The Federated **S**ervice-**O**riented **I**ntegration **F**ramework (SOIF) for Complex Engineering System Design

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Dissertation Description

Problem Statement:

1. Engineering system complexity increases due to:
   - ♦ larger size of engineering systems
   - ♦ larger amount of data and variables
   - ♦ more perspectives that are simultaneously involved in the development
   - ♦ more participants and resources which are globally distributed
2. The complexity of development process of complex engineering systems increases due to
   - ♦ more nested iterations and most of them are time-consuming
   - ♦ more overlapping design procedures
   - ♦ multi-level decomposition and integration
   - ♦ more complex design & manufacturing organizations
3. The existing integration environments for product development have shortcomings as follows:
   - ♦ not well defined organization and management processes; lack of standardized process templates
   - ♦ not well integrated distributed data and its management (e.g. ModelCenter)
   - ♦ not user-friendly interfaces (e.g. FIPER)
   - ♦ no QoS for time-consuming services

Conclusion:

The Object-Oriented distributed design framework is needed with:

- ♦ unified design process templates with common standardized service interfaces
- ♦ remote observer/observable master data model for efficient data integration and management
- ♦ mobile service UI relevant for product designers
- ♦ QoS for time-consuming design services

Objective/Approach

Objective:

The federated **S**ervice-**O**riented **I**ntegration **F**ramework (SOIF) for complex engineering system design based on ESDS (**E**ngineering **S**ystem **D**evelopment **S**upport environment—a distributed and collaborative design environment developed at BeiHang University, Beijing, China) and SORCER

Approach:

1. Review literature on Systems Engineering, CMMI, IPPD, SE, and SOA etc.
2. Analyze requirements for unified design process templates, remote observer/observable master data, mobile service UI, and QoS for time-consuming design services
3. Define requirements specification and architecture of FSOIF
4. Define unified design process templates and develop standardized service interfaces
5. Develop remote observer/observable master data model by using service context model
6. Develop mobile service UI relevant for engineering designers
7. Define QoS for time-consuming design services
8. Prototype above components and deploy SIOF
9. Test and deploy the SIOF system

Schedule

Literature review document	February 18, 2008
Requirements analysis report	March 8, 2008
Requirements specification and architecture of SOIF in form of UML models	March 30, 2008
Unified design process templates and standardized service interfaces	April 30, 2008
Remote observer/observable master data model	June 10, 2008
Mobile service UIs	July 10, 2008
QoS for time-consuming design services	August 10, 2008
System integration	September 30, 2008
System test report	October 30, 2008

Benefits

1. Complexity reduction of complicated engineering system development process by creation of a standardized service-oriented process template based on the universal IPPD model
2. The application and implementation of the *federated* IPPD approach can result in:
   a) Reduced cycle time to deliver a product
   b) Reduced system and product cost
   c) Reduced risk
   d) Improved quality
3. Easier and flexible data organization and management by using service context model
4. Seamless access to distributed resources and improved capability of data sharing and resources utilization in SIOF
5. Zero install and user friendly service UIs for engineering designers
6. Federated resources availability via QoS in SOIF