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Rapid Development of Database Interfaces with Oracle APEX, Used for the Controls Systems at CERN

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Abstract

The need to rapidly prototype, build and deploy applications and to be able to react immediately to the changing user requirements is a challenge facing every enterprise. CERN – the largest particle research centre in the world – has tremendous data storage requirements, encompassing many different databases and has to quickly provide interfaces to visualize the data. This article will cover how Oracle APEX has been used to build several different database-centric interfaces related to the accelerator complex. Real-world applications will be discussed and it will be shown how Oracle APEX has met the preliminary requirements of the application developers and the user community at CERN. The article will address the question of when APEX could be a suitable choice of application development technology, and will share a developer's first-hand experience of both the good and bad points.

Data Browsing Interfaces 'window-on-data'

Requirements

- Database-centric reporting utilities
- Web-deployed interfaces
- Access to data from disparate locations
- Quickly respond to new requirements
- Rapid application development - Agile programming
- Fast prototyping and short time to production deployment

Alarms

Accelerators Entities and Signals

Equipment Codes Catalogues

Oasis

Power Converters Configuration

Controls Configuration

Portals

History Log Browsers

ORACLE Databases

Controls Configuration

- Role-Based Access
- Front-End Computers & Servers
- Accelerators Timing System
- Video Observation System
- Controls Devices & Class Property Model
- Fixed Displays
- Beam Interlock Systems
- Devices Working Sets & Metaproperties
- Common Console Manager

Controls Configuration Power Converters DB

Operational Data: Alarms DB

QA: Accelerators Entities & Signals Naming DB

Operational Data: Open Analogue Signal Information System DB

Controls Systems Infrastructure

CENTRAL OPERATOR CONSOLES

FIXED DISPLAYS

LOCAL OPERATOR CONSOLES

FILE SERVERS

Linux/HP-ProLiant APPLICATION SERVERS

PVSS /Linux PC SCADA SERVERS

TIMING GENERATION

RTLinux/DS VME Front-Ends

Linux/Lynx/DO PC Front-Ends

uPCI Front-Ends

PLCs

BEAM POSITION MONITORS, QUENCH PROTECTION AGENTS, POWER CONVERTERS, BEAM INTERLOCKS, RF SYSTEMS, ETC.

ACTUATORS AND SENSORS CRYOGENICS VACUUM

ANALOGUE SIGNAL SYSTEM

Data Management Domains

- Layout
- Controls
- Configuration
- QA
- Assets
- Operational Data

CERN Accelerator Complex

ORACLE Application Express

- ⇨ Web-based 4GL graphical application development environment
- ⇨ Standard feature of the Oracle database
- ⇨ Ease of use, rapid development cycle
- ⇨ Allows declarative development style
- ⇨ Ready to use widgets and page components
- ⇨ Templates and libraries for professional look-and-feel
- ⇨ APEX runs inside the Oracle database
  - : as close as possible to the data
  - : can utilise all features of the Oracle database
  - : as reliable as the database server

Oracle RDBMS

APEX

<APEX Metadata>

<Web Server> mod_plsql

<User>

<PL/SQL Engine>

<Application Developer>

<Stored Data>

- ⇨ APEX supports
  - : client-side scripting for more dynamic, interactive, feature-rich interfaces
  - : can easily incorporate Web 2.0 functionality

- ⇨ PL/SQL driven
  - : code reusability - PL/SQL packages in the database

- ⇨ Developers skill-set, which helps starting development with APEX
  - : Oracle developers - PL/SQL, SQL expertise
  - : Web-developers skills - HTML, CSS, JavaScript, AJAX
  - : Experience in another 4GL environment

Effort

APEX Learning Curve

Without the given skill-set

With the given skill-set

Results

- ⇨ Easy to incorporate web-services
- ⇨ Establish best practices, coding standards, naming conventions

Oracle DB

APEX Workspace

SSL

<Web Service>

DB User: Controls_config

User authentication handled by a CERN central web-service

- ⇨ Organizing the APEX workspaces for best quality of service
- ⇨ Reduce migration effort by packaging the application for a single-file, single-step deploy

DEVELOPMENT

Oracle DB

APEX Workspace

DB User dev: Controls_configuration

TEST

Oracle DB

APEX Workspace

DB User test: Controls_configuration

PRODUCTION

Oracle DB

APEX Workspace

DB User prod: Controls_configuration

- ⇨ Attention to
  - : version control - coarse vs fine granularity export - APEXExportSplitter
  - : number of database connections

Conclusion

Oracle Application Express is a mature development tool optimized for building web-enabled window-on-data type applications. Oracle development expertise is a prerequisite for rapid and effective results, especially for more complex or relatively large user interfaces. Good programming policy and practices remain important for overall maintainability. For the data browsing tools of the CERN accelerators complex, APEX fulfills the stringent application needs. The APEX user interfaces are continuously used by a wide user community of accelerator operators and equipment specialists.

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