TECHNICAL MEMORANDUM

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Report on the sixth meeting of Member State Computing Representatives, 3-5 June 1991

A. Lea (compiler)

Operations Department

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European Centre for Medium-Range Weather Forecasts
Europäisches Zentrum für mittelfristige Wettervorhersage
Centre européen pour les prévisions météorologiques à moyen

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PREFACE

The sixth meeting of Member State Computing Representatives took place from 3-5 June 1991 at ECMWF. Nineteen Member State (MS) personnel from fifteen Member States took part, the list of attendees is given in Annex 1.

As in previous meetings the Head of Computer Division (Geerd-R. Hoffmann) opened by giving an overview of the Computer Division's status and plans. This was followed by each Member State Computing Representative giving a short presentation about the use their particular service makes of ECMWF's computer facilities. The remainder of the meeting was a mixture of discussion sessions on the Centre's computer services and technical presentations about some specific aspects of the Centre's computer facilities. The meeting formally ended at 12.30 on 5 June, but about half of the Representatives stayed on to attend the optional sessions on graphics on the afternoon of 5 June. The programme is given in the Annex 2.

This report briefly summarises each session, in particular concentrating on the discussions. Part 1 covers ECMWF's contributions, part 2 the Member State contributions. All the reports in part 2 have been provided by the Representatives themselves.

PART 1

ECMWF Staff Contributions

1. ECMWF'S COMPUTER STATUS AND PLANS

Geerd-R. Hoffmann

1. INTRODUCTION

Since the last meeting of Computing Representatives some two years ago, there have been few personnel changes in the Computer Division, figure 1 shows the current staff. We are finding it increasingly difficult to recruit into certain positions, in particular for some aspects of Systems Section work. This has had an impact on some of our achievements.

Since the last meeting there have been a lot of hardware and system changes. From the user point of view it has been the biggest change since our service began in 1978, in particular the switching from COS to UNICOS. Recent achievements have included:

* replacement of the CRAY X-MP/48 with the CRAY Y-MP8/8-64, including the switch from COS to UNICOS

* the replacement of the IBM MSS 3851 mass storage system by a Storage Tek ACL 4400 Nearline robot storage system

* replacement of the Cyber 855s by a Cyber 962

* a standardisation of print services on PostScript devices

* the introduction internally of workstations

* upgrading of the network to Member States

Figure 2 shows the current configuration. Because of all these changes, the major delays to the forecast increased in 1990, figure 3 has the details.

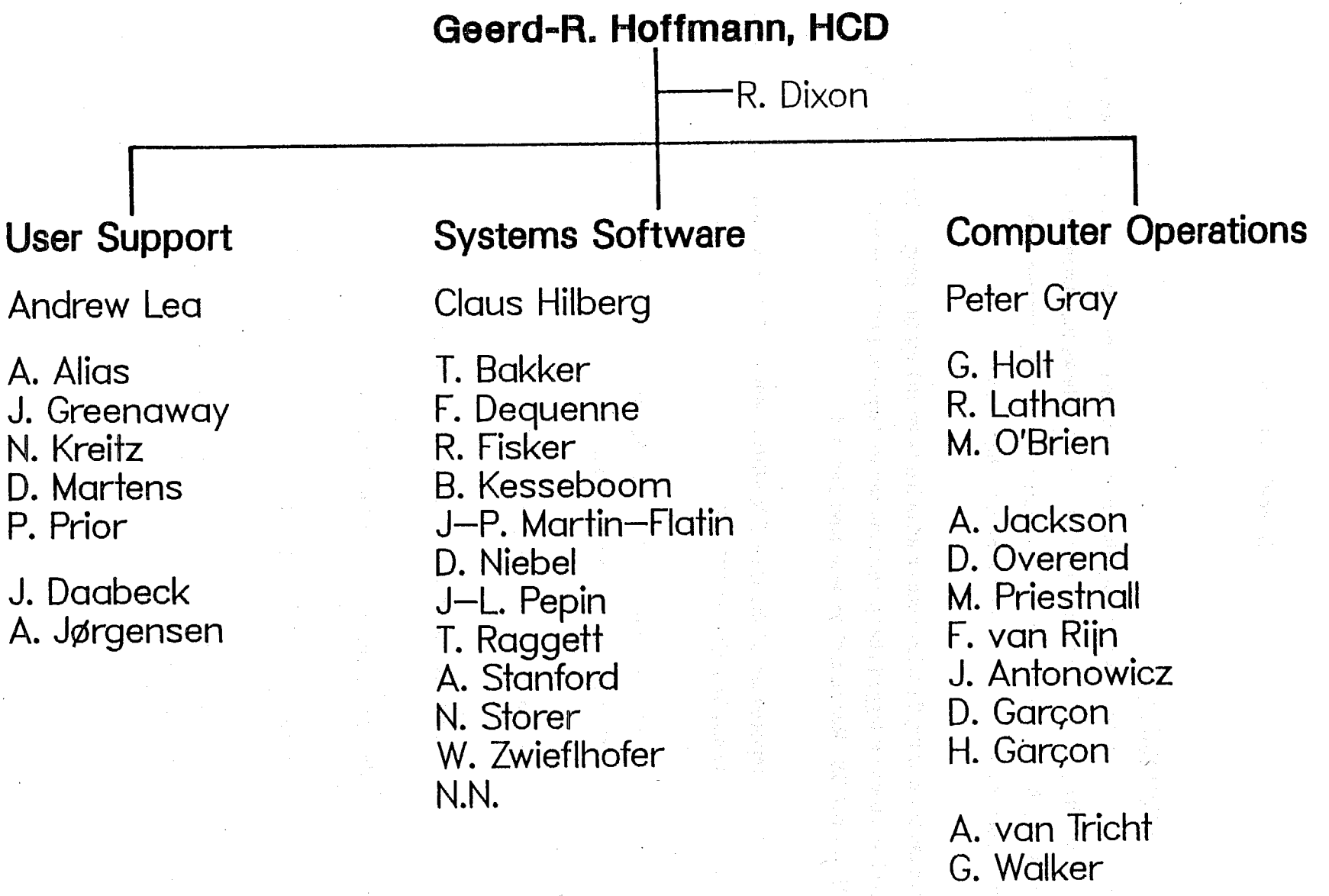


Fig. 1 Current staff of Computer Division (excluding operators)

Fig. 2 **Computer configuration of ECMWF**

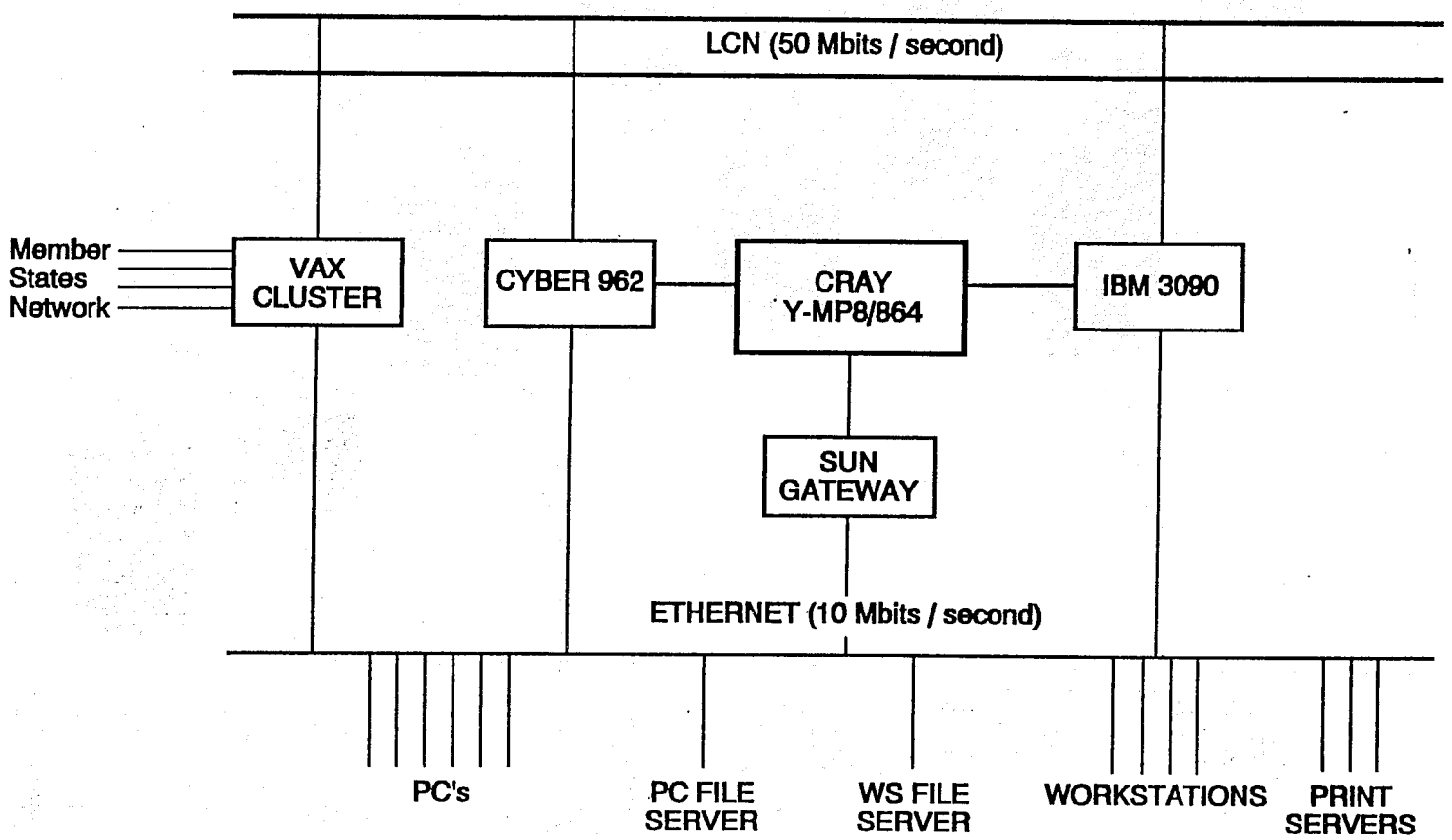
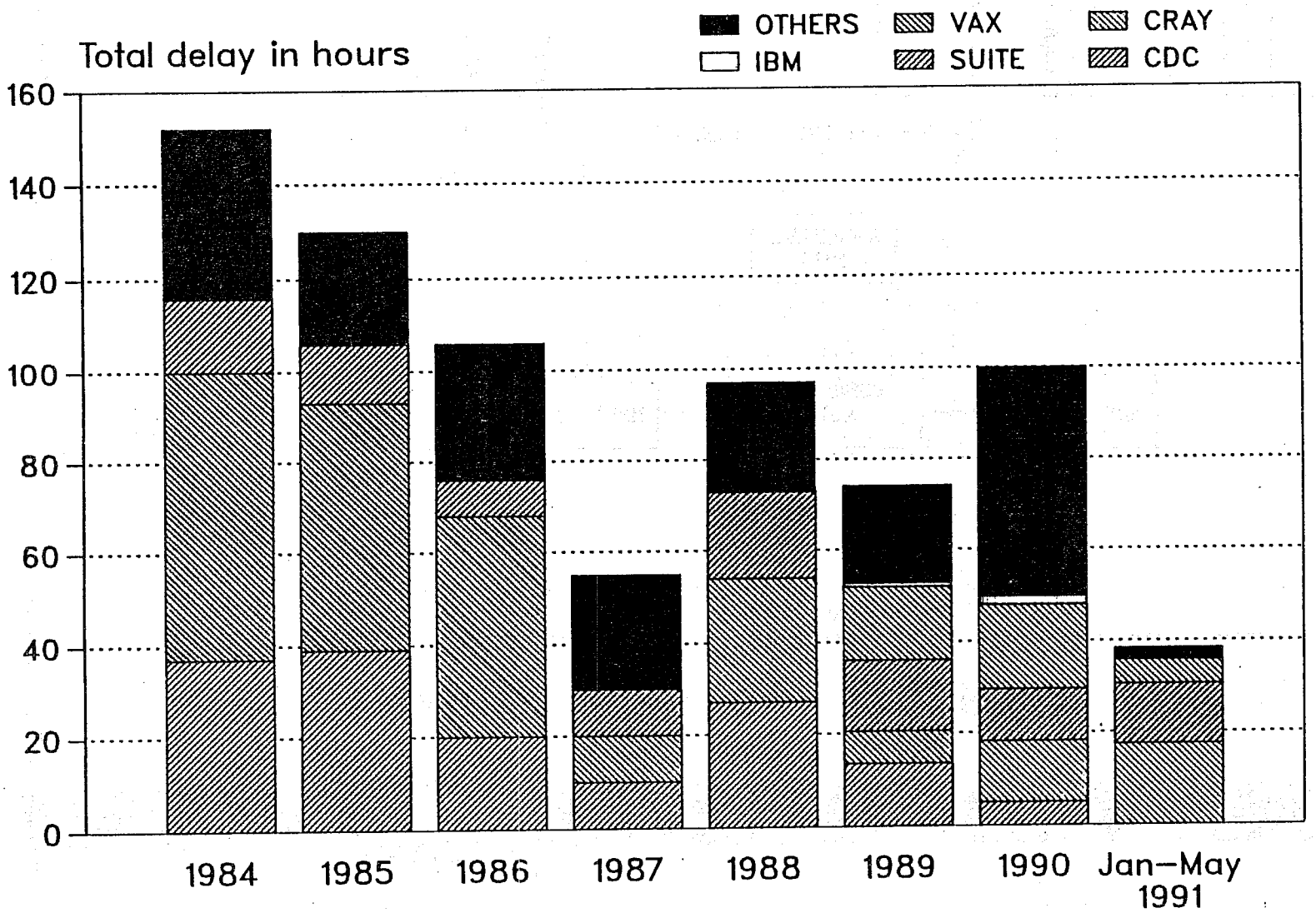


Fig. 3 Causes of major forecast delays



2. CRAY Y-MP8/8-64

The machine was delivered on 15 June 1990, and following our standard acceptance procedures a trial service began on 17 July 1990. It passed its final acceptance on 2 August with 99% availability and 180 hours meantime between failures. A trial service for Member States began on 1 October 1990, but immediately ran into problems because the VAX based RQS software did not work reliably. On 7 November, the dissemination products were generated from the Y-MP based forecast, from that point on the X-MP was no longer effectively the main compute server.

The CRAY Y-MP8/8-64 is the first phase of a 4½ year service contract that ECMWF has concluded with Cray Research, which calls for an increase in performance over that period. The performance is measured in terms of a "unit" (defined by the Centre and known as a PPU). The system installed now delivers 1.4 PPUs, in July 1992 the Y-MP8 will be replaced by a Y-MP16/12 which will deliver 4 PPUs, and in July 1994 that will be upgraded to a Y-MP16/16 to deliver 5 PPUs.

The initial disks (DD-40s) delivered with the system have not proved too reliable (one failure per month approximately). Thus Cray Research have replaced them with more modern, and hopefully more reliable, DD-41s. It is too soon yet to say whether, indeed, they are more reliable.

Up until a month ago, the main system has been rather reliable, however, recently we have had a series of CPU failures leading to some long down times. We are continuing to monitor the situation carefully.

The CPU utilisation suffered a serious drop in January/February with user utilisation decreasing dramatically while idle and system time increased. The problem was due to ldcaching, whereby low priority jobs would take all the buffers, forcing high priority jobs to run at disk access speeds rather than cache memory speeds. This significantly decreased the model efficiency and hence the overall utilisation. After getting considerable help from Cray we changed our ldcache philosophy and now utilisation is good again.

Users should note, however, that turnaround may get worse again when the T213 parallel runs begin. Also, the dissemination timetable will be much tighter after the T213 goes into production. Overall, we expect a period of increasing turnaround times, longer queues, more congestion, until the Y-MP16 comes into operation in a year's time.

A great deal of software had to be migrated from COS to UNICOS, this has now been largely completed and, once again, we can continue to develop the service to provide new features and facilities.

The only problem area is RQS, it has taken a long time for Cray to deliver and then stabilise the service. Unfortunately, ECMWF is the first user of this software and had to act as "guinea pig". We apologise to the Member States for all the problems they have suffered over the past year, mainly due to RQS.

3. IBM System

The IBM MSS 3851 mass storage maintenance ceased in 1991 and hence we had to replace it. In parallel to this, a new archiving policy was adopted by the Centre. This new policy will mean we have approximately one additional TByte (1000 Gbytes) of data to store each year. Following the usual Centre's procedure, we issued an ITT in spring last year. On the basis of the replies, the Centre chose a Storage Tek ACL 4400 Nearline system, to be installed in 3 phases. The first phase (2 silos, approximately 11000 cartridge capacity) has been installed, in the second and third phases another silo will be installed in May 1992 and May 1993 respectively, making a total of 4 silos in all and providing 4 TByte storage. The current archived data is of the order of 3.6 TBytes, of which 2.2 TBytes is MARS data.

Predicting the growth in CFS (ECFILE) traffic over the next four years showed that the present IBM 3090 cannot cope with that growth. Hence we are now in the middle of another tender exercise, this time to replace the 3090 itself, early in 1992. Already the present 3090 is at full load. averaging more than 80% CPU utilisation through the 24 hour period. Thus we are dangerously close to overload. The new system will be about 6 times the power of the present one to be able to support the CRAY Y-MP 16. Looking to the longer term future, the Centre will study UNITREE, a UNIX based system similar to CFS. This is because CFS will probably be no longer developed, as interest is moving away from this old MVS based system towards UNIX based ones.

4. CYBER SYSTEM

In January 1991 we replaced our two Cyber 855 systems with one Cyber 962. The new machine is of the same CPU power as one 855, but has a lot more memory - 64 Mbytes (cf 32 and 16 Mbytes on the 855s). This has meant that interactive response is now much better, as interactive tasks use a lot of memory but not a great deal of CPU resources.

The disk system is the same size (13 Gbytes) but is now a disc array system with parity units. That means if one disk fails user data is reconstructed from the parity information stored on other disks. Therefore, the disk service the user sees should be much more reliable. Also the total channel bandwidth to disk is much higher (50 Mbytes/sec cf 17 Mbytes/sec), eliminating another bottleneck.

Physically, the Cyber 962 is much smaller than the 855s, releasing a lot of machine hall floor space. The 962 also uses less electricity and is air cooled, making it a much simpler system to install and run.

So far the system reliability has been very good, only 2 incidents to date.

The Centre plans to replace NOS/VE in 1993 with a workstation based environment (see below). However, because of some delays in putting together that workstation environment, it is possible we may retain NOS/VE slightly longer than currently planned.

5. PRINT SERVICES

We now use the PostScript de facto standard on our main printers and this will be the only standard we support in future.

Printer hardware currently includes:

* DEC LPS 40 and 20 laser printers for bulk A3 and A4 output
* NEC PostScript printers for general user and secretarial office printers
* Océ colour A3 and A4 printers

6. MEMBER STATE NETWORKS

Some recent or planned upgrades include:

* a 64 kb/sec link to the UK Meteorological Office has been installed, using DECNET routers;

* a 64 kb/sec pilot project link to Meteo France, running both the old ECNET protocols and TCP/IP based ones. This link works well, but we still have to develop a means whereby data dissemination and job submission can be done using the TCP/IP based protocols;

* a 64 kb/sec pilot project link will shortly be installed to DWD, Germany. This will run DECNET and TCP/IP protocols simultaneously;

* we believe that Italy will request a 64 kb/sec link shortly.

For these 64 kb/sec links the Centre pays the equivalent cost of a 9600 b/sec link, the remaining costs are then paid by the Member State concerned. A report on the pilot project links will be made to the Technical Advisory Committee in October.

DEC has announced the availability of DECNET V, an ISO OSI based set of protocols. It is the Centre's intention to study DECNET V carefully, and, providing no major problems are foreseen, to move to it. Thus DECNET Member States should be aware that we may ask them to change to DECNET V at some point. This is in line with the Centre's stated policy of using internationally agreed standards wherever possible.

7. WORKSTATIONS

To help in the migration project, last year we installed some SUN SPARC 1+ workstations. Subsequently, we have decided to continue with this philosophy and are working on providing a good environment for workstation users. This will include:

* ecfile access direct from the workstation
* MARS access
* programming environments e.g. a better editor, CASE tools etc.
* Fortran, C
* MAGICS, METVIEW
* an office environment e.g. mail, word processing
* general printer access

8. VAX

The VAX configuration has changed recently, figure 4 shows the latest state. We now have only 2 11/750s left, running the old ECNET protocols. There are currently two 8350s, one of which will shortly be replaced by 6310. There is also one 6210. Hopefully, we can work towards a system consisting of two 6310 machines, a 6210 as backup, plus two 11/750 machines for ECNET sites. This should simplify our cluster configuration, making it easier to maintain.

We are not aware of any major problems on dissemination of data to Member States, most remote systems can now handle the data volumes adequately. The trend in total volume of data received daily from Member States is static at about 30 Mbytes per day total. The trend in data volumes transmitted is slowly increasing, mainly due to more products being requested. The current volume transmitted is around 120-150 Mbytes per day.

9. NETWORKS

Figure 5 shows the current networks installed at the centre. A later session will go into this in much more detail. The only points to note now is that the Centre hopes to phase out LCN by the end of the year, replacing it by an FDDI based system. In 1992/3, Superlink will be replaced by a HiPPI based system, running at 800 Mbits per second. Once those links have been achieved, all out internal network will be running standard protocols, making future replacement/additions very much easier.

Routers will be used to connect our internal network with similar internal networks in Member States. The 64 kb/sec link to France is just one such example.

Fig. 4

ECMWF VAX configuration
May 1991

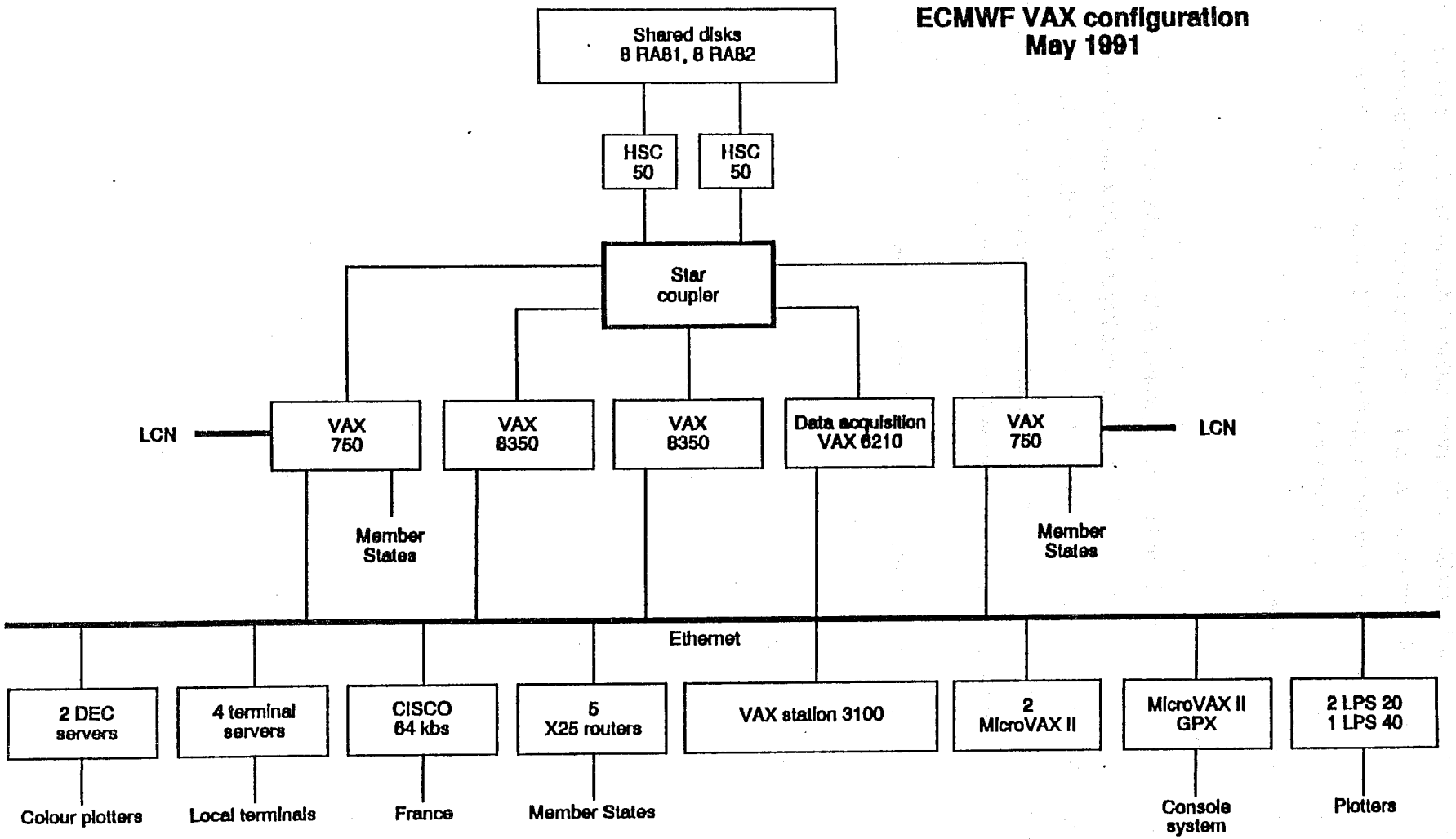
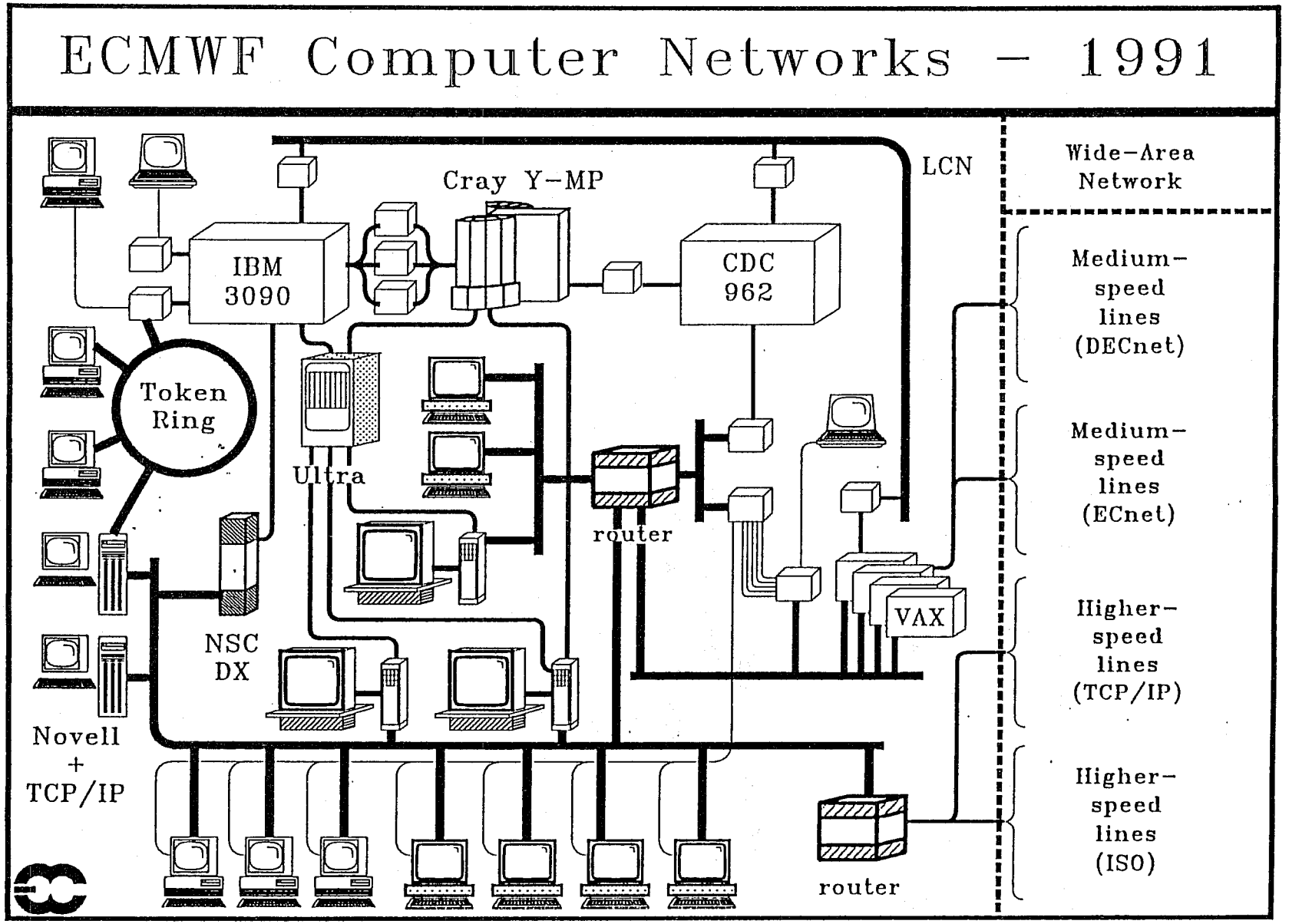


Fig. 5


ECMWF Computer Networks – 1991
Cray Y-MP
LCN
Wide-Area Network
IBM 3090
CDC 962
Token Ring
Ultra
router
Medium-speed lines (DECnet)
Medium-speed lines (ECnet)
VAX
NSC DX
Higher-speed lines (TCP/IP)
Novell + TCP/IP
Higher-speed lines (ISO)
router

2. USER SUPPORT SERVICES

Andrew Lea

1. STAFF

Two people have left the section since the last meeting. Bert Kesseboom has transferred to the Systems Section (VAX system support) and Dimitris Maretis has left ECMWF.

Antoinette Alias and Ditlef Martens have joined the section, both bringing a wealth of UNIX knowledge. Their responsibilities are in the area of UNIX and workstation support. In addition, Ditlef is responsible for the UNICOS accounting system. Table 1 shows all the User Support staff and how to contact them.

2. COMMUNICATIONS

Integration of ECMWF's various electronic mail services is underway. Currently, UNICOS, UNIX (on workstations), NOS/VE and VAX/VMS form a unified system. However, in practice the VAX/VMS link has not proved reliable, and until this problem is resolved the Centre is not advertising this unified system. The Centre's DOS based PC system mail facility is currently not included at all.

Once the above problem is resolved, the Centre will ask each Member State user what is his preferred mail system. Mail then sent from any system to a given user will be automatically sent to his preferred mail system, eliminating the need for the user to have to check several mail services separately.

The Centre is setting up a link to the international Internet service, to ultimately replace the present EARN/Bitnet link. Mail to/from EARN/Bitnet will still be handled as Internet has a gateway to that particular network.

The daily NEWS facility on the VAX seems to be little used. Recently it went down for a period, no one noticed, and no one complained! Currently it holds:

* daily machine schedule (as displayed on the TV system at ECMWF)
* a copy of the latest News Sheet

TABLE 1: HOW TO CONTACT USER SUPPORT

Telephone (ECMWF operator): +44 734 499 000 **Facsimile:** +44 734 869 450 **Telex:** 847 908 ECMWF G

Postal address: ECMWF, Shinfield Park, READING, RG2 9AX, UNITED KINGDOM

	TELEPHONE		ELECTRONIC MAIL*			
	INTERNAL	EXTERNAL	INTERNAL	EXTERNAL (INTERNET)	USER IDENTIFIER	ROOM NUMBER
ADVISORY	Bleeper 139	Operator, & ask to bleep 139	ADVISORY	ADVISORY@ECMWF.CO.UK	ADVISORY	
ANTOINETTE ALIAS	2382	+44 734 499 382	UST@ECMWF	AALIAS@ECMWF.CO.UK	UST	224
JOHN GREENAWAY	2385	+44 734 499 385	USJ@ECMWF	JGREENAWAY@ECMWF.CO.UK	USJ	226
NORBERT KREITZ	2381	+44 734 499 381	USN@ECMWF	NKREITZ@ECMWF.CO.UK	USN	207
ANDREW LEA	2380	+44 734 499 380	USA@ECMWF	ALEA@ECMWF.CO.UK	USA	227
DITLEF MARTENS	2383	+44 734 499 383	USD@ECMWF	DMARTENS@ECMWF.CO.UK	USD	206
PAM PRIOR	2384	+44 734 499 384	USP@ECMWF	PPRIOR@ECMWF.CO.UK	USP	225

* Other alias names can also be used, see bulletin B3.4/2

A quick poll of the representatives present showed that it still is of occasional use, hence it will be retained, but on a minimum maintenance basis.

With regard to non-electronic methods of communication, it would appear that the Centre should offer an annual Computing Representatives' meeting. If insufficient representatives believe that a meeting in a particular year is of value, then that meeting will be cancelled.

3. DOCUMENTATION

With the demise of both the NOS/BE and COS operating systems, much of the previously supplied ECMWF documentation can be thrown away. Table 2 lists all that which can now be discarded. Work continues on the bulletin series, table 3 lists the changes since the last meeting, plus those being currently worked on.

In order to help new users, a "New User Pack" of basic documentation has been created. This pack will be sent automatically to each new user once he is registered. The basic contents of the pack are:

* a form containing the user's registration details, including initial passwords

* a description of the main computer systems and networks

* a list of the manuals the user should have in his office (if at ECMWF), or that have been sent to each Member State

* information on how to contact User Support

* a copy of the latest ECMWF Newsletter

* copies of the following ECMWF Computer Bulletins:

  Classification and current contents

  Index

  B0.2/3 Security

  B1.0/3 Introduction to the UNICOS system at ECMWF

* a form to complete concerning which electronic mail system the user prefers to use

More systems are becoming available that provide user documentation in electronic form, some examples being the NOS/VE topic system, and the UNIX main page facility. As an initial move in this direction User Support has made available ASCII text copies of its basic UNICOS documentation in the directory /ec/ecmwf/information

Several of these documents have been prepared under WordPerfect, the Centre's standard word processing system. A few Computing Representatives said they would be interested in having the master version of these documents in WordPerfect internal format being made available as well as the ASCII version.

Looking to the future, the concept of an "information server" is being studied. This would be a (UNIX based?) system, accessible by all users, which would hold the bulk of the Centre produced computer literature in electronic form. In the shorter term the use of the UNICOS "news" facility is being investigated as an addition to, or perhaps replacement of, the News Sheet system.

TABLE 2: OBSOLETE MANUALS, BULLETINS AND NEWS SHEETS

Now that the Cray COS (and NOS/BE) service has terminated, the following manuals, bulletins and news sheets can be thrown away.

Manuals

All Cray COS specific manuals can be disposed of. Note that some manuals, e.g. CFT77, are common to both COS and UNICOS, and hence can be retained for UNICOS use if they are still up to date, i.e. valid for UNICOS 5.

Bulletins

The following can be disposed of:

B1.0/1, B1.2/1, B1.6/1, B2.2/1, B2.7/1, B3.2/1, B4.1/2, B4.4/1, B4.9/1, B4.9/2, B4.9/3, B4.9/4, B4.10/2, B5.2/1, B5.2/2, B5.2/3, B5.2/6, B5.2/11, B6.3/1, B6.3/2, B6.5/1, B6.7/1, B6.7/2, B6.7/3, B6.7/4, B7.1/1, B7.1/2, B7.2/1, B7.7/1, B8.1/1, B8.1/2, B8.1/3, B8.1/4, B8.3/2

News Sheets

The following can be thrown away:

89, 135, 158, 187, 194, 201, 208, 226, 227, 241, 244.

A list of those still valid is given in the ECMWF Newsletter.

TABLE 3: BULLETINS ISSUED OR REVISED SINCE APRIL 1989

Classification and current contents	
Index	
B0.2/3	Security
B1.0/3	Introduction to the UNICOS system at ECMWF
B2.8/1(1)	Terminal emulators for PCs - a basic introduction
B3.4/1	The EARN network
B3.5/1	Data transmission to and from Member States
B5.2/5(1)	The ECMWF METEOGRAM system
B5.2/14	The diagnostic and plotting package "BPP"
B8.2/1	Supporting incoming/outgoing magnetic tapes at ECMWF
B8.3/1(1)	ECFILE concepts
B8.3/3	ECFILE access from NOS/VE

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BULLETINS BEING WORKED ON NOW

B1.0/2(1)	An introduction to the VAX interactive system
B2.5/1(1)	NOS/VE service - self-tuition notes
B2.5/2(1)	Summary of ECMWF provided features in NOS/VE
B3.4/2	Integrated electronic mail services
B6.7/2	MARS User Guide

4. TUITION

Based on feedback from the 1990 training course, the programme for subsequent courses has been thoroughly revised. The new course now takes 3 weeks and is structured as follows:

week 1	Introduction to UNIX and to shell programming
week 2	UNICOS specific items (e.g. batch job submission), plus ECMWF features (e.g. ecfile)
week 3	MARS and MAGICS

Response from the March 1991 course held in the above format showed that it was much more successful. This course will now be repeated in the autumn, 7-25 October 1991.

One problem encountered on the last course was of people registering to attend and then withdrawing at the very last minute. Some 5 people dropped out of the last course, reducing the audience to 2 people for some of the first week. For the future the Centre may ask those who register to confirm they will attend, before deciding definitely to hold the course.

On the specific topic of UNIX/UNICOS tuition, the following material exists to help users when moving to the system for the first time:

* many books exist on UNIX, these should be used to obtain a first introduction

* the Centre has produced a UNICOS Introductory Guide which can then be used to learn UNICOS specific items

* the Centre has also produced several example batch jobs which the user can copy and amend to suit his own needs. Copies of the jobs are accessible from VAX/VMS, NOS/VE, workstations (UNIX) and UNICOS.

5. ACCOUNTING

An accounting scheme is now running on UNICOS that is similar in many respects to the scheme that ran under COS. Details of this new scheme have been published and the scheme itself has been

running since the beginning of the year. Some points to note under this scheme:

* using high priority means that the user job is charged at 5x the normal rate;

* charging is based on the concept of single tasked jobs. If a user can multitask his job then a discount factor operates. That discount factor depends on the number of CPUs the job actually used. That can vary from run to run depending on the remaining job load in the machine. Thus users will see a varying discount factor for the same job from run to run depending on the machine load at the time;

* the definition of the Cray unit has been revised and then renormalised to yield approximately 10,000 units per day. Experience over the first 5 months of the years has shown that about 9400 units per day are actually being achieved.

This accounting scheme is being constantly watched to see how well it performs. Based on experience gathered it may be revised if necessary.

To help users find out the status of their allocations, a new utility has been provided called acct_status. Details were published in News Sheet 267.

To help Computing Representatives, a second utility is being created which will allow representatives to move allocations between accounts under their control. It is call acct_admin and a trial version will be made available for one or two representatives to try out before being generally released.

6. SOFTWARE LIBRARIES

The Centre now provides two libraries of general use, ECLIB and NAG.

Little development has taken place on ECLIB recently, mostly due to the fact that Cray's own libraries have taken over many of the functions previously done by ECLIB routines. Recently a correction was issued to the FFT routines, and trial versions of faster forms of GBYTES, SBYTES were made available.

NAG mark 14 has recently been received and will be put up in test mode. At this release NAG is implementing a change to the naming convention for the UNICOS version, basically all names ending

in the letter F will now end in the letter E. This is to bring the UNICOS library into line with their convention for single precision names (ending in E) and double precision names (ending in F). Users will be given one full release to change their calls to reflect the new names. Annex 3 reproduces NAG's "Mark 14 News" which gives an overview of the changes at this release. Of the Representatives present, 3 believed that some of their users may be using NAG routines.

QUESTIONS

P. Henning Are the News Sheets stored in electronic form somewhere for all to access?

A. Lea Yes, they are in NOS/VE in the catalog

.POOL.NEWS_SHEETS

and they go back to News Sheet number 213, dated 16 Feb. 1988.

J. Greenaway Previously, some Member States have asked what is the availability of manuals for Member States?

A. Lea The Centre has provided one set of basic UNICOS manuals to each Member State. In addition, several copies of ECMWF Computer Bulletins are provided. A list of the manuals provided is given in the New User Pack.

S. Pasquini Are the Meteorological and Computer Bulletins up to date? Do I have the latest versions?

A. Lea Some are, but regrettably many are not. It is a manpower problem, it takes a lot of effort to keep them up to date and, due to lack of manpower, it is not possible to provide the necessary effort. With regard to whether you have the latest versions, we can send out a list of what the currently issued bulletins are, and then you can check for yourself.

J. Juega Users have rather lost track of what routines, libraries, data etc. the Centre has made available for Member States to use. Could a list of such things be kept, in electronic form, for users to look at?

A. Lea A good idea, we will look into it.

J. Juega In the changeover from COS to UNICOS some problems were seen, for example are the orography fields still available, if so where?

A. Lea The orography (or geopotential) fields are in MARS, field code 129, MARS abbreviation Z (as part of the surface data)

J. Juega Using acct_admin can we add new projects?

D. Martens No. This is because the Centre needs to ensure the correct permissions and privileges are given.

L. Campbell How does one use high priority via a VAX submitted job?

D. Martens Add a QSUB parameter to the UNICOS job
#QSUB/QUEUE=HIGH

S. Kruizinga Is EMOSLIB still available?

J. Greenaway Yes, it is maintained by the Meteorological Division rather than the Computer Division though. Note that we recently moved the interpolation routines from ECLIB to EMOSLIB.

3. COMPUTER OPERATIONS MATTERS

Peter Gray

Computer Operations consists of about 30 staff and our task is to run the computer systems and associated services. We have a shift staff (1 shift leader plus 3 operators) on duty 24 hours a day, 365 days a year. In addition, there are some contract operators (manning the output area and mounting magnetic tapes), plus day support staff.

The first problem I would like to cover is that of the computer building itself, in particular its leaking roof! Two years ago a second roof was put up over the first, as the first was leaking. That second roof is only 40cm above the first and thus condensation builds up. That condensation collects on the old roof and then leaks down into the computer hall through the various holes in the original roof. The agency that built the Centre is now studying how to cure the problem.

The second problem was that cracks had appeared in the concrete subfloor in the Computer Hall over the plant room. This has been solved by having epoxy resin injected into the cracks.

The third problem has been the false floor. The original floor had no effective lateral support and, indeed, we had had two minor collapses in the floor, luckily no one was seriously hurt. We are, therefore, replacing the floor, section by section, as the opportunity arises. This new floor is much more substantial, with better lateral support. We have done a lot already, we hope to complete it by the end of next year.

On the mechanical and electrical side, we have

* replaced all the air conditioning units, the old ones had become unreliable and going rusty;

* replaced many valves in the cooling circuits;

* replaced the original (toxic) chilled water which was over the limit on new safety regulations;

* replaced the fresh air units, which again were becoming unreliable and rusty;

* increased the cooling capacity from 4 to 5 chiller units (to cope with the increased load from the Y-MP installation);

* increased the chilled water pump capacity;

* installed a PC based plant monitor. One side effect of this has been to highlight where electricity savings can be made.

As you have already heard, much has changed within the machine hall. Over the past 2 years we have

* compressed the area occupied by the original CDC 855 systems;

* moved the telecommunications equipment to make space for the Y-MP. This involved moving Member State lines as well, with down times only on the order of a couple of hours per Member State. This whole move was completed by the end of 1989;

* installed the Cray Y-MP8, including all the additional power, chilled water, freon pipework etc. The actual delivery and installation of the machine went very well, Cray Research did an excellent job;

* replaced the 2 Cyber 855s by a Cyber 962 system. This has released some 75 sq. metres of floor space and given us electricity savings of the order of £40K per year. In addition, the Cyber 962 disc system is much more reliable than those on the 855s. This replacement was completed early this year;

* replaced all the computer hall lighting as the old wiring was becoming very brittle and dangerous;

* moved the operator consoles into a screened off, separate, area. This makes it more compact, much less noisy, gives better lighting and, in general, is a calmer place to work. It has been a highly successful move;

* installed the Storage Tek tape silos in April/May of this year. This also involved relabelling 28,000 cartridges and loading the most recently used 10,000 of them into the

silos. Service started 3 weeks ago and has reduced manual mounts from 1000 per day to around 20 per day now;

* replaced the Cray Y-MP original DD40 discs with (hopefully) more reliable DD41 discs. Incidentally, this has also saved floor space as the new discs occupy only a quarter the space of the old ones.

Figure 1 shows the current layout in the machine hall, showing just how much has changed, compared with how it was in figure 2.

Current work includes:

* replacing the fire alarm system;

* replacing the security system;

* adding extra diesel backup power (needed for the Y-MP16 due next year);

* improving various health and safety aspects;

* replacing the emergency power off system;

* training operators in the philosophy of running UNIX based system (which is quite different from the old COS and NOS/BE ways of working);

* increasing the level of automatic monitoring and checking, e.g. supervisor status display, data acquisition, Member State queues etc.;

* setting up a fault reporting desk, to ensure a common method and contact point for all fault reporting in future.

Over the next few months there will be the following to do

* install a Cyber 4000 machine in July. This will act as a link between the Cyber 962 and

an FDDI network. It will also act as a bridge between NOS/VE and the UNIX world to help VE users move to UNIX;

* install an FDDI network later this year;

* replace a VAX 8350 with a VAX 6310;

* replace two MicroVAX 2 systems with one MicroVAX 3100;

* prepare for, and then install, the IBM 3090 replacement at the end of year;

* prepare for, and then install, the Cray Y-MP16 in mid-1992;

* make various sundry changes to save electrical power.

Finally, we make great efforts here to keep the Member State links going 100% of the time. Sometimes a link goes down and after much investigation this end we find it was a scheduled break your end, but no one had informed us. Thus, please ensure, whenever you plan to take your link down to let us know in advance. It saves us much work being told in advance.

QUESTIONS

S. Pasquini What service contracts do you have for various machines?

P. Gray Equipment that is needed for the production of the operational forecast is usually on 24 hours a day, 365 days a year, maintenance. Other equipment is usually covered 8 hours a day Monday to Friday. Some equipment is on a time and materials cover where we deem that to be cheaper than taking out a maintenance contract. The Cray call out is on a one hour response time, the IBM on a 4 hour response time.

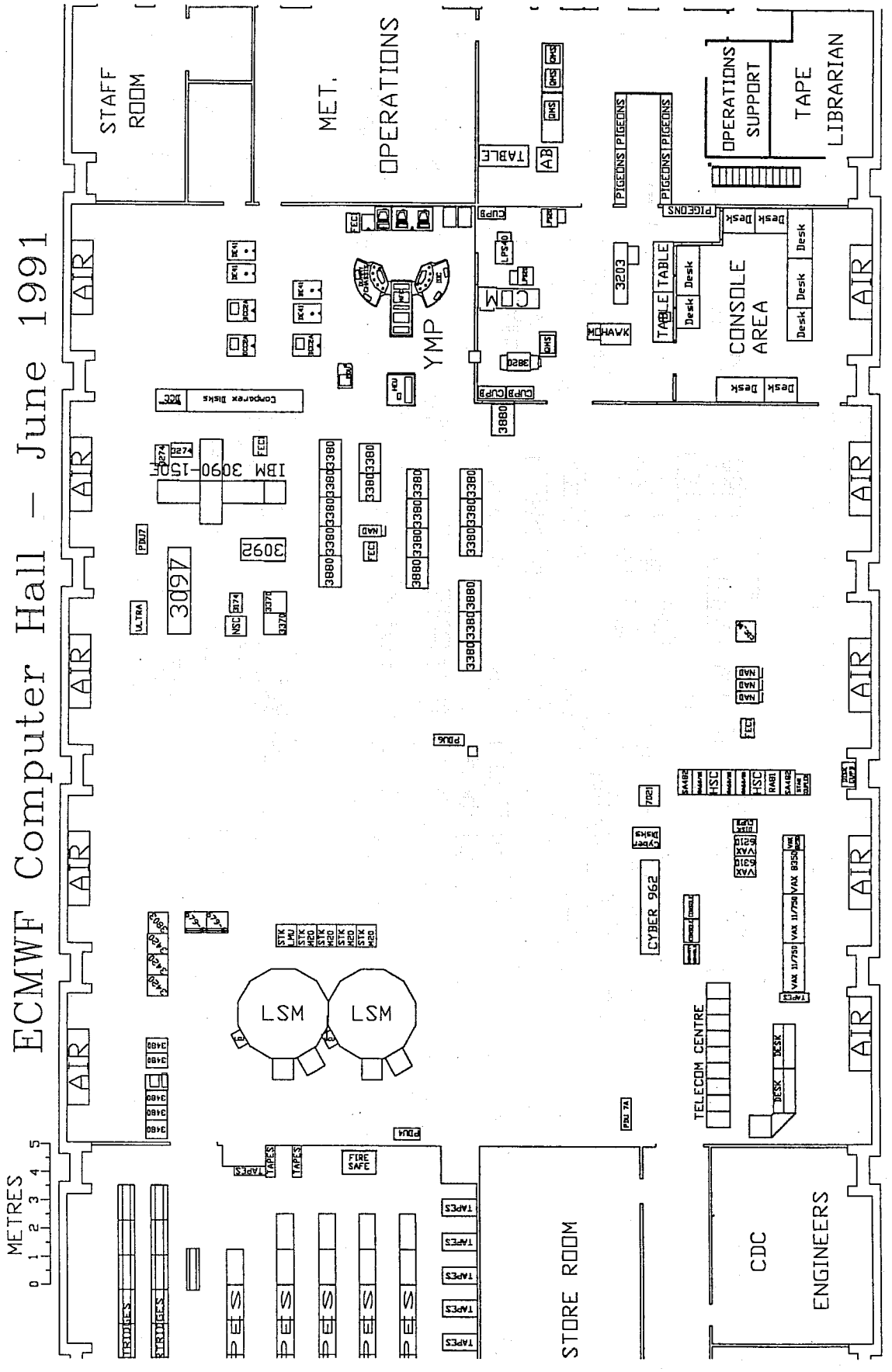
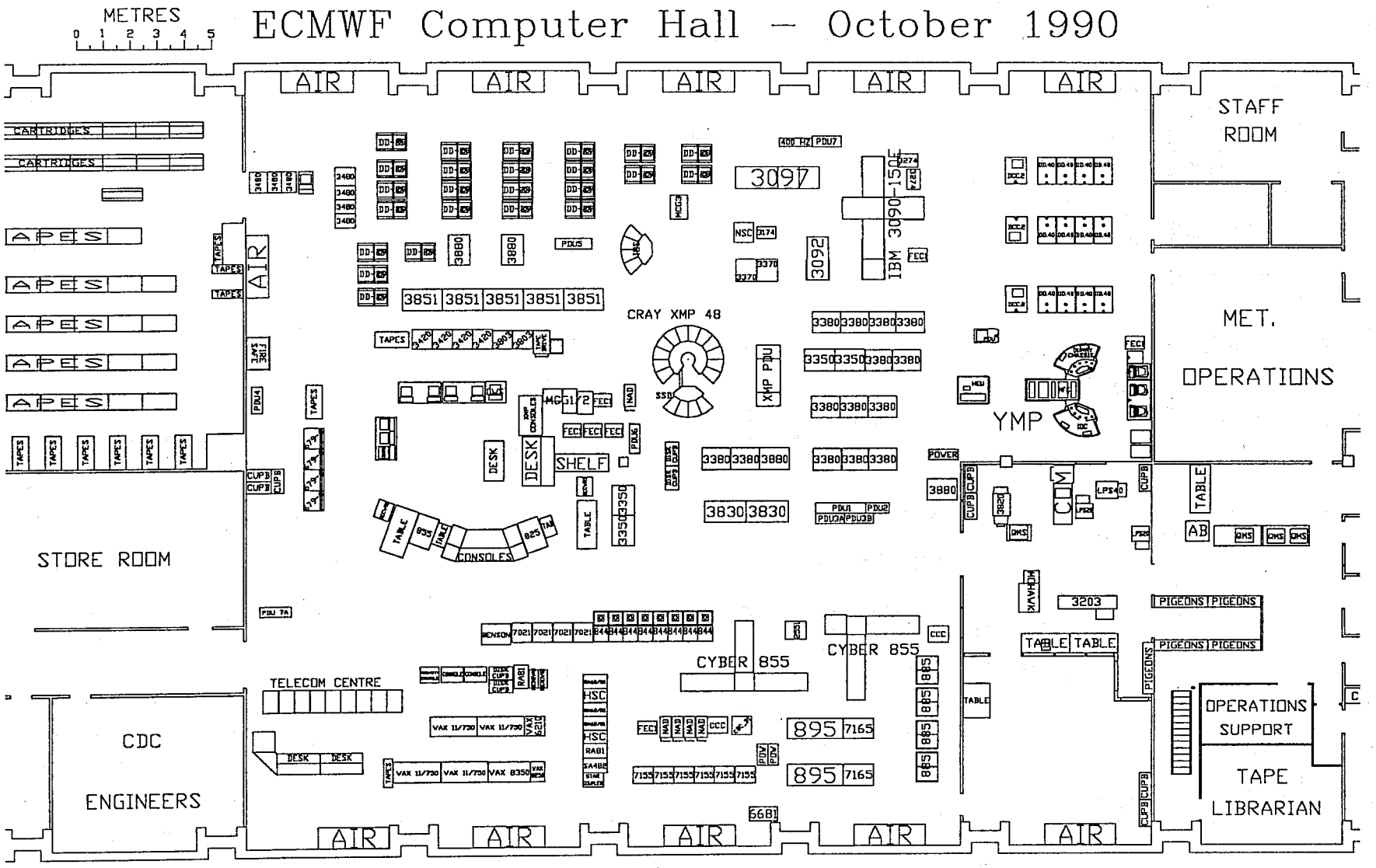

ECMWF Computer Hall – June 1991
METRES
0 1 2 3 4 5
STAFF ROOM
MET. OPERATIONS
TABLE
PIGEONS
OPERATIONS SUPPORT
TAPE LIBRARIAN
CONSOLE AREA
TABLE
Desk
YMP
IBM 3090-150J
3092
3097
3880
3380
LSM
LSM
CYBER 962
TELECOM CENTRE
DESK
STORE ROOM
CDC
ENGINEERS
AIR
TAPES
FIRE SAFE
BRIDGES
PES

Fig. 1

Fig. 2


METRES
0 1 2 3 4 5
ECMWF Computer Hall – October 1990
AIR
STAFF ROOM
MET. OPERATIONS
STORE ROOM
CDC ENGINEERS
TELECOM CENTRE
OPERATIONS SUPPORT
TAPE LIBRARIAN
CRAY XMP 48
YMP
CYBER 855
CYBER 855
IBM 3090-150E
3097
3092
CONSOLES
APES
CARTRIDGES
TAPES
PIGEONS
TABLE
DESK
SHELF
POWER
AIR

4. NETWORKS AT THE CENTRE

Richard Dixon

1. A VITAL SERVICE

A Local Area Network (LAN) was first installed in the Centre in 1983. Since then reliance on the various networks has increased so much that the operational rôle could not be carried out without them. The networks are a strategic resource; the information arteries of the computing service.

Since the start in 1983 with Control Data's LCN, the Centre has added many more network facilities. DECnet, CDCnet, the PC network and the Sun workstations, general TCP/IP connections to all the major systems, and now TCP/IP connections to Member States, have successively been integrated into the overall system. Figure 1 shows the current ECMWF computer networks.

With a good local network service installed the computer systems can perform specialised functions, so that, as in the Centre's present system, the file services, interactive services, and high-speed floating point computation are located on different machines. This makes it possible to change and upgrade the individual systems without destroying the overall service.

Local networks and the services they offer are now expected as a matter of course in any computer service environment. To support the computing services vital to the Centre's operational and research rôles, constant monitoring of the networks is needed, and plans must be made to keep them up to date and effective.

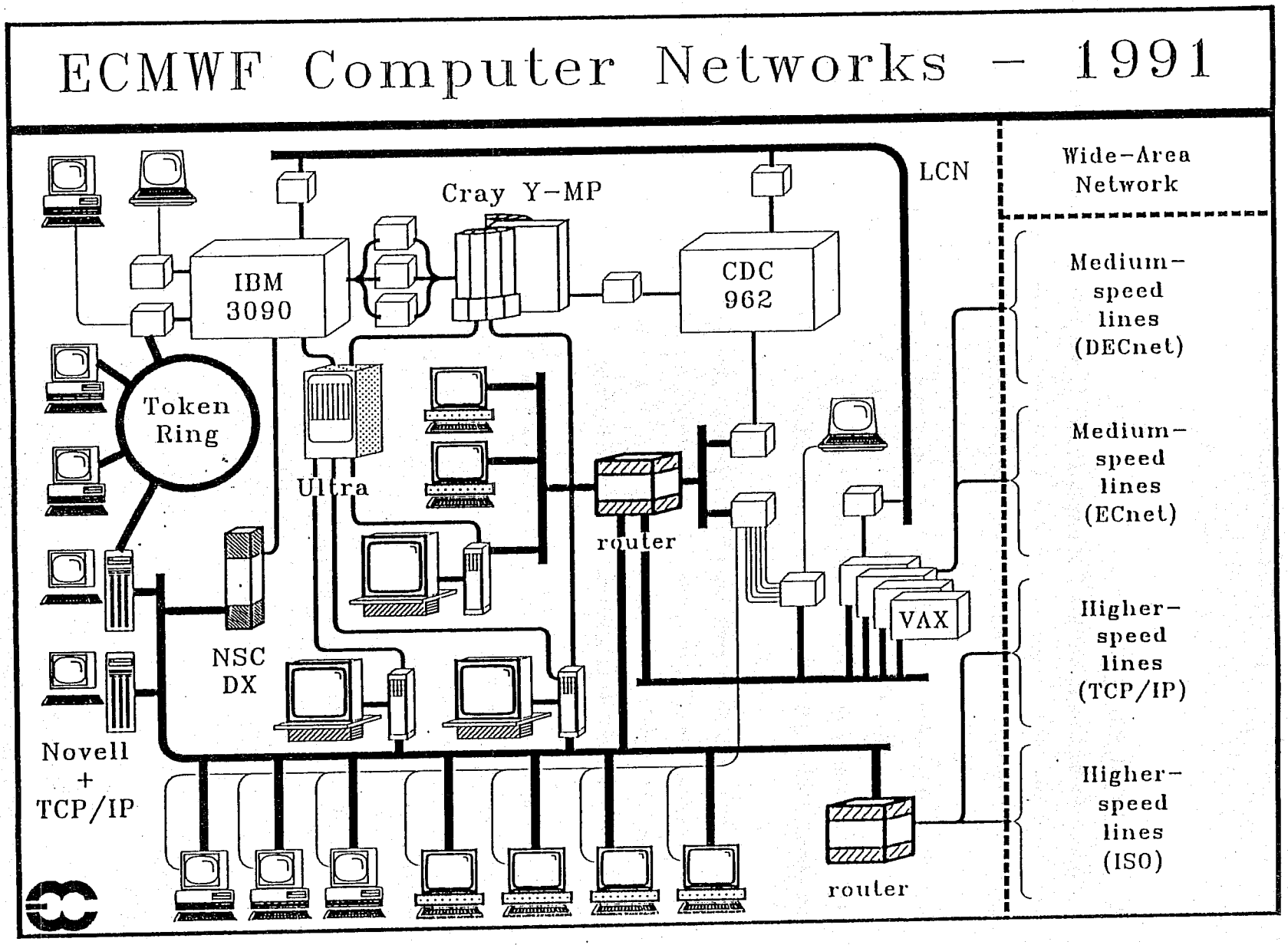
2. BITS, BYTES AND COPPER WIRES

Data networks function at two distinct levels*. There is the **physical** level (e.g. wires, connectors and voltages), and the **logical** level (files, commands and data).

To connect computer systems physically, they must each use the same connector, the same type of wire, and must agree as to the voltages and timings used on the link. A physical connection is not sufficient, however. To get useful work out of the connection, it must be made at a logical level. To do this, the same **protocol** - the set of conventions governing a conversation between computers - must be used. Usually, the physical nature of the connection determines how much data can pass along it

* Actually, at many more than two (*pace* OSI), but these two are obvious to the observer.

Fig. 1


ECMWF Computer Networks – 1991
LCN
Wide-Area Network
Cray Y-MP
IBM 3090
CDC 962
Token Ring
Ultra
router
VAX
NSC DX
Novell + TCP/IP
router
Medium-speed lines (DECnet)
Medium-speed lines (ECnet)
Higher-speed lines (TCP/IP)
Higher-speed lines (ISO)

(its bandwidth), and the protocol determines what meanings the data may have (for example one might be able to transfer a file, start an interactive session, submit a job, issue a warning).

At the Centre, a number of different physical connections are used for the networks: LCN (which is to be replaced in 1991); direct channel connections (from Cray to IBM and to CDC); IBM Token Ring (used between some of the office PCs and the IBM mainframe), the Ultra network and Ethernet. The Ethernet has the largest number of connections, and it carries a variety of protocols: the PC network, the VAXes, the CDC machines and the *open* protocol TCP/IP. All exist happily together on the same cable.

3. AN OPEN AND SHUT CASE

In the early days of computer networks, the physical connections and the protocols which used them were usually part of a single package provided by the network supplier. This is true, for example, of Control Data's early mainframe network, LCN. The protocol which runs over LCN is called RHF; the physical connection used for RHF is LCN. Only LCN supports RHF, and only RHF can use LCN. This means that there is no possibility of taking a machine with some other type of network attachment and connecting it easily into an LCN/RHF network: the network is a **closed** one.

More recently, the computer industry has moved towards **open** networks. Openness means different things to different people: at its most ambitious it implies that any machine should be able to communicate with any other machine, using any available link, and without burdening users with details of physical connections. Most protocols today achieve a degree of openness: they can usually use a variety of physical connections from different suppliers.

However there are only two protocols (properly *protocol families*, since they each contain many different elements) which can claim to be truly open; these are **TCP/IP** and **OSI**. Some of the advantages of true open protocols are obvious: they allow computers to be assembled (like Lego bricks) into complex systems, and they obviate the need to worry about compatibility. They also eliminate dependence on a single supplier, and introduce a useful element of competition between suppliers.

With this generation of protocols, it is possible to make a logical connection between machines, even when there is no direct physical connection, provided both machines understand the same common

protocol. Other machines in the network act as **gateways** (or **routers** or **bridges***) to complete the path. The Centre's Cray, for example, has physical connections only to the IBM and CDC mainframe computers, and to a Sun file server, yet it exchanges data with Sun workstations in offices, with the PC network, and with Member States.

The TCP/IP protocol family is available on all the Centre's machines. It is the protocol of choice for new applications, being very closely integrated with the UNIX operating system used on the Cray and on the workstations. TCP/IP is the world's most widely understood protocol, available for PCs to Supercomputers and on almost all systems between. Unfortunately, it is not very well standardised, and some systems may mysteriously fail to communicate with others using what should be the same protocol; nevertheless, this protocol at present offers the best option available.

For many years, the Centre has declared its intention to move to the use of OSI protocols as soon as practicable. OSI protocols have the advantage of being better standardised than TCP/IP, and the services available (file transport, interactive access, etc.) are generally more complete. Unfortunately, the OSI systems at present on the market are expensive to install, only partially implemented, and are slow compared to TCP/IP. The situation will continue to be monitored.

3. THE LAN SPEED RECORD

The different physical networks have very different characteristics when their capacity for data is measured.

The old LCN network can in theory handle up to 50 million bits per second in total, but only 6 million bits per second can be delivered to any one machine. It is intended to replace the LCN network during this year with an optical fibre system.

The Ethernet, by contrast, can carry only 10 million bits per second in total, but at least 8 million bits per second can be delivered to a single machine. (The server for the PC network alone can create this much traffic.) Because of the way in which Ethernet works, it is impossible to use more than about 80% of its capacity without bringing the entire network to a halt: it is important to keep track of how busy it is. In order to avoid problems of saturation some structural changes to Ethernet will be needed during 1991 - probably splitting it into several sections.

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* These terms have different technical meanings, but the essential function they describe is similar.

The replacement for the LCN network will be the optical fibre system known as FDDI. This has a theoretical maximum data rate of 100 million bits per second. It does not suffer from the Ethernet effect that traffic stops completely if too much is presented to the network, and it is therefore much more suitable for use as the main connection to the larger machines. FDDI connections will be made to IBM, CDC and DEC in 1991, and to most of the larger systems during 1992.

Even higher bandwidth than this will be needed for connections such as that between the Cray and the main file server (running the ECFILE service). At present these are handled with single point-to-point channel connections and closed protocols; it would obviously be better to use open protocols and connections. The probable open standard for connections which must handle this intense load is the HiPPI channel, which can handle 800 million bits per second in total. HiPPI is not truly a network (a HiPPI connection is only from point to point), and needs more equipment in the form of switches or routers to make a 'real' LAN.

All the above-mentioned are either **bus** or **ring** networks, i.e. the network is in the form of an open-ended (bus) or closed loop (ring) cable, which visits each of the machines on the network. Quite different from these is a final contender for the speed record: the Ultra network. An experimental Ultra Hub 1000 has been installed, with connections to Cray, IBM and the Sun servers. The Ultra hub is a network in a single box; connections are taken to it from each of the computer systems it connects (a **star** network). The Ultra network has a total capacity of at least 1000 million bits per second, but in the Centre's installation it is limited by the connections to each machine which are quite slow; only 25 million bits per second is available to any single system. However, faster channels are available (a HiPPI channel can be used), and the Ultra may be useful for some high-speed networking needs.

4. SUPPLY AND DEMAND

For the Centre's future networks, a model in which three different kinds of service coexist in a hierarchy is envisaged.

A low-performance (slow) service is needed for office areas, and for low to medium capacity machines. These will use Ethernet as they do today. Ethernet can now be connected very cheaply, and is very cost-effective for systems that can live within its limitations. The present large network will be broken down into several smaller departmental or functional networks; this allows higher demand from individual machines to be handled without choking the network.

The time when Ethernet can suffice for the strategic mainframe connections is coming to an end; a higher performance general-purpose network is needed. This network will carry traffic between mainframe machines, and also traffic between the separate Ethernets serving small machines. It will be constructed using FDDI (Fibre Distributed Data Interface) over twin optical fibre links. FDDI links can be fault tolerant, so that a break at any one point is not fatal to the network. The bandwidth of the FDDI network, 100 million bits per second, should be sufficient to meet demand for a number of years.

Finally, as already mentioned, a network will be needed to carry traffic between the Centre's main computing systems: in particular the supercomputer ('compute server') and the data handler ('file server'). It is estimated that the data rate needed on this connection will be about 24 Megabytes per second (200 million bits per second). This will probably be constructed using HiPPI channels, with an Ultra network hub and/or a HiPPI switch. Installation of this high-performance network is expected in 1994.

5. WIDER ISSUES

The use of open protocols on its internal networks provides a very convenient and useful way for the Centre to offer better service to Member States. Since TCP/IP can be used successfully on international links (*Wide Area* Networks), it is possible to interconnect the Centre's network with those of Member States and to use the same TCP/IP protocols as used for connections between the Centre's own machines. This can make use of the Centre's service much simpler for Member States, providing direct file transport and interactive connection.

An experiment is being conducted at present with a digital link to Meteo France, which carries 64 thousand bits per second. This is connected to the Ethernet through a router at each end of the line, effectively connecting the local network at the Centre with that at Meteo France. So far this has been quite successful, and provides a much better service to users there. A similar connection to Deutscher Wetterdienst will be installed very soon.

A report will be made to the Technical Advisory Committe in the Autumn on the progress of these links. If there is no adverse experience to report, it is likely that use of digital links with routers and TCP/IP protocols will become an approved means of connection to the Centre, allowing more Member States to take advantage of the improved service.

6. CONCLUSION

In the eight years since its first network installation, the Centre has become vitally dependent on the service provided by the networks. Without them, a computer centre of such a scale could neither be constructed nor operated effectively.

The plans for the networks should equip the Centre to meet increasing demands for network performance and reliability in the coming years. The results should also be apparent to Member States, with the provision of a reliable, fast and accessible service.

QUESTIONS

S. Pasquini How can data dissemination and remote job submission be done across a TCP/IP link?

R. Dixon It cannot be done yet, we are currently working on it. That is why the links to Meteo France and DWD have the old protocols running in parallel with TCP/IP.

J. Juega Can ECMWF support 2 links to each Member State indefinitely?

R. Dixon If done over one physical connection (as with Meteo France and DWD) then no great problem. However, for other reasons we would like to reduce links to just one set of protocols. The ECNET protocols are non-standard and we cannot develop or maintain them, thus we would like to see them go. DECnet is no problem, but again, we would like to see, eventually, just one set of protocols to ease maintenance and support. TCP/IP is the current de facto standard, hence we would like to see this as our short term standard too.

5. MARS

Rex Gibson

1. WMO GRIB REPRESENTATION CHANGES

WMO has now approved a revision of FM 92 GRIB to come into effect on 6 November 1991. It will be known as "edition 1", the version in use now will then be known as "edition 0". The new edition will include:

* a revised section 0, including an increase in its total length
* support for many additional map projections
* the use of complex packing and quasi-regular grids for grid point data
* both decimal and binary scaling
* initial support for image data

To accommodate these changes the Centre has developed a new GRIB handling package, known as GRIBEX. Features in this new package include:

* new routines and calls to decode/encode GRIB edition 1
* backwards compatibility to previous editions of GRIB when decoding
* encoding to the new edition only
* inclusion of a special version of DECOGB to assist users during the transition

It is the Centre's intention to move to the new edition for the T213 model which is shortly to go into the operational forecast. Details are being sent to Member States. Basically, the Centre will move to the new edition completely as of 6 November 1991. Between now and then there will be a

transition phase. The source code for GRIBEX is now available. The Centre recommends that current users of DECOGB switch over to GRIBEX as soon as possible.

2. INTRODUCTION OF THE QUASI-REGULAR GAUSSIAN GRID

Development of the T213 forecast system has shown that there are considerable advantages to be gained by using a Gaussian grid with reduced numbers of points on each latitude from 50° to the poles. These advantages are both in terms of the reduced computational resources required and in the smaller volume of data to be archived.

The "quasi-regular grid" approximates to equally spaced points in the polar regions, while retaining a resolution at least as high as that used in the tropics. The actual number of points in each latitude row is given in Annex 4.

The consequences of introducing this new grid, with the T213 model, are that

* GRIB edition 1 must be used to archive the data for the T213 model, as previous editions cannot represent it;

* to enable this the new GRIB software (GRIBEX) will be introduced into MARS on 18 June;

* GRIB based dissemination products will remain in the old edition until 6 November, thereafter they will be in edition 1 format;

* all T213 data, and all older data which has been interpolated or sub-area extracted by MARS, will be recoded in the new GRIB format from the date the T213 model comes into operation.

3. MARS SUPPORT FOR OBSERVATIONS

Details have recently been sent to Technical Advisory Committee representatives about the initial support being provided for the retrieval of observations from MARS.

Work is now progressing well on converting the backlog of observations to BUFR and adding them into MARS. Currently, all data from 1.1.1986 has been added (with the exception of one month).

The processing of data from 1.1.1980 has, so far, reached 1.4.1983. It is hoped to complete the task by the end of August.

To retrieve observations the command used is very similar to that used for fields data, for example:

```
retrieve,repres=BUFR,
class=....,
type=....,
stream=....,
obstype=....,
expver=....,
date=....,
time=....,
area=....,
targets=....etc.
end
```

This current version has the following initial restrictions:

* time is limited to every 3 hours only e.g.

  time/to/time2

  where

  time1 = 00,03,...21

  time2 = 03,06,...24

* the area can be global, or octants only

  (G,N1,...N4, S1....S4)

* the observation type (obstype) can be all, or one of the 9 basic BUFR table A observation types; sub-types are not yet supported

* the target file will be BUFR in Cray blocked file format. Note that external unpacking software is available.

The WMO BUFR specification will be updated with operational effect from 6 November 1991. ECMWF's BUFR software is being enhanced to take these changes into account, but in such a way as to make it backwards compatible. Data in MARS will gradually move to the new specification, new streams (e.g. ERS-1) as they are received, remaining streams probably from 4 november 1991.

QUESTIONS

P. Henning Will the existing DECOGB work with the new GRIB data format?

R. Gibson No, but a new routine GRIBEX will be available from 18 June which can handle both old and new formats. Both Cray and Vax versions will be available, we have tried to make GRIBEX as portable as possible. All that will be needed are the GBYTES/SBYTES routines, copies of which can also be obtained from ECMWF. You can switch to using GRIBEX as soon as you like after 18 June. It will handle the existing format now, and the new format introduced on 6 November.

J. Juega How does the reduced grid look on a lat/long projection?

R. Gibson I displayed the reduced grid on a polar stereo-graphic projection to show that, physically, all points are now more or less equally spaced. Both MARS and the dissemination system will provide a conversion into a standard Gaussian grid.

L. Campbell For those who take products at full model resolution, will they have to change to the reduced grid?

R. Gibson No, a full Gaussian grid at model resolution will continue to be available even after 6 November. It will be an interpolated version, probably a straight linear interpolation.

L. Campbell Doing a linear interpolation across land/sea boundaries can distort fields.

R. Gibson We are aware of this potential problem. Although the first method of interpolation will be a simple one, later we may introduce a method that takes account of land/sea masks to avoid this problem.

S. Kruizinga Will the new decoding software be available via the VAX public disk?

R. Gibson Yes, and in future we plan to update it at roughly 6 month intervals.

R. Rudsar Have the new GRIB and BUFR specifications been made available to Member States?

R. Gibson We are eagerly awaiting the official copies from WMO. In the meantime, ECMWF has a "patched" document from the CBS working group meeting.

S. Long Are the GTS products to be changed?

R. Gibson Yes, GRIB products will be changed as from 6 November 1991.

P. Henning What about the MARS manual?

R. Gibson Currently it is being typed, on its 3rd iteration.

P. Henning ECMWF's version of GRIB has always been non-standard, what will happen to it?

R. Gibson The new GRIB specification now allows centres, such as ourselves, to define their own parameter codes. Thus ECMWF's version now becomes legal.

J. Böttcher Will ECMWF continue to use the same GRIB table 2 as it has done in the past?

R. Gibson Yes, for the time being. The T213 model is a major change, we do not want to introduce another change (to the GRIB tables) at the same time in case we have to go back to the T106 model for a while.

6. SECURITY ISSUES

Geerd-R. Hoffmann

On 7 August 1990 the Centre issued its official Security Policy document, copies of which have gone to all Member States, and will be given to all new users when they are registered. Note in paragraph 7 it states the following:

> **"the national meteorological services of the Centre's Member States are recommended to implement similar security checks on their end of the links to the Centre."**

Since ECMWF cannot enforce security at the remote end of any link, the Centre assumes that any access carrying a correct identifier/password combination is a legal user. Thus, it is the Member States who are responsible for ensuring that the user is, indeed, the correct bona fide user and not someone who has illegally got hold of a valid identifier/password combination.

Remote sites who are, in turn, connected to other networks have a responsibility to keep hackers etc. who might try to access us through these linked networks out of the ECMWF system.

ECMWF has asked each Member State to appoint a Security Contact Point, all Member States have now made such appointments.

The Centre has already suffered "hacking" incidents. The first involved the public packet switched (PSS) network connection. The hacker came through PSS and via our X25 link connected to NOS/VE. From there he tried to access UNICOS but failed to find a valid identifier/password combination. At that point our operators were alerted and put a stop to it.

We have a security dial-in system for local use to connect home PCs to the Centre. The telephone number concerned is not publicised, but even so someone found it out. We have seen several attempts of hackers trying to get through this security dial-in system, but failing at every attempt.

Another incident involved our DECnet links. A hacker managed to break into a Member State DECnet machine and through that machine he connected to us. He found his way into an account which had the ability only to read mail. He managed to overcome that restriction by using standard

DEC mail features. Thus he now had full user access. He was spotted at this time, however, and he was disconnected.

From these incidents it is obvious that all systems are susceptible to attempts by hackers to gain access, both here at the Centre and at your sites. We should all thus be alert. This is why the Centre makes such a strong point about keeping passwords secure. These passwords are the only barrier ultimately against determined hackers, hence we try to keep them as confidential as possible. It does, however, lead to the problems seen by Member States in setting/changing passwords.

Lastly, we have recently suffered computer virus attacks, we found 3 when we checked all our PCs. Two were boot sector viruses (Joshi, Stoned) which were a nuisance but did little damage. The third (Cascade) could have caused a total loss of disk, but it was caught in time. We have contacted all people we sent diskettes to after the probable date of infection, we hope we did not pass any of them on. Again, it shows we all have to be vigilant in keeping out undesirable software. This is a real problem.

In summary, we have been attacked by several methods and hence we are now being very cautious.

Discussion

The UK Computing Representative put forward the idea that a nominated representative in each Member State should be able to change passwords, and also to enable identifiers that had become disabled for some reason or other. The Centre agreed that this was technically possible, but that Member State agreement would be required before such a scheme could be implemented on the main 3 systems (UNICOS, VAX/VMS, NOS/VE). A majority of the Computing Representatives agreed it should be requested and that each Member State would be given the option of whether it wish to change passwords or not. Thus this proposal will be put to the next meeting of the Technical Advisory Committee in October. It was requested that the Centre make it clear to Member States the degree of responsibility these nominated representatives were taking on, so that there was no misunderstanding.

The Italian Computing Representative suggested that the Centre should, periodically, hold meetings with Member State representatives regarding matters of joint interest on security. The Centre felt that was a good idea, perhaps the first meeting being held after the Centre has done its two year security audit.

Other points made during the discussions were:

* most Member States have files on their disc systems holding jobs to be submitted to ECMWF. Those files will almost certainly contain passwords embedded in them. This is a big security loophole;

* common operator jobs (e.g. repeat dissemination) will either have passwords embedded in them, or all the operators at a given site will have to know the password;

* batch jobs rejected by RQS can have the password shown in clear text on the returned output;

* if unauthorised use is made of ECMWF systems via a Member State link, then that link may be subject to immediate disconnection (except for data dissemination) until it can be made secure again.

7. SYSTEMS PLANS

Claus Hilberg

1. UNICOS

The basic philosophy is always to upgrade to the most recent level of UNICOS, although not necessarily immediately. This ensures the Centre can take advantage of the latest features and can get the maximum level of support From Cray Research.

Currently, the Centre uses UNICOS 5. Level 6 has been released and work on it has begun at the Centre. The actual release to go into operation may well be level 6.1, probably sometime in August or September. Among the features to note at this level are:

* improved Autotasking

* microtasked mathematical libraries ("libsci")

* new file system

* long file names are no longer truncated to 14 characters

* chown and chgrp become restricted commands

* minor Berkeley UNIX (BSD) or POSIX inspired changes

* fta/ftua for more reliable file transfer

On the negative side, we expected programs to increase in size, perhaps by as much as 100K words.

Early in 1992 will come UNICOS 7, this is the first release to use AT & T's UNIX V release 4.

The Fortran compiler CFT77 release 5 comes with UNICOS 6. A couple of points to note about this release of Fortran:

* some combinations of assign and OPEN will change

* IF (EOF (tape)) disappears, the current compiler warns about this already

The C compiler command cc will now, by default, use the standard C (scc) compiler.

Finally, that as far as we are currently aware, no system changes are expected for the Y-MP16 to be installed in mid-1992.

2. VAX/VMS

Again, our philosophy is to keep up to date with releases of VMS. Currently, we are running VMS 5.4 on most machines in the cluster. Later this year we expect to upgrade to release 5.5, no user related changes are expected with this release.

DEC will shortly announce its OSI version of DECnet, namely DECnet phase 5. The Centre will study it carefully as we wish to implement it in order to adhere to the Centre's policy of using international standards wherever possible. Some points to note:

* this release will contain the ISO OSI transport layer protocols

* we believe it may improve TCP/IP support

* it will be backwards compatible with our current DECnet network

* it will resolve the present area number problem

Member States who run DECnet currently should seriously consider moving to DECnet phase V in order to gain the above advantages.

Shortly, there will be some hardware changes to the cluster, in particular a 6310 will be acquired to replace one of the 8350s. Again, we expect no direct user impact. Later we will investigate whether we can remove the other 8350, reducing the main hardware to just two large 6310 systems plus two VAX 750.

3. WIDE AREA NETWORKS

At this time, the Centre has no plans to modify the current NTC or NTS services. However, the 64 kbps experimental link with France has led to the NTS system being enhanced to support file transfer using FTP, including dissemination. Currently problems are seen with the transfer of binary data (format incompatibility) and some aspects of security require to be sorted out. However, at the basic level, this 64 kbps link has been a great success. A similar link is now being set up to Germany and it is believed that Italy will shortly request such a link.

The RQS system handles Member State batch job access from the VAX system to the Cray. So far, we have been using a pre-release which, in its early versions, proved rather unreliable. It appears now to have settled down. The first official release is due, at the end of June. **[NOTE: After the meeting we were informed it has now slipped to July. The Centre thus hopes to install it in August/September]**. We have also been informed that the next release, due in November, will allow UNIX style #QSUB commands to be used inside the batch jobs. That, at least, will make them compatible with jobs submitted via other means e.g. from NOS/VE.

4. NOS/VE

The next release is due very shortly, namely to level 1.5.3, we hope to implement it sometime in June. Later, in the autumn, release 1.6.1 will become available and, again, we will implement it as soon as we can. Neither of these two releases will introduce much change at the user level.

The first intermachine network used at ECMWF was LCN from Control Data, running the proprietary RHF protocol. We hope to finally phase out this network at the end of 1991, replacing it with TCP/IP protocols running on FDDI based network. This will simplify the number and complexity of networks we have to support. At that time, the MFLINK and MFQUEUE commands will disappear.

Control Data's NQS/VE is now available for beta testing. This would allow us to consider replacing the Cray station, again simplifying our network access to the Cray. However, before we take that step we need to look at it thoroughly to ensure that there are no hidden problems.

5. CFS/ECFILE

Recently, the Centre carried out a major upgrade of CFS to level 59. We had not upgraded since level 55 and hence there was a lot of work to do. This new level was required for, amongst other things, its support of our Storage Tek ACL 4400 Nearline tape robot system.

Also with this release came further useful features. To make them available to the users will require changes to ECFILE on the various worker machines. Some of the improvements will include:

* file sizes up to 500 Mbytes

* wildcard characters in commands

* better format of the list command output

* better STATUS command

* better performance

Changes to ECFILE that are currently being worked on will provide TCP/IP as the basic machine to machine protocol. This will mean that

* telnet can be used for administrative functions e.g. directory listing

* ftp can be used for file transfer

* ecfile will be available on all systems that support TCP/IP

* it will replace the present NOS/VE interface and provide interfaces from workstations (running UNIX) and VAX/VMS

* a highly optimised version will replace the current link interface to the Cray

The current state of progress is that a version handling non file transfer commands has been released internally for testing by a few users. Actual file transfer via ftp is planned for later in 1991. In parallel, an X-windows interface is being developed for workstation users.

It should be noted, however, that various security issues must be addressed before Member States are given direct access to CFS via TCP/IP links.

Finally, note that CFS is now to be known by its commercial name, DATATREE.

QUESTIONS

S. Pasquini What will be the situation for the IBM and VAX systems in the move towards UNIX?

C. Hilberg The Centre has no current plans to replace VAX/VMS or IBM MVS with UNIX at this stage, although, of course, it is the Centre's long term plan to move to UNIX based standardised systems (i.e. POSIX).

P. Henning Will DECNET Phase V have any negative impact?

C. Hilberg We do not know yet about DECNET Phase V to be able to say anything.

J. Juega How dependent is CFS on IBM specific hardware and operating systems?

C. Hilberg CFS is 100% dependent on IBM's MVS operating system, although not specifically on IBM hardware. An alternative to CFS now exists, namely UNITREE. This runs on many UNIX based platforms, including IBM hardware. The Centre proposes to study it very carefully.

A. Lea If there are problems with UNICOS 6 can we go back to UNICOS 5, I am thinking in particular of the new file system?

C. Hilberg UNICOS 6 will support both old and new file systems. We will implement UNICOS 6 with the old file systems and then later move the file systems over one by one to the new format. Thus we can wait to see if there are any UNICOS 6 problems before we use the file systems. Note that we believe UNICOS 7 will only support the new file system format.

8. UNICOS; MIGRATION AND FIRST EXPERIENCES

Neil Storer

1. INTRODUCTION

The first exposure we had to UNICOS was in some training courses at the end of 1989. In January 1990, we were given access to the Cray Research (UK) bureau service at Bracknell, about 15 Centre staff then started to use UNICOS extensively to begin migration. Our own service began in July 1990 and became the sole Cray service from January 1991 onwards. This talk attempts to highlight a few points we have thus learnt in our 18 months of experience.

2. PROGRAMME

Migrating programs from COS to UNICOS proved not to be too difficult. Most Centre programs are written in Fortran and provided they were compiled under CFT77 on COS, they usually migrated to UNICOS without any modification. Only a few "system dependent" codes needed totally rewriting e.g. ecfile and fdb. Some users, however, took the opportunity to recode, to take advantage of the different file structure UNICOS offered.

The CAL assembler is almost identical under COS and UNICOS (there is just one instruction different), the few assembler codes we have were successfully ported without change.

The source code utility, UPDATE, is available on both COS and UNICOS. Other than creating a new PL the existing COS libraries migrated without problem.

3. FILES

COS provided two file types (COS BLOCKED- CB UNBLOCKED-U), whereas UNICOS has three (COS BLOCKED, UNBLOCKED, UNIX TEXT-UT). Some of the defaults, especially from Fortran, changed - so care had to be taken.

Data Type	COS default	UNICOS default
Text (e.g. source code)	CB	UT
Fortran formatted I/O	CB	UT
Fortran unformatted I/O	CB	CB
Fortran buffer I/O	CB	CB
Fortran direct access I/O	CB	U

Cray provided a utility, USCPBLOCK to convert CB files to U or UT files (and vice versa), it worked well. Users could use ecfile to move text files from COS to UNICOS by storing them as transparent DF=UT.

Again, we saw no major problems in the transferring of COS files to the UNICOS file system.

4. JCL

This was the main area of work for most users, the UNICOS commands are quite different from those COS provided. This is where a large part of the migration effort was spent. Some points to note:

* COS has less than 100 JCL commands, UNICOS has more than 500

* COS JCL is fairly rudimentary, UNICOS is very "feature-rich" and comprehensive

* COS JCL commands tend to be rigid and specific in their functions, many UNICOS commands are quite general and can be combined in various ways to do quite complex tasks e.g. by the use of pipes and filters.

Users usually took some time to migrate their first two or three programs, however, once they had a basic pattern set up the remaining programs could be migrated quickly. A few points of interest:

* the use of SUN workstations speeded up migration considerably, as it allowed multiple windows with each window logged on to a separate service;

* the ability to be able to log on interactively to UNICOS was crucial in the initial learning phase for users, it allowed mistakes to be dealt with immediately and some of the more obscure rules of UNICOS (UNIX) to be understood much quicker (via trial and error);

* the more extensive file system directory structure available in UNICOS meant that more elaborate file handling could be set up, replacing some often rather obscure COS system methods for dealing with many files in a job;

* the simultaneous access from UNICOS and SunOS to NFS based files has meant that workstation users can monitor/check/change files without necessarily going to UNICOS.

5. NETWORKING

The Cray X-MP was linked to other machines via 2 means:

* Control Data's LCN via the Cyber systems, this was the main route for most file transfers and was heavily used;

* Superlink to the IBM data handling machine for access to CFS.

Both LCN and Superlink are proprietary products, making them difficult to maintain or to add new systems to. On the other hand, access to UNICOS is now mainly via ethernet running the TCP/IP set of protocols. These protocols are not proprietary and have become available on a wide variety of systems, so much so that they have become the de facto standard. Thus TCP/IP is now being very heavily used as the main, general purpose file transport between most major systems. LCN is no longer used for Cray file transfer.

Superlink is available under UNICOS and is used to transfer files between the Cray and IBM systems. The fact that it is identical, from a user point of view, to the COS version, simplified migrating ecfile initially. Later we can then switch to TCP/IP file transfer once higher speed, FDDI based, links are available between Cray and the IBM.

Although ftp (file transfer protocol available under TCP/IP) is easy to use between most systems, it does rely on each system being available throughout the transfer. An asynchronous ftp would be much better, as it could then deal with the situation where one system is temporarily unavailable. Such a version of ftp (known as fta) has just been made available by Cray, it should make file transfer more resilient.

6. JOB SUBMISSION

For a long time batch job access to COS was via the NOS/BE station, later via LCN. Such batch jobs only used upper case characters and, of course, no interactive course was allowed.

UNIX, on the other hand, was originally an interactive system, hence UNICOS has had to add a lot of support to run a batch service. That support is via NQS on the Cray and a corresponding product RQS on the VAX and SUN systems. Quite a lot of batch jobs enter UNICOS by this means. A second method of job submission is via the NOS/VE station, many jobs are submitted this way.

Finally, some batch jobs are submitted directly on the Y-MP from UNICOS interactive sessions. To support all these methods there have been some changes to the batch job submission systems and methods on various machines.

UNICOS/UNIX jobs require both lower and upper case characters to be supported. This required modifications to be made to the job submission systems at some Member State sites.

7. I/O OPTIMISATION

As we discussed earlier this year, I/O optimisation can be crucial in ensuring the whole machine runs efficiently.

A typical Fortran I/O request can involve the system in moving the data up to 5 times for each user request. Depending on the type of data involved, this can either make it all very efficient, or very inefficient!

The various stages possible are:

* user program writes data into the user defined storage area

* library I/O routines copy it to a library buffer

* the system copies it to a system cache

* the system then copies it to a cache area on the SSD (known as LDCache)

* finally the data is copied to the I/O device itself

One of the main functions of both the library buffer and the system cache is to collect "ill formed" I/O requests, in other words to handle those requests which are not exact multiples of 512 words. However, if the user can issue read/write which are exactly 512 words long, then these two (library buffer, system cache) can be by-passed, speeding up the I/O considerably e.g.

```
assign -s u fort.12
```

will achieve this.

The use of LDCache is controlled by the system, not by the user. The Centre has set up LDCache areas for the main user file systems and providing the "hit rate" is over 90% then a lot of disk accesses are saved. By hit rate one means that, on a read the data required was in LDCache already and did not have to be read from disk, on a write there was sufficient free space on the LDCache that it did not have to be flushed to disk first. The problem we ran into early this year was that far too much flushing of LDCache was taking place, reducing the I/O of many programs to run at disk speeds rather than SSD speeds.

Figures 1 and 2 show the various issues and trade offs that exist, plus a summary of the default Fortran buffering.

Figure 1 - Issues and Tradeoffs

Method	Advantages	Disadvantages
Formatted	Human readable	Very slow
Unformatted	Faster than formatted	Not human readable
Blocked (Fortran only)	May skip forward and backward between records; good for short records	Takes time to insert control words
Unblocked	Faster - no control words	Must be unformatted; cannot manipulate records
Unbuffered	One system call per transfer; data handled only once	Must be unblocked; no read-ahead, bad for short records
Buffer size (Fortran: assign (1)) (C: setvbuf (3C))	Bigger is better for heavily used files (but no bigger than record size with random access and "assign -s bin")	Uses a lot of memory; buffer larger than record size is not good for random access
Synchronous	Simple, normal	Waste real time waiting
Asynchronous	I/O to different files overlaps in real time; I/O and CPU work overlap in real time	Must be unbuffered; higher CPU/system overhead; harder to debug (potential data dependency)
Sequential	Simple; fast for most needs	Hard to skip around; cannot change data in middle of file
Nonsequential	Can change or access data anywhere in file	Slow for sequential needs; higher CPU overhead
System buffers	physical I/O requests occur asynchronously	No user control (system controlled)
Asynchronous Queued (Fortran only)	Multiple requests to one file asynchronously	High CPU/system overhead; complicated; had to debug

Figure 2 FORTRAN I/O Summary

CRAY X-MP/Y-MP

Type	File format	Buffering	Other characteristics
Sequential Formatted	Text	System buffered, Library buffered	Synchronous
Sequential Unformatted	Blocked	System buffered, Library buffered	Synchronous, buffer size control
Buffer In/Buffer Out	Blocked	System buffered, Library buffered	Synchronous
Buffer In/Buffer Out	Unblocked	Unbuffered (-s u)	Asynchronous
Direct Access Formatted	Text	System buffered, Library buffered	Synchronous
Direct Access Unformatted	Unblocked	System buffered, Library buffered	Synchronous

QUESTIONS

S. Pasquini Member State jobs enter the Centre vis the VAX systems, how then are they sent to the Cray?

N. Storer There is no direct ethernet connection available to a Cray Y-MP system. Cray do, however, provide a front-end interface for SUN systems. Hence we use two Sun systems (known as the gateways) to transparently connect the Y-MP to the ethernet based TCP/IP services.

As an experiment we currently have installed an Ultra network box. Therefore your jobs go from VAX to SUN gateway and then through Ultra to the Cray. All this is transparent to the user though.

J. Juega I have been testing sendtm using small files, plus an assign -s cos statement, the files coming from a Fortran write. If I omit the assign the file is not transmitted correctly - any recommendations?

N. Kreitz Transferring Fortran binary files is generally OK. However, there is one combination, namely UT format files, which are then transferred as binary, which fails. This should now be flagged as an error by sendtm (although it used to work under COS).

R. Rudsar Does the Sun gateway need to know anything about the packets it passes to and from the Cray?

N. Storer No. RQS on the VAX sets up a link by asking to talk to NQS on the Cray. The SUN recognises the TCP/IP based packets coming from the VAX for the Cray and just routes them through (currently via the Ultra), it does not need to know anything about the contents of these packets. Similarly in the reverse direction.

There is an RQS system on the Suns themselves, this is for job submission by workstation users to the Cray and has nothing to do with VAX based RQS packets going to and from the Cray.

9. DISCUSSION SESSION

S. Pasquini — If a very long batch output file is sent back over the link, it can hold up many small files. This is especially true at night when DD files can be delayed. Can the NTS software offer better queue handling so that large files can be held to one side until (say) all DD files have been transmitted? If a DD file becomes ready for transmission while a long output file is being transmitted, can the latter be suspended automatically to allow the DD file through?

G. Sakellarides — Greece has seen the same problem.

ECMWF — This is something we will investigate.

J. Juega — Spain may request at the next Technical Advisory Committee meeting that it be allowed to have a second leased line at 9.6 Kbps, running TCP/IP, to provide interactive access, all the necessary costs being borne by Spain.

ECMWF — Thank you for the information. We would suggest that Spain holds some technical discussions with ECMWF before the Technical Advisory Committee meeting so that various options can be explored in advance.

S. Pasquini — Are any Member States interested in proposing to the Centre that ECMWF run another "NTS" style of project, but this time using TCP/IP rather than DECNET?

[S. Orrhagen, R. Rudsar and S. Kruizinga supported this idea]

ECMWF — We would need to consider what could be offered before any specific proposals were put to the Member States.

S. Pasquini — In order to help Member States keep in touch with each others' computer/telecommunications developments relevant to ECMWF, would the Centre consider having a regular item in the ECMWF Newsletter where such changes could be mentioned?

ECMWF The Centre always welcomes contributions to the ECMWF Newsletter. Such contributions should come from the Member States themselves, rather then ECMWF, because Member States will wish to control what information is included in such items.

S. Orrhagen Could the Centre approach Member States again to see if there is more interest now in setting up a VAX bulletin board (based on VAX NOTES) where Member States Computing Representatives can keep in touch with each other?

ECMWF As an alternative we would like to suggest that the electronic mail system could be used, once all current mail systems have been successfully integrated. That way all Representatives can be included, not just those with VAX access. If electronic mail does not prove satisfactory for this purpose, then we can consider a VAX bulletin board again.

S. Orrhagen Until the unified mail service is available, could those Representatives with VAX access keep in touch using VAX MAIL? For example, by the creation of a mail group for Representatives in the group. Although it will only reach those with VAX access that would be better than nothing.

ECMWF The Centre can indeed investigate this idea by contacting all Representatives to see who is interested and who is willing to have his identifier known by others.

S. Orrhagen What is the Centre's response to the second of the UK's proposals, namely allowing Computing Representatives to see the status of all jobs from his Member State?

ECMWF On UNICOS this can be done already using the qstat command (which has been recently modified to list all user jobs) followed by a filter to select those jobs of the Member State concerned. On the VAX the DISCJ command lists all user jobs (UNICOS, VAX), to be investigated if a filter is possible.

S. Pasquini Please circulate to Computing Representatives a list of the still valid Computing and Meteorological Bulletins, indicating the latest versions they should have.

ECMWF Will do.

S. Orrhagen Sweden supports the idea of an annual Computing Representatives' meeting. Perhaps it could be held in conjunction with a specialist topic meeting, such as security. Also, if meetings are held infrequently, then the presentations need to be long to give an overview and to cover all the changes. It might be preferable to have an annual meeting where one concentrates on the changes only. That way the meeting could be shorter.

ECMWF We will try to take these ideas into account when proposing the next meeting.

ANNEXES

ANNEX 1

MEMBER STATE COMPUTING REPRESENTATIVES' MEETING

3-5 JUNE 1991

ATTENDEES

REPRESENTATIVES

L. Frappez	Belgium
P. Henning*	Denmark
J. Böttcher*	F.R. Germany
J. Juega*	Spain
E. Monreal*	Spain
J. Toussaint*	France
G. Sakellaridis	Greece
L. Campbell*	Ireland
S. Pasquini*	Italy
S. Kruizinga	Netherlands
R. Rudsar	Norway
G. Kaindl	Austria
T. Hopeakoski*	Finland
S. Orrhagen	Sweden
B. Bachofner	Switzerland
K. Robertson	UK
S. Long	UK
R. Pallister	UK
C. Little*	UK

*Optional session on graphics

ECMWF

G-R. Hoffmann	Head, Computer Division
P. Gray	Head, Computer Operations
C. Hilberg	Head, Systems Software
A. Lea	Head, User Support
A. Alias	User Support
J. Greenaway	User Support
N. Kreitz	User Support
D. Martens	User Support
P. Prior	User Support
G. Holt	Computer Operations
T. Bakker	Systems Software
R. Dixon	Systems Software
R. Fisker	Systems Software
N. Storer	Systems Software
R. Gibson	Head, Met. Applications, Met. Division
J. Hennessy	Met. Applications, Met. Division
J. Daabeck	Head, Graphics Group
A. Jørgensen	Graphics Group
P. O'Sullivan	Graphics Group
K. Petersen	Graphics Group

MEMBER STATE COMPUTER REPRESENTATIVES' MEETING

E C M W F
Shinfield Park, Reading, U.K.

3 - 5 June 1991

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Monday, 3 June

14.00	Welcome	Chairman, G-R. Hoffmann
	ECMWF's computer status and plans	
15.15	**C O F F E E**	
15.45	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 connection 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)

17.30 Cocktail Party

* * * * * * * * * *

Tuesday, 4 June

09.00	Member States (continued)	
10.00	**C O F F E E**	
10.30	User Support services	A. Lea
11.15	Operational services	P. Gray
11.45	Recent machine hall installations	P. Gray
12.30	**L U N C H***	

* During this lunchbreak machine room tours will be arranged if required. Interested participants should contact their User Support Contact Point.

14.00 Networks at the Centre

		D. Dixon
15.00	**C O F F E E**	
15.30	MARS	R. Gibson
16.15	Security issues	G-R. Hoffmann
17.00	Finish	

Evening informal pub dinner with User Support

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Wednesday, 5 June

09.00	Systems plans	C. Hilberg
10.00	**C O F F E E**	
10.30	UNICOS: migration and first experiences	N. Storer
11.30	Discussion session	A. Lea
12.30	Finish	
14.00	**Optional session** on Graphics - MAGICS and MicroMAGICS	
	Introduction	J. Daabeck
	MAGICS 4.0 update	P. O'Sullivan
	Installation of MAGICS	A. Jørgensen
15.00	**C O F F E E**	
15.30	Using X windows for development of interactive applications	K. Petersen
16.00	Demonstrations to include:	
	MicroMAGICS/PC	
	MicroMAGICS/SUN	
	MAGICS/SUN	

Mark 14 News

1. New Features of Mark 14

Mark 14 represents a further considerable expansion of the NAG Fortran Library. It contains a total of 889 documented routines, of which 160 are new at this Mark. Two new chapters have been introduced:

G03 – Multivariate Analysis

X05 – Date and Time Utilities

There have been systematic revisions to the style of routine documents, designed to make them clearer and more readable, especially the specifications of parameters. The new style of specifications is described in detail in the document 'Essential Introduction'.

Out of 160 new routines, 66 are in the Statistics chapters. They include facilities (in the stated chapters) for:

- statistical distribution functions, allowing for non-integer degrees of freedom and non-central distributions (G01)
- linear regression modelling, allowing for: weights; rank-deficient models; adding or deleting observations or variables; standardized residuals and influence statistics; and model selection routines (G02)
- generalized linear models (G02)
- principal component analysis; canonical correlation analysis; canonical variate analysis (G03)
- nonparametric statistics (G08)

New routines have been introduced in other chapters of the Library for:

- roots of complex polynomials (C02)
- solution of systems of nonlinear equations, by reverse communication (C05)
- inverse Laplace transforms (C06)
- elliptic P.D.E.'s (D03)
- Volterra equations of the 2nd kind (D05)
- bi-cubic spline interpolation and evaluation (E01/E02)
- constrained nonlinear least-squares problems (E04)
- real and complex *QR* factorizations and related operations (F01)
- matrix storage conversion (F01)
- real and complex SVD (F02)
- mixed integer LP (H)
- special functions (S)
- printing matrices (X04)
- date, time and CPU time (X05)

The F06 Chapter now includes the Level 3 BLAS and the Sparse Level 1 BLAS.

Efficient performance on vector-processing machines has been extended to additional routines in the following areas:

- linear algebra (F01, F02, F04, new and revised routines)
- linear regression (G02, new routines)
- nonlinearly constained optimization (E04, revised routine)

– random number generators (G05, new routines)

– multidimensional quadrature (D01, new routine)

– P.D.E.'s (D03, new routine)

In selected implementations of the Library we are using modified versions of some frequently used linear algebra routines. The modified versions use block algorithms and call Level 3 BLAS, and on some machines can achieve much better performance than the usual versions which call Level 2 BLAS.

2. New Routines

For details, please refer to the relevant chapter introductions and routine documents. Routines in the F06 chapter are described in the F06 Chapter Introduction; they do not have individual routine documents. A concise summary of the purpose of all documented routines in the Library is given in the document 'Contents Summary, Mark 14' (with the exception of routines which have been superseded).

The following 160 new routines are included in the NAG Fortran Library at Mark 14:

C02AFF	F01ZBF	F06ZPF	G02DDF	G08CDF
C02AHF	F01ZCF	F06ZRF	G02DEF	G08CGF
C02AJF	F01ZDF	F06ZTF	G02DFF	G08EAF
C05NDF	F02SWF	F06ZUF	G02DGF	G08EBF
C05PDF	F02SXF	F06ZWF	G02DKF	G08ECF
C06LBF	F02SYF	G01ALF	G02DNF	G08EDF
C06LCF	F02UWF	G01ARF	G02EAF	G13AUF
D01GDF	F02UXF	G01ASF	G02ECF	H02BBF
D02MVF	F02UYF	G01EBF	G02EEF	S01BAF
D02MZF	F02WUF	G01ECF	G02FAF	S01EAF
D03FAF	F06ERF	G01EDF	G02GAF	S14ACF
D05BAF	F06ETF	G01EEF	G02GBF	S14ADF
E01DAF	F06EUF	G01EFF	G02GCF	S14BAF
E02DEF	F06EVF	G01EYF	G02GDF	S15DDF
E02DFF	F06EWF	G01EZF	G02GKF	X04CAF
E04UPF	F06EXF	G01FBF	G02GNF	X04CBF
E04UQF	F06GRF	G01FCF	G02HKF	X04CCF
E04URF	F06GSF	G01FDF	G02HLF	X04CDF
F01CTF	F06GTF	G01FEF	G02HMF	X04CEF
F01CWF	F06GUF	G01FFF	G03AAF	X04CFF
F01QCF	F06GVF	G01GBF	G03ACF	X04DAF
F01QDF	F06GWF	G01GCF	G03ADF	X04DBF
F01QEF	F06YAF	G01GDF	G05FAF	X04DCF
F01QFF	F06YCF	G01GEF	G05FBF	X04DDF
F01QGF	F06YFF	G01HAF	G05FDF	X04DEF
F01QJF	F06YJF	G01JCF	G07DDF	X04DFF
F01QKF	F06YPF	G02BTF	G08AGF	X04EAF
F01RFF	F06YRF	G02BUF	G08AHF	X04EBF
F01RGF	F06ZAF	G02BWF	G08AJF	X05AAF
F01RJF	F06ZCF	G02BXF	G08AKF	X05ABF
F01RKF	F06ZFF	G02DAF	G08CBF	X05ACF
F01ZAF	F06ZJF	G02DCF	G08CCF	X05BAF

3. Withdrawn Routines

The following routines have been withdrawn from the NAG Fortran Library at Mark 14. Warning of their withdrawal was included in the Mark 13 Library Manual, together with advice on which routines to use instead. The relevant Chapter Introduction documents give more detailed guidance.

Withdrawn Routine	Recommended Replacement
D02QAF, D02XGF, D02XHF	D02QFF and associated routines
F01CAF	F06QHF
F01CBF	F06QHF
F01CFF	F06QFF
F01CMF	F06QFF
F01DEF	SDOT/DDOT/F06EAF
F02WBF	F02WEF
F02WCF	F02WEF
F05ABF	SNRM2/DNRM2/F06EJF
X02ADF	X02AJF and X02AKF
X02AEF	X02AMF
X02AFF	X02AMF
X02BAF	X02BHF
X02BCF	X02AMF
X02BDF	X02AMF

4. Routines Scheduled for Withdrawal

The routines listed below are scheduled for withdrawal from the NAG Fortran Library, because improved routines have now been included in the Library. Users are advised to stop using routines which are scheduled for withdrawal immediately and to use recommended replacement routines instead. The relevant chapter introduction documents give further guidance, including detailed advice on how to change a call to the old routine into a call to the new routine.

The following routines will be withdrawn at Mark 15:

Routine scheduled for withdrawal	Recommended Replacement
C02ADF	C02AFF
E01ACF	E01DAF and E02DEF
F01CDF	F01CTF
F01CEF	F01CTF
F01CGF	F01CTF
F01CHF	F01CTF
F01LZF	F02SWF and F02SXF
F01QAF	F01QCF
F01QBF	F01QJF
F02SZF	F02SYF
H02BAF	H02BBF

The following routines have been superseded, but will not be withdrawn from the Library until Mark 16 at the earliest. They are being retained at Mark 14 for compatibility with other NAG products, and to give users a longer time to make the transition to the new routines.

Superseded routine	Recommended Replacement
C02AEF	C02AGF
E02DBF	E02DEF
E04HBF	not needed except with E04JBF
E04JBF	E04UCF
E04KBF	E04UCF
F02WAF	F02WEF
G01BAF	G01EBF
G01BBF	G01EDF
G01BCF	G01ECF
G01BDF	G01EEF

G01CAF	G01FBF
G01CBF	G01FDF
G01CCF	G01FCF
G01CDF	G01FEF
G02CJF	G02DAF and G02DGF
G08ABF	G08AGF
G08ADF	G08AHF, G08AKF and G08AJF
G08CAF	G08CBF
M01AJF	M01DAF, M01ZAF and M01CAF
M01AKF	M01DAF, M01ZAF and M01CAF
M01APF	M01CAF
X02AAF	X02AJF
X02ABF	X02AKF
X02ACF	X02ALF
X02AGF	X02AMF

5. Routines Revised at Mark 14

5.1. Incomplete Elliptic Integrals

S21BAF may now be called with $Y < 0$, and S21BDF may now be called with $R < 0$, in which case the routines compute the Cauchy principal values of the integrals.

5.2. Complex Bessel Functions

Some minor revisions have been made to the S17D and S18D routines for complex Bessel functions, in order to improve the accuracy of some results, especially when the results are close to the underflow threshold, and to avoid some unnecessary overflows.

5.3. Time Series Analysis

In G05EGF, NA may now be set to 0 in order to simulate a pure moving-average process.

G13DCF will now automatically initialize the array QQ to the sample variance-covariance matrix between the time series if on entry QQ is set to zero.

5.4 Symmetric Eigenvalue Problems

The following routines for reducing a symmetric or Hermitian matrix to tridiagonal form have been revised:

F01AGF F01AJF F01AYF F01BCF

As a result, small eigenvalues of the original matrix are now computed to greater accuracy in certain implementations. As a side-effect, the parameter TOL has become a dummy parameter.

ANNEX 4

N160 Quasi-regular Gaussian grid

Row	Points per row	Latitude (deg)	Row	Points per row	Latitude (deg)	Row	Points per row	Latitude (deg)
1	12	89.57	55	360	59.25	109	576	28.92
2	16	89.01	56	360	58.69	110	576	28.36
3	20	88.45	57	360	58.13	111	576	27.80
4	24	87.89	58	360	57.57	112	576	27.24
5	30	87.33	59	360	57.00	113	576	26.68
6	40	86.77	60	360	56.44	114	576	26.12
7	45	86.21	61	360	55.88	115	600	25.55
8	50	85.65	62	375	55.32	116	600	24.99
9	60	85.08	63	375	54.76	117	600	24.43
10	64	84.52	64	375	54.20	118	600	23.87
11	72	83.96	65	384	53.63	119	600	23.31
12	75	83.40	66	400	53.07	120	600	22.75
13	80	82.84	67	400	52.51	121	600	22.18
14	90	82.28	68	400	51.95	122	600	21.62
15	96	81.72	59	400	51.39	123	600	21.06
16	100	81.15	70	405	50.83	124	600	20.50
17	108	80.59	71	432	50.27	125	640	19.94
18	120	80.03	72	432	49.70	126	640	19.38
19	120	79.47	73	432	49.14	127	640	18.81
20	128	78.91	74	432	48.58	128	640	18.25
21	135	78.35	75	432	48.02	129	640	17.69
22	144	77.78	76	450	47.46	130	640	17.13
23	144	77.22	77	450	46.90	131	640	16.57
24	150	76.66	78	450	46.33	132	640	16.01
25	160	76.10	79	450	45.77	133	640	15.44
26	160	75.54	80	480	45.21	134	640	14.88
27	180	74.98	81	480	44.65	135	640	14.32
28	180	74.41	82	480	44.09	136	640	13.76
29	180	73.85	83	480	43.53	137	640	13.20
30	192	73.29	84	480	42.96	138	640	12.64
31	192	72.73	85	480	42.40	139	640	12.07
32	200	72.17	86	480	41.84	140	640	11.51
33	216	71.61	87	500	41.28	141	640	10.95
34	216	71.05	88	500	40.72	142	640	10.39
35	216	70.48	89	500	40.16	143	640	9.83
36	225	69.92	90	500	39.59	144	640	9.27
37	240	69.36	91	500	39.03	145	640	8.71
38	240	68.80	92	512	38.47	146	640	8.14
39	240	68.24	93	512	37.91	147	640	7.58
40	256	67.68	94	512	37.35	148	640	7.02
41	256	67.11	95	540	36.79	149	640	6.46
42	256	66.55	96	540	36.22	150	640	5.90
43	288	65.99	97	540	35.66	151	640	5.34
44	288	65.43	98	540	35.10	152	640	4.77
45	288	64.87	99	540	34.54	153	640	4.21
46	288	64.31	100	540	33.98	154	640	3.65
47	288	63.74	101	540	33.42	155	640	3.09
48	300	63.18	102	540	32.85	156	640	2.53
49	300	62.62	103	576	32.29	157	640	1.97
50	300	62.06	104	576	31.73	158	640	1.40
51	320	61.50	105	576	31.17	159	640	0.84
52	320	60.94	106	576	30.61	160	640	0.28
53	320	60.37	107	576	30.05			
54	324	59.81	108	576	29.49			

PART 2

Member State Computing Representatives' Contributions

R.M.I. 29-05-1991

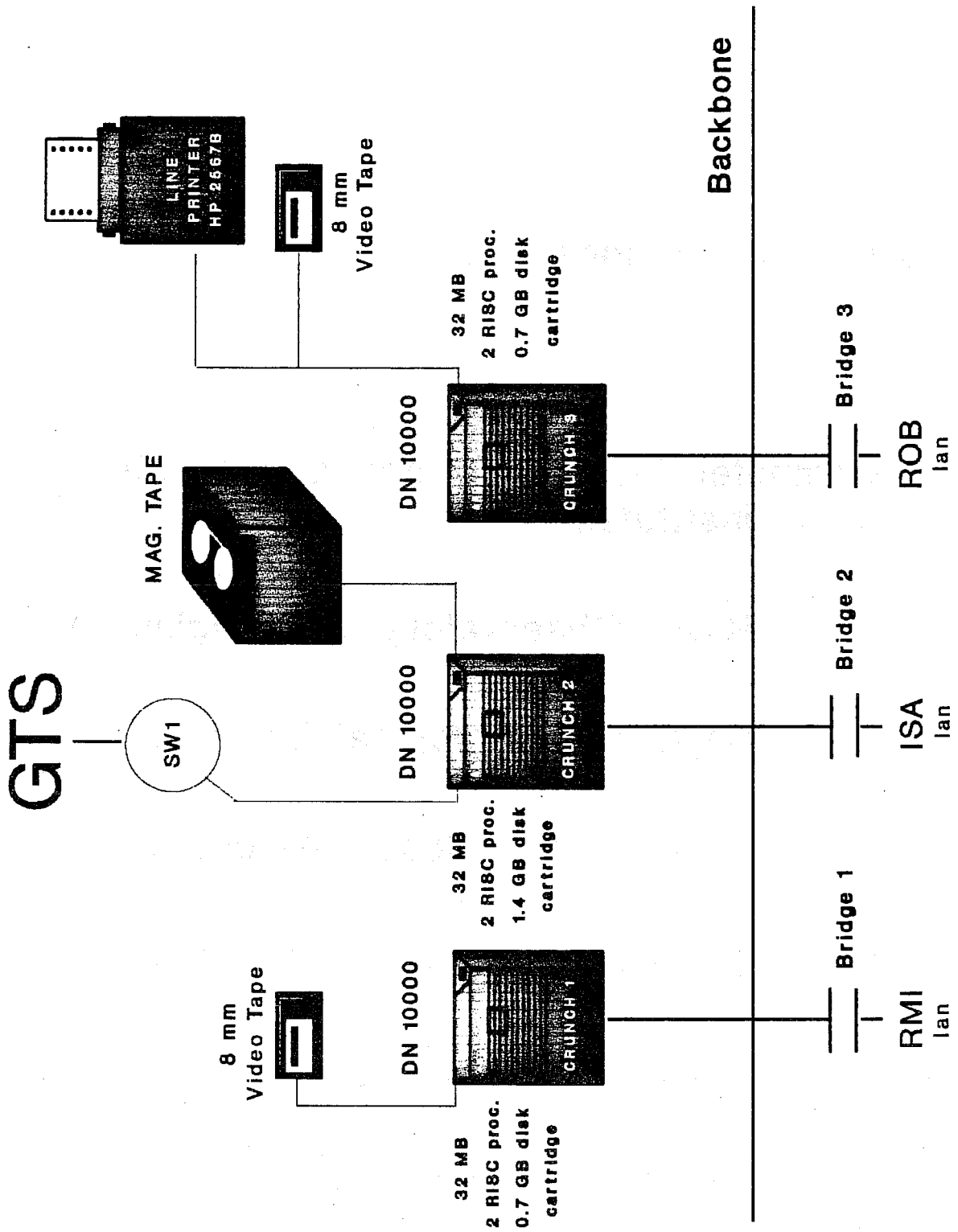
Computer installation and budget shared by 3 institutes :

- ✓ Royal Observatory of Belgium
- ✓ Royal Meteorological Institute
- ✓ Institute for Space Aeronomy

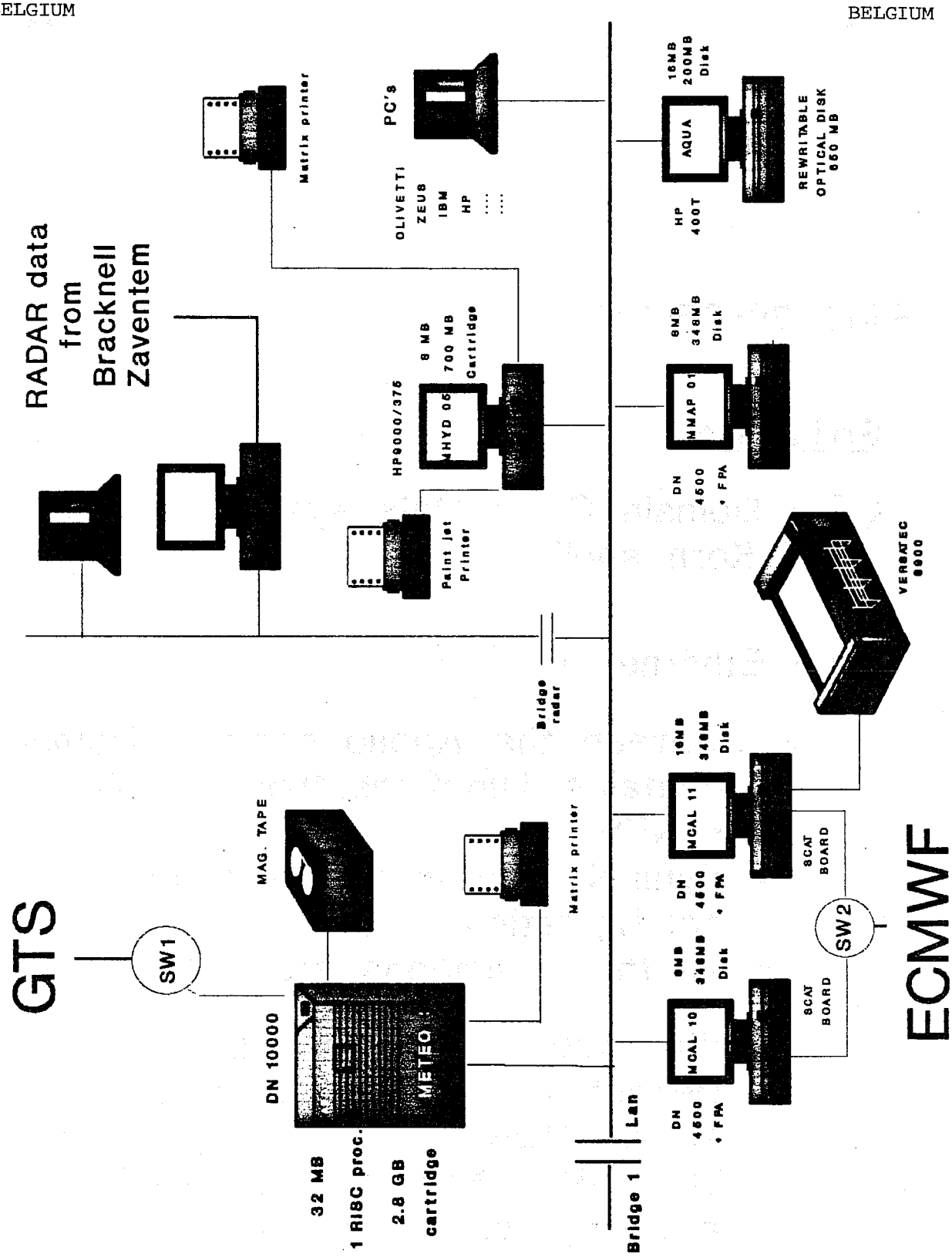
One year ago, renewal of the installation :

- 1 number crunching unit
- 1 departemental unit per institute
- Introduction of a lan

BELGIUM


GTS
SW1
MAG. TAPE
LINE PRINTER HP 2667B
8 mm Video Tape
8 mm Video Tape
DN 10000
CRUNCH 3
32 MB
2 RISC proc.
0.7 GB disk cartridge
DN 10000
CRUNCH 2
32 MB
2 RISC proc.
1.4 GB disk cartridge
DN 10000
CRUNCH 1
32 MB
2 RISC proc.
0.7 GB disk cartridge
Backbone
Bridge 3
ROB lan
Bridge 2
ISA lan
Bridge 1
RMI lan

BELGIUM


GTS
SW1
DN 10000
METEO
32 MB
1 RISC proc.
2.8 GB
cartridge
MAG. TAPE
Matrix printer
Bridge 1
Lan
MCAL 10
DN 4500 + FPA
8MB 340MB Disk
SCAT BOARD
MCAL 11
16MB 340MB Disk
Bridge radar
RADAR data from Bracknell Zaventem
Matrix printer
PC's
OLIVETTI
ZEUS
IBM
HP
HP9000/375
WHYD 05
8 MB 700 MB Cartridge
Paint jet Printer
MMAP 01
8MB 340MB Disk
HP 400T
AQUA
16MB 200MB Disk
REWRITABLE OPTICAL DISK 650 MB
VERSATEC 8000
SW2
ECMWF

BELGIUM

R.M.I 29-05-1991

Software

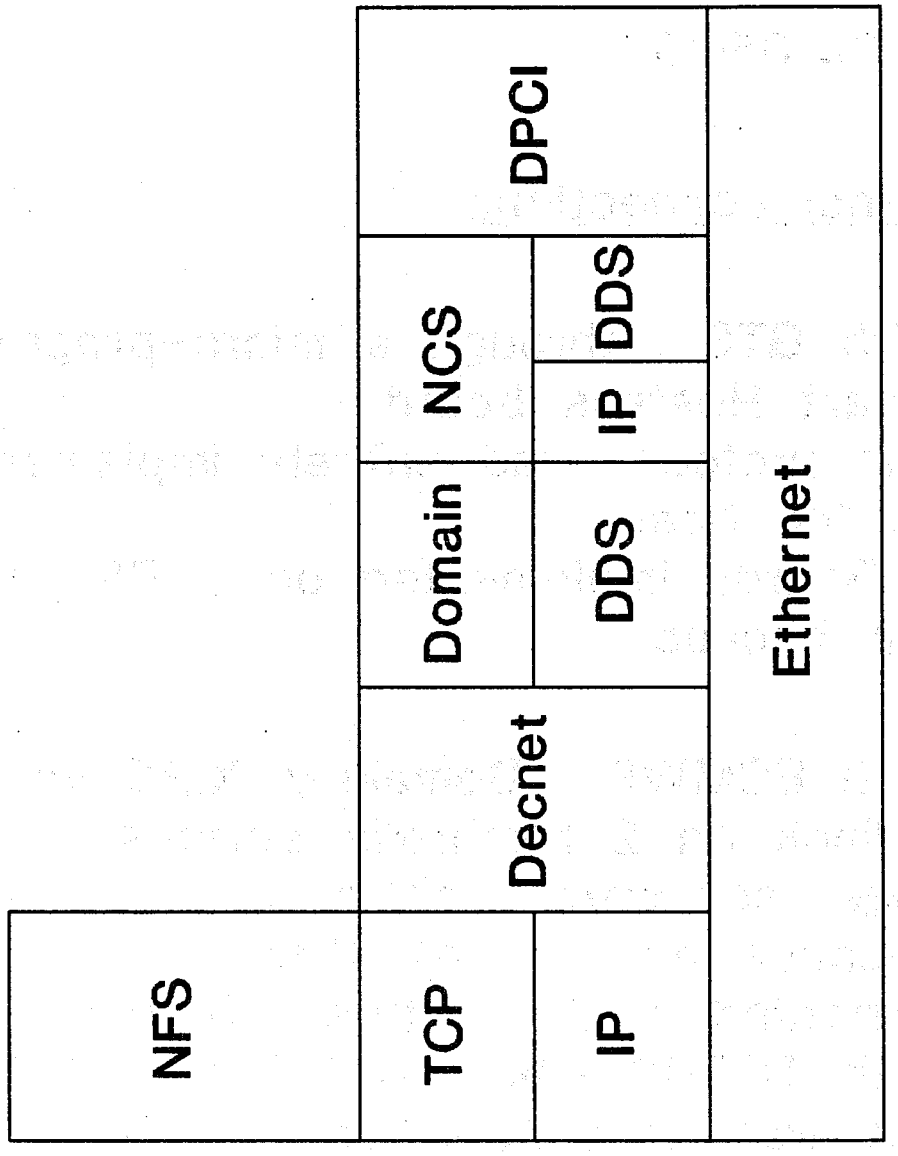
OS : Domain OS + Unix sys V emulation
Korn shell

lan : Ethernet +

✓ between the Apollo nodes : Domain
- contains functionalities of TCP/IP + NFS
- dynamic protocol with automatic configuration
- all the commands are network wide

✓ with other work stations :
- Decnet for a VAX computer at the ROB
- TCP/ IP + NFS for HP stations and Unix or Xenix PC's

✓ with DOS PC's : DPCI
same functionalities as PC NFS
➡ problems with "old" PC's


NFS
TCP
IP
Decnet
Domain
DDS
NCS
IP
DDS
DPCI
Ethernet

BELGIUM

R.M.I. 29-05-1991

External connections

✓ with GTS : through a micro-programmed Smart Hostess board.
The protocol was entirely implemented on the board.
2 Boards implemented on 2 DN 10000 for backup.

✓ with ECMWF : Domain / X.25 with Eclinck on 2 Motorolla servers
→ software problem but not solved because of lack of time.
Expected in the future : Domain / X.25 with TCP/IP when available by HP (it was announced for this year).

✓ with the public X.25 network : through a pad connected to a HP station of the Institute of Space Aeronomy.

R.M.I. 29-05-1991

Network computing : NCS

Backup : with OMNIBACK
through the lan for the Unix stations.
uses NCS

Libraries

- mathematical : Naglib 13.0g2.0 on DN 10000 and Motorolla WS
- graphical : Uniras 6.1f (GKS) on Motorolla WS
- relational DB : Ingres 6.2 on DN 10000 and and client on Motorolla WS

BELGIUM

R.M.I. 29-05-1991

No more project run at ECMWF and no project planned for the next couple of years.

The only application will be occasionally data retrieval through MARS .

Questions & comments (Belgium)

G.-R. Hoffmann I understand that you are interested, in the future, to move to TCP/IP protocols on the link to ECMWF, how will you go about providing job submission to our systems?

L. Frappez We hope to use RQS, something which Hewlett Packard will provide later.

A. Lea What is the optical disk to be used for?

L. Frappez For holding archive data.

G.-R. Hoffmann Just a warning to those Member States considering replacing their present link protocols with TCP/IP based ones - in our pilot project with France we have discovered that files sent from the VAX to the Member State via ftp are transferred, but arrive in a different format to that when transmitted by the present protocols. The actual format they arrive in also depends on which version of ftp is used at either end. The main problem is that the end of record markers differ. Thus please note that you will have to modify your programs that handle these incoming files.

DENMARK

The system at DMI.

Our present system is seen on the diagram. It has changed a lot since the last presentation, and it is going to change more in the near future.

The system is organized around an ethernet and we use Decnet and TCP/IP as protocols for transfer.

The Unisys 2200 (U2200) is still running and most of the plotting is done on a Versatec plotter connected to that computer.

We now has a VAX cluster, with shadowed diskes consisting of VAX 6410 and VAX 6210.

You may also see two VAX stations.

A Convex 220 vector processor has been installed, primary for running of the HIRLAM prognosis.

This computer should be replaced by a more powerfull Convex in the near future.

Most of the meteorological input is now done on the VAX'es. As you know the ECBIT line into the U2200 has now been cancelled and the 9600 bps line to ECMWF is coupled to an x25 router from where the products are sent into the VAX cluster (alias dmivax). The disseminated files are stored in GRIB code.

The GTS bulletins from Bracknell is sent into the VAX cluster the same way.

We have also got some SUN workstations, which are already playing an important role, and will be even more important in the future (see later on).

The bulletins from the domestic line Ring1 and the line from Stocholm with data from the other nordic countries are still entering the U2200 directly and some outgoing lines are also connected to the

When a disseminated file has arrived a programme is triggered which sorts the file for those fields which are going to be used on the U2200.

As we are not able to use GRIB files on that computer a program is run on the VAX, which converts those files into GRID bulletins which is sent into U2200, where they are decoded by the GRID decoding programme on that machine.

A programme is also triggered on the Convex and the files which are going to be used there are transferred.

The disseminated files are used for several purposes.

The field transferred to the Convex are used as boundary values for The HIRLAM model.

The fields transferred to the U2200 are used for several purposes. First a great amount of prognostic charts are produced, among them contouring maps, meteograms, precipitation and cloud maps etc for use in the daily forecasting service.

The disseminated fields are also used for some special forecasts.

Contour analysis- and prognostic charts are plotted for the southern hemisphere for use by our ship routing.

We also use the accumulated precipitation for a special forecast.

Forecasts are sent to the Great Belt project (tunnel and bridge across that water).

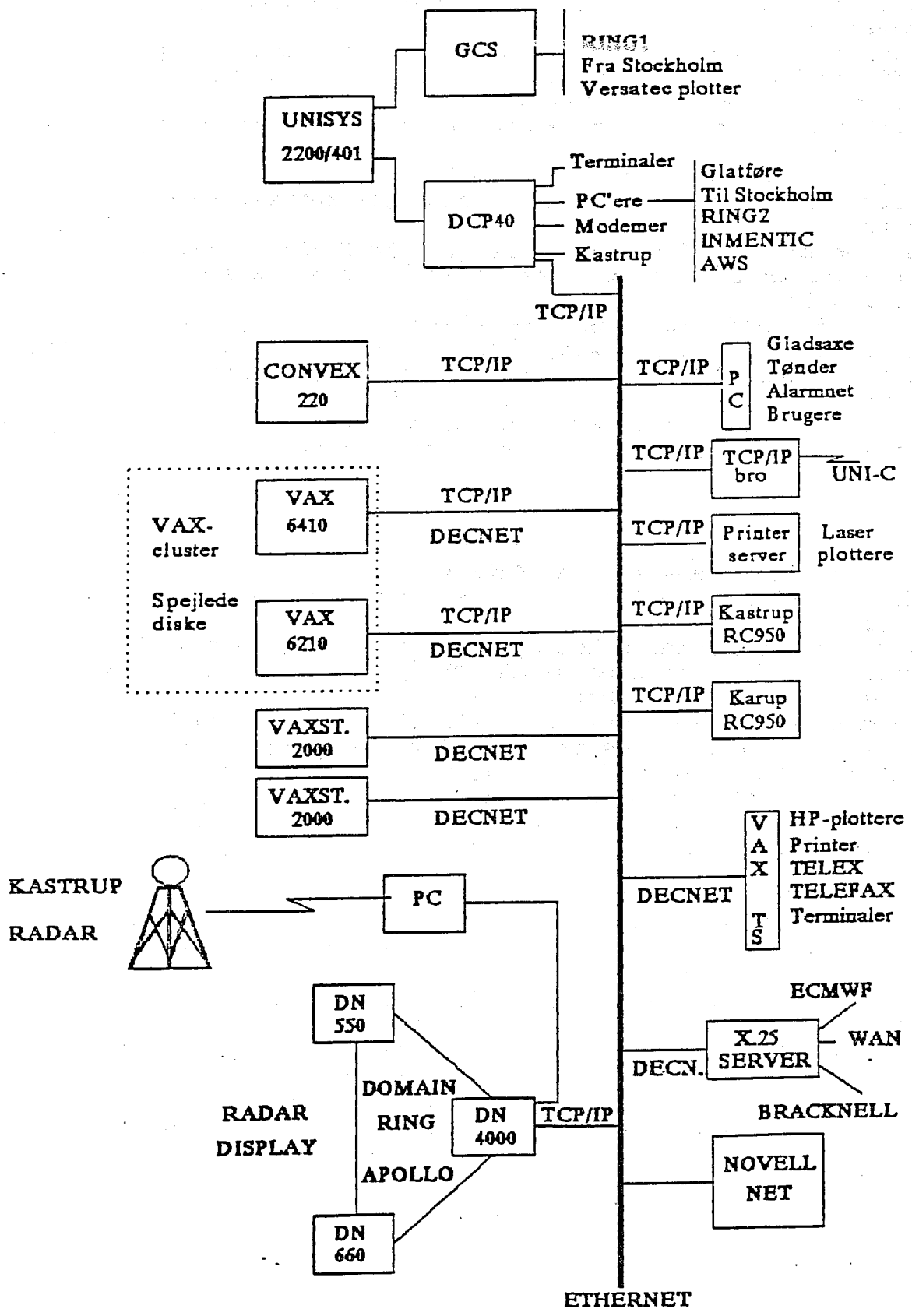
Special forecasts are made of wind and temperature in the upper atmosphere etc.
Our experience with the new Decnet link has been very good.
The fields have been received perfectly, (apart from delay caused by computer breakdown of course).
The trigging system are used and we are very fond of it.

Also batch jobs have been run at the centre.
A great deal of those jobs have been data retrieval from the MARS data base.
Experimental jobs for improvement of the HIRLAM model are run.
Calculation of data on isentropic levels and trajectory calculations are being made.
Use of radiosonde data has been planned.
Some calculations are beeing made at ECMWF, for example one person at DMI are using MARS data and data on isentropic levels calculated by Terry Davies.
People are quite satisfied with the service offered by the center.
The change to UNICOS does not seem to have caused any trouble.

Concerning our plans for the future:
U2200 is beeing phased out. It shall disappear early in 1992. The plans are 1. april.
This of course causes a lot of work. The communication lines still connected to U2200 shall be moved. The line from ECMWF has already benn moves as mentioned above.
The decoding (pre-processing) shall also run on the VAX'es. For that purpose we have got the centres pre-processing programs, which we are going to use, but some modifications have to be made. We are already able to plot SYNOPS decoded on the VAX system on a pen plotter, but it has not been put into operational use yet. A method of correcting observations has also to be made as well as a message switching system.
We are working on the GRID to GRIB pre_processing programme. The number of GRID bulletin types which can be treated are going to be extended. For example we cannot decode GRID bulletins with two parameters in one bulletin.
A great task is to move the plotting now done on the Versatec. The planning of this is in the very beginning, but we have bought some SUN workstations, and it is the intention to make the calculation of the plot on those stations. The output should be a post-script file which may be shown on the screen and/or plotted on a laser plotter.
We have got two laser plotters one in A3 and one in A4 format.

Danmarks Meteorologiske Institut

EDB-system



1. COMPUTER CONFIGURATION AT THE METEOROLOGICAL COMPUTER CENTRE OF THE GERMAN WEATHER SERVICE (DWD) IN OFFENBACH

1.1 Main computers

1.1.1 CRAY Y-MP 4/432 (Operating system UNICOS)

4 CPUs with 256 MBytes memory, cycle speed 6 ns
1 GByte sheared memory
Theoretical maximum speed in one CPU
330 MFlops (vector) and 20 MFlops (scalar)
3 separate I-O-processors (32 MBytes buffer) with
4 * 6 MByte, 3 * 100 MByte and 1 * 1000 MByte channels for connection with tape units and disks, the CYBERs and the local CDCNET
2 tape units and 10 disks (1200 MBytes each)

Used for operational forecasts, plotting of forecast products and research

1.1.2 CDC CYBER 180 - 990E (Operating system NOS/VE)

1 CPU with 32 MBytes memory, includes vector processor
Theoretical maximum speed 60 MFlops (vector) and
7.4 MFlops (scalar)
3 tape units and 12 * 611 MBytes disk storage

Used for decoding of incoming data (ASCII or binary), preparation of output products and other operational business

1.1.3 CDC CYBER 180 - 860A (Operating system NOS/VE)

1 CPU with 64 MBytes memory, speed 2.6 MFlops
4 tape units and 24 * 611 MBytes disk storage

Stand-by reserve for the CYBER 990, otherwise used for non-operational business like programm developing and other non-real-time business

1.2 Networks

1.2.1 Loosely coupled network (LCN) (50 Mbits/s)

Connects the two CYBERs and the telecommunication computers

1.2.2 CDCNET (10 Mbits/s)

Connects the two CYBERs and the CRAY with terminals, printers and plotters, graphical work stations, satellite data system and external users (via public networks)

1.3 Special systems

1.3.1 Satellite data system
2 Microvax II (Operating system VMS)

Used for preparation of satellite pictures (from METEOSAT and NOAA), vertical profiles of temperature and humidity (from NOAA)

1.3.2 Interactive graphical system
10 CYBER 910-400 work stations and
electrostatic color plotter CalComp 5825

Used for preparation of movies of satellite pictures, significant weather charts and other graphics

1.3.3 Telecommunication system
Cluster of VAX 8550 and Microvax II computers

Used for connections to GTS, ECMWF, ESA, national PTT network

2. PRESENT PROJECTS AT ECMWF

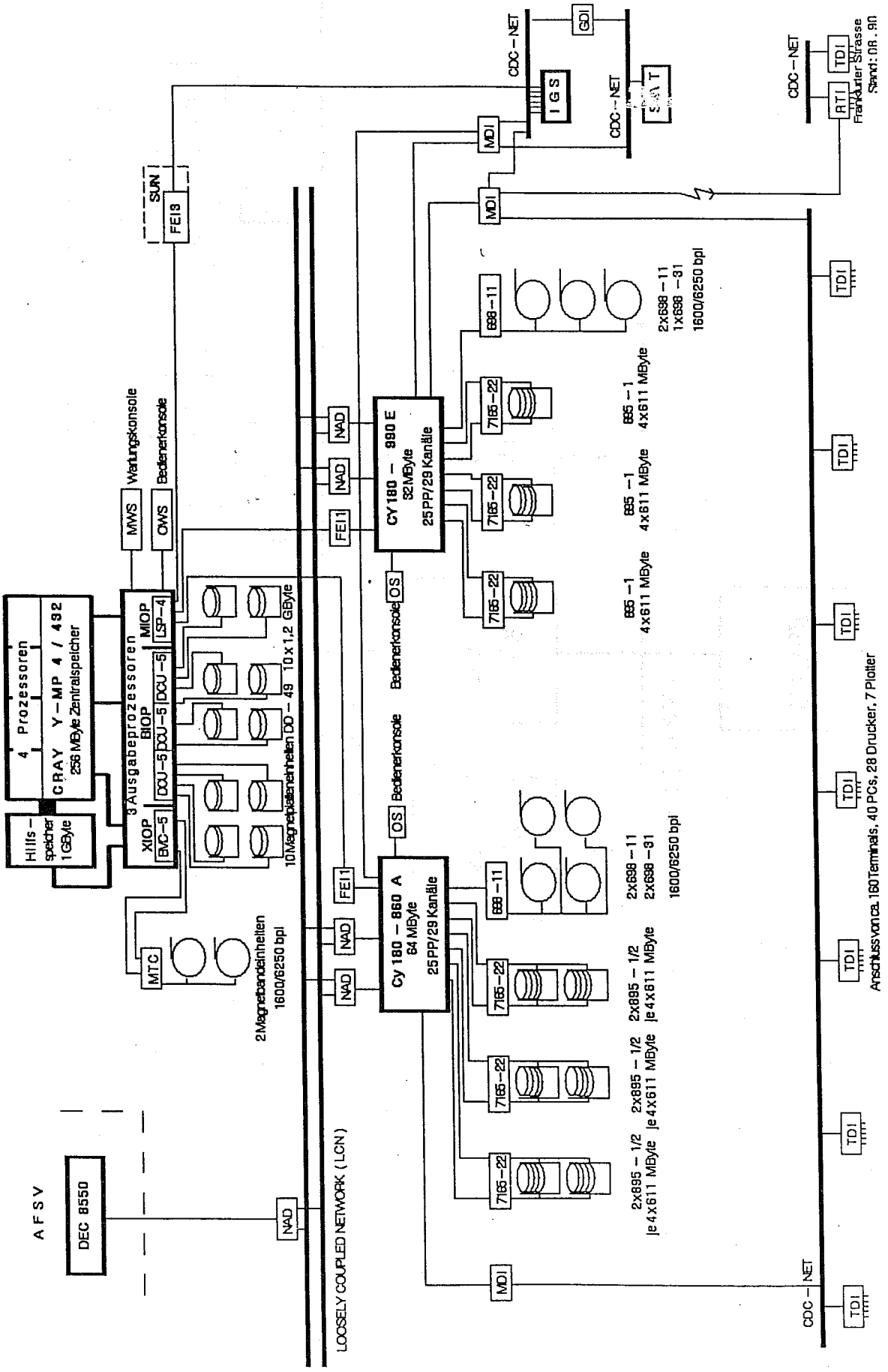
Development of a high-resolution limited area "Deutschland" model
Test of the global model as used by DWD against ECMWF model
Simulation of climate by use of the so call "Europa" model

3. PLANS TO USE ECMWF IN FUTURE

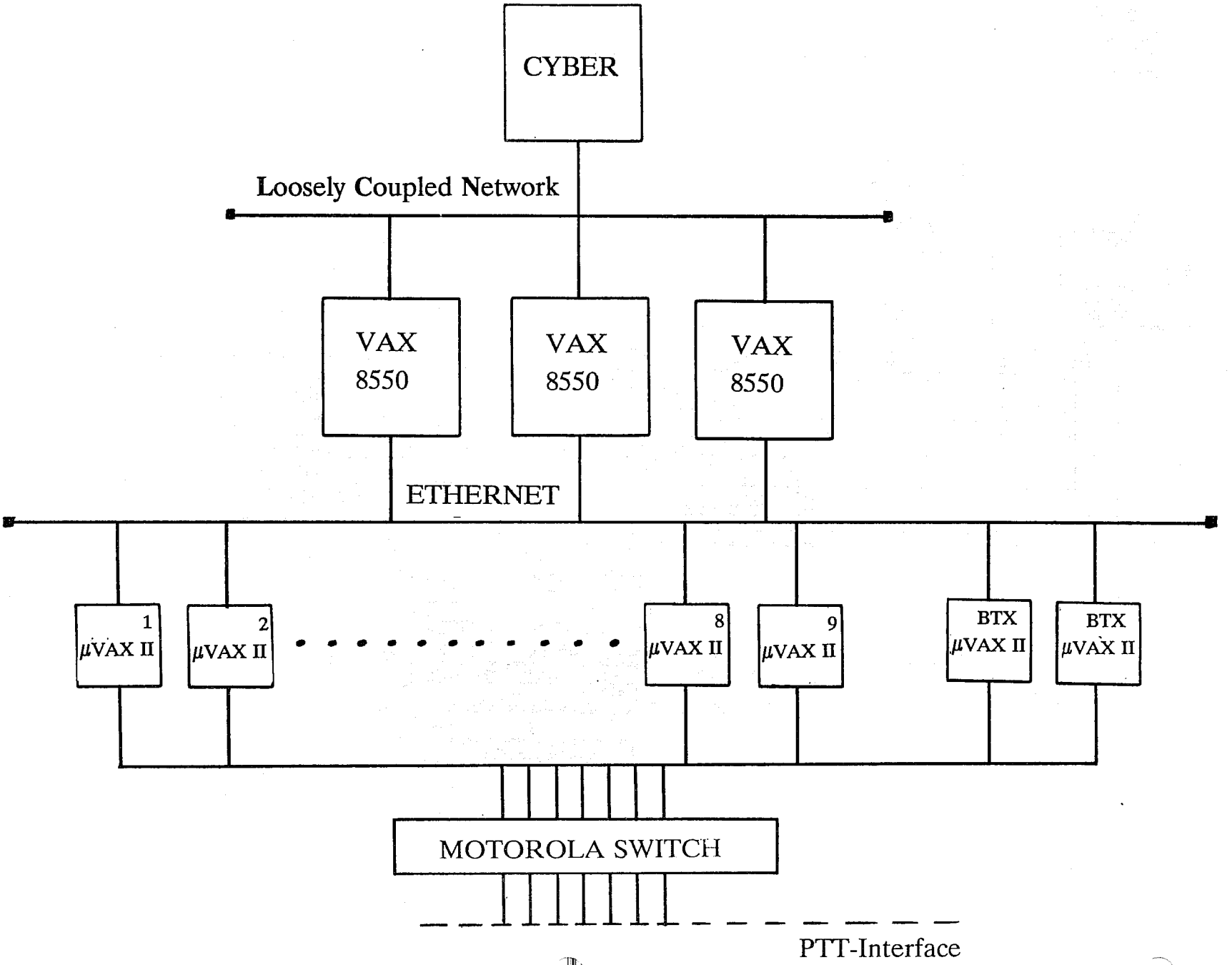
Continuation of present work but with upgraded connection between Offenbach and Reading (64 kbits/s TCP/IP). However, although a TCP/IP connection would be better than present possibilities, the DWD would prefer the installation of a RHF connection permitting access like in CDCNET and, therefore, having a lot of advantages over the TCP/IP.

GERMANY

METEOROLOGISCHES RECHENZENTRUM

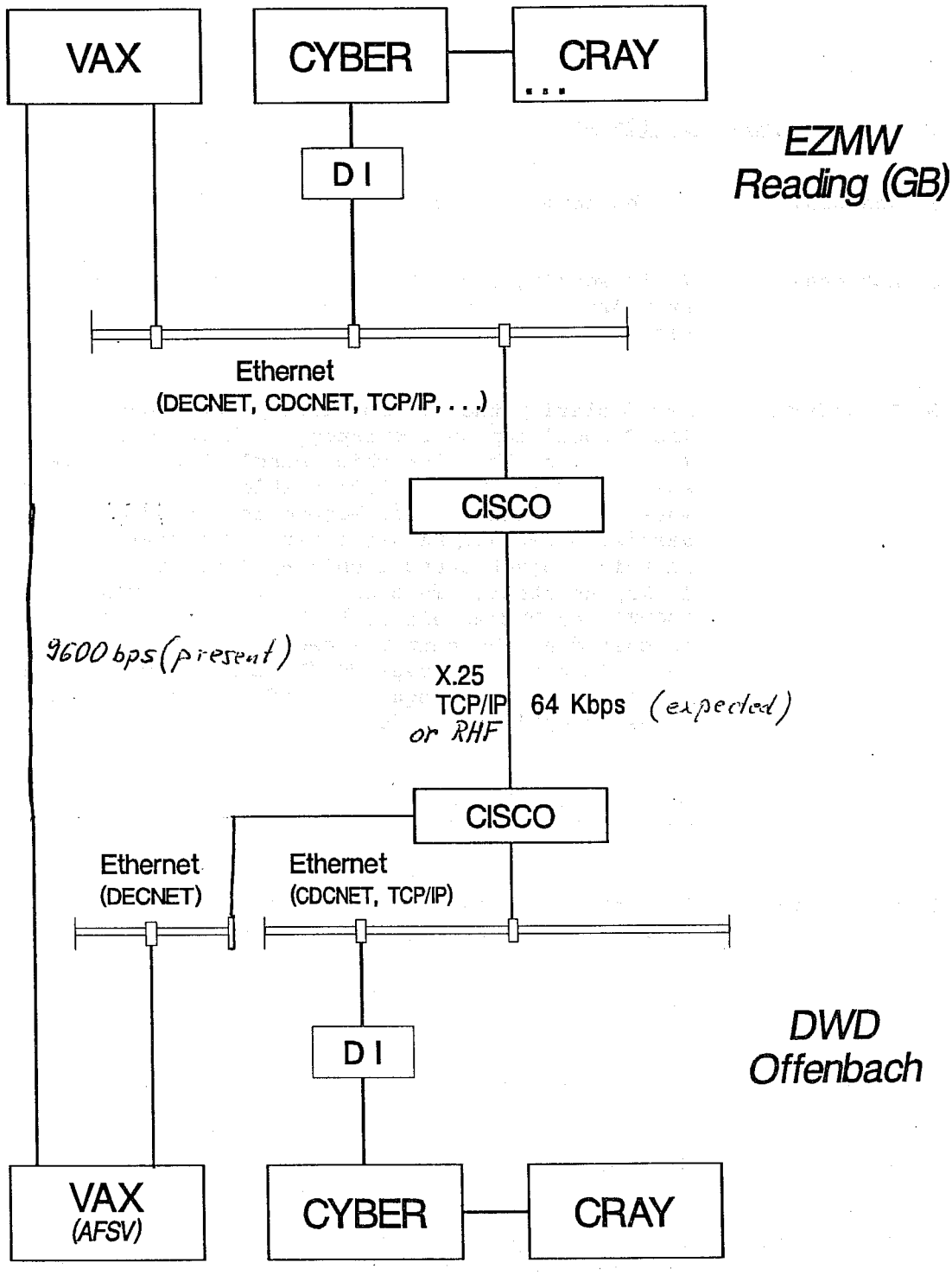


TELECO..IM-CENTRE OFFEI.BACH



GERMANY

Prinzipieller Aufbau einer 64 Kbps-Verbindung zwischen DWD u. EZMW



Questions & comments (Germany)

S. Pasquini — Is the communication software from SDL working yet?

J. Böttcher — It is working under X25, and we can get GRIB products from Bracknell and ECMWF, but it is not 100% finished yet.

G.-R. Hoffmann — May I clarify the 64 Kbps link pilot project and its TAC/Council approved strategy. We use CISCO boxes (routers) on the link which handle two separate protocol suites. The first is TCP/IP which runs direct to our internal Ethernet. The second is X25 level, which carries ECnet and DECnet traffic (as now) to the VAXes. In this project Council only approved these types of links, no other. Thus any other requirement (e.g. CDCNET, or DECnet direct to Ethernet) will need to be discussed at the next TAC meeting. Note that the present Centre's plans envisage NOS/VE disappearing in 1993. If any Member States require it after that they could fund it as an optional project.

P. Henning — Does the 64 Kbps link, as it runs now, preserve the present transparency for DECnet links?

G.-R. Hoffmann — Yes, the users do not realise how the link functions, to them it is completely transparent.

D. Martens — Will CISCO always support TCP/IP?

G.-R. Hoffmann — Yes, it is their main market.

G. Sakellarides — Can one run TCP/IP links at 9600 bps?

G.-R. Hoffmann — Technically yes, the CISCO route can run at 9600 bps. However, the present Council policy (for the pilot project) is that TCP/IP can only be used at 64 Kbps and above. Hence it would need a Council policy change.

MEMBER STATE COMPUTING REPRESENTATIVE MEETING 3-5 JUNE 1991

Member State: SPAIN, Comp. Repres: J.Juega

1. Computing Environment

Figure I displays the computing environment actually installed at our Institute. The link with ECMWF (ECNET L2) was already described in the Report on 5th MSCRM that was issued as Technical Memorandum Nº 163 by ECMWF last August 1989.

The following Glossary translates the labels and boxes shown in the figure:

SIRAM: Radar Network	KDX: Channel I/F	IAC: Comm.Processor
SIPREN:Numerical Forecasting	MULT:Channel I/F	D:G::Terminal Contr.
SAIDAS:Satellite System	NCP: Comm.Processor	ONEs:Graph.Display
SINAT: Telecomm. Message-Switch	3270:Terminal Contr.	W.C.:LAN

Our Fujitsu Mainframe serves as a destination for all data types concentrated by the different systems. Interactive access to all users is available from workstations ranging from 3270 terminals and PCs to sophisticated image and graphics workstations.

Not shown in the figure are additional networks that concentrate the information through the PC access to the NCP. In this category we can mention the automatic station network (150 stations), and the lightning detector network (15 stations).

Completely out of the figure is the Facsimile network that uses both, analog and digital technology, and being today mostly a manual process.

2. Communications

ECMWF links directly to our Host computer, as well as Bracknell, for reception of disseminated products for use in our LAM as boundary conditions and other applications. These links are X.25 at 4.8 Kbps.

Our SINAT system deals with the standard GTS links being capable of supporting WMO BSC, WMO X.25, AFTN, MOTNE, TELEX, DIAL IN/OUT, and all national TTY links to airports, observatories, Regional Centers, etc.

Internally, the LAN concept is not really implemented as such, and relies on dedicated lines linking computers, and specialized channel I/Fs.

3. Use of ECMWF computing resources

Also described in the Technical Memorandum Nº 163, are our past experiences using ECMWF computing resources. The present year has shown a decreasing use of the CRAY Y-MP mostly due to the impact of the new UNICOS restrictions for our installation added to the low performance that an ECNET L2 link offers today.

4. Future Plans

Our plans envisage the adquisition of a 'Number Cruncher' to improve our forecasting capabilities, following closely the HIRLAM concept. This will mean an increasing demand on use of the ECMWF facilities related with experimentation and retreival from MARS.

We have acquired a network of UNIX based minicomputers to assist the Regional Centers in their daily work. Also plans for renewal of our Message-Switch hardware are in progress. The result will be a more

standard networking complex at our Institute with enhanced telecommunication features that will help in our responsabilities with public demand of meteorological information that was not commercially structured in the past.

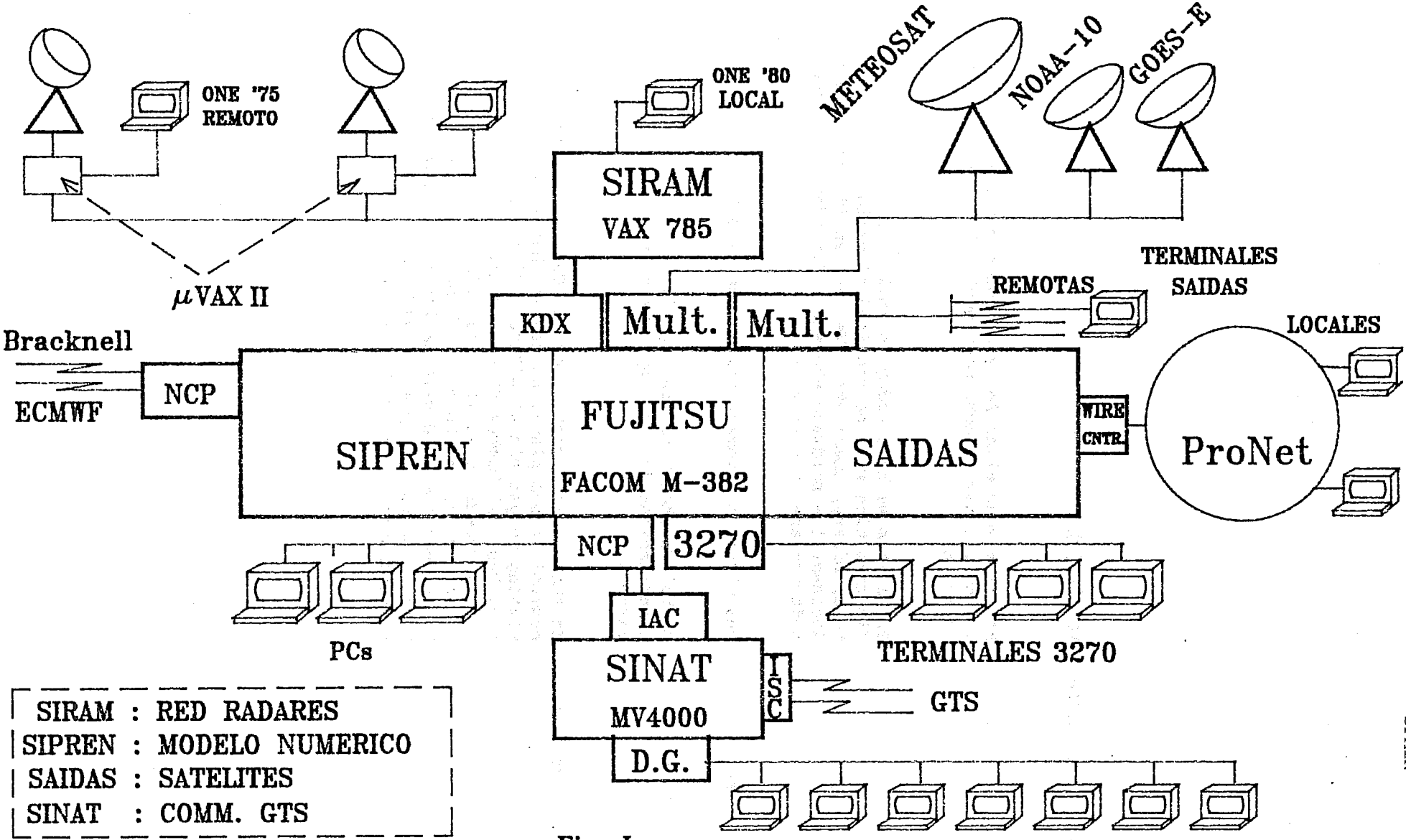

ONE '75
REMOTO
ONE '80
LOCAL
METEOSAT
NOAA-10
GOES-E
SIRAM
VAX 785
μVAX II
TERMINALES
SAIDAS
REMOTAS
KDX
Mult.
Mult.
LOCALES
Bracknell
ECMWF
NCP
SIPREN
FUJITSU
FACOM M-382
SAIDAS
WIRE
CNTR.
ProNet
NCP
3270
IAC
PCs
TERMINALES 3270
SINAT
MV4000
ISC
GTS
D.G.
SIRAM : RED RADARES
SIPREN : MODELO NUMERICO
SAIDAS : SATELITES
SINAT : COMM. GTS

Fig. I

Questions & comments (Spain)

S. Pasquini — What are your plans for your telecommunications software? I know you have bought previously Global Weather Dynamics software.

J. Juega — The system we have today is small, we see more dissemination will be required of various types, e.g. text, binary, image etc. We have an ITT out this year to increase the hardware element. Our ideas for future software are currently open.

S. Pasquini — Any plans to automate fax transmission?

J. Juega — Global Weather Dynamics has already integrated fax transmissions into the systems they can provide, using PC servers.

G.-R. Hoffmann — In the future directive of the Centre's telecommunications plans, no mention has ever been made of us wishing to get rid of DECnet medium-speed lines (up to 9600 bps), 12 Member States run such links now. For higher speeds we would go for LAN bridges rather than DECnet, so as not to create a bottleneck on the VAXes. We foresee future dissemination direct from the UNIX-based systems, our present VAXes could not handle the dissemination on 18 Member State lines all at 64 Kbps!

MEMBER STATES

COMPUTER REPRESENTATIVES MEETING

ECMWF

PRESENTATION OF METEO – FRANCE

STATEMENT

3 – 5 JUNE 1991

AT

READING

METEO FRANCE

SCEM/TTI/DEV

ASSISTANCE

J.TOUSSAINT

SUMMARY

1. The SCEM computer service

1.0. Introduction

The SCEM computer service has known before and knows again since july 1989 an important period of transformations that has taken place along the following lines :

A. Changing of operating system

A.1 Implementation on NOS/E of the files and programs that only worked on our development machine.
This made possible the creation of an assistance team who, together with the system team, managed to :

- Train the NOS/VE users
- Give information to users by the means of topics on-line
- Help the users concerning the realisation of the the migration and conversion from NOS files and programs to NOS/VE
- Implement the CRAY station on NOS/VE
- Implement the new graphics tools (NCAR, MAGICS and and GKS)
- Create new software of communication between mainframes and working stations (SENTF and RSU).

Nos service is now limited and is to be stopped.

A.2. Getting used to the operating system UNIX
Because of the increasing arrival of the materials using the operating system UNIX (Convex : Archives Machine, CRAY: super computer and the new machine of the forecast line) it will be necessary to provide a training for the new system as soon as september 1991.

B. Removal from Paris to Toulouse

The removal started in may with the implementation of a relay machine so that the Meteo operating line will not be interrupted, and will go on until august with a temporary stop of the development machines during the second fortnight of july .
The removal must take place from the 15/5/91 to the 15/08/91

C. Purchase and implementation of new materials

As soon as october 1991 an archives machine CONVEX C220 equipped with the UNIX operating system will be installed in new computer service with UNITREE.

The files transfer between CRAY, CONVEX and the CDC computers will be managed by a FDDI with speeds up to 100 megabytes/s, which will be implemented in september. The implementation of FDDI can only be made with NOS/VE release 1.5.3.

The super computer CRAY II must be implemented in Toulouse in December 1991.

The operational machine (CDC CYBER 860) will be replaced in 1994 by a machine with an UNIX system.

1.1 Present situation

(in appendix : present configuration)

Our computer service is merely linked to 2 computers CDC. The Meteo-France operational line of implementation is managed by a Cyber 860 (monoprocessor, 16 Mips, 32 Megabytes of central memory) which is made itself of 4 895 disks (i.e 2,4 gigaoctets) et de 2 885 disks (i.e 1,36go)

A CYBER 960 (monoprocessor, 16 Mips, 64 Megabytes of central memory) is devoted to developement. The capacity of disks is 16 gigaoctets.

These 2 computers are linked by a connection of 1 Megabits/s to the CRAY 2 of CCVR on which run our operational models of Emeraude and Peridot, forecast. About 600 hours per month of CPU monoprocessor of CRAY II are now used, a third of which for operational tasks.

The management of climatological data is made on a CYBER 930 (monoprocessor, 3,3 Mips, 32 Megaoctets of central memory). An 'ORACLE' SGBD is implented on this computer, which works with NOS/VE and has a disk space of 3 go (2 disks are integrated in the 930 and 2 X MD).

In Paris a double local network CDCNET (of a CSMA/CD type) provides the interconnection between the various computers and the other peripherics (printers, versatecs, plotters).

1.2. During the removal period

During the whole period of removal of the CDC computers, Control Data lends us in Toulouse a Cyber 860 with 10 885 disks, so that we will always have 2 running machines. This should curable us to prevent any stop of the operational since we will always have a free mainframe, even if the implementation machine breaks down. The development services (NOS/VE and NOS) themselves will be stopped for a fortnight in july and will probably be seriously disturbed in august. A 1 Megabits/second has been established, between Toulouse and Palaiseau(of CRAY II) enable the use of models and the delivering of results in Toulouse. The link Paris-Reading will be transferred to Toulouse in july. The Data Dissemination files, if the operational keeps being operated by a computer in Paris, will possibly be reorientated towards Paris.

FRANCE

1.3. Final Situation

(in appendix : final configuration)

The final configuration implemented in Toulouse will be similar to the one in Paris at the data control level. The only changes that will occur concern the network : the latter will be modified and this CDCNET network replaced by an TCP/IP network.An archiving machine will be implemented in octobre in Toulouse. A storagetek robot will be managed by a Convex C220 with 20 Gigaoctets in line and a 1200 gigaoctets capacity that will be in 4 years multiplied by 4. This file machine will work with an UNIX implemented system and will have the Unitree software to manage the archived files. Morever, the CRAY 2 that we now share at the CCVR with 7 other partners will be implemented in Toulouse at the end of the year for Météo France.. The link between the CRAY 2 and the CONVEX will be made by FDDI network.

1.4. The link with the ECMWF

(in appendix : link with Reading)

A faster link of 64 Kbs has been implemented in Reading and Paris. The link uses the TCP/IP protocol and escables us to work in interaction with Telnet and with FTP for the transfer of files between Reading and Paris. This link has known some problems at the beginning of may but gives now full satisfaction to its users.

1.5. Creation of an assistance service for the users

An assistance service has been created at TTI the 1st january 1990 and can answer a certain number of questions that the users are likely to ask themselves (USER validations , allocations of disk spaces and link between services). It moreover partly undertakes specialized training or the running systems, provides the users with a structured and easy-using ON_LINE information (TOPICS),provides them with standard procédure libraries and can deal with the migration and conversion from a whole given implementation system to another.

2. Projects run at ECMWF

2.1. List of users and their consumption

SHARING OUT RESOURCES AT ECMWF

				(Consumption/month)			
RESOURCES	1991	CRAY	CFS	0128	0225	0325	0422
NAME	USER	Kunits	Mbytes	Kunits	Kunits	Kunits	Kunits
ROSSET	FRAUIOPC	5.0	4000	0.0	0.0	0.0	0.0
PHU LE VAN	FRLMDCLI	7.0	6000	0.0	0.0	0.0	0.0
PIEDELIEVRE	FRSMIRSO	1.0	1000	0.0	0.0	0.0	0.0
SOUS TOTAL	EXTERNALS	13.0	11000	0.0	0.0	0.0	0.0
URBAN	FRRMPERL	10.0	3000	1.0	5.3	0.1	1955.1
CLOCHARD	FRRMENMP	2.5	2000	0.0	0.0	0.0	0.0
TOTAL	CRMD	12.5	5000	1.0	5.3	0.2	1955.1
JAVELLE	FRSCSTAT	2.0	500	0.0	0.0	0.0	0.0
GUILLAUME	FRSCPMAR	4.5	1500	23.5	3.8	136.9	117.2
PIERRARD	FRSCANOB	19.0	3000	0.0	0.0	0.0	0.0
VEYRE	FRSCCTRL	1.5	400	0.1	0.0	0.0	0.0
GERBIER	FRSCGRAP	1.5	100	0.0	0.0	0.0	0.0
MUSSON	FRSCTRAN	8.5	500	10.1	5.1	1.0	1.4
QUINTO	FRSCTTID	3.81	13700	0.0	0.0	0.0	0.0
TOTAL	SCEM	40.81	19700	33.9	8.8	137.9	118.6
BRET	FRTOMESO	1.0	1000	0.0	0.0	0.0	0.0
CARIOLLE	FRTODCLI	40.0	10000	3.1	51.9	87.3	203.4
LAFORE	FRTOCOPT	4.0	800	0.0	0.0	0.0	0.0
SENESI	FRTOASPI	0.5	200	0.0	0.0	0.0	0.0
TOTAL	CNRM	45.5	12000	3.1	51.9	87.3	203.4
TOTAL FRANCE		109.81	47700	38.0	66.0	225.4	2277.1

2.2. Evolution of projects

Time consumption on the CRAY YMP is below usual consumption (2277.1/2606.0). This situation is due to the users for the 4 first months (validation with VAX and implementation of a new link 64 Kbs), but is likely to be reversed afterwards (CRAY unavaible during the removal period and improvement of the link with the ECMWF).

3. Remarks on the ECMWF service

3.1. Questions

At the beginning of the year the users have been deterred by the subscription they had take. If they wanted to use the service. Could we not think of a system as reliable as it is now for the ECMWF but less compelling for the users ? The giving up of the NOS service on the Météo-France development service and the new link with Reading implics that we must be able to the one they had before. We must make sure that they will still be able to use the service to submit works and get the result of treatment back in the wait-queue.

The definitions of the Météo-France terminals are different from those defined in Reading

Access to data

- How can we have access to the models forecast archives before 1985 since they do not appear on the 'Mars' archives ?
- How can we have access to the observations concerning the weather ?

3.2.Proposals

- Submission of the jobs in Reading

Our 2 teams of Reading and Meteo-France will have to define the required procedures to carry out the batch job submission software of works because CDC cannot give us the CDC NQS package before the beginning of the year 1992.fin 1991 début 1992.

- Definition of terminals

Insert in the prologue mode for the user a certain number of 'TDU' type for coordinate the function keys: we will not give more than 2 or 3 definitions.

FRANCE

4. Plans over next couple of years.

Specials projects

You have received my letter that indicates the future consumption for years (1992, 1993,1994)

Running projects

It is too early to give now an estimation concerning the consumption of resources.
Could we ask the users in september 1991 their consumption of resources to estimate for years to come ?

General projects between member states.

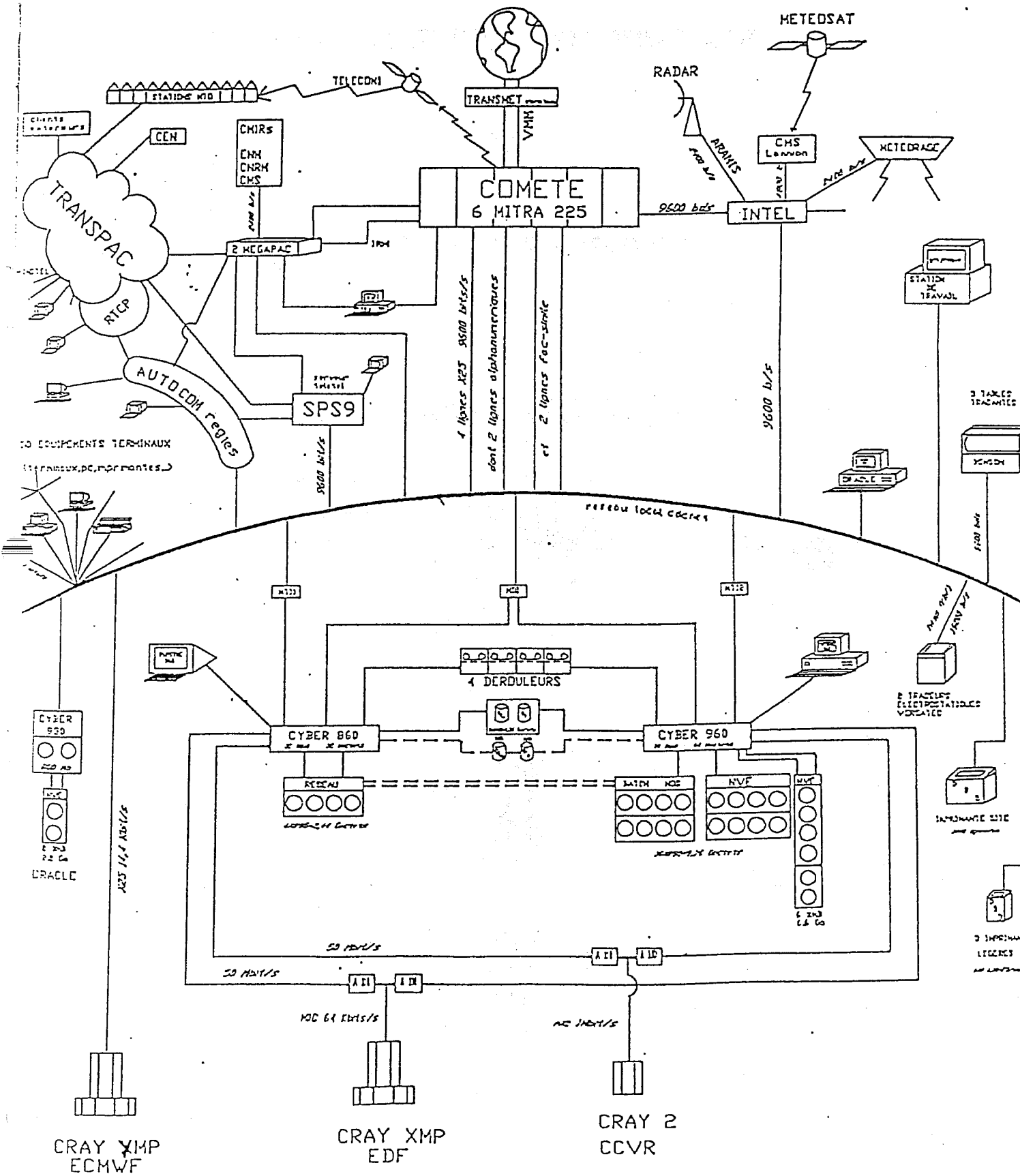
How is the posting of consumption to be done ?
Will they be included in the running projects ?

Décembar 1990

METEO FRANCE

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

DIAGRAM OF COMPUTER EQUIPMENT AT PARIS

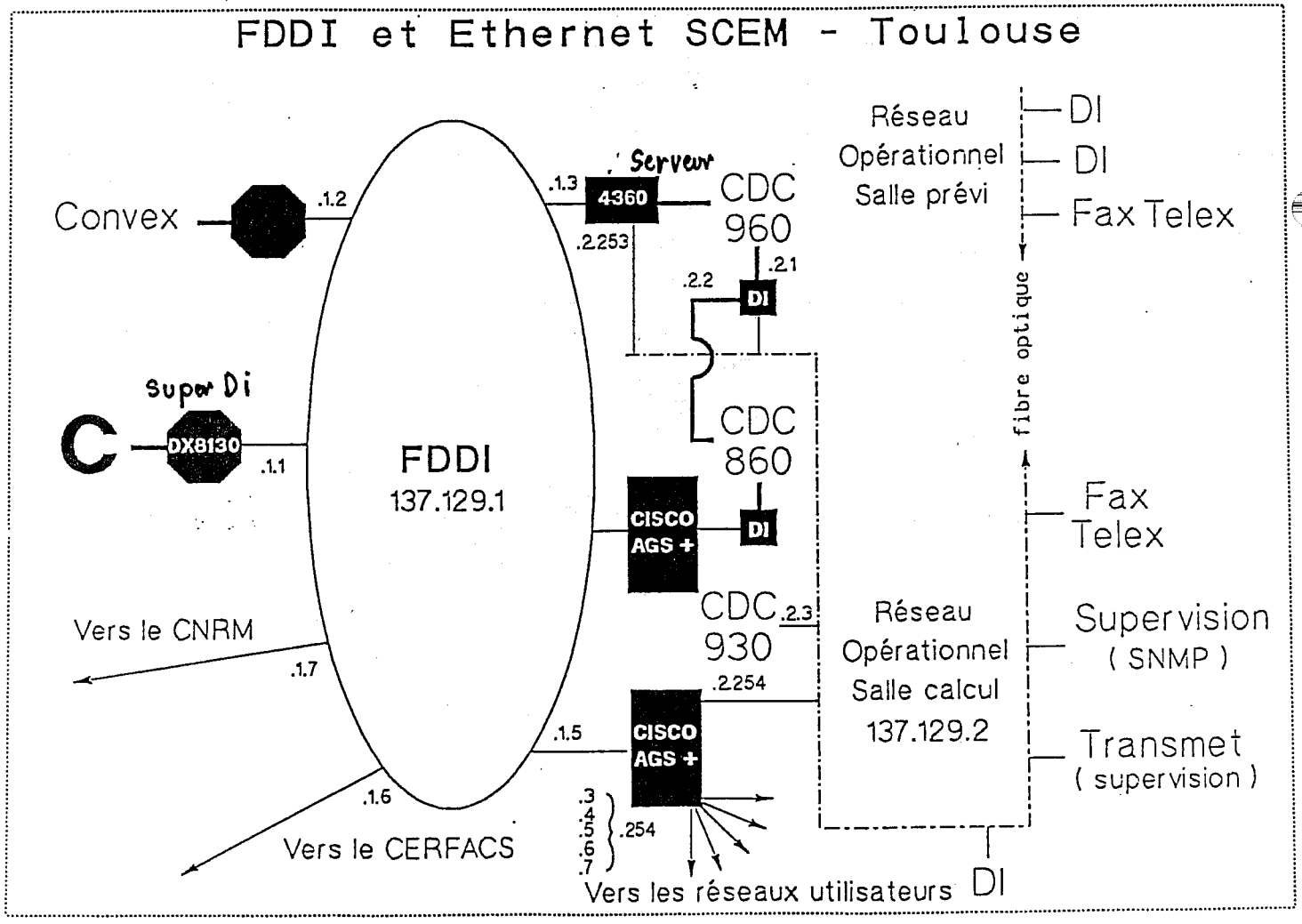


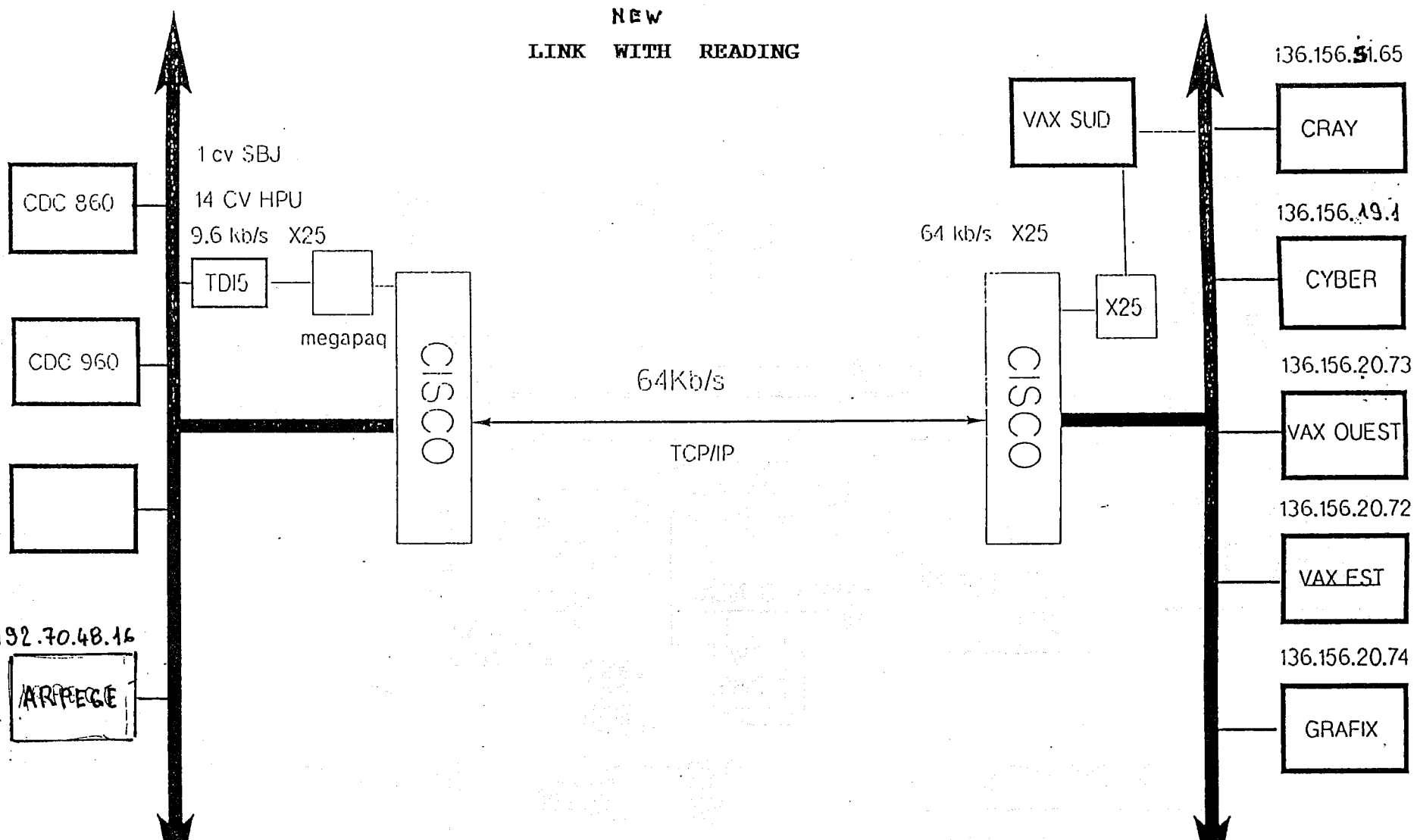
FRANCE

DIAGRAM OF COMPUTER EQUIPMENT

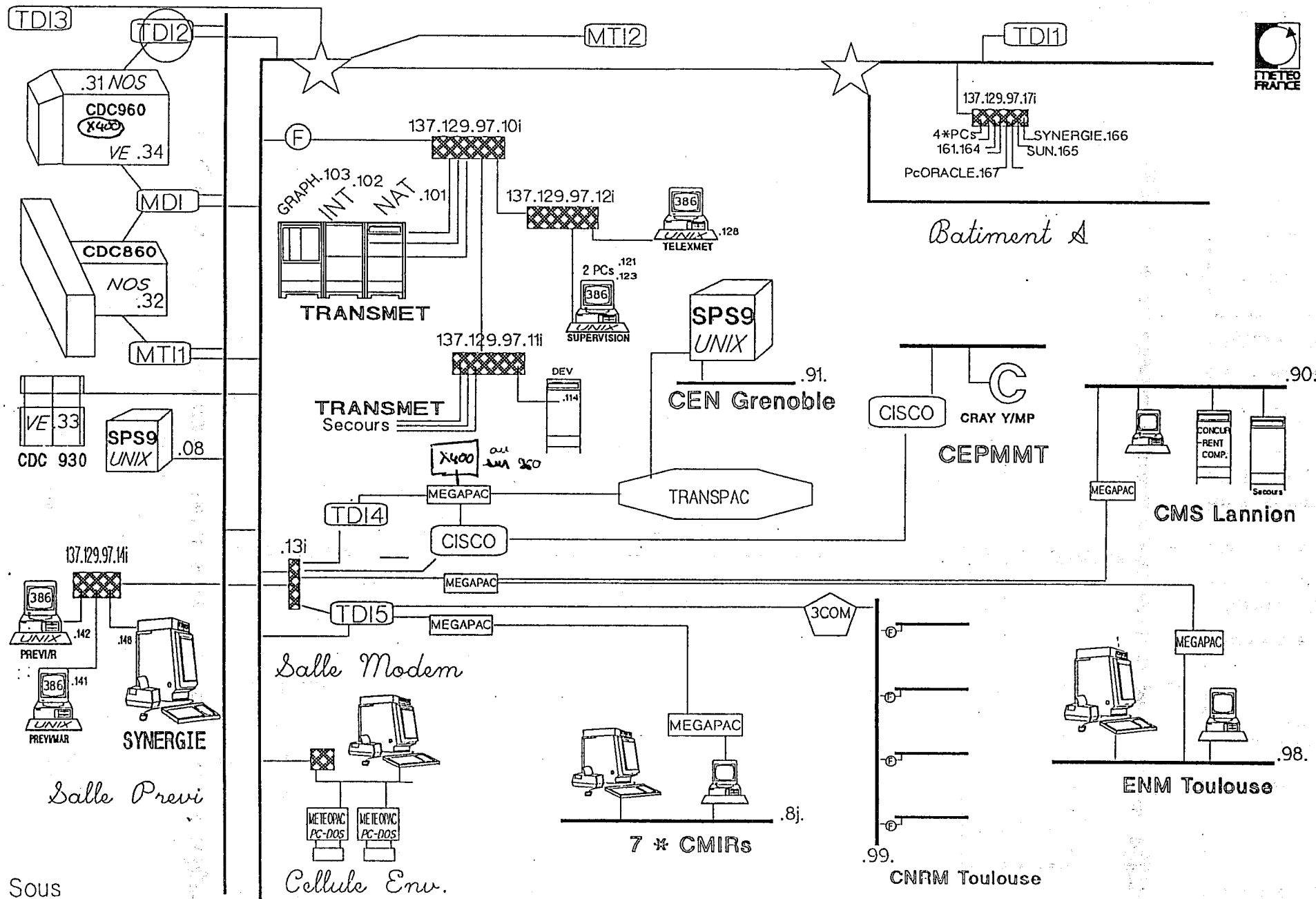
AT

TOULOUSE 1/9/1991




NEW
LINK WITH READING
1 cv SBJ
14 CV HPU
9.6 kb/s X25
CDC 860
CDC 960
TDI5
megapaq
CISCO
64Kb/s
TCP/IP
CISCO
64 kb/s X25
X25
VAX SUD
136.156.51.65
CRAY
136.156.19.1
CYBER
136.156.20.73
VAX OUEST
136.156.20.72
VAX EST
136.156.20.74
GRAFIX
192.70.48.16
ARPEGE
Telnet
FTP

FRANCE



Sous Réseaux IP: 139.127.96.
139.127.97.
ETHERNETs

METEO-FRANCE Réseau ETHERNET/CDCNET/IP:137.129. 01/05/90

FRANCE

Questions & comments (France)

G.-R. Hoffmann — Where does the ECMWF link enter into the Toulouse system?

J. Toussaint — Through a CISCO route connected to the FDDI ring. On this new link the main problem is the loss of end-of-record markers on dissemination files received.

G.-R. Hoffmann — This data record format problem is important, we need to find a solution. I understand also there has been a problem of differing terminal definitions between here and Paris making interactive use difficult.

HELLENIC NATIONAL METEOROLOGICAL SERVICE (HNMS)

COMPUTER CONFIGURATION

1. Mainframe

The HNMS uses as mainframe a Cyber 170/825 computer of 262 Kwords main memory. In total, the available on-line disk storage 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
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 calcomp plotter 1070 or by a graphical display tektronics 4010 and a serial graphical printer connected to it.

2. Telecommunication system

Two Cyber 18/20

OPERATING SYSTEM MSOS 5.0

COMPILERS: FORTRAN

TELECOMMUNICATION PACKAGE: MSS (ODSI).

One Cyber 18/20 is used for the telecommunication, and the other Cyber as a backup system and also for plotting.

The present computer system is shown in Fig. 1. Within 6 months the present telecommunication system Cyber 18/20 will be removed and will be replaced by a new telecommunication system (Fig. 2). The software has been developed in the Greek Meteorological Service, in a UNIX environment in C language. At present, the new telecommunication system is undergoing tests. It is connected parallel to the Cyber 18/20 and is used operationally for the GTS connection to Rome with a standard X.25 protocol.

3. Main projects using the ECMWF computers

a) Statistical programs using the ECMWF archives for local forecasting purposes and

b) test for running a LAM

c) MARS retrieval.

4. Plans

1. A mini computer will take over the telecommunication with ECMWF.
2. To get a workstation in UNIX environment to take over the graphics.
3. Enhance the Ethernet with the CDCNET.
4. Replacing the Cyber 170/825 with a new machine in UNIX environment.

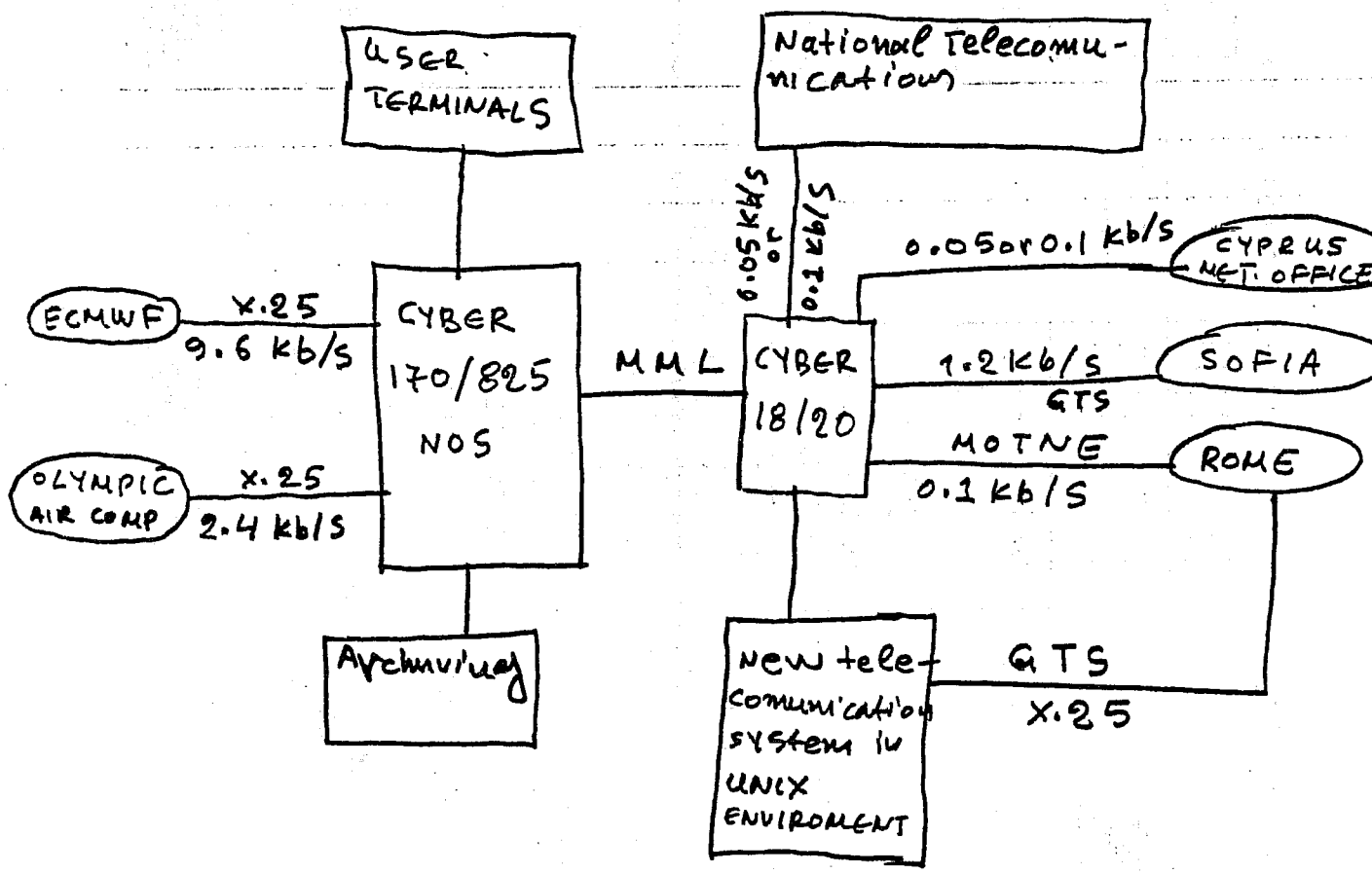
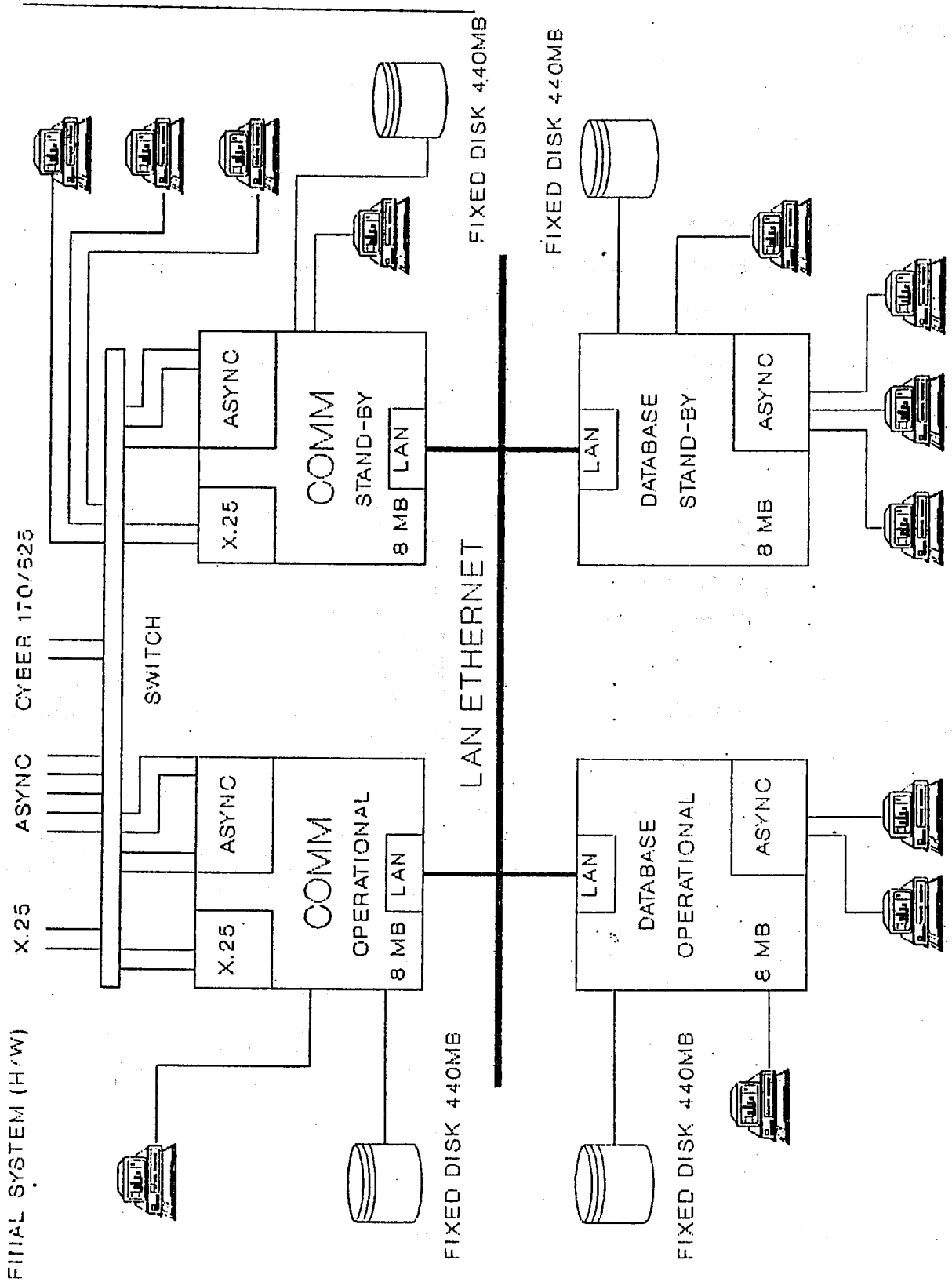


Fig. 1 Present Computer system

Fig. 1: Present computer system

GREECE

Fig. 2: New telecommunication system



Questions & comments (Greece)

G.-R. Hoffmann Who is doing the software for the Cirrus project?

G. Sakellarides This was done by a group of 10 military personnel who had had extensive computer experience elsewhere. The software has been developed now, and has been in test for the past 6 months.

J. Greenaway What graphical software do you use?

G. Sakellarides To plot model products, the old ECMWF graphical software (Contour Package). To plot observations, some software from Ocean Dynamics that runs on the Cyber 18/20. with the help of Ireland we have transferred that software to the Cyber 175 also.

Our future plans are to get workstations that will do graphics as well.

Use of ECMWF computer service by the Irish Meteorological Service

1. Computer Configuration

The computer configuration at the Irish Meteorological Service is shown in Fig. 1. A number of processors, including two VAX 11/780's, a MicroVAX 3100, a DEC 2060 and a MIPS workstation are connected together over Ethernet in a Local Area Network. The connection to ECMWF is a 9600 baud link via an X25 router.

2. Use of ECMWF Computers

1. A wide range of analysis and forecast products is received in the routine daily dissemination from ECMWF.

2. The MAGICS graphics package has been installed on the VAX 11/780 computers. While the MAGICS system is not at present used operationally, it has proved extremely useful in several 'once-off' studies. A sample plot of isotachs and wind arrows is shown in Fig. 2 - plots of this type have been used to investigate reports from pilots of en-route weather conditions.

3. The ECMWF computer facilities are occasionally used to produce wind trajectory plots - an example is shown in Fig. 3.

4. Ireland is a member of the HIRLAM project. Most development work is done on the MIPS workstation, using 'first guess' and boundary value fields retrieved from MARS. Some experiments are also run on the CRAY.

3. Future plans

We anticipate a large increase in the volume of data transmitted to Ireland from ECMWF in the coming years. This is due to a number of factors:

1. Increased requirement for forecast and analysis fields at model resolution to support the HIRLAM project.

2. Transmission of data in graphical meta-file format.

For these and other reasons it may be desirable to increase the capacity of the communications link between Ireland and the Centre.

IRELAND

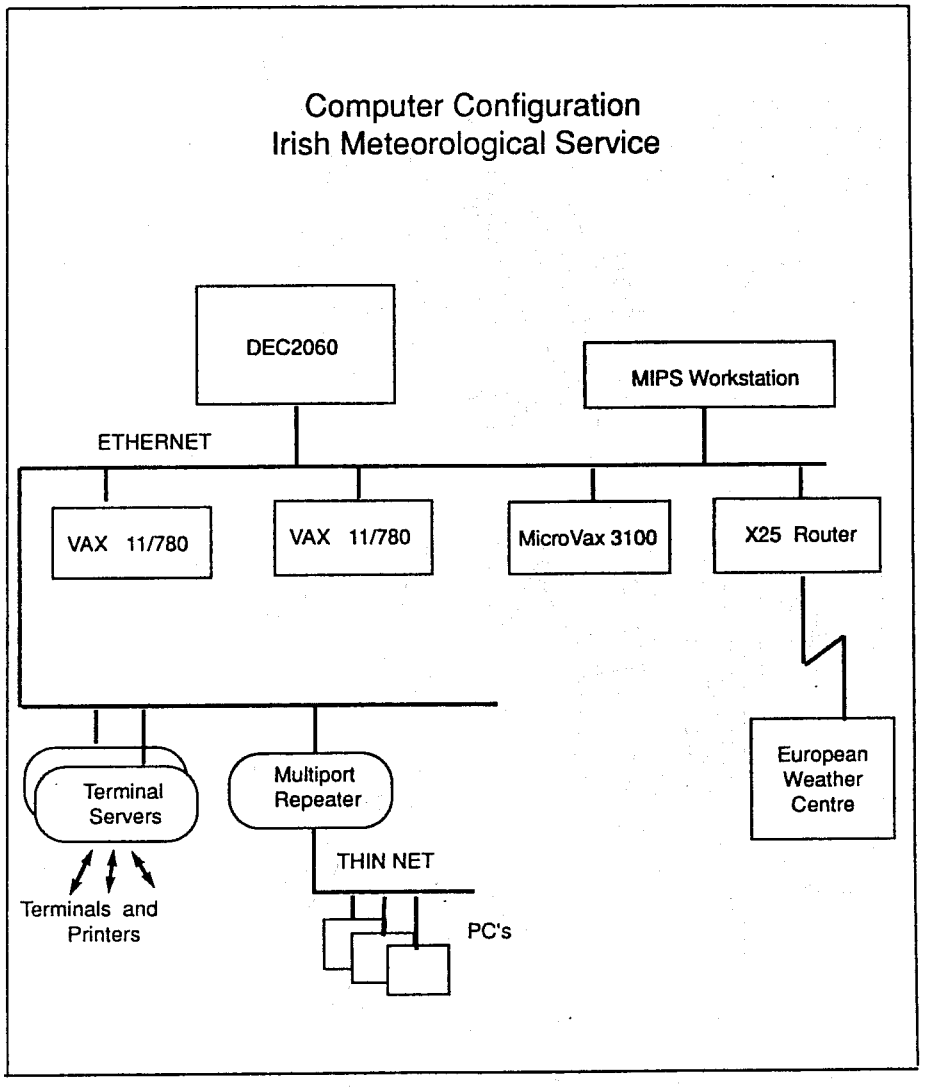


FIGURE 1

IRELAND

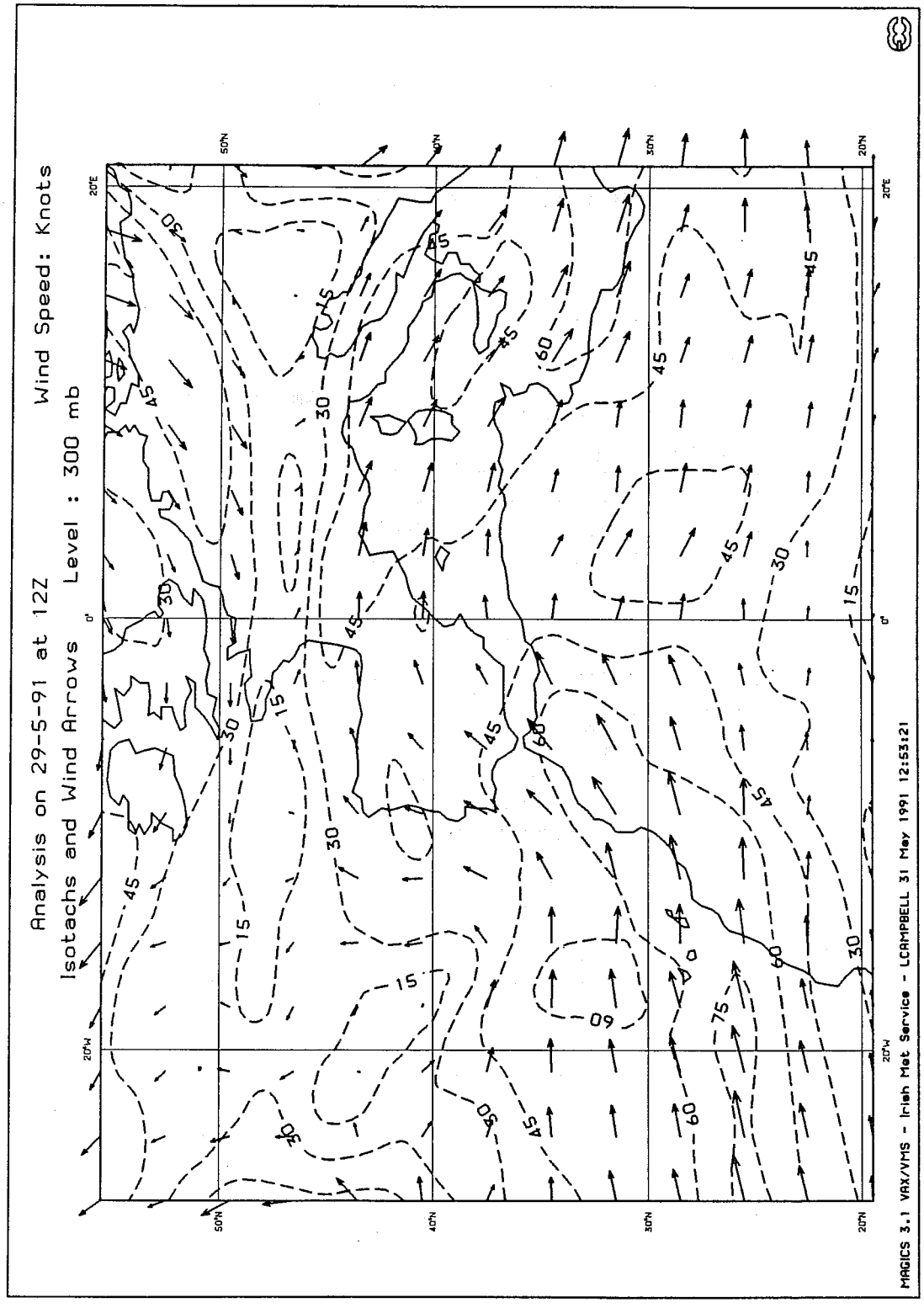


FIGURE 2

IRELAND

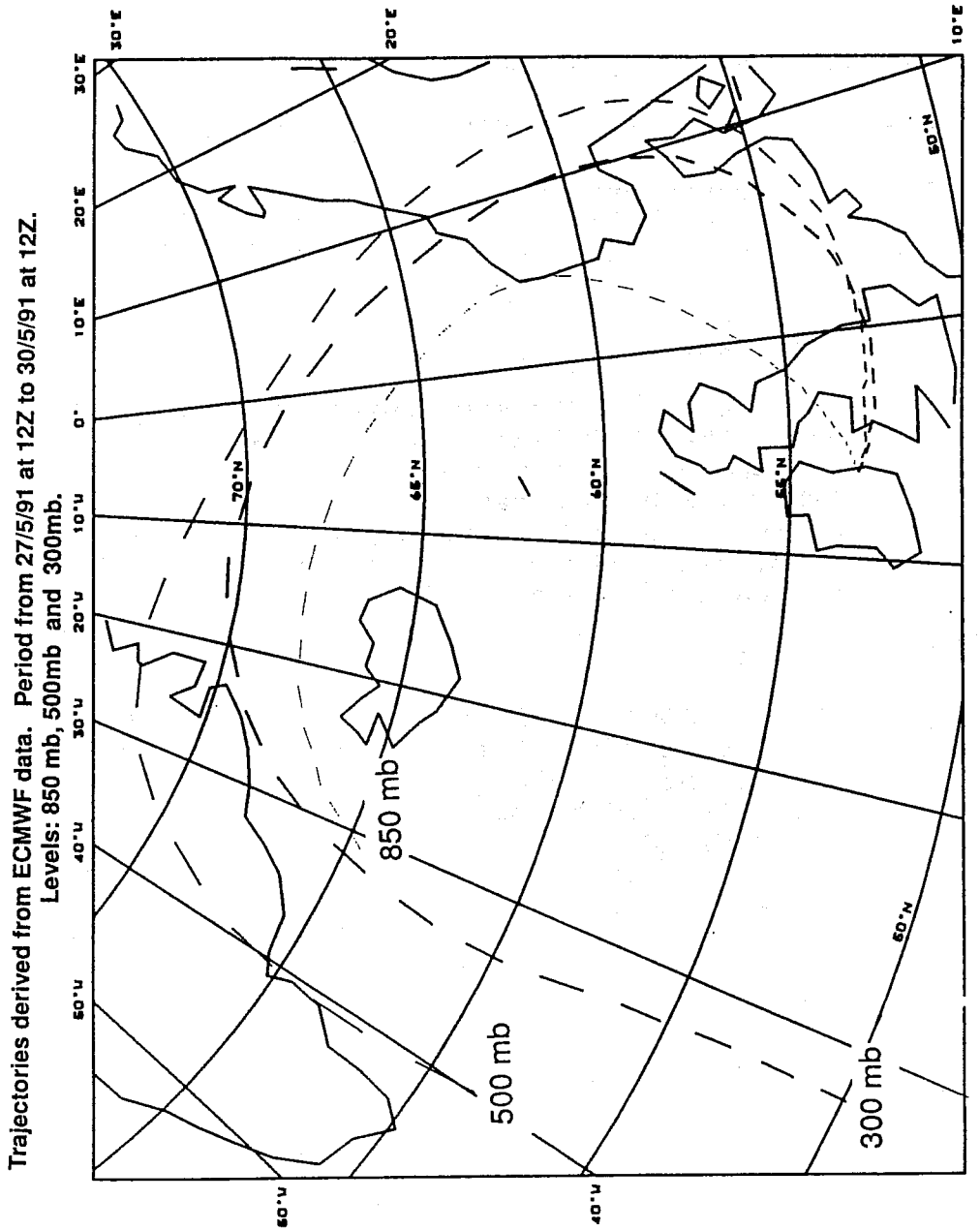


FIGURE 3

ITALY

ITALY - S. Pasquini

ITALIAN METEOROLOGICAL SERVICE

Computing representative: S. Pasquini.

I. Computer equipment and ECMWF connection.

The main components of the central computer system are shown in figures 1 and 2. From a functional point of view it can be divided in the following areas.

A. Front-end area.

It handles the telecommunications concerning both the WMO/GTS functions and the ICAO (MOTNE, AFTN) networks. It is based on two IBM S/1 minicomputers, one operational the other in standby. The system is able of a automatic switchover in case of failure. The software has been developed by IBM.

B. Host area.

The IBM 3090 12 E performs the operational work concerning the analisys and forecast model, post processing model, graphical applications and meteorological database. The IBM 4381 P 13 provides interactive service and it is used for research and development and as back-up.
In the near future the IBM 3090 will upgraded initially to a 3090 15 T and later to a dual processor system with vector facility.

C. Back-end area.

It deals with the access of remote users to the meteorological database and to the interactive graphical service.

D. VAX area.

It is based on two VAX 8250 and at the moment it handles the ECMWF connection with DECNET/NTS software and for software development. THe ECMWF link is now at 9600 bps but we are going to request the upgrading at 64000 bps mainly to support the national users interested in accessing the ECMWF

archives. In the near future the system will be used to support the DEC/GWDI telecommunications software to replace the IBM S/1 computers and software.

E. MDD area.

It deals with the dissemination of meteorological data via the Meteosat satellite mainly to African and Middle East countries.

F. Meteosat and Tiros area.

It deals with the reception of data and images from the meteorological satellites. Moreover the system, based on two microvax 3800 provides image animation and TOVS retrieval.

II. Projects, experience and plans.

Italian research users are particularly interested in accessing ECMWF archives. Last year we have established a computer link with the Research National Council and there are three more requests of connection pending.
The problems experienced are related to the possibility of delay or failure of operational data dissemination due to RJE activity. It could be useful to investigate how to make indipendent the two types of flow. Moreover the connected users often belong to wide computers networks so the security issue is increasingly important as far as the user support activity. Lastly I can mention the difficulties riported in updating the passwords by not well experienced users.

The plans of ECMWF usage mainly concern the testing of the high resolution forecast model and the development of the new postprocessing model.

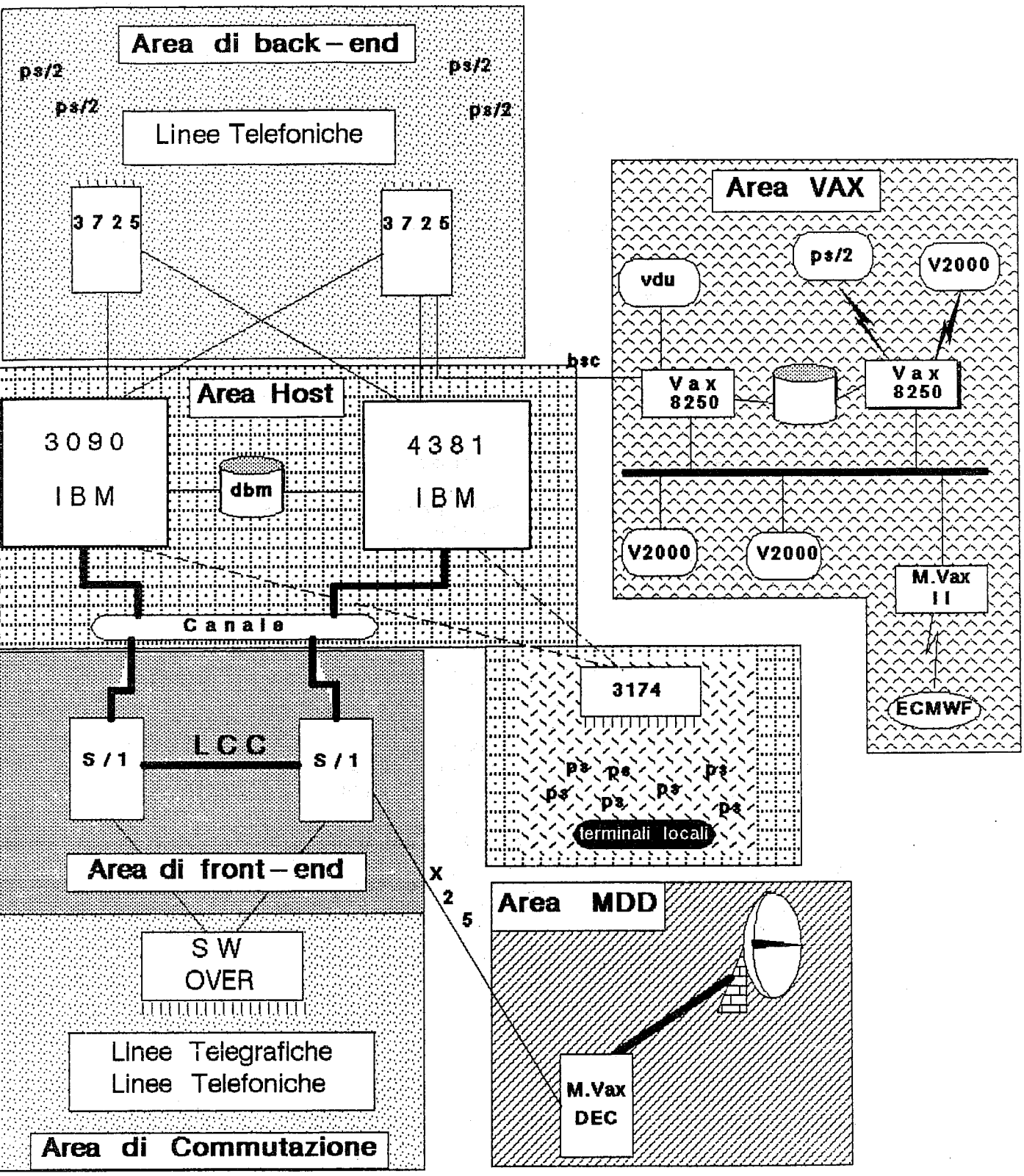


Fig. 1

AREE FUNZIONALI DEL CELD / CNMCA

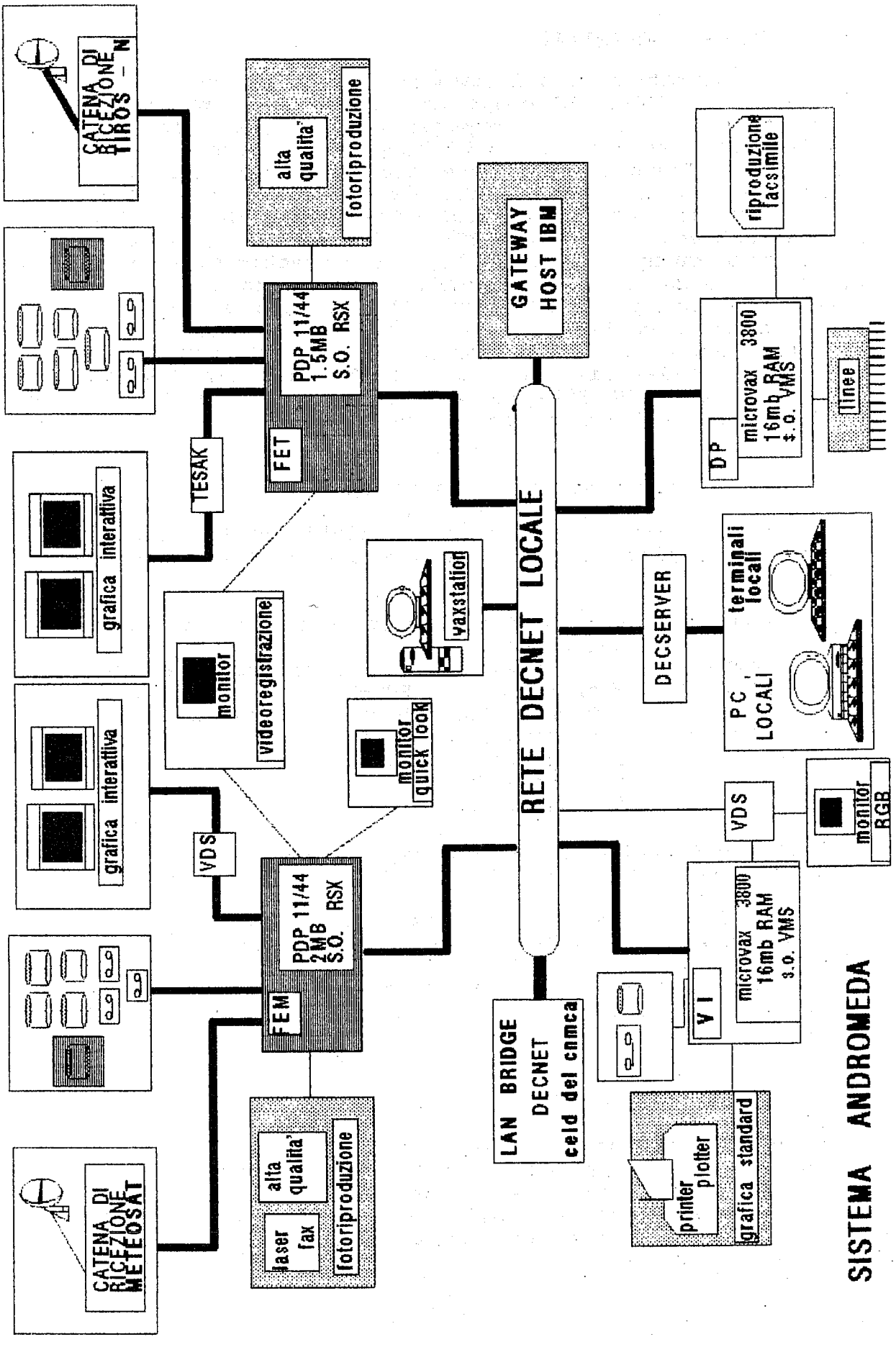

METEOSAT - TIROS AREA
CATENA DI RICEZIONE TIROS - N
CATENA DI RICEZIONE METEOSAT
alta qualita'
fotoriproduzione
laser
fax
alta qualita'
fotoriproduzione
PDP 11/44 1.5MB S.O. RSX
FET
PDP 11/44 2MB S.O. RSX
FEM
TESAK
VDS
VDS
grafica interattiva
grafica interattiva
monitor
videoregistrazione
monitor
quick look
vaxstation
RETE DECNET LOCALE
GATEWAY HOST IBM
LAN BRIDGE DECNET cedd del cnmca
DECSERVER
terminali locali
PC LOCALI
DP
microvax 3800 16mb RAM s.o. VMS
riproduzione facsimile
linee
VDS
monitor RGB
VI
microvax 3800 16mb RAM s.o. VMS
printer
plotter
grafica standard
SISTEMA ANDROMEDA

FIG. 2

The Netherlands

1. Computer Equipment

The migration of all computer production from the UNISYS A-series to CONVEX/VAX computers is still in progress. This means that our current computer configuration is a rather complex one with many types of computers, protocol converters and so on. Therefore only the parts relevant for the ECMWF connection are depicted in the added figure. The solid lines and blocks present the current situation with regard to the logical connection with the ECMWF. The dotted parts depict the firstcoming changes in these logical connections. Within a few month all dissemination products will be routed to the new Message Switching System which will in turn distribute these products at a bulletin level to internal (KNMI) as well as external users, e.g. Air Force. The direct transfer of X-files and J-files will be canceled. The user services will be expanded with a PC-File Server, running PCSA, which will be used for Remote Job Entry and so on.

2. Use of Computing Resources at ECMWF

In 1990 almost 80% of the available units were used by our users. Typical examples on the use of the computing resources are:

- NLOOEDDY eddy heat transport in the ocean (25% of the Dutch account)
- NLDMLAM development of a limited area model
- NLDMARCH retrieval of ECMWF archived fields for internal research and external use
- NLAUT computation of trajectories supporting the interpretation of air-borne air polution measurements and testing of the nuclear incidents procedure

Most of these applications will be continued in 1991. Projects with expected substantial use of resources in 1991 are:

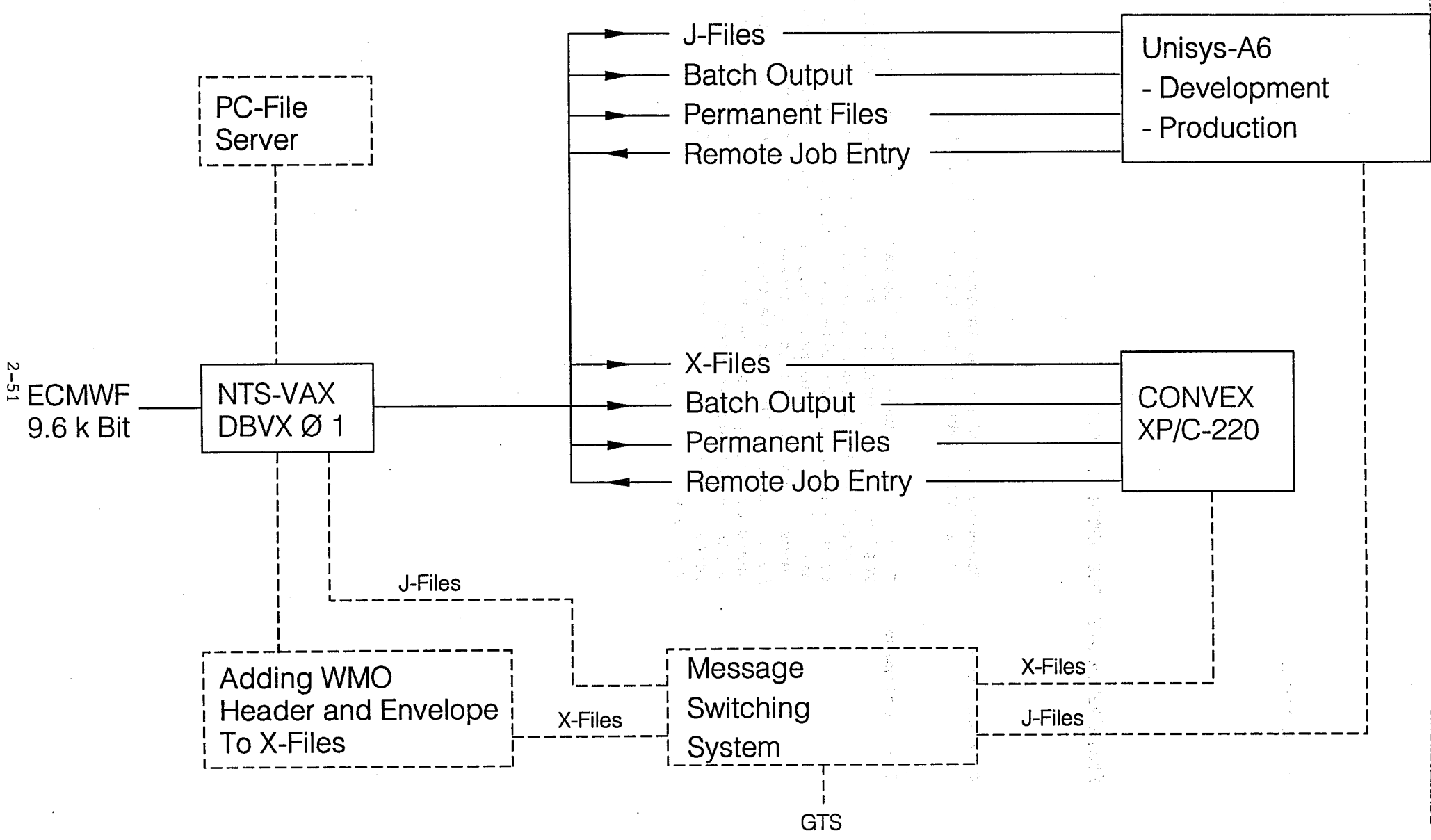
- NLDMWGAC modelling of atmospheric blocking
- NLGLOMAC EUROTRAC-project, Ozone transport

In the coming years we expect to use about 25% of our account in the Optional Programs on the Global Wave Model and the 00Z run.

3. Experience using ECMWF computers

Mostly the users are very statisfied with the troughput of the new YMP. This holds too for the current responsetimes of the system. However, small changes in the operating system or in standard programs still create a lot of confusion. Furthermore the current procedure for reactivating a user who has been deactivated is felt to be too timeconsuming and cumbersome.

Logical Connections With ECMWF



Questions & comments (Netherlands)

S. Kruizinga — Users would like more interactive control of their jobs on the Cray, what is the Centre's view about this?

G.-R. Hoffmann — Currently the users can interactively access VAX/VMS, NOS/VE and Cray UNICOS. The Cray is a vector machine bought for its processor power, and is not really suited to extensive interactive use. Currently, we see about 30 users logged on interactively at any one time and this seems to be ok. If it increases a lot, however, it could be a problem. We believe the Cray should be used for its computational power, and that interactive work should be offloaded to workstations. Using NFS files users can get access to data on either machine. We believe that is the way forward.

Rebecca Rudsar
DNMI, Oslo, Norway

May 1991

THE COMPUTING ENVIRONMENT AT DNMI

Computer Resources

Computers :

Tandem ext10
- dual CPU, 2 * 8 Mbyte
- dual disk system, 2 * 256 Mbyte

IBM 9370 model 90
- memory 16 Mbyte
- disk storage capacity 5 Gbyte
- 35 terminals / PCs

MicroVax 1
- memory 16 Mbyte
- disk storage capacity 456 Mbyte

MicroVax 2
- memory 16 Mbyte
- disk storage capacity 1.2 Gbyte

MicroVax 3
- memory 9 Mbyte
- disk storage capacity 140 Mbyte

Norsk Data (NORD) * 8
- total online disk storage capacity approx. 2 Gbyte (interchangeable disks)
- 70 terminals / PCs

Norsk Data (NORD) * 2
- situated at the forecasting departments at Bergen and Tromsø.

Workstations
- Silicon Graphics, Sun SPARC station, IBM RS6000

Networks :

Cosmos
- connecting NORD computers

Hyperchannel
- connecting Tandem, IBM 9370, a MicroVax and a NORD computer.

Ethernet
- connecting IBM 9370, a MicroVax and several workstations and PCs.

Graphical Devices :

- 2 Versatec electrostatic plotters
- Hewlett Packard pen plotters
- Laser printers

NORWAY

The Tandem ext10 computer was installed in spring 1989 and has been used for GTS communication since January '90. It has a dual CPU and disk system for backup purposes. All data is transferred to a NORD computer for decoding and further processing.

MicroVax 1 is used for communication with ECMWF. The telecommunication link has a speed of 9600 bps. The dissemination data, which is approx. 7Mbyte, is transferred to the IBM 9370. The data is then converted from GRIB format and stored in direct access files which form a Field Database.
It is also possible, should the IBM 9370 be unavailable, to transfer the dissemination data to the NORD computer system.

MicroVax 2 is connected to an IVAS workstation and runs the MISAT satellite system. The MISAT project is in its last phase and the system is to be installed in the Forecasting department in the near future.

MicroVax 3 is used for radar information. At present it is not connected to the rest of the system. A Nordic project group is evaluating the requirements necessary for the establishment of a network connecting radar stations in Norway, Sweden, Finland, Denmark and Iceland.

The IBM 9370 is connected via the University network to a CRAY X-MP situated at Trondheim. The CRAY X-MP has 2 processers, 16 MWord memory and 32 MWord Solidstate Storage Device. The telecommunication line has a theoretical speed of 2 Mbps. The TCP/IP protocol is used for data transfer.

The Norwegian Limited Area Model for Numerical Weather Prediction has been run on the CRAY since May 1990. Other compute intensive jobs such as the Maritime Prediction models for ocean waves and storm surge have been converted to run on the CRAY and will be executed as part of the operational suite in the very near future. All pre- and post- processing is performed on the IBM 9370.

All data products have previously been distributed to the forecasting centres at Bergen and Tromsø, and to the airports via the Cosmos network. Routers have now been installed at Bergen and Tromsø and the distribution process will use the TCP/IP protocol.

The NORD computers are the oldest part of the system and are gradually being replaced. Hopefully a new computer will be installed in autumn 1991. It's function will be to replace three of the NORD computers which at present contain the historical and online databases.

The final decision as to which computer will be installed has not yet been made. The specification of requirements emphasised that the computer should be capable of symmetric multiprocessing and that software should be based on standard products such as Unix, NFS, X-windows, Open/Motif and a commercial database.

ECMWF Products

Dissemination data received from ECMWF is, as mentioned before, converted from GRIB format and placed in our present fields database. The data is then accessible by the graphics package which has been developed at DNMI.

The data is also used

1) for general forecasting by the forecasting department.

2) as boundary values for the Norewegian limited area models.

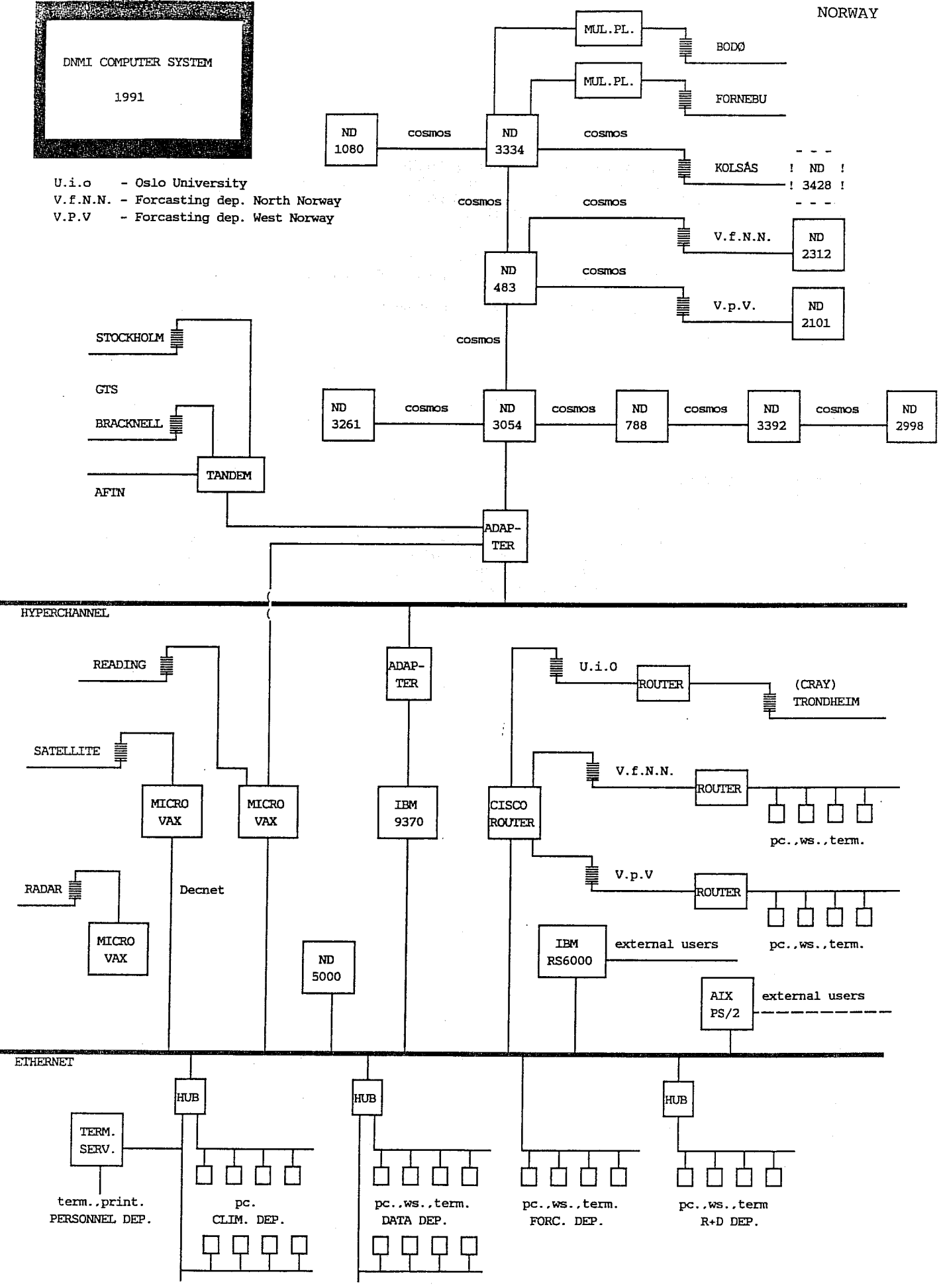
3) as backup for the Norwegian limited area models.

4) as input to the maritime and air pollution models.

Norway is a member of the HIRLAM project and the results of experiments run at ECMWF are transferred to DNMI for evaluation.

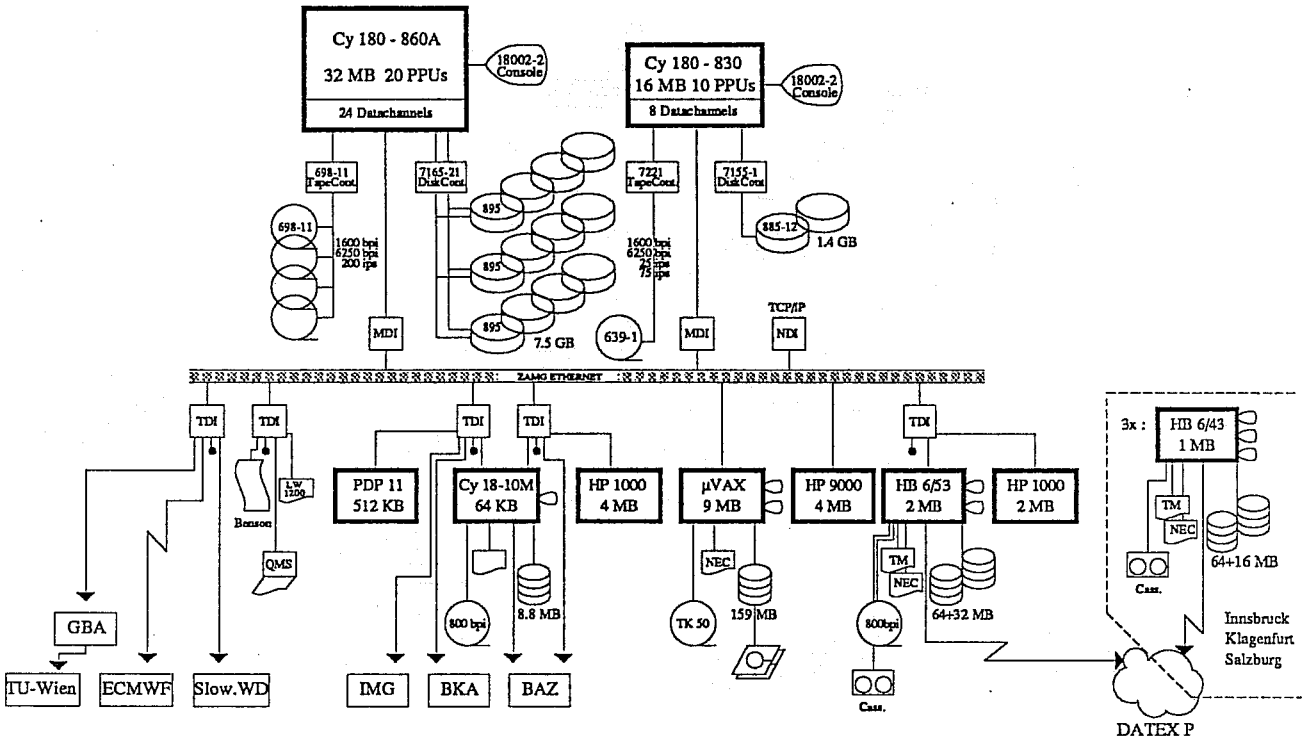
Planned Projects at ECMWF

Norway is one of nine countries which are involved in the Optional Wave Project. If approved by the Council in June, the intention is to run a wave model once daily. The project is planned to start in January 1992 and 5.3% of our allocated computer units will be designated.


NORWAY
DNMI COMPUTER SYSTEM
1991
U.i.o - Oslo University
V.f.N.N. - Forcasting dep. North Norway
V.P.V - Forcasting dep. West Norway
MUL.PL.
BODØ
MUL.PL.
FORNEBU
ND 1080
cosmos
ND 3334
cosmos
KOLSÅS
! ND 3428 !
cosmos
cosmos
V.f.N.N.
ND 2312
ND 483
cosmos
V.p.V.
ND 2101
cosmos
STOCKHOLM
GTS
BRACKNELL
AFIN
TANDEM
ND 3261
cosmos
ND 3054
cosmos
ND 788
cosmos
ND 3392
cosmos
ND 2998
ADAP-TER
HYPERCHANNEL
READING
SATELLITE
MICRO VAX
MICRO VAX
RADAR
MICRO VAX
Decnet
ADAP-TER
IBM 9370
ND 5000
U.i.O
ROUTER
(CRAY) TRONDHEIM
V.f.N.N.
ROUTER
pc.,ws.,term.
CISCO ROUTER
V.p.V
ROUTER
pc.,ws.,term.
IBM RS6000
external users
AIX PS/2
external users
ETHERNET
HUB
HUB
HUB
TERM. SERV.
term.,print.
PERSONNEL DEP.
pc.
CLIM. DEP.
pc.,ws.,term.
DATA DEP.
pc.,ws.,term.
FORC. DEP.
pc.,ws.,term
R+D DEP.

Central Institute for Meteorology and Geodynamics, Austria

a1.1) Computer equipment (Hardware / before september 1991)



• = Terminals, PCs, Printer

Vienna:

Local area network: TCP/IP and Control Data CDCNET
(Ethernet with 8 Communication devices (Motorola 68000 based)

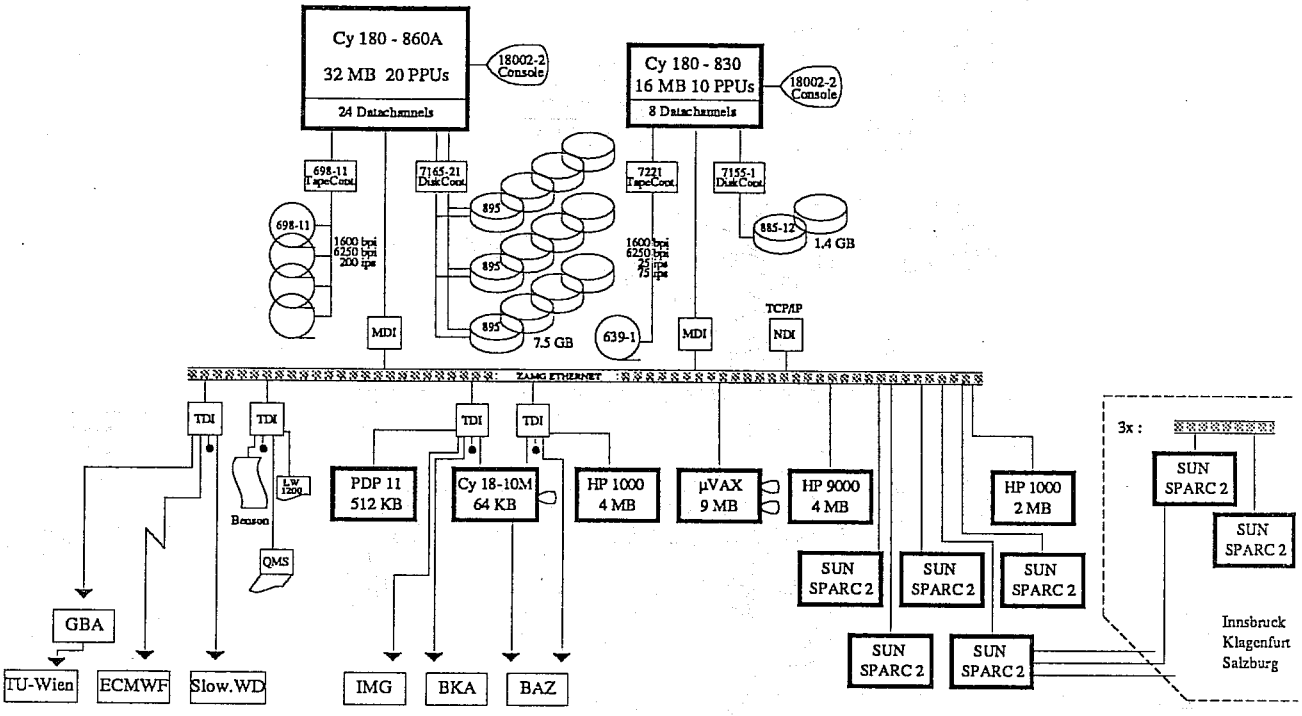
Cyber 180-860A (32 MB Centralmemory, 20 periph. processors)
895 Disk storage unit (7.5 billion bytes, 12 spindles)
698 Magnetic Tape Units (4 Units, 6250/1600 bpi, 200ips)
Cyber 180-830 (16 MB Centralmemory, 10 periph. processors)
885-12 Disk storage Unit (1.4 billion bytes, 2 spindles)
639-1 Magnetic Tape Unit (1 Unit, 6250/1600 bpi, 25/75 ips)
Cyber 18 - 10 M
Digital PDP 11/34
Hewlett Packard HP9000
2 Hewlett Packard HP1000
Digital Micro VAX II - VAXSTATION
Bull Mini 6/53 *(will be replaced)*

Salzburg, Innsbruck, Klagenfurt:

BULL Mini 6/43 (one in each branch office) *(will be replaced)*

Central Institute for Meteorology and Geodynamics, Austria

a1.2) Computer equipment (Hardware / after september 1991)



• = Terminals, PCs, Printer

Wide area network: Vienna - Klagenfurt - Salzburg - Innsbruck

Vienna:

Local area network: TCP/IP and Control Data CDCNET
(Ethernet with 8 Communication devices (Motorola 68000 based)

Cyber 180-860A (32 MB Centralmemory, 20 periph. processors)
895 Disk storage unit (7.5 billion bytes, 12 spindles)
698 Magnetic Tape Units (4 Units, 6250/1600 bpi, 200ips)
Cyber 180-830 (16 MB Centralmemory, 10 periph. processors)
885-12 Disk storage Unit (1.4 billion bytes, 2 spindles)
639-1 Magnetic Tape Unit (1 Unit, 6250/1600 bpi, 25/75 ips)
Cyber 18 - 10 M
Digital PDP 11/34
Hewlett Packard HP9000
2 Hewlett Packard HP1000
Digital Micro VAX II - VAXSTATION
5 Sun SPARCstation 2

Salzburg, Innsbruck, Klagenfurt:

Local area network: TCP/IP (connected to the network in Vienna via leased lines)

2 Sun SPARCstation 2 (in each branch office)

Central Institute for Meteorology and Geodynamics, Austria

Communicationlines, Terminals and I/O-equipment:

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
> 100 lines: (9600 bd - 38400 bd) Terminals, Personalcomputers, Printers,
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),
asyn. dial up: (2400 bd) - Slovenian weather service (Ljubljana),
X.25: (9600 bd) *3 - branch offices (Salzburg, Klagenfurt, Innsbruck),
DATEX-P: (9600 bd) connection - (public package switching network).

a2) Computer equipment (Software / after september 1991)

Cybers:	NOS/VE 1.5.3 (Operatingsystem)
	VX/VE 5.2.3 (Unix - Subsystem)
	Fortran, Pascal, C, Cybil(Cyber Implementation Language)
Cyber 18:	MSOS (Operatingsystem)
	Fortran
PDP/11:	RT11 (Operatingsystem)
	Assembler
HP 9000:	HP-UX (Unix-Operatingsystem)
	C, Fortran
HP 1000:	RTE-A (Operatingsystem)
	Assembler
VAXSTATION:	VMS 5.0 (Operatingsystem)
	Fortran
SPARCstations:	SunOS 4.1 (Unix-Operatingsystem)
	C, Fortran

a3) Computer equipment (Graphic Software / after september 1991)

Cybers:	GK-2000 Version 3 (GKS Level 2B)
	MAGICS
	Erlgraph
	Benslib
	Postscript
VAXSTATION:	Digital-GKS Level 2C
	GTS-GRAL GKS Level 2B
	MAGICS
	Postscript
SPARCstations:	Sun GKS
	MAGICS
	Sun Vision (Visualisation and imageprocessing software)

a4) Computer equipment (ECMWF - Link)

CDCNET: full X.25, 9600 bd (leased line - modem - TDI - CDCNET - Cyber)
NAM/VE Applications: FTP, EEP (developed from CDC Austria)
interactive facility, RJE, DD-file support, remote output support, PF support
DATEX-P: interactive access to the Cyber 962 and CRAY-Y/MP

Central Institute for Meteorology and Geodynamics, Austria

b1) 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
   - aequivalent 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, geographic areas and main pressure level) and transport of air pollution
(ZAMG, Slov.w.s)

QFA. The forecast of the weather for distinct points
(supply company, avelange forecast, traffic, news papers, broadcast and television, telephone, ...)

Model output data verification (27 synoptic stations)
T2m temperature, precipitation, cloudiness, humidity index, 1000 hPa wind

Central Institute for Meteorology and Geodynamics, Austria

b2) Special projects run at ECMWF

"Synoptic vertical heat fluxes: Comparison diagnosed versus modeled data"
(M.Hantel, Univ. Vienna Institute for Meteorology and Geophysics, Dept. for Theoretical Physics)

"Objective Verification of statistical local forecasts"
(M.Ehrendorfer, Univ. Vienna Institute for Meteorology and Geophysics, Dept. for Theoretical Physics)

C) Experience, suggestions and queries

- problems with the periodic change of the password
  'changing-job' timeout, dayfilemessages abstruse

- PREPEXP under UNICOS not possible
  Currently an interactive connection is being established to the ECMWF-CDCNET via Datex-P. This link should enhance the facilities to perform numerical experiments on the CRAY-Y/MP at ECMWF. However, it turns out that it is currently not possible to perform experiments using PREPEXP under UNICOS for special project investigators not located at ECMWF. It is hoped that this facility will be enabled soon for special project investigators which would ensure more efficient use of the computer time allocated to the relevant special projects.

D) Plans involving ECMWF usage

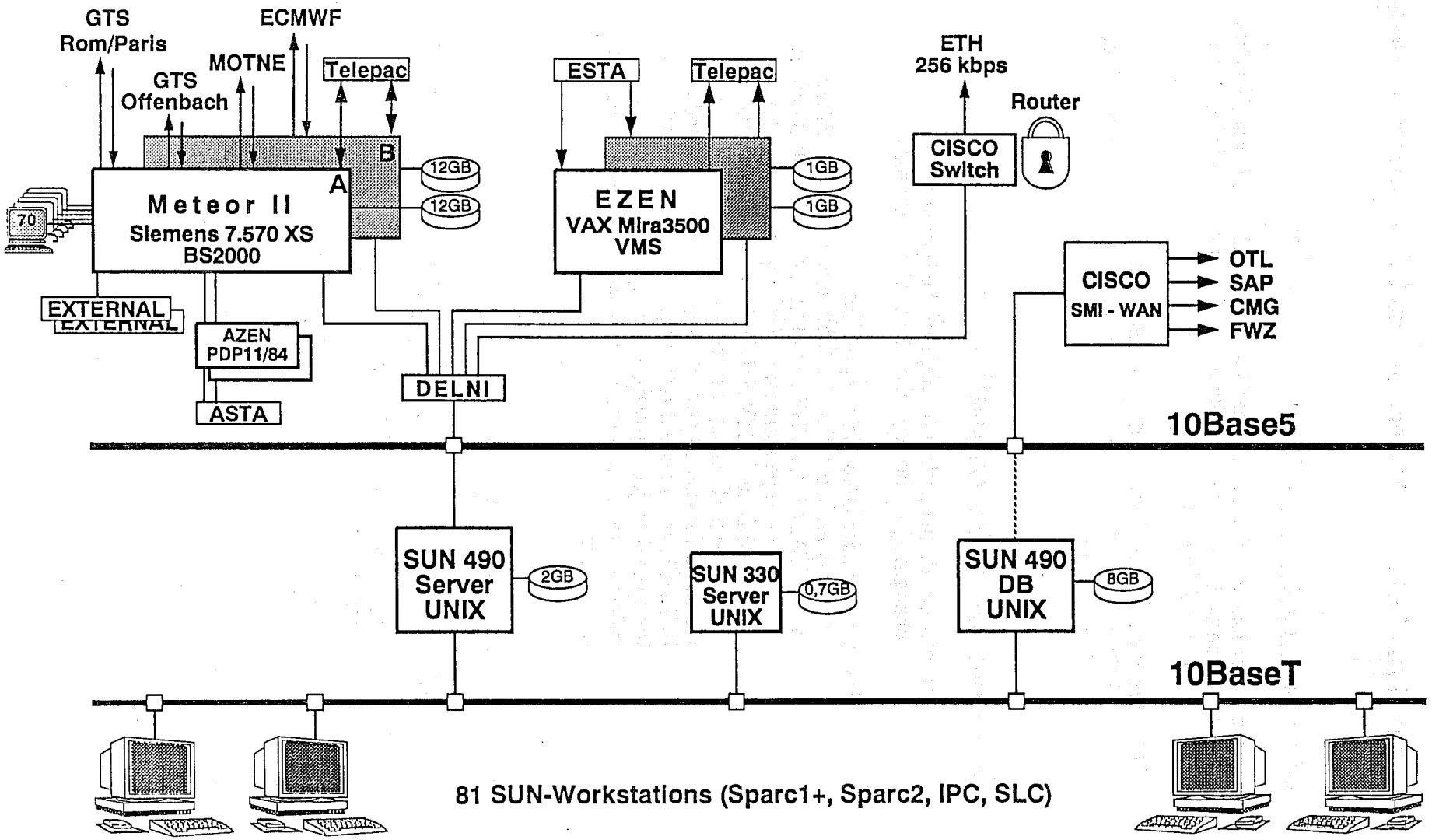
graphic representations on workstations (Sun / GKS, MAGICS, Sun Vision)

- representation of PIB and SIB data
- differences of datafields
- superposition of different data fields
- representation of graphic loops
- charts in METEOSAT - projection

participation in the project to produce 00 UTC forecasts at ECMWF

Schweizerische Meteorologische Anstalt
Institut suisse de météorologie
Istituto svizzero di meteorologia
Swiss Meteorological Institute

COMPUTER DIAGRAM SMI-LAN (APRIL 91)

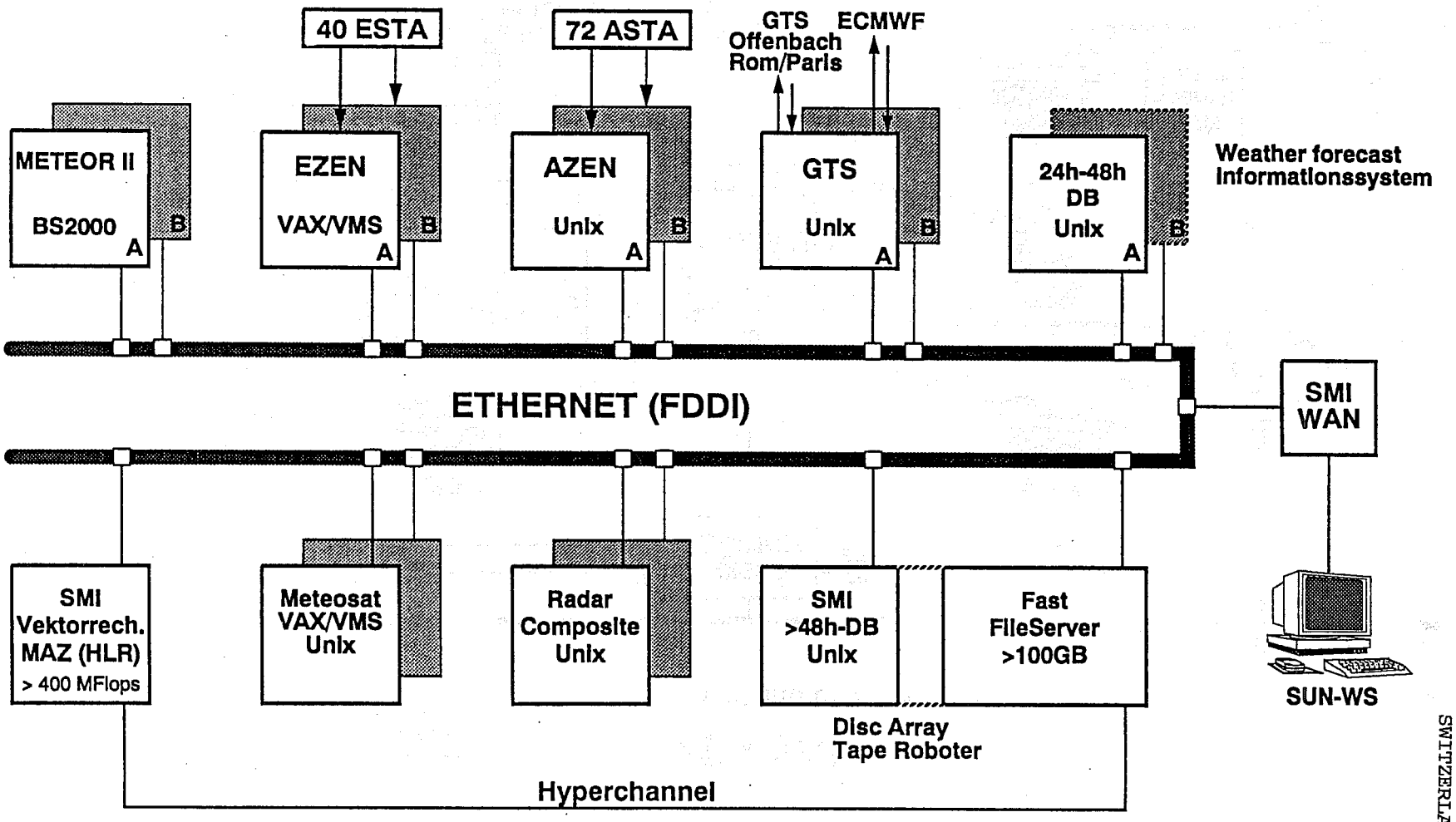


3.5.91 I-APE / ure I-SYB / Bz

SWITZERLAND

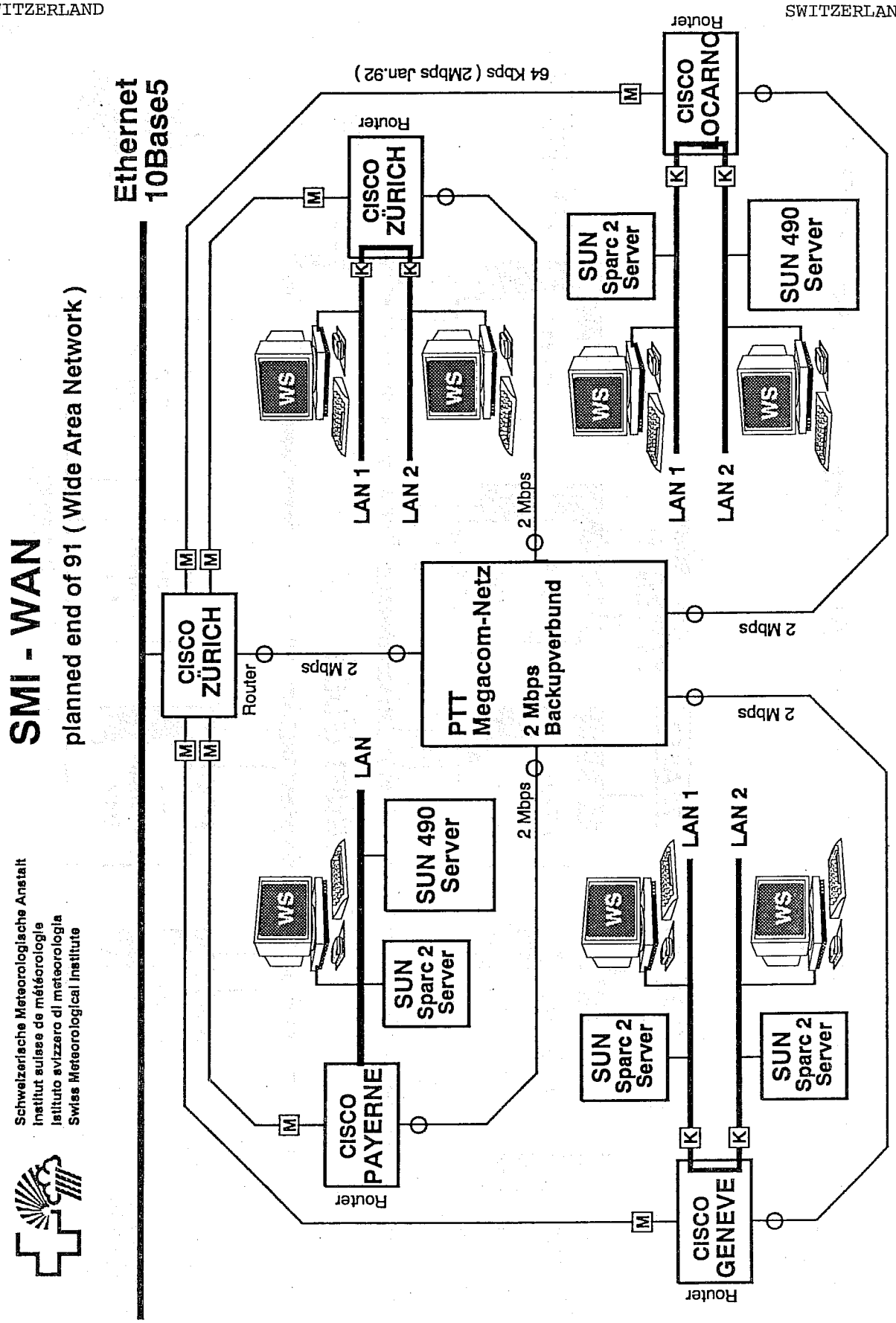
Schweizerische Meteorologische Anstalt
Institut suisse de météorologie
Istituto svizzero di meteorologia
Swiss Meteorological Institute

Plans for detachment METEOR II



SWITZERLAND

SWITZERLAND



3.5.91 I-APE / ure I-SYB / Bz

Questions & comments (Switzerland)

G. Sakellarides — Could you tell us more about your future plans to connect to ECMWF?

B. Bachofner — We plan for a 64 Kbps link running DECNET. Perhaps also access via a SUN workstation and an Internet link, but we still have to discuss this with the Centre.

G.-R. Hoffmann — On the diagram for Meteo 2 you show the SMI vector computer and the file server connection as Hyperchannel, is this a fixed plan or just an idea?

B. Bachofner — It is just an idea. It may well be changed to something else, e.g. FDDI.

FINLAND

Projects run at ECMWF

1 HIRLAM (High-resolution limited area model)

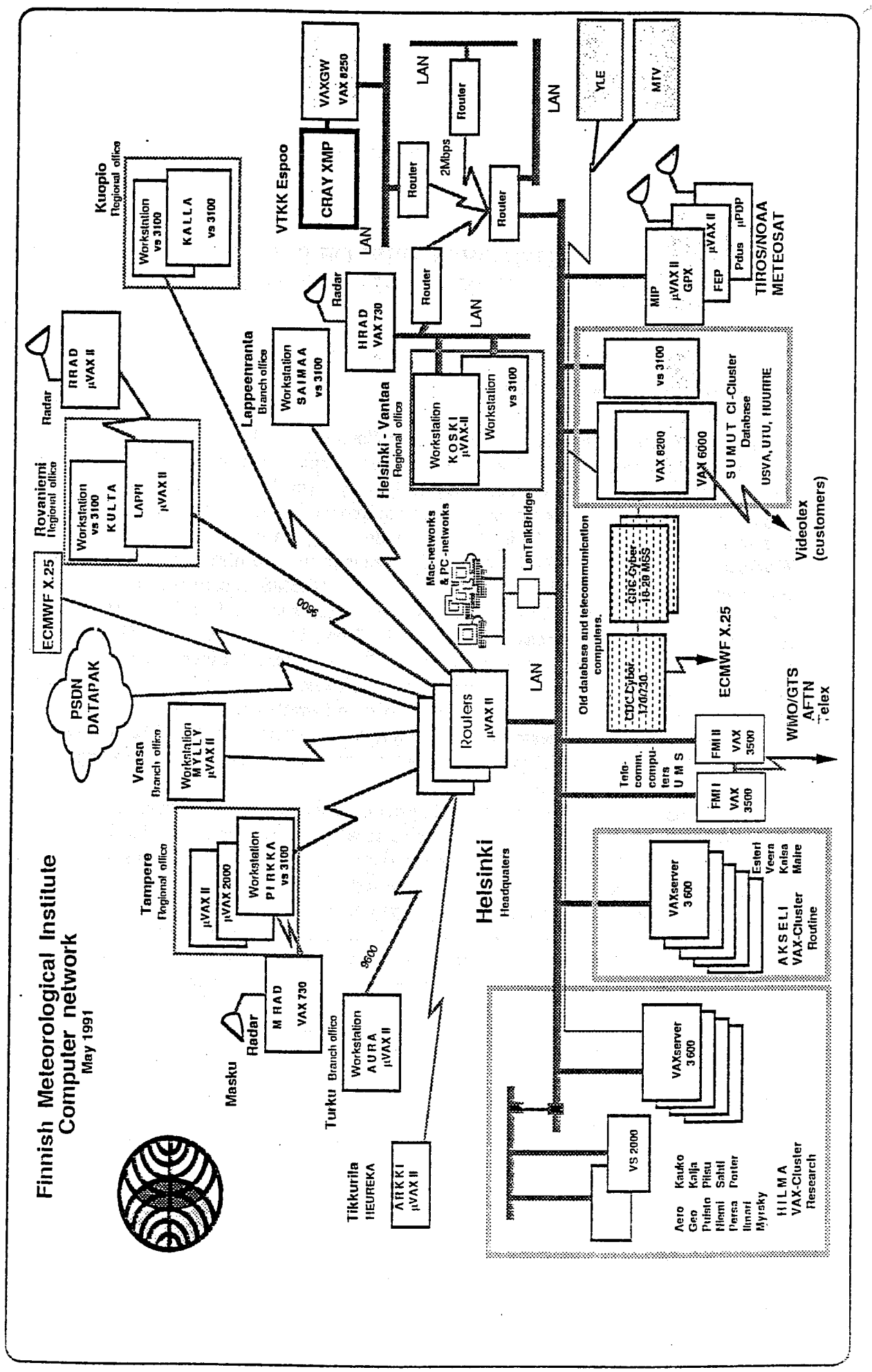
2 KNMI trajectory model

3 Propagation study
(the effects of atmosphere for satellite communication purposes)

4 Mesoscale modelling

5 Installation of ECMWF pre-processing system

6 MARS


Finnish Meteorological Institute
Computer network
May 1991
Helsinki
Headquarters
Routers µVAX II
LAN
PSDN DATAPAK
ECMWF X.25
9600
Vaasa
Branch office
Workstation MYLLY µVAX II
Tampere
Regional office
µVAX II
µVAX 2000
Workstation PIRKKA vs 3100
Masku
Radar
MRAD VAX 730
Turku
Branch office
Workstation AURA µVAX II
Tikkurila
METEREKA
ARKKI µVAX II
Rovaniemi
Regional office
Radar
RRAD µVAX II
Workstation vs 3100 KULTA
LAPPI µVAX II
Kuopio
Regional office
Workstation vs 3100
KALLA vs 3100
Lappeenranta
Branch office
Workstation SAIMAA vs 3100
Radar
HRAD VAX 730
Helsinki - Vantaa
Regional office
Workstation KOSKI µVAX-II
Workstation vs 3100
Router
LAN
VTKK Espoo
CRAY XMP
VAXGW VAX 8250
Router
2Mbps
Router
LAN
Mac-networks & PC -networks
LanTalkBridge
Old database and telecommunication computers.
CDC Cyber 170/730
CDC Cyber 180 MSS
ECMWF X.25
Tele-comm. comput-ers U M S
FMI VAX 3500
FMI II VAX 3500
WMO/GTS
AFTN
Telex
VAXserver 3600
Esterl Veera Kalsa Maire
AKSELI
VAX-Cluster
Routine
VAXserver 3600
VS 2000
Aero Kauko
Geo Kalja
Pulsio Pilsu
Ilmi Sahti
Persa Porter
Ilmari
Mynsky
HILMA
VAX-Cluster
Research
VAX 8200
VAX 6000
vs 3100
SUMUT CI-Cluster
Database
USVA, UTU, HUUTTE
Videotex
(customers)
MIP µVAX II GPX
FEP µVAX II
Pdus µPDP
TIROS/NOAA
METEOSAT
YLE
MTV

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 comprising of one VAX 6000/510 and one VAX 6000/410 with a total disk capacity of 14 Gbyte (in the near future to be extended to 17 Gbyte) and a variety of different supporting equipment. There is also a mixed interconnect Vax cluster (using ethernet). This cluster provides two µVaxs (3100 and 3300), two Workstation 2000 and six Workstation 3100 means to use the disk-system. As decnet node for communication with ECMWF there is a X25-Router (DEMSA) serving. There is also a Vax 4000/310 to serve the satellite receiving and processing system. This Vax-system also support two systems for regional forcasting. A µVax 3100 provides the means for distributing data to customers via modems located on a Decserver 200 on ethernet. Since last time SMHI has taken on the responsability for running the Swedish system connecting to the GTS. For this purpuse there is powerfull Tandem CLX740 system installed called Metcom as a replacement for the old Unisys based Atesto system. On site there is also a double HP2000 system mainly for data collection from GTS via a direct link to the Metcom system and plotting of observations in near real time.
At the regional centers there are µVax II 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 image-processing systems connected to the Vaxs. At teh regional centers there are also HP 1000 systems connected to GTS for reception and plotting of observations. There are presently four Vax systems supporting weather-radars, one in Norrköping, one in Stockholm, one in Göteborg and one on the island of Gotland. There is also a connection between Malmö and the Kastrup weather radar in the vicinity of Copenhagen. The plans call for three more weather radar systems to be installed within the foreseable future. All SMHI Vax systems are supported by local area networks (ethernet). 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 regional transport

- Aerodynamics and airpollution modelling

- Extraction of data for operational usage

- Hydrodynamic models

- Exergy in the atmosphere

- Trajectory studies

- Atmospheric chemistry

iii) Experience using ECMWF computers:

Usage of ECMWF computer resources for HIRLAM development.

The joint Nordic-Dutch-Irish HIRLAM system is now operational in Finland and Denmark on local supercomputers. In parallel with the routine operations, further development of the system is taking place on the ECMWF Cray Y-MP/8 system. The basic idea of using the ECMWF computer system for the HIRLAM work is to keep a "master" version of the system available for all group members. This master system, known as "HIRLAM-1" is used for research and development, and as a master copy for local installations, benchmarks etc.

The development work is carried out by group members in all the HIRLAM member states. For this, parts of the national resource allocations in the different countries, as well as allocations in a special project, are being utilized. Since the work is carried out by several group members in different countries, it is not possible to separate what work has been done under which account. Below the most important tasks worked on so far during 1991 are described.

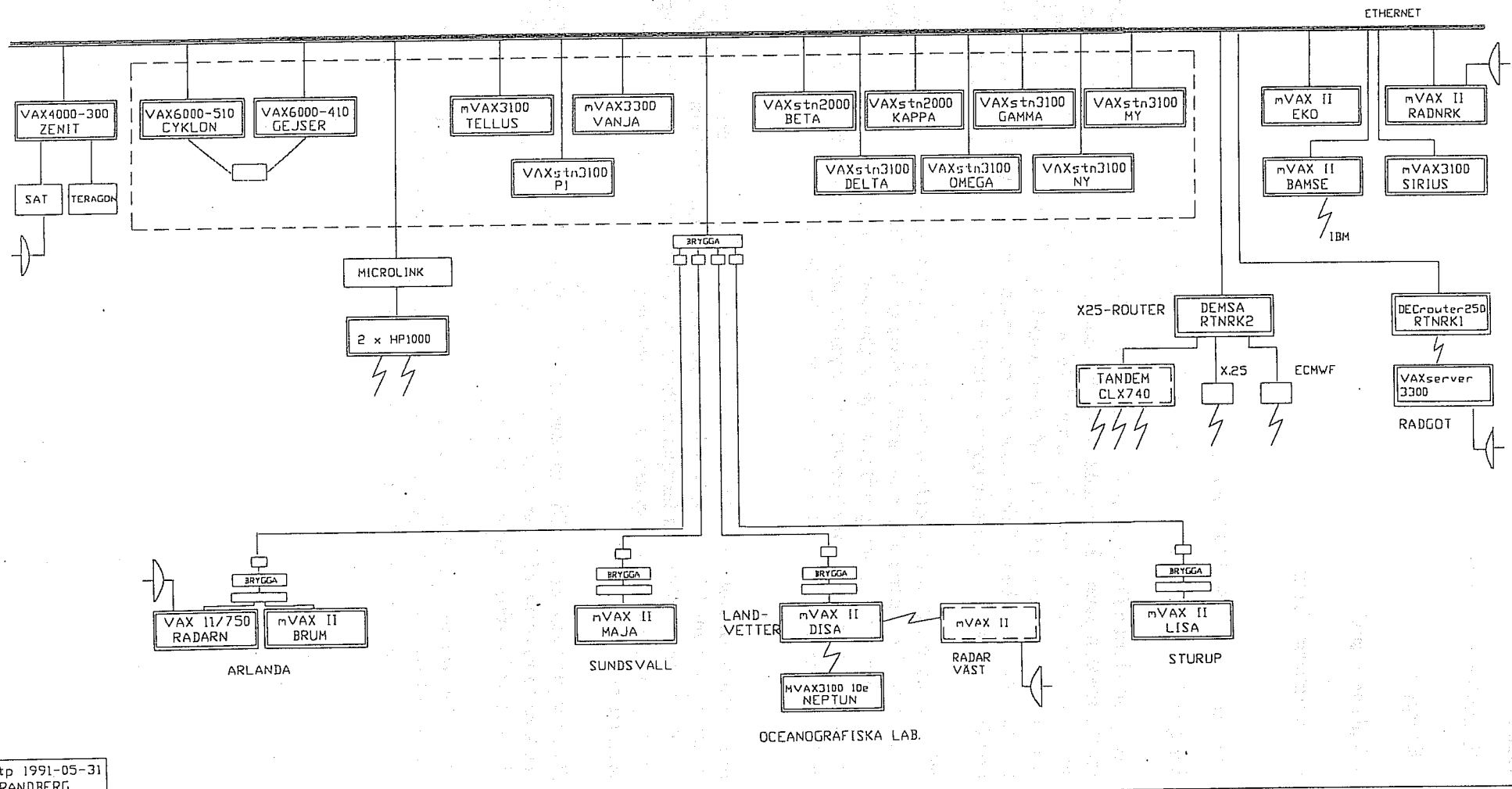
Migration to Unicos. With the transfer to Unicos, HIRLAM-1 had to be migrated to the new operating system. This work is being carried out by group members at KNMI. Problems in the VAX-Unicos interface has hampered the work severely and caused a lot of aggravation in the Dutch group. Parts of the system is now working, and experimentation with the full system can start anew.

Recoded forecast model. The forecast model, both the "dynamics" and the "physics" has been recoded to improve efficiency, modularity, parallelizability and readibility. The work is almost finished and testing is now in progress.

New formulations. Alternative formulations for the dynamics of the forecast model are being developed and tested. Semi-Lagrangean time integration techniques, both with two time-levels and three, are being tuned and evaluated. A spectral formulation on the limited area has been designed, coded and is now also being tested.

iv) Plans:

SMHI COMPUTER SYSTEM



SMHI/Tdtp 1991-05-31
ROLF STRANDBERG

2-70

SWEDEN

SWEDEN

Questions & comments (Sweden)

G.-R. Hoffmann I understand that SMHI is looking at expanding its computer facilities in order to run HIRLAM?

S. Orrhagen There has been a tender out for hardware to run the HIRLAM model. It is now being evaluated, a decision in perhaps a couple of weeks. This will be a joint project between SMHI and the military weather service. The equipment will not be located at SMHI.

UK METEOROLOGICAL OFFICE

A. Dickinson

Member States Computing Representatives' Meeting, 3-5th June, 1991

1. Computer equipment and connections to ECMWF

There have been several major changes to the computing environment at the Met Office over the past two years. As shown in Figure 1 the main computer system now consists of two 8 processor Cray Y-MPs with an Hitachi HDS EX100 (IBM compatible) mainframe acting as the front end. The first of the Crays is used for operational work and model development while the second Cray is used primarily for climate prediction studies.

The telecommunications computer system is shown in Figure 2. Links to ECMWF go via NETLINK which consists of 2 MicroVaxs, one acting as backup. NETLINK is a node on the Office-wide ethernet network known as CDN (Central Data Network). The line to ECMWF is currently rated at 64 Kbits/sec. Receipt of observational data and dissemination of products via the GTS is performed by the PHASE IV system. Along with Offenbach, the UK provides the connection between ECMWF and the GTS.

Batch job submission to ECMWF is done via menus from the Hitachi mainframe. Output may be browsed, printed or archived. Interactive access to the Centre's Cray or VAXs is potentially available from any workstation on the network, but this facility is currently restricted to use by the computing representative.

2. Projects, experience and plans

Many of our users are occasional and seem to have problems remembering their password or resetting it when it expires. Confusion can arise when there are problems with the link or delays in turn round of batch jobs. I would like to propose that computing representatives with interactive access be given the facility to reset passwords. This would take some of the load off the member state contact point and speed up the process of re-establishing user accounts. A second proposal is that a facility be developed to allow computing representatives with interactive access to view the status of all jobs from their country. The current *qstat* facility provided by UNICOS is inadequate in this respect. A more general facility covering queues on the telecommunications VAXes would be even more valuable.

In the past the non-standard Fortran used in programs written for the Cyber 205 and the low capacity of the link have prevented full usage of our allocation of resources. Now that we are hardware compatible with the Centre, the potential is there for greater use of these resources. Whether we are able to make full use of our allocation will depend on how quickly our own systems become saturated and the timing of upgrades by the respective centres.

UNITED KINGDOM

Many of the UK projects at ECMWF have fallen quiescent while new codes have been developed for our own Cray computer system. The main usage has probably been access of MARS data. Current UK projects are as follows:

1. FORECASTING RESEARCH
   Mesoscale dynamics

2. LONG RANGE FORECASTING
   Global modelling on the monthly timescale

3. STRATOSPHERIC MODELLING
   Modelling the dynamics of the upper atmosphere

4. DIAGNOSTIC STUDIES
   Diagnostics based on ECMWF analyses

UNITED KINGDOM

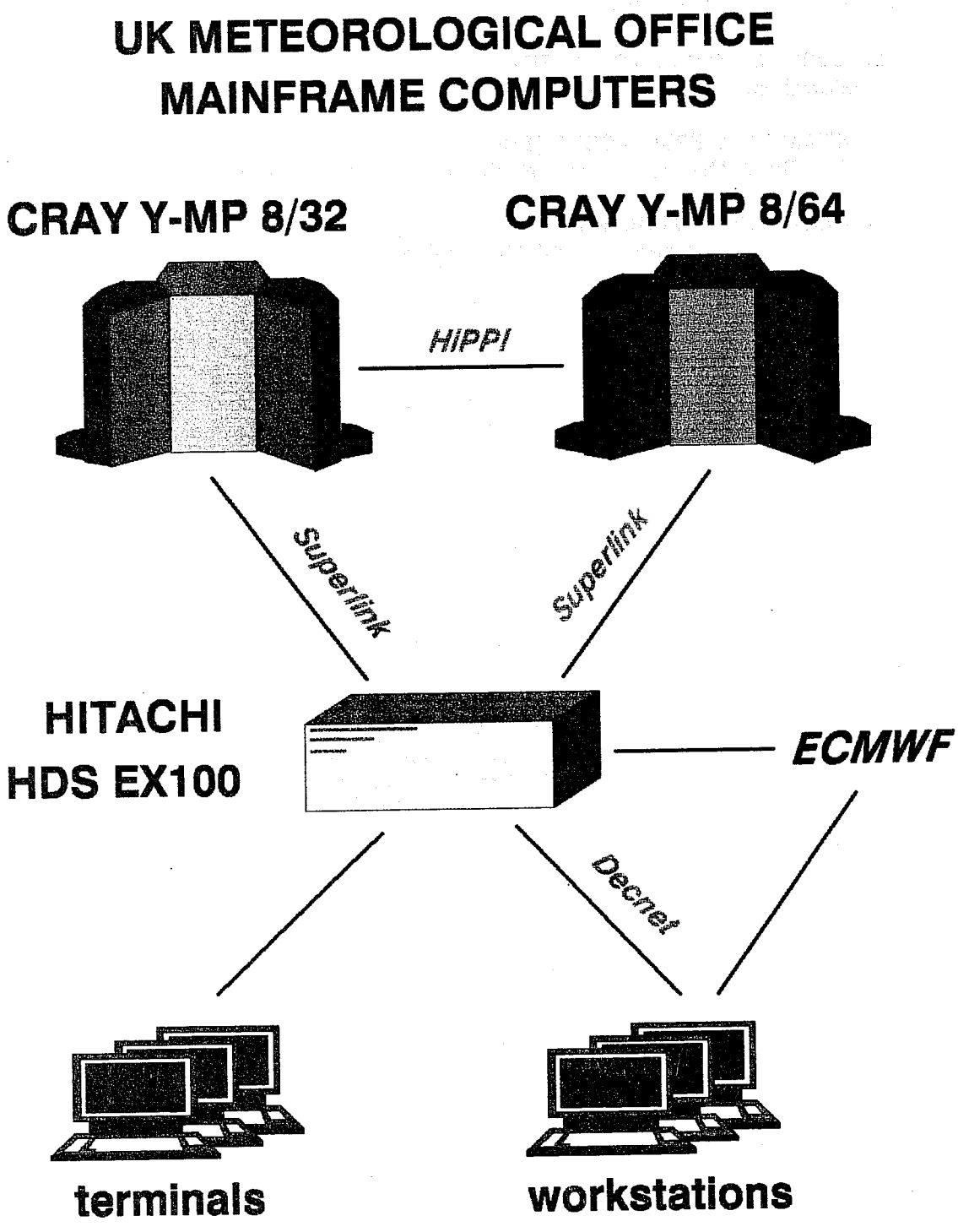
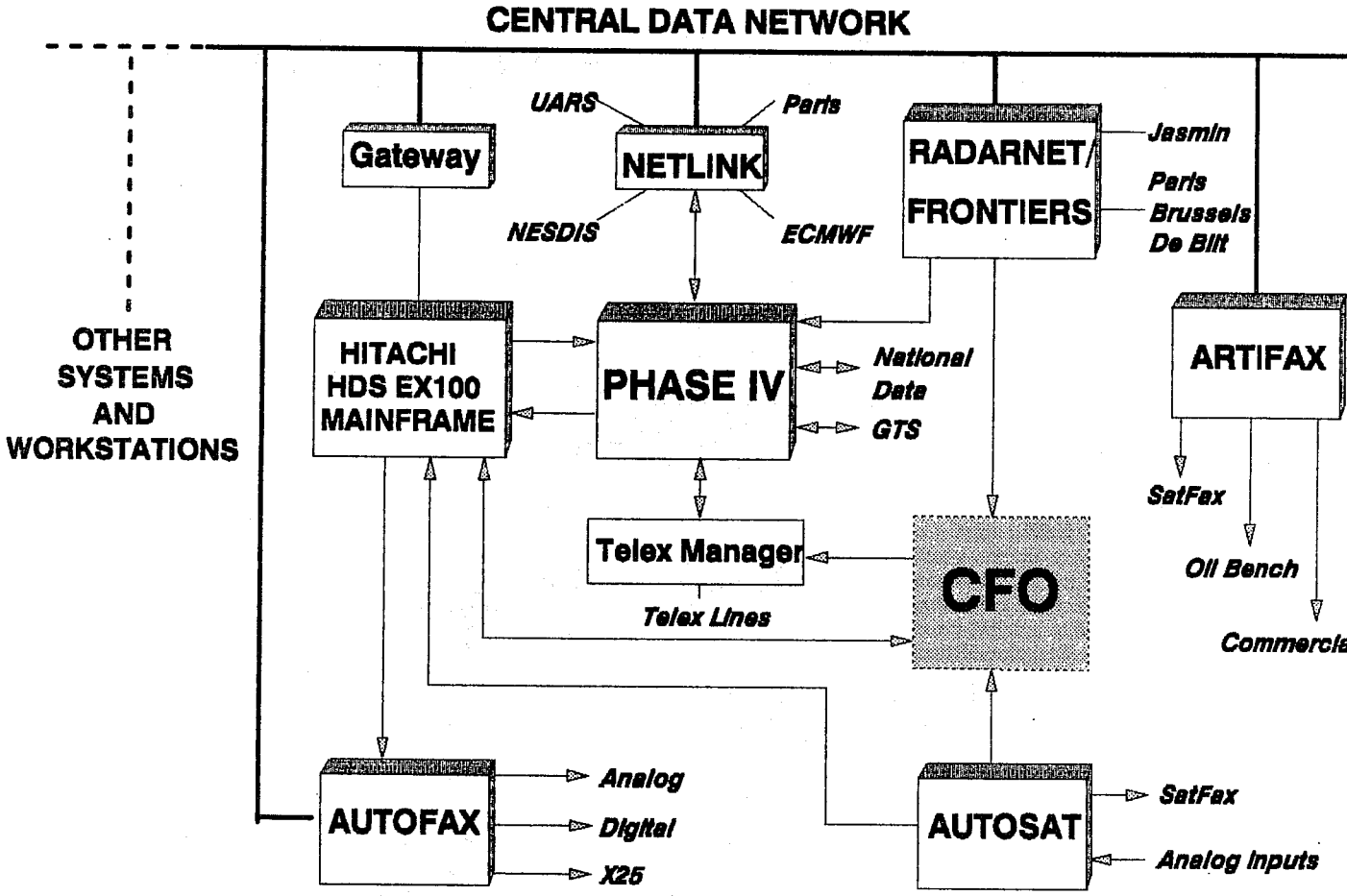


Figure 1

UNITED KINGDOM

UK METEOROLOGICAL OFFICE TELECOMMUNICATIONS COMPUTER SYSTEM



GATEWAY
2 x DEC MicroVAX
Interlink gateways to mainframe computer system
NETLINK
2 x DEC MicroVAX plus 2 x X25 router
Support of links to ECMWF and other centres using X25 and DECnet protocols
ARTIFAX
DEC MicroVAX plus PC fax gateways
Automated distribution of T4 code fax
PHASE IV
7 x Tandem TXP
Control of national and international data networks; specialised data handling
AUTOSAT
2 x DEC 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

BRACKNELL-ECMWF LINK

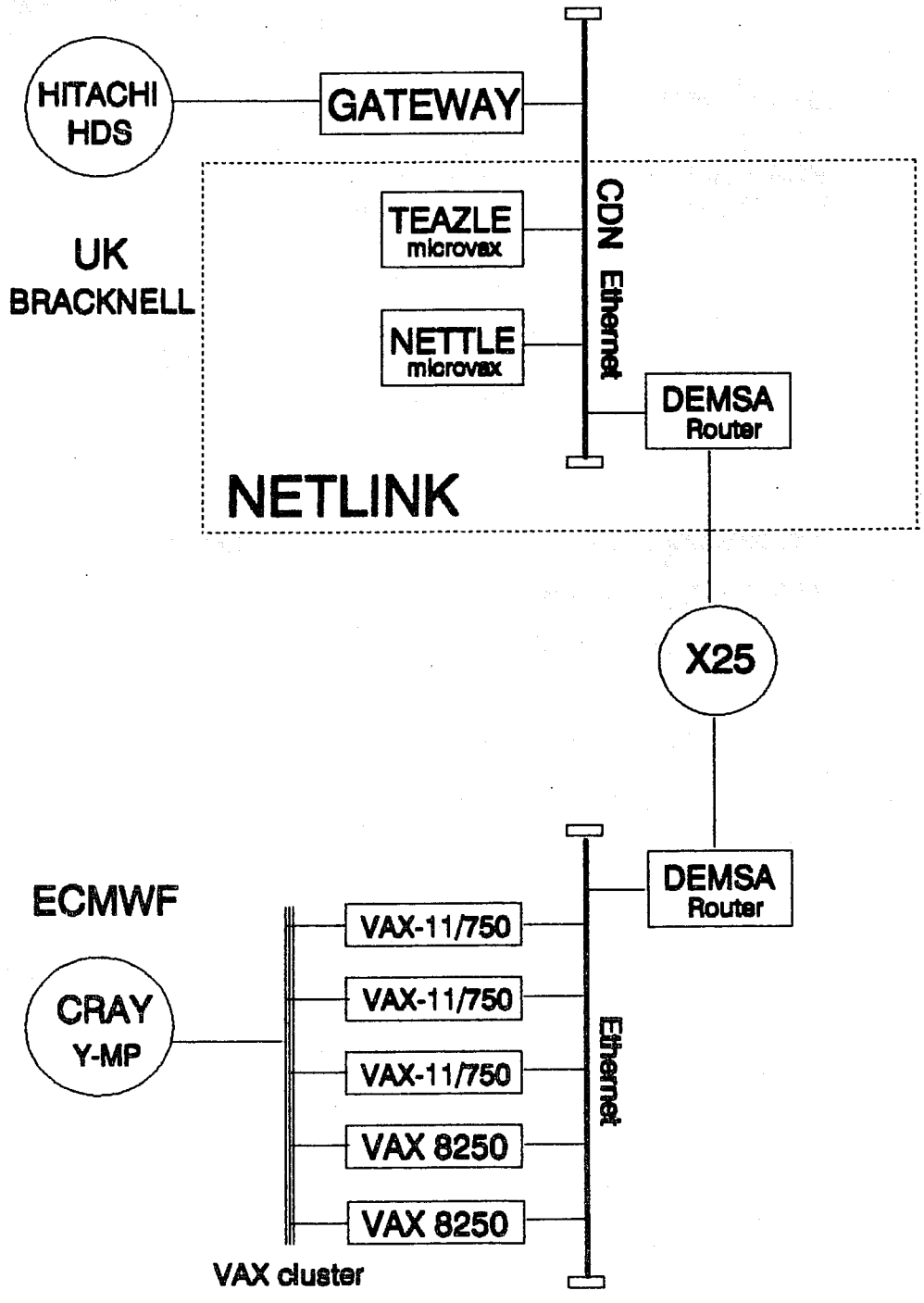


Figure 3.

Questions & comments (United Kingdom)

S. Pasquini — How are the fax handled automatically?

K. Robertson — Input is either digital or analogue. They are then sent out automatically according to a schedule, rather than by hand as it used to be done.

S. Pasquini — Who wrote the software?

S. Long — Most written in-house at the UKMO.

S. Pasquini — Does the Hitachi replace your previous IBM system?

K. Robertson — Yes, it went in without a problem.

S. Pasquini — How are the observations transferred from the GTS to ECMWF? Is the Hitachi involved?

S. Long — The incoming GTS data goes to the Tandem system and to the MicroVAX via an X.25 link, then via another X.25 link to ECMWF. The Hitachi is not involved at all.