Electronic Tolling System in the Slovak Republic

National Motorway Company (NDS), Slovakia

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Vilnius, May 12th 2010
Key Facts about Slovak ETC

- It is a **multi-lane, free-flow GPS/GSM based ETC system**.

- Toll data collection is based on an **obligatory, self-installable on board unit (OBU)**:
  - The OBU requires electrical power from the vehicle but no external antennas are necessary. It contains GNSS (i.e. GPS), GSM and microwave DSRC. It is fully compliant with EC regulations.
  - A refundable deposit (€ 50) is collected from the users to partly cover the cost of the OBU.

- The **ETC network comprises of more than 2000 km** of motorways, expressways and 1st class roads

- **Enforcement** of ETC is based on 46 fixed and portable roadside installations and 30 mobile enforcement units.

- The **back office software system** is **fully redundant** and located in two separate data centres for reliability reasons. **Data protection procedures** are implemented.
The Project (1)
Concept, Tendering and Implementation

• Work on the technical and operation concept and preparation of the tender phase started in 2007. The ETC system was designed, build and operated by a private entity on behalf of the National Motorway Company (NDS).

• The tender for the an ETC service was prepared in the second half of 2007 and bids from interested operators were submitted in early spring 2008.

• The implementation phase lasting 12 months started with signage of a service contract with the operator SkyToll on January 13th 2009.

• During 2009 the ETC system was implemented by SkyToll governed by a team of NDS experts.

• During testing more than 300 000 kilometres were logged to ensure proper segment recognition and charging. The system was considered operationally ready by an independent technical auditor and conditionally accepted in December 2009 and operation started on January 1st 2010.

• By the end of June 2010, full acceptance is expected.
The Project (2)
Challenge and Risks

- The challenge was to establish the **second free-flow GPS/GSM based ETC system** (the German system was the first). Three main differences are:
  - the **on-board-unit (OBU) is „self-installable“** (no tachograph connection or gyroscope) enabling an ETC system not requiring a „dual component“ (e.g. a manual booking),
  - **toll calculation is done in the back-office** simplifying the charging mechanisms,
  - apart from motor- and expressways (some) **1st class roads** are tolled.

- During the implementation phase lasting 12 months **three essential areas of risks were managed**:
  - The **system design and roll-out including localisation and testing**: Extensive **micro-management procedures** were put in place. **Effective communication** between the stakeholders was established.
  - The **management of OBU supply** in a wide **distribution network**: During the **rapid ramp-up** additional capacity was put in place. **Queuing** was **unavoidable** but it was **limited in length and duration**. For a limited period of time customers can pay manually (ticket) for certain transit routes. These procedures enable a smoother roll-out in the first months.
  - The **distribution of OBUs** to all customers: **Occasional, foreign users** pose a (financial) challenge to every OBU based ETC operator. **Interoperability and/or EETS will provide a means to address this challenge.**
The Tolled Network

- The **ETC network comprises of more than 2000 kilometres** of motorways, expressways and 1st class roads:
  - 577 kilometres of tolled motor- and expressways, and
  - 3 316 kilometres of 1st class road. However out of these 1 379 kilometres are tolled (42%).
Overview about the Slovak ETC System

System Components (1)

Overview

Operational Processes
Management of OBU
(block, unblock, monitoring, update software and GEO model)

Digitised model of roads

Central information system

Electronic Tolling Back Office

Road Usage Data

GSM/GPRS network

On board unit (OBU)

GPS system
System Components (2)
On board unit details

- **Essential Parts:**
  - Built-in GPS antenna and receiver
  - GSM / GPRS Module
  - DSRC / Microwave module
  - According to Automotive Standards
  - Motion sensor
  - Unauthorized manipulation sensor

- **Technical Data**
  - Processor: ARM9, 200MHz, až do 300 MIPS
  - Memory: RAM 32 MB, NAND-Flash 128 MB
  - GSM / GPRS modem: quad band, multi-slot class 12
  - GPS receiver: SiRF Star III™
  - Operating Voltage (DC): 9V ... 32V
  - Consumption(24V): počas prevádzky (typ.) 50 mA
  - Dimensions (without holder): 145 x 126 x 61
  - Weight: cca. 505g (with battery)
System Components (3)
More detailed block diagram
System Components (4)
Data Collection and Tolling Mechanism

- Toll Data Collection (including distances for calculation of tolls) is based on segments with predefined lengths using GPS positions for reference.
- If some segments are grouped into one section, toll payer is charged only when all segments within section have been used.
- The logic of segment detection is implemented in the OBU using simple geo reference objects (entry point, control point and direction of travel).
- The actual tolling is done in the back-office (very similar to the principles followed in the mobile phone industry).
Operational data after 18 weeks of operation

- 168,146 vehicles registered; 161,829 OBUs distributed; 27,808 OBUs have been returned after usage (occasional foreign users).
- 32% of the registered users are Slovakian based and 68% of the registered users are from other countries.
- Tolls collected exceed €40 Mio from approximately 89 Mio transactions.
Questions & Discussion