Computer Reservation Systems Auditing Headaches in the Airline Industry

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ABSTRACT

This paper discusses a problem faced by the Airline industry, the problem being reservations auditing. The problem is generated by two factors: the first is the lack of standardization of the computerized reservation systems. The second factor is the lack of the auditing software. Such problem faces most of the airline industry today especially the smaller airline companies.

OVERVIEW

Computer Reservation Systems (CRS) is well known computer system to any airline traveler. CRS for an airline contains information on that airline flights only and used by that airlines' employees to make reservations. Whenever a traveler wants to make a reservation on a flight s/he must go to the airline office or to a travel agent who would make the reservation via CRS using the computer terminal located on a desk. Such systems are provided by many organizations i.e. APPOLO, Galileo, Amadues, Worldspan and SABRE.

Due to the costly manual processing and with the coming of computers; IBM with American airlines created the famous CRS SABRE during 1953-64. Later other CRS systems were developed. The Global distribution System (GDS) started with the Joint Industry Computerized System (JICRS) in 1974. In 1986, GDS split off from airline industry, which really forced many airlines to merge. Many GDSs came to existence afterwards.

Today, many travel agents use GDSs. In fact, almost 98% of the travel agents now use GDS in the USA, many use multiple systems. GDS became used not only for airline reservation but also for car rentals, hotel booking, and cruise. In fact, SABRE connects 560001 travel agents, Galileo connects 460002, Amadeus 652403, and Worldsapn 160004 travel agents, such numbers are claimed on their web sites.

With the internet coming about and the information highway establishment, the CRS/GDS went all online. Today a traveler can make reservation at a certain flight and buy the airline ticket using the internet, reducing the role of the travel agent but not eliminating it. Still, there exists a need for the travel agent since not all people are internet users and the role of credit cards is very limited especially in countries that do not relay on credit cards transactions.

CRS/GDS are money-generating industries that depend on a service provided to both the airlines and the traveler. Any traveler or travel agent is blind to the airline services unless this airline is listed in one of the CRSs. In essence, the airline must participate in one of the well known CRSs so that when a traveler or travel agent request a travel line i.e. New York – London the system will show the service of the airline on that line or segment along with the price of such service. Needless to say, airlines submit their scheduled flights to the intended CRS. Such service enhances the competitive edge of the airline as well as the CRS; in other words, both the CRS as well as the airline benefit from such service. The CRS will be obsolete if it only catered for the services of one airline; on the other hand, the airline needs the exposure so that it will be known to as many passengers as possible. Although the end user of the service (traveler) will pay for such service in one form or another, still the airline will have to pay for such services when the transaction is not consummated. For example, when a traveler cancels or changes the reservation still such transaction cost money (cost is measured per transaction) and therefore the airline will have to pay for such service to the CRS.

Description of How The Reservation Works

Understanding the process of reservation is essential to understand the problem at hand. In the reservation system, there are four major players: GDS, Airline Company, Travel Agent, and Passenger. To each has a role to play.

The Airline provides the GDS with scheduled flights and all details pertaining to the flight from seats to type of plane, prices and discounts etc. The data provided to the GDS from the Airline is usually agreed upon based on an agreement between the airline and the designated GDS.
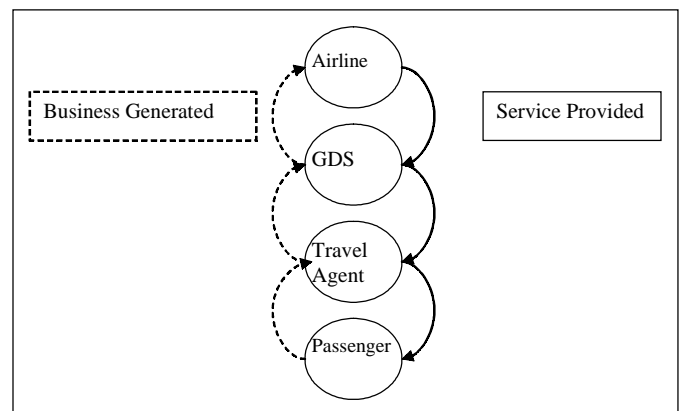
The GDS in turn stores the information on its system (distributed system is a must) and allow the travel agent to access such information in order to reserve a seat on a certain flight for a passenger. The travel agent will acquire the services of the GDS by buying the service and the computer terminals with the software installed on them.

The travel agent is encouraged by the GDS to use their system (and not other competing GDS system) by offering discounts to the travel agents. In other words, the more the travel agent makes reservations the bigger the discount. The travel agent and the GDS are cooperating to market the airline in return the airline pays the GDS money for each transaction made i.e. SABRE (well known GDS) charges airline XYZ a certain amount because traveler agent made a reservation on XYZ flight from New York-London. SABRE charges per transaction made on that flight via their system.

The passenger, who is being served by the travel agent, will at the end pay for this service by paying for the airline ticket. Needless to say, passengers are always hunting for low price air fares.

In summary, each one of the players is providing a service to the next player in return for money. By providing the service to one player, it will generate business for the other. Therefore, the GDS generate business for the airline and provide the service to travel agent. The travel agent generates the business for the GDS and provides a service to the passenger. The passenger is the lowest on the food chain; s/he receives the final service intended by the airline and is the one that pays for all the accumulated expenses. Therefore, travel agent and GDS are commissioners for the original service provider (airline) and the original service seeker (passenger). Figure 1 pictures the process of service food chain.

Figure 1: Service chain of the reservation game

One must mention here that commissioners usually make money on somebody's account. When the GDS encourages and motivate the travel agent to make as many reservations as possible and there are not enough passengers what will the travel agent do to generate work? Surly the travel agent will generate fake or false reservations! This usually entails loss for the airline. In the next section this problem will be explored in detail.

The Problem

As said before the GDS encourages the travel agent to make as many reservations as possible. GDS motivate the travel agent by offering discounts among other things. The travel agent in turn may resort to less than ethical way of business generation i.e. false or fake reservations.

When GDS bills the airline company every month, the airline will audit the transactions. The airline makes sure that the transactions are correct. First, one must know how the fake transaction looks like. There are many forms of falsified transaction in fact one must fish for such transaction the following are example:

- Use of false passenger names for reservations i.e. Tome and Jerry, Sinbad, etc and then canceling the reservation.
- Using original passenger names for duplicate reservations and canceling i.e. reserve for the same person in more than one seat class then canceling.
- Reserving a number of seats (more than 9 seats) for high demand periods then canceling them.
- Using normal reservations then canceling.

The whole idea here is travel agent makes the reservation and then cancel will generate money for the GDS and loss for the airline, this is called *passive booking*. The airline company has the right to refuse such transactions, but first the airline must prove or show such transaction existed. This sounds fair yet this job is very slow since the GDS provides the airline with hundreds of thousands transactions. Each GDS provides the airline with electronic/hard copy of the transaction enquired during each month. Therefore, it is very hard for the auditor to chase all the different false tractions. What is worse is that some travel agents do such false transactions cross-monthly. In other words, travel agent makes the reservation in one month and then cancels the same transaction in the next month. Next, the job of the auditor will be discussed in details.

The Auditor

The auditor job is to make sure that the bill debited to the airline company is rightly acquired. The auditor checks the charges and can refuse payment to the GDS if s/he finds that the transaction is false. Simply, if the auditor is efficient then money will be saved on account of the airline company. Such job requires accounting capabilities and computer skill mainly searching and data base enquiries. Most efficient auditors are good accountants with a keen eye for catching mistakes and improper actions. With all the amount of data delivered by the GDS search operations are becoming more and more important so is the job of the auditor becoming harder and harder.

The auditor job entails many responsibilities:

- Approving the bills
- Searching and data mining

The auditor must develop skills in search methods for example to investigate the bill validity the auditor must know how the reservation operation works and must have accounting skills. The auditor must also know the contract details signed by her/his airline with each GDS.

As can be seen the auditor must acquire many skills and the nature of the work is investigative and inquisitive at the same time. One skill usually well favored in the auditor is the ability to argue her/his point of view with many parties including parties in his own company as well as the GDS [Interview 1]. In addition, auditors work is usually un-noticeable since the auditors work with papers and number therefore their jobs is not high profile job. Yet a mistake in the job is very costly and important.

The data sent by the GDSs is not standard, each GDS has its own data format and each has a set of rules for charging the airline. The auditor is supposed to be well aware of the accounting rules of the GDS as well as the agreement signed between her/his airline and the GDS. For example, Gallieo does not charge airline XYZ for canceling reservation but may charge airline ABC for such cancellation depending on the agreement between the two.

Why the middle man?

One may ask her why the airline cannot eliminate the two middle players: the GDS and travel agents. The answer for such enquiry is *No*, because the airline wants to reach the passenger and tried in the old days to reach the passenger directly and it was not feasible. However, with the age of the Internet such strategy is becoming very inviting but it must be accompanied with cooperation between different airlines. Next, a brief description of each major GDS with a look at the billing information sent by the GDS to the Airline.

Bill Information Data of GDS & CRS

During this research many GDS and CRS systems where under investigation most of them use ORACLE as database and provide in general the following data in their Billing Information Data Tapes (BIDT). The BIDT includes:

- Passenger Record Number (PNR)
- Flight number
- Flight date, departure time, arrival time
- Reservation date
- Name of passenger
- From city
- To city
- Territory
- Line type
- Billing category

Data in BIDT is sent to the Airline for auditing and paying the GDS for the transaction made. Data usually sent as ASCII files on a CD, disks, tapes etc. The following gives a brief description for each of the GDS/CRS the author has researched.

Galileo& Apollo

Both are well known GDS systems that merged. Although as business entities are merged yet they are not merged in their accounting rules nor in their data sent to the airline companies. Each transaction or segment reserved an auditor must calculate it based on the rules whether the segment was reserved on Apollo or Galileo . The CD sent to the airline usually has two files one has the data coming from Apollo and one coming from Galileo. The files names are name of airline, month, year and 1V or 1G (1V means Apollo and 1G means Galileo). The extension of the files is DAT. Both Apollo and Galileo serve the following airlines UAL, BA, Swiss, KLM, USAir, Alitalia, Air Canada, Austrian, Aer Lingus.

SABRE

Semi-Automatic Business Research Environment (SABRE) is a system that was fruit of the idea consummated by American Airlines President C.R. Smith and R. Blair Smith, a senior sales representative for IBM, met on an American Airlines flight from Los Angeles to New York in 19535. When SABRE became reality in the 60s it processed 84,000 calls daily. In 1990s SABRE introduced the Best Fare Finding which the ability to search based on price. In 2000 Sabre introduced the eVoya a Webtop. Using HP machine and database, this can be seen as TravelCity on the Internet [sab 1].

AMADEUS

Born 1987 by Air France, Iberia, Lufthansa, and SAS (no longer a shareholder). In 1997 launched the e-travel after reaching 300 million booking in 1996 which was acquired from ORACLE corporation and in 2002 the British Airways joined in6. AMADEUS serves the following airlines: Lufthansa, Air France, Iberia, and Continental [ama 2].

WORLDSPAN

Founded in 1990 WORLDSPAN serves and owned by the following airlines: Delta Air Lines, Northwest Airlines, and American Airlines. More than 50% of its work is online and provides for 20,000 travel agents with the help of a mainframe that processes 4.71 billion messages and peak rate reaches 3,663 messages per second [world]. The average number of passengers in their system is 25.7 million [world 3].

The Dilemma

Looking at the previous, one can say that the Auditor has too much to handle rather than too much data. Can we really say that we have too much data? Is that what we the human race strived for all these years? Or is this problem a typical case of data mining?

Data mining by definition is:

sorting through data to identify patterns and establish relationships. Data mining parameters include:

- *Association* - looking for patterns where one event is connected to another event
- *Sequence* or path analysis - looking for patterns where one event leads to another later event
- *Classification* - looking for new patterns (May result in a change in the way the data is organized but that's ok)
- *Clustering* - finding and visually documenting groups of facts not previously known
- *Forecasting* - discovering patterns in data that can lead to reasonable predictions about the future

Data mining techniques are used in mathematics, cybernetics, and genetics. Web mining, a type of data mining used in customer relationship management (CRM), takes advantage of the huge amount of information gathered by a Web site to look for patterns in user behavior [tech traget].7

"There are two primary reasons for this difficulty. First, schema integration is more difficult for scientific databases than for business sources, because of the complexity of the concepts and the associated relationships. While this difference has not yet been fully explored, it is an important consideration when determining how to integrate autonomous sources. Second, scientific data sources have highly dynamic data representations (schemata). When a data source participating in a warehouse changes its schema, both the mediator transferring data to the warehouse and the warehouse itself need to be updated to reflect these modifications. The cost of repeatedly performing these updates in a traditional warehouse, as is required in a dynamic environment, is prohibitive. relationships between data and the dynamic source schemata." [Critchlow et al.,2000].

Which really brings the question is the auditor becoming a data minor, others suggested in some literature DBA or CIA8 [Medina, 2002]. Well, whatever the auditor is becoming and no matter what we like to call such a problem or label it; the problem still exists and will need solving.

Solutions

Solutions to this problem do exist and some of them are Zeus and CORNERSTONE. Both are well-known auditing software used by many airlines [lanyon 4] and [corner 5]. The main characteristics desired in the solution are:

- Increase productivity and save time and money.
- Fresh
- Accurate
- Competitive Content
- Browser-Based Interface
- User-Friendly
- Screen Position
- Flexible and dynamic reports

Problems with current solutions

The main problem with the current auditing programs is that the reports that these programs produces are so immense and detailed in such manner that the report itself needs data mining. The number of reports is unmanageable, so is the data included in the report (some reports run to hundreds of pages). In same token, these reports are not dynamic, and some how the programs forgot the idea of *drill down* reports.

Also, current solution only deals after the damage is done. In other words, when the travel agent made a passive transaction, s/he really blocked the airline from using a seat to fly another passenger. It is urgent that the airline catches the passive transaction before the damage is really done [*interview 1*].

Proposed solution

One can describe the proposed solution and any solution must be flexible because of the nature of the problem. Also, it must be GUI because of the nature of the user (Auditor). The flexibility must be in both: business rules (programming) and for the reporting side (interactive reports).

The nature of the problem explicitly needs a programmer stand by, because every GDS/CRS changes the business rules as they see fit with the supply and demand factor. Therefore, any auditing program must be flexible in this regard. On the other hand, the reports must be GUI and flexible to satisfy the needs of the auditor. The auditor would like to have drill down bills and reports.

The solution must be on line with the databases of the GDS/CRS for a number of reasons: amount of data, redundant of data among GDS/CRS (same passenger reserves a seat on tow CRSs), redundant data across more than one month etc. Due to all these reasons the better solution would be a setting much like the application service providing (ASP). The following graph pictures all GDS/CRS being hooked to ASP then the ASP is definitely liaison with the CRS/GDS and the airline company. The airline will be able to access the data and ask from the ASP to modify the reports. The headache will be transferred to the ASP but at least not one airline will carry the cost of such solution
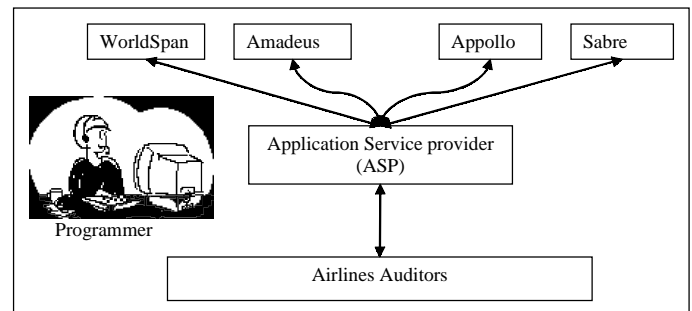
Rules of selecting the passive segments must also be flexible. Solution must be interactive so that catching passive segments that will block airlines from using the seats for passengers who really are flying.

In order to better solve the problem any technical person including the programmers must be deeply involved in the problem, in other words, each person involved in the solution must work with the travel agents, airline auditor, and GDS/CRS. Because of the nature of the industry and the problem, one must learn all the ins and outs.

CONCLUSION

The problem of integration of multi source data is not new [Bornhovd, 1999]. In fact such problem is faced across the world especially now since the internet is becoming part of our life. Yet such problem is not usually faced and swept under the rug. This problem only shows the incapability the computer world in facing such challenge of standardizations. Yet this problem is not only integration problem it is the problem of warring factions of the industry where a great deal of money is involved and a greater amount of money is being generated by taking advantage of such problem. "Business decisions must rely not only on company-internal data but also on external data from competi-

Figure 2: ASP Proposed Solution

tors or relevant events. This information can be obtained from the WWW but must be integrated with the data in a company's data warehouse" [Zhu, et al., 2000]. "As a result, information about real world objects may spread over different data sources and may be partial and inconsistent" [Liu & Ling, 2000]. There are different names for this problem and many classifications, but that is all it is. The question will always rise to ask can we really help!

ACKNOWLEDGEMENT

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FOOTNOTES

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