COM201: System Analysis and Design

Lecture 5: Designing the Solution

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1. Title
2. Overview
3. System Development

- **Purpose: Highlight which part of the course model this theme relates to**

Notes:

- **There are many lectures and tutorials in our course corresponding to design phase.**
- **Today is an overview of design with some work on functional design (that design that supports that actual functions or processing the system will do)**

4. Recall Simple Information System

- **Purpose: Review basic information system model**

Notes:

- **This diagram provides further context (I – P – O)**
- ***User interface:*** **that part of the system that users see**
- ***Processing:*** **sometimes called business logic, what the system actually does, the mechanics of it if you like**
- ***Data:*** **where the data resides for use by the processing component (captured, stored, modified, distributed)**

5.

Purpose: An example of a building – Guggenheim Museum in Manhattan, New York

Notes:

- **Buildings are not simply built, they are designed first.**
- **So what tools can be used?**

6.

Purpose: An example, a sketch of the building

Notes:

- **Could be an artist's rendition of the building to show clients early to give a rough idea.**
- **This could have resulted from a brainstorming or initial planning session.**
- **Could use it to seek feedback from the client (person paying for the project).**

7.

Purpose: An elevation drawing of the same building.

Notes:

- **This is elevation plan of the ground floor.**
- **It also shows the main gallery.**
- **This would be one diagram in a set of blueprints or plans that the constructors of the building would work from**
- **This also forms part of the documentation for the project.**
- **We do the exact same thing when we build systems which we will look at in coming weeks.**

8.

Purpose: Photograph shows Stakeholders, architect and 3D real-world model (from 1945)

Notes:

- **Producing a model like this lets the client get a feel for how the building will look and is able to provide feedback before a stone has been laid.**
- **We produce something called a prototype that serves the same purpose**
- **What we have seen a different ways to view the project from a design perspective**
- **That is, we are working out how to implement the solution from the information gathered in the analysis phase**

9. SDLC Review: Design

Purpose: Review analysis slide from lecture 2 (original content sourced from Satzinger et al.)

Notes:

- **Discuss idea of problem domain. i.e, business area that requires computerized solution**

Introduction:

- **Shifting from analysis phase**
- **Taking the good work done there to a more complete, more refined representation which can be used**
- **A set of designs comprise the major output of this phase.**
- **We are taking the requirements from the analysis phase (could be models, text, etc.) and taking these forward to a single solution (i.e., implement requirements)**
- **We now care about technology, in particular what form the final solution will take (platform, development tools, networking, …)**
- **Prepare the detailed design needs for a new system or make modifications to an existing one.**
- **How the system is going to do it (support business activities, implement requirements).**
- **Effectively the blueprints that coders (programmers) will work from of the new system or modifications of existing one (recall architecture analogy)**
- **Represented as models, specifications and so on.**
- **Once these are correct and signed off, the construction can proceed.**
- **We are primarily interested in SW related activities focused around data, process, and user interface.**

Activities:

- **Design and integrate the network**
- **Design the application architecture**
- **Design the user interface(s)**
- **Design the system interface(s) – work with other systems**
- **Design and integrate the database**
- **Prototype for design (both analysis and design)**
- **Design and integrate the system controls – later lecture ----------→ cont.**

10.

Purpose: Eemphasise the point of the design phase using this statement.

Notes:

- **Discuss idea of problem domain. i.e, business area that requires computerized solution**

11. Key Design Activities

Purpose: Discuss different areas or activities requiring design.

Notes:

i. **Network: Connecting system components and people with information**

Typically performed by a specialist such as a network engineer or systems engineer

ii. **Architecture: describes how work will actually be carried out by people and computers**

iii. **User interfaces: Designed for optimal interactions with system**

Recent roles such as usability specialists and human factor engineers used for this purpose

iv. **System interfaces: Define how system components and system can communicate with other parts of the system or other systems**

Specify how system will exchange information between different services

v. **Database: The underlying schema purposely designed for this system**

vi. **Prototype: Confirm design choices and elicit feedback**

Evolutionary vs. revolutionary

vii. **System controls: Protect data and ensure system works as it should**

Authentication, authorised access and other protection measures

Design disaster recovery procedures and technology selection

12. Levels of Information Design

Purpose: Discuss how information is represented at different levels of detail (high = human viewpoint and low = computer representation)

Notes:

- **Levels of abstraction**
- **Taking essential characteristics of the real-world and incorporating them in a some kind of graphical representation of them**
- **Abstracting real world phenomenon (we looked at last week with one technique – ERDs)**
- **High → closer to real world**
- **Low → closer to computer representation (binary)**

- The design abstraction layers can become more intuitive when we replace the existing terms with business, system model, and technology models
- On right-hand side are design artefacts or representations for data (or database) related designs

1- Conceptual design:

- Abstract key characteristics of the thing in question but only those relevant to the domain
- As close to the real world as possible → documenting the real world (ERDS, class diagrams etc.)
- Attempts to abstract or represent real-world information and relationships from domain
- Output here is typically referred to as domain models
- Entirely independent of implementation concerns (i.e., No concern for the type of database to store resulting data)

2 - Logical design:

- More closely associated with documenting the real world in terms of corresponding, typically relational database structures (more specific).
- Preparing database schema
- Specification:
- Applied to generic database solution
- Data model but not technology dependent (typically relational model → coming up)
- Implementation:
- Technology chosen and database schema transformed to meet requirements of technology

3 - Physical design:

- Physical storage within the database
- Records, pointers, tracks, sectors, etc.
- As we will see handled by the DBMS and invisible to users.
- Performance, response time, indexes, tuning, etc.

13. Why use Models for Design?

Purpose: Discuss the value of using modelling techniques in design

Notes:

- One key reason is that systems are complex and diagrams help simply the different aspects of them

- Aid communication as people can understand models, diagrams
- Attempt to represent complex phenomena through abstracting key characteristics (e.g., people)
- Attempt to understand relationships between objects.
- Identify possible problems
- Clear up misunderstandings
- Serve different perspectives (aspects of system, roles stakeholders play)

Approaches:

- Miniature replicas
- Virtual 3D models (paper, wood, clay, wax, …)
- Blueprints
- Diagrams on paper
- Electronic designs

14. Modeling

Purpose: Show examples of different models

Notes:

- Examples of diagramming techniques from the UML (Unified Modeling Language) collection. (E.g. starUML- www.staruml.com = Free ware)
- Attempts to represent and document different aspects of the proposed solution.
- Captured in these diagrams are activities, interactions, transactions, events, things, roles, components, relationships, …
- Models shown: Use case diagram, state diagram, sequence diagram, class diagram, and package diagram

15. Recall Source Documents

Purpose: Relook at order form information and how this can be broken up into entities

Notes:

- Illustrate the kind of information we can obtain and how we can use this information:
- Identify things of interest which eventually form aspects of the database.

- **We can take this analysis and construct a model that represents this information and associated relationships**

16. Resulting Conceptual Design

Purpose: This an ERD that can be drawn from the order form on the previous slide

Notes:

- **In this case a database design model called an ERD**
- **This conceptual level model will be the focus of next lecture.**
- **Show how entities and relationships map to form.**
- **Rich source of information**

17. What Does *Unified* Mean?

Purpose: Explains the term 'unified' in the context of the UML.

Notes:

- **Tied in with goals of the development of the UML**
- **The UML can represent most existing models as well as or better than original.**
- **The UML is seamless from requirements to deployment (same notations and concepts used in different stages)**
- **The UML is intended to be as good or better than any general purpose modelling language for most application areas (model most application domains)**
- **The UML is intended to be usable for systems implemented in various implementation languages (programming), platforms, databases, 4GLs, firmware, etc.**
- **The UML is intended to be used as the underlying modelling language in any development process**

18. Example UML Diagrams

Purpose: Show notations of various UML diagrams

Notes:

Class

- **Structure of system.**
- **Model concepts in application domain and things invented to implement an application (e.g. user interface)**

Collaboration:

- **Highlights how different parts of the system interact**

State machine:

- **Represents potential life histories of an object of a class. (lifetime)**
- **An event occurs, which triggers a transition which changes the state of some piece of information in the system**

Use Case:

- **Models the functionality of the proposed system as perceived by people or things that interact with the system**
- **A use case itself is effectively a unit of functionality.**
- **Really crucial diagram that can be employed at the beginning of a project.**

19. Example UML Diagrams (cont')

Purpose: Show notations of various UML diagrams

Notes:

- **Activity:**
  - Represents the flow of control for performing some task or computation
  - Can model program logic or the workflow associated with an activity that the system will need to support.
  - Could tie to a Use Case diagram
- **Sequence:**
  - Shows a set of message calls between objects over a time period
  - Implicitly shows specific order of messages over a time period
  - Also shows the roles that the classes play to support some activity
- **Package:**
  - A way to organise models by grouping in some way.
  - For example, these are analysis models, these are design models (sketch vs. blueprint)
  - Or, different subsystems (HR, Accounting, Logistics, etc.)