ACCELERATOR LATTICE AND MODEL SERVICES

P. Chu (chu@frib.msu.edu), H. Lv, F. Guo, C. Wang, Z. Zhao, G. Shen

Facility for Rare Isotope Beams (FRIB), Michigan State University, East Lansing, MI 48824 USA

Introduction

- Machine tuning applications rely on lattice and beam simulation data
  - Embed online model within apps
  - From lattice/model server
- Service-oriented Architecture (SOA) for better code and data reusability
- Lattice/Model service can potentially host any models
  - Important for complex machines needing multiple models

Application Architecture

- Should support both desktop and web applications
- 3-tier architecture
  - Database
    - Holding lattice and model data
    - MySQL based, generic schema for various modeling tools
    - Access API in JPA (Java Persistence API)
  - Business Layer
    - Inline model simulation
    - Data API for direct access to DB
    - REST API for accessing DB/data via service
  - Client applications
    - Thin client apps
    - Possible component reuse for both desktop and web applications

Abstract

Physics model based beam tuning applications are essential for complex accelerators. Traditionally, such applications acquire lattice data directly from a persistent data source and then carry out model computation within the applications. However, this approach often suffers from poor performance and modelling tool limitation. A better architecture is to offload heavy database query and model computation from the application instances. A database has been designed for hosting lattice and physics modelling data while a set of web based services then provide lattice and model data for the beam tuning applications to consume. Preliminary lattice and model services are based on standard J2EE Glassfish platform with MySQL database as backend data storage. Such lattice and model services can greatly improve the performance and reliability of physics applications.

Prototype Lattice/Model Service

- Data API – Convenient methods for accessing data in database, e.g.
  - getElementByName("an_element_name")
  - setElementProperty("an_element_name", "property_category", "property_name", "data_type", property_value)
- REST Service API – Web convention for accessing data in database, e.g.
- J2EE Glassfish based web service with REST
  - Jersey implementation

Prototype Applications

- Desktop-based Model Management App for running Open XAL
  - Online Model, viewing saved model data, and other features
    - First cut data API only, future hook to the service
  - Web interface for managing lattice data in database

Conclusion

The authors would like to express special thanks to Dr. Don Dohan for his contribution to the database design and many valuable advices. The rest of the database collaboration team’s help on database related issues as well as the compatibility of the lattice and model database with the other database domains are also greatly appreciated. Early discussion with Dr. Juhao Wu and many other physicists is greatly benefit to the project.

Acknowledgment

This material is based upon work supported by the U.S. Department of Energy Office of Science under Cooperative Agreement DE-SC0000661.

Michigan State University designs and establishes FRIB as a DOE Office of Science National User Facility in support of the mission of the Office of Nuclear Physics.