

# AN OVERVIEW OF SYSTEMS ANALYSIS:

## SYSTEMS ANALYSIS AND THE ROLE OF THE SYSTEMS ANALYST

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### Lecture 1

21.10.2014, Tuesday

# A Series of Lectures

- 1.The Role of the Systems
- 2.Project Planning and Project Management
- 3.Project Management Techniques
- 4. Investigating System Requirements.
- 5. Use cases.
- 6. Domain classes.
- 7. Extending the requirements models.
- 8. Designing user and systems interfaces.
- 9. Making the system operational.

# Outline of This Lecture

- Terminologies: Software Development; Systems Analysis and Design; and Systems Development Lifecycle
- Introduction to Ridgeline Mountain Outfitters
- Iterative Development
- Developing RMO's Tradeshow Systems

# Terminology – Software Development and Systems Analysis & Design

- **Computer application** (app) – a computer software program that executes on a computing device to carry out a specific set of functions
  - Modest scope
- **Information system** – a set of interrelated components that collects, processes, stores, and provides as output the information needed to complete business tasks
  - Broader in scope than “app”
  - Includes database and related manual processes

# Terminology (continued)

- **Project** – a planned undertaking that has a beginning and end and that produces some definite result
  - Used to develop an information system
  - Requires knowledge of systems analysis and systems design tools and techniques

## Terminology (continued)

- **Systems analysis** – those activities that enable a person to understand and specify what an information system should accomplish
- **Systems design** – those activities that enable a person to define and describe in detail the system that solves the need

# Terminology (continued)

- **System development lifecycle (SDLC)** – the entire process consisting of all activities required to build, launch, and maintain an information system
  - Identify the problem or need and obtain approval
  - Plan and monitor the project
  - Discover and understand the details of the problem or need
  - Design the system components that solve the problem or satisfy the need
  - Build, test, and integrate system components
  - Complete system tests and then deploy the solution

# Terminology (continued)

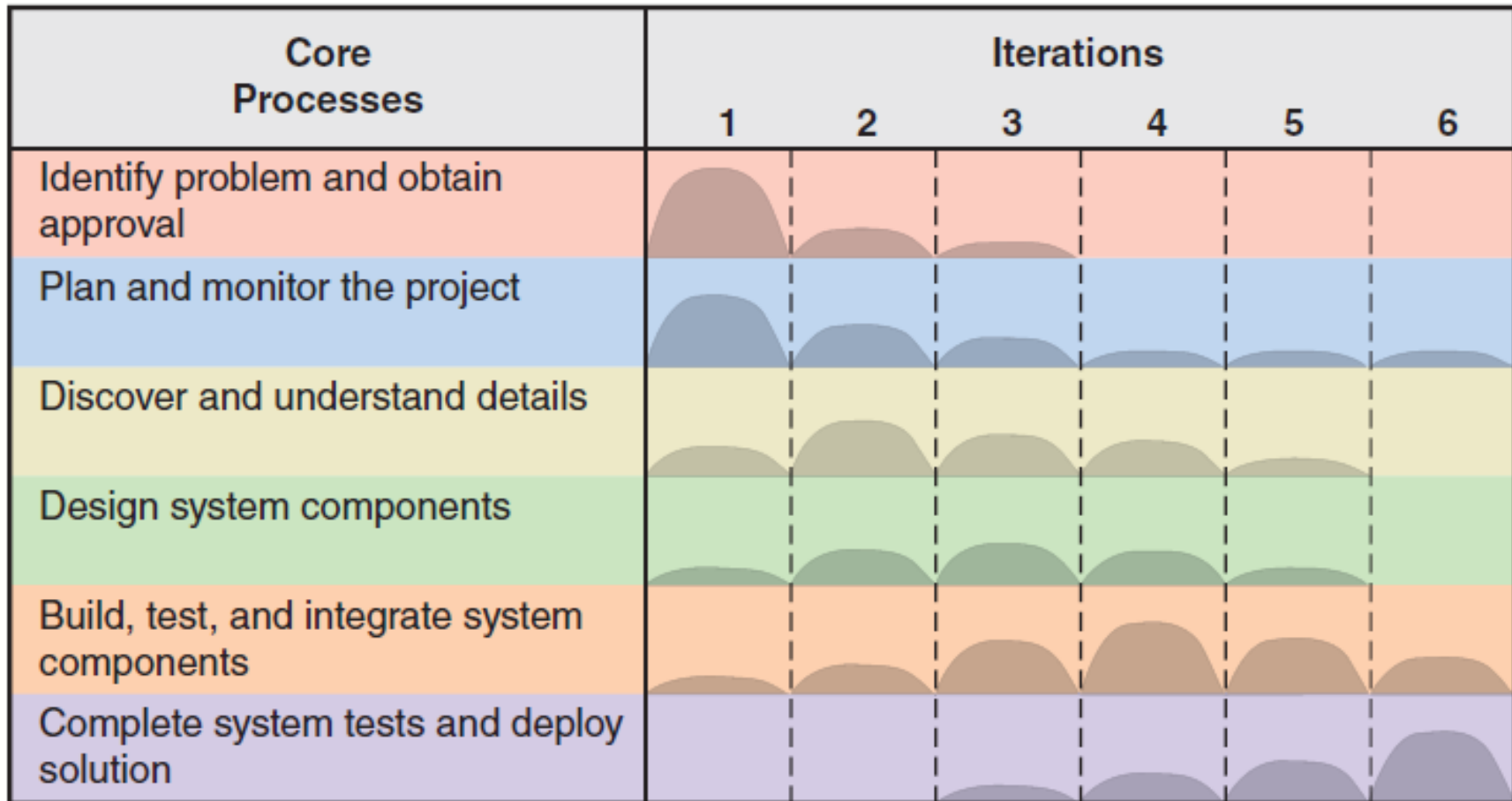
- **Information systems development process** – the actual approach used to develop a particular information system (aka: ***methodology***)
  - Unified process (UP)
  - Extreme programming (XP)
  - Scrum
- Most processes/methodologies now use Agile and Iterative development



# Terminology (continued)

- **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

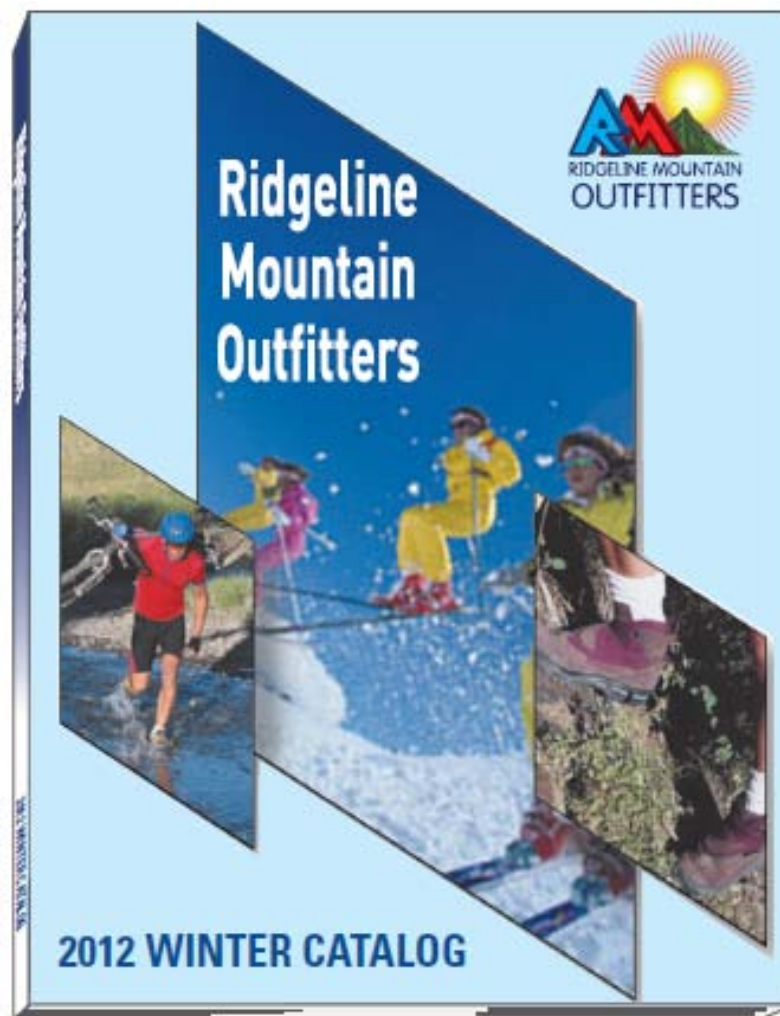
# Iterative and Agile Systems Development Lifecycle (SDLC)



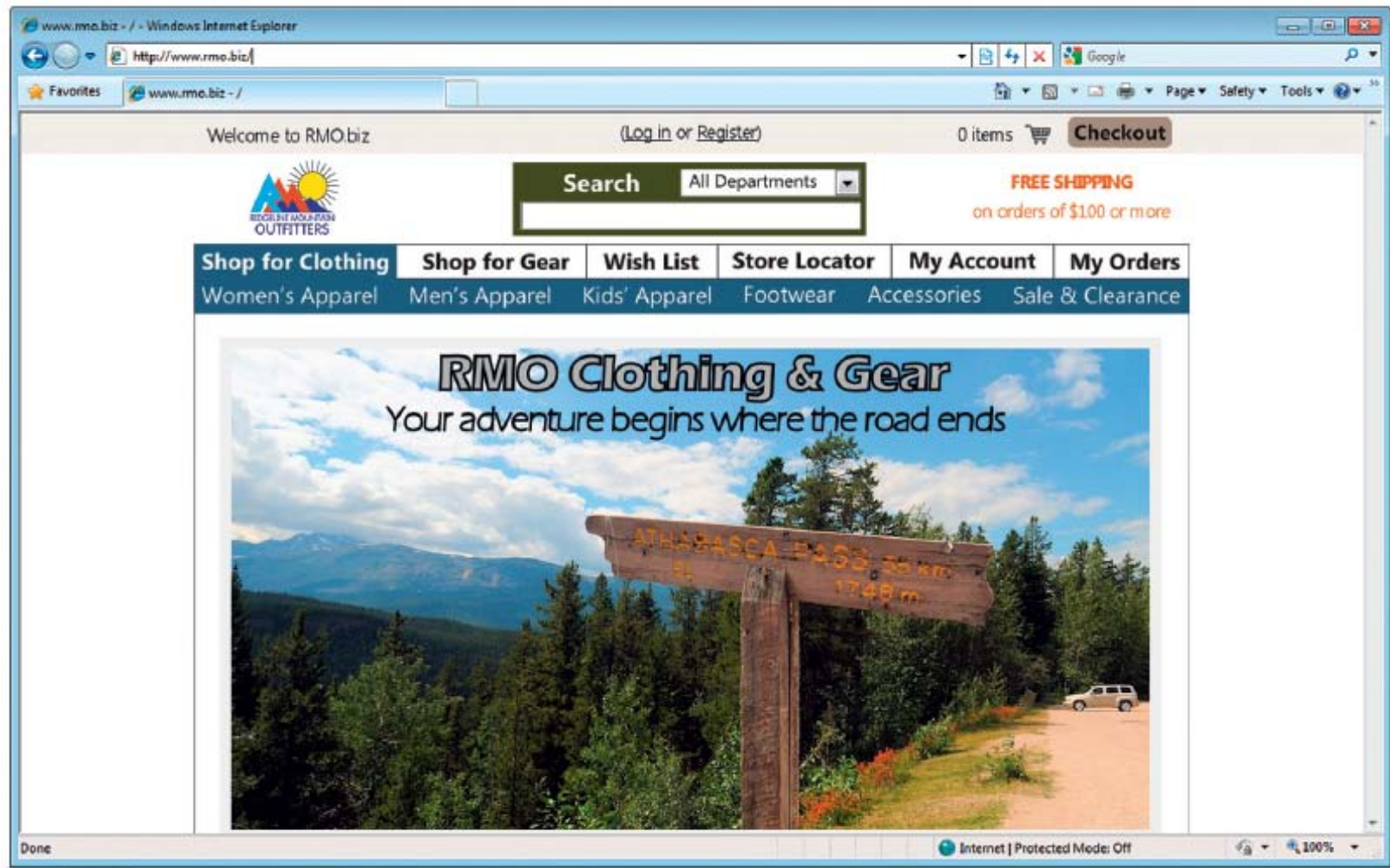
# Ridgeline Mountain Outfitters (RMO)

- Large Retail Company
  - outdoor and sporting clothing and accessories
  - Skiing, mountain biking, water sports
  - Hiking, camping, mountain climbing
- Rocky Mountain and Western States
  - Started mail order and phone order
  - Added retail stores
  - Added extensive E-business component

# Ridgeline Mountain Outfitters (RMO)



# Ridgeline Mountain Outfitters (RMO)



The image shows a screenshot of the website www.rmo.biz in a Windows Internet Explorer browser. The browser's address bar shows the URL http://www.rmo.biz/. The website's header includes a welcome message "Welcome to RMO.biz", a login/register link "(Log In or Register)", and a shopping cart icon showing "0 items" and a "Checkout" button. The RMO logo, featuring a stylized mountain and sun, is on the left. A search bar with a dropdown menu set to "All Departments" is in the center. To the right, a "FREE SHIPPING" banner states "on orders of \$100 or more". Below the search bar is a navigation menu with links for "Shop for Clothing", "Shop for Gear", "Wish List", "Store Locator", "My Account", and "My Orders". Underneath these are sub-links: "Women's Apparel", "Men's Apparel", "Kids' Apparel", "Footwear", "Accessories", and "Sale & Clearance". The main content area features a large banner image of a mountain landscape with a wooden signpost that reads "ATHABASCA BASE CAMP 1748 m". The banner text says "RMO Clothing & Gear" and "Your adventure begins where the road ends". The browser's status bar at the bottom shows "Done" and "Internet | Protected Mode: Off".

# RMO Tradeshow System

- Sample project
- 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 tradeshow
- **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



### 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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# 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

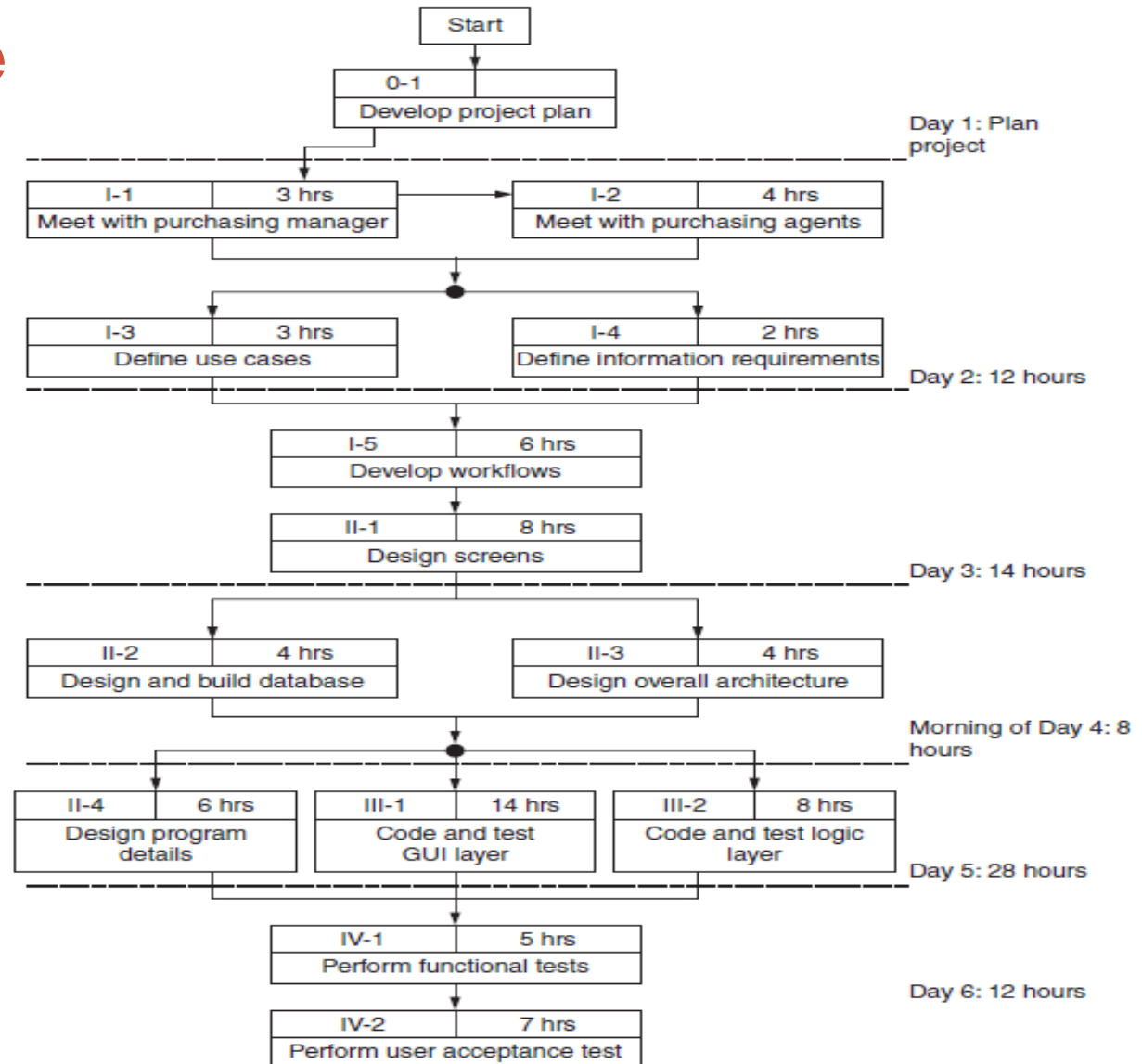
Based on the  
next four core  
processes in  
SDLC

## 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



## 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

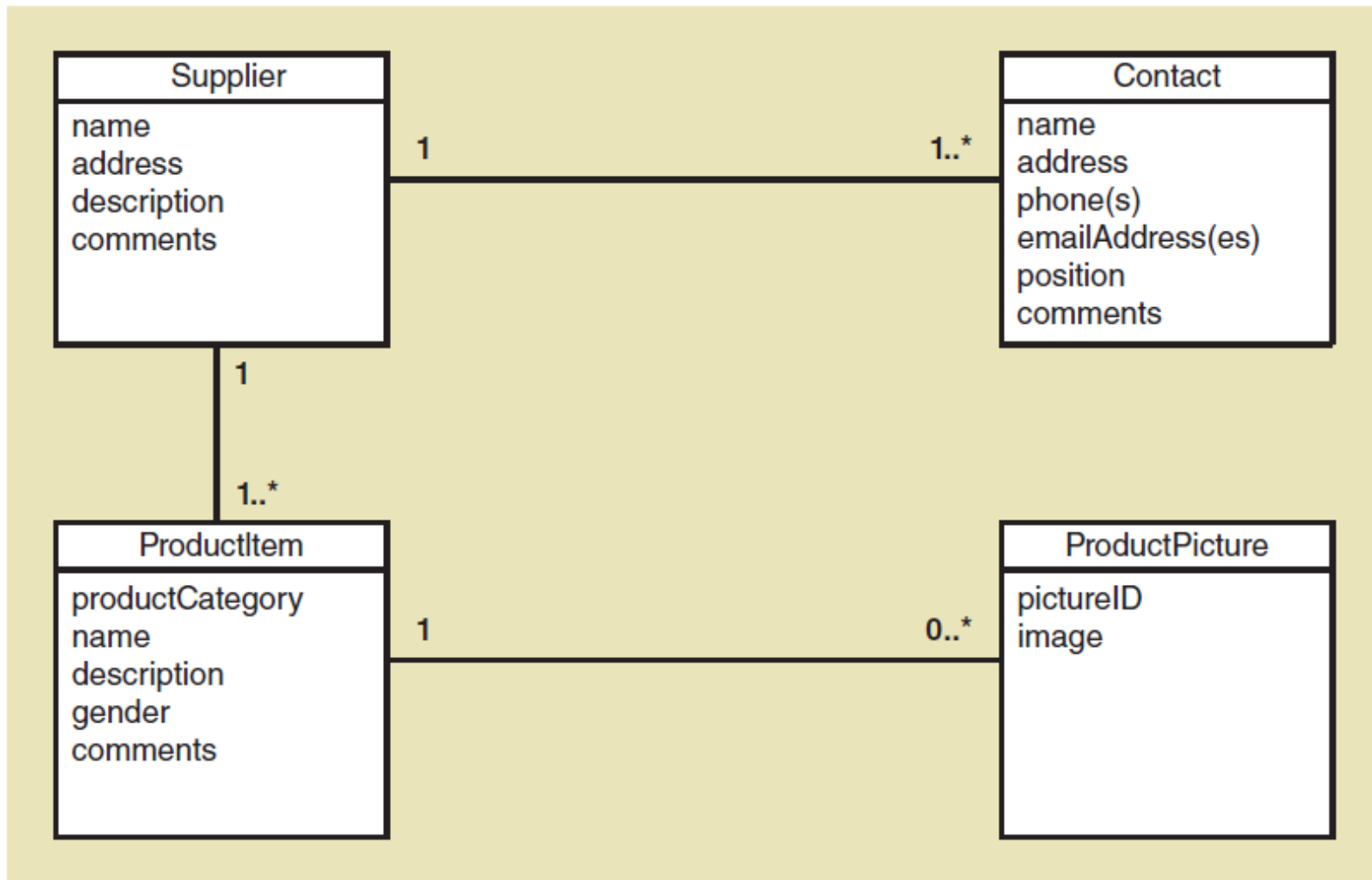
# Identify Object Classes

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

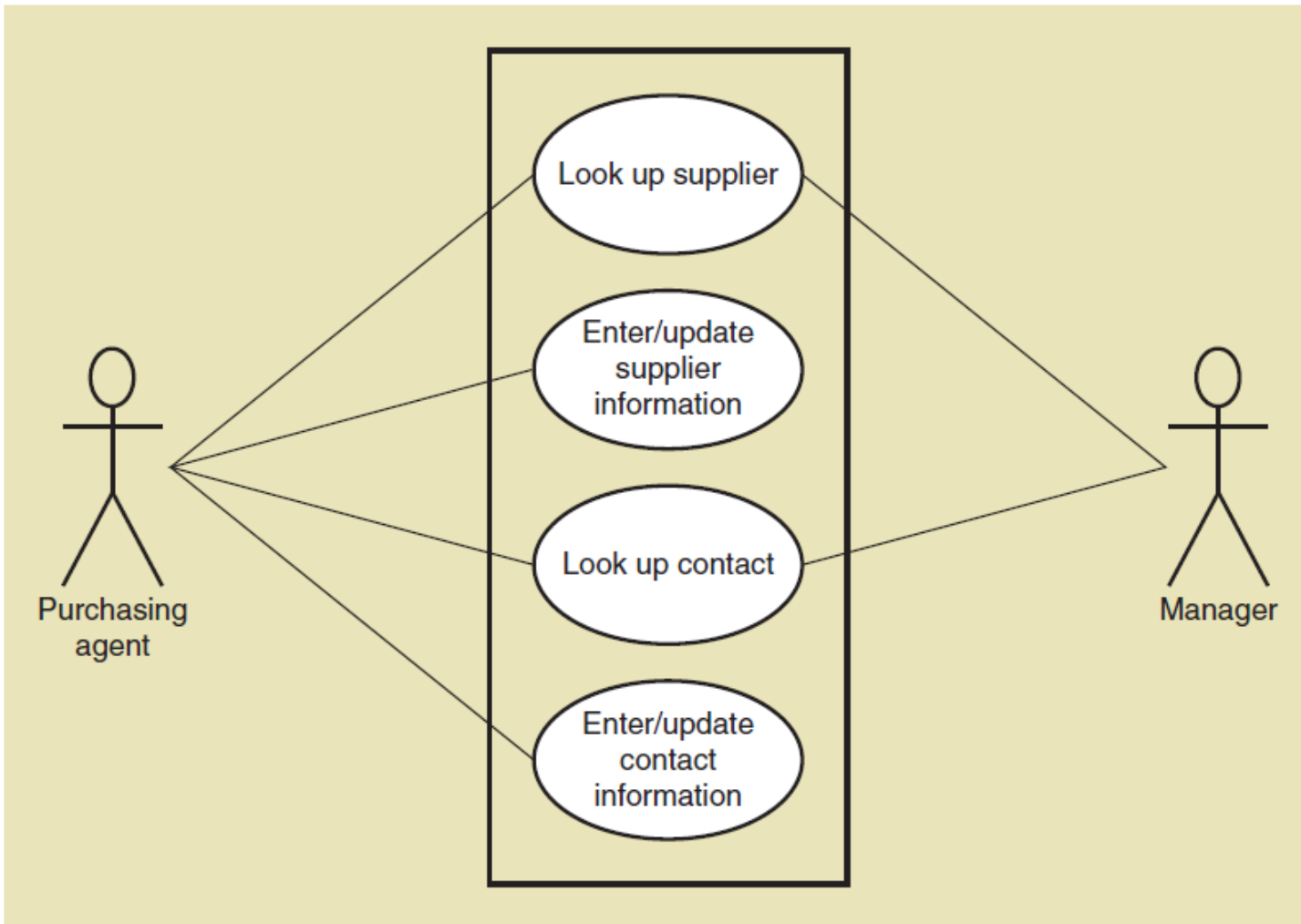
- Core Process 3: Discover and Understand Details
  - Do in-depth fact-finding to understand requirements
  - Understand and document the detailed workflow of each use case
- Core Process 4: Design System Components
  - Define the user experience with screens and reports

# Details Focus on Supplier Information Subsystem

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

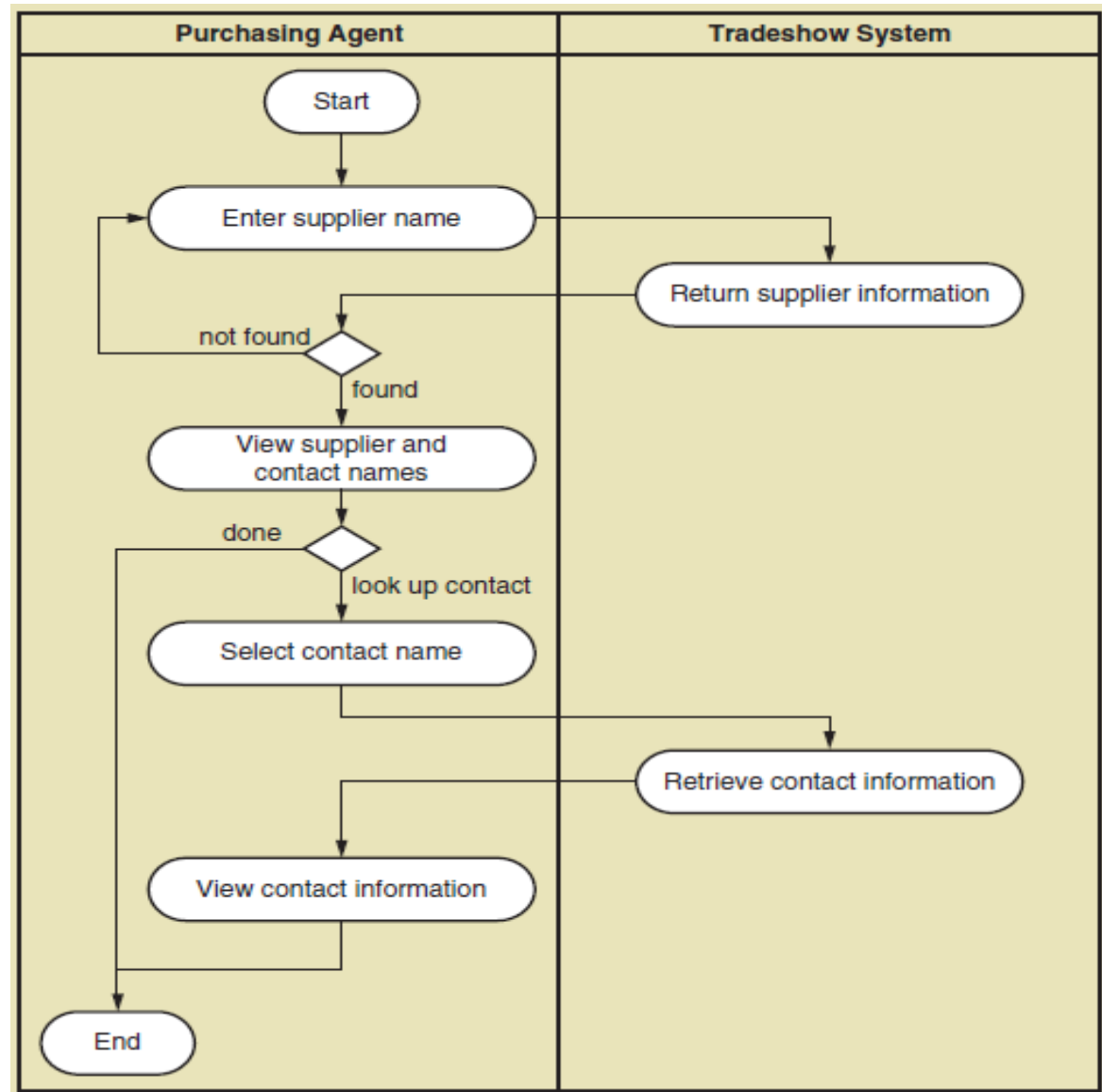
# Use Case Diagram

## Supplier information subsystem



# Activity Diagram (Workflow)

Look up supplier  
use case







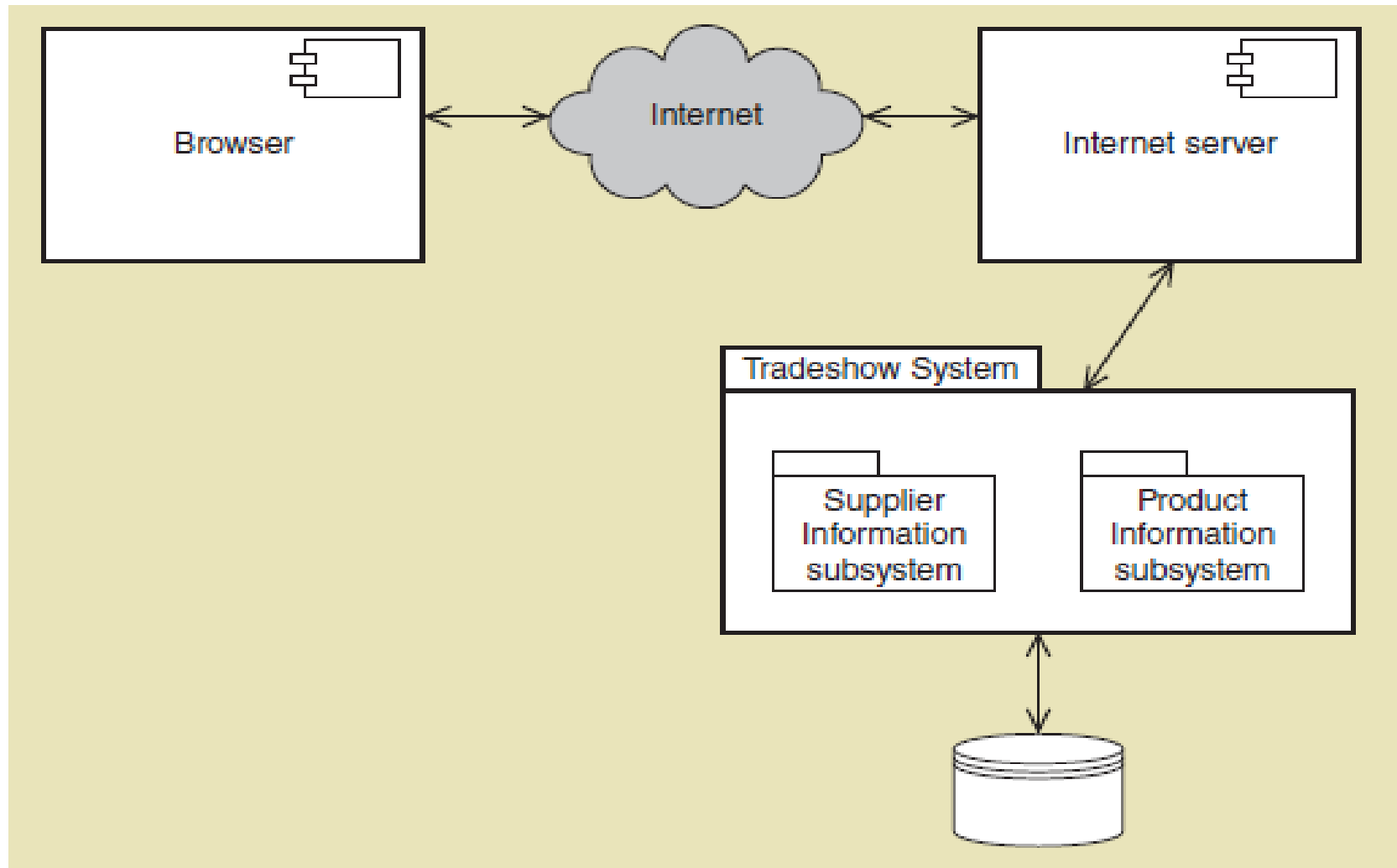
# Day 4 Activities

- 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

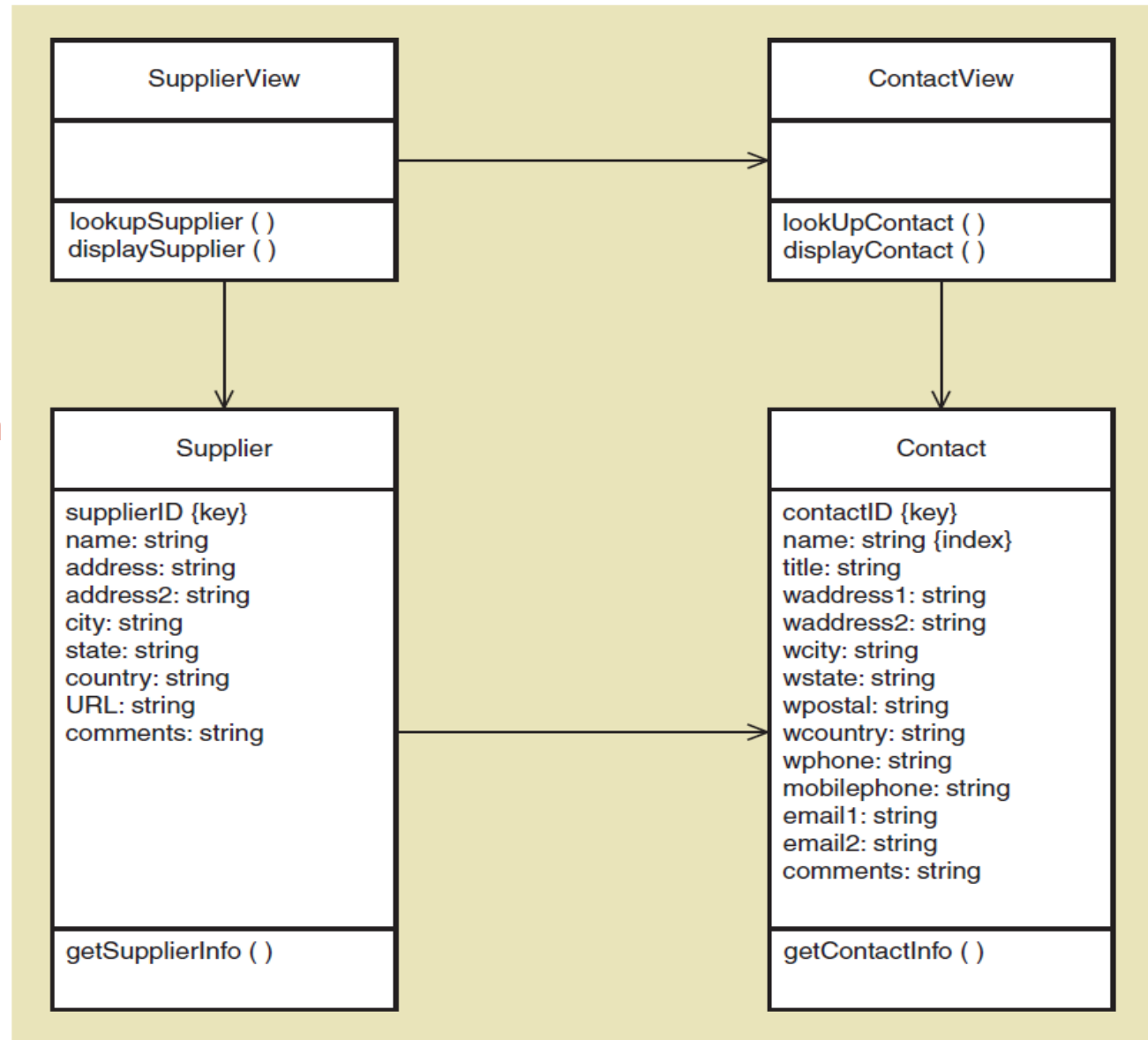
# Architectural Configuration Diagram



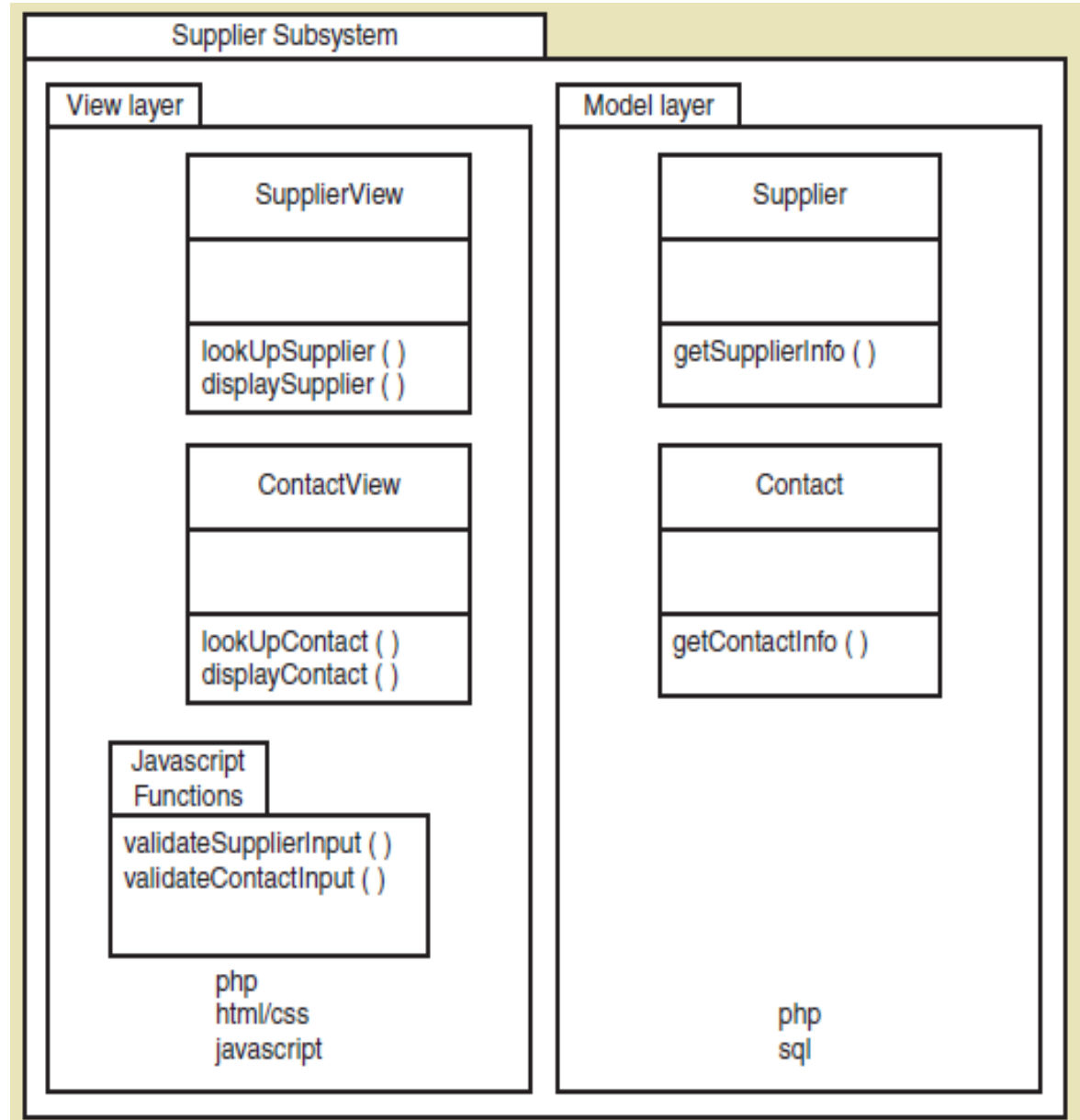
# Preliminary Design Class Diagram

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();
    }

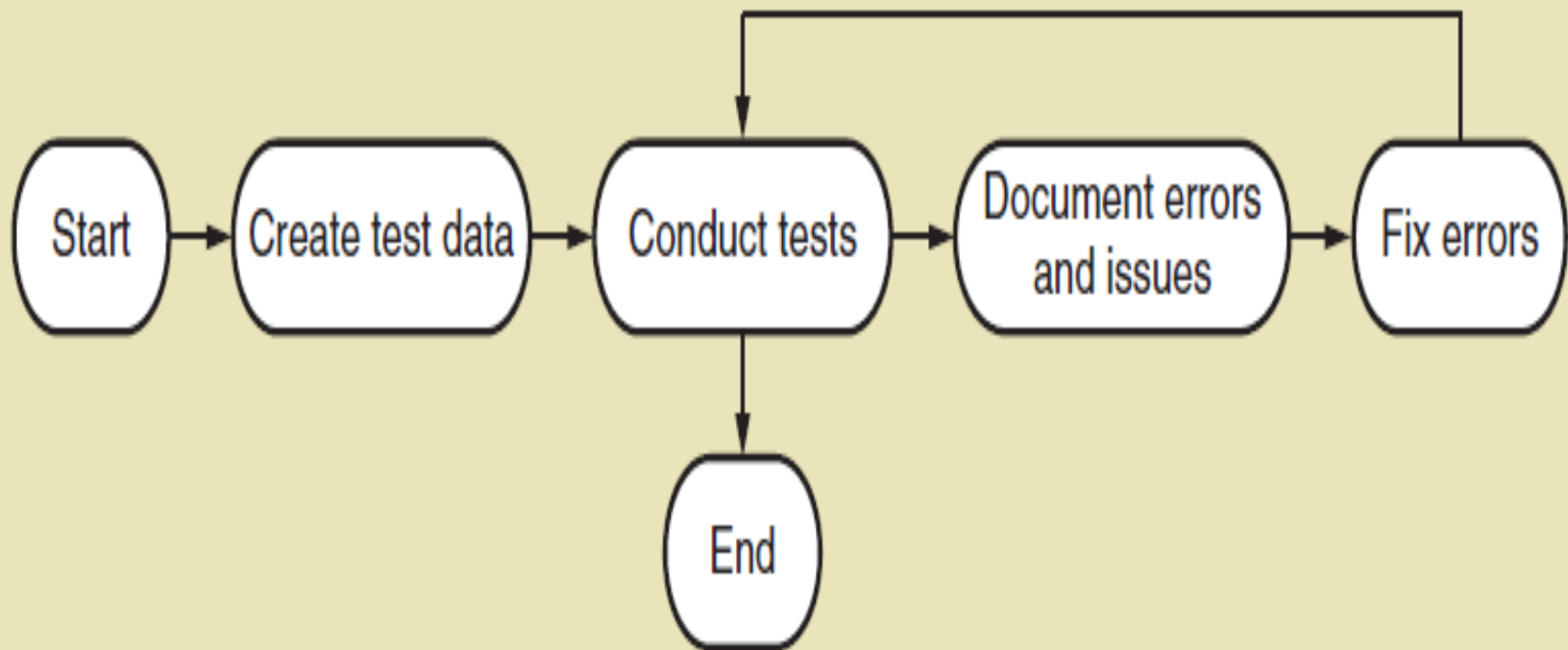
    function lookupSupplier()
    {
        include('lookupSupplier.inc.html');
    }

    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



RIDGELINE MOUNTAIN  
OUTFITTERS

Web Search

RMO Database Search

Supplier Name

Product Category

Product

Country

Contact Name

Search Results

Supplier Name	Contact Name	Contact Position

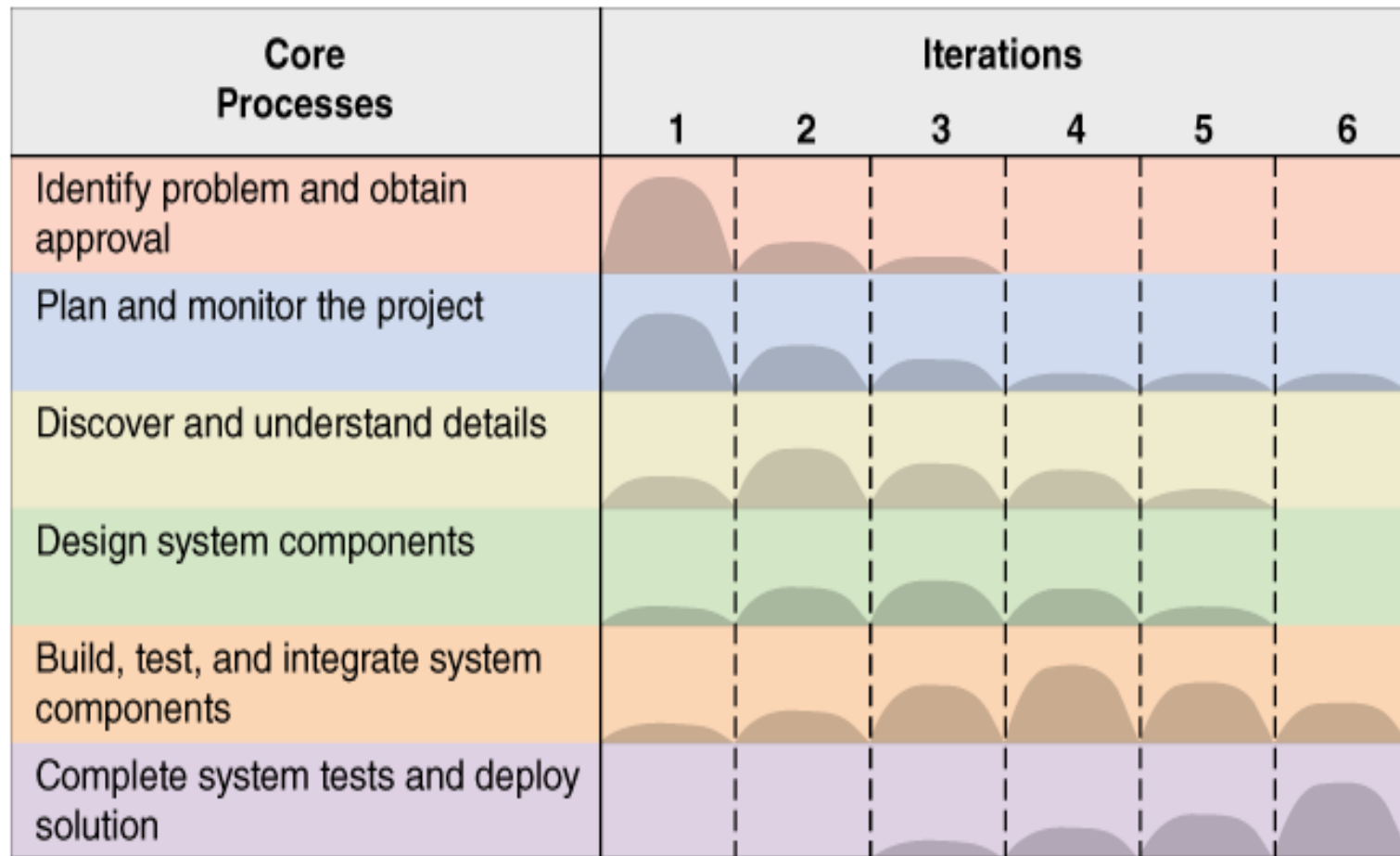
# Day 6 Activities

- 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)

# It is about Activities and Tasks in the SDLC



# Summary

- Developing information systems that solve an organization need
- The whole process for one small information system
- System development involves 6 core processes, known as the SDLC
- The basic processes shown in systems analysis

# Summary

- Important terminologies 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



# The Role of a System Analyst

- The Analyst as a Business Problem Solver
- Systems That Solve Business Problems
- Required Skills of the Systems Analyst
- Analysis-Related Careers

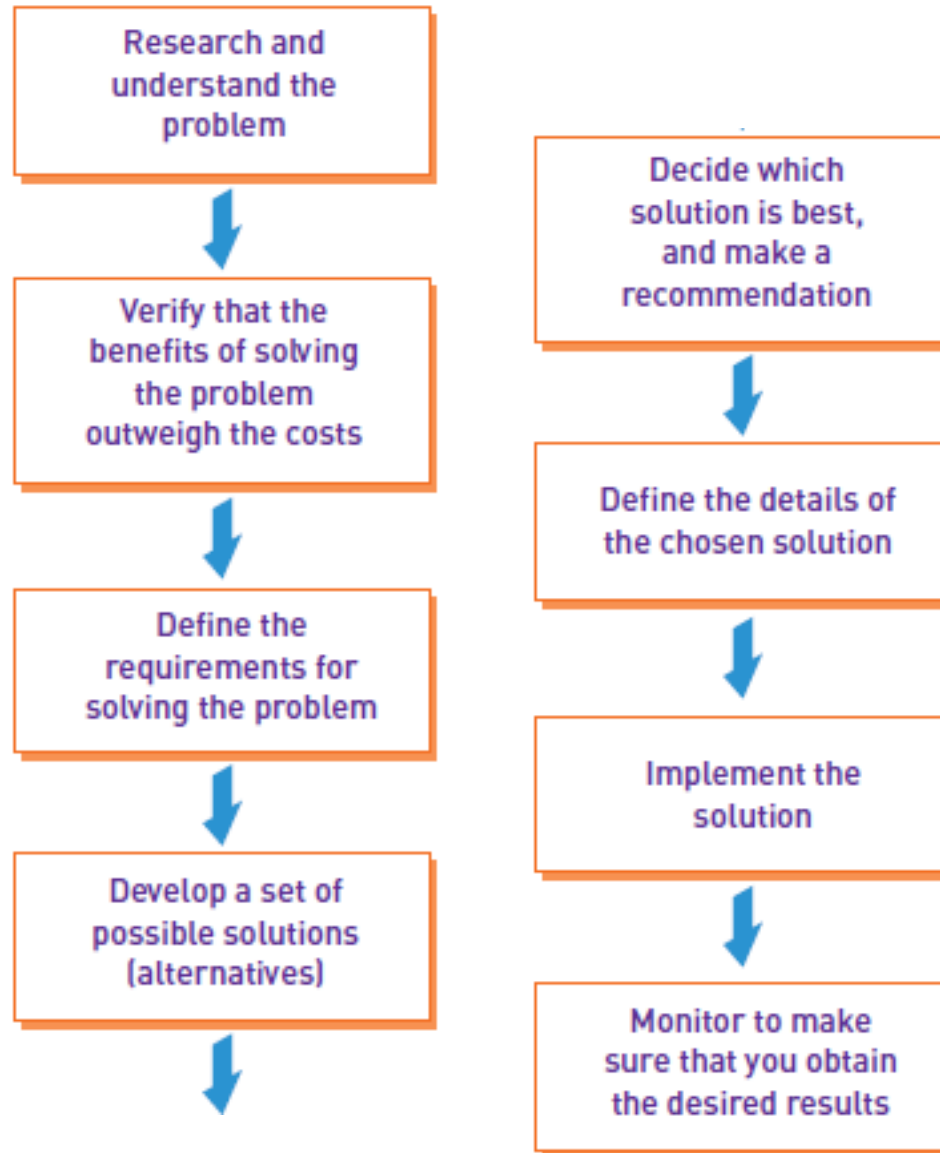
# Problems to be Solved

- How to process customer orders around the clock without adding to the selling cost?
  - Customers want to order products any time of the day or night.
- How some parameters affect production and allow planners to explore different scenarios before committing to a specific plan?
  - Production needs to plan very carefully the amount of each type of product to produce each week.
- How to order in smaller lots and accept daily shipments to take advantage of supplier discounts?
  - Suppliers want to minimize their inventory holding costs by shipping parts used in the manufacturing process in smaller daily batches.

## Problems to be Solved (continued)

- How to collect and analyse information on customer behaviour that marketing can put to use
  - Marketing wants to better anticipate customer needs by tracking purchasing patterns and buyer trends.
- How to collect, analyse, and present all the financial information management wants
  - Management continually wants to know the current financial picture of the company, including profit and loss, cash flow, and stock market forecasts.
- How to process transactions for flexible health plans, wellness programs, employee investment options, retirement accounts, and other benefit programs offered to employees?
  - Employees demand more flexibility in their benefits programs, and management wants to build loyalty and morale.

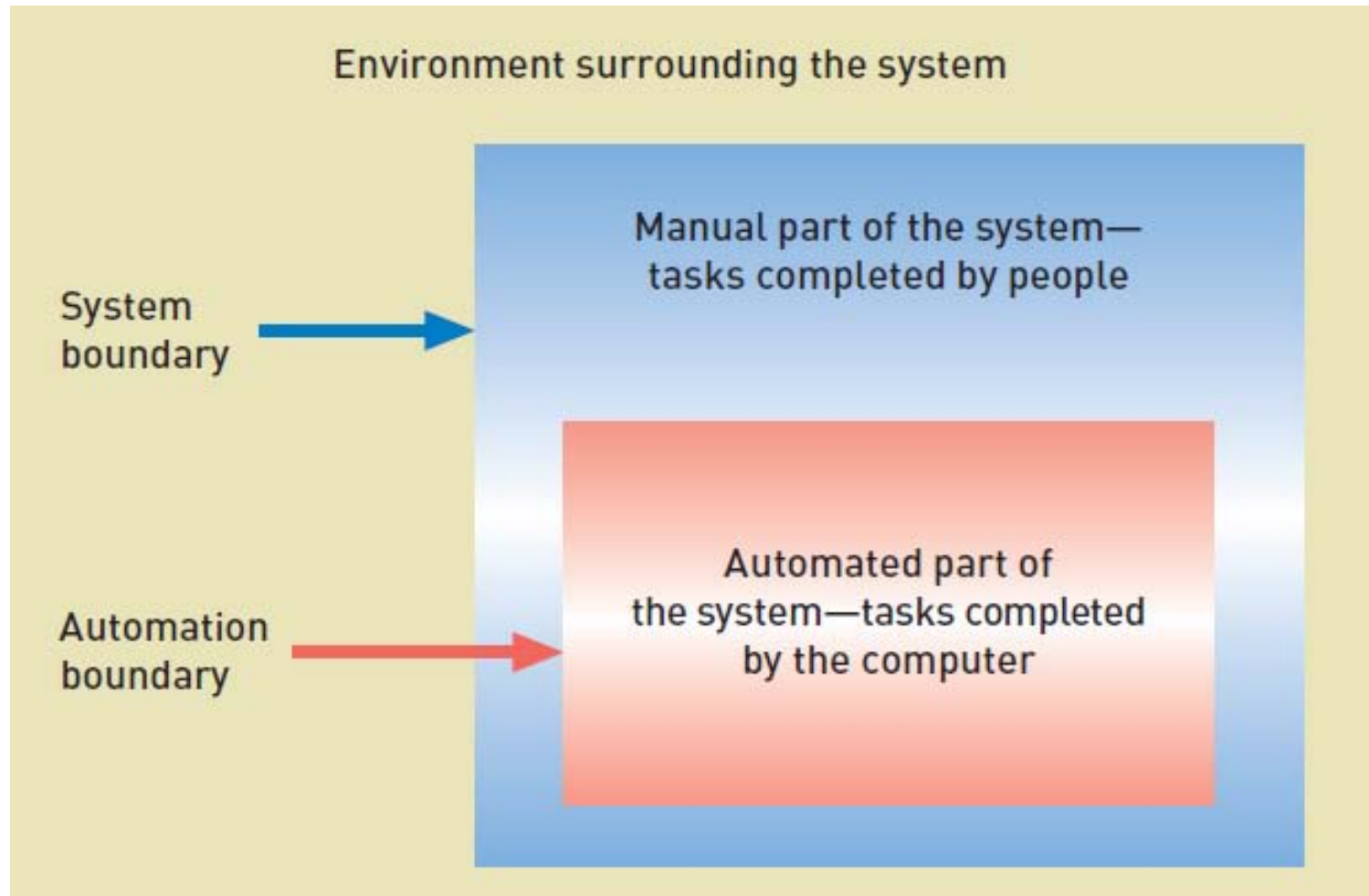
# Analyst's Approach to Problem Solving



# Systems Concepts

- **System** – a collection of interrelated components that function together to achieve some outcome
- **Information system** – a collection of interrelated components that collect, process, store, and provide as output the information needed to complete business tasks
- **Subsystem** – a system that is part of a larger system
- **Functional decomposition** – dividing a system into components based on subsystems that are further divided into smaller subsystems
- **System boundary** – the separation between a system and its environment that inputs and outputs must cross
- **Automation boundary** – the separation between the automated part of a system and the manual part of a system

# Systems Concepts



# Types of Information Systems

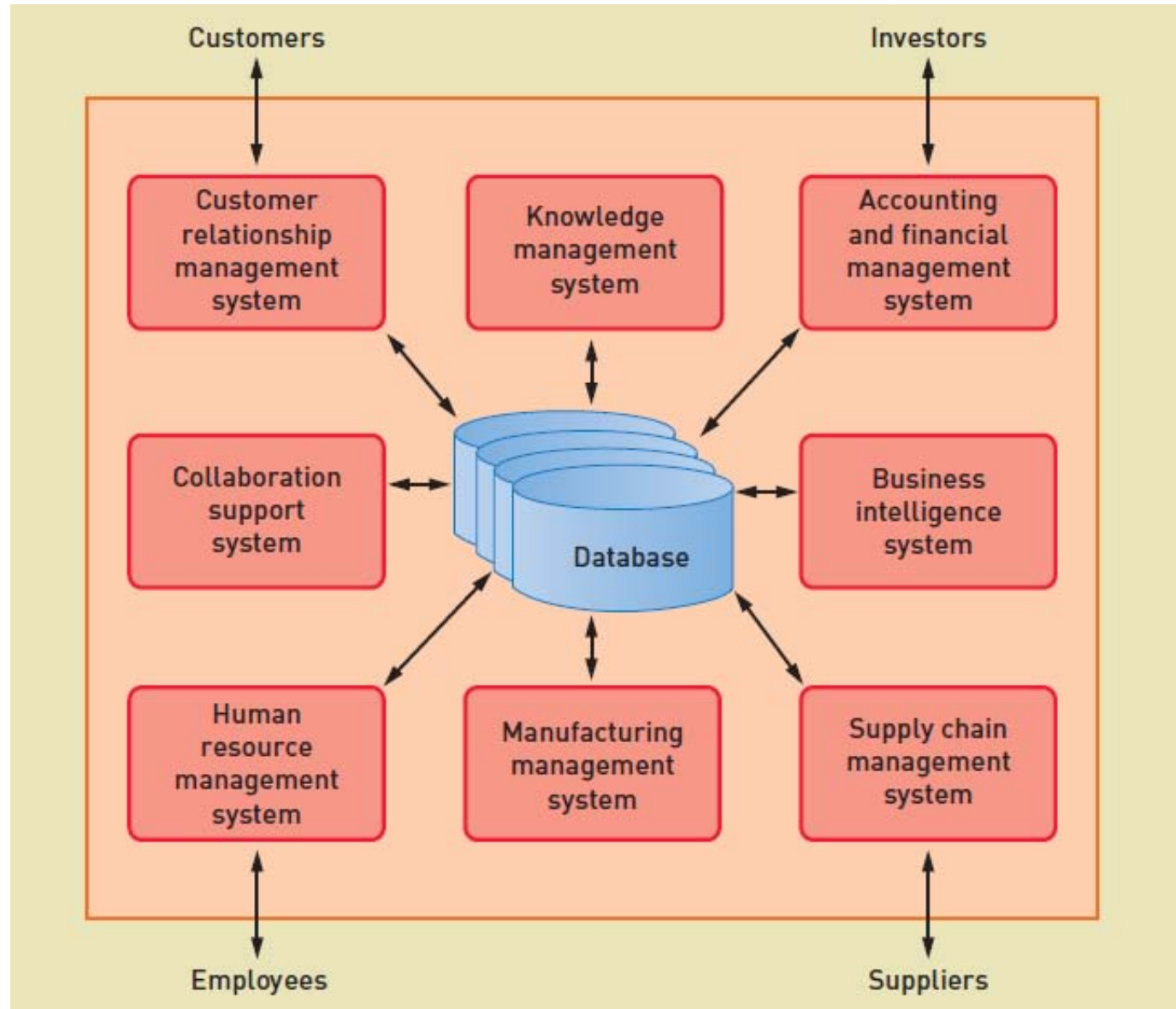
- **Customer relationship management (CRM) system** – a system that supports marketing, sales, and service operations involving direct and indirect customer interaction
- **Supply chain management (SCM) system** – a system that seamlessly integrates product development, product acquisition, manufacturing, and inventory management
- **Accounting and financial management (AFM) system** – a system that records accounting information needed to produce financial statements and other reports used by investors and creditors
- **Human resource management (HRM) system** – a system that supports such employee-related tasks as payroll, benefits, hiring, and training

# Types of Information Systems

- **Manufacturing management system** – a system that controls internal production processes that turn raw materials into finished goods
- **Knowledge management system (KMS)** – a system that supports the storage of and access to documents from all parts of the organization
- **Collaboration support system (CSS)** – a system that enables geographically distributed personnel to collaborate on projects and tasks
- **Business intelligence system** – a system that supports strategic planning and executive decision making
- **Enterprise resource planning (ERP)** – a process in which an organization commits to using an integrated set of software packages for key information systems



# Types of Information Systems

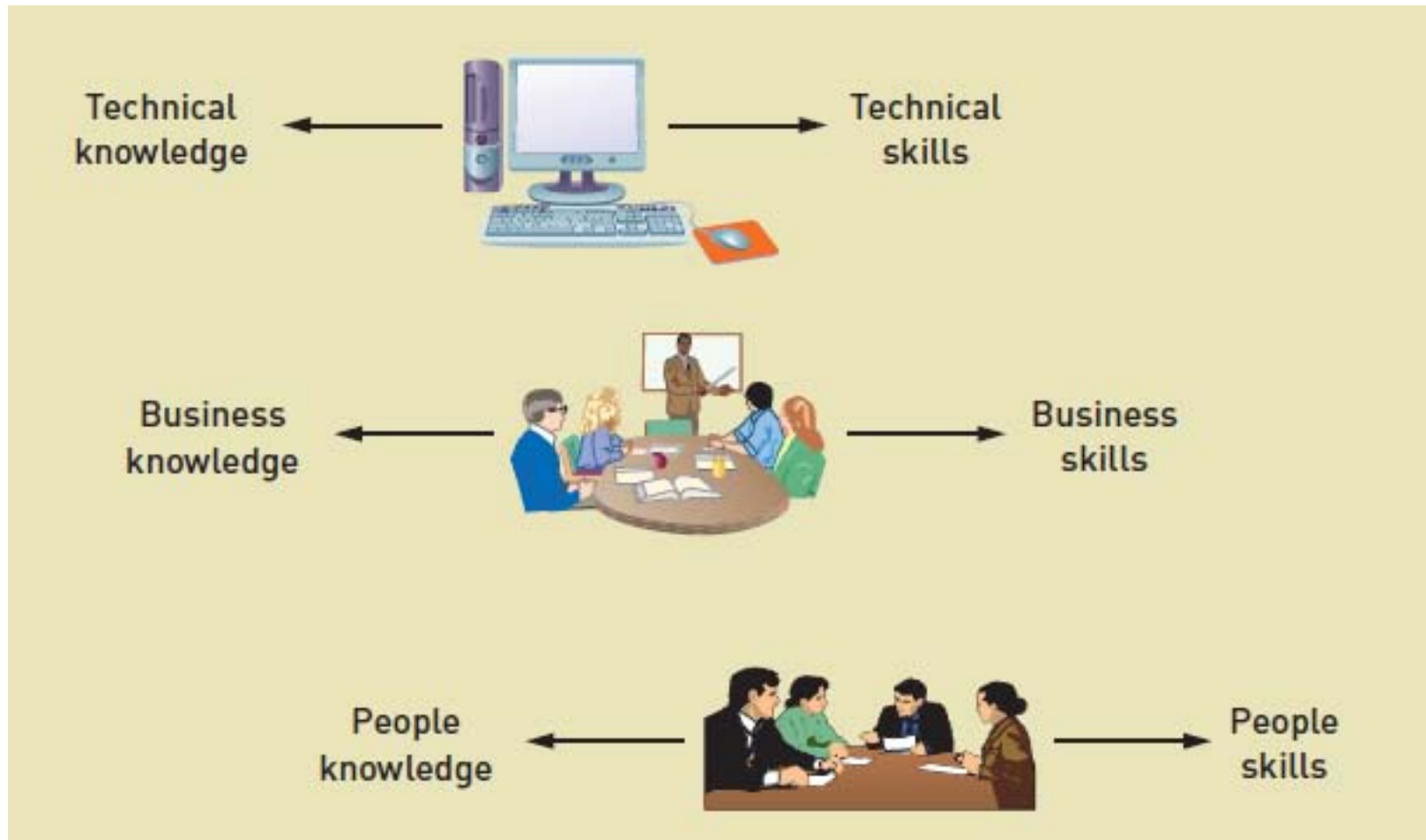


# Components of Information Systems



# Knowledge and Skills

## Required of a systems analyst



# Knowledge and Skills

## Tools and techniques

- **Tools** – a software application that assists developers in creating models or other components required for a project
- **Techniques** – strategies for completing specific system development activities
  - Project planning techniques
  - Cost/benefit analysis techniques
  - Interviewing techniques
  - Requirements modeling techniques
  - Architectural design techniques
  - Network configuration techniques
  - Database design techniques

# Technical Knowledge and Skills

- Computers and how they work
- File, database, and storage hardware and software
- Input and output hardware and software
- Computer networks and protocols
- Programming languages, operating systems, and utilities
- Communication and collaboration technology such as digital telephones, videoconferencing, and Web-based document management systems

# Business Knowledge and Skills

- What business functions do organizations perform?
- How are organizations structured?
- How are organizations managed?
- What type of work goes on in organizations (finance, manufacturing, marketing, customer service, etc)?
- What the specific organization does
- What makes it successful
- What its strategies and plans are
- What its traditions and values are

# People Knowledge and Skills

- **Interpersonal skills** are perhaps the analyst's most important skills because analysts rely on others, including managers, users, programmers, technical specialists, customers, and vendors, to take a system from initial idea to final implementation
- The analyst must **develop rapport** with users who may be resistant to change, negotiate with management for such resources as budget, time, and personnel, and manage development personnel with many different skills, capabilities, and attitudes
- The analyst must be **an effective teacher, mentor, confidant, collaborator, manager, and leader**, shifting easily among those roles many times over the course of a typical work day

# Analysis Related Careers

- Employment in the fields of information systems and computer technology spans a wide variety of skills, organizations, and roles
- In-house development, including analysis and design, is especially common in security-sensitive industries, national defense, and research and development in national laboratories
- Many software development jobs have shifted to companies that produce and sell ERP and package software
- Changes in software development, technology, and business practices have created many new career opportunities for analysts, including sales and support of ERP software; business analysts for user organizations; auditing, compliance, and security; and Web development



# A Variety of Job Titles

- Programmer analyst
- Business systems analyst
- System liaison
- End-user analyst
- Business consultant
- Systems consultant
- Systems support analyst
- Systems designer
- Software engineer
- System architect
- Web architect
- Webmaster
- Web developer

# Summary

- A system's analyst is someone who solves business problems by using information systems technology
- Problem solving means looking into the problem in great detail, understanding everything about the problem, generating several alternatives for solving the problem, and then picking the best solution.
- Information systems are usually part of the solution, and information systems development is much more than writing programs
- A system is a collection of interrelated components that function together to achieve some outcome

# Summary (continued)

- Information systems components can be thought of as subsystems that interact or as hardware, software, inputs, outputs, data, people, and procedures
- Many different types of systems solve organizational problems, including customer relationship management systems, supply chain management systems, human resource management systems, manufacturing management systems, accounting and financial management systems
- A systems analyst needs broad knowledge and a variety of skills, including technical, business, and people knowledge and skills

## Summary (continued)

- Systems analysis and design work is done by people with a variety of job titles—not only ‘systems analyst’ but programmer analyst, systems consultant, systems engineer, and Web developer, among others
- Analysts also work for consulting firms, as independent contractors, and for companies that produce software packages