MIGRATION OF THE CONFIGURATION DATABASE FOR PSI CYCLOTRON ACCELERATORS

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Abstract

The Production Configuration Database is running with Oracle Database Server 7.3 on an OpenVMS platform. This system will be migrated to an Oracle Server 9i running on a Linux platform. The Information storage holds data for different subsystems (Device Definition, Device Control Settings, Equipment, Interlock etc.) A new requirement is the configuration of VME and PLC-based Device Control. A description of the migration path, the development of new Database Applications and the progress of the project is reported

INTRODUCTION

The configuration for PACS (**P**roton **A**ccelerator **C**ontrol **S**ystem) at PSI is stored in a relational database system from Oracle. Fig. 1 shows the main components in this context. IOCs (I/O Computers formerly denoted as **F**ront **E**nd **C**omputers) are fed with configuration data at their boot time. Control system workstations for development and operation also use database configuration data for starting their applications or making a Device IO access through a shared object library.

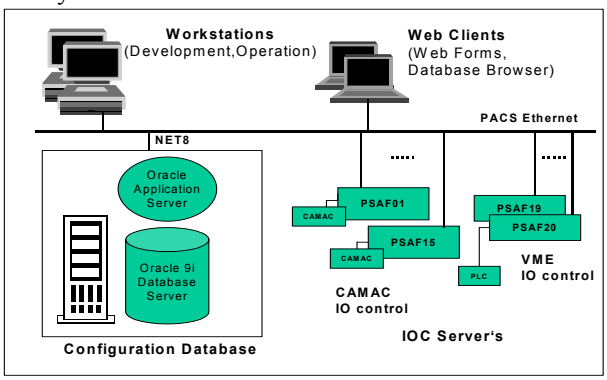

Fig. 1**:** Architecture of configuration database for the **P**roton **A**ccelerator **C**ontrol **S**ystem (PACS)

For the new database the "Oracle 9i Enterprise Server Engine" running on a Linux platform (Redhat 7.x) has been chosen. In addition on the same machine the "Oracle Application Server" is running as a middle tier to the end user. The main task of this server is to deliver the new Oracle Web Forms to an Intranet Web Client for Database Entry. This server can also be used in the future as a normal Web Server for static or dynamic documentation of our database.

The main characteristics with respect to content and applications of our configuration database are the following :

Information Areas	Device Definition, Device Control, Equipment, Interlock, TouchPanel and Transport
Oracle Applications	Database Maintenance/Entry using Oracle Forms
Client Programs	Database Extraction, Generation and Deployment using PLSQL, Proc*C++, and/or Java Language
Database Browser	A graphical tool for Device Information retrieval (at present implemented as X-Windows Application
Database Statistics	~3250 Devices, ~12500 Attributes ~75 relational database tables ~40 Oracle Form Applications

(1) Device Definition holds everything about definitions and organization of all the elements in our accelerator complex as seen by the operator. This may be a bending magnet, quadrupole, profile monitor, a pump etc. Each Device has a unique name (up to 8 characters) according to our Device naming convention and is arranged into machine parts. Each Device is connected to a parent device according to the physical arrangement along the beamline. Device Listings ("Holy List's") may be produced from this information.

(2) *Device Control* is the main data source for our IOCs which includes information about Hardware IO address configuration, software driver functionality, parameter settings for analog/digital Device Attributes, etc. It also includes special device data for formulas (virtual device control) and for profile monitor control.

(3) *Equipment* means the definition and organization of installed hardware components in terms of crates, modules and submodules. Each hardware modul belongs to one of the supported types: VME, PLC, CAMAC, ROAD-C or CAN.

(4*) Interlock* holds data tables for description of our Run Permit system. Interlock modules are organized into areas, groups and sections. Each module is mapped to an IOC and has configurable input/output function tables. The Interlock tables feed data input for the Interlock monitor application and for the Interlock server service started at IOC level.

(5) *Touchpanel*, the toplevel client application in the Control Room has it's configuration stored in the central database, too. MMI (Man Machine Interface) Buttons are arranged into areas and categories. Each Button in the MMI may be configured to start an application. The Touchpanel configuration data are extracted into binary and pure ASCII data files.

(6) *Transport* holds specification tables for the definition of various beamlines. Beam element properties for bending magnets, quadrupoles, etc. are stored. The input for the computer simulation program TRANSPORT may be generated .

MIGRATION OF SYSTEM

Redesign

Before moving the complete database content, a redesign of our table structure has been done in order to improve the structure with respect to the criteria redundancy and integrity of data. The Software Design Tool (Power Designer) has been used for this purpose. Existing tables have been modified and new tables were introduced for the description of the new VME IO modul upgrade. The result is a modified physical table model together with SQL-scripts for the creation of the structures (tables, triggers, views).

DB Setup

A new database setup on a Linux Platform (Redhat 7.x) has been done. The data from our production database (Oracle 7.3, OpenVMS) has been loaded into the prototype step by step using SQL scripts. On the same platform Oracle's Application Server software bundle has been installed and configured for executing Oracle Web Forms through the Intranet.

Database Entry ,Oracle Form Applications

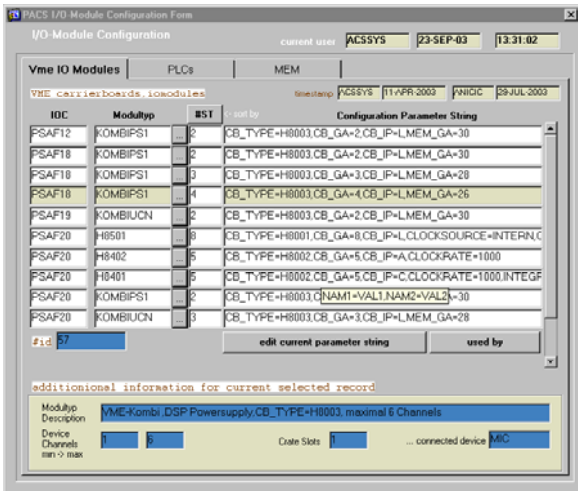

Fig. 2: New Oracle Web Form for configuration of VME I/O modules and new PLC IOC interface.

The most effort and work has been invested in the migration and development of new Data Entry Form Applications (see Fig. 2). The old text based SQL*Forms couldn't be used for the new system. For Development the "Oracle Developer Forms 6i" product is used on a NT-platform. Several complex Data Entry Forms have been developed to fill the data into the tables for Device Definition, Device Control, Equipment, etc. . In order to build a complex Data Entry Form the data source on the users screen is either based on a single table, an object view or a stored procedure. When the User enters or modifies database records several checks for validation against the actual database are done before the requested entry is committed.

A PLSQL library has been built for using generic functionality. After development the source code is deployed to the platform where the Application Server resides. After compilation the executable may be accessed on the Intranet. All of the Webforms are organized into a Menu System by categories. A User and database role based security check is done before starting a single application.

DATABASE DEPLOYMENT

XML is a popular data format for several reasons: it's human readable, self-describing and portable. Therefore it's used as data exchange format between our Database Server and the IOCs. The xml-datafile is generated by a Java Stored Procedure which is triggered from a Oracle Form Menu option. The datafile contains data for all IOCs and all IOC-services (like PIOSer, BLKSer, LOOPSer, see [1]). After the extraction process the data file is transformed to its binary equivalent. Each IOC gets its own binary input file. Further on, the binary configuration file may be deployed to the corresponding IOC. The User can pick a list of IOCs, copy the data and reboot the corresponding IOCs.

For the Client Device Access Library another method for data exchange has been taken over from the old system. With the help of a "ProC* application" a C-Source Code is generated from the database. After extraction this output must be deployed, compiled and linked into a platform specific shared library (Linux and OpenVMS).

Interlock and TouchPanel Application data are generated in a similar way. A Java Stored Procedure executes a runtime process ("ProC* application or Java program") which produces output in binary, ascii or xml format. A generic Oracle picklist Form has been written in order to select and copy the data files from the database server to the destination workstation/server platform.

CONCLUSION

A new database system for PACS has been established on a Linux platform. All the data tables from an Oracle 7.3 Server Instance have been loaded and migrated into a new structure running on an Oracle9i Server successfully. The system has been brought into production and can be easily extended to support new data requirements.

Oracle Web Forms 6i together with Oracle's Java and XML technology has been used to handle the data input and output. The development for porting the Oracle Web Forms has been done in about 1 Manyear .

Some problems arised, when executing the web forms from a linux client web browser. For such a user a client/server implementation based on the Motif X Window System is provided.

In the near future the configuration database and their applications will be reused for the PROSCAN project as well.

REFERENCES

[1] D. Anicic et. al, "Replacement of Magnet Power Supplies Control and Field-bus for the PSI Cyclotron Accelerators ," ICALEPS'01, San Jose , Nov 2001.