Conceptualizing the Water Management System with UML
Iterative Development Process

- Apply an iterative development process (IDP) widely used to create commercial software
  - Use exercises to define actors, their responsibilities, and their interactions
  - Keep it simple, do only what is required to reach understanding
  - Leads to system requirements
  - Supports creation of adaptive software
Phases in IDP

- **Analyze** – what are the questions we want to answer and what are the key components needed to answer it?
- **Design** – how might we represent our conceptual model of the actual system using math and software constructs?
- **Implement** – “code” design in a software development environment
IDP Basic Steps

- Define Use Cases
- Define Conceptual Model
- Define Interaction Diagrams
- Define Design Class Diagrams
- Implement in small steps and test frequently
Graphical Modeling
Notation

Unified Modeling Language (UML)
What is UML?

- The Unified Modeling Language is a visual language for specifying, constructing and documenting artifacts of systems.
- It is the de facto standard diagramming notation for drawing or presenting pictures related to object-oriented software.
- Can be complicated but we are keeping it simple.
No Silver Bullet

- UML is simply a standard diagramming notation – boxes, lines, etc.
- Visual modeling with common notation can be helpful
- Does not replace the need for system knowledge and sound design skills
- Just as a word processor does not write, UML does not analyze or design
How Have We Used UML?

- As a sketch tool during interactive conceptual modeling of an actual system of interest (e.g. predicting urban water demand)
- To illustrate how existing analytical tools work (e.g. Urban Water Use Model)
- To help create new software implementations
3 Basic UML Artifacts

- Use case
  - Narrative description of intended use of the software
- Class diagram
  - Properties of each object and relationships between objects
- Sequence diagram
  - Dynamic view of interaction between objects
Urban Water Use

Applying Object-Oriented Techniques and UML to Document DWR Process
Estimate Water Use in a Study Area

Goal Level: Sea Level

Main Success Scenario:

1. Planner sends water use survey forms to public water systems and commercial and industrial water users.
2. Public water systems and commercial and industrial water users complete survey forms and send them to data entry.
3. Data entry converts survey data to digital format.
4. Data entry sends digital survey data to QA/QC.
5. QA/QC conducts quality control/quality assurance process.
6. QA/QC sends digital data to Urban Water Use Model.
7. Planner requests demographic data for study area from demographer.
8. Demographer processes demographic data for study area.
9. Demographer sends demographic data to Urban Water Use Model.
11. Planner reviews Urban Water Use Model output.
12. Urban Water Use Model outputs is taken as estimate of urban water use in study area.

Extensions
10a: Urban Water Use Models fails to run
   .1 Planner checks for missing and invalid input data.
   .2 Planner inputs missing data or corrects invalid data, returns to MSS at step 10.
1. sends PWSS survey forms
2. returns completed survey forms
3. sends Cmm., Ind. & Self-Supply survey forms
4. returns completed survey forms
5. sends completed survey forms
6. sends survey data
7. sends survey data
8. enters QA/QC PWSS data
9. enters QA/QC C & I self-supply data
10. enters QA/QC survey data
11. sends QA/QC survey data
12. requests demographic data by DAU/county
13. processes DOF and US Census population data
14. sends demographic data
15. sends urban water use data by DAU/county
16. calculates PWSS deliveries
17. calculates self-supply C & I withdrawals
18. calculates self-supply residential withdrawals
19. sends urban water use data by DAU/county

Comm. & Ind. Self-Supply Water Users
Public Water System Data Entry Operator QA/QC Specialist Urban Water Use Database Demographer Urban Model
Main Success Scenario:

1. **User starts the California Urban Water Use Model**
   The User Interface displays the Main Interface;

2. **User imports PWSS data of the year of interest**
   **Route:** Main Interface \ Import.
   Choose a year from pull down list to match the year of the data. Click Import. A new window pops up which let the user navigate to the data folder. Input Class ensures the integrity of the imported data. Data Base Class creates a new table to host the newly imported data. Click Done to go back to the main interface.

3. **User adds the population of the DAU-County of the year of interest**
   Population data should be added to the table named “tblDAUCountyYears”

4. **User QA/QC imported PWSS data**
   **Route:** Main Interface \ Input... \ Public Water System (PWS) System.
   Choose a Year. Choose a PWS to inspect. The user can correct errors by directly typing in the correct info or number. The user can also choose to override the imported data by choosing one of two override check boxes, Override Production and Delivery Values or Override Delivery Values only

5. **User enters DAU-Counties where PWS resides**
   **Route:** Main Interface \ Input... \ Public Water System (PWS) System.
   Under tab General, click Add New to enter all the DAU-Counties where PWS resides and the PWS population residing in each of the DAU-Counties. The same info and values can also be entered using, **Route:** Main interface \ Input \ PWS Sub Groups.
   User identifies all PWSs within the DAU-County, and enter the same population value.

6. **User enters Self Supply Users**
   **Route:** Main interface \ Input \ Self Supply Users
   Choose a Year, DAU-County, and Self Supply User. Click on Add New to add Production and Delivery.

7. **User chooses representative PWSs for residual self supply users**
   **Route:** Main interface \ Input \ DAU County Data
   The default representative PWSs used to calculate residual self supply users are PWS subgroups within the boundary of the DAU-County. User can also select the check box of Override Representative Residual PWS data to type in new data to represent the residual self supply users.

8. **User requests to show final results**
   **Route:** Main interface \ Reports... \ DAU-County Deliveries

9. **System provides the final results**
   System shows monthly water deliveries of all customer classes for each DAU-County. User can query this table to narrow to the data needed.
**Business Rules**

- Compute PWS per capita water use by customer class()
- Compute indoor/outdoor water use()
- Compute self supply users water use()
- Compute residual area water use()

**Input**

- Check input file()

**Data Base**

**Hardware**

**User Interface**

**Scenario Management System**

**Output**

- Request output data()

Calculate per capita production
2. get per capita deliveries
3. get per capita deliveries

6. get per capita deliveries
5. calculate PWS sub-group water production
4. calculate PWS sub-group water deliveries

3. get PWS sub-group water production

9. get PWS sub-group population

11. get DAU/county population

2. calculate per capita production

8. calculate per capita production

10. get PWS sub-group per capita water use by customer class

12. calculate DAU/county residual population

6. calculate DAU/county residual water use by customer class

15. get self supply DAU/county residual water use by customer class

18. get self supply DAU/county water use

20. calculate DAU/county indoor water use

17. get DAU/county percent minimum month residential water use indoor

16. calculate DAU/county indoor water use by customer class

19. calculate DAU/county indoor water use by customer class

18. calculate DAU/county outdoor water use by customer class

17. calculate DAU/county outdoor water use by customer class

16. calculate DAU/county residual water use by customer class

15. calculate DAU/county residual water use by customer class

13. calculate DAU/county water use by customer class

12. calculate DAU/county water use by customer class

11. calculate DAU/county water use by customer class

10. calculate DAU/county water use by customer class

9. calculate DAU/county water use by customer class

8. calculate DAU/county water use by customer class