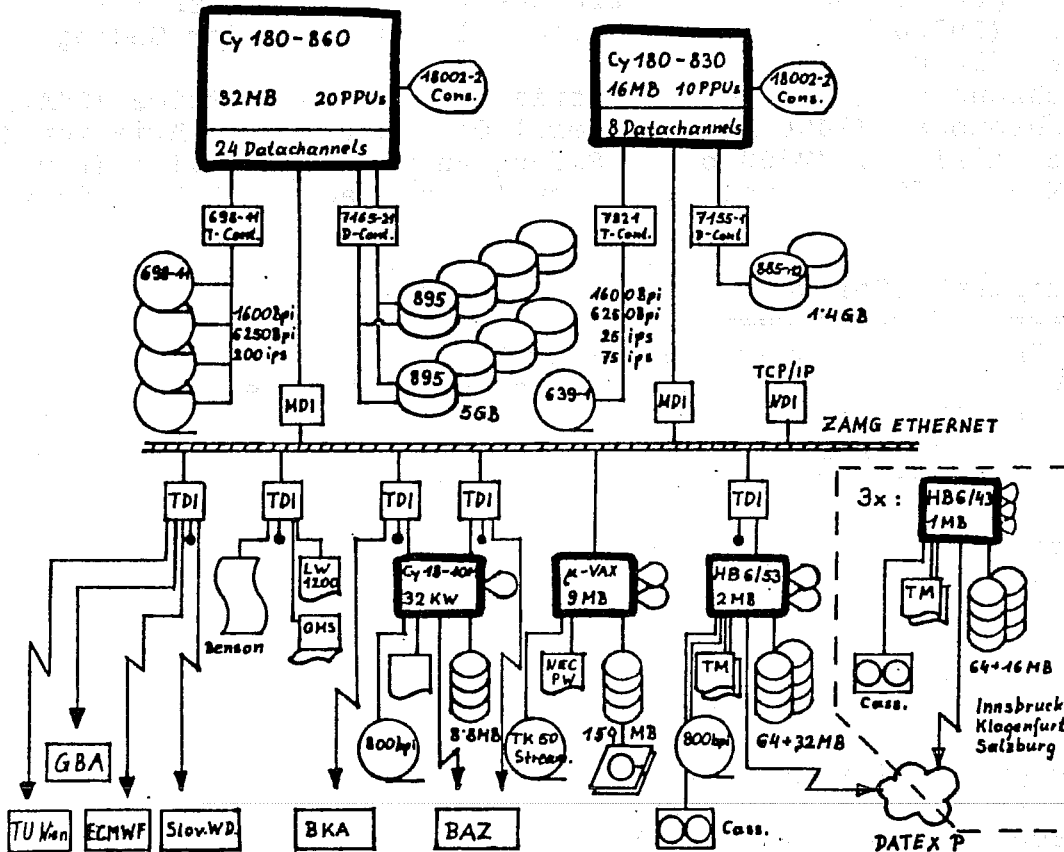


Fig. 2: Communication between DNMI and ECMWF

Central Institute for Meteorology and Geodynamics, Vienna, Austria

A) Computer equipment (Hardware)



Control Data CDCNET based Computer network  
 (Ethernet with 8 Communication Processors ( Motorola 68000 based )):

- Cyber 180-860A (32 MB Centralmemory, 20 periph. processors, 10 mips)
- 895 Disk Storage Unit (5 billion bytes, 8 spindles)
- 698 Magnetic Tape Units (4 Units, 6250/1600 bpi, 200ips)
- Cyber 180-830 (16 MB Centralmemory, 10 periph. processors, 1.5 mips)
- 885-12 Disk Storage Unit (1.4 billion bytes, 2 spindels)
- 639-1 Magnetic Tape Unit (1 Unit, 6250/1600 bpi, 25/75 ips)
- Micro VAX II - VAXSTATION (9 MB Centralmemory, 0.9 mips)
- RD54 Disk Unit (159 million bytes)
- TK50 streamer cartridge (1/2 inch, 95 million bytes)
- BULL Mini 6/53 (2 MB Centralmemory, 0.25- mips)
- Disks: (64 million bytes fix, 2 \* 16 million bytes removable)
- Magnetic Tape Unit: (1/2 inch, 800 bpi)
- ( Each branch office [Salzburg, Innsbruck and Klagenfurt]:
- BULL Mini 6/43 (2 MB Centralmemory, 0.2 mips)
- Disks: (64 million bytes fix, 16 million bytes removable) )

## Communicationlines, Terminals and I/O-equipement:

Central Printer: Centronics LW1200 (1200 lpm, 96 char. ASCII)  
 QMS-S800+ (Laser, 8 pages/min, 300\*300 dpi)  
 Epson FX-100  
 NEC Pinwriter P9XL

Plotter: Benson 1645-R

90 Lines: (9600bd-38400bd) Terminals, Personalcomputers, Printers,  
 Minicomputers (Hewlett Packard 9000, HP 1000, Cyber 18);  
 HDLC: (19200 bd) - Austrian Federal Institute for Geology (GBA),  
 X.25: (9600 bd) - ECMWF,  
 asynchronous: (2400 bd) - Austrian Chancellors office (BKA),  
 asynchronous: (2400 bd) - Federal Office of Civil Aviation (BAZ),  
 async. dial up: (2400 bd) - Slovenian weather service (Ljubljana)  
 DATEX\_P: (9600) connection - (public package switching network)

## Computer equipment (Software)

=====  
 Cybers: NOS/VE 1.3.1 ( Operatingssystem )  
 VX/VE 2.5.3 ( =Unix AT&T System V - Subsystem )  
 Fortran 77  
 Pascal level 1 ISO 7185  
 Cybil ( Cyber Implementation Language )  
 C  
 Libraries: IMSL, NAG  
 VAXSTATION: VMS 5.0  
 Fortran 77  
 Bulls: GCOS 6 2.1  
 Fortran 77

## Computer equipment (Graphic Software)

=====  
 Cybers: GK-2000 Version 3 ( GKS Level 2B )  
 Erlgraph  
 Benslib  
 Postscript  
 VAXSTATION: Digital-GKS Level 2C  
 GTS-GRAL GKS Level 2B  
 MAGICS  
 Postscript

## Computer equipment (ECMWF-Link)

=====  
 CDCNET: full X.25, 9600bd (leased line - modem - TDI - CDCNET - Cyber)  
 NAM/VE Applications: FTP developed from CDC Austria  
 EEP - " -  
 interactive facility, RJE-facility,  
 DD file support, Remote output file support  
 planed: PF support, CGM-graphic file support

## B) Projects ( daily computed results based on ECMWF - products )

=====

Model-output-diagnosis (MOD) consisting of 2 blocks:

## 1. PIB - primary information block

Consists of direct model output (DMO) and derived quantities (ZAMG,BAZ,Slov.w.s./output as printed graphic and pixelgraphic):

- absolute topography 1000 hPa
- absolute topography 500 hPa
- advection of absolute vorticity 500 hPa
- equivalent thickness 500/850 hPa
- thermal frontal parameter
- thermal advection of the thickness-temperature 500/1000 hPa
- humidity index 500/850 hPa
- precipitation

## 2. SIB - secondary information block

Consists of direct model output (DMO) and further derived quantities: (ZAMG)

- temperature 850 hPa
- vertical velocity 850, 700, 500 hPa
- ECMWF cloud cover
- relative vorticity 500 hPa
- vorticity of shear 500, 300 hPa
- vorticity of curvature 500 hPa
- isotachs 300 hPa
- divergency 1000, 850, 700, 500, 300 hPa
- deformation (stretching and shear) 500, 300 hPa
- thickness chart 500/850 hPa
- thermal vorticity 500/850 hPa
- thermal vorticity of curvature 500/850 hPa
- relative humidity 850, 700 hPa
- advection of relative humidity 850, 700 hPa
- time till condensation 850, 700 hPa
- Showalter-Index 850, 700 hPa
- frontogenetic Parameter

Trajectories 1000,850,700,500,300 hPa for 7 austrian Cities.

( ZAMG, BAZ / numeric and printed graphic representation )

Trajectories for very short forecasting ( variable timeinterval, geographical areas and main pressure level ) and transport of air pollution.

( ZAMG, Slov.w.s.)

QFA. The forecast of the weather for distinct points.

For: supply company, avalanche forecast, traffic, news papers, broadcast and television, forecasts given on telephone, ...

Model output data verification ( 27 synoptic stations )

T2m temperature, precipitation, cloudiness, humidity index, 1000 hPa wind

participation on the experiment "Prediction of forecast skill" (12/88-2/89)

qualitycontrol of temp- and winddata of radiosondingstation Vienna in comparison with neighbourstations



## B) Special projects run at ECMWF

=====

"Synoptic vertical heat fluxes: Comparison diagnosed versus modelled data"  
 ( M.Hantel, Institute for Meteorology and Geophysics, dept. for  
 Theoretical Physics )

"Objective verification of statistical local forecasts"  
 ( M.Ehrendorfer, Institute for Meteorology and Geophysics, dept. for  
 Theoretical Physics )

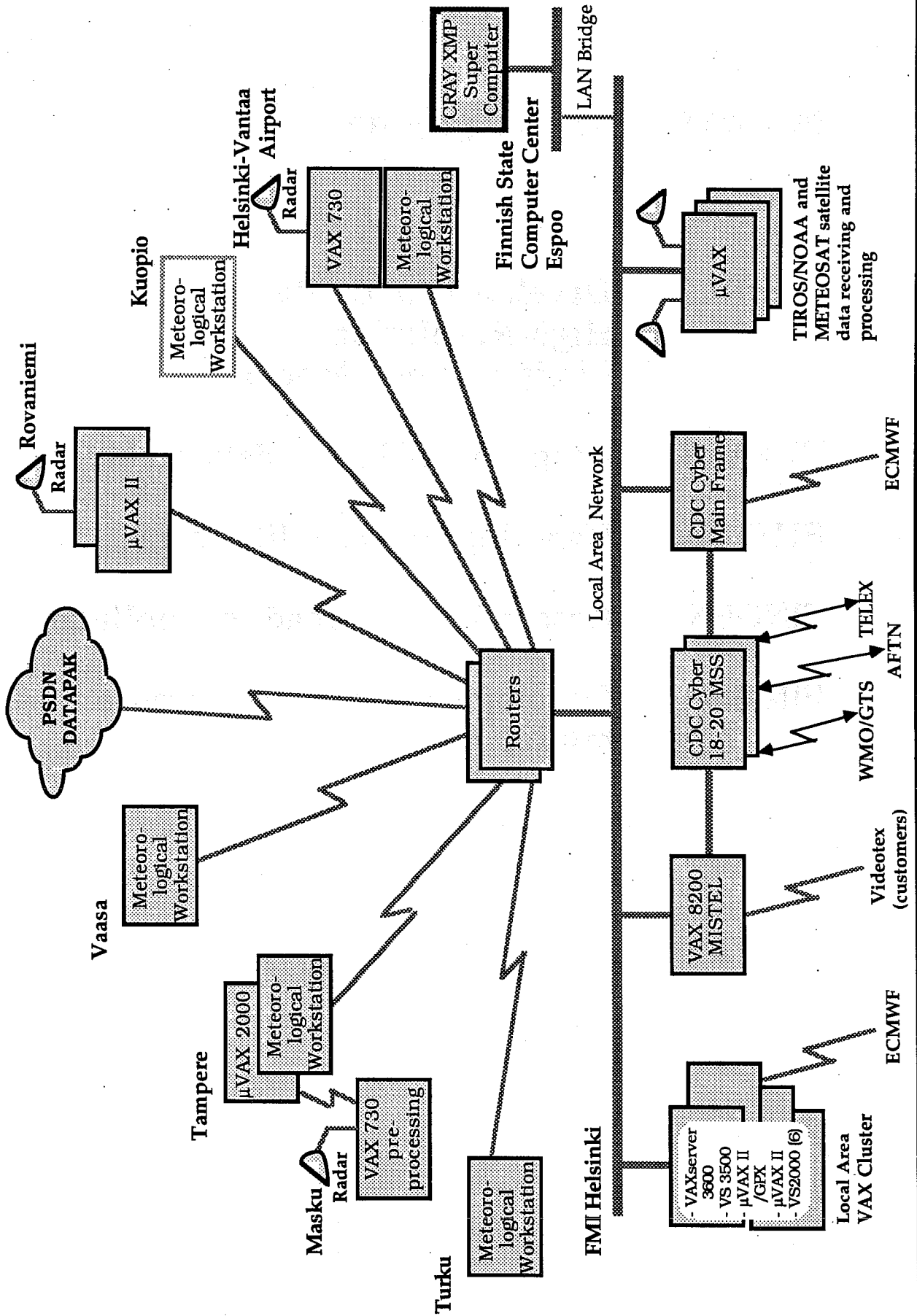
## C) Plans for the future

- =====
- transmission of CGM graphic files
  - MAGICS for representation of PIB and SIB data
  - differences of datafields
  - superposition of different data fields
  - representation of graphic loops on workstations
  - charts in METEOSAT-projection
  - forecast of wind and temperature for the new destinations of AUA

## D) Experience, suggestions and queries

- =====
- high stability of the Link-Software
  - sometimes problems to activate the Link ( multiple resettings of the  
   | lines on both sites necessary )
  - priority of DD-files retransmission-request batchjobs very poor  
   ( interactive: no problem )
  - DD-files retransmission-request batchjob on a high priority
  - detailed description of the structure of CGM graphic files from ECMWF
  - availability of Micro MAGICS (date:PC/DOS, plans:Unix-workstations ?)
  - GRIB-code for ECMWF products (date, decodingroutines for memberstates)
  - BUFR-code (encoding-, and decodingroutines for memberstates)

The Data Processing System of the Finnish Meteorological Institute (February 1989)



## PROJECTS RUN AT ECMWF

FIHIRL	Development of the Nordic High-Resolution Limited Area Model
FIMARS	Usage of ECMWF data archives
FIUPPA	Handling of satellite data
FINGEN	Research of spread of pollutants
FIMESO	Development of a sea-breeze model

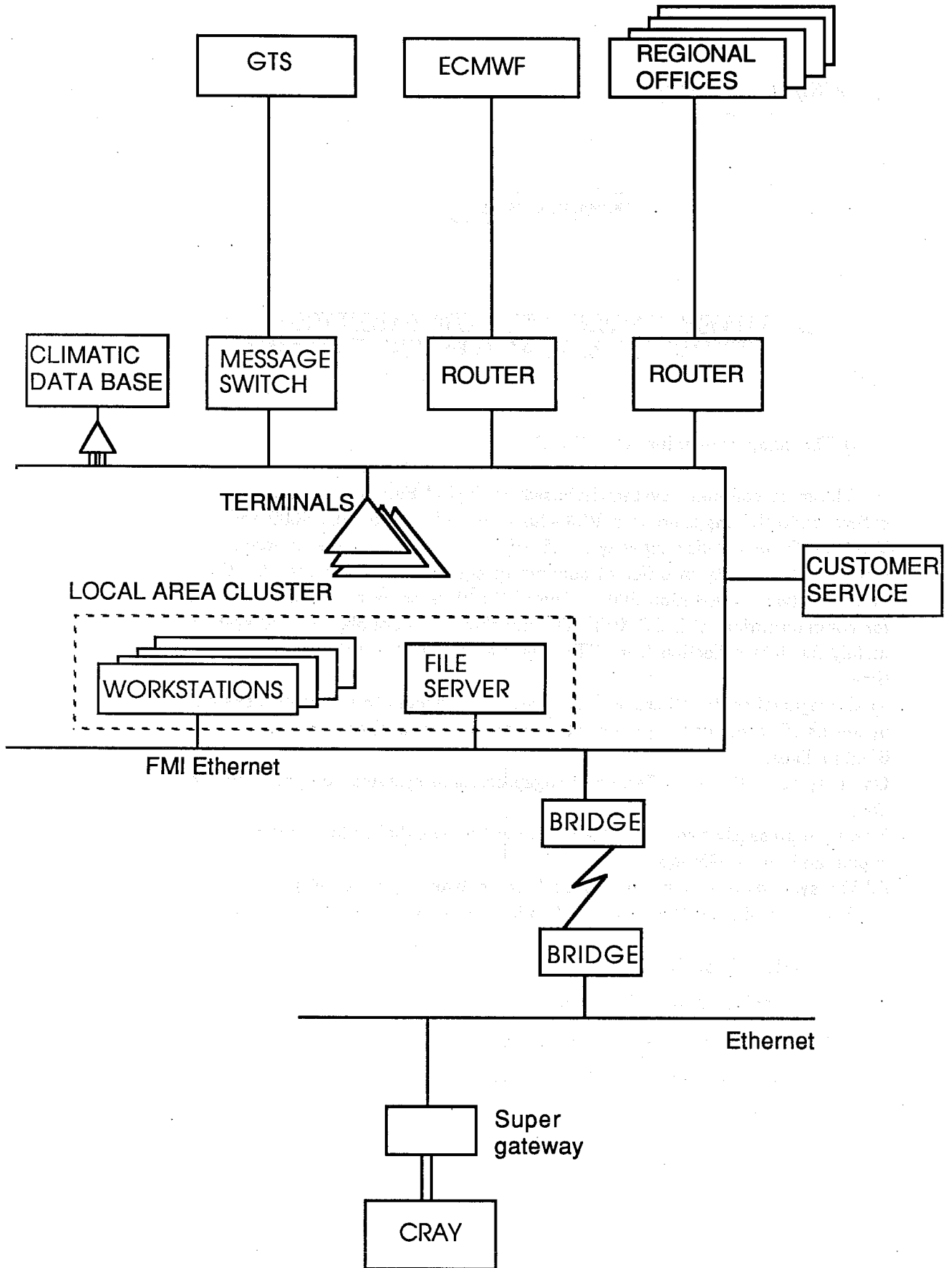


Fig. 3. The computer networking for the NWP system for Finnish Meteorological Institute

SMHI/Tdt 1989-04-09  
Sten Orrhagen

## Sweden

### A BRIEF OVERVIEW OF SWEDISH ACTIVITIES IN RELATION TO ECMWF.

#### i) The computer equipment at SMHI:

The main computer system is based on Digital Equipment VAXs. At location in Norrköping there is a VAX cluster including two VAX 8600 and one VAX 11/750 with a disk capacity of 9.5 Gbyte (in the near future to become 14 Gbyte) and a variety of different supporting equipment. There are also three <sup>1</sup>Vaxs and two Workstation 2000. One of the <sup>1</sup>Vaxs serve as the decnet node for communication with ECMWF. On site there is a double HP2000 system mainly for data collection from GTS and plotting of observations in near real time.

At the regional centers there are <sup>1</sup>Vax systems connected to the central system by means of decnet using bridges interconnecting the local area networks using 64 kbits lines.

On all systems there are Teragon imageprocessing systems connected to the Vaxs.

There are presently two Vax systems supporting weather-radars, one in Norrköping and one in Göteborg.

All Vax systems are supported by local area networks (eathernet).

For further details see the attached diagram outlining the SMHI Vax system.

#### ii) Projects run at ECMWF:

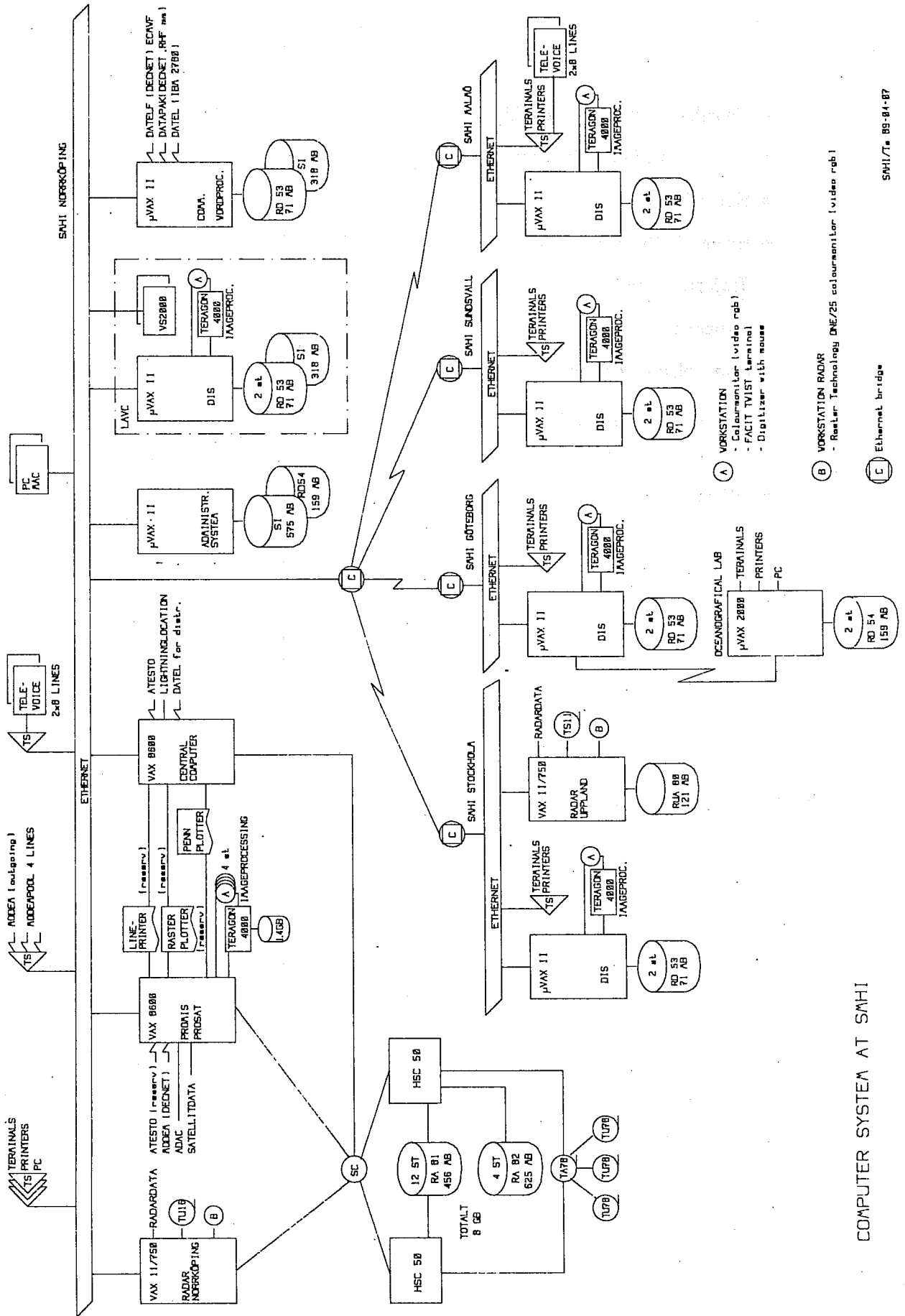
- High resolution limited area model development
- Research on the mesoscale dynamics
- Aerodynamics and airpollution modelling

<sup>1</sup>  $\mu$  (micro)

- Calculation of rain probabilities
- Extraction of data for operational usage
- Hydrodynamic models
- Exergy in the atmosphere
- Trajectory studies
- Dynamics of long waves
- Atmospheric chemistry

iii) Experience using ECMWF computers:

iv) Plans:



COMPUTER SYSTEM AT SMHI

SMHI/Ts 89-01-87

## UK METEOROLOGICAL OFFICE

Computing Representative : A. Dickinson

1. Computer equipment and RJE connection

The past year has seen major enhancements to the Meteorological Office's central computing facility. The main processing power is now provided by an ETA-10 (E series) computer. This system is still undergoing acceptance trials and so at the present time a Cyber 205, installed in 1981, continues to provide the computer resources for our operational work. The ETA-10 configuration is based on 4 vector processors each of which is twice as powerful as the Cyber 205. The processors have access to 64 million words of shared memory and the overall system has a peak performance of around 3000 MFLOPS. Operational forecast programs being developed on the ETA-10 are designed to multi-task across all 4 processors.

A general purpose 4 processor IBM 3084Q hosts both the ETA-10 and the Cyber 205. In the event of failure a dual processor IBM 3081D is used as 'cold' backup. The IBM system provides interactive terminal support via ISPF and links to other computer systems, as well as the normal range of peripherals. Further details are given in Figure 1.

The current RJE connection is shown in Figure 2. The link to ECMWF goes through the TPU (telecommunications processing unit) which consists of two Ferranti Argus 700G minicomputers. One of these is on line, whilst the second acts as backup. Conversion to and from X25 protocol is carried out on these computers. The link to ECMWF is rated at 9.6 Kb/s although in practice the actual speed can be somewhat less. Jobs for submission to the Centre's computers are prepared on the IBM mainframe using ISPF. The RJE software only supports character transfers, but we are able to transfer enough formatted data to support a limited amount of graphical output.

The TPU is due to be phased out towards the end of 1989 and will be replaced by a MicroVAX 2000 based system. A link between the NTS and the MicroVAX has already been established and testing is underway. The MicroVAX system can support transfer rates of up to 64 Kb/s. It is expected that the link to ECMWF will run at this enhanced rate once the new system is fully operational.

2. Projects, experience and plans

In recent years we have been unable to make full use of our allocation of ECMWF computing resources. The main reason for this is that most of the code developed on our Cyber 205 and ETA-10 computers is written in non-standard extensions to FORTRAN. Hence it is difficult for projects to transfer to the Cray X-MP computer at ECMWF. This is particularly true of projects using our forecast or climate models. New versions of these models are now being developed and are being written in FORTRAN 8X. This will allow these codes to be run on Cray or other supercomputer systems as well as on our ETA-10. It is expected that the new models will be available sometime in 1990 and that a significant increase in UK usage will date from this time (provided that FORTRAN 8X is supported at ECMWF).

The accessibility of the ECMWF computer system, while clearly easier for



UK residents, is nevertheless a problem. UK university users may only submit their programs during visits to the Centre and Met Office users find it easier to run programs on our own system, particularly at times like the present when turnaround is much faster on our ETA-10. However, the introduction of the MicroVAX based link will allow interactive access to the Centre and we plan to provide connections for external users at universities as well as Met Office staff. This will clearly improve accessibility and should attract more UK users onto the Centre's computers.

The projects currently run at ECMWF are listed below.

---

#### UK PROJECTS

---

1. LONG-RANGE FORECASTING 30%

- Using a global model to look at prediction on the timescale of a month

2. DIAGNOSTIC STUDIES 20%

- Accessing ECMWF's meteorological archives for diagnostic purposes

3. FORECASTING RESEARCH 40%

- Development of new integration schemes

4. MESOSCALE MODELLING 10%

- Integrations using a non-hydrostatic convective scale model

UK METEOROLOGICAL OFFICE

CENTRAL COMPUTER INSTALLATION

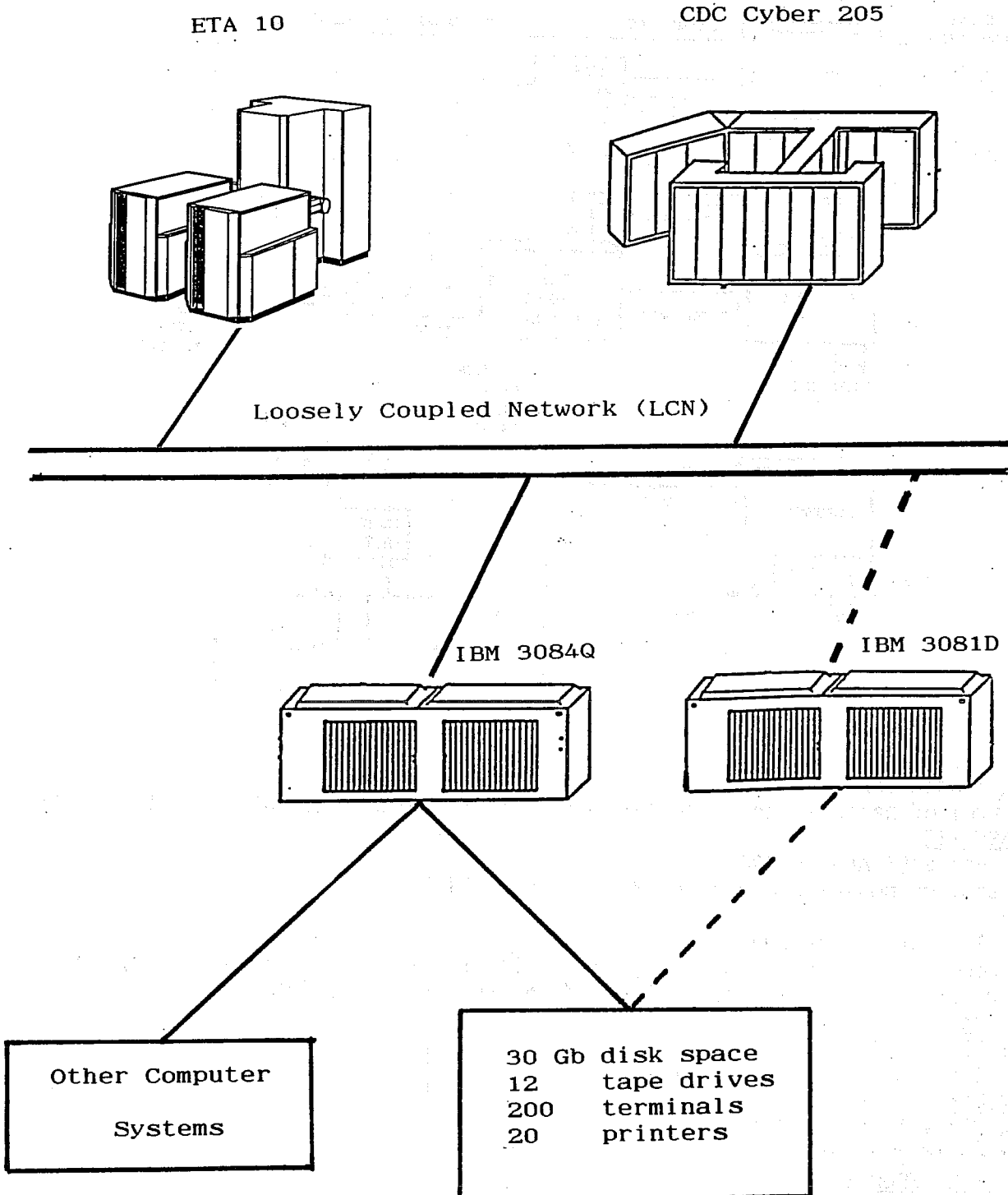
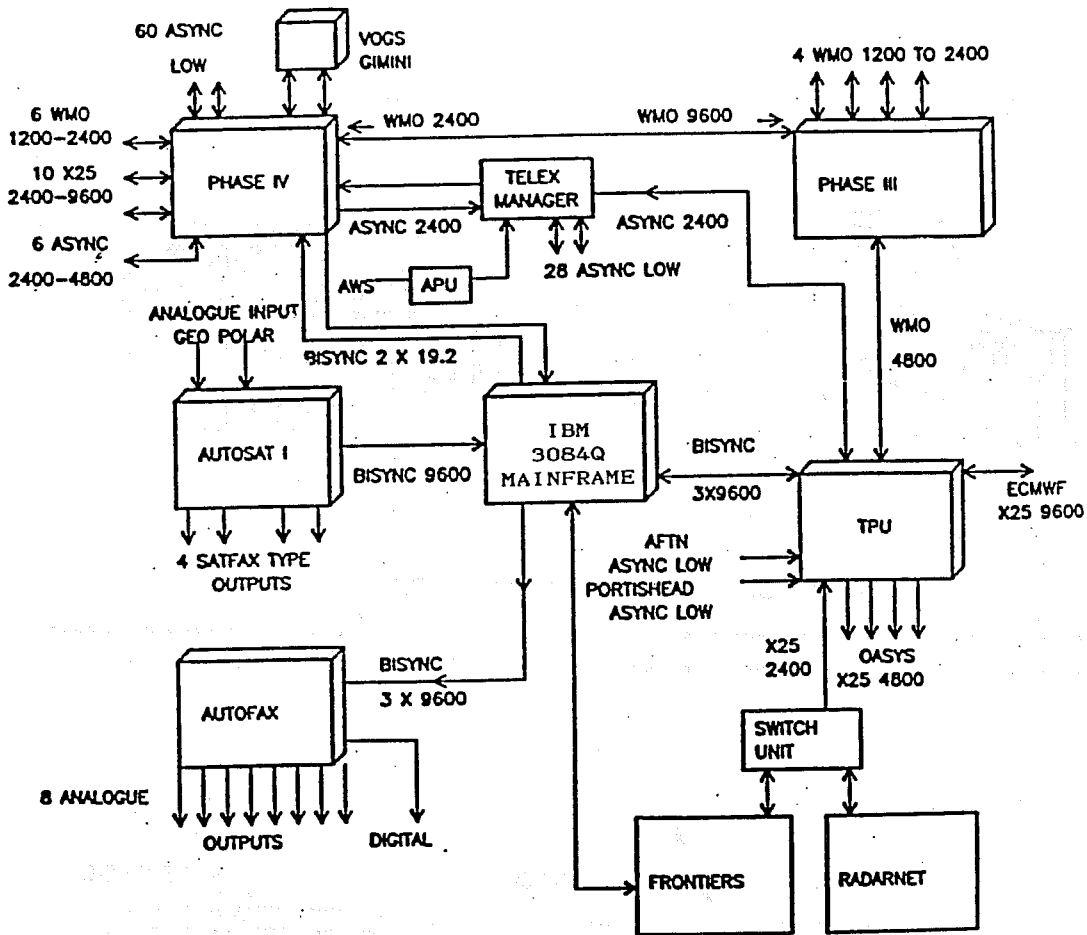


Figure 1

UK METEOROLOGICAL OFFICE

TELECOMMUNICATIONS COMPUTER SYSTEM



PHASE IV

7 x Tandem TXP

Control of national and international data networks; specialised data handling.

PHASE III

2 x Ferranti Argus 700S

Control of medium speed international data links.

TPU

3 x Ferranti Argus 700G

Protocol conversion (IBM Bisynch/WMO/X25); report level handling; ship and airep reports; ECMWF link control; data management for OASYS connections.

AUTOSAT

A-1 PDP 11/60

Provision of satellite imagery.

AUTOFAX

2 x Ferranti Argus 700 GX

Automated distribution of facsimile products.

RADARNET\FRONTIERS

DEC PDP 11/44; DEC VAX 11/750

Composites UK and European radar data; combines satellite and radar data to produce short range rainfall forecasts.

Figure 2

**ANNEX**

***Programme and List of Attendees***

MEMBER STATE COMPUTING REPRESENTATIVES MEETING 11-14 APRIL 1989P R O G R A M M ETuesday, 11 April

- 09.00 CR Welcome G.-R. Hoffmann
- ECMWF's Computer Division status and plans G.-R. Hoffmann
- 10.00 C O F F E E
- 10.30 CR Member States
- Each representative will be asked to speak for a maximum of 10 minutes outlining their Member State's involvement (actual or planned) in the computer service at ECMWF. This should include:
- diagram of own computer equipment, and of RJE equipment connected to ECMWF
  - projects run at ECMWF
  - experience using ECMWF computers, including suggestions and queries regarding the present service
  - plans (involving ECMWF usage over next couple of years)
- 12.30 L U N C H
- 13.30 CR Member States (continued)
- 14.30 C O F F E E
- 15.00 CR User Support services A. Lea
- 15.30 CR NOS/VE overview N. Kreitz

Wednesday, 12 April

- 09.00 LT NTS system - Member States' software for linking to ECMWF A. Bakker
- 10.00 C O F F E E
- 10.30 CR Planning a supercomputer installation (a case study) P. Gray
- 12.00 L U N C H
- 13.30 CR Operational services G. Holt
- 14.30 LT Data acquisition project, based on a VAX 6210 R. Dixon  
R. Gibson
- 15.00 C O F F E E
- 15.30 LT Data acquisition project (continued)
- 16.00 Machine Hall tour

Thursday, 13 April

- 09.00 CR System plans C. Hilberg
- 09.30 CR Data transfer to Member States via the telecommunications link N. Kreitz
- 10.00 C O F F E E
- 10.30 LT ECFILE - ECMWF's central file store N. Storer
- 12.30 L U N C H
- 13.30 LT MARS - ECMWF's meteorological archive J. Hennessy
- 15.00 C O F F E E
- 15.30 LT CFT77 - Cray's new optimising compiler R. Fisker
- 16.00 LT New supervisor system (SMS) C. Hilberg  
A2

Friday, 14 April

09.00	LT	MAGICS status and support	P. O'Sullivan
09.30	LT	MAGICS/GKS overview and enhancements	P. O'Sullivan
10.00		COFFEE	
10.30	LT	MicroMAGICS overview	J. Daabeck
11.00	LT	GKS and its use in MAGICS	A. Jørgensen
		- CGM overview and status of metafile distribution to Member States	
11.45		Video (MAGICS animation)	P. O'Sullivan
12.00	CR	Final discussions	
12.30		LUNCH & DEPART	

Notes concerning locations

CR - Conference Room (Council Chamber)

LT - Lecture Theatre

Coffee is served on the Concourse

**MEMBER STATE COMPUTING REPRESENTATIVES MEETING 11-14 APRIL 1989**

**ATTENDEES**

**REPRESENTATIVES**

L. Frappez (Mrs)	Belgium
P. Henning	Denmark
B. Dietzer	Germany
J. Juega	Spain
J-M. Quinto	France
S. Roger	France
D. Murphy	Ireland
S. Pasquini	Italy
N. van der Plank	Netherlands
R. Rudsar (Ms)	Norway
G. Kaindl	Austria
T. Hopeakoski	Finland
S. Orrhagen	Sweden
A. Dickinson	U.K.

**ECMWF**

G-R. Hoffmann	Head, Computer Division
P. Gray	Head, Computer Operations
C. Hilberg	Head, Systems Software
A. Lea	Head, User Support
J. Greenaway	User Support
B. Kesseboom	User Support
N. Kreitz	User Support
D. Maretis	User Support
P. Prior (Mrs)	User Support
G. Holt	Computer Operations
M. O'Brien	Computer Operations
T. Bakker	Systems Software
K. Colman	Systems Software
R. Dixon	Systems Software
R. Fisker	Systems Software
N. Storer	Systems Software
R. Gibson	Met. Applications, Met. Division
J. Hennessy	Met. Applications, Met. Division
J. Daabeck	Graphics
A. Jørgensen	Graphics
P. O'Sullivan	Graphics