Case Study: Starting the Student Registration System

Chapter 3

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Software Engineering

- The implementation of a transaction processing application is a significant engineering endeavor
  - The project must complete
    - On time
    - On budget
  - The completed system must
    - Satisfy the customer's needs
    - Meet every one of its requirements
    - Operate efficiently and reliably

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Software Engineering

- Those goals are surprisingly difficult to achieve
- According to a published study of 16,000 IT projects
  - Only 16% completed successfully – on time and on budget
  - Of those that did not complete successfully
    - Average completion time was 222% over schedule
    - Average cost was 189% over budget
    - 31% were cancelled before they were completed

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Good Software Engineering Practice

- Bases on many years of experience, the recommended steps in carrying out a Software Engineering project are:
- Statement of Objectives
  - Brief statement made by the customer of what the objectives of the system are

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Steps in a Software Engineering Project (cont'd)

- Requirements Document
  - Expansion of Statement of Objectives
  - Describes what the system is supposed to do
    - Not how it does it (that is in the Design Document)
  - Prepared by customer
  - In some contexts, the Requirements Document is a request for proposal from the customer to various implementation groups that might want to build the system

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Steps in a Software Engineering Project (cont'd)

- Specification Document
  - An expanded version of the Requirements Document
  - Describes in great detail exactly what the system is supposed to do
    - In particular the entire user interface must be specified, including all screens, all controls, etc
  - Prepared by implementation group in collaboration with customer
  - In some contexts, the Specification Document is a contract between the implementation group and the customer as to what will be delivered

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Steps in a Software Engineering Project (cont'd)

- The remaining steps are described in Chapter 12
  - Design Document
  - Test Plan
  - Code
  - Testing
  - Delivery

Requirements Document for the Student Registration System

- A complete Requirements Document for the Student Registration System is given in the text
  - Requirements are numbered so they can be referred to in other documents, such as the Test Plan, which must ensure that a test exists for each requirement
  - Requirements are stated with words such as "must" and "shall"
    - Words such as "should" and "can" do not connote a mandatory requirement and should be avoided

Issues

- Frequently while analyzing the Requirements Document to produce the Specification Document, issues arise that must be brought to the attention of the customer and resolved
  - The Requirements Document might be inconsistent or incomplete in certain areas
  - It is important to get such issues resolved early in the project, since it becomes increasingly expensive to made changes as the project proceeds

Application Generators

- The Student Registration System requires a sophisticated user interface, which must be described in its Specification Document
- An application generator can be of significant help in specifying and building such an interface and, in fact, in implementing the entire system

Components of an Application Generator

- A Graphical User Interface Designer to help design and implement the GUI
- A programming language that can be used to write application programs
- An Integrated Programming Development Environment, including a program editor, debugger, etc.
- A mechanism to allow the application programs to connect to the database and execute SQL statements

Visual Objects

- The GUI Designer contains built in objects for forms and controls on those forms
  - Pushbuttons, textboxes, etc.
- These forms and controls can be thought of as **visual objects**
- Visual objects have two data structures
  - A data structure that represents the semantic, non-visual aspects of the object
    - For a textbox, its name and the text string stored in it
  - A data structure that represents the visual aspects of the object
    - For a textbox, its location on the screen, shape, size, color, etc

Visual Objects (cont'd)

- Visual objects also contain a set of methods we call a **drawing engine**
  - Uses the information in the visual attributes of the object to draw its visual representation
  - Keeps the visual representation and the visual attributes consistent
    - If the location attribute is changed, it moves the visual representation
    - If the visual representation is moved (with the mouse), it changes the location attribute

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GUI Generation

- Using the built-in visual objects, and perhaps customizing them, the GUI designer can quickly design a GUI
  - The existence of the built-in objects with their drawing engines considerably simplifies the task of designing and building the GUI
  - A proposed GUI should be shown to the customer at an early stage to get his feedback so that any requested changes can be made

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Events and Procedures

- After designing the GUI, the application designer must design and implement the application procedures that
  - Cause forms to be displayed
  - Gather the information from the screen
  - Initiate transactions to access the database
  - Display the results of the transaction
  - Produce appropriate printed reports
- These application procedures are **event driven**

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Events

- An event is some action (usually) initiated by the user at run time
  - A particular button is clicked
- The application programmer can associate a particular application program with a particular event
  - When a particular button is clicked, a particular program is executed

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Referring to GUI Objects

- Application programs can refer to attributes of objects on the screen

  st = IDbox.txt

  outbox.txt = "This is the text"

  where

  st is a variable in the application program

  IDbox and *outbox* are the names of objects corresponding to controls on the screen

  txt is an attribute of both *IDbox* and *outbox*

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Specification Document

- Now that we have discussed how application generators can be used to design and build GUIs, we return to our discussion of the Specification Document, which includes a specification of the GUI

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Partial Contents of a Specification Document

- A picture of every form on the GUI with every control specified
- A description of what happens when each control is used
  - What application procedure is executed
  - What changes in the form occur
  - What error situations can occur and what happens
- A description of each interaction with the system
  - Information input by user
  - Textual description of what happens
  - List of conditions under which it succeeds or fails and what happens in each case

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Partial Contents of a Specification Document (cont'd)

- Integrity constraints of the enterprise
- System issues
  - Hardware and software used by the system
- Throughput and response time constraints
- Project planning information
  - Milestones
  - Deliverables
  - Costs

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Specification Document for the Student Registration System

- Preparing the Specification Document for the Student Registration System is an exercise for the students
- Initial portions of some sections are given in the text

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