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COMP6115
Object Oriented Analysis and Design

Session #3

Requirements Determination

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Learning Outcomes

LO1: Identify the basic concept of advance topic in Object Oriented Analysis and Design

LO2 : Use the knowledge to develop documentation for object oriented software analysis and design using Unified Modelling Language

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Chapter 3: Requirements Determination

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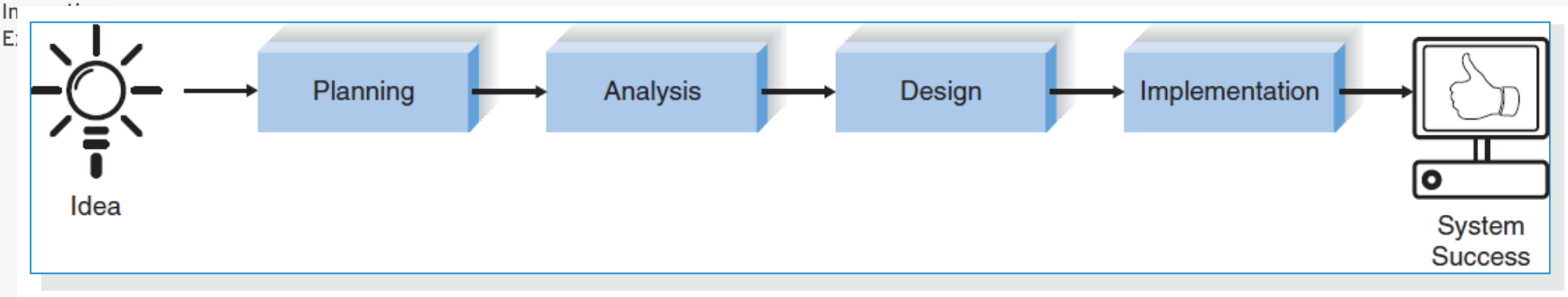
Learning Objectives

- Learn how to create a requirements definition
- Learn various requirements analysis techniques
- Learn when to use each requirements analysis techniques
- Learn how to gather requirements using interviews, JAD sessions, questionnaires, document analysis & observation
- Learn various requirements documentation techniques such as concept maps, story cards & task-lists
- Understand when to use each requirements-gathering technique
- Be able to begin the creation of a system proposal

Introduction

- The systems development process transforms the existing (as is) system into the proposed (to be) system
- Requirements determination
  - **The single most critical step of the entire SDLC**
  - Changes can be made easily in this stage
  - **Most (>50%) system failures are due to problems with requirements**
  - The iterative process of OOSAD is effective because:
    - Small batches of requirements can be identified and implemented **incrementally**
    - The system will evolve over time



The Systems Development Life Cycle

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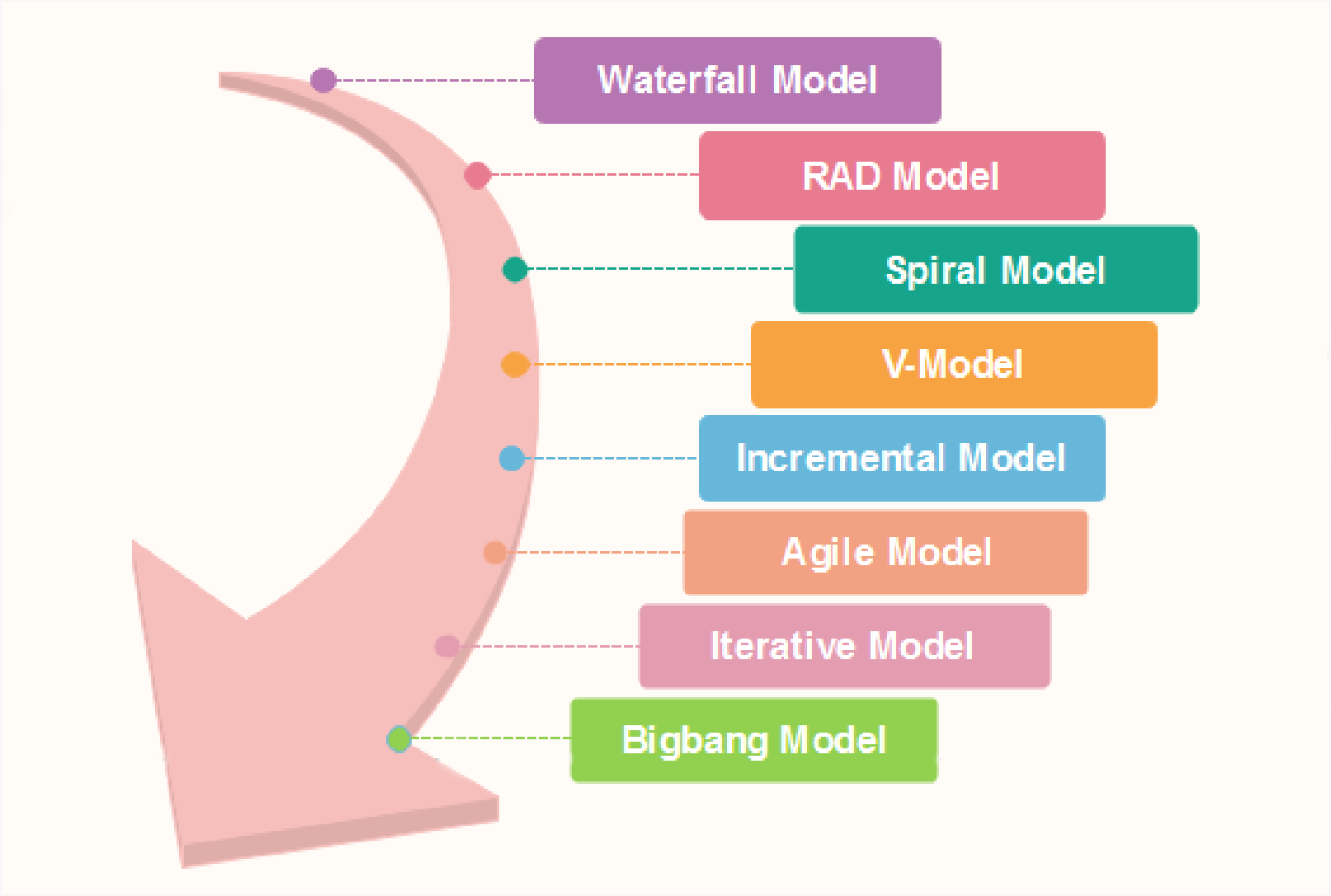
SDLC Models



Requirements Determination

- Purpose:
- to convert **high level business requirements** (from the system request) into **detailed requirements** that can be used as inputs for **creating UML models**

- What is a requirement?
  - **A statement of what the system must do or a characteristic it must have**
  - Will later evolve into a technical description of how the system will be implemented

- Types:
  - Functional: relates to a **process or data**
  - Non-functional: relates to **performance or usability**

Requirements Definition

- Functional & non-functional requirements listed in outline format
- May be **prioritized**
  - **Time**
  - **Business Value:**
    - **make money, save money, don't lose money**
  - **Complexity**
  - **Social Factors (Users)**
- **Provides information needed in subsequent workflows**
- **Defines the scope of the system**

Requirements:

- Req 1
- Req 2
- ~~Req 3~~
- Req 4

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Nonfunctional Requirements

1. **Operational Requirements**
   1.1. The system will operate in Windows environment.
   1.2. The system should be able to connect to printers wirelessly.
   1.3. The system should automatically back up at the end of each day.

2. **Performance Requirements**
   2.1. The system will store a new appointment in 2 seconds or less.
   2.2. The system will retrieve the daily appointment schedule in 2 seconds or less.

3. **Security Requirements**
   3.1. Only doctors can set their availability.
   3.2. Only a manager can produce a schedule.

4. **Cultural and Political Requirements**
   4.1. No special cultural and political requirements are anticipated.

Functional Requirements

1. **Manage Appointments**
   1.1. Patient makes new appointment.
   1.2. Patient changes appointment.
   1.3. Patient cancels appointment.

2. **Produce Schedule**
   2.1. Office Manager checks daily schedule.
   2.2. Office Manager prints daily schedule.

3. **Record Doctor Availability**
   3.1. Doctor updates schedule

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Determining Requirements

- Business & IT personnel need to collaborate
- Strategies for problem analysis:
  - **Root cause analysis**
  - **Duration analysis**
  - **Activity-based costing**
  - **Informal benchmarking**
  - Outcome analysis
  - Technology analysis
  - Activity elimination

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Determining Requirements

- Requirements are best determined by systems analysts ***and*** business people together
- Techniques for identifying requirements
  - Interviews, questionnaires and/or observation
  - Joint application development (JAD)
  - Document analysis

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Creating a Requirements Definition

- Determine the types of functional and non-functional requirements applicable to the project
- Use requirements-gathering techniques to collect details
- Analysts work with users to verify, change and prioritize each requirement
- Continue this process through analysis workflow, but be careful of scope creep
- Requirements that meet a need but are not within the current scope can be **added to a list of future enhancements**

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Problems in Requirements Determination

- Analyst may not have access to the correct users
- Requirement's specifications may be inadequate
- Some requirements may not be known in the beginning
- Verifying and validating requirements can be difficult

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Requirements Analysis Strategies

- **Problem analysis**
  - Ask users to identify problems with the current system
  - Ask users how they would solve these problems
  - Good for improving efficiency or ease-of-use

- **Root cause analysis**
  - Focus is on the cause of a problem, not its solution
  - Create a prioritized list of problems
  - Try to determine their causes
  - Once the causes are known, solutions can be developed

Requirements Analysis Strategies(Cont.)

- **Duration analysis**
  - Determine the time required to complete each step in a business process
  - Compare this to the total time required for the entire process
  - Large differences suggest problems that might be solved by:
    - Integrating some steps together
    - Performing some steps simultaneously (in parallel)

- **Activity-based costing**
  - Same as duration analysis but applied to costs

- **Informal benchmarking**
  - Analyzes similar processes in other successful organizations

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Requirements Analysis Strategies(Cont.)

- Outcome analysis
  - What does the customer ~~want~~ **need** in the end?
  - ***BUILD ME A MACHINE LEARNING MODEL TO MONITOR THE NEW PRODUCT CAMPAIGNS THAT WE HAVE!***
    - ***SENTIMENT ANALYSIS → POSITVE AND NEGATIVE***
  - ***BUILD ME A WEBSITE THAT INTEGRATE WITH SOCIAL MEDIA!***
    - ***WHAT FOR?***
- **Technology analysis**
  - Apply new technologies to business processes & identify benefits
  - CLOUD SYSTEM/TECHNOLOGIES: **Google** Drive, OneDrive (**Azure**), Amazon Cloud (**AWS**), **Alibaba** Cloud, etc.
  - Budget (same price), Performance, **Relationship with other software**
- **Activity elimination**
  - Eliminate each activity in a business process in a “force-fit” exercise

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Requirements Gathering Techniques

- Process is used to:
  - **Uncover all requirements**
    (those uncovered late in the process are more difficult to incorporate)
  - Build support and trust among users

- **Which technique(s) to use?**
  - **Interviews → Qualitative**
  - **Questionnaires → Quantitative**
  - **Joint Application Development (JAD)**
  - **Document analysis**
  - **Observation**

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Interviews

- Most popular technique—if you need to know something, just ask
- Process:
  1. Select people to **interview** & create a schedule
  2. Design interview questions (Open-ended, closed-ended, & probing types of questions)
  3. Prepare for the interview (Unstructured vs. structured interview organized in a logical order)
  4. Conduct the interview (Top-down vs. bottom-up)
  5. Follow-up after the interview

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Question Types

Types of Questions	Examples
Closed-ended questions	• How many telephone orders are received per day? • How do customers place orders? • What information is missing from the monthly sales report?
Open-ended questions	• What do you think about the current system? • What are some of the problems you face on a daily basis? • What are some of the improvements you would like to see in a new system?
Probing questions	• Why? • Can you give me an example? • Can you explain that in a bit more detail?

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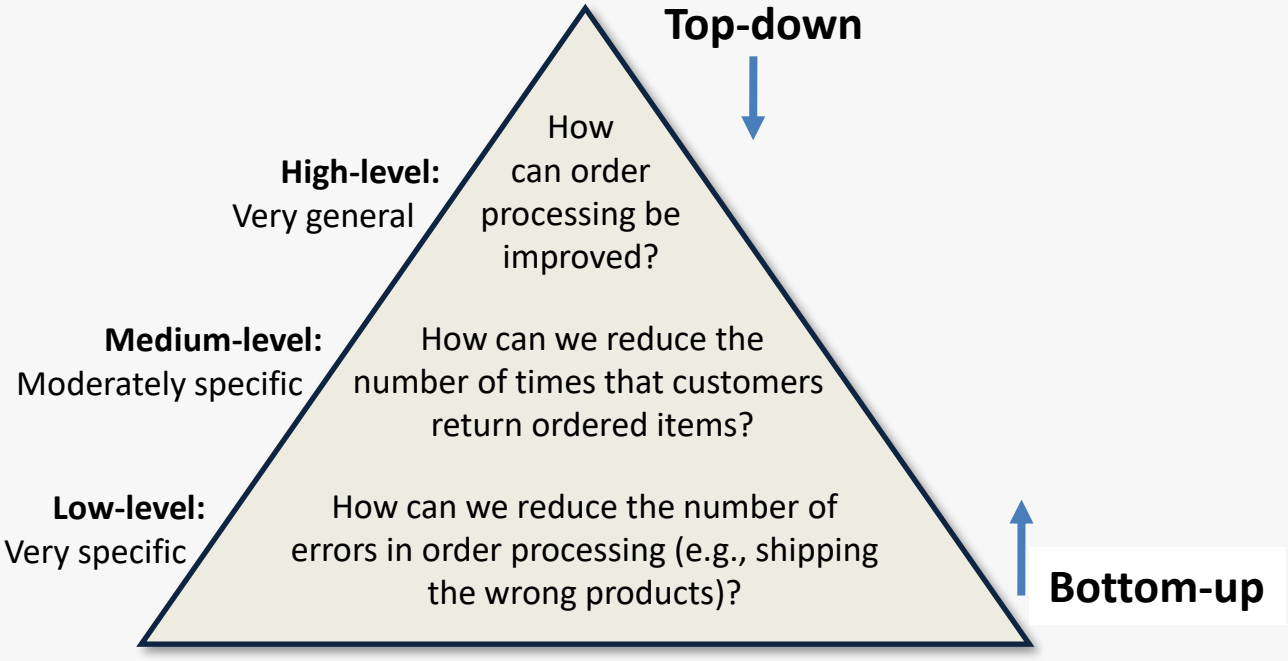
Interviewing Strategies



Post-Interview

- Prepare notes and send to the interviewee for verification

Interview Notes Approved by: Linda Estey

Person Interviewed: Linda Estey,
Director, Human Resources

Interviewer: Barbara Wixom

Purpose of Interview:

- Understand reports produced for Human Resources by the current system
- Determine information requirements for future system

Summary of Interview:

- Sample reports of all current HR reports are attached to this report. The information that is not used and missing information are noted on the reports.
- Two biggest problems with the current system are:
  1. The data are too old (the HR Department needs information within two days of month end; currently information is provided to them after a three-week delay)
  2. The data are of poor quality (often reports must be reconciled with departmental HR database)
- The most common data errors found in the current system include incorrect job level information and missing salary information.

Open Items:

- Get current employee roster report from Mary Skudrna (extension 4355).
- Verify calculations used to determine vacation time with Mary Skudrna.
- Schedule interview with Jim Wack (extension 2337) regarding the reasons for data quality problems.

Detailed Notes: See attached transcript.

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Joint Application Development (JAD)

- **Joint user-analyst meeting hosted by a facilitator**
  - 10 to 20 users
  - 1 to 2 scribes as needed to record the session
  - Usually in a specially prepared room
- Meetings can be held electronically and anonymously
  - Reduces problems in group settings
  - Can be held remotely
- Sessions require careful planning to be successful
  - **Users may need to bring documents or user manuals**
  - **Ground rules should be established**

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Questionnaires

- A set of written questions used to obtain information from individuals
- May be paper based or electronic (e.g., web based)
- Common uses:
  - Large numbers of people
  - Need both information and opinions
  - When designing for use outside the organization (customers, vendors, etc.)
- Typical response rates:
  - < 50% (paper); < 30% (Web)
  - How to increase? Give incentive!

Questionnaire Steps

- Select the participants
  - Identify the population
  - Use representative samples for large populations
- Designing the questionnaire
  - Careful question selection
  - Remove ambiguities
- Administering the questionnaire
  - Working to get good response rate
  - Offer an incentive (e.g., a free pen)
- Questionnaire follow-up
  - Send results to participants
  - Send a thank-you

Good Questionnaire Design

- Begin with non-threatening and interesting questions
- Group items into logically coherent sections
- No important items at the very end
- Do not crowd a page with too many items
- Avoid abbreviations
- Avoid biased or suggestive items or terms
- Number questions to avoid confusion
- Pretest to identify confusing questions
- Provide anonymity to respondents

Document Analysis

- Provides information about the “as-is” system
- Review technical documents when available
- Review typical user documents:
  - Forms
  - Reports
  - Policy manuals
- Look for user additions to forms
- Look for unused form elements

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Observation

- Users/managers often don't remember everything they do
- Checks validity of information gathered in other ways
- **Behaviors may change when people are watched**
  - **Workers tend to be very careful when watched**
  - **Keep a low profile**
  - **Try not to interrupt or influence workers**
- Be careful not to ignore periodic activities
  - Weekly … Monthly … Annually

Requirements-Gathering Techniques Compared

- A combination of techniques may be used
- Document analysis & observation require little training; JAD sessions can be very challenging

	Interviews	Joint Application Design	Questionnaires	Document Analysis	Observation
Type of information	As-is, improvements, to-be	As-is, improvements, to-be	As-is, improvements	As-is	As-is
Depth of information	High	High	Medium	Low	Low
Breadth of information	Low	Medium	High	High	Low
Integration of information	Low	High	Low	Low	Low
User involvement	Medium	High	Low	Low	Low
Cost	Medium	Low–Medium	Low	Low	Low to Medium

Alternative Techniques

- Concept Maps
  - Represent meaningful relationships between concepts
  - Focus individuals on a small number of key ideas

- User Stories, Story Cards & Task Lists
  - Associated with agile development methods
  - Very low tech, high touch, easily updatable, and very portable
  - Captured using story cards (index cards)
  - Capture both functional and nonfunctional requirements.

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Story Cards & Task Lists

- Capture requirement using story cards (index cards)
- File card with single requirement
- Each requirement (card) is discussed
  - How much effort is required to implement it
  - A task list is created for each requirement (story)
  - Large requirements can be split into smaller sections
  - The story can be prioritized by risk level and importance

The System Proposal

- Combines all material created in planning & analysis
- Included sections:
  - Executive summary
    - Provides all critical information is summary form
    - Helps busy executives determine which sections they need to read in more detail
  - The system request
  - The workplan
  - The feasibility analysis
  - The requirements definition
  - Current models of the system (expected to evolve)

System Proposal Template

1. **Table of Contents**
2. **Executive Summary**

   A summary of all the essential information in the proposal so a busy executive can read it quickly and decide what parts of the proposal to read in more depth.
3. **System Request**

   The revised system request form (see Chapter 2).
4. **Workplan**

   The original workplan, revised after having completed analysis (see Chapter 2).
5. **Feasibility Analysis**

   A revised feasibility analysis, using the information from analysis (see Chapter 2).
6. **Requirements Definition**

   A list of the functional and nonfunctional business requirements for the system (this chapter).
7. **Functional Model**

   An activity diagram, a set of use case descriptions, and a use-case diagram that illustrate the basic processes or external functionality that the system needs to support (see Chapter 4).
8. **Structural Models**

   A set of CRC cards, class diagram, and object diagrams that describe the structural aspects of the to-be system (see Chapter 5). This may also include structural models of the current as-is system that will be replaced.
9. **Behavioral Models**

   A set of sequence diagrams, communication diagrams, behavioral-state machines, and a CRUDE matrix that describe the internal behavior of the to-be system (see Chapter 6). This may include behavioral models of the as-is system that will be replaced.
10. **Appendices**

    These contain additional material relevant to the proposal, often used to support the recommended system. This might include results of a questionnaire survey or interviews, industry reports and statistics, and so on.

Summary

- Presented in this chapter:
  - **Discussion of functional and non-functional requirements determination**
  - Requirements analysis strategies
    - problem analysis, root cause analysis, duration analysis, activity-based costing analysis, informal benchmarking analysis, outcome analysis, technology analysis and activity elimination
  - Requirements gathering techniques
    - Interviews, joint application development, questionnaires, document analysis and observation
  - Alternative requirements documentation techniques
    - concept maps, story cards and task lists
  - The system proposal

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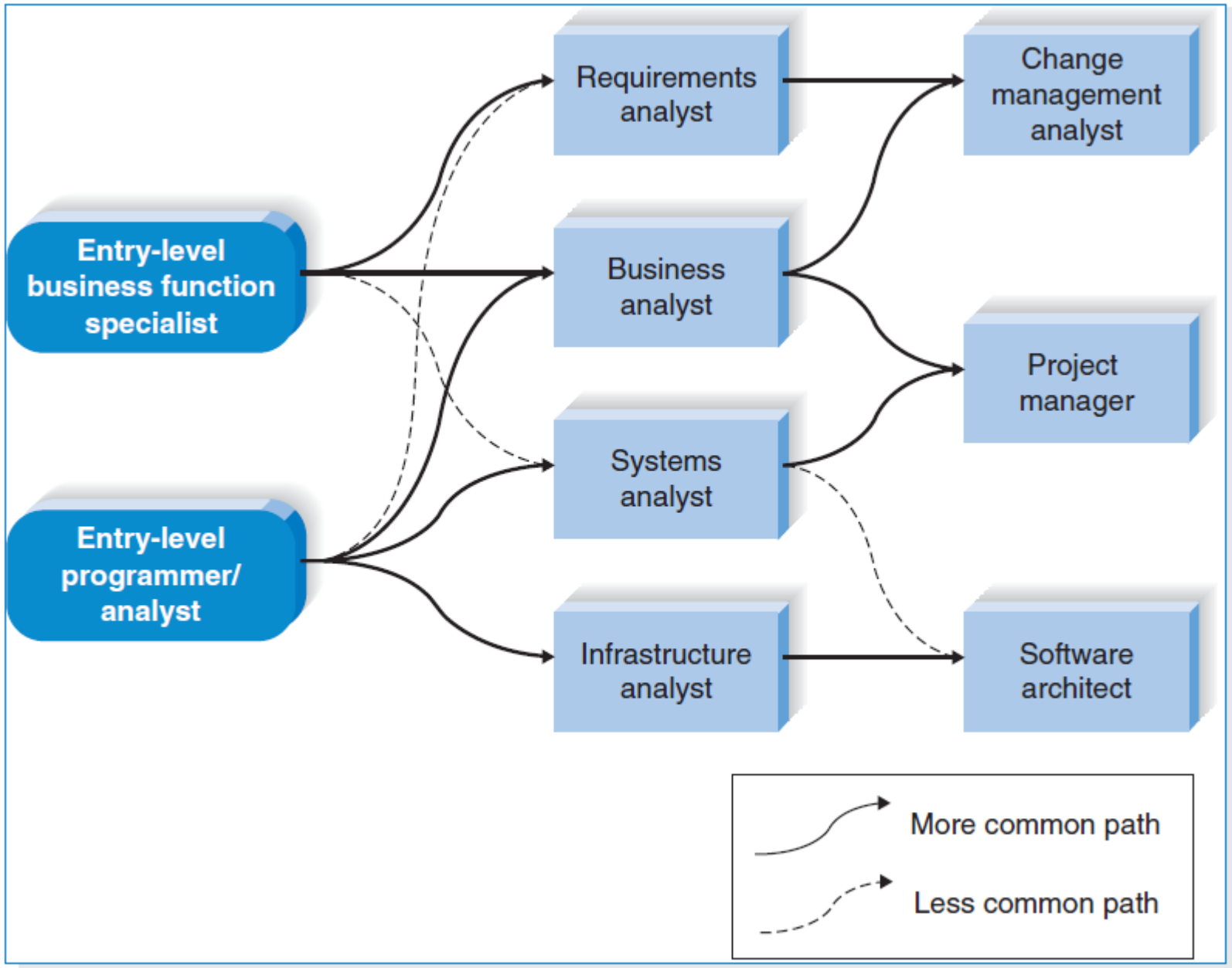

Career Paths for System Developers

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Exercise

- Locate a news article in an IT about an organization that is implementing a new computer system.
- Describe the tangible and intangible values that the organization likely will realize from the new system!

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References

Denis, Wixom,Tegarden. (2015). Systems Analysis and Design: An Object-Oriented Approach with UML. 5th edition. ISBN: 978-1-118-80467-4, John Wiley & Sons, Inc, Denver (USA)