Paper 384-2012

Factoring Upgrades into Overbooking Decisions for Hotels and Casinos

Alex Dietz, Natalie G. Osborn, and Tugrul Sanli, PhD., SAS Institute, Cary, NC

ABSTRACT

Overbooking is a must for any business that accepts reservations and subsequently runs the risk of cancellations and no-shows. In hotels, the practice of overbooking requires a fine balance between guest service, operational procedure, and revenue optimization. For hotels with multiple room types, the complexity is multiplied. Adding new room types allows you to reach a broader market, but every new room type added increases the risk of underutilized rooms. An overbooking strategy that properly accounts for upgrades helps you make better decisions on pricing, inventory control, and overbooking. This paper explores a methodology and the benefits from factoring upgrades into overbooking decisions for hotels and casinos.

INTRODUCTION

The purpose of this paper is to explain why factoring upgrades into overbooking helps a hotel make better decisions. In this paper, we will introduce the concept of overbooking and the characteristics of the industries where overbooking is required. We will review the different goals and subsequent different policies that can be used when approaching overbooking. Further, we will address the operational impacts of overbooking, and how these are complicated in a multiple inventory class environment. Using a hotel example, we will illustrate how overbooking can be applied at total hotel and multiple inventory category levels. Finally, we will introduce the practice of upgrading and explain how to account for upgrades when calculating overbooking.

OVERBOOKING

Overbooking occurs when a firm with constrained capacity and sells more units of inventory than they have available. Overbooking is applicable in industries with the following characteristics: (Phillips, 2005)

- Capacity (or supply) is constrained and perishable, and bookings are accepted for future use.
- Customers are allowed to cancel or no-show.
- The cost of denying service to a customer with a booking is relatively low.

WHY OVERBOOK?

In any business that accepts advance bookings with refundable sales subsequently runs the risk of cancellations and no-shows. A business overbooks so that they can protect themselves from cancellations and no-shows. Without overbooking, that business would be faced with unused units of inventory and subsequent loss of revenue.

Overbooking can lead to rewards such as increased utilization of capacity, and maximized revenue for the firm that employs the practice. On the flip side, overbooking can also lead to risks such as oversold situations where there is not enough inventory available for all customers of the firm who have bookings. In this case, the firm must deny some of its customer's service, which might result in the need for compensating the customer, customer dissatisfaction and potentially future loss of revenue from that customer, who might decide not to purchase from that firm again.

The simplest solution to reducing unused units of inventory is to use a deterministic model that calculates the amount of overbooking based on the capacity of the business and the expected no-show/cancellation rate. The challenge with the deterministic model is that it assumes that there is no variance in no-shows and cancellations – an assumption that rarely holds true.

The "lack of variance in no shows and cancellations" assumption itself is not a "deal killer" for the deterministic model, if:

a) The cost of over-sales versus the benefit from additional sales is near-equivalent;
b) The variance is distributed equally around the mean (as in a Normal distribution), and
c) There are no refunds on cancellations or no-shows;

then, the optimal answer will tend to be to overbook according to the deterministic model.

However, it is rarely the case that bookings follow a normal distribution and the risks and reward of overbooking are relatively equal. In some cases the risk of overbooking far exceeds the rewards, and in other cases the rewards of

overbooking far exceeds the risks. Let's illustrate this using a resort hotel example from the hospitality and travel industry. A resort hotel located in a remote area of southwestern USA, famous for their unique spa program, is unlikely to deny service to a customer who arrives for a week-long, full service spa visit. Not only is there no-where equivalent where that customer could be re-located, or "walked" as the industry commonly calls the practice, but the loss of revenue is much higher. The loss of revenue for this customer includes 7 days of room rate, full food and beverage spend, and multiple spa treatments, which is significantly higher than the potential increase in revenue gained from overbooking. In addition, the dissatisfaction felt by a customer who values this unique spa experience only compounds the impact of the loss of revenue.

In comparison, a 3 star business hotel located in a city well populated with other hotels and indeed, other hotels belonging to the same brand, can expect the rewards from overbooking to far exceed the risks. A customer, who arrives late at night for a one night stay, might be expected to produce little incremental revenue from food, beverage and other services for the hotel. Denying service or "walking" the customer is easy for the hotel, because there are several other hotels close by, and they can even minimize dissatisfaction and potential loss of loyalty from that customer by walking them to a better hotel within the same brand, thus negating the need for compensation. In fact, in several cities where denied service has come to be expected by the business traveller, dissatisfaction can be minimized or negated.

OVERBOOKING APPROACHES

To overcome the impact of variations in no-shows and cancellations, the variations need to be accounted for mathematically, using a mix of the risk vs. reward approach. In addition to the deterministic model, it has been recognized that there are three other approaches to overbooking that are based on different desired outcomes by the company that is undertaking the overbooking practice. (Phillips, 2005)

1. An *economic* policy involves explicitly estimating the costs of denied service and weighing these costs against the potential revenue to determine the booking levels that maximize expected total revenue minus expected overbooking costs.

2. A *service-level* policy involves managing to a specific target – for example, targeting no more than one instance of denied service for every 5,000 shows.

3. A *hybrid* policy is one in which risk-based limits are calculated, but constrained by service-level considerations.

As stated earlier, the practice of overbooking requires a fine balance between guest service, operational procedure and revenue optimization. Economic policies are almost solely concerned with the optimization of revenue– balancing the expected cost of denied service with the potential additional revenue from incremental sales. This approach is sometimes in direct opposition to guest service goals, in that the main outcome of an economic policy is purely maximizing revenue, and potentially focused only on the short term. It is also often difficult to quantify the cost of denied service, because along with tangible costs of paying for the customer to be re-booked, interim expenses such as meals and any monetary compensation paid to the customer, you also need to account for the relatively intangible costs associated with customer dissatisfaction. This cost not only varies by the day according to the mix of business/customers you are forecasting to accept, but also by the value of those customers to you in the long term. It is the intangible factors that make managing overbooking an operational challenge for many types of businesses.

On the other hand, a service-level policy allows you to manage the impact of compensating for no-shows and cancellations on your operations. With a service-based policy, the focus is to not exceed a set number of instances of denied services. The challenge with using a service based policy alone is that revenue can only be maximized to the extent that you have allowed it to be through the service level set. Finally, a hybrid overbooking policy allows the advantage of maximized revenue associated with the risk-based policy whilst being constrained by the safety of a service-level that will minimize the impact on operations.

WHAT FACTORS INFLUENCE THE CALCULATION OF CORRECT OVERBOOKING?

If overbooking as a strategy, however it is implemented, is used by a firm to account for no-shows and cancellations, then it is useful to review those factors that most influence the calculation of overbooking. In the hospitality & travel industry, overbooking can be influenced by no-shows and cancellations, available capacity, the anticipated gain, or benefit from overbooking, and the estimated risks of overbooking.

No-shows and cancellations vary as a result of several factors. The day of week and/or time of year can have an influence on the no-show rates experienced. In a hotel, you might see a higher no-show rate on Sunday, when the business traveller booked for that night does not show for the reservation made by his travel company, because she/he prefers to spend another night at home. Hotels might experience lower no-show rates during summer periods because their business is mainly made up of family groups who have planned their vacations well in advance and are unlikely to no-show or even make changes that can be interpreted as a cancellation.

The mix of business at a hotel can influence the no-show and cancellation rate. Some types of business are more likely to no-show or cancel than others. The level of demand at a hotel can also influence the now-show and cancellation rate. Hotels that are busy might have more, or less no-shows and cancellations.

Group reservations can be a large contributor to the no-show rates and cancellation rates. While groups are inherently more variable, inconsistent treatment of groups can cause significant changes in no-show and cancellation rates.

Uncertainty surrounding the available capacity can also result in changes to overbooking. For the cruises and resorts, stay-overs and early check-outs are more unusual, but for a business hotel, customers who stay longer or leave earlier than their original booking, whether due to a handling error with the booking or a change of circumstances for the customer, can contribute to changes in the available capacity.

Uncertainty also plays a factor when estimating the gain from overbooking and the estimated risk from overbooking, along with other external factors. Heavy demand periods where few alternatives for re-accommodating the customer will lead to an increase in the cost of denied service, which will in turn influence an economic model for overbooking.

OPERATIONAL IMPACTS OF OVERBOOKING

For the hospitality and travel industry, overbooking has some specific operational impacts when it comes to denying a customer service. In a hotels and airlines, good business practice involves targeting specific customers to be denied service in advance of the delivery of that service. Let's explore this in further detail. Hotels that select which customers to deny service to in advance have much more control over some of the costs of denied service. Choices for re-accommodation of that customer are greater, customer dissatisfaction can be mitigated further if the customer is aware before they arrive at the hotel, versus upon arrival when they might be tired and ready to rest, and by selecting the right customer, impact on the revenue can be reduced. What do we mean by the right customer? Well, just as airlines call for passengers who are not making connections to volunteer for denied service, hotels should select those customers who are only planning to stay for the lowest number of nights. This is to reduce the impact of denied service on surrounding nights. So, from an operational perspective hotel operators want to consider:

- Who to walk – customers who are shorter stays (reduced revenue loss to the property), customers who have not stayed before (lower probability that the walked customer will lead to future revenue loss), etc.
- When to walk – it is generally better practice to review the expected arrivals early in the day, and determine if and whom to walk, and ensure that arrangements have been made to re-accommodate the customer elsewhere while options for re-accommodation are still available.
- How to walk – unlike the airline industry, treatment of customers who are denied service is not regulated in hotels, and is thus at the discretion of the hotel.

OVERBOOKING WITH MULTIPLE INVENTORY CLASSES

The challenges of calculating overbooking becomes much more complicated when the total capacity is broken into multiple inventory types, such as might be found in accommodation rooms for a hotel. To understand how to approach the multiple inventory classes overbooking problem, let's first approach why the total capacity might be divided into multiple types of inventory.

Multiple inventory classes allow a firm to appeal to multiple buyers, which further allows access to improved revenues through rate premiums. In addition, multiple inventory classes improve the possibility of a customer staying with a hotel, versus seeking the type of room they desire at another, competitors hotel. Different inventory classes give you access to customers that you might not have been able to acquire in the past, not to mention the fact that many hotels are unlikely to have all rooms in the hotel exactly the same. How a hotel decides to break down its room into different classes might be based on a number of factors, including physical size of the room, internal layout of the room, view from the room, location of the room, whether floor, tower or cabana style room, and access to additional services (such as a hotel executive level rooms which come with butler service) among other factors.

Proper revenue management becomes significantly more difficult in a multiple inventory class environment. The risk with multiple inventory classes is that demand for each class might be inconsistent. This can result in not selling all inventory classes to capacity. Overbooking, when applied to individual inventory classes, can be used to minimize the impact of inconsistent demand.

OVERBOOKING DISTRIBUTION: TOP DOWN OR BOTTOM UP?

In addition to the approaches to how to calculate overbooking outlined earlier in this paper, there are also different approaches when it comes to distributing the overbooking calculated. These can be categorized as a top down or bottom up approach.

With the top down distribution, overbooking is created for the total hotel level, with no-shows and cancellations, anticipated gain or benefit and estimated risk, also calculated at the total hotel level. Once the overbooking calculation is made; it can be apportioned out to each of the inventory classes as shown in Figure 1.

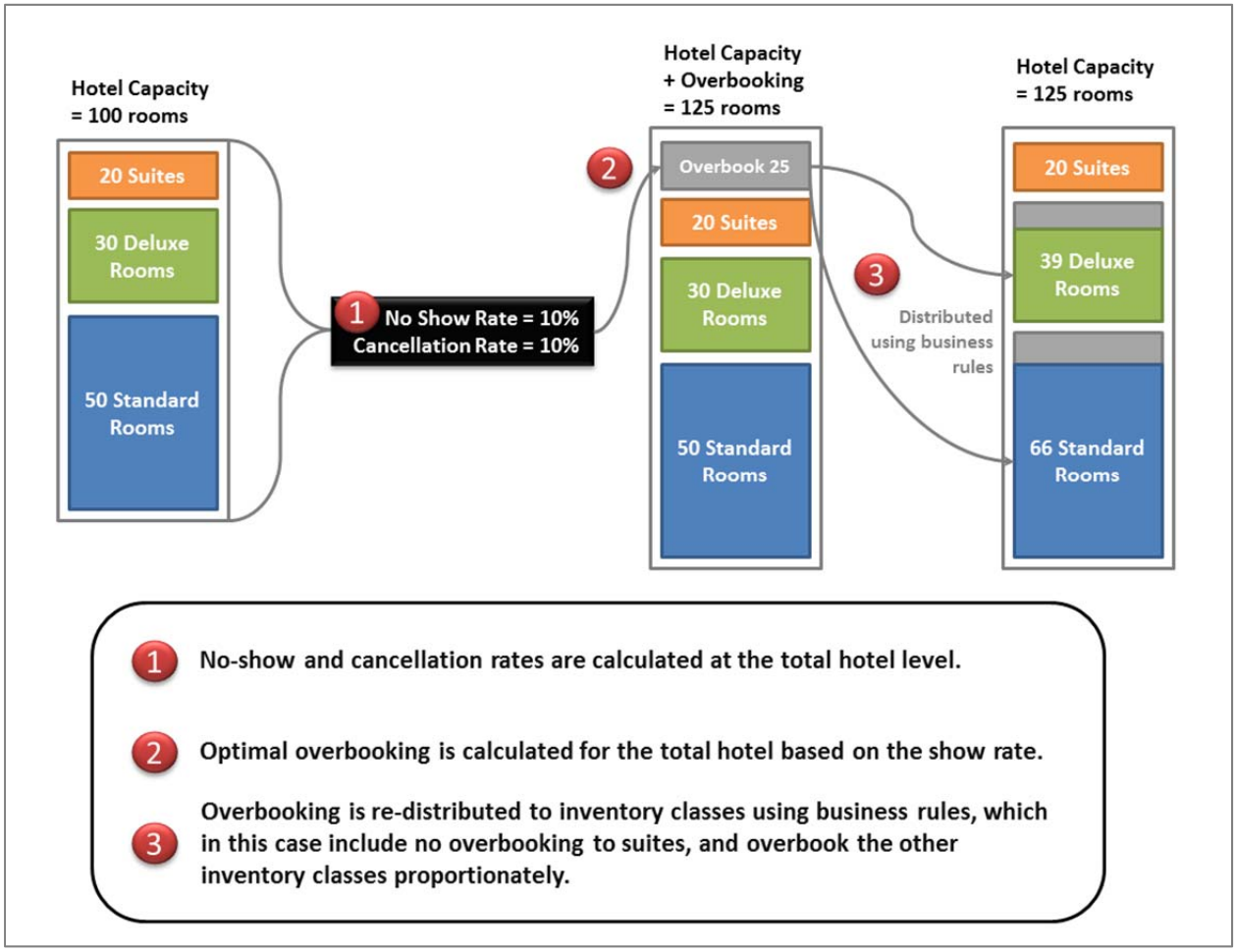

Figure 1. Overbooking using a top-down distribution

There are some disadvantages to this approach. Business rules can constrain the overbooking and therefore the ability for the hotel to maximize revenue. In addition, no-shows, cancellations, anticipated gain and estimated risk can vary by inventory type, so calculating at the total hotel level will overlook these differences. If working with multiple inventory classes it is more accurate to calculate overbooking independently for each inventory class, as show in Figure 2.

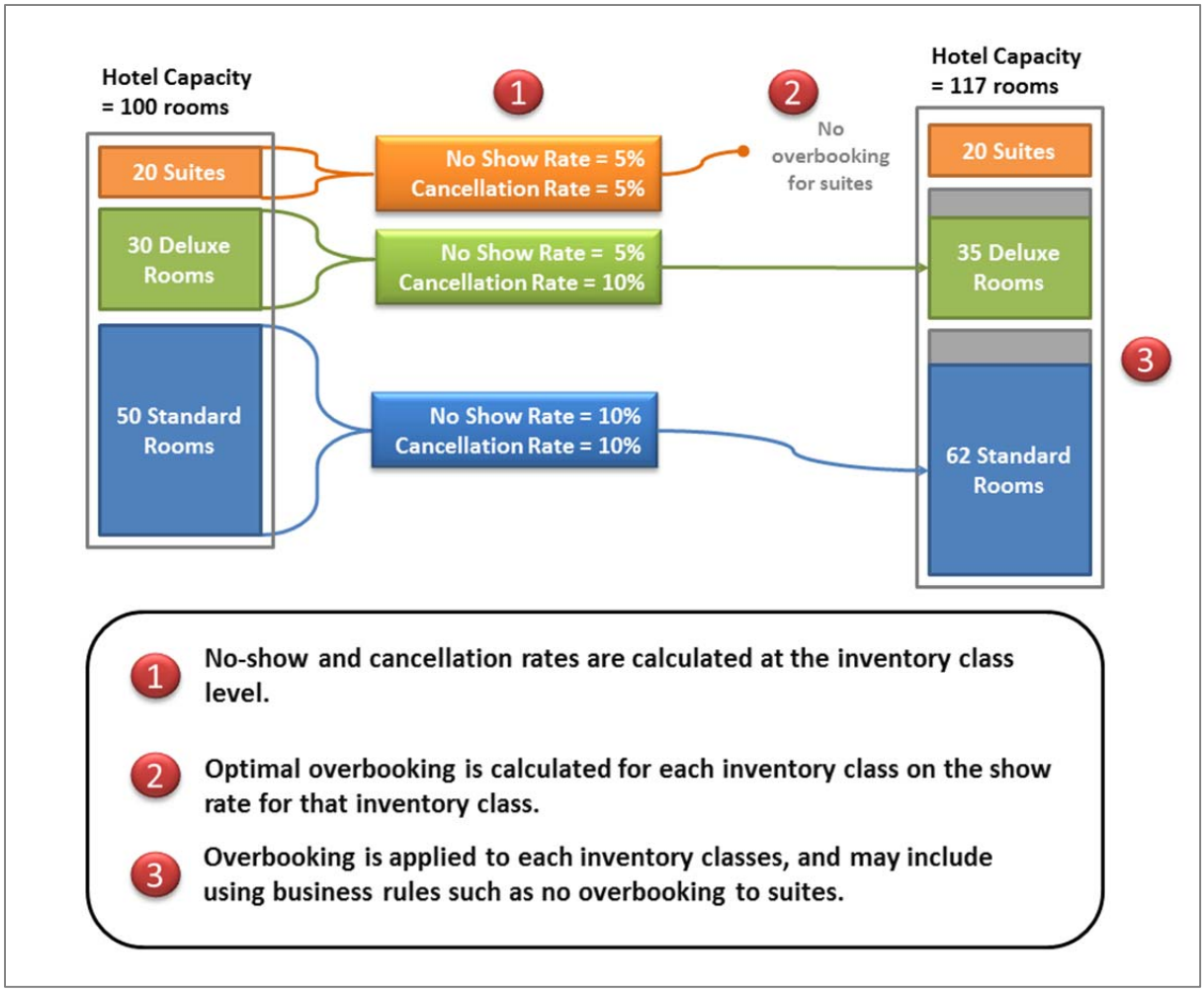

Figure 2. Overbooking using a bottom up distribution

The bottom up approach shown in Figure 2 works very well if bookings are taken and each inventory class, but does not take into account movement of bookings between the inventory classes due to the widespread practice of upgrading.

WHAT IS UPGRADING?

Upgrading is the practice of re-allocating bookings made for one inventory class level to that of another inventory class. The hospitality and travel industry generally practices “upgrading” to ensure that they capture excess demand in lower inventory classes when there is not enough demand for higher inventory classes. Let’s look at a hotel example to illustrate.

Regardless of how a hotel’s accommodation rooms are broken into different inventory classes, the goal of the hotel management is to maximize revenue from their entire capacity. When demand is inconsistent across their inventory classes, hotel managers will turn to the practice of upgrading to “even out” the impacts of that inconsistent demand. When a hotel manager needs to deny service to a customer with a booking in one of their inventory classes, it does not make sense to “walk” that customer to a competitor versus accommodating them in a higher class of room at their own hotel. The likely outcome for a hotel manager who has more demand for one inventory class than available capacity and needs to deny service to some of the customers holding bookings for those classes of room is to upgrade those customers to a higher class of room that is unlikely to fill to capacity. Additionally, the manager has in this case reduced the cost of denied service, while at the same time increasing the utilization of capacity as a whole.

You can also see the practice of upgrading evident in the airline industry. If you have ever walked through the first class cabin of a US domestic airline cabin, you might notice that the cabin is very often full, despite the fact that few, if any customers in that cabin have paid the first class fare. Airlines upgrade their customers into first class to avoid capture more demand and avoid denied service in the economy cabin while letting a first class cabin seat remain

empty.

Upgrades between Inventory classes at hotels are likely to happen multiple times on a daily basis. Not only do hotels need to maximize use of all of their capacity, but there are other operational causes for upgrading. A hotel might be participating in a loyalty program that determines certain customers should be upgraded according to their loyalty program status, as recognition of their loyalty. Hotels might also want to recognize through upgrades those customers who have brought in additional business for the hotel, such as tour leaders and group organizers. In contrast, hotels have long used upgrades as a means to placate dissatisfied hotel customers, and reduce the risk of further lost business to their hotel.

The practice of upgrading creates shifting of bookings between inventory classes, which if not accounted for can have a significant impact on the success of overbooking. The best answer to this problem is to factor upgrades into the overbooking process. Accounting for upgrades in the overbooking calculation involves identifying the upgrade path form each inventory class to the next. This usually is most efficient when starting at what is considered to the "highest" or least standard inventory category. The idea of the upgrade path is to express how inventory is shared between inventory classes during the practice of upgrading. In Figure 3, we take the result of our 100 room hotel example from Figure 2, and illustrate how defining an upgrade path helps account for upgrading.

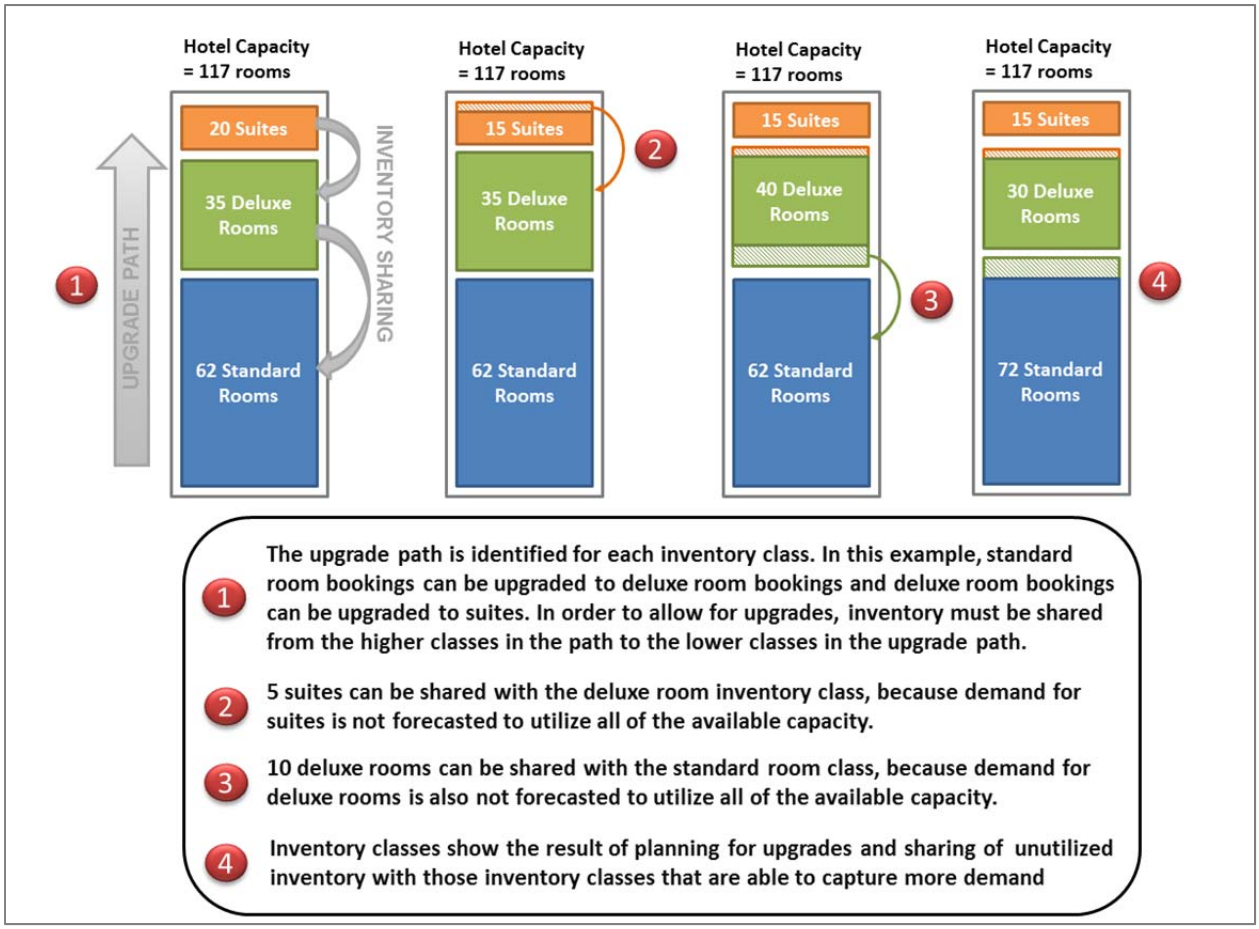

Figure 3. Overbooking using a bottom up distribution and allowing for upgrades.

Allowing for upgrades when calculating overbooking means a hotel's capacity is better utilized. When trying to allocate capacity for upgrades, it is important to look at the demand versus the capacity for each inventory class along the upgrade path. A simple way of doing this is to look at excess expected demand at the lower inventory class and allocate any extra unused rooms from the higher inventory class as "upgrades". This approach lacks two important things, one, it ignores the uncertainty in demand, and two, it ignores the value of demand. A better approach is to consider the last room value (or, LRV – hotel industry commonly uses this term for a value of a resource, similar to bid price used in the airline industry) for each inventory class, and use an approach that balances the LRV's by inventory class dynamically while deciding on the upgrades. The LRV calculation is complex and already contains the value and uncertainty of demand.

The LRV also assists with dynamically deciding each upgrade by helping identify whether it better to upgrade a customer to a higher inventory class and accept an additional unit of demand in a lower inventory class, or better to the deny that additional unit of demand in the lower inventory class so that one can be accepted in the higher inventory class.

Hotels might also decide to pose limits on overbooking and upgrading. These limits need to be taken into account when calculating overbooking. As a safe-guard against walking a customer, the total hotel level of overbooking sets a limit on total number of on-books exceeding the hotel capacity.

CONCLUSION

Overbooking occurs when a firm with constrained capacity and sells more units of inventory than they have available. Overbooking can be influenced by no-shows and cancellations, available capacity, the anticipated gain, or benefit from overbooking, and the estimated risks of overbooking. In the hospitality & travel industry, particularly hotels, the practice of overbooking requires a fine balance between guest service, operational procedure and revenue optimization. For hotels with multiple inventory classes, the complexity is multiplied, as the widespread practice of upgrading in a multiple inventory environment has the ability to constantly change the available capacity for each inventory class. Whether using an economic policy, service-level policy or hybrid of the two, it is important that the practice of upgrading is taken into account so that the calculation of overbooking is accurate.

REFERENCES

Phillips, Robert L. 2005. *Pricing and Revenue Optimization.* Pages 210, 211. Stanford Business Books.

CONTACT INFORMATION

Your comments and questions are valued and encouraged. Contact the author at:

Name: Natalie Osborn
SAS Campus Drive
SAS Institute, Inc
E-mail: natalie.osborn@sas.com
Web: www.sas.com
Work Phone: +1 919-531 9216