Traditional revenue management systems give availability priority to point-to-point fares over connecting tariffs. This can result in lost sales. RM systems are now coming available that can distinguish between types of demand and favour connecting fares over single point-to-point sales.

Revenue management to favour connecting traffic

Revenue management (RM) systems have traditionally favoured point-to-point fares over connecting fares, and have focused on maximising revenue per sector rather than network revenue. RM systems are now becoming available that can prioritise connecting fares over single point-to-point fares, and so maximise an airline's revenue across its entire network operation.

Traditional RM systems may have had the right approach when a hub is too small to generate enough connecting passengers, but they will lose potential revenue with larger hubs as for every possible pair of connecting flights, one of two point-to-point segments may not sold. A traditional RM system, however, is programmed to give point-to-point fares higher availability, and so a connecting fare for both segments cannot be sold. The result is that the revenue from the one point-to-point segment sold is less than the revenue of the connecting fare. The connecting fare could have been sold had the RM system been able to give it priority over single point-to-point fares.

There are four possible scenarios that can result for each pair of connecting flights, ordered in terms of the highest revenue:

1) Both point-to-point segments are sold.
2) A connecting fare is sold, which is higher than the fare of one of the single segments.
3) Only one of the two point-to-point segments is sold, and the other is not .
4) Neither point-to-point segment is sold, with the result that no revenue is generated.

An airline would like to sell both point-to-point segments, but if this does not happen, then the next best scenario is to sell the connecting fare.

Traditional RM systems have been unable to distinguish between the demand from point-to-point passengers and connecting passengers, and simply favour the demand that provides the highest revenue.

"Traditional leg-based RM systems make availability decisions on individual flights. These systems do not consider the 'true' origin-destination market (the combination of the passenger's beginning and end point of travel) in which the passenger is flying. They are therefore unable to maximise total network profitability," explains Jim Barlow, vice president at Sabre Airline Solutions. "In particular, when optimising fare availability for one flight these systems may assume that space is available for connecting demand on the other connecting flights, when in fact there is no space available. These systems operate in this manner primarily for reasons of convenience. To explicitly represent the number of origin-destination combinations produces data volumes that can be overwhelming. The underlying origin-destination mathematical optimisation problem is also very difficult to solve."

Brian Wishlinski, director of airline solutions at PROS Revenue Management expresses similar points. "In their first generation, RM systems were leg-based. These systems maximised revenue on all of the legs in an airline's network. They recommended seat inventory allocations based on this style of optimisation, which could cause high-yielding connecting bookings to be rejected in favour of local bookings. O&D (connecting passenger) RM systems, like PROS O&D 2.0, have overcome this deficiency by forecasting demand at the origin-destination level and optimising overall network revenue."

With the evolution of RM systems, airlines can now choose from new systems produced by Sabre, PROS and Lufthansa Systems. "PROS customers include over 80% of the airlines that use a third-party vendor for their revenue management solution needs. This includes 240 applications installed at 103 clients on every inhabited continent in the world," says Wishlinski.

"The Sabre Airlines Solutions RM product is called AirMax and operates in both leg-based and origin-destination based modes. AirMax's origin-destination mode ('AirMax O&D') has been available for over eight years and is currently used by American Airlines, United Airlines, US Airways, Cathay Pacific and several other carriers." Says Barlow, "AirMax O&D explicitly recognises over 100 million combinations of origin-destination connections, itineraries, and booking classes. For most airlines, this figure represents all passenger traffic combinations in one year."

Thomas Bueermann, head of revenue management systems of Lufthansa Systems, is also very confident of his company's product. "Our system has increased forecasting quality through passenger name record (PNR)-based forecasting and has the most advanced network optimisation algorithm. This has significantly out-performed all other network optimisation engines in recent benchmark simulations. Our product PNRPro is a special module that allows airlines to improve their no-show forecasts with a unique technique based on decision trees and the use of full information available in the PNRs. Lufthansa Airlines is the first customer and enjoys additional revenue through more precise over-booking forecasting. The product has an innovative approach for dealing with RM and pricing in a low fare, restriction-free environment. It produces an average reduction of 25% in forecast error compared to other leading RM systems, yielding significant revenue improvements after optimisation."

"PROS O&D 2.0 forecasts booking demand at the origin-destination (O&D) level, allowing an airline to maximise its revenue over its entire network. This

KLM is one of the first airlines to develop a RM system that can distinguish between types of demand and maximise revenue from connecting passengers. KLM has so far realised a 1.5% revenue gain from the system.

methodology allows airlines to realise the full revenue benefit of connection bookings," says Wishlinski.

Can a RM system put the different levels of demand in order of the highest revenue, and prioritise different fares accordingly so as to maximise system revenue? "AirMax O&D explicitly considers all (almost all for very large airlines) combinations of origin-destination connections, itineraries and bookings classes. It forecasts passenger demand and recognises the revenue contribution (fare) of each combination," says Barlow. "It also recognises cases where point-of-sale distinctions are important (in international markets for example). AirMax O&D then solves a large mathematical optimisation problem to determine which connections, itineraries, and booking classes (fares) to make available by utilising limited capacity to maximise total network revenue. AirMax O&D will favour connecting fares, which maximise revenue, when they compete with point-to-point fares. Such conditions arise when the connecting fare is larger than the point-to-point fare and capacity is available on both connecting flights."

"The PROS airline solutions rank demand by their relative revenue benefit and save space for the bookings that provide the most value to the airline," says Wishlinski. "PROS O&D 2.0 will provide space for a booking that is most beneficial to the airline, whether it be a high-fare local passenger or a connecting passenger. Inventory allocation is completed with the goal of maximising overall network revenue."

This raises the question of how can these systems can distinguish between point-to-point and connecting passengers. In other words, how can these systems determine which level of demand will generate the highest level of revenue?

"AirMax O&D explicitly represents the 'true' origin-destination in which the passenger is flying. This representation requires large data volumes to be processed, but allows better revenue management practices. In AirMax O&D, passenger demand is forecasted for every origin-destination, itinerary, and booking class (fare) combination. The primary output of AirMax O&D decides which of these combinations to accept and which to reject," says Barlow.

Wishlinski answers these questions from another perspective. "A fare value is determined for each demand level forecast. These fares are based on historical usage, as well as current fares selling in the market place. The forecasts and associated fares are used by the network optimisation algorithm to determine which bookings should be accepted to maximise overall network revenue."

Distinguishing connecting passengers from point-to-point passengers is not enough, however. The more important issue is to gauge the different levels of demand for point-to-point and connecting passengers across an airline's network. AirMax's O&D forecasts passenger demand for every origin-destination, itinerary, and booking class (fare) combination. AirMax O&D produces these forecasts by analysing historical trends using state-of-the-art forecasting technology. "The decision to accept or reject a booking is made based on its overall network revenue contribution. The PROS O&D-level forecasts demand, which would include local and connecting traffic, and their fare values, to determine which bookings should be accepted," says Wishlinski.

Investment

How much should an airline invest to update its RM system and how long before it recoups its investment? "An airline should invest in RM systems to the extent that it can get a reasonable return. Each airline's return on investment differs depending on the costs involved and the degree of RM sophistication currently used. This 'payback' time, though, is usually measured in weeks and months, not years," says Barlow.

Wishlinski answers this question in more detail. "Implementation of the PROS O&D system has allowed our client airlines to realise a 1-2% revenue gain over a traditional leg-based system. The level of investment depends on each airline. To derive the most benefit from an O&D system, airlines must have reliable sources of data, intelligent and motivated analysts and flexible distribution channels. The large domestic US airlines have each spent in excess of $10 million to install O&D RM systems, whereas smaller airlines have spent much less. Typically, the benefit is realised in less than one year, which provides a compelling business argument for this capital expenditure. During an engineering study, PROS works with client airlines to determine the cost, in terms of both financial and personnel time commitment, as well as the benefits of an O&D system."

"Our client airlines can recoup their investment within a couple of months. It

Several airlines are interested in updating their RM systems to optimise revenue from connecting traffic. South African Airways is one, but the airline is using a PROS product.

is a sensible investment for any airline with a significant degree of connecting traffic (that is, more than 20%). Real figures relating to revenue gain are difficult to measure, as the airline industry's and airlines' circumstances change daily. The means for measurement are thus simulations and benchmarks. An airline can generally expect to have increases in the single digits, depending on the individual circumstances," says Bueermann.

"We are interested in updating our systems. The benefits of updating will far exceed the cost," says Adrian Hamilton-Manns, executive vice president of alliances revenue management and network designing at South African Airways. "I do not think it necessary for an airline to develop a RM system by itself. The system is just a function of an airline. For example, South African Airways is using a PROS product."

However, some airlines prepare to produce and develop the systems themselves rather than buy from outside. KLM has developed the Odyssey system, which is believed to be one of the most advanced RM systems in the world. The heart of Odyssey's optimisation model is based on mathematical models developed by Massachusetts Institute of Technology (MIT). The system itself is developed jointly by KLM and Manugistics. The programming language is C++ and the methodology is based on O&D demand and passenger net value (PNV) forecasting. "In general PNV forecasting is more accurate than demand forecasting," says Pieter Bootsmar, vice president of revenue management at KLM. "We fully understand the importance of the system to KLM and we are the first airline in the world to develop and update our RM system to maximise revenue from connecting passengers. We updated this system in 2001, and it generates 1.5% more revenue for KLM. It is KLM's competitive advantage and core competence."

Hubs

How large should a hub be to attract connecting passengers? "The economics of a hub dictate that the revenue from the number of connecting markets served is greater than the additional costs of operating a hub. For each airline, these factors depend on geography, the demographics of the region served, competitor schedules and the underlying labour costs," says Barlow. For AirMax O&D to add significant value to an airline, it is recommended that an airline have at least 25% connecting traffic at its major hub.

Bueermann expresses similar views, but argues that 20% connecting traffic is sufficient to for an airline to justify updating its RM system.

"An airline's hub should be large enough to attract a solid base of local passengers, as well as connecting passengers," says Wishlinski.

"A hub should at have at least four daily banks and 20 daily connections to attract sufficient volume of connecting passengers," says Hamilton-Manns. "The location of a hub is essential for an RM system. However, hub congestion will strongly influence the efficiency of the system. For example, British Airways's RM system is very sophisticated, but Heathrow Airport is too congested for BA to build efficient banks, which has a negative impact on this system's efficiency."

"How many connecting passengers a hub can attract depends on the hub's size, which is decided by its geographical location. KLM's home market is too small to form enough local traffic, but its Amsterdam hub has connecting passengers in virtually every direction. There are huge flows of intra-European traffic between Germany and the UK, for example, but also between Scandinavia and Southern Europe. Moreover, Amsterdam is a typical intercontinental European hub, where traffic flows are being accommodated between Europe and Asia, North America, Africa, the Middle East and South America. We have 17,000 city-pair connections in our network and another 20,000 connections in our partner network. Connecting passengers account for 70% of our traffics. So the network justifies our advanced revenue management system," says Bootsmar.

Will the difference between European and American hubs affect the application of RM systems in the airlines based in these regions? "European hubs are typically slot-controlled and have more capacity issues, as a result of which, there are usually more operational delays. In terms of RM, these issues are typically represented in the flight schedule. So there are generally more combinations of origin-destination connecting itineraries available to American passengers," says Barlow.

Wishlinski makes a different point. "American and European hubs vary in size and structure. Most US hubs operate with several daily departure banks. The majority of passengers are connecting passengers from different points, and most of these connections are domestic. European hubs, however, focus on international connections and operate on a somewhat smaller scale."

Bueermann plays down the difference in American and European hubs on these RM systems. "When it comes to applying our RM, the answer is easy: our methods are neutral to the hub structure of any particular region. Our system is indifferent to these aspects. The point is to help the airlines maximise their revenue, regardless of the decisions they make." AC