Chapter 1
An overview of systems analysis and design

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Learning outcome

- Student can explain the characteristic of iterative system development in SDLC
- Student can plan the development process for Information system.

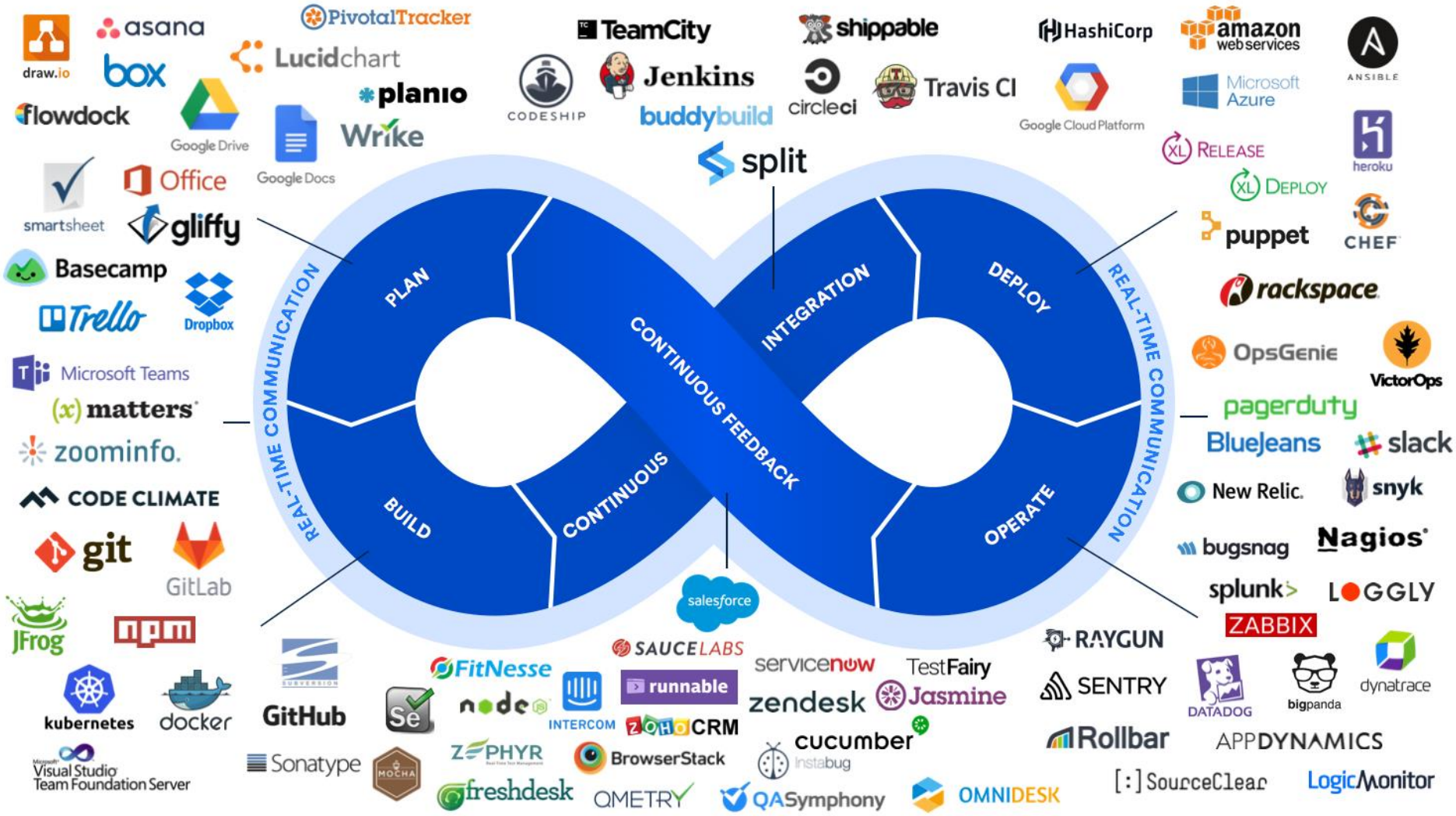
Outline

- Software development
- System analysis
- System design
- Systems Development Life Cycle (SDLC)
- Example development
  Ridgeline Mountain Outfitters (RMO)
- Iterative development
- Developing tradeshow system of RMO

Software Development

- The knowledge in computer when you want to develop a software.
  - Operating system: OSX, Linux, Windows,…
  - Interfacing or hardware: Laptop, Desktop, iPad, Smartphone,…
  - Programming language: C, C++, Java, Delphi, VB, FoxPro, Python …
  - Web development: PHP, ASP, JavaScript,

DevOps



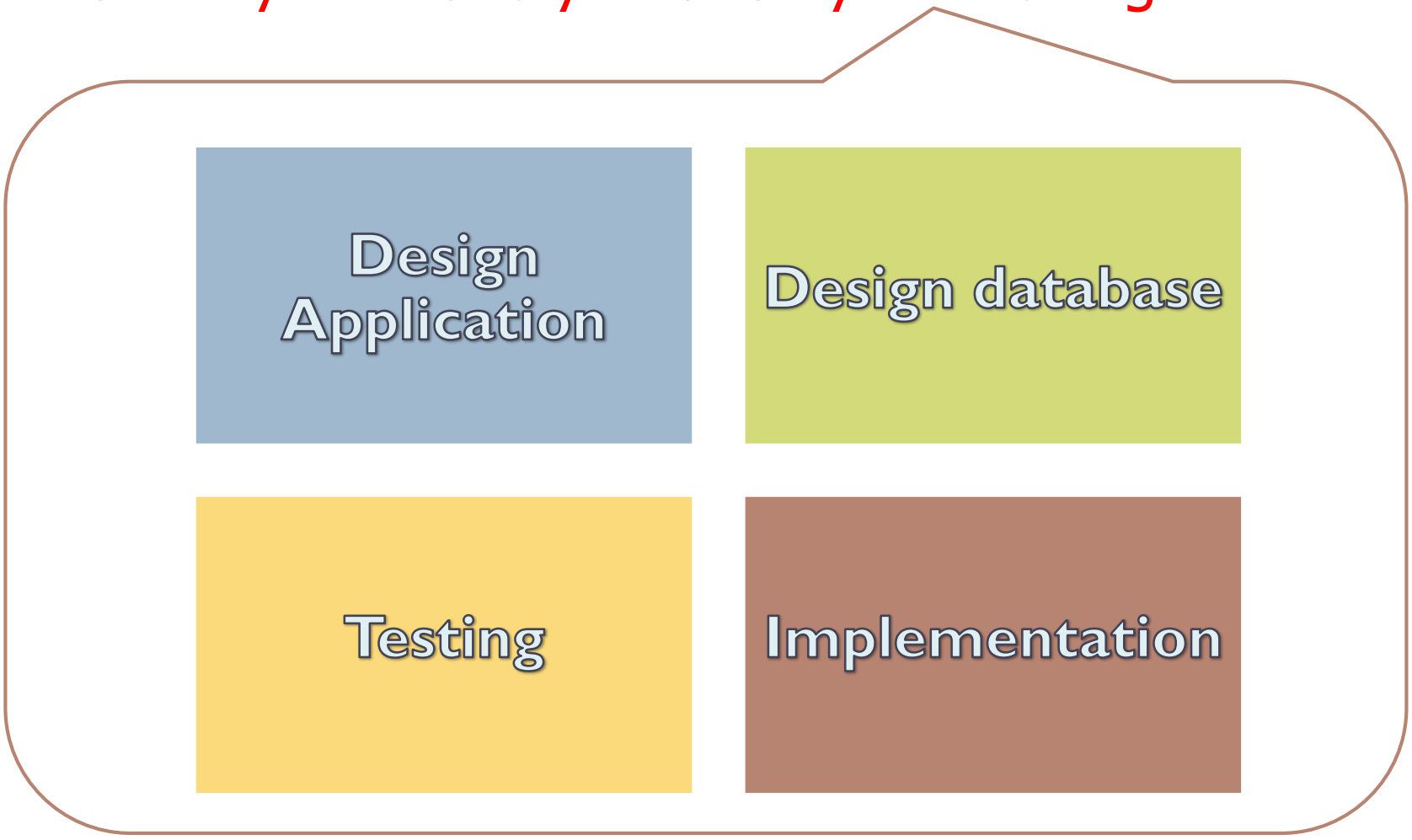
DevOps is a set of practices that combines software development (Dev) and information-technology operations (Ops) which aims to shorten the systems development life cycle and provide continuous delivery with high software quality. –Wikipedia

Software Analysis and Design

What is system analysis and system design?

Software Analysis and Design

What is system analysis and system design?



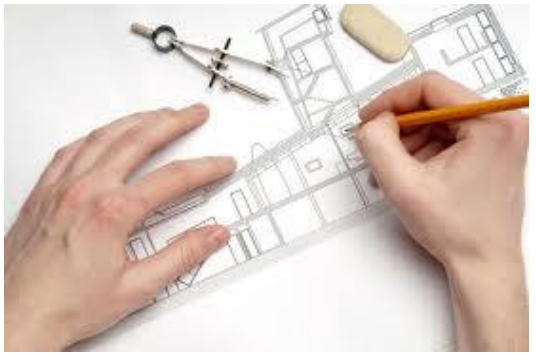
- Computer application or "APP" is a compute software that execute on the computer device to carry out a specific function or set of related functions

- Information system is a set of interrelated computer component that collects process, stores, and provides as output the information needed to complete business tasks.

Buyer

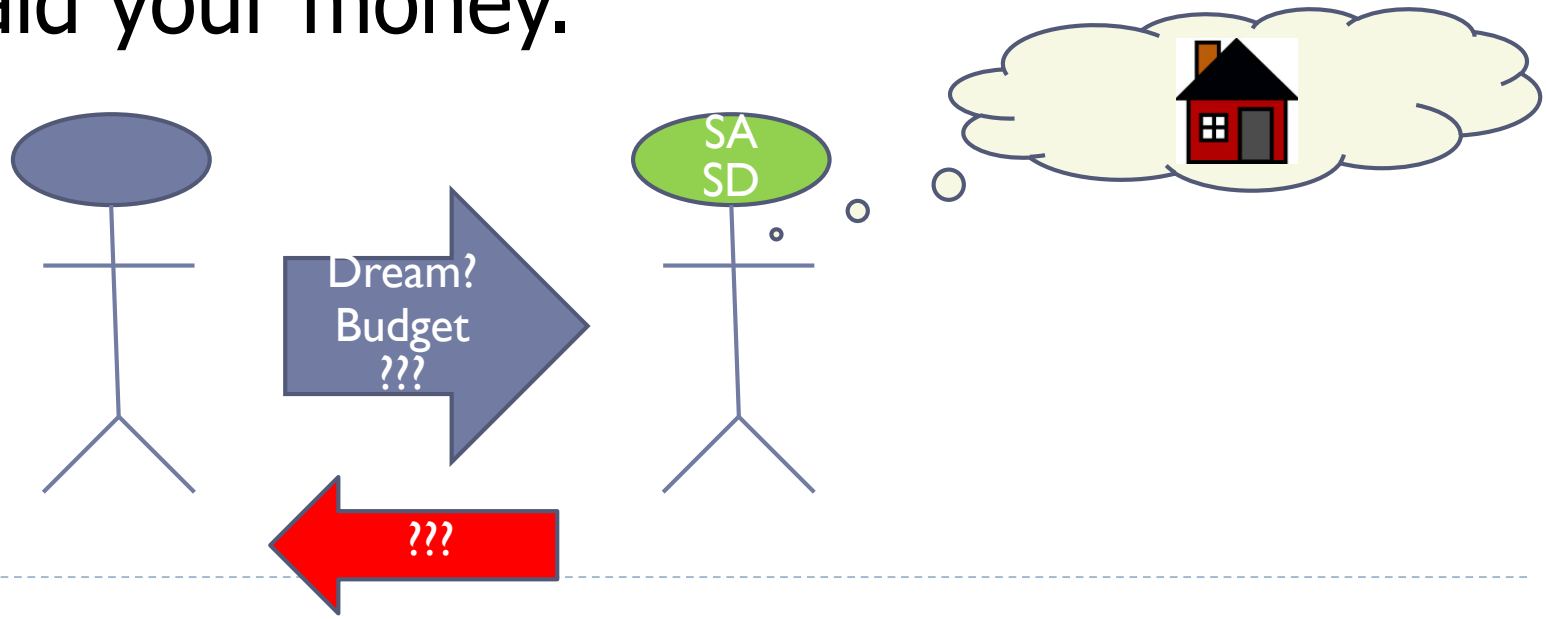
Architect

Builder



Buyer

- Tell the dream of your house.
- Set the budget
- Inspect or check the quality house before paid your money.



Architect / SA SD

- Planning
- Capturing the vision
- Understand details
- Specifying need
- Verify and satisfier vision

System Analyst (SA)

Comparison
Building a house VS a Software

- Buyer
- Architect
- Builder

- Customer
- System Analyst
- System Design
- Programmer
- Tester
- Trainer

SA&D skills

SA consist of those activity that enable a person to understand and specify what new system should accomplish.

SD consist of those activities that enable a person to describe in detail the system solves the need.

Hard skills (Technical)

- Technology, Networking, Programming, Hardware, Compatibility of devices, Design,

Soft skills (Communication)

- Negotiation, Presentation, Interview, Talking to user …

Project

Project is a piece of planned work or an activity which is completed over a period of time

Software Development Life Cycle (SDLC)

Prototype

A prototype typically simulates only a few aspects of, and may be completely different from, the final product.

End-user development

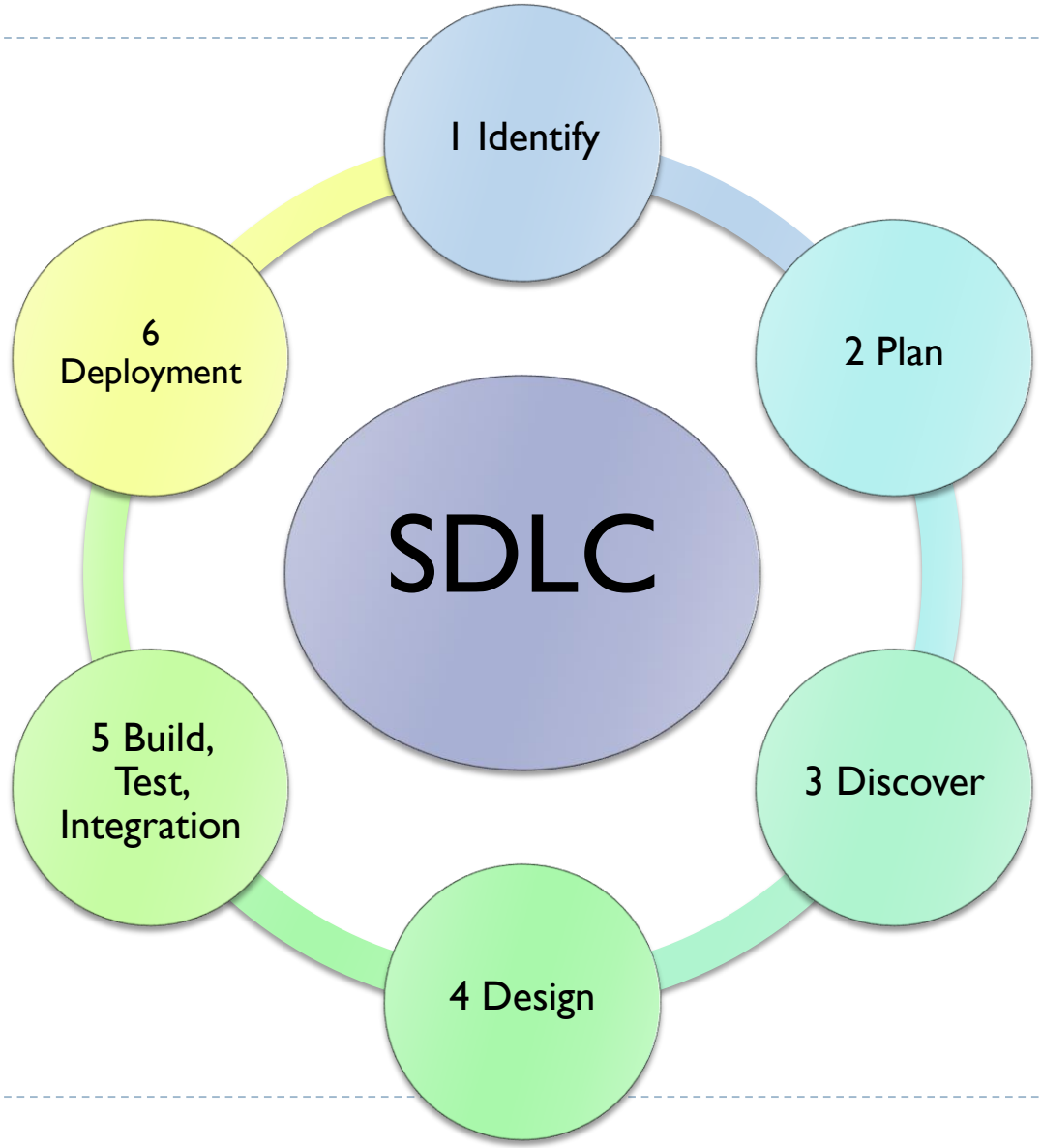
A research topic or small project assignment

Rapid Application Development

RAD uses minimal planning by lacking pre-planning and makes it easy change requirement.

Agile development

Software Development Life Cycle



- Agile development – an information system development process that emphasizes flexibility to anticipate new requirements during development
  - Fast on feet; responsive to change

- Iterative development -- an approach to system development in which the system is "grown" piece by piece through multiple iterations
  - Complete small part of system (mini-project), then repeat processes to refine and add more, then repeat to refine and add more, until done

Introduction to RMO company

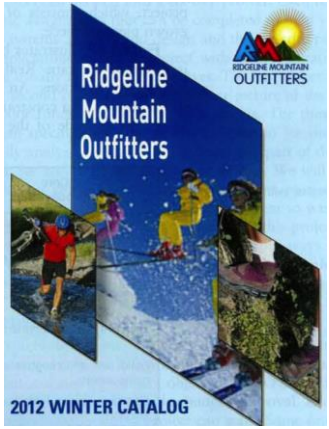
- Ridgeline Mountain Outfitters company
- Large retail company
- Clothing, accessories of outdoor sport activity

- 2010, summer sports clothes

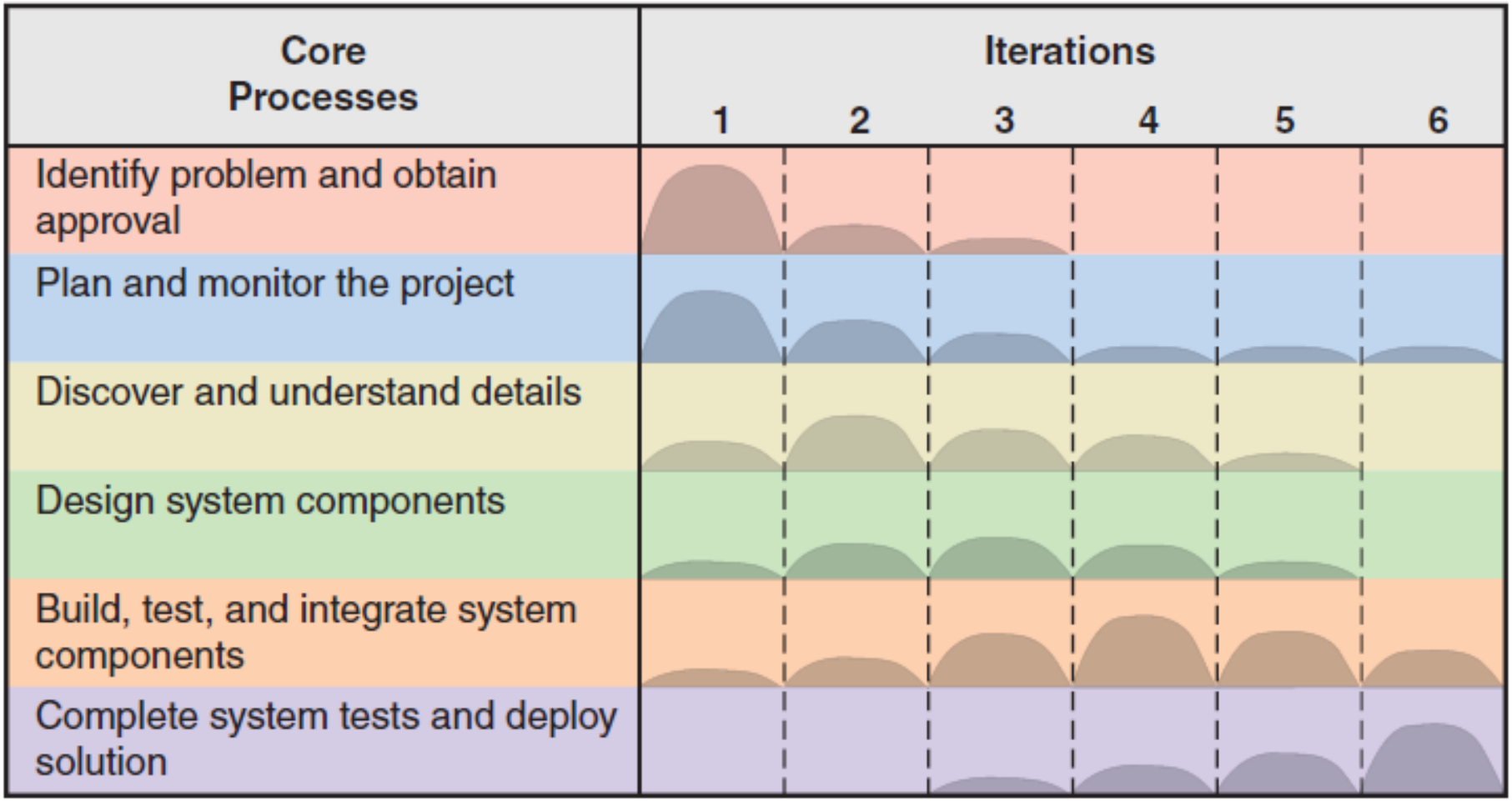
  Snowboarding, Mountain biking, Water skiing, Jet skiing, River running, Jogging, hiking, ATV biking, Camping, Mountain climbing, rappelling

History of RMO

- 1980s, local clothing stores, in Park city, Utah
- 1990s, direct sell to customers
  - Catalogs with mail-in
  - Telephone orders
- 1994, expanded to 10 retail outlets
- Last year,
  - Retail store revenue was $67M
  - Telephone + mail-order were $10M
  - Web-based sales were $200M
- In the past, plan to initiate a project to develop
  - A system collecting and tracking information



Iterative and Agile System Development Life Cycle



RMO Tradeshow System

- Sample project for chapter
- Small information system (app)
- Being added to larger supply chain management system
- Demonstrates one iteration of the small project, assuming there are more
- Goes through all six core processes of SDLC
- Plan is to complete iteration in six days

RMO Tradeshow System

- **Problem--** purchasing agents attend apparel and fabric trade shows around the world to order new products from suppliers
- **Need**– information system (app) to collect and track information about suppliers and new products while at tradeshows
- **Tradeshow Project**– is proposed
  - Supplier information subsystem
  - Product information subsystem

Pre-Project Activities

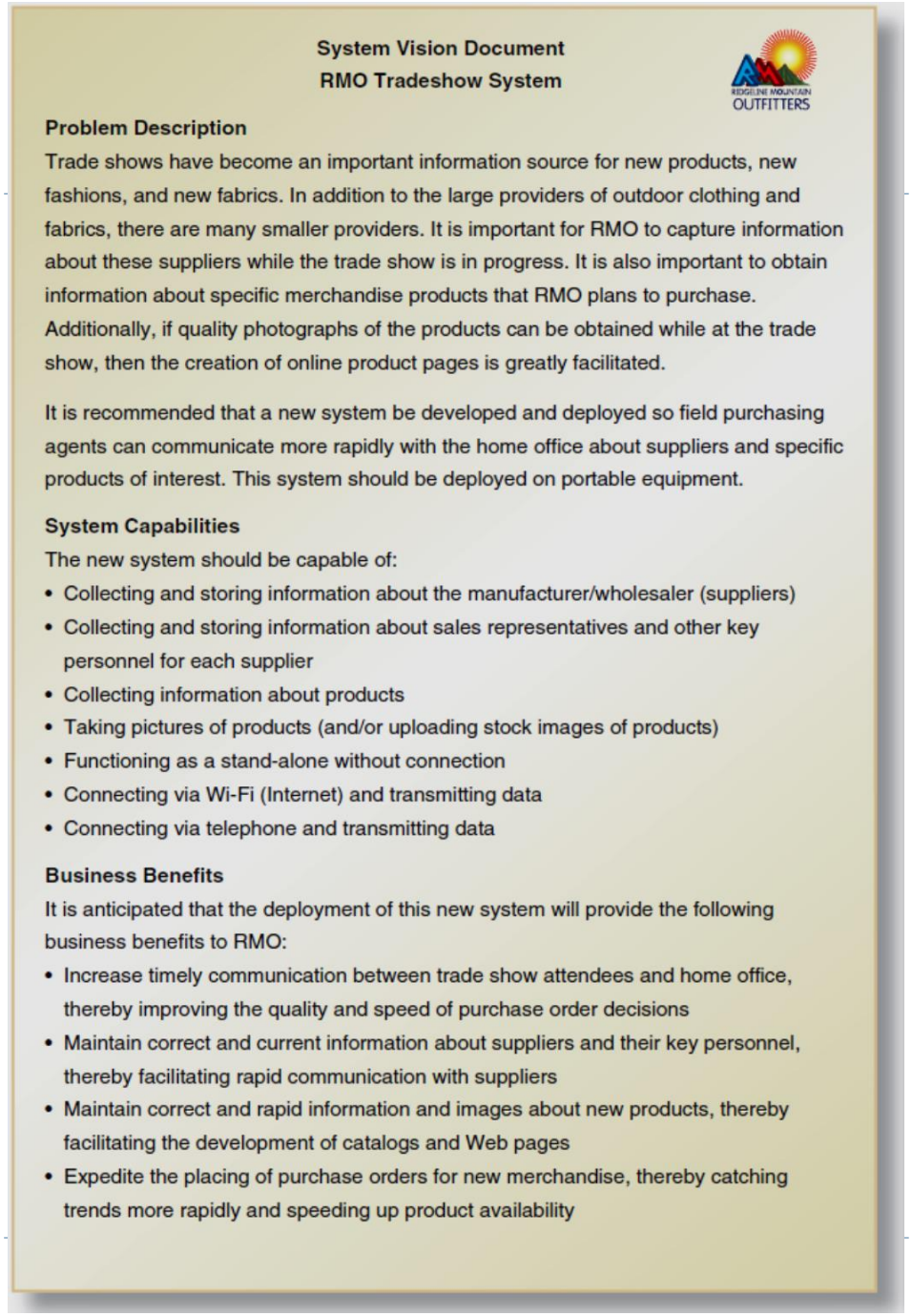
- Identify the problem and document the objective of the system (core process 1)
  - Preliminary investigation
  - System Vision Document
- Obtain approval to commence the project (core process 1)
  - Meet with key stakeholders, including executive management
  - Decision reached, approve plan and budget

System Vision Document

Problem description

System capabilities

Business benefits



System Vision Document
RMO Tradeshow System

RIDGELINE MOUNTAIN OUTFITTERS

Problem Description

Trade shows have become an important information source for new products, new fashions, and new fabrics. In addition to the large providers of outdoor clothing and fabrics, there are many smaller providers. It is important for RMO to capture information about these suppliers while the trade show is in progress. It is also important to obtain information about specific merchandise products that RMO plans to purchase. Additionally, if quality photographs of the products can be obtained while at the trade show, then the creation of online product pages is greatly facilitated.

It is recommended that a new system be developed and deployed so field purchasing agents can communicate more rapidly with the home office about suppliers and specific products of interest. This system should be deployed on portable equipment.

System Capabilities

The new system should be capable of:

- Collecting and storing information about the manufacturer/wholesaler (suppliers)
- Collecting and storing information about sales representatives and other key personnel for each supplier
- Collecting information about products
- Taking pictures of products (and/or uploading stock images of products)
- Functioning as a stand-alone without connection
- Connecting via Wi-Fi (Internet) and transmitting data
- Connecting via telephone and transmitting data

Business Benefits

It is anticipated that the deployment of this new system will provide the following business benefits to RMO:

- Increase timely communication between trade show attendees and home office, thereby improving the quality and speed of purchase order decisions
- Maintain correct and current information about suppliers and their key personnel, thereby facilitating rapid communication with suppliers
- Maintain correct and rapid information and images about new products, thereby facilitating the development of catalogs and Web pages
- Expedite the placing of purchase orders for new merchandise, thereby catching trends more rapidly and speeding up product availability

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Example TOR

ความต้องการของระบบสารสนเทศงานศูนย์ฝึกและอบรมเด็กแลเยาวชน

พัฒนาระบบสารสนเทศงานศูนย์ฝึกและอบรมเด็กและเยาวชน เป็นลักษณะ Online Real time เพื่อการบริหารจัดการข้อมูลเด็กและเยาวชนโดยระบบต้องรองรับการบันทึก แก้ไข ปรับปรุง สืบค้น ส่งต่อข้อมูลเกี่ยวกับเด็กหรือเยาวชน ตลอดจนเรียกดูรายงานหรือสถิติเด็กและเยาวชนได้ตั้งแต่ขั้นตอนการรับตัว จนถึงการปล่อยตัว โดยทุกขั้นตอนเจ้าของข้อมูลต้องนำเข้าหรือปรับปรุงข้อมูลตามหน้าที่ความรับผิดชอบในแต่ละตำแหน่งของตน โดยระบบต้องสามารถเชื่อมโยงกับระบบงานคดี(CM)และระบบศูนย์ฝึกและอบรมเด็กและเยาวชน (TR) ประกอบด้วยขั้นตอน ดังนี้

ลงทะเบียนรับตัวเด็กและเยาวชน

1. ลงทะเบียนรับตัวตามคำพิพากษาสั่งฝึกอบรมของศาล
2 ตรวจสอบข้อมูลของเด็กและเยาวชนในระบบ ซึ่งสถานพินิจฯจะเป็นผู้ส่งข้อมูลให้ศูนย์ฝึกและอบรม
3. จัดเก็บข้อมูลจากแบบประเมินระดับการควบคุมในศูนย์ฝึกและอบรม

การจำแนกเด็กและเยาวชน

1. จัดเก็บข้อมูลการจำแนกกลุ่มเด็กตามสภาพปัญหา
2. จัดเก็บข้อมูลการรายงานของนักวิชาชีพ
3. จัดเก็บข้อมูลความเห็นของคณะกรรมการสหวิชาชีพ

การจัดทำแผนการแก้ไขบำบัดฟื้นฟูเด็กและเยาวชน

1. จัดเก็บข้อมูลแผนการแก้ไขบำบัดฟื้นฟู
2. จัดเก็บข้อมูลการติดตามการปฏิบัติตามแผนการแก้ไขบำบัดฟื้นฟู

Day 1 Activities

- Core Process 2: Plan the Project
  - Determine the major components (functional areas) that are needed
    - Supplier information subsystem
    - Product information subsystem
  - Define the iterations and assign each function to an iteration
    - Decide to do Supplier subsystem first
    - Plan one iteration as it is small and straight forward
  - Determine team members and responsibilities

Work Breakdown Structure for Iteration

Based on the next four core processes in SDLC

Work Breakdown Structure

I. Discover and understand the details of all aspects of the problem.
   1. Meet with the Purchasing Department manager. ~ 3 hours
   2. Meet with several purchasing agents. ~ 4 hours
   3. Identify and define use cases. ~ 3 hours
   4. Identify and define information requirements. ~ 2 hours
   5. Develop workflows and descriptions for the use cases. ~ 6 hours

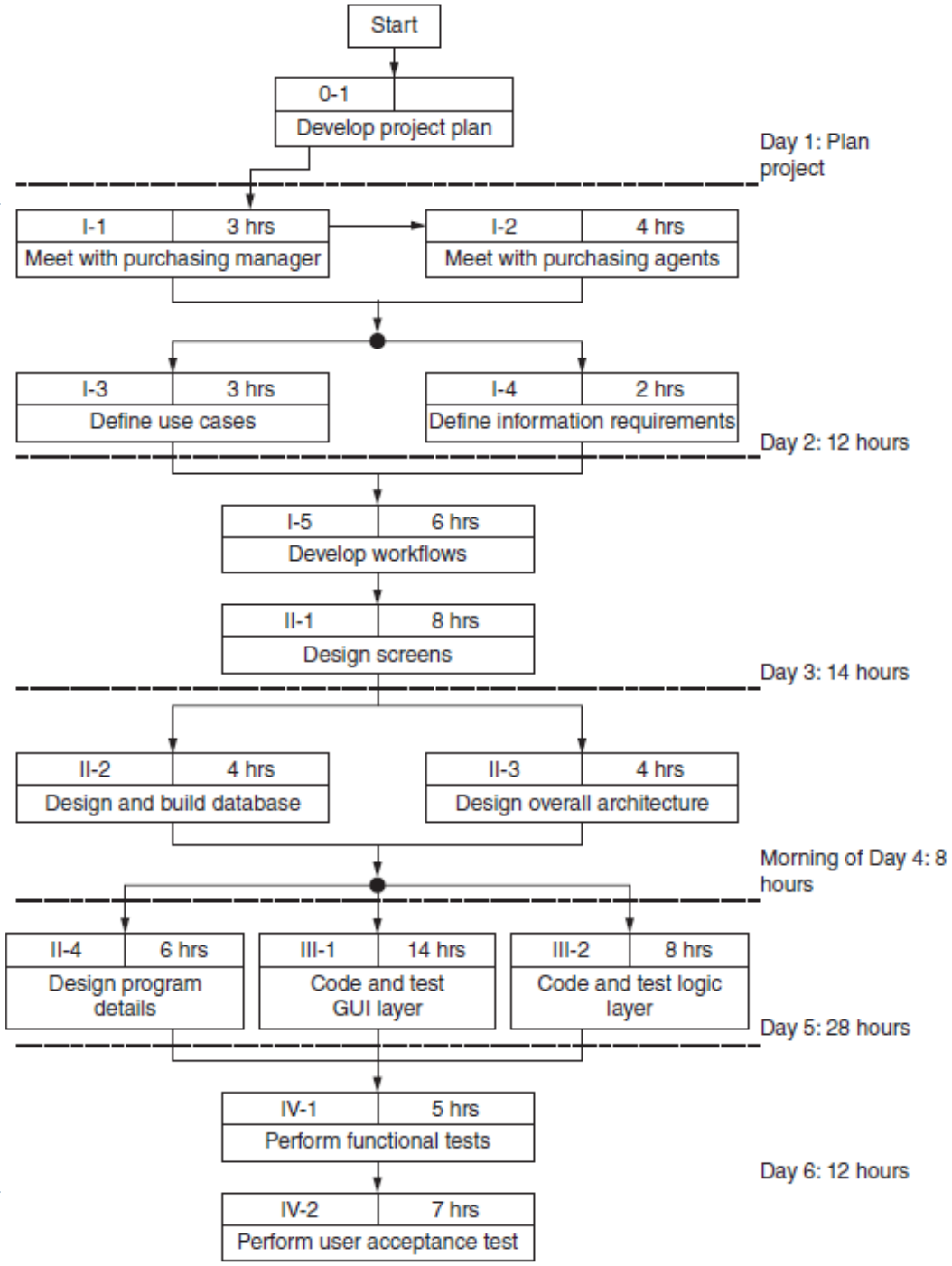
II. Design the components of the solution to the problem.
   1. Design (lay out) input screens, output screens, and reports. ~ 8 hours
   2. Design and build database (attributes, keys, indexes). ~ 4 hours
   3. Design overall architecture. ~ 4 hours
   4. Design program details. ~ 6 hours

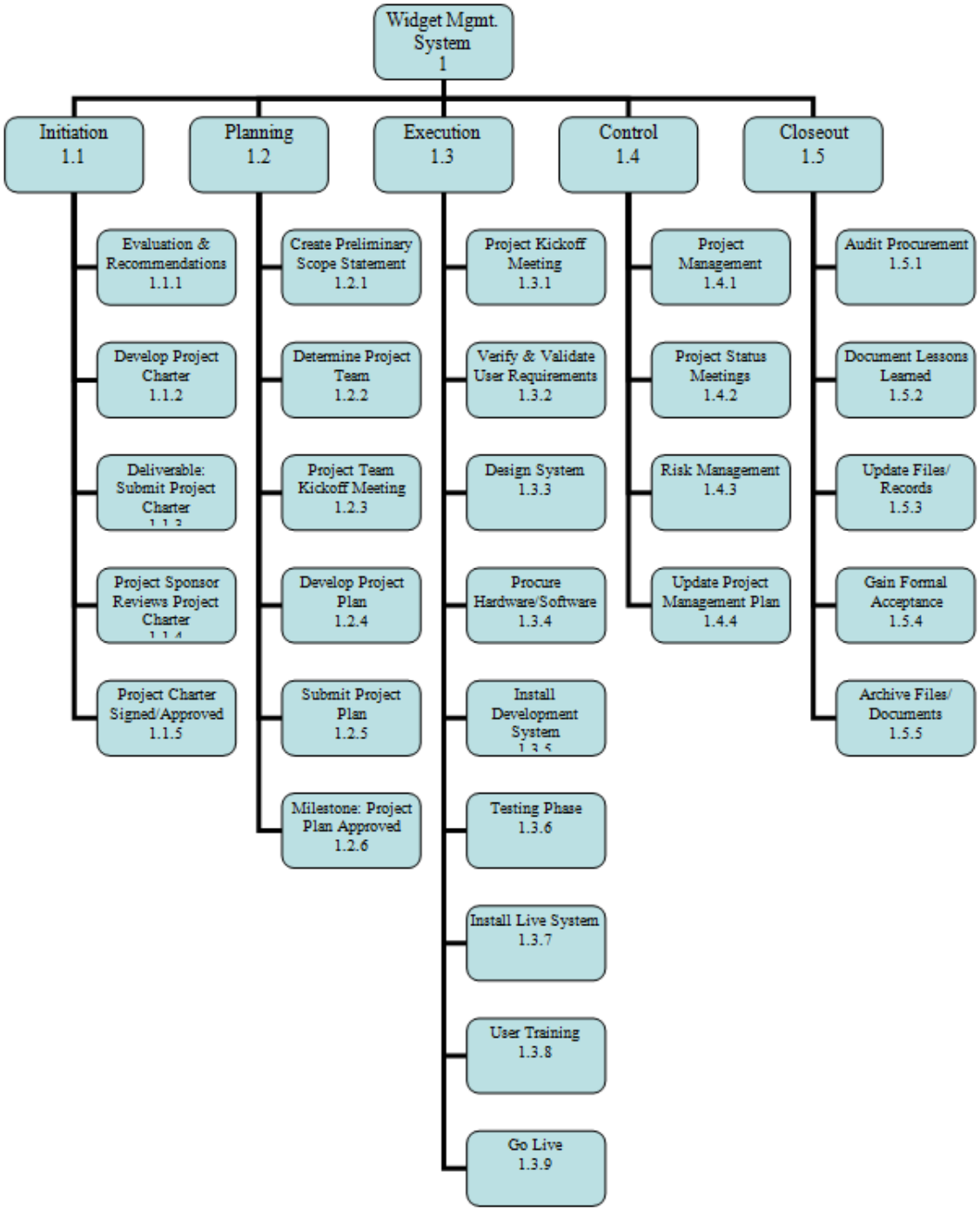
III. Build the components and integrate everything into the solution.
   1. Code and unit test GUI layer programs. ~ 14 hours
   2. Code and unit test Logic layer programs. ~ 8 hours

IV. Perform all system-level tests and then deploy the solution.
   1. Perform system functionality tests. ~ 5 hours
   2. Perform user acceptance test. ~ 8 hours

Work Sequence Draft for Iteration

Elaborates on Work Breakdown Structure

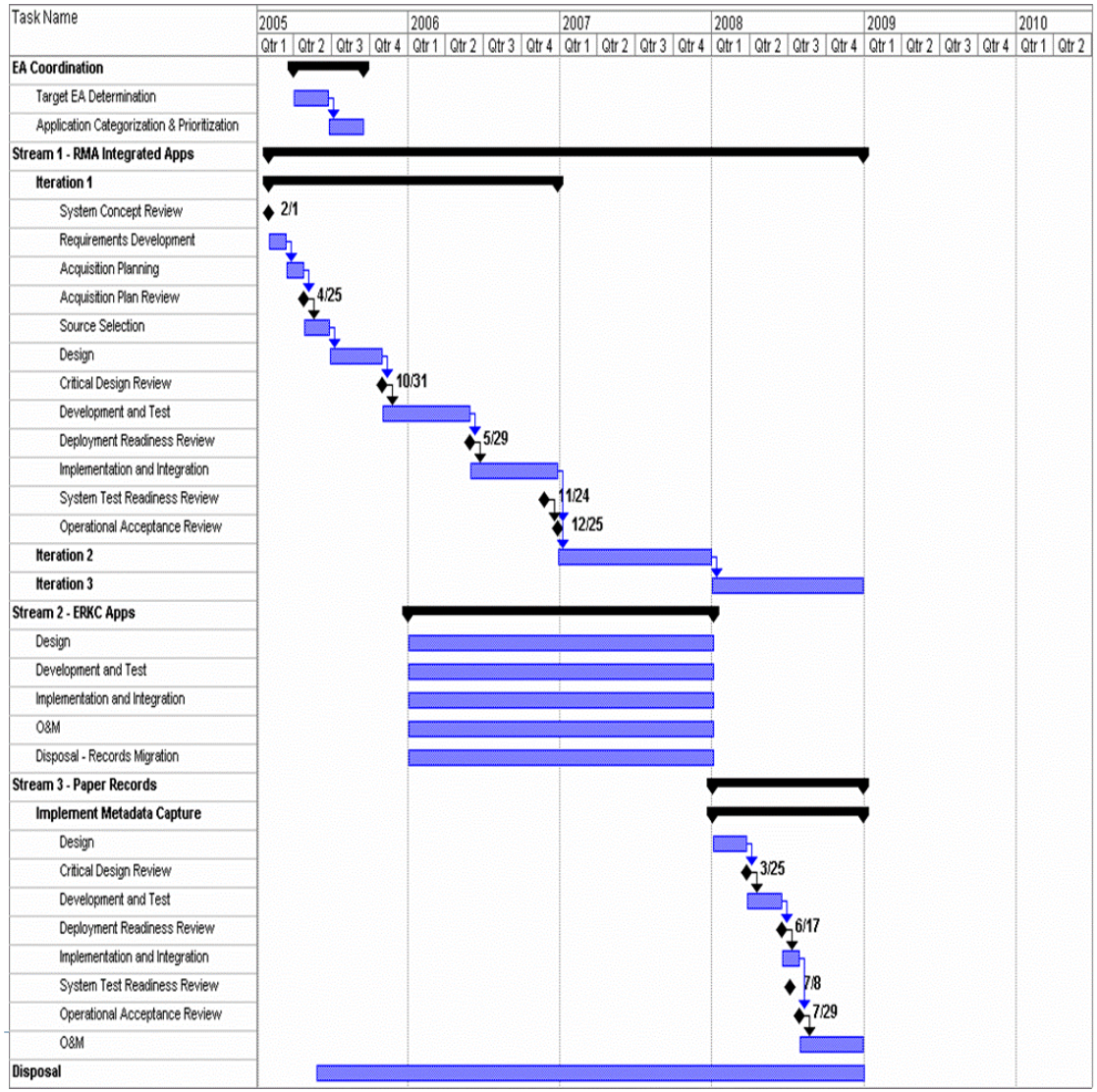



Widget Mgmt. System 1
Initiation 1.1
Planning 1.2
Execution 1.3
Control 1.4
Closeout 1.5
Evaluation & Recommendations 1.1.1
Develop Project Charter 1.1.2
Deliverable: Submit Project Charter
Project Sponsor Reviews Project Charter
Project Charter Signed/Approved 1.1.5
Create Preliminary Scope Statement 1.2.1
Determine Project Team 1.2.2
Project Team Kickoff Meeting 1.2.3
Develop Project Plan 1.2.4
Submit Project Plan 1.2.5
Milestone: Project Plan Approved 1.2.6
Project Kickoff Meeting 1.3.1
Verify & Validate User Requirements 1.3.2
Design System 1.3.3
Procure Hardware/Software 1.3.4
Install Development System
Testing Phase 1.3.6
Install Live System 1.3.7
User Training 1.3.8
Go Live 1.3.9
Project Management 1.4.1
Project Status Meetings 1.4.2
Risk Management 1.4.3
Update Project Management Plan 1.4.4
Audit Procurement 1.5.1
Document Lessons Learned 1.5.2
Update Files/ Records 1.5.3
Gain Formal Acceptance 1.5.4
Archive Files/ Documents 1.5.5

WBD dictionary

Level	WBS Code	Element Name	Definition
1	1	Widget Management System	All work to implement a new widget management system.
2	1.1	Initiation	The work to initiate the project.
3	1.1.1	Evaluation & Recommendations	Working group to evaluate solution sets and make recommendations.
3	1.1.2	Develop Project Charter	Project Manager to develop the Project Charter.
3	1.1.3	Deliverable: Submit Project Charter	Project Charter is delivered to the Project Sponsor.
3	1.1.4	Project Sponsor Reviews Project Charter	Project sponsor reviews the Project Charter.
3	1.1.5	Project Charter Signed/Approved	The Project Sponsor signs the Project Charter which authorizes the Project Manager to move to the Planning Process.
2	1.2	Planning	The work for the planning process for the project.
3	1.2.1	Create Preliminary Scope Statement	Project Manager creates a Preliminary Scope Statement.
3	1.2.2	Determine Project Team	The Project Manager determines the project team and requests the resources.
3	1.2.3	Project Team Kickoff Meeting	The planning process is officially started with a project kickoff meeting which includes the Project Manager, Project Team and Project Sponsor (optional).
3	1.2.4	Develop Project Plan	Under the direction of the Project Manager the team develops the project plan.
3	1.2.5	Submit Project Plan	Project Manager submits the project plan for approval.

WBD in Gantt Chart



Day 2 Activities

- Core Process 3: Discover and Understand Details
  - Do preliminary fact-finding to understand requirements
  - Develop a preliminary list of use cases and a use case diagram
  - Develop a preliminary list of classes and a class diagram

Identify Use Cases

Both subsystems

Use Case	Description
Look up supplier	Using supplier name, find supplier information and contacts
Enter/update supplier information	Enter (new) or update (existing) supplier information
Look up contact	Using contact name, find contact information
Enter/update contact information	Enter (new) or update (existing) contact information
Look up product information	Using description or supplier name, look up product information
Enter/update product information	Enter (new) or update (existing) product information
Upload product image	Upload images of the merchandise product

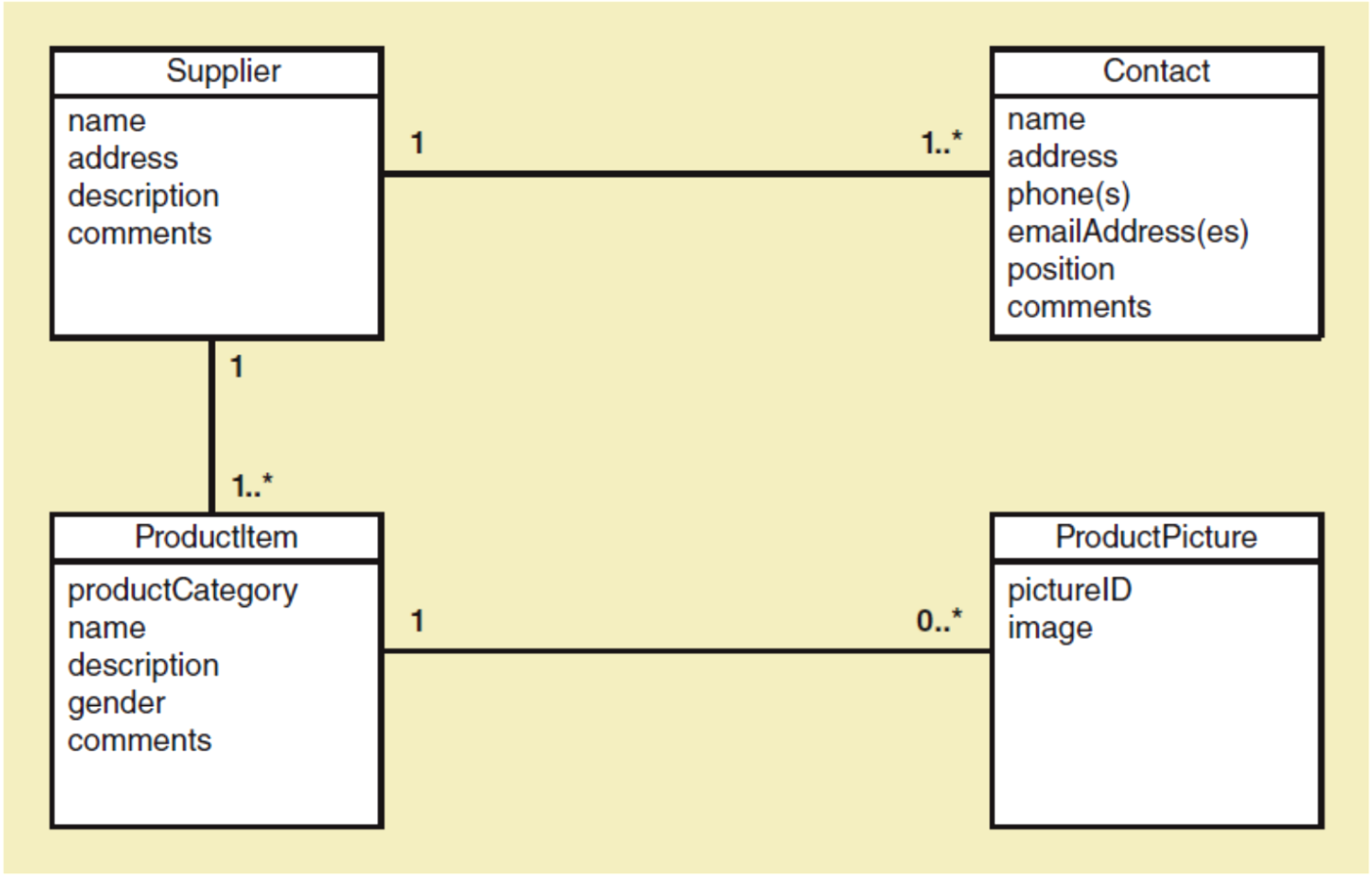
Identify Object Classes

Both subsystems

Object Classes	Attributes
Supplier	supplier name, address, description, comments
Contact	name, address, phone(s), e-mail address(es), position, comments
Product	category, name, description, gender, comments
ProductPicture	ID, image

Preliminary Class Diagram

Both subsystems



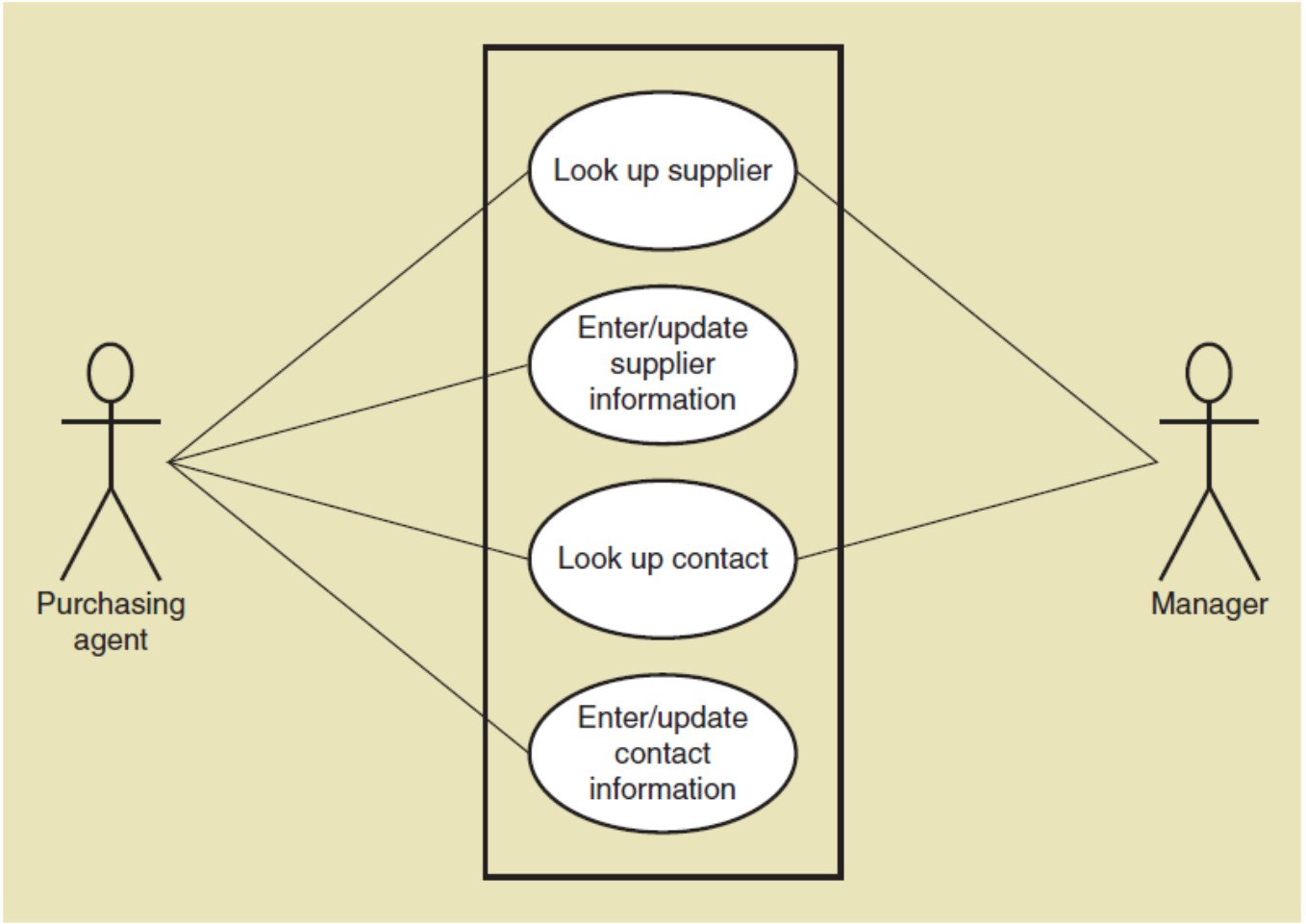
Day 3 Activities

- Core Process 3: Discover and Understand Details
  - Do in-depth fact-finding to understand requirements
  - Understand and document the detailed workflow of each use case
- Core Process 4: Design System Components
  - Define the user experience with screens and reports

Details Focus on Supplier Information Subsystem

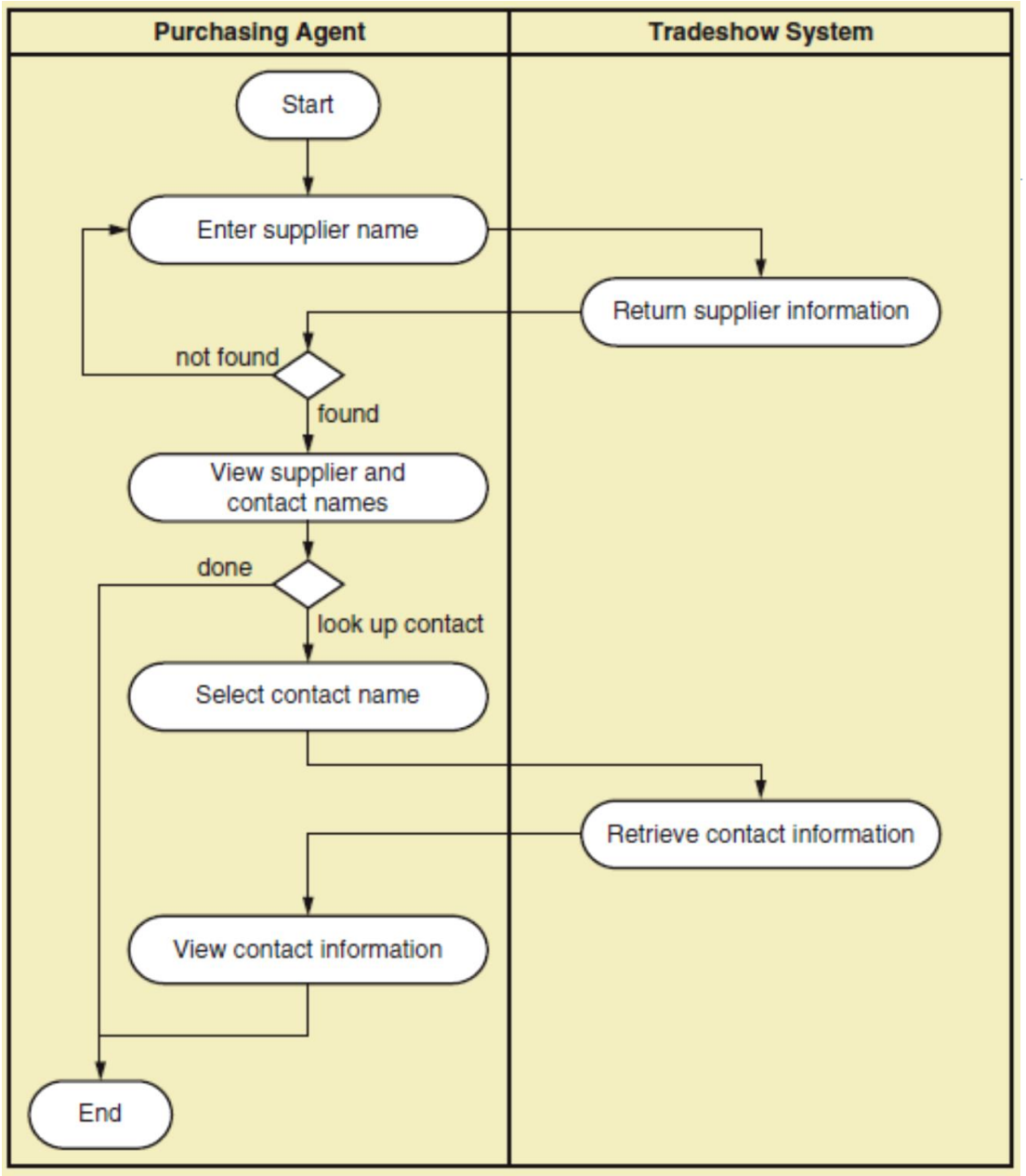
- Use cases:
  - Look up supplier
  - Enter/update supplier information
  - Lookup contact information
  - Enter/update contract information

Use Case Diagram
Supplier information subsystem



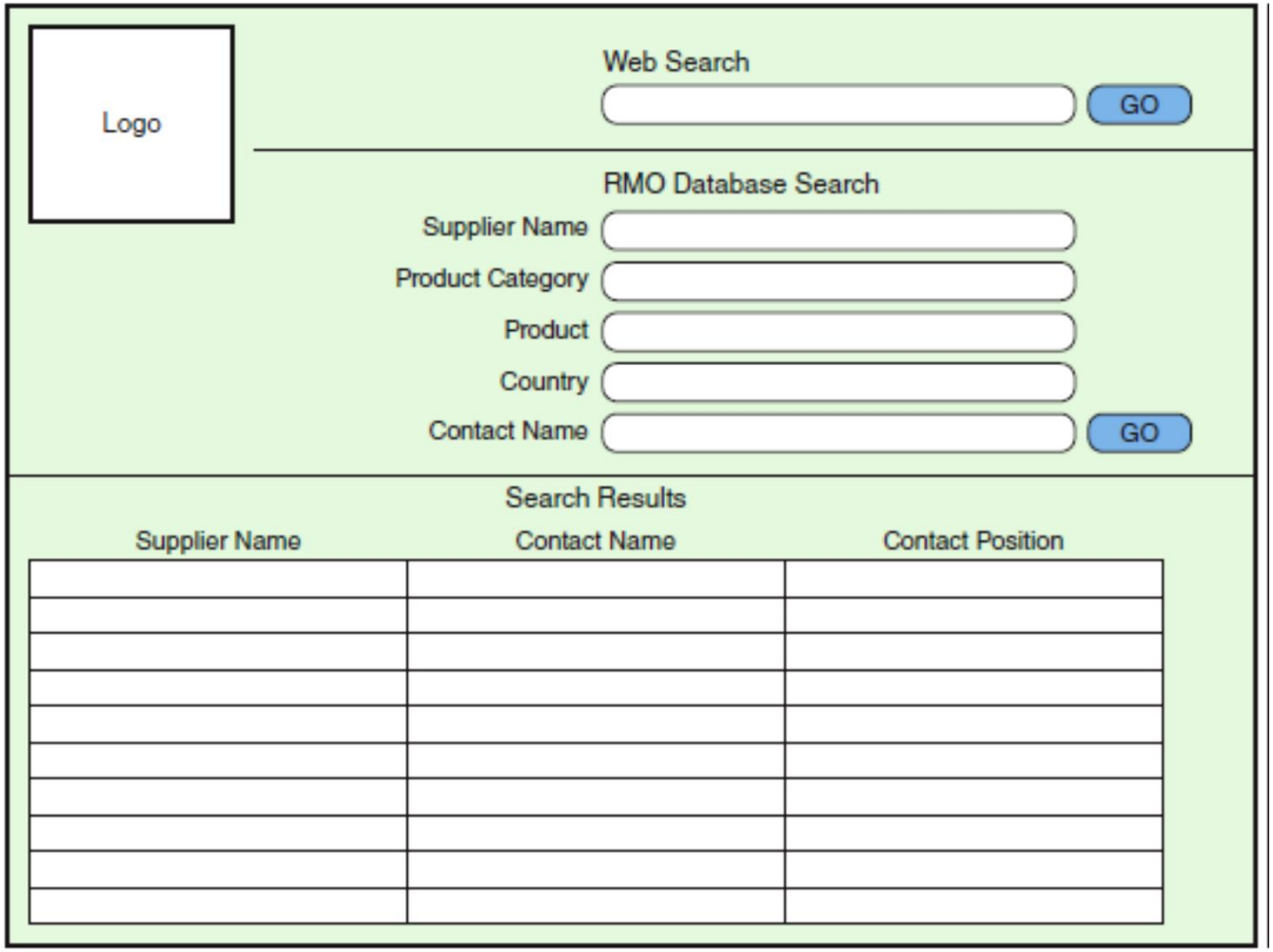
Activity Diagram (Workflow)

Look up supplier use case



Draft Screen Layout

Look up supplier use case



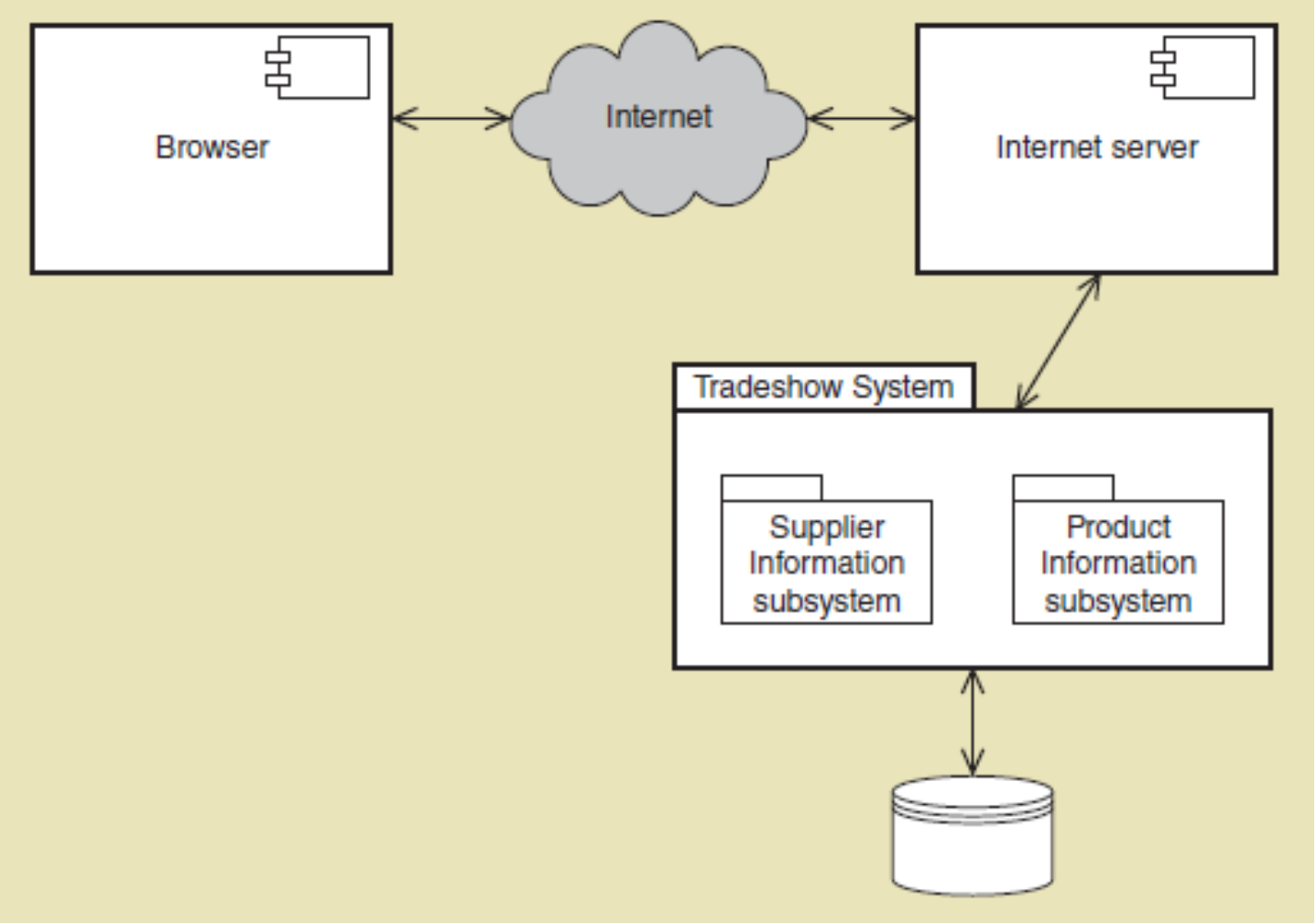
Day 4 Activities

- Core Process 4: Design System Components
  - Design the database (schema)
    - Table design
    - Key and index identification
    - Attribute types
    - Referential integrity
  - Design the system's high level structure
    - Browser, Windows, or Smart phone; OO or procedural
    - Architectural configuration (components)
    - Design class diagram
    - Subsystem architectural design

Database Schema

Table Name	Attributes
Supplier	SupplierID: integer {key} Name: string {index} Address1: string Address1: string City: string State-province: string Postal-code: string Country: string SupplierWebURL: string Comments: string
Contact	ContactID: integer {key} SupplierID: integer {foreign key} Name: string {index} Title: string WorkAddress1: string WorkAddress2: string WorkCity: string WorkState: string WorkPostal-code: string WorkCountry: string WorkPhone: string MobilePhone: string EmailAddress1: string EmailAddress2: string Comments: string

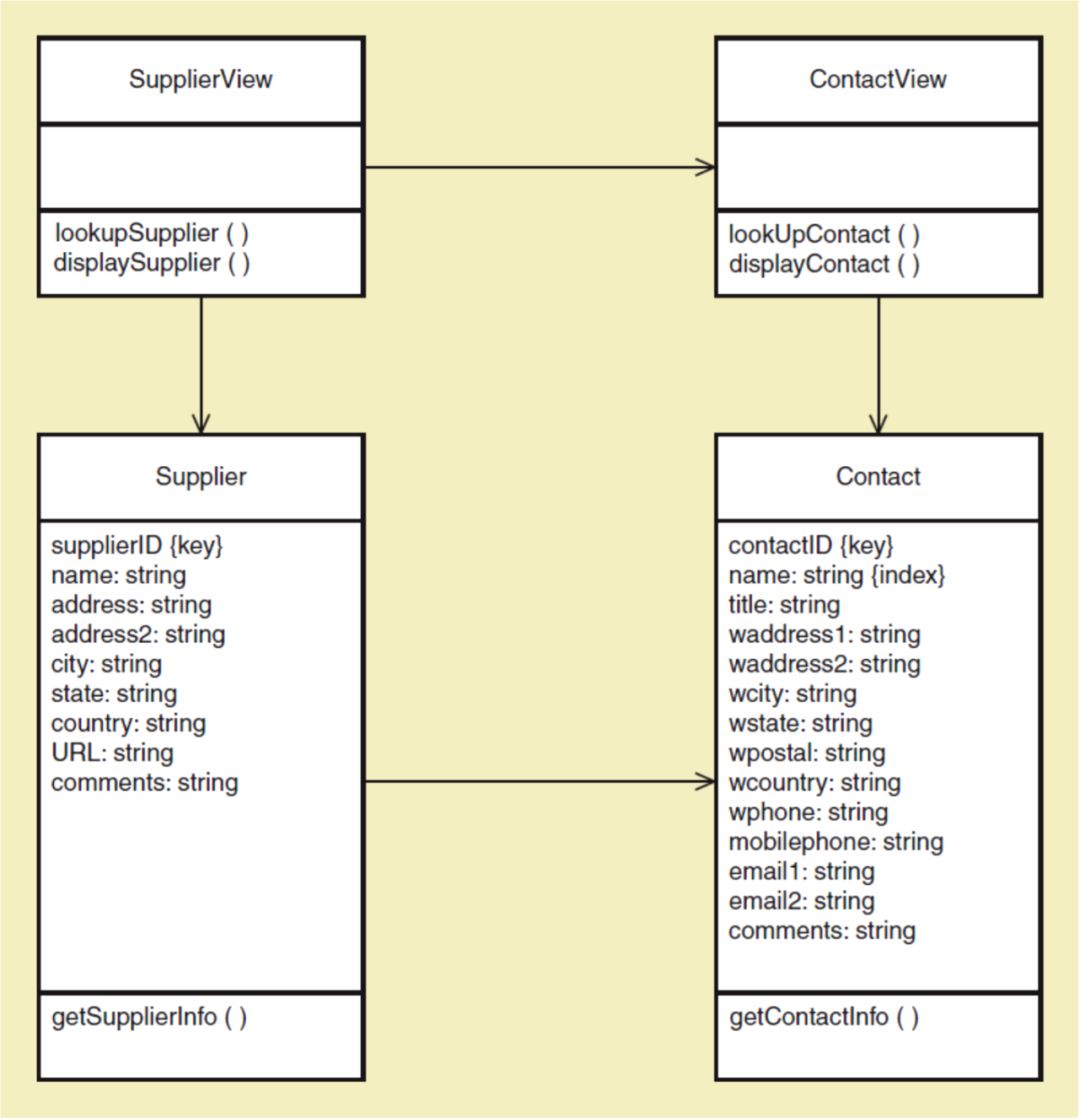
Architectural Configuration Diagram



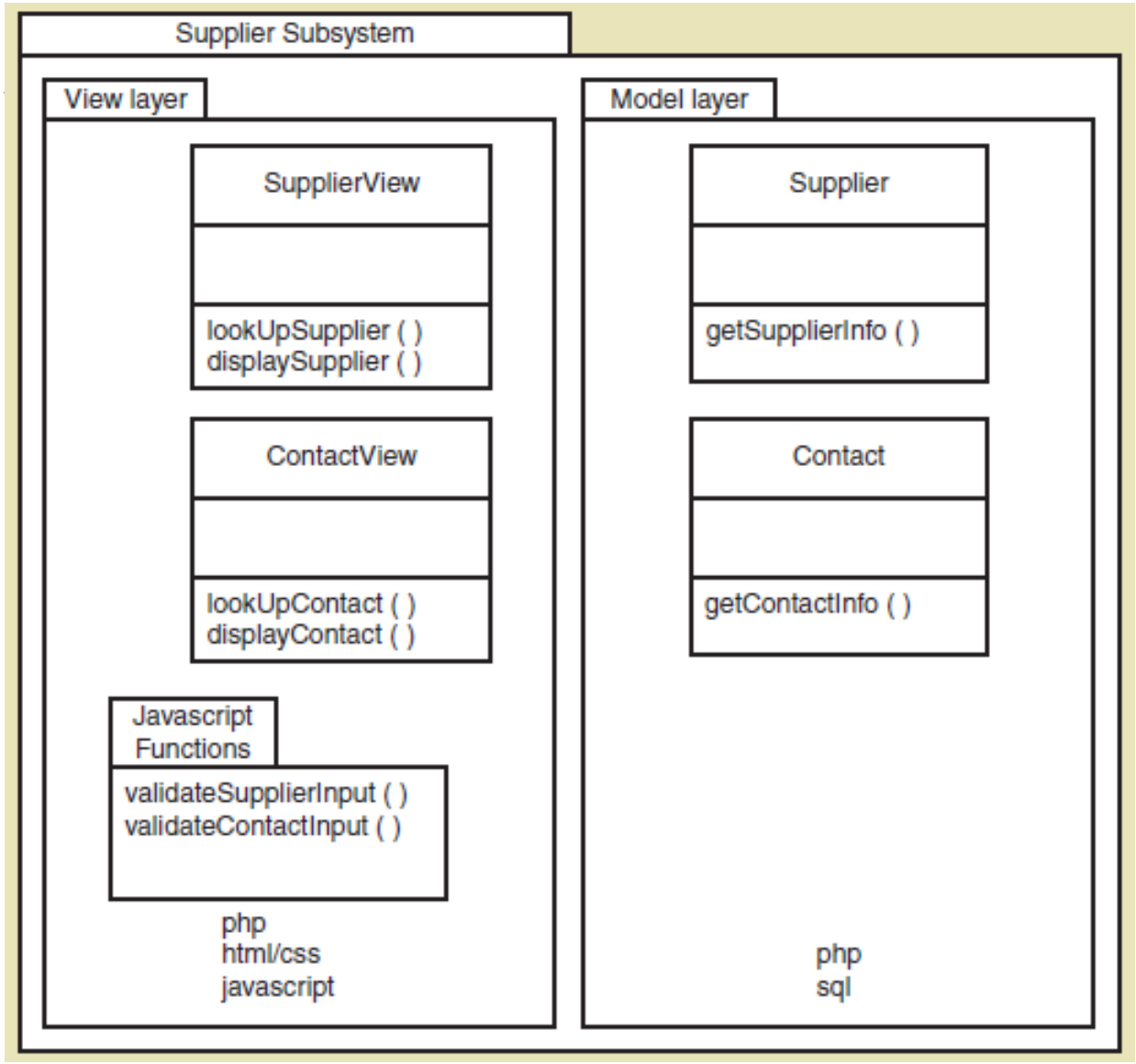
Preliminary Design Class Diagram

Includes View Layer Classes and Domain Layer Classes

Need to add Utility Classes as well



Subsystem Architectural Design Diagram



Notes on Managing the Project

- Lots of design diagrams shown
  - Design in a complex activity with multiple levels
    - High level architectural
    - Low level detailed design
  - One diagram builds on/complements another
  - Not everything is diagrammed, especially for a small project. Pick and choose.
- Programming is also done concurrently
  - You don't design everything then code
  - You do some design, some coding, some design, some coding

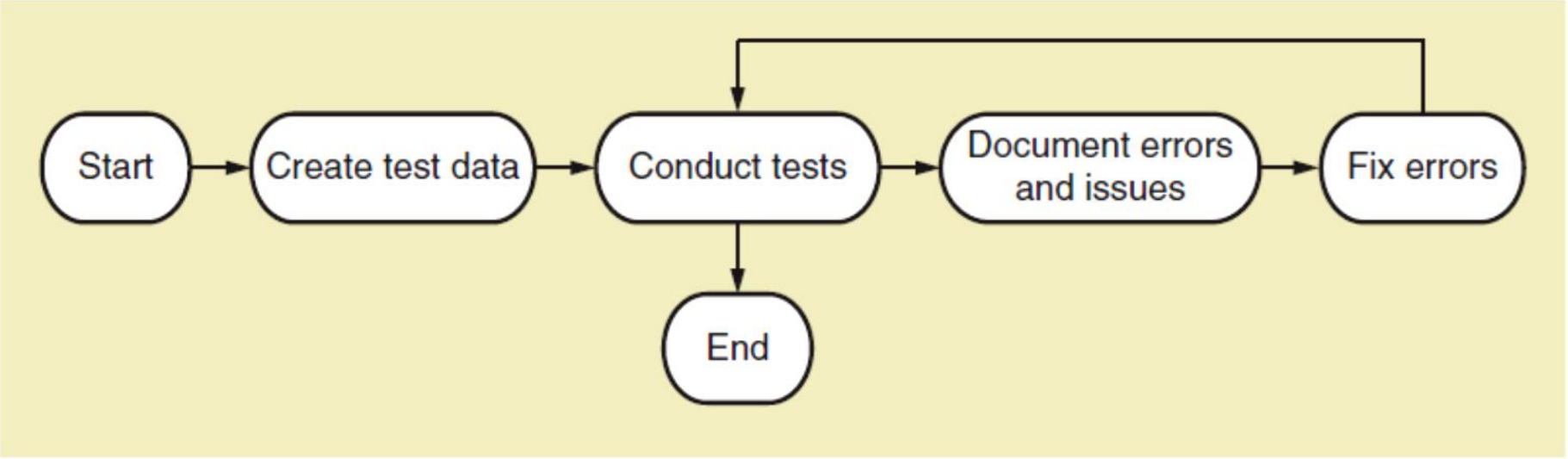
Day 5 Activities

- Core Process 4: Design System Components
  - Continue with design details
  - Proceed use case by use case
- Core Process 5: Build, Test, and Integrate System Components
  - Continue programming (build)
  - Build use case by use case
  - Perform unit and integration tests

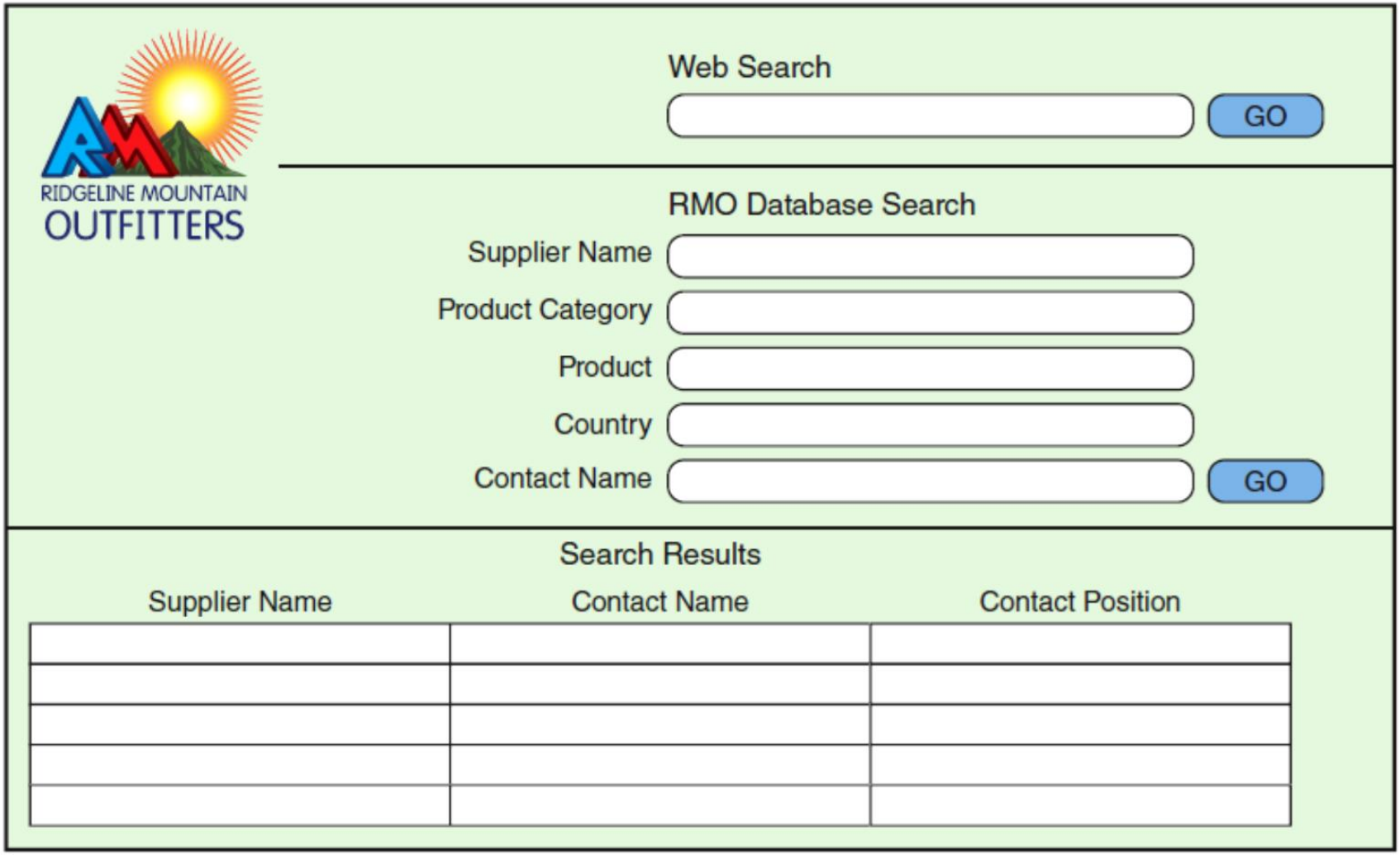
Code Example for One Class

```
<?php
    class SupplierView
    {
        private Supplier $theSupplier;

        function __construct()
        {
            $this->theSupplier = new Supplier();
        }

        function lookupSupplier()
        {
          include('lookupSupplier.inc.html');
        }

        function displaySupplier()
        {
              include('displaySupplierTop.inc.html');
              extract($_REQUEST);    // get Form data
            //Call Supplier class to retrieve the data
            $results = $theSupplier->getSupplierInfo($supplier, $category,
                                              $product, $country, $contact);

           foreach ($results as $resultItem){
           ?>
                    <tr>
                        <td style="border:1px solid black">
                              <?php echo $resultItem->supplierName?></td>
                        <td style="border:1px solid black">
                               <?php echo $resultItem->contactName?></td>
                        <td style="border:1px solid black">
                           <?php echo $resultItem->contactPosition?></td>
                    </tr>
            <?php }
            include('displaySupplierFoot.inc.html');
        }
    }
?>
```

Workflow of Testing Tasks



Screen Capture for Look up supplier use case



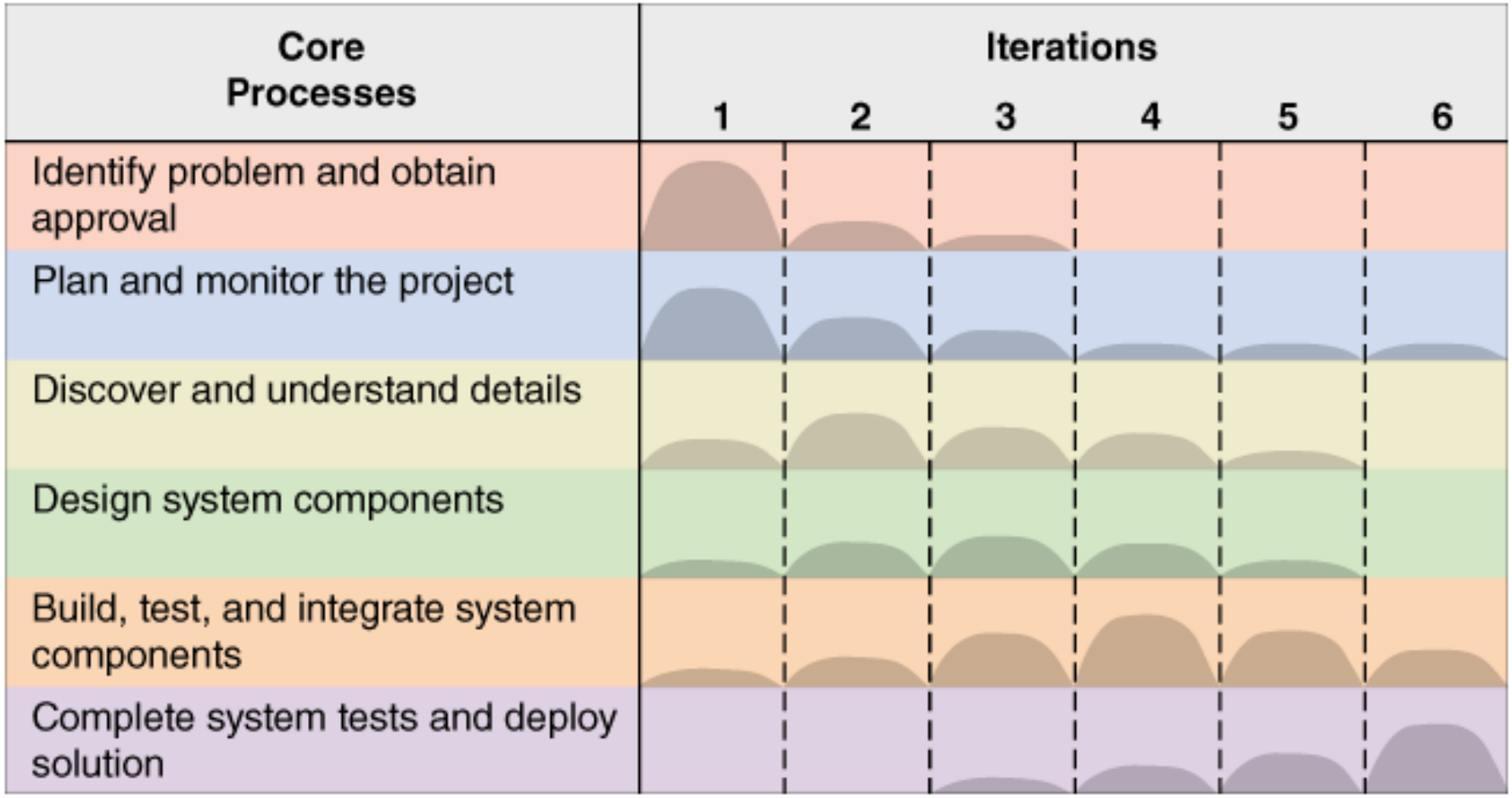
Day 6 Activities

- Core Process 6: Complete System Testing and Deploy System
  - Perform system functional testing
  - Perform user acceptance testing
  - Possibly deploy part of system

First Iteration Recap

- This was a 6 day iteration of small project
  - Most iterations are longer (2 to 4 weeks)
  - This project might be 2 iterations
  - Most projects have many more iterations
- End users need to be involved, particularly in day 1, 2, 3 and 6.
- Days 4 and 5 involved design and programming concurrently.
  - Lots of time was spent programming along with design (not emphasized here)

This Book is about Activities and Tasks in the SDLC



Where You Are Headed

- Chapter 1: From Beginning to End
  - Small project overview emphasizing analysis and design and iterative development
  - Done!
- Online Chapter A: The Systems Analyst
  - More about the role of the systems analyst in systems development, including system concepts and careers
- Chapter 2: Investigating System Requirements
  - More about core process 3: Systems analysis activities
- Chapter 3: Use Cases
  - Techniques for Identifying and modeling use cases for systems analysis

Where You Are Headed

- Chapter 4: Domain Modeling
  - Techniques for Identifying and modeling domain classes for systems analysis
- Chapter 5: Extending the Requirements Models
  - Modeling more details about use cases and domain classes for systems analysis
- Online Chapter B: The Traditional Approach to Requirements
  - Systems analysis using data flow diagrams (DFDs) in place of use case descriptions and use case diagrams
  - Not as common now, but widely known by experienced developers

Where You Are Headed

- Chapter 6: Essentials of Design
  - More about core process 4: system design activities
- Chapter 7: Designing User and System Interfaces
  - Human computer interaction, user interface design principles, outputs and reports, system interfaces
- Chapter 8: Approaches to System Development
  - More about the SDLC, models, tools, techniques, and agile methodologies
- Chapter 9: Project Planning and Project Management
  - More about core processes 1 and 2

Where You Are Headed

- Online Chapter C: Project Management Techniques
  - More hands on project management skills
- Chapter 10: Object-Oriented Design: Principles
  - Design principles, design models, and designing use cases
- Chapter 11: Object-Oriented Design: Use Case Realization
  - Three layer design and design patterns
- Chapter 12: Databases, Controls, and Security
  - More about database design and protecting the integrity of the system.

Where You Are Headed

- Chapter 13: Making the System Operational
  - More about core processes 5 and 6: programming, testing, and deployment
- Chapter 14: Current Trends in System Development
  - Trends in system development methodologies: Unified process, extreme programming, and scrum
  - Trends in technology infrastructure
  - Trends in software availability
  - The Web as an application platform

Summary

- This text is about developing information systems that solve an organization need
- Chapter 1 takes you through the whole process for one small information system
- System development involves 6 core processes, known as the SDLC
- The rest of the text elaborates on the basic processes shown in chapter 1

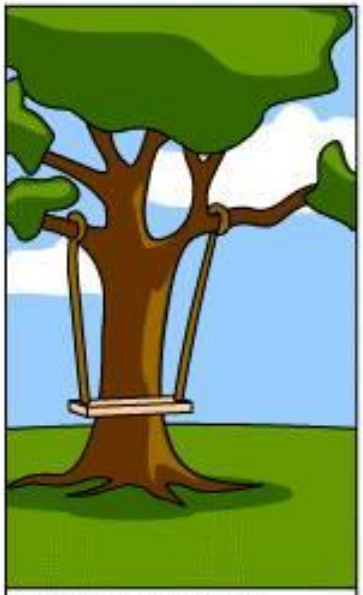
Summary

- Terms to review and know include:
  - Computer application
  - Information system
  - Project
  - Systems analysis
  - System design
  - System development lifecycle (SDLC)
  - Information system development process (methodology)
  - Agile development
  - Iterative development

Summary

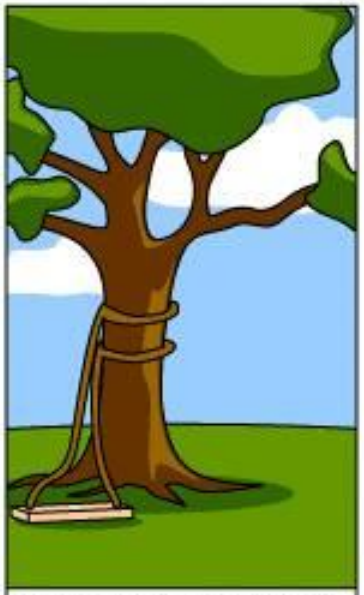
- System vision document
- Work breakdown structure
- Work sequence draft
- Use cases
- Use case diagram
- Object classes (domain classes)
- Class diagram
- Design class diagram
- High level structural design (architectural design)
- Database schema
- Screen layout

How the customer explained it



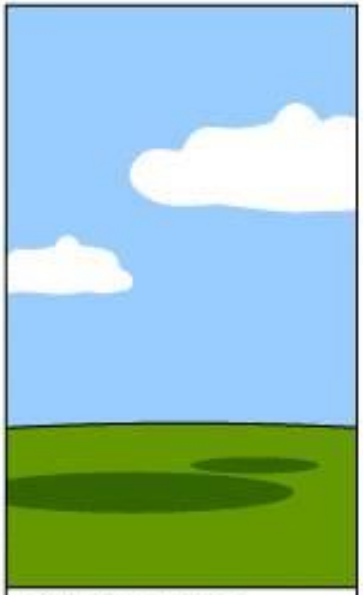
How the Project Leader understood it

How the Analyst designed it

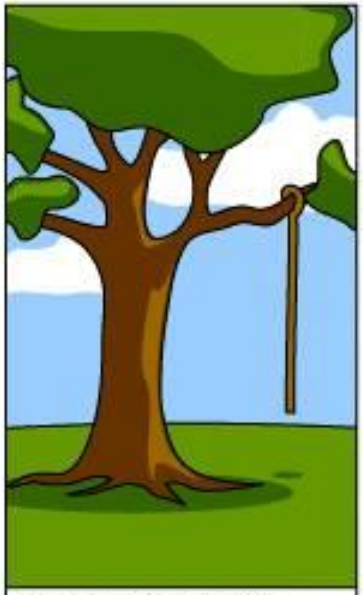


How the Programmer wrote it

How the Business Consultant described it

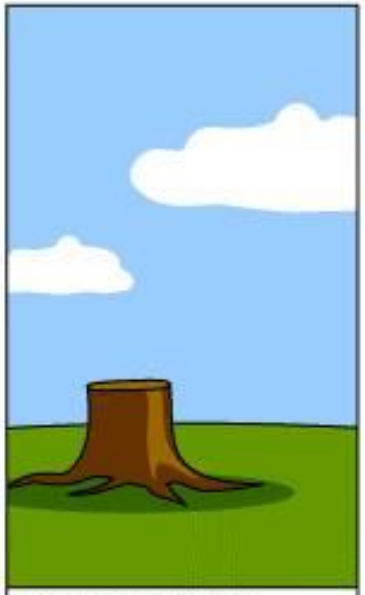


How the project was documented



What operations installed

How the customer was billed



How it was supported

What the customer really needed