

Milestones in the History of the Hungarian Railways' Ticket Sales

L. Szabó, K. Galambos

SZE Közlekedési Tanszék, MÁV-START ZRt. Informatikai Szervezet

Phone: 96/503 494, 1/511-2345, Fax: 96/613 561, 1/511-1324

e-mail: szala@sze.hu, galambos.krisztian@mav-start.hu

Abstract: This article includes the practice of the Hungarian Railways' ticket sales since the appearance of the first ticket dispensers to the present day. Different ticket sales methods and the linking of ticketing systems to other computer systems will be presented. This study shows the deficiencies of today's ticket sales system, and the main directions of future development.

Keywords: *ticket dispenser, international trains' reservation, reservations via telephone, Mobile Ticketing System, ticket-printing machines, complex distribution system, on-board ticket sales*

Introduction

The necessity of implementing an integrated computerized IT system was already included in the MÁV 2000 concept of the year 1991. To raise passenger transport services' quality, this concept aimed to introduce a customer-friendly travelling, information and trading system. The system's economic benefits was seen especially in effective sales support, which results in revenue growth, the market-oriented optimization of capabilities and in cost reduction.

Developing a passenger-friendly distribution system greatly contributes to increase attractiveness of rail passenger services. The ability of multi-channel service selling is expected from a modern distribution system. Nowadays significant proportion of sales still happens through station channels. Shifting these rates to sales by ticket machines or online is desirable. The introduction of the bar-coded ticket system and the chip card system are also parts of the future plans. The integrated development of domestic and international distribution systems can enhances the passenger-friendly nature of distribution systems. The ticket sales system must to provide services without manual involvement even in corporal accounting and administration processes. The third important factor – which must be handle with priority in the development of ticket sales systems – is the connection with other distribution and non-distribution systems (for example management control systems) and scheduling databases.

1. Generally about the passenger information systems

Regardless of transport sub-sectors, the existing and efficient information system, which helps the passengers travels, are important elements of the passenger transport services' attractiveness. An ability to increase the complexity of passenger services is the global interconnection and interoperability of each sub-sectors' systems. This globalization often comes with the involvement of hotel and restaurant distribution services.

1.1. Application areas of the passenger transport IT systems

Based on traveling and regardless of subsector breakdowns the IT systems' services are concentrated in two main areas:

- auxiliary processes like operations before and after traveling
- main process, which can be related to the actual traveling.

In terms of passenger transport technologies the auxiliary processes includes preparation and finishing operations. The complex passenger transport information systems cover these operations in the form of different IT services. The most important auxiliary processes are providing scheduling and pricing informations and selling electronic seat-reservation vouchers and railway tickets. Other services also include hire of vehicles, reservations from other systems and extracting different subsequent travel informations.

The main process' goal is to generate informations which could serve traffic control and the accounting of different performances, not only informing passengers and expectants. The time values and the current location of the vehicle can be shown to the traveling public during the journey.

1.2. The distribution system of seat-reservation vouchers and tickets

Selling tickets is one of the most important auxiliary processes of passenger transport, which includes selling seat-reservation vouchers and railway tickets. They are commonly known as distribution system. The most important primary data groups are:

- infrastructure (stationary and moving equipment)
 - schedule
 - tariff
 - other (for example job-IDs, statistical codes, tax IDs, etc.).

The infrastructure primary data group contains the data which are necessary for describe clearly the transport routes (reservation sections) and properties of the vehicles for generating reservation offers. Important to specify the train IDs among scheduling data. The other groups' data are needed to generate a lot of information and certificate.

The most important output groups are:

- producing seat-reservation vouchers and railway tickets
 - passenger (reservation) lists
 - different trading statistics
 - supporting traffic control

- supporting schedule planning.

Producing and ordering seat-reservation vouchers and railway tickets can be made not only by transport companies, but in a lot of different access points with network availabilities. [1]

In the following we will review the development of the domestic distribution system of seat-reservation vouchers and railway tickets.

1.3. Specifics of railway distribution

Obviously these systems must also be complied with expectations described in section 1.2., however we need to mention some specifics which are characterized in rail transport. A railway company's ticket distribution system has to provide other services beyond directly related services to passenger transport. They have to make those services available which are provided by other railway companies and partner agencies. These partner agencies can be transport companies, major hotel chains or even airlines. The railway company's ticket distribution system is definitely connected to a management control system, which provides important data for the leading information system which supports decisions about passenger transport. The large-scale scheme of the railway company's ticketing system and its environment is shown in Figure 1.

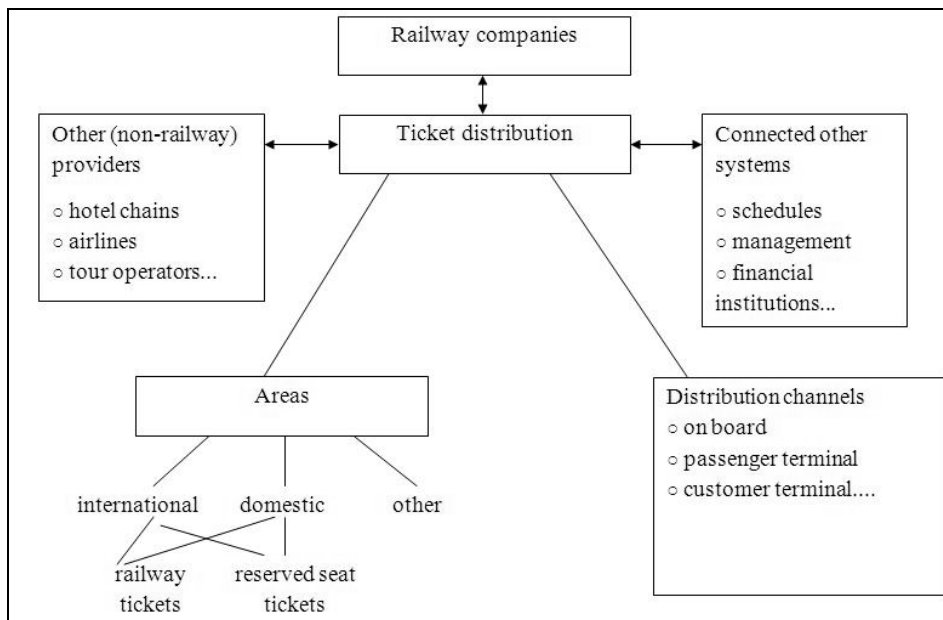


Figure 1: Large-scale scheme of the railway company's ticketing system and its environment (Source: made by the author, Lajos Szabó)

2. Chapters from the history of the hungarian railway ticket distribution

The chronological presentation of the MÁV's distribution systems from the 90's is also the illustration of the current distribution systems, as there haven't been any comprehensive replacement of the entire distribution system in the past few years.

2.1. The past

The first electromechanical ticket-printing machines in Hungary were installed in 1958 at the Budapest-Keleti Pályaudvar, developed by Allgemeine Elektrizitäts-Gesellschaft (A.E.G.). This ticket printing-machine, which had landscaped control panel, could generate 630 different types of tickets, and could be operated electrically or manually. With these machines the cashier press the ticket at the passenger ticket windows during the ticket change process, and the machine counts the issued tickets at the same time. These two machines functioned until the end of the sixties. [2]

In 1793 fifteen Italian SASIB ticket-printing machine were purchased. Two types of these electrical ticket machines came to Hungary. They had electrical control panel. The bigger one, which could print 1000 different types of tickets, were operated at the MÁV Public Relations Office, and the smaller ones, programmed to 500 different tickets, were operated at different locations; 10 at the Budapest-Déli Pályaudvar, 2-2 at the Budapest-Keleti Pályaudvar, and at the railway station of Debrecen. On these machines the cashier had to find the appropriate ticket type in a crosshair, and had to print the ready ticket onto a separately inserted carton sheet. They used brown cartons for second-class tickets and green ones for the first-class tickets. The red lines onto the express trains' cartons were printed previously. When the VAT were simplified in 1980, temporary solutions were used at the machine's reinstallation because of the scarce currency, but along with it they were operated until 31th December 1998, after that they were replaced to Hungarian-made MAEF machines. [2]

The first electronic ticket issuing machine in Hungary was made by the Dutch Simmonds Precisions Company. The thought of ticketing's extensive mechanization were raised for the first time at the end of the 70s at MÁV. Chief Executive Officer Zoltán Szűcs, who otherwise was highly efficient, recognized the importance of the issue, and he also would have canceled the procurement of an electric locomotive in order to appropriate mechanization. Several companies offered to develop the electrical cash register, including the Swedish ALMEX, the Swiss BILEXA and the Dutch Simmonds Precision. The MÁV's ideas were elaborated by Dr. Sándor Szabó, István Nagy, Imre Perger and György Horváth, under the leadership of Deputy Head of Department Miklós Süle. Based on the prepared descriptions, tables and block diagrams the Dutch company made a simple, easy-to-handle machine, what didn't slowed down the process of ticketing noticeably, but simplified accounting and statistical recording significantly. The machine produced tickets based on the seven-digit code numbers, which had already proven in statistical recording. The base ticket was the passenger train's second-class ticket. The different reduced price tickets could be produced based on this, so for a passenger, who traveled in second-class, the cashier only had to type in the charging zone and press the eject button. The prototype was operated at the MÁV Public Relations Office until the ticket's currency conversion to forint in 1978-80. The

two devices, which were made after the tariff system changes, worked at the Budapest-Déli Pályaudvar from 1982 to the tariff increase in 1989. Additional purchase was failed due to chronic scarce currency. The devices which cannot be used any more due to tariff changes were scrapped in 1996. [2]

The IT systems appearance in the field of distribution is illustrated well in Figure 2.

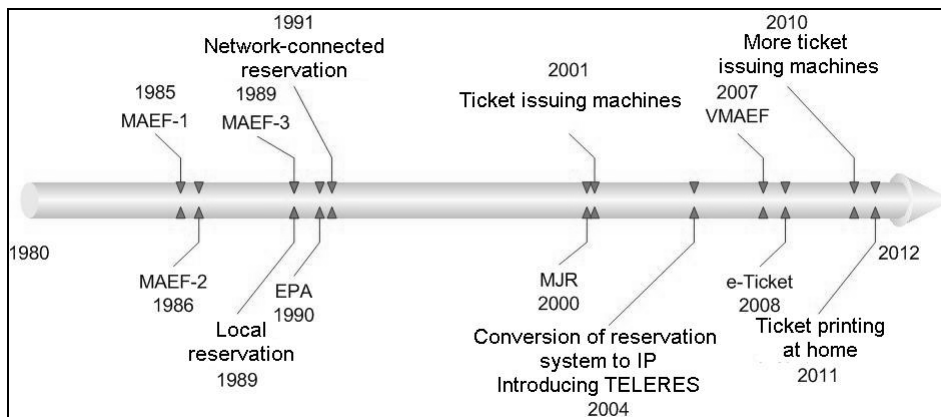


Figure 2: Timeline of the distribution systems' introduction

In order to reservation in international trains, the MÁV joined to the DB's automated location center in Frankfurt am Main, where the five founding member railways – DB, ÖBB, DSB, SNCB, CFL – stored all of their place-maintained train services' places. Electro-mechanical ticket printers – aka. Walther terminals – were installed to the location center of Budapest and to the Public Relations Office in the Andrassy út for printing seat-reservation vouchers. The requirements of those service areas which didn't have an EPA machine were received in the location center of Budapest via telex, fax and telephone. At the beginning the ÖBB railway company also maintained the MÁV trains' informations. After that in 1990 10 PC-based EPA terminals were installed to railway stations, travel agencies, ticket offices in Budapest, and to the location center of Budapest. Our trains' basic data are supplied on ZBR terminals by MÁV in its own discretion. At present MÁV-START have 69 terminals in checkouts, which cause a significant decrease in the amount of location transmissions. [3]

2.1.1. Installing the MAEF ticket issuing machines (1985)

The first Hungarian electronic ticket issuing machine is the MAEF. The need for domestic development came to the front due to the impossible purchasing of Simmonds Precision's devices. The young engineers of the TBKF (Távközlési és Biztosítóberendezési Központi Főnökség) – Dénes Büky, Tibor Kovács and Tamás Laczkó – using the principles of the Dutch machine, developed a simple electric device as an innovation, which was produced by the Zöld Mező TSZ at the beginning, and later the Data-Press. The first 10 MAEF-1 ticket issuing machines were installed in 1985 at the Nyugati Pályaudvar's ticket offices. 26 MAEF-2 second-generation devices were commissioned in the end of 1986 at the Keleti and the Nyugati Pályaudvar. The Trade Service formulated new requirements in 1989. The mechanization of domestic

reservation of seats became an urgent task, which brought along with the ticket issuing machines' modernization. The machines had to make suitable for working in the network. This led to the development of the MAEF-3 machines. The construction of the X-25 network started in 1990 as an experiment by MÁV, and the MÁV's domestic placeholder network were installed onto it. At first the three main railway stations were connected, and after comes the other provincial bigger and smaller stations continuously.

The general proliferation of the MAEF ticket issuing system took place only in the mid-nineties. Functionally "needle-matrix" tickets replaced the traditional (crusted, labeled and reform) tickets, which were hegemonic before.

The ticket-issuing machines had two main parts: a central unit – which included a printer unit, and a keyboard for data input – and a connectable monitor (normally monochrome, CRT). The "application software" enabled to issue kilometer-zone tickets, so the railway tickets contained the distance in kilometers instead of starting place and destination. The paper tapes, which were used at the beginning, were replaced to thermal paper, which is still in use. [4]



Figure 3: Cash register at Széchenyi-hegy station [4]

The ticket issuing machines, which were developed by the TBKF's engineers, were made, developed and operated by Data-Press and its predecessors. From 2007 they provide system support as Data-Press Informatikai Szolgáltató Kft.

In 2004 every MAEF-3 ticket issuing machines' CRT monitors were replaced to LCD monitors, because the ticket's masks were burned into their kinescope's phosphor layers. The matrix printers were modernized by replacing them with STAR TSP 700 thermal printers, which are functioning reliably so far.

The matrix printers' knocking noise disappeared from ticket offices, the cashiers welcomed the faster and quieter printing. The operating costs are significantly reduced, too.

The MÁV-START Személyszállító Zrt. was founded in 1st of July 2007. At the same time they introduced ticketing levels, which were an expectation of the owner (the Hungarian state). This method isn't based on kilometer zones. The starting place and the destination are on the tickets as contexts. For this the MAEF devices had to be reprogrammed and expanded. This meant connecting keyboards (which were indispensable for entering station names), increasing the processors' performances, and memory upgrading. In addition these machines became capable of performing many new functions, such as issuing IC tickets ordered by phone. [6]

2.1.2. Installing the Domestic Reservation System (RES)

The MÁV's manual reservation system could not meet the increasing traffic demands nor quantitatively or qualitatively, so it was the time to mechanize domestic reservation using modern computer technology. The DATA-PRESS's employees created a software for commercially available computers, which is suitable for storing and dealing out domestic trains' places, and can operate the reservation services smoothly.

In 1989 new personal computers (PCs) had been installed at the Keleti, the Nyugati and the Déli Pályaudvar in Budapest. All operating MAEF-3 cash registers were connected to these PCs via local networks. From that time cashiers can give railway tickets and seat-reservation vouchers directly from cash registers. Travel-back tickets (express trains' reservations from other railway stations) was still asked and issued by telephone.

The next step was the network connection among PCs (1990-1991). Every scheduled stop-off point was connected into the network. The reservation database was created decentralized with collecting devices, which were situated in starting railway stations. The current logical infrastructure follows this method, 16 contingent storage devices record the main data of the trains which are traveling with reservation.

The RES programme also creates passenger transport reports about tickets sold by cash registers, generates monthly statistics about MAEF-3 devices, which are connected on local networks, and manages reservations and issuing.

In 2004 telephone reservations were centralized and modernized with a new callcenter with AVAYA technology. The new customer support did not only have to give informations about schedule and pricing, but they had to record IC reservations, too. For this a new application called TELERES was developed, which can store reservation data, and ensures to take orders at stations with ticket issuing machines.

2.1.3. The introduction of the Mobile Ticketing System (MJR)

It was one of the goals of the Passenger Transport Management of MÁV Rt that the registration of their products and services' distribution will be realized in a networked, IT-supported system. To achieve this goal the Info*Sys Kft. created the Mobile Ticketing System (hereinafter referred to MJR), supplemented the previous development efforts. The MJR fits into the MÁV Rt.'s passenger transport distribution system, and ensures ticketing with mobile ticket issuing devices which are compatible with other systems. The MJR's hardware devices on system startup are:

- PSION WorkAbout (hereinafter referred to mobile ticket issuing device) – British-made mini-computer designed for hand-held use
- HuniPrint matrix printer – purposefully planned Hungarian-made mobile printer with rechargeable built-in nickel-cadmium battery
- Pentium II. PC with SVGA monitor 14"
- Peripherals:
 - Epson LX 300 printer
 - docking station for data transmission
 - external modem.



Figure 4: Mobile ticket issuing device

Two softwares provide the system's operation. One of them is the application on the mobile ticket issuing device, and the other is the PC-side MÁVSYS accounting system.

The HuniPrint matrix printers, which were used at the beginning, were replaced to Citizen CMP10 thermal printers. This step eliminated the rudimentary operational difficulties caused by these printers' operations. Currently 1750 PSION WorkAbout devices ensure the network coverage. These devices are not assigned to person but passenger trains' scheduled rounds. The conductors can account in 52 stations with this device. [7]

2.1.4. Ticket-printing machines

In 2001 the MÁV Rt.'s management aimed to deploy ticket-printing machines in order to serve passengers in a faster and more modern way without queuing. There was an important aspect that deploying these machines didn't require a new application of human resources. The development was ready to September 2001, made by Data-Press. After that 12 devices were deployed, at first at the area of Budapest (Nyugati

Pályaudvar: 6, Keleti Pályaudvar: 3, Déli Pályaudvar: 3 devices), then in 2010 two other, more modern devices at the railway stations of Pestszentlőrinc and Ferihegy.

Ticket-printing machines are suitable for credit card transaction via OTP besides cash payment, and they sell the tickets based on the ticketing levels.

2.1.5. Online sales

In ticket sales the next great step forward was the introduction of the online sales system, the E-TICKET. With the upgrading of the application, it can be used in international traffic for limited types of tickets from 2010. The system's operational core is the online version of the MÁV Zrt.'s scheduling software (commonly known as ELVIRA). The system could be introduced so fast, because it was built on the existing scheduling and pricing system. In the E-TICKET system every ticket (with selected route, time, discounts, seat, class and other conditions) can be placed onto the customer's carts. Seat-reservation vouchers and spare tickets are available for the selected ticket, which also placed onto the cart. These tickets, which can belong to different passengers or travels, can be paid simultaneously via a totally safe, online banking payment system using credit card. The system issues paper based or electronic bill about the transaction.

In the beginning the tickets' receiving was ensured by 58 KIOSKs (ticket issuing devices with touchscreen), which were placed onto 40 busy stations. Home ticket printing made the online sales more widely reachable, because it means that the tickets' receiving was no longer bound to selected stations. These tickets include a QR code, which consists of the necessary data for verifying the purchased tickets. Currently the conductors check this QR code with an application installed onto an Android-based Motorola Defy cellular phone. They can do it in online or offline mode, depending on network conditions.

The innovation of internet sales continues, and the MÁV-Start Zrt. enabled payment via mobile balance from May 2012 in cooperation with the following mobile network operators: Magyar Telekom, Telenor Magyarország and Vodafone Magyarország. Recently online sales became possible by e-Ticket system with appropriate credit cards, but with using this new payment method in purchasing process the whole transaction is just as easy, and we can finish it by using our cellular phone only. During the purchasing process, the system send a confirmation message for the customer, and then the total amount appears on the mobile balance.

2.1.6. Development of complex distribution

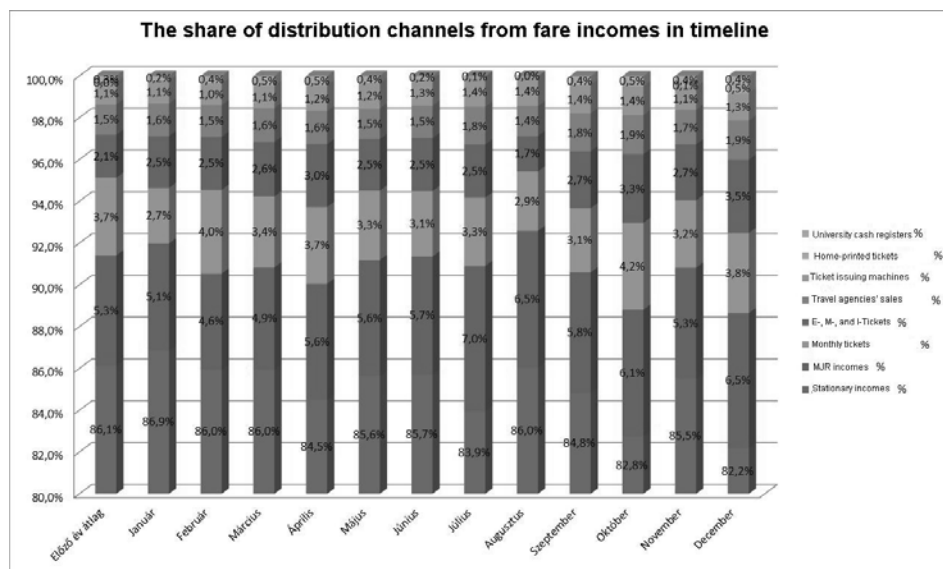
The MÁV already decided in 1995 to establish a modern complex distribution system, which worked under the name of MHR (Menetjegyeladási, Helyfoglalási és Utastájékoztatói Információs Rendszer) within the company. This project started by IBM (International Business Machines Corporation) as prime contractor and by TLC (Transport-, Informatik- und Logistik Consulting GmbH) as subcontractor. In 2000 the MÁV refused the presented program after its first test. In 2001 the IBM, the TLC and the MÁV conducted negotiations about continuing the project MHR with the agreed terms. They signed the modified contract of the MHR in December 2001. TLC became

prime contractor. It's task was creating a new program for the MÁV until 2004, which will be based on the German KURS 90' system. But this project was suspended by the former management in 2006 on nearly 50% of readiness.

2.2. The present

In addition with the development of distribution systems we described above, the continuous automatization of different techniques can be observed, however these systems are still working evidently side by side. From terminols which remained at traditional cash registers to online sales, the MÁV-START Zrt.'s ticketing system is made up of system elements which are showing different technological improvements. This technological backwardness is established due to the lack of comprehensive development in the past decade, which became more and more necessary.

The MÁV-START's service distribution is realized through the channels of Figure 5.



5: The share of distribution channels from fare incomes
(Source: MÁV-START Zrt. controlling compilation)

The international distribution is realized via Internet by using traditional ticketing, 69 EPA terminals and limited tickets.

The current equipment:

- VMAEF ticket issuing machines 391
- MJR conductor devices 1750
- Automatic printing machines 14
- E-TICKET kiosks 58
- EPAs 69.

2.2.1. The weaknesses of the distribution system

- Our existing distribution system doesn't have APEH authorization, and there is no possibility for giving bill via VMAEF machines. The credit card payment is limited due to the lack of connection between the POS terminals and the ticket issuing machines.
 - The 40% of cash registers perform a significant amount of traditional ticketing.
 - Currently the MÁV-START doesn't have a fund system for international ticketing.
 - The PSION WorkAbout mobile computer is a construction from 1997, and it's maintenance become more and more expensive. The ticket issuing machines are not capable for online connection, so exchange of data is possible with docking only.
 - The automatic ticket dispensers are capable for limited suburban ticket issuing only, and there aren't enough dispensers.
 - Internal and international reservation systems are not interoperable yet, so other country's place contingents are not reachable directly from internal fund systems. In addition there is no possible way to book tickets for the domestic trains of MÁV-START Zrt. from abroad.

2.3. Vision of the future

A global complex distribution system's development will be reasonable in the future because of the lack of the distribution system's development, the lack of connections between different systems, and the different software solutions among systems.

It was the MÁV's main goal with the project MHR, and also it's the MÁV-START Zrt's primary target with the project JÉ. This is one of the key projects of the MÁV-START, and it was started to renewing ticket sales.

Expectations of Project JÉ:

- Implementing a centralized, server-sided distributing and accounting system with the approval of the NAV (Nemzeti Adó- és Vámhivatal, previously called APEH), instead of the current ticket issuing machines.
- Accounting and administration processes without manual involvement.
- Establishing a ticketing system with barcodes, and an online checking system without manual processes in all distribution channels.
- Establishing a chip card system for expensive, season ticket-like products (Adjusting with the national unified traffic card system's development and it's standard solutions and recommendations).
- Integrated development of domestic and international distribution.

The base of the development concept was the pursuit of the complex distribution system's uniformity and simplicity (Figure 6). Unified services can be ensured in different distribution channels if they are using a common database, and the methods of routing, pricing and other functions are the same. So a new centralized (server-sided) search logic will serve out the requests of cash registers, issuing machines and the requests from on-board and internet sources. Server-sided and non-local installed

applications need stable online connection, but their maintenances, upgrades, updates and operation are safer, faster and easier. [8]

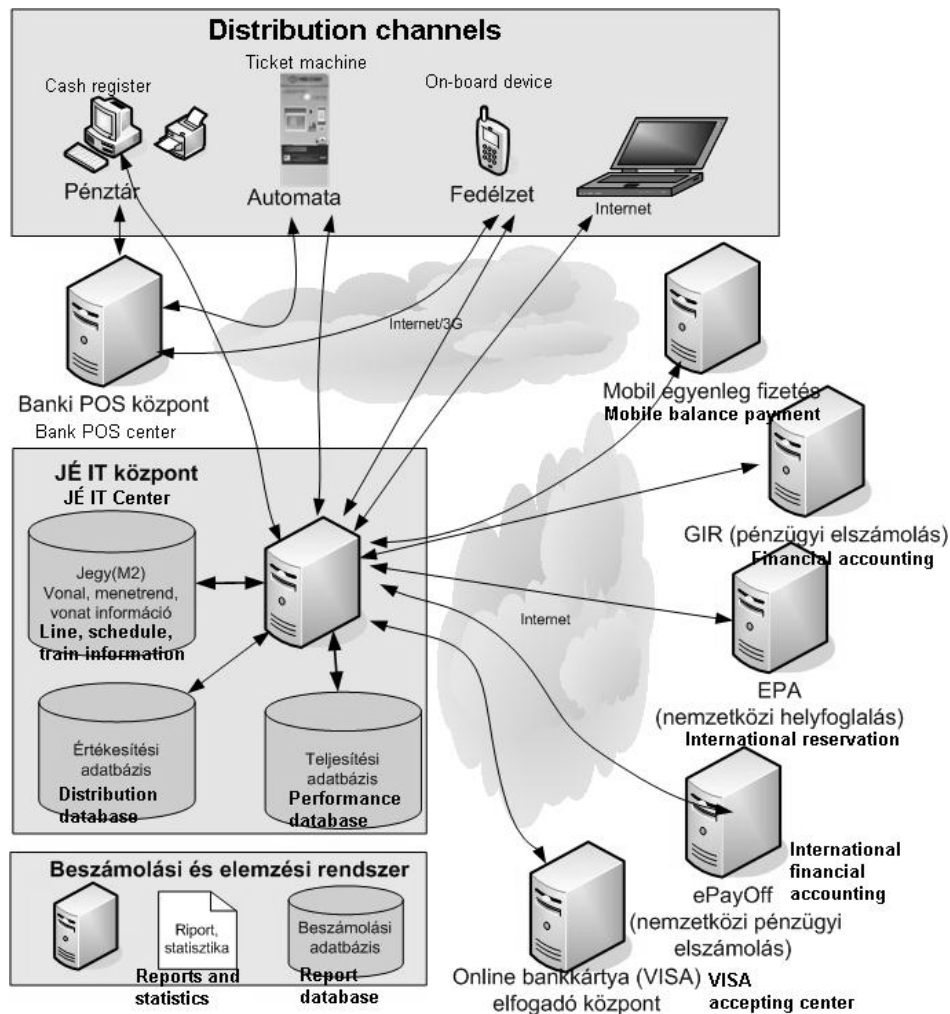


Figure 6: Architecture of the planned system
(Source: Ticket distribution renewing concept)

Besides Project JÉ, 48 ticketing machines' public procurement process is on queue. This machines will be installed to the 100 (40 machines: Budapest Nyugati – Szolnok) and the 120A (8 machines: Rákoshegy, Rákoskert, Ecser, Pusztaszentistván, Tápiószentmárton, Zagyvarékas) lines in next year. These are fully functional machines, which can do more than limited ticket issuing.

2.4. Connections with other systems

Figure 7 shows the current distribution systems and their connection points.

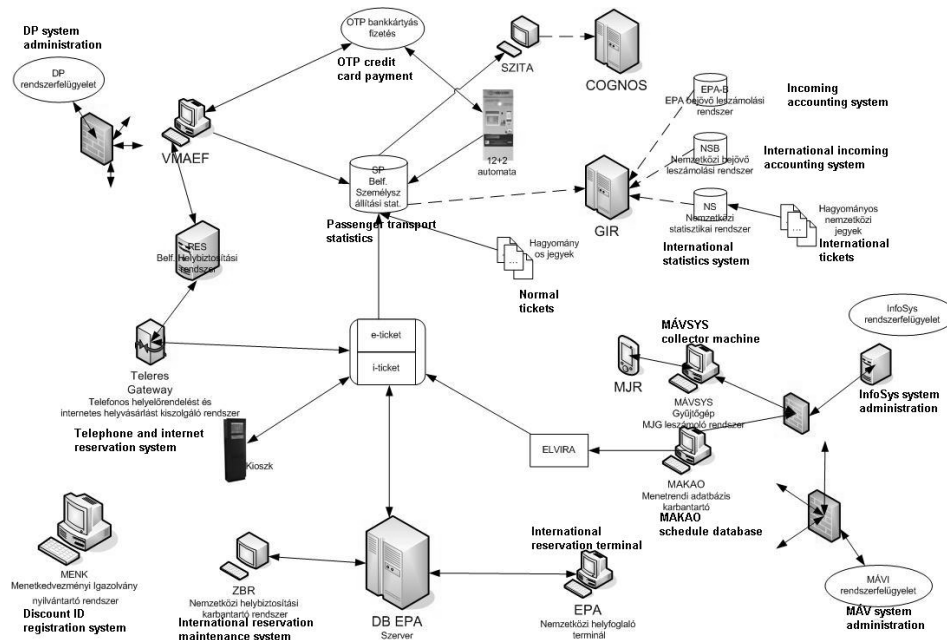


Figure 7: Connections of distribution systems
(Made by Krisztián Galambos)

Every internal distribution system reports to the SP (internal passenger transport statistic system), and it's results are being accounted to the company's management control system, the GIR. The processed results about international ticketing and incoming accounts will be stored here, too.

The RES domestic reservation system grouping the ticket issuing machines, ensuring the distribution of domestic seat-reservation vouchers, furthermore it collects and forwards the ticket issuing machines' monthly accounting data. Online sales reservations are also get information via the RES, while scheduling and pricing basic data is being generated via the scheduling database registry software (MAKAO). The MAKAO also generates scheduling data for international data exchange and ticket issuing devices.

Conclusion

In the past few years there was not any comprehensive development in the area of Hungarian railway ticket distribution, which could make the global distribution system renewed. But there was some improvements, which were counted as milestones. In 1974 the MÁV joined to the international reservation system centered in Frankfurt am

Main, and then started the introduction of mechanized ticket issuing at busy ticket offices in the eighties. The distribution of mechanized seat-reservation vouchers started at bigger railway stations of Budapest in 1989, which was progressively expanded to every reservation-obliged railway stations. For helping the suburban transport in Budapest, ticket issuing machines were installed in the capital city's railway stations in 2001. In 2004 the telephone reservations were centralized. The MÁV-START Zrt. was founded in the 1st of July 2007. At the same time they introduced ticketing levels, which were a great step forward in domestic conditions. There is traditional ticketing in the 40% of ticket offices, and the MÁV-START does not have a fund system for international ticket issuing. Internal and international reservation systems are not interoperable. The absence of connections and different software solutions between systems is typical due to the above-mentioned lack of global developments. That is why is so important to develop a simple and unified complex distribution system.

References

- [1] Dr. Zvikli Sándor et al.: *Közlekedésinformatika*, Universitas-Győr Nonprofit Kft, (2008).
- [2] MÁV Rt.: *Vasúti Nagylexikon I*, Budapest, (2005).
- [3] Baritsa Csaba: *Személyszállítási Informatikai Rendszerek MÁV-START Zrt.*, Budapest, (2002).
- [4] <http://iho.hu/hir/maef>
- [5] http://www.gyermekvasut.hu/chrw_news.php?extend.351
- [6] MÁV-START Zrt: *VMAEF jegykiadó gép felhasználói kézikönyv P. 5. sz. Utasítás Állandó jellegű pénztári rendelet*, Budapest, (2008).
- [7] MÁV-START Zrt: *MJR-2 MJG felhasználói kézikönyv 1/2009*
- [8] *Jegyértékesítés megújítása koncepció (Előterjesztés a MÁV-START Zrt. FEB részére)*, Budapest, (2009).