PARIS ROISSY CHARLES DE GAULLE INTERNATIONAL AIRPORT PASSENGERS SIMULATION

Guillaume LAGAILLARDE
www.1Point2.eu
5 rue de la Poste
SEYSSINET, 38170, FRANCE

ABSTRACT

Every day 100 000 passengers pass through Paris Roissy Charles de Gaulle airport (CDG) making it Second HUB in Europe for passengers. Half of these passengers are connecting passengers arriving from a landing plane and having to catch an outgoing plane through a complex set of walkways, escalators, security control, bus and shuttle network.

This poster shows how 1Point2 used simulation linked with passenger and traffic database to produce a predictive simulation model of passenger flows inside airport following individually each passenger from plane landing or airport arrival to connection plane take off or airport exit to Paris city.

We show how ergonomic interface for model end user and database link with model for input and output data helped airport operator to reduce missed connection percentage and plan airport modification and organization season after season.

1   PROBLEM SIZE AND PROJECT OBJECTIVES

CDG passenger airport has seven terminals connected through a network of walkways, bus, escalators and security lines. Each terminal serves tens of connected and remote plane parking making it a huge maze for passengers having to hurry to catch their planes. Queuing at different security check point or to access a bus is highly dependent **on planes parking affectation**, security **lines staffing** and **busses capacity** and time table. Only a comprehensive simulation taking into account individually each passenger can help understand and evaluate the impact of big and small changes in Airport design and/or organization.

Bellow table gives an idea of model size to be taken into account in the simulation.

Object	Number	Comments
Passengers	> 100 000 / day	Each has to be individually taken into account with its own profile and traveling path inside airport
Flights	>1500 / day	Terminal/Fligts affectation can of course have a huge impact on connecting time for passengers.
Terminals	7	Airport is large and terminals can be far away from each other requiring buss or shuttle traveling for connecting passengers.
Plane parking	>300	There are connected and remote parking. Parking choice for each plane impacts connections and passenger traveling time inside airport.
Security check-point	>100	Each can have its own staffing and opening time. Model shall help size this.
Bus and shuttle	>30	Each bus has a finite capacity, bus stop sequence and traveling time. Model shal help negociate this with supplier.
Waiting rooms	>50	They have finite capacity and level of comfort is an important parameter for airport.
Checking lines	>50	
Walkways	>150	
escalators	>50	

Model has to meet several goals in terms of short and long term decisions. Medium term decisions taken twice a year before each new aerial season imply that delivered model should be used on a regular basis by end users who are not programmers but decision makers who should be autonomous using the simulation model. Interface has to be as friendly user as possible and computing time short enough so that users can try and compare different scenarios during their decision process independently from any third party consultant and or programmer.

Calculation speed is very important for model usability. One full day of Airport activity takes **less than 10 minutes** on a i5 LapTop.

2   DISCRETE EVENT SIMULATION LINKED WITH A DATABASE SOFTWARE
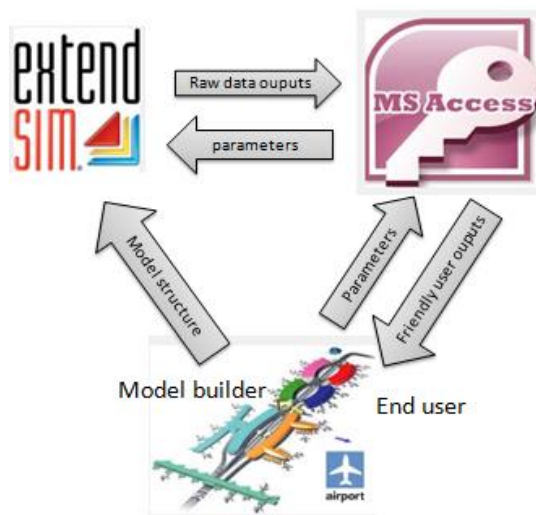
Two constraints drove our software choice in this project :

- Huge amount of data to be organized and taken into account in the model

- Need of a flexible and scalable discrete event simulation model

Core simulation model is made with **ExtendSim** in which we built a dedicated versatile custom library containing objects (parkings, escalator, bus, security checkpoint etc...) we can link together to construct CDG airport network. ExtendSim has its own internal database which was very effective in terms of calculation time, model having to access continuously to database to get data but also to write detail of every event concerning each passenger.

Model could have been done only using ExtendSim but as data were already available in an **Microsoft ACCESS** application and as we needed friendly user custom data input forms and specific versatile output data analysis we decided to link ExtendSim with Microsoft ACCESS and to code all data input and result analysis human machine interface inside Microsoft ACCESS. ExtendSim and Microsoft Access communicate through ActiveX Data Objects (ADO) to import and export Databases.

3   PROJECT OUTPUTS AND BENEFITS

Airport operator has a tool allowing him to automatically import detailed traffic forecast already existing in an ACCESS database and to setup its model parameters through a Microsoft Access application containing custom forms. Run of one model takes less than 10 minutes for one exploitation day with 100 000 passengers. Has the model export raw output data for all events occurring to each passenger end user can also use Microsoft ACCESS data mining capabilities to make fine analysis of results, filtering for example passengers having missed their connection, looking in detail at reasons why connections were missed.

The use of simulator allowed airport operator to renegotiate bus timetables and security check point staffing. Each season, different planes-terminal affectations are tested and impact on successful connection percentage is calculated using the simulator. Simulator became a key tool in season organization process directly participating to more than 1% increase in successful connection percentage. A missed connection cost more than 50€ per passenger. 1% missed connection represent more than 500 passengers per day. Which makes more than 7 M€ per year !