

# WIRELESS RAILWAY

Marko Zupanc  
Holding Slovenske železnice, d.o.o.  
SVTK Celje, ul. XIV. divizije 2, 3000 Celje,  
[marko.zupanc@tirnet.net](mailto:marko.zupanc@tirnet.net)

mag. Boštjan HERNAVS  
PAP Avtomatika, d.o.o.  
Kolarjeva ulica 47, 1000 Ljubljana  
[bostjan.hernavs@pap-skupina.si](mailto:bostjan.hernavs@pap-skupina.si)

## Abstract

Extending control and operability from office and desk to any point of railway at any moment is becoming a reality as we speak. Mobile and wireless computing is changing the way engineers, supervisors, workers and managers think and it is changing the way they do their jobs. Instead of traveling from field to the office and back and using various applications to collect and process valuable data, the wireless technologies in combination with web-based applications are drastically reducing time and operation costs. Wireless technologies, new programming techniques and applications have evolved from unreliable and experimental pioneers to reliable, fail-safe and powerful providers of information services with obvious benefits. Largest world corporations Intel, Cisco and others joined forces with BNSF railway company in development of one of the largest railway wire/wireless networks in north America. By covering almost 80.000 km of tracks with wireless connectivity they are setting an example and paving the way for others to follow. An European market is not an exception. Wireless LAN in combination of software applications is showing dramatic improvements in any aspect imaginable. Wireless railway is here.

## Key words

Wireless, Wi-Fi, Track-side productivity, Coverage, Aironet, Wireless applications, ITS wireless systems

## 1. Definition of a problem and goals of the article

How to enhance productivity and efficiency of inspection, maintenance and service processes in companies like railways? Covering railway assets with a tight communication connectivity is a real challenge because usually the area of coverage is large and because of its variety it demands specific solutions for specific areas. Until now workers from maintenance teams travelled from field to local offices and back to gather, process and print information and then again implemented solutions and measures back to the field. Often they needed to carry stacks of instructions and manuals which were needed on field for schedule planning and on field inspections. But new technologies such as wireless networks did not remain unseen by some railway managements. Advantages of new technologies were obvious. We will see how american railway company BNSF<sup>1</sup> enhanced productivity of their employees using advantages of wireless technologies and we will also try to explain why large IT corporations should take serious steps into the development of transportation intelligence and new technologies throughout the world.

---

<sup>1</sup> Burlington Northern Santa Fe Railway – Mid and western United States railway operator

## 2. Sheer size of the giant

BNSF is the American railway company with 40,000 employees. It is known by its innovative thinking and pioneering spirit resulting in innovations such as tri-level auto rack cars, printing telegraph, centralized traffic control, in route mail sorting and logistics systems. BNSF railways are managing around 80,000 km of railway and they are also applying the latest environmental measures and energy efficiency.

But all those innovations and measures do not stop there. The company is investing into cutting-edge technologies and making partnerships with largest IT companies of the world, such as Intel and Cisco.



Image 1: BNSF railway network

Source: <http://www.rockfordil.com/pdf/Maps>  
(january 2007)

But why?

Imagine that you are supposed to manage a production line which is 80,000 miles long, in offices and on the field and spans over the whole continent. And you have to manage it 24 hours a day, 7 days a week. Immense costs which the reduction of themselves would make any management interested. So this company sees an information technology and especially wireless and mobile technologies as a strategic advantage. For them this

technology is becoming critical for managing its huge complexity.

BNSF is a key factor of US economy and it concentrates on long-haul transportation. It is also one of the world's largest transporters of rail-to-road, ship-to-rail and other intermodal traffic. BNSF is also one of the best examples of how mobile and wireless solutions are changing industry today. The goal of implementing those solutions in BNSF was to enable more productivity of their workers which are constantly on the move.

## 3. Right information is everything

Neglecting the information and speed of accessing the right one is something that no company should afford. Railway is of course no exception. The difference between accessing proper information about certain problem on the field itself rather than having to fetch that information in distant office is many times the difference between getting the job or leaving it to the competition to handle. Railway imposes quite some problems for achieving information accessibility on field. There are bridges,

tunnels, distant and harder accessible tracks as well as its sheer size which wireless information service needs to cover. There are also big questions about security of wireless signal itself in addition to already known rigorous security demands of railway itself.

## 4. How did they do it?

BNSF decided to exploit the use of wireless technology to the maximum. They decided to cooperate with two largest IT companies in the world, Intel and Cisco Systems.

BNSF mounted more than 600 Cisco Aironet<sup>2</sup> access points and over 6000 wireless client devices, both notebooks, cellular phones and other handheld devices. In addition to these solutions there is also a well designed and supported wired-side applicative complex installed on Intel-based servers throughout BNSF network. This wireless LAN pilot showed dramatic improvements for the company and built a huge, ITS network.

## 5. Track side productivity improvement

Implementing new wireless technologies in ITS systems are embraced by field staff. One would expect at least some resistance to these new technologies since most of the workers have been in the company for decades. Surprisingly they are just as happy to handle the mouse of the computer as they were, when they handled their wrenches. According to one of the foremen on the field, their desk expanded and is now 320 kilometres long. They can do all their office work anywhere at any location they are at the moment.

User friendly, well designed and purpose-oriented software makes these wireless railway interconnections even more usable. Instead of digging throughout piles of numbers and text, field operators use graphics supported client applications. I can not stress enough what a difference these applications in combination with well-trained personnel make, compared to the competition.

BNSF foresaw the importance of accessing information at the right time but they are not laughing at their competition at all. They are simply saying: "It's your turn now!"

## 6. Fourth dimension - time

<sup>2</sup> Cisco Aironet – A wireless network system designed by Cisco.

To remain connected all the time, BNSF implemented Cisco hotspots with wireless connectivity industry standard 802.11b in field offices and at each end of a certain subdivision. To cover more remote areas they used Cingular wireless coverage in combination with company's own radio towers, which served as backbones of WLANs<sup>3</sup>. Co-operation with Intel made on-field connectivity even easier. Intel's Centrino mobile technology implements wireless and Bluetooth connectivity so with appropriate operating system all field devices, whether they are notebooks, pocket PCs or other mobile devices, they are practically ready for use when taken out of the boxes.

When workers work on the field, they now make less requests for train location calls to dispatchers which is saving time and money. Using Cingular<sup>4</sup> card they now log in the web application which provides them with an exact train location.

They can also access manuals, histories of device servicing and usage reviews of materials. They now know more exactly what to do and when and carry out tasks with more precision and consistence.

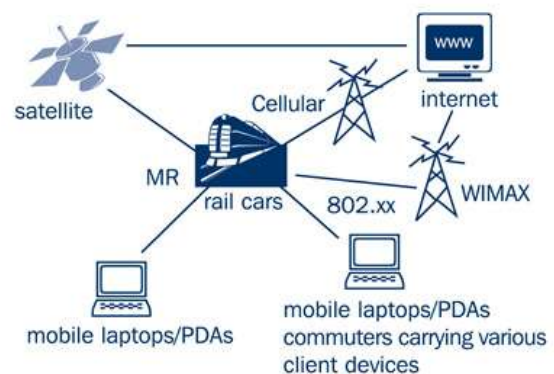


Image 2: Railway interconnectivity example  
Source: <http://www.calccit.org/images>  
(august 2006)

<sup>3</sup> WLAN – Wireless local area network, parallel to wired local area network, except the media is radio instead of wires. Of course security additions such as WPA 2 needed to be implemented due to the nature of radio communications.

<sup>4</sup> Cingular operates wireless networks using different communication standards including GSM



and not just wait to be outgrown in the rainforest of information technology.

Senior vice president of corporate development and marketing at Sybase: "The ability to use data at the right time and place can have a dramatic effect on a company's ability to make informed, agile decisions."

And if we are afraid of wireless technology, we have to open our eyes a little bit more and look around us. This technology has reached a level of maturity. A famous fact-based research provider Aberdeen Group published their research about mobile technology experience. The results shown a productivity boost of 100 percent after only two years of wireless implementation.

## 7. Conclusion

Global business is being transformed because of mobile and wireless connections. Faster accessible information means competitive advantage. It is no longer enough just to sell products or services, it is important to keep adding value to them and it is no longer enough just to try and keep existing customers, but to gather new ones.

So railway should not remain merely a service of transportation. The value should and can be added everywhere you look. Wireless connectivity of workers adds value to safety and reduces delays. Wireless connectivity of customers adds value to existing services and keeps customers more informed. New wireless software applications add value to information processing, business intelligence and also a satisfaction for workers in practically any section. And of course, wireless connectivity adds value to the key factor of competitive advantage, which is time itself.

Not so long ago the phrases such as "get connected", "go online", "take your business anywhere" were inviting customers and companies to embrace new wired and wireless technologies. Today

these technologies matured and new phrases took place. "Stay connected", "Stay online" or "keep your business up and running anywhere" are some of the most obvious ones. We saw a role model example of a traditionally orthodox business such as railway embracing new technologies and making huge progress and competitive advantage.

Wireless ITS systems in railway? Yes, it's here.

Sources:

[1] 3G Wireless with 802.16 and 802.11 Wimax and Wifi  
(Clint Smith, John Meyer - July 2004)

[2] Leaders Count:  
The story of BNSF railway  
(Lawrence Kaufman – September 2005)

[3] <http://www.intel.com/business/casestudies/bnsf.pdf> (2006)

[4] [http://www.bnsf.com/employees/communications/bnsf\\_today/2006/02/2006-02-06-d.html](http://www.bnsf.com/employees/communications/bnsf_today/2006/02/2006-02-06-d.html) (February 6<sup>t</sup>, 2006)

[5] <http://www.computerworld.com/action/article.do?command=viewArticleBasic&articleId=112779> (September 18, 2006)