UNIVERSITY OF
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Software Engineering

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Online Travel & Hotel Booking System (Travpedia)

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Contents

1 Specification

Travpedia is an online travel and accommodation booking system. Travel and accommodation companies are able to subscribe to Travpedia for a monthly subscription cost of £200 plus an initial £50 joining fee. This subscription allows the company to offer their products on the Travpedia website where they can be purchased by visiting users. Products that are advertised on the Travpedia website include accommodation, package holidays and travel by air, rail and sea. One or more products may be combined into a single booking.

Visitors to the website, after registering an account, are able to search for all available products offered by these subscribed companies. They are able to search with a number of criteria including type of product, location, date and price. Users can then view these search results and book and pay for products through the website. Users may also rate and review accommodation and package holidays that they have purchased. A product gains a review score based on these ratings. This review rating system provides further search criteria whereby a user can filter search results by review score.

Payments made by both subscribing companies and users are handled online by a third party consortium. Subscribers must pay by debit or credit card while users have the additional option of paying with gift vouchers offered by Travpedia.

Users are able to view bookings they have made and, where possible, cancel these bookings and receive a refund via the third party consortium.

Travpedia disseminates advertisements and promotional offers to users based on previous patterns of use and previous purchases. These personalised offering are sent to mobile phones through SMS and email accounts. Users may opt out of receiving SMS and email alerts.

Travpedia also has a number of critical compliance and security requirements. Travpedia stores users' personal information and payment details that should not be disclosed to other parties or kept for any longer than necessary. If this data is maliciously accessed, disclosed, leaked or manipulated it could breach confidentiality and data protection. Furthermore, any transaction information sent to the third party consortium used for payment must be kept secure. This is done with encryption using 128-bit SSL certificates.

During peak time, Travpedia receives up to one million simultaneous users and is designed to handle this number of users. The design is also scalable to accommodate its growing number of users and subscribers. This system is used by users 24 hours a days and must be always available. All data that Travpedia stores must also be kept safe from system failures. For this reason, user account details, itinerary and transaction data and subscribers' data are stored and backed up on three database servers in three distinct locations. Two of these locations are in the UK and the other is in the USA. This allows Travpedia to minimise downtime after unforeseen system failures.

1.1 Scope

The scope of our design is limited primarily to subsystems devoted to user's interactions with the Travpedia website. In particular, we will consider the following:

- Travpedia account registration.
- Searching for products.
- Making new bookings.
- Viewing and cancelling previous bookings.

1.2 Assumptions

We have made a number of assumptions regarding the external systems and remaining internal subsystems described in the whole system specification. We assume that these other subsystems have their own interface with which we can communicate when necessary.

Subscribers All aspects of company subscriptions to Travpedia are handled by the Subscriber Subsystem.

Consortium The third party consortium will deal with all aspects of forwarding user payments to Travpedia's subscribers. We will be responsible for sending user payments to this consortium who will then respond accordingly about the success of the transaction.

Global Distribution System A system used by travel and accommodation booking agents which acts as an intermediary, providing information and an operational interface. Our system will use this agency to handle all external booking procedures.

User Database There is a database for user profile and account data. We can make requests to this database to retrieve and update this data.

Product Database There is a database for all travel and accommodation product data. We can make requests to this database to retrieve and update this data.

Backup In the case of both databases, we assume that the Backup Subsystem handles ensuring this data is backed up across the three distinct database locations. Finally, this subsystem also ensures that data is not held longer than necessary in order to comply with the Data Protection Act.

Recommendations Users can receive additional product recommendations by email and/or phone notifications. Our system will provide the user with the option to receive, or opt out of these, but the Recommendation Subsystem deals with the selection and dissemination of this information.

2 Requirements

2.1 Functional Requirements

1. Registration
   1.1. The system shall allow the user to register for a new account.
      1.1.1. The system shall require the user to provide a name and valid email address
      1.1.2. The system shall require the user to choose and enter a password for his/her account
      1.1.3. The system shall contact the user by email to confirm that registration is complete
   1.2. Logging in
      1.2.1. The system shall require the user to log in using their registered email address and password in order to use the facilities offered by Travpedia via the website
2. User Account
   2.1. The system shall allow the user to view his/her account details
   2.2. The system shall allow the user to amend his/her account details
   2.3. The system shall allow the user to save payment information in his/her account
   2.4. The system shall allow the user to save mailing preference information in his/her account
3. Search
   3.1. The system shall allow a user to search for products using a combination of one or more criteria
      3.1.1. The system shall allow the user to search by type of product
      3.1.2. The system shall allow the user to search by specifying a target price range
      3.1.3. The system shall allow the user to search for accommodation and/or package holidays by location
      3.1.4. The system shall allow the user to search for accommodation and/or package holidays by specifying a start date and an end date
      3.1.5. The system shall allow the user to search for travel by point of departure and/or destination
      3.1.6. The system shall allow the user to search for travel by specifying a start date and, optionally, a return date
      3.1.7. The system shall allow the user to specify the number of rooms required
      3.1.8. The system shall allow the user to specify the number of seats required
   3.2. The system shall enable the user to filter search results
      3.2.1. The system shall enable the user to filter results by price range
      3.2.2. The system shall enable the user to filter accommodation results by star rating
   3.3. The system shall enable the user to sort search results
      3.3.1. The system shall enable the user to sort results by price
      3.3.2. The system shall enable the user to sort results by review score
      3.3.3. The system shall enable the user to sort accommodation results by star rating

3.3.4. The system shall enable the user to sort travel results by departure time

4. Make a new booking
   4.1. The system shall allow the user to make a new accommodation booking
   4.2. The system shall allow the user to make a new travel booking
   4.3. The system shall allow the user to make a new package holiday booking
   4.4. The system shall allow the user combine one or more products into a single booking
5. View or cancel an existing booking
   5.1. The system shall allow the user to view an existing booking
   5.2. The system shall allow the user to cancel a booking
6. Make a payment
   6.1. The system shall allow the user to make a payment by either or both of the following
      6.1.1. The system shall allow the user to pay by credit/debit card
      6.1.2. The system shall allow the user to pay by Travpedia voucher
   6.2. The system shall send the user an email to their registered email address confirming details of the completed payment.

2.2 Non-Functional Requirements

2.2.1 Product Requirements

1. Efficiency
   1.1. The system shall respond to a search request in under 10 seconds
   1.2. The system shall respond to a user login request within 3 seconds
   1.3. The system shall send all confirmation emails withing 2 minutes.
   1.4. The system shall be capable of handling 1 million simultaneous users during peak time.
2. Dependability
   2.1. The system shall be available 24/7 for 99% of the time. (Availability)
   2.2. The system shall require users to confirm all booking and payment transactions before executing to mitigate against user error (Error-tolerance)
   2.3. The system will operate a mirror server - the principal and mirror servers will be located at geographically separate locations in the UK.
   2.4. The system will provide a further database server in the USA in order to facilitate disaster recovery.
3. Usability
   3.1. The system shall be easy to use (as evidenced by 80% positive feedback from 'usability' questions on user satisfaction questionnaires).
   3.2. The system shall provide the user with context specific help.
   3.3. The system shall provide the user with information on the progress of all searches taking more than 3 seconds.
4. Security

4.1. The system should block user access after 5 consecutive failed login attempts

4.2. The system shall secure and encrypt all financial transactions passed to the third party consortium using 128-bit SSL certificates

4.3. The system shall secure and encrypt all user data passed to the Global Distribution System (GDS) using 128-bit SSL certificates

2.2.2 Organisational Requirements

1. Development

   1.1. The system shall operate on all major web browsers e.g. Internet Explorer, Firefox, Chrome, Safari

   1.2. The system shall operate on both desktop and mobile platforms

2. Standards

   2.1. The system shall conform with all requirements laid down in the company's ISO 9001:2008 Quality Management Procedures

2.2.3 External Requirements

1. Interoperability

   1.1. The system shall integrate with the GDS in order to ensure correct processing of user bookings

   1.2. The system shall correctly integrate with the third party consortium that handles payments

2. Legislative & Ethical

   2.1. The system shall comply with the Payment Card Industry Data Security Standards (PCI DSS)

   2.2. The system shall comply with all requirements of the UK Data Protection Act 2003.

   2.3. The system shall comply with level AA of the Web Content Accessibility Guidelines.

3 Use Case Diagram

The use case diagram below represents a user's interaction with the Travpedia system and the ways in which these actions are handled by the system and external and third party systems. Each use case is a simple view of what would be a more complex series of events to realise it.

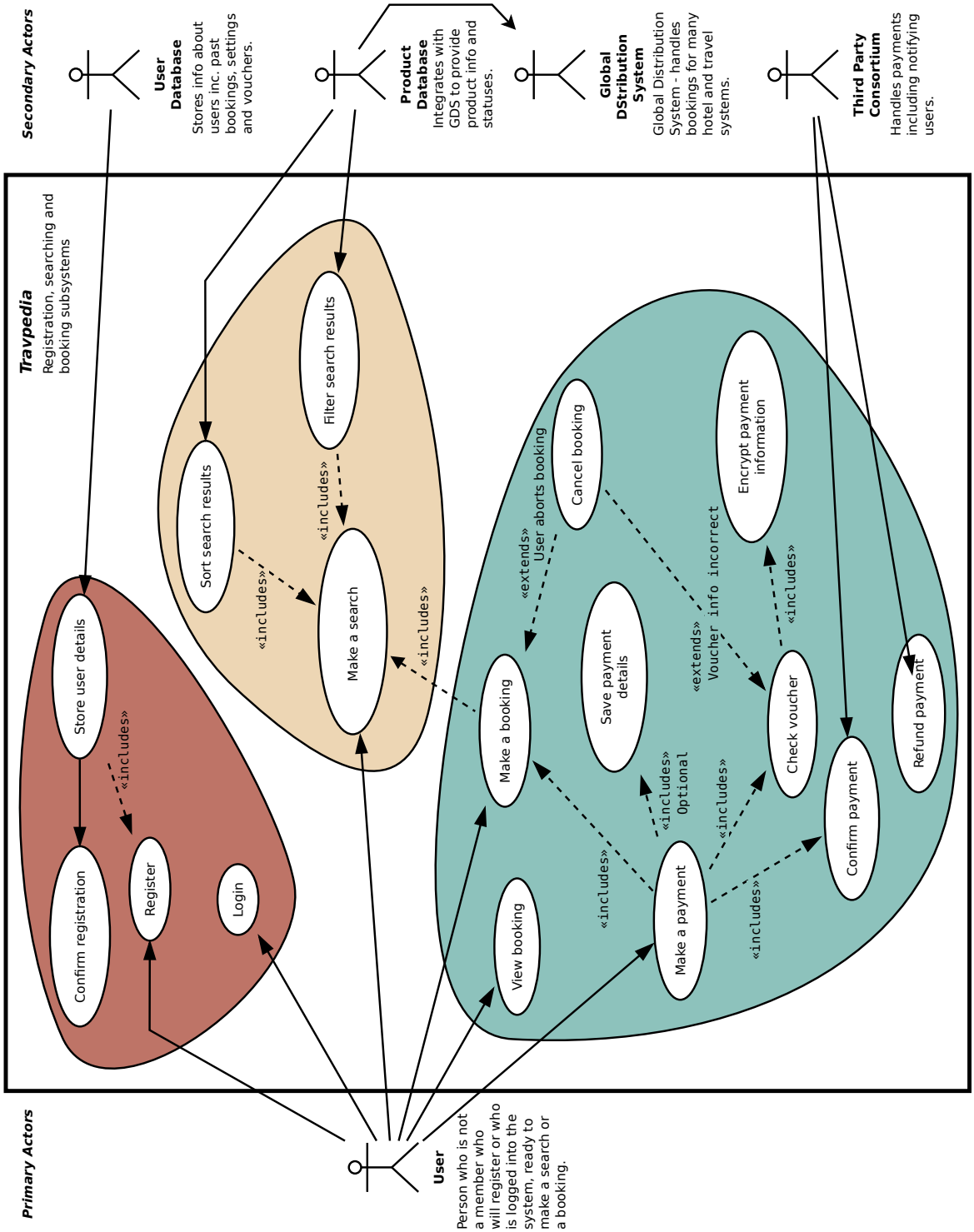

Figure 1: *Use case diagram*

4 Detailing a Use Case

4.1 Use Case: Register

Actors

- User (primary actor)
- UserDatabase (secondary actor)

Pre-conditions

1. User does not have an account with Travpedia
2. User has an email address

Flow of events (Success Scenario)

1. User opens the Travpedia website
2. User is on the homepage and clicks "Create an Account" link
3. The system presents the user with an interface with empty fields asking for the following details:
   - Name
   - Email Address
   - Password
   - Confirm Password
4. User fills these fields in and clicks "Next"
5. User then has the option to provide their mobile number and tick "please text and email me with Travpedia deals and promotional offers" if they wish to receive this service
6. User ticks "I have read and agree to the Terms and Conditions"
7. User clicks "Create Account" button. If any details are invalid or a field has not been filled, the user will be shown an error message and asked to re-enter their information
8. The system validates the users details and sends a confirmation email to the users email address
9. The system displays a message telling the user that they should have received a confirmation email and that they should open this email to verify their email address
10. User opens the confirmation email and clicks on the link to verify their email address
11. The system redirects them back to Travpedia website and informs the user that their registration was successful

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Post-conditions

1. Details are stored in the user database and backed up
2. The user is now registered and is signed in
3. The user can now search and make a booking

Scenarios

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1. User forgets to tick the box confirming they have read and agree to the terms and conditions – cannot proceed to next page
2. User does not confirm their email address, their registration is incomplete
3. User leaves the interface before clicking "Create Account", registration is incomplete

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Additional Notes

The user has the opportunity to update their profile by going into their account, here they can specify travel and hotel preferences.

4.2 Use Case: Make a Booking (Hotel Only)

Actors

- User (primary actor)
- User Database (secondary actor)
- Product Database (secondary actor)
- Third Party Consortium (secondary actor)

Pre-conditions

1. User is registered with Travpedia
2. User has signed in

Flow of events (Success Scenario)

1. User is on the homepage where they can begin entering their search criteria
2. User ticks "Accommodation". Other options include:
   - Travel
   - Package Holiday
3. The interface changes slightly to accommodate booking a hotel only, the following details are required:
   - Destination/Hotel name (User can enter postcode, city, region or specific hotel)
   - Check in date (link to a calendar)
   - Check out date (link to a calendar)
   - How many rooms
   - Target price range
4. User clicks "Search"
5. The system presents the user with a list of available hotels, who have subscribed to Travpedia, matching their search criteria
6. User browses the search results. Can filter by price and star rating and sort by price, review score and star rating

7. User click on the hotel they would like to book
8. The system presents the user with a more detailed view of the hotel including photos
9. User selects the number of room they require
10. User clicks “Book Now”
11. The system presents the user with an interface with empty fields asking for various payment details:
    - Name on card
    - Billing address
    - Card type
    - Card number
    - Expiry date
    - Security number
    - Voucher code (if entered, the system will reload the page displaying the new price to pay)
    - Option to have Travpedia save payment details
12. User fills in all the fields
13. User ticks to agree to terms and conditions
14. User clicks “Pay Now”
15. User is presented with another screen summarising booking and payments details
16. User clicks “Confirm”
17. The transaction information is securely passed by the system to the credit/debit card consortium where the user”s payment details are validated
18. The booking is processed and handled by the GDS
19. The system redirects the users to a page thanking them for their booking

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Post-conditions

1. User receives a confirmation email
2. Details of the booking are stored in the user database – behaviour of user is used to determine future promotional offers and recommendations
3. Payment details are securely stored in the user database (if user selects to save payment details)
4. Details of the booking are available to view in “Manage Bookings”

Scenarios

1. The destination or hotel name the user has specified produces no matches

2. User enters the incorrect account number – consortium confirms this, system generates an error message
3. User may think booking is complete after clicking "Pay Now" – leaves website before clicking "Confirm" – booking is incomplete
4. When user clicks "Confirm", the system loads for several minutes and eventually times out – booking is incomplete

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4.3 Use Case: Make a Booking (Travel by Plane)

Actors

- User (primary actor)
- User Database (secondary actor)
- Product Database (secondary actor)
- Third Party Consortium (secondary actor)

Pre-conditions

1. User is registered with Travpedia
2. User has signed in

Flow of events (Success Scenario)

1. User is on the homepage where they can begin entering their search criteria
2. User ticks "Travel". Other options include:
   - Accommodation
   - Package Holiday
3. The interface changes slightly to accommodate booking a journey
4. User ticks "One way", the following details are required:
   - Type (of transport)
   - Date (link to calendar)
   - Start location
   - End location
   - Number of
5. User clicks "Search"
6. The system presents the user with a list of available flights, whose airline companies have subscribed to Travpedia, matching their search criteria
7. User browses the search results. Can filter by price range and sort by price and departure time
8. User clicks on the journey they would like to book
9. The system presents the user with a more detailed view of the flight

10. User selects how many items of luggage they wish to take on the flight
11. User clicks “Book Now”
12. The system presents the user with an interface with the total price and empty fields asking for various payment details:
    - Passport number
    - Passport issue date
    - Name on card
    - Billing address
    - Card type
    - Card number
    - Expiry date
    - Security number
    - Voucher code (if entered, the system will reload the page displaying the new price to pay)
    - Option to have Travpedia save payment details
13. User fills in all the fields
14. User ticks to agree to terms and conditions
15. User clicks “Pay Now”
16. User is presented with another screen summarising booking and payments details
17. User clicks “Confirm”
18. The transaction information is securely passed by the system to the credit/debit card consortium where the user”s payment details are validated
19. The booking is processed and handled by the GDS
20. The system redirects the users to a page thanking them for their booking

---

Post-conditions

1. User receives a confirmation email
2. Details of the booking are stored in the user database – behaviour of user is used to determine future promotional offers and recommendations
3. Payment details are securely stored in the user database (if user selects to save payment details)
4. Details of the booking are available to view in “Manage Bookings”
5. Airline company is notified of the booking

Scenarios

1. The search criteria produces no results

2. User enters an invalid passport number - error message

4.4 Use Case: Cancel a Booking

Actors

- User (primary actor)
- Product Database (secondary actor)
- User Database (secondary actor)

Pre-conditions

1. User is registered
2. User is logged in
3. User has made a booking
4. The terms and conditions of the booking in question specify that cancellations are permitted

Flow of events (Success Scenario)

1. User clicks “Manage Bookings” on the website”s homepage
2. The system directs the user to a page showing their past and current bookings
3. User clicks on the booking they wish to cancel
4. The system shows the booking in more detail with an option to cancel the booking
5. User clicks “Cancel booking”
6. User is asked to confirm that they are sure they want to cancel the booking
7. User clicks “Confirm Cancellation”
8. This information is relayed to the credit/debit card consortium which will handle the refund
9. The system redirects the user to a page confirming their cancellation was successful

Post-conditions

1. Hotel company is notified of the cancellation
2. User receives email confirmation of cancellation
3. Booking is removed from the user”s account in “Manage Bookings”
4. Both databases are updated of changes
5. User receives appropriate refund

Scenarios

1. User disputes a no refund policy – not possible using website. User must contact the company directly
2. User leaves the website after clicking “Cancel Booking” – User has not clicked “Confirm Cancellation” – Booking has not been cancelled

5 Activity Diagram

The activity diagram models the scenario for the user searching for and making an accommodation booking.

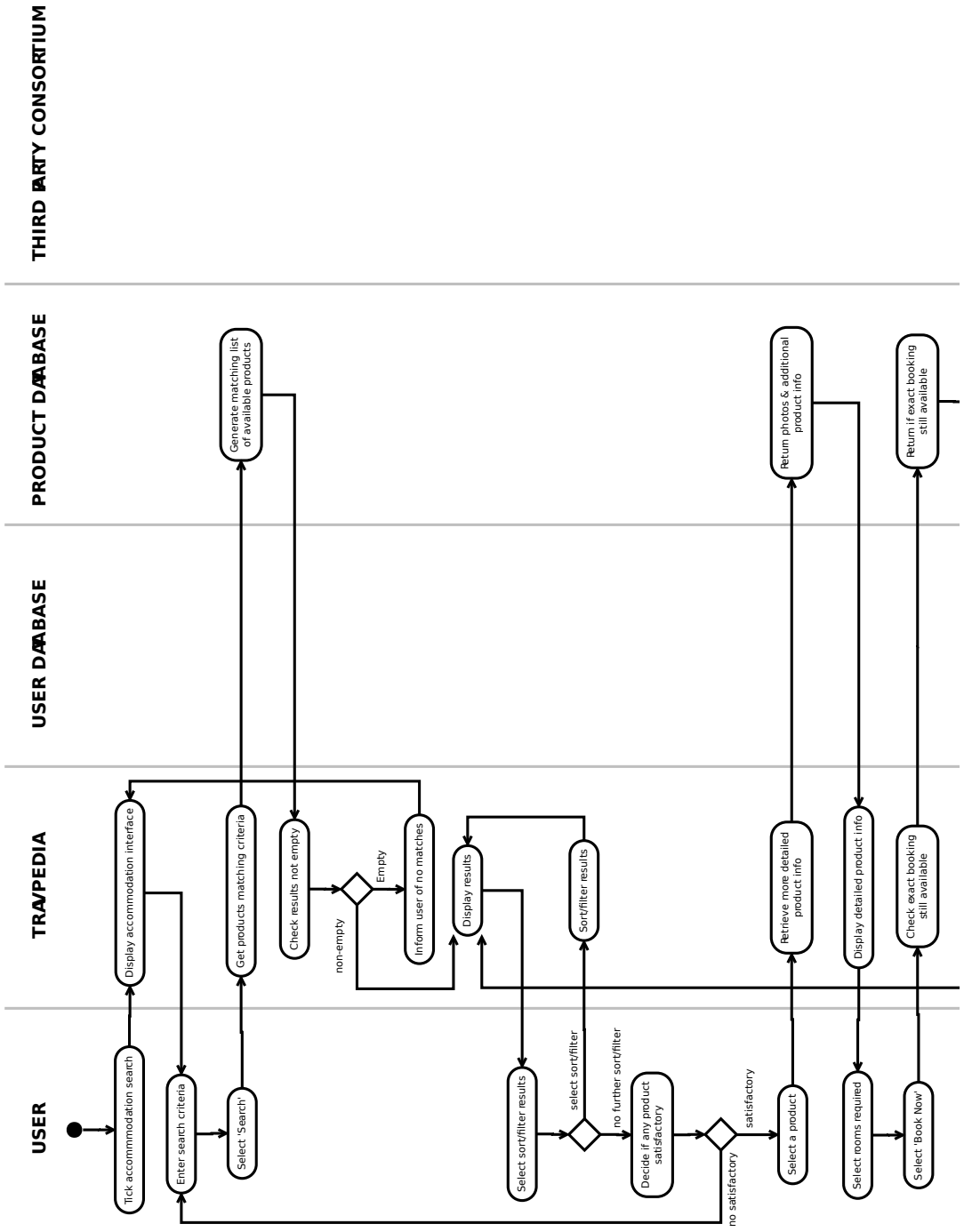

Figure 2: *Activity diagram*

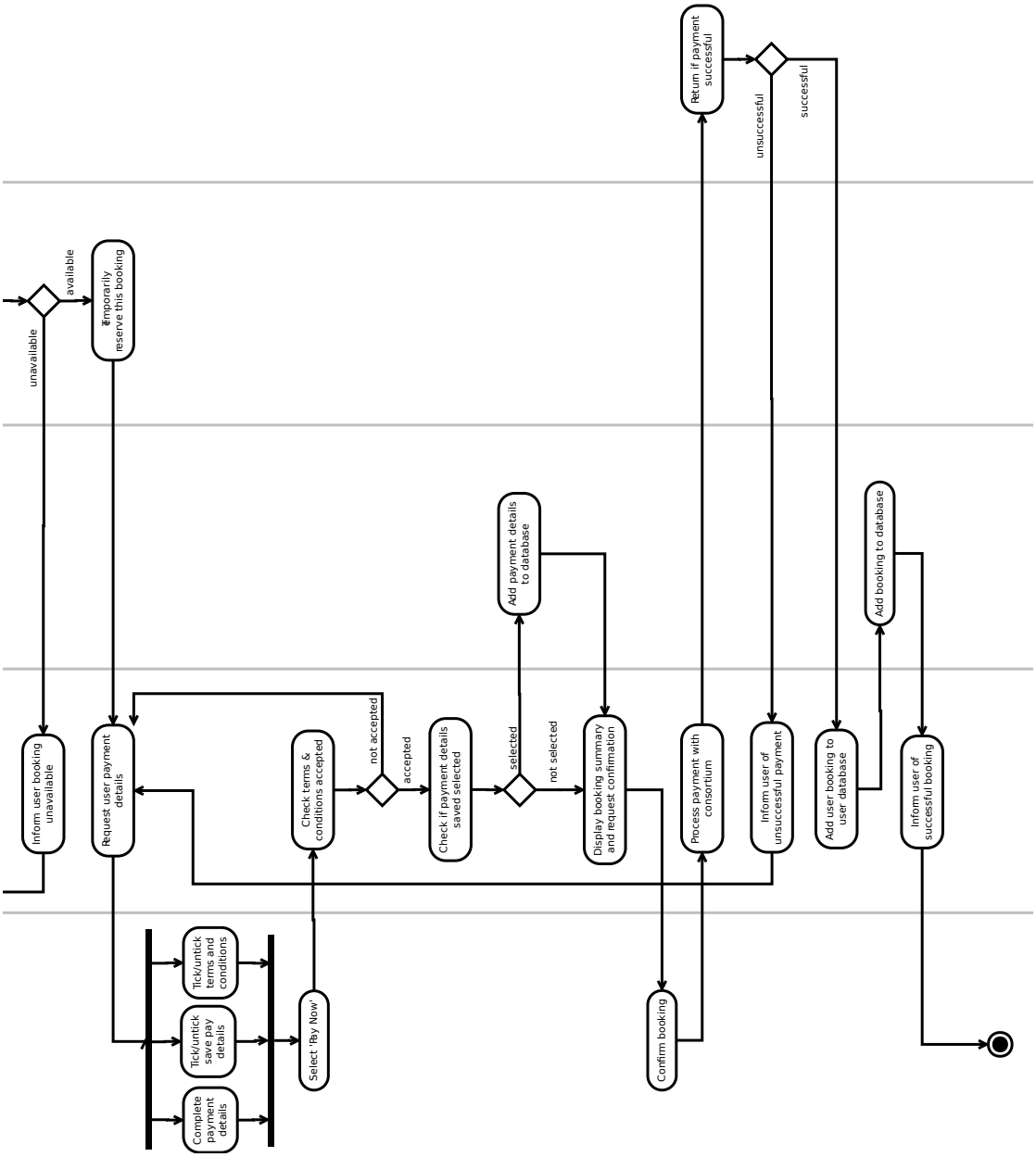

Figure 3: *Activity diagram*

6 Class Analysis

6.1 Responsibility-Driven Analysis

The analysis of the specification for the Travpedia system is shown below. Sections in italic font are considered out of scope, red words are nouns and blue are verbs.

> **Travpedia** is an online travel and accommodation **booking system**.
>
> *Travel and accommodation companies are able to subscribe to Travpedia for a monthly subscription cost of £200 plus an initial £50 joining fee. This subscription allows the company to offer their products on the Travpedia website where they can be purchased by visiting users.*
>
> **Products** that are **advertised** on the Travpedia **website** include **accommodation**, **package holidays** and **travel** by **air**, **rail** and **sea,**
>
> Visitors to the website, after **registering** an **account**, are able to **search** for all available products **offered** by these subscribed **companies**. They are able to search with a number of **criteria** including **type of product**, **location**, **date** and **price**. Users can then view these **search results** and **book** and **pay** for products through the website. Users may also **rate** and **review** individual products and services that they have **purchased**. A product gains a review score based on these ratings. This review rating system provides further search criteria whereby a user can **filter** search results by **review score**.
>
> **Payments** made by both subscribing companies and users are **handled** online by a third party **consortium**. **Subscribers** must pay by **debit** or **credit card** while users have the additional option of paying with gift **vouchers** offered by Travpedia.
>
> Users are able to **view bookings** they have made and, where possible, **cancel** these bookings and **receive** a **refund** via the third party consortium.
>
> *Travpedia disseminates advertisements and promotional offers to users based on previous patterns of use and previous purchases. These personalised offering are sent to mobile phones through SMS and email accounts.*
>
> Users may **opt out** of receiving phone and email **alerts**.

6.2 Nouns

Noun	Accepted as Class	Class Name	Rationale
Travpedia booking system website	No		The whole system is the Travpedia website
account user visitor	Yes	User	Class will hold user information, payment details, mailing preferences and details of bookings
advertisement promotional offer	No		Part of subscriber promotions subsystem, outside scope
product service	Yes	Product	Superclass

Noun (Cont.)	Accepted	Class Name	Rationale
type of product	No		This is defined by the subclasses of Product
accommodation	Yes	Accommodation	Subclass of Product
package	Yes	PackageHoliday	Subclass of Product
travel	Yes	Travel	Subclass of Product
air	Yes	Flight	Subclass of Travel, subclasses used because different forms of travel have some common attributes and some distinct ones
rail	Yes	Rail	Subclass of Travel
sea	Yes	Ferry	Subclass of Travel
alerts	No		Part of promotional mailing subsystem
booking	Yes	Booking	Class holds all information about an individual booking
company subscriber	No		Part of subsystem that handles company subscriptions
consortium	No		Part of payment sub-system
payment credit card debit card gift voucher refund	Yes	Payment	Class holds information relating to a payment (refund is a negative payment)
search results	Yes	SearchResults	Class holds result of an individual search
criteria date price location	No		These are attributes of SearchResults
review	Yes	Review	Class holds a product review
review score product rating	No		These are attributes of a review

6.3 Verbs

Verb	Accepted as method	Rationale (if rejected)
advertise	No	Out of Scope
register	Yes	
search	Yes	

Verb (Cont.)	Accepted	Rationale
offer		Generic term
book	Yes	
pay	Yes	
rate	No	Out of Scope
review	No	Out of Scope
purchase	No	Is encompassed by book and pay
filter	Yes	
handle	No	Generic term
view	Yes	
cancel	Yes	
receive		Out of Scope
opt out	No	This would be accomplished by setting a field variable in the User, getters and setters are assumed and are not explicitly included here

6.4 CRC Analysis

Responsibilities of a class are things it knows and things it does. Terminology used here:

Has this is required

May have this is optional

Maintains used where class contains a collection of zero more objects

User	
Superclass:	
Subclass:	
Responsibilities:	*Collaborators:*
Maintains user profile information	
Maintains stored payment method information	
Maintains user preferences	
Maintains a collection of past and current bookings	Booking

Product (Abstract)	
Superclass:	
Subclass: PackageHoliday, Accommodation, Journey	
Responsibilities:	*Collaborators:*
A superclass maintaining information about a journey or accommodation product Has a product reference Has a price	Journey PackageHoliday Accommodation

Journey	
Superclass: Product	
Subclass:	
Responsibilities:	*Collaborators:*
Maintains information about a particular journey: dates, start and end location Has a transport type Is bookable	

Accommodation	
Superclass: Product	
Subclass:	
Responsibilities:	*Collaborators:*
Maintains details about the accommodation Maintains information Is able to calculate its review score Has a star rating Is reviewable	 Review

Package Holiday	
Superclass: Product	
Subclass:	
Responsibilities:	*Collaborators:*
Maintains information about a PackageHoliday Is reviewable Maintains a collection of reviews	 Review

Booking	
Superclass:	
Subclass:	
Responsibilities:	*Collaborators:*
Has one or more Travel Products	Travel Product
Is payable	
Is viewable	
Is cancellable	

Payment	
Superclass:	
Subclass:	
Responsibilities:	*Collaborators:*
Maintains a collection of Travpedia Vouchers used	Travpedia Voucher
May know details of payment card used	Payment card
May know card authorization code	
Can send itself to payment subsystem	

Search Results	
Superclass:	
Subclass:	
Responsibilities:	*Collaborators:*
Has criteria	Travel Product
Maintains a collection of Travel Products that satisfy its criteria	
Can sort itself by price or review score	
Can filter itself by price range, review score, board basis or star rating	Review

Reveiw	
Superclass:	
Subclass:	
Responsibilities:	*Collaborators:*
Maintains all information pertaining	Accommodation PackageHoliday

7 First Cut Class Diagram

The first cut class diagram shows the results of the noun verb analysis that we performed. Some of the nouns and verbs were not suitable to keep as classes and methods as they were generic or duplicated. The diagram shows the basic skeletal structure that will adopted for the system.

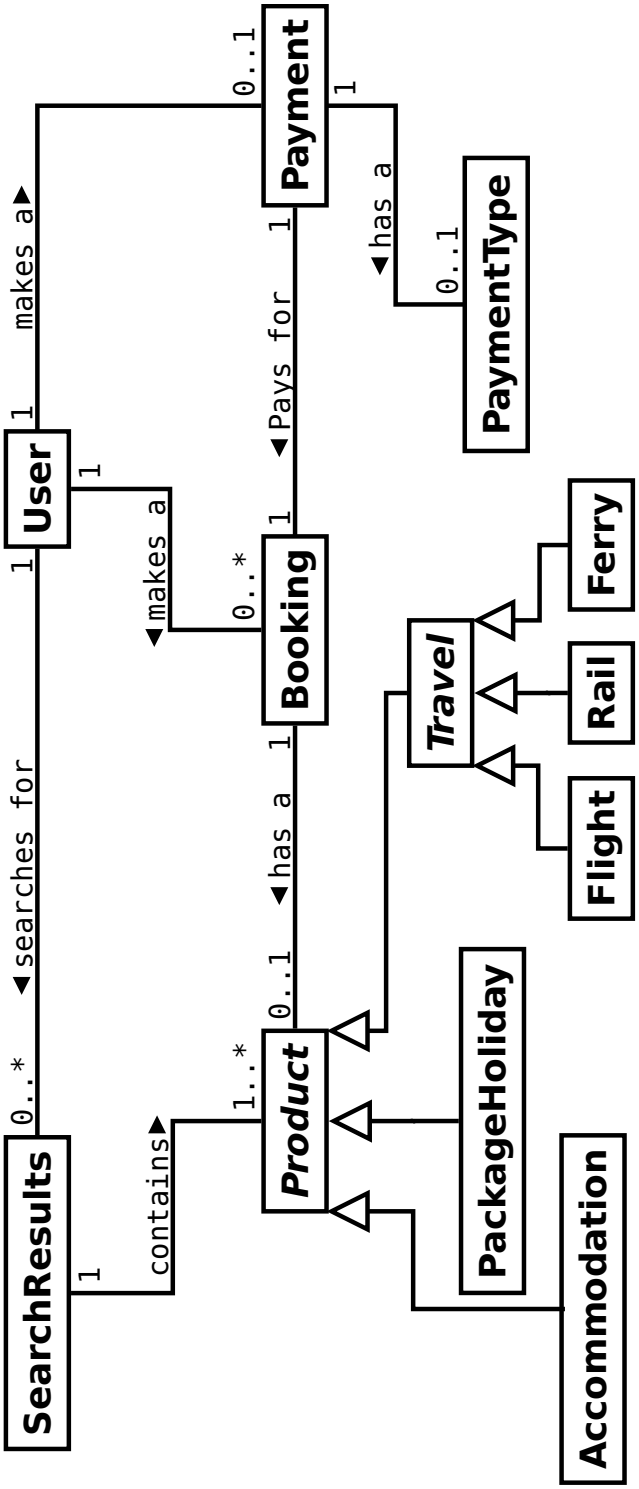

Figure 4: *First cut class diagram*

8 Class Diagram

The class diagram is an extension of the first cut class diagram with methods and class hierachies included. It is assumed that getters and setters are included for many of the field variables, but these have been left off for brevity.

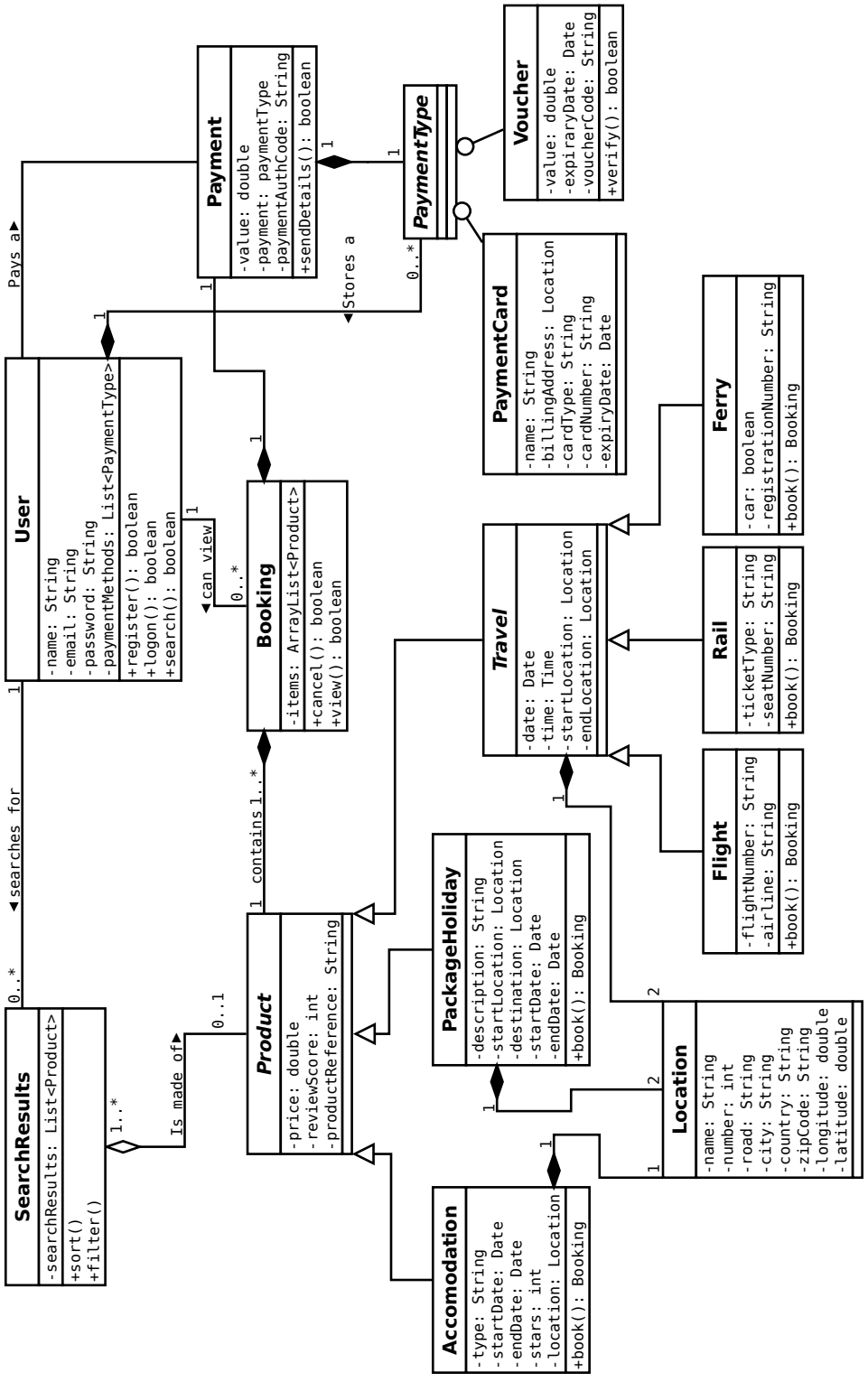

Figure 5: *Class diagram*

9 Object Diagram

The object diagram below relates the following scenario:

> A user called Howard Evans wants to book accomodation at a five star hotel in London. He wants to pay by card and stay for 5 nights starting on Christmas day this year.

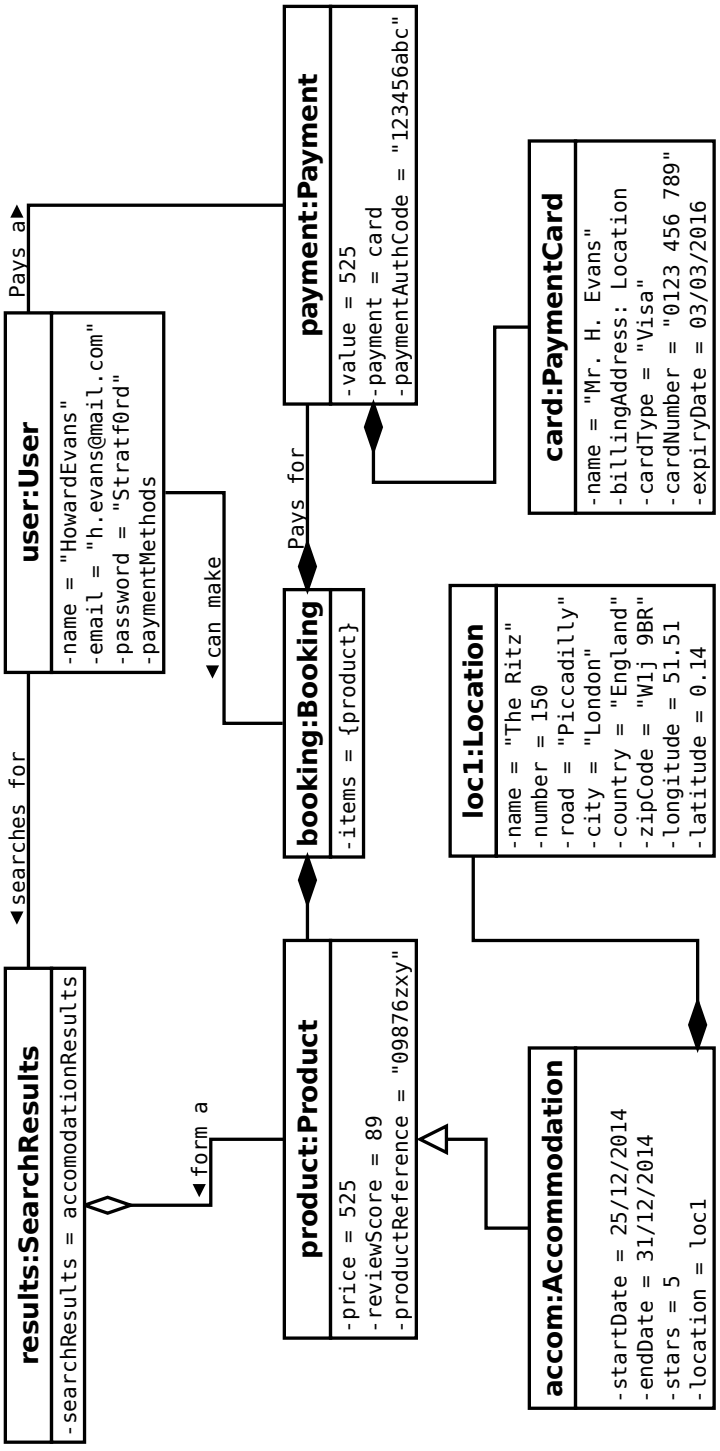

Figure 6: *Object diagram*

10 Sequence Diagram

Scenario: User searches for a hotel and sorts by price. Assume user is logged on and on the homepage

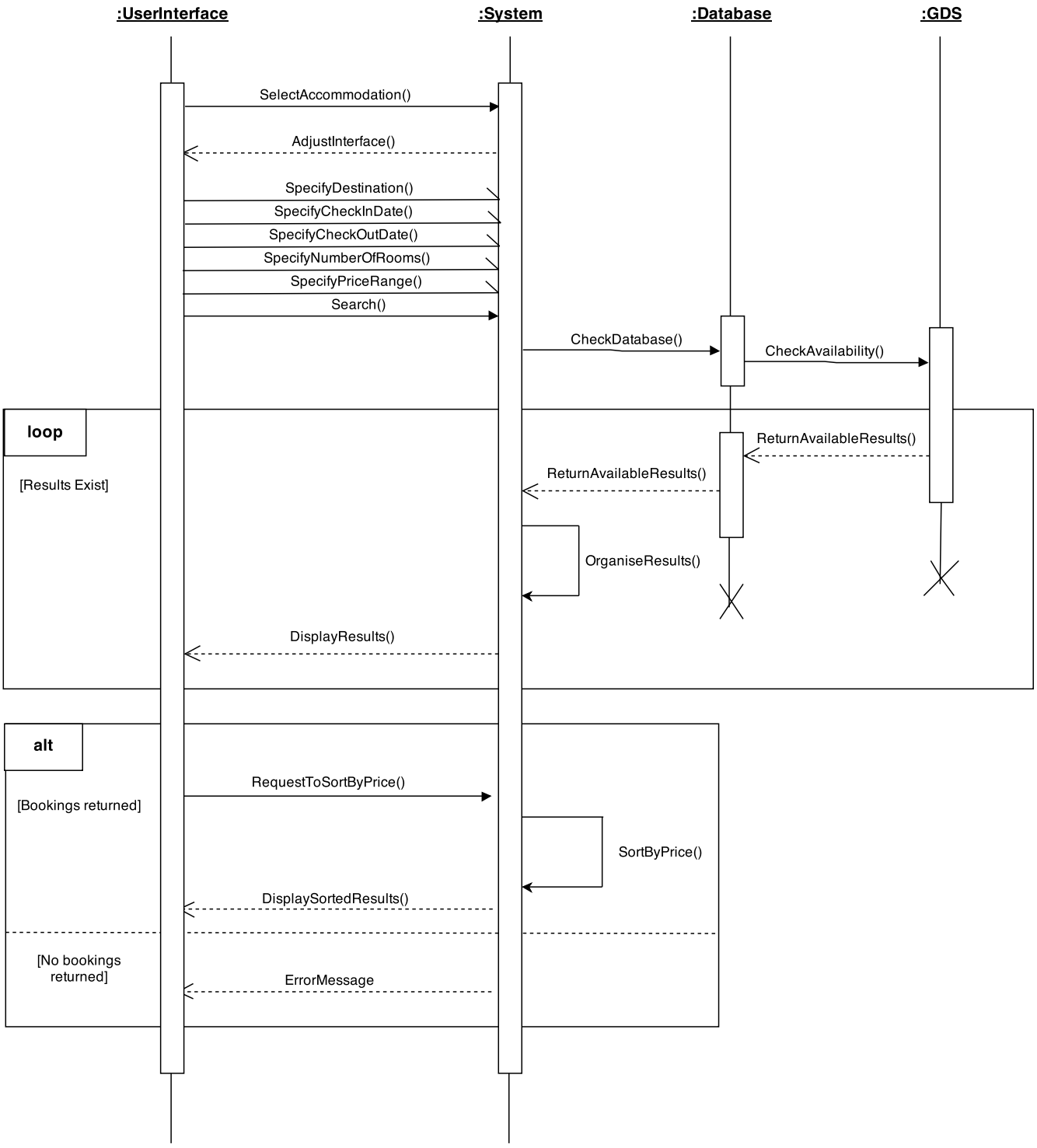

Figure 7: *Sequence diagram*

11 State Diagram

This state diagram, of the searching and booking system, shows the scenario for the user searching for and making an accommodation booking.

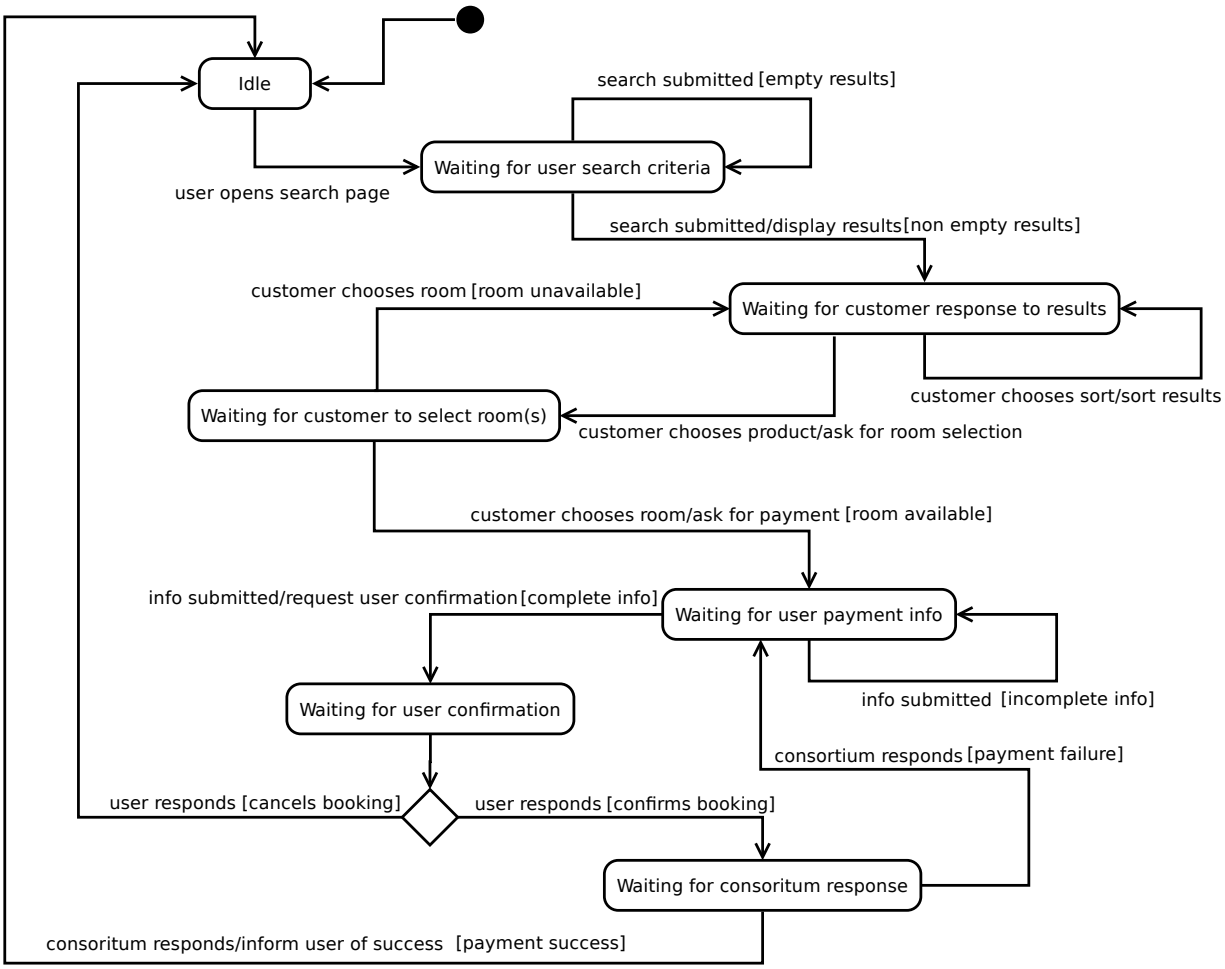

Figure 8: *State diagram*

12 Component Diagram

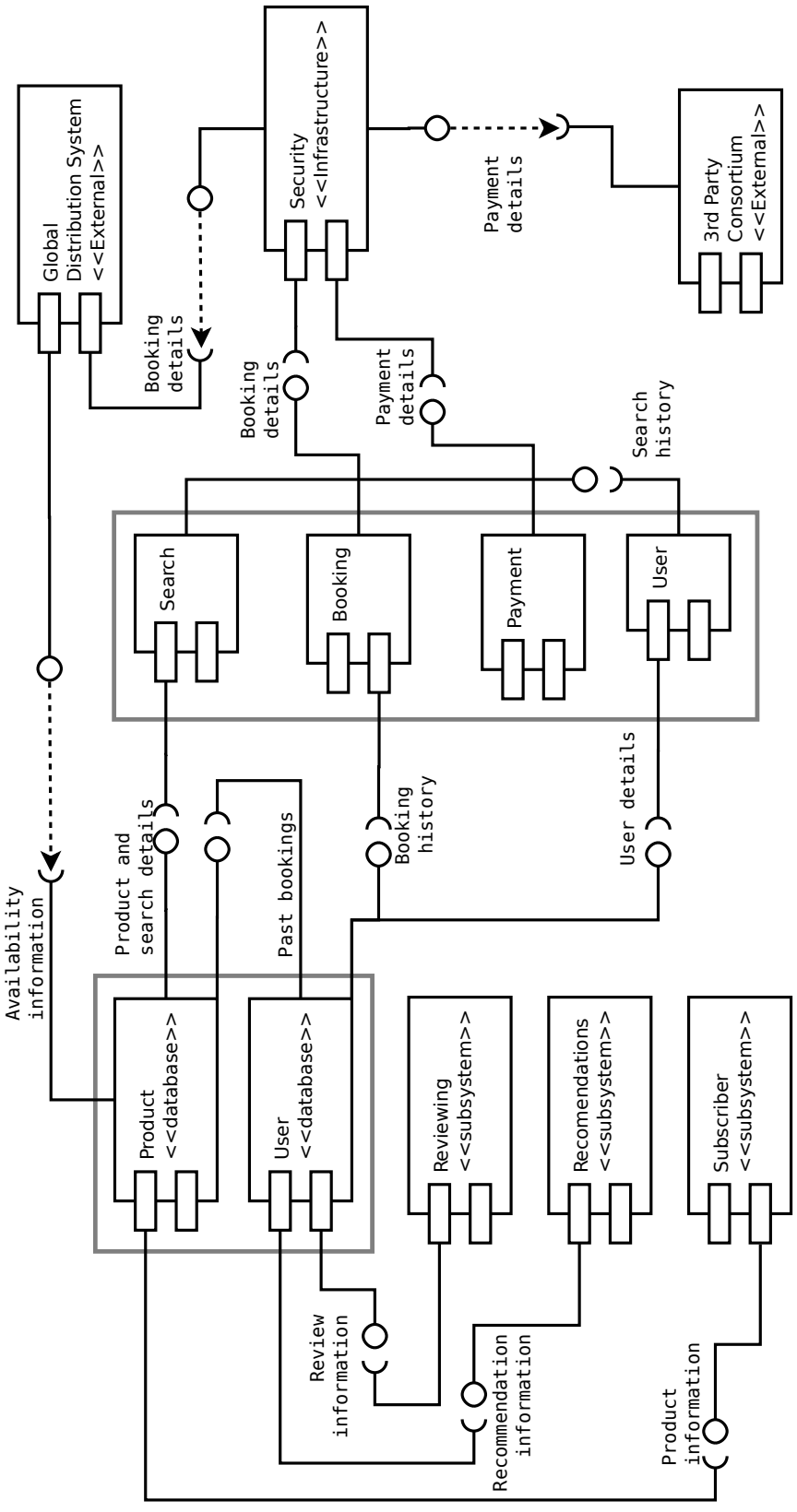

Figure 9: *Component diagram*

13 Deployment Diagrams

The first deployment diagram shows a possible implementation of a three tier architecure. This incorporates the security aspects of the design separately in the database and the business logic layers.

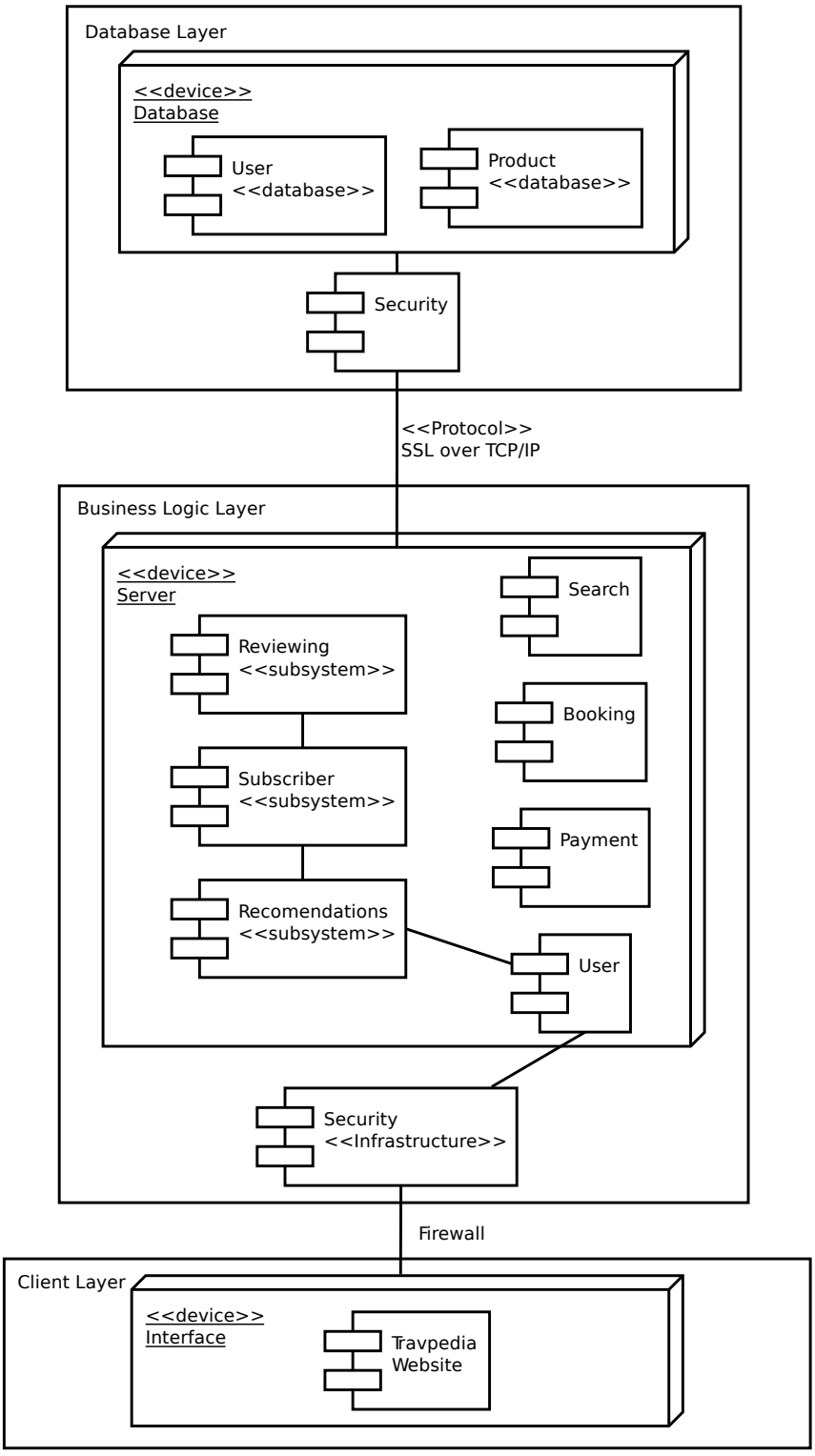

Figure 10: *Three tier deployment diagram*

The second deployment diagram shows a four tier architecure. This separates the security aspects into a separate layer which means that the security can be handled by a single system rather than being separated across different layers.

Were this system to be built, we would recommend the four tier architecture shown here as this reduces overall complexity (since elements are not duplicated) and so improves reliability as well as increasing security.

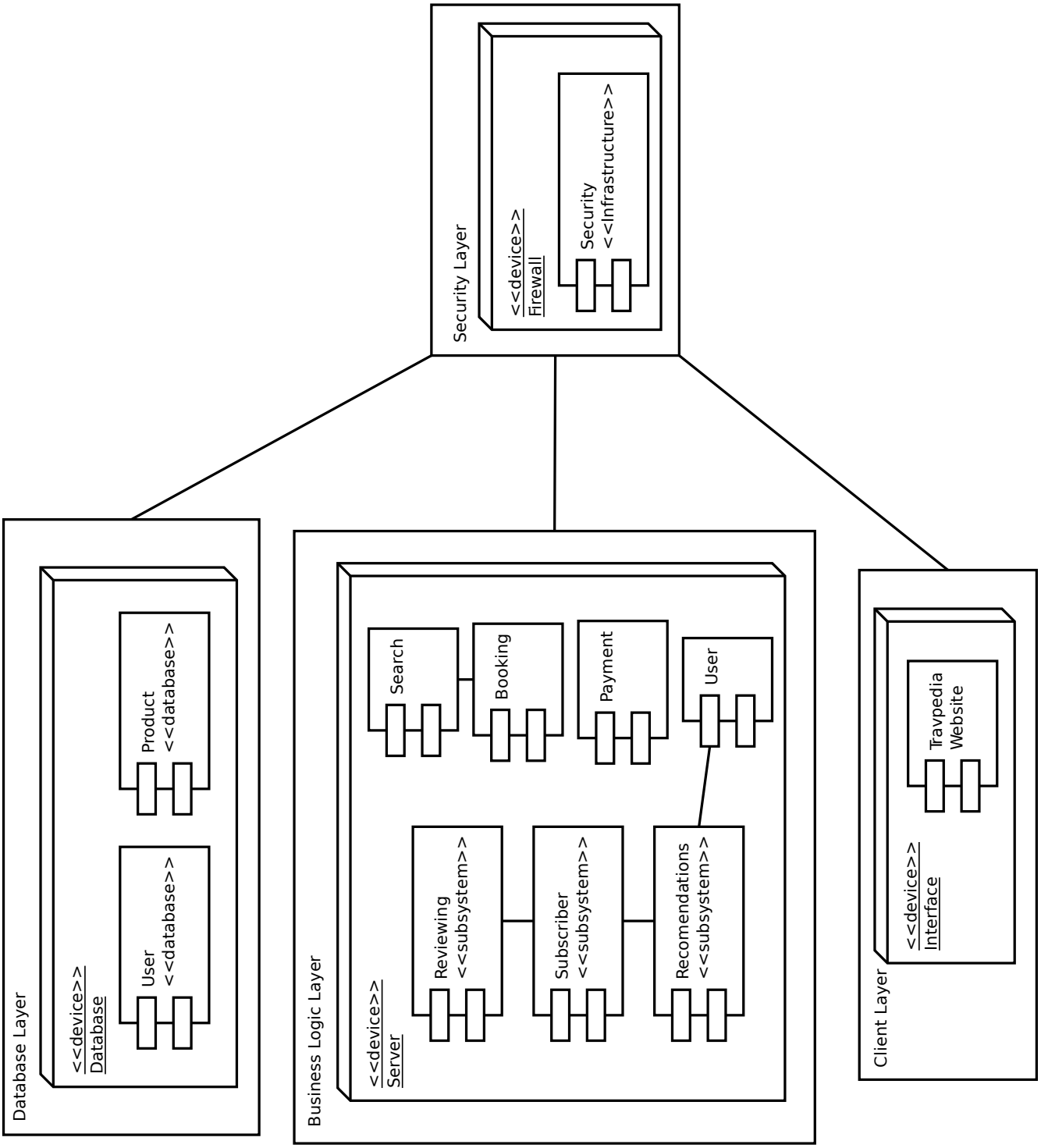

Figure 11: *Four tier deployment diagram*