A domain model-centric approach to J2EE development

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Overview

- What is a domain model centric approach?
- When should you consider using it?
- How would you use it?
  - Architecture
  - Design
  - Implementation
  - EIS Integration
What
Implementing Business Logic

- Using objects to model the business domain
- Model supports complex application logic
  - It's more than data validation/verification
- Persistence is secondary consideration
  - Focus is the business logic not the data
- Essentially it's an OO application

Process-centric approach versus data-centric
When
Data-centric vs Process-centric

Data-centric
- Data-driven
- Ad hoc query-based, decision support
- Record-oriented, batch processing
- Wrapping existing database

Process-centric
- Process-driven
- Navigational access
- Complex application logic
- Object-oriented
- Building a new application
Pro’s & Con’s

Pro’s
- Fully leverage OO benefits
- Long term payoff as application complexity increases

Con’s
- Requires OO expertise
- Higher cost of entry for simply application
How
Application Data & Enterprise Data

- **Application Data** is the domain model objects, distinct from **Enterprise Data**
  - Application data modeled as objects
  - Enterprise data already exists in other systems

- Interact with application data and transact with enterprise data

- Application data doesn’t need to leave the middle-tier
What about the database?

- Still need to persist application data
- Interest is in storing/retrieving objects not rows/columns
Alternative Solutions

- **O/R Mapping Tools**
  - Reduces coding effort
  - Proprietary
  - Mapping overhead
  - Extra coding effort
  - Mapping overhead

- **DAO Design Pattern**
  - Reduces coding effort
  - J2EE standard
  - Mapping overhead
  - Ease of use

- **EJB 2.0 CMP**
  - Reduces coding effort
  - J2EE standard
  - Mapping overhead
  - Ease of use

- **Java Data Objects**
  - No coding effort
  - Java standard
  - Open choice of datastore
  - Transparent object persistence
  - Could use ODB as middle-tier database

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Contentious Conjecture…

“J2EE doesn’t offer much support for domain model-centric applications”
How (Architecture)
How
(Design)
Domain vs Component Models

- Crucial to distinguish between Domain & Component models
  - Domain model
    - Models the data and relationships as Objects
  - Component model
    - Models external, remote interfaces

- Merging the two leads to “fine grained” EJ Bs, every Java class being an EJB
  - Fine structure is too inefficient for heavy weight components

- Focus on “coarse grained” EJ Bs
  - Coarse structure diminishes benefits of OO approach
  - But good for defining interfaces & enterprise services
Modeling the Domain

Data Objects
- Objects that represent “real-world” entities
  - Customer; Order; Product
- And their relationships
  - Customer “can have many” Orders

Built using Java Classes
- Light-weight
- Intra-VM access only
Modeling the Components

- Enterprise Java Beans
  - Interfaces that represent interactions
    - A customer “can place” an Order
    - Provides a view or “façade” onto the domain model
  - And their enterprise services
    - Security; naming; transaction management

- Built using Enterprise Java Beans
  - Heavy-weight
  - Inter-VM access, distributed

http://martinfowler.com/eaaCatalog/remoteFacade.html
Combines benefits of both Object modeling and EJB development

**Domain model**

- **Account**
  - **Portfolio**
    - **Position**
      - **Trade**
        - **Equity**

**Component Model**

- **AdminBean**
  - `createCustomer()`
  - `createInstrument()`

- **AccountBean**
  - `makeTrade()`
  - `getPortfolioDetails()`
  - `getTradeHistory()`

- **InstrumentBean**
  - `getAll()`
  - `getQuote()`

**Use Cases**

- Façade for Account/Instrument
  - Separates business methods for managing domain model

- Façade for Account
  - Customer interactions, hides underlying navigational model

- Façade for Instrument
  - Manipulates all Instruments, hides underlying inheritance model
How
(Implementation)
Software Layering

- Separate implementation and isolate dependencies
  - Simplifies development, testing, debug, maintenance
- Loosely-coupled components
  - Isolate client versus server-side classes
  - Simplifies distributed deployment
- Three main layers
  - Model
  - View
  - Control
Classes in this package do not depend on any external classes and are all serializable.
Model (Domain Object Model)

- **Data Objects**
  - Complex data, complex data relationships
  - Fine-grained
  - Persistent and transactional

- **No business logic**
  - Mainly getters/setters

- **Independent of View and Controller layers**
  - Although may throw exceptions
View (External Data Interchange)

- Light-weight Java classes
  - Serializable, non-persistent, non-transactional
  - Simple data and simple data relationships
  - Ideally immutable
  - No external dependencies
- No business logic
  - Mainly getters/setters
- Instantiated by Controller layer, representation of Model layer

http://martinfowler.com/eaaCatalog/dataTransferObject.html
Control (Business Logic)

- External Interfaces
  - Business Logic
  - Coarse-grained operations on domain model
  - Handles persistence and transactions
- Manages the Model Layer and instantiates the View Layer
Control (cont’d)

- Implement business logic as normal Java classes
  - Simplifies unit testing and debugging
  - Can be re-used with JSP/Servlets

- EJBs layer on top of business logic classes
  - Add inter-component interactions
  - Add transaction propagation/management
  - Supports distributed deployment
package trade.control.ejb
Exceptions

- Identify internal versus external exceptions
  - Internal exceptions never thrown outside of Control Layer
- External exceptions belong to View Layer
  - No internal dependencies
package trade.view.exception

Exception
Serializable

InvalidAccountException

+InvalidAccountException(message)

RuntimeException
Serializable

PersistenceException

+PersistenceException(message)

InvalidConditionException

+InvalidConditionException(message)

InvalidOperationException

+InvalidOperationException(message)
An Example…

control

AccountSessionBean

AccountController

SessionBean

AccountRef

AccountDetails

Account

login(user: String, password: String): AccountRef
details(ref: AccountRef): AccountDetails
createPortfolio(ref: AccountRef): void

login(user: String, password: String): AccountRef
details(ref: AccountRef): AccountDetails
createPortfolio(ref: AccountRef): void

<<delegates>>

<<creates>>

<<manages>>
Roles & Responsibilities

- J2EE + light-weight object persistence allows the Domain model to be separated from the Component model
- Domain model is implemented as Java objects
- J2EE manages the Component model
  - Components manipulate the domain model as Java objects
  - Components are stateless SessionBeans
How
(EIS Integration)
Enterprise Coordination

- Coordination of “Application Data” with Enterprise Information Systems (EIS)

- Different approaches depending on needs
  - Synchronous
    - Distributed Transaction Management (XA)
  - Asynchronous
    - Omni or bi-directional

- Connectivity
  - Point-to-point
    - JDBC/JCA
  - Message-oriented
    - JMS
Synchronous Coordination

- J2EE provides a Java Transaction Service
  - Distributed Transaction Manager
- Use J2EE architecture to build application
  - “Application Data” managed in the middle-tier
  - EIS connectivity via JDBC/CMPI/JCA/JMS
- Transform objects to/from EIS representation as required
  - Tables/XML/…
  - Cache EIS data as “Application Data” for long running transactions
- Synchronization controlled by J2EE
  - Just need to call appropriate EJBs
- Message-driven Beans facilitate near-synchronous coordination
Synchronous

Sequence of events:

1. `AccountSessionBean` updates Account
2. `AccountSessionBean` calls `TradeSessionBean` to execute a trade
3. `TradeSessionBean` executes trade
4. J2EE commits transaction
Considerations

Pros

- Guaranteed consistency

Cons

- Expensive
- Prone to unavailability of external systems
  - Unless using JMS
- Prone to performance bottlenecks of external systems
Using Message-driven Beans

Sequence of events:
1. AccountSessionBean updates Account
2. AccountSessionBean sends message to TradeSessionBean
3. TradeSessionBean reads message
4. TradeSessionBean executes trade
Considerations

Pros
- De-couples middle-tier from enterprise systems

Cons
- Not synchronous
- Additional complexity
Asynchronous Coordination

- Middle-tier persistence guarantees long term storage
  - It’s a database!
- Use J2EE architecture to build application
  - “Application Data” managed in middle-tier
- Periodically propagate “business transactions” from middle-tier to enterprise systems and vice-versa
  - Time-based; # of transactions; ...
- Omni-directional
  - From or to the middle-tier
- Bi-directional
Propagating changes from Middle-tier

- **Within J2EE**
  - External event triggers EJB to perform synchronization
    - EIS connectivity via JDBC/CMP/JCA/JMS
  - Transform objects to EIS representation
    - Tables/XML/flat-files

- **Outside J2EE**
  - Batch processing
    - External application periodically exports changes from middle-tier to appropriate EIS representation

- Suitable for propagating new “data”
  - No conflicts, “data” owner by middle-tier
Within J2EE

Sequence of events:

1. AccountSessionBean updates Accounts
2. An external trigger calls TradeSessionBean
3. TradeSessionBean gets trades from middle-tier
4. TradeSessionBean executes batch of trades
Outside J2EE

Sequence of events:

(1) AccountSessionBean updates Account
(2) External application reads updates
(3) External application executes batch of trades
Propagating changes to the Middle-tier

**Within J2EE**
- External event triggers EJB to perform synchronization
  - EIS connectivity via JDBC/CMPI/JCA/JMS
- Transform EIS data to appropriate object representation

**Outside J2EE**
- Batch processing
  - External application periodically exports changes from EIS to appropriate object representation

**Suitable for propagating new “data” or changes to reference data**
- No conflicts, “data” owned by Enterprise
Within J2EE

Sequence of events:

1. External system sends message to InstrumentSessionBean
2. InstrumentSessionBean reads message
3. InstrumentSessionBean creates new instrument in the middle-tier
Outside J2EE

Sequence of events:

(1) External application reads changes from external system

(2) External application creates new instruments in the middle-tier

(3) InstrumentSessionBean can read new instruments
Considerations

Pros
- Decouples middle-tier from enterprise systems
- Possible to coordinate with batch-oriented systems

Cons
- Not synchronous
- Not bi-directional
Bi-directional Coordination

- Replication of changes to/from middle-tier
  - Data changed both in the middle-tier and enterprise system
- Introduces potential for conflicting updates
  - Best approach is to avoid need for bi-directional updates
Summary

- Domain model-centric approach is good for process-centric applications
  - Keep object management orthogonal to the component modeling
- Domain model can easily support many use-cases and applications
- Software layering simplifies development and reduces software dependencies
- Utilize J2EE capabilities for EIS Integration
Interesting Design Patterns

Sun Java Center J2EE Patterns
- Session Façade
- Value Object
- Data Access Object
- Value Object Assembler

Martin Fowler’s Information System Architecture
http://martinfowler.com/eaaCatalog/
- Domain Model
- Data Transfer Object
- Remote Façade
Thank you