FOURTH EGOWS MEETING

Offenbach
15 - 18 June 1993

Deutscher Wetterdienst
Offenbach

Report on the Fourth Meeting of the

European Group on Operational Meteorological Workstations

(EGOWS)

Offenbach, 15 - 18 June 1993

DWD
Deutscher Wetterdienst

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Foreword

The great number of participants at the 4. Meeting of the "European Group on Operational Meteorological Workstations" again shows the importance of the development of interactive graphical systems for the operational forecast service. We noticed with pleasure, that, apart from necessary technical requirements, meteorological topics became more and more important.

An extensive talk "Graphics Standards for Meteorological Workstations" was presented by Dr. Göbel of the "Fraunhofer Institute for Computer Graphics". The abstract is not included in this report, as all participants have already received a copy.

The abstracts of the talks are printed in chronological order. I would like to express my thanks to Mr. H.-J. Koppert for the preparation and chairing of the Meeting and to Ms. Habermehl and Mr. Mehley for taking care of the participants.

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Fourth Meeting of European Working Group
on Operational Meteorological Workstations (EGOWS)
15 - 18 June 1993
Deutscher Wetterdienst, Offenbach

TECHNICAL WORKSHOP ON GRAPHICS-STANDARDS PROGRAMMING

15th June

	10.00 a.m.	Welcome W. Kusch H.-J. Koppert (Chairman)	
	10.30 a.m.	first part of lecture on "Graphics Standards for Meteorological Workstations" by Dr. M. Goebel (Fraunhofer Institute for Computer Graphics)	
	12.00 a.m.	lunch	
	1.00 p.m.	second part of lecture on Graphics Standards	
	2.30 p.m.	Coffee Break	
	3.40 p.m.	J. Daabeck	ECMWF
	4.00 p.m.	G. Schmidt	DWD
Paper	4.20 p.m.	S. Haucke / Dr. Pusack	DWD
	4.40 p.m.	Coffee break	
	5.00 p.m.	discussion	

MAIN MEETING

	16th June	Presentations by EGOWS members contributions and discussion	
Paper	9.00 a.m.	Mr. Akeroyd / Mr. Trevelyan	UK - Meteorological office
Paper	9.45 a.m.	Mr. Beniçou / Mrs. Voidrot	FRANCE - Meteo France (with demonstration on SUN-workstation)
	10.30 a.m.	Coffee break	
		contributions and discussions:	
Paper	11.00 a.m.	Mr. Brock / Mr. Hansen	DENMARK - DMI (with demonstration on SUN-workstation/Apple Quadra)
	11.45 a.m.	lunch	

	1.00 p.m.	Mr. Christoffersen	NORWAY - Norwegian Meteorological Institute
	1.30 p.m.	Mr. Daabeck	ECMWF
	2.30 p.m.	Mr. Dahlén	SWEDEN - SMHI
	3.00 p.m.	Coffee break	
	3.45 p.m.	Mr. Gerard	BELGIUM - Institute Royal Meteorologique de Belgique
	Demo	DMI (Apple/Sun)	

Visiting of Analysis and Forecast Center (AVZ), Walk through Frankfurt

<u>17th June</u>

	9.00 a.m.	Mr. Göstl / Dr. Lipa	AUSTRIA - Zentralanstalt für Meteorologie und Geodynamik (with demonstration on SUN-workstation)
Paper	9.30 a.m.	Mr. Hamilton	IRELAND - Meteorological Service Department of Tourism and Transport
	10.00 a.m.	Coffee break	
	10.30 a.m.	Mr. Lemcke	THE NETHERLANDS - KNMI
Paper	11.00 a.m.	Mr. Niemelä	FINLAND - Finnish Meteorological Institute
Paper	11.40 a.m.	<u>Mr. Gemein</u> / Mr. Stroh	GERMANY - Amt für Wehrgeophysik (with demonstration on workstation)
	00.30 p.m.	lunch	
Paper	1.30 p.m.	Mr. Pogoda	GERMANY, Deutscher Wetterdienst (with demonstration on workstation)
	2.15 p.m.	Mr. Koppert	GERMANY, Deutscher Wetterdienst) (with demonstration on workstation)
	2.45 p.m.	Coffee break	

3.15 p.m.	Demonstrations on workstations	
	AWG (Germany)	(Apollo)
	DWD	(CDC)
	ZAMG	(Sun)
	METEO FRANCE	(Sun)

about
5.00 p.m. social evening

<u>18th june</u>

9.00 a.m. Final discussion

10.30 a.m. Coffee break

closing about 00.30 p.m.

Experiences with GKS at the German Weather Service

by Sibylle Haucke and Dr. Martin Pusack

Ladie(s) and gentlemen !

I belong to a team of five software developers in Potsdam. We are engaged in a project for the computer aided weather monitoring and forcasting in the regional offices, named meteorological application and presentation system MAP.
This system includes the recognition, storage, computation and representation of observation data. It is also provided with products of the central office at Offenbach, e.g. the output of the European Forcasting Modell (Europamodell) of the German Weather Service, and Satellite and Radar Image Data.

I want to report about our experiences in developing graphical presentation systems. At first something about the history.
There were first developments on PC-XT in 1988.
The Data Presentation System provides output (time series diagrams and surface weather charts) on screen, plotter and printer.
We used Turbo-Pascal under DOS and a GKS implementation of Robotron Dresden.
Since 1990 we have used PC 386/486 with SCO-UNIX and Silicon Graphics graphical workstations with IRIX. Now C is the standard programing language and we use a GKS implementation of GTSGRAL Darmstadt.
Since 1991 we are integrating all available software modules like AUTOTEMP - a temp evaluation program, IGS - an interactiv graphical system , SAT - a satellite picture presentation program.

I only want to speak about problems of graphical presentation of meteorological data and not about recognition, storage and so on.

The aim of the development from point of presentation is the presentation of various meteorological information together in a unique picture. A mindest possible range of combinations shall be placed at the users disposal.

At present the following is realized:
We have a presentation system with special routines for each kind of data, which are:
- observed synop data on surface weather charts
- GRID - based isolines can be added to these synop data
- time series of observations from meteorological stations
- aerological data on geographical background and on interactiv thermodynamic diagrams
- satellite images
- products of the IGS

Until now we have worked on PC with a VGA driver and on workstation with a

graphics library based driver for GKS .
Since some months we have collected experiences with a hardware independent driver for X11.

There are two essential questions, for which the developer must find a reasonable answer:
First: How can the user communicate with the system ?
Second: How to create a good design of data presentation with useful information for the operator ?

The answer to the first question is of decisive importance for the acceptance of the system by the user.
A user interface must be of nice appearence , it has to allow to reach data presentations with a small number of actions and must exclude operating errors.
Until short time ago we havn't had at hand a GKS implementation , working under OSF/Motif.
That´s why, at present the user has to make chooses from GKS-drawed motif-like menus via locator request.
GKS- involved fade in and fade out of the menus is very slow.
This is not the original task of the GKS graphic and will be substituted by an OSF/Motif surface.
Moreover because alfanumerical program modules shall be dealed, it would be stupid to do choices with GKS-drawed menus.

The only task of GKS should be the pure presentation and the produce of graphical output.
Only in this domains the capabilities of GKS (philosophy of Metafile and segment managment) has a powerful effect.

As user interface the OSF/Motif package , based on the X11 standard is a good choice.
At this the graphical output takes place in a DrawAreaWidget , which is inserted in the tree structure of the OSF/Motif application.
All generated graphical objects are stored as segments in WISS and if necessary they can be faded in or faded out or may be transformed.
So the output to printer, plotter or as Metafile is possible on a simple way with Copy Segment to Workstation.
All aspect source flags are set to individual.

We think, that a strict separation of user interface on the one hand and the graphical output on the other hand is the reasonablest solution for us for the next time.So the positiv facilities of GKS and OSF/Motif are used on the best way.

Now we have got a release of GKS- implementation, that runs under OSF/Motif.
We think, that the work on converting software to OSF/Motif and at same time the realization of combining several meteorological products will take much time.

Now I want to speak about some problems having appeared in the past and appearing at present.

1. While developing our software we had to pay attention, that the used GKS implementation was originally written in FORTRAN programming language.
Above all transportation of strings (for example in the GKS function Get Text) requires special arrangements like temporary storing. The result is a loss of performance.

2. More generally performance is an essential problem.
On our machines the graphical output is too slow. The causes are not clear. May be the hardware equipment is too poor or the GKS software does not use the graphic workstation capabilities optimally.
Test programs yet show considerable differences between GKS workstations of different types in our GKS implementation.
We wrote some test routines, wich work on principle in the same way :
They read the test configuration from a configuration file, written in ASCII format and consisting of workstation type, the number of test runs, the number of elements to draw, the output attributes. After this the drawing test starts.
The time between start and end of drawing was measured. The quotient "time difference per number of test runs" is a measure of drawing speed. All conditions and results of the test are stored in a text file.
Simple tests were made referring to the functions POLYLINE, CELL AREA and GET TEXT. Tests for the segment handling will follow.
A comparison between a GKS workstation with and without an X11 driver shows the following:
Considering the POLYLINE function the difference is small.
For GET TEXT the GKS workstation with X11 driver is faster with the factor of 6 to 17, depending on the text font and precision.
The CELL AREA speed differences are the highest. If the dimension in each direction is 100, the time factor is about 34. It grows rapidly with the cell area dimension.
Alltogether we can say, that the performance of an X11-driven GKS workstation is essentially better than another one. But also is true, that the control functions (like OPEN WORKSTATION) consume more time in relation to a
GL workstation. This happens normally only once or twices, so it's not important.
We will test other GKS implementations too, for example Xelion's S-GKS.

3. The program system runs under different conditions (for example on PC or graphical workstation). That's way the GKS Description Table and the Workstation Description Tables have different design. Further on GKS control functions have not the same effect on GKS workstations of different types.
Initializing data like GKS workstation type, deferral state, implicit regeneration mode or prompt-echo-types of locator devices from a configuration file allws an easy configuration of GKS.
As a matter of fact in that way parts of the description tables will be maked directly usable for the operator. It would be much easier, if the description tables themsefe were textfiles .

4. I want to remark, that comfortable working is possible only on a screen of at least 19 inch to match the amount of information.

5. For certain applications it is necessary to make a choice by graphical input in the GKS window. For example you have to choose a meteorological observation station or a certain area from a geographical map.
If the GKS application runs in an X11 window you have two ways to do this :
Either a locator request by GKS function gives GKS world coordinates or a mouse event request gives coordinates in the X11 window.
We don't now yet, wich way is more effectively.

6. In the future it will be always more important to represent graphical products of several sources together in one picture.
Because many products bring with them their output attributes too for the layout of the hole picture it is absolutely necessary to be careful, if you make entries in the GKS Description Table.
For example the design of the colour table is an important point. You cannot avoid changes, if you want to realize demands of users.
As a rule we do the following :
The first half of the colour table is kept fixed. We use this colours to represent static products like metafiles.
The second half can be changed in correlation to the actual wishes of users. You can use it to design graphic products on a dynamical way.
Concretely it means for reading a metafile :
If the GKS function GET ITEM TYPE FROM GKSM recognizes, that a change in a description table demanded, you have to prevent this. After READ ITEM FROM GKSM an own routine must substitute the function INTERPRETE ITEM.

7. It is important for us and today a matter of course , that a GKS implementation can also read and write Computer Graphics Metafiles and pixmaps. This is surely no problem, if the GKS runs under X.
The implementation used by us has functions to handle pixmaps. We intend to use them, when we represent satellite pictures. But at the moment we have yet no experiences with it.

Thank you for your attention.

1994

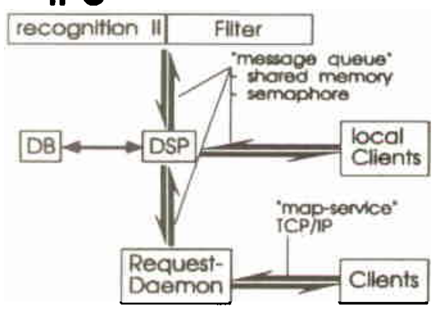
- spring
  - integration applications for climatology
- end
  - integration of RADAR and satellite pictures
  - automatic processing of products

1995

- spring
  - "AUTOTAF"
- summer
  - local models
  - statistical postprocessing

Thank you for your attention

IPC



Installed Computers March 1993

- AUTOTEMP-PC:
  - WÄ Berlin, Essen, Stuttgart, München, Nürnberg, Hannover, Bremen, Schleswig, Frankfurt, SWA Hamburg
- IGS-Workstations
  - SWA Hamburg, WA Frankfurt, Potsdam, Berlin, AVZ

Installations 1993

- RISC-PC
  - WÄ Freiburg, Trier, Dresden, Leipzig, Potsdam, Rostock, Weimar
  - FWW Saarbrücken
  - WDS Langen
- Workstations
  - WÄ Essen, München, Leipzig, Potsdam, Stuttgart, SWA Hamburg, WDS Langen

1992

- April
  - AUTOTEMP becomes operational
    - DataPresentationSystem
    - AUTOTEMP
    - C-ISAM-database
- November
  - operational test SWIS at Essen and Frankfurt
    - using OSF/Motif

1993 (1)

- February
  - extended versionen of DPSU and AUTOTEMP
    - DMO, GRID
  - Administrator's Toolbox
- spring/summer
  - decision which GKS will be used
  - new database

1993 (2)

- summer
  - full integration of SWIS
  - integration of STURMWARN
- autumn
  - full OSF/Motif-version
  - expansion of database
  - 1. version of "Mischpult"
  - weather monitoring

Meteorological Application and Presentation System (MAP)

a short description

Object Of The MAP Project

- to develop a system of meteorological applications to run in regional weather offices
- data sent by the central office will be
  - received
  - stored
  - processed
  - displayed for forecasting purposes

Roots + Reasons

- different applications as stand alone systems (IGS, AUTOTEMP) developed to run at the central office
- the need at the regional offices to have tools for their work

What We Are Doing

- integration of different systems
- combination of diifferent data
- automatation of every day's work
- standardization the user interface
- implementation new applications

Projects To Integrate

- DPS (in operation)
- IGS (in operation)
- WORKRVZ (in operation)
- AUTOTEMP (in operation)
- IGA_ZWV (in operation)
- RADAR
- MEDIEN

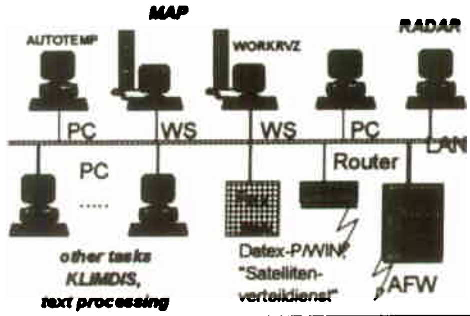
Communication

- AFW (in operation)
- FAX_E
- DWDNET

Parts Of MAP

- MAP/SWIS
  - in operation at Essen and Frankfurt since winter 1992/93
- MAP/STURMWARN
  - test will start at München in October 1993

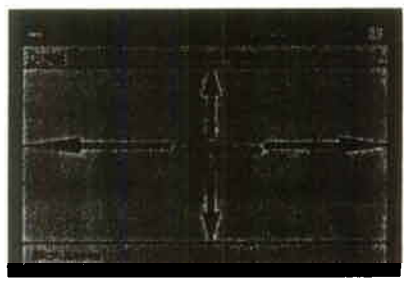
A Typical LAN



Programming Standards

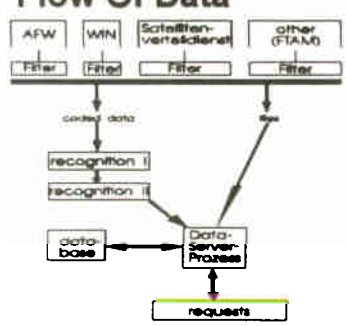
- UNIX
- TCP/IP
- ISO/OSI-protocols in future
- programming languages C und FORTRAN
- X-Windows
- OSF/Motif
- GKS

A MAP-Motif-Window



MAP-"Mischpult"

Flow Of Data



The HORACE Project

The separation of GUIs and Applications in software development within the HORCE project.

David Akeroyd
Systems Development Branch
The Met. Office
Bracknell
UK

1. Background.

1.1 Since the introduction of Graphical User Interfaces (GUIs), it has been common practice to incorporate the GUI within the code of the application. With the advent of the X Window System the application code has become a subordinate part of the code defining the GUI. The application code now comprising of modules that are executed when some form of user action takes place, such as clicking a mouse button when the cursor is over a widget. Whatever the case, the GUI and the application are bound together as one single executable task.

1.2 Before the HORACE project began, GUIs for operational systems within the Met. Office had been created using GKS type primitives. Each representation of a real control object such as a push button, toggle, slider etc. had to be constructed from scratch. Obviously the code that made up common devices such as these were incorporated into libraries for re-use by other software developers, but these home made devices were complicated, difficult to maintain and definitely none standard.

1.3 With the introduction of workstations into the Met. Office it was obvious that the best thing to do would be to use the native GUI standard, that of the X window System and in particular the Motif toolkit. Although this was a good idea in principle there were several disadvantages, particularly to the HORACE project.

- Even using the MOTIF toolkit, creating a GUI uses many more lines of code than even a home grown GUI.

- GUIs written using MOTIF generally require a good knowledge of the C programming language, and all our software developers use FORTRAN.

- There are many hundreds of person years of software already written in FORTRAN within the Met. Office, chart plotting and contouring packages for instance, which would be difficult to incorporate as subordinate modules of a C encoded MOTIF GUI.

1.4 The answer to the first problem was obvious, buy in a GUI builder package to alleviate the problem of having to hand encode the GUIs, leaving only the functionality (callbacks) to be developed.

1.5 This however still left the remaining problems of staff training and software re-use. It became apparent that it would be better to give a few people a greater depth of understanding of C and MOTIF and leave the application developers to work in FORTRAN. But how to incorporate the FORTRAN code of the application developers with the C and MOTIF code of the GUI , and what about the re-use problem. It became clear that the neatest solution would be to divorce the GUI from the application completely and have them run as two separate processes communicating with one another.

2. The advantages of the separation of GUIs from applications.

2.1 The GUI may be prototyped in isolation from the application, allowing potential users to try the look and feel of the application without the application being written, or only part written. This allows the developers to check that the software being developed will fulfil the functional requirement. This is facilitated by the use of a GUI builder but could be done without one.

2.2 Re-use of existing applications without major re-structuring. There are two ways of doing this, either add modules that can communicate with the GUI, or communicate with an existing application by the GUI sending data to and receiving data from the GUI as if the GUI were talking to a standard alphanumeric terminal using the Unix interprocess communication facility of pipes.

2.3 Splitting the GUI and application completely means that two developers can work in parallel but asynchronously, thus shortening the development elapse times.

2.4 Updates to X-windows and MOTIF only require the re-building of the GUIs with no impact on the application. Obviously the same applies if the application needs amending.

2.5 As previously stated, GUI expertise can be concentrated into a small team thereby giving them a greater depth of knowledge, rather than having it spread more thinly throughout the development team. This means that anything out of the ordinary is less likely to stall the development.

2.6 Development of the GUI by a small group of people makes for easier enforcement of consistency of the GUI across the project.

2.7 The fact that the GUI is separate and can be produced easily mean that so long as the underlying functionality of the GUI is unchanged then cosmetic changes to the GUI in response to user criticism can be easily achieved.

2.8 Allows more than one application per GUI if desired, see section 3.

2.9 Easing of the critical path, because parallel development is possible although both the application and the GUI must be finished before the functionality is satisfied. If one is finished before the other, it releases that developer to move on to other things.

3. Which should be the client and which the server?

3.1 During the analysis phase of a project, one attempts to model the functionality of the system and the data flows therein. This then leads on to the design of tasks to fulfil the required functionality. These task designs are then developed into applications. If the applications are to have GUIs then the GUIs must also be modelled in the designs, this works if the GUI and the application are one, but leads to very complex designs.

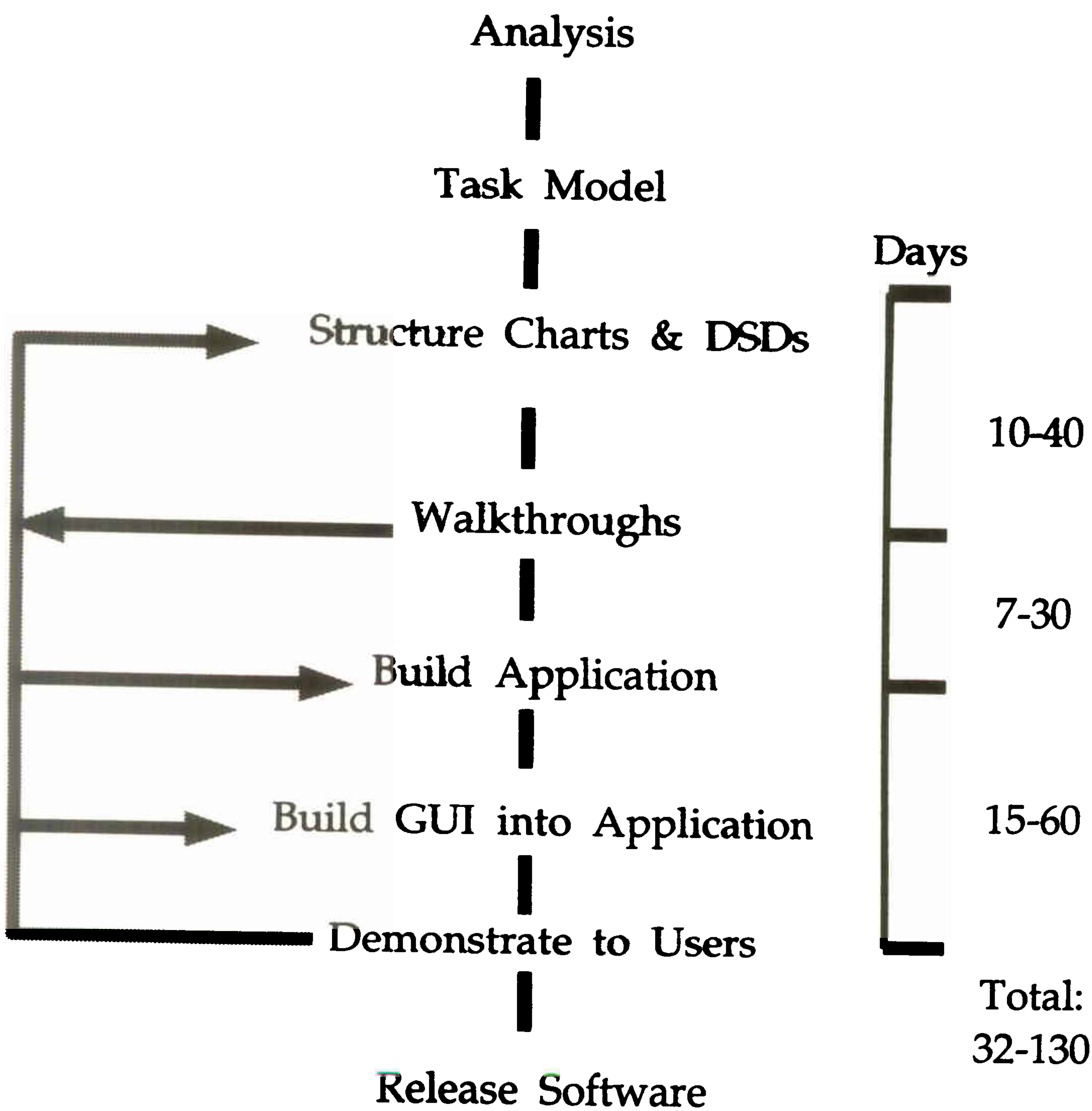
3.2 If the application and GUI are separated into two tasks within the design then these should be modelled separately, but just how do you model a GUI?. It soon became apparent that if you use a GUI builder then in fact you don't, you use the prototype GUI as the design, and with the builder used in the HORACE project this design can be documented. But what information do you use to design the prototype? Well if the application has been designed then its data flows into and out of the application are defined. These flows can be used as the basis for the design of the GUI, the GUI is then prototyped, checked against the analysis and demonstrated to the users. In this approach the application can be viewed as the client and the GUI as the server of the application.

3.3 This approach works but there are problems, the first is that although the prototype GUI can be checked without any functionality in place, the application has to be written before it can be checked. If the application is viewed in isolation from the GUI, then if the analysis and design are done correctly then the application should produce the required functionality, the problem is that as far as the user is concerned the application is driven by the GUI where as in fact using this approach the GUI is driven by the requirements of the application, it soon becomes obvious that there is conflict here and this can only be resolved when the GUI and application are hooked together. If this produces difficulties then it may be that either the GUI or the application or both have to be altered.

3.4 The solution to this would appear to lie in the fact that the use of MOTIF means that the application is naturally subordinate to the GUI, thus it is the GUI that is the client whos request for functionality is served by the application. In this method the GUI is prototyped, using the GUI builder, before the application is designed. This can then be checked against the analysis and demonstrated to the users. If this checks out then data flows from the GUI to the application can be specified and the application designed to satisfy the demand of the GUI. The GUI can now be built and the application developers can go ahead and design and build the application. When they are linked together there should be less conflict as the application is now satisfy the requirements of the GUI and hence the user. The chances of either of them, particularly the GUI, being in need of amendment are significantly reduced.

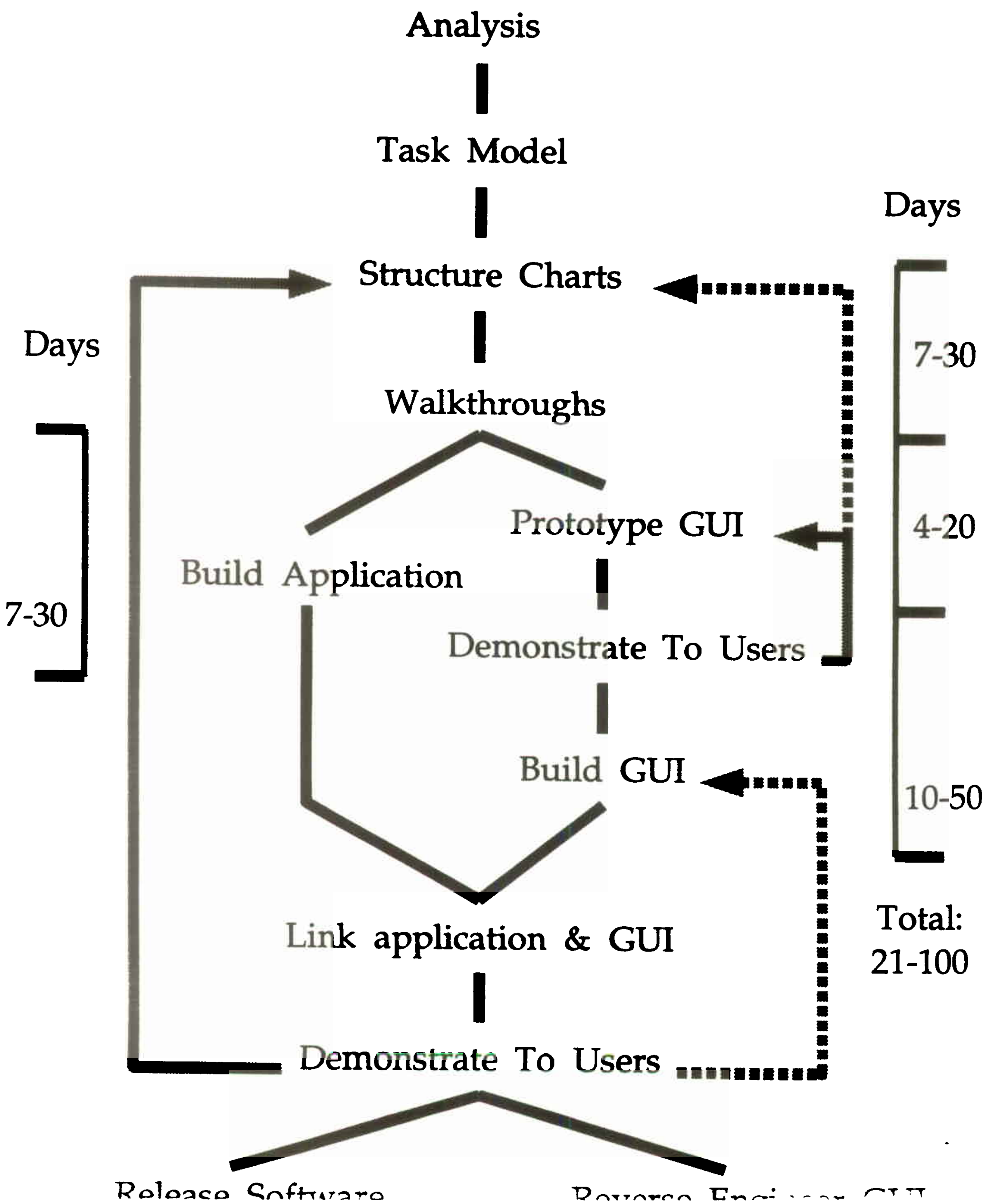
3.5 Making the application the client makes it easier to identify where it would be useful to have more than one application per GUI.

"Classical" method of software production
(not using a GUI Builder)



Client/Server approach, application as client

(using a GUI builder)



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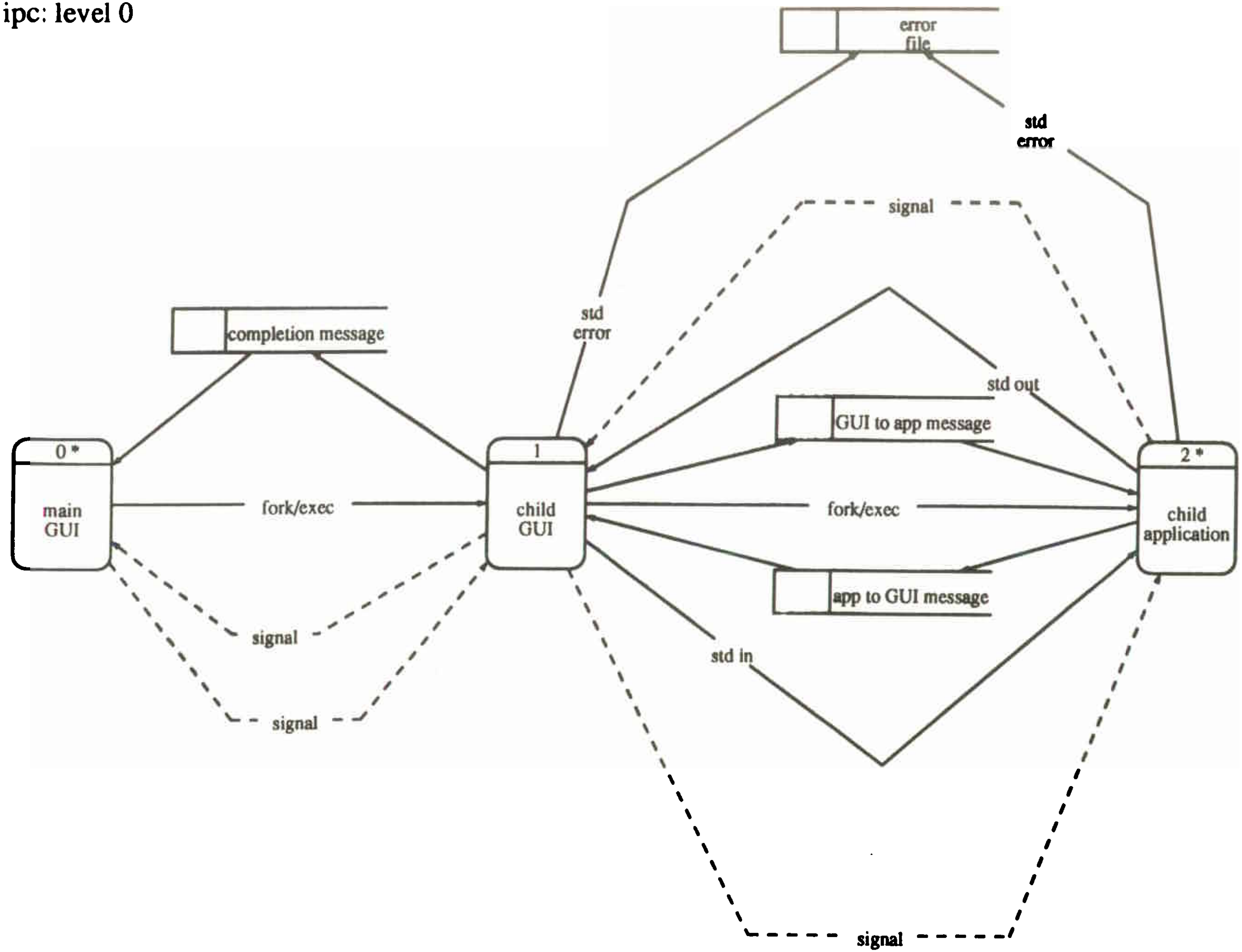

error
file
std
error
signal
completion message
std
error
std out
GUI to app message
0 *
main
GUI
fork/exec
1
child
GUI
fork/exec
2 *
child
application
app to GUI message
signal
std in
signal
signal

The HORACE Project

P.J Trevelyan
U.K. Met Office

1) Introduction.

The U.K. met office has two principle Forecast offices for the U.K. located at Bracknell and at High Wycombe. These offices are in the process of being modernised under the HORACE project. The reasons for the modernisation are many fold; in common with many older systems the current systems suffer from overloading, unreliable software, difficulty in upgrading and are not rationalised or integrated. The aim of this paper is to describe how the new workstation based system will change the working practices of the forecasters, particularly within the central forecast office (the C.F.O) although much of the discussion will also apply to High Wycombe.

2) Current Position within the C.F.O.

Currently work within the C.F.O. is a combination of the use of soft and hard copy products. The traditional pencil/rubber technique is used to analyse hard copy charts and the important features highlighted. Reference is continually made to hard copy output, e.g. satellite imagery, as well as data displayed on terminals. The range of displays varies from simple alphanumeric to high quality graphics such as the IBM5080. The alphanumeric data displayed ranges from raw observational data to NWP grid point data, some simple derived parameters eg freezing level, trajectories etc. and analysis of upper air data in a tabular form. The amount of data that can be displayed is quite large, but the various interfaces tend to be clumsy and inconsistent with each other, e.g. some use GKS GUIs, whereas others use a home grown language known as TALKBACK, which is obsolete. On the high resolution displays chosen model fields may be overlaid with observational data such as observations and imagery. The choice of the NWP data to be displayed is quite large, but inflexible, i.e. the forecaster has a pre-set list of fields available. A few dedicated tasks are also available such as the calculation of maximum and minimum temperatures. Hard copy output is printed from large quantities of CALCOMP (35 mm) film, which are produced via the mainframe computer. Some film contains observational data, but the largest proportion contains fields of NWP data, which includes the wave model output.

3) Description of the New Workstation Based System.

The new system will consist of a network of very powerful high speed workstations (19 HP 735s and 11 HP 720s) linked to local data storage, hard-copy devices and direct output facilities. Forecaster workstation positions will have two large graphic screens controlled by a keyboard and mouse; one screen will normally be in display mode with the other available

for interactive work. The forecaster will have control of both and be able to switch from one to the other. Each workstation will use standard X11/Motif windowing and the forecaster will be able to move and re-size windows as desired. For graphics applications, panning, zooming and overlaying will be available and graphics/text constructed on screen will be transmitted directly from the workstation.
Figure 1 shows the network topology for the C.F.O. and illustrates how the data will flow around the network from the mainframe computer and into the HORACE system. Numerical weather prediction (N.W.P.) data will come from the CRAY YMP and through the HDS EX100 and be stored on the two fileservers. Observational data will come from the TROPICS system (the telecommunications computer) which is connected to the system via Ethernet. There are two Hewlett Packard fileservers(HP897), each with 8 Mbyte of disk space and there is full disk mirroring, so minimising the effects of a disk crash. A third fileserver is used as a back up. A lot of effort is being put into the writing of the database which is being written using an ISAM toolkit, relational databases were considered, but due to the large amounts of data and their complex nature, it was decided to write our own. The amount of data received by the system is expected to grow considerably over the next ten years from the current value of 2,844 Mbytes per day to 13,922 Mbytes per day. The hard copy devices are connected locally and are available from all the positions, the A0 electrostatic plotter will be able to plot a monochrome chart in approx. 1 minute.

4) Projected Benefits.

The completion of the first major phase within the C.F.O. will provide all staff with flexible, much improved, and extended display facilities, although the increase in functionality will not be dramatic. The interfaces will be fast, simple and logical to use. Forecasters will be able to display and appraise observations (surface, upper air), in combination with the following facilities:

A) Rapid access to all observational data.
B) Contouring and display of NWP data on a choice of maps.
C) Plotting of observations either full or partial, on a choice of maps.
D) Overlaying plotted charts with imagery and/or NWP products.
E) Zooming the plotted chart ,with the number of observations displayed increasing with the level of zoom
F) Panning.
G) Animation.
H) Flexible displays of vertical data (tephigrams).
I) Display of all NWP model grid point data.

5) Changes in the Work Practices.

In April 1993 the RAFC (Regional Area Forecast Centre) began to produce upper air aviation significant weather charts, in a suitable form for facsimile, using semi automatic means on a workstation. The forecaster uses a

graphical editor to construct significant weather elements by reference to NWP softcopy charts available as CGMs (Computer Graphics Metafiles). Tropopause heights, jet-streams, areas of clear air turbulence and convective activity are also available in a first-guess format as model products and are gradually being introduced, as modifications to the facilities are improved. With the full automation of the forecast office at Bracknell, it will be possible to examine each of these elements with overlays of actual reports, imagery and NWP fields to reach editing decisions. The work practices used to automate the significant weather chart will also be applicable to other charts, especially the prognosis charts (T+24,48,72, 96,120). The current method of preparation is to use NWP output as a starting point and using continuity and the various evidence available (particularly NWP forecasts from other centres) proceed via a process of iteration until the final product is arrived at. Upon completion the forecast chart is hand copied and then disseminated.
Many products combine text and graphics and the present method of preparation is slow and clumsy requiring some hand drawing and the creation of text on a remote text editor and then positioning the NWP hard copy alongside the map and text. The final product is then photocopied and faxed. With the new workstations it will be straightforward to construct the map in one window adding any lines denoting areas and construct the text in another window and then simply paste the text on to the map. The final product is then ready for automatic transmission.

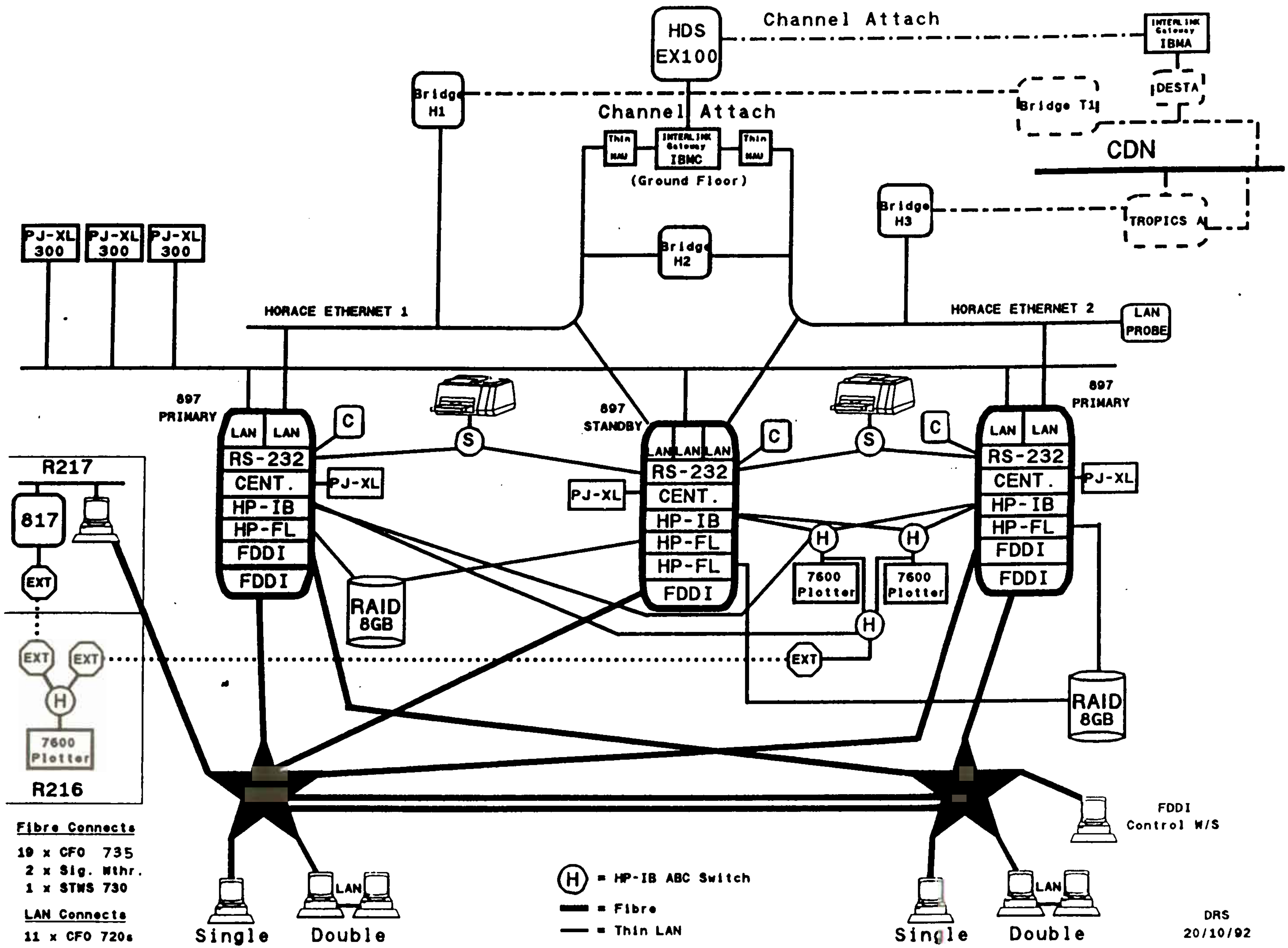
6) <u>Future Developments.</u>

There is no doubt that there is a wide scope for helping the forecaster in accessing and analysing data easily and quickly. Chart analysis forms a large part of the forecasters activity and the use of overlays will greatly help especially with surface charts. The full plotted chart would provide the starting point with local contouring of the data. This could then be compared with the NWP fields as well as automatically produced frontal analysis (perhaps using WBPT fields). By panning and zooming, the whole chart could be examined and by using other overlays (NWP and imagery) the fronts could be re-positioned and changed. With contouring packages now able to cope with discontinuities, the isobars will automatically be drawn to the fronts. After the adjustments and alterations the fronts would be labelled, and the chart transmitted automatically. At present chart areas are pre-defined, but the choice of user defined areas is desirable and will be offered soon after the initial phase has been completed. Currently the emphasis is on displaying quasi horizontal fields ,but in the future, more use will be made of three dimensional visualisation and the use of colour rendering. As in any scientific discipline, meteorology is evolving and it is important that new diagnostics will be easily and quickly incorporated, (e.g. potential vorticity), as it is essential that the forecaster is able to view the data in more than just the traditional way. Much would be gained if the forecaster was able to view easily, cross sections eg a frontal area and be able to examine the structure. Looking at time changes is also important eg cloud top temperatures, where such information would help in the forecasting of shower activity.

At Bracknell there is a team of forecasters whose job it is to evaluate observational data and if necessary amend the derived initial numerical model fields and the ability to monitor and subsequently change the model data in a consistent way will be of great help. There is also plenty of scope for using the workstation to automate various tasks such as:- precipitation type (i.e. rain or snow), fog and stratus clearance (and development), shower development (including thunderstorms), mountain waves, and many others. Much research is now being done in meso-scale processes and various parameters could be calculated from the upper ascents eg SCAPE(slant wise convective potential energy) which would help in the forecasting of shower activity especially in frontal zones. In conclusion, it is important that new technology really helps the forecasters to make a better use of the data and helps them to reach a better understanding of the dynamical and physical processes taking place. The use of advanced graphics will help, but it is important that the forecaster finds them useful. The advent of high speed localised computing would be wasted if all that we did was to speed up and automate current techniques and practices and it is therefore essential that forecasters are consulted in the most useful ways of exploiting these new technologies so that they have more time to evaluate the data and be able to use modern theories to their best advantage.

FIG 1

Met. Office - HORACE-C Configuration



THE SYNERGIE PROJECT STATUS

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1. INTRODUCTION

The Synergie project is a Meteo France project of meteorological workstation for weather monitoring and forecasting targeted to operational weather forecasters. This project was already introduced during the previous EGOWS meetings. Therefore, we will emphasize here its current state and the inside of its kernel.

Since the third EGOWS meeting the Synergie project has evolved in different ways :

- new functionnalities were added,
- the kernel was restructured and the technical software development reorganized,
- at the project management level, cycles were defined.

2. NEW FUNCTIONALITIES

We always fell that **superimposition** would be a tricky functionality to provide : On one hand our users want to be able to superimpose "any data to any data" (as they express their need), but of course you will never superimpose imagery to a tephigram for instance ; On the other hand the software controls the user interaction with the user interface in order to prevent the user from asking something not relevant or impossible :a color code informs him which request is possible . In other respects the operational forecasters deals with datas which are available on specific domains and uses to look at them using different projections. Even if we simplify the superimposition feature to these problems, it is clear that it is one of the most difficult features to develop.

In this context the superimposition functionality pushed us to develop several modules of dialogue between the kernel and the user interface. These modules allow to know and control at any time what is displayed or iconified on the screen. A detailed analysis of these modules was made with an Object Oriented Analysis "CASE tool".

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In addition of the superimposition, these modules allow us to :

- ask the user to confirm new requests for data that are already displayed on the screen,
- control the number of animations allowed,
- clean the screen when the user asks it and provide means to reorganise the screen layout whenever it becomes to messy.

We also added a **cross section** functionnality : the user can ask for a vertical cross section on any horizontal model output. He can then superimpose several parameters on this cross section.

Another new feature is the possibility to display **satellite imagery** issued from Meteosat and Noaa satellites. The user can of course superimpose model outputs or plotted observations to the images. He can zoom in and out or scroll over a full resolution display.

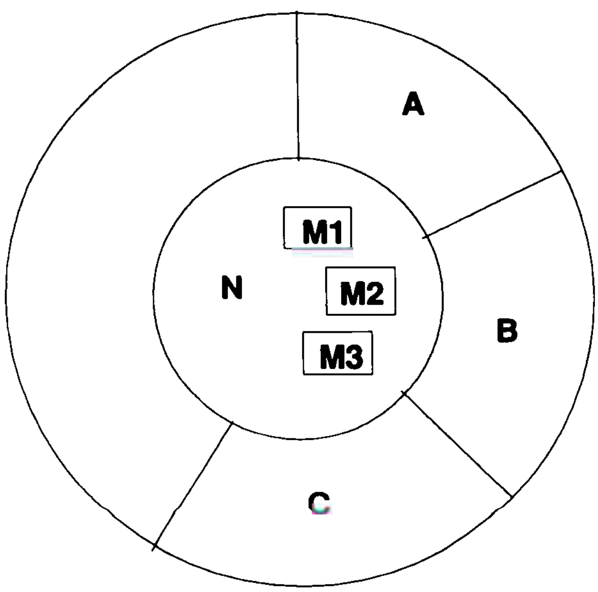
At last the software can animate model outputs as well as satellite imagery : the user can control the **animation** speed very easily through a scrollbar and a VCR-like board.

Before the end of the year, we will add at least : radar imagery and lightning impacts, sensible weather elements, forecasted vertical soundings from model fields, the notion of product validated or not by the forecaster, production tools for external users and tools to define interactively any geographical domain.

3. A KERNEL ARCHITECTURE BASED ON TWO CONCEPTS

The recent developments and the adaptation of our Synergie_0 prototype for the French overseas territories helped us to restructure the kernel.

The kernel (N) is not a server, it is part of each **visualisation module** and it is the same for all the visualisation modules (A, B, C...). Each type of data (model output, observations, imagery, ...) corresponds to a specific visualisation module and vice versa. Each window on the screen corresponds to a process dynamically launched by the main application through the global user interface.



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The kernel controls the arguments, creates the X environment, the drawing areas and the local user interface (buttons, toggles, timer ...). It calculates the initial window size and initialises the MAGICS environment. Depending on the type of data, the kernel initialises the relevant working modes (M1, M2, M3...).

A **working mode** corresponds to a mouse behavior. Each window has a default working mode (usely the zoom). The user can change it to any other available working mode. Currently the vertical cross sections are implemented as a working mode on model output. The working mode concept allows us to follow the user reasoning. Other future working modes will be for instance tephigrams or meteograms.

Each action of the software is detailed as a FIFO stack of atomic tasks. An atomic task is any code meanwhile no X event is considered. The kernel controls this stack..

The visualisation modules manage the data in memory and visualize these data in an X window or a GKS workstation upon request from the kernel.

Thanks to this architecture, any new functionality may be considered either as a new type of data or as a new mouse working mode.

To validate this idea we are currently trying to integrate related projects such as projects of elaboration of databases of sensible weather forecasts on land and oceans.

In order to facilitate the collaboration and consistency between these several projects and inside our own team and software, we wrote two basic documents :

- a kernel development guide,
- and a User Interface Style Guide.

The first one is dedicated to developers who would want to enrich the kernel with a new working mode or a new type of data. The second one aims at gathering ergonomics rules in order to ensure to provide the forecasters with friendly, homogeneous and consistant interfaces.

4. NEW POLICY OF DEVELOPMENT

4.1. One software , several configurations

Thanks to the new structure of the software, we will be able to make specific configurations for the data, the features or the user interface, which will fit any kind of forecasting activity. A special .h file contains compilation directives to tailor the software.

Specific software developments aiming at achieving the specific configurations will be done in 1994. It will concern regional matters, aeronautic, marine, sensible weather elements, and overseas problems.

4.2. Development cycles

In order to better control the project calendar, we defined development cycles of two or three months. This was possible because the technical bases are now clear, the kernel is quite stable, and the development policy is defined by the two documents we already mentioned. The remote developers are fully operational and this dynamic even gave rise to new proposals from overseas territories, who want to participate by developing specific features such as cyclone trajectories display for instance.

5. BACKGROUND ACTIVITIES

DIAPASON is a METEO FRANCE project of remake of the meteorological databases and of the various processes which make up the numerical weather prediction suit. For this major project METEO FRANCE investigated the available RDBMS. As Synergie is closely linked to this project we participated in this investigation and Synergie will use the same RDBMS as DIAPASON. Currently it seems that we will go to a use of the NEONS software which is in the public domain and to ORACLE Version 7 if the portage of NEONS on this RDBMS is satisfactory.

We also worked on the Xelion GKS which could be a good alternative to the GKX layer, specifically for postscript outputs. We should replace GKX by a commercial GKS (Xelion if it is fully satisfactory) during the last semester of 1993.

6. CONCLUSION

By now, we can still hope to respect our initial planning. This is to say that we should install an operational version during the first semester of 1994 at the central services and in the metropolitan regional centers on more or less 30 hardwares. The overseas territories should be equiped by the end of 1994, beginning of 1995.

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Workstations at the Weather Service

June 1993

Jacob Brock

The workstation project at the Danish Meteorological Institute is still based on an almost homogenous Sun hardware platform. The past year has been marked by three major issues: The joining of the civil aviation and general weather services, a major upgrade of the Sun operating system and initial steps in transitioning from OpenWindows to Motif as user interface.

Current work

The joining of the civil aviation and general branches will bring together the staff of the two services into a new operations at the central office, for which it is being rebuild at the moment. There has been a lot of considerations on the use of EDP-equipment in the new operations, and it has been designed with workstations and PCs as integrated tools instead of being randomly placed add-ons as they are today.

The new office will be operational by 1st September this year, and by now most of the hardware for it has been obtained. At the moment we are putting up a test site in which we can tune the new setup. It will be a Client-Server architecture with 5 servers and a number of workstations running in an X-terminal way.

Upgrading the operating system from Sun OS 4 to Sun OS 5 has to be done as soon as possible as the latest Sun workstations use microSPARC CPUs, and this architecture is only supported by Sun OS 5 (at least as goes for Sun software). The upgrade is not a simple task as Sun has gone from BSD-Unix to System V Release 4, and has changed the format of binary executables. So all scripts must be checked for correctness and all our libraries, utilities and applications must be recompiled.

Although it looked as if it could be hard work, it has not been too bad so far. Porting of scripts and programs seems to require only minor modifications. But there is a lot of new things to get used to in system administration. One of the major benefits from System V seems to be the Application Packaging system. It is an integrated software installation and software data base application, which can bundle programs, supporting files and installation commands into a packet. This packet is transferred to the target machine and the program is installed with a single command. As most of our applications includes 5-10 files of different types, system administration can be reduced a lot if each application installs by itself in a consistent manner.

Late '92 we had a lot of considerations on which windowing system to use in the future. Up till then we had been using XView, but then Sun announced XView to be phased out. So either we had to go for Open Look Intrinsics Toolkit (OLIT) or make a complete change to Motif. We finally decided to migrate to Motif. We were convinced that Sun would have to surrender to Motif at some stage. But the announcement from Sun about 3 months later that the new graphical user interface for Sun would be Motif, came somewhat sooner than we had expected. Initially we have started the migration to Motif without having a GUI builder as we have not been able to decide, which one to use. Either they are too expensive, insists on an intermediate layer of code, can not merge stubfiles, have had bugs in the C-code generated or not been pure Motif. But we keep looking.

Hardware and communication

At the moment, the weather service has got 22 workstations operational. 8 are placed at the central office in Copenhagen, 12 are installed at regional offices and airfields across the country, and 2 are placed in Greenland. Apart from these, we have placed a "copy" of an operational workstation at the University of Copenhagen for educational purposes. The 8 machines in Copenhagen are working off an ordinary 10 Mbit thin ethernet, which is segmented. The regional offices and airfields are net-built into the ethernet via 64 kb permanent connections. Greenland is connected via 2400 baud dial-up X.25. Very expensive, so we will probably go for a permanent 2400 baud connection soon

14 workstations are used for development and for purposes, which are operational, but which can be done outside the operations area (verification for instance). 6 are allocated for the graphics development group: One for each of the 4 people in the group, a common file server for development and a test machine, which we can "crash" without disturbing others when testing new setups and software. The remaining 8 are used for part time software development and by meteorologists working from their offices.

At the moment 4 new workstations are being installed for in-house education of new meteorologists and a further 12 will go into the new operations.

At the moment, DMI has some 100 workstations up and running:

Departments	
Administration	1
Database	15
EDP	17
Observation	3
Research	31
Weather service	36
Total	103

Number of workstations at DMI, June 1993

Data distribution

Every day, most of the operational workstations receive between 100 and 300 Mbyte of data. To control this huge flow of data, we were looking for an off-the-shelf product, but we did not succeed in finding one. So eventually we modified the Unix print system, which can print files on printers network wide, into our own system, which we call data queues. Basically, the only modification we had to do, was to implement a special output filter for the print-queues, which would redirect the contents of the print job to a file instead of sending it to a printer port. But on top of this we have build mechanisms for signalling running programs that new data has arrived, and mechanisms for routing data past servers, which may be temporarily down.

The reliability of the data queues is high, more than 99 % of data gets distributed without any problems. Occasionally a file is lost or turns up as a null-file, but it is very rare compared to other ways of distribution, we have tried. One of the advantages of using the print system is its spooling capability. So if an operational machine goes down for some reason or has to be rebooted, data for it is not lost, just queued at one of the servers servicing it. This advantage can of course turn back on us, because if an operational machine goes down unobserved, the data servers might overflow the spool area, but programs supervising the data queues usually detects and reports any problems before they get critical.

New applications

Monitoring of lightnings

DMI gets data from 3 lightning detectors distributed at the edges of Denmark. They are tuned to detect vertical lightnings, and each detector reports angle, timestamp and intensity of any potential incident to a server at DMI. This server matches the incoming reports and calculates the estimated position of incidents. Any incidents, which are likely to be lightnings, are relayed to the workstations running the lightning monitor program as soon as possible, and shown on a map. The application has got features for zooming into specific areas, showing the age distribution of lightning, a replay function to make it easier to determine in which direction a thunderstorm is heading, and an archive function which lets you go back in time and look at old lightnings.

ObsShow

The traditional way of presenting observations was to plot them. ObsShow has taken this plotting onto the screen, but it can of course put them back onto paper if wanted. Observations are shown using the standard synoptic symbols. The number of parameters to show at the same time, the density of observations, and the geographical area can be freely selected by the user. ObsShow can also display soundings.

Data are stored in a locally developed database, and in archive mode and if the workstation is connected to the central compute server, data for at least one year back can be accessed.

Revised storm surge program

The very first application developed for workstations at DMI, was a program for storm surge warning, using SunView and GKS. This program has been refined and ported to XView. It displays current water level readings and forecasts waterlevels based on different statistical models. It is also capable of transmitting fax-messages to other authorities and radio stations in case the meteorologist judges it necessary to warn against a possible storm surge.

Satellite archiving

An archiving system for storing all NOAA and a selection of MeteoSat images is being developed. All channels of all NOAA passages received will be archived on ExaByte tape. In parallel, information about which areas are covered by a passage will be stored in an on-line database, and miniature printouts of relevant parts will be printed for an image catalogue.

The archiving will be done using a tape robot, which can handle 10 ExaByte tapes of 5 Gb storage capacity each. And the database can be used for creating an extraction list of images covering a specified area.

Operational replay

For the training of new meteorologists, we are going to implement a system, which will make it possible to replay data for a given period into a closed network of workstations. The replay may be done faster than real time, but in strict chronological order.

Data for these replays will be recorded as a dump of all relevant, live data, whenever an interesting and/or instructive situation occurs. Recording can be initiated and terminated by the request of a senior meteorologist, and data for at least 24 hours back from initiation time will be available for dumping.

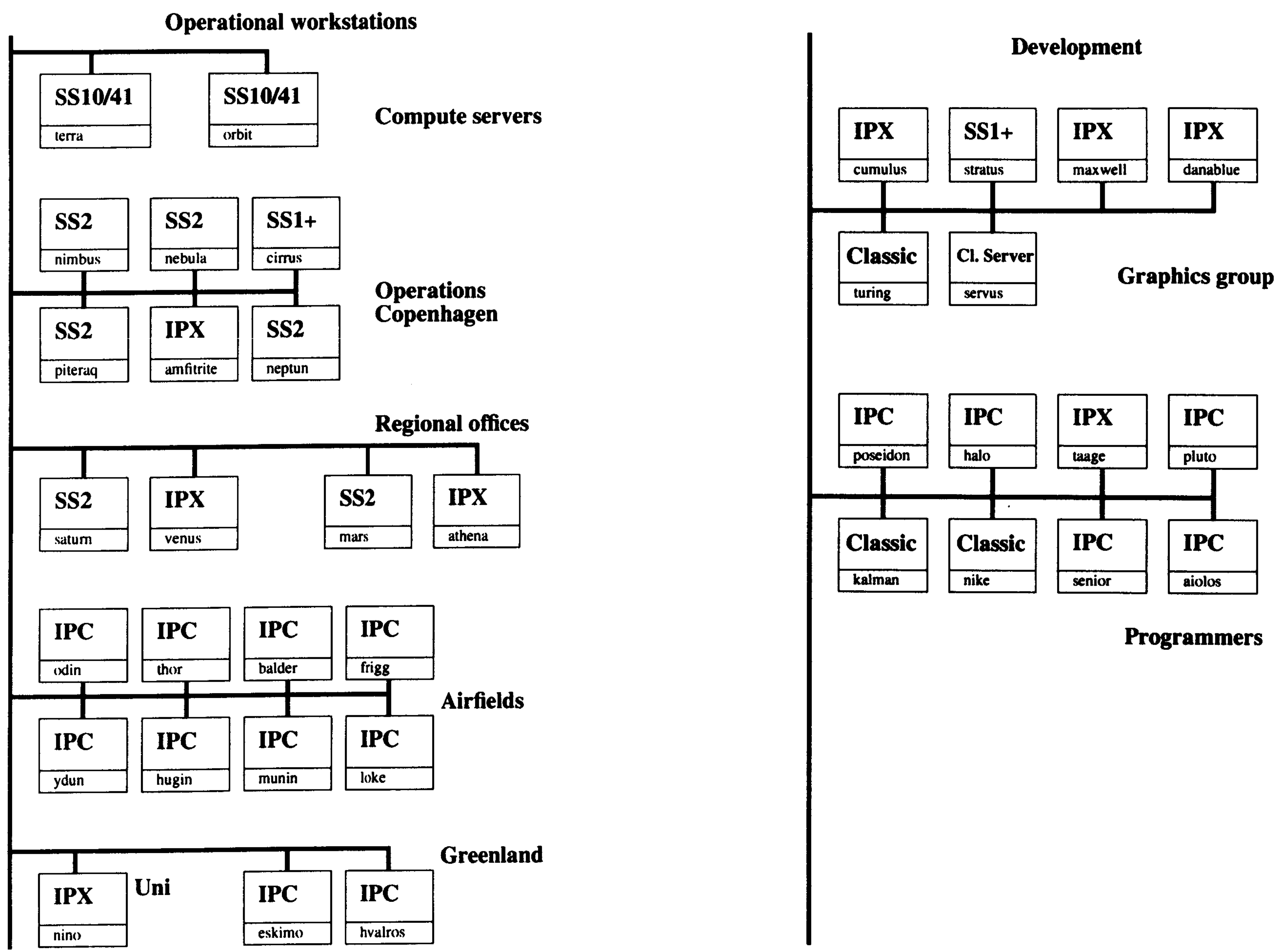
Data for recording and replay will be buffered on a 2.8 Gb disk and stored on 5 Gb ExaByte tapes.

Status

It was a small beginning two and a half years ago, when the first workstation was cautiously put in a corner of the operations. But as it was realized that workstations could replace a lot of dedicated hardware, which was wearing out, for the display of images from satellites and radar, things got turbulent. Numerous applications had to be developed, but the development was to a great extend ruled by which of the dedicated equipment was going to fail next. A lot of new hardware had to be put into place at the same time. And as regional offices were included in the workstation project, communication became an issue too. So the first part of the workstation project was a matter of getting as much as possible up and running as fast as possible.

Now we are in a phase of consolidation. This means cleaning up and coordinating the different - and sometimes even opposing - ad hoc "quick and dirty" solutions, which were applied. It means implementing a formal release procedure for and version control of applications. And it means writing technical documentations and user guides.

Soon the project of making workstations the primary tool in the weather service will be in its final phase when the new operations is set up and put into work. There will no doubt be some adjustments to do within the first couple of months of operation, but a major milestone is being reached in making workstations the primary working tool for danish meteorologists.


Operational workstations
SS10/41
terra
SS10/41
orbit
Compute servers
SS2
nimbus
SS2
nebula
SS1+
cirrus
SS2
piteraq
IPX
amfitrite
SS2
neptun
Operations
Copenhagen
Regional offices
SS2
saturn
IPX
venus
SS2
mars
IPX
athena
IPC
odin
IPC
thor
IPC
balder
IPC
frigg
IPC
ydun
IPC
hugin
IPC
munin
IPC
loke
Airfields
Greenland
IPX
nino
Uni
IPC
eskimo
IPC
hvalros
Development
IPX
cumulus
SS1+
stratus
IPX
maxwell
IPX
danablue
Classic
turing
Cl. Server
servus
Graphics group
IPC
poseidon
IPC
halo
IPX
taage
IPC
pluto
Classic
kalman
Classic
nike
IPC
senior
IPC
aiolos
Programmers

Graphic Production for Newspaper

Ole Hansen

Introduction.

Last year DMI decided to develop a system for the production of graphic weather-forecasts to newspapers. At that time DMI did produce forecasts for newspapers, but it was up to the individual newspaper to build up their graphic presentation based on informations delivered by DMI.
The types of products in mind varies considerably and include:

- Maps with weather-symbols
- Temperature- and Synop tables
- Maps with isobars.
- Temperature- and precipitation-histograms
- One week forecasts in graphic presentation

In addition, each of these products was divided into 3 subsets: fixed, semi-custom- and custom-design. In the first case the layout is fixed and is delivered as is to the recipients. Font- and color-changes are done by the recipients. In semi-custom products the basic layout is fixed, but colors, fonts and weather-symbols are specified by the customer and included in the graphic at production time. In the last case everything is specified by the customer
The system should be able to produce all the mentioned products with a minimum of man-power-requirement. For a given semi-custom product, all custom-variants should be produced in one step. The system should be simple to use and involve a minimum of drawing effort from the meteorologist.

System considerations.

At first a SUN-based solution was considered, since we already had a great number of SUN-workstations and experience on this platform, but development of an application from scratch turned out to be too costly compared to the expected revenue from the product. We then directed our attention to various drawing-programs. The programs had to use a format, which was used by most of the recipients. Consequently we asked a number of newspaper-companies about their use of drawing-programs, formats and hardware-platforms. The majority used the Adobe Illustrator, Aldus Freehand and Quark Express on Apple Platforms. Since the former 3 programs were only available on Apple and DOS platforms, we decided to use Apple Quadra 700 as our hardware platform. At the same time Adobe announced, that they planned to port their products to SUN-platforms, and we chose Illustrator as our drawing tool expecting, that we will be able to move the system to a SUN-platform later without changing software tools. DMI had at that time no experience with Apple-platforms, and we had to face a lot of integration problems of these machines into our environment. To limit these problems, we decided to place as much as possible of the system on SUN-platforms, leaving only the drawing part to the Apple Quadra.

System architecture.

The system can be divided into 3 main parts:

- Data collection and inspection
- Graphic Production

• Delivery

The data collection and inspection part involves inspection of forecasts, SynopEdit etc. and takes place on a SUN-platform. The graphic production takes place on Apple Quadra and temperature-, precipitation- table take place on a SUN-platform. The products are delivered to the customers by modem through DMI's communication-server

Interfacing the Apple- and Sun-platform.

A major problem of the project was to interface the two hardware platforms in a feasible way. The graphics produced on the Apple platforms depends on easy access to various meteorologic data sets, which resides on SUN-platforms. In addition the graphics are delivered to the customer through a SUN-based communication-server. Apple-computers are normally grouped in networks based on the AppleTalk or Ethertalk protocol, whereas SUN-computers used Ethernet. By using Apple Computers equipped with Ethertalk Phase II we are able to connect Apple computers directly to the existing ethernet without using Kinetic Boxes as routers.
Data are exchanged between SUN- and Apple-computers by using SUN-computers as file-servers for the Apple Computers. This interface is achieved by 2 software-packages - Pathway 7.0 from Woolongong and Columbia University's AppleTalk Packages (CAP). The latter package, which is public domain, includes in addition a bundle of unix-programs, which emulates some of the most frequently used Apple Programs such as (un)compressing - stuffit/binhex -, emulation of Appletalk Printers by Unix-spoolers and various Apple file system administration programs.

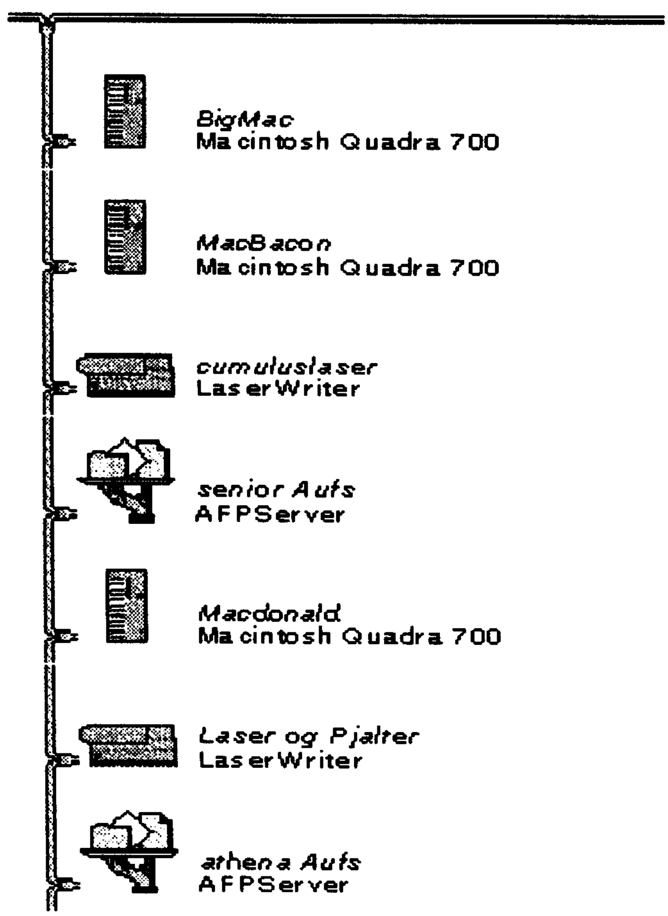


Figure 1: Network architecture.

The figure above shows the network architecture seen from the Apple Quadra's. At the moment we have 3 Apple Quadra 700 and 2 Sun Workstations acting as fileservers.

Graphics Production.

As mentioned before the production of graphic takes place using the Adobe Illustrator drawing program. Each production starts with an empty template, and the meteorologist imports weather symbols and place them as wanted. Text such as 5-day forecast and various data are imported from files on Sun fileservers. The meteorologist has only to inspect and make adjustments.
The next two figures show an example starting with an empty template and ending with a regional 72 hour forecast including temperature and precipitation curves.

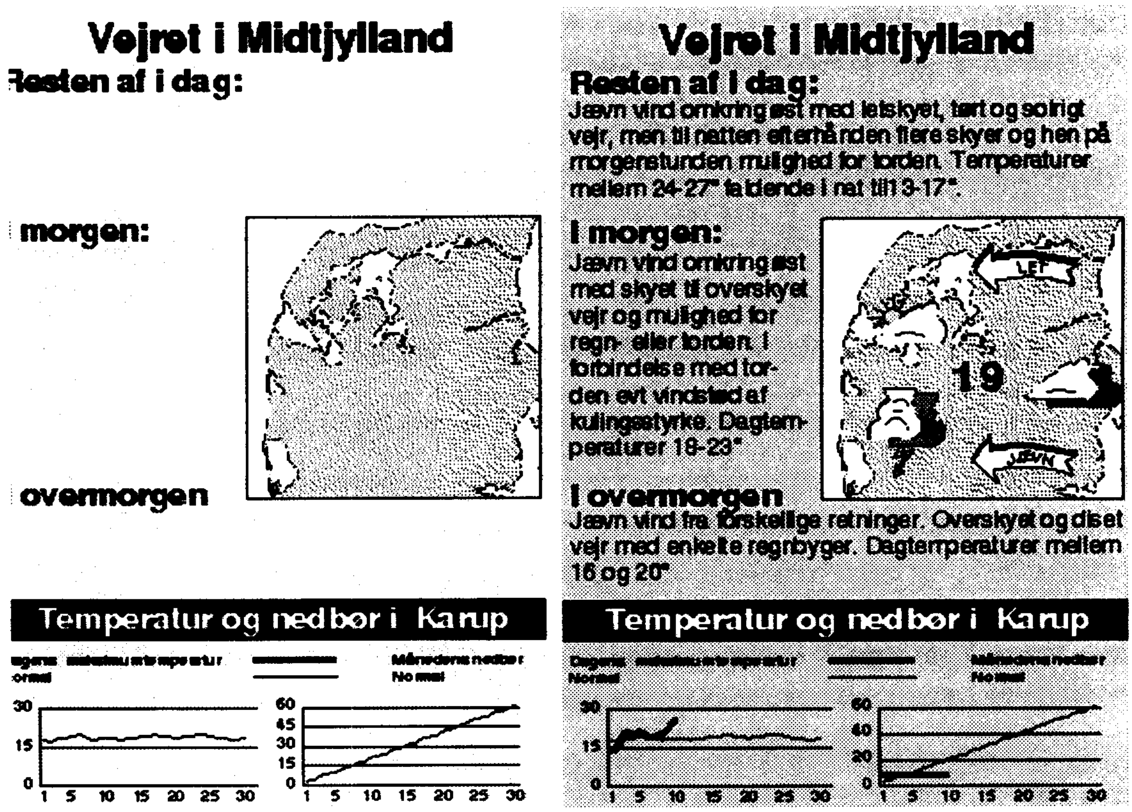


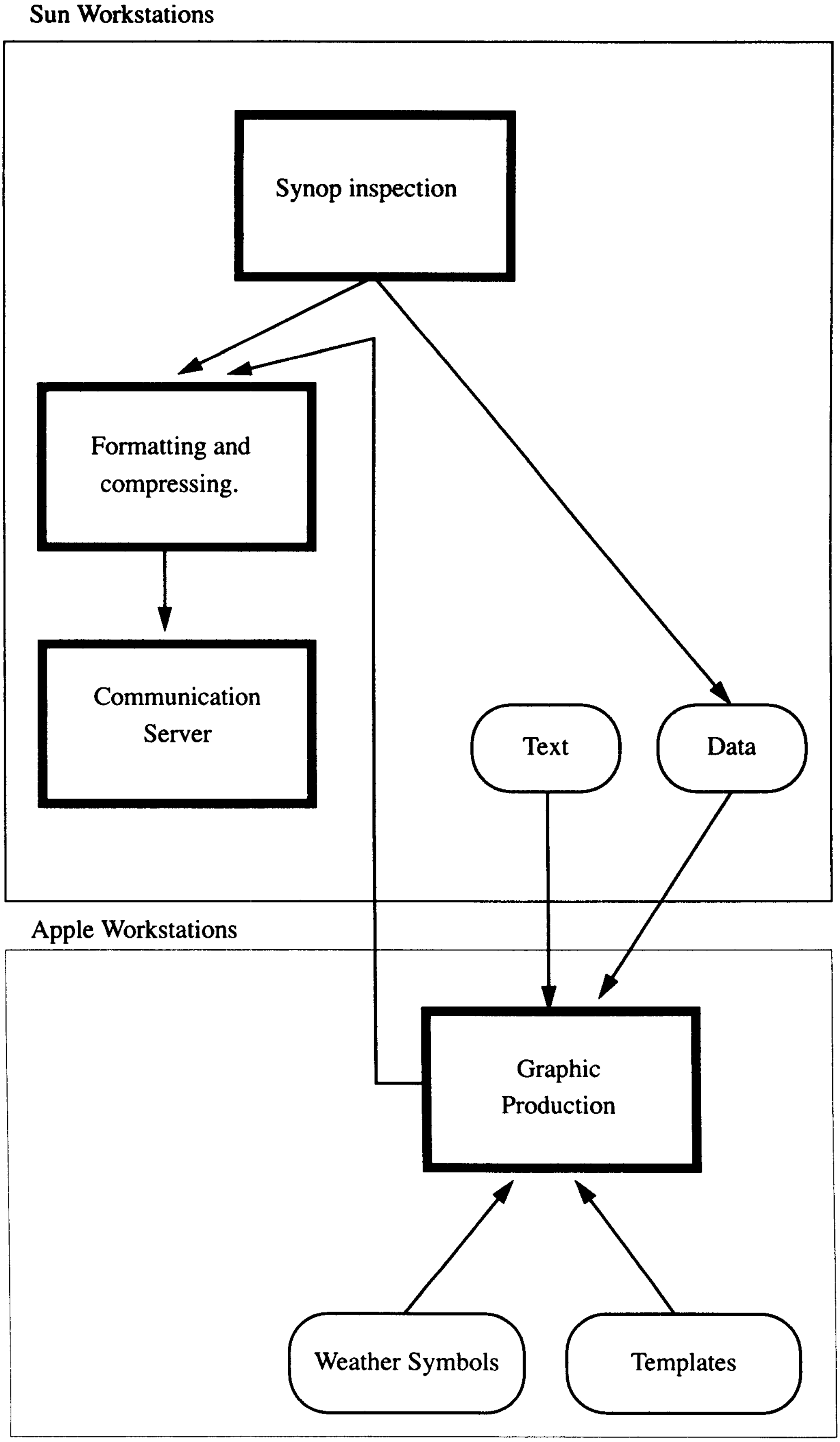
Figure 2: Graphical presentation of a regional weather forecast.

Inspection of Synopdata.

The inspection of synop-data takes place on SUN-workstations. Since the amount and type of the synop-data various considerably from newspaper to newspaper, a spreadsheet-like program has been developed, where the individual columns can be configured to different interpretation for each product. The format of the output-data is completely user-controlled using Pearl-scripts and the products are automatically compressed in Stuffit archives and send to the communication-server or just delivered to an Apple-computer for use in graphic templates.

The entire system is sketched in the following diagram

Figure 3: System Overview.



The Computer Graphics System Used at the Irish Meteorological Service

(J.Hamilton, Meteorological Service, Glasnevin Hill, Dublin 9, Ireland)

Introduction

This is my first attendance at EGOWS and consequently I feel it is appropriate to present a fairly detailed account of the software and hardware configuration at the Irish Meteorological Service. However, since much of the system is due to be replaced in the coming year, I will concentrate on the parts of the system which are likely to remain and on our plans for the future.

Overview of the Hardware

We have quite a mix of hardware and much of it is due for replacement within the next year or so. Until about a year ago our operational system consisted of the following components :

--Two VAX-11/780 computers used for telecommunications

--A DEC-2050 mainframe used for NWP, graphics and Climatology

We have started to replace this system and the plan is to replace the general purpose mainframe computer with a number of dedicated servers. The current configuration is [see Figure 1] :

--A VAX cluster consisting of a MicroVax 3100 and two VAX 4200 used for telecommunications

--A MIPS RS-4000 Millenium used for decoding observations and NWP products and for the graphical display of such products

--A DEC-System 5000/200 server and 10 DEC-station 5000/120 workstations running INGRES [a commercial data-base package] used by the Climatological Division

--A MIPS RS-3000 Magnum workstation used for the development and testing of an operational NWP system by the Research Division

--A Silicon Graphics Challenge-L server which will be used to run the HIRLAM NWP model. There is also a Silicon Graphics Indigo workstation.

--Two Apple Macintosh computers used for desk-top publishing

--Various MS-DOS PC's used for word-processing etc.

--A VAX-server 3300 and three VAX-station 3100 workstations used for displaying the output of the Ericsson doppler radar at Dublin Airport

The DEC-2050 is still in use but it is planned to take it out of service within the next few months.

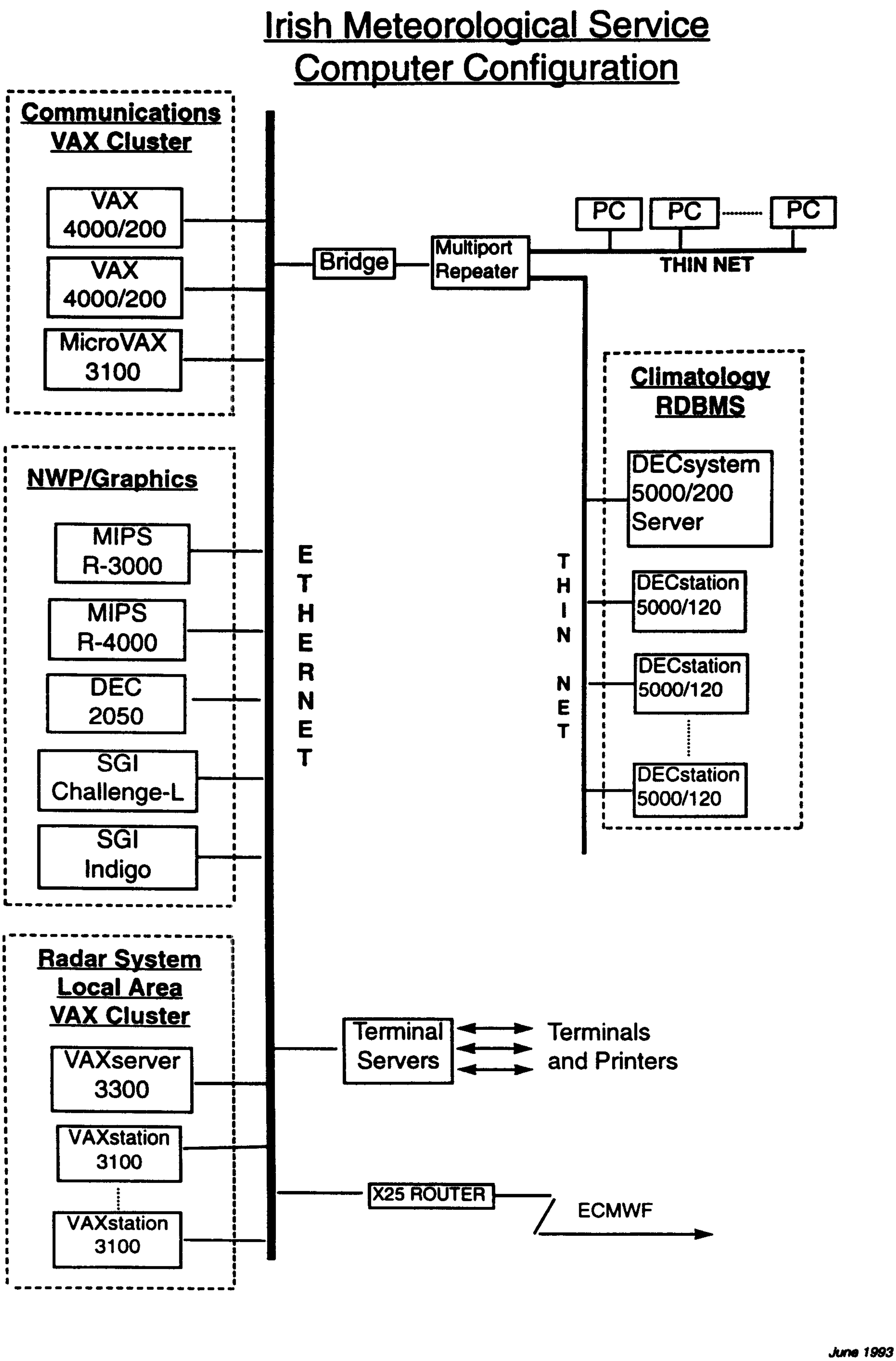


Figure 1: The computer configuration at the Irish Meteorological Service [June-1993].

Overview of the Software

Computer graphics plays an increasingly important role in the work of the Service and we have a number of graphics systems -- some are commercial systems and some were developed in-house. The following is a list :

--We have two digitised radar stations in Ireland. One [at Shannon Airport] is quite old and is due for replacement within the next few years; the other [at Dublin Airport] is a newly installed Doppler radar [built by Ericsson]. Both radars are linked into the COST radar network and various composite plots [including composites covering parts of England and Wales] are available on PC displays in the forecast offices. Options on the PC include choice of area and the display of animation loops. The software was purchased from 'The Computer Department' -- a firm in England.

--The Ericsson radar system includes VAX-station workstations in the forecast offices. There are a number of display options including time loops, Doppler winds and vertical cross-sections. The cross-section option is particularly impressive in that the user can display a cross-section along a line joining any two points on the surface within the range of the radar -- the straight line joining the points need not pass through the location of the radar. This software was provided by Ericsson.

--There are a number of self-contained satellite display systems which use secondary data. One system [an Alden APTS-C receiver, purchased in 1978] is used to display NOAA images on a MuFax machine; another system [a Technavia Skyciever Silver system] is used to display MeteoSat data on a VDU. We plan to start receiving primary data within the next 2-3 years. However, we have made no decision on the type of system we will use.

--The in-house developed graphics systems include a package to display observations and/or NWP products in hardcopy form on pre-printed sheets using on-line Hewlett-Packard Draftmaster plotters. In addition, plots can be produced using Canon laser printers. The package includes a meteogram plotting option. [See figure 2 for an example of a plot of observations; figure 3 for a meteogram plot].

--Plots destined for the Hewlett-Packard plotters [or the Canon laser printers] are stored as random access binary files containing vectors. Each file may contain one or more plots [e.g. a file could contain a number of plots of geopotential at various standard levels]. Packages exist to display such plot-files on any of the available output devices which include the Hewlett-Packard plotters, the Canon laser printers, a PostScript laser printer, the DEC-REGIS terminals [VT-340's] and an X-windows workstation. A zoom option is available in the case of the graphics terminals. The plot-files can be copied between different computers using a utility which converts back and forth between random access binary files and sequential ascii files.

--The forecasters also have access to an on-line interactive graphics system [called CHARTS] which allows the display of NWP products on a colour graphics terminal [a DEC VT-340]. CHARTS uses a command language which has been designed to be as easy to use as possible. Thus the forecaster can request plots with commands like the following :

```
PLOT 24HOUR ECMWF SURFACE PRESSURE
PLOT 2DAY 500MB GEOPOTENTIAL
```

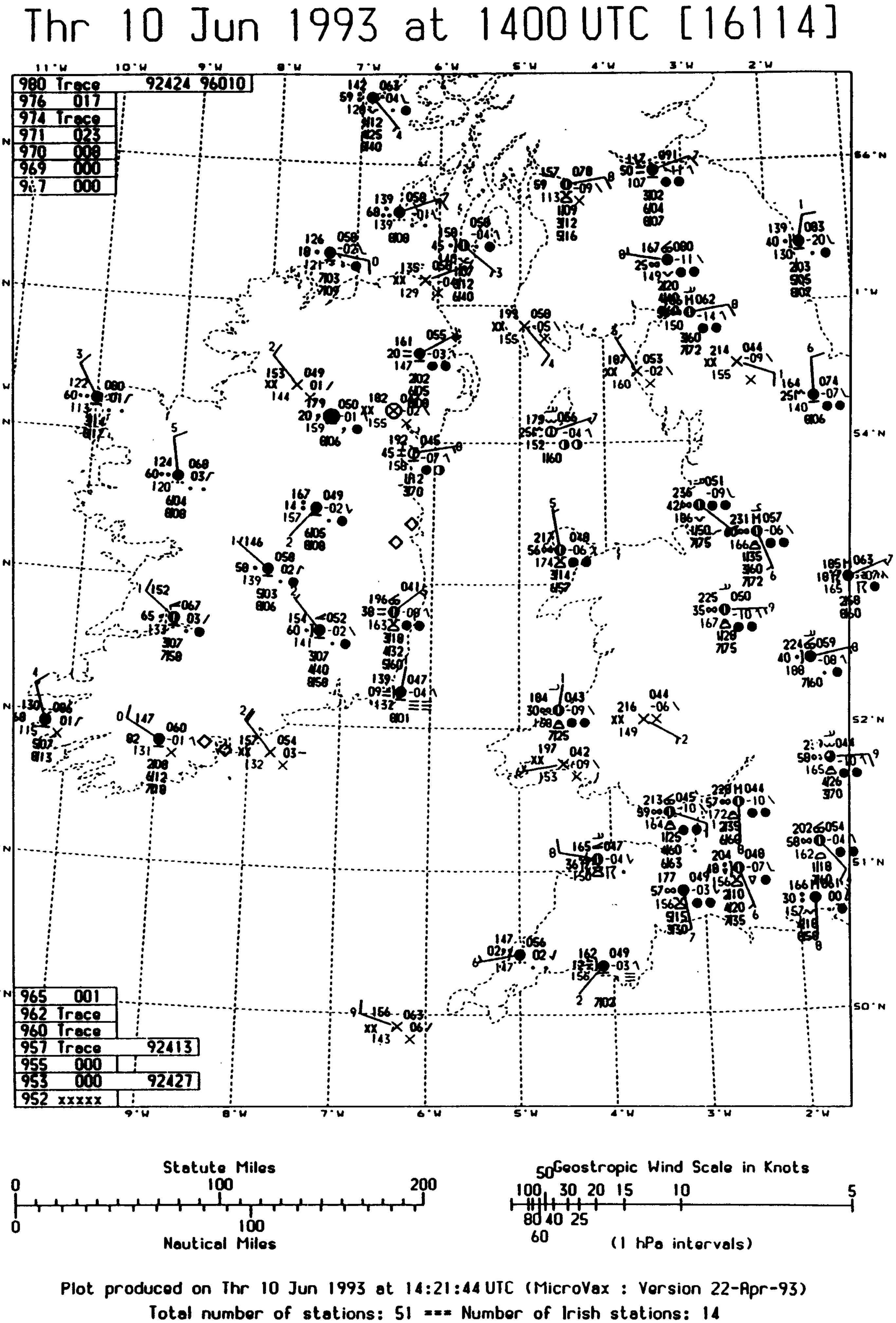


Figure 2: A plot of hourly observations produced on a Canon laser printer. This plot illustrates the the use of the background map routines [note the latitude-longitude lines are clipped at the coastlines] and the routines for plotting SYNOP reports.

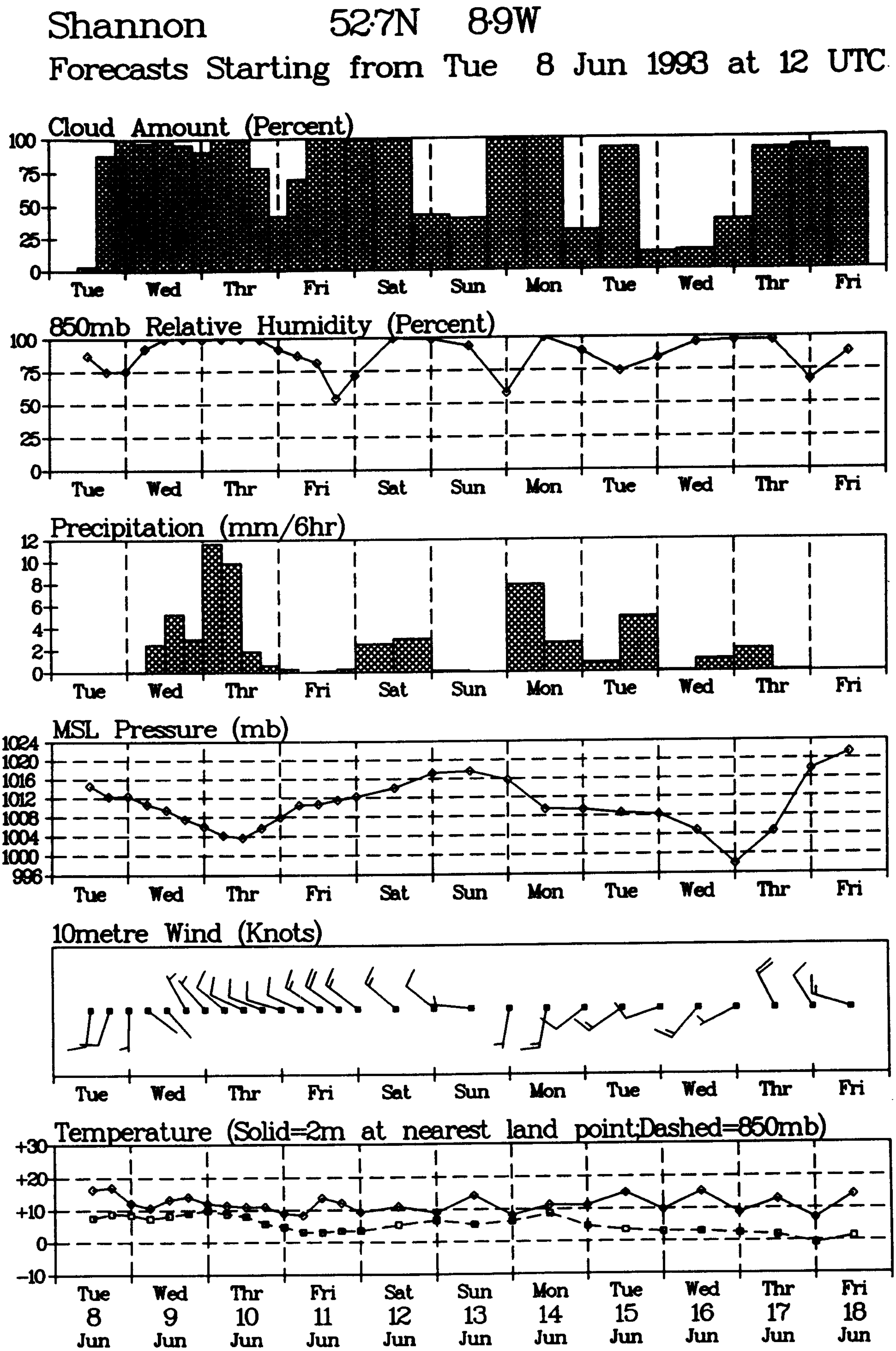


Figure 3: A Meteogram [produced on a Canon laser printer].

PLOT 24HOUR 1000-500MB GEOPOTENTIAL

Full details of the CHARTS command language are given in Hamilton [1984]. Note that the third example plots a thickness chart. Commands can be abbreviated. There is an on-line HELP system, a hardcopy option, a script option [viz. the so-called OBEY files], and ambigious or incorrect commands produce meaningful error messages. The system remembers the parameters entered with previous commands and these become the defaults for subsequent commands -- this reduces typing to a minimum. The forecaster can also request plots of upper-air ascents as tephigrams.

--An in-house developed system is used to analyse and draw climatological maps of mean monthly temperature, mean monthly sunshine and total monthly rainfall. See Hamilton et al [1988].

--The climatological section produces a monthly climatological newsletter [the Monthly Weather Bulletin]. This is prepared using an Apple Macintosh and the Quark Xpress desk-top publishing system. The graphs and contour plots used in this bulletin are produced using our own graphics packages. [See figure 4 for a sample page of the bulletin. Note the contour plot rainfall].

--We have implemented the ECMWF MAGICS package. This package is used for special projects [e.g. we produced special charts, for internal use, during the recent Irish expedition to Everest, see figure 5]. MAGICS has been implemented on a MicroVAX using our own [minimal] version of GKS. Output can be produced on any of the available graphics devices including a graphics screen or on a laser-printer.

The Irish graphics system [including a contouring package, a package for displaying background maps, various packages for plotting observations and the CHARTS program] was originally developed on the DEC-2050. The various components have been ported to the MicroVAX, the DEC-Server 5000, the MIPS-Magnum and the MIPS-Millenium. We will shortly be porting it to the Silicon Graphics Challenge-L and the Silicon Graphics Indigo. This is not expected to present any major difficulties since all the software [with the exception of the X interface] is written in standard Fortran-77.

Use of X-terminals

The CHARTS program [used for displaying NWP products] is being transferred from the DEC-2050 to the MIPS-Millenium server. However, initially, it will run using VT-340 terminals. These are dumb terminals which use the DEC-REGIS graphics language. In the short to medium term it is planned to replace these devices with terminals and/or local workstations running X-windows.

We have made a start on developing applications for X-windows. Our first application [written in C and Fortran-77 using Xlib] is a package to display plot-files on an X-terminal. It includes a zoom option where the user can select a sub-area of the main picture using a mouse.

Short Term Plans

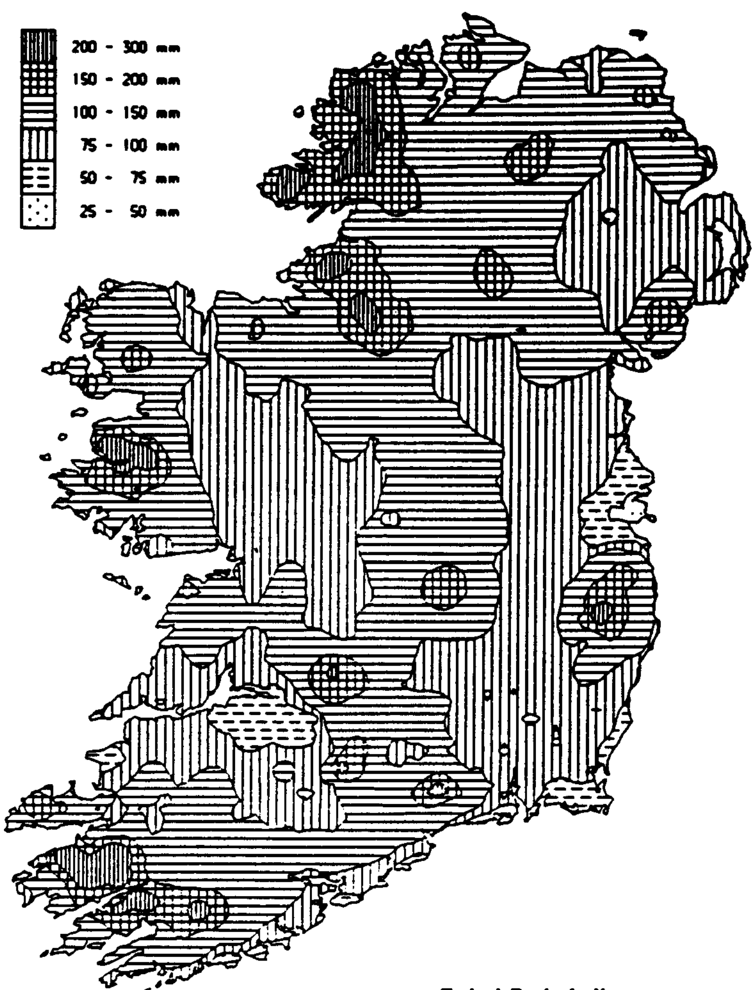
The CHARTS program is the main forecaster interface to NWP products. It is planned to upgrade this system [but still using dumb terminals] as follows :

Another wet April

It was a very wet month overall at most stations. More than twice the normal amounts of rain fell in parts of the midlands and north. Clones' total of 116mm set a new record at the station and Malin Head's total of 124.5mm equals the previous station record for the month of April, set in 1961. However both April '92 and April '91 were also wet months, so although most other stations recorded substantial amounts of rain during the month, their recently-set records still stand.

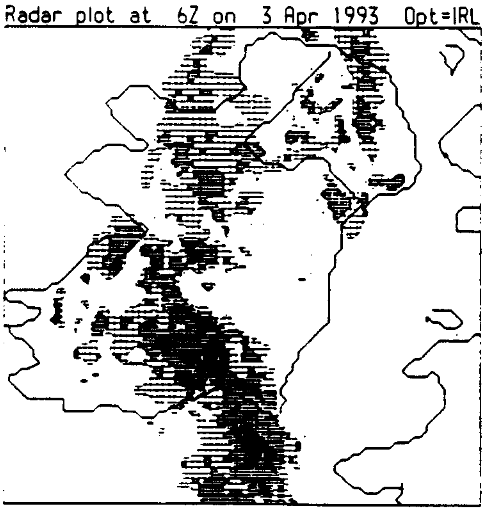
Amounts generally were between 30% and 120% above normal. Rainfall totals were close to normal only in some eastern coastal areas and in parts of the southwest. The total of 45.9mm measured at Dublin's Merrion Square exactly equals the April normal amount there.

Significant amounts of rain fell on between eleven and fifteen days in the south and east, but there were up to twenty such days in the north and west. The first ten days or so provided the wettest period: 60% of Malin Head's total for the month and two thirds of Rosslare's rain fell during that period. The 3rd, 4th and 5th were the wettest days, with more than two inches of rain (51.8mm) falling at Kenmare in Co. Kerry on the 4th, the greatest daily fall of the month. Falls of over an inch were also recorded on the 2nd, 5th, 7th, 8th and 17th.

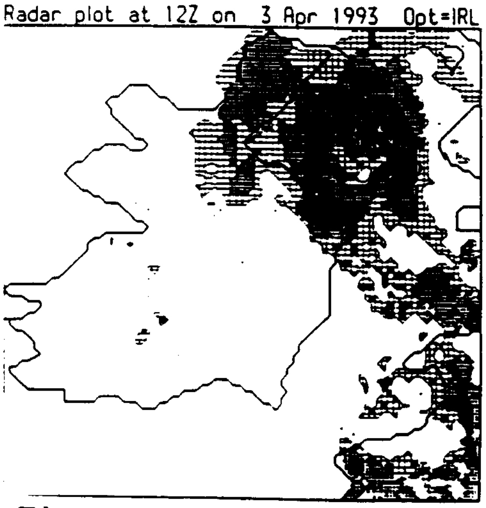


Total Rainfall *(mm)*

Radar plot at 6Z on 3 Apr 1993 Opt=IRL



Radar plot at 12Z on 3 Apr 1993 Opt=IRL



Left *These radar images show the patterns of rainfall on Saturday the 3rd as a frontal wave crossed the country from west to east.*

Below *The number of wetdays - days with 1mm or more of rain - in each county during April 1993.*

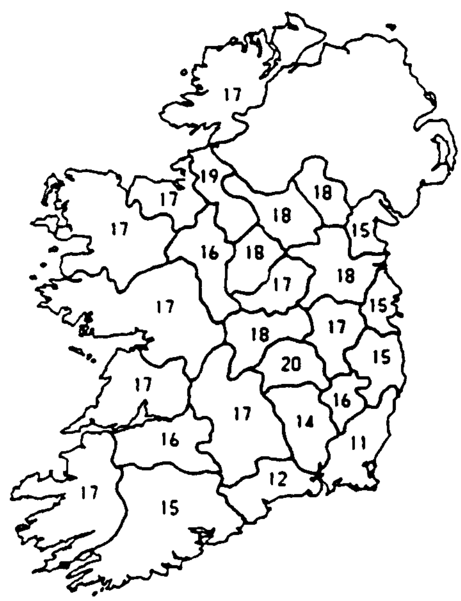


Figure 4: A page of the 'Monthly Weather Bulletin'. The text was produced using Quark Xpress but the various contour plots [of radar and of rainfall] were produced with the Irish graphics system, plotted on a laser printer and then scanned in.

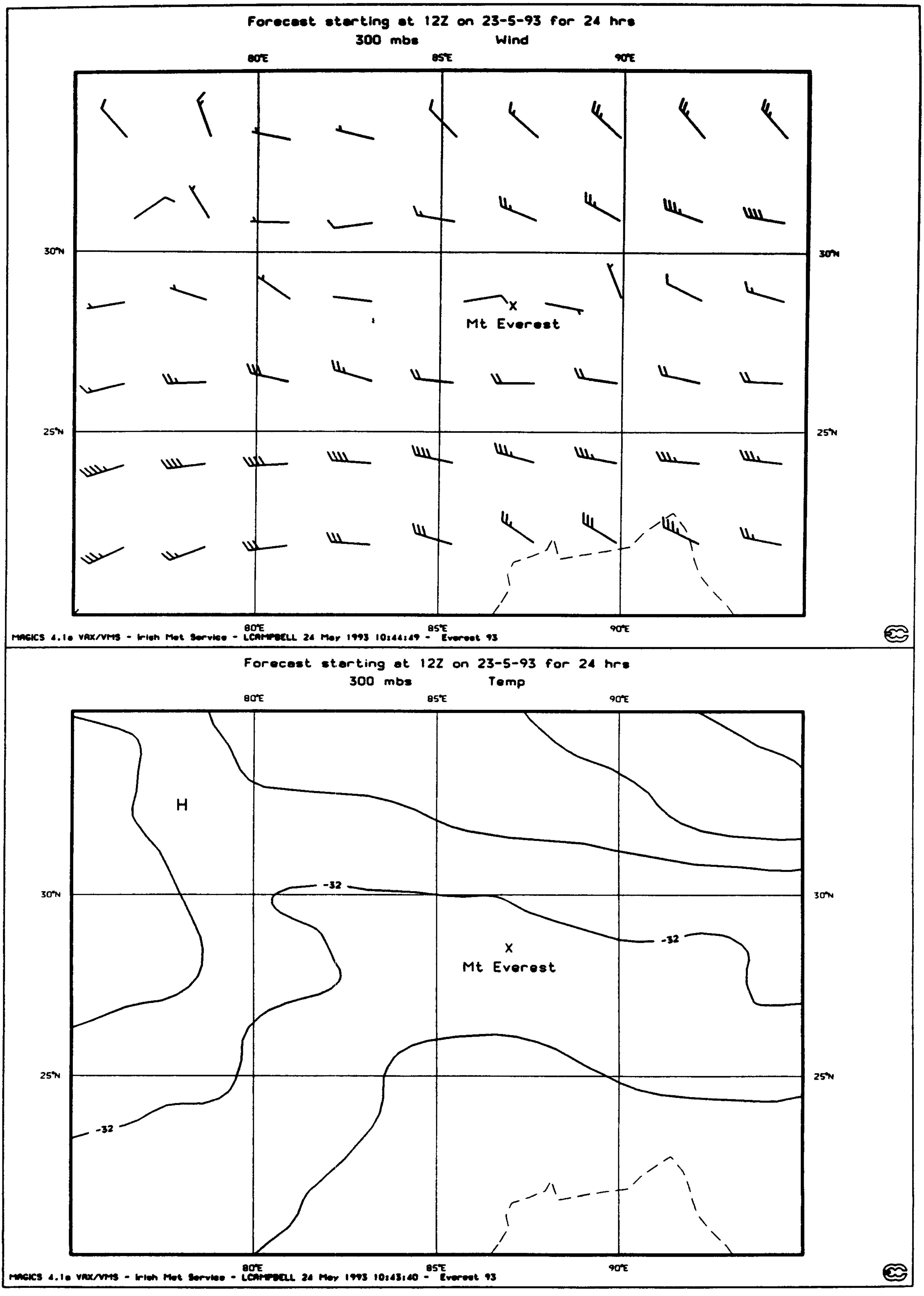


Figure 5: A plot produced with the ECMWF MAGICS package.

--We plan to get NWP products at higher resolution. Previously, due to computer limitations [e.g. the maximum program size on the DEC-2050 is 1-Megabyte], CHARTS could only display ECMWF data at 300-KM resolution. During the past week we have started to receive ECMWF data on the Gaussian grid [approximately 0.5-degrees by 0.5 degrees] and this high resolution data is now available in CHARTS. It is received from ECMWF in GRIB code rather than the old ECBIT code. [Figure 6 shows a sample high resolution plot of rainfall]. We plan in the near future to upgrade the resolution of the UKMO data.

--We intend to plot more derived products. At present we plot 850Mb wet bulb potential temperature [used as an aid to locate fronts], a snow indicator [viz. the probability of snow given that precipitation will occur], the analysed and predicted height of the freezing level [calculated from ECMWF NWP products] and the maximum top-height of CB's [also calculated from ECMWF products]. We intend to look at some other derived parameters such as better frontal indicators and various stability indices.

--We hope to expand the list of products, available with CHARTS, to include output from the ECMWF and UKMO wave models. Also, we want to include the option of plotting ensemble forecast products from ECMWF.

--Finally, we hope to increase the quality of the plots by using more expensive options, supported by the graphics package, such as higher quality lettering, improved background maps [with shading and with clipping of the latitude/longitude lines against the coastline] and better shading between contours. The implementation of many of these options is limited by the baud rate to the graphics terminals [currently 9600-baud]. Figure 7 shows a plot of wave information [produced on a laser printer] which shows some of the more expensive plotting options.

Our plans in the short term do not include an interactive system for plotting observations [apart from tephigrams]. This is because of the low resolution of the VT-340 terminals. However, in the longer term, we would hope to produce such plots.

Medium Term Plans

When the output of HIRLAM becomes available [towards the end of this year] we want to extend CHARTS to plot these products. At this stage we also hope to consider the whole future of the graphics system. We intend to move to an X-windows system and we are considering various options :

--Continue with the present graphics system based on the Irish contouring and mapping packages

--Develop a system based on the ECMWF MAGICS package

--Develop a system based on the HIRLAM MetGraf package

--Develop a hybrid system based on elements of the above three packages

At present we intend to continue using the CHARTS command processor, since it has proved to be powerful, easy to learn and popular with the forecasters. However, we would like to extend it to allow for multiple windows.

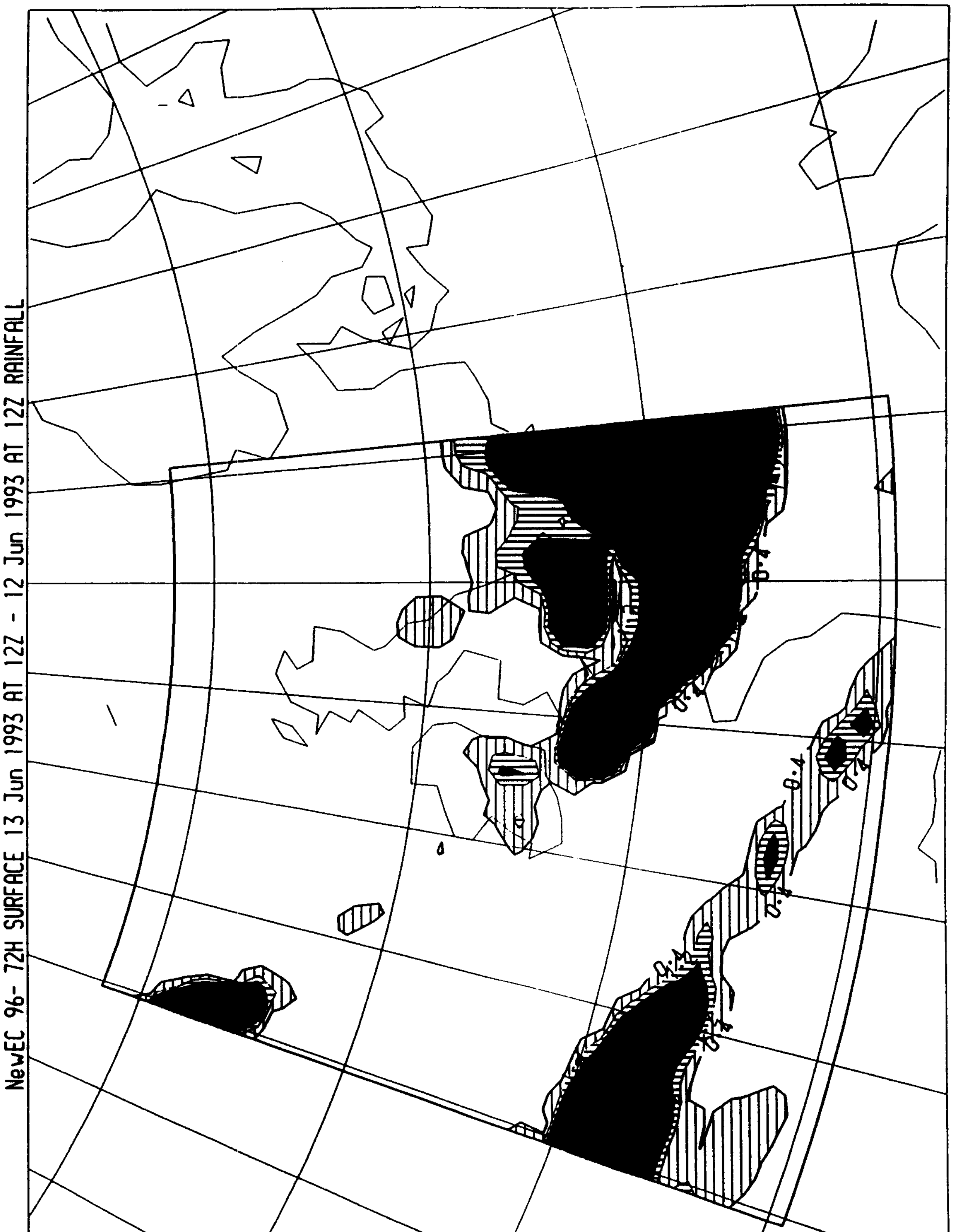


Figure 6: A plot of rainfall [produced with the HARDCOPY command from the CHARTS program].

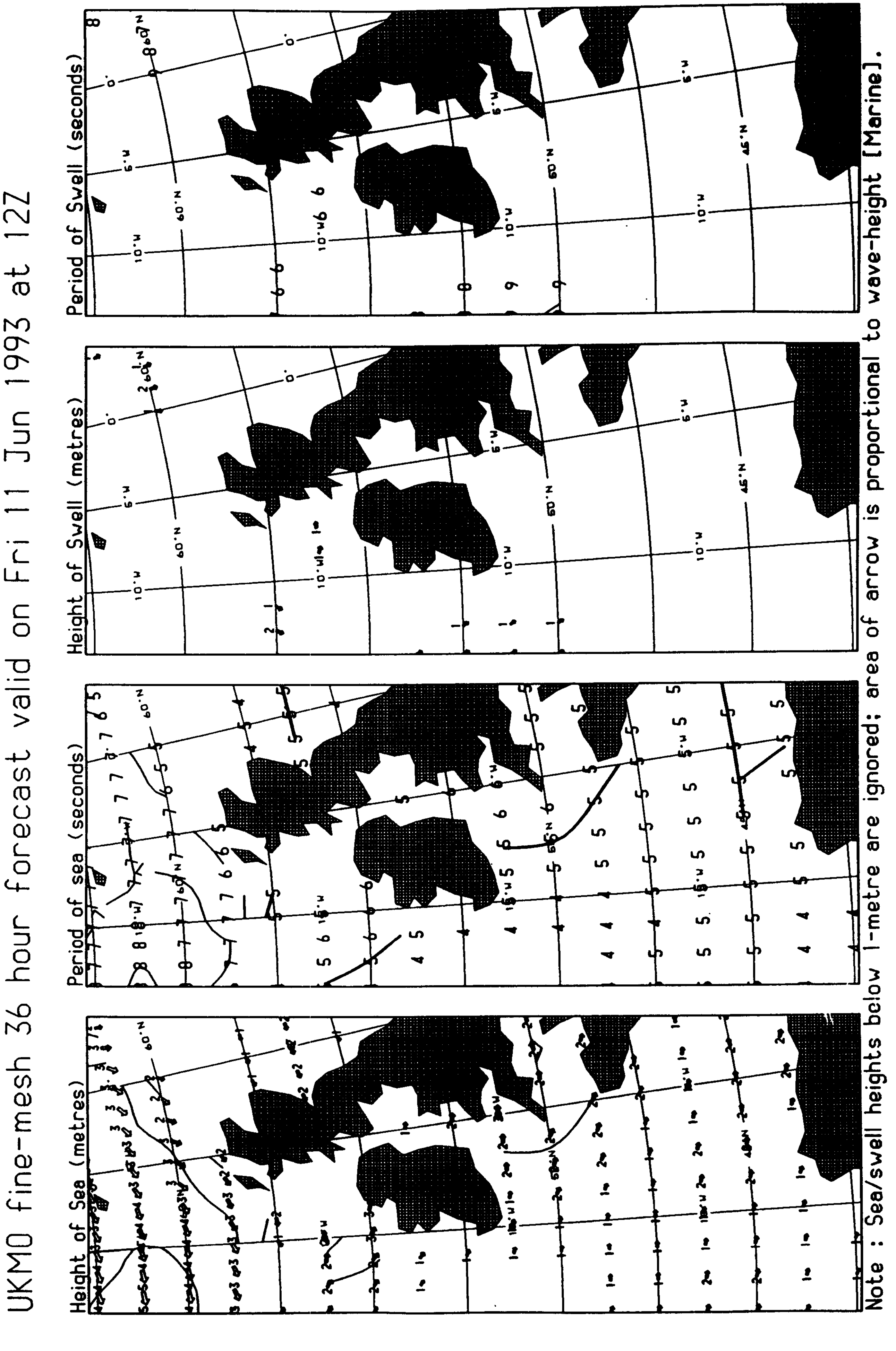


Figure 7: A plot of output from the UKMO wave model. Note the shading over land.

Finally we intend to upgrade the graphics system available to the Research section. The requirements for NWP research are different to those for operational forecasting. The present system allows the user to produce plots on either eta-levels or pressure levels, and to produce difference plots between two runs of the model. We hope to extend the system to allow the user to plot cross-sections and a selection of derived products.

Longer Term Plans

In the longer term we plan to switch to local workstations running X-windows. Ideally we would like an integrated system which would combine the plotting of satellite pictures, radar images, observations and NWP products. We would also like the forecaster to be able to display cross section plots.

At present many forecasts are produced in the form of meteograms derived from direct model output. The forecaster can modify these meteograms [before transmission to customers] using a crude interactive system. This is becoming unwieldly as the number of meteograms has been increasing. It has been suggested that we should develop an interactive system to allow the forecaster to modify the raw NWP products [displayed as fields] rather than the meteograms. The forecaster could then produce meteogram plots from the modified products. This application would definitely need a workstation [as opposed to a dumb terminal like a VT-340] and a final decision on this approach is likely to be postponed until after workstations have been installed in the forecast offices.

We hope to start receiving primary satellite data within the next year or two; also we hope to upgrade the radar system at Shannon Airport [since the present radar is nearing the end of its useful life]. These upgrades will also influence the final selection of hardware and software for use by the forecaster.

Final Remarks

We are only starting to use workstations. We hope to continue development and our ideal system is one which will allow the forecaster to display any product on the screen. This ideal is probably a few years away but it is a goal we should aim at.

References

Hamilton, J.E.M., [1984] : 'The Design of an Interactive Graphics System for the Display of Meteorological Fields', Software Practice and Experience, Vol. 14, No. 6, p. 587-600 (June 1984).

Hamilton, J.E.M., Lennon, P. and O'Donnell B., [1988] : 'Objective Analysis of Monthly Climatological Fields of Temperature, Sunshine, Rainfall Percentage and Rainfall Amount', J. Climat., 8, pp109-124, 1988.

Kari Niemelä, Finnish Meteorological Institute

An experiment to develop multi-platform Meteorological Workstation software using OOP

Background

Our present Meteorological Workstation sofware runs on DECs VAXstation hardware and is based on VAX proprietary graphics library UIS. The hardware is gradually getting out-dated. In fact the production of new suitable hardware has already been discontinued. It is not possible to continue on the basis of our present sofware on any platform, because porting it to any other graphics system would require major reprogramming.

Ideas

Because the software would anyway have to be rewritten, we were aiming to try to develop a system that could be easily ported on different platforms. Also the possibility to develop a system, that allows to build different kinds of workstations as well for forecasters as for customers, was kept in mind. Object oriented programming (OOP) was said to offer high productivity and easy manageability. The OOP-language offering possibilities to port to several platforms is C++.

Object Oriented Programming

OOP is based on the concepts "class" and "object". Compared with traditional languages "class" may be associated with type and "object" with variable, but this comparison offers only the first idea. Objects can also be seen as a kind of client-server system: client objects send requests to server objects (function calls), server objects act and return answers to the requests (function return values).

An OOP language normally has the following features:
- ENCAPSULATION: The data and the functions acting on them, are packed into a unit called CLASS. The implementation part is hidden from the clients, who see only the interface part of the class. Normally direct access to the data is prohibited; data should be accessed only by METHODS (functions) of the class.
- INHERITANCE: New classes are typically derived (inherited) from existing classes. Only new or modified functions need to be programmed. Inheritance increases code re-use.

- POLYMORPHISM: Same function names can be used to gain different results depending on the context. Thus if we have a method "plot", requested for object of type "temperature", it knows to present its value as a number, while for object of type "low cloud" it knows to draw a synoptic symbol. As users of these classes we do not need to know the exact plotting methods, only that these objects are able to plot themselves.

These features make OOP well suited for modelling real world phenomena. Single small phenomena are described by classes (encapsulated data and functions). Different phenomena interact by sending requests to each other. Similar phenomena with small differences can be described with classes inherited from existing ones. Polymorphism makes life easier as we need not invent different names for similar functions. After we have built some basic classes, we can describe more and more complex phenomena (create new classes) using and inheriting the existing classes.

Project

A project was started to study the use of OOP in meteorological applications. Six people were appointed to participate in the project. None of us had previous experience on C++, but a long experience of procedural languages, mainly Fortran. So the project had to start with training. Pure training courses were used little; the main training method was self or group study. A couple of us were familiar with the principles of OOP for several years and for them it was clearly easier to quickly adapt on new programming methods.

As the main goals of the project were stated:
- to get familiar with OOP
- to learn C++, the most portable and joinable of the OOP-languages
- to test the OOP-concept with a small meteorological application
- to make a decision of the applicability of OOP at the FMI

Five of the project members had PC with Borland C++, one had MacIntosh with MacApp programming environment. We had a unix file server, where project files were accessible to everybody.

Project Results

The concrete result of the project was a simple zoomable synop plotting on a geographical background. It was run on PC, Mac and Unix environments. The software in each of the platforms consisted of three parts:

1) Base code common to every platform ("meteorological class library")

2) Device dependent toolboxes (interface between parts 1 and 3), having standard interfaces towards part 1.
3) Fully system specific user interface part (Object Windows Library in PC, MacApp in MacIntosh and Motif in Unix)

code	% of own code	% of total code
Base code	>95	20...99
Toolbox	2...4	1
User interface	1...2	50...80

Besides of that we have created a programming environment working quite satisfactorily. Small problems between PC, Mac and Unix arose because of different carriage return marks and special character sets (scandinavian caharacters).

Experiences

Designing classes is not a straightforward task, because there are a number of ways to accomplish it. To succesfully produce object oriented code demands an object oriented way of thinking and an object based method of design.

Transfer from traditional ways of programming into OOP is not easy, because it demands a completely different way of thinking. C++ may not be the best choice to learn object oriented way of thinking; one of the drawbacks of C++ is that it does not force you into object oriented programming, but allows you (accidentally or deliberately) write traditional code, because all the properties of C are available as well.

The classes resulting from satisfactory object oriented programming should be such that
- they consist of short and clear member functions (resulting code is more likely to be correct),
- the classes form a clear inheritance hierachy, where the same code is not found in several places (easier maintainability),
- the applications programmer only sees the necessary member functions i.e. the data representation and part of the member functions are hidden from the user (prevents incorrect use of data)
- the classes may be used as such, or they may by inheritance be transformed into a more usable form (increases reusability of the code)

Path: helle.fmi.fi!pouta.fmi.fi!not-for-mail
From: karhila@pouta.fmi.fi (Vesa Karhila)
Newsgroups: fmi.egows
Subject: Welcome
Date: 14 Jun 1993 12:57:12 +0300
Organization: Finnish Meteorological Institute
Lines: 34
Message-ID: <1vhi1o$97u@pouta.fmi.fi>
NNTP-Posting-Host: pouta.fmi.fi
Summary: Opening of the EGOWS group
Keywords: egows

Welcome to the EGOWS News Group <fmi.egows>!

E uropean
G roup on
O perational Meteorological
W ork
S tations

The Finnish Meteorological Institute created this News group to honour the fourth annual EGOWS meeting in the Deutscher Wetterdienst, Offenbach am Main, June 15-18 1993.

This News group offers a continuous discussion forum for the EGOWS people, available also outside the few annual EGOWS meeting days. We also welcome other people working with meteorological workstation software, to join <fmi.egows>.

The discussion language should be English.

This is not a public News group. In order to join the group your News manager has to tell NNTP server the name of our server, i.e. news.fmi.fi. Detailed information is available from Jyrki Rissanen in FMI (email: jyrki.rissanen@fmi.fi).

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The German Military Geophysical Service's

GEOPHYSICAL DATA AND INFORMATION SYSTEM (GEDIS)

for Airbase MetOffices and Regional Forecast Subcenters

(German procurement name: Beratungsterminal)

Paper presented by
H. Peter Gemein and Karl W. Stroh

(German Military Geophysical Office,
Mont Royal, 5580 Traben-Trarbach, Germany)

GEDIS is an operational meteorological workstation system for the support of the German Military Geophysical Service's (GMGS) outstations (stationary Airbase MetOffices and Mobile Forecasting Units). It has been developed for the GMGS by "SIEMENS-NIXDORF-Informationssysteme" on WS30/6xx workstations (equivalent to the Hewlett-Packard Apollo 400 Series). Each installation will consist of

- 2 graphics workstations,
- laser and ink-jet printing periphery.

The workstations are linked by Apollo-Token-Ring. The configuration can be divided into two one-workstation-systems by opening the Token Ring without causing any restriction to the functionality.

The Regional Forecast Subcenters will have an additional scanner for digitizing weather charts to be transmitted to other outstations.

Hardware characteristics of the individual workstation:

- ≥ 64 MByte RAM,
- 8 bitplanes,
- 2048*1024 pixels (1280*1024 pixels visible),
- 1.3 GByte mass storage capacity,
- Giga tape,
- primary user interface: mouse,
- keyboard.

System software:

- DOMAIN OS Version 10.3.5.4,
- X-WINDOW,
- ANSI-C and FORTRAN77 compilers,
- OSF-MOTIF user interface, created by DIALOG-BUILDER,
- C-ISAM database.

The **application software** is briefly described in the following:

(1) **Communication** between GEDIS and the GMGS communications computer network is done via the public dedicated line network (4800 to 9600 b/s) and the public package switching network, both run under **X.25-transmission-protocol**. Only **WMO recommended data formats** are accepted (message format and GRIB).

Satellite based communication is anticipated for the future, particularly for the mobile operating environment.

(2) Up to three **individual broadcast programs** may be defined by the forecasters for each installation. Additionally there are **answer-to-request** functions available.

(3) There is a **message switching** function for the link between the existing local airbase weather information system and the GMGS communications network.

(4) The user dialog runs entirely via **OSF-MOTIF-menus** on the screen, selections and interrupts being done via **mouse**, text entries via **keyboard**.

(5) **Screen display manager** functions allow for zooming (particularly of decluttered weather depiction charts), choice of geographical background maps and diagrams (T, log p) and their components and resolution.

Up to two meteorological objects (field, TEMPS, etc.) may be overlayed to the map or diagram background at one time.

(6) Application manager functions enable the forecaster to set up an **individual, mission tailored working environment** (data presentation environment) not only for the individual MetOffice in general but also for the individual forecaster and for specific situations or tasks (army exercises etc.).

(7) Incoming **data** are **processed in real time**.

(8) **Text editing** is included. Messages are entered into screen masks. The system converts them into WMO-messages and transmits them to GMGS's various communications computers for redistribution.

(9) A special function only for the Regional Forecast Subcenters enables their forecasters to **scan weather charts** and enter them as bit-graphics into the communications network.

(10) Up to 10 **watchdogs** check and indicate the arrival of very important data, e.g.: warnings, TAF amendments, etc. The forecaster may define the subject of this checking function individually.

(11) **Alphanumerical data** are displayed in sorted form **in sets of windows** whose contents may be defined by the forecaster.

This function is to widely replace the conventional clip-boards.

(12) For surface and upper air weather depiction charts a decluttering procedure is used in order to prevent station models to overlay each other. There are conventional presentation models as well as single and multiple parameter presentation, partly with threshold setting by the forecaster. While such a chart is displayed, additional incoming data is added to the display automatically in quasi real time, thus providing a **self-updating weather watch function.** The 24-hour day is divided into 48 **fixed half-hour-time-slices** which all the data are distributed to, depending of their date-time-group. In general a display call refers to one of these time-slices. However, it is also possible to display the last-30-minutes data or the last-60-minutes data, thus referring to **time slices that continuously progress with the wall time.** This function delivers a self-updating display, too. It even automatically clears individual data from the display as soon as it becomes "too old".

(13) **Upper air soundings** can be presented, analyzed, and evaluated (determination and calculation of a number of values, indices, etc.).

(14) **Surface and upper air model output** is received from GMGO's forecast center (GMGO is the German Military Geophysical Office). The **gridpoint fields** are stored and can be presented as vector-graphics (isolines), gridpoint values, or gridpoint symbols, respectively.

(15) **All other types of vector charts** being transmitted as vector graphics files can be presented.

(16) **Bit-graphics charts** are available from the GMGO and from the Regional Subcenters (e.g.: Central Tactical Analysis (CTA) and Forecast (CTF) and Unified Weather Forecasts (UWF) being constructed on GMGO's Interactive Graphics System, as well as scanned charts).

(17) The forecaster may **predefine** a number of **graphical products** that are calculated from the data base. Each product may contain a number of 1, 2, 4, 6, 9, 16 or even 25 individual charts next to each other in differrent printing formats, equivalent to a standard set of conventional multiple facsimile charts (e.g.: a number of geopotential forecast isoline fields or a number of TEMP-diagrams). Each individual chart may contain one or two meteorological objects (field, TEMPS, etc.). These products can either be called on the screen interactively or can automatically be computed according to a user defined internal time table. The contents refers to the time of presentation, not to the time of definition.

(18) As for pixel-graphics, there are **radar images** (PL- and PC) from the "Deutscher Wetterdienst" Weather Radar System

available on the Radar-PC; it provides single image and **film loop** presentation.

Soon the 2-dimensional PL-Images will be replaced by the 3-dimensional local radar-cubes. A new software is being developed by the GMGO for the presentation of such 3-dim images on the GEDIS.

Later, special **high resolution satellite images and/or derived products** are thought to be received and displayed. (Remark: most MetOffices are already running SDUS stations)

(19) For the preparation of graphical briefing documents functions for **manual construction** of weather charts are planned. Again the mouse will be used for selecting and positioning of symbols, lines, colors, etc.

(20) A major point is the existence of a number of **numerical decision aids** developed by the GMGO, including:
+ terrain effect models, especially wind over complex terrain,
+ diffusion of pollution over complex terrain,
+ forecasting of fog caused by radiation,
+ aircraft icing conditions,
+ ray tracing plots for radar, millimeter wave, and infrared propagation,
+ trafficability forecasting

and others.

(21) All user actions are saved in a logbook. In case of military airplane crash the complete meteorological data set, the logbook, and other important data are saved on tape. A special software application mode enables specialists of the GMGO to later **investigate** the influence of weather and flight forcasting on the **aircraft accident**. The investigation mode regards the original point of time of any kind of performed user action and the respective time dependent data situation.

(22) This particular software mode will also be used by the GMGS forecaster school. The students will be **trained** to handle selected, archived weather situations **under reality-close conditions**.

It should be mentioned, that the average **image generation time** for an individual display stays within 10 seconds, many displays being much faster.

Currently, GEDIS is undergoing semi-operational troop trials on three different Airbase MetOffices. As soon as the trials have been finished successfully, another request for proposition will be made in order to choose new hardware for the series installation. The application software will be implemented on proposed hardware for performance tests before a decision on the contractor is made. This type of procurement procedure matches with the extremely fast progress in computer technology and the still declining prices for graphical workstation hardware.

The installation of GEDIS on 59 stationary and 24 mobile outstations is planned to begin in 1995.

Special hint concerning the exhibited configuration:

1. As the acceptance test has only been passed by the end of May, time was too short to establish a direct data line to one of the GMGS message switching centers for this EGOWS meeting (The German TELECOM requires 6 weeks for switching a line). Consequently the data presented is conserved data and the real time update functions mentioned in paras (8), (9), and (11) can't be demonstrated in full action.
2. By the same reason, the above mentioned numerical decision aids haven't been completely installed, yet.

The Meteorological Application and Presentation System (MAP) - a short description

by Michael Pogoda

The main task of the MAP-project is to develop a system of meteorological applications to run in regional weather offices. MAP works with data sent by the central office. This data will be received, stored, processed, displayed for different forecasting purposes.

Up to 1992 there were different applications as stand alone systems (IGS, AUTO-TEMP). These applications were developed to run at the central office. But there was also the need at the regional offices to have tools for their work, handle a great amount of data, retrieve data quickly.

These are the things to do pressed into some keywords:

-integration of different systems
-combination of different data
-automatation of every day's work
-standardization of the user interface
-implementation of new applications

As told above there are some projects to integrate into the more general MAP-project. These are:

DPS	[Data Presentation System]	(in operation)
IGS	[Inteactive Graphical system]	(in operation)
WORKRVZ	[Satelite image processing and displaying]	(in operation)
AUTOTEMP	[Temp evaluation program]	(in operation)
IGA_ZWV	[Interactive Graphical Applications for the Central Weather forecaste Service]	(in operation)
RADAR		
MEDIEN		

There are some other projects concerned with Communication

AFW	[automatic message transmitting]	(in operation)
FAX_E	[satelite data transmitting system]	
DWDNET	[the met.of. wide area network]	

These projects give the infrastructure for MAP.

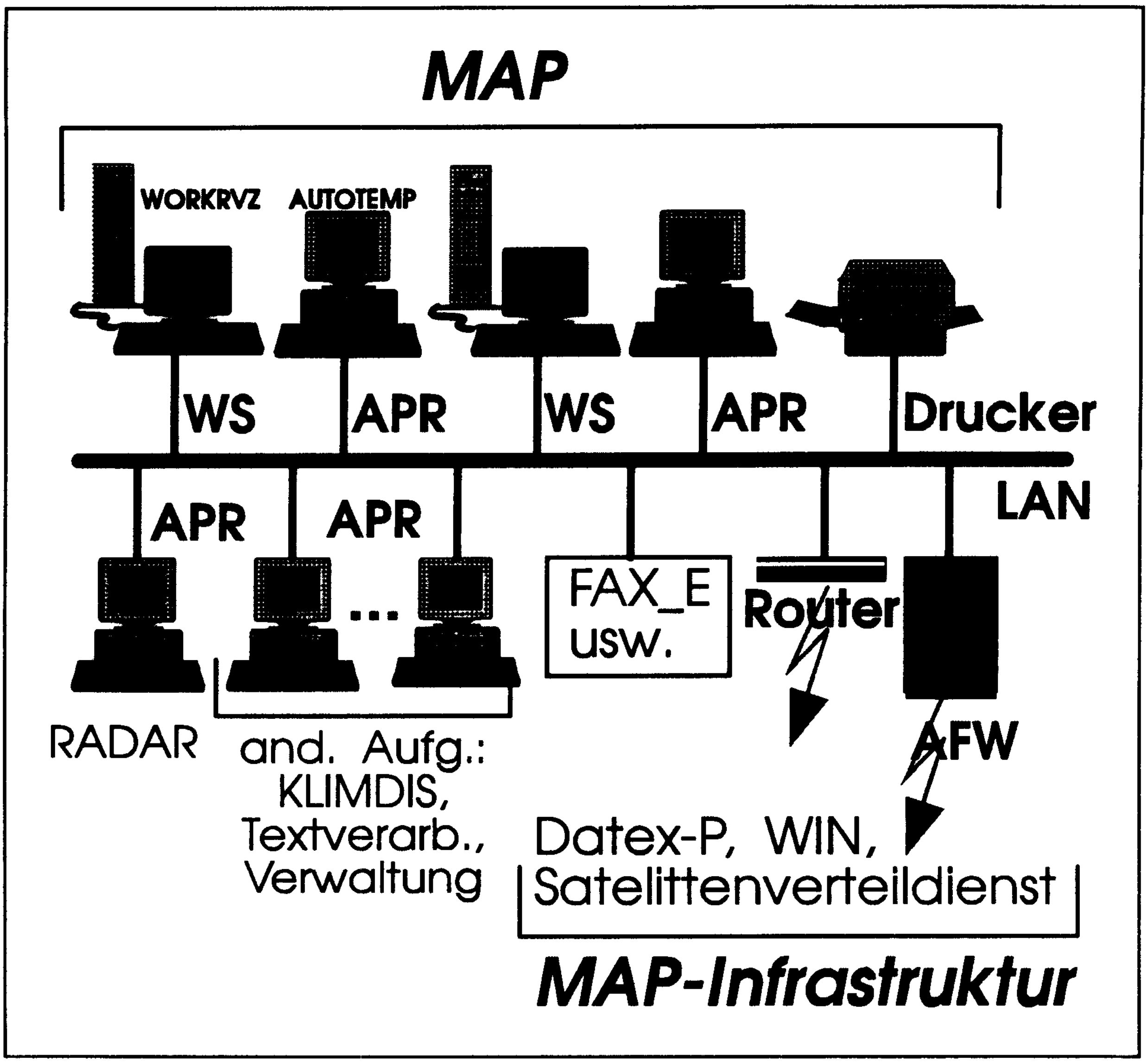
Some additional projects will be developed as direct parts of the MAP project. At this time there are two prjects very important:

MAP/SWIS [Road state and weather information system]
(in operation at Essen and Frankfurt since winter 1992/93)

MAP/STURMWARN

[storm warning system]

(test will start at München in October 1993)



A typical LAN at a regional forecast office consists of

- 2 workstations
- 1-2 personal computers (This will be so called "RISC-PC")
- Laserprinters (A4 and A3).

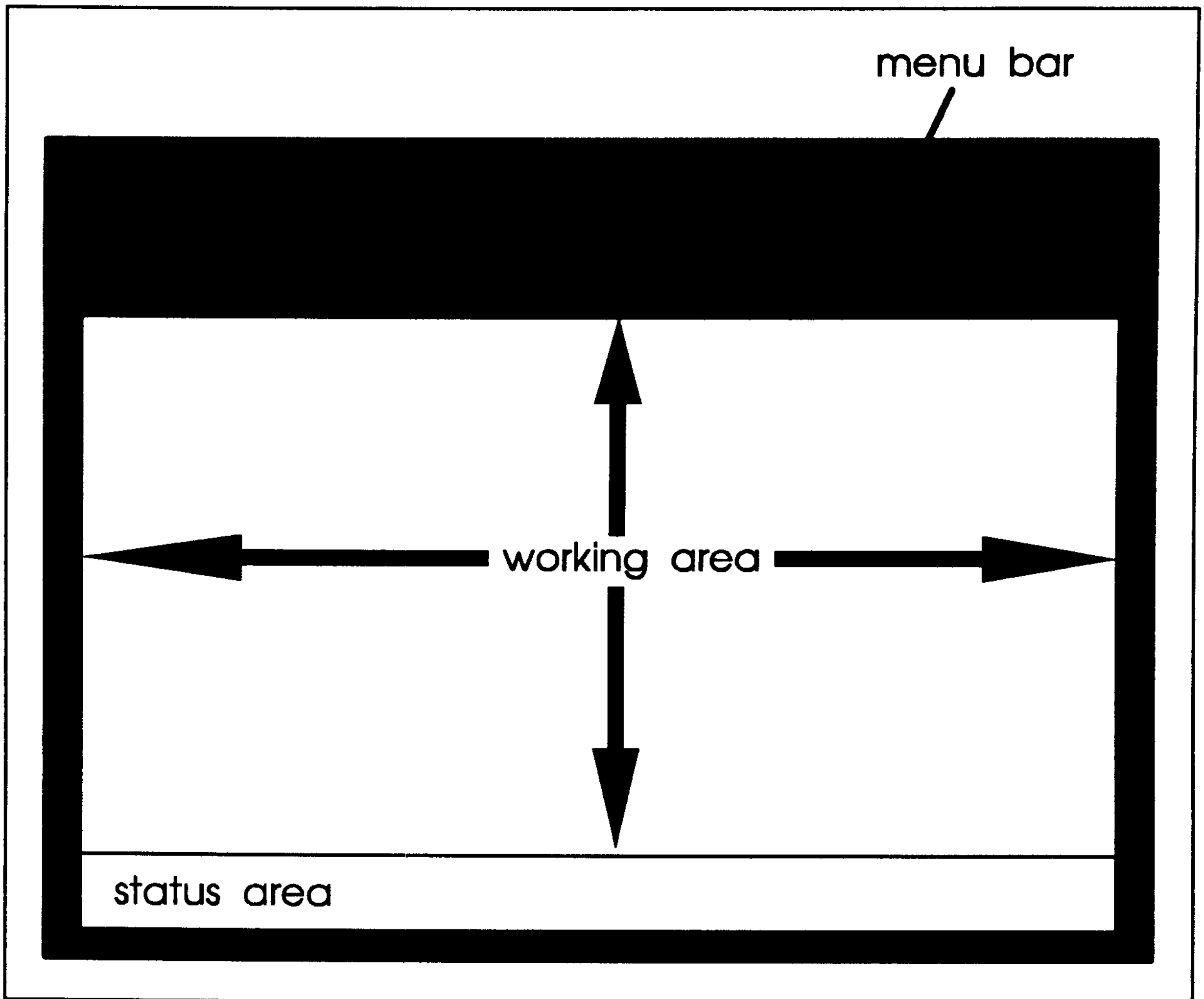
the following picture shows a typical local area network:

Some programming standards are important. These standard are typical for such a project as the EGOWS has shown:

- UNIX
- TCP/IP
- ISO/OSI-protocols in future

programming languages C und FORTRAN
X-Windows
OSF/Motif
GKS

As told above Motif is used. A MAP-Motif-window has the following form:



For the MAP project we developed a special database. This was necessary because the C-ISAM database was not fast enough.
Now we have a client-server-model and it is possible to get data from the server through the whole local area network.
We have used standard UNIX-tools for this database implementation like message queues, shared memory and sockets.

The following short look at installed computers and marks is given as a short timetable.

Installed Computers March 1993

AUTOTEMP-PC:

WÄ Berlin, Essen, Stuttgart, München, Nürnberg, Hannover, Bremen, Schleswig, Frankfurt, SWA Hamburg

Final Discussion of EGOWS-Group

The meeting decided to continue with an annual cycle of informational meetings in order to stay informed about the developments in the participating countries. EGOWS covers the same topics like the AMS IIPS conference but is non-commercial, cheaper, and makes the interchange of informations for the europeans much easier.

The meeting reinvestigated the recommendations on MWS-developments and standards. The list of recommendations will not be repeated here. Only supplements and modifications will be given.

- Extended GRIB, as recommended by WMO for image storage, should be considered. Extended Grib is investigated by ECMWF and Brasil.

- Open-GL should be investigated as an upcoming standard

- OPEN-LOOK is no longer recommended

- Tests on OOP-programming performed in Finland (Infos via email, see contribution) and at ECMWF

- MAC for DTP purposes, eventually commercial DTP-software as an integral part of the MWS. Interactive work based on precomputed maps.

The participants exchanged their experience with their databases:

- France: Oracle V.6, restricted to length of binary objects, upgrading to V.7
  Project Database-Test (tested ORACLE, EMPRESS): Recommendation for ORACLE due to Climatological Data Handling
- Germany: own development, UNIX cells
- Belgium: -
- Netherlands: INGRES Climatological, extended to all GTS-Data, on test for MWS
- Austria: SYBASE 4.8/4.9, indexed, Allocation of 100 MB, fast, stable, next Release with even better Backup
  Disadvantages EMPRESS: no Disc Control, field oriented, poor recover performance (5 GB/20hr)
- Slovenia: no database
- Denmark: UNIX File System, also used for images
- Sweden: RDB/SM-Ingress (?) MIMER- Swedish Database
- Finland: Oracle
- UK: ISAM-Toolkit, own development,

NWP-Data on Direct Access File

- Norway: Oracle (due to Climatological Handling)
- ECMWF: EMPRESS
- WMO: no database, Direct Access File, NAVY/NCAR-Empress, Price Comparison (k$) SYBASE 26-40, Empress 5

NEONS on top of EMPRESS is under test at METEO FRANCE. Results will be presented in 94.

Most of the participating countries do have their MWS running operationally complying to the standards set up by our group. Therefore it was agreed that future contributions should not focus on well known features of their workstation, unless the design has changed significantly from their latest report. It was seen necessary to concentrate our discussions on other topics, like user interfaces or meteorological applications.

It was agreed to save half a day for contributions on user interfaces and another half a day for contributions on meteorological applications.
It was seen necessary to define a MWS User Interface Style Guide. This style-guide should help to design GUI's especially for the meteorologists, that are easy and fast to use. The design should involve the forecaster at an early stage, and should allow indidvidual configurations.
Request to all participants: Short report on experience with GUI and recommendation to GUI's (written form in advance),

Next Meeting

Mr. Jacob Brock kindly invited the EGOWS group to Kopenhagen in June 1994.
The proposed dates for the EGOWS 5 are 21 - 24 June 1994

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