4th INTERNATIONAL CONFERENCE
TRANSPORT SYSTEMS TELEMATICS TST'04

ZESZYTY NAUKOWE
POLITECHNIKI ŚLĄSKIEJ 2004
TRANSPORT z.55, nr kol. 1657

eGIS_PKP, SLIM system,
TELESTRADA_SLK

Andrzej MRÓWCZYŃSKI[1]
Marian OSTASZ[2]
Paweł MASIKOWSKI[3]

SELECTED BASIC TELEMATICS PROJECTS IN THE RAILWAY TRANSPORT

The Railway Telecommunication is now in progress of developing and implementing several telematics projects dedicated for railway transport. These are,, among others, projects: eGIS_PKP, SLIM, TELESTRADA_SLK, TELEGRAMY_IP, VPN described in this paper.

WYBRANE BAZOWE PROJEKTY TELEMATYCZNE W TRANSPORCIE KOLEJOWYM

Telekomunikacja Kolejowa jest w fazie opracowania i implementacji wielu projektów telematycznych dedykowanych dla transportu kolejowego. Należą do nich opisane w artykule następujące projekty: eGIS_PKP, SLIM, TELESTRADA_SLK, TELEGRAMY_IP, VPN.

1. INTRODUCTION

Liberalization of the market, including the liberalization of market in the transport of goods and persons, imposes a necessity to rationalize the offers in such a way as to enable the final success of the project. A basis for rationalization of services is, above all, raising the quality of railway infrastructure, that should feature:

- ⇒ High safety,
- ⇒ A possibility to handle the traffic with high speed; already now, in order to reach a competitive passenger transport offer, even in the regional traffic, it is often necessary to have a railway network of maximum speed of more than160 km/h; in the inter-regional transport the high speed lines are now the most often applied solution ,
- ⇒ Timeliness and regular travels,
- ⇒ The communication of service within the railway network with the services in the networks of other means of transport, that could be acceptable for the client.

[1] Railway Telecommunications, Ltd, Al. Jerozolimskie 140, 02-305 Warsaw, a.mrowczynski@pkp.com.pl
[2] Railway Telecommunications, Ltd, Al. Jerozolimskie 140, 02-305 Warsaw, marian.ostasz@pkp.com.pl
[3] Railway Telecommunications, Ltd, Al. Jerozolimskie 140, 02-305 Warsaw, p.masikowski@pkp.com.pl

In the conditions of market competition, the more and more important is quality of commercial customer service system:

⇒ The high counseling intelligence in the selection of service variant,
⇒ Competitive price,
⇒ Large scope of devices and complementary services,
⇒ Complete, updated and available user friendly information for the customer before, during and after process of travel/transport.

It is a fact that qualitative attributes in the transport of people and goods become more and more the key for competitiveness of railway transport operators in respect of other communication means.

In order to fulfill the above requirements of high quality and performance of transport systems, it is necessary to use the integrated teleinformation/telematics solutions using the digital telecom platforms for stationary and mobile communication.

The strong requirements set before the control and managing processes in the railway transport, and especially in high speed train driving apply also to the remote communication systems in the man-to-man and man-to-machine channels, and especially machine-to-machine channels.

The basic and necessary requirement for the machine-to-machine communication channel *(automaton-to-automaton)* is safe and reliable digital transmission system

The market behavior, versatile customer service, variety of operators and subjects, but one layer of infrastructure complete with adequate control and traffic management technology, as well as transport management, all these factors require a necessity of a consistent strategy for implementation of basic telematics services namely for this purpose.

2. PROJECT eGIS_PKP I SLIM

The name ***eGIS_PKP*** shall be understood as a system using the geographic and descriptive information of possessed spatial resources. The databae in a ***eGIS_PKP*** system is a geographical space information with data assigned to them, describing the resources being managed by the Companies. The most often, the space data are written in a form of a vector model and the descriptive data in the relational database. In the railway practice, the vector model is mote suitable *(for example for descriptionof track layout topology)*

The introduction of data to the vector database ***eGIS_PKP*** may be performed in two ways:

⇒ Manually through the keyboard; *most often for small update of descriptions (records),*
⇒ Automatically, using the data from satellite system *(GPS)*; *mainly in order to introduce the geographic coordinates of an object in the area, for example by a service technician with a palmtop with GPS module who, during the service activities updates the record of telecommunication cubicle description in the passport system.* ,
⇒ Semi-automatically, in the process of analog map digitization process: *usually in the cycle of adding technical and operational characteristics of the station from schematic plan, to the **eGIS** database, using an analog-digital converter,*
⇒ Automatically in the scanning and vectoring process.

In order to use the documentation developed till now in the various text editors as. MS Word, MS Excel, Corel, MPEG, Access ..., the ***eGIS*** platform enables easy creation of *(„loaders")* from files of various formats.

Tools of ***eGIS*** platform enable also such practical operation on the various information layers:

⇒ Update, cutting, aggregation, selecting with condition, joining, pasting,

Finding a common part of various information layers and creation of buffer zones around the object (for example – for analysis of a crisis situation – superposition of electronic D-29 zone on the road map in order to establish the access roads to the accident)

A very important feature of **eGIS** platform is enabling import of geographical information and integration with geo-base; this ensures compatibility of engineering in various areas. For which the topographic maps are the basis.

Creation of an ***eGIS_PKP*** system will enable management on the appropriate levels of:

⇒ Creation and maintaining, with a desired detail level, of electronic documentation of space resources, adapted to the needs of each Company,

⇒ Creation of resource management, design and development system, analysis of all data necessary for customer service,

⇒ Easy visualization of the situation on the 3-D digital maps, *(for example, D-29 of railway PKP network)*,

⇒ Creation of efficient management and direction of resources, also in real time, using the database organized on ***eGIS*** platform,

⇒ Quick, safe and authorized access from any place to the 3-D information and information about resources being managed, reduction of resource management costs.

We have to emphasize that the establishing of Physical Network Inventory database (***PNI*** – *Physical Network Inventory, above all for passports)* of the space resources managed by the transport operators and infrastructure operators, should take place in parallel with the creation of a server of Dynamic Network Inventory for railway facilities (***DNI*** – *Dynamic Network Inwentory*) with isomorphic structure of ***PNI***. Appropriate relations between the object descriptions in the fixed database and with dynamic location of railway objects database create a possibility of easy logical description *(**LNI** – Logical Network Inventory)* of objects and processes in the applications for the purpose of managing and directing the company resources, which is illustrated on Fig.1.

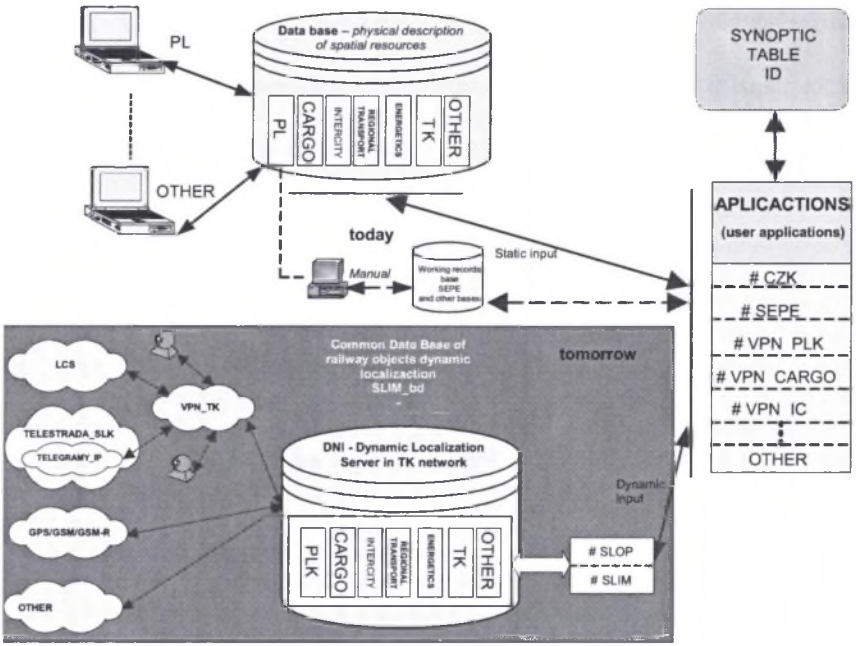

Fig.1. Relations bweteen ***PNI***, ***DNI*** databases and instances of applications

The idea ***SLIM*** means a tele-information system of location of mobile railway objects using at its input the data on geographical coordinates of the facility taken from the global satellite positioning system *(**GPS** – Global Positioning System)*, as well as messages with sectional location i.e. with block section, trunk line section, track section, railway line.

In the last years, the prices of ***GPS*** receiving equipment have dropped significantly and thus the satellite navigation in logistics and transport became more and more common. Railway transport is an area that is greatly suitable for use of ***GPS*** signal, because it features open space, non-built area, and in Poland additionally lack of railway tunnels. The ***SLIM*** system will support the rational disposal of mobile operator's resources in real time. The general structure of ***SLIM*** system is presented on Fig.2.

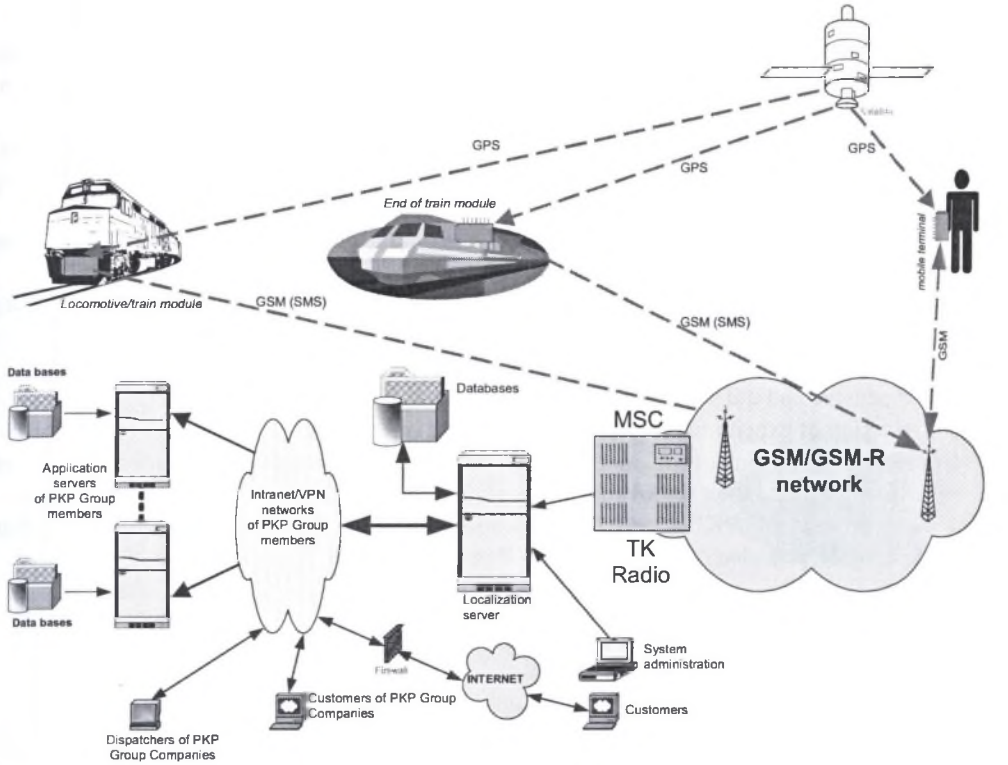

Fig.2. General architecture of ***SLIM*** system for PKP group units

SLIM enables implementation of TI systems for fleet management, transport planning,, current follow up of shipping contract, vehicle diagnostics, increase of property use degree, increase of productivity and efficiency of customer service.

SLIM connected with ***eGIS_PKP*** system will enable the remote supervision and visual monitoring of object and equipment condition, for example, verification of traction substation condition at the moment of fire alarm appearance. Using the IT technology, ***SLIM*** will enable realization of the safety support system for level crossing and other railway facilities in terms of organization and tasks of appropriate services. Based upon ***eGIS*** systems, ***SLIM*** will enable creation of proficient tools for managing a crisis situation in the Crisis Management Centers.

Arrival at the support of managing and driving of transport service realization with application of European standard technology ***ERTMS/GSM-R***, will be a many-years long and costly process. Independent of ***ERTMS*** construction, the European railways DB AG, SNCF for dynamic location of shippings use signals from satellite systems as a solution that is definitely less expensive and possible to realize in a much shorter time.

These solutions fulfill a complementary function in the transport managing process and may fulfill basic function in fleet management and operation in Crisis Management Center.

The development of ***SLIM*** system with ***eGIS_PKP*** platform will also enable:

⇒ Creation of shipping route planning application and its optimization, taking into account the client order conditions, including *„just in time"* formula with dynamic follow-up of shipping contract realization,

⇒ Creation of planning and supervision real time application of hazardous material transport and shipping with exceeded loading gauge *(present location, shipping condition, expected delivery time....),*

⇒ Creation of the systems according to the formula ***plan/condition***, for real time management of service realization and information systems in personal transport.,

⇒ Creation of diagnostic systems of supervised mobile resources and support of their management in real time.

Advantages of ***SLIM*** system use

⇒ Inexpensive and quick realization *(one contractor, clear responsibility)*,

⇒ Limitation of expenditures to one TI service and one supervision system,

⇒ Efficient management of mobile and stationary equipment and quick location of malfunctions and their removal,

⇒ Rational use of PKP's telecommunication skeleton network and radio exchange ***MSC/GSM***, and also ***MSC/GSM/GSM-R*** in the future.

3. PROJECT TELESTRADA_SLK

Modernization of railway lines provides for centralization of railway traffic management, This requires application of efficient and reliable teletransmission infrastructure, preferably digital one, in order to get a possibility of safe data sending to all cooperating systems within the controlled area. The data exchange network structure should be adapted to the technical specifics of control and management of railway traffic.

The Railway Telecommunication develops for this purpose a system of digital process communication and data transmission called ***TELESTRADA_SLK.***

The ***SLK*** platform contains the following functionalities:

⇒ Digital channels for control functions: *railway traffic control system, power facilities, electrical traffic organization, information for travelers, time network, information boards on the stations and stops, information boards on roads for use of wheel traffic on the level crossings.*

⇒ Digital channels for shipping management support function: *exchange of service telegrams (instance on Fig.4.), train follow-up system messages (instance on Fig. 3.), fiscal shipping documents cash machines,*

⇒ Digital channels for remote supervision and diagnostics: *the system for reinforcing the safety at level crossings, visual system of railway object supervision, for example ,railway power generation in the traction substations, monitoring of fire prevention and anti-burglary systems condition, subsystems of axle sets diagnostics (overheated axles and flat locations)*,

⇒ Creation of process group's access to the Intranet of Group PKP S.A.,

⇒ Creation of autonomous network ***VPN*** for Companies of Group PKP S.A. (*instance on Fig.5.)*,

⇒ Creation of Internet access to the railway area *(in the wire and wireless WiFi technique*).

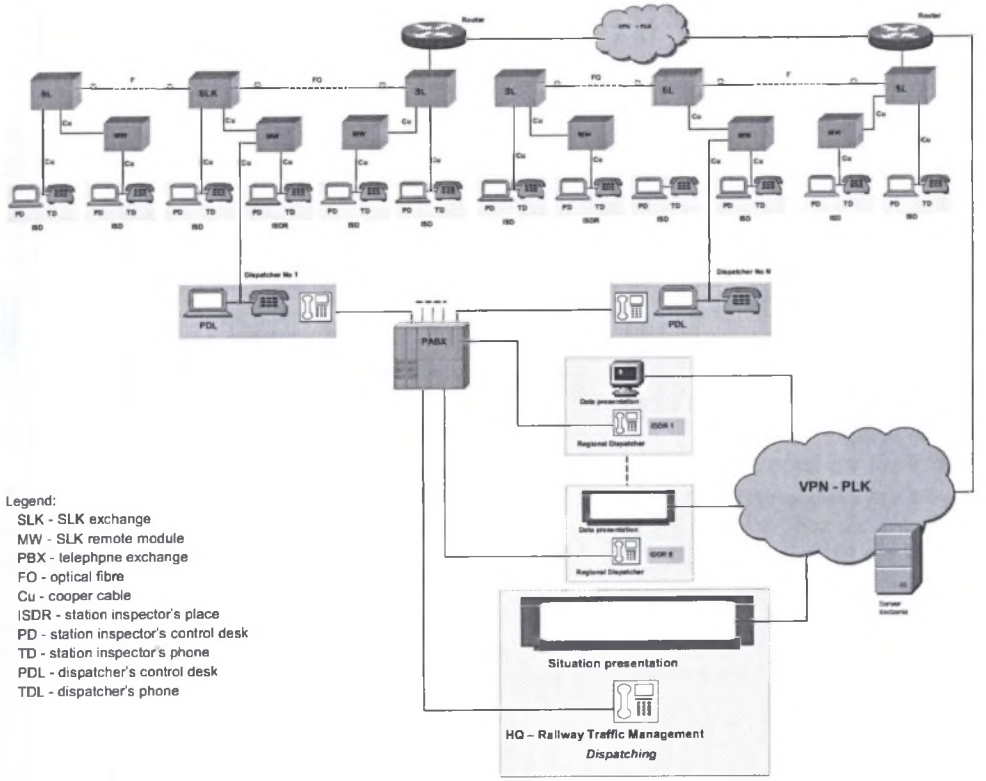

Fig.3. Conceptual design of dispatcher connection network in the ***TELESTRADA_SLK*** technology with simultaneous apossibility of sending messages to the train traffic control system

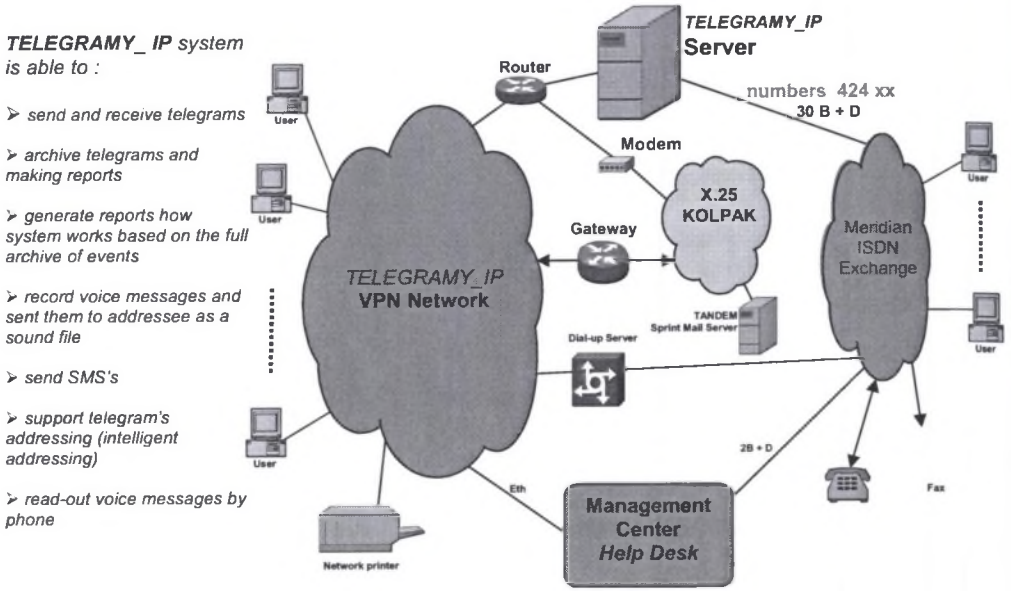

Fig.4. ***TELEGRAMY_IP*** – system of safe service on-duty message exchange *(information)* for monitoring, directing and managing processes in the railway transport

MPLS Protocol enables creation of VPN (Virtual Private Networks).

VPN services for PKP Group – ensure communication for many users based on only one common network infrastructure. Groups of users belonging to different subnetworks are logical separated among each other.

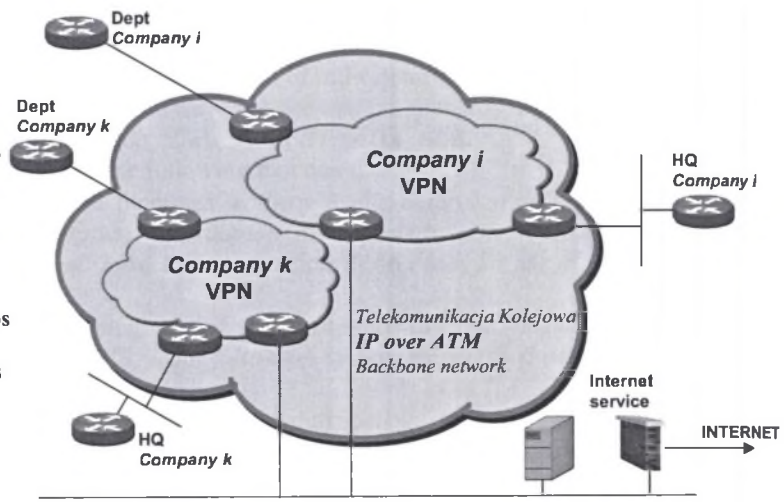

Fig.5. Diagram of creating a corporate network for Companies of Group PKP

4. CONCLUSIONS

The services offered by the Railway Telecommunication on the basis of presented telematics projects are able to satisfy the full range of teleinformation needs for control managing and supervision in the railway transport, ensuring reliability, high level of service quality and possibilities of flexible creation of improvements according to the user's requirements. The centralized control and maintenance systems ***NMS*** *(Network Management System)* being applied, enable current analysis of network operation, its supervision and dynamic configuration. The selected railway telematics projects that have been presented in this paper are based upon worldwide telecommunication standards and *(protocols, technologies, interfaces)* enable rendering of safe, reliable and efficient services at the level that is on par with he first-class railways in European Union.

A special area of interest are telecommunication services developed by the Railway Telecommunication for the unified European control, management and supervision of shippings in the railway transport ***ERTMS/GSM-R***. Even now, Railway Telecommunication takes part in the preparation of uniform data exchange networks, based upon IP platform, for infrastructure operators and railway shipping operator, such as ***GSM-R*** *(Global System Mobile for Railways)*, ***EURATEL*** *(European Railway Telecommunication)*, ***EURADAT*** *(European Railway Data Network)*.

Reviewer: Ph. D. Andrzej Białoń