Rail Yield management at Trenitalia. IBM approach

Yield management (YM) is an umbrella term for a set of strategies that enable capacity-constrained industries to realise optimum revenue from operations.

Rail YM aims at maximising revenues on each combination train/date of departure by optimally managing the seat availability per Origin-Destination (O&D) or leg at each price level through the booking horizon. Since 2005, Trenitalia, the main Italian railway undertaking, operates a YM System (YMS) developed by IBM, integrated with the Reservation System, able to optimise the capacity allocation starting from a defined set of business rules.

The YMS: (i) provides the forecast of the potential demand –additive with unconstrained and multiplicative correction - at each point of the `load curve', (ii) optimises the capacity al-location, (iii) simulates the effects of the new set of inventory controls, resilient with distinct orders of arrival, (iv) monitors spill, spoilage, stifling and results achieved based on the 'revenue opportunity' estimation.

The two-stage, scenario-based stochastic optimisation model is represented as a linear programme, taking into consideration O&D, fares, scenarios, legs. Protection levels are set against dilution, with a partial nesting technique. In 2014, the YMS managed dynamically 222 trains average/day carrying 45 million passengers.

It optimised approximatively 4 million instances, leading to nearly 120 billion decisions! YMS provided satisfactory results through a crucial decade for the former monopoly Trenitalia, with the opening of competition on Italian high-speed rail routes •

The Optimization Model

Data — Unconstrained Scenarios — Stochastic Linear Program — Constrained Scenarios