Use of a UML Model as a Database Repository for Use Cases

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Agenda

- Use Case Templates in Word
- IEC Use Case Methodology Project
- From UML Metamodel to Repository Design
- Repository Structure
- Program Model
• Domain Experts work well in Word Templates
  – Easy flow of thinking onto page
  – Template can guide writer step by step to more detailed elaboration

• System Engineers work well in CASE tools
  – UML is robust and flexible for design analysis

• Round Trip Engineering
  – Need to iterate between System Engineering View (UML) and Domain Expert View (WORD)

• Needed: Tool that allows traversing between two views
Use Case Standardization Project

- IEC TC8 Smart Grid Use Case Methodology Team
  - Part 1: Use Case Approach – Motivation and Processes
  - Part 2: Definition of Use Case Template, Actor List and Requirements List for Energy Systems
  - Part 3: Use UML and XMLSchema to Define Repository and Intermediate Use Case Representations
  - Part 4: IntelliGrid Method for Projects

- EPRI IntelliGrid™ Use Case Template
  - Hundreds of Use Cases done using this template since 2004
  - Tools built to allow Import/Export of Use Cases
  - Support for Use Case capture in UML for IEC TC57WG14
  - Publish Use Case Importer/Exporter on SourceForge 2012

- Hypertek, Inc.
  - Part of original IntelliGrid team
  - Contracted to Perform Revised Use Case Template Import/Export
  - Worked with EDF/EPRI to implement TC8 Part 2 and Part 3 methodology
  - To be published as Open Source on SourceForge end of 2012
Use Cases Standardization

- Use Cases provide a useful basis for
  - Interoperability
    - Define how standards are used
    - Define abnormal (error) situation handling
  - Business and Technical requirements
    - IT security and privacy
    - Safety
    - Performance
    - Reliability
    - ...
  - Terminology
  - Standards gap analysis
  - Testing and certification programs
IEC 62559 Use Case Template

1. Description of the Use Case
   1.1 Name of Use Case
   1.2 Version Management
   1.3 Scope and Objectives of Use Case
   1.4 Narrative of Use Case
   1.5 General Remarks

2. Diagrams of Use Case

3. Technical Details
   3.1 Actors: People, Systems, Applications, Databases, the Power System, and Other Stakeholders
   3.2 Preconditions, Assumptions, Post condition, Events
   3.3 References / Issues
   3.4 Further Information to the Use Case for Classification / Mapping

4. Step by Step Analysis of Use Case
   4.1 Steps – Normal
   4.2 Steps – Alternative, Error Management, and/or Maintenance/Backup Scenario
   4.3 Steps – ....

5. Information Exchanged

6. Common Terms and Definitions
## Use Case Scenario Details

**Scenario Name:** Authorized Third Party Establishes Relationship with Data Custodian

<table>
<thead>
<tr>
<th>Step No.</th>
<th>Event</th>
<th>Name of Process/Activity</th>
<th>Description of Process/Activity</th>
<th>Service</th>
<th>Information Producer (Actor)</th>
<th>Information Receiver (Actor)</th>
<th>Information Exchanged</th>
<th>Requirements, R-ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Desire to establish Third Party relationship with Data Custodian</td>
<td>Create Third Party ID</td>
<td>Authorized Third Party requests that the Data Custodian establish relationship</td>
<td>CREATE</td>
<td>Third Party</td>
<td>Data Custodian</td>
<td>Application Information</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>REPLY</td>
<td>REPLY</td>
<td>REPLY</td>
<td>Data Custodian</td>
<td>Third Party</td>
<td>Third PartyID</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Desire to check status</td>
<td>Read Service Status</td>
<td>Third Party checks their ability to connect to the service, and obtains the current status of the service</td>
<td>GET</td>
<td>Third Party</td>
<td>Data Custodian</td>
<td>Service Status</td>
<td></td>
</tr>
</tbody>
</table>
From UML Model to XML Schema*

UML Use Case Metamodel
- Actors, Information, requirements, Scenarios, ...

Exchange Profile
- Containment, multiplicity, structure

Use Case XSD
- Allows structured XML representation of a Use Case that mirrors Repository

Provides a model of elements of Use Cases and their relationships

Establishes directional associations and multiplicities to imply a specific hierarchy

An explicit XML Schema that defines how parts from the Word template can be extracted and organized based on the metamodel

*Concept derived from IEC TC57 methodology for profiling UML models to XML
Use Case Template UML
Exchange Profile

Expanded view

class ExchangedProfile
+PrimaryActor 0..1
+Predecessor 0..1
+Successor 0..1
+TriggeringEvent 0..1

Ref_Actor
+ id :String
+ name :String [0..1]

Ref_InformationModel
+ id :String
+ name :String [0..1]

Step
+ description :String
+ event :String
+ id :String
+ name :String
+ number :Decimal
+ service :String

Scenario
+ description :String [0..1]
+ id :String
+ name :String
+ postCondition :String [0..1]
+ preCondition :String [0..1]
+ triggeringEvent :String

Ref_Scenario
+ id :String
+ name :String [0..1]

Ref_Actor
+ id :String
+ name :String [0..1]

Ref_InformationProducer
+ id :String
+ name :String [0..1]

Ref_InformationReceiver
+ id :String
+ name :String [0..1]

Ref_InformationModel
+ id :String
+ name :String [0..1]

Ref_Step
+ id :String
+ name :String [0..1]
Use Case Template XML Schema

```
UC:UseCaseRepository_Type
  ├── description
  │    └── id
  │      └── name
  │        ├── ActorLibrary
  │        │    └── DomainLibrary
  │        │    └── InformationModelLibrary
  │        │    └── RequirementLibrary
  │        │    └── UseCaseLibrary
  │        └── UseCaseRepository
```

UML Repository Model

Actors, Information, Requirements are part of Platform Independent Model (PIM)

Object Instance Diagrams
UseCaseLibrary

Dynamic Activity and Sequence Diagrams

Static Use Case Information
Use Case Diagram

UC: Use Case Diagram

- Data Custodian (from Service Provider)
- Customer (from Customers)
- Third Party (from Service Provider)

Use Case: C-1.1.1 Energy Services Provider Interface

- Name: Energy Services Provider Interface
- ID: C-1.1.1
- Classification: National
- Keywords: ESPI, Green Button, PAP10, PAP20
- Level of Depth: Detailed
- Prioritization: High
- Scope: Exchange of Energy Usage Information from Data Custodian (utility enterprise customer information system) and a Third Party service provider.
- Viewpoint: Technical
Generated Sequence Diagram

Third Party

CREATE(ApplicationInformation)

Data Custodian

GET(ServiceStatus)

REPLY(ThirdPartyID)
Generated Activity Diagram

ACTIVITY DIAGRAM

ServiceStatus : ServiceStatus
ThirdPartyID : ThirdPartyID
ApplicationInformation : ApplicationInformation

CREATE(ApplicationInformation)
GET(ServiceStatus)
REPLY(ThirdPartyID)
REPLY
Read Service Status
ActivityFinal

Grid-Interop 2012
Use Case Importer

Key

- Design consideration/inputs
- Input/output files
- Intermediary files
- Process/implementation
- IEC and EDF design inputs
- End user knowledge

EA eap (database)

Processing

EA Importer Mapping

EA APIs and Documentation

IEC TC-8 Template

Test Use Case Information

User Edit

Use Case Template

Word Doc(s)

Use Case HTML

TIDY

Use Case XHTML

xsit

Use Case XML

xsit

Use case model xsd

EA Use Case UML Model

Mapping

EA APIs and Documentation

Processing

EA Importer Mapping

Design consideration/inputs

Input/output files

Intermediary files

Process/implementation

IEC and EDF design inputs

End user knowledge
EA Use Case Exporter

Key

- Design consideration/inputs
- Input/output files
- Intermediary files
- Process/implementation
- IEC and EDF design inputs
- End user knowledge

Diagram:

- EA eap (database)
  - Structure
  - Actors
  - Domains
  - Info models
  - Seq. diagram
  - Act. diagram
  - Use Case diagram

- Processing
- xslt
- EA Use Case XHTML
- Use case model xsd
- Use Case XML
- EA Use Case Template
- EA Use Case UML Model
- EA Exporter Mapping
- EA APIs and Documentation
Questions