Management Information System Task Force Note

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Subject: Relational data base services supported by DD

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ORACLE AT CERN

The Oracle Relational Data Base Management System (RDBMS) is operational at CERN on VAX computers, on the IBM 3090 under VM/CMS, and on IBM-compatible PC’s. Oracle is written in C and was originally developed on DEC computers. New facilities continue to be developed and distributed by Oracle Corporation initially for VMS. CERN is a European Beta Test site for new versions of Oracle. The European supplier is ORCE (ORacle Corporation Europe), located at Naarden (NL). Of potential future interest at CERN is the port to Norsk Data computers being developed by ORCE, and due to be completed by end of 1986. Also, Oracle is being offered as standard software on the IBM RT, which is currently being evaluated at CERN.

ORACLE AND SQL

Relational Data Base Management Systems are the outcome of ideas presented in a 1970 paper [1] by E.F.Codd. An RDBMS allows the application implementor to build up data bases consisting of collections of relations, which in the case of Oracle are simply called tables. If certain normal form rules [2] are respected when the tables are designed, the data base will have no unnecessary redundancy, so that updating can be performed with minimum risk of inconsistency.

Several ‘query’ languages have been invented for relational data bases, but the Structured Query Language (SQL), which is used in Oracle and also in IBM’s SQL/DS and DB2, is the most widely accepted. SQL is an ANSI standard and a draft ISO standard. It is used both for data manipulation, (that is querying, insertion, updating and deletion of data in tables) and for data definition (that is creation, modification and dropping, etc. of tables). SQL is also used for specifying such things as user access to tables, and the locking strategy to be used during concurrent updating. A good introduction to SQL is ‘Oracle Overview and Introduction to SQL’ [3] published by Oracle Corp. and obtainable from Christiane Ball (3349).

ORACLE FACILITIES

SQL commands can be executed fully interactively using the terminal interface facility SQL*PLUS, but this alone would not be sufficient for the development of applications which have to be used daily by people inexperienced in computing, or which require more elaborate reporting facilities. Various packages are provided for these and other purposes.

Formatted screens for data input, updating and querying for specific applications can be designed by means of the Interactive Application Facility (IAF). SQL commands can be invoked from behind a screen in multiple circumstances such as the cursor leaving a field, on query, on update etc. Also, functions written in Fortran or C and called user exits, can be invoked for special purposes in the same circumstances. IAF is now being augmented by a screen painter in a package called SQL*FORMS which permits even easier design of screens.
At CERN a screen painter, called EIAP, which works in conjunction with IAF, was developed for the VAX and has proved extremely useful. In fact, while awaiting SQL*FORMS on the IBM, it is found worthwhile to use EIAP on the VAX to develop screens for the IBM; the IAF files, and other Oracle files, are completely compatible between the two machines except for two little-used characters. On the IBM, IAF is not so pleasant to use because of the more limited number of function keys and the lack of interaction at character level. Also, at CERN with standard terminals connected to the IBM, screen widths have been limited up to now to 80 characters instead of 132, and it is still not possible to have underlining or reverse video.

For simple report generation, SQL*PLUS allows output with such basic embellishments as page and column headings, breaks, sub-totals, etc. For more elaborate reports, there is the RPT facility which allows one to combine SQL commands with either SCRIPT or Oracle's own text processing language, RPF. Although very useful, particularly with nested SQL commands, RPT has been found to be rather slow and is due to be replaced by a more efficient Oracle report generator.

Some reports are produced using the Host Language Interface (HLI) to Oracle from a programming language such as Fortran or COBOL. The HLI, which of course can be used for much more general purposes than report generation, exists in two forms: the Call Interface and the Pre-Compiler. With the Call Interface, Oracle is accessed by calling subroutines (in the case of Fortran), while with the Pre-Compiler the Oracle commands are inserted in the program in an easy syntax which is converted to HLI calls in a special pass before compilation. The pre-compiler syntax is compatible with that of IBM's SQL/DS.

Other Oracle features available to the general user are:

- concurrent multi-user access with update locking down to the level of rows in tables
- possibility to roll back a series of update commands,
- ability to allow sharing of tables, or parts of tables, with other users,
- built-in data dictionaries, and possibility of auditing operations on a user's tables by means of them,
- ODL for loading data from a flat file into a table,
- export (and import) of a user's tables for archiving purposes and for transfer between data bases on the same or different computers.

Facilities which are available, but are not not yet delivered with production status, include: SQL*GRAPH for business graphics, SQL*CALC for spreadsheets, and SQL*MENU for Oracle menus.

COMMUNICATIONS

While waiting for SQL*NET to provide more fully distributed data base functionality as promised by Oracle Corp., it is possible today [4] to:

- download a table to a PC from VAX VMS, and vice-versa, but not yet from VM/CMS,
- run Oracle facilities on one VAX VMS machine accessing a data base in another machine linked via Decnet,
- access databases in a VAX Cluster from multiple copies of Oracle in different machines,
- make virtual HLI calls to Oracle running in one machine, from a C program in another machine (not necessarily running Oracle) where the two machines are linked by a common protocol such as TCP/IP, using a facility called Pythia, based on Remote Procedure Calls and developed in DD [5] [6].
APPLICATIONS

The applications on the LEP VAXes are described in the note [7] in this series by Josi Schinzel. Only applications on IBM VM/CMS and on VXCRNA, the VAX 8600 providing a general physics service will be discussed here. However, the application developed by DD for LEP stock—keeping should be mentioned as it illustrates the use of a user exit from IAF, written in Fortran, for the purpose of printing immediately a form containing information typed onto the screen but in a different format.

The Oracle service under VM/CMS started up only at the beginning of 1986, and many applications are still under development. There are 130 registered user data bases, which cover a spectrum of purpose ranging from learning, through application development, to production. Users from the LEP experiments, all four of which are represented, are involved mainly in investigating the use of RDBMS for various phases in the control of data taking. It should be remarked that for the majority of physics applications, the Oracle feature of most interest is the Fortran Pre-Compiler, whereas for the engineering and administrative applications it is the Interactive Application Facility.

Some of the applications in full or partial production, either in DD Division or developed with substantial DD participation, are:

- **DD**
  Microprocessor fabrication — stocks, orders, deliveries, configurations.
- **DD**
  Workshop jobs management.
- **H**
  Central library external address lists, and White Book of HEP institutes.
- **DD**
  Inventory.
- **DBS**
  Goods dispatching, and arrivals. In both of these applications, completed forms are printed on a Xerox 3700 laser printer.
- **DD**
  Program library — distribution of library material.
- **DD**
  Computer accounting. This is a preliminary pilot implementation by a Summer Student.
- **EP/DD**
  Fastbus Modules Management.
- **DD**
  SW Group software licences, and accounting.
- **SFS**
  Inventory.
- Telephone directory, and user abbreviations.

Oracle is installed on VXCRNA as a 12—user service for physics applications, under a special licence agreement which limits the maximum number of concurrent users. On this machine, there are 42 registered data base users, of whom 23 belong to Aleph.

Two notable applications concerning the physicists, rather than the experiments, are in production:

1. A system for keeping track of persons and institutes involved in LEP experiments, with mailing lists, electronic mail addresses, etc. This system was developed by Aleph and has been adopted by Delphi. It could be transferred to IBM VM/CMS.
2. A directory of electronic mail addresses, updatable by the users themselves, and accessible from other VAX computers and from IBM VM/CMS. This facility was developed in DD and is based on Remote Procedure Calls to Oracle through networks, a facility which was also developed in DD.

THE ROLE OF DD DIVISION

DD Division essentially maintain the Oracle data base service on the computers installed in the Centre, but do not develop the applications except for some pilot projects, and for a few cases where no computer expertise whatsoever is available for the project. Maintaining an Oracle service involves, amongst other things:

- Introduction and testing of new versions of Oracle and facilities.
- Data Base Administration monitoring for efficiency, tidying up of data bases, ensuring backup, etc., etc.
- Registration of Oracle users, and maintaining a data base of applications.
- Reporting problems to ORCE and keeping users informed of the results.
- Development and management of utilities, including a library of IAF user exit functions.
- Editing and distribution of documentation, and maintenance of a HELP facility.
- Assistance in the design of data bases, and the development of applications.
- Coordination between users, except in the case of the LEP VAXes where this function is performed by LEP Division.
- Organization of Oracle courses by ORCE at CERN. Up to now courses in French have been given entirely by DD.

In addition, DD have undertaken responsibility for the distribution and first-line support of Oracle on computers used for physics at CERN or elsewhere, in the framework of special licensing agreements between ORCE and the HEP institutes collaborating with CERN.
REFERENCES


7. Schinzel, J. Audit of the LEP Database service.