KU KONKUK UNIVERSITY

# Software Modeling & Analysis

KUPE (Konkuk Unified Process for Education) With Case Study

-OOPT (Object Oriented Process with Trace)

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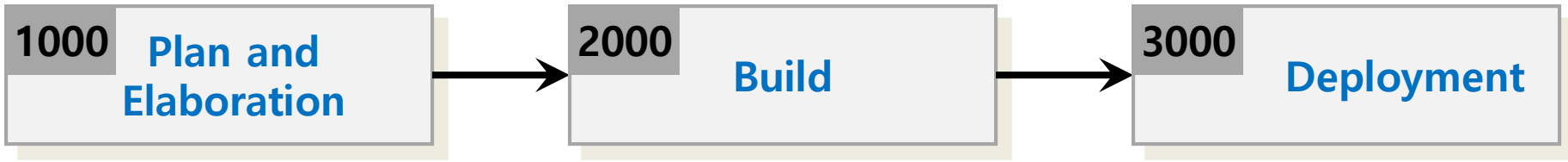
DEPENDABLE SOFTWARE LABORATORY

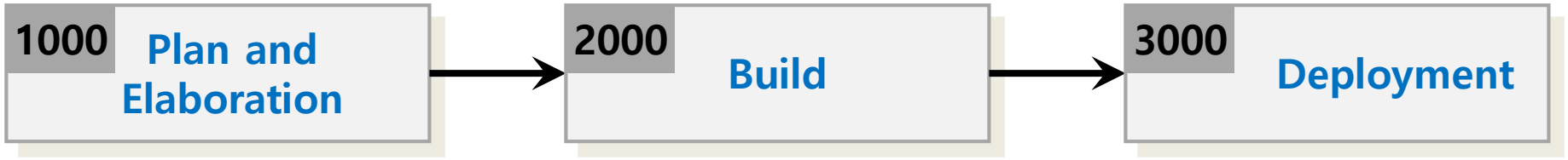
# What is KUPE?

- KUPE (Konkuk Unified Process for Education)
  - A software process based on RUP
  - Revision of OSP (by Tailored to SE classes in universities) and OOPT

- Characteristics of KUPE
  - 3 Stages
    1. Iterative : Multiple development cycles
    2. Incremental : System grows incrementally as each cycle is completed
    3. Architecture : Stage > Cycle > Phase > Activity



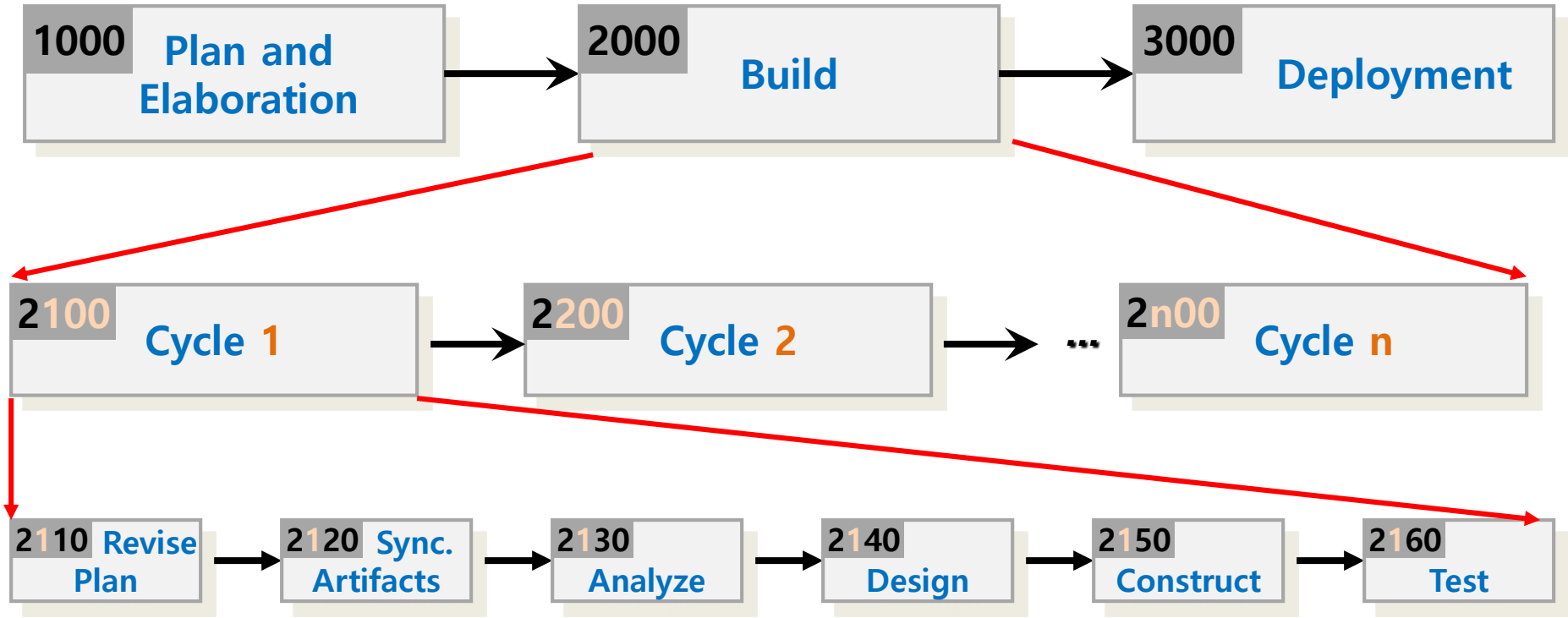
# 1. 3 Stages



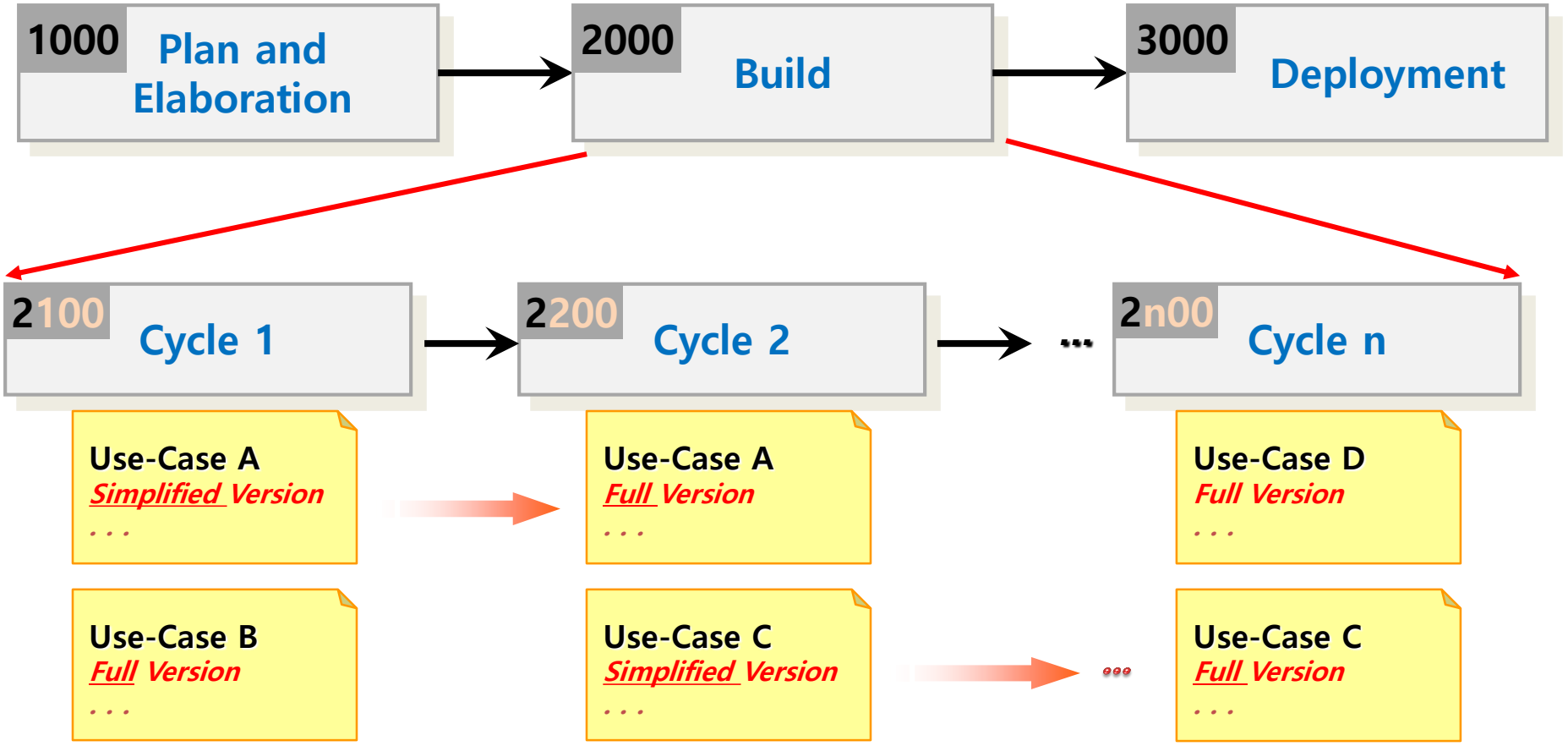

- Stage 1000 : Plan and Elaboration
  - Planning, defining requirements, building prototyping, etc
  - Corresponding to Inception/Elaboration phases in the RUP
- Stage 2000 : Build
  - Construction of the system
  - Corresponding to Construct phase in the RUP
- Stage 3000 : Deployment
  - Implementation of the system into use
  - Corresponding to Transition phase in the RUP

# 2. Iterative Development

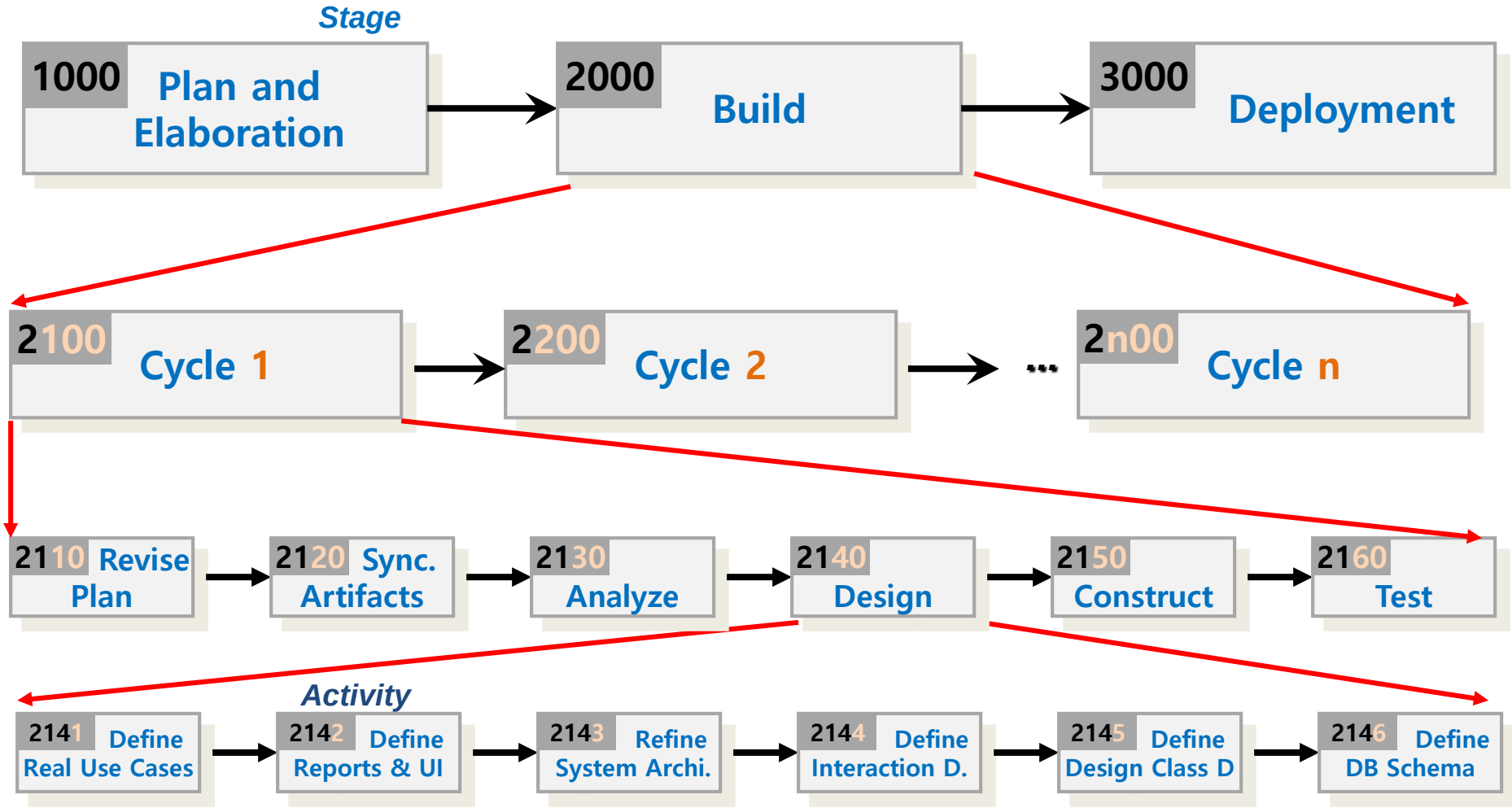
- Multiple iterations in the Build stage
- Each iteration took about 2 to 8 weeks



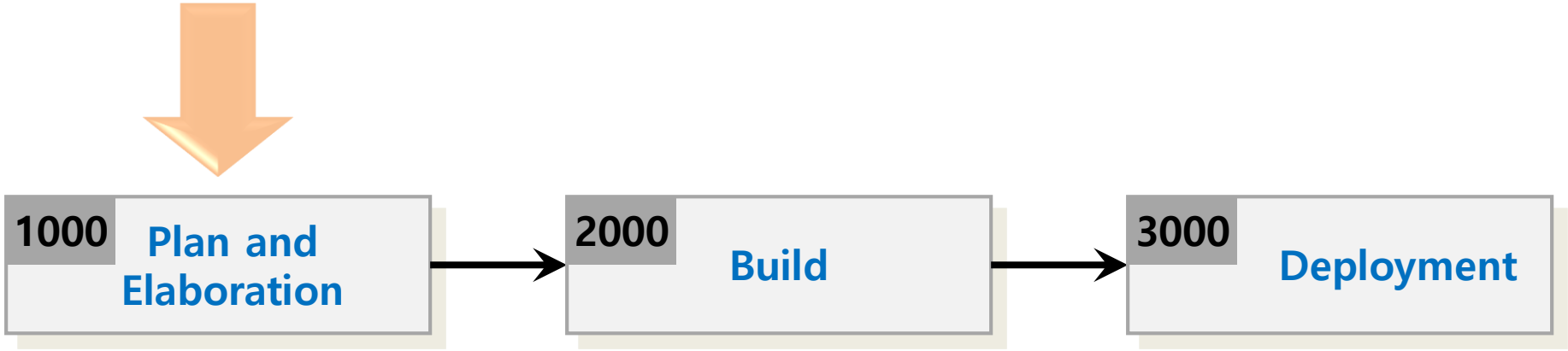
# 3. Incremental Development



# 4. Architecture of KUPE

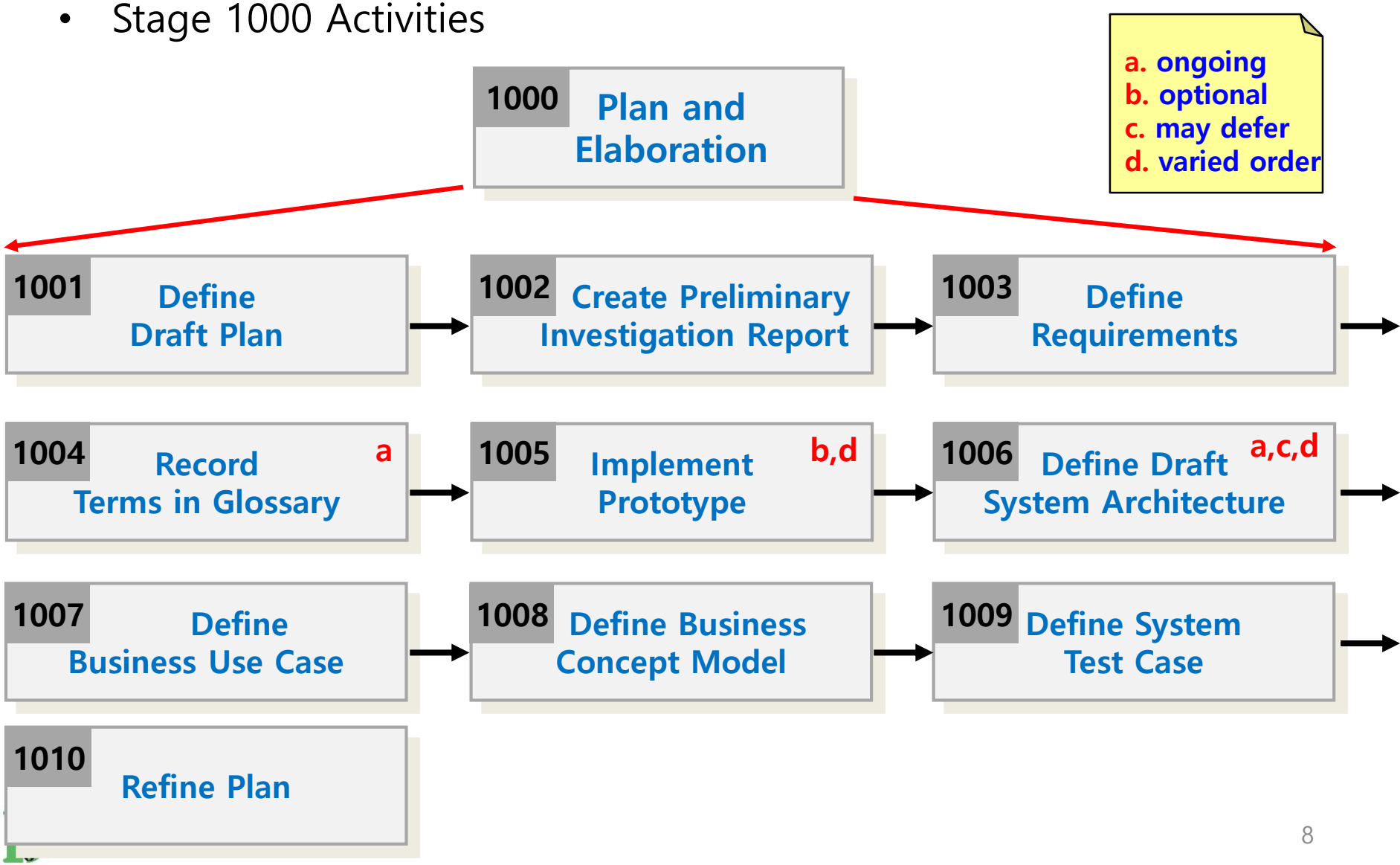


# Stage 1000.
# Plan and Elaboration

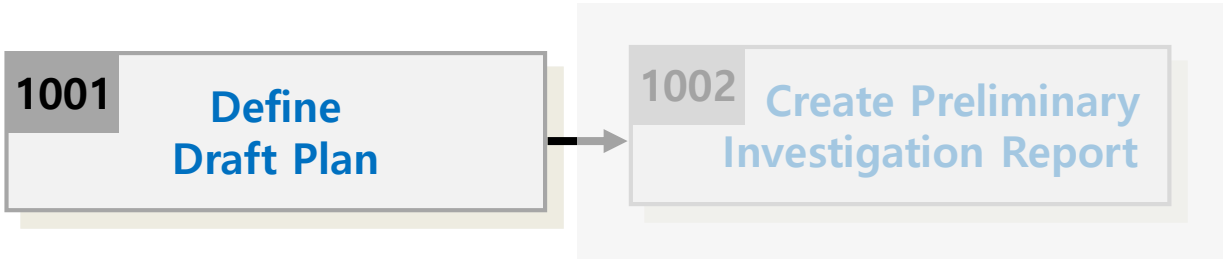


# Stage 1000. Plan and Elaboration

- Stage 1000 Activities

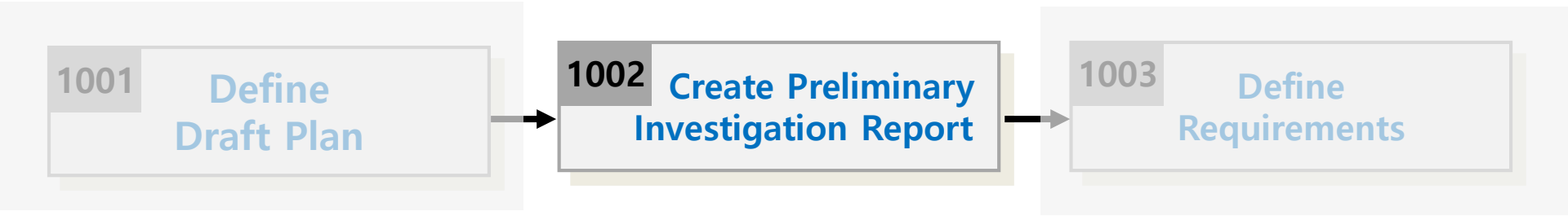


# Activity 1001. Define Draft Plan




- Description
  - Write a draft plan for schedule, resources, budget, objective, etc
  - Input : related documents of previous similar projects
  - Output : a draft project plan
- Steps
  1. Write motivation and objective of project
  2. Write scope of project
  3. Identify and write functional requirements
  4. Identify and write non-functional requirements
  5. Estimate resources (human efforts(M/M), human resources, duration, budget)

# Activity 1002.
# Create Preliminary Investigation Report




- Description
  - Write an investigation report on alternatives, business needs, risk, etc
  - Input : draft project plan
  - Output : an investigation report
- Steps
  1. Write alternative solutions
  2. Write project's justification (business needs)
  3. Identify and manage risks, and write risk reduction plans
  4. Analyze business market
  5. Write managerial issues

# Activity 1003. Define Requirements


- Description
  - Write a requirement specification for a product
  - Input : draft project plan, investigation report
  - Output : a requirement specification
- What is a requirement? (IEEE Std 610.12-1990)
  - A condition or capability needed by a user to solve a problem or achieve an objective.
  - A condition or capability that must be met or possessed by a system or system component to satisfy a contract, standard, specification, or other formally imposed documents.
  - A documented representation of a condition or capabilities as in (1) or (2)

# Activity 1003. Define Requirements

- Functional requirements
  - A requirement that specifies a function that a system or system component must be able to perform
  - Analyzed and Realized in Use-Case model

- Non-functional requirements
  - Constraints on the services or functions offered by the system as timing constraints, constraints on the development process, standards, etc.
  - Portability, Reliability, Usability, Efficiency(Space, Performance)
  - Delivery, Implementation, Standards
  - Ethical, Interoperability, Legislative(Safety, Privacy)

- Recommended reference : IEEE Std. 830-1998

# Activity 1003. Define Requirements

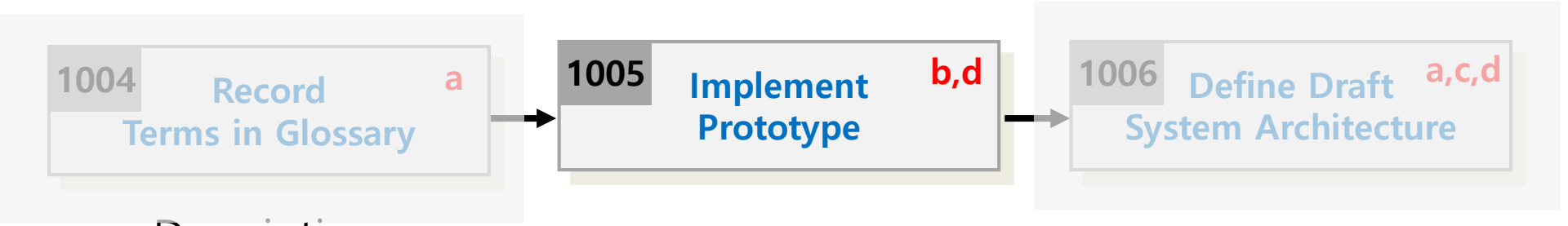
- Steps
  1. Gather all kinds of useful documents
  2. Write an overview statement (objective and name of the system, etc.)
  3. Determine customers who use the product
  4. Write goals of the project
  5. Identify system functions
     - Functional requirements
     - Add function references(such as R1.1, …) into the identified functions
     - Categorize identified functions into Event, Hidden, and Frill
  6. Identify system attributes
     - Non-functional requirements
  7. Identify other requirements (Optional)
     - Assumptions, Risks, Glossary, etc.

| Categorization | |
|---|---|
| Event | should perform / visible to users |
| Hidden | should performs / invisible to users |
| Frill | optional |

# Activity 1004. Record Terms in Glossary

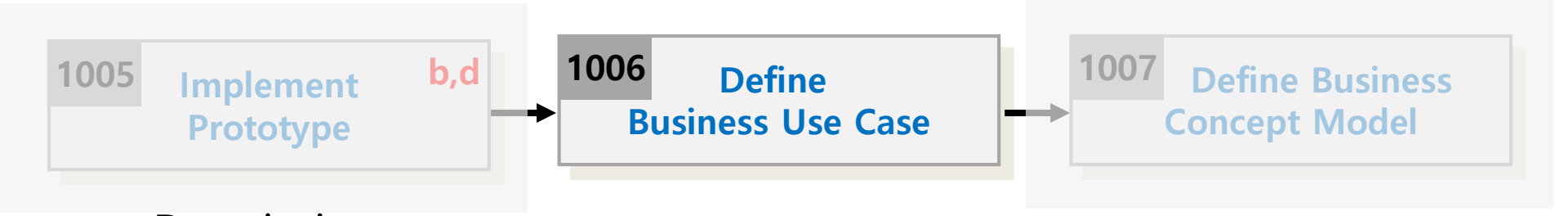

- Description
  - Similar to "Data Dictionary"
  - Dictionary of terms and any associated information(constraints and rules)
  - Input : requirements specification
  - Output : a term dictionary
- Steps
  1. Describe meaning of terms specified in requirements specification
  2. Write alias of each term

# Activity 1005. Implement Prototype

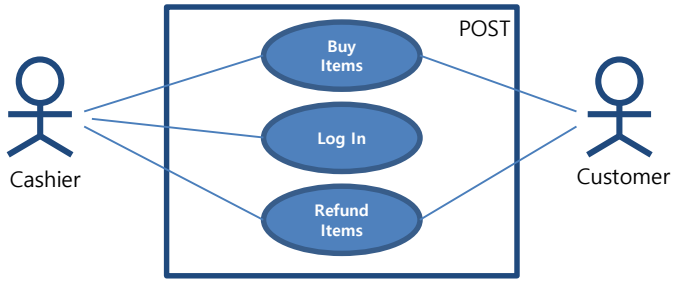



- Description
  - Develop a prototype system to permit use feedback, determine feasibility, or investigate timing or other issues
  - Input : requirements specification
  - Output : a prototype
- Steps
  1. Develop a prototype

# Activity 1006. Define Business Use Case

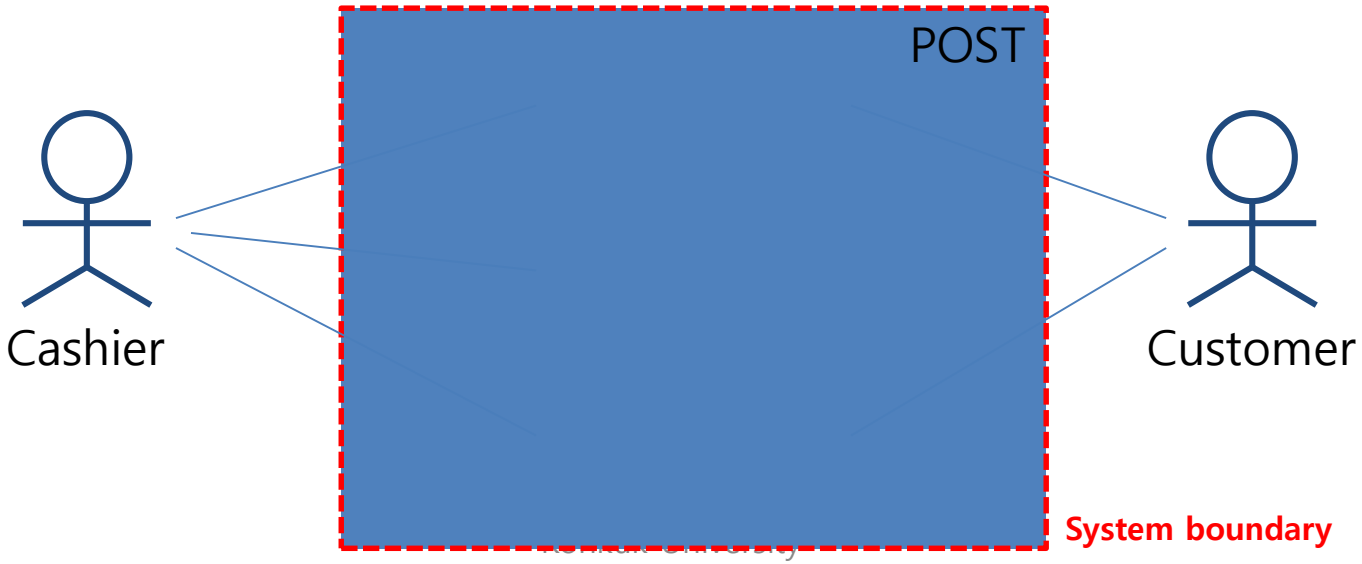



- Description
  - To obtain a deeper understanding of the processes and requirements identified so far
  - Identify business tasks as business use cases, and illustrate their relationships in use case diagrams
  - Input : requirements specification
  - Output : a business use case model (High-level use case)
    - Business Use Case Diagram
    - Business Use Case Description



# Activity 1006. Define Business Use Case

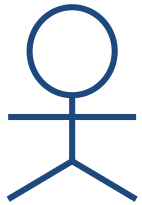
- Steps
  1. Determine system boundary in order to identify what is external versus internal, and what the responsibilities of the system are
     - Typical system boundary includes:
       - Hardware/Software boundary of a device / computer system
       - Department of an organization
       - Entire organization



# Activity 1006. Define Business Use Case

2. Identify the actors related to a system or organization
   - An actor is anything with behavior, including the system under discussion(SuD) itself when it calls upon the services of other systems
   - Actors are not only the roles played by people, but also organizations, software, and machines

   - Primary Actors
     - Have user's goals fulfilled through using services the system provides
     - Primary actors can be other computer systems (i.e. watchdog)
   - Supporting Actors
     - Provide services to the system under design
     - Often a computer system could be a supporting actor



Actor

# Activity 1006. Define Business Use Case

3. Identify user goals for each actor
4. Record the primary actors and their goals in an actor-goal list

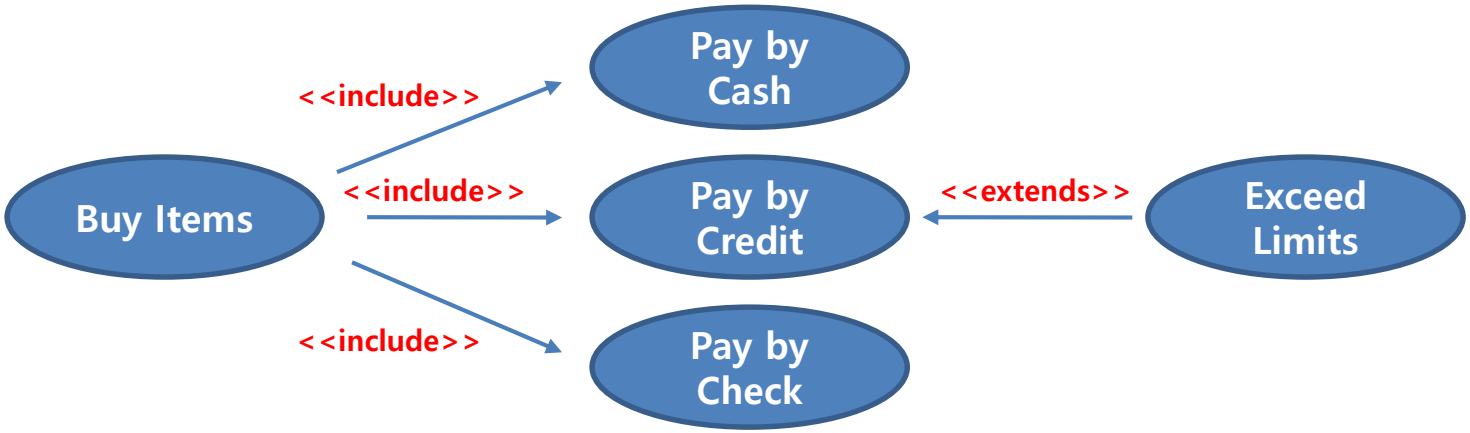
| Actor | Goal |
|---|---|
| Cashier | Process sales<br>Process rentals<br>Handle returns<br>Cash in<br>Cash out<br>… |
| System Admin. | Add users<br>Modify users<br>Delete users<br>Manage securities<br>… |

# Activity 1006. Define Business Use Case

5. Define use cases that satisfy user goals
   - Identify use cases by actor-based
     - For each actor, identify the processes they initiate or participate in
   - Identify use cases by event-based
     - Identify the external events that a system must respond to
     - Related the events to actors and use cases
   - Name them according to their goals
6. Allocate system functions identified during the requirements specification into related use cases
7. Categorize identified use cases into primary, secondary, and optional use cases
   - Primary use cases : major common processes
   - Secondary use cases : minor or rare processes
   - Optional use cases : processes that may not be tackled

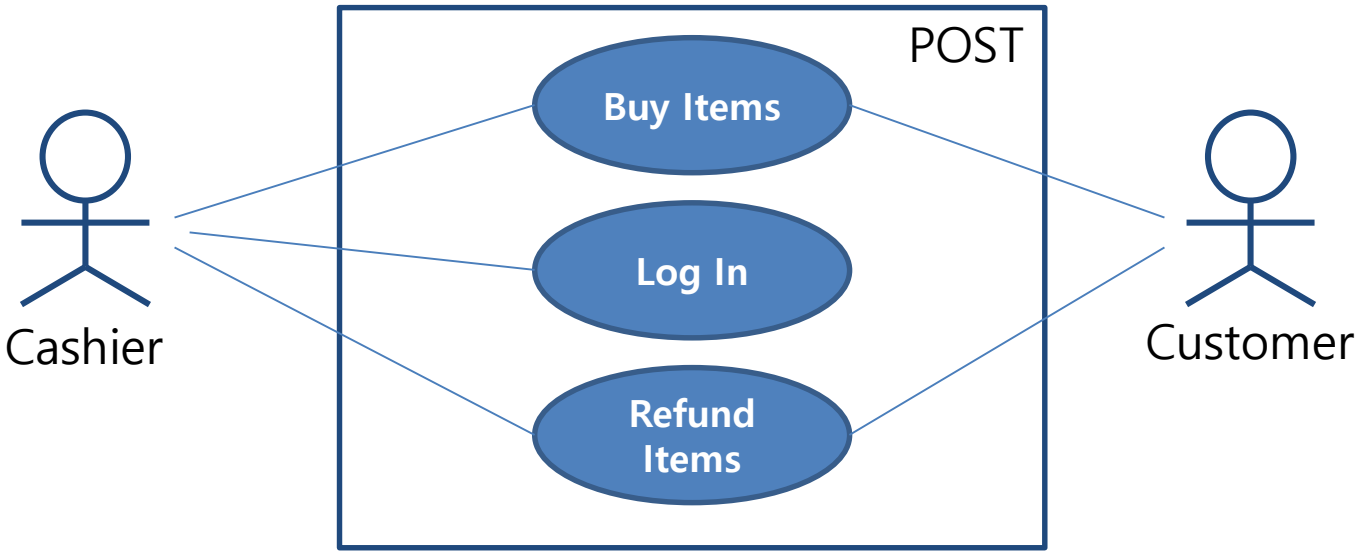
# Activity 1006. Define Business Use Case

8. Identify relationships between use cases
   - Write major steps or branching activities of one use case as several separate use cases using "include" relationship, when they are too complex, long, and duplicated to understand
   - Use "extends" relationship when an exceptional activity is occurred in use case



# Activity 1006. Define Business Use Case

9. Draw a use case diagram




9. Describe use cases
   - Describe the detail information of use cases
     - Name, Actor, Description

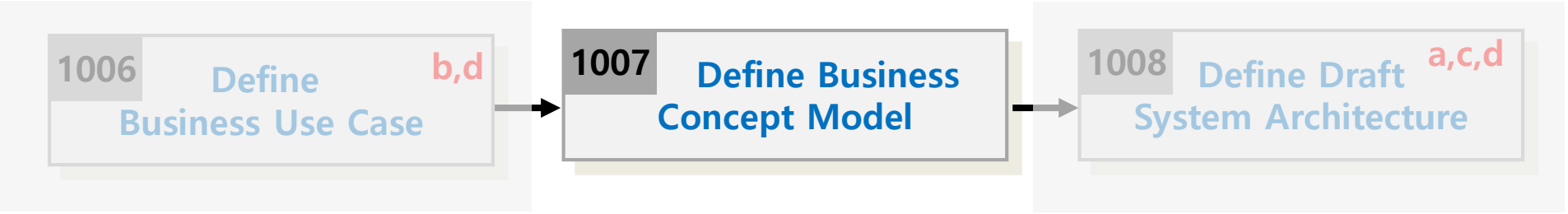
| Use Case | The name of use case |
|---|---|
| Actors | Associated actor |
| Description | Abstract information of use case |

# Activity 1006. Define Business Use Case

11. Rank use cases according to the followings:
    a. Significant impact on the architectural design
    b. Significant information and insight regarding the design
    c. Include risky, time-critical, or complex functions
    d. Involve significant research, or new and risky technology
    e. Represent primary line-of-business processes
    f. Directly support increased revenue or decreased costs
    - The ranking scheme may use a simply fuzzy classification such as high-medium-low
    - High ranking use cases need to be tackled in early development cycle

| Rank | Use case | Justification |
|---|---|---|
| High | Buy Items | It's the triggering event of all processes |
| Medium | Add New Users<br>Log In<br>Refund Items | Affects security<br>…<br>… |
| Low | Cash out<br>Start Up<br>Shut Down | Minimum effect on the architecture<br>…<br>… |

# Activity 1007. Define Business Concept Model

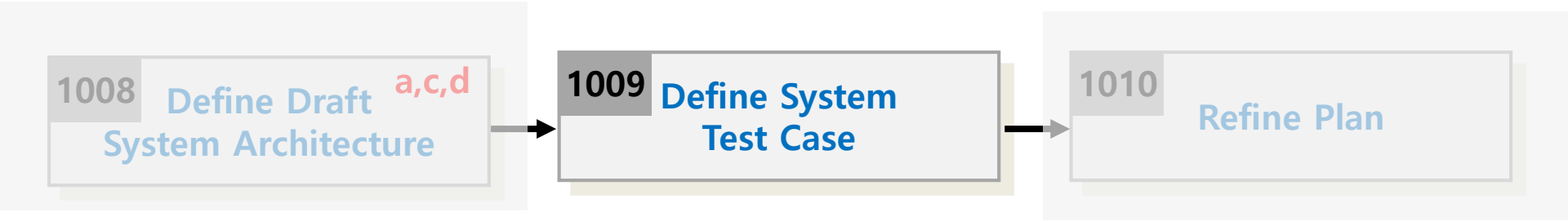



- Description
  - Identify "business concept" in the target domain which can be candidates for "classes"
  - Input : requirements specification, term dictionary
    business use case model
  - Output : a business concept model
- Steps
  1. Identify business terms or business concepts from requirements specification or through interviews with domain experts
  2. Define identified terms as business concepts
     - Implementation details can't be business concepts

# Activity 1008.
# Define Draft System Architecture


- Description
  - Construct a rough preliminary system architecture model
  - Input : requirements specification
    business use case model
  - Output : a draft system architecture
- Steps
  1. Define logical/physical layers of the target system
  2. Separate the whole system into several subsystems
  3. Assign business use cases into each subsystem
  4. Identify and draw up hardware resources

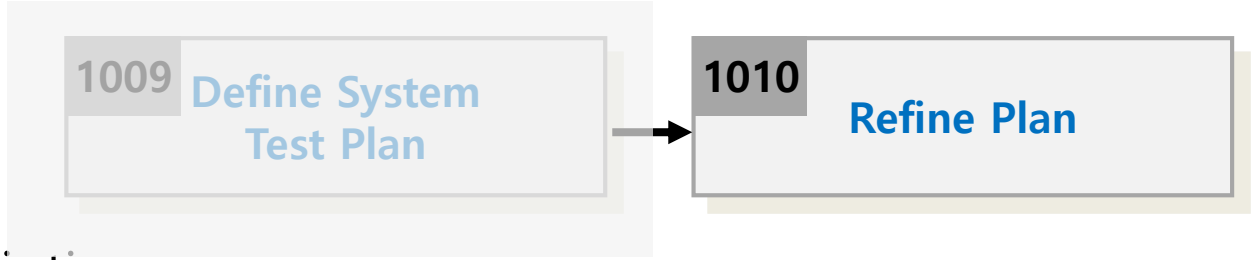
# Activity 1009. Define System Test Case




- Description
  - Define test Case of the system
  - Input : requirements specification, business use case model
    business concept model
  - Output : system test plan

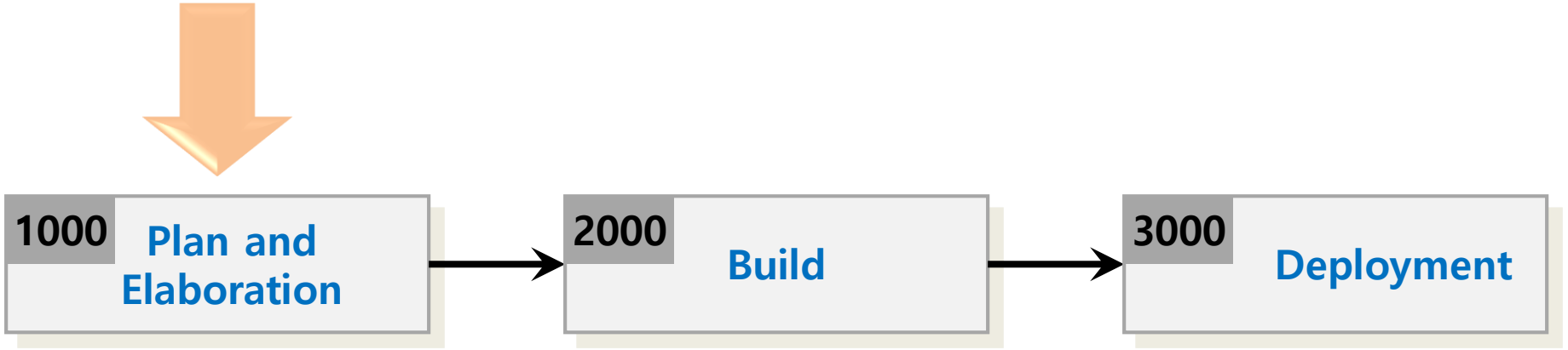
- Steps
  1. Identify requirements, use case
  2. Planning system test cases accordance with use case models
     - Category partitioning, brute force, etc
  3. Mapping the test plan with functional requirements specification
     - Identify 100% functional requirements coverage

# Activity 1010. Refine Plan




- Description
  - Refine the draft project plan generated in activity 1001
  - Input : all outputs of OSP stage 1000
  - Output: a refined project report
- Steps
  1. Review draft project plan, based on requirements specification, business use case model, business concept model, and draft system architecture
  2. Refine project's scope, duration, cost, and other resources

# Stage 1000.
# Plan and Elaboration
## -Case Study-



# WEBTOON PAINT

Team 2
200911371 김민철
200911381 김진현
200911417 정명권

## 목차



## 목표

Paran

NATE

웹툰을 제공하는 포탈에
웹툰 그리기 툴을 판매

## 제품설명 (1/7)

- 만화의 이미지들을 불러온다.

기존방법


창이 많아서 번거로움

WebToon Paint

프로그램 아래에 탭으로 늘어남

## 제품설명(2/7)

- 각 컷을 붙여서 넣는다.

기존방법


손으로 일일히 파일을
이어 붙여야 함.

WebToon Paint


그림합치기 버튼으로
자동으로 합쳐짐

## 제품설명(3/7)

- 합쳐진 파일을 업로드 용량에 맞춰 분할함.

기존방법


자르기 전에는 사진의
용량을 알기 어려움.

WebToon Paint


업로드 버튼을 통해 자
동으로 분할

## 제품설명(4/7)

- 나눈 파일들을 순서에 맞춰서 업로드함

기존방법


여러 개의 파일을 하나
씩 올려야 함.

WebToon Paint


업로드 버튼을 통해 자
동으로 업로드

## 제품설명(5/7)

- 썸네일을 만든다.

기존방법

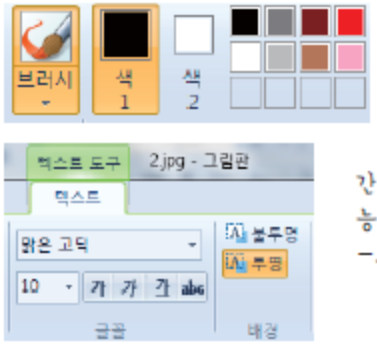

썸네일용 이미지를 따
로 만들어야 함.

WebToon Paint


업로드 할 때 로드된
그림들 중에서 선택

# 제품설명(6/7)

## 텍스트 박스와 브러쉬




간단한 브러시와 텍스트박스 기능
-그림파일 오/탈자 수정이 쉽다.

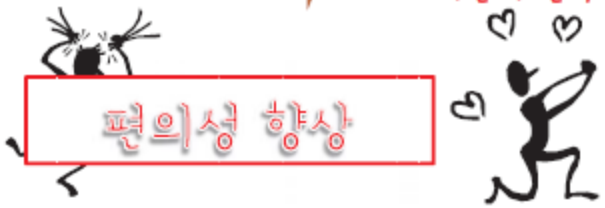
# 제품설명(7/7)

## 기존방법

복잡하다.
추가작업이 많다.
시간이 오래 걸린다.

## WebToon Paint

단순하다.
추가작업이 없다.
시간이 단축된다.




# 기대효과

### 웹툰 사이트가 얻는 이득

- 웹툰작가들의 시간을 아낌.
- 웹툰작가들의 편의성 향상.
- 웹툰에 대한 진입장벽 감소를 통한 잠재적 웹툰작가 증가.

### 우리가 얻는 이득

- 프로그램 판매비용
- 유지, 보수 비용

**웹툰 사이트의 양적, 질적 향상!**

# 소요비용과 예상수익

- 개발비 200만원
- 1-6 man-month
- 가용인원 3명
- 개발기간 8주

사이트에 업로드 하는 과정은
사이트에 맞춰서 판매할 때 제작

- 네이버, 다음, 파란 등 각 사이트에 약 800만원에 제공

프로그램 판매 이득
/ 2400~4000만원

- 추후 유지 보수비용을 받음

# Activity 1001. Define Draft Plan

- Motivation
  - 인쇄 시스템 디자인 및 구축

- Objective
  - 요청한 인쇄 매수에 따라 금액을 투입하면 인쇄가 되는 시스템 구축

- Functional Requirements
  - 사용자를 계정 별로 관리한다.
    - 계정은 사용자가 원하는 대로 생성 하며 사용자 계정은 id/pw와 잔액 정보를 가진다.
    - 계정 별로 잔액을 충전 할 수 있다.
  - 인쇄는 1장당 50원의 요금을 받는다.
    - 인쇄 진행 시 계정 잔액에서 필요한 만큼 차감한다.
  - 관리자는 프린터의 정보 및 계정 정보를 확인 할 수 있다.
    - 용지 부족 시 이에 대한 알림을 준다.
    - 부족한 용지를 보충 할 수 있다.
    - 계정 목록 및 잔액을 확인 할 수 있다.

# Activity 1001. Define Draft Plan

- Non-Functional Requirements
  - 인쇄 품질은 충분히 좋아야 한다.
  - 인쇄 가격은 적당해야 한다.
  - 프린터는 소음이 적어야 한다.

- Resource
  - Human Efforts : 1-0.5 M/M
  - Cost : 250,000

# Activity 1003. Define Requirements

- Functional Requirements (Rev. 1001)
  - 사용자를 계정 별로 관리한다.
    - 계정은 사용자가 원하는 대로 생성 하며 사용자 계정은 id/pw와 잔액 정보를 가진다.
    - 계정 별로 잔액을 충전 할 수 있다.
    - 사용자는 프린터 사용 전에 계정을 먼저 생성해야 한다.
    - Id/pw 가 일치하는 경우에만 인쇄가 가능하도록 한다.
      - 로그인, 로그아웃이 가능 하다.
  - 인쇄는 1장당 50원의 요금을 받는다.
    - 인쇄 진행 시 계정 잔액 확인 후 필요한 만큼 차감한다.
      - 잔액이 부족할 경우 인쇄 진행이 되지 않도록 한다.
  - 관리자는 프린터의 정보 및 계정 정보를 확인 할 수 있다.
    - 용지 부족 시 이에 대한 알림을 준다.
    - 부족한 용지를 보충 할 수 있다.
    - 계정 목록 및 잔액을 확인 할 수 있다.
    - 전체 수익금을 확인 할 수 있다.

# Activity 1003. Define Requirements

| Ref. # | Function | Category |
|---|---|---|
| R 1.1 | System Access | Event |
| R 1.2 | Make Account | Event |
| R 1.3 | Identify Balance | Event |
| R 1.4 | Recharge Balance | Event |
| R 2.1 | Request Print | Event |
| R 2.2 | Check Balance | Hidden |
| R 3.1 | Identify Paper | Event |
| R 3.2 | Recharge Paper | Event |
| R 3.3 | Identify User | Event |
| R 3.4 | Identify Money | Event |

# Activity 1004. Record Terms in Glossary

| Glossary | Description |
|---|---|
| Balance | 사용 가능한 요금을 표시한 잔액 |
| Paper | 사용 가능한 용지 잔량 |
| User | 프린터 사용자들의 계정 |

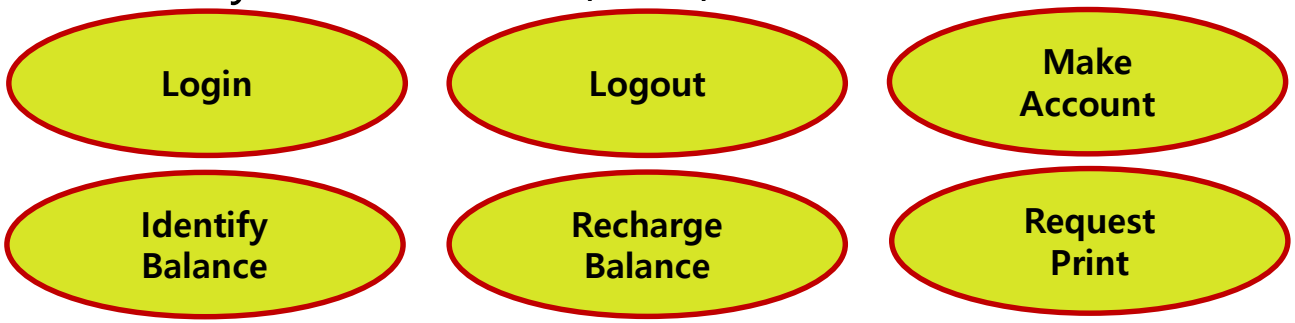
# Activity 1006. Define Business Use Case

- Define System boundary

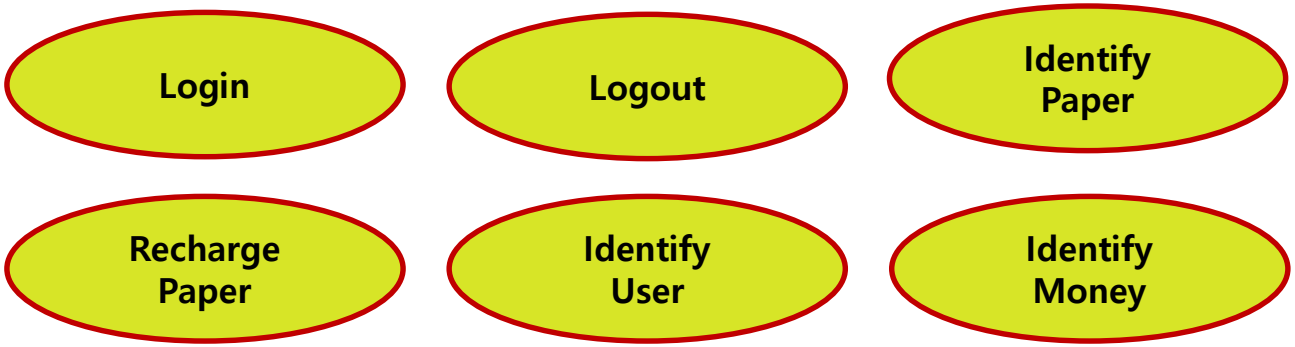

- Identify the actors
  - User : 인쇄를 위해 시스템과 상호작용하는 actor
  - Manager : 인쇄 시스템 사용자, 용지 등을 관리하기 위해 상호작용하는 actor

# Activity 1006. Define Business Use Case

- Use-cases by actor based (User)




- Use-cases by actor based (Manager)



# Activity 1006. Define Business Use Case

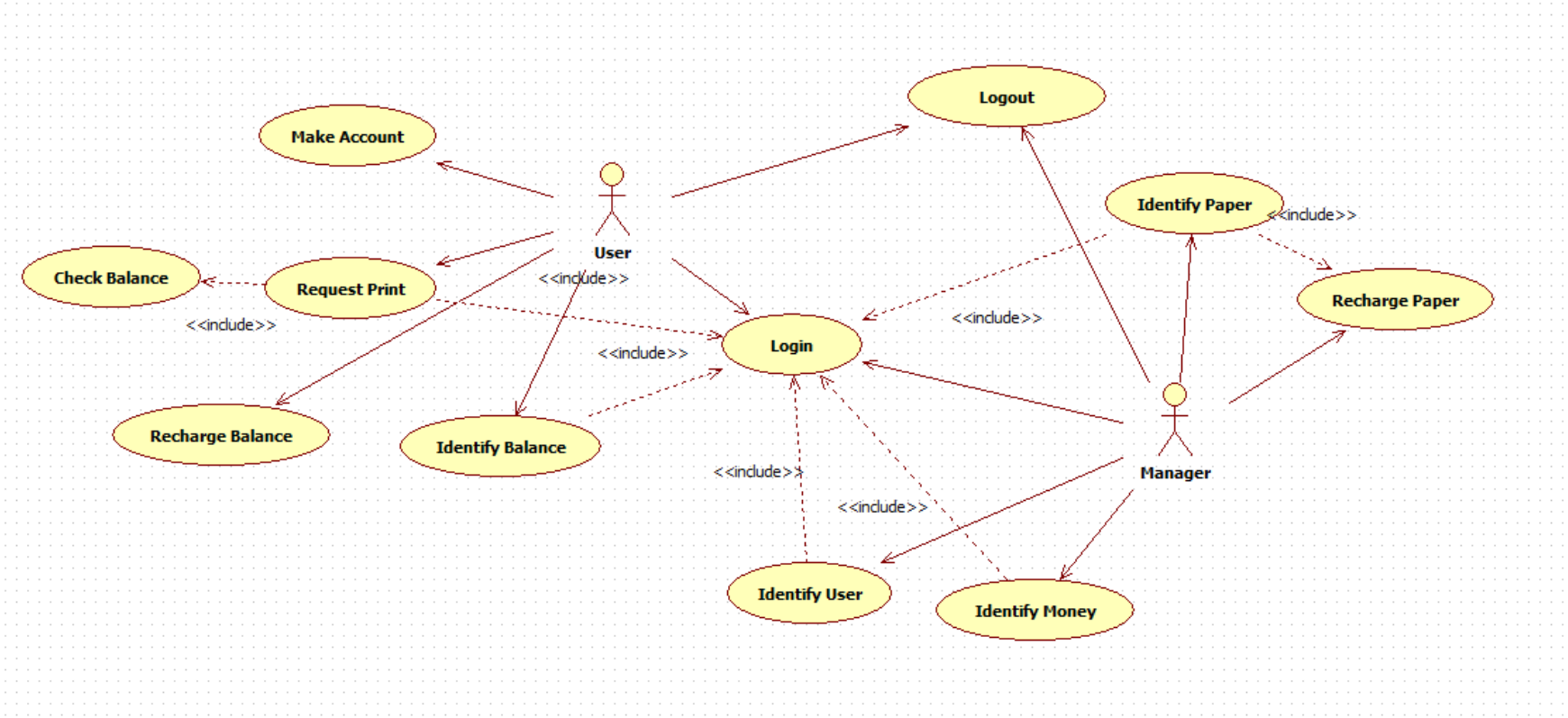
- Use-cases by event based


- Allocate system functions into related use cases and categorize

| Ref. # | Function | Use Case Number & Names | Category |
|---|---|---|---|
| R 1.1 | System Access | 1. Login | Primary |
| R 1.1 | System Access | 2. Logout | Primary |
| R 1.2 | Make Account | 3. Make Account | Primary |
| R 1.3 | Identify Balance | 4. Identify Balance | Primary |
| R 1.4 | Recharge Balance | 5. Recharge Balance | Primary |
| R 2.1 | Request Print | 6. Request Print | Primary |
| R 2.2 | Check Balance | 7. Check Balance | Primary |
| R 3.1 | Identify Paper | 8 Identify Paper | Primary |
| R 3.2 | Recharge Paper | 9. Recharge Paper | Primary |
| R 3.3 | Identify User | 10. Identify User | Primary |
| R 3.4 | Identify Money | 11. Identify Money | Primary |

# Activity 1006. Define Business Use Cases

- Use case diagram



# Activity 1006. Define Business Use Cases

- Describe use cases

| Use Case | Login |
|---|---|
| Actors | User, Manager |
| Description | - 사용자 or 관리자가 시스템을 사용하기 위해 id, pw를 입력 받는다.<br>- 이 use case는 입력 받은 id/pw 와 저장된 회원 정보를 확인하여 id, pw가 일치하는 경우 시스템 사용을 승인 한다.<br>- 회원인 경우 user로 관리자인 경우 manager로 로그인 하고 화면을 전환한다. |

| Use Case | Logout |
|---|---|
| Actors | User, Manager |
| Description | - 사용자 or 관리자가 시스템을 사용 해제 하기 위한 use case 이다.<br>- 사용 승인 상태를 해제하고 초기화면으로 돌아간다. |

# Activity 1006. Define Business Use Cases

- Describe use cases

| Use Case | Make Account |
|---|---|
| Actors | User, Manager |
| Description | - 이 use case는 id/pw 를 입력 받는다<br>- 입력 받은 id 와 일치하는 id가 없는 경우 사용자 계정을 생성한다. |

| Use Case | Identify Balance |
|---|---|
| Actors | User |
| Description | - 현재 로그인 된 사용자의 계정에 충전된 잔액을 화면에 표시한다. |

| Use Case | Recharge Balance |
|---|---|
| Actors | User |
| Description | - 충전할 금액의 값을 입력 받는다<br>- 현재 로그인 된 사용자의 계정에 해당 금액만큼 잔액을 충전 한다. |

# Activity 1006. Define Business Use Cases

| Use Case | Request Print |
|---|---|
| Actors | User |
| Description | - 이 use case는 출력할 매수를 입력 받는다.<br>- 잔액 확인 후 잔액이 충분한 경우 인쇄를 진행 한다. |

| Use Case | Check Balance |
|---|---|
| Actors | Event |
| Description | - 출력 요청 이후에 매수와 잔액을 비교하여 출력 가능 여부를 계산한다. |

| Use Case | Identify Paper |
|---|---|
| Actors | Manager |
| Description | - 이 use case는 관리자로 로그인한 경우에 프린터의 용지 잔량을 확인한다. |

# Activity 1006. Define Business Use Cases

| Use Case | Recharge Paper |
|---|---|
| Actors | Manager |
| Description | - 이 use case는 보충할 용지의 매수를 입력 받는다.<br>- 입력한 용지의 매수 만큼 프린터의 용지를 보충한다. |

| Use Case | Identify User |
|---|---|
| Actors | Manager |
| Description | - 관리자로 로그인한 경우에 생성된 계정의 정보를 확인 할 수 있다. |

| Use Case | Identify Money |
|---|---|
| Actors | Manager |
| Description | - 관리자로 로그인한 경우에 지금까지의 총 매출을 확인 할 수 있다. |

# Activity 1006. Define Business Use Cases

- Rank use cases

| Rank | Use Case Number & Names | Category |
|---|---|---|
| High | 1. Login | Primary |
| High | 2. Logout | Primary |
| High | 3. Make Account | Primary |
| High | 4. Identify Balance | Primary |
| High | 5. Recharge Balance | Primary |
| High | 6. Request Print | Primary |
| High | 7. Check Balance | Primary |
| High | 8 Identify Paper | Primary |
| High | 9. Recharge Paper | Primary |
| High | 10. Identify User | Primary |
| High | 11. Identify Money | Primary |

# Activity 1007. Define Business Concept Model

- Identify the business concept

| | | |
|---|---|---|
| Account | Balance | Print |
| Manage | Access | login |
| logout | Charge | |

# Activity 1009. Define System Test Cases

- Identify requirements and use cases

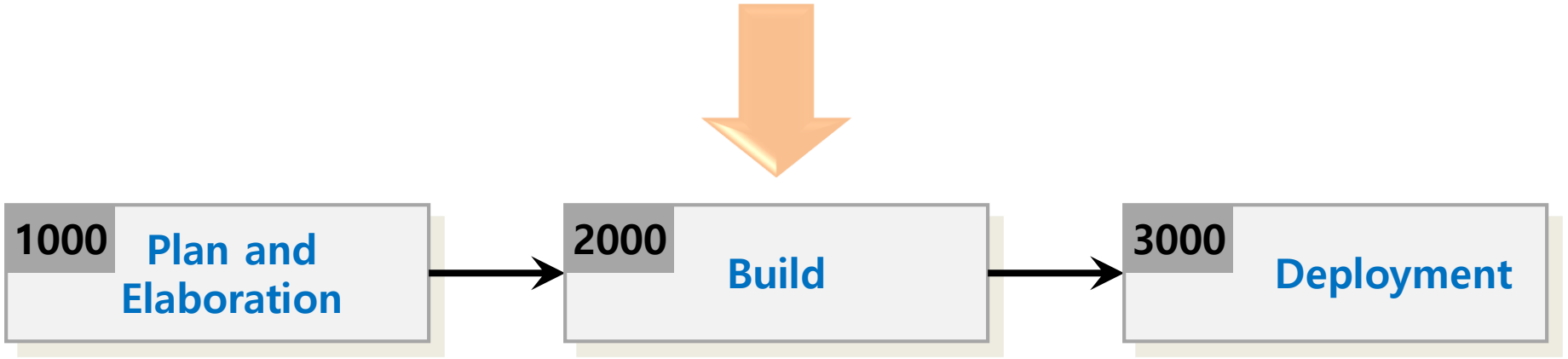
| Ref. # | Function | Use Case Number & Names |
|---|---|---|
| R 1.1 | System Access | 1. Login |
| R 1.1 | System Access | 2. Logout |
| R 1.2 | Make Account | 3. Make Account |
| R 1.3 | Identify Balance | 4. Identify Balance |
| R 1.4 | Recharge Balance | 5. Recharge Balance |
| R 2.1 | Request Print | 6. Request Print |
| R 2.2 | Check Balance | 7. Check Balance |
| R 3.1 | Identify Paper | 8 Identify Paper |
| R 3.2 | Recharge Paper | 9. Recharge Paper |
| R 3.3 | Identify User | 10. Identify User |
| R 3.4 | Identify Money | 11. Identify Money |

# Activity 1009. Define System Test Case

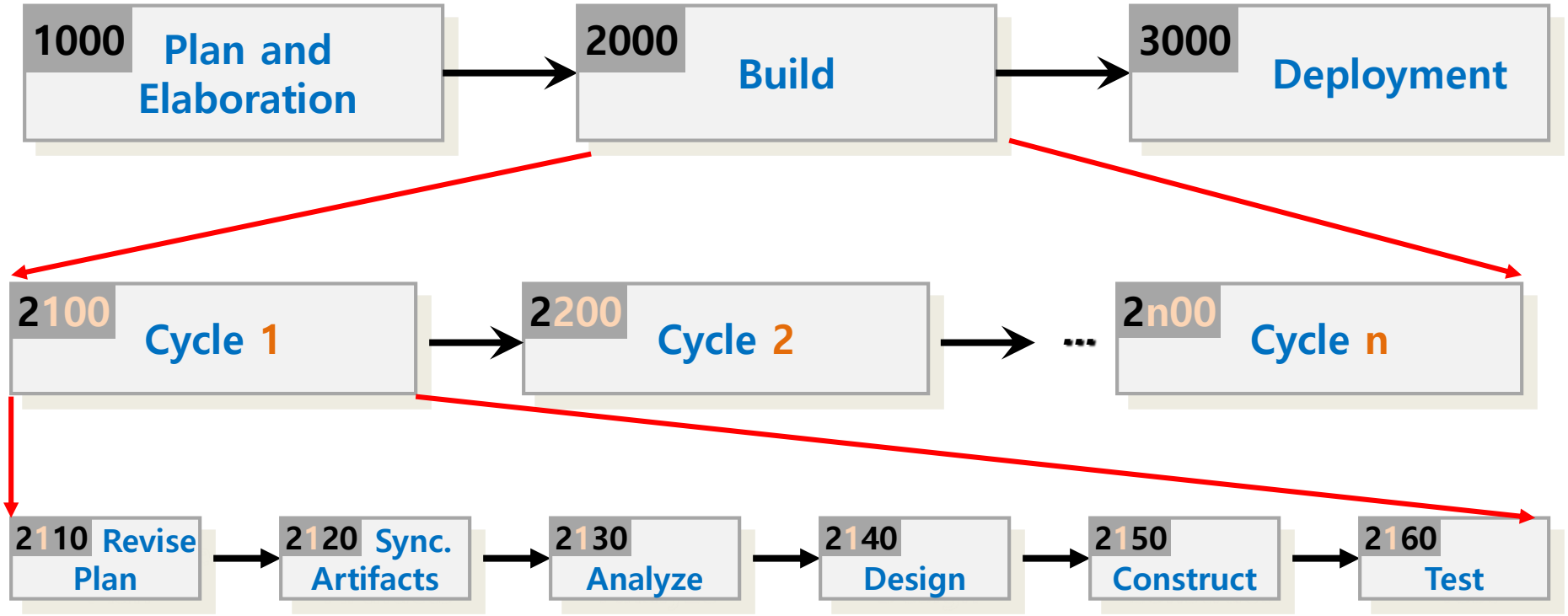
- Define system test plan and mapping with system function
  - Brute force 방식으로 생성

| Test Number | Test 항목 | Description | Use Case | System Function |
|---|---|---|---|---|
| 1 | 로그인 시험 | Id, pw를 입력하고 로그인 시도를 하여 로그인 기능 test | 1. Login | R 1.1 |
| 2 | 로그아웃 시험 | 로그아웃 버튼을 눌러 로그아웃 기능 test | 2. Logout | R 1.1 |
| 3 | 계정 생성 시험 | 계정 생성 데이터를 입력하여 계정 생성 기능 test | 3. Make Account | R 1.2 |
| 4 | 잔액 확인 시험 | 잔액 확인 버튼 동작 여부 test | 4. Identify Balance | R 1.3 |
| 5 | 잔액 충전 시험 | 금액을 입력하고 잔액 충전 기능 test | 5. Recharge Balance | R 1.4 |
| 6 | 인쇄 버튼 시험 | 인쇄 매수를 입력하고 인쇄 기능 test | 6. Request Print | R 2.1 |
| 7 | 잔액 체크 시험 | | 7. Check Balance | R 2.2 |
| 8 | 용지 확인 시험 | 용지 잔량 출력 test | 8 Identify Paper | R 3.1 |
| 9 | 용지 충전 시험 | 용지 충전 test | 9. Recharge Paper | R 3.2 |
| 10 | 사용자 목록 확인 시험 | 전체 사용자 목록 출력 test | 10. Identify User | R 3.3 |
| 11 | 수익 확인 시험 | 총 수익 출력 test | 11. Identify Money | R 3.4 |

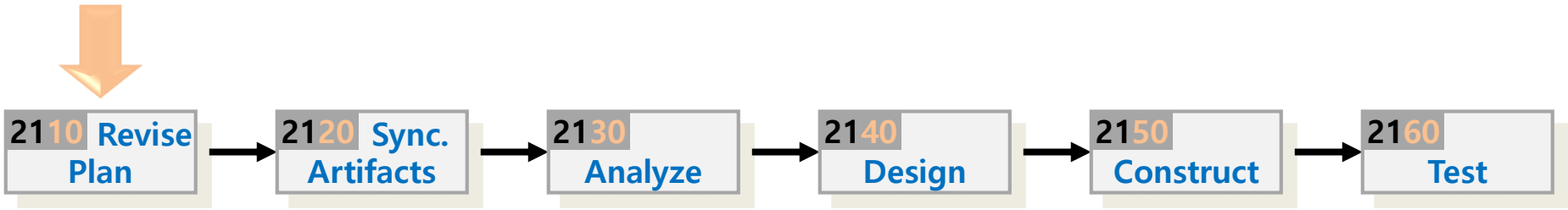
# Stage 2000.
# Build



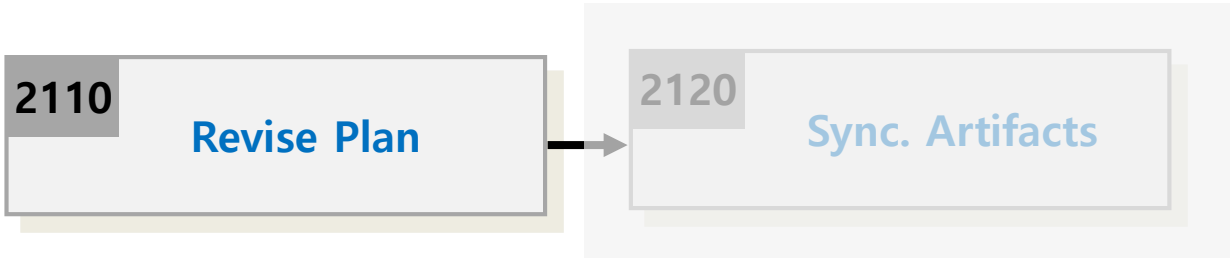
# 6 Phases of 'Build' Stage



# Phase 2010.
# Revise Plan

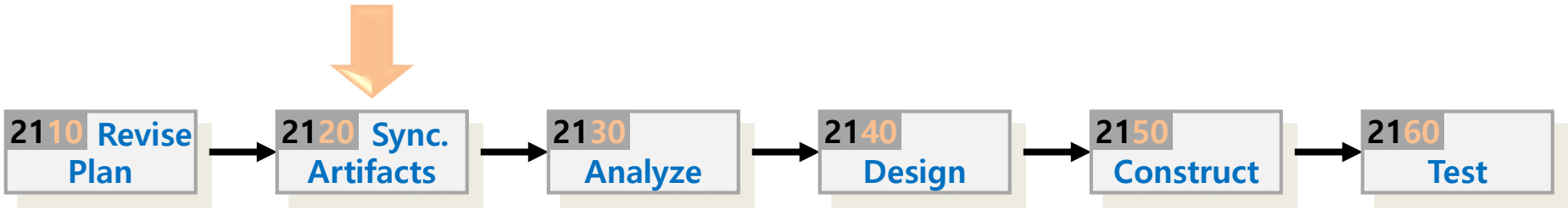


# Phase 2010. Revise Plan




- Description
  - Correct and enhance the project plan and requirement definition based on the intermediate deliverables
  - Input : intermediate deliverables
  - Output : A refined project plan, a refined requirement specification
- Steps

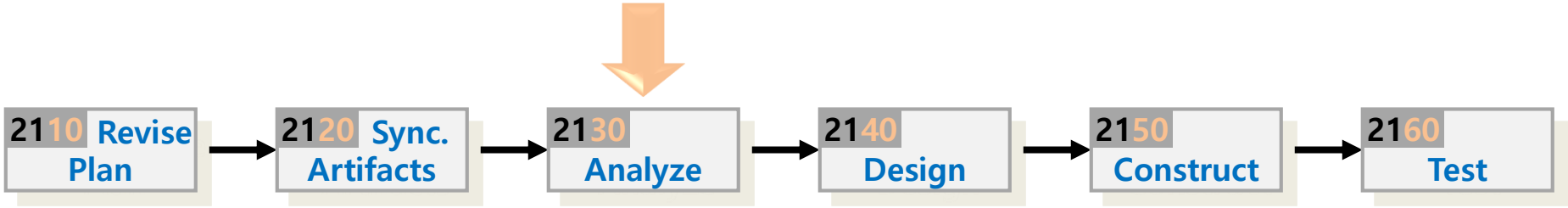
# Phase 2020.
# Synchronize Artifacts



# Phase 2020. Synchronize Artifacts


- Description
  - Configure and manage various types of artifacts (Project Repository)
  - Control versions and variations
  - Input :
  - Output :
- Steps

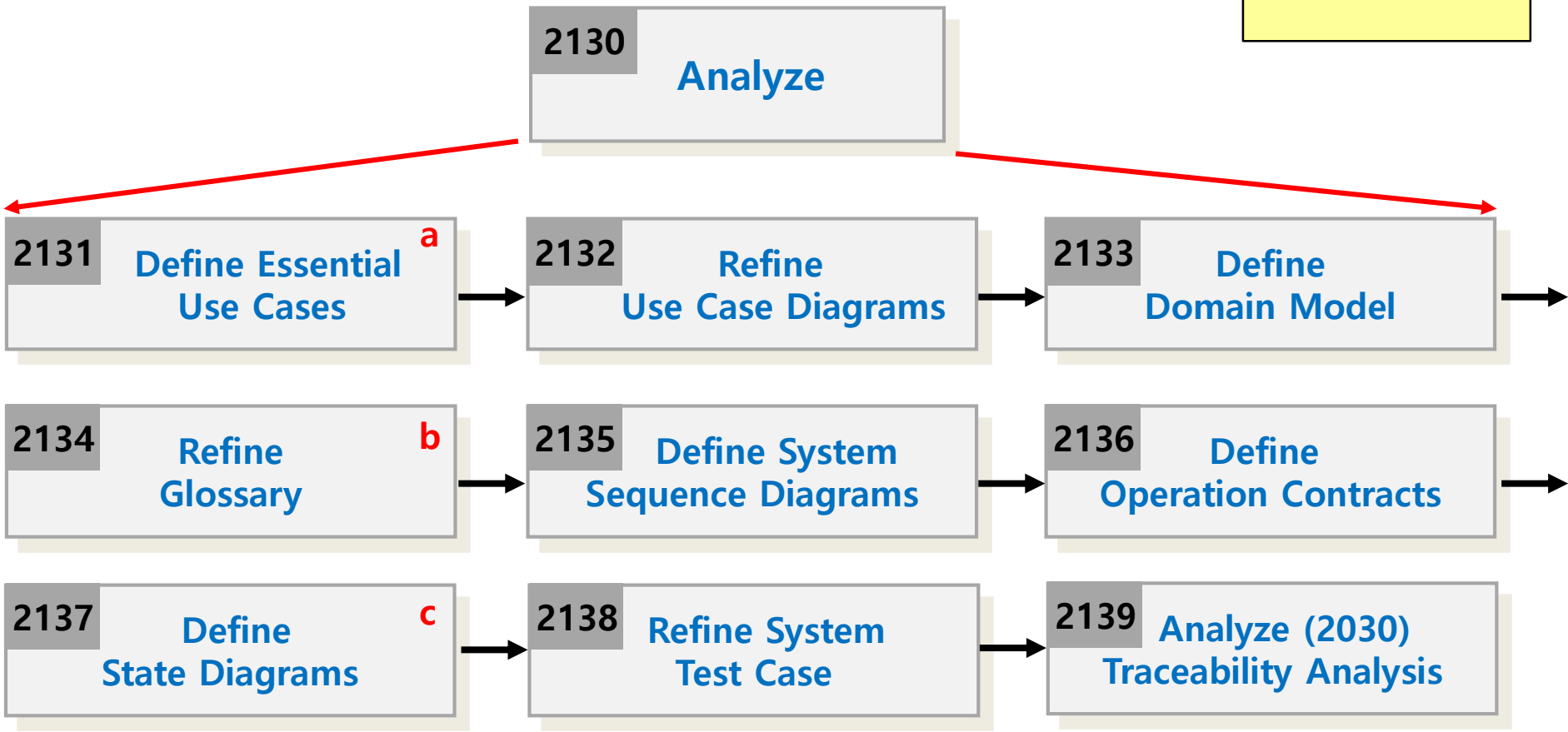
# Phase 2030.
# Analyze



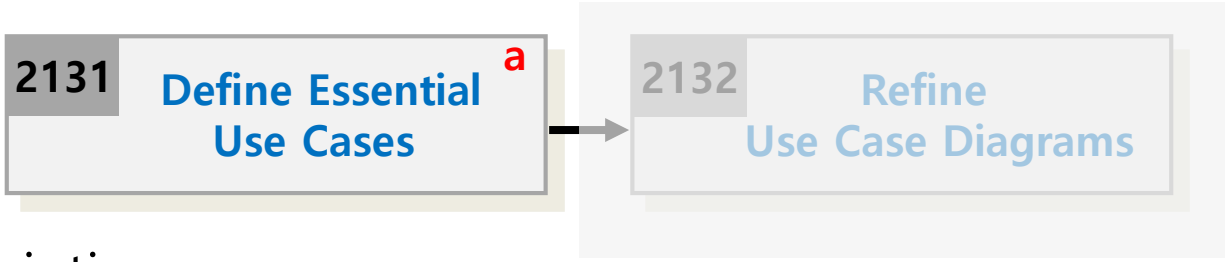
# Phase 2030. Analyze

- Phase 2030 Activities

a. if not yet done
b. ongoing
c. optional



# Activity 2031. Define Essential Use Cases




- Description
  - Add event flows to business use case(high-level) descriptions
  - Input : business use case descriptions (activity 1006)
  - Output : An essential use case descriptions
  - Standard applied : expanded use case format

# Activity 2031. Define Essential Use Cases

- Step
  1. Select each use case from business use cases
  2. Identify system functions related to the selected use case from requirements specification
  3. Identify related use cases to the selected use case from business use cases
  4. Identify courses of events for each use case from the requirements specification
     - Typical courses of events (main event flow)
     - Alternative courses of events
     - Exceptional courses of events
  5. Write essential use cases based on typical and alternative courses of events flows by applying expanded use case format.

# Activity 2031. Define Essential Use Cases

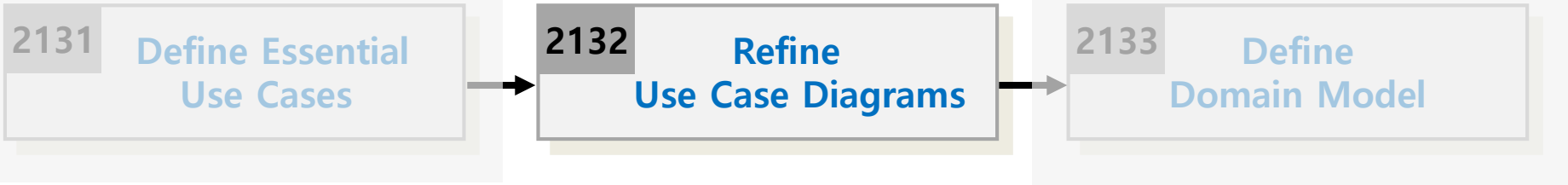
- Expanded Use Case Format
  - Use case: Use Case Name
  - Actors: Actor Name
  - Purpose: The purpose of Use Case
  - Overview: The overview of Use Case
  - Type: Primary, Secondary, or Optional
  - Cross References: System functions in Req. Spec
  - Pre-Requisites: An essential pre-condition
  - Typical Courses of Events: Abstract scenario about the flow of events
  - Alternative Courses of Events:
  - Exceptional Courses of Events: define exceptional cases

# Activity 2031. Define Essential Use Cases

- Example: “Buy Items”

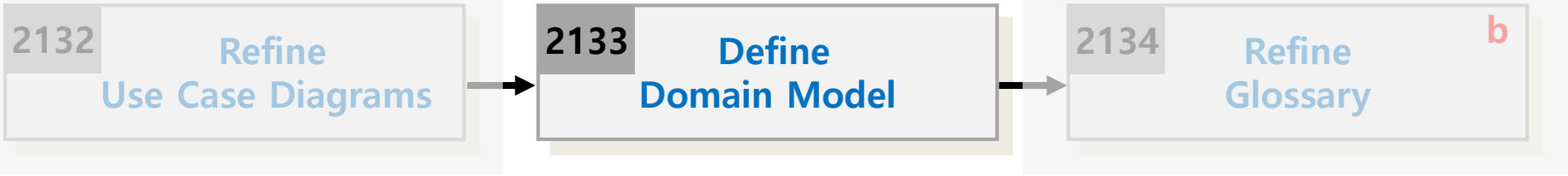
| | |
|---|---|
| **Use Case** | Buy Items |
| **Actor** | Customer, Cashier |
| **Purpose** | Capture a sale and its payment |
| **Overview** | A Customer arrives at a checkout with items to purchase. The Cashier records the items and collects a payment, which may be authorized. On completion, the Customer leaves with the items. |
| **Type** | Primary and Essential |
| **Cross Reference** | Functions: R1.1, R1.2, R1.3, R1.7, R1.9, R2.1, R2.2, R2.3, R2.4<br>Use Cases: Log In use case |
| **Pre-Requisites** | N/A |
| **Typical Courses of Events** | (A) : Actor, (S) : System<br>1. (A) This use case begins when a customer arrives at the POST to checkout with items to purchase.<br>2. (A) The Cashier records each item.(E1)<br>3. (S) Determines the item price and adds the item information to the running sales transaction.<br>4. (A) On completion of item entry, the cashier indicates to the POST that item entry is complete.<br>5. (S) Calculates and presents the sale total.<br>6. (A) The Cashier tells the customer the total. |
| **Alternative Courses of Events** | … |
| **Exceptional Courses of Events** | E1: If invalid item identifier entered, indicate error. |

# Activity 2032. Refine Use Case Diagrams




- Description
  - Validate and modify the 'Business Use-Case Diagram'
  - Input : business use case model, essential use case descriptions
  - Output : A refined use case diagram
  - Standard applied : UML's use case diagram
- Step
  1. Review business use case diagrams according to essential use case descriptions
  2. Refine use case diagrams by adding or refining use cases and relationships

# Activity 2033. Define Domain Model




- Description
  - Define domain concept model by reviewing input artifacts
  - Input : essential use case descriptions, business concept model
  - Output : A conceptual class diagram
  - Standard applied : UML's use case diagram

- What is domain model?
  - A representation of conceptual classes identified from a real world
  - Illustrates meaningful conceptual classes in a problem domain.
  - Conceptual models
  - Widely used as a source of inspiration for designing software objects.

# Activity 2033. Define Domain Model

- Step
  1. List concepts(domain class) from use cases or business concept model
     - Guideline 1
       - Identify concepts by making a list of candidate concepts from the 'Concept Category List'
     - Guideline 2
       - Identity the noun and noun phrases in expanded use cases description and consider them as candidate concepts or attributes

# Activity 2033. Define Domain Model

- By using guideline 1
  - 'Concept Category List' may contain many common categories that are usually worth to consider

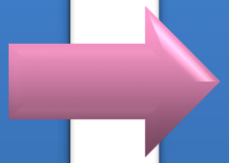
| Concept Category | Examples |
|---|---|
| Physical or tangible objects | POST |
| Specifications, designs, or descriptions of things | Product Specification |
| Places | Store |
| Transactions | Sale<br>Payment |
| Transaction line items | Sales Line Item |
| Roles of people | Cashier |
| Containers of other things | Store |
| Things in a container | Item |
| Other computer or electro-mechanical systems external to our system | Credit Card Authorization System |
| … | … |

# Activity 2033. Define Domain Model

- By using guideline 2
  - The fully dressed use cases are an excellent description
  - Scenario of the use case or use case descriptions can be used.

**Main Success Scenario (or Basic Flow):**
1. Customer arrives at a POS checkout with goods and/or services to purchase.
2. Cashier starts a new sale.
3. Cashier enters item identifier.
4. System records sale line item and presents item description, price, and running total. Price is calculated from a set of price rules.
5. System presents total price with taxes calculated.
6. Cahier tells Customer the total, and asks for payment.
7. Customer pays and System handles payment.
8. System logs the completed sale and sends sale and payment information to external accounting (for accounting and commissions) and inventory system (to update inventory).
9. System presents receipt.
10. Customer leaves with receipt and goods (if any).

…



**Register**
**Product Specification**
**Item**
**Sales Item**
**Store**
**Cashier**
**Sale**
**Customer**
**Payment**
**Manager**
**Product Catalog**

# Activity 2033. Define Domain Model

2. Assign class names into concepts
   - Use the existing names in the domain
   - Do not add things that are not there
3. Identify associations according to association categories

| Association Category | Identified Associations |
|---|---|
| A is a physical part of B | Drawer – POST |
| A is a logical part of B | SalesLineItem – Sale |
| A is physically contained in/on B | POST – Store<br>Item – Shelf |
| A is logically contained in B | ItemDescription – Catalog |
| A is a description for B | ItemDescription – Item |
| A is a line item of a transaction or report B | SalesLineItem – Sale |
| A is known/logged/recorded/reported/captured in B | Sale – POST |
| A is a member of B | Cashier –Store |
| A is an organizational submit of B | Department – Store |
| … | … |

# Activity 2033. Define Domain Model

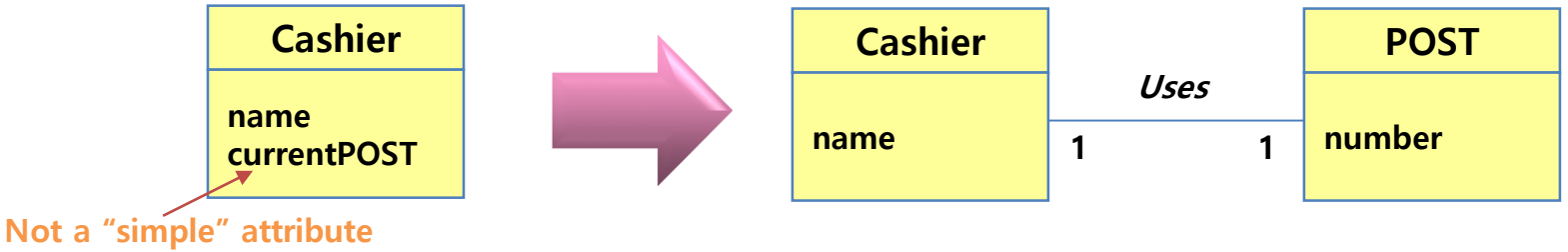
4. Assign priorities into identified associations
   - High priority association categories are
     - A is a physical or logical part of B.
     - A is physically or logically contained in/on B.
     - A is recorded in B.
   - Should avoid showing redundant or derivable associations

5. Assign names into associations
   - *"Type Name" – "Verb Phrase" – "Type Name"*
   - Association names should start with a capital letter.

# Activity 2033. Define Domain Model

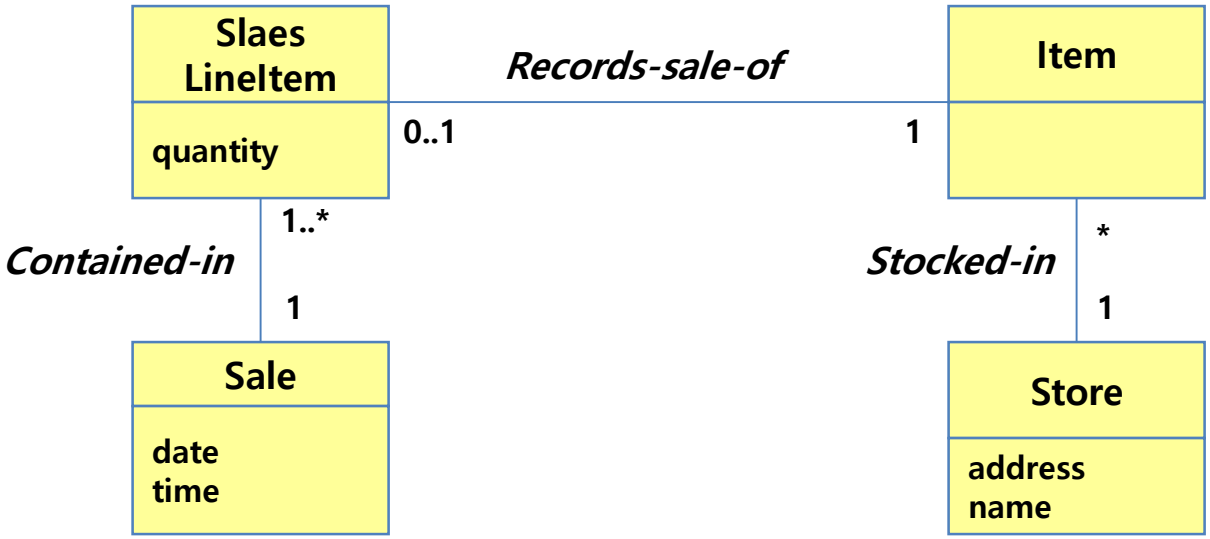
6. Add multiplicity into the ends of an association


7. Identify attributes by reading
   - requirement specifications, current use cases under consideration, simplification, clarification, and assumption documents
   - Attributes should be simple attributes or pure data values
     - Boolean, Date, Number, String, Time
     - Address, Color, Geometrics(Point, Rectangle,…), Phone Number, Social Security Number, Universal Product Code(UPC), ZIP or postal codes, Enumerated types.



# Activity 2033. Define Domain Model

8. Draw them in a conceptual class diagram

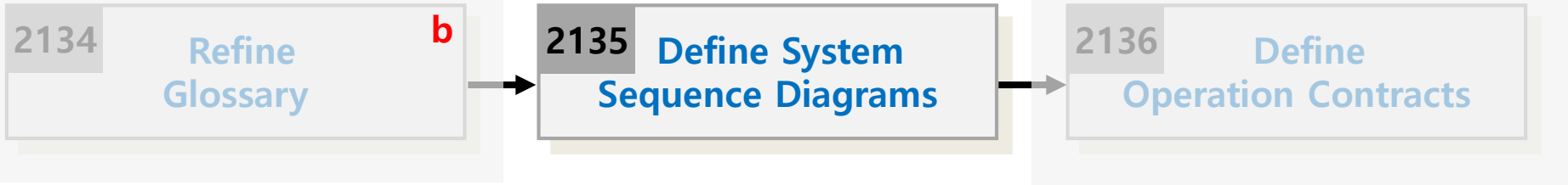


# Activity 2034. Refine Glossary


- Description
  - Lists and refines all the terms in order to improve communication and reduce the risk of misunderstanding
  - Input : term dictionary, essential use case descriptions, conceptual class diagram
  - Output : A refined term dictionary
- Step
  1. Refine terms defined in the Plan and Elaborate Phase(use cases, attributes, concept, etc.) during development cycle.
  2. Record terms as following format:

| Term | Category | Comments |
|---|---|---|
| Payment | Concept (Class) | a cash payment |
| … | … | … |

# Activity 2035.
# Define System Sequence Diagrams



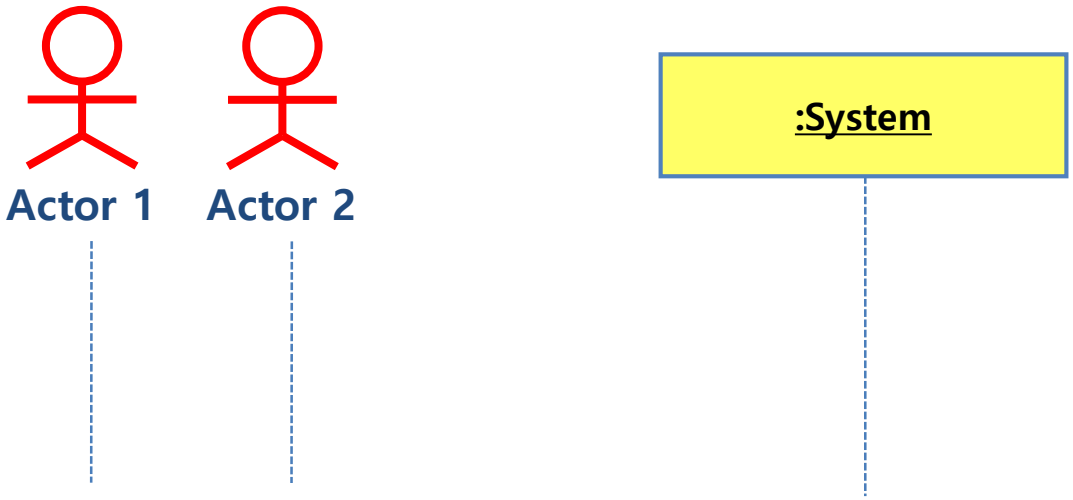

- Description
  - Illustrates events from actors to systems.
  - To investigate the system to build
  - Input : essential use case descriptions, use case diagram
  - Output : A sequence diagram

# Activity 2035.
# Define System Sequence Diagrams

- What is a system sequence diagram(SSD) ?
  - A picture that shows the events that external actors generate, their orders, and inter-system events
  - **All systems are treated as a black box**
  - The emphasis of the diagram is events that cross the system boundary from actors to systems
  - SSDs should be defined for
    - Main success scenarios
    - Frequent, complex, or alternative scenarios

# Activity 2035.
# Define System Sequence Diagrams

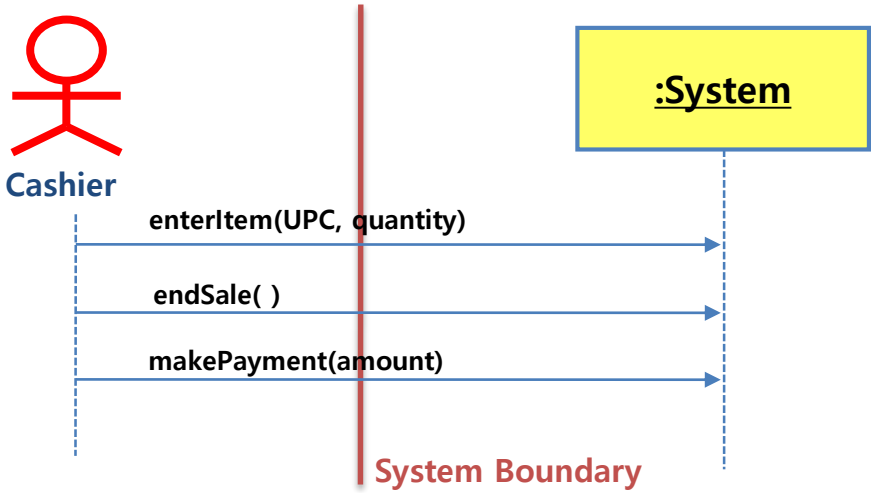
- Step
  1. Draw a black box representing the system based on a use case
  2. Identify each actor that directly operate on the system from the typical(normal) course of events in a use case
     - Draw a line for each actor



# Activity 2035.
# Define System Sequence Diagrams

3. Determine system boundary
   - Hardware/software boundary of a device or computer system
   - Department of an organization or Entire organization
- Identify the system(external) events that each actor generates by according to typical course of events in a use case
- Name system events
  - Should be expressed at the level of intent rather than of the physics
  - Name a system event with a verb and an objective like "enterItem"

**Scenario: Buy Items**



# Activity 2035.
# Define System Sequence Diagrams

4. Include the use case text which corresponds to system event to the left of the system sequence diagram

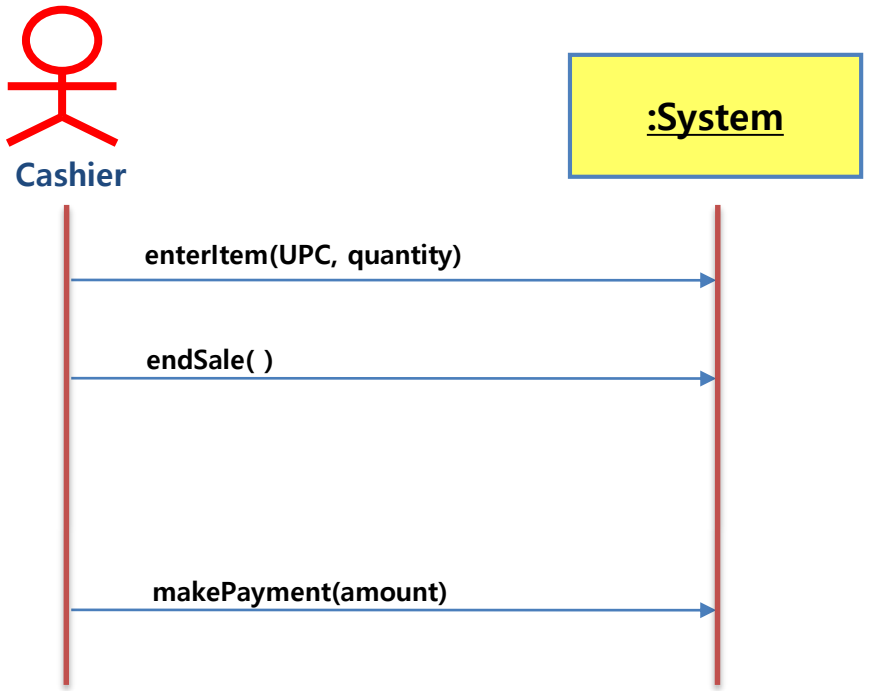
**USE CASE: Buy Items**

**Typical Course of Events**

**1. This use case begins when a Customer arrives at the POST to checkout with items to purchase.**

**2. The Cashier records the universal product code(UPC) from each item. If there is more than one of the same item, the Cashier can enter the quantity as well.**

**3. System determines the item price and adds the item information to the running sales transaction. The description and price of the current item are displayed.**



# Activity 2036. Define Operation Contracts


- Description
  - Define contracts for system operations
  - Input : system sequence diagram, conceptual class diagram
  - Output : Operation Contracts

- What is a contract?
  - A document that describes what an operation commits to achieve
  - Written for each system operation to describe its behavior
  - System Operation Contract : Describes changes in states of overall system when a system operation is invoked

# Activity 2036. Define Operation Contracts

- Step
  1. Identify system operations from system sequence diagrams
     - A system operation : an operation of the system that executes in response to a system event in sequence diagram.
  2. Fill in operation name sections with contract's names
     - Name: enterItem(upc: number, quantity: integer)
  3. Fill in responsibilities sections
     - Responsibilities: Enter sale of an item and add it to the sale.
       Display the item description and price.
  4. Fill in post-condition sections
     - Post-conditions are declarations about the system state that are true when the operation has finished.
  5. Fill in pre-condition sections
     - Pre-conditions define assumptions about the state of the system at the beginning of the operation.
  6. Fill in other (optional) sections

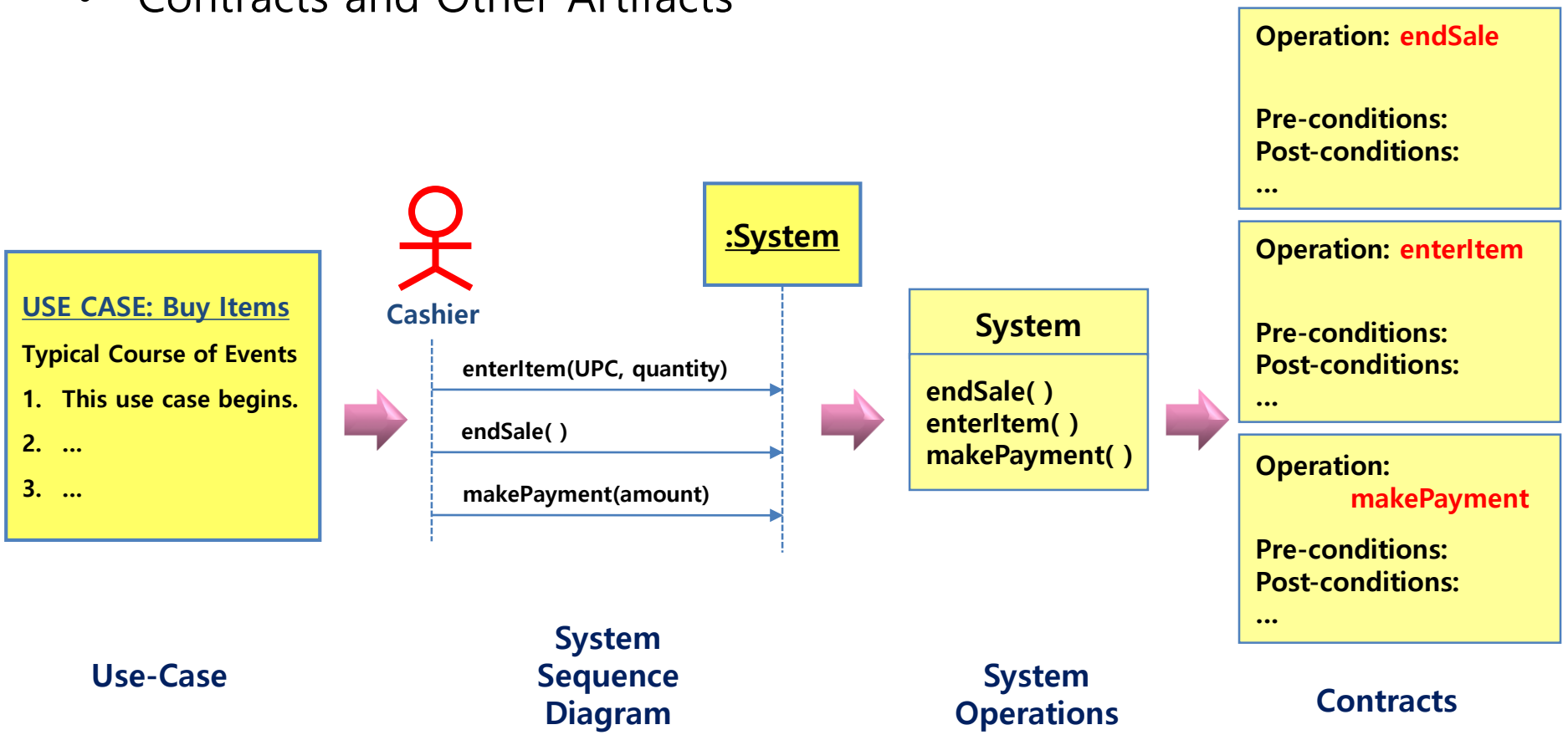
# Activity 2036. Define Operation Contracts

- Operation Contracts Format

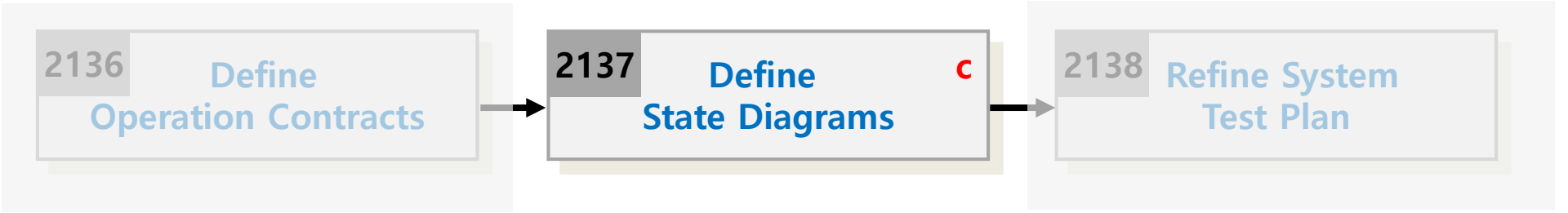
| | |
|---|---|
| **Name** | Name of operation, and parameters |
| **Responsibilities** | An informal description of the responsibilities that the operation must fill |
| **Type** | Name of type(concept, software class, interface) |
| **Cross References** | System function reference numbers, use cases, etc. |
| **Notes** | Design notes, algorithms, and so on. |
| **Exceptions** | Exceptional cases |
| **Output** | Non-UI outputs, such as messages or records that are sent outside of the system |
| **Pre-conditions** | Assumptions that the state of the system before execution of the operation |
| **Post-conditions** | The state of the system after completion of the operation |
| **…** | |

# Activity 2036. Define Operation Contracts

- Contracts and Other Artifacts



# Activity 2037. Define State Diagrams




- Description
  - Describes all possible states of the system, use cases, or objects
  - Input : essential use case diagram, conceptual class diagram
  - Output : A state diagrams

- Three kinds of State diagrams:
  1. Use case state diagram
  2. System state diagram
  3. Class state diagram

# Activity 2037. Define State Diagrams

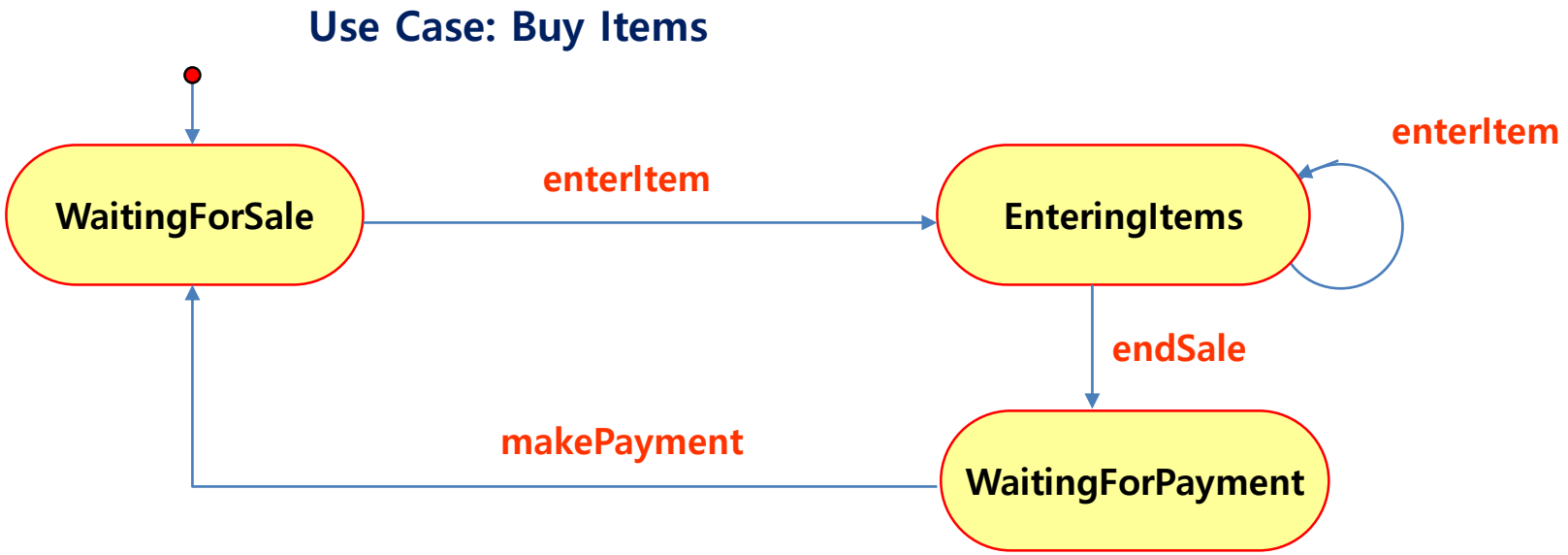
- Event
  - A significant or noteworthy occurrence
  - Ex) a telephone receiver is taken off the hook

- State
  - Condition of an object at a moment in time
  - Ex) a telephone is in the state of being "idle" after the receiver is placed on the hook and until it is taken off the hook

- Transition
  - A relationship between two states that indicates that when an event occurs and the object moves from one state to another
  - Ex) when the event "off hook" occurs, transition occurs from the "idle" to "active" state

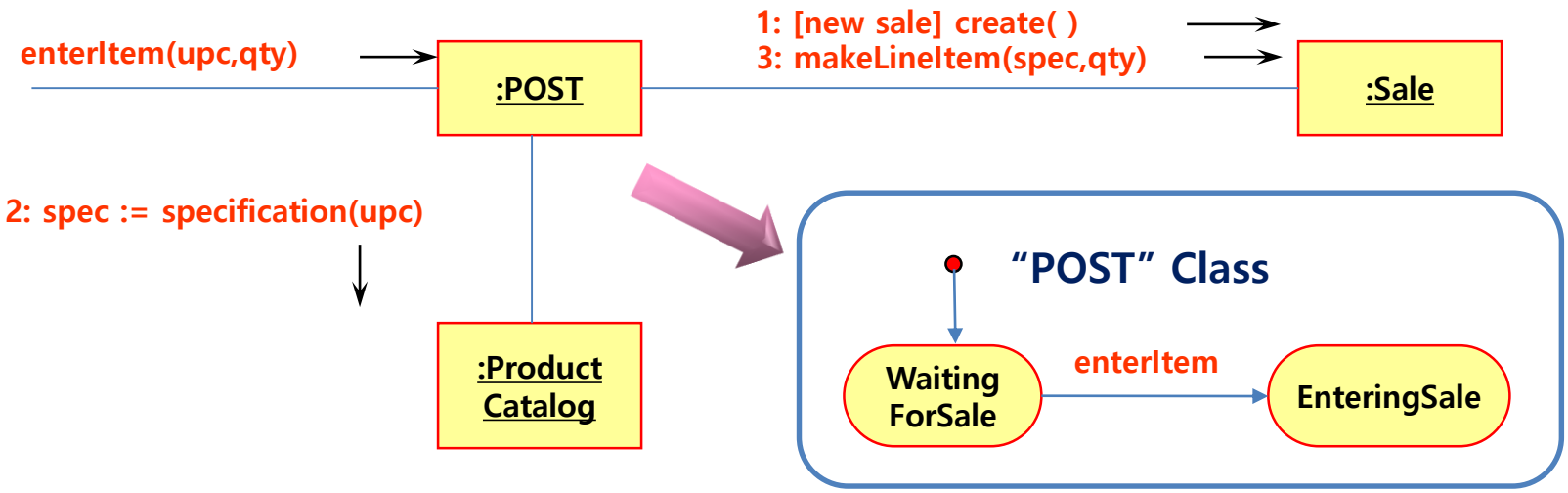
# Activity 2037. Define State Diagrams

- Use Case State Diagram
  - A state diagram that depicts the overall system events and their sequence within a use case



# Activity 2037. Define State Diagrams

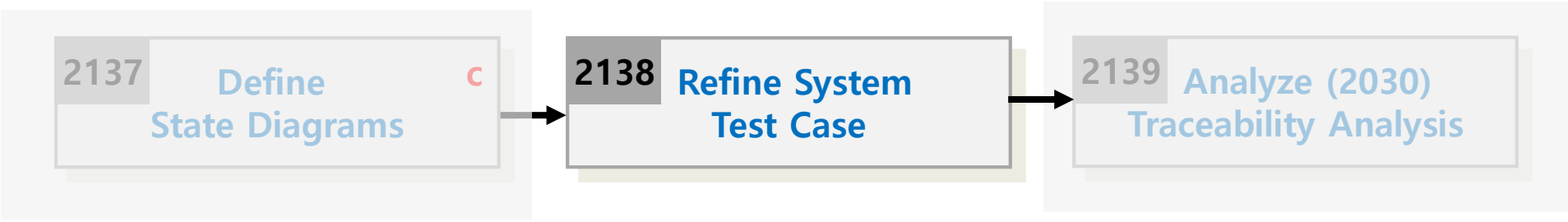
- Class State Diagram
  - A state diagram that depicts state changes of a class across all the use cases
  - Identify a class from interaction diagram
  - A union of all the use case state diagrams



# Activity 2037. Define State Diagrams

- System State Diagram
  - Identify system events from system sequence diagram
  - Determine sequence of system events
  - Assign system events into transition of state diagram
  - This is an optional activity

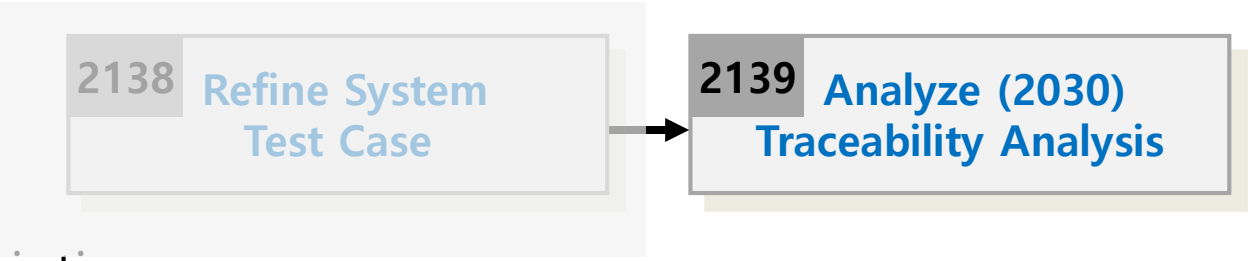
# Activity 2038. Refine System Test Case




- Description
  - Refine system test plan by using additional information
  - Input : essential use case description, system test plan, sequence diagram
  - Output : refined system test plan

- Step :
  - Refine the results of activity 1009 with the results of analyze process

# Activity 2039.
# Analyze (2030) Traceability Analysis



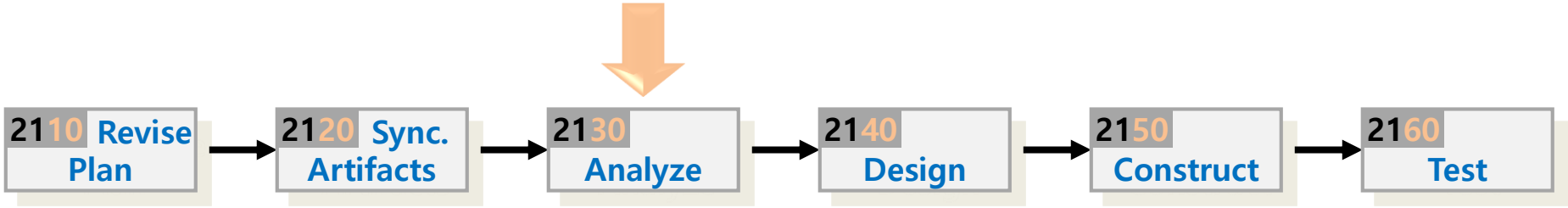

- Description
  - Analysis the connection of results which are the results of analyze (2030) step
    - Identify the connection of use cases, system sequence diagram and operation contracts
  - Input : Essential use case description, sequence diagram
    operation contracts
  - Output : Traceability analysis result
- Step
  - Writing the relations about the results of each step

# Activity 2039.
# Analyze (2030) Traceability Analysis

- Example of Analyze traceability

| System Function | Use Case | Operation |
|---|---|---|
| R 1.1 System Access | Login | 1: enterInfo |
| R 1.2 Make Account | Logout | 2: reqLogin |
| R 1.3 Identify Balance | Make Account | 3: reqLogout |
| R 1.4 Recharge Balance | Identify Balance | 4: reqMakeAcc |
| R 2.1 Request Print | Recharge Balance | 5: enterAccInfo |
| R 2.2 Check Balance | Request Print | 6: reqAccount |
| R 3.1 Identify Paper | Check Balance | 7: reqBalance |
| R 3.2 Recharge Paper | Identify Paper | 8: enterFee |
| R 3.3 Identify User | Recharge Paper | 9: reqRecharge |
| R 3.4 Identify Money | Identify User | 10: enterSheet |
| | Identify Money | 11: reqPrint |
| | | 12: reqPaperIdentify |
| | | 13: enterPaperNum |
| | | 14: reqCharge |
| | | 15: reqUserInfo |
| | | 16: reqMoneyInfo |

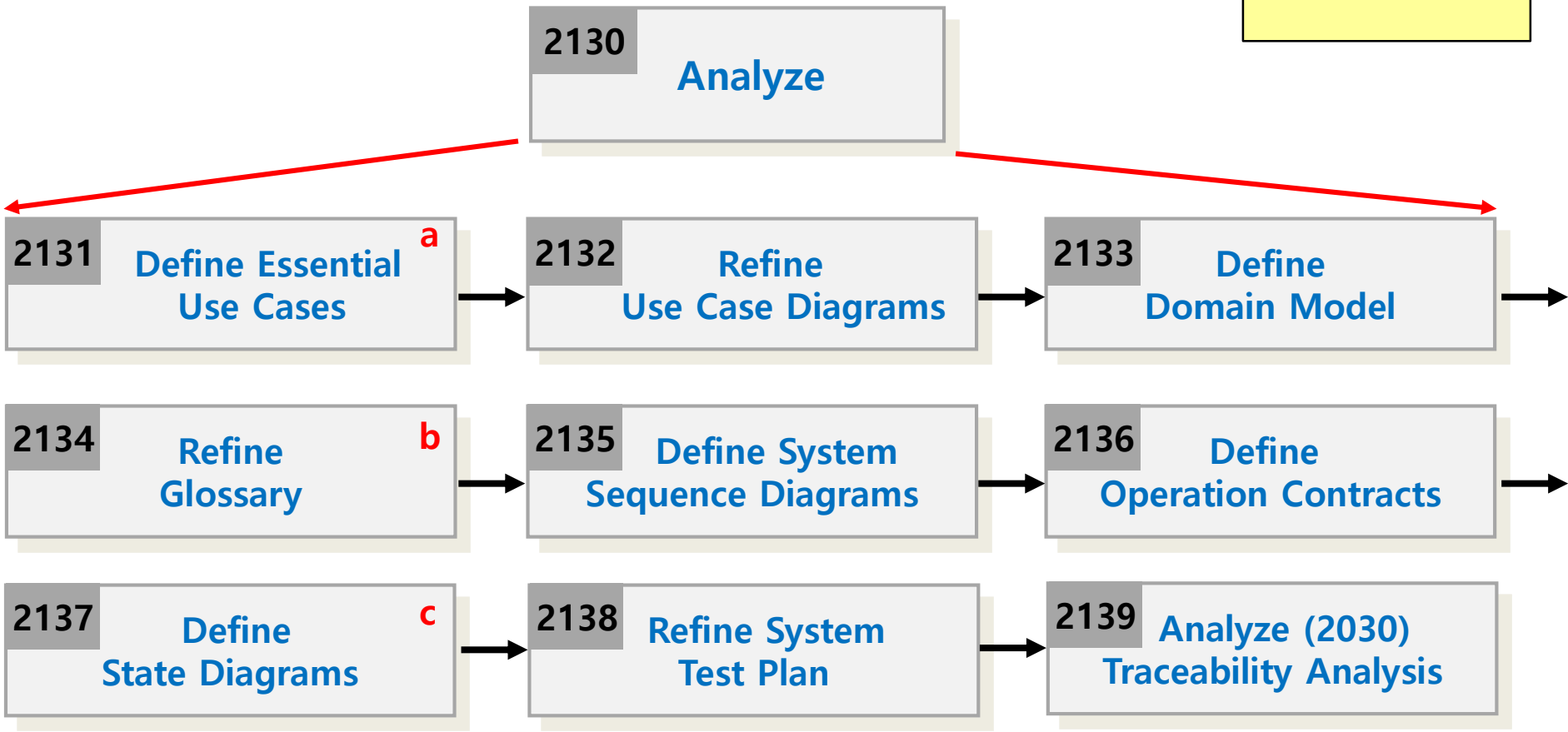
# Phase 2030.
# Analyze
## -Case Study-



# Phase 2030. Analyze

- Phase 2030 Activities

a. if not yet done
b. ongoing
c. optional



# Activity 2031. Define Essential Use Cases

| | |
|---|---|
| **Use Case** | Login |
| **Actor** | User, Manager |
| **Purpose** | User와 manager가 시스템에 접속하기 위해 로그인 할 수 잇도록 한다. |
| **Overview** | ID/PW 를 입력 받아 계정과 비밀번호가 일치하는 경우 user or manager로 로그인 한다.<br>일치하는 계정이 없는 경우 로그인 되지 않는다. |
| **Type** | Primary |
| **Cross Reference** | Functions: R 1.1,<br>Use Cases: |
| **Pre-Requisites** | N/A |
| **Typical Courses of Events** | (A) : Actor, (S) : System<br>1. (A) : ID/PW를 입력 한다.<br>2. (A) : 로그인을 요청한다.<br>3. (S) : 일치하는 계정이 있는지 검사 후 존재 하는 경우 user or manage로 접속 승인 한다. |
| **Alternative Courses of Events** | … |
| **Exceptional Courses of Events** | E1. 일치하는 계정이 없는 경우 접속되지 않는다. |

# Activity 2031. Define Essential Use Cases

| | |
|---|---|
| **Use Case** | Logout |
| **Actor** | User, Manager |
| **Purpose** | 접속된 User or Manager의 접속을 종료한다. |
| **Overview** | Logout 버튼을 누르면 접속된 user or manager의 접속을 종료하고 초기화면으로 돌아간다. |
| **Type** | Primary |
| **Cross Reference** | Functions: R 1.1<br>Use Cases: |
| **Pre-Requisites** | Login이 선행 되어야 한다. |
| **Typical Courses of Events** | (A) : Actor, (S) : System<br>1. (A) : 로그아웃을 요청 한다.<br>2. (S) : 시스템 접속을 종료하고 초기화면으로 돌아간다. |
| **Alternative Courses of Events** | … |
| **Exceptional Courses of Events** | N/A |

# Activity 2031. Define Essential Use Cases

| | |
|---|---|
| **Use Case** | Make Account |
| **Actor** | User |
| **Purpose** | 새로운 사용자 계정을 생성한다. |
| **Overview** | 생성할 계정의 id/pw를 입력 후 생성 버튼을 눌러 새로운 사용자 계정을 생성 할 수 있다. 새로 생성한 계정은 동일한 id가 없는 경우에만 생성 된다. |
| **Type** | Primary |
| **Cross Reference** | Functions: R 1.2<br>Use Cases: |
| **Pre-Requisites** | N/A |
| **Typical Courses of Events** | (A) : Actor, (S) : System<br>1. (A) : 계정 생성을 요청한다.<br>2. (A) : ID/PW를 입력 한다.<br>3. (S) : ID/PW를 확인 하여 기존 사용자와 비교 한다.<br>4. (S) : 계정 생성에 적합한 경우 사용자 계정을 생성 한다. |
| **Alternative Courses of Events** | … |
| **Exceptional Courses of Events** | E1. 동일한 id를 가진 계정이 이미 존재하는 경우 생성하지 않는다. |

# Activity 2031. Define Essential Use Cases

| | |
|---|---|
| **Use Case** | Identify Balance |
| **Actor** | User |
| **Purpose** | 사용자 계정에 남아있는 잔액을 확인 한다. |
| **Overview** | 사용자의 잔액 확인 요청 시 남아있는 잔액을 확인하여 출력 한다. |
| **Type** | Primary |
| **Cross Reference** | Functions: R 1.3<br>Use Cases: |
| **Pre-Requisites** | 사용자로 login이 선행 되어야 한다. |
| **Typical Courses of Events** | (A) : Actor, (S) : System<br>1. (A) : 잔액 확인을 요청 한다.<br>2. (S) : 해당 사용자의 잔액을 확인 후 출력 한다. |
| **Alternative Courses of Events** | … |
| **Exceptional Courses of Events** | |

# Activity 2031. Define Essential Use Cases

| | |
|---|---|
| **Use Case** | Recharge Balance |
| **Actor** | User |
| **Purpose** | 해당 사용자 계정에 잔액을 충전 한다. |
| **Overview** | 입력 받은 금액 만큼 해당 사용자 계정에 잔액을 충전 한다. |
| **Type** | Primary |
| **Cross Reference** | Functions: R 1.4<br>Use Cases: |
| **Pre-Requisites** | 사용자로 login이 선행 되어야 한다. |
| **Typical Courses of Events** | (A) : Actor, (S) : System<br>1. (A) : 금액을 입력 한다.<br>2. (A) : 잔액 충전을 요청한다.<br>3. (S) : 입력 받은 금액 만큼 사용자 계정에 잔액을 충전 한다. |
| **Alternative Courses of Events** | … |
| **Exceptional Courses of Events** | |

# Activity 2031. Define Essential Use Cases

| | |
|---|---|
| **Use Case** | Request Print |
| **Actor** | User |
| **Purpose** | 사용자의 요청을 받아 인쇄를 진행 한다. |
| **Overview** | 사용자의 요청을 받아 입력된 매수 만큼 인쇄를 진행 한다. |
| **Type** | Primary |
| **Cross Reference** | Functions: R 2.1, R 2.2<br>Use Cases: |
| **Pre-Requisites** | 사용자로 login이 선행 되어야 한다. |
| **Typical Courses of Events** | (A) : Actor, (S) : System<br>1. (A) : 인쇄 매수를 입력하고 인쇄를 요청한다.<br>2. (S) : 인쇄 매수에 따라 필요한 요금을 계산한다.<br>3. (S) : 사용자 계정의 잔액과 비교한다.<br>4. (S) : 수익을 기록 한다.<br>5. (S) : 인쇄를 진행 한다. |
| **Alternative Courses of Events** | … |
| **Exceptional Courses of Events** | E 1. 입력 매수에 비해 잔액이 부족한 경우 인쇄를 진행하지 않는다.<br>E 2. 용지 잔량이 부족할 경우 인쇄가 되지 않는다. |

# Activity 2031. Define Essential Use Cases

| | |
|---|---|
| **Use Case** | Check Balance |
| **Actor** | Event-based |
| **Purpose** | 인쇄 진행 시 잔액과 필요 요금을 확인 및 비교 한다. |
| **Overview** | 사용자의 요청에 의해 인쇄 진행 시 시스템의 요청을 받아 필요 요금과 잔액을 체크한다. |
| **Type** | Primary |
| **Cross Reference** | Functions: R 2.1, R 2.2<br>Use Cases: Request Print |
| **Pre-Requisites** | 시스템에 인쇄 요청 후에 동작 한다. |
| **Typical Courses of Events** | (A) : Actor, (S) : System<br>1. (S - A) : 사용자의 인쇄 요청을 받은 시스템이 잔액 확인을 요청한다.<br>2. (S) : 사용자 계정의 잔액과 필요한 요금비교를 통해 인쇄 가능 여부를 체크 한다. |
| **Alternative Courses of Events** | … |
| **Exceptional Courses of Events** | E 1. 잔액이 부족한 경우 인쇄 불가 신호를 보낸다. |

# Activity 2031. Define Essential Use Cases

| | |
|---|---|
| **Use Case** | Identify Paper |
| **Actor** | Manager |
| **Purpose** | 시스템 관리자가 프린터에 남은 용지를 확인 할 수 있다. |
| **Overview** | 시스템 관리자의 요청에 따라 프린터에 남은 용지 잔량을 확인한다. |
| **Type** | Primary |
| **Cross Reference** | Functions: R 3.1<br>Use Cases: |
| **Pre-Requisites** | Manager로 로그인 되어 있어야 한다. |
| **Typical Courses of Events** | (A) : Actor, (S) : System<br>1. (A) : 시스템에 용지 잔량 확인을 요청 한다.<br>2. (s) : 남은 용지 잔량을 확인 후 출력 한다. |
| **Alternative Courses of Events** | … |
| **Exceptional Courses of Events** | |

# Activity 2031. Define Essential Use Cases

| | |
|---|---|
| **Use Case** | Identify Paper |
| **Actor** | Manager |
| **Purpose** | 시스템 관리자가 프린터에 남은 용지를 확인 할 수 있다. |
| **Overview** | 시스템 관리자의 요청에 따라 프린터에 남은 용지 잔량을 확인한다. |
| **Type** | Primary |
| **Cross Reference** | Functions: R 3.1<br>Use Cases: |
| **Pre-Requisites** | Manager로 로그인 되어 있어야 한다. |
| **Typical Courses of Events** | (A) : Actor, (S) : System<br>1. (A) : 시스템에 용지 잔량 확인을 요청 한다.<br>2. (s) : 남은 용지 잔량을 확인 후 출력 한다. |
| **Alternative Courses of Events** | … |
| **Exceptional Courses of Events** | |

# Activity 2031. Define Essential Use Cases

| | |
|---|---|
| **Use Case** | Recharge Paper |
| **Actor** | Manager |
| **Purpose** | 시스템 관리자의 요청에 따라 시스템의 용지 잔량을 충전 한다. |
| **Overview** | 시스템 관리자가 요청한 매수 만큼 시스템의 용지 잔량을 충전 한다. |
| **Type** | Primary |
| **Cross Reference** | Functions: R 3.2<br>Use Cases: |
| **Pre-Requisites** | Manager로 로그인 되어 있어야 한다. |
| **Typical Courses of Events** | (A) : Actor, (S) : System<br>1. (A) : 충전할 용지 매수를 입력 한다.<br>2. (A) : 용지 충전을 요청 한다.<br>3. (s) : 요청 받은 수 만큼의 용지를 충전 한다. |
| **Alternative Courses of Events** | … |
| **Exceptional Courses of Events** | E 1. 입력 받은 매수가 없는 경우 충전이 되지 않는다. |

# Activity 2031. Define Essential Use Cases

| | |
|---|---|
| **Use Case** | Identify User |
| **Actor** | Manager |
| **Purpose** | 관리자가 사용자들의 정보를 확인 한다. |
| **Overview** | 관리자의 요청에 따라 사용자들의 id/pw, 잔액 정보를 확인한다. |
| **Type** | Primary |
| **Cross Reference** | Functions: R 3.3<br>Use Cases: |
| **Pre-Requisites** | Manager로 로그인 되어 있어야 한다. |
| **Typical Courses of Events** | (A) : Actor, (S) : System<br>1. (A) : 사용자 정보 확인을 요청한다.<br>2. (S) : 사용자들의 정보를 출력 한다. |
| **Alternative Courses of Events** | … |
| **Exceptional Courses of Events** | |

# Activity 2031. Define Essential Use Cases

| | |
|---|---|
| **Use Case** | Identify Money |
| **Actor** | Manager |
| **Purpose** | 총 수익을 확인 한다. |
| **Overview** | 관리자의 요청에 따라 지금까지의 총 수익을 확인 한다. |
| **Type** | Primary |
| **Cross Reference** | Functions: R 3.4<br>Use Cases: |
| **Pre-Requisites** | Manager로 로그인 되어 있어야 한다. |
| **Typical Courses of Events** | (A) : Actor, (S) : System<br>1. (A) : 수익 확인을 요청 한다.<br>2. (S) : 지금까지의 누적 수익을 출력 한다. |
| **Alternative Courses of Events** | … |
| **Exceptional Courses of Events** | |

# Activity 2033. Define Domain Model

- List concepts from use cases or business concept model

| | | |
|---|---|---|
| Account | Balance | Print |
| Manage | Access | login |
| logout | Charge | |

# Activity 2033. Define Domain Model

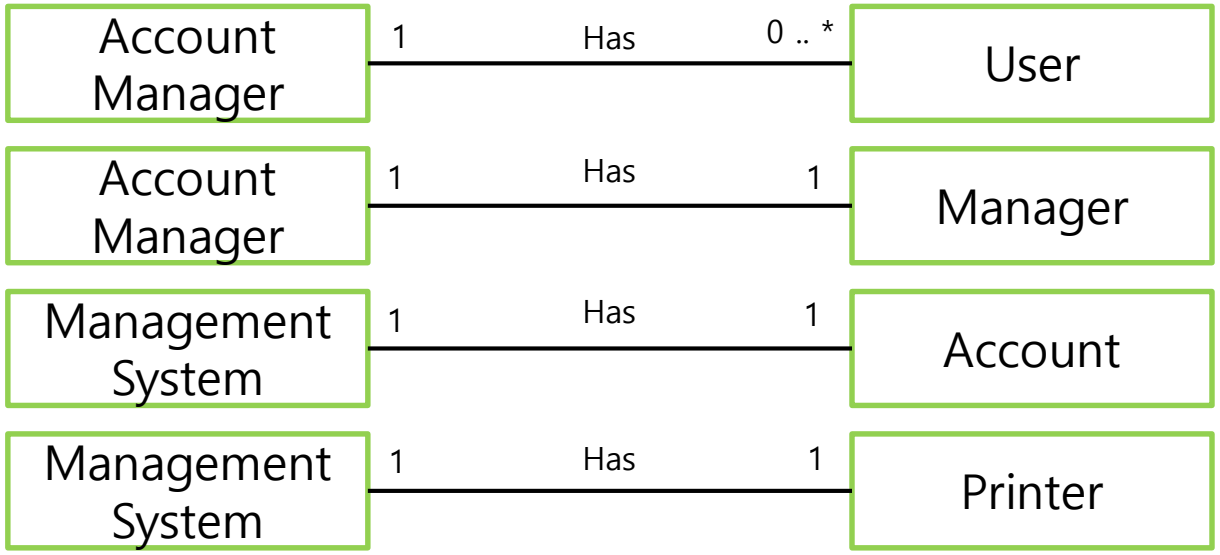
- Assign class names into concepts
- Draw a conceptual class diagram


- Identify and add associations

| Association Category | Associations |
|---|---|
| A has B | ManagementSystem - Printer<br>ManagementSystem - Account<br>Account – User<br>Account – Manager |

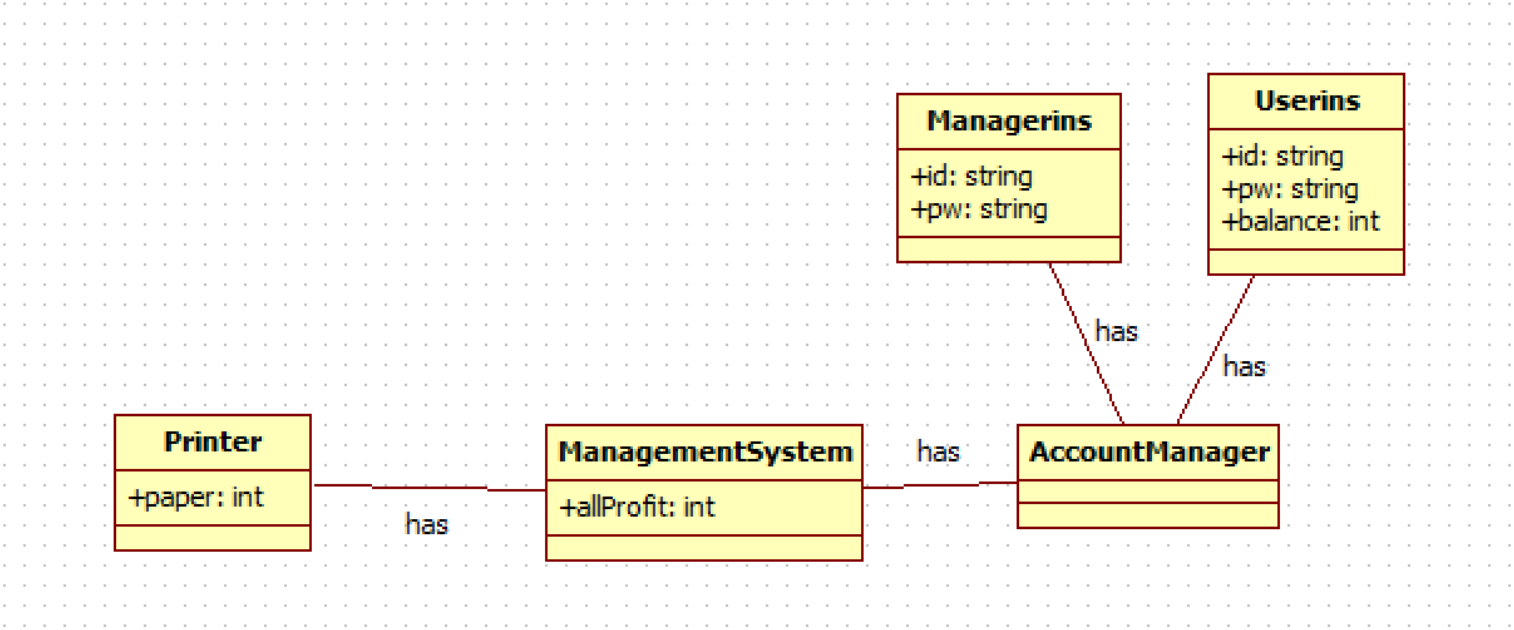
# Activity 2033. Define Domain Model

- Add Roles and Multiplicity



# Activity 2033. Define Domain Model

- Draw a conceptual class diagram and add attributes



# Activity 2034. Refine Glossary

| Glossary | Description |
|---|---|
| Paper:int | 용지 잔량 |
| allProfit:int | 전체 수익금 |
| currentMode:String | 현재 로그인된 계정의 모드<br>(user, manager) |
| currentScreen:String | 현재 스크린의 상태 표현<br>시작 화면, 계정생성, 유저, 매니저 |
| id:String | 아이디 |
| pw:String | 비밀번호 |
| balance:int | User 계정의 잔액 정보 |

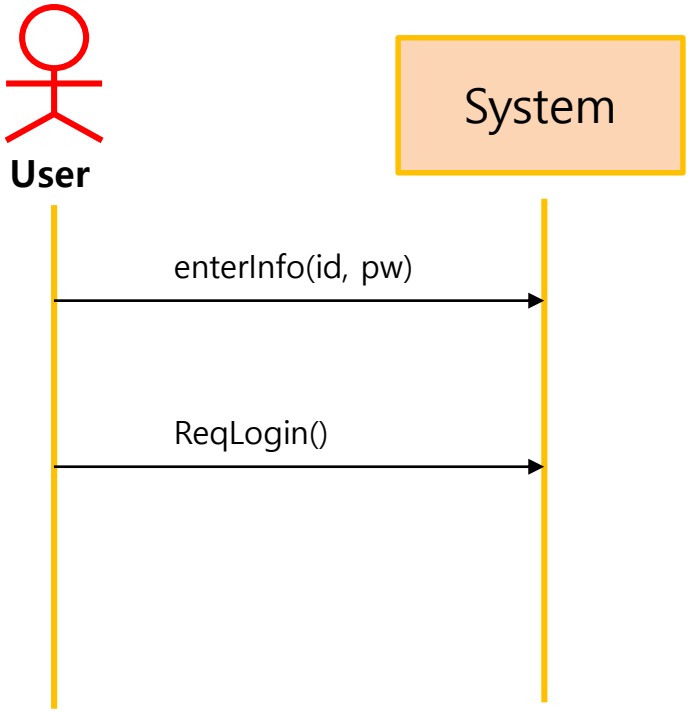
# Activity 2035.
# Define System Sequence Diagrams

| Use Case | Name of Actor-Activated Event |
|---|---|
| 1. Login | enterInfo |
| | reqLogin |
| 2. Logout | reqLogout |
| 3. Make Account | reqMakeAcc |
| | enterAccInfo |
| | reqAccount |
| 4. Identify Balance | reqBalance |
| 5. Recharge Balance | enterFee |
| | reqRecharge |
| 6. Request Print | enterSheet |
| | reqPrint |
| 8 Identify Paper | req Identify Paper |
| 9. Recharge Paper | enterPaperNum |
| | reqCharge |
| 10. Identify User | reqUserInfo |
| 11. Identify Money | reqMoneyInfo |

# Activity 2035.
# Define System Sequence Diagrams

Use Case : Login

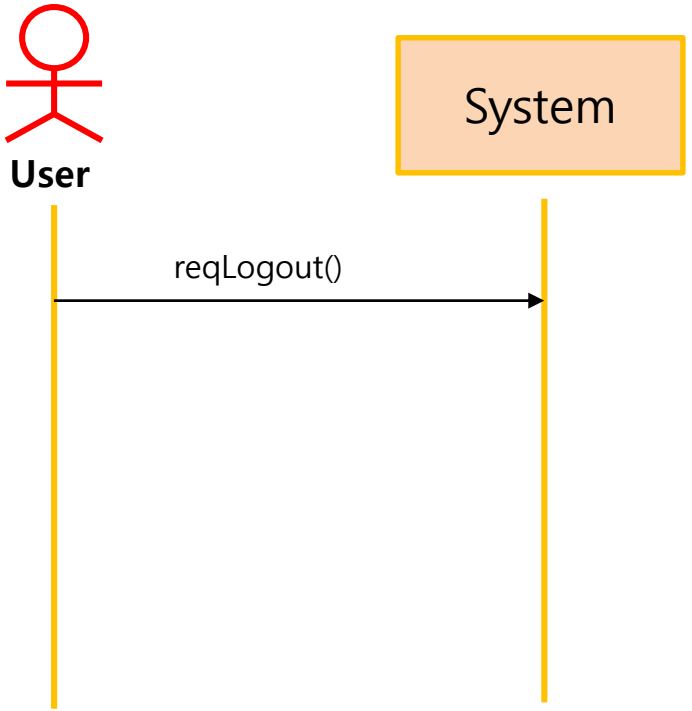
1. 사용자가 id, pw를 입력 한다.
2. 사용자가 로그인을 요청 한다.
3. 계정과 일치할 경우 로그 인을 승인 한다.



# Activity 2035.
# Define System Sequence Diagrams

Use Case : Logout

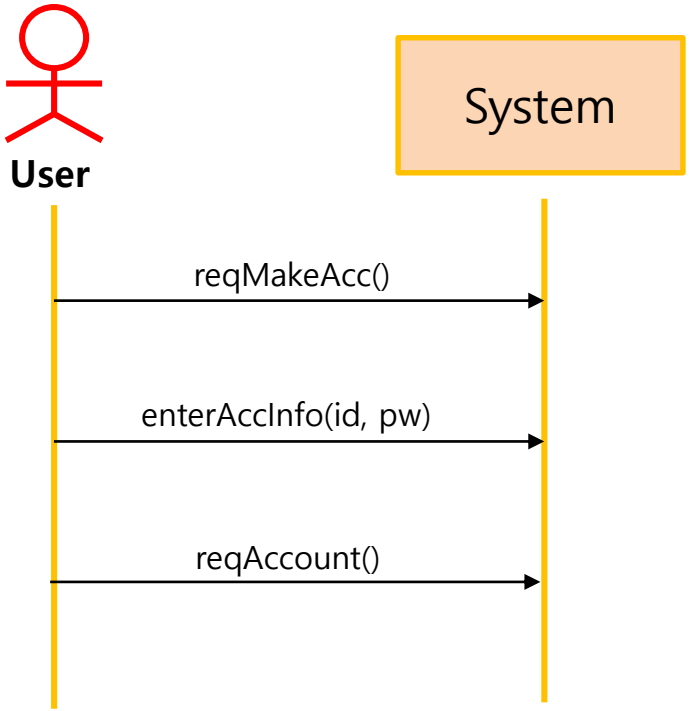
1. 사용자가 logout을 요청 한다.
2. 시스템에서 초기화 후 접속 종료 한다.



# Activity 2035.
# Define System Sequence Diagrams

Use Case : make Account

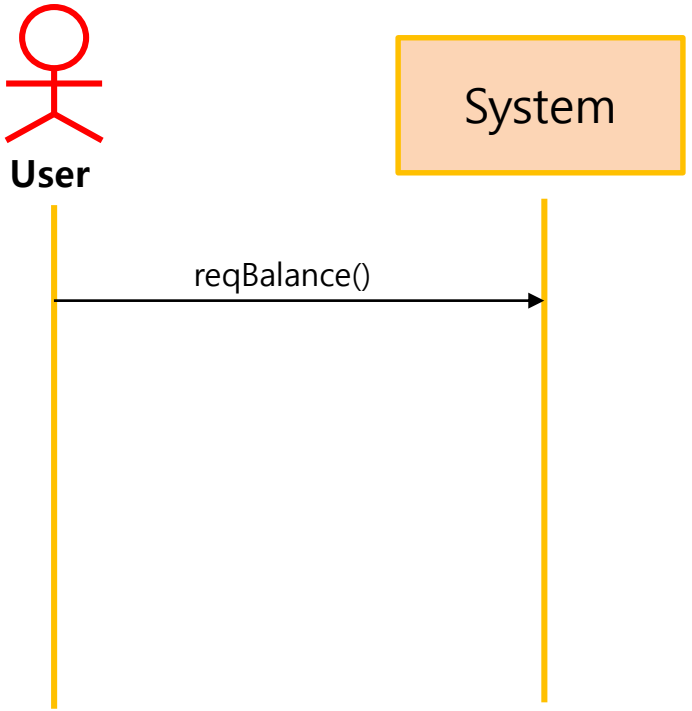
1. 사용자가 계정 생성을 요청 한다.
2. 사용자가 생성할 계정의 정보를 입력 한다.
3. 정보 입력 후 승인을 요청 한다.
4. 시스템이 계정 정보 확인 후 계정을 생성 한다.



# Activity 2035.
# Define System Sequence Diagrams

Use Case : Identify Balance

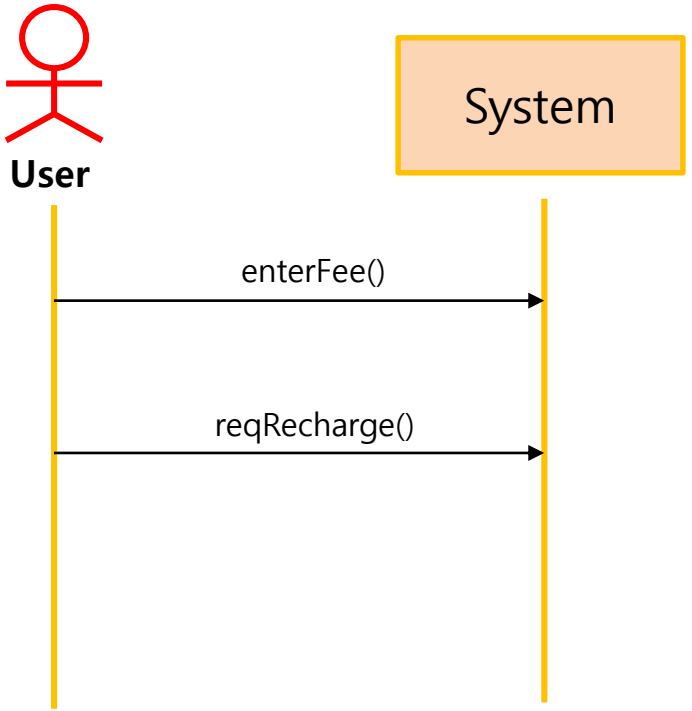
1. 사용자가 잔액 정보 확인을 요청 한다.
2. 시스템이 해당 사용자의 정보를 출력 한다.



# Activity 2035.
# Define System Sequence Diagrams

Use Case : Recharge Balance

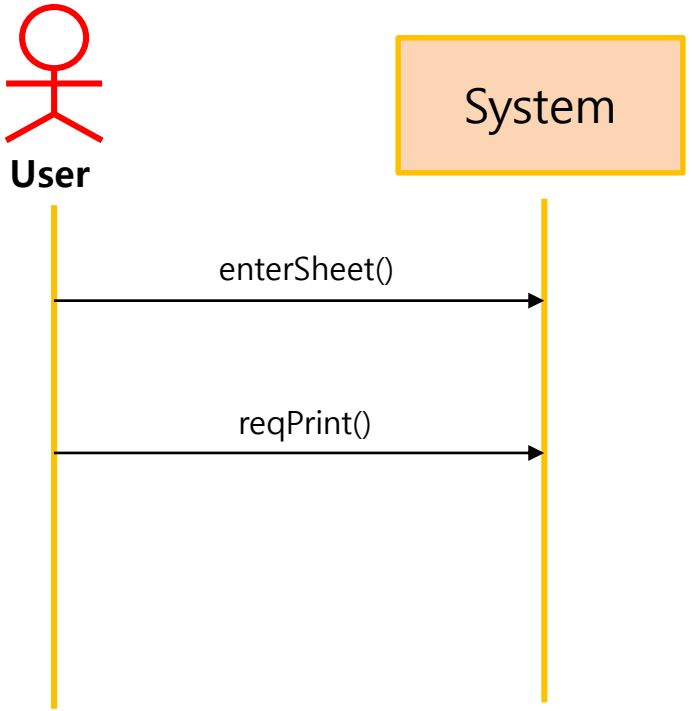
1. 사용자가 충전 금액을 입력 한다.
2. 사용자가 잔액 충전을 요청 한다.
3. 시스템이 요청 받은 금액만큼 잔액을 충전 한다.



# Activity 2035.
# Define System Sequence Diagrams

Use Case : Request Print

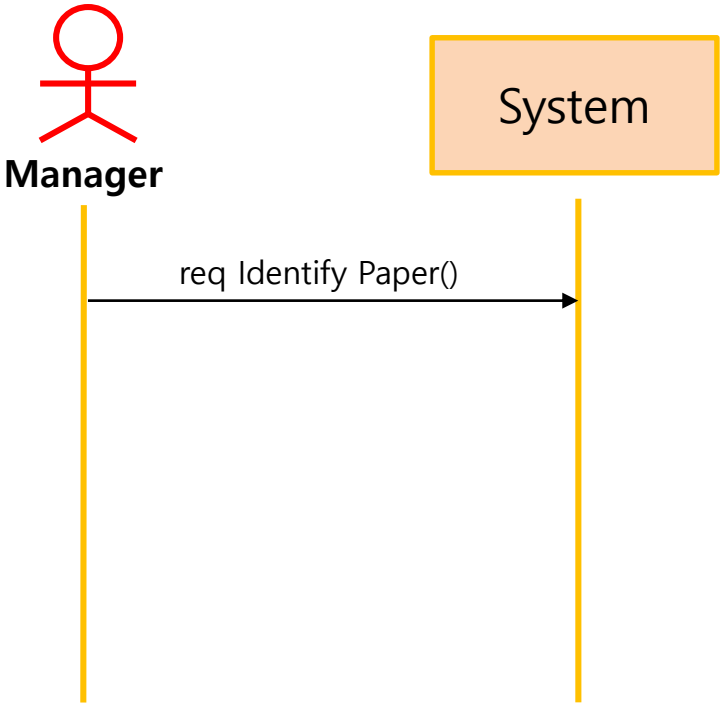
1. 사용자가 인쇄 매수를 입력 한다.
2. 사용자가 출력을 요청 한다.
3. 시스템이 잔액 확인 후 인쇄를 진행 한다.



# Activity 2035.
# Define System Sequence Diagrams

Use Case : Identify Paper

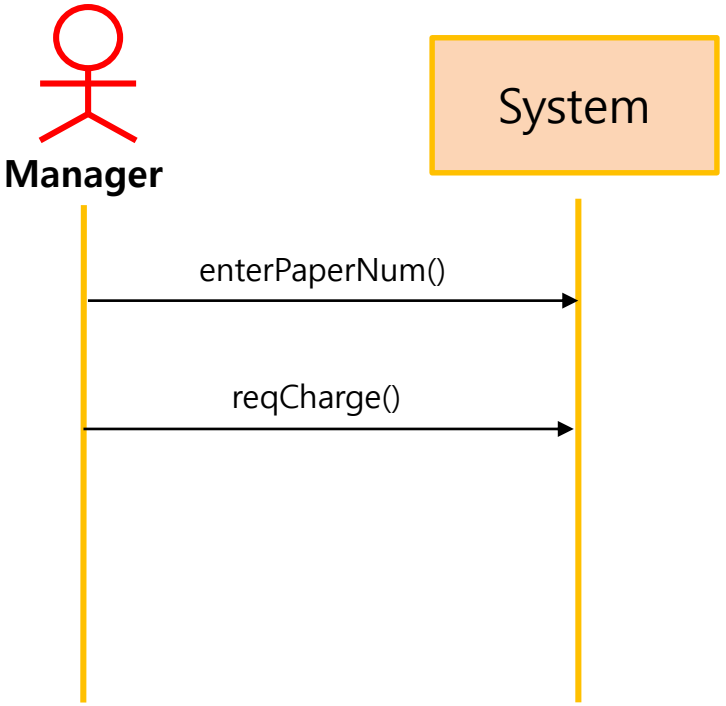
1. 관리자가 용지 잔량 확인을 요청 한다.
2. 시스템이 남은 용지 잔량을 출력 한다.



# Activity 2035.
# Define System Sequence Diagrams

Use Case : Recharge Paper

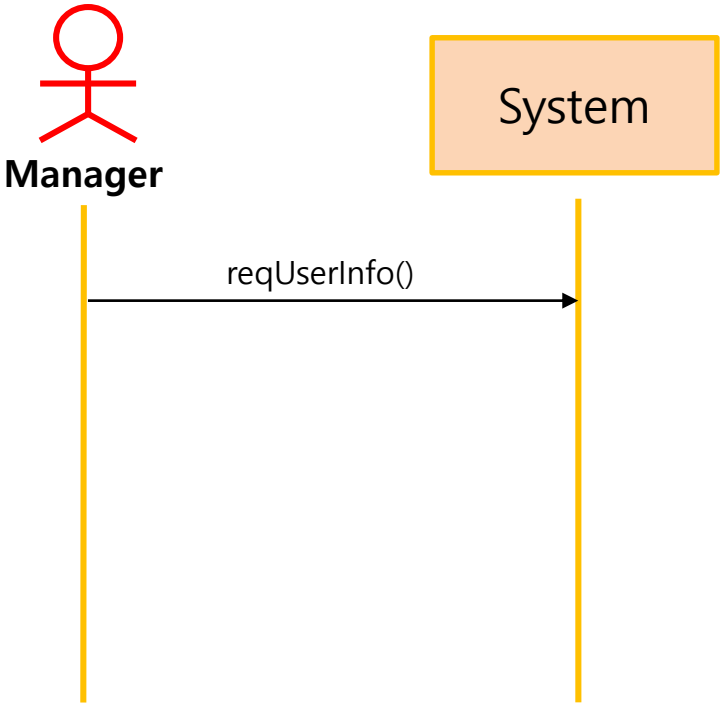
1. 관리자가 충전할 용지 매수를 입력 한다.
2. 용지 충전을 요청 한다.
3. 시스템이 입력된 매수 만큼 용지를 충전 한다.



# Activity 2035.
# Define System Sequence Diagrams

Use Case : Identify User

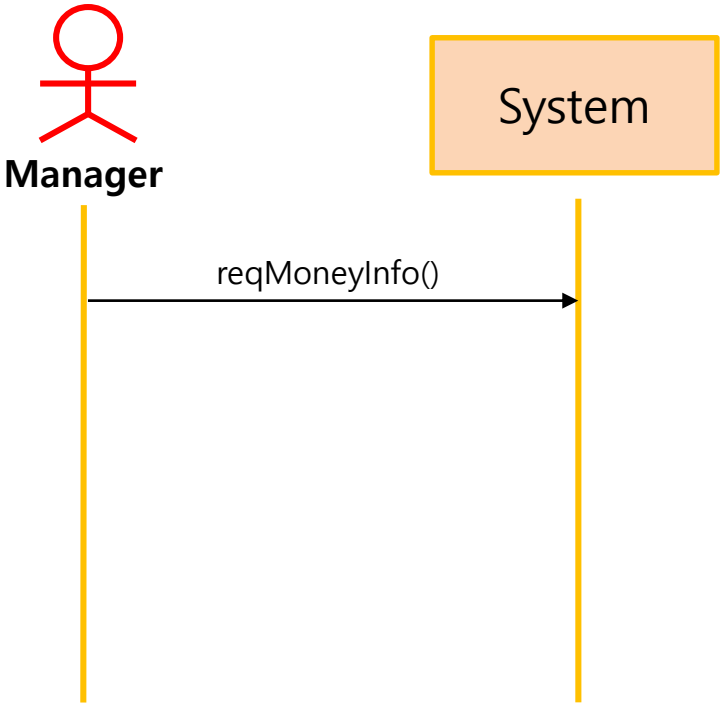
1. 관리자가 사용자 정보를 요청 한다.
2. 시스템이 사용자들의 정보를 출력 한다.



# Activity 2035.
# Define System Sequence Diagrams

Use Case : Identify Money

1. 관리자가 수익정보를 요청 한다.
2. 시스템이 전체 수익 정보를 출력 한다.



# Activity 2036. Define Operation Contracts

- Identify system operations from system sequence diagrams

| Use Case | Name of Actor-Activated Event | System Operations |
|---|---|---|
| 1. Login | 1:enterInfo() | 1:enterInfo() |
| | 2:reqLogin() | 2:reqLogin() |
| 2. Logout | 3:reqLogout() | 3:reqLogout() |
| 3. Make Account | 4:reqMakeAcc() | 4:reqMakeAcc() |
| | 5:enterAccInfo() | 5:enterAccInfo() |
| | 6:reqAccount() | 6:reqAccount() |
| 4. Identify Balance | 7:reqBalance() | 7:reqBalance() |
| 5. Recharge Balance | 8:enterFee() | 8:enterFee() |
| | 9:reqRecharge() | 9:reqRecharge() |
| 6. Request Print | 10:enterSheet() | 10:enterSheet() |
| | 11:reqPrint() | 11:reqPrint() |
| 8 Identify Paper | 12:req Identify Paper() | 12:reqPaperIdentify() |
| 9. Recharge Paper | 13:enterPaperNum() | 13:enterPaperNum() |
| | 14:reqCharge() | 14:reqCharge() |
| 10. Identify User | 15:reqUserInfo() | 15:reqUserInfo() |
| 11. Identify Money | 16:reqMoneyInfo() | 16:reqMoneyInfo() |

# Activity 2036. Define Operation Contracts

- Fill contracts according to the format

| Name | enterInfo |
|---|---|
| Resposibilities | id, pw를 입력 받는다. |
| Type | System |
| Cross References | R 1.1 |
| Notes | |
| Exceptions | N/A |
| Output | N/A |
| Pre-Conditions | N/A |
| Post-Conditions | id, pw 정보를 화면에 출력 한다. |

# Activity 2036. Define Operation Contracts

- Fill contracts according to the format

| Name | reqLogin |
|---|---|
| Resposibilities | id, pw를 확인하고 로그인을 시도 한다. |
| Type | System |
| Cross References | R 1.1 |
| Notes | |
| Exceptions | id, pw 가 일치 하지 않으면 오류 메시지를 출력하고 로그인 승인 X |
| Output | N/A |
| Pre-Conditions | N/A |
| Post-Conditions | Account 의 user, manager instance와 id, pw 비교 일치할 경우 해당 계정으로 로그인 후 화면 전환 |

# Activity 2036. Define Operation Contracts

- Fill contracts according to the format

| Name | reqLogout |
|---|---|
| Resposibilities | 시스템에서 로그아웃 한다 |
| Type | System |
| Cross References | R 1.1 |
| Notes | |
| Exceptions | 로그인 된 상태 이어야 한다. |
| Output | N/A |
| Pre-Conditions | N/A |
| Post-Conditions | 시스템에서 로그아웃 된다. |

# Activity 2036. Define Operation Contracts

- Fill contracts according to the format

| Name | reqMakeAcc |
|---|---|
| Resposibilities | 사용자 계정 생성을 요청 한다. |
| Type | System |
| Cross References | R 1.2 |
| Notes | |
| Exceptions | N/A |
| Output | N/A |
| Pre-Conditions | N/A |
| Post-Conditions | 사용자 계정 생성 상태가 된다. |

# Activity 2036. Define Operation Contracts

- Fill contracts according to the format

| Name | enterAccInfo |
|---|---|
| Resposibilities | 생성할 사용자 계정 정보를 입력 한다. |
| Type | System |
| Cross References | R 1.2 |
| Notes | |
| Exceptions | N/A |
| Output | N/A |
| Pre-Conditions | N/A |
| Post-Conditions | 입력한 정보를 화면에 출력 한다. |

# Activity 2036. Define Operation Contracts

- Fill contracts according to the format

| Name | reqAccount |
|---|---|
| Resposibilities | 정보대로 계정 생성을 요청 한다. |
| Type | System |
| Cross References | R 1.2 |
| Notes | |
| Exceptions | 동일한 id가 존재할 경우 생성하지 않는다. |
| Output | User class의 instance |
| Pre-Conditions | N/A |
| Post-Conditions | 사용자 계정을 생성 한다. |

# Activity 2036. Define Operation Contracts

- Fill contracts according to the format

| Name | reqBalance |
|---|---|
| Resposibilities | 잔액 정보 확인을 요청 한다. |
| Type | System |
| Cross References | R 1.3 |
| Notes | |
| Exceptions | N/A |
| Output | N/A |
| Pre-Conditions | 사용자 로그인 상태 이어야 한다. |
| Post-Conditions | 잔액 정보를 출력 한다. |

# Activity 2036. Define Operation Contracts

- Fill contracts according to the format

| Name | enterFee |
|---|---|
| Resposibilities | 충전할 금액을 입력 한다. |
| Type | System |
| Cross References | R 1.4 |
| Notes | |
| Exceptions | N/A |
| Output | N/A |
| Pre-Conditions | 사용자 로그인 상태 이어야 한다. |
| Post-Conditions | 입력한 금액을 출력 한다. |

# Activity 2036. Define Operation Contracts

- Fill contracts according to the format

| Name | reqRecharge |
|---|---|
| Resposibilities | 잔액 충전을 요청 한다. |
| Type | System |
| Cross References | R 1.4 |
| Notes | |
| Exceptions | N/A |
| Output | User.balance 변경 |
| Pre-Conditions | 사용자 로그인 상태 이어야 한다.<br>입력된 금액이 있어야 한다. |
| Post-Conditions | 사용자 계정에 금액을 충전 한다. |

# Activity 2036. Define Operation Contracts

- Fill contracts according to the format

| Name | enterSheet |
|---|---|
| Resposibilities | 인쇄할 매수를 입력 한다. |
| Type | System |
| Cross References | R 2.1 |
| Notes | |
| Exceptions | N/A |
| Output | N/A |
| Pre-Conditions | 사용자 로그인 상태 이어야 한다. |
| Post-Conditions | 입력한 인쇄 매수를 출력 한다. |

# Activity 2036. Define Operation Contracts

- Fill contracts according to the format

| Name | reqPrint |
|---|---|
| Resposibilities | 인쇄를 요청 한다. |
| Type | System |
| Cross References | R 2.1, R 2.2 |
| Notes | |
| Exceptions | 잔액이 매수 * 요금보다 작으면 인쇄가 진행되지 않는다. |
| Output | 인쇄 결과, User.balance 변경 |
| Pre-Conditions | 입력된 인쇄 매수가 있어야 한다.<br>사용자 로그인 상태 이어야 한다. |
| Post-Conditions | 사용한 금액만큼 사용자의 잔액이 감소 된다.<br>입력된 인쇄 매수를 초기화 한다. |

# Activity 2036. Define Operation Contracts

- Fill contracts according to the format

| Name | reqPaperIdentify |
|---|---|
| Resposibilities | 시스템의 용지 잔량 확인을 요청 한다. |
| Type | System |
| Cross References | R 3.1 |
| Notes | |
| Exceptions | N/A |
| Output | N/A |
| Pre-Conditions | 관리자 로그인 상태 이어야 한다. |
| Post-Conditions | 용지 잔량을 출력 한다. |

# Activity 2036. Define Operation Contracts

- Fill contracts according to the format

| Name | enterPaperNum |
|---|---|
| Resposibilities | 충전할 용지 양을 입력 한다. |
| Type | System |
| Cross References | R 3.2 |
| Notes | |
| Exceptions | N/A |
| Output | N/A |
| Pre-Conditions | 관리자 로그인 상태 이어야 한다. |
| Post-Conditions | 입력한 용지 매수를 출력 한다. |

# Activity 2036. Define Operation Contracts

- Fill contracts according to the format

| Name | reqCharge |
|---|---|
| Resposibilities | 시스템의 용지 충전을 요청 한다. |
| Type | System |
| Cross References | R 3.2 |
| Notes | |
| Exceptions | N/A |
| Output | Printer.paper 변경 |
| Pre-Conditions | 관리자 로그인 상태 이어야 한다.<br>용지 매수 입력이 되어 있어야 한다. |
| Post-Conditions | 프린터의 용지 잔량을 충전 한다.<br>화면의 입력한 용지 매수를 초기화 한다. |

# Activity 2036. Define Operation Contracts

- Fill contracts according to the format

| Name | reqUserInfo |
|---|---|
| Resposibilities | 모든 사용자 계정의 정보 확인을 요청 한다. |
| Type | System |
| Cross References | R 3.3 |
| Notes | |
| Exceptions | N/A |
| Output | N/A |
| Pre-Conditions | 관리자 로그인 상태 이어야 한다. |
| Post-Conditions | 사용자 정보를 출력 한다. |

# Activity 2036. Define Operation Contracts

- Fill contracts according to the format

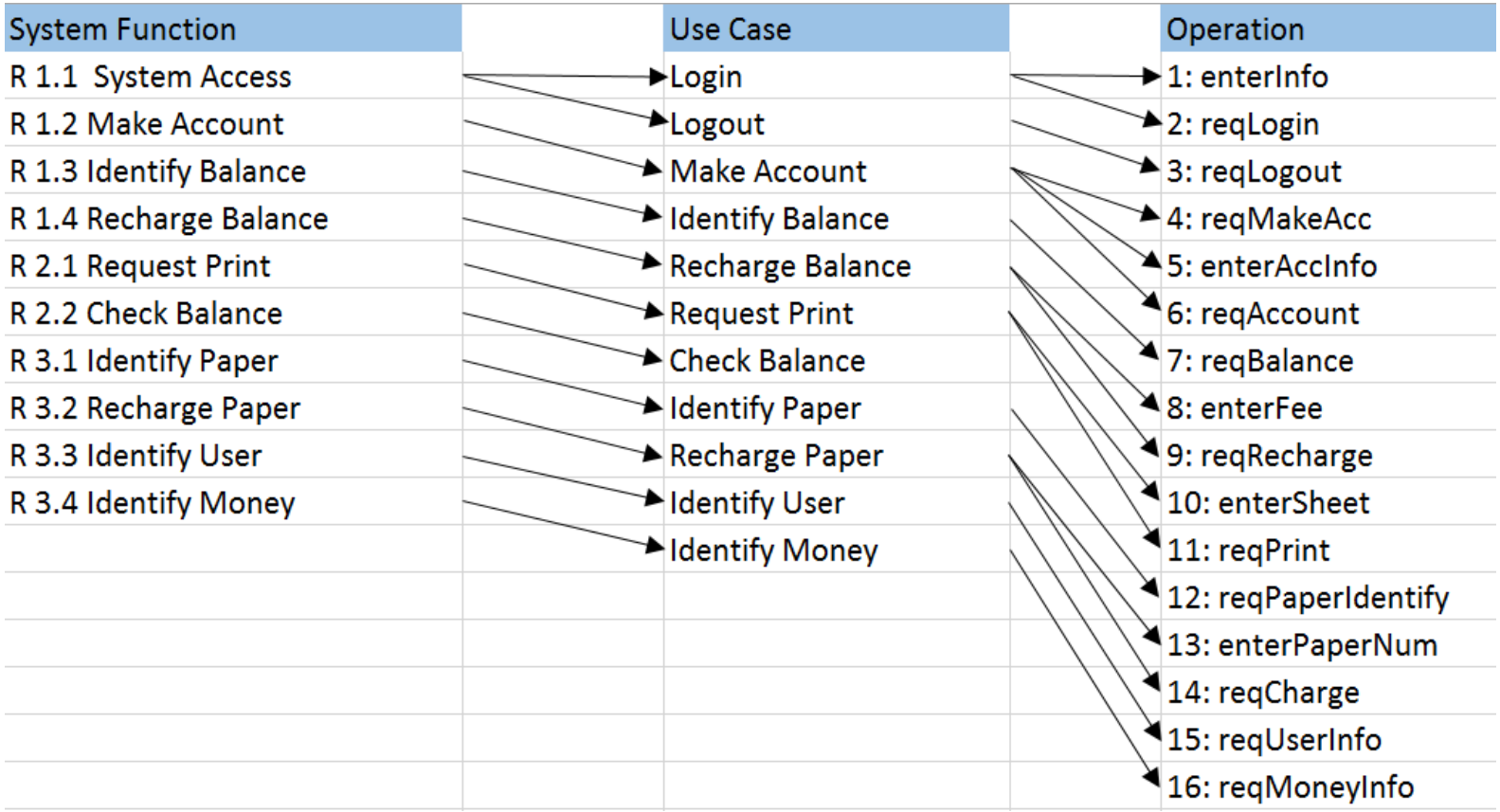
| Name | reqMoneyInfo |
|---|---|
| Resposibilities | 수익금 확인을 요청 한다. |
| Type | System |
| Cross References | R 3.4 |
| Notes | |
| Exceptions | N/A |
| Output | N/A |
| Pre-Conditions | 관리자 로그인 상태 이어야 한다. |
| Post-Conditions | 시스템의 전체 수익금을 출력 한다. |

# Activity 2038. Refine System Test Case

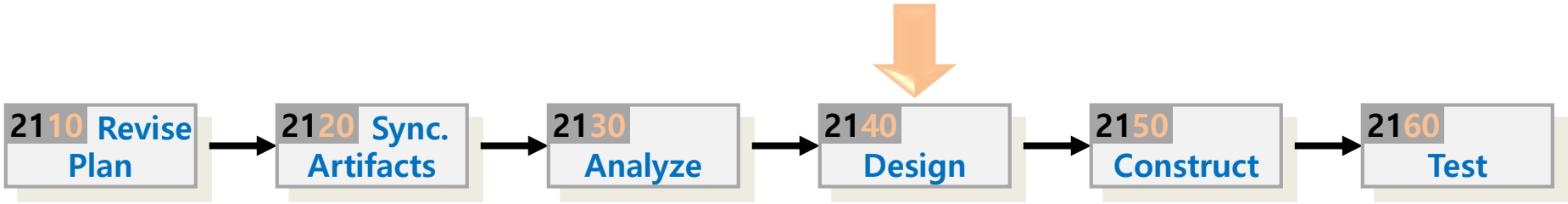
| Test Number | Test 항목 | Description | Use Case | System Function |
|---|---|---|---|---|
| 1 – 1 | 로그인 시험 | 존재하는 계정의 Id, pw를 입력하고 로그인 시도를 하여 로그인 기능 test | 1. Login | R 1.1 |
| 1 - 2 | 로그인 시험 | 존재하지 않는 계정의 Id, pw를 입력하고 로그인 시도를 하여 로그인 기능 test | 1. Login | R 1.1 |
| 2 | 로그아웃 시험 | 로그인 상태에서 로그아웃 버튼을 눌러 로그아웃 기능 test | 2. Logout | R 1.1 |
| 3 | 계정 생성 시험 | 계정 생성 데이터를 입력하여 계정 생성 기능 test | 3. Make Account | R 1.2 |
| 4 | 잔액 확인 시험 | 잔액 확인 버튼 동작 여부 test | 4. Identify Balance | R 1.3 |
| 5 | 잔액 충전 시험 | 금액을 입력하고 잔액 충전 기능 test | 5. Recharge Balance | R 1.4 |
| 6 | 인쇄 버튼 시험 | 인쇄 매수를 입력하고 인쇄 기능 test | 6. Request Print | R 2.1 |
| 7 – 1 | 잔액 체크 시험 | 잔액이 충분한 상태에서 인쇄 매수를 입력하고 인쇄 기능 test 수행 | 7. Check Balance | R 2.2 |
| 7 – 2 | 잔액 체크 시험 | 잔액이 부족한 상태에서 인쇄 매수를 입력하고 인쇄 기능 test 수행 | 7. Check Balance | R 2.2 |
| 8 | 용지 확인 시험 | 용지 잔량 출력 버튼을 통해 기능 test | 8 Identify Paper | R 3.1 |
| 9 | 용지 충전 시험 | 충전할 용지 수량을 입력하고 용지 충전 test | 9. Recharge Paper | R 3.2 |
| 10 | 사용자 목록 확인 시험 | 전체 사용자 목록 출력 test | 10. Identify User | R 3.3 |
| 11 | 수익 확인 시험 | 총 수익 출력 test | 11. Identify Money | R 3.4 |

# Activity 2039.
# Analyze (2030) Traceability Analysis

- Relations between system function(requirements spec), use cases and operations



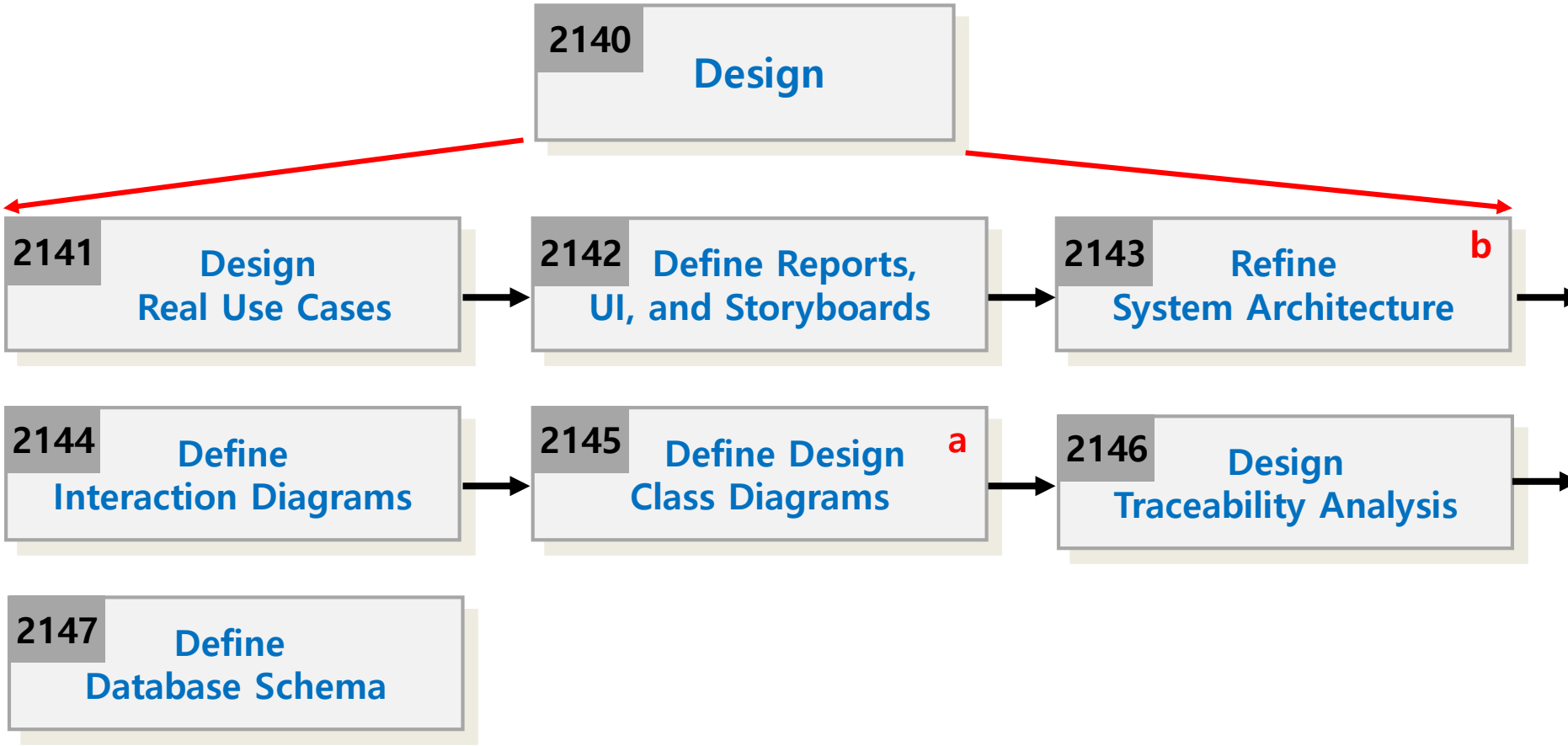
# Phase 2040.
# Design



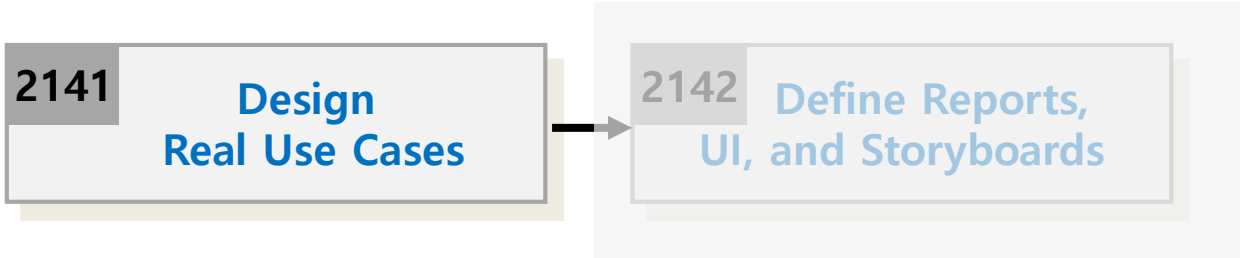
# Phase 2040. Design

- Phase 2040 Activities

a. In parallel with interaction diagrams
b. Varied order



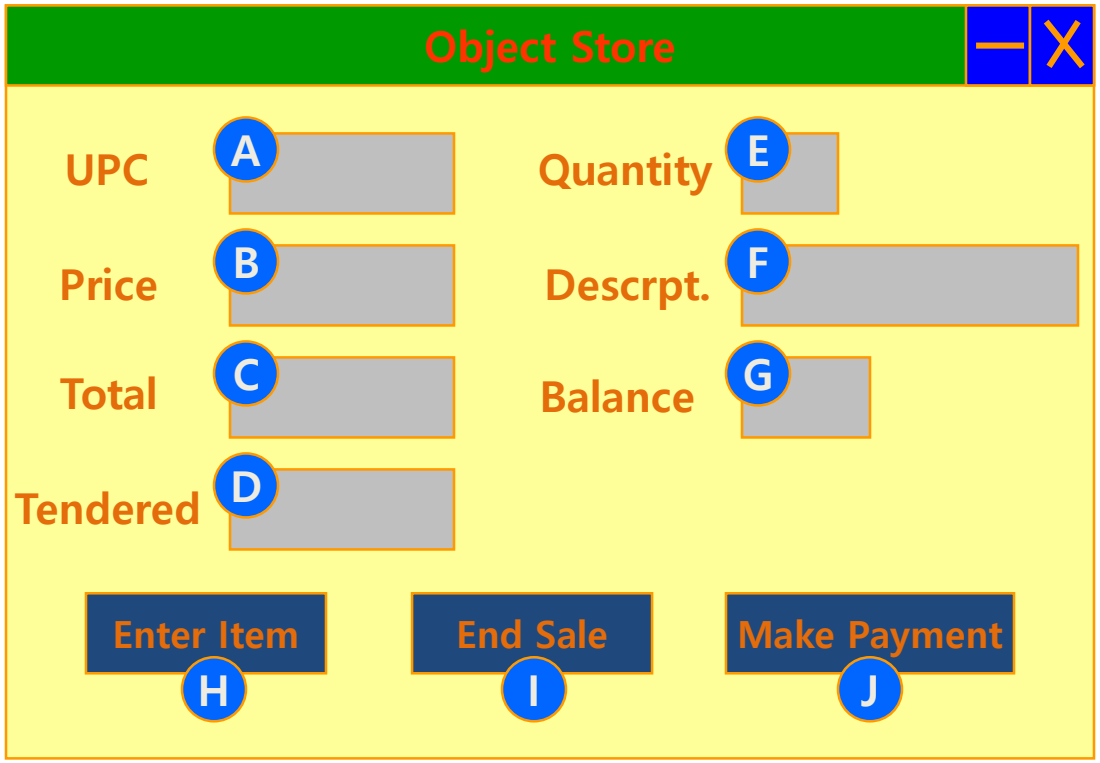
# Activity 2041. Design Real Use Cases




- Description
  - It describes real/actual design of the use case in terms of concrete input and output technology and its overall implementation.
  - If a graphical user interface is involved, the real use case will include diagrams of the GUI and discussion of the low-level interactions with interface widgets.
  - Input : Essential Use Case Descriptions
  - Output : Real Use Case Descriptions

# Activity 2041. Design Real Use Cases

- Steps
  1. Select each use case from essential use cases
  2. Add user interface widgets into the expanded format, and concrete implementation details into the typical courses of events




Window-1

# Activity 2041. Design Real Use Cases

| | |
|---|---|
| **Use Case** | Buy Items – Version 1 (Cash only) |
| **Actor** | Customer, Cashier |
| **Purpose** | Capture a sale and its cash payment |
| **Overview** | A Customer arrives at a checkout with items to purchase. The Cashier records the items and collects cash payment, which may be authorized. On completion, the Customer leaves with the items. |
| **Type** | Primary and Real |
| **Cross Reference** | Functions: R1.1, R1.2, R1.3, R1.7, R1.9, R2.1<br>Use Cases: Log In use case |
| **Pre-Requisites** | N/A |
| **UI Widgets** | Window-1 |
| **Typical Courses of Events** | (A) : Actor, (S) : System<br>1. (A) This use case begins when a customer arrives at the POST to checkout with items to purchase.<br>2. (A) For each item, the Cashier types an UPC in A of Window-1. If there is more than one of an item, the quantity may optionally be entered in E. They press B after each item entry. (E1)<br>3. (S) Adds the item information to the running sales transaction. The description and price of the current item are displayed in B and F of Window1.<br>4. (A) The Cashier tells the customer the total. |
| **Alternative Courses of Events** | … |
| **Exceptional Courses of Events** | E1: If an invalid UPC is entered, indicate an error. |

# Activity 2042.
# Define Reports, UI, and Storyboards

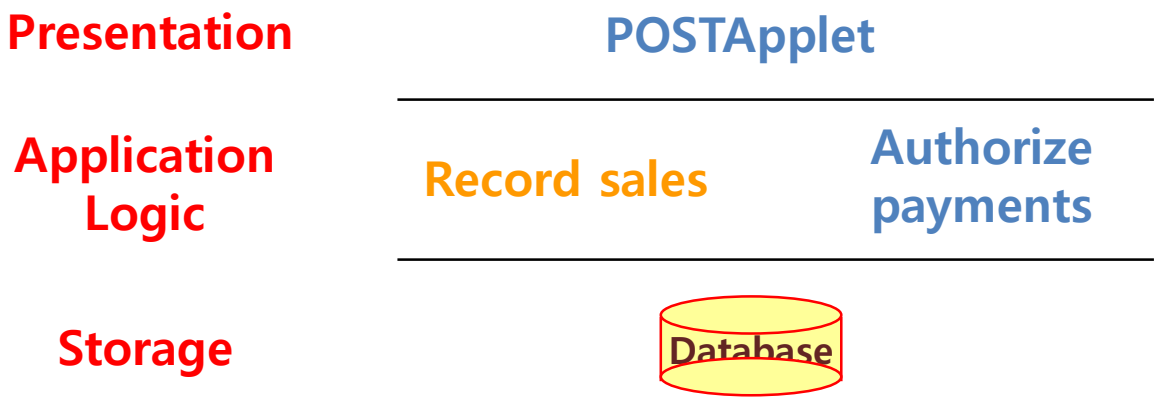

- Description
  - Design UI storyboard and UI components.
  - Input : Requirements Specification, Real Use Case Descriptions
  - Output : UI Storyboard, UI Component Design Specification

# Activity 2043. Refine System Architecture


- Description
  - Refine draft system architecture developed in the plan stage
  - Input : Draft System Architecture
  - Output : A package diagram, a deployment diagram
  - Standards Applied
    - UML's Package Diagram
    - UML's Deployment Diagram

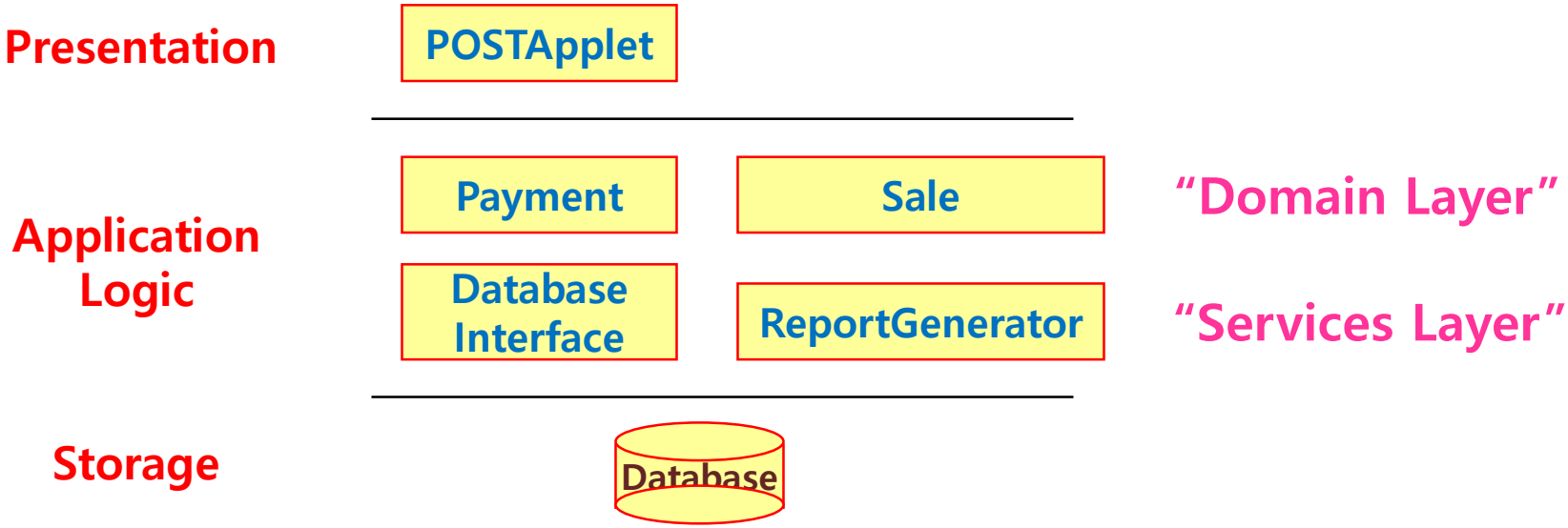
# Activity 2043. Refine System Architecture

- Steps (1~3: Deployment diagram , 4~7: Package diagram)
  1. Define a 3-tier layered system architecture
     - Presentation Layer : Windows, Reports, and so on
     - Application Logic Layer : Tasks and rules that govern the process
     - Storage Layer : Persistent storage mechanism



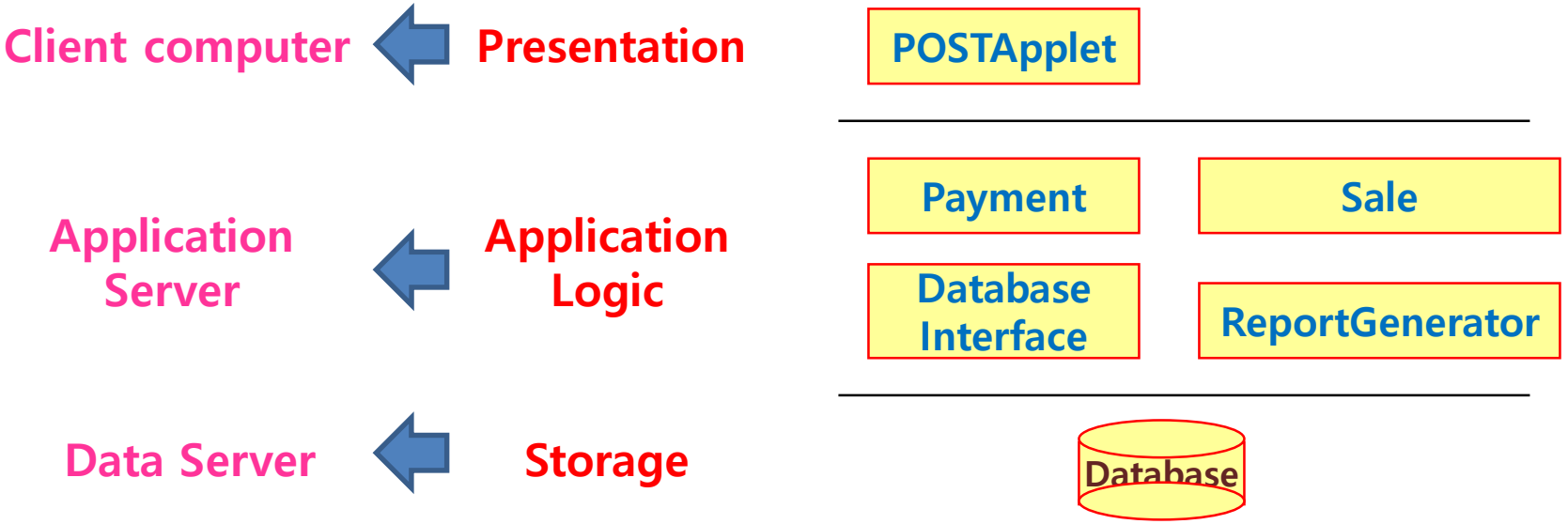
# Activity 2043. Refine System Architecture

2. Decompose the application logic tier into finer layers
   - Domain object layer
     - Classes representing domain concepts
   - Service layer
     - Service objects for functions such as database interaction, reporting, communications, security, and so on



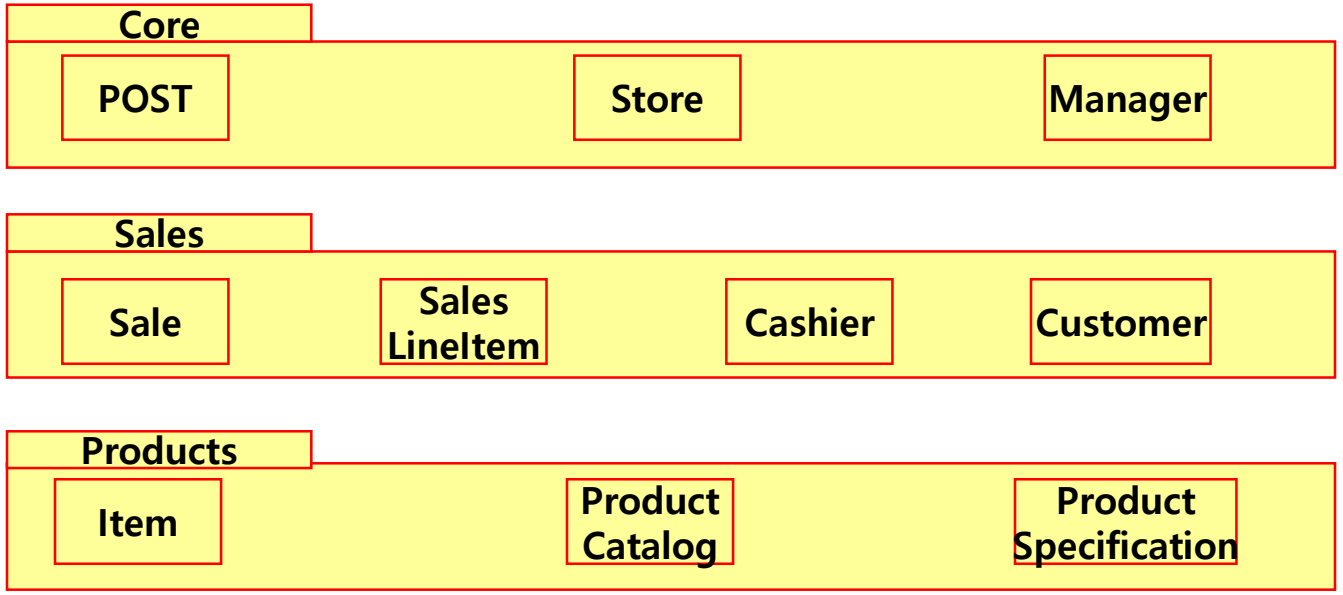
# Activity 2043. Refine System Architecture

3. Assign each tier into different physical computing nodes, and/or different processes



# Activity 2043. Refine System Architecture

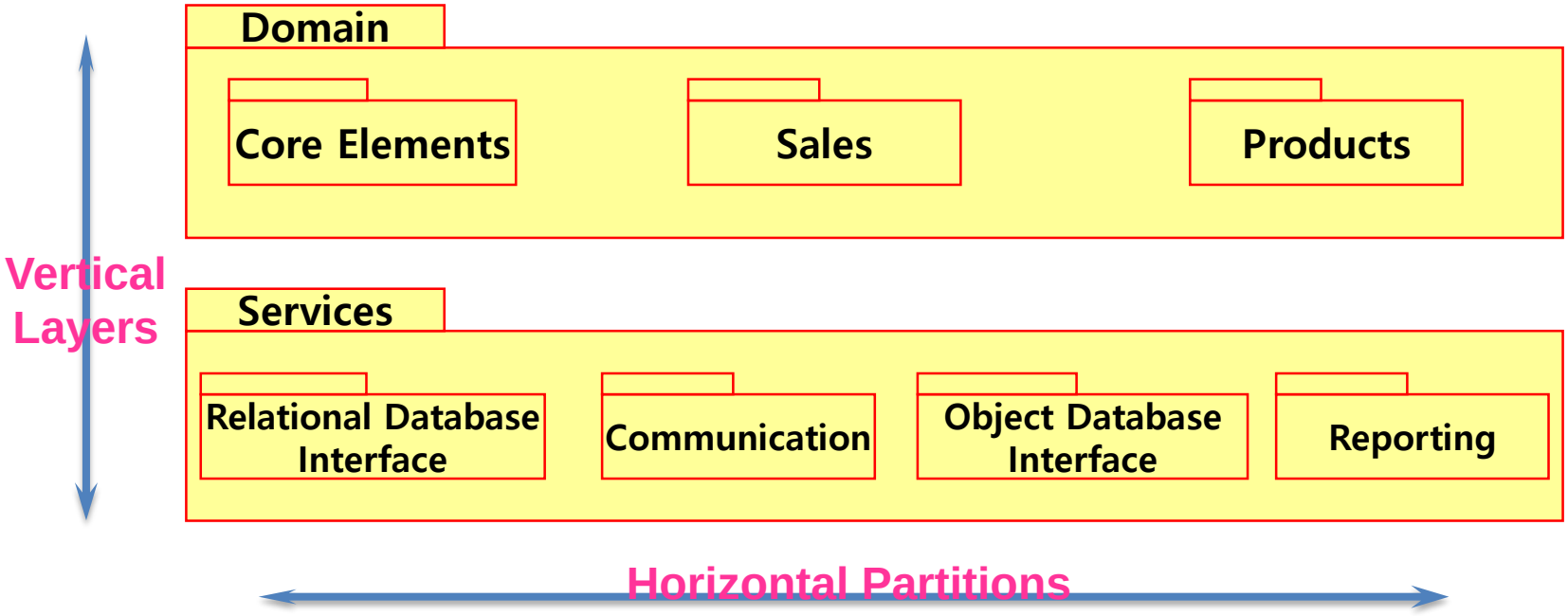
4. Identify packages
   - Place elements together
     - that are in the same subject area-closely related by concept or purpose, or that are in a type hierarchy together
     - that participate in the same use cases or
     - that are strongly associated



# Activity 2043. Refine System Architecture

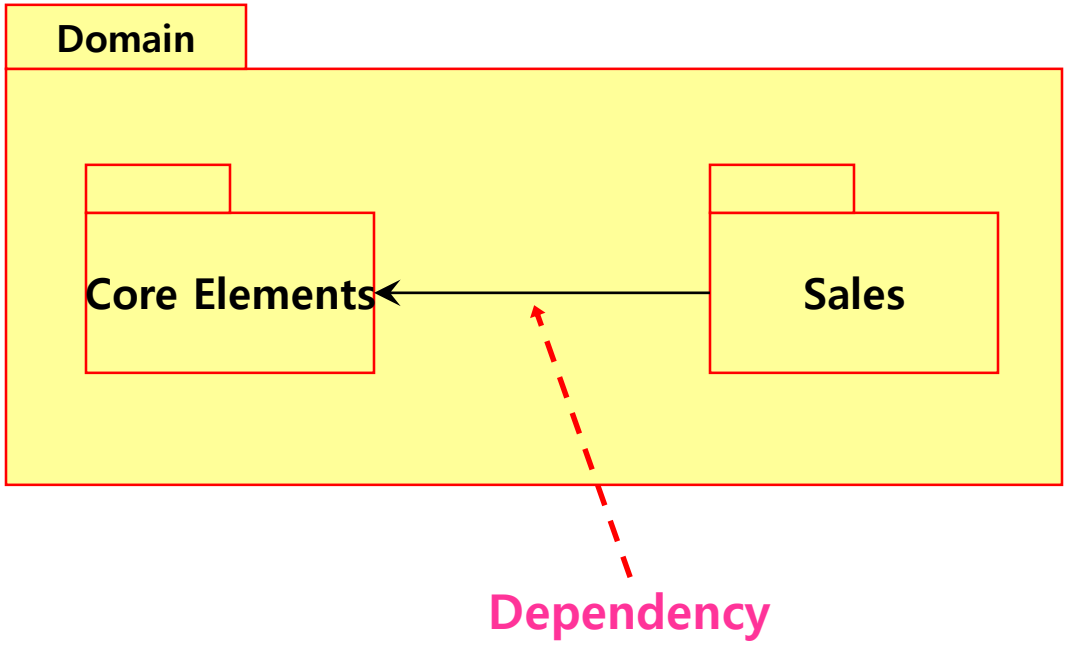
5. Layers of the architecture :
   - vertical tiers

   Partitions of the architecture :
   - horizontal division of relatively parallel subsystems



# Activity 2043. Refine System Architecture

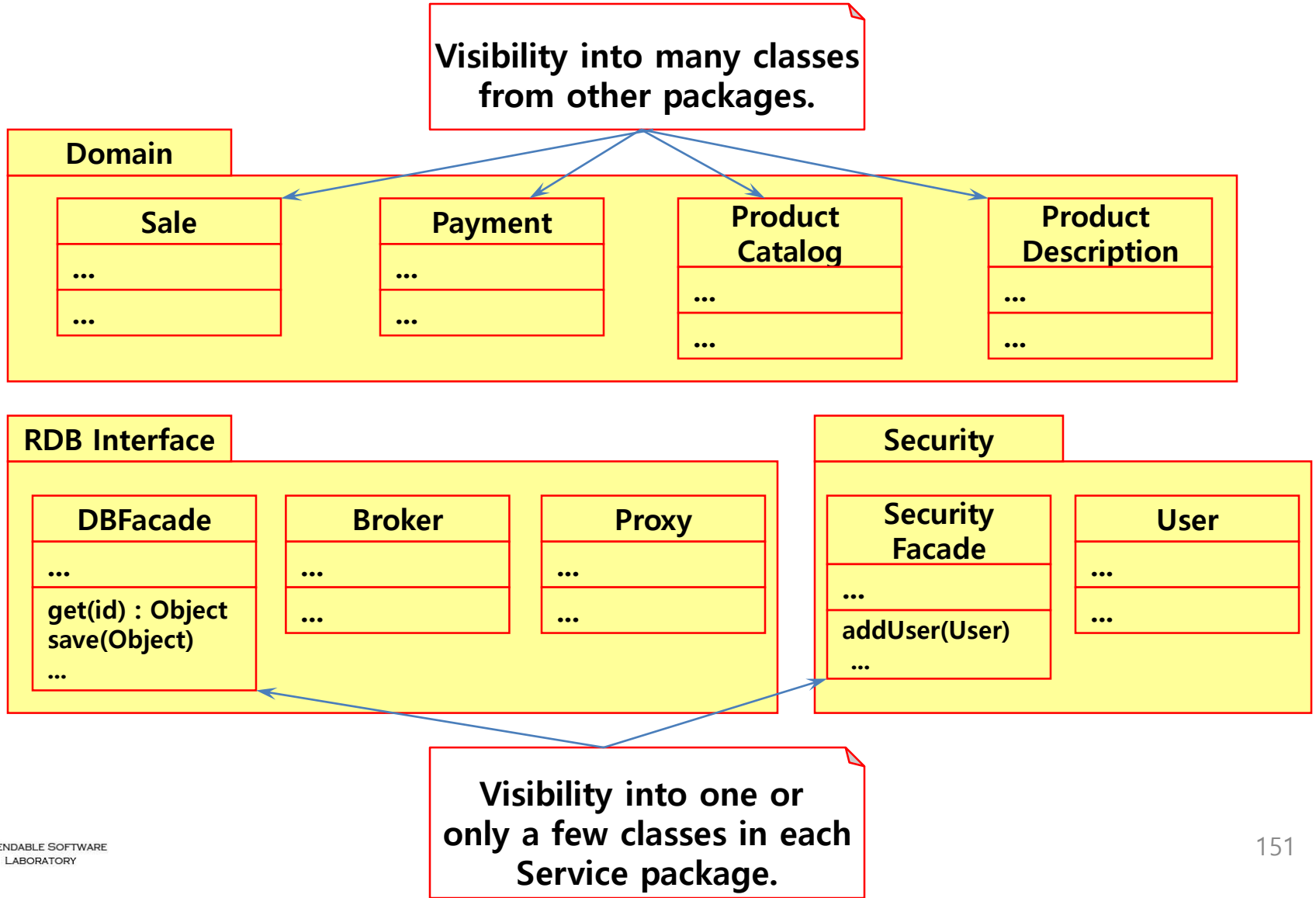
6. Determine package dependencies
   - Dependency relationships indicates coupling between packages.



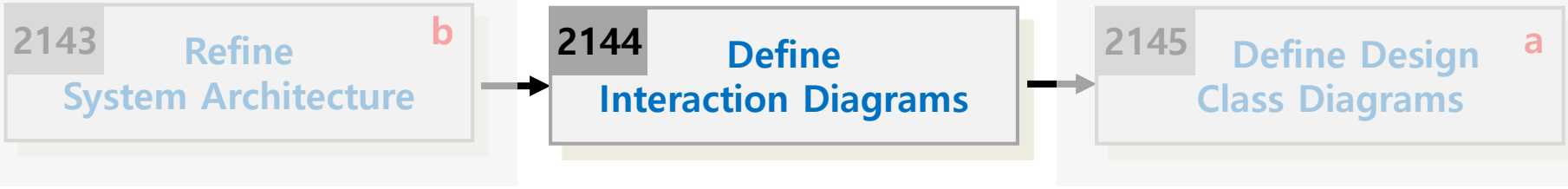
# Activity 2043. Refine System Architecture

7. Assign visibility between package classes.
   - Access into the Domain packages
     - Some packages, typically the presentation package, have visibility into many of the classes representing domain concepts
   - Access into the Service packages
     - Some packages, typically the Domain and Presentation packages, have visibility into only one or a very few classes in each particular Service package
   - Access into the Presentation packages
     - No other packages have direct visibility to the Presentation layer

# Activity 2043. Refine System Architecture



# Activity 2044. Define Interaction Diagrams




- Description
  - Collaboration diagrams illustrate object interactions in a graph or network format.
  - To illustrate how objects interactions via messages to fulfill tasks.
  - Input : Real Use Case Descriptions
  - Output : An interaction diagram
  - Standards Applied
    - UML's **Sequence Diagram** or Collaboration Diagram

# Activity 2044. Define Interaction Diagrams

- Interaction diagram is a generalization of two more specialized UML diagram types:
  - Collaboration diagram
  - Sequence diagram
- The both can be used to express similar message interactions

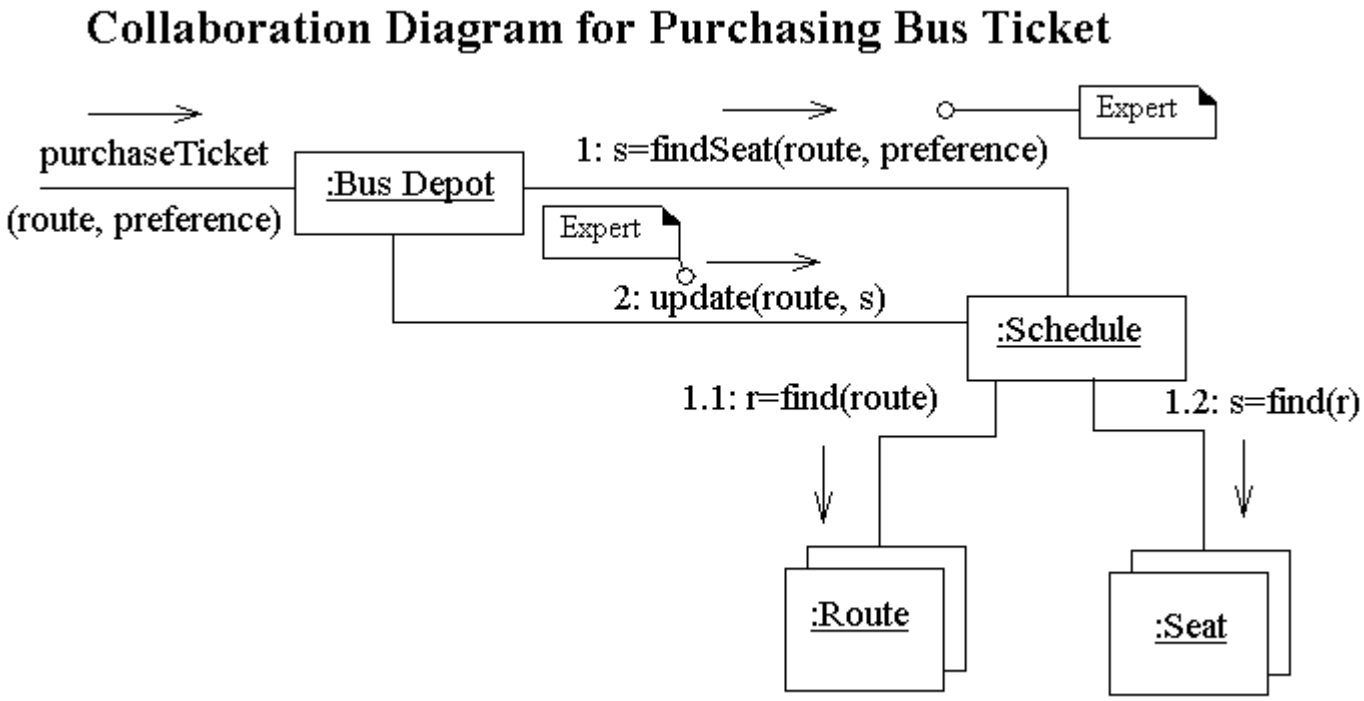
- Collaboration Diagram
  - Illustrates object interactions in a graphs or network format
- Sequence Diagram
  - Illustrates interactions in a kind of fence format, in which each new object is added to the right.

# Activity 2044. Define Interaction Diagrams

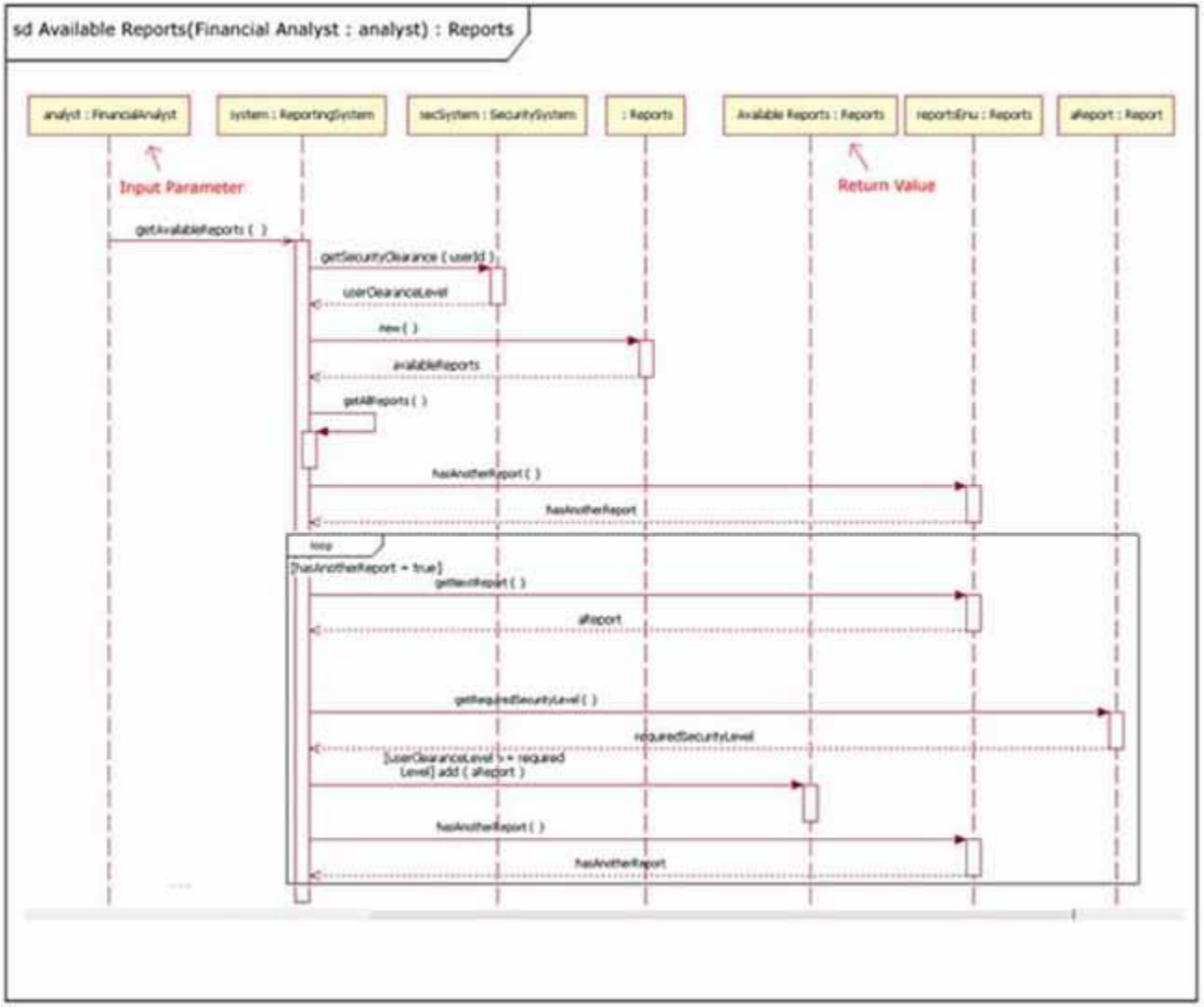
- Sequence Diagram vs. Collaboration Diagram

| Type | Strengths | Weaknesses |
|---|---|---|
| Sequence Diagram | Clearly shows sequence or time ordering of messages | Forced to extend to the right, when adding new objects with consuming horizontal space |
| Collaboration Diagram | Space economical and flexible to add new objects in two dimensions<br>Better to illustrate complex branching, iteration, and concurrent behavior | Difficult to see sequence of messages |

# Collaboration diagram example



# Sequence diagram example



# Activity 2044. Define Interaction Diagrams

- Steps
  1. Draw up actors
  2. Deploy objects or classes participating each use case from the real use case descriptions and conceptual class diagram
  3. Design a system of interacting objects to fulfill the tasks.
     - Regard the use case description as a starting point

# Activity 2044. Define Interaction Diagrams

- Illustrating Classes and Instances


Class


Instance


Named Instance

# Activity 2044. Define Interaction Diagrams

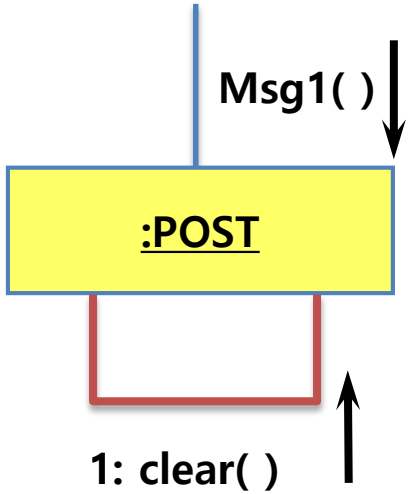
- Illustrating Links and Parameters
  - A link is a connection path between two instances.


- Illustrating a Return Value

# Activity 2044. Define Interaction Diagrams

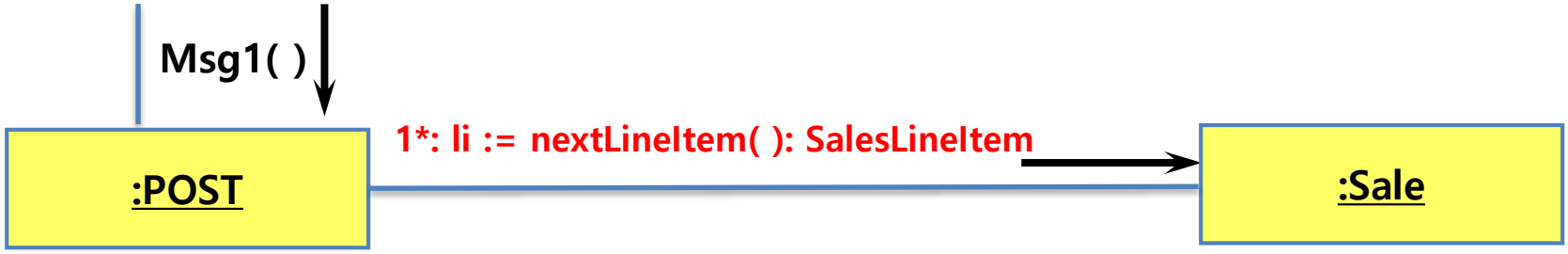
- Message Syntax
  - return := message(parameter : parameterType) : returnType
  - Standard UML message syntax


- Illustrating Messages to 'Self' ('This')

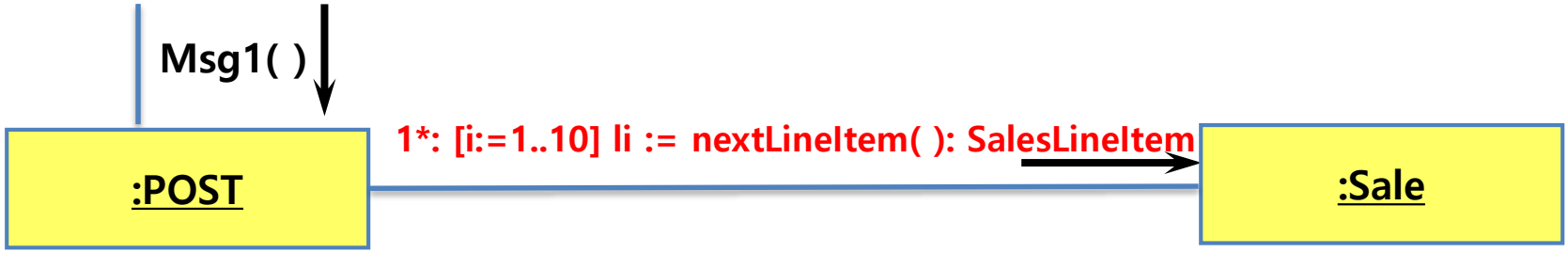


# Activity 2044. Define Interaction Diagrams

- Illustrating Iterations
  - Iteration




  - Iteration Clause

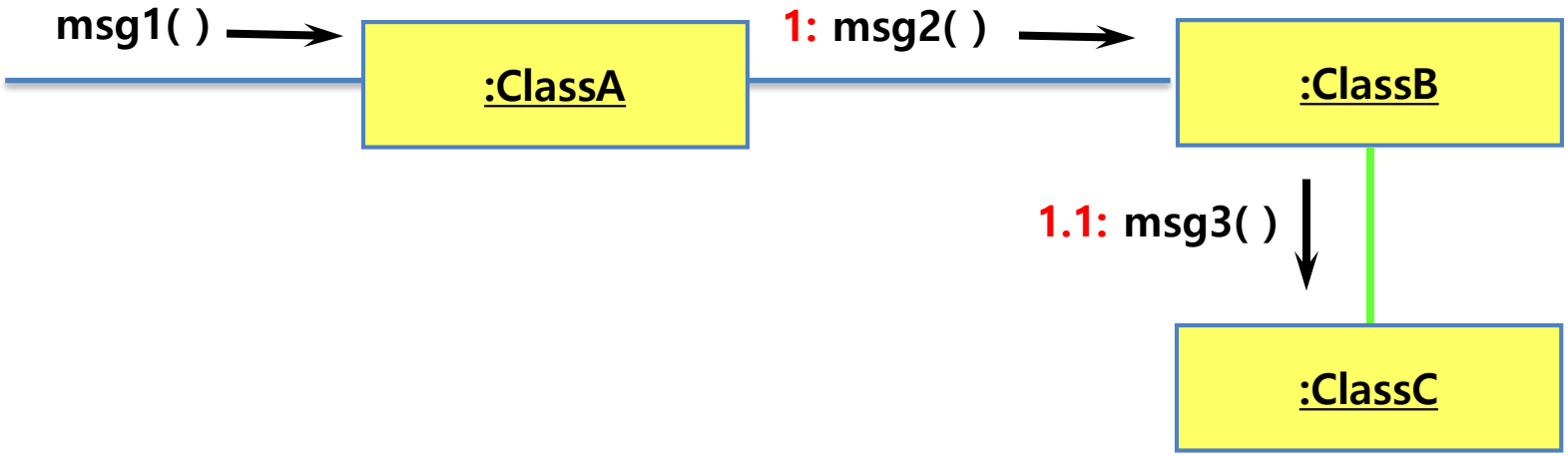


# Activity 2044. Define Interaction Diagrams

- Illustrating Creation of Instances
  - Creating message with optional initializing parameters"
- Illustrating Conditional Messages

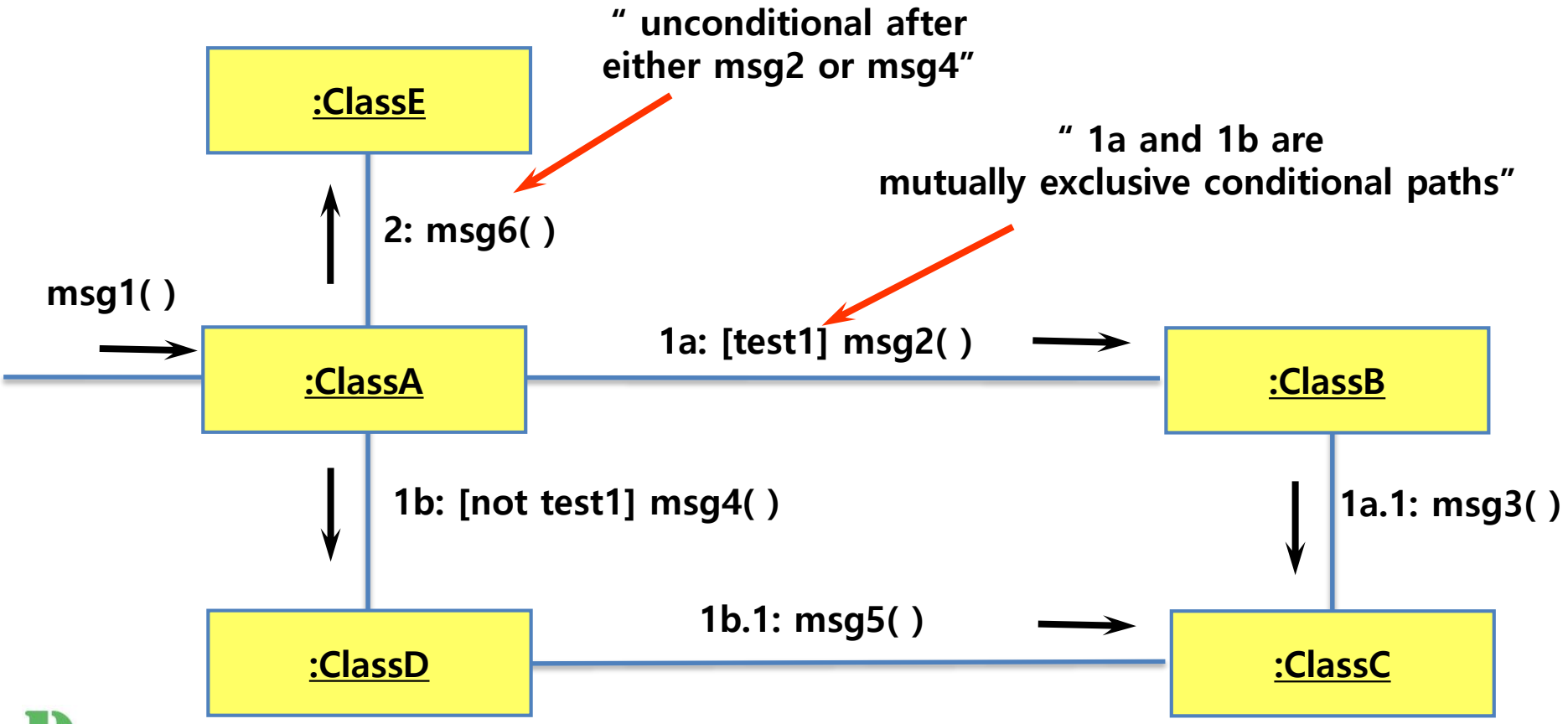
# Activity 2044. Define Interaction Diagrams

- Illustrating Message Number Sequencing
  - The first message is not numbered
  - The order and nesting of subsequent messages are shown with a legal numbering scheme



# Activity 2044. Define Interaction Diagrams

- Illustrating Mutually Exclusive Conditional Paths

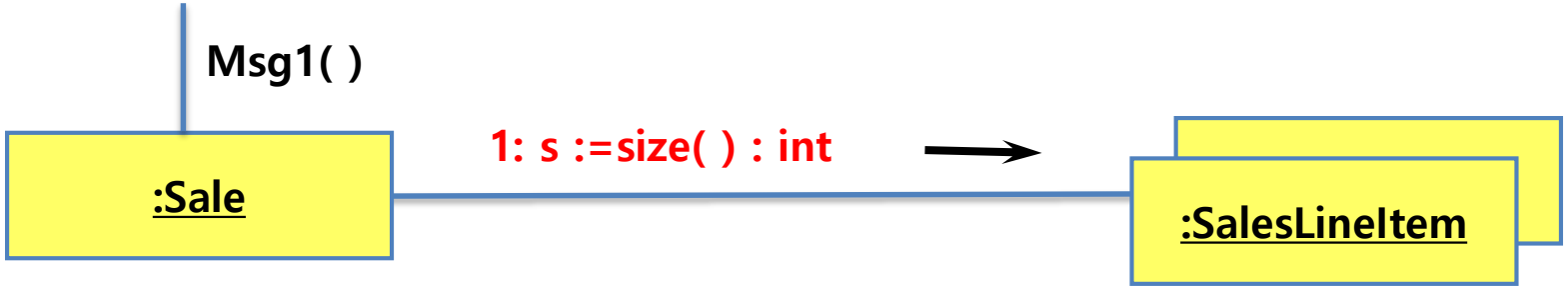


# Activity 2044. Define Interaction Diagrams

- Illustrating Collections
  - A multi-object, or set of instances, may be shown with a stack icon

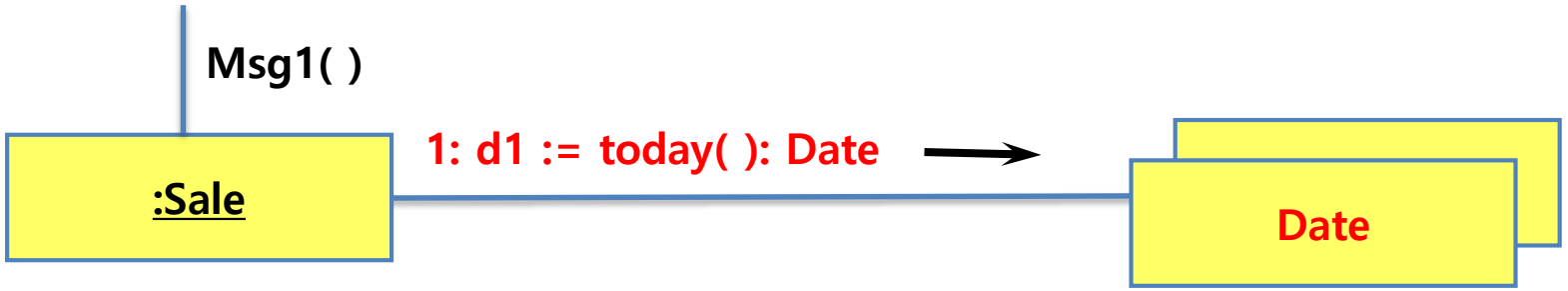
# Activity 2044. Define Interaction Diagrams

- Illustrating Messages to Multi-objects
  - A message to a multi-object icon indicates that it is sent to the collection object itself

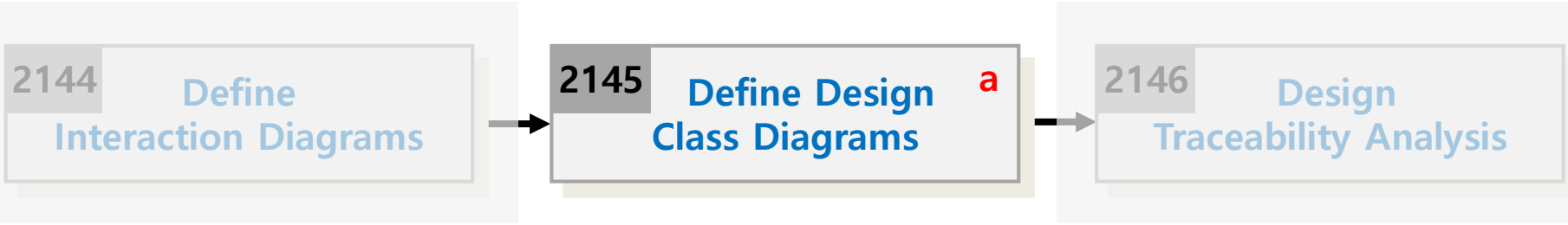


# Activity 2044. Define Interaction Diagrams

- Illustrating Messages to a Class Object
  - Messages may be sent to a class itself not an instance, in order to invoke class methods



# Activity 2045. Define Design Class Diagrams




- Description
  - Describes more details in conceptual class diagram
  - Add navigability, dependency, data type, operation signature, parameters, return types, and so on.
  - Input : Interaction Diagram, Conceptual Class Diagram
  - Output : A Design Class Diagram
  - Standards Applied
    - UML's Class Diagram

# Activity 2045. Define Design Class Diagrams

- Steps
  1. Identity all classes
  2. Draw them in a class diagram
  3. Add attributes
  4. Add method names
  5. Add type information to the attributes and methods
  6. Add the associations
  7. Add navigability arrows
  8. Add dependency

# Activity 2045. Define Design Class Diagrams

- Step 1. Identify all classes
  - by scanning all interaction diagrams
  - listing classes mentioned

POST

ProductCatalog

Store

Payment

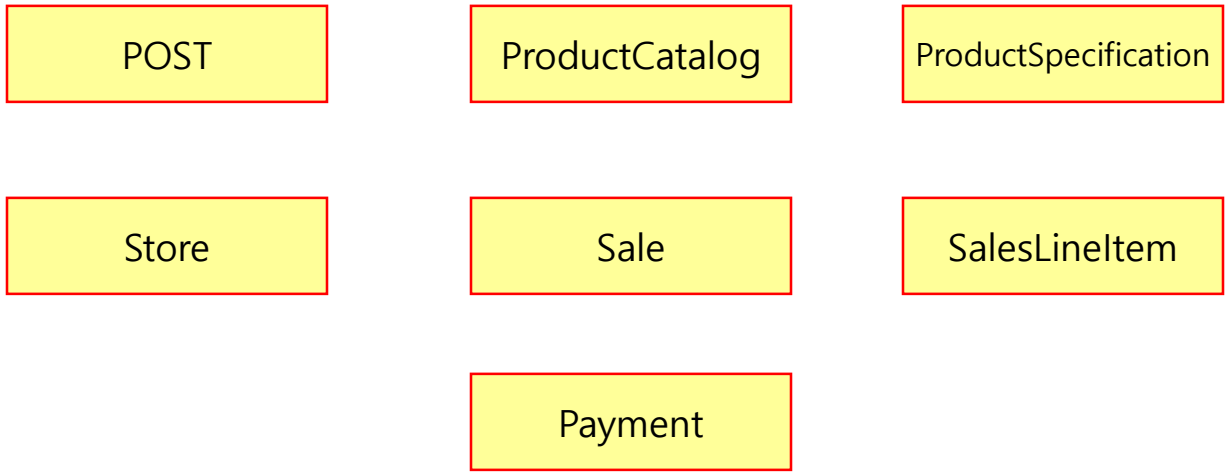
Sale

ProductSpecification

SalesLineItem

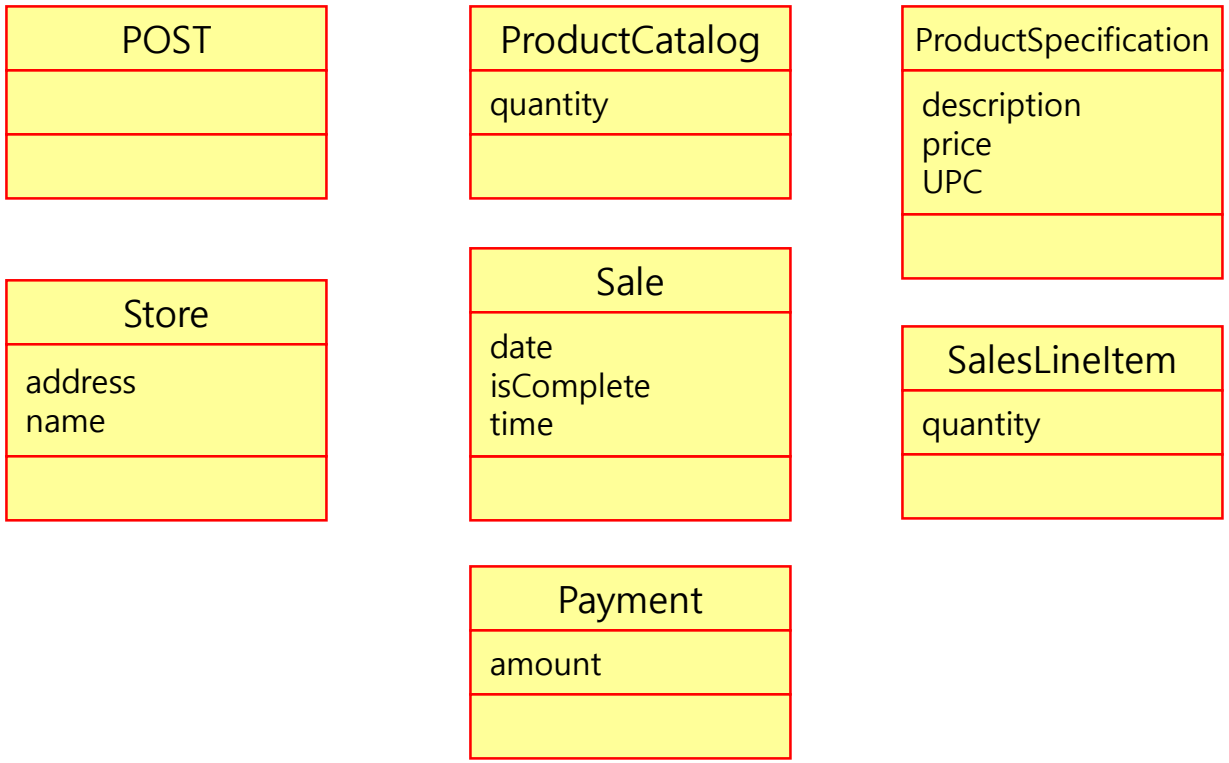
# Activity 2045. Define Design Class Diagrams

- Step 2. Draw a class diagram
  - includes classes found in Step 1



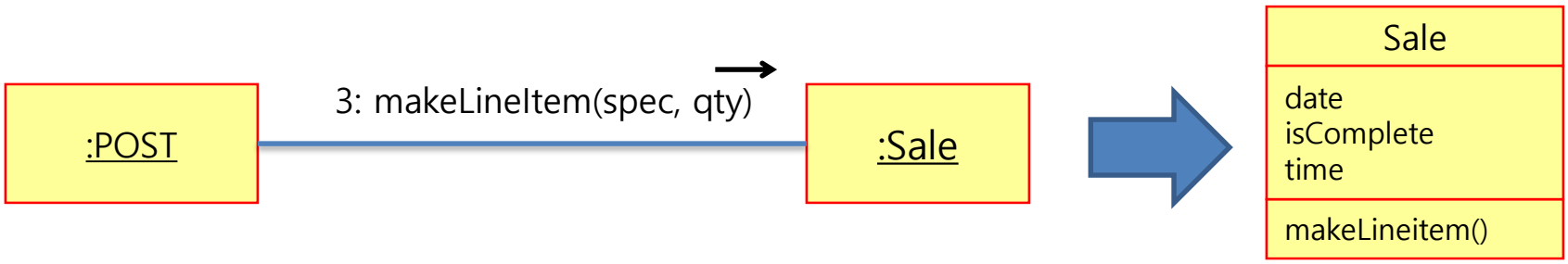
# Activity 2045. Define Design Class Diagrams

- Step 3. Add attributes
  - Include the attributes previously identified in the conceptual class diagram that are also used in the design

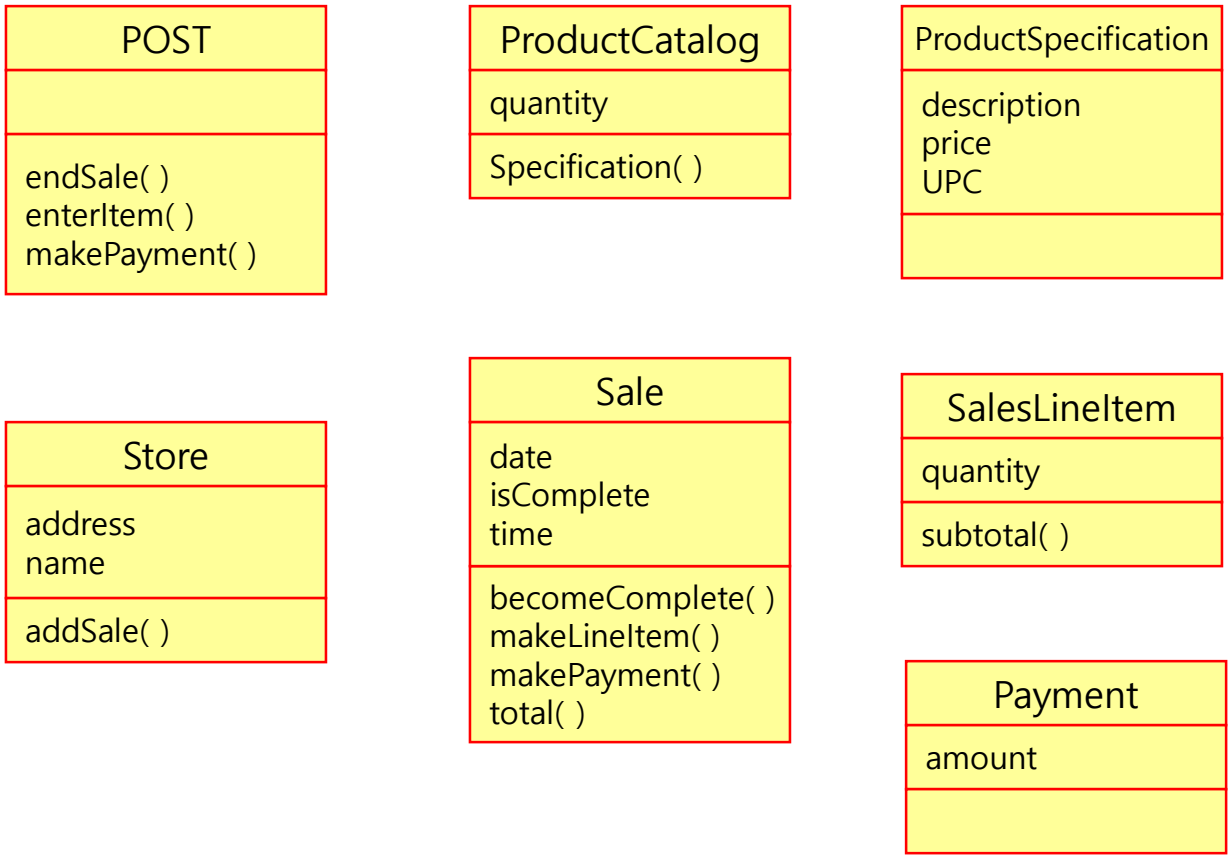


# Activity 2045. Define Design Class Diagrams

- Step 4. Add method names
  - Identify method of each class by scanning the interaction diagrams
  - The messages sent to a class in interaction diagrams must be defined in the class
  - Don't add
    - creation methods and constructors
    - accessing methods
    - messages to a multiobject



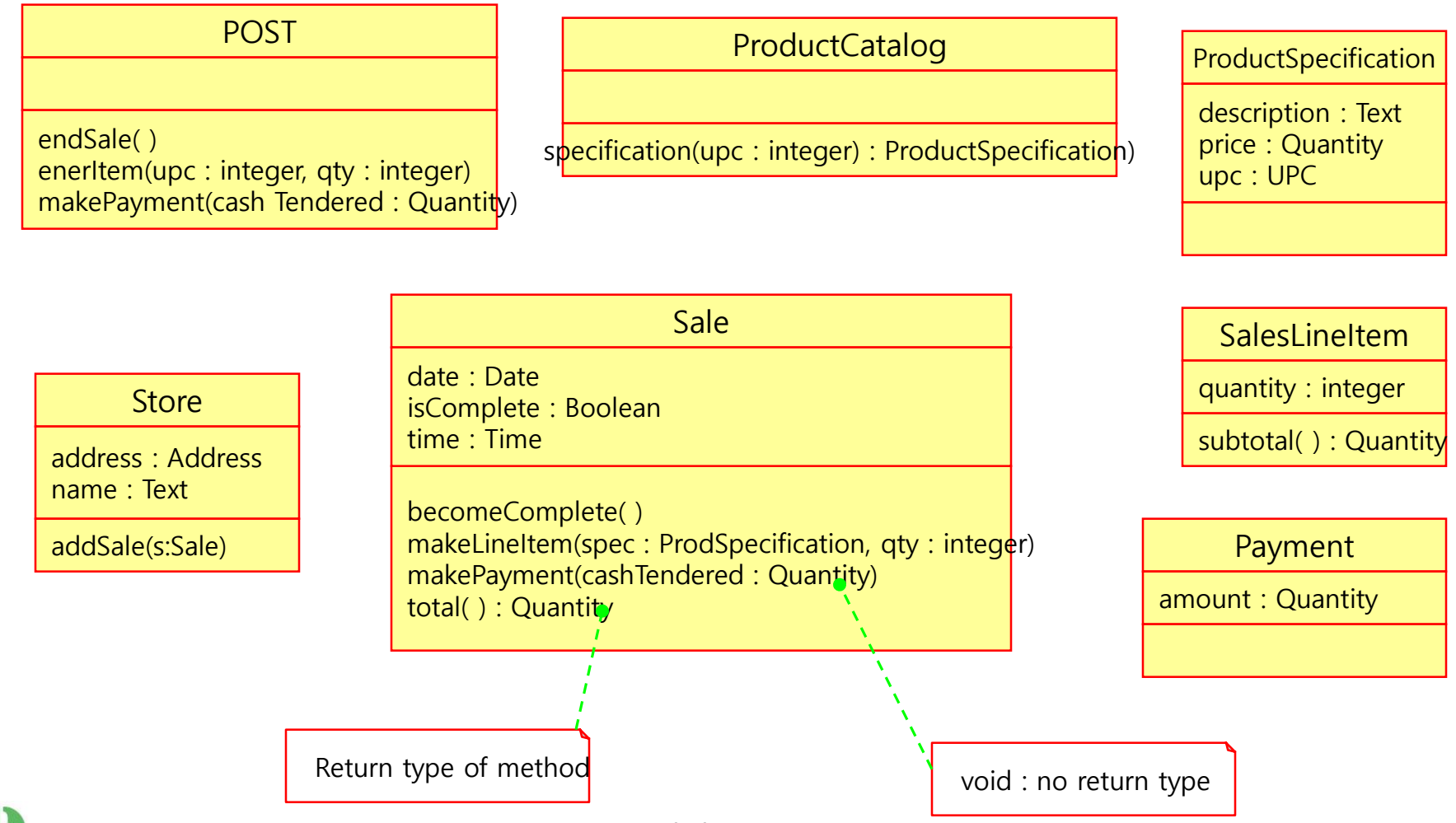
# Activity 2045. Define Design Class Diagrams



# Activity 2045. Define Design Class Diagrams

- Step 5. Add type information
  - Show types of attributes, method parameters, and method return values optionally.
  - Determine whether to show type information or not
    - When using a CASE tool with automatic code generation, exhaustive details are necessary
    - If it is being created for software developers to read, exhaustive detail may adversely effect the noise-to-value ratio

# Activity 2045. Define Design Class Diagrams

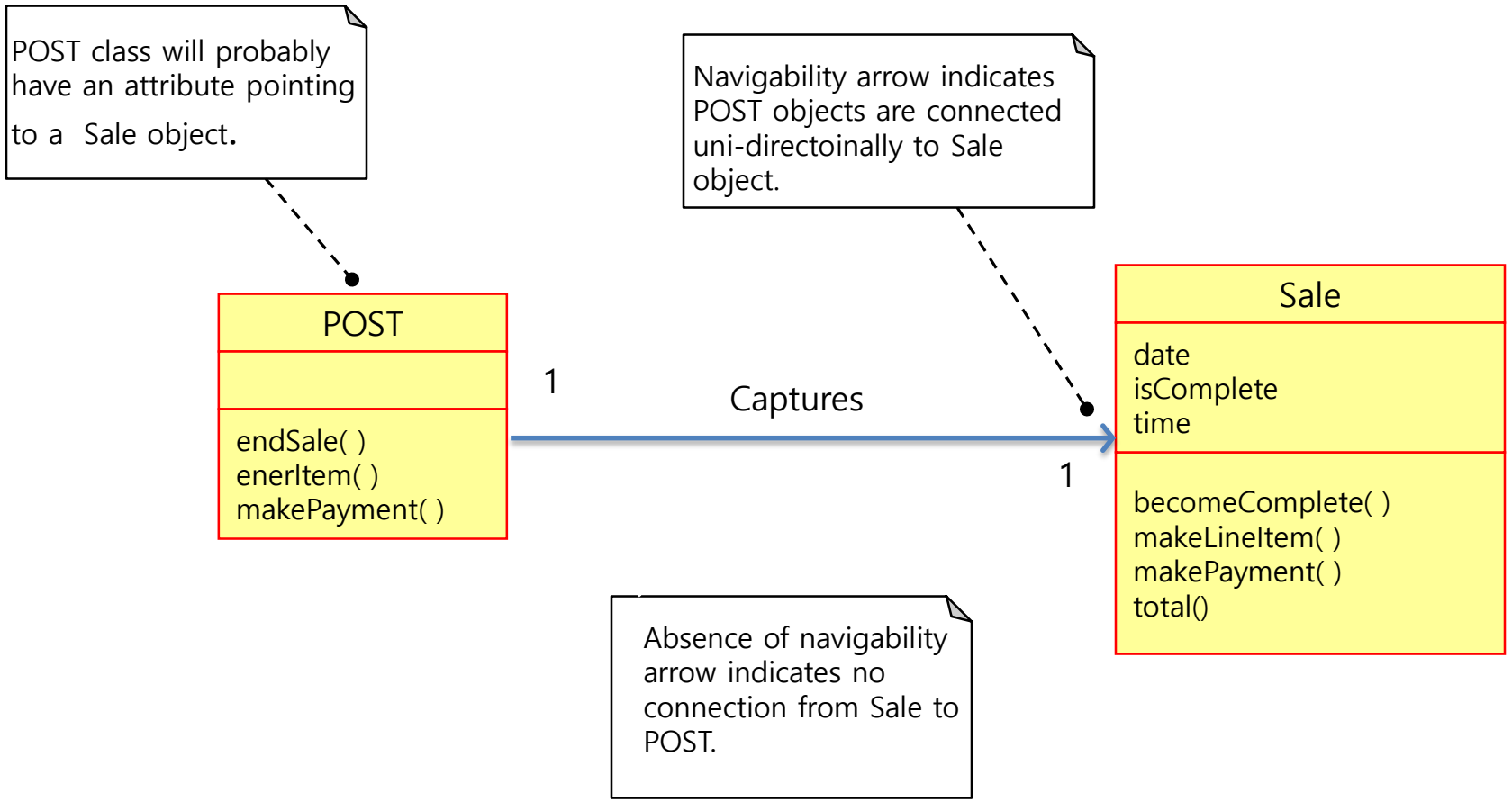


# Activity 2045. Define Design Class Diagrams

- Step 6. Add associations
  - Choose associations by software-oriented need-to-know criterion from the interaction diagrams

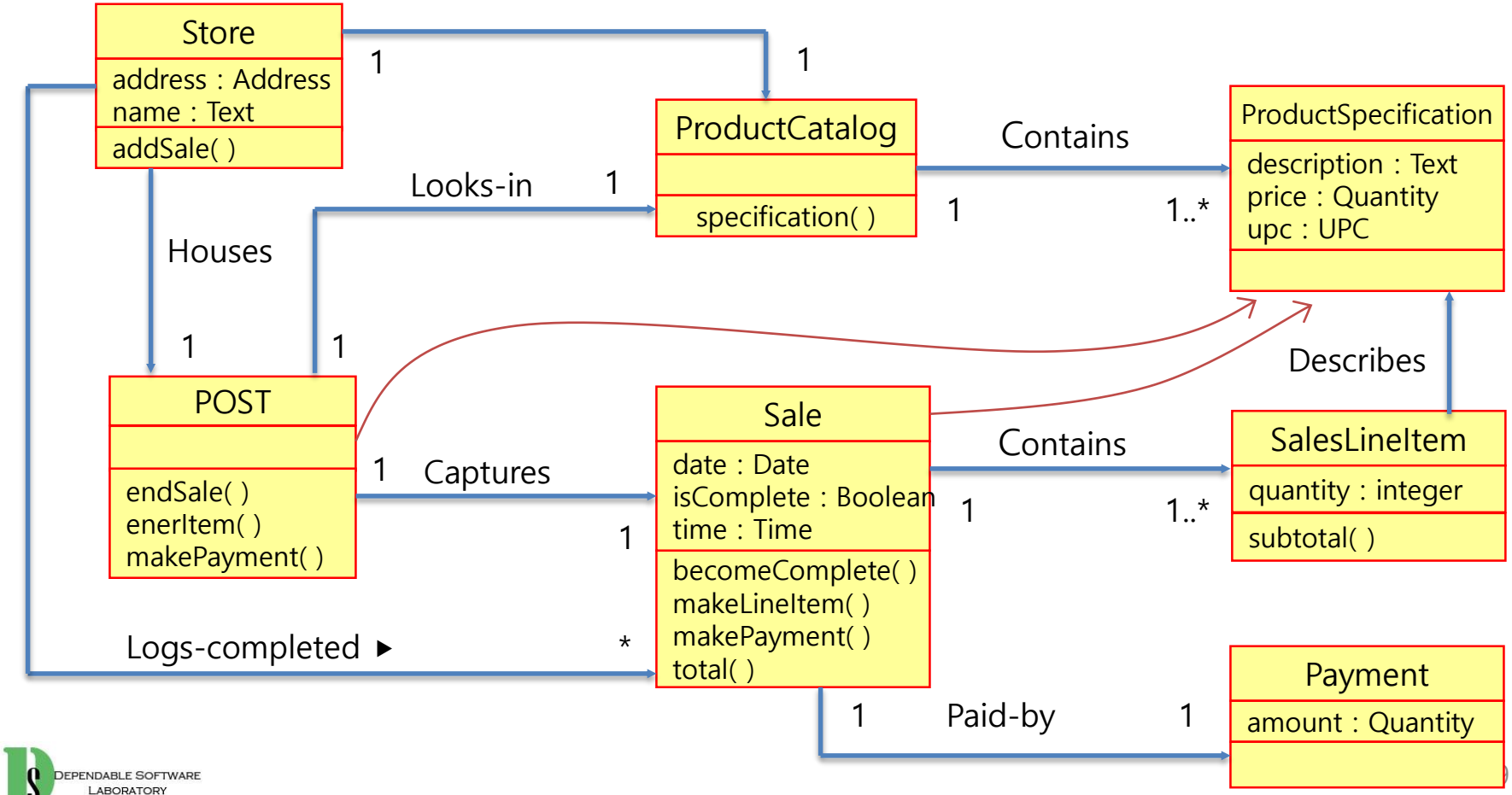
- Step 7. Add navigability arrows
  - According to the interaction diagram
  - Common situations to define navigability
    - A sends a message to B
    - A creates an instance B
    - A needs to maintain a connection to B

# Activity 2045. Define Design Class Diagrams

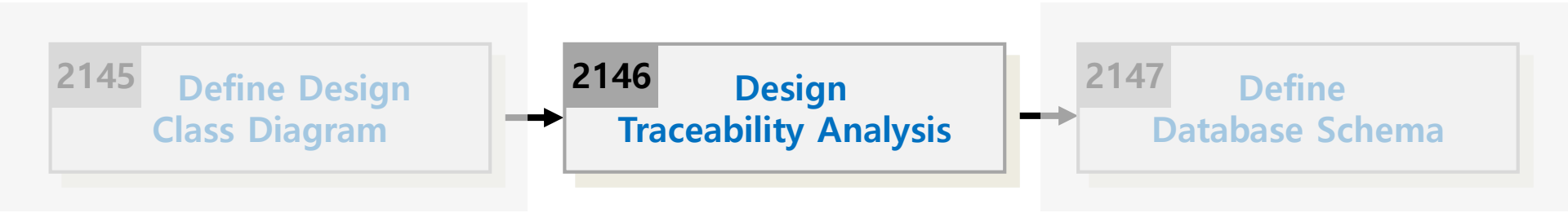


# Activity 2045. Define Design Class Diagrams

- Step 8. Add dependency relationship
  - when there is non-attribute visibility between classes
  - Non-attribute visibility : parameter, global, or locally declared visibility



# Activity 2046. Design Traceability Analysis




- Description
  - Analysis the connection of results which are the results of analyze and design step
    - Identify the connection of use cases and class, methods and test cases
  - Express the traces about requirements to test cases

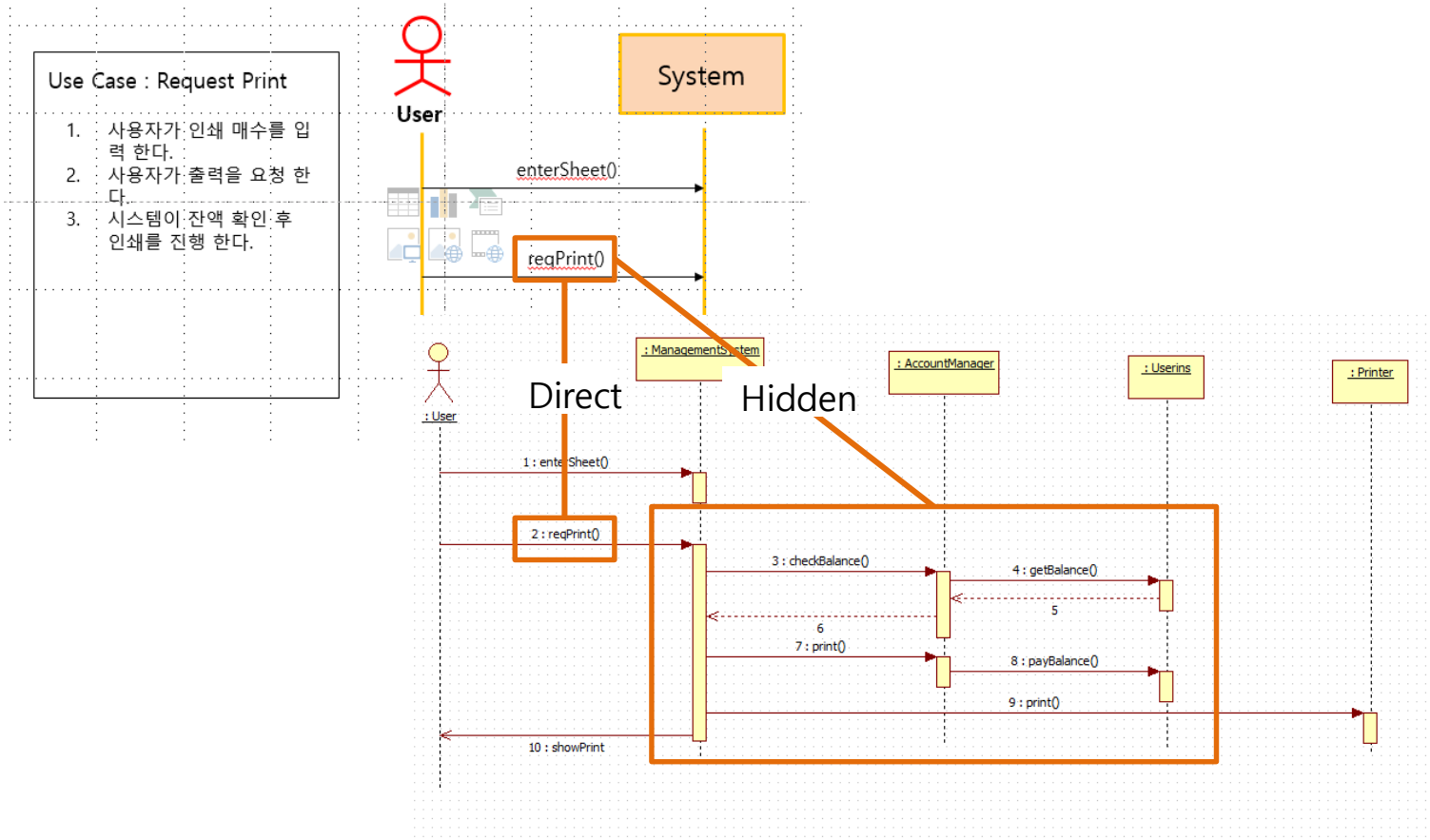
  - Input : Real use case description, design class diagram, functional requirements, System test cases
  - Output : Traceability analysis result

# Activity 2046. Design Traceability Analysis

- Steps:
  1. Identify the related information of essential and real use cases
     - 1:1 or more
  2. Identify the traces between operation contracts(2036) and operations in interaction diagram(2044)
     - Express the direct contacts or hidden contacts
  3. Identify the relations of the results of step 2 and class diagram (class, method)
  4. Writing the results of the analysis
  5. If the operations which are not expressed directly in this step (e.g. GUI related operation like text input), they should be written by 2053

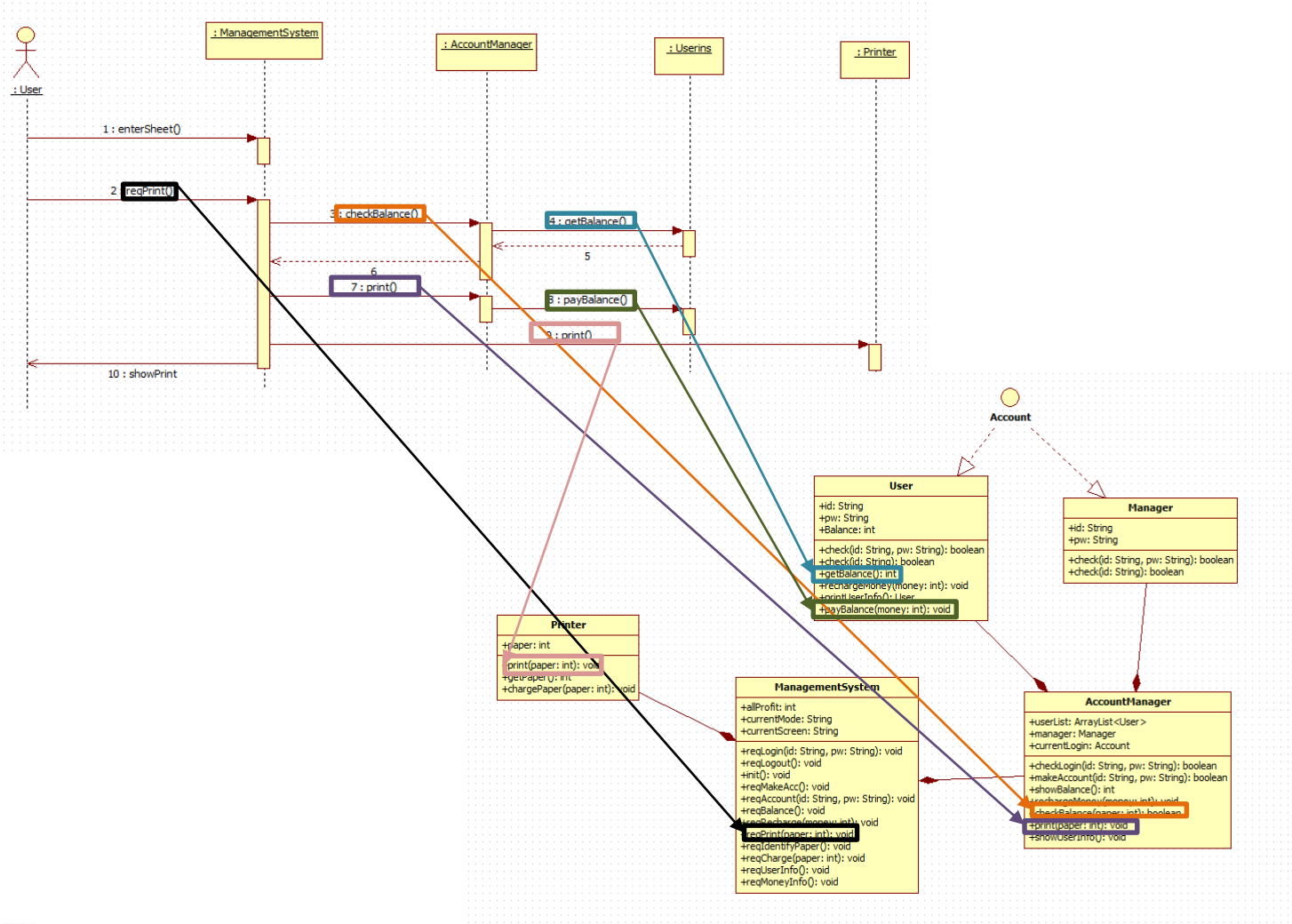
# Activity 2046. Design Traceability Analysis

- Draw up the traces between operation contracts(2036) and operations in interaction diagram(2044)
  - Direct : Operation which is connected directly
  - Hidden : Operations which are used to operate the function invisibly

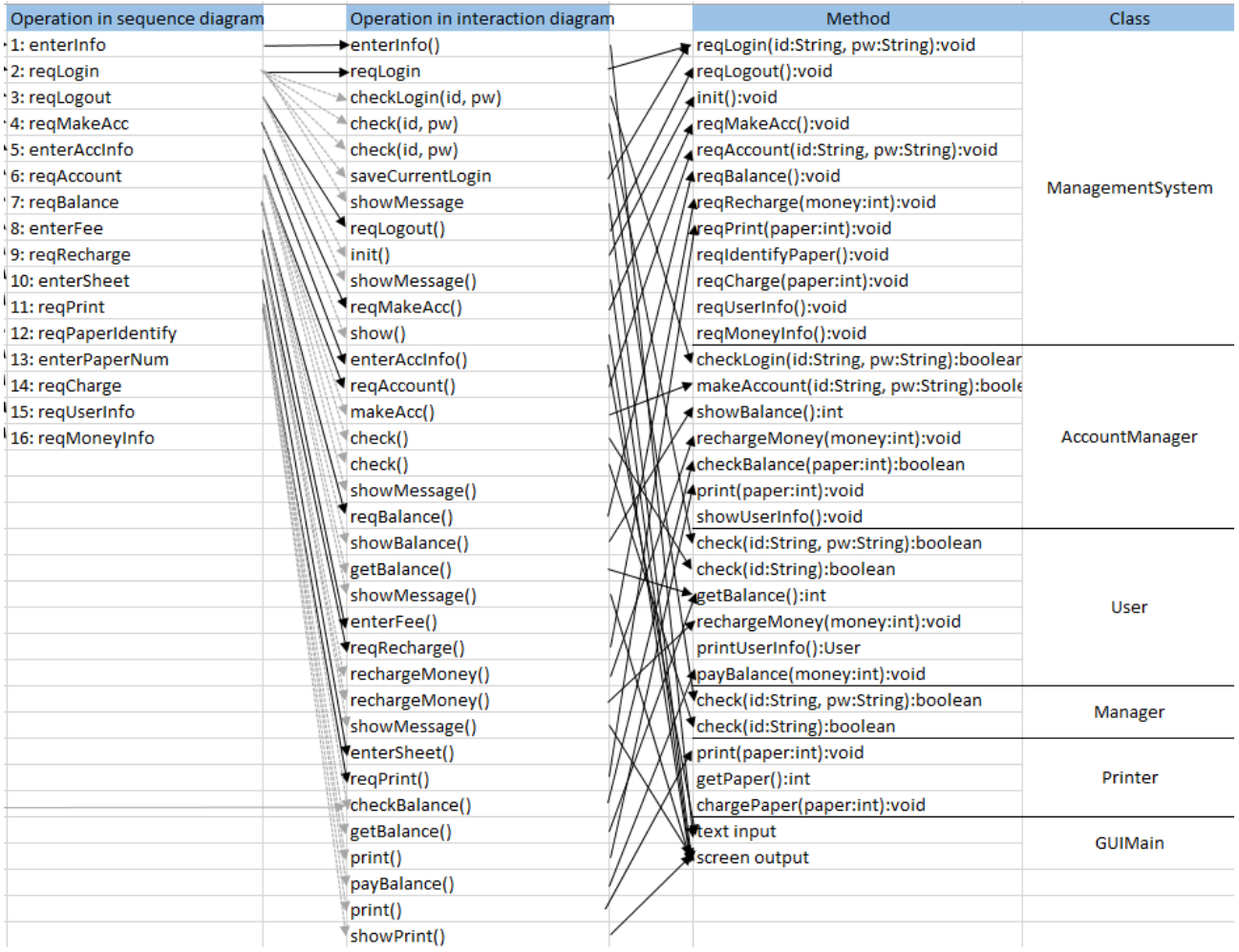


# Activity 2046. Design Traceability Analysis

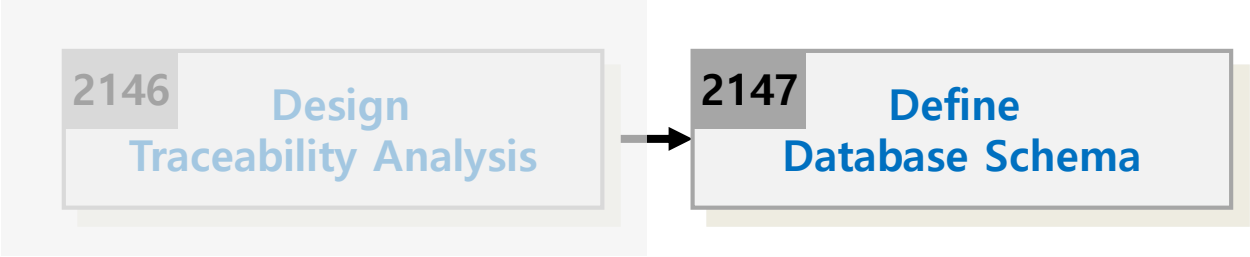
- The results of step 3 and 4



# Activity 2046. Design Traceability Analysis

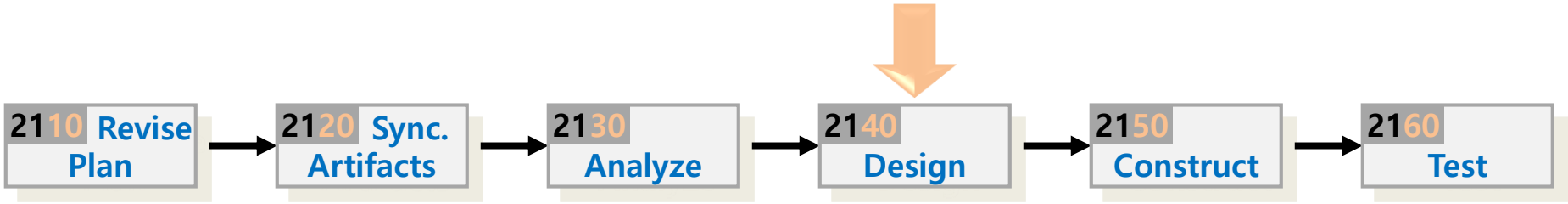


# Activity 2047. Define Database Schema




- Description
  - Design database, table, and records
  - Map classes into tables
  - Input : Design Class Diagram
  - Output : A Database Schema
- Steps:
  1. Map classes into tables
  2. Map relationships between classes into relations between tables
  3. Map attributes into fields of tables
  4. Design Schema

# Phase 2040.
# Design
## -Case Study-



# Activity 2041. Design Real Use Cases

| | |
|---|---|
| **Use Case** | Login |
| **Actor** | User, Manager |
| **Purpose** | User와 manager가 시스템에 접속하기 위해 로그인 할 수 잇도록 한다. |
| **Overview** | ID/PW 를 입력 받아 계정과 비밀번호가 일치하는 경우 user or manager로 로그인 한다.<br>일치하는 계정이 없는 경우 로그인 되지 않는다. |
| **Type** | Primary |
| **Cross Reference** | Functions: R 1.1, |
| **Pre-Requisites** | N/A |
| **Typical Courses of Events** | (A) : Actor, (S) : System<br>1. (A) : 화면에 ID, PW 를 입력 한다.<br>2. (A) : 로그인 버튼을 누른다.<br>3. (S) : Account의 User instance들의 id, pw와 비교 한다.<br>4. (S) : 일치하는 instance가 존재하는 경우 user로 로그인 한다.<br>5. (S) : Account의 Manager instance들의 id, pw와 비교 한다.<br>6. (S) : 일치하는 instance가 존재하는 경우 manager 로 로그인 한다.<br>7. (S) : 현재 로그인된 계정을 기록 한다. |
| **Alternative Courses of Events** | … |
| **Exceptional Courses of Events** | E1. 일치하는 계정이 없는 경우 접속되지 않는다. |

# Activity 2041. Design Real Use Cases

| | |
|---|---|
| **Use Case** | Logout |
| **Actor** | User, Manager |
| **Purpose** | 접속된 User or Manager의 접속을 종료한다. |
| **Overview** | Logout 버튼을 누르면 접속된 user or manager의 접속을 종료하고 초기화면으로 돌아간다. |
| **Type** | Primary |
| **Cross Reference** | Functions: R 1.1 |
| **Pre-Requisites** | Login이 선행 되어야 한다. |
| **Typical Courses of Events** | (A) : Actor, (S) : System<br>1. (A) : 로그아웃 버튼을 누른다.<br>2. (S) : ManagementSystem의 현재 로그인 정보를 초기화 한다.<br>3. (S) : 초기화면으로 돌아간다. |
| **Alternative Courses of Events** | … |
| **Exceptional Courses of Events** | N/A |

# Activity 2041. Design Real Use Cases

| | |
|---|---|
| **Use Case** | Make Account |
| **Actor** | User |
| **Purpose** | 새로운 사용자 계정을 생성한다. |
| **Overview** | 생성할 계정의 id/pw를 입력 후 생성 버튼을 눌러 새로운 사용자 계정을 생성 할 수 있다. 새로 생성한 계정은 동일한 id가 없는 경우에만 생성 된다. |
| **Type** | Primary |
| **Cross Reference** | Functions: R 1.2 |
| **Pre-Requisites** | N/A |
| **Typical Courses of Events** | (A) : Actor, (S) : System<br>1. (A) : 계정 생성 버튼을 누른다.<br>2. (S) : 계정생성 화면으로 전환 한다.<br>3. (A) : 화면에 id, pw를 입력 한다.<br>4. (A) : 생성 요청 버튼을 누른다.<br>5. (S) : Account의 user instance의 id를 확인 하여 기존 사용자와 비교 한다.<br>6. (S) : 일치하는 id가 없는 경우 user instance를 생성하여 사용자 계정을 생성 하고 초기 정보를 입력 한다. |
| **Alternative Courses of Events** | … |
| **Exceptional Courses of Events** | E1. 동일한 id를 가진 계정이 이미 존재하는 경우 생성하지 않는다. |

# Activity 2041. Design Real Use Cases

| | |
|---|---|
| **Use Case** | Identify Balance |
| **Actor** | User |
| **Purpose** | 사용자 계정에 남아있는 잔액을 확인 한다. |
| **Overview** | 사용자의 잔액 확인 요청 시 남아있는 잔액을 확인하여 출력 한다. |
| **Type** | Primary |
| **Cross Reference** | Functions: R 1.3 |
| **Pre-Requisites** | 사용자로 login이 선행 되어야 한다. |
| **Typical Courses of Events** | (A) : Actor, (S) : System<br>1. (A) : 잔액 확인 버튼을 누른다.<br>2. (S) : 현재 로그인된 user instance에서 balance값을 출력 한다. |
| **Alternative Courses of Events** | … |
| **Exceptional Courses of Events** | |

# Activity 2041. Design Real Use Cases

| | |
|---|---|
| **Use Case** | Recharge Balance |
| **Actor** | User |
| **Purpose** | 해당 사용자 계정에 잔액을 충전 한다. |
| **Overview** | 입력 받은 금액 만큼 해당 사용자 계정에 잔액을 충전 한다. |
| **Type** | Primary |
| **Cross Reference** | Functions: R 1.4 |
| **Pre-Requisites** | 사용자로 login이 선행 되어야 한다. |
| **Typical Courses of Events** | (A) : Actor, (S) : System<br>1. (A) : 화면에 금액을 입력 한다.<br>2. (A) : 잔액 충전 버튼을 누른다.<br>3. (S) : 입력 받은 금액 만큼 해당 user instance.balance 에 증가 시킨다. |
| **Alternative Courses of Events** | … |
| **Exceptional Courses of Events** | E1. 음수 값은 처리하지 않고 오류 메시지를 보낸다. |

# Activity 2041. Design Real Use Cases

| | |
|---|---|
| **Use Case** | Request Print |
| **Actor** | User |
| **Purpose** | 사용자의 요청을 받아 인쇄를 진행 한다. |
| **Overview** | 사용자의 요청을 받아 입력된 매수 만큼 인쇄를 진행 한다. |
| **Type** | Primary |
| **Cross Reference** | Functions: R 2.1, R 2.2 |
| **Pre-Requisites** | 사용자로 login이 선행 되어야 한다. |
| **Typical Courses of Events** | (A) : Actor, (S) : System<br>1. (A) : 화면에 필요 인쇄 매수를 입력 한다.<br>2. (A) : 인쇄 버튼을 누른다.<br>3. (S) : ManagementSystem에서 매수에 따라 요금을 계산 한다.<br>4. (S) : check balance use case를 통해 잔액을 비교 한다.<br>5. (S) : 잔액이 부족하면 ERROR 메시지 후 종료 한다.<br>6. (S) : 인쇄 매수와 printer의 paper를 비교하여 부족할 경우 종료 한다.<br>7. (S) : printer 의 paper를 매수 만큼 감소 시킨다.<br>8. (S) : allProfit 을 요금 만큼 증가 시킨다.<br>9. (S) : user instance.balance를 요금만큼 감소 시킨다. |
| **Alternative Courses of Events** | … |
| **Exceptional Courses of Events** | E 2. 매수가 음수일 경우 진행하지 않는다. |

# Activity 2041. Design Real Use Cases

| | |
|---|---|
| **Use Case** | Check Balance |
| **Actor** | Event-based |
| **Purpose** | 인쇄 진행 시 잔액과 필요 요금을 확인 및 비교 한다. |
| **Overview** | 사용자의 요청에 의해 인쇄 진행 시 시스템의 요청을 받아 필요 요금과 잔액을 체크한다. |
| **Type** | Primary |
| **Cross Reference** | Functions: R 2.1, R 2.2<br>Use Cases: Request Print |
| **Pre-Requisites** | 시스템에 인쇄 요청 후에 동작 한다. |
| **Typical Courses of Events** | (A) : Actor, (S) : System<br>1. (S - A) : 사용자의 인쇄 요청을 받은 시스템이 잔액 확인을 요청한다.<br>2. (S) : user instance 의 balance와 필요 요금을 비교한 결과를 보낸다. |
| **Alternative Courses of Events** | … |
| **Exceptional Courses of Events** | |

# Activity 2041. Design Real Use Cases

| | |
|---|---|
| **Use Case** | Identify Paper |
| **Actor** | Manager |
| **Purpose** | 시스템 관리자가 프린터에 남은 용지를 확인 할 수 있다. |
| **Overview** | 시스템 관리자의 요청에 따라 프린터에 남은 용지 잔량을 확인한다. |
| **Type** | Primary |
| **Cross Reference** | Functions: R 3.1 |
| **Pre-Requisites** | Manager로 로그인 되어 있어야 한다. |
| **Typical Courses of Events** | (A) : Actor, (S) : System<br>1. (A) : 용지 확인 버튼을 누른다.<br>2. (S) : printer 의 paper 값을 출력 한다. |
| **Alternative Courses of Events** | … |
| **Exceptional Courses of Events** | |

# Activity 2041. Design Real Use Cases

| | |
|---|---|
| **Use Case** | Recharge Paper |
| **Actor** | Manager |
| **Purpose** | 시스템 관리자의 요청에 따라 시스템의 용지 잔량을 충전 한다. |
| **Overview** | 시스템 관리자가 요청한 매수 만큼 시스템의 용지 잔량을 충전 한다. |
| **Type** | Primary |
| **Cross Reference** | Functions: R 3.2 |
| **Pre-Requisites** | Manager로 로그인 되어 있어야 한다. |
| **Typical Courses of Events** | (A) : Actor, (S) : System<br>1. (A) : 화면에 충전할 매수를 입력 한다.<br>2. (A) : 용지 충전 버튼을 누른다.<br>3. (S) : 입력된 용지 수 만큼 printer의 paper값을 증가 시킨다. |
| **Alternative Courses of Events** | … |
| **Exceptional Courses of Events** | E 1. 입력 받은 매수가 없거나 음수인 경우 충전이 되지 않는다. |

# Activity 2041. Design Real Use Cases

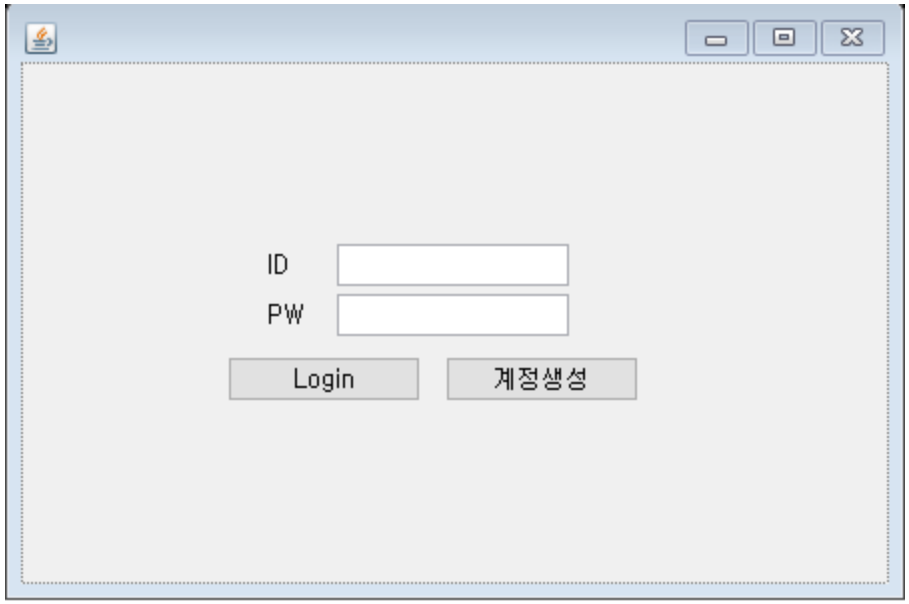
| | |
|---|---|
| **Use Case** | Identify User |
| **Actor** | Manager |
| **Purpose** | 관리자가 사용자들의 정보를 확인 한다. |
| **Overview** | 관리자의 요청에 따라 사용자들의 id/pw, 잔액 정보를 확인한다. |
| **Type** | Primary |
| **Cross Reference** | Functions: R 3.3 |
| **Pre-Requisites** | Manager로 로그인 되어 있어야 한다. |
| **Typical Courses of Events** | (A) : Actor, (S) : System<br>1. (A) : 사용자 확인 버튼을 누른다.<br>2. (S) : Account 의 모든 user instance 정보를 출력 한다. |
| **Alternative Courses of Events** | … |
| **Exceptional Courses of Events** | E1. user instance 에 아무 정보가 없는 경우 출력하지 않는다. |

# Activity 2041. Design Real Use Cases

| | |
|---|---|
| **Use Case** | Identify Money |
| **Actor** | Manager |
| **Purpose** | 총 수익을 확인 한다. |
| **Overview** | 관리자의 요청에 따라 지금까지의 총 수익을 확인 한다. |
| **Type** | Primary |
| **Cross Reference** | Functions: R 3.4 |
| **Pre-Requisites** | Manager로 로그인 되어 있어야 한다. |
| **Typical Courses of Events** | (A) : Actor, (S) : System<br>1. (A) : 수익 확인 버튼을 누른다.<br>2. (S) : allProfit 값을 출력 한다. |
| **Alternative Courses of Events** | … |
| **Exceptional Courses of Events** | |

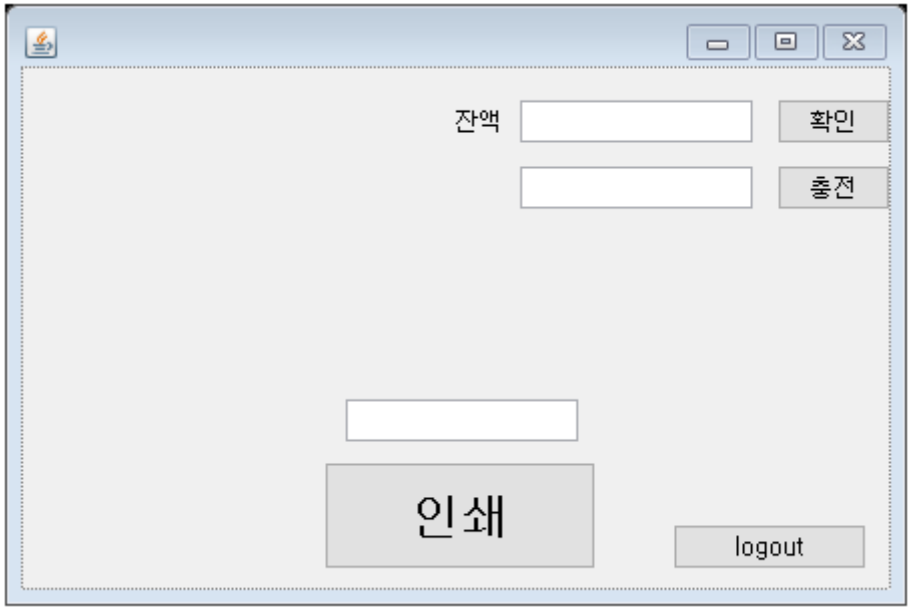
# Activity 2042.
# Define Reports, UI, and Storyboards

- 로그인 초기 화면 예시



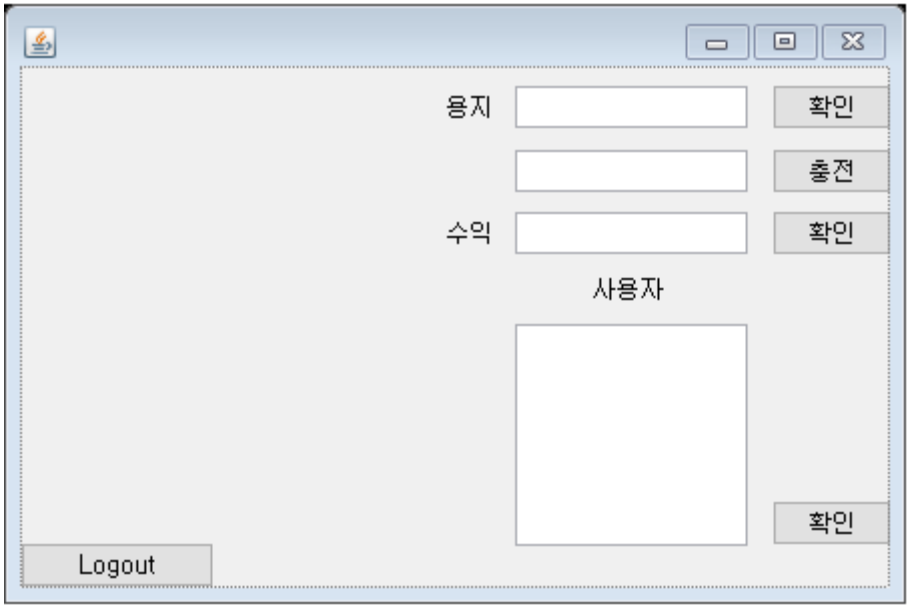
# Activity 2042.
# Define Reports, UI, and Storyboards

- 사용자 화면 예시



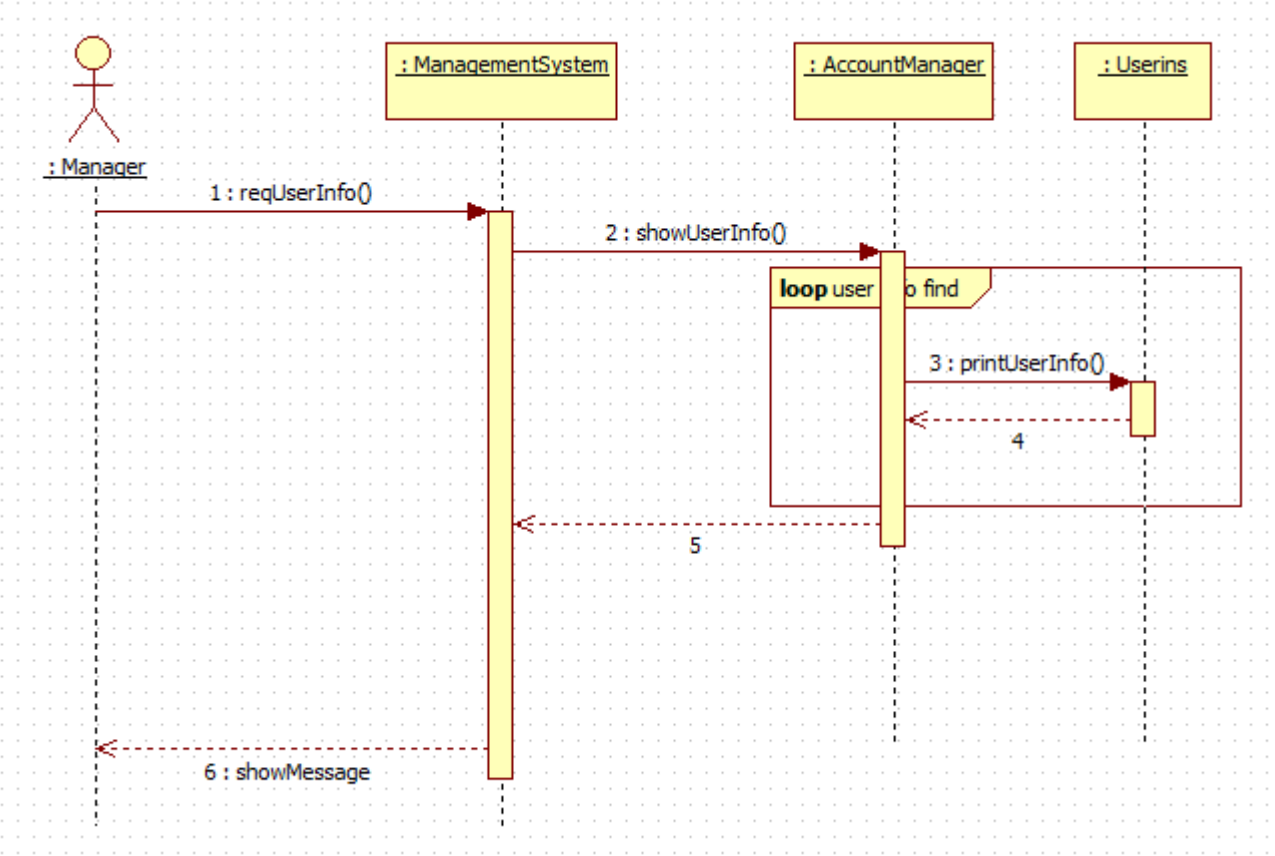
# Activity 2042.
# Define Reports, UI, and Storyboards

- 매니저 관리 화면 예시



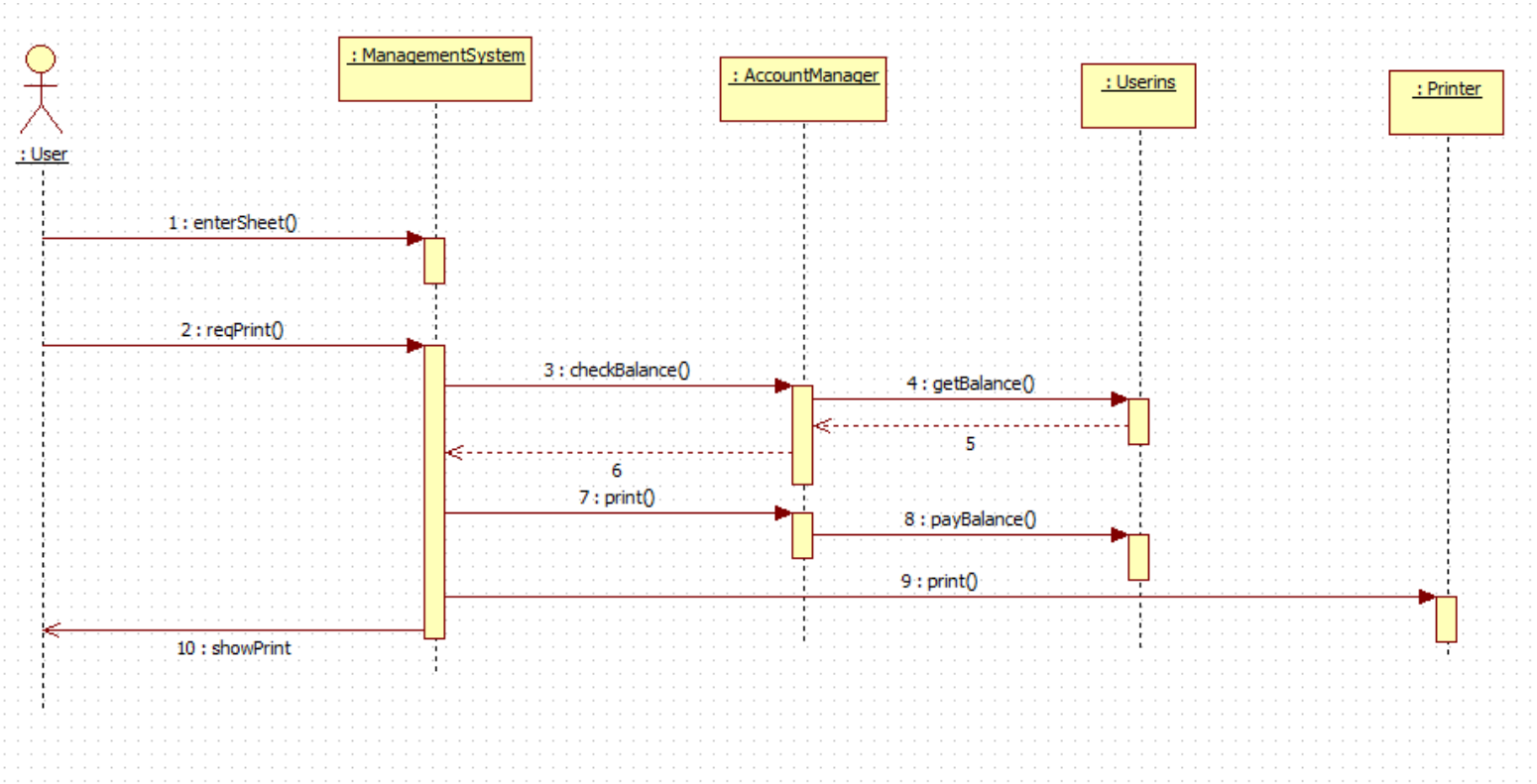
# Activity 2044. Define Interaction Diagrams

- Sequence diagram으로 작성
  - Identify User use case example

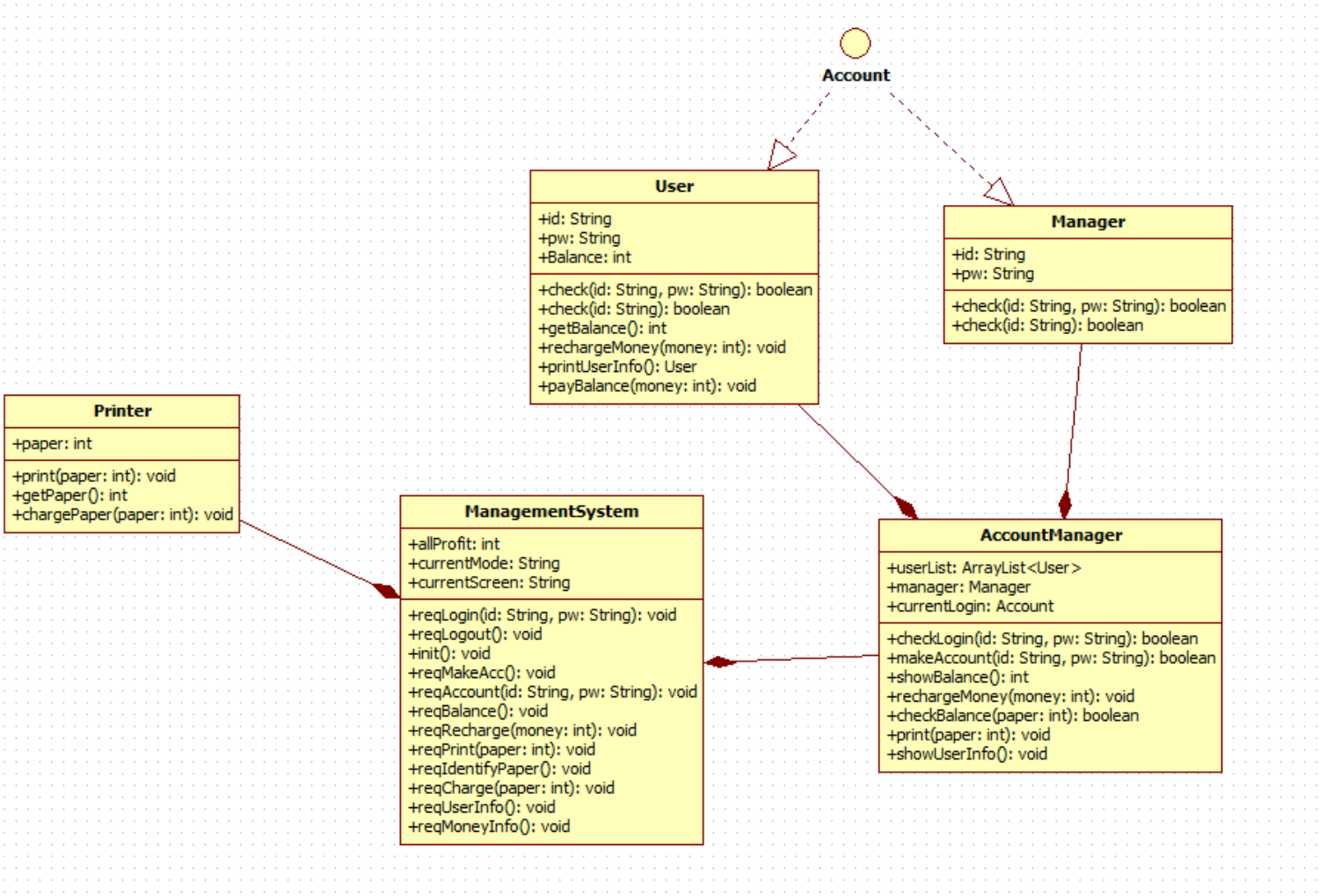


# Activity 2044. Define Interaction Diagrams

– Request Print use case

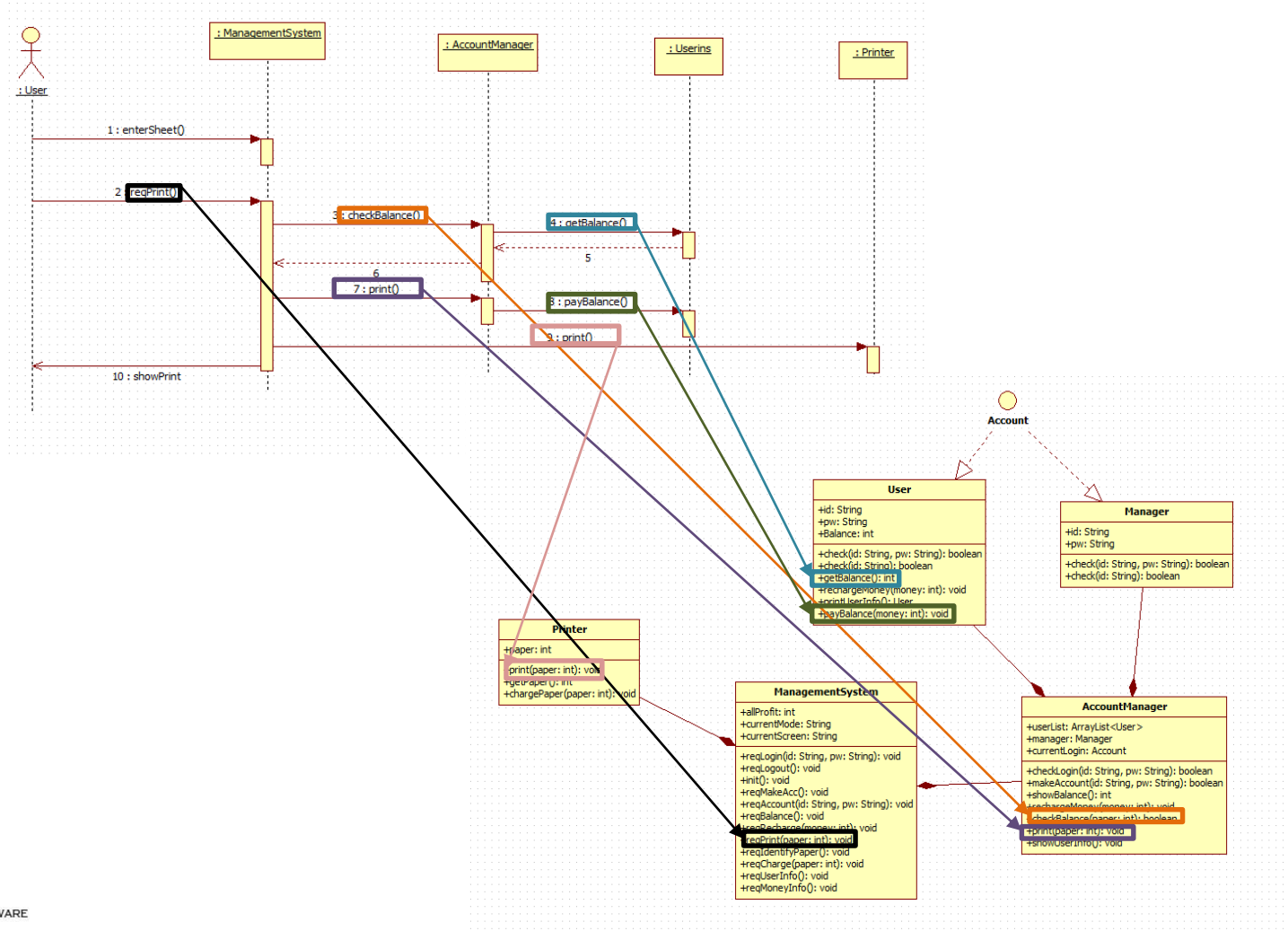


# Activity 2045. Define Design Class Diagrams



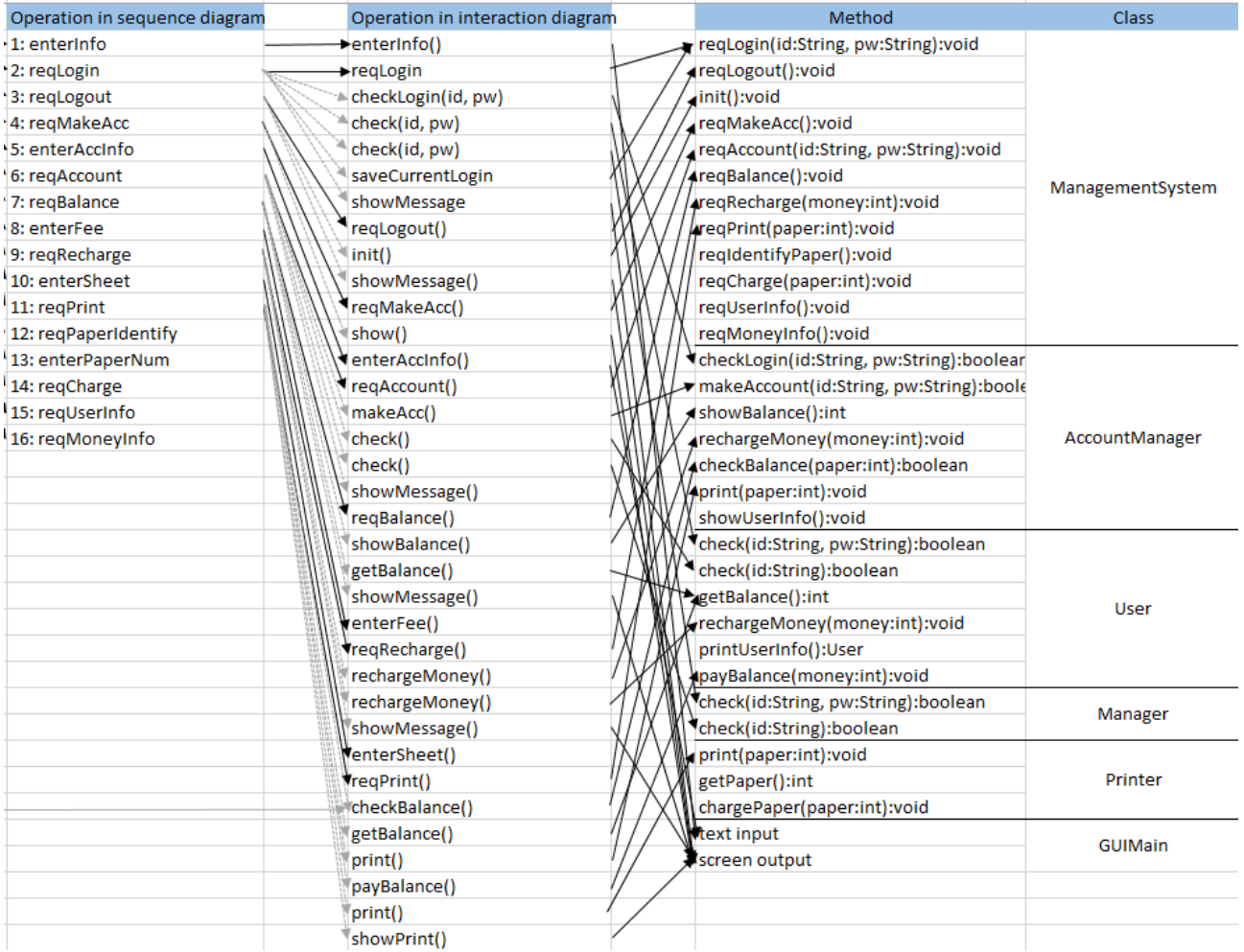
# Activity 2046. Design Traceability Analysis

- Tracing operations in interaction diagram with class diagram



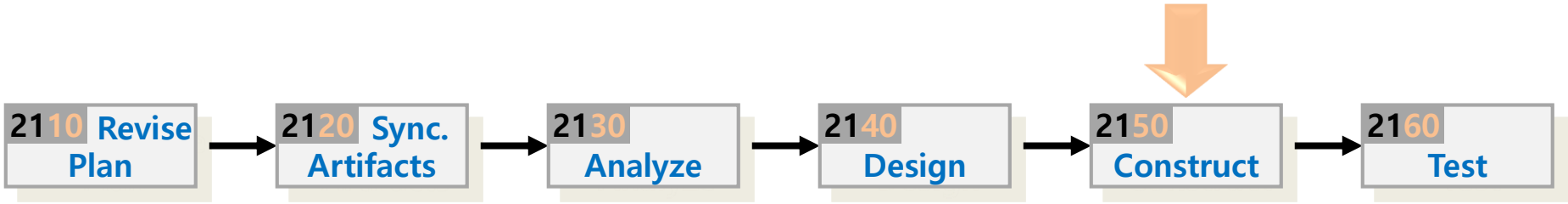
# Activity 2046. Design Traceability Analysis

- Tracing operations in interaction diagram with class diagram



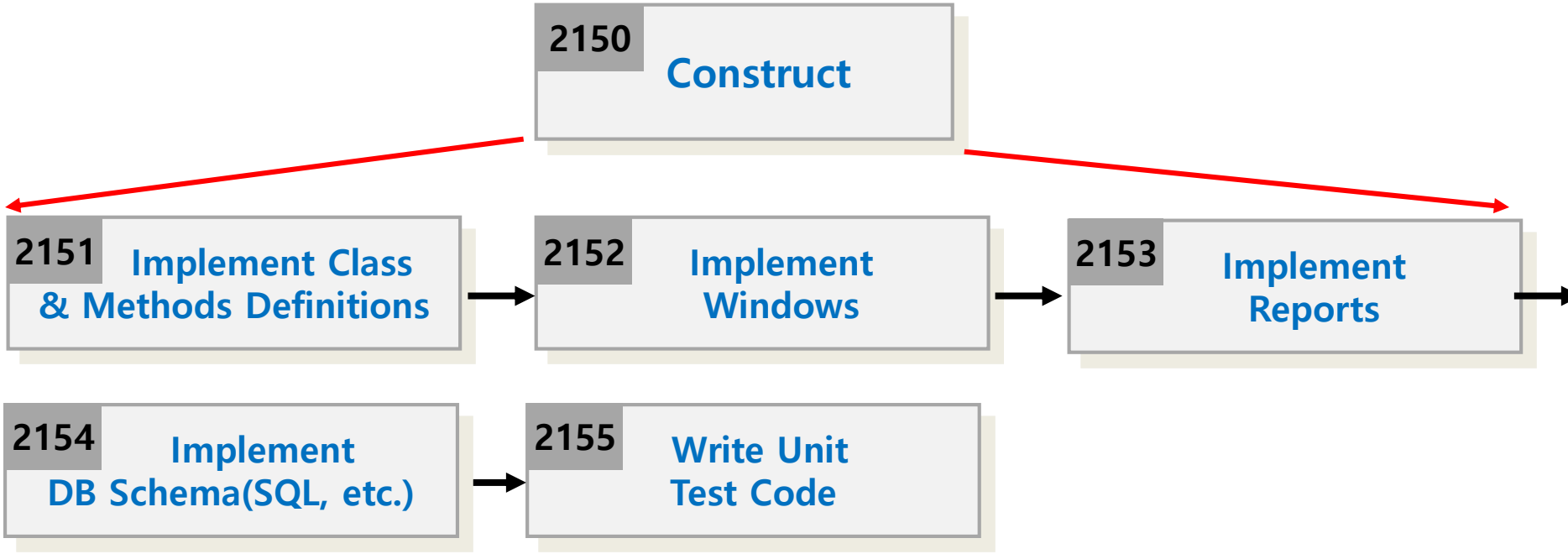
| Operation in sequence diagram | Operation in interaction diagram | Method | Class |
|---|---|---|---|
| 1: enterInfo | enterInfo() | reqLogin(id:String, pw:String):void | ManagementSystem |
| 2: reqLogin | reqLogin | reqLogout():void | |
| 3: reqLogout | checkLogin(id, pw) | init():void | |
| 4: reqMakeAcc | check(id, pw) | reqMakeAcc():void | |
| 5: enterAccInfo | check(id, pw) | reqAccount(id:String, pw:String):void | |
| 6: reqAccount | saveCurrentLogin | reqBalance():void | |
| 7: reqBalance | showMessage | reqRecharge(money:int):void | |
| 8: enterFee | reqLogout() | reqPrint(paper:int):void | |
| 9: reqRecharge | init() | reqIdentifyPaper():void | |
| 10: enterSheet | showMessage() | reqCharge(paper:int):void | |
| 11: reqPrint | reqMakeAcc() | reqUserInfo():void | |
| 12: reqPaperIdentify | show() | reqMoneyInfo():void | |
| 13: enterPaperNum | enterAccInfo() | checkLogin(id:String, pw:String):boolean | AccountManager |
| 14: reqCharge | reqAccount() | makeAccount(id:String, pw:String):boole | |
| 15: reqUserInfo | makeAcc() | showBalance():int | |
| 16: reqMoneyInfo | check() | rechargeMoney(money:int):void | |
| | check() | checkBalance(paper:int):boolean | |
| | showMessage() | print(paper:int):void | |
| | reqBalance() | showUserInfo():void | |
| | showBalance() | check(id:String, pw:String):boolean | User |
| | getBalance() | check(id:String):boolean | |
| | showMessage() | getBalance():int | |
| | enterFee() | rechargeMoney(money:int):void | |
| | reqRecharge() | printUserInfo():User | |
| | rechargeMoney() | payBalance(money:int):void | |
| | rechargeMoney() | check(id:String, pw:String):boolean | Manager |
| | showMessage() | check(id:String):boolean | |
| | enterSheet() | print(paper:int):void | Printer |
| | reqPrint() | getPaper():int | |
| | checkBalance() | chargePaper(paper:int):void | |
| | getBalance() | text input | GUIMain |
| | print() | screen output | |
| | payBalance() | | |
| | print() | | |
| | showPrint() | | |

# Phase 2050.
# Construct



# Phase 2050. Construct

- Phase 2050 Activities



# Activity 2051.
# Implement Class & Methods Definitions

**2151 Implement Class & Methods Definitions**

- Description
  - Implement class & methods in accordance with design class diagram
  - Describes the description of class and methods
    - It is used to design unit test cases
  - Input : Design class diagram, real use cases, Interaction diagram
  - Output : Class & Methods description
- Steps:
  1. Identify all classes and methods in design class diagram(2045)
  2. Writing description of the target by using below format
  3. Implement

# Activity 2051.
# Implement Class & Methods Definitions

| | |
|---|---|
| **Type** | Class or Method |
| **Name** | The name of class o method |
| **Purpose** | Writing the purpose of class or method |
| **Overview (Class)** | Information of class or method |
| **Cross Reference** | Functions: Writing related system functions<br>Use Cases : Writing related use cases |
| **Input (Method)** | Writing all of inputs of methods |
| **Output (Method)** | Writing the output of methods |
| **Abstract operation (Method)** | Writing operation information of methods briefly |
| **Exceptional Courses of Events** | Writing exception state and handling information |

# Activity 2052. Implements Windows

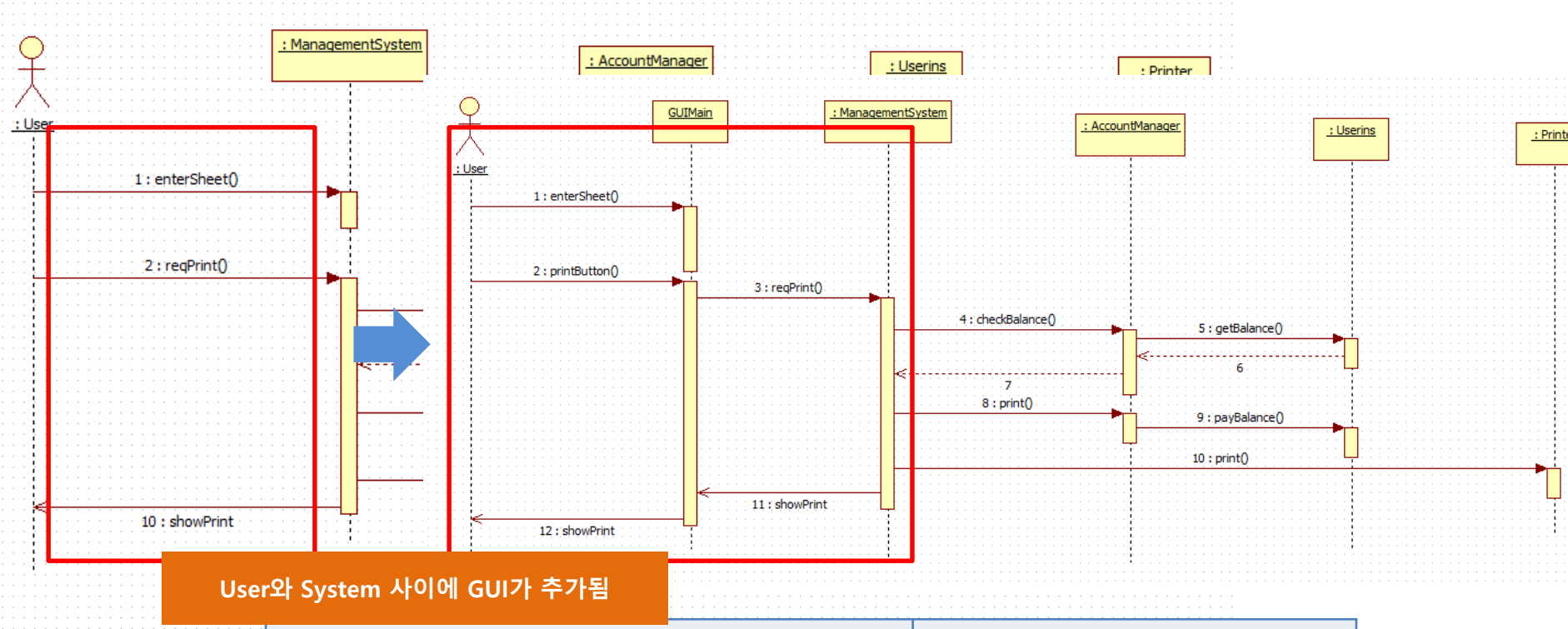

- Description
  - Define relations between GUI and operation
    - Implements GUI class between actor and system
  - Input : Interaction diagram, design class diagram, real use case description, UI Story board, operation contracts
  - Output : GUI implements results and description, Refined Class Diagram
- Steps:
  1. Define GUI system operation between Actor and System in interaction diagram
  2. Draw the refined interaction diagram by adding GUI operation
  3. Draw up the description (using below format) of GUI operation in diagram

# Activity 2052. Implements Windows

| Name | A name of operation |
|---|---|
| Resposibilities | Writing the paper number to text box |
| Type | GUI |
| Cross References | R 2.1 |
| Notes | Shows the value of text box in screen |
| Pre-Conditions | User should be logged in before |
| Post-Conditions | Paper text box shows the input value |

# Activity 2052. Implements Windows

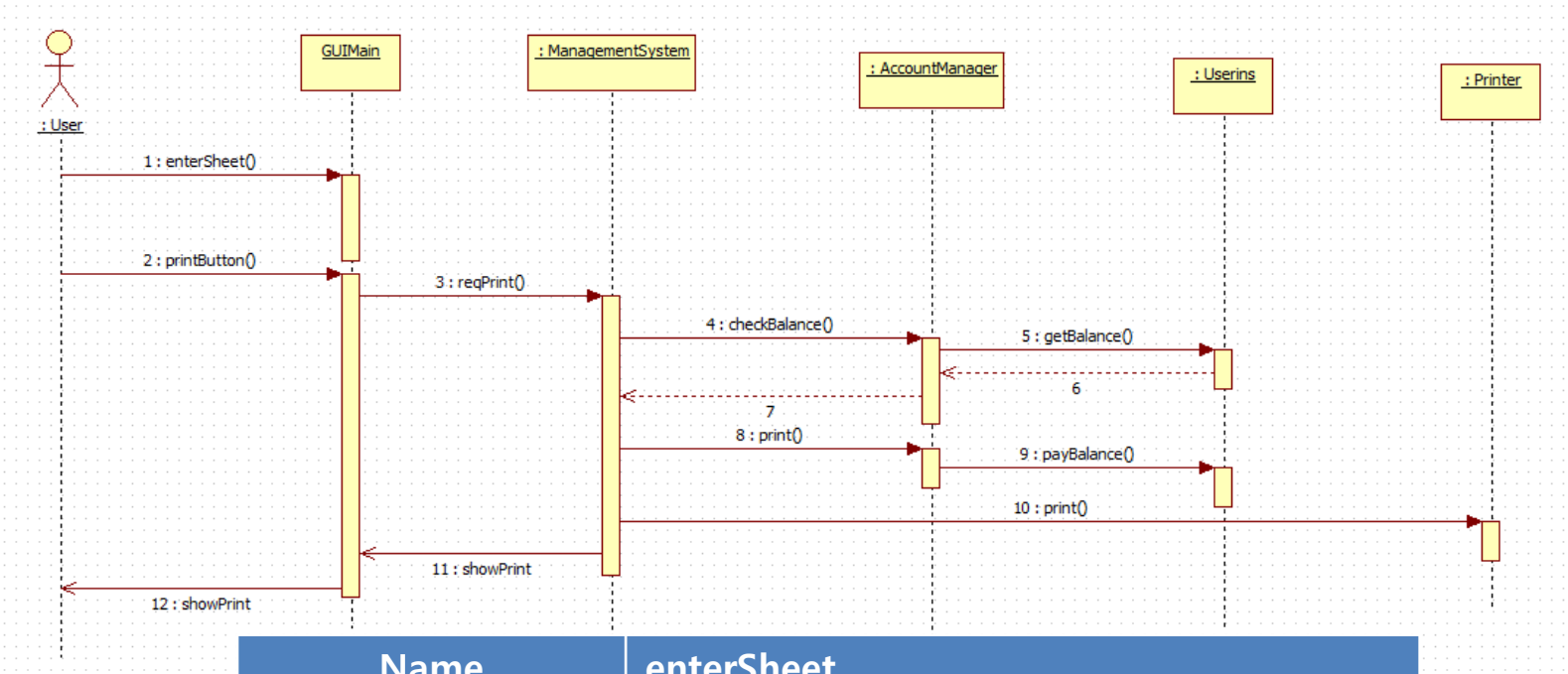
- An example of operations in Request Print use case




| enterSheet | (text input with only GUI) | Text Input |
|---|---|---|
| reqPrint | | Connection with printButton |
| showPrint | Print message | Connection with showPrint |

# Activity 2052. Implements Windows

- Request Print use case




| Name | enterSheet |
|---|---|
| Resposibilities | Text box 에 인쇄 매수를 입력 한다. |
| Type | GUI |
| Cross References | R 2.1 |
| Notes | Text box 에 입력한 숫자를 화면이 표시한다. |
| Pre-Conditions | 유저 로그인 상태 |
| Post-Conditions | Paper text box 에 입력 값 표시 |

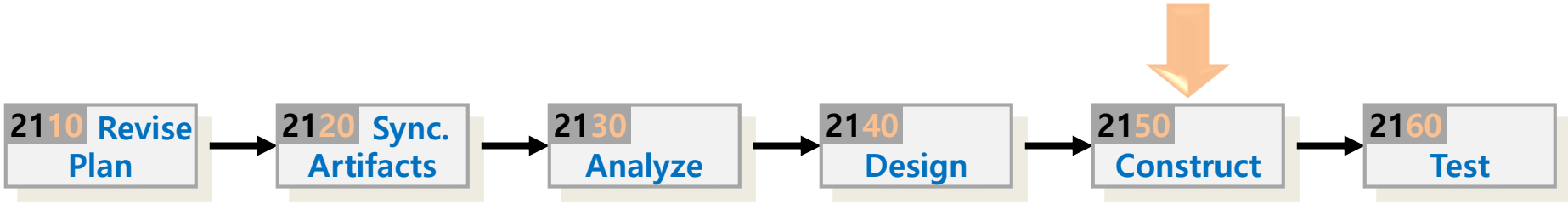
# Activity 2053. Implement Reports


- Description
  - Reports which have information of analysis, design results is refined and implemented in this process again
  - Input : All of information
  - Output : Analysis, design reports

# Activity 2055. Write Unit Test Code


- Description
  - Writing test code for performing unit testing
  - Input : Implements results, class & methods definitions
  - Output : Unit test code
- Steps:
  1. Identify all methods in design
  2. Writing unit test code accordance with the definition of methods

# Phase 2050.
# Construct
## -Case Study-



# Activity 2051.
# Implement Class & Methods Definitions

- Class definitions

| | |
|---|---|
| **Type** | Class |
| **Name** | ManagementSystem |
| **Purpose** | GUI 를 포함한 메인 클래스로써 ACTOR 와의 연결 관계를 가지며 다른 기능 들을 지원하기 위한 class |
| **Overview** | |
| **Cross Reference** | Functions: All<br>Use Cases : All |
| **Exceptional Courses of Events** | |

# Activity 2051.
# Implement Class & Methods Definitions

| | |
|---|---|
| **Type** | Class |
| **Name** | AccountManager |
| **Purpose** | User, manager 계정 관리와 관련 기능에 대한 class |
| **Overview** | |
| **Cross Reference** | Functions: R 1.2, R 1.3, R 1.4, R 2.1, R 2.2<br>Use Cases : |
| **Exceptional Courses of Events** | |

| | |
|---|---|
| **Type** | Class |
| **Name** | User |
| **Purpose** | User 계정 정보 저장을 위한 class |
| **Overview** | |
| **Cross Reference** | Functions: R 1.1, R 1.2, R1.3, R 1.4, R 2.1, R 2.2, R 3.3<br>Use Cases : |
| **Exceptional Courses of Events** | |

# Activity 2051.
# Implement Class & Methods Definitions

| | |
|---|---|
| **Type** | Class |
| **Name** | Manager |
| **Purpose** | Manager 계정 정보 저장을 위한 class |
| **Overview** | |
| **Cross Reference** | Functions: R 1.1<br>Use Cases : |
| **Exceptional Courses of Events** | |

| | |
|---|---|
| **Type** | Class |
| **Name** | Printer |
| **Purpose** | 인쇄 시스템의 프린터 정보 관리 및 기능 관리를 위한 class |
| **Overview** | |
| **Cross Reference** | Functions: R 3.1, R 3.2, R 3.4<br>Use Cases : |
| **Exceptional Courses of Events** | |

# Activity 2051.
# Implement Class & Methods Definitions

- Method definitions

| | |
|---|---|
| **Type** | Method |
| **Name** | reqLogin in ManagementSystem class |
| **Purpose** | User, manager 의 login 요청을 처리하기 위한 method |
| **Cross Reference** | Functions: R 1.1<br>Use Cases : 1. Login |
| **Input (Method)** | id: String, pw: String |
| **Output (Method)** | N/A |
| **Abstract operation (Method)** | 1. 유저가 입력한 id, pw와 함께 로그인 요청을 받아 accountManager class의 checkLogin 함수를 호출 한다. |
| **Exceptional Courses of Events** | |

# Activity 2051.
# Implement Class & Methods Definitions

| | |
|---|---|
| **Type** | Method |
| **Name** | reqLogout in ManagementSystem class |
| **Purpose** | User, manager의 logout 요청을 처리하기 위한 method |
| **Cross Reference** | Functions: R 1.1<br>Use Cases : 2. Logout |
| **Input (Method)** | N/A |
| **Output (Method)** | N/A |
| **Abstract operation (Method)** | 1. Actor의 logout 버튼 입력을 받아 init 함수를 호출 해 현재 로그인 계정 및 화면 초기화 (currentScreen, currentMode) 한다. |
| **Exceptional Courses of Events** | N/A |

# Activity 2051.
# Implement Class & Methods Definitions

| | |
|---|---|
| **Type** | Method |
| **Name** | rechargeMoney in User class |
| **Purpose** | User 계정 instance에 잔액 충전 |
| **Cross Reference** | Functions: R 1.4<br>Use Cases : recharbe balance |
| **Input (Method)** | Money:int |
| **Output (Method)** | N/A |
| **Abstract operation (Method)** | 1. 현재 instance의 balance값을 input 으로 들어온 money 만큼 증가 시킨다. |
| **Exceptional Courses of Events** | N/A |

# Activity 2051.
# Implement Class & Methods Definitions

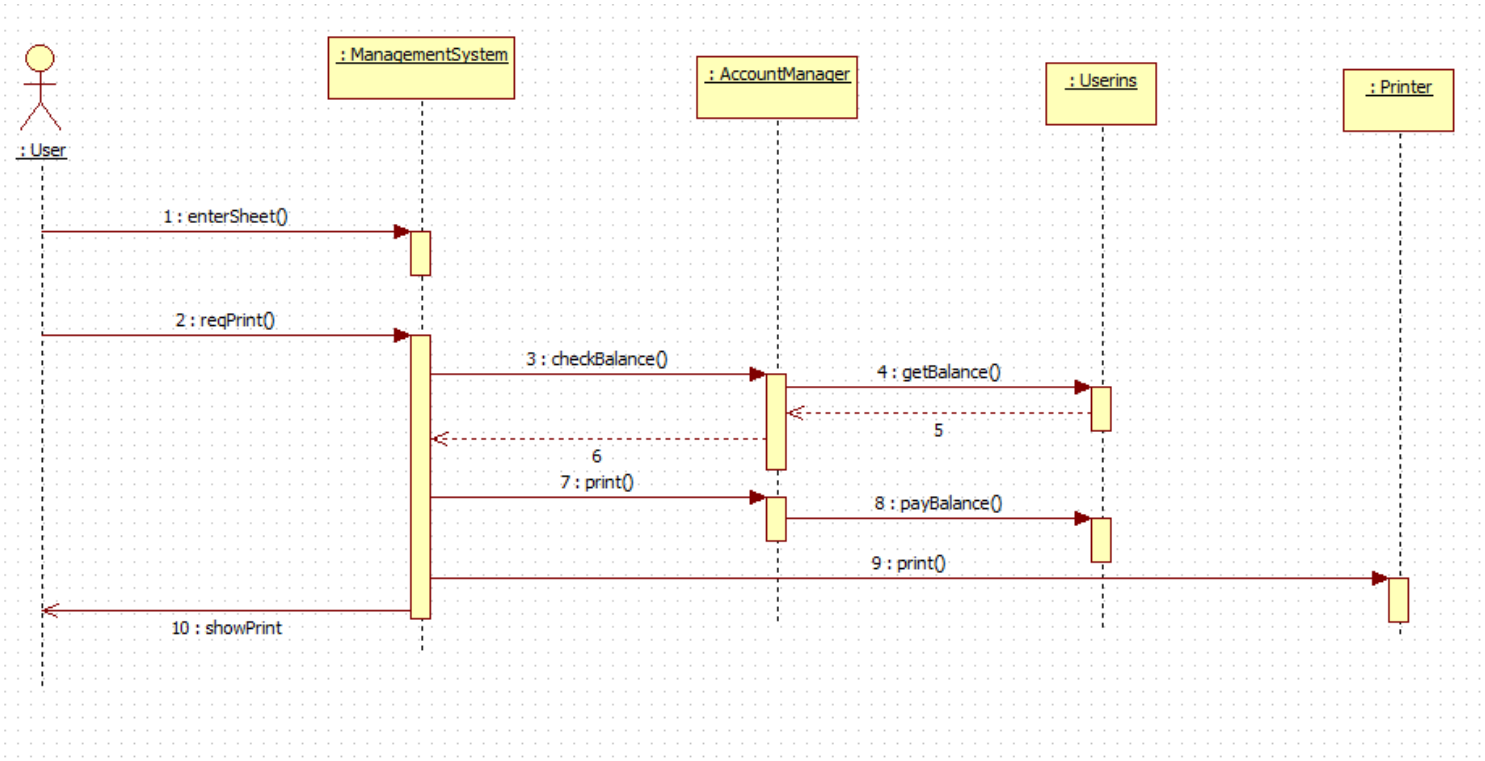
| | |
|---|---|
| **Type** | Method |
| **Name** | reqPrint in ManagementSystem class |
| **Purpose** | User 의 인쇄 요청을 처리하기 위한 method |
| **Cross Reference** | Functions: R 2.1, 2.2<br>Use Cases : Request Print |
| **Input (Method)** | paper:int |
| **Output (Method)** | N/A |
| **Abstract operation (Method)** | 1. AccountManager의 checkBalance 메소드를 호출 한다.<br>2. checkBalance 메소드 실행 결과가 인쇄 가능일 경우 AccountManager의 print 메소드와, Printer의 print 메소드를 호출 하며 각각 paper를 인자로 전달 한다.<br>3. 인쇄 불가능의 경우 에러 메시지를 전달 한다. |
| **Exceptional Courses of Events** | N/A |

# Activity 2051.
# Implement Class & Methods Definitions

| | |
|---|---|
| **Type** | Method |
| **Name** | makeAccount in AccountManager class |
| **Purpose** | User, manager 계정에 같은 id가 존재하는지 check 하는 메소드 |
| **Cross Reference** | Functions: R 1.2<br>Use Cases : 3. Make Account |
| **Input (Method)** | id: String, pw: String |
| **Output (Method)** | Boolean |
| **Abstract operation (Method)** | 1. userList 탐색을 통해 각 user instance 별로 check 메소드를 호출 한다.<br>2. Manager instance의 check 메소드를 호출 한다.<br>3. 각 instance의 check 메소드 호출 결과가 모두 존재하지 않는 경우 새로운 user instance를 생성 후 userList에 삽입 한다.<br>4. 생성한 새 user instance의 id, pw를 설정하고 balance 초기화 후 true를 리턴 한다.<br>5. 같은 id를 가진 계정이 존재하는 경우 false를 리턴 한다. |
| **Exceptional Courses of Events** | N/A |

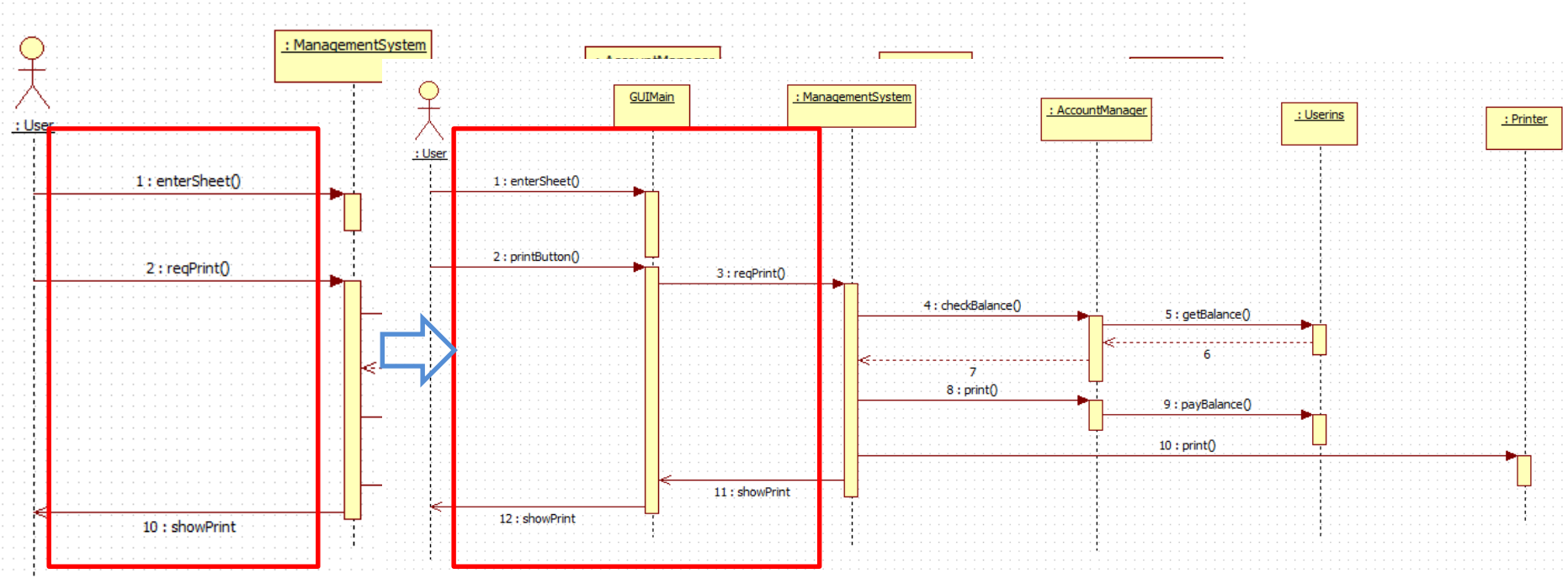
# Activity 2052. Implements Windows

- An example of operations in Request Print use case



# Activity 2052. Implements Windows

- An example of operations in Request Print use case




| enterSheet GUI 만 존재 (text 입력) | Text 입력 |
|---|---|
| reqPrint | printButton 과 연결 |
| showPrint Print message | showPrint 와 연결 |

# Activity 2052. Implements Windows

| Name | enterSheet |
|---|---|
| Resposibilities | Text box 에 인쇄 매수를 입력 한다. |
| Type | GUI |
| Cross References | R 2.1 |
| Notes | Text box 에 입력한 숫자를 화면이 표시한다. |
| Pre-Conditions | 유저 로그인 상태 |
| Post-Conditions | Paper text box 에 입력 값 표시 |

| Name | printButton |
|---|---|
| Resposibilities | Print button 을 누른다. |
| Type | GUI |
| Cross References | R 2.2 |
| Notes | Print button을 눌러 reqPrint 메소드를 호출하고, text의 값을 전달 한다. |
| Pre-Conditions | 유저 로그인 상태, paper text box 에 입력 값 존재 |
| Post-Conditions | SystemManagement class의 reqPrint 메소드를 호출하여 print를 진행 한다. |

# Activity 2053. Implement Reports

- Report 작성
  - 1000 result
  - 2030 result
  - 2040 result
  - 2050 result

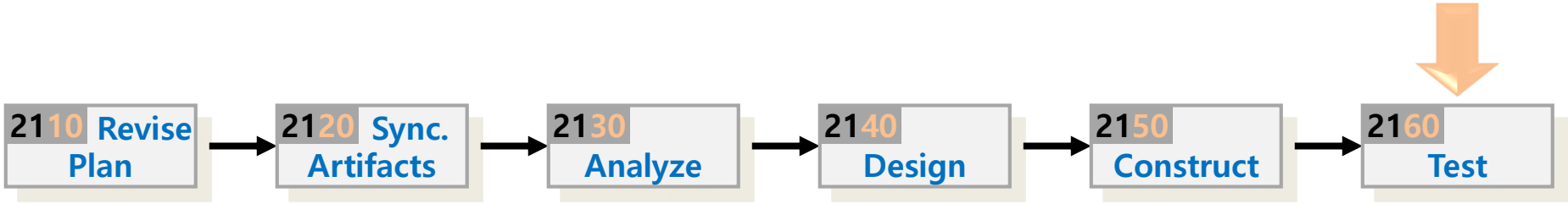
- 본 예제는 현재 ppt에 포함

# Activity 2055. Write Unit Test Code

- 앞의 method description을 이용하여 unit test code 작성
  - Method description의 input, output, abstract operation 등 이용

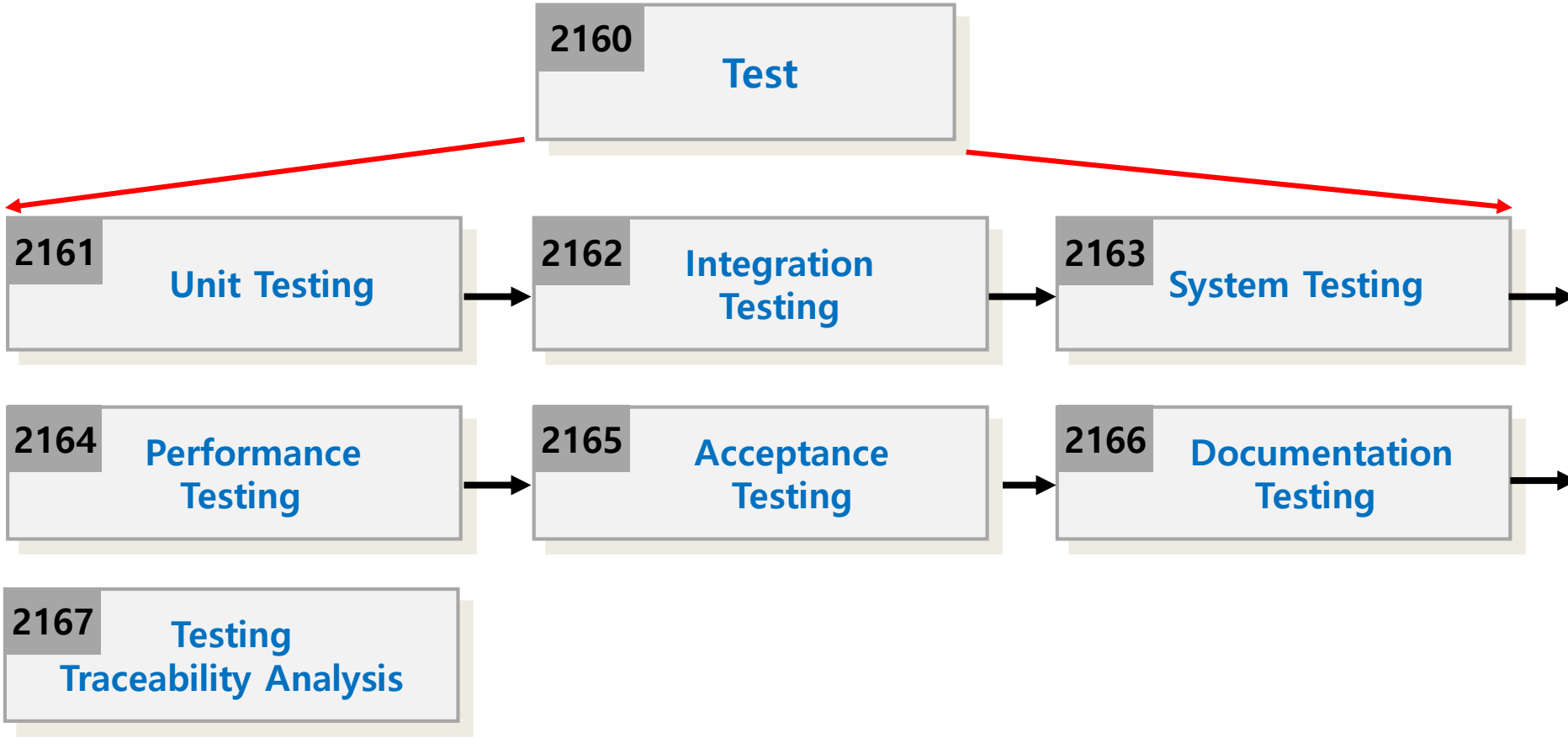
```
@Test
public void testSetlight() {
        special.setlight(50, 50, 500, 600);
        this.assertEquals(1,special.getlight());
        special.setlight(600, 50, 500, 600);
        this.assertEquals(2,special.getlight());

        special.setlight(700, 800, 500, 600);
        this.assertEquals(4,special.getlight());
        special.setlight(50, 800, 500, 600);
        this.assertEquals(3,special.getlight());
}
```

# Phase 2060.
# Test

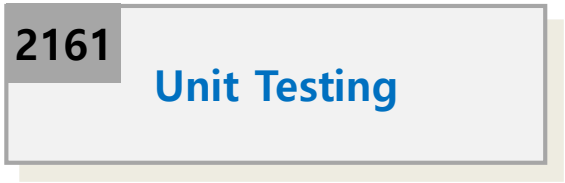


# Phase 2060. Test

- Phase 2060 Activities



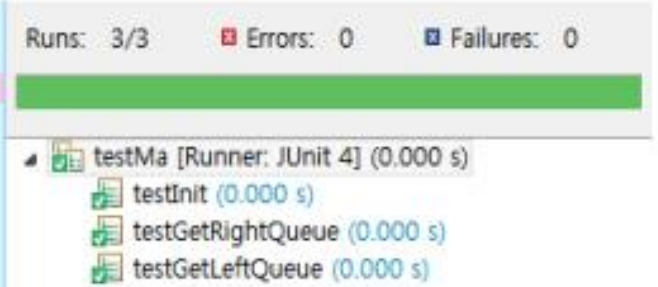
# Activity 2061. Unit Testing



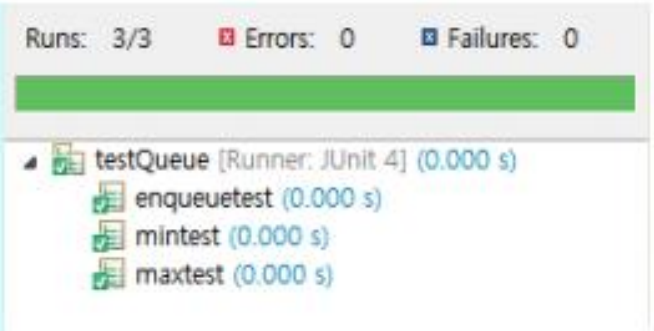

- Description
  - unit testing is a software testing method by which individual units of source code, sets of one or more computer program modules together with associated control data, usage procedures, and operating procedures, are tested to determine whether they are fit for use.
  - Perform unit testing and identify the results of testing
  - Input : Unit test code, implement results
  - Output : Unit testing results, reports
- Steps:
  1. Performing unit test with test codes and implement results of each methods (JUnit)

# Unit test code example

```
movementAlgorithm mA = new movementAlgorithm();
@Test
public void testInit() {
    mA.init();
    assertNotNull(mA.left);
    assertNotNull(mA.right);
}
@Test
public void testGetLeftQueue(){
    mA.init();
    assertNotNull(mA.getLeftQueue());
}
@Test
public void testGetRightQueue(){
    mA.init();
    assertNotNull(mA.getRightQueue());
}
```



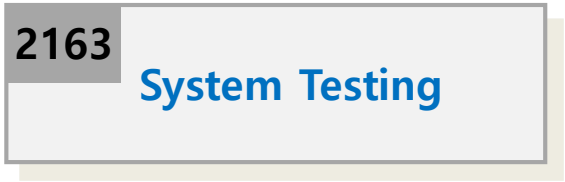

```
queue testqueue = new queue();
@Test
public void enqueuetest() {
    assertEquals(1,testqueue.size());
    assertNotNull(testqueue.trail);
}

@Test
public void mintest(){
    assertNotNull(testqueue.min());
}

@Test
public void maxtest(){
    assertNotNull(this.testqueue.max());
}
```



# Activity 2062. Integration Testing


- Description
  - Integration testing is the phase in software testing in which individual software modules are combined and tested as a group
  - Input : Class & Method definitions
  - Output : Integration testing results, reports

# Activity 2063. System Testing




- Description
  - System testing of software or hardware is testing conducted on a complete, integrated system to evaluate the system's compliance with its specified requirements.
  - Input : Implements results, system test plan and cases
  - Output : System testing results, reports
- Steps:
  1. Identify system test cases before defined
  2. Set the test data of test cases for testing
  3. Performing system testing with system test plan and cases (JFeature)

# Activity 2063. System Testing

- Set the test data of test cases for testing
  - Example of test case 1-1 & 1-2

| 1 – 1 | 로그인 시험 | 존재하는 계정의 Id, pw를 입력하고 로그인 시도를 하여 로그인 기능 test | 1. Login | R 1.1 |
|---|---|---|---|---|
| 1 - 2 | 로그인 시험 | 존재하지 않는 계정의 Id, pw를 입력하고 로그인 시도를 하여 로그인 기능 test | 1. Login | R 1.1 |

  - 1-1 : id 입력란에 test, pw 입력란에 test 입력 후 login 버튼을 누른다.
  - 1-2 : id 입력란에 test2, pw 입력란에 asdf 입력 후 login 버튼을 누른다.

# Activity 2064. Performance Testing


- Description
  - Performance testing is in general, a testing practice performed to determine how a system performs in terms of responsiveness and stability under a particular workload.
  - Input : Implements result (program)
  - Output : Performance testing results, reports

# Activity 2065. Acceptance Testing

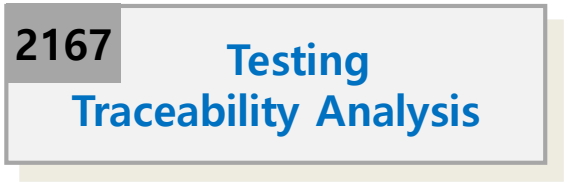

- Description
  - Acceptance testing is a test conducted to determine if the requirements of a specification or contract are met
  - It is used to determine the final acceptance
  - Input : Requirements specification, system
  - Output : Acceptance testing results, reports

# Activity 2066. Documentation Testing

2166 **Documentation Testing**

- Description
  - Documentation testing is a type of non-functional testing
  - It intends to check the quality of documentation
  - Input : All documents in process
  - Output : Documentation testing results, reports

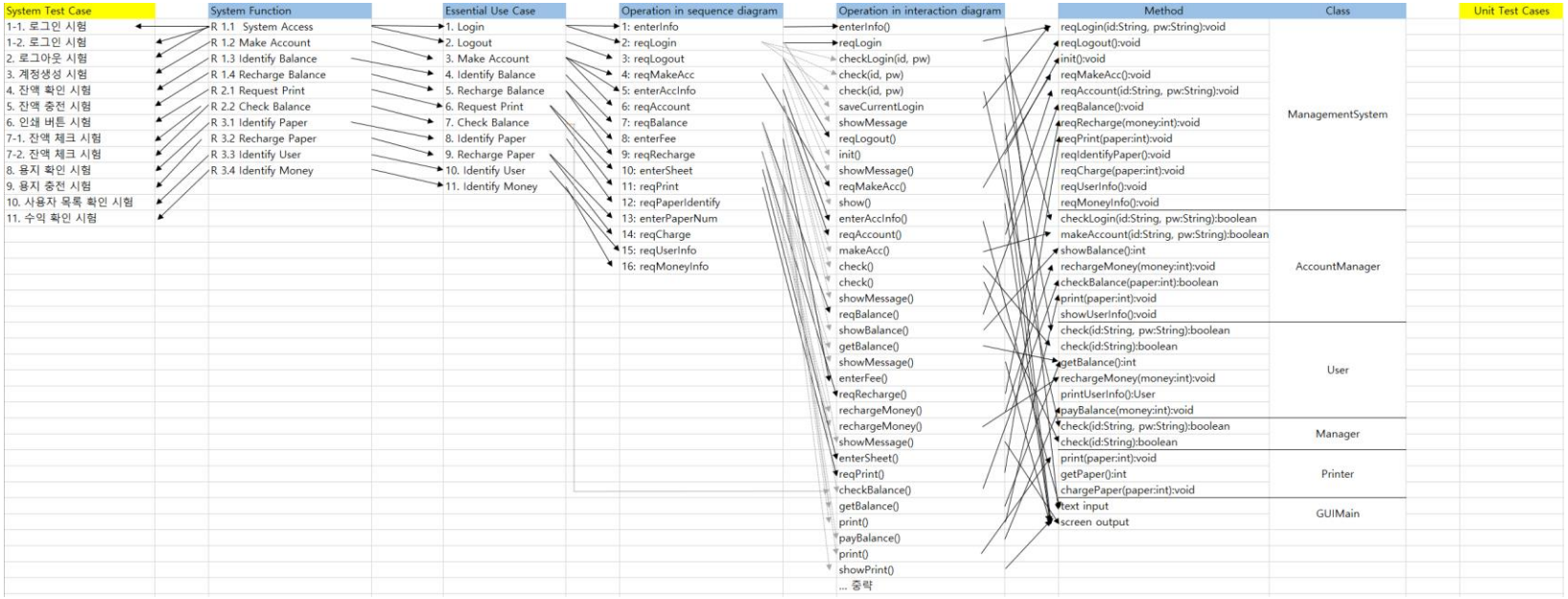
# Activity 2066. Testing Traceability Analysis



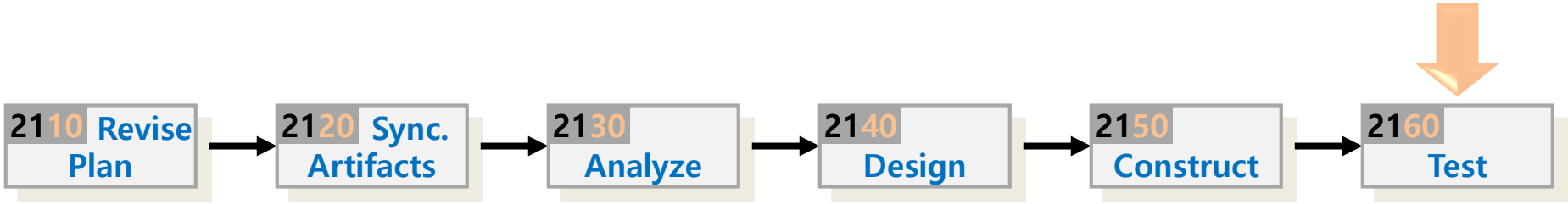

- Description
  - Identify the relations between design and test cases
  - Input : Testing results, traceability documents
  - Output : Testing – design traceability reports

- Step
  1. Identify system test cases and unit test cases
  2. Identify the relations between requirements and system test cases
     - System test cases should be covered all requirement specification
  3. Identify the relations between methods (component) and unit test cases

# Traceability analysis example



# Phase 2060.
# Test
# -Case Study-



# Activity 2061. Unit Testing

- 2055에서 작성한 unit test code를 이용하여 testing후 report 작성

# Activity 2063. System Testing

- Identify system test cases before defined

| Test Number | Test 항목 | Description | Use Case | System Function |
|---|---|---|---|---|
| 1 – 1 | 로그인 시험 | 존재하는 계정의 Id, pw를 입력하고 로그인 시도를 하여 로그인 기능 test | 1. Login | R 1.1 |
| 1 - 2 | 로그인 시험 | 존재하지 않는 계정의 Id, pw를 입력하고 로그인 시도를 하여 로그인 기능 test | 1. Login | R 1.1 |
| 2 | 로그아웃 시험 | 로그인 상태에서 로그아웃 버튼을 눌러 로그아웃 기능 test | 2. Logout | R 1.1 |
| 3 | 계정 생성 시험 | 계정 생성 데이터를 입력하여 계정 생성 기능 test | 3. Make Account | R 1.2 |
| 4 | 잔액 확인 시험 | 잔액 확인 버튼 동작 여부 test | 4. Identify Balance | R 1.3 |
| 5 | 잔액 충전 시험 | 금액을 입력하고 잔액 충전 기능 test | 5. Recharge Balance | R 1.4 |
| 6 | 인쇄 버튼 시험 | 인쇄 매수를 입력하고 인쇄 기능 test | 6. Request Print | R 2.1 |
| 7 – 1 | 잔액 체크 시험 | 잔액이 충분한 상태에서 인쇄 매수를 입력하고 인쇄 기능 test 수행 | 7. Check Balance | R 2.2 |
| 7 – 2 | 잔액 체크 시험 | 잔액이 부족한 상태에서 인쇄 매수를 입력하고 인쇄 기능 test 수행 | 7. Check Balance | R 2.2 |
| 8 | 용지 확인 시험 | 용지 잔량 출력 버튼을 통해 기능 test | 8 Identify Paper | R 3.1 |
| 9 | 용지 충전 시험 | 충전할 용지 수량을 입력하고 용지 충전 test | 9. Recharge Paper | R 3.2 |
| 10 | 사용자 목록 확인 시험 | 전체 사용자 목록 출력 test | 10. Identify User | R 3.3 |
| 11 | 수익 확인 시험 | 총 수익 출력 test | 11. Identify Money | R 3.4 |

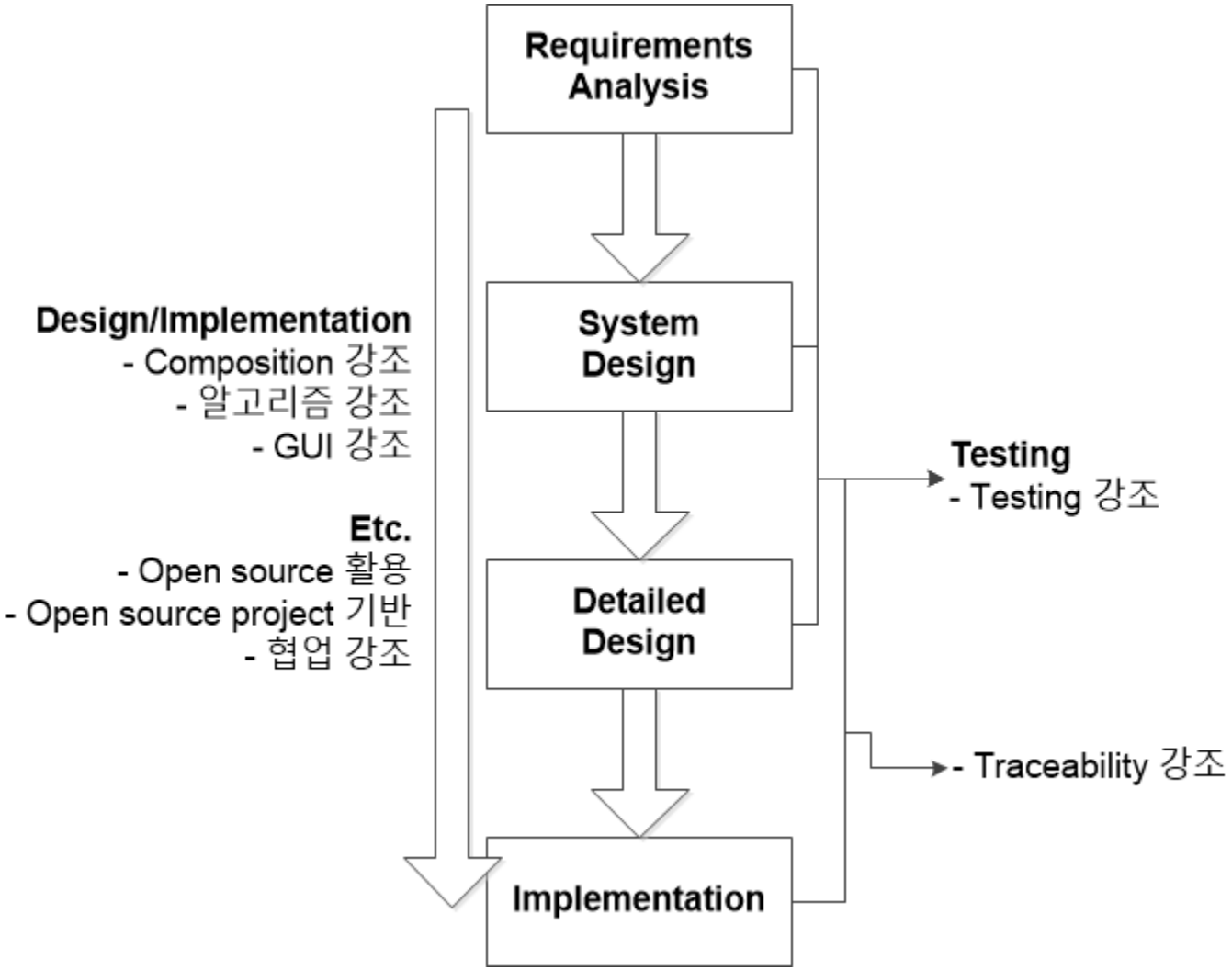
# Activity 2063. System Testing

- Set the test data of test cases for testing
  - Example of test case 1-1 & 1-2

| 1 – 1 | 로그인 시험 | 존재하는 계정의 Id, pw를 입력하고 로그인 시도를 하여 로그인 기능 test | 1. Login | R 1.1 |
|---|---|---|---|---|
| 1 - 2 | 로그인 시험 | 존재하지 않는 계정의 Id, pw를 입력하고 로그인 시도를 하여 로그인 기능 test | 1. Login | R 1.1 |

  - 1-1 : id 입력란에 test, pw 입력란에 test 입력 후 login 버튼을 누른다.
  - 1-2 : id 입력란에 test2, pw 입력란에 asdf 입력 후 login 버튼을 누른다.

# 발전 방향


Requirements Analysis
System Design
Detailed Design
Implementation
Design/Implementation
- Composition 강조
- 알고리즘 강조
- GUI 강조
Etc.
- Open source 활용
- Open source project 기반
- 협업 강조
Testing
- Testing 강조
- Traceability 강조