Truck Tolling Solutions - Technological Possibilities for implementation

Lorand Dancso
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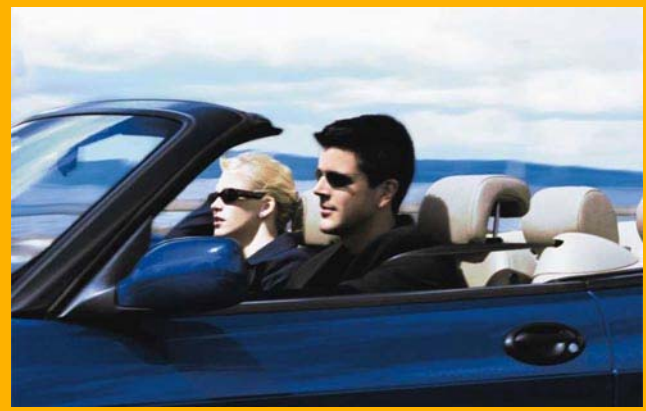


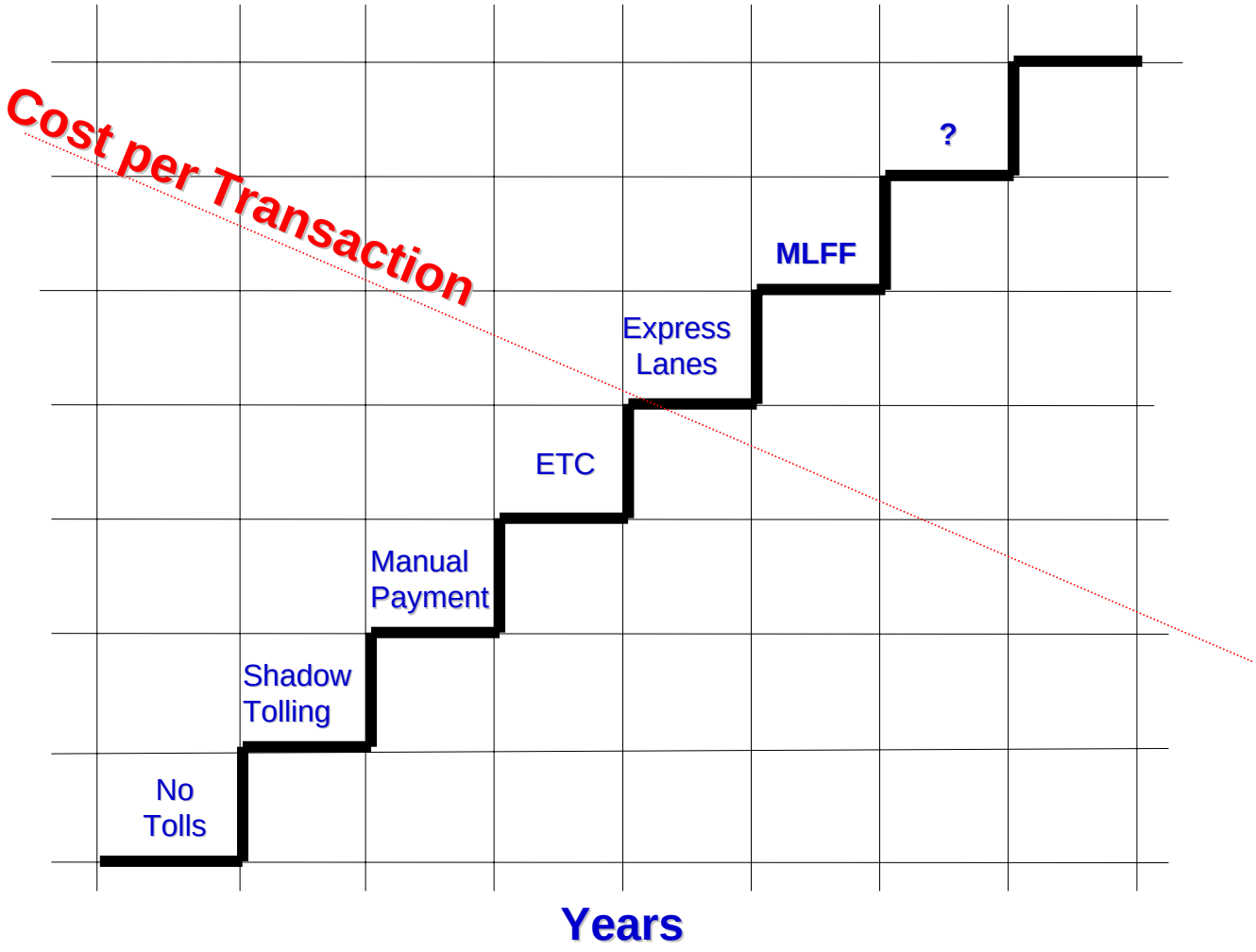

Outline

- Factors for a successful nationwide Truck Tolling Scheme
- Technological possibilities
- Enforcement strategy
- Truck Tolling Scheme in the Czech Republic
- Conclusion

Introduction

- Successful nationwide Truck Tolling schemes do work, in terms of technical, organizational and commercial aspects
- A successful nationwide scheme needs to
  - Guarantee maximum incomes through high charging and enforcement quotas
  - Use proven technology to reduce risks
  - Support flexible tolling schemes and tariff structures
  - High scalability and a high automation rate
  - Ensure nationwide and EU interoperability
  - Scalability for increasing user numbers
  - Use of inexpensive, reliable and easy-to-install OBUs
  - Ensure that traffic is not obstructed by tolling scheme
  - Make distribution and personalisation of OBUs as simple as possible
  - Guarantee income and fair treatment of user through an efficient enforcement system

The evolution in tolling

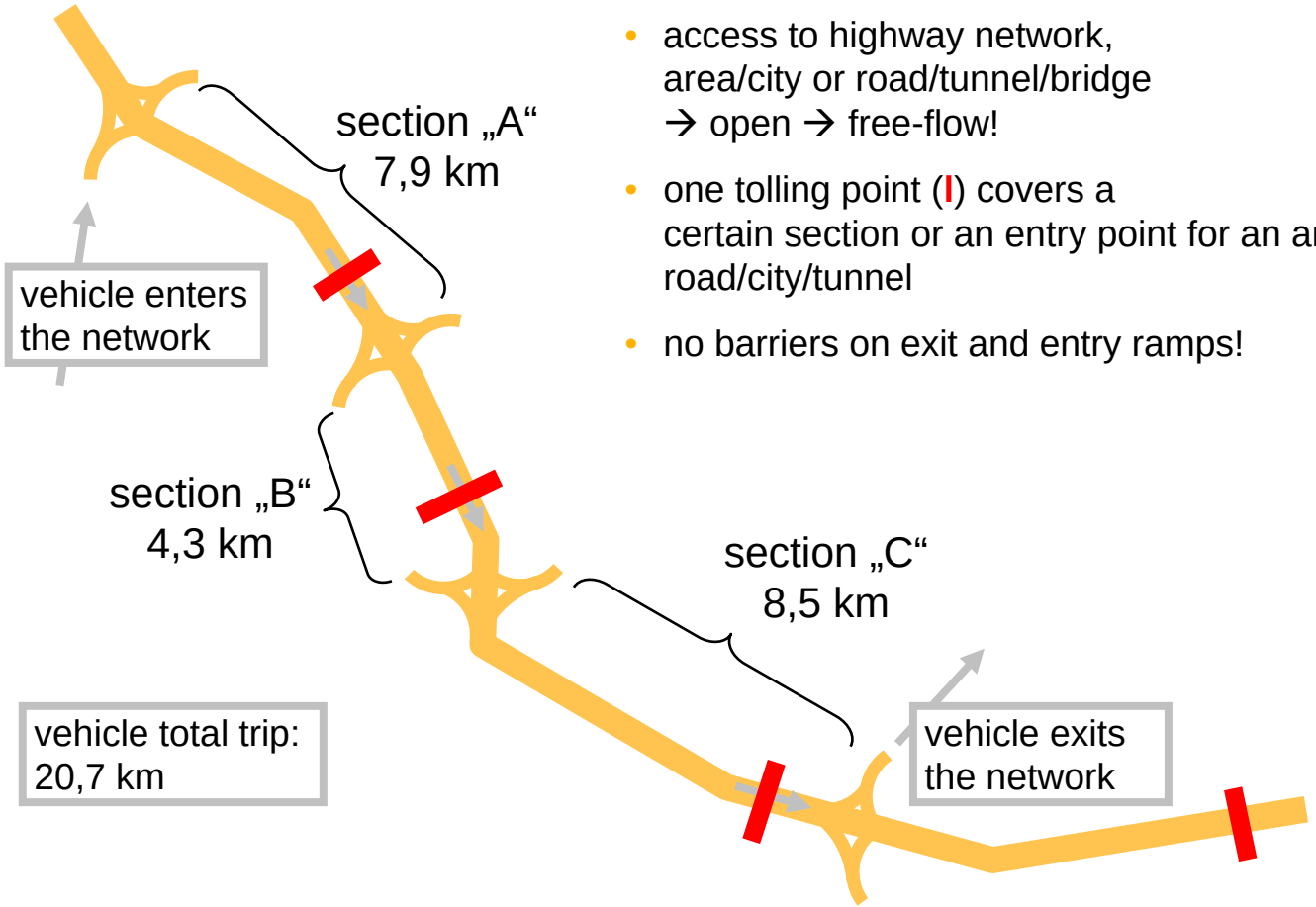


Lane throughput comparison for different operation modes

System	Vehicles per hour and lane
Manual, with barriers	200 - 300
ETC, with barriers	500 - 650
ETC, Stop & Go	~ 1.000
Multi-Lane Free-Flow	~ 3.000 depending on road capacity

The right tolling operation mode for nationwide Truck Tolling System

Nationwide schemes are operated most effectively in a free flow mode

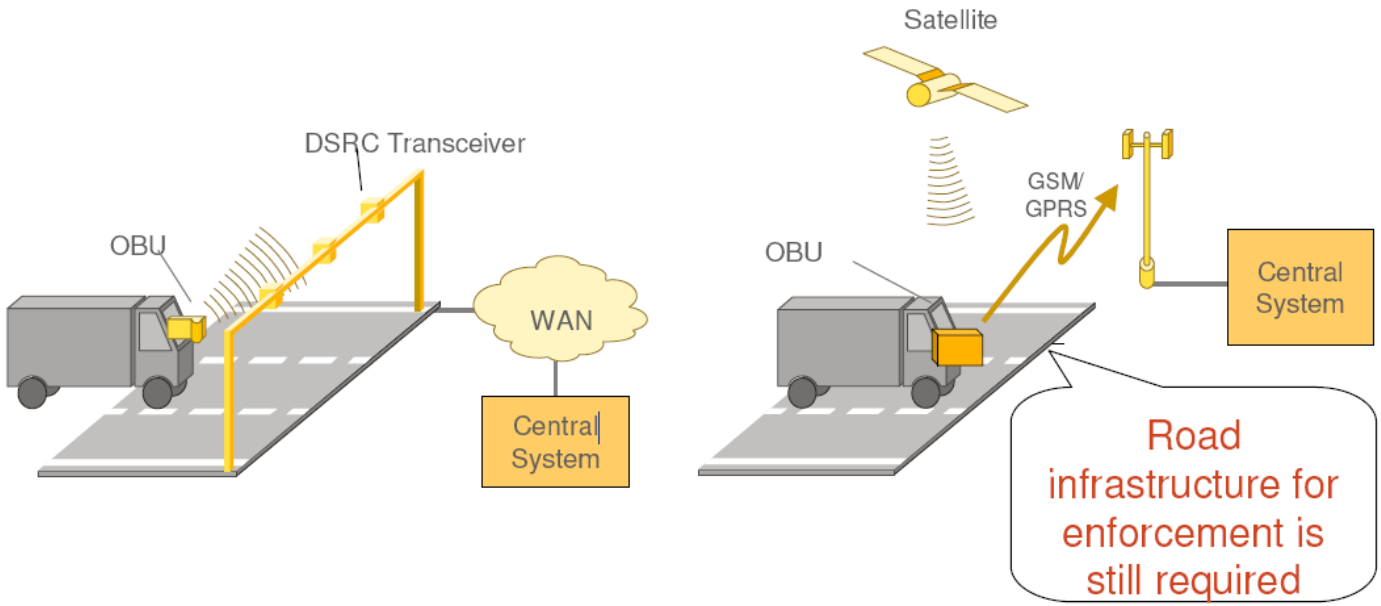


- access to highway network,
  area/city or road/tunnel/bridge
  → open → free-flow!
- one tolling point (I) covers a
  certain section or an entry point for an area/city or a
  road/city/tunnel
- no barriers on exit and entry ramps!

Truck Tolling Technologies

Two predominant technologies for MLFF Truck Tolling systems:

- **Microwave 5.8 GHz (CEN DSRC)**
  - Complete standards
- **GNSS / CN**
  - Only draft standards available, only proprietary systems installed or offered



Comparison of the two technologies

DSRC

Advantages	Limitations
• High performance and accuracy • Very reliable • Low-cost OBU (easy to install) • Low operation cost • Flexibility with regard to "All-Vehicle Tolling"	• Roadside infrastructure needed • Limited flexibility for "All-Road" tolling schemes

GNSS/CN (Satellite)

Advantages	Limitations
• Less roadside equipment needed • Flexibility with regard to "All-Road Tolling" • Enhanced telematic services possible	• Lower performance levels • More complex and expensive OBU – limited scalability • Higher operating costs

The right Technology Choice

DSRC

- DSRC charging of all users on motorways and main roads
- Mandatory low-cost OBU (optimal for transit users)
- High reliability and accuracy ensures maximum income

GNSS/DSRC

- GNSS charging of all users on rural roads
- Flexible system (e.g. adding new toll roads)
- Little road side equipment needed

DSRC ensures interoperability and allows country-wide enforcement

A system concept is needed which is based on various technologies combining the benefits of each technology in a fully integrated single solution.

Transaction cost vs. mode of operation

Tolling Mode of Operation	Cost (€)
Automatic Number Plate Reading – ANPR	1.90
Ticket / Voucher	0.35
Manual Tolling	0.33
Automatic Coin Machine & barrier	0.27
GNSS	0.24
DSRC – Multi-Lane Free-Flow	0.12

*) Cost for mode of operation:
The costs are typical costs and include the complete costs for investment and operation of the tolling scheme.
Source: IBTTA

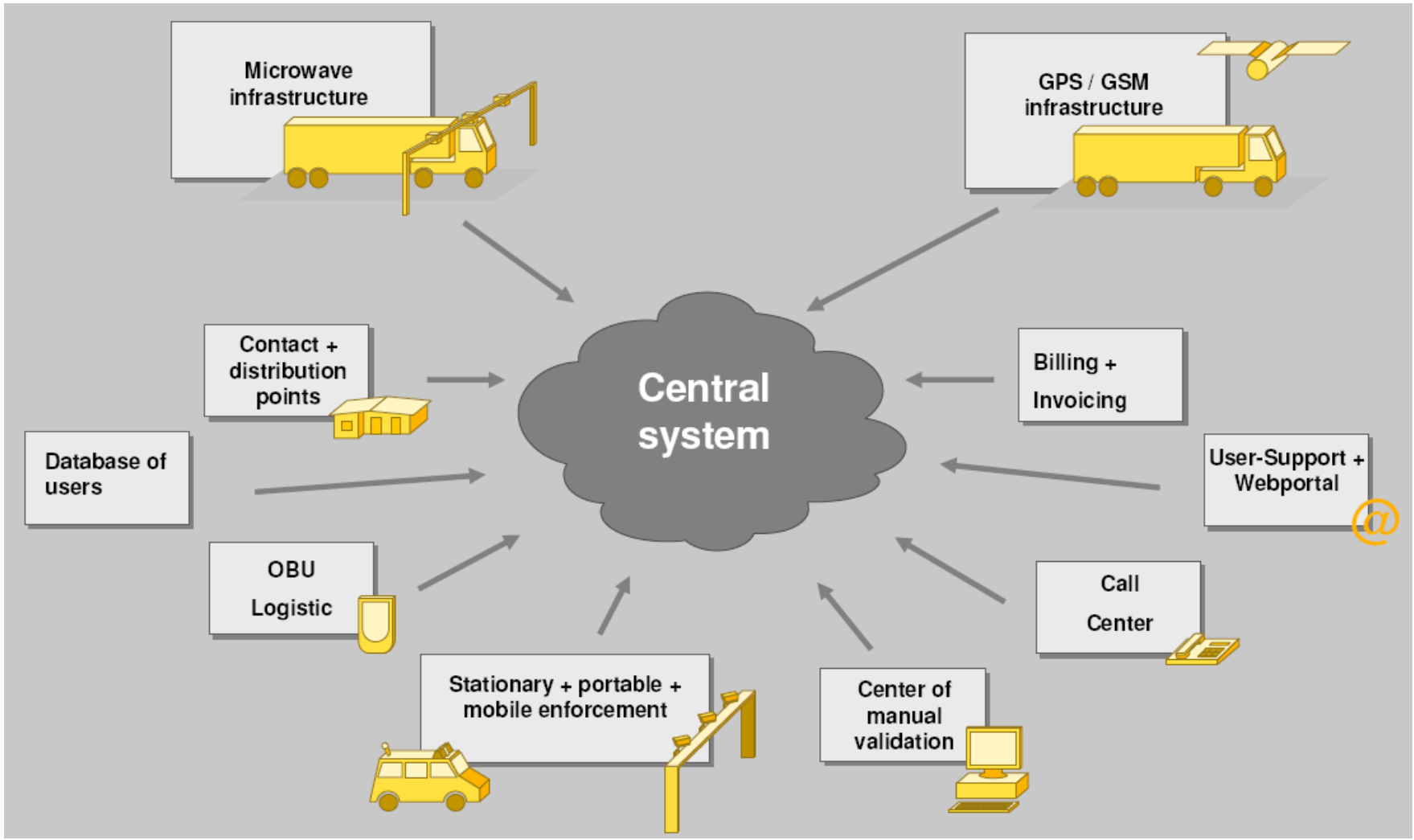
Enforcement

- Enforcement is an essential part of tolling systems ensuring
  - Correct toll collection
  - Fair and equal treatment of all road users, incl. foreigners
  - Increase of the acceptance in the tolling system
  - Guaranteed maximum of revenues
- Enforcement technology
  - Enforcement based on licence-plates by Automatic Number Plate Recognition (ANPR)
    - is not effective: falsification of licence-plates
    - expensive in operation (Example: London)
  - Enforcement based on OBUs & license plates
    - very effective: vehicle licence number has fixed link to vehicle OBU
    - reduces operations costs
- Right level of enforcement is a combination of
  - fixed enforcement installation →located at strategic important points with high traffic volumes
  - portable enforcement installations → ensuring surprising effect
  - Mobile enforcement equipment → enabling manual and automatic checks on the whole tolled road network

Existing Truck Tolling Systems in Europe

- Multi Lane Free Flow mode of operation in all countries having nationwide Truck Tolling System introduced
- No obstruction of traffic by the toll scheme
- Highest comfort for the users
- Start of operation:
  - Austria 2004
  - Germany 2005
  - Czech Republic 2007
- Enforcement Technologies:
  - Vehicle detection & classification
  - ANPR –automatic number plate reading
  - IR-imaging

Czech Truck Tolling System - overview



First year of operation in Czech Republic

- Achieved revenue for the all year was higher than expected (EUR 195 million)!
- Only after 10 month of operation the collected toll footed up to EUR 163 million – this revenue was originally expected for the all year 2007!
- Estimation is, that toll collection will exceed EUR 231 million in 2008, EUR 35 million more against 2007!
- Only after six (6) month of operation, the total amount of the collected toll reached the total capital expenditure!
- By the end of 2007 almost 296.000 active OBUs registered in the system, which exceeds even 3 times more the highest expectations!
- The average toll transaction per day was 614,280.
- Toll statistics have shown that the highest toll incomes are in the third decade of every month, between the 20th and 30th day of every month, which is most likely related to economic production cycles. It therefore comes as no surprise that the strongest days in 2007 were 28 November (EUR 793,208) and 27 November (EUR 786,406).

Conclusion

- Successful nationwide tolling schemes do work, in terms of technical, organizational and commercial aspects
- System complexity –and additional effort –result from legal framework, technological constraints, and operational reasons
- Nationwide schemes are operated most effectively in a free flow mode, as long as the enforcement systems are effective and deterrent to ensure the revenues
- Technology
  - DSRC on highways and main roads enables
    - High accuracy and reliability ensuring highest income for roads with high traffic volumes
    - Mandatory use of low-cost OBU → Extendibility (stepwise introduction of tolling schemes), Traffic Management, Access systems,…
  - GNSS in combination with DSRC on rural roads enables
    - Flexible extension to “All-Road Tolling”
- Enforcement has two positive effects: It ensures the proper payment of the toll, and it can generate additional revenues by itself, if so wished by the tolling entity, and if so authorized by the legislation
- Interoperability is very important – it is mainly determined by legal and contractual situation. Technology & standardization are already available; the implementation is on its way

Lorand Dancso

Kapsch TrafficCom AG | System engineering
Wagenseilgasse 1 | A-1120 Vienna | Austria

Tel. +43 (0) 50 811 2533
mobile +43 (0)664 628 2533
Fax +43 (0)50 811 99 2533
e-mail lorand.dancso@kapsch.net
www.kapschtraffic.com
www.kapsch.net