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Creating Use Case Scenarios and Forms

Objectives

Upon completion of this module, you should be able to:

- Identify and document scenarios for a use case
- Create a Use Case form describing a summary of the scenarios in the main and alternate flows
- Describe how to reference included and extending use cases.
- Identify and document non-functional requirements (NFRs), business rules, risks, and priorities for a use case
- Identify the purpose of a Supplementary Specification Document

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Additional Resources

Additional resources – The following references provide additional information on the topics described in this module:

- Booch, Grady, James Rumbaugh, Ivar Jacobson. *The Unified Modeling Language User Guide*. Reading: Addison Wesley Longman, Inc., 1999.
- Jacobson, Ivar. *Object-Oriented Software Engineering*. Harlow: Addison Wesley Longman, Inc., 1993.
- Rosenberg, Doug, Kendall Scott. *Use Case Driven Object Modeling with UML (A Practical Approach)*. Reading: Addison Wesley Longman, Inc., 1999.
- Rosenberg, Doug, Kendall Scott. *Applying Use Case Driven Object Modeling with UML (An Annotated e-Commerce Example)*. Reading: Addison Wesley Longman, Inc., 2001
- Folwer, Martin, Kendall Scott. *UML Distilled (2nd ed)*. Reading: Addison Wesley Longman, Inc., 2000.
- Larman, Craig. *Applying UML and Patterns (3rd ed)*. Upper Saddle River: Prentice Hall, 2005.

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Process Map

This module covers the first steps in the Requirements Gathering and Requirements Analysis workflows. Figure 4-1 shows the activities and artifacts covered in this module.

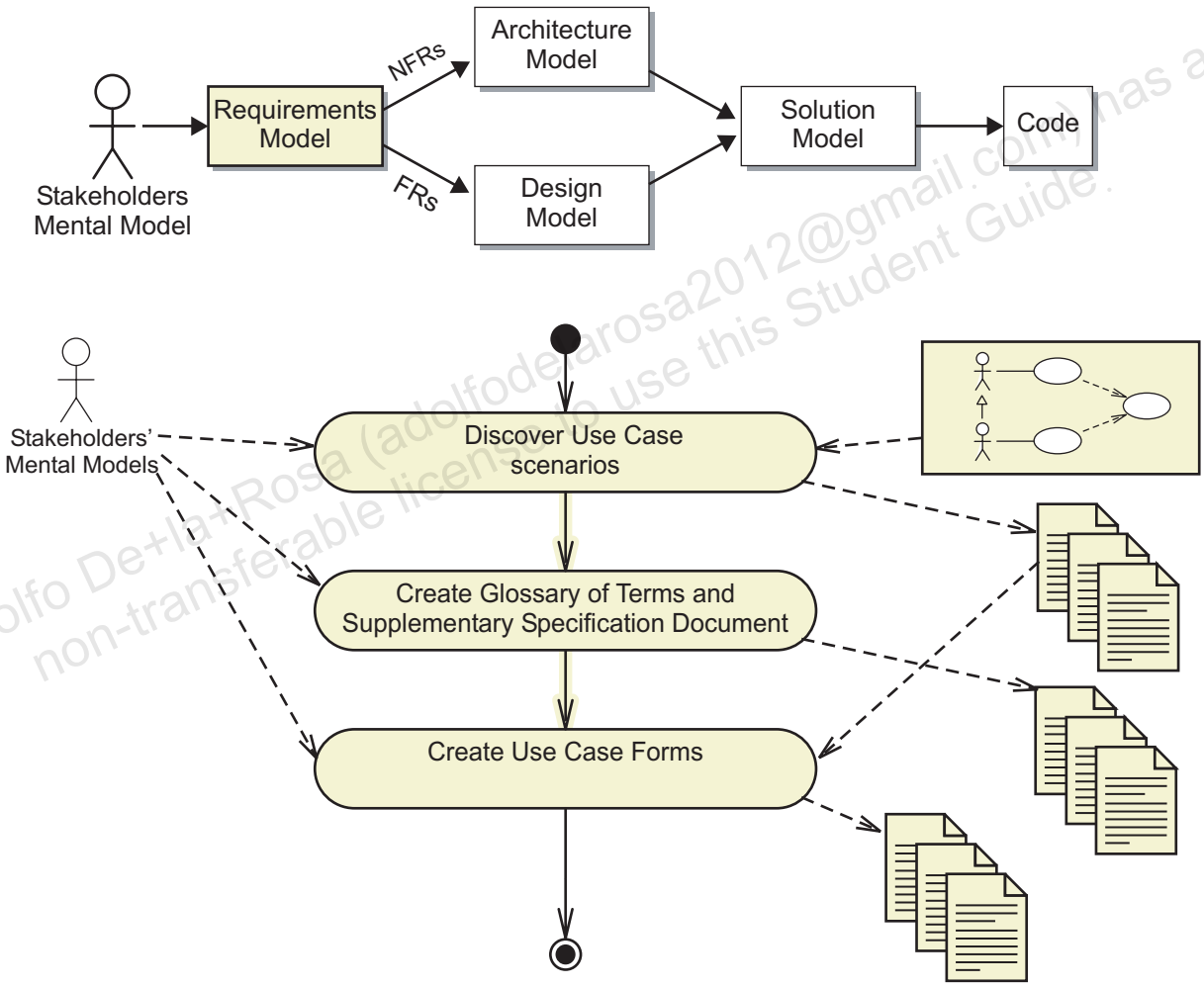

Figure 4-1 Use Case Scenarios and Forms Process Map

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Recording Use Case Scenarios

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A use case represents a system behavior from the actor's perspective. A *Use Case scenario* is a concrete example of a use case; that is, a single instance of an actor interacting with the use case. Use Case scenarios can be derived from existing business practices or from observing the use of an existing system (which the proposed system is replacing).

A Use Case scenario should:

- Be as specific as possible

  Provide specific information. This will provide a clear and tangible expression of the use case. You may use people's names in the narrative, but only if it adds clarity. These documents should be confidential to the client so it is acceptable and appropriate to use the real names of the client's customers and employees.

- Never contain conditional statements

  You should never have a sentence in the scenario that includes an if statement. For example, this would be unacceptable: "If the customer requests a double room, ask them if they will have additional guests." Instead, create multiple scenarios to cover every case.

- Begin the same way but have different outcomes

  Each scenario for the same use case should begin with the actor in the same state. For example, a booking agent does not begin to create a new reservation in the middle of updating another reservation. To create a reservation, the agent must be waiting for a phone call from a customer.

- Not specify too many user interface details

  The Use Case scenario should focus on the details of the workflow of the use case. It might contain some UI information, but it should not explain all elements of the UI.

- Show successful as well as unsuccessful outcomes (in different scenarios)

  It is important to write scenarios in which the outcomes are unsuccessful as well as those that were successful. Record these different scenarios.

Use Case scenarios drive several other Object-Oriented Analysis and Design (OOAD) workflows. Use Case scenarios are primarily used to create Use Case forms and Test Plans. They may also be used in the creation of Activity diagrams and Object diagrams.

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Selecting Use Case Scenarios

While it is ideal to have multiple scenarios for all use cases, doing so would take a lot of time. Therefore, you can select appropriate use cases for scenario creation by using the following criteria:

- The use case involves a complex interaction with the actor.

  For trivial use cases it might be sufficient to document only a single, successful scenario. For complex use cases, it is important to capture several scenarios, each with a slightly different path through the use case workflow.

- The use case has several potential failure points, such as interaction with external systems or a database.

  For example, one failure point is that the customer's credit card does not have the necessary funds to confirm the reservation. In this scenario, the booking agent can put the reservation on hold until the customer can resolve the credit card problem with the bank or the customer can provide a different credit card. This would be two different scenarios.

Note – Some methodologies, such as UP, make extensive use of Use Case scenarios. Other methodologies, such as XP, use *user stories.* XP defines the FRs of the system by the complete set of user stories. User stories drive the daily development cycle.

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There are two types of scenarios:

- Primary (Happy) scenarios record successful results.

  Simple use cases might only have one primary scenario, but complex use cases might have many. Each primary scenario records an event in which the results of the use case were successful. For example, the Manage Reservation use case might include a scenario in which a customer books only one room and another scenario in which a customer books several rooms and uses a promotion for a discount. Success is determined by the client-side stakeholders.

- Secondary (Sad) scenarios record failure events.

  Each secondary scenario records an event in which the results of the use case were unsuccessful. For example, the Manage Reservation use case might include a scenario in which the customer cannot book a room because of the lack of availability or in which the customer's credit card is declined.

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Writing a Use Case Scenario

A Use Case scenario is a story that:

- Describes how an actor uses the system and how the system responds to the actions of the actor.

  To say that a Use Case scenario is a story is a great metaphor. A story has all of the characteristics that were described about scenarios. Stories are a sequence of specific events that happen to specific people and things. In a Use Case scenario, the people are the actors and sometimes other people that the actor is interacting with. The events are the actions that take place between the actor and the system.

- Has a beginning, a middle, and an end.

  Like any good story, a Use Case scenario has a beginning which tells us what the actor was doing when the use case begins. For a given use case, it is important that the beginning of each scenario is the same. This beginning text is often called the *trigger point* of the use case. This means that the use case has a specific starting point relative to the system. For example, in the Create a Reservation use case, the booking agent being requested to create a reservation will be the trigger.

  The middle of the Use Case scenario provides the bulk of the details about how the actor interacts with the system and possibly other people or actors or other external systems.

  The end of the Use Case scenario tells us how the story ends. Was it a happy ending? (Was the use case successful?) Or was it a sad ending? (Did the customer fail to reserve a room, because the hotel was booked up for that weekend?)

The following is an example a Primary (Happy) Use Case scenario for the Create a Reservation use case:

In the Beginning

The use case begins when the booking agent receives a request to make a reservation for rooms in the hotel.

The beginning of the Create Reservation use case has the booking agent receiving a request to make a reservation.

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Note – We have avoided specifying the source of that request, but we could have stated it was a phone call from a customer.

In the Middle

The booking agent enters the arrival date, the departure date, and the quantity of each type of room that is required. The booking agent then submits the entered details. The system finds rooms that will be available during the period of the reservation and allocates the required number and type of rooms from the available rooms. The system responds that the specified rooms are available, returns the provisional reservation number, and marks the reservation as “held”. The booking agent accepts the rooms offered.

This narrative is fairly terse and has no specific details of dates or room types. You may specify more details if you believe that the details are of significant value. For instance, you might want to specific boundary conditions for valid and invalid dates.

This narrative has also avoided using any specific user interface (UI). Therefore, it can be used for a variety of UIs. For example, the narrative will be applicable for a voice UI or online bookings, where the booking agent could be changed to Actor. However, there are many cases when you will have to specify the UI details. This is particularly true when discussing the scenarios with some of the users who prefer to discuss screens, buttons, lists, and so on.

The booking agent selects that the customer has visited one of the hotels in this group before, and enters the zip code and customer name. The system finds and returns a list of matching customers with full address details. The booking agent selects one of the customers as being the valid customer. The system assigns this customer to the reservation. The booking agent performs a payment guarantee check. This check is successful.

In the End

The system assigns the payment guarantee to the reservation and changes the state of the reservation to “confirmed”. The system returns the reservation ID and booking details.

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The end of the scenario describes the *post condition* of the use case. At this stage the system has completed its work and the booking agent only needs to inform the customer of the booking details.

Note – By delegating the payment guarantee to a sub-use case, we have avoided having to specify the details of the payment guarantee at this point.

The following is an example a Secondary (Sad) Use Case scenario for the Create a Reservation use case:

In the Beginning

The use case begins when the booking agent receives a request to make a reservation for rooms in the hotel.

In the Middle

The booking agent enters the arrival date, the departure date, and the quantity of each type of room that is required. The booking agent then submits the entered details. The system responds that there are no rooms available of any type for date range specified in the request.

In the End

The use case ends.

The following is another example of a Secondary (Sad) Use Case scenario for the Create a Reservation use case:

In the Beginning

The use case begins when the booking agent receives a request to make a reservation for rooms in the hotel.

In the Middle

The booking agent enters the arrival date, the departure date, and the quantity of each type of room that is required. The booking agent then submits the entered details. The system responds that the

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specified rooms are available, returns the provisional reservation number, and marks the reservation as “held”. The booking agents accepts the rooms offered.

The booking agent selects that the customer has visited one of the hotels in this group before, and enters the zip code and customer name. The system finds and returns a list of matching customers with full address details. The booking agent selects one of the customers as being the valid customer. The system assigns this customer to the reservation. The booking agent performs a payment guarantee check. The check is unsuccessful. The booking agent performs a second payment guarantee check. The check is unsuccessful. The booking agent cancels the request.

In the End

The system removes the reservation and frees the allocated rooms.

There are obviously many more successful and unsuccessful scenarios that can be documented.

In addition, you should write scenarios for the different actors (roles) that will use this use case. In this example, you should write scenarios for an online booker and the Travel Agent System. If the scenarios are significantly different, you may consider creating a separate use case for each different actor (role).

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Supplementary Specifications

Some of the project information that you gather cannot be stored with the use cases because this information needs to be shared by several use cases.

Note – Some of the project information is often shared by two or more (often all) of the use cases.

This additional information can be documented in a Supplementary Specification Document, which often contains:

- NFRs
- Project Risks
- Project Constraints
- Glossary of Terms

Many companies create a Supplementary Specification Document to document this information. However, the name of this document often varies.

Note – Project risks and constraints will be discussed later in the course.

Note – A Supplementary Specification Document may have been created at the beginning of the project. In that case, you will just add new details to the document at this stage.

Non-Functional Requirements (NFRs)

Non-functional requirements (NFRs) define the qualitative characteristics of the system. As in an animal, the NFRs describe strength, speed, and agility of the internal features of the animal. How fast can the animal move? How much weight can the animal carry?

- NFRs describe features of a system that support *how* an operation is performed.

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NFRs include: how fast an operation is processed, how many operations can be performed simultaneously, how easy it is to add new features to the system, how easy the system is to manage, how easy the system is to use, and so on.

- Any adverbial phrase can be an NFR.

  An adverb is the part of speech that expresses some relation of manner or quality, place, time, degree, number, cause, and so on. With respect to software systems, adverbs often express qualities of how well the system must perform.

  NFR Examples:

  - NFR1: The system must support 200 simultaneous users in the Web application.
  - NFR2: The process for completing any reservation activity must take the average user no more than 10 minutes to finish.
  - NFR3: The capacity of reservation records could grow to 2,600 per month.
  - NFR4: The Web access shall use the HTTPS transport layer when critical customer information is being communicated.
  - NFR5: The numerical accuracy of all financial calculations (for example, reports and customer receipts) should follow a 2-significant-digit precision with standard rounding of intermediate results.
  - NFR6: The System must be available “7 by 24 by 365”. However, the applications can be shut down for maintenance once a week for one hour. This maintenance activity should be scheduled between 3 a.m. and 6 a.m.
  - NFR7: Based on historical evidence, there are approximately 600 reservations per month per property.
  - NFR8: The search for available rooms must take no longer than 30 seconds.

Glossary of Terms

The Glossary of Terms defines business or IT terms that will be used in the project.

This is a living document, which should be appended with new terms, or amended if a term is found to be incorrect or needs redefinition.

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Table 4-1 Shows a sample of terms that would be used in the Hotel System.

Term	Definition
Reservation	An allocation of a specific number of rooms, each of a specified *room type*, for a specified period of days.
Date Range	Specifies a start date and an end date.
Room Type	A room type indicates the number of beds, *basic rate*, and configuration of the room.
Room Number	A number that uniquely identifies a room within a *hotel*.
Room Name	Some rooms, such as conference rooms, are identified by a name instead of a number.
Room	A resource that can be allocated to a reservation, and is occupied by that reservation *customer* and their *guests* for the *date range* of the *reservation*. A room is identified by either a *room name* or a *room number*. Each room is assigned a *room type*.
Payment Guarantee	Debit/Credit card pre-authorization or purchase order from either corporate companies or travel agents.
Basic Rate	The per day price for a room type without any additional *in-line charges* or *promotions*.
Receipt	A document given to the *customer* at the time of *check out*. A receipt contains customer information and a summation of all of the charges incurred during the customer's stay at the property. Charges include room charge, taxes, and *line-item charges*, such as food and beverage charges and phone call charges.
Promotion	A discount or upgrade offered to the *customer* in hopes of selling a particular service or product. A discounted room rate for weekday customers is an example of a promotion used to get more business during days when there is customarily low *occupancy*.

Table 4-1 Example Glossary of Terms for the Hotel System

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Creating a Use Case Form

Description of a Use Case Form

A Use Case form provides a tool to record the detailed analysis of a single use case and all its scenarios. Table 4-2 lists the elements of the Use Case form.

Table 4-2 Use Case Form Elements

Form Element	Description
Use Case Name	The name of the use case from the Use Case diagram.
Description	A one-line or two-line description of the purpose of the use case.
Actors	This element should list all relevant actors that are permitted to use this use case.
Priority	This is used to describe the relative priority of this use case. Priority is often in the form of MuSCoW prioritization, which is Must have, Should have, Could have, or Won't have.
Risk	A High, Medium, or Low ranking of this use case's risk factors.
Pre-conditions and assumptions	The conditions that must be true. If these conditions are not true, the outcome of the use case cannot be predicted.
Extension Points	A list of any extension points used by this use case.
Extends	A list of any use cases that this use case extends.
Trigger	The condition that "informs" the actor that the use case should be invoked.
Flow of Events	The primary trace of user actions and events that constitute this use case.
Alternate Flows	Any and all secondary traces of user actions and events that are possible in this use case.
Post-conditions	The conditions that shall exist after the use case has been completed.

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Table 4-2 Use Case Form Elements (Continued)

Form Element	Description
Business Rules	A list of business rules that must be complied with and that are related to this use case. These rules might be referred to during the execution of the use case in the main flow and the alternate flow, but this is not always necessary. You can describe these rules in this form. Alternatively, you can refer to the list in the Supplementary Specification Document.
Non-Functional Requirements	A list of the NFRs that are related to this use case. You can either summarize the NFRs or list their codes from the Supplementary Specification Document.
Notes	Any other information that can be of value regarding this use case.

Some methodologies recommend more or less analysis of the use cases. The Analysis workflow presented in this module tends to be more detailed. Less detailed analyses might only determine the Flow of Events. After learning about this Use Case form, you can choose which elements are important for your project.

Use Case forms are not standard. There are different styles that can be used to create a Use Case form. For example, some forms separate some items from the Alternate Flow section into an additional section named Exception Flow. The exact description of these differences in style vary between companies.

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Creating a Use Case Form

Perform these steps to determine the information for the Use Case form:

4. Determine a brief description from the primary scenarios.
5. Determine the actors who initiate and participate in this use case from the Use Case diagrams.
6. Determine the priority of this use case from discussions with the stakeholders.
7. Determine the risk from scenarios and from discussions with the stakeholders.
8. Determine the extension points from the Use Case diagrams.
9. Determine the pre-conditions from the scenarios.
10. Determine the trigger from the scenarios.

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11. Determine the flow of events from the primary (happy) scenarios.
12. Determine the alternate flows from the secondary (sad) scenarios.
13. Determine the business rules from scenarios and from discussions with stakeholders.
14. Determine the post-conditions.
15. Determine the new NFRs from discussions with stakeholders.
16. Add notes for information—gathered from discussions with stakeholders—that does not fit into the standard sections of the form.

Fill in Values for the Use Case Form

Fill in elements from the information already gathered or by reviewing these forms with the stakeholders to add or enhance the requirements. Table 4-3 is an example of some elements required for the Create Reservation use case.

Table 4-3 Partial Example Use Case Form for the Create Reservation Use Case

Form Element	Description
Use Case Name	Create Reservation
Description	The Customer requests a reservation for hotel rooms for a date range. If all the requested rooms are available, the price is calculated and offered to the Customer. If details of the customer and a payment guarantee are provided, then the reservation will be confirmed to the Customer.
Actor(s)	Primary: Booking Agent, Online Booker, Travel Agent System Secondary: None Note: Primary actors are proxies for the Customer.
Priority	Must have Note: This use case is essential to this system.
Risk	High Note: The risk is high primarily because of the complexity of identifying if rooms are available and the number of different actor roles that can use this use case.

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Table 4-3 Partial Example Use Case Form for the Create Reservation Use Case

Form Element	Description
Trigger	A Customer wishes to make a reservation in the hotel.
Pre-conditions	At least one room exists in the hotel. Primary Actor can be identified.
Post-conditions	One reservation is added. Payment guarantee details are recorded.
Non-Functional Requirements	*NFR1 (Simultaneous Users)* *NFR2 (Duration of Use Case)* *NFR4 (Web Security)* *NFR6 (System Availability)* *NFR8 (Max Time for Room Availability Search)*
Notes	A fast method of checking room availability is still under investigation.

Primary actors are the actors who must perform the use case to satisfy their job roles. A secondary actor is any other actor who can participate in the use case, but cannot initiate it. For example, a booking agent is primarily responsible for creating reservations along with an online booker and the Travel Agent System. Therefore, these actors are the primary actors. However, the Electronic Payment System will just participate in the Perform Payment Transaction use case. Therefore, Electronic Payment System is a secondary actor.

Note – The example Hotel System assumes that the scenarios for the booking agent, online booker, and Travel Agent System are identical except for the interface to the device. If this is not the case, a minor variation can be shown by using the alternate paths. However, if there are major differences, a separate use case may be used.

You can document that other actors can assume the role of a booking agent. For example, the receptionist and duty manager roles can assume the role of a booking agent.

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Fill in Values for the Main Flow of Events

Table 4-4 is an example of the main flow of events of the Create Reservation use case. These are derived from a primary scenario.

Table 4-4 Main Flow of Events of the Create Reservation Use Case

Main Flow of Events	*1:* Use Case starts when Customer requests to create a reservation *2:* Customer enters types of rooms, arrival date, and departure date [A1] [A2] *2.1:* System creates a reservation and reserves rooms applying BR3 [A3] *2.3:* System calculates quoted price applying BR4 *2.3.1* System records quoted price *2.4:* System notifies Customer of reservation details (including rooms and price) *3:* Customer accepts rooms offered [A5] *3.1:* Extension Point (new customer) [A6] *3.2:* Extension Point (payment guarantee) [A7] *3.3:* System changes reservation status to "confirmed" *3.4:* System notifies Customer of confirmed reservation details 4: Use case ends

Note – It is common to use a Dewey Decimal style of numbering for flow of events in Use Case forms as shown in the above example. In this style, a Use Case form usually start with an organized sequence and hierarchy of substeps—for example 1, 1.1, 1.2. 1.3, 1.3.1, 1.4, 2, 2.1, 2.2, and so on. During the modeling process, you often need to add or remove steps, which can be achieved without the need to renumber the existing steps. This can affect the sequential numbering, but is less prone to mistakes.

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Fill in Values for the Alternate Flow of Events

Table 4-5 is an example of the alternate flow of events of the Create Reservation use case. These alternate flow of events are derived from the secondary scenarios and any remaining primary scenarios.

- Perform a *difference analysis* between the scenario used for the main flow and each of the other scenarios (in turn).
- The alternate flows are the steps that are different between the scenario used for the main flow and each of the other scenarios.

Table 4-5 Alternate Flows of the Create Reservation Use Case

Alternate Flows	*A1:* Customer can enter duration instead of departure date, go to step 2.1 [A2] *A2:* Failed date check BR1. Notify error to Customer, go to step 2 *A3:* Complying with BR2, System determines that required rooms are not available, System upgrades one or more room types, go to step 2.1[A4] *A4:* No further upgrades available. Notify message to Customer, go to step 2 *A5:* Rooms offered are declined, go to step A9 *A6:* Customer already exists, Customer enters customer name and zip code, System searches for matching customers, notifies Customer of matching customers, Customer selects correct customer details, go to step 3.2 [A8] *A7:* Payment guarantee fails. Notify message to Customer, go to step 3.2 *A8:* Existing customer not found, go to step 3.1 *A9:* Reservation not confirmed, reservation deleted, use case ends *At any time:* Customer may cancel the use case, use case ends [A9] *After use case inactivity of 10 minutes:* use case ends [A9]

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Fill in Values for the Business Rules

Table 4-5 is an example of the business rules of the Create Reservation use case.

Table 4-6 Business Rules of the Create Reservation Use Case

Business Rules (BR)	*BR1*: The arrival date must not be before today's date, and departure date must be after arrival date *BR2:* Overbooking is not allowed *BR3:* Reservations with assigned rooms but no payment guarantee have a status of "held" *BR4:* The quoted price is the sum the base price of the room types after applying BR5 and BR6 *BR5:* Seasonal Adjustment can be applied if reservation dates are applicable BR6: Offer adjustments can be applied if reservation qualifies *BR7:* Reservations with "held" status can be deleted *BR8:* Reservations with a status of "confirmed" must be linked to a payment guarantee and a customer *BR9:* Reservation must not exist without being linked to at least one room

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Summary

- A Use Case scenario is written to provide a detailed description of the activities involved in one instance of the use case.
- Use Case scenarios should provide as many different situations as possible so that the whole range of activities for that use case are documented.
- Use Case scenarios provide much detail about a use case. An analysis of this detail is recorded in the Use Case form.

  The activities of a use case are distilled into Flow of Events portion of the Use Case form. Alternate flows are identified from unusual situations in one or more scenarios.

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