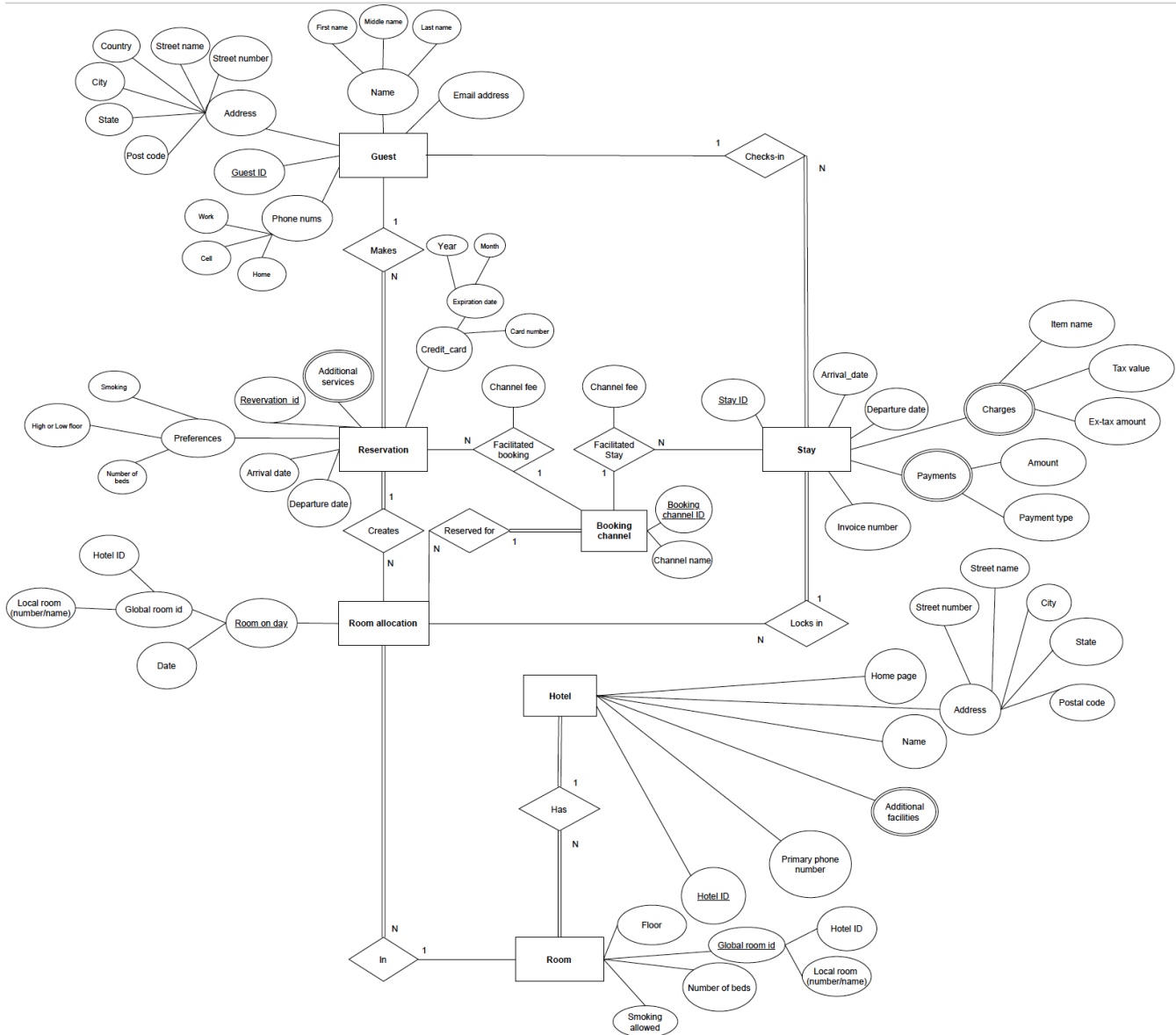


This report describes a database model for WNB Hotel Group to facilitate their data management. With the system, the hotel chain can provide high-quality service with optimal utilisation of resources, contributing to the profitability of its operations.

#### **Assumptions on Conceptual Data Model**

- A single guest can make multiple reservations either through the hotel's booking system and through one or multiple booking channels.
- Regardless of booking method (own webpage or booking channel), Guest IDs are matched across bookings.
- Cancellation of reservation is permitted before checking in.
- Booking channels have access to the number of rooms available in the hotel.
- At least 2 rooms will be available for the booking channels at any given time.
- A system external to the database allocates rooms to be reserved for booking channels at all times.
- Invoice number is generated when the guest is at the check out table.
- A guest can only request additional services which are available at the hotel.
- Validity of the credit card is checked by an external system and information is saved in a secure hash format.
- Additional services requests of guests are only fulfilled given availability.

## ER Diagram



## **Description of Entities and Attributes**

### **Entities:**

Our conceptual schema consists of **7** entities. Each entity is listed and explained in the following table:

Entity	Explanation
Hotel	It identifies a single hotel with a hotel ID (a unique identifier), name, and contact information such as address, web URL, and phone numbers.
Room	It identifies every hotel room in the chain with information on which hotel it is in and what its local room number or name is. Additionally, it contains information on the floor on which it is located, number of beds, and whether smoking is allowed.
Room allocation	A room allocation keeps track of the status of a room (identified by a hotel and a local room name/number) on a given date. It contains a link to one of either a reservation, a stay, or a booking channel. The absence of a room allocation for a particular room and day means that the room is available for any purpose (if in the future) or that the room was unused (if in the past).
Reservation	Reservations keep track of all information related to reservations, such as a reservation IDs (unique), the guests' IDs, check-in and check-out dates, guests' preferences, and their credit card details. Reservations only exist until either the guest checks in or cancels the reservation. If the guest does check in, a subset of the information is retained and transformed into a Stay entity.
Booking Channel	Booking channels exist as separate entities to link together information about their roles across the booking process. Every booking channel has a name and an ID.

Stay	<p>A stay entity is generated when a guest checks in to stay in a room. An instance contains information about the stay, including a stay ID (unique identifier), arrival and departure dates, the guest's ID, as well as invoice details.</p>
Guest	<p>Every guest has a unique guest ID associated with it, as well as a number of attributes relating to their addresses, names and contact details. These are kept track of across different means of booking to ensure that guests are not present twice in the database.</p>

**Entity Attributes:**

Bold text represents primary keys, descriptions omitted in self-explanatory cases.

**1. Hotel**

Entity	Attribute(: Sub-attribute)	Description
Hotel	<b>Hotel ID</b>	<b>Unique identifier of a hotel. Primary key.</b>
	Name	Hotel's name, example: The Ritz-Carlton Madrid, The Westin Palace Barcelona etc.
	Home page	Hotel website.
	Address:	Full address of the hotel. Composite attribute.
	- Post code	
	- State	
	- City	
	- Street name	
	- Street number	
	Primary phone number	
	Additional facilities	Additional facilities available at the hotel (conference rooms etc.). Multivalued attribute.

## 2. Room

Entity	Attribute	Description
Room	Global room ID:	Global room ID is a composite primary key.
	- Hotel ID	Identifier of the hotel the room is located in.
	- Local room name or number	The name or number of a given room used in the given hotel.
	Floor	Floor number of the room.
	Number of beds	
	Smoking allowed	Smoking/Non-smoking room.

## 3. Room allocation

Entity	Attribute	Description
Room allocation	Room on day:	Composite Primary key made up of room identifier and date.
	- Global room ID	Same definition as in the case of Room.
	- Date	Date identified as year, month and day of allocation.

#### 4. Reservation

Entity	Attribute	Description
Reservation	Reservation ID	Reservation number generated at the time of booking. Primary key.
	Preferences:	Booking preferences for the rooms.
	- Smoking	
	- Number of beds	
	- High or low floor	
	Arrival date	Expected check-in of guest.
	Departure date	Expected check-out of guest.
	Credit card:	Securely stored credit card details (e.g. information is hashed).
	- Credit card number	
	- Credit card expiry year	
	- Credit card expiry month	
	Additional services	Additional services/facilities requested by the client subject to availability. Multivalued attribute.

## 5. Guest

Entity	Attribute	Description
Guest	Guest ID	Generated unique identifier of a guest. Primary key.
	Address:	Full address of guest.
	- Post code	
	- State	
	- City	
	- Country	
	- Street name	
	- Street number	
	Phone numbers:	Provided phone numbers of guests.
	- Cell	
	- Work	
	- Home	
	Email address	
	Name:	Full name of guest.
	- First_name	
	- Middle_name	
	- Last_name	



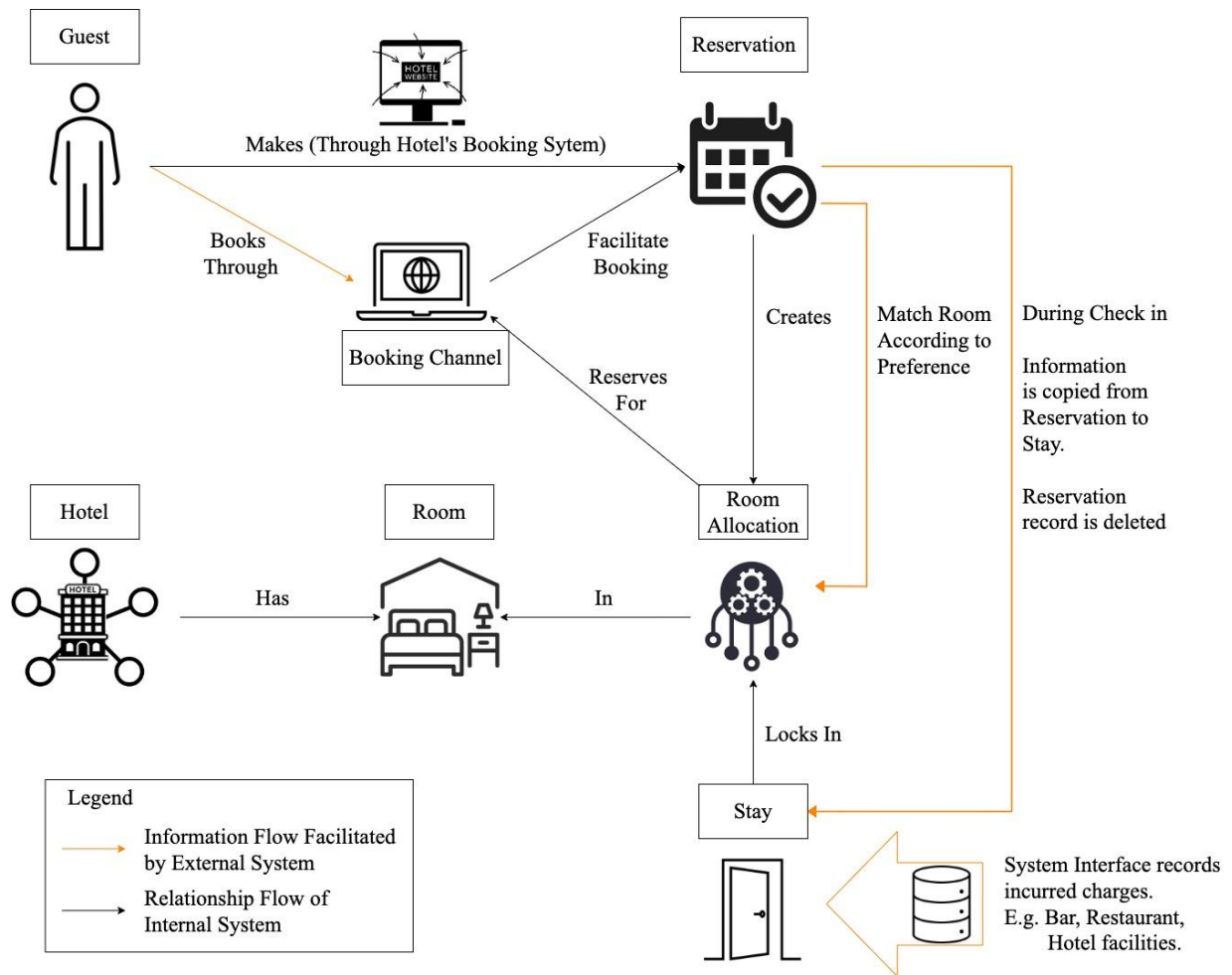
## 6. Stay

Entity	Attribute	Description
Stay	Stay ID	Unique identifier. Primary key.
	Arrival Date	The date of check-in.
	Departure date	The historical or expected check-out date.
	Invoice number	Official invoice number generated at the end of the stay.
	Charges:	Charges incurred by the guest. Multivalued attribute.
	- Item name	
	- Ex-tax value	Value of the charge without taxes.
	- Tax value	Taxes due on charge.
	Payments:	Guest payments. Multivalued attribute.
	- Payment type	Type of payment, e.g. Visa/Cash
	- Amount	

## 7. Booking channel

Entity	Attribute	Description(Value)
Booking channel	Channel ID	Unique identifier of each booking channel. Primary key.
	Channel name	Name of booking channel.

## Relationship Flow



### Information and relationship flows:

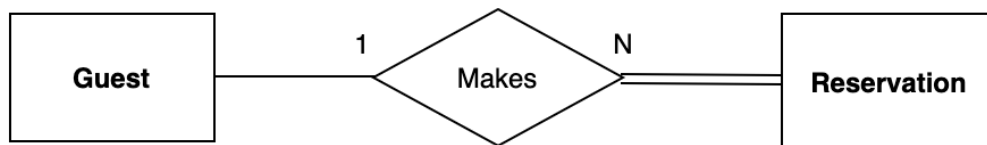
1. A guest reserves a room in a hotel either through the hotel's booking system or a booking channel, providing arrival and departure dates, personal information and credit card details. Additionally, they may provide preferences for the room and additional services requested. Multiple reservations per guest are permitted.
2. After a reservation is confirmed, a unique reservation ID is created. This reservation ID is used to create a room allocation while an external system attempts to match the room preferences to available rooms.
3. When the guest checks in, the reservation entry is converted into a stay entry, updating the room allocation accordingly.

4. During the stay, charges (room fee, food charges, additional services) incurred are entered into the database by an external system.
5. On check out, the guest will receive an invoice. Detailed breakdown of the charges, payment details are shown and an official invoice number is generated. The invoice can be either printed or provided in an online form.

### **Relationships, cardinalities and participation constraints**

Single line refers to partial participation constraint and double line to total participation constraint (existence dependency).

#### **Guest : Reservation (1:N)**



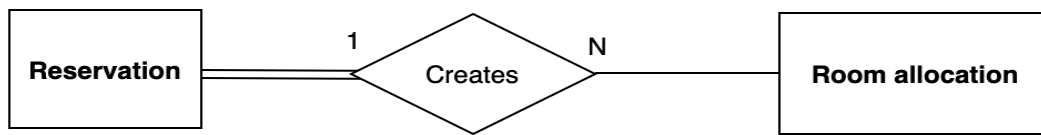
Reservations are made by one guest. A guest can make multiple reservations through direct booking or via booking channels. Every reservation must be made by a guest but not every guest needs to have active reservations.

#### **Guest : Stay (1:N)**



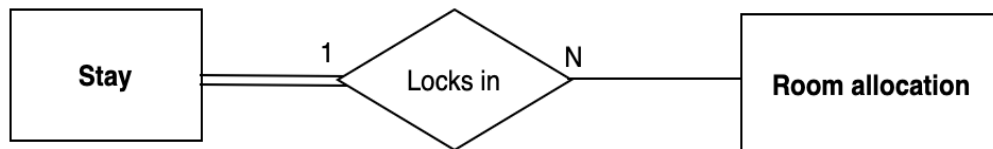
A guest can check in for multiple stays at the hotel chain. However, a stay can only be associated with one lead guest. Not every guest needs to have a stay checked-in, but every stay must have been checked in by a guest.

### Reservation : Room Allocation (1:N)



Every reservation needs to have room allocation(s) associated with it to ensure the room is not used for anything else on that date. For reservations across multiple days, room allocations are generated for every day of the reservation. Every reservation must have (a) respective room allocation(s), but not every room allocation belongs to a reservation.

### Stay : Room Allocation (1:N)



Every room stay needs to have room allocation(s) associated with it to ensure the rooms are not used for any other purpose during the days of the stay, and to ensure that past stays are being kept track of. For stays across multiple days, room allocations for every day of the stay are locked in.

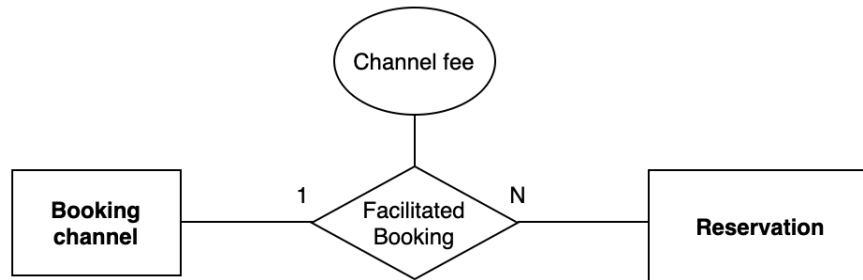
Partial participation from room allocation, but total participation from stay. Every stay must lock in at least one room allocation, but not every room allocation belongs to a stay.

### Room Allocation : Booking Channel (N:1)



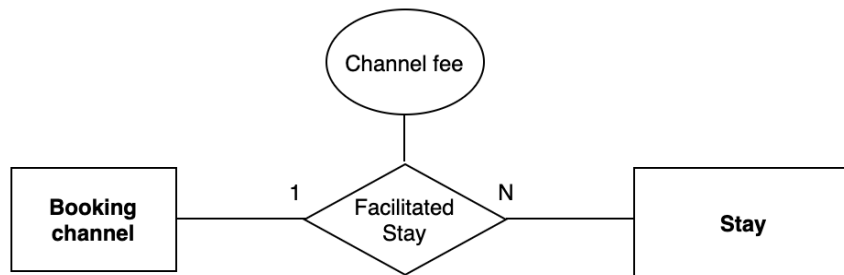
Room allocations are created for booking channels by an external system to keep track of the rooms reserved to each of the channels. Every channel has at least 2 rooms at every hotel reserved to them at any given time. Every booking channel must have reserved room allocations, but not every room allocation belongs to a booking channel.

### Booking Channel : Reservation (1:N)



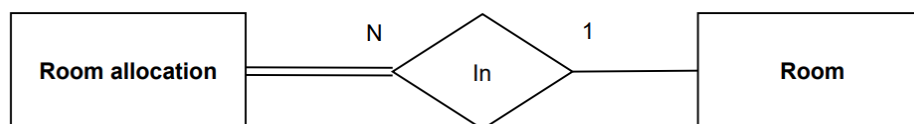
A booking channel can facilitate booking to make multiple reservations but one reservation is only bound to one booking channel. Not every booking channel needs to have facilitated a reservation, and not every reservation is facilitated by a booking channel. In cases where a reservation is facilitated by a booking channel, a tentative channel fee is stored.

### Booking Channel : Stay (1:N)



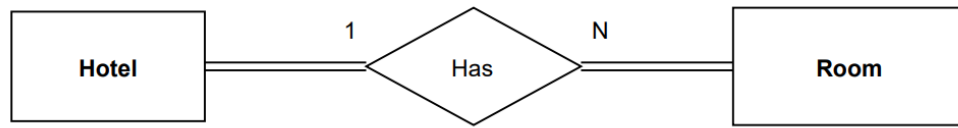
One booking channel can facilitate multiple stays, but a specific stay is only bound to one specific booking channel. Not every booking channel needs to have facilitated stays, and not every stay is facilitated by a booking channel. In cases where a stay is facilitated by a booking channel, the channel fee is stored.

### Room Allocation : Room (N:1)



A room allocation is made for one room for one night, so a room can have allocations for every unique date. Each room allocation must have a room assigned into it, although not all rooms need to have allocations, in the case of new rooms for example.

### Hotel : Room (1:N)



A hotel has many rooms but a specific room can only be found in one specific hotel. Each hotel must contain rooms, and each room within a hotel must be associated with the hotel.

### Assumptions of Physical Schema:

- Assume the official invoice number cannot contain letters of the alphabet, only numbers.
- Guests can only see the rooms available for the selected period of staying.
- When the guest checks in to stay in the hotel, a Stay ID will be created. Reservation ID will be deleted. Information from the Reservation ID will be copied to the Stay ID.

## Questions

**1a). The total spent for the customer for a particular stay (checkout invoice).**

Assumption:

1. Total spent includes taxes paid.

```
SELECT S.Guest_id, S.Stay_id, SUM(IP.Amount) FROM Stay S
  INNER JOIN Invoice_payments IP ON IP.Stay_id = S.Stay_id
  -- To specify a particular stay:
WHERE S.Stay_id = 12345;
```

**2a). The most valuable customers in the last two months.**

Assumption:

1. Last two months means to count all stays that started in the last two months.
2. Value means total spent including taxes paid

```
SELECT G.Guest_id, SUM(IP.Amount) AS Total_spent FROM Stay S
  INNER JOIN Guest G ON G.Guest_id = S.Guest_id
  INNER JOIN Invoice_payments IP ON IP.Stay_id = S.Stay_id
  -- Based on https://www.sqlite.org/lang\_datefunc.html
WHERE date(S.Arrival_date) >= date('now', '-2 months')
GROUP BY G.Guest_id
ORDER BY Total_spent DESC LIMIT 10;
```

**2b). The most valuable customers in the past year**

Assumption:

1. Based on [https://www.sqlite.org/lang\\_datefunc.html](https://www.sqlite.org/lang_datefunc.html), Assuming by past year, the last 365 days are meant.
2. If all stays since the start of the year are meant, "-1 year" would be replaced by "start of year".

```
SELECT G.Guest_id, SUM(IP.Amount) AS Total_spent FROM Stay S
INNER JOIN Guest G ON G.Guest_id = S.Guest_id
INNER JOIN Invoice_payments IP ON IP.Stay_id = S.Stay_id
WHERE date(S.Arrival_date) >= date('now', "-1 year")
GROUP BY G.Guest_id
ORDER BY Total_spent DESC LIMIT 10;
```

**2c). The most valuable customers from the beginning of the records.**

```
SELECT G.Guest_id, SUM(IP.Amount) AS Total_spent FROM Stay S
INNER JOIN Guest G ON G.Guest_id = S.Guest_id
INNER JOIN Invoice_payments IP ON IP.Stay_id = S.Stay_id
GROUP BY G.Guest_id
ORDER BY Total_spent DESC LIMIT 10;
```



**3. Which are the top countries where our customers come from?**

```
SELECT Country, COUNT(Guest_id) AS Frequency FROM Guest
GROUP BY Country
ORDER BY Frequency DESC LIMIT 10;
```

**4. How much did the hotel pay in referral fees for each of the platforms that we have contracted with?**

**Assumption:**

1. Arrival date on the last day of the month means channel fees are charged for that month.
2. Only include stays that finished on or before the end of the last month

```
SELECT C.Channel_id, C.Channel_name, SUM(S.Channel_fee) AS Total_fees
FROM Booking_channel C
INNER JOIN Stay S on S.Channel_id=C.Channel_id
WHERE date(S.Arrival_date) <= date("now","start of month",-1 day")
GROUP BY C.Channel_name;
```

5. What is the utilization rate for each hotel (that is the average billable days of a hotel specified as the average utilization of room bookings for the last 12 months)

**Assumption:**

1. Only joining to retrieve hotel name:
2. To ensure that only stays count as utilised days:

```
SELECT Name, Hotel_id, AVG(Utilisation) FROM
(
  SELECT H.Name, H.Hotel_id, R.Room_name_or_number,
  COUNT(RA.date)/365.0 AS Utilisation FROM Room_allocation RA
  INNER JOIN Room R on RA.(Hotel_id, Room_name_or_number) = R.(Hotel_id,
  Room_name_or_number)
  INNER JOIN Hotel H on R.Hotel_id = H.Hotel_id
  WHERE date(RA.Date) >= date("now","-1 year")
  AND Stay_id NOT NULL
  GROUP BY R.Hotel_id, R.Room_name_or_number
)
GROUP BY Hotel_id;
```

6. Calculate the Customer Value in terms of total spent for each customer before the current booking.

**Assumption:**

1. Total spent includes taxes paid
2. Stay only includes previous stays, so no need to filter anything.
3. Only include Guest\_ids that also have reservations.
4. Guest\_id could be specified if looking for specific  
-- HAVING S.Guest\_id = 12345

```
SELECT S.Guest_id, SUM(IP.Amount) AS Total_spent FROM Stay S
INNER JOIN Invoice_payments IP ON IP.Stay_id = S.Stay_id
GROUP BY S.Guest_id

HAVING S.Guest_id IN (SELECT DISTINCT Guest_id FROM Reservation);
```

**A2 Part**

**A logical data schema**

