
UNIT 11 ICTs IN INDIAN RAILWAYS

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11.0 LEARNING OUTCOMES

After studying this Unit, you should be able to:

- explain the role of ICTs in Passenger Reservation System of Indian Railways;
- highlight the use of ICTs in National Train Enquiry System;
- describe Alpha Migration facility of Indian Railways;
- discuss the facilities of Internet Enquiries and Ticket Booking; and
- explain Unreserved Ticketing System of the Indian Railways.

11.1 INTRODUCTION

Indian Railways (IR) is the world's second-largest railway, with 6,853 stations, 63,028 kilometres of track, 37,840 passenger coaches and 2,22,147 freight cars. Annually, it carries some 5.50 million passengers and 492 million tons of freight. Everyday it carries 15 million people. It meets nearly 22% of the total passenger transportation needs and nearly 60% of long distance travel needs of the people of the country. Passenger business accounts for 31% of its revenue. During the year 2004-05, 5490 million passengers were carried with 570 billion passenger kilometres and Rs. 14,035 crores passenger earnings.

IR is one of the most advanced ministries in India, with an innovative and extensive IT environment. ICTs are playing a vital role in IR vast operation and many of its services and functions are now being facilitated by the applications of ICT. In this Unit, we will be discussing more on this theme.

11.2 ICTs IN INDIAN RAILWAYS

ICTs are playing an important role in this largest public sector of the country in delivery of various services. IR is one of the first few government departments to introduce computers in the country. Computerisation on IR started in the late 60s with the induction of IBM 1401s in the nine zonal railways, three production units and the Railway Board. Many applications were computerised, such as, Passenger Revenue and Goods Accounting, Financial Management, Inventory. Operating Statistics etc. While these systems proved to be beneficial to the Railways, they were soon found to be inadequate to cater to the increasing requirements. It was in the VII th plan period from 1985-90 when these IBM 1401s were replaced with third and fourth generation computer systems. Computerisation in the production units and the zonal railways were strengthened, and computers were introduced in the divisions, workshops and stores. Also, many new areas for computerisation such as Passenger Reservation System (PRS), Freight Operations Information System (FOIS) etc. were initiated. These developments are now beginning to show impacts on both the Railway system and its users.

In 1986, the Ministry of Railways established a separate organisation to take up all computer activities on IR. This organisation came to be known as the Centre for Railway Information Systems (CRIS).

We will now discuss the functions of this Centre in detail.

11.3 CENTRE FOR RAILWAY INFORMATION SYSTEMS

In 1986, Ministry of Railways established the Centre for Railway Information Systems (CRIS), New Delhi to be an umbrella for all computer activities on Indian Railways. The Centre started functioning from July 1987. It is an autonomous organisation headed by a Managing Director. CRIS is mainly a project-oriented organisation engaged in development of major computer systems on the Railways. It has acquired special knowledge and expertise in the field of informatics.

The need for a separate organisation was considered better suited to take up all computer activities on IR mainly for the following reasons:

- to avoid duplication of efforts by individual Railways;
- to ensure standardisation of computer hardware and software on the Railways;
- to undertake design and development of major applications on Railways requiring higher levels of expertise, faster decision making and system wide applicability;
- to insulate the organisation from day to day working of the Railways so that its objectives are not lost sight of;
- need for a combined effort of Railways and computer specialists, considered best suited for the development of the computer applications on Railways;

- need for development of expertise in highly specialised fields like Operation Research, Simulation, Expert System, CAD/CAM, Process Control etc; and
- need for greater flexibility to keep pace with the fast changing technology.

CRIS looks into seven main projects, namely:

- Passenger Reservation System (PRS)
- National Train Enquiry System (NTES)
- Alpha Migration
- Internet Enquiries
- Booking of Tickets on Internet; and
- Unreserved Ticketing System (UTS)
- Freight Operations Information System (FOIS)

We will now discuss them individually.

11.3.1 Passenger Reservation System

As mentioned in the earlier paragraph, IR has a very vast scope of operation. It is the world's second-largest railway, annually carrying some 5.50 million passengers and 492 million tons of freight. Of the 15 million passengers who climb aboard one of 8,520 trains each day, about 550,000 have reserved accommodations. Their journeys can start in any part of India and end in any other part, with travel times as long as 48 hours and distances up to several thousand kilometres. The challenge is to provide a reservation system that can support such a huge number—regardless of whether it's measured by kilometres, passenger numbers, routing complexity, or simply the sheer scale of country.

Passenger Reservation System (PRS) started in 1985 as a pilot project in New Delhi. The avowed objective was to provide reserved accommodation on any train from any counter preparation of train charts and account of the money collected. When initial pilot project was implemented at Delhi, the software (referred to as version I) had a number of limitations. These were mainly removed in next version, that is, version II implemented in 1987. With the addition of new locations and many redefinitions needed, the new version III evolved in 1990. Even the version III (of the earlier software called Impress) fell far short of the growing expectations of the travelling public and the need was felt to have a software which has the capabilities of providing the networking of the five independent PRS nodes namely Secundrabad, Delhi, Kolkata, Mumbai and Chennai. On 18th April 1999, all the five PRS nodes were finally networked together.

Now anywhere to anywhere reserved ticketing became a possibility on any PRS booking terminal. In order to facilitate the availability, PNR status, and other journey planning information to the common public, various interfaces like the Interactive Voice Response System (IVRS) on the telephone, Touch Screens at

selective locations, RAPID, DISPLAY, Passenger Operated Enquiry Terminals (POET) and Daily Press Availability Reports through newspapers have been provided.

There are now 705 Computerised Reservation Centres all over the country providing 9.5 lakh reservations every day. 150 new Passenger Reservation System (PRS) locations are to be commissioned very soon. In the coming years, all district headquarters will be provided with computerised reservation facility, so that one does not have to go far off distances for reservation or wait for telegram system, which takes many days.

CRIS has implemented and hosted IR own Website namely 'www.indianrail.gov.in' and offers PRS enquiries on the internet. The enquiries pertain to accommodation availability, PNR status, station code, train schedule and train fares. Enquiries are also made available through short messaging service on mobile. The site receives a maximum of 1.7 million hits per day.

PRS uses the following infrastructure to implement the reservation and ticketing system, namely:

- HP's Alpha Server hardware
- operating system-Open VMS 7.3-2
- routers to implement a network of 5 PRS Centres over 2 Mb leased DOT lines
- over 4000 terminals connected to the 5 Centres over DOT and leased lines; and
- DecNet phase V/TCP-IP networking software.

11.3.2 National Train Enquiry System

The National Train Enquiry System (NTES) was implemented as a pilot project in August 1998. NTES is a centralised information system, which provides up-to-date and accurate information to the passengers regarding:

- arrival/ departure of passenger trains including expected time of arrival (ETA) of trains;
- platform berthing of passenger trains;
- journey planning;
- facilities available at stations; and
- Railway rules

This information is collected from stations, control offices and other database administrators. Under NTES, position of trains running on real time basis is fed to computers after every half an hour in 61 control offices all over the country. Thus, when a train starts from a starting station, position of its running is known all over the country and is supplied to enquiries and IVRS. This helps in improving the quality of information also.

IVRS has been installed at 100 stations and is being extended to other stations, so that passengers can get train running position as well as reservation status on telephone.

Besides IVRS, information is also made available to the user through Display Boards, Public Address System, Face-to-Face Enquiry, CCTV and Internet.

At present, reservation information on cell phones is provided in the cities of Kolkata and Delhi. Availability of reservation and status is also given on the IR Website- www.indianrail.gov.in.

NTES phase II is presently running at all five PRS sites. All 5 servers (Secunderabad, New Delhi, Kolkata, Mumbai and Chennai) running the NTES application have been networked. It now runs on Alpha server machine and under UNIX using Sybase as the RDBMS.

11.3.3 Alpha Migration

One of the key technical achievements of CRIS is a sophisticated reservation and ticketing application called Country Wide Network for Enhanced Reservation and Ticketing (CONCERT).

The primary challenge for CRIS is to provide an efficient passenger service by ensuring maximum uptime for its reservation/ticketing and enquiry application. Railway must prepare charts that map passengers with their seats, and must post these charts outside each coach. CONCERT software enables the preparation of skeleton charts in advance for each train for the next three journey days.

The current CONCERT application represents a steady progression of using the latest technologies available. In the mid-1980s, IR first computerised its reserved ticketing operation on VAX™ systems running VMS™. This was done from five regional passenger reservation centres, each of which was a stand-alone site with its own local database. During the mid- to late 1990s, CRIS introduced CONCERT, which linked the five-passenger reservation centres so that reserved tickets from any station of IR could be issued to any other station from a single window.

The entire CONCERT application, since its inception, had been hosted on 5 VAX-VMS clusters located at the five PRS sites, that is, New Delhi, Mumbai, Kolkata, Chennai and Secunderabad.

With the tremendous growth of PRS terminals all over the country and the extra load of various interface software, such as internet enquiries, the overall load on the backend PRS system had increased manifold. Hence, a need was felt to move the existing application from the VAX-VMS servers to Alpha VMS servers. This has helped in harnessing time.

11.3.4 Internet Enquiries

Since Railways is the most commonly used mode of transport by common people in India, information regarding journey planning, fare enquiries, PNR status, accommodation availability and like enquiries are of utmost importance to the common public.

Till now, the following methods were available to access this information:

- enquiry counters at Railway stations;
- press availability reports published in daily newspaper;
- announcements on TV and radio; and
- IVRS system on telephones

However, the people faced difficulties with these methods. They had to stand in long queues in front of the enquiry counter to get the latest information. Also, most of the time information was not updated. The telephone lines were found congested, which made it difficult to make prompt enquiries.

CRIS developed and deployed the IR Website 'www.indianrail.gov.in' for the purpose of information dissemination to general public since February 2000, with a view towards overcoming the many shortcomings mentioned above. The site provides information pertaining to trains between a pair of stations, that is, all the trains between the selected source and destination station; accommodation availability that is, latest seat availability position of the chosen class, date, train and route; PNR status, that is, latest updated status of passengers; and train schedule giving complete path information of a particular train with the arrival and departure time at a station.

Besides, the Website also displays static information pertaining to:

- rules- reservation rules, refund rules, break journey rules, luggage rules, etc.
- general matters- season tickets, circular journey, booking locations, concession forms for physically challenged, general reservation forms, telebooking and tatkal booking;
- tourist and travel agents; and
- special trains-Rajdhani trains, Shatabadi trains, tatkaal trains, etc.

11.3.5 Booking of Tickets on Internet

On 28th February 2000, all the common enquiries like trains between a given pair of stations, reservation availability, PNR status, fare, train schedule and station codes were made available to the common public through the Internet. It has in a very short span of time become one of the most popular web sites in India, with peak daily hits of the order of 1.7 million hits per day.

The information is also available through SMS service on mobile phones, all over India.

Now, passengers can access Rail reservation site 'www.irctc.co.in' for information and booking. After the train date and class is chosen and other particulars filled in, the transaction is processed through electronic payment gateway of ICICI Bank, which authorises the payment. Thereafter, ticket is booked and PNR is generated and advised to the customer. Entire transaction is

fully secured and all information remains confidential and travels in encrypted form through telecommunication channels. Credit card details are not stored in IRCTC database or anywhere.

Ticket can be delivered at doorstep through courier and the option of collection of ticket from nominated counters is also available. A service charge is also levied on total value of transaction for credit card usage. In addition, passengers have to pay a nominal fee per ticket for sleeper/ordinary chair car and upper classes.

Internet booking can be availed from 0800 hrs to 2000 hrs from Monday to Saturday and from 0800 hrs to 1400 hrs on Sundays. Likewise, tickets can also be cancelled from any of the Railway PRS counters. Refund amount is reflected in the credit card bill. There is no cash refund.

11.3.6 Unreserved Ticketing System

More than 1.2 crore Rail passengers travel in unreserved coaches and trains every day and thus form the bulk of rail users. For this category of passengers, Railways have introduced the facility of Computerised Unreserved Ticketing System (UTS). The first stage was introduced as a pilot project on 15 August 2002 at 10 railway stations of Delhi. Another 13 stations of Delhi area were provided with UTS counters in the second stage on 2nd October 2002. It has since been extended in an integrated manner to more than 180 stations now all over the country. UTS system has been planned to take over the printed card tickets or tickets issued by self-printing ticket machines gradually.

UTS will provide the facility to purchase unreserved ticket three days in advance of the date of journey. A passenger can buy a ticket for any destination from the UTS counter for all such destinations, which are served by that station.

Cancellation of tickets has also been simplified. Passengers can cancel their tickets one day in advance of the journey from any station provided with a UTS counter. On the day of journey, the ticket can be cancelled from station from which the journey was to commence.

11.3.7 Freight Operations Information Systems

Besides the above mentioned, CRIS is concerned with the task of design, development and implementation of the Freight Operations Information Systems (FOIS), along with its associated communications infrastructure. Though the Government of India had set up FOIS for the Indian Railways in 1982, but with the establishment of CRIS in 1986, all computer activities on IR were given to it.

With the rapid growth of freight traffic from 73.2 million tonnes in 1950-51 to over 522 million tonnes in 2001-02, FOIS has come a long way in enabling booking and delivery of consignment on computer, station accounting, railway receipt generation and transmission, and better interface with customers. It has helped in terminal management with networking of 132 additional points, 84 nodal consist reporting points, and 48 originating terminals. Wagon wise consignment tracking, clearing of stock holding, invoice based consignment tracking, invoice based loading originating tonnage and revenues, wagon wise inter change, statement of missing wagons, and linking of unconnected consignments has been possible with FOIS.

11.4 SECURITY

In recent years, computerised information has become increasingly important. Corporate networks and the Internet connect organisations across the globe. In order to ensure that the data residing on these networks remain secure, individual nations have to set up their National Computer Emergency Response Team (CERT). The Indian CERT (CERT-in) was set up in 2003. IR being part of the critical information infrastructure of the nation, has set up the sectoral CERT called CERT-Rail to secure the various databases and networks on IR, that is, PRS, FOIS, COIS, MIS, AFRES, PRIME, etc.

Cyber security is needed to prevent intrusion of unwanted elements in the network/computer. It involves protecting information by preventing, detecting and responding to attacks. Among the dangers of security failing are stealing/loss of vital information, altering of data/files or crash of the entire system.

The issue of cyber security has been addressed by CERT-Rail, which helps in:

- creating security awareness among the users;
- conducting training and research;
- predicting future activity and providing early warning;
- formulating security policies/guidelines for IR;
- vulnerability assessment on Railway applications and networks;
- setting up an Incident Response Team;
- evaluating various security products for the IR; and
- maintaining liaison with Indian Computer Emergency Response Team (CERT-in), the apex organisation for providing response to cyber security incidents in India.

Security has been ensured through the system of authentication, authorisation and accounting through digital signatures or certificates; data confidentiality, data integrity, and data non-repudiation.

Security is provided at four levels, namely hardware level, operating system level, network level and application level.

At the hardware level, there are servers located at the five Centres, manned and controlled by Railway personnel. All accesses to the system are through secure terminals and access is restricted.

At the operating systems level, Open VMS is being used as the OS for CONCERT, True64 Unix is being used for Web site and NTES, and DECNET network protocol is being used for all the applications. Use of proprietary OS and networking protocol, whose usage is limited, makes it difficult for hackers and intruders to affect the system. Both Open VMS and True64 Unix are very secure OS and regular updates and patches are applied, whenever they are released. Open VMS provides for high grade of security features such as 'proprietary' and 'closed features' of the OS. There are passwords at two levels. Also, there are

limited user accounts with privilege policy according to user specific needs. The protection privileges of the critical application programmes have been set, so that they can be run only from the specified user accounts. Both OVMS and True64 have extensive logging and auditing features, which can be enabled.

At the application level, there are security privileges at two levels, that is, user level and terminal level. Enquiry is only readable access to the database, booking has writing access for ticketing only, and supervisory privileges entail updates on the database for implementing special functionality.

Security in call centres/enquiries is ensured with backend PRS/NTES connected to the call centre in a secure manner. Security of Website is ensured through firewall, which provides maximum security by virus checking, URL blocking and blacklisting and comprehensive logging. Periodic changes of passwords at the firewall, web server, mail server and Internet backend servers are the regular steps taken for web security. There is regular checking of firewall status and its log files. Checking of web server files, directories and user accounts is done consistently. There are regular backups of configuration files and source code files. All logins on the Internet backend server are logged and monitored.

The IR aims to conduct periodic audit of the system, provide security related training for its personnel, make all PRS servers sit behind firewall, and resort to digital signatures and certification agencies in near future.

11.5 CONCLUSION

IR is constantly looking for new ideas to simplify and streamline procedures for the convenience of passengers. In this endeavour, they have introduced several path-breaking technologies on the Railway system over the years.

Today, IR is offering several technological facilities for passengers such as Passenger Reservation System, National Train Enquiry System, Alpha Migration, Unreserved Ticketing System, Internet Booking, etc. ICT has benefited the customers by enabling the facilities of online enquiries, online reservation, comfortable ticket purchasing, and advance planning of unreserved journey.

These technological innovations have also improvised the IR by reducing the overload of its enquiry counters and reservation counters. IR is able to plan extra trains and coaches as per trend of sales registered in the system. Unreserved itinerary planning and tickets availability from any station to any station has been made possible.

11.6 ACTIVITY

Discuss a major national ICT experiment e.g. Posts and Telegraphs of India.

11.7 KEY CONCEPTS

VMS: Visual Memory System, known also as OpenVMS, an operating system.

VAX: was originally an acronym for Virtual Address Extension, because the VAX was

seen as a 32-bit extension of the older 16-bit PDP-11, and the first models were, in fact, called VAX-11 for the same reason. It is a 32-bit computing architecture that supports an orthogonal instruction set and virtual addressing. It was developed in the mid-1970s by Digital Equipment Corporation (DEC). VAX has been perceived as the quintessential CISC processing architecture, with its very large number of addressing modes and machine instructions, including instructions for such complex operations as queue insertion/deletion and polynomial evaluation. VAX computer systems can run several operating systems, usually BSD UNIX or or DEC's VMS, Ultrix, and VAXeln. The VAX architecture and VMS operating system were engineered concurrently to take maximum advantage of each other.

CISC: Complex Instruction Set Computer is a microprocessor Instruction Set Architecture (ISA) in which each instruction can execute several low-level operations, such as a load from memory, an arithmetic operation, and a memory store, all in a single instruction.

Poly- are an important class of simple and smooth functions. Here, simple means nominal they are constructed using only multiplication and addition. Smooth means they are infinitely differentiable, i.e., they have derivatives of all finite orders. Because of their simple structure, polynomials are very easy to evaluate, and are used extensively in numerical analysis for polynomial interpolation or to numerically integrate more complex functions.

DEC-: is a proprietary suite of network protocols created by Digital Equipment Corporation, originally released in 1975 in order to connect two PDP-11 minicomputers. It evolved into one of the first peer-to-peer network architectures, thus making DEC into a networking powerhouse in the 1980s.

11.8 REFERENCES AND FURTHER READINGS

<http://www.encyclopaedia.thefreedictionary.com/>

Indian Railways Websites have been the major source of reference for this Unit. These Websites are mentioned as below:

<http://www.indianrail.gov.in>

http://www.indianrail.gov.in/cc_reservation.html

<http://www.indianrail.gov.in/abcris.html>

<http://www.indianrail.gov.in/abcrisntes.html>

<http://www.indianrail.gov.in/abcrisam.html>

<http://www.indianrail.gov.in/abcrisprs.html>

http://www.indianrail.gov.in/abcris_web.html

<http://www.indianrail.gov.in/abcrisuts.html>

<http://www.irsuggestions.org/servicetopassengers.htm>

<http://www.rb.railnet.gov.in>