

System Analysis and Design

L05. Use Cases

Topics

- What are Use Cases?
- Terminology Definitions
- Use-Case Model in UP
- Types and Formats of Use Cases (Formality Types)
- Fully Dressed Use Cases

What are Use Cases?

- Use cases are **text stories** (not diagrams!) of some actor using a system to meet user goals.
- They are used to discover and record **system requirements**
- If a diagram clarifies the text, use it.

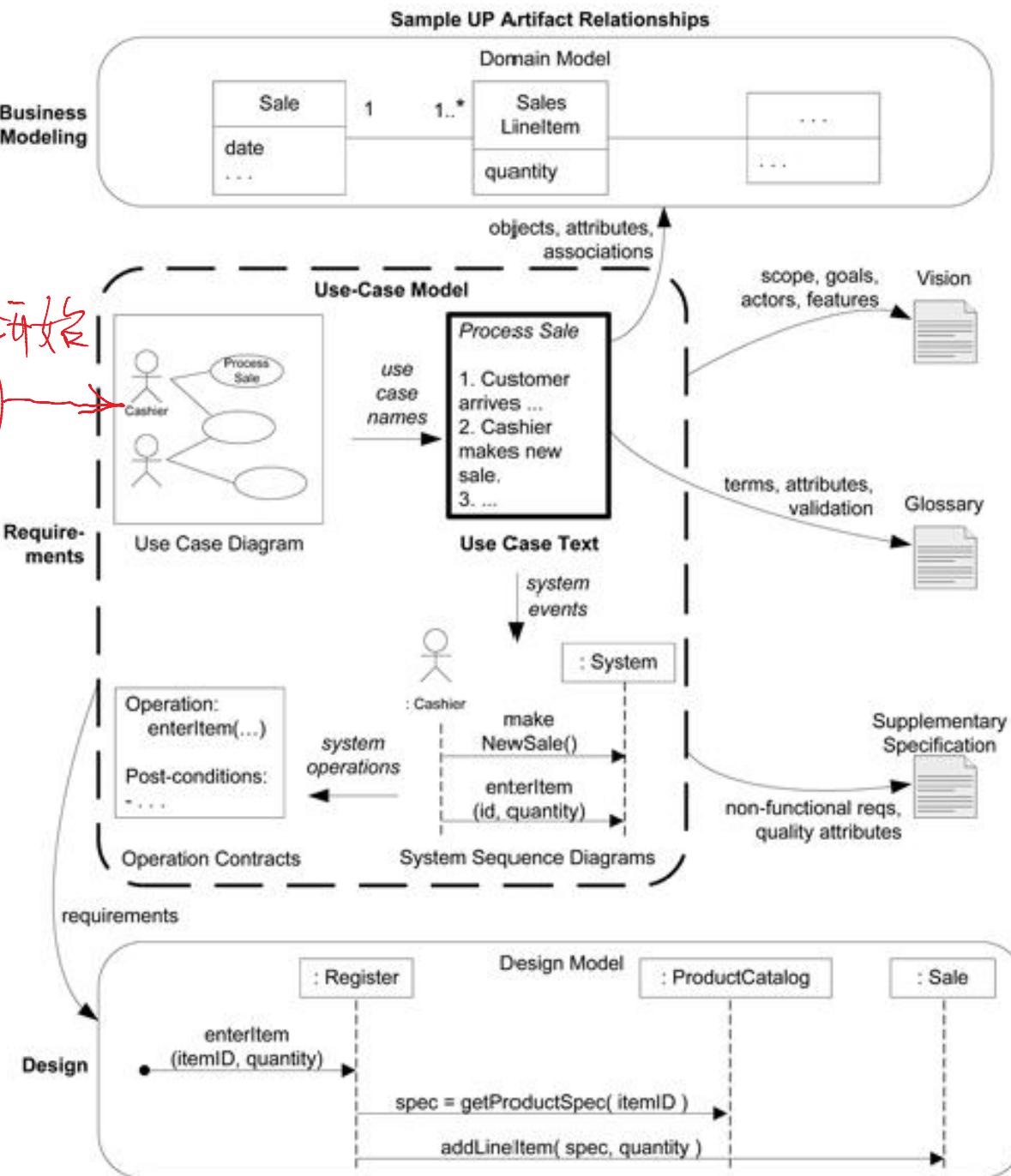
UP工作之间)的相互影响

Sample UP artifact influence

- High-level goals and use case diagrams are input to the creation of the use case text.
- The use cases can in turn influence many other analysis, design, implementation, project management, and test artifacts.

Sample UP artifact influence

软件开发生命周期
影响因素关系图



Terminologies

- **Actor** – Actors are roles played not only by people, but by organizations, software, and machines.
- **Scenario** – Specific sequence of actions and interactions between actors and the system. (also called *a use-case instance*)
- **Use Case** is *a collection of related success and failure scenarios* that describe an actor using a system to support a goal
- [RUP Use Case] *A set of use-case instances*, where each instance is a sequence of actions a system performs that yields an observable result of value to a particular actor

What are Three Kinds of Actors?

- There are three kinds of external actors in relation to the system under discussion (SuD):
- **Primary actor** has user goals fulfilled through using services of the SuD. (To find user goals, which drive the use cases.) *主参与者*
- **Supporting actor** provides a service to the SuD. The automated payment authorization service is an example. (To clarify external interfaces and protocols.) *支撑参与者*
- **Offstage actor** has an interest in the behavior of the use case, but is not primary or supporting; for example, a government tax agency. (To ensure that *all* necessary interests are identified and satisfied.) *幕后参与者*.

Use-Case Model in UP

- The UP defines the **Use-Case Model** within the Requirements discipline.
- Primarily, this is **the set of all written use cases**; it is a model of the system's functionality and environment.
- The Use-Case Model is not the only requirement artifact in the UP.
 - There are also the Supplementary Specification, Glossary, Vision, and Business Rules.
- The Use-Case Model may optionally include a UML use case diagram to show the names of use cases and actors, and their relationships.
- There is nothing object-oriented about use cases

Why Use Cases?

- Use cases are a good way to help keep it **simple**, and make it possible for domain experts or requirement donors to themselves write (or participate in writing) use cases.
- *They emphasize the user goals and perspective*
- A strength of use cases is the ability to **scale both up and down** in terms of sophistication and formality. 基于其精练的技巧和形式，有很大伸缩性。

三种格式

Three Formats of Use Cases

- **Brief** – Terse, one-paragraph summary, usually the main success scenario. Create during early requirements phase. 简约格式
- **Casual** – Informal paragraph format. Can cover various scenarios in multiple 非正式格式 paragraphs.
- **Fully-dressed** – All steps and variations written in detail. Has supporting sections, success guarantees, main scenario, alternate scenarios, etc. 详述格式

A Brief Use Case

简约设计例

Process Sale:

A customer arrives at a checkout with items to purchase. The cashier uses the POS system to record each purchased item. The system presents a running total and line-item details. The customer enters payment information, which the system validates and records. The system updates inventory. The customer receives a receipt from the system and leaves with the items.

A casual format use case with alternate scenarios

非正常例

Handle Returns

- *Main Success Scenario:* **主情景**
A customer arrives at a checkout with items to return. The cashier uses the POS system to record each returned item ...
- *Alternate Scenarios:* **备选情景**
 - If the customer paid by credit, and the reimbursement transaction to their credit account is rejected, inform the customer and pay them with cash.
 - If the item identifier is not found in the system, notify the Cashier and suggest manual entry of the identifier code (perhaps it is corrupted).
 - If the system detects failure to communicate with the external accounting system, ...

Fully dressed Use Case 詳述例

Use Case: Buy a Product (Describe user's goal in user's language) 目标

Actors: Customer, System (Why is it a good idea to define actors?) 参与者

1. Customer browses through catalog and selects items to buy
2. Customer goes to check out
3. Customer fills in shipping information (address; next-day or 3-day delivery)
4. System presents full pricing information, including shipping
5. Customer fills in credit card information
6. System authorizes purchase
7. System confirms sale immediately
8. System sends confirming email to customer

(Did we get the main scenario right?)

Alternative: Authorization Failure (At what step might this happen?) 备注1

- 6a. At step 6, system fails to authorize credit purchase
Allow customer to re-enter credit card information and re-try

Alternative: Regular customer (At what step might this happen?) 备注2

- 3a. System displays current shipping information, pricing information, and last four digits of credit card information
- 3b. Customer may accept or override these defaults
Return to primary scenario at step 6

Template of Fully Dressed Use Cases

詳述各項細節

Fully dressed use cases show more detail and are structured; they dig deeper.

Use Case Section	Comment
Use Case Name	Start with a verb.
Scope	The system under design.
Level	"user-goal" or "subfunction"
Primary Actor	Calls on the system to deliver its services.
Stakeholders and Interests	Who cares about this use case, and what do they want?
Preconditions	What must be true on start, and worth telling the reader?
Success Guarantee	What must be true on successful completion, and worth telling the reader.
Main Success Scenario	A typical, unconditional happy path scenario of success.
Extensions	Alternate scenarios of success or failure.
Special Requirements	Related non-functional requirements.
Technology and Data Variations List	Varying I/O methods and data formats.
Frequency of Occurrence	Influences investigation, testing, and timing of implementation.
Miscellaneous	Such as open issues.

Scope

- Defines **how broad** the use case is.
- This can be for the whole system, as in the POS example, or narrow, as in a use case for creating a journal entry in an accounting system.

Level

- **User-goal Level:** Scenarios that let a user (a primary actor) get something done.
Corresponds to an elementary business process (EBP). *用户目标级*
- **Subfunction Level:** smaller steps required to support a user goal. *子功能级*
 - is usually created to factor out duplicate substeps shared by several regular use cases (to avoid duplicating common text)

Primary Actor

- The person (or sometimes object) that calls upon system services to fulfill a goal. (When might an actor not be a person?)

指明用例的主参与者

关联者及其关注点列表 (重要)

Stakeholders and Interests List

- It suggests and bounds **what the system must do**.
- The **stakeholders** are people who have a reason to want this system.
- The **Interests** are their reasons for wanting it and what they expect from it.
- You could view the system as a **contract** between various stakeholders.
- The use case, as the contract for behavior, captures *all and only* the behaviors related to satisfying the stakeholders' interests

Preconditions and Success Guarantee

- Don't need unless you are stating something non-obvious and noteworthy, to help the reader gain insight.
- Preconditions state what must ALWAYS be true before you can start the scenario. This often defines the success of another use case.
*前-用例
成功*
- Success guarantees (or Postconditions) state what must be true on successful completion of the use case.

Main Success Scenario and Steps (or Basic Flow)

- It describes a typical success path that satisfies the interests of the stakeholders.
 - You get your groceries, the store gets your money, inventory is reduced, etc.
- It often does *not* include any conditions or branching. 不包含条件和分支。
 - it is arguably more comprehensible and extendible to be very consistent and defer all conditional handling to the Extensions section 可以将条件处理放入扩展中。
- Steps: 三种可能的步骤：
 - An interaction between actors 参与者之间的交互。
 - Validation (by the system) 系统的验证。
 - State change to the system 系统状态的改变。

扩展 (备选流程)

Extensions or Alternate Flows

- These are usually the majority of the text.
- These include all other possible outcomes (scenarios or branches), both success and failure.
- Extension scenarios are branches from the main success scenario, and so can be notated with respect to its steps 1...N.
- An extension has two parts: the condition and the handling.

Performing Another Use Case

- Use cases can branch to other use cases.
For example, if a POS system rejects a bar code, the cashier can request alternate lookup.
- Denote this by underlining:
Cashier performs Find Product Help to get item ID
and price *another use case*.

Special Requirements

- If a non-functional requirement, quality attribute, or constraint **relates specifically to a use case**, record it with the use case. *可以将一些其它的需求关联进用例.*
- These include **qualities** such as performance, reliability, and usability, and design constraints (often in I/O devices) that have been mandated or considered likely.
- Recording these with the use case **is classic UP advice**. Ultimately move and consolidate all non-functional requirements in the Supplementary Specification.

Technology and Data Variations

- Technical variations on *how* something must be done, but not what:
 - Scan bar code
 - Key item ID
 - RFID
 - It is noteworthy to record this in the use case.
 - But *avoid early design decisions*, keep things general.
 - It is also necessary to understand *variations in data schemes*,
 - such as using UPCs or EANs for item identifiers, encoded in bar code symbology
- 应该如何输入编码, (早期 how)*
- 何时 (when)*
- 数据格式的使用.*

Fully Use Case Example 1

Use Case UC1: Process Sale

Scope: NextGen POS application

Level: user goal

Primary Actor: Cashier

Stakeholders and Interests: *关联人及其关注点 (重要)*

- Cashier: Wants accurate, fast entry, and no payment errors, as cash drawer shortages are deducted from his/her salary.
- Salesperson: Wants sales commissions updated.
- Customer: Wants purchase and fast service with minimal effort. Wants easily visible display of entered items and prices. Wants proof of purchase to support returns.
- Company: Wants to accurately record transactions and satisfy customer interests. Wants to ensure that Payment Authorization Service payment receivables are recorded. Wants some fault tolerance to allow sales capture even if server components (e.g., remote credit validation) are unavailable. Wants automatic and fast update of accounting and inventory.

Fully Use Case Example 2

- Manager: Wants to be able to quickly perform override operations, and easily debug Cashier problems.
- Government Tax Agencies: Want to collect tax from every sale. May be multiple agencies, such as national, state, and county.
- Payment Authorization Service: Wants to receive digital authorization requests in the correct format and protocol. Wants to accurately account for their payables to the store.

Preconditions: Cashier is identified and authenticated.

Success Guarantee (or Postconditions): Sale is saved. Tax is correctly calculated. Accounting and Inventory are updated. Commissions recorded. Receipt is generated. Payment authorization approvals are recorded.

} 只有在有需要
} 才加入

Fully Use Case Example 3

Main Success Scenario (or Basic Flow)

主成功场景

1. Customer arrives at 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 calculated from **a set of price rules**.
Cashier repeats steps 3-4 until indicates done.
5. System presents total with taxes calculated.
6. Cashier tells Customer the total, and asks for payment.
7. Customer pays and System handles payment.
8. System logs completed sale and sends sale and payment information to the external Accounting system (for accounting and commissions) and Inventory system (to update inventory).
9. System presents receipt.
10. Customer leaves with receipt and goods (if any).

操作的序列,有序了,一般没有分支

Fully Use Case Example 4

Extensions (or Alternative Flows)

用例的大部分文本出现在这一节。

*a. At any time, Manager requests an override operation: 全体

1. System enters Manager-authorized mode.
2. Manager or Cashier performs one Manager-mode operation. e.g., cash balance change, resume a suspended sale on another register, void a sale, etc. } 动作序列
3. System reverts to Cashier-authorized mode.

*b. At any time, System fails: 系统失败

To support recovery and correct accounting, ensure all transaction sensitive state and events can be recovered from any step of the scenario.

1. Cashier restarts System, logs in, and requests recovery of prior state.
2. System reconstructs prior state.

2a. System detects anomalies preventing recovery: 条件(内部失败)(扩展)

1. System signals error to the Cashier, records the error, and enters a clean state. } 动作序列
2. Cashier starts a new sale.

Fully Use Case Example 5

1a Customer or Manager indicate to resume a suspended sale.

1.Cashier performs resume operation, and enters the ID to retrieve the sale.

2.System displays the state of the resumed sale, with subtotal.

2a. Sale not found.

1.System signals error to the Cashier.

2.Cashier probably starts new sale and re-enters all items.

3.Cashier continues with sale (probably entering more items or handling payment).

2-4a. Customer tells Cashier they have a tax-exempt status (e.g., seniors, native peoples)

1.Cashier verifies, and then enters tax-exempt status code.

2.System records status (which it will use during tax calculations)

Fully Use Case Example ₆

3a. Invalid item ID (not found in system):

1. System signals error and rejects entry.

2. Cashier responds to the error:

2a. There is a human-readable item ID (e.g., a numeric UPC):

1. Cashier manually enters the item ID.

2. System displays description and price.

2a. Invalid item ID: System signals error. Cashier tries alternate method

2b. There is no item ID, but there is a price on the tag:

1. Cashier asks Manager to perform an override operation.

2. Managers performs override.

3. Cashier indicates manual price entry, enters price, and requests standard taxation for this amount (because there is no product information, the tax engine can't otherwise deduce how to tax it)

2c. Cashier performs Find Product Help to obtain true item ID and price.

子用例の3段階

2d. Otherwise, Cashier asks an employee for the true item ID or price, and does either manual ID or manual price entry (see above).

Fully Use Case Example 7

3b. There are multiple of same item category and tracking unique item identity not important (e.g., 5 packages of veggie-burgers):

 1.Cashier can enter item category identifier and the quantity.

3c. Item requires manual category and price entry (such as flowers or cards with a price on them):

 1.Cashier enters special manual category code, plus the price.

3-6a: Customer asks Cashier to remove (i.e., void) an item from the purchase: This is only legal if the item value is less than the void limit for Cashiers, otherwise a Manager override is needed.

 1.Cashier enters item identifier for removal from sale.

 2.System removes item and displays updated running total.

 2a. Item price exceeds void limit for Cashiers:

 1.System signals error, and suggests Manager override.

 2.Cashier requests Manager override, gets it, and repeats operation.

Fully Use Case Example 8

3-6b. Customer tells Cashier to cancel sale:

- 1.Cashier cancels sale on System.

3-6c. Cashier suspends the sale:

- 1.System records sale so that it is available for retrieval on any POS register.
- 2.System presents a "suspend receipt" that includes the line items, and a sale ID used to retrieve and resume the sale.

4a. The system supplied item price is not wanted (e.g., Customer complained about something and is offered a lower price):

- 1.Cashier requests approval from Manager.
- 2.Manager performs override operation.
- 3.Cashier enters manual override price.
- 4.System presents new price.

Fully Use Case Example ⁹

5a. System detects failure to communicate with external tax calculation system service:

1. System restarts the service on the POS node, and continues.

1a. System detects that the service does not restart.

1. System signals error.

2. Cashier may manually calculate and enter the tax, or cancel the sale.

5b. Customer says they are eligible for a discount (e.g., employee, preferred customer):

1. Cashier signals discount request.

2. Cashier enters Customer identification.

3. System presents discount total, based on discount rules.

Fully Use Case Example 10

- 5c. Customer says they have credit in their account, to apply to the sale:
- 1.Cashier signals credit request.
 - 2.Cashier enters Customer identification.
 - 3.Systems applies credit up to price=0, and reduces remaining credit.
- 6a. Customer says they intended to pay by cash but don't have enough cash:
- 1.Cashier asks for alternate payment method.
 - 1a. Customer tells Cashier to cancel sale. Cashier cancels sale on System.
- 7a. Paying by cash:
- 付了
残金
現金*
- 1.Cashier enters the cash amount tendered.
 - 2.System presents the balance due, and releases the cash drawer.
 - 3.Cashier deposits cash tendered and returns balance in cash to Customer.
 - 4.System records the cash payment.

Fully Use Case Example 11

7b. Paying by credit:

支付的扩展，对这样的扩展，完全可以描述为 - 了独立用例

1. Customer enters their credit account information.

2. System displays their payment for verification.

3. Cashier confirms.

 3a. Cashier cancels payment step:

 1. System reverts to "item entry" mode.

4. System sends payment authorization request to an external Payment Authorization Service System, and requests payment approval.

 4a. System detects failure to collaborate with external system:

 1. System signals error to Cashier.

 2. Cashier asks Customer for alternate payment.

Fully Use Case Example ¹²

7b. Paying by credit:

5.System receives payment approval, signals approval to Cashier, and releases cash drawer (to insert signed credit payment receipt).

5a. System receives payment denial:

1.System signals denial to Cashier.

2.Cashier asks Customer for alternate payment.

5b. Timeout waiting for response.

1.System signals timeout to Cashier.

2.Cashier may try again, or ask Customer for alternate payment.

6.System records the credit payment, which includes the payment approval.

7.System presents credit payment signature input mechanism.

8.Cashier asks Customer for a credit payment signature. Customer enters signature.

9.If signature on paper receipt, Cashier places receipt in cash drawer and closes it.

Fully Use Case Example

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7c. Paying by check...

7d. Paying by debit...

7e. Cashier cancels payment step:

1.System reverts to "item entry" mode.

7f. Customer presents coupons:

1.Before handling payment, Cashier records each coupon and System reduces price as appropriate. System records the used coupons for accounting reasons.

1a. Coupon entered is not for any purchased item:

1.System signals error to Cashier.

9a. There are product rebates:

1.System presents the rebate forms and rebate receipts for each item with a rebate.

9b. Customer requests gift receipt (no prices visible):

1.Cashier requests gift receipt and System presents it.

9c. Printer out of paper.

1.If System can detect the fault, will signal the problem.

2.Cashier replaces paper.

3.Cashier requests another receipt.

Fully Use Case Example 14

Special Requirements

特殊需求, 非必需需求

- Touch screen UI on a large flat panel monitor. Text must be visible from 1 meter.
 - Credit authorization response within 30 seconds 90% of the time.
 - Somehow, we want robust recovery when access to remote services such the inventory system is failing.
 - Language internationalization on the text displayed.
 - Pluggable business rules to be insertable at steps 3 and 7.
 - ...
-
- If a non-functional requirement, quality attribute, or constraint relates specifically to a use case, record it with the use case.
 - it is useful to ultimately move and consolidate all non-functional requirements in the Supplementary Specification.

Fully Use Case Example 15

Technology and Data Variations List

技术与数据的各种可能形式

*a. Manager override entered by swiping an override card through a card reader, or entering an authorization code via the keyboard.

3a. Item identifier entered by bar code laser scanner (if bar code is present) or keyboard.

3b. Item identifier may be any UPC, EAN, JAN, or SKU coding scheme.

7a. Credit account information entered by card reader or keyboard.

7b. Credit payment signature captured on paper receipt. But within two years, we predict many customers will want digital signature capture.

Frequency of Occurrence: Could be nearly continuous.

出现频率

Open Issues

仍未解决的问题

What are the tax law variations?

Explore the remote service recovery issue.

What customization is needed for different businesses?

Must a cashier take their cash drawer when they log out?

Can the customer directly use the card reader, or does the cashier have to do it?