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Computerized Passenger Reservation System for Indian Railways – Its Development and System Architecture

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ABSTRACT

This paper explores the need, development of computerized passenger reservation system for Indian railways. The passenger reservation system is based on online transaction processing. It was given the name Integrated Multi-train Passenger REServation System (IMPRESS) which later developed into single image system called Countrywide Network Of Computerized Enhanced ReservaTion (CONCERT). Then this paper goes onto the general architecture of the system which is 3-tier client server architecture. Apart from the obvious advantage of being computerized over manual reservation and enquiry, this paper explores other advantage of implementing this system and its future.

Keywords— passenger reservation, computerized enhanced reservation, integrated multi-train, IMPRESS, CONCERT

Introduction

Indian Railways is the principal mode of transport in the country. It is one of the world's largest rail networks under a single management. The route length is around 63,332 km with more than 8000 stations [1]. As it is the backbone of nation's transport system, IR owns more than 25,000 wagons, 45,000 different types of coaches and 8000 locomotives. The system carries about 5,000 million passengers generating a traffic output of 340 billion passenger kms [2, 3].

Need for Computerized PRS

The seat/ berth reservation on trains is pretty complex activity, not only because of the volumes involving around lac seats/ berth reservations per day, but also because of several different categories of trains operating, using some 72 types of coaches with seven classes of reservation, more than 40 types of quotas and more than 80 kinds of concessional tickets [1,]. The method of calculation of fare is also quite complex as charges are based on distance, comfort level and transit time. Also there were many infirmities with the manual system like the current status did not get updated, it was slow and time consuming, inadvertent errors and malpractices in reservation were there [4]. Because of the complexity and sheer volumes involved, there was a need for development of computerized reservation system [3, 4].

Development Of The System

The pilot project consisting of a few trains was implemented at New Delhi in 1985 by joint efforts of CRIS and CMC [3]. Then, there was no looking back. The major milestones in the development of PRS are shown in the figure 1. The passenger reservation system was given the name Integrated Multi-train Passenger REServation System (IMPRESS) which could handle the functional requirements of reservation, enquiry, accounting and charting [4, 5]. It also had backup and recovery facilities. The entire PRS system was based on five stand-alone systems (New Delhi, Mumbai, Calcutta, Chennai and Secunderabad). Other stations were connected as remote terminals to the existing five computer systems for accessing the entire database of host computer [5]. But with stand-alone architecture, it is not possible to do a reservation at a terminal from databases in two different host computers. There was a provision of remote terminals from more than one host computer to partially take care of this, but that meant passenger had to stand in more queues [6]. This one-to-one communication and linkage reduced the overall efficiency of the system and led to the development of single image system called CONCERT (Countrywide Network of Computerized Enhanced ReservaTion [6, 7]. It is one-to-many communication thus requiring less process time. In the first phase of CONCERT implementation, IMPRESS software version at the two stand-alone PRS systems (Secunderabad and New Delhi) which later got extended to other systems. After the full scale implementation, requirement of communication channels came down, as there was no need to extend circuits for connecting remote terminal to particular PRS location only, as every terminal became universal [7]. It also added multiple lap functionality resulting in better customer service.
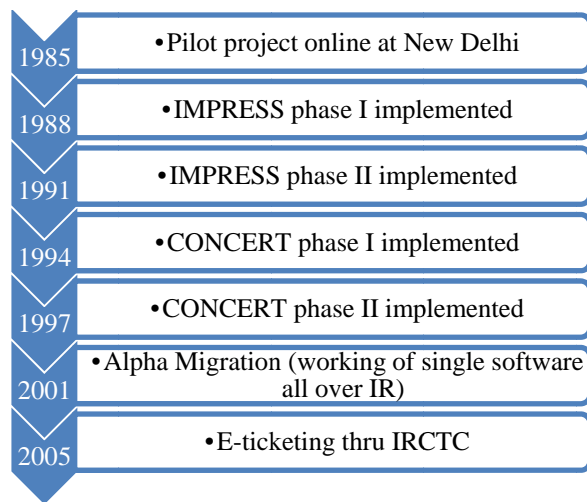
1985	• Pilot project online at New Delhi
1988	• IMPRESS phase I implemented
1991	• IMPRESS phase II implemented
1994	• CONCERT phase I implemented
1997	• CONCERT phase II implemented
2001	• Alpha Migration (working of single software all over IR)
2005	• E-ticketing thru IRCTC

Figure 1 Chronological order of system implementation

IMPRESS was developed in the language of FORTRAN and consisted of some 27,00 Sub routines [6,7]. Then CONCERT was developed in open VMS platform in C (about 70%) and FORTRAN language using a flat file system. It was based on 3-tier client server architecture using RTR (reliable Transaction Router) as middleware. RTR software along with router hardware provides the backbone for message routing feature for WAN (Wide Area Network). Client server architecture is used to achieve easy hardware expansion ability in future [7]. This type of 3-tier architecture is common feature for railways system like FOIS also [8]. It is currently hosted on state of the art converged infrastructure (64-bit Itanium blade servers). Frontend uses DEC forms, C and FORTRAN as development tools. Communication of all the terminals with their servers is achieved by 2 mbps channel lines, fibre optic cables/ microwave channels, switches, modem, multiplexers, etc.[9]

The network topology is a mesh type topology which is shown in figure 2. The system has distributed architecture with 5 server clusters in the 5 server cities mentioned earlier. On-line reservation of passenger traffic is being carried out through these systems with many other on-line and off-line activities, which will be mentioned in next section. Network protocol is based on TCPIP and DECNET [7].

Major Functions and Advantages

Apart from online reservation, all the server systems have many on-line and off-line functions [6].

1.   Main On-line functions

It includes reservations (fee computing & ticketing), cancellations (computation of clerkage/cancellation fees and refunds), Modifications (postponing, preponing and modification journey, supervisory operations, enquiries, chart preparations, and verification of data [6].

2.   Main Off-line Functions

The main offline function is to generate account reports. There are many types of reports generated either daily, periodically and monthly like gross earnings, trainwise delay status report, safety surcharge report cancellation, non-issue etc. These reports are utilized for making station balance sheet, cancellation trends, issue bills to defence, parliament, etc., traffic forecasting etc.[6] Off-line function also includes database maintenance and statistical report generation.

IR provides many reservation services like mobile ticketing, web ticketing, Kiosk-based ticketing, Centralized (hybrid) based ticketing etc. Also apart from this, it has time table and scheduling system and traffic management system[7,9].

3.   Benefits of CONCERT

The system that has been implemented has changed the face of passenger reservation for Indian Railways. It is a route based reservation system which facilitates its users, tickets from any station to any station. Infact, multiple laps of reservation can be handled from single terminal that too round the clock. Advance reservation is also now made possible [7]. Changes in train profiles (train carriage addition, replacement, de-allocation), route structures, etc., can be made effective because of online on itme information and data reporting.

Any train running schedule like alternate trains, summer specials can be accommodated [7, 9].

Data reports provide on-line aggregation of EIS figures such as revenue, seat / berth utilisation, etc, and presentation of the summarised data in the form of visual analytics from the operational system's information store. The data aggregation is done incrementally, to inflict minimal impact. The system is built on open standards and can be easily integrated with similar products and applications with open standards [6, 7].

It provides and stores automatic database recovery against all kinds of hardware and software failures

which also gives us complete audit trails for transactions and data access.

The application software is parametric, and standard railway business rules are incorporated in the form of data instead of being part of the logic [4,6].
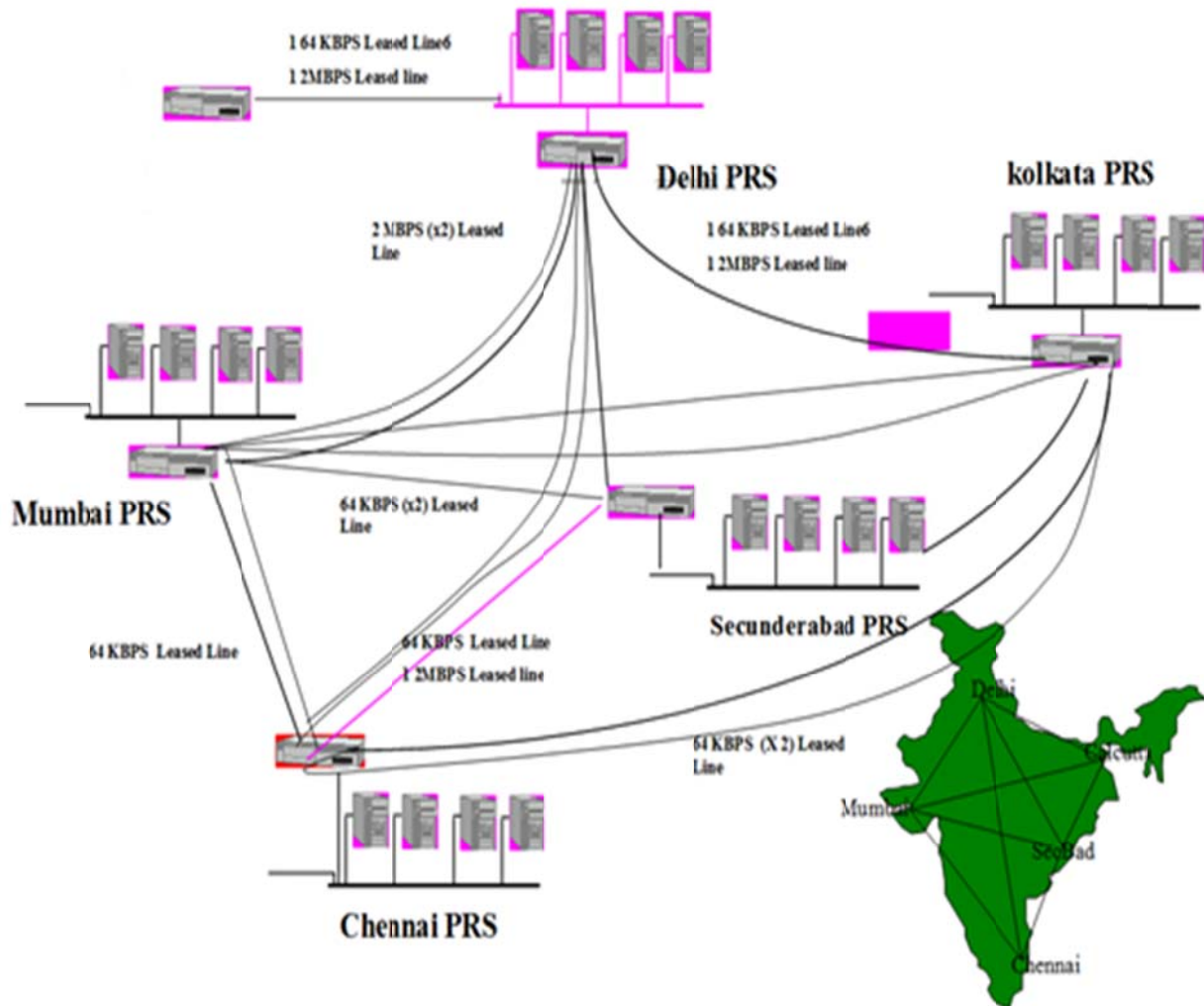

Figure 2 CONCERT network topology

Some Problems with the System

But according to a recent report, there are some deficiencies with PRS design necessitating manual interventions during program terminations and link failures. There were some issues regarding current day reservation systems and reservation for intermediate stations. The coaching refund system was not integrated with the PRS. And there were some deficiencies both in physical access and logical access controls. But these will be taken care whilst development and upgradation [9].

Conclusions

The passenger reservation is a complex activity because of sheer volumes and types of coaches etc. Also, transactions have a good variety. So the CRIS and CMC have developed IMPRESS/ CONCERT based on 3 tier server client architecture. It has a mesh type topology with five server systems in five cities of India. Overall, it has proved to be a boon not only for passengers but also for railways functioning since, it generates all the reports necessary for optimization and decision making. It is an on-line, real time passenger reservation system.

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