Lecture 2: Elaboration Tasks and Domain Modeling
Processes - Caveat

• Generic process applied to project with very different characteristics
• All kinds of traditional tasks (requirements, design, coding, testing) at all phases
• Confusing as to what is done in each abstract phase, such as Elaboration
• Part of System Development: construct a custom process for the project
Elaboration Tasks

• Explore concepts from requirements/use cases
• Domain models: basic concepts and their inter-relationships
• Basic architectural concepts for system
• System sequence interactions – system events, UI basics
Stable System Design and Domain Models

• Systems change
  – Incremental development
  – Changing requirements
  – Post deployment enhancement

• Design for change
  – Simulation of problem domain
  – Functionality added to simulation
Domain Models

• Graphical Model
• Nodes:
  – Concepts/conceptual classes
  – Attributes: properties of classes
• Arcs: Relationships between concepts
• Particular kind of UML Class Model
Sample Partial Domain Model

[Diagram of domain model with classes and relationships, including:
- LogOn
- SetMemberData
- GetADate
- Preferences
- DateDescription
- DatingSystem
- NoDateMessage
- HasA
- Database
- MemberData
- PersonalProps]
Domain Model Does and Don’ts

• √ Static Model
  - E.g. Parts explosion diagram

• √ Real World Concepts
  - E.g. Gender Preference in Dating System Application

• √ Overdo concept list

• × Dynamic Flow Chart
  - One entity sends a message to another

• × Software Entities
  - E.g. GenderPreferenceText Field in DS

• × Leave out concepts
Domain Models and Data Base Models

• Entity Relationship Diagrams
  – Similar to domain modes

• Used to identify:
  – Tables = Concepts
  – Columns/fields = Concept attributes
  – Table links = Concept relationships
Finding Concepts

• Define the boundary of the system
• Noun and noun phrase identification from prose descriptions and use cases
• Concept category checklists
• Special cases
Nouns and Noun Phrases for DS

- User
- Dating System
- LogOn
- Name
- Member
- Member Option Choice
- Error Message
- GetADate
- DataBase
- SetMemberData
- Preferences
- DateDescription
- NoDateMessage
- MemberData
- PersonalProps
Concept Categories and the DS

• Physical Objects: user, member
• Descriptions: personal props, preferences
• Roles: member, dater, administrator
• Containers: DS Data Base
• Organizations: DS Accounting Dept.
• Events: logon, getADate, SetMemberData
• Abstract nouns: session
Descriptions

• Descriptions of other concepts that have a lifetime of their own
  – E.g. dater properties in Dating System
    • May be stored in data base
    • May be changed

• Alternative is to make the information an attribute of a concept
  – primitive class attributes vs class variables
Events

• Things to which system will have to respond
  – E.g. logon, date-request

• Object oriented approach to events: create an instance of an event object which “knows how to process such events”
  • E.g. Java GUI:
    – create event listener objects which have a method for processing the associated event
    – add the listeners to the object that is the source of the event
    – when event occurs, listener objects are “executed”
Associations

- Describe semantically meaningful relationships between concepts
- Give the structure of the domain model
- May be annotated with roles and multiplicity designators
- Important to not miss concepts
- Important to not over-do associations
Finding Associations

• Need to know criteria
  – Needed for operation of system
  – Have a lifetime of importance
  – E.g. link between DS Member and Account is necessary.
  – E.g. link between Administrator and GetaDate request is not necessary.

• Association category checklists
Association Category Checklists

• A is a physical or logical part of B
  – E.g. Physical Characteristics and Personal Characteristics are part of Dater Properties

• A is physically or logically contained in B
  – E.g. MembershipData contained in MemberDB

• A is recorded in/by B
  – DatingSystem records occurrence of User Asking for a Date event
Associations and Class Design

- Logical Parts
- Class Variables: the objects in one class consist of an aggregation of objects from other classes
- Contained in
- A vector or other container class contains objects of one or more other classes
Association Details

- Names
- Multiplicity
  - One to one, many to many, one to many
- Direction of association
Domain Model Example
Attributes

- Problem domain properties
- Should have primitive data type values
- If property is a (complex) object, should be a separate concept with a linking association
  - E.g. Dater has Dater Properties. This is a complex object and should be its own concept. Linking association:

```
  +-------------------+  Describes  +-------------------+
  | Dater             |    *     | Dater Properties  |
  +-------------------+     1     +-------------------+
```
Associations vs Attributes –

- Has Parts to it
- Special operations associated with it
- Has its own attributes
- Quantity with a unit
- Abstraction of an entity with above properties

- Standard data types (integer, string, …)
- Quantity with a unit
- Note: use of foreign keys (primitive key value used to identify a complex object) not acceptable
Associations vs Attributes – Why Associations?

• Allows postponing of details
• Leads to a design that facilitates change
• Recognizes that some kinds of properties/descriptions may have a life of their own

E.g. In a complex DS could have a catalog of personality profiles, which we use to classify a member/user
Domain Models and Attributes

• Not enough room in graphical models
• Give separate documents showing domain model concepts with their attributes
• E.g.

<table>
<thead>
<tr>
<th>Logon</th>
<th>SetMemberData</th>
</tr>
</thead>
<tbody>
<tr>
<td>-Name: : string</td>
<td>-Gender : bool</td>
</tr>
<tr>
<td>-UserType : char</td>
<td>-Religion : string</td>
</tr>
<tr>
<td></td>
<td>-Occupation : string</td>
</tr>
</tbody>
</table>
UML and Domain Models

• UML does not have Domain Models
• UML class diagrams
  – can be used for several purposes
  – Conceptual classes as in Domain Model
    • Attributes but no methods
  – Design classes from design activities
    • Graphical representation of PL classes
Domain Models and System Increments

• Construct for current iteration concepts, associations and attributes
• Will augment with later increments
• May include concepts not in current increment as part of “extra is better than missing” approach