Universal communication infrastructure for locomotives

U. Lieske
Head of System Integration, PC-Soft GmbH, Germany

Abstract

As international freight transport becomes increasingly essential for the competitiveness of the European economy, operators must further address the challenges of efficiency and quality of their vehicle fleets in the years ahead. Here, modern information and communication technologies offer major opportunities for the future. The German PC-Soft GmbH is a specialized company on the market that provides operators with a mobile solution that is situated directly on the vehicle. With 20 years of history and an experienced team of railway consultants and maintenance specialists, PC-Soft develops and implements customer-oriented solutions that support the computer-aided asset management of vehicle fleets.

Keywords: asset management, maintenance, teleservice, locomotives.

1 Introduction

Manufacturers, operators and service providers know the requirements for high availability of their vehicles with optimum use of resources. Above all, the frequently great distances between service centre and vehicle, the difficult situation regarding availability of resources (spare parts, operating and auxiliary equipment, specialists) require efficient monitoring of the running operation and fast and targeted remedying of faults. To cater even more flexibly to increased teleservice requirements, PC-Soft has developed a unique communication solution, named zedas®mobile [1]. System data and status information relevant to the effective organisation of servicing and maintenance strategies are recorded immediately on the vehicle, processed and electronically made available to service personnel. The central aim is to ensure system availability and optimisation of maintenance strategies based on real operating data and status

WIT Transactions on The Built Environment, Vol 114, © 2010 WIT Press
www.witpress.com, ISSN 1743-3509 (on-line)
doi:10.2495/CR100201

information from dispersed systems. The mobile status capture has been developed as an industrial solution that fully meets the demands of tough operating conditions. It can be used without any retroactive effect on process control on any type of vehicle. The possibility of decentralised recording of operating and status data for all components, as well as location-independent provision of information, has been taken into account when developing the system.

In the immediate vicinity of the object to be maintained, the system performs the following tasks:

– Capturing and processing of operating data
– Gaining of status information
– Automatic status monitoring and alarming
– Reconciliation of plant data with the service centre
– Temporary monitoring and analysis of critical plants
– Remote diagnosis of systems by external specialists
– GPS-aided position capturing and recording
– Driving/operational reporting
– Warranty monitoring of plants
– Calculable and profitable full service contracts

2 Starting position

Mobile systems operating over a wide geographical spread, such as locomotives, need online communication links to various back-end systems. The communications technology linking these systems must therefore be open and of universal applicability for different tasks and the technical communication solutions strategically planned and adopted for the long term. Conformity with

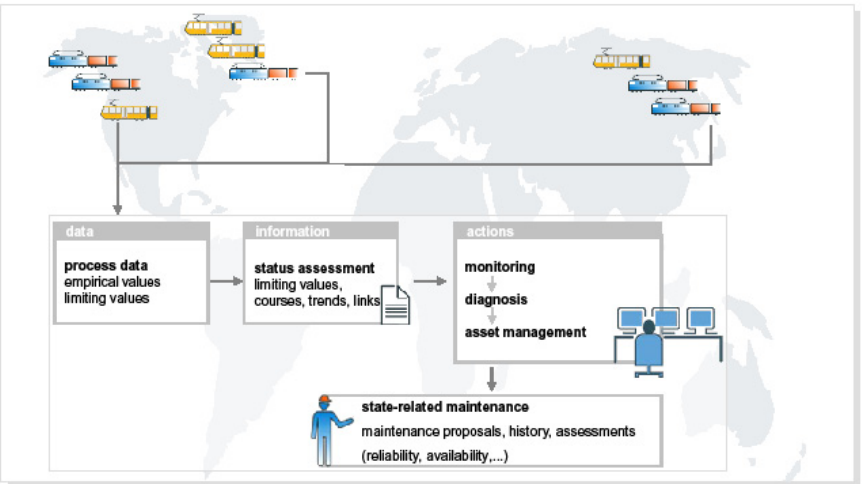

Figure 1: Functionality of mobile plant management with zedas®mobile.

established technical standards is taken for granted. For the purposes of actual use, the communications technology link is a system infrastructure task and not part of the solution. Exceptions to the above are safety-related applications (e.g. ETCS), most of which require special communication solutions on account of the particular demands on transmission reliability and availability.

It makes particular sense to separate the communications infrastructure from the concrete application as various demands are made on the technical solution, the ideal situation being that the application is developed with a bias towards solutions, new and innovative processes are integrated quickly, and allowance is made for upgrading but also for replacing the entire application at a later date without involving great complexity or cost. The communications solution itself needs to have universality and longevity, and the availability of spare parts must be guaranteed over a long period. Extensive work needs to be done on the technical system, e.g. for the installation of power supply and cabling for antennas, therefore it is normally very costly to replace the communications system. Indeed, most information technology applications host several applications in one technical system, e.g. for logging of operational data, remote diagnosis or scheduling, and operate via a shared physical infrastructure.

3 Solution

Hence the need, given this backdrop, for a universally applicable communications solution like zedas®mobile which is compatible with international standards (e.g. GSM, UMTS, WLAN). Users engaged in varied tasks for different organisations can communicate with several others.

zedas®mobile consists of two components:

- an on-board computer [2] fit for industrial applications and railway use (see Figure 2)
- a secure, i.e. encrypted, mobile communication link [3] via WLAN, UMTS or GSM (see Figure 3).

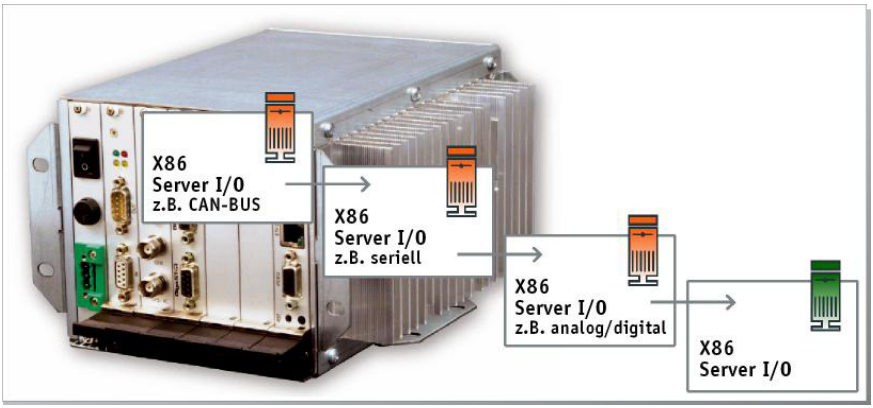

Figure 2: Diagram of compact, industrial-strength onboard computer.

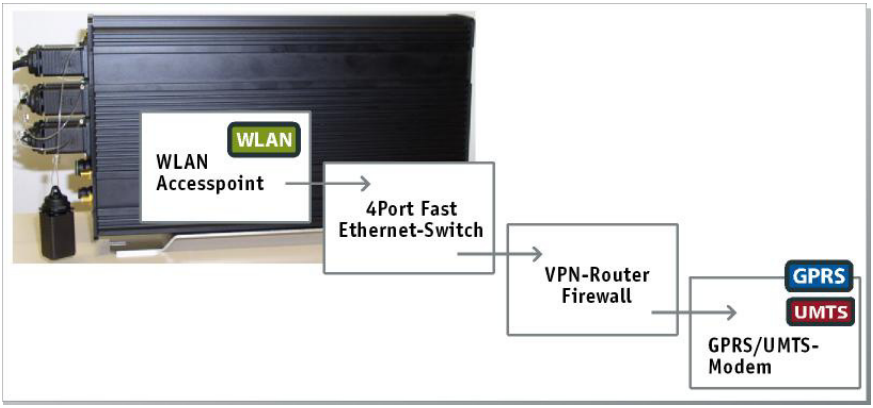

Figure 3: Diagram of compact, industrial-strength onboard communication unit.

Various communication modules can be added to the on-board computer, adding flexibility and enabling data to be exchanged via various field bus systems (e.g. MVB, CAN) or via serial interfaces. Direct analogue or digital I/O signal interfaces are also possible. The on-board computer is fitted with a GPS receiver which enables the locomotive to be located and acts as a time standard for all applications. The computer is powerful enough for on-board signal storage and pre-processing, leaving only alarm messages needing to be transmitted to the control centre. Not only does this speed up communications but it also helps to lower the cost of communications.

If you have an Ethernet port it is possible for additional on-board computers or control units to be connected directly to the communication box if required. Data can also be exchanged with mobile terminal equipment in close range via WLAN. To all intents and purposes, the locomotive or technical installation is then practically a satellite station in communication with the company network, with security guaranteed by the use of modern encryption methods like Virtual Private Network or Wi-Fi Protected Access (see Figure 4).

4 Conclusion

The communications solution discussed above constitutes a universal infrastructure development for locomotives and other mobile technical systems. A sophisticated infrastructure means enhanced efficiency and reduced costs of communication. The solution boasts flexibility, long-term viability and security of collaboration for users in different organisations for e.g. diagnosis and servicing of technical systems. From a maintenance point of view, resulting operations free of breakdowns and owing to status- and load-oriented maintenance and modern teleservice ensure planned system performance and savings on cost-intensive call-outs and manual inspections.

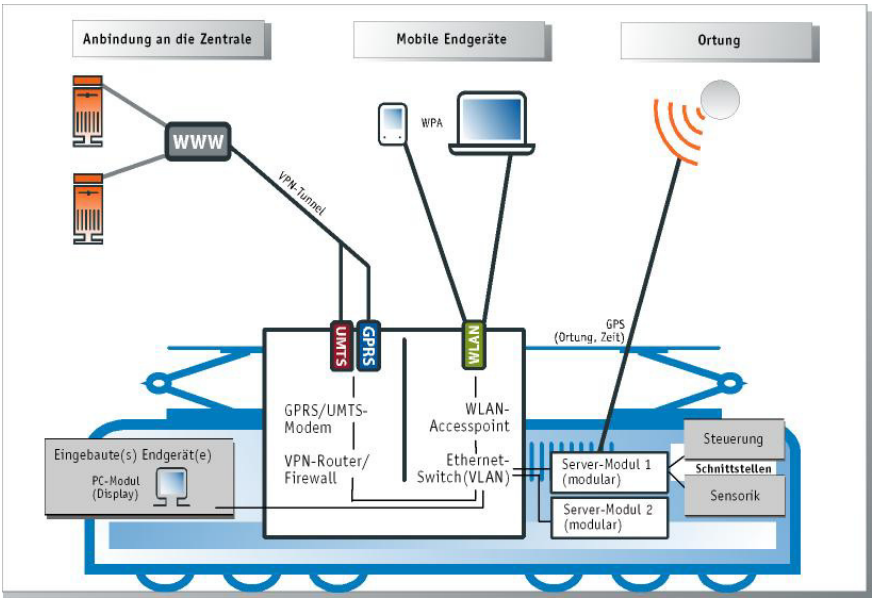

Figure 4: Example application - universal communications infrastructure for a locomotive.

References

[1] PC-Soft, www.pcsoft.de
[2] EMTrust, www.emtrust.de
[3] FMN, www.fmn.de