SKYTOLL

Consulting Services

Design, build up, finance and operation of the Electronic Monitoring and Toll Collection System

CONTENTS

INTRODUCTION
OF SKYTOLL, A.S.

HISTORY AND SUCCESSFUL PROJECTS

SkyToll, a.s. was established in 2008 by a group of technological and financial investors for the purpose of participating in an open tender for provision of the electronic toll collection service in the Slovak Republic.

The National Motorway Company (NDS) is responsible for development and maintenance of the road network in Slovakia as well as for collection of payments for its use. In 2008 NDS decided to develop an electronic toll system on motorways, expressways and 1st class roads for lorries with the maximum permissible weight over 3.5 tons and buses. The project objective was to increase the efficiency of collection of fees for road use and the success rate of toll collection using cutting edge technological solutions (replacement of the existing system of motorway stickers for these categories of vehicles). SkyToll, a.s. won the open tender and on 13 January 2009 concluded the contract with NDS, under which SkyToll committed to design, build and for 13 years of the system operation to provide complex services of electronic toll collection on the specified road sections in Slovakia.

In less than 12 months SkyToll developed a customer service network, necessary infrastructure, implemented information systems and formed an expert team, which provided for the ETC system development and commissioning of the service as such. Since 1 January 2010 SkyToll has administered one of the most cutting edge ETC systems and currently Slovakia is in the group of global leaders in the ETC area. At the system start-up the specified road sections included almost 2400 km of motorways, expressways and selected 1st class roads. After several expansions the system now covers 17,762 km of roads (all motorways, expressways and 1st, 2nd and 3rd class roads). This system uses the satellite GPS-GSM technology, which provides maximum flexibility in expansion of the toll road network within the Slovak Republic. The satellite technology is used to determine the distance driven on the specified road sections by means of the On-Board Unit (OBU). The OBUs used in the Slovak Republic include all three key technologies for international cooperation: GNSS (standardised satellite technology), GSM/GPRS (interoperable network for data transmission) and DSRC (for enforcement interoperability for satellite as well as for conventional microwave systems). The OBU transmits data of the location into the central system through channels of the GSM-GPRS mobile network. The central system informs the toll calculation on the basis of data and it will issue an invoice for the vehicle owner.

The Slovak ETC system is ready for integration with other European systems in the greater area of the European Electronic Toll Service. As a result the Slovak Republic meets all the conditions to offer relevant experience with implementation of the European directives 2004/52/EC and 2009/750/EC on interoperability of the ETC systems in Europe.

SkyToll considers it very important to deal with the issue of data security and personal data protection. Therefore, the company introduced the Information Security Management System according to ISO 27001 and received a certificate for this system.

PROFESSIONAL EXPERIENCE AND COMPETENCIES

In the implementation of its projects SkyToll obtained extensive professional experience, which can be applied for the successful execution of the project of electronic toll collection as a compensation for damage caused to the federal roads by vehicles having the permissible weight exceeding 3.5 tons.

Complex solution provider:

SkyToll designed the complex service of electronic toll collection, built and integrated system domains and service organization, defined efficient operational processes and operates the complex service of electronic toll collection in Slovakia.

Strong experience and successful implementation:

Fast and cost efficient implementation of the electronic toll collection system is possible to achieve in case of having the know-how and the broad experience from successful implementation and efficient operation of a toll collection system. SkyToll offers the experience starting from legislation, complex setup of the solution and guaranties for the delivery including financing and successful and efficient operation.

Commercial and technological operation:

SkyToll operates all of the services and components including toll collection, customer services, enforcement services, OBU distribution and maintenance, IT administration and operation (monitoring centre, technological support and maintenance).

Optimized operational processes:

The Back-office, the Points of Sale and the Call Center are designed to meet the customers' needs and expectations of customers. All the services covering customer registration, customer data changes, the OBU handover to the customer and its collection from the customer, receiving payments, providing information, receiving of claims are under one roof and ready for communication in several languages, thus being extremely convenient for transit transport drivers.

Expert consulting and project financing:

Besides the complex technological delivery, SkyToll is able, based on its experience with financing of the big European projects, to secure financing for the whole project as well as for the toll system operation itself during the period of repayment of the investment by the government.

Research, development and innovation:

Thanks to the complex technological platform SkyToll has also the competence to provide the suggestions for further enhancement of the system and for development, delivery and operation of additional solutions and new services.

In-house product portfolio for delivering E2E solution:

SkyToll as a solution provider creates the effective end-to-end solution based on the components from its own portfolio. Already today it utilises the unique combination of technologies that represent the basis for the information traffic systems of the future. The application thereof erases the boundary between the present and the future.

Beneficial cooperation:

SkyToll is a strong partner with experience from implementation and management of real projects. In its design for provision of an integrated service for the Russian ETC project, SkyToll offers long-term partnership and cooperation, consultation and support for ongoing optimisation of the whole service of electronic toll collection as well as for implementation of development requirements for the system or the business.

SUMMARY OF OFFERED SERVICES

CONSULTING SERVICES DURING INDIVIDUAL STAGES OF THE PROJECT

Considering the complex project and operation of the system of electronic toll collection for the purpose of compensating damages caused by vehicles with the maximum permissible weight over 3,5 tons (with possibility to charge personal cars too) on the specified road sections and short commissioning deadlines we believe that early delivery of know how is one of the most important factors of the project.

Scope of the project can be divided into three stages:

1. **Design stage of the ETC system;**
2. **Development stage of the ETC system and integration with existing components;**
3. **Migration, cutover, launching and operating stage of the ETC system.**

The ETC design stage is the most critical part in terms of application know how and important decisions. This stage requires to:

- Analysis of existing solution and components;

- Create a common and optimized ETC concept;

- Definition of requirements for ETC;

- Definition of the integration and migration strategy;

- Prepare adjustments in legislation to create conditions for ETC;

- Create project planning by stages;

- dentification of risks, critical points of the project and business processes including the mitigation design.

In **the ETC development stage** consulting assistance includes:

- Definition of kPi and operation SLA methodology and creation of a technical and application architecture of ETC;

- Create an architecture of operational processes for ETC handling;

- Definition of individual operational processes;

- Design of the organisation and the functional structure of the ETC Operator;

- Integration of partial and existing systems;

- Preparation of employee work instructions from business processes;

- Preparation and execution of ETC testing;

- Preparation and execution of acceptance tests;

- Providing user trainings.

In **the launching and operating stage** the consulting services focus on:

• Assistance with launching of ETC and related services into commercial operation;

• Support in dealing with issues discovered by monitoring key performance indicators and ETC performance;

• Analysis of efficiency of operational processes, work ergonomics related to operational processes and preparation of designs for optimisation of business processes.

ELECTRONIC TOLL COLLECTION (ETC) SYSTEM DESIGN STAGE

PREPARATION OF THE GENERAL CONCEPT

The service includes analysis of existing toll collection system including system for weight in motion, the local legislation relevant for toll collection on the specified road sections in the country, analysis of the concession and/or service contract on development of the ETC system for vehicles over 3.5 tons (with possibility to charge personal cars too) and workshops with the key employees of the ETC Operator. The collected information will be used to prepare the document of the General Concept of the system, which will include and describe:

- The principles of toll collection with emphasis on the manner and the technology of toll collection;

- Design of the application architecture, which will include in particular description of the basic system components and mutual links among the individual components;

- Basic parameters of the system, which will include parameters such as the scope of toll roads, the vehicle categories with toll liability, the number of vehicles with toll liability, the number of Points of Sale, the number of toll gates, the number of enforcement vehicles, etc.;

- The strategy of ETC development, which will include in particular recommendations for preparing project documentation for the ETC development stage, including infrastructure development, delivery of individual components, their integration. This part of the concept will also include the policy for acceptance of the individual ETC components and their integration and the education and training policy;

- The strategy for ETC launch, which will include in particular the strategy for preregistration of vehicles into the system, previous delivery of OBUs to the Points of Sale, the marketing campaign strategy and so on;

- The strategy of the system operation for individual key processes of toll collection;

- The glossary of terms and abbreviations.

REQUIREMENTS DEFINITION ON ETC

The service includes preparation of the Model of Requirements, which will include requirements on ETC together with the requirements related to objectives of the solution and the measurement of its parameters. Requirements will originate from the General concept of the ETC system. The model of requirements will include:

- Requirements overview, i.e. the list of all the requirements divided into logical groups;

- Business requirements, i.e. high-level requirements placed on ETC, which express goals that the solution should achieve and the metrics that will be used for measuring its success (for example SLA);

- Organisation and process requirements, i.e. requirements on individual groups of the ETC Operator's staff;

- System requirements, i.e. requirements on systems and application and their characteristics divided into:

  – Functional requirements describing the system behaviour and functionality, business rules and information to be processed by the system. The functional requirements will be further divided into:

  Business Rules – the list of business rules, which will need to be implemented in terms of the solution;
  Features – individual system functionalities;
  User interface – requirements on displays and their controls;
  Interfaces – requirements on interfaces between the ETC components;

  – Non-functional requirements describing the environment in which the system has to work efficiently and the qualitative requirements that the system has to meet. The non-functional requirements will be further divided into:

  Performance – requirements defining the system performance parameters such as the number of processed transactions per second, network latency and other measurable aspects of the system including the system speed and response with regards to the proposed retention policy;
  Scalability – requirements defining the system operation parameters with regards to the system size, the number and the volume of transactions, the number of users and the distribution centres;
  Security – requirements on data access (information security) and also physical security of the data;

Persistence – requirements on operational and performance criteria for information storage, including the requirements on redundancy, back-up, the database system, monitoring, files and other storage mechanisms;

Transport – limitations and requirements affecting information exchange between the centres. They include requirements on networks, protocols, the quality of services and so on.

- Transition Requirements, i.e. requirements regarding the ETC system launching, migration and cutover existing systems.

- Technical requirements, which will specify the required characteristics and limitations of the individual ETC components and the ETC system as a whole, which is to be developed or delivered and operated afterwards, with emphasis on:

  – requirements on the applied technologies;
  – delivery requirements;
  – implementation requirements;
  – requirements resulting from the standards for IT systems development.

PREPARATION OF RECOMMENDATIONS FOR LEGISLATIVE ADJUSTMENTS

The service includes a differential analysis of the local legislation relevant for toll collection on the toll road sections in country valid at the time of the Service provision and also for the prepared or planned (if relevant) concession contract for development and provision of the ETC service.

The analysis will in particular focus on the obligations specified by the legislation related to toll collection, namely for vehicle operators and drivers as well as for the ETC Operator.

Recommendations for legislative adjustments will be produced based on the differential analysis and also recommendations for preparing the general business terms and conditions for a contract with the vehicle operators, which will contribute to securing optimum conditions for compliance with the terms and conditions of the concession and/or service contract and efficient operation of the system.

RISK MANAGEMENT

The service will cover the identifications of risks, their evaluation and management in all stages - Design, Development and Operation of the ETC system.

The risks will be recorded and monitored in risk registers. Risk management will be carried out by forming a working group with participation of representatives of the main parties involved. The process of risk management will consist of the following six main areas:

- Identification: Risks are identified by means of revision and project management activity. Significant risks will be recorded in the project risk register.

- Analysis: Evaluation of the probability of risk occurrence and impact on the ETC system performance, especially in relation to time delay, financial expenses and the impact of customer requirements.

- Setting of priorities: Timeline specification for risk processing.

- Planning: Identification of measures for reducing risks and their possible elimination.

- Monitoring: Monitoring of risks and measures for their reduction.

- Communication: Provide information (internal and external) about discovered risks and possible future risks.

ETC DEVELOPMENT STAGE

PREPARATION OF THE SLA METHODOLOGY

The service includes the definition of SLA parameters of ETC with emphasis on toll collection efficiency, the scope of enforcement coverage, the system availability, the time of the system restoration and so on and preparation of the methodology for measurement and evaluation of the defined SLA parameters either in case of ETC as such and also of individual components.

PREPARATION OF THE BUSINESS PROCESS ARCHITECTURE

The service includes a detailed analysis of business processes defined in the document of the General concept of the system and workshops with the key employees of the ETC Operator.

The analyses and the workshops will result in preparation of the business process architecture, which will include categorisation of the processes according to their functional areas, description of goals and owners of the individual processes and their mutual links.

The business process architecture will include the key processes of electronic toll collection as well as supporting processes for facilitating the system operation.

BUSINESS PROCESSES OF THE ETC OPERATOR

The service includes a detailed analysis of business processes defined in the document of the Business process architecture and workshops with the key employees of the ETC Operator. Based on the analyses and the workshops we will prepare a detailed d escription of individual business processes. Description of individual processes will especially include attributes such as:

- the purpose of a process;

- a process executor;

- process steps;

- necessary resources (external and internal).

DESIGN OF THE ORGANISATION AND FUNCTIONAL STRUCTURE OF THE ETC OPERATOR

Formation of the organisational structure takes into account distribution of work in terms of the processes of the operational and financial and economic activities of the ETC Operator. As a result the formation will take into account the following main principles:

- an optimum solution – reduction in the number of management platforms and levels and also definition of rational links between the management platforms, levels and components;

- an adaptable solution – adaptability of the structures to changes in the external environment;

- an operative solution – a fast response when making management decisions and also their fast and precise implementation into the managed system;

- a reliable solution – reliable exchange of all information between the managing subject of the system and the managed subject of the system;

- an economic solution – minimisation of expenses on maintenance of the management apparatus under the condition of mandatory fulfilment of specified tasks.

Building an organisational structure provides for an equilibrium between management functions and tasks, completeness and content completeness and integrity of management processes, correspondence between the number and the composition of staff on one hand and the volume and the complexity of works on the other, completeness of provided information necessary for production and technological processes, completeness of technological means provided for management processes taking into account their nomenclature, efficiency and the speed of action. The organisational structure takes into account:

- territorial distribution of the ETC Operator;

- requirements on the ETC Operator's activities defined in the tender documentation requirements;

- Requirements on the ETC Operator's activities regulated by the government bodies and the legislation.

In addition the organisational structure has to have the capability of being formed within the short deadlines set for the ETC development.

CONSULTING AND SUPPORTING SERVICES IN ETC DEVELOPMENT

The service includes provision of expert consulting and supervision especially for:

• delivery of individual components of the ETC system including a data centre, enforcement gantries, Points of Sale, the call centre and others according to the General Concept of the ETC system;

• integration of the components;

• performance of whiteness tests with attendance of the ETC Operator's staff;

• training of the ETC Operator's staff;

• checking of the progress of works on selected control days in terms of development and delivery of the individual ETC system components;

• development of the company and the organisational structure of the ETC Operator;

• Implementation of processes.

Furthermore the service includes preparation of the design for management of the ETC system changes in the course of its operation.

CONSULTING SERVICES FOR PREPARATION OF THE ETC SYSTEM LAUNCHING

The service includes preparation of the policy for acceptance of the individual ETC components, their integration and also verification of the readiness of the ETC Operator for the system operation. The policy will include:

• Individual tests of the system components (a test of correct functioning of all parts of the system hardware and software, including telecommunication elements);

• Individual tests of the ETC software equipment modules (a test of designed functions of the software modules);

• Integration tests and tests of the ETC interfaces (a test of data sharing between the software modules and the external environment);

• ETC stress test (a performance test with artificially created high stress);

• ETC security test (a test of data security against misuse, damage and destruction, accidental loss, modification, unauthorised access and disclosure as well as against any unacceptable forms of processing);

• Verification of processes defined in the document of the Business Process Architecture;

• A complex test of the ETC system, the system needs to comply with all the designed functions without outages, malfunctions and defects in continuous operation for the period of 48 hours (a test of the ETC system as a whole with process participation).

The service also includes supervision over the execution of the acceptance tests and the ETC system launching in accordance with the policy defined in the General Concept of the ETC system.

ETC OPERATION STAGE

CONSULTING AND SUPPORTING SERVICES IN ETC OPERATION

The service covers provision of consulting services right after the system launching. The service will include in particular supervision over the monitoring of key efficiency and effectiveness indicators of the individual process areas defined in the General Concept of the ETC system.

In case of not meeting defined quality indicators of the ETC system operation, recommendations will be proposed to carry out preventive and corrective measures to secure removal of the causes that lead to deterioration in the quality of the ETC operation.

ETC OPTIMISATION IN THE COURSE OF ITS OPERATION FROM THE PERSPECTIVE OF BUSINESS PROCESSES

The service includes recommendations for optimisation or adjustment of ETC processes and components based on findings from the ETC system operation.

PILOT PROJECT

As the technology for satellite based electronic tolling system is unique and the finally chosen system will affect a huge number of road users for a long time we offer to provide a Pilot project to enable the stakeholders to evaluate the advantages of our system with minimal costs. The goal of the Pilot project is to demonstrate the flexibility of the satellite based electronic tolling system and the speed at which it can be built. The Pilot project consist of phases Preparation, Integration, Validation and Presentation.

Preparation

The Preparation phase starts with the design of hardware and software architecture necessary for processing of the virtual electronic tolling on the selected tolled road network, which can cover the whole tolled road network of the particular country.

Based on designed architecture the electronic tolling system is deployed on dedicated SkyToll´s testing infrastructure and customized for particular country based on the actual or planned or suggested toll legislation depending on current toll

legislation status and stakeholders needs. Besides the system customization the tolled road segments are defined. Their number is based on the number of cross-roads and the places where the vehicle can drive or leave the tolled roads. Thanks to the technology used, no single toll gate has to be built, as it is not necessary for road charging or traffic flow monitoring.

The most difficult stage of the Preparation phase is the creation of a geomodel. This is a set of virtual objects that are used to identify the usage of defined tolled roads segments by vehicles.

Integration

The key activity of the integration phase is the import of geomodel to the central system and integration of dedicated on-board unit with configured and prepared electronic tolling system. Correct integration of all components is verified by simulated test runs. So far without a real vehicle and on the roads in fact several thousand kilometers from the test room.

Validation

The main activity in the Validation phase is the testing of all processes and components, including on-board units and the geomodel, directly in the road traffic. When verifying the particular importance is placed on correct recording of crossings the intersections and driving along tolled road segments parallel to unpaid roads. Realized journeys of vehicles equipped with onboard units are using the GSM technology transferred to the central system for further processing.

Presentation

The final part of the Pilot project is the real time and on site presentation of selected business processes as registration, onboard unit hand out and hand in and billing.

During the presentation a test drive is provided and its processing in the real time is shown including alarms and warning signalizing reaching of defined thresholds and prohibited road users actions (opening on-board unit, GPS jamming, etc). The presentation attendees have the possibility to try the system on computers installed in the presentation room, i.e. to put their hands on the system including on-board units and execute some processes on their own.

PROFESSIONAL SERVICES

System integration covers processes and procedures from gathering requirements, system and architecture design, interface definition, systems management, and solution development for the purpose of developing large-scale complex systems.

These complex systems involve hardware and software and coupled with new requirements to add significant added functionality. Systems integration generally involves combining products of several contractors to produce the working system.

Services listed below can either be provided for overall solution or only for partial segments of the solution.

LIFE-CYCLE ACTIVITIES

Application of systems integration processes and procedures generally follows the life cycle for systems engineering. Minimally, these systems engineering life-cycle phases are requirements definition, design and development, and operations and maintenance. For systems integration, these three phases are usually expanded to include feasibility analysis, program and project plans, logical and physical design, design compatibility and interoperability tests, reviews and evaluations.

REQUIREMENT ANALYSIS

Requirement analysis at project offering services concentrates on high-level analysis of tender documentation and/or other documentation relevant to phase before submission of binding offer. The services focus on:

SOLUTION DESIGN
Solution design at project offering services concentrates on high-level solution design that respects rather limited information available in tender documentation and, prospectively, also other relevant documentation.

PROJECT DEVELOPMENT SERVICES
Project development services (also known as build-up services) focus on establishment of overall solution up to the moment when the solution is put in full operation and it enters support phase.

System Integration
System integration services support composing overall solution from selected components including partial and complex testing. Validation phase of the project covers detail planning of the validation campaigns to confirm the readiness of the system to start official operation.

Launch
- Supporting activities elated to starting the operation

- Supporting xternal activities related to starting the operation

PROJECT MANAGEMENT

Project management covers coordination of activities related to preparation of specification documents, customization, deployment, testing, training and handover to support organization.

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