MERLIN - A PROTOTYPING SYSTEM FOR THE EARTH SCIENCES

S.G.Chapman
IBM UK Scientific Centre
Winchester, ENGLAND.

Summary: This paper gives an overview of the Objectives of the MERLIN System used for research into Application Prototyping at the IBM UK Scientific Centre. (UKSC)

1. INTRODUCTION

While this paper does not apply specifically to Operational Weather Forecasting Systems, it does show a way in which new systems could be developed. Often the UKSC works with external organisations to form alliances to explore and develop new applications, and an alliance with ECMWF to look at new forecasting techniques could be possible.

By the very nature of the alliance program, one of the recurring tasks is to build a prototype application as a demonstration vehicle. The MERLIN System attempts to simplify the process, obtaining the required function by allowing us to assemble existing tools which are "glued" together under the control of an interpreter.

2. WHY MERLIN

The original alliances which led to the MERLIN project were Meteorology, Seismology, modelling of Fire and Smoke, and Oceanography. As these four elements (AIR, EARTH, FIRE AND WATER) constituted the four primeval elements of Alchemy, a great Alchemist was needed - hence MERLIN!

3. MERLIN NOW

3.1 Hardware

The MERLIN System is based on the IBM RISC System/6000 range of machines. It will run on all models from the 320 to the 730. However, the most extensively tested software has been run on a model 530. Because of the extensive networking capabilities of the AIX environment, different parts of a MERLIN Application may run on different machines over a TCP/IP link. This is transparent to the user.

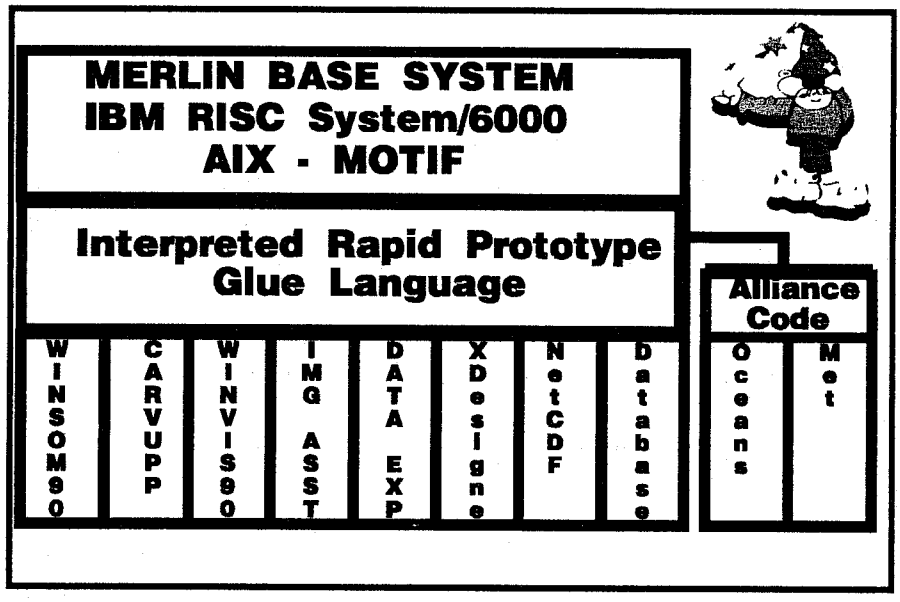
Because this is a development system, no use is generally made of special purpose hardware, e.g. graphics accelerators. Such hardware features could be incorporated if necessary, although great care must then be taken to ensure that the code is only run on an appropriate machine.

3.2 Software

MERLIN runs under AIX and uses OSF/MOTIF for windowing as the operating environ-

ment. This gives all the prototypes a similar "look and feel" at the user interface.

The MERLIN Architecture is shown below. It consists of the AIX Operating System, the Interface or "glue" interpreter layer, and the tools themselves. Provision also has to be made for the later addition of code generated by the Alliance partners, code which the MERLIN developers will never see. Specifically, provision has to be made for gluing in code for which the source is not available when the MERLIN system itself is compiled.



3.2.1 AIX/OSF/MOTIF

AIX is the standard IBM offering of UNIX. It provides all the standard UNIX function, plus some usability enhancements. OSF/MOTIF is the Open System Foundation windowing system. This Graphical User Interface is becoming a "standard" and is used here to provide all the usual interfacing functions.

3.2.2 The Interpreter

To provide the interactive capability of the system, an Interpreter is interposed between the tools themselves and the operating system. This interpreter is capable of understanding the data requirements for each tool, their input and output capabilities, and can thus modify output from one tool before providing it as input to another. The Interpreter is also capable of interfacing to C, FORTRAN and other languages. Much of this interfacing is made automatic by the use of "function prototypes" in "header" files. This Interpreter was developed from a UKSC Interpreter originally used for interactive control of Constructive Solid Geometry Models.

3.2.3 NetCDF

To provide a common internal file format, and to facilitate the exchange of data between the MERLIN system and other systems, NetCDF was chosen as a file standard. This is a

self describing file format, with sufficient information in the header to allow software encapsulation techniques to be used to isolate the user from the details of the data storage. NetCDF was developed by the US Environmental Sciences Community as a standard data exchange format. It has been extensively tested within this community and is constantly being updated and improved. It is currently supported by the University Corporation for Atmospheric Research at the Unidata Program Centre and is sponsered by the National Science Foundation. It is available free from an anonymous FTP directory at **unidata.ucar.edu**. To subscribe to the mailing list, send a request vis FTP to **netcdfgroup-admin@unidata.ucar.edu.**

3.2.4 The toolkit.
By "tool" we mean any piece of useful software, written in any language. Just about any stand alone tool with an application programming interface can be used as part of the toolkit. Image processing forms a large part of the activity at the Scientific Centre and so much of the application work has been developed using image processing techniques.The IBM Image Assistant suite of software has been extensively used to provide the require function. It should be noted that databases, networking software, etc., are all tools in this context. It should be noted that although the OSF/MOTIF interface has been drawn above the Interpreter, it is in fact simply another tool which the Interpreter uses. It has been drawn as a special layer because of its importance as the user interface. Because of this flexibility, MERLIN can emulate almost any kind of system.

4.0 APPLICATIONS

The main applications modelled here have been seismic, meteorological and oceanographic. This is not because of a limitation of the MERLIN concept, but rather a concious decision to restrict the application area to a manageable domain.

4.1 Seismic

An application was developed for a major Oil Company to allow rapid exploration of the (large) volumes of seismic data. This tool was assembled from existing components to give the correct function and feel. Activity is now under way to develop the concepts explored and to decide how to further exploit these ideas.

4.2 Meteorology

An alliance with the Meteorological Office at Bracknell led to an application to rapidly view a stack of data from the Mesoscale model with the intent to develop new methods for interaction with the data during the initialisation phase.

4.3 Oceanography

A fusion of two disparate datasets was used to create an animation of the flow of warm water eddies from the Indian Ocean to the Southern Atlantic. Previously, this data was

not usually viewed in context. While nothing fundamentally new was discovered by this animation, it provide a powerful demonstration tool for visualising the flow. This collaboration is continuing.

5.0 DISCUSSION

While the interpreter approach is very applicable to most of the activities it does have its drawbacks. If the data/parameter passing between tools is fairly simple, then very little performance penalty will be seen because of the Interpreter. However, as is often the case, the data/parameter manipulation is quite complex. In this case the interpreter may become a bottleneck and a performance penalty will be incurred. Whether this is acceptable is very application dependent. However, it should be remembered that this system is for demonstration of concepts. and thus performance is not a primary consideration. Once the basic concepts of an operational system have been demonstrated, a properly coded system may be written. The writing of this operational system will be greatly assisted by the knowledge gained from the prototyping activity.

6.0 CONCLUSION

This approach to building application prototypes for demonstration of new function has been shown to be of great value. It is hoped that interested parties will contact the Scientific Centre if they feel that there is sufficient scope for a collaborative venture.