

METVIEW/ws
Manipulation and Visualisation of Meteorological Data In Workstations
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1. Overview

We will talk about the METVIEW/ws project, which will implement a Meteorological Workstation. METVIEW/ws' definition of a Meteorological Workstation will be given. A project overview will be presented and its feasibility evaluated. The current status will be reviewed, concluding with a description of the final system.

2. The Meteorological Workstation

METVIEW/ws defines a Meteorological Workstation as a interactive application system for research and operational meteorologists. It combines interactive data access, manipulation and visualisation.

3. The METVIEW/ws Project

3.1 Background

METVIEW/ws is a cooperative project between ECMWF and INPE/CPTEC, Brazil with assistance from MeteoFrance. Preceding the project, some interactive, X Windows based pilot systems were developed, such as Xsection (cross_sections) and Metbatch (interactive edition and execution of METVIEW/batch job scripts).

Although ideas for METVIEW/ws have been around for some years, the first formal systems analysis draft is dated 20 November, 1990. A succession of papers led to the current draft 3, Functionality Specification. Based on the Spring development, INPE/CPTEC finalised the version 0.1 prototype of METVIEW/ws in October 1991, forming the basis for further development.

Currently, the development teams consist of G. Camara, R. Cartaxo, U. Freitas, F.Ii, J.R.Oliveira, A. Battaiola at INPE/CPTEC, and J.Daabeck, B.Norris, S.Thepaut, E.Nishimura and Keld Petersen at ECMWF.

3.2 Objectives

- (i) To provide an interactive environment for accessing meteorological fields, observations and images ("original data").
- (ii) To provide an interactive environment for manipulation of data creating derived fields, observations, images or other data types ("derived data");

- (iii) To provide an interactive environment for the visualising of original or derived data in 2-D.
- (iv) To base the development on approved or de facto standards.
- (v) To reuse as much existing software as possible.
- (vi) To follow the existing procedures at ECMWF and INPE/CPTEC.

3.3 User Requirements

We will not describe all the user requirements, but concentrate on the principles of introducing an interactive system. METVIEW/ws will for some users be the first interactive meteorological system they have used. It will therefore provide tools for the user to produce the same output with less work. Users solve specific problems, depending on their tasks. Therefore applications are provided, each with a specific focus. Most users will continue to use batch, and a batch version must be available as well.

4. Feasibility

Interactive window based systems have been around for some time. However, it is only now that sufficient tools are available, making it feasible to complete a project of METVIEW/ws's magnitude with a small team. Tools include Unix, X Windows, NFS, object-oriented programming, graphics standards and mature internal support software.

5. Current Status - METVIEW/ws 0.1

INPE/CPTEC developed the first METVIEW/ws prototype, version 0.1. Developed on Sun computers it uses Sun XView and C++. Version 0.1 features include data input from GRIB fields and images, superposition and zooming of fields and images, MAGICs graphics - contouring and wind charts in cylindrical, mercator, polar stereographic and satellite projections, animation loops, and interactive drawing and edition of fronts.

6. METVIEW/ws, Functionality Specification, Draft 3

6.1 Overview

The Functionality Specification, Draft 3 (called Draft 3) describes the structure of the next METVIEW/ws version, leaving implementation details open for evaluation. A firm foundation of principles and structure common to all applications is defined to ensure a consistent behaviour when implemented by a team and to guarantee expandability. This will ensure a long software life cycle. Although interactivity is the main focus, batch processing is a requirement. It must be easy to use, making the user a meteorologist, not a computer user. Finally, it must be easy to implement with a small team.

6.2 Interactive and Batch

METVIEW/ws will come in two versions. An interactive version with an X Windows based graphical user interface and distributed application processing, and a batch version using the METVIEW/ws Command Language.

6.3 Applications - The User View Of METVIEW/ws

METVIEW/ws presents meteorological concepts and solutions. The system is limited to the access, manipulation and visualisation of meteorological data, making it possible to break all applications into a set of common functionalities, so that code can be shared. This will lead to the implementation of eight Common Functionality Services :

- (i) Data extraction
- (ii) Database selection
- (iii) Data sequencing
- (iv) Data manipulation
- (v) Definition of visual attributes
- (vi) Define plot locations
- (vii) Visualisation
- (viii) Hardcopy plot

METVIEW/ws implements three types of applications :

- (i) The General Application, a special application giving unrestricted access to all of METVIEW/ws's Common Functionality Services, making it ideal for experimentation.
- (ii) Specific Applications. These solve particular focused problems, such as displaying cross-sections, metgrams etc. They will be separate load modules networked to METVIEW/ws.
- (iii) External Applications. These are non-METVIEW/ws applications that usually will provide input data for METVIEW/ws. Users can start, stop and monitor these, but there is no intelligent communication to them.

6.4 Data Access

METVIEW/ws will access data using the methods available at the local site. INPE/CPTEC will use the METDATA system. ECMWF will use their MARS based archival/retrieval system combined with interactive access to FDB and RDB structures.

In order to shield the METVIEW/ws user from the technicalities and differences in access methods, a system independent Data Unit is defined, referencing data in meteorological terms.

6.5 Visualisation

METVIEW/ws has three primary definitional units, the Data Units, the Visdef (visual definitions) and Plot Window/Plot Subwindow (location of plots).

Data Units referencing database items are Original Data Units. Manipulations performed on a Data Unit yield Derived Data Units. Furthermore, Data Sequences are multiple Data Units that can be operated on as a single item.

A Visdef describes a series of visual attributes (e.g. contour line style, colours etc). A Visdef is not bound to any Data Unit, but is merely a description of the visual look of a chart, should the Visdef be applied with some data and displayed.

A Plot Window is a rectangular container for multiple plot areas. These individual plot areas are called Plot Subwindows, and can be organized in a row/column structure.

Soft Visualisation is implemented. By binding any arbitrary combination of a Data Unit, Visdef and Plot Subwindow a chart is produced. This allows for flexibility in changing attributes and plot location with minimal effort. In addition, by allowing the three components to be sequences, multiple drawings can be made with a single selection.

6.6 Distributed Processing

METVIEW/ws is a distributed system. Application processing and certain CPU demanding services (e.g. data manipulation and visualisation) will be separate load modules networked to METVIEW/ws. This is all transparent to the user, who should merely experience higher efficiency of processing. To implement this NFS and RPC programming techniques will be used.

6.7 Processing Modes

In METVIEW/ws the user can interact with METVIEW/ws through the interactive graphical user interface or through Command Macros. METVIEW/ws defines all of its functions through an equivalent command language, MCL. A Command Macro is a file of MCL commands. Thus METVIEW/ws has three processing modes :

- (i) Interactive with graphical user interface;
- (ii) Interactive with Command Macros;
- (iii) Batch with Command Macros;

6.8 System Configurability

METVIEW/ws is configurable so that changes can be made easily in response to a changing system environment and user preferences.