Flexible Data Driven Experimental Data Analysis at the National Ignition Facility

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Abstract

After each target shot at the National Ignition Facility (NIF), scientists require data analysis within 30 minutes from ~30 diagnostic instrument systems. To meet this goal, NIF engineers created the Shot Data Analysis (SDA) Engine that uses the Oracle Business Process Execution Language (BPEL) platform to configure analyses and archive results. While this provided for a very powerful and flexible analysis product, it still required software developers to create each unique analysis configuration executed by the SDA engine. As more and more diagnostics were developed and the demand for analysis increased, the development team was not able to keep pace with the rate of change. To solve this problem, the Data Systems team undertook the approach of creating a data-driven framework that allows users to specify the analysis configuration (analysis routine, inputs and outputs), input data sources, and results archive destinations as data that is stored in the database. The creation of this Data Driven Engine (DDE) has decreased the manpower required to integrate new analysis and has simplified maintenance of existing configurations. The architecture and functionality of the Data Driven Engine will be presented along with examples.

Data Mapper Technologies

- BPEL
- COTS product
- Web Services
- XML

Data Driven Engine

- Java/DB2
- Web Services
- XML
- Excel Spreadsheets

New Data Driven Engine

- Java
- Web Services
- XML
- WebDAV
- Groovy/Velocity Macros
- Struts/HTML/JavaScript

Data Driven Analysis Engine consists of an Analysis Director that sequences the analysis for each diagnostic; a Data Mapper that maps data from data sources (Archive, Calibration, NIF Configuration) to analysis, and maps results to the archive; and a Cluster of Analysis Servers that execute the analysis routines. We migrated the Data Mapper from a COTS Workflow product to an in-house developed data-driven application that significantly reduces the time to integrate new analyses.

New DDE Data Driven Engine

Pros:
- Includes Macro ability for complex logic
- Provides a web interface to specify data mapping
- Interface mimics the Interface Document currently used by analysis developers

Cons:
- Required time to develop the tool

Analysis Integration Time

In the field of SW development, the general strategy is to use COTS products wherever possible in order to minimize local development effort and to maximize the capabilities and experience of another development team. However, there are times when the replacement of COTS products with custom software yields significant benefits in terms of tailored functionality that fully meets the user needs and makes better use of development dollars. In migrating from BPEL to the DDE, the Analysis team at NIF achieved:

1. more efficient re-use of existing capabilities and functions; 2. simpler, user-specified data mapper configurations; 3. increased transparency and maintainability of data mapper configurations; 4. load balancing that handles peak loads predictably and reliably; 5. less manpower to add a new analysis to the Shot Data Analysis Engine; 6. fewer dedicated, specialized software developers.

With the new DDE, the team is expecting to be able to achieve:

1. greater simplification and maintainability of data mapper configurations; 2. additional decrease in manpower needed to integrate a new analysis.