ACCELERATOR LATTICE AND MODEL SERVICES

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Introduction

- Machine tuning applications rely on lattice and beam simulation data
  - Embed online model within apps
  - From lattice/model server
    - Better performance and reliability for apps
- 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

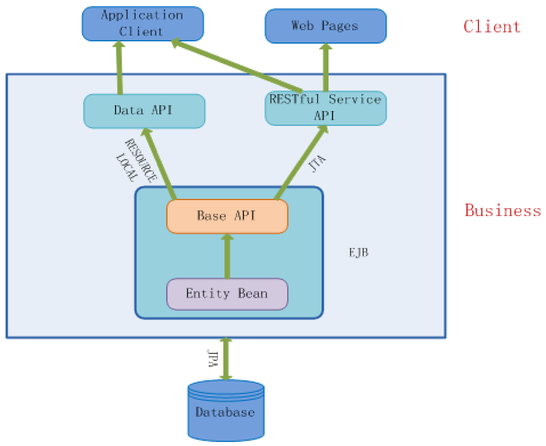

Figure: Lattice and Model Service architecture diagram.

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.
  - *http://localhost:8080/modelDBREST/webresources/beamlineSequence/name/FE*
- **J2EE Glassfish based web service with REST**
  - Jersey implementation

```
<?xml version="1.0" encoding="UTF-8" standalone="true"?>
- <beamlineSequence>
    <beamlineSequenceId>45</beamlineSequenceId>
    <firstElementName>FE_START</firstElementName>
    <lastElementName>FE_END</lastElementName>
    <sequenceDescription>NULL</sequenceDescription>
    <sequenceLength>43.917797</sequenceLength>
    <sequenceName>FE</sequenceName>
</beamlineSequence>
```

Figure: An example for REST API for query of a selected beamline segment.

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

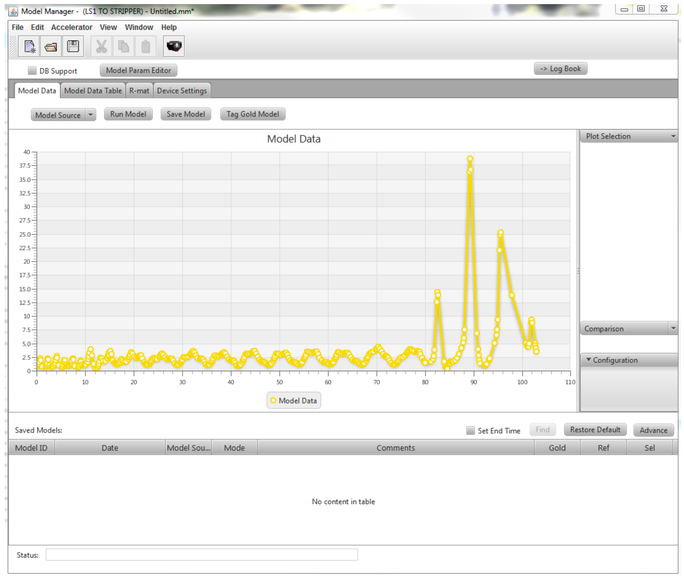

Figure: Database schema for storing model related data.

Conclusion

- Prototype Lattice/Model Service with Glassfish
  - Might try to implement in EPICS v.4
- Add more REST APIs for model data access
- Add real-time model to the service
- Change the desktop-based Model Manager App to acquire model data from the service instead of inline calculation
- Develop a model benchmark suite based on the Model Service so various models can be compared easily

Acknowledgment

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